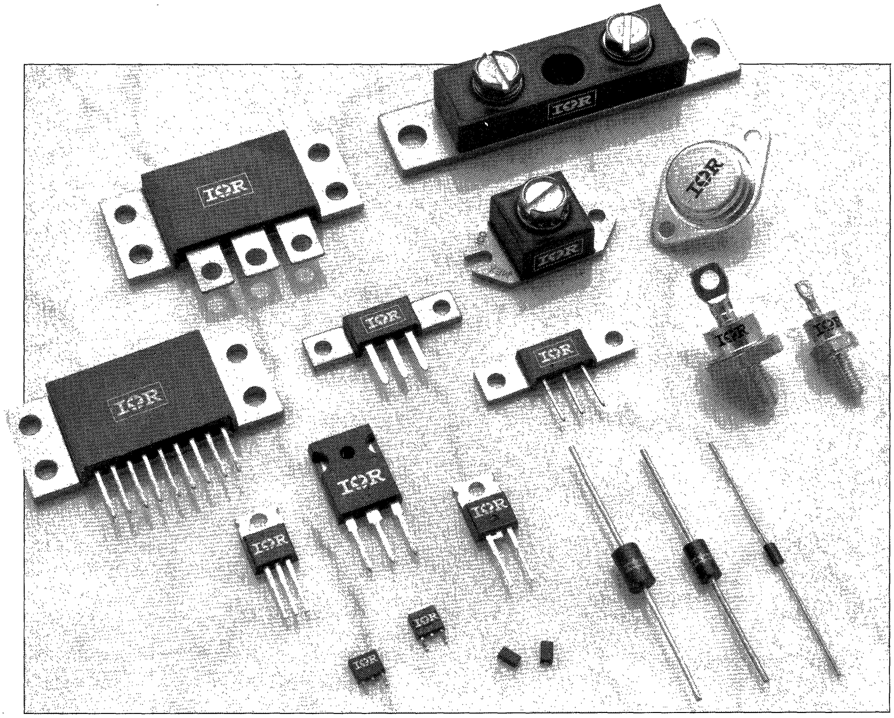
SCHOTTKY DIODE DESIGNER'S MANUAL SDM-1

Price: $10.00 U.S.

SDM 1

SCHOTTKY
DIODE
Designer's Manual

International
IOR Rectifier



About the SDM-1 Manual

This Designer's Manual is specifically dedicated to International Rectifier's family of Schottky devices as of January 1992. These diode products are fully covered in the Schottky data sheets section. Also featured in this manual are various selection guides, cross references, reliability data and a very comprehensive Applications Handbook, one of the industry's most extensive technical publications ever devoted to Schottky diodes.

The Applications Handbook

The data contained in our Schottky Applications Handbook covers virtually every area of Schottky selection and design-in criteria for most power supply applications. It offers a concise look at IR's Schottky product range by reviewing the different packages, die sizes, and electrical characteristics of our Schottky processes. Also presented is an in-depth analysis of performance trade-offs between different Schottky types, and a number of design guidelines to steer the user to the best choice in Schottky to meet most any common power supply circuit requirement.

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SCHOTTKY DIODES

SURFACE MOUNT AND AXIAL LEAD
SINGLE CHIP DISCRETE
CENTER TAP DISCRETE
CENTER TAP MODULES
LOW PROFILE MODULES
HALF PAK MODULES

Schottky Diode
APPLICATIONS AND PRODUCT DATA

SDM-1
First Printing

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Schottky Diode Designer's Manual

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In the interest of product improvement, International Rectifier
reserves the right to change specifications without notice.

Schottky Diode Designer's Manual

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Schottky Diode Designer's Manual

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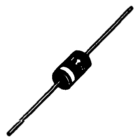
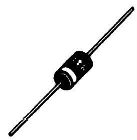
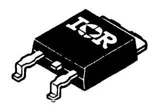
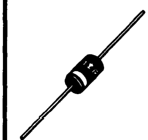
Schottky Diode Selection Guide

SURFACE MOUNT AND AXIAL LEAD PACKAGES

VOLTAGE	0.77A to 1.5A  D - 64	1A  DO - 204AL	3A  C-16	3A to 5A  D - PAK	6A CENTER TAP D - PAK	5A to 10A  DO - 204AR
15V ORING						95SQ015 (D-89)
30V STD						
40V	15MQ040 (D-15) 10MQ040 (D-3)	11DQ04 (D-53)	31DQ04 (D-65)	30WQ04F (D-17) 50WQ04F (D-29)	6CWQ04F (D-41)	
45V STD						90SQ045 (D-85)
45V HIGH TEMP.						80SQ045 (D-81)
60V	10MQ060 (D-7)	11DQ06 (D-57)	31DQ06 (D-69)	30WQ06F (D-21) 50WQ06F (D-33)	6CWQ06F (D-45)	
90V	10MQ090 (D-11)					
100V		11DQ10 (D-61)	31DQ10 (D-73)	30WQ10F (D-25) 50WQ10F (D-37)	6CWQ10F (D-49)	50SQ100 (D-77)
150V						

Notes:
1) (D-xxx) Signifies the page number of the data sheet

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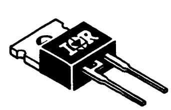
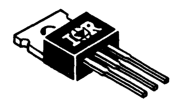
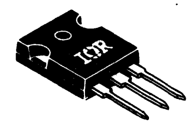
TO - 220 AND TO - 247 PACKAGES

	6A to 12A	15A to 20A	10A to 20A	25A to 30A	30A	40A
						
VOLTAGE	TO - 220AC		CENTER TAP TO - 220AB		CENTER TAP TO - 247AC	
15V ORING		19TQ015 (D-113)				
30V STD				32CTQ030 (D-159)		
45V LOW VF						
45V STD	12TQ045 (D-105)	20TQ045 (D-117)	15CTQ045 (D-135)	25CTQ045 (D-147)	30CPQ045 (D-171) MBR3045PT (D-199)	40CPQ045 (D-187)
45V HIGH TEMP.	6TQ045 (D-93) 10TQ045 (D-101) MBR745 (D-121) MBR1045 (D-123)	18TQ045 (D-109) MBR1645 (D-125)	12CTQ045 (D-131) 20CTQ045 (D-143) MBR1545CT (D-163) MBR2045CT (D-165)	30CTQ045 (D-151) MBR2545CT (D-169)		
60V				30CTQ060 (D-155)	30CPQ060 (D-175)	40CPQ060 (D-191)
100V	8TQ100 (D-97)		16CTQ100 (D-139) MBR20100CT (D-167)		30CPQ100 (D-179)	40CPQ100 (D-195)
150V			10CTQ150 (D-127)		30CPQ150 (D-183)	

Notes:
1) (D-xxx) Signifies the page number of the data sheet

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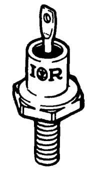
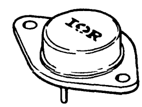
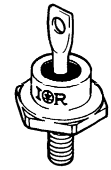
HERMETIC PACKAGES

VOLTAGE	20A to 30A  DO - 4	40A to 60A  CENTER TAP TO - 3	50A to 95A  DO - 5
15V ORING			95HQ015 (D-263)
30V STD			55HQ030 (D-247)
40V	1N6096 (D-227)		1N6098 (D-267)
45V LOW VF			
45V STD	20FQ045 (D-215) 21FQ045 (D-219)		50HQ045 (D-239) 51HQ045 (D-243)
45V HIGH TEMP.	30FQ045 (D-223) 1N6391 (D-231)	40CDQ045 (D-201) 60CDQ045 (D-205) MBR3045CT (D-209)	85HQ045 (D-259) 75HQ045 (D-255) 1N6392 (D-271) MBR7545 (D-275)
100V			60HQ100 (D-251)
150V			

Notes:
1) (D-xxx) Signifies the page number of the data sheet

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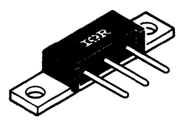
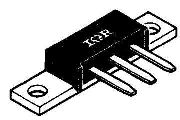
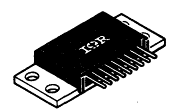
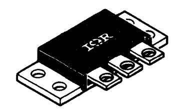
MODULES

VOLTAGE	60A  CENTER TAP D - 61 - 6	80A  CENTER TAP D - 61 - 8	150A  ISOLATED CENTER TAP D - 60	160A  ISOLATED CENTER TAP TO - 249
15V ORING		85CNQ015 (D-317)		
30V STD	62CNQ030 (D-289)	82CNQ030 (D-305)	62CMQ030 (D-329) 152CMQ030 (D-329)	162CMQ030 (D-345)
45V LOW VF		84CNQ045 (D-313)		
45V STD	60CNQ045 (D-281)	80CNQ045 (D-297)	60CMQ045 (D-321) 150CMQ045 (D-321)	160CMQ045 (D-337)
45V HIGH TEMP.	61CNQ045 (D-285)	81CNQ045 (D-301)	61CMQ045 (D-325) 151CMQ045 (D-325)	161CMQ045 (D-341)
60V				
100V	63CNQ100 (D-293)	83CNQ100 (D-309)	63CMQ100 (D-333) 153CMQ100 (D-333)	163CMQ100 (D-349)
150V				

Notes:

1) (D-xxx) Signifies the page number of the data sheet

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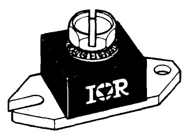
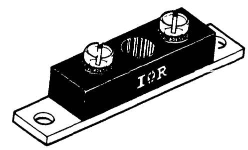
MODULES



HALF - PAK



CENTER TAP
TO - 244

VOLTAGE	120A (HALF - PAK)	180A (HALF - PAK)	240A (HALF - PAK)	200A (CENTER TAP TO - 244)	300A (CENTER TAP TO - 244)	400A (CENTER TAP TO - 244)
15V ORING	125NQ015 (D-373)	185NQ015 (D-393)	245NQ015 (D-417)	225CNQ015 (D-441)		
30V STD	122NQ030 (D-361)	182NQ030 (D-385)	242NQ030 (D-405)	220CNQ030 (D-433)		440CNQ030 (D-465)
45V LOW VF	124NQ045 (D-369)		244NQ045 (D-413)	224CNQ045 (D-437)		444CNQ045 (D-469)
45V STD	120NQ045 (D-353)	180NQ045 (D-377)	240NQ045 (D-397)	200CNQ045 (D-421)		400CNQ045 (D-453)
45V HIGH TEMP.	121NQ045 (D-357)	181NQ045 (D-381)	241NQ045 (D-401)	201CNQ045 (D-425)	301CNQ045 (D-445)	401CNQ045 (D-457)
60V						
100V	123NQ100 (D-365)	183NQ100 (D-389)	243NQ100 (D-409)	203CNQ100 (D-429)	303CNQ100 (D-449)	403CNQ100 (D-461)
150V						

Notes:
1) (D-xxx) Signifies the page number of the data sheet

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SECTION C

CROSS REFERENCE

CROSS
REFERENCE

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IR replacement numbers indicate the nearest IR equivalent and, in most instances, provide the user with an exact replacement device, or one of greater current and/or voltage rating. The user must qualify the replacement acceptability by reviewing the electrical, mechanical and thermal characteristics of the specific devices involved. For this reason, IR cannot guarantee that the suggested replacement part will, in every instance, serve as an exact replacement, and, therefore, assumes no responsibility for any consequences in the use of the replacements.

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Schottky Diode Cross Reference

Industry Part Number	IR Direct Replacement	IR Similar Replacement	Pg. No.
1N5817		11DQ03	D-53
1N5818		11DQ03	D-53
1N5819		11DQ04	D-53
1N5820		31DQ03	D-65
1N5821		31DQ03	D-65
1N5822		31DQ04	D-65
1N5826		20FQ035	D-215
1N5827		20FQ035	D-215
1N5828	20FQ040		D-215
1N5829		30FQ035	D-223
1N5830		30FQ035	D-223
1N5831		30FQ040	D-223
1N5832		50HQ035	D-239
1N5833		50HQ035	D-239
1N5834	50HQ040		D-239
1N6095	1N6095		D-227
1N6096	1N6096		D-227
1N6097	1N6097		D-267
1N6098	1N6098		D-267
1N6391	1N6391		D-231
1N6392	1N6392		D-271
4VQ03CTF		6CWQ03F	D-41
4VQ04CTF		6CWQ04F	D-41
4VQ05CTF		6CWQ05F	D-45
4VQ06CTF		6CWQ06F	D-45
4VQ09CTF		6CWQ09F	D-49
4VQ10CTF		6CWQ10F	D-49
5KQ03		6TQ035	D-93
5KQ04		6TQ040	D-93
5KQ09		8TQ090	D-97
5KQ10		8TQ100	D-97
6CWQ03F	6CWQ03F		D-41
6CWQ04F	6CWQ04F		D-41
6CWQ05F	6CWQ05F		D-45
6CWQ06F	6CWQ06F		D-45
6CWQ09F	6CWQ09F		D-49
6CWQ10F	6CWQ10F		D-49
6TQ035	6TQ035		D-93
6TQ040	6TQ040		D-93
6TQ045	6TQ045		D-93
6VQ03CTF		6CWQ03F	D-41
6VQ04CTF		6CWQ04F	D-41
6VQ05CTF		6CWQ05F	D-45
6VQ06CTF		6CWQ06F	D-45
6VQ09CTF		6CWQ09F	D-49
6VQ10CTF		6CWQ10F	D-49
8TQ060	8TQ080		D-97
8TQ080	8TQ080		D-97
8TQ090	8TQ100		D-97
8TQ100	8TQ100		D-97
10CTQ140	10CTQ150		D-127
10CTQ150	10CTQ150		D-127
10KQ03		12TQ035	D-105
10KQ04		12TQ040	D-105
10KQ09		8TQ100	D-97
10KQ10		8TQ100	D-97
10MQ040	10MQ040		D-3
10MQ060	10MQ060		D-7
10MQ090	10MQ090		D-11
10TQ030	10TQ035		D-101
10TQ035	10TQ035		D-101
10TQ040	10TQ040		D-101
10TQ045	10TQ045		D-101
11DQ03	11DQ03		D-53
11DQ04	11DQ04		D-53
11DQ05	11DQ05		D-57
11DQ06	11DQ06		D-57
11DQ09	11DQ09		D-61
11DQ10	11DQ10		D-61
11EQ03		11DQ03	D-53
11EQ04		11DQ04	D-53
11EQ05		11DQ05	D-57
11EQ06		11DQ06	D-57
11EQ09		11DQ09	D-61
11EQ10		11DQ10	D-61
11EQS03		11DQ03	D-53
11EQS04		11DQ04	D-53
11EQS05		11DQ05	D-57
11EQS06		11DQ06	D-57
11EQS09		11DQ09	D-61
11EQS10		11DQ10	D-61
12CTQ030	12CTQ035		D-131
12CTQ035	12CTQ035		D-131
12CTQ040	12CTQ040		D-131
12CTQ045	12CTQ045		D-131
12TQ030	12TQ035		D-105
12TQ035	12TQ035		D-105
12TQ045	12TQ045		D-105
15CTQ030	15CTQ035		D-135
15CTQ035	15CTQ035		D-135
15CTQ040	15CTQ040		D-135
15CTQ045	15CTQ045		D-135
15MQ040	15MQ040		D-15
16CTQ060	16CTQ080		D-139
16CTQ080	16CTQ080		D-139
16CTQ100	16CTQ100		D-139

Schottky Diode Cross Reference

Industry Part Number	IR Direct Replacement	IR Similar Replacement	Pg. No.
16MQ30		20FQ035	D-215
16MQ40		20FQ040	D-215
18TQ030	18TQ035		D-109
18TQ035	18TQ035		D-109
18TQ040	18TQ040		D-109
18TQ045	18TQ045		D-109
19TQ007	19TQ015		D-113
19TQ015	19TQ015		D-113
20CTQ030	20CTQ035		D-143
20CTQ035	20CTQ035		D-143
20CTQ040	20CTQ040		D-143
20CTQ045	20CTQ045		D-143
20FQ030	20FQ035		D-215
20FQ035	20FQ035		D-215
20FQ040	20FQ040		D-215
20FQ045	20FQ045		D-215
20TQ035	20TQ035		D-117
20TQ040	20TQ040		D-117
20TQ045	20TQ045		D-117
21DQ03		31DQ03	D-65
21DQ04		31DQ04	D-65
21DQ05		31DQ05	D-69
21DQ06		31DQ06	D-69
21DQ09		31DQ09	D-73
21DQ10		31DQ10	D-73
21FQ030	21FQ035		D-219
21FQ035	21FQ035		D-219
21FQ040	21FQ040		D-219
21FQ045	21FQ045		D-219
25CTQ030	25CTQ035		D-147
25CTQ035	25CTQ035		D-147
25CTQ040	25CTQ040		D-147
25CTQ045	25CTQ045		D-147
30CPQ035	30CPQ035		D-171
30CPQ040	30CPQ040		D-171
30CPQ045	30CPQ045		D-171
30CPQ050	30CPQ050		D-175
30CPQ060	30CPQ060		D-175
30CPQ080	30CPQ080		D-179
30CPQ100	30CPQ100		D-179
30CPQ150	30CPQ150		D-183
30CTQ030	30CTQ035		D-151
30CTQ035	30CTQ035		D-151
30CTQ040	30CTQ040		D-151
30CTQ045	30CTQ045		D-151
30CTQ050	30CTQ050		D-155
30CTQ060	30CTQ060		D-155
30FQ030	30FQ035		D-223

Industry Part Number	IR Direct Replacement	IR Similar Replacement	Pg. No.
30FQ035	30FQ035		D-223
30FQ040	30FQ040		D-223
30FQ045	30FQ045		D-223
30VQ03F	30WQ03F		D-17
30VQ04F	30WQ04F		D-17
30VQ05F	30WQ05F		D-21
30VQ06F	30WQ06F		D-21
30VQ09F	30WQ09F		D-25
30VQ10F	30WQ10F		D-25
30WQ03F	30WQ03F		D-17
30WQ04F	30WQ04F		D-17
30WQ05F	30WQ05F		D-21
30WQ06F	30WQ06F		D-21
30WQ09F	30WQ09F		D-25
30WQ10F	30WQ10F		D-25
31DQ03	31DQ03		D-65
31DQ04	31DQ04		D-65
31DQ05	31DQ05		D-69
31DQ06	31DQ06		D-69
31DQ09	31DQ09		D-73
31DQ10	31DQ10		D-73
31MQ30		50HQ035	D-239
31MQ40		50HQ040	D-239
32CTQ030	32CTQ030		D-159
40CDQ030	40CDQ035		D-201
40CDQ035	40CDQ035		D-201
40CDQ040	40CDQ040		D-201
40CDQ045	40CDQ045		D-201
40CPQ035	40CPQ035		D-187
40CPQ040	40CPQ040		D-187
40CPQ045	40CPQ045		D-187
40CPQ050	40CPQ050		D-191
40CPQ060	40CPQ060		D-191
40CPQ080	40CPQ080		D-195
40CPQ100	40CPQ100		D-195
41MQ30		50HQ035	D-239
41MQ40		50HQ040	D-239
50HQ030	50HQ035		D-239
50HQ035	50HQ035		D-239
50HQ040	50HQ040		D-239
50HQ045	50HQ045		D-239
50SQ060	50SQ080		D-77
50SQ080	50SQ080		D-77
50SQ090	50SQ100		D-77
50SQ100	50SQ100		D-77
50VQ03F		50WQ03F	D-29
50VQ04F		50WQ04F	D-29
50VQ05F		50WQ05F	D-33

Schottky Diode Cross Reference

Industry Part Number	IR Direct Replacement	IR Similar Replacement	Pg. No.
50VQ06F		50WQ06F	D-33
50VQ09F		50WQ09F	D-37
50VQ10F		50WQ10F	D-37
50WQ03F	50WQ03F		D-29
50WQ04F	50WQ04F		D-29
50WQ05F	50WQ05F		D-33
50WQ06F	50WQ06F		D-33
50WQ09F	50WQ09F		D-37
50WQ10F	50WQ10F		D-37
51HQ030	51HQ035		D-243
51HQ035	51HQ035		D-243
51HQ040	51HQ040		D-243
51HQ045	51HQ045		D-243
55HQ015	55HQ030		D-247
55HQ020	55HQ030		D-247
55HQ025	55HQ030		D-247
55HQ030	55HQ030		D-247
60CDQ030	60CDQ035		D-205
60CDQ035	60CDQ035		D-205
60CDQ040	60CDQ040		D-205
60CDQ045	60CDQ045		D-205
60CMQ035	150CMQ035		D-321
60CMQ040	150CMQ040		D-321
60CMQ045	150CMQ045		D-321
60CNQ035	60CNQ035		D-281
60CNQ040	60CNQ040		D-281
60CNQ045	60CNQ045		D-281
60HQ060	60HQ080		D-251
60HQ080	60HQ080		D-251
60HQ090	60HQ100		D-251
60HQ100	60HQ100		D-251
61CMQ035	151CMQ035		D-325
61CMQ040	151CMQ040		D-325
61CMQ045	151CMQ045		D-325
61CNQ035	61CNQ035		D-285
61CNQ040	61CNQ040		D-285
61CNQ045	61CNQ045		D-285
61MQ30		50HQ035	D-239
61MQ40		50HQ040	D-239
62CMQ025	152CMQ030		D-329
62CMQ030	152CMQ030		D-329
62CNQ025	62CNQ030		D-289
62CNQ030	62CNQ030		D-289
63CMQ060	153CMQ080		D-333
63CMQ080	153CMQ080		D-333
63CMQ100	153CMQ100		D-333
63CNQ060	63CNQ080		D-293
63CNQ080	63CNQ080		D-293
63CNQ100	63CNQ100		D-293
75HQ030	75HQ035		D-255
75HQ035	75HQ035		D-255
75HQ040	75HQ040		D-255
75HQ045	75HQ045		D-255
80CNQ035	80CNQ035		D-297
80CNQ040	80CNQ040		D-297
80CNQ045	80CNQ045		D-297
80SQ030	80SQ035		D-81
80SQ035	80SQ035		D-81
80SQ040	80SQ040		D-81
80SQ045	80SQ045		D-81
81CNQ035	81CNQ035		D-301
81CNQ040	81CNQ040		D-301
81CNQ045	81CNQ045		D-301
82CNQ025	82CNQ030		D-305
82CNQ030	82CNQ030		D-305
83CNQ060	83CNQ080		D-309
83CNQ080	83CNQ080		D-309
83CNQ100	83CNQ100		D-309
84CNQ035	84CNQ035		D-313
84CNQ040	84CNQ040		D-313
84CNQ045	84CNQ045		D-313
85CNQ007	85CNQ015		D-317
85CNQ015	85CNQ015		D-317
85HQ030	85HQ035		D-259
85HQ035	85HQ035		D-259
85HQ040	85HQ040		D-259
85HQ045	85HQ045		D-259
90SQ030	90SQ035		D-85
90SQ035	90SQ035		D-85
90SQ040	90SQ040		D-85
90SQ045	90SQ045		D-85
95HQ015	95HQ015		D-263
95SQ015	95SQ015		D-89
120NQ035	120NQ035		D-353
120NQ040	120NQ040		D-353
120NQ045	120NQ045		D-353
121NQ035	121NQ035		D-357
121NQ040	121NQ040		D-357
121NQ045	121NQ045		D-357
122NQ030	122NQ030		D-361
123NQ080	123NQ080		D-365
123NQ100	123NQ100		D-365
124NQ035	124NQ035		D-369
124NQ040	124NQ040		D-369
124NQ045	124NQ045		D-369
125NQ015	125NQ015		D-373

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150CMQ035	150CMQ035		D-321
150CMQ040	150CMQ040		D-321
150CMQ045	150CMQ045		D-321
151CMQ035	151CMQ035		D-325
151CMQ040	151CMQ040		D-325
151CMQ045	151CMQ045		D-325
152CMQ030	152CMQ030		D-329
153CMQ080	153CMQ080		D-333
153CMQ100	153CMQ100		D-333
160CMQ035	160CMQ035		D-337
160CMQ040	160CMQ040		D-337
160CMQ045	160CMQ045		D-337
161CMQ035	161CMQ035		D-341
161CMQ040	161CMQ040		D-341
161CMQ045	161CMQ045		D-341
162CMQ030	162CMQ030		D-345
163CMQ080	163CMQ080		D-349
163CMQ100	163CMQ100		D-349
180NQ035	180NQ035		D-377
180NQ040	180NQ040		D-377
180NQ045	180NQ045		D-377
181NQ035	181NQ035		D-381
181NQ040	181NQ040		D-381
181NQ045	181NQ045		D-381
182NQ030	182NQ030		D-385
183NQ080	183NQ080		D-389
183NQ100	183NQ100		D-389
185NQ015	185NQ015		D-393
200CNQ035	200CNQ035		D-421
200CNQ040	200CNQ040		D-421
200CNQ045	200CNQ045		D-421
201CNQ035	201CNQ035		D-425
201CNQ040	201CNQ040		D-425
201CNQ045	201CNQ045		D-425
203CNQ080	203CNQ080		D-429
203CNQ100	203CNQ100		D-429
220CNQ030	220CNQ030		D-433
224CNQ035	224CNQ035		D-437
224CNQ040	224CNQ040		D-437
224CNQ045	224CNQ045		D-437
225CNQ015	225CNQ015		D-441
240NQ035	240NQ035		D-397
240NQ040	240NQ040		D-397
240NQ045	240NQ045		D-397
241NQ035	241NQ035		D-401
241NQ040	241NQ040		D-401
241NQ045	241NQ045		D-401
242NQ030	242NQ030		D-405
243NQ080	243NQ080		D-409
243NQ100	243NQ100		D-409
244NQ035	244NQ035		D-413
244NQ040	244NQ040		D-413
244NQ045	244NQ045		D-413
245NQ015	245NQ015		D-417
301CNQ035	301CNQ035		D-445
301CNQ040	301CNQ040		D-445
301CNQ045	301CNQ045		D-445
303CNQ080	303CNQ080		D-449
303CNQ100	303CNQ100		D-449
400CNQ035	400CNQ035		D-453
400CNQ040	400CNQ040		D-453
400CNQ045	400CNQ045		D-453
401CNQ035	401CNQ035		D-457
401CNQ040	401CNQ040		D-457
401CNQ045	401CNQ045		D-457
403CNQ080	403CNQ080		D-461
403CNQ100	403CNQ100		D-461
440CNQ025	440CNQ030		D-465
440CNQ030	440CNQ030		D-465
444CNQ035	444CNQ035		D-469
444CNQ040	444CNQ040		D-469
444CNQ045	444CNQ045		D-469
BYV10-30	11DQ03		D-53
BYV10-40	11DQ04		D-53
BYV10-60	11DQ06		D-57
BYV18-35	12CTQ035		D-131
BYV18-40A	12CTQ040		D-131
BYV18-45	12CTQ045		D-131
BYV19-35	10TQ035		D-101
BYV19-40A	10TQ040		D-101
BYV19-45	10TQ045		D-101
BYV20-35	20FQ035		D-215
BYV20-40A	20FQ040		D-215
BYV20-45	20FQ045		D-215
BYV21-35	20FQ035		D-215
BYV21-40A	20FQ040		D-215
BYV21-45	20FQ045		D-215
BYV33-35	20CTQ035		D-143
BYV33-40A	20CTQ040		D-143
BYV33-45	20CTQ045		D-143
BYV43-35	25CTQ035		D-147
BYV43-40A	25CTQ040		D-147
BYV43-45	25CTQ045		D-147
BYV73-35	30CPQ035		D-171
BYV73-40A	30CPQ040		D-171
BYV73-45	30CPQ045		D-171

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BYV118-35	12CTQ035		D-131
BYV118-40	12CTQ040		D-131
BYV118-45	12CTQ045		D-131
BYV120-35	30FQ035		D-223
BYV120-40	20FQ040		D-215
BYV120-45	30FQ045		D-223
BYV121-35	20FQ035		D-215
BYV121-40	20FQ040		D-215
BYV121-45	20FQ045		D-215
BYV133-35	20CTQ035		D-143
BYV133-40	20CTQ040		D-143
BYV133-45	20CTQ045		D-143
BYV143-35	30CTQ035		D-151
BYV143-40	30CTQ040		D-151
BYV143-45	30CTQ045		D-151
C8P03Q		15CTQ035	D-135
C8P04Q		15CTQ040	D-135
C10P03Q		15CTQ035	D-135
C10P04Q		15CTQ040	D-135
C10P09Q		16CTQ100	D-139
C10P10Q		16CTQ100	D-139
C16P03Q		30CPQ035	D-171
C16P04Q		30CPQ040	D-171
C16P05Q		30CPQ050	D-175
C16P06Q		30CPQ060	D-175
C16P09Q		30CPQ100	D-179
C16P10Q		30CPQ100	D-179
C25P03Q		30CPQ035	D-171
C25P04Q		30CPQ040	D-171
C25P05Q		30CPQ050	D-175
C25P06Q		30CPQ060	D-175
C25P09Q		30CPQ100	D-179
C25P10Q		30CPQ100	D-179
C30P03Q	30CPQ035		D-171
C30P04Q	30CPQ040		D-171
C30P05Q	30CPQ050		D-175
C30P06Q	30CPQ060		D-175
C30P09Q	30CPQ100		D-179
C30P10Q	30CPQ100		D-179
CPT12035		200CNQ035	D-421
CPT12040		200CNQ040	D-421
CPT12045		200CNQ045	D-421
CPT12050		203CNQ080	D-429
CPT20035		200CNQ035	D-421
CPT20040		200CNQ040	D-421
CPT20045		200CNQ045	D-421
CPT20050		203CNQ080	D-429
CPT20130		220CNQ030	D-433

Industry Part Number	IR Direct Replacement	IR Similar Replacement	Pg. No.
CPT20135		201CNQ035	D-425
CPT30035		301CNQ035	D-445
CPT30040		301CNQ040	D-445
CPT30045		301CNQ045	D-445
CPT30050		303CNQ080	D-449
CPT40035		400CNQ035	D-453
CPT40040		400CNQ040	D-453
CPT40045		400CNQ045	D-453
CPT40050		403CNQ080	D-461
CPT40135		400CNQ035	D-453
EA20QS03-F	30WQ03F		D-17
EA20QS04-F	30WQ04F		D-17
EA20QS05-F	30WQ05F		D-21
EA20QS06-F	30WQ06F		D-21
EA20QS09-F	30WQ09F		D-25
EA20QS10-F	30WQ10F		D-25
EA30QS03-F		50WQ03F	D-29
EA30QS04-F		50WQ04F	D-29
EA30QS05-F		50WQ05F	D-33
EA30QS06-F		50WQ06F	D-33
EA30QS09-F		50WQ09F	D-37
EA30QS10-F		50WQ10F	D-37
EA40QC03-F		6CWQ03F	D-41
EA40QC04-F		6CWQ04F	D-41
EA40QC05-F		6CWQ05F	D-45
EA40QC06-F		6CWQ06F	D-45
EA40QC09-F		6CWQ09F	D-49
EA40QC10-F		6CWQ10F	D-49
EA60QC03-F	6CWQ03F		D-41
EA60QC04-F	6CWQ04F		D-41
EA60QC05-F	6CWQ05F		D-45
EA60QC06-F	6CWQ06F		D-45
EA60QC09-F	6CWQ09F		D-49
EA60QC10-F	6CWQ10F		D-49
EC10QS03		10MQ040	D-3
EC10QS04	10MQ040		D-3
EC10QS05		10MQ060	D-7
EC10QS06	10MQ060		D-7
EC10QS09	10MQ090		D-11
EC15QS03		15MQ040	D-15
EC15QS04	15MQ040		D-15
FST2035	20CTQ035		D-143
FST2045	20CTQ045		D-143
FST3030	30CPQ035		D-171
FST3040	30CPQ040		D-171
FST3050	30CPQ050		D-175
FST3060	30CPQ060		D-175
FST5030		40CPQ035	D-187

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FST5040		40CPQ040	D-187
FST5050		40CPQ050	D-191
FST6035		150CMQ035	D-321
FST6040		150CMQ040	D-321
FST6045		150CMQ045	D-321
FST6050		153CMQ080	D-333
FST8035		80CNQ035	D-297
FST8040		80CNQ040	D-297
FST8045		80CNQ045	D-297
FST8050		83CNQ080	D-309
FST8130		82CNQ030	D-305
FST8135		80CNQ035	D-297
FST10030		162CMQ030	D-345
FST10035		161CMQ035	D-341
FST10130		152CMQ030	D-329
FST10135		151CMQ035	D-325
FST12030		162CMQ030	D-345
FST12035		161CMQ035	D-341
FST16035		160CMQ035	D-337
FST16040		160CMQ040	D-337
FST16045		160CMQ045	D-337
FST16050		163CMQ080	D-349
FST17135		160CMQ035	D-337
FST17140		160CMQ040	D-337
FST17145		160CMQ045	D-337
FST17150		163CMQ080	D-349
FST19035		160CMQ035	D-337
FST19040		160CMQ040	D-337
FST19045		160CMQ045	D-337
FST19050		163CMQ080	D-349
FST20035		200CNQ035	D-421
FST20040		200CNQ040	D-421
FST20045		200CNQ045	D-421
FST20050		203CNQ080	D-429
FST30035		301CNQ035	D-445
FST30040		301CNQ040	D-445
FST30045		301CNQ045	D-445
FST30050		303CNQ080	D-449
MBR030		11DQ03	D-53
MBR040		11DQ04	D-53
MBR115P		11DQ03	D-53
MBR120P		11DQ03	D-53
MBR130P	11DQ03		D-53
MBR140P	11DQ04		D-53
MBR150	11DQ05		D-57
MBR160	11DQ06		D-57
MBR170		11DQ09	D-61
MBR180		11DQ09	D-61
MBR190	11DQ09		D-61
MBR320		31DQ03	D-65
MBR320P		31DQ03	D-65
MBR330	31DQ03		D-65
MBR330P	31DQ03		D-65
MBR340	31DQ04		D-65
MBR340P	31DQ04		D-65
MBR350	31DQ05		D-69
MBR360	31DQ06		D-69
MBR370		31DQ09	D-73
MBR380		31DQ09	D-73
MBR390	31DQ09		D-73
MBR735	MBR735	6TQ035	D-121, D-93
MBR745	MBR745	6TQ045	D-121, D-93
MBR1035	MBR1035	10TQ035	D-123, D-101
MBR1045	MBR1045	10TQ045	D-123, D-101
MBR1050		8TQ080	D-97
MBR1060	8TQ080		D-97
MBR1070	8TQ080		D-97
MBR1080	8TQ080		D-97
MBR1090	8TQ100		D-97
MBR1100	11DQ10		D-61
MBR1535CT	MBR1535CT	12CTQ035	D-163, D-131
MBR1545CT	MBR1545CT	12CTQ045	D-163, D-131
MBR1550CT	16CTQ080		D-139
MBR1560CT	16CTQ080		D-139
MBR1635	MBR1635	18TQ035	D-125, D-109
MBR1645	MBR1645	18TQ045	D-125, D-109
MBR2035CT	MBR2035CT	20CTQ035	D-165, D-143
MBR2045CT	MBR2045CT	20CTQ045	D-165, D-143
MBR2060CT	30CTQ060		D-151
MBR2070CT	16CTQ080		D-139
MBR2080CT	MBR2080CT	16CTQ080	D-167, D-139
MBR2090CT		16CTQ100	D-139
MBR2535CT	MBR2535CT	30CTQ035	D-169, D-151
MBR2545CT	MBR2545CT	30CTQ045	D-169, D-151
MBR2530CTL		32CTQ030	D-159
MBR2535CTL		25CTQ035	D-147
MBR3100	31DQ10		D-73
MBR3520		30FQ035	D-223
MBR3535	30FQ035		D-223
MBR3545	30FQ045		D-223
MBR6015L		55HQ030	D-247
MBR6020L		55HQ030	D-247
MBR6025L		55HQ030	D-247
MBR6030L	55HQ030		D-247
MBR6035	75HQ035		D-255
MBR6045	75HQ045		D-255

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MBR6535	75HQ035		D-255
MBR6545	75HQ045		D-255
MBR7535	MBR7535	75HQ035	D-275, D-255
MBR7540	MBR7540	75HQ040	D-275, D-255
MBR7545	MBR7545	75HQ045	D-275, D-255
MBR8035		85HQ035	D-259
MBR8045		85HQ045	D-259
MBR3035CT	MBR3035CT	40CDQ035	D-209, D-201
MBR3045CT	MBR3045CT	40CDQ045	D-209, D-201
MBR3035PT	MBR3035PT	30CPQ035	D-199, D-171
MBR3045PT	MBR3045PT	30CPQ045	D-199, D-171
MBR3045WT	30CPQ045		D-171
MBR3050PT		30CPQ050	D-175
MBR3060PT		30CPQ060	D-175
MBR4035PT		40CPQ035	D-187
MBR4045PT		40CPQ045	D-187
MBR4045WT	40CPQ045		D-187
MBR4050PT		40CPQ050	D-191
MBR4060PT		40CPQ060	D-191
MBR10100	8TQ100		D-97
MBR12035CT		201CNQ035	D-425
MBR12045CT		201CNQ045	D-425
MBR16035CT		160CMQ035	D-337
MBR16045CT		160CMQ045	D-337
MBR16050CT		163CMQ080	D-349
MBR20015CTL		220CNQ030	D-433
MBR20020CTL		220CNQ030	D-433
MBR20025CTL		220CNQ030	D-433
MBR20030CTL		220CNQ030	D-433
MBR20035CT		201CNQ035	D-425
MBR20045CT		201CNQ045	D-425
MBR20050CT		203CNQ080	D-429
MBR20060CT		203CNQ080	D-429
MBR20080CT	MBR2080CT	16CTQ080	D-167, D-139
MBR20100CT	MBR20100CT	16CTQ100	D-167, D-139
MBR30035CT		301CNQ035	D-445
MBR30045CT		301CNQ045	D-445
MBR30050CT		303CNQ080	D-449
MBR30060CT		303CNQ080	D-449
MBRD330		30WQ03F	D-17
MBRD340		30WQ04F	D-17
MBRD350		30WQ05F	D-21
MBRD360		30WQ06F	D-21
MBRD630CT	6CWQ03F		D-41
MBRD640CT	6CWQ04F		D-41
MBRD650CT	6CWQ05F		D-45
MBRD660CT	6CWQ06F		D-45
MS104	11DQ04		D-53

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MS105	11DQ05		D-57
MS106	11DQ06		D-57
MS304	31DQ04		D-65
MS305	31DQ05		D-69
MS306	31DQ06		D-69
MS503		80SQ035	D-81
MS504		80SQ045	D-81
MS505		50SQ080	D-77
MS506		50SQ080	D-77
MS835		80SQ035	D-81
MS840		80SQ040	D-81
MS845		80SQ045	D-81
MS1003	10TQ035		D-101
MS1004	10TQ040		D-101
MS1005		8TQ080	D-97
MS1006		8TQ080	D-97
MS1635	18TQ035		D-109
MS1645	18TQ045		D-109
PBYR735	6TQ035		D-93
PBYR740	6TQ040		D-93
PBYR745	6TQ045		D-93
PBYR1035	10TQ035		D-101
PBYR1040	10TQ040		D-101
PBYR1045	10TQ045		D-101
PBYR1535CT	15CTQ035		D-135
PBYR1540CT	15CTQ040		D-135
PBYR1545CT	15CTQ045		D-135
PBYR1635	18TQ035		D-109
PBYR1640	18TQ040		D-109
PBYR1645	18TQ045		D-109
PBYR2035CT	20CTQ035		D-143
PBYR2040CT	20CTQ040		D-143
PBYR2045CT	20CTQ045		D-143
PBYR2535CT	30CTQ035		D-151
PBYR2540CT	30CTQ040		D-151
PBYR2545CT	30CTQ045		D-151
PBYR3035PT	30CPQ035		D-171
PBYR3040PT	30CPQ040		D-171
PBYR3045PT	30CPQ045		D-171
PBYR30035CT		301CNQ035	D-445
PBYR30040CT		301CNQ040	D-445
PBYR30045CT		301CNQ045	D-445
PBYR40035CT		401CNQ035	D-457
PBYR40040CT		401CNQ040	D-457
PBYR40045CT		401CNQ045	D-457
PHBR1635	18TQ035		D-109
PHBR1640	18TQ040		D-109
PHBR1645	18TQ045		D-109

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SB030		11DQ03	D-53
SB040		11DQ04	D-53
SB120		11DQ03	D-53
SB130	11DQ03		D-53
SB140	11DQ04		D-53
SB150	11DQ05		D-57
SB160	11DQ06		D-57
SB190	11DQ09		D-61
SB320		31DQ03	D-65
SB330		31DQ03	D-65
SB340		31DQ04	D-65
SB350		31DQ05	D-69
SB360		31DQ06	D-69
SB390		31DQ09	D-73
SB520		80SQ035	D-81
SB530		80SQ035	D-81
SB540		80SQ040	D-81
SB550		50SQ080	D-77
SB560		50SQ080	D-77
SB590		50SQ100	D-77
SB1100		11DQ10	D-61
SB3100		31DQ10	D-73
SB5100	50SQ100		D-77
SBL530	6TQ035		D-93
SBL530CT	12CTQ035		D-131
SBL540	6TQ040		D-93
SBL540CT	12CTQ040		D-131
SBL1030	10TQ035		D-101
SBL1030CT	12CTQ035		D-131
SBL1040	10TQ040		D-101
SBL1040CT	12CTQ045		D-131
SBL1050		8TQ080	D-97
SBL1060		8TQ080	D-97
SBL1630CT	15CTQ035		D-135
SBL1640CT	15CTQ040		D-135
SBL3030PT	30CPQ035		D-171
SBL3040PT	30CPQ040		D-171
SBR2535	20FQ035		D-215
SBR3035	30FQ035		D-223
SBR3040	30FQ040		D-223
SBR3045	30FQ045		D-223
SBR6030	55HQ030		D-247
SBR6035	50HQ035		D-239
SBR8035	85HQ035		D-259
SBR8040	85HQ040		D-259
SBR8045	85HQ045		D-259
SBT3035	40CDQ035		D-201
SBT3040	40CDQ040		D-201
SBT3045	40CDQ045		D-201
SD41	SD41		D-235
SD51	SD51		D-277
SD241	SD241		D-211
SD241P		30CP035	D-171
USD335C	40CDQ035		D-201
USD535	75HQ035		D-255
USD545	75HQ045		D-255
USD635	6TQ035		D-93
USD635C	12CTQ035		D-131
USD640	6TQ040		D-93
USD640C	12CTQ040		D-131
USD645	6TQ045		D-93
USD645C	12CTQ045		D-131
USD735	10TQ035		D-101
USD735C	20CTQ035		D-143
USD740	10TQ040		D-101
USD740C	20CTQ040		D-143
USD745	10TQ045		D-101
USD745C	20CTQ045		D-143
USD835	12TQ035		D-105
USD840	12TQ040		D-105
USD845	12TQ045		D-105
USD935	18TQ035		D-109
USD940	18TQ040		D-109
USD945	18TQ045		D-109
VSK13	12CTQ030		D-131
VSK14	12CTQ040		D-131
VSK130	11DQ03		D-53
VSK140	11DQ04		D-53
VSK1035	10TQ035		D-101
VSK1045	10TQ045		D-101
VSK1530	1N6095		D-227
VSK1540	1N6096		D-227
VSK1680	16CTQ080		D-139
VSK2035	20CTQ035		D-143
VSK2045	20CTQ045		D-143
VSK2435	30CTQ035		D-151
VSK2445	30CTQ045		D-151

Schottky Diode Designer's Manual

Schottky Diode Designer's Manual

Data Sheets

The power device listed in this Designer's Manual represent International Rectifier's most recent Schottky diode line. The data presented in this manual supersedes all previous specifications.

International IOR Rectifier

International IOR Rectifier

10MQ040

SCHOTTKY RECTIFIER

1.1 Amp

Major Ratings and Characteristics

Characteristics	10MQ040	Units
$I_{F(AV)}$ Rectangular waveform	1.1	A
V_{RRM}	40	V
I_{FSM} @ tp = 5 μs sine	120	A
V_F @ 1.1Apk, T_J = 125°C	0.51	V
T_J	- 40 to 125	°C

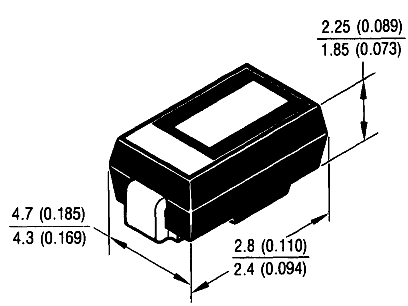
Description/Features

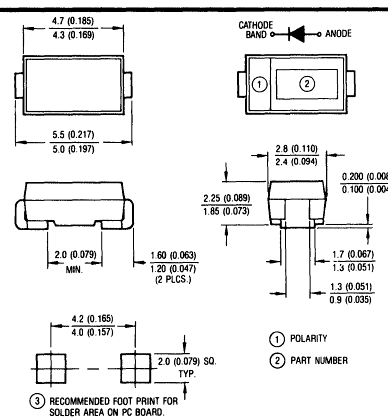
The 10MQ040 surface mount Schottky rectifier has been designed for applications requiring low forward drop and very small foot prints on PC boards. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS





Outline D - 64

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-473

Voltage Ratings

	Part number	10MQ040
V_R	Max. DC Reverse Voltage (V)	40
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	10MQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	1.1	A	50% duty cycle @ T_C = 92 °C, rectangular wave form On PC board 3mm. x 3mm. island	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	120	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current * See Fig. 7	30		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	10MQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.55	V	@ 1.1A	T_J = 25 °C
	* See Fig. 1	0.71	V	@ 2.2A	
		0.51	V	@ 1.1A	T_J = 125 °C
		0.67	V	@ 2.2A	
I_{RM}	Max. Reverse Leakage Current (1)	1	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2	50	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	50	pF	V_R = 10V_{DC}, T_J = 25°C, test signal = 1Mhz	
L_S	Typical Series Inductance	2.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	10MQ	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	160	°C/W	DC operation
wt	Approximate Weight	0.07(0.026)	g (oz.)	
	Case Style	D-64		

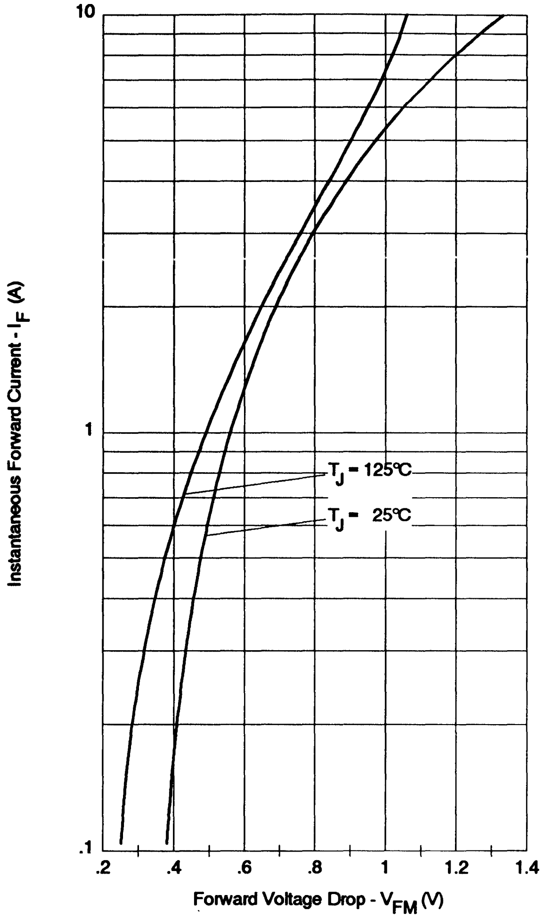


Fig. 1 - Maximum Forward Voltage Drop Characteristics

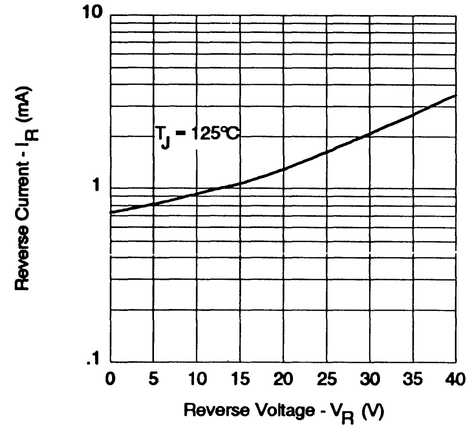


Fig. 2 - Typical Peak Reverse Current Vs. Reverse Voltage

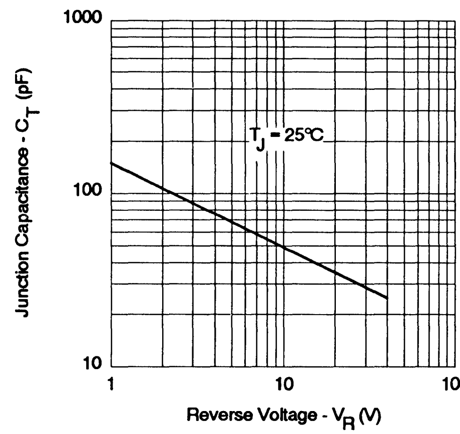


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

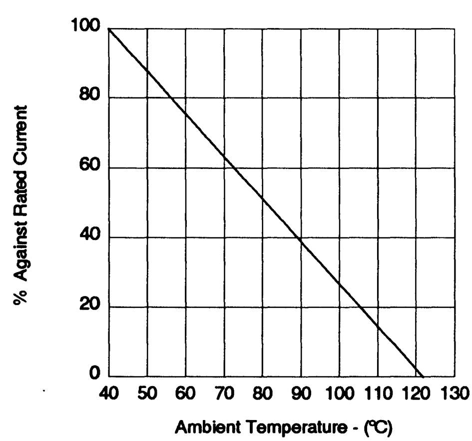


Fig. 4 - Maximum % Against Rated Current Vs. Ambient Temperature

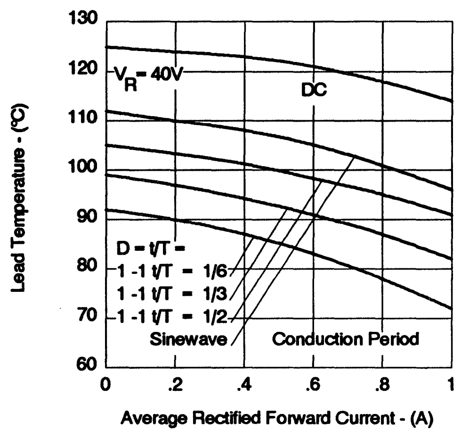


Fig. 5 - Maximum Average Forward Current Vs. Allowable Lead Temperature

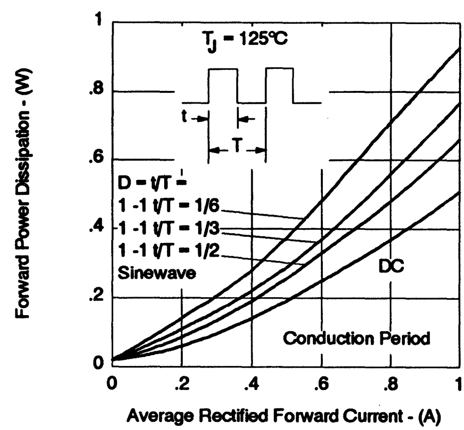


Fig. 6 - Maximum Average Forward Dissipation Vs. Average Forward Current

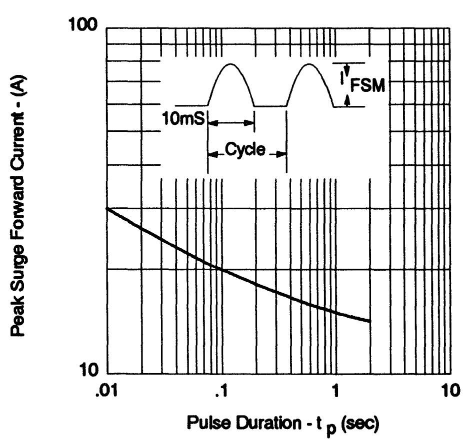


Fig. 7 - Maximum Peak Surge Forward Current Vs. Pulse Duration

International Rectifier

10MQ060

SCHOTTKY RECTIFIER

0.77 Amp

Major Ratings and Characteristics

Characteristics	10MQ060	Units
$I_{F(AV)}$ Rectangular waveform	0.77	A
V_{RRM}	60	V
I_{FSM} @ tp = 5 μs sine	40	A
V_F @ 0.77Apk, T_J = 125°C	0.57	V
T_J	-40 to 125	°C

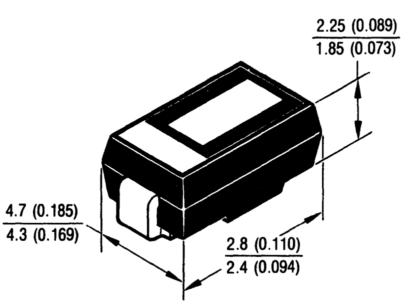
Description/Features

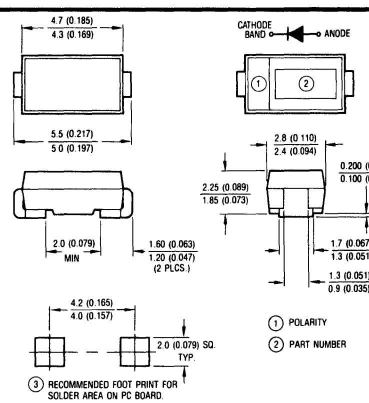
The 10MQ060 surface mount Schottky rectifier has been designed for applications requiring low forward drop and very small foot prints on PC boards. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS





Outline D - 64

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-473

Voltage Ratings

	Part number	10MQ060
V_R	Max. DC Reverse Voltage (V)	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	10MQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	0.77	A	50% duty cycle @ T_C = 110 °C, rectangular wave form On PC board 3mm. x 3mm. island	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current *See Fig. 7	40	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		10		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	10MQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.62	V	@ 0.77A	T_J = 25 °C
		0.80	V	@ 1.54A	
		0.57	V	@ 0.77A	T_J = 125 °C
		0.72	V	@ 1.54A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	1	mA	T_J = 25 °C	V_R = rated V_R
		7.5	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	33	pF	V_R = 10V_{DC}, T_J = 25°C, test signal = 1Mhz	
L_S	Typical Series Inductance	2.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	10MQ	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	160	°C/W	DC operation
wt	Approximate Weight	0.07(0.026)	g (oz.)	
	Case Style	D-64		

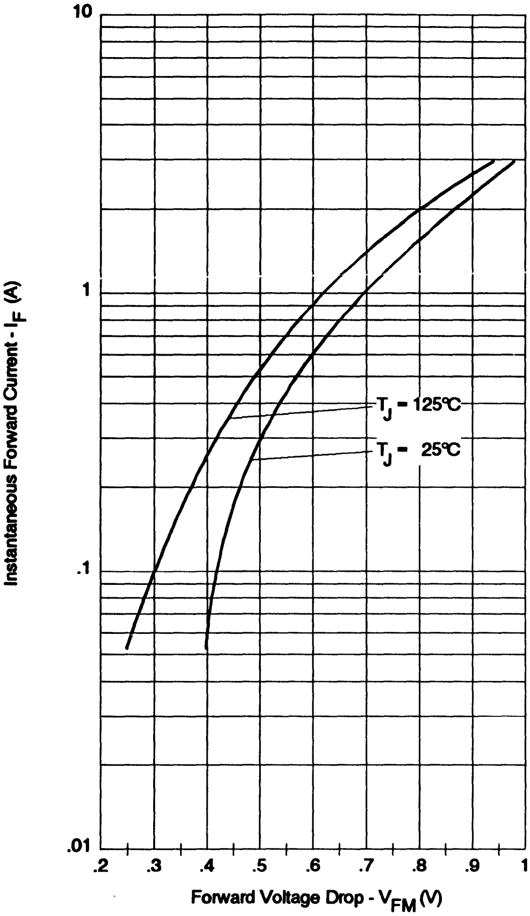


Fig. 1 - Maximum Forward Voltage Drop Characteristics

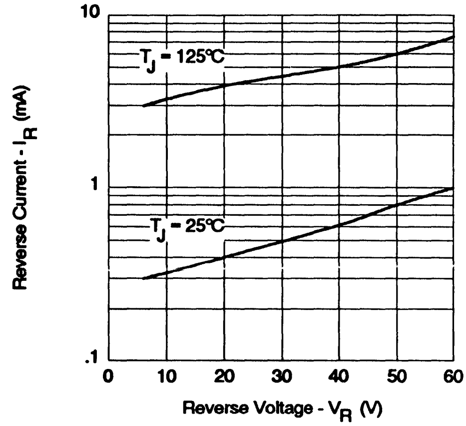


Fig. 2 - Typical Peak Reverse Current Vs. Peak Reverse Voltage

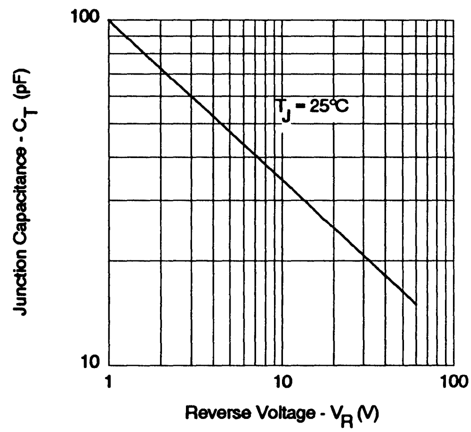


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

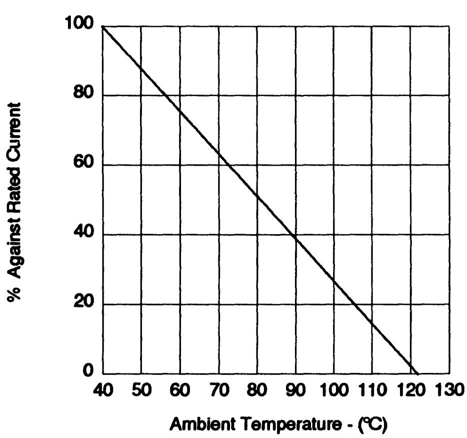


Fig. 4 - Maximum % Against Rated Current Vs. Ambient Temperature

SURFACE MOUNT & AXIAL LEAD

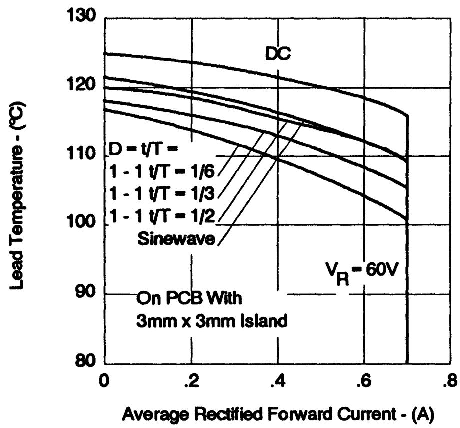


Fig. 5 - Maximum Average Forward Current Vs. Allowable Lead Temperature

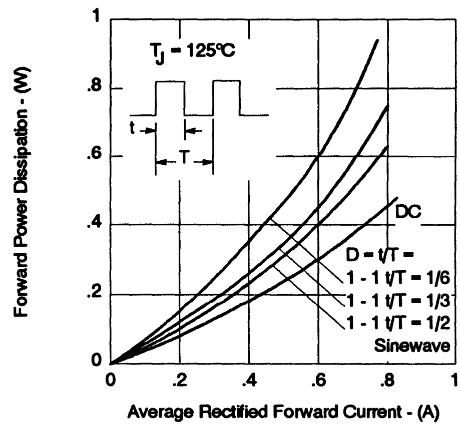


Fig. 6 - Maximum Average Dissipation Vs. Average Forward Current

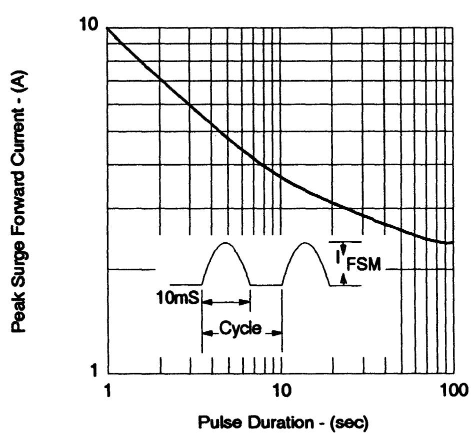


Fig. 7 - Maximum Peak Surge Forward Current Vs. Pulse Duration

International IOR Rectifier

10MQ090

SCHOTTKY RECTIFIER

0.77 Amp

Major Ratings and Characteristics

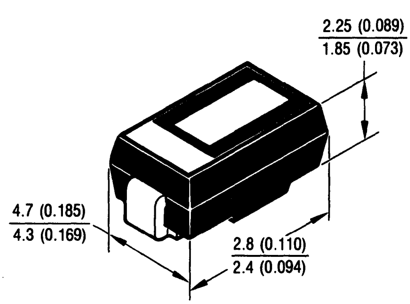
Characteristics	10MQ090	Units
$I_{F(AV)}$ Rectangular waveform	0.77	A
V_{RRM}	90	V
I_{FSM} @ tp = 5 μs sine	40	A
V_F @ 0.77Apk, T_J = 125°C	0.65	V
T_J	-40 to 125	°C

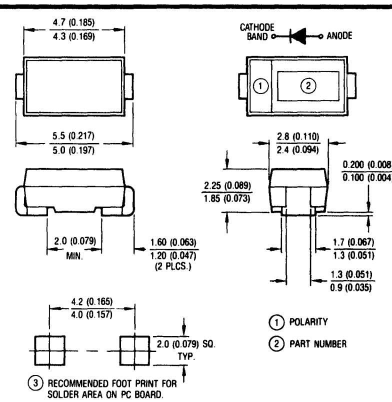
Description/Features

The 10MQ090 surface mount Schottky rectifier has been designed for applications requiring low forward drop and very small foot prints on PC boards. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D - 64

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-473

Voltage Ratings

	Part number	10MQ090
V_R	Max. DC Reverse Voltage (V)	90
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	10MQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	0.77	A	50% duty cycle @ T_C = 110 °C, rectangular wave form On PC board 3mm. x 3mm. island	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	40	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current *See Fig. 7	10		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	10MQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.81	V	@ 0.77A	T_J = 25 °C
	* See Fig. 1	0.96	V	@ 1.54A	
		0.65	V	@ 0.77A	T_J = 125 °C
		0.76	V	@ 1.54A	
I_{RM}	Max. Reverse Leakage Current (1)	1	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2	5.0	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	28	pF	V_R = 10V_{DC}, T_J = 25°C, test signal = 1Mhz	
L_S	Typical Series Inductance	2.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	10MQ	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	160	°C/W	DC operation
wt	Approximate Weight	0.07(0.026)	g (oz.)	
	Case Style	D-64		

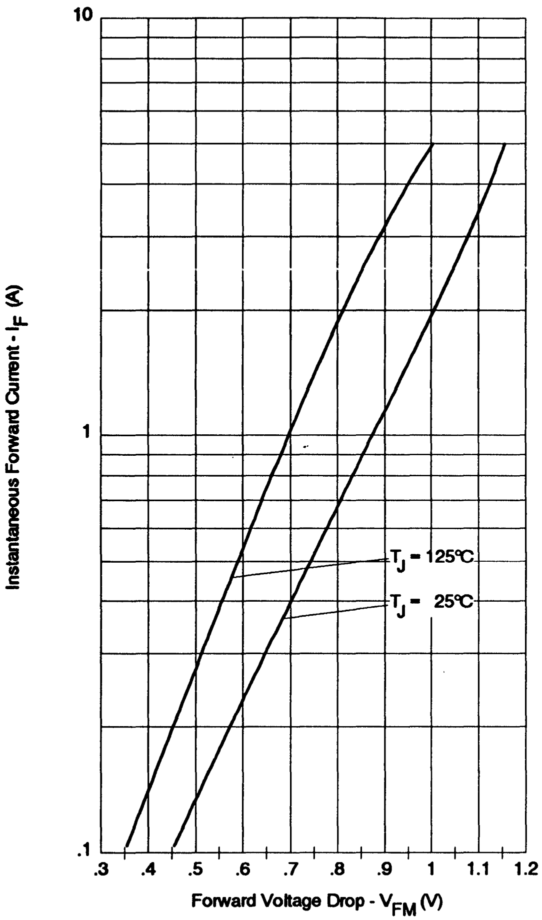


Fig. 1 - Maximum Forward Voltage Drop Characteristics

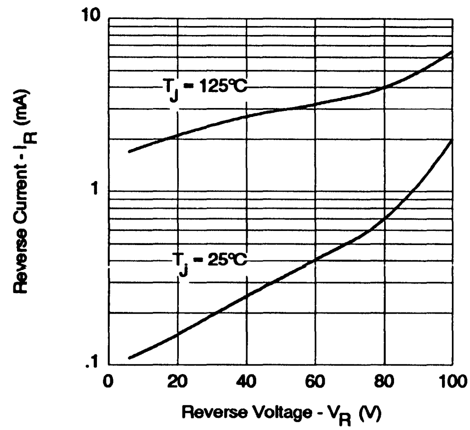


Fig. 2 - Typical Peak Reverse Current Vs. Peak Reverse Voltage

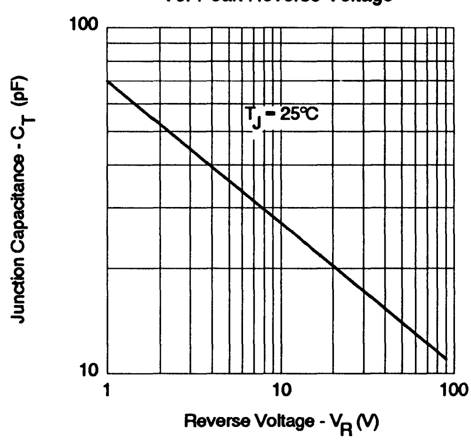


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

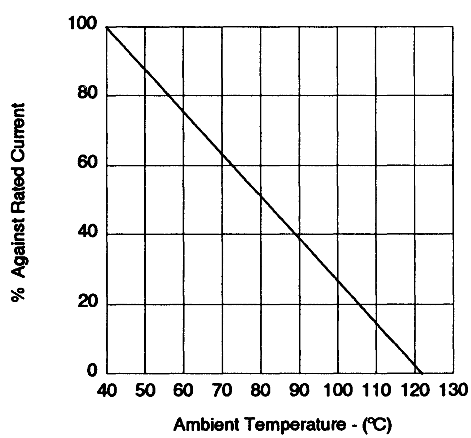


Fig. 4 - Maximum % Against Rated Current Vs. Ambient Temperature

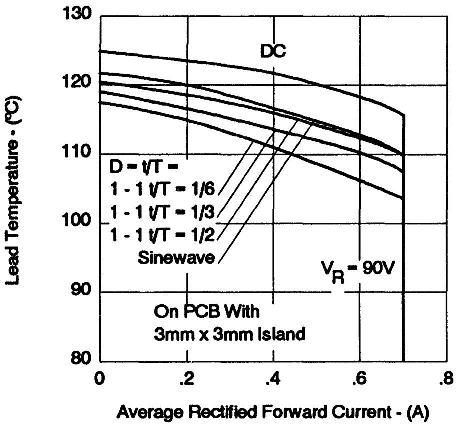


Fig. 5 - Maximum Average Forward Current Vs. Allowable Lead Temperature

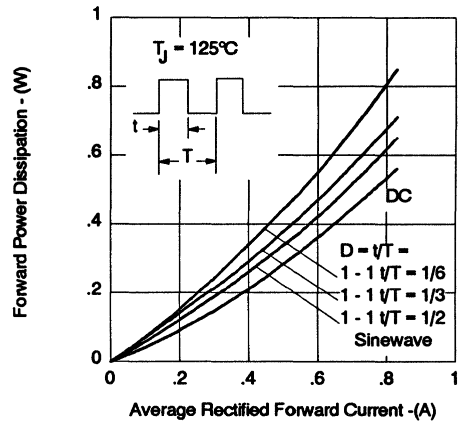


Fig. 6 - Maximum Average Dissipation Vs. Average Forward Current

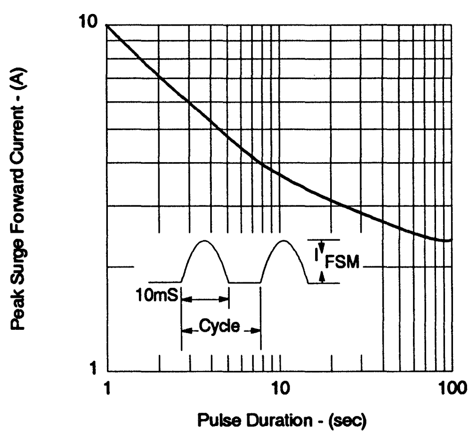


Fig. 7 - Maximum Peak Surge Forward Current Vs. Pulse Duration

International Rectifier

15MQ040

SCHOTTKY RECTIFIER

1.5 Amp

Major Ratings and Characteristics

Characteristics	15MQ040	Units
$I_{F(AV)}$ @ 180° Rectangular	1.7	A
@ 180° Sinusoidal	1.5	A
V_{RWM}	40	A
I_{FSM} @ 50Hz	60	A
V_F @ 1.5Apk, T_J = 25°C	64	V
T_J	-40 to 125	°C

Description/Features

The 15MQ040 is a 1.5A Schottky rectifier and is designed to be used for low-power applications where a reverse voltage of 40 volts is accountered and surface mounting is required.

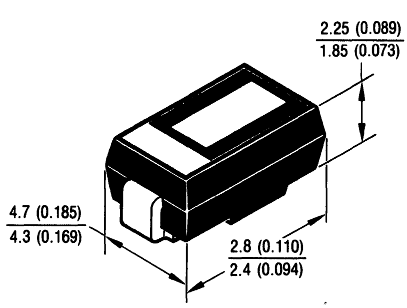
Applications

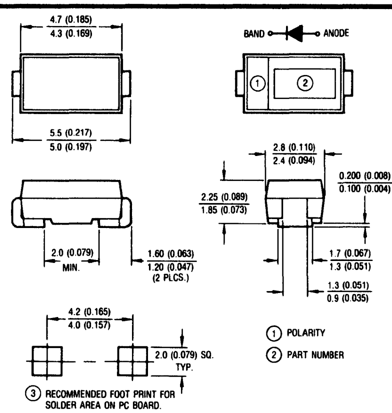
- Switching power supplies
- Meter protection
- Reverse protection for power input to PC board circuits
- Battery isolation and charging
- Low threshold voltage diode
- Free-wheeling or by-pass diode
- Low voltage clamp

Features

- Surface mountable
- Extremely low forward voltage
- Improved reverse blocking voltage capability relative to other Schottkys of similar size
- Compact size

CASE STYLE AND DIMENSIONS





Outline D - 64

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-473

Voltage Ratings

	Part number	15MQ040
V_R	Max. DC Reverse Voltage (V)	40
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Electrical Specifications

	Parameters	15MQ	Units	Conditions
$I_{F(AV)}$	Max. Average Output Current	1.7	A	180° conduction, rectangular waveform
		1.5	A	180° conduction, sinusoidal waveform
I_{FSM}	Max. Peak One Cycle Non-Repetitive	60	A	50Hz half cycle sine wave or 6ms rectangular pulse
	Surge Current	64	A	60Hz half cycle sine wave or 5ms rectangular pulse
V_{FM}	Max. Peak Forward Voltage	0.55	V	$T_J = 25°C$ at rated $I_{F(AV)}$
I_R	Max. dc Reverse Current	5.0	mA	$T_J = 25°C$ V_R = rated V_R
I_{RM}	Max. Peak Reverse Current	50	mA	$T_C = 125°C$ V_R = rated V_R
C_T	Typical Junction Capacitance	70	pF	$T_C = 25°C$ $V_R = 10V_{DC}$ 1Mhz test signal

Thermal-Mechanical Specifications

	Parameters	15MQ	Units	Conditions
T_J	Max. Operating Junction Temperature	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	150	°C/W	
wt	Approximate Weight	0.07(0.026)	g (oz.)	
	Case Style	D-64		

International IOR Rectifier

30WQ03F
30WQ04F

SCHOTTKY RECTIFIER

3.3 Amp

Major Ratings and Characteristics

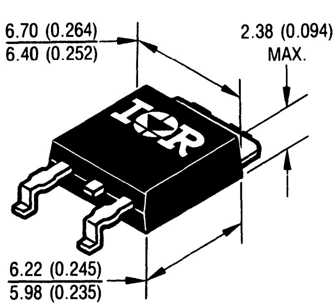
Characteristics	30WQ..F	Units
$I_{F(AV)}$ Rectangular waveform	3.3	A
V_{RRM}	30/40	V
I_{FSM} @ tp = 5 μs sine	470	A
V_F @ 3 Apk, T_J = 25°C	0.62	V
T_J	- 40 to 125	°C

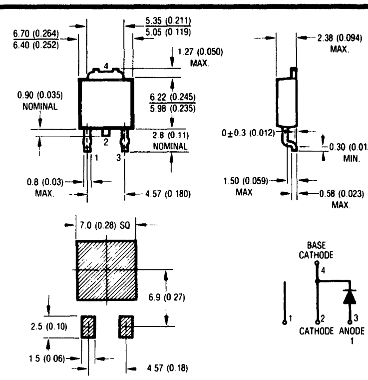
Description/Features

The 30WQ..F surface mount Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC board. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

Part number	30WQ03F	30WQ04F
V_R Max. DC Reverse Voltage (V)	30	40
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	30WQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	3.3	A	50% duty cycle @ T_C = 105 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	470	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		40		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	30WQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop * See Fig. 1 (1)	0.62	V	@ 3A	T_J = 25 °C
		0.88	V	@ 6A	
		0.56	V	@ 3A	T_J = 125 °C
		0.69	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current * See Fig. 2 (1)	2	mA	T_J = 25 °C	V_R = rated V_R
		12	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	110	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	30WQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	6.0	°C/W	DC operation * See Fig. 4
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

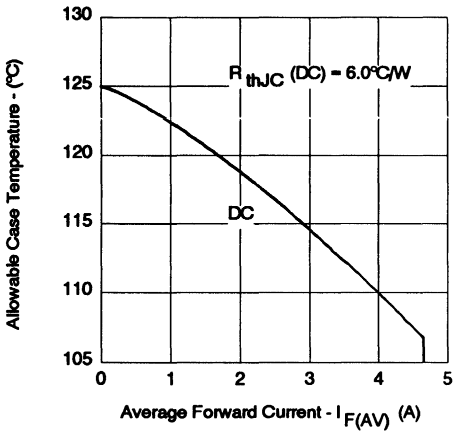


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

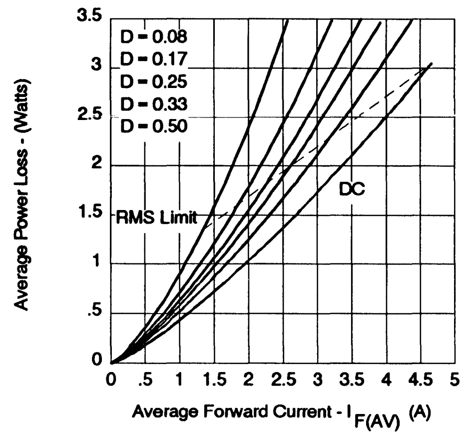


Fig. 6 - Forward Power Loss Characteristics

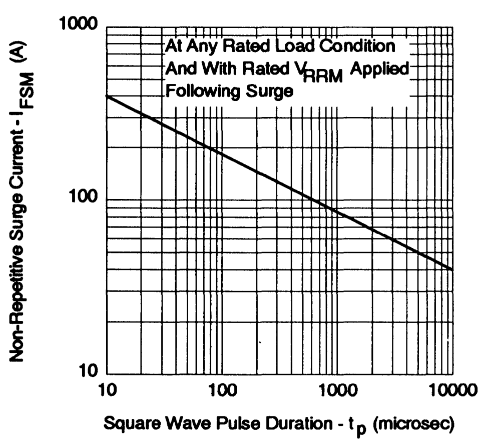


Fig. 7 - Maximum Non-Repetitive Surge Current

SURFACE MOUNT & AXIAL LEAD

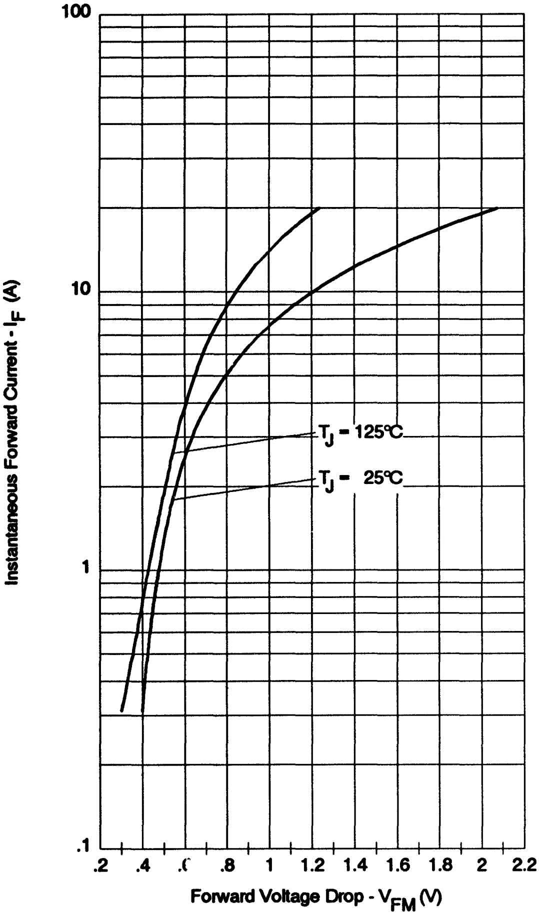


Fig. 1 - Maximum Forward Voltage Drop Characteristics

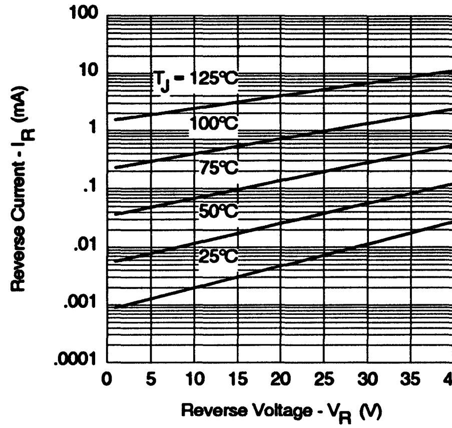


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

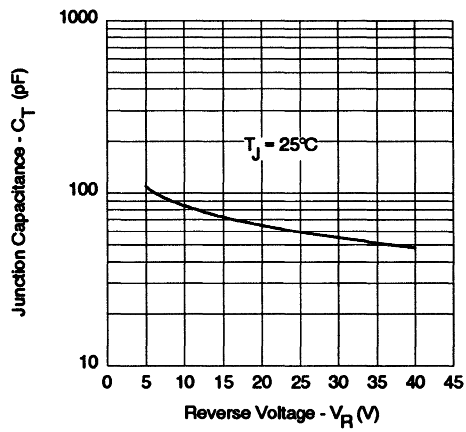


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

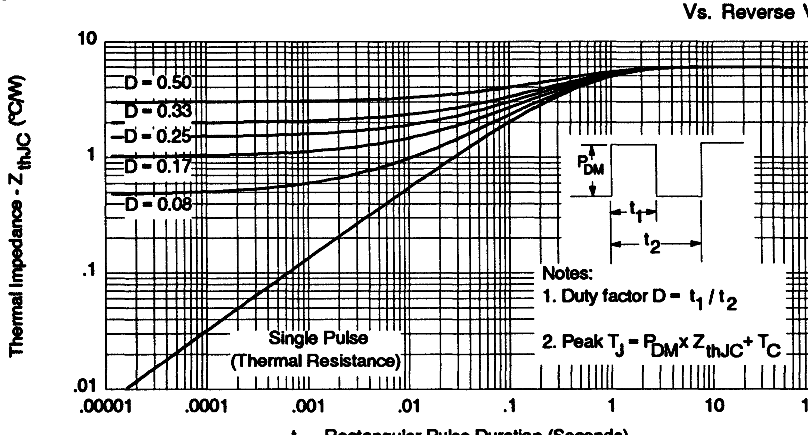


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

International
IOR Rectifier

30WQ05F
30WQ06F

SCHOTTKY RECTIFIER

3.3 Amp

Major Ratings and Characteristics

Characteristics	30WQ..F	Units
$I_{F(AV)}$ Rectangular waveform	3.3	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 μs sine	360	A
V_F @ 3 Apk, T_J = 25°C	0.70	V
T_J	- 40 to 125	°C

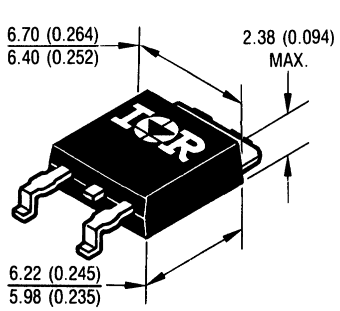
Description/Features

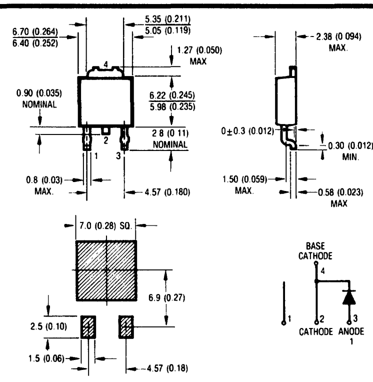
The 30WQ..F surface mount Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC board. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

	Part number	30WQ05F	30WQ06F
V_R	Max. DC Reverse Voltage (V)	50	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	30WQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	3.3	A	50% duty cycle @ T_C = 104°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current *See Fig. 7	360	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		40		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	30WQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop * See Fig. 1 (1)	0.70	V	@ 3A	T_J = 25 °C
		1.14	V	@ 6A	
		0.60	V	@ 3A	T_J = 125 °C
		0.79	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current * See Fig. 2 (1)	2	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	95	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	30WQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	6.0	°C/W	DC operation *See Fig. 4
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

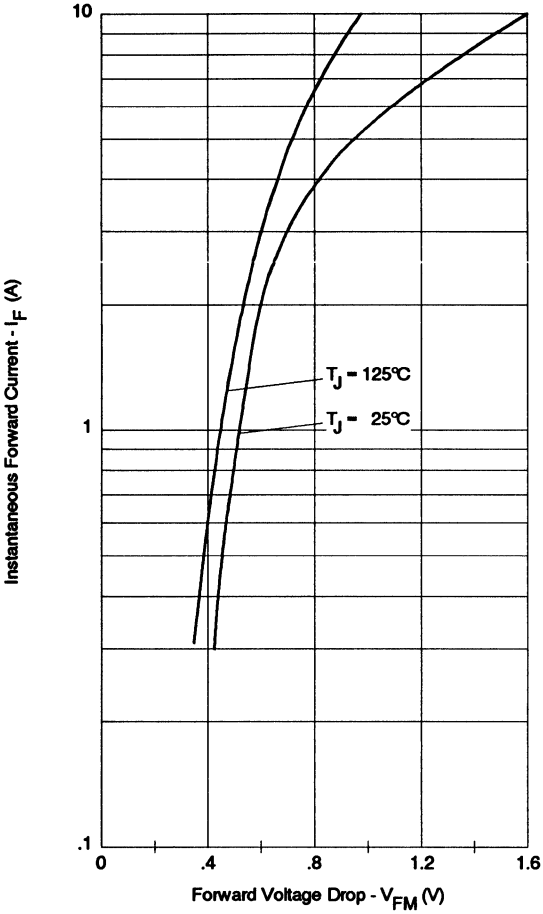


Fig. 1 - Maximum Forward Voltage Drop Characteristics

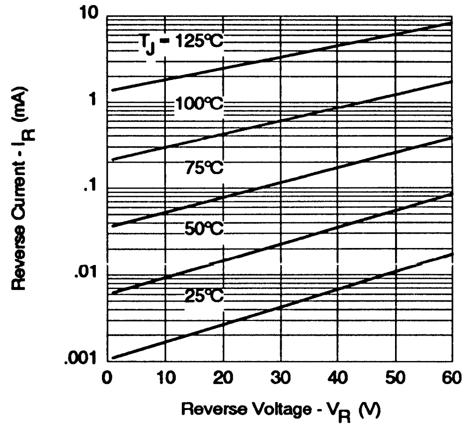


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

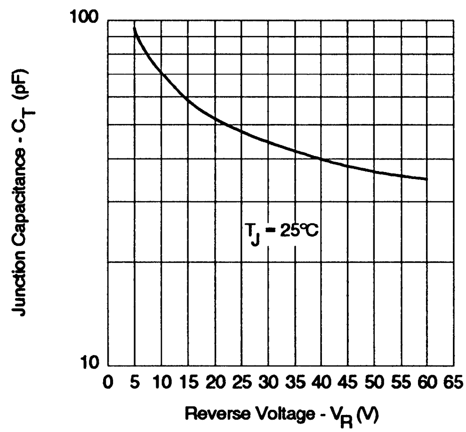


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

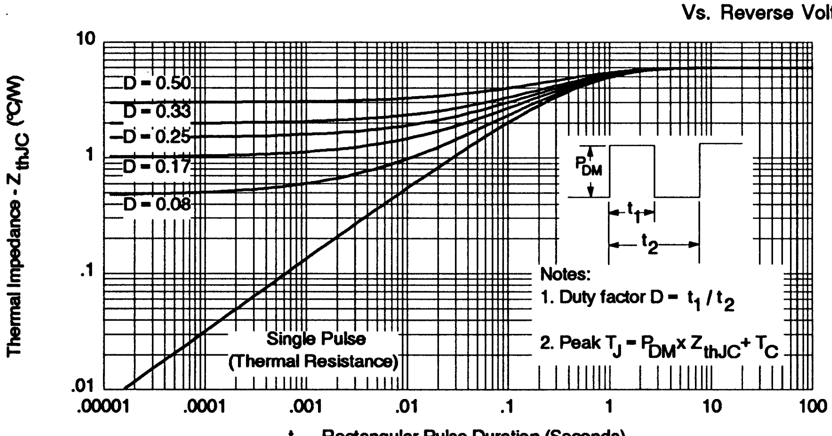


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

SURFACE MOUNT & AXIAL LEAD

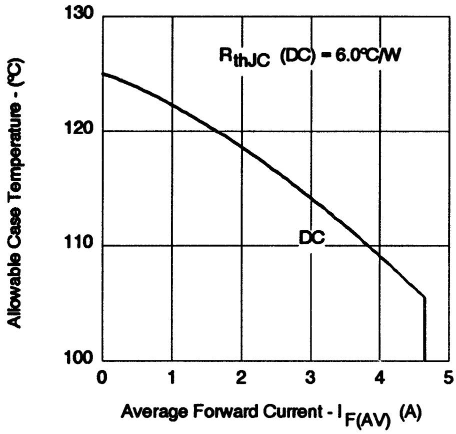


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

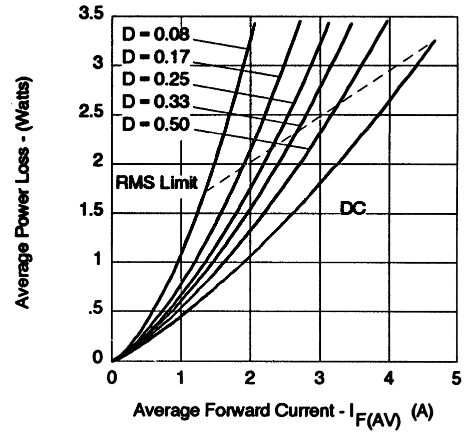


Fig. 6 - Forward Power Loss Characteristics

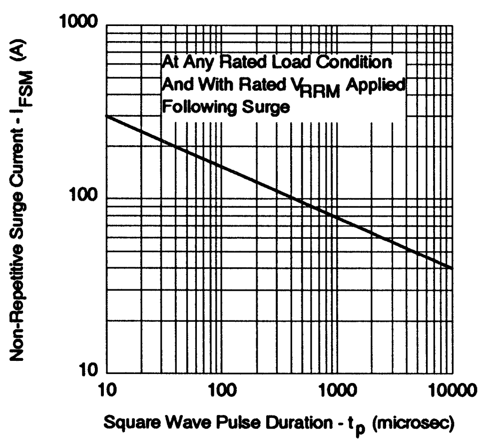


Fig. 7 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

30WQ09F
30WQ10F

SCHOTTKY RECTIFIER — 3.3 Amp

SURFACE MOUNT & AXIAL LEAD

Major Ratings and Characteristics

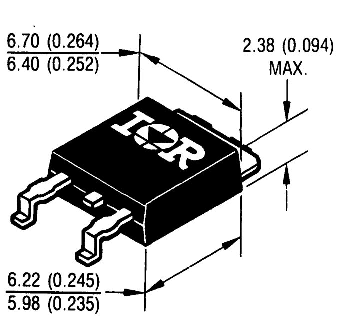
Characteristics	30WQ..F	Units
$I_{F(AV)}$ Rectangular waveform	3.3	A
V_{RRM}	90/100	V
I_{FSM} @ tp = 5 µs sine	210	A
V_F @ 3 Apk, T_J = 25°C	0.91	V
T_J	-40 to 125	°C

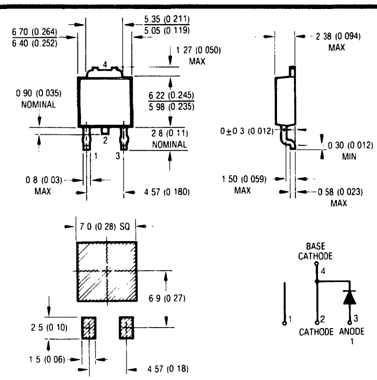
Description/Features

The 30WQ..F surface mount Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC board. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

	Part number	30WQ09F	30WQ10F
V_R	Max. DC Reverse Voltage (V)	90	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	30WQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	3.3	A	50% duty cycle @ T_C = 103°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current *See Fig. 7	210	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		40		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	30WQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop * See Fig. 1 (1)	0.91	V	@ 3A	T_J = 25 °C
		1.03	V	@ 6A	
		0.74	V	@ 3A	T_J = 125 °C
		0.86	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current * See Fig. 2 (1)	1	mA	T_J = 25 °C	V_R = rated V_R
		2	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	60	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	30WQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	6.0	°C/W	DC operation *See Fig. 4
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

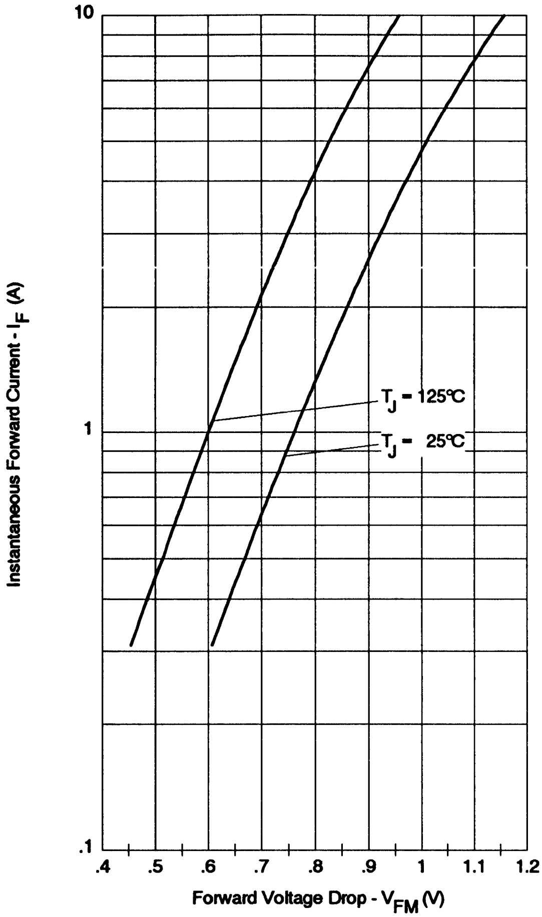


Fig. 1 - Maximum Forward Voltage Drop Characteristics

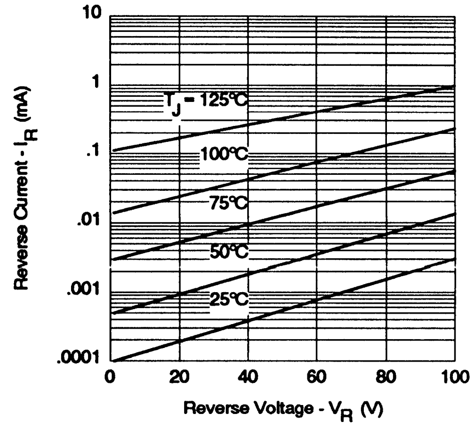


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

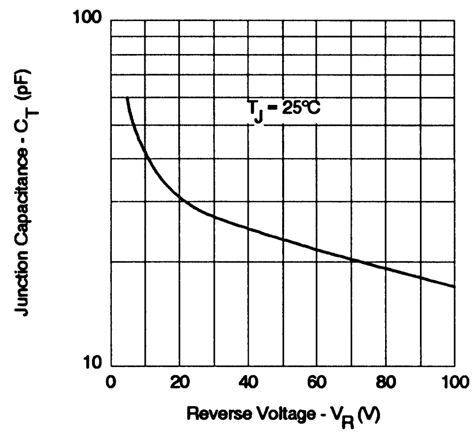


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

SURFACE MOUNT & AXIAL LEAD

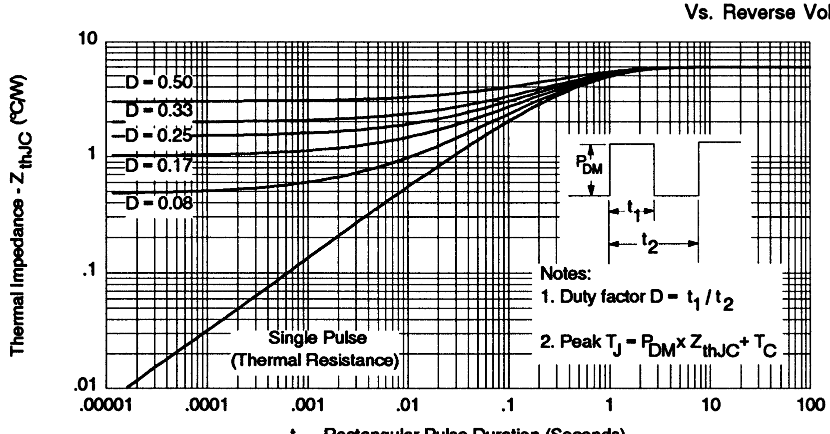


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

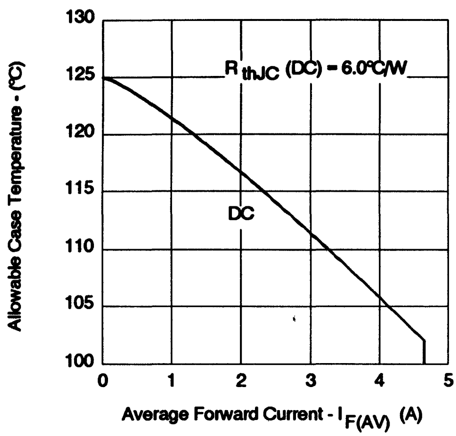


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

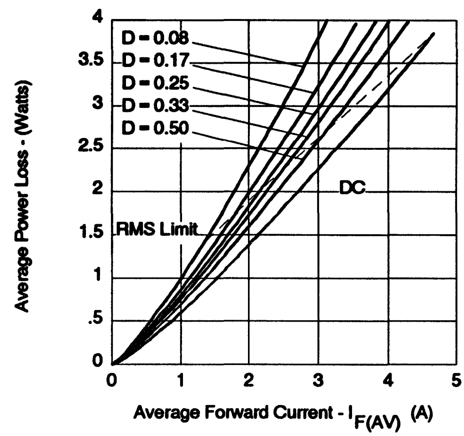


Fig. 6 - Forward Power Loss Characteristics

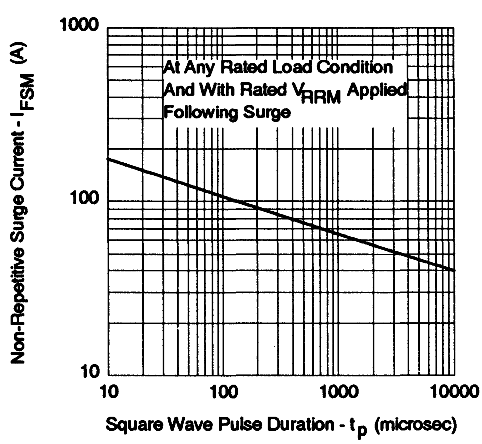


Fig. 7 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

50WQ03F
50WQ04F

SCHOTTKY RECTIFIER

5.5 Amp

Major Ratings and Characteristics

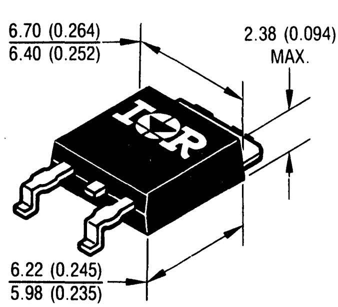
Characteristics	50WQ..F	Units
$I_{F(AV)}$ Rectangular waveform	5.5	A
V_{RRM}	30/40	V
I_{FSM} @ 60Hz	470	A
V_F @ 5 Apk, T_J = 25°C	0.65	V
T_J	- 40 to 125	°C

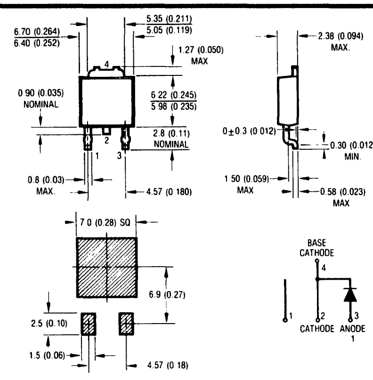
Description/Features

The 50WQ..F surface mount Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC board. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

	Part number	50WQ03F	50WQ04F
V_R	Max. DC Reverse Voltage (V)	30	40
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	50WQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	5.5	A	50% duty cycle @ T_C = 92 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	470	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current *See Fig. 7	42		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	50WQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.65	V	@ 5A	T_J = 25 °C
	* See Fig. 1 (1)	0.90	V	@ 10A	
		0.60	V	@ 5A	T_J = 125 °C
		0.78	V	@ 10A	
I_{RM}	Max. Reverse Leakage Current	3	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2 (1)	20	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	180	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	50WQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	6.0	°C/W	DC operation *See Fig. 4
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

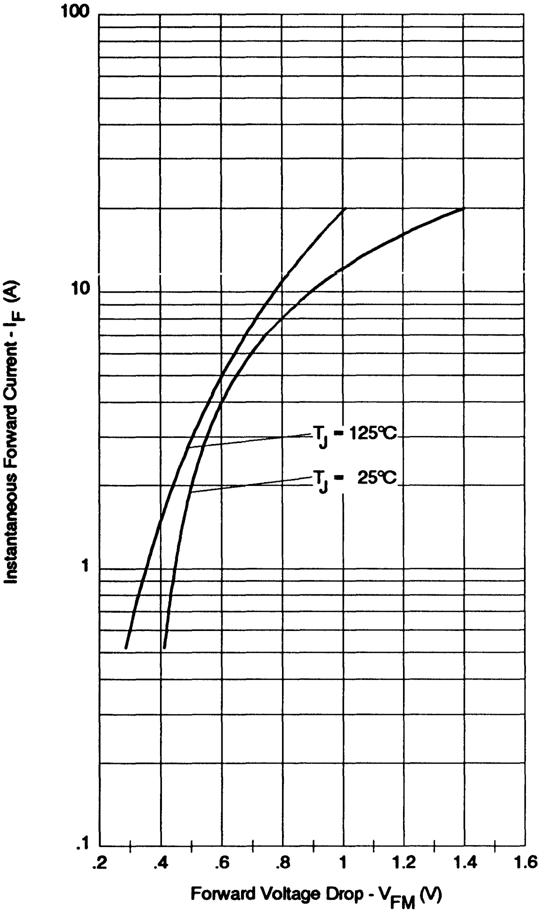


Fig. 1 - Maximum Forward Voltage Drop Characteristics

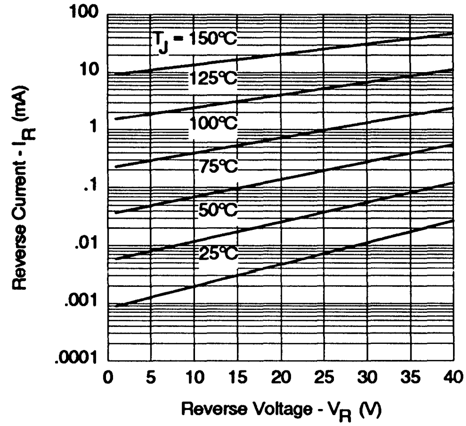


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

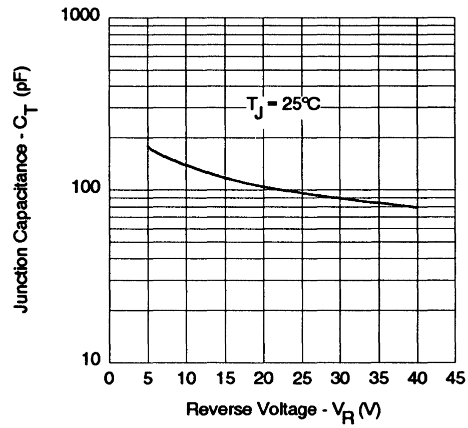


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

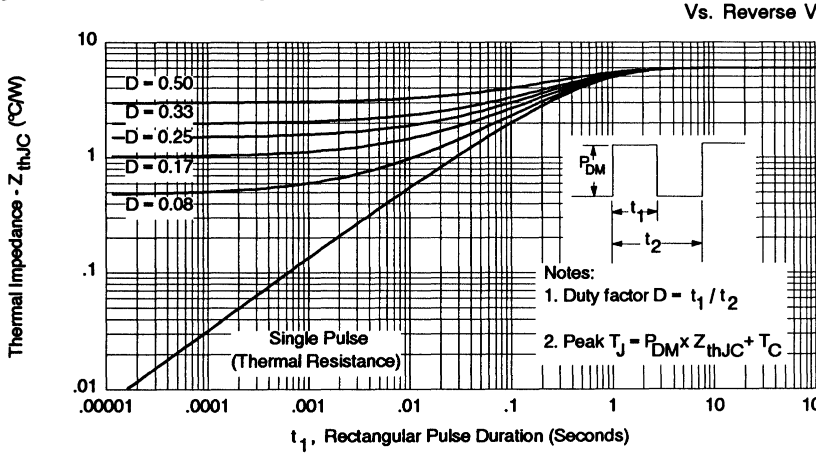


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

SURFACE MOUNT & AXIAL LEAD

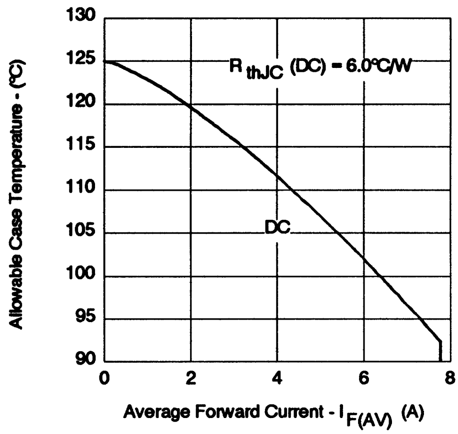


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

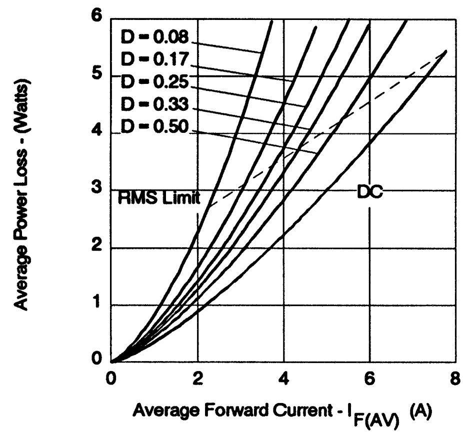


Fig. 6 - Forward Power Loss Characteristics

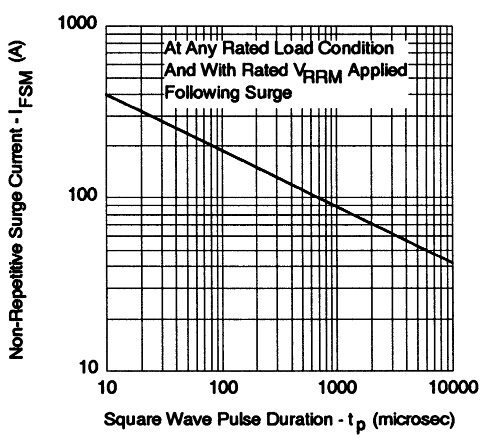


Fig. 7 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

50WQ05F
50WQ06F

SCHOTTKY RECTIFIER

5.5 Amp

Major Ratings and Characteristics

Characteristics	50WQ..F	Units
$I_{F(AV)}$ Rectangular waveform	5.5	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 μs sine	360	A
V_F @ 5 Apk, T_J = 25°C	0.70	V
T_J	-40 to 125	°C

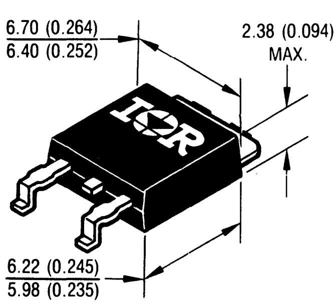
Description/Features

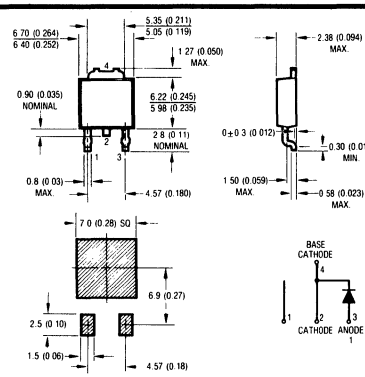
The 50WQ..F surface mount Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC board. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

	Part number	50WQ05F	50WQ06F
V_R	Max. DC Reverse Voltage (V)	50	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	50WQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	5.5	A	50% duty cycle @ T_C = 89 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	360	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		42		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	50WQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop * See Fig. 1 (1)	0.70	V	@ 5A	T_J = 25 °C
		1.07	V	@ 10A	
		0.66	V	@ 5A	T_J = 125 °C
		0.80	V	@ 10A	
I_{RM}	Max. Reverse Leakage Current * See Fig. 2 (1)	3	mA	T_J = 25 °C	V_R = rated V_R
		30	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	150	pF	V_R = $5V_{DC}$, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	50WQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	6.0	°C/W	DC operation * See Fig. 4
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

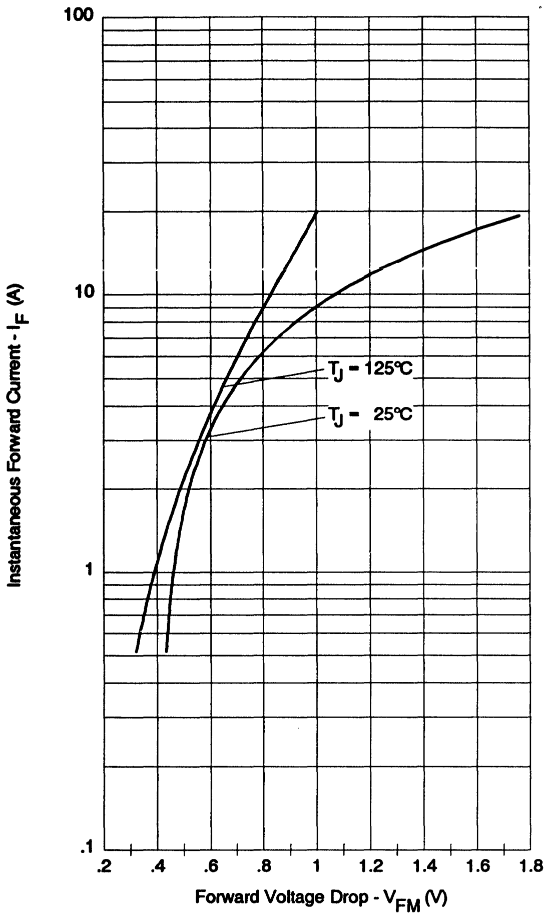


Fig. 1 - Maximum Forward Voltage Drop Characteristics

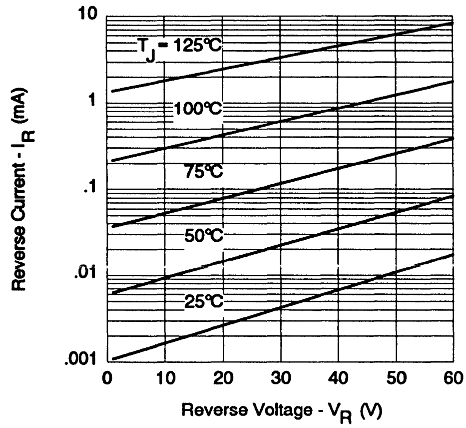


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

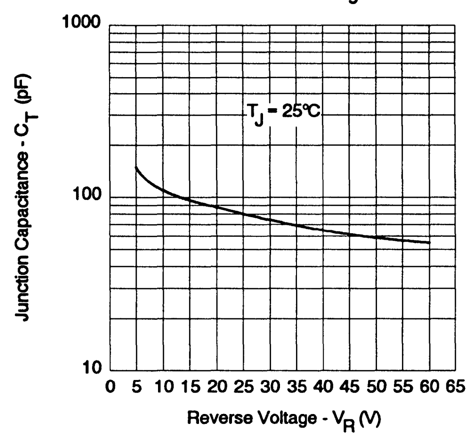


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

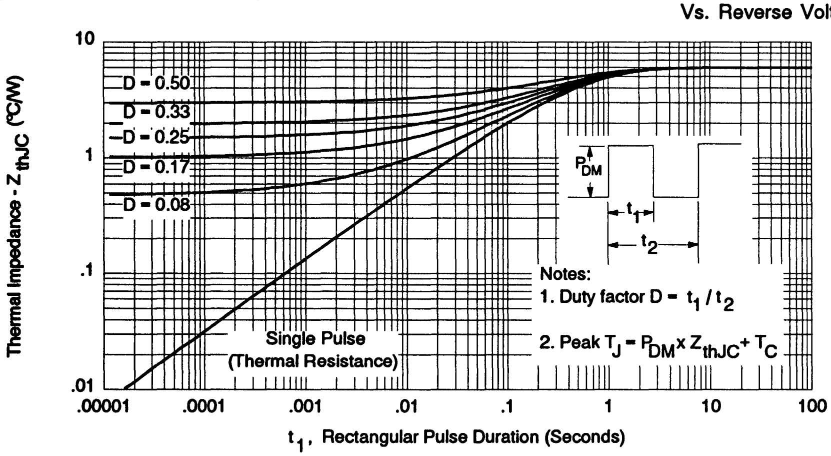


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

SURFACE MOUNT & AXIAL LEAD

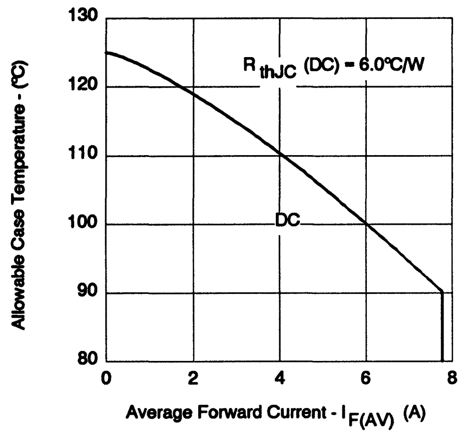


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

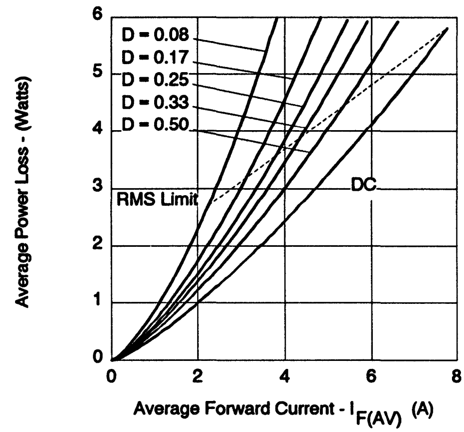


Fig. 6 - Forward Power Loss Characteristics

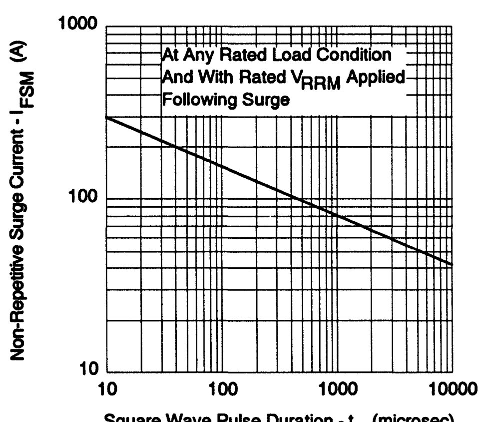


Fig. 7 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

50WQ09F
50WQ10F

SCHOTTKY RECTIFIER

5.5 Amp

Major Ratings and Characteristics

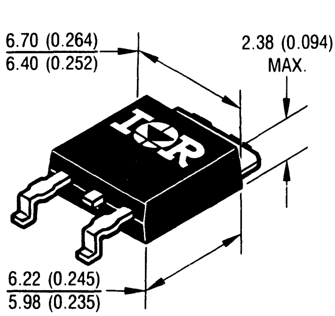
Characteristics	50WQ..F	Units
$I_{F(AV)}$ Rectangular waveform	5.5	A
V_{RRM}	90/100	V
I_{FSM} @ tp = 5 μs sine	210	A
V_F @ 5 Apk, T_J = 25°C	0.93	V
T_J	- 40 to 125	°C

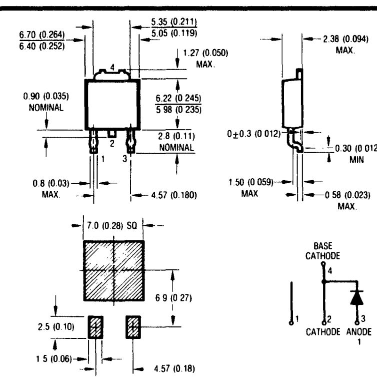
Description/Features

The 50WQ..F surface mount Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC board. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

Part number	50WQ09F	50WQ10F
V_R Max. DC Reverse Voltage (V)	90	100
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

Parameters	50WQ..F	Units	Conditions	
$I_{F(AV)}$ Max. Average Forward Current * See Fig. 5	5.5	A	50% duty cycle @ T_C = 90 °C, rectangular wave form	
I_{FSM} Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	210	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	42		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

Parameters	50WQ..F	Units	Conditions	
V_{FM} Max. Forward Voltage Drop * See Fig. 1 (1)	0.93	V	@ 5A	T_J = 25 °C
	1.08	V	@ 10A	
	0.77	V	@ 5A	T_J = 125 °C
	0.89	V	@ 10A	
I_{RM} Max. Reverse Leakage Current * See Fig. 2 (1)	1	mA	T_J = 25 °C	V_R = rated V_R
	3	mA	T_J = 125 °C	
C_T Typical Junction Capacitance	100	pF	V_R = $5V_{DC}$, (test signal range 100Khz to 1Mhz) 25 °C	
L_S Typical Series Inductance	5.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

Parameters	50WQ..F	Units	Conditions
T_J Max. Junction Temperature Range	-40 to 125	°C	
T_{stg} Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC} Max. Thermal Resistance Junction to Case	6.0	°C/W	DC operation * See Fig. 4
wt Approximate Weight	0.3 (0.01)	g (oz.)	
Case Style	D-PAK		Similar to TO-252AA

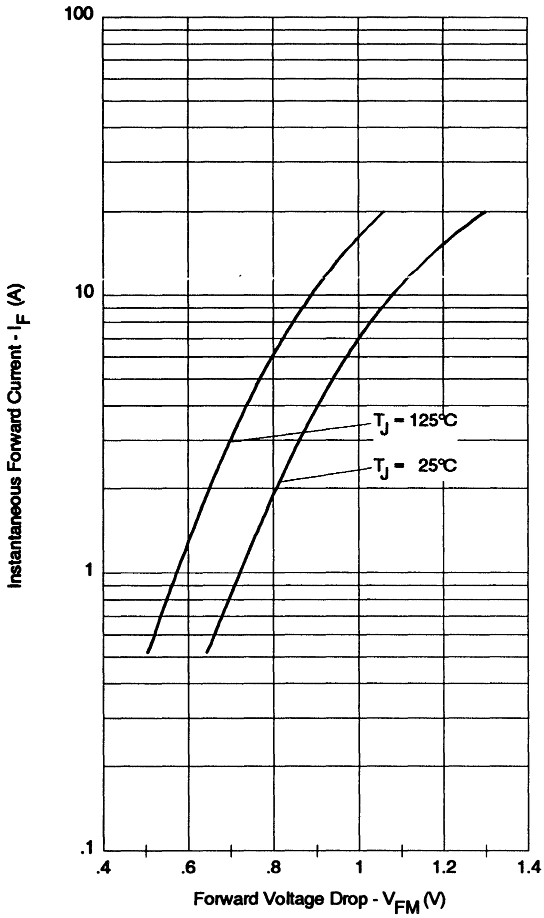


Fig. 1 - Maximum Forward Voltage Drop Characteristics

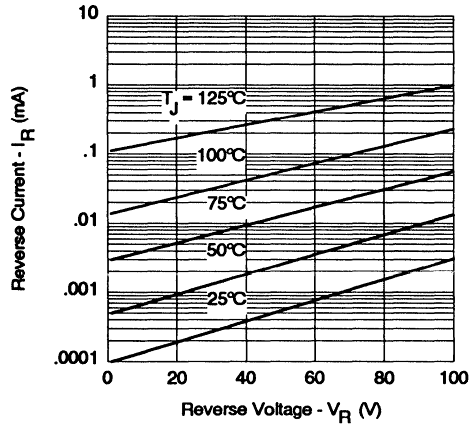


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

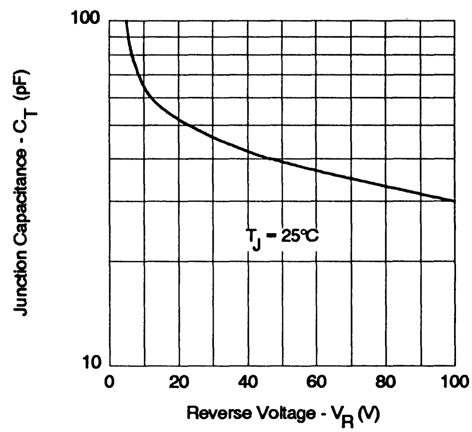


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

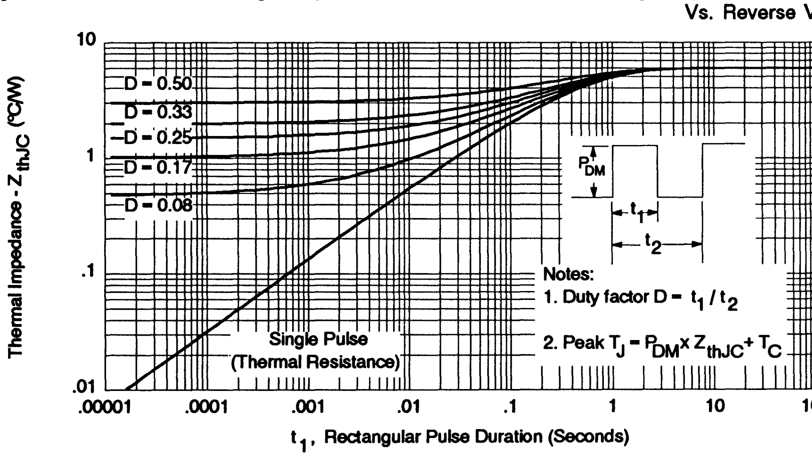


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

SURFACE MOUNT & AXIAL LEAD

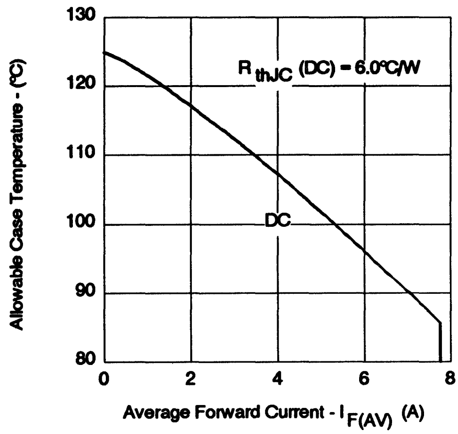


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

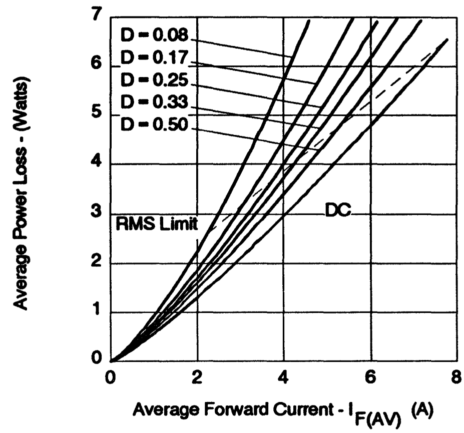


Fig. 6 - Forward Power Loss Characteristics

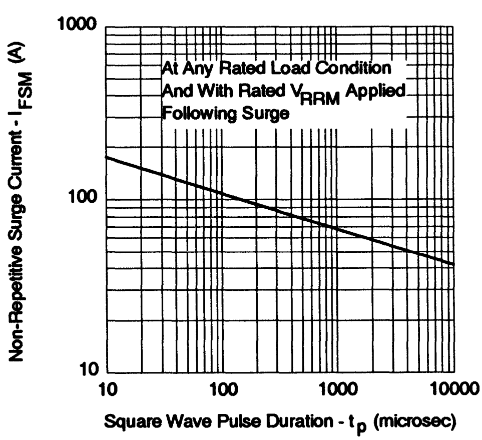


Fig. 7 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

6CWQ03F
6CWQ04F

SCHOTTKY RECTIFIER

6.6 Amp

Major Ratings and Characteristics

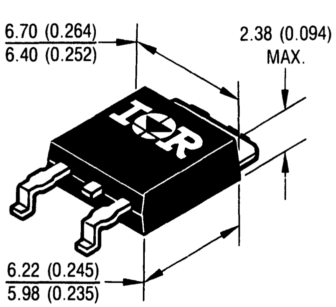
Characteristics	6CWQ..F	Units
$I_{F(AV)}$ Rectangular waveform	6.6	A
V_{RRM}	30/40	V
I_{FSM} @ tp = 5 μs sine	470	A
V_F @ 3Apk, T_J = 25°C (per leg)	0.55	V
T_J	- 40 to 125	°C

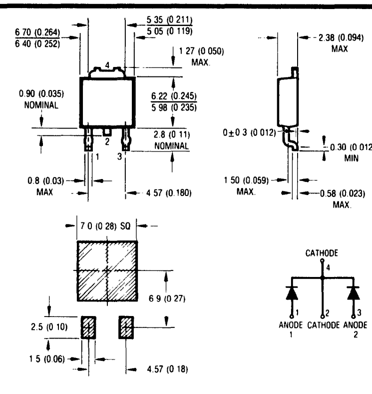
Description/Features

The 6CWQ..F surface mount, center tap, Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC boards. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Center tap configuration
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

	Part number	6CWQ03F	6CWQ04F
V_R	Max. DC Reverse Voltage (V)	30	40
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	6CWQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	6.6	A	50% duty cycle @ T_C = 97 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	470	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current (Per Leg) *See Fig. 7	42		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	6CWQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.55	V	@ 3A	T_J = 25 °C
		0.71	V	@ 6A	
		0.50	V	@ 3A	T_J = 125 °C
		0.63	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	3	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance (Per Leg)	180	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	6CWQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	5.0	°C/W	DC operation *See Fig. 4
R_{thJA}	Max. Thermal Resistance Junction to Ambient	80	°C/W	DC operation PC Board mounted print land = 20x20mm
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

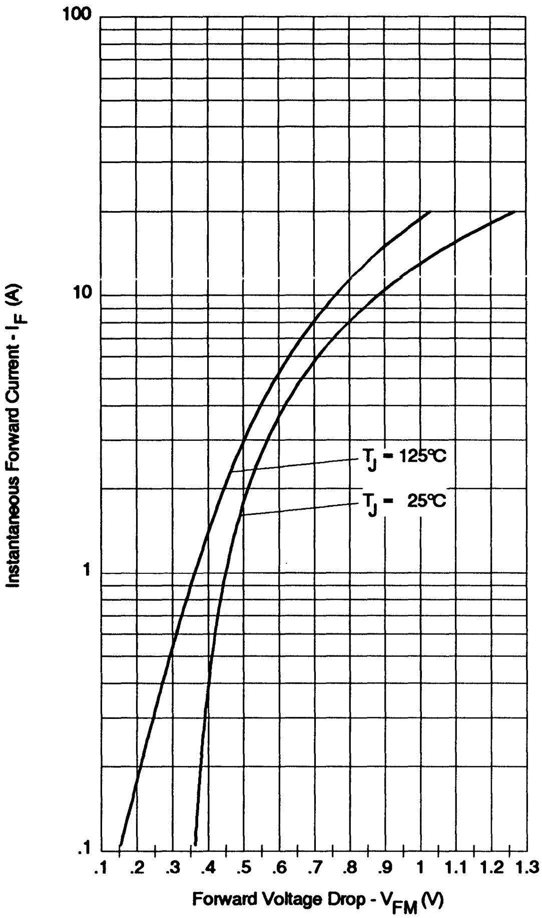


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

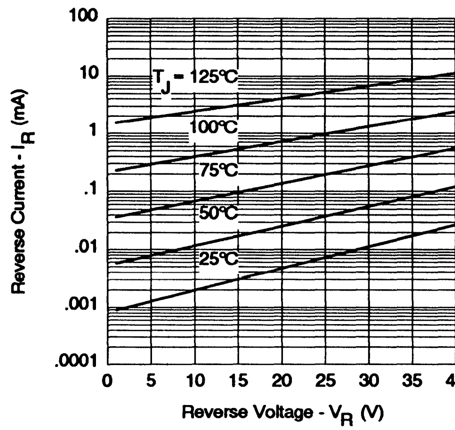


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

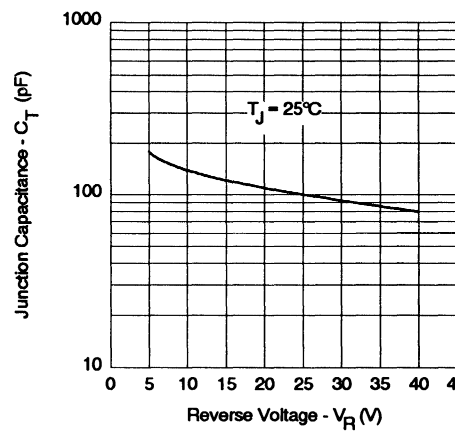


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

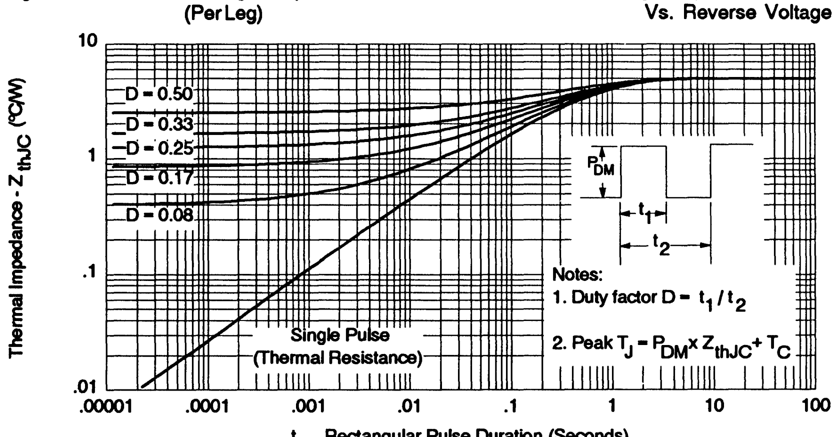


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

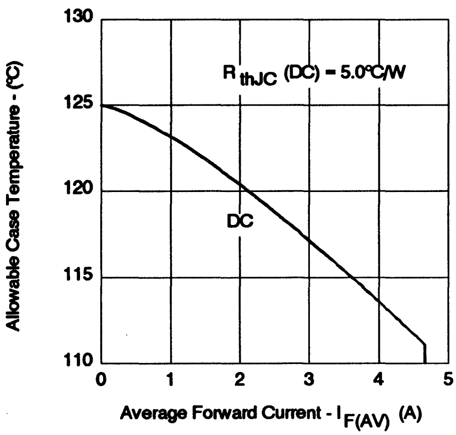


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

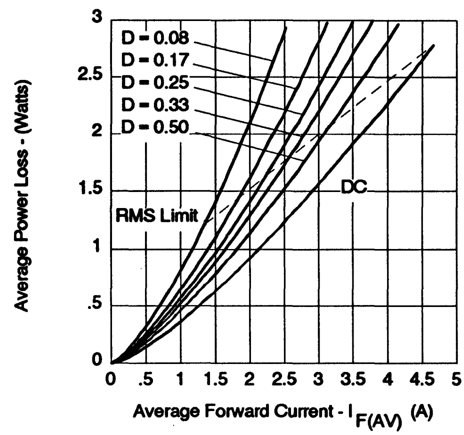


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

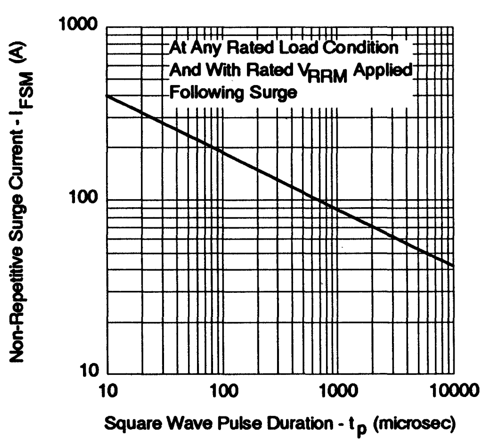


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

International IOR Rectifier

6CWQ05F
6CWQ06F

SCHOTTKY RECTIFIER — 6.6 Amp

Major Ratings and Characteristics

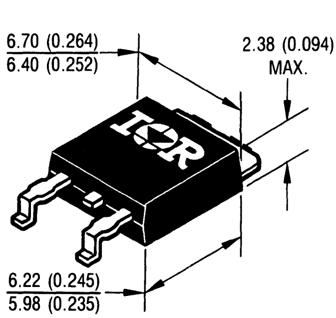
Characteristics	6CWQ..F	Units
$I_{F(AV)}$ Rectangular waveform	6.6	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 µs sine	360	A
V_F @ 3 Apk, T_J = 25°C (per leg)	0.58	V
T_J	-40 to 125	°C

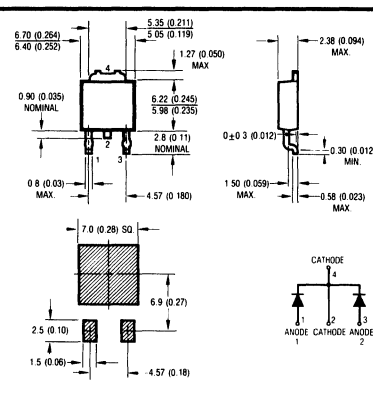
Description/Features

The 6CWQ..F surface mount, center tap, Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC boards. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Center tap configuration
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

	Part number	6CWQ05F	6CWQ06F
V_R	Max. DC Reverse Voltage (V)	50	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	6CWQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	6.6	A	50% duty cycle @ T_C = 92 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) *See Fig. 7	360	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		42		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	6CWQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.58	V	@ 3A	T_J = 25 °C
		0.77	V	@ 6A	
		0.54	V	@ 3A	T_J = 125 °C
		0.67	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	3	mA	T_J = 25 °C	V_R = rated V_R
		30	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance (Per Leg)	150	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	6CWQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	5.0	°C/W	DC operation *See Fig. 4
R_{thJA}	Max. Thermal Resistance Junction to Ambient	80	°C/W	DC operation PC Board mounted, print land = 20x20mm
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

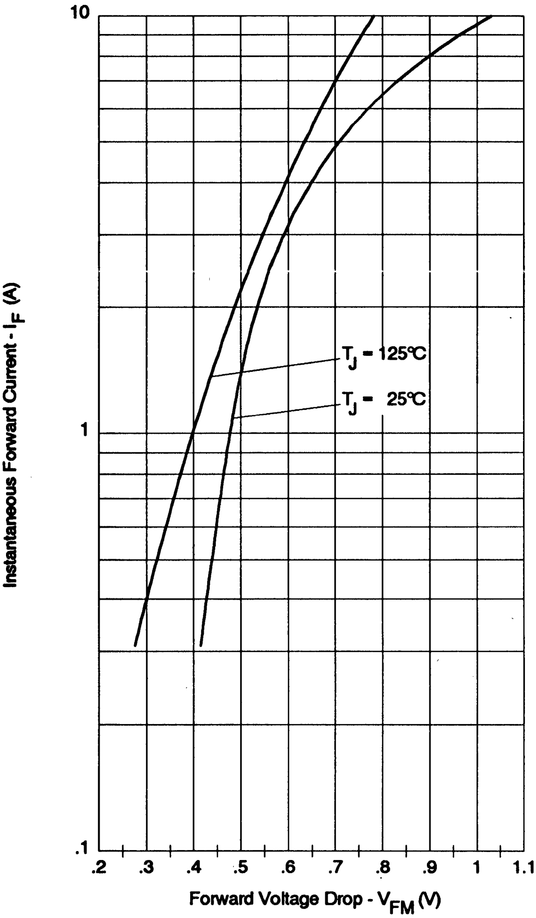


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

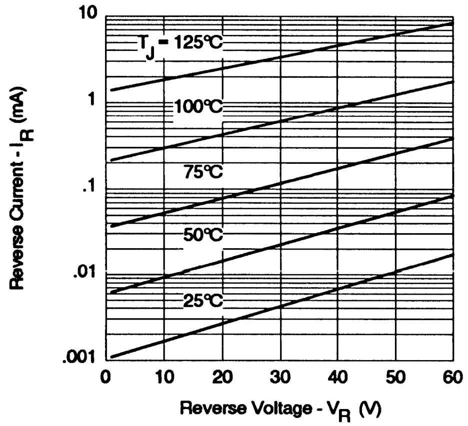


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

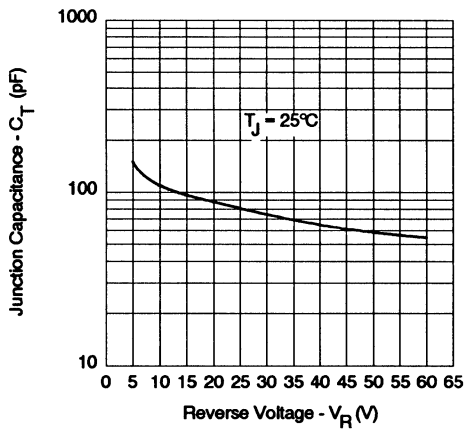


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

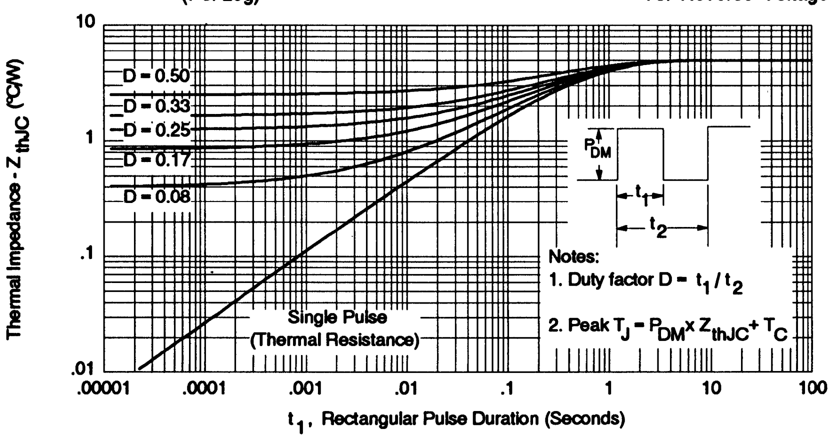


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

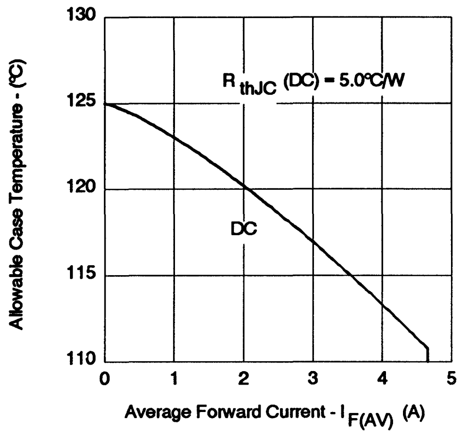


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

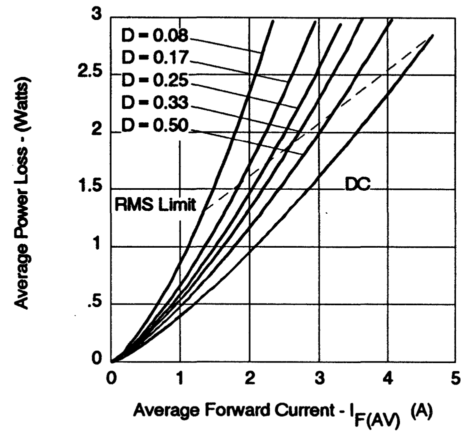


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

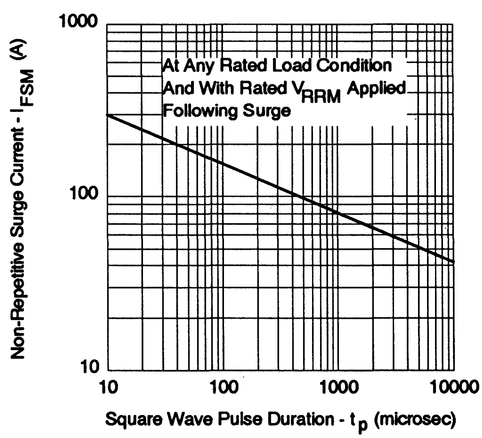


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

International Rectifier

6CWQ09F
6CWQ10F

SCHOTTKY RECTIFIER

6.6 Amp

Major Ratings and Characteristics

Characteristics	6CWQ..F	Units
$I_{F(AV)}$ Rectangular waveform	6.6	A
V_{RRM}	90/100	V
I_{FSM} @ tp = 5 μs sine	210	A
V_F @ 3 Apk, T_J = 25°C (per leg)	0.85	V
T_J	- 40 to 125	°C

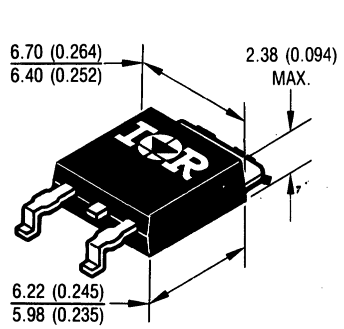
Description/Features

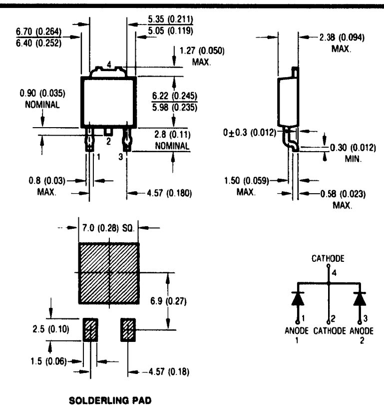
The 6CWQ..F surface mount, center tap, Schottky rectifier has been designed for applications requiring low forward drop and small foot prints on PC boards. Typical applications are in disk drives, switching power supplies, converters, free-wheeling diodes, battery charging, and reverse battery protection.

- Popular D-PAK outline
- Center tap configuration
- Small foot print, surface mountable
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS





D - PAK Outline (Similar to TO-252AA)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-474

Voltage Ratings

	Part number	6CWQ09F	6CWQ10F
V_R	Max. DC Reverse Voltage (V)	90	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	6CWQ..F	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	6.6	A	50% duty cycle @ T_C = 94 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	210	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current (Per Leg) *See Fig. 7	42		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	6CWQ..F	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.85	V	@ 3A	T_J = 25 °C
	(Per Leg) * See Fig. 1 (1)	0.97	V	@ 6A	
		0.70	V	@ 3A	T_J = 125 °C
		0.79	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current	1	mA	T_J = 25 °C	V_R = rated V_R
	(Per Leg) * See Fig. 2 (1)	3	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance (Per Leg)	100	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	Measured lead to lead 5mmfrom package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	6CWQ..F	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	5.0	°C/W	DC operation *See Fig. 4
R_{thJA}	Max. Thermal Resistance Junction to Ambient	80	°C/W	DC operation PC Board mounted, print land = 20x20mm
wt	Approximate Weight	0.3 (0.01)	g (oz.)	
	Case Style	D-PAK		Similar to TO-252AA

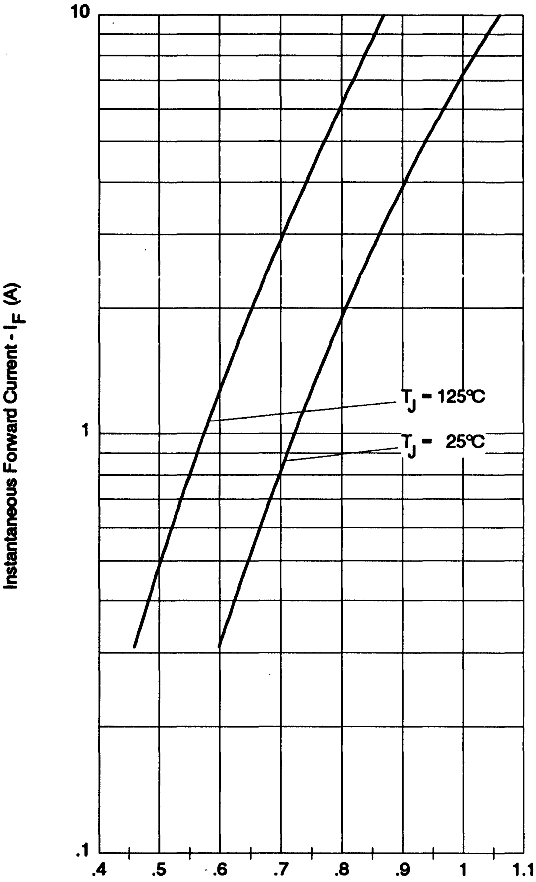


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

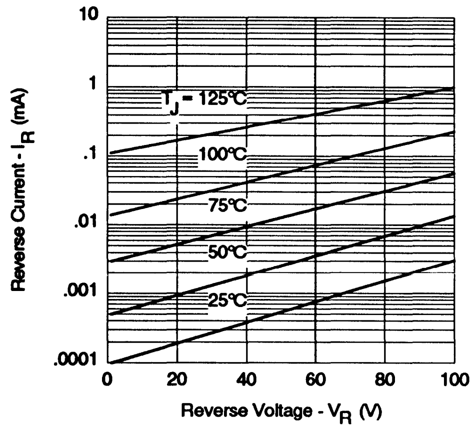


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

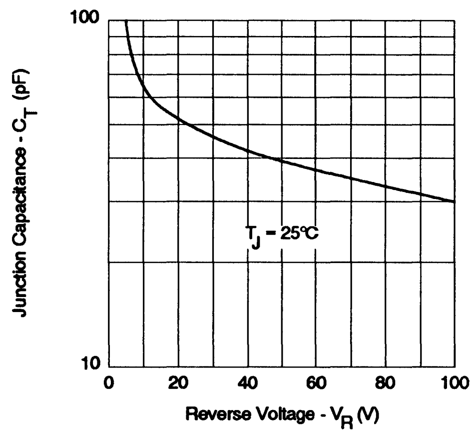


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

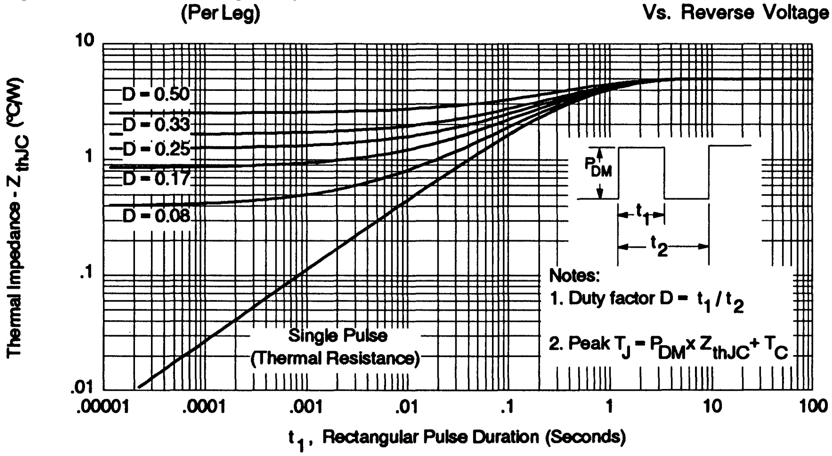


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

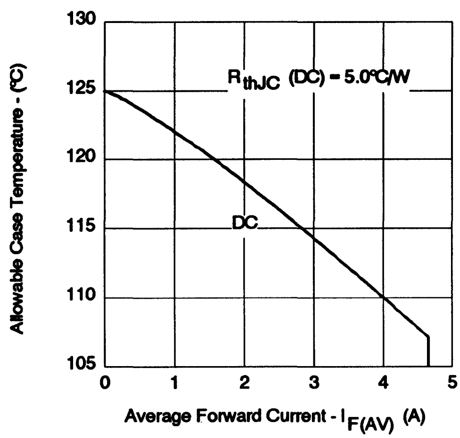


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

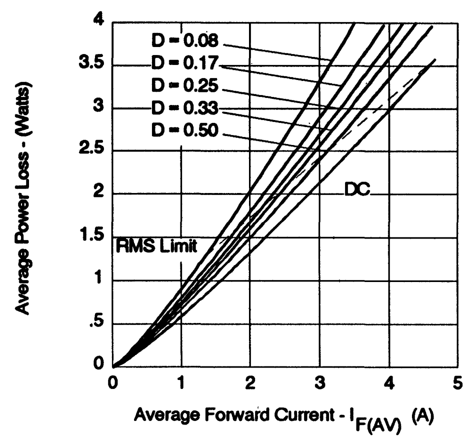


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

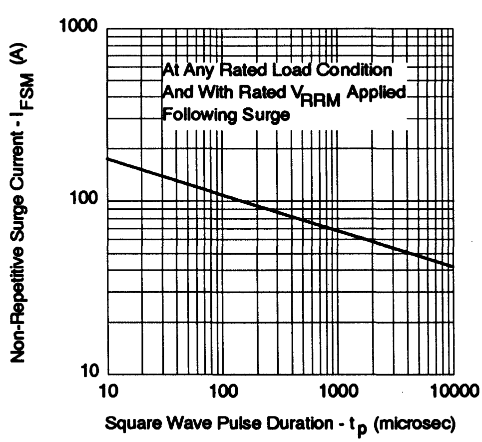


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

International IOR Rectifier

11DQ03
11DQ04

SCHOTTKY RECTIFIER

1.1 Amp

SURFACE MOUNT & AXIAL LEAD

Major Ratings and Characteristics

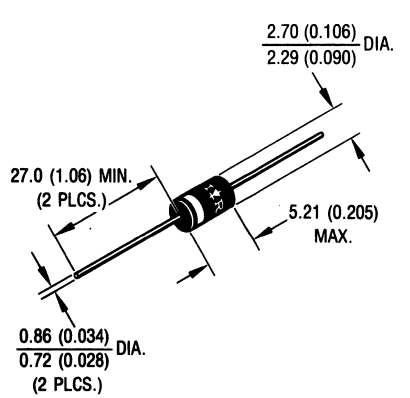
Characteristics	11DQ..	Units
$I_{F(AV)}$ Rectangular waveform	1.1	A
V_{RRM}	30/40	V
I_{FSM} @ tp = 5 μs sine	240	A
V_F @ 1 Apk, T_J = 25°C	0.55	V
T_J	-40 to 125	°C

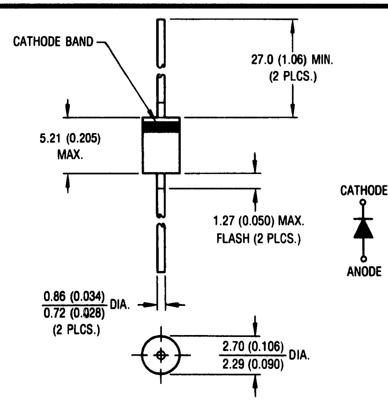
Description/Features

The 11DQ.. axial leaded Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- Low profile, axial leaded outline
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conform to JEDEC Outline DO-204AL (DO-41)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-475

Voltage Ratings

Part number		11DQ03	11DQ04
V_R	Max. DC Reverse Voltage (V)	30	40
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

Parameters		11DQ..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 4	1.1	A	50% duty cycle @ T_A = 58 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	240	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current * See Fig. 6	40		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

Parameters		11DQ..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.55	V	@ 1A	T_J = 25 °C
	* See Fig. 1 (1)	0.71	V	@ 2A	
		0.50	V	@ 1A	T_J = 125 °C
		0.61	V	@ 2A	
I_{RM}	Max. Reverse Leakage Current	1.0	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2 (1)	6.0	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	60	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

Parameters		11DQ..	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	130	°C/W	DC operation Without cooling fin
R_{thJA}	Typical Thermal Resistance Junction to Ambient with PC Board Mounted	81	°C/W	PC board mounted [L = 8mm (0.315 in.)] Solder land area 100mm² (0.155 in².)
wt	Approximate Weight	0.33(0.012)	g (oz.)	
	Case Style	DO-204AL(DO-41)		

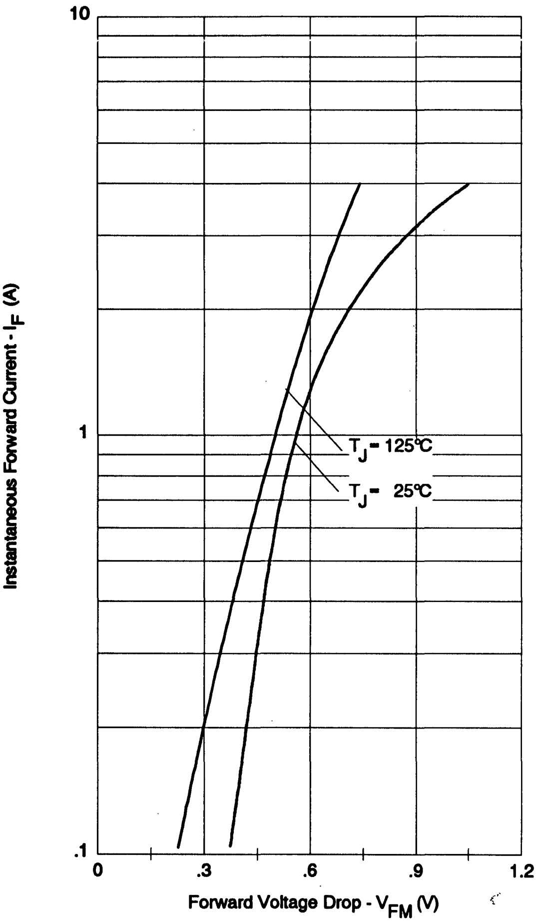


Fig. 1 - Maximum Forward Voltage Drop Characteristics

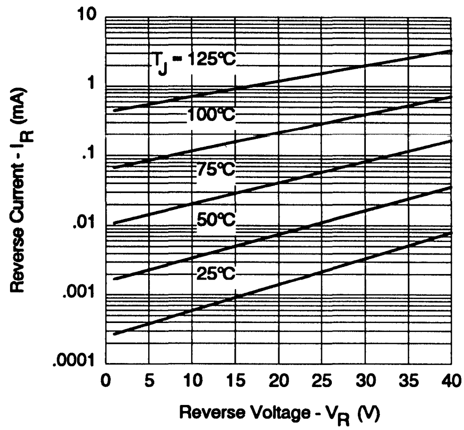


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

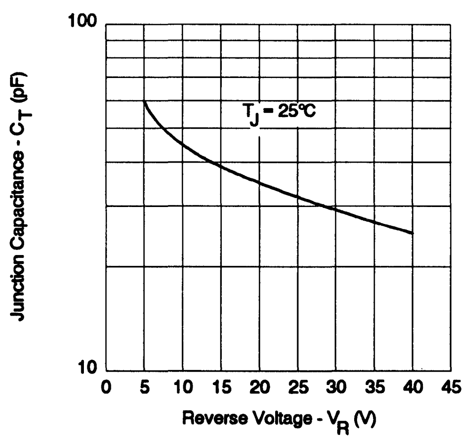


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

SURFACE MOUNT & AXIAL LEAD

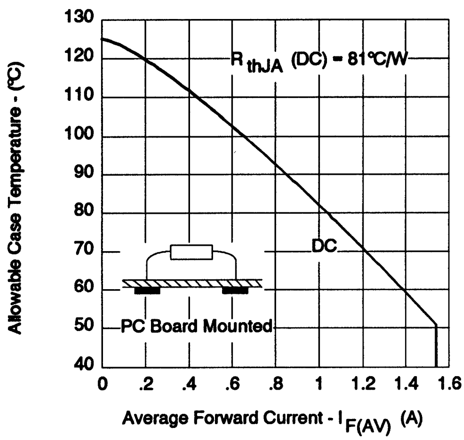


Fig. 4 - Maximum Ambient Temperature Vs. Average Forward Current, Printed Circuit Board Mounted

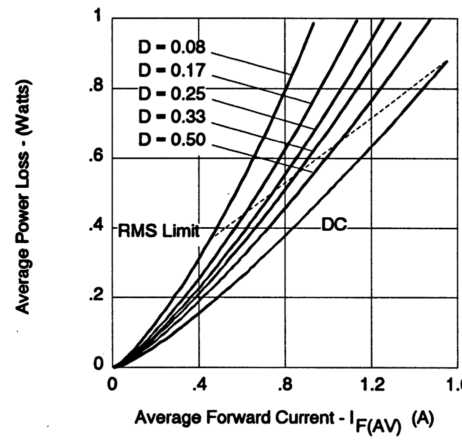


Fig. 5 - Forward Power Loss Characteristics

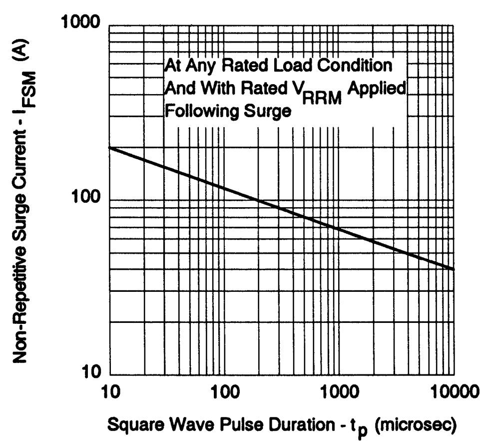


Fig. 6 - Maximum Non-Repetitive Surge Current

International Rectifier

11DQ05
11DQ06

SCHOTTKY RECTIFIER

1.1 Amp

Major Ratings and Characteristics

Characteristics	11DQ..	Units
$I_{F(AV)}$ Rectangular waveform	1.1	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 μs sine	150	A
V_F @ 1 Apk, T_J = 25°C	0.58	V
T_J	- 40 to 125	°C

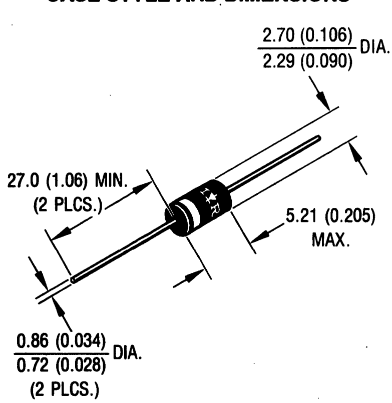
Description/Features

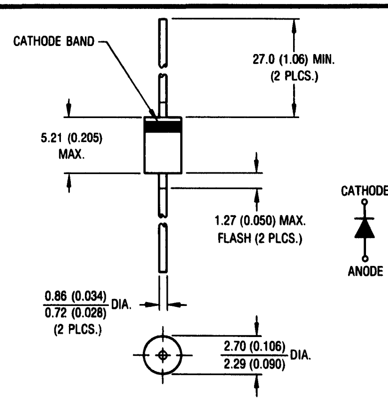
The 11DQ.. axial leaded Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- Low profile, axial leaded outline
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS





Conform to JEDEC Outline DO-204AL (DO-41)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-475

Voltage Ratings

	Part number	11DQ05	11DQ06
V_R	Max. DC Reverse Voltage (V)	50	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	11DQ..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 4	1.1	A	50% duty cycle @ T_A = 40°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	150	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current *See Fig. 6	25		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	11DQ..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.58	V	@ 1A	T_J = 25 °C
	* See Fig. 1 (1)	0.76	V	@ 2A	
		0.53	V	@ 1A	T_J = 125 °C
		0.64	V	@ 2A	
I_{RM}	Max. Reverse Leakage Current	1.0	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2 (1)	11	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	55	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	11DQ..	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	130	°C/W	DC operation Without cooling fin
R_{thJA}	Typical Thermal Resistance Junction to Ambient with PC Board Mounted	81	°C/W	PC board mounted [L = 8mm (0.315 in.)] Solder land area 100mm² (0.155 in².)
wt	Approximate Weight	0.33(0.012)	g (oz.)	
	Case Style	DO-204AL(DO-41)		

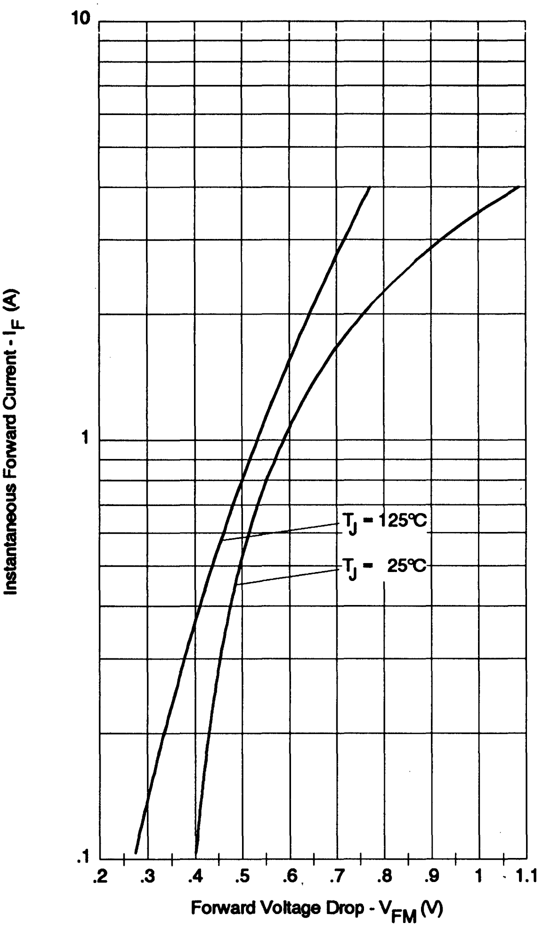


Fig. 1 - Maximum Forward Voltage Drop Characteristics

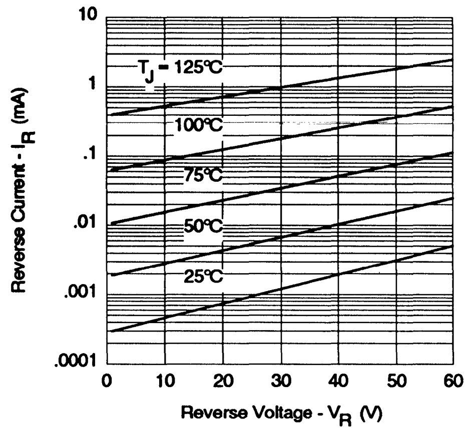


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

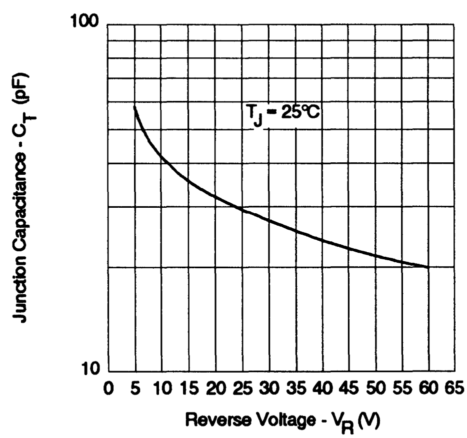


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

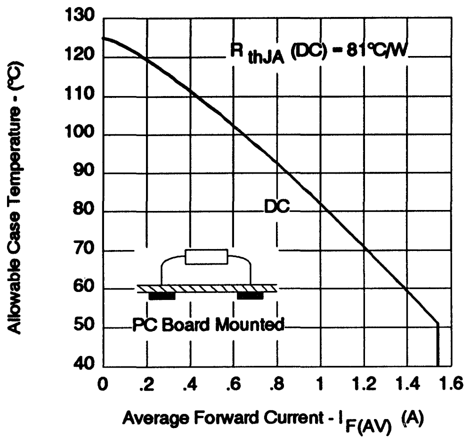


Fig. 4 - Maximum Ambient Temperature Vs. Average Forward Current, Printed Circuit Board Mounted

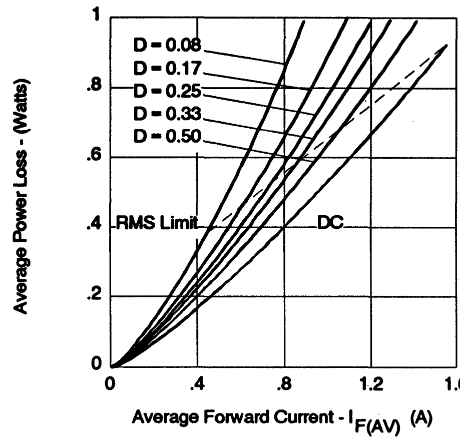


Fig. 5 - Forward Power Loss Characteristics

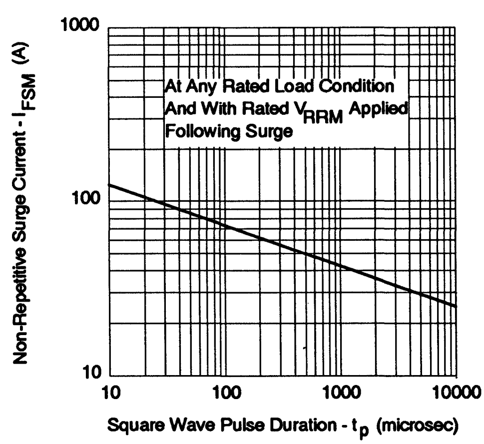


Fig. 6 - Maximum Non-Repetitive Surge Current

International
IOR Rectifier

11DQ09
11DQ10

SCHOTTKY RECTIFIER

1.1 Amp

Major Ratings and Characteristics

Characteristics	11DQ..	Units
$I_{F(AV)}$ Rectangular waveform	1.1	A
V_{RRM}	90/100	V
I_{FSM} @ tp = 5 μs sine	90	A
V_F @ 1 Apk, T_J = 25°C	0.85	V
T_J	- 40 to 125	°C

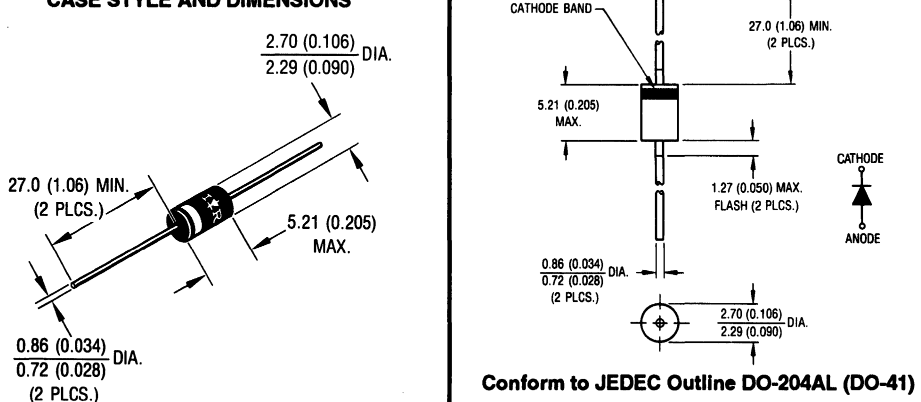
Description/Features

The 11DQ.. axial leaded Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- Low profile, axial leaded outline
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS



Conform to JEDEC Outline DO-204AL (DO-41)
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-475

Voltage Ratings

Part number	11DQ09	11DQ10
V_R Max. DC Reverse Voltage (V)	90	100
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

Parameters	11DQ..	Units	Conditions	
$I_{F(AV)}$ Max. Average Forward Current *See Fig. 4	1.1	A	50% duty cycle @ T_C = 48°C, rectangular wave form	
I_{FSM} Max. Peak One Cycle Non-Repetitive Surge Current *See Fig. 6	90	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	15		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

Parameters	11DQ..	Units	Conditions	
V_{FM} Max. Forward Voltage Drop * See Fig. 1 (1)	0.85	V	@ 1A	T_J = 25 °C
	0.96	V	@ 2A	
	0.68	V	@ 1A	T_J = 125 °C
	0.78	V	@ 2A	
I_{RM} Max. Reverse Leakage Current * See Fig. 2 (1)	0.5	mA	T_J = 25 °C	V_R = rated V_R
	1.0	mA	T_J = 125 °C	
C_T Typical Junction Capacitance	35	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

Parameters	11DQ..	Units	Conditions
T_J Max. Junction Temperature Range	-40 to 125	°C	
T_{stg} Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA} Max. Thermal Resistance Junction to Ambient	130	°C/W	DC operation Without cooling fin
R_{thJA} Typical Thermal Resistance Junction to Ambient with PC Board Mounted	81	°C/W	PC board mounted [L = 8mm (0.315 in.)] Solder land area 100mm² (0.155 in².)
wt Approximate Weight	0.33(0.012)	g (oz.)	
Case Style	DO-204AL(DO-41)		

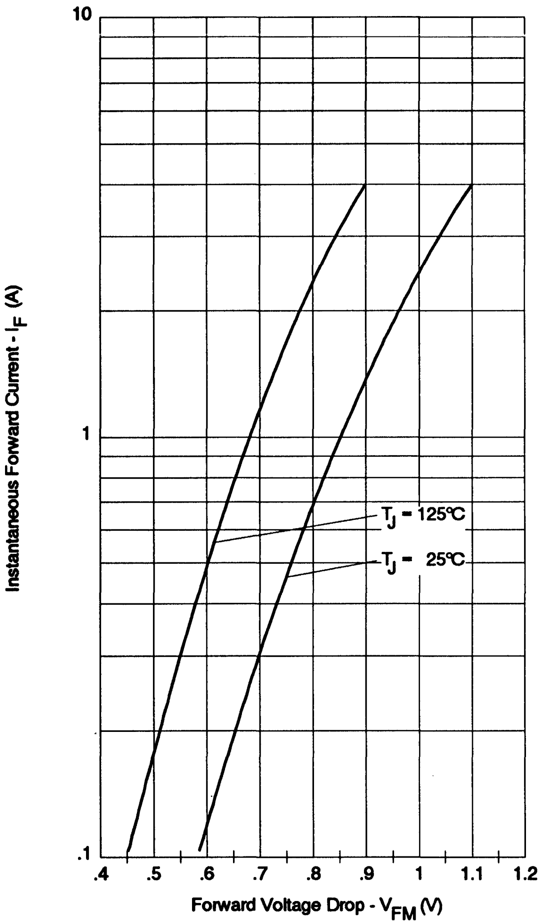


Fig. 1 - Maximum Forward Voltage Drop Characteristics

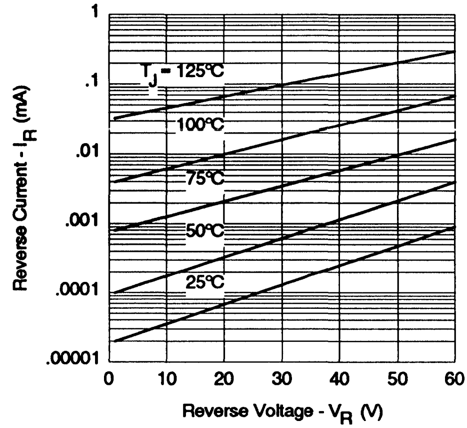


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

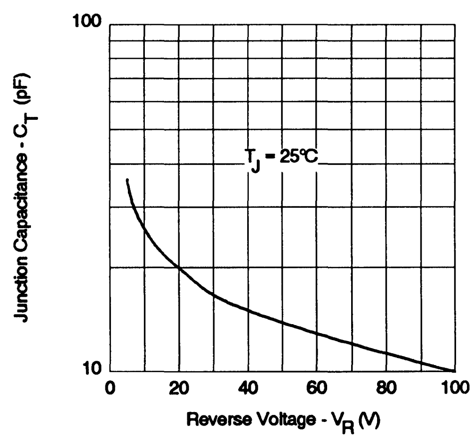


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

SURFACE MOUNT & AXIAL LEAD

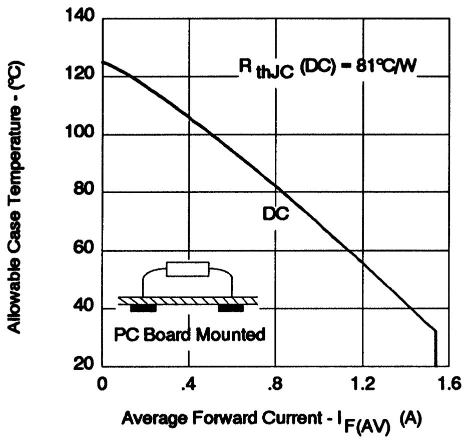


Fig. 4 - Maximum Ambient Temperature Vs. Average Forward Current, Printed Circuit Board Mounted

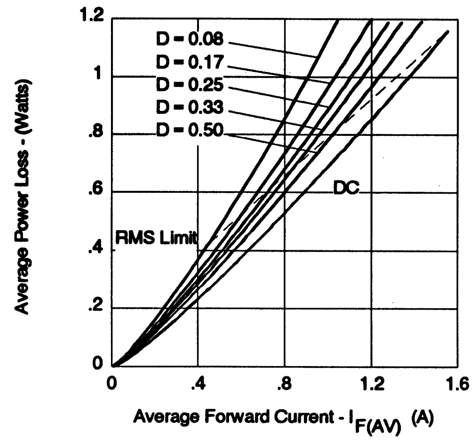


Fig. 5 - Forward Power Loss Characteristics

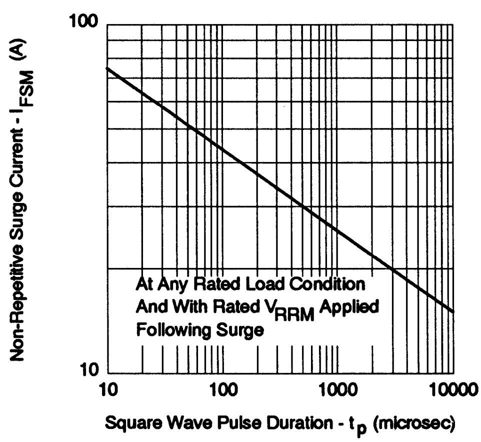


Fig. 6 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

31DQ03
31DQ04

SCHOTTKY RECTIFIER

3.3 Amp

SURFACE MOUNT & AXIAL LEAD

Major Ratings and Characteristics

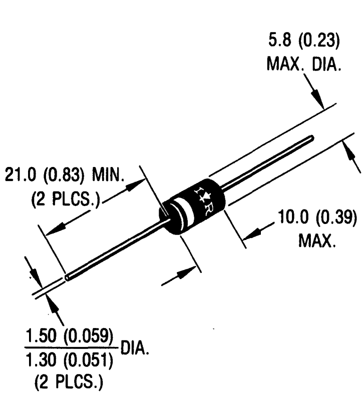
Characteristics	31DQ..	Units
$I_{F(AV)}$ Rectangular waveform	3.3	A
V_{RRM}	30/40	V
I_{FSM} @ tp = 5 µs sine	470	A
V_F @ 3 Apk, T_J = 25°C	0.55	V
T_J	-40 to 125	°C

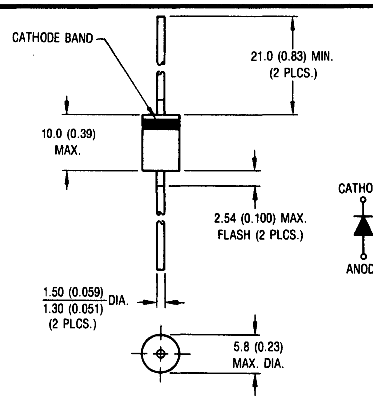
Description/Features

The 31DQ.. axial leaded Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- Low profile, axial leaded outline
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline C - 16
Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-475

Voltage Ratings

	Part number	31DQ03	31DQ04
V_R	Max. DC Reverse Voltage (V)	30	40
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	31DQ..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 4	3.3	A	50% duty cycle @ T_A = 35 °C, rectangular wave form With cooling fins	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	470	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current * See Fig. 6	95		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	31DQ..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.55	V	@ 3A	T_J = 25 °C
	* See Fig. 1 (1)	0.71	V	@ 6A	
		0.51	V	@ 3A	T_J = 125 °C
		0.62	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current	3	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2 (1)	25	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	190	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	9.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	31DQ..	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	80	°C/W	DC operation Without cooling fins
R_{thJA}	Typical Thermal Resistance Junction to Ambient	34	°C/W	With fin 20 x 20 (0.79 x 0.79) 1.0 (0.04) thick. Dimensions in millimeters (inches)
wt	Approximate Weight	1.2 (0.042)	g (oz.)	
	Case Style	C-16		

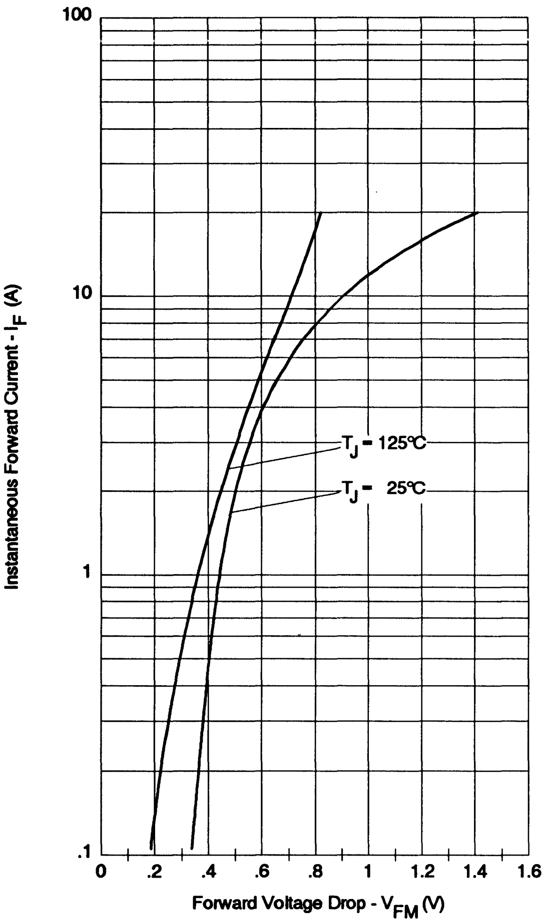


Fig. 1 - Maximum Forward Voltage Drop Characteristics

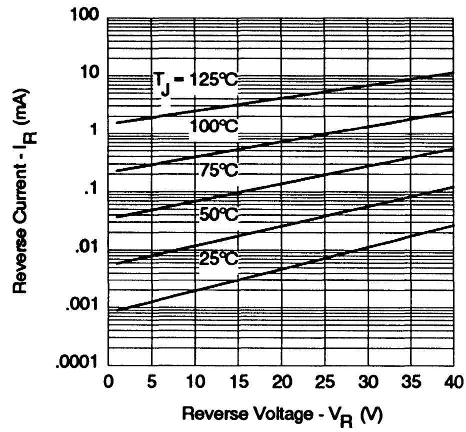


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

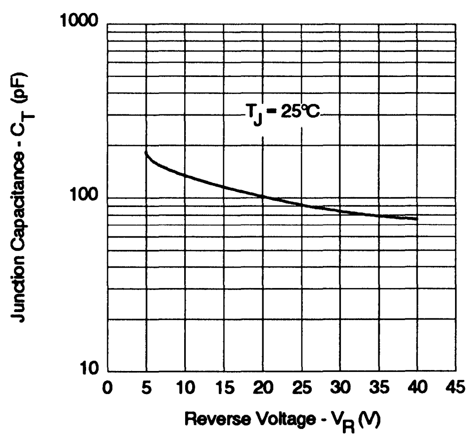


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

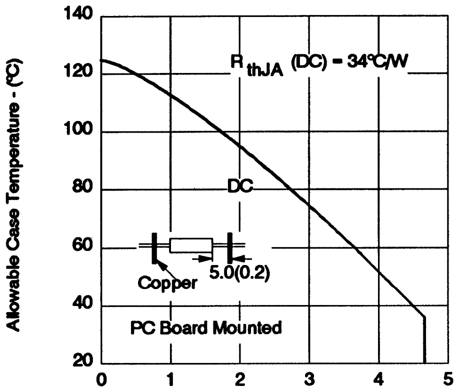


Fig. 4 - Maximum Allowable Case Temperature Vs. Average Forward Current, With Fins

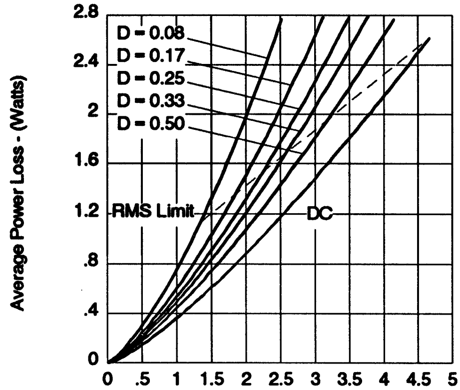


Fig. 5 - Forward Power Loss Characteristics

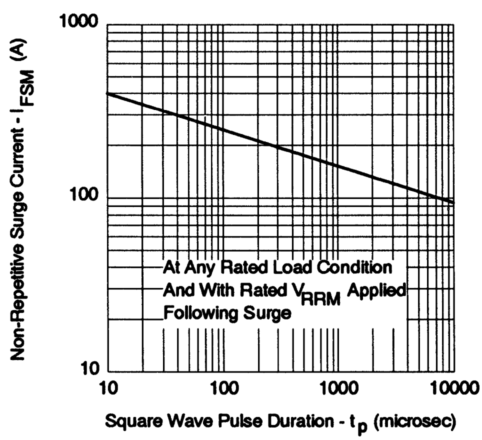


Fig. 6 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

31DQ05
31DQ06

SCHOTTKY RECTIFIER

3.3 Amp

SURFACE MOUNT & AXIAL LEAD

Major Ratings and Characteristics

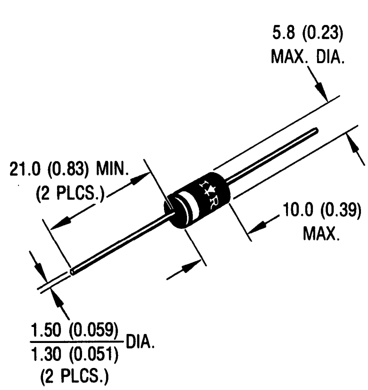
Characteristics	31DQ..	Units
$I_{F(AV)}$ Rectangular waveform	3.3	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 μs sine	360	A
V_F @ 3 Apk, T_J = 25°C	0.58	V
T_J	- 40 to 125	°C

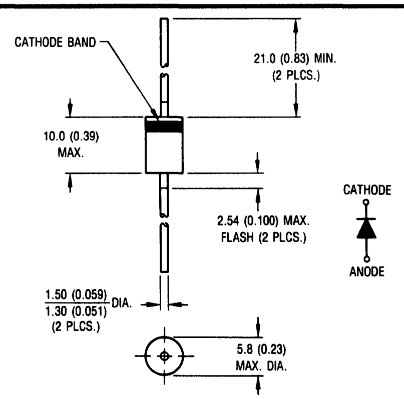
Description/Features

The 31DQ.. axial leaded Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- Low profile, axial leaded outline
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline C - 16

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-475

Voltage Ratings

Part number		31DQ05	31DQ06
V_R	Max. DC Reverse Voltage (V)	50	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

Parameters		31DQ..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 4	3.3	A	50% duty cycle @ T_A = 19 °C, rectangular wave form With cooling fins	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current *See Fig. 6	360	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		60		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

Parameters		31DQ..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop * See Fig. 1 (1)	0.58	V	@ 3A	T_J = 25 °C
		0.75	V	@ 6A	
		0.53	V	@ 3A	T_J = 125 °C
		0.64	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current * See Fig. 2 (1)	3	mA	T_J = 25 °C	V_R = rated V_R
		30	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	160	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	9.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

