

A Short-Form Reference to  
Harris Semiconductor  
Products

GUIDE GUIDE GUIDE  
**PRODUCT**  
**SELECTION**  
GUIDE

1992



**HARRIS**  
SEMICONDUCTOR

# PRODUCT SELECTION GUIDE

**This product guide represents the full line of Harris Semiconductor products.**

The guide is organized into eight numbered sections, each with lettered subsections. For example, Section 6 is the POWER Section which comprises five subsections: MOSFETs (6A); IGBTs (6B); Bipolar (6C); Rectifiers (6D); and Transient Voltage Protection (6E). There are three search methods available for your convenience:

**DEVICE CATEGORY LISTING** is located on page iv. This lists categories of devices such as "Amplifiers," and "Microprocessors" with reference to one of the eight sections plus the sub-section.

**PART NUMBER INDEX** (pages 1 to 25) provides Harris part numbers sorted alphanumerically and indicating the product selection guide page number, a databook reference, whether the part is available in military grade, and the datasheet file number.

**SECTION TABLE OF CONTENTS** on page v shows the eight sections (New Products, Analog, Data Acquisition, Digital, Application Specific, Power, Hi-Rel & Rad-Hard, and ASIC), and what product categories can be found in each.

**SALES OFFICE LISTING** is located in the back of this book. It lists Harris sales offices, plus representative and distributor locations throughout the world.

Only key product information -- key features, ratings, or characteristics -- is given for each of the products referenced in this book. For complete, current and detailed technical specifications for any device you are interested in, please contact the nearest Harris sales outlet (see SALES OFFICE LISTING at back of this book).

Literature requests can also be directed to:

**Harris Semiconductor Literature Department**  
P.O. Box 883, M/S CB1-28  
Melbourne, Florida 32901  
FAX 407/724-3299

Harris Semiconductor products are sold by description only. All specifications in this product guide are applicable only to packaged products; specifications for die are available upon request. Harris reserves the right to make changes in circuit design, specifications and other information at any time without prior notice. Accordingly, the reader is cautioned to verify that information in this publication is current before placing orders. Reference to products of other manufacturers are solely for convenience of comparison and do not imply total equivalency of design, performance, or otherwise.

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Printed in U.S.A. 7/92



# 1992 HARRIS CORPORATION

*Harris is a worldwide company focused on four major businesses - electronic systems, semiconductors, communications and Lanier Worldwide office equipment. We use advanced technologies to provide innovative and cost-effective solutions to our commercial and government customers in more than 130 countries, and we are committed to providing products, systems, and services of the highest quality. Fiscal 1992 sales exceeded \$3 billion.*

## HARRIS PRODUCTS

**Electronic Systems:** Satellite communication terminals, tracking and control systems; terrestrial communication systems; secure and jam-resistant communication systems; spaceborne information processing systems; missile and spacecraft instrumentation; advanced avionic systems; digital terrain displays; video teleconferencing systems; command and control systems; information and signal processing systems; automatic maintenance and test systems; systems software and integration; telecommunication networks; test-program software for avionics; simulation and training systems; technical support services; real-time super-mini- and microcomputers; air traffic control and airport management systems; custom integrated telecommunication networks; energy management systems; newspaper text-processing and pagination systems.

**Semiconductors:** Standard, custom, and semicustom integrated circuits and discrete products for analog, mixed-signal and power-Control applications. Product portfolio includes devices for analog signal processing, digital signal processing, data conversion, interface, logic, microcontrollers, microprocessors, microprocessor peripherals, power conditioning, and intelligent power. Also, custom and standard application-specific ICs for military, communication, and automotive applications. Key technologies include: CMOS (Complementary Metal Oxide Semiconductor), DI (Dielectric Isolation) including bipolar DI, CMOS/SOS (Silicon-On-Sapphire), CMOS/SOI (Silicon-On-Insulator) GaAs (Gallium Arsenide), BiCMOS (Mixed Bipolar and CMOS), bipolar and MOS power, MOV (Metal Oxide Varistors), and radiation hardening.

**Communications:** Microwave- and light-wave transmission equipment; HF/VHF/UHF radios; radio and television transmission systems and radio-studio equipment; digital network switches; voice information systems; private branch exchanges; telephone subscriber-loop test systems; remote terminal diagnostic systems; craft tools and test sets; paging systems; turnkey communication systems and services; printed-circuit-board design software.

**Office Equipment:** Copying systems; facsimile transmission units; information management systems; document retrieval and management systems; presentation systems; portable and desktop dictation equipment, central dictation systems, voice loggers, voice recognition workstations, and digital-dictation software and supplies.

## LEADERSHIP POSITIONS IN:

### Electronic Systems

- Largest producer of multimedia networking systems for the U.S. government
- A leading producer of satellite communication earth stations for the U.S. government
- Major supplier of information and communication systems to the Federal Aviation Administration
- A market leader in government meteorological data processing systems
- A market leader in ATE for military applications
- A market leader in aerospace communication and information handling systems
- Largest supplier of test-program set software
- A market leader in compact-range antenna systems
- A market leader in fiber-optic communication systems

### Semiconductors

- Seventh-largest merchant producer of semiconductors in the U.S.
- Largest producer of semiconductors for government applications worldwide
- A major producer of semiconductors for U.S. automobiles
- Leading supplier of telecom subscriber-line interface circuits (SLICs)
- An industry leader in custom and semicustom analog and mixed-signal ASICs (application specific integrated circuits)
- Pioneer in CMOS (complementary metal oxide semiconductor), GaAs (gallium arsenide), intelligent-power, DI (dielectric isolation), and radiation-hardened technologies

### Communications

- Largest U.S. supplier of radio- and television-broadcast transmitters
- Largest distributor of radio-broadcast equipment
- Largest producer of low- and medium-capacity private microwave radio equipment in North America
- Largest supplier of craft test sets and tools to the U.S. telephone industry
- A world leader in high-frequency long-range radios, secure communications, high-speed HF data transmission, and automatic link establishment
- A world leader in high-resolution digital video imaging transmission over narrow-band circuits

### Office Equipment

- One of the world's largest independent distributors of office equipment (1,600 sales and service locations in more than 50 countries) Market leader in dictating equipment. Largest supplier of digital dictation systems
- Seventh-largest supplier of copiers in U.S.
- Among top 10 suppliers of facsimile machines in U.S.

# HARRIS SEMICONDUCTOR

## MILITARY AND AEROSPACE DIVISION

P.O. Box 883 Melbourne, Florida 32902 • 407-724-7000

### Additional Locations:

Findlay, Ohio; Milpitas, California; Research Triangle Park, North Carolina; Kuala Lumpur, Malaysia

Military and Aerospace Division has been an industry leader for nearly three decades in radiation-hardened (rad-hard) integrated circuits that provide high performance and high reliability in severe operating environments. The division has met or exceeded the needs of space, tactical weapons, strategic weapons, and secure communication programs since 1962. The division is the number one (based on revenue) supplier of integrated circuits to the U.S. military.

### Major Products:

- Logic devices
- SRAMs (Static Random Access Memories)
- PROMs (Programmable Read-Only Memories)
- Op Amps (Operational Amplifiers)
- Analog multiplexers
- Microprocessors
- Analog switches
- Gatearrays
- Standard-cell analog ASICs (application-specific integrated circuits) and mixed-signal ASICs
- Full custom devices

### Major Process Technologies:

- Radiation hardening

### Applications:

Missiles, radar, sonar, navigation equipment, secure communication, fire control, and electronic counter-measure applications. Programs include Trident I and II, SICBM (Small Intercontinental Ballistic Missile), Peacekeeper, the JPL Mars Observer space vehicle, and the Air Force Global Positioning Systems (GPS). Harris' semiconductors were used in various capacities during Operation Desert Storm aboard the Patriot, TOW (Tube-launched Optically-tracked Wire-guided), Stinger Sparrow, Hellfire, and Copperhead missiles; in satellite tracking systems; and aboard the F-1a5, F-16, and F-18 fighter-bombers.

## SEMICONDUCTOR PRODUCTS DIVISION

P.O. Box 883 Melbourne, Florida 32902 • 407-724-7000

### Additional Locations:

Findlay, Ohio; Mountaintop, Pennsylvania; Somerville, New Jersey; Dundalk, Ireland; Singapore; Kuala Lumpur, Malaysia Semiconductor Products Division designs, manufactures, and markets discrete semiconductors and analog, digital, and mixed-signal integrated circuits for signal-processing and power-control applications for both commercial and military uses.

### Major Products:

- Op Amps (Operational Amplifiers)
- Switches
- Multiplexers
- Sample and hold amplifiers
- Analog switches
- A/D, D/A converters
- Microprocessors
- Microcontrollers
- SLICs (subscriber line interface circuits)
- Digital Signal Processing (DSP) circuits
- Power MOS (metal oxide semiconductors)
- Power processing products
- MOV (metal oxide varistors)
- Intelligent power products
- CMOS (complementary metal oxide semiconductor) logic circuits

### Major Process Technologies:

- Power BiMOS (bipolar metal oxide semiconductors)
- High frequency bipolar/power MOS
- High voltage bipolar/power MOS
- BiCMOS/analog/digital
- CMOS
- Dielectric isolation

### Applications:

- Automotive (antilock braking systems, engine controls, emission controls, air-bag systems)
- Video displays
- Instrumentation
- Medical imaging
- Computer keyboards
- Modems and printers
- Disc drives
- Motor controllers
- Power supplies
- Sensors
- Line-voltage regulators
- Test equipment
- PBX and central office telecommunications equipment

# DEVICE CATEGORY LISTING

<b>CATEGORY</b>	<b>SECTION</b>	<b>SUB-SECTION</b>
Amplifiers	Analog	2A
ASIC, Mixed Signal	ASIC	8B
ASIC, Bipolar	ASIC	8A
Consumer Circuits	Application Specific	5C
Data Converters	Data Acquisition	3B
Digital Signal Processing	Application Specific	5A
High Reliability Circuits	Hi-Rel & Rad-Hard	7A
Intelligent Power	Analog	2B
Logic	Digital	4C
Memory	Digital	4A
Microcontrollers	Digital	4A
Microprocessors	Digital	4A
Multiplexers	Data Acquisition	3C
Peripheral Circuits	Digital	4B
Power, IGBTs	Power	6B
Power, MOSFETs	Power	6A
Power, Transient Protection	Power	6E
Power Processing	Analog	2B
Power, Bipolar	Power	6C
Power, Rectifiers	Power	6D
PowerASIC™	ASIC	8B
Rad-Hard Circuits	Hi-Rel & Rad-Hard	7B
Sample and Hold Amplifiers	Data Acquisition	3A
Special Analog Circuits	Analog	2C
Switches, Analog	Data Acquisition	3C
Telecommunications Circuits	Application Specific	5B

# SECTION TABLE OF CONTENTS

## 1 - New Products and Publications

## 2 - Analog

- 2A • Amplifiers
- 2B • Intelligent Power/Power Processing
- 2C • Special Analog Circuits

## 3 - Data Acquisition

- 3A • Sample and Hold
- 3B • Data Converters
- 3C • Switches and Multiplexers

## 4 - Digital

- 4A • Microprocessors, Microcontrollers  
and Memory
- 4B • Peripherals
- 4C • Logic

## 5 - Application Specific

- 5A • Digital Signal Processing
- 5B • Telecommunications
- 5C • Consumer (Auto, TV, Radio)

## 6 - Power

- 6A • MOSFET
- 6B • IGBT
- 6C • Bipolar
- 6D • Rectifier
- 6E • Transient Protection

## 7 - Hi-Rel & Rad-Hard

- 7A • High Reliability
- 7B • Rad-Hard

## 8 - ASIC

- 8A • Bipolar
- 8B • Mixed Signal & Power ASIC



# Alphanumeric Part Numbering Index

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1N3053A	6C10			
1N4245	6D3			2093
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2N6055	6C7	BIP		563
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2N6057	6C7	BIP		1185
2N6058	6C7	BIP		1185

## Databook Code Legend

BIP - Bipolar Power  
 CDP - CDP6805 & Peripheral  
 CD4 - CD4000 Series  
 DAQ - Data Acquisition  
 DSP - Digital Signal Processing  
 IP - Intelligent Power

DB220.1  
 DB260.1  
 DB250.5  
 DB301.1  
 DB302  
 DB304

LIN - Linear and Telecom  
 MIC - Microprocessor Products  
 MOS - Power MOSFETs  
 RH - Rad Hard/Hi Rel  
 TVS - Transient Voltage Suppression

DB550 1  
 DB303  
 DB223.2  
 DB235.2  
 DB450.2

## Military Availability Code

1 - Non-Compliant  
 2 - Fully Compliant  
 3 - DESC, SMD Qualified  
 4 - JAN Qualified



# Alphanumeric Part Numbering Index

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2N6703	6C10	BIP		1187
2N6704	6C11	BIP		1187
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## Databook Code Legend

BIP	- Bipolar Power	DB220.1	LIN	- Linear and Telecom	DB550.1
CDP	- CDP6805 & Peripheral	DB260.1	MIC	- Microprocessor Products	DB303
CD4	- CD4000 Series	DB250.5	MOS	- Power MOSFETs	DB223.2
DAQ	- Data Acquisition	DB301.1	RH	- Rad Hard/Hi Rel	DB235.2
DSP	- Digital Signal Processing	DB302	TVS	- Transient Voltage Suppression	DB450.2
IP	- Intelligent Power	DB304			

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1	- Non-Compliant
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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
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40406	6C9			219
40407	6C10			219

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
40408	6C10			219
40412	6C1			211
80C286	4A3	MIC	2	2947
80C86	4A3	MIC	2,3	2957
80C88	4A3	MIC	2	2949
82C284	4B1	MIC	2	2968
82C37A	4B11	MIC	2	2967
82C50A	4B13	MIC	2	2958
82C52	4B13	MIC	2,3	2990
82C54	4B4	MIC	2,3	2970
82C55A	4B12	MIC	2,3	2969
82C59A	4B10	MIC	2,3	2784
82C82	4B9	MIC	2,3	2975
82C83	4B9	MIC	2,3	2971
82C84A	4B1	MIC	2,3	2974
82C85	4B1	MIC	2	2976
82C86	4B9	MIC	2,3	2977
82C87	4B9	MIC	2,3	2978
82C88	4B11	MIC	2,3	2979
82C89	4B11	MIC	2,3	2980
A114A/B/C/D/E/F/M	6D3	BIP		2179
A115A/B/C/D/E/F/M	6D3	BIP		2180
A14A/C/E/F/P	6D3	BIP		2178
A15A/F	6D3	BIP		2175
A214A/B/F/G	6D3	BIP		2164
A315A/B/F/G	6D3	BIP		2163
AD590	2C6	DAQ		3171
AD7520/30	3B4	DAQ	2	3104
AD7521/31	3B4	DAQ		3104
AD7523	3B4	DAQ		3105
AD7533	3B4	DAQ		3106
AD7541	3B4	DAQ		3107
AD7545	3B4	DAQ		3108
ADC0802L	3B1	DAQ		3094
ADC0803L	3B1	DAQ		3094
ADC0804	3B1	DAQ		3094
BD239/A/B/C	6C2,3	BIP		669
BD240/A/B/C	6C1,2	BIP		670
BD241/A/B/C	6C2,3	BIP		671
BD242/A/B/C	6C1,2	BIP		672
BD243/A/B/C	6C2,3	BIP		673
BD244/A/B/C	6C1,2	BIP		674
BD277	6C2			667
BD500/B	6C1,2	BIP		1108
BD501/B	6C3	BIP		1108
BD533	6C2	BIP		1236
BD534	6C2	BIP		1236
BD535	6C2	BIP		1236
BD536	6C2	BIP		1236
BD537	6C3	BIP		1236
BD538	6C1	BIP		1236
BD550/B	6C3	BIP		1109
BD643	6C6	BIP		1241
BD647	6C7	BIP		1241
BD649	---	BIP		1241
BD750/A/B/C	6C1			1251
BD751/A/B/C	6C3			1251