Parameters		31DQ..	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	80	°C/W	DC operation Without cooling fins
R_{thJA}	Typical Thermal Resistance Junction to Ambient	34	°C/W	With fin 20 x 20 (0.79 x 0.79) 1.0 (0.04) thick. Dimensions in millimeters (inches)
wt	Approximate Weight	1.2 (0.042)	g (oz.)	
	Case Style	C-16		

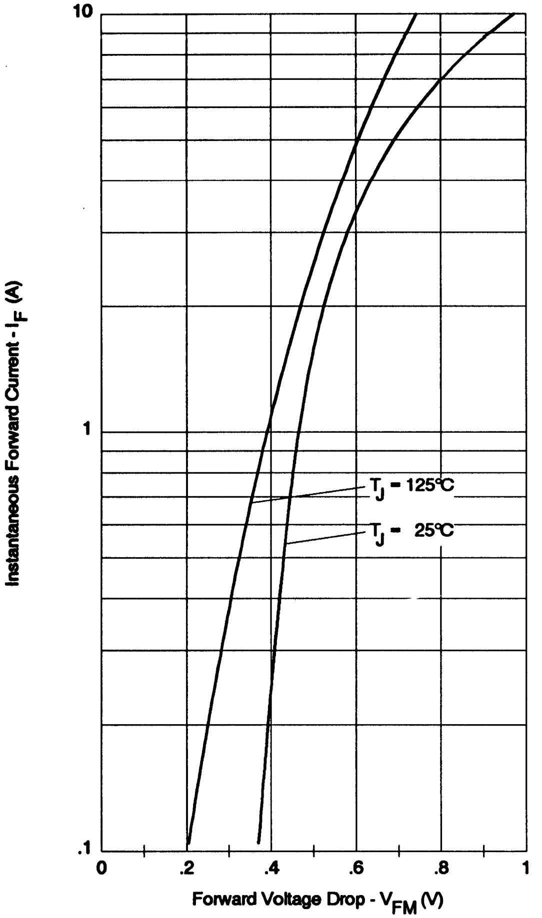


Fig. 1 - Maximum Forward Voltage Drop Characteristics

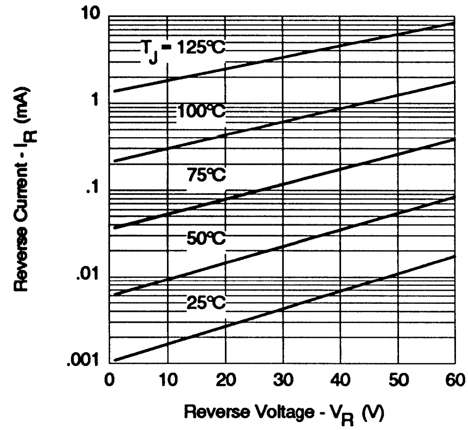


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

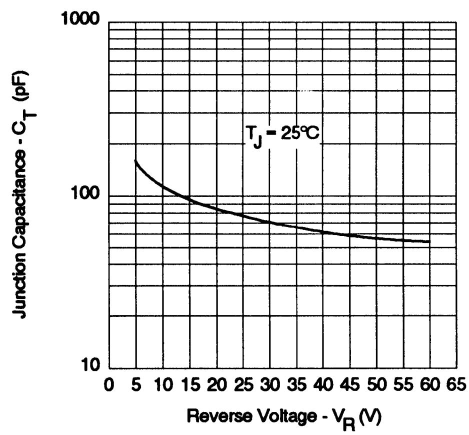


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

SURFACE MOUNT & AXIAL LEAD

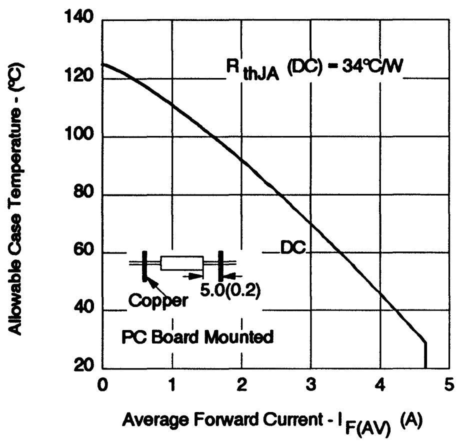


Fig. 4 - Maximum Allowable Case Temperature Vs. Average Forward Current, With Fins

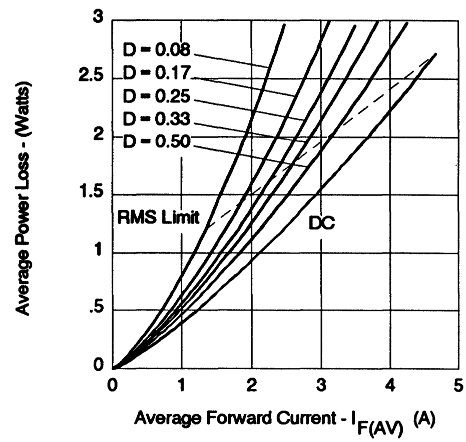


Fig. 5 - Forward Power Loss Characteristics

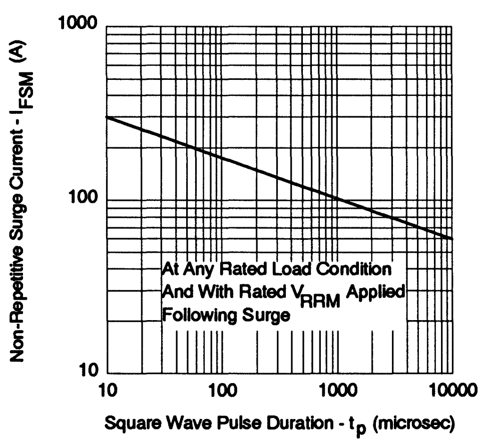


Fig. 6 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

31DQ09
31DQ10

SCHOTTKY RECTIFIER

3.3 Amp

SURFACE MOUNT & AXIAL LEAD

Major Ratings and Characteristics

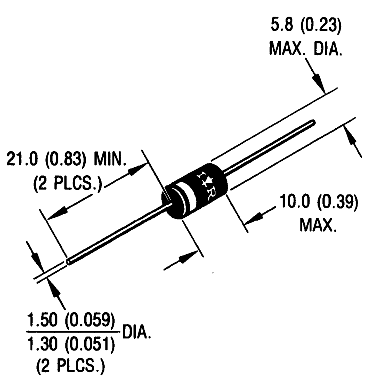
Characteristics	31DQ..	Units
$I_{F(AV)}$ Rectangular waveform	3.3	A
V_{RRM}	90/100	V
I_{FSM} @ tp = 5 µs sine	210	A
V_F @ 3 Apk, T_J = 25°C	0.85	V
T_J	-40 to 125	°C

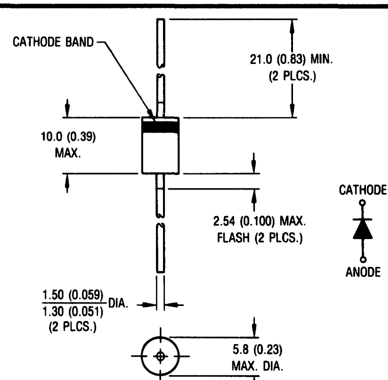
Description/Features

The 31DQ.. axial leaded Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- Low profile, axial leaded outline
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline C - 16

Dimensions in millimeters and inches

FOR TAPE AND REEL INFORMATION SEE PAGE D-475

Voltage Ratings

Part number	31DQ09	31DQ10
V_R Max. DC Reverse Voltage (V)	90	100
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	31DQ..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 4	3.3	A	50% duty cycle @ T_A = 25°C, rectangular wave form With cooling fins	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current *See Fig. 6	210	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		35		10ms Sine or 6ms Rect. pulse	

Electrical Specifications

	Parameters	31DQ..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop * See Fig. 1 (1)	0.85	V	@ 3A	T_J = 25 °C
		0.97	V	@ 6A	
		0.69	V	@ 3A	T_J = 125 °C
		0.80	V	@ 6A	
I_{RM}	Max. Reverse Leakage Current * See Fig. 2 (1)	1	mA	T_J = 25 °C	V_R = rated V_R
		4	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	110	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	9.0	nH	Measured lead to lead 5mm from package body	

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	31DQ..	Units	Conditions
T_J	Max. Junction Temperature Range	-40 to 125	°C	
T_{stg}	Max. Storage Temperature Range	-40 to 125	°C	
R_{thJA}	Max. Thermal Resistance Junction to Ambient	80	°C/W	DC operation Without cooling fins
R_{thJA}	Typical Thermal Resistance Junction to Ambient	34	°C/W	With fin 20 x 20 (0.79 x 0.79) 1.0 (0.04) thick. Dimensions in millimeters (inches)
wt	Approximate Weight	1.2 (0.042)	g (oz.)	
	Case Style	C-16		

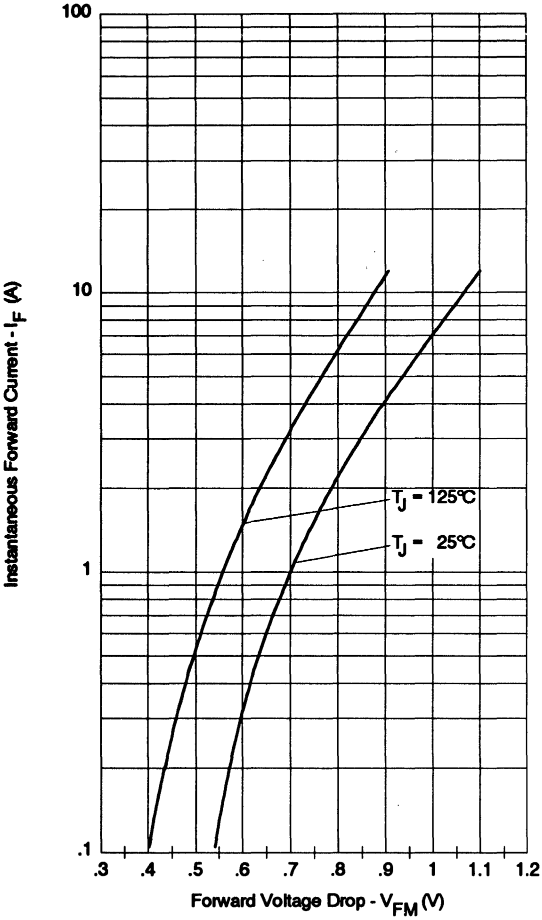


Fig. 1 - Maximum Forward Voltage Drop Characteristics

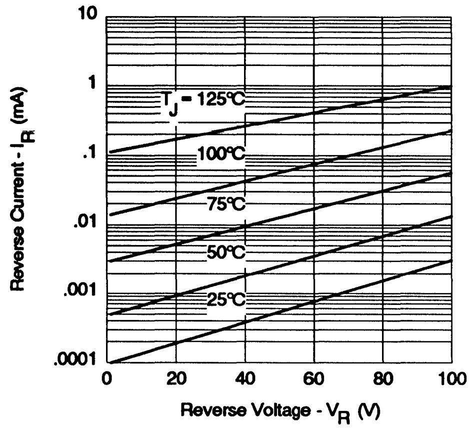


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

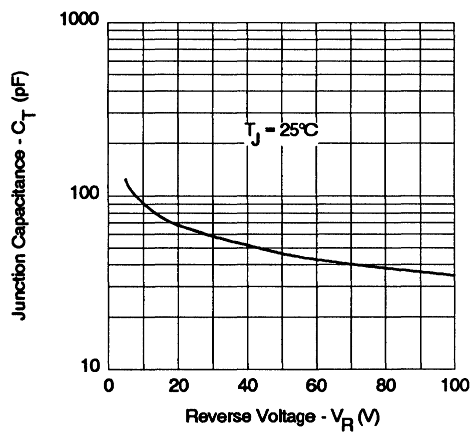


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

SURFACE MOUNT & AXIAL LEAD

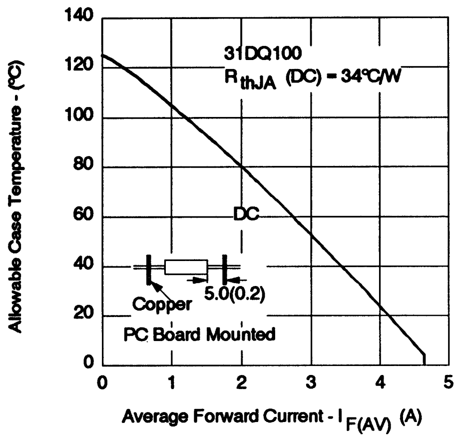


Fig. 4 - Maximum Allowable Case Temperature Vs. Average Forward Current, With Fins

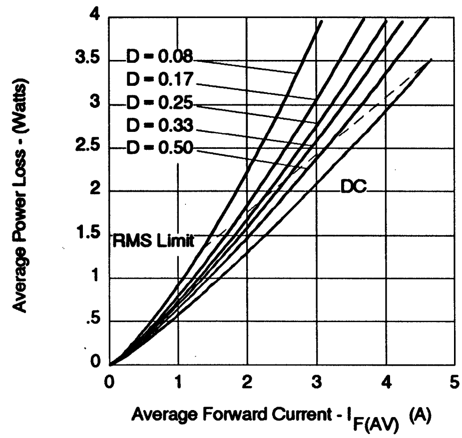


Fig. 5 - Forward Power Loss Characteristics

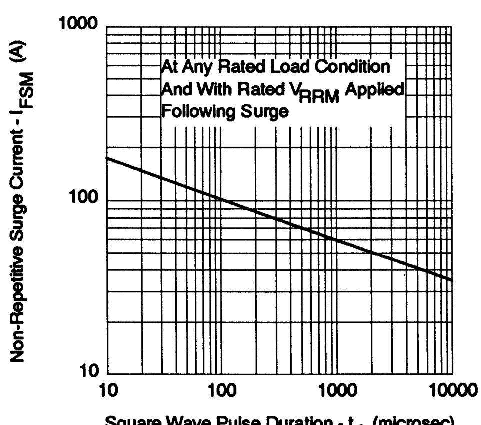


Fig. 6 - Maximum Non-Repetitive Surge Current

International IOR Rectifier

50SQ... SERIES

SCHOTTKY RECTIFIER

5 Amp

Major Ratings and Characteristics

Characteristics	50SQ...	Units
$I_{F(AV)}$ Rectangular waveform	5	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp=5µs sine	1900	A
V_F @ 5Apk, T_J=125°C	0.52	V
T_J	-55 to 175	°C

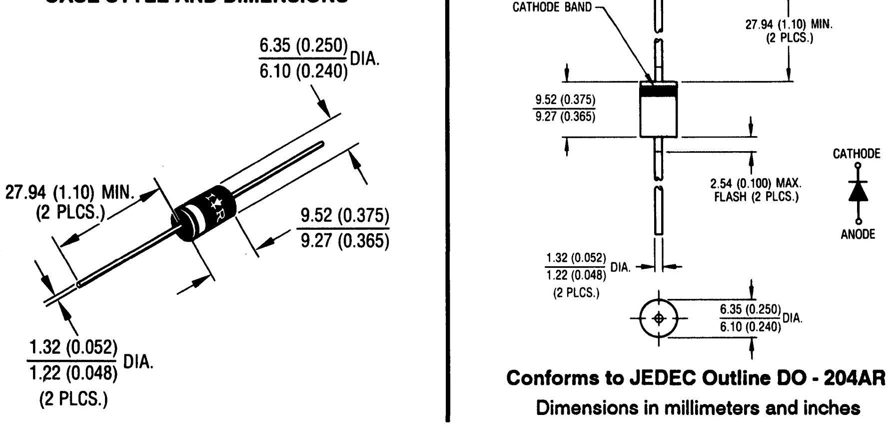
Description/Features

The 50SQ axial leaded Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175°C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS



Conforms to JEDEC Outline DO - 204AR

Dimensions in millimeters and inches

Voltage Ratings

	Part number	50SQ080	50SQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	50SQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	5	A	50% duty cycle @ T_C = 119°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	1900	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		290		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	15	mJ	T_J = 25 °C, I_{AS} = 1.0 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current	1.0	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	50SQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.66	V	@ 5A	T_J = 25 °C
		0.77	V	@ 10A	
		0.52	V	@ 5A	T_J = 125 °C
		0.62	V	@ 10A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	0.55	mA	T_J = 25 °C	V_R = rated V_R
		7	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	500	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	10	nH	Measured lead to lead 5mm from body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	50SQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 175	°C	
R_{thJL}	Max. Thermal Resistance Junction to Lead	8.0	°C/W	DC operation * See Fig. 4 1/8 inch lead leangth
R_{thJA}	Typical Thermal Resistance, Junction to Air	44	°C/W	
wt	Approximate Weight	1.4(0.049)	g (oz.)	
	Case Style	DO-204AR		JEDEC

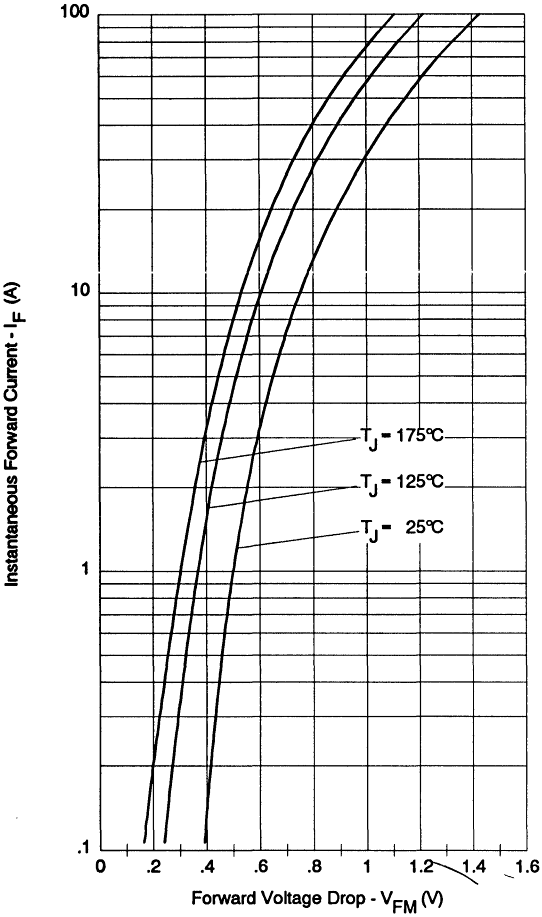


Fig. 1 - Maximum Forward Voltage Drop Characteristics

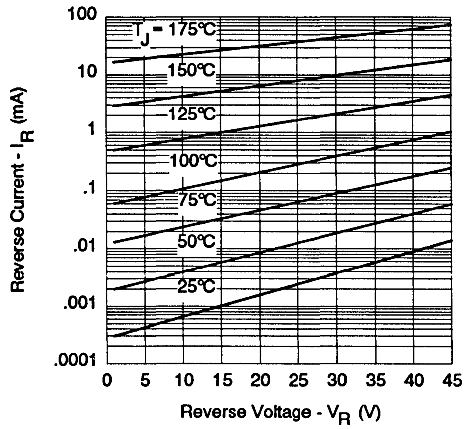


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

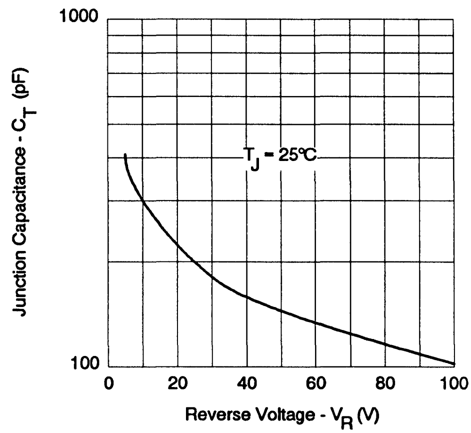


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

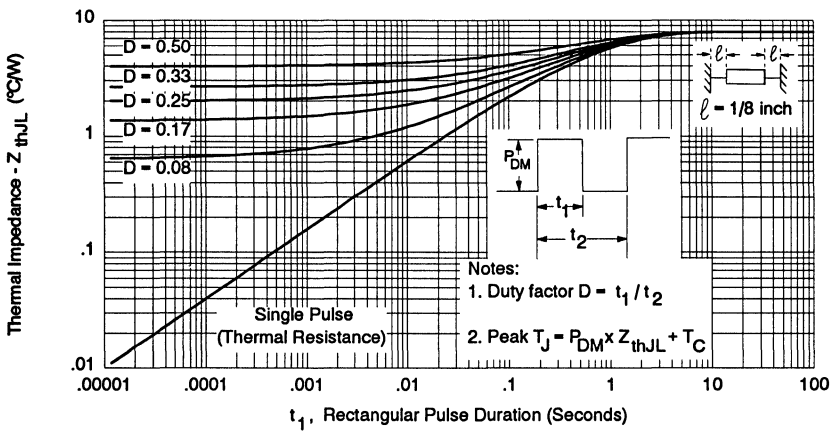


Fig. 4 - Maximum Thermal Impedance Z_{thJL} Characteristics

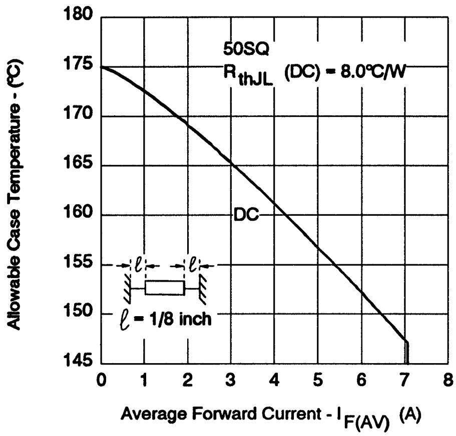


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

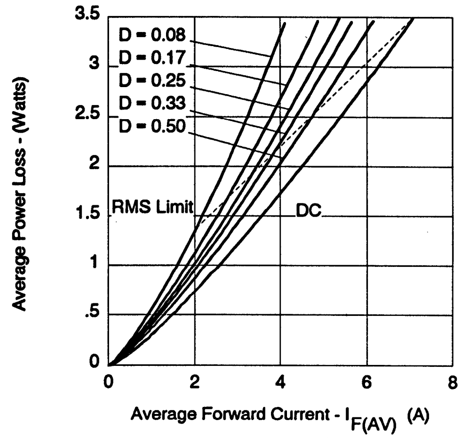


Fig. 6 - Forward Power Loss Characteristics

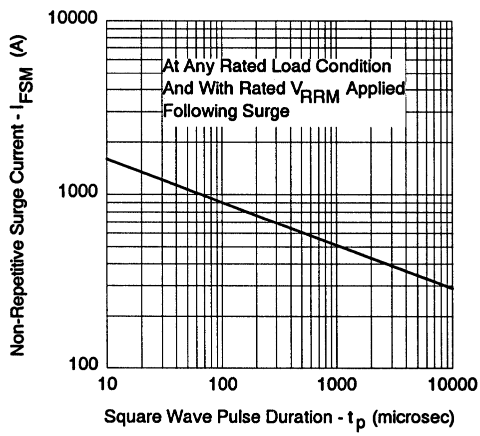


Fig. 7 - Maximum Non-Repetitive Surge Current

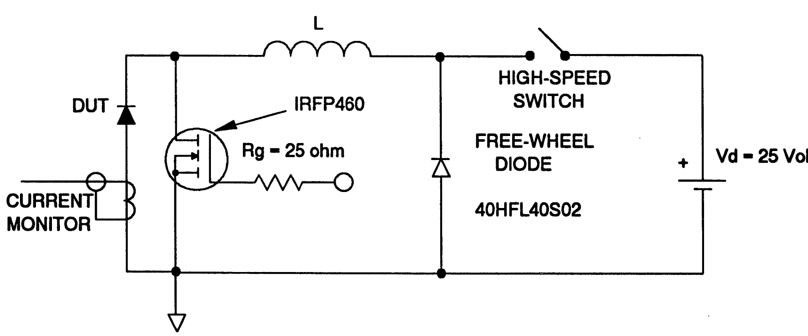


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

80SQ... SERIES

SCHOTTKY RECTIFIER

8 Amp

Major Ratings and Characteristics

Characteristics	80SQ...	Units
$I_{F(AV)}$ Rectangular waveform	8	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5μs sine	2400	A
V_F @ 8 Apk, T_J = 125°C	0.44	V
T_J	-55 to 175	°C

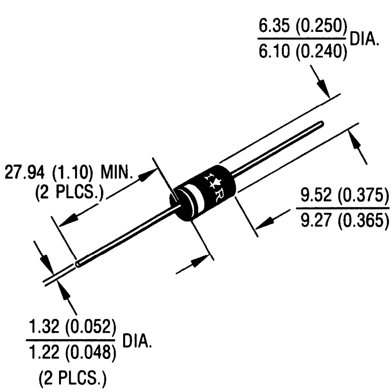
Description/Features

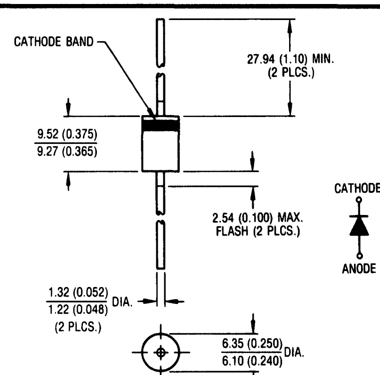
The 80SQ axial leaded Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175°C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

SURFACE MOUNT & AXIAL LEAD

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO - 204AR

Dimensions in millimeters and inches

Voltage Ratings

	Part number	80SQ035	80SQ040	80SQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	80SQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	8	A	50% duty cycle @ T_C = 119° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	2400	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current * See Fig. 7	380		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	10	mJ	T_J = 25 °C, I_{AS} = 1.6 Amps, L = 7.8 mH	
I_{AR}	Repetitive Avalanche Current	1.6	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	80SQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.53	V	@ 8A	T_J = 25 °C
	* See Fig. 1	0.60	V	@ 16A	
		0.44	V	@ 8A	T_J = 125 °C
		0.55	V	@ 16A	
I_{RM}	Max. Reverse Leakage Current (1)	2	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2	15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	10.0	nH	Measured lead to lead 5mm from body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	80SQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 175	°C	
R_{thJL}	Max. Thermal Resistance Junction to Lead	8.0	°C/W	DC operation * See Fig. 4 1/8 inch lead length
R_{thJA}	Typical Thermal Resistance, Junction to Air	44	°C/W	
wt	Approximate Weight	1.4(0.049)	g (oz.)	
	Case Style	DO-204AR		JEDEC

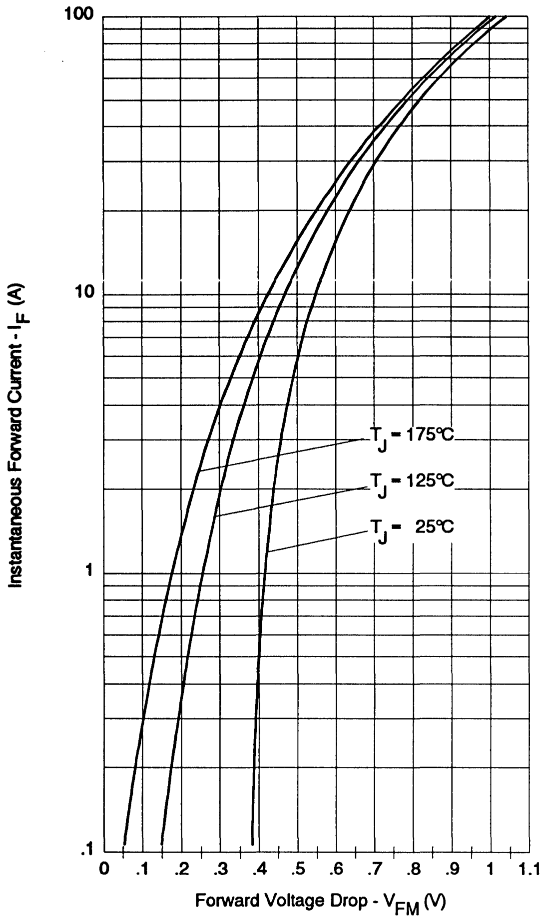


Fig. 1 - Maximum Forward Voltage Drop Characteristics

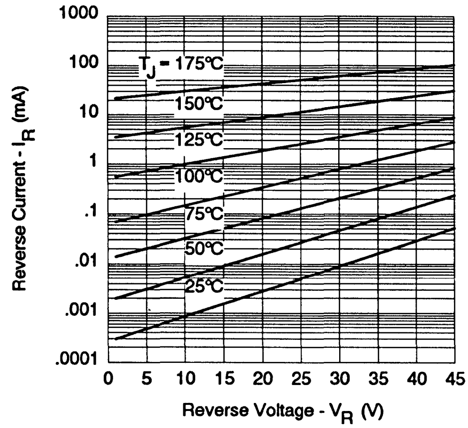


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

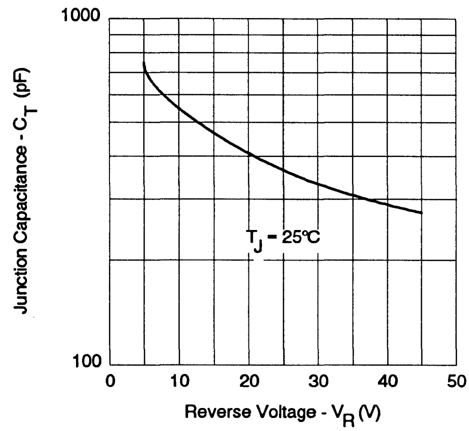


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

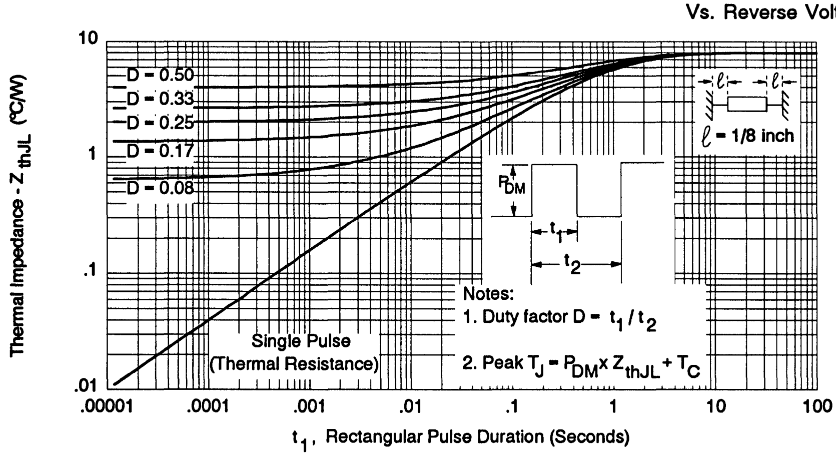


Fig. 4 - Maximum Thermal Impedance Z_{thJL} Characteristics

SURFACE MOUNT & AXIAL LEAD

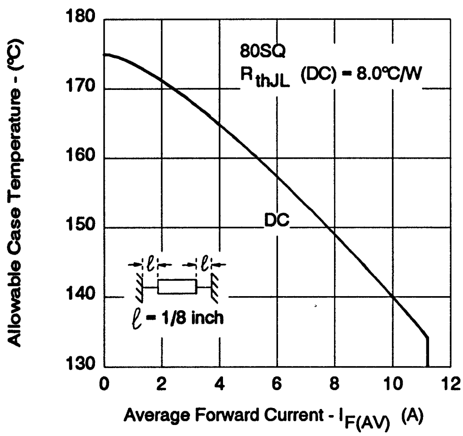


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

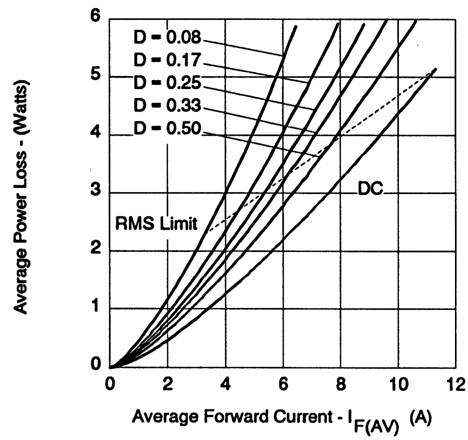


Fig. 6 - Forward Power Loss Characteristics

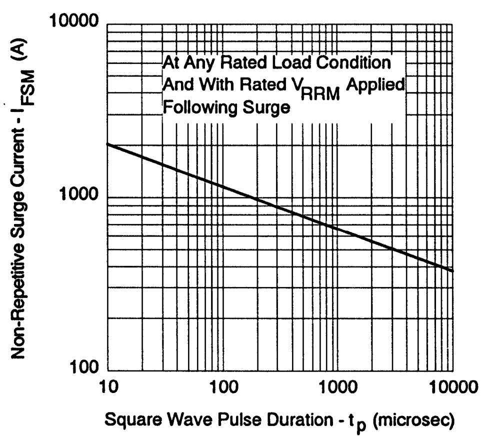


Fig. 7 - Maximum Non-Repetitive Surge Current

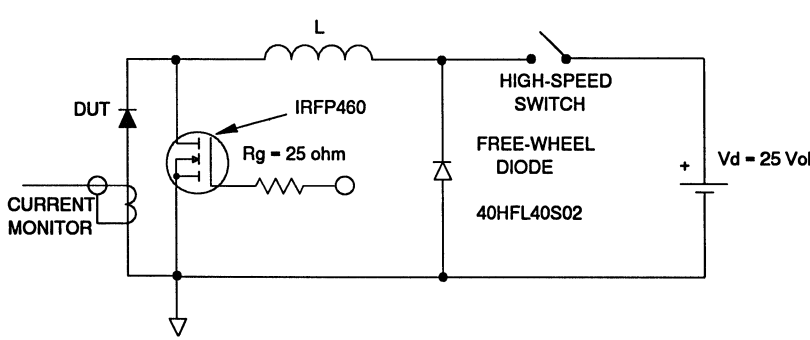


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

90SQ... SERIES

SCHOTTKY RECTIFIER

9 Amp

Major Ratings and Characteristics

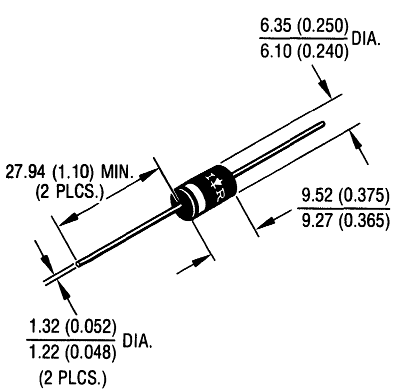
Characteristics	90SQ...	Units
$I_{F(AV)}$ Rectangular waveform	9	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	2150	A
V_F @ 9 Apk, T_J = 125°C	0.42	V
T_J	-55 to 150	°C

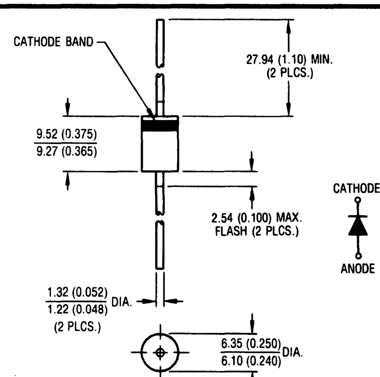
Description/Features

The 90SQ axial leaded Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150°C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO - 204AR
Dimensions in millimeters and inches

Voltage Ratings

	Part number	90SQ035	90SQ040	90SQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	90SQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	9	A	50% duty cycle @ T_C = 69° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	2150	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		340		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	12	mJ	T_J = 25 °C, I_{AS} = 1.8 Amps, L = 7.4 mH	
I_{AR}	Repetitive Avalanche Current	1.8	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	90SQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.48	V	@ 9A	T_J = 25 °C
		0.57	V	@ 18A	
		0.42	V	@ 9A	T_J = 125 °C
		0.52	V	@ 18A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	1.75	mA	T_J = 25 °C	V_R = rated V_R
		70	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	10.0	nH	Measured lead to lead 5mm from body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	90SQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 150	°C	
R_{thJL}	Max. Thermal Resistance Junction to Lead	8.0	°C/W	DC operation * See Fig. 4 1/8 inch lead leangth
R_{thJA}	Typical Thermal Resistance, Junction to Air	44	°C/W	
wt	Approximate Weight	1.4(0.049)	g (oz.)	
	Case Style	DO-204AR		JEDEC

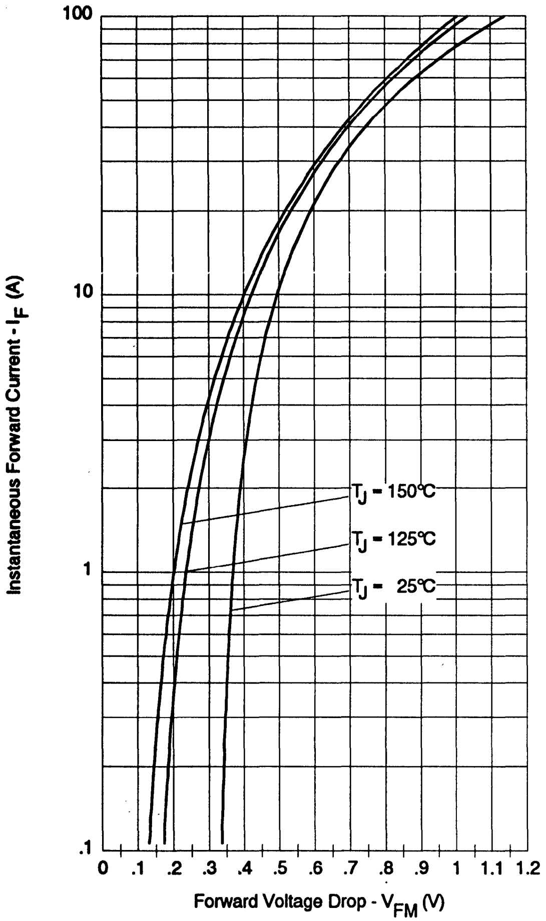


Fig. 1 - Maximum Forward Voltage Drop Characteristics

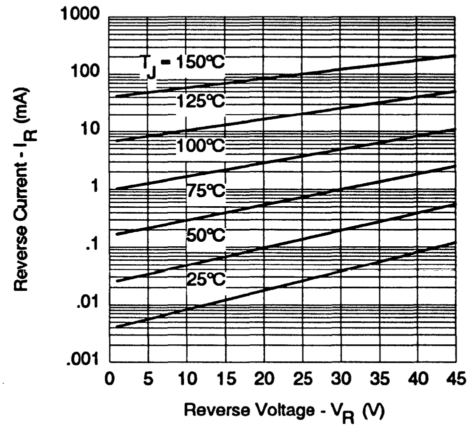


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

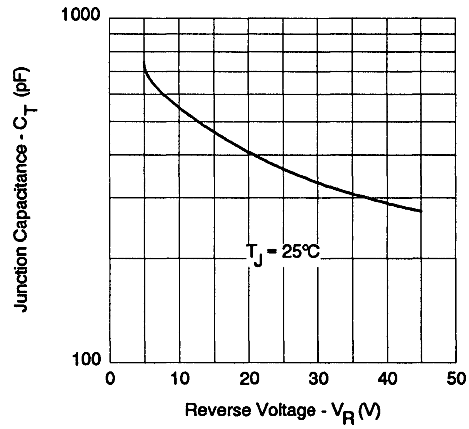


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

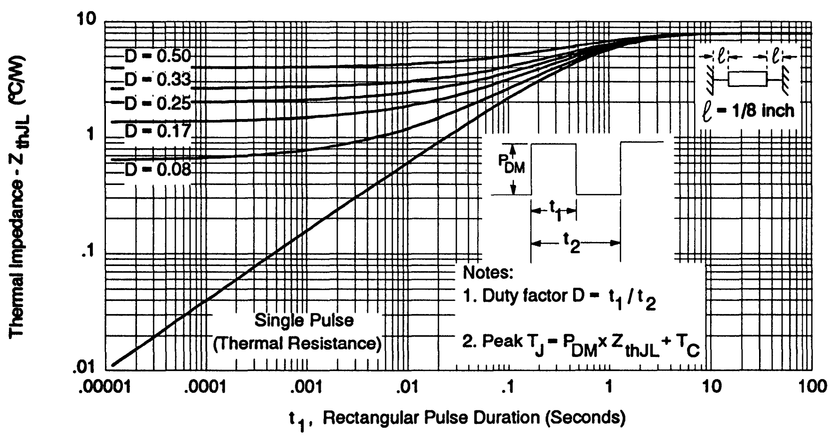


Fig. 4 - Maximum Thermal Impedance Z_{thJL} Characteristics

SURFACE MOUNT & AXIAL LEAD

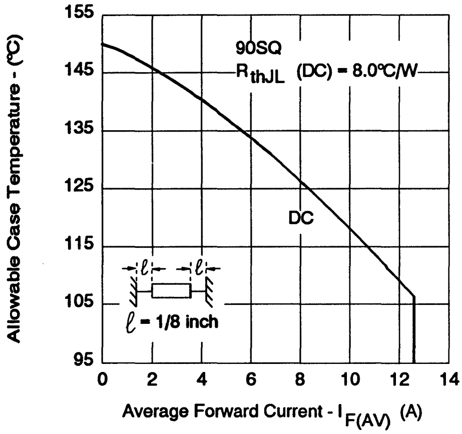


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

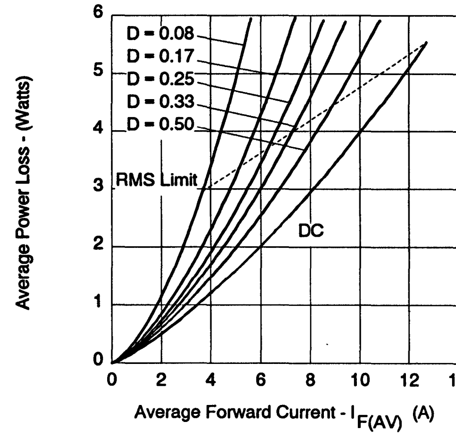


Fig. 6 - Forward Power Loss Characteristics

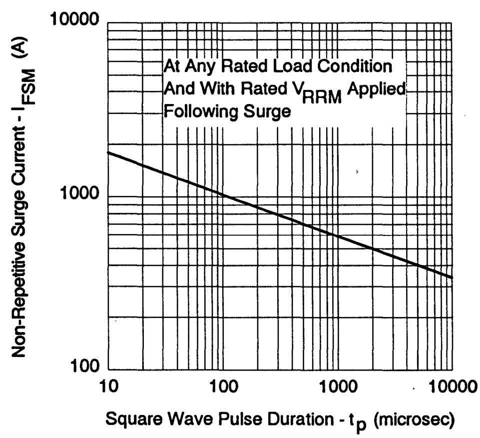


Fig. 7 - Maximum Non-Repetitive Surge Current

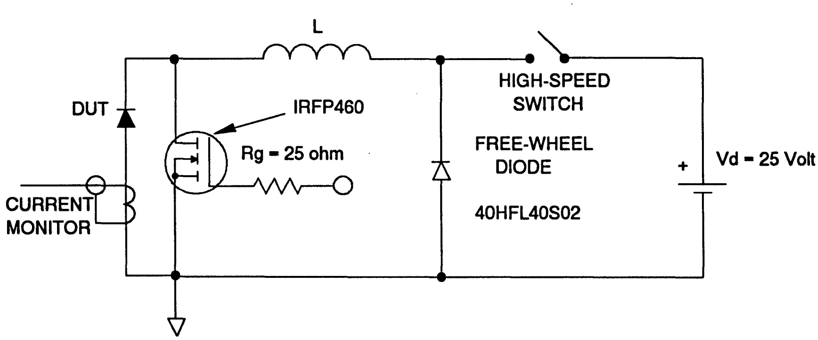


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

95SQ015

SCHOTTKY RECTIFIER

9 Amp

Major Ratings and Characteristics

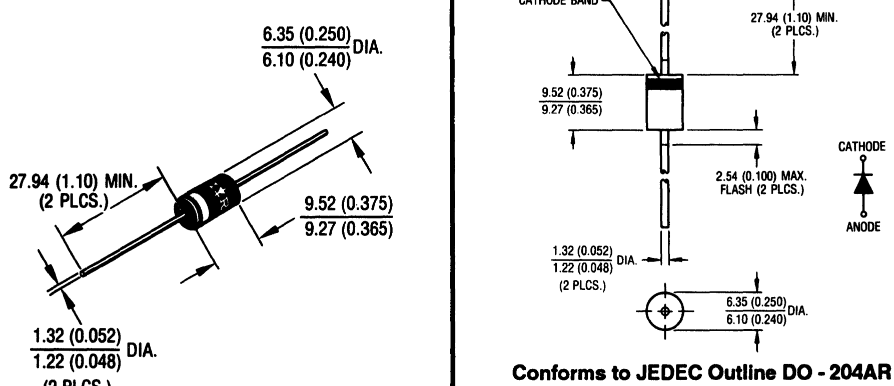
Characteristics	95SQ015	Units
$I_{F(AV)}$ Rectangular waveform	9	A
V_{RRM}	15	V
I_{FSM} @ tp = 5μs sine	2900	A
V_F @ 9 Apk, T_J = 75°C	0.25	V
T_J	-55 to 100	°C

Description/Features

The 95SQ015 axial leaded Schottky rectifier has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100° C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100° C T_J operation
- Optimized for OR-ing applications
- Ultra low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance

CASE STYLE AND DIMENSIONS



Conforms to JEDEC Outline DO - 204AR

Dimensions in millimeters and inches

Voltage Ratings

	Part number	95SQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	95SQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	9	A	50% duty cycle @ T_C = 55° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	2900	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	4.50	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 9 mH	
I_{AR}	Repetitive Avalanche Current	1	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 3 x V_R typical	

Electrical Specifications

	Parameters	95SQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.31	V	@ 9A	T_J = 25 °C
		0.37	V	@ 18A	
		0.25	V	@ 9A	T_J = 75 °C
		0.31	V	@ 18A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	7	mA	T_J = 25 °C	V_R = rated V_R
		348	mA	T_J = 100 °C	
		310	mA	T_J = 100 °C	V_R = 12V
		190	mA	T_J = 100 °C	V_R = 5V
C_T	Max. Junction Capacitance	1300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	10.0	nH	Measured lead to lead 5mm from body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	95SQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 100	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 100	°C	
R_{thJL}	Max. Thermal Resistance Junction to Lead	8.0	°C/W	DC operation * See Fig. 4 1/8 inch lead leangth
R_{thJA}	Typical Thermal Resistance, Junction to Air	44	°C/W	
wt	Approximate Weight	1.4(0.049)	g (oz.)	
	Case Style	DO-204AR		JEDEC

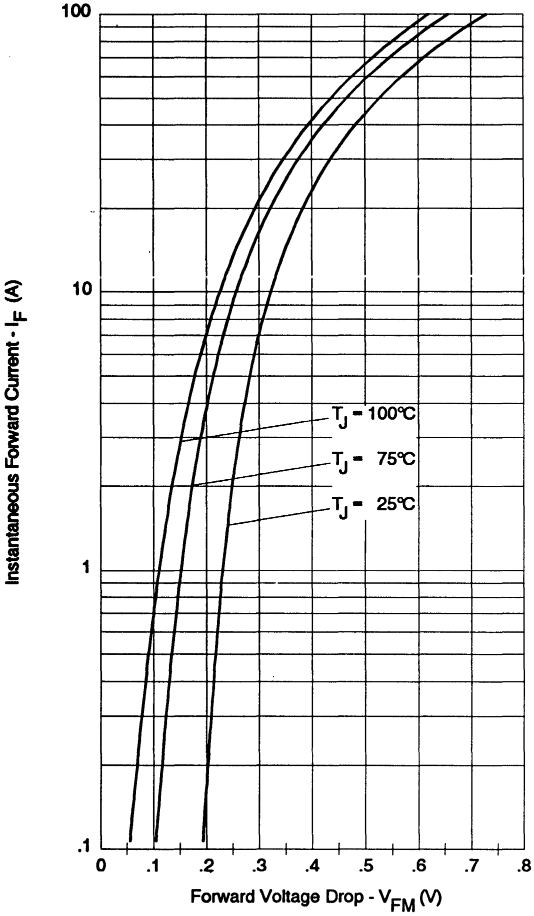


Fig. 1 - Maximum Forward Voltage Drop Characteristics

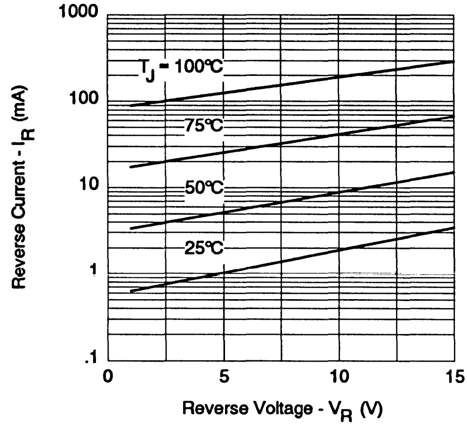


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

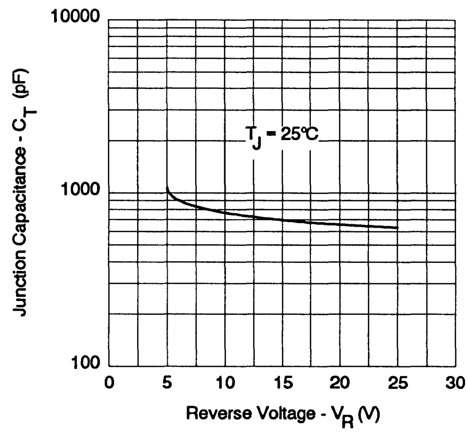


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

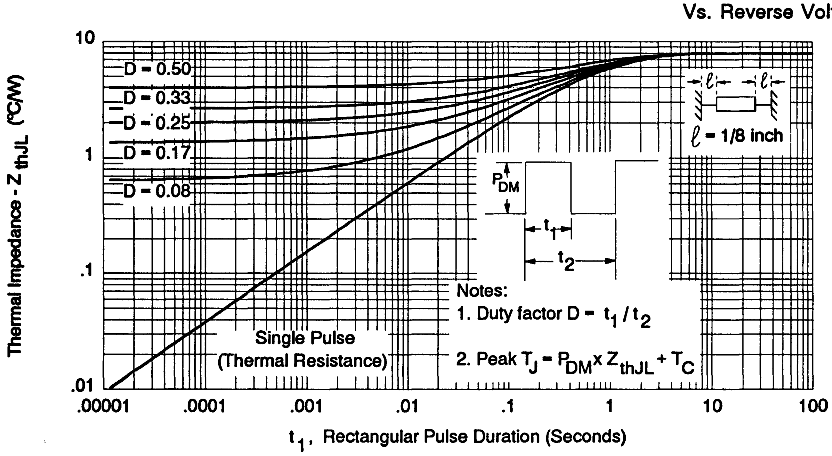


Fig. 4 - Maximum Thermal Impedance Z_{thJL} Characteristics

SURFACE MOUNT & AXIAL LEAD

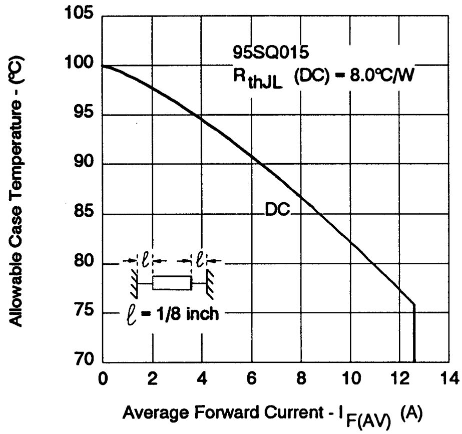


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

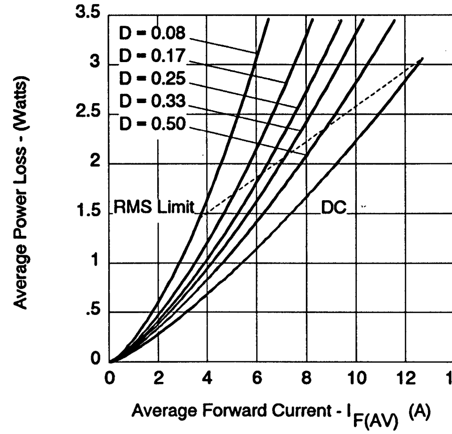


Fig. 6 - Forward Power Loss Characteristics

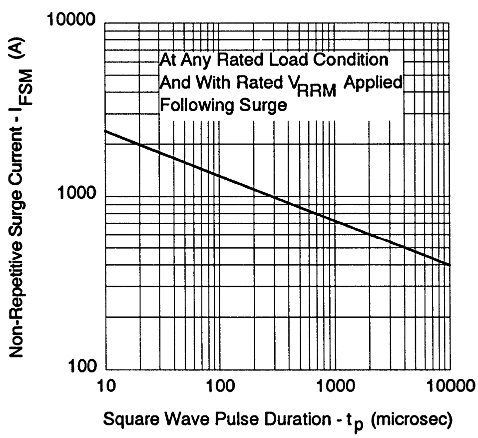


Fig. 7 - Maximum Non-Repetitive Surge Current

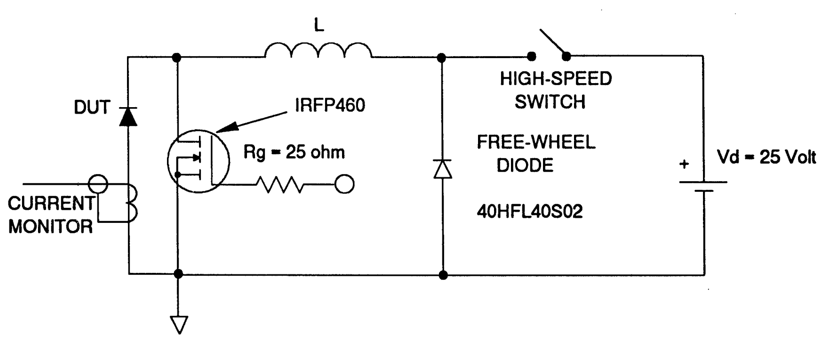


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

6TQ... SERIES

SCHOTTKY RECTIFIER

6 Amp

Major Ratings and Characteristics

Characteristics	6TQ...	Units
$I_{F(AV)}$ Rectangular waveform	6	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	690	A
V_F @ 6 Apk, T_J = 125°C	0.51	V
T_J	-55 to 175	°C

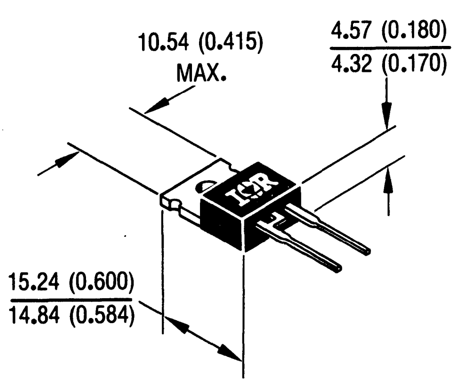
Description/Features

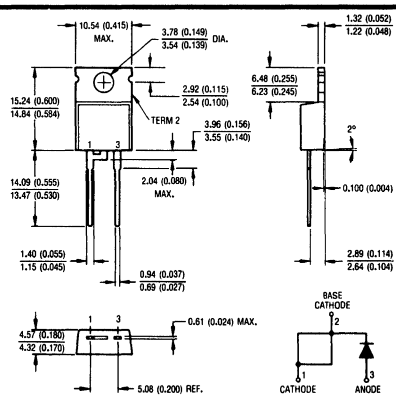
The 6TQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AC

Dimensions in millimeters and inches

Voltage Ratings

Part number	6TQ035	6TQ040	6TQ045
V_R Max. DC Reverse Voltage (V) V_{RWM} Max. Working Peak Reverse Voltage (V)	35	40	45

Absolute Maximum Ratings

	Parameters	6TQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	6	A	50% duty cycle @ T_C = 163° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	690	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		140		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	8	mJ	T_J = 25 °C, I_{AS} = 1.20 Amps, L = 11.10 mH	
I_{AR}	Repetitive Avalanche Current	1.20	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	6TQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.57	V	@ 6A	T_J = 25 °C
		0.69	V	@ 12A	
		0.51	V	@ 6A	T_J = 125 °C
		0.63	V	@ 12A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	0.8	mA	T_J = 25 °C	V_R = rated V_R
		7	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		6TQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.2	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

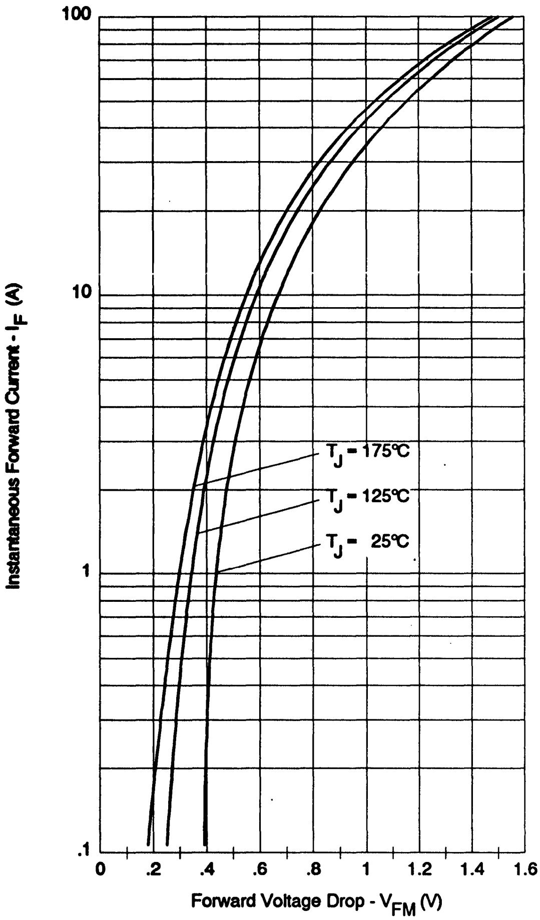


Fig. 1 - Maximum Forward Voltage Drop Characteristics

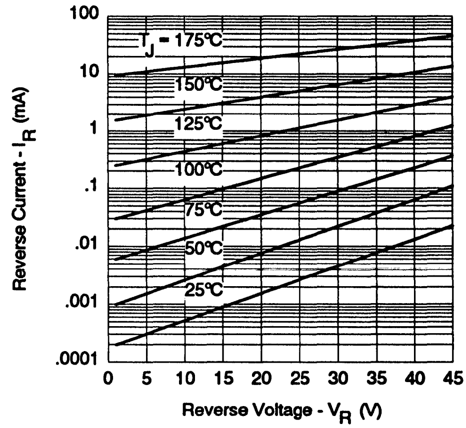


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

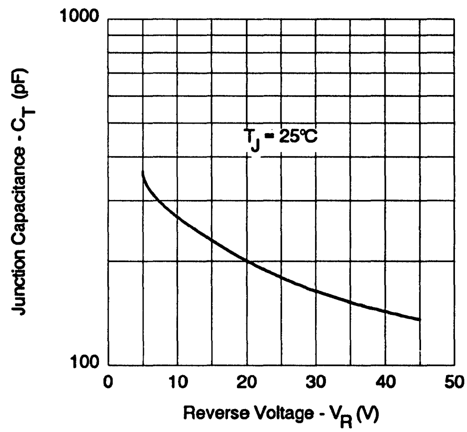


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

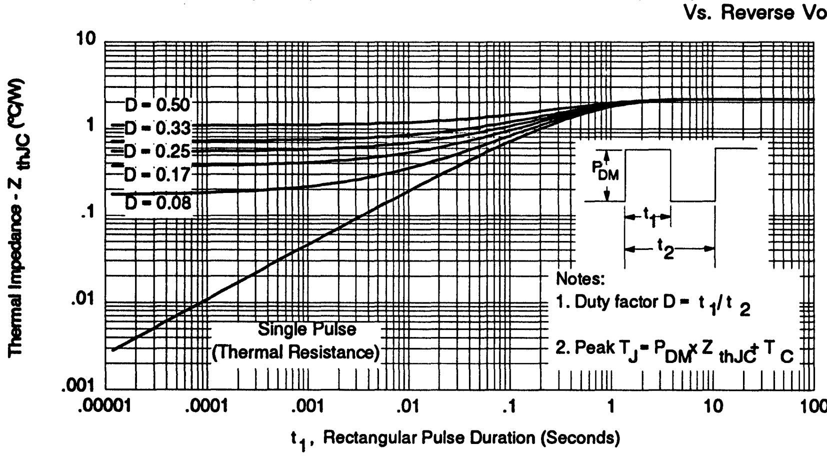


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

PLASTIC TO-220 & TO-247

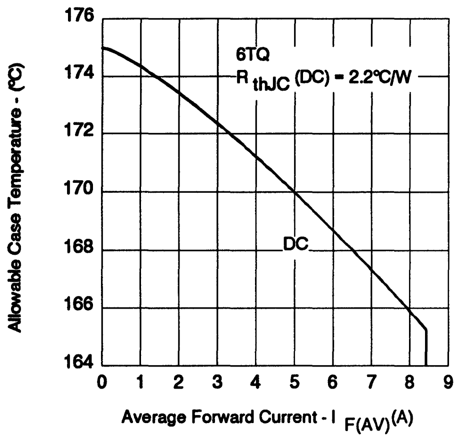


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

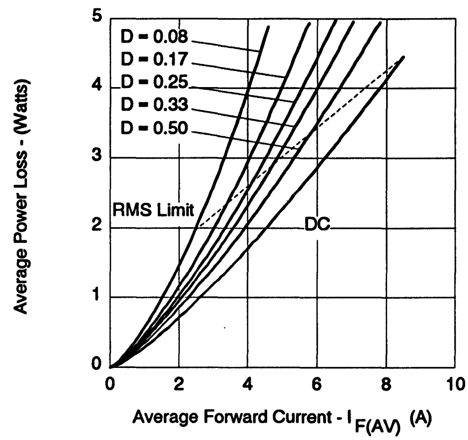


Fig. 6 - Forward Power Loss Characteristics

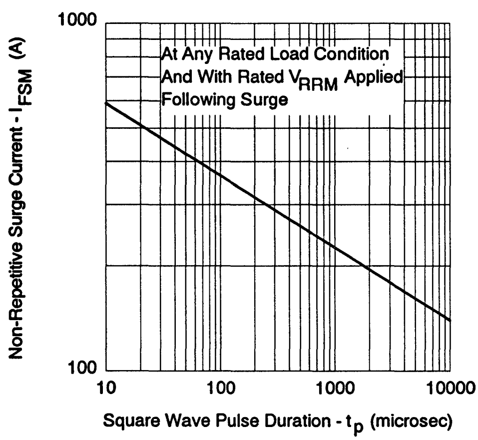


Fig. 7 - Maximum Non-Repetitive Surge Current

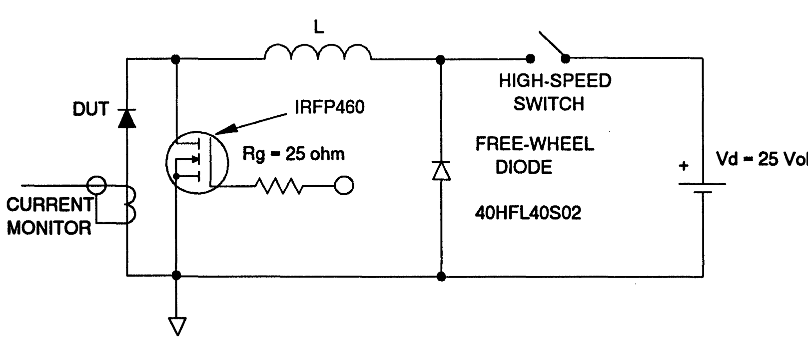


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

8TQ... SERIES

SCHOTTKY RECTIFIER

8 Amp

Major Ratings and Characteristics

Characteristics	8TQ...	Units
$I_{F(AV)}$ Rectangular waveform	8	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	850	A
V_F @ 8 Apk, T_J = 125°C	0.58	V
T_J	-55 to 175	°C

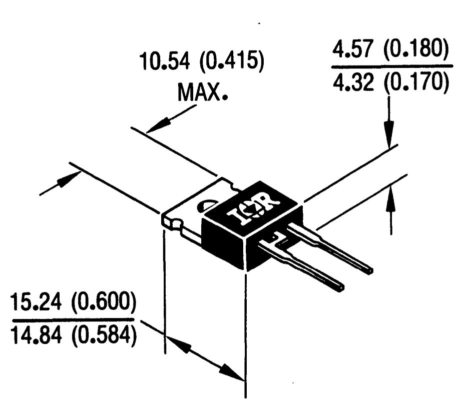
Description/Features

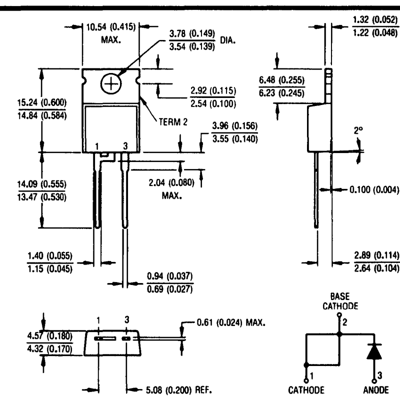
The 8TQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AC

Dimensions in millimeters and inches

Voltage Ratings

	Part number	8TQ080	8TQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	8TQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	8	A	50% duty cycle @ T_C = 157° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	850	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		230		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	7.50	mJ	T_J = 25 °C, I_{AS} = 0.50 Amps, L = 60 mH	
I_{AR}	Repetitive Avalanche Current	0.50	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	8TQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.72	V	@ 8A	T_J = 25 °C
		0.88	V	@ 16A	
		0.58	V	@ 8A	T_J = 125 °C
		0.69	V	@ 16A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	0.55	mA	T_J = 25 °C	V_R = rated V_R
		7	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	500	pF	V_R = $5V_{DC}$, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	8	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		8TQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.0	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

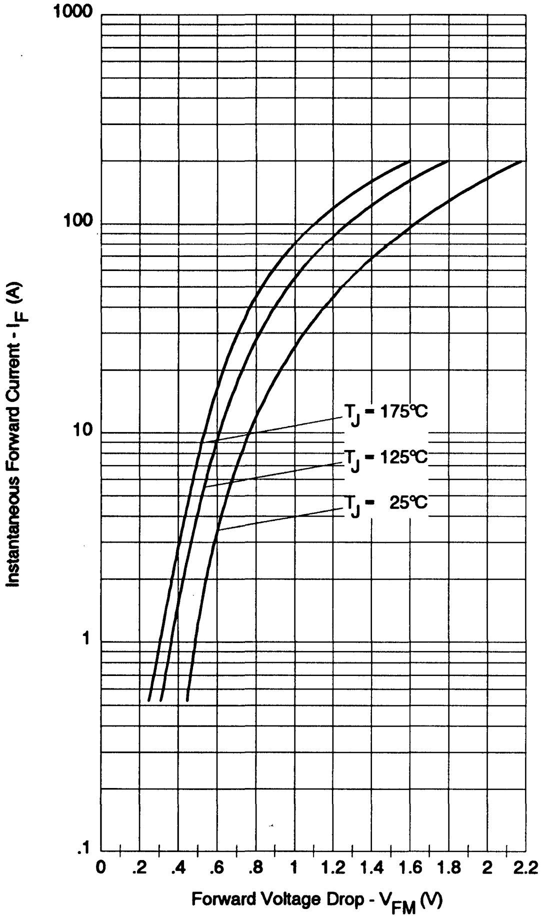


Fig. 1 - Maximum Forward Voltage Drop Characteristics

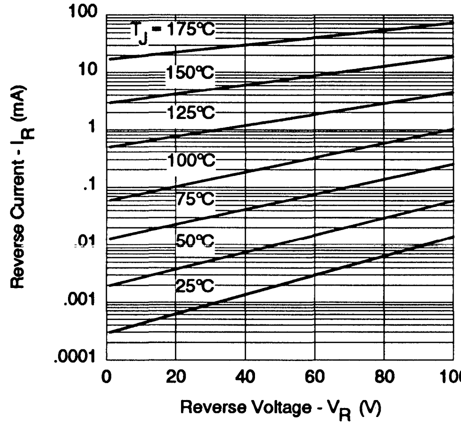


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

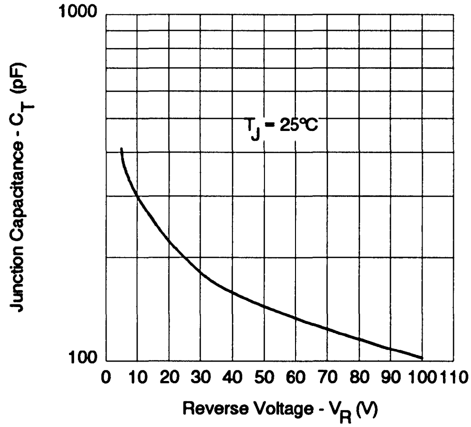


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

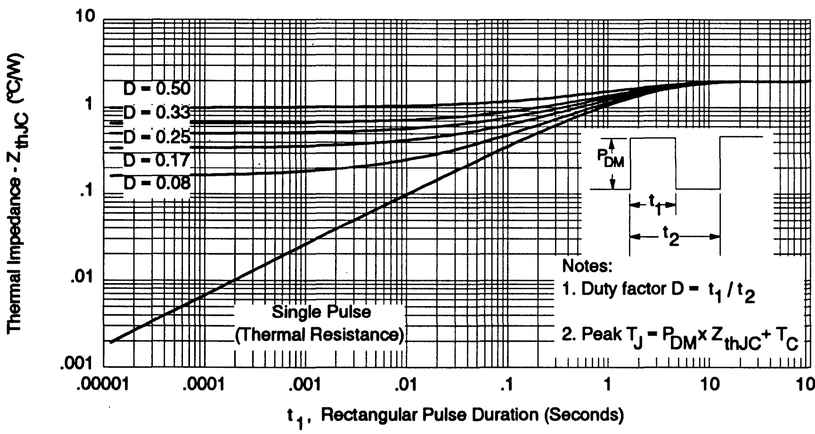


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

PLASTIC TO-220 & TO-247

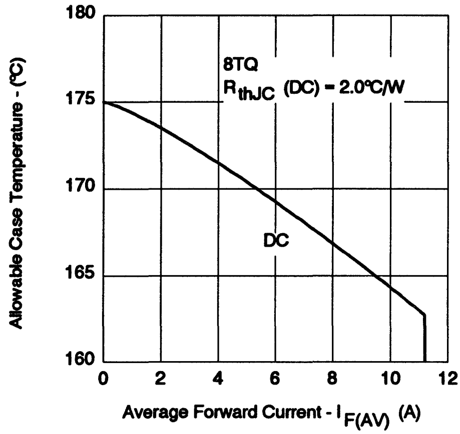


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

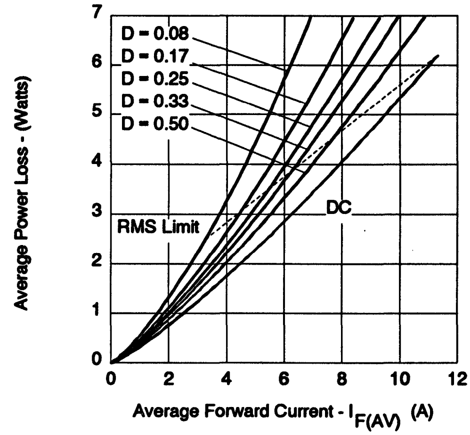


Fig. 6 - Forward Power Loss Characteristics

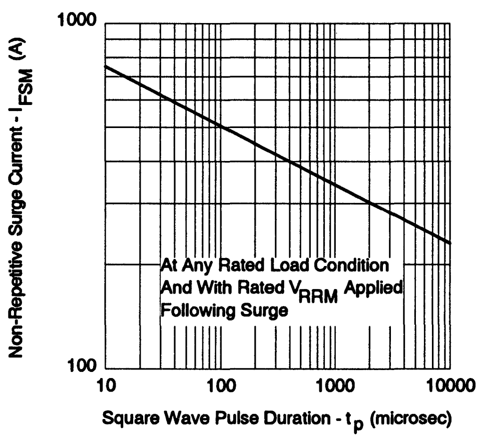


Fig. 7 - Maximum Non-Repetitive Surge Current

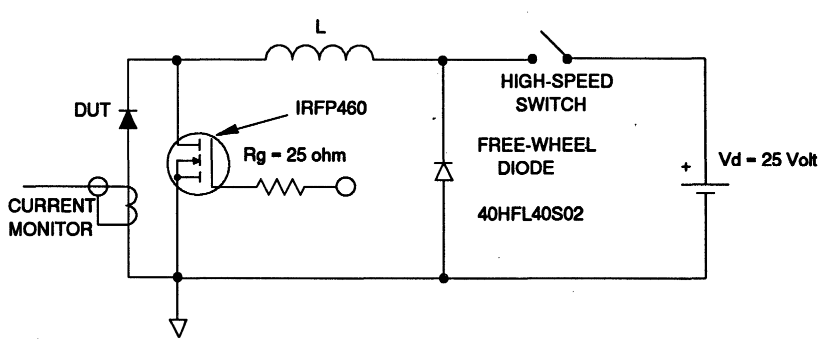


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

10TQ... SERIES

SCHOTTKY RECTIFIER

10 Amp

Major Ratings and Characteristics

Characteristics	10TQ...	Units
$I_{F(AV)}$ Rectangular waveform	10	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	1050	A
V_F @ 10 Apk, T_J = 125°C	0.49	V
T_J	-55 to 175	°C

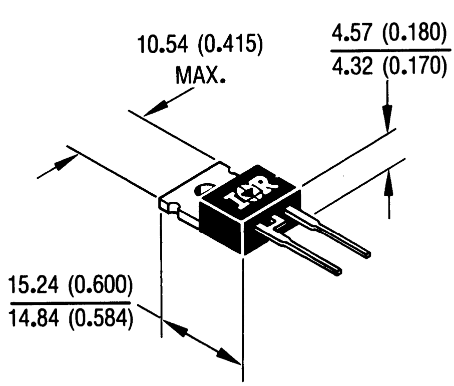
Description/Features

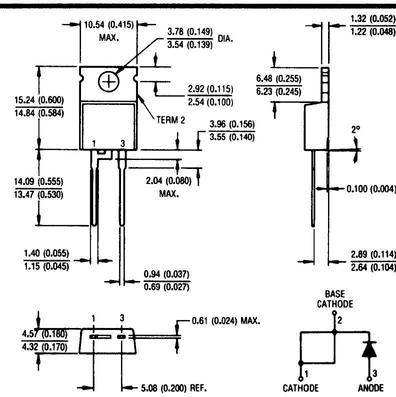
The 10TQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175°C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC
TO-220 &
TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AC

Dimensions in millimeters and inches

Voltage Ratings

	Part number	10TQ035	10TQ040	10TQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	10TQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	10	A	50% duty cycle @ T_C = 151°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	1050	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		280		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	13	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 6.5 mH	
I_{AR}	Repetitive Avalanche Current	2	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	10TQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.57	V	@ 10A	T_J = 25 °C
		0.67	V	@ 20A	
		0.49	V	@ 10A	T_J = 125 °C
		0.61	V	@ 20A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	2	mA	T_J = 25 °C	V_R = rated V_R
		15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		10TQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.0	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

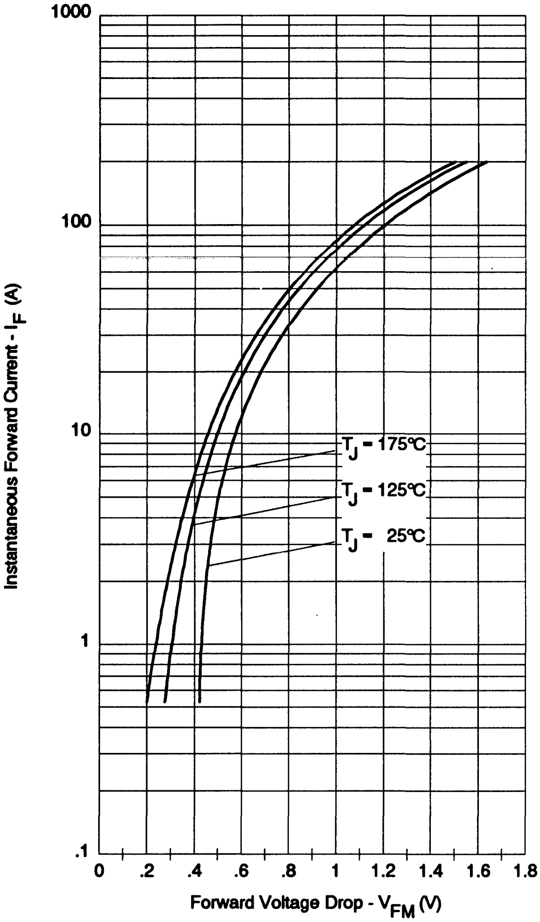


Fig. 1 - Maximum Forward Voltage Drop Characteristics

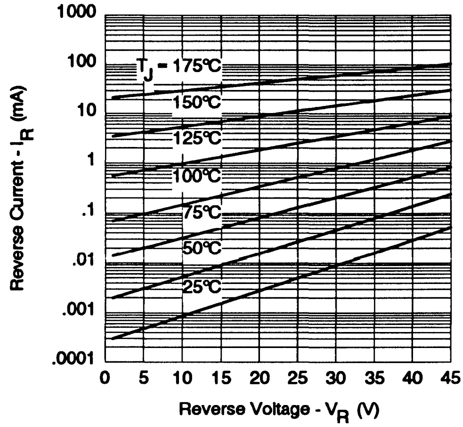


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

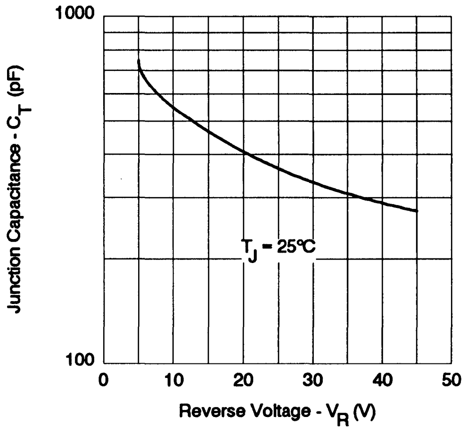


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

PLASTIC TO-220 & TO-247

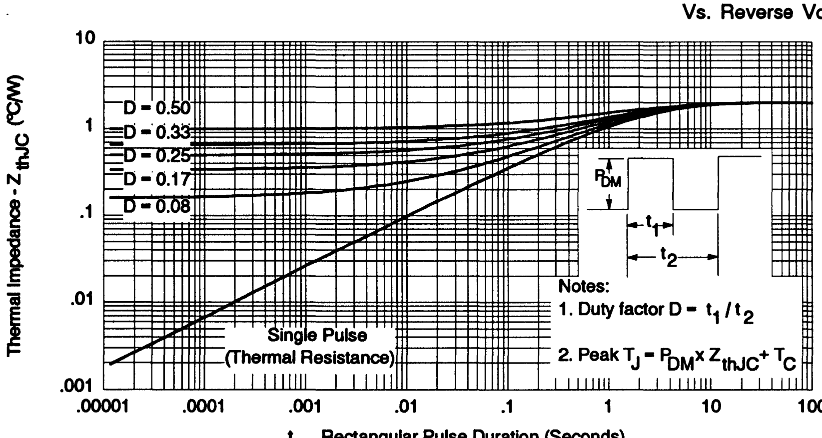


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

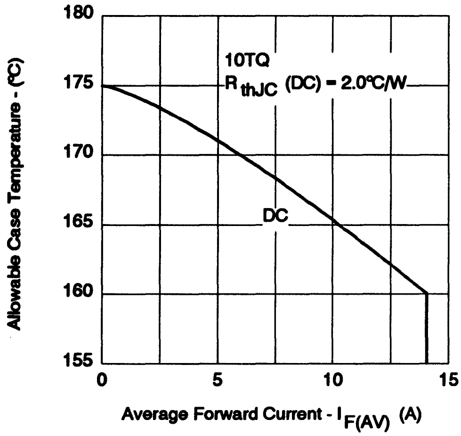


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

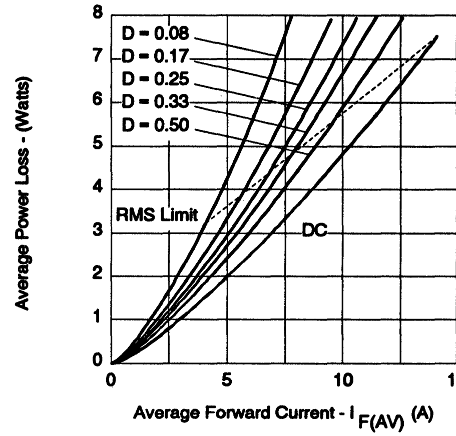


Fig. 6 - Forward Power Loss Characteristics

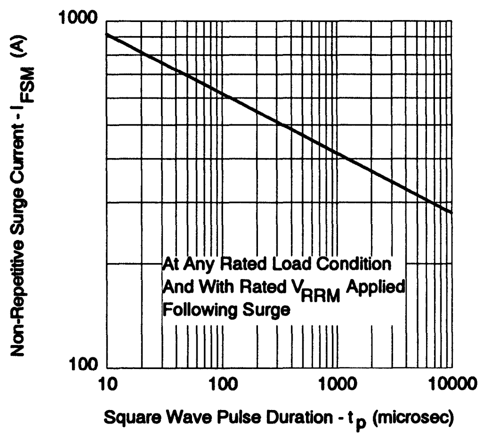


Fig. 7 - Maximum Non-Repetitive Surge Current

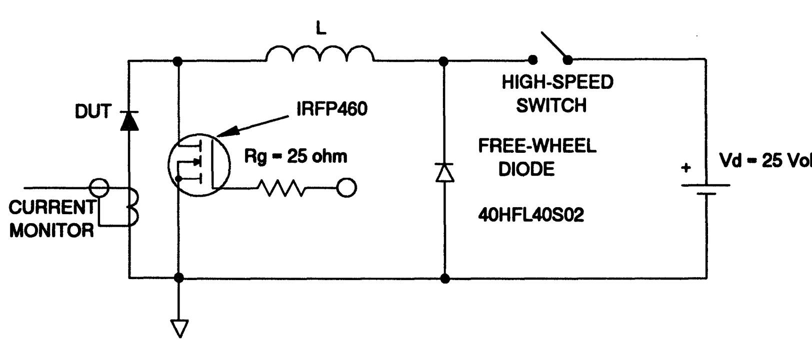


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

12TQ... SERIES

SCHOTTKY RECTIFIER — 15 Amp

Major Ratings and Characteristics

Characteristics		12TQ...	Units
$I_{F(AV)}$	Rectangular waveform	15	A
V_{RRM}		35 to 45	V
I_{FSM}	@ tp = 5 μs sine	990	A
V_F	@ 15 Apk, T_J = 125°C	0.50	V
T_J		-55 to 150	°C

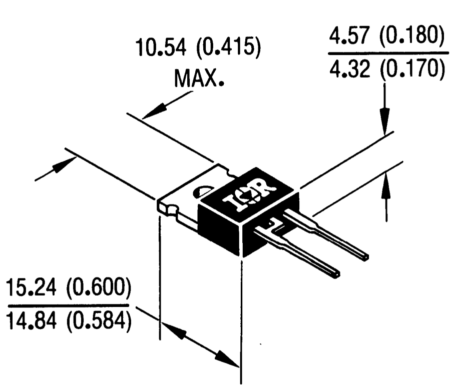
Description/Features

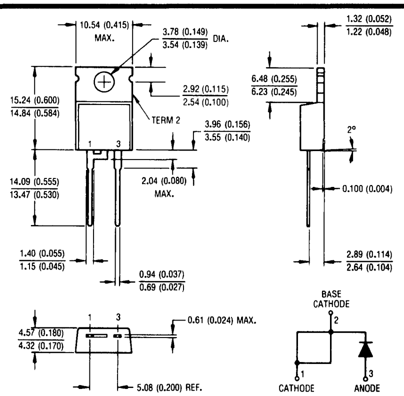
The 12TQ Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AC

Dimensions in millimeters and inches

Voltage Ratings

Part number	12TQ035	12TQ040	12TQ045
V_R Max. DC Reverse Voltage (V)	35	40	45
V_{RWM} Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	12TQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	15	A	50% duty cycle @ T_C = 120° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	990	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		250		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	16	mJ	T_J = 25 °C, I_{AS} = 2.4 Amps, L = 5.5 mH	
I_{AR}	Repetitive Avalanche Current	2.4	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	12TQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.56	V	@ 15A	T_J = 25 °C
		0.71	V	@ 30A	
		0.50	V	@ 15A	T_J = 125 °C
		0.64	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	1.75	mA	T_J = 25 °C	V_R = rated V_R
		70	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		12TQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.0	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

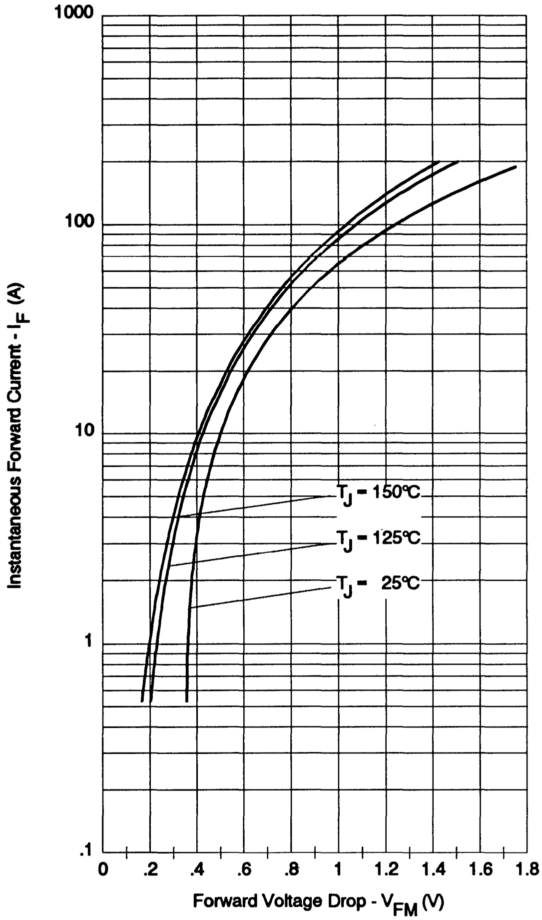


Fig. 1 - Maximum Forward Voltage Drop Characteristics

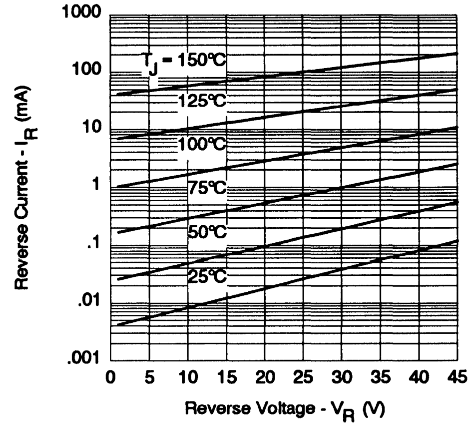


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

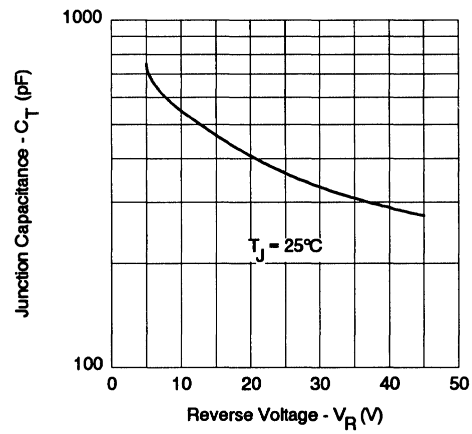


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

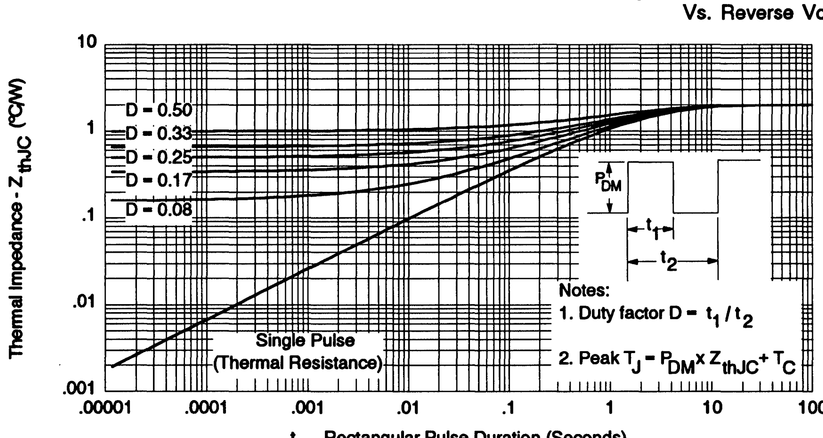


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

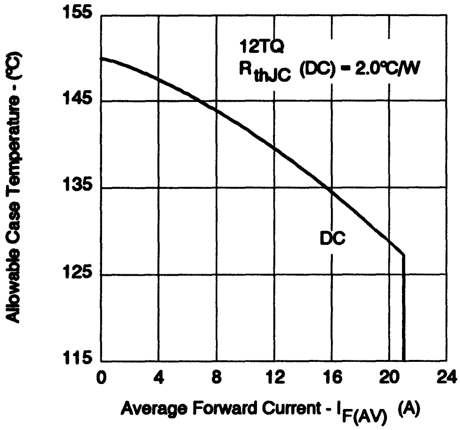


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

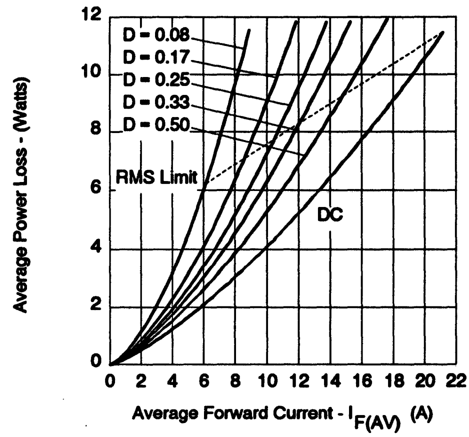


Fig. 6 - Forward Power Loss Characteristics

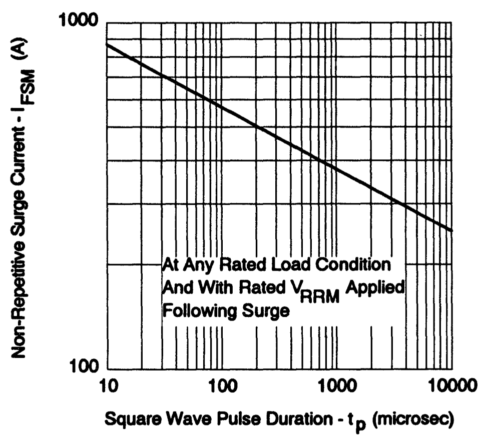


Fig. 7 - Maximum Non-Repetitive Surge Current

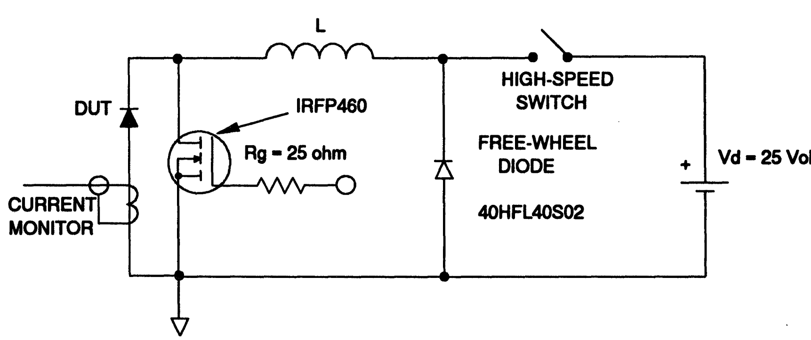


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

18TQ... SERIES

SCHOTTKY RECTIFIER

18 Amp

Major Ratings and Characteristics

Characteristics	18TQ...	Units
$I_{F(AV)}$ Rectangular waveform	18	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	1800	A
V_F @ 18 Apk, T_J = 125°C	0.53	V
T_J	-55 to 175	°C

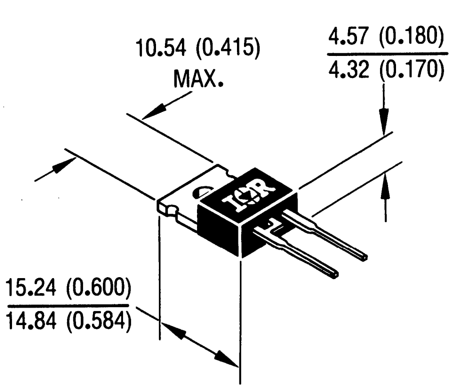
Description/Features

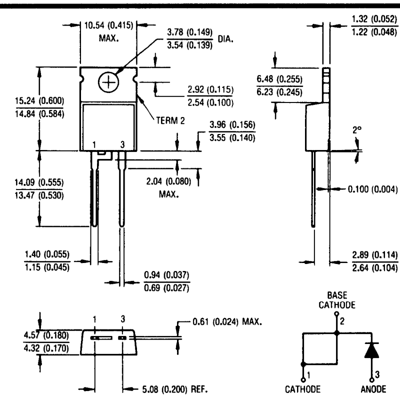
The 18TQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175°C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AC

Dimensions in millimeters and inches

Voltage Ratings

	Part number	18TQ035	18TQ040	18TQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	18TQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	18	A	50% duty cycle @ T_C = 149° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	1800	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		390		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	24	mJ	T_J = 25 °C, I_{AS} = 3.6 Amps, L = 3.7 mH	
I_{AR}	Repetitive Avalanche Current	3.6	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	18TQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.60	V	@ 18A	T_J = 25 °C
		0.72	V	@ 36A	
		0.53	V	@ 18A	T_J = 125 °C
		0.67	V	@ 36A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	2.5	mA	T_J = 25 °C	V_R = rated V_R
		25	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		18TQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.50	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

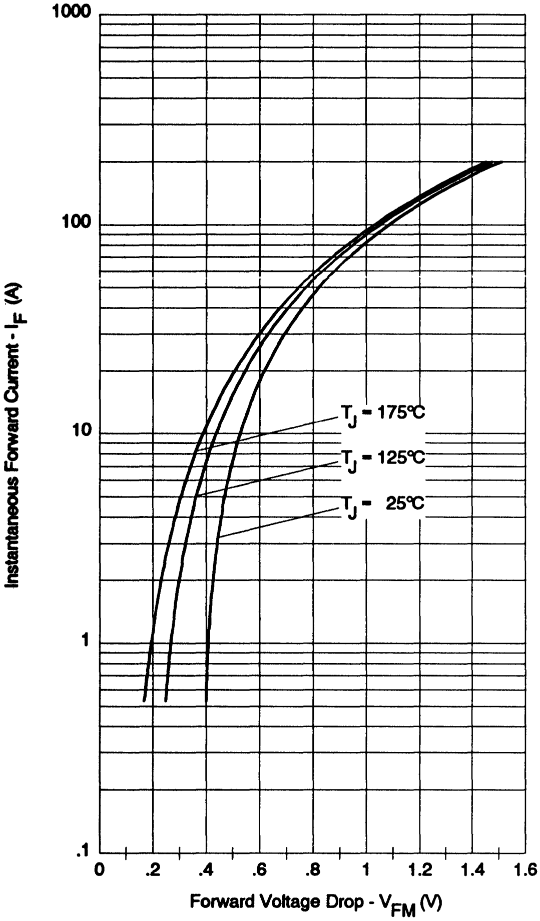


Fig. 1 - Maximum Forward Voltage Drop Characteristics

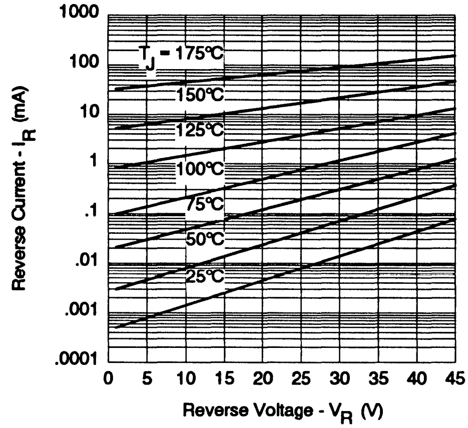


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

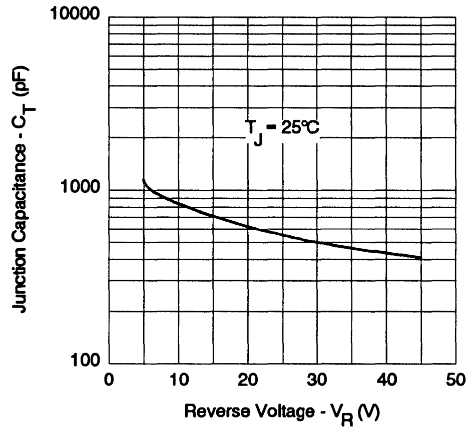


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

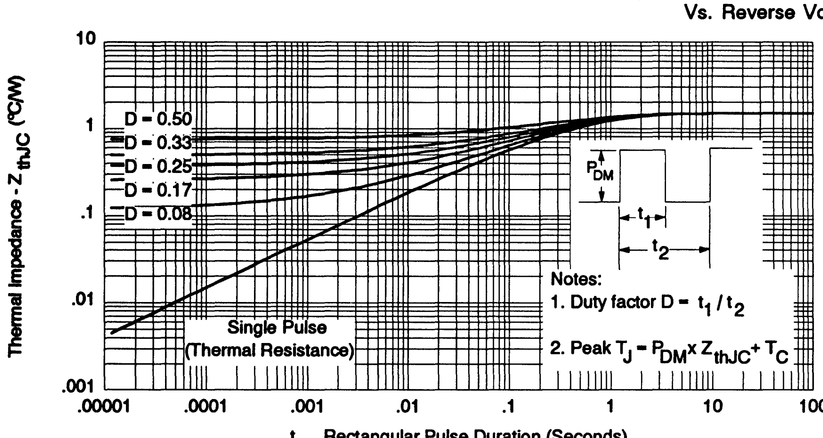


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

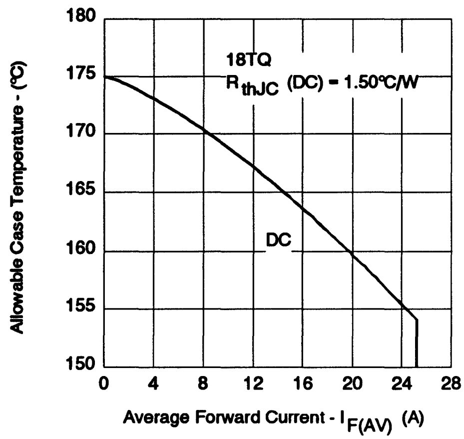


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

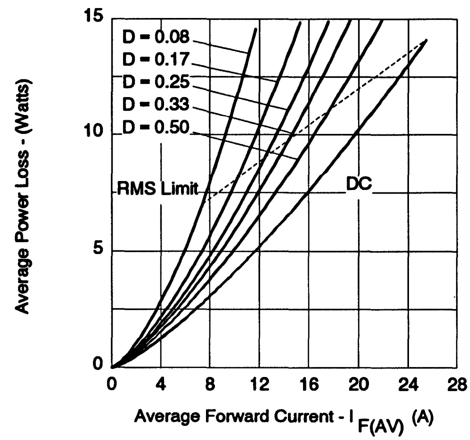


Fig. 6 - Forward Power Loss Characteristics

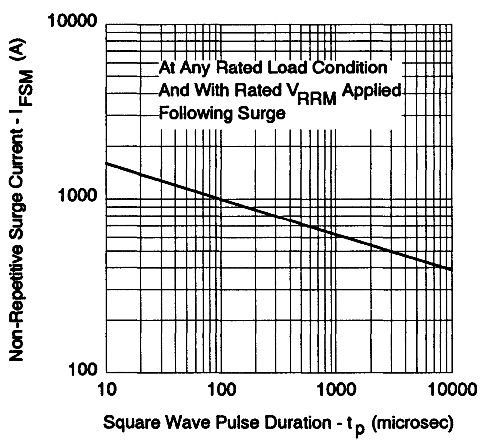


Fig. 7 - Maximum Non-Repetitive Surge Current

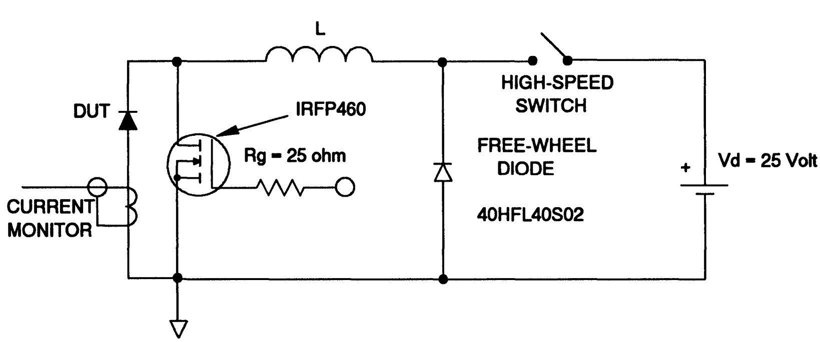


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

19TQ015

SCHOTTKY RECTIFIER

19 Amp

Major Ratings and Characteristics

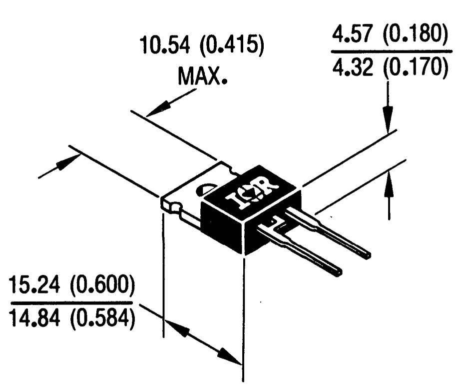
Characteristics	19TQ015	Units
$I_{F(AV)}$ Rectangular waveform	19	A
V_{RRM}	15	V
I_{FSM} @ tp = 5 µs sine	700	A
V_F @ 19 Apk, T_J = 75°C	0.32	V
T_J	-55 to 100	°C

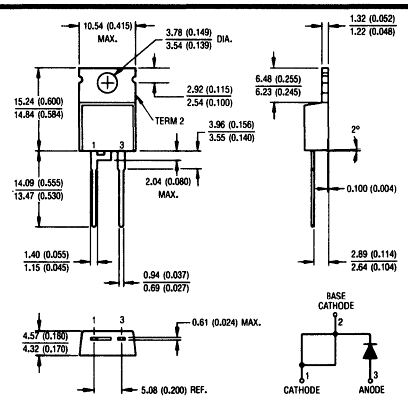
Description/Features

The 19TQ015 Schottky rectifier has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100° C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100° C T_J operation
- Optimized for OR-ing applications
- Ultra low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AC

Dimensions in millimeters and inches

Voltage Ratings

	Part number	19TQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	19TQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	19	A	50% duty cycle @ T_C = 80° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	700	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		330		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	6.75	mJ	T_J = 25 °C, I_{AS} = 1.50 Amps, L = 6 mH	
I_{AR}	Repetitive Avalanche Current	1.50	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 3 x V_R typical	

Electrical Specifications

	Parameters	19TQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.36	V	@ 19A	T_J = 25 °C
		0.46	V	@ 38A	
		0.32	V	@ 19A	T_J = 75 °C
		0.43	V	@ 38A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	10.5	mA	T_J = 25 °C	V_R = rated V_R
		522	mA	T_J = 100 °C	
		465	mA	T_J = 100 °C	V_R = 12V
		285	mA	T_J = 100 °C	V_R = 5V
C_T	Max. Junction Capacitance	2000	pF	V_R = $5V_{DC}$, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		19TQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 100	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 100	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.50	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

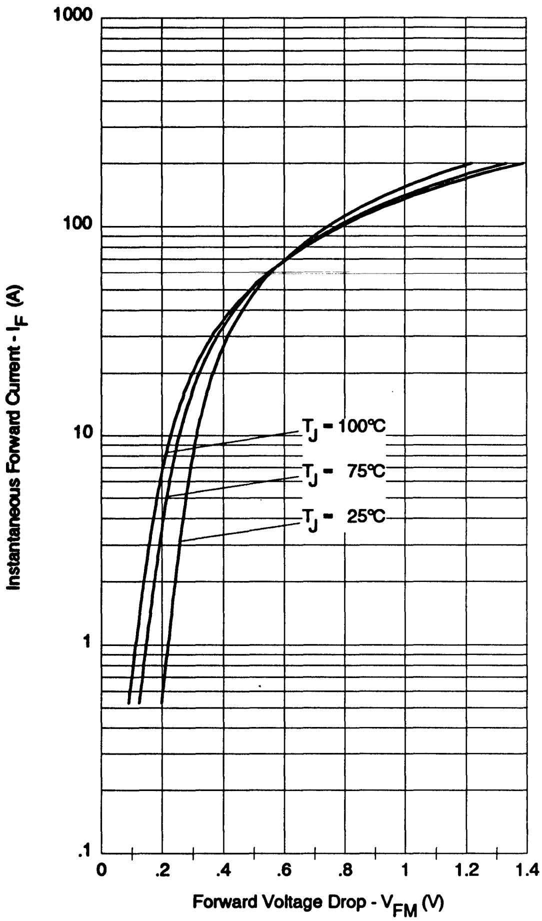


Fig. 1 - Maximum Forward Voltage Drop Characteristics

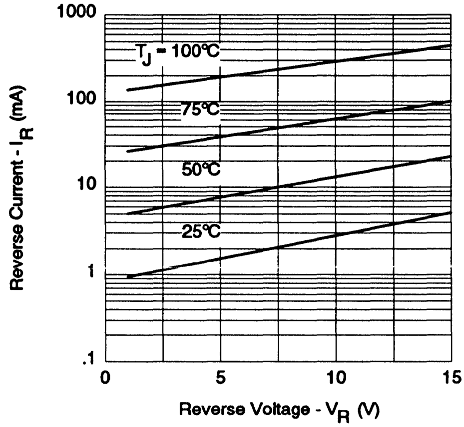


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

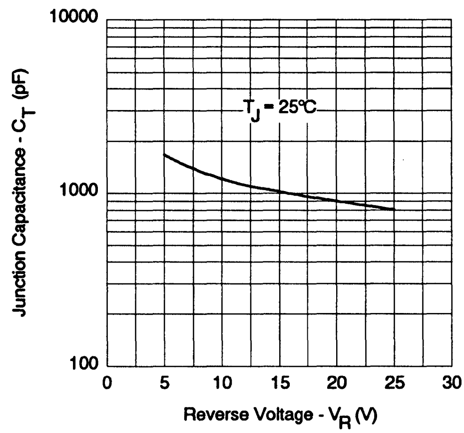


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

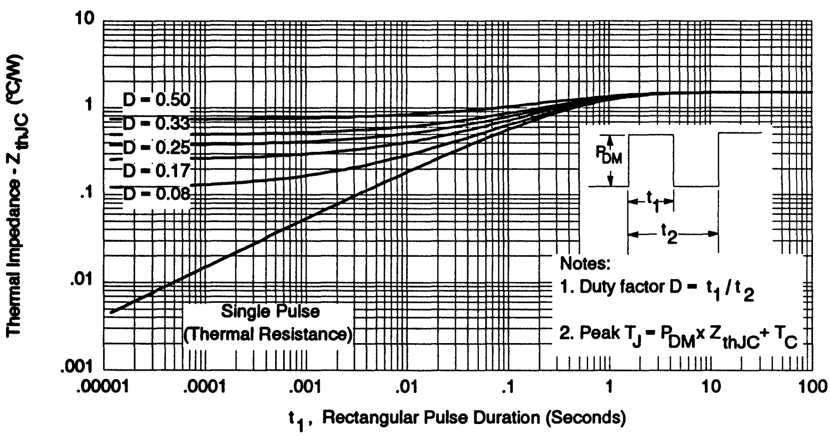


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

PLASTIC TO-220 & TO-247

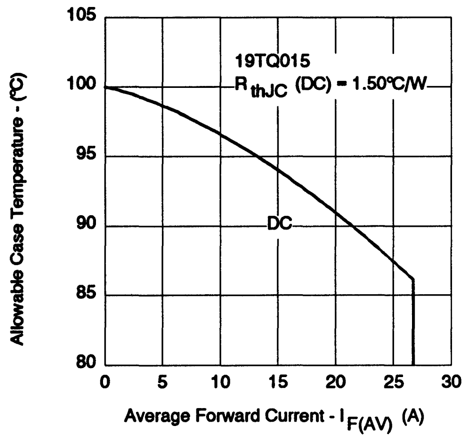


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

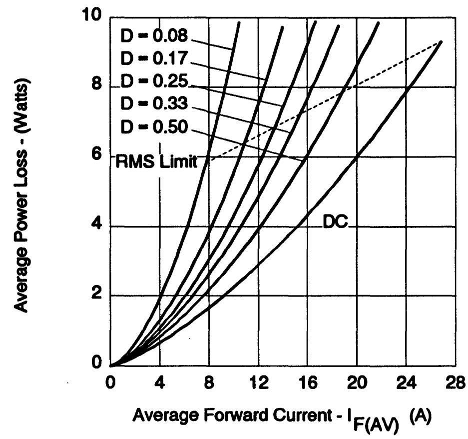


Fig. 6 - Forward Power Loss Characteristics

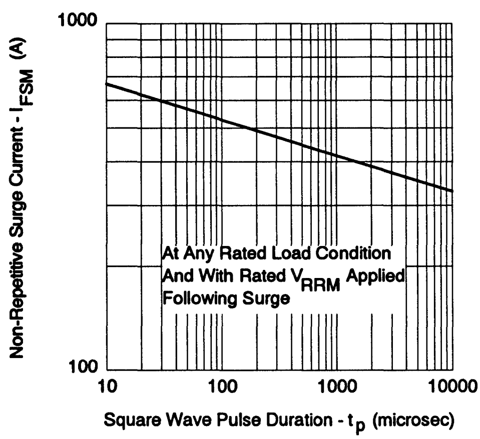


Fig. 7 - Maximum Non-Repetitive Surge Current

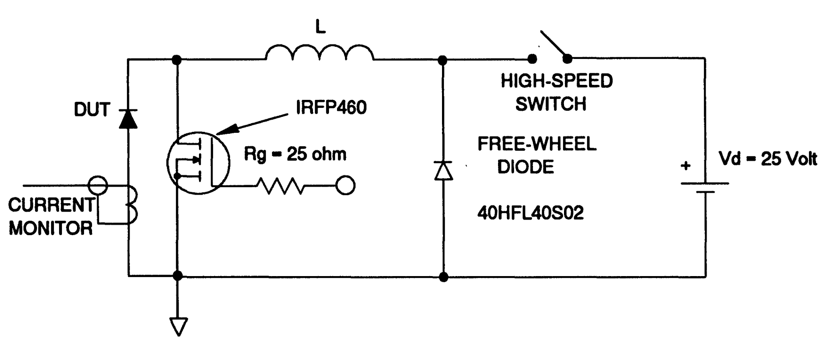


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

20TQ... SERIES

SCHOTTKY RECTIFIER

20 Amp

Major Ratings and Characteristics

Characteristics	20TQ...	Units
$I_{F(AV)}$ Rectangular waveform	20	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	1800	A
V_F @ 20 Apk, T_J = 125°C	0.51	V
T_J	-55 to 150	°C

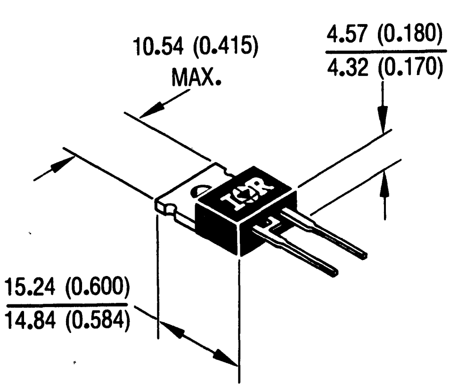
Description/Features

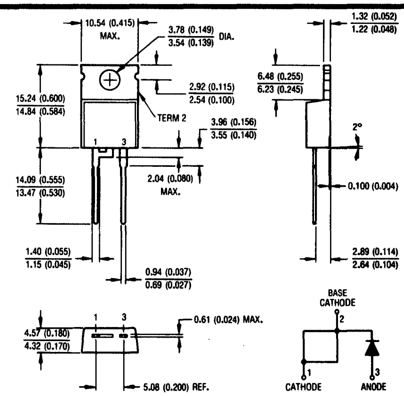
The 20TQ Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AC

Dimensions in millimeters and inches

Voltage Ratings

	Part number	20TQ035	20TQ040	20TQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	20TQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	20	A	50% duty cycle @ T_C = 116° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	1800	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	27	mJ	T_J = 25 °C, I_{AS} = 4 Amps, L = 3.4 mH	
I_{AR}	Repetitive Avalanche Current	4	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	20TQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.57	V	@ 20A	T_J = 25 °C
		0.73	V	@ 40A	
		0.51	V	@ 20A	T_J = 125 °C
		0.67	V	@ 40A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	2.7	mA	T_J = 25 °C	V_R = rated V_R
		105	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	20TQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	1.50	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	2 (0.07)	g (oz.)	
T	Mounting Torque Min.	6 (5)	Kg-cm (lbf-in)	
	Max.	12 (10)		
	Case Style	TO-220AC		JEDEC

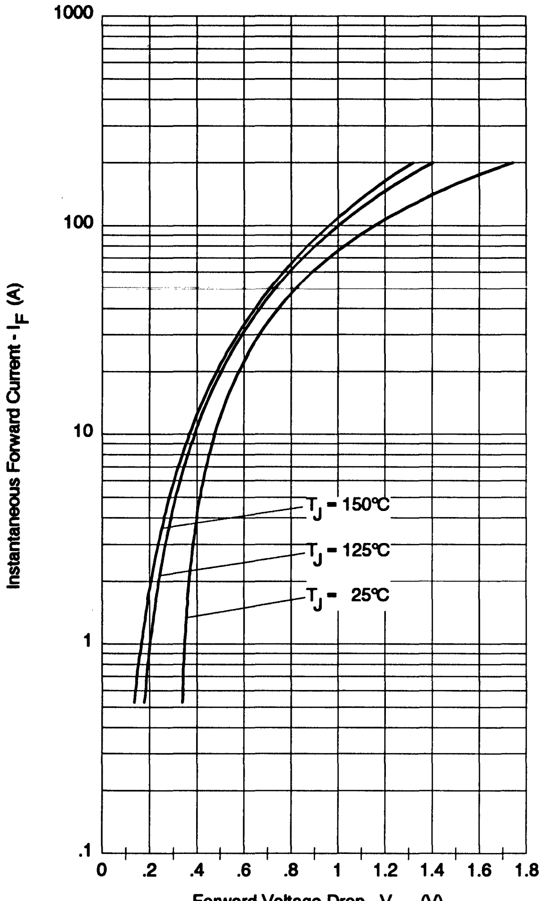


Fig. 1 - Maximum Forward Voltage Drop Characteristics

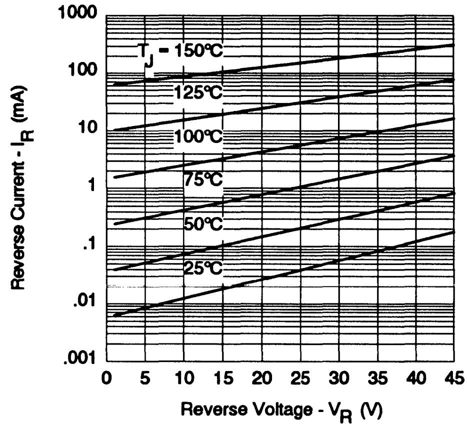


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

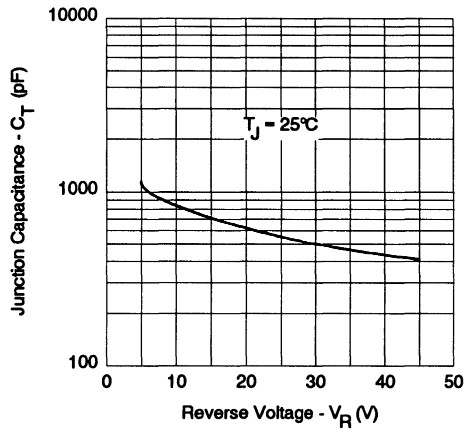


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

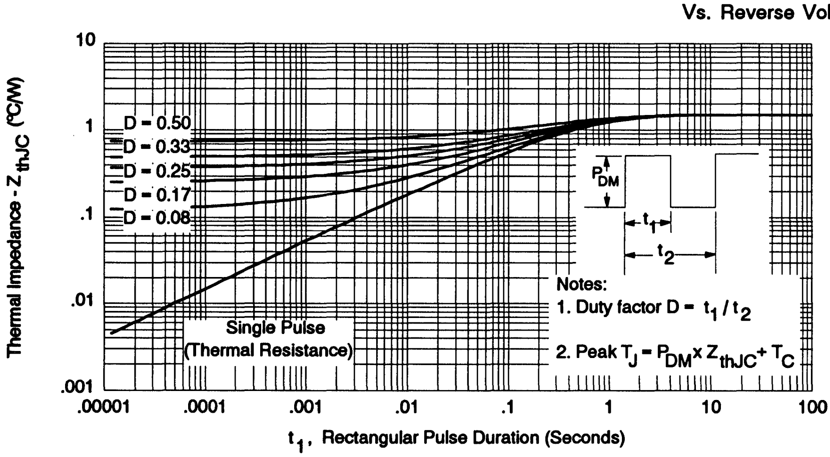


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

PLASTIC TO-220 & TO-247

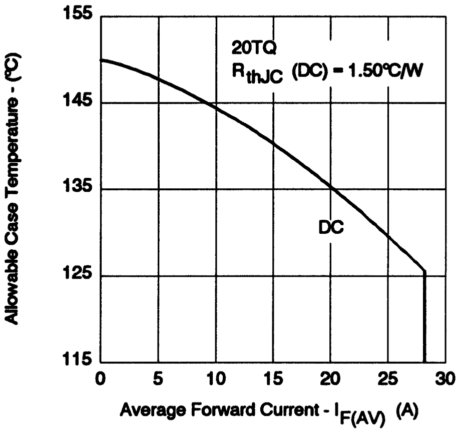


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

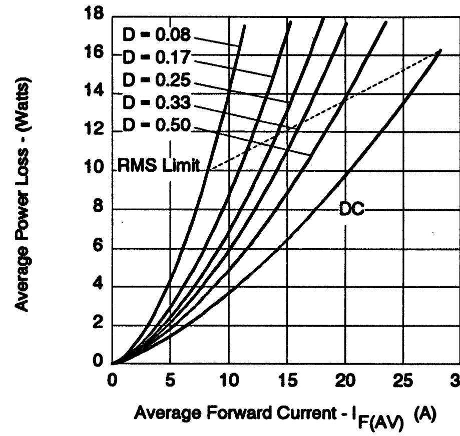


Fig. 6 - Forward Power Loss Characteristics

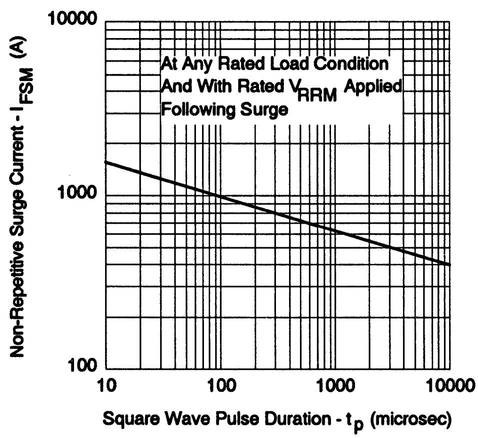


Fig. 7 - Maximum Non-Repetitive Surge Current

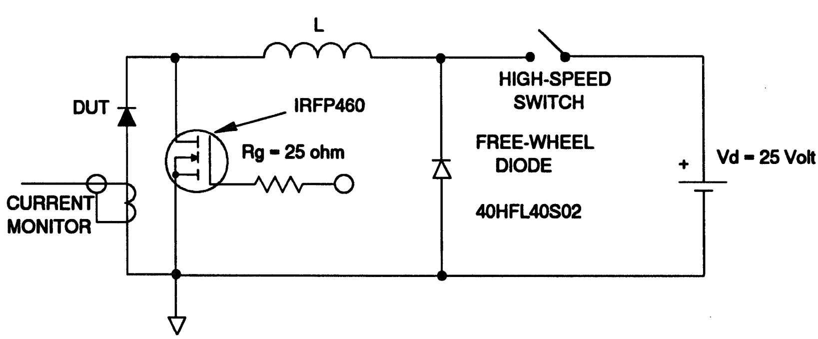


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

MBR735
MBR745

SCHOTTKY RECTIFIER

7.5 Amp

Major Ratings and Characteristics

Characteristics	MBR7..	Units
$I_{F(AV)}$ Rectangular waveform	7.5	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 μs sine	690	A
V_F @ 7.5 Apk, T_J = 125°C	0.57	V
T_J	-65 to 150	°C

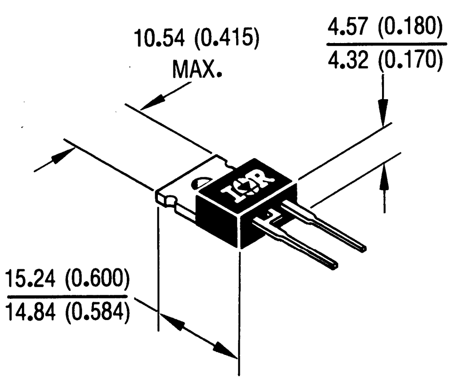
Description/Features

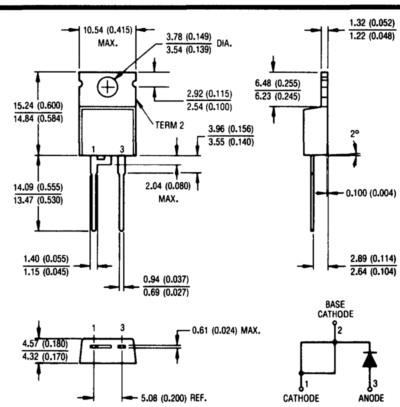
The MBR7.. Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-220AC

Dimensions in millimeters and inches

Voltage Ratings

	Part number	MBR735	MBR745
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	MBR7..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current	7.5	A	@ T_C = 120 °C, (Rated V_R)	
I_{FSM}	Non-Repetitive Peak Surge Current	690	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		150		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	1.0	A	2.0 μsec 1.0 KHz	

Electrical Specifications

	Parameters	MBR7..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.84	V	@ 15A	T_J = 25 °C
		0.57	V	@ 7.5A	T_J = 125 °C
		0.72	V	@ 15A	
I_{RM}	Max. Instantaneus Reverse Current	0.1	mA	T_J = 25 °C	Rated DC voltage
	(1)	15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		MBR7..	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		3.0	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

* For Additional Informations and Graphs, Please See the 6TQ Series

International
IOR Rectifier

MBR1035
MBR1045

SCHOTTKY RECTIFIER

10 Amp

Major Ratings and Characteristics

Characteristics	MBR10..	Units
$I_{F(AV)}$ Rectangular waveform	10	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 µs sine	1050	A
V_F @ 10 Apk, T_J = 125°C	0.57	V
T_J	-65 to 150	°C

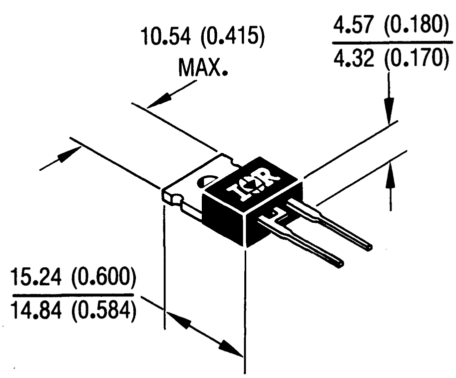
Description/Features

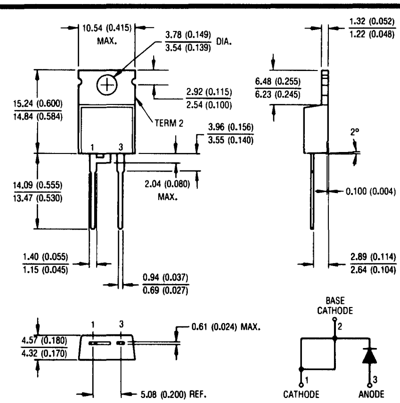
The MBR10.. Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-220AC
Dimensions in millimeters and inches

Voltage Ratings

	Part number	MBR1035	MBR1045
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	MBR10..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current	10	A	@ T_C = 120 °C, (Rated V_R)	
I_{FSM}	Non-Repetitive Peak Surge Current	1050	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		150		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	1.0	A	2.0 µsec 1.0 KHz	

Electrical Specifications

	Parameters	MBR10..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.84	V	@ 20A	T_J = 25 °C
		0.57	V	@ 10A	T_J = 125 °C
		0.72	V	@ 20A	
I_{RM}	Max. Instantaneus Reverse Current (1)	0.1	mA	T_J = 25 °C	Rated DC voltage
		15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	MBR10..	Units	Conditions
T_J	Max. Junction Temperature Range	-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	2.0	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	2 (0.07)	g (oz.)	
T	Mounting Torque Min.	6 (5)	Kg-cm (lbf-in)	
	Max.	12 (10)		
	Case Style	TO-220AC		JEDEC

* For Additional Informations and Graphs, Please See the 10TQ Series

International IOR Rectifier

MBR1635
MBR1645

SCHOTTKY RECTIFIER

16 Amp

Major Ratings and Characteristics

Characteristics	MBR16..	Units
$I_{F(AV)}$ Rectangular waveform	16	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 µs sine	1800	A
V_F @ 16 Apk, T_J = 125°C	0.57	V
T_J	- 65 to 150	°C

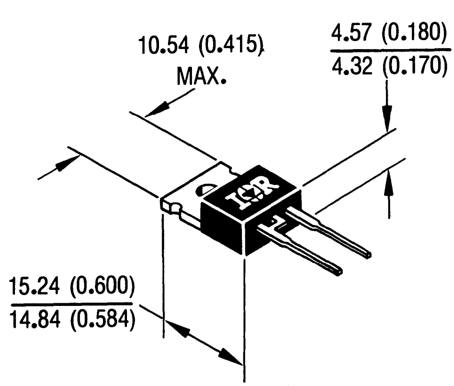
Description/Features

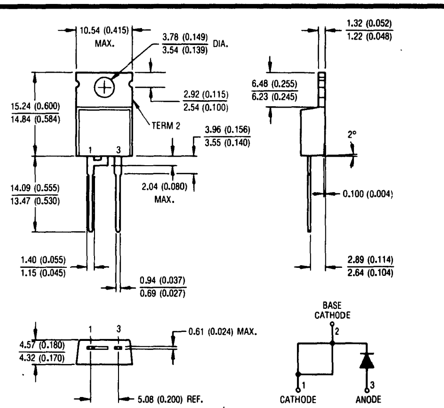
The MBR16.. Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-220AC

Dimensions in millimeters and inches

Voltage Ratings

	Part number	MBR1635	MBR1645
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	MBR16..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current	16	A	@ T_C = 125 °C, (Rated V_R)	
I_{FSM}	Non-Repetitive Peak Surge Current	1800	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		150		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	1.0	A	2.0 µsec 1.0 KHz	

Electrical Specifications

	Parameters	MBR16..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.63	V	@ 16A	T_J = 25 °C
		0.57	V	@ 16A	T_J = 125 °C
I_{RM}	Max. Instantaneus Reverse Current	0.2	mA	T_J = 25 °C	Rated DC voltage
	(1)	40	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		MBR16..	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AC		JEDEC

* For Additional Informations and Graphs, Please See the 18TQ Series

International
IOR Rectifier

10CTQ150

SCHOTTKY RECTIFIER

10 Amp

Major Ratings and Characteristics

Characteristics		10CTQ150	Units
$I_{F(AV)}$	Rectangular waveform	10	A
V_{RRM}		150	V
I_{FSM}	@ tp = 5 μs sine	620	A
V_F	@ 5 Apk, T_J = 125°C (per leg)	0.73	V
T_J		- 55 to 175	°C

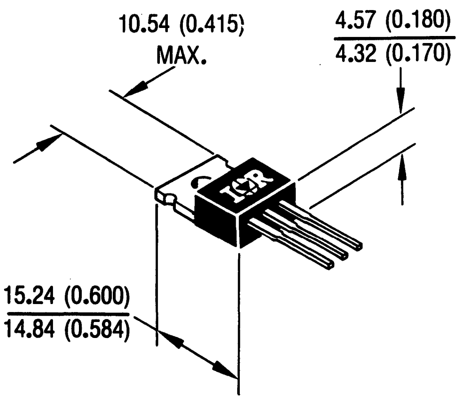
Description/Features

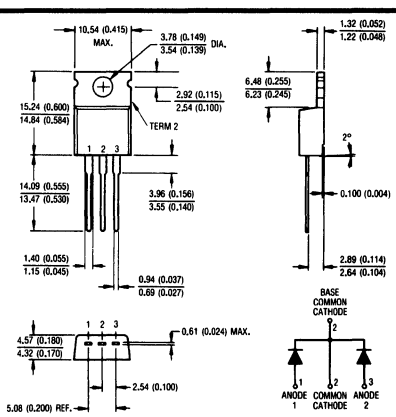
The 10CTQ150 center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC
TO-220 &
TO-247

CASE STYLE AND DIMENSIONS





Conform to JEDEC outline TO - 220AB
Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	10CTQ150
V_R	Max. DC Reverse Voltage (V)	150
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	10CTQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	10	A	50% duty cycle @ T_C = 145 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	620	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		115		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	6.75	mJ	T_J = 25 °C, I_{AS} = 0.30 Amps, L = 150 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	0.30	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	10CTQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.93	V	@ 5A	T_J = 25 °C
		1.10	V	@ 10A	
		0.73	V	@ 5A	T_J = 125 °C
		0.86	V	@ 10A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.05	mA	T_J = 25 °C	V_R = rated V_R
		7	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	200	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	10CTQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)	3.50	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)	1.75	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	2 (0.07)	g (oz.)	
T	Mounting Torque Min.	6 (5)	Kg-cm (lbf-in)	
	Max.	12 (10)		
	Case Style	TO-220AB		JEDEC

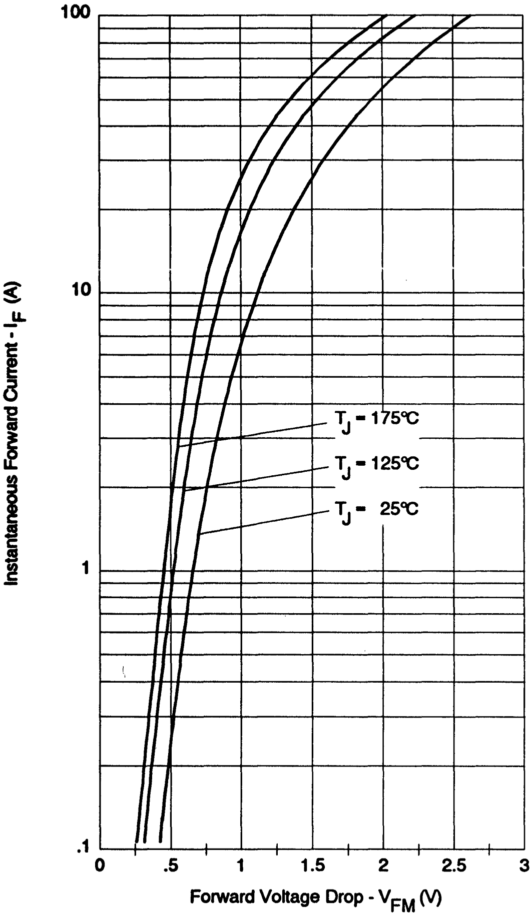


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

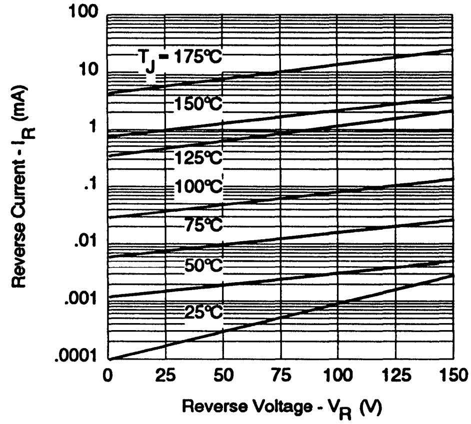


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

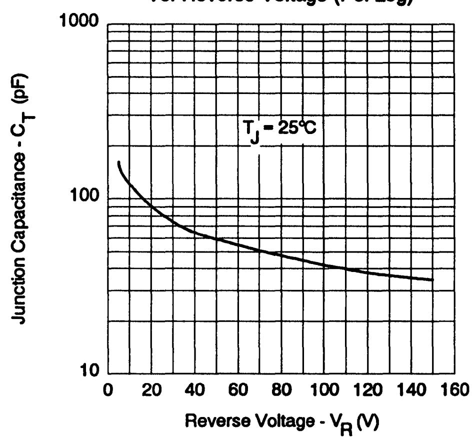


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

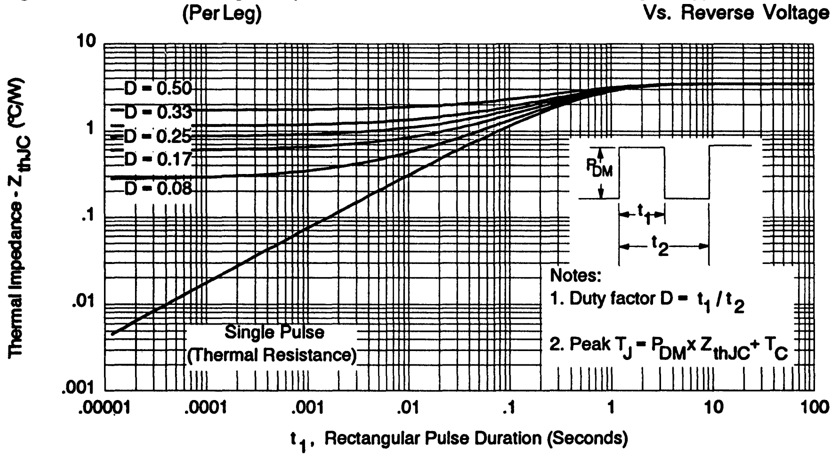


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC
TO-220 &
TO-247

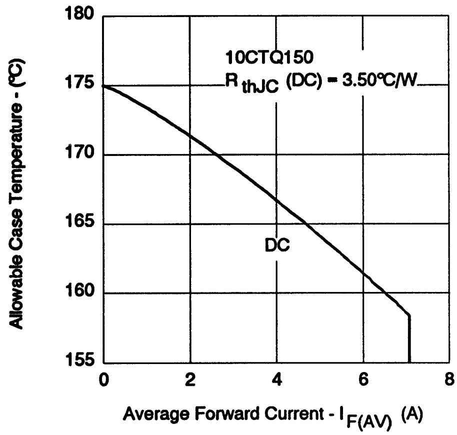


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

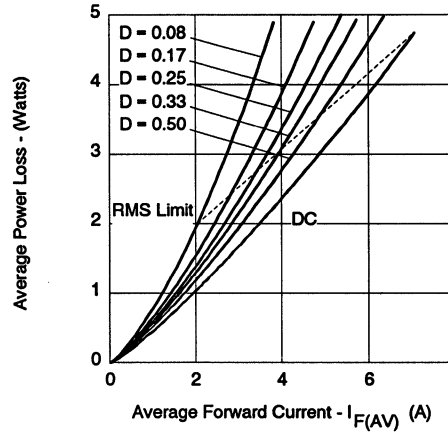


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

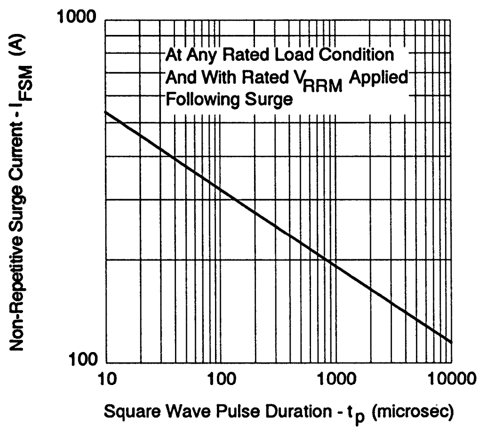


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

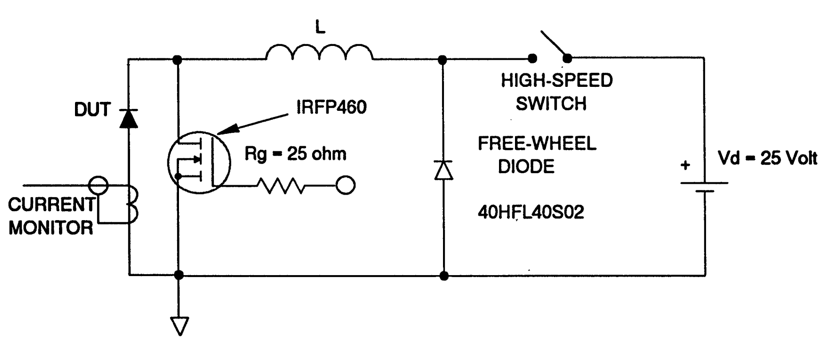


Fig. 8 - Unclamped Inductive Test Circuit

PD-2.054B

International
IOR Rectifier

12CTQ... SERIES

SCHOTTKY RECTIFIER

12 Amp

Major Ratings and Characteristics

Characteristics	12CTQ...	Units
$I_{F(AV)}$ Rectangular waveform	12	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	690	A
V_F @ 6 Apk, T_J = 125°C (per leg)	0.51	V
T_J	-55 to 175	°C

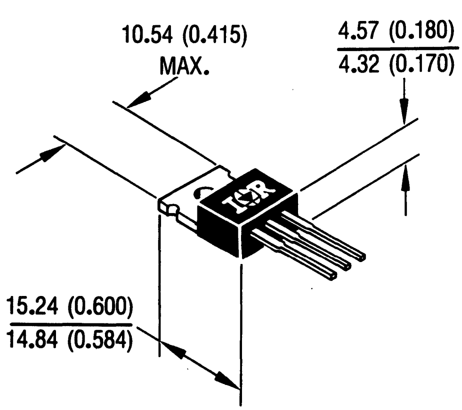
Description/Features

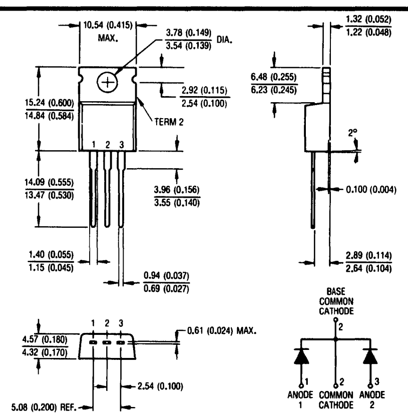
The 12CTQ center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conform to JEDEC outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

Part number	12CTQ035	12CTQ040	12CTQ045
V_R Max. DC Reverse Voltage (V)	35	40	45
V_{RWM} Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	12CTQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	12	A	50% duty cycle @ T_C = 157°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	690	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		140		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	8	mJ	T_J = 25 °C, I_{AS} = 1.20 Amps, L = 11.10 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1.20	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	12CTQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.57	V	@ 6A	T_J = 25 °C
		0.69	V	@ 12A	
		0.51	V	@ 6A	T_J = 125 °C
		0.63	V	@ 12A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.8	mA	T_J = 25 °C	V_R = rated V_R
		7.0	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		12CTQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.50	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.75	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

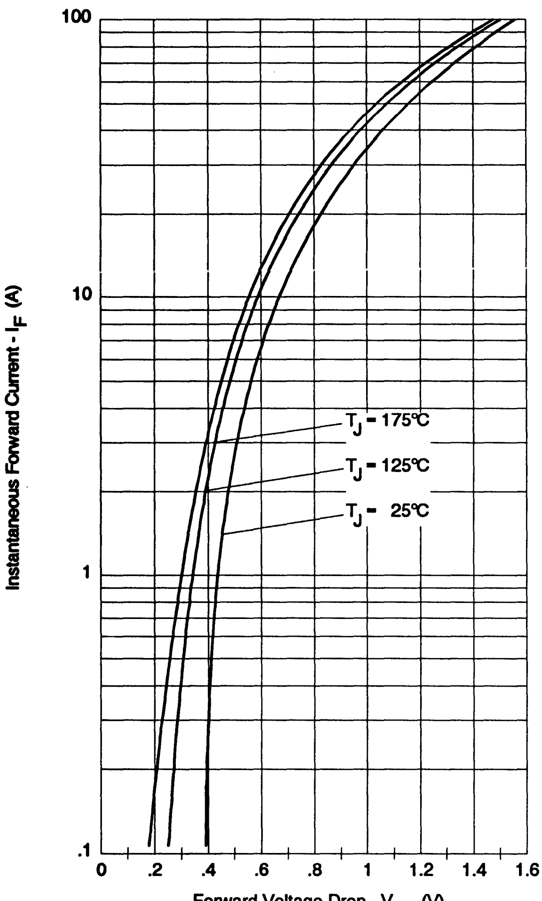


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

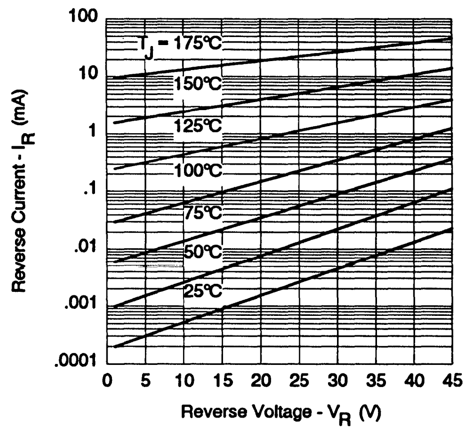


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

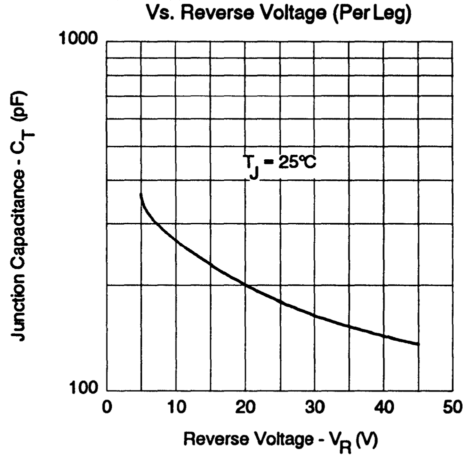


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

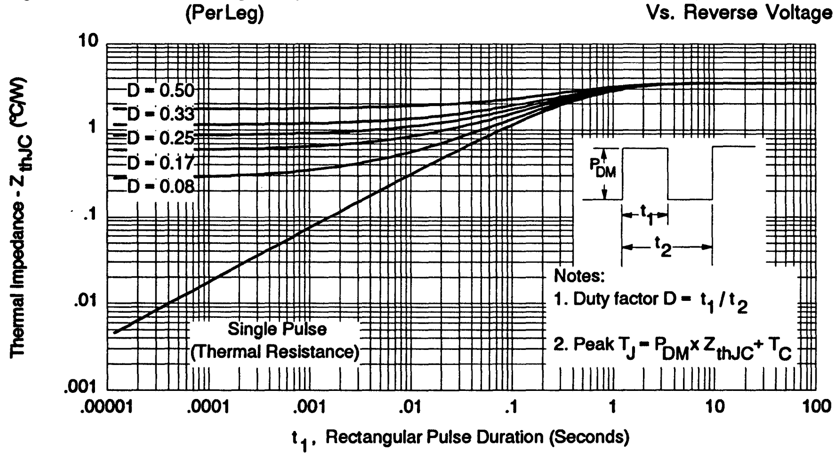


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

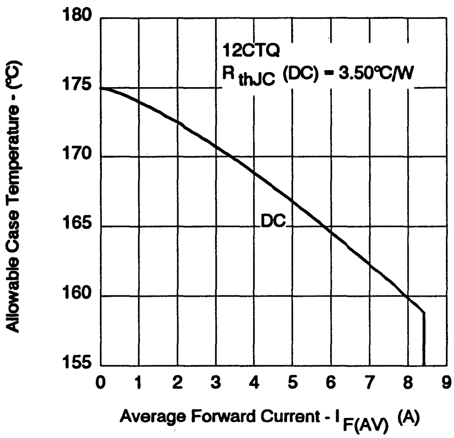


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

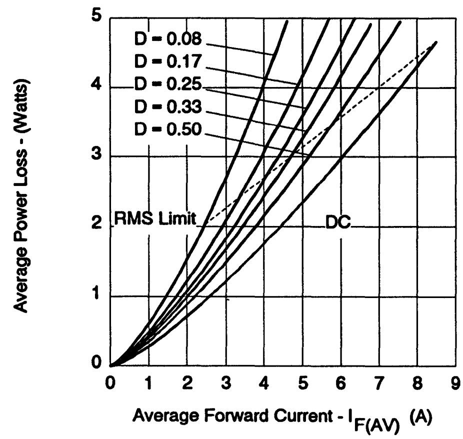


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

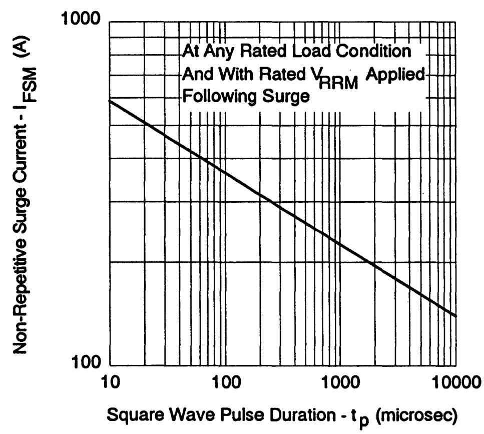


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

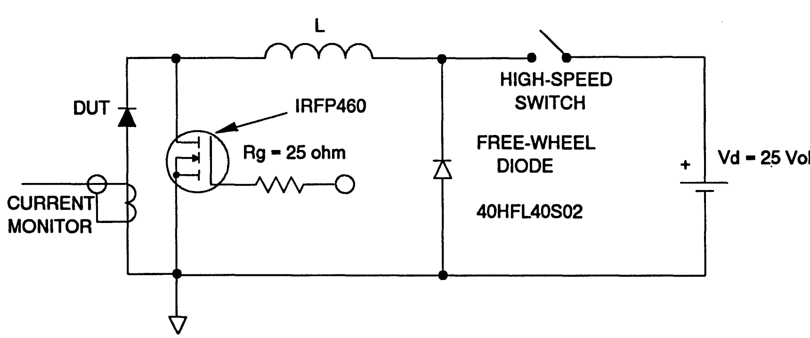


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

15CTQ... SERIES

SCHOTTKY RECTIFIER

15 Amp

Major Ratings and Characteristics

Characteristics	15CTQ...	Units
$I_{F(AV)}$ Rectangular waveform	15	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	810	A
V_F @7.5 Apk, T_J = 125°C (per leg)	0.51	V
T_J	-55 to 150	°C

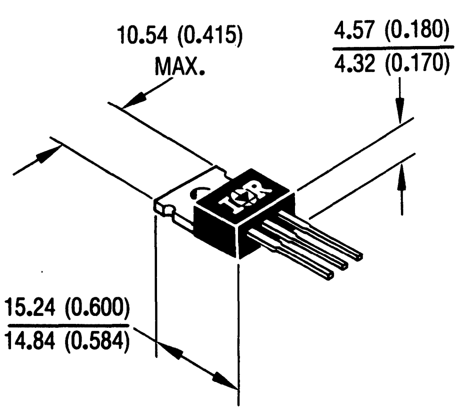
Description/Features

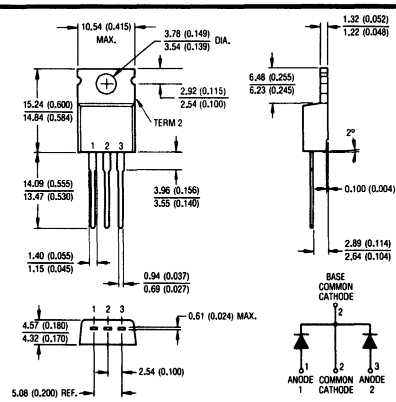
The 15CTQ center tap Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	15CTQ035	15CTQ040	15CTQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	15CTQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	15	A	50% duty cycle @ T_C = 123 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	810	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		145		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	10	mJ	T_J = 25 °C, I_{AS} = 1.5 Amps, L = 8.90 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1.5	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	15CTQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.55	V	@ 7.5A	T_J = 25 °C
		0.70	V	@ 15A	
		0.51	V	@ 7.5A	T_J = 125 °C
		0.65	V	@ 15A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.8	mA	T_J = 25 °C	V_R = rated V_R
		32	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		15CTQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.50	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.75	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2.0 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

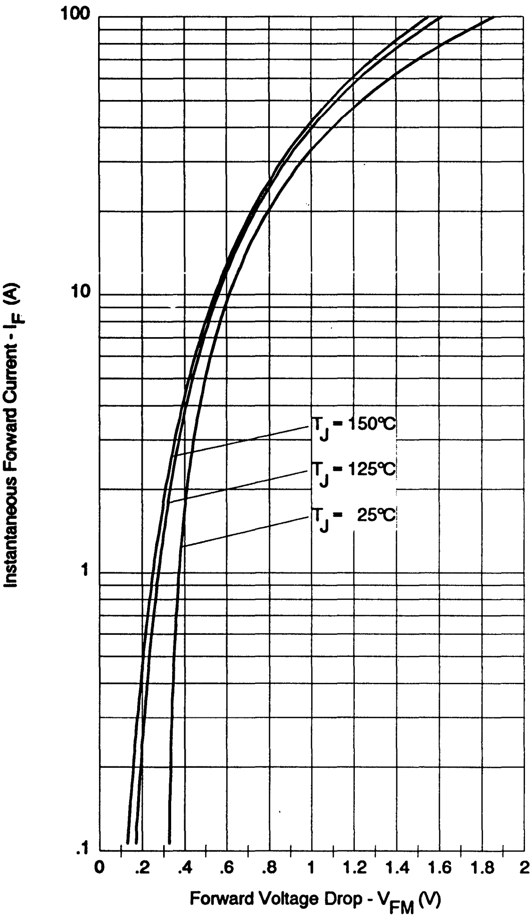


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

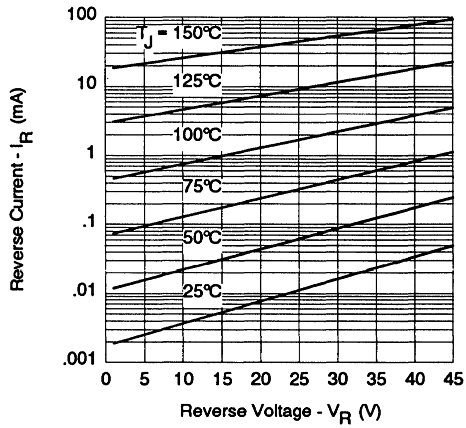


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

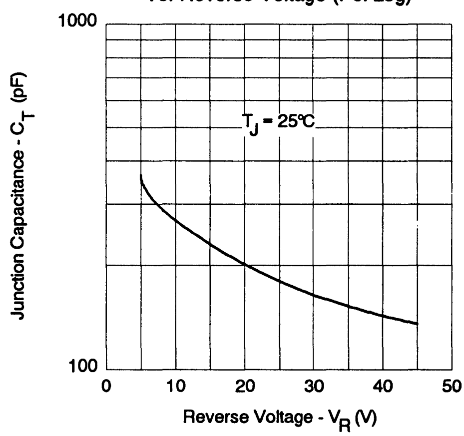


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

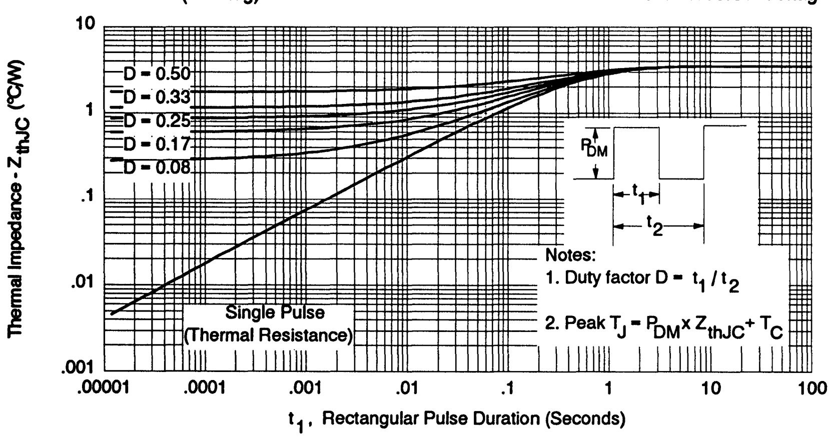


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

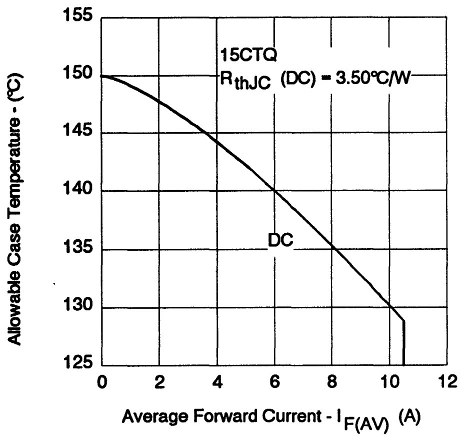


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

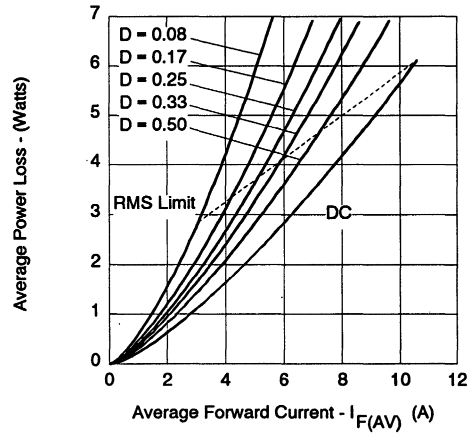


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

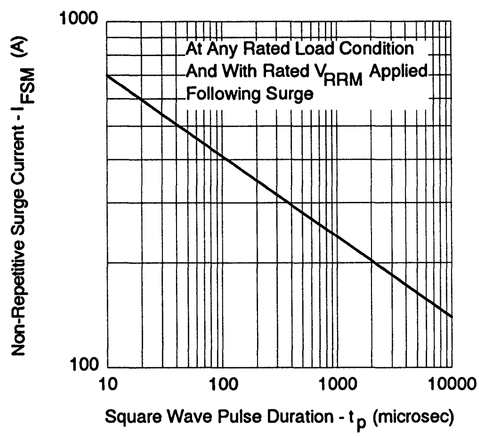


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

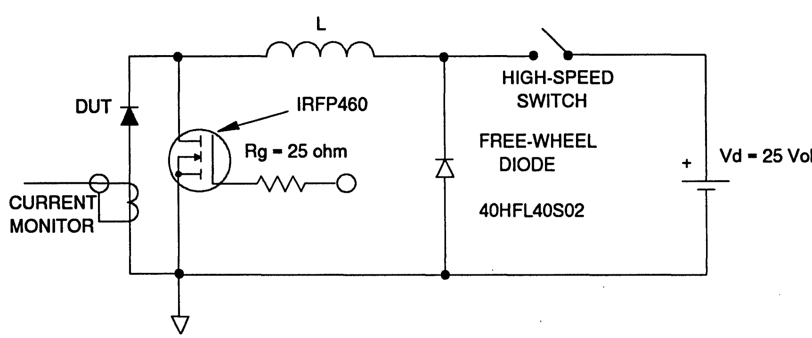


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

16CTQ... SERIES

SCHOTTKY RECTIFIER

16 Amp

PLASTIC TO-220 & TO-247

Major Ratings and Characteristics

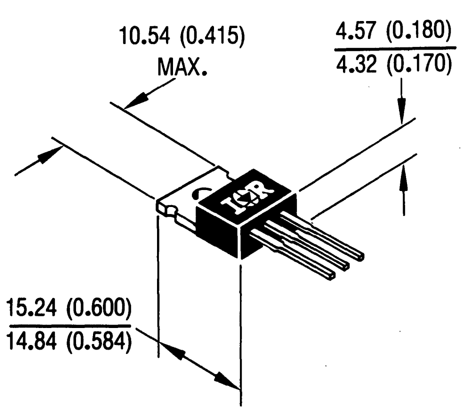
Characteristics	16CTQ...	Units
$I_{F(AV)}$ Rectangular waveform	16	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	850	A
V_F @ 8 Apk, T_J = 125°C (per leg)	0.58	V
T_J	- 55 to 175	°C

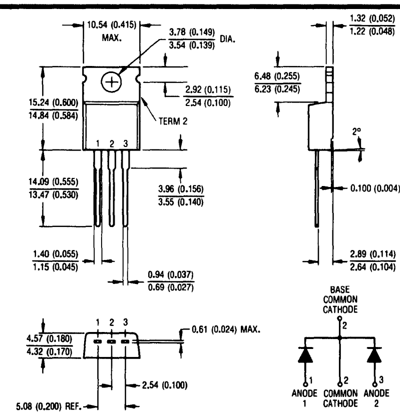
Description/Features

The 16CTQ center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conform to JEDEC outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

Part number	16CTQ080	16CTQ100
V_R Max. DC Reverse Voltage (V)	80	100
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	16CTQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	16	A	50% duty cycle @ T_C = 145°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	850	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		275		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	7.50	mJ	T_J = 25 °C, I_{AS} = 0.50 Amps, L = 60 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	0.50	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	16CTQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.72	V	@ 8A	T_J = 25 °C
		0.88	V	@ 16A	
		0.58	V	@ 8A	T_J = 125 °C
		0.69	V	@ 16A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.55	mA	T_J = 25 °C	V_R = rated V_R
		7.0	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	500	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		16CTQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

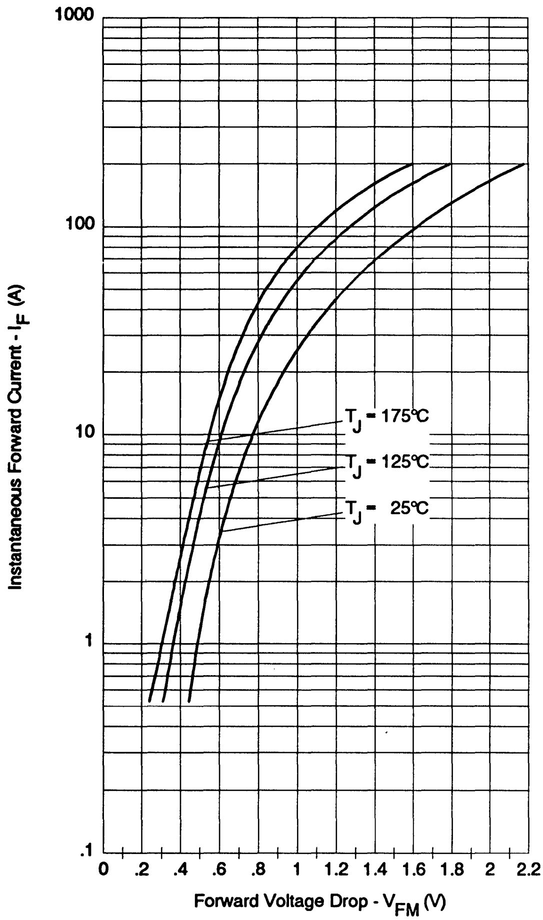


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

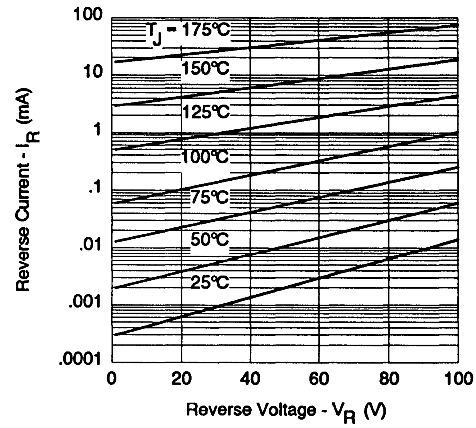


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

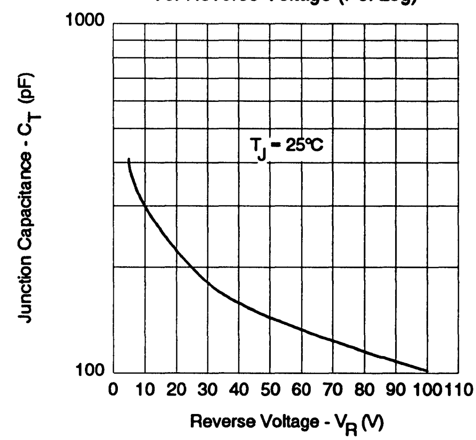


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

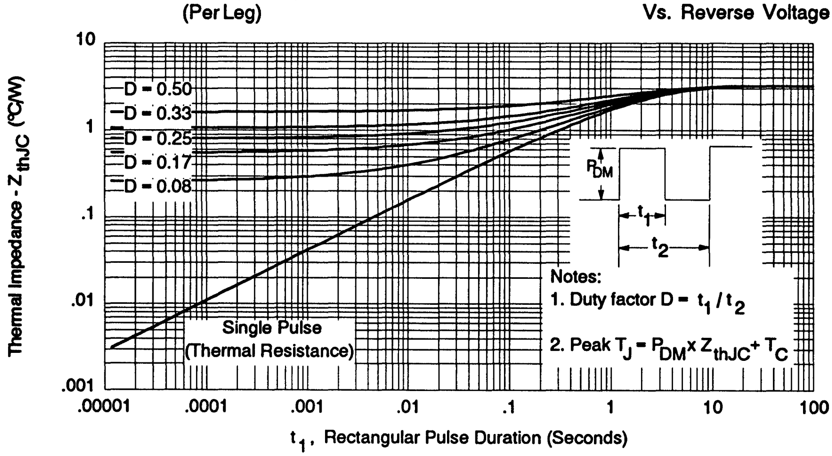


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

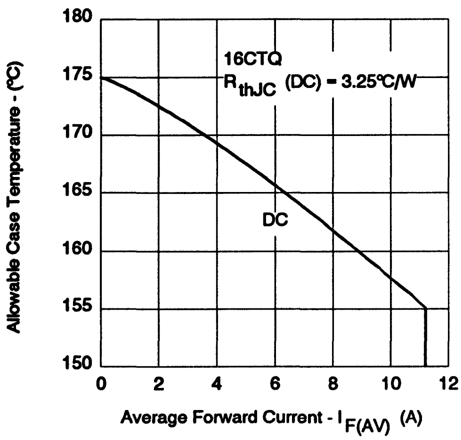


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

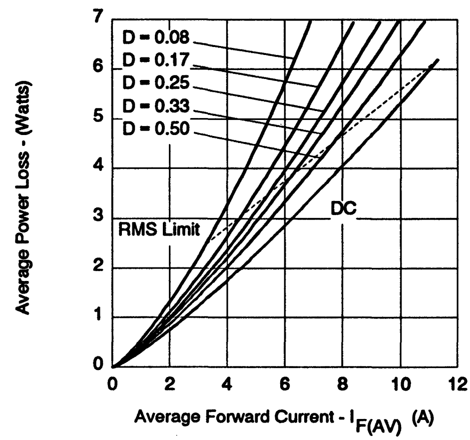


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

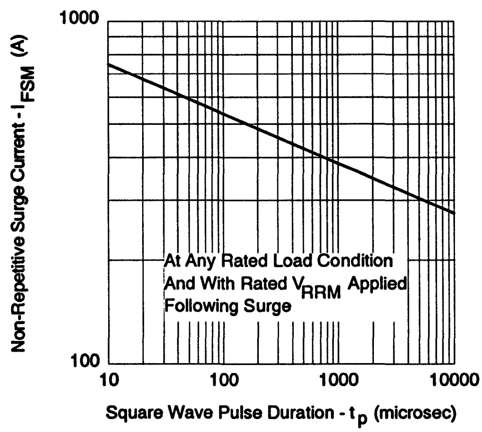


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

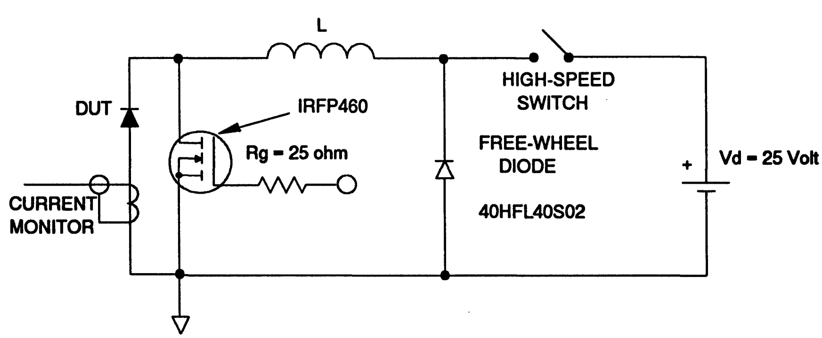


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

20CTQ... SERIES

SCHOTTKY RECTIFIER

20 Amp

Major Ratings and Characteristics

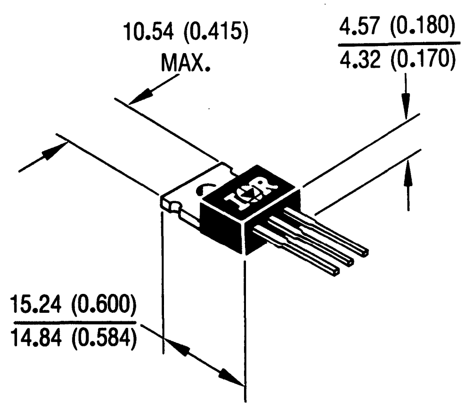
Characteristics	20CTQ...	Units
$I_{F(AV)}$ Rectangular waveform	20	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	1060	A
V_F @ 10 Apk, T_J = 125°C (per leg)	0.57	V
T_J	- 55 to 175	°C

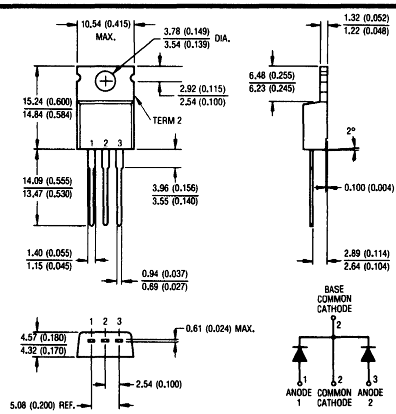
Description/Features

The 20CTQ center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conform to JEDEC outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	20CTQ035	20CTQ040	20CTQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	20CTQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	20	A	50% duty cycle @ T_C = 145°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	1060	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		265		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	13	mJ	T_J = 25 °C, I_{AS} = 2.0 Amps, L = 6.5 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	2.0	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	20CTQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.64	V	@ 10A	T_J = 25 °C
		0.76	V	@ 20A	
		0.57	V	@ 10A	T_J = 125 °C
		0.68	V	@ 20A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	2	mA	T_J = 25 °C	V_R = rated V_R
		15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		20CTQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

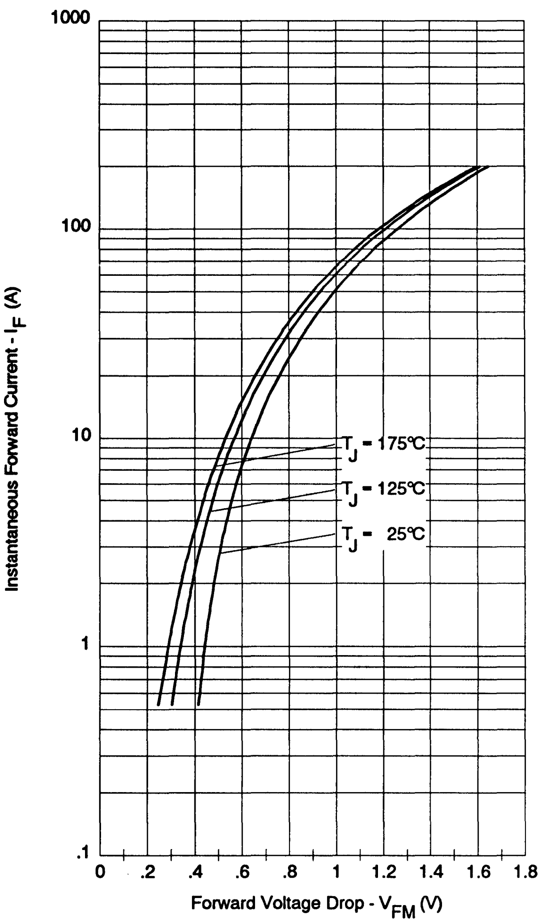


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

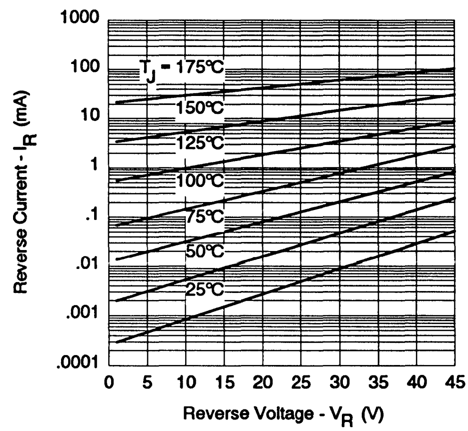


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

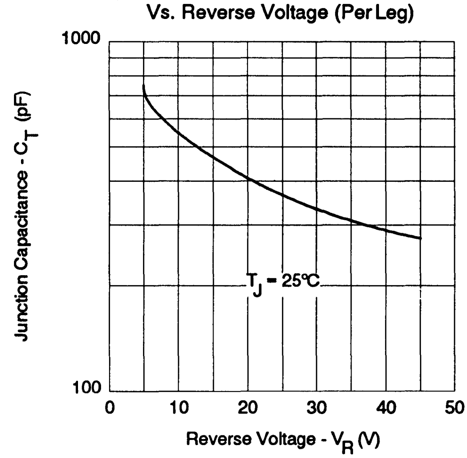


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

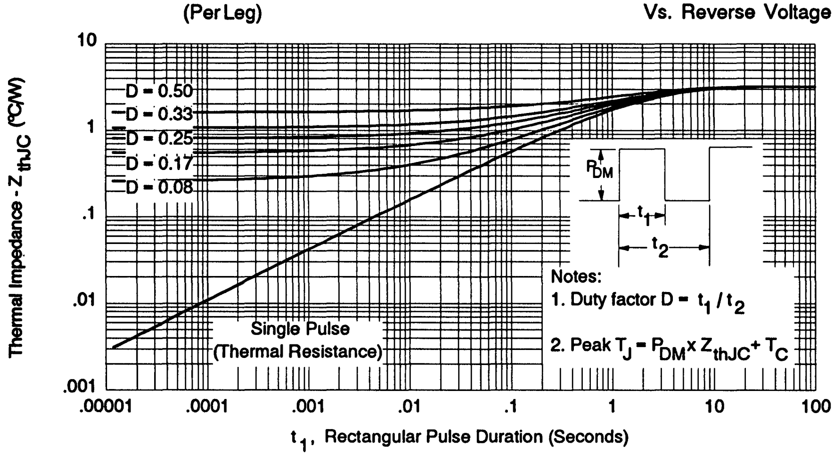


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

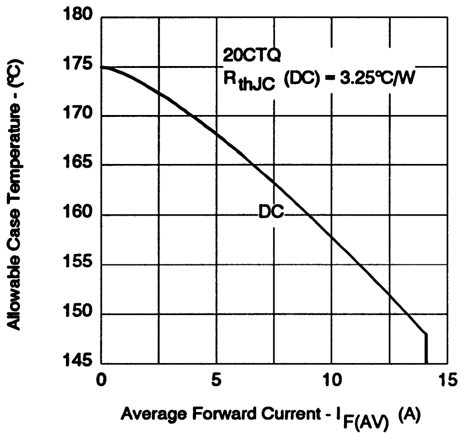


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

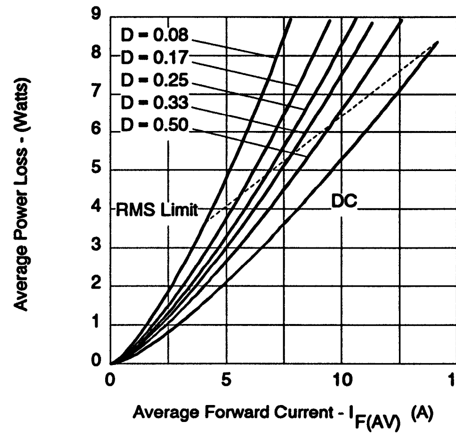


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

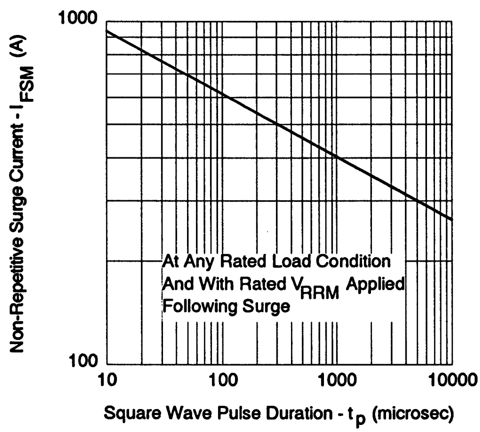


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

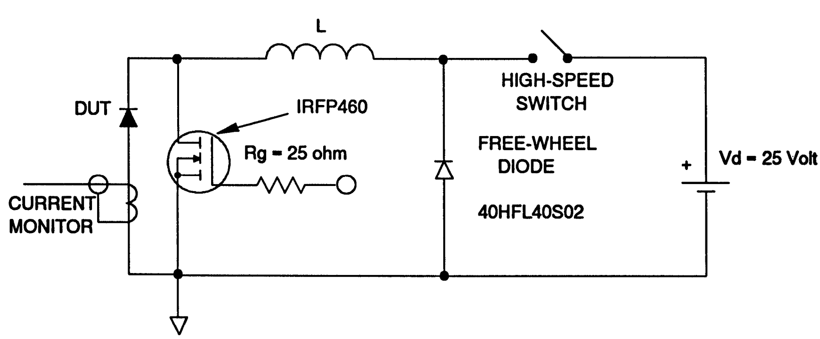


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

25CTQ... SERIES

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	25CTQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	990	A
V_F @ 15 Apk, T_J = 125°C (per leg)	0.50	V
T_J	-55 to 150	°C

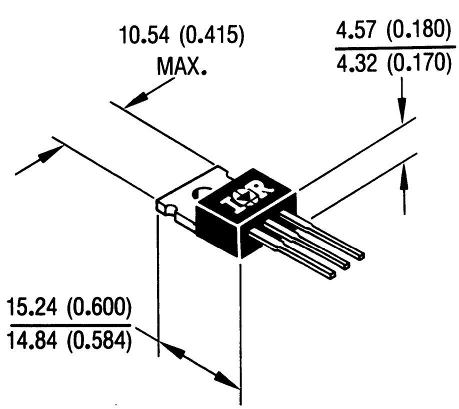
Description/Features

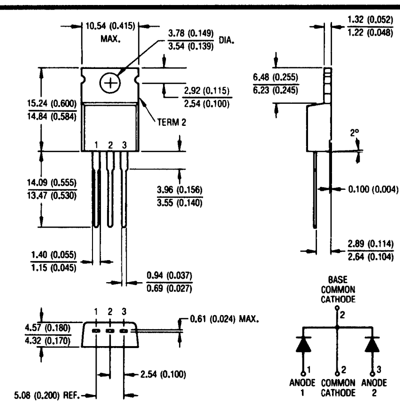
The 25CTQ center tap Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	25CTQ035	25CTQ040	25CTQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	25CTQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 102 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	990	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		250		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	20	mJ	T_J = 25 °C, I_{AS} = 3 Amps, L = 4.40 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	3	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	25CTQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.56	V	@ 15A	T_J = 25 °C
		0.71	V	@ 30A	
		0.50	V	@ 15A	T_J = 125 °C
		0.64	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.75	mA	T_J = 25 °C	V_R = rated V_R
		70	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		25CTQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2.0 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

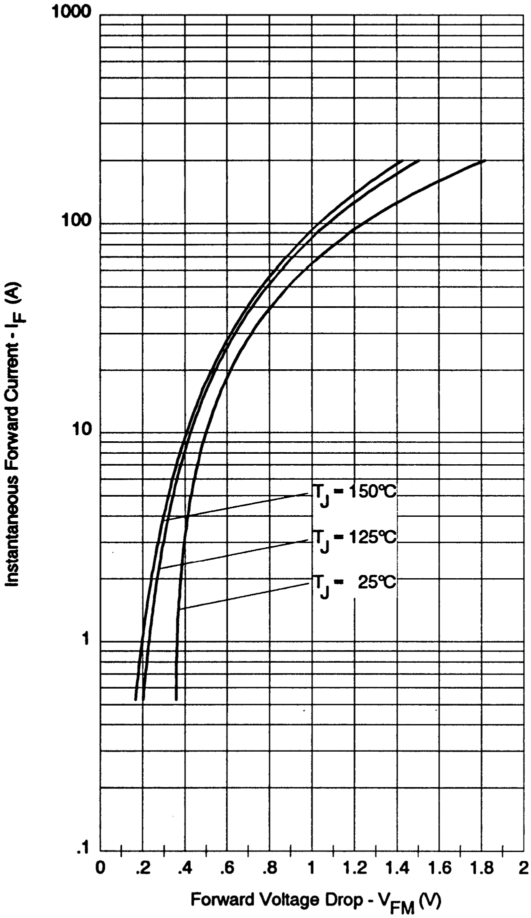


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

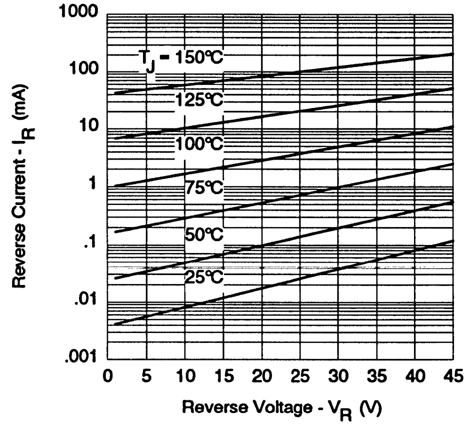


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

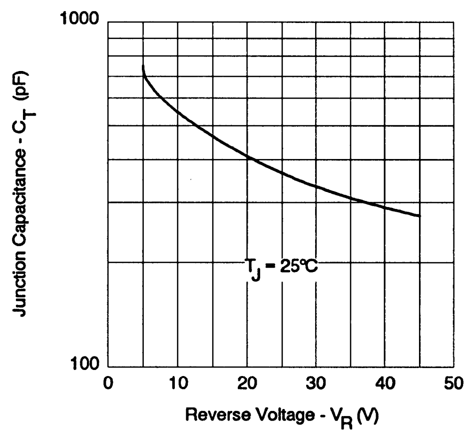


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

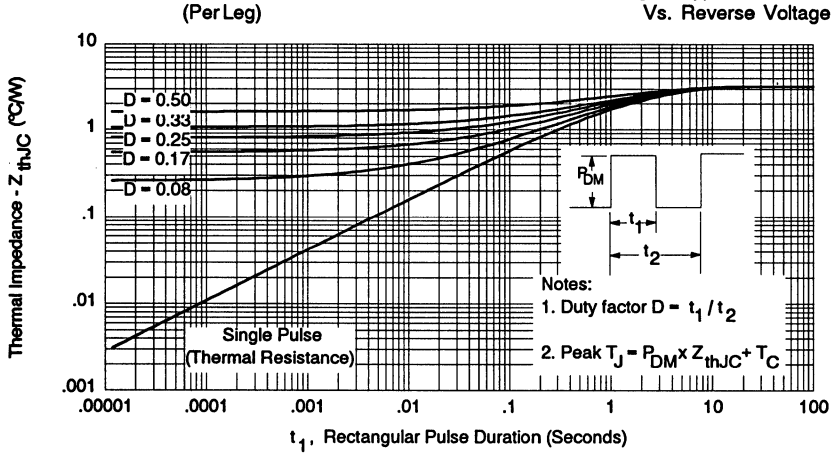


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

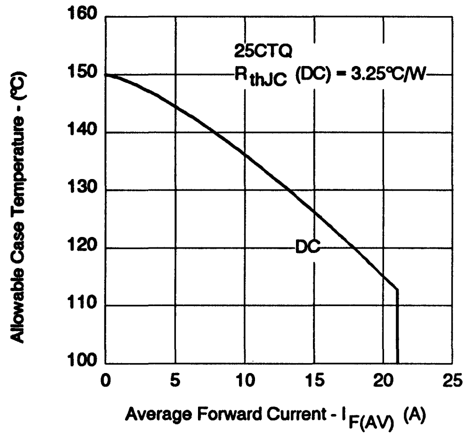


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

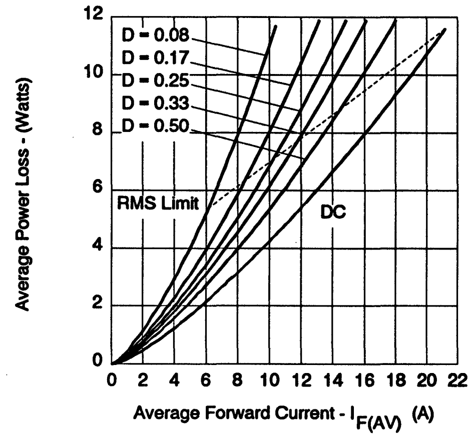


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

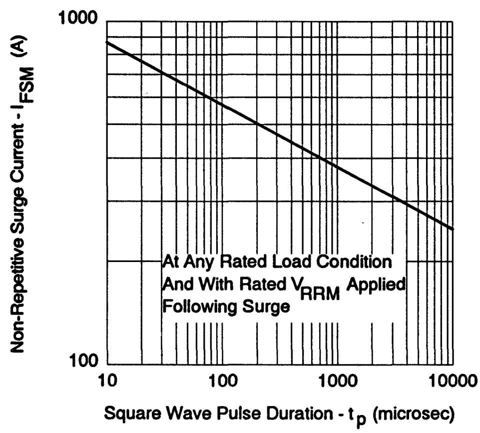


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

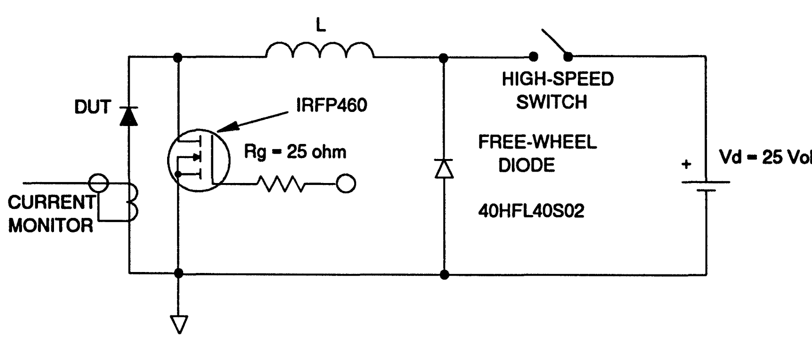


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

30CTQ035
30CTQ040
30CTQ045

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

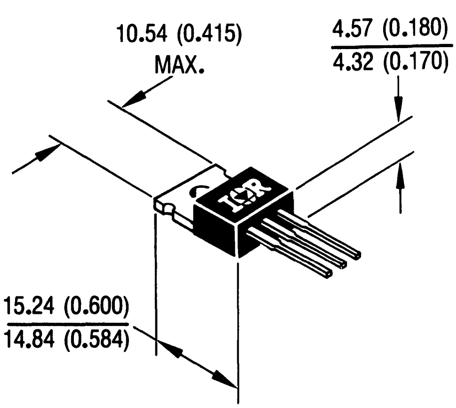
Characteristics	30CTQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35/40/45	V
I_{FSM} @ tp = 5 μs sine	1060	A
V_F @ 15 Apk, T_J = 125°C (per leg)	0.56	V
T_J	-55 to 175	°C