### Databook Code Legend

BIP - Bipolar Power	DB220.1	LIN - Linear and Telecom	DB550.1
CDP - CDP6805 & Peripheral	DB260.1	MIC - Microprocessor Products	DB303
CD4 - CD4000 Series	DB250.5	MOS - Power MOSFETs	DB223.2
DAQ - Data Acquisition	DB301.1	RH - Rad Hard/Hi Rel	DB235.2
DSP - Digital Signal Processing	DB302	TVS - Transient Voltage Suppression	DB450.2
IP - Intelligent Power	DB304		

### Military Availability Code

1 - Non-Compliant
2 - Fully Compliant
3 - DESC, SMD Qualified
4 - JAN Qualified

# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
BD797	6C2			1242
BD799	6C3			1242
BD800	6C1			1242
BD895/A	6C6	BIP		1240
BD897/A	6C7	BIP		1240
BD899/A	6C7	BIP		1240
BD901	6C7	BIP		1240
BDX18	6C2	BIP		994
BDX33/A/B/C/D	6C6,7,8	BIP		993
BDX34/A/B/C/D	6C6	BIP		994
BDX53/A/B/C	6C6,7			1213
BDX83/A/B/C	6C6,7			955
BDY55	6C10	BIP		1215
BDY56	6C10	BIP		1215
BDY58R	6C11	BIP		1206
BDY90	6C10	BIP		1289
BDY91	6C10	BIP		1289
BDY92	6C10	BIP		1289
BFT28	6C1			815
BUW40/A/B	6C4			1308
BUW41/A/B	6C4	BIP		1275
BUW64/A/B/C	6C10,11	BIP		1199
BUX10A	6C10			1216
BUX11A	6C11	BIP		1353
BUX12	6C3			
BUX13	6C4			
BUX14	6C4	BIP		1203
BUX15	6C4			1227
BUX16/A/B/C	6C3,4			800
BUX17/A/B/C	6C3,4			
BUX20A	6C10			1264
BUX21	6C11	BIP		1172
BUX31/A/B	6C4			1283
BUX32/A/B	6C4	BIP		1285
BUX33/A/B	---	BIP		1354
BUX39	6C10	BIP		1211
BUX40A	6C10			1217
BUX42	6C3			1218
BUX43	6C4			1214
BUX44	6C4			1210
BUX45	6C4			1231
BUX47	6C4			1284
BUX66/A/B/C	6C1	BIP		870
BUX67/A/B/C	6C1			
BUY69A/B/C	6C3,4	BIP		1237
BUZ11	6A4	MOS		2253
BUZ20	6A5	MOS		2254
BUZ21	6A6			1172
BUZ31	6A8			2415
BUZ32	6A8	MOS		2416
BUZ351	6A10	MOS		2266
BUZ41	---			1222
BUZ41A	6A11	MOS		2256
BUZ42	6A11			1218
BUZ45	6A11	MOS		2257
BUZ45A	6A11	MOS		2258
BUZ45B	6A11	MOS		2259

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
BUZ60	6A10	MOS		2260
BUZ60B	6A10	MOS		2261
BUZ71	6A4	MOS		2418
BUZ71A	6A4	MOS		2419
BUZ72A	6A5	MOS		2262
BUZ73A	6A8	MOS		2263
BUZ76	6A10	MOS		2264
BUZ76A	6A10	MOS		2265
BYW51100	6D2	BIP		1412
BYW51150	6D2	BIP		1412
BYW51200	6D2	BIP		1412
CA1191	5C8			1347
CA124	2A7,8,10	LIN		796
CA1391	5C2	LIN		981
CA1394	5C2	LIN		981
CA139/A	2C4	LIN		795
CA1458	2A10	LIN		531
CA1523	2B10	IP		1785
CA1524	2B10	LIN,IP		1239
CA1558	2A10	LIN		531
CA158/A	2A6,7,8,9,10	LIN		1019
CA2111A	5C1			
CA224	2A6,7,10	LIN		796
CA239/A	2C4	LIN		795
CA2524	2B10	LIN		1239
CA258/A	2A6,7,10	LIN		1019
CA2604	2A7,10	LIN		1019
CA3011	5C1			
CA3013	5C1			129
CA3014	5C1			129
CA3018/A/E	2C2,3	LIN	1	338
CA3020	---	LIN		339
CA30283	2A13		1	N/A
CA3028A/B	2A13	LIN	1	382
CA3039	2C2,3	LIN	1	343
CA3045/6	2C2,3	LIN	1	341
CA3049	2A13,2C3	LIN	1	611
CA3053	2A13	LIN		382
CA3054	2A13,2C2,3	LIN		338
CA3058	---			703
CA3059	2B8	LIN,IP		490
CA3060	---	LIN		537
CA3065	5C1			
CA3070	5C4			468
CA3078/A	2A7,10	LIN		535
CA3079	2B8	LIN,IP		490
CA3080	---	LIN	1	475
CA3081	2C2,3	LIN	1	480
CA3082	2C2,3	LIN		480
CA3083	2C2,3	LIN	1	481
CA3084	2C2,3			
CA3085/A/B	2B11	LIN,IP	1	491
CA3086	2C2,3	LIN		483
CA3088	5C8			560
CA3089	5C2	LIN		561
CA3094/A/B	2A7	LIN	1	598
CA3096	2C2,3	LIN		595

## Databook Code Legend

BIP - Bipolar Power	DB220.1	LIN - Linear and Telecom	DB550 1
CDP - CDP6805 & Peripheral	DB260.1	MIC - Microprocessor Products	DB303
CD4 - CD4000 Series	DB250.5	MOS - Power MOSFETs	DB223 2
DAQ - Data Acquisition	DB301.1	RH - Rad Hard/Hi Rel	DB235 2
DSP - Digital Signal Processing	DB302	TVS - Transient Voltage	DB450 2
IP - Intelligent Power	DB304	Suppression	

## Military Availability Code

1 - Non-Compliant
2 - Fully Compliant
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4 - JAN Qualified

# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CA3100	---	LIN	1	625
CA3102	2A13, 5C1	LIN		611
CA3126	5C4	LIN		860
CA3127	2C2,3	LIN		662
CA3128Q	5C4			
CA3130/A	2A8,9,10	LIN	1	817
CA3138E	2C2,3			
CA3140/A	2A8,10	LIN	1	957
CA3141E	2C2,3	LIN		906
CA3146/A	2C2,3	LIN		532
CA3154	5C3			1183
CA3160/A	2A8,10	LIN	1	978
CA3161	3B3, 4B6	DAQ		1079
CA3162	3B3	DAQ		1080
CA3163E	5C6			1092
CA3164A	5C9			1139
CA3165	5C10	IP		1278
CA3168	4B6	DAQ		1140
CA3169	2B6	IP		1277
CA3179	5C6			1176
CA3183/A	2C2,3	LIN		532
CA3189	5C2	LIN		1046
CA3193/A	2A6,10	LIN		1249
CA3194	5C5	LIN		1270
CA3202	5C3			1348
CA3210	5C3			1361
CA3217	5C5	LIN		1332
CA3218	5C3			1637
CA3224	5C7			1553
CA3227	2C3	LIN,IP		1345
CA3228	5C10	IP		1436
CA3232	5C6			1506
CA3234E	5C5			
CA3236	5C3			1681
CA3237	5C8	IP		1480
CA3238E	5C7			1468
CA324	2A6,7,8,10	LIN		796
CA3240/A	2A4,5,8,9,10	LIN		1050
CA3241	5C3			
CA3242	2B8	MOS		1561
CA3246	2C2,3	LIN,IP		1345
CA3247	5C6			2110
CA3252	---			1542
CA3253	5C9			1847
CA3254	5C9			1705
CA3255	5C9			1705
CA3256	2A3,12	LIN		1769
CA3260/A	2A4,5,8,9,10	LIN	1	1266
CA3261	---			1833
CA3262/A	2B8	MOS,IP		1836
CA3263	5C7			1922
CA3272	2B8	MOS,IP		2223
CA3273	2B7	MOS,IP		2113
CA3274	2B7	MOS,IP		2222
CA3280/A	2A4,5,6	LIN	1	1174
CA3290/A	2C4	LIN	1	1049
CA3304	3B1	DAQ		1790

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CA3306	3B1	DAQ	1	1792
CA3310	3B1	DAQ		1851
CA3318	3B1	DAQ		1908
CA3338	3B4	DAQ		1850
CA339/A	2C4	LIN		765
CA3420/A	2A8,9,10	LIN		1320
CA3440/A	2A7,8,10	LIN		1381
CA3450	2A4,5	LIN		1732
CA3524	2B10	LIN		1239
CA358/A	2A6,7,8,10	LIN		1019
CA5130/A	2A7,8,9,10	LIN		1266
CA5160/A	2A7,8,9,10	LIN		1924
CA5260/A	2A4,5,7,8,9,10	LIN		1929
CA5420/A	2A8,9,10	LIN		1925
CA5470	2A4,5,8,9,10	LIN		1946
CA555	2C5	LIN		834
CA723/C	2B11	LIN,IP		788
CA741	2A10	LIN	1	531
CD14538B	4C11	CD4	1,2	2098
CD22100	5B4	LIN		1076
CD22101	5B4	LIN		2871
CD22102	5B4	LIN		2871
CD22103A	5B6	LIN		1310
CD22202	5B5	LIN		1695
CD22203	5B5	LIN		1695
CD22204	5B5	LIN		1696
CD22212	---			1896
CD22301	5B6	LIN		1368
CD22354A	5B3	LIN		1682
CD22357A	5B3	LIN		1682
CD22401	---			1388
CD22402	5C4	LIN		1886
CD22777	---	CD4		1899
CD22859	5B5	LIN		1257
CD22M3493	5B4	LIN		2491
CD22M3494	5B4	LIN		2793
CD4000B	4C10	CD4	1,2,4	985
CD4001B	4C11	CD4	1,2,4	985
CD4001UB	4C11	CD4	1,2	945
CD4002B	4C11	CD4	1,2,4	985
CD4002UB	---		2	945
CD4006B	4C11	CD4	1,2	1033
CD4007UB	4C11	CD4	1,2,4	977
CD4008B	---	CD4		951
CD4009UB	4C11	CD4	1,2	940
CD40100B	4C12	CD4	1,2	980
CD40101B	---		1,2	1000
CD40102B	4C12	CD4	1,2	984
CD40103B	4C12	CD4	1,2	984
CD40104B	---		1	1220
CD40105B	4C12	CD4	1,2	1044
CD40106B	4C11	CD4	1,2	1017
CD40107B	4C11	CD4	1,2	1015
CD40108B	---		1,2	1011
CD40109B	4C11	CD4	1,2	3196
CD4010B	4C11	CD4	1,2	940
CD40110B	4C12	CD4		1125

### Databook Code Legend

BIP	- Bipolar Power	DB220.1
CDP	- CDP6805 & Peripheral	DB260.1
CD4	- CD4000 Series	DB250.5
DAQ	- Data Acquisition	DB301.1
DSP	- Digital Signal Processing	DB302
IP	- Intelligent Power	DB304

LIN	- Linear and Telecom
MIC	- Microprocessor Products
MOS	- Power MOSFETs
RH	- Rad Hard/Hi Rel
TVS	- Transient Voltage Suppression

DB550.1
DB303
DB223.2
DB235.2
DB450.2

### Military Availability Code

1	- Non-Compliant
2	- Fully Compliant
3	- DESC, SMD Qualified
4	- JAN Qualified

# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CD40114B	---			1116
CD40116	4C11	CD4	1	1234
CD40117B	4C11	CD4	2	1333
CD4011B	4C11	CD4	1,2,4	3079
CD4011UB	4C11	CD4	1,2	947
GD4012B	4C11	CD4	1,2,4	3079
CD4013B	4C11	CD4	1,2,4	936
CD40147B	4C11	CD4	2	1117
CD4014B	4C11	CD4	1,2,4	1043
CD4015B	4C11	CD4	1,2,4	1024
CD40160B	4C12	CD4	1,2	1047
GD40161B	4C12	CD4	1,2	1047
CD40162B	4C12	CD4	1,2	1047
CD40163B	4C12	CD4	1,2	1047
CD4016B	4C12	CD4	1,3	953
CD40174B	4C11	CD4	1,2	1031
CD40175B	4C11	CD4	1,2	1326
CD4017B	4C12	CD4	1,2,4	1113
CD40181B	---		2	989
CD4018B	4C12	CD4	1,2,4	1034
CD40192B	4C12	CD4	1,2	993
CD40193B	4C12	CD4	1,2	993
CD40194B	4C12	CD4	1,2	1220
CD4019B	4C11,12	CD4	1,2,4	1045
CD4020B	4C12	CD4	1,2,4	1063
CD4021B	4C12	CD4	1,2,4	1043
CD4022B	4C12	CD4	1,2,4	1113
CD4023B	4C11	CD4	1,2,4	3079
CD4024B	4C12	CD4	1,2,4	1063
CD40257B	4C12	CD4	1,2	982
CD4025B	4C11	CD4	1,2,4	985
CD4026B	4C12	CD4	2	1118
CD4027B	4C11	CD4	1,2,4	942
CD4028B	4C11	CD4	1,2,4	1016
CD4029B	4C12	CD4	1,3	1028
CD4030B	4C11	CD4	1,2,4	1055
CD4031B	4C11	CD4	1,2	1073
CD4033B	4C12	CD4	1,2	1118
CD4034B	4C12	CD4	1,2	1062
CD4035B	4C12	CD4	1,2	1101
CD4038B	---		1	1081
CD4040B	4C12	CD4	1,2,4	1063
CD4041UB	4C11	CD4	1,2	934
CD4042B	4C11	CD4	1,2	954
CD4043B	4C11	CD4	1,2	956
CD4044B	4C11	CD4	1,2	956
CD4045B	4C12	CD4		1119
CD4046B	4C12	CD4	1,2	1099
CD4047B	4C11	CD4	1,3	1123
CD4048B	4C11	CD4	1,2	1124
CD4049UB	4C11	CD4	1,2,4	926
CD4050B	4C11	CD4	1,2,4	926
CD4051B	4C12	CD4	1,2	902
CD4052B	4C12	CD4	1,2	902
CD4053B	4C12	CD4	1,3	902
CD4054B	4C12	CD4	2	834
CD4055B	4C12	CD4		634