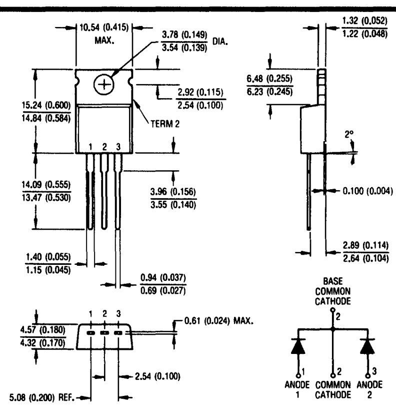
Description/Features

The 30CTQ... center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-220 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

Part number	30CTQ035	30CTQ040	30CTQ045
V_R Max. DC Reverse Voltage (V) / V_{RWM} Max. Working Peak Reverse Voltage (V)	35	40	45

Absolute Maximum Ratings

	Parameters	30CTQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 127°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	1060	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		265		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	20	mJ	T_J = 25 °C, I_{AS} = 3.0 Amps, L = 4.40 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	3.0	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	30CTQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.62	V	@ 15A	T_J = 25 °C
		0.76	V	@ 30A	
		0.56	V	@ 15A	T_J = 125 °C
		0.70	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	2	mA	T_J = 25 °C	V_R = rated V_R
		15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		30CTQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

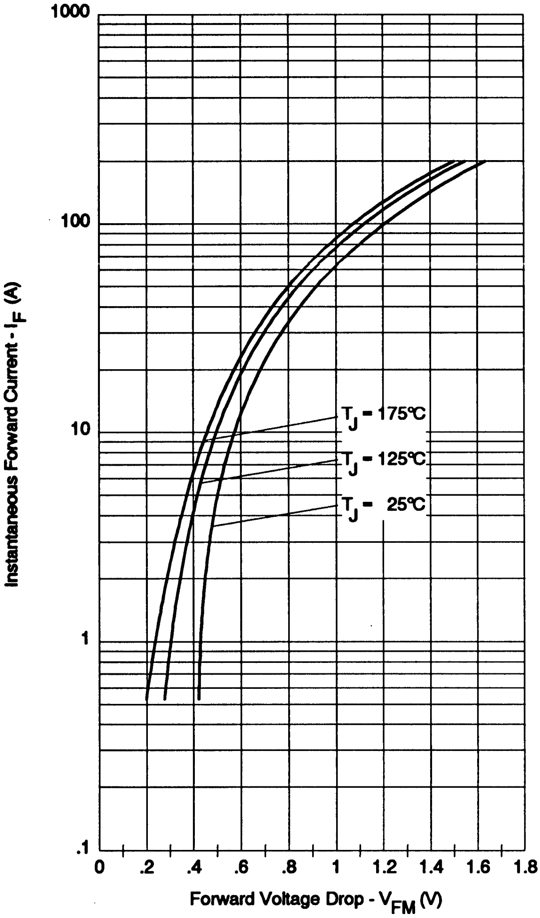


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

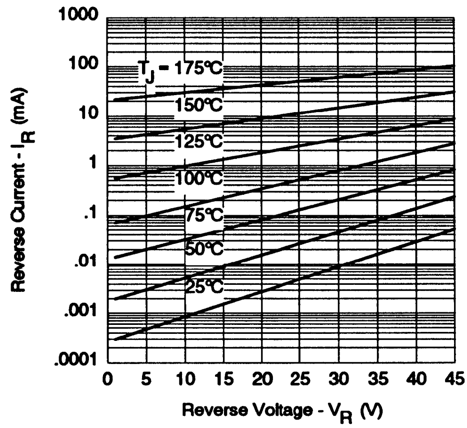


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

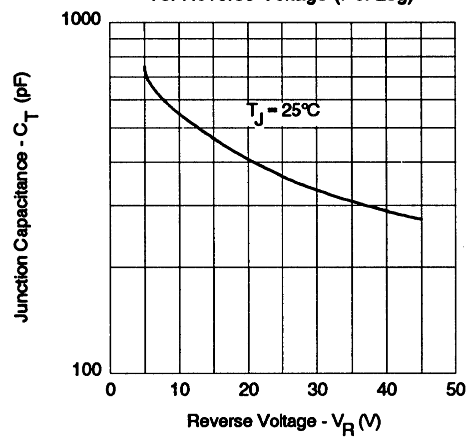


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

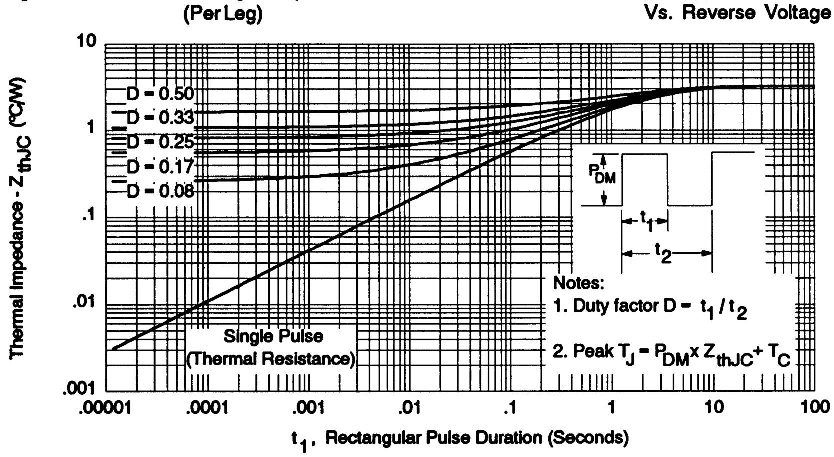


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

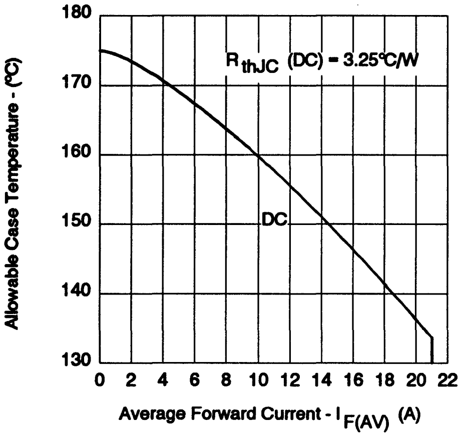


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

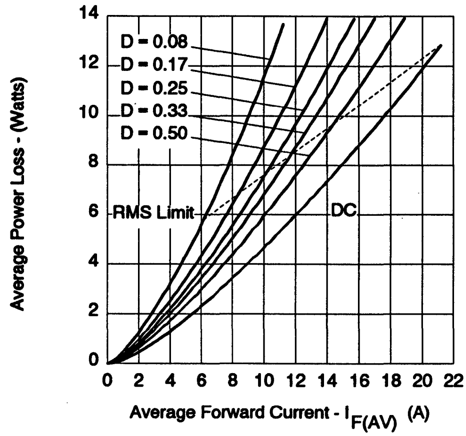


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

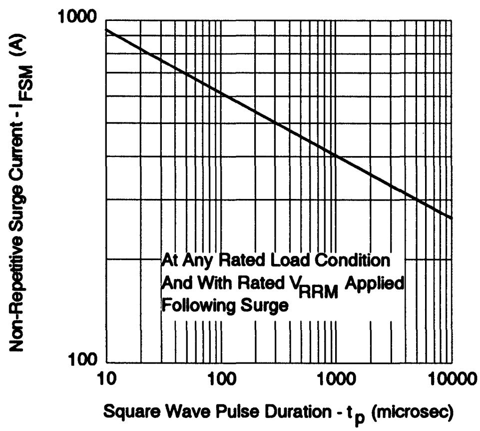


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

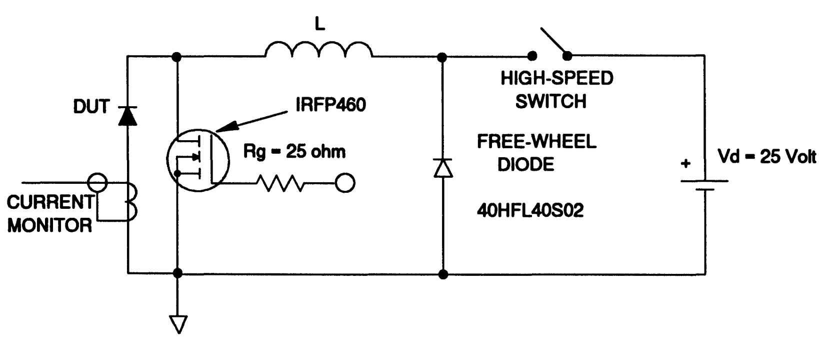


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

30CTQ050
30CTQ060

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	30CTQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 μs sine	1000	A
V_F @ 15 Apk, T_J = 125°C (per leg)	0.56	V
T_J	-55 to 150	°C

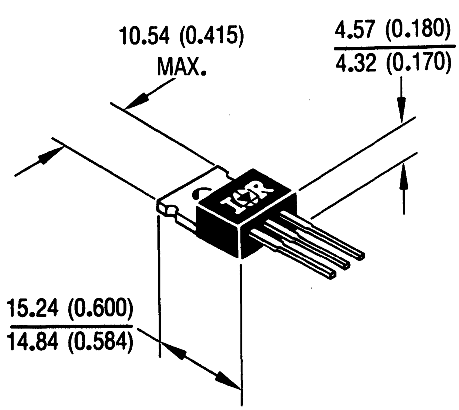
Description/Features

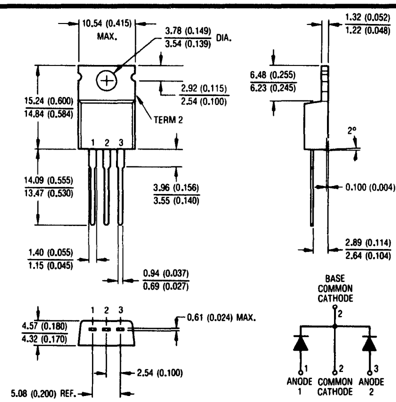
The 30CTQ... center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	30CTQ050	30CTQ060
V_R	Max. DC Reverse Voltage (V)	50	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	30CTQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 97 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	1000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		260		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	13	mJ	T_J = 25 °C, I_{AS} = 1.50 Amps, L = 11.5 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1.50	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	30CTQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.62	V	@ 15A	T_J = 25 °C
		0.82	V	@ 30A	
		0.56	V	@ 15A	T_J = 125 °C
		0.71	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.80	mA	T_J = 25 °C	V_R = rated V_R
		45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	720	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		30CTQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm	
		Max.	12 (10)	(lbf-in)	
	Case Style		TO-220AB		JEDEC

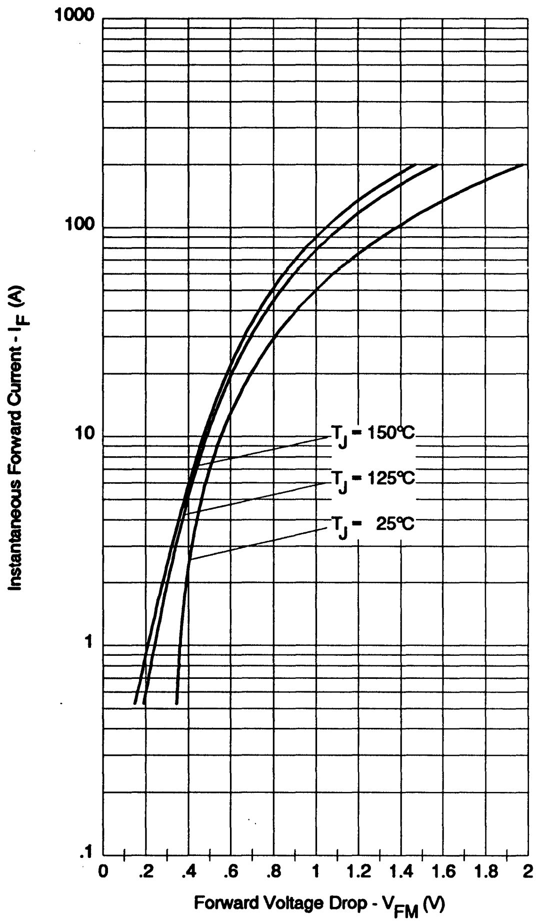


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

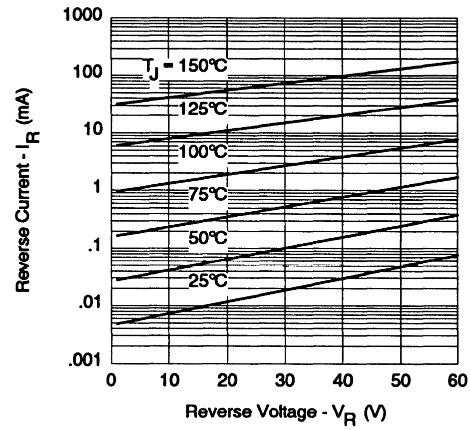


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

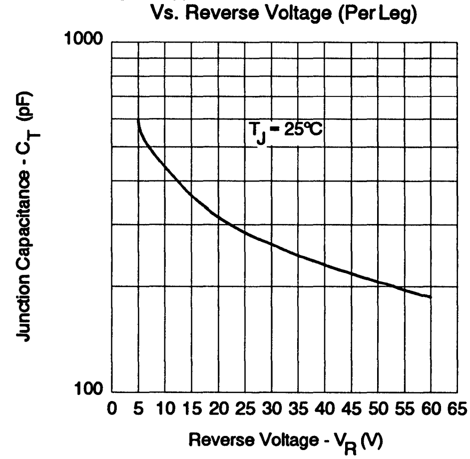


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

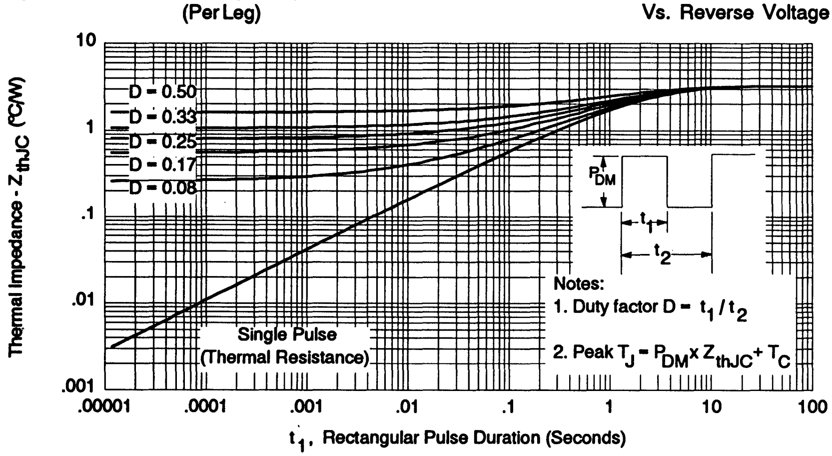


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC
TO-220 &
TO-247

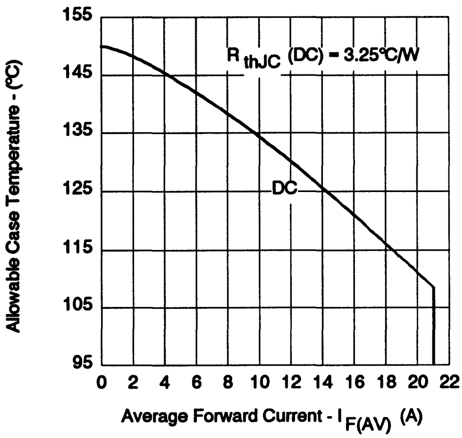


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

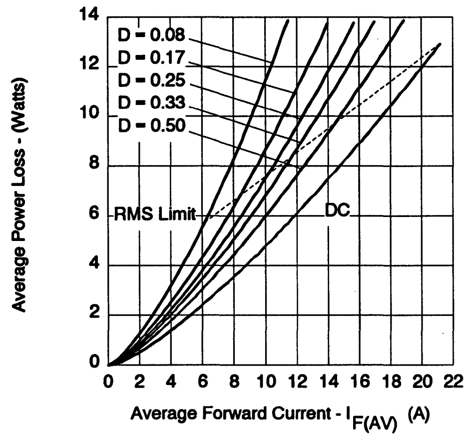


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

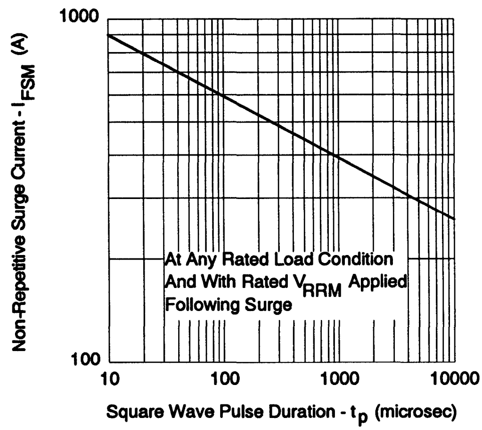


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

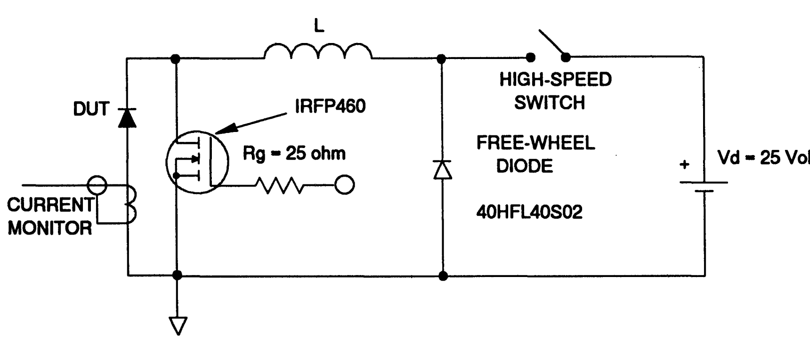


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

32CTQ030

SCHOTTKY RECTIFIER

30 Amp

PLASTIC TO-220 & TO-247

Major Ratings and Characteristics

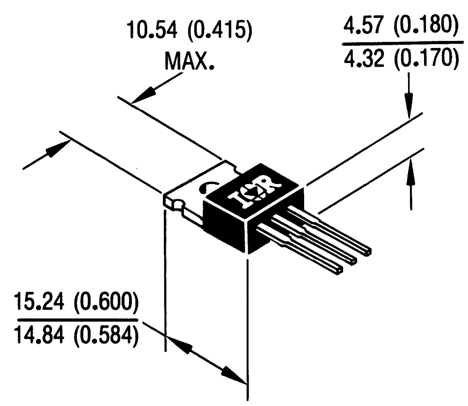
Characteristics	32CTQ030	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 µs sine	900	A
V_F @ 15 Apk, T_J = 125°C (per leg)	0.40	V
T_J	-55 to 150	°C

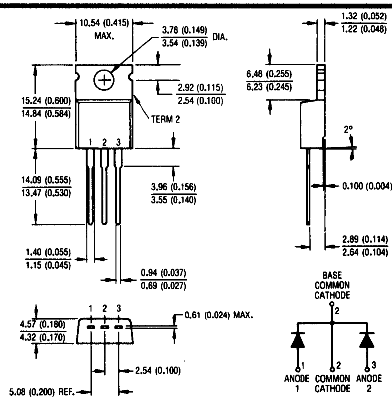
Description/Features

The 32CTQ030 center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	32CTQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	32CTQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 109 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	900	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		250		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	13	mJ	T_J = 25 °C, I_{AS} = 3 Amps, L = 2.90 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	3	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	32CTQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.49	V	@ 15A	T_J = 25 °C
		0.58	V	@ 30A	
		0.40	V	@ 15A	T_J = 125 °C
		0.53	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.75	mA	T_J = 25 °C	V_R = rated V_R
		97	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		32CTQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		3.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

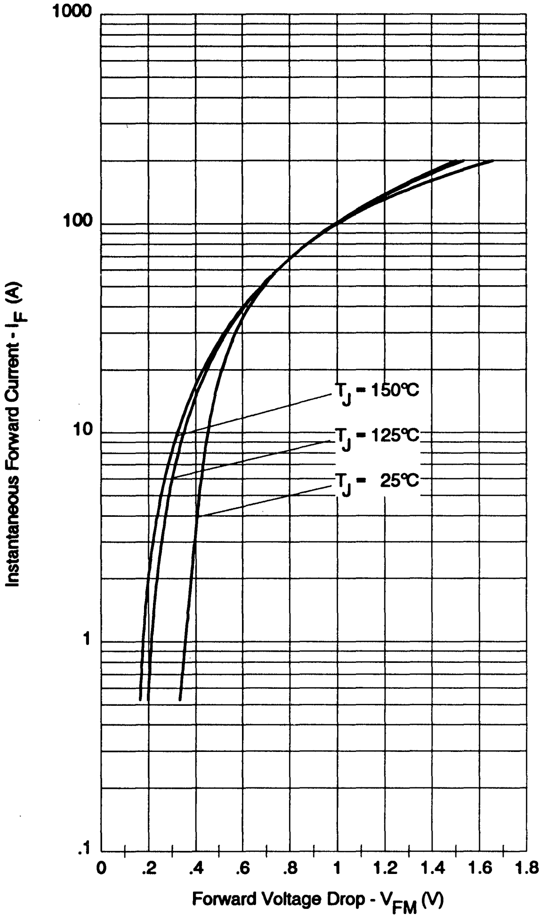


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

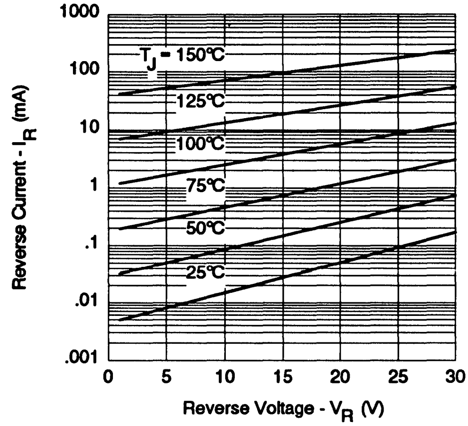


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

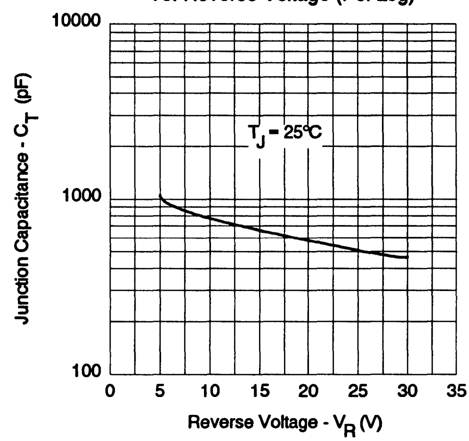


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

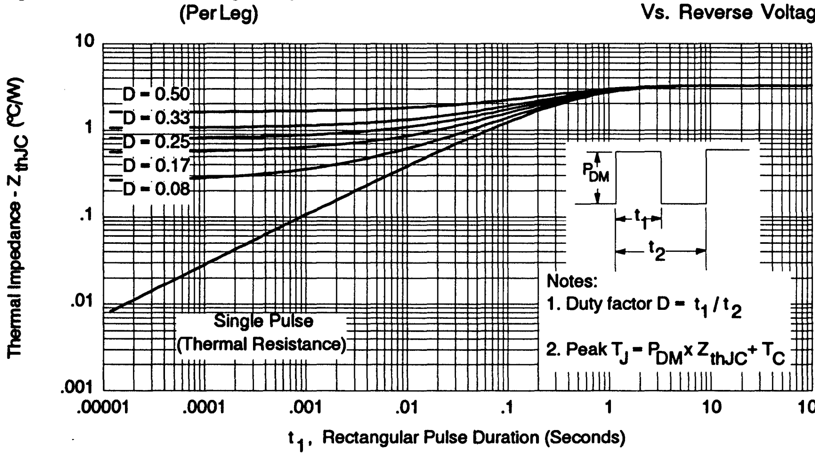


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

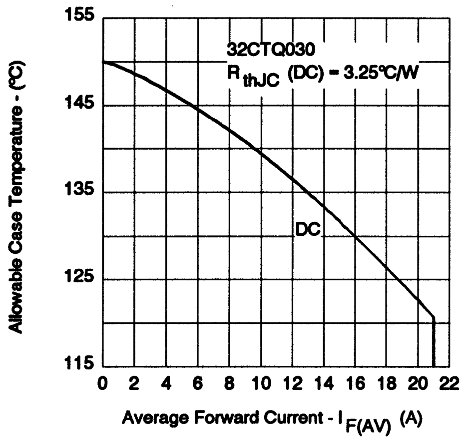


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

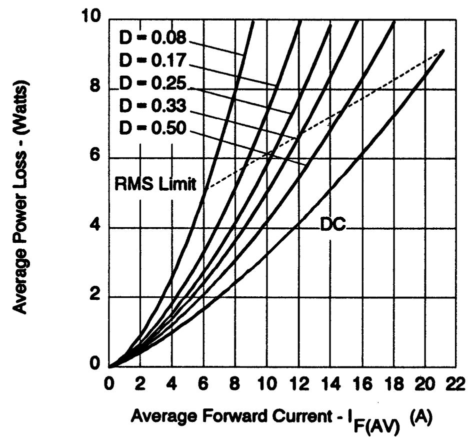


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

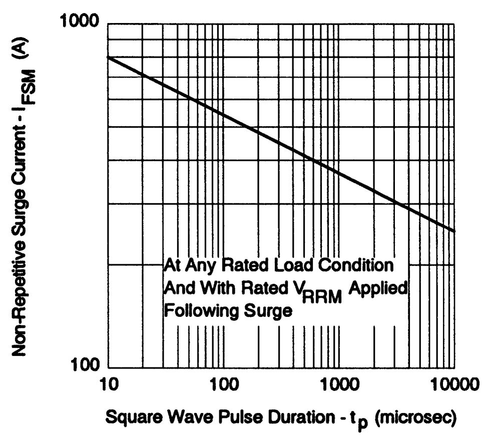


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

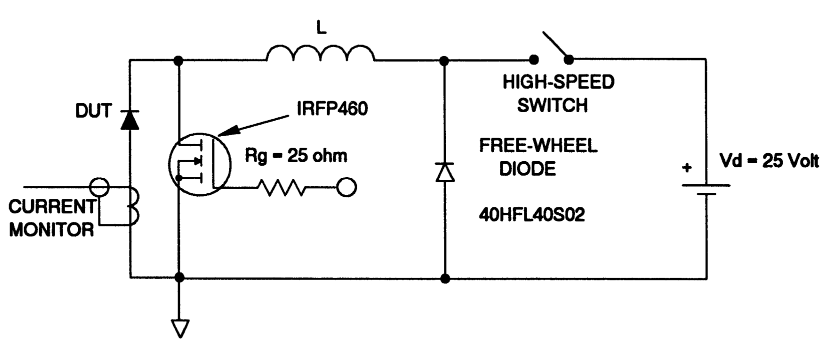


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

MBR1535CT
MBR1545CT

SCHOTTKY RECTIFIER

15 Amp

Major Ratings and Characteristics

Characteristics	MBR15..CT	Units
$I_{F(AV)}$ Rectangular waveform	15	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 μs sine	690	A
V_F @ 7.5 Apk, T_J = 125°C	0.57	V
T_J	- 65 to 150	°C

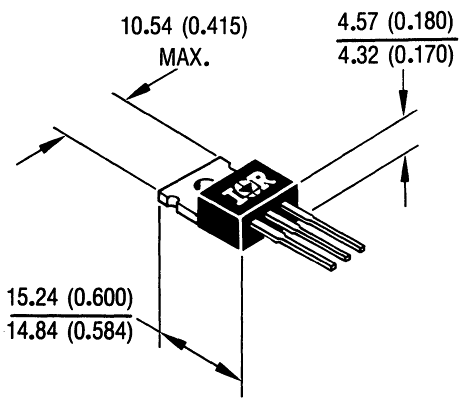
Description/Features

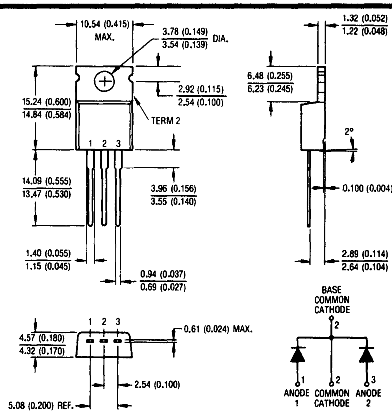
The MBR15..CT center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	MBR1535CT	MBR1545CT
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	MBR15..CT	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current (Per Leg)	7.5	A	@ T_C = 105 °C, (Rated V_R)	
	(Per Device)	15			
I_{FSM}	Max. Peak One Cycle Non Repetitive Surge	690	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		150		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	1.0	A	2.0 µsec 1.0 KHz	

Electrical Specifications

	Parameters	MBR15..CT	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.84	V	@ 15A	T_J = 25 °C
	(1)	0.57	V	@ 7.5A	T_J = 125 °C
		0.72	V	@ 15A	
I_{RM}	Max. Instantaneus Reverse Current	0.1	mA	T_J = 25 °C	Rated DC voltage
	(1)	15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		MBR15..CT	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		3.0	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
R_{thJA}	Max. Thermal Resistance Junction		60	°C/W	DC operation
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

* For Additional Informations and Graphs, Please See the 12CTQ Series

International IOR Rectifier

MBR2035CT
MBR2045CT

SCHOTTKY RECTIFIER

20 Amp

Major Ratings and Characteristics

Characteristics	MBR20..CT	Units
$I_{F(AV)}$ Rectangular waveform	20	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 µs sine	1060	A
V_F @ 10 Apk, T_J = 125°C	0.57	V
T_J	- 65 to 150	°C

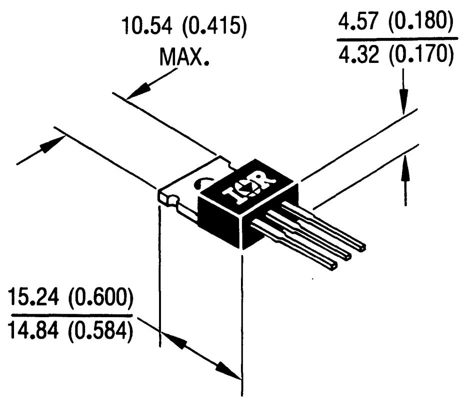
Description/Features

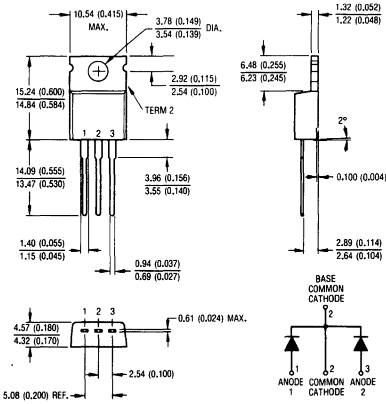
The MBR20..CT center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC
TO-220 &
TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	MBR2035CT	MBR2045CT
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	MBR20..CT	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current	20	A	@ T_C = 135°C, (Rated V_R)	
I_{FSM}	Max. Peak One Cycle Non Repetitive Surge	1060	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		150		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	1.0	A	2.0 µsec 1.0 KHz	

Electrical Specifications

	Parameters	MBR20..CT	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.84	V	@ 20A	T_J = 25 °C
	(1)	0.57	V	@ 10A	T_J = 125 °C
		0.72	V	@ 20A	
I_{RM}	Max. Instantaneus Reverse Current	0.1	mA	T_J = 25 °C	Rated DC voltage
	(1)	15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		MBR20..CT	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.0	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		2 (0.07)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-220AB		JEDEC

* For Additional Informations and Graphs, Please See the 20CTQ Series

International IOR Rectifier

MBR2080CT
MBR2090CT
MBR20100CT

SCHOTTKY RECTIFIER

20 Amp

Major Ratings and Characteristics

Characteristics	MBR20...CT	Units
$I_{F(AV)}$ Rectangular waveform	20	A
V_{RRM}	80/90/100	V
I_{FSM} @ tp = 5 μs sine	850	A
V_F @ 10Apk, T_J = 125°C	0.7	V
T_J	- 65 to 150	°C

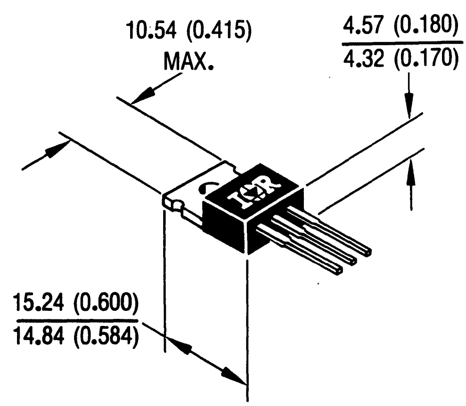
Description/Features

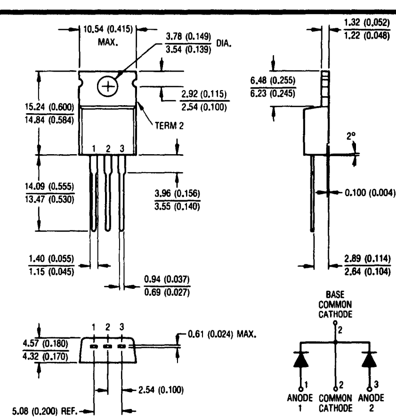
The MBR20...CT center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

	Part number	MBR2080CT	MBR2090CT	MBR20100CT
V_R	Max. DC Reverse Voltage (V)	80	90	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	MBR20...CT	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current (Per Leg)	10	A	@ T_C = 133°C, (Rated V_R)	
I_{FSM}	Non Repetitive Peak Surge Current	850	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		150		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	0.5	A	2.0 µsec 1.0 KHz	

Electrical Specifications

	Parameters	MBR20...CT	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.80	V	@ 10A	T_J = 25 °C
	(1)	0.95	V	@ 20A	
		0.70	V	@ 10A	T_J = 125 °C
		0.85	V	@ 20A	
I_{RM}	Max. Instantaneus Reverse Current	0.15	mA	T_J = 25 °C	Rated DC voltage
	(1)	150	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	500	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	MBR20...CT	Units	Conditions
T_J	Max. Junction Temperature Range	-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	2.0	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.50	°C/W	Mounting surface, smooth and greased
R_{thJA}	Max. Thermal Resistance Junction	60	°C/W	DC operation
wt	Approximate Weight	2 (0.07)	g (oz.)	
T	Mounting Torque Min.	6 (5)	Kg-cm (lbf-in)	
	Max.	12 (10)		
	Case Style	TO-220AB		JEDEC

* For Additional Informations and Graphs, Please See the 16CTQ Series

International IOR Rectifier

MBR2535CT
MBR2545CT

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

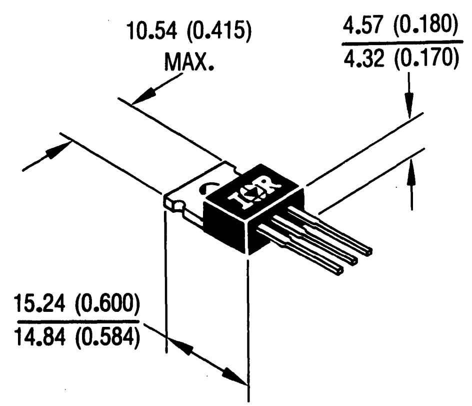
Characteristics	MBR25..CT	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 μs sine	1060	A
V_F @ 30 Apk, T_J = 125°C	0.73	V
T_J	-65 to 150	°C

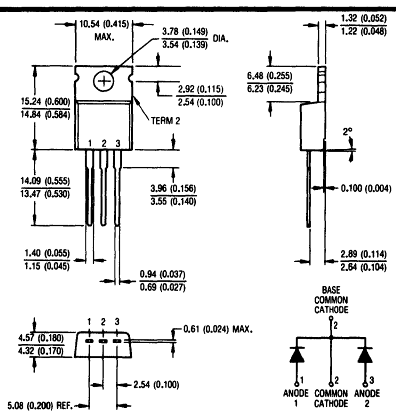
Description/Features

The MBR25..CT center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-220 package
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-220AB

Dimensions in millimeters and inches

FOR OPTIONAL LEADFORM OPTIONS SEE PAGES D-476 & D-477

Voltage Ratings

Part number		MBR2535CT	MBR2545CT
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

Parameters		MBR25..CT	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current	30	A	@ T_C = 130°C, (Rated V_R)	
I_{FSM}	Max. Peak One Cycle Non Repetitive Surge	1060	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		150		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	1.0	A	2.0 µsec 1.0 KHz	

Electrical Specifications

Parameters		MBR25..CT	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.82	V	@ 30A	T_J = 25 °C
	(1)	0.73	V	@ 30A	T_J = 125 °C
I_{RM}	Max. Instantaneus Reverse Current	0.2	mA	T_J = 25 °C	Rated DC voltage
	(1)	40	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	8.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

Parameters		MBR25..CT	Units	Conditions
T_J	Max. Junction Temperature Range	-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	1.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	2 (0.07)	g (oz.)	
T	Mounting Torque Min.	6 (5)	Kg-cm (lbf-in)	
	Max.	12 (10)		
	Case Style	TO-220AB		JEDEC

* For Additional Informations and Graphs, Please See the 30CTQ Series

International IOR Rectifier

30CPQ035
30CPQ040
30CPQ045

SCHOTTKY RECTIFIER

30 Amp

PLASTIC TO-220 & TO-247

Major Ratings and Characteristics

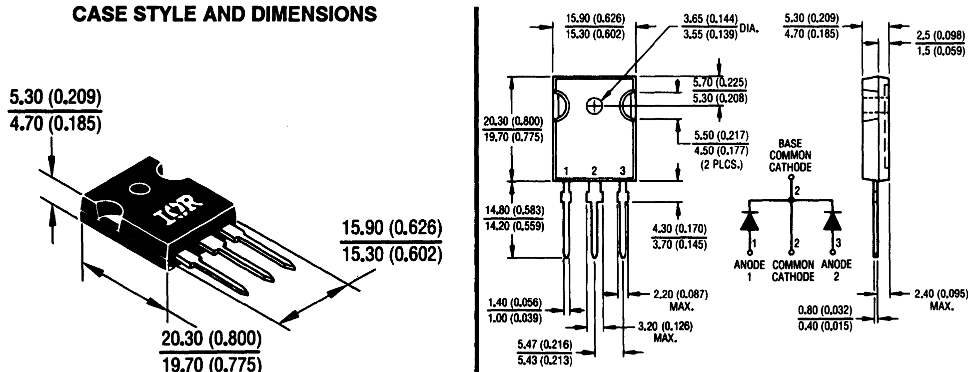
Characteristics	30CPQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35/40/45	V
I_{FSM} @ tp = 5 μs sine	1020	A
V_F @ 15 Apk, T_J=125°C (per leg)	0.50	V
T_J	-55 to 150	°C

Description/Features

The 30CPQ... center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS



Conforms to JEDEC Outline TO-247AC (TO-3P)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	30CPQ035	30CPQ040	30CPQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	30CPQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 124 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	1020	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		265		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	20	mJ	T_J = 25 °C, I_{AS} = 3 Amps, L = 4.4 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	3	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	30CPQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.54	V	@ 15A	T_J = 25 °C
		0.68	V	@ 30A	
		0.50	V	@ 15A	T_J = 125 °C
		0.64	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.75	mA	T_J = 25 °C	V_R = rated V_R
		70	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		30CPQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		2.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

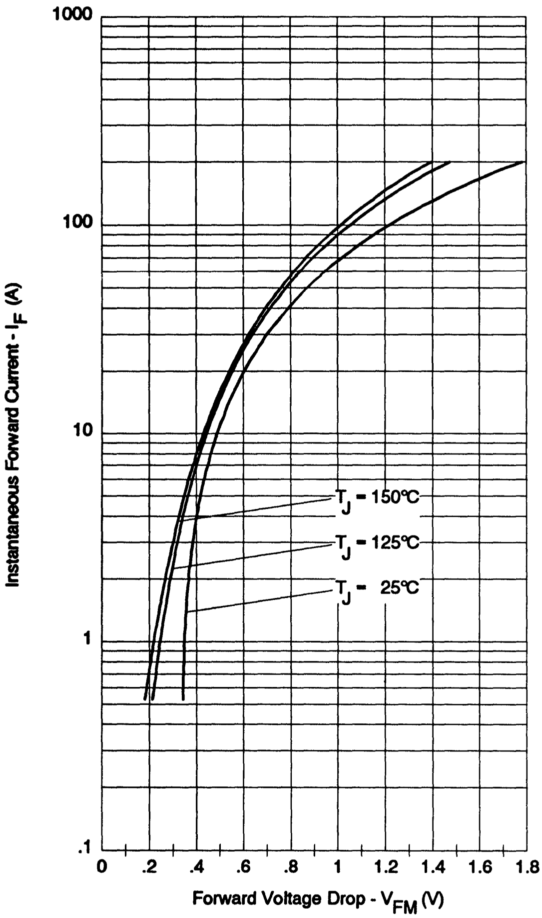


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

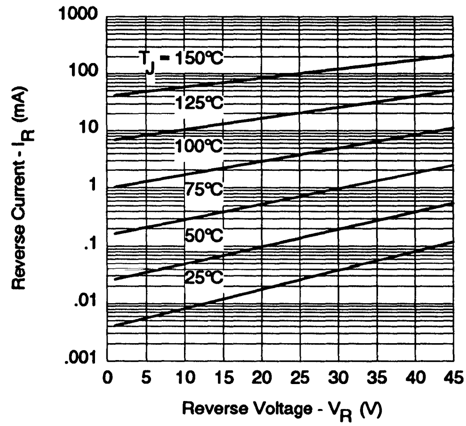


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

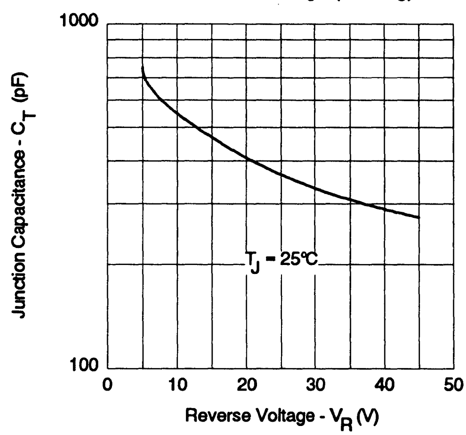


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

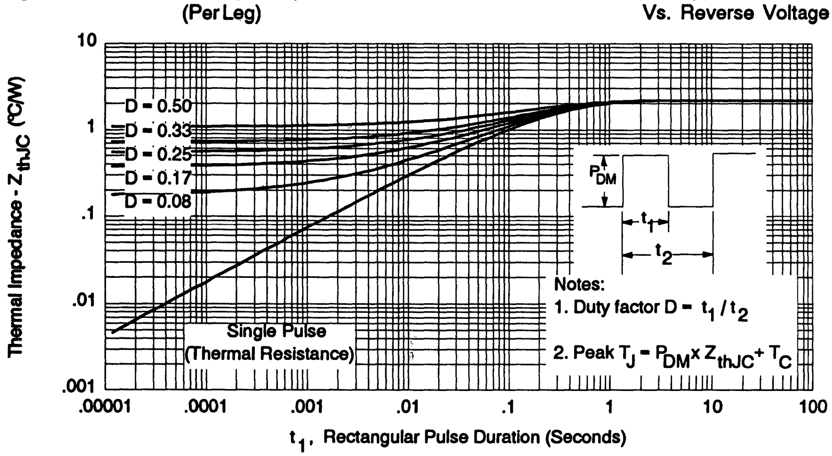


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

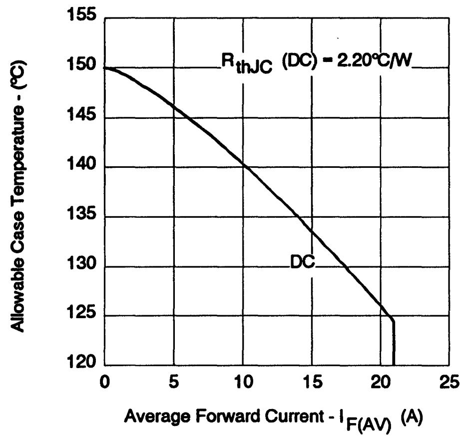


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

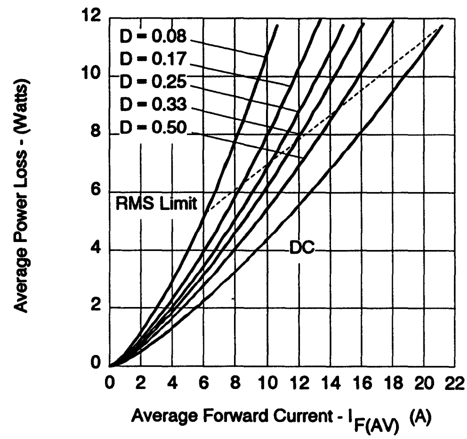


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

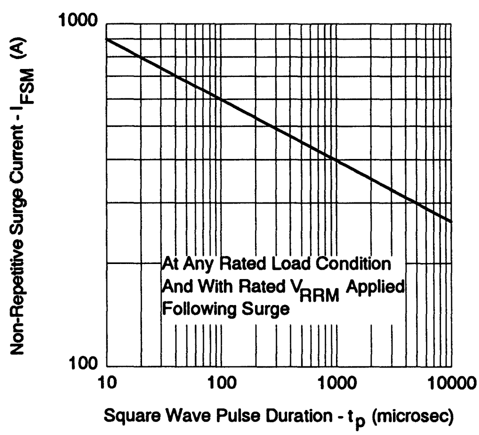


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

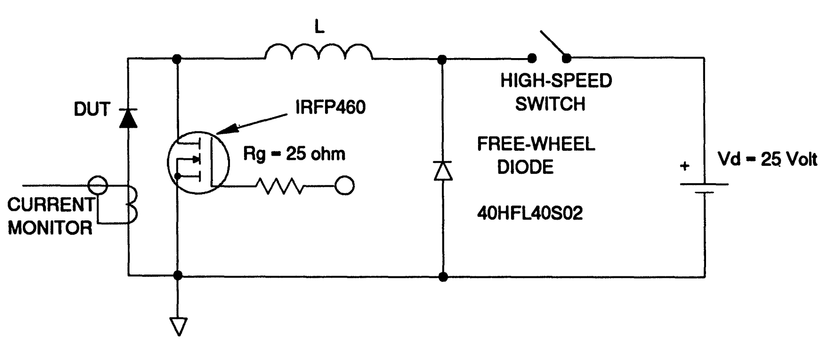


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

30CPQ050
30CPQ060

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	30CPQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 μs sine	1020	A
V_F @ 15 Apk, T_J = 125°C (per leg)	0.56	V
T_J	- 55 to 150	°C

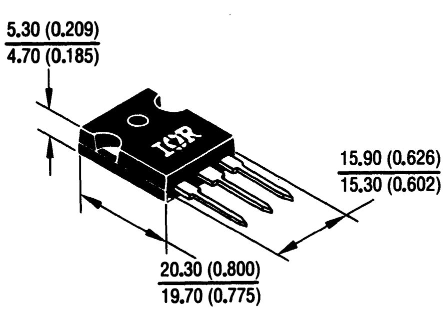
Description/Features

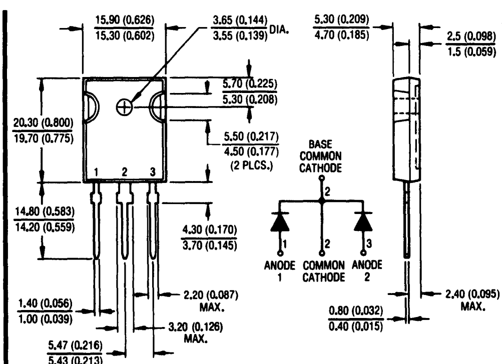
The 30CPQ... center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC (TO-3P)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	30CPQ050	30CPQ060
V_R	Max. DC Reverse Voltage (V)	50	60
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	30CPQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 112 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	1020	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		265		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	13	mJ	T_J = 25 °C, I_{AS} = 1.50 Amps, L = 11.5 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1.50	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	30CPQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.60	V	@ 15A	T_J = 25 °C
		0.80	V	@ 30A	
		0.56	V	@ 15A	T_J = 125 °C
		0.70	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.80	mA	T_J = 25 °C	V_R = rated V_R
		45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	720	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		30CPQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		2.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

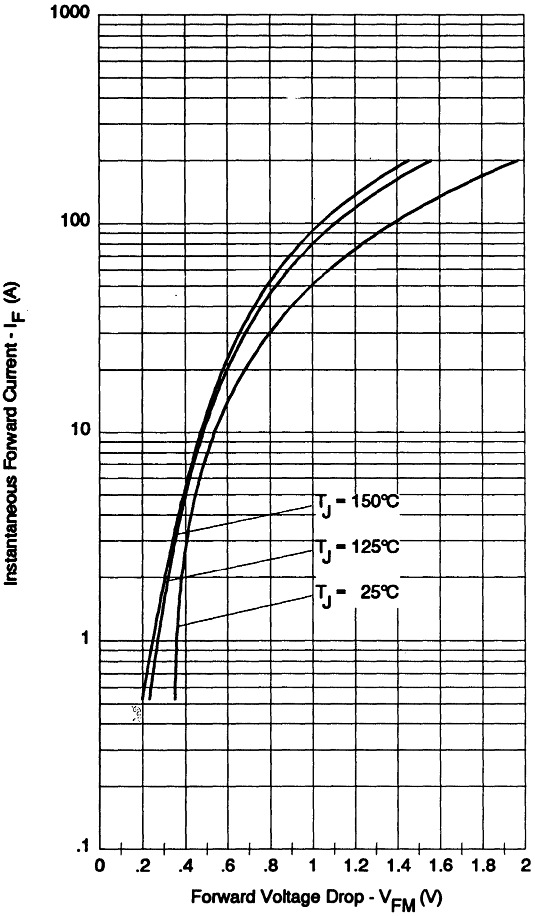


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

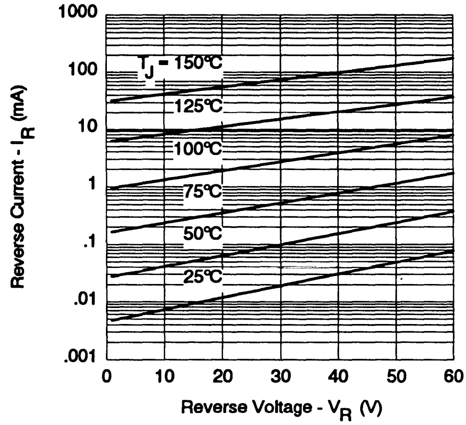


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

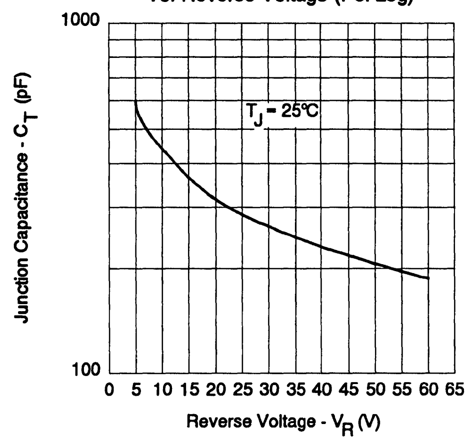


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

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TO-220 &
TO-247

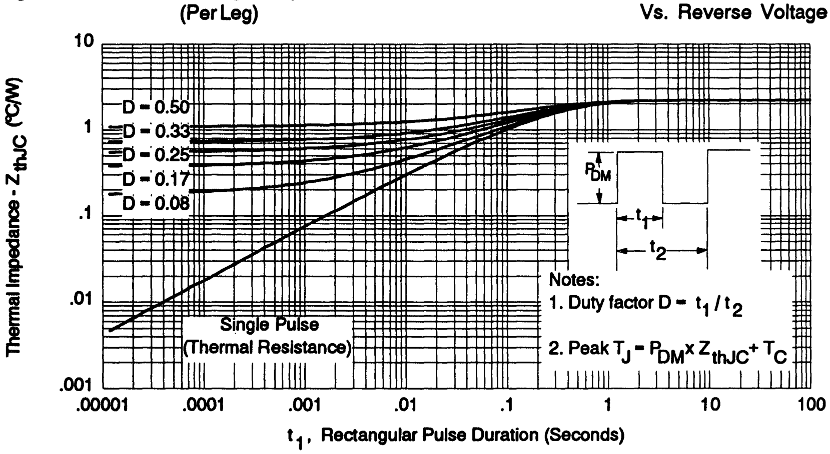


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

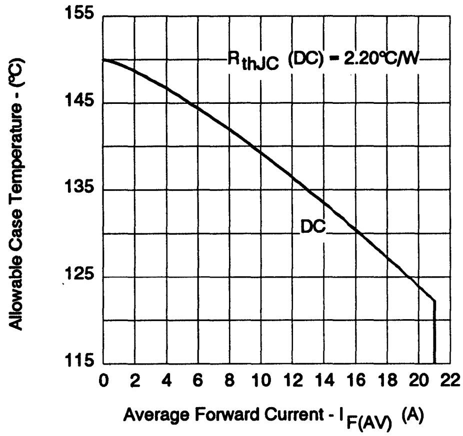


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

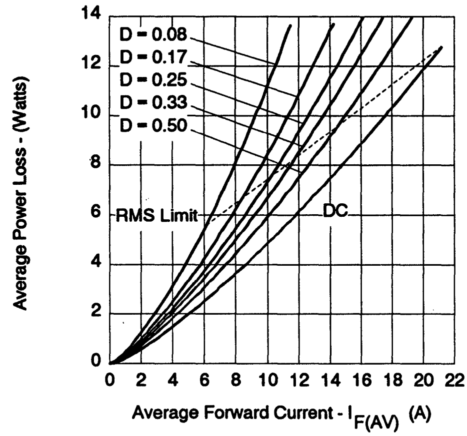


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

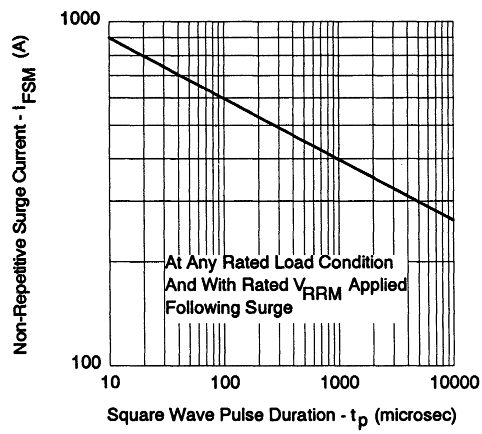


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

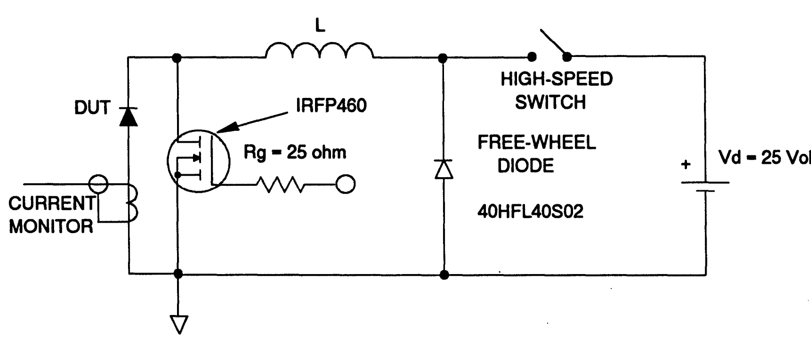


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

30CPQ080
30CPQ100

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	30CPQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	80/100	V
I_{FSM} @ tp = 5 μs sine	920	A
V_F @ 15 Apk, T_J = 125°C (per leg)	0.67	V
T_J	-55 to 175	°C

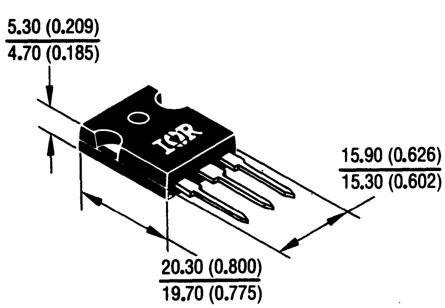
Description/Features

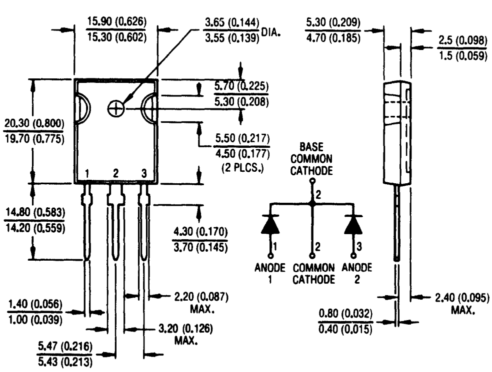
The 30CPQ... center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC
TO-220 &
TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC (TO-3P)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	30CPQ080	30CPQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	30CPQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 140°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	920	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		240		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	7.50	mJ	T_J = 25 °C, I_{AS} = 0.50 Amps, L = 60 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	0.50	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	30CPQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.86	V	@ 15A	T_J = 25 °C
		1.05	V	@ 30A	
		0.67	V	@ 15A	T_J = 125 °C
		0.81	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.55	mA	T_J = 25 °C	V_R = rated V_R
		7	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	500	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		30CPQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		2.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

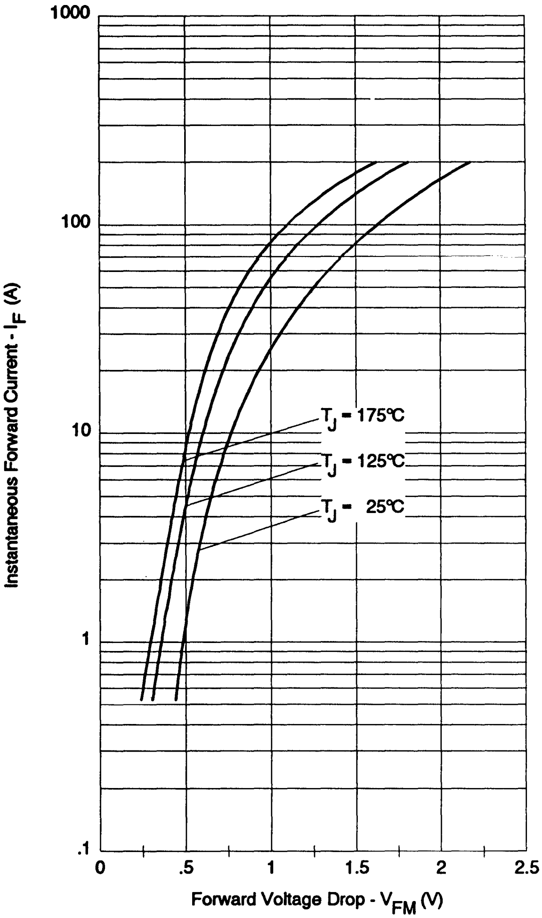


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

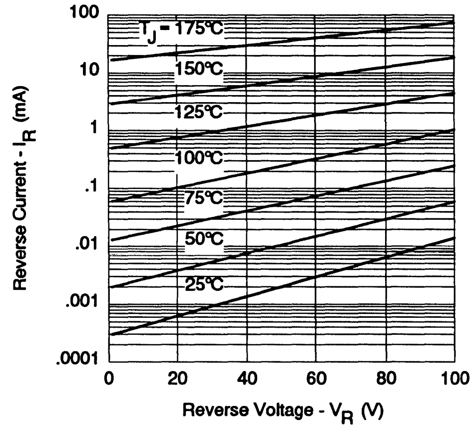


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

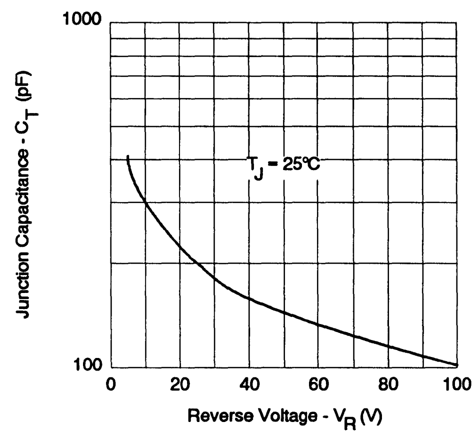


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

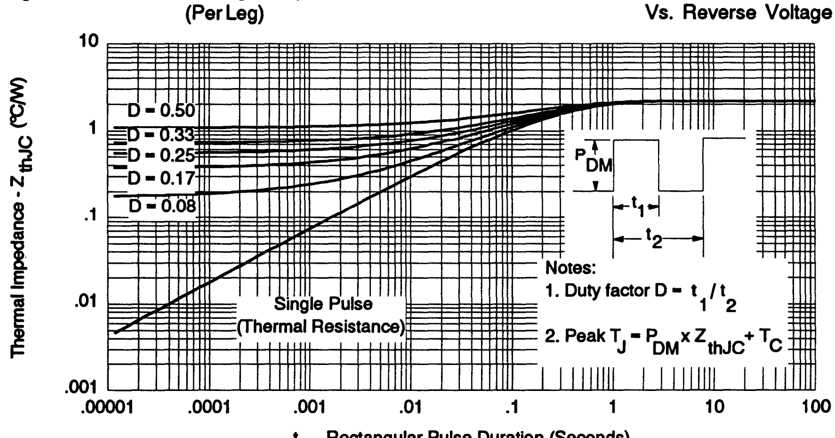


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC
TO-220 &
TO-247

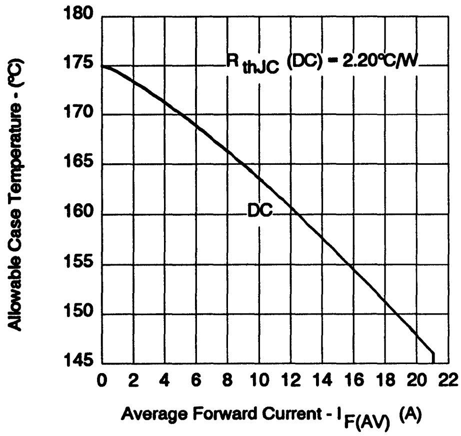


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

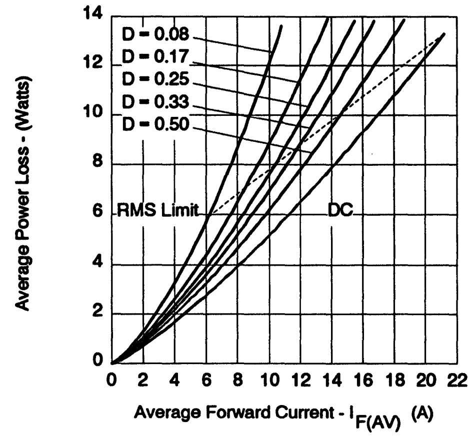


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

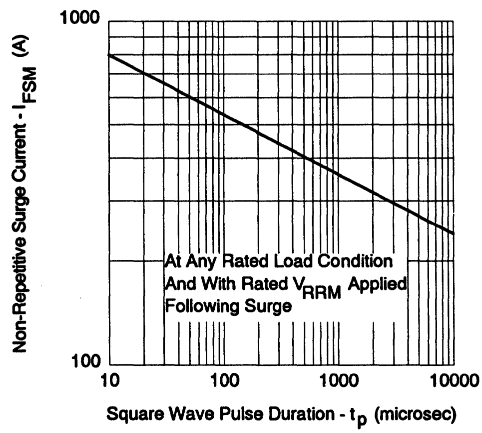


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

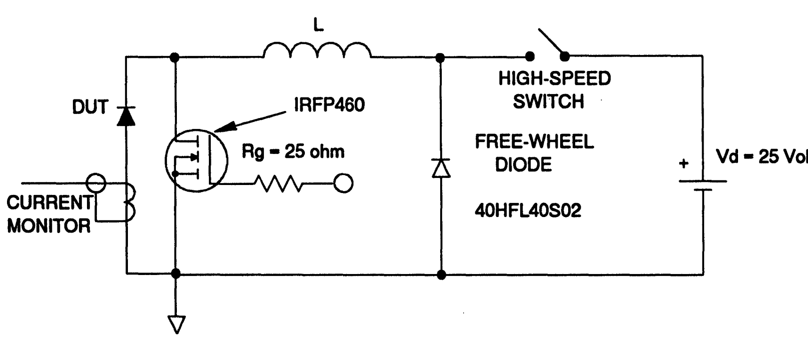


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

30CPQ150

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	30CPQ150	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	150	V
I_{FSM} @ tp = 5 µs sine	1000	A
V_F @ 15 Apk, T_J=125°C (per leg)	0.78	V
T_J	- 55 to 175	°C

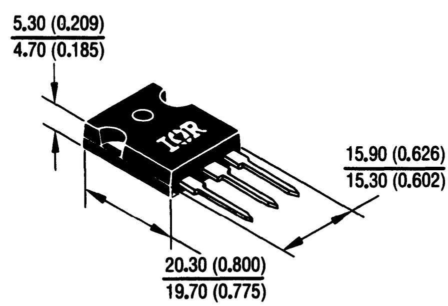
Description/Features

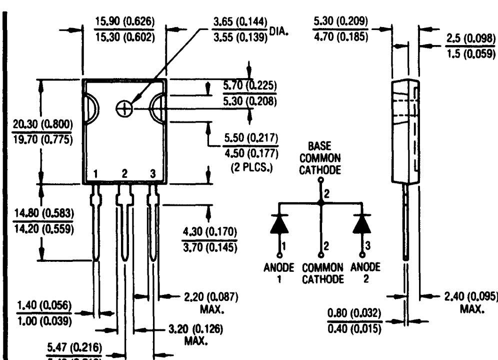
The 30CPQ150 center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC (TO-3P)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	30CPQ150
V_R	Max. DC Reverse Voltage (V)	150
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	30CPQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 131°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	1000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		340		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	11.25	mJ	T_J = 25 °C, I_{AS} = 0.50 Amps, L = 90 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	0.50	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	30CPQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	1.00	V	@ 15A	T_J = 25 °C
		1.19	V	@ 30A	
		0.78	V	@ 15A	T_J = 125 °C
		0.93	V	@ 30A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	0.1	mA	T_J = 25 °C	V_R = rated V_R
		15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	340	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		30CPQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		2.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

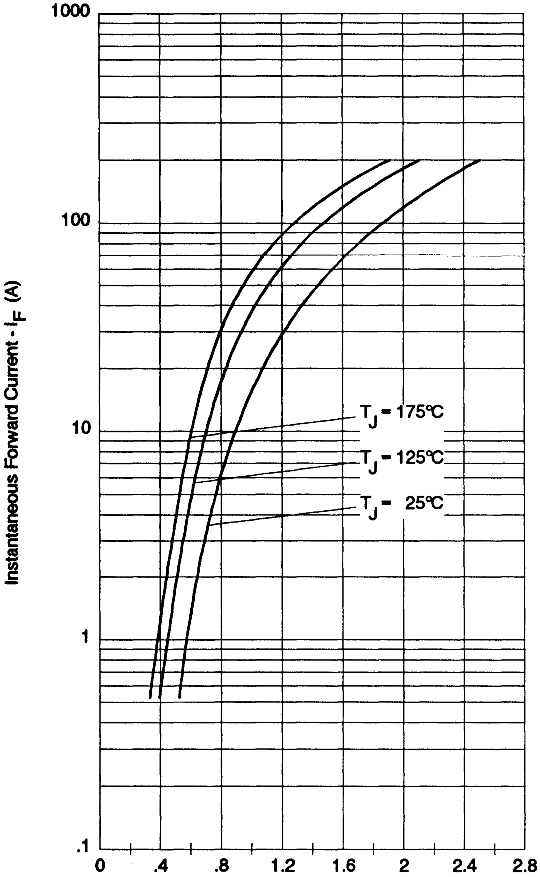


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

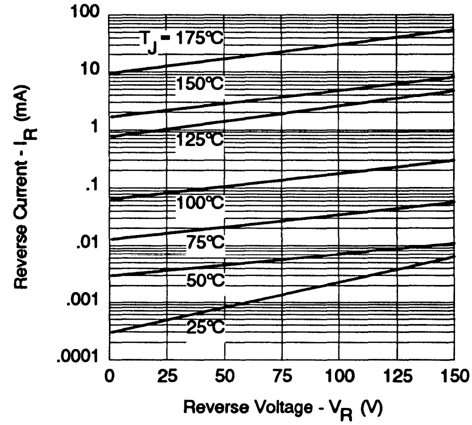


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

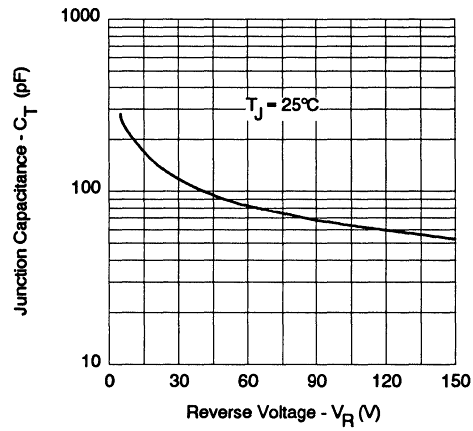


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

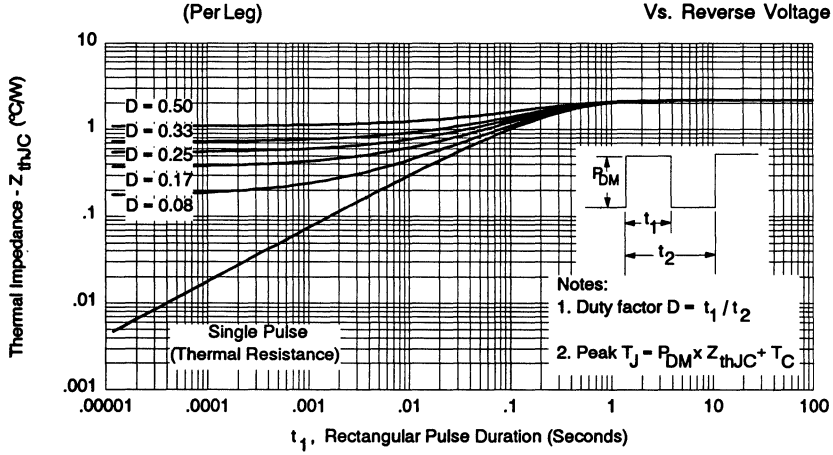


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC TO-220 & TO-247

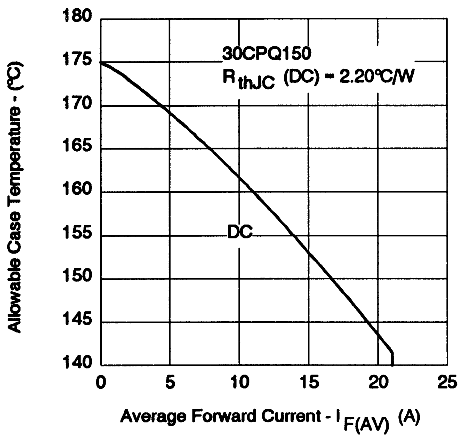


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

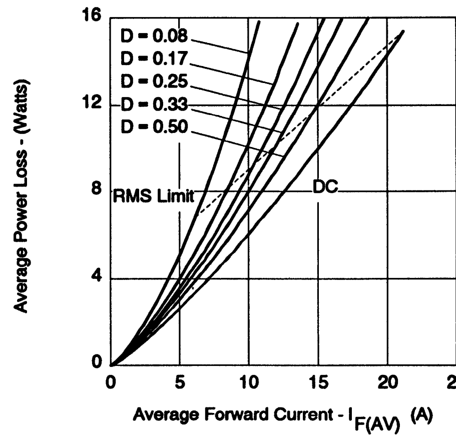


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

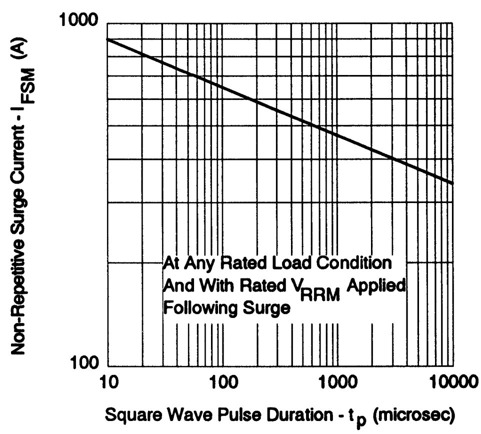


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

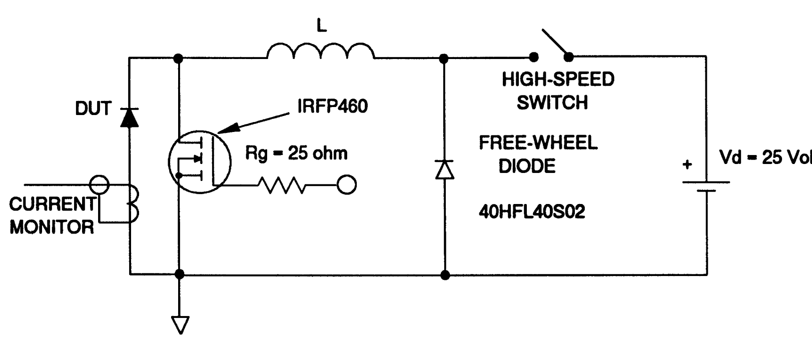


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

40CPQ035
40CPQ040
40CPQ045

SCHOTTKY RECTIFIER

40 Amp

Major Ratings and Characteristics

Characteristics	40CPQ...	Units
$I_{F(AV)}$ Rectangular waveform	40	A
V_{RRM}	35/40/45	V
I_{FSM} @ tp = 5 μs sine	3500	A
V_F @ 20 Apk, T_J = 125°C (per leg)	0.43	V
T_J	-55 to 150	°C

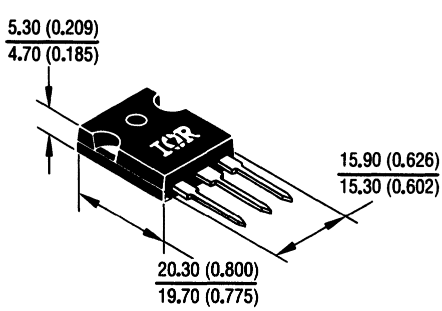
Description/Features

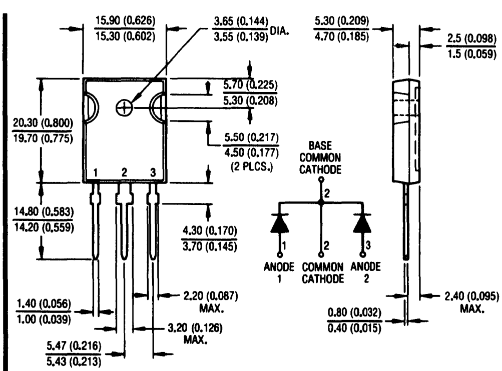
The 40CPQ... center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC (TO-3P)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	40CPQ035	40CPQ040	40CPQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	40CPQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	40	A	50% duty cycle @ T_C = 120 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	3500	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current (Per Leg) * See Fig. 7	430		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	27	mJ	T_J = 25 °C, I_{AS} = 4 Amps, L = 3.4 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	4	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	40CPQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.49	V	@ 20A	T_J = 25 °C
		0.59	V	@ 40A	
		0.43	V	@ 20A	T_J = 125 °C
		0.56	V	@ 40A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	4	mA	T_J = 25 °C	V_R = rated V_R
		150	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1850	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		40CPQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

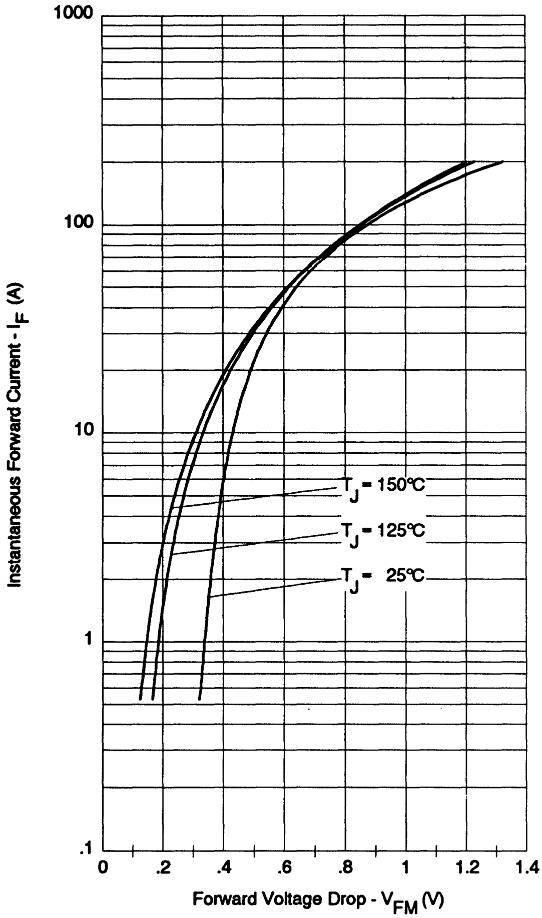


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

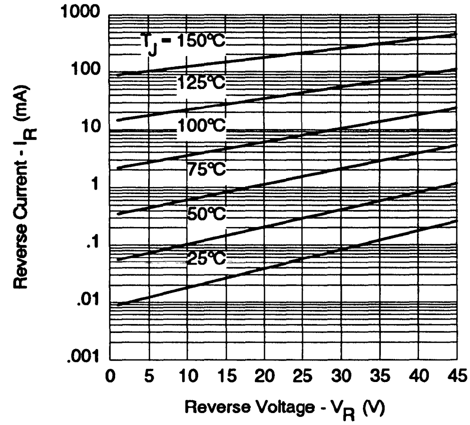


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

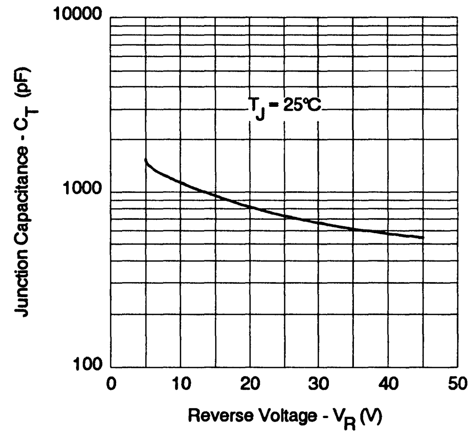


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

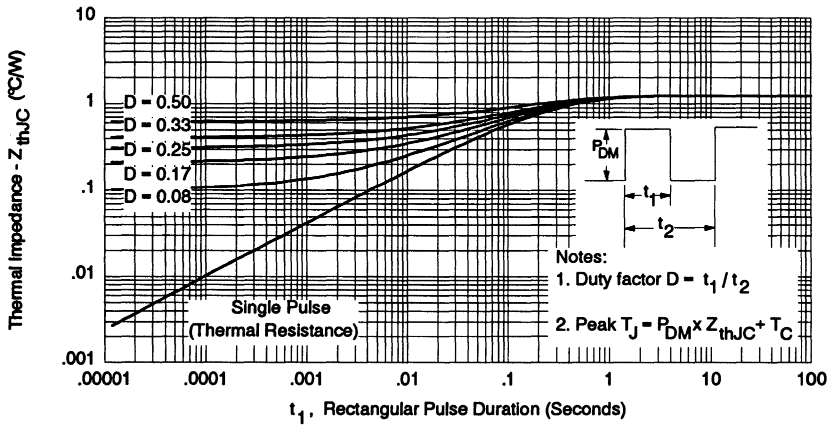


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

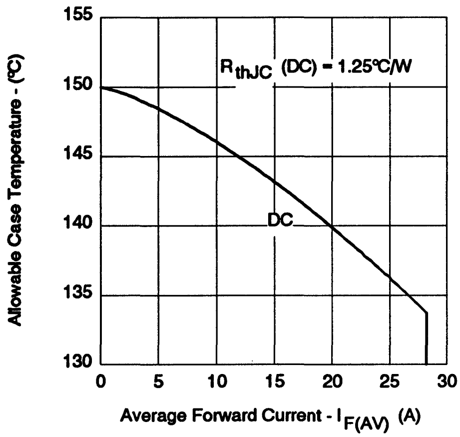


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

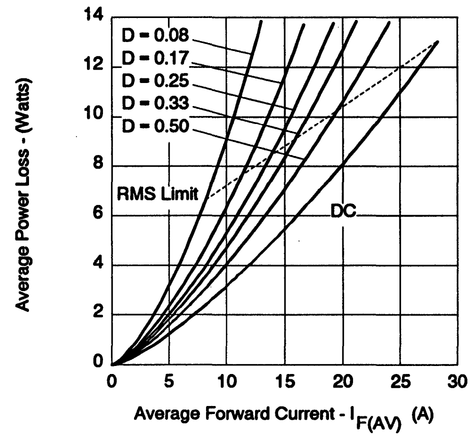


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

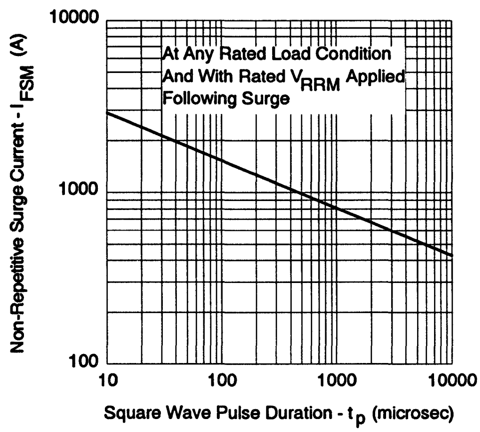


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

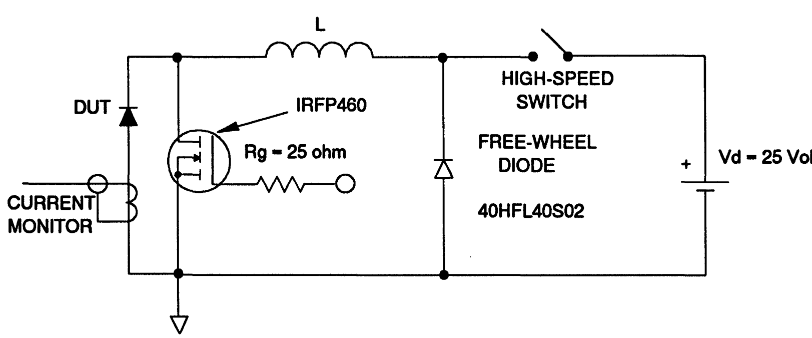


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

40CPQ050
40CPQ060

SCHOTTKY RECTIFIER

40 Amp

Major Ratings and Characteristics

Characteristics	40CPQ...	Units
$I_{F(AV)}$ Rectangular waveform	40	A
V_{RRM}	50/60	V
I_{FSM} @ tp = 5 μs sine	3200	A
V_F @ 20 Apk, T_J = 125°C (per leg)	0.49	V
T_J	- 55 to 150	°C

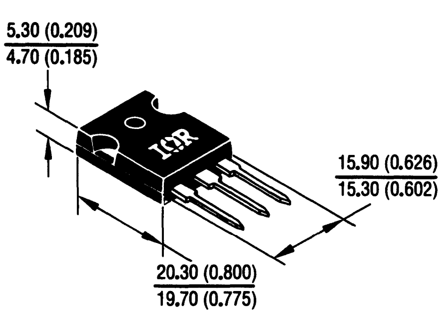
Description/Features

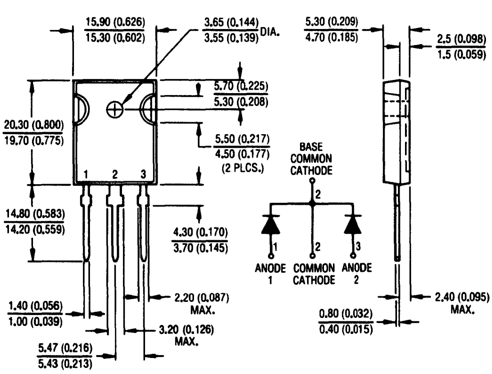
The 40CPQ... center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

PLASTIC TO-220 & TO-247

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC (TO-3P)

Dimensions in millimeters and inches

Voltage Ratings

Part number	40CPQ050	40CPQ060
V_R Max. DC Reverse Voltage (V)	50	60
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	40CPQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	40	A	50% duty cycle @ T_C = 120 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	3200	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		320		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	18	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 9.0 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	2	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	40CPQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.53	V	@ 20A	T_J = 25 °C
		0.68	V	@ 40A	
		0.49	V	@ 20A	T_J = 125 °C
		0.64	V	@ 40A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.7	mA	T_J = 25 °C	V_R = rated V_R
		96	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		40CPQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

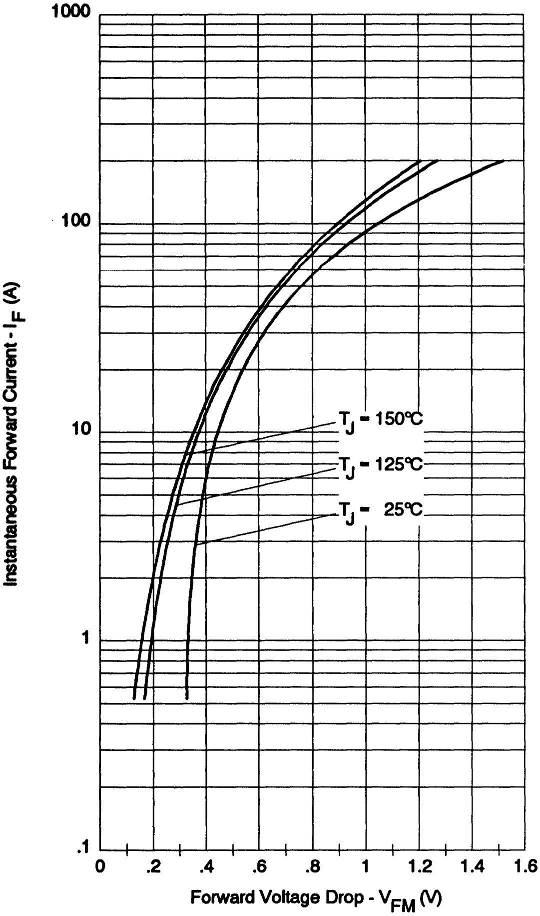


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

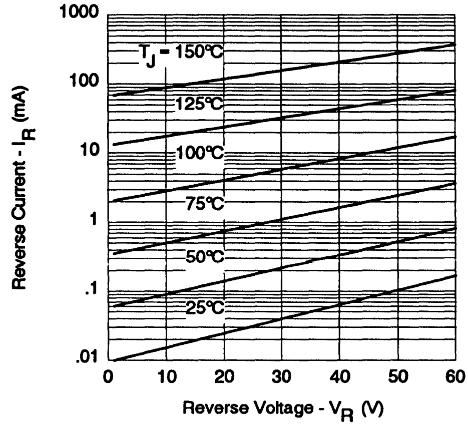


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

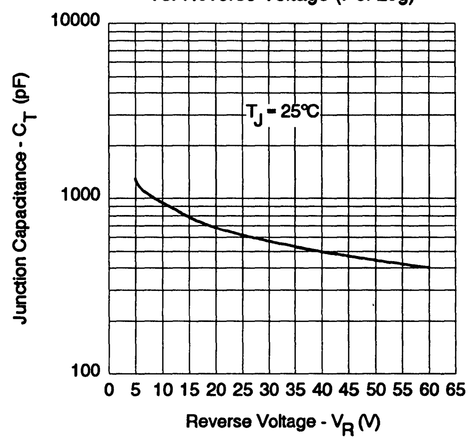


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

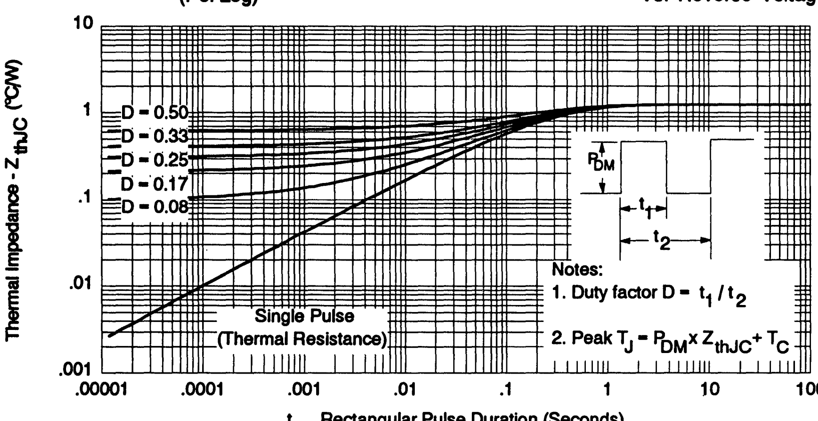


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC
TO-220 &
TO-247

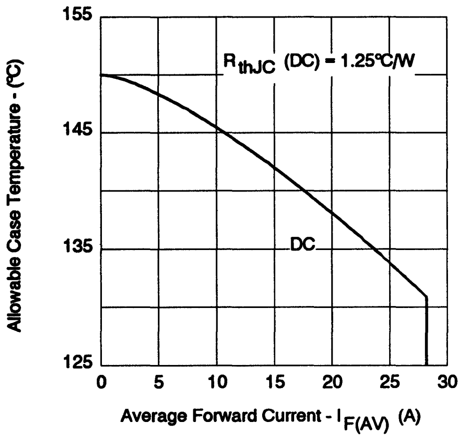


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

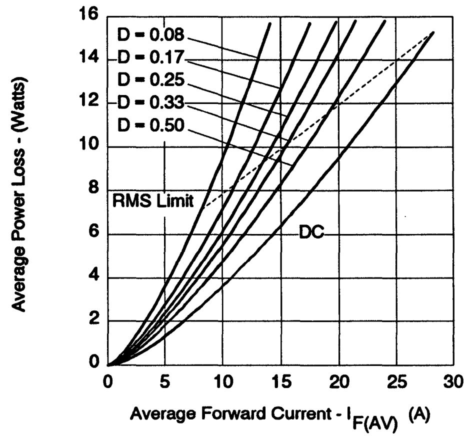


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

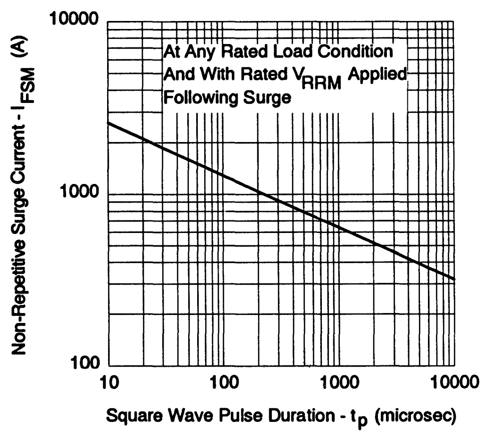


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

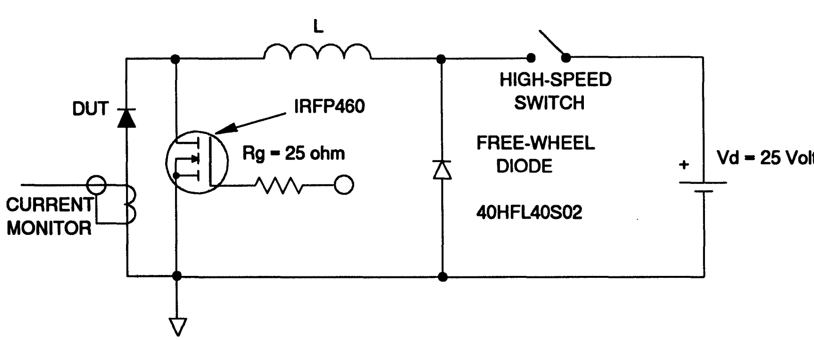


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

40CPQ080
40CPQ100

SCHOTTKY RECTIFIER

40 Amp

Major Ratings and Characteristics

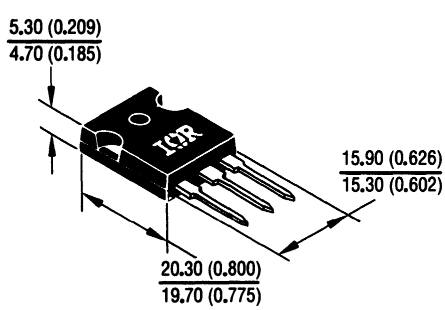
Characteristics	40CPQ...	Units
$I_{F(AV)}$ Rectangular waveform	40	A
V_{RRM}	80/100	V
I_{FSM} @ tp = 5 μs sine	2950	A
V_F @ 20 Apk, T_J = 125°C (per leg)	0.61	V
T_J	- 55 to 175	°C

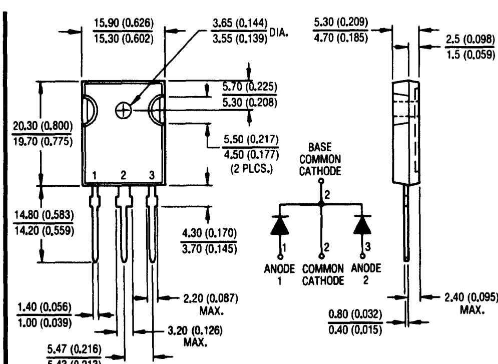
Description/Features

The 40CPQ... center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC (TO-3P)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	40CPQ080	40CPQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	40CPQ...	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	40	A	50% duty cycle @ T_C = 145°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	2950	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		300		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	11.25	mJ	T_J = 25 °C, I_{AS} = 0.75 Amps, L = 40 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	0.75	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	40CPQ...	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.77	V	@ 20A	T_J = 25 °C
		0.91	V	@ 40A	
		0.61	V	@ 20A	T_J = 125 °C
		0.75	V	@ 40A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.25	mA	T_J = 25 °C	V_R = rated V_R
		15	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		40CPQ...	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.25	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.63	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

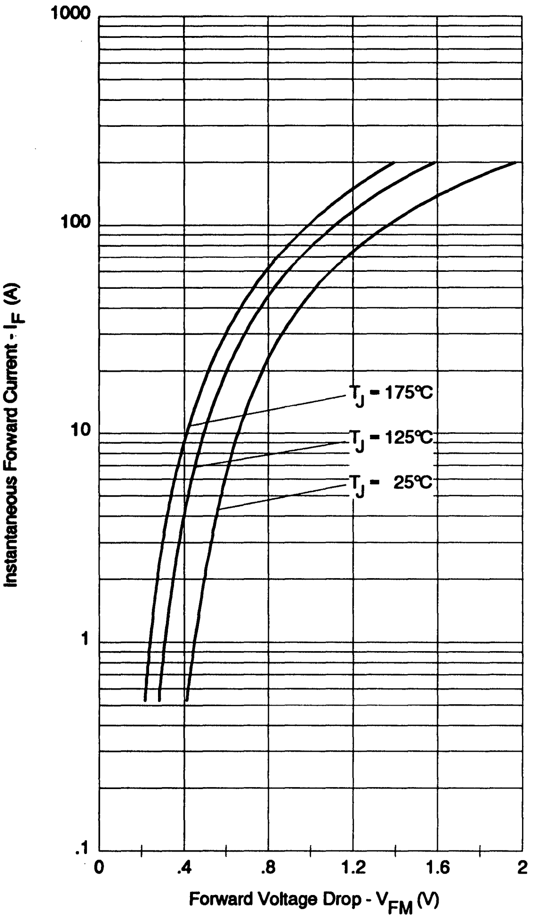


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

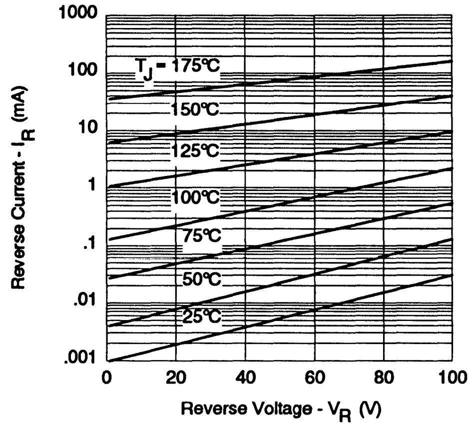


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

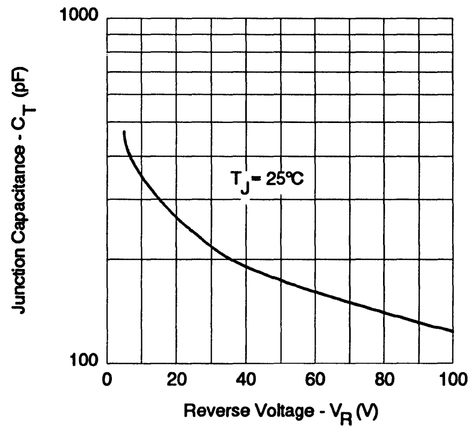


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

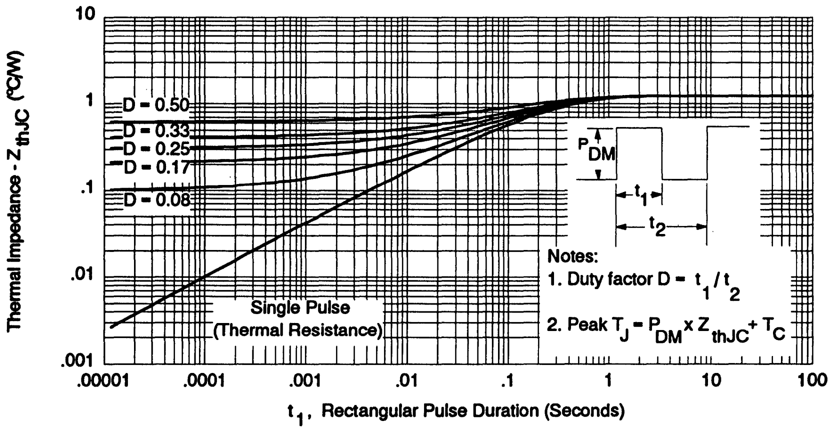


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

PLASTIC
TO-220 &
TO-247

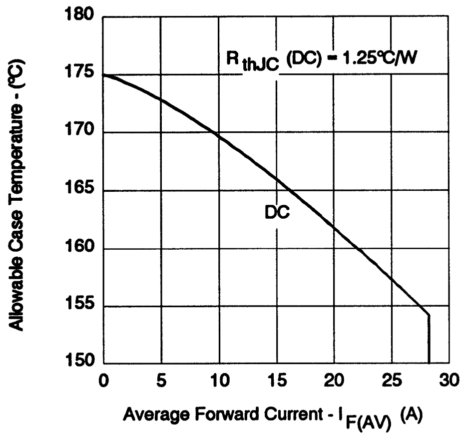


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

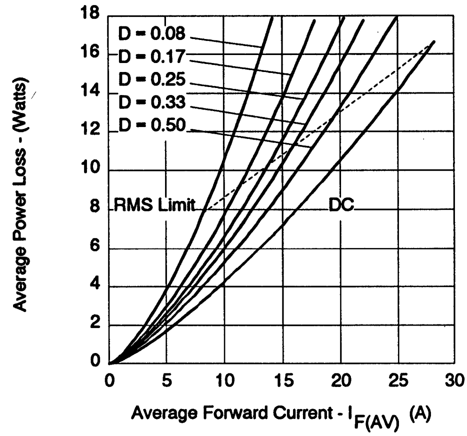


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

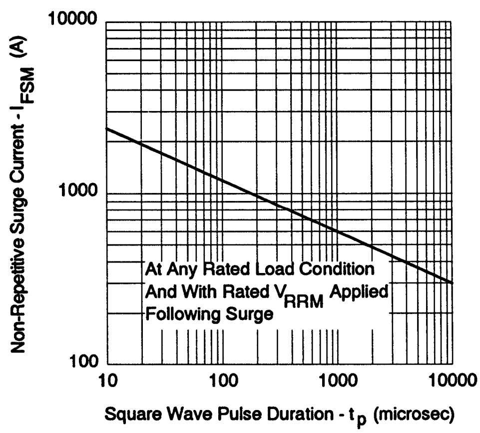


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

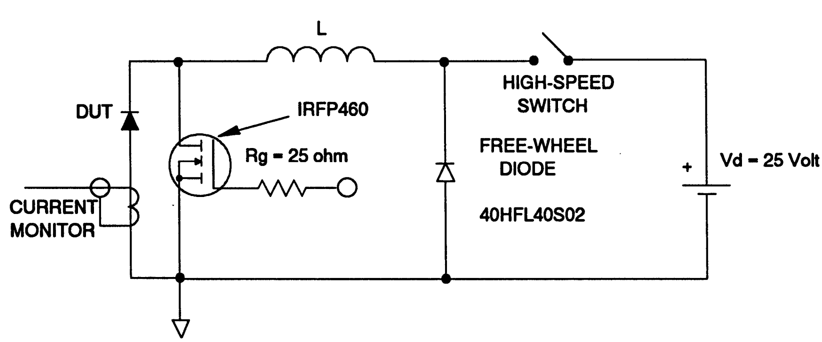


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

MBR3035PT
MBR3045PT

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

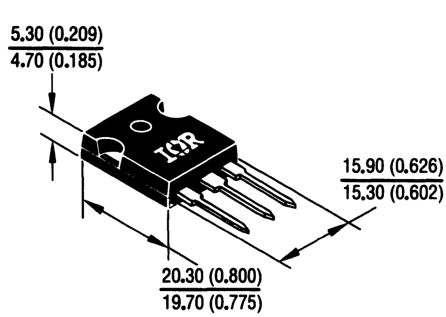
Characteristics	MBR30..PT	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 μs sine	1020	A
V_F @ 20 Apk, T_J = 125°C	0.60	V
T_J	- 65 to 150	°C

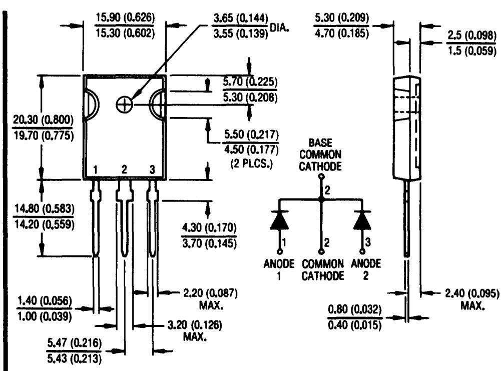
Description/Features

The MBR30..PT center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-247 package
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-247AC (TO-3P)
Dimensions in millimeters and inches

Voltage Ratings

	Part number	MBR3035PT	MBR3045PT
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	MBR30..PT	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current (Per Leg)	15	A	@ T_C = 105 °C, (Rated V_R)	
	(Per Device)	30			
I_{FSM}	Non Repetitive Peak Surge Current	1020	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		200		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	2.0	A	2.0 µsec 1.0 KHz	

Electrical Specifications

	Parameters	MBR30..PT	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.76	V	@ 30A	T_J = 25 °C
	(1)	0.60	V	@ 20A	T_J = 125 °C
		0.72	V	@ 30A	
I_{RM}	Max. Instantaneus Reverse Current	1.0	mA	T_J = 25 °C	Rated DC voltage
	(1)	100	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		MBR30..PT	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.40	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.24	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		6 (0.21)	g (oz.)	
T	Mounting Torque	Min.	6 (5)	Kg-cm (lbf-in)	
		Max.	12 (10)		
	Case Style		TO-247AC(TO-3P)		JEDEC

* For Additional Informations and Graphs, Please See the 30CPQ045 Series

International IOR Rectifier

40CDQ... SERIES

SCHOTTKY RECTIFIER

40 Amp

Major Ratings and Characteristics

Characteristics	40CDQ...	Units
$I_{F(AV)}$ Rectangular waveform	40	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	2000	A
V_F @ 20 Apk, T_J = 125°C (per leg)	0.55	V
T_J	- 65 to 175	°C

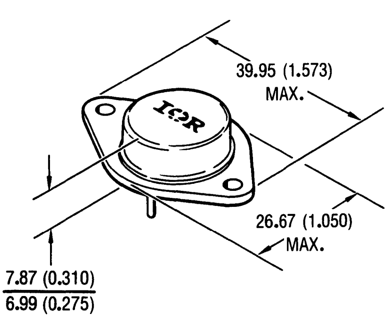
Description/Features

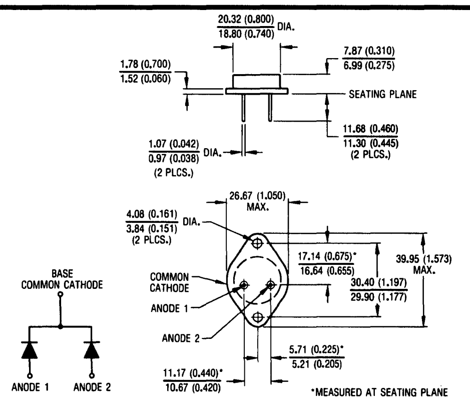
The 40CDQ center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-3 package
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-204AA (TO-3)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	40CDQ035	40CDQ040	40CDQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	40CDQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	40	A	50% duty cycle @ T_C = 135 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	2000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	27	mJ	T_J = 25 °C, I_{AS} = 4 Amps, L = 3.4 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	4	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	40CDQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.62	V	@ 20A	T_J = 25 °C
		0.79	V	@ 40A	
		0.55	V	@ 20A	T_J = 125 °C
		0.71	V	@ 40A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	2.5	mA	T_J = 25 °C	V_R = rated V_R
		25	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	10.0	nH	Measured mounting plane to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		40CDQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		2.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		1.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.20	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		11.4(0.40)	g (oz.)	
T	Mounting Torque	Min.	12(10)	Kg-cm (lbf-in)	
		Max.	17(15)		
	Case Style		TO-204AA (TO-3)		JEDEC

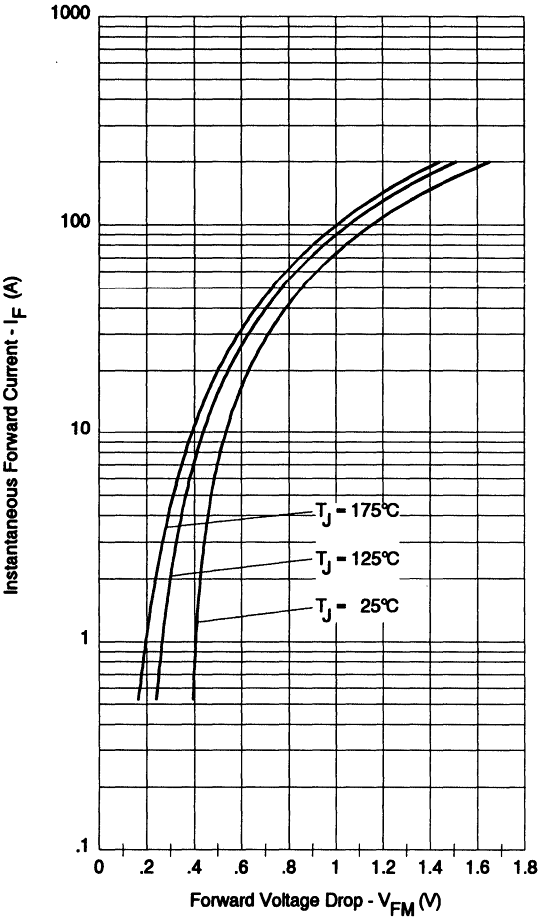


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

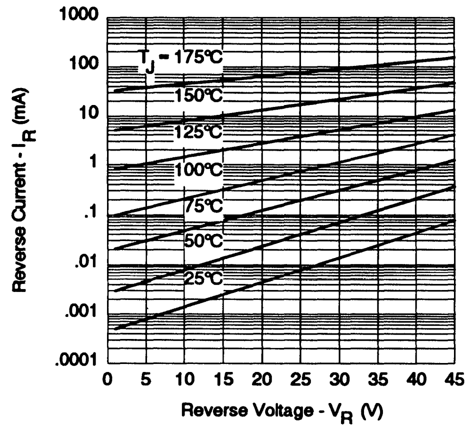


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

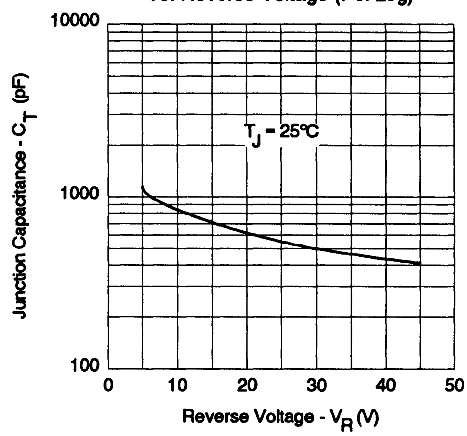


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

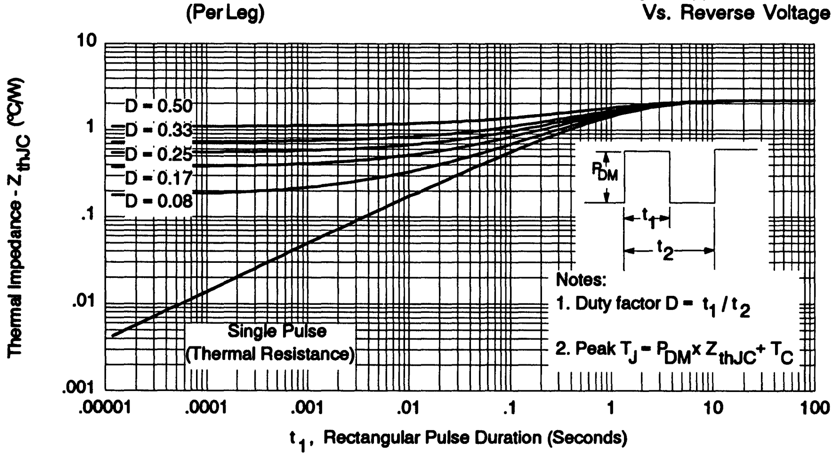


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

HERMETIC TO-3, DO-4, DO-5

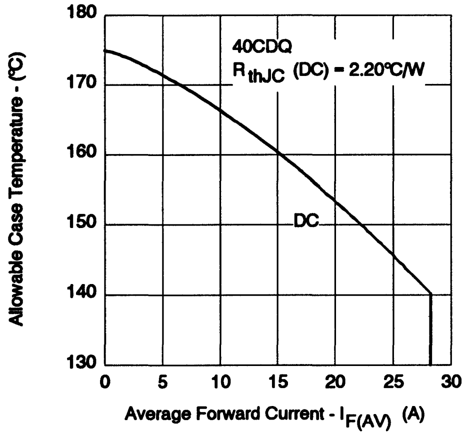


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

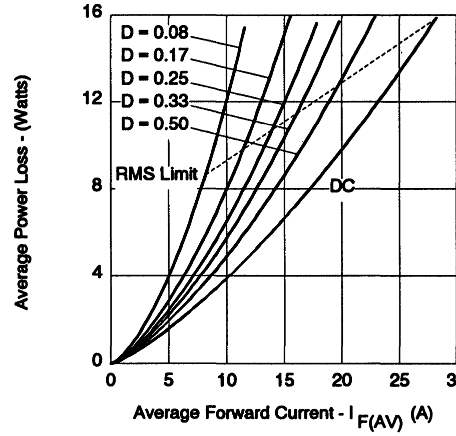


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

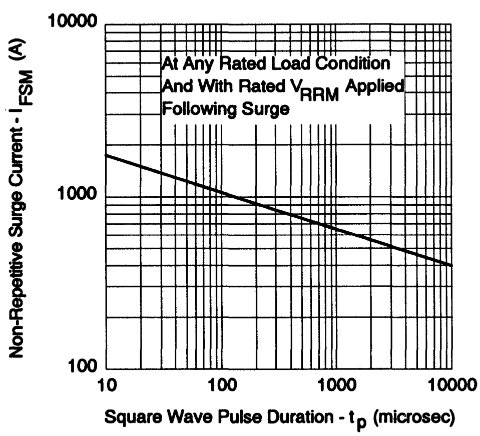


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

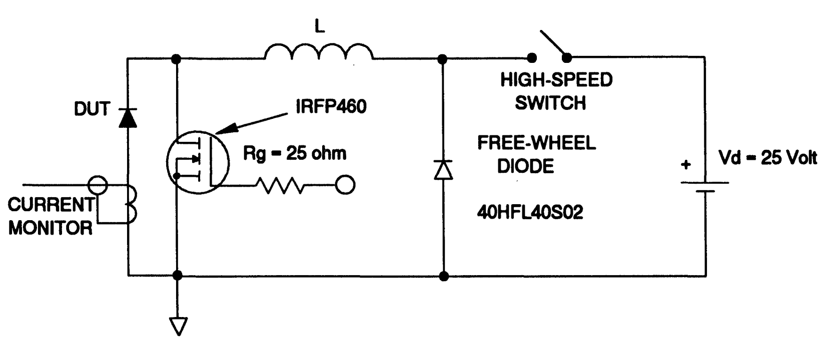


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

60CDQ... SERIES

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	60CDQ...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	2300	A
V_F @ 30 Apk, T_J = 125°C (per leg)	0.62	V
T_J	-65 to 175	°C

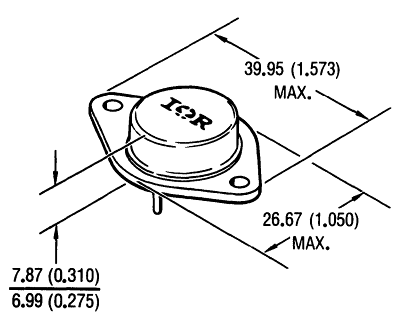
Description/Features

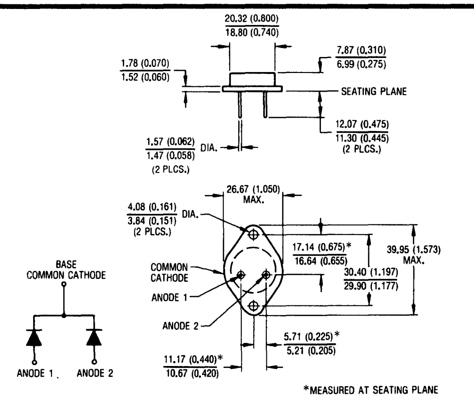
The 60CDQ center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-3 package
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-204AE(Modified TO-3)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	60CDQ035	60CDQ040	60CDQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	60CDQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 112 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	2300	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		420		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	40	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 2.2 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	6	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	60CDQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.67	V	@ 30A	T_J = 25 °C
		0.87	V	@ 60A	
		0.62	V	@ 30A	T_J = 125 °C
		0.80	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	2.5	mA	T_J = 25 °C	V_R = rated V_R
		25	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	10.0	nH	Measured mounting plane to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	60CDQ	Units	Conditions
T_J	Max. Junction Temperature Range	-65 to 175	°C	
T_{stg}	Max. Storage Temperature Range	-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)	2.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)	1.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.20	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	11.4(0.40)	g (oz.)	
T	Mounting Torque Min.	12(10)	Kg-cm (lbf-in)	
	Max.	17(15)		
	Case Style	TO-204AE (TO-3)		Modified JEDEC

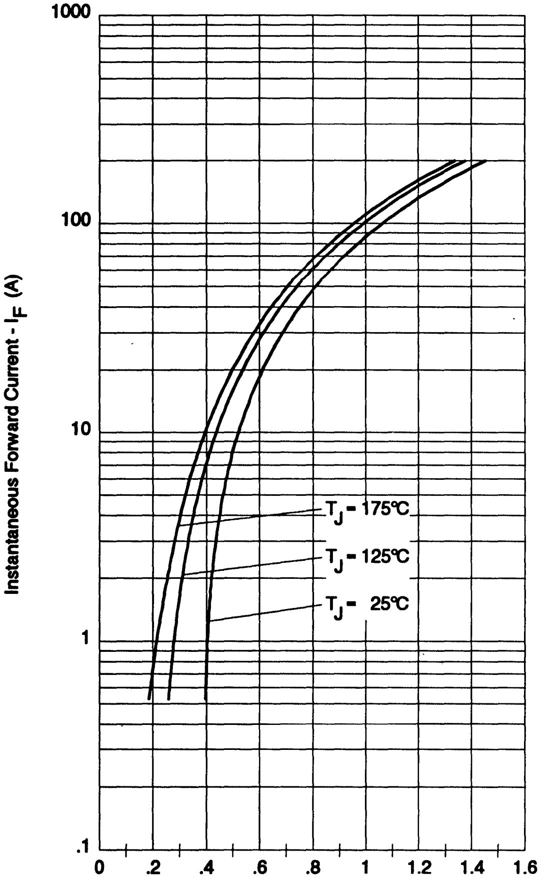


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

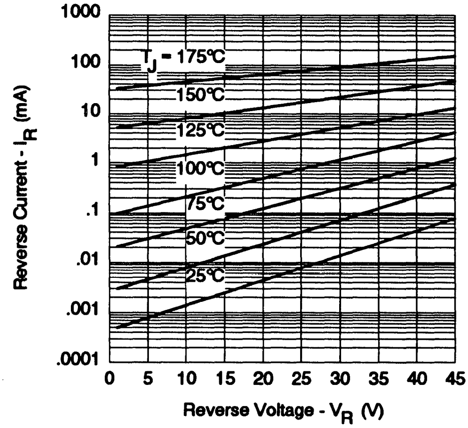


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

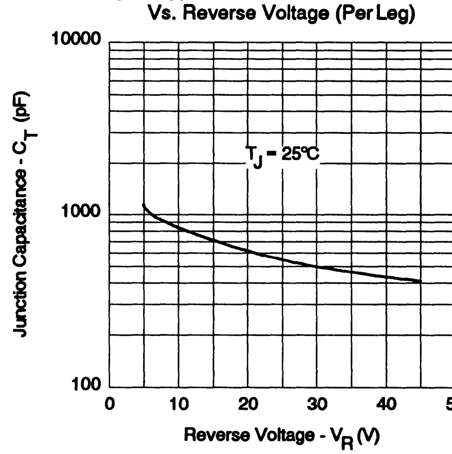


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

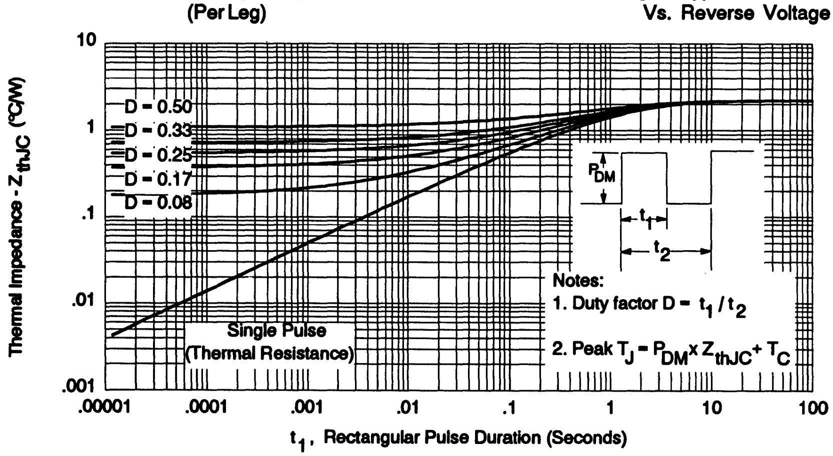


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

HERMETIC TO-3, DO-4, DO-5

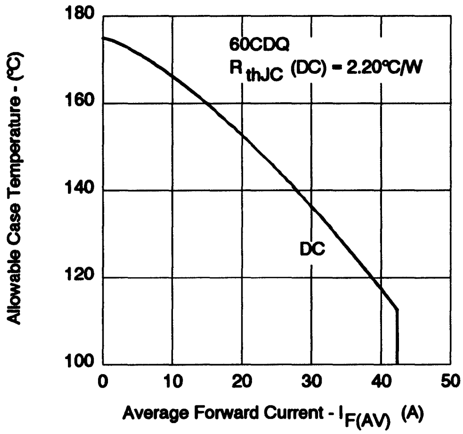


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

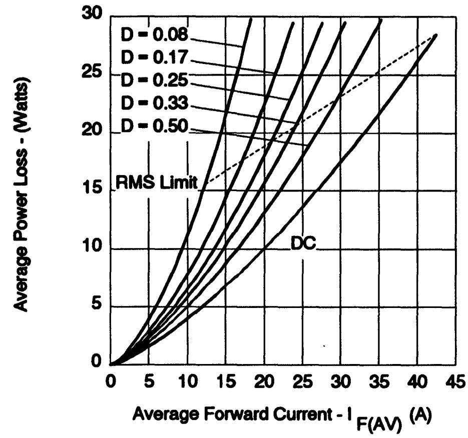


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

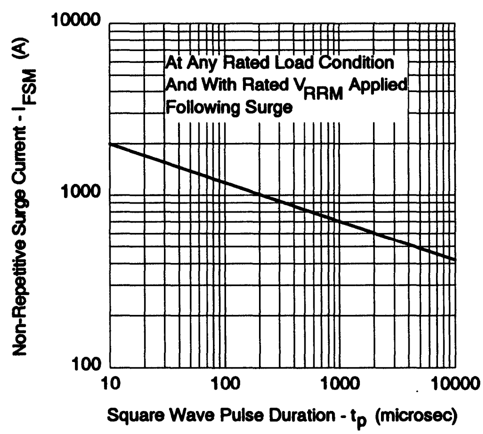


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

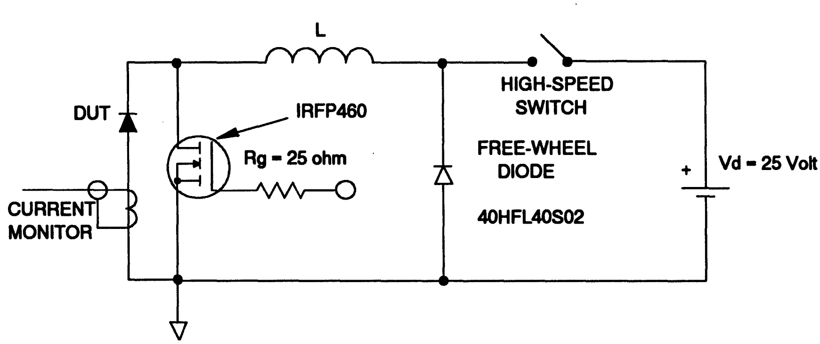


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

MBR3035CT
MBR3045CT

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	MBR30..CT	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35/45	V
I_{FSM} @ tp = 5 μs sine	2000	A
V_F @ 15Apk, T_J = 125°C	0.60	V
T_J	-65 to 150	°C

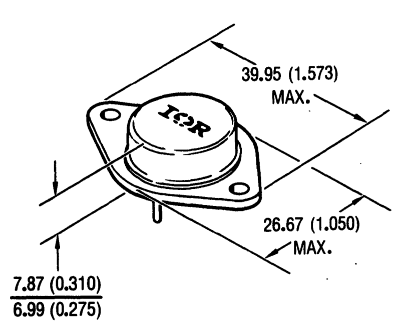
Description/Features

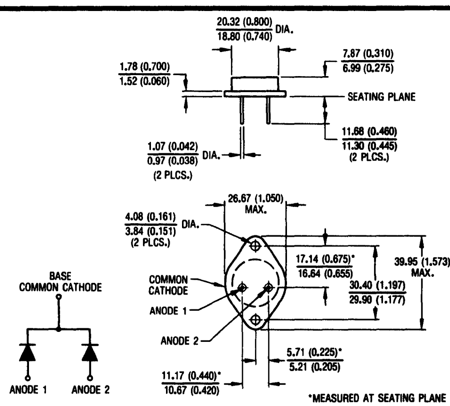
The MBR30..CT center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap TO-3 package
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-204AA (TO-3)
Dimensions in millimeters and inches

Voltage Ratings

Part number		MBR3035CT	MBR3045CT
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

Parameters		MBR30..CT	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current (Per Leg)	15	A	@ T_C = 105 °C, (Rated V_R)	
	(Per Device)	30			
I_{FSM}	Non Repetitive Peak Surge Current	2000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		400		Surge applied at rated load condition halfwave single phase 60Hz	
I_{RRM}	Peak Repetitive Reverse Surge Current	2.0	A	2.0 µsec 1.0 KHz	

Electrical Specifications

Parameters		MBR30..CT	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.76	V	@ 30A	T_J = 25 °C
	(1)	0.60	V	@ 20A	T_J = 125 °C
		0.72	V	@ 30A	
I_{RM}	Max. Instantaneus Reverse Current	1.0	mA	T_J = 25 °C	Rated DC voltage
	(1)	60	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	10.0	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

Parameters			MBR30..CT	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.40	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.20	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		11.4 (0.4)	g (oz.)	
T	Mounting Torque	Min.	12 (10)	Kg-cm (lbf-in)	
		Max.	17 (15)		
	Case Style		TO-204AA(TO-3)		JEDEC

* For Additional Informations and Graphs, Please See the 40CDQ Series

International
IOR Rectifier

SD241

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	SD241	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	35/45	V
I_{FSM} @ 60Hz	400	A
V_F @ 30Apk, T_J = 25°C (per leg)	0.82	V
T_J	-55 to 175	°C

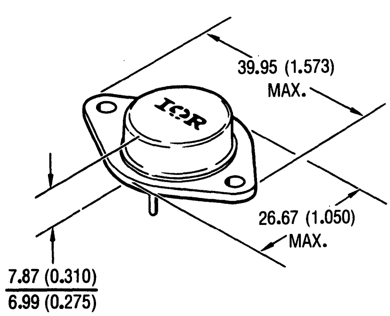
Description/Features

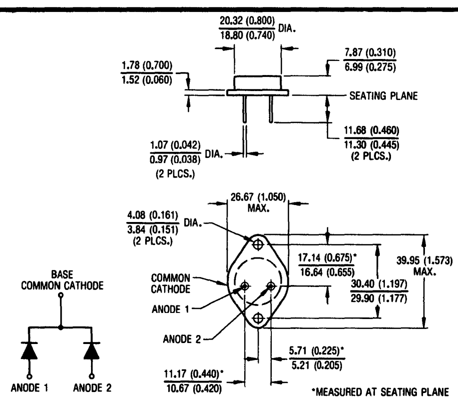
The SD241 center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap TO-3 package
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-204AA (TO-3)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	SD241
V_R	Max. DC Reverse Voltage (V)	35/45 (1)
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

(1) For SD241 rated V_{RWM} and V_{RRM} = 45V @ T_J = 25°C , = 35V @ T_J = 150°C

Absolute Maximum Ratings

	Parameters	SD241	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 120°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	400	A	60Hz half cycle sine wave or 5ms rectangular pulse	Following any rated load condition and with rated V_{RRM} applied

Electrical Specifications

	Parameters	SD241	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (2)	0.82	V	@ 30A	T_J = 25 °C
		1.09	V	@ 60A	
		0.92	V	@ 60A	T_J = 175 °C
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (2)	10	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	10.0	nH	Measured mounting plane to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/µs		

(2) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		SD241	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.40	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.70	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.20	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		11.4(0.40)	g (oz.)	
T	Mounting Torque	Min.	12(10)	Kg-cm (lbf-in)	
		Max.	17(15)		
	Case Style		TO-204AA (TO-3)		JEDEC

* For Additional Informations and Graphs, Please See the 40CDQ Series

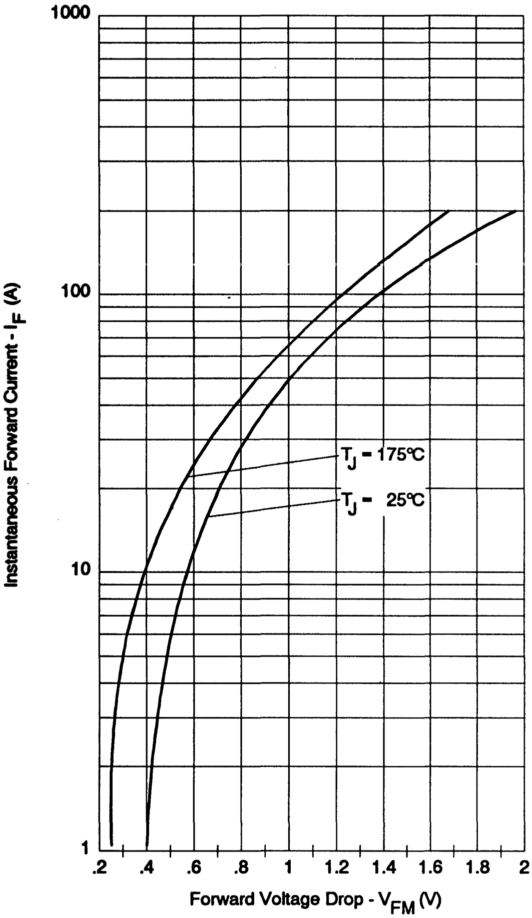


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

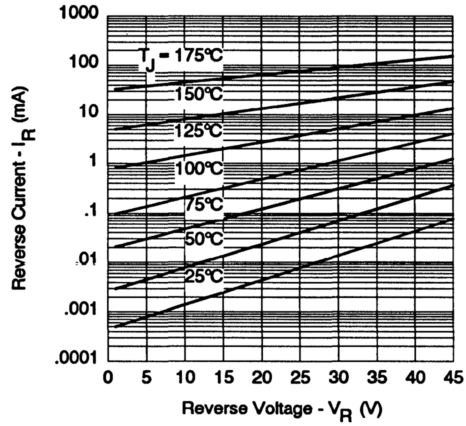


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

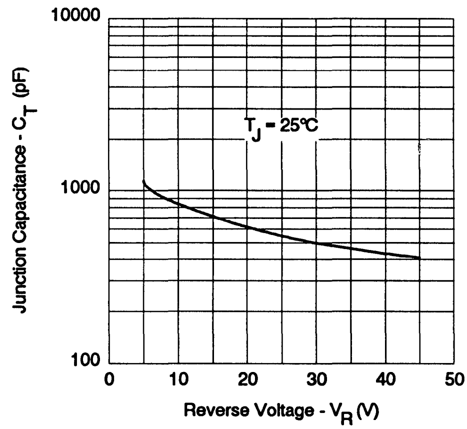


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

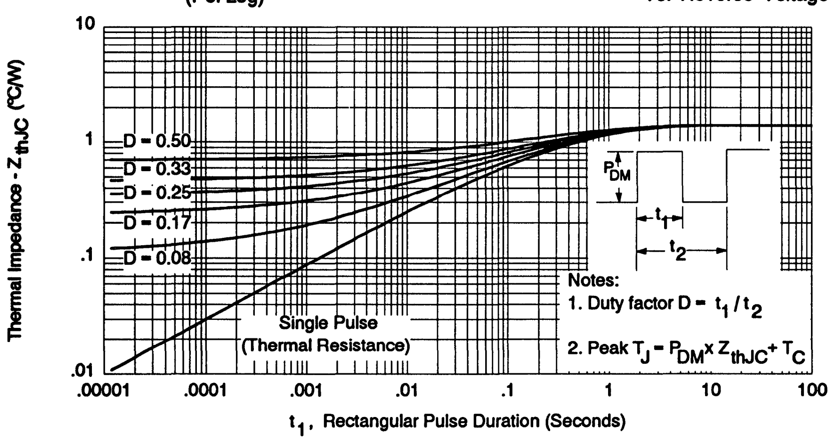


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

HERMETIC TO-3, DO-4, DO-5

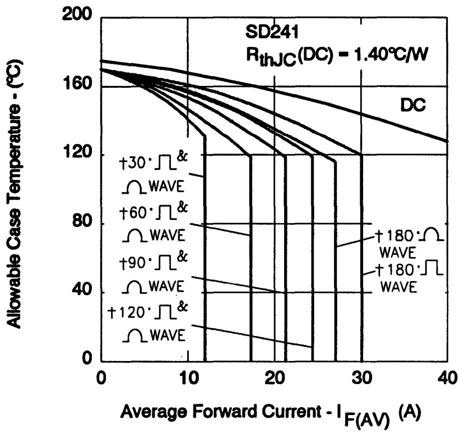


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

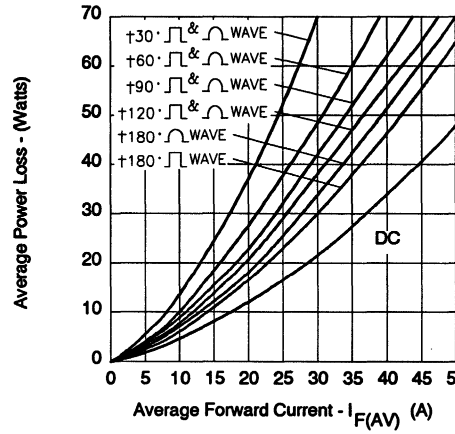


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

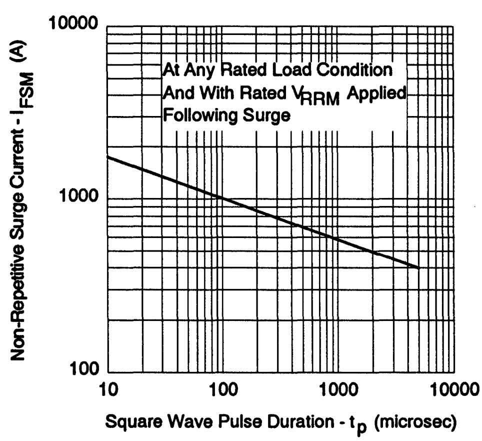


Fig.7 - Max. Non-Repetitive Surge Current (Per Leg)

International
IOR Rectifier

20FQ... SERIES

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	20FQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	7800	A
V_F @ 30 Apk, T_J = 125°C	0.47	V
T_J	- 65 to 150	°C

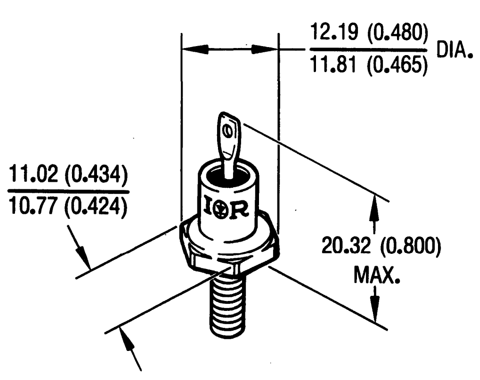
Description/Features

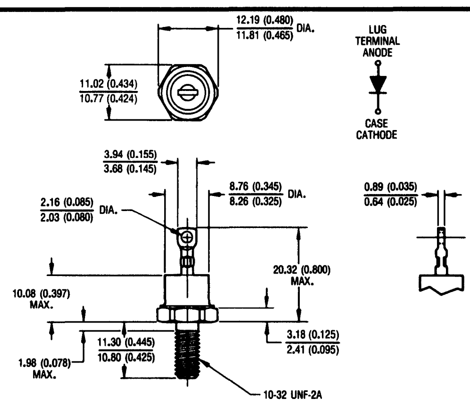
The 20FQ Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AA (DO-4)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	20FQ035	20FQ040	20FQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	20FQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 111° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	7800	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current * See Fig. 7	800		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	40	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 2.2 mH	
I_{AR}	Repetitive Avalanche Current	6	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	20FQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.53	V	@ 30A	T_J = 25 °C
	* See Fig. 1	0.65	V	@ 60A	
		0.47	V	@ 30A	T_J = 125 °C
		0.61	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (1)	4	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2	150	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1850	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		20FQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.25	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		5.8 (0.20)	g (oz.)	
T	Mounting Torque	Min.	14 (12)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	23 (20)		
	Case Style		DO-203AA(DO-4)		JEDEC

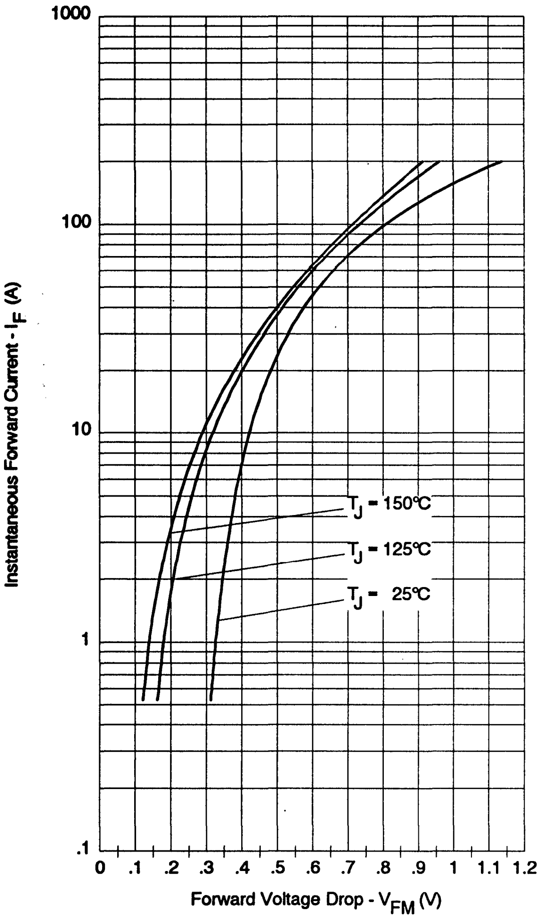


Fig. 1 - Maximum Forward Voltage Drop Characteristics

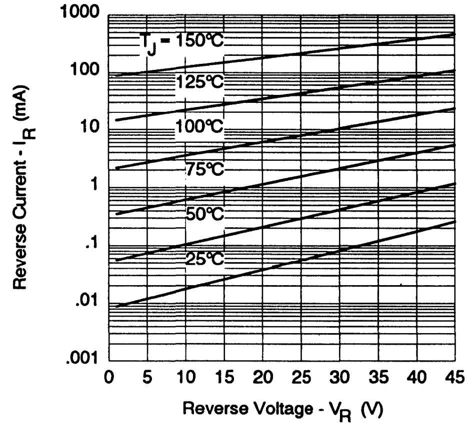


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

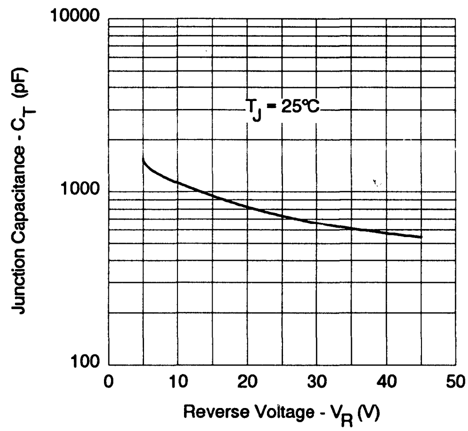


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

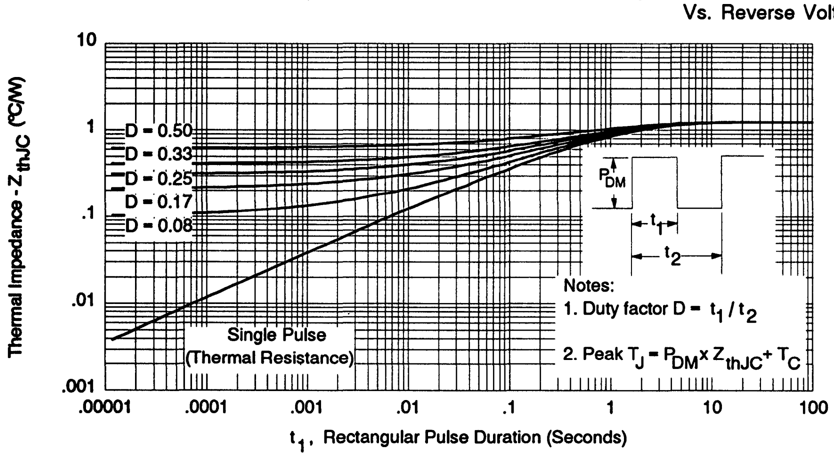


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC
TO-3, DO-4,
DO-5

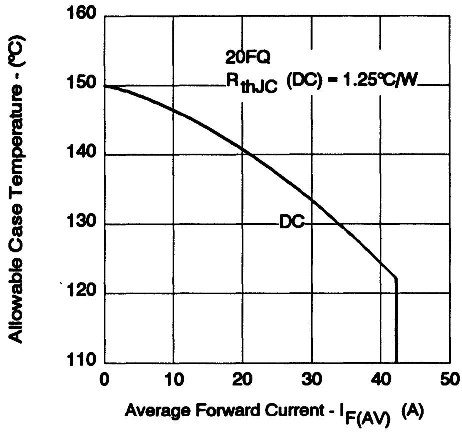


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

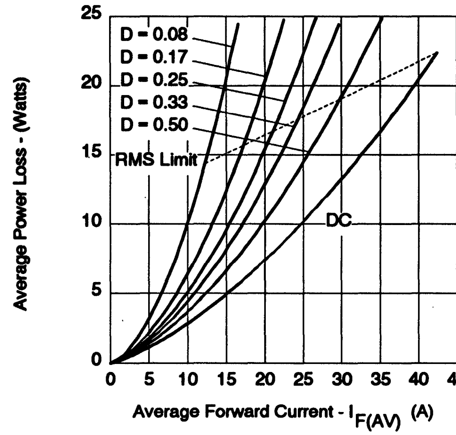


Fig. 6 - Forward Power Loss Characteristics

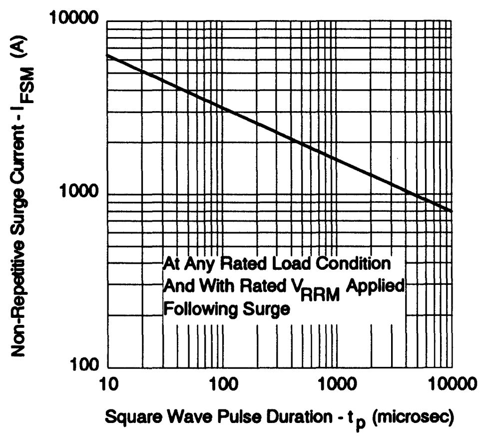


Fig. 7 - Maximum Non-Repetitive Surge Current

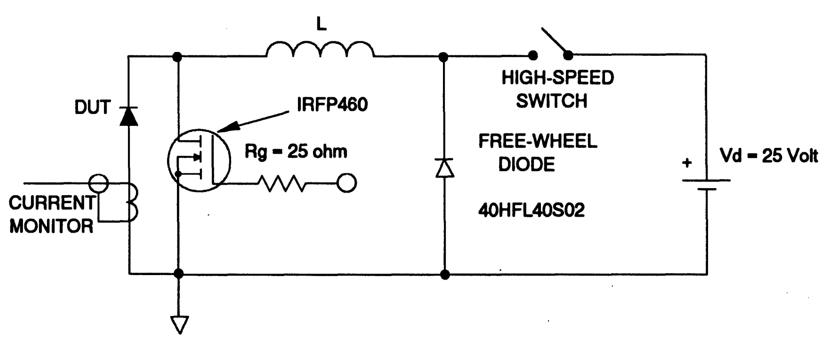


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

21FQ... SERIES

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	21FQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	7800	A
V_F @ 30 Apk, T_J = 125°C	0.51	V
T_J	-65 to 150	°C

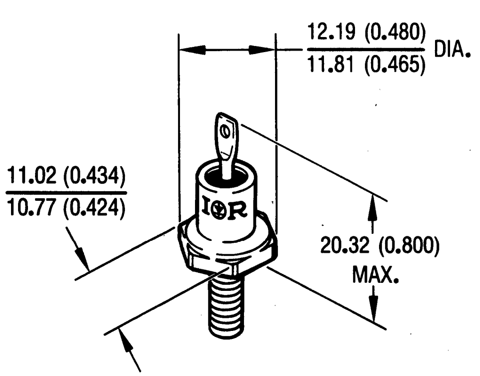
Description/Features

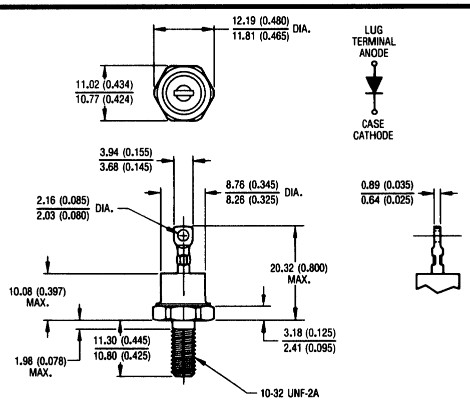
The 21FQ Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC
TO-3, DO-4,
DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AA (DO-4)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	21FQ035	21FQ040	21FQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	21FQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 107 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	7800	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		600		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	40	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 2.2 mH	
I_{AR}	Repetitive Avalanche Current	6	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	21FQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.57	V	@ 30A	T_J = 25 °C
		0.69	V	@ 60A	
		0.51	V	@ 30A	T_J = 125 °C
		0.65	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	4	mA	T_J = 25 °C	V_R = rated V_R
		150	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1850	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		21FQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.25	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		5.8 (0.2)	g (oz.)	
T	Mounting Torque	Min.	14 (12)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	23 (20)		
	Case Style		DO-203AA(DO-4)		JEDEC

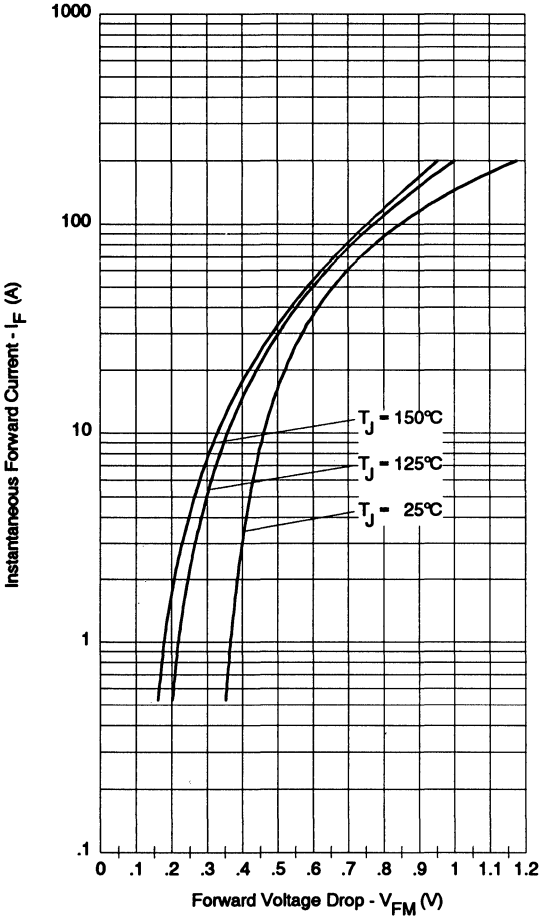


Fig. 1 - Maximum Forward Voltage Drop Characteristics

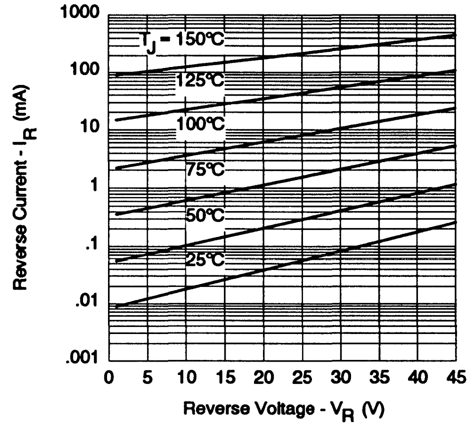


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

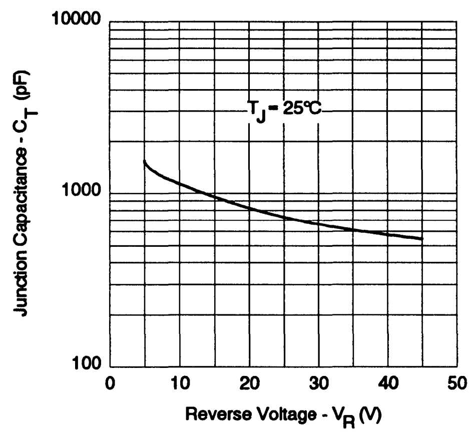


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

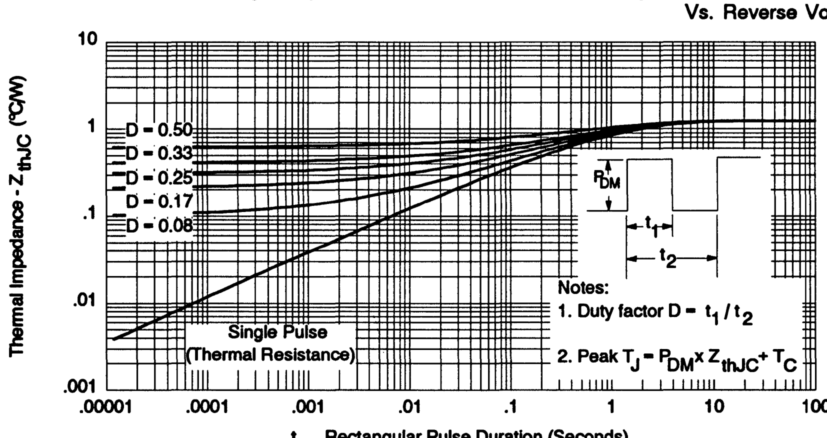


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC
TO-3, DO-4,
DO-5

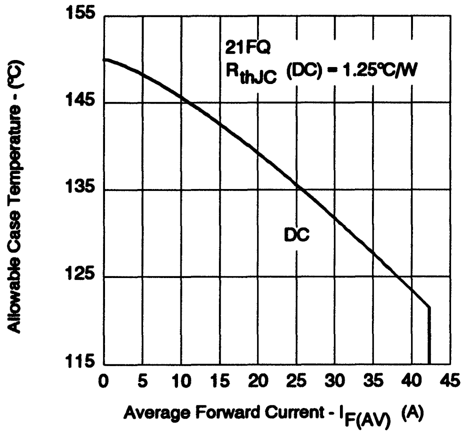


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

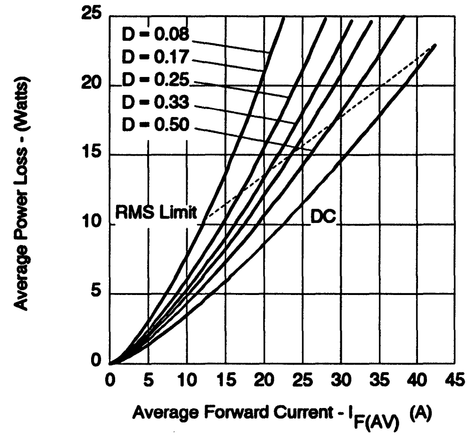


Fig. 6 - Forward Power Loss Characteristics

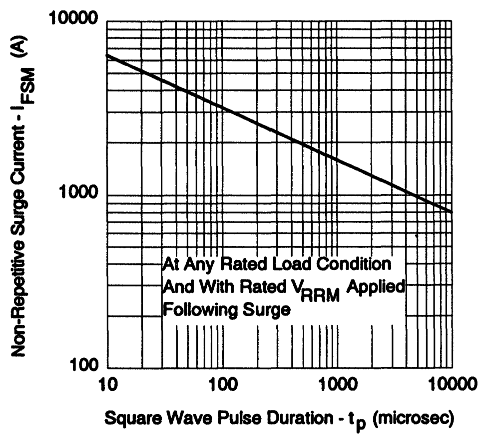


Fig. 7 - Maximum Non-Repetitive Surge Current

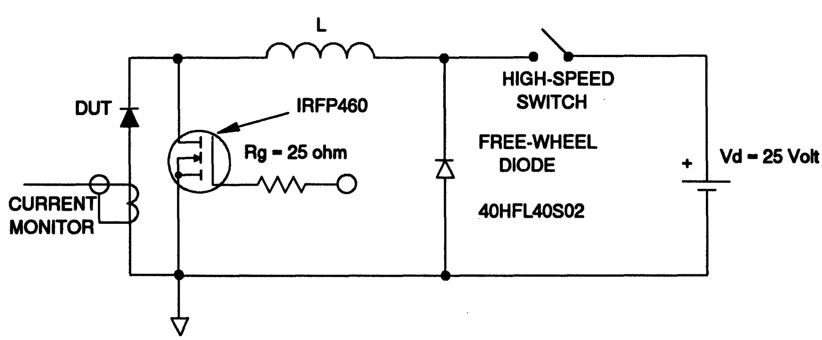


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

30FQ... SERIES

SCHOTTKY RECTIFIER

30 Amp

Major Ratings and Characteristics

Characteristics	30FQ...	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	9600	A
V_F @ 30 Apk, T_J = 125°C	0.54	V
T_J	- 65 to 175	°C

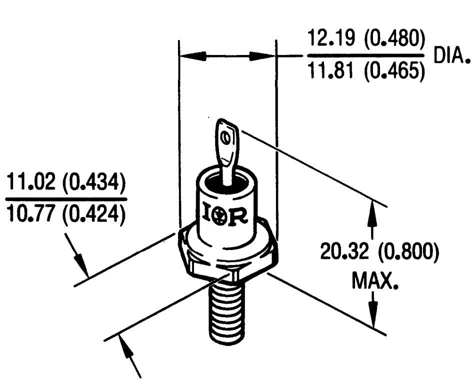
Description/Features

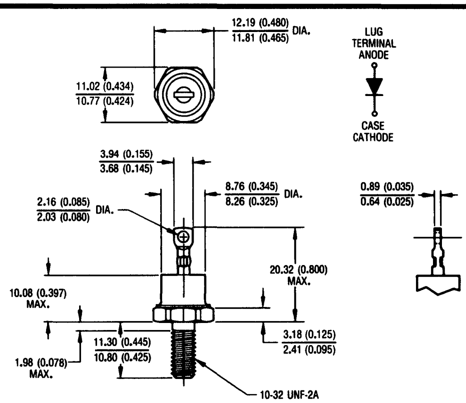
The 30FQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175°C T_J operation
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AA (DO-4)

Dimensions in millimeters and inches

Voltage Ratings

Part number	30FQ035	30FQ040	30FQ045
V_R Max. DC Reverse Voltage (V)	35	40	45
V_{RWM} Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	30FQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 144 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	9600	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		640		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	40	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 2.2 mH	
I_{AR}	Repetitive Avalanche Current	6	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	30FQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.64	V	@ 30A	T_J = 25 °C
		0.75	V	@ 60A	
		0.54	V	@ 30A	T_J = 125 °C
		0.64	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	4	mA	T_J = 25 °C	V_R = rated V_R
		35	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1850	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		30FQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.25	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		5.8 (0.20)	g (oz.)	
T	Mounting Torque	Min.	14 (12)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	23 (20)		
	Case Style		DO-203AA(DO-4)		JEDEC

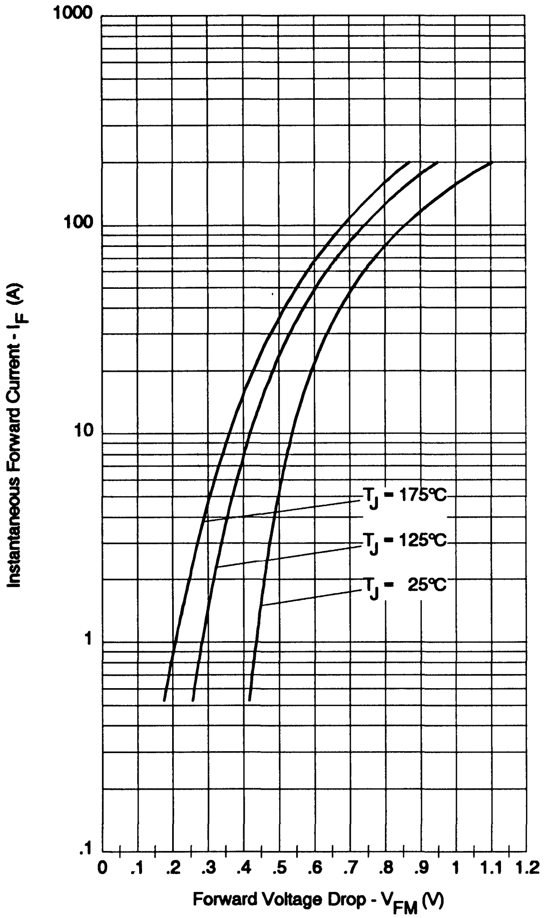


Fig. 1 - Maximum Forward Voltage Drop Characteristics

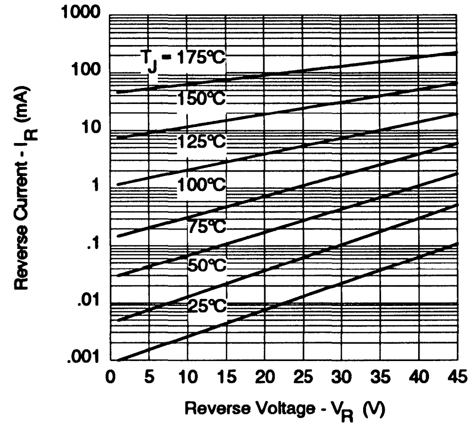


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

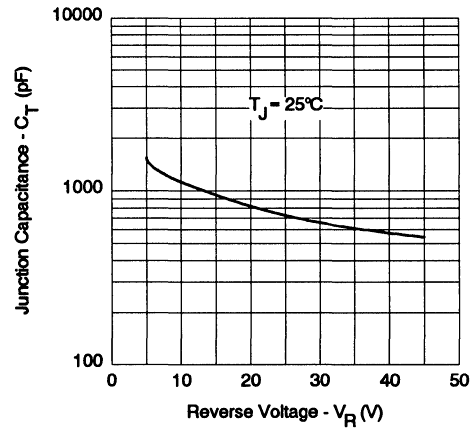


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

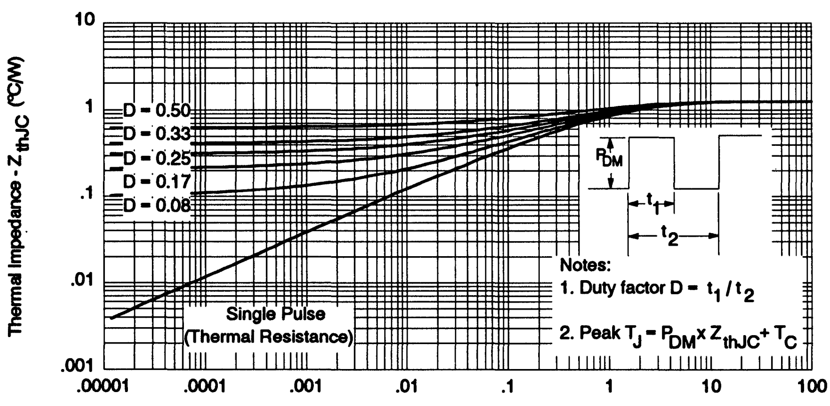


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC TO-3, DO-4, DO-5

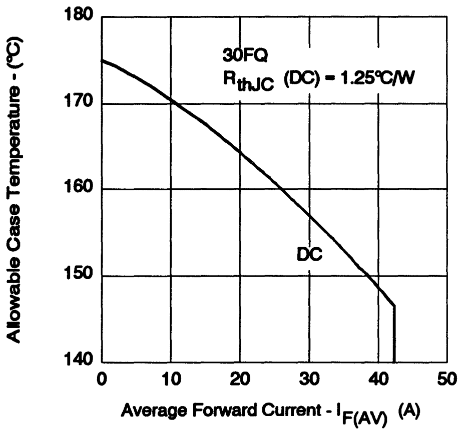


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

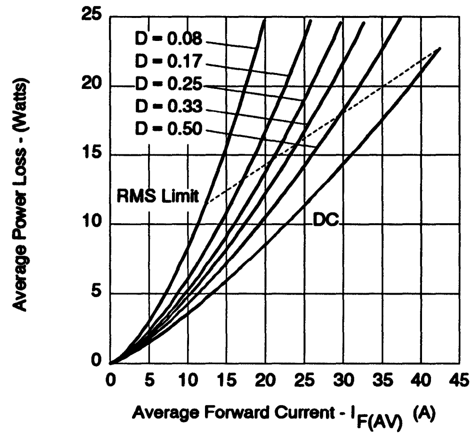


Fig. 6 - Forward Power Loss Characteristics

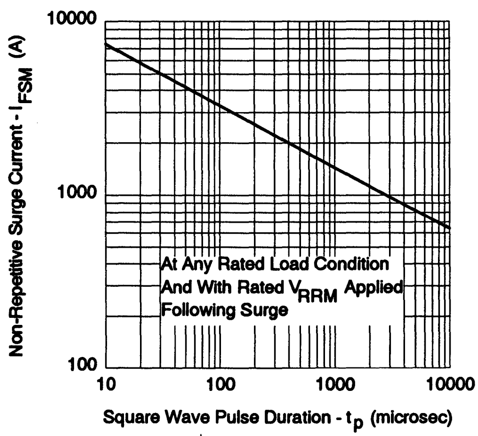


Fig. 7 - Maximum Non-Repetitive Surge Current

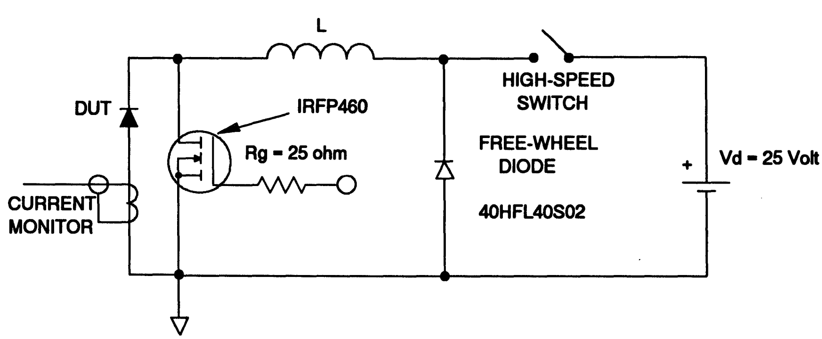


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

1N6095
1N6096

SCHOTTKY RECTIFIER

25 Amp

Major Ratings and Characteristics

Characteristics	1N6095, 1N6096.	Units
$I_{F(AV)}$ Rectangular waveform	25*	A
V_{RRM}	30/40*	V
I_{FSM} @ 60Hz	400*	A
V_F @ 80 Apk, T_J = 70°C	0.86*	V
T_J	- 65 to 125*	°C

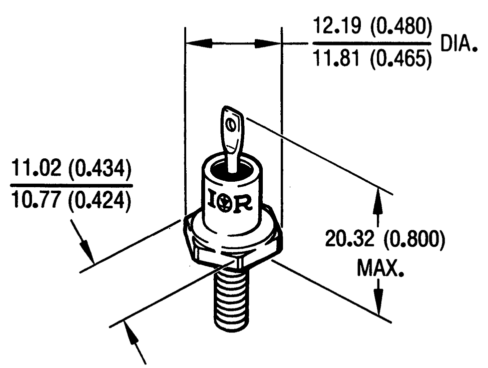
* JEDEC Registered Values

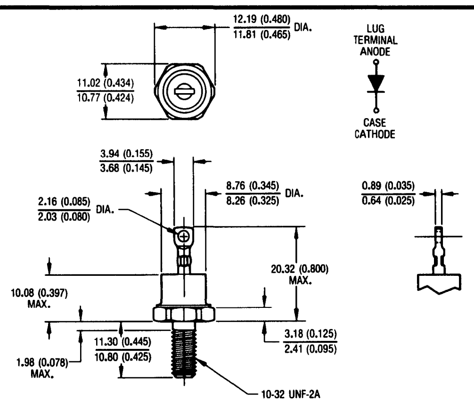
Description/Features

The 1N6095, 96. Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 125°C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 125° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AA (DO-4)

Dimensions in millimeters and inches

IOR

Voltage Ratings

Part number		1N6095	1N6096
V_R	Max. DC Reverse Voltage (V)	30*	40*
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

Parameters		1N609.	Units	Conditions
$I_{F(AV)}$	Max. Average Forward Current See Fig. 5	25*	A	50% duty cycle @ T_C = 105 °C, rectangular wave form
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current See Fig. 7	400*	A	60Hz halfwave, single phase
E_{AS}	Non-Repetitive Avalanche Energy	40	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 2.20 mH
I_{AR}	Repetitive Avalanche Current	6	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical

Electrical Specifications

Parameters		1N609.	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) See Fig. 1	0.86*	V	@ 80A	T_J = 70 °C
I_{RM}	Max. Reverse Leakage Current (1)	60	mA	T_J = 25 °C	V_R = rated V_R
	See Fig. 2	250*	mA	T_J = 125 °C	
C_T	Typical Junction Capacitance	6000*	pF	V_R = 1V_{DC}, test signal range 100Khz to 1Mhz 25 °C	
L_S	Typical Series Inductance	6.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

Parameters			1N609.	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 125*	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 125*	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.0*	°C/W	DC operation See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		5.8 (0.2)	g (oz.)	
T	Mounting Torque	Min.	14 (12)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	23 (20)		
	Case Style		DO-203AA(DO-4)		JEDEC

* JEDEC Registered Values

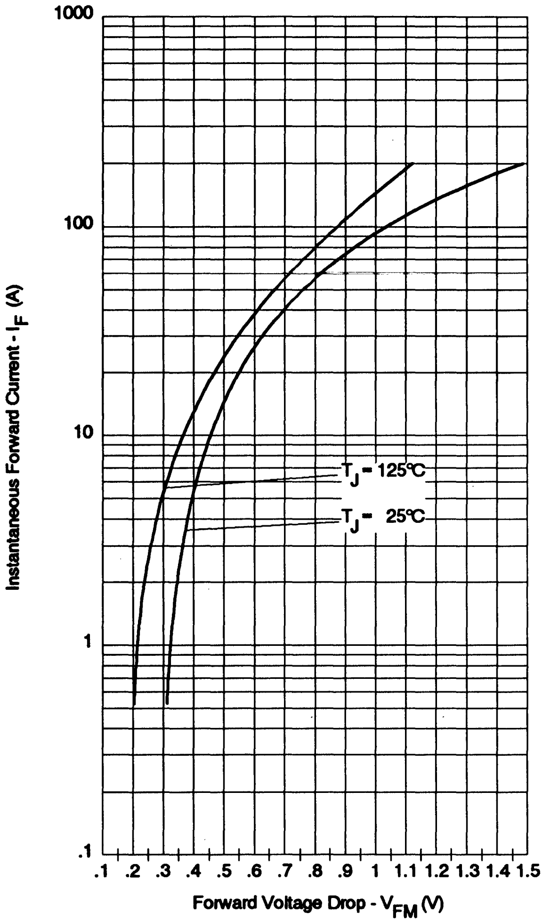


Fig. 1 - Maximum Forward Voltage Drop Characteristics

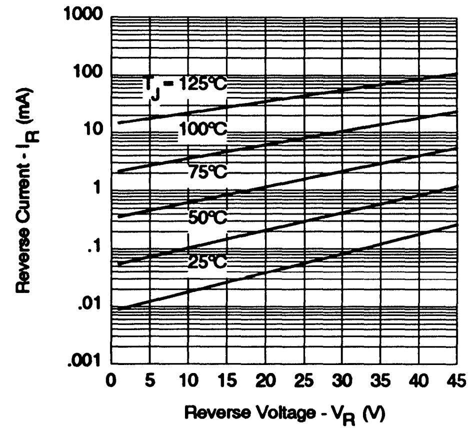


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

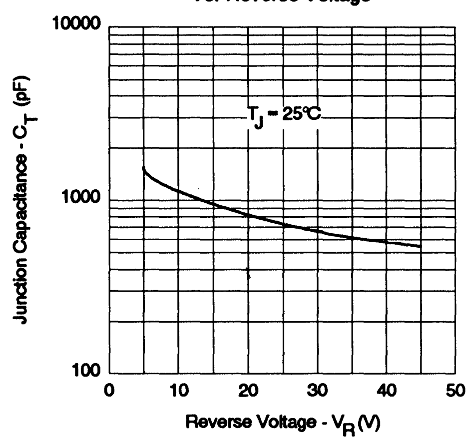


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

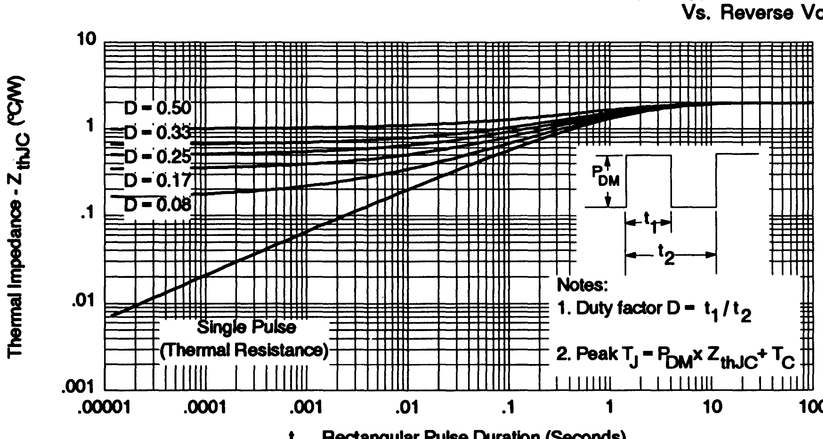


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

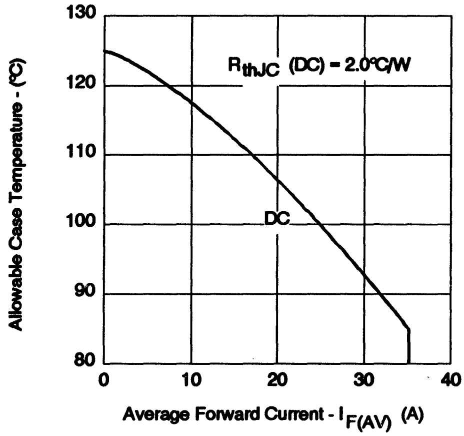


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

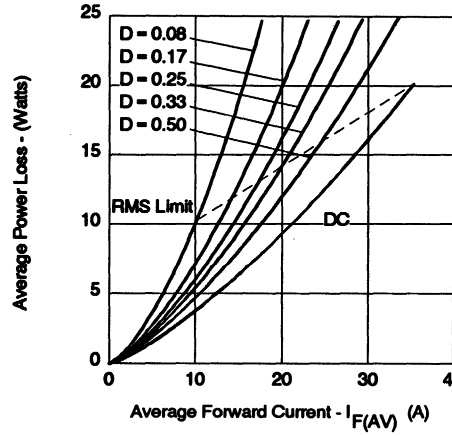


Fig. 6 - Forward Power Loss Characteristics

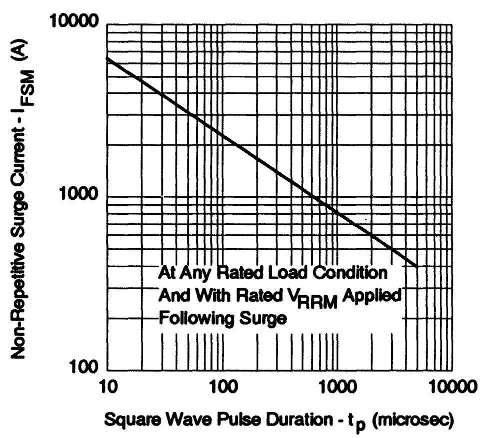


Fig. 7 - Maximum Non-Repetitive Surge Current

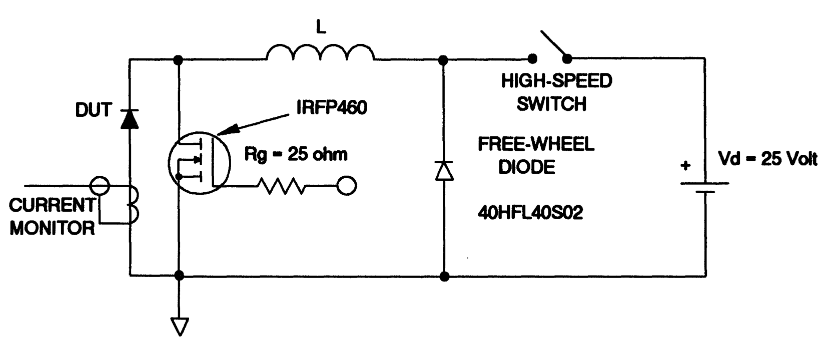


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

1N6391

SCHOTTKY RECTIFIER

25 Amp

Major Ratings and Characteristics

Characteristics	1N6391	Units
$I_{F(AV)}$ Rectangular waveform	25*	A
V_{RRM}	45	V
I_{FSM} @ 60Hz	600*	A
V_F @ 25Apk, T_J=25°C	0.64	V
T_J	-55 to 175*	°C

* JEDEC Registered Value

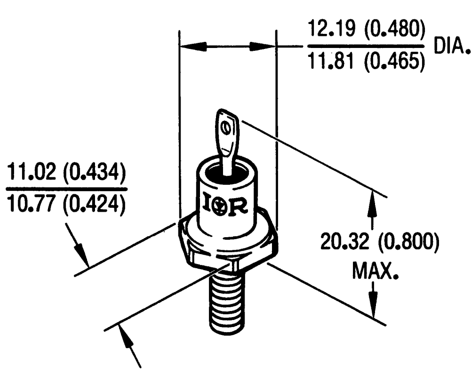
Description/Features

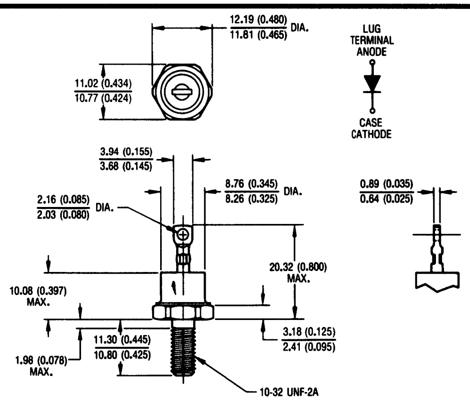
The 1N6391 Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging
- Military qualified versions also available

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AA (DO-4)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	1N6391
V_R	Max. DC Reverse Voltage (V)	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	1N6391	Units	Conditions
$I_{F(AV)}$	Max. Average Forward Current	25*	A	50% duty cycle @ T_C = 115 °C, rectangular wave form
	See Fig. 5	22.5*		50% duty cycle @ T_C = 115 °C, sinusoidal wave form
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current See Fig. 7	9600	A	5μs Sine or 3μs Rect. pulse. Following any rated load condition and with rated V_{RRM} applied
		600*		60Hz half cycle sine wave or 5ms rectangular pulse
E_{AS}	Non-Repetitive Avalanche Energy	40	mJ	T_J = 25 °C, I_{AS} = 6.0 Amps, L = 2.20 mH
I_{AR}	Repetitive Avalanche Current	6.0	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical

Electrical Specifications

	Parameters	1N6391	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.44*	V	@ 5A	T_J = 25 °C
	See Fig. 1	0.78*	V	@ 50A	
		0.55*	V	@ 5A	T_J = - 55 °C
I_{RM}	Max. Reverse Leakage Current (1)	15*	mA	T_J = 25 °C	V_R = rated V_R
	See Fig. 2	40*	mA	T_J = 125 °C	
		400*	mA	T_J = 175 °C	
		400*	mA	T_J = -55 °C	
C_T	Max. Junction Capacitance	2000*	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change	10,000	V/μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		1N6391	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175*	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175*	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.0*	°C/W	DC operation See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50*	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		5.7 (0.2)	g (oz.)	
T	Mounting Torque	Min.	1.35 (12)	N-m	Non-lubricated threads
		Max.	1.70 (15*)	(lbf-in)	
	Case Style		DO-203AA(DO-4)		JEDEC

* JEDEC Registered Values

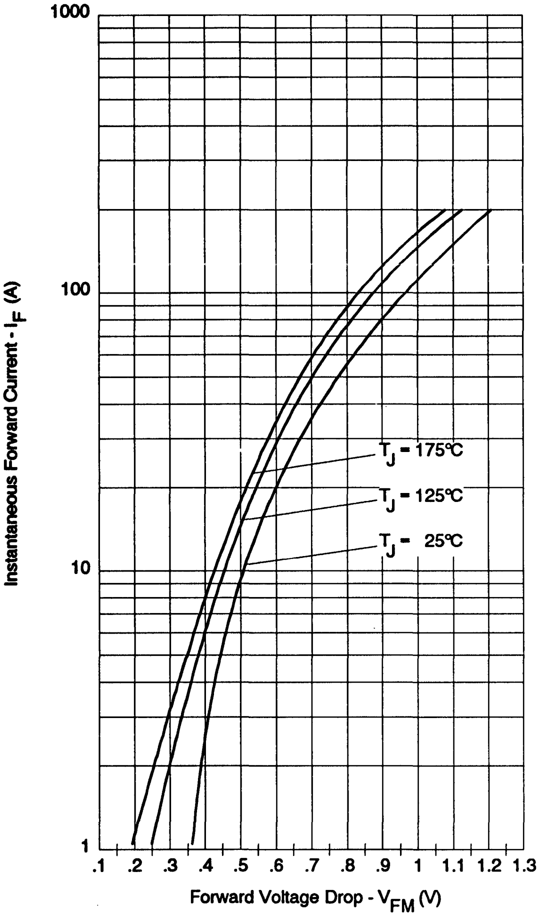


Fig. 1 - Maximum Forward Voltage Drop Characteristics

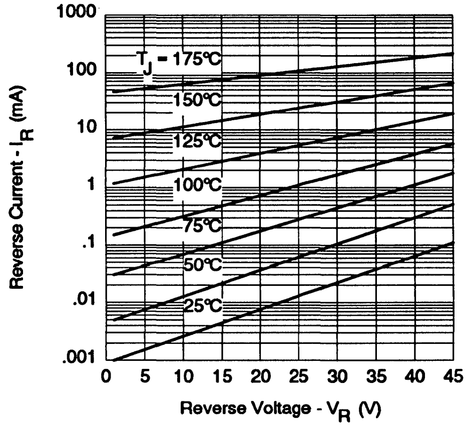


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

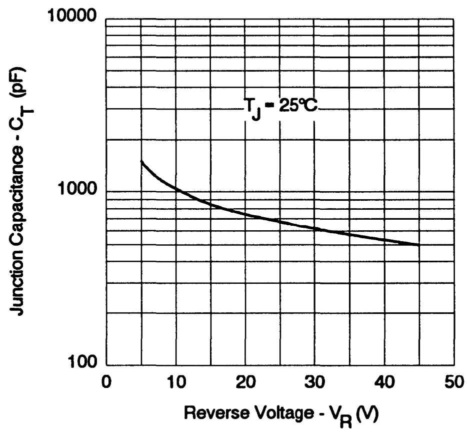


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

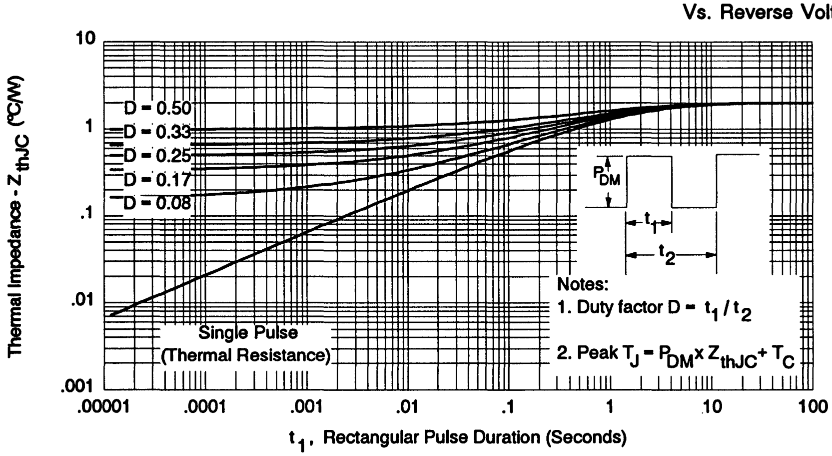


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC TO-3, DO-4, DO-5

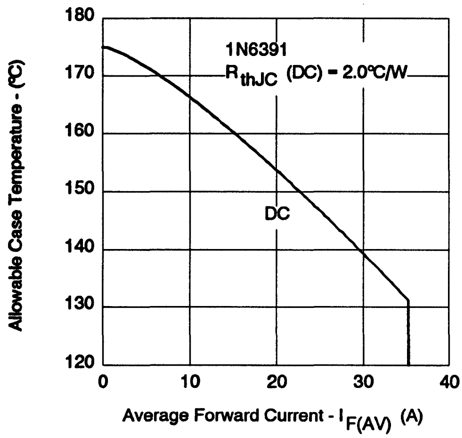


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

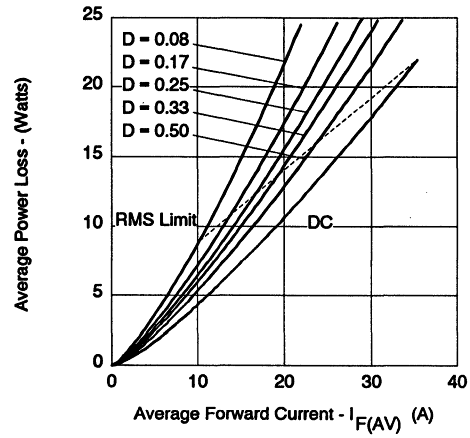


Fig. 6 - Forward Power Loss Characteristics

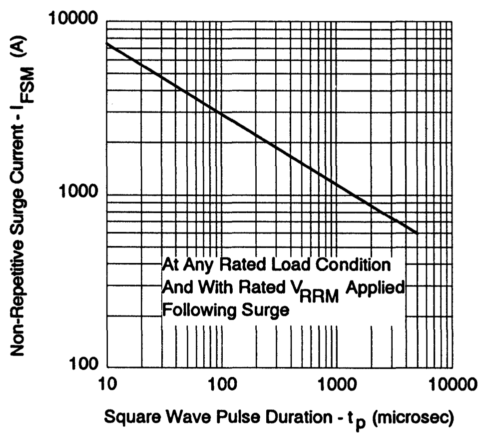


Fig. 7 - Maximum Non-Repetitive Surge Current

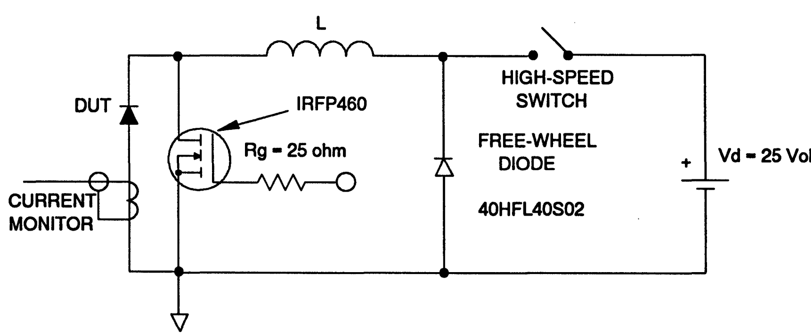


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

SD41

SCHOTTKY RECTIFIER — 30 Amp

Major Ratings and Characteristics

Characteristics	SD41	Units
$I_{F(AV)}$ Rectangular waveform	30	A
V_{RWM}	35/45	V
I_{FSM} @ 60Hz	600	A
V_F @ 60Apk, T_J = 150°C	0.70	V
T_J	-65 to 150	°C

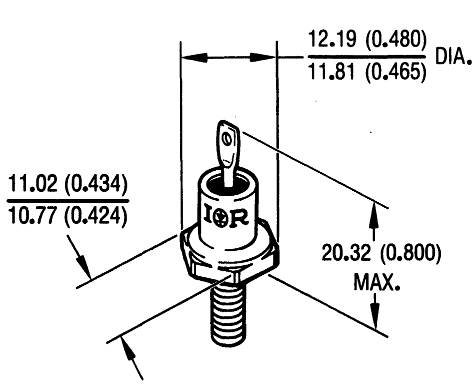
Description/Features

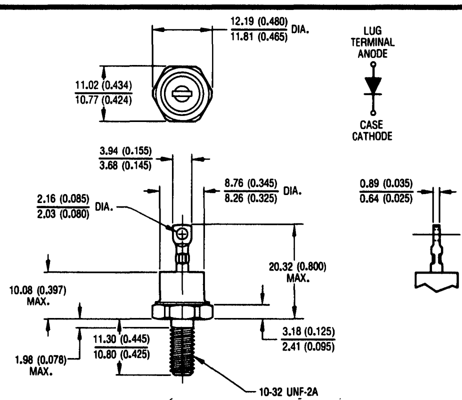
The SD41 Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AA (DO-4)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	SD41
V_R	Max. DC Reverse Voltage (V)	35/45 (1)
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

(1) For SD41 rated V_{RWM} and V_{RRM} = 45V @ T_J = 25°C , = 35V @ T_J = 150°C

Absolute Maximum Ratings

	Parameters	SD41	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	30	A	50% duty cycle @ T_C = 96° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	600	A	60Hz half cycle sine wave or 5ms rectangular pulse	Following any rated load condition and with rated V_{RRM} applied

Electrical Specifications

	Parameters	SD41	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (2) * See Fig. 1	0.58	V	@ 30A	T_J = 25 °C
		0.75	V	@ 60A	
		0.70	V	@ 60A	T_J = 150 °C
I_{RM}	Max. Reverse Leakage Current (2) * See Fig. 2	50	mA	T_J = 25 °C	V_R = rated V_R
		125	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	2000	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/µs		

(2) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		SD41	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		2.0	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.50	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		5.8 (0.20)	g (oz.)	
T	Mounting Torque	Min.	14 (12)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	23 (20)		
	Case Style		DO-203AA(DO-4)		JEDEC

* For Additional Information and Graphs, Please See the 21FQ Series

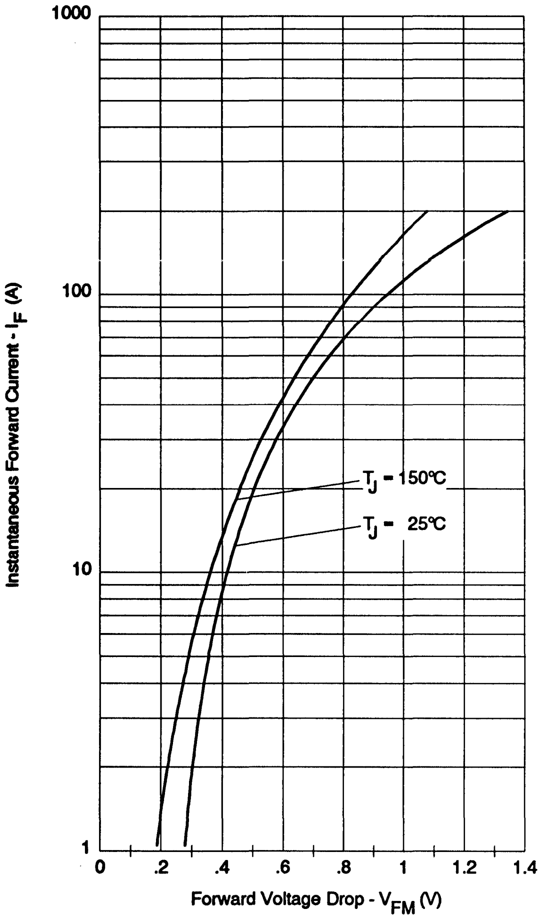


Fig. 1 - Maximum Forward Voltage Drop Characteristics

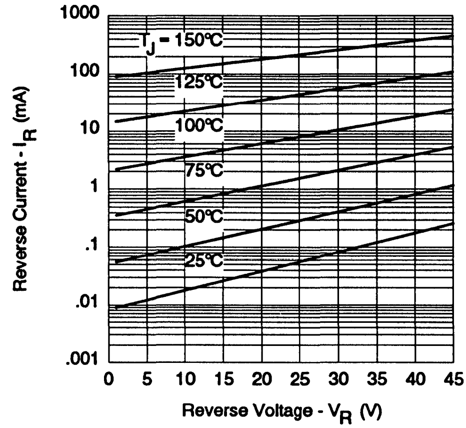


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

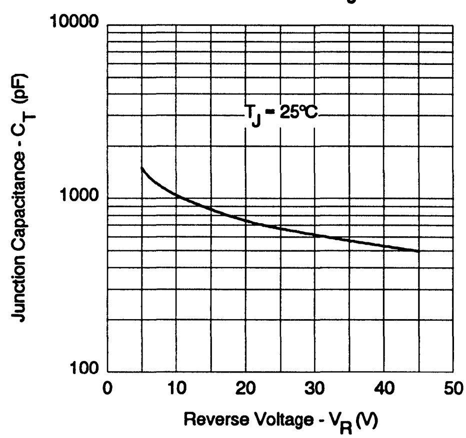


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

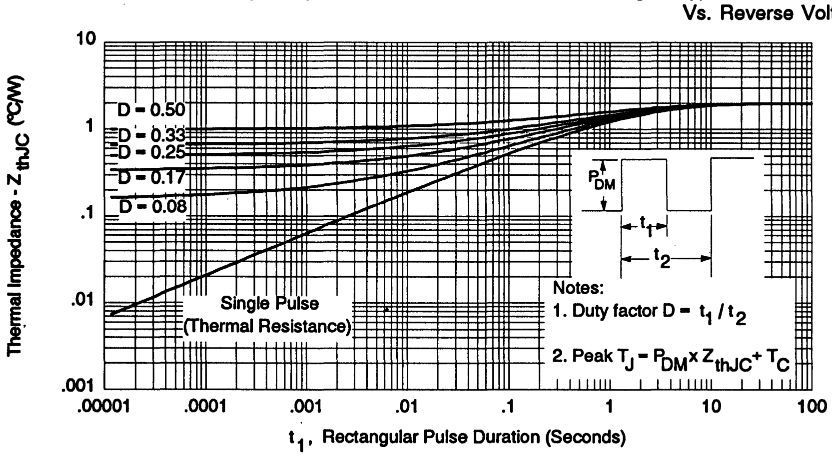


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC TO-3, DO-4, DO-5

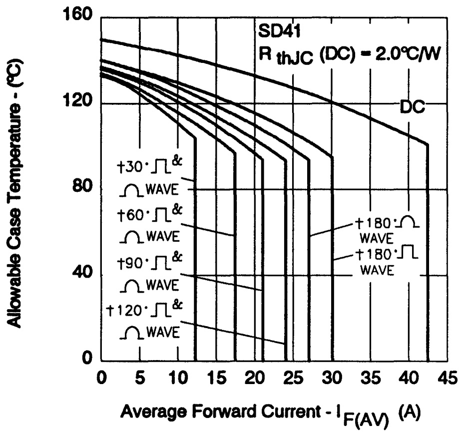


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

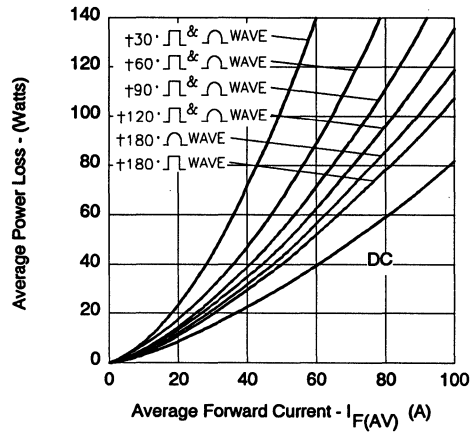


Fig. 6 - Forward Power Loss Characteristics

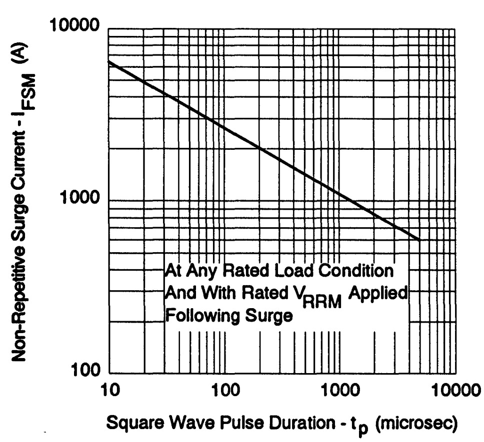


Fig. 7 - Max. Non-Repetitive Surge Current

International IOR Rectifier

50HQ... SERIES

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	50HQ...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	10,800	A
V_F @ 60 Apk, T_J = 125°C	0.53	V
T_J	- 65 to 150	°C

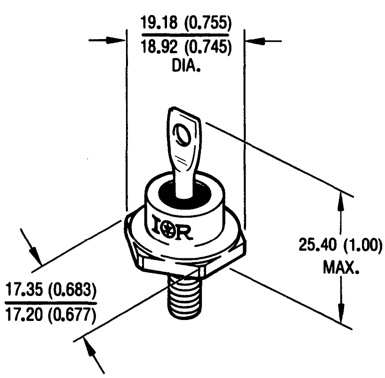
Description/Features

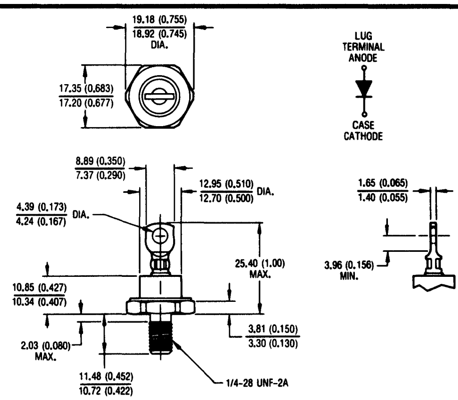
The 50HQ Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)
Dimensions in millimeters and inches

Voltage Ratings

	Part number	50HQ035	50HQ040	50HQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	50HQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 101°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	10,800	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1150		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	81	mJ	T_J = 25 °C, I_{AS} = 12 Amps, L = 1.12 mH	
I_{AR}	Repetitive Avalanche Current	12	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	50HQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.60	V	@ 60A	T_J = 25 °C
		0.78	V	@ 120A	
		0.53	V	@ 60A	T_J = 125 °C
		0.69	V	@ 120A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	5	mA	T_J = 25 °C	V_R = rated V_R
		200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		50HQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.83	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

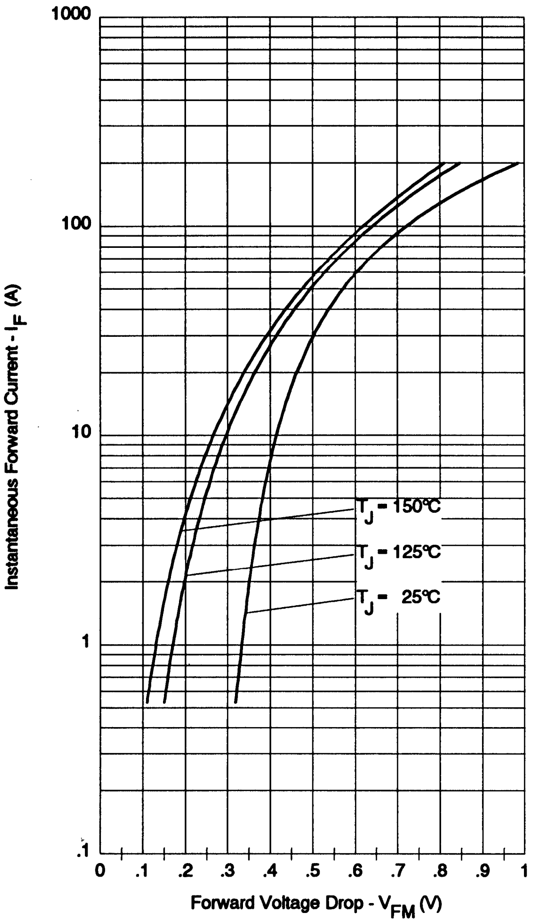


Fig. 1 - Maximum Forward Voltage Drop Characteristics

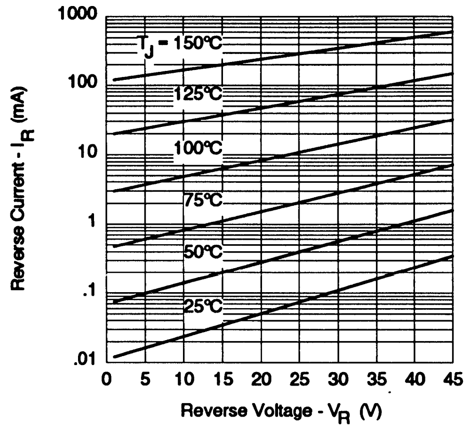


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

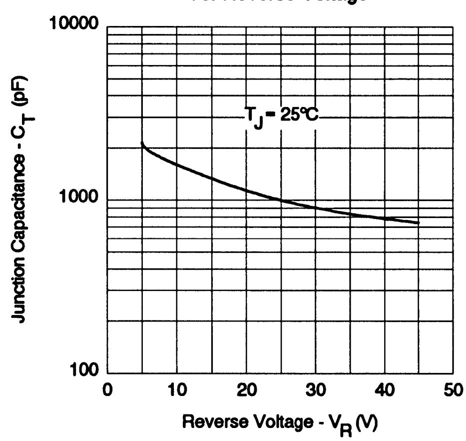


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

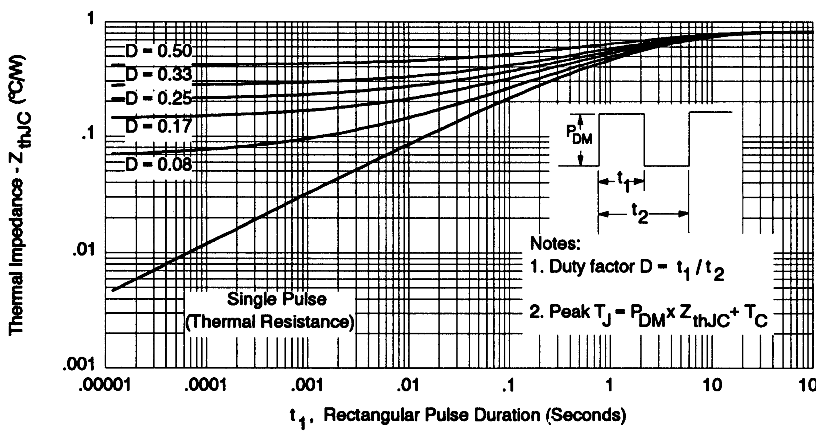


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

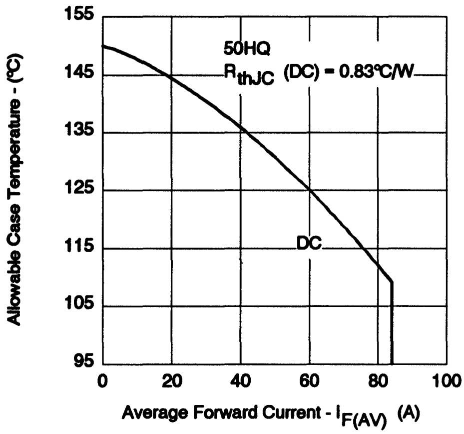


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

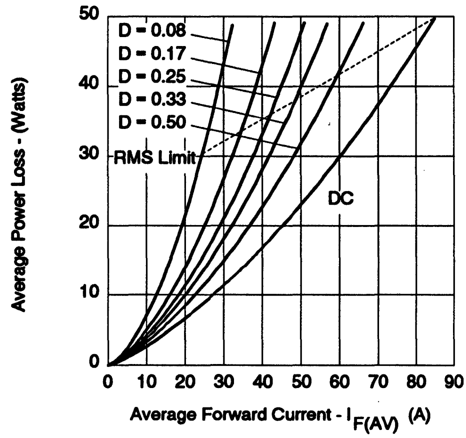


Fig. 6 - Forward Power Loss Characteristics

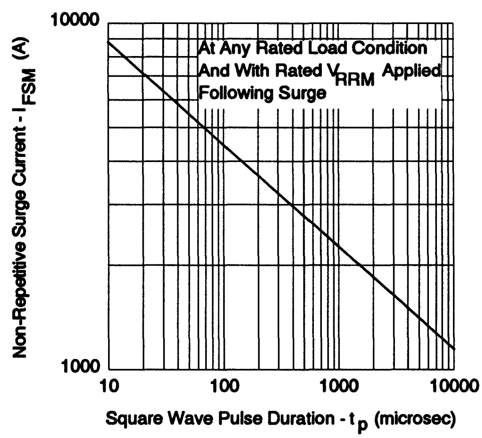


Fig. 7 - Maximum Non-Repetitive Surge Current

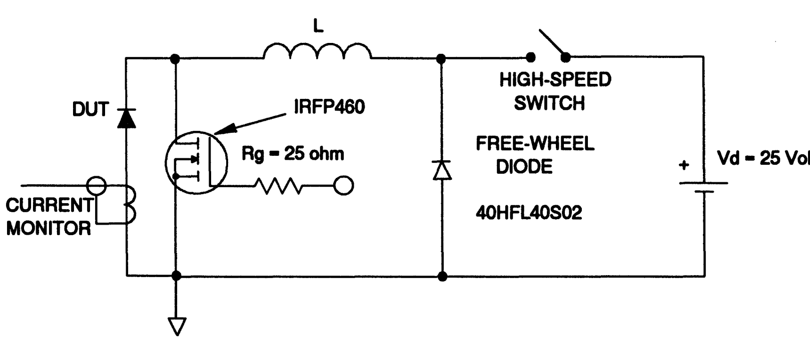


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

51HQ... SERIES

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	51HQ...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	10,800	A
V_F @ 60 Apk, T_J = 125°C	0.58	V
T_J	-65 to 150	°C

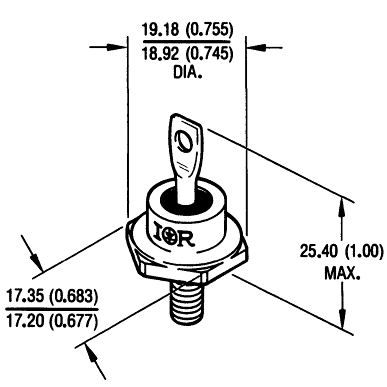
Description/Features

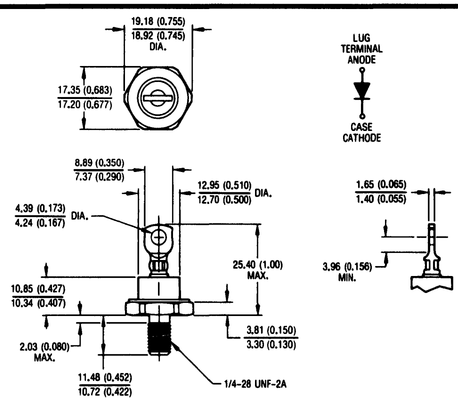
The 51HQ Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3 DO-4 DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	51HQ035	51HQ040	51HQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	51HQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 96 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	10,800	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1150		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	81	mJ	T_J = 25 °C, I_{AS} = 12 Amps, L = 1.12 mH	
I_{AR}	Repetitive Avalanche Current	12	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	51HQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.65	V	@ 60A	T_J = 25 °C
		0.83	V	@ 120A	
		0.58	V	@ 60A	T_J = 125 °C
		0.74	V	@ 120A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	5	mA	T_J = 25 °C	V_R = rated V_R
		200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		51HQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.83	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

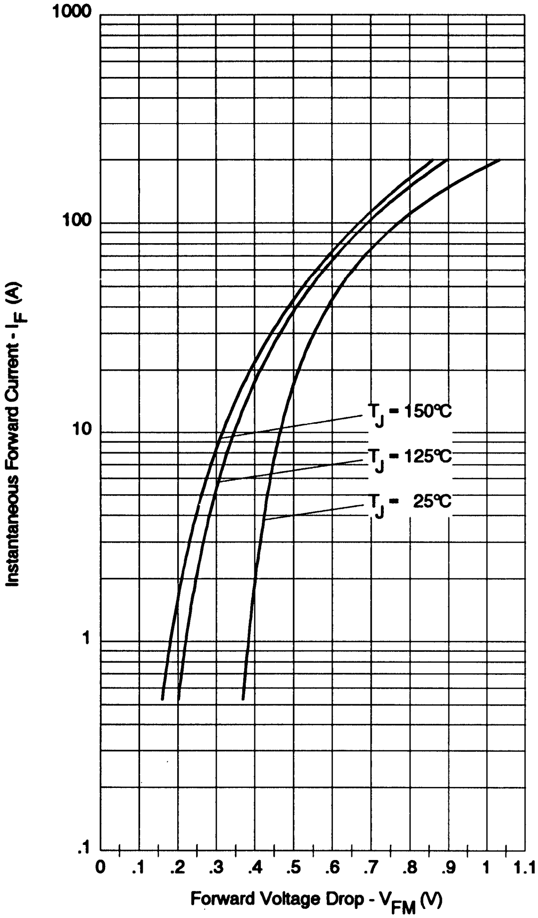


Fig. 1 - Maximum Forward Voltage Drop Characteristics

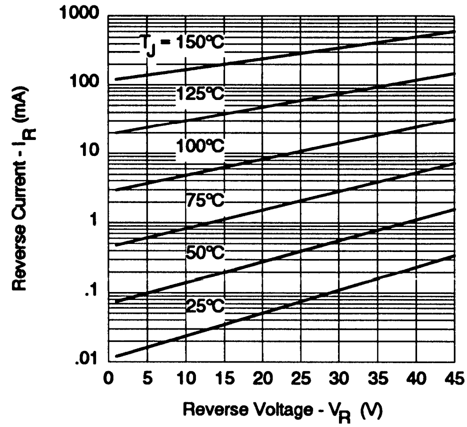


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

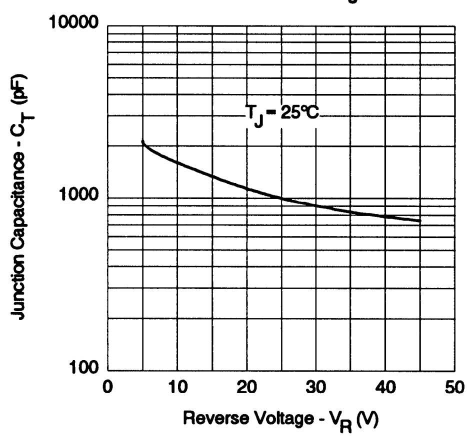


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

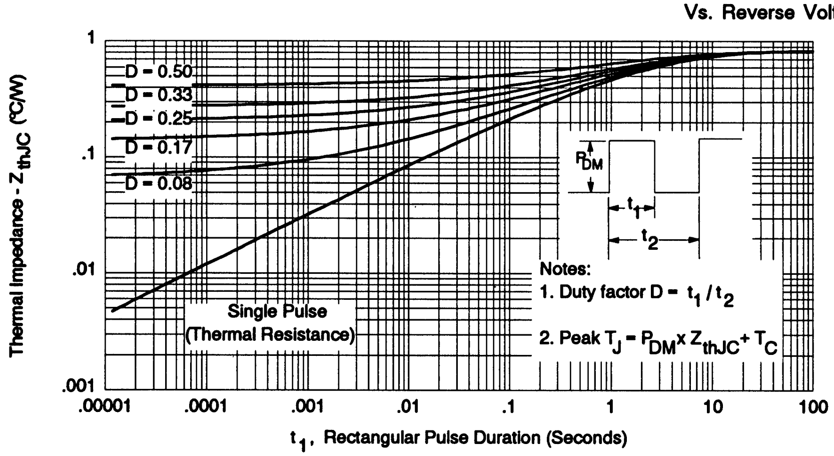


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC TO-3, DO-4, DO-5

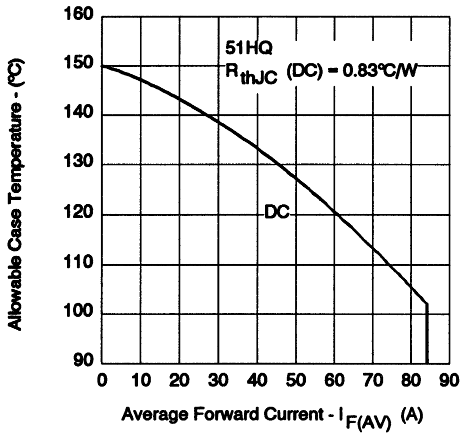


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

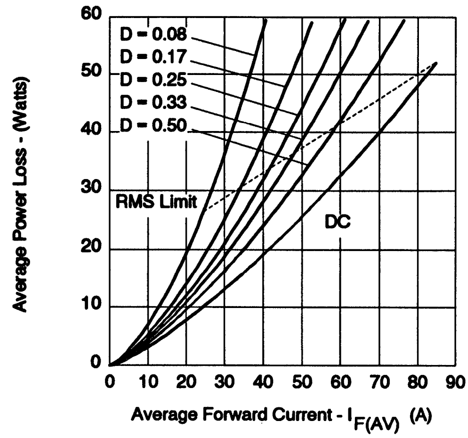


Fig. 6 - Forward Power Loss Characteristics

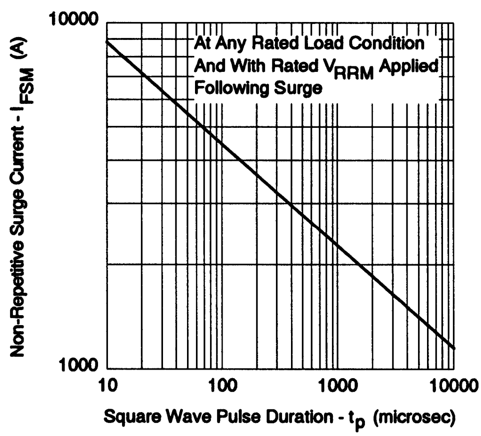


Fig. 7 - Maximum Non-Repetitive Surge Current

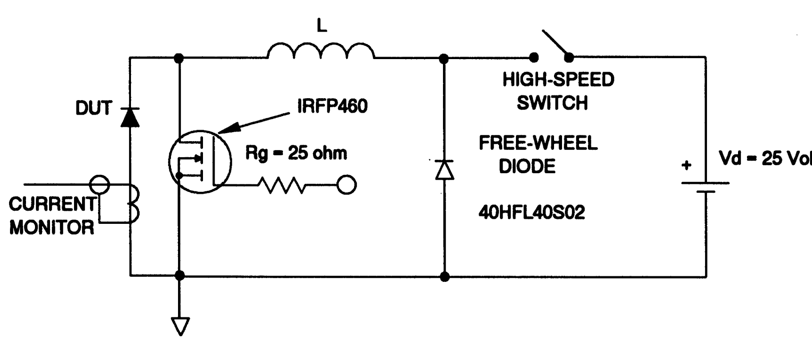


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

55HQ030

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	55HQ030	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	12,000	A
V_F @ 60 Apk, T_J = 125°C	0.41	V
T_J	- 65 to 150	°C

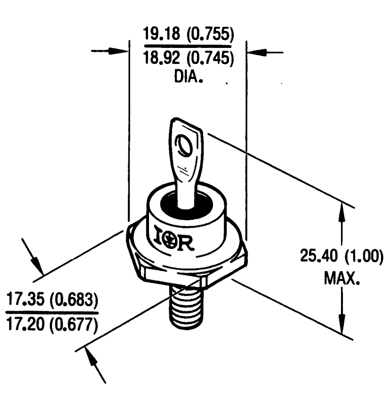
Description/Features

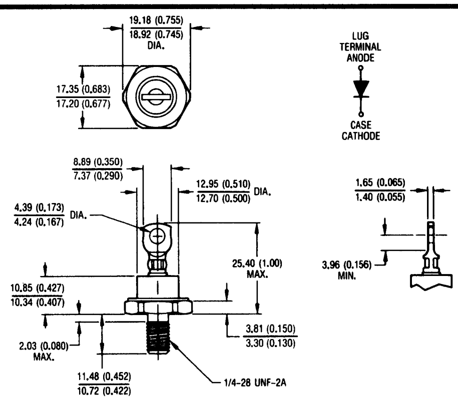
The 55HQ030 Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

Part number	55HQ030
V_R Max. DC Reverse Voltage (V)	30
V_{RWM} Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	55HQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 110°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	12,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1200		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	54	mJ	T_J = 25 °C, I_{AS} = 12 Amps, L = 0.75 mH	
I_{AR}	Repetitive Avalanche Current	12	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	55HQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.50	V	@ 60A	T_J = 25 °C
		0.59	V	@ 120A	
		0.41	V	@ 60A	T_J = 125 °C
		0.55	V	@ 120A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	5	mA	T_J = 25 °C	V_R = rated V_R
		280	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	3700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		55HQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.83	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

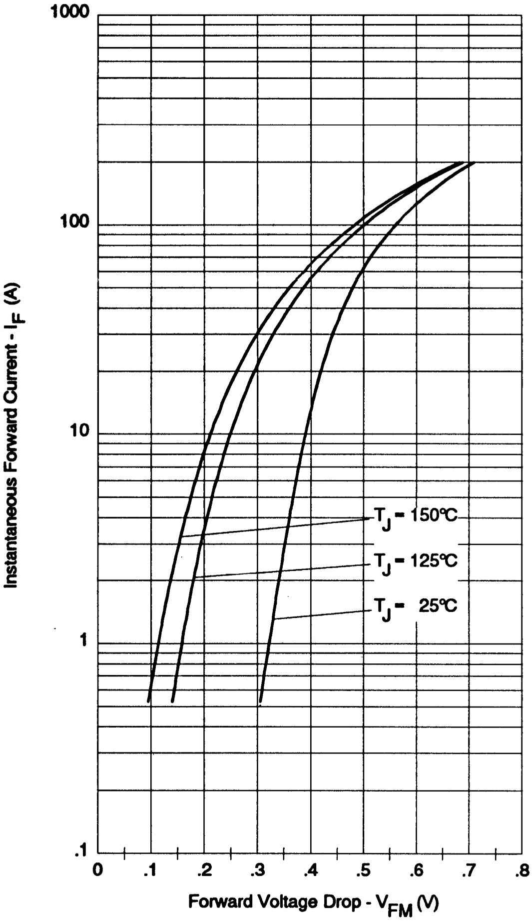


Fig. 1 - Maximum Forward Voltage Drop Characteristics

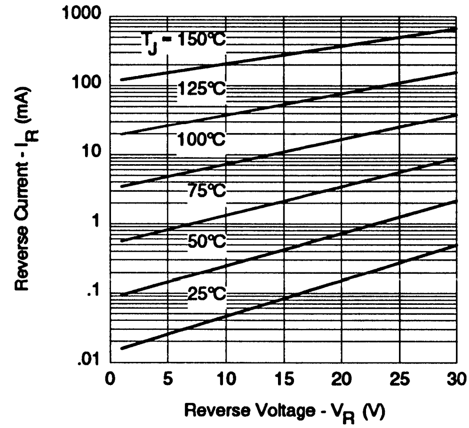


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

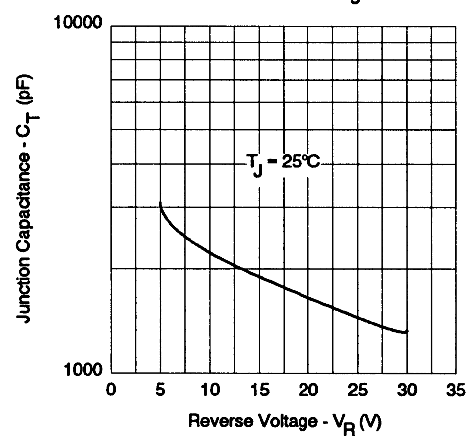


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

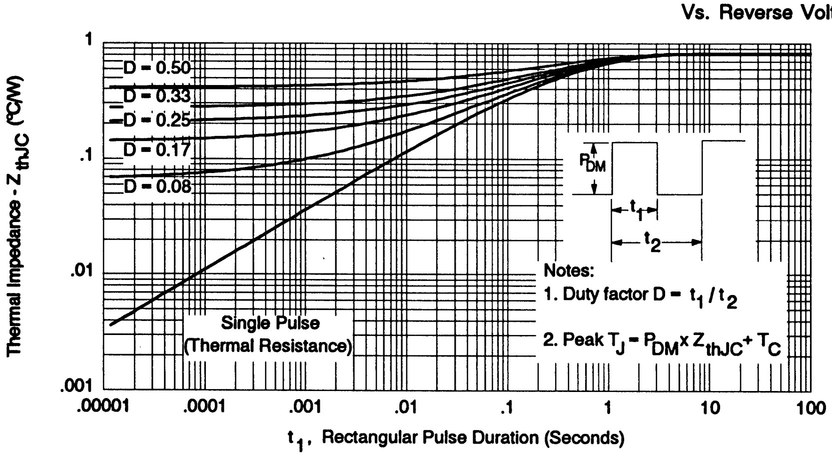


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC
TO-3, DO-4,
DO-5

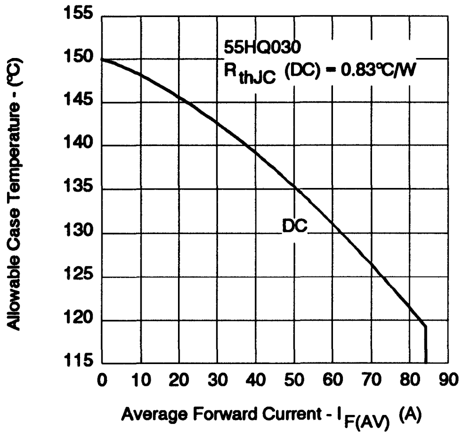


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

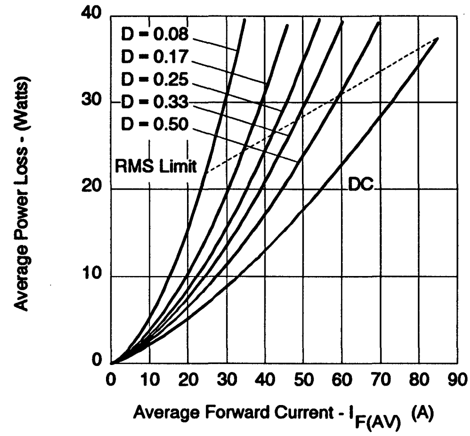


Fig. 6 - Forward Power Loss Characteristics

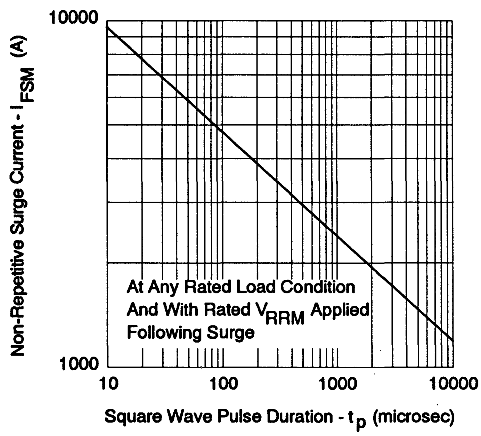


Fig. 7 - Maximum Non-Repetitive Surge Current

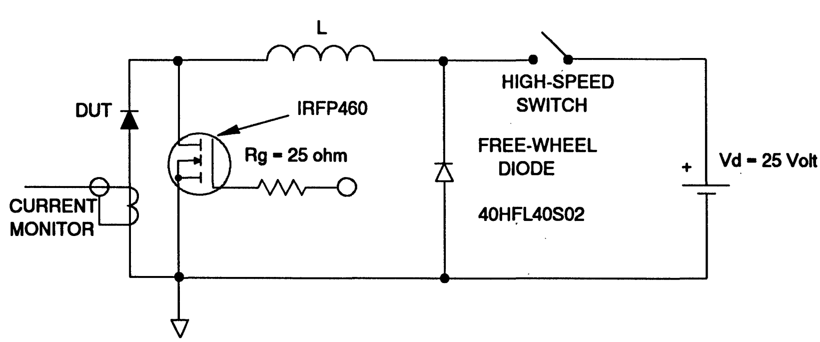


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

60HQ... SERIES

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	60HQ...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	8400	A
V_F @ 60 Apk, T_J = 125°C	0.70	V
T_J	- 65 to 175	°C

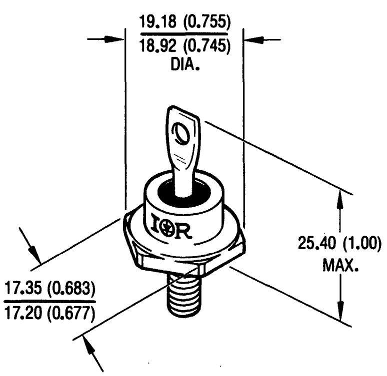
Description/Features

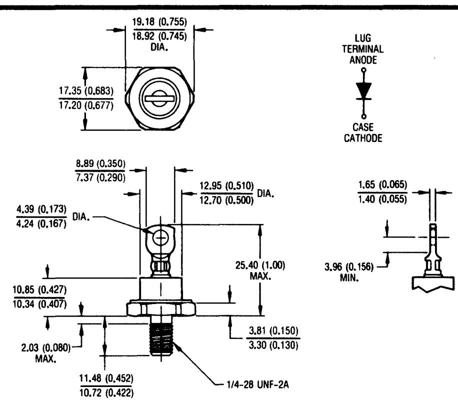
The 60HQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175 °C T_J operation
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	60HQ080	60HQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	60HQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 118 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	8400	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1200		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current	1	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	60HQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.89	V	@ 60A	T_J = 25 °C
		1.09	V	@ 120A	
		0.70	V	@ 60A	T_J = 125 °C
		0.84	V	@ 120A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	1.5	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		60HQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.83	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

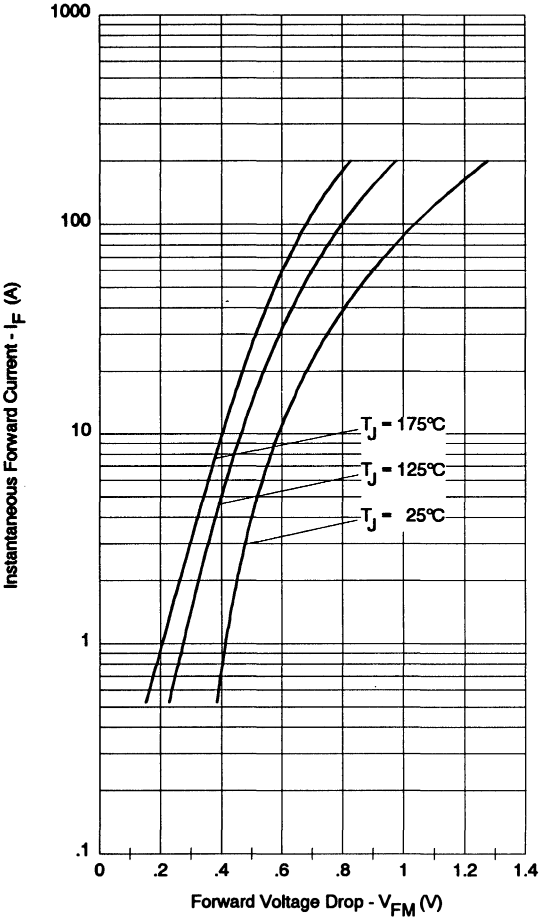


Fig. 1 - Maximum Forward Voltage Drop Characteristics

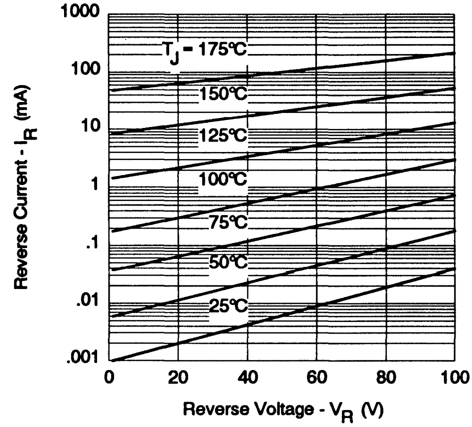


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

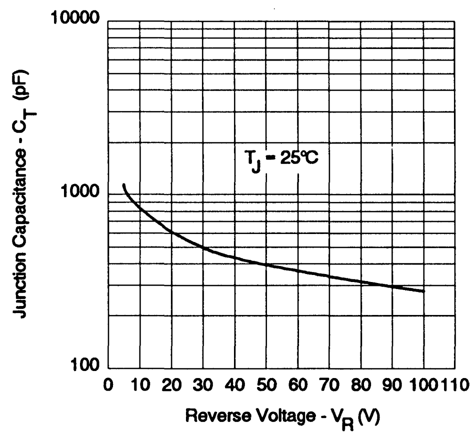


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

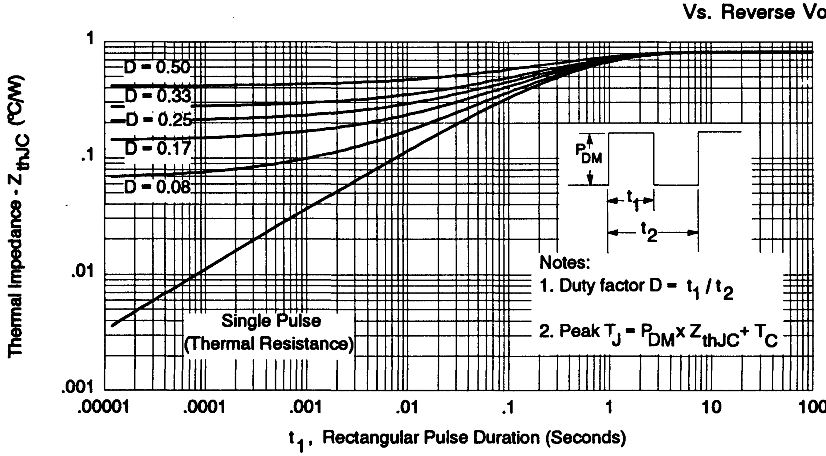


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC TO-3, DO-4, DO-5

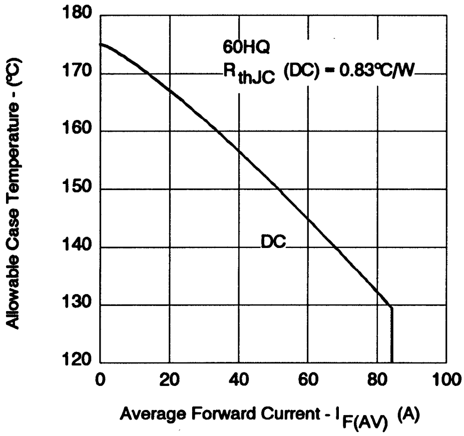


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

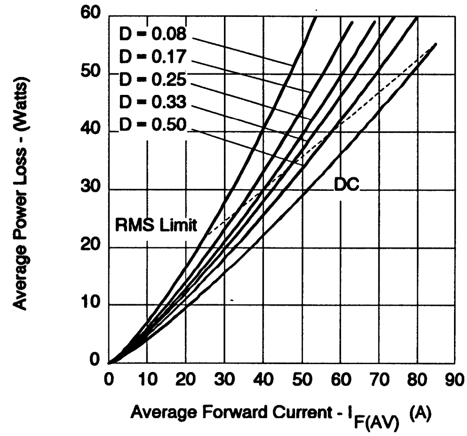


Fig. 6 - Forward Power Loss Characteristics

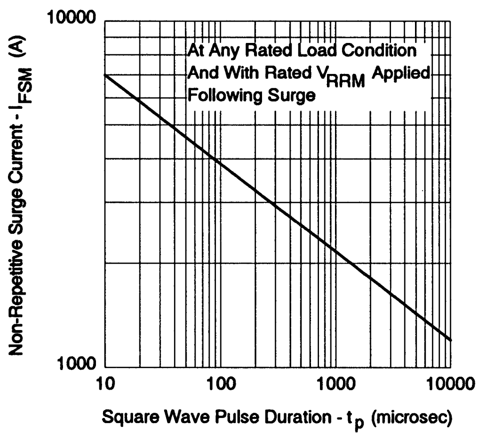


Fig. 7 - Maximum Non-Repetitive Surge Current

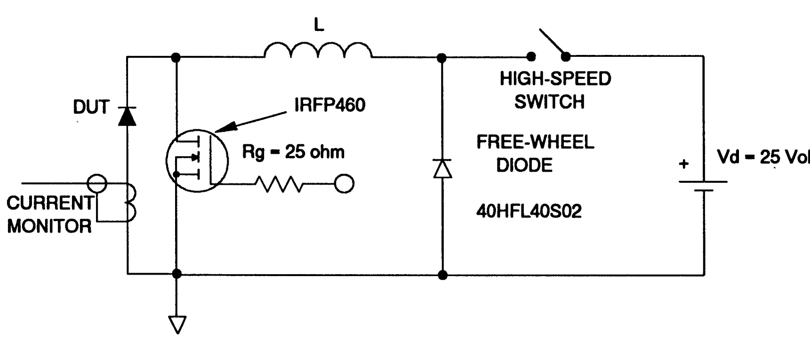


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

75HQ... SERIES

SCHOTTKY RECTIFIER

75 Amp

Major Ratings and Characteristics

Characteristics	75HQ...	Units
$I_{F(AV)}$ Rectangular waveform	75	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	9000	A
V_F @ 75 Apk, T_J = 125°C	0.63	V
T_J	- 65 to 175	°C

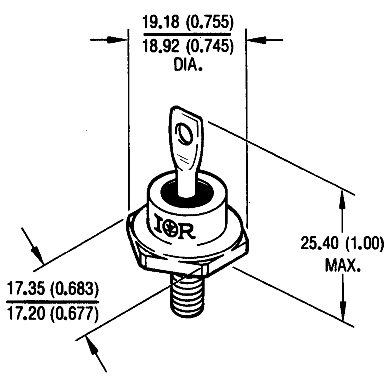
Description/Features

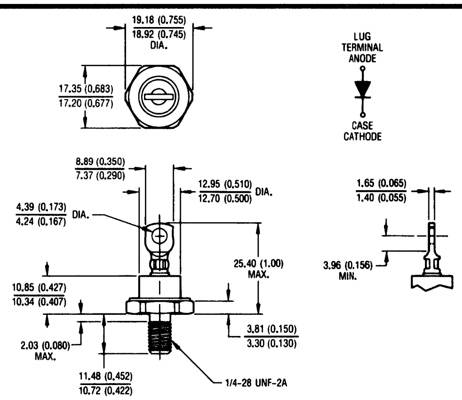
The 75HQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175 °C T_J operation
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC
TO-3, DO-4,
DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	75HQ035	75HQ040	75HQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	75HQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	75	A	50% duty cycle @ T_C = 117 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	9000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1180		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	101	mJ	T_J = 25 °C, I_{AS} = 15 Amps, L = 0.9 mH	
I_{AR}	Repetitive Avalanche Current	15	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	75HQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.71	V	@ 75A	T_J = 25 °C
		0.88	V	@ 150A	
		0.63	V	@ 75A	T_J = 125 °C
		0.78	V	@ 150A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	5	mA	T_J = 25 °C	V_R = rated V_R
		45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		75HQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.83	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

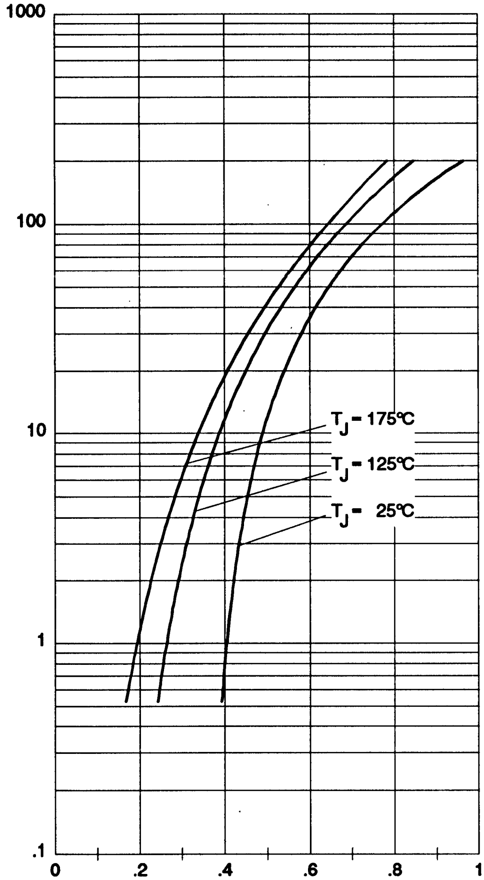


Fig. 1 - Maximum Forward Voltage Drop Characteristics

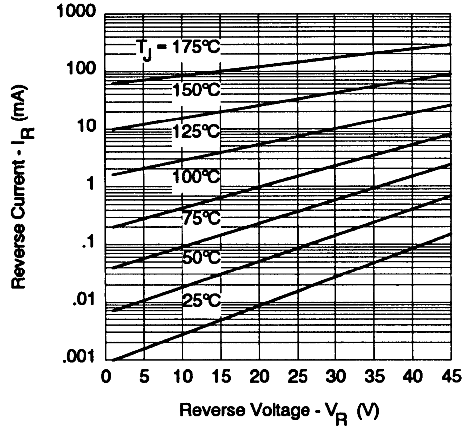


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage

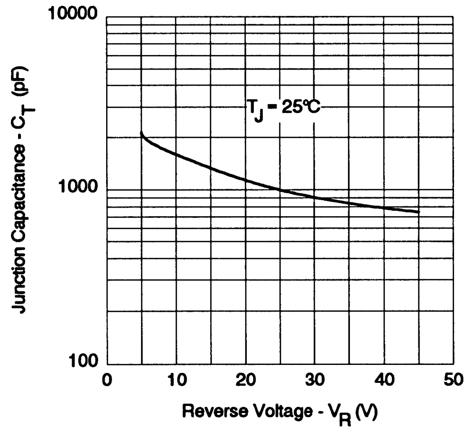


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

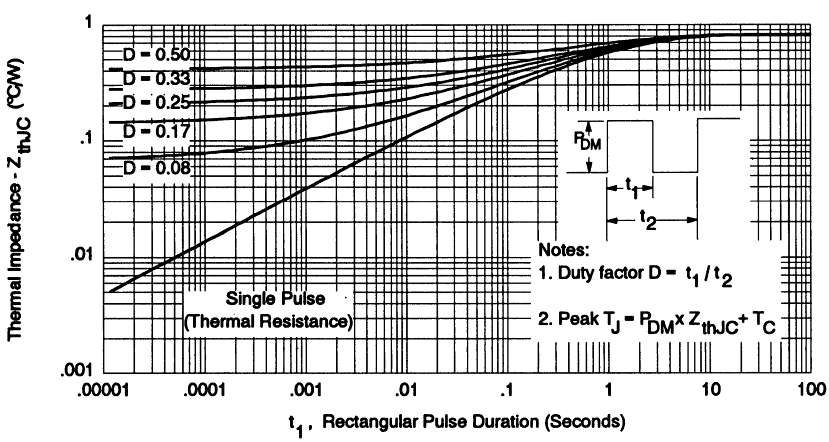


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC TO-3, DO-4, DO-5

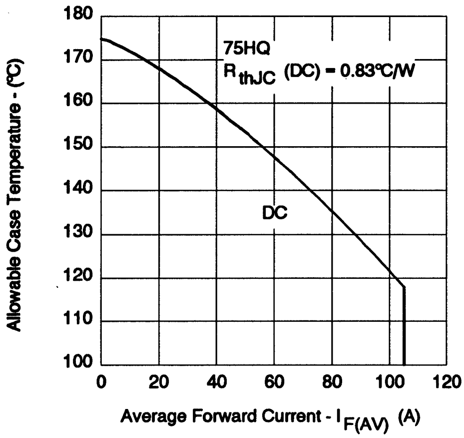


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

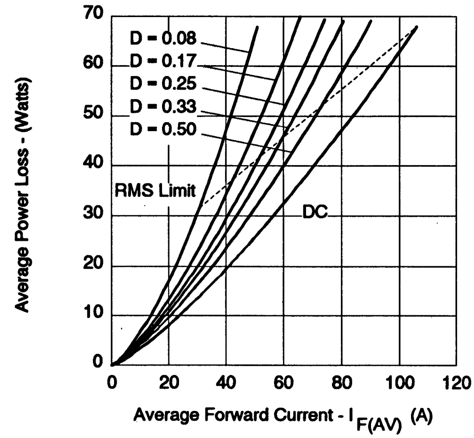


Fig. 6 - Forward Power Loss Characteristics

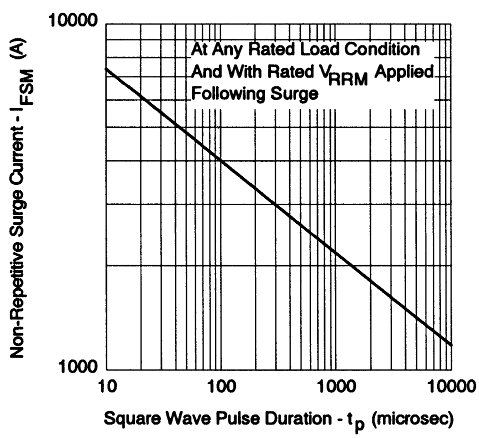


Fig. 7 - Maximum Non-Repetitive Surge Current

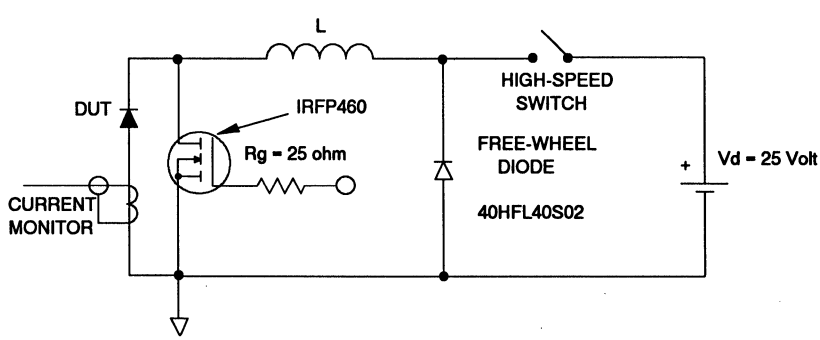


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

85HQ... SERIES

SCHOTTKY RECTIFIER

85 Amp

Major Ratings and Characteristics

Characteristics	85HQ...	Units
$I_{F(AV)}$ Rectangular waveform	85	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	9000	A
V_F @ 85 Apk, T_J = 125°C	0.62	V
T_J	- 65 to 175	°C

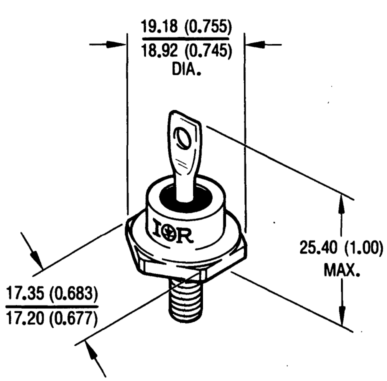
Description/Features

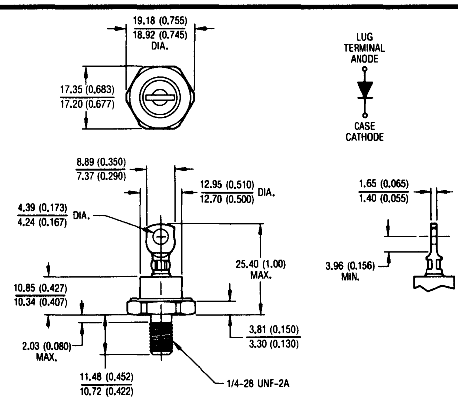
The 85HQ Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175°C T_J operation
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	85HQ035	85HQ040	85HQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	85HQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	85	A	50% duty cycle @ T_C = 112° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	9000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current * See Fig. 7	1130		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	114	mJ	T_J = 25 °C, I_{AS} = 17 Amps, L = 0.79 mH	
I_{AR}	Repetitive Avalanche Current	17	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	85HQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.72	V	@ 85A	T_J = 25 °C
	* See Fig. 1	0.89	V	@ 170A	
		0.62	V	@ 85A	T_J = 125 °C
		0.77	V	@ 170A	
I_{RM}	Max. Reverse Leakage Current (1)	5	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2	45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		85HQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.83	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

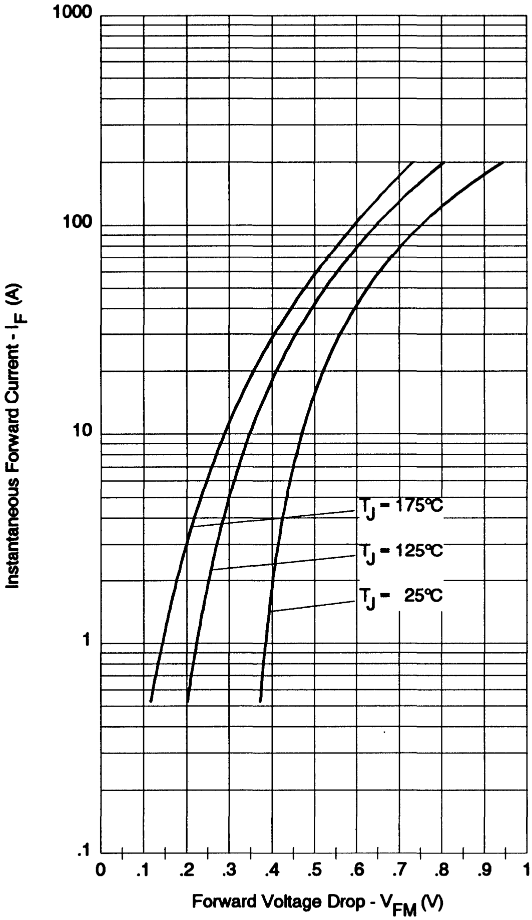


Fig. 1 - Maximum Forward Voltage Drop Characteristics

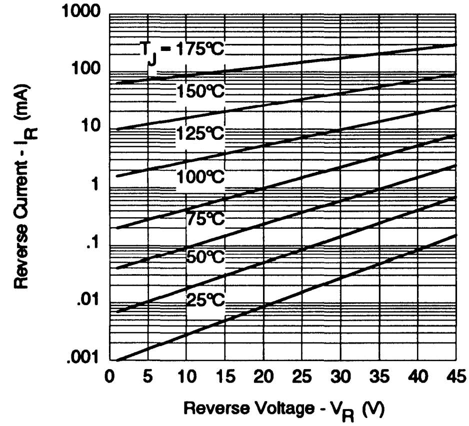


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage

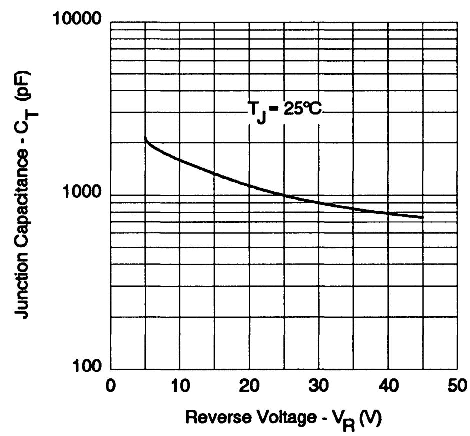


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

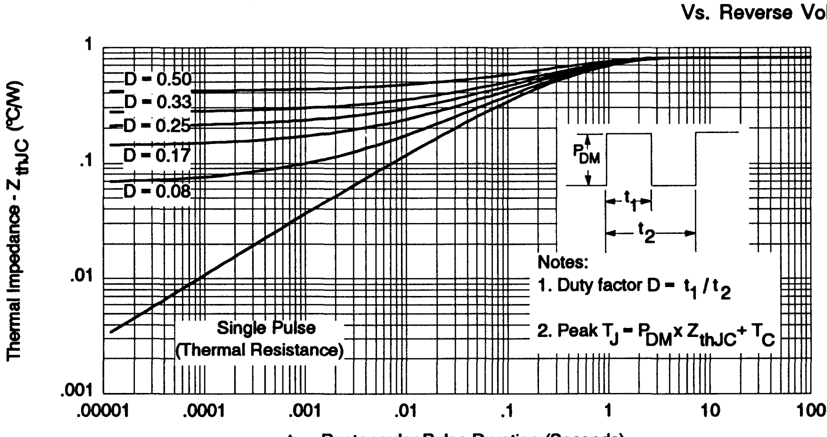


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC
TO-3, DO-4,
DO-5

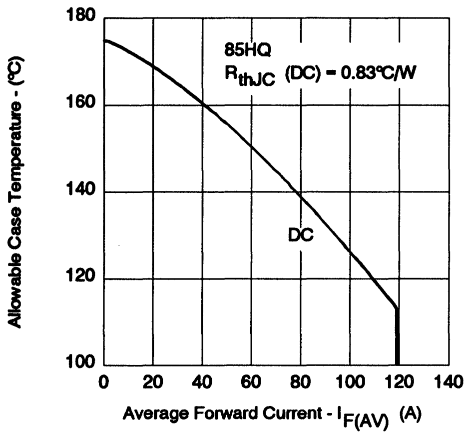


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

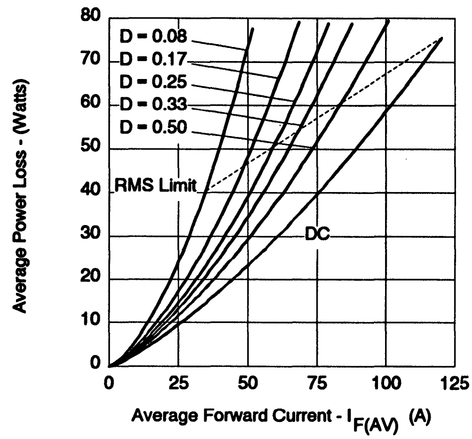


Fig. 6 - Forward Power Loss Characteristics

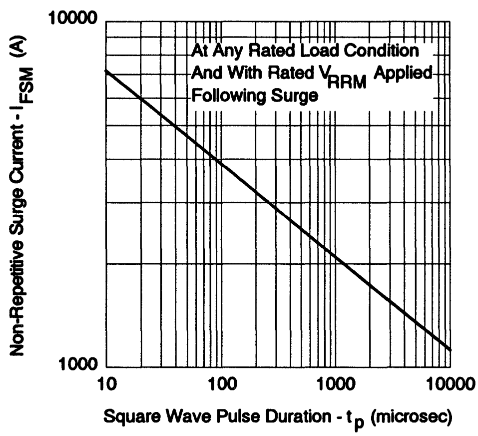


Fig. 7 - Maximum Non-Repetitive Surge Current

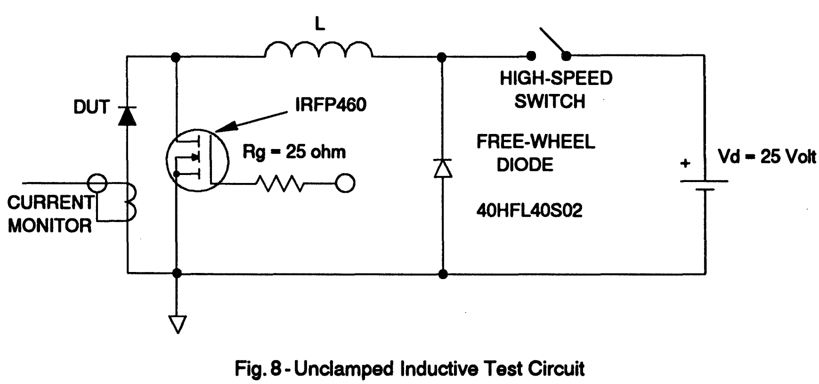


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

95HQ015

SCHOTTKY RECTIFIER

95 Amp

Major Ratings and Characteristics

Characteristics	95HQ015	Units
$I_{F(AV)}$ Rectangular waveform	95	A
V_{RRM}	15	V
I_{FSM} @ tp = 5 μs sine	7500	A
V_F @ 95 Apk, T_J = 75°C	0.39	V
T_J	- 65 to 100	°C

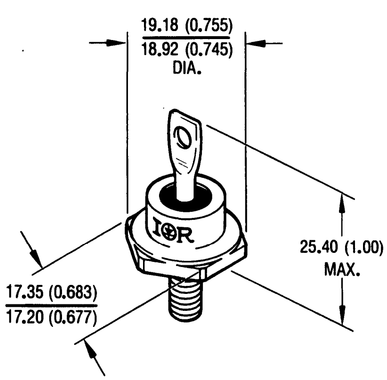
Description/Features

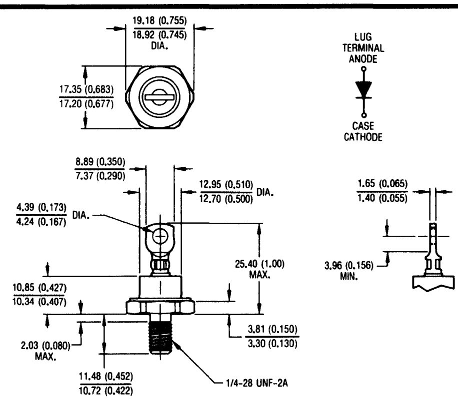
The 95HQ015 Schottky rectifier has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100° C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100° C T_J operation
- Optimized for OR-ing applications
- Ultra low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic package

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	95HQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	95HQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	95	A	50% duty cycle @ T_C = 44°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	7500	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1200		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	9	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 4.5 mH	
I_{AR}	Repetitive Avalanche Current	2	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 3 x V_R typical	

Electrical Specifications

	Parameters	95HQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.46	V	@ 95A	T_J = 25 °C
		0.62	V	@ 190A	
		0.39	V	@ 95A	T_J = 75 °C
		0.55	V	@ 190A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	20	mA	T_J = 25 °C	V_R = rated V_R
		1000	mA	T_J = 100 °C	
		890	mA	T_J = 100 °C	V_R = 12V
		540	mA	T_J = 100 °C	V_R = 5V
C_T	Max. Junction Capacitance	3600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		95HQ	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 100	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 100	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.83	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

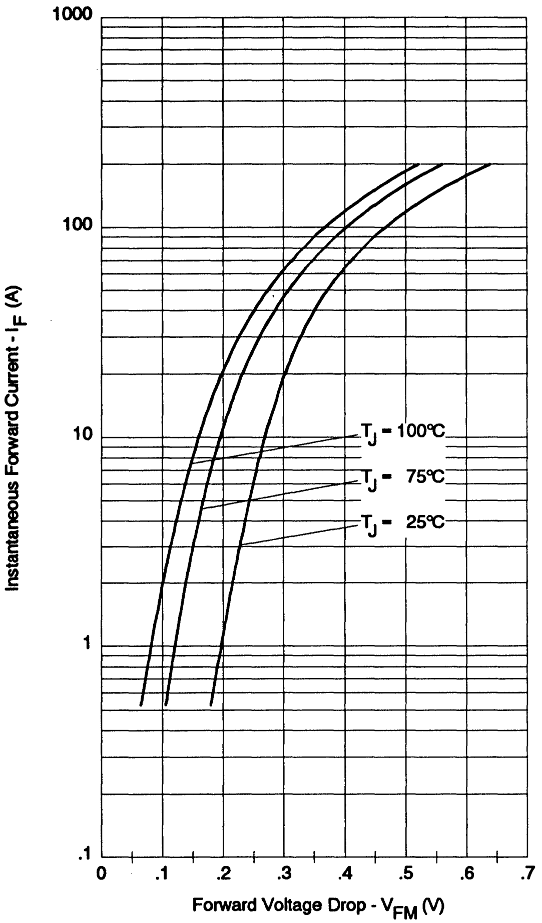


Fig. 1 - Maximum Forward Voltage Drop Characteristics

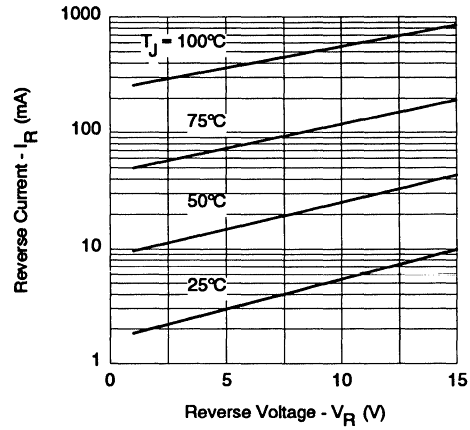


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

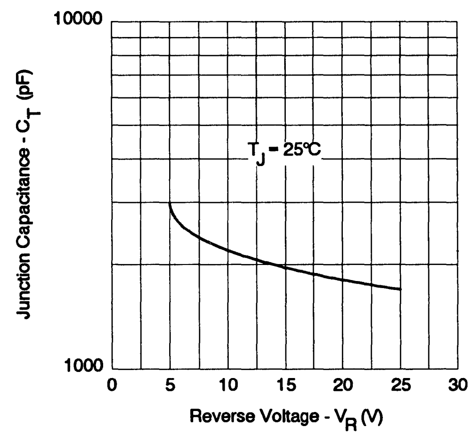


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

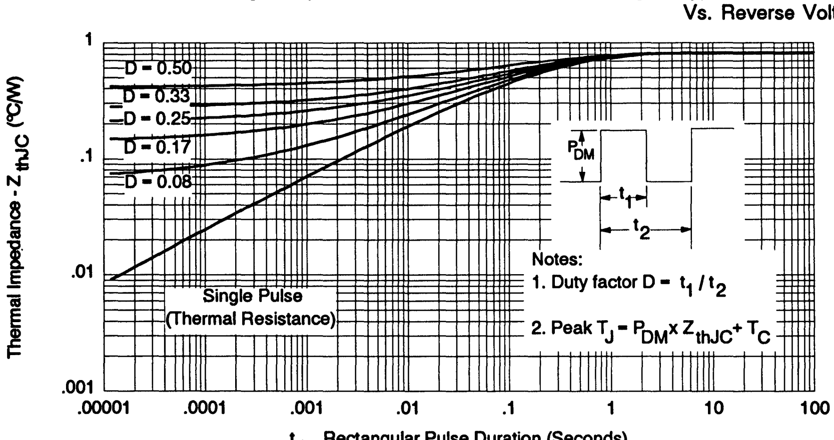


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC TO-3, DO-4, DO-5

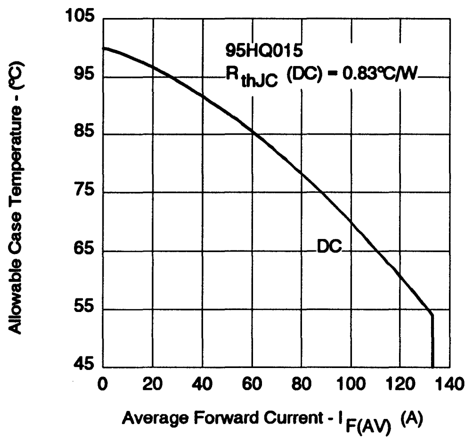


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

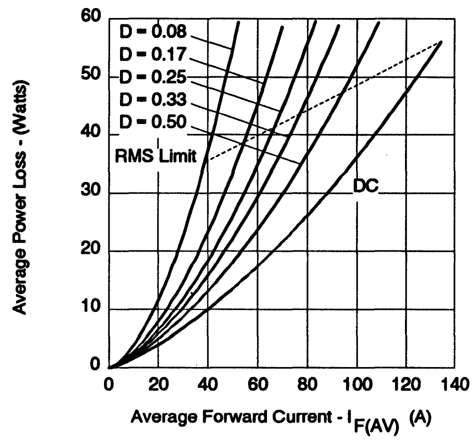


Fig. 6 - Forward Power Loss Characteristics

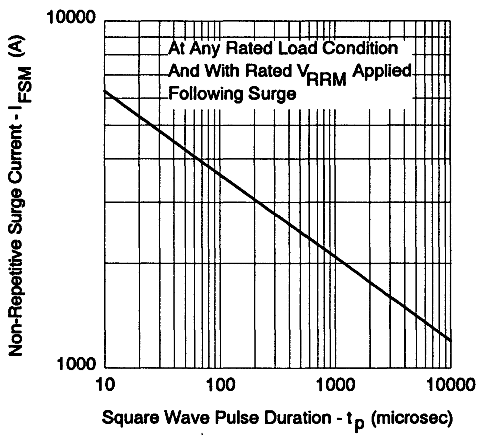


Fig. 7 - Maximum Non-Repetitive Surge Current

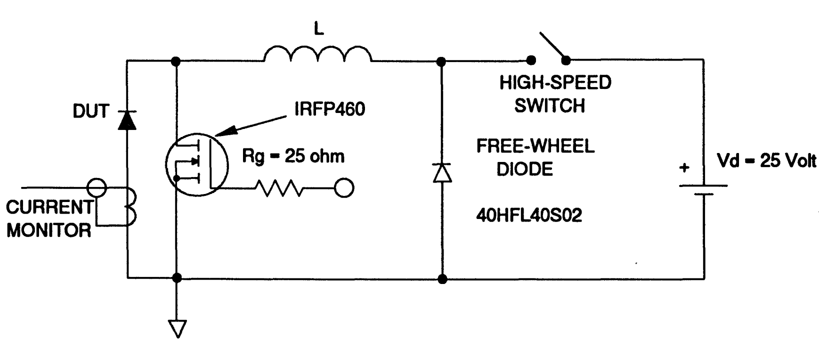


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

1N6097
1N6098

SCHOTTKY RECTIFIER

50 Amp

Major Ratings and Characteristics

Characteristics	1N609.	Units
$I_{F(AV)}$ Rectangular waveform	50*	A
V_{RRM}	30/40*	V
I_{FSM} @ 60Hz	800*	A
V_F @ 160Apk, T_J = 70°C	0.86*	V
T_J	-65 to 125*	°C

* JEDEC Registered Values

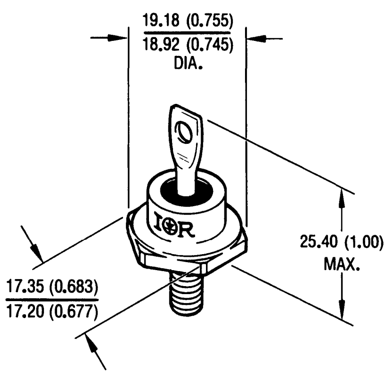
Description/Features

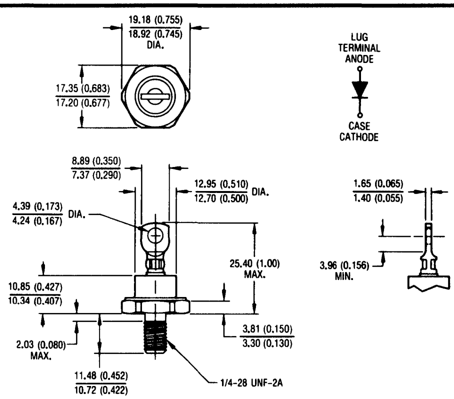
The 1N609. Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 125° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 125° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC TO-3, DO-4, DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	1N6097	1N6098
V_R	Max. DC Reverse Voltage (V)	30*	40*
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	1N609.	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current See Fig. 5	50*	A	50% duty cycle @ T_C = 70 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	10,800	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current See Fig. 7	800*		60Hz halfwave, single phase	
E_{AS}	Non-Repetitive Avalanche Energy	81	mJ	T_J = 25 °C, I_{AS} = 12 Amps, L = 1.12 mH	
I_{AR}	Repetitive Avalanche Current	12	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	1N609.	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.60*	V	@ 10A	T_J = 25 °C
	See Fig. 1	0.86*	V	@ 160A	T_J = 70 °C
I_{RM}	Max. Reverse Leakage Current (1)	75	mA	T_J = 25 °C	V_R = rated V_R
	See Fig. 2	250*	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	7000*	pF	V_R = 1V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		1N609.	Units	Conditions
T_J	Max. Junction Temperature Range		-65 to 125*	°C	
T_{stg}	Max. Storage Temperature Range		-65 to 125*	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.0*	°C/W	DC operation See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		15 (0.53)	g (oz.)	
T	Mounting Torque	Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	46 (40)		
	Case Style		DO-203AB(DO-5)		JEDEC

* JEDEC Registered Values

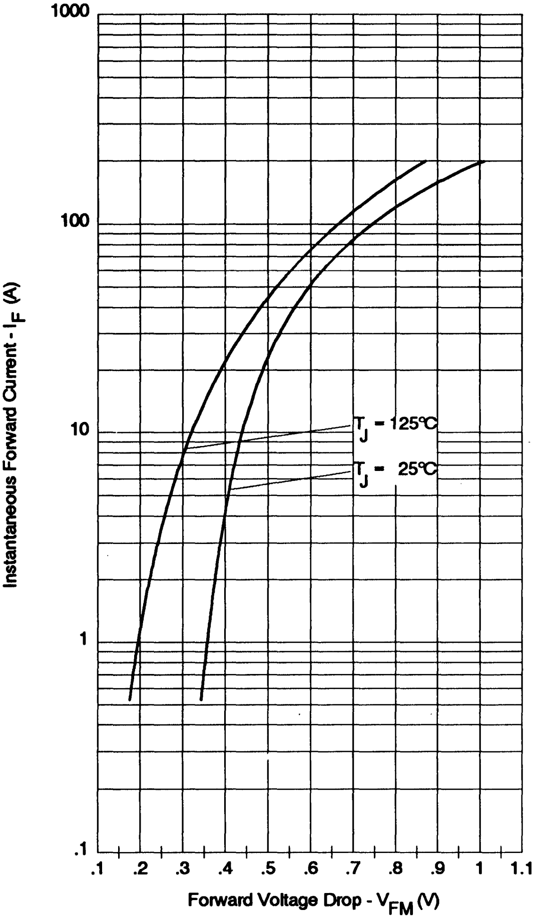


Fig. 1 - Maximum Forward Voltage Drop Characteristics

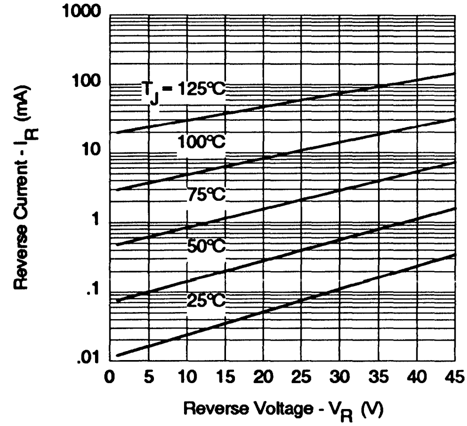


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

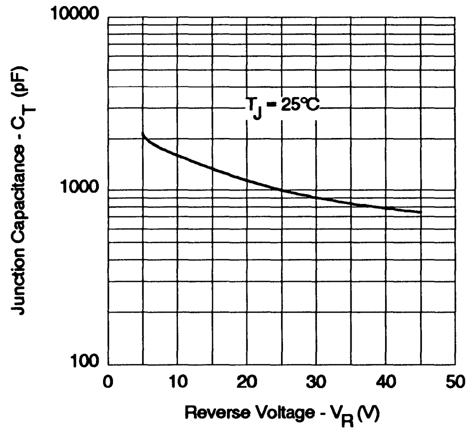


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

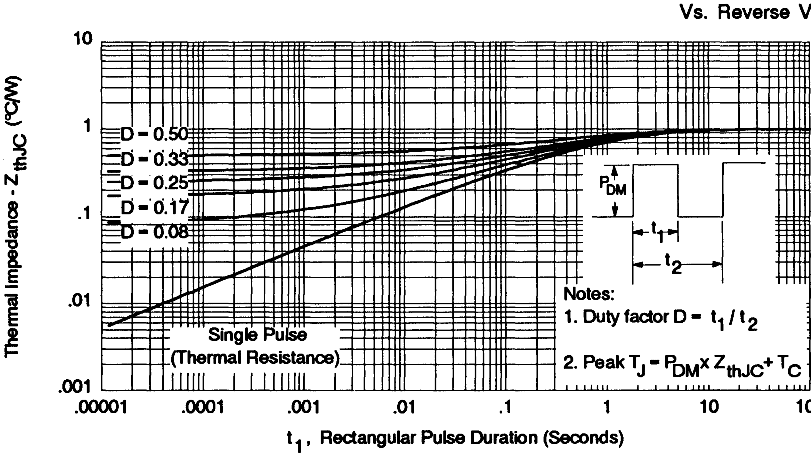


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC
TO-3, DO-4,
DO-5

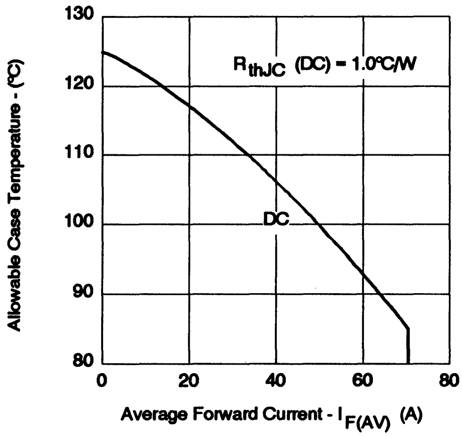


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

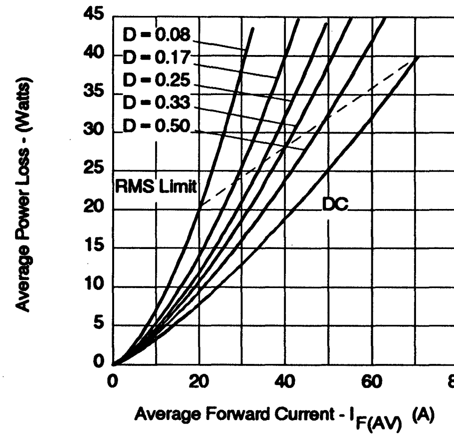


Fig. 6 - Forward Power Loss Characteristics

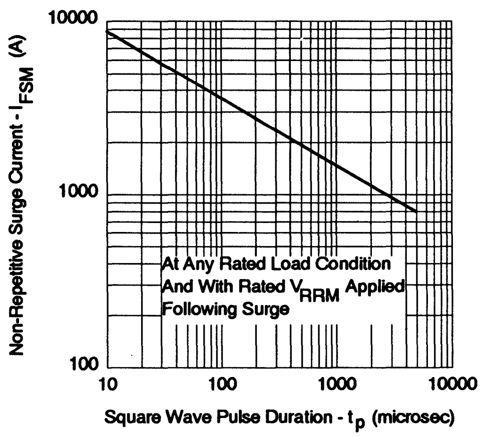


Fig. 7 - Maximum Non-Repetitive Surge Current

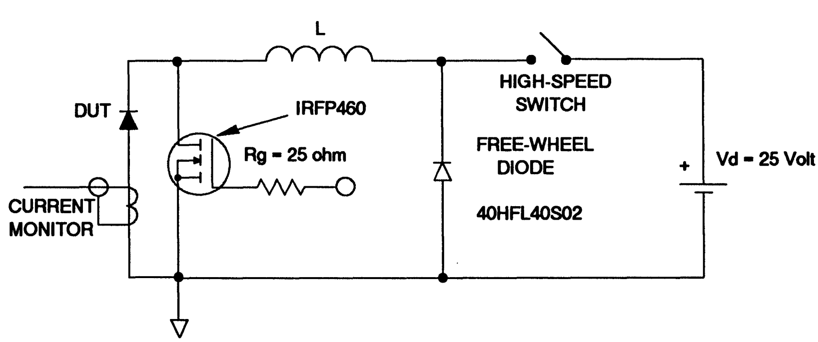


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

1N6392

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	1N6392	Units
$I_{F(AV)}$ Rectangular waveform	60*	A
V_{RWM}	45*	V
I_{FSM} @ 60Hz	1000*	A
V_F @ 60Apk, T_J = 25°C	0.68*	V
T_J	-55 to 175*	°C

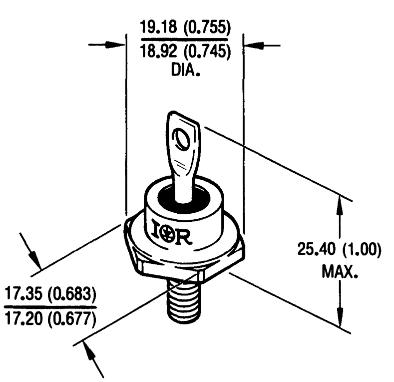
* JEDEC Registered Values

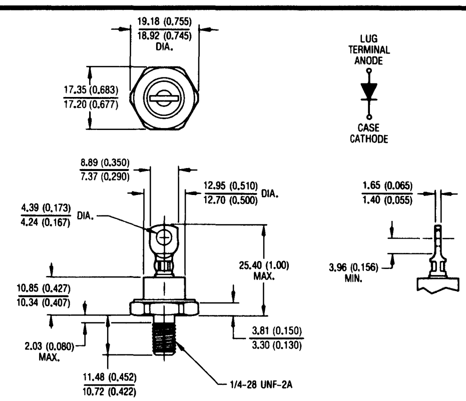
Description/Features

The 1N6392 Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging
- Military qualified versions also available

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

Part number	1N6392
V_R Max. DC Reverse Voltage (V)	45*
V_{RWM} Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

Parameters		1N6392	Units	Conditions
$I_{F(AV)}$	Max. Average Forward Current	60*	A	50% duty cycle @ T_C = 115 °C, rectangular wave form
	See Fig. 5	54*		50% duty cycle @ T_C = 115 °C, sinusoidal wave form
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current See Fig. 7	9000	A	5μs Sine or 3μs Rect. pulse. Following any rated load condition and with rated V_{RRM} applied
		1000*		60Hz half cycle sine wave or 5ms rectangular pulse
E_{AS}	Non-Repetitive Avalanche Energy	101	mJ	T_J = 25 °C, I_{AS} = 15 Amps, L = 0.9 mH
I_{AR}	Repetitive Avalanche Current	15	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical

Electrical Specifications

Parameters		1N6392	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.47*	V	@ 10A	T_J = 25 °C
	See Fig. 1	0.68*	V	@ 60A	
		0.82*	V	@ 120A	
		0.59*	V	@ 10A	T_J = - 55 °C
I_{RM}	Max. Reverse Leakage Current (1)	20*	mA	T_J = 25 °C	V_R = rated V_R
	See Fig. 2	60*	mA	T_J = 125 °C	
		600*	mA	T_J = 175°C	
C_T	Max. Junction Capacitance	3000	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

Parameters			1N6392	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175*	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175*	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		1.0*	°C/W	DC operation See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.25*	°C/W	Mounting surface, smooth and greased
R_{thCA}	Max. Thermal Resistance, Case to		7.0*	°C/W	R_{thCA} is the value for which device blocking stability with rated V_R or V_{RWM} applied assured, when T_A = 25°C and T_C = 148°C (DC) or T_C = 163°C (AC operation)
wt	Approximate Weight		15.6(0.55)	g (oz.)	
T	Mounting Torque	Min.	2.26 (20)	N-m	Non-lubricated threads
		Max.	3.39 (30)	(lbf-in)	
	Case Style		DO-203AB(DO-5)		JEDEC

* JEDEC Registered Values

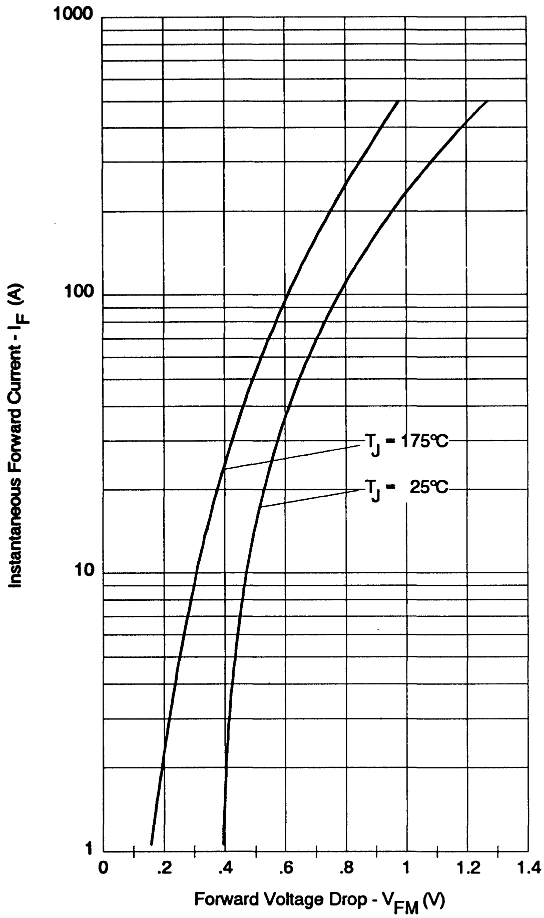


Fig. 1 - Maximum Forward Voltage Drop Characteristics

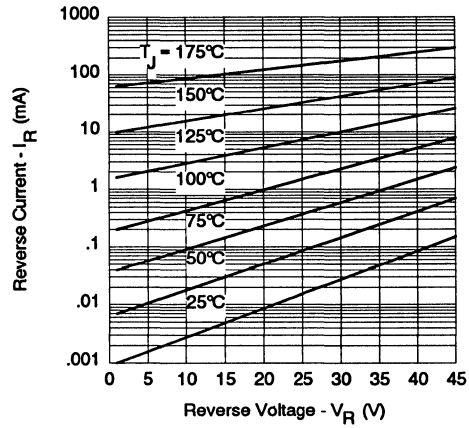


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

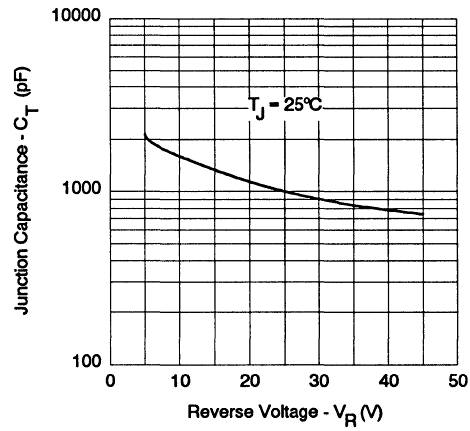


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

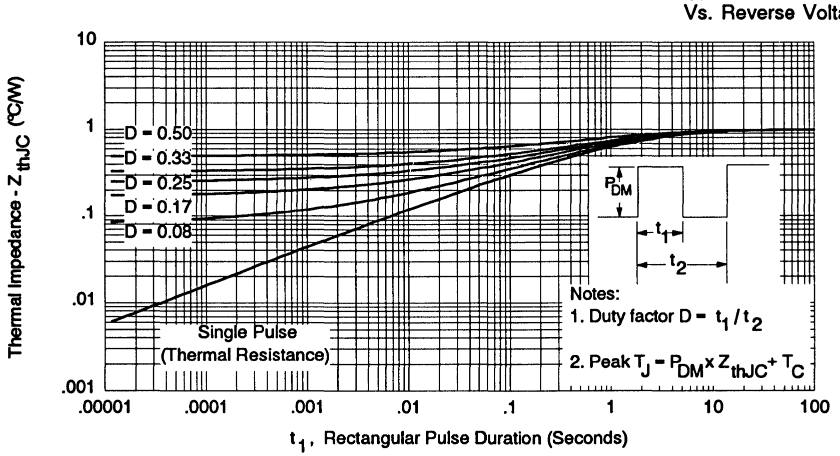


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC
TO-3, DO-4,
DO-5

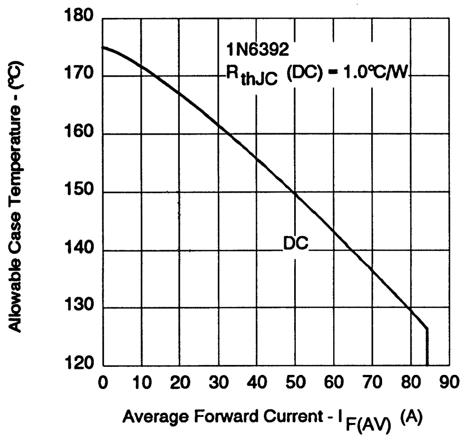


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

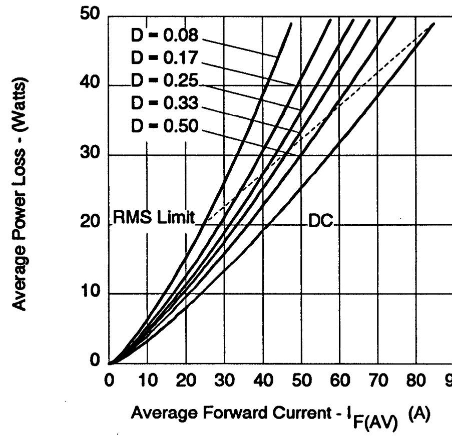


Fig. 6 - Forward Power Loss Characteristics

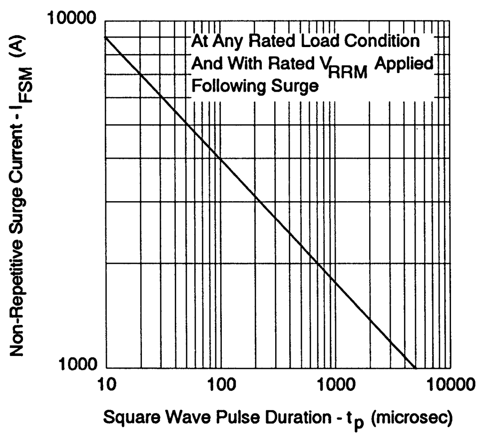


Fig. 7 - Maximum Non-Repetitive Surge Current

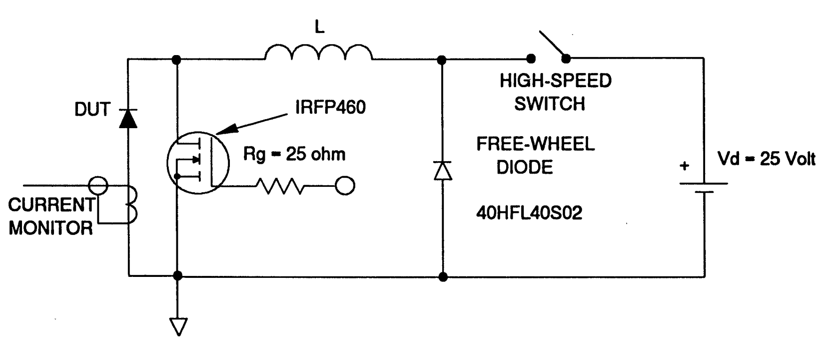


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

MBR7535
MBR7545

SCHOTTKY RECTIFIER

70 Amp

Major Ratings and Characteristics

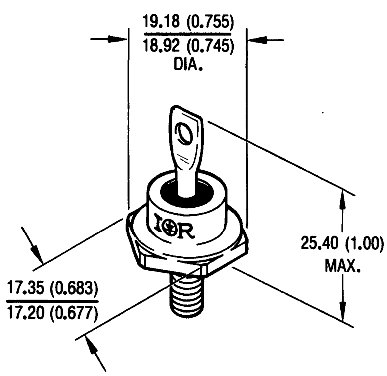
Characteristics	MBR75..	Units
$I_{F(AV)}$ Rectangular waveform	70	A
V_{RRM}	35/45	V
I_{FSM} @ 60Hz	1000	A
V_F @ 60Apk, T_J = 125°C	0.60	V
T_J	-65 to 150	°C

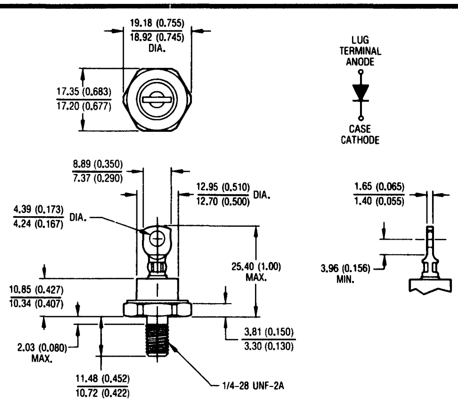
Description/Features

The MBR75.. Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	MBR7535	MBR7545
V_R	Max. DC Reverse Voltage (V)	35	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	MBR75..	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current	70	A	@ T_C = 90 °C, (Rated V_R)	
I_{FSM}	Non-Repetitive Peak Surge Current	9000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1000		Surge applied at rated load condition halfwave single phase 60Hz	

Electrical Specifications

	Parameters	MBR75..	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.60	V	@ 60A	T_J = 125 °C
		0.90	V	@ 220A	
I_{RM}	Max. Instantaneus Reverse Current (1)	150	mA	T_J = 125 °C	Rated DC voltage
C_T	Max. Junction Capacitance	4000	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	MBR75..	Units	Conditions
T_J	Max. Junction Temperature Range	-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	0.83	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	15 (0.53)	g (oz.)	
T	Mounting Torque Min.	23 (20)	Kg-cm (lbf-in)	
	Max.	46 (40)		
	Case Style	DO-203AB (DO-5)		JEDEC

* For Additional Informations and Graphs, Please See the 75HQ Series

International
IOR Rectifier

SD51

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	SD51...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	35/45	V
I_{FSM} @ 60Hz	800	A
V_F @ 120Apk, T_J=150°C	0.75	V
T_J	-65 to 150	°C

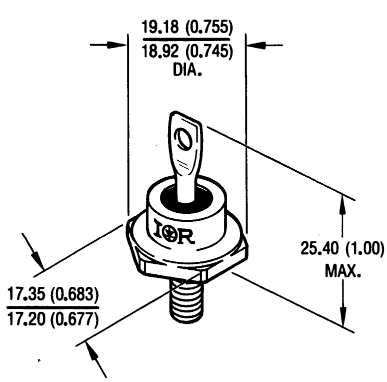
Description/Features

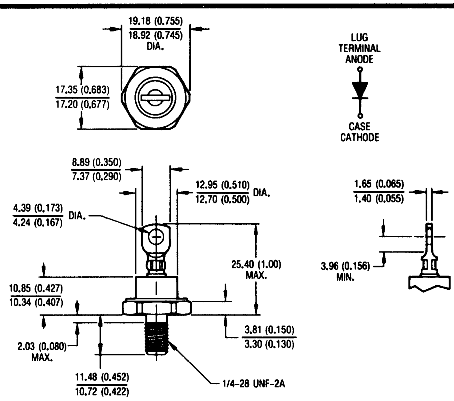
The SD51 Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Hermetic packaging

HERMETIC
TO-3, DO-4,
DO-5

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline DO-203AB (DO-5)

Dimensions in millimeters and inches

Voltage Ratings

	Part number	SD51
V_R	Max. DC Reverse Voltage (V)	35/45 (1)
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

(1) For SD51 V_{RWM} and V_{RRM} = 45V @ T_J = 25°C , =35V @ T_J = 150°C

Absolute Maximum Ratings

	Parameters	SD51	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 90°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	800	A	60Hz half cycle sine wave or 5ms rectangular pulse	Following any rated load condition and with rated V_{RRM} applied

Electrical Specifications

	Parameters	SD51	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (2) * See Fig. 1	0.58	V	@ 35A	T_J = 25 °C
		0.66	V	@ 60A	
		0.86	V	@ 120A	
		0.75	V	@ 120A	T_J = 150 °C
I_{RM}	Max. Reverse Leakage Current (2) * See Fig. 2	50	mA	T_J = 25 °C	V_R = rated V_R
		200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	2900	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.5	nH	Measured from top of terminal to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	1000	V/µs		

(2) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters	SD51	Units	Conditions
T_J	Max. Junction Temperature Range	-65 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-65 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case	1.0	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.25	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	15 (0.53)	g (oz.)	
T	Mounting Torque Min.	23 (20)	Kg-cm (lbf-in)	Non-lubricated threads
	Max.	46 (40)		
	Case Style	DO-203AB(DO-5)		JEDEC

* For Additional Informations and Graphs, Please See the 50HQ Series

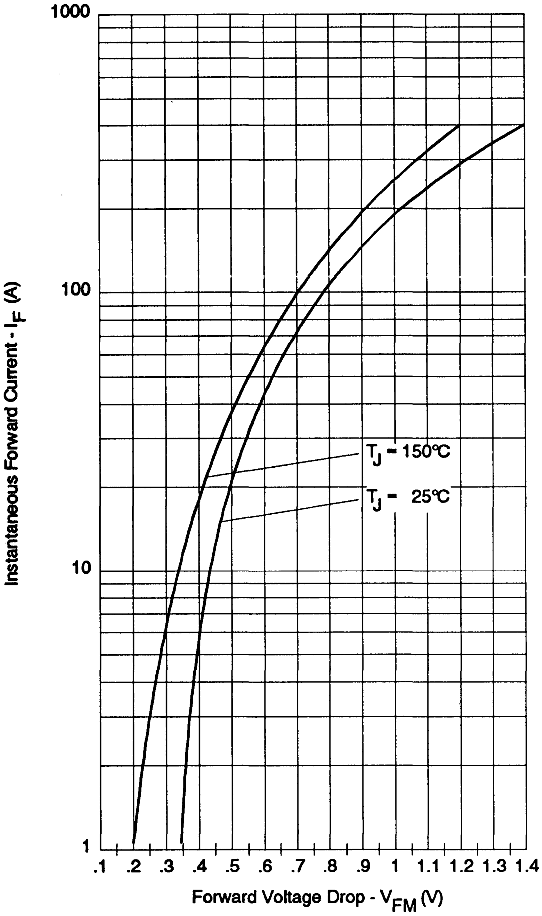


Fig. 1 - Maximum Forward Voltage Drop Characteristics

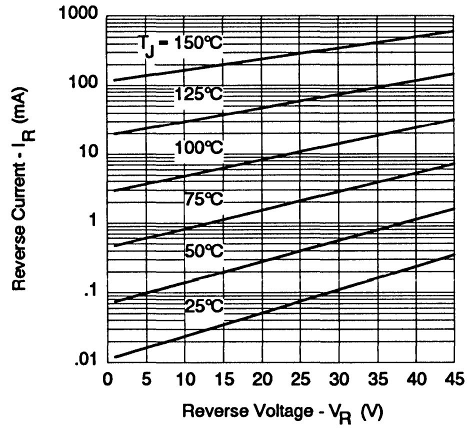


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

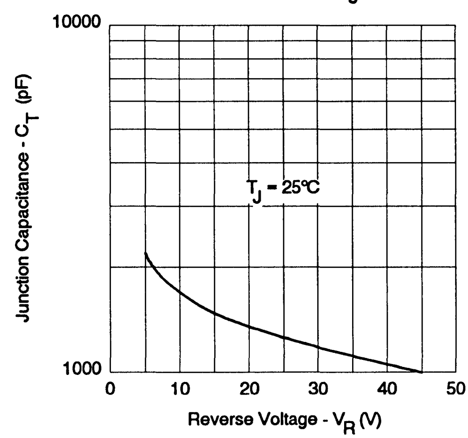


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

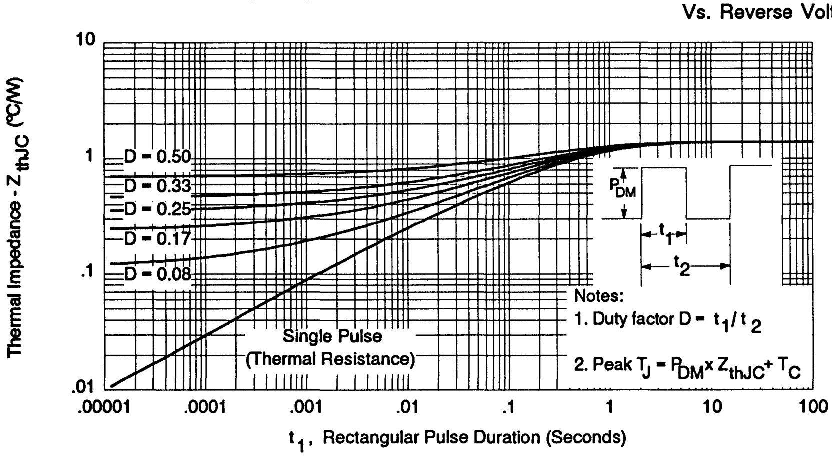


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HERMETIC
TO-3, DO-4,
DO-5

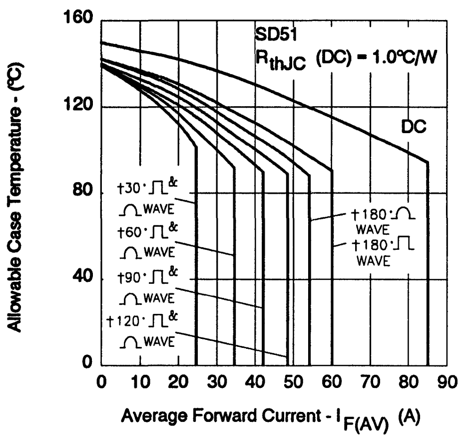


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

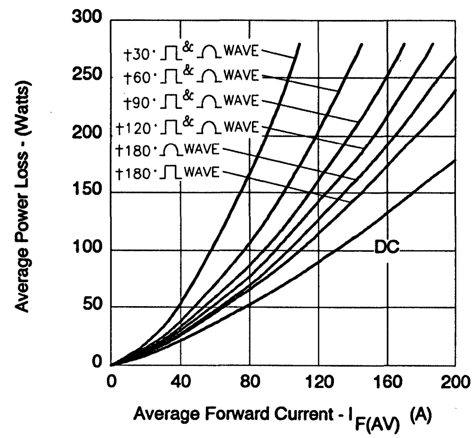


Fig. 6 - Forward Power Loss Characteristics

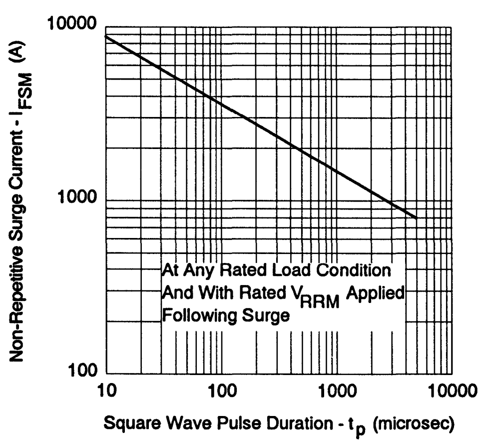


Fig. 7 - Max. Non-Repetitive Surge Current

International IOR Rectifier

60CNQ... SERIES

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	60CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	6300	A
V_F @ 30 Apk, T_J = 125°C (per leg)	0.44	V
T_J	-55 to 150	°C

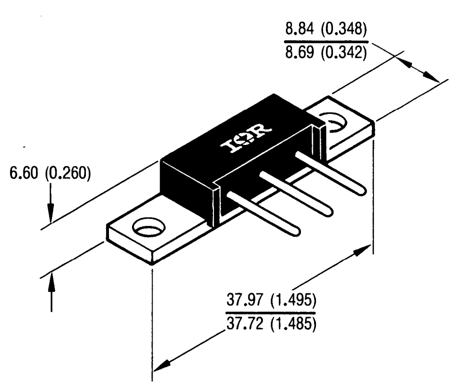
Description/Features

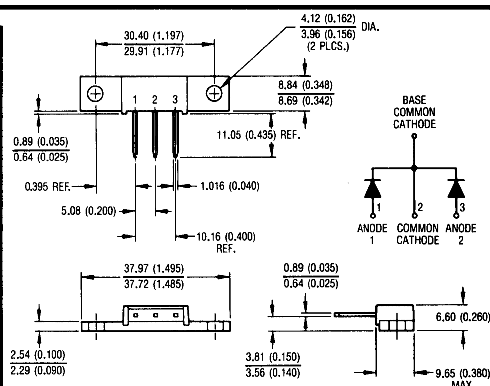
The 60CNQ center tap Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap module
- Very low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Outline D - 61 - 6

Dimensions in millimeters and inches

Voltage Ratings

Part number	60CNQ035	60CNQ040	60CNQ045
V_R Max. DC Reverse Voltage (V) V_{RWM} Max. Working Peak Reverse Voltage (V)	35	40	45

Absolute Maximum Ratings

	Parameters	60CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 116 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	6300	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		850		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	40	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 2.2 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	6	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	60CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.52	V	@ 30A	T_J = 25 °C
		0.64	V	@ 60A	
		0.44	V	@ 30A	T_J = 125 °C
		0.59	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	6.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		60CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-6		

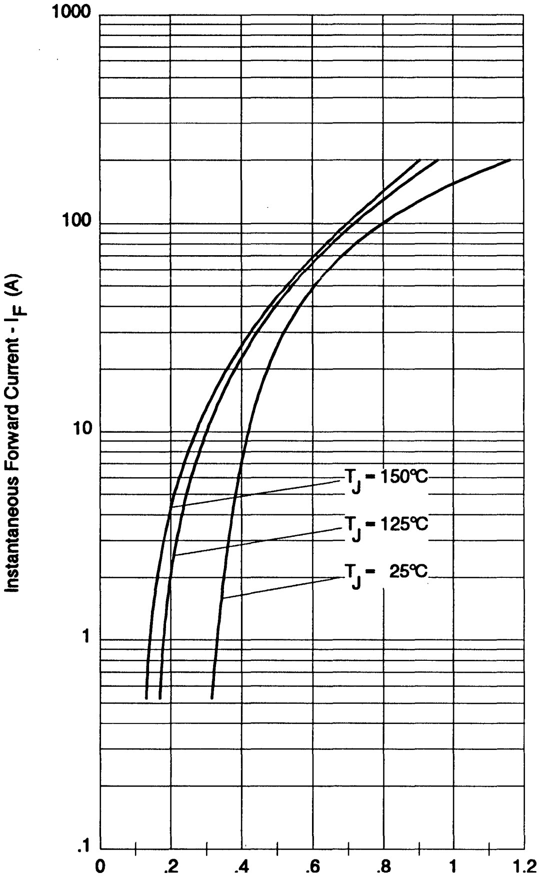


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

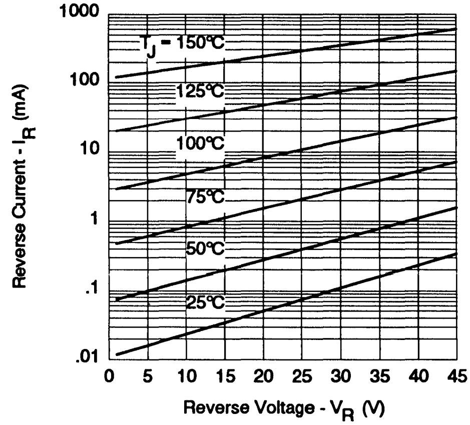


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

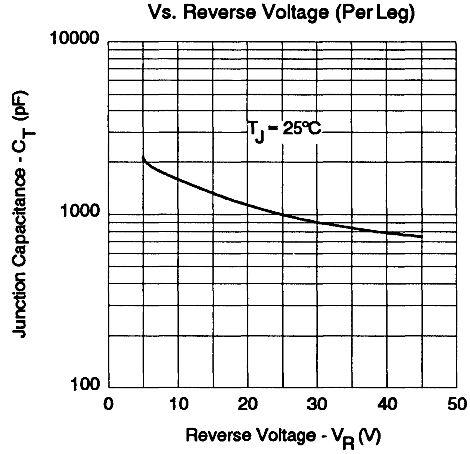


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

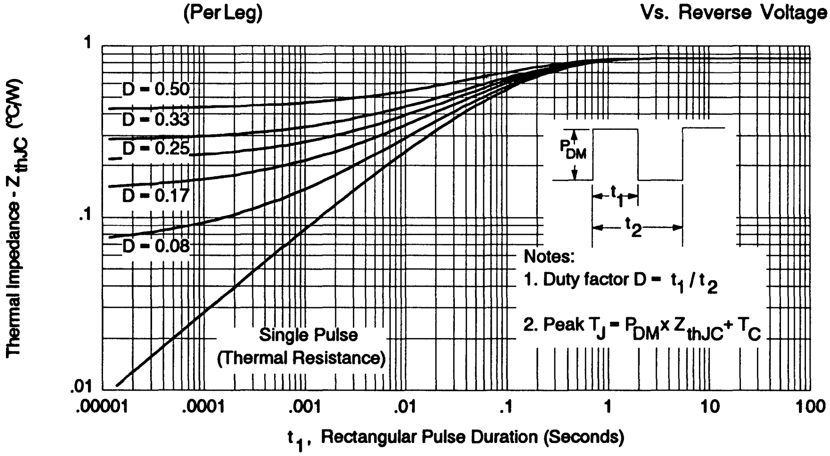


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

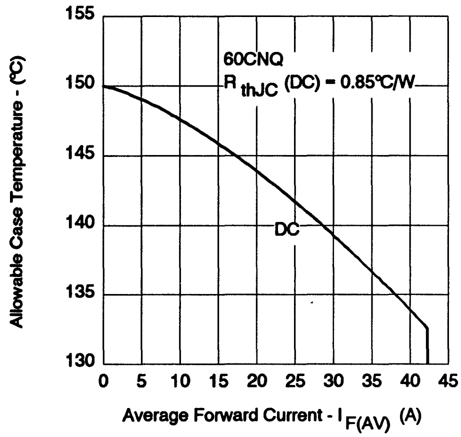


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

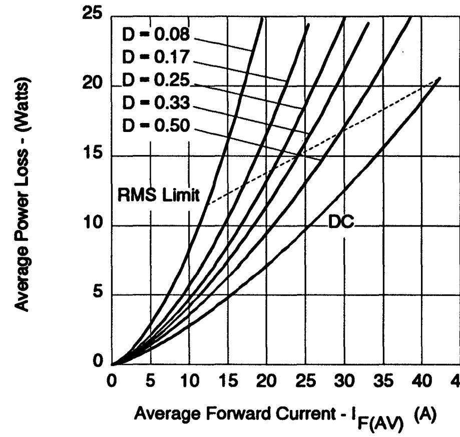


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

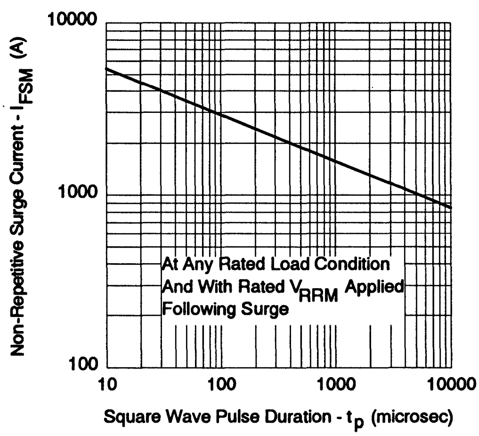


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

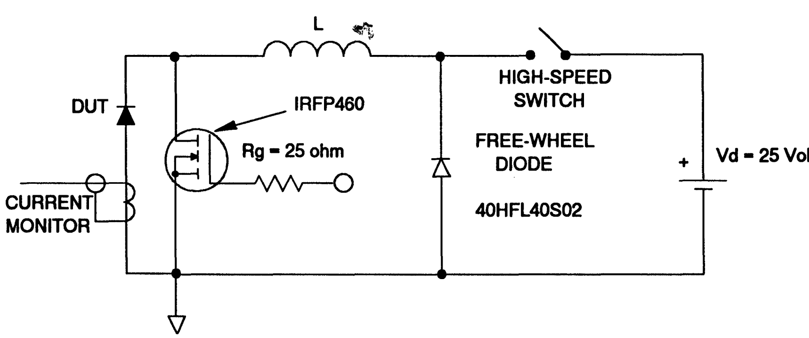


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

61CNQ... SERIES

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	61CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	6300	A
V_F @ 30 Apk, T_J = 125°C (per leg)	0.49	V
T_J	- 55 to 175	°C

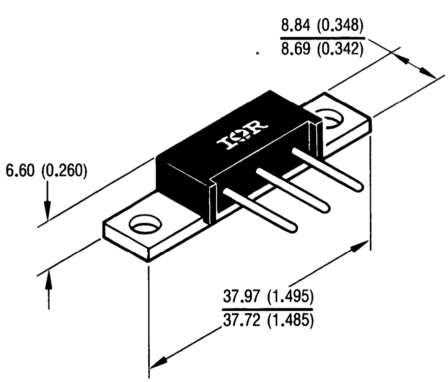
Description/Features

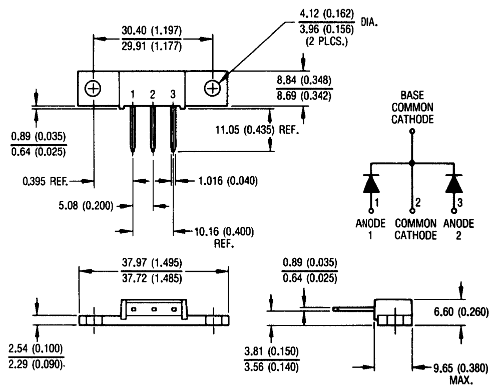
The 61CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Outline D - 61 - 6

Dimensions in millimeters and inches

Voltage Ratings

	Part number	61CNQ035	61CNQ040	61CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	61CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	60	A	50% duty cycle @ T_C = 149 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	6300	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		820		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	40	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 2.2 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	6	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	61CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.56	V	@ 30A	T_J = 25 °C
		0.68	V	@ 60A	
		0.49	V	@ 30A	T_J = 125 °C
		0.60	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	6.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		61CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-6		

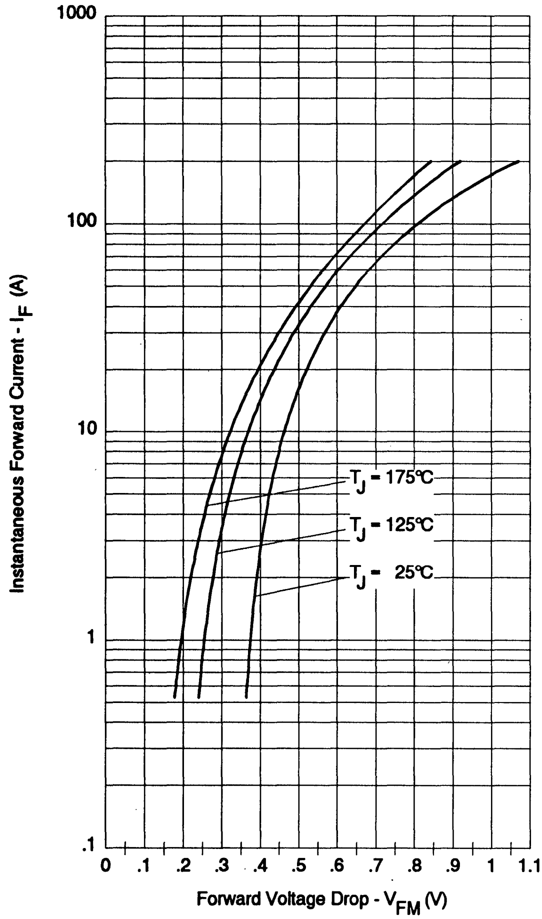


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

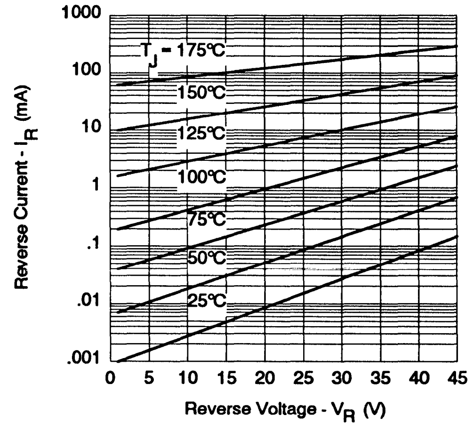


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

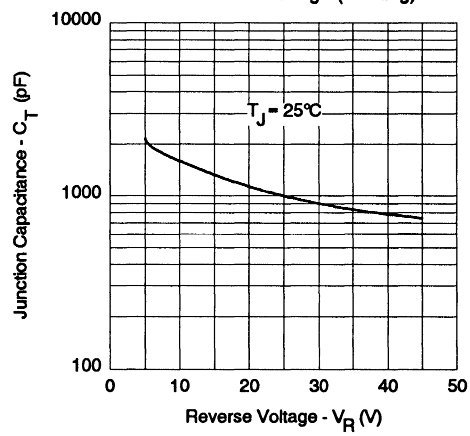


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

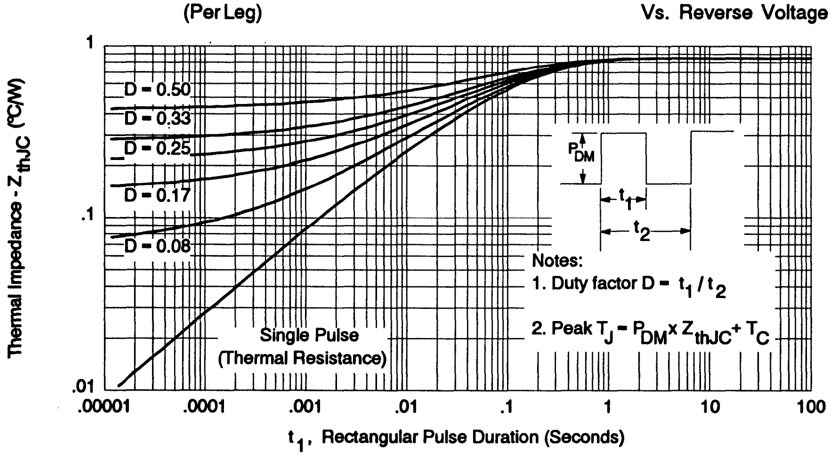


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

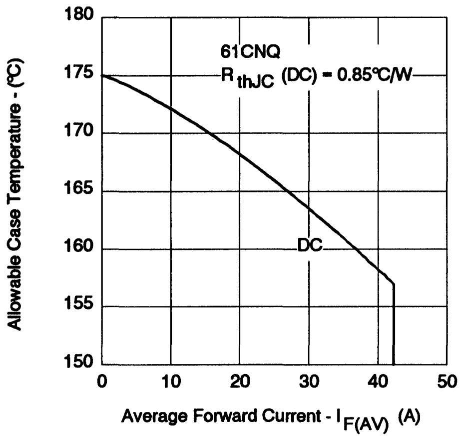


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

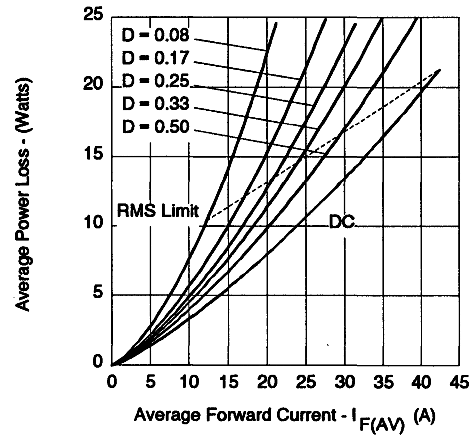


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

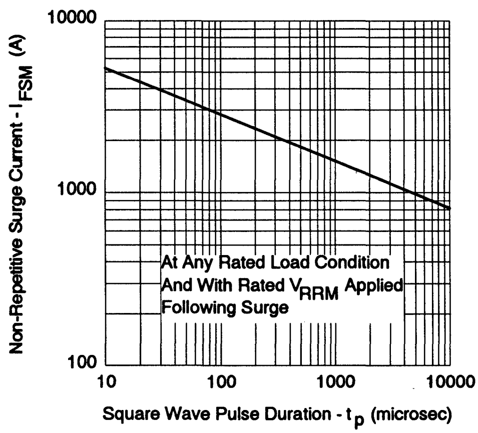


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

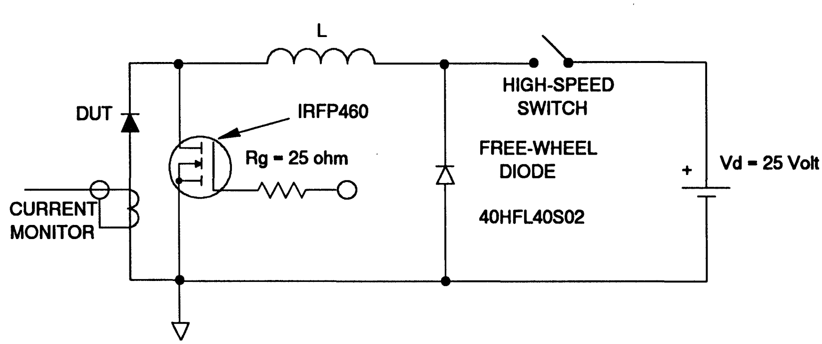


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

62CNQ030

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

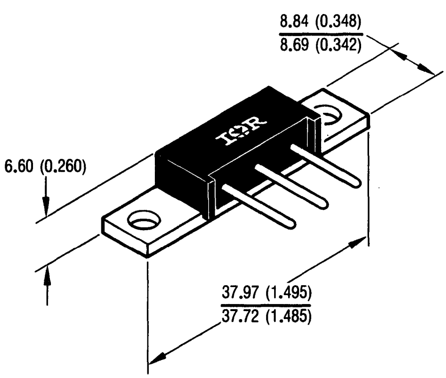
Characteristics	62CNQ030	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	4600	A
V_F @ 30 Apk, T_J = 125°C (per leg)	0.35	V
T_J	-55 to 150	°C

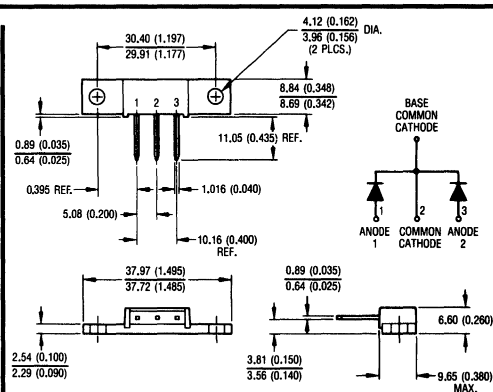
Description/Features

The 62CNQ030 center tap Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150 °C T_J operation
- Center tap module
- Very low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

CASE STYLE AND DIMENSIONS





Outline D - 61 - 6

Dimensions in millimeters and inches

LOW PROFILE MODULES

Voltage Ratings

	Part number	62CNQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	62CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	60	A	50% duty cycle @ T_C = 135 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	4600	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		780		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	27	mJ	T_J = 25 °C, I_{AS} = 6 Amps, L = 1.5 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	6	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	62CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.46	V	@ 30A	T_J = 25 °C
		0.53	V	@ 60A	
		0.35	V	@ 30A	T_J = 125 °C
		0.44	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		280	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	3700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	6.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	62CNQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)	0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)	0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	7.8 (0.28)	g (oz.)	
T	Mounting Torque Min.	40 (35)	Kg-cm (lbf-in)	
	Max.	58 (50)		
	Case Style	D-61-6		

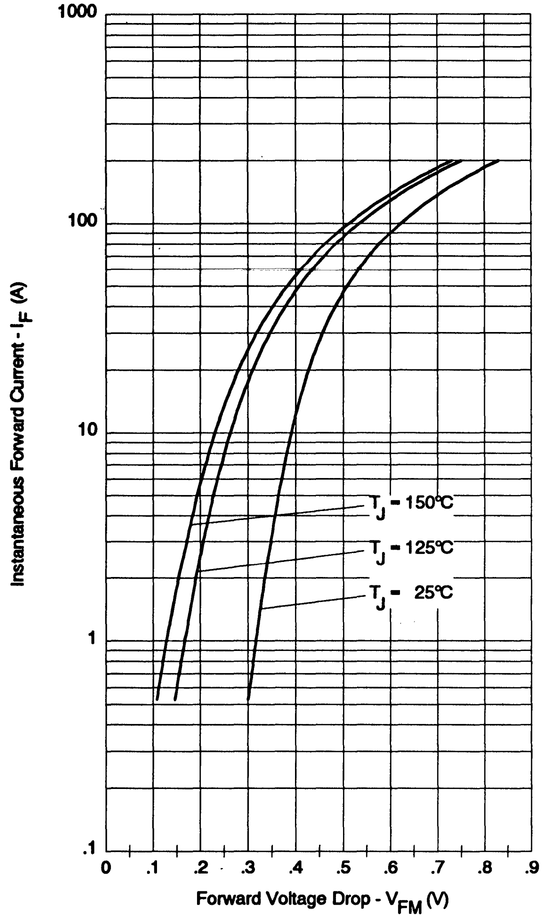


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

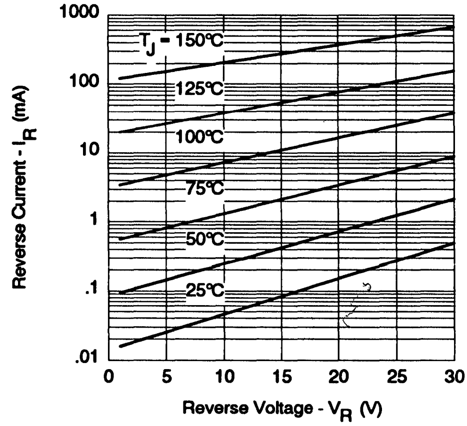


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

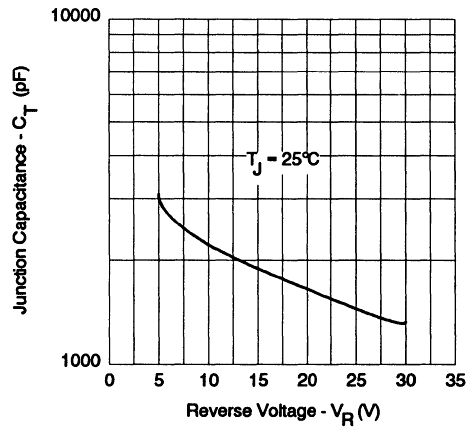


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

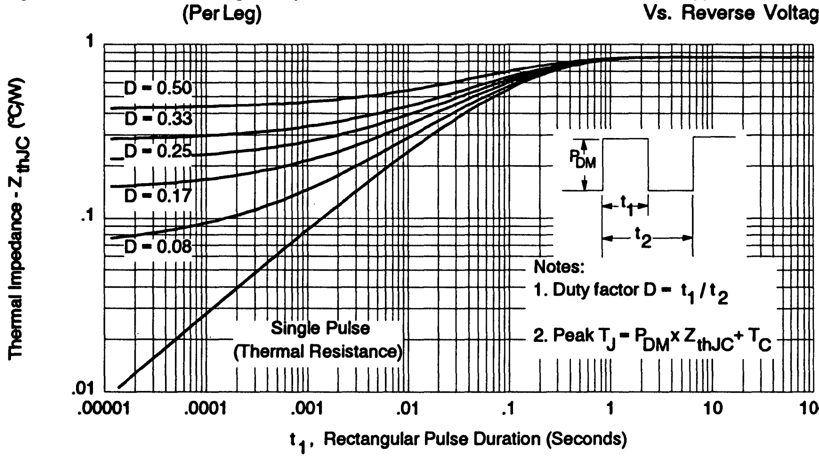


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

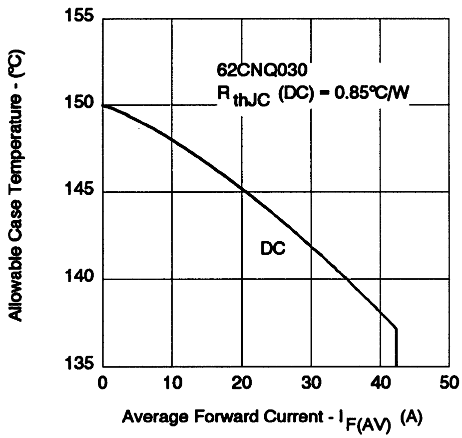


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

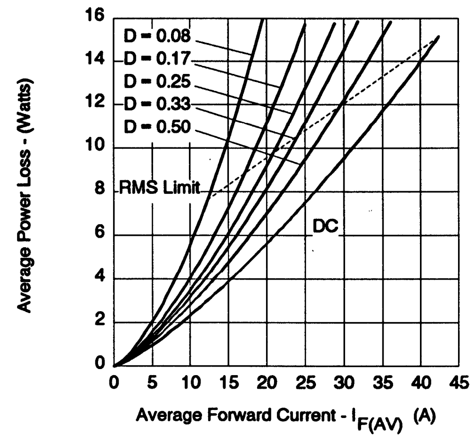


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

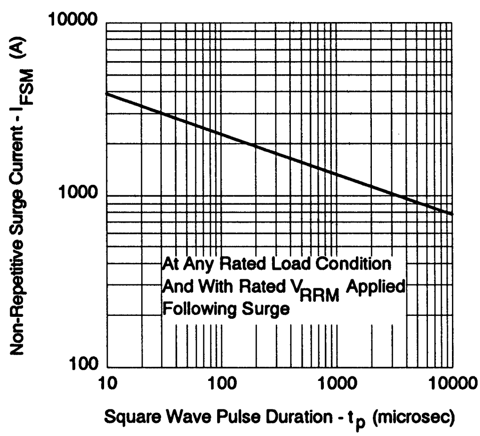


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

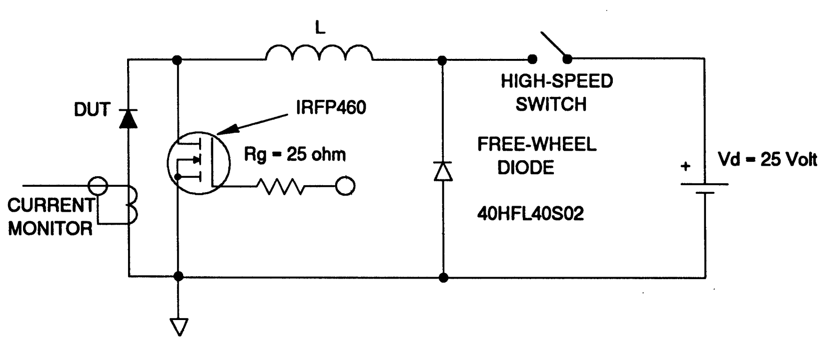


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

63CNQ... SERIES

SCHOTTKY RECTIFIER

60 Amp

Major Ratings and Characteristics

Characteristics	63CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	60	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	8200	A
V_F @ 30 Apk, T_J = 125°C (per leg)	0.64	V
T_J	- 55 to 175	°C

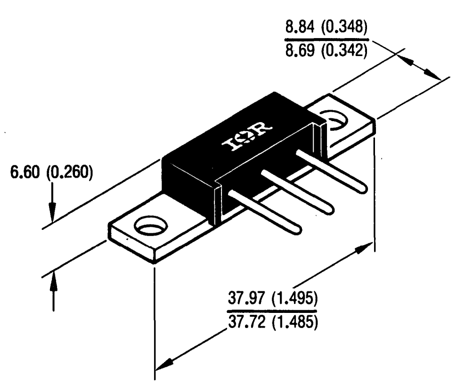
Description/Features

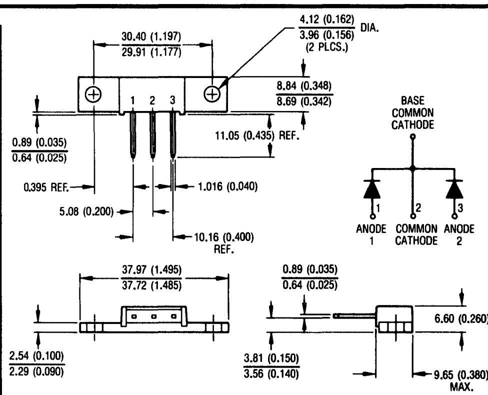
The 63CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Outline D - 61 - 6

Dimensions in millimeters and inches

Voltage Ratings

	Part number	63CNQ080	63CNQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	63CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	60	A	50% duty cycle @ T_C = 155 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) *See Fig. 7	8200	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		620		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	63CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.77	V	@ 30A	T_J = 25 °C
		0.93	V	@ 60A	
		0.64	V	@ 30A	T_J = 125 °C
		0.76	V	@ 60A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.5	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	6.0	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		63CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation *See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-6		

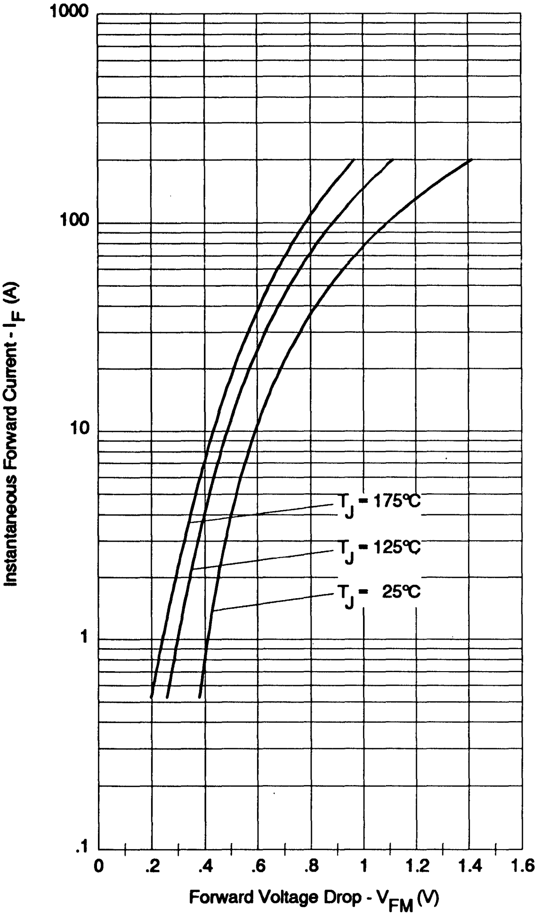


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

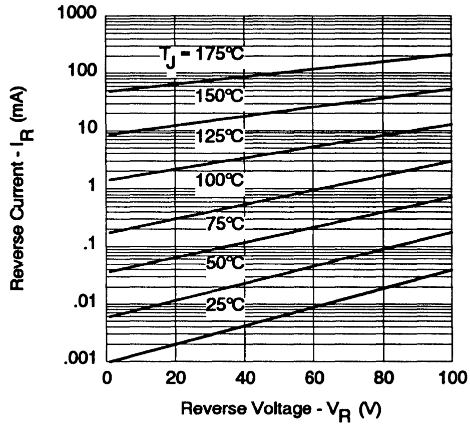


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

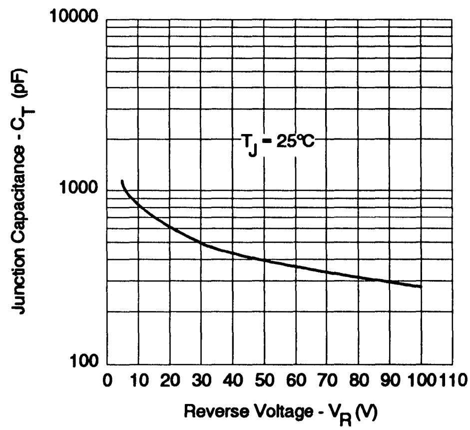


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

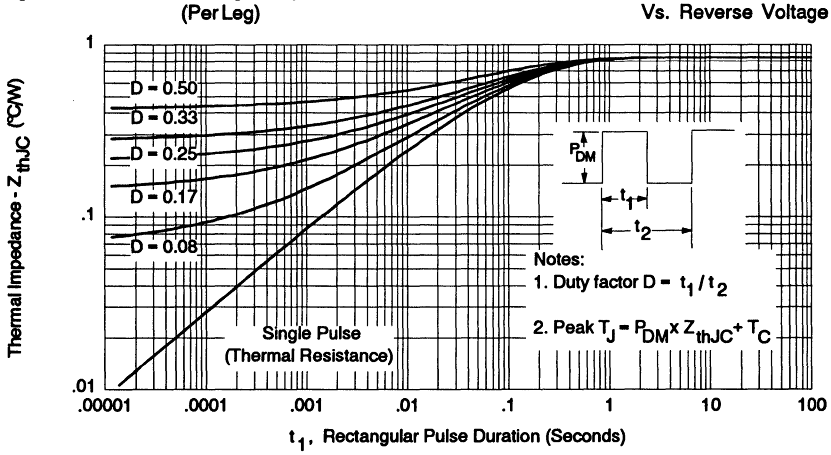


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

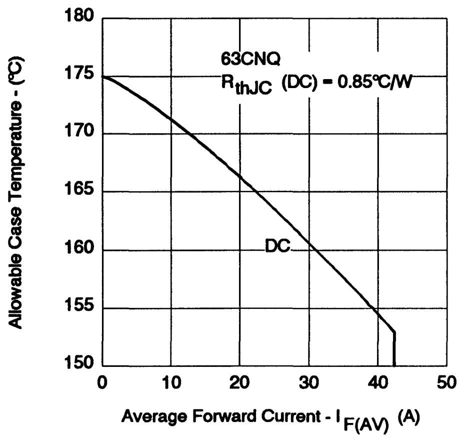


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

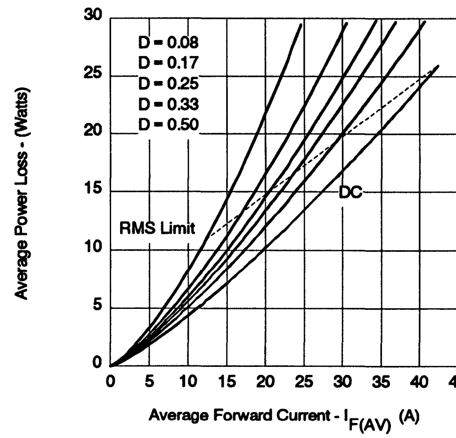


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

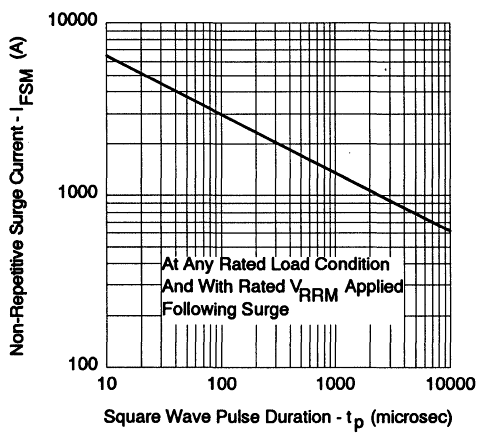


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

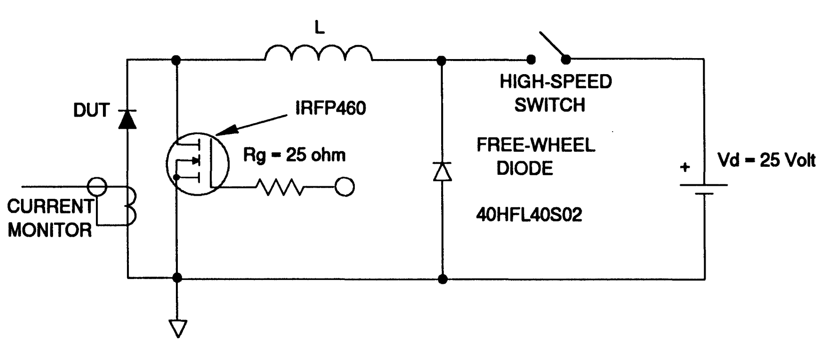


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

80CNQ... SERIES

SCHOTTKY RECTIFIER

80 Amp

Major Ratings and Characteristics

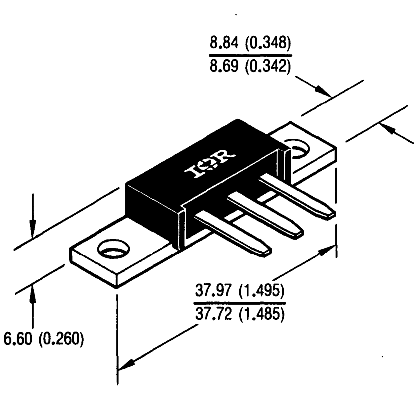
Characteristics	80CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	80	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	5800	A
V_F @ 40 Apk, T_J = 125°C (per leg)	0.47	V
T_J	-55 to 150	°C

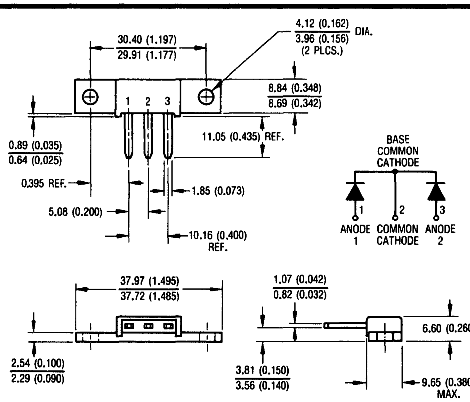
Description/Features

The 80CNQ center tap Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Center tap module
- Very low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

CASE STYLE AND DIMENSIONS





Outline D-61-8
Dimensions in millimeters and (inches)

LOW PROFILE MODULES

Voltage Ratings

	Part number	80CNQ035	80CNQ040	80CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	80CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	80	A	50% duty cycle @ T_C = 109 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	5800	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		750		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	54	mJ	T_J = 25 °C, I_{AS} = 8 Amps, L = 1.7 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	8	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	80CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.52	V	@ 40A	T_J = 25 °C
		0.66	V	@ 80A	
		0.47	V	@ 40A	T_J = 125 °C
		0.61	V	@ 80A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		80CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-8		

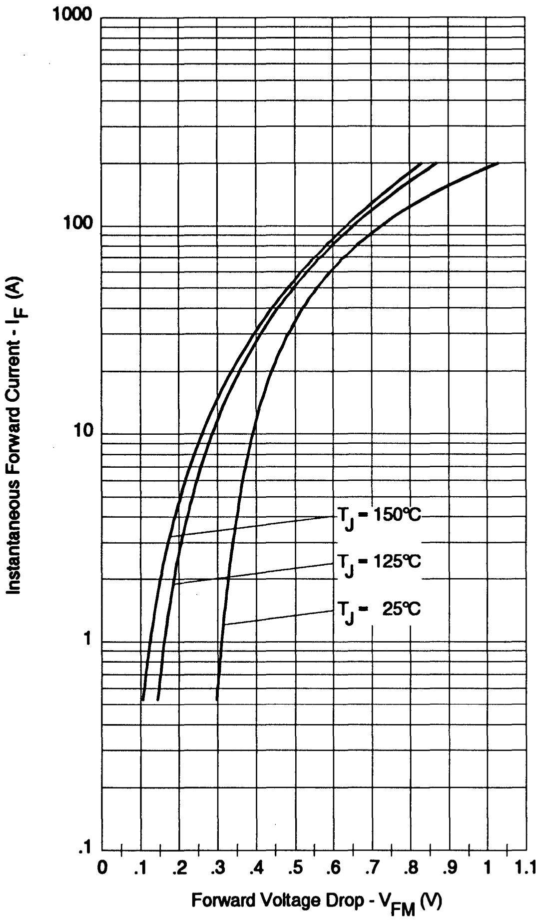


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

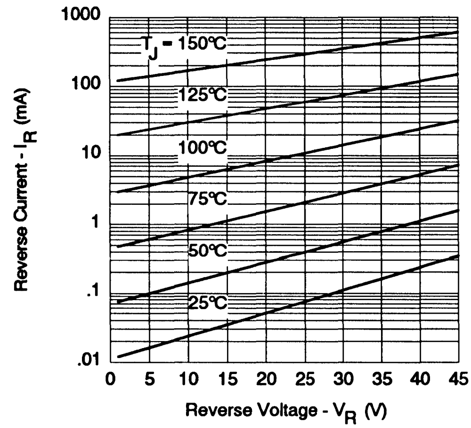


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

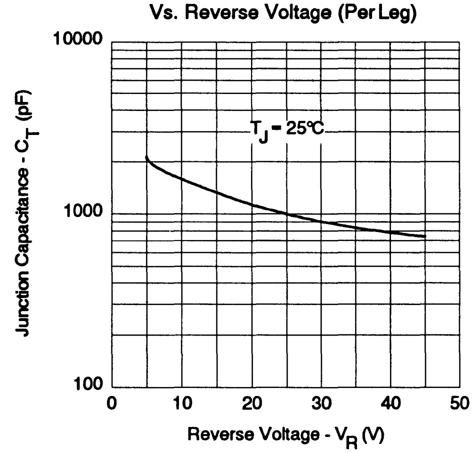


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

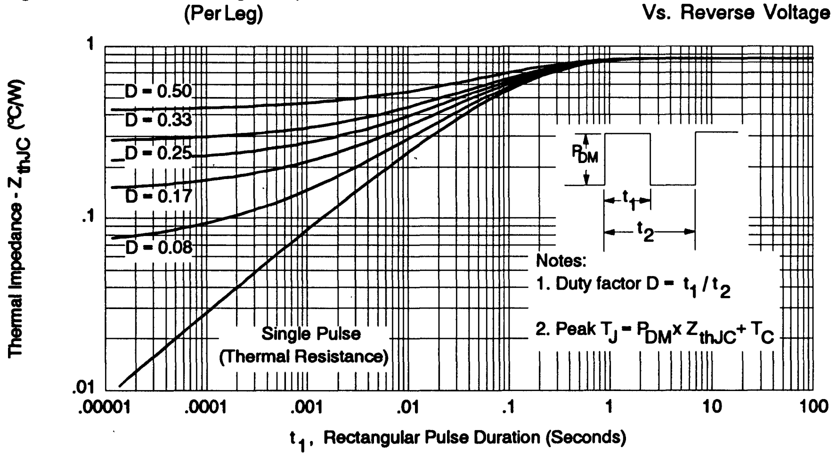


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

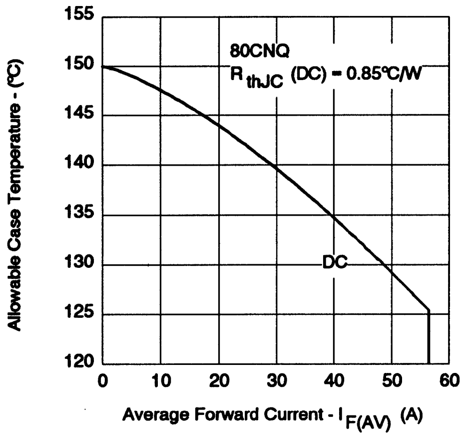


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

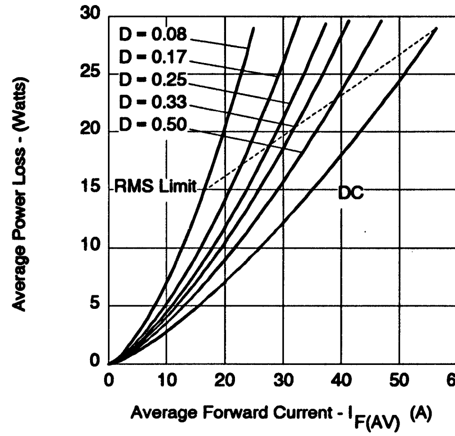


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

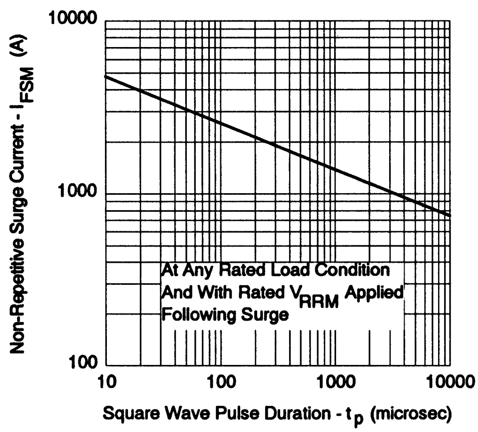


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

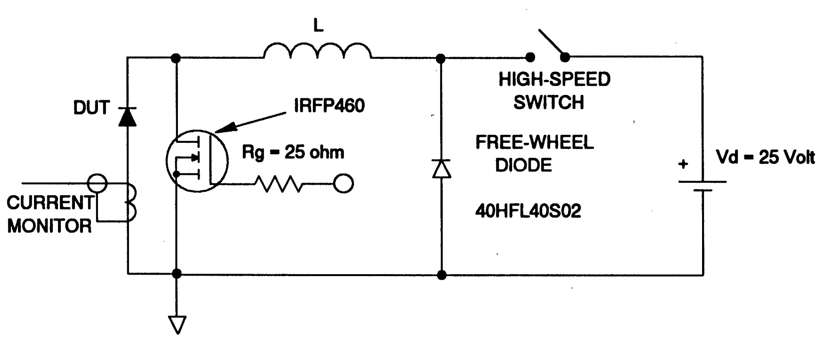


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

81CNQ... SERIES

SCHOTTKY RECTIFIER

80 Amp

Major Ratings and Characteristics

Characteristics	81CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	80	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	4600	A
V_F @ 40 Apk, T_J = 125°C (per leg)	0.54	V
T_J	-55 to 175	°C

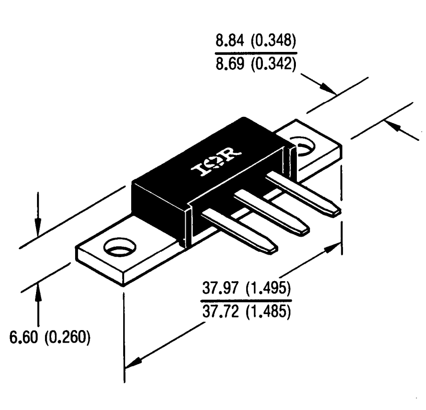
Description/Features

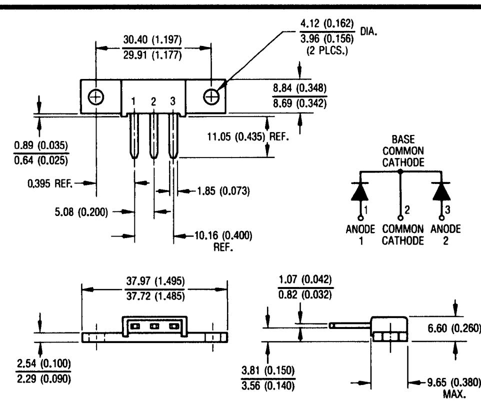
The 81CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Outline D-61-8
Dimensions in millimeters and (inches)

Voltage Ratings

	Part number	81CNQ035	81CNQ040	81CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	81CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	80	A	50% duty cycle @ T_C = 141 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	4600	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		790		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	54	mJ	T_J = 25 °C, I_{AS} = 8 Amps, L = 1.7 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	8	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	81CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.60	V	@ 40A	T_J = 25 °C
		0.74	V	@ 80A	
		0.54	V	@ 40A	T_J = 125 °C
		0.66	V	@ 80A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = $5V_{DC}$, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		81CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-8		

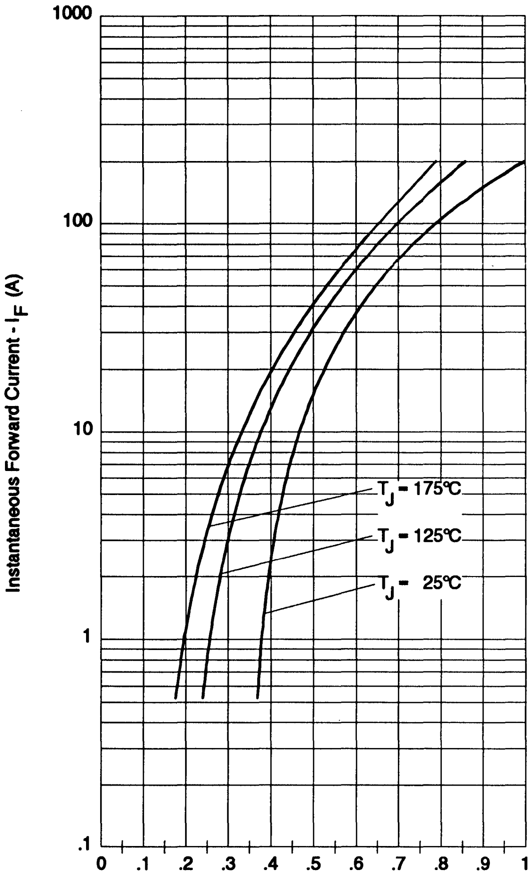


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

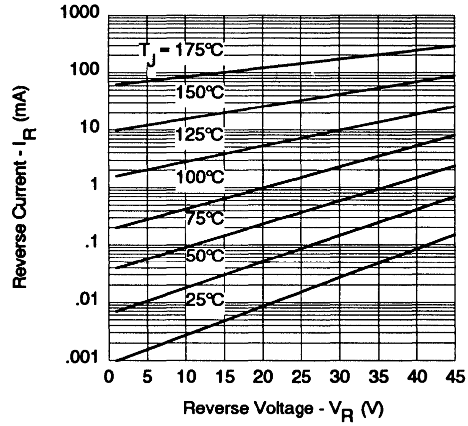


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

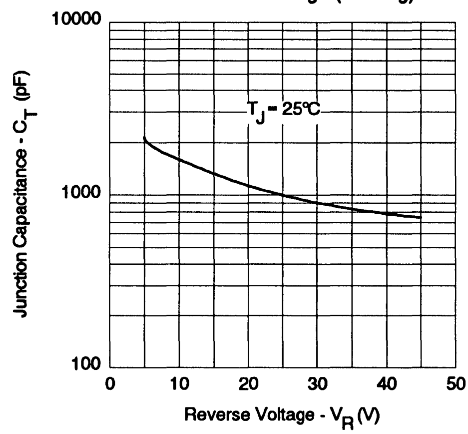


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

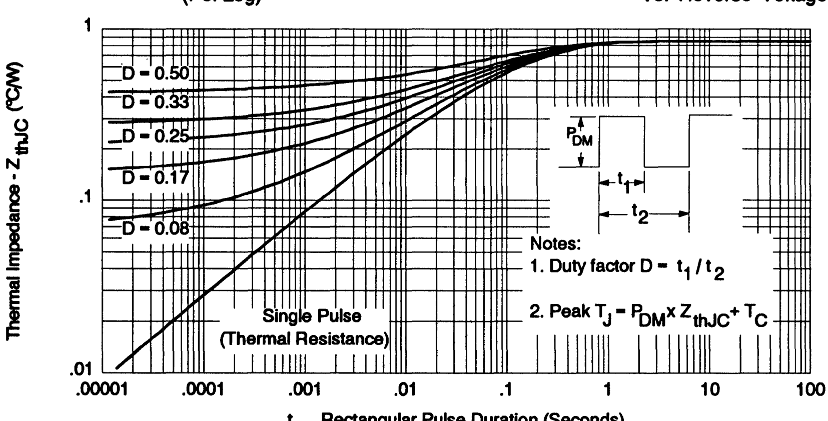


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

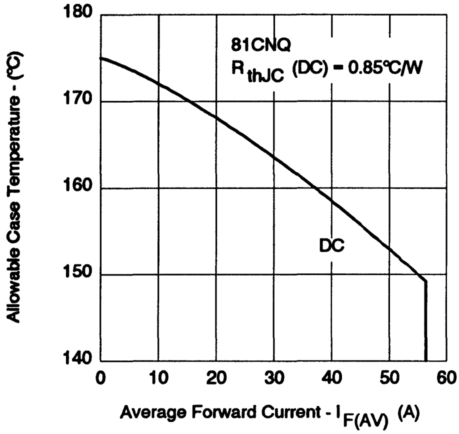


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

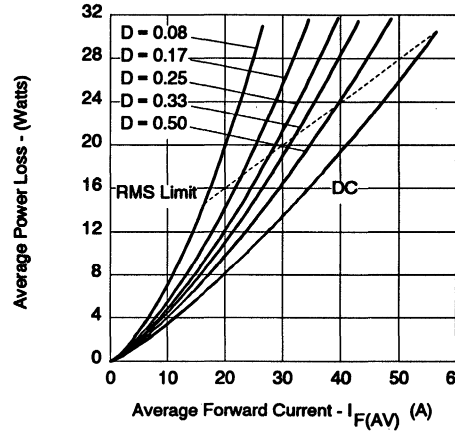


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

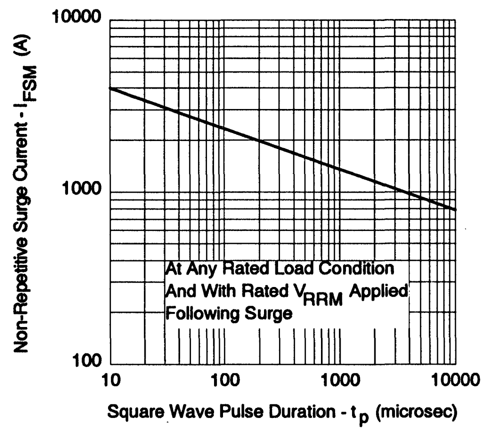


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

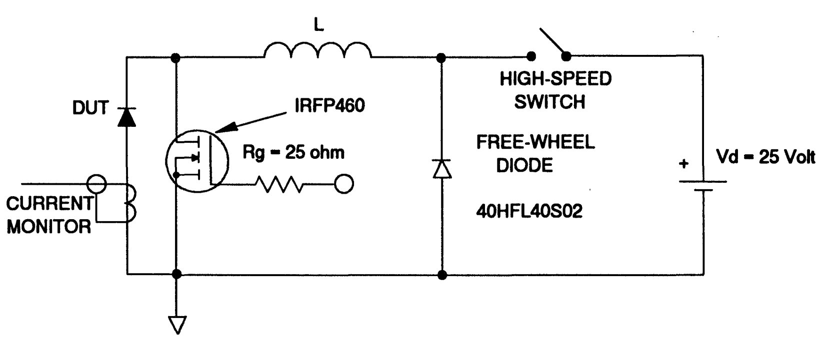


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

82CNQ030

SCHOTTKY RECTIFIER

80 Amp

Major Ratings and Characteristics

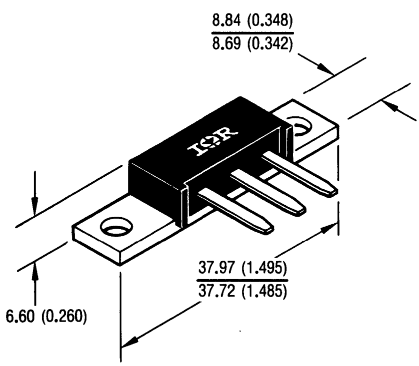
Characteristics	82CNQ030	Units
$I_{F(AV)}$ Rectangular waveform	80	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	5100	A
V_F @ 40 Apk, T_J = 125°C (per leg)	0.37	V
T_J	- 55 to 150	°C

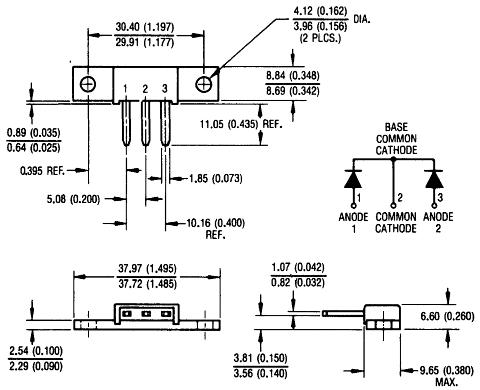
Description/Features

The 82CNQ030 center tap Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150 °C T_J operation
- Center tap module
- Very low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

CASE STYLE AND DIMENSIONS





Outline D - 61 - 8

Dimensions in millimeters and inches

LOW PROFILE MODULES

Voltage Ratings

	Part number	82CNQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	82CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	80	A	50% duty cycle @ T_C = 119 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	5100	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		880		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	36	mJ	T_J = 25 °C, I_{AS} = 8 Amps, L = 1.12 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	8	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	82CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.47	V	@ 40A	T_J = 25 °C
		0.55	V	@ 80A	
		0.37	V	@ 40A	T_J = 125 °C
		0.47	V	@ 80A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		280	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	3700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	82CNQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)	0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)	0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	7.8 (0.28)	g (oz.)	
T	Mounting Torque Min.	40 (35)	Kg-cm (lbf-in)	
	Max.	58 (50)		
	Case Style	D-61-8		

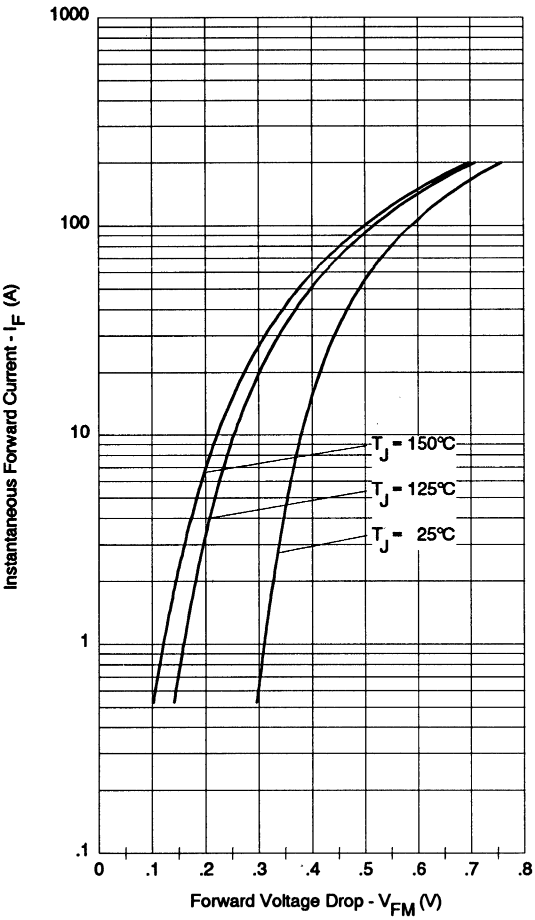


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

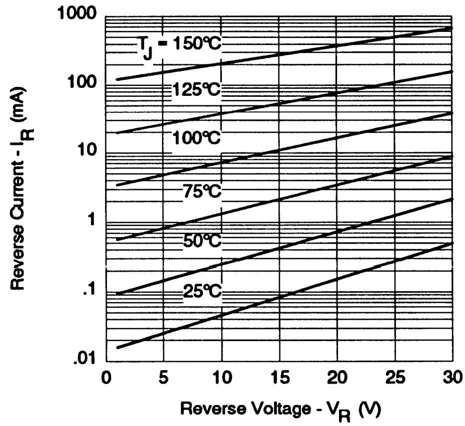


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

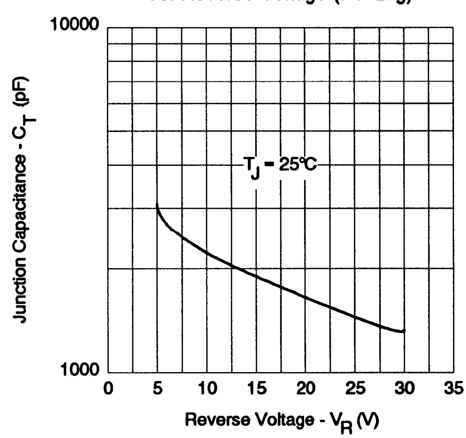


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

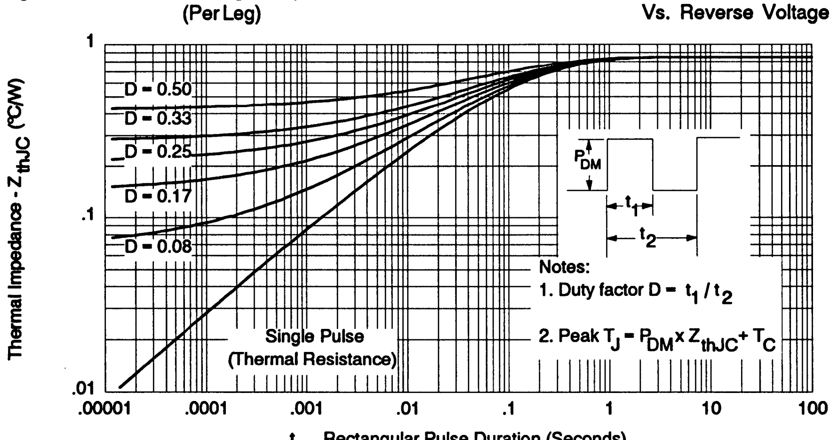


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

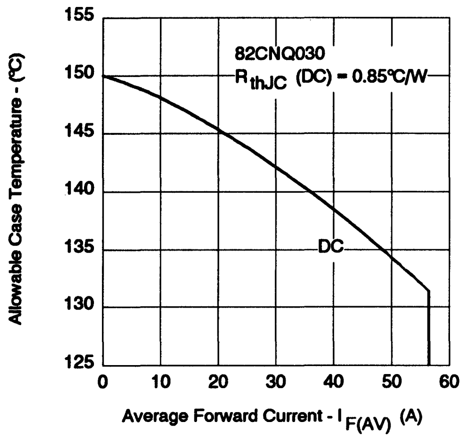


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

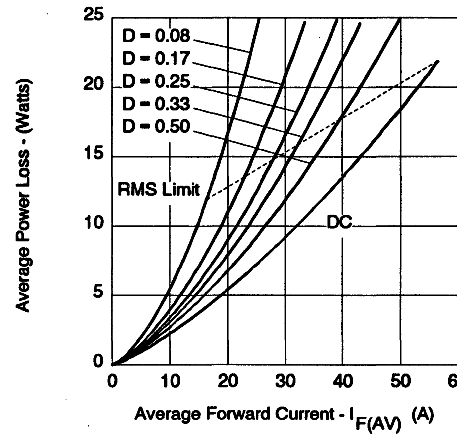


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

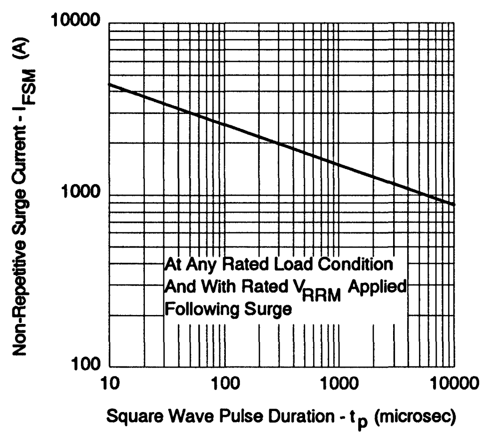


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

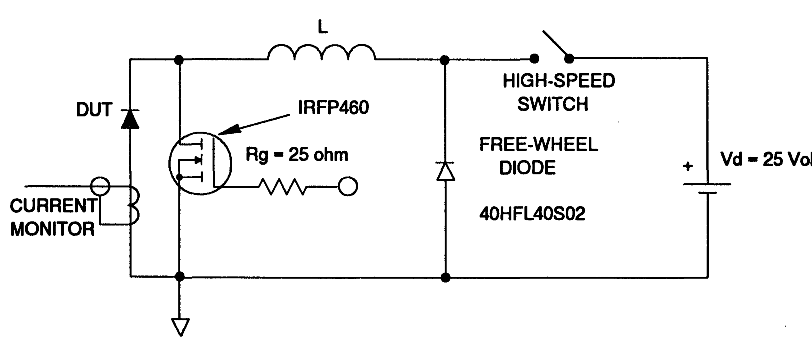


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

83CNQ... SERIES

SCHOTTKY RECTIFIER

80 Amp

Major Ratings and Characteristics

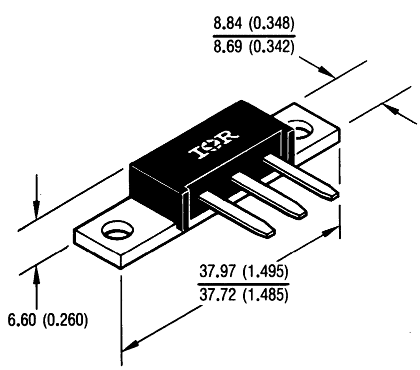
Characteristics	83CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	80	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	7000	A
V_F @ 40 Apk, T_J = 125°C (per leg)	0.67	V
T_J	- 55 to 175	°C

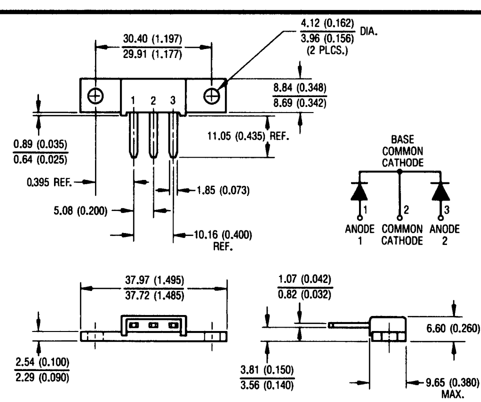
Description/Features

The 83CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

CASE STYLE AND DIMENSIONS





Outline D-61-8

Dimensions in millimeters and (inches)

Voltage Ratings

Part number	83CNQ080	83CNQ100
V_R Max. DC Reverse Voltage (V)	80	100
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	83CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	80	A	50% duty cycle @ T_C = 132 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	7000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		720		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	83CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.81	V	@ 40A	T_J = 25 °C
		1.00	V	@ 80A	
		0.67	V	@ 40A	T_J = 125 °C
		0.82	V	@ 80A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.5	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		83CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-8		

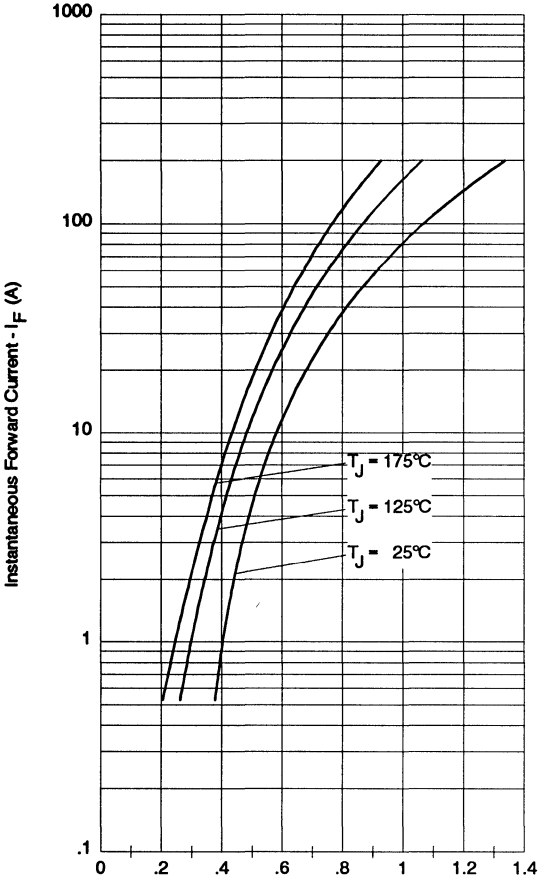


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

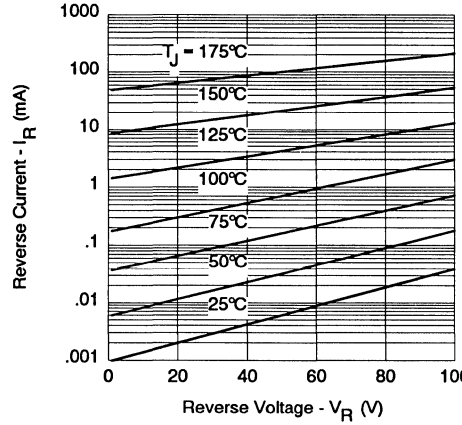


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

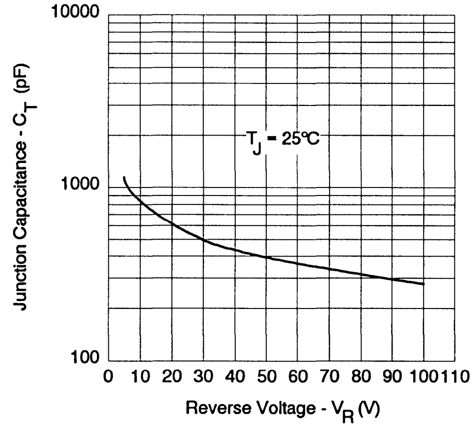


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

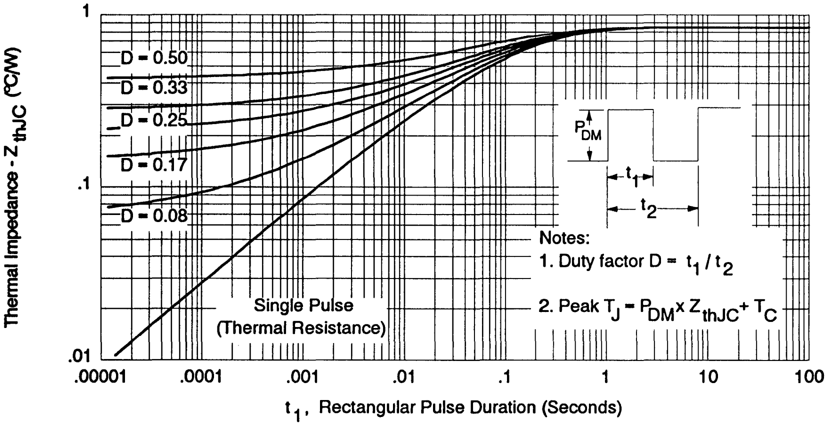


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

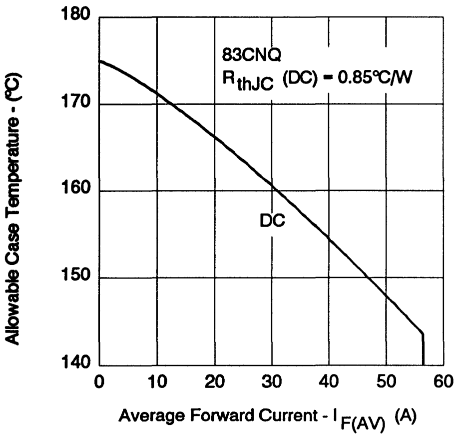


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

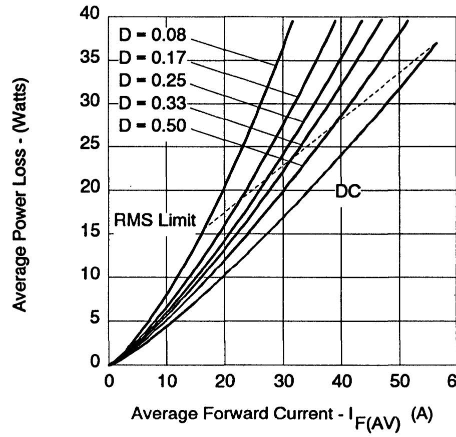


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

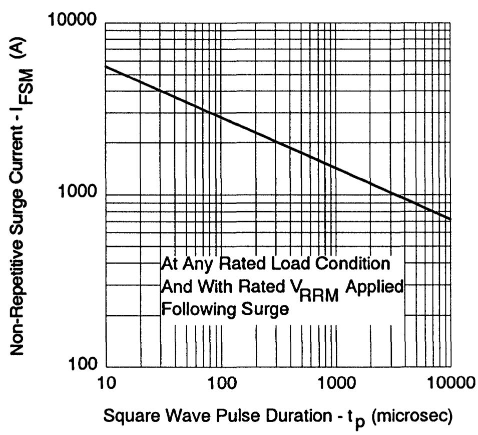


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

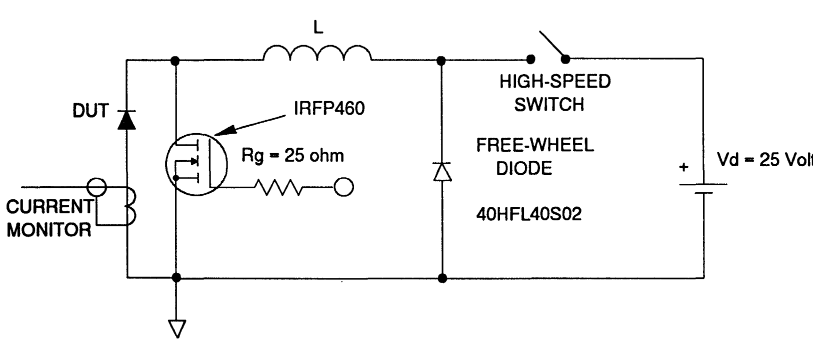


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

84CNQ... SERIES

SCHOTTKY RECTIFIER

80 Amp

Major Ratings and Characteristics

Characteristics	84CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	80	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	8000	A
V_F @ 40 Apk, T_J = 100°C (per leg)	0.44	V
T_J	- 55 to 125	°C