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CD4056B	4C12	CD4	2	634
CD4059A	4C12	CD4	1	898
GD4060B	4C12	CD4	1,2	1120
CD4063B	---	CD4	1,2	805
CD4066B	4C12	CD4	1,2,4	1114
CD4067B	4C12	CD4	1,2	3190
CD4068B	4C11	CD4	1,2	809
CD4069UB	4C11	CD4	1,2,4	804
CD4070B	4C11	CD4	1,2,4	910
CD4071B	4C11	CD4	1,2,4	807
CD4072B	4C11	CD4	1,2,4	807
CD4073B	4C11	CD4	1,2,4	806
CD4075B	4C11	CD4	1,2,4	807
CD4076B	4C11,12	CD4	1,2	903
CD4077B	4C11	CD4	1,2,4	910
CD4078B	4C11	CD4	1,3	810
CD4081B	4C11	CD4	1,2,4	808
CD4082B	4C11	CD4	1,2,4	808
CD4085B	4C11	CD4	1,2,4	811
CD4086B	4C11	CD4	1,2,4	812
CD4093B	4C11	CD4	1,2	836
CD4094B	4C12	CD4	1,2,3	3194
CD4095B	4C11	CD4	1,2	879
CD4096B	4C11	CD4	1,2	879
CD4097B	4C12	CD4	1,2	3190
CD4098B	4C11	CD4	1,2,4	979
CD4099B	4C11,12	CD4	1,2,4	848
CD4502B	4C11	CD4	1,2,4	1002
GD4503B	4C11	CD4	1,2	1224
CD4504B	4C11	CD4	1,2	1846
CD4506B	4C11	CD4	1,2	1009
CD4510B	4C12	CD4	1,2	899
CD4511B	4C12	CD4	1,2	901
CD4512B	4C12	CD4	1,2	1032
CD4514B	4C11	CD4	1,2	3195
CD4515B	4C11	CD4	1,2	3195
CD4516B	4C12	CD4	1,2	899
CD4517B	4C11	CD4	1,2	1148
CD4518B	4C12	CD4	1,2	808
CD4519B	4C11,12	CD4		1723
CD4520B	4C12	CD4	1,3	808
CD4521B	4C12	CD4		1735
CD4522B	4C12	CD4		1710
CD4527B	---	CD4	1,2	1006
CD4529B	4C12	CD4		1720
CD4532B	4C11	CD4	1,2	876
CD4536B	4C12	CD4	1,2	1186
CD4538B	4C11	CD4		1245
CD4541B	---	CD4	2	1378
CD4543B	4C12	CD4	1,2	1327
CD4555B	4C11,12	CD4	1,3	858
CD4556B	4C11,12	CD4	1,3	858
CD4560B	---	CD4		1711
CD4566B	4C12	CD4		1728
CD4572UB	4C11	CD4		1704
CD4585B	---	CD4	1,3	1146
CD4724B	4C11,12	CD4	2	1111

### Databook Code Legend

BIP - Bipolar Power  
 CDP - CDP6805 & Peripheral  
 CD4 - CD4000 Series  
 DAQ - Data Acquisition  
 DSP - Digital Signal Processing  
 IP - Intelligent Power

DB220.1  
 DB260.1  
 DB250.5  
 DB301.1  
 DB302  
 DB304

LIN - Linear and Telecom  
 MIC - Microprocessor Products  
 MOS - Power MOSFETs  
 RH - Rad Hard/Hi Rel  
 TVS - Transient Voltage Suppression

DB550.1  
 DB303  
 DB223.2  
 DB235.2  
 DB450.2

### Military Availability Code

1 - Non-Compliant  
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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CD54/74AC/ACT00	4C5	ACT	2	1855
CD54/74AC/ACT02	4C5	ACT	2	1978
CD54/74AC/ACT04	4C5	ACT	2	1945
CD54/74AC/ACT05	4C5	ACT	2	1945
CD54/74AC/ACT08	4C5	ACT	2	1950
CD54/74AC/ACT10	4C5	ACT	2	1977
CD54/74AC/ACT109	4C6	ACT	2	1967
CD54/74AC/ACT112	4C6	ACT	2	1987
CD54/74AC/ACT138	4C6	ACT	2	1909
CD54/74AC/ACT139	4C6	ACT	2	1953
CD54/74AC/ACT151	4C6	ACT	2	1980
CD54/74AC/ACT153	4C6	ACT	2	1966
CD54/74AC/ACT157	4C6	ACT	2	1910
CD54/74AC/ACT158	4C6	ACT	2	1910
CD54/74AC/ACT161	4C6	ACT	2	1959
CD54/74AC/ACT163	4C6	ACT	2	1959
CD54/74AC/ACT164	4C6	ACT	2	1954
CD54/74AC/ACT174	4C6	ACT	2	1973
CD54/74AC/ACT191	4C6	ACT	2	1911
CD54/74AC/ACT193	4C6	ACT	2	1947
CD54/74AC/ACT20	4C5	ACT	2	1976
CD54/74AC/ACT238	4C9	ACT	2	1909
CD54/74AC/ACT240	4C5	ACT	2	1856
CD54/74AC/ACT241	---	ACT	2	1856
CD54/74AC/ACT244	4C5	ACT	2	1856
CD54/74AC/ACT245	4C6	ACT	2	1907
CD54/74AC/ACT251	4C6	ACT	2	1981
CD54/74AC/ACT253	4C6	ACT	2	1985
CD54/74AC/ACT257	4C6	ACT	2	1955
CD54/74AC/ACT258	4C6	ACT	2	1955
CD54/74AC/ACT273	4C6	ACT	2	1979
CD54/74AC/ACT280	4C6	ACT	2	1957
CD54/74AC/ACT283	4C6	ACT	2	1912
CD54/74AC/ACT299	4C6	ACT	2	1958
CD54/74AC/ACT32	4C5	ACT	2	1951
CD54/74AC/ACT323	4C6	ACT	2	1958
CD54/74AC/ACT373	4C5	ACT	2	1882
CD54/74AC/ACT374	4C6	ACT	2	1883
CD54/74AC/ACT533	4C5	ACT	2	1882
CD54/74AC/ACT534	4C6	ACT	2	1883
CD54/74AC/ACT540	4C5	ACT	2	1857
CD54/74AC/ACT541	4C5	ACT	2	1857
CD54/74AC/ACT563	4C5	ACT	2	1956
CD54/74AC/ACT564	4C6	ACT	2	1948
CD54/74AC/ACT573	4C5	ACT	2	1956
CD54/74AC/ACT574	4C6	ACT	2	1948
CD54/74AC/ACT623	4C6	ACT	2	1968
CD54/74AC/ACT74	4C6	ACT	2	1881
CD54/74AC/ACT7623	4C6	ACT	2	1969
CD54/74AC/ACT86	4C5	ACT	2	1952
CD54/74FCT240/AT	4C3	FCT		2227
CD54/74FCT241/AT	4C3	FCT		2227
CD54/74FCT244/AT	4C3	FCT		2227
CD54/74FCT245/AT	4C3	FCT		2301
CD54/74FCT273/AT	4C3	FCT		2303
CD54FCT377/AT	4C3	FCT	3	2388
CD54FCT640/AT	4C3	FCT	3	2398

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CD54FCT643/AT	4C3	FCT	2	2398
CD54/74FCT29520A/BT	4C3	FCT		2401
CD54/74FCT2952A/BT	4C3	FCT		2400
CD54/74FCT2953A/BT	4C3	FCT		2400
CD54/74FCT373/AT	4C3	FCT		2230
CD54/74FCT374/AT	4C3	FCT		2305
CD54/74FCT533/AT	4C3	FCT		2230
CD54/74FCT534/AT	4C3	FCT		2305
CD54/74FCT540/AT	4C3	FCT		2383
CD54/74FCT541/AT	4C3	FCT		2383
CD54/74FCT543/AT	4C3	FCT		2399
CD54/74FCT544/AT	4C3	FCT		2399
CD54/74FCT563/AT	4C3	FCT		2304
CD54/74FCT564/AT	4C3	FCT		2295
CD54/74FCT573/AT	4C3	FCT		2304
CD54/74FCT574/AT	4C3	FCT		2295
CD54/74FCT623/AT	4C3	FCT		2302
CD54/74FCT646/AT	4C3	FCT		2393
CD54/74FCT647/AT	4C3	FCT		2402
CD54/74FCT648/AT	4C3	FCT		2393
CD54/74FCT649/AT	4C3	FCT		2402
CD54/74FCT651/AT	4C3	FCT		2229
CD54/74FCT652/AT	4C3	FCT		2229
CD54/74FCT653/AT	4C3	FCT		2403
CD54/74FCT654/AT	4C3	FCT		2403
CD54/74FCT7623/AT	4C3	FCT		2358
CD54/74FCT821A/BT	4C3	FCT		2390
CD54/74FCT822A/BT	4C3	FCT		2390
CD54/74FCT823A/BT	4C3	FCT		2389
CD54/74FCT824A/BT	4C3	FCT		2389
CD54/74FCT841A/BT	4C3	FCT		2397
CD54/74FCT842A/BT	4C3	FCT		2397
CD54/74FCT843A/BT	4C3	FCT		2396
CD54/74FCT844A/BT	4C3	FCT		2396
CD54/74FCT861A/BT	4C3	FCT		2392
CD54/74FCT862A/BT	4C3	FCT		2392
CD54/74FCT863A/BT	4C3	FCT		2391
CD54/74FCT864A/BT	4C3	FCT		2391
CD54/74HC4049	4C7	HCT		1543
CD54/74HC4050	4C7	HCT		1543
CD54/74HC7266	4C7	HCT		1780
CD54/74HCU04	4C7	HCT		1655
CD54/74HC/HCT00	4C7	HCT	3,4	1464
CD54/74HC/HCT02	4C7	HCT	3,4	1647
CD54/74HC/HCT03	4C7	HCT	3	1832
CD54/74HC/HCT04	4C7	HCT	3,4	1471
CD54/74HC/HCT08	4C7	HCT	3,4	1549
CD54/74HC/HCT10	4C7	HCT	3,4	1551
CD54/74HC/HCT107	4C7	HCT	3	1722
CD54/74HC/HCT109	4C7	HCT	3	1667
CD54/74HC/HCT11	4C7	HCT	3	1475
CD54/74HC/HCT112	4C7	HCT	3	1843
CD54/74HC/HCT123	4C8	HCT	3	1708
CD54/74HC/HCT125	4C7	HCT	3	1771
CD54/74HC/HCT126	4C7	HCT	3	1772
CD54/74HC/HCT132	4C9	HCT	2	1649
CD54/74HC/HCT137	4C9	HCT	2	1886

## Databook Code Legend

BIP - Bipolar Power  
 CDP - CDP6805 & Peripheral  
 CD - CD4000 Series  
 DAQ - Data Acquisition  
 DSP - Digital Signal Processing  
 IP - Intelligent Power

DB220.1  
 DB260.1  
 DB250.5  
 DB301.1  
 DB302  
 DB304

LIN - Linear and Telecom  
 MIC - Microprocessor Products  
 MOS - Power MOSFETs  
 RH - Rad Hard/Hi Rel  
 TVS - Transient Voltage Suppression

DB550.1  
 DB303  
 DB223.2  
 DB235.2  
 DB450.2

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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CD54/74HC/HCT138	4C9	HCT	3	1477
CD54/74HC/HCT139	4C9	HCT	3	1545
CD54/74HC/HCT14	4C9	HCT	3	1781
CD54/74HC/HCT147	4C9	HCT	3	1773
CD54/74HC/HCT151	4C8	HCT	3	1645
CD54/74HC/HCT153	4C8	HCT	3	1774
CD54/74HC/HCT154	4C9	HCT	3	1657
CD54/74HC/HCT157	4C8	HCT	3	1642
CD54/74HC/HCT158	4C8	HCT	3	1642
CD54/74HC/HCT160	4C8	HCT	3	1550
CD54/74HC/HCT161	4C8	HCT	3	1550
CD54/74HC/HCT162	4C8	HCT	3	1550
CD54/74HC/HCT163	4C8	HCT	3	1550
CD54/74HC/HCT164	4C7	HCT	3	1658
CD54/74HC/HCT165	4C7	HCT	3	1672
CD54/74HC/HCT166	4C7	HCT	2	1501
CD54/74HC/HCT173	4C7	HCT	3	1641
CD54/74HC/HCT174	4C7	HCT	3	1608
CD54/74HC/HCT175	4C7	HCT	3	1474
CD54/74HC/HCT181	4C8	HCT	2	1829
CD54/74HC/HCT182	4C8	HCT	2	1830
CD54/74HC/HCT190	4C8	HCT	3	1662
CD54/74HC/HCT191	4C8	HCT	3	1662
CD54/74HC/HCT192	4C8	HCT	3	1674
CD54/74HC/HCT193	4C8	HCT	3	1674
CD54/74HC/HCT194	4C7	HCT	3	1668
CD54/74HC/HCT195	4C7	HCT	3	1482
CD54/74HC/HCT20	4C7	HCT	3	1601
CD54/74HC/HCT21	4C7	HCT	3	1782
CD54/74HC/HCT221	4C8	HCT	3	1670
CD54/74HC/HCT22106	5B4	HCT		1719
CD54/74HC/HCT237	4C9	HCT	3	1886
CD54/74HC/HCT238	4C9	HCT	3	1477
CD54/74HC/HCT240	4C7	HCT	3	1656
CD54/74HC/HCT241	4C7	HCT	2	1656
CD54/74HC/HCT242	4C9	HCT	2	1488
CD54/74HC/HCT243	4C9	HCT	3	1488
CD54/74HC/HCT244	4C7	HCT	3	1656
CD54/74HC/HCT245	4C9	HCT	3	1651
CD54/74HC/HCT251	4C8	HCT	3	1489
CD54/74HC/HCT253	4C8	HCT	2	1673
CD54/74HC/HCT257	4C8	HCT	3	1650
CD54/74HC/HCT258	4C8	HCT	2	1775
CD54/74HC/HCT259	4C9	HCT	3	1727
CD54/74HC/HCT27	4C7	HCT	3	1648
CD54/74HC/HCT273	4C7	HCT	3	1479
CD54/74HC/HCT280	4C8	HCT	3	1669
CD54/74HC/HCT283	4C8	HCT	3	1848
CD54/74HC/HCT297	4C9	HCT	2	1852
CD54/74HC/HCT299	4C7	HCT	3	1485
CD54/74HC/HCT30	4C7	HCT	3	1652
CD54/74HC/HCT32	4C7	HCT	3,4	1643
CD54/74HC/HCT354	4C8	HCT	2	1690
CD54/74HC/HCT356	4C8	HCT	2	1690
CD54/74HC/HCT365	4C7	HCT	3	1539
CD54/74HC/HCT366	4C7	HCT	3	1539
CD54/74HC/HCT367	4C7	HCT	3	1538