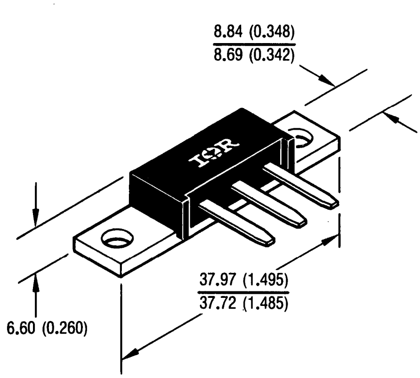
Description/Features

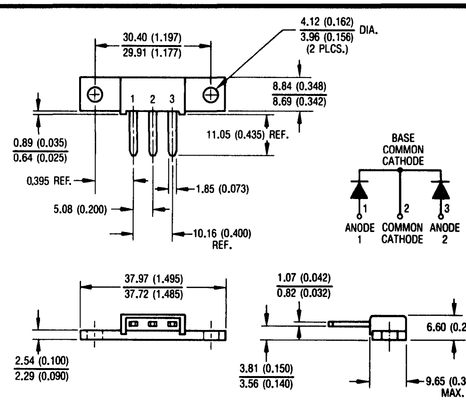
The 84CNQ center tap Schottky rectifier module series has been optimized for extremely low forward voltage drop, with higher leakage. The proprietary barrier technology allows for reliable operation up to 125° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 125° C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Extremely low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, small footprint, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Outline D - 61 - 8

Dimensions in millimeters and inches

Voltage Ratings

	Part number	84CNQ035	84CNQ040	84CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	84CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	80	A	50% duty cycle @ T_C = 91 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	8000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current (Per Leg) * See Fig. 7	620		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	54	mJ	T_J = 25 °C, I_{AS} = 8 Amps, L = 1.7 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	8	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	84CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.49	V	@ 40A	T_J = 25 °C
	(Per Leg) * See Fig. 1 (1)	0.62	V	@ 80A	
		0.44	V	@ 40A	T_J = 100 °C
		0.60	V	@ 80A	
I_{RM}	Max. Reverse Leakage Current	5	mA	T_J = 25 °C	V_R = rated V_R
	(Per Leg) * See Fig. 2 (1)	600	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		84CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 125	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-8		

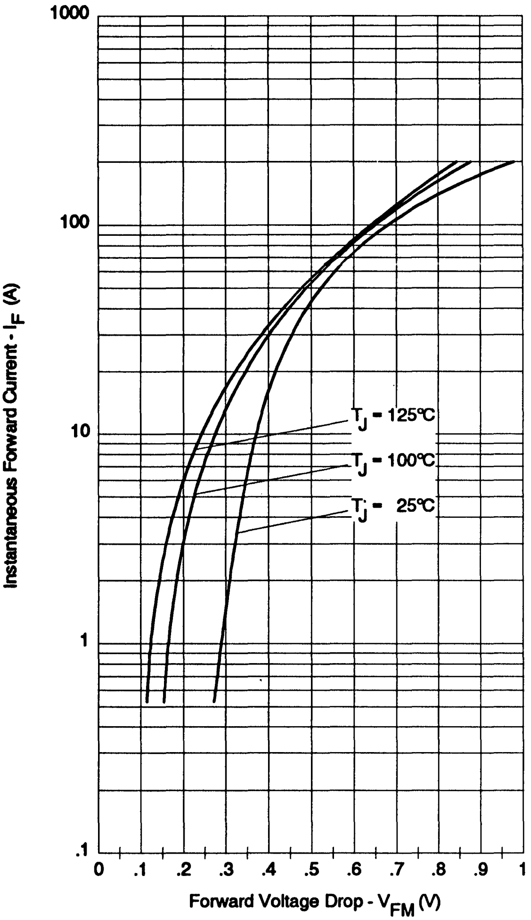


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

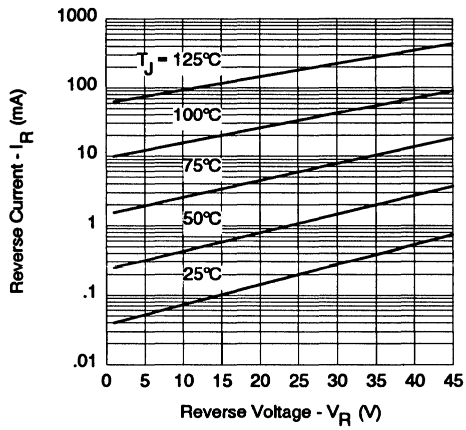


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

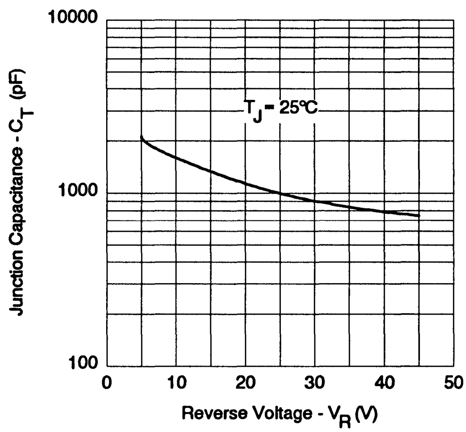


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

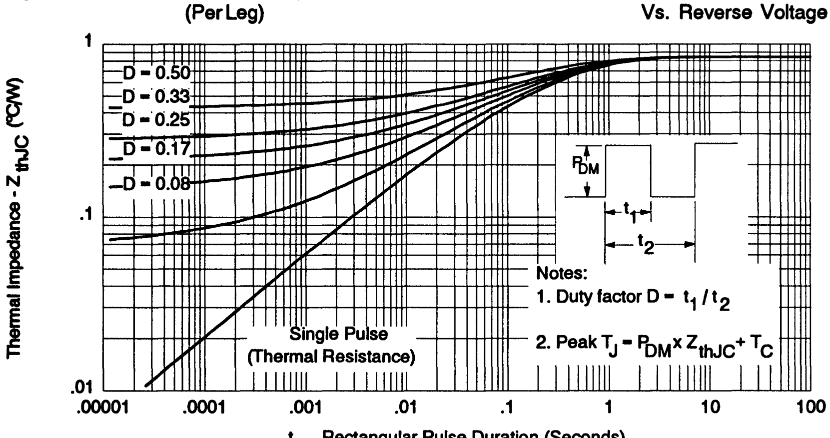


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

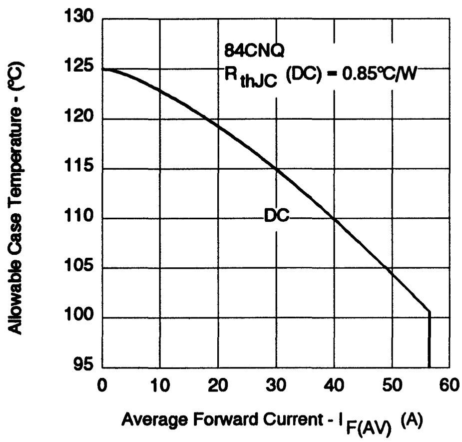


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

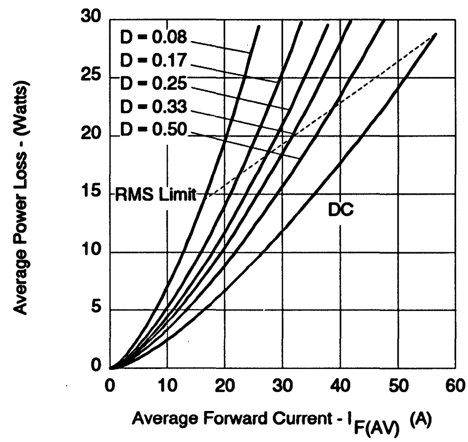


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

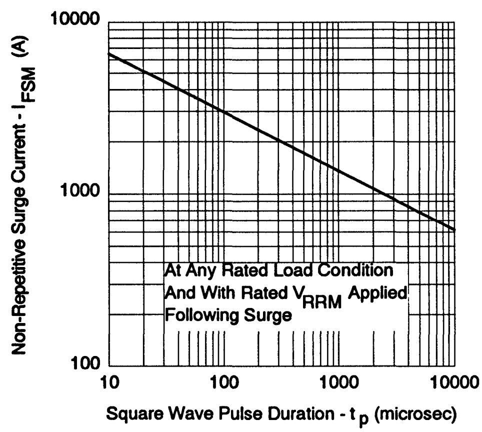


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

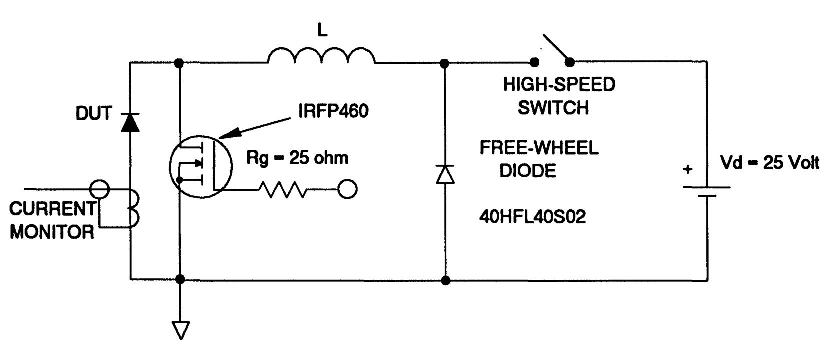


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

85CNQ015

SCHOTTKY RECTIFIER

80 Amp

Major Ratings and Characteristics

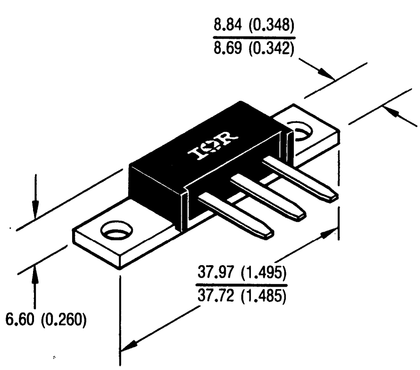
Characteristics	85CNQ015	Units
$I_{F(AV)}$ Rectangular waveform	80	A
V_{RRM}	15	V
I_{FSM} @ tp = 5 μs sine	5200	A
V_F @ 40 Apk, T_J = 75 °C	0.32	V
T_J	- 55 to 100	°C

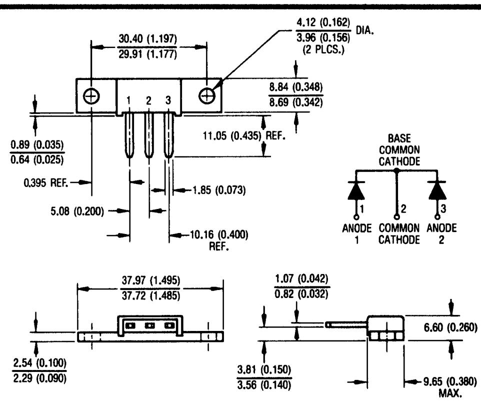
Description/Features

The 85CNQ015 center tap Schottky rectifier module has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100 °C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100 °C T_J operation
- Center tap module
- Optimized for OR-ing applications
- Ultra low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low profile, small footprint, high current package

CASE STYLE AND DIMENSIONS





Outline D - 61 - 8

Dimensions in millimeters and inches

Voltage Ratings

	Part number	85CNQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	85CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	80	A	50% duty cycle @ T_C = 78 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	5200	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		850		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	9	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 4.50 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	2	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 3 x V_R typical	

Electrical Specifications

	Parameters	85CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.36	V	@ 40A	T_J = 25 °C
		0.45	V	@ 80A	
		0.32	V	@ 40A	T_J = 75 °C
		0.42	V	@ 80A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	20	mA	T_J = 25 °C	V_R = rated V_R
		1000	mA	T_J = 100 °C	
		890	mA	T_J = 100 °C	V_R = 12V
		540	mA	T_J = 100 °C	V_R = 5V
C_T	Max. Junction Capacitance (Per Leg)	3600	pF	V_R = $5V_{DC}$, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.5	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		85CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 100	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 100	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.85	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.42	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.30	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		7.8 (0.28)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-61-8		

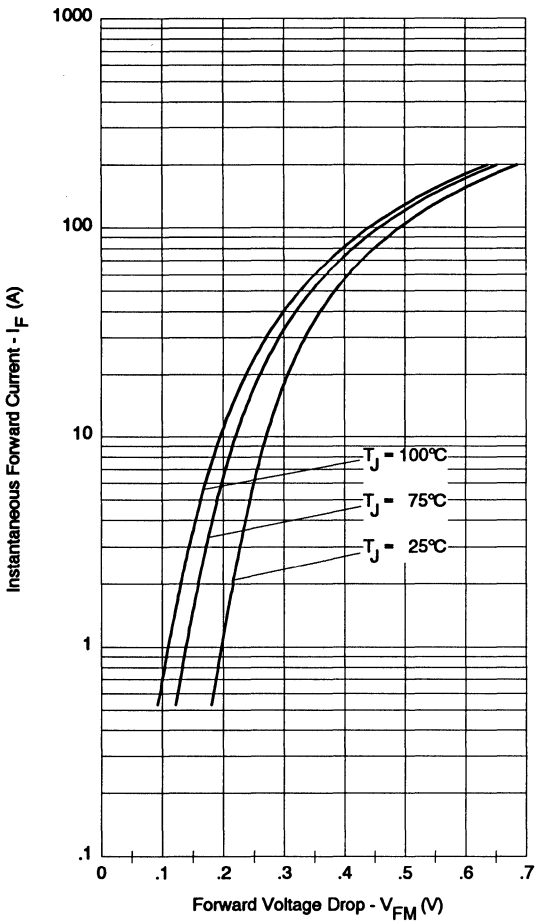


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

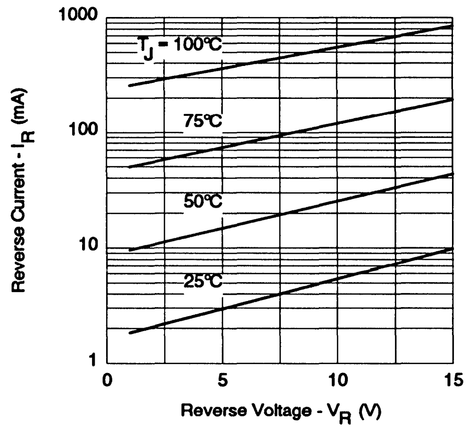


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

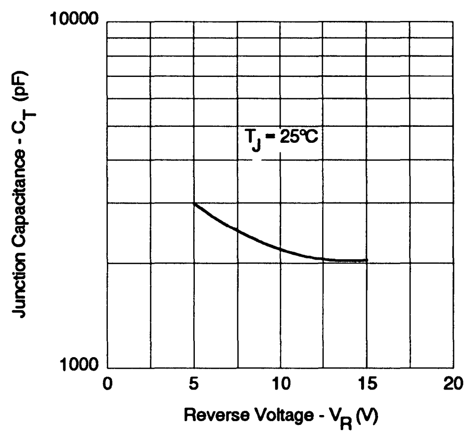


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

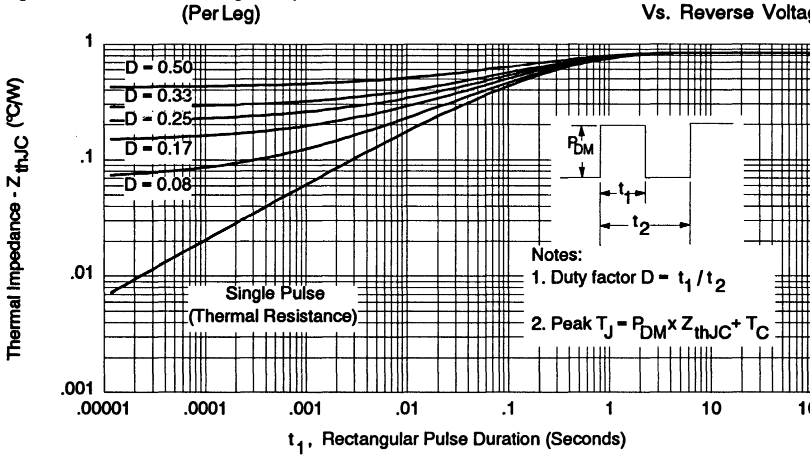


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

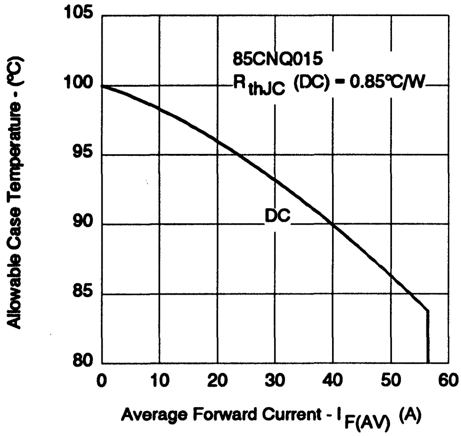


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

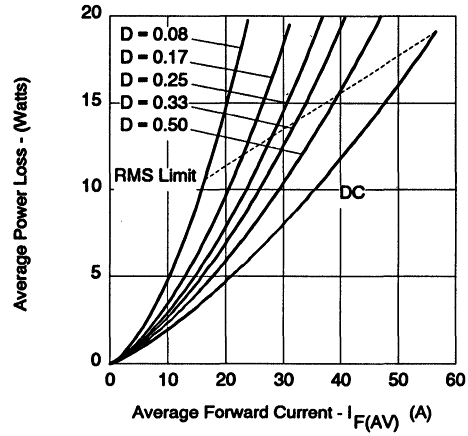


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

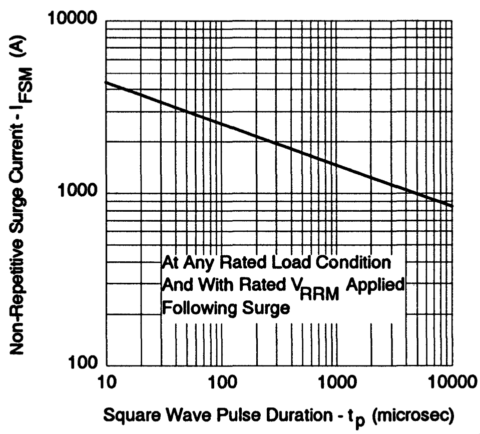


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

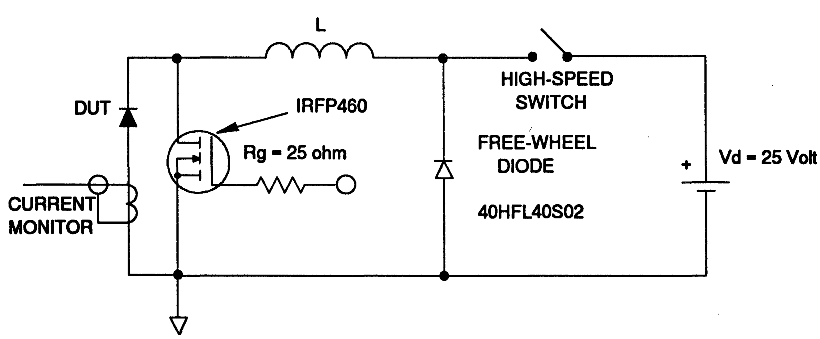


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

150CMQ... SERIES

SCHOTTKY RECTIFIER

150 Amp

Major Ratings and Characteristics

Characteristics	150CMQ...	Units
$I_{F(AV)}$ Rectangular waveform	150	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	6600	A
V_F @ 75 Apk, T_J = 125°C (per leg)	0.60	V
T_J	-55 to 150	°C

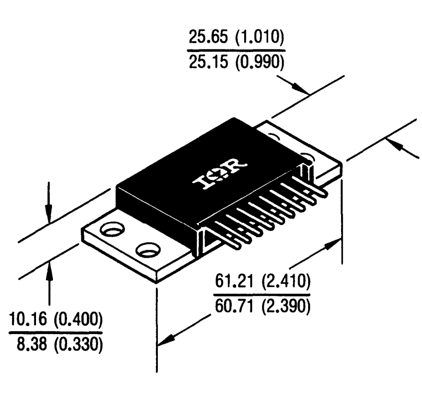
Description/Features

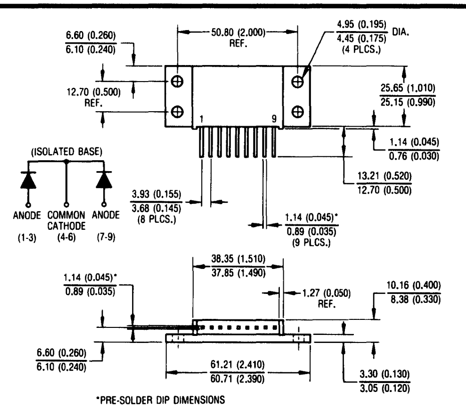
The 150CMQ isolated, center tap Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Isolated heatsink
- Center tap module
- Multiple leads per terminal for high frequency, high current PC board mounting
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Outline D-60 (Modified JEDEC TO-249AA)
Dimensions in millimeters and inches

Voltage Ratings

	Part number	150CMQ035	150CMQ040	150CMQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	150CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	150	A	50% duty cycle @ T_C = 71 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	6600	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		800		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	101	mJ	T_J = 25 °C, I_{AS} = 15 Amps, L = 0.9 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	15	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	150CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.64	V	@ 75A	T_J = 25 °C
		0.87	V	@ 150A	
		0.60	V	@ 75A	T_J = 125 °C
		0.79	V	@ 150A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	9.2	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters	150CMQ	Units	Conditions
T_J	Max. Junction Temperature Range	-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range	-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)	1.0	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)	0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink	0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight	56 (2.0)	g (oz.)	
T	Mounting Torque Min.	40 (35)	Kg-cm (lbf-in)	
	Max.	58 (50)		
	Case Style	D-60 (TO-249AA)		Modified JEDEC

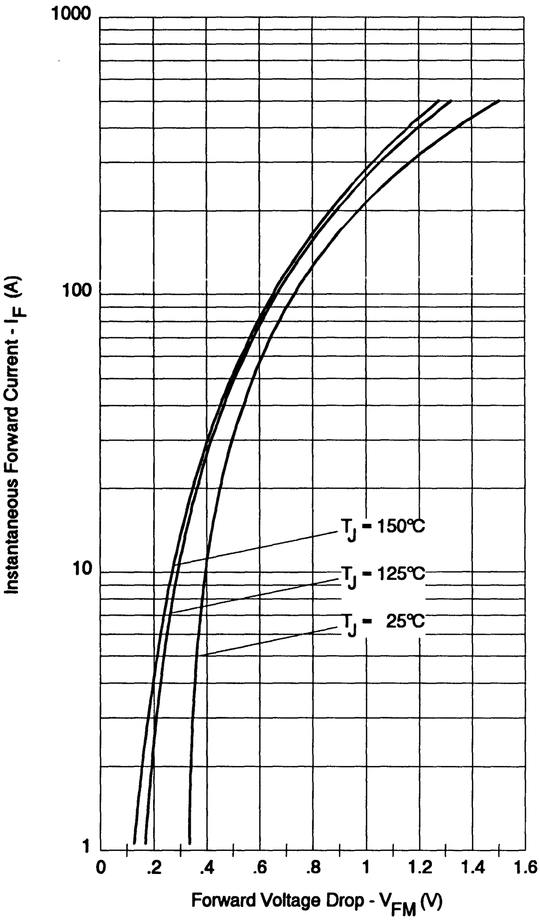


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

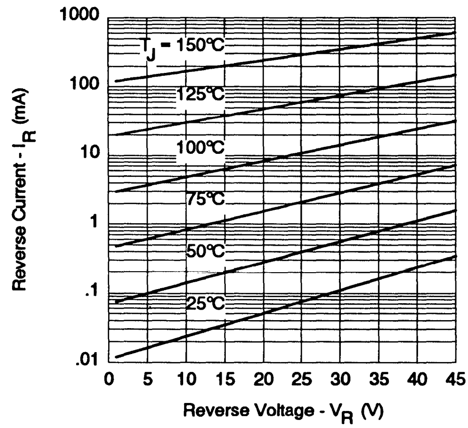


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

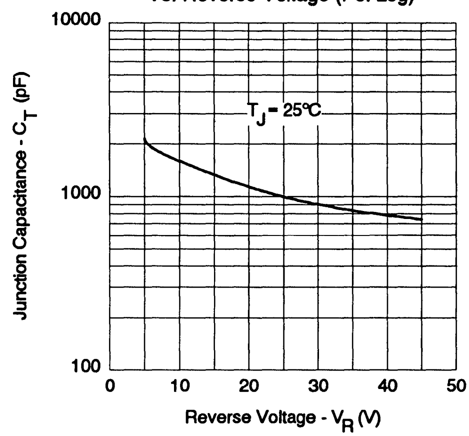


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

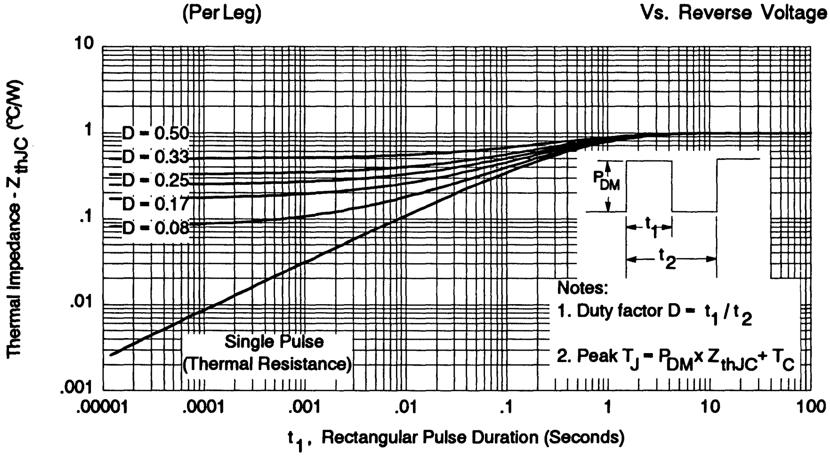


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

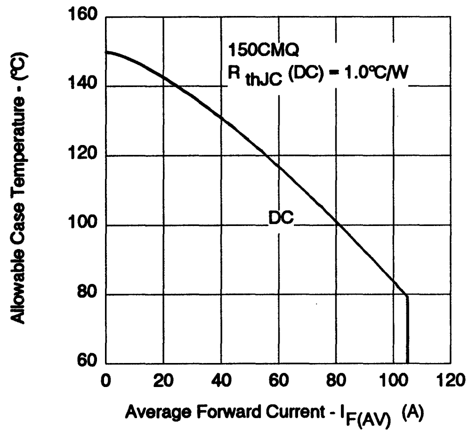


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

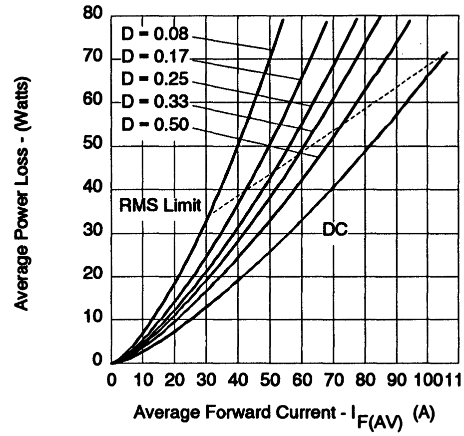


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

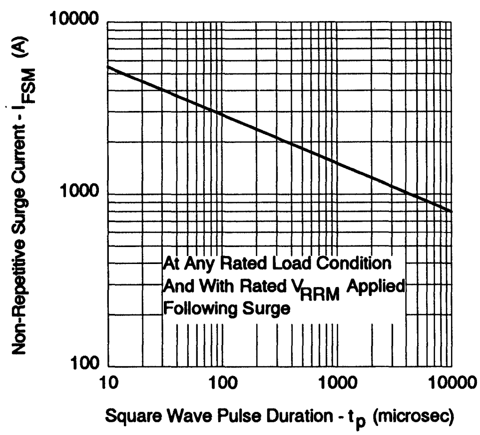


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

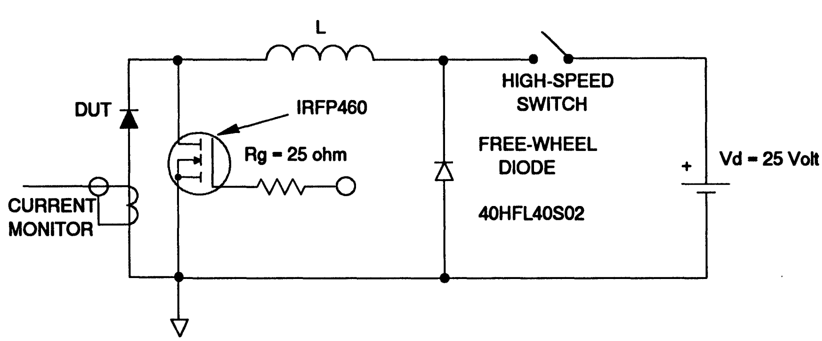


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

151CMQ... SERIES

SCHOTTKY RECTIFIER

150 Amp

Major Ratings and Characteristics

Characteristics	151CMQ...	Units
$I_{F(AV)}$ Rectangular waveform	150	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	9200	A
V_F @ 75Apk, T_J = 125°C (per leg)	0.65	V
T_J	-55 to 175	°C

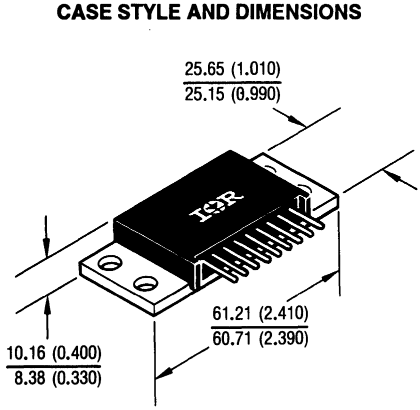
Description/Features

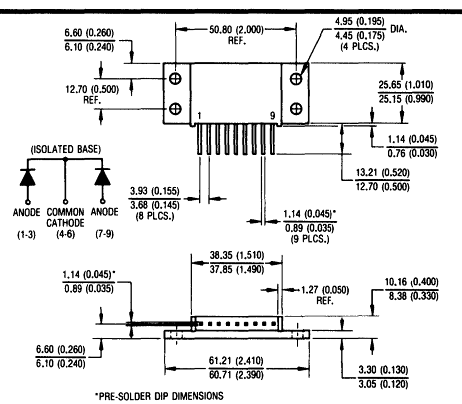
The 151CMQ isolated center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Isolated heatsink
- Center tap module
- Multiple leads per terminal for high frequency, high current PC board mounting
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Outline D-60 (Modified JEDEC TO-249AA)
Dimensions in millimeters and inches

Voltage Ratings

	Part number	151CMQ035	151CMQ040	151CMQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	151CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	150	A	50% duty cycle @ T_C = 104°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	9200	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1200		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	101	mJ	T_J = 25 °C, I_{AS} = 15 Amps, L = 0.9 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	15	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	151CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.71	V	@ 75A	T_J = 25 °C
		0.92	V	@ 150A	
		0.65	V	@ 75A	T_J = 125 °C
		0.82	V	@ 150A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	9.2	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		151CMQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.0	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		56 (2.0)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-60 (TO-249AA)		Modified JEDEC

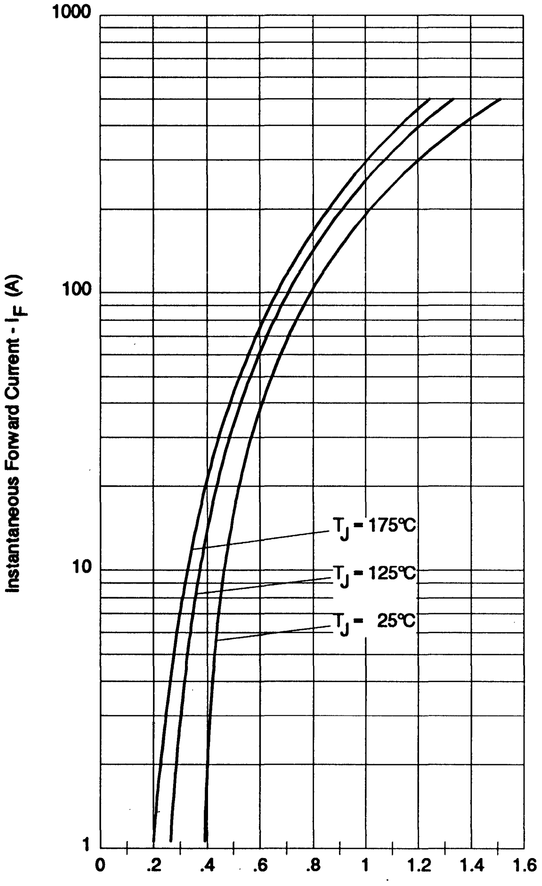


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

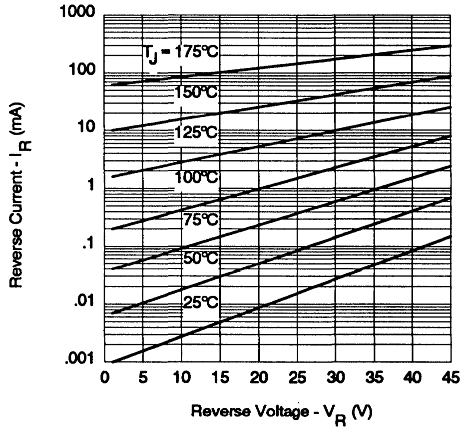


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

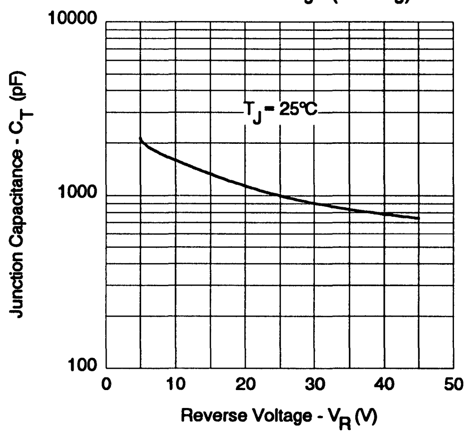


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

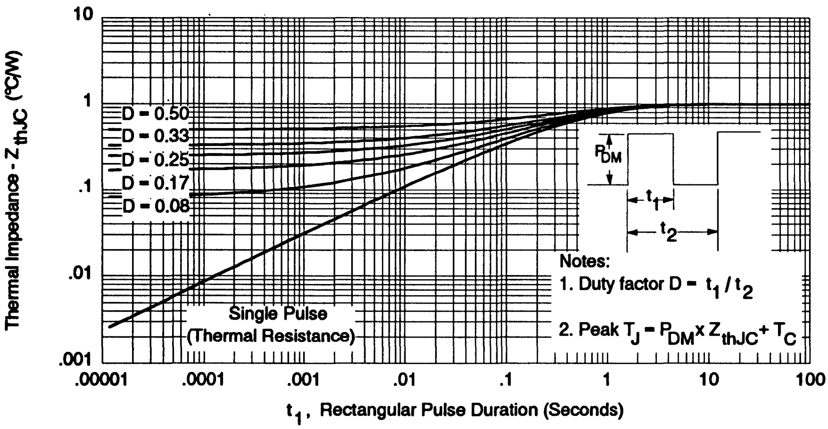


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

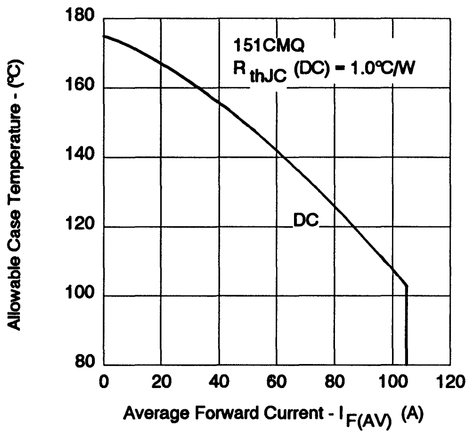


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

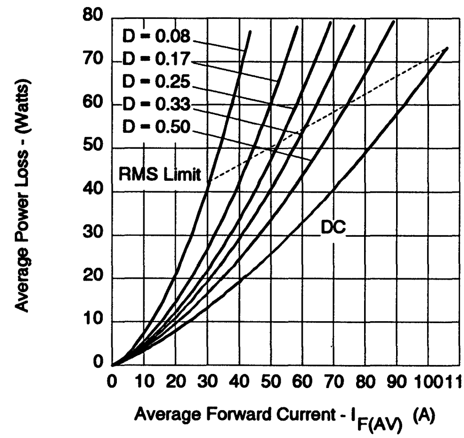


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

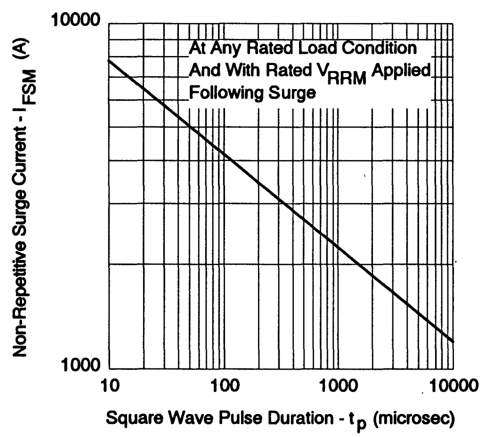


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

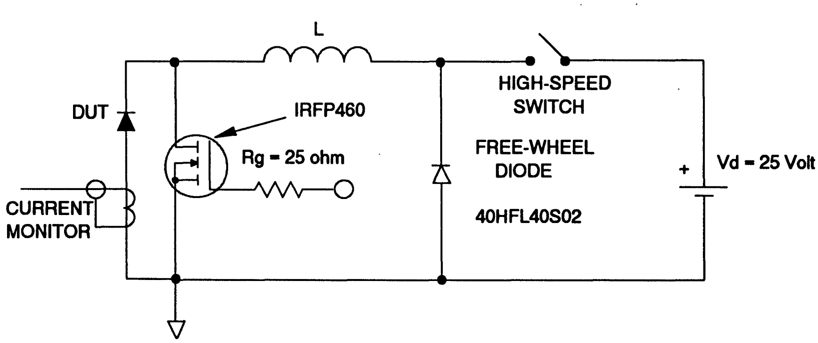


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

152CMQ030

SCHOTTKY RECTIFIER

150 Amp

Major Ratings and Characteristics

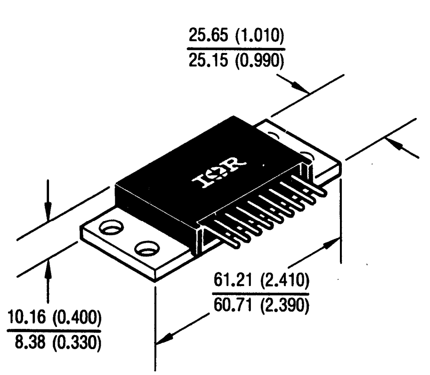
Characteristics	152CMQ030	Units
$I_{F(AV)}$ Rectangular waveform	150	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	7800	A
V_F @ 75Apk, T_J = 125°C (per leg)	0.47	V
T_J	- 55 to 150	°C

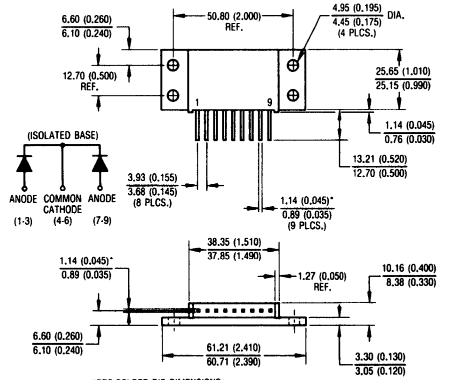
Description/Features

The 152CMQ030 isolated, center tap Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150 °C T_J operation
- Isolated heatsink
- Center tap module
- Multiple leads per terminal fpr high frequency, high current PC board mounting
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

CASE STYLE AND DIMENSIONS





Outline D-60 (Modified JEDEC TO-249AA)
Dimensions in millimeters and inches

Voltage Ratings

	Part number	152CMQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	152CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	150	A	50% duty cycle @ T_C = 85 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	7800	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1000		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	68	mJ	T_J = 25 °C, I_{AS} = 15 Amps, L = 0.6 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	15	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	152CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.55	V	@ 75A	T_J = 25 °C
		0.69	V	@ 150A	
		0.47	V	@ 75A	T_J = 125 °C
		0.66	V	@ 150A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		280	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	3700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	9.2	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		152CMQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.0	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		56 (2.0)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-60 (TO-249AA)		Modified JEDEC

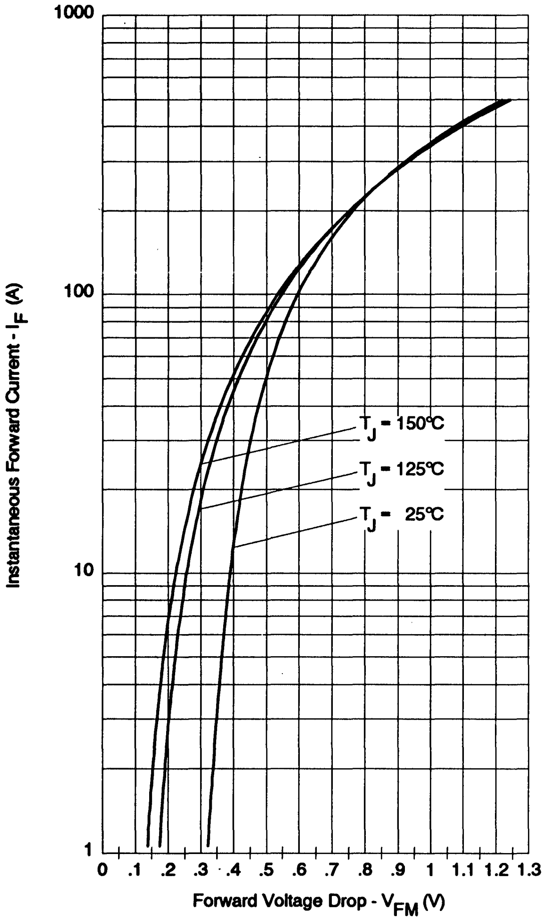


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

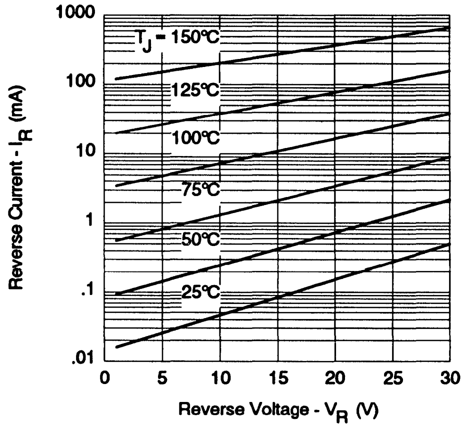


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

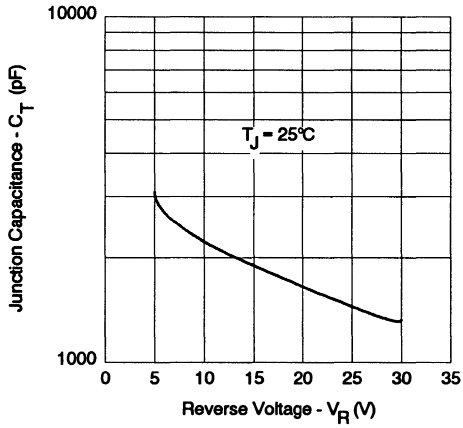


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

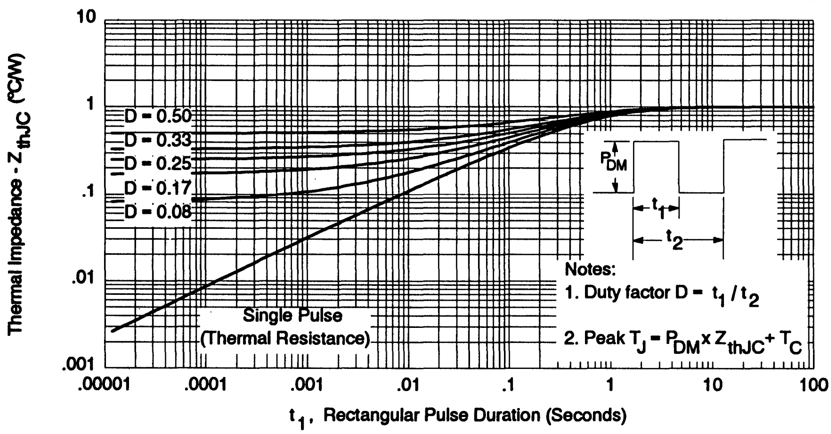


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

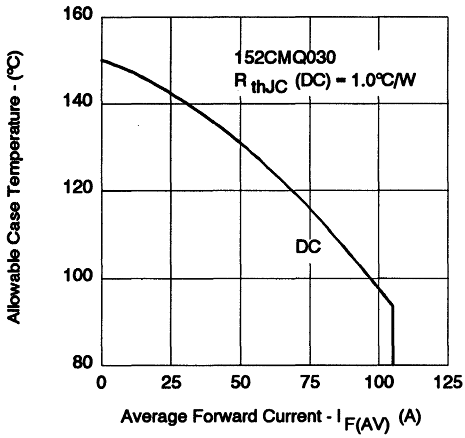


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

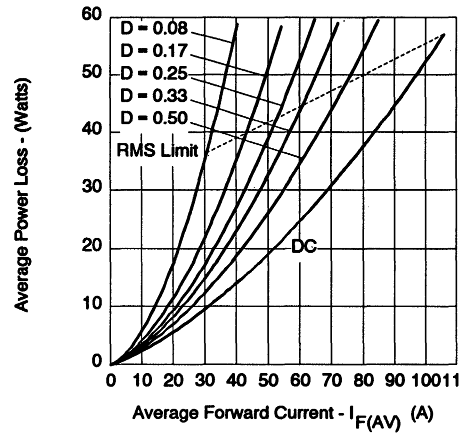


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

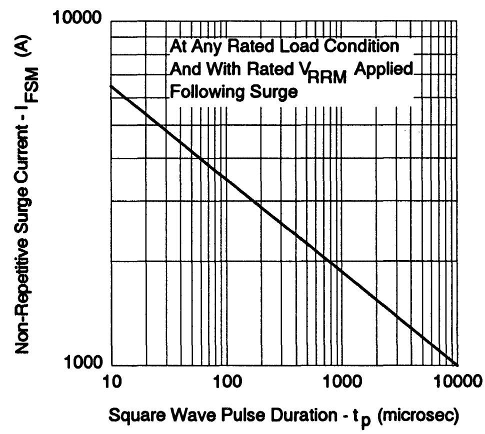


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

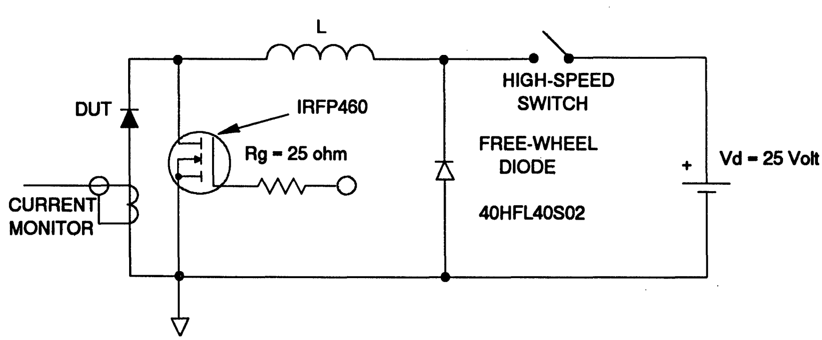


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

153CMQ... SERIES

SCHOTTKY RECTIFIER

150 Amp

Major Ratings and Characteristics

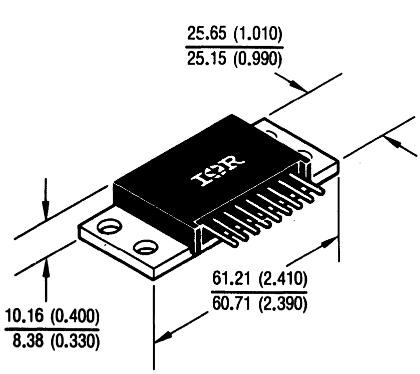
Characteristics	153CMQ...	Units
$I_{F(AV)}$ Rectangular waveform	150	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 µs sine	7000	A
V_F @75Apk, T_J = 125°C (per leg)	0.80	V
T_J	-55 to 175	°C

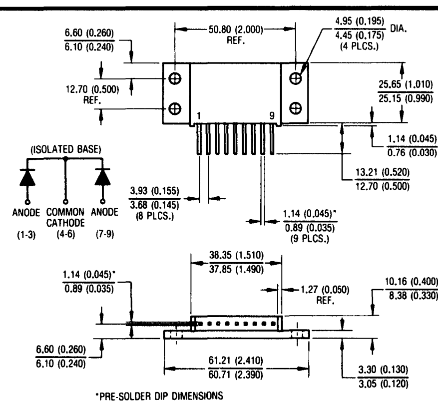
Description/Features

The 153CMQ isolated, center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175 °C T_J operation
- Isolated heatsink
- Center tap module
- Multiple leads per terminal for high frequency, high current PC board mounting
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

CASE STYLE AND DIMENSIONS





Outline D-60 (Modified JEDEC TO-249AA)

Dimensions in millimeters and inches

Voltage Ratings

Part number	153CMQ080	153CMQ100
V_R Max. DC Reverse Voltage (V)	80	100
V_{RWM} Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	153CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	150	A	50% duty cycle @ T_C = 90 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) *See Fig. 7	7000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		720		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	153CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.96	V	@ 75A	T_J = 25 °C
		1.19	V	@ 150A	
		0.80	V	@ 75A	T_J = 125 °C
		0.99	V	@ 150A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.5	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	9.2	nH	Measured lead to lead 5mm from package body	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		153CMQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.0	°C/W	DC operation *See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		56 (2.0)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		D-60 (TO-249AA)		Modified JEDEC

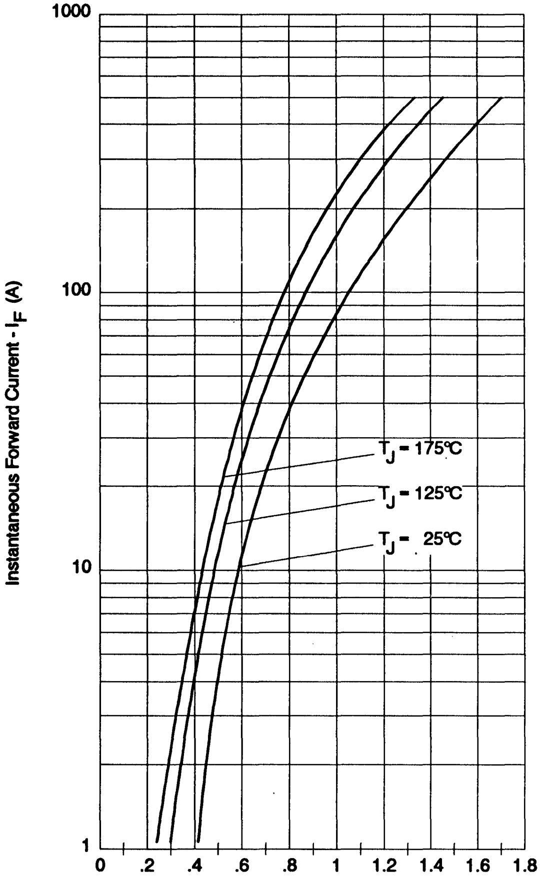


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

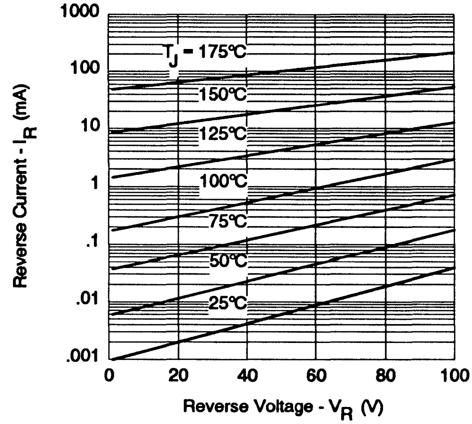


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

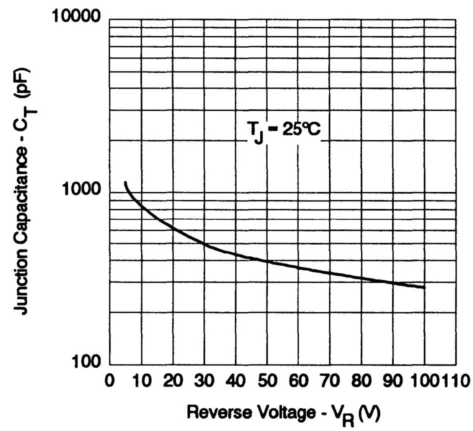


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

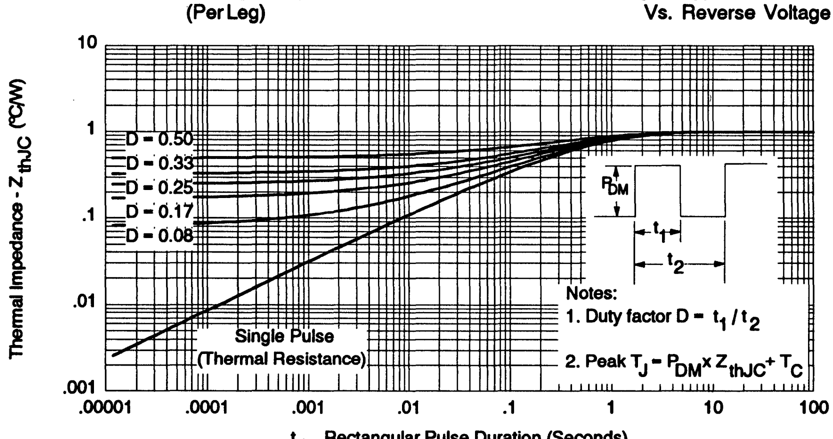


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

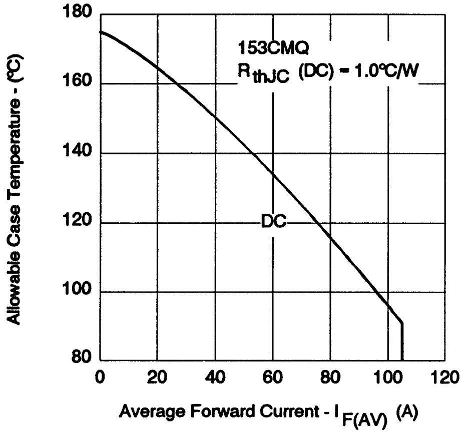


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

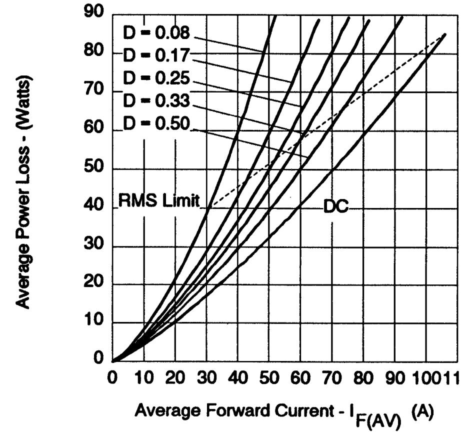


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

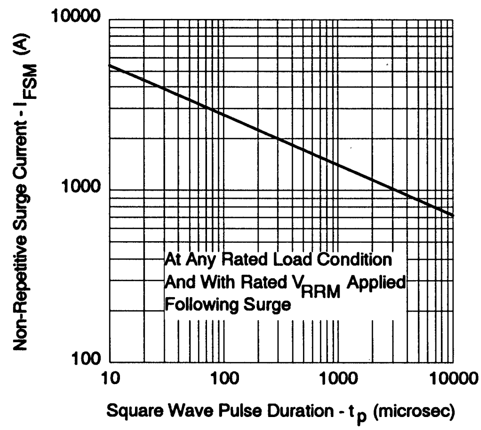


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

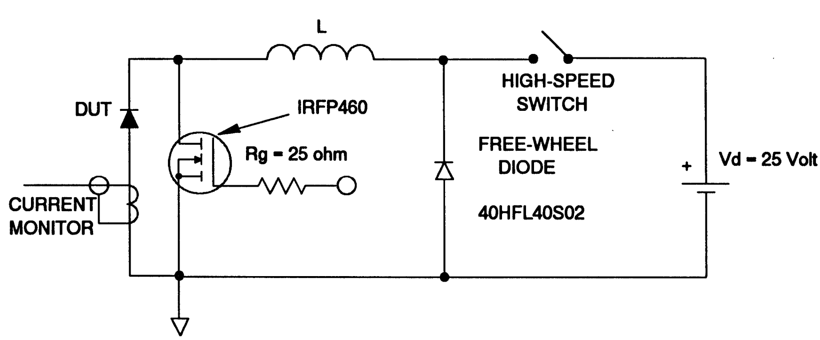


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

160CMQ... SERIES

SCHOTTKY RECTIFIER

160 Amp

Major Ratings and Characteristics

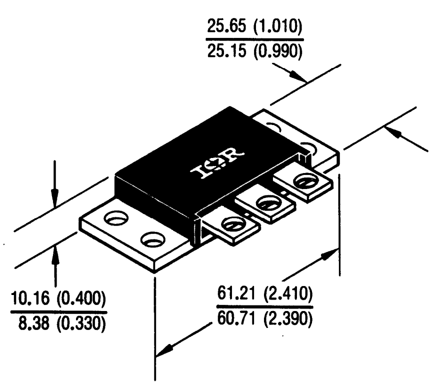
Characteristics	160CMQ...	Units
$I_{F(AV)}$ Rectangular waveform	160	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	6400	A
V_F @ 80 Apk, T_J = 125°C (per leg)	0.60	V
T_J	-55 to 150	°C

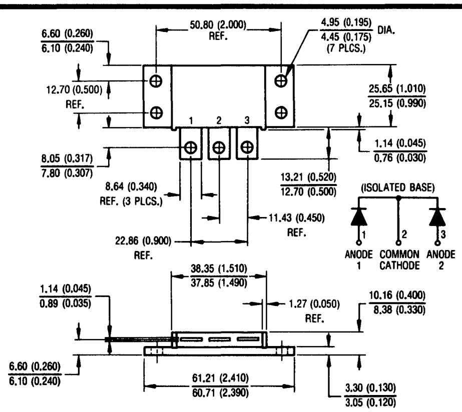
Description/Features

The 160CMQ isolated, center tap Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Isolated heatsink
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 249AA
Dimensions in millimeters and inches

Voltage Ratings

Part number	160CMQ035	160CMQ040	160CMQ045
V_R Max. DC Reverse Voltage (V) V_{RWM} Max. Working Peak Reverse Voltage (V)	35	40	45

Absolute Maximum Ratings

	Parameters	160CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	160	A	50% duty cycle @ T_C = 69 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	6400	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		750		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	108	mJ	T_J = 25 °C, I_{AS} = 16 Amps, L = 0.84 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	16	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	160CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.64	V	@ 80A	T_J = 25 °C
		0.86	V	@ 160A	
		0.60	V	@ 80A	T_J = 125 °C
		0.76	V	@ 160A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured from terminal hole to terminal hole	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		160CMQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.0	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		58 (2.0)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		TO-249AA		JEDEC

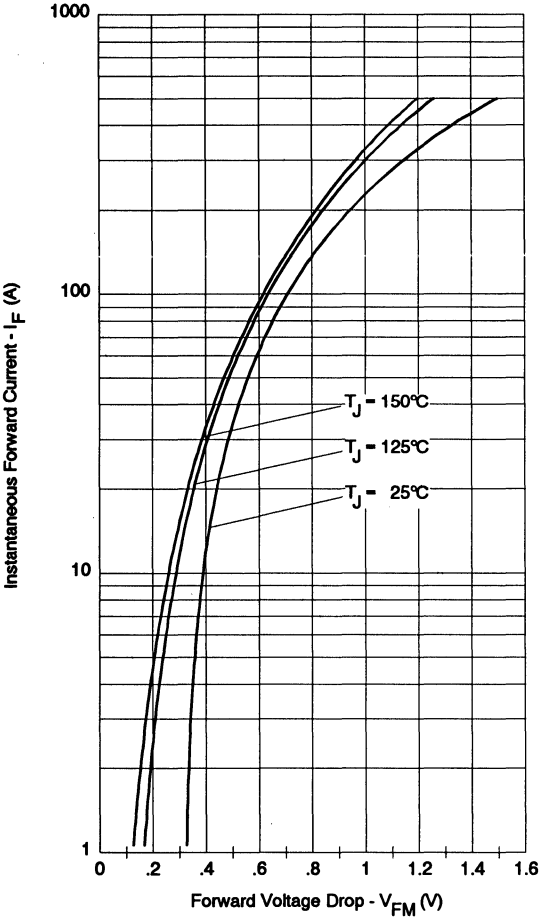


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

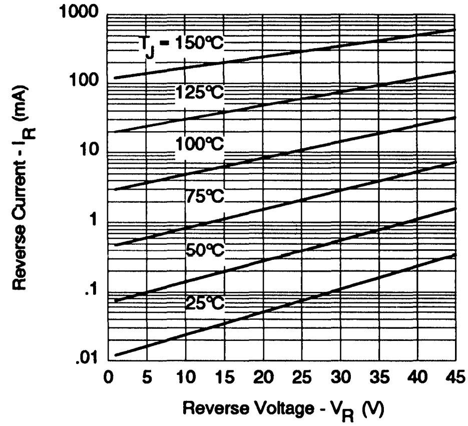


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

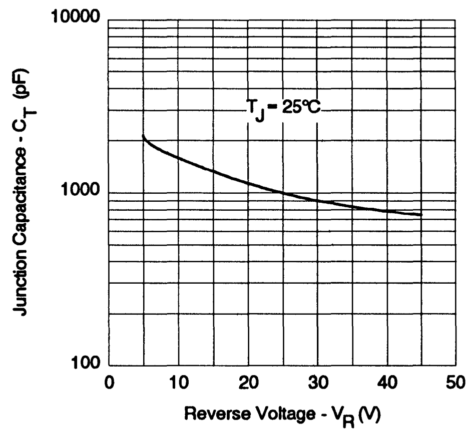


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

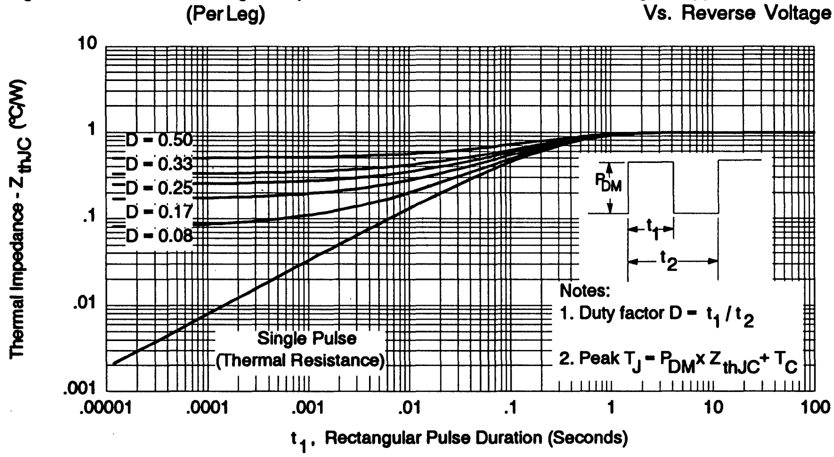


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

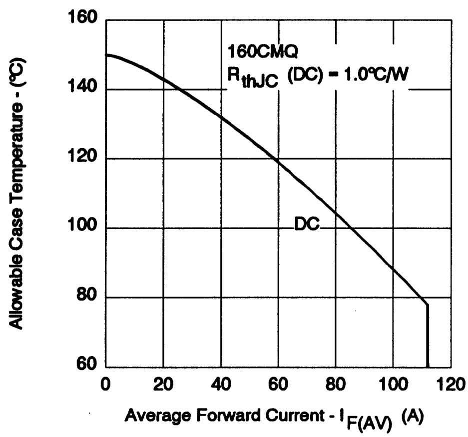


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

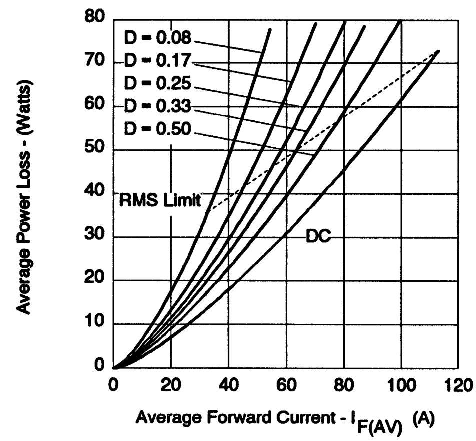


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

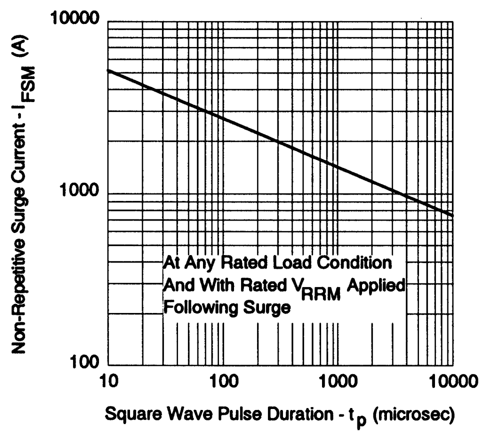


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

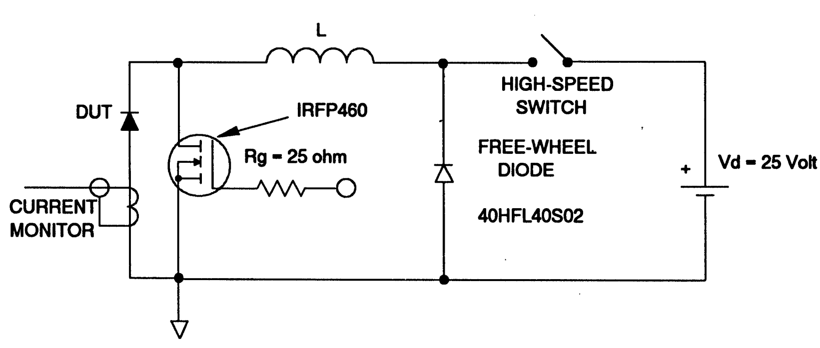


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

161CMQ... SERIES

SCHOTTKY RECTIFIER

160 Amp

Major Ratings and Characteristics

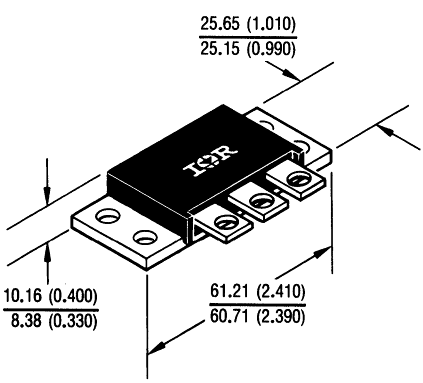
Characteristics	161CMQ...	Units
$I_{F(AV)}$ Rectangular waveform	160	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	11,500	A
V_F @ 80 Apk, T_J = 125°C (per leg)	0.63	V
T_J	- 55 to 175	°C

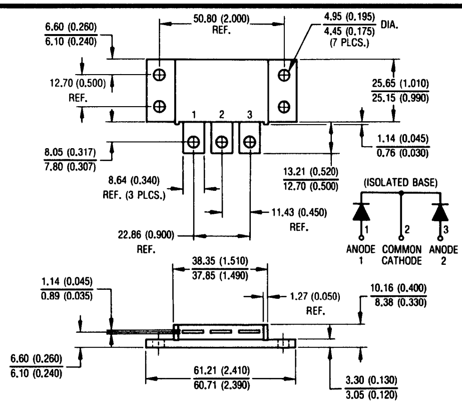
Description/Features

The 161CMQ isolated, center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Isolated heatsink
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 249AA

Dimensions in millimeters and inches

LOW PROFILE MODULES

Voltage Ratings

	Part number	161CMQ035	161CMQ040	161CMQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	161CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	160	A	50% duty cycle @ T_C = 101 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	11,500	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		900		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	108	mJ	T_J = 25 °C, I_{AS} = 16 Amps, L = 0.84 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	16	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	161CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.71	V	@ 80A	T_J = 25 °C
		0.88	V	@ 160A	
		0.63	V	@ 80A	T_J = 125 °C
		0.79	V	@ 160A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		45	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2600	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured from terminal hole to terminal hole	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		161CMQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.0	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		58 (2.0)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		TO - 249AA		JEDEC

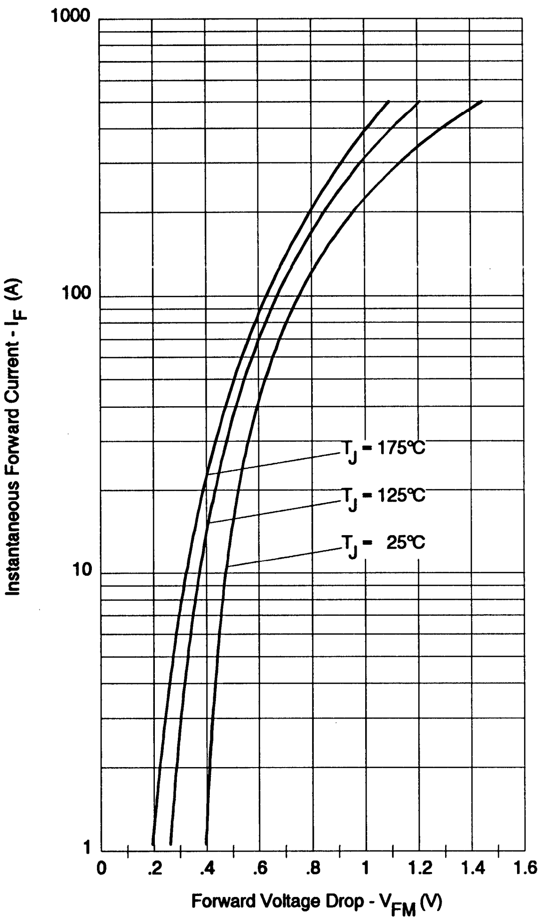


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

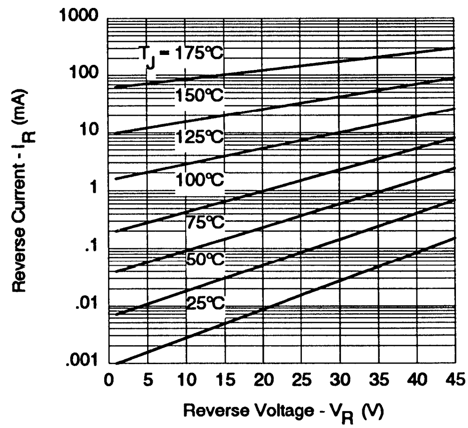


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

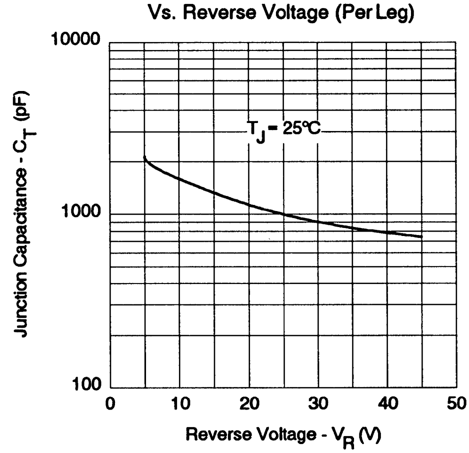


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

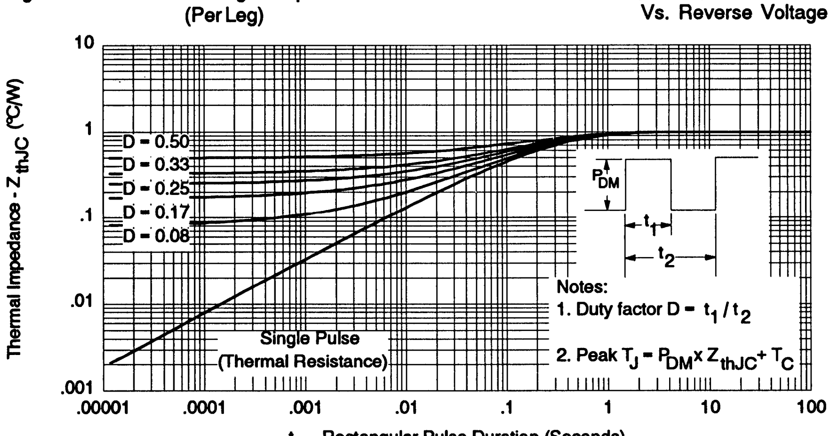


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

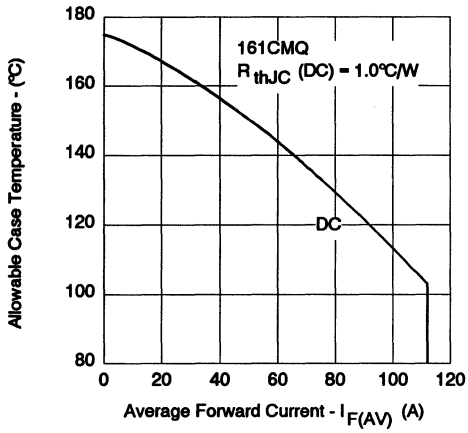


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

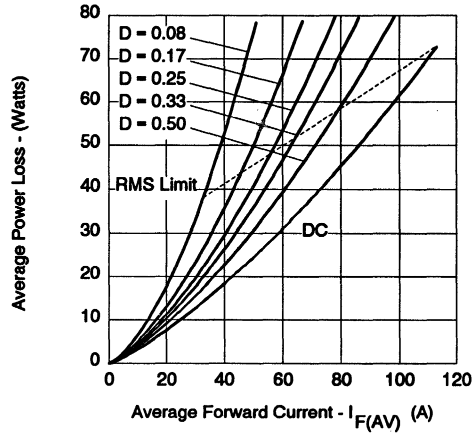


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

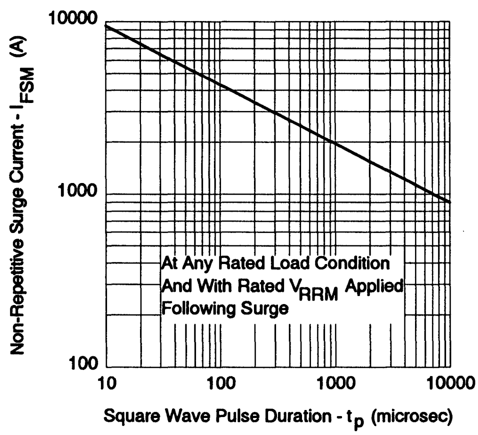


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

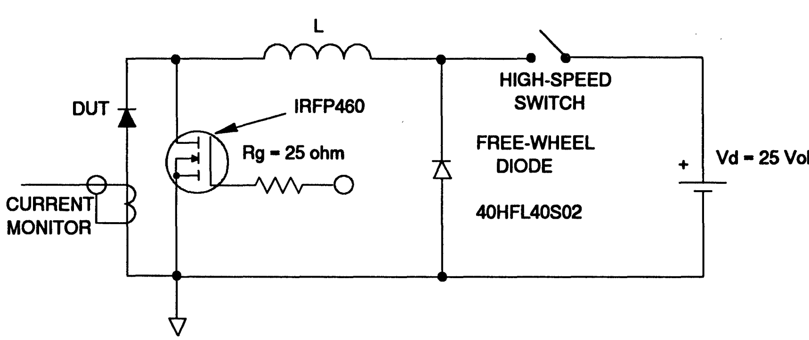


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

162CMQ030

SCHOTTKY RECTIFIER

160 Amp

Major Ratings and Characteristics

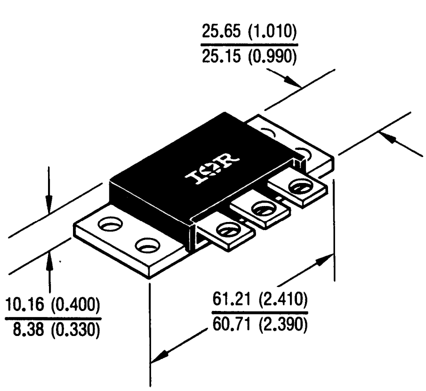
Characteristics	162CMQ030	Units
$I_{F(AV)}$ Rectangular waveform	160	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	7900	A
V_F @ 80 Apk, T_J = 125°C (per leg)	0.46	V
T_J	-55 to 150	°C

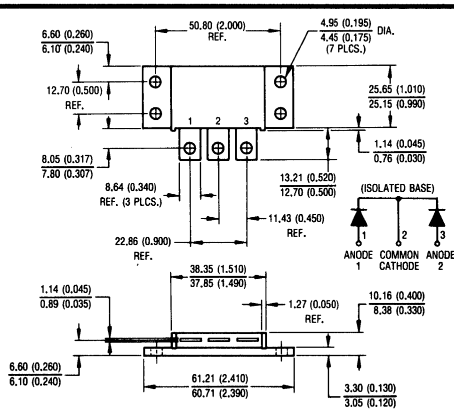
Description/Features

The 162CMQ030 isolated, center tap Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150 °C T_J operation
- Isolated heatsink
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 249AA
Dimensions in millimeters and inches

Voltage Ratings

Part number		162CMQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	162CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	160	A	50% duty cycle @ T_C = 83 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	7900	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		980		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	72	mJ	T_J = 25 °C, I_{AS} = 16 Amps, L = 0.56 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	16	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	162CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.53	V	@ 80A	T_J = 25 °C
		0.65	V	@ 160A	
		0.46	V	@ 80A	T_J = 125 °C
		0.63	V	@ 160A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	5	mA	T_J = 25 °C	V_R = rated V_R
		280	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	3700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured from terminal hole to terminal hole	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		162CMQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.0	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		58 (2.0)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		TO-249AA		JEDEC

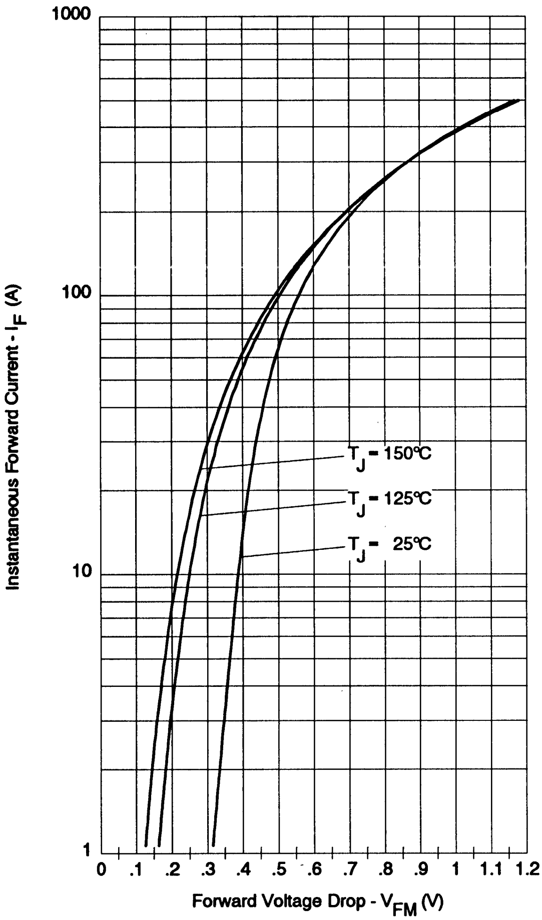


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

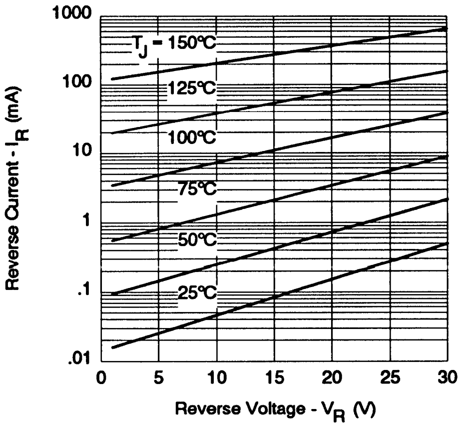


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

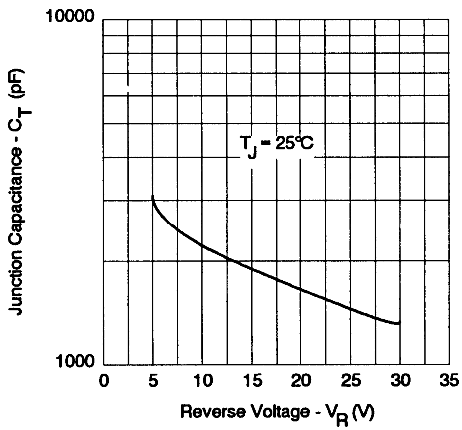


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

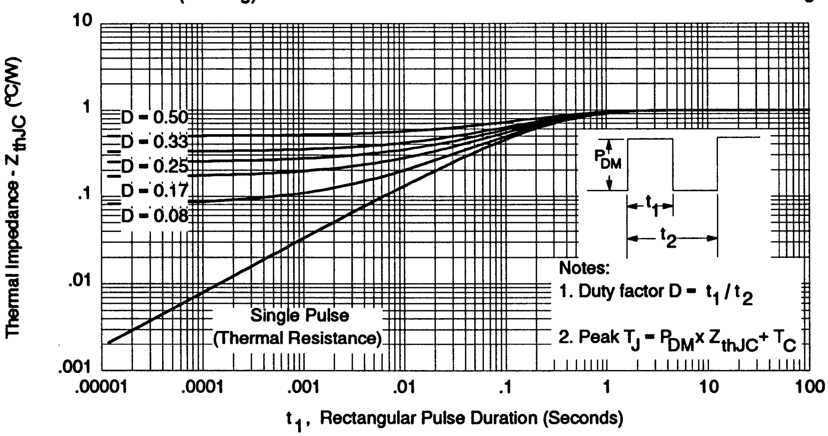


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

LOW PROFILE MODULES

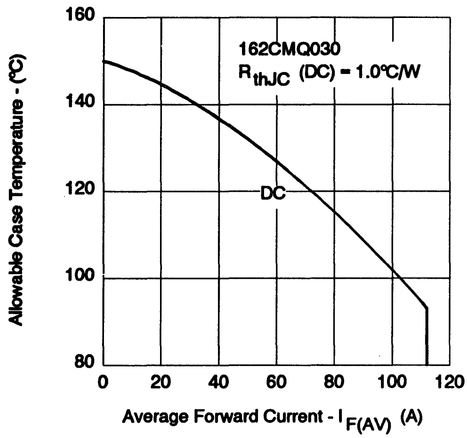


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

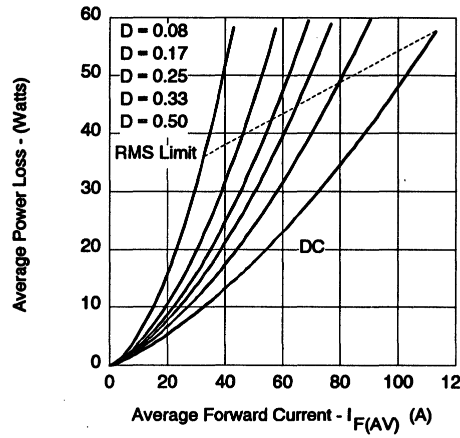


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

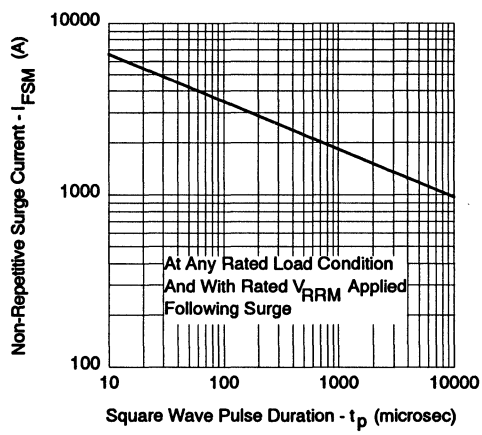


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

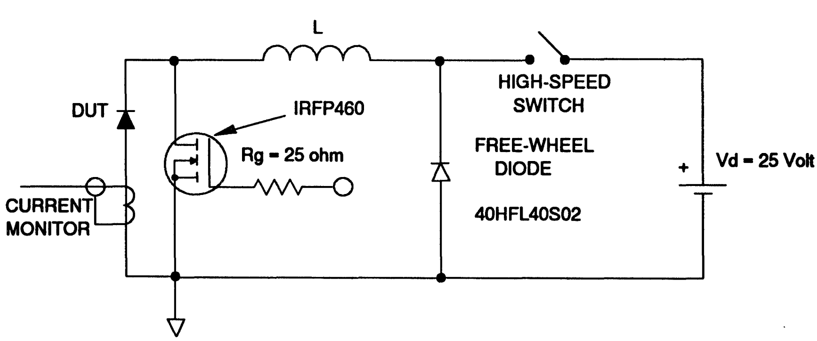


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

163CMQ... SERIES

SCHOTTKY RECTIFIER

160 Amp

Major Ratings and Characteristics

Characteristics	163CMQ...	Units
$I_{F(AV)}$ Rectangular waveform	160	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	9000	A
V_F @ 80 Apk, T_J = 125°C (per leg)	0.80	V
T_J	- 55 to 175	°C

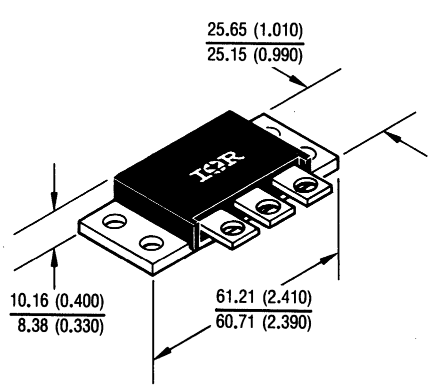
Description/Features

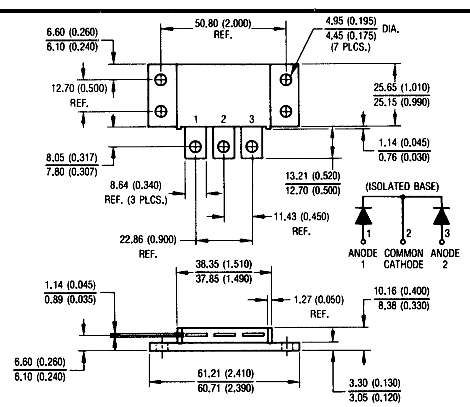
The 163CMQ isolated center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175 °C T_J operation
- Isolated heatsink
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- Low profile, high current package

LOW PROFILE MODULES

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO - 249AA

Dimensions in millimeters and inches

Voltage Ratings

	Part number	163CMQ080	163CMQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	163CMQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	160	A	50% duty cycle @ T_C = 87 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) *See Fig. 7	9000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		800		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	163CMQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.98	V	@ 80A	T_J = 25 °C
		1.17	V	@ 160A	
		0.80	V	@ 80A	T_J = 125 °C
		0.96	V	@ 160A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	1.5	mA	T_J = 25 °C	V_R = rated V_R
		20	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	1400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	8.0	nH	Measured from terminal hole to terminal hole	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		163CMQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		1.0	°C/W	DC operation *See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.50	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		58 (2.0)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Case Style		TO - 249AA		JEDEC

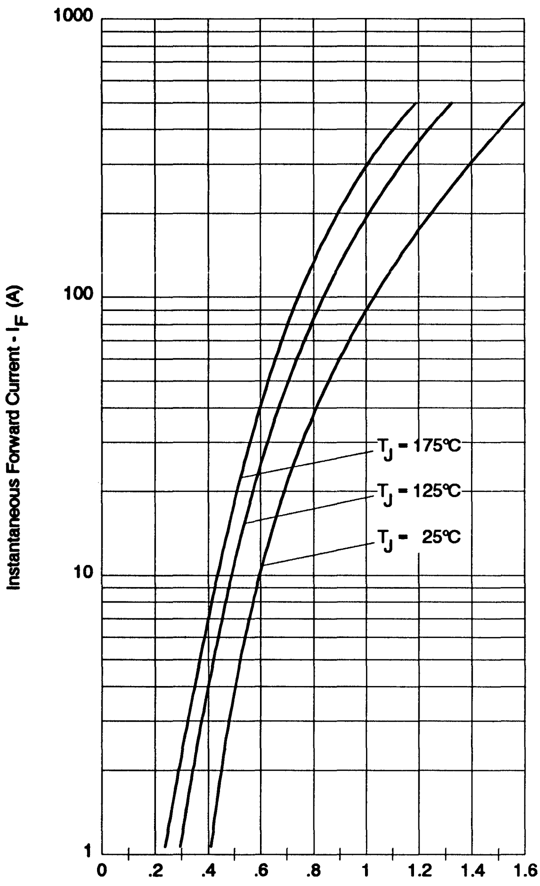


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

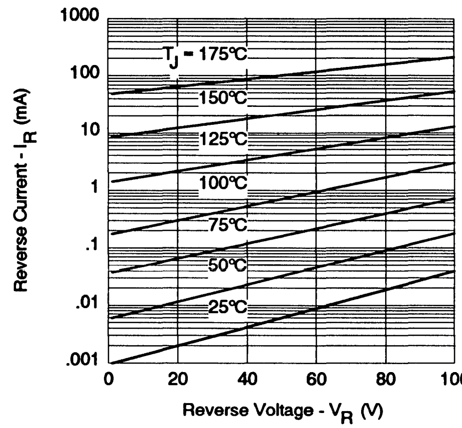


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

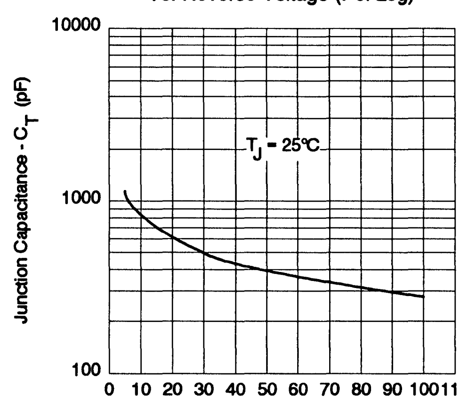


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

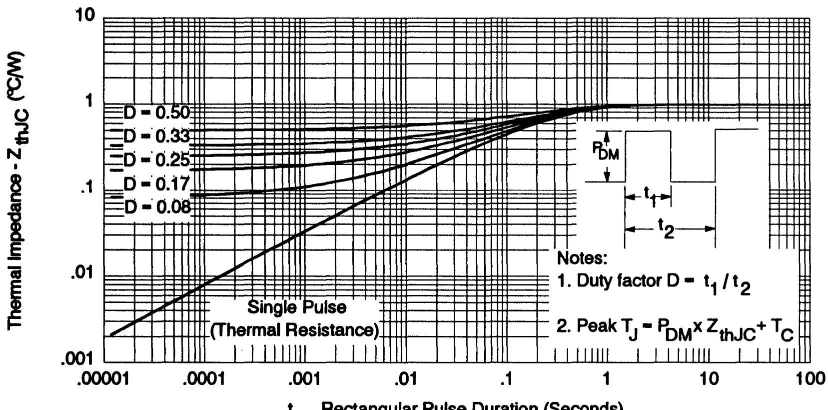


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

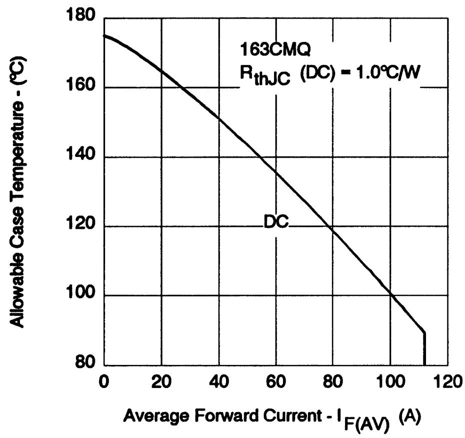


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

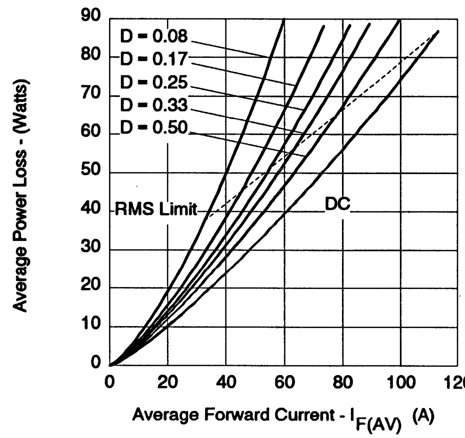


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

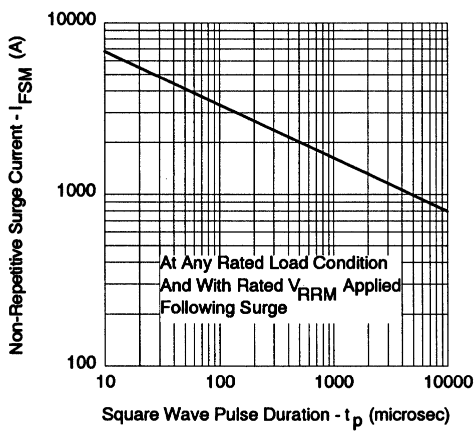


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

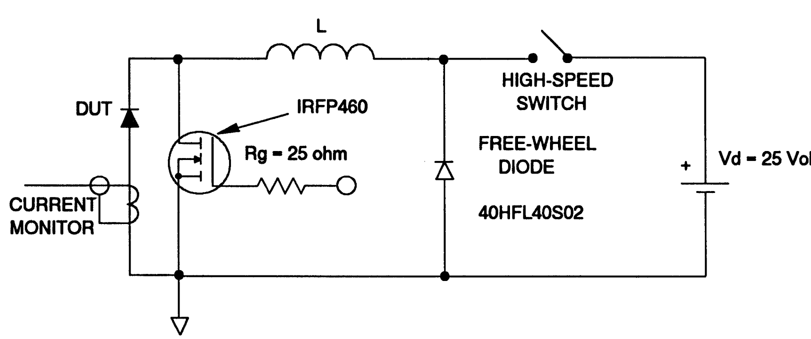


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

120NQ... SERIES

SCHOTTKY RECTIFIER

120 Amp

Major Ratings and Characteristics

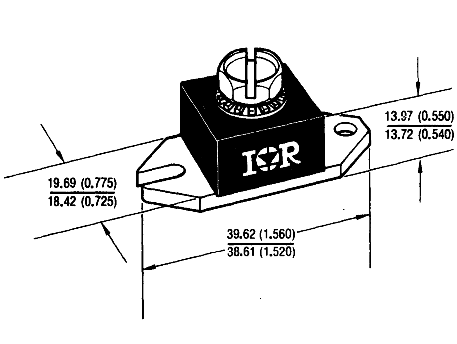
Characteristics	120NQ...	Units
$I_{F(AV)}$ Rectangular waveform	120	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	29,000	A
V_F @ 120Apk, T_J = 125°C	0.52	V
T_J	-55 to 150	°C

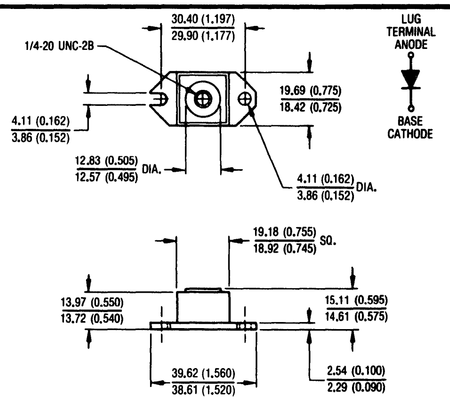
Description/Features

The 120NQ high current Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces two parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





HALF-PAK

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	120NQ035	120NQ040	120NQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	120NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	120	A	50% duty cycle @ T_C = 99° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	29,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1550		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	81	mJ	T_J = 25 °C, I_{AS} = 12 Amps, L = 1.12 mH	
I_{AR}	Repetitive Avalanche Current	12	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	120NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.57	V	@ 120A	T_J = 25 °C
		0.73	V	@ 240A	
		0.52	V	@ 120A	T_J = 125 °C
		0.69	V	@ 240A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	10	mA	T_J = 25 °C	V_R = rated V_R
		400	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	5200	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		120NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.40	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

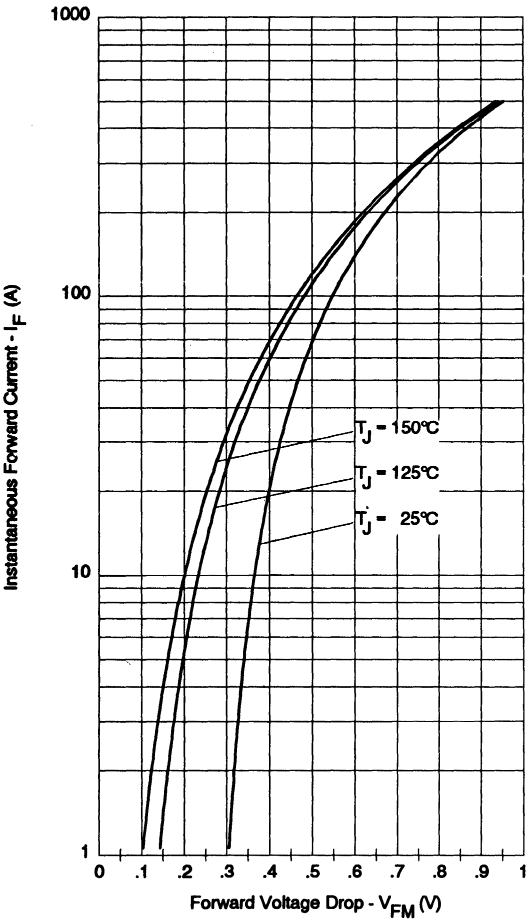


Fig. 1 - Maximum Forward Voltage Drop Characteristics

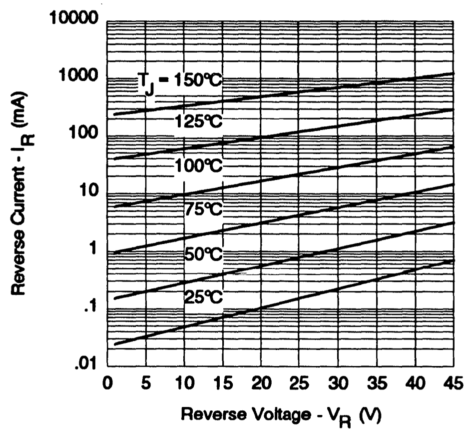


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

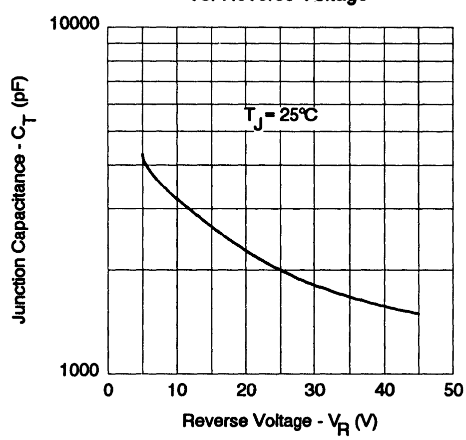


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

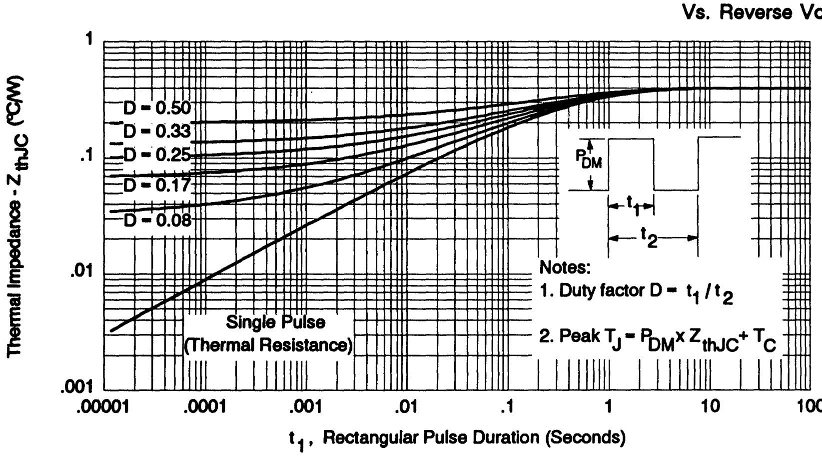


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

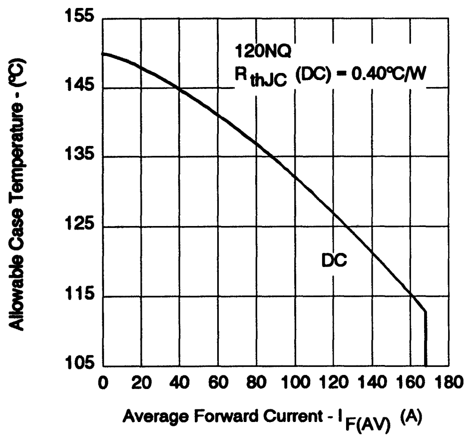


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

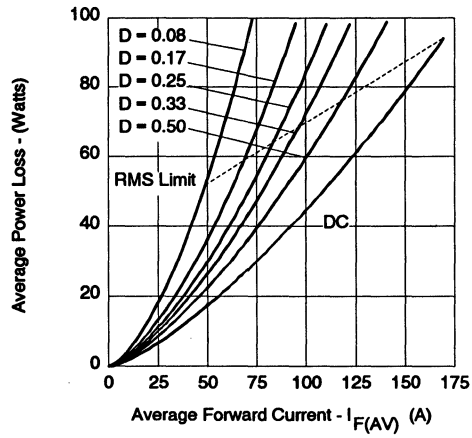


Fig. 6 - Forward Power Loss Characteristics

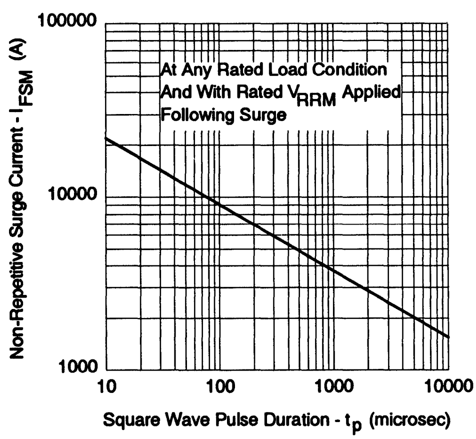


Fig. 7 - Maximum Non-Repetitive Surge Current

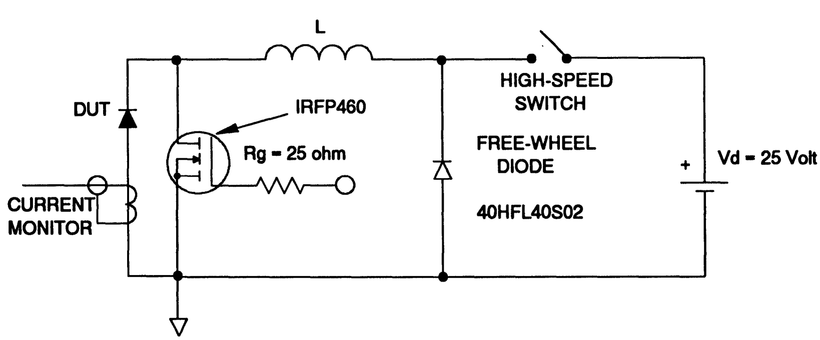


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

121NQ... SERIES

SCHOTTKY RECTIFIER

120 Amp

Major Ratings and Characteristics

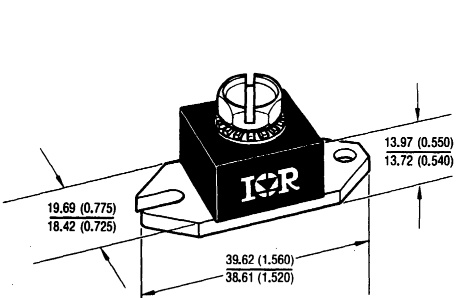
Characteristics	121NQ...	Units
$I_{F(AV)}$ Rectangular waveform	120	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	19,800	A
V_F @ 120Apk, T_J = 125°C	0.56	V
T_J	-55 to 175	°C

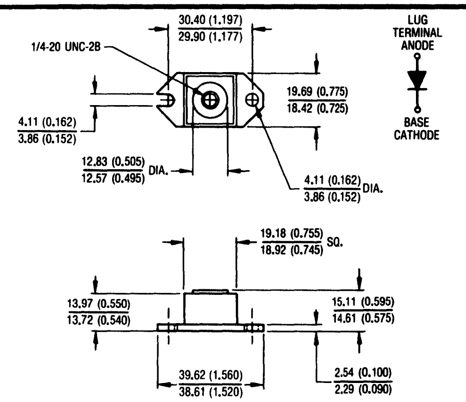
Description/Features

The 121NQ high current Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces two parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





HALF-PAK
Dimensions in millimeters and inches

Voltage Ratings

	Part number	121NQ035	121NQ040	121NQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	121NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	120	A	50% duty cycle @ T_C = 133° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	19,800	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		2200		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	81	mJ	T_J = 25 °C, I_{AS} = 12 Amps, L = 1.12 mH	
I_{AR}	Repetitive Avalanche Current	12	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	121NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.65	V	@ 120A	T_J = 25 °C
		0.83	V	@ 240A	
		0.56	V	@ 120A	T_J = 125 °C
		0.70	V	@ 240A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	10	mA	T_J = 25 °C	V_R = rated V_R
		90	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	5200	pF	V_R = $5V_{DC}$, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		121NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.40	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

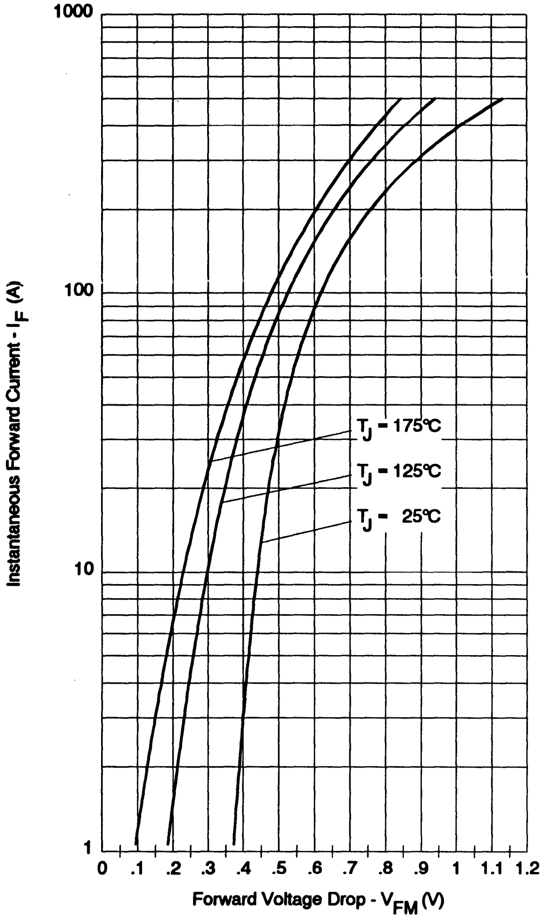


Fig. 1 - Maximum Forward Voltage Drop Characteristics

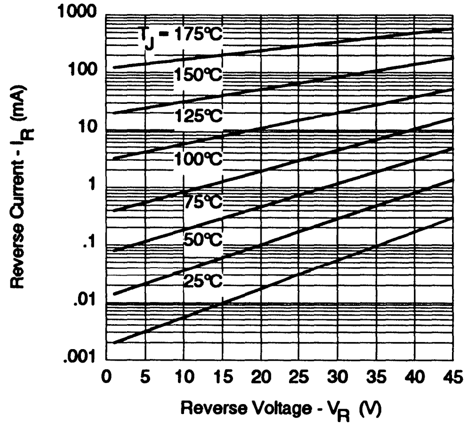


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

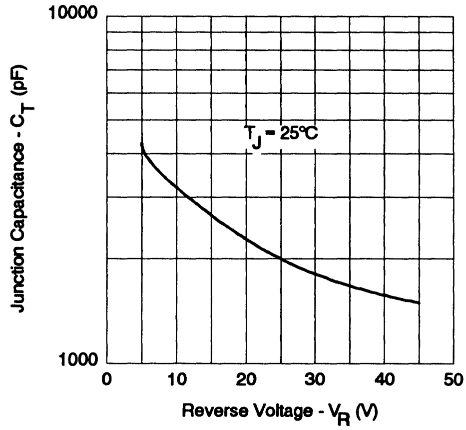


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

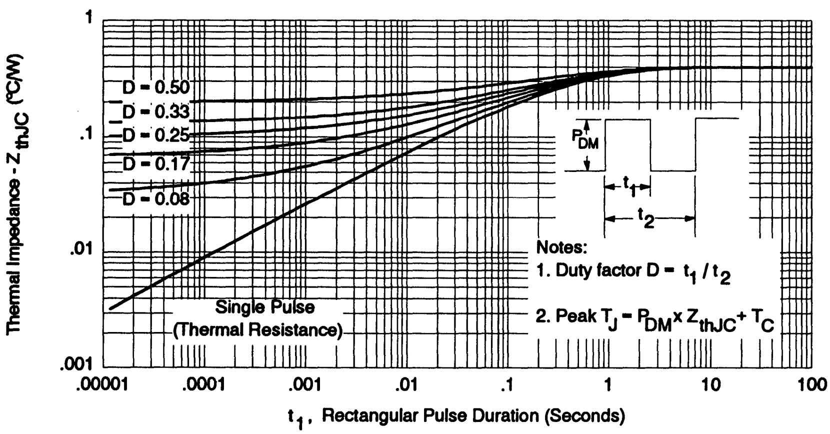


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

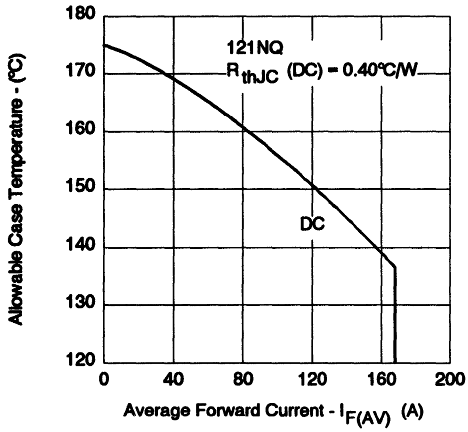


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

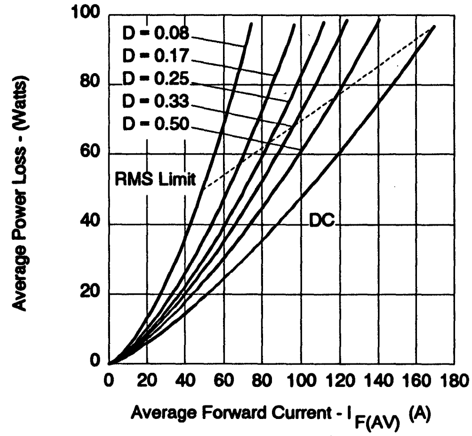


Fig. 6 - Forward Power Loss Characteristics

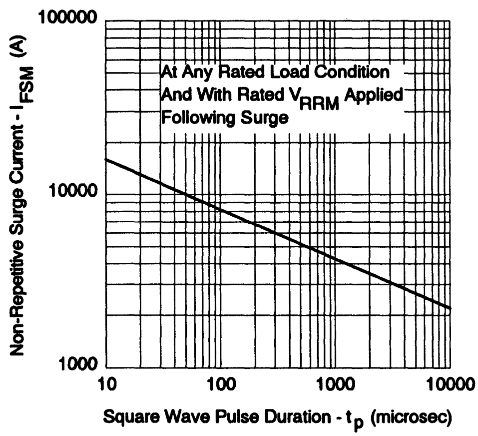


Fig. 7 - Maximum Non-Repetitive Surge Current

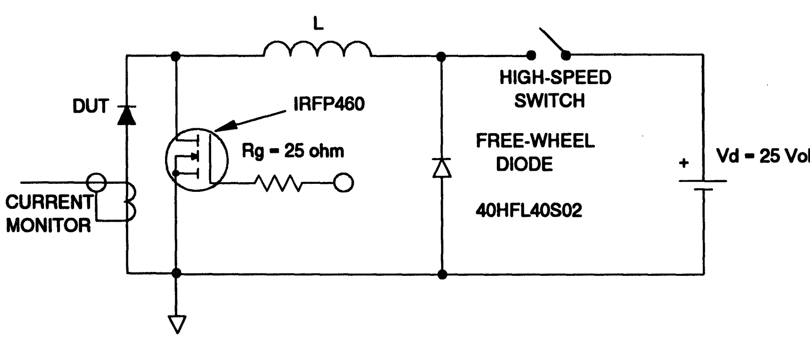


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

122NQ030

SCHOTTKY RECTIFIER

120 Amp

Major Ratings and Characteristics

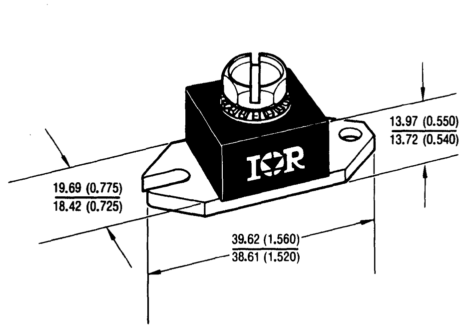
Characteristics	122NQ030	Units
$I_{F(AV)}$ Rectangular waveform	120	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 µs sine	22,500	A
V_F @ 120Apk, T_J = 125°C	0.41	V
T_J	- 55 to 150	°C

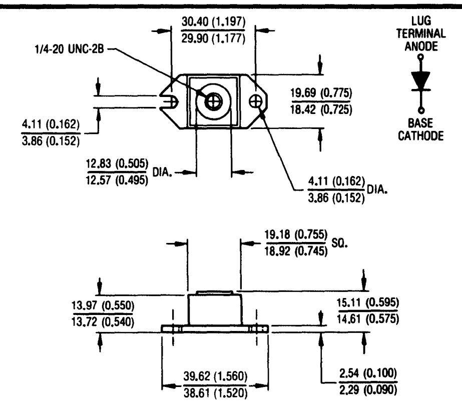
Description/Features

The 122NQ030 high current Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces two parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





HALF-PAK

Dimensions in millimeters and inches

Voltage Ratings

	Part number	122NQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	122NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	120	A	50% duty cycle @ T_C = 110° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	22,500	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		2400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	54	mJ	T_J = 25 °C, I_{AS} = 12 Amps, L = 0.75 mH	
I_{AR}	Repetitive Avalanche Current	12	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	122NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.49	V	@ 120A	T_J = 25 °C
		0.59	V	@ 240A	
		0.41	V	@ 120A	T_J = 125 °C
		0.54	V	@ 240A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	10	mA	T_J = 25 °C	V_R = rated V_R
		560	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	7400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		122NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.40	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

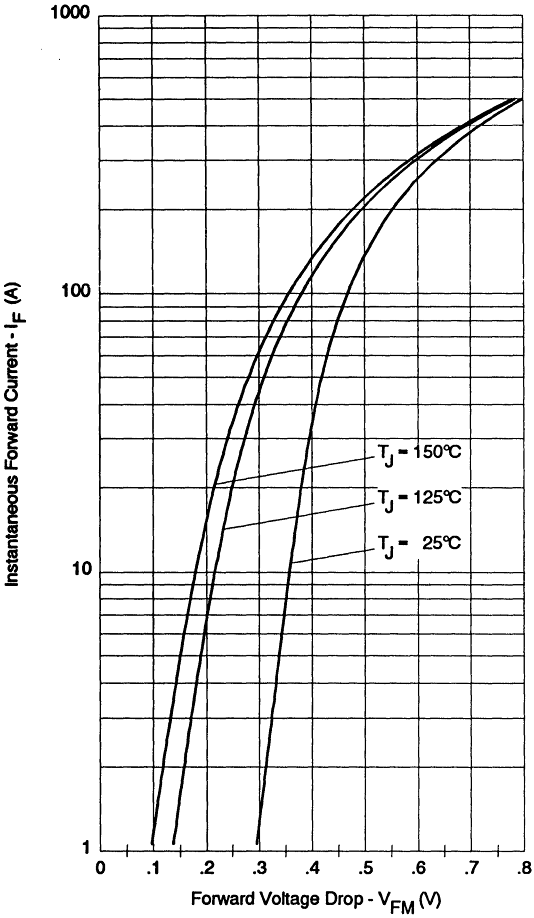


Fig. 1 - Maximum Forward Voltage Drop Characteristics

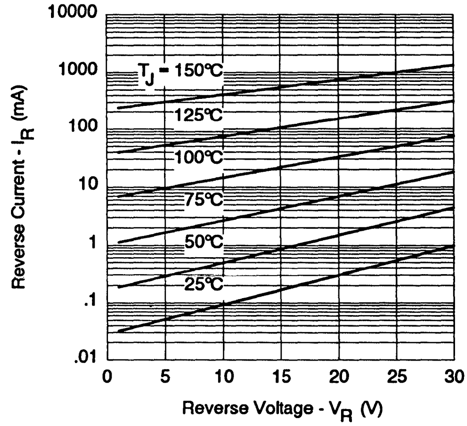


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

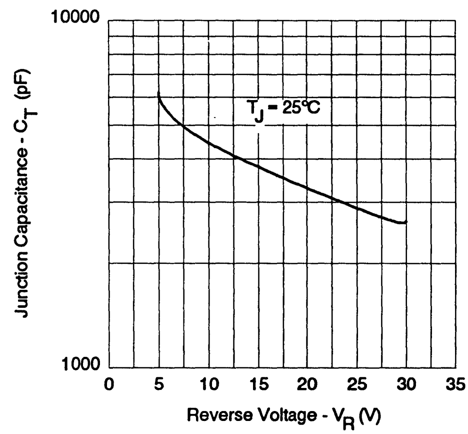


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

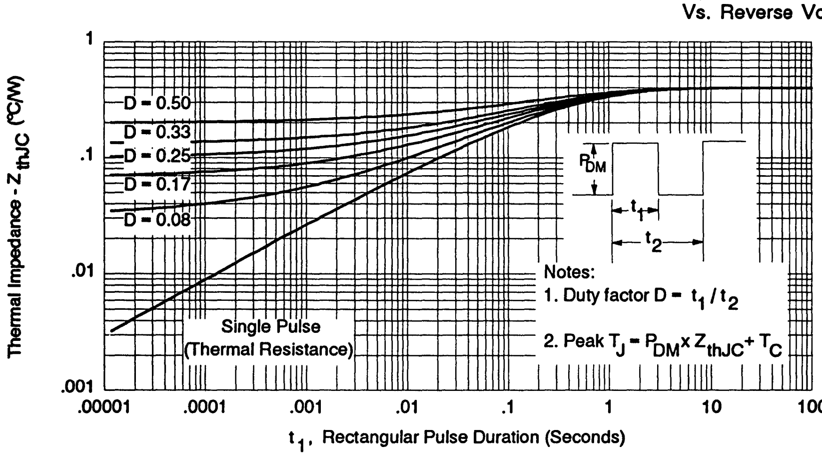


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

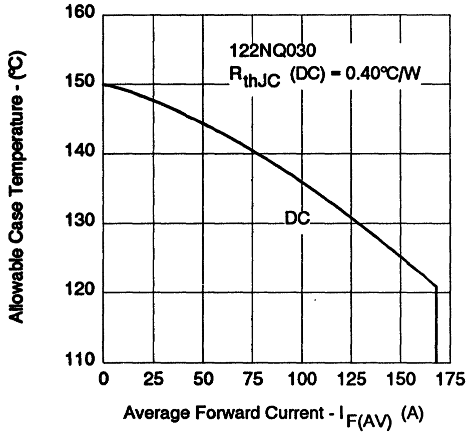


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

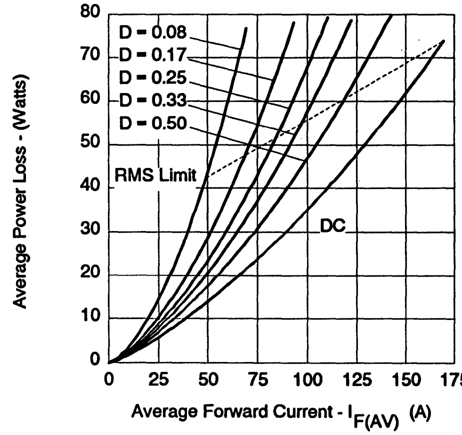


Fig. 6 - Forward Power Loss Characteristics

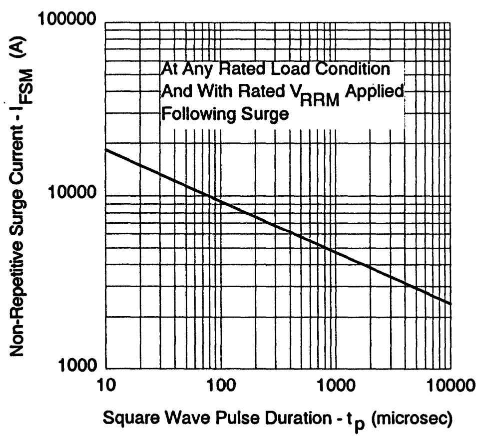


Fig. 7 - Maximum Non-Repetitive Surge Current

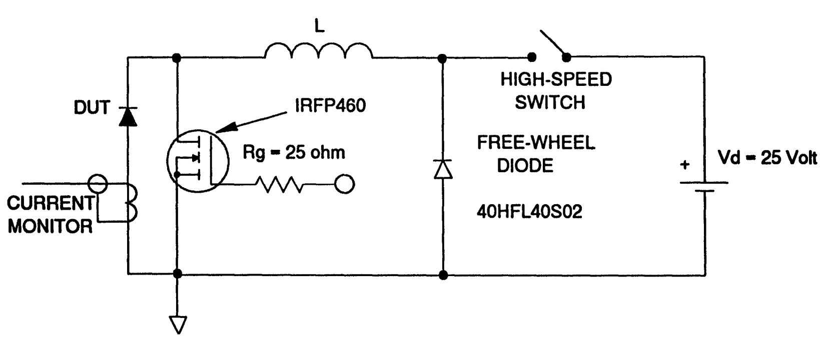


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

123NQ... SERIES

SCHOTTKY RECTIFIER

120 Amp

Major Ratings and Characteristics

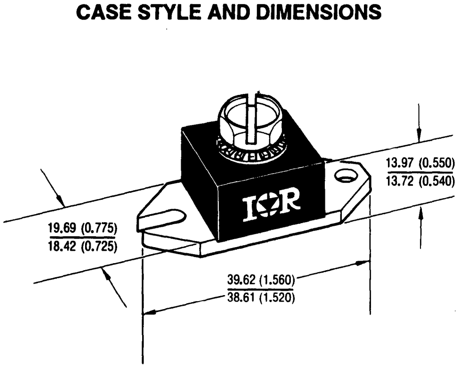
Characteristics	123NQ...	Units
$I_{F(AV)}$ Rectangular waveform	120	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	16,000	A
V_F @ 120Apk, T_J = 125°C	0.74	V
T_J	- 55 to 175	°C

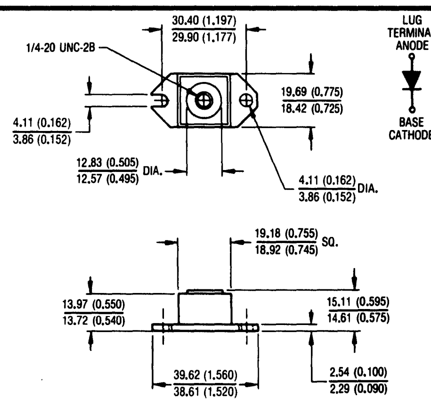
Description/Features

The 123NQ high current Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces two parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





HALF-PAK

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	123NQ080	123NQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	123NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	120	A	50% duty cycle @ T_C = 121° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	16,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		2100		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current	1	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	123NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.91	V	@ 120A	T_J = 25 °C
		1.08	V	@ 240A	
		0.74	V	@ 120A	T_J = 125 °C
		0.88	V	@ 240A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	3	mA	T_J = 25 °C	V_R = rated V_R
		40	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	2650	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		123NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.40	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

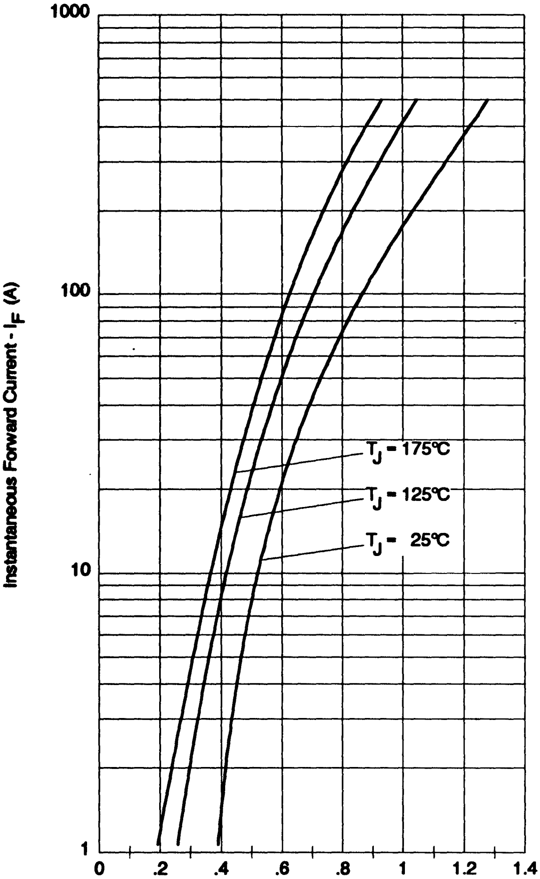


Fig. 1 - Maximum Forward Voltage Drop Characteristics

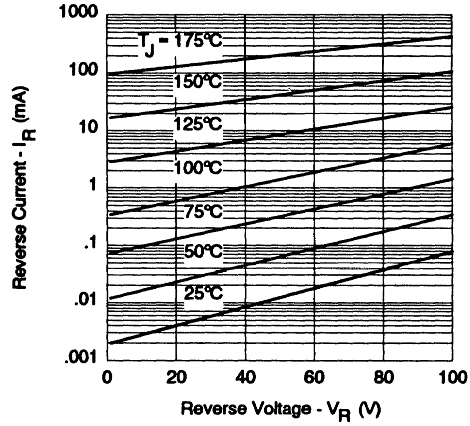


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

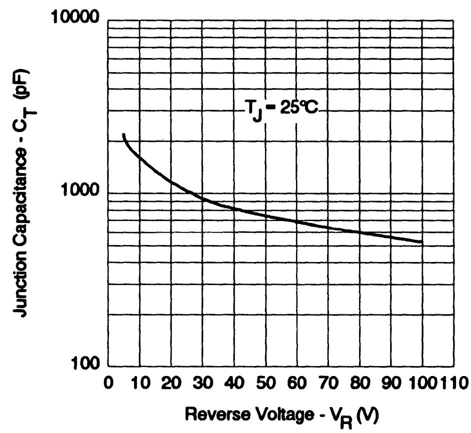


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

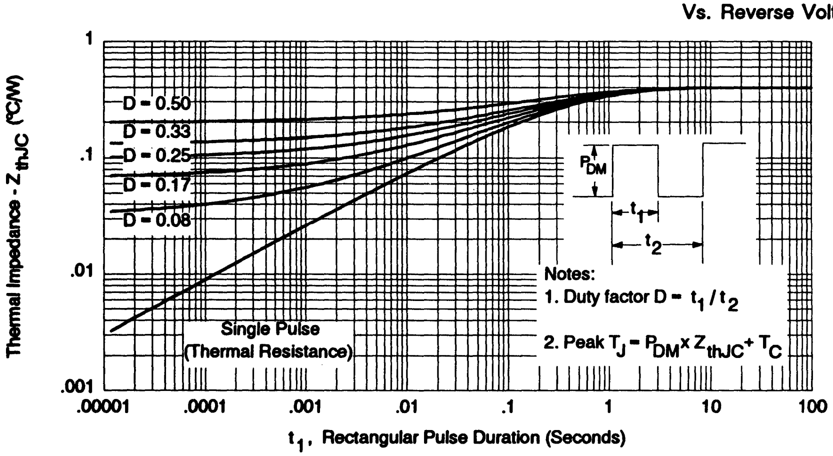


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

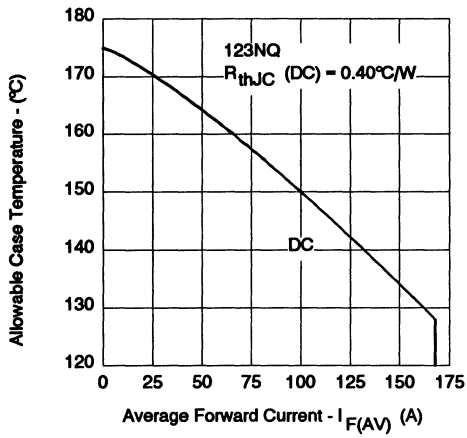


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

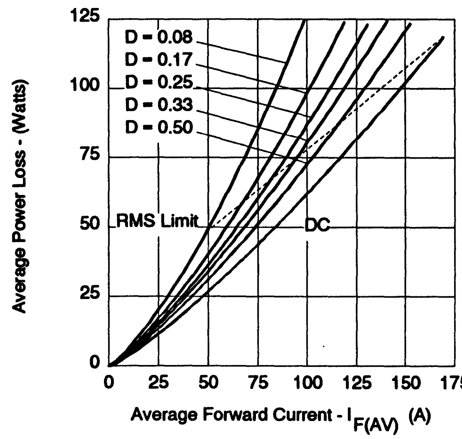


Fig. 6 - Forward Power Loss Characteristics

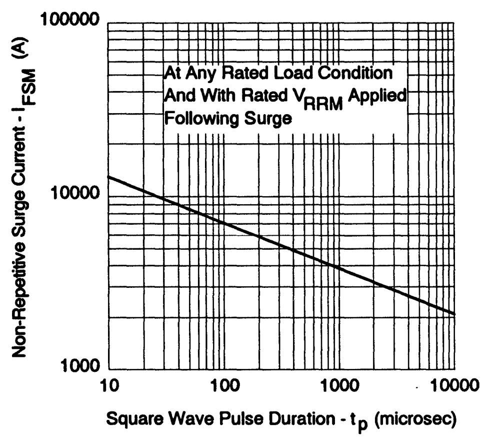


Fig. 7 - Maximum Non-Repetitive Surge Current

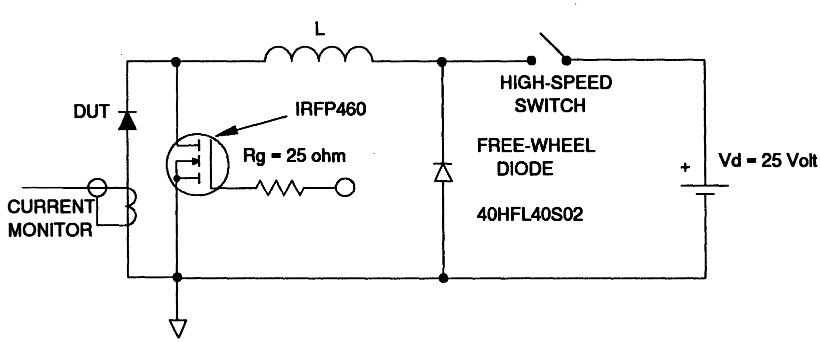


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

124NQ... SERIES

SCHOTTKY RECTIFIER

120 Amp

Major Ratings and Characteristics

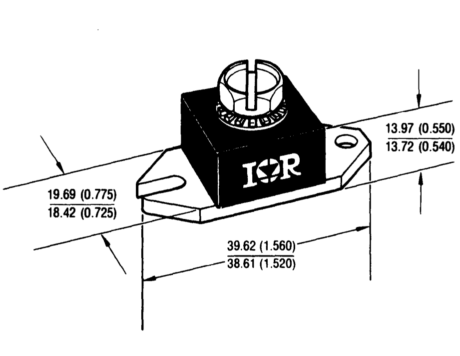
Characteristics	124NQ...	Units
$I_{F(AV)}$ Rectangular waveform	120	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	27,000	A
V_F @ 120Apk, T_J = 100°C	0.52	V
T_J	-55 to 125	°C

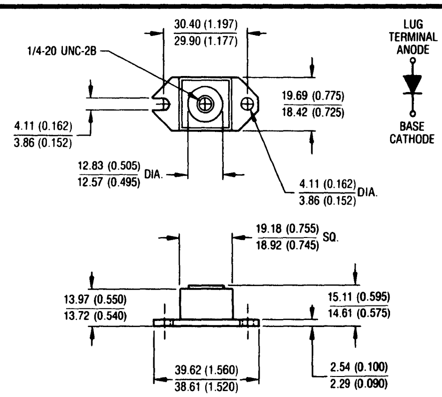
Description/Features

The 124NQ high current Schottky rectifier modules have been optimized for extremely low forward voltage drop, with higher leakage. The proprietary barrier technology allows for reliable operation up to 125° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, welding, and reverse battery protection.

- 125° C T_J operation
- Unique high power, HALF-PAK™ module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Extremely low forward voltage drop
- High frequency operation
- Guard ring enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D-67
Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

Part number	124NQ035	124NQ040	124NQ045
V_R Max. DC Reverse Voltage (V)	35	40	45
V_{RWM} Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	124NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	120	A	50% duty cycle @ T_C = 76° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	27,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current *See Fig. 7	2400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	135	mJ	T_J = 25 °C, I_{AS} = 20 Amps, L = 0.67 mH	
I_{AR}	Repetitive Avalanche Current	20	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	124NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1)	0.54	V	@ 120A	T_J = 25 °C
	* See Fig. 1	0.71	V	@ 240A	
		0.52	V	@ 120A	T_J = 100 °C
		0.71	V	@ 240A	
I_{RM}	Max. Reverse Leakage Current (1)	10	mA	T_J = 25 °C	V_R = rated V_R
	* See Fig. 2	1200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	5200	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		124NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 125	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.40	°C/W	DC operation *See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

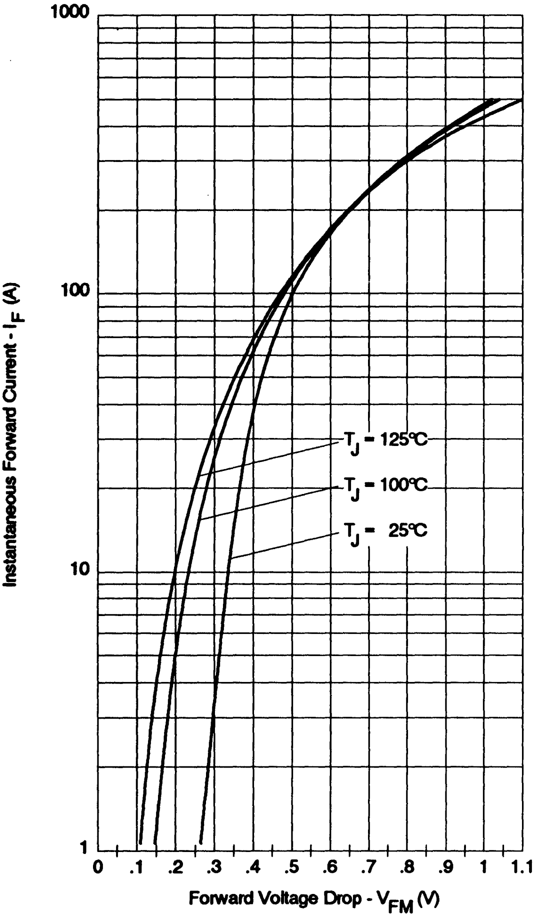


Fig. 1 - Maximum Forward Voltage Drop Characteristics

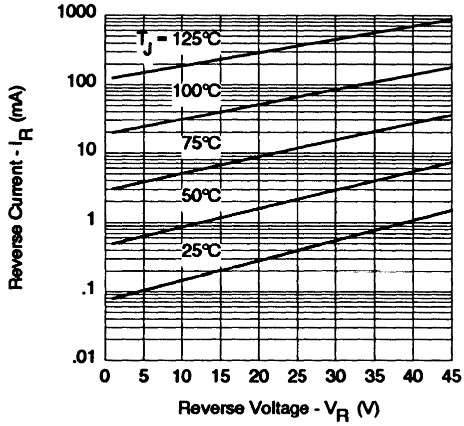


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

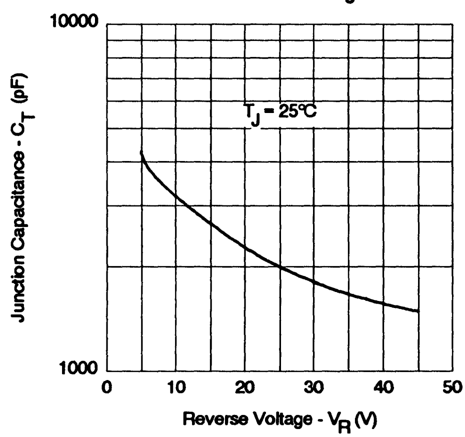


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

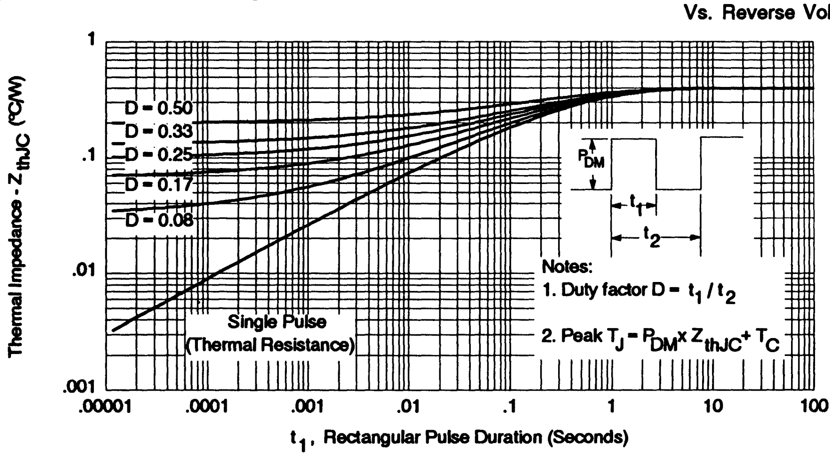


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

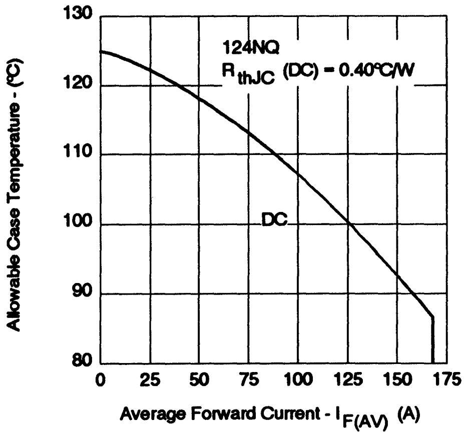


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

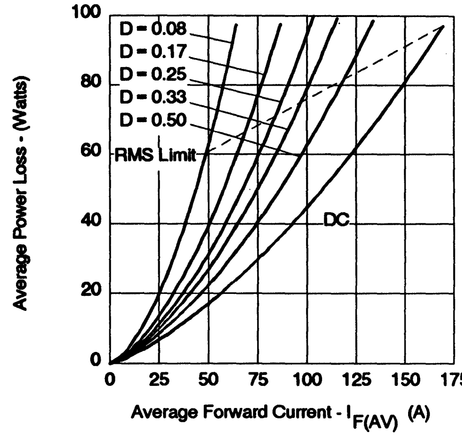


Fig. 6 - Forward Power Loss Characteristics

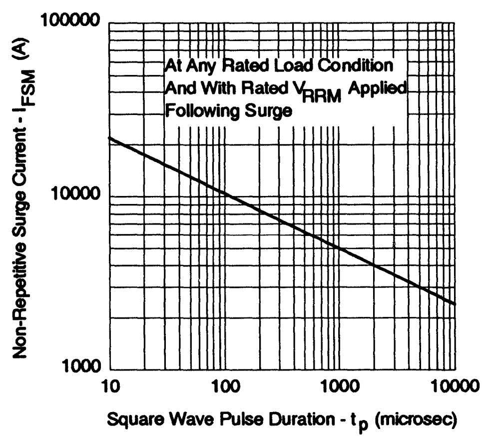


Fig. 7 - Maximum Non-Repetitive Surge Current

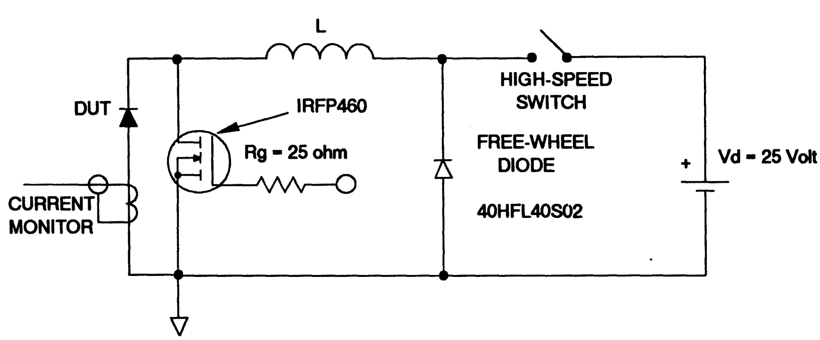


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

125NQ015

SCHOTTKY RECTIFIER

120 Amp

Major Ratings and Characteristics

Characteristics	125NQ015	Units
$I_{F(AV)}$ Rectangular waveform	120	A
V_{RRM}	15	V
I_{FSM} @ tp = 5 μs sine	10,800	A
V_F @ 120 Apk, T_J = 75°C	0.33	V
T_J	-55 to 100	°C

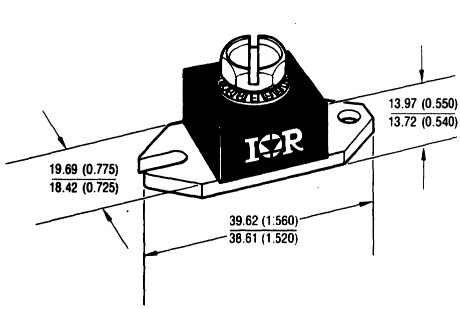
Description/Features

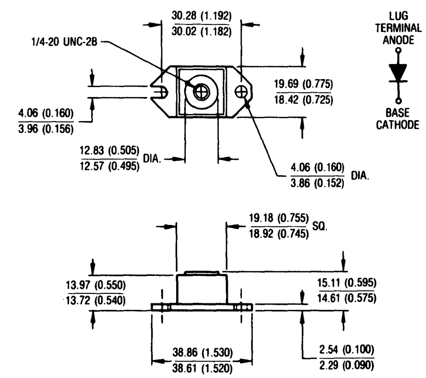
The 125NQ015 high current Schottky rectifier module has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100 °C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100 °C T_J operation
- Unique high power, HALF-PAK™ module
- Optimized for OR-ing applications
- Ultra low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance

HALF PAK MODULES

CASE STYLE AND DIMENSIONS





Outline D-67

Dimensions in millimeters and inches

Voltage Ratings

	Part number	125NQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	125NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	120	A	50% duty cycle @ T_C = 71° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	10,800	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1700		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	9	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 4.5 mH	
I_{AR}	Repetitive Avalanche Current	2	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 3 x V_R typical	

Electrical Specifications

	Parameters	125NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.39	V	@ 120A	T_J = 25 °C
		0.52	V	@ 240A	
		0.33	V	@ 120A	T_J = 75 °C
		0.45	V	@ 240A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	40	mA	T_J = 25 °C	V_R = rated V_R
		2000	mA	T_J = 100 °C	
		1780	mA	T_J = 100 °C	V_R = 12V
		1080	mA	T_J = 100 °C	V_R = 5V
C_T	Max. Junction Capacitance	7700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		125NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 100	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 100	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.40	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

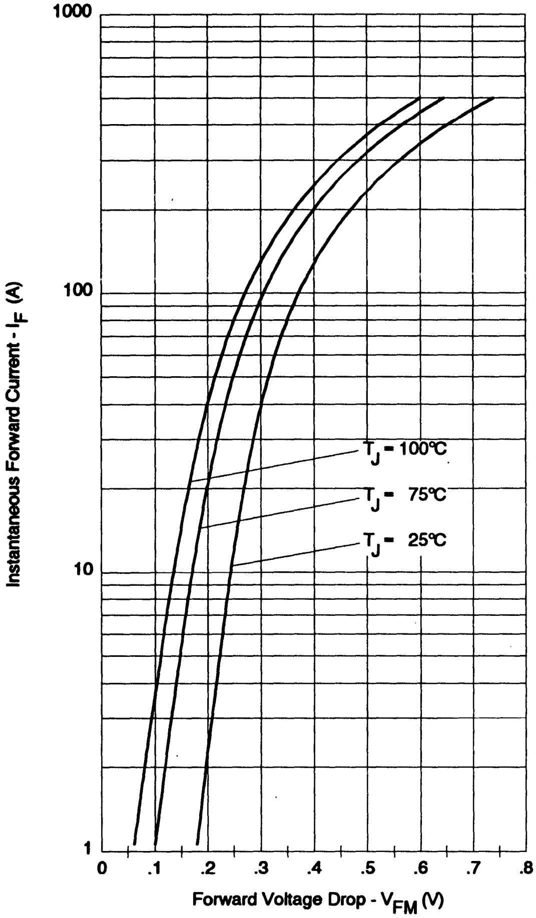


Fig. 1 - Maximum Forward Voltage Drop Characteristics

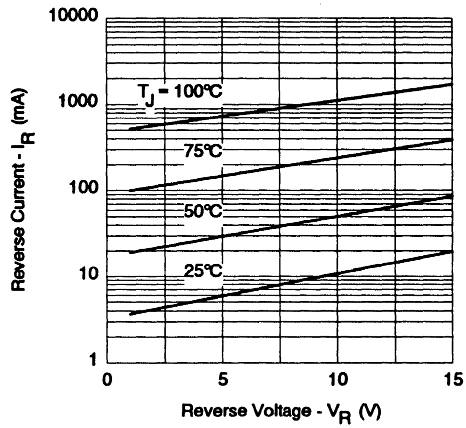


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

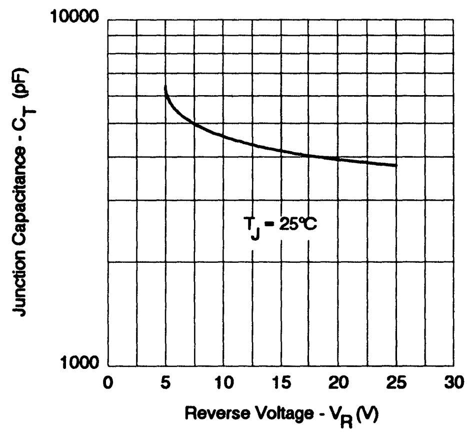


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

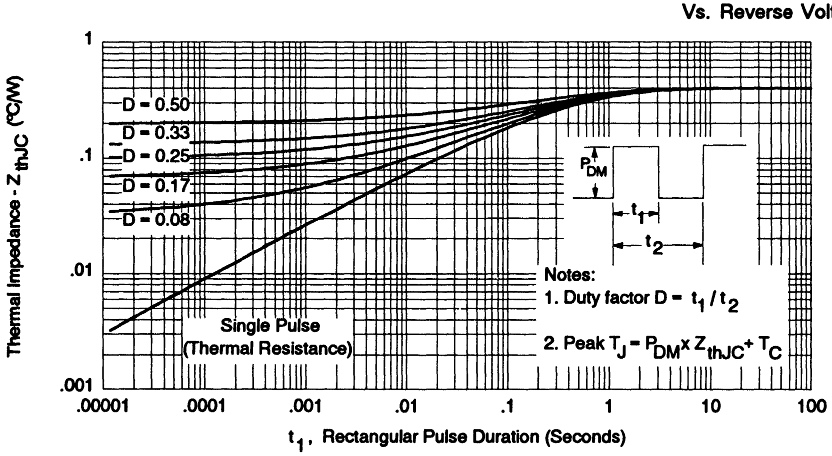


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

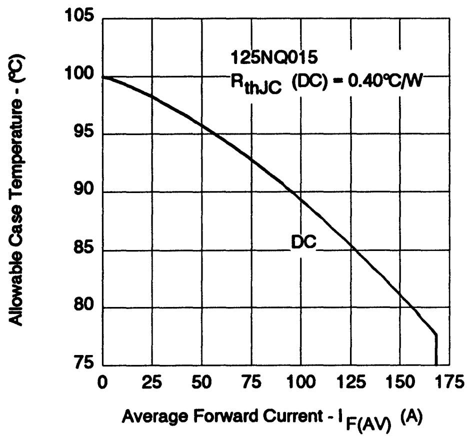


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

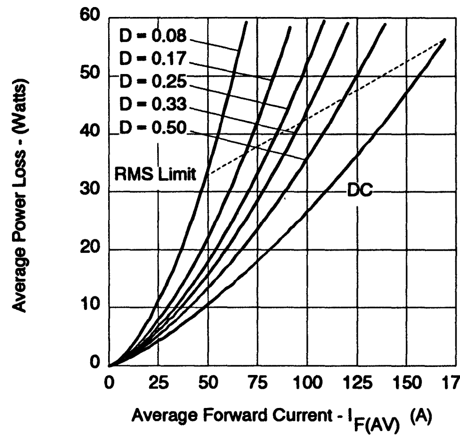


Fig. 6 - Forward Power Loss Characteristics

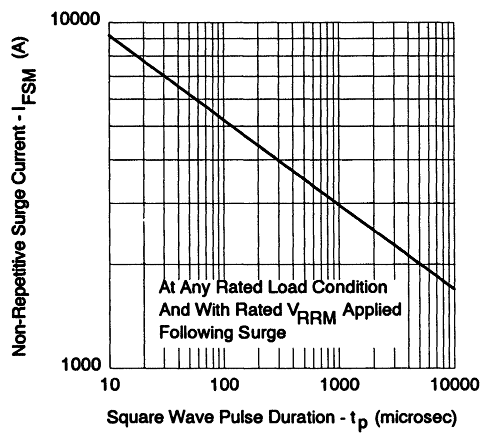


Fig. 7 - Maximum Non-Repetitive Surge Current

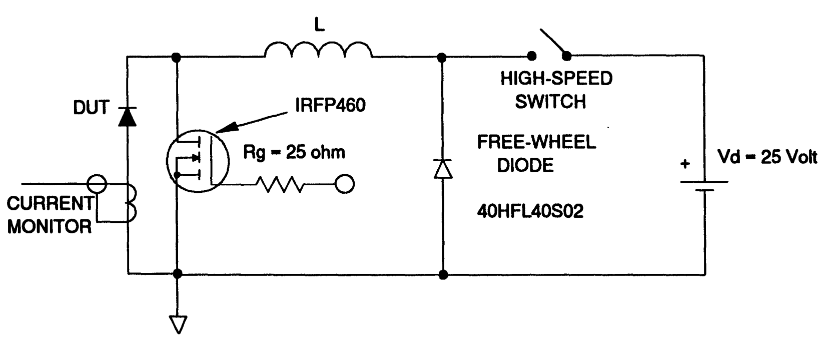


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

180NQ... SERIES

SCHOTTKY RECTIFIER

180 Amp

Major Ratings and Characteristics

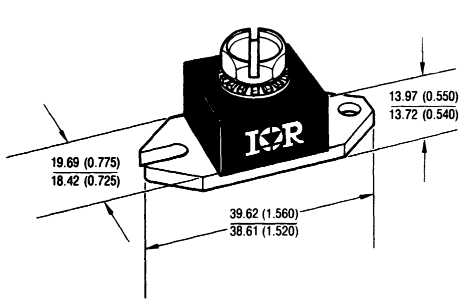
Characteristics	180NQ...	Units
$I_{F(AV)}$ Rectangular waveform	180	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	25,500	A
V_F @ 180Apk, T_J=125°C	0.56	V
T_J	-55 to 150	°C

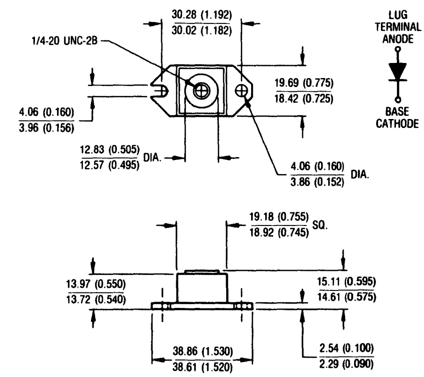
Description/Features

The 180NQ high current Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces three parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D-67

Dimensions in millimeters and inches

Voltage Ratings

	Part number	180NQ035	180NQ040	180NQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	180NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	180	A	50% duty cycle @ T_C = 90° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	25,500	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		2900		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	243	mJ	T_J = 25 °C, I_{AS} = 36 Amps, L = 0.37 mH	
I_{AR}	Repetitive Avalanche Current	36	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	180NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.60	V	@ 180A	T_J = 25 °C
		0.78	V	@ 360A	
		0.56	V	@ 180A	T_J = 125 °C
		0.75	V	@ 360A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	15	mA	T_J = 25 °C	V_R = rated V_R
		600	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	7700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.0	nH	From the top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		180NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.30	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

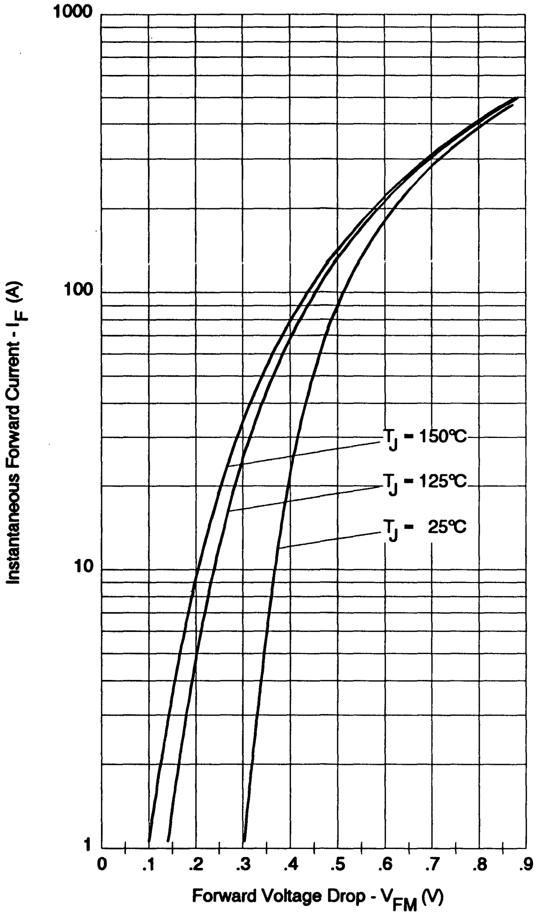


Fig. 1 - Maximum Forward Voltage Drop Characteristics

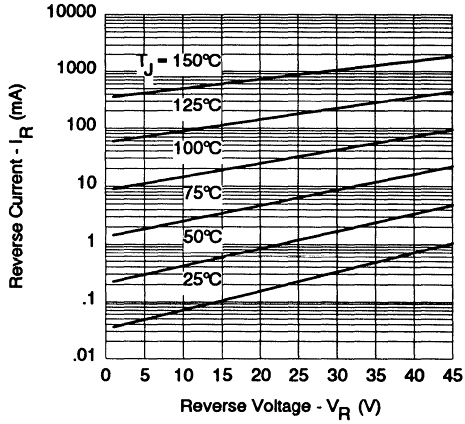


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

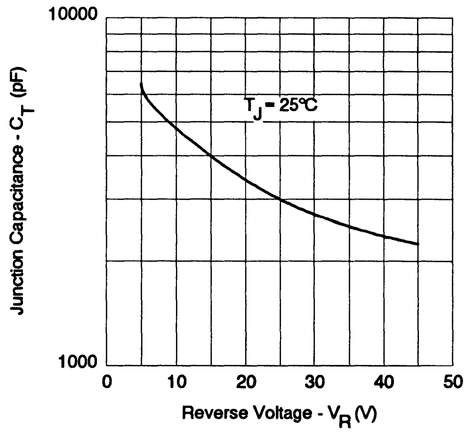


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

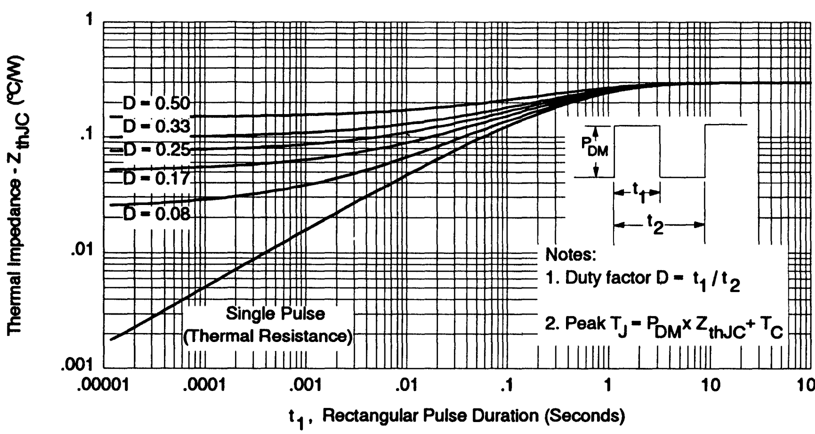


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

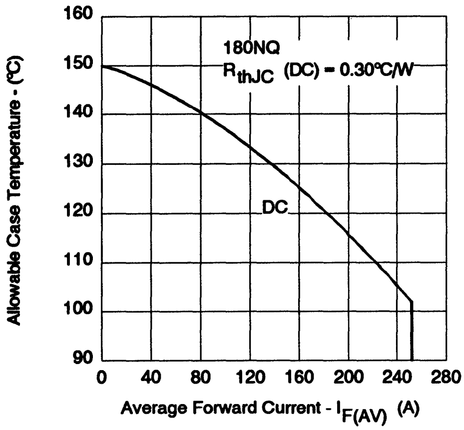


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

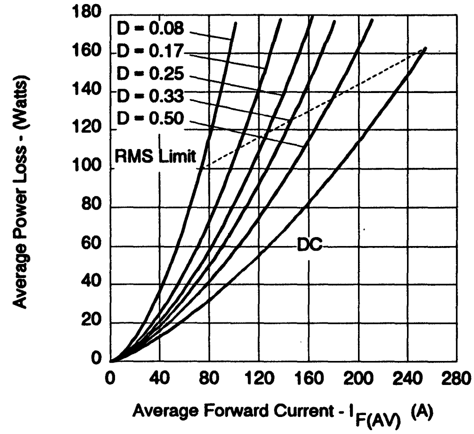


Fig. 6 - Forward Power Loss Characteristics

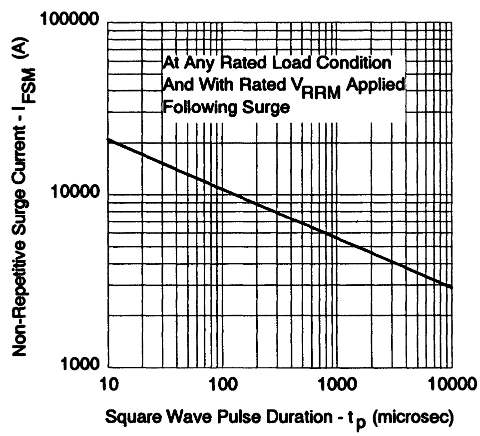


Fig. 7 - Maximum Non-Repetitive Surge Current

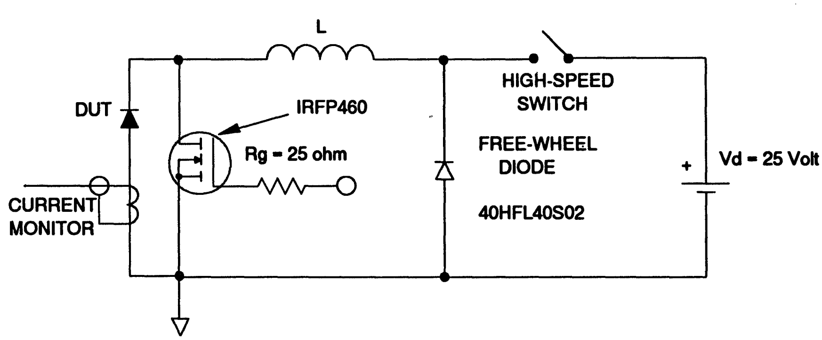


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

181NQ... SERIES

SCHOTTKY RECTIFIER

180 Amp

Major Ratings and Characteristics

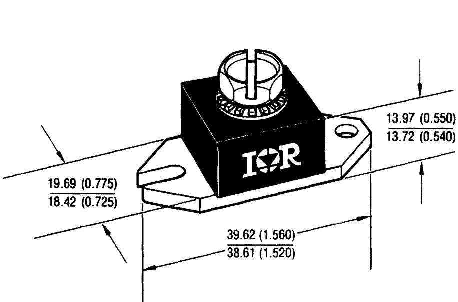
Characteristics	181NQ...	Units
$I_{F(AV)}$ Rectangular waveform	180	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	22,000	A
V_F @ 180Apk, T_J = 125°C	0.56	V
T_J	-55 to 175	°C

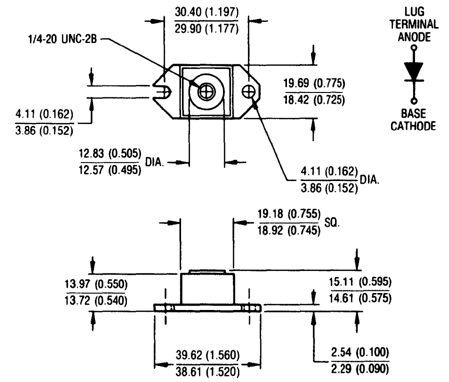
Description/Features

The 181NQ high current Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces three parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D-67

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

Part number	181NQ035	181NQ040	181NQ045
V_R Max. DC Reverse Voltage (V)	35	40	45
V_{RWM} Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

Parameters	181NQ	Units	Conditions	
$I_{F(AV)}$ Max. Average Forward Current * See Fig. 5	180	A	50% duty cycle @ T_C = 125° C, rectangular wave form	
I_{FSM} Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	22,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	2500		10ms Sine or 6ms Rect. pulse	
E_{AS} Non-Repetitive Avalanche Energy	243	mJ	T_J = 25 °C, I_{AS} = 36 Amps, L = 0.38 mH	
I_{AR} Repetitive Avalanche Current	36	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

Parameters	181NQ	Units	Conditions	
V_{FM} Max. Forward Voltage Drop (1) * See Fig. 1	0.66	V	@ 180A	T_J = 25 °C
	0.80	V	@ 360A	
	0.56	V	@ 180A	T_J = 125 °C
	0.69	V	@ 360A	
I_{RM} Max. Reverse Leakage Current (1) * See Fig. 2	15	mA	T_J = 25 °C	V_R = rated V_R
	135	mA	T_J = 125 °C	
C_T Max. Junction Capacitance	7800	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S Typical Series Inductance	6.0	nH	From the top of terminal hole to mounting plane	
dv/dt Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

Parameters		181NQ	Units	Conditions
T_J Max. Junction Temperature Range		-55 to 175	°C	
T_{stg} Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC} Max. Thermal Resistance Junction to Case		0.30	°C/W	DC operation * See Fig. 4
R_{thCS} Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt Approximate Weight		25.6 (0.9)	g (oz.)	
T Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
	Max.	29 (25)		
Terminal Torque	Min.	23 (20)		
	Max.	46 (40)		
Case Style		HALF-PAK		

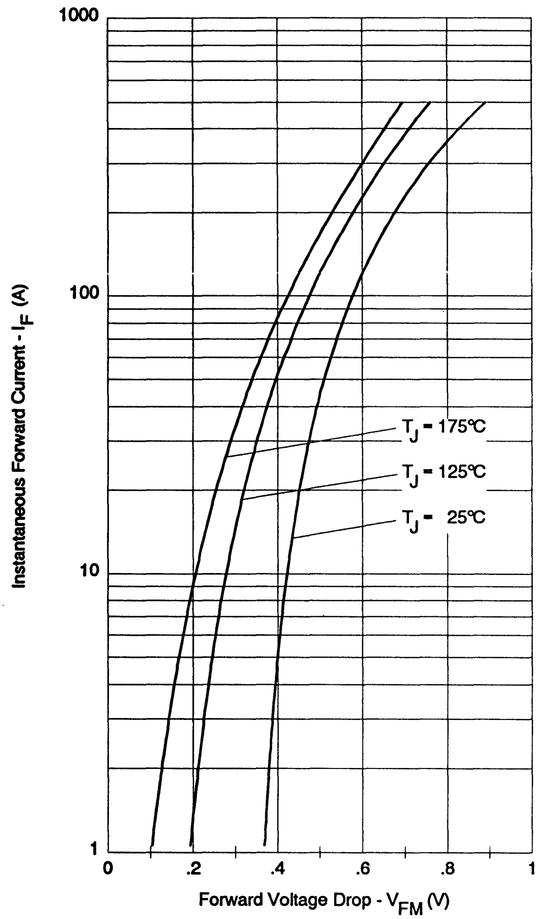


Fig. 1 - Maximum Forward Voltage Drop Characteristics

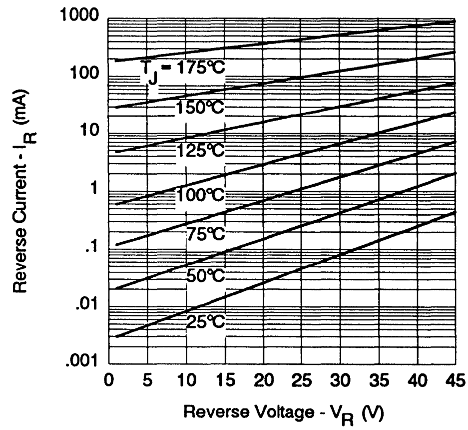


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

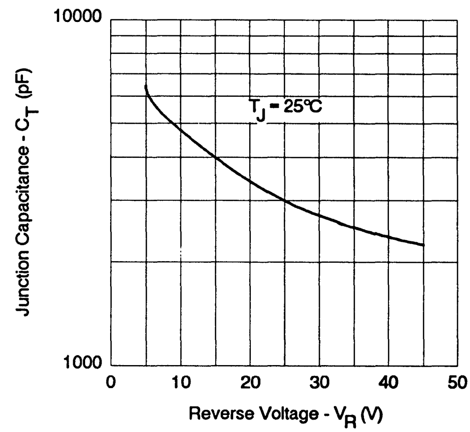


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

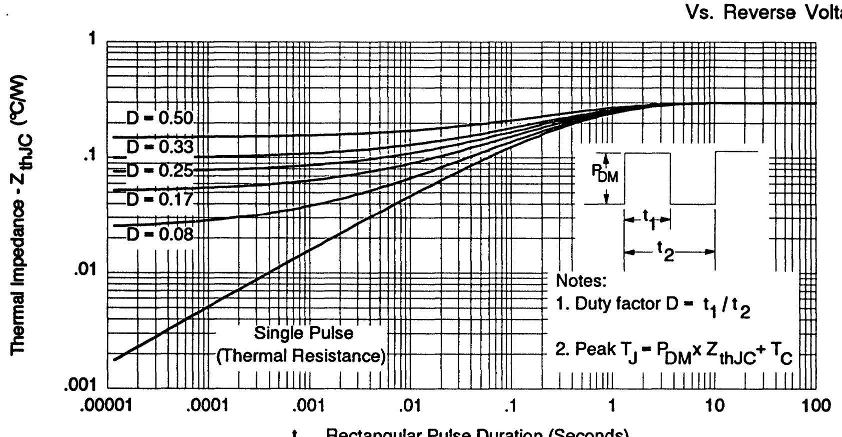


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

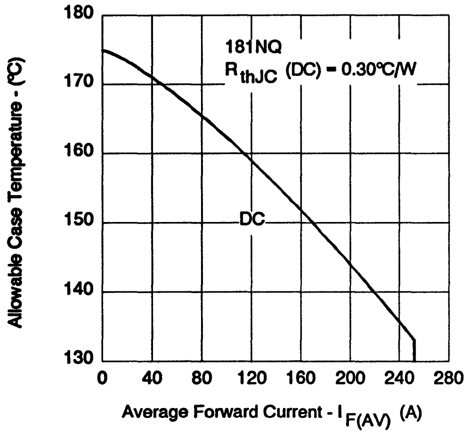


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

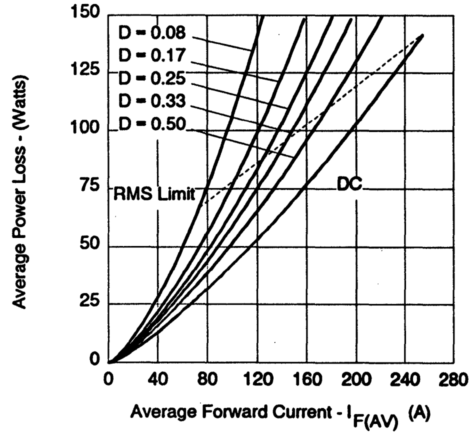


Fig. 6 - Forward Power Loss Characteristics

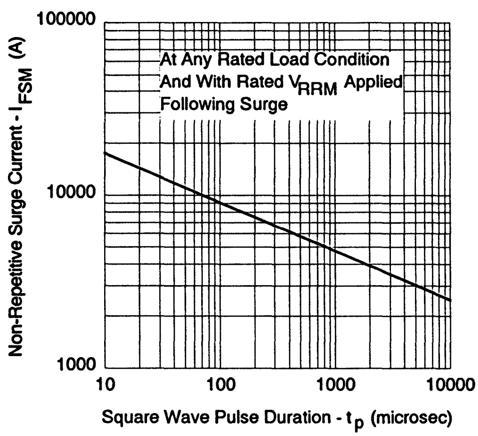


Fig. 7 - Maximum Non-Repetitive Surge Current

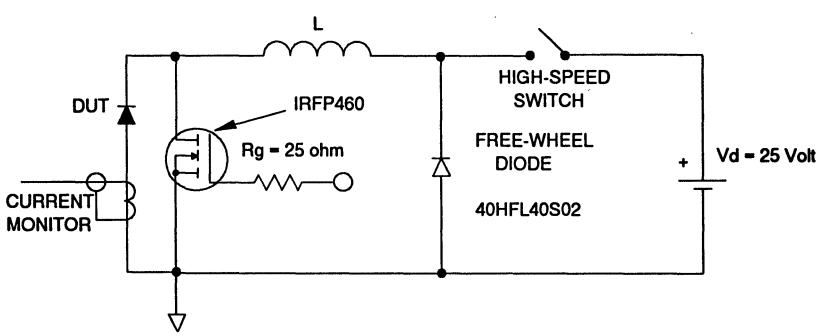


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

182NQ030

SCHOTTKY RECTIFIER

180 Amp

Major Ratings and Characteristics

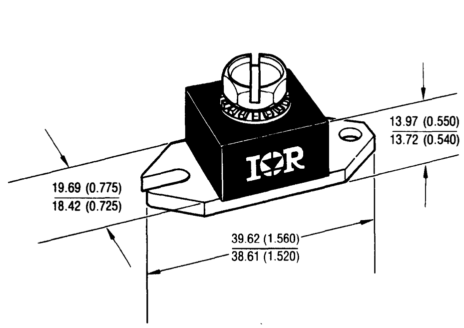
Characteristics	182NQ030	Units
$I_{F(AV)}$ Rectangular waveform	180	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	30,000	A
V_F @ 180Apk, T_J = 125°C	0.41	V
T_J	-55 to 150	°C

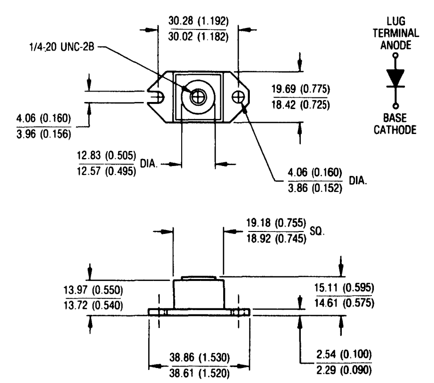
Description/Features

The 182NQ030 high current Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces three parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D-67

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	182NQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	182NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	180	A	50% duty cycle @ T_C = 107° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	30,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3450		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	162	mJ	T_J = 25 °C, I_{AS} = 36 Amps, L = 0.25 mH	
I_{AR}	Repetitive Avalanche Current	36	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	182NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.51	V	@ 180A	T_J = 25 °C
		0.61	V	@ 360A	
		0.41	V	@ 180A	T_J = 125 °C
		0.54	V	@ 360A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	15	mA	T_J = 25 °C	V_R = rated V_R
		840	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	7700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		182NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.30	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

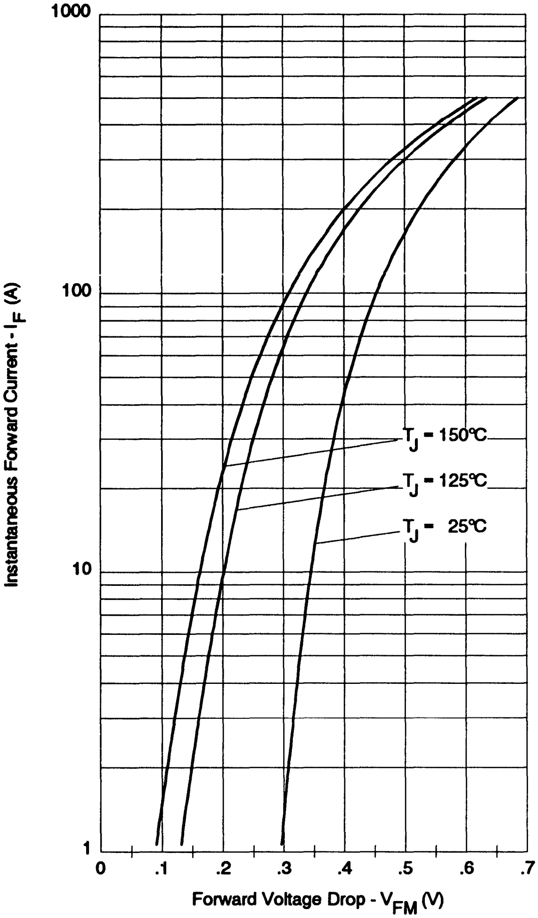


Fig. 1 - Maximum Forward Voltage Drop Characteristics

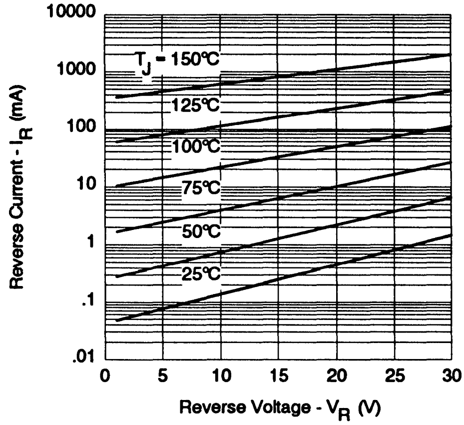


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

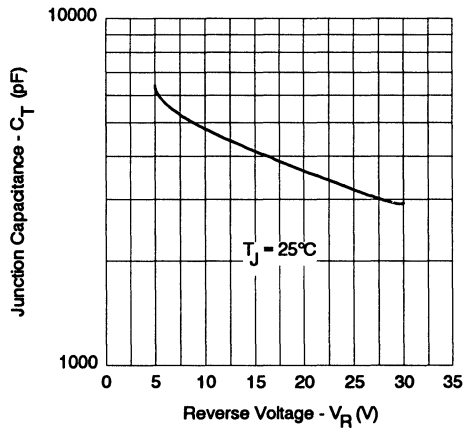


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

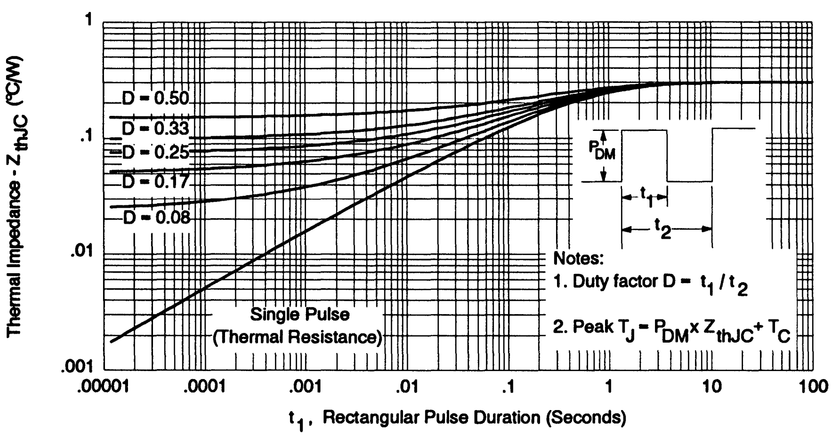


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

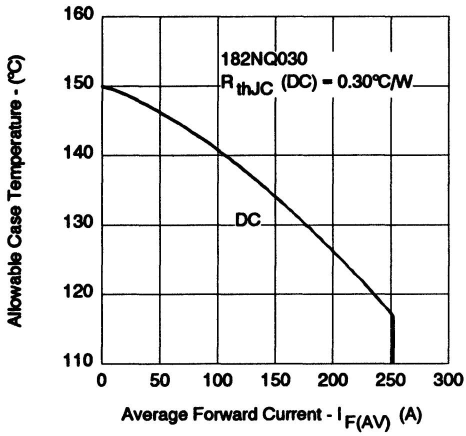


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

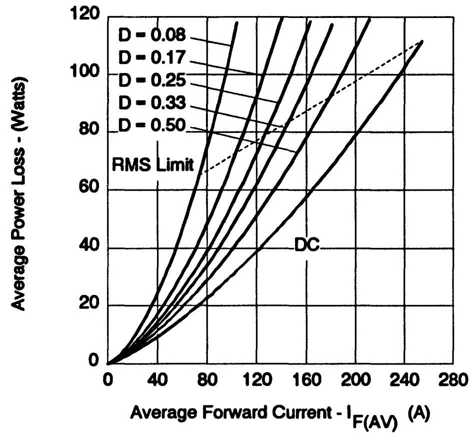


Fig. 6 - Forward Power Loss Characteristics

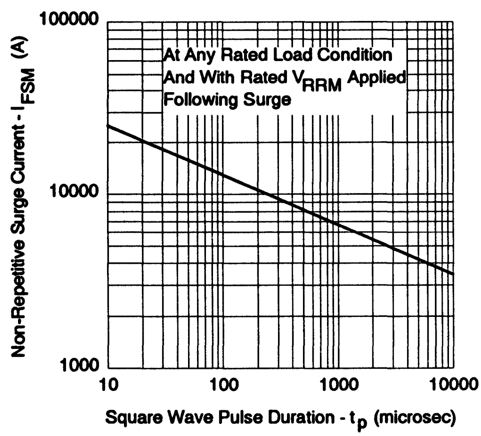


Fig. 7 - Maximum Non-Repetitive Surge Current

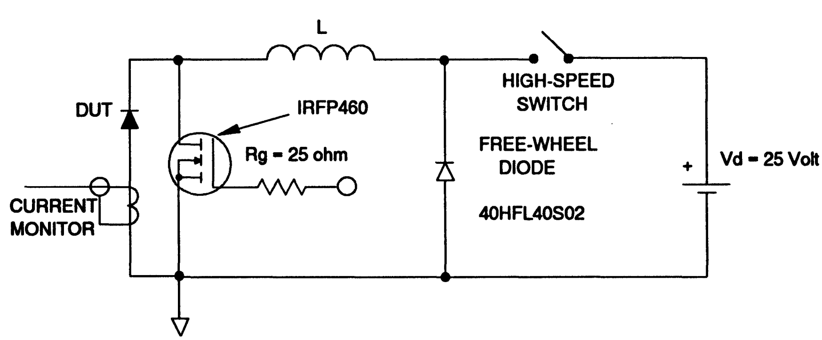


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

183NQ... SERIES

SCHOTTKY RECTIFIER

180 Amp

Major Ratings and Characteristics

Characteristics	183NQ...	Units
$I_{F(AV)}$ Rectangular waveform	180	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	22,000	A
V_F @ 180Apk, T_J = 125°C	0.75	V
T_J	-55 to 175	°C