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CD54/74HC/HCT368	4C7	HCT	3	1638
CD54/74HC/HCT373	4C9	HCT	3,4	1679
CD54/74HC/HCT374	4C7	HCT	3	1663
CD54/74HC/HCT377	4C7	HCT	3	1675
CD54/74HC/HCT390	4C8	HCT	3	1838
CD54/74HC/HCT393	4C8	HCT	3	1653
CD54/74HC/HCT4002	4C7	HCT	3	1776
CD54/74HC/HCT40102	4C8	HCT	2	1596
CD54/74HC/HCT40103	4C8	HCT	3	1596
CD54/74HC/HCT40104	4C8	HCT	2	1661
CD54/74HC/HCT40105	4C8	HCT	2	1834
CD54/74HC/HCT4015	4C8	HCT	2	1678
CD54/74HC/HCT4016	4C9	HCT	2	1917
CD54/74HC/HCT4017	4C8	HCT	3	1639
CD54/74HC/HCT4020	4C8	HCT	3	1484
CD54/74HC/HCT4024	4C8	HCT	3	1683
CD54/74HC/HCT4040	4C8	HCT	3	1483
CD54/74HC/HCT4046A	4C9	HCT	3	1854
CD54/74HC/HCT4051	4C9	HCT	2	1676
CD54/74HC/HCT4052	4C9	HCT	3	1676
CD54/74HC/HCT4053	4C9	HCT	3	1676
CD54/74HC/HCT4059	4C8	HCT	3	1853
CD54/74HC/HCT4060	4C8	HCT	3	1654
CD54/74HC/HCT4066	4C9	HCT	3	1777
CD54/74HC/HCT4067	4C9	HCT	2	1783
CD54/74HC/HCT4075	4C7	HCT	3	1778
CD54/74HC/HCT4094	4C8	HCT	2	1779
CD54/74HC/HCT42	4C9	HCT	3	1689
CD54/74HC/HCT423	4C8	HCT	2	1708
CD54/74HC/HCT4316	4C9	HCT	2	1916
CD54/74HC/HCT4351	4C9	HCT	2	2145
CD54/74HC/HCT4352	4C9	HCT	2	2145
CD54/74HC/HCT4353	4C9	HCT	2	2145
CD54/74HC/HCT4510	4C8	HCT	2	1823
CD54/74HC/HCT4511	4C9	HCT	3	1786
CD54/74HC/HCT4514	4C9	HCT	2	1597
CD54/74HC/HCT4515	4C9	HCT	2	1597
CD54/74HC/HCT4516	4C8	HCT	2	1823
CD54/74HC/HCT4518	4C8	HCT	2	1665
CD54/74HC/HCT4520	4C8	HCT	2	1665
CD54/74HC/HCT4538	4C8	HCT	3	1671
CD54/74HC/HCT4543	4C9	HCT	2	1822
CD54/74HC/HCT533	4C9	HCT	3	1599
CD54/74HC/HCT534	4C7	HCT	3	1640
CD54/74HC/HCT540	4C7	HCT	2	1659
CD54/74HC/HCT541	4C7	HCT	2	1659
CD54/74HC/HCT563	4C9	HCT	3	1599
CD54/74HC/HCT564	4C7	HCT	3	1640
CD54/74HC/HCT573	4C9	HCT	3	1679
CD54/74HC/HCT574	4C7	HCT	2	1663
CD54/74HC/HCT583	4C8	HCT	2	1828
CD54/74HC/HCT597	4C8	HCT	3	1915
CD54/74HC/HCT840	4C9	HCT	3	1677
CD54/74HC/HCT643	4C9	HCT	2	1677
CD54/74HC/HCT646	4C9	HCT	3	1664
CD74HC/HCT647	---	HCT		
CD54/74HC/HCT648	4C9	HCT	2	1664

### Databook Code Legend

BIP	- Bipolar Power	DB220.1
CDP	- CDP6805 & Peripheral	DB260.1
CD4	- CD4000 Series	DB250.5
DAQ	- Data Acquisition	DB301.1
DSP	- Digital Signal Processing	DB302
IP	- Intelligent Power	DB304

LIN	- Linear and Telecom	DB550.1
MIC	- Microprocessor Products	DB303
MOS	- Power MOSFETs	DB223.2
RH	- Rad Hard/Hi Rel	DB235.2
TVS	- Transient Voltage Suppression	DB450.2

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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CD74HC/HCT851	---	HCT		2229
CD74HC/HCT853	---	HCT		
CD74HC/HCT854	---	HCT		
CD54/74HC/HCT870	4C8	HCT	2	1660
CD54/74HC/HCT888	4C8	HCT	3	1646
CD54/74HC/HCT7038	4C9	HCT	2	1872
CD54/74HC/HCT7048A	4C9	HCT		1920
CD54/74HC/HCT73	4C7	HCT	3	1721
CD54/74HC/HCT74	4C7	HCT	3,4	1476
CD54/74HC/HCT75	4C9	HCT	3	1666
CD54/74HC/HCT85	4C8	HCT	3	1770
CD54/74HC/HCT86	4C7	HCT	3	1844
CD54/74HC/HCT93	4C8	HCT	2	1849
CD74HC/HCT852	---	HCT		2229
CD7211	4C12	CD4		1725
CD7211A	4C12	CD4		1725
CD7211AM	4C12	CD4		1726
CD7211M	4C12	CD4		1726
CD74AC/ACT14	4C5	ACT		1984
CD74AC/ACT175	4C6	ACT		1964
CD74AC/ACT297	4C5	ACT		2195
CD74AC/ACT846	4C6	ACT		1970
CD74AC/ACT647	4C6	ACT		1982
CD74AC/ACT848	4C6	ACT		1970
CD74AC/ACT849	4C6	ACT		1982
CD74AC/ACT851	4C6	ACT		1974
CD74AC/ACT852	4C6	ACT		1974
CD74AC/ACT853	4C6	ACT		1975
CD74AC/ACT854	4C6	ACT		1975
CD74AC/ACT7060	4C6	ACT		2062
CD74AC/ACT7061	4C6	ACT		2062
CD74HC/HCT7030	4C8	HCT		2122
CD74ACT7651	4C6	ACT		2196
CDP1802A	4A4	MIC	1	1305
CDP1802AC	4A4	MIC	1	1305
CDP1802BC	4A4	MIC		1305
CDP1805AC	4A4	MIC		1370
CDP1806AC	4A4	MIC		1370
CDP1821C	4A5	MIC	1	1200
CDP1822	4A5	MIC	1	1074
CDP1823	4A5	MIC	1	1198
CDP1824	4A5	MIC	1	1103
CDP1826C	4A5	MIC		1311
CDP1851	4B12	MIC		1056
CDP1852	4B12	MIC	1	1166
CDP1853	4B7	MIC	1	1189
CDP1854	4B13	MIC	1	1193
CDP1855	---	MIC		1053
CDP1871	4B15	MIC		1374
CDP1872	4B12	MIC		1255
CDP1874	4B12	MIC		1255
CDP1875	4B12	MIC		1255
CDP1877	4B10	MIC		1319
CDP1878	4B4	MIC		1341
CDP1879	4B3	MIC		1360
CDP1881	4B7	MIC		1367
CDP1882	4B7	MIC		1367

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
CDP1883	4B7	MIC		1507
CDP6402	4B13	MIC		1328
CDP65C51	4B13	CDP		2747
CDP6805E2	4A1,2	CDP		2746
CDP6805E3	4A1,2	CDP		2746
CDP6805F2	4A1,2	CDP		1360
CDP6805G2	4A1,2	GDP		1364
CDP6818	4B3	CDP		1375
CDP6823	4B12	CDP		1377
CDP6853	4B13	CDP		1487
CDP68HC05C4	4A1,2	CDP		2748
CDP68HC05C8	4A1,2	CDP		2748
CDP68HC05D2	4A1,2	CDP		1857
CDP68HC05J3	4A2	CDP		
CDP68HC68A2	3B1, 4B15	CDP		1963
CDP68HC68P1	4B12,16	CDP		1858
CDP68HC68P2	4B8,16	CDP		2767
CDP68HC68R1	4A5,4B16	CDP		1544
CDP68HC68R2	4A5,4B16	CDP		1544
CDP68HC68S1	4B8,16	CDP		1918
CDP68HC68T1	4B3,16	CDP		1547
CDP68HC68W1	4B4,16	CDP		1919
CDP68HCL05C4	4A1,2	CDP		2748
CDP68HCL05C8	4A1,2	CDP		2748
CDP68HSC05C4	4A1,2	CDP		2748
CDP68HSC05C8	4A1,2	CDP		2748
D40C1	6C6	BIP		2333
D40C4	6C6	BIP		2333
D40C7	6C6	BIP		2333
D40D1	6C9	BIP		2334
D40D2	6C9	BIP		2334
D40D4	6C10	BIP		2334
D40D5	6C10	BIP		2334
D40D7	6C10	BIP		2334
D40D8	6C10	BIP		2334
D40E1	6C9	BIP		2335
D40E5	6C10	BIP		2335
D40K1	6C6	BIP		2336
D40K2	6C6	BIP		2336
D40K3	6C6	BIP		2336
D40K4	6C7	BIP		2336
D40V1	6C11	BIP		2337
D40V2	6C11	BIP		2337
D40V3	6C11	BIP		2337
D41D1	6C9	BIP		2338
D41D2	6C9	BIP		2338
D41D4	6C9	BIP		2338
D41D5	6C9	BIP		2338
D41D7	6C9	BIP		2338
D41D8	6C9	BIP		2338
D41E1	6C9	BIP		2339
D41E5	6C9	BIP		2339
D41E7	6C9	BIP		2339
D41K1	6C6	BIP		2340
D41K2	6C6	BIP		2340
D41K3	6C6	BIP		2340
D41K4	6C6	BIP		2340

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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
D42C1	6C9	BIP		2341
D42C10	6C10	BIP		2341
D42C11	6C10	BIP		2341
D42C12	6C10	BIP		2341
D42C2	6C9	BIP		2341
D42C3	6C9	BIP		2341
D42C4	6C10	BIP		2341
D42C5	6C10	BIP		2341
D42C6	6C10	BIP		2341
D42C7	6C10	BIP		2341
D42C8	6C10	BIP		2341
D42C9	6C10	BIP		2341
D43C1	6C9	BIP		2342
D43C10	6C9	BIP		2342
D43C11	6C9	BIP		2342
D43C12	6C9	BIP		2342
D43C2	6C9	BIP		2342
D43C3	6C9	BIP		2342
D43C4	6C9	BIP		2342
D43C5	6C9	BIP		2342
D43C6	6C9	BIP		2342
D43C7	6C9	BIP		2342
D43C8	6C9	BIP		2342
D43C9	6C9	BIP		2342
D44C1	6C9	BIP		2343
D44C10	6C10	BIP		2343
D44C11	6C10	BIP		2343
D44C12	6C10	BIP		2343
D44C2	6C9	BIP		2343
D44C3	6C9	BIP		2343
D44C4	6C10	BIP		2343
D44C5	6C10	BIP		2343
D44C6	6C10	BIP		2343
D44C7	6C10	BIP		2343
D44C8	6C10	BIP		2343
D44C9	6C10	BIP		2343
D44D1	6C6	BIP		2344
D44D2	6C6	BIP		2344
D44D3	6C7	BIP		2344
D44D4	6C7	BIP		2344
D44D5	6C7	BIP		2344
D44D6	6C7	BIP		2344
D44E1	6C6	BIP		2345
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D44H1	6C10	BIP		2346
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D44H11	6C10	BIP		2346
D44H2	6C9	BIP		2346
D44H4	6C10	BIP		2346
D44H5	6C10	BIP		2346
D44H7	6C10	BIP		2346
D44H8	6C10	BIP		2346
D44Q1	6C11	BIP		2347
D44Q3	6C11	BIP		2347
D44T1	6C11	BIP		2348
D44T2	6C11	BIP		2348

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D44TD3	6C4	BIP		2349
D44TD4	6C4	BIP		2349
D44TD5	6C4	BIP		2349
D44VH1	6C10	BIP		2350
D44VH10	6C10	BIP		2350
D44VH4	6C10	BIP		2350
D44VH7	6C10	BIP		2350
D44VM1	---	BIP		2351
D44VM10	---	BIP		2351
D44VM4	---	BIP		2351
D44VM7	---	BIP		2351
D45C1	6C9	BIP		2352
D45C10	6C9	BIP		2352
D45C11	6C9	BIP		2352
D45C12	6C9	BIP		2352
D45C2	6C9	BIP		2352
D45C3	6C9	BIP		2352
D45C4	6C9	BIP		2352
D45C5	6C9	BIP		2352
D45C6	6C9	BIP		2352
D45C7	6C9	BIP		2352
D45C8	6C9	BIP		2352
D45C9	6C9	BIP		2352
D45D1	6C6	BIP		2353
D45D2	6C6	BIP		2353
D45D3	6C6	BIP		2353
D45D4	6C6	BIP		2353
D45D5	6C6	BIP		2353
D45D6	6C6	BIP		2353
D45E1	6C6	BIP		2354
D45E2	6C6	BIP		2354
D45E3	6C6	BIP		2354
D45H1	6C2,9	BIP		2355
D45H10	6C1,9	BIP		2355
D45H11	6C9	BIP		2355
D45H2	6C2,9	BIP		2355
D45H4	6C2,9	BIP		2355
D45H5	6C2,9	BIP		2355
D45H7	6C1,9	BIP		2355
D45H8	6C1,9	BIP		2355
D45VH1	6C9	BIP		2356
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D45VH4	6C9	BIP		2356
D45VH7	6C9	BIP		2356
D45VM1	6C9	BIP		2357
D45VM10	6C9	BIP		2357
D45VM4	6C9	BIP		2357
D45VM7	6C9	BIP		2357
D64DV5	6C8	BIP		2361
D64DV6	6C8	BIP		2361
D64DV7	6C8	BIP		2361
D64EV5	6C8	BIP		2361
D64EV6	6C8	BIP		2361
D64EV7	6C8	BIP		2361
D72F5T1	6C10	BIP		2363

### Databook Code Legend

BIP	- Bipolar Power	DB220.1
CDP	- CDP6805 & Peripheral	DB260.1
CD4	- CD4000 Series	DB250.5
DAQ	- Data Acquisition	DB301.1
DSP	- Digital Signal Processing	DB302
IP	- Intelligent Power	DB304

LIN	- Linear and Telecom	DB550.1
MIC	- Microprocessor Products	DB303
MOS	- Power MOSFETs	DB223.2
RH	- Rad Hard/Hi Rel	DB235.2
TVS	- Transient Voltage Suppression	DB450.2

### Military Availability Code

1	- Non-Compliant
2	- Fully Compliant
3	- DESC, SMD Qualified
4	- JAN Qualified

# Alphanumeric Part Numbering Index

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DG182	3C1,2	DAQ	2	3114
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DG200	3C1,2	DAQ	2	3115
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DG201A	3C1,2	DAQ	2	3117
DG202	3C1,2	DAQ	2	3117
DG211	3C1,2	DAQ		3118
DG212	3C1,2	DAQ		3118
DG300A	3C1,2	DAQ	2	3119
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DG308A	3C1,2	DAQ	2	3120
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GE1002	6D3			2161
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HA-2406	2A4,5,11	LIN		2892
HA-2420	3A,1	LIN	1,2,3	2856
HA-2425	3A,1	LIN		2856
HA-2444	2A3,4,5,11	LIN	2	2490
HA-2500/2/5	---	LIN	1,2,4	2890
HA-2510/2/5	---	LIN	1,2,4	2893
HA-2520	2A5	LIN	1,2,4	2894
HA-2522	2A5	LIN	1,2	2894
HA-2525	2A5	LIN		2894
HA-2529	2A5	LIN	2	2894
HA-2539	2A4,5	LIN	1,2	2896
HA-2540	2A4,5	LIN	1,2	2897
HA-2541	2A5	LIN	1,2	2898
HA-2542	2A5,13	LIN	1,2	2899
HA-2544	2A5	LIN	2,3	2900
HA-2546	2C1	LIN	2	2861
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HA-2548	2A4,5,6	LIN	2	2901
HA-2556	2C1	LIN	2	2477
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HA-2600/2/5	---	LIN	1,2,4	2902
HA-2620	2A4	LIN	1,2,4	2903
HA-2622	2A4	LIN	1,2	2903
HA-2625	2A4	LIN		2903
HA-2640/5	2A9	LIN	1,2,3	2904
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HA-2842	2A2,4,5	LIN	2	2786
HA-2850	2A2,4,5	LIN	1,2	2844
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HA-4905	2C4	LIN		2855
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HA-5004	2A4,5,11	LIN	2	2923
HA-5020	2A1,4,5,11	LIN		2845
HA-5033	2A13	LIN	1,2	2924
HA-5101	2A4	LIN	2,3	2905
HA-5102	2A4,6	LIN	2,3	2925
HA-5104	2A4,6	LIN	1,2,3	2925
HA-5111	---	LIN	2	2905
HA-5112	2A4,5,6	LIN	2	2925
HA-5114	2A4,5,6	LIN	1,2,3	2925
HA-5127A	2A6	LIN	2	2906

## Databook Code Legend

BIP	- Bipolar Power
CDP	- CDP6805 & Peripheral
CD4	- CD4000 Series
DAQ	- Data Acquisition
DSP	- Digital Signal Processing
IP	- Intelligent Power
DB220.1	
DB260.1	
DB250.5	
DB301.1	
DB302	
DB304	

LIN	- Linear and Telecom
MIC	- Microprocessor Products
MOS	- Power MOSFETs
RH	- Rad Hard/Hi Rel
TVS	- Transient Voltage Suppression

## Military Availability Code

DB550.1	1 - Non-Compliant
DB303	2 - Fully Compliant
DB223.2	3 - DESC, SMD Qualified
DB235.2	4 - JAN Qualified
DB450.2	

# Alphanumeric Part Numbering Index

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HA-5135	2A6	LIN	1,2	2907
HA-5137/A	2A6	LIN	2	2908
HA-5142	2A8	LIN		2909
HA-5144	2A6,7,8	LIN	2	2909
HA-5147/A	2A4,6	LIN	2	2910
HA-5160	2A4,5	LIN		2911
HA-5162	2A4	LIN		2911
HA-5170	2A6	LIN	1	2912
HA-5177/A	2A6	LIN	2	2913
HA-5190	2A4,5	LIN	1,2	2914
HA-5195	2A4,5	LIN		2914
HA-5221	2A4,5,6	LIN	2	2915
HA-5222	2A4,5,6	LIN	2	2915
HA-5232	2A6,7,9	LIN		2851
HA-5234	2A6,7,9	LIN		2851
HA-5320	3A,1	LIN	1	2857
HA-5330	3A,1	LIN	2,3	2858
HA-5340	3A,1,2	LIN	2	2859
HA-7712A/B	---	LIN		2760
HA-7713A/B	---	LIN		2760
HC5504B	5B3	LIN		2886
HC-5502B	5B3	LIN		2884
HC-5504DLC	5B3	LIN		2443
HC-5509B	5B3	LIN		2799
HC-5524	5B3	LIN		2798
HC-55536	5B7	LIN		2888
HC-55564	5B7	LIN		2889
HC-5560	5B6	LIN		2887
HD-15530	4B14	MIC	1,3	2960
HD-15531/B	4B14	MIC	1	2961
HD-4702	4B13	MIC	2	2954
HD-6402R	4B13	MIC	2	2956
HD-6406	4B13		1	
HD-6408	4B14	MIC		2952
HD-6409	4B14	MIC	2	2951
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HFA1130	2A1,4,5,11			
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HFA-0001	2A1,4,5	LIN	2	2916
HFA-0002	2A1,4,5	LIN	2	2917
HFA-0003	2C4	LIN	2	2749
HFA-0003L	2C4	LIN		2749
HFA-0005	2A4,5	LIN	2	2918
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HGTA32N60E2	6B2,4	MOS		2833
HGTB12N50D1C	6B4			
HGTB12N60D1C	6B3	MOS		2326
HGTD10N40F1	6B2,4	MOS		2425
HGTD10N40F1S	6B2,4	MOS		2425
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HGTD6N50E1	6B2,4	MOS		2413

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HGTG24N60D1	6B2,4	MOS		2831
HGTG24N60D1D	6B3,4	MOS		2797
HGTG30N120E2	6B2			
HGTG32N60E2	6B2,4	MOS		2828
HGTG34N100E2	6B2	MOS		2827
HGTH12N40C1	6B2	MOS		1697
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HGTH12N50C1	6B2,4	MOS		1697
HGTH12N50C1D	6B3,4	MOS		2273
HGTH12N50E1	6B2,4	MOS		1697
HGTH12N50E1D	6B3,4	MOS		2273
HGTH20N40C1	6B2,4	MOS		2174
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HGTH20N50C1	6B2,4	MOS		2174
HGTH20N50C1D	6B3,4	MOS		2271
HGTH20N50E1	6B2,4	MOS		2174
HGTH20N50E1D	6B3,4	MOS		2271
HGTM12N40C1	6B2,4	MOS		1697
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HGTM12N50E1	6B2,4	MOS		1697
HGTM12N60D1	6B2,4	MOS		2829
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HGTM20N100E2	6B4			
HGTM20N40C1	6B2,4	MOS		2174
HGTM20N40E1	6B2,4	MOS		2174
HGTM20N50C1	6B2,4	MOS		2174
HGTM20N50E1	6B2,4	MOS		2174
HGTM24N60D1	6B2,4	MOS		2832
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HGTP10N40C1	6B2,4	MOS		1697
HGTP10N40C1D	6B3,4	MOS		2405
HGTP10N40E1	6B2,4	MOS		1697
HGTP10N40E1D	6B3,4	MOS		2405
HGTP10N40F1D	6B3			
HGTP10N50C1	6B2,4	MOS		1697
HGTP10N50C1D	6B3,4	MOS		2405
HGTP10N50E1	6B2,4	MOS		1697
HGTP10N50E1D	6B3,4	MOS		2405
HGTP10N50F1D	6B3,4	MOS		2751
HGTP12N60D1	6B2,4	MOS		2830
HGTP15N40C1	6B2,4	MOS		2174
HGTP15N40E1	6B2,4	MOS		2174
HGTP15N50C1	6B2,4	MOS		2174
HGTP15N50E1	6B2,4	MOS		2174
HGTP6N40E1D	6B3	MOS		2795

### Databook Code Legend

BIP	- Bipolar Power	DB220.1
CDP	- CDP6805 & Peripheral	DB260.1
CD4	- CD4000 Series	DB250.5
DAQ	- Data Acquisition	DB301.1
DSP	- Digital Signal Processing	DB302
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LIN	- Linear and Telecom	DB550.1
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### Military Availability Code

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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
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HI-303	3C1	DAQ		3125
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HI-565A	3B4	DAQ	2	3109
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### Databook Code Legend

BIP - Bipolar Power  
 CDP - CDP6805 & Peripheral  
 CD4 - CD4000 Series  
 DAQ - Data Acquisition  
 DSP - Digital Signal Processing  
 IP - Intelligent Power

DB220.1  
 DB260.1  
 DB260.5  
 DB301.1  
 DB302  
 DB304

LIN - Linear and Telecom  
 MIC - Microprocessor Products  
 MOS - Power MOSFETs  
 RH - Rad Hard/Hi Rel  
 TVS - Transient Voltage Suppression

DB550.1  
 DB303  
 DB223.2  
 DB235.2  
 DB450.2

### Military Availability Code

1 - Non-Compliant  
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# Alphanumeric Part Numbering Index

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BIP	- Bipolar Power	DB220.1
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CD4	- CD4000 Series	DB250.5
DAQ	- Data Acquisition	DB301.1
DSP	- Digital Signal Processing	DB302
IP	- Intelligent Power	DB304

LIN	- Linear and Telecom	DB550.1
MIC	- Microprocessor Products	DB303
MOS	- Power MOSFETs	DB223.2
RH	- Rad Hard/Hi Rel	DB235.2
TVS	- Transient Voltage Suppression	DB450.2

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# Alphanumeric Part Numbering Index

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### Databook Code Legend

BIP	- Bipolar Power	DB220.1
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DB303	
DB223.2	
DB235.2	
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# Alphanumeric Part Numbering Index

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IRFF120/R	6A5	MOS		1563
IRFF121/R	6A4	MOS		1563
IRFF122/R	6A5	MOS		1563
IRFF123/R	6A4	MOS		1563
IRFF130/R	6A5	MOS		1564
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IRFF313/R	6A9	MOS		1888
IRFF320/R	6A9	MOS		1890
IRFF321/R	6A9	MOS		1890
IRFF322/R	6A9	MOS		1890
IRFF323/R	6A9	MOS		1890
IRFF330/R	6A10	MOS		1893
IRFF331/R	6A9	MOS		1893
IRFF332/R	6A10	MOS		1893
IRFF333/R	6A9	MOS		1893
IRFF420/R	6A11	MOS		1891
IRFF421/R	6A10	MOS		1891
IRFF422/R	6A11	MOS		1891
IRFF423/R	6A10	MOS		1891
IRFF430/R	6A11	MOS		1894
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IRFF9222	6A14	MOS		2288
IRFF9223	6A14	MOS		2288
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IRFF9231	6A14	MOS		2225
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IRFP141R	6A5	MOS		2086
IRFP142R	6A6	MOS		2086
IRFP143R	6A5	MOS		2086
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IRFP240R	6A8	MOS		2087
IRFP241/R	6A7	MOS		2087
IRFP242R	6A8	MOS		2087
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IRFP247	6A8	MOS		2211
IRFP250/R	6A8	MOS		2330
IRFP251/R	6A7	MOS		2330
IRFP252/R	6A8	MOS		2330
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IRFP255	6A8	MOS		2289
IRFP256/R	---	MOS		2289
IRFP257	6A8	MOS		2289
IRFP340R	6A10	MOS		2088
IRFP341R	6A9	MOS		2088
IRFP342R	6A10	MOS		2088
IRFP343R	6A9	MOS		2088
IRFP350/R	6A10	MOS		2319
IRFP351/R	6A9	MOS		2319
IRFP352/R	6A10	MOS		2319
IRFP353/R	6A9	MOS		2319
IRFP360	6A10	MOS		2290
IRFP362	6A10	MOS		2290
IRFP440/R	6A11	MOS		2089
IRFP441R	6A11	MOS		2089
IRFP442/R	6A11	MOS		2089
IRFP443R	6A11	MOS		2089
IRFP450/R	6A11	MOS		2331
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IRFP9243	6A14	MOS		2294
IRFPC40R	6A12	MOS		2158
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### Databook Code Legend

BIP	- Bipolar Power	DB220.1
CDP	- CDP6805 & Peripheral	DB260.1
CD4	- CD4000 Series	DB250.5
DAQ	- Data Acquisition	DB301.1
DSP	- Digital Signal Processing	DB302
IP	- Intelligent Power	DB304

LIN	- Linear and Telecom	DB550.1
MIC	- Microprocessor Products	DB303
MOS	- Power MOSFETs	DB223.2
RH	- Rad Hard/Hi Rel	DB235.2
TVS	- Transient Voltage Suppression	DB450.2

### Military Availability Code

1	- Non-Compliant
2	- Fully Compliant
3	- DESC, SMD Qualified
4	- JAN Qualified



# Alphanumeric Part Numbering Index

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IRFU321	6A9	MOS		2412
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MUR1615CT	6D2	MOS		1885
MUR1620CT	6D2	MOS		1885
MUR3010PT	6D2	MOS		2775
MUR3015PT	6D2	MOS		2775
MUR3020PT	6D2	MOS		2775
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MUR8100E	6D1	MOS		2780
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MUR840	6D1	MOS		2091
MUR850	6D1	MOS		2091
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RCA6341	6C11	BIP		1205
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RCA9116C/D/E	6C1	BIP		1061
RCA9166A/B	6C3			1293
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RCA9228A/B/C/D	6C7,8	BIP		1448
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RFD12N06RLE	6A2	MOS		2407
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RFD14N05L/LSM	6A2	MOS		2246
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RFD16N05	6A4	MOS		2367
RFD16N05L/LSM	6A2	MOS		2269
RFD16N05SM	6A4	MOS		2367
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RFD3055RLESM	6A2	MOS		2407
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RFD4N06L/LSM	6A2	MOS		2837
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RFD8P05	6A13	MOS		2384
RFD8P05SM	6A13	MOS		2384
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### Databook Code Legend

BIP	- Bipolar Power
CDP	- CDP6805 & Peripheral
CD4	- CD4000 Series
DAQ	- Data Acquisition
DSP	- Digital Signal Processing
IP	- Intelligent Power

DB220.1
DB260.1
DB250.5
DB301.1
DB302
DB304

LIN	- Linear and Telecom
MIC	- Microprocessor Products
MOS	- Power MOSFETs
RH	- Rad Hard/Hi Rel
TVS	- Transient Voltage Suppression

DB550.1
DB303
DB223.2
DB235.2
DB450.2

### Military Availability Code

1	- Non-Compliant
2	- Fully Compliant
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4	- JAN Qualified

# Alphanumeric Part Numbering Index

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RFG60P05E	6A13	MOS		2745
RFG70N06	6A4	MOS		3206
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RFH10N50	6A11	MOS		1629
RFH12N35	6A9	MOS		1630
RFH12N40	6A10	MOS		1630
RFH25N18	6A7	MOS		1631
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RFL1N08	6A4	MOS		1385
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RFL1N10	6A5	MOS		1385
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RFL1N15	6A6	MOS		1444
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RFL1P10	6A13	MOS		1535
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RFM12N10	6A5	MOS		1386
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RFM12P08	6A13	MOS		1495
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RFM25N06L	6A2			
RFM3N45	6A10	MOS		1384
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RFM4N35	6A9	MOS		1495
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RFM5P12	6A14	MOS		1463
RFM5P15	6A14	MOS		1463
RFM6N45	6A11	MOS		1494
RFM6N50	6A11	MOS		1494
RFM6P08	6A13	MOS		1490
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RFP12N08	6A5	MOS		1386
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RFP12N10	---	MOS		1386
RFP12N10L	6A2			
RFP12N18	6A7	MOS		1461
RFP12N20	6A8	MOS		1461
RFP12P08	6A13	MOS		1495

### Databook Code Legend

BIP - Bipolar Power	DB220.1	LIN - Linear and Telecom	DB550.1
CDP - CDP6805 & Peripheral	DB260.1	MIC - Microprocessor Products	DB303
CD4 - CD4000 Series	DB250.5	MOS - Power MOSFETs	DB223.2
DAQ - Data Acquisition	DB301.1	RH - Rad Hard/Hi Rel	DB235.2
DSP - Digital Signal Processing	DB302	TVS - Transient Voltage Suppression	DB450.2
IP - Intelligent Power	DB304		