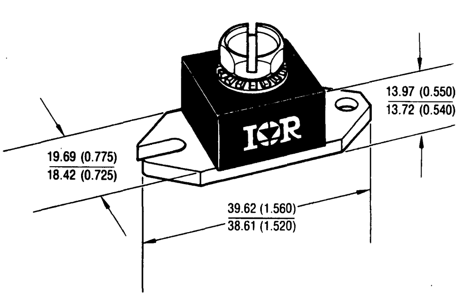
Description/Features

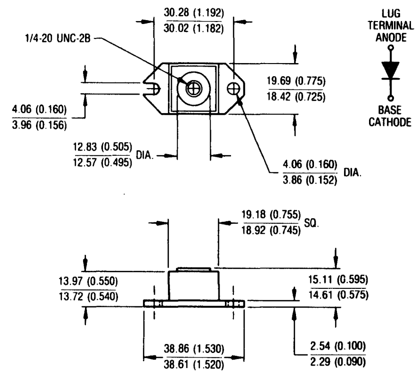
The 183NQ high current Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces three parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

HALF PAK MODULES

CASE STYLE AND DIMENSIONS





Outline D-67

Dimensions in millimeters and inches

Voltage Ratings

	Part number	183NQ080	183NQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	183NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	180	A	50% duty cycle @ T_C = 116° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	22,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1550		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current	1	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	183NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.95	V	@ 180A	T_J = 25 °C
		1.14	V	@ 360A	
		0.75	V	@ 180A	T_J = 125 °C
		0.89	V	@ 360A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	4.5	mA	T_J = 25 °C	V_R = rated V_R
		60	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	4150	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		183NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.30	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

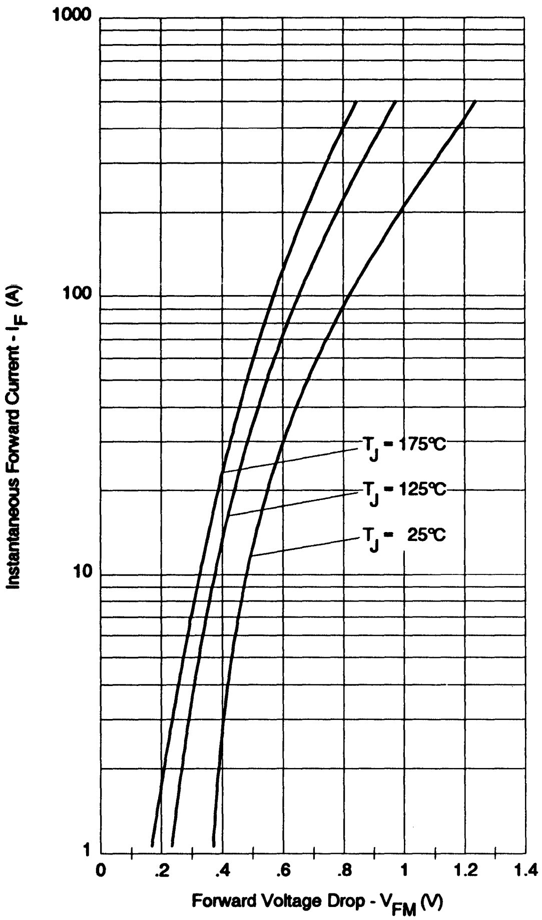


Fig. 1 - Maximum Forward Voltage Drop Characteristics

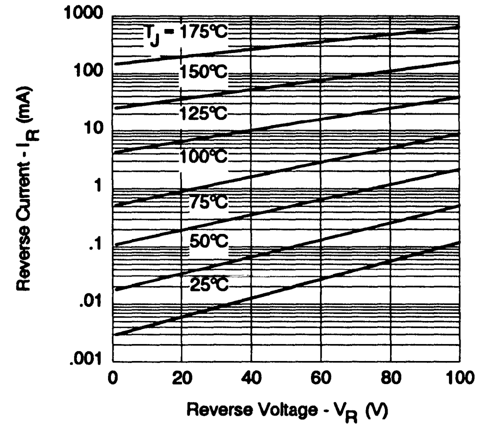


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

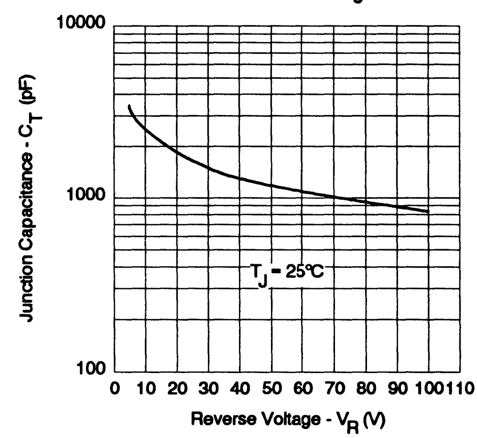


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

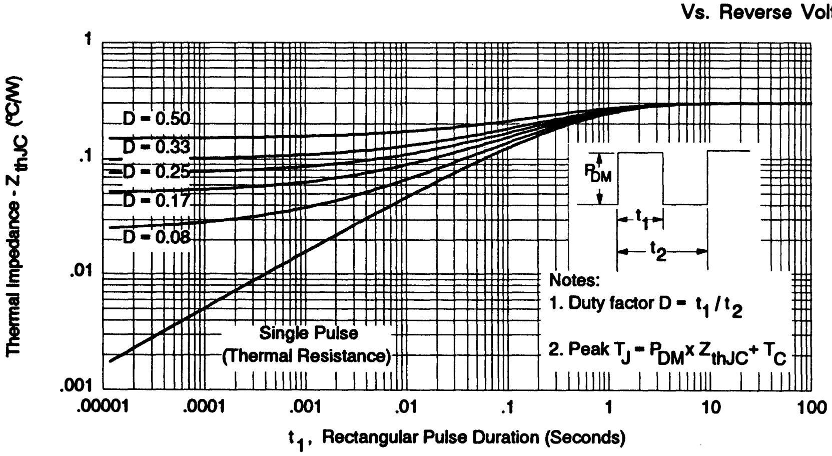


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

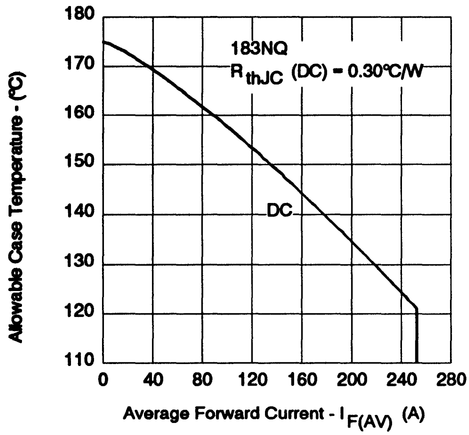


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

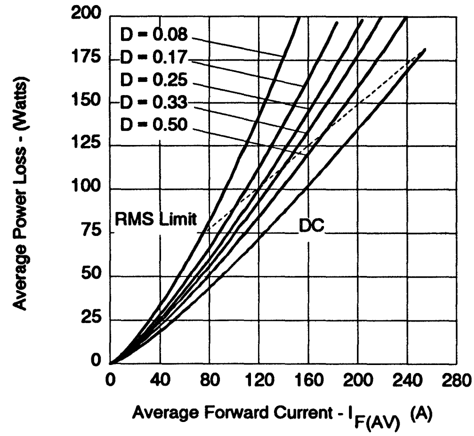


Fig. 6 - Forward Power Loss Characteristics

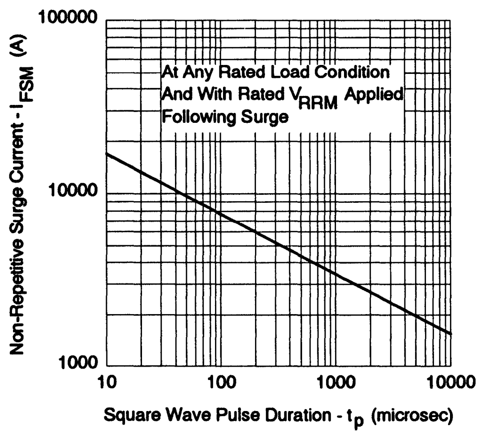


Fig. 7 - Maximum Non-Repetitive Surge Current

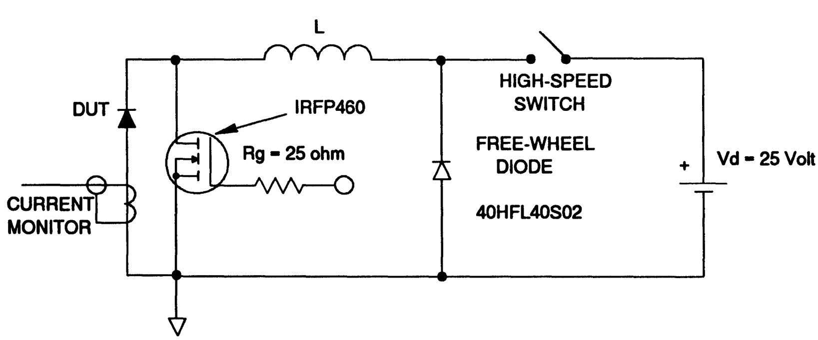


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

185NQ015

SCHOTTKY RECTIFIER

180 Amp

Major Ratings and Characteristics

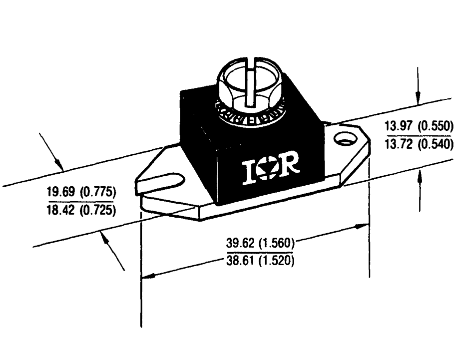
Characteristics		185NQ015	Units
$I_{F(AV)}$	Rectangular waveform	180	A
V_{RRM}		15	V
I_{FSM}	@ tp = 5 μs sine	15,000	A
V_F	@ 180 Apk, T_J = 75°C	0.34	V
T_J		- 55 to 100	°C

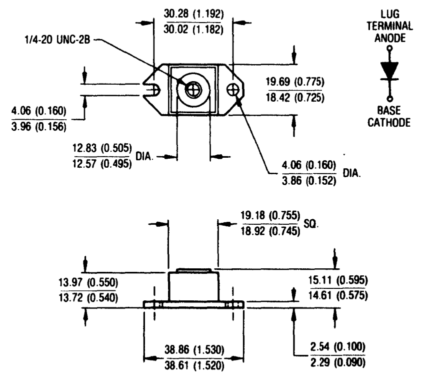
Description/Features

The 185NQ015 high current Schottky rectifier module has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100 °C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100 °C T_J operation
- Unique high power, HALF-PAK™ module
- Optimized for OR-ing applications
- Ultra low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance

CASE STYLE AND DIMENSIONS





Outline D-67
Dimensions in millimeters and inches

Voltage Ratings

	Part number	185NQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	185NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	180	A	50% duty cycle @ T_C = 66° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	15,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		2250		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	9	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 4.5 mH	
I_{AR}	Repetitive Avalanche Current	2	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 3 x V_R typical	

Electrical Specifications

	Parameters	185NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.40	V	@ 180A	T_J = 25 °C
		0.51	V	@ 360A	
		0.34	V	@ 180A	T_J = 75 °C
		0.45	V	@ 360A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	60	mA	T_J = 25 °C	V_R = rated V_R
		3000	mA	T_J = 100 °C	
		2670	mA	T_J = 100 °C	V_R = 12V
		1620	mA	T_J = 100 °C	V_R = 5V
C_T	Max. Junction Capacitance	12,300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	6.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		185NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 100	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 100	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.30	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

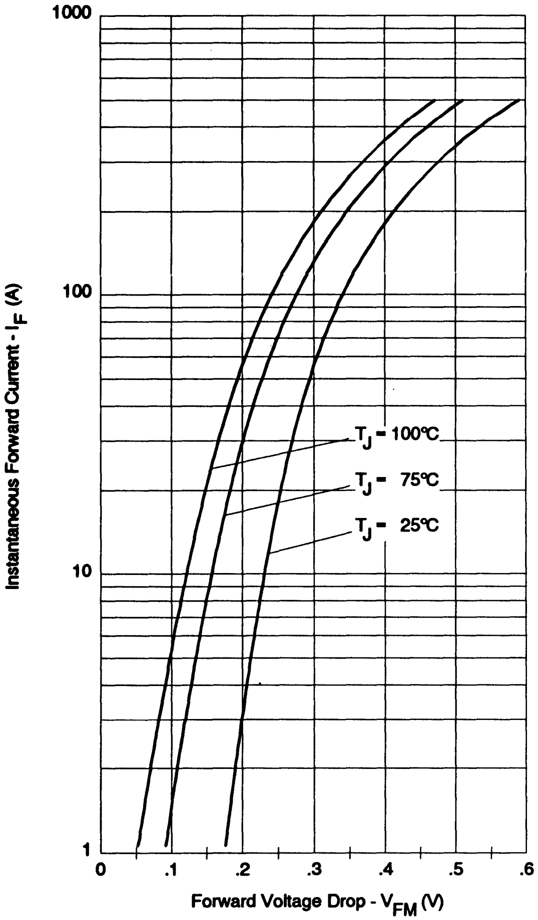


Fig. 1 - Maximum Forward Voltage Drop Characteristics

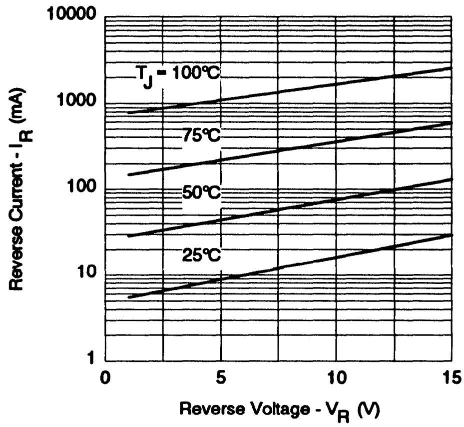


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

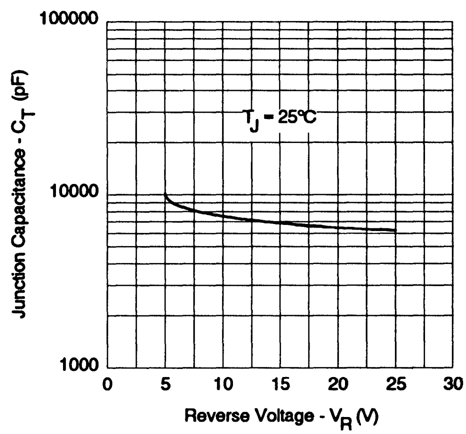


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

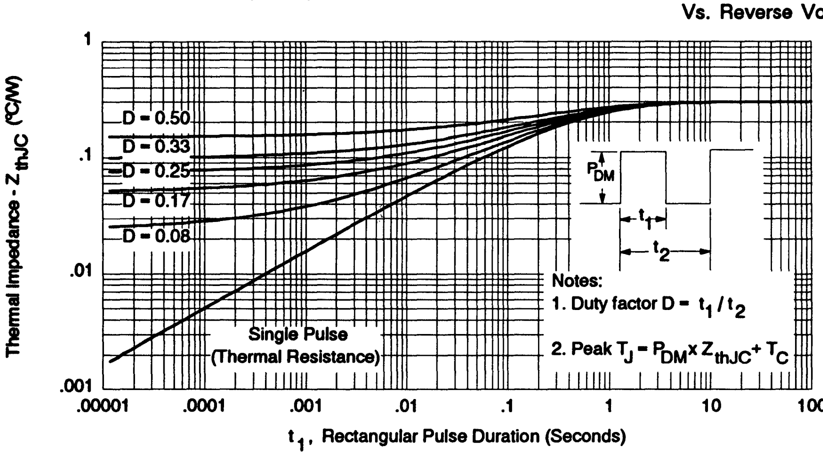


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

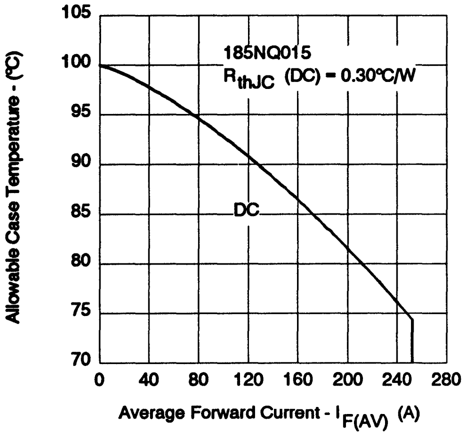


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

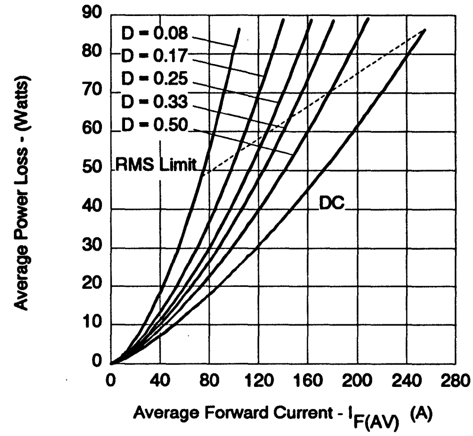


Fig. 6 - Forward Power Loss Characteristics

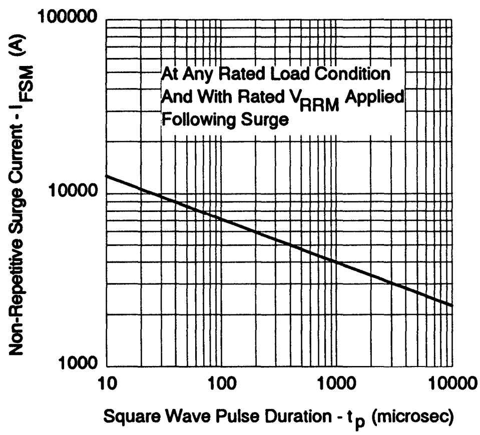


Fig. 7 - Maximum Non-Repetitive Surge Current

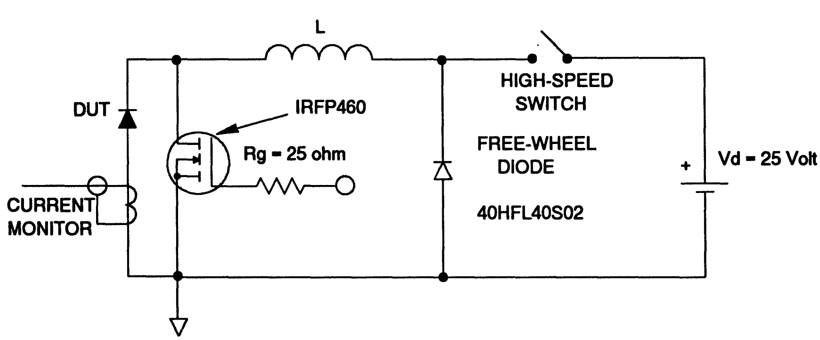


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

240NQ... SERIES

SCHOTTKY RECTIFIER

240 Amp

Major Ratings and Characteristics

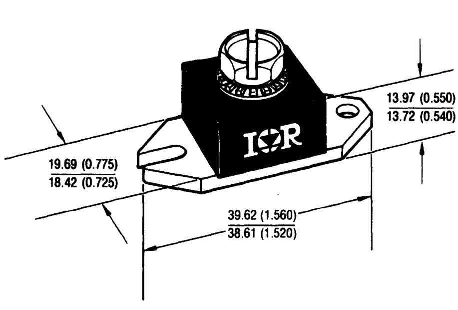
Characteristics	240NQ...	Units
$I_{F(AV)}$ Rectangular waveform	240	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	26,000	A
V_F @ 240Apk, T_J = 125°C	0.55	V
T_J	-55 to 150	°C

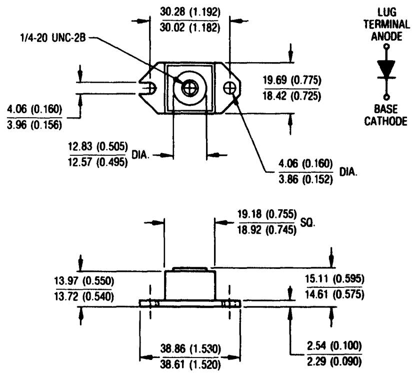
Description/Features

The 240NQ high current Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces four parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D-67

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	240NQ035	240NQ040	240NQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	240NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	240	A	50% duty cycle @ T_C = 96° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	26,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	324	mJ	T_J = 25 °C, I_{AS} = 48 Amps, L = 0.28 mH	
I_{AR}	Repetitive Avalanche Current	48	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	240NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.61	V	@ 240A	T_J = 25 °C
		0.81	V	@ 480A	
		0.55	V	@ 240A	T_J = 125 °C
		0.74	V	@ 480A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	20	mA	T_J = 25 °C	V_R = rated V_R
		800	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	10,300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		240NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.20	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

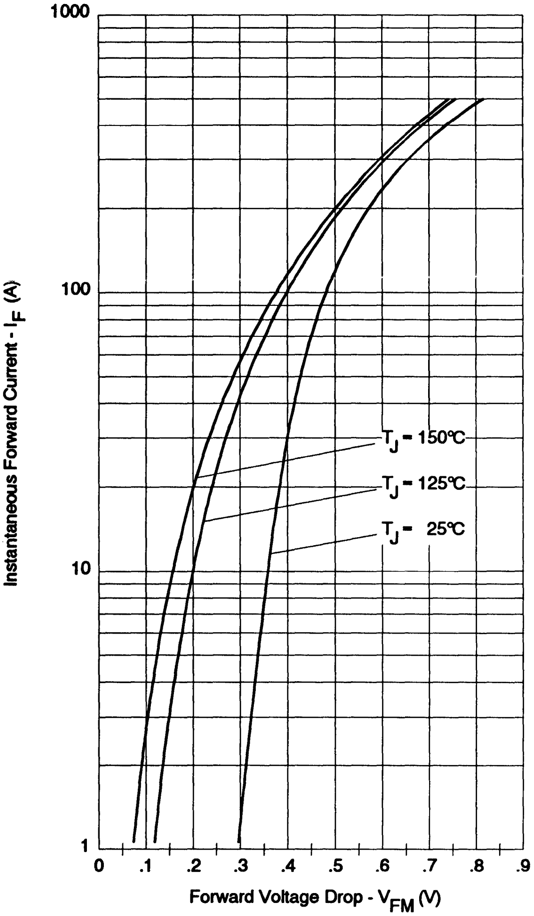


Fig. 1 - Maximum Forward Voltage Drop Characteristics

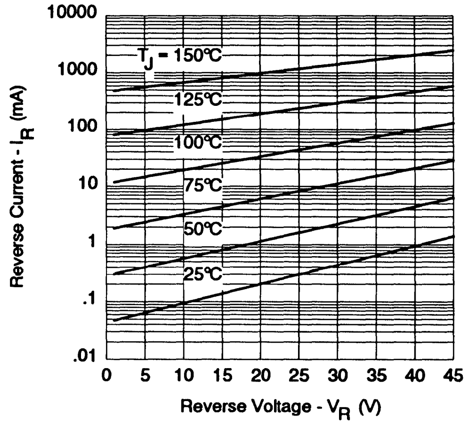


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

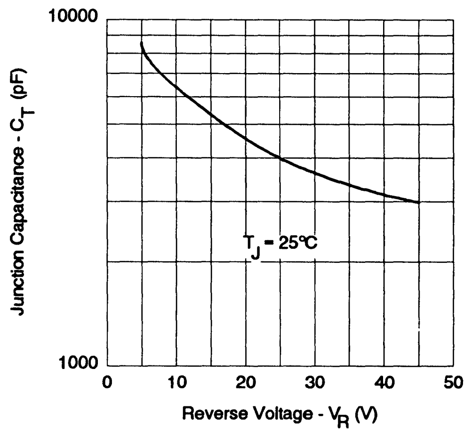


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

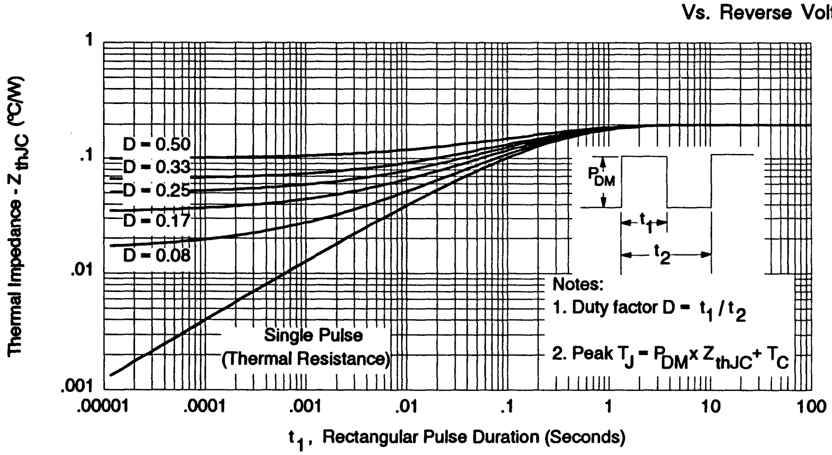


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

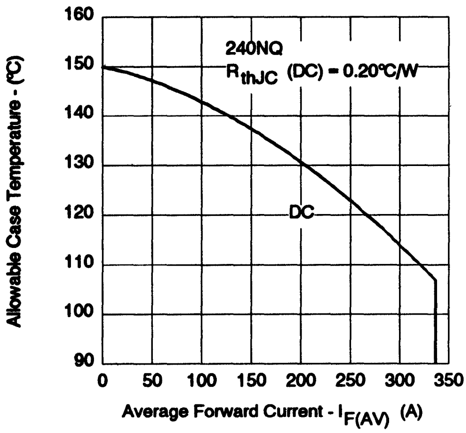


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

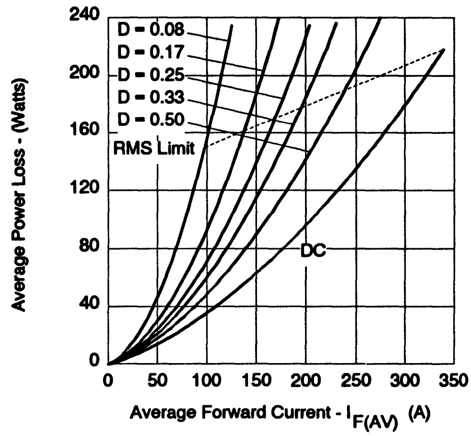


Fig. 6 - Forward Power Loss Characteristics

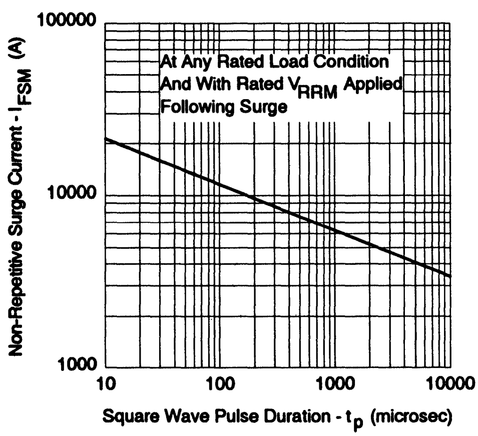


Fig. 7 - Maximum Non-Repetitive Surge Current

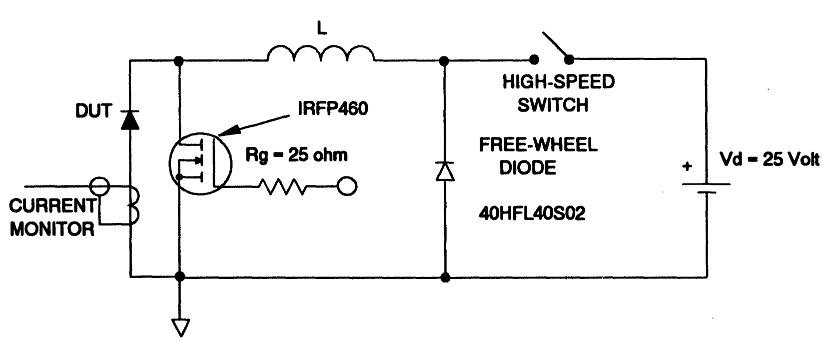


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

241NQ... SERIES

SCHOTTKY RECTIFIER

240 Amp

Major Ratings and Characteristics

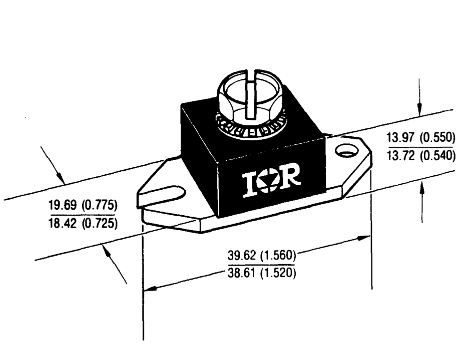
Characteristics	241NQ...	Units
$I_{F(AV)}$ Rectangular waveform	240	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	25,000	A
V_F @ 240Apk, T_J = 125°C	0.59	V
T_J	-55 to 175	°C

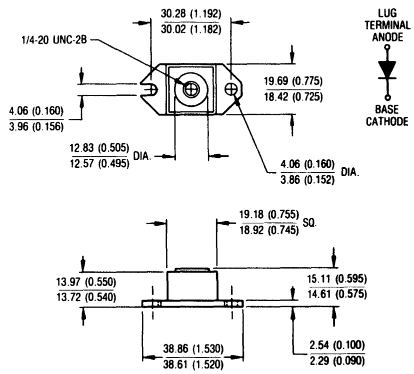
Description/Features

The 241NQ high current Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces four parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D-67
Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	241NQ035	241NQ040	241NQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	241NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	240	A	50% duty cycle @ T_C = 130° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	25,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3450		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	324	mJ	T_J = 25 °C, I_{AS} = 48 Amps, L = 0.28 mH	
I_{AR}	Repetitive Avalanche Current	48	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	241NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.69	V	@ 240A	T_J = 25 °C
		0.82	V	@ 480A	
		0.59	V	@ 240A	T_J = 125 °C
		0.72	V	@ 480A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	20	mA	T_J = 25 °C	V_R = rated V_R
		180	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	10,300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		241NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.20	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

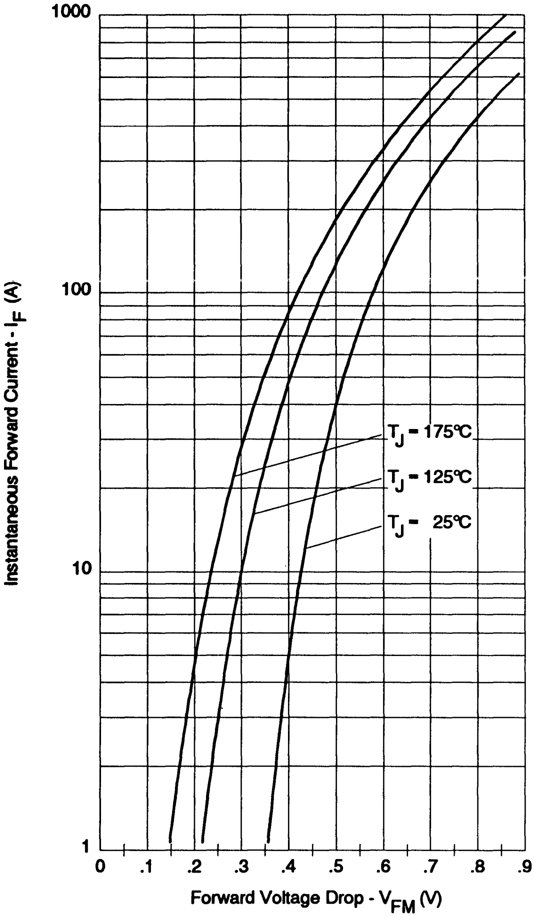


Fig. 1 - Maximum Forward Voltage Drop Characteristics

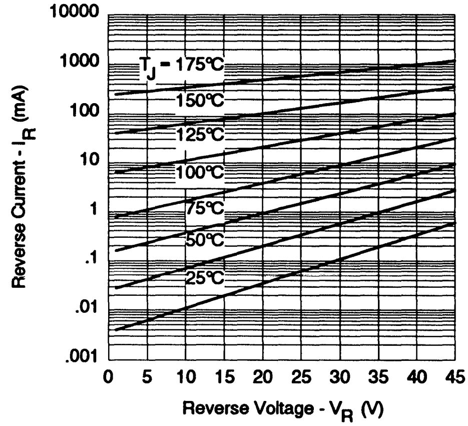


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

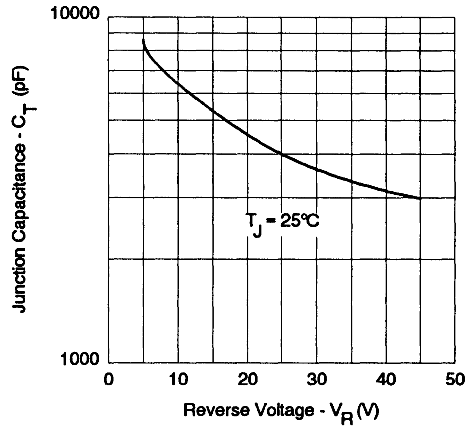


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

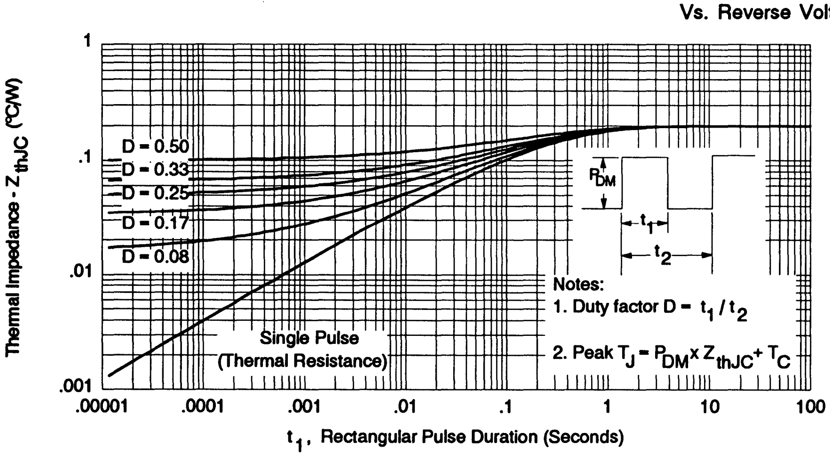


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

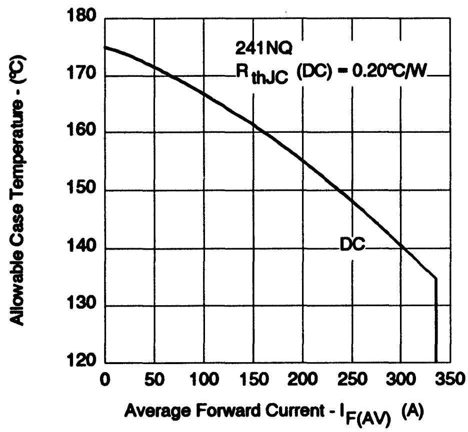


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

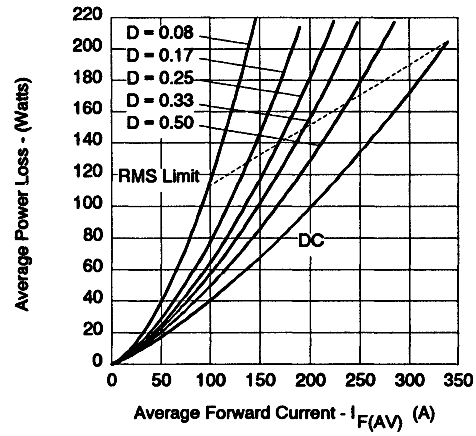


Fig. 6 - Forward Power Loss Characteristics

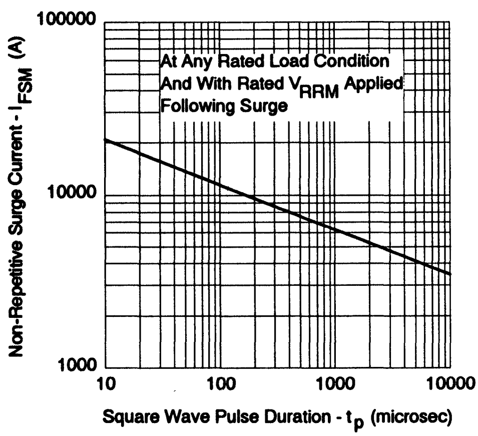


Fig. 7 - Maximum Non-Repetitive Surge Current

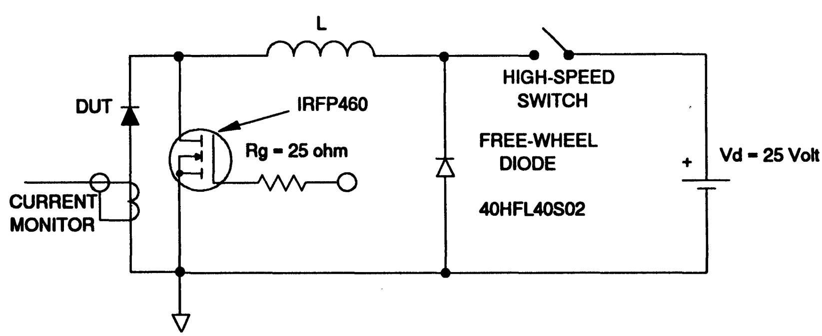


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

242NQ030

SCHOTTKY RECTIFIER

240 Amp

Major Ratings and Characteristics

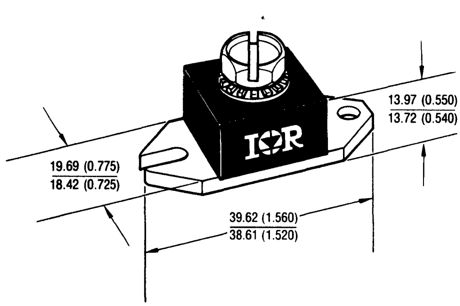
Characteristics	242NQ030	Units
$I_{F(AV)}$ Rectangular waveform	240	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	27,000	A
V_F @ 240Apk, T_J = 125°C	0.42	V
T_J	-55 to 150	°C

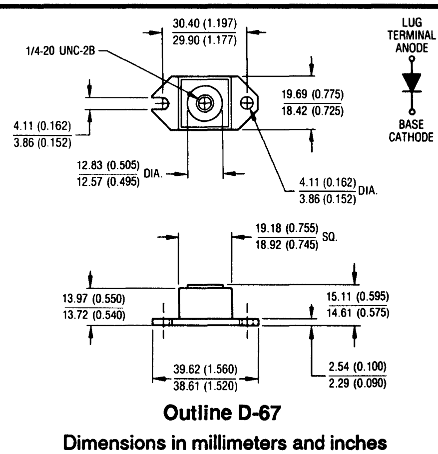
Description/Features

The 242NQ030 high current Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces four parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Outline D-67

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	242NQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	242NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	240	A	50% duty cycle @ T_C = 111°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	27,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3000		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	216	mJ	T_J = 25 °C, I_{AS} = 48 Amps, L = 0.19 mH	
I_{AR}	Repetitive Avalanche Current	48	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	242NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.51	V	@ 240A	T_J = 25 °C
		0.62	V	@ 480A	
		0.42	V	@ 240A	T_J = 125 °C
		0.54	V	@ 480A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	20	mA	T_J = 25 °C	V_R = rated V_R
		1120	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	14,800	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		242NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.20	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

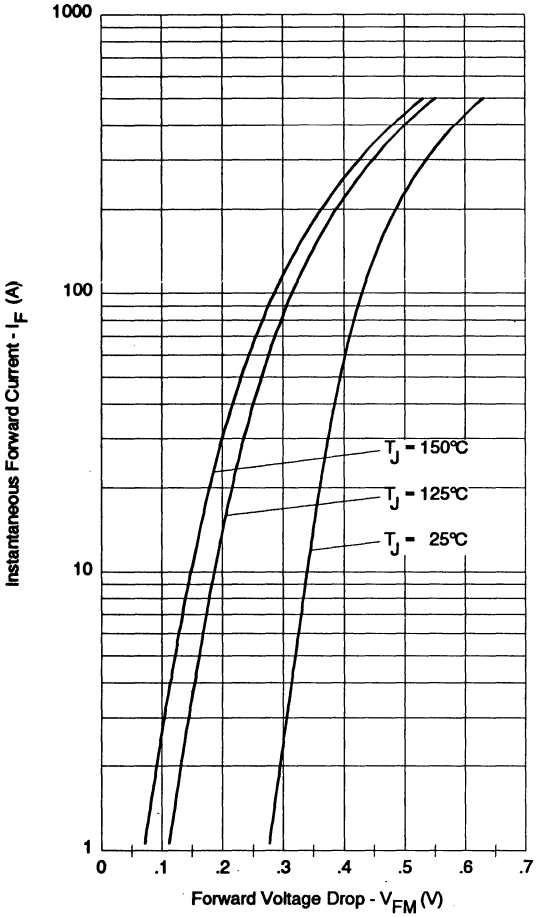


Fig. 1 - Maximum Forward Voltage Drop Characteristics

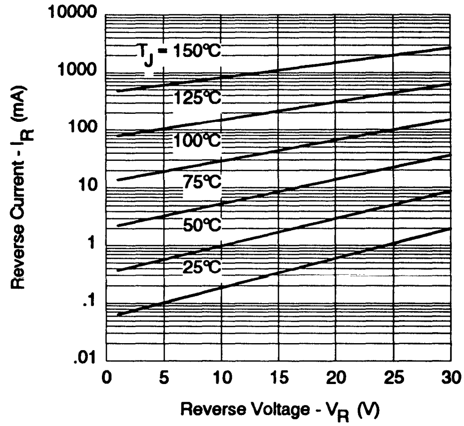


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

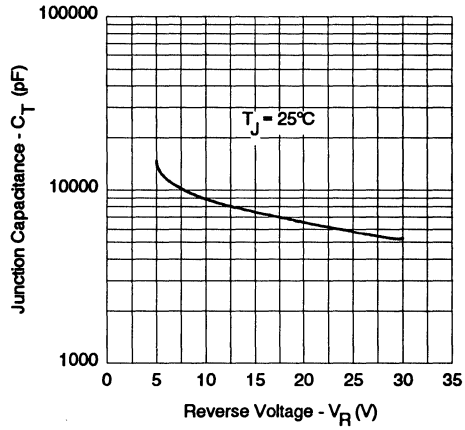


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

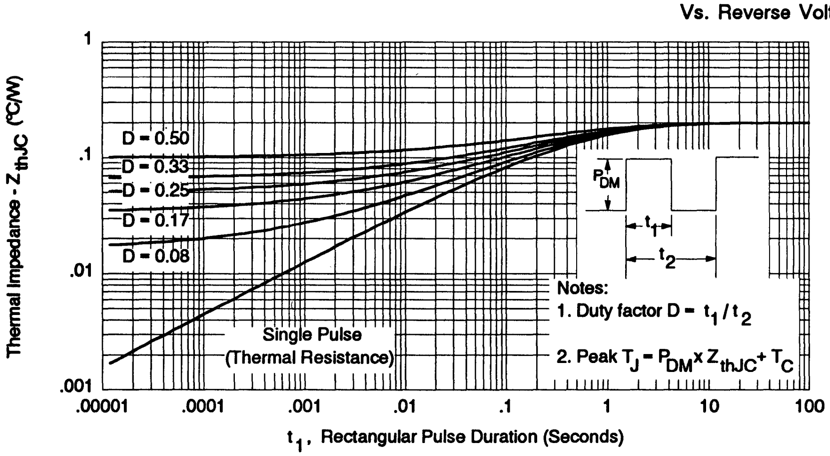


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

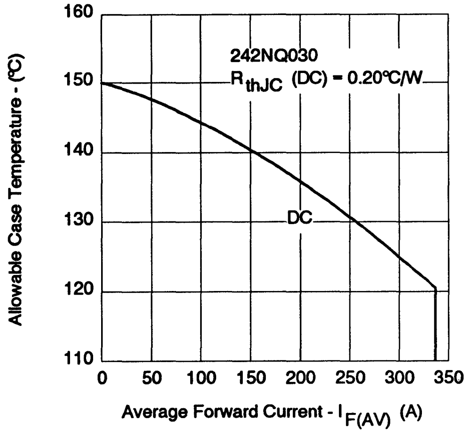


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

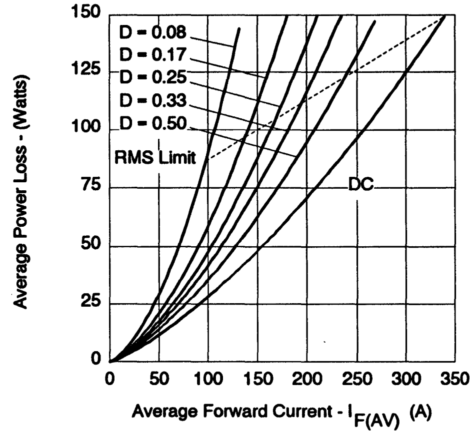


Fig. 6 - Forward Power Loss Characteristics

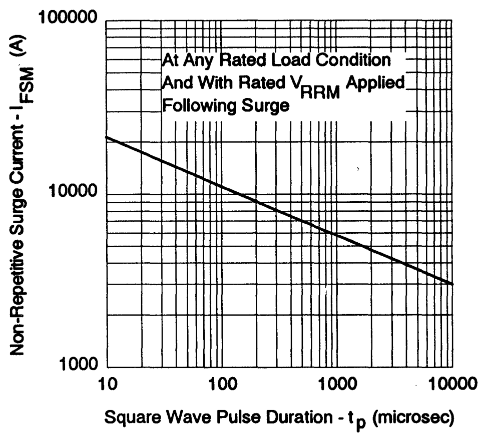


Fig. 7 - Maximum Non-Repetitive Surge Current

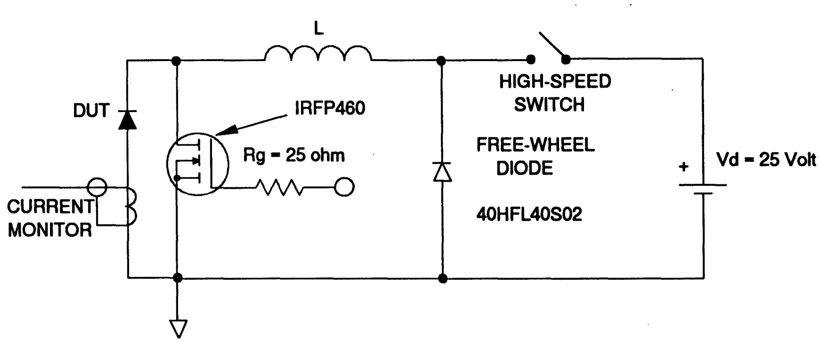


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

243NQ... SERIES

SCHOTTKY RECTIFIER

240 Amp

Major Ratings and Characteristics

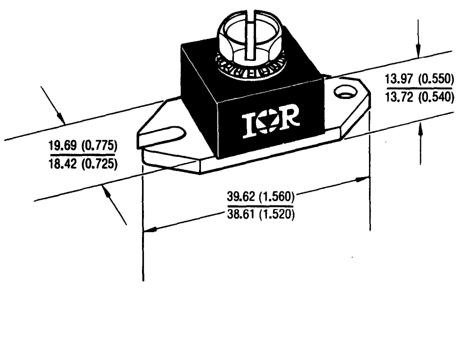
Characteristics	243NQ...	Units
$I_{F(AV)}$ Rectangular waveform	240	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	25,500	A
V_F @ 240Apk, T_J=125°C	0.72	V
T_J	-55 to 175	°C

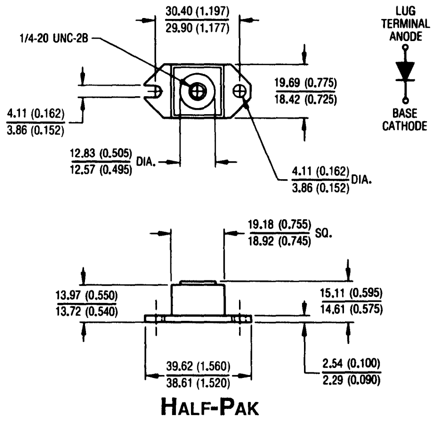
Description/Features

The 243NQ high current Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 175° C T_J operation
- Unique high power, HALF-PAK™ module
- Replaces four parallel DO-5's
- Easier to mount and lower profile than DO-5's
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





HALF-PAK

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	243NQ080	243NQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	243NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	240	A	50% duty cycle @ T_C = 120° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	25,500	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3300		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current	1	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	243NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.86	V	@ 240A	T_J = 25 °C
		1.01	V	@ 480A	
		0.72	V	@ 240A	T_J = 125 °C
		0.86	V	@ 480A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	6	mA	T_J = 25 °C	V_R = rated V_R
		80	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	5500	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		243NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.20	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

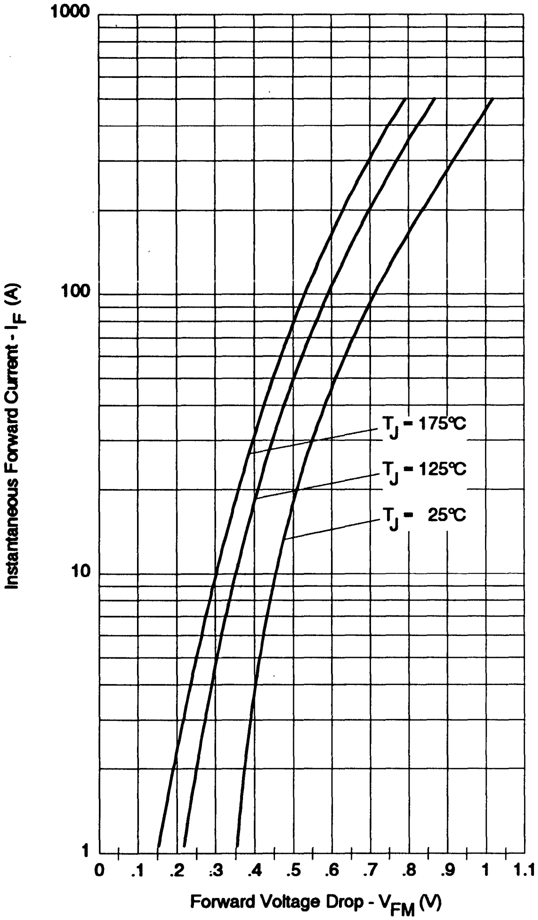


Fig. 1 - Maximum Forward Voltage Drop Characteristics

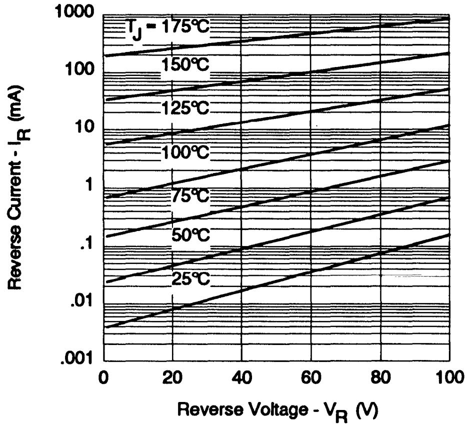


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

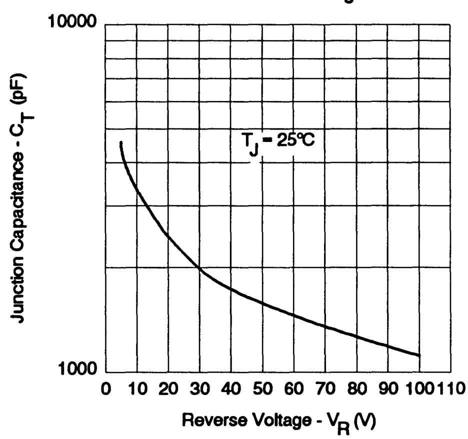


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

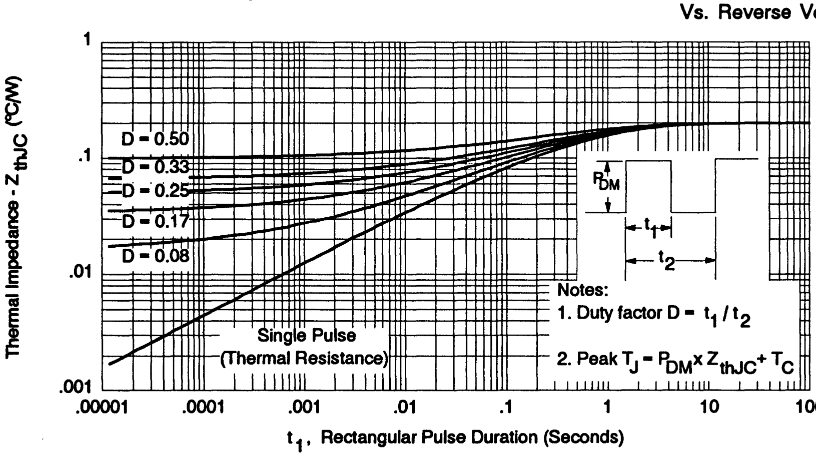


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

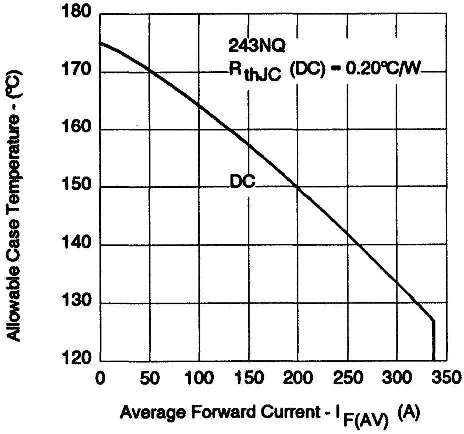


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

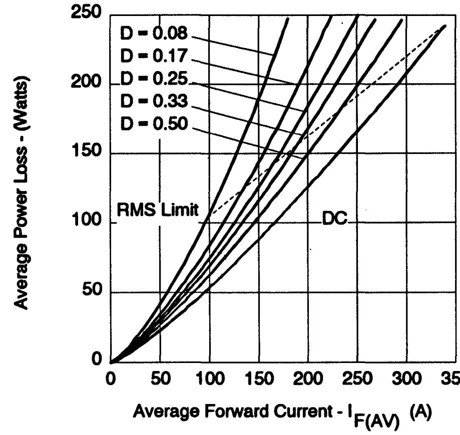


Fig. 6 - Forward Power Loss Characteristics

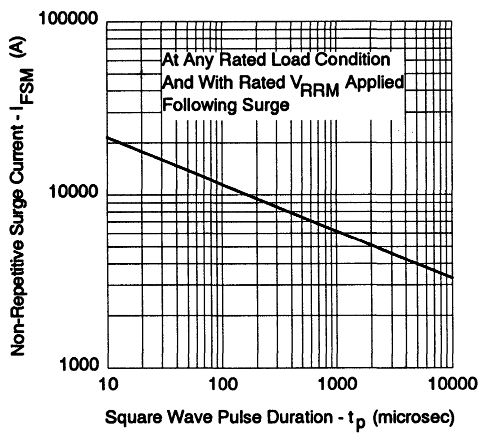


Fig. 7 - Maximum Non-Repetitive Surge Current

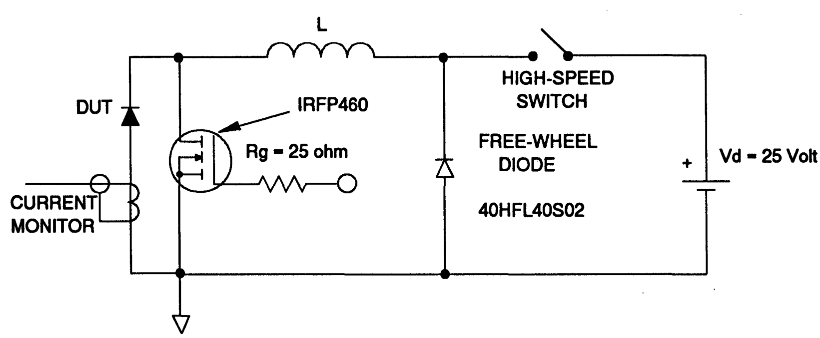


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

244NQ... SERIES

SCHOTTKY RECTIFIER

240 Amp

Major Ratings and Characteristics

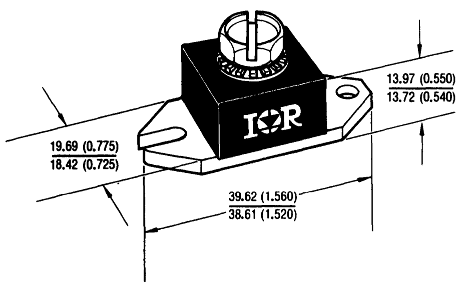
Characteristics	244NQ...	Units
$I_{F(AV)}$ Rectangular waveform	240	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	35,000	A
V_F @ 240Apk, T_J = 100°C	0.52	V
T_J	-55 to 125	°C

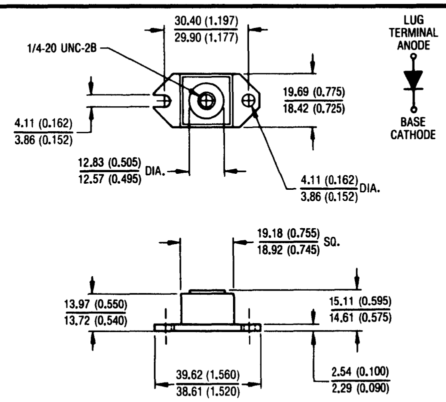
Description/Features

The 244NQ high current Schottky rectifier modules have been optimized for extremely low forward voltage drop, with higher leakage. The proprietary barrier technology allows for reliable operation up to 125° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, welding and reverse battery protection.

- 125° C T_J operation
- Unique high power, HALF-PAK™ module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Extremely low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





HALF-PAK

Dimensions in millimeters and inches

HALF PAK MODULES

Voltage Ratings

	Part number	244NQ035	244NQ040	244NQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	244NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	240	A	50% duty cycle @ T_C = 75° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current *See Fig. 7	35,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3800		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	270	mJ	T_J = 25 °C, I_{AS} = 40 Amps, L = 0.34 mH	
I_{AR}	Repetitive Avalanche Current	40	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	244NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.55	V	@ 240A	T_J = 25 °C
		0.73	V	@ 480A	
		0.52	V	@ 240A	T_J = 100 °C
		0.72	V	@ 480A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	20	mA	T_J = 25 °C	V_R = rated V_R
		2400	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance	10,300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		244NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 125	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.20	°C/W	DC operation *See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

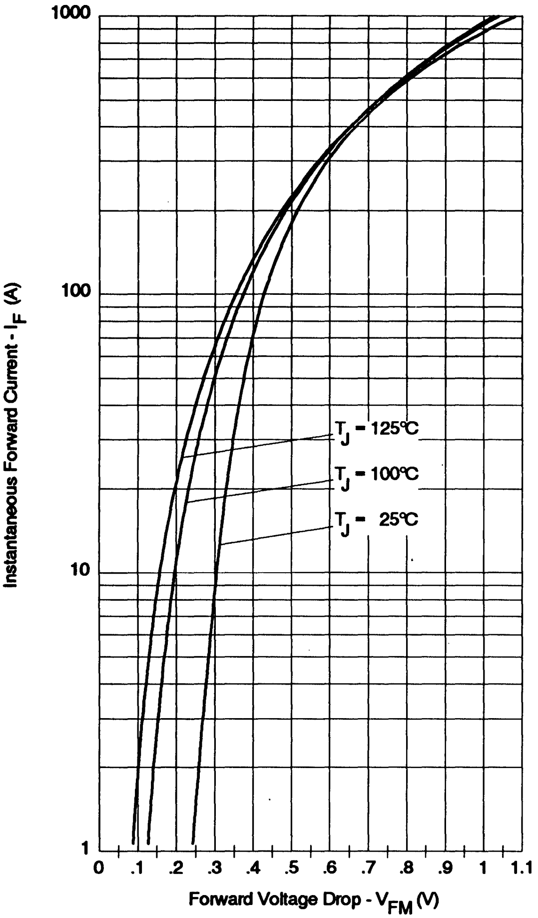


Fig. 1 - Maximum Forward Voltage Drop Characteristics

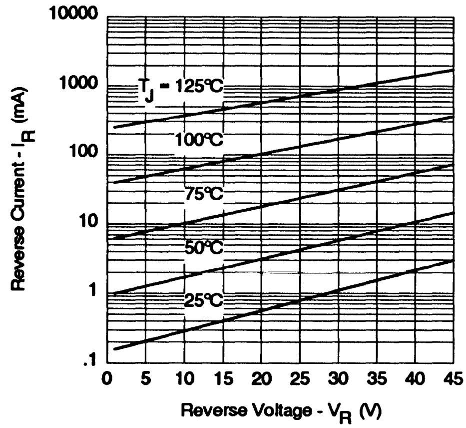


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

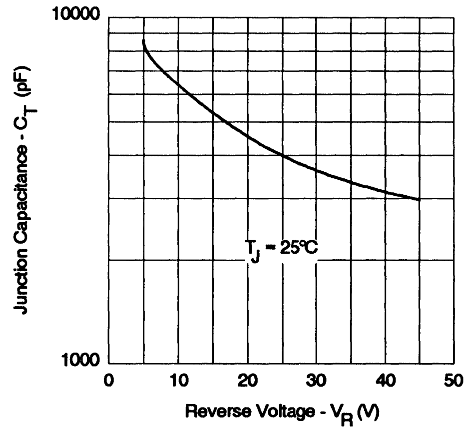


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

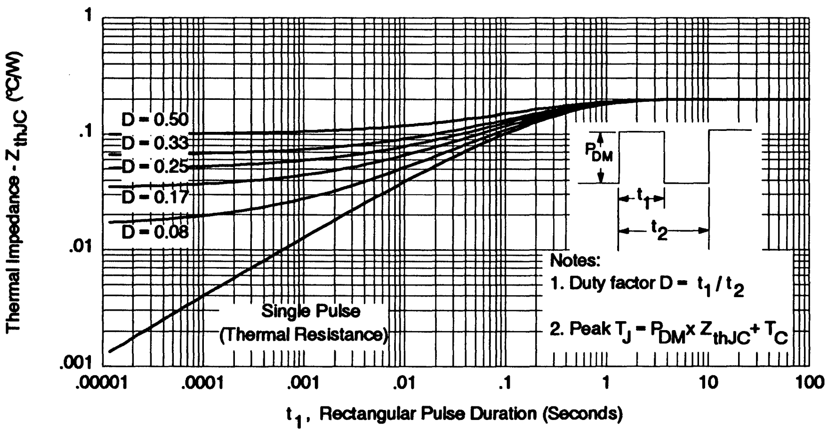


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

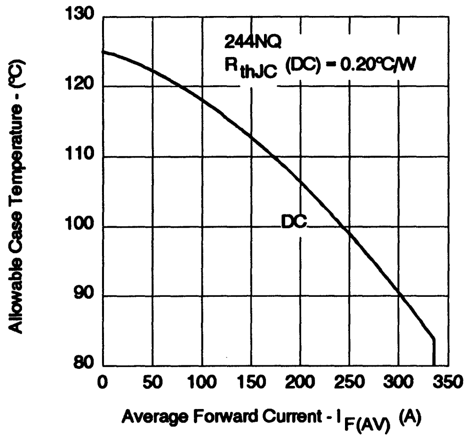


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

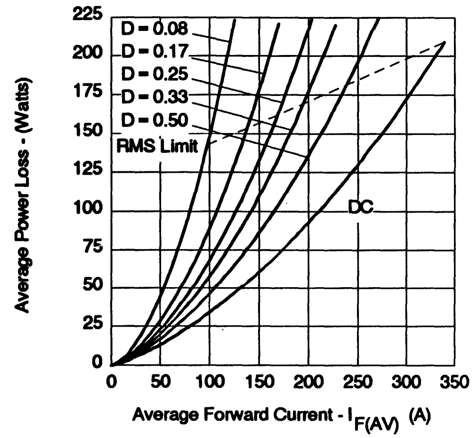


Fig. 6 - Forward Power Loss Characteristics

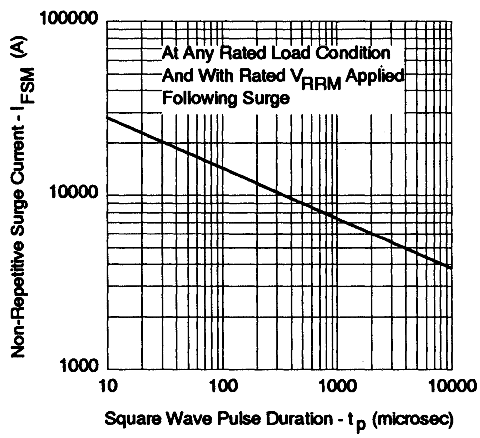


Fig. 7 - Maximum Non-Repetitive Surge Current

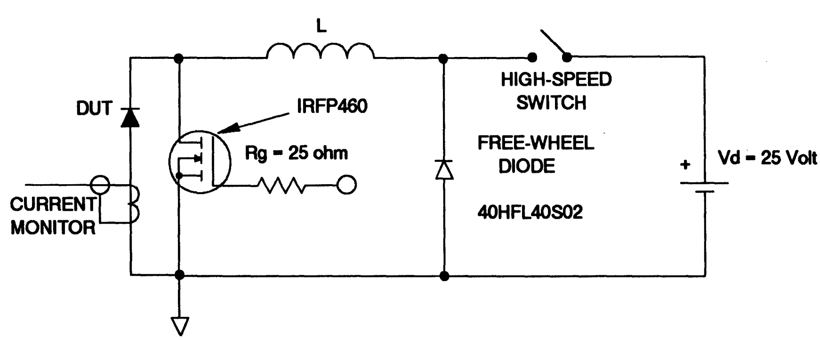


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

245NQ015

SCHOTTKY RECTIFIER

240 Amp

Major Ratings and Characteristics

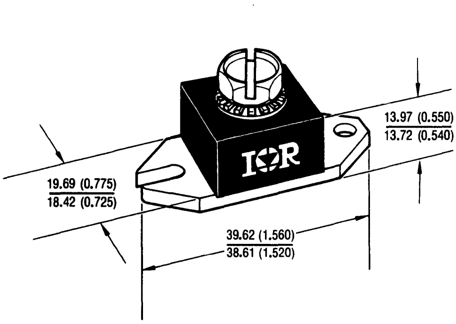
Characteristics		245NQ015	Units
$I_{F(AV)}$	Rectangular waveform	240	A
V_{RRM}		15	V
I_{FSM}	@ tp = 5 µs sine	20,000	A
V_F	@ 240 Apk, T_J = 75°C	0.34	V
T_J		- 55 to 100	°C

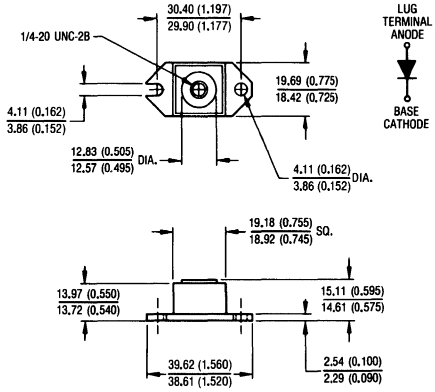
Description/Features

The 245NQ015 high current Schottky rectifier module has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100 °C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100 °C T_J operation
- Unique high power, HALF-PAK™ module
- Optimized for OR-ing applications
- Ultra low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance

CASE STYLE AND DIMENSIONS





HALF-PAK

Dimensions in millimeters and inches

HALF PAK MODULES

IOR

Voltage Ratings

	Part number	245NQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	245NQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	240	A	50% duty cycle @ T_C = 70° C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current * See Fig. 7	20,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3000		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy	9	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 4.5 mH	
I_{AR}	Repetitive Avalanche Current	2	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 3 x V_R typical	

Electrical Specifications

	Parameters	245NQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (1) * See Fig. 1	0.40	V	@ 240A	T_J = 25 °C
		0.51	V	@ 480A	
		0.34	V	@ 240A	T_J = 75 °C
		0.44	V	@ 480A	
I_{RM}	Max. Reverse Leakage Current (1) * See Fig. 2	80	mA	T_J = 25 °C	V_R = rated V_R
		4000	mA	T_J = 100 °C	
		3560	mA	T_J = 100 °C	V_R = 12V
		2160	mA	T_J = 100 °C	V_R = 5V
C_T	Max. Junction Capacitance	15,800	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25 °C	
L_S	Typical Series Inductance	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle < 2%

Thermal-Mechanical Specifications

	Parameters		245NQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 100	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 100	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case		0.20	°C/W	DC operation * See Fig. 4
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.15	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		25.6 (0.9)	g (oz.)	
T	Mounting Torque	Min.	17 (15)	Kg-cm (lbf-in)	Non-lubricated threads
		Max.	29 (25)		
	Terminal Torque	Min.	23 (20)		
		Max.	46 (40)		
	Case Style		HALF-PAK		

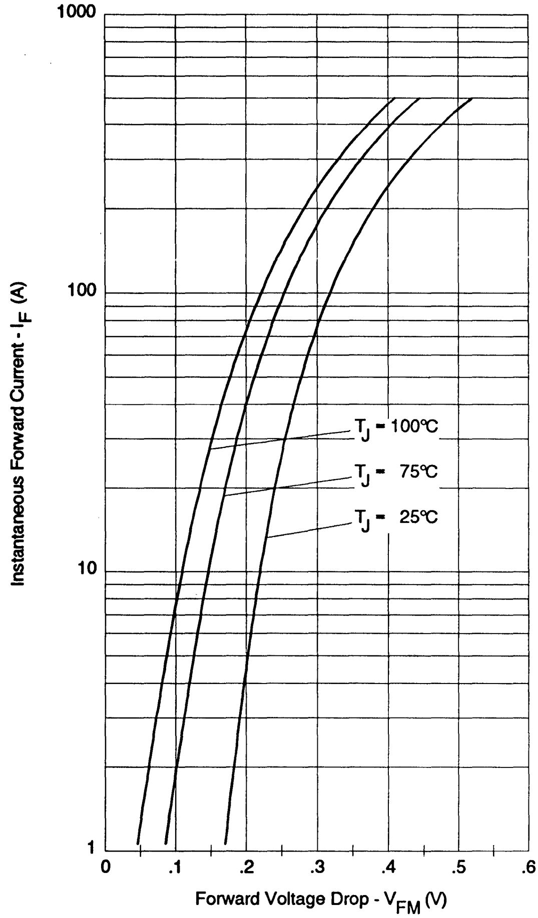


Fig. 1 - Maximum Forward Voltage Drop Characteristics

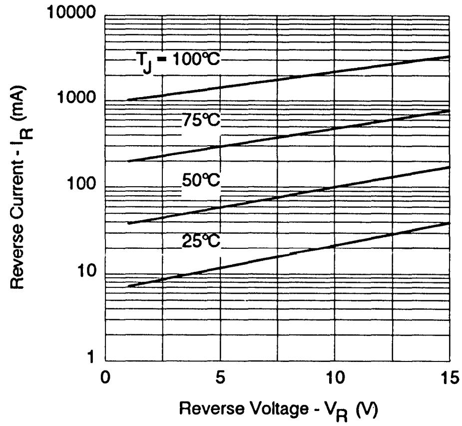


Fig. 2 - Typical Values of Reverse Current Vs. Reverse Voltage

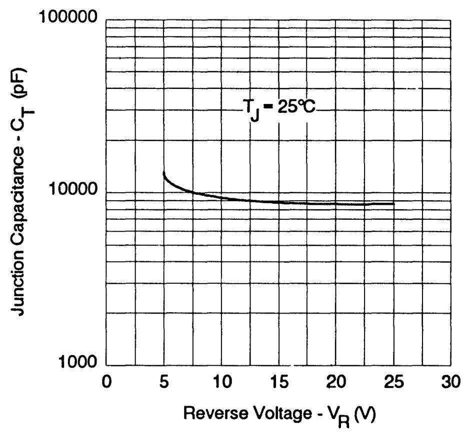


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

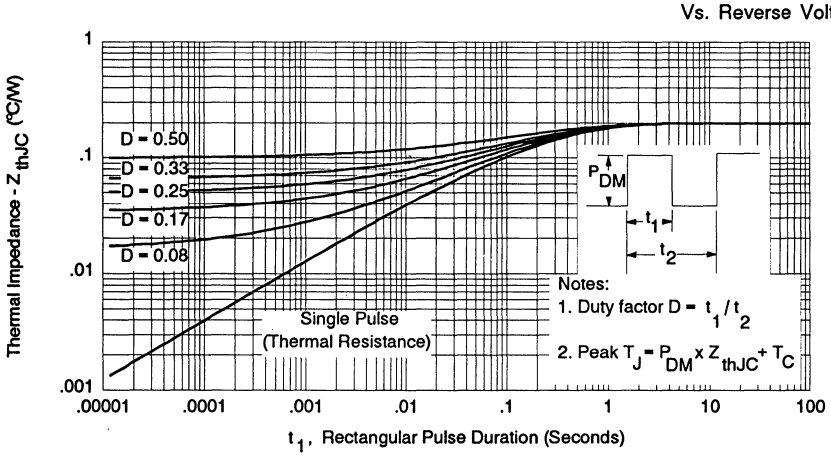


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

HALF PAK MODULES

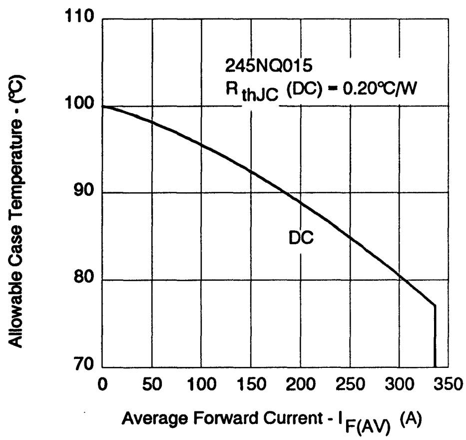


Fig. 5 - Maximum Allowable Case Temperature Vs. Average Forward Current

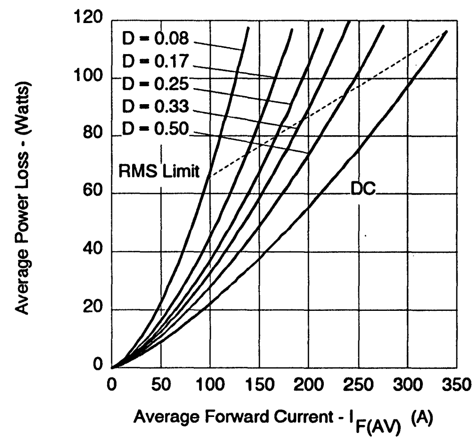


Fig. 6 - Forward Power Loss Characteristics

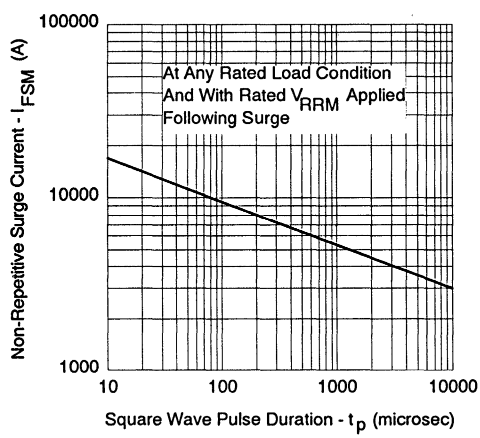


Fig. 7 - Maximum Non-Repetitive Surge Current

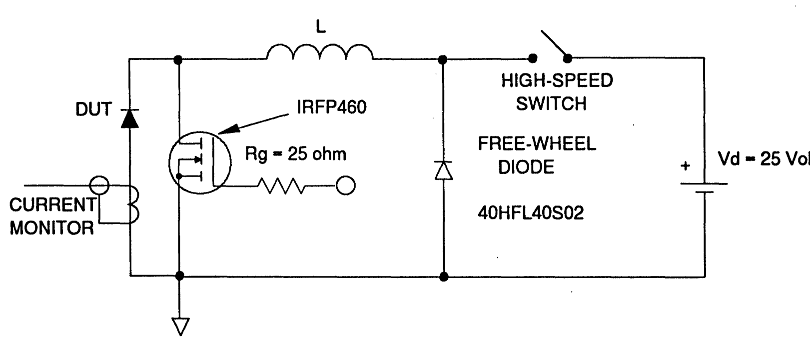


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

200CNQ... SERIES

SCHOTTKY RECTIFIER

200 Amp

Major Ratings and Characteristics

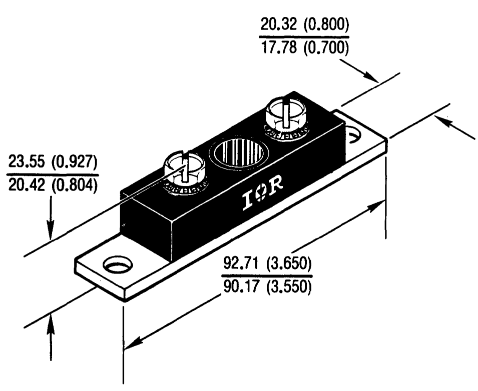
Characteristics	200CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	200	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	26,000	A
V_F @ 100Apk, T_J = 125°C (per leg)	0.49	V
T_J	- 55 to 150	°C

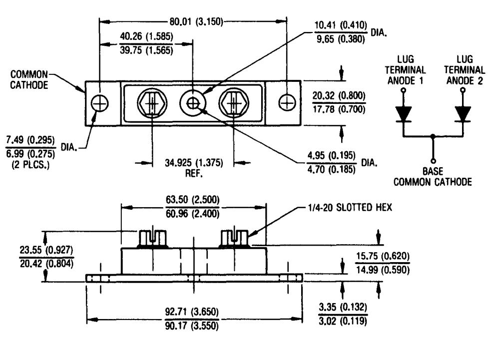
Description/Features

The 200CNQ center tap, high current, Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, and reverse battery protection.

- 150 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	200CNQ035	200CNQ040	200CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	200CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	200	A	50% duty cycle @ T_C = 108 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	26,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1550		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	135	mJ	T_J = 25 °C, I_{AS} = 20 Amps, L = 0.67 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	20	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	200CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.54	V	@ 100A	T_J = 25 °C
		0.68	V	@ 200A	
		0.49	V	@ 100A	T_J = 125 °C
		0.64	V	@ 200A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	10	mA	T_J = 25 °C	V_R = rated V_R
		400	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	5200	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		200CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.40	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.20	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface , smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO - 244AB		Modified JEDEC

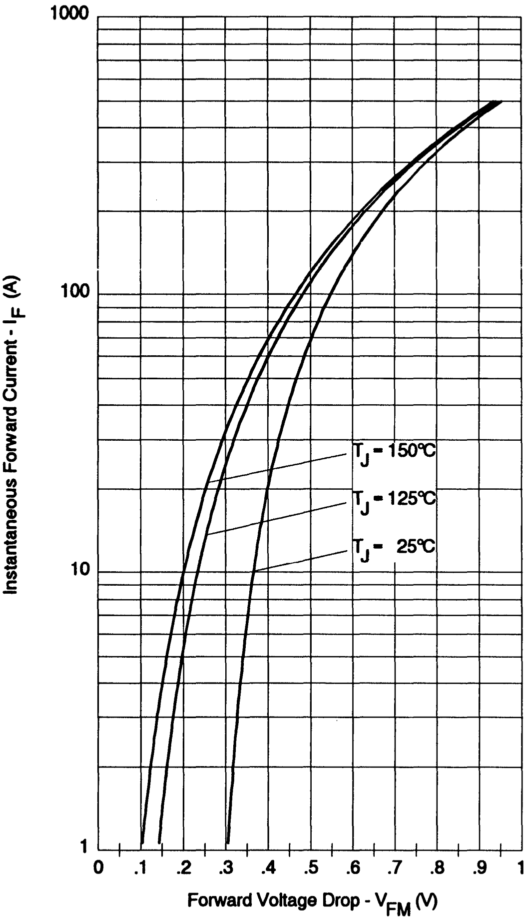


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

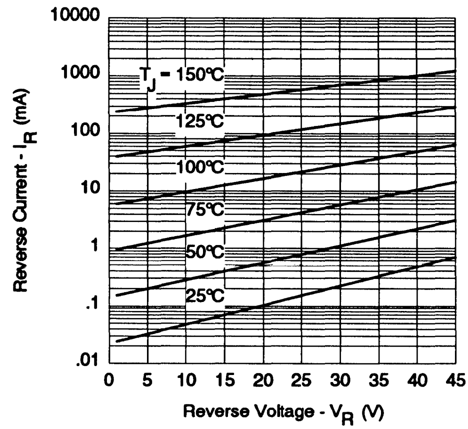


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

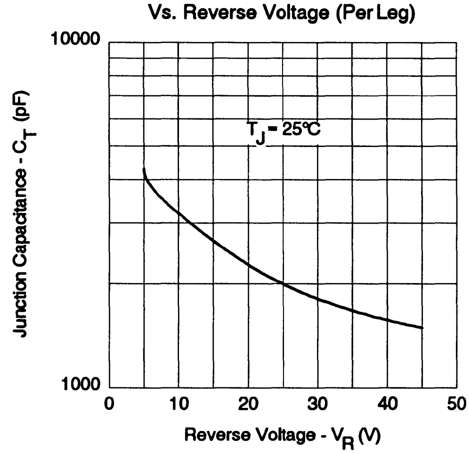


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

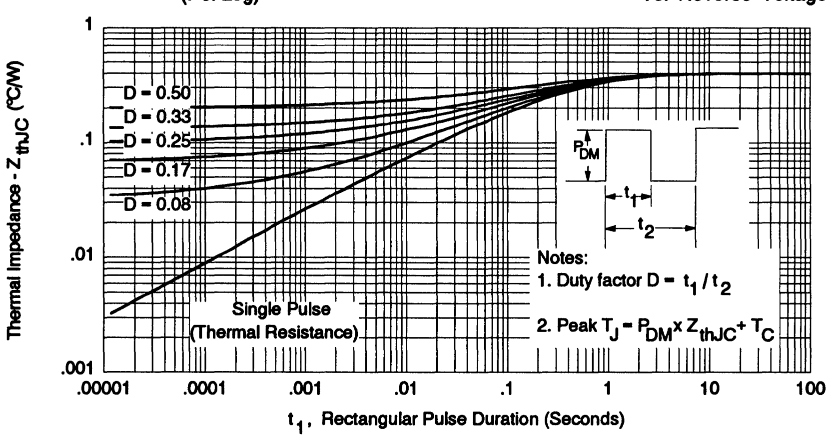


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

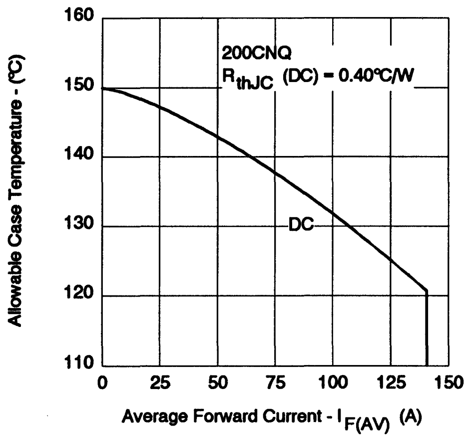


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

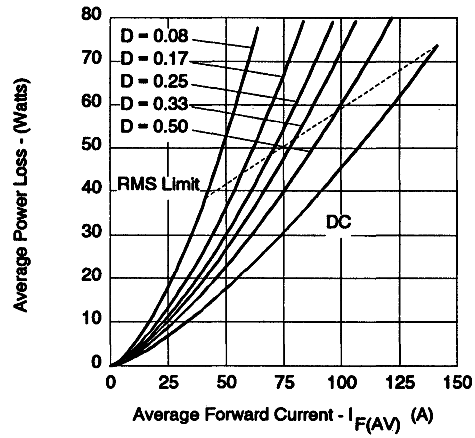


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

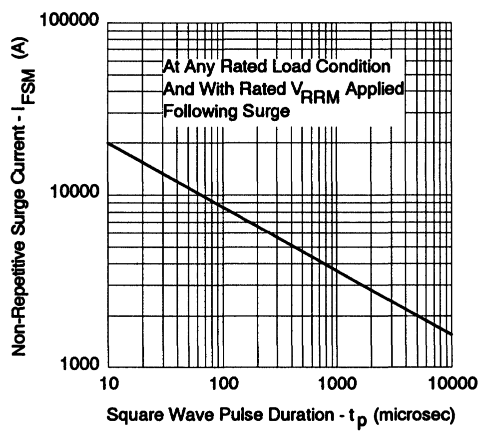


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

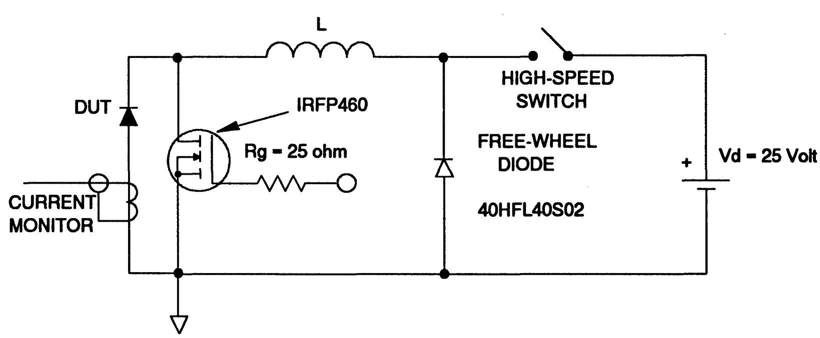


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

201CNQ... SERIES

SCHOTTKY RECTIFIER

200 Amp

Major Ratings and Characteristics

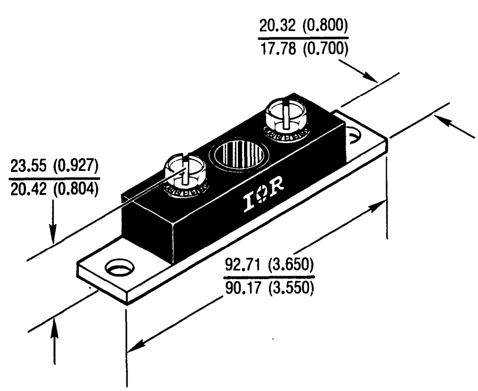
Characteristics	201CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	200	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	16,000	A
V_F @ 100Apk, T_J=125°C (per leg)	0.58	V
T_J	-55 to 175	°C

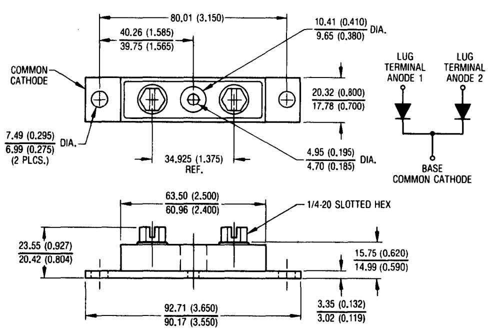
Description/Features

The 201CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175° C junction temperature. Typical applications are in high current switching power supplies, converters, free-wheeling diodes, welding, and reverse battery protection.

- 175° C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB
Dimensions in millimeters and inches

Voltage Ratings

	Part number	201CNQ035	201CNQ040	201CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	201CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	200	A	50% duty cycle @ T_C = 138 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	16,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3200		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	135	mJ	T_J = 25 °C, I_{AS} = 20 Amps, L = 0.67 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	20	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	201CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.67	V	@ 100A	T_J = 25 °C
		0.81	V	@ 200A	
		0.58	V	@ 100A	T_J = 125 °C
		0.71	V	@ 200A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	10	mA	T_J = 25 °C	V_R = rated V_R
		90	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	5200	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		201CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.40	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.20	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO-244AB		Modified JEDEC

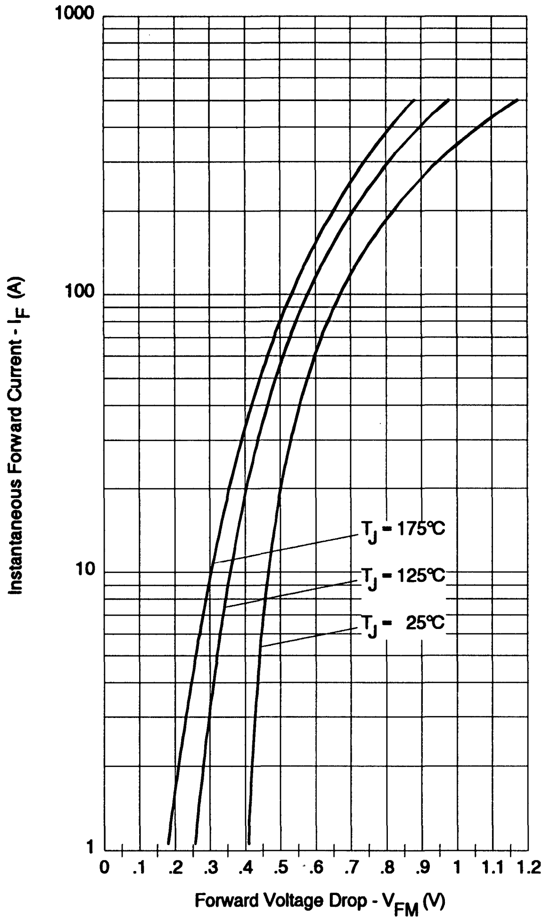


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

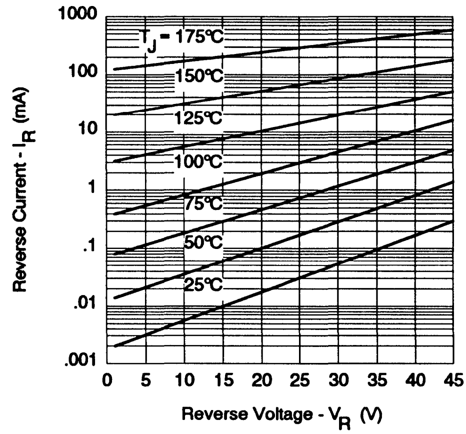


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

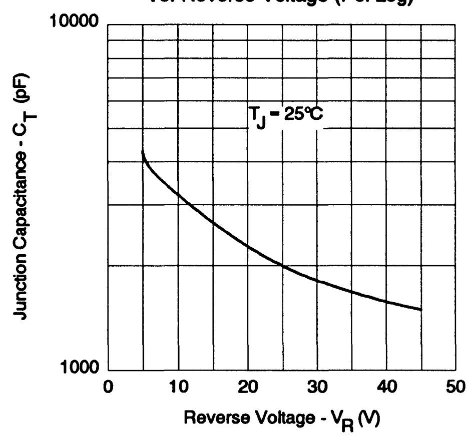


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

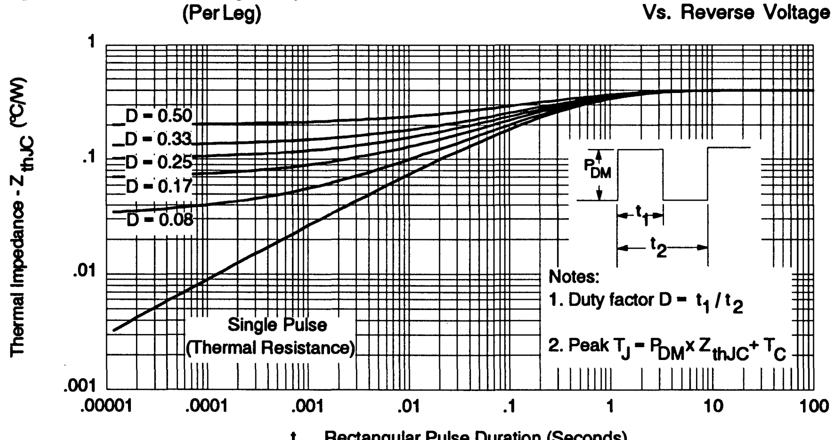


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

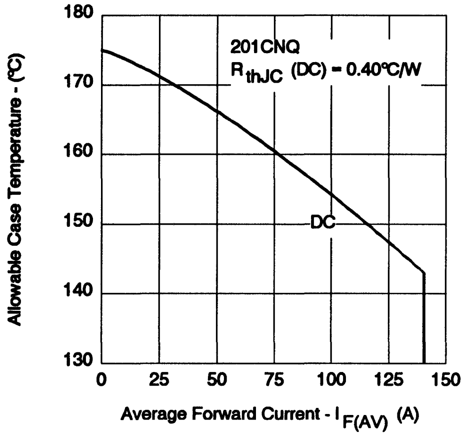


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

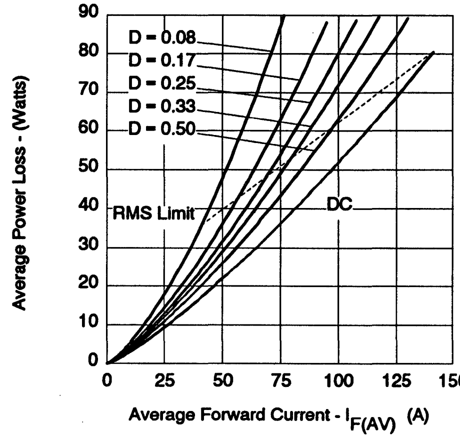


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

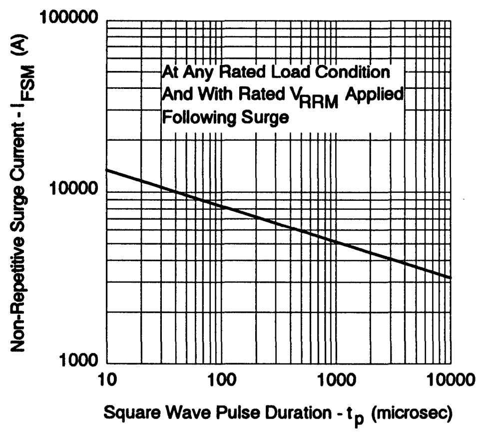


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

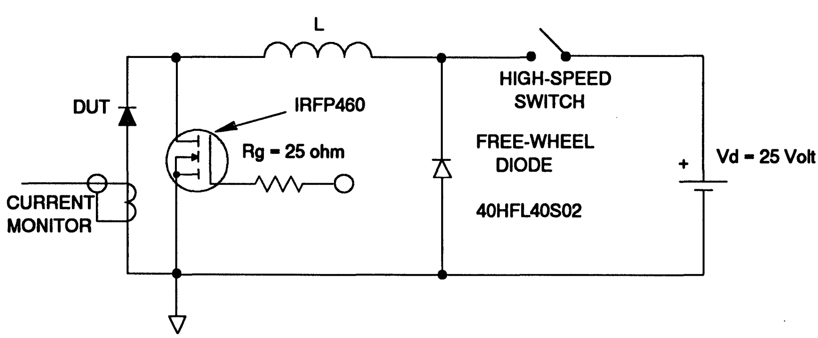


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

203CNQ... SERIES

SCHOTTKY RECTIFIER

200 Amp

Major Ratings and Characteristics

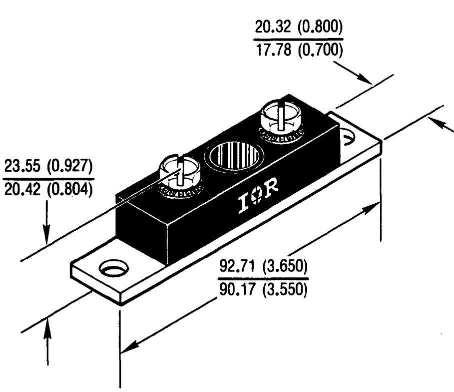
Characteristics	203CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	200	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	16,000	A
V_F @ 100Apk, T_J=125°C (per leg)	0.70	V
T_J	-55 to 175	°C

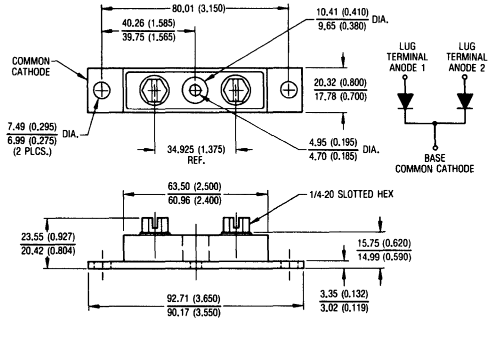
Description/Features

The 203CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in high current switching power supplies, plating power supplies, UPS systems, converters, free-wheeling diodes, welding, and reverse battery protection.

- 175 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	203CNQ080	203CNQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	203CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	200	A	50% duty cycle @ T_C = 130 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	16,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		2100		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	203CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.86	V	@ 100A	T_J = 25 °C
		1.03	V	@ 200A	
		0.70	V	@ 100A	T_J = 125 °C
		0.84	V	@ 200A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	3	mA	T_J = 25 °C	V_R = rated V_R
		40	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	2650	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		203CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.40	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.20	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO-244AB		Modified JEDEC

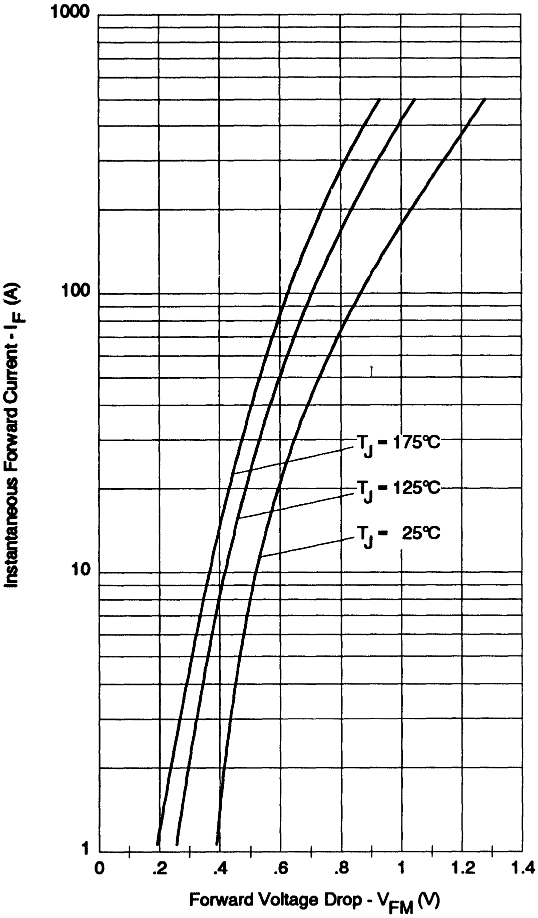


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

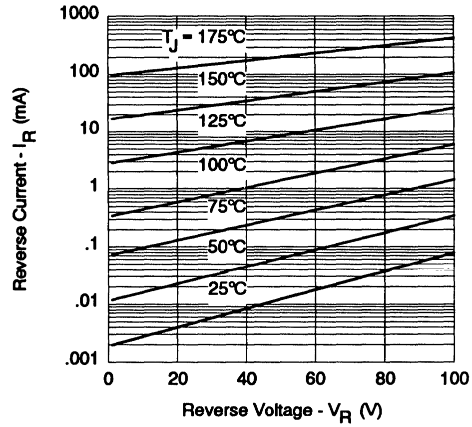


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

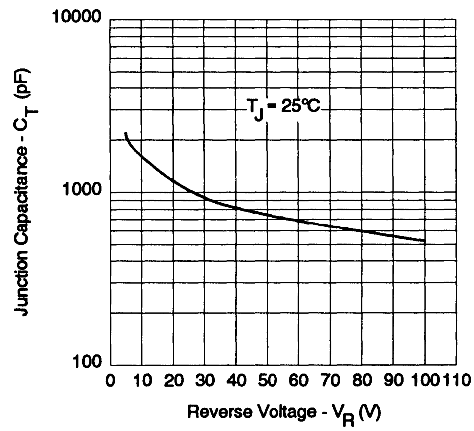


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

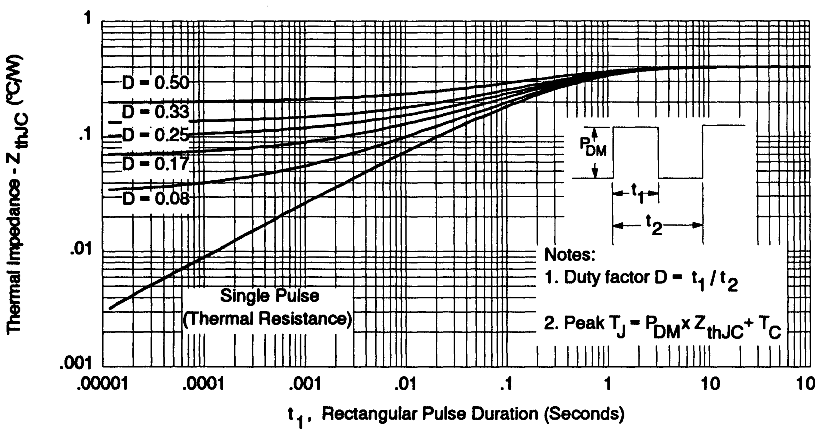


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

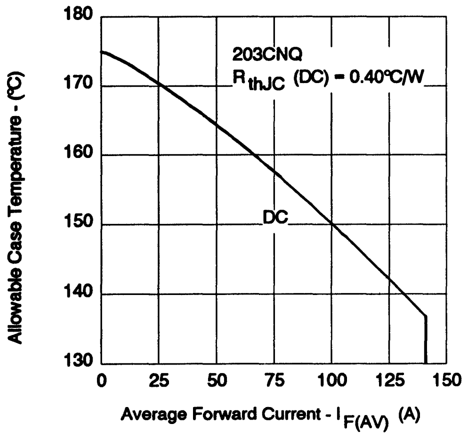


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

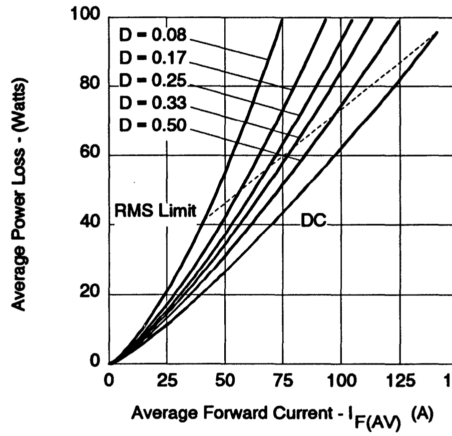


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

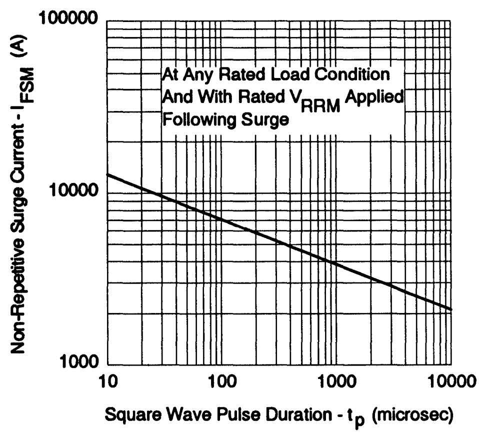


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

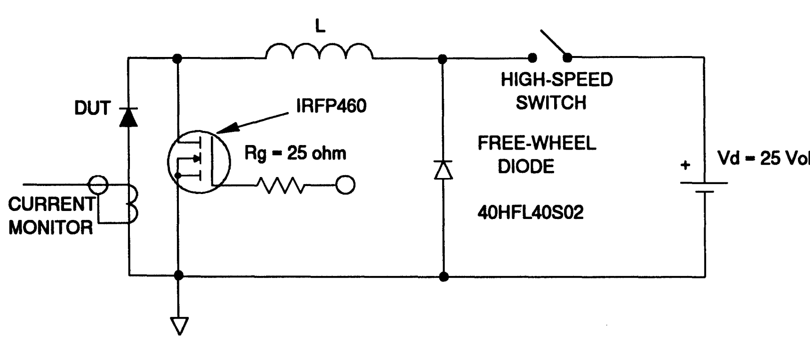


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

220CNQ030

SCHOTTKY RECTIFIER

220 Amp

Major Ratings and Characteristics

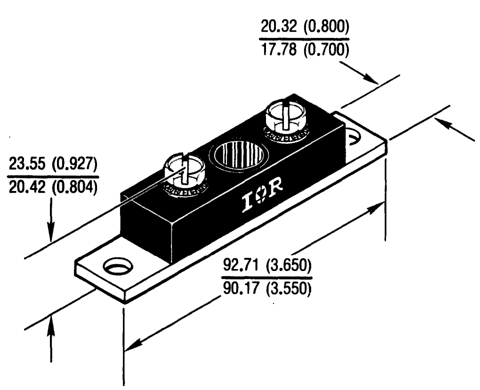
Characteristics	220CNQ030	Units
$I_{F(AV)}$ Rectangular waveform	220	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 μs sine	22,500	A
V_F @ 110Apk, T_J = 125°C (per leg)	0.40	V
T_J	-55 to 150	°C

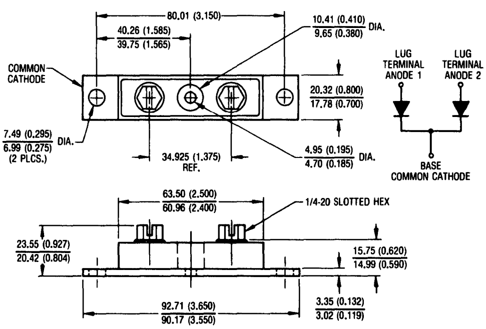
Description/Features

The 220CNQ030 center tap, high current, Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, welding and reverse battery protection.

- 150 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	220CNQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	220CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	220	A	50% duty cycle @ T_C = 114°C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	22,500	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		2400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	99	mJ	T_J = 25°C, I_{AS} = 22 Amps, L = 0.41 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	22	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	220CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.48	V	@ 110A	T_J = 25 °C
		0.57	V	@ 220A	
		0.40	V	@ 110A	T_J = 125 °C
		0.52	V	@ 220A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	10	mA	T_J = 25 °C	V_R = rated V_R
		560	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	7400	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		220CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.40	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.20	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO - 244AB		Modified JEDEC

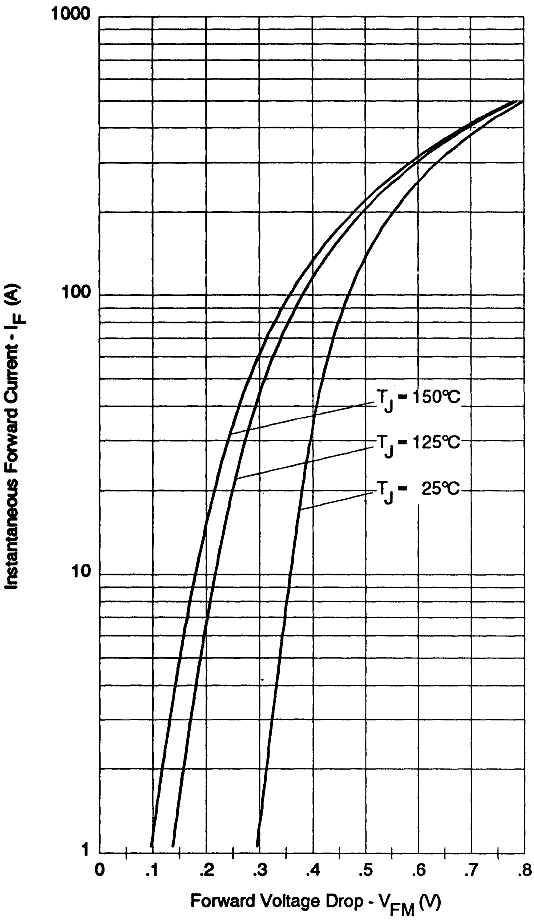


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

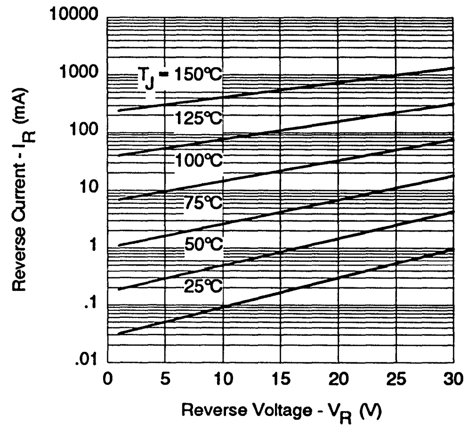


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

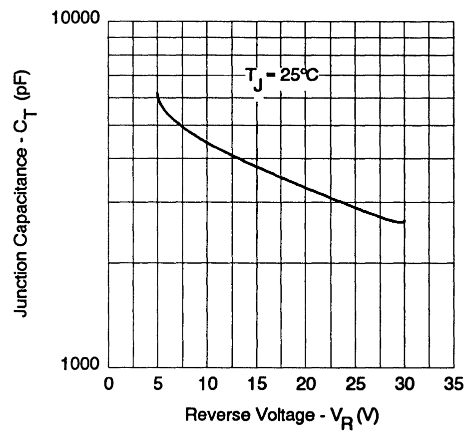


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

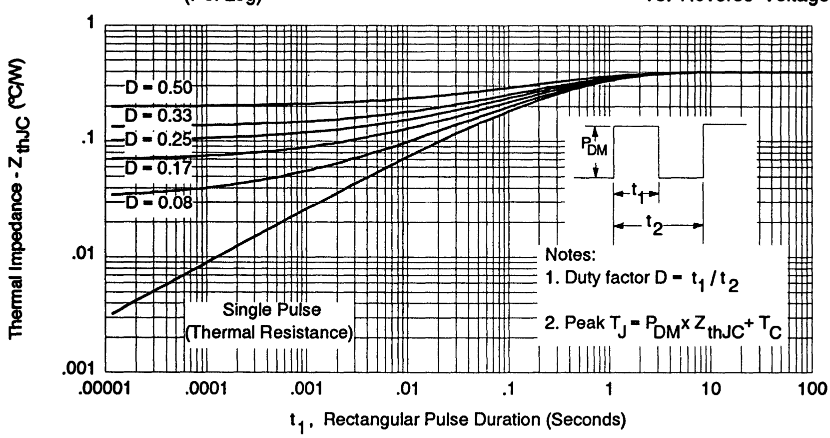


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

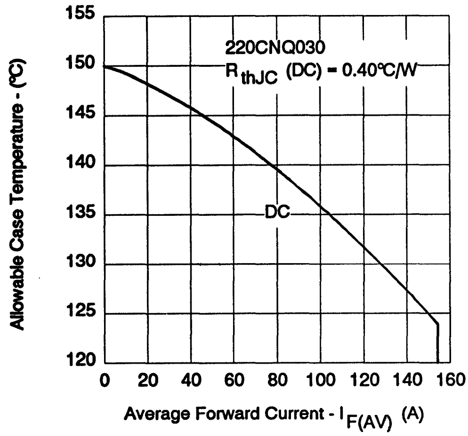


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

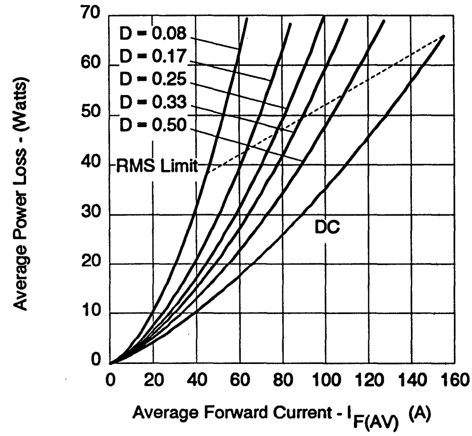


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

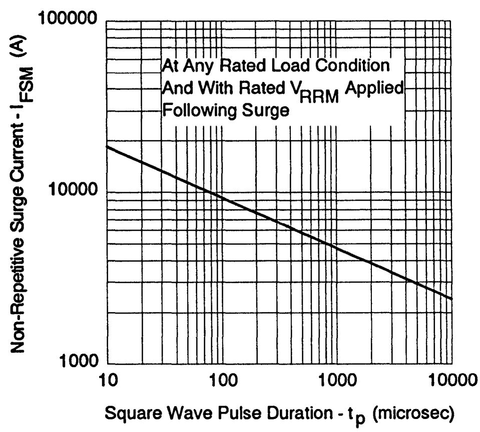


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

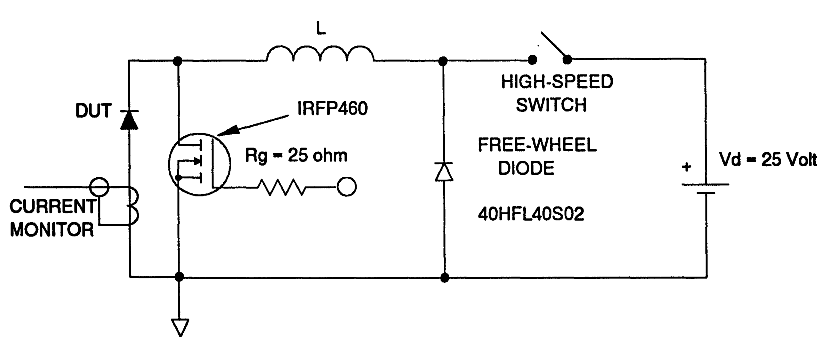


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

224CNQ... SERIES

SCHOTTKY RECTIFIER

220 Amp

Major Ratings and Characteristics

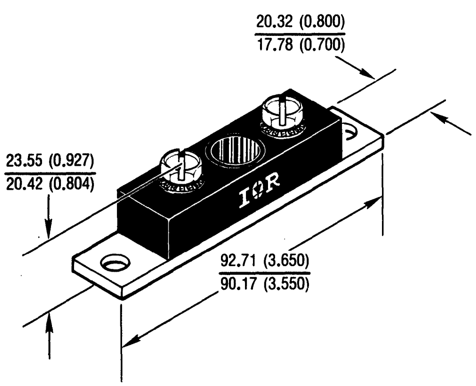
Characteristics	224CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	220	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	27,000	A
V_F @ 110Apk, T_J = 100°C (per leg)	0.50	V
T_J	- 55 to 125	°C

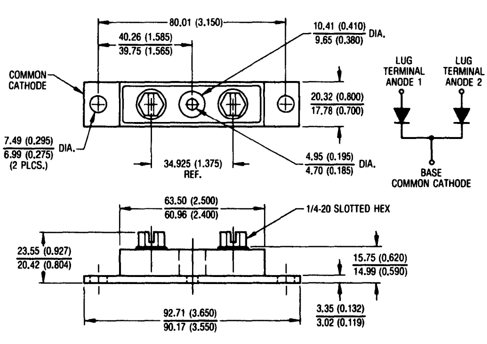
Description/Features

The 224CNQ high current, center tap Schottky rectifier module series has been optimized for extremely low forward voltage drop, with higher leakage. The proprietary barrier technology allows for reliable operation up to 125° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, welding, and reverse battery protection.

- 125° C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Extremely low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB
Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	224CNQ035	224CNQ040	224CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	224CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	220	A	50% duty cycle @ T_C = 81 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	27,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current (Per Leg) *See Fig. 7	2400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	135	mJ	T_J = 25 °C, I_{AS} = 20 Amps, L = 0.67 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	20	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	224CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.52	V	@ 110A	T_J = 25 °C
		0.68	V	@ 220A	
		0.50	V	@ 110A	T_J = 100 °C
		0.68	V	@ 220A	
I_{RM}	Max. Reverse Leakage Current	10	mA	T_J = 25 °C	V_R = rated V_R
	(Per Leg) * See Fig. 2 (1)	1200	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	5200	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		224CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 125	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.40	°C/W	DC operation *See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.20	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO - 244AB		Modified JEDEC

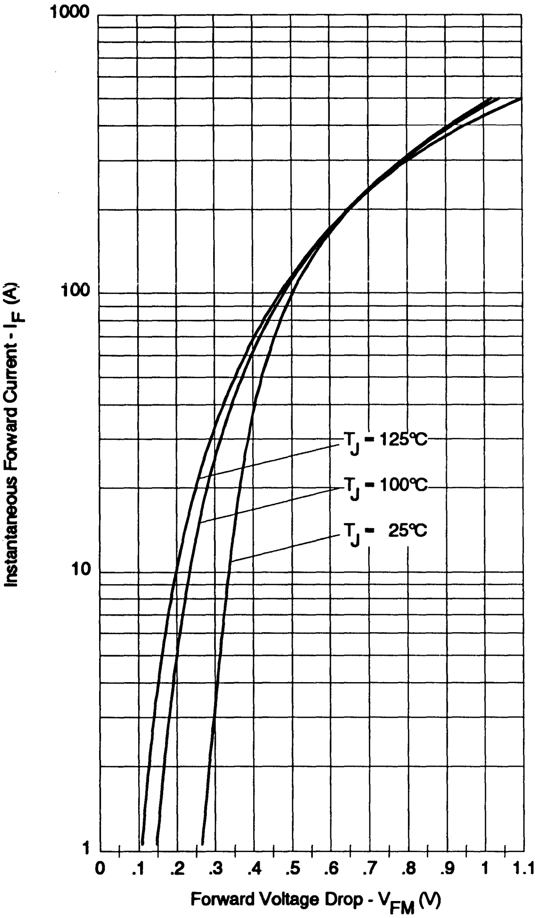


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

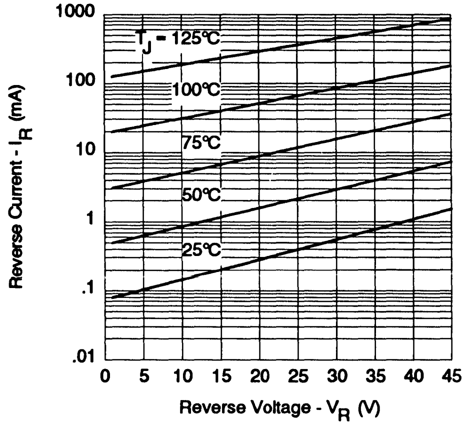


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

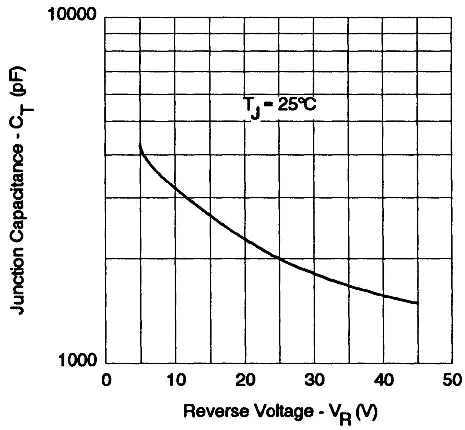


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

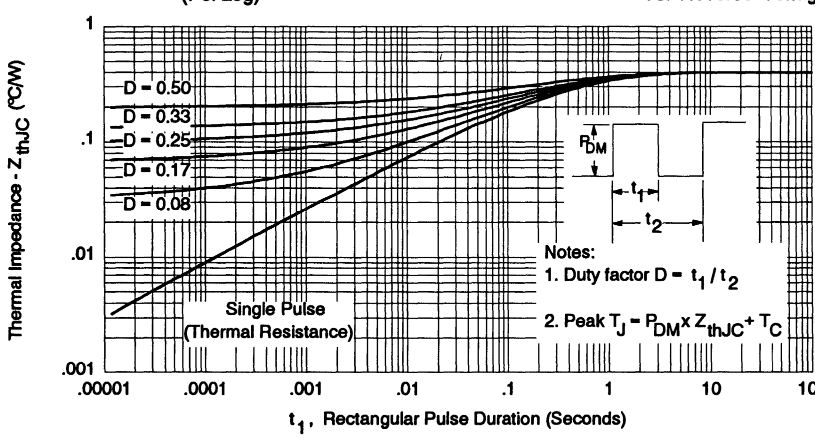


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

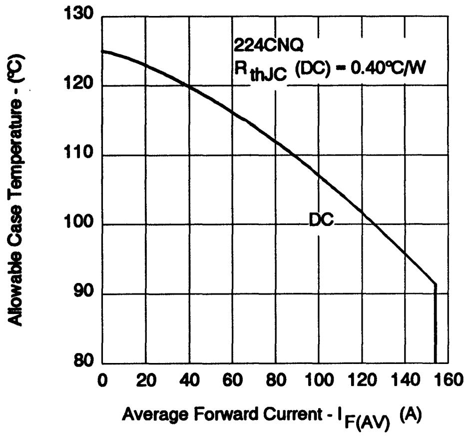


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

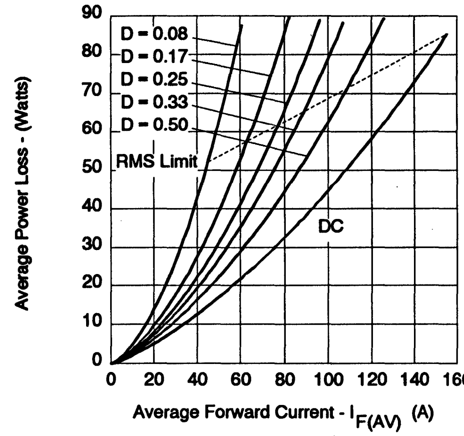


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

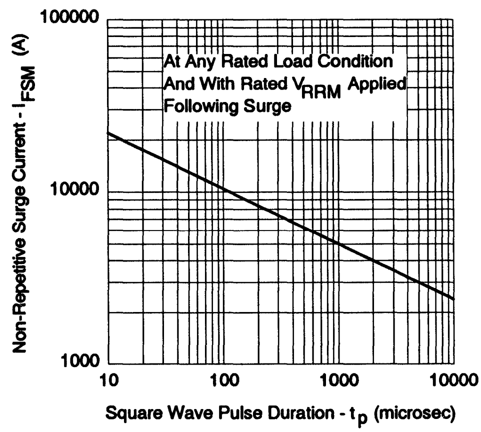


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

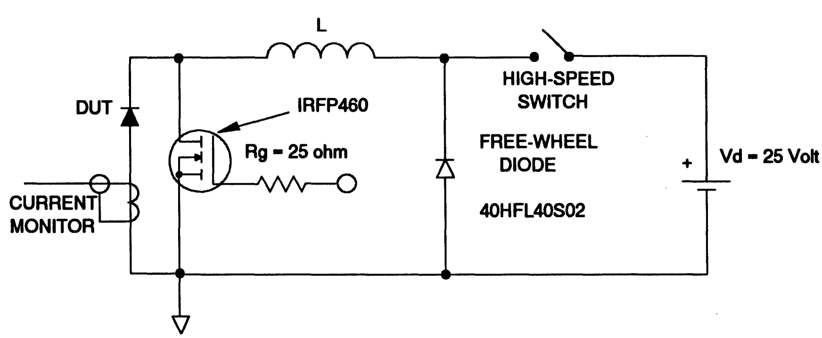


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

225CNQ015

SCHOTTKY RECTIFIER

220 Amp

Major Ratings and Characteristics

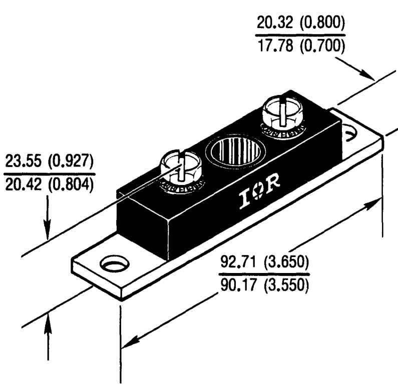
Characteristics	225CNQ015	Units
$I_{F(AV)}$ Rectangular waveform	220	A
V_{RRM}	15	V
I_{FSM} @ tp = 5 μs sine	10,800	A
V_F @ 110Apk, T_J=75°C (per leg)	0.32	V
T_J	- 55 to 100	°C

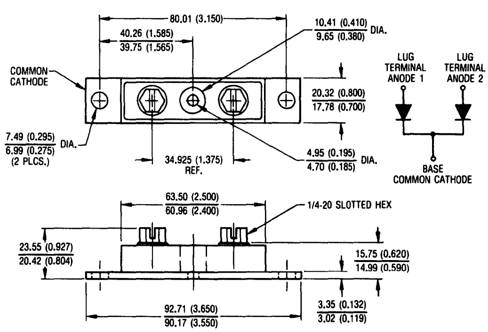
Description/Features

The 225CNQ015 high current, center tap Schottky modules have been optimized for ultra low forward voltage drop specifically for the OR ' ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 100° C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

- 100° C T_J operation
- Center tap module
- Optimized for OR ' ing applications
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Ultra low forward voltage drop
- High frequency operation
- Guard ring enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	225CNQ015
V_R	Max. DC Reverse Voltage (V)	15
V_{RWM}	Max. Working Peak Reverse Voltage (V)	25

Absolute Maximum Ratings

	Parameters	225CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	220	A	50% duty cycle @ T_C = 74 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	10,800	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		1700		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	9	mJ	T_J = 25 °C, I_{AS} = 2 Amps, L = 4.5 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	2	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 3.0 x V_R typical	

Electrical Specifications

	Parameters	225CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.38	V	@ 110A	T_J = 25 °C
		0.49	V	@ 220A	
		0.32	V	@ 110A	T_J = 75 °C
		0.42	V	@ 220A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	40	mA	T_J = 25 °C	V_R = rated V_R
		2000	mA	T_J = 125 °C	
		1780	mA	T_J = 100 °C	V_R = 12 V
		1080	mA	T_J = 100 °C	V_R = 5 V
C_T	Max. Junction Capacitance (Per Leg)	7700	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		225CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 100	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 100	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.40	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.20	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO - 244AB		Modified JEDEC

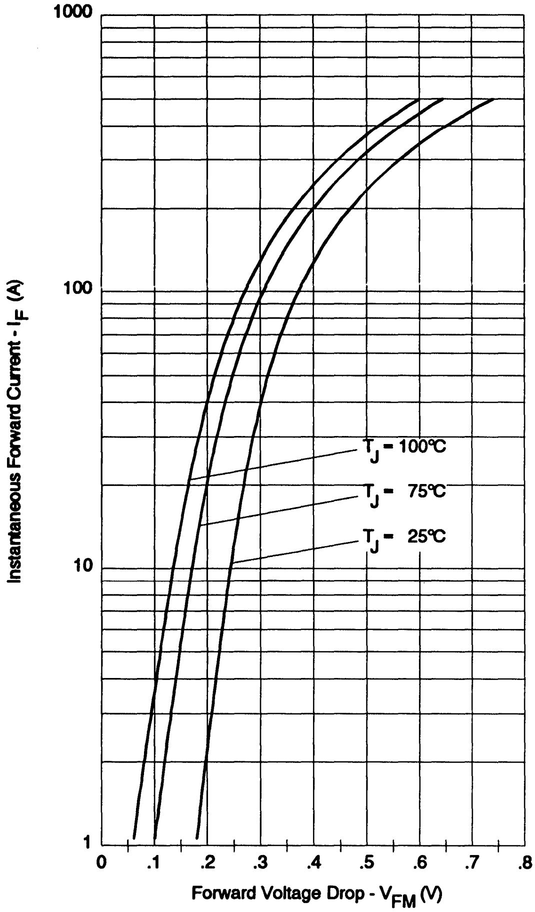


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

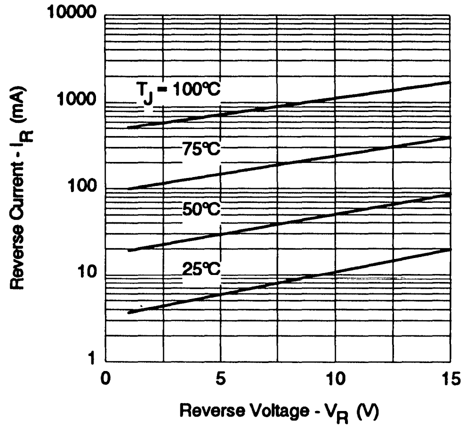


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

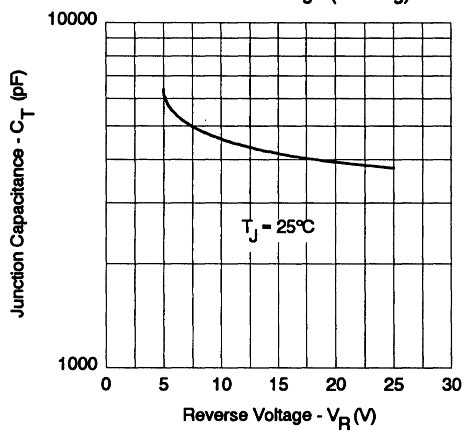


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

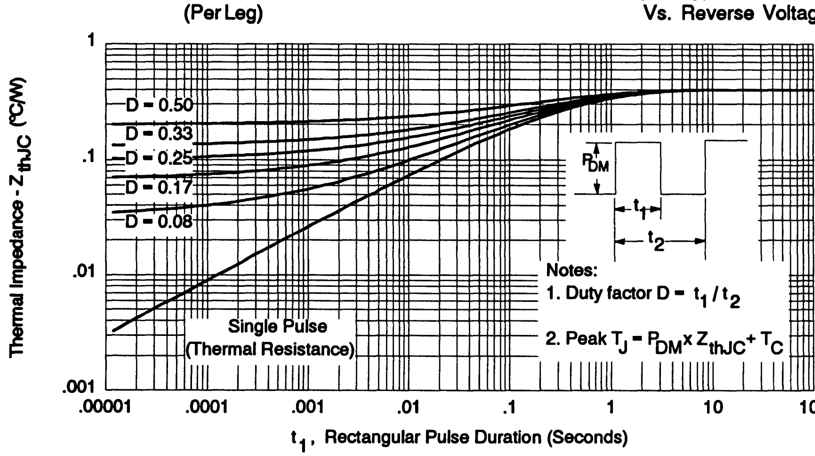


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

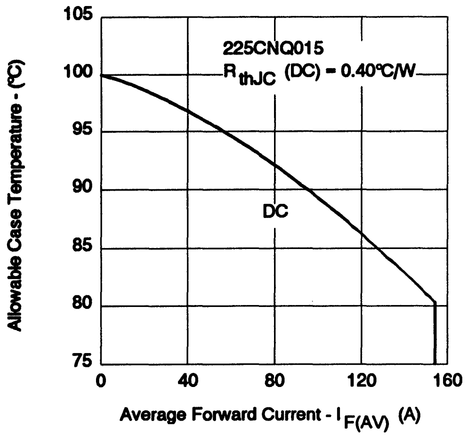


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

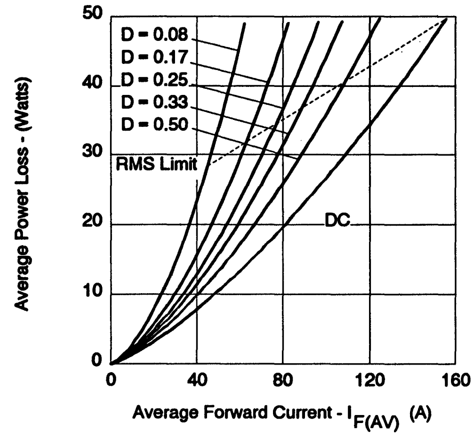


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

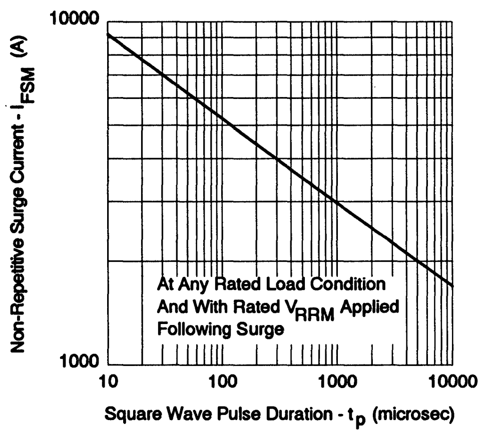


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

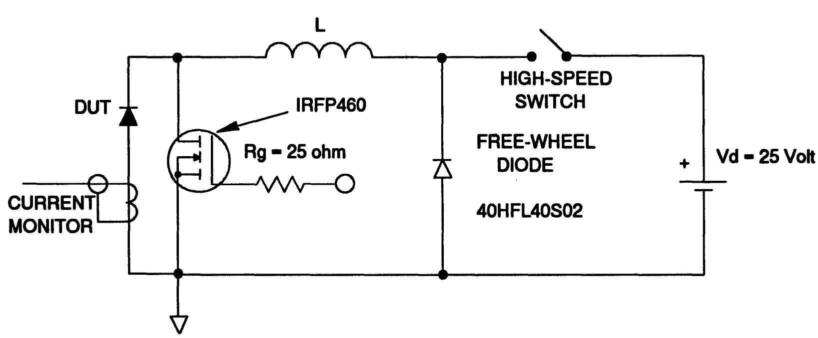


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

301CNQ... SERIES

SCHOTTKY RECTIFIER

300 Amp

Major Ratings and Characteristics

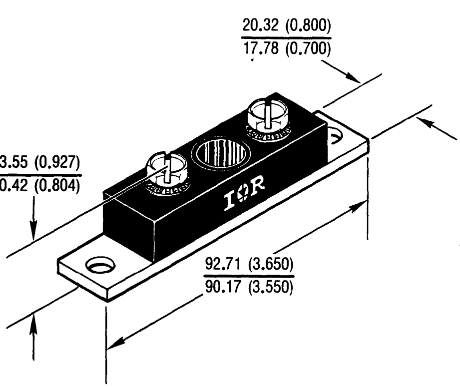
Characteristics	301CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	300	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	16,000	A
V_F @ 150Apk, T_J=125°C (per leg)	0.59	V
T_J	-55 to 175	°C

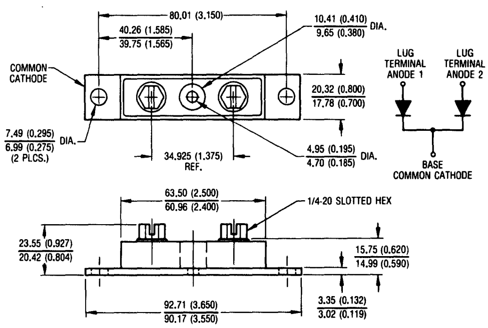
Description/Features

The 301CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in high current switching power supplies, converters, free-wheeling diodes, welding, and reverse battery protection.

- 175°C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	301CNQ035	301CNQ040	301CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	301CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	300	A	50% duty cycle @ T_C = 120 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) *See Fig. 7	16,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3200		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	202	mJ	T_J = 25 °C, I_{AS} = 30 Amps, L = 0.45 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	30	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	301CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.69	V	@ 150A	T_J = 25 °C
		0.90	V	@ 300A	
		0.59	V	@ 150A	T_J = 125 °C
		0.76	V	@ 300A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	10	mA	T_J = 25 °C	V_R = rated V_R
		90	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	5200	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	7.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		301CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.40	°C/W	DC operation *See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.20	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO - 244AB		Modified JEDEC

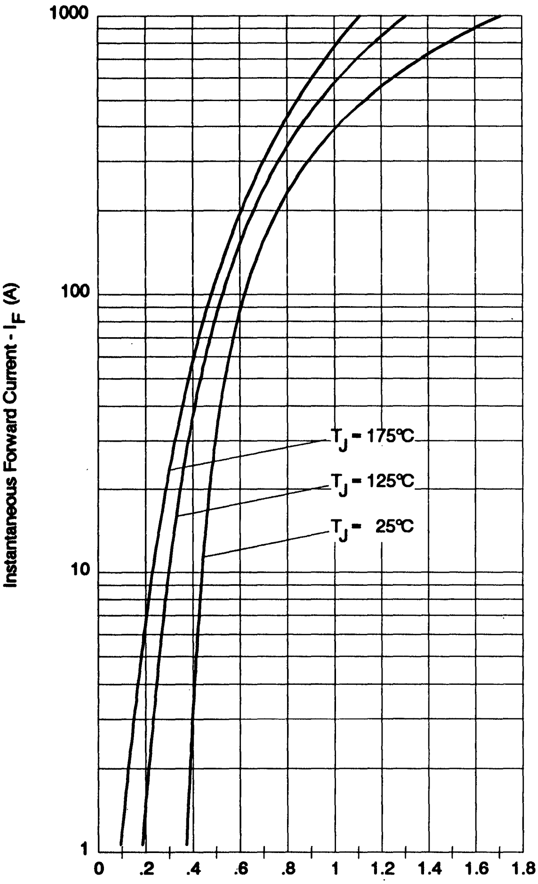


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

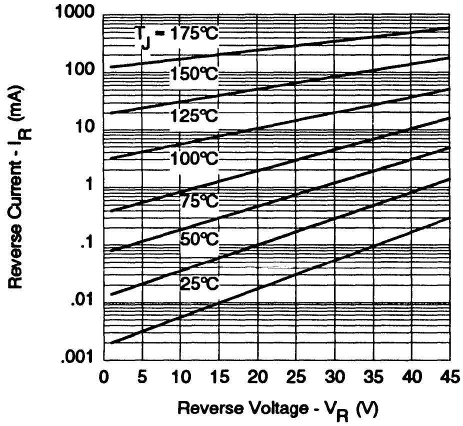


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

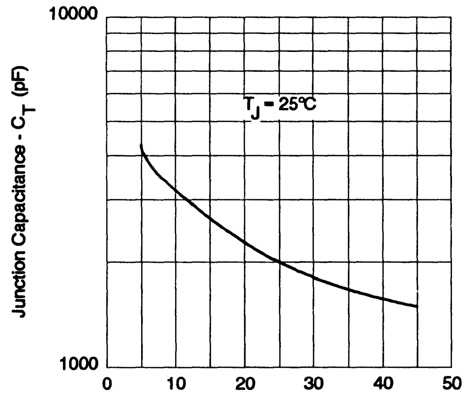


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

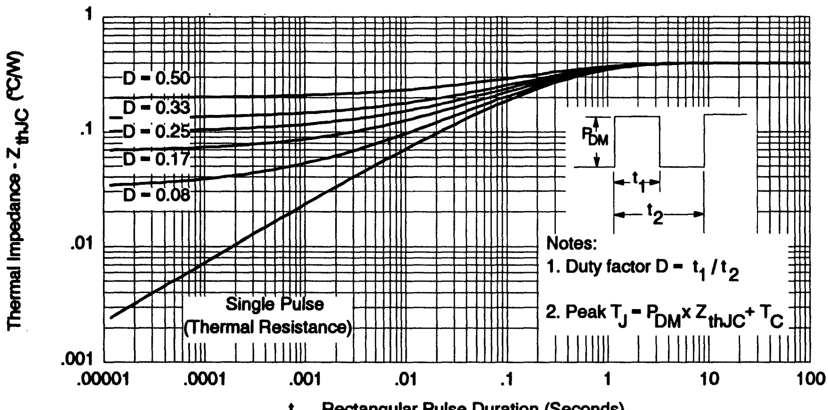


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

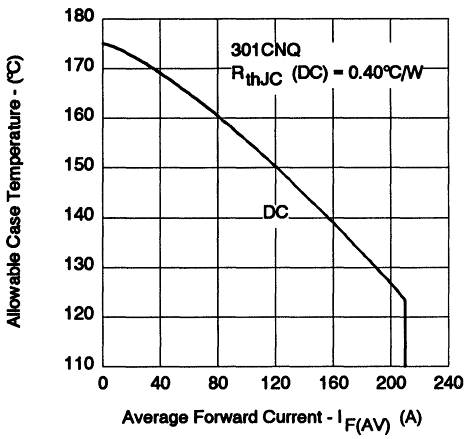


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

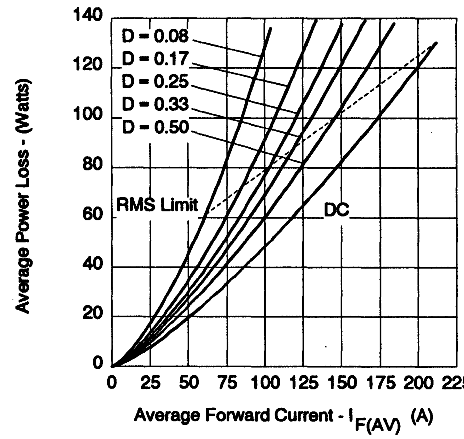


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

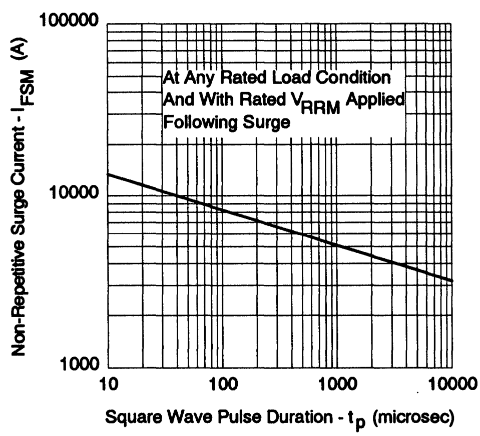


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

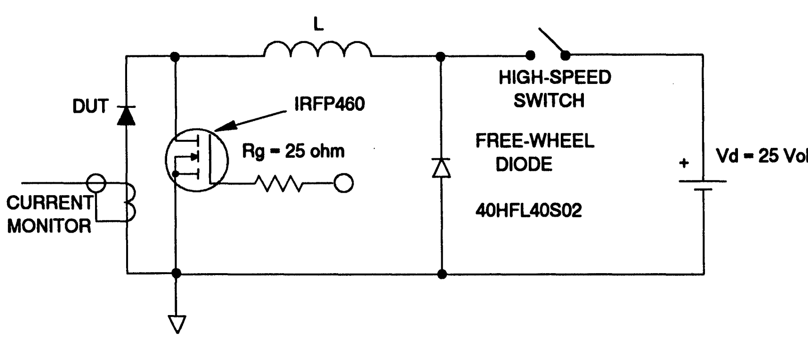


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

303CNQ... SERIES

SCHOTTKY RECTIFIER

300 Amp

Major Ratings and Characteristics

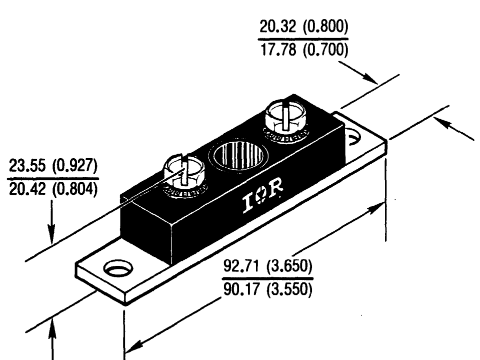
Characteristics	303CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	300	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	22,000	A
V_F @ 150Apk, T_J=125°C (per leg)	0.72	V
T_J	- 55 to 175	°C

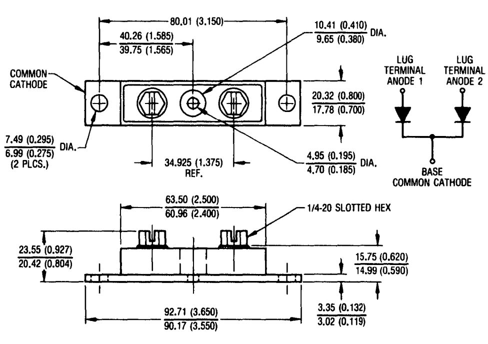
Description/Features

The 303CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in high current switching power supplies, plating power supplies, UPS systems, converters, free-wheeling diodes, welding, and reverse battery protection.

- 175 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

Voltage Ratings

	Part number	303CNQ080	303CNQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	303CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	300	A	50% duty cycle @ T_C = 126 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive	22,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
	Surge Current (Per Leg) * See Fig. 7	2500		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	303CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop	0.91	V	@ 150A	T_J = 25 °C
	(Per Leg) * See Fig. 1 (1)	1.09	V	@ 300A	
		0.72	V	@ 150A	T_J = 125 °C
		0.85	V	@ 300A	
I_{RM}	Max. Reverse Leakage Current	4.5	mA	T_J = 25 °C	V_R = rated V_R
	(Per Leg) * See Fig. 2 (1)	60	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	4150	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	6.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		303CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.30	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.15	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO-244AB		Modified JEDEC

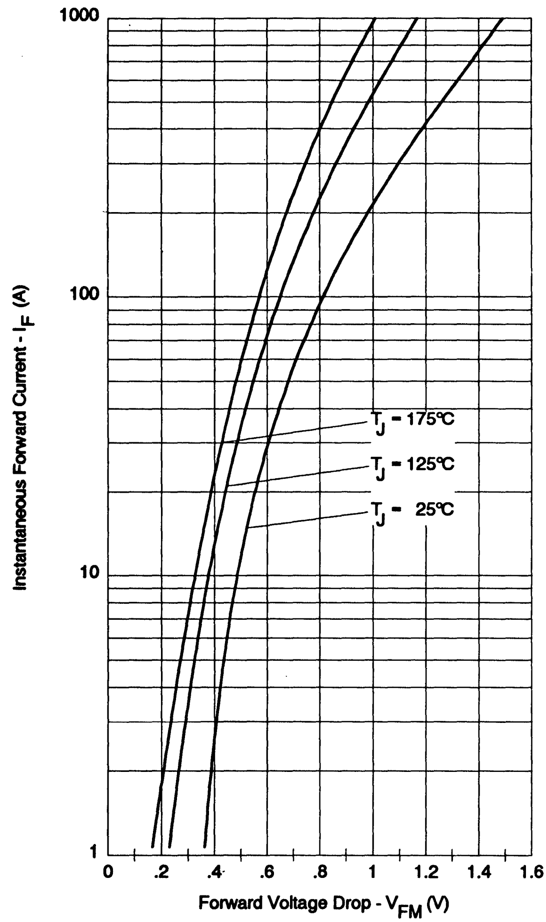


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

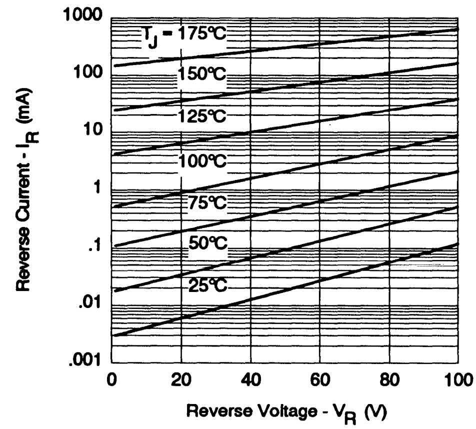


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

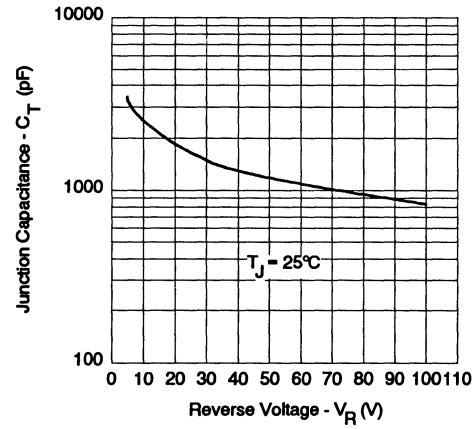


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

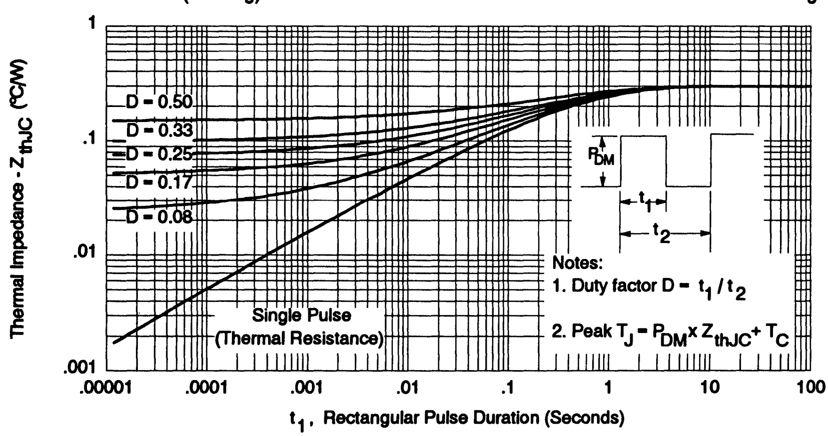


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

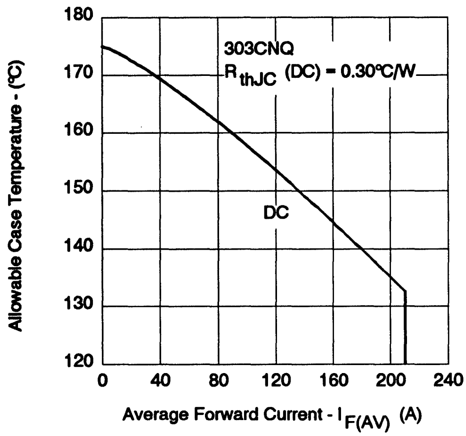


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

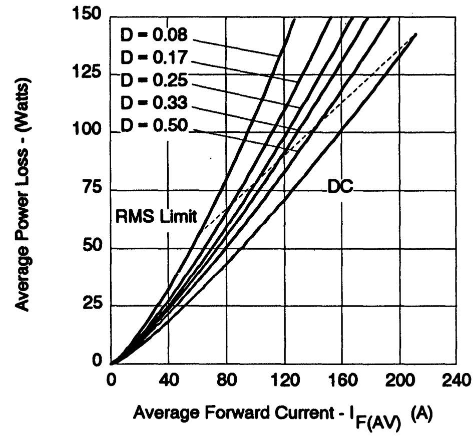


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

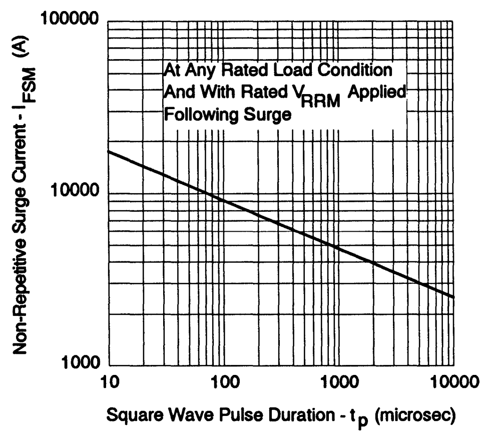


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

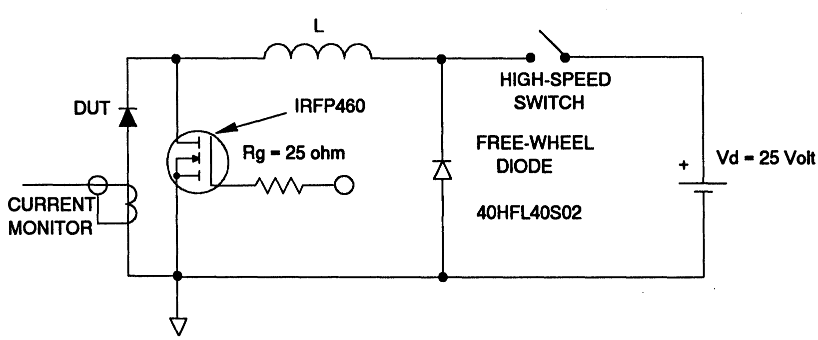


Fig. 8 - Unclamped Inductive Test Circuit

International
IOR Rectifier

400CNQ... SERIES

SCHOTTKY RECTIFIER

400 Amp

Major Ratings and Characteristics

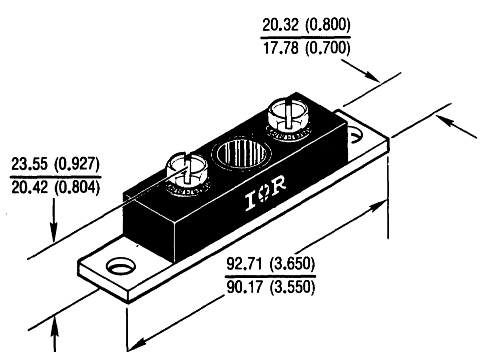
Characteristics	400CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	400	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 µs sine	29,000	A
V_F @ 200Apk, T_J = 125°C (per leg)	0.52	V
T_J	-55 to 150	°C

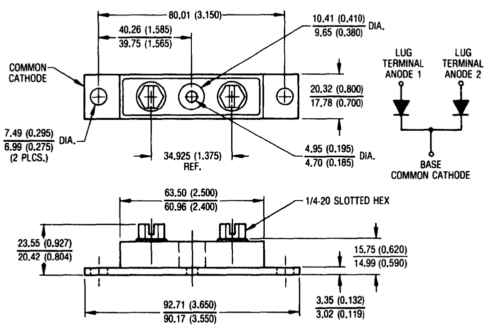
Description/Features

The 400CNQ center tap, high current, Schottky rectifier module series has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, welding, and reverse battery protection.

- 150 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB
Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	400CNQ035	400CNQ040	400CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	400CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	400	A	50% duty cycle @ T_C = 105 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	29,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3400		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	180	mJ	T_J = 25 °C, I_{AS} = 40 Amps, L = 0.22 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	40	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	400CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.57	V	@ 200A	T_J = 25 °C
		0.73	V	@ 400A	
		0.52	V	@ 200A	T_J = 125 °C
		0.68	V	@ 400A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	20	mA	T_J = 25 °C	V_R = rated V_R
		800	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	10,300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		400CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO-244AB		Modified JEDEC

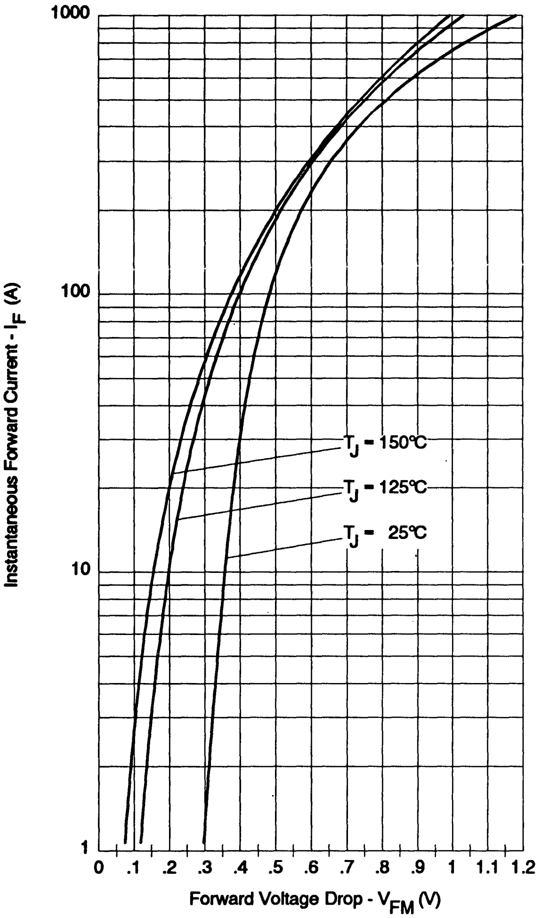


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

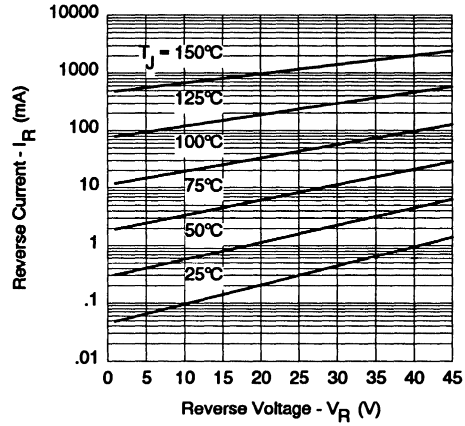


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

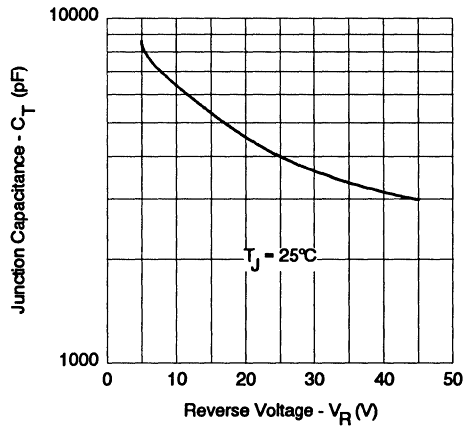


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

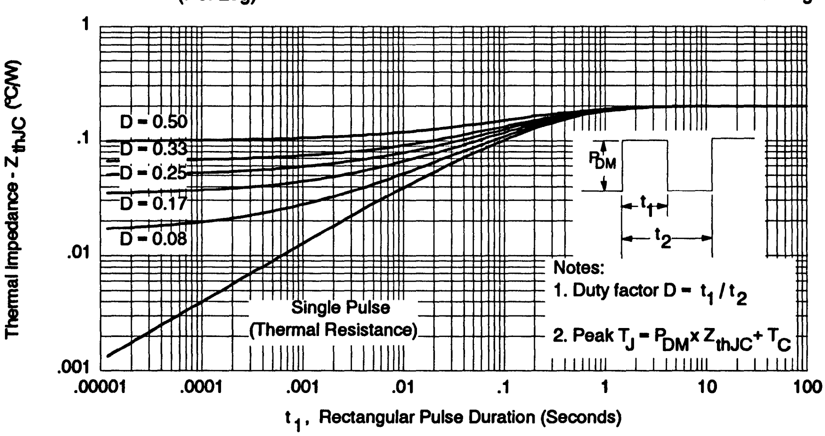


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

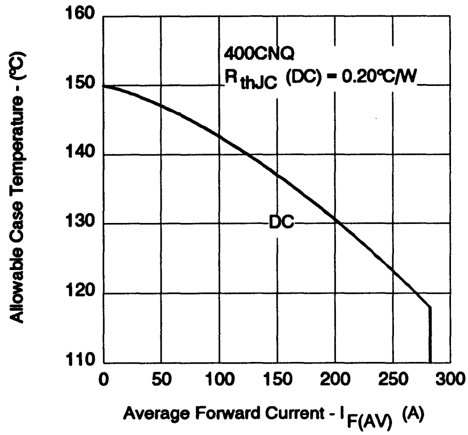


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

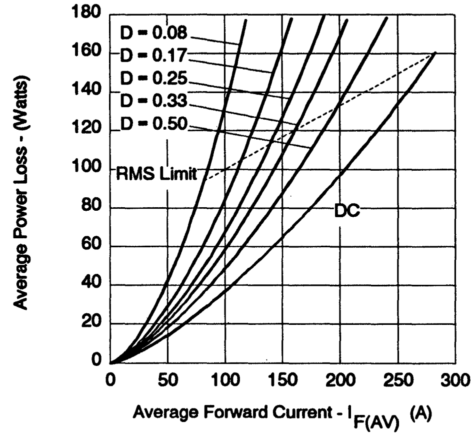


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

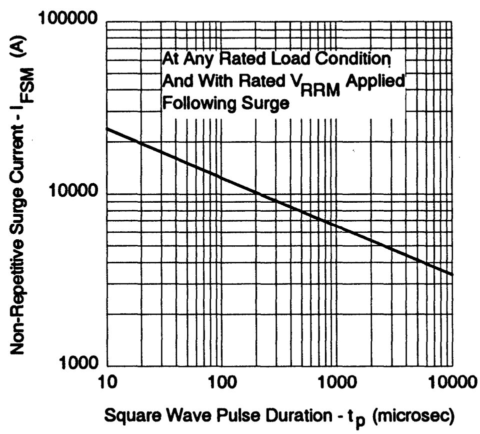


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

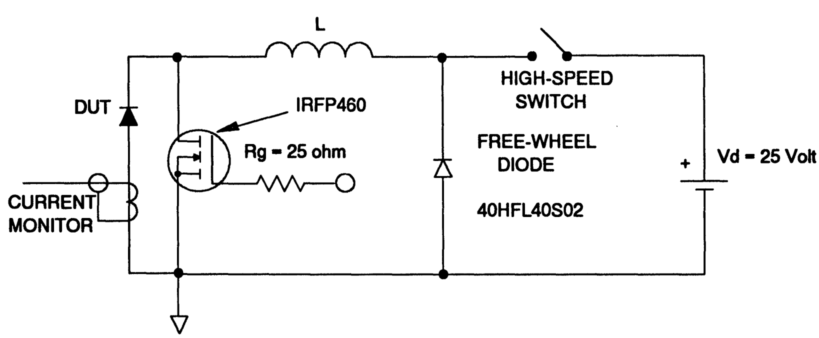


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

401CNQ... SERIES

SCHOTTKY RECTIFIER

400 Amp

Major Ratings and Characteristics

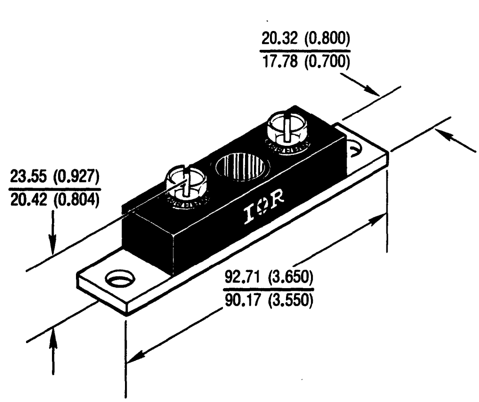
Characteristics		401CNQ...	Units
$I_{F(AV)}$	Rectangular waveform	400	A
V_{RRM}		35 to 45	V
I_{FSM}	@ tp = 5 μs sine	25,000	A
V_F	@ 200Apk, T_J = 125°C (per leg)	0.56	V
T_J		- 55 to 175	°C

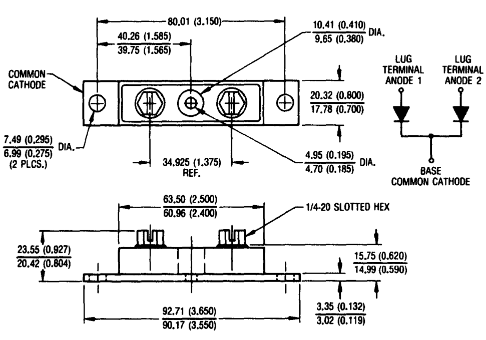
Description/Features

The 401CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in high current switching power supplies, converters, free-wheeling diodes, welding, and reverse battery protection.

- 175°C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	401CNQ035	401CNQ040	401CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	401CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	400	A	50% duty cycle @ T_C = 138 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) *See Fig. 7	25,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3450		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	270	mJ	T_J = 25 °C, I_{AS} = 40 Amps, L = 0.34 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	40	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	401CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.67	V	@ 200A	T_J = 25 °C
		0.78	V	@ 400A	
		0.56	V	@ 200A	T_J = 125 °C
		0.68	V	@ 400A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	20	mA	T_J = 25 °C	V_R = rated V_R
		180	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	10,300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		401CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.20	°C/W	DC operation *See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO - 244AB		Modified JEDEC

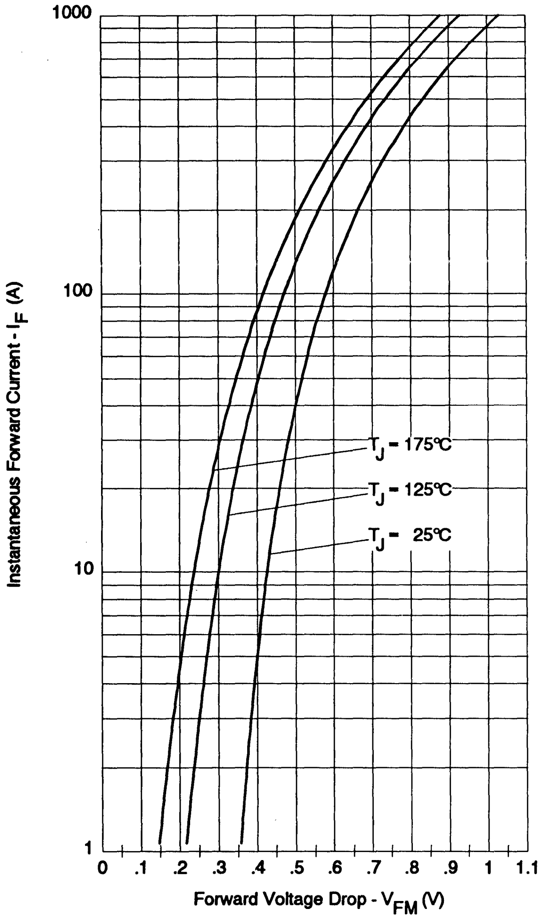


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

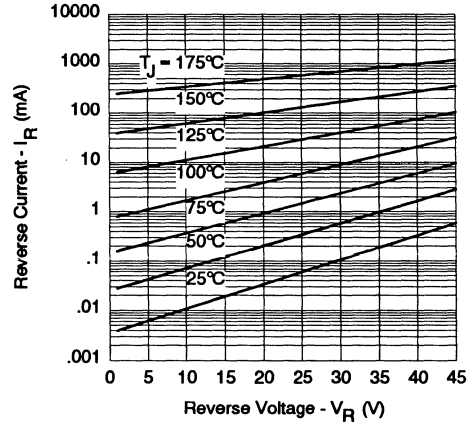


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

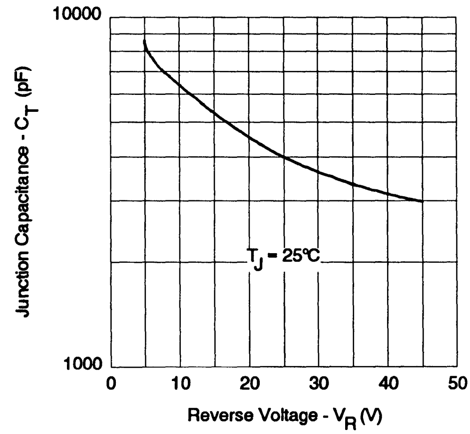


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

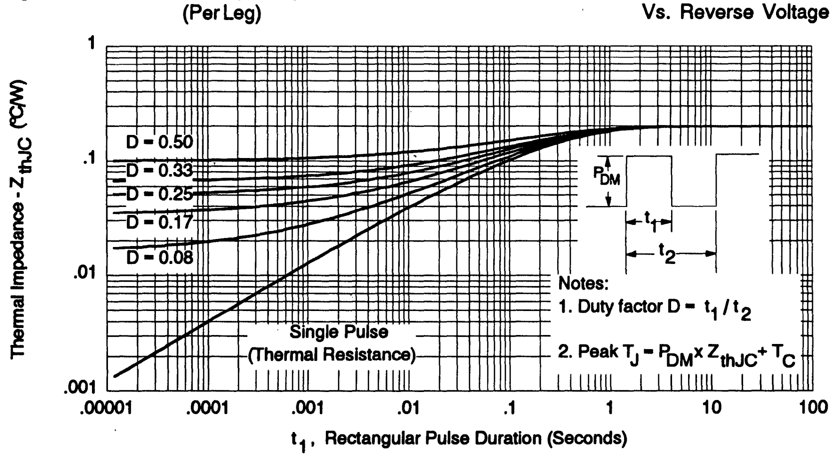


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

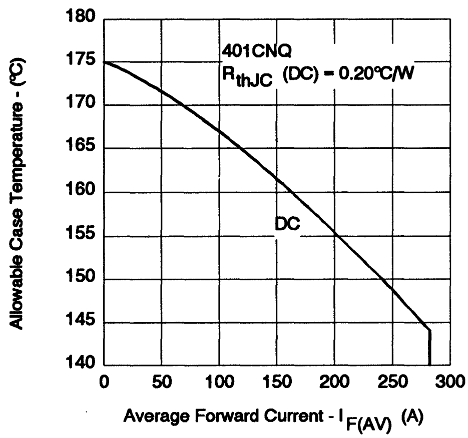


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

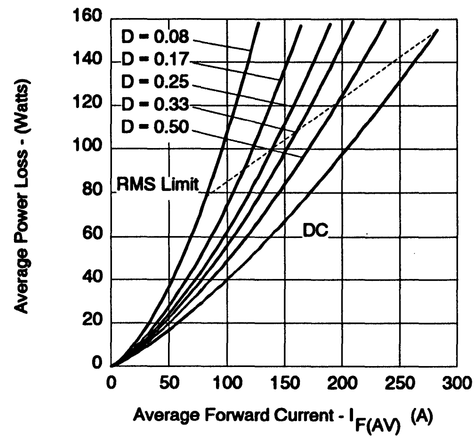


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

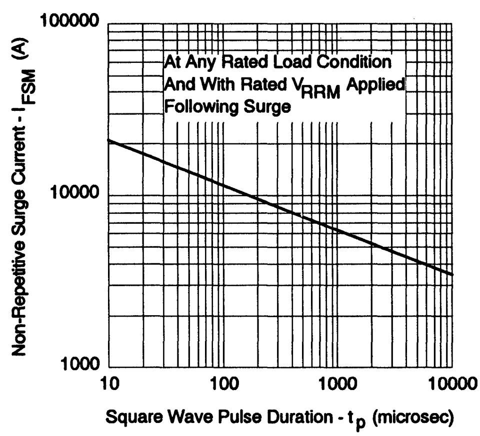


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

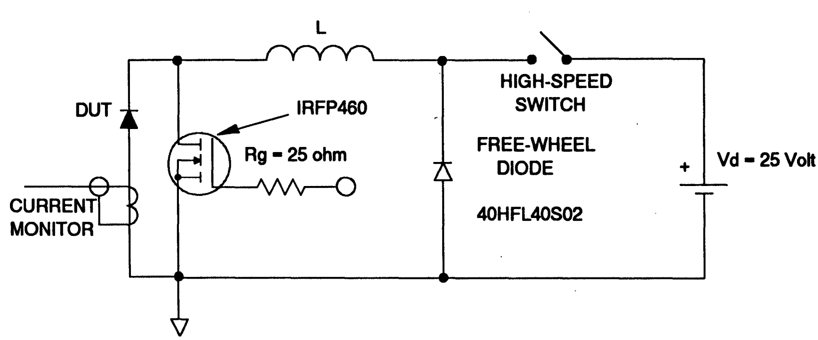


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

403CNQ... SERIES

SCHOTTKY RECTIFIER

400 Amp

Major Ratings and Characteristics

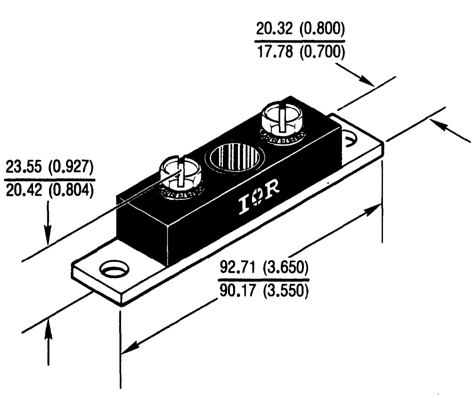
Characteristics	403CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	400	A
V_{RRM}	80 to 100	V
I_{FSM} @ tp = 5 μs sine	25,500	A
V_F @ 200Apk, T_J = 125°C (per leg)	0.69	V
T_J	- 55 to 175	°C

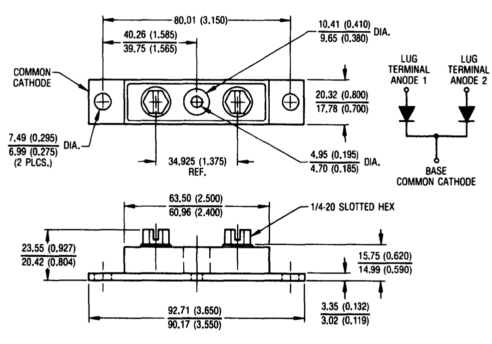
Description/Features

The 403CNQ center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in high current switching power supplies, plating power supplies, UPS systems, converters, free-wheeling diodes, welding, and reverse battery protection.

- 175 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	403CNQ080	403CNQ100
V_R	Max. DC Reverse Voltage (V)	80	100
V_{RWM}	Max. Working Peak Reverse Voltage (V)		

Absolute Maximum Ratings

	Parameters	403CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	400	A	50% duty cycle @ T_C = 105 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	25,500	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3300		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	15	mJ	T_J = 25 °C, I_{AS} = 1 Amps, L = 30 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	1	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	403CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.83	V	@ 200A	T_J = 25 °C
		0.97	V	@ 400A	
		0.69	V	@ 200A	T_J = 125 °C
		0.82	V	@ 400A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	6	mA	T_J = 25 °C	V_R = rated V_R
		80	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	5500	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		403CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 175	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 175	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO-244AB		Modified JEDEC

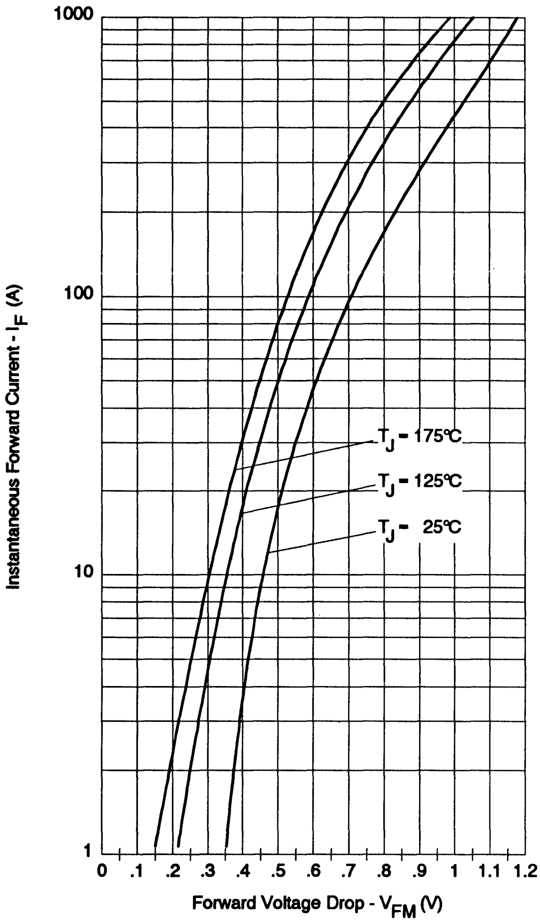


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

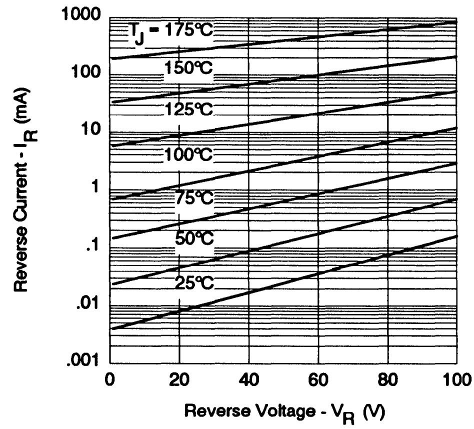


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

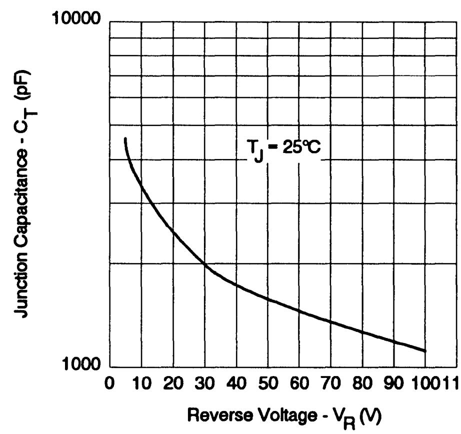


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

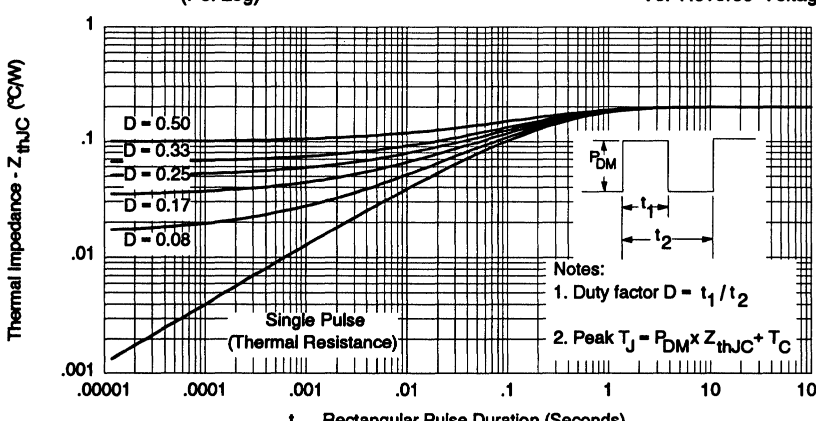


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

TO-244 MODULES

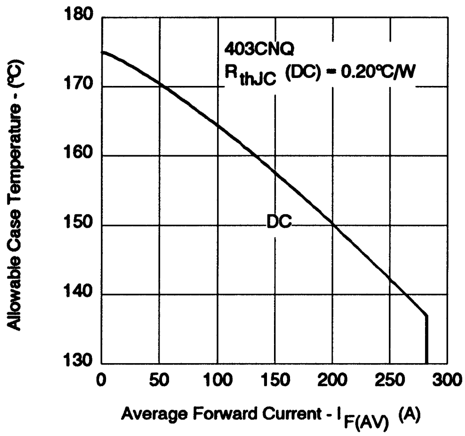


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

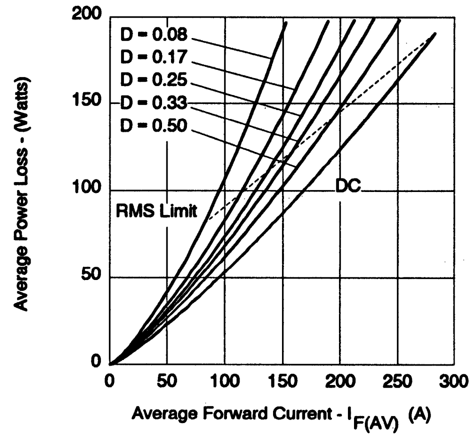


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

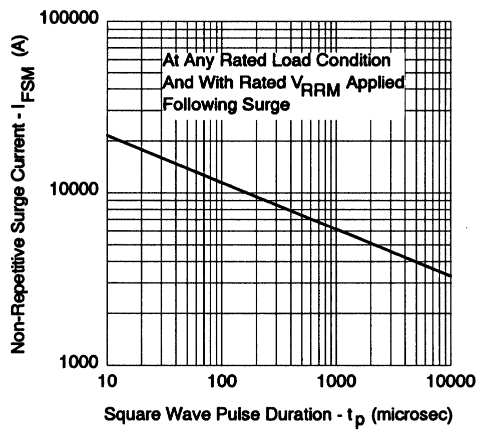


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

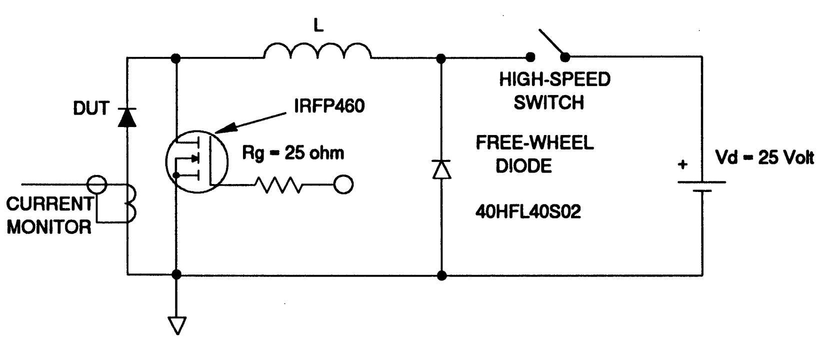


Fig. 8 - Unclamped Inductive Test Circuit

International IOR Rectifier

440CNQ030

SCHOTTKY RECTIFIER

440 Amp

Major Ratings and Characteristics

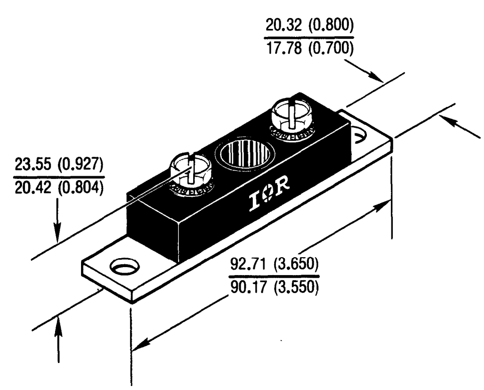
Characteristics	440CNQ030	Units
$I_{F(AV)}$ Rectangular waveform	440	A
V_{RRM}	30	V
I_{FSM} @ tp = 5 µs sine	27,000	A
V_F @ 220Apk, T_J = 125°C (per leg)	0.41	V
T_J	- 55 to 150	°C

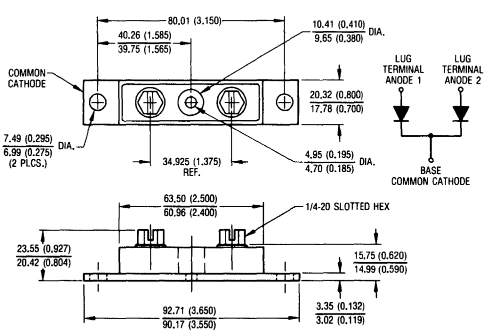
Description/Features

The 440CNQ030 center tap, high current, Schottky rectifier module has been optimized for very low forward voltage drop, with moderate leakage. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, welding and reverse battery protection.