### Military Availability Code

1 - Non-Compliant
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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
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RFP15N08L	6A2	MOS		2840
RFP15N12	---	MOS		1443
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RFP2N08	6A4	MOS		2883
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RUR1560	6D1	MOS		2778
RUR1570	6D1	MOS		2878
RUR1580	6D1	MOS		2878
RUR1590	6D1	MOS		2878
RUR1610CT	6D2	MOS		1885
RUR1615CT	6D2	MOS		1885
RUR1620CT	6D2	MOS		1885
RUR3010	6D1	MOS		2777
RUR30100	6D1	MOS		2877
RUR3015	6D1	MOS		2777
RUR3020	6D1	MOS		2777
RUR3040	6D1	MOS		2776
RUR3050	6D1	MOS		2776
RUR3060	6D1	MOS		2776
RUR3070	6D1	MOS		2877
RUR3080	6D1	MOS		2877
RUR3090	6D1	MOS		2877
RUR610	6D1	MOS		1355
RUR8100	6D1	MOS		2780
RUR815	6D1	MOS		1355
RUR820	6D1	MOS		1355
RUR840	6D1	MOS		2091
RUR850	6D1	MOS		2091
RUR860	6D1	MOS		2091
RUR870	6D1	MOS		2780
RUR880	6D1	MOS		2780
RUR890	6D1	MOS		2780
RURD1510	6D2	MOS		2775
RURD15100	6D2	MOS		2934
RURD1515	6D2	MOS		2775
RURD1520	6D2	MOS		2775
RURD1540	6D2	MOS		2774
RURD1550	6D2	MOS		2774
RURD1560	6D2	MOS		2774
RURD1570	6D2	MOS		2934
RURD1580	6D2	MOS		2934
RURD1590	6D2	MOS		2934
RURD1610	6D2	MOS		1383

### Databook Code Legend

BIP	- Bipolar Power
CDP	- CDP6805 & Peripheral
CD4	- CD4000 Series
DAQ	- Data Acquisition
DSP	- Digital Signal Processing
IP	- Intelligent Power

DB220.1
DB260.1
DB250.5
DB301.1
DB302
DB304

LIN	- Linear and Telecom
MIC	- Microprocessor Products
MOS	- Power MOSFETs
RH	- Rad Hard/Hi Rel
TVS	- Transient Voltage Suppression

DB550 1
DB303
DB223.2
DB235.2
DB450.2

### Military Availability Code

1	- Non-Compliant
2	- Fully Compliant
3	- DESC, SMD Qualified
4	- JAN Qualified

# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
RURD1615	6D2	MOS		1383
RURD1620	6D2	MOS		1383
RURD3010	6D2	MOS		2773
RURD30100	6D2	MOS		2932
RURD3015	6D2	MOS		2773
RURD3020	6D2	MOS		2773
RURD3040	6D2	MOS		2772
RURD3050	6D2	MOS		2772
RURD3060	6D2	MOS		2772
RURD3070	6D2	MOS		2932
RURD3080	6D2	MOS		2932
RURD3090	6D2	MOS		2932
RURD810	6D2	MOS		1356
RURD815	6D2	MOS		1356
RURD820	6D2	MOS		1356
RURDG1510	6D2			2775
RURDG15100	6D2			2933
RURDG1515	6D2			2775
RURDG1520	6D2			2775
RURDG1540	6D2			2774
RURDG1550	6D2			2774
RURDG1560	6D2			2774
RURDG1570	6D2			2933
RURDG1580	6D2			2933
RURDG1590	6D2			2933
RURDG3010	6D2			3277
RURDG30100	6D2			2935
RURDG3015	6D2			3277
RURDG3020	6D2			3277
RURDG3040	6D2			3212
RURDG3050	6D2			3212
RURDG3060	6D2			3212
RURDG3070	6D2			2935
RURDG3080	6D2			2935
RURDG3090	6D2			2935
RURG3010	6D1			3213
RURG30100	6D1			
RURG3015	6D1			
RURG3020	6D1			
RURG3040	6D1			3212
RURG3050	6D1			3212
RURG3060	6D1			3212
RURG3070	6D1			3213
RURG3080	6D1			3213
RURG3090	6D1			
RURG50100	6D1			
RURG5040	6D1			3211
RURG5050	6D1			3211
RURG5060	6D1			3211
RURG5070	6D1			
RURG5080	6D1			
RURG5090	6D1			
RURG80100	6D1			
RURG8040	6D1			
RURG8050	6D1			
RURG8060	6D1			
RURG8070	6D1			

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
RURG8080	6D1			
RURG8090	6D1			
RURU100100	6D1			
RURU100120	6D1			
RURU10040	6D1			
RURU10050	6D1			
RURU10060	6D1			
RURU10070	6D1			
RURU10080	6D1			
RURU10090	6D1			
RURU150100	6D1			
RURU15040	6D1			
RURU15050	6D1			
RURU15060	6D1			
RURU15070	6D1			
RURU15080	6D1			
RURU15090	6D1			
RURU50100	6D1			
RURU5040	6D1			2940
RURU5050	6D1			2940
RURU5060	6D1			2940
RURU5070	6D1			
RURU5080	6D1			
RURU5090	6D1			
RURU80100	6D1			
RURU8040	6D1			
RURU8050	6D1			
RURU8060	6D1			
RURU8080	6D1			
RURU8090	6D1			
SGT03U13	6E2	TVS		1692
SGT06U13	6E2	TVS		1692
SGT10S10	6E2	TVS		1691
SGT23B13	---	TVS		1895
SGT23U13	6E2	TVS		1692
SGT27B13	---	TVS		1895
SGT27B27	---	TVS		1895
SGT27S10	6E2	TVS		1691
SGT27S23	6E2	TVS		2762
SP600	2B1.5	IP		2428
SP601	2B1.5	IP		2429
SP720	2B2.9			
TIP100	6C7	BIP		1153
TIP101	6C7	BIP		1153
TIP102	6C7	BIP		1153
TIP110	6C7	BIP		1336
TIP111	6C7	BIP		1336
TIP112	6C7	BIP		1336
TIP115	6C6	BIP		1387
TIP116	6C6	BIP		1387
TIP117	6C6	BIP		1387
TIP120	6C7	BIP		998
TIP121	6C7	BIP		998
TIP122	6C7	BIP		998
TIP125	6C6	BIP		997
TIP126	6C6	BIP		997
TIP127	6C6	BIP		997

### Databook Code Legend

BIP - Bipolar Power	DB220.1	LIN - Linear and Telecom	DB550.1
CDP - CDP6805 & Peripheral	DB260.1	MIC - Microprocessor Products	DB303
CD4 - CD4000 Series	DB250.5	MOS - Power MOSFETs	DB223.2
DAQ - Data Acquisition	DB301.1	RH - Rad Hard/Hi Rel	DB235.2
DSP - Digital Signal Processing	DB302	TVS - Transient Voltage Suppression	DB450.2
IP - Intelligent Power	DB304		

### Military Availability Code

1 - Non-Compliant
2 - Fully Compliant
3 - DESC, SMD Qualified
4 - JAN Qualified

# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
TIP29/A/B/C	6C2,3	BIP		990
TIP30/A/B/C	6C1,2	BIP		988
TIP31/A/B/C	6C2,3	BIP		991
TIP32/A/B/C	6C1,2	BIP		987
TIP41/A/B/C	6C2,3	BIP		992
TIP42/A/B/C	6C1,2	BIP		996
TIP47	6C3	BIP		978
TIP48	6C4	BIP		978
TIP49	6C4	BIP		978
TIP50	6C4	BIP		978
TIP52	6C4	BIP		1212
TIP563	6C4	BIP		1212
UA741	2A10	LIN		531
V1000LA160B	6E5,12	TVS		2190
V1000LA80A	6E5,12	TVS		2190
V100CH8	6E5,9	TVS		2186
V100MA4A/B/S	6E5,13	TVS		2191
V100RA16	6E6,17	TVS		2193
V100RA8	6E6,16	TVS		2193
V100ZA05	6E5,19	TVS	3	2184
V100ZA15	6E5,19	TVS	3	2184
V100ZA3	6E5,19	TVS	3	2184
V100ZA4	6E5,19	TVS	3	2184
V112BB60	6E6	TVS		2183
V112CA60	6E6,8	TVS		2187
V120CH8	6E5,9	TVS		2186
V120MA1A	6E13	TVS		2191
V120MA2B/S	6E5,13	TVS		2191
V120RA16	6E6,17	TVS		2193
V120RA8	6E6,16	TVS		2193
V120ZA05	6E5,19	TVS	3	2184
V120ZA1	6E5,19	TVS	3	2184
V120ZA4	6E5,19	TVS	3	2184
V120ZA6	6E5,19	TVS	3	2184
V12CP22	6E10	TVS		2188
V12RA8	6E6,16	TVS		2193
V12ZA05	6E5,18	TVS		2184
V12ZA1	6E5,18	TVS	5	2184
V12ZA2	6E5,18	TVS	5	2184
V130LA1/2	6E5,12	TVS	5	2190
V130LA10A	6E5,12	TVS	5	2190
V130LA20A/B	6E5,12	TVS	4,5	2190
V130LA5	6E5,12	TVS		2190
V130PA20A/C	6E6,15	TVS		2192
V131BA60	6E6	TVS		2183
V131CA32	6E6,8	TVS		2187
V131CA40	6E6,8	TVS		2187
V131DA40	6E6,10	TVS		2189
V131DB40	6E6,10	TVS	3	2189
V131HA32	6E7,11	TVS		2973
V131HA40	6E7,11	TVS		2973
V131NA34	6E7,14	TVS		2825
V140LA10A	6E5,12	TVS		2190
V140LA2	6E5,12	TVS		2190
V140LA5	6E5,12	TVS		2190
V142BB60	6E6	TVS		2183
V142CA60	6E6,8	TVS		2187

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
V14MLA1206	6E3	TVS		
V150CH8	6E5,9	TVS		2186
V150LA1/2	6E5,12	TVS	5	2190
V150LA10A	6E5,12	TVS	5	2190
V150LA20A/B	6E5,12	TVS	4,5	2190
V150LA5	6E5,12	TVS		2190
V150MA1A	6E13	TVS		2191
V150MA2B	6E5,13	TVS		2191
V150PA20A/C	6E6,15	TVS		2192
V150RA16	6E6,17	TVS		2193
V150RA8	6E6,16	TVS		2193
V150ZA05	6E5,19	TVS	3	2184
V150ZA1	6E5,19	TVS	3	2184
V150ZA4	6E5,19	TVS	3	2184
V150ZA8	6E5,19	TVS	3	2184
V151BA60	6E6	TVS		2183
V151CA32	6E6,8	TVS		2187
V151CA40	6E6,8	TVS		2187
V151DA40	6E6,10	TVS		2189
V151DB40	6E6,10	TVS	3	2189
V151HA32	6E7,11	TVS		2189
V151HA40	6E7,11	TVS		2973
V151NA34	6E7,14	TVS		2825
V172BB60	6E6	TVS		2183
V172CA60	6E6,8	TVS		2187
V175LA10A	6E5,12	TVS		2190
V175LA2	6E5,12	TVS		2190
V175LA5	6E12	TVS		2190
V180CH8	6E5,9	TVS		2186
V180MA1A	6E13	TVS		2191
V180MA3B	6E5,13	TVS		2191
V180RA16	6E6,17	TVS		2193
V180RA8	6E6,16	TVS		2193
V180ZA05	6E5,19	TVS	3	2184
V180ZA1	6E5,19	TVS	3	2184
V180ZA10	6E5,19	TVS	3	2184
V180ZA5	6E5,19	TVS	3	2184
V18CH8	6E5,9	TVS		2186
V18CP22	6E10	TVS		2188
V18MA1A	6E13	TVS		2191
V18MA1B/S	6E5,13	TVS		2191
V18MLA1206	6E3	TVS		
V18MLA1210	6E3	TVS		
V18RA16	6E6,17	TVS		2193
V18RA8	6E6,16	TVS		2193
V18ZA05	6E5,18	TVS		2184
V18ZA1	6E5,18	TVS		2184
V18ZA2	6E5,18	TVS		2184
V18ZA3	6E5,18	TVS		2184
V18ZA40	6E5,18	TVS		2184
V200CH8	6E5,9	TVS		2186
V200CP16	6E5,10	TVS		2188
V200CP20	6E5,10	TVS		2188
V200CP22	6E5,10	TVS		2188
V200RA16	6E6,17	TVS		2193
V200RA22	6E6,17	TVS		2193
V200RA8	6E6,16	TVS		2193

## Databook Code Legend

BIP - Bipolar Power  
 CDP - CDP6805 & Peripheral  
 CD4 - CD4000 Series  
 DAQ - Data Acquisition  
 DSP - Digital Signal Processing  
 IP - Intelligent Power

DB220.1  
 DB260.1  
 DB250.5  
 DB301.1  
 DB302  
 DB304

LIN - Linear and Telecom  
 MIC - Microprocessor Products  
 MOS - Power MOSFETs  
 RH - Rad Hard/Hi Rel  
 TVS - Transient Voltage Suppression

## Military Availability Code

DB550.1  
 DB303  
 DB223.2  
 DB235.2  
 DB450.2

1 - Non-Compliant  
 2 - Fully Compliant  
 3 - DESC, SMD Qualified  
 4 - JAN Qualified

# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
V202BB60	6E6	TVS		2183
V202CA60	6E6,8	TVS		2187
V220CH8	6E5,9	TVS		2186
V220MA2A	6E13	TVS		2191
V220MA4B	6E13	TVS		2191
V220RA16	6E6,17	TVS		2193
V220RA8	6E6,16	TVS		2193
V220ZA05	6E5,19	TVS		2184
V22CH8	6E5,9	TVS		2186
V22MA1A/B/S	6E5,13	TVS		2191
V22RA16	6E6,17	TVS		2193
V22RA8	6E6,16	TVS		2193
V22ZA05	6E5,18	TVS	3	2184
V22ZA1	6E5,18	TVS	3,5	2184
V22ZA2	6E5,18	TVS	3	2184
V22ZA3	6E5,18	TVS	3,5	2184
V230LA10	6E5,12	TVS		2190
V230LA20A	6E5,12	TVS		2190
V230LA4	6E5,12	TVS		2190
V240CH8	6E5,9	TVS		2186
V240CP16	6E5,10	TVS		2188
V240CP20	6E5,10	TVS		2188
V240CP22	6E5,10	TVS		2188
V240RA16	6E6,17	TVS		2193
V240RA22	6E6,17	TVS		2193
V240RA8	6E6,16	TVS		2193
V242BB60	6E6	TVS		2183
V242CA60	6E6,8	TVS		2187
V24RA22	6E6,17	TVS		2193
V24ZA50	6E5,18	TVS	3,5	2184
V250LA10	6E12	TVS		2190
V250LA2/4	6E5,12	TVS	5	2190
V250LA20A	6E5,12	TVS	5	2190
V250LA40A/B	6E5,12	TVS	5	2190
V250PA40A/C	6E6,15	TVS		2192
V251BA60	6E6	TVS		2183
V251CA32	6E6,8	TVS		2187
V251CA40	6E6,8	TVS		2187
V251CA60	6E6,8	TVS		2187
V251DA40	6E6,10	TVS		2189
V251DB40	6E6,10	TVS	3	2189
V251HA32	6E7,11	TVS		2973
V251HA40	6E7,11	TVS		2973
V251HA50	6E7	TVS		2973
V251HA60	6E7	TVS		2973
V251MA34	6E7	TVS		2191
V251NA34	6E14	TVS		2825
V26MLA1206	6E3	TVS		
V26MLA1210	6E3	TVS		
V270MA2A	6E13	TVS		2191
V270MA4B	6E13	TVS		2191
V270RA16	6E6,17	TVS		2193
V270RA22	6E6,17	TVS		2193
V270RA8	6E6,16	TVS		2193
V270ZA05	6E5,19	TVS		2184
V271BA60	6E6	TVS		2183
V271CA32	6E6,8	TVS		2187