- 150 °C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Very low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

TO-244 MODULES

Voltage Ratings

	Part number	440CNQ030
V_R	Max. DC Reverse Voltage (V)	30
V_{RWM}	Max. Working Peak Reverse Voltage (V)	

Absolute Maximum Ratings

	Parameters	440CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current * See Fig. 5	440	A	50% duty cycle @ T_C = 115 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) * See Fig. 7	27,000	A	5µs Sine or 3µs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3000		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	198	mJ	T_J = 25 °C, I_{AS} = 44 Amps, L = 0.20 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	44	A	Current decaying linearly to zero in 1 µsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	440CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.50	V	@ 220A	T_J = 25 °C
		0.60	V	@ 440A	
		0.41	V	@ 220A	T_J = 125 °C
		0.52	V	@ 440A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	20	mA	T_J = 25 °C	V_R = rated V_R
		1120	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	14,800	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ µs		

(1) Pulse Width < 300µs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		440CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 150	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 150	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.20	°C/W	DC operation * See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO-244AB		Modified JEDEC

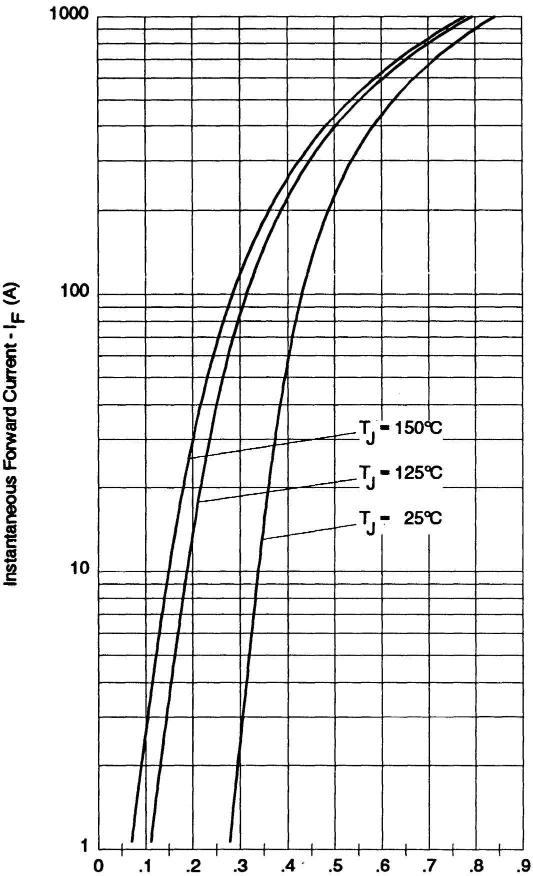


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

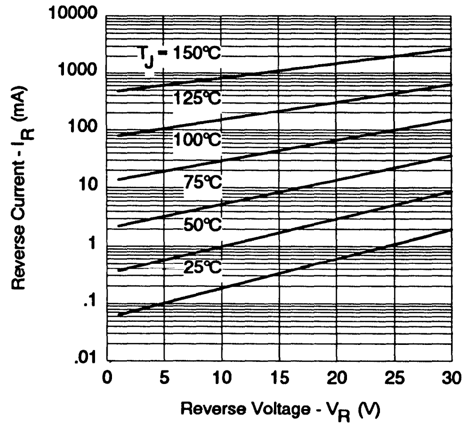


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

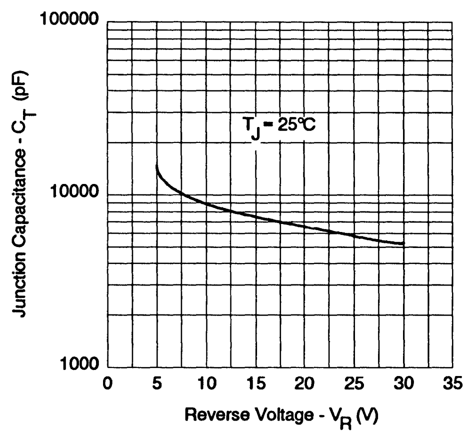


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

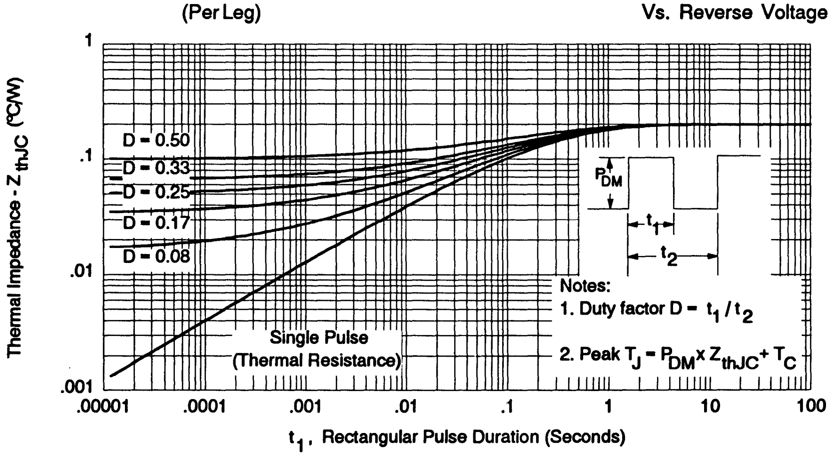


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

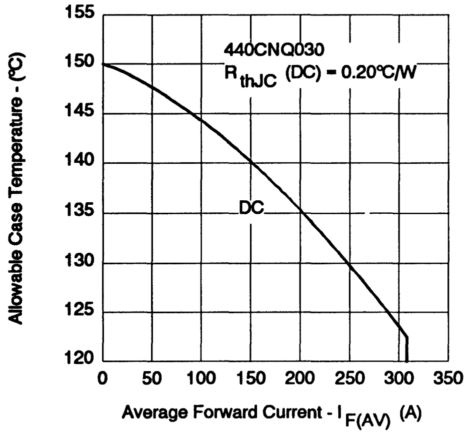


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

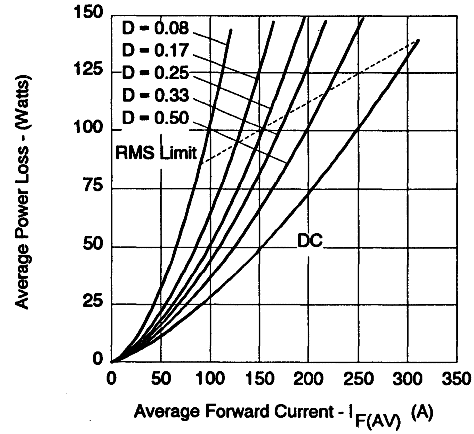


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

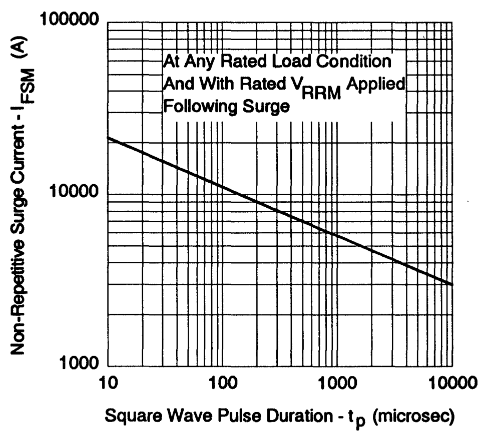


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

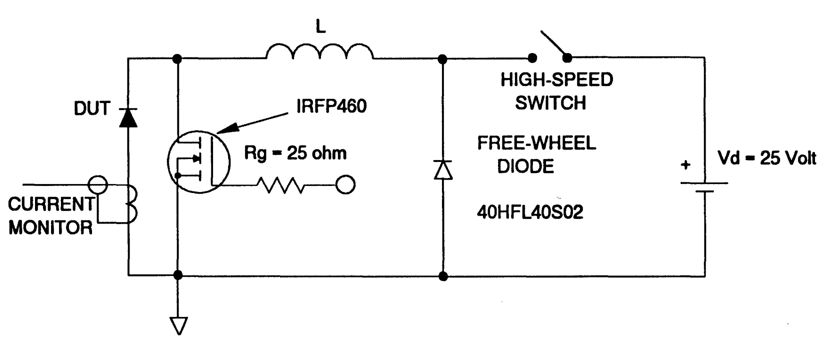


Fig. 8 - Unclamped Inductive Test Circuit

International Rectifier

444CNQ... SERIES

SCHOTTKY RECTIFIER

440 Amp

Major Ratings and Characteristics

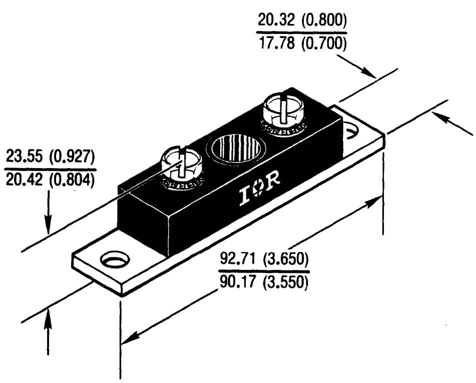
Characteristics	444CNQ...	Units
$I_{F(AV)}$ Rectangular waveform	440	A
V_{RRM}	35 to 45	V
I_{FSM} @ tp = 5 μs sine	35,000	A
V_F @ 220Apk, T_J = 100°C (per leg)	0.51	V
T_J	- 55 to 125	°C

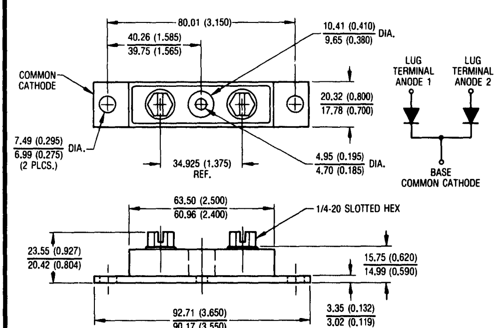
Description/Features

The 444CNQ high current, center tap Schottky rectifier module series has been optimized for extremely low forward voltage drop, with higher leakage. The proprietary barrier technology allows for reliable operation up to 125° C junction temperature. Typical applications are in switching power supplies, converters, free-wheeling diodes, welding, and reverse battery protection.

- 125° C T_J operation
- Center tap module
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Extremely low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability

CASE STYLE AND DIMENSIONS





Modified JEDEC Outline TO - 244AB

Dimensions in millimeters and inches

Voltage Ratings

	Part number	444CNQ035	444CNQ040	444CNQ045
V_R	Max. DC Reverse Voltage (V)	35	40	45
V_{RWM}	Max. Working Peak Reverse Voltage (V)			

Absolute Maximum Ratings

	Parameters	444CNQ	Units	Conditions	
$I_{F(AV)}$	Max. Average Forward Current *See Fig. 5	440	A	50% duty cycle @ T_C = 81 °C, rectangular wave form	
I_{FSM}	Max. Peak One Cycle Non-Repetitive Surge Current (Per Leg) *See Fig. 7	35,000	A	5μs Sine or 3μs Rect. pulse	Following any rated load condition and with rated V_{RRM} applied
		3800		10ms Sine or 6ms Rect. pulse	
E_{AS}	Non-Repetitive Avalanche Energy (Per Leg)	270	mJ	T_J = 25 °C, I_{AS} = 40 Amps, L = 0.34 mH	
I_{AR}	Repetitive Avalanche Current (Per Leg)	40	A	Current decaying linearly to zero in 1 μsec Frequency limited by T_J max. V_A = 1.5 x V_R typical	

Electrical Specifications

	Parameters	444CNQ	Units	Conditions	
V_{FM}	Max. Forward Voltage Drop (Per Leg) * See Fig. 1 (1)	0.53	V	@ 220A	T_J = 25 °C
		0.69	V	@ 440A	
		0.51	V	@ 220A	T_J = 100 °C
		0.68	V	@ 440A	
I_{RM}	Max. Reverse Leakage Current (Per Leg) * See Fig. 2 (1)	20	mA	T_J = 25 °C	V_R = rated V_R
		2400	mA	T_J = 125 °C	
C_T	Max. Junction Capacitance (Per Leg)	10,300	pF	V_R = 5V_{DC}, (test signal range 100Khz to 1Mhz) 25°C	
L_S	Typical Series Inductance (Per Leg)	5.0	nH	From top of terminal hole to mounting plane	
dv/dt	Max. Voltage Rate of Change (Rated V_R)	10,000	V/ μs		

(1) Pulse Width < 300μs, Duty Cycle <2%

Thermal-Mechanical Specifications

	Parameters		444CNQ	Units	Conditions
T_J	Max. Junction Temperature Range		-55 to 125	°C	
T_{stg}	Max. Storage Temperature Range		-55 to 125	°C	
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Leg)		0.20	°C/W	DC operation *See Fig. 4
R_{thJC}	Max. Thermal Resistance Junction to Case (Per Package)		0.10	°C/W	DC operation
R_{thCS}	Typical Thermal Resistance, Case to Heatsink		0.10	°C/W	Mounting surface, smooth and greased
wt	Approximate Weight		79 (2.80)	g (oz.)	
T	Mounting Torque Base	Min.	40 (35)	Kg-cm (lbf-in)	
		Max.	58 (50)		
	Mounting Torque Center Hole	Typ.	17 (15)		
	Terminal Torque	Min.	58 (50)		
		Max.	86 (75)		
	Case Style		TO - 244AB		Modified JEDEC

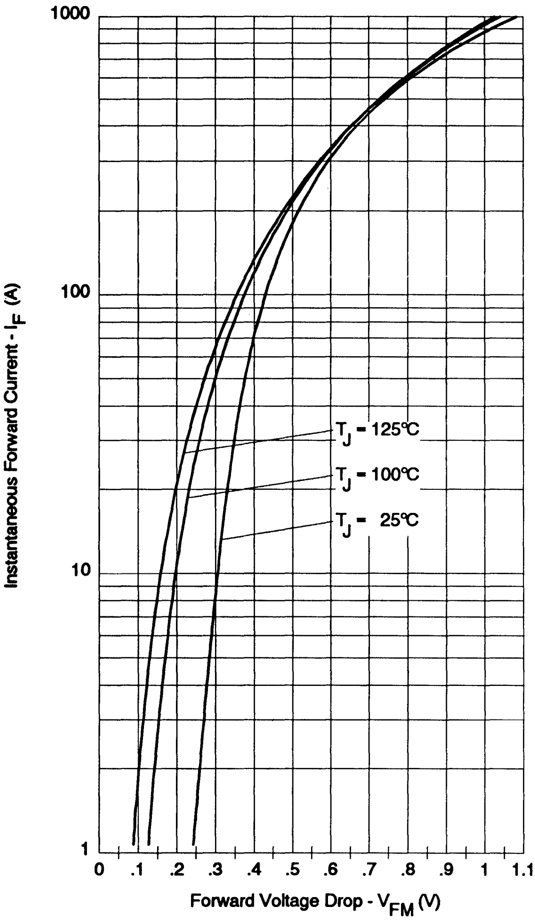


Fig. 1 - Max. Forward Voltage Drop Characteristics (Per Leg)

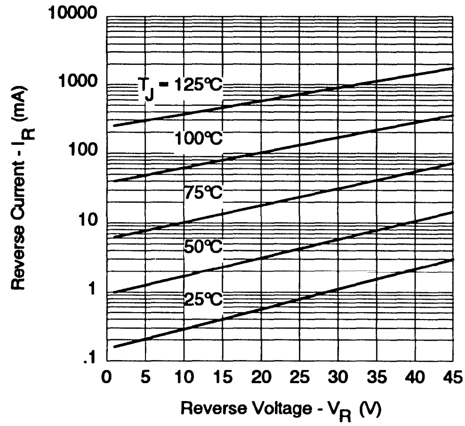


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage (Per Leg)

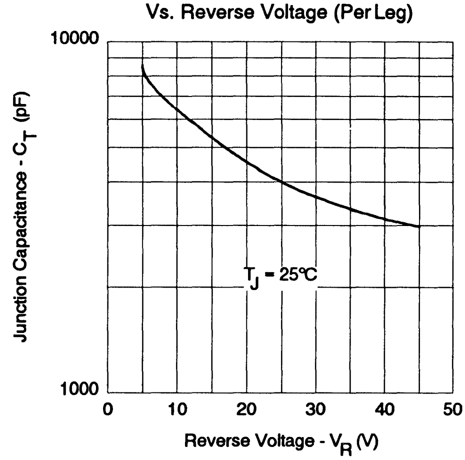


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage (Per Leg)

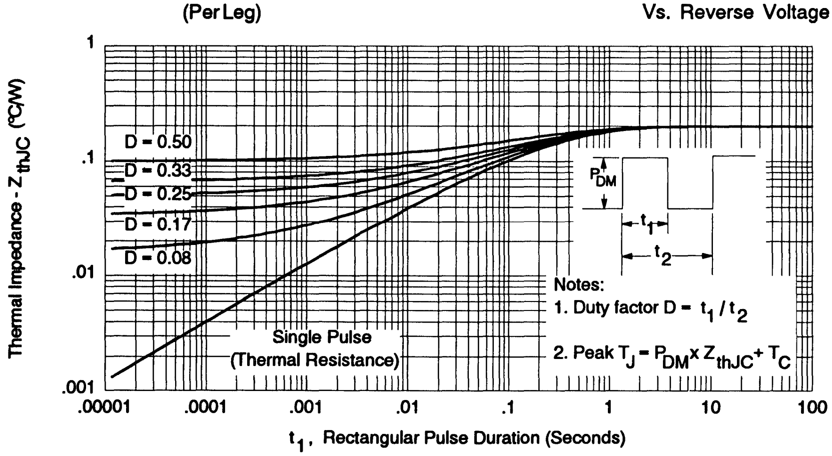


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics (Per Leg)

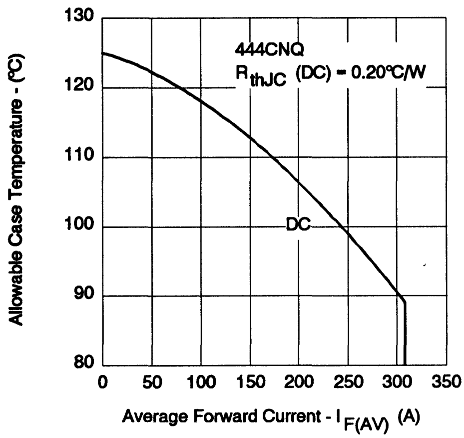


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current (Per Leg)

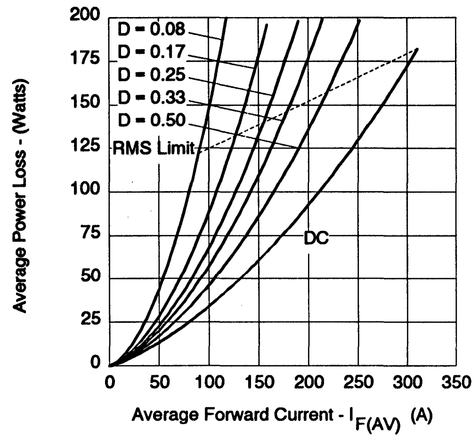


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

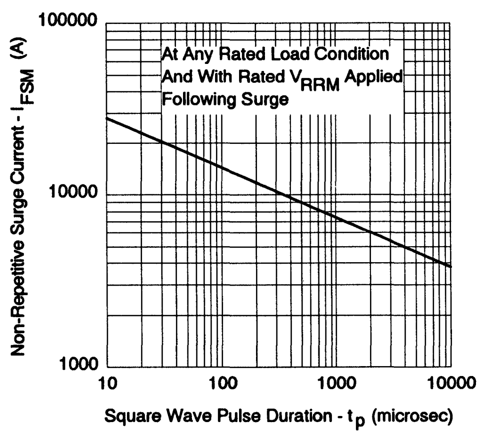


Fig. 7 - Max. Non-Repetitive Surge Current (Per Leg)

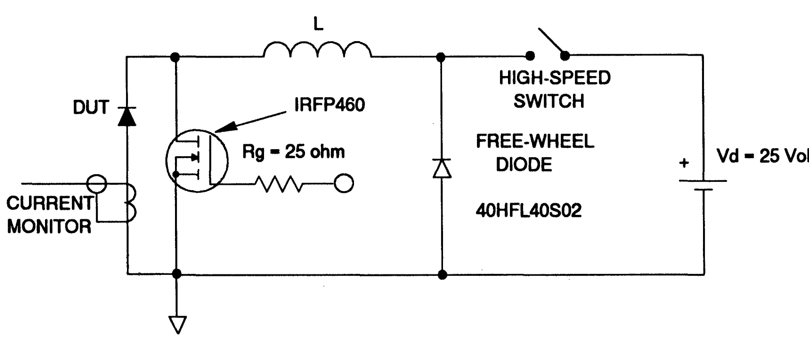


Fig. 8 - Unclamped Inductive Test Circuit

Tape and Reel Information for 10MQ Series

IDENTIFICATION

Marking and identification
Each devices has 3 digits for identification. All 3 digits face the same direction. See the drawing below for the marking code.

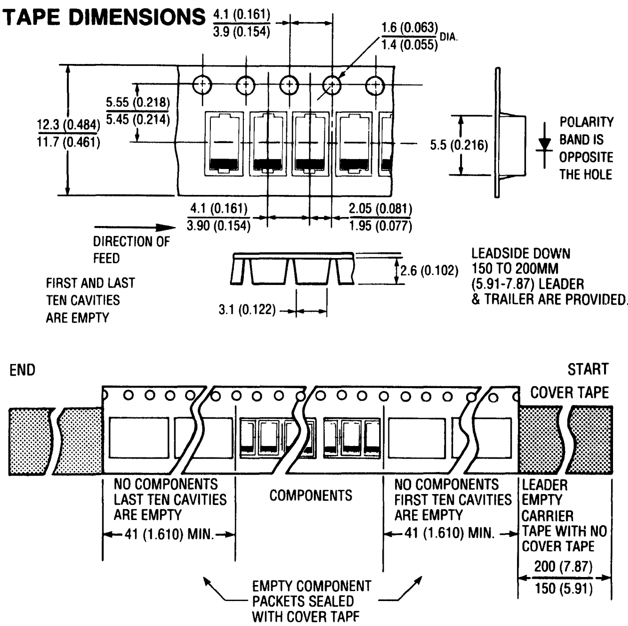
1st digit = device type & voltage
2nd digit = month manufactured
3rd digit = year manufactured

Example: A L 7
- 7 — 1987
- L — November
- A — 30V Schottky (10MQ030)

1st Digit Schottky	2nd Digit Month		3rd Digit Year
A = 30V	A = JAN	G = JUL	7 = 87
B = 40V	B = FEB	H = AUG	8 = 88
C = 50V	C = MAR	J = SEP	9 = 89
D = 60V	D = APR	K = OCT	0 = 90
E = 90V	E = MAY	L = NOV	
F = 100V	F = JUN	M = DEC	
G = 200V			

PACKAGING

TAPE DIMENSIONS



ORDERING INFORMATION

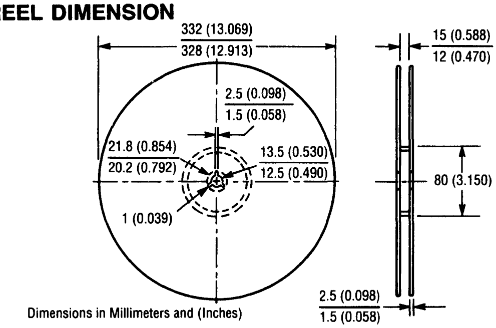
10MQ Series – Tape and Reel
when ordering indicate the part number and the quantity (in multiples of 7,500 pieces).

Example: 10MQ040TR – 15,000 pieces

10MQ Series – Bulk Quantities
when ordering, indicate the part number and the quantity in multiples of 1,000 pieces. Bulk quantities are supplied in plastic packages.

Example: 10MQ040 – 4,000 pieces
10MQ090 – 4,000 pieces

REEL DIMENSION

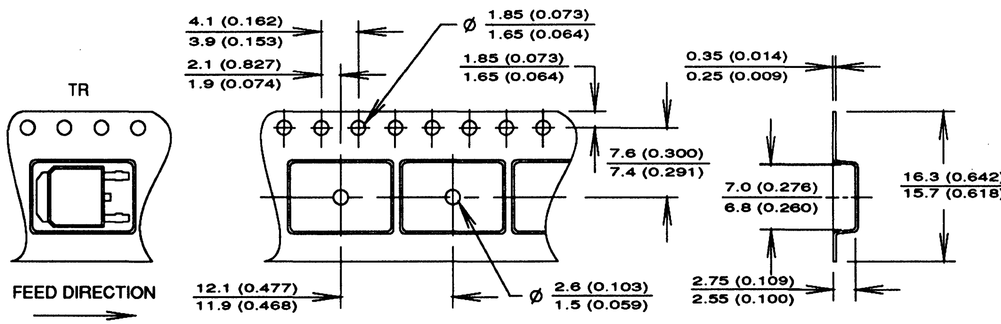


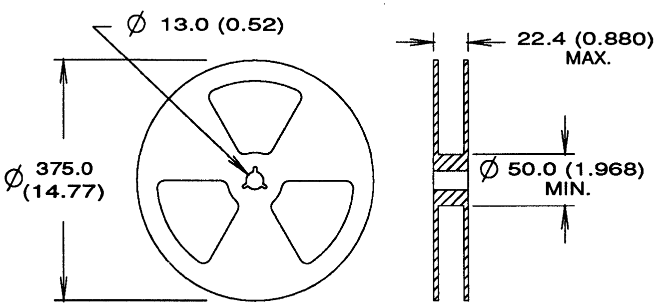
7500 Pieces Per Reel

Dimensions in Millimeters and (Inches)

TO-244 MODULES

Tape and Reel Information for 30WQ, 50WQ, and 6CWQ Series





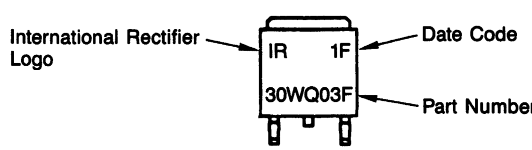
TO-252AA Tape & Reel

When ordering, indicate the part number and the quantity. Quantities are in multiples of 2,000 pieces per reel for TR.

e.g., 30WQ04F TR three-reel order is 6,000 pieces.

TO-252AA (D-Pak) Part Marking Information

Example: This is 30WQ04F with Date Code 1F.



Tape and Reel Information for 11DQ and 31DQ Series

Axial lead devices are packed in accordance with EIA standard RS-296-D and specifications given below.

SERIES	COMPONENT PITCH A	INNER TAPE PITCH B	CUMULATIVE PITCH TOLERANCE
	± 0.5 mm (0.020")	± 1.5 mm (0.059")	
11DQ	5.0 mm	26.0 mm	2.0 mm/20 pitch
31DQ	10.0 mm	52.4 mm	2.0 mm/10 pitch

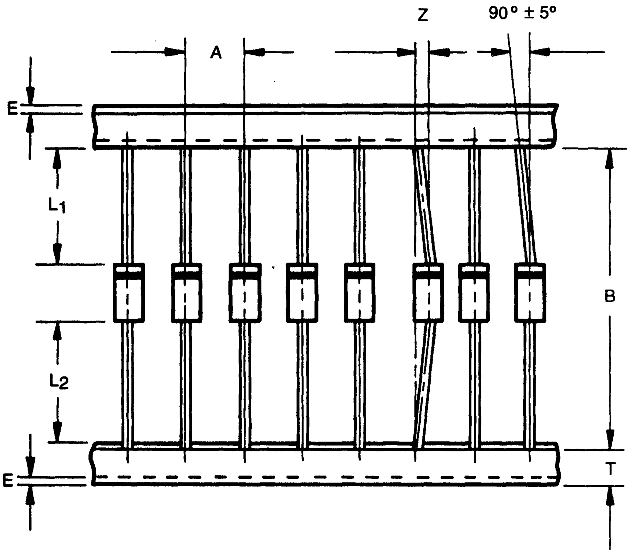
ORDERING INFORMATION

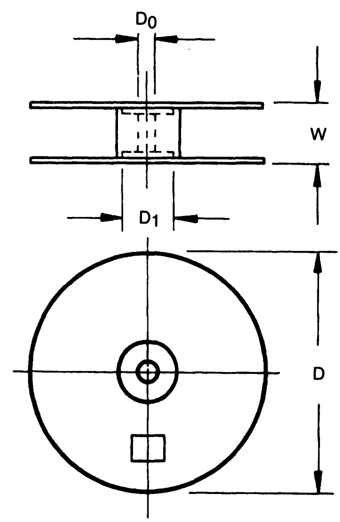
11DQ Series — Tape and Reel
when ordering indicate the part number and the quantity (in multiples of 5,000 pieces).

Example: 11DQ04 TR — 10,000 pieces

31DQ Series — Tape and Reel
when ordering indicate the part number and the quantity (in multiples of 1,200 pieces).

Example: 31DQ06 TR — 2,400 pieces





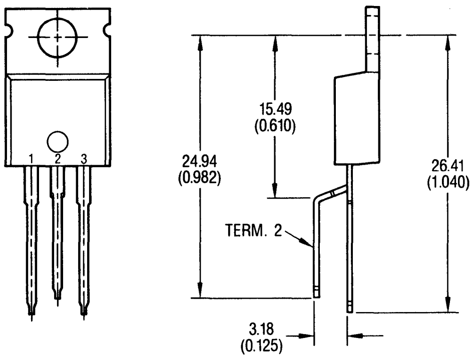
11DQ Series — 5,000 per reel
31DQ Series — 1,200 per reel

ITEM	SYMBOL	SPECIFICATIONS (mm)	SPECIFICATIONS (inch)
Component alignment	Z	1.2 max.	0.048 max.
Tape width	T	6.0 ±0.4	0.236 ±0.016
Exposed adhesive	E	0.8 max.	0.032 max.
Body eccentricity	$\lvert L_1 - L_2 \rvert$	1.0 max.	0.040 max.
Reel outside diameter	D	330.0	13.0
Reel inner diameter	D_1	85.7 ±0.3	3.375 ±0.012
Feed hole diameter	D_0	16.6 ±0.4	0.655 ±0.016
Reel width	W	79.0 ±1.0	3.110 ±0.040

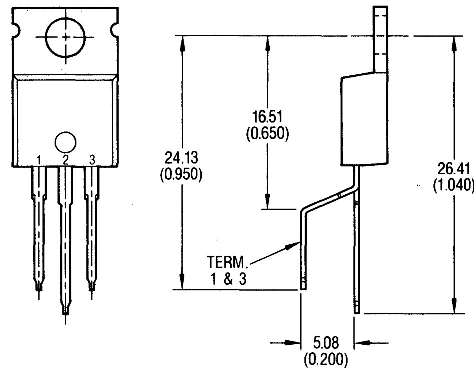
NOTE: 1. Each component lead shall be sandwiched between tapes for a minimum of 3.2 mm (0.126").
2. The reel width 'W' for 26 mm taping is 50.0 ±1.0 mm (1.97" ± 0.040")

TO-220 Optional Leadforms

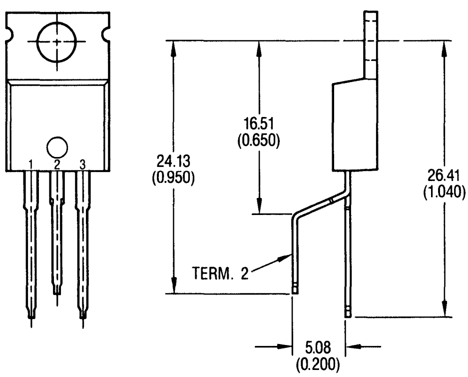
International Rectifier now offers standard leadform in various configurations to allow the flexibility to meet the variety of design requirements. Shown below are IR's standard leadform offerings. To order a device with leadforming, simply state the desired TO-220 SCHOTTKY Part Number then indicate the leadform of your choice with the three digit suffix. For the correct suffix refer to the leadform options which are shown below. Example: 12CTQ045-004 is an 12CTQ045 SCHOTTKY with an option -004 leadform.



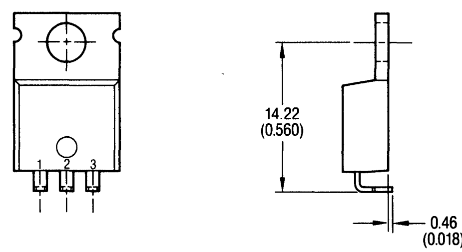
OPTION -003



OPTION -004



OPTION -005(1)



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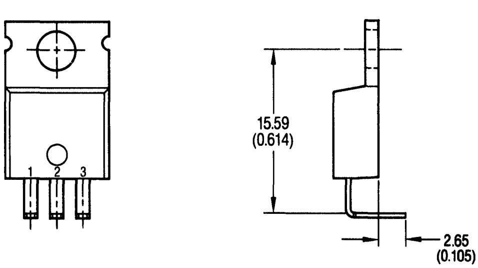
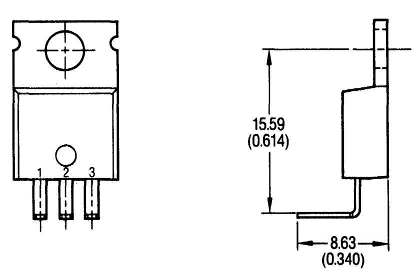


OPTION -009



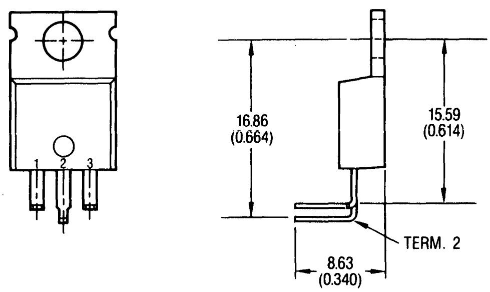
OPTION -010

Tolerance ± 0.010 Inches

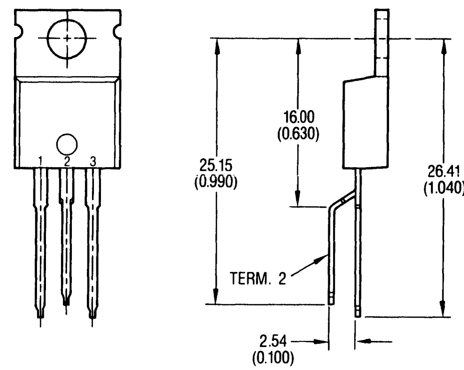
Dimensions in Millimeters and (Inches)

TO-220 Optional Leadforms

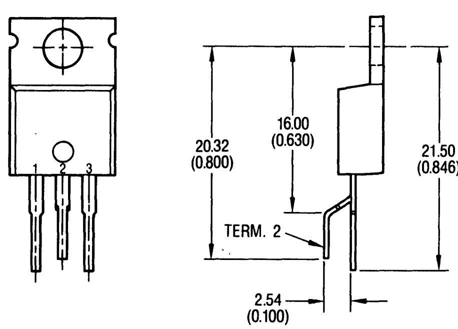
International Rectifier now offers standard leadform in various configurations to allow the flexibility to meet the variety of design requirements. Shown below are IR's standard leadform offerings. To order a device with leadforming, simply state the desired TO-220 SCHOTTKY Part Number then indicate the leadform of your choice with the three digit suffix. For the correct suffix refer to the leadform options which are shown below. Example: 12CTQ045-004 is an 12CTQ045 SCHOTTKY with an option -004 leadform.



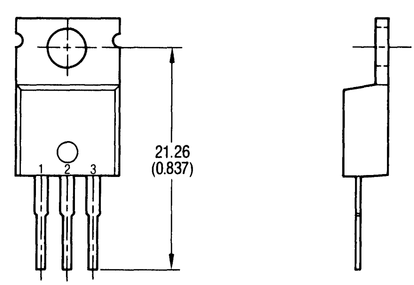
OPTION -011



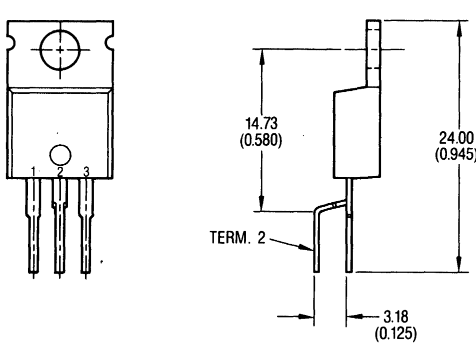
OPTION -012



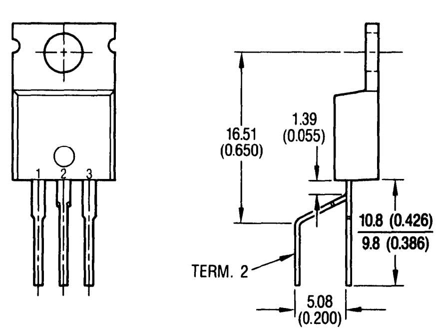
OPTION -013



OPTION -017



OPTION -018



OPTION -029

Tolerance ± 0.010 Inches

Dimensions in Millimeters and (Inches)

Schottky Diode Designer's Manual

International Rectifier

D-478

SECTION E

APPLICATION NOTES

APPLICA-
TION
NOTES

Schottky Applications Information

Contents

Selecting and Designing In The Right Schottky

Summary

International Rectifier offers a broad line of Schottky rectifiers with a variety of packages, rated currents, voltages, and rated junction temperatures. These Schottky rectifiers are intended for use in a variety of power supply applications.

This application note has the following purposes:

- Provide a familiarization with the foundations of IR's Schottky product range by reviewing the different packages, die sizes, and electrical characteristics of the various Schottky processes. Show how these all come together to form an overall product matrix that serves the design needs of virtually any power supply application.
- Review and explain the Schottky data sheet.
- Review the application performance trade-offs between different Schottky types, and give *Guidelines* that steer the user to the best choice of Schottky to meet given application requirements.
- Give design procedures to determine the worst-case design operating point, estimate the losses and select the heatsink for the Schottkys, in the most common power supply circuits.
- Review the techniques for suppressing switching voltage transients and the fundamentals of snubber design.
- Present a comprehensive "Schottky Selection Guide for Power Supplies," which shows, at a glance, the different possible Schottky choices and performance trade-offs for a wide range of different power supply requirements, for the most common power supply circuits.

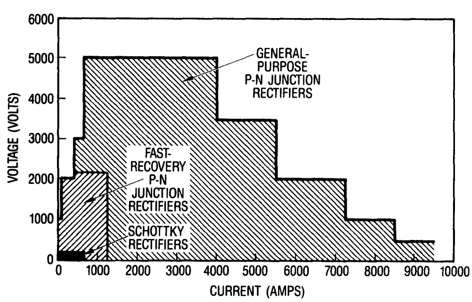


Figure 1. Available ratings of Schottky rectifiers relative to P-N junction rectifiers.

Why a Schottky?

Schottky rectifiers occupy a small corner of the total spectrum of available rectifier voltage and current ratings illustrated in Figure 1. They are, nonetheless, the rectifier of choice for low voltage switching power supply applications, with output voltages up to a few ten of volts, particularly at high switching frequency. For this reason, Schottkys account for a major segment of today's total rectifier usage. This is illustrated in Figure 2.

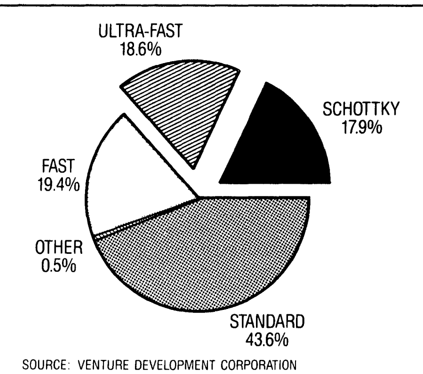


Figure 2. Schottky usage by sales volume relative to total rectifier market. (1989 U.S. Market)

The Schottkys' unique electrical characteristics set them apart from conventional PN junction rectifiers, in the following important respects:

- Lower forward voltage drop
- Lower blocking voltage
- Higher leakage current
- Virtual absence of reverse recovery charge

The two fundamental characteristics of the Schottky that make it a winner over the PN junction rectifier in low voltage switching power supplies are its *lower forward voltage drop,* and virtual *absence of minority carrier reverse recovery.*

The *absence* of minority carrier *reverse recovery* means virtual absence of switching losses within the Schottky itself. Perhaps more significantly, the problem of switching voltage transients and attendant oscillations is less severe for Schottkys than for PN junction rectifiers. Snubbers are therefore smaller and less dissipative.

The *lower forward voltage drop* of the Schottky means lower rectification losses, better efficiency, and smaller heatsinks.

Forward voltage drop is a function of the Schottky's reverse voltage rating. The maximum voltage rating of today's Schottky rectifiers is about 150V. At this voltage, the Schottky's forward voltage drop is lower than that of a fast recovery epitaxial PN junction rectifier by 150 to 200mV. At lower voltage ratings, the lower forward voltage drop of the Schottky becomes progressively more pronounced, and more of an advantage.

A 45V Schottky, for example, has a forward voltage drop of 0.4 to 0.6V, versus 0.85 to 1.0V for a fast epitaxial PN junction rectifier. A 15V Schottky has a mere 0.3 to 0.4V forward voltage drop.

A conventional fast recovery epitaxial PN junction rectifier, with a forward voltage drop of 0.9V would dissipate about 18% of the output power of a 5V supply. A Schottky, by contrast, reduces rectification losses to the range of 8 to 12%.

These are the simple reasons why Schottkys are virtually always preferred in low voltage high frequency switching power supplies.

I. SCHOTTKY PRODUCT RANGE

International Rectifier's Schottky product range, when viewed for the first time through a glance at the catalog or at individual product data sheets, may appear daunting to the engineer who wants to focus quickly on the best choice of product for his needs.

The quickest route to familiarity with the product range is an understanding of its basic ingredients. Figure 3 illustrates that all members of the IR Schottky product matrix stem from three basic categories of ingredients:

A. Schottky Process Type
B. Schottky Die
C. Package

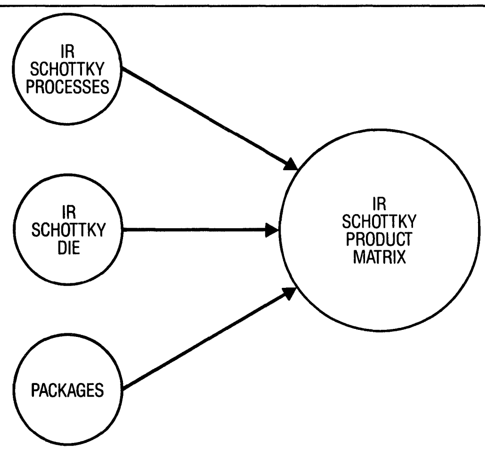


Figure 3. Basic ingredients of the International Rectifier Schottky product matrix.

A familiarity with the above ingredients helps the user gain an understanding of the factors that will lead to the right Schottky choice to satisfy given application requirements.

A. Schottky Processes

International Rectifier offers Schottkys made by several different processes. Each process produces a different mix of electrical characteristics.

The four most application-important characteristics of a Schottky are:

Forward voltage drop
Reverse leakage current
Reverse blocking voltage
Maximum permissible junction temperature

The basic hallmarks of any process are its maximum rated junction temperature — the T_{Jmax} Class and the "prime"[1] rated voltage, the V_{RRM} Class. These two basic hallmarks are set by the process; they in turn determine the forward voltage drop and reverse leakage current characteristics.

Table 1 shows a listing of the basic IR Schottky processes.

TABLE 1
Basic Schottky processes.

T_{Jmax} CLASS	V_{RRM} CLASS
100	15
125	45
150	30
150	45
150	60
175	45
175	100
175	150

1. How the Schottky Process Effects the Forward Voltage Drop

Forward Voltage Drop vs V_{RRM} Class

For any given current density, the Schottky's forward voltage drop increases as its V_{RRM} Class increases. (As would be expected, forward voltage drop also increases as operating current density increases.)

Figures 4 and 5 show relationships between forward voltage drop and V_{RRM} Class at different operating current densities for 150°C and 175°C T_{Jmax} Class Schottkys respectively.

[1]The "prime" rated voltage is the highest voltage rating offered for the process. Lower voltage ratings are also offered within the same process, but the other electrical characteristics remain the same.

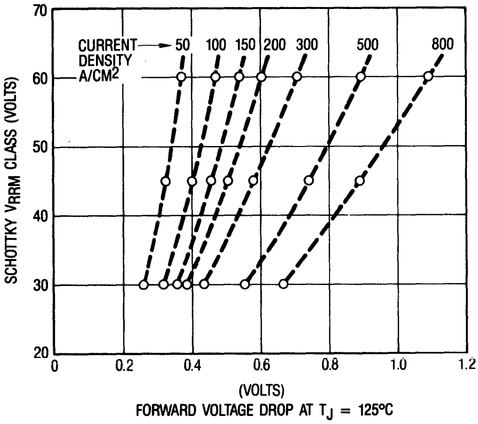


Figure 4. Relationships between Schottky V_{RRM} class and forward voltage drop, for 150°C T_{Jmax} class Schottkys.

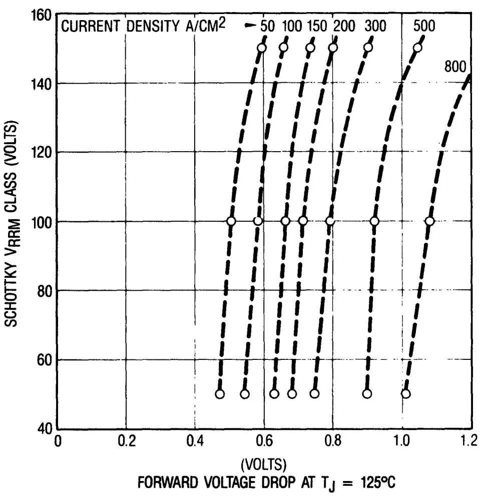


Figure 5. Relationships between Schottky V_{RRM} class and forward voltage drop for 175°C T_{Jmax} class Schottkys.

Forward Voltage Drop vs T_{Jmax} Class

Forward voltage drop generally increases as the T_{Jmax} Class increases, though this is a function also of the operating current density and junction temperature.

Figure 6 shows the relationships between forward voltage drop, operating current, and T_{Jmax} Class, for a given (45V) V_{RRM} Class, at 125°C junction temperature.

For current density below about 800A/cm², the forward voltage drop *increases* as the T_{Jmax} Class *increases.* At about 800A/cm², the forward voltage drop of all classes become approximately the same. Above 800A/cm², the characteristics actually crossover.

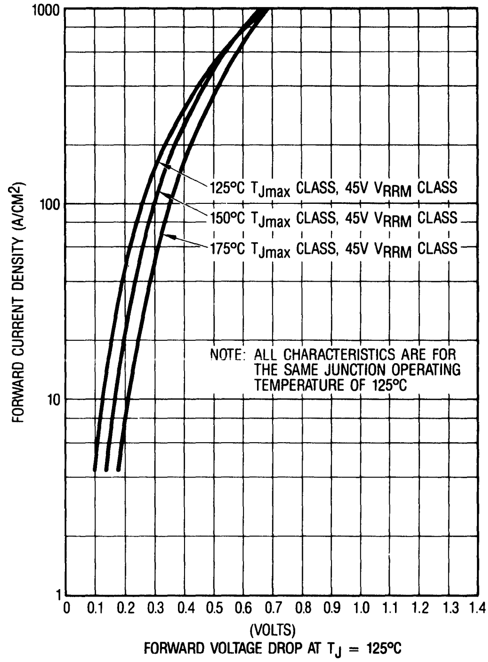


Figure 6. Relationships between forward current density and forward voltage drop for different Schottky T_{Jmax} classes.

In most applications the operating current density will be below the crossover point, typically in the range of 400 to 600A/cm². Flyback converters are an exception, because they operate with rather high peak to average current ratio.

2. Relationships Between Forward Voltage Drop, Operating Current and Junction Temperature.

Typical relationships between forward voltage drop, current and operating temperature, for 45V, 150 and 175°C T_{Jmax} Class Schottkys, are illustrated in Figures 7 and 8 respectively.

Forward voltage drop decreases quite significantly as junction temperature increases. Thus forward conduction losses *decrease* as operating junction temperature *increases.*

3. How the Schottky Process Effects Leakage Current

Figure 9(a) through (d) shows typical relationships between leakage current and applied reverse voltage for each of the IR Schottky processes at different operating junction temperatures. This demonstrates how the leakage current depends both on the T_{Jmax} and V_{RRM} Classes.

For a given T_{Jmax} Class, leakage current at rated V_{RRM} and rated T_{Jmax} decreases as the V_{RRM} Class increases, as illustrated by points A in Figure 9(c) for the 150°C T_{Jmax} Class families and points B in Figure 9(d), for the 175°C

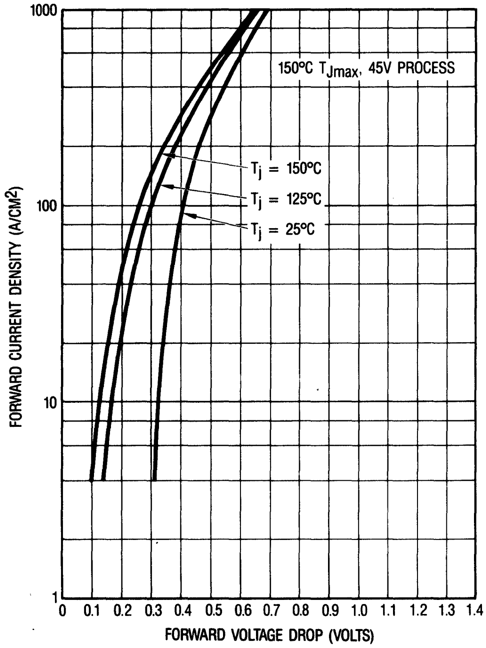


Figure 7. Relationships between forward current density and forward voltage drop for the 150°C/45V Schottky process at different operating junction temperatures.

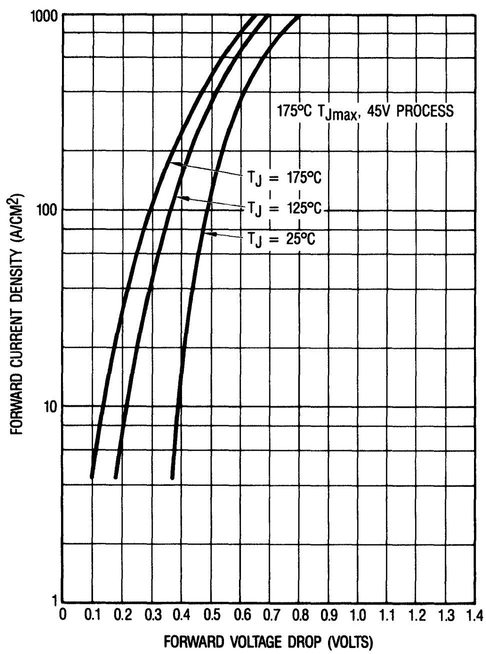


Figure 8. Relationships between forward current density and forward voltage drop for the 175°C/45V Schottky process, at different operating junction temperatures.

T_{Jmax} Class families. At any given operating junction temperature and applied voltage, the higher the T_{Jmax} Class, the lower the leakage current. This is immediately evident from Figure 9. Also, within any given T_{Jmax} Class, the higher the V_{RRM} Class the lower the leakage current.

Note that the leakage current scale in Figure 9 is logarithmic. Thus, for a given applied voltage and junction operating temperature, there is about an order of magnitude difference in leakage current between the 175°C and 150°C T_{Jmax} Classes. The 100°C, 15V process has a leakage current which is almost two orders of magnitude higher than for the 150°C, 30V process.

4. Relationships Between Leakage Current, Reverse Voltage and Junction Temperature

Figure 9 also shows the dependence of leakage current on the operating voltage and junction temperature within any given process. Reverse leakage current increases with applied reverse voltage, and with junction temperature. The variation of leakage current with voltage at a given temperature follows an approximately "proportional" relationship, until the applied voltage approaches the "avalanche" region. The relationship between leakage current and temperature, at a given voltage, on the other hand, is "exponential."

Figure 10 shows typical relationships between operating temperature and leakage current, at rated V_{RRM}, for the 150°C/45V and 175°C/45V Schottky processes.

5. Junction Capacitance

An important circuit-characteristic of the Schottky is its junction capacitance. This is a function of the area and thickness of the Schottky die, and of the applied voltage.

The higher the V_{RRM} Class, the greater the die thickness, and the lower the junction capacitance. This is illustrated in Figure 11.

Junction capacitance is essentially independent of the Schottky's T_{Jmax} Class, and of operating temperature.

6. Summary of Effect of Schottky Process and Operating Conditions on Electrical Characteristics

Table 2 gives a qualitative summary of the effect of Schottky process on conduction voltage, leakage current, and capacitance.

Table 3 gives a summary of the effects of operating junction temperature, forward current, and reverse voltage on conduction voltage, leakage current, and capacitance.

B. Schottky Die Sizes

The size of the Schottky die (in combination with the package), determines the current rating. IR's Schottky die sizes, for current ratings of 8A and above, are shown in Table 4.

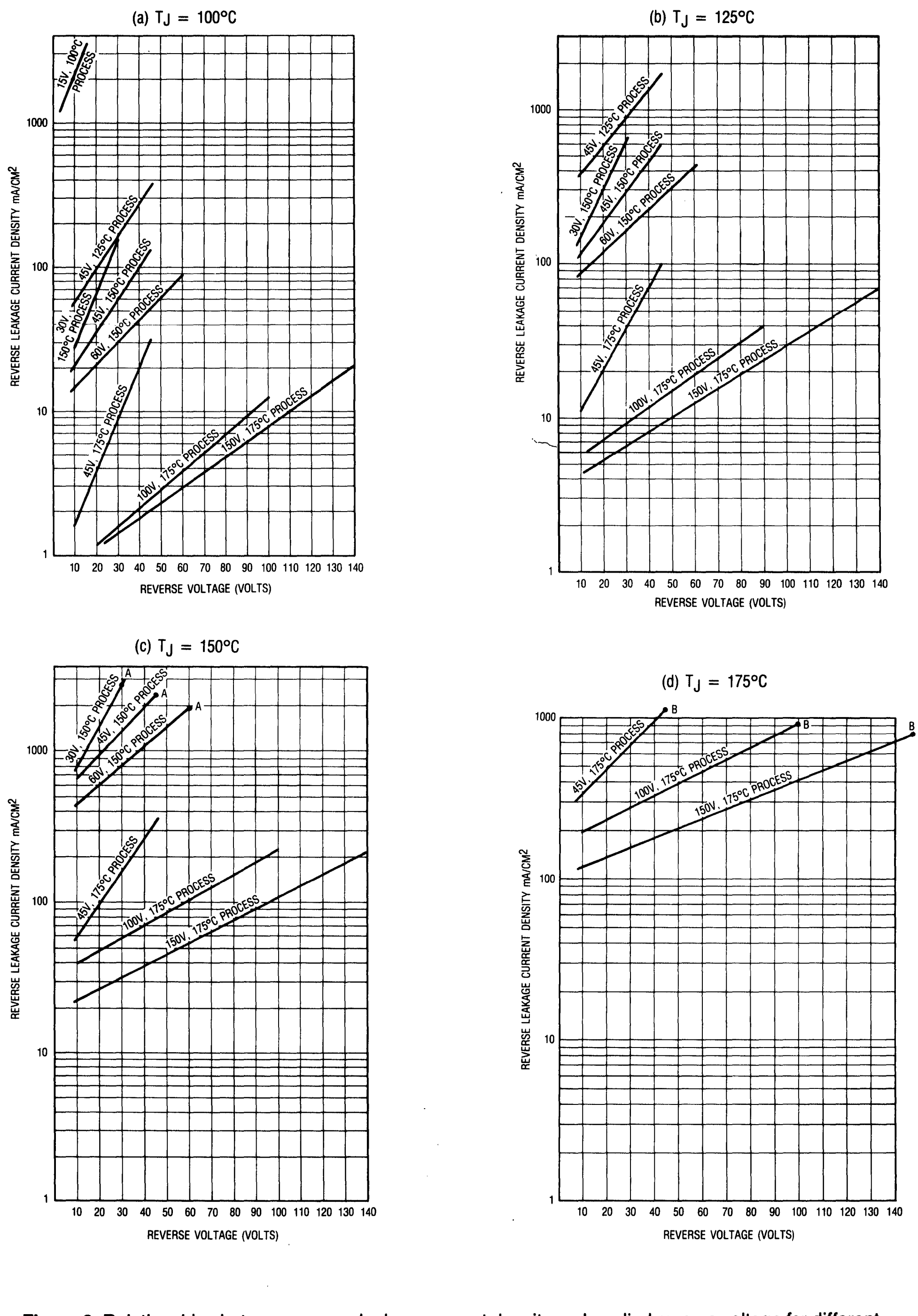


Figure 9. Relationships between reverse leakage current density and applied reverse voltage for different Schottky process types for operating junction temperatures as indicated.

APPLICATION NOTES

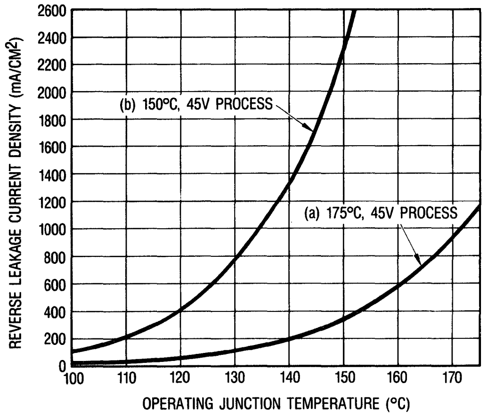


Figure 10. Typical relationships between reverse leakage current density and operating junction temperature.

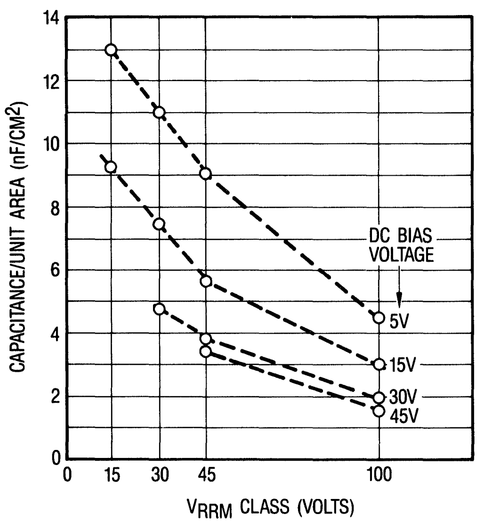


Figure 11. Typical Schottky self-capacitance versus V_{RRM} class, measured at various bias voltages.

TABLE 2
Effect of process on Schottky characteristics.

SCHOTTKY PROCESS CHARACTERISTIC	RESULTING EFFECT ON				
	V_F AT GIVEN T_J	V_F AT T_{Jmax}	I_R AT GIVEN T_J	I_R AT T_{Jmax}	C
T_{Jmax} CLASS ↑	↑	↑ SLIGHTLY	↓	↓	—
V_{RRM} CLASS ↑	↑	↑	↓	↓	↓

TABLE 3
Effect of operating conditions on Schottky characteristics for a given Schottky process.

IMPOSED OPERATING CONDITION	RESULTING EFFECT ON		
	V_F	I_R	C
T_J ↑	↓	↑	—
I_F ↑	↑	—	—
V_R ↑	—	↑	↓

TABLE 4
Schottky die sizes.

SCHOTTKY DIE SIZE EACH SIDE		TYPICAL CURRENT RANGE (A)
THOUSANDTHS INCH	MM	
90	2.29	10 – 15
125	3.18	10 – 30
150	3.81	18 – 40
175	4.45	30 – 40
200	5.08	50 – 100

Schottkys with current ratings above the capability of the single largest die use combinations of parallel die.

C. Packages

International Rectifier Schottky packages are shown in Figure 12. These range from surface mount and axial lead types, with ratings of a few amperes, to large dual Schottky modules with ratings in excess of 400A.

Most of these packages are industry standards and do not require special discussion. The following notes draw attention to specific features.

1. Dual Schottkys

Many IR packages contain two Schottkys connected in the common-cathode configuration. This provides the complete output rectifier function of the common transformer "center tap" and "forward" rectifier circuits in a single package.

2. Isolated Packages

The Schottky is most usually connected electrically to the cooling surface of the package. The cooling surface serves the double duty of transmitting heat away from the package and of being one of the electrical connections.

The D-60 and TO-249AA packages (Figure 12) are an exception. The cooling surface of these packages is electrically isolated. This allows the use of a grounded heatsink, as well as minimizing capacitively coupled ground current.

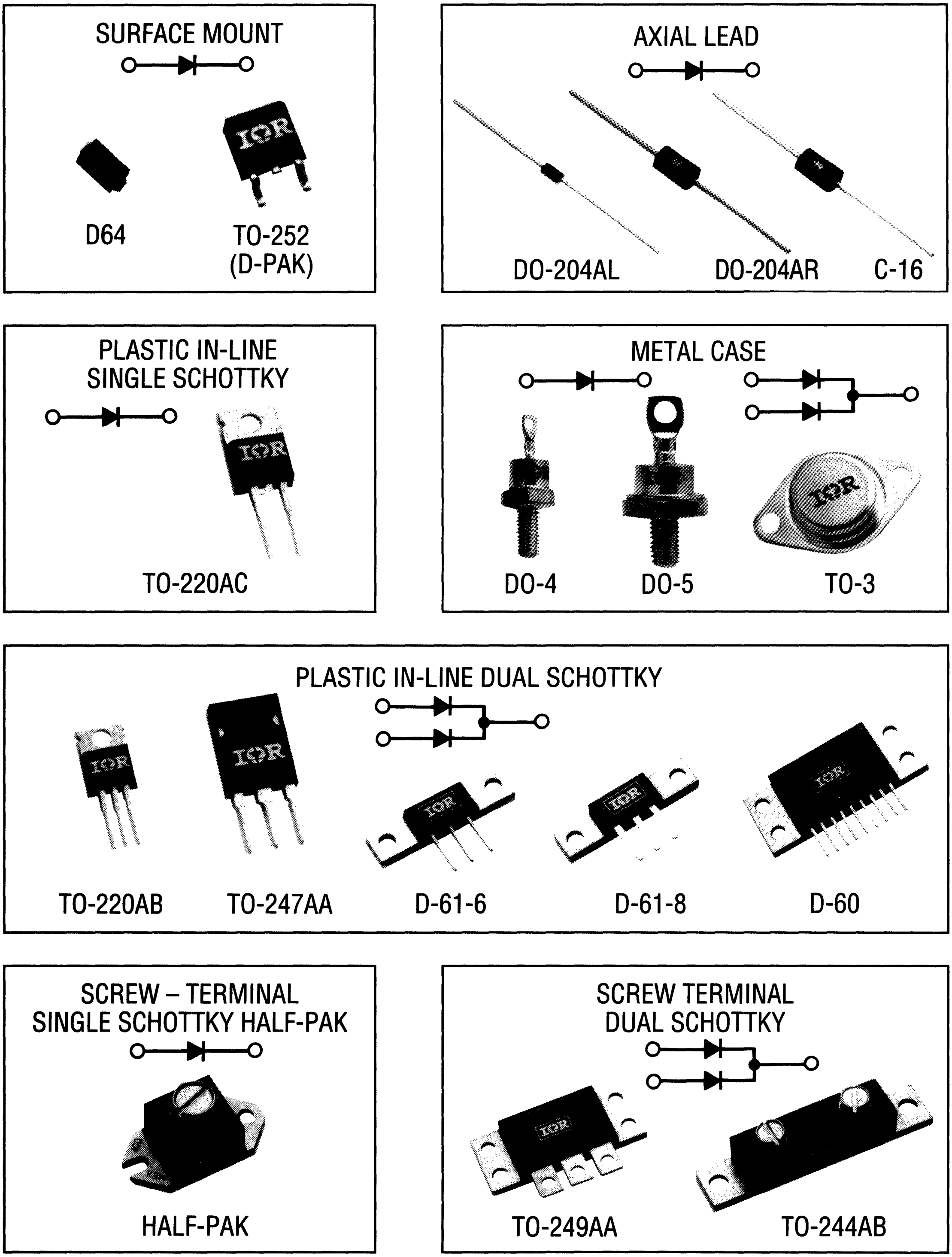


Figure 12. Schottky packages.

3. HALF-PAK®

IR's HALF-PAK module (Figure 12) contains a single Schottky. The HALF-PAK is a development from the TO-244AB dual Schottky module, hence the name HALF-PAK.

The International Rectifier HALF-PAK offers the advantage of greater compactness, flexibility of physical layout, and ease of connections to the high frequency output transformer of the power supply. It also offers flexibility in the choice of current rating and allows physically similar Schottkys but with different current ratings to be used in forward converters. This can be more compatible with the *forward* and *freewheeling* functions of the circuit than using equally-rated Schottkys.

TABLE 5(a)
Schottky product matrix.

PROCESS		DIE SIZE		NO. LEGS	NO. DIE PER LEG	PACKAGE	FAMILY
T_{Jmax} °C	V_{RRM} V	INCH	MM				
100	15	0.125	3.18	1	1	DO-204AR	95SQ
		0.150	3.81	1	1	TO-220AC	19TQ
		0.200	5.08	1	1	DO-5	95HQ
					2	HALF-PAK	125NQ
					3		185NQ
					4		225CNQ
				2	1	D-61-8	85CNQ
125	45	0.200	5.08	2	1	D-61-8	84CNQ
				2	2	TO-244AB	224CNQ
					4		444CNQ
150	30	0.125	3.18	2	1	TO-220AB	32CTQ
		0.200	5.08	1	1	DO-5	55HQ
				1	2	HALF-PAK	122NQ
					3		182NQ
					4		242NQ
				2	1	D-61-6	62CNQ
						D-61-8	82CNQ
				2	1	D-60	152CMQ
						TO-249AA	162CMQ
				2	2	TO-244AB	220CNQ
				2	4		440CNQ
150	45	0.125	3.18	1	1	DO-204AR	90SQ
						TO-220AC	12TQ
		0.150	3.81				20TQ
		0.175	4.45			DO-4	20FQ
							21FQ
		0.200	5.08			DO-5	50HQ
							51HQ
					2	HALF-PAK	120NQ
					3		180NQ
					4		240NQ
		0.090	2.29	2	1	TO-220AB	15CTQ
		0.125	3.18				25CTQ
						TO-247AA	30CPQ045
		0.175	4.45				40CPQ045
		0.200	5.08			D-61-6	60CNQ
						D-61-8	80CNQ
						D-60	150CMQ
						TO-249AA	160CMQ
					2	TO-244AB	200CNQ
					4		400CNQ
150	60	0.125	3.18	2	1	TO-220AB	30CTQ060
						TO-3P	30CPQ060
		0.175	4.45				40CPQ060

D. The Schottky Product Matrix

In the previous sections the individual ingredients of the IR Schottky product range — process, die size and package — have been described. Given these basic ingredients, many variations of specific products are possible.

The International Rectifier Schottky product matrix represents those combinations of ingredients that are most commonly needed in power supply designs. Evolving new power supply requirements and evolving Schottky processes and packages will continue to add new types to the range.

Table 5 shows the combinations of processes, die sizes, and packages that form IR's overall Schottky product matrix[2].

TABLE 5(b)
Schottky product matrix.

PROCESS		DIE SIZE		NO. LEGS	NO. DIE PER LEG	PACKAGE	FAMILY
T_{Jmax} °C	V_{RRM} V	INCH	MM				
175	45	0.125	3.18	1	1	DO-204AR	80SQ
						TO-220AC	10TQ
		0.090	2.29				6TQ
		0.150	3.81				18TQ
		0.175	4.45			DO-4	30FQ
		0.200	5.08			DO-5	75HQ
							85HQ
					2	HALF-PAK	121NQ
					4		241NQ
		0.090	2.29	2	1	TO-220AB	12CTQ
		0.125	3.18				20CTQ
							30CTQ045
		0.150	3.81			TO-247AA	40CDQ
							60CDQ
						D-61-6	61CNQ
						D-61-8	81CNQ
						D-60	151CMQ
						TO-249AA	161CMQ
					2	TO-244AB	201CNQ
					2		301CNQ
					4		401CNQ
175	100	0.125	3.18	1	1	DO-204-AR	50SQ
						TO-220AC	8TQ
		0.200	5.08			DO-5	60HQ
					2	HALF-PAK	123NQ
					3		183NQ
					4		243NQ
		0.125	2.29	2	1	TO-220AB	16CTQ
						TO-247AA	30CPQ100
		0.175	4.45				40CPQ100
		0.200	5.08			D-61-6	63CNQ
						D-61-8	83CNQ
						D-60	153CMQ
						TO-294AA	163CMQ
					2	TO-244AB	203CNQ
					3		303CNQ
					4		403CNQ
175	150	0.090	2.29	2	1	TO-220AB	10CTQ
						TO-247AA	30CPQ100

[2]These tabulations focus on ratings of 8A and above; the smaller surface mount and axial lead types are not included.

II. THE SCHOTTKY DATA SHEET

The IR Schottky data sheet provides all the pertinent information needed to design the Schottky into a specific circuit. The purpose of the following description is to provide an awareness and understanding of the information in the data sheet.

We will do this by taking a step-by-step walk through the data sheet.

A. Absolute Maximum Ratings

V_{RWM} — Maximum working peak reverse voltage

This is the maximum peak voltage that can be applied to the Schottky, without the reverse leakage current exceeding the specified limit.

$I_{F(AVE)}$ — Maximum average forward current

This is the maximum average forward current that the Schottky is rated to carry, with the stated current waveform (normally rectangular, with a 50% duty cycle), at the stated case temperature.

This rating is based on the junction temperature reaching a set value, usually somewhat less than the rated T_{Jmax}, under the stated conditions.

I_{FSM} — Maximum peak one-cycle non-repetitive surge current

This is the maximum one cycle peak current that the Schottky can carry, under a non-repetitive fault condition with full rated voltage applied immediately following the surge.

In typical switching power supply operation, fault current is detected and quite rapidly arrested by control of the switching transistor(s). The data sheet gives the Schottky's surge capability for short-time durations that are typical of the response of a power supply's protective control circuitry.

The single cycle surge rating is also stated for a 10 millisecond half-sinusoidal current pulse, which is pertinent to applications where the Schottky is used as a low voltage line-frequency rectifier.

Non-repetitive surge ratings are supplemented by a graph in the data sheet that shows the rated surge current as a function of surge duration. A representative graph is shown in Figure 13.

Note that the surge rating places no restriction on the initial case temperature, (so long as this is less than T_{Jmax}). The instantaneous junction temperature during surge significantly exceeds the Schottky's rated T_{Jmax}; the peak reverse leakage current following the current surge will also significantly exceed the maximum specified value at T_{Jmax}.

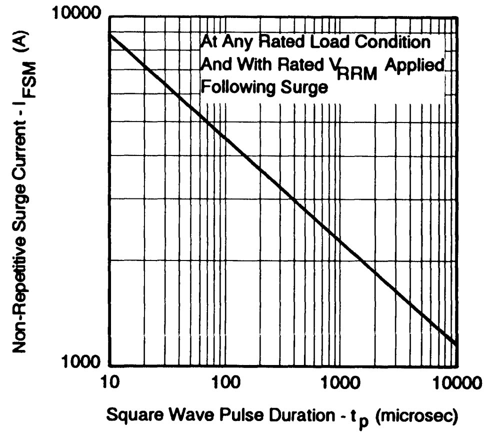


Figure 13. Maximum non-repetitive surge current for 50HQ045.

Because of the extreme operating conditions implied in this rating, the *non-repetitive* surge rating is just that. It can be regarded as a "safety net," to be called into play for *abnormal* fault conditions, which occur infrequently. It should not be used for repetitive surge events, such as start-up current surges that occur each time a power supply is switched on.

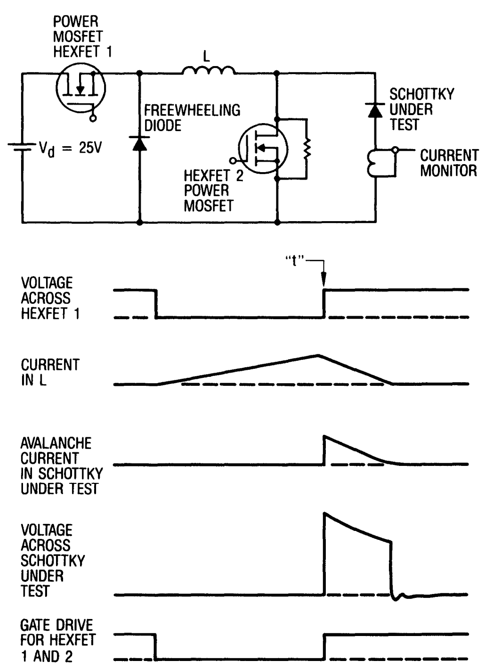


Figure 14. Avalanche energy test circuit and timing waveforms.

E_{AS} — Non repetitive avalanche energy

This is the energy that the Schottky can absorb, when reverse current is discharged into it from an inductor. The test circuit in the data sheet is shown in Figure 14. The sequence of operation is as follows:

Power MOSFETs 1 and 2 are simultaneously turned on, and current in the inductor L ramps up. At time t, the current reaches the specified test value, and both devices are simultaneously turned OFF. Current stored in the inductor now discharges into the Schottky, the circuit being completed via the freewheeling diode.

A typical oscillogram of Schottky current and voltage is shown in Figure 15. Note that the peak avalanche voltage is about 1.5x the Schottky's reverse voltage.

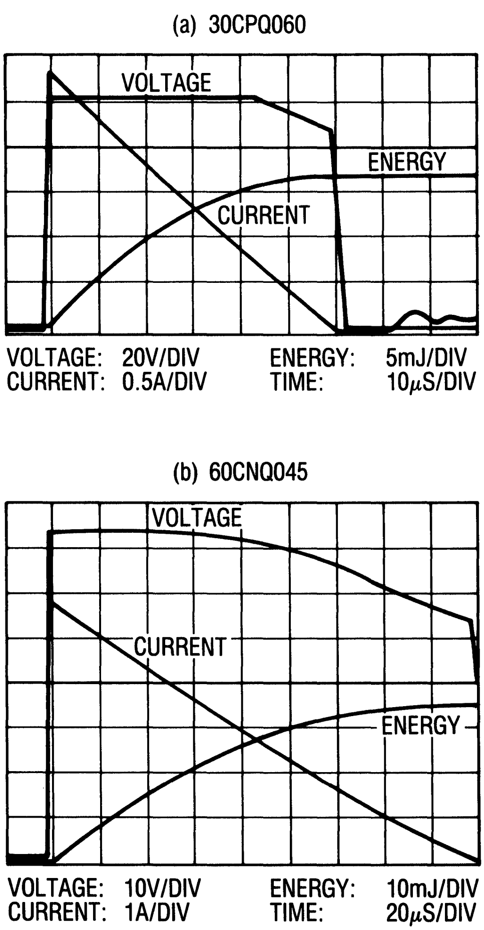


Figure 15. Typical oscillograms of voltage, current and energy for avalanche operation of Schottky.

I_{AR} — Repetitive avalanche current

This is the maximum reverse current that the Schottky can absorb repetitively, from a precharged inductor. The inductance value must be such that the current decays to zero within the specified avalanche time.

The repetitive avalanche current, I_{AR}, has the same value as the current specified for the non-repetitive E_{AS} rating. With such a high avalanche current, the peak avalanche voltage will typically "climb" to about 1.5x the Schottky's rated voltage.

An essential difference between the I_{AR} and E_{AS} ratings is that the inductance that satisfies the time constraint (1μs) of the repetitive I_{AR} rating will have a much smaller value — typically 100 to 200 times smaller — than the value specified for the non-repetitive E_{AS} test. A repetitive avalanche time of 1μs is still, however, much longer than would result from the leakage inductance of a normal switching power supply transformer.

B. Electrical Specifications

V_{FM} — Maximum Forward Voltage Drop

This is the maximum voltage drop of a "limit" device at the stated current and junction temperature.

Specific values in the data sheet tabulation are supplemented by a graph that shows maximum voltage drop versus current at various junction temperatures. A representative graph of this type is shown in Figure 16.

Both the numerical values of voltage drop given in the data sheet's tabulation, and the V_F graphs, represent the maximum voltage drop of a "limit" device. They can, therefore, be used directly for worst-case design purposes. Actual voltage drop is typically less than the maximum.

I_{RM} — Maximum reverse leakage current

This is the maximum reverse leakage current that a "limit" device will exhibit, at the rated reverse voltage, at the stated junction temperature.

The tabulated "limit" data is supplemented by graphs that show typical reverse leakage current versus reverse voltage, for a wide range of junction operating temperatures. A representative graph is shown in Figure 17.

The worst-case maximum value of leakage current for any particular operating condition can be conservatively estimated from the graph by applying the same relationship between the "limit" value in the data sheet's tabulation and the corresponding typical value in the graph.

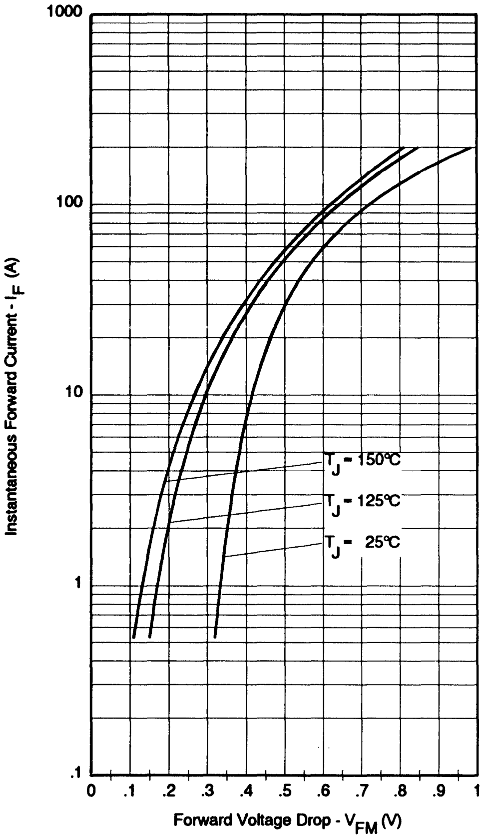


Figure 16. Maximum forward voltage drop characteristics (50HQ045).

C_T — *Maximum junction capacitance*

This is the maximum value of junction capacitance, at the stated test condition. The guaranteed "limit" value is supplemented by a graph that shows typical values as a function of reverse voltage. A representative data sheet graph is shown in Figure 18.

The Schottky's junction capacitance is essentally independent of temperature.

L_S — *Typical series inductance*

This is the typical terminal-to-terminal inductance of the Schottky.

dv/dt

This is the maximum rate of change of voltage that can be applied to the Schottky. International Rectifier Schottkys are rated at 10,000V/μs. This translates to just a few nanoseconds rise time to the Schottky's normal working voltage.

The rating is a reference to the fact that some manufacturers' Schottkys may have (or may have had) limited dv/dt capability. Some users are, therefore, sensitive to the issue. IR Schottkys have always had "practically unrestricted" dv/dt capability.

C. Thermal Specifications

T_J — *Maximum junction temperature range*

The maximum and minimum operating junction temperature range.

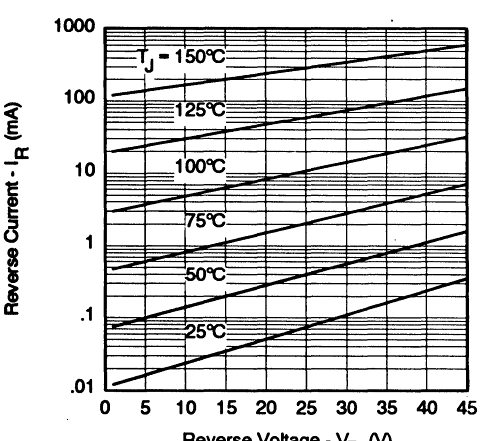


Figure 17. Typical values of reverse current vs. reverse voltage (50HQ045).

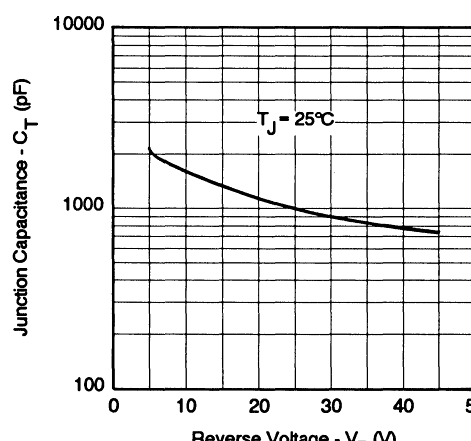


Figure 18. Typical junction capacitance vs. reverse voltage (50HQ045).

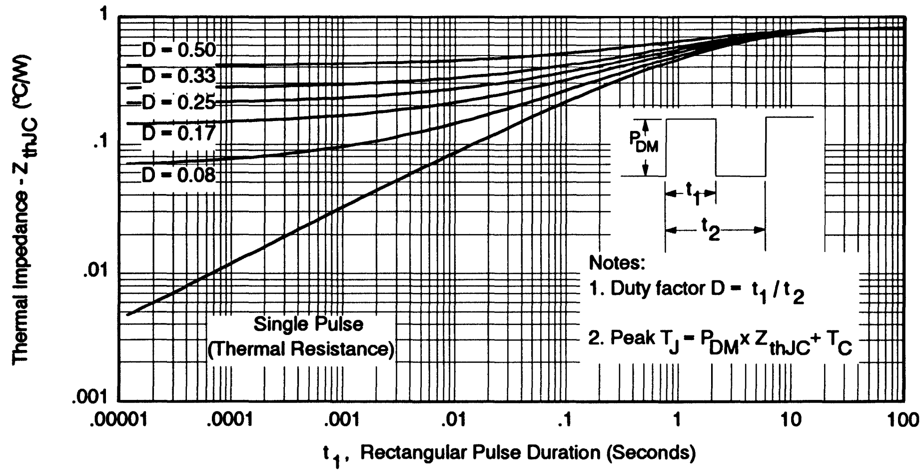


Figure 19. Maximum thermal impedance Z_{thJC} characteristics (50HQ045).

T_{Stg} — Maximum storage temperature range

The maximum and minimum storage temperature range.

R_{thJC} — Junction to case thermal resistance

This is the maximum value of junction to case thermal resistance for steady dc operation.

The value of dc thermal resistance tabulated in the data sheet is supplemented by a graph showing *single pulse* and *duty cycle* thermal impedance as a function of pulse duration. A representative graph is shown in Figure 19.

Peak junction temperature for any duty cycle application can be calculated directly from the transient thermal impedance characteristics. The curve labelled *single pulse* shows the rise of junction temperature per watt of power dissipation as a function of pulse duration. As would be expected, junction temperature rise increases as pulse duration increases — leveling off to a steady value for pulse durations above ten seconds or so.

The single pulse curve is useful for determining transient junction temperature rise for single or very low duty cycle pulses of power; it is not directly useable for repetitive power pulses, such as are usually encountered in switching power supply applications.

The duty cycle curves show effective thermal impedance for repetitive operation at different duty cycles, and allow peak junction temperature rise for repetitive operation to be calculated directly. These curves are related to the single pulse curve by the following relationship:

Effective junction to case thermal impedance for pulse duration t

$$= D \bullet R_{JC} + (1\text{-}D) \bullet R_{JC(t)}$$

where D = duty cycle

R_{JC} = steady state thermal resistance

$R_{JC(t)}$ = transient thermal impedance for pulse duration t

The above effective thermal impedance when multiplied by the power dissipation *during the conduction period t* (i.e., the power within the conduction pulse itself, not the power averaged over the whole cycle), gives the value of the repetitive peak junction-to-case temperature rise.

The effective thermal impedance for any duty cycle D increases as pulse duration increases, showing that the peak junction temperature rise increases as frequency decreases.

The reason is illustrated by the waveforms in Figure 20(a) and (b). Both sets of waveforms are for the same power dissipation and duty cycle, but for different operating frequencies. The cycle-by-cycle fluctuations of junction temperature at 1kHz in Figure 20(a) are "discernable," while those at 10kHz in Figure 20(b) are not.

As frequency increases, thermal inertia of the junction "smooths" instantaneous temperature fluctuations, and the junction responds more to average, rather than peak, power dissipation. At frequencies above a few kHz, and duty cycles above 20% or so, cycle-by-cycle temperature fluctuations are usually small, and peak junction temperature rise is essentially equal to the average power dissipation, multiplied by the dc junction-to-case thermal resistance.

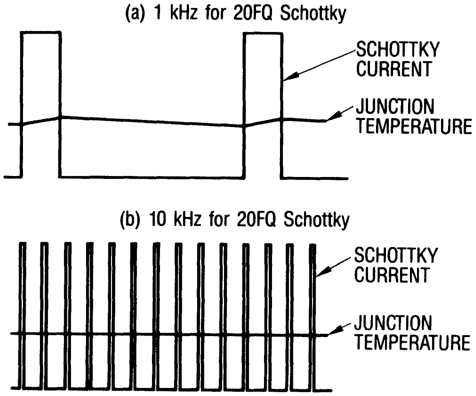


Figure 20. Idealized current and junction temperature waveforms. Conduction duty cycle = 0.17.

R_{thCS} — *Case to sink thermal resistance*

This is the typical value of case to sink thermal resistance, with the heatsink mounting surface smooth and thermal compound evenly applied.

T — Mounting Torque

Screw-mounted devices have both minimum and maximum values of rated torque that can be applied to the mounting screws. Stud devices have both minimum and maximum rated values of torque that can be applied to the device. These torque ratings apply to non-lubricated threads. Screw-terminal packages also have rated maximum and minimum torques that can be applied to the terminals.

Over-application of torque can result in mechanical damage to the device, while under-application may fail to achieve the proper thermal and/or electrical contact, the result being high values of thermal resistance and/or voltage drop.

III. WHICH SCHOTTKY?

As has been seen, the International Rectifier Schottky rectifier range comprises a broad matrix formed from the following basic ingredients:

- Packages
- Die sizes (i.e., current ratings)
- Processes (i.e., mixes of T_{Jmax}, V_{RRM}, V_F, and reverse leakage characteristics)

Having a grasp for the above, the next step is for the circuit designer to understand the impact of the choice of Schottky — particularly that of Schottky size and process — on circuit operating performance and heatsink requirements. The designer also needs to know how to identify and set the worst-case "limit" operating point for the Schottky in his particular application.

A. General Application Guidelines

Figure 21 shows a summary of *"General Application Guidelines"* that define the fundamentals on which the Schottky selection process should be based.

Each of these *General Guidelines* is explained in the following sections.

1. Setting the operating temperature margin

General Guideline 1: The Schottky's maximum operating junction temperature must be less than the Schottky's rated T_{Jmax}, by a margin that keeps the reverse losses under control. The required junction temperature margin increases as the maximum design operating current density decreases.

Power losses in a Schottky comprise two main components: Conduction losses and reverse leakage losses.

Average conduction losses are dictated by the forward current, forward voltage drop, or "conduction voltage," and conduction duty cycle, (i.e., the portion of the total cycle for which the Schottky is in conduction). Forward voltage drop is itself a function of junction temperature, decreasing somewhat with increasing temperature.

Average reverse leakage losses depend upon the reverse leakage current, the applied reverse voltage and the reverse voltage duty cycle, (i.e., the portion of the total cycle for which the Schottky blocks reverse voltage). Reverse leakage current increases exponentially with junction temperature, as already illustrated in Figure 10.

Thus, for any given set of operating conditions — current, conduction duty cycle, reverse voltage, and reverse voltage duty cycle — forward conduction losses *decrease* to some degree, while reverse leakage losses *increase* quite rapidly, with increasing junction temperature.

The relationship between the sum of the forward and reverse losses and junction temperature, for a 50HQ045 Schottky, under the stated operating conditions, is illustrated in Figure 22.

The operating point on the Schottky's power loss versus junction temperature characteristic is determined by the junction to ambient thermal resistance. This, in turn, is largely dictated by the heatsink on which the Schottky is mounted.

For a given design ambient temperature, T_{AMB}, decreasing the junction to ambient thermal resistance (by using a larger heatsink) moves the operating point to a lower junction temperature, as illustrated in Figure 22. (For example, with R_{JA} = 3.93°C/W, the operating junction temperature is 135°C; with R_{JA} = 3.27°C, it is 120°C).

APPLICA-
TION
NOTES

DESIGN GUIDELINES

Guideline 1.

The Schottky's maximum operating junction temperature must be less than the Schottky's rated T_{Jmax}, by a margin that keeps the reverse losses under control. The required junction temperature margin increases as the maximum operating design current density decreases.

Guideline 2.

The smallest heatsink is the one that gives a safe, but not excessive, thermal margin. Sizing the heatsink to minimize the total losses, or to arbitarily add thermal margin, can require a disproportionately large heatsink.

Guideline 3.

Schottky losses and heatsink size can be decreased by selecting a larger Schottky. This can be a very effective way of decreasing the overall physical size of the output rectifier, though eventually a point of diminishing returns is reached.

Guideline 4.

A Schottky of a given size with a higher T_{Jmax} class has larger losses, but can operate at a higher heatsink temperature, and therefore with a smaller heatsink, than a Schottky with a lower T_{Jmax} class. Thus a higher T_{Jmax} class Schottky generally optimizes heatsink size, while a lower T_{Jmax} class Schottky generally optimizes efficiency.

Guideline 5.

If system constraints, not the Schottky's temperature capability, dictate the maximum permissible heatsink temperature, then the smallest heatsink will be obtained with the most efficient Schottky.

Guideline 6.

Selection of a larger Schottky can facilitate operation at a higher ambient temperature.

Guideline 7.

The higher the ambient temperature, the more a Schottky with higher rated T_{Jmax} will help reduce the heatsink size.

Guideline 8.

Within a given T_{Jmax} class, lowest losses and smallest heatsink will usually be obtained by selecting the Schottky from the lowest voltage class that is compatible with the circuit voltage.

Applicable General Guideline	Schottky Choice made by Designer		RESULTING EFFECT ON PERFORMANCE				
			Operating		Heatsink size	Losses	Max T_{amb}
			T_J	T_S			
1, 4, 7	RATED T_J (T_{Jmax} class)	⇑	↑	↑	↓	↑	↑
1, 3, 6	SCHOTTKY SIZE	⇑	↓	↑	↓	↓	↑
8	RATED V_{RRM} (V_{RRM} class)	⇑	↑	↓	↑	↑	
1, 2	HEATSINK SIZE	⇑	↓	↓	↑	↑↓	↑
5	HEATSINK TEMP	⇓	↓	↓	↑	↑	↓

Figure 21. Summary of general application design guidelines.

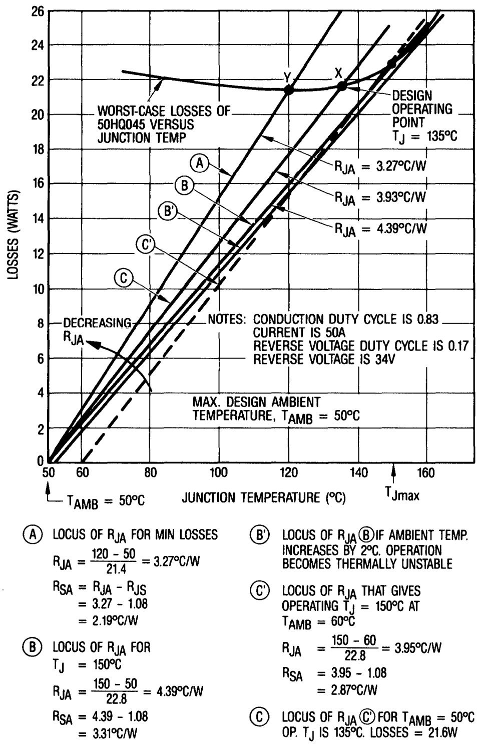


Figure 22. **Comparison of different heatsink thermal resistances and operating points.** ***(General Guidelines 1 and 2).***

Clearly, use of a heatsink that gives a junction to ambient thermal resistance locus that is nearly tangential to the Schottky loss curve is a flirtation with thermal instability. Locus B, for example, gives an operating junction temperature of T_{Jmax}. This operating point, in this particular example, borders on instability. An increase in ambient temperature of about 2°C above the design maximum would shift locus B to position B' and thermal runaway would occur.

A safe basis for setting the heatsink thermal resistance is to size it so that the operating junction temperature reaches T_{Jmax} only when the *ambient* temperature exceeds the maximum design value by a set margin, say 10 to 15°C. Based on a 10°C margin in *ambient* temperature, the maximum junction operating temperature in the example considered in Figure 22 would be about 135°C, as illustrated.

Operation of this same Schottky at a lower value of maximum design current will translate to a higher junction temperature margin being needed for a given ambient temperature margin; this is because of the greater non-linearity between losses and junction temperature at lower operating current.

Figure 23 shows a set of relationships between the losses and junction temperature, for a given operating voltage, with varying levels of maximum design operating current. Loci of the junction to ambient thermal resistance that satisfy a fixed *ambient* temperature margin of 10°C are shown. Because the reverse losses remain constant as the design operating current decreases, the total losses and the heatsink size do not decrease proportionately with decreasing design current.

The safe design operating junction temperature (point X) decreases significantly with decreasing current, to maintain a safe distance from the point of thermal instability. Note that the fixed 10°C ambient margin translates to a junction temperature margin that varies from 15 to 55°C, as the maximum design forward current decreases.[3]

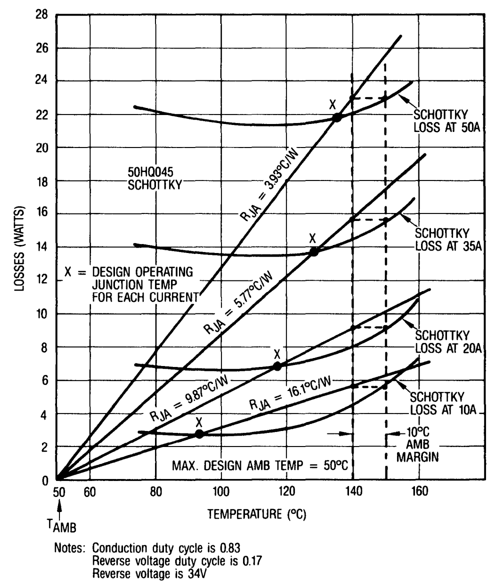


Figure 23. Characteristics illustrating the reduction in design operating junction temperature as the Schottky's design operating current is reduced. ***(General Guideline 1).***

[3]In a situation where the reverse losses are significant in relation to the forward losses, *two* intersection points are possible on the Schottky power loss curve. The higher of these intersection points is critically unstable and has no physical meaning.

This can be understood by considering that operation is at the "high" intersection point and postulating a small increase in junction temperature; this would result in immediate thermal runaway, because the losses increase faster than the heatsink can arrest them. A small decrease in temperature, on the other hand, would precipitate a further "cascading" decrease, until the lower, stable intersection point is reached.

2. Axial Lead Schottkys

An axial lead Schottky is not designed for mounting directly on a heatsink, or to have heat directly removed from the surface of the package. Heat removal from the junction is via the leads to a terminal post or a copper clad area on a PC board.

Heat removal from an axial lead Schottky cannot, therefore, be as efficient as from a "heatsinkable" package, and power density and current density must as a result be relatively low. Reverse power losses, which are independent of current, will thus be relatively high.

Operation of an axial lead Schottky is a good example of the situation discussed above, in which the operating current density is relatively low. The design operating junction temperature must be significantly less than the Schottky's rated T_{Jmax} to keep a safe margin from thermal runaway.

Loss characteristics for the International Rectifier axial leaded 50SQ100 Schottky, operating in a 15V Flyback power supply at output currents of 3.5 and 4.5A, are illustrated in Figure 24. The 3.5A design requires a junction to ambient thermal resistance of 44°C/W, while the 4.5A design requires 35°C/W. In the first case, the design junction operating temperature margin is 25°C, and in the second case, 30°C below the rated maximum. This is based on a 10°C *ambient* temperature margin.

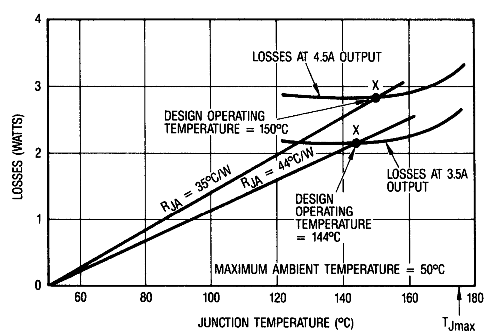


Figure 24. Operating characteristics and operating points for 50SQ100 axial lead Schottky in 15V flyback converter, at output currents of 3.5 and 4.5A.

3. Setting the Heatsink Thermal Resistance

General Guideline 2: *The smallest heatsink design is the one that gives a safe but not excessive thermal margin. Sizing the heatsink to minimize the total losses, or to arbitrarily add thermal margin, can require a disproportionately large heatsink.*

Thermal resistance is the *ratio* of temperature rise to losses. If minimum losses occur at a relatively low operating junction temperature, then heatsink temperature rise would have to be kept relatively low to minimize the losses, requiring a relatively low value of heatsink thermal resistance. Thus, a relatively large heatsink would be needed, particularly because the physical size of the heatsink often increases disproportionately with decreasing thermal resistance.

In the example illustrated in Figure 22, minimum total losses, 21.4W, occur at a junction temperature of about 120°C, (point Y). Line A is the locus of the required junction to ambient thermal resistance needed to achieve this operating point. This has a slope of 3.27°C C/W. The corresponding thermal resistance of the heatsink would be 3.27 — 1.08 = 2.2°C/W.

Locus C, on the other hand, which is sufficient to maintain a safe thermal margin, corresponds to a heatsink thermal resistance of about 2.9°C/W. This is a 31% higher heatsink thermal resistance than that for minimum losses; the corresponding physical size of the heatsink could typically be 30 to 40% smaller.

Arbitrary addition of thermal margin has similar disproportionate repercussions on the heatsink size. The effect is particularly compounded in a situation where reverse losses are low and conduction losses predominate. In this case, increasing the heatsink size (beyond that required for a safe design) only increases the losses, because conduction losses increase with decreasing temperature. This would require a disproportionate increase in heatsink size, while the efficiency would simultaneously be degraded.

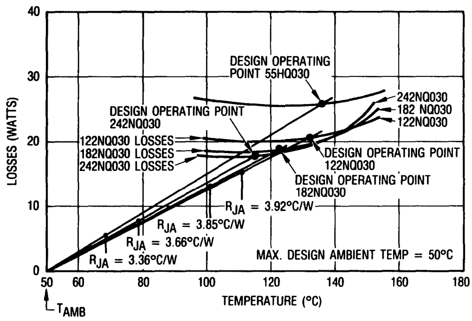
4. Increasing the Die Size

General Guideline 3: *Schottky losses and heatsink size can be decreased by selecting a larger Schottky. This can be a very effective way of decreasing the overall physical size of the output rectifier, though eventually a point of diminishing returns is reached.*

For given output voltage and current, a larger Schottky will operate at lower current density, and hence with lower conduction losses. Reverse losses, however, will be higher because reverse current of a larger die will be higher. The net result, up to a point, will be lower total losses and a smaller heatsink. At some point, however, further increasing the Schottky die area may start to require a larger heatsink in order to keep the junction temperature low enough that a safe distance from thermal instability is maintained. This point will not typically be reached in practical application.

An example is illustrated in Figure 25, and summarized in Table 6. Four different 30V, 150°C Schottkys are assumed to operate in a 5V, 100A power supply, at a conduction duty cycle of 0.5, and a reverse voltage duty cycle of 0.5, with a reverse voltage of about 11V. The design operating points for the four Schottkys are shown.

The 55HQ030 (1 x 200 mil die per leg), though adequate, has total losses of about 10.4% of the output power, and requires a heatsink thermal resistance of 2.27°C/W.



Notes: Conduction duty cycle is 0.5
Current is 100A
Reverse voltage duty cycle is 0.5
Reverse voltage is 11.4V

Figure 25. Operating characteristics and operating points for different sizes of Schottky in a 5V 100A power supply. *(General Guideline 3).*

The 122NQ030, (2 x 200 mil die per leg), has smaller total losses, about 8.2% of the output power. The required heatsink has a thermal resistance of 3.37°C/W and, therefore, will be significantly smaller.

The 182NQ030 (3 x 200 mil die per leg) gives a further decrease in losses to about 7.5% of the output power. The heatsink required to "suppress" the reverse loss contribution, and keep a safe operating junction temperature, has only slightly higher thermal resistance than that needed for the 120NQ030.

Finally, the 242NQ030 (4 x 200 mil sq die) has marginally lower losses. The heatsink required, however, has slightly lower thermal resistance than needed than for the 182NQ030.

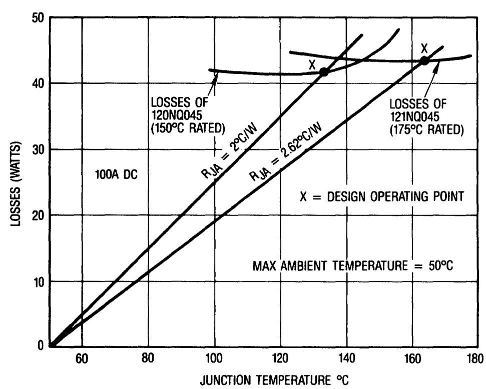
To summarize, moving from the one-die 55HQ030 to the two-die 122NQ030 achieves significant improvements in efficiency and heatsink size. The larger International Rectifier 182NQ030 and 242NQ030 Schottkys, however, offer small additional advantage in terms of efficiency, and none in terms of heatsink size.

It should be stated that consideration of the larger Schottkys in this example has been done to illustrate that a point of diminishing returns can be reached, rather than to represent a "real" choice that would be seriously considered by the designer. After all, a 242NQ Schottky operating with 50% duty cycle is about a 5 to 1 "overkill," relative to the design output current of 100A.

5. Using a Higher T_{Jmax} Class to Reduce Heatsink Size

***General Guideline 4:** A Schottky of a given size with a higher T_{Jmax} class has larger losses, but can operate at a higher heatsink temperature and therefore with a smaller heatsink, than a Schottky with a lower T_{Jmax} class.*

Thus a higher T_{Jmax} class Schottky generally optimizes heatsink size, while a lower T_{Jmax} class Schottky generally optimizes efficiency.



Notes: Conduction duty cycle is 0.83
Reverse voltage duty cycle is 0.17
Reverse voltage is 34V
Individual heatsink assumed

Figure 26. Operating characteristics and operating points illustrating that a 175°C rated Schottky (121NQ045) has higher losses, but requires a smaller heatsink than a comparable 150°C rated Schottky (120NQ045). *(General Guideline 4).*

TABLE 6

Summary of data illustrating that increasing the Schottky size reduces losses and heatsink size, but eventually reaches point of diminishing returns.

SCHOTTKY TYPE	LOSSES PER SCHOTTKY W	LOSSES (2 SCHOTTKYS) % OUTPUT POWER	DESIGN OPERATING T_J °C	T_{JA} °C	R_{JA} °C/W	R_{JS} °C/W	HEATSINK R_{SA} °C/W
55HQ030	26	10.4	137	87	3.35	1.08	2.27
122NQ030	20.4	8.2	130	80	3.92	0.55	3.37
182NQ030	18.7	7.5	122	72	3.85	0.45	3.4
242NQ030	18.0	7.2	116	66	3.67	0.35	3.32

NOTES: CONDUCTION DUTY CYCLE IS 0.5
CURRENT IS 100A
REVERSE VOLTAGE DUTY CYCLE IS 0.5
REVERSE VOLTAGE IS 11.4V
MAXIMUM DESIGN AMBIENT TEMPERATURE IS 50°C

This guideline represents an important choice available to the circuit designer. It is a restatement of the fact that the lowest losses don't necessarily mean the smallest heatsink.

If efficiency, minimization of total losses, and relatively low heatsink temperature are more important than minimization of the size of the heatsink, then a lower T_{Jmax} class Schottky may be the better choice. If minimization of heatsink size is more important than minimization of losses, then a higher T_{Jmax} class Schottky will generally be the better choice.

A typical example comparing the operating points and heatsink requirements of the International Rectifier 120NQ045 (150°C rated) and 121NQ045 (175°C rated) Schottkys, in a 100A, 5V forward converter, is illustrated in Figure 26.

The 150°C rated 120NQ045 Schottky has the lower losses. The higher junction to ambient temperature rise of the 175°C Schottky, however, allows a higher heatsink thermal resistance — hence a *smaller* heatsink.

These results are summarized in Table 7.

TABLE 7
Comparison of losses and heatsinks required for 150°C and 175°C "T_{Jmax} Class" Schottkys, operating in a 100A, 5V power supply. *(General Guideline 4).*

SCHOTTKY TYPE	T_{Jmax} RATING	SCHOTTKY LOSSES	DESIGN OPERATING T_J	R_{JA}	HEATSINK R_{SA}
	°C	W	°C	°C/W	°C/W
120NQ045	150	41.5	133	2	1.4
121NQ045	175	43.5	163	2.62	2.07

NOTES: CONDUCTION DUTY CYCLE IS 0.83
REVERSE VOLTAGE DUTY CYCLE IS 0.17
REVERSE VOLTAGE IS 34V

6. Designing for a Given Heatsink Temperature

Another consideration is whether other components are to be mounted on the heatsink with the Schottkys. Higher T_{Jmax} class Schottkys allow a higher heatsink temperature; this temperature might be too high for the other components on the same heatsink.

Sometimes, too, safety requirements may dictate that the heatsink temperature does not exceed some limit, for example 100°C. This could force the design to a larger heatsink and a Schottky with a lower rated T_{Jmax}, though if heatsink temperature as such is not an issue, a better approach might be to use a separate heatsink for the "lower temperature" components.

General Guideline 5: *If system constraints, not the Schottky's temperature capability, dictate that the heatsink temperature must be kept to some maximum, then the smallest heatsink will be obtained with the most efficient Schottky.*

In this design situation, both the maximum heatsink temperature and the maximum ambient temperature are defined. Hence the heatsink to ambient temperature rise is defined. It is therefore axiomatic that the highest heatsink thermal resistance (i.e., the smallest heatsink) will be obtained with the lowest loss Schottky.

7. Designing for High Ambient Temperature

General Guideline 6: *Selection of a larger Schottky can facilitate operation at a higher ambient temperature.*

As shown under *Guideline 3,* losses of a correctly chosen larger Schottky and the corresponding heatsink size, are smaller than for a smaller Schottky. This can be particularly helpful where the ambient temperature is high, and heatsink requirements are more stringent.

Table 8 shows a comparison of design operating points for International Rectifier 55HQ030 and 120NQ030 Schottkys, operating in the 5V, 100A power supply, at maximum design ambient temperatures of 50°C, 70° and 85°C.

TABLE 8
Comparison of losses and heatsinks required for 55HQ030 (1 x 0.200 x 0.200 Die) and 122NQ030 (2 x 0.200 x 0.200 Die), for design ambient temperatures of 50°C, 70°C, and 85°C. *(General Guideline 6).*

SCHOTTKY TYPE	T_{AMB}	SCHOTTKY LOSSES	DESIGN OPERATING T_J	T_{JA}	R_{JA}	R_{JS}	HEATSINK R_{SA}
	°C	W	°C	°C	°C/W	°C/W	°C/W
55HQ030	50	26	137	87	3.35	1.08	2.27
	70	26	138	68	2.62		1.54
	85	26	139	54	2.08		1.0
122NQ030	50	20.4	130	80	3.92	0.55	3.37
	70	20.5	134	64	3.12		2.57
	85	20.8	136	51	2.45		1.9

NOTES: CONDUCTION DUTY CYCLE IS 0.5
CURRENT IS 100A
REVERSE VOLTAGE DUTY CYCLE IS 0.5
REVERSE VOLTAGE IS 11.4V

The size of the heatsink required for the larger 120NQ030, particularly for ambient temperatures of 70°C and 85°C, will be considerably smaller than that needed for the smaller 50HQ030.

General Guideline 7: *The higher the ambient temperature, the more a Schottky with a higher rated T_{Jmax} will help reduce the heatsink size.*

As ambient temperature increases, the allowable margin between junction and ambient temperature shrinks less rapidly for a Schottky with a higher rated T_{Jmax}. Thus, the required thermal resistance of the heatsink shrinks less rapidly. An example, chosen particularly to illustrate the point, is summarized in Table 9.

TABLE 9

Comparison of losses and heatsinks required for 150°C and 175°C "T_J Class" Schottkys, at ambient temperatures of 50°C and 70°C. *(General Guideline 7).*

SCHOTTKY TYPE	T_{Jmax} RATING	T_{AMB}	SCHOTTKY LOSSES	DESIGN OPERATING T_J	T_{JA}	HEATSINK R_{SA}
	°C	°C	W	°C	°C	°C/W
120NQ045	150	50	73.5	135	85	0.61
		70		137	67	0.36
121NQ045	175	50	76.5	162	112	0.91
		70		163	93	0.66

NOTES: SCHOTTKY S2 IN FORWARD CONVERTER ON INDIVIDUAL HEATSINK
CONDUCTION DUTY CYCLE IS 0.83
CURRENT IS 150A
REVERSE VOLTAGE DUTY CYCLE IS 0.17
REVERSE VOLTAGE IS 34V

At a 50°C ambient, the 150°C rated 120NQ045 requires a heatsink with a thermal resistance of 0.61°C/W; the 175°C rated 121NQ045 requires a heatsink thermal resistance of 0.91°C/W.

At 70°C ambient, the 150°C Schottky needs a heatsink with an ultra-low thermal resistance of 0.36°C per watt. The heatsink thermal resistance required for the 175°C rated Schottky is about 83% higher, and much more achievable.

8. Selecting the Right Voltage Class

General Guideline 8: *Within a given T_{Jmax} class, lowest losses and smallest heatsink will usually be obtained by selecting the Schottky from the lowest voltage class that is compatible with the circuit voltage.*

A lower voltage class Schottky has lower forward voltage drop and lower conduction losses. Reverse leakage losses of a lower voltage Schottky will be somewhat higher. But generally total losses will be lower and heatsink size smaller, for the Schottky with the lowest voltage class compatible with the circuit operating voltage.

A typical example is summarized in Table 10. The heatsink and losses of a "correctly chosen" 30V rated 122NQ030, versus those of a 45V rated 120NQ045, in a 5V, 150A bridge converter, are compared. Losses of the 30V Schottky are 9.6% of the output power, versus 11.8% for the 45V rated Schottky. The heatsink for the 30V Schottky has 17% higher thermal resistance and will be appropriately smaller.

IV. OPERATING CONDITIONS IMPOSED ON THE SCHOTTKYS IN SWITCHING POWER SUPPLIES

A prerequisite to designing a Schottky into a power supply is to define the operating current and voltage waveforms that are imposed on the Schottkys. These operating waveforms depend upon the circuit.

Figures 27, 29, and 31, show the most common "forward," "bridge" and "flyback" switching power supply circuits respectively. Idealized current and voltage waveforms for each circuit are shown in Figures 28, 30, and 32 respectively.

Regulation of the output voltage is achieved by controlling the conduction duty cycle of the switching transistor (or transistors). As the input voltage increases, the conduction duty cycles of the Schottkys change; peak Schottky voltage increases, and the voltage-duty cycle (i.e., the portion of the cycle during which reverse voltage is applied) decreases.

Calculation of the conduction power losses of the Schottkys requires definition of the current waveforms, and of the range of conduction duty cycle. Calculation of the reverse power losses requires definition of the reverse voltage applied to the Schottkys and of the associated voltage-duty cycle.

The current and voltage operating conditions will now be examined. It will be assumed that the maximum conduction duty cycle of the switching transistor (or transistors) is 0.5, at the extreme end of the operating range where the input voltage is minimum and the output current is maximum. At this point, the PWM controller works "flat out" to deliver the required output voltage. As load current decreases, or as input voltage increases, the transistor conduction duty cycle is cut back by the PWM controller to maintain a constant output voltage.

TABLE 10

Comparison of losses and heatsinks for 30V and 45V class, 150°C class Schottkys, for a 5V 150A bridge converter. *(General Guideline 8).*

SCHOTTKY TYPE	T_{Jmax} RATING	VOLTAGE RATING	CONDUCTION LOSSES PER SCHOTTKY	REVERSE LOSSES PER SCHOTTKY	TOTAL LOSSES BOTH SCHOTTKYS % POWER OUT	DESIGN OPERATING JUNCTION TEMP.	MAXIMUM SINK TEMP.	HEATSINK THERMAL RESISTANCE
	°C	V	W	W	%	°C	°C	°C/W
122NQ030	150	30	34.2	1.6	9.6	130	110	0.84
120NQ045	150	45	43.1	1.25	11.8	138	114	0.72

NOTE: INPUT VOLTAGE RANGE IS 2:1

APPLICATION NOTES

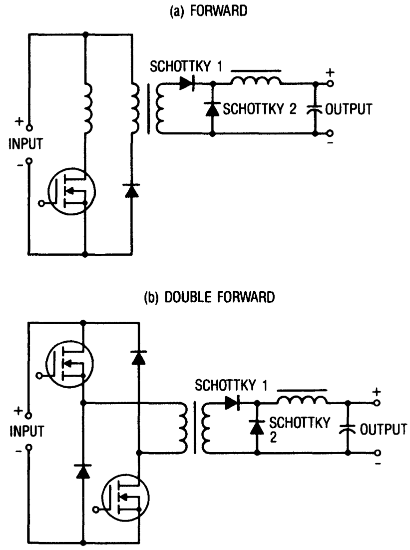


Figure 27. Basic schematics of forward and double forward converters.

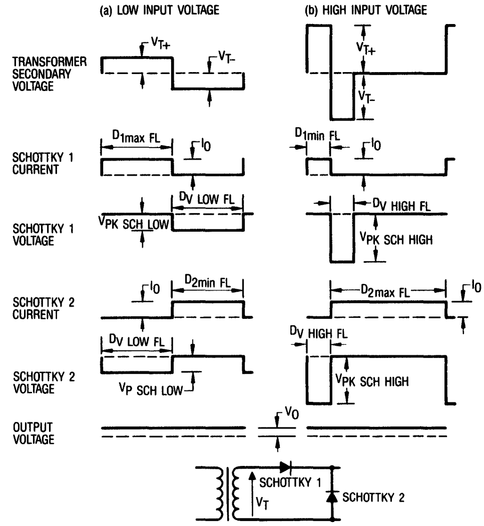


Figure 28. Idealized Schottky voltage and current waveforms in "forward" converter circuits.

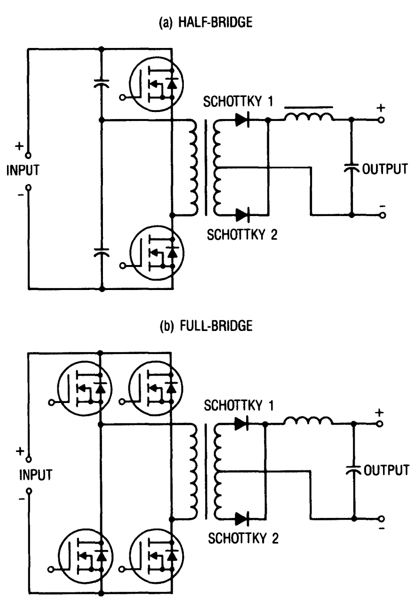


Figure 29. Basic schematics of half-bridge and full-bridge converters.

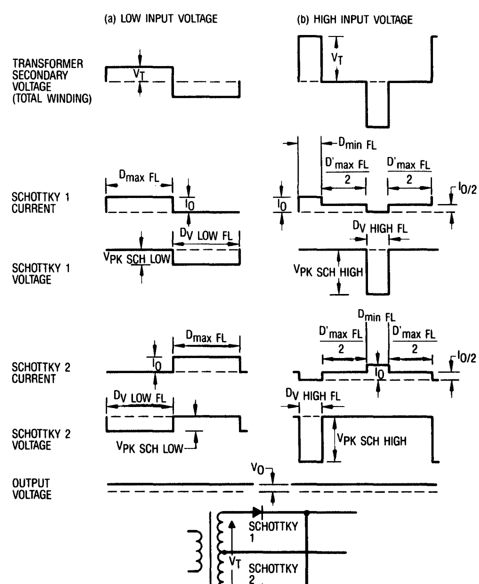


Figure 30. Idealized Schottky voltage and current waveforms in "bridge" converter circuits.

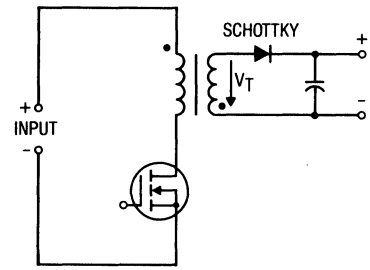


Figure 31. Basic schematic of flyback converter.

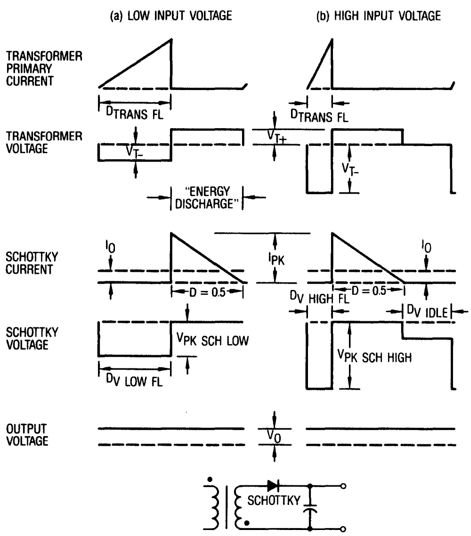


Figure 32. Idealized Schottky voltage and current waveforms in flyback converter.

A. Forward and Double Forward Converters

Forward and Double Forward converters impose essentially the same operating current and voltage waveforms on the output Schottky rectifiers.

The output rectifier circuit and idealized waveforms are shown in Figure 28.

1. Schottky Current and Conduction Duty Cycle

Low Input Voltage

At full load and low input voltage, the conduction duty cycle of Schottky 1 is:

$$D_{1maxFL} = 0.5 \qquad (1)$$

Likewise, the conduction duty cycle of Schottky 2 is:

$$D_{2minFL} = 0.5 \qquad (2)$$

At all conduction duty cycles, each Schottky is assumed to carry a constant current, I_O, throughout its conduction period. (This ignores the small super-imposed ripple component.)

High Input Voltage

At full load and high input voltage, the conduction duty cycle of Schottky 1 is:

$$D_{1minFL} = 0.5 \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \qquad (3)$$

The conduction duty cycle of Schottky 2 is

$$D_{2maxFL} = 1 - D_{1minFL}$$

$$= 1 - 0.5 \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \qquad (4)$$

$V_{IN\ LOW\ FL}/V_{IN\ HIGH\ FL}$ is the ratio of low to high input voltage at full output current.

2. Schottky Voltage and Voltage-Duty Cycle

The general relationship between the peak transformer voltage, V_T, (which is essentially the same as the peak Schottky voltage, $V_{PK\ SCH}$) the output voltage, V_O, and the conduction duty cycle D_{1FL} of Schottky 1, at full output current is:

$$V_T = \frac{(1 + y)\ V_O + V_F}{D_{1FL}} \qquad (5)$$

$$= V_{PK\ SCH}$$

where y = voltage drop across the smoothing inductor at full load, expressed as a fraction of V_O

V_F = forward voltage drop of Schottky at full current

Substituting a typical value for y, of 0.04, and for V_F, of 0.5, gives:

$$V_T = V_{PK\ SCH} = \frac{1.04\ V_O + 0.5}{D_{1FL}} \qquad (6)$$

Low Input Voltage

Substituting $D_{1maxFL} = 0.5$ (equation (1)), into equation (6), the peak Schottky voltage at low input voltage and full load is:

$$V_{P\ SCH\ LOW} = \frac{1.04V_O + 0.5}{0.5} \qquad (7)$$

The voltage-duty cycle at full load and low input voltage, $D_{V\ LOW\ FL}$, is:

$$D_{V\ LOW\ FL} = D_{ImaxFL} \quad (8)$$
$$= 0.5$$

High Input Voltage

Substituting for D_{IminFL} (equation (3)) into equation (6), the peak Schottky voltage at high input voltage and full load is:

$$V_{PK\ SCH\ HIGH} = \frac{(1.04V_O + 0.5)}{0.5} \frac{V_{IN\ HIGH\ FL}}{V_{IN\ LOW\ FL}} \quad (9)$$

The voltage duty cycle at full load and high input voltage, $D_{V\ HIGH\ FL}$, is:

$$D_{V\ HIGH\ FL} = D_{IminFL}$$

$$= 0.5 \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \quad (10)$$

The above assumes that the input voltage has a steady value of $V_{IN\ HIGH\ FL}$. In practice, this voltage will have some superimposed ripple.

The actual peak Schottky voltage could perhaps be 10% higher than that given by equation (9). The Schottky voltage will also be somewhat higher than given by equation (9) at no load, due to "natural" input voltage rise as load current decreases.

B. Half- and Full-Bridge Circuits

Half- and Full-Bridge converters impose essentially the same operating waveforms on the Schottky output rectifiers.

The output rectifier circuit and idealized current and voltage waveforms are shown in Figure 30.

1. Schottky Current and Conduction Duty Cycle

Low Input Voltage

At full load and low input voltage, the conduction duty cycles of both Schottkys are

$$D_{maxFL} = 0.5 \quad (11)$$

Each Schottky is assumed to carry a constant current I_O throughout its conduction period.

High Input Voltage

At full load and high input voltage, each Schottky carries the full load current I_O for duty cycle D_{minFL}, given by:

$$D_{minFL} = 0.5 \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \quad (12)$$

During the intervening "freewheeling" periods, each Schottky carries half the full load current, $I_O/2$, for a total duty cycle D'_{maxFL}, given by:

$$D'_{maxFL} = 1 - \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \quad (13)$$

2. Schottky Voltage and Voltage Duty Cycle

Inspection of the voltage waveforms in Figures 28 and 30 shows that the relationships between peak Schottky voltage, output voltage, and input voltage are the same for the bridge circuits as for the forward converter circuits.

Equations (7) through (10) therefore apply.

C. Flyback Circuit

The flyback circuit can be operated in either of two different modes. Energy stored in the transformer secondary during the flyback period can either be partially discharged or totally discharged. The latter mode is common and will be assumed here.

The output rectifier circuit, and idealized waveforms of current and voltage associated with the "total energy discharge" mode, are shown in Figure 32.

1. Schottky Current and Conduction Duty Cycle

The duration of the energy discharge period, during which the Schottky conducts, is a function of the output voltage, the output current, and the inductance of the transformer's secondary. It is *not* related to the power supply's input voltage.

Thus, for a given output voltage and full load output current, the Schottky conduction period remains *constant,* regardless of the input voltage. Thus, the Schottky's full load conduction duty cycle typically will remain constant at 0.5, independent of the input voltage. This is assumed to be the case here.

Unlike the case in the forward and bridge converters, the Schottky current waveform is triangular, as illustrated. The current ramps down from an initial peak, I_{PK}, of 4x the average load current, to zero, over half the output cycle.

The average and rms values of the Schottky current are:

$$I_{AV\ SCH} = I_O \quad (14)$$

$$I_{RMS\ SCH} = 4 \frac{I_O}{\sqrt{3}} \quad (15)$$

2. Schottky Voltage and Voltage Duty Cycle

During the Schottky conduction period, the positive transformer secondary voltage is:

$$V_{T+} = V_O + V_F \qquad \textbf{(16)}$$

where V_F is the Schottky's forward voltage drop. Assuming V_F has a nominal value of 0.5V, then:

$$V_{T+} = V_O + 0.5 \qquad \textbf{(17)}$$

During the transistor conduction period, D_{TRANS}, the negative voltage-integral across the transformer secondary is equal and opposite to the voltage integral during the Schottky's conduction period. Therefore:

$$V_{T-} D_{TRANS\ FL} = (V_O + 0.5)\ 0.5 \qquad \textbf{(18)}$$

The peak Schottky voltage, $V_{PK\ SCH}$, during the transistor conduction period is the sum of V_O and V_T.

$$V_{PK\ SCH} = V_O + \frac{(V_O + 0.5)\ 0.5}{D_{TRANS\ FL}} \qquad \textbf{(19)}$$

The corresponding voltage duty cycle is:

$$D_{V\ FL} = D_{TRANS\ FL} \qquad \textbf{(20)}$$

During the idle period, when both the transistor and the Schottky are OFF:

$$V_{PK\ SCH} = V_O \qquad \textbf{(21)}$$

The corresponding idle voltage duty cycle is:

$$D_{V\ IDLE} = 0.5 - D_{TRANS} \qquad \textbf{(22)}$$

Low Input Voltage

At low input voltage and full load, $D_{TRANS\ FL} = 0.5$. Substituting into equation (19):

$$V_{PK\ SCH\ LOW} = V_O + (V_O + 0.5)$$
$$= 2\ V_O + 0.5 \qquad \textbf{(23)}$$

Substituting into equation (20):

$$D_{V\ LOW\ FL} = 0.5 \qquad \textbf{(24)}$$

High Input Voltage

The conduction duty cycle of the transistor at full load and high input voltage is:

$$D_{TRANS} = 0.5\ \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \qquad \textbf{(25)}$$

Substituting into equation (19):

$$V_{PK\ SCH\ HIGH} = V_O + (V_O + 0.5)\ \frac{V_{IN\ HIGH\ FL}}{V_{IN\ LOW\ FL}} \qquad \textbf{(26)}$$

Substituting into equation (20) and (25):

$$D_{V\ HIGH\ FL} = D_{TRANS\ FL}$$
$$= 0.5\ \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \qquad \textbf{(27)}$$

Substituting into equation (22) and (25):

$$D_{V\ IDLE} = 0.5 - D_{TRANS}$$
$$= 0.5 - 0.5\ \frac{V_{IN\ LOW\ FL}}{V_{IN\ HIGH\ FL}} \qquad \textbf{(28)}$$

As load current decreases, the conduction duty cycle of the transistor will decrease, shortening the period during which the Schottky is exposed to the highest peak voltage.

The amplitude of the peak Schottky voltage will increase somewhat above that given by equation (26), due to natural voltage rise as load current diminishes.

D. Summary of Circuit Operating Conditions

1. General Relationships

Table 11 gives a summary of the general relationships between Schottky current, output current, and input voltage range, and between Schottky voltage, output voltage, voltage duty cycle and input voltage range, for forward, bridge, and flyback circuits.

2. Quantification of Output Voltage and Input Voltage Range, as a Function of Schottky Voltage Rating

The output voltage and permissible range of input voltage, against which the power supply is able to maintain a constant output voltage, can now be quantitatively established for each Schottky voltage class, for each type of power supply circuit considered. Table 12 gives a summary. This information is derived from the general relationships shown in Table 11.

Table 12 assumes that the maximum Schottky voltage at full load and maximum input voltage is about 75% of the Schottky's repetitive voltage rating. This leaves about a 33% margin for switching voltage transients. This will generally be adequate, especially in view of the transient avalanche capability of International Rectifier Schottkys.

TABLE 11
General relationships for Schottky current and voltage.

CIRCUIT	SCHOTTKY CURRENT @ DUTY CYCLE				SCHOTTKY VOLTAGE @ DUTY CYCLE	
	AT MINIMUM INPUT VOLTAGE		AT MAXIMUM INPUT VOLTAGE		AT FULL LOAD, MINIMUM INPUT VOLTAGE	AT FULL LOAD, MAXIMUM INPUT VOLTAGE
	S1	S2	S1	S2	S1 AND S2	S1 AND S2
FORWARD CONVERTER DOUBLE FORWARD CONVERTER	I_O @ 0.5	I_O @ 0.5	I_O @ $0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$	I_O @ $1 - 0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$	$2\ (1.04\ V_O + 0.5)$ @ 0.5	$2\ (1.04\ V_O + 0.5) \frac{V_{IN\ HIGH}}{V_{IN\ LOW}}$ @ $0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$
HALF BRIDGE FULL BRIDGE	I_O @ 0.5	I_O @ 0.5	I_O @ $0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$ AND $\frac{I_O}{2}$ @ $1 - \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$		$2\ (1.04\ V_O + 0.5)$ @ 0.5	$2\ (1.04\ V_O + 0.5) \frac{V_{IN\ HIGH}}{V_{IN\ LOW}}$ @ $0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$
FLYBACK	$I_{PK} = 4\ I_O$ @ 0.5	—	$I_{PK} = 4\ I_O$ @ 0.5	—	$2\ (V_O + 0.5)$ @ 0.5	$(0.5 + V_O) \frac{V_{IN\ HIGH}}{V_{IN\ LOW}} + V_O$ @ $0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$ AND V_O @ $0.5 - 0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$

TABLE 12
Output voltage and input voltage range versus Schottky voltage class.

SCHOTTKY VOLTAGE CLASS	OUTPUT VOLTAGE	FORWARD, DOUBLE FORWARD, HALF-BRIDGE AND BRIDGE CONVERTERS			FLYBACK CONVERTERS		
		MAXIMUM RATIO HIGH TO LOW INPUT VOLTAGE	TYPICAL AC LINE INPUT VOLTAGE RANGE	MAXIMUM SCHOTTKY VOLTAGE (EXCLUDING TRANSIENTS)	MAXIMUM RATIO HIGH TO LOW INPUT VOLTAGE	TYPICAL AC LINE INPUT VOLTAGE RANGE	MAXIMUM SCHOTTKY VOLTAGE (EXCLUDING TRANSIENTS)
30	2.5	3.5:1	80 TO 280	22			
30	5	2:1	80 TO 160 160 TO 320	23	3:1	85 TO 255	22
45	5	3:1	85 TO 255	34	5:1	60 TO 300	33
	12				1.75:1	90 TO 155 180 TO 310	34
60	5	4:1	65 TO 260	46			
	12	1.7:1	90 TO 155 180 TO 310	44	2.6:1	65 TO 170 130 TO 340	45
	15				2:1	80 TO 160 150 TO 300	46
100	12	3:1	85 TO 255	78	5:1	60 TO 300	75
	15	2.3:1	70 TO 160	74	4:1	75 TO 300	77
150	15	3.4:1	80 TO 270	110	6:1	60 TO 360	108

E. Impact of Input Power Factor Correction

It has been tactily assumed so far that a conventional line input rectifier, as shown in Figure 33(a), is used to convert the incoming ac line voltage to primary dc voltage. The steady state primary voltage rises and falls in direct relationship to rising and falling ac line input voltage. The conduction duty cycle of the transistor (or transistors) in the high frequency switching converter is regulated to keep a fixed output voltage.

In a "universal" power supply, designed to operate from nominal line voltages of, say, 115 and 240V, (without change of input rectifier circuit connection), the total range of conduction duty cycle of the transistors could be about 3 to 1. The output Schottkys would, therefore, be exposed to about a 3 to 1 range of applied reverse voltage.

While such designs are common, particularly at lower power levels, many higher power designs, (above a few hundred watts) are expected in future to use a primary boost converter, as shown in Figure 33(b).

The major purpose of the boost converter is to correct the power factor of the input ac line current, by actively forcing a sinusoidal ac line current to flow. A secondary benefit of the boost converter is that its output voltage — the voltage across the reservoir capacitor C — can be regulated to a constant value, as the input ac line voltage varies. For example, the output voltage of the boost converter could be held at 400V, over a range of input line voltage from, say, 80 to 280V.

With this front-end regulation, the high frequency switching converter is not exposed to widely varying input voltage, and therefore does not need to provide a wide range of conduction angle control, at least in normal operation.

A reduced range of input voltage for the switching converter means a lower peak voltage applied to the output Schottkys. This opens the door for improving the efficiency of the output rectifier by using Schottkys with a lower V_{RRM} class and correspondingly lower forward voltage drop.

In the ideal case (for the Schottkys), a design could be conceived where each Schottky operates at a constant 50% conduction duty cycle, and is exposed to just twice the output voltage. Thus, a 5V power supply could use a 15V Schottky.

A common design requirement, though, must not be ignored. This is that the output power must be maintained, uninterrupted, in the event of transient (typically one or two cycle) loss of input ac line voltage. When this occurs, the input boost converter can no longer keep a constant voltage on the primary reservoir capacitor, because temporarily there is "nothing to boost." The reservoir capacitor must now continue to deliver energy to the load, while holding a sufficient voltage that the switching converter, by its own pulse width control, can maintain the required output voltage.

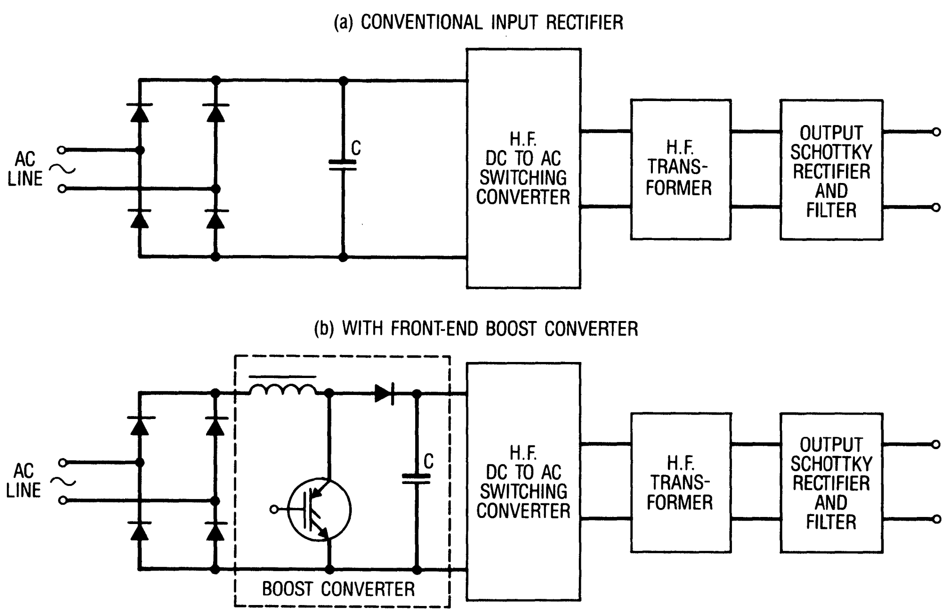


Figure 33. Functional diagrams of switching power supplies with (a) conventional input line rectifier and with (b) boost converter to correct the input line power factor.

How much the voltage on the primary reservoir capacitor will decay under this transient condition depends upon the duration of the power outage, and the size of the reservoir capacitor. In any event, the only means of regulating the output voltage in this situation is by duty cycle control of the transistors of the switching converter. This means, unfortunately, that the normal operating duty cycle of the switching converter must be cut back to keep the necessary reserve in hand for temporary line outages. The resulting peak voltage applied to the Schottkys will be less than the ideal minimum.

Thus, though the range of Schottky conduction duty cycle and applied reverse voltage can be reduced by a front-end boost converter, some range of regulation within the switching converter will often still be needed, and the required Schottky voltage rating will "suffer" accordingly.

Nonetheless, for a given output voltage, it will often be possible to "drop down" a Schottky voltage class. Thus, a 5V power supply might now typically use a 30V rated Schottky, where previously it needed a 45V rating. Likewise, 12 and 15V power supplies might drop from 60 or 100V Schottkys, to 45V types.

The required Schottky voltage rating will depend upon the duration of ac line outage over which output power must be maintained, and upon the size the primary reservoir capacitor.

Table 13 shows the range of primary voltage droop permissible for various "reduced voltage class" Schottkys, for 5, 12, and 15V outputs, where a front-end regulator is used. It is assumed that the peak voltage applied to the Schottky (exclusive of switching transients) would be about 70% of the rated repetitive working voltage.

TABLE 13

Permissible voltage drop on primary reservoir (boost converter) capacitor, for various V_{RRM} class Schottkys and various output voltages.

SCHOTTKY V_{RRM} CLASS	OUTPUT VOLTAGE	MAX. PERMISSIBLE TRANSIENT VOLTAGE DROOP P.U. OF NOMINAL OPERATING VOLTAGE
15	2.5	0.6
30	5	0.5
45	12	0.82
60	12	0.6
	15	0.77

CIRCUIT-RELATED DESIGN GUIDELINES

Guideline 1.

In a Forward Converter with two similar Schottkys, Schottky 2 generally has greater losses than Schottky 1. The heatsink must be sized to keep the junction temperature of Schottky 2 within safe limits, under the worst-case condition of high input voltage and full load current.

Guideline 2.

Judicious selection of "Mixed Schottkys" for a Forward Converter that operates over a wide range of input voltage can allow Schottky 1 to be a "lower-rated" device than Schottky 2. Total losses will be a little higher, but heatsink size will be virtually the same.

Guideline 3.

A common heatsink for both Schottkys in a Forward Converter allows the Schottky with the highest losses to take advantage of the other's "share" of heatsink. The size of a single common heatsink will generally be physically smaller than the combined size of the heatsinks needed for each Schottky individually.

Guideline 4.

Total Schottky losses in the Forward and Bridge converters are essentially the same, using the same Schottkys. The heatsink for a Bridge converter, however, can be significantly smaller, because the symmetrical operation of the Bridge versus the assymetrical operation of the Forward converter results in equal power sharing between the Schottkys and a lower individual junction to sink temperature rise.

Guideline 5.

Schottkys of a given die size and process type have essentially the same worst-case design losses, regardless of their package type, for given output current, output voltage, and input voltage range. But Schottky package type will determine heatsink thermal resistance.

Guideline 6.

In a Flyback Converter, a 175°C rated Schottky will generally offer similar or better efficiency, while requiring a significantly smaller heatsink, than a 150°C rated Schottky.

Figure 34. Summary of **circuit-related** design guidelines.

V. DESIGNING THE SCHOTTKY INTO A SWITCHING POWER SUPPLY

General guidelines have been presented that outline the fundamental basics behind choosing a Schottky, sizing the heatsink and setting a safe operating temperature.

Knowing a power supply's output voltage, output current, input voltage range and maximum ambient temperature, and having tentatively chosen a candidate Schottky, the engineer can now get down to the final design task of determining the required heatsink thermal resistance, operating junction temperature, and worst-case losses.

It will generally be assumed, for Forward and Bridge converters, that both Schottkys are mounted on a common heatsink. (The Flyback converter, of course, has only one Schottky.) A common heatsink is inherent for a dual Schottky, where both rectifiers are housed in a single package. It will also be the most frequent choice where individual Schottkys are used.

During the course of the following design presentation, several important points relating to Schottky requirements and their performance in the different circuits will emerge. These *Circuit Related Guidelines* are collected together in Figure 34, and are offered, for the moment, without explanation. Each will be discussed as it is encountered.

A. Heatsink Temperature Determined by Schottky Temperature Capability

It is assumed in the following sections, that for any chosen Schottky, of whatever T_{Jmax} or V_{RRM} class, the objective is to minimize the size of the heatsink, consistent only with maintaining a safe operating temperature margin for the Schottkys.

In some designs an overriding requirement may exist that the heatsink temperature must not exceed a given maximum. Depending upon the choice of Schottky, this may or may not be coincidentally satisfied by a "minimum heatsink" design. If not, the heatsink size will have to be increased beyond the minimum that gives a safe thermal design for the Schottky. This design situation will be addressed later.

1. Forward and Double-Forward Converters

a. Schottky 1 and Schottky 2 the same

The design procedure will be illustrated by considering a 200A, 5V forward (or double-forward) converter, using two International Rectifier 240NQ045 Schottkys. The maximum ambient temperature is 50°C; the range of input voltage variation is 3:1.

As defined in Table 11, the range of conduction duty cycle of Schottky 1 is 0.5 to 0.17, and of Schottky 2, the range is 0.5 to 0.83. The maximum reverse voltage applied to each Schottky occurs at maximum input voltage and is 34V (excluding switching transients), at a duty cycle of 0.17.

Operation at high input voltage

The worst-case design operating condition will be at full output current and high input voltage. At this point, Schottky 2 carries the output current for most of the cycle (83%) and will have significantly higher losses than Schottky 1. The heatsink must be sized to ensure that Schottky 2 operates safely within its thermal limits at this point.

The first step in determining the heatsink thermal resistance is to derive the relationship between the total (forward and reverse) losses of each Schottky, at full load and high input voltage, as a function of junction temperature.

The conduction losses of Schottky 1 at junciton temperature T_J are:

$$P_{COND1} = I_O \bullet (V_F @ I_O @ T_J) \bullet D_{1\,minFL} \quad \textbf{(29)}$$

where I_O is the output current and $(V_F @ I_O @ T_J)$ is the limiting forward voltage drop at current I_O and junction temperature T_J.

The reverse losses of Schottky 1 at junction temperature T_J are:

$$P_{REV1} = V_R \bullet (I_R @ V_R @ T_J) \bullet D_{1minFL} \quad \textbf{(30)}$$

where V_R is the applied reverse voltage and $(I_R @ V_R @ T_J)$ is the maximum reverse leakage current at reverse voltage V_R and junction temperature T_J.

The total losses of Schottky 1 at junction temperature T_J are:

$$P_{TOT1} = P_{COND1} + P_{REV1} \quad \textbf{(31)}$$

The conduction losses of Schottky 2 at junction temperature T_J are:

$$P_{COND2} = I_O \bullet (V_F @ I_O @ T_J) \bullet (1 - D_{1minFL}) \quad \textbf{(32)}$$

The reverse losses of Schottky 2 at junction temperature T_J are:

$$P_{REV2} = V_R \bullet (I_R @ V_R @ T_J) \bullet D_{1minFL} \quad \textbf{(33)}$$

The total losses of Schottky 2 at junction temperature T_J are:

$$P_{TOT2} = P_{COND2} + P_{REV2} \quad \textbf{(34)}$$

Figure 35 shows the power losses of Schottkys 1 and 2, as a function of junction temperature, calculated from equations (29) through (33), for the 240NQ045 Schottkys operating in the above 200A 5V Forward Converter, at

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the worst-case asymmetrical operating condition, at which D_{1minFL} is 0.17.

The forward voltage drop and reverse leakage current data given in the data sheet for the 240NQ045 have been used to calculate the losses. The relationships given in the data sheet between reverse leakage current, junction temperature and reverse voltage, are representative of a typical device. A conservative multiplier of 1.5 has been applied to the reverse loss component of the total losses shown in Figure 35, to represent an absolute worst-case design.

We are now set to calculate the required thermal resistance of the heatsink. As discussed in Section A1, a good design criterion is to base the heatsink thermal resistance on the hypothetical scenario that it would take an increase of 10°C in the *ambient* temperature *above* the design maximum, for the Schottky's operating junction temperature to reach T_{Jmax}.

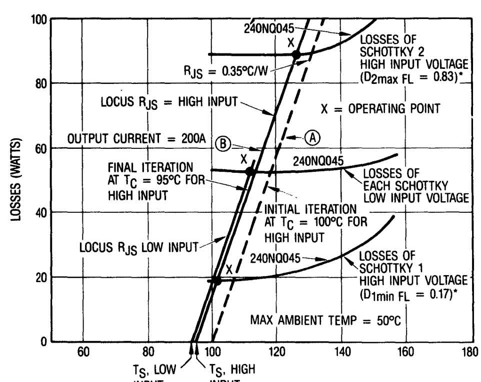
The total losses under this hypothetical scenario can be conservatively estimated by assuming that both Schottkys would simultaneously operate at T_{Jmax}. This is pessimistic, because Schottky 1 actually runs cooler than Schottky 2; therefore, the total losses assumed for it would be a bit higher than "reality," (adding a bit more conservatism to the resulting design).

From the power loss curves for Schottky 1 and Schottky 2 in Figure 35:

$$P_{TOT2} = 99\ W\ @\ T_J = 150°C$$

$$P_{TOT1} = 33\ W\ @\ T_J = 150°C$$

$$P_{TOT1} + P_{TOT2} = 132\ W$$



Notes: Conduction duty cycle at high input is 0.17/0.83 for Schottky 1 and 2
Conduction duty cycle at low input is 0.5/0.5 for Schottky 1 and 2
Reverse voltage duty cycle at high input is 0.17/0.17 for Schottky 1 and 2
Reverse voltage at high input is 34V
Reverse voltge duty cycle at low input is 0.5/0.5 for Schottky 1 and 2
Reverse voltage at low input is 11.4V
*See Figure 28

Figure 35. Operating characteristics for 200A, 5V forward converter "same Schottky" design. Both Schottkys are 240NQ045. *(Common Heatsink).*

The junction to ambient temperature rise of Schottky 2 under this condition is:

$$T_{JA,S2} = 150 - (T_{AMB} + 10)$$
$$= 150 - (50 + 10)$$
$$= 90°C$$

$$T_{JS,S2} = P_{TOT2}\ R_{JS2}$$
$$= 99 \bullet 0.35$$
$$= 34.7°C$$

$$T_{SA} = T_{JA,S2} - T_{JS,S2}$$
$$= 90 - 34.7$$
$$= 55.3°C$$

$$R_{SA} = \frac{T_{SA}}{(P_{TOT1} + P_{TOT2})}$$
$$= \frac{55.3}{132}$$
$$= 0.42°C/W$$

Having determined the required heatsink thermal resistance, it remains now to determine the operating points for Schottkys 1 and 2, at the actual maximum design ambient temperature of 50°C.

This is done by a simple reiterative procedure:

Start by picking a sink temperature T_S (for example, 100°C.) In Figure 35, draw the straight line locus of $R_{J\text{-}S}$ (0.35°C/W for the 240NQ045) that intersects the temperature axis at 100°C (Line A). Read the losses of Schottky 1 and Schottky 2 at the intersection points of line A with the Schottky loss curves:

$$P_{TOT2} = 89.5\ W$$

$$P_{TOT1} = 19\ W$$

Compare the already established design value of R_{SA} (0.42°C/W) with the value of R_{SA} that would yield the assumed sink to ambient temperature rise (in this case, 100 – 50 = 50°C), when operating with the above combined Schottky losses:

$$R_{SA} = \frac{100 - 50}{89.5 + 19}$$
$$= 0.46°C/W$$

The above value of R_{SA} is higher than the already established known design value. Therefore, the originally assumed value of T_S of 100°C was too high.

Reiterate with a lower value of T_C. Try:

$$T_S = 95°C$$

From the intersection of the new locus (B) of R_{JS} with the Schottky loss curves:

$$P_{TOT2} = 89W \text{ (@ } T_J \text{ of } 126°C)$$

$$P_{TOT1} = 19W \text{ (@} T_J \text{ of } 102°C)$$

$$R_{SA} = \frac{95 - 50}{(89 + 19)}$$

$$= 0.42°C/W$$

The above value of R_{SA} is the already established "known" design value. Therefore the assumed value of T_S of 95°C was correct.

A summary of the above data is shown in Table 14.

Operation at low input voltage

The foregoing design analysis has dealt with the worst-case operating condition, under which the conduction duty cycle and power dissipation of Schottky 2 is much higher than that of Schottky 1. At this point Schottky 2 runs at a higher junction temperature, 126°C, versus 102°C for Schottky 1. The heatsink must, therefore, be sized to keep the necessary operating temperature margin for Schottky 2.

At the low end of the input voltage range, both Schottkys operate at the same duty cycle, (it is assumed here to be 0.5). At this point, the conduction losses of Schottky 1 will be higher than at high input voltage, while those of Schottky 2 will be lower. The combined conduction losses of both Schottkys will be about the same as at high input voltage, because the output current is the same and Schottky forward voltage drops are virtually the same (i.e., ignoring small differences of junction temperature).

At low input voltage, a much lower reverse voltage, about 11V, is applied to each Schottky. Though the voltage-duty cycle is longer (0.5 versus 0.17), the reverse losses will be lower.

Total combined forward and reverse losses of both Schottkys will, therefore, be lower and the heatsink temperature will be lower. Schottky 1, will, however, operate at a higher junction temperature than at high input voltage, because of its greater conduction duty cycle, though it will run cooler than Schottky 2 at maximum input voltage.

Losses of the two Schottkys at minimum input voltage are shown as a function of operating junction temperature in Figure 35. Given the already established heatsink thermal resistance of 0.42°C/W, the operating point x' shown in Figure 35 is determined, by the same process of reiteration used above.

The losses of each Schottky are now 52.5W, and the operating junction temperature is about 113°C.

A summary of the above data is included in Table 14.

Unbalanced operation of Schottkys in Forward Converters

At this point, the following *Circuit Related Guideline* can be summarized.

Circuit-Related Guideline 1: *In a Forward Converter with two similar Schottkys, Schottky 2 generally has greater losses than Schottky 1. The heatsink must be sized to keep the junction temperature of Schottky 2 within safe limits, under the worst-case condition of high input voltage and full load current.*

b. Schottkys 1 and 2 different

As has been seen, a Forward Converter operates at "lopsided" duty cycles for the two Schottkys. This imposes much greater losses on Schottky 2 than on Schottky 1.

TABLE 14
Summary of data for various 5V, 200A power supply designs. Max. Ambient Temperature = 50°C; Input Voltage Range = 3.1.

CIRCUIT	HEATSINK R_{SA} °C/W	SCHOTTKY 1					SCHOTTKY 2					TOTAL LOSSES BOTH SCHOTTKYS	
		TYPE	LOW INPUT VOLTAGE		HIGH INPUT VOLTAGE		TYPE	LOW INPUT VOLTAGE		HIGH INPUT VOLTAGE		LOW INPUT VOLTAGE	HIGH INPUT VOLTAGE
			LOSSES W	WKG T_J °C	LOSSES W	WKG T_J °C		LOSSES W	WKG T_J °C	LOSSES W	WKG T_J °C		
FORWARD	0.42	240NQ045	52.5	113	19	102	240NQ045	52.5	113	89	126	105	108
FORWARD	0.43	120NQ045	64	135	22.5	111	240NQ045	53	118	89	129	117	112
FORWARD	SCHOTTKY 1 0.83 SCHOTTKY 2 0.56	120NQ045	64	138	23	82	240NQ045	53	98	90	132	117	113
BRIDGE	0.61	240NQ045	53	133	47	124	240NQ045	53	133	47	124	106	94

As illustrated in Table 14, in a 200A, 5V Forward Converter, the maximum losses of Schottky 1, of 52.5W, occur at minimum input voltage; by contrast the maximum loses of Schottky 2, of 89W, occur at maximum input voltage. Schottky 1, in reality, is under-utilized; it could be replaced by a smaller device.

Assume that Schottky 1 is replaced by the lower current 120NQ045, while Schottky 2 remains a 240NQ045. Both are still mounted on the same heatsink.

The losses of each Schottky, at the minimum and maximum input voltage operating conditions, are shown as a function of junction temperature in Figure 36.

It is not immediately obvious which operating condition (high or low input voltage) will dictate the required heatsink size. At low input voltage, Schottky 1 has higher losses and will run hotter than Schottky 2, particularly because, being a smaller device, its junction to sink thermal resistance is higher.

At high input voltage Schottky 2 has higher losses, and even though it has lower thermal resistance, will probably run hotter than Schottky 1. Total combined losses of both Schottkys will probably be somewhat greater at high input voltage because reverse losses are higher.

Each operating condition needs to be examined, to ascertain which is most severe and therefore governs the choice of heatsink.

At low input voltage, Schottky 1 definitely runs hotter than Schottky 2, (because both have the same current and conduction duty cycle, and Schottky 1 is smaller than Schottky 2). The heatsink must hold the Schottky 1 junction temperature to 150°C at an ambient of (T_{AMB} + 10°C):

$$T_{JA1} = 150 - 60$$

$$= 90°C$$

$$T_{JS1} = P_{TOT1} \bullet R_{JS1}$$

$$= 65 \bullet 0.55$$

$$= 36°C$$

$$\therefore T_{SA} = 90 - 36$$

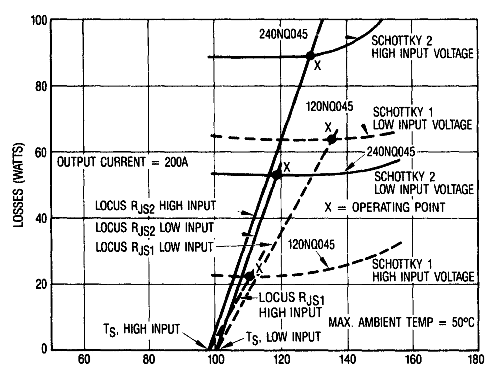
$$= 54°C$$

The total losses of both Schottkys will be assumed (conservatively) to be the sum of their losses at T_{Jmax} = 150°C

$$\therefore R_{SA} = \frac{54}{(65 + 55)}$$

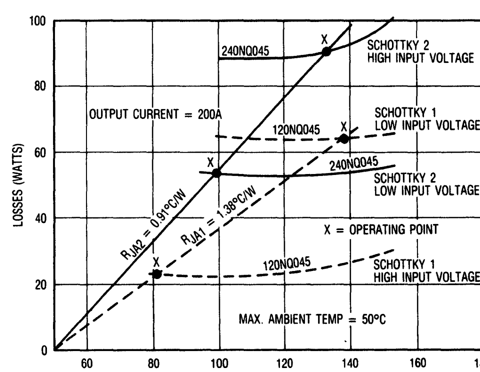
$$= 0.45°C/W \qquad \textbf{(35)}$$

At high input voltage, it needs to be checked which Schottky will have the greatest junction to sink temperature rise, under the hypothetical scenario of the operating junction temperature just reaching rated T_{Jmax} at (T_{AMB} + 10). Whichever Schottky has the greatest temperature rise under this condittion is the one which will govern the needed heatsink for this operating condition.



Notes: Conduction duty cycle at high input is 0.17/0.83 for Schottky 1 and 2
Conduction duty cycle at low input is 0.5/0.5 for Schottky 1 and 2
Reverse voltage duty cycle at high input is 0.17/0.17 for Schottky 1 and 2
Reverse voltage duty cycle at low input is 0.5/0.5 for Schottky 1 and 2
Reverse voltage at high input is 34V
Reverse voltage at low input is 11.4V

Figure 36. Operating characteristics for 200A, 5V forward converter "mixed Schottky" design. Schottky 1 is 120NQ045, Schottky 2 is 240NQ045. *(Common Heatsink).*



Notes: Conduction duty cycle at high input is 0.17/0.83 for Schottky 1 and 2
Conduction duty cycle at low input is 0.5/0.5 for Schottky 1 and 2
Reverse voltage duty cycle at high input is 0.17/0.17 for Schottky 1 and 2
Reverse voltage duty cycle at low input is 0.5/0.5 for Schottky 1 and 2
Reverse voltage at high input is 34V
Reverse voltage at low input is 1.4V

Figure 37. Operating characteristics for 200A 5V forward converter "mixed Schottky" design. Schottky 1 is 120NQ045, Schottky 2 is 240NQ045. *(Individual Heatsinks).*

Referring to Figure 36, Schottky 1 will have a junction to sink temperature rise of:

$$T_{JS1} = P_{TOT1} \bullet R_{JS1}$$

$$= 29 \bullet 0.55$$

$$= 16°C$$

Schottky 2 will have a junction to sink temperature rise of:

$$T_{JS2} = P_{TOT2} \bullet R_{JS2}$$

$$= 99 \bullet 0.35$$

$$= 34.7°C$$

Clearly, Schottky 2 governs the required heatsink.

Proceeding with the calculation for Schottky 2:

$$T_{JA2} = 150 - 60$$

$$= 90°$$

$$T_{JS2} = P_{TOT2} \bullet R_{JS2}$$

$$= 99 \bullet 0.35$$

$$= 34.7°C$$

$$\therefore T_{SA} = 90 - 34.7$$

$$= 55.3°C$$

$$\therefore R_{SA} = \frac{55.3}{99 + 29}$$

$$= 0.43°C/W \qquad \textbf{(36)}$$

Comparing the value of R_{SA} given by equations (35) and (36), for the low and high input voltage conditions respectively, a smaller heatsink thermal resistance (just) is required for the high input voltage condition. This, therefore, takes precedence and the required heated thermal resistance is:

$$R_{SA} = 0.43°C/W.$$

It remains now to find the actual operating point of each Schottky at the actual maximum design ambient temperature of 50°C.

Again, this is done for the minimum and maximum input voltage conditions, by assuming a sink temperature, (and hence a sink to ambient temperature difference), and drawing the locus of junction to sink thermal resistance of each Schottky, which intersects the temperature axis at the assumed sink temperature.

The losses at the intersection points of each assumed thermal resistance locus with its Schottky loss curve are summed and multiplied by the known heatsink thermal resistance of 0.43°C/W. When the resulting sink to ambient temperature equals the originally assumed value, the originally assumed sink temperature was the correct choice.

Figure 36 shows loci of the junction to sink thermal resistances of Schottkys 1 and 2 that emanate from the correct sink temperatures (98°C and 100°C) for the high and low input voltage conditions respectively.

Table 14 gives a summary of operating junction temperatures and power losses.

c. Comparison of "Same Schottky" versus "Mixed Schottky" designs

The "Same Schottky" and "Mixed Schottky" design results, shown in Table 14, call for comment.

The worst-case total losses of the "Mixed Schottky" design are about 9% higher. This is a result of substituting a smaller 120NQ045 Schottky for the larger 240NQ045, as Schottky 1.

The required heatsink, however, is virtually the same for both designs. The reason is that the worst-case design condition has shifted from Schottky 2 at high input voltage to Schottky 1 at low input voltage. This smaller Schottky can be permitted to operate at a somewhat higher junction temperature than Schottky 2 because its lower reverse leakage current requires a somewhat smaller temperature margin.

These conclusions are summarized as follows:

Circuit-Related Guideline 2: *Judicious selection of "Mixed Schottkys" for a Forward Converter that operates over a wide range of input voltage can allow Schottky 1 to be a lower-rated device than Schottky 2. Total losses will be a little higher, but heatsink size will be virtually the same.*

d. Individual heatsinks

Sometimes, where Schottkys 1 and 2 are selected as different types, to match them to the asymmetrical circuit operation, it could also be physically convenient to have each on its own heatsink, essentially thermally isolated from the other.

An individual heatsink must be sized exclusively for the highest losses of its Schottky, without being able to take relief from the fact that when one Schottky is heavily loaded, the other is lightly loaded, and vice versa.

An analysis of heatsink requirements and operating junction temperatures in the same 200A, 5V Forward Converter considered above, using mixed 120NQ045 and 240NQ045 Schottkys with individual heatsinks, is shown in Figure 37.

Schottky 1 has maximum losses at low input voltage. The locus of junction to ambient thermal resistance needed for an operating junction temperature of 150°C at (T_{AMB} + 60°C) is shown.

The intersection of the thermal resistance locus with the Schottky's power loss characteristic gives an operating junction temperature of 138°C, with corresponding losses of 64W.

$$R_{JA1} = \frac{(138 - 50)}{64}$$

$$= 1.38°C/W$$

$$\therefore R_{SA1} = R_{JA1} - R_{JS1}$$

$$= 1.38 - 0.55$$

$$= 0.83°C/W$$

Schottky 2 has maximum losses at high input voltage. The locus of junction to ambient thermal resistance needed for an operating junction temperature of 150°C at (T_{AMB} + 10) is shown.

The intersection point of the thermal resistance locus with the Schottky's power loss versus junction temperature characteristic gives an operating junction temperature of 132°C, with losses of 90W.

$$R_{JA2} = \frac{(132 - 50)}{90}$$

$$= 0.91°C/W$$

$$\therefore R_{SA2} = R_{JA2} - R_{JS2}$$

$$= 0.91 - 0.35$$

$$= 0.56°C/W$$

Table 14 summarizes the operating temperatures, power losses and heatsink requirements for the two Schottkys.

e. Common vs individual heatsinks

The above results confirm the following:

Circuit-Related Guideline 3: *A common heatsink for both Schottkys in a Forward Converter allows the Schottky with the highest losses to take advantage of the other's "share" of heatsink. The size of a single common heatsink will generally be physically smaller than the combined size of the heatsinks needed for each Schottky individually.*

2. Bridge Converters

In a bridge converter, the Schottkys operate symmetrically. Since both Schottkys deliver the same power into the heatsink, each can be considered to interact only with its "half" of the heatsink. Analytically, this is equivalent to each Schottky being mounted on an individual heatsink that has twice the thermal resistance of the single combined heatsink.

To illustrate a design example, consider again a 200A, 5V power supply with a maximum ambient temperature of 50°C, and a 3 to 1 range of input voltage, using 240NQ045 Schottkys.

Figure 38 shows the calculated losses of each Schottky as a function of junction temperature, at the maximum and minimum input voltage operating conditions. The losses, as before, are calculated from the forward voltage drop and reverse leakage current information given in the Schottky's data sheet, in combination with the Schottkys' operating conditions defined in Table 11. Note that half the total output current freewheels through both Schottkys during portions of each cycle.

Figure 38 shows that at T_{Jmax} (150°C), the losses are highest at high input voltage, due to the contribution of the reverse losses. This is the operating condition that the heatsink must cater to, under the hypothetical scenario that the ambient temperature rises 10°C above maximum.

The required locus of junction to ambient thermal resistance is shown. At high input voltage, the operating junction temperature of each Schottky is 122°C, and the losses 48W. At low input voltage, the operating junction temperature is 132°C, and the losses 53W.

$$R_{JA} = \frac{132 - 50}{53}$$

$$= 1.55°C/W$$

$$R_{SA1} = R_{SA2} = (1.55 - 0.35)$$

$$= 1.2°C/W \text{ (for each Schottky)}$$

$$R_{SA} = \frac{1.2}{2}$$

$$= 0.6°C/W \text{ (combined for both Schottkys)}$$

The above information is summarized in Table 14.

3. Comparison of Heatsink Requirements for Forward and Bridge Converters

The design results for the Forward and Bridge converters shown in Table 14 illustrate an important advantage of the Bridge Converter, so far as the output Schottkys are concerned.

Circuit-Related Guideline 4: *Total Schottky losses in the Forward and Bridge Converters are essentially the same, using the same Schottkys. The heatsink for a Bridge converter, however, can be significantly smaller, because* *the symmetrical operation of the Bridge versus the asymmetrical operation of the Forward Converter results in equal power sharing between the Schottkys and a lower individual junction to sink temperature rise.*

The reason is that the Bridge does not have the "lopsided" operating condition of the Forward converter at high input voltage. This asymmetrical operation causes uneven power-sharing between the two Schottkys. The result is that the junction temperature rise of Schottky 2 above the sink is significantly greater than that of Schottky 1, allowing less permissible sink to ambient temperature difference, and demanding a larger heatsink.

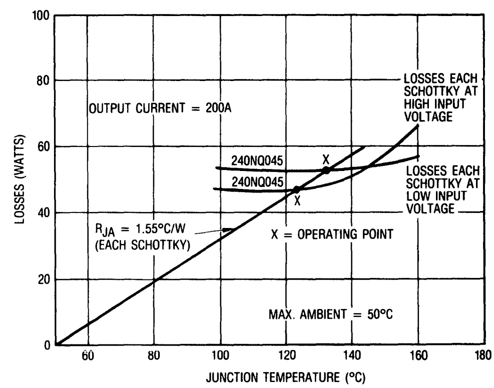
A further fact, though not specifically addressed by Table 14, is summarized as follows:

***Circuit-Related Guideline 5:** Schottkys of a given die size and process type have essentially the same worst-case design losses, regardless of their package type, for given output current, output voltage, and input voltage range. But Schottky package type will determine heatsink thermal resistance, because different package types have different junction to sink thermal resistance.*

The reason is that for a given operating junction temperature, Schottky losses are determined by the die, not (to any significant degree) by the package.

The required junction to ambient thermal resistance is set by the maximum safe junction operating temperature; for a given design ambient, this temperature will be essentially the same, regardless of Schottky package, or whether the circuit is a Forward or Bridge converter.

Differences in the junction to heatsink thermal resistance for different package types are therefore reflected directly as differences in the thermal resistance required for the external heatsink; but these differences have no significant influence on the losses. A "low" package thermal resistance means a "high" heatsink thermal resistance, and vice versa.



Notes: Conduction duty cycle at high input is 0.17 at 200A and 0.66 at 100A, each Schottky.
Conduction duty cycle at low input is 0.5 at 200A each Schottky.
Reverse voltage duty cycle at high input is 0.17 each Schottky
Reverse voltage duty cycle at low input is 0.5 each Schottky
Reverse voltage at high input is 34V
Reverse voltage at low input is 11.4V

Figure 38. Operating characteristics for 200A, 5V bridge converter with 240NQ045 Schottkys.

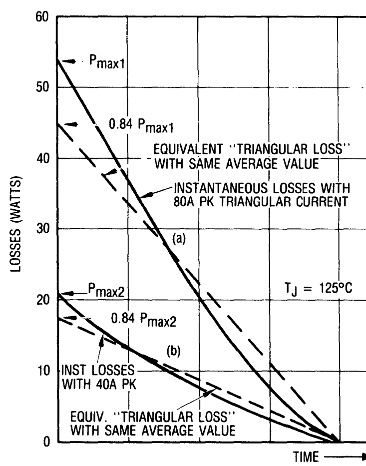


Figure 39. Instantaneous conduction losses of 20FQ045 Schottky with triangular "flyback" current waveforms of (a) 80A peak and (b) 40A peak, corresponding to average dc output currents of flyback converter of 20A and 10A respectively.

4. Flyback Converters

With reference to the operating waveforms shown in Figure 32, the assumed duty cycle of the Schottky current at full load is constant at 0.5, independent of the input voltage. Thus, the Schottky's full load conduction losses are independent of the input voltage.

Reverse power losses, on the other hand, are a function of the input voltage and are maximum at maximum input voltage.

a. Conduction Losses

The waveshape of the Schottky current is triangular, as shown in Figure 32.

The initial peak value of the Schottky current is 4x the dc output current. The average Schottky losses due to this triangular current waveform need to be calculated. A simple rule of thumb for doing this will now be demonstrated, by reference to a specific example.

Instantaneous conduction losses in a 20FQ045 Schottky, with triangular current waveforms having peak values of 80A and 40A, are shown in Figure 39. As illustrated, the average losses for each current are about the same as would be obtained with an equivalent triangular loss waveform, with an initial value of approximately 0.84 x the actual initial loss value.

This gives the following empirical rule for calculating the average conduction losses:

Average conduction losses	=	*average value of an equivalent triangular loss waveform, having a peak value of 0.84 x the actual peak losses.*

This rule is convenient, because it eliminates the need to calculate the actual instantaneous losses over the full current waveform, as has been done in Figure 39. Instead it is necessary only to calculate the value, at the initial peak of the current, then apply the rule to find the average losses.

Application of the above rule to the specific examples shown in Figure 39 gives the following results, for a Flyback Converter using the 20FQ045 Schottky, operating with a conduction duty cycle of 0.5:

Peak Flyback Current A	Average (DC) Output A	Peak Conduction Losses W	Average Conduction Losses (Peak losses x 0.84 x 0.5 x 0.5) W
40	10	20.5	4.3
80	20	53.5	11.25

b. Reverse Power Losses

The highest reverse power losses occur at maximum input voltage. Using the information in Table 11, for junction temperature T_J:

$$P_{REV} = V_{R1} \bullet (I_R @ V_{R1} @ T_J) \bullet D_{1min} + V_O \bullet (I_R @ V_O @ T_J) \bullet D_{V,IDLE} \quad (37)$$

where

$$V_{R1} = (0.5 + V_O) \frac{V_{IN\ HIGH}}{V_{IN\ LOW}} + V_o$$

$$D_{1min} = \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$$

$$D_{VIDLE} = 0.5 - 0.5 \frac{V_{IN\ LOW}}{V_{IN\ HIGH}}$$

In general, the second term of equation (37), representing the reverse power loss during the idle period, is small by comparison with the first term, and can be neglected.

c. Design Example

The design procedure to determine the operating point and heatsink requirements for a flyback converter will be illustrated by considering a 5V supply, operating over a 5:1 range of input, for the output currents and Schottky types shown in the three left hand columns of Table 15.

Figure 40 shows the calculated (combined conduction and reverse) losses of the Schottky, plotted as a function of junction temperature, for each of the above designs. Junction to ambient thermal resistance loci and design operating points are also shown. The design operating points for each situation are summarized in Table 15.

d. Schottky Performance in Flyback Converters

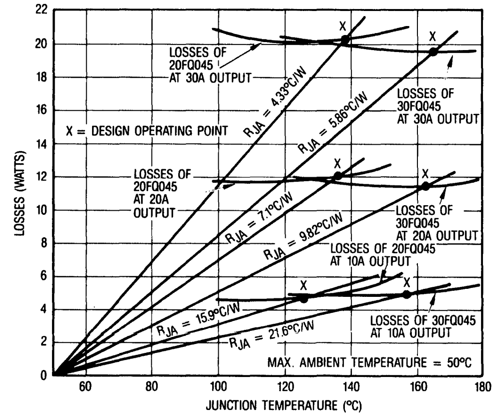
The design results summarized in Table 15 illustrate the following:

***Circuit Related Guideline 6:** In a flyback converter, a 175°C rated Schottky will generally offer similar or better efficiency, while requiring a significantly smaller heatsink, than a 150°C rated Schottky.*

The reason why the 175°C rated Schottky offers the same or better efficiency stems from the forward voltage drop characteristics of the two processes, compared earlier in Figures 5 and 6. At high peak current density, the

TABLE 15
Comparisons of design data for 5V, 10, 20 and 30A flyback converters using 20FQ045 (150°C rated) and 30FQ045 (175°C rated) Schottkys.

DC OUTPUT CURRENT A	SCHOTTKY TYPE	RATED T_{Jmax} °C	R_{JA} °C/W	R_{SA} °C/W	SCHOTTKY LOSSES W	SCHOTTKY LOSSES %	OPERATING T_J °C
10	20FQ045	150	15.9	14.1	4.6	9.2	123
10	30FQ045	175	21.6	19.9	4.85	9.7	155
20	20FQ045	150	7.1	5.4	12	12	135
20	30FQ045	175	9.82	8.1	11.4	11.4	162
30	20FQ045	150	4.33	2.6	20.3	13.5	138
30	30FQ045	175	5.86	4.1	19.6	13.0	165



Notes: Conduction duty cycle is 0.5.
Reverse voltage of 33V is applied for 0.1 duty cycle.
Reverse voltage of 5V is applied for 0.4 duty cycle.

Figure 40. Operating characteristics for 5V, 30A, 20A and 10A flyback converters using 20FQ045 (150°C T_{Jmax}) and 30FQ045 (175°C T_{Jmax} Schottkys.

forward voltage drop of a 175°C rated Schottky is about the same or lower than that of a 150°C rated Schottky.

The flyback converter operates at relatively high peak current density; it therefore favors this property of the 175°C rated Schottky.

Heatsink size required for a 175°C Schottky is significantly smaller, because the allowable junction temperature rise is greater.

B. Heatsink Temperature Constrained by System Requirement

The prime objective of the design procedure outlined so far has been to size the heatsink to provide a safe operating temperature margin for the Schottky. The resulting heatsink temperature depends upon the choice of Schottky and could typically be anywhere between 80°C and 130°C.

Sometimes system requirements will dictate that the heatsink temperature does not exceed a given maximum; this may override basic Schottky thermal stability considerations.

If the maximum design operating current is close to the rated current of the chosen Schottky, the internal junction to case temperature rise will be relatively large; the heatsink temperature will need to be relatively low and therefore may anyway be less than the maximum allowed by the system. Conversely, if the maximum design operating current is significantly lower than the Schottky's rated current, the heatsink temperature for a stable thermal design can be relatively high, and may be higher than the system will allow.

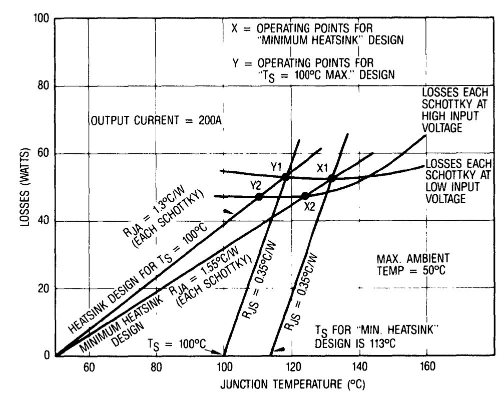
For situations where the maximum heatsink temperature must be limited, the foregoing "minimum heatsink" design procedure is valid only if the resulting heatsink temperature is lower than the allowed maximum. If not, the thermal resistance of the heatsink must be reduced, below that needed for the "minimum heatsink" design (thus adding further thermal margin to the Schottky's worst-case design operating point).

In a design where the heatsink need be determined only by the temperature capability of the Schottky, a higher T_{Jmax} class Schottky will generally yield a smaller heatsink, and a higher heatsink temperature, but not optimum efficiency.

In a design that disallows a heatsink temperature above a given maximum, a lower T_{Jmax}, more efficient, Schottky will always give a smaller heatsink, provided that the design maximum heatsink temperature allows a stable Schottky junction operating temperature.

1. Designing for a Given Heatsink Temperature

The procedure for determining the thermal resistance for a given maximum design heatsink temperature is illustrated in Figure 41.



Notes: Conduction duty cycle at high input is 0.17 at 200A and 0.66 at 100A, each Schottky
Conduction duty cycle at low input is 0.5 at 200A each Schottky.
Reverse voltage duty cycle at high input is 0.17 each Schottky.
Reverse voltage duty cycle at low input is 0.5 each Schottky.
Reverse voltage at high input is 34V.
Reverse voltage at low input is 11.4V.

Figure 41. Operating characteristics for 200A, 5V bridge converter with 240NQ045 Schottkys.

A maximum design heatsink temperature of 100°C is assumed for the Bridge converter previously considered in Figure 38. The heatsink temperature for the "minimum heatsink" design already considered is 113°C. This is now greater than the permitted design maximum.

The power losses in each Schottky for a heatsink temperature of 100°C are found by drawing the locus of the junction to sink thermal resistance for the Schottky (°.35°C/W), that passes through the temperature axis at 100°C. The corresponding operating points are Y1 and Y2, at low and high input voltage respectively.

The losses are highest at low input voltage, and are 53W per Schottky. Therefore:

$$R_{SA} = \frac{T_S - T_{AMB}}{\text{Total Schottky Losses}}$$

$$= \frac{(100 - 50)}{2 \times 53}$$

$$= 0.47°C/W$$

The above value of thermal resistance, 0.47°C/W, needed for a maximum heatsink temperature of 100°C, compares with the previously determined value of 0.6°C/W, for the "minimum heatsink" design.

VI. SILICON VERSUS HEATSINK TRADE-OFFS

As has been seen, the thermal resistance required of the heatsink, for a given power supply output current, can be significantly influenced by the choice of Schottky type, as well as by the choice of converter circuit. So far, we have observed the effect of Schottky and circuit choice, in terms of heatsink thermal resistance values — but have not related these values to the actual physical size of the heatsink.

Before considering some actual examples, it will be instructive to consider the fundamental relationship between Schottky power dissipation (hence operating current) and the required heatsink thermal resistance.[4]

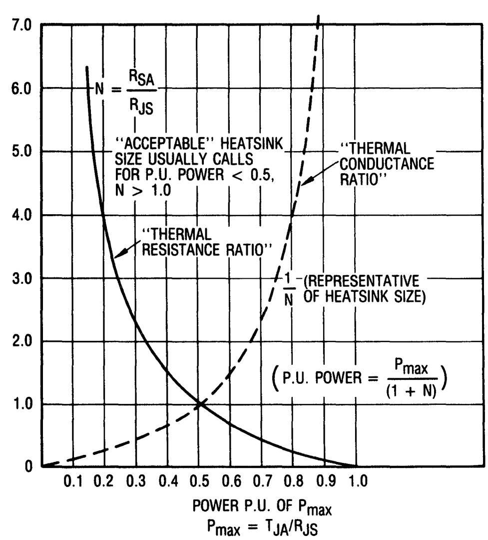


Figure 42. "Thermal resistance ratio" and "heatsink size" versus power dissipation.

[4]These fundamentals actually apply to all power semiconductors, not just Schottkys.

A. Power Dissipation vs Thermal Resistance

As the operating power dissipation in a Schottky increases, the required heatsink thermal resistance decreases more than inversely, because the increasing internal temperature rise allows less available temperture rise for the heatsink.

As more of the total available (i.e., junction to ambient) temperature rise is "used up" in the junction to sink temperature rise, less is available for the sink.

The increasing demand on the heatsink with increasing power dissipation can be expressed in terms of the *ratio* of the external (i.e., heatsink to ambient) and internal (i.e., junction to sink) thermal resistances[5]. The general relationship is shown in Figure 42. The reciprocal of the thermal resistance ratio (the thermal conductance ratio) increases much more rapidly than the increase of power.

To accentuate the problem, the physical *size* of the heatsink will generally increase more than proportionally to the thermal conductance ratio, because heatsinks become relatively less efficient thermally as they grow larger. On top of this, operating current increases less than proportionally with increasing power because the Schottky's voltage drop rises as the current rises. Thus, a point of diminishing returns is reached beyond which the heatsink size becomes disproportionate to the extra current that it permits.

For these reasons, it is rare to find a practical design for which the R_{SA}: R_{JS} *thermal resistance ratio* is less than unity. (Liquid cooling is an exception.) A *thermal resistance ratio* close to unity is representative of a design where the physical size of the heatsink will be quite large relative to the Schottky. Designs that are sensitive to heatsink size generally cannot have such a low thermal resistance ratio as this. For these designs, it will generally be necessary to use "more Schottky" and "less heatsink."

B. Design Examples

1. "Minimum heatsink" design

Figure 43 illustrates various conceivable examples of Schottky and heatsink combinations, for a 200A, 5V power supply, designed to operate over a 3:1 range of input voltage.

These examples are based upon a "minimum heatsink" design, that allows a safe operating temperature margin for the Schottky, without other constraints on the heatsink temperature. The examples consider the 200, 201, 400, and 401CNQ Schottkys, in Forward and Bridge converters.

The forced air cooled heatsink extrusion shown in Figure 45 is assumed.

The major impact of the choice of Schottky and the choice of circuit, on the heatsink size are clearly demonstrated.

[5]Case-to-sink thermal resistance is lumped with the device thermal resistance in this ratio.

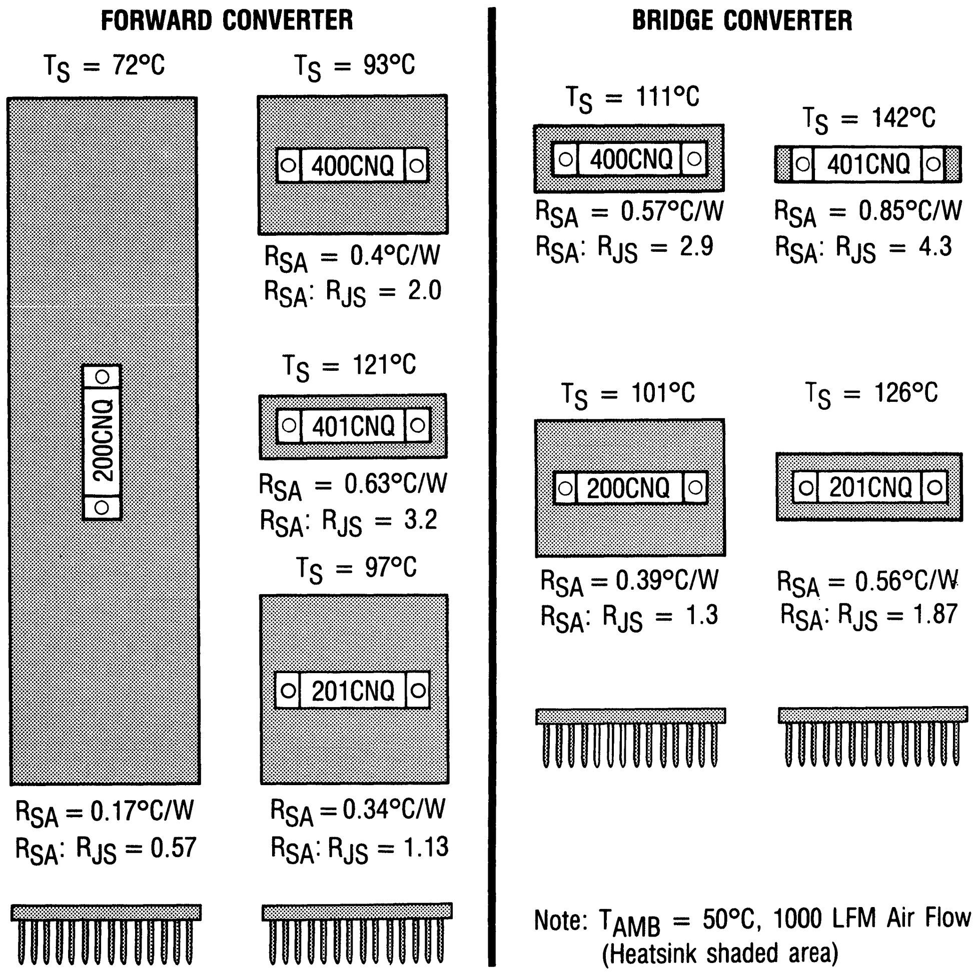


Figure 43. Various possible Schottky/heatsink choices for a 200A, 5V power supply, where heatsink temperature is determined by Schottky temperature capability only.

The following conclusions can be drawn:

(a) The 200 CNQ, in the Forward converter, requires an impractically large heatsink. The corresponding R_{SA}: R_{JS} ratio is less than 1.0.