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
V271CA40	6E6,8	TVS		2187
V271CA60	6E6,8	TVS		2187
V271DA40	6E6,10	TVS		2189
V271DB40	6E6,10	TVS	3	2189
V271HA32	6E7,11	TVS		2973
V271HA40	6E7,11	TVS		2973
V271HA50	6E7			
V271HA60	6E7			
V271NA34	6E7,14	TVS		2825
V275LA10	6E5,12	TVS		2190
V275LA2/4	6E5,12	TVS		2190
V275LA20A	6E5,12	TVS		2190
V275LA40A/B	6E5,12	TVS	4	2190
V275PA40A/C	6E6,15	TVS		2192
V27CH8	6E5,9	TVS		2186
V27MA1A/B/S	6E5,13	TVS		2191
V27RA16	6E6,17	TVS		2193
V27RA8	6E6,16	TVS		2193
V27ZA05	6E5,18	TVS	3	2184
V27ZA1	6E5,18	TVS	3	2184
V27ZA2	6E5,18	TVS	3	2184
V27ZA4	6E5,18	TVS	3	2184
V27ZA60	6E5,18	TVS	3	2184
V282BB60	6E6	TVS		2183
V282CA60	6E6,8	TVS		2187
V300LA2/4	6E5,12	TVS		2190
V320LA20A	6E5,12	TVS		2190
V320LA40B	6E5,12	TVS	4	2190
V320PA40A/C	6E6,15	TVS		2192
V321BA60	6E6	TVS		2183
V321CA32	6E6,8	TVS		2187
V321CA40	6E6,8	TVS		2187
V321CA60	6E6,8	TVS		2187
V321DA40	6E6,10	TVS		2189
V321DB40	6E6,10	TVS	3	2189
V321HA32	6E7,11	TVS		2973
V321HA40	6E7,11	TVS		2973
V321HA50	6E7			
V321HA60	6E7			
V321NA34	6E7,14	TVS		2825
V330MA2A	6E13	TVS		2191
V330MA5B	6E13	TVS		2191
V330ZA05	6E5,19	TVS		2184
V33CH8	6E5,9	TVS		2186
V33MA1A/B/S	6E5,13	TVS		2191
V33MLA1206	6E3	TVS		
V33RA16	6E6,17	TVS		2193
V33RA8	6E6,16	TVS		2193
V33ZA05	6E5,18	TVS	3	2184
V33ZA1	6E5,18	TVS	3,5	2184
V33ZA2	6E5,18	TVS	3	2184
V33ZA5	6E18	TVS	3,5	2184
V33ZA70	6E5,18	TVS	3,5	2184
V360CH8	6E5,9	TVS		2186
V360RA16	6E6,17	TVS		2193
V360RA8	6E6,16	TVS		2193
V36RA22	6E6,17	TVS		2193

## Databook Code Legend

BIP - Bipolar Power  
 CDP - CDP6805 & Peripheral  
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 DSP - Digital Signal Processing  
 IP - Intelligent Power

DB220.1  
 DB260.1  
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 DB301.1  
 DB302  
 DB304

LIN - Linear and Telecom  
 MIC - Microprocessor Products  
 MOS - Power MOSFETs  
 RH - Rad Hard/Hi Rel  
 TVS - Transient Voltage Suppression

DB550.1  
 DB303  
 DB223.2  
 DB235.2  
 DB450.2

## Military Availability Code

1 - Non-Compliant  
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# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
V36ZA80	6E5,18	TVS	3	2184
V390CH8	8E5,9	TVS		2186
V390MA3A	6E13	TVS		2191
V390MA6B	6E13	TVS		2191
V390RA16	6E6,17	TVS		2193
V390RA22	6E6,17	TVS		2193
V390RA8	6E6,16	TVS		2193
V390ZA05	6E5,19	TVS		2184
V39CH8	6E5,9	TVS		2186
V39CP20	6E5,10	TVS		2188
V39CP22	6E5,10	TVS		2188
V39MA2A/B/S	6E5,13	TVS		2191
V39RA16	6E6,17	TVS		2193
V39RA8	6E6,16	TVS		2193
V39ZA05	6E5,18	TVS	3	2184
V39ZA1	6E5,18	TVS	3	2184
V39ZA3	6E5,18	TVS	3	2184
V39ZA6	6E5,18	TVS	3	2184
V3.5MLA1206	6E3	TVS		
V420LA10	6E5,12	TVS		2190
V420LA20A	6E5,12	TVS	5	2190
V420LA40B	6E5,12	TVS	5	2190
V420PA40A/C	6E6,15	TVS		2192
V421BA60	6E6	TVS		2183
V421CA32	6E6,8	TVS		2187
V421CA40	6E6,8	TVS		2187
V421CA60	6E6,8	TVS		2187
V421DA40	6E6,10	TVS		2189
V421DB40	6E6,10	TVS	3	2189
V421HA32	6E7,11	TVS		2973
V421HA40	6E7,11	TVS		2973
V421HA50	6E7			
V421HA60	6E7			
V421NA34	6E7,14	TVS		2825
V42MLA1206	6E3	TVS		
V430CH8	6E5,9	TVS		2186
V430MA3A	6E13	TVS		2191
V430MA7B	6E13	TVS		2191
V430RA16	6E6,17	TVS		2193
V430RA22	6E6,17	TVS		2193
V430RA8	6E6,16	TVS		2193
V430ZA05	6E5,19	TVS		2184
V470ZA05	6E5,19	TVS		2184
V47CH8	6E5,9	TVS		2186
V47CP16	6E5,10	TVS		2188
V47CP20	6E5,10	TVS		2188
V47CP22	6E5,10	TVS		2188
V47MA2A/B/S	6E5,13	TVS		2191
V47RA16	6E6,17	TVS		2193
V47RA8	6E6,16	TVS		2193
V47ZA05	6E5,19	TVS	3	2184
V47ZA1	6E5,19	TVS	3	2184
V47ZA3	6E5,19	TVS	3	2184
V47ZA7	6E5,19	TVS	3	2184
V480LA40A	6E5,12	TVS	5	2190
V480LA80B	6E5,12	TVS	5	2190
V480PA80A/C	6E6,15	TVS		2192

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V481BA60	6E6	TVS		2183
V481CA32	6E6,8	TVS		2187
V481CA40	6E6,8	TVS		2187
V481CA60	6E6,8	TVS		2187
V481DA40	6E6,10	TVS		2189
V481DB40	6E6,10	TVS	3	2189
V481HA32	6E7,11	TVS		2973
V481HA40	6E7,11	TVS		2973
V481HA50	6E7	TVS		2973
V481HA60	6E7	TVS		2973
V481NA34	6E7,14	TVS		2825
V510LA40A	6E5,12	TVS	5	2190
V510LA80B	6E5,12	TVS	5	2190
V510PA80A/C	6E6,15	TVS		2192
V511BA60	6E6	TVS		2183
V511CA32	6E6,8	TVS		2187
V511CA40	6E6,8	TVS		2187
V511CA60	6E6,8	TVS		2187
V511DA40	6E6,10	TVS		2189
V511DB40	6E6,10	TVS	3	2189
V511HA32	6E7,11	TVS		2973
V511HA40	6E7,11	TVS		2973
V511HA50	6E7	TVS		2973
V511HA60	6E7	TVS		2973
V511NA34	6E7,14	TVS		2825
V56CH8	6E5,9	TVS		2186
V56MA2A/B/S	6E5,13	TVS		2191
V56MLA1206	6E3	TVS		
V56RA16	6E6,17	TVS		2193
V56RA8	6E6,16	TVS		2193
V56ZA05	6E5,19	TVS	3	2184
V56ZA2	6E5,19	TVS	3	2184
V56ZA3	6E5,19	TVS	3	2184
V56ZA8	6E5,19	TVS	3	2184
V571BA60	6E6	TVS		2183
V571CA32	6E6,8	TVS		2187
V571CA40	6E6,8	TVS		2187
V571CA60	6E6,8	TVS		2187
V571DA40	6E6,10	TVS		2189
V571DB40	6E6,10	TVS	3	2189
V571HA32	6E7,11	TVS		2973
V571HA40	6E7,11	TVS		2973
V571HA50	6E7			
V571HA60	6E7			
V571NA34	6E7,14	TVS		2825
V575LA40A	6E5,12	TVS		2190
V575LA80B	6E5,12	TVS		2190
V575PA80A/C	6E6,15	TVS		2192
V5.5MLA1206	6E3	TVS		
V660LA100B	6E5,12	TVS		2190
V660LA50A	6E5,12	TVS		2190
V660PA100A/C	6E6,15	TVS		2192
V661BA60	6E6	TVS		2183
V661CA32	6E6,8	TVS		2187
V661CA40	6E6,8	TVS		2187
V661CA60	6E6,8	TVS		2187
V661DA40	6E6,10	TVS		2189

## Databook Code Legend

BIP	- Bipolar Power	DB220.1
CDP	- CDP6805 & Peripheral	DB260.1
CD4	- CD4000 Series	DB250.5
DAQ	- Data Acquisition	DB301.1
DSP	- Digital Signal Processing	DB302
IP	- Intelligent Power	DB304

LIN	- Linear and Telecom	DB550.1
MIC	- Microprocessor Products	DB303
MOS	- Power MOSFETs	DB223.2
RH	- Rad Hard/Hi Rel	DB235.2
TVS	- Transient Voltage Suppression	DB450.2

## Military Availability Code

1	- Non-Compliant
2	- Fully Compliant
3	- DESC, SMD Qualified
4	- JAN Qualified

# Alphanumeric Part Numbering Index

HARRIS PART #	PAGE #	DATA BOOK CODE	MIL BOOK CODE	FILE #
V661DB40	0E6,10	TVS	3	2189
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V661HA40	0E7,11	TVS		2973
V661HA50	0E7			
V661HA60	0E7			
V661NA34	0E7,14	TVS		2825
V680ZA05	0E5,19			
V68CH8	0E5,9	TVS		2186
V68MA3A/B/S	0E5,13	TVS		2191
V68MLA1206	0E3	TVS		
V68RA16	0E6,17	TVS		2193
V68RA8	0E6,16	TVS		2193
V68ZA05	0E5,19	TVS	3	2184
V68ZA10	0E5,19	TVS	3,5	2184
V68ZA2	0E5,19	TVS	3,5	2184
V68ZA3	0E5,19	TVS	3	2184
V750ZA05	0E5,19			
V751BA60	0E6	TVS		2183
V751CA32	0E6,8	TVS		2187
V751CA40	0E6,8	TVS		2187
V751CA60	0E6,8	TVS		2187
V751DA40	0E6,10	TVS		2189
V751DB40	0E6,10	TVS	3	2189
V751HA32	0E7,11	TVS		
V751HA40	0E7,11	TVS		2973
V751HA50	0E7			
V751HA60	0E7			
V751NA34	0E7,14	TVS		2825
V82CH8	0E5,9	TVS		2186
V82MA3A/B/S	0E5,13	TVS		2191
V82RA16	0E6,17	TVS		2193
V82RA8	0E6,16	TVS		2193
V82ZA05	0E5,19	TVS	3	2184
V82ZA12	0E5,19	TVS	3,5	2184
V82ZA2	0E5,19	TVS	3,5	2184
V82ZA4	0E5,19	TVS	3	2184
V881BA60	0E6	TVS		2183
V881CA60	0E6,8	TVS		2187
V8RA8	0E6,16	TVS		2193
V8ZA05	0E5,18	TVS		2184
V8ZA1	0E5,18	TVS	5	2184
V8ZA2	0E5,18	TVS	5	2184

## Databook Code Legend

BIP - Bipolar Power	DB220.1	LIN - Linear and Telecom	DB550.1
CDP - CDP6805 & Peripheral	DB260.1	MIC - Microprocessor Products	DB303
CD4 - CD4000 Series	DB250.5	MOS - Power MOSFETs	DB223.2
DAQ - Data Acquisition	DB301.1	RH - Rad Hard/Hi Rel	DB235.2
DSP - Digital Signal Processing	DB302	TVS - Transient Voltage Suppression	DB450.2
IP - Intelligent Power	DB304		

## Military Availability Code

1 - Non-Compliant
2 - Fully Compliant
3 - DESC, SMD Qualified
4 - JAN Qualified





# 1- New Products and Publications

## Major Publications Available

<b>DESCRIPTION</b>	<b>PUBLICATION NUMBER</b>
Analog Military Data Book	Order by Title
Bipolar Power Data Book	DB220.1
CD4000B Series Data Book	DB250.5
Data Acquisition Data Book	DB301.1
Digital Military Data Book	Order by Title
Digital Signal Processing Data Book	DB302
Intelligent Power ICs Data Book	DB304
Linear and Telecom Data Book	DB500.1
Microprocessor Products Data Book	DB303
Power MOSFETs Data Book	DB223.2
Rad-Hard/Hi Rel Data Book	DB235.2 (10/92)
Transient Voltage Suppression Devices Data Book	DB450.2
6805 Micro Brochure	BR-005
ASIC Technology Brochure	BR-004.1
DSP Brochure	BR-016
DSP User's Directory	BR-015
High Performance Operational Amplifiers	BR-0A870.INTL
High Performance Operational Amplifiers	BR-0A870.NA
Sales Location Brochure	BR-007