(b) The 400A rated Schottkys generally require substantially less heatsink than the 200A rated Schottkys.

(c) The 175°C rated Schottkys (201 and 401CNQ) require significantly smaller heatsinks than the 150°C rated Schottkys (200 and 400CNQ) in any given situation. Heatsink temperatures, though, are consistently higher for the 175°C Schottkys.

(d) The Bridge circuit requires a significantly smaller heatsink than the Forward Converter for any given design situation. This is because of the symmetrical operation of the Bridge versus the asymmetrical operation of the Forward converter.

2. Heatsink temperature restricted

Figure 44 illustrates various examples of Schottky and heatsink combinations, for a 200A, 5V Bridge converter, where the overriding design criterion is that the heatsink temperature must not exceed 100°C.

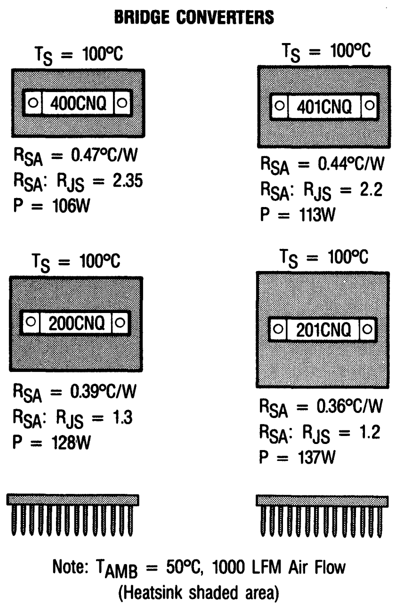


Figure 44. Comparison of various Schottky/heatsink choices for a 200A, 5V power supply where heatsink temperature is restricted to 100°C.

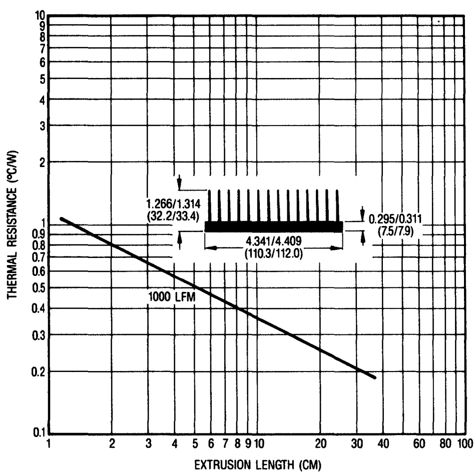


Figure 45. Typical relationship between length of heatsink extrusion and thermal resistance.

The following conclusions can be drawn:

(a) The heatsink size required for a given Schottky type is larger than that needed for the "minimum heatsink" design represented in Figure 43.

(b) The more "silicon intensive" 400/401CNQ modules require smaller heatsinks than their 200/201CNQ counterparts.

(c) The 150°C T_{Jmax} class Schottkys, with their lower losses, require smaller heatsinks than the less efficient 175°C T_{Jmax} class Schottkys.

This is a reversal of the "roles", depicted in Figure 43, for a "minimum heatsink, unrestricted sink temperature" design. In that case, the less efficient 175°C class Schottkys require smaller heatsinks, because their operating temperatures are higher.

VII. "OR-ING" SCHOTTKY

A. What It Is

Critical loads often employ parallel-connected power supplies, with redundant power capability, to enhance system reliability. In the event of failure of one or more power supplies, the healthy ones continue to supply uninterrupted power to the load.

In these situations, an OR-ING[6] rectifier is connected in series with the output of each power supply, as illustrated in Figure 46. When all power supplies operate normally, each "OR-ING" diode carries the output current of its power supply and has no reverse voltage applied. Failure of any power supply results in that OR-ING diode ceasing to carry current; instead it blocks the system output voltage, preventing current from flowing back into the faulty supply from the others.

It is critically important that the voltage drop of an OR-ING diode is low, in order to maintain the best possible system efficiency. The OR-ING diode's voltage rating need be compatible only with the system voltage, which typically will be 5V. A continuous voltage rating of 15V is therefore more than adequate for an OR-ING diode in a 5V system.

The required characteristics of an OR-ING diode lend themselves well to a low V_{RRM} class, low T_{Jmax} class Schottky. International Rectifier 15V, 100°C process Schottkys are ideally suited to this duty; in fact, they were developed specially for this purpose.

Their forward voltage drop is about 350mV, and their continuous reverse dc voltage rating is 15V. Peak transient working voltages of 25V are permissible. This allows for short-lived overvoltages that might occur, for example, during "hot" replacement of a failed power supply.

[6] The term "OR-ING" derives from the logic "OR" function, provided by a logic "OR-ING" diode. In the logic context, the function of a group of OR-ING diodes is to accept two or more input signals and deliver an output "1" signal whenever one or more inputs has a "1" value. If any input has a "0" value, that does not effect the output signal, so long as at least one signal has a "1" value.

In the power supply context, the "OR-ING" diode allows power to flow to the load whenever one or more supplies delivers normal voltage. If one or more supplies fail, or are not functional, this does not effect or load the "OR-ED" system output.

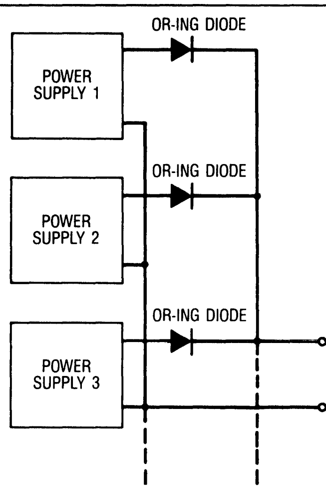


Figure 46. Connection of OR-ing diodes in the outputs of individual power supplies to provide redundancy.

B. Designing In The OR-ING Schottky

In common with other Schottkys, the forward voltage drop of International Rectifier's OR-ING Schottky decreases as operating junction temperature increases. Best efficiency is therefore obtained by allowing the OR-ING diode to operate close to its rated T_{Jmax}.

The following examples illustrate that a heatsink sized for the forward conduction losses will be more than adequate to handle the reverse power losses when the OR-ING diode switches from forward conduction to reverse blocking.

Example

Figure 47 shows the relationship between forward conduction losses and junction temperature for the International Rectifier 19TQ015 OR-ING Schottky, for continuous forward currents of 15 and 25A. The relationship between continuous reverse power and junction temperature, for an applied reverse voltage of 5V, is also shown.

Loci of junction to ambient thermal resistance are shown, for an ambient temperature of 50°C and a junction operating temperature of 90°C. Corresponding loci of junction to case thermal resistance (1.5°C/W) show that for 25A operating current, the operating case temperature will be 77°C, and for 15A, 83.5°C.

In the event of a power supply failure, the Schottky's case temperature will momentarily stay unchanged, and operation will move to point A, for the 25A design, and to point B, for the 15A design, on the reverse power loss characteristic. In either case, a solid "non-tangential" intersection point, between the locus of junction to case thermal resistance and the reverse power loss characteristic is obtained, ensuring that the operation will be stable.

As the Schottky cools down — the reverse power loss being significantly less than the previous forward conduction loss — the operating points on the reverse power characteristics will move to A' and B', for the 25A and 15A heatsink designs respectively, assuming that the Schottky is mounted on its own heatsink. If all OR-ING diodes are mounted on a common heatsink, then the operating points would stay close to A and B, for the 25A and 15A designs respectively.

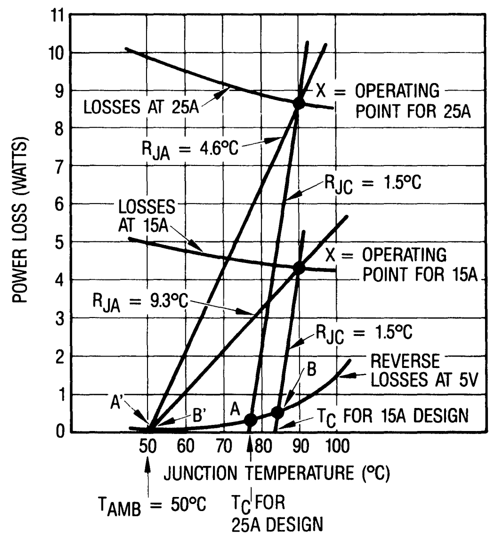


Figure 47. Characteristics and design operating points for 19TQ015 Schottky in 15A and 25A "OR-ing" application.

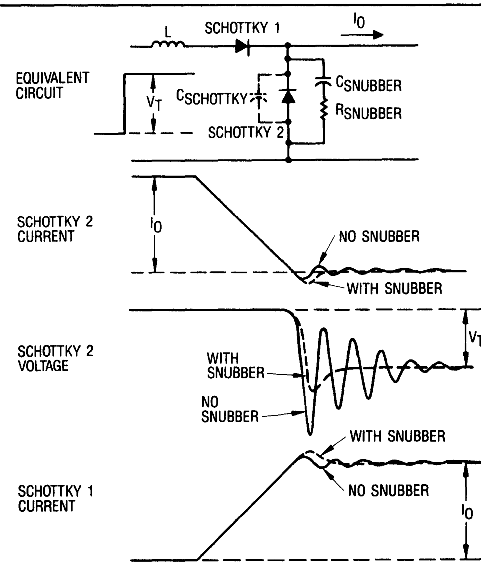


Figure 48. Equivalent circuit and operating waveforms during commutation with and without a snubber.

APPLICA-TION NOTES

VIII. SWITCHING TRANSIENTS

When current in the Schottky is rapidly switched, a voltage transient is generated, due to interaction between circuit inductance and the Schottky's self-capacitance. This happens, for example, in a Forward or Bridge Converter, whenever the output transformer voltage changes polarity. The transformer's leakage inductance, as well as "stray" circuit inductance, forms a resonant circuit with the Schottky's self-capacitance. Figure 48 shows an equivalent circuit and idealized current and voltage waveforms during commutation.

With no snubber, the reverse voltage across the outgoing Schottky overshoots, to about twice the transformer voltage; this is followed by an underdamped oscillation, at the resonant frequency of the circuit inductance with the Schottky's capacitance.[7]

A snubber serves the dual purpose of reducing the Schottky's peak reverse voltage and of damping the high frequency oscillation.

IR's Schottkys are rated to absorb avalanche energy, at voltage above the normal working voltage. This will not stop oscillation from occuring below the Schottky's avalanche voltage, which will typically be about 1.5x the Schottky's rated working voltage. The switching oscillations typically have a frequency in the range of 1 to 15 MHz and may be undesirable, because of the electrical interference they create. A snubber will usually be needed, if only to dampen the oscillation.

Thus the Schottky avalanche property will generally not eliminate the need for a snubber. What is does do is provide a valuable "insurance" against abnormal voltage transients; it also eliminates the need for a generous operating voltage margin, which allows the size and losses of the damping snubber to be minimized.

A. Snubber Circuit Design

The R-C snubber circuit requires careful dimensioning. Energy equal to $1/2\ C_{SNUBBER}\ V^2$ is dissipated each time the snubber capacitor is charged or discharged.[8] Thus total energy equal to $C_{SNUBBER}\ V^2$ is lost in each snubber during each switching cycle. ($1/2\ C_{SNUBBER}\ V^2$ when the Schottky turns ON, and $1/2\ C_{SNUBBER}\ V^2$ when it turns OFF). The snubber capacitance must be kept as small as possible, consistent with achieving the required damping of the switching oscillation, in order to minimize the snubber losses.

Though, for a given capacitance, the value of the snubber resistance has no effect upon the net energy dissipation, it does have a major effect upon the amplitude of the voltage oscillation.

If the snubber resistance is too small, then the snubber capacitance, in effect, is connected almost directly in parallel with the Schottky capacitance. The circuit will be underdamped and resonate at a frequency of $1/[2\pi \bullet \sqrt{L \bullet (C_{SCHOTTKY} + C_{SNUBBER})}]$.

If the snubber resistance is too large, it will not damp the oscillations caused by the Schottky capacitance. The circuit will now have an underdamped oscillation at a frequency of $1/[2\pi \bullet \sqrt{(L \bullet C_{SCHOTTKY}}]$.

Figures 49 through 53 show switching voltage and current waveforms, based on a linear approximation of the Schottky self-capacitance. A value of 1nF is assumed; this would be representative, for example, of a 50HQ Schottky.

Figure 49 illustrates the effect of the choice of snubber resistance, with a fixed snubber capacitance, equal to 6x the Schottky capacitance. (N = 6, where N is the ratio of snubber to Schottky capacitance). These waveforms confirm that a snubber resistance that is either too large or too small results in an oscillation that is underdamped and has substantial voltage overshoot. With the "correct" value of snubber resistance, effective damping of the oscillation is achieved; the peak voltage is kept to about 45V, for a 34V transformer voltage.

Figure 50 illustrates the effect of increasing the snubber capacitance, to 10x Schottky capacitance. The peak Schottky voltage is now just over 40V, for a 34V transformer voltage. These waveforms show virtually "perfect" damping.

Figures 51 and 52 show the effect of higher circuit inductance — 300nH and 1μH respectively-compared with 100nH in Figures 49 and 50. These waveforms demonstrate that with proper choice of the snubber resistance, the size of the snubber capacitance, for a given voltage overshoot, stays about the same with increasing circuit inductance. Of course, a larger inductance means a slower voltage rise time, and a lower amplitude snubber current.

The waveforms in Figure 53 are for a reduced transformer voltage, of 28V. The snubber capacitance values range from 6 to 2x the Schottky capacitance. The value of snubber resistance in each case is chosen to maximize the damping.

These waveforms demonstrate the trade-off between voltage overshoot and snubber capacitance. A snubber capacitance of 6x the Schottky's capacitance is needed to limit the peak Schottky voltage to 36V. The snubber capacitance can be reduced to just 2x the Schottky's capacitance, if the voltage is allowed to rise to 43V.

Thus, by taking advantage of the ruggedness of IR's Schottkys and paring down the operating voltage margin, the size and losses of the snubber can be significantly reduced.

[7] The Schottky's capacitance is non-linear and is a function of the applied voltage. The circuit operation can be approximated by assuming a linear capacitance of about the value obtained at the full circuit operating voltage.

[8] This is fundamental, and independent of the value of circuit inductance or snubber resistance. V is the level to which the capacitor voltage settles when the oscillation is completed, i.e. it is the operating voltage delivered by the output transformer, **not** the peak voltage to which the capacitor voltage may overshoot.

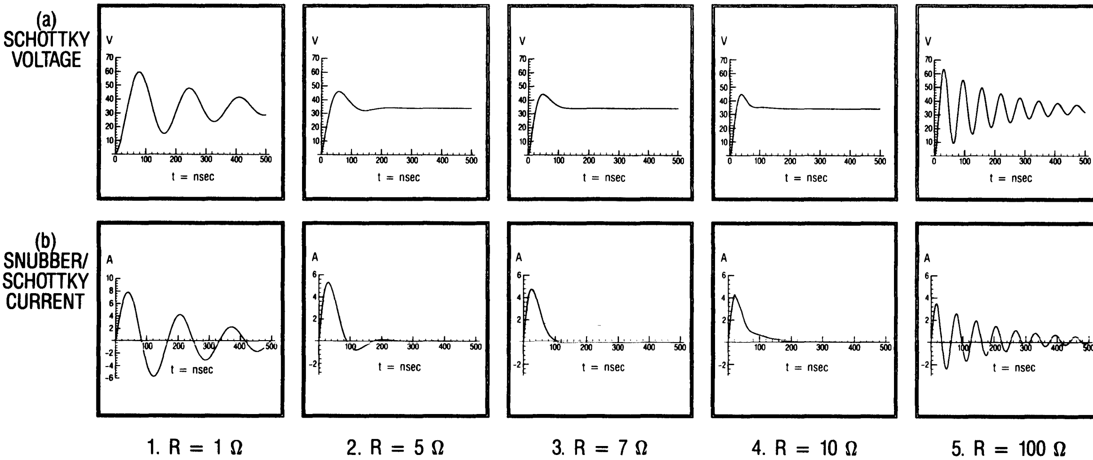


Figure 49. Waveforms of (a) commutating voltage across Schottky and (b) combined current in snubber and self-capacitance of Schottky, for various values of snubber resistance. N = $C_{Snubber}/C_{Schottky}$ = 6.

$C_{Schottky}$ = 1nF $C_{Snubber}$ = 6nF L = 100nH V_T = 34V

(Reference Figure 48)

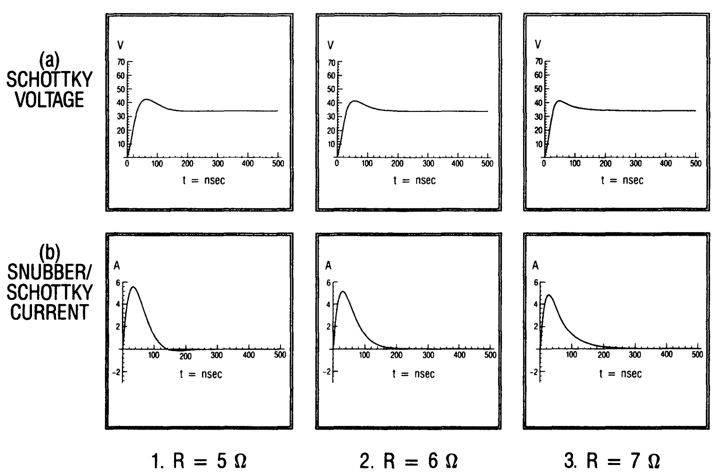


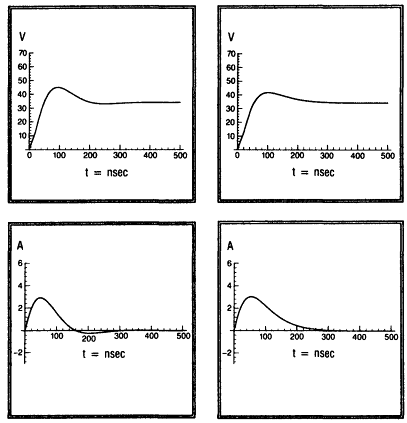
Figure 50. Waveforms of (a) commutating voltage across Schottky and (b) combined current in snubber and self-capacitance of Schottky, for various values of snubber resistance. N = $C_{Snubber}/C_{Schottky}$ = 10.

$C_{Schottky}$ = 1nF $C_{Snubber}$ = 10nF L = 100nH V_T = 34V

(Reference Figure 48)

(a) SCHOTTKY VOLTAGE

(b) SNUBBER/ SCHOTTKY CURRENT



N = 6 $C_{Snubber}$ = 6nF

N = 10 $C_{Snubber}$ = 10nF

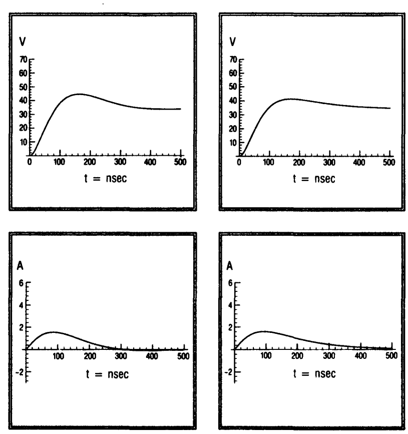
Figure 51. Waveforms of (a) commutating voltage across Schottky and (b) combined current in snubber and self-capacitance of Schottky, for different values of snubber capacitance. (= N x Schottky Capacitance).

$C_{Schottky}$ = 1nF $R_{Snubber}$ = 10 Ohms L = 300nH V_T = 34V

(Reference Figure 48)

(a) SCHOTTKY VOLTAGE

(b) SNUBBER/ SCHOTTKY CURRENT



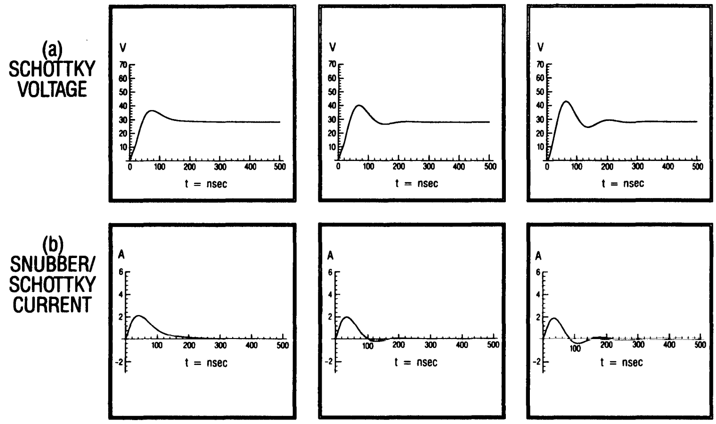
N = 6 $C_{Snubber}$ = 6nF

N = 10 $C_{Snubber}$ = 10nF

Figure 52. Waveforms of (a) commutating voltage across Schottky and (b) combined current in snubber and self-capacitance of Schottky, for different values of snubber capacitance. (= N x Schottky Capacitance).

$C_{Schottky}$ = 1nF $R_{Snubber}$ = 20 Ohms L = 1μH V_T = 34V

(Reference Figure 48)



N = 6	N = 3	N = 2
$C_{Snubber}$ = 6nF	$C_{Snubber}$ = 3nF	$C_{Snubber}$ = 2nF
$R_{Snubber}$ = 15Ω	$R_{Snubber}$ = 18Ω	$R_{Snubber}$ = 23Ω

Figure 53. Waveforms of (a) commutating voltage across Schottky and (b) combined current in snubber and self-capacitance of Schottky, for various values of snubber resistance.

$C_{Schottky}$ = 1nF L = 300nH V_T = 34V

(Reference Figure 48)

IX. SCHOTTKY RECTIFIER SELECTION GUIDES FOR SWITCHING POWER SUPPLIES

Tables 16 through 18 show Schottky Rectifier Selection Guides for "Forward," "Bridge" and "Flyback" converters for a range of output currents and output voltages.

The following explanations will help in using these Tables:

- Tables 16(a) through (g) cover Forward Converters, with output currents from 5 to 30A. These Tables apply to the "single-ended" and "double-ended" Forward Converter circuits shown in Figure 27.
- Bridge Converters are not covered below output current of 50A, because they are generally not used at lower current levels.
- Tables 17(a) through 17(i) cover Forward and Bridge Converters, with Output Currents from 50 to 400A. Forward Converters can be "single" or "double-ended," as shown in Figure 27. Bridge Converters can be "half-bridge" or "full bridge," as shown in Figure 29.
- Tables 18(a) through 18(f) cover Flyback Converters, with output currents from 5 - 150A. These Tables apply to a Flyback converter operating in the "total energy transfer" mode, with a fixed conduction duty cycle of 50%, as depicted in Figure 32.
- For each power supply specification, the possible Schottky choices are grouped first by package type. For each package type, several choices of specific Schottky type may generally be possible. These choices show how "Schottky silicon" (within the given package) can be traded against the heatsink thermal resistance and losses.
- For each Schottky type, two selections of heatsink thermal resistance — R_{SA} and $R_{SA(100)}$ — are shown.

R_{SA} represents the "minimum heatsink" design (i.e. the largest possible value of thermal resistance). This value is based on a design safety margin which allows the ambient temperature to rise 10°C above the design maximum, before the Schottky operating junction temperature will reach T_{Jmax}.

The second value of heatsink thermal resistance, $R_{SA(100)}$, is needed to keep the heatsink temperature to 100°C — even though the Schottkys themselves can be safely operated at higher heatsink temperature.

This gives a point of reference for design situations where system constraints, other than the capabilities of the Schottkys themselves, dictate the heatsink

The Schottky losses obtained with $R_{SA(100)}$ are generally higher than those for the "minimum" heatsink, because conduction losses are higher at lower operating temperature.

- The maximum range of input voltage specified in the selection Guides is the maximum range permitted by the voltage rating of the Schottky; it corresponds to a 33% margin between the peak transformer voltage (exclusive of the switching transient) and the Schottky's rated working voltage.

Heatsink thermal resistance required for a lower input voltage range will generally be higher (i.e. the heatsink will be smaller). This is particularly so for the Forward Converters, for which the greater the range of input voltage, the greater the asymmetry of conduction between the Schottkys.

- The Selection Guides are based on a maximum design ambient temperature of 50°C.

The heatsink thermal resistance required for a higher maximum design ambient temperature can be estimated using the formula in the footnote of the Table. This formula assumes that the heatsink has the same temperature (and therefore the Schottky has the same operating junction temperature) as at 50°C ambient. This is conservative for the "minimum heatsink" (R_{SA}) value, because for a given margin of 10°C in the design *ambient* temperature, the greater "temperature stability" of the larger heatsink for higher *ambient* actually would allow a somewhat higher Schottky operating *junction* temperature.

Conversely, the formula applied to a lower ambient temperature will yield a slightly optimistic value for R_{SA}, and should be used as a guideline only, recognizing that the actual value for R_{SA} will be rather lower than that calculated. □

Schottky Diode Designer's Manual

SCHOTTKY SELECTION GUIDE

For "Forward Converters"

International Rectifier

APPLICATION NOTES

TABLE 16a
Schottky selection guide for "forward" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} °C/W	Max Total Schottky Loss %(I_O•V_O) %	Max T_S °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_S=100°C $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
5	5	3:1	6TQ045	10TQ045	175	36.7	9.0	133	136	135	21.2	9.4
5	5	3:1	6TQ045	6TQ045	175	37.0	10.3	145	146	150	19.1	10.5
5	5	3:1	12CTQ045	12CTQ045	175	35.5	10.2	141	143	150	19.2	10.4
5	12	3:1	8TQ100	8TQ100	175	21.8	4.5	109	111	115	18.4	4.5
5	12	3:1	16CTQ100	16CTQ100	175	22.2	4.5	110	114	119	18.5	4.5
5	12	4:1	10CTQ150	10CTQ150	175	24.7	6.0	139	144	153	13.2	6.3
5	15	2:1	8TQ080	8TQ080	175	18.9	3.7	102	104	107	18.3	3.7
5	15	2:1	16CTQ080	16CTQ080	175	19.3	3.6	102	108	111	18.4	3.6
5	15	3.4:1	10CTQ150	10CTQ150	175	22.9	4.9	134	139	148	13.2	5.0
7.5	2.5	3.5:1	32CTQ030	32CTQ030	150	19.1	14.8	103	107	113	18.1	14.8
7.5	5	3:1	6TQ045	10TQ045	175	24.4	10.0	142	147	149	12.8	10.5
7.5	5	3:1	6TQ045	6TQ045	175	23.4	11.1	147	149	156	12.1	11.1
7.5	5	3:1	15CTQ045	15CTQ045	150	14.9	11.0	112	119	127	12.2	10.9
7.5	5	3:1	12CTQ045	12CTQ045	175	21.8	11.0	140	147	156	12.1	11.0
7.5	5	3:1	20CTQ045	20CTQ045	175	19.4	10.8	129	134	143	12.4	10.8
7.5	12	3:1	8TQ100	8TQ100	175	16.2	5.0	123	126	132	11.0	5.1
7.5	12	3:1	16CTQ100	16CTQ100	175	15.9	4.9	120	127	135	11.2	5.0
7.5	12	4:1	10CTQ150	10CTQ150	175	14.8	6.6	137	149	160	7.9	7.1
7.5	15	2:1	8TQ080	8TQ080	175	14.5	4.0	115	120	123	11.1	4.0
7.5	15	2:1	16CTQ080	16CTQ080	175	14.3	4.0	114	122	128	11.2	4.0
7.5	15	3.4:1	10CTQ150	10CTQ150	175	14.1	5.3	135	146	158	7.9	5.7

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S − T_{amb})/((I_O•V_O)•Total Schottky Loss %).

TABLE 16b
Schottky selection guide for "forward" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} °C/W	Max Total Schottky Loss $\%(I_O \bullet V_O)$ %	Max T_S °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for $T_S = 100°C$ $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
10	2.5	3.5:1	32CTQ030	32CTQ030	150	15.2	14.9	107	112	120	13.4	14.9
10	5	2:1	32CTQ030	32CTQ030	150	10.9	7.8	92	100	105		
10	5	3:1	12TQ045	20TQ045	150	11.6	8.8	101	106	108	11.3	8.8
10	5	3:1	12TQ045	12TQ045	150	12.0	9.1	105	109	114	11.0	9.1
10	5	3:1	18TQ045	18TQ045	175	16.3	9.5	127	129	135	10.5	9.5
10	5	3:1	10TQ045	10TQ045	175	17.3	10.3	139	141	149	9.6	10.4
10	5	3:1	10TQ045	18TQ045	175	17.4	9.6	133	139	141	10.1	9.9
10	5	3:1	6TQ045	10TQ045	175	18.0	10.6	146	153	155	8.8	11.4
10	5	3:1	6TQ045	18TQ045	175	18.1	10.3	143	150	148	9.1	10.9
10	5	3:1	15CTQ045	15CTQ045	150	10.0	11.7	109	120	130	8.6	11.6
10	5	3:1	25CTQ045	25CTQ045	150	10.8	9.1	99	107	115		
10	5	3:1	20CTQ045	20CTQ045	175	13.9	11.5	130	140	150	8.7	11.5
10	5	3:1	12CTQ045	12CTQ045	175	15.2	11.7	139	151	161	8.1	12.3
10	5	3:1	30CTQ045	30CTQ045	175	16.0	10.2	132	140	149	9.7	10.3
10	5	3:1	30CPQ045	30CPQ045	150	11.1	10.7	109	114	121	9.4	10.7
10	5	3:1	40CDQ045	40CDQ045	175	15.9	9.5	125	128	135	10.5	9.5
10	5	4:1	30CTQ060	30CTQ060	150	10.4	10.3	103	112	122	9.7	10.2
10	5	4:1	30CPQ060	30CPQ060	150	11.6	10.3	110	115	122	9.8	10.2
10	12	1.7:1	30CTQ060	30CTQ060	150	7.7	4.3	90	100	105		
10	12	1.7:1	30CPQ060	30CPQ060	150	8.6	4.3	95	101	105		
10	12	3:1	16CTQ100	16CTQ100	175	12.1	5.1	124	136	145	7.9	5.3
10	12	3:1	30CPQ100	30CPQ100	175	13.2	5.1	131	137	144	7.8	5.3
10	12	4:1	10CTQ150	10CTQ150	175	9.8	6.9	131	149	163	5.7	7.4
10	12	4:1	30CPQ150	30CPQ150	175	12.1	5.9	135	141	151	6.8	6.1
10	15	2:1	16CTQ080	16CTQ080	175	11.2	4.1	120	132	139	7.9	4.2

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, $R_{sa} = (\text{Max } T_S - T_{amb})/((I_O \bullet V_O) \bullet \text{Total Schottky Loss } \%)$.

TABLE 16c
Schottky selection guide for "forward" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} °C/W	Max Total Schottky Loss %(I_O•V_O) %	Max T_S °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_S=100°C $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
10	15	2:1	30CPQ080	30CPQ080	175	12.2	4.1	126	133	138	7.8	4.3
10	15	3.4:1	10CTQ150	10CTQ150	175	9.5	5.6	129	147	161	5.6	5.9
10	15	3.4:1	30CPQ150	30CPQ150	175	11.2	4.8	130	136	146	6.8	4.9
15	2.5	3.5:1	55HQ030	55HQ030	150	9.2	13.1	95	97	100		
15	2.5	3.5:1	32CTQ030	32CTQ030	150	8.2	17.7	104	117	128	7.5	17.6
15	2.5	3.5:1	62CNQ030	62CNQ030	150	8.8	13.5	95	97	101		
15	5	2:1	32CTQ030	32CTQ030	150	6.5	9.1	94	107	116		
15	5	3:1	12TQ045	20TQ045	150	7.5	10.3	108	117	120	6.5	10.2
15	5	3:1	10TQ045	18TQ045	175	10.8	10.9	138	148	152	5.9	11.3
15	5	3:1	6TQ045	10TQ045	175	17.9	7.6	153	165	154	8.0	8.4
15	5	3:1	20FQ045	20FQ045	150	7.4	8.2	96	99	104		
15	5	3:1	15CTQ045	15CTQ045	150	4.5	13.8	97	119	135		
15	5	3:1	25CTQ045	25CTQ045	150	5.9	10.8	98	114	126		
15	5	3:1	20CTQ045	20CTQ045	175	7.3	13.3	123	142	158	5.0	13.3
15	5	3:1	30CTQ045	30CTQ045	175	9.1	11.8	130	148	161	5.3	12.6
15	5	3:1	30CPQ045	30CPQ045	150	7.0	11.0	108	117	126	6.1	10.9
15	5	3:1	40CDQ045	40CDQ045	175	9.9	10.8	130	137	147	6.2	10.7
15	5	4:1	30CTQ060	30CTQ060	150	5.7	11.6	99	117	132		
15	5	4:1	30CPQ060	30CPQ060	150	6.9	11.6	111	121	131	5.8	11.6
15	12	1.7:1	30CTQ060	30CTQ060	150	4.8	5.0	93	110	119		
15	12	1.7:1	30CPQ060	30CPQ060	150	5.8	5.0	102	112	118	5.5	5.0
15	12	3:1	16CTQ100	16CTQ100	175	6.9	5.6	120	141	155	4.8	5.8
15	12	3:1	30CPQ100	30CPQ100	175	8.1	5.6	132	144	154	4.7	5.9
15	12	4:1	30CPQ150	30CPQ150	175	7.2	6.4	133	147	159	4.1	6.9

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S – T_{amb})/((I_O•V_O)•Total Schottky Loss %).

TABLE 16d
Schottky selection guide for "forward" converters.

Output Current I_o A	Output Voltage V_o V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} °C/W	Max Total Schottky Loss %(I_o•V_o) %	Max T_s °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_s=100°C $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
15	15	2:1	16CTQ080	16CTQ080	175	6.7	4.6	119	139	151	4.8	4.7
15	15	2:1	30CPQ080	30CPQ080	175	7.7	4.6	130	142	150	4.7	4.8
15	15	3.4:1	30CPQ150	30CPQ150	175	6.8	5.2	130	144	156	4.0	5.5
20	2.5	3.5:1	55HQ030	55HQ030	150	7.8	13.9	104	106	111	7.2	14.0
20	2.5	3.5:1	32CTQ030	32CTQ030	150	5.2	18.3	98	116	131		
20	2.5	3.5:1	62CNQ030	62CNQ030	150	7.3	14.2	102	105	111	7.1	14.2
20	5	2:1	55HQ030	55HQ030	150	5.2	7.4	88	91	94		
20	5	2:1	32CTQ030	32CTQ030	150	4.5	9.3	92	111	122		
20	5	2:1	62CNQ030	62CNQ030	150	4.9	7.5	86	91	94		
20	5	3:1	12TQ045	20TQ045	150	5.3	11.0	109	121	126	4.6	10.8
20	5	3:1	10TQ045	10TQ045	175	6.9	12.2	134	148	160	4.0	12.4
20	5	3:1	10TQ045	18TQ045	175	7.8	11.3	138	153	156	4.3	11.7
20	5	3:1	20FQ045	20FQ045	150	5.7	8.7	100	106	112		
20	5	3:1	30FQ045	30FQ045	175	8.2	9.9	131	137	145	5.0	10.0
20	5	3:1	25CTQ045	25CTQ045	150	3.6	11.3	91	114	131		
20	5	3:1	20CTQ045	20CTQ045	175	4.4	14.0	112	141	161	3.6	14.0
20	5	3:1	30CTQ045	30CTQ045	175	5.5	12.5	119	146	163	3.9	13.0
20	5	3:1	30CPQ045	30CPQ045	150	4.6	11.7	104	118	130	4.3	11.6
20	5	3:1	40CPQ045	40CPQ045	150	5.5	9.1	100	106	113	5.5	9.1
20	5	3:1	40CDQ045	40CDQ045	175	7.2	11.0	129	141	153	4.5	11.0
20	5	3:1	60CNQ045	60CNQ045	150	5.3	8.4	94	99	104		
20	5	3:1	61CNQ045	61CNQ045	175	8.2	9.2	125	129	136	5.4	9.2
20	5	4:1	30CTQ060	30CTQ060	150	3.2	12.3	90	115	135		
20	5	4:1	30CPQ060	30CPQ060	150	4.5	12.3	106	121	134	4.1	12.3
20	5	4:1	40CPQ060	40CPQ060	150	5.6	10.2	107	114	122	4.9	10.1

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_s − T_{amb})/((I_o•V_o)•Total Schottky Loss %).

TABLE 16e
Schottky selection guide for "forward" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} ° C/W	Max Total Schottky Loss %(I_O•V_O) %	Max T_S °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_S=100°C $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
20	12	1.7:1	30CTQ060	30CTQ060	150	3.0	5.3	88	114	126		
20	12	1.7:1	30CPQ060	30CPQ060	150	4.0	5.3	101	117	125	3.9	5.3
20	12	1.7:1	40CPQ060	40CPQ060	150	4.1	4.3	92	101	105		
20	12	3:1	30CPQ100	30CPQ100	175	5.6	5.8	128	146	159	3.4	6.2
20	12	3:1	40CPQ100	40CPQ100	175	6.2	5.1	125	134	143	4.0	5.2
20	12	3:1	63CNQ100	63CNQ100	175	5.8	4.9	118	125	132	4.2	5.0
20	12	4.2:1	30CPQ150	30CPQ150	175	4.9	6.5	126	147	162	3.0	7.0
20	15	2:1	30CPQ080	30CPQ080	175	5.5	4.8	128	146	156	3.4	5.0
20	15	2:1	40CPQ080	40CPQ080	175	5.7	4.1	120	130	136	4.0	4.2
20	15	2:1	63CNQ080	63CNQ080	175	5.2	4.0	112	120	125	4.2	4.0
20	15	3.4:1	30CPQ150	30CPQ150	175	4.7	5.3	125	146	161	3.0	5.6
25	2.5	3.5:1	55HQ030	55HQ030	150	6.5	14.9	111	114	120	5.3	15.2
25	2.5	3.5:1	32CTQ030	32CTQ030	150	2.8	22.6	90	120	139		
25	2.5	3.5:1	62CNQ030	62CNQ030	150	5.9	15.0	105	110	116	5.3	15.0
25	5	2:1	55HQ030	55HQ030	150	4.6	8.0	96	100	104		
25	5	2:1	32CTQ030	32CTQ030	150	2.7	11.6	89	119	134		
25	5	2:1	62CNQ030	62CNQ030	150	4.1	7.8	90	96	101		
25	5	3:1	12TQ045	20TQ045	150	3.8	11.9	106	125	131	3.4	11.9
25	5	3:1	10TQ045	18TQ045	175	5.7	12.4	138	158	160	3.1	13.0
25	5	3:1	20FQ045	20FQ045	150	4.4	9.7	103	112	120	4.1	9.7
25	5	3:1	20FQ045	50HQ045	150	4.9	9.0	105	115	115	4.4	9.0
25	5	3:1	30FQ045	30FQ045	175	6.2	10.7	133	142	152	3.6	11.0
25	5	3:1	30FQ045	75HQ045	175	6.9	10.1	137	147	148	3.8	10.5
25	5	3:1	30CTQ045	30CTQ045	175	3.2	13.6	103	140	163	2.9	13.6
25	5	3:1	30CPQ045	30CPQ045	150	3.0	12.6	98	118	133		

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S – T_{amb})/((I_O•V_O)•Total Schottky Loss %).

TABLE 16f
Schottky selection guide for "forward" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} ° C/W	Max Total Schottky Loss $\%(I_O \bullet V_O)$ %	Max T_S °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for $T_S = 100°C$ $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
25	5	3:1	40CPQ045	40CPQ045	150	4.0	10.5	102	112	121	3.8	10.5
25	5	3:1	40CDQ045	40CDQ045	175	5.2	11.9	127	144	158	3.3	12.2
25	5	3:1	84CNQ045	84CNQ045	125	3.6	8.1	87	92	98		
25	5	3:1	60CNQ045	60CNQ045	150	4.2	9.3	99	106	113		
25	5	3:1	61CNQ045	61CNQ045	175	6.5	9.8	129	135	143	4.1	9.8
25	5	4:1	30CPQ060	30CPQ060	150	2.8	13.4	97	119	136		
25	5	4:1	40CPQ060	40CPQ060	150	4.1	11.1	107	117	127	3.6	11.0
25	12	1.7:1	30CPQ060	30CPQ060	150	2.7	5.8	97	119	130		
25	12	1.7:1	40CPQ060	40CPQ060	150	3.2	4.7	95	107	112		
25	12	3:1	30CPQ100	30CPQ100	175	3.9	6.2	122	147	163	2.5	6.6
25	12	3:1	40CPQ100	40CPQ100	175	4.6	5.5	126	139	149	2.9	5.7
25	12	3:1	63CNQ100	63CNQ100	175	4.6	5.2	122	132	141	3.2	5.3
25	12	4:1	30CPQ150	30CPQ150	175	3.1	7.1	117	145	164	2.2	7.4
25	15	2:1	30CPQ080	30CPQ080	175	3.9	5.0	124	148	161	2.5	5.3
25	15	2:1	40CPQ080	40CPQ080	175	4.3	4.5	123	136	144	2.9	4.5
25	15	2:1	63CNQ080	63CNQ080	175	4.3	4.2	117	127	134	3.2	4.2
25	15	3.4:1	30CPQ150	30CPQ150	175	3.1	5.7	116	144	163	2.2	5.9
30	2.5	3.5:1	55HQ030	55HQ030	150	5.5	14.2	109	112	118	4.7	14.2
30	2.5	3.5:1	62CNQ030	62CNQ030	150	4.9	15.2	106	112	120	4.4	15.2
30	5	2:1	55HQ030	55HQ030	150	4.0	7.6	95	100	104		
30	5	2:1	62CNQ030	62CNQ030	150	3.6	7.9	92	100	105		
30	5	3:1	20TQ045	20TQ045	150	2.7	12.5	101	118	132	2.6	12.5
30	5	3:1	12TQ045	20TQ045	150	2.8	12.6	102	126	133	2.6	12.6

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, $R_{sa} = (\text{Max } T_S - T_{amb})/((I_O \bullet V_O) \bullet \text{Total Schottky Loss \%})$.

TABLE 16g
Schottky selection guide for "forward" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} ° C/W	Max Total Schottky Loss %(I_O•V_O) %	Max T_S °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_S=100°C $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
30	5	3:1	18TQ045	18TQ045	175	4.0	12.8	127	145	159	2.6	12.9
30	5	3:1	20FQ045	20FQ045	150	3.5	9.9	102	113	123	3.4	9.9
30	5	3:1	20FQ045	50HQ045	150	4.1	9.3	106	118	119	3.6	9.2
30	5	3:1	30FQ045	30FQ045	175	5.2	10.6	132	144	155	3.1	10.9
30	5	3:1	30FQ045	75HQ045	175	5.6	10.4	138	148	151	3.1	10.6
30	5	3:1	30FQ045	85HQ045	175	6.2	9.6	139	153	152	3.2	10.3
30	5	3:1	30CPQ045	30CPQ045	150	2.1	13.0	92	116	135		
30	5	3:1	40CPQ045	40CPQ045	150	3.2	10.8	102	114	125	3.1	10.8
30	5	3:1	40CDQ045	40CDQ045	175	3.5	12.8	118	142	160	2.6	12.9
30	5	3:1	60CDQ045	60CDQ045	175	3.7	12.4	119	142	159	2.7	12.5
30	5	3:1	60CNQ045	60CNQ045	150	3.4	9.8	100	109	118	3.4	9.8
30	5	3:1	61CNQ045	61CNQ045	175	5.3	10.1	130	138	148	3.3	10.1
30	5	4:1	30CPQ060	30CPQ060	150	1.8	14.0	89	117	138		
30	5	4:1	40CPQ060	40CPQ060	150	3.1	11.6	104	118	131	2.9	11.6
30	12	1.7:1	30CPQ060	30CPQ060	150	1.9	6.0	92	120	132		
30	12	1.7:1	40CPQ060	40CPQ060	150	2.6	5.0	96	110	118		
30	12	3:1	60HQ100	60HQ100	175	4.4	4.9	128	136	144	2.8	5.0
30	12	3:1	30CPQ100	30CPQ100	175	2.8	6.4	114	145	164	2.1	6.6
30	12	3:1	40CPQ100	40CPQ100	175	3.7	5.6	124	141	153	2.4	5.8
30	12	3:1	63CNQ100	63CNQ100	175	3.8	5.4	124	136	147	2.5	5.5
30	12	4:1	30CPQ150	30CPQ150	175	2.1	7.4	107	143	165	1.8	7.5
30	15	2:1	60HQ080	60HQ080	175	4.1	4.0	123	131	137	2.8	4.0
30	15	2:1	30CPQ080	30CPQ080	175	2.9	5.2	116	147	162	2.1	5.3
30	15	2:1	40CPQ080	40CPQ080	175	3.5	4.6	122	139	149	2.4	4.6
30	15	2:1	63CNQ080	63CNQ080	175	3.6	4.3	120	133	141	2.5	4.4
30	15	3.4:1	30CPQ150	30CPQ150	175	2.1	5.9	106	142	164	1.8	6.0

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S – T_{amb})/((I_O•V_O)•Total Schottky Loss %).

Schottky Diode Designer's Manual

SCHOTTKY SELECTION GUIDE

For "Forward" and "Bridge" Converters

International IOR Rectifier

APPLICATION NOTES

TABLE 17a

Schottky selection guide for "forward" and "bridge" converters.

						FORWARD CONVERTERS							BRIDGE CONVERTERS					
Output Current I_O	Output Voltage V_O	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax}	Heatsink R_{sa}	Max Total Schottky Loss $\%(I_O \bullet V_O)$	Max T_S	Max wkg jn temp. Schottky1	Max wkg jn temp. Schottky2	Heatsink for T_S=100°C $R_{sa}(100)$	Max Total Schottky Loss with $R_{sa}(100)$	Heatsink R_{sa}	Max Total Schottky Loss	Max T_S	Max wkg jn temp.	Heatsink for T_S=100°C $R_{sa}(100)$	Max Total Schottky Loss with $R_{sa}(100)$
A	V				°C	° C/W	%	°C	°C	°C	° C/W	%	° C/W	%	°C	°C	° C/W	%
50	2.5	3.5:1	55HQ030	55HQ030	150	3.02	16.4	112	121	131	2.43	16.5	3.74	15.7	123	134	2.44	16.4
50	2.5	3.5:1	152CMQ030	152CMQ030	150	2.62	17.6	108	119	130	2.28	17.5	3.36	17.0	121	134	2.31	17.3
50	2.5	3.5:1	62CNQ030	62CNQ030	150	2.57	17.2	105	120	132	2.33	17.2	3.39	16.4	120	135	2.35	17.0
50	2.5	3.5:1	82CNQ030	82CNQ030	150	2.65	16.8	106	120	131	2.39	16.8	3.47	16.0	120	134	2.40	16.6
50	2.5	3.5:1	122NQ030	122NQ030	150	3.30	14.2	109	111	117	2.79	14.4	3.70	13.5	112	117	2.84	14.1
50	5	2:1	55HQ030	55HQ030	150	2.47	8.5	103	113	120	2.34	8.5	2.84	8.3	109	120	2.40	8.3
50	5	2:1	152CMQ030	152CMQ030	150	2.17	9.1	99	111	119			2.56	8.8	107	120	2.26	8.8
50	5	2:1	62CNQ030	62CNQ030	150	2.11	8.9	97	112	121			2.54	8.7	105	121	2.30	8.7
50	5	2:1	122NQ030	122NQ030	150	2.29	7.5	93	97	101			2.44	7.3	95	100		
50	5	3:1	50HQ045	50HQ045	150	2.09	10.6	105	118	129	1.90	10.5	2.66	10.2	118	132	1.93	10.3
50	5	3:1	20FQ045	50HQ045	150	2.11	10.9	107	132	130	1.83	10.9						
50	5	3:1	30FQ045	30FQ045	175	2.31	11.8	118	144	161	1.66	12.0	3.13	11.5	140	165	1.66	12.0
50	5	3:1	30FQ045	85HQ045	175	3.24	10.8	138	163	160	1.75	11.5						
50	5	3:1	85HQ045	85HQ045	175	3.27	10.4	135	147	158	1.84	10.9	4.03	10.0	151	164	1.84	10.9
50	5	3:1	150CMQ045	150CMQ045	150	1.88	10.8	101	116	128	1.83	10.8	2.48	10.6	116	131	1.90	10.5
50	5	3:1	151CMQ045	151CMQ045	175	2.83	11.3	130	145	158	1.76	11.4	3.58	10.9	148	164	1.76	11.4
50	5	3:1	60CDQ045	60CDQ045	175	0.92	14.9	84	133	164			1.87	14.6	118	165	1.36	14.7
50	5	3:1	60CNQ045	60CNQ045	150	1.55	11.5	95	114	129			2.20	11.3	112	132	1.78	11.2
50	5	3:1	61CNQ045	61CNQ045	175	2.51	11.6	123	142	158	1.72	11.6	3.31	11.3	144	164	1.72	11.6
50	5	3:1	200CNQ045	200CNQ045	150	2.37	8.3	99	104	110			2.68	8.0	104	110	2.48	8.1
50	5	3:1	201CNQ045	201CNQ045	175	3.27	10.1	133	137	145	1.96	10.2	3.76	9.7	141	148	1.96	10.2
50	5	3:1	120NQ045	120NQ045	150	2.40	8.3	100	104	109	2.40	8.3	2.70	8.0	104	110	2.48	8.1
50	5	3:1	121NQ045	121NQ045	175	3.71	8.8	131	134	141	2.28	8.8	4.20	8.4	138	144	2.29	8.7
50	12	3:1	60HQ100	60HQ100	175	2.44	5.3	128	144	157	1.48	5.6	3.08	5.1	145	161	1.48	5.6
50	12	3:1	153CMQ100	153CMQ100	175	2.00	5.9	121	142	156	1.38	6.1	2.66	5.7	142	162	1.38	6.1
50	12	3:1	63CNQ100	63CNQ100	175	1.81	6.0	115	140	158	1.37	6.1	2.53	5.8	138	163	1.37	6.1
50	12	3:1	203CNQ100	203CNQ100	175	2.45	5.1	125	132	140	1.60	5.2	2.83	4.9	134	143	1.60	5.2
50	12	3:1	123NQ100	123NQ100	175	2.53	5.1	127	133	141	1.59	5.2	2.90	4.9	135	143	1.59	5.2

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S − T_{amb})/(($I_O \bullet V_O$)•Total Schottky Loss %).

TABLE 17b
Schottky selection guide for "forward" and "bridge" converters.

Output Current I_O (A)	Output Voltage V_O (V)	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} (°C)	FORWARD CONVERTERS: Heatsink R_{sa} (° C/W)	Max Total Schottky Loss $\%(I_O \bullet V_O)$ (%)	Max T_S (°C)	Max wkg jn temp. Schottky1 (°C)	Max wkg jn temp. Schottky2 (°C)	Heatsink for T_S=100°C $R_{sa}(100)$ (° C/W)	Max Total Schottky Loss with $R_{sa}(100)$ (%)	BRIDGE CONVERTERS: Heatsink R_{sa} (° C/W)	Max Total Schottky Loss (%)	Max T_S (°C)	Max wkg jn temp. (°C)	Heatsink for T_S=100°C $R_{sa}(100)$ (° C/W)	Max Total Schottky Loss with $R_{sa}(100)$ (%)
50	15	2:1	60HQ080	60HQ080	175	2.35	4.4	127	143	153	1.48	4.5	2.79	4.2	139	156	1.48	4.5
50	15	2:1	153CMQ080	153CMQ080	175	1.96	4.8	121	141	153	1.37	4.9	2.41	4.7	135	157	1.37	4.9
50	15	2:1	63CNQ080	63CNQ080	175	1.79	4.8	115	140	154	1.36	4.9	2.29	4.7	131	157	1.36	4.9
50	15	2:1	203CNQ080	203CNQ080	175	2.24	4.1	119	127	133	1.60	4.2	2.49	4.0	125	134	1.60	4.2
50	15	2:1	123NQ080	123NQ080	175	2.31	4.1	121	128	134	1.59	4.2	2.54	4.0	127	135	1.59	4.2
75	2.5	3.5:1	55HQ030	55HQ030	150	1.55	18.5	104	122	135	1.44	18.5	2.15	17.9	122	140	1.45	18.4
75	2.5	3.5:1	152CMQ030	152CMQ030	150	1.25	20.4	98	120	137			1.85	19.7	118	141	1.32	20.3
75	2.5	3.5:1	82CNQ030	82CNQ030	150	1.13	19.3	91	117	136			1.83	18.8	114	140	1.41	19.0
75	2.5	3.5:1	220CNQ030	220CNQ030	150	2.09	15.5	111	117	125	1.72	15.5	2.49	14.7	119	127	1.74	15.3
75	2.5	3.5:1	182NQ030	182NQ030	150	2.12	14.4	107	111	117	1.84	14.5	2.40	13.7	112	117	1.88	14.2
75	2.5	3.5:1	122NQ030	122NQ030	150	2.16	15.1	111	116	124	1.78	15.1	2.55	14.4	119	126	1.80	14.8
75	2.5	3.5:1	122NQ030	182NQ030	150	2.25	14.4	111	117	121	1.84	14.5						
75	5	2:1	55HQ030	55HQ030	150	1.39	9.6	100	118	129			1.75	9.3	111	130	1.43	9.3
75	5	2:1	152CMQ030	152CMQ030	150	1.14	10.6	95	118	131			1.52	10.3	109	132	1.29	10.3
75	5	2:1	82CNQ030	82CNQ030	150	1.04	9.9	89	115	129			1.47	9.8	104	130	1.37	9.7
75	5	2:1	220CNQ030	220CNQ030	150	1.60	8.1	98	106	112			1.79	7.8	102	111	1.70	7.8
75	5	2:1	182NQ030	182NQ030	150	1.46	7.6	92	97	101			1.58	7.4	94	100		
75	5	2:1	122NQ030	182NQ030	150	1.60	7.6	96	103	105								
75	5	2:1	122NQ030	122NQ030	150	1.65	7.8	98	105	110			1.83	7.6	102	110	1.76	7.6
75	5	3:1	50HQ045	50HQ045	150	1.01	11.8	95	118	134			1.52	11.5	116	139	1.15	11.6
75	5	3:1	30FQ045	30FQ045	175	1.39	13.3	119	146	164	0.98	13.6	1.83	13.0	139	166	0.98	13.6
75	5	3:1	30FQ045	85HQ045	175	1.59	12.3	124	166	161	1.05	12.7						
75	5	3:1	85HQ045	85HQ045	175	1.65	11.8	123	146	162	1.11	12.0	2.15	11.4	142	165	1.11	12.0
75	5	3:1	150CMQ045	150CMQ045	150	0.83	12.4	89	116	135			1.36	12.1	112	139	1.10	12.1
75	5	3:1	151CMQ045	151CMQ045	175	1.36	12.8	115	143	162	1.03	13.0	1.87	12.4	137	165	1.03	13.0
75	5	3:1	80CNQ045	80CNQ045	150	0.66	12.1	80	112	135			1.27	11.9	106	139	1.13	11.8
75	5	3:1	81CNQ045	81CNQ045	175	1.16	12.8	106	140	163	1.04	12.9	1.75	12.4	132	165	1.04	12.9
75	5	3:1	200CNQ045	200CNQ045	150	1.52	9.4	104	113	121	1.42	9.4	1.84	9.1	113	123	1.45	9.2

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S − T_{amb})/(($I_O \bullet V_O$)•Total Schottky Loss %).

TABLE 17c
Schottky selection guide for "forward" and "bridge" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	FORWARD CONVERTERS: Rated T_{jmax} °C	Heatsink R_{sa} °C/W	Max Total Schottky Loss %(I_O•V_O) %	Max T_s °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_s=100°C $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %	BRIDGE CONVERTERS: Heatsink R_{sa} °C/W	Max Total Schottky Loss %	Max T_s °C	Max wkg jn temp. °C	Heatsink for T_s=100°C $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
75	5	3:1	201CNQ045	201CNQ045	175	2.01	11.0	133	143	153	1.21	11.0	2.44	10.6	147	159	1.21	11.0
75	5	3:1	120NQ045	120NQ045	150	1.56	9.4	105	113	121	1.42	9.4	1.86	9.1	114	123	1.45	9.2
75	5	3:1	120NQ045	240NQ045	150	1.64	8.5	102	112	110	1.56	8.5						
75	5	3:1	121NQ045	121NQ045	175	2.32	9.8	135	142	152	1.35	9.9	2.75	9.4	147	157	1.35	9.9
75	12	3:1	60HQ100	60HQ100	175	1.25	5.9	116	145	162	0.91	6.1	1.75	5.6	139	166	0.91	6.1
75	12	3:1	153CMQ100	153CMQ100	175	0.94	6.6	105	141	163	0.84	6.6	1.45	6.3	132	166	0.84	6.6
75	12	3:1	203CNQ100	203CNQ100	175	1.57	5.5	127	140	151	0.98	5.6	1.93	5.3	141	155	0.98	5.6
75	12	3:1	123NQ100	123NQ100	175	1.61	5.5	130	142	152	0.96	5.8	1.95	5.3	143	156	0.96	5.8
75	12	3:1	123NQ100	183NQ100	175	1.67	5.2	129	142	146	1.00	5.5						
75	12	3:1	123NQ100	243NQ100	175	1.70	5.1	127	141	138	1.05	5.3						
75	15	2:1	60HQ080	60HQ080	175	1.26	4.8	118	146	160	0.91	4.9	1.66	4.6	136	164	0.91	4.9
75	15	2:1	153CMQ080	153CMQ080	175	0.98	5.3	108	143	161	0.83	5.3	1.37	5.1	129	164	0.84	5.3
75	15	2:1	203CNQ080	203CNQ080	175	1.49	4.4	124	138	147	0.98	4.5	1.73	4.3	134	149	0.98	4.5
75	15	2:1	123NQ080	123NQ080	175	1.52	4.5	127	139	147	0.96	4.6	1.75	4.4	136	149	0.96	4.6
75	15	2:1	123NQ080	243NQ080	175	1.53	4.1	121	135	131	1.04	4.3						
100	2.5	3.5:1	55HQ030	55HQ030	150	0.80	20.8	92	120	138			1.28	20.0	114	141	0.98	20.4
100	2.5	3.5:1	152CMQ030	152CMQ030	150	0.53	22.5	80	113	137			1.02	22.1	106	140	0.91	22.1
100	2.5	3.5:1	220CNQ030	220CNQ030	150	1.49	15.8	109	119	129	1.27	15.8	1.86	15.2	121	132	1.29	15.6
100	2.5	3.5:1	122NQ030	122NQ030	150	1.52	15.8	110	119	129	1.27	15.8	1.89	15.2	122	132	1.28	15.6
100	2.5	3.5:1	122NQ030	182NQ030	150	1.66	14.9	112	122	126	1.33	15.1						
100	2.5	3.5:1	122NQ030	242NQ030	150	1.73	14.5	113	123	123	1.34	14.9						
100	5	2:1	55HQ030	55HQ030	150	0.78	10.6	92	119	134			1.13	10.4	109	137	0.96	10.4
100	5	2:1	152CMQ030	152CMQ030	150	0.55	11.4	81	114	133			0.91	11.4	102	136	0.88	11.3
100	5	2:1	220CNQ030	220CNQ030	150	1.21	8.1	99	110	117			1.40	7.9	106	118	1.26	7.9
100	5	2:1	182NQ030	182NQ030	150	1.17	7.7	95	103	108			1.30	7.5	99	107		
100	5	2:1	122NQ030	122NQ030	150	1.24	8.1	101	110	117	1.22	8.1	1.43	7.9	107	118	1.26	7.9
100	5	2:1	122NQ030	182NQ030	150	1.25	7.8	99	109	112								

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_s − T_{amb})/((I_O•V_O)•Total Schottky Loss %).

TABLE 17d
Schottky selection guide for "forward" and "bridge" converters.

Output Current I_O (A)	Output Voltage V_O (V)	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} (°C)	FORWARD CONVERTERS Heatsink R_{sa} (°C/W)	FORWARD CONVERTERS Max Total Schottky Loss $\%(I_O \bullet V_O)$ (%)	FORWARD CONVERTERS Max T_S (°C)	FORWARD CONVERTERS Max wkg jn temp. Schottky1 (°C)	FORWARD CONVERTERS Max wkg jn temp. Schottky2 (°C)	FORWARD CONVERTERS Heatsink for T_S=100°C $R_{sa}(100)$ (°C/W)	FORWARD CONVERTERS Max Total Schottky Loss with $R_{sa}(100)$ (%)	BRIDGE CONVERTERS Heatsink R_{sa} (°C/W)	BRIDGE CONVERTERS Max Total Schottky Loss (%)	BRIDGE CONVERTERS Max T_S (°C)	BRIDGE CONVERTERS Max wkg jn temp. (°C)	BRIDGE CONVERTERS Heatsink for T_S=100°C $R_{sa}(100)$ (°C/W)	BRIDGE CONVERTERS Max Total Schottky Loss with $R_{sa}(100)$ (%)
100	5	3:1	85HQ045	85HQ045	175	0.91	12.7	108	142	164	0.78	12.8	1.33	12.4	132	166	0.78	12.8
100	5	3:1	151CMQ045	151CMQ045	175	0.63	14.1	95	137	164			1.08	13.7	124	165	0.71	14.0
100	5	3:1	200CNQ045	200CNQ045	150	1.04	10.1	103	116	128	0.98	10.1	1.34	9.8	116	131	1.01	9.9
100	5	3:1	201CNQ045	201CNQ045	175	1.38	11.5	130	145	158	0.85	11.8	1.75	11.2	148	165	0.85	11.8
100	5	3:1	301CNQ045	301CNQ045	175	1.59	10.4	132	146	158	0.94	10.6	1.98	10.0	149	164	0.94	10.6
100	5	3:1	180NQ045	180NQ045	150	1.05	9.9	102	111	120	1.01	9.9	1.27	9.5	110	121	1.04	9.6
100	5	3:1	120NQ045	120NQ045	150	1.08	10.2	105	117	128	0.99	10.1	1.36	9.8	117	131	1.01	9.9
100	5	3:1	120NQ045	180NQ045	150	1.10	9.9	105	117	123	1.01	9.9						
100	5	3:1	120NQ045	240NQ045	150	1.23	9.2	107	120	119	1.08	9.2						
100	5	3:1	121NQ045	121NQ045	175	1.59	10.6	134	146	158	0.92	10.8	1.97	10.2	150	164	0.92	10.8
100	5	3:1	181NQ045	181NQ045	175	1.70	9.8	133	141	151	1.01	9.9	2.02	9.3	144	155	1.01	9.9
100	5	3:1	121NQ045	241NQ045	175	1.73	9.9	136	149	150	0.97	10.3						
100	12	3:1	60HQ100	60HQ100	175	0.65	6.4	100	141	165			1.07	6.0	128	167	0.65	6.4
100	12	3:1	203CNQ100	203CNQ100	175	1.04	5.8	122	142	156	0.71	5.9	1.37	5.6	142	162	0.71	5.9
100	12	3:1	123NQ100	123NQ100	175	1.08	5.8	125	143	157	0.69	6.0	1.40	5.6	144	162	0.69	6.0
100	12	3:1	183NQ100	183NQ100	175	1.16	5.5	126	139	150	0.74	5.7	1.41	5.2	139	153	0.74	5.7
100	12	3:1	123NQ100	183NQ100	175	1.19	5.5	129	148	153	0.71	5.8						
100	15	2:1	60HQ080	60HQ080	175	0.70	5.1	104	145	164	0.64	5.1	1.03	4.9	126	166	0.65	5.1
100	15	2:1	153CMQ080	153CMQ080	175	0.46	5.7	89	140	164	0.00	0.0	0.80	5.5	116	165	0.60	5.6
100	15	2:1	203CNQ080	203CNQ080	175	1.02	4.7	121	141	153	0.70	4.7	1.24	4.6	135	156	0.70	4.7
100	15	2:1	123NQ080	123NQ080	175	1.05	4.7	124	142	153	0.69	4.8	1.27	4.6	138	157	0.69	4.8
100	15	2:1	123NQ080	183NQ080	175	1.13	4.5	126	145	148	0.71	4.7						
100	15	2:1	123NQ080	243NQ080	175	1.16	4.3	125	145	141	0.75	4.5						
150	2.5	3.5:1	220CNQ030	220CNQ030	150	0.67	19.3	98	119	135			0.98	18.8	119	140	0.70	19.1
150	2.5	3.5:1	440CNQ030	440CNQ030	150	0.94	15.6	105	115	125	0.86	15.6	1.17	15.0	116	127	0.87	15.3
150	2.5	3.5:1	122NQ030	122NQ030	150	0.73	18.9	102	120	135	0.70	18.9	1.03	18.4	121	140	0.71	18.7
150	2.5	3.5:1	182NQ030	182NQ030	150	0.91	16.8	107	120	131	0.80	16.8	1.17	16.0	121	134	0.80	16.7
150	2.5	3.5:1	122NQ030	182NQ030	150	0.92	17.4	110	129	133	0.75	17.7						
150	2.5	3.5:1	242NQ030	242NQ030	150	1.00	15.7	108	117	126	0.85	15.7	1.21	14.9	118	127	0.86	15.5

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S − T_{amb})/(($I_O \bullet V_O$)•Total Schottky Loss %).

TABLE 17e
Schottky selection guide for "forward" and "bridge" converters.

Output Current I_o A	Output Voltage V_o V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	FORWARD CONVERTERS Heatsink R_{sa} ° C/W	Max Total Schottky Loss $\%(I_o \bullet V_o)$ %	Max T_s °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_s=100°C $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %	BRIDGE CONVERTERS Heatsink R_{sa} ° C/W	Max Total Schottky Loss %	Max T_s °C	Max wkg jn temp. °C	Heatsink for T_s=100°C $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
150	2.5	3.5:1	122NQ030	242NQ030	150	1.04	16.7	115	134	130	0.78	17.1						
150	5	2:1	220CNQ030	220CNQ030	150	0.61	9.9	95	116	129			0.80	9.8	108	130	0.69	9.7
150	5	2:1	440CNQ030	440CNQ030	150	0.72	8.1	94	105	112			0.83	7.9	99	111		
150	5	2:1	122NQ030	122NQ030	150	0.66	9.7	98	117	128			0.84	9.6	110	130	0.70	9.5
150	5	2:1	182NQ030	182NQ030	150	0.74	8.7	99	112	121			0.88	8.5	106	120	0.78	8.5
150	5	2:1	242NQ030	242NQ030	150	0.76	8.1	97	106	112			0.86	7.9	101	112	0.84	7.9
150	5	2:1	122NQ030	182NQ030	150	0.77	9.0	102	121	123	0.74	9.0						
150	5	2:1	182NQ030	242NQ030	150	0.79	8.3	99	113	115	0.00	0.0						
150	5	2:1	122NQ030	242NQ030	150	0.82	8.7	103	123	118	0.76	8.7						
150	5	3:1	200CNQ045	200CNQ045	150	0.43	12.0	89	114	134			0.70	11.8	112	138	0.57	11.8
150	5	3:1	444CNQ045	444CNQ045	125	0.43	9.7	82	95	106			0.61	9.4	93	107		
150	5	3:1	400CNQ045	400CNQ045	150	0.63	10.2	98	112	123			0.81	9.9	110	125	0.67	9.9
150	5	3:1	201CNQ045	201CNQ045	175	0.66	13.0	115	144	163	0.50	13.3	0.92	12.7	137	166	0.50	13.3
150	5	3:1	301CNQ045	301CNQ045	175	0.76	12.1	119	146	163	0.53	12.6	1.02	11.7	140	166	0.53	12.6
150	5	3:1	401CNQ045	401CNQ045	175	0.98	10.7	129	143	155	0.61	11.0	1.23	10.3	144	160	0.61	11.0
150	5	3:1	120NQ045	120NQ045	150	0.47	12.0	92	116	133			0.72	11.8	114	138	0.57	11.8
150	5	3:1	244NQ045	244NQ045	125	0.47	9.7	84	96	105			0.64	9.4	95	107		
150	5	3:1	180NQ045	180NQ045	150	0.55	11.6	97	115	130			0.76	11.2	114	133	0.59	11.3
150	5	3:1	240NQ045	240NQ045	150	0.66	10.2	101	113	123	0.65	10.2	0.83	9.9	112	125	0.67	9.9
150	5	3:1	120NQ045	240NQ045	150	0.69	10.8	106	131	127	0.61	10.9						
150	5	3:1	121NQ045	121NQ045	175	0.80	11.9	121	145	161	0.55	12.0	1.05	11.6	141	165	0.55	12.0
150	5	3:1	181NQ045	181NQ045	175	0.95	10.9	128	145	158	0.60	11.2	1.22	10.6	147	165	0.60	11.2
150	5	3:1	241NQ045	241NQ045	175	1.02	10.7	132	144	155	0.61	11.0	1.25	10.3	146	160	0.61	11.0
150	5	3:1	121NQ045	241NQ045	175	1.05	11.0	136	160	159	0.58	11.5						
150	12	3:1	203CNQ100	203CNQ100	175	0.49	6.4	107	142	163	0.43	6.5	0.75	6.1	133	166	0.43	6.5
150	12	3:1	303CNQ100	303CNQ100	175	0.59	6.0	114	141	159	0.45	6.2	0.84	5.8	137	164	0.45	6.2
150	12	3:1	403CNQ100	403CNQ100	175	0.68	5.6	118	137	152	0.49	5.7	0.89	5.4	136	155	0.49	5.7
150	12	3:1	123NQ100	123NQ100	175	0.52	6.4	111	142	162	0.42	6.6	0.76	6.2	135	166	0.42	6.6
150	12	3:1	183NQ100	183NQ100	175	0.63	6.0	118	143	159	0.44	6.3	0.86	5.8	140	164	0.44	6.3

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max $T_S - T_{amb}$)/(($I_o \bullet V_o$)•Total Schottky Loss %).

TABLE 17f
Schottky selection guide for "forward" and "bridge" converters.

						FORWARD CONVERTERS							BRIDGE CONVERTERS					
Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	Heatsink R_{sa} ° C/W	Max Total Schottky Loss %(I_O•V_O) %	Max T_S °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_S=100°C $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %	Heatsink R_{sa} ° C/W	Max Total Schottky Loss %	Max T_S °C	Max wkg jn temp. °C	Heatsink for T_S=100°C $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
150	12	3:1	123NQ100	183NQ100	175	0.64	6.2	121	152	160	0.43	6.4						
150	12	3:1	243NQ100	243NQ100	175	0.72	5.6	122	138	151	0.49	5.7	0.91	5.4	138	155	0.49	5.7
150	12	3:1	123NQ100	243NQ100	175	0.75	5.8	128	159	156	0.45	6.1						
150	15	2:1	203CNQ080	203CNQ080	175	0.51	5.2	110	144	161	0.42	5.2	0.71	5.0	130	164	0.42	5.2
150	15	2:1	303CNQ080	303CNQ080	175	0.58	4.9	115	141	156	0.44	5.0	0.75	4.8	131	158	0.44	5.0
150	15	2:1	403CNQ080	403CNQ080	175	0.65	4.5	116	135	147	0.49	4.5	0.79	4.4	129	149	0.49	4.5
150	15	2:1	123NQ080	123NQ080	175	0.54	5.2	113	144	160	0.42	5.3	0.72	5.1	133	164	0.42	5.3
150	15	2:1	183NQ080	183NQ080	175	0.62	4.9	119	142	155	0.44	5.0	0.78	4.8	134	158	0.44	5.0
150	15	2:1	243NQ080	243NQ080	175	0.69	4.5	120	136	146	0.49	4.6	0.81	4.4	131	149	0.49	4.6
150	15	2:1	123NQ080	243NQ080	175	0.71	4.8	126	158	152	0.45	4.9						
200	2.5	3.5:1	220CNQ030	220CNQ030	150	0.37	20.4	88	118	139			0.63	19.6	111	141	0.50	20.0
200	2.5	3.5:1	440CNQ030	440CNQ030	150	0.65	16.4	104	119	131	0.61	16.4	0.87	15.7	118	134	0.62	16.2
200	2.5	3.5:1	122NQ030	122NQ030	150	0.41	20.4	92	120	138			0.65	19.6	114	141	0.50	20.0
200	2.5	3.5:1	182NQ030	182NQ030	150	0.58	17.7	101	121	135	0.56	17.7	0.83	17.0	120	139	0.57	17.6
200	2.5	3.5:1	242NQ030	242NQ030	150	0.68	16.2	105	118	129	0.62	16.1	0.88	15.6	119	133	0.63	15.9
200	2.5	3.5:1	182NQ030	242NQ030	150	0.69	16.5	107	127	131	0.60	16.8						
200	2.5	3.5:1	122NQ030	242NQ030	150	0.70	17.7	112	139	133	0.56	18.0						
200	5	2:1	220CNQ030	220CNQ030	150	0.36	10.4	88	118	134			0.55	10.2	106	136	0.49	10.2
200	5	2:1	440CNQ030	440CNQ030	150	0.53	8.5	95	111	121			0.64	8.3	103	120	0.60	8.3
200	5	2:1	122NQ030	122NQ030	150	0.40	10.4	92	119	134			0.57	10.2	108	136	0.49	10.2
200	5	2:1	182NQ030	182NQ030	150	0.51	9.2	97	116	127			0.64	9.0	108	128	0.56	9.0
200	5	2:1	122NQ030	182NQ030	150	0.51	9.6	99	127	130								
200	5	2:1	242NQ030	242NQ030	150	0.56	8.3	96	110	118			0.66	8.1	104	118	0.61	8.1
200	5	2:1	122NQ030	242NQ030	150	0.58	9.2	103	132	124	0.54	9.2						
200	5	3:1	200CNQ045	200CNQ045	150	0.17	13.0	72	110	137			0.39	12.8	101	139	0.39	12.8
200	5	3:1	444CNQ045	444CNQ045	125	0.26	10.0	76	95	109			0.43	9.8	92	112		
200	5	3:1	201CNQ045	201CNQ045	175	0.34	13.8	97	138	164			0.56	13.4	126	166	0.36	13.7
200	5	3:1	400CNQ045	400CNQ045	150	0.40	10.9	93	114	129			0.57	10.6	111	132	0.47	10.6

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S – T_{amb})/((I_O•V_O)•Total Schottky Loss %).

TABLE 17g
Schottky selection guide for "forward" and "bridge" converters.

Output Current I_o	Output Voltage V_o	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax}	FORWARD CONVERTERS Heatsink R_{sa}	Max Total Schottky Loss %(I_o•V_o)	Max T_s	Max wkg jn temp. Schottky1	Max wkg jn temp. Schottky2	Heatsink for T_s=100°C $R_{sa(100)}$	Max Total Schottky Loss with $R_{sa(100)}$	BRIDGE CONVERTERS Heatsink R_{sa}	Max Total Schottky Loss	Max T_s	Max wkg jn temp.	Heatsink for T_s=100°C $R_{sa(100)}$	Max Total Schottky Loss with $R_{sa(100)}$
A	V				°C	° C/W	%	°C	°C	°C	° C/W	%	° C/W	%	°C	°C	° C/W	%
200	5	3:1	301CNQ045	301CNQ045	175	0.41	13.1	103	142	165	0.38	13.2	0.63	12.5	129	167	0.38	13.2
200	5	3:1	401CNQ045	401CNQ045	175	0.63	11.2	121	142	158	0.44	11.3	0.85	10.9	142	164	0.44	11.3
200	5	3:1	120NQ045	120NQ045	150	0.21	13.0	77	112	136			0.42	12.8	104	139	0.39	12.8
200	5	3:1	244NQ045	244NQ045	125	0.30	10.0	80	96	109			0.45	9.8	94	112		
200	5	3:1	180NQ045	180NQ045	150	0.31	12.1	87	113	133			0.51	12.0	111	138	0.42	11.9
200	5	3:1	240NQ045	240NQ045	150	0.43	10.9	97	115	129			0.60	10.6	113	132	0.47	10.7
200	5	3:1	120NQ045	240NQ045	150	0.44	11.7	102	137	132	0.43	11.7						
200	5	3:1	181NQ045	181NQ045	175	0.61	11.3	119	144	161	0.43	11.5	0.83	11.0	141	165	0.43	11.5
200	5	3:1	241NQ045	241NQ045	175	0.67	11.3	125	143	158	0.44	11.3	0.87	10.9	145	164	0.44	11.3
200	5	3:1	121NQ045	241NQ045	175	0.68	11.7	129	164	161	0.41	12.2	0.70	12.4	136	170	0.38	13.0
200	12	3:1	203CNQ100	203CNQ100	175	0.24	6.7	89	137	165			0.46	6.3	121	166	0.32	6.6
200	12	3:1	303CNQ100	303CNQ100	175	0.34	6.3	102	139	162	0.33	6.3	0.56	6.0	130	166	0.33	6.3
200	12	3:1	403CNQ100	403CNQ100	175	0.44	5.8	111	138	157	0.36	5.8	0.64	5.6	135	162	0.36	5.8
200	12	3:1	183NQ100	183NQ100	175	0.38	6.3	107	141	162	0.33	6.4	0.58	6.0	133	166	0.33	6.4
200	12	3:1	243NQ100	243NQ100	175	0.48	5.8	117	140	157	0.36	5.9	0.66	5.6	139	162	0.36	5.9
200	12	3:1	123NQ100	243NQ100	175	0.49	6.0	121	163	160	0.33	6.2						
200	15	2:1	203CNQ080	203CNQ080	175	0.27	5.4	93	142	164			0.44	5.2	119	165	0.31	5.3
200	15	2:1	303CNQ080	303CNQ080	175	0.36	5.1	104	142	160	0.32	5.1	0.52	4.9	127	163	0.33	5.1
200	15	2:1	403CNQ080	403CNQ080	175	0.44	4.7	112	138	153	0.35	4.7	0.57	4.6	129	156	0.36	4.7
200	15	2:1	183NQ080	183NQ080	175	0.39	5.1	109	143	160	0.33	5.1	0.54	4.9	130	163	0.33	5.1
200	15	2:1	243NQ080	243NQ080	175	0.47	4.7	116	140	153	0.35	4.7	0.60	4.6	132	156	0.35	4.7
200	15	2:1	183NQ080	243NQ080	175	0.48	4.8	119	152	155	0.34	4.9						
250	2.5	3.5:1	220CNQ030	220CNQ030	150	0.11	22.8	65	108	138			0.34	22.4	98	140		
250	2.5	3.5:1	440CNQ030	440CNQ030	150	0.41	18.2	96	119	135			0.61	17.4	117	139	0.45	17.9
250	2.5	3.5:1	122NQ030	122NQ030	150	0.14	23.2	70	110	138			0.35	22.8	101	140	0.35	22.8
250	2.5	3.5:1	182NQ030	182NQ030	150	0.32	19.7	89	117	136			0.53	19.1	113	140	0.41	19.3
250	2.5	3.5:1	122NQ030	242NQ030	150	0.40	20.4	101	141	131	0.39	20.4						
250	2.5	3.5:1	242NQ030	242NQ030	150	0.45	18.2	101	120	135	0.44	18.2	0.64	17.4	120	139	0.44	18.0
250	2.5	3.5:1	182NQ030	242NQ030	150	0.45	18.6	103	130	135	0.43	18.7						

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_s − T_{amb})/((I_o•V_o)•Total Schottky Loss %).

TABLE 17h
Schottky selection guide for "forward" and "bridge" converters.

Output Current I_O (A)	Output Voltage V_O (V)	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} (°C)	FORWARD CONVERTERS: Heatsink R_{sa} (° C/W)	FORWARD: Max Total Schottky Loss %(I_O•V_O) (%)	FORWARD: Max T_S (°C)	FORWARD: Max wkg jn temp. Schottky1 (°C)	FORWARD: Max wkg jn temp. Schottky2 (°C)	FORWARD: Heatsink for T_S=100°C $R_{sa}(100)$ (° C/W)	FORWARD: Max Total Schottky Loss with $R_{sa}(100)$ (%)	BRIDGE CONVERTERS: Heatsink R_{sa} (° C/W)	BRIDGE: Max Total Schottky Loss (%)	BRIDGE: Max T_S (°C)	BRIDGE: Max wkg jn temp. (°C)	BRIDGE: Heatsink for T_S=100°C $R_{sa}(100)$ (° C/W)	BRIDGE: Max Total Schottky Loss with $R_{sa}(100)$ (%)
250	5	2:1	220CNQ030	220CNQ030	150	0.14	11.6	70	113	135			0.31	11.5	94	138		
250	5	2:1	440CNQ030	440CNQ030	150	0.36	9.4	92	114	127			0.47	9.2	104	127	0.44	9.2
250	5	2:1	182NQ030	242NQ030	150	0.26	9.6	81	109	129								
250	5	2:1	182NQ030	182NQ030	150	0.30	10.1	88	116	131			0.44	9.9	105	132	0.40	9.9
250	5	2:1	122NQ030	242NQ030	150	0.36	10.5	97	137	125								
250	5	2:1	242NQ030	242NQ030	150	0.39	9.4	96	115	127			0.49	9.2	107	127	0.43	9.2
250	5	3:1	301CNQ045	301CNQ045	175	0.14	14.6	76	131	165			0.36	14.1	113	166	0.28	14.3
250	5	3:1	400CNQ045	400CNQ045	150	0.21	12.2	83	112	133			0.38	11.9	107	137	0.34	11.9
250	5	3:1	401CNQ045	401CNQ045	175	0.41	12.1	112	142	162	0.32	12.3	0.59	11.7	136	166	0.32	12.3
250	5	3:1	180NQ045	180NQ045	150	0.13	13.5	72	109	136			0.31	13.3	101	138	0.30	13.3
250	5	3:1	240NQ045	240NQ045	150	0.25	12.2	89	114	133			0.41	11.9	111	137	0.34	11.9
250	5	3:1	181NQ045	181NQ045	175	0.38	12.1	107	141	163			0.56	11.8	132	166	0.33	12.3
250	5	3:1	121NQ045	241NQ045	175	0.43	12.9	119	167	161	0.30	13.3						
250	5	3:1	241NQ045	241NQ045	175	0.45	12.1	118	144	162	0.32	12.4	0.61	11.7	140	166	0.32	12.4
250	12	3:1	303CNQ100	303CNQ100	175	0.17	6.9	85	136	165			0.36	6.4	119	167	0.25	6.6
250	12	3:1	403CNQ100	403CNQ100	175	0.28	6.1	101	138	161	0.27	6.1	0.45	5.9	130	165	0.27	6.1
250	12	3:1	243NQ100	243NQ100	175	0.32	6.1	108	140	160	0.27	6.2	0.48	5.9	134	165	0.27	6.2
250	15	2:1	303CNQ080	303CNQ080	175	0.19	5.5	90	141	164			0.34	5.2	116	165	0.25	5.4
250	15	2:1	403CNQ080	403CNQ080	175	0.29	4.9	103	140	158	0.26	5.0	0.42	4.8	125	161	0.27	4.9
250	15	2:1	243NQ080	243NQ080	175	0.32	4.9	110	141	158	0.27	5.0	0.44	4.8	130	161	0.27	5.0
300	2.5	3.5:1	440CNQ030	440CNQ030	150	0.28	18.5	88	116	136			0.47	18.0	113	140	0.37	18.1
300	2.5	3.5:1	182NQ030	182NQ030	150	0.20	20.5	80	115	138			0.39	19.7	107	141	0.34	19.9
300	2.5	3.5:1	122NQ030	242NQ030	150	0.26	21.0	92	140	129								
300	2.5	3.5:1	242NQ030	242NQ030	150	0.32	18.5	94	118	135			0.49	18.0	116	140	0.37	18.2
300	2.5	3.5:1	182NQ030	242NQ030	150	0.32	19.2	96	129	136								
300	5	2:1	440CNQ030	440CNQ030	150	0.25	9.5	86	114	129			0.37	9.3	102	130	0.36	9.3
300	5	2:1	182NQ030	182NQ030	150	0.20	10.5	82	116	134			0.34	10.2	102	136	0.33	10.2

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_S − T_{amb})/((I_O•V_O)•Total Schottky Loss %).

TABLE 17I
Schottky selection guide for "forward" and "bridge" converters.

Output Current I_o A	Output Voltage V_o V	Max Input Voltage Range	Schottky 1 Part No.	Schottky 2 Part No.	Rated T_{jmax} °C	FORWARD CONVERTERS Heatsink R_{sa} °C/W	Max Total Schottky Loss %(I_o•V_o) %	Max T_s °C	Max wkg jn temp. Schottky1 °C	Max wkg jn temp. Schottky2 °C	Heatsink for T_s=100°C $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %	BRIDGE CONVERTERS Heatsink R_{sa} °C/W	Max Total Schottky Loss %	Max T_s °C	Max wkg jn temp. °C	Heatsink for T_s=100°C $R_{sa}(100)$ °C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
300	5	2:1	242NQ030	242NQ030	150	0.29	9.5	91	115	128			0.39	9.3	105	130	0.36	9.3
300	5	2:1	182NQ030	242NQ030	150	0.29	9.8	93	127	130								
300	5	3:1	301CNQ045	301CNQ045	175								0.24	14.3	102	166	0.23	14.4
300	5	3:1	401CNQ045	401CNQ045	175	0.28	12.5	102	140	163	0.27	12.6	0.44	12.1	130	166	0.27	12.6
300	5	3:1	181NQ045	181NQ045	175	0.23	12.8	94	137	164			0.40	12.4	124	166	0.26	12.7
300	5	3:1	241NQ045	241NQ045	175	0.32	12.5	110	142	163	0.26	12.7	0.46	12.1	134	166	0.26	12.7
300	12	3:1	403CNQ100	403CNQ100	175	0.17	6.3	88	134	162			0.33	6.1	121	165	0.22	6.2
300	15	2:1	403CNQ080	403CNQ080	175	0.18	5.1	92	138	160			0.31	5.0	119	163	0.22	5.0
350	2.5	3.5:1	440CNQ030	440CNQ030	150	0.17	19.7	79	113	137			0.34	19.1	107	140	0.30	19.2
350	2.5	3.5:1	182NQ030	182NQ030	150	0.07	23.0	63	108	139			0.24	22.2	97	140		
350	2.5	3.5:1	242NQ030	242NQ030	150	0.21	19.6	86	116	137			0.36	19.1	111	140	0.30	19.3
350	5	2:1	440CNQ030	440CNQ030	150	0.17	10.1	79	114	132			0.28	9.9	99	133		
350	5	2:1	242NQ030	242NQ030	150	0.20	10.1	85	115	132			0.30	9.9	103	133	0.29	9.9
350	5	3:1	401CNQ045	401CNQ045	175	0.16	13.3	87	134	164			0.31	13.0	120	165	0.22	13.1
350	5	3:1	241NQ045	241NQ045	175	0.20	13.3	96	137	163			0.33	13.0	126	165	0.22	13.2
350	12	3:1	403CNQ100	403CNQ100	175	0.08	6.8	73	130	164			0.23	6.4	112	166	0.18	6.5
400	2.5	3.5:1	440CNQ030	440CNQ030	150	0.09	21.1	70	112	139			0.25	20.0	101	141	0.25	20.0
400	2.5	3.5:1	242NQ030	242NQ030	150	0.14	20.5	79	115	139			0.29	19.6	107	141	0.25	19.8
400	5	2:1	440CNQ030	440CNQ030	150	0.10	10.7	72	114	135			0.22	10.4	95	137		
400	5	2:1	242NQ030	242NQ030	150	0.15	10.5	81	116	135			0.25	10.2	101	136	0.25	10.2
400	5	3:1	401CNQ045	401CNQ045	175	0.10	13.6	76	130	164			0.24	13.1	113	165	0.19	13.3
400	5	3:1	241NQ045	241NQ045	175	0.14	13.5	87	134	164			0.26	13.1	119	165	0.19	13.3

1. Schottkys on common heatsink.
2. Max amb temp = 50°C.
3. For higher T_{amb}, R_{sa} = (Max T_s − T_{amb})/((I_o•V_o)•Total Schottky Loss %).

SCHOTTKY SELECTION GUIDE

For "Flyback" Converters

International
IOR Rectifier

TABLE 18a
Schottky selection guide for "flyback" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky Part No.	T_{jmax} °C	Heatsink R_{sa} ° C/W	Max Total Schottky Loss %(I_O•V_O) %	Max T_S °C	Max wkg. jn. temp. °C	Heatsink for T_S=100°C R_{sa}(100) ° C/W	Max Total Schottky Loss with R_{sa}(100) %
5	5	5:1	12TQ045	150	28.9	9.8	120	127	20.9	9.5
5	5	5:1	6TQ045	175	34.2	12.4	156	163	15.8	12.7
5	5	5:1	10TQ045	175	38.6	10.5	151	158	18.9	10.6
5	5	5:1	18TQ045	175	55.0	6.5	139	142	30.0	6.7
5	12	1.7:1	12TQ045	150	18.5	4.1	96	102		
5	12	1.7:1	10TQ045	175	29.1	4.5	129	136	18.7	4.4
5	12	1.7:1	6TQ045	175	30.1	5.4	147	155	15.7	5.3
5	12	1.7:1	18TQ045	175	31.6	2.8	104	107	29.2	2.9
5	12	4:1	8TQ080	175	31.0	5.1	145	153	15.5	5.4
5	15	4:1	8TQ100	175	29.3	4.1	141	148	15.5	4.3
7.5	5	5:1	20FQ045	150	19.2	8.6	112	118	15.7	8.5
7.5	5	5:1	30FQ045	175	27.6	9.2	145	151	14.2	9.4
7.5	5	5:1	12TQ045	150	17.1	11.2	122	132	12.3	10.9
7.5	5	5:1	20TQ045	150	17.5	10.8	121	129	12.5	10.7
7.5	5	5:1	10TQ045	175	22.7	11.8	151	162	11.1	12.0
7.5	5	5:1	18TQ045	175	37.9	6.9	148	153	18.7	7.1
7.5	12	1.7:1	20FQ045	150	10.5	3.7	85	90		
7.5	12	1.7:1	30FQ045	175	17.7	4.0	113	120	13.9	4.0
7.5	12	1.7:1	20TQ045	150	11.3	4.6	97	106		
7.5	12	1.7:1	12TQ045	150	12.5	4.7	103	114	11.8	4.7
7.5	12	1.7:1	6TQ045	175	17.5	6.2	147	161	9.0	6.2
7.5	12	1.7:1	10TQ045	175	18.8	5.2	137	149	11.0	5.0
7.5	12	1.7:1	18TQ045	175	24.9	3.0	117	123	18.4	3.0
7.5	12	4:1	8TQ080	175	19.6	5.5	147	160	9.4	5.9

1. Max amb temp = 50°C.
2. For higher T_{amb}, R_{sa} = (Max T_S − T_{amb})/((I_O•V_O)•Total Schottky Loss %).

TABLE 18b
Schottky selection guide for "flyback" converters.

Output Current I_o	Output Voltage V_o	Max Input Voltage Range	Schottky Part No.	T_{jmax}	Heatsink R_{sa}	Max Total Schottky Loss $\%(I_o \bullet V_o)$	Max T_s	Max wkg. jn. temp.	Heatsink for $T_s = 100°C$ $R_{sa}(100)$	Max Total Schottky Loss with $R_{sa}(100)$
A	V			°C	° C/W	%	°C	°C	° C/W	%
7.5	15	4:1	8TQ100	175	18.9	4.5	145	157	9.4	4.7
10	5	5:1	20FQ045	150	14.2	9.4	117	125	10.8	9.2
10	5	5:1	30FQ045	175	19.8	9.8	148	156	10.1	9.9
10	5	5:1	12TQ045	150	11.2	12.6	120	136	8.1	12.4
10	5	5:1	20TQ045	150	12.1	11.7	121	133	8.7	11.5
10	5	5:1	10TQ045	175	14.9	13.0	147	163	7.7	13.1
10	5	5:1	18TQ045	175	26.5	7.5	150	157	13.0	7.7
10	12	1.7:1	20FQ045	150	8.6	4.0	91	100		
10	12	1.7:1	30FQ045	175	14.0	4.2	121	130	9.9	4.2
10	12	1.7:1	20TQ045	150	8.5	5.0	101	113	8.3	5.0
10	12	1.7:1	12TQ045	150	8.8	5.4	107	123	7.8	5.3
10	12	1.7:1	10TQ045	175	12.9	5.7	138	154	7.6	5.5
10	12	1.7:1	18TQ045	175	19.2	3.3	125	133	12.8	3.2
10	12	4:1	8TQ080	175	13.4	6.0	145	163	6.4	6.5
10	15	4:1	8TQ100	175	13.0	4.8	144	162	6.4	5.2
15	2.5	6.5:1	55HQ030	150	13.2	15.0	124	130	8.9	15.0
15	5	3:1	55HQ030	150	10.3	7.7	110	116	8.7	7.7
15	5	5:1	30FQ045	175	12.2	10.7	147	161	6.0	11.0
15	5	5:1	50HQ045	150	9.7	9.7	120	128	7.0	9.5
15	5	5:1	18TQ045	175	15.1	8.7	148	161	7.6	8.7
15	12	1.7:1	30FQ045	175	9.5	4.7	130	145	6.0	4.7
15	12	1.7:1	50HQ045	150	6.2	4.1	96	104		
15	12	1.7:1	18TQ045	175	10.3	4.5	133	149	6.3	4.4

1. Max amb temp = 50°C.
2. For higher T_{amb}, $R_{sa} = (\text{Max } T_s - T_{amb})/((I_o \bullet V_o) \bullet \text{Total Schottky Loss } \%)$.

TABLE 18c
Schottky selection guide for "flyback" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky Part No.	T_{jmax} °C	Heatsink R_{sa} ° C/W	Max Total Schottky Loss $\%(I_O \bullet V_O)$ %	Max T_S °C	Max wkg. jn. temp. °C	Heatsink for $T_S = 100°C$ $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
15	12	4:1	60HQ080	175	11.0	4.8	146	155	5.4	5.1
15	15	4:1	60HQ100	175	10.4	3.9	142	151	5.4	4.1
20	2.5	6.5:1	55HQ030	150	9.1	16.3	124	133	6.2	16.2
20	5	3:1	55HQ030	150	7.5	8.4	113	122	6.1	8.2
20	5	5:1	30FQ045	175	8.1	11.5	143	163	4.2	11.9
20	5	5:1	75HQ045	175	9.1	10.9	150	161	4.5	11.2
20	5	5:1	18TQ045	175	10.7	8.9	145	163	5.4	9.2
20	12	1.7:1	30FQ045	175	6.6	5.1	131	152	4.1	5.0
20	12	1.7:1	75HQ045	175	7.2	4.8	133	145	4.4	4.7
20	12	1.7:1	18TQ045	175	9.0	3.9	135	154	5.4	3.9
20	12	4:1	60HQ080	175	7.8	5.1	147	160	3.8	5.5
20	15	4:1	60HQ100	175	7.5	4.2	144	157	3.8	4.4
25	2.5	6.5:1	55HQ030	150	6.7	17.5	124	135	4.6	17.4
25	5	3:1	55HQ030	150	5.8	9.0	115	127	4.5	8.8
25	5	5:1	30FQ045	175	5.8	12.1	138	164	3.2	12.6
25	5	5:1	50HQ045	150	5.0	11.3	120	136	3.6	11.2
25	5	5:1	85HQ045	175	7.2	10.8	148	163	3.6	11.1
25	12	1.7:1	30FQ045	175	4.9	5.4	129	157	3.1	5.3
25	12	1.7:1	50HQ045	150	3.7	4.9	104	120	3.4	4.9
25	12	1.7:1	85HQ045	175	6.0	4.8	135	150	3.6	4.7

1. Max amb temp = 50°C.
2. For higher T_{amb}, R_{sa} = (Max T_S – T_{amb})/(($I_O \bullet V_O$)•Total Schottky Loss %).

TABLE 18d
Schottky selection guide for "flyback" converters.

Output Current I_O (A)	Output Voltage V_O (V)	Max Input Voltage Range	Schottky Part No.	T_{jmax} (°C)	Heatsink R_{sa} (°C/W)	Max Total Schottky Loss %($I_O \bullet V_O$) (%)	Max T_S (°C)	Max wkg. jn. temp. (°C)	Heatsink for $T_S = 100°C$ $R_{sa}(100)$ (°C/W)	Max Total Schottky Loss with $R_{sa}(100)$ (%)
25	12	4:1	60HQ080	175	5.9	5.4	145	162	2.9	5.7
25	15	4:1	60HQ100	175	5.7	4.3	143	160	2.9	4.6
30	2.5	6.5:1	55HQ030	150	4.8	19.5	120	136	3.5	19.2
30	2.5	6.5:1	122NQ030	150	6.4	15.5	124	130	4.3	15.5
30	5	3:1	55HQ030	150	4.2	10.0	114	130	3.4	9.8
30	5	3:1	122NQ030	150	5.0	8.0	110	117	4.2	7.9
30	5	5:1	50HQ045	150	3.7	12.2	118	138	2.7	12.3
30	5	5:1	85HQ045	175	5.5	11.6	145	164	2.8	11.9
30	5	5:1	120NQ045	150	4.7	9.8	119	127	3.5	9.5
30	5	5:1	121NQ045	175	6.6	10.0	149	158	3.3	10.0
30	12	1.7:1	50HQ045	150	2.9	5.4	105	126	2.6	5.3
30	12	1.7:1	85HQ045	175	4.6	5.1	135	155	2.8	5.0
30	12	1.7:1	121NQ045	175	4.9	4.3	126	134	3.3	4.2
30	12	4:1	60HQ080	175	4.6	5.6	142	164	2.3	6.1
30	12	4:1	123NQ080	175	4.9	5.3	144	155	2.5	5.5
30	15	4:1	60HQ100	175	4.4	4.5	141	163	2.3	4.9
30	15	4:1	123NQ100	175	4.7	4.3	141	151	2.5	4.4
50	2.5	6.5:1	122NQ030	150	3.3	17.5	123	135	2.3	17.4
50	2.5	6.5:1	182NQ030	150	3.8	15.4	123	132	2.6	15.4
50	5	3:1	122NQ030	150	2.9	9.0	115	127	2.3	8.8
50	5	3:1	182NQ030	150	3.0	8.0	110	119	2.5	7.9
50	5	5:1	120NQ045	150	2.4	11.2	118	134	1.8	10.9

1. Max amb temp = 50°C.
2. For higher T_{amb}, R_{sa} = (Max T_S – T_{amb})/(($I_O \bullet V_O$)•Total Schottky Loss %).

TABLE 18e
Schottky selection guide for "flyback" converters.

Output Current I_O	Output Voltage V_O	Max Input Voltage Range	Schottky Part No.	T_{jmax}	Heatsink R_{sa}	Max Total Schottky Loss $\%(I_O \bullet V_O)$	Max T_S	Max wkg. jn. temp.	Heatsink for $T_S = 100°C$ $R_{sa}(100)$	Max Total Schottky Loss with $R_{sa}(100)$
A	V			°C	°C/W	%	°C	°C	°C/W	%
50	5	5:1	180NQ045	150	2.5	10.6	117	129	1.9	10.3
50	5	5:1	121NQ045	175	3.6	10.9	148	163	1.8	11.3
50	12	1.7:1	180NQ045	150	1.7	4.4	95	106		
50	12	1.7:1	121NQ045	175	3.0	4.8	135	151	1.7	4.8
50	12	4:1	123NQ080	175	2.8	5.6	144	162	1.4	6.0
50	12	4:1	183NQ080	175	2.9	5.3	144	158	1.5	5.6
50	15	4:1	123NQ100	175	2.7	4.6	142	161	1.4	4.8
50	15	4:1	183NQ100	175	2.8	4.3	140	155	1.5	4.5
75	2.5	6.5:1	122NQ030	150	1.7	20.6	117	138	1.3	20.6
75	2.5	6.5:1	182NQ030	150	2.2	17.5	121	136	1.5	17.5
75	2.5	6.5:1	242NQ030	150	2.4	16.0	122	133	1.7	15.9
75	5	3:1	122NQ030	150	1.6	10.6	112	134	1.3	10.4
75	5	3:1	182NQ030	150	1.9	9.0	113	128	1.5	8.9
75	5	3:1	242NQ030	150	2.0	8.2	111	121	1.6	8.1
75	5	5:1	121NQ045	175	1.9	12.4	139	165	1.04	12.8
75	5	5:1	241NQ045	175	2.4	10.7	147	161	1.21	11.0
75	12	1.7:1	121NQ045	175	1.7	5.4	132	159	1.03	5.4
75	12	1.7:1	241NQ045	175	1.9	4.7	130	144	1.19	4.7
75	12	4:1	183NQ080	175	1.7	5.8	139	163	0.91	6.1
75	12	4:1	243NQ080	175	1.9	5.4	141	158	1.01	5.5
75	15	4:1	183NQ100	175	1.7	4.7	137	161	0.90	4.9
75	15	4:1	243NQ100	175	1.8	4.4	138	155	1.01	4.4

1. Max amb temp = 50°C.
2. For higher T_{amb}, $R_{sa} = (\text{Max } T_S - T_{amb})/((I_O \bullet V_O) \bullet \text{Total Schottky Loss } \%)$.

TABLE 18f
Schottky selection guide for "flyback" converters.

Output Current I_O A	Output Voltage V_O V	Max Input Voltage Range	Schottky Part No.	T_{jmax} °C	Heatsink R_{sa} ° C/W	Max Total Schottky Loss $\%(I_O \bullet V_O)$ %	Max T_S °C	Max wkg. jn. temp. °C	Heatsink for $T_S = 100°C$ $R_{sa}(100)$ ° C/W	Max Total Schottky Loss with $R_{sa}(100)$ %
100	2.5	6.5:1	182NQ030	150	1.3	19.7	115	137	1.02	19.6
100	2.5	6.5:1	242NQ030	150	1.6	17.4	121	136	1.14	17.5
100	5	3:1	182NQ030	150	1.2	10.1	110	132	1.00	10.0
100	5	3:1	242NQ030	150	1.4	9.0	113	129	1.12	8.9
100	5	5:1	241NQ045	175	1.6	11.5	143	163	0.85	11.7
100	12	1.7:1	241NQ045	175	1.3	5.0	130	151	0.84	5.0
100	12	4:1	243NQ080	175	1.3	5.7	137	161	0.71	5.9
100	15	4:1	243NQ100	175	1.2	4.6	135	159	0.71	4.7
150	5	3:1	242NQ030	150	0.69	10.8	106	134	0.63	10.7
150	5	5:1	241NQ045	175	0.84	12.8	130	164	0.51	13.0
150	12	1.7:1	241NQ045	175	0.72	5.6	123	158	0.51	5.5

1. Max amb temp = 50°C.
2. For higher T_{amb}, $R_{sa} = (\text{Max } T_S - T_{amb})/((I_O \bullet V_O) \bullet \text{Total Schottky Loss } \%)$.

Schottky Diode Designer's Manual

International Rectifier

Schottky Diode Designer's Manual

QUALITY, RELIABILITY, AND SCHOTTKY RECTIFIERS

AN-987: "Utilizing Schottky Rectifier Die In Assembly"

APPLICATION NOTES

Quality, Reliability, and Schottky Rectifiers

International Rectifier's line of Schottky products is well known in the industry as the vanguard of design innovation and performance. Its complete range of voltage and package options offer the designer a full complement of power device tools. In addition, supporting the Schottky product line is the most extensive quality and reliability program that monitors each step of the process from wafer fabrication to final test. The goal of the International Rectifier Schottky Quality and Reliability Program is to provide a medium where a continuous improvement philosophy is followed.

Schottky Quality Program

While traditional quality programs rely on extensive inspections by an outside group, or a Quality Assurance department, the Schottky quality program at International Rectifier has put the responsibility for quality on every person in the plant facility. Process operators, engineers, production supervisors and managers all contribute to a constant quality improvement process.

The Schottky quality gauge is drawn by an extensive *Statistical Process Control* (SPC) program. This program is "operator driven" and, therefore, relies on each of the process operators for parameter data gathering and necessary corrective action. Supporting this process is a thorough education program which emphasizes ownership of the process to each of the operators. They receive extensive training about their operation, the key parameters which are a result of their operation, and how these affect the final quality of the product.

When a process goes out of control, corrective action is taken in a team atmosphere where the operators and, when necessary, process engineers and managers, determine root causes and implement the necessary correction. The opjective os this process is to drive the decision down to the owner of the operation.

Schottky Reliability Program

The Schottky Reliability Program is modelled after the well known HEXFET Reliability Program which was pioneered back in the early 1980's, and is broken down into two segments. The first segment is the *Statistical Reliability Sampling* program. This program is designed to test for infant mortality type failure modes. The second segment, the *Long Term Reliability Program*, subjects samples to tests with longer duration and is designed to take the devices to the wearout region and therefore, determine the wearout failure mechanisms.

Reliability Testing Procedures and Tests

All tests are conducted with statistically significant samples. Complete parameter testing is performed at specific intervals on each device. A failure occurs when a device has deteriorated beyond its parametric limit and/or it has exhibited a significant parameter shift. All wafer lots are subjected to a short term reliability test that checks for infant mortality type problems under the Statistical Reliability Sampling program. Randomly selected lots from each package type and wafer lot number are used for the long term reliability program.

Environment Stress Test

High Temperature Reverse Bias (HTRB)

Defects at the die level, primarily near the Schottky barrier, originating at the wafer fabrication process, can be exposed using this test. A reverse bias of 100% of the rated voltage is applied to the device. The device temperature is kept elevated at or near the rated junction temperature. A 1000 hour duration constitutes the full evaluation with read and record intervals at 24, 168, 500 and 1000 hours.

Typical Failure Mode

The typical failure mode is degradation of the reverse leakage current and/or a deterioration of the breakdown voltage. If contamination is severe and stress values are held high, this can result in thermal runaway resulting in a short.

Environmental Stress Test

Temperature Cycling

Die attach fatigue resulting from expansion mismatch, improper solder application, etc., can be localized using this test. The stress cycle subjects the parts to extreme variations in temperature. The parts are cycled between two preset chambers: -55°C and +150°C at 15 minutes in each with no transition delay. Parameter testing is monitored at 10, 25, 50, 100 and at 100 cycle increments until 1000 cycles is achieved.

Typical Failure Mode

Failures are caused by a deteriorated contact between the die and substrate or wire bond resulting in an increase of the forward voltage (V) drop and/or increase of the thermal resistance. Stress interactions between the contact and barrier metallization can also result in breakdown voltage and degradation.

Environment Stress test

Temperature and Humidity Bias

This test is performed on all non-hermetic encapsulated packages. Parts are exposed to a high temperature and humidity chamber at ambient pressure to determine their ability to withstand the damaging effect of this environment. An 80% reverse bias is applied as an acceleration factor. The conditions are 85°C and a relative humidity of 85%. The typical duration is 1000 hours.

Typical Failure Mode

Two types of failure mechanisms are most probable. Metal corrosion at the wire bond die interface can result in separation. Electrical degradation begins with an increase in V_f until contact is completely interrupted. Moisture penetration is followed by ionic contamination, which can create alternate current paths along the die surface resulting an unstable reverse leakage characteristic.

Environmental Stress Test

Power Cycling

The purpose of power cycling is to simulate the thermal and current pulsing stresses which devices will encounter in actual circuit applications. The simulation is achieved by the on/off application of power to each device. Forward current is maintained until the device junction temperature reaches its rated value. When this point is reached, the device is turned off and allowed to cool under forced air ventilation. The length of the cycle depends on the Schottky device parameters under test. The package design impacts the heat sink size and thermal conductivity parameters such that these influence the cycle duration as well.

Typical Failure Mode

Like temperature cycling, failures are generally caused by a deteriorated contact between the die and substrate or wire bond as a result of expansion dissimilarities. The initial outcome is an increase of the forward voltage (V_f) drop. Stress interaction on the die and immediate surroundings is more strenuous, however. Shorts have been observed and attributable to fracture propagation as a result of solder mismatching and irregular solder formation.

Reporting

In order to aid the engineer in his design, a Schottky Reliability and Quality Report is published every six months by International Rectifier. This report is designed to aid the qualification and characterization process and to give the user a brief summary of the quality and reliability characteristics of the Schottky products. □

Utilizing SCHOTTKY Rectifier Die In Assembly

by Bret Daniels

Introduction

This application note describes the Schottky rectifiers available from International Rectifier in die and wafer form. These epitaxial diode die feature a proprietary, high reliability planar technology utilizing a guard ring structure for maximized ruggedness. Hybrid packaging of these die results in substantial savings in weight and volume compared to standard packaging, as well as significant improvements in electrical performance, particularly lead inductance. Most of the same parts are available in finished packages; thus, development work and evaluation can be easily performed before converting the design for die application. A cross reference of packaged product to die part numbers is included in this application note.

Characteristics

Schottky die sizes presently available from International Rectifier are summarized in Table 1. These sizes range from 43.3 (1.100) to 275 (6.985) mil/side (mm/side). Sizes 43.3 and 66.1 are available only in wafer form while all others are available in both wafer and die forms. The evolution of International Rectifier Schottky diodes has resulted in four unique processes and six voltage grades. The *OR'ing, Low V_F Efficient, Standard,* and *"830" processes* have each been optimized to minimize power dissipation based upon the electrical and thermal requirements of various applications and operating modes. The *six voltage grades* available are 15V, 30V, 45V, 60V, 100V, and 150V.

Probing

Because of limitations when electrical probing in die form, some of the specifications of equivalent packaged devices cannot be tested or guaranteed in die form. Typically, these are high current forward characteristics, high temperature characteristics, surge capability (I_{FSM}), thermal resistance (R_{thJC}), series inductance (L_S), and avalanche (E_{AS} and I_{AR}). However, each wafer is 100% probed at room temperature for maximum reverse voltage (V_R), maximum reverse leakage current (I_R), and low current forward voltage drop (V_F).

During electrical probing, the rejected die are inked for identification. The wafer is then cut and the die mechanically separated. The rejected die are discarded and the remaining die are 100% visually inspected, loaded into waffle pack trays, and packed for shipment.

Handling and Shipping

Schottky die from International Rectifier are classified as non-static sensitive devices but are packaged in conductive trays for convenience. The chip tray capacities for each die size are shown in Table 1. These trays are then sealed in electrostatic shielding bags for shipment. Wafers are shipped in non-conductive, polyethylene wafer carriers.

Once opened, the die must be stored in a dry, inert atmosphere, such as nitrogen, prior to assembly. Die should be handled with DuPont Teflon®-tipped vacuum pencils to prevent mechanical damage. Any non-conformance to the electrical or visual inspection specifications in this application note must be reported in writing to International Rectifier within 30 days after shipment of the lot. International Rectifier assumes no responsibilities for die which have been subjected to further processing, such as mount-down, wire-bonding, or encapsulation. In the interest of product improvement, IR reserves the right to make design or processing changes without prior notice.

Visual Inspection of Die

International Rectifier Schottky rectifier die are designed to meet the visual inspection criteria of Mil-Standard 750, Method 2072, and are visually screened to a 0.04% AQL level.

Mounting Backside (Cathode) of Die

The Schottky die have a titanium/nickel/silver cathode metallization which is suitable for either solder paste or solder preform mounting using solders such as 92.5%/5%/2.5% Pb/In/Ag solder. It is recommended that solders containing silver are used due to silver dissolution of the backside metal in the absence of silver in the solder.

Any of the commonly used header or substrate materials, such as copper and copper-plated beryllia or alumina, are acceptable. The substrate must be free of oxides prior to assembly either by chemical cleaning or hydrogen pre-firing techniques. Mounting of Schottky die is generally accomplished in a profiled belt furnace or by using a hotplate reflow technique. Infrared or vapor phase reflow are also acceptable methods for die mounting. If using solder preforms or solder paste, cleaning must always be performed afterwards.

The furnace zone setting will depend upon hybrid mass, material, fixturing, and belt speed. The Schottky die temperature must not exceed 400°C, nor be in the range of 350 to 400°C for greater than one minute. A clean furnace of hydrogen atmosphere is recommended, although an atmosphere of nitrogen or forming gas (nitrogen-hydrogen, 85%-15%) is acceptable.

It is also possible to mount the die using conductive adhesives, although this is not currently used in production at International Rectifier.

Molybdenum Tabs

In solder applications, due to thermal expansion stresses exerted on the larger die sizes (200 mil/side and greater), International Rectifier recommends the use of molybdenum or other thermally matched tabs on the anode and cathode. The selection of tab material and/or plating must be such that it can be soldered to the silver metallization of the top and bottom metals.

International Rectifier offers standard options of molybdenum tabs soldered to the anode, cathode, or both. These are available in both round and square configurations and various sizes appropriate for a particular die size. These options are listed in Table 2. To order die with molybdenum tabs add the suffix number of the option required to the end of the die part number.

Anode Connection

Electrical connection to the anode should be a solder connection for all devices with silver top metallization. For all parts with aluminum top metallization, electrical connection to the anode is by ultrasonic bonding with aluminum wire. The wire diameter and number of wires should be chosen to suit the current requirements. For enhanced reliability, all copper piece parts that come into contact with the anode metallization must be nickel-clad or nickel-plated to eliminate copper contact with the Schottky barrier.

Caution must be exercised during wire bonding to ensure that the bonding footprint remains within the bonding pad area; otherwise, device failure can result. The bonding pad area is centered on the die and the outside edges of the die are not part of the bonding area so neither solder, in the case of silver metallization, nor wire, in the case of aluminum metallization, may make contact with the perimeter. The bonding pad area is different for each die size and the dimensions of each are listed in Table 1.

Likewise, wire bonding equipment settings should be optimized and a wire pull test performed (e.g., see Method 2037, Mil Standard 750) to monitor wire bond strength uniformity. Destructive sample testing and 100% non-destructive testing is recommended. Re-bonding of wire bond rejects can be performed although decreased yield can be expected from such reworks.

Encapsulation

Prior to encapsulation, the die or assembly should be kept in a moisture-free environment. For non-hermetic packaging, a semiconductor grade silicone elastomer may be applied. Cleaning of the die or assembly prior to coating is recommended. Immediately prior to encapsulation, especially for hermetic packages, a 150°C, two-hour bake should be performed to remove any surface moisture. Capping of hermetic packages should be performed in a dry-nitrogen atmosphere.

Conclusion

The use of Schottky rectifier die for hybrid assemblies can result in significant reduction in overall package size and significant improvements in performance and efficiency. In addition, several Schottky die can readily be mounted on the same heatsink to form circuit configurations or to parallel devices. The operational advantages of International Rectifier Schottky rectifiers, thereby, can be realized in very compact, custom package configurations. □

Note: Teflon is a trademark of DuPont.

Table I

Schottky Rectifier Die

Wafer(1) Part Number	Die(2) Part Number	Die "A" Length/Side (in.) mm	Bond Pad "B" Length/Side (in.) mm	Anode Metallization (topside)	Process	Tray Quantity
SC043H100SWB	N/A	(0.0433) 1.10	(0.0362) 0.92	Silver	830	N/A
SC043S040SWB	N/A	(0.0433) 1.10	(0.0362) 0.92	Silver	Standard	N/A
SC043S060SWB	N/A	(0.0433) 1.10	(0.0362) 0.92	Silver	Standard	N/A
SC066H100AWB	N/A	(0.0661) 1.68	(0.0591) 1.50	Aluminum	830	N/A
SC066H100SWB	N/A	(0.0661) 1.68	(0.0591) 1.50	Silver	830	N/A
SC066S040AWB	N/A	(0.0661) 1.68	(0.0591) 1.50	Aluminum	Standard	N/A
SC066S040SWB	N/A	(0.0661) 1.68	(0.0591) 1.50	Silver	Standard	N/A
SC066S060AWB	N/A	(0.0661) 1.68	(0.0591) 1.50	Aluminum	Standard	N/A
SC066S060SWB	N/A	(0.0661) 1.68	(0.0591) 1.50	Silver	Standard	N/A
SC090H045AWB	SC090H045A	0.0900 (2.29)	0.0700 (1.78)	Aluminum	830	196
SC090H150AWB	SC090H150A	0.0900 (2.29)	0.0700 (1.78)	Aluminum	830	196
SC090S045AWB	SC090S045A	0.0900 (2.29)	0.0700 (1.78)	Aluminum	Standard	196
SC125R015SWB	SC125R015S			Silver	OR'ing	100
SC125H045AWB	SC125H045A	0.125 (3.18)	0.105 (2.67)	Aluminum	830	100
SC125H045SWB	SC125H045S	0.125 (3.18)	0.105 (2.67)	Silver	830	100
SC125H100AWB	SC125H100A	0.125 (3.18)	0.105 (2.67)	Aluminum	830	100
SC125H100SWB	SC125H100S	0.125 (3.18)	0.105 (2.67)	Silver	830	100
SC125H150AWB	SC125H150A	0.125 (3.18)	0.105 (2.67)	Aluminum	830	100
SC125S030AWB	SC125S030A	0.125 (3.18)	0.105 (2.67)	Aluminum	Standard	100
SC125S045AWB	SC125S045A	0.125 (3.18)	0.105 (2.67)	Aluminum	Standard	100
SC125S045SWB	SC125S045S	0.125 (3.18)	0.105 (2.67)	Silver	Standard	100
SC125S060AWB	SC125S060A	0.125 (3.18)	0.105 (2.67)	Aluminum	Standard	100
SC150H045AWB	SC150H045A	0.150 (3.81)	0.130 (3.30)	Aluminum	830	49
SC150R015AWB	SC150R015A	0.150 (3.81)	0.130 (3.30)	Aluminum	OR'ing	49
SC150S045AWB	SC150S045A	0.150 (3.81)	0.130 (3.30)	Aluminum	Standard	49
SC175H045SWB	SC175H045S	0.175 (4.45)	0.155 (3.94)	Silver	830	49
SC175H100AWB	SC175H100A	0.175 (4.45)	0.155 (3.94)	Aluminum	830	49
SC175H100SWB	SC175H100S	0.175 (4.45)	0.155 (3.94)	Silver	830	49
SC175S045AWB	SC175S045A	0.175 (4.45)	0.155 (3.94)	Aluminum	Standard	49
SC175S045SWB	SC175S045S	0.175 (4.45)	0.155 (3.94)	Silver	Standard	49
SC175S060AWB	SC175S060A	0.175 (4.45)	0.155 (3.94)	Aluminum	Standard	49
SC200E045SWB	SC200E045S	0.200 (5.08)	0.180 (4.57)	Silver	Efficient	36
SC200H045SWB	SC200H045S	0.200 (5.08)	0.180 (4.57)	Silver	830	36
SC200H100AWB	SC200H100A	0.200 (5.08)	0.180 (4.57)	Aluminum	830	36
SC200H100SWB	SC200H100S	0.200 (5.08)	0.180 (4.57)	Silver	830	36
SC200R015SWB	SC200R015S	0.200 (5.08)	0.180 (4.57)	Silver	OR'ing	36
SC200S030SWB	SC200S030S	0.200 (5.08)	0.180 (4.57)	Silver	Standard	36
SC200S045SWB	SC200S045S	0.200 (5.08)	0.180 (4.57)	Silver	Standard	36
SC275H045SWB	SC275H045S	0.275 (6.99)	0.255 (6.48)	Silver	830	25
SC275H100SWB	SC275H100S	0.275 (6.99)	0.255 (6.48)	Silver	830	25
SC275S030SWB	SC275S030S	0.275 (6.99)	0.255 (6.48)	Silver	Standard	25
SC275S045SWB	SC275S045S	0.275 (6.99)	0.255 (6.48)	Silver	Standard	25

(1) Die in probed un-cut, wafer form

(2) Die in probed waffle pack form

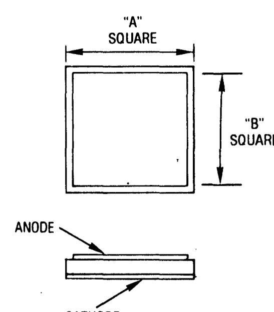
(3) All die and bond pads are square (see diagram next page)

Table II Schottky Molybdenum Tab Suffixes and Descriptions

Suffix Number	Applicable Die Size	Top Moly (Anode)	Shape	Bottom Moly (Cathode)	Shape
J01	0.200 (5.08)	0.150 (3.81) dia.	Round	N/A	—
J02	0.200 (5.08)	0.150 (3.81) dia.	Round	0.283 (7.19) dia.	Round
J03	0.200 (5.08)	0.150 (3.81) dia.	Round	0.215 (5.46) dia.	Square
J04	0.200 (5.08)	N/A	—	0.283 (7.19) dia.	Round
J05	0.200 (5.08)	N/A	—	0.215 (5.46) dia.	Square
J06	0.200 (5.08)	0.150 (3.81) dia.	Square	N/A	—
J07	0.200 (5.08)	0.150 (3.81) dia.	Square	0.283 (7.19) dia.	Round
J08	0.200 (5.08)	0.150 (3.81) dia.	Square	0.215 (5.46) dia.	Square
J09	(These suffix numbers are for future use.)				
J10					
J11					
J12	0.175 (4.45)	0.125 (3.18) dia.	Round	N/A	—
J13	0.175 (4.45)	0.125 (3.18) dia.	Round	0.250 (6.35) dia.	Round
J14	0.175 (4.45)	0.125 (3.18) dia.	Round	0.190 (4.83) dia.	Square
J15	0.175 (4.45)	N/A	—	0.250 (6.35) dia.	Round
J16	0.175 (4.45)	N/A	—	0.190 (4.83) dia.	Square
J17	(These suffix numbers are for future use.)				
J18					
J19					
J20	0.275 (6.99)	0.190 (4.83) dia.	Round	N/A	—
J21	0.275 (6.99)	0.190 (4.83) dia.	Round	0.295 (7.49) dia.	Square
J22	0.275 (6.99)	N/A	—	0.295 (7.49) dia.	Square

NOTES:

1) All dimensions are inches (mm)
2) Solder joints are 0.002 (0.508) thick typical
3) Die thickness is 0.0145 (0.3683) +/-0.0005 (0.0127)
4) Die length and width tolerance is +/-0.003 (0.0762)
5) Top moly is 0.010 (0.254) thick and bottom moly is 0.020 (0.508) thick
6) Moly thickness tolerance is +/-0.002 (0.0508)
7) Moly length and width tolerance is +/-0.002 (0.508)



CROSS REFERENCE
Packaged Schottky Rectifier Product Versus Die

Part Number	Die Number
MBR745	SC090H045A
MBR1035	SC125H045A
MBR1045	
MBR1545CT	SC090H045A
MBR1645	SC150H045A
MBR2045CT	SC125H045A
MBR2535CT	SC125H045A
MBR2534CT	
MBR2080CT	SC125H100A
MBR20100CT	
MBR3045CT	SC150H045A
MBR3045PT	SC125S045A
MBR7545	SC200H045S
SD41	SC175S045S
SD51	SC200S045S
SD241	SC150H045A
1N6095	SC175S045S
1N6096	
1N6097	SC200S045S
1N6098	
1N6391	SC175H045S
1N6392	SC200H045S
6CWQ03F	SC066S040A
6CWQ04F	
6CWQ05F	SC066S060A
6CWQ06F	
6CWQ09F	SC066H100A
6CWQ10F	
6TQ035	SC090H045A
6TQ040	
6TQ045	
8TQ080	SC125H100A
8TQ100	
10CTQ150	SC090H150A
10MQ040	SC043S040S
10MQ060	SC043S060S
10MQ090	SC043H100S
10TQ035	SC125H045A
10TQ040	
10TQ045	
11DQ03	SC043S040S
11DQ04	
11DQ05	SC043S060S
11DQ06	
11DQ09	SC043H100S
11DQ10	

Part Number	Die Number
12CTQ035	SC090H045A
12CTQ040	
12CTQ045	
12TQ035	SC125S045A
12TQ040	
12TQ045	
15CTQ035	SC090S045A
15CTQ040	
15CTQ045	
16CTQ080	SC125H100A
16CTQ100	
18TQ035	SC150H045A
18TQ040	
18TQ045	
19TQ015	SC150R015A
20CTQ035	SC125H045A
20CTQ040	
20CTQ045	
20FQ035	SC175S045S
20FQ040	
20FQ045	
20TQ035	SC150S045A
20TQ040	
20TQ045	
21FQ035	SC175S045S
21FQ040	
21FQ045	
25CTQ035	SC125S045A
25CTQ040	
25CTQ045	
30CPQ035	SC125S045A
30CPQ040	
30CPQ045	
30CPQ050	SC125S060A
30CPQ060	
30CPQ080	SC125H100A
30CPQ100	
30CPQ150	SC125H150A
30CTQ035	SC125H045A
30CTQ040	
30CTQ045	
30CTQ050	SC125S060A
30CTQ060	
30FQ035	SC175H045S
30FQ040	
30FQ045	

Part Number	Die Number
30WQ03F	SC066S040A
30WQ04F	
30WQ05F	SC066S060A
30WQ06F	
30WQ09F	SC066H100A
30WQ10F	
31DQ03	SC066S040S
31DQ04	
31DQ05	SC066S060S
31DQ06	
31DQ09	SC066H100S
31DQ10	
32CTQ030	SC125S030A
40CDQ035	SC150H045A
40CDQ040	
40CDQ045	
40CPQ035	SC175S045A
40CPQ040	
40CPQ045	
40CPQ050	SC175S050A
40CPQ060	
40CPQ080	SC175H100A
40CPQ100	
50HQ035	SC200S045S
50HQ040	
50HQ045	
50SQ080	SC125H100S
50SQ100	
50WQ03F	SC066S040A
50WQ04F	
50WQ05F	SC066S060A
50WQ06F	
50WQ09F	SC066H100A
50WQ10F	
51HQ035	SC200S045S
51HQ040	
51HQ045	
55HQ030	SC200S030S
60CDQ035	SC150H045A
60CDQ040	
60CDQ045	
60CNQ035	SC200S045S
60CNQ040	
60CNQ045	
60HQ080	SC200H100S
60HQ100	

Cross Reference
Packaged Schottky Rectifier Product Versus Die

Part Number	Die Number
61CNQ035	SC200H045S
61CNQ040	
61CNQ045	
61CNQ050	
62CNQ030	SC200S030S
63CNQ080	SC200H100S
63CNQ100	
75HQ035	SC200H045S
75HQ040	
75HQ045	
80CNQ035	SC200S045S
80CNQ040	
80CNQ045	
80SQ035	SC125H045S
80SQ040	
80SQ045	
81CNQ035	SC200H045S
81CNQ040	
81CNQ045	
81CNQ050	
82CNQ030	SC200S030S
83CNQ080	SC200H100S
83CNQ100	
84CNQ035	SC200E045S
84CNQ040	
84CNQ045	
85CNQ015	SC200R015S
85HQ035	SC200H045S
85HQ040	
85HQ045	
90SQ035	SC125S045S
90SQ040	
90SQ045	
95HQ015	SC200R015S
95SQ015	SC125R015S
120NQ035	SC200S045S*
120NQ040	
120NQ045	

Part Number	Die Number
121NQ035	SC200H045S*
121NQ040	
121NQ045	
121NQ050	
122NQ030	SC200S030S*
123NQ080	SC200H100S*
123NQ100	
125NQ015	SC200R015S*
150CMQ035	SC200S045S*
150CMQ040	
150CMQ045	
151CMQ035	SC200H045S*
151CMQ040	
151CMQ045	
151CMQ050	
152CMQ030	SC200S030S*
153CMQ080	SC200H100S*
153CMQ100	
160CMQ035	SC200S045S*
160CMQ040	
160CMQ045	
161CMQ035	SC200H045S*
161CMQ040	
161CMQ045	
161CMQ050	
162CMQ030	SC200S030S*
163CMQ080	SC200H100S*
163CMQ100	
180NQ035	SC200S045S*
180NQ040	
180NQ045	
182NQ030	SC200S030S*
183NQ080	SC200H100S*
183NQ100	
186NQ015	SC200R015S*
200CNQ035	SC200S045S*
200CNQ040	
200CNQ045	

Part Number	Die Number
201CNQ035	SC200H045S*
201CNQ040	
201CNQ045	
201CNQ050	
203CNQ080	SC200H100S*
203CNQ100	
220CNQ030	SC200S030S*
224CNQ035	SC200E045S*
224CNQ040	
224CNQ045	
240NQ035	SC200S045S*
240NQ040	
240NQ045	
241NQ035	SC200H045S*
241NQ040	
241NQ045	
241NQ050	
242NQ030	SC200S030S*
243NQ080	SC200H100S*
243NQ100	
245NQ015	SC200R015S*
301CNQ035	SC200H045S*
301CNQ040	
301CNQ045	
301CNQ050	
303CNQ080	SC200H100S*
303CNQ100	
400CNQ035	SC200S045S*
400CNQ040	
400CNQ045	
401CNQ035	SC200H045S*
401CNQ040	
401CNQ045	
401CNQ050	
403CNQ080	SC200H100S*
403CNQ100	
440CNQ030	SC200S030S*
444CNQ035	SC200E045S*
444CNQ040	
444CNQ045	

*Denotes more than one die per leg

Schottky Diode
Designer's Manual

SECTION F

OTHER
PRODUCTS

OTHER
PRODUCTS

Additional Products From International Rectifier

The following is an abridged section that features other International Rectifier power semiconductor products not covered in this Schottky Diode Designer's Manual.
Individual data sheets offering complete technical data on all other products shown on the following pages are also available from any International Rectifier sales office, representative or agent.

International
IOR Rectifier

FullPak
Fully-isolated HEXFETs

FullPak HEXFETs are fully-isolated versions of the popular TO-220 and TO-247 ("TO-3P") packages. The well-known benefits of HEXFET power MOSFETs include voltage control, fast switching, temperature stability, ease of paralleling, low on-state resistance, high transconductance, superior dv/dt and avalanche ruggedness, and a broad range of voltages and ratings. In addition, these devices provide the designer with a cost-saving alternative in situations where electrical isolation is required.

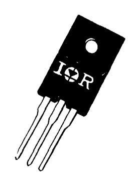
FullPak HEXFETs are excellent for use in a wide array of commercial applications in consumer, automotive, telecommunications, computer and industrial circuits (switching power supplies, amplifiers, and high-energy pulse circuits).

If you have an application where your circuit enclosure and/or heatsinks must be grounded (or your internal circuitry must be isolated from the heatsink/enclosure), then *the FullPak is for you.* Until now, semiconductors were insulated from grounded heatsinks with insulating washers and nylon screws. Improper installation of insulating hardware caused failures which resulted in poor reliability which in turn led to higher manufacturing and servicing costs.

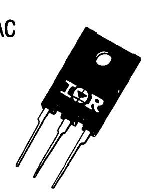
FullPak HEXFETs allow you to mount directly to grounded metal work, eliminating the need for insulating hardware and without a significant change in thermal characteristics. The convenient TO-220 and TO-3P size packages provide the advantage for existing designs and equipment to be retrofitted without modification! The FullPak also provides 2000 Vdc isolation (1500Vac, 60Hz) while contributing only about 12pF (typ.) from drain to heatsink.

See the tables below for the FullPak to fit your needs!

Isolated TO-220

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFIZ24 IRFIZ34 IRFIZ44	60	0.10 0.05 0.028	14 20 30	**ISO-TO-220** SIMILAR to TO-220AB
IRFI530 IRFI540	100	0.16 0.077	9.7 17	
IRFI630 IRFI640	200	0.40 0.18	5.9 9.8	
IRFI634 IRFI644	250	0.45 0.28	5.6 7.9	
IRFI730 IRFI740	400	1.0 0.55	3.5 5.4	
IRFI820 IRFI830 IRFI840	500	3.0 1.5 0.85	2.1 3.1 4.6	

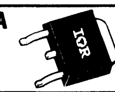
Isolated TO-247

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFIP044 IRFIP054	60	0.028 0.014	40 64	**ISO-TO-3P** SIMILAR to TO-247AC
IRFIP140 IRFIP150	100	0.077 0.055	23 31	
IRFIP240 IRFIP250	200	0.18 0.085	14 22	
IRFIP244 IRFIP254	250	0.28 0.14	11 17	
IRFIP340 IRFIP350	400	0.055 0.30	8.0 11	
IRFIP440 IRFIP448 IRFIP450	500	0.85 0.60 0.40	6.4 7.9 10	

Logic-Level HEXFETs

Logic-level HEXFETs feature the same basic characteristics as their well-established standard-gate counterparts — but instead of requiring a full 10V from gate to source to turn on, logic-level HEXFETs require only 5V to achieve full enhancement. This allows direct interface between power loads and logic-IC level output signals — hence the name "logic-level." This simplification of the gate drive requirement means significant cost savings, design simplification and higher reliability through the elimination of costly excess circuitry.

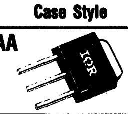
Surface Mount D-Pak

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRLR014	60	0.20	8.5	**TO-252AA** D-Pak 
IRLR024		0.10	16	
IRLR110	100	0.54	4.6	
IRLR120		0.27	8.4	

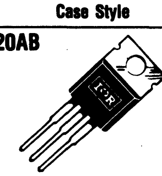
HEXDIP

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRLD014	60	0.20	1.7	**HD-1** SIMILAR MO-001AN 
IRLD024		0.10	2.5	
IRLD110	100	0.54	1.0	
IRLD120		0.27	1.3	

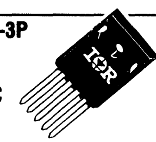
TO-251 I-Pak

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRLU014	60	0.02	8.5	**TO-251AA** I-Pak 
IRLU024		0.10	16	
IRLU110	100	0.54	4.6	
IRLU120		0.27	8.4	

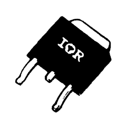
TO-220

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRLZ14	60	0.20	10	**TO-220AB** 
IRLZ24		0.10	17	
IRLZ34		0.05	30	
IRLZ44		0.028	35	
IRL510	100	0.54	5.6	
IRL520		0.27	9.2	
IRL530		0.16	14	
IRL540		0.077	28	

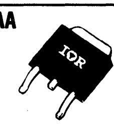
HEXSense Current Sensing N-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRCZ24 IRCZ34 IRCZ44	60	0.10 0.050 0.028	17 30 50	**5 PIN TO-220** SIMILAR to TO-204AA 
IRC530 IRC540	100	0.16 0.077	14 29	
IRC630 IRC640	200	0.40 0.18	9.0 18	
IRC634 IRC644	250	0.45 0.28	8.1 14	
IRC730 IRC740	400	1.0 0.55	5.5 10	
IRC830 IRC840	500	2.0 0.85	4.0 8.0	
IRCP054 IRCP250 IRCP450	60 200 400	0.014 0.085 0.40	40 33 14	**5 PIN TO-3P** SIMILAR to TO-247AC 

Surface Mount Devices N-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFS1Z0	100	2.4	0.90	**TO-243AA** SOT-89 
IRFR014 IRFR024	60	0.20 0.10	8.4 16	**TO-252AA** D-Pak 
IRFR110 IRFR120	100	0.54 0.27	4.7 8.4	
IRFR210 IRFR220	200	1.5 0.80	2.6 4.8	
IRFR214 IRFR224	250	2.0 1.1	2.2 3.8	
IRFR310 IRFR320	400	3.6 1.8	1.7 3.1	
IRFR420	500	3.0	2.4	
IRFRC20	600	4.4	2.0	

Surface Mount Devices P-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFR9014 IRFR9024	-60	0.50 0.28	-5.6 -9.6	**TO-252AA** D-Pak 
IRFR9110 IRFR9120	-100	1.2 0.60	-3.4 -6.3	
IRFR9210 IRFR9220	-200	3.0 1.5	-2.0 -3.6	

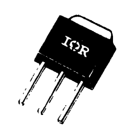
HEXDIP N-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFD014 IRFD024	60	0.20 0.10	1.7 2.5	**HD-1** SIMILAR to MO-001AN 
IRFD110 IRFD120 IRFD1Z0	100	0.54 0.27 2.4	1.0 1.3 0.50	
IRFD210 IRFD220	200	1.5 0.80	0.60 0.80	

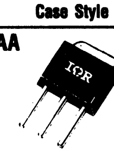
HEXDIP P-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFD9014 IRFD9024	-60	0.50 0.28	-1.1 -1.6	**HD-1** SIMILAR to MO-001AN 
IRFD9110 IRFD9120	-100	1.2 0.60	-0.7 -1.0	
IRFD9210 IRFD9220	-200	3.0 1.5	-0.40 -0.58	

TO-251 N-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFU014 IRFU024	60	0.20 0.10	8.4 16	**TO-251AA** I-Pak 
IRFU110 IRFU120	100	0.54 0.27	4.7 8.4	
IRFU210 IRFU220	200	1.5 0.80	2.6 4.8	
IRFU214 IRFU224	250	2.0 1.1	2.2 3.8	
IRFU310 IRFU320	400	3.6 1.8	1.7 3.1	
IRFU420	500	3.0	2.4	
IRFUC20	600	4.4	2.0	

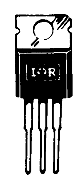
TO-251 P-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFU9014 IRFU9024	-60	0.50 0.28	-5.6 -9.6	**TO-251AA** I-Pak 
IRFU9110 IRFU9120	-100	1.2 0.60	-3.4 -6.3	
IRFU9210 IRFU9220	-200	3.0 1.5	-2.0 -3.6	

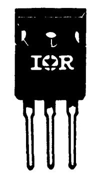
TO-220 N-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFZ14 IRFZ24 IRFZ34 IRFZ44	60	0.20 0.10 0.050 0.028	10 17 30 50	**TO-220AB** 
IRF510 IRF520 IRF530 IRF540	100	0.54 0.27 0.16 0.077	5.6 9.2 14 28	
IRF610 IRF620 IRF630 IRF640	200	1.5 0.80 0.40 0.18	3.3 5.2 9.0 18	
IRF614 IRF624 IRF634 IRF644	250	2.0 1.1 0.45 0.28	2.7 4.4 8.4 14	
IRF710 IRF720 IRF730 IRF740	400	3.6 1.8 1.0 0.55	2.0 3.3 5.5 10	
IRF820 IRF830 IRF840	500	3.0 1.5 0.85	2.5 4.5 8.0	
IRFBC20 IRFBC30 IRFBC40	600	4.4 2.2 1.2	2.2 3.6 6.2	
IRFBE20 IRFBE30	800	6.5 3.2	1.8 3.1	
IRFBF20 IRFBF30	900	8.0 4.0	1.6 2.8	
IRFBG20 IRFBG30	1000	11.5 5.6	1.3 2.3	

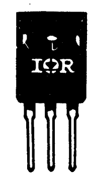
TO-220 P-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRF9Z14 IRF9Z24 IRF9Z34	-60	0.50 0.28 0.14	-4.7 -9.7 -18	**TO-220AB** 
IRF9510 IRF9520 IRF9530 IRF9540	-100	1.2 0.60 0.30 0.20	-3.0 -6.8 -12 -19	
IRF9610 IRF9620 IRF9630 IRF9640	-200	3.0 1.5 0.80 0.50	-1.75 -3.5 -6.5 -11	

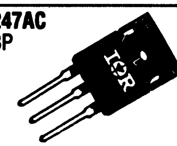
TO-247 N-Channel

Part Number	BV_{DSS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Max. Continuous Drain Current (Amps)	Case Style
IRFP044 IRFP054	60	0.028 0.014	57 70	**TO-247AC** TO-3P 
IRFP140 IRFP150	100	0.077 0.055	31 40	
IRFP240 IRFP250 IRFP260	200	0.18 0.085 0.070	20 33 38	
IRFP244 IRFP254 IRFP264	250	0.28 0.14 0.095	15 23 32	

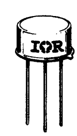
TO-247 N-Channel

Part Number	BV$_{DSS}$ Drain Source Voltage (Volts)	R$_{DS(on)}$ On-State Resistance (Ohms)	I$_D$ Max. Continuous Drain Current (Amps)	Case Style
IRFP340	400	0.55	11	**TO-247AC** TO-3P 
IRFP350		0.30	16	
IRFP360		0.20	23	
IRFP440	500	0.85	8.8	
IRFP448		0.60	11	
IRFP450		0.40	14	
IRFP460		0.27	20	
IRFPC30	600	2.2	4.3	
IRFPC40		1.2	6.8	
IRFPC50		0.60	11.6	
IRFPE30	800	3.2	3.7	
IRFPE40		2.0	5.3	
IRFPE50		1.2	7.2	
IRFPF30	900	4.0	3.3	
IRFPF40		2.5	4.7	
IRFPF50		1.6	6.8	
IRFPG30	1000	5.6	2.8	
IRFPG40		3.5	4.3	
IRFPG50		2.0	6.1	

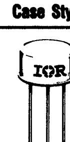
TO-247 P-Channel

Part Number	BV$_{DSS}$ Drain Source Voltage (Volts)	R$_{DS(on)}$ On-State Resistance (Ohms)	I$_D$ Max. Continuous Drain Current (Amps)	Case Style
IRFP9140	-100	0.20	-19	**TO-247AC** TO-3P 
IRFP9240	-200	0.50	-11	

TO-39 N-Channel

Part Number	BV$_{DSS}$ Drain Source Voltage (Volts)	R$_{DS(on)}$ On-State Resistance (Ohms)	I$_D$ Max. Continuous Drain Current (Amps)	Case Style
IRFF110	100	0.60	3.5	**TO-205AF** TO-39 
IRFF120		0.30	6.0	
IRFF130		0.18	8.0	
IRFF210	200	1.50	2.2	
IRFF220		0.80	3.5	
IRFF230		0.40	5.5	
IRFF310	400	3.6	1.35	
IRFF320		1.8	2.5	
IRFF330		1.0	3.5	
IRFF420	500	3.0	1.6	
IRFF430		1.5	2.8	

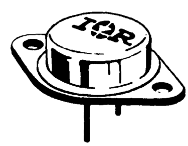
TO-39 P-Channel

Part Number	BV$_{DSS}$ Drain Source Voltage (Volts)	R$_{DS(on)}$ On-State Resistance (Ohms)	I$_D$ Max. Continuous Drain Current (Amps)	Case Style
IRFF9110	-100	1.2	-2.6	**TO-205AF** TO-39 
IRFF9120		0.60	-3.5	
IRFF9130		0.30	-6.5	
IRFF9210	-200	3.0	-1.6	
IRFF9220		1.5	-2.5	
IRFF9230		0.80	-4.0	

HEXFET Power MOSFETs
Plastic Insertable Package

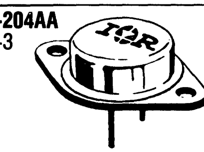
TO-3 N-Channel

Part Number	BVDSS Drain Source Voltage (Volts)	RDS(on) On-State Resistance (Ohms)	ID Max. Continuous Drain Current (Amps)	Case Style
IRF034	60	0.050	30	**TO-204AA** TO-3
IRF044		0.028	30	
IRF054		0.014	30	
IRF130	100	0.16	14	
IRF140		0.077	28	
IRF150		0.055	30	
IRF230	200	0.40	9.0	
IRF240		0.18	18	
IRF250		0.085	30	
IRF234	250	0.45	8.4	
IRF244		0.28	14	
IRF254		0.14	22	
IRF330	400	1.0	5.5	
IRF340		0.55	10	
IRF350		0.30	14	
IRF360		0.20	25	
IRF430	500	1.5	4.5	
IRF440		0.85	8.0	
IRF448		0.60	9.6	
IRF450		0.40	13	
IRF460		0.27	21	
IRFAC30	600	2.2	3.6	
IRFAC40		1.2	6.2	
IRFAC50		0.58	10.6	
IRFAE30	800	3.2	3.1	
IRFAE40		2.0	4.8	
IRFAE50		1.2	7.1	
IRFAF30	900	4.0	2.8	
IRFAF40		2.5	4.3	
IRFAF50		1.6	6.2	
IRFAG30	1000	5.6	2.3	
IRFAG40		3.5	3.9	
IRFAG50		2.0	5.6	

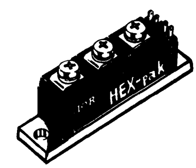
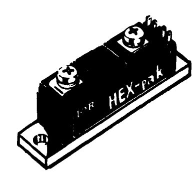


TO-3 P-Channel

Part Number	BVDSS Drain Source Voltage (Volts)	RDS(on) On-State Resistance (Ohms)	ID Max. Continuous Drain Current (Amps)	Case Style
IRF9130	-100	0.30	-12	**TO-204AA** TO-3
IRF9140		0.20	-19	
IRF9230	-200	0.80	-6.5	
IRF9240		0.50	-11	



TO-240 N-Channel

Part Number	BVDSS Drain Source Voltage (Volts)	RDS(on) On-State Resistance (Ohms)	ID Continuous Drain Current 25°C Case (Amps)	IDM Pulse Drain Current (Amps)	PD Max Power Dissipation (Watts)	Case Style
IRFK2D054	60	0.010	120	480	500	**TO-240AA**
IRFK2D150	100	0.028	72	288		
IRFK2D250	200	0.043	54	216		
IRFK2D350	400	0.150	25	100		
IRFK2D450	500	0.200	22	88		
IRFK2DC50	600	0.350	18	72		
IRFK2DE50	800	0.600	12	48		
IRFK2F054	60	0.010	120	480		
IRFK2F150	100	0.028	72	288		
IRFK2F250	200	0.043	54	216		
IRFK2F350	400	0.150	25	100		
IRFK2F450	500	0.200	22	88		
IRFK2FC50	600	0.350	16	72		
IRFK2FE50	800	0.600	12	48		
IRFK3D150	100	0.020	125	435	625	
IRFK3D250	200	0.030	70	280		
IRFK3D350	400	0.100	37	148		
IRFK3D450	500	0.135	33	132		
IRFK3DC50	600	0.230	24	96		
IRFK3F150	100	0.020	125	435		
IRFK3F250	200	0.030	70	280		
IRFK3F350	400	0.100	37	148		
IRFK3F450	500	0.135	33	132		
IRFK3FC50	600	0.230	24	96		
IRFK4H054	60	0.005	150	960	500	**TO-240AA**
IRFK4H150	100	0.014	145	580		
IRFK4H250	200	0.021	108	432		
IRFK4H350	400	0.075	50	200		
IRFK4H450	500	0.100	44	176		
IRFK4HC50	600	0.175	35	140		
IRFK4HE50	800	0.300	26	104		
IRFK4J054	60	0.005	150	960		
IRFK4J150	100	0.014	145	580		
IRFK4J250	200	0.021	108	432		
IRFK4J350	400	0.075	50	200		
IRFK4J450	500	0.100	44	176		
IRFK4JC50	600	0.175	35	140		
IRFK4JE50	800	0.300	26	104		
IRFK6H150	100	0.010	150	720	625	
IRFK6H250	200	0.015	140	560		
IRFK6H350	400	0.050	75	300		
IRFK6H450	500	0.067	66	264		
IRFK6HC50	600	0.100	48	192		
IRFK6J150	100	0.010	150	720		
IRFK6J250	200	0.015	140	560		
IRFK6J350	400	0.050	75	300		
IRFK6J450	500	0.067	66	264		
IRFK6JC50	600	0.100	48	192		

Government/ Space Products

Life, Power-Age, Environmental and Military Testing Capabilities — USA MIL-S-19500 Qualified

Life Tests and Power-Age Capabilities

A. High temperature storage life testing up to 200°C.

B. Voltage temperature stress tests at both ambient and elevated conditions.

C. Free air operation life. Test capability, 1000 positions for power transistors, and 1500 positions for power diodes.

D. HTRB test capabilities over 25,000 positions for V_{GS} and for V_{DS} burn-in for HEXFETs, and more than 2000 positions for diodes, SCRs and Schottkys.

E. Computerized readout equipment.

F. Intermittent operating life tests at various cycles and power levels.

Environmental Test Capabilities

TEST	CAPABILITY
Acceleration, Sustained Centrifuge	50-30,000g (Standard)
Altitude (Barometric Pressure, Reduced)	450,000 Ft. Simulated Altitude at T_A = 25°C
Moisture Resistance	25-85°C 85% RH
Salt Atmosphere/Spray	25°C to 71°C, up to 20% Salt Solution by Weight
Seal-Gross, Fine Leak	1 x 10^{-8} atm cc/sec, Fluorocarbons, Mineral Oils, FC-43, Hydrostatic Pressure: 0-100 psig
Symbolization (Resistance to Solvents)	Permanent Marking
Shock (Mechanical)	Pulse Shape — Approximately Half-sine 500-1500g at 0.5-1.0 msec
Solderability	Up to 260°C
Temperature Cycling	−65°C to 200°C
Terminal Strength (Lead Integrity)	Lead Fatigue, Tension, Stud Torque, Terminal Torque
Thermal Shock	−65°C to 200°C
Vibration, Fatigue	5-20g Fixed Frequency
Vibration, Variable	5-2000 Hz as Limited by 1 inch DA and 60 inches/second Velocity; 0-20g (Standard)

Military Test Standard Capabilities

TEST CATEGORY	MIL-STD-202	MIL-STD-750
Barometric Pressure (reduced)	Method 105, All Conditions	Method 1001, All Conditions
Moisture Resistance	Method 106	Method 1021
Resistance to Solvents	Method 215	Method 1022
Salt Atmosphere	Method 101, All Conditions	Method 1041, Method 1046
Seal, Gross Leak	Method 112B, Conditions A, B & D	Method 1071, Conditions C, D & F
Seal, Fine Leak	Only Method 112B, Condition C Procedure IIIA	Method 1071, Condition H
Solderability	Method 208	Method 2026
Soldering Heat	Method 210, All Conditions	Method 2031
Temperature Cycling	Method 102, All Conditions	Method 1051, All Conditions
Terminal Strength	Method 211, All Conditions	Method 2036, All Conditions
Terminal Shock (Glass Strain)	Method 107, All Conditions	Method 1056, All Conditions
Acceleration, Sustained (Centrifuge)	Method 212, All Conditions	Method 2006
Shock (Mechanical)	Method 213, Conditions D, E & F	Method 2016
Vibration, Fatigue	Method 201	Method 2046
Vibration, Variable Frequency	Method 204	Method 2056
PIND	—	Method 2052
Power Cycling	—	Method 1042

Life, Power-Age, Environmental and Military Testing Capabilities — Europe

Life Test and Power-Age Capabilities

A. High temperature storage life testing up to 200°C.
B. Voltage temperature stress tests at both ambient and elevated conditions.
C. HTRB test capabilities over 5000 positions for V_{GS} and for V_{DS} burn-in for HEXFETs.
D. Computerized measurement and readout equipment.
E. Intermittent operating life tests at various cycles and power levels.

Environmental Test Capabilities

TEST	
Acceleration, Sustained Centrifuge	50 to 30,000g (Standard)
Altitude (Barometric Pressure Reduced	450,000 Ft. Simulated Altitude at T_A = 25°C
Moisture Resistance	25°C to 85°C, 85% Relative Humidity
Seal-Gross, Fine Leak	1 x 10^{-8} atm cc/sec, Fluorocarbons, Mineral Oils, FC-43, Hydrostatic Pressure: 0 to 100 psig
Symbolisation (Resistance to Solvents)	Permanent Marking
Solderability	Up to 250°C
Temperature Cycling	-65°C to 200°C
Terminal Strength (Lead Integrity)	Lead Fatigue, Tension, Stud Torque, Terminal Torque
Thermal Shock	-85°C to 200°C

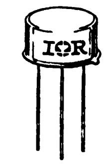
Military Test Standard Capabilities

TEST CATEGORY	MIL-STD-750 / ESA/SCC	CECC 50,000
Barometric Pressure (reduced)	Method 1001	—
Moisture Resistance	Method 1021	4.4.2
Resistance to Solvents	Method 1022	4.2.3
Seal, Gross Leak	Method 1071, Conditions C, D & F	4.4.10 Qc
Seal, Fine Leak	Method 1071, Condition H	4.4.10 Qc
Solderability	Method 2026	4.4.7
Soldering Heat	Method 2031	4.4.8
Temperature Cycling	Method 1051, All Conditions	4.4.4 Na
Terminal Strength	Method 2036, All Conditions	4.4.9, All Conditions
Terminal Shock (Glass Strain)	Method 1056, All Conditions	4.4.9, All Conditions
Acceleration, Sustained (Centrifuge)	Method 2006	4.4.11
PIND	Method 2052	—
Power Cycling	Method 1042	—

HEXFET, Mil-Qualified

TO39/HEXFET/N-Channel

Part Numbers			Hexfet Cross	Voltage	Current T_C = 25°C	MIL-S-19500	Qualification	Case Style
JEDEC	JANTX	JANTXV	Reference		(A)			
2N6782	JANTX2N6782	JANTXV2N6782	IRFF110	100V	3.5	/556	19500-1262-83	**TO-205AF** TO-39
2N6784	JANTX2N6784	JANTXV2N6784	IRFF210	200V	2.25	/556	19500-1262-83	
2N6786	JANTX2N6786	JANTXV2N6786	IRFF310	400V	1.25	/556	19500-1262-83	
2N6788	JANTX2N6788	JANTXV2N6788	IRFF120	100V	6.0	/555	19500-1263-83	
2N6790	JANTX2N6790	JANTXV2N6790	IRFF220	200V	3.5	/555	19500-1263-83	
2N6792	JANTX2N6792	JANTXV2N6792	IRFF320	400V	2.0	/555	19500-1263-83	
2N6794	JANTX2N6794	JANTXV2N6794	IRFF420	500V	1.5	/555	19500-1263-83	
2N6796	JANTX2N6796	JANTXV2N6796	IRFF130	100V	8.0	/557	19500-1263-83	
2N6798	JANTX2N6798	JANTXV2N6798	IRFF230	200V	5.5	/557	19500-1261-83	
2N6800	JANTX2N6800	JANTXV2N6800	IRFF330	400V	3.0	/557	19500-1261-83	
2N6802	JANTX2N6802	JANTXV2N6802	IRFF430	500V	2.5	/557	19500-1261-83	

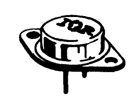


TO39/HEXFET/P-Channel

2N6845	JANTX2N6845	JANTXV2N6845	IRFF9120	-100V	-4.0	/563	19500-1094-86
2N6847	JANTX2N6847	JANTXV2N6847	IRFF9220	-200V	-2.5	/563	19500-1094-86
2N6849	JANTX2N6849	JANTXV2N6849	IRFF9130	-100V	-6.5	/564	19500-1093-86
2N6851	JANTX2N6851	JANTXV2N6851	IRFF9230	-200V	-4.0	/564	19500-1093-86

TO3/HEXFET/N-Channel

2N6756	JANTX2N6756	JANTXV2N6756	IRF130	100V	14.0	/542	19500-488-81	**TO-204AA** TO-3
2N6758	JANTX2N6758	JANTXV2N6758	IRF230	200V	9.0	/542	19500-488-81	
2N6760	JANTX2N6760	JANTXV2N6760	IRF330	400V	5.5	/542	19500-488-81	
2N6762	JANTX2N6762	JANTXV2N6762	IRF430	500V	4.5	/542	19500-489-81	
2N6764	JANTX2N6764	JANTXV2N6764	IRF150	100V	38.0	/543	19500-490-81	
2N6766	JANTX2N6766	JANTXV2N6766	IRF250	200V	30.0	/543	19500-490-81	
2N6768	JANTX2N6768	JANTXV2N6768	IRF350	400V	14.0	/543	19500-960-82	
2N6770	JANTX2N6770	JANTXV2N6770	IRF450	500V	12.0	/543	19500-960-82	

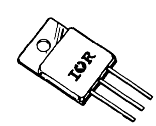


TO3/HEXFET/P-Channel

2N6804	JANTX2N6804	JANTXV2N6804	IRF9130	-100V	-12.0	/562	19500-811-86
2N6806	JANTX2N6806	JANTXV2N6806	IRF9230	-200V	-6.5	/562	19500-811-86

TO254/HEXFET/N-Channel

2N7218	JANTX2N7218	JANTXV2N7218	IRFM140	100V	28.0	/596	19500-703-91	**TO-254AA** M-PAK (1)
2N7219	JANTX2N7219	JANTXV2N7219	IRFM240	200V	18.0	/596	19500-703-91	
2N7221	JANTX2N7221	JANTXV2N7221	IRFM340	400V	10.0	/596	19500-703-91	
2N7222	JANTX2N7222	JANTXV2N7222	IRFM440	500V	8.0	/596	19500-703-91	
2N7224	JANTX2N7224	JANTXV2N7224	IRFM150	100V	34.0	/592	19500-703-91	
2N7225	JANTX2N7225	JANTXV2N7225	IRFM250	200V	27.4	/592	19500-703-91	
2N7227	JANTX2N7227	JANTXV2N7227	IRFM350	400V	14.0	/592	19500-703-91	
2N7228	JANTX2N7228	JANTXV2N7228	IRFM450	500V	12.0	/592	19500-705-91	



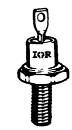
TO254/HEXFET/P-Channel

2N7236	JANTX2N7236	JANTXV2N7236	IRFM9140	-100V	-18.0	/595	19500-503-91
2N7237	JANTX2N7237	JANTXV2N7237	IRFM9240	-200V	-11.0	/595	19500-503-91

(1) PACKAGES CONTAINING BERYLLIA SHALL NOT BE GROUND, SANDBLASTED, MACHINED, OR HAVE OTHER OPERATIONS PERFORMED ON THEM WHICH WILL PRODUCE BERYLLIA OR BERYLLIUM DUST. FURTHERMORE, BERYLLIUM OXIDE PACKAGES SHALL NOT BE PLACED IN ACIDS THAT WILL PRODUCE FUMES CONTAINING BERYLLIUM.

Schottky Diodes — MIL-Qualified

D04 & D05/Schottky

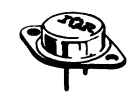
Part Numbers				Voltage (V)	Industrial Current Rating (A)	Military Current Rating (A)	MIL-S-19500	Qualification	Case Style
JEDEC	JAN	JANTX	JANTXV						
1N6391	JAN1N6391	JANTX1N6391	JANTXV1N6391	45	25	25	/553	19500-647-83	D04 
1N6392	JAN1N6392	JANTX1N6392	JANTXV1N6392	45	60	60	/554	19500-648-83	D05 

Government/ Space Products

HEXFET, CECC Qualified — Europe

T03/HEXFET/N-Channel

Basic Type	V_{DS} (V)	$R_{DS(on)}$ (Ohms)	CECC Specification	Issue No.	Issue Date	Level of Quality Assessment and CECC 50 000 Screen Level Options	Case Outline
IRF044	60	0.028	50 012-056	1	6/91	E-,EA,EB,EC,ED	TO-204AA TO-3
IRF120	100	0.30	50 012-012	2	6/83	E-,EA,EB,EC,ED	
IRF130	100	0.18	50 012-013	2	6/83	E-,EA,EB,EC,ED	
IRF140	100	0.077	50 012-056	1	6/91	E-,EA,EB,EC,ED	
IRF150	100	0.055	50 012-014	2	6/83	E-,EA,EB,EC,ED	
IRF220	200	0.80	50 012-102	2	6/83	E-,EA,EB,EC,ED	
IRF230	200	0.40	50 012-013	2	6/83	E-,EA,EB,EC,ED	
IRF240	200	0.18	50 012-056	1	6/91	E-,EA,EB,EC,ED	
IRF250	200	0.085	50 012-014	2	6/83	E-,EA,EB,EC,ED	
IRF330	400	1.00	50 012-013	2	6/83	E-,EA,EB,EC,ED	
IRF340	400	0.40	50 012-013	1	6/91	E-,EA,EB,EC,ED	
IRF350	400	0.30	50 012-014	2	6/83	E-,EA,EB,EC,ED	
IRF430	500	1.50	50 012-012	2	6/83	E-,EA,EB,EC,ED	
IRF440	500	0.85	50 012-056	1	6/91	E-,EA,EB,EC,ED	
IRF450	500	0.40	50 012-014	2	6/83	E-,EA,EB,EC,ED	

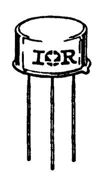


T03/HEXFET/P-Channel

IRF9130	-100	0.30	50 012-015	2	6/83	E-,EA,EB,EC,ED
IRF9140	-100	0.20	50 012-057	1	6/83	E-,EA,EB,EC,ED
IRF9230	-200	0.80	50 012-015	1	1/91	E-,EA,EB,EC,ED
IRF9240	-200	0.50	50 012-057	1	6/83	E-,EA,EB,EC,ED

T039/HEXFET/N-Channel

2N6782	100	0.60	50 012-027			E-,EA,EB,EC,ED	TO-205AF TO-39
2N6788	100	0.30	50 012-028			E-,EA,EB,EC,ED	
2N6796	100	0.18	50 012-029			E-,EA,EB,EC,ED	
2N6790	200	0.80	50 012-028	1	3/85	E-,EA,EB,EC,ED	
2N6798	200	0.40	50 012-029			E-,EA,EB,EC,ED	
2N6800	400	1.00	50 012-029			E-,EA,EB,EC,ED	

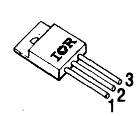


T039/HEXFET/P-Channel

2N6845	-100	0.60	50 012-036			E-,EA,EB,EC,ED
2N6849	-100	0.30	50 012-037	1	6/91	E-,EA,EB,EC,ED
2N6847	-200	1.50	50 012-036			E-,EA,EB,EC,ED
2N6851	-200	0.80	50 012-037			E-,EA,EB,EC,ED

T0257/HEXFET/N-Channel

IRFY044(M)	60	0.03	50 012-062			E-,EA,EB,EC,ED	TO-257AA Y-PAK
IRFY120(M)	100	0.31	50 012-060			E-,EA,EB,EC,ED	
IRFY130(M)	100	0.19	50 012-061			E-,EA,EB,EC,ED	
IRFY140(M)	100	0.092	50 012-062			E-,EA,EB,EC,ED	
IRFY240(M)	200	0.19	50 012-062	1	10/91	E-,EA,EB,EC,ED	
IRFY340(M)	400	0.55	50 012-062			E-,EA,EB,EC,ED	
IRFY430(M)	500	1.50	50 012-061			E-,EA,EB,EC,ED	
IRFY440(M)	500	0.85	50 012-062			E-,EA,EB,EC,ED	



	1	2	3
IRFY	G	D	S
IRFY(M)	D	S	G

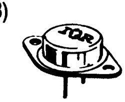
T0257/HEXFET/P-Channel

IRFY9120(M)	-100	0.60	50 012-063			E-,EA,EB,EC,ED
IRFY9130(M)	-100	0.31	50 012-064	1	10/91	E-,EA,EB,EC,ED
IRFY9140(M)	-100	0.21	50 012-065			E-,EA,EB,EC,ED
IRFY9240(M)	-200	0.50	50 012-065			E-,EA,EB,EC,ED

Government/ Space Products

HEXFET, ESA/SCC — Qualified — Europe

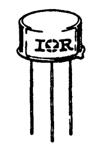
TO3/HEXFET/N-Channel

Basic Type	V_{DS} (V)	$R_{DS(on)}$ (Ohms)	ESA/SCC Specification	Variant	Test Level	Issue No.	Issue Date	Outline
2N6764	100	0.055	5205/013	-01	B,C			**TO-204AA** (TO-3) 
2N6766	200	0.085	5205/013	-02	B,C	2A	3/85	
2N6768	400	0.30	5205/013	-03	B,C			

TO3/HEXFET/P-Channel

Basic Type	V_{DS} (V)	$R_{DS(on)}$ (Ohms)	ESA/SCC Specification	Variant	Test Level	Issue No.	Issue Date
2N6804	-100	0.30	5206/004	-01	B,C	1A	12/85
2N6806	-200	0.80	5206/004	-02	B,C	1A	

TO39/HEXFET/N-Channel

Basic Type	V_{DS} (V)	$R_{DS(on)}$ (Ohms)	ESA/SCC Specification	Variant	Test Level	Issue No.	Issue Date	Outline
2N6796	100	0.18	5205/019	-01	B,C	1A	12/85	**TO-205AF** (TO-39) 
2N6782	100	0.60	5205/014	-01	B,C	1A	3/84	
2N6798	200	0.40	5205/019	-03	B,C	1A	12/85	
IRFF210	200	1.50	5205/014	-		-	Pending	
2N6800	400	1.00	5205/019	-05	B,C	1A	12/85	
IRFF310	400	3.60	5205/014	-	-	-	Pending	
2N6802	500	1.50	5205/019	-07	B,C	1A	12/85	

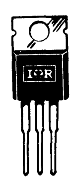
TO39/HEXFET/P-Channel

Basic Type	V_{DS} (V)	$R_{DS(on)}$ (Ohms)	ESA/SCC Specification	Variant	Test Level	Issue No.	Issue Date
2N6849	-100	0.30	5206/003	-01	B,C	1	12/85
2N6851	-200	0.80	5206/003	-02	B,C	1	

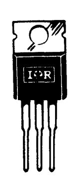
TO ORDER SPECIFY BASIC TYPE, SPECIFICATION, VARIANT,LOT A
E.G. 2N6764, SCC520S/013.018, ISSUE N:2 DATED 3/88.

HEXFET, DEF STAN — 59/61 Part 80 — Tested — Europe

TO220/HEXFET/N-Channel

Basic Type	V_{DS} (V)	$R_{DS(on)}$ (Ohms)	IR Document	Option	Outline
IRFZ14		0.20	-		**TO-220AB** 
IRFZ24	60	0.10	-		
IRFZ34		0.05	-		
IRFZ44		0.028	-		
IRF510		0.54	E2957		
IRF520	100	0.27	E2958		
IRF530		0.16	E2959		
IRF540		0.077	E2960		
IRF610		1.50	E2957		
IRF620	200	0.80	E2958	F,FX	
IRF630		0.40	E2959		
IRF640		0.18	E2960		
IRF614		2.00	-		
IRF624	250	1.10	-		
IRF634		0.45	-		
IRF644		0.28	-		
IRF710		3.60	E2957		
IRF720	400	1.80	E2958		
IRF730		1.00	E2959		
IRF740		0.55	E2960		
IRF820		3.00	E2958		
IRF830	500	1.50	E2959		
IRF840		0.85	E2960		

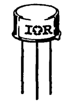
TO220/HEXFET/P-Channel

Basic Type	V_{DS} (V)	$R_{DS(on)}$ (Ohms)	IR Document	Option	Outline
IRF9Z14		0.50	-		**TO-220AB** 
IRF9Z24	-60	0.28	-		
IRF9Z34		0.14	-		
IRF9510		1.20	-	F,FX	
IRF9520	-100	0.60	E2961		
IRF9530		0.30	E2962		
IRF9540		0.20	-		
IRF9610		3.00	-		
IRF9620	-200	1.50	E2961		
IRF9630		0.80	E2962		
IRF9640		0.50	-		

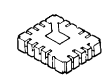
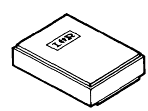
Government/ Space Products

HEXFET High Reliability

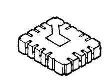
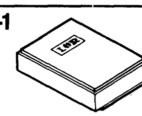
T039/HEXFET Logic Level/N-Channel

Part Number	V_{DS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Continuous Drain Current 25°C Case (Amps)	I_{DM} Pulse Drain Current (Amps)	P_D Max Power Dissipation (Watts)	Case Style
IRLF110	100	0.60	3.5	14	15	**TO-205AF** TO-39 
IRLF120		0.35	5.3	21	20	
IRLF130		0.20	8	33	25	

LCC/SMD/HEXFET/N-Channel

Part Number	V_{DS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Continuous Drain Current 25°C Case (Amps)	I_{DM} Pulse Drain Current (Amps)	P_D Max Power Dissipation (Watts)	Case Style
IRFE024	60	0.15	7.4	30	14	**LCC** 
IRFE110	100	0.60	3.1	12	11	
IRFE120	100	0.30	4.8	19	14	
IRFE130	100	0.18	7.4	30	22	
IRFE210	200	1.50	1.8	7.2	11	
IRFE220	200	0.80	2.8	11	14	
IRFE230	200	0.40	4.8	19	22	
IRFE310	400	3.60	1.2	4.8	11	
IRFE320	400	1.80	1.8	7.2	14	
IRFE330	400	1.00	3.0	12	22	
IRFE420	500	3.00	1.4	5.6	14	
IRFE430	500	1.50	2.5	10	22	
IRFN044	60	0.40	34	136	75	**SMD-1** 
IRFN054	60	0.027	45	180	100	
IRFN140	100	0.10	22	88	75	
IRFN150	100	0.073	27	108	100	
IRFN240	200	0.18	14	56	75	
IRFN250	200	0.10	22	88	100	
IRFN340	400	0.55	8	32	75	
IRFN350	400	0.315	11	44	100	
IRFN440	500	0.89	6	24	75	
IRFN450	500	0.42	10.4	41	100	
IRFNG40	1000	3.50	3	12	75	
IRFNG50	1000	2.00	4.5	18	100	

LCC/SMD/HEXFET/P-Channel

Part Number	V_{DS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Continuous Drain Current 25°C Case (Amps)	I_{DM} Pulse Drain Current (Amps)	P_D Max Power Dissipation (Watts)	Case Style
IRFE9024	-60	0.28	-5.4	-22	14	**LCC** 
IRFE9110	-100	1.20	-2.2	-8.8	11	
IRFE9120	-100	0.60	-3.5	-14	14	
IRFE9130	-100	0.30	-6.5	-25	22	
IRFE9210	-200	3.00	-1.3	-5.2	11	
IRFE9220	-200	1.50	-2.1	-8.4	14	
IRFE9230	-200	0.80	-3.6	-14	22	
IRFN9140	-100	0.20	-17	-68	75	**SMD-1** 
IRFN9240	-200	0.51	-8	-32	75	

OTHER PRODUCTS

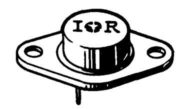
Government/ Space Products

Other Products From IR

HEXFET High Reliability

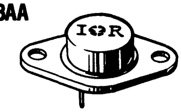
TO66/HEXFET/N-Channel Not For Future Designs

Part Number	V_{DS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Continuous Drain Current 25°C Case (Amps)	I_{DM} Pulse Drain Current (Amps)	P_D Max Power Dissipation (Watts)	Case Style
IRFJ120	100	0.3	8	32	40	**TO-213AA** TO-66
IRFJ130		0.18	12	40	50	
IRFJ140		0.085	15	60	70	
IRFJ220	200	0.8	5	20	40	
IRFJ230		0.4	8	32	50	
IRFJ240		0.18	13	52	70	
IRFJ320	400	1.8	3	12	40	
IRFJ330		1.0	4.5	18	50	
IRFJ340		0.55	7.5	30	70	
IRFJ420	500	3.0	2.5	10	40	
IRFJ430		1.5	3.8	15	50	
IRFJ440		0.85	6	24	70	



TO66/HEXFET/P-Channel Not For Future Designs

IRFJ9130	-100	0.31	-8.5	-34	50	**TO-213AA** TO-66
IRFJ9140	-100	0.21	-18.0	-72	70	
IRFJ9230	-200	0.81	-5.5	-22	50	
IRFJ9240	-200	0.51	-8.0	-32	70	

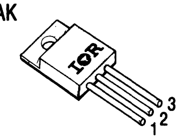


TO257/HEXFET/N-Channel

IRFY120(M)	100	0.31	7.4	29.2	30	**TO-257** Y-PAK
IRFY130(M)	100	0.19	10.8	43.2	45	
IRFY140(M)	100	0.092	18.4	73.6	60	
IRFY240(M)	200	0.19	12.4	49.6	60	
IRFY340(M)	400	0.55	6.9	27.6	60	
IRFY430(M)	500	1.50	3.5	14	45	
IRFY440(M)	500	0.85	5.5	22	60	

TO257/HEXFET/P-Channel

IRFY9120(M)	-100	0.60	-5.3	-21.2	30
IRFY9130(M)		0.31	-9.3	-37.2	45



	1	2	3
IRFY	G	D	S
IRFY(M)	D	S	G

Government/ Space Products

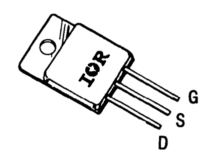
HEXFET High Reliability

T0254/HEXFET/N-Channel

Part Number	V_{DS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Continuous Drain Current 25°C Case (Amps)	I_{DM} Pulse Drain Current (Amps)	P_D Max Power Dissipation (Watts)	Case Style
IRFM044	60	0.04	25	210	150	**TO-254AA** M-PAK (1)
IRFM054	60	0.022	25	150	150	
IRFM140	100	0.100	25	110	150	
IRFM150	100	0.065	25	160	150	
IRFM240	200	0.200	18	72	125	
IRFM250	200	0.100	25	100	150	
IRFM340	400	0.56	8.5	40	125	
IRFM350	400	0.31	15	60	150	
IRFM440	500	0.86	8	32	125	
IRFM450	500	0.42	13	52	150	

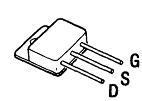
T0254/HEXFET/P-Channel

Part Number	V_{DS} (Volts)	$R_{DS(on)}$ (Ohms)	I_D (Amps)	I_{DM} (Amps)	P_D (Watts)
IRFM9130	-100	0.31	-11.5	-48	75
IRFM9140	-100	0.21	-17.3	-69	125
IRFM9230	-200	0.81	-6.5	-26	75
IRFM9240	-200	0.51	-10.7	-43	125



TO-258/HEXFET/N-Channel

Part Number	V_{DS} (Volts)	$R_{DS(on)}$ (Ohms)	I_D (Amps)	I_{DM} (Amps)	P_D (Watts)	Case Style
IRFV360	400	0.21	22	80	250	**TO-258**
IRFV460	500	0.27	21	70		



M0036/HEXFET/N-Channel

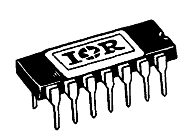
Part Number	V_{DS} (Volts)	$R_{DS(on)}$ (Ohms)	I_D (Amps)	I_{DM} (Amps)	P_D (Watts)	Case Style
IRFG110	100	0.8	0.95	4	1.4	**MO-036AB**

M0036/HEXFET/P-Channel

Part Number	V_{DS} (Volts)	$R_{DS(on)}$ (Ohms)	I_D (Amps)	I_{DM} (Amps)	P_D (Watts)
IRFG9110	-100	1.4	-0.75	-3	1.4

M0036/HEXFET/N & P Channel

Part Number	V_{DS} (Volts)	$R_{DS(on)}$ (Ohms)	I_D (Amps)	I_{DM} (Amps)	P_D (Watts)
IRFG5110	100	0.8	1	4	1.4
	-100	0.8	-0.95	-4	
IRFG6110	100	0.8	0.95	4	
	-100	1.4	-0.95	-3.5	



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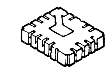
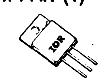
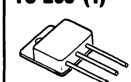
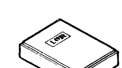
Schottky Diodes — High Reliability

Part Number	V_{RRM} (V)	$I_{F(AV)}$ @ T_C = 100°C Per Package	V_{FM}/leg @ T_C = 125°C (V)	@ I_{FM}	I_{FSM} Single Pulse 10 ms Sine	I_{RM} @ T_j = 125°C & Rated V_{RWM} (mA)	Max. T_j (°C)	Case Style
5EQ100	100	25	1.31	50	180	15	150	LCC 
8EQ045	45	32	1.38	64	180	15	150	
22GQ100	100	35*	1.38	70	300	45	150	TO-254AA M-PAK (1) 
25GQ045	45	35*	1.30	70	300	45	150	
22CGQ045	45	35*	0.91	35	300	20	150	
15CGQ100	100	35*	0.96	35	300	45	150	
12CGQ150	150				300	20	150	
45CKQ100	100	45*	0.96	45	540	45	150	TO-258 (1) 
60CKQ045	45	45*	0.83	45	540	45	150	
15CLQ100	100	40	1.01	40	180	45	150	SMD-1 
20CLQ045	45	80	1.16	80	180	20	150	

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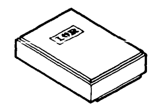
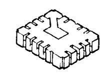
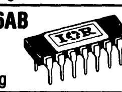
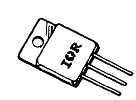
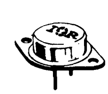
Government/ Space Products

Radiation Hard HEXFETs

Part Number	Radiation Test Level KRads (Si)	V_{DS} Drain Source Voltage (Volts)	$R_{DS(on)}$ On-State Resistance (Ohms)	I_D Continuous Drain Current 25°C Case (Amps)	I_{DM} Pulse Drain Current (Amps)	P_D Max Power Dissipation (Watts)	Case Style
IRHN7054	100	60	0.027	45	180	100	**SMD-1** 
IRHN7150	100	100	0.065	27	108	100	
IRHN7250	100	200	0.11	22	88	100	
IRHN7450	100	500	0.45	10.4	41	100	
IRHN8054	1000	60	0.027	45	180	100	
IRHN8150	1000	100	0.065	27	108	100	
IRHN8250	1000	200	0.11	22	88	100	
IRHN8450	1000	500	0.45	10.4	41	100	WT. 2.4g
IRHE7110	100	100	0.6	3.5	14	15	**LCC** 
IRHE7130	100	100	0.18	8	32	25	
IRHE7230	100	200	0.44	5	20	25	
IRHE8110	1000	100	0.6	3.5	14	15	
IRHE8130	1000	100	0.18	8	32	25	
IRHE8230	1000	200	0.44	5	20	25	WT. 0.42g
IRHG7110	100	100	0.80	0.95	4	1.4	**MO-036AB**  WT. 1.3g
IRHF7110	100	100	0.6	3.5	14	15	**TO-205AF** TO-39 
IRHF7130	100	100	0.18	8	32	25	
IRHF7230	100	200	0.44	5	20	25	
IRHF8110	1000	100	0.6	3.5	14	15	
IRHF8130	1000	100	0.18	8	32	25	
IRHF8230	1000	200	0.44	5	20	25	WT. 0.98g
IRHM7130	100	100	0.18	14	56	75	**TO-254AA (1)** 
IRHM7230	100	200	0.40	9.0	36	75	
IRHM7054	100	60	0.027	35	220	150	
IRHM7150	100	100	0.065	34	136	150	
IRHM7250	100	200	0.100	27.4	110	150	
IRHM7450	100	500	0.42	12	48	150	
IRHM7360	100	400	0.20	25	100	300	
IRHM8130	1000	100	0.18	14	56	75	
IRHM8230	1000	200	0.40	9.0	36	75	
IRHM8054	1000	60	0.027	35	220	150	
IRHM8150	1000	100	0.065	34	136	150	
IRHM8250	1000	200	0.100	27.4	110	150	
IRHM8450	1000	500	0.42	12	48	150	
IRHM8360	1000	400	0.20	25	100	300	WT. 9.3g
IRH7130	100	100	0.18	14	56	75	**TO-204AA/AE** TO-3 
IRH7230	100	200	0.40	9.0	36	75	
IRH7054	100	60	0.027	35	220	150	
IRH7150	100	100	0.065	34	136	150	
IRH7250	100	200	0.100	27.4	110	150	
IRH7450	100	500	0.42	12	48	150	
IRH7360	100	400	0.20	25	100	300	
IRH8130	1000	100	0.18	14	56	75	
IRH8230	1000	200	0.40	9.0	36	75	
IRH8054	1000	60	0.027	35	220	150	
IRH8150	1000	100	0.065	34	136	150	
IRH8250	1000	200	0.100	27.4	110	150	
IRH8450	1000	500	0.42	12	48	150	WT. 11.5g

- **DEMONSTRATES EXCELLENT THRESHOLD VOLTAGE STABILITY AND BREAKDOWN VOLTAGE STABILITY AT TOTAL RADIATION DOSES AS HIGH AS 1 MEGARAD.**
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Schottky Diode Designer's Manual

International Rectifier

Other Catalogs from IR

Order No.	**Description**
HDM-1, Vol. 2	DIPs, D-Paks, I-Paks, Logic Level Devices – HEXFET Designer's Manual
IGBT-2	Insulated Gate Bipolar Transistors (IGBTs) Designer's Manual
MPIC-4	Microelectronic Relays Designer's Manual
PMD-I	Power Modules Designer's Manual (Medium and High Power Rectifiers/Thyristors)
NRPM-2	Rectifiers, Standard Recovery Type
SHVR-1	Rectifiers, Standard Recovery Type – High Power
FRPM-1	Rectifiers, Fast Recovery Type
NTPM-2	Thyristors, Phase Control Type
IPM-1	Thyristors, Inverter Type
SFC	Short Form Catalog – Power Semiconductors Product Digest

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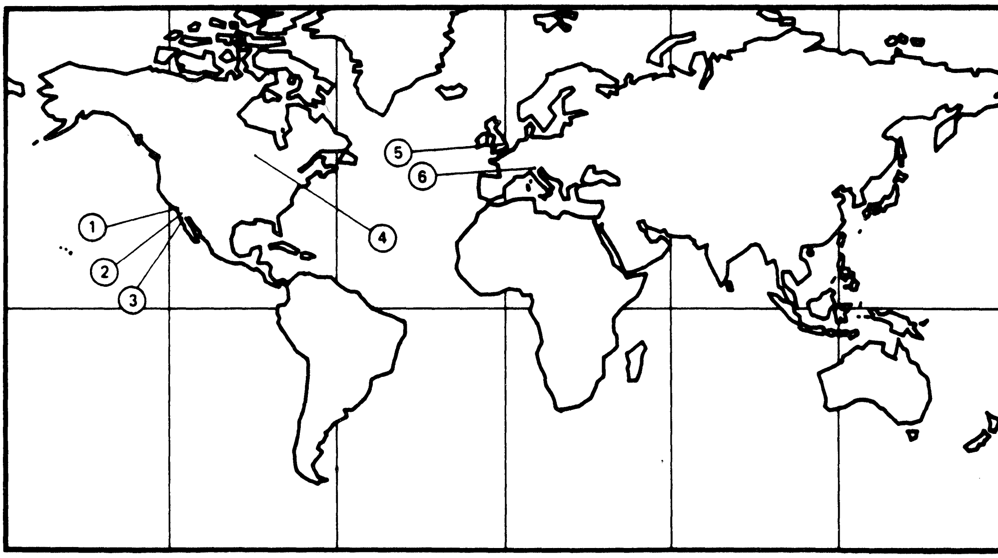

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