# New Product Information

Harris Part Number	Product Features & Benefits	Target Market/Applications
<b>Analog Signal Processing</b>		
CA3256E - BIMOS Video Switch and Amp	<ul style="list-style-type: none"> <li>• One-Chip System Solution Replaces 5 Analog Switches, a 2-to-4 Decoder and a Buffer Amplifier</li> <li>• Lower Price than Maxim's MAX454 Mux/Amp, yet has Five Channels vs Maxim's Four</li> <li>• High Output Current of 30 mA Max is ideal for Video Line Driver Applications</li> <li>• 25MHz Unity Gain Bandwidth</li> </ul>	<ul style="list-style-type: none"> <li>• Security Monitor Switching</li> <li>• TV/CATV Audio/Video Switch</li> <li>• Video Multiplex Switch (Video Teleconferencing Systems)</li> <li>• 75 Ohm Video Amp/Line Driver</li> <li>• Video Signal - Level Control</li> <li>• Video Signal Adder/Fader</li> </ul>
HA-2444 - Video Op Amp	<ul style="list-style-type: none"> <li>• 45MHz Unity Gain Bandwidth</li> <li>• Differential Phase/Gain of 0.03°/0.03%</li> <li>• 60 dB Crosstalk Rejection</li> <li>• 60ns Channel Selection</li> </ul>	<ul style="list-style-type: none"> <li>• Broadcast Video</li> <li>• Medical Imaging Displays</li> <li>• RGB Imaging</li> <li>• Frame Grabbers</li> </ul>
HA-2556 - Four Quadrant Voltage Output Analog Multiplier	<ul style="list-style-type: none"> <li>• 350V/us High Speed Voltage Output</li> <li>• 1.5% Low Multiplication Error</li> <li>• 5uA Input Bias Currents</li> <li>• -60dB Y Input Feedthrough</li> <li>• 30MHz Wide X and Y Channel Bandwidth</li> <li>• 0.10dB Gain Tolerance to 10MHz</li> </ul>	<ul style="list-style-type: none"> <li>• Military Avionics</li> <li>• Missile Guidance Systems</li> <li>• Medical Imaging Displays</li> <li>• Video Mixers</li> <li>• Sonar AGC Processors</li> <li>• Radar Signal Conditioning</li> <li>• Voltage Controlled Amplifier</li> <li>• Vector Generator</li> </ul>
HA-2557 - Four Quadrant Current Output Analog Multiplier	<ul style="list-style-type: none"> <li>• 1.5% Low Multiplication Error</li> <li>• 5uA Input Bias Currents</li> <li>• -60dB Y Input Feedthrough @ 5MHz</li> <li>• 100MHz Wide X and Y Channel Bandwidth</li> </ul>	<ul style="list-style-type: none"> <li>• Military Avionics</li> <li>• Missile Guidance Systems</li> <li>• Video Mixers</li> <li>• Sonar AGC Processors</li> <li>• Radar Signal Conditioning</li> <li>• Voltage Controlled Amplifier</li> <li>• Vector Generator</li> </ul>
HA-2839 *HA-2840 - Op Amp	<ul style="list-style-type: none"> <li>• Very High Slew Rate Wideband Op Amp</li> <li>• 600 MHz Gain Bandwidth Product, 625 V/μs Slew Rate</li> <li>• 10 MHz Full Power Bandwidth</li> <li>• Differential Phase/Gain of 0.03°/0.03%</li> <li>• Low Supply Current (13 mA max.), Low Offset Voltage (0.6 mV)</li> <li>• Pin Compatible with Existing HA-2539/40</li> <li>• Lower Cost-Improved Versions of the AD840 and EL2039/40</li> <li>• Harris is Only Supplier Offering SOIC Option (2840)</li> </ul>	<ul style="list-style-type: none"> <li>• Medical Diagnostic Equipment</li> <li>• RF Processors and Amplifiers</li> <li>• High Speed Data Acq., Comm. Systems</li> <li>• Industrial/Medical Imaging</li> <li>• Radar/Sonar, Guidance Systems</li> <li>• Instrumentation, Test Equipment</li> <li>• Pulse Amplifiers, RF Oscillators</li> </ul>
*HA-2841 - Op Amp	<ul style="list-style-type: none"> <li>• Unity Gain Stable Wideband Video Op Amp</li> <li>• 54 MHz Unity Gain Bandwidth</li> <li>• 240 V/μs Slew Rate, Fast Rise Time of 3 ns</li> <li>• Differential Phase/Gain of 0.03°/0.03%</li> <li>• Low Supply Current of 11 mA max.</li> <li>• Pin Compatible with Existing HA-2541</li> <li>• Lower Cost, Improved Version of the AD841 and EL2041</li> </ul>	<ul style="list-style-type: none"> <li>• Broadcast Video Sync Separators, Video Routers and Switchers, Video/Cable Drivers</li> <li>• RF Processors and Amplifiers</li> <li>• High Speed Data Acq., Comm. Systems</li> <li>• High Frequency Signal Conditioning</li> <li>• Industrial/Medical Imaging</li> <li>• Radar/Sonar, Guidance Systems</li> <li>• Instrumentation</li> <li>• Pulse Amplifiers</li> </ul>
*HA-2842 - Op Amp	<ul style="list-style-type: none"> <li>• Wideband High Output Current Video Op Amp</li> <li>• 80 MHz Gain Bandwidth Product</li> <li>• 375 V/μs Slew Rate, 100 mA Output Current</li> <li>• Differential Phase/Gain of 0.03°/0.03%</li> <li>• Fast Rise Time of 3 ns</li> <li>• Low Supply Current of 15 mA max.</li> <li>• Pin Compatible with Existing HA-2542</li> <li>• Lower Cost, Improved Version of the AD842</li> </ul>	<ul style="list-style-type: none"> <li>• Broadcast Video - Sync Separators, Video Routers and Switchers, Video/Cable Drivers</li> <li>• RF Processors and Amplifiers</li> <li>• High Speed Data Acquisition Communication Systems</li> <li>• High Frequency Signal Conditioning</li> <li>• Industrial/Medical Imaging</li> <li>• Radar/Sonar, Guidance Systems</li> <li>• Instrumentation</li> <li>• Pulse Amplifiers</li> </ul>

# New Product Information

Harris Part Number	Product Features & Benefits	Target Market/Applications
<b>Analog Signal Processing Cont'd.</b>		
<p><b>*HA-2850</b> - Op Amp</p>	<ul style="list-style-type: none"> <li>• High Speed Low Power Op Amp</li> <li>• 470 MHz Gain Bandwidth Product, 340 V/<math>\mu</math>s Slew Rate</li> <li>• 5.4 MHz Full Power Bandwidth</li> <li>• Differential Phase/Gain of 0.03°/0.03%</li> <li>• Low Supply Current of 8 mA max., Low Offset Voltage of 0.6 mV</li> <li>• Pin Compatible with Existing HA-2540/2840</li> <li>• Lower Cost, Lower Power Version of the AD840 and EL2040</li> <li>• Harris is only Supplier Offering SOIC</li> </ul>	<ul style="list-style-type: none"> <li>• Medical Diagnostic Equipment</li> <li>• RF Processors and Amplifiers</li> <li>• High Speed Data Acquisition, Communication Systems</li> <li>• Industrial/Medical Imaging</li> <li>• Radar/Sonar, Guidance Systems</li> <li>• Instrumentation, Test Equipment</li> <li>• Pulse Amplifiers, RF Oscillators</li> </ul>
<p><b>HA-5020</b> - Amplifier, Current Feedback</p>	<ul style="list-style-type: none"> <li>• 100 MHz Unity Gain Bandwidth Current Feedback Amplifier</li> <li>• Differential Gain/Phase of 0.02%/0.03°, Gain Flatness of 0.1 dB</li> <li>• 31.5 mA Output Current, 800 V/<math>\mu</math>s Slew Rate</li> <li>• Provides a Disable Pin to Allow for Multi-Channel Designs. Eliminates the Need for a Multiplexer and Lowers Power Consumption</li> <li>• Low Input Voltage Noise of 4.5 nV/ <math>\sqrt</math>Hz - Important for Medical Imaging Applications</li> <li>• Wide Supply Voltage Range - <math>\pm</math> 5V to <math>\pm</math> 15V</li> <li>• Low Supply Current - 10 mA max.</li> <li>• Lower Cost, Improved Version of the EL2020 (Pin Compatible)</li> </ul>	<ul style="list-style-type: none"> <li>• Broadcast Video - Video Keyers, Sync Separators, Video Mixers, Video Routers/Switchers, and Special Effects</li> <li>• Video/Cable Drivers</li> <li>• Industrial/Medical Imaging</li> <li>• RGB Imaging - Frame Grabbers and Multi-Media</li> <li>• Radar and Guidance Systems</li> <li>• Heads-Up Displays</li> <li>• High Speed Communication and Data Acquisition Systems</li> </ul>
<p><b>HFA-0003/L</b> - Ultra High Speed Precision Comparator</p>	<ul style="list-style-type: none"> <li>• User Programmable Hysteresis (HFA-0003L)</li> <li>• 2.0 ns Prop. Delay (HFA-0003)</li> <li>• 2.1 ns Prop. Delay, 900 ps min. Pulse Width (HFA-0003L)</li> <li>• 270 MHz Tracking Bandwidth</li> <li>• 1mV Offset Voltage, 4<math>\mu</math>V/°C Drift, 5<math>\mu</math>A Bias Current</li> <li>• 70 dB Large Signal Voltage Gain</li> <li>• 30 mA Output Current (min.)</li> <li>• HFA-0003L is a Pin Compatible Improved Version of the AD96685, MAX9685, and SP9685</li> <li>• HFA-0003 is a Pin Compatible Improved Version of the MAX9690 and SP9680</li> </ul>	<ul style="list-style-type: none"> <li>• Automated Test Equipment</li> <li>• Communications Systems</li> <li>• High Speed Data Acquisition Systems</li> <li>• Fiber Optic Receivers</li> <li>• High Speed Instrumentation</li> <li>• Guidance Systems</li> <li>• Peak/Signal Detectors</li> <li>• Line Receivers</li> <li>• Trigger Circuits</li> <li>• Limiters</li> </ul>
<p><b>HFA1100/20/30</b> - Ultra High Speed Current Feedback</p>	<ul style="list-style-type: none"> <li>• Harris' Proprietary Complementary Bipolar UHF Process</li> <li>• Full Characterization of RF Parameters</li> <li>• 850MHz -3dB Bandwidth</li> <li>• 2500V/<math>\mu</math>s Very Fast Slew Rate</li> <li>• 11ns Fast Settling Time (0.1%)</li> <li>• 60mA High Output Current</li> <li>• User Programmable Output Voltage Clamp (HFA1130)</li> <li>• &lt;1ns Overload Recovery (HFA1130)</li> </ul>	<ul style="list-style-type: none"> <li>• Video Switching and Routing</li> <li>• Pulse and Video Amplifiers</li> <li>• Wideband Amplifiers</li> <li>• RF/IF Signal Processing</li> <li>• Flash A/D Driver</li> <li>• Medical Imaging Systems</li> </ul>
<p><b>HFA1110</b> - Ultra High Speed Closed Loop Buffer Amplifier</p>	<ul style="list-style-type: none"> <li>• Harris' Proprietary Complementary Bipolar UHF Process</li> <li>• 700Mhz Wide -3dB Bandwidth</li> <li>• 2500V/<math>\mu</math>s Very Fast Slew Rate</li> <li>• 7ns Fast Settling Time (0.2%)</li> <li>• 60mA High Output Current</li> <li>• 0.99V/V Excellent Gain Accuracy</li> <li>• User Programmable for Closed-Loop Gains of +1, -1 or +2 without use of External Resistors</li> </ul>	<ul style="list-style-type: none"> <li>• Video Switching and Routing</li> <li>• RF/IF Processors</li> <li>• Driving Flash A/D Converters</li> <li>• High-Speed Communications</li> <li>• Impedance Transformation</li> <li>• Line Driving</li> <li>• Radar Systems</li> </ul>
<p><b>HFA5250</b> - Ultra High Speed Monolithic Pin Driver</p>	<ul style="list-style-type: none"> <li>• Harris' Proprietary Complementary Bipolar UHF Process</li> <li>• Provides Variable Amplitude Digital Pulses</li> <li>• +7V to -2V Wide Output Range</li> <li>• 350MHz High Digital Data Rate</li> <li>• 2V/ns Very Fast Slew Rate</li> <li>• Precise 50 ohm Output Impedance</li> </ul>	<ul style="list-style-type: none"> <li>• IC Tester Pin Electronics</li> <li>• Pattern Generators</li> <li>• Pulse Generators</li> <li>• Emulators/Development Systems</li> <li>• Built-In Test Equipment (BITE)</li> </ul>

# New Product Information

Harris Part Number	Product Features & Benefits	Target Market/Applications
<b>Intelligent Power</b>		
<b>HIP2500</b> - Intelligent Power Half-Bridge 500 VDC Driver	<ul style="list-style-type: none"> <li>Optimized to Drive MOS Gated Power Devices in Half-Bridge Topologies</li> <li>500 Volt Maximum Rating, HVIC Process</li> <li>Ability to Interface and Drive N-Channel Power Devices</li> <li>Floating Bootstrap Power Supply for Upper Rail Drive</li> <li>100kHz Operation</li> <li>Peak Drive up to 2.0 Amps</li> </ul>	<ul style="list-style-type: none"> <li>High Frequency Switch-Mode Power Supply</li> <li>Induction Heating and Welding</li> <li>Switch Mode Amplifiers</li> <li>AC and DC Motor Drives</li> <li>Electronic Lamp Ballasts</li> <li>Battery Chargers</li> <li>UPS Inverters</li> </ul>
<b>ICL7644, ICL7645, ICL7646, ICL7647</b> - Step-up Converter, Low Voltage	<ul style="list-style-type: none"> <li>Low Start-Up Voltage 0.9V (typ)</li> <li>Shut Down Feature 5uA (Quiescent)</li> <li>Low Battery Indication</li> <li>Standby Current 80uA (typ)</li> <li>Variety of Parts Meet Designers Needs</li> </ul>	<ul style="list-style-type: none"> <li>Battery Powered Applications</li> <li>Single Cell Instruments</li> <li>Solar Powered Devices</li> <li>Radio Controlled Receivers</li> <li>Portable Instruments</li> <li>4-20 mA Loop Powered Devices</li> <li>Battery Back-Up</li> </ul>
<b>SP720</b> - Overvoltage Protection Array	<ul style="list-style-type: none"> <li>An Array of SCR/Diode Bipolar Structures for ESD and Over Voltage Protection</li> <li>2 Protection SCR Devices per Input</li> <li>An Array of 14 Diode Pairs</li> <li>1A Current Capability</li> <li>Low "On" Resistance</li> <li>+5V to +30V Supply Range</li> <li>Designed to Provide Over Voltage Protection</li> <li>Fast Switching-6ns Risetime</li> </ul>	<ul style="list-style-type: none"> <li>Microprocessor/Logic Input Protection</li> <li>Data Bus Protection</li> <li>Analog Device Input Protection</li> <li>Voltage Clamp</li> </ul>
<b>HRP2540</b>	<ul style="list-style-type: none"> <li>High Forward Current, High Reverse Energy Controlled Avalanche Power Rectifier</li> <li>Low Forward Voltage Drop (1.1V Max. at 100A)</li> <li>Controlled Maximum Avalanche Voltage (40V Max. at 40A)</li> </ul>	<ul style="list-style-type: none"> <li>Alternator Rectification</li> <li>Accessory Load Dump Protector</li> <li>High Current Forward Voltage Clamp</li> </ul>
<b>Data Conversion</b>		
<b>HI-5700</b> 8 Bit, 20MSPS - Flash A/D Converter	<ul style="list-style-type: none"> <li>For High Speed Converter Applications Where Wide Bandwidth and Low Power are Essential                             <ul style="list-style-type: none"> <li>50 Nanosecond Conversion</li> <li>18 MHz Full Power Input Bandwidth</li> <li>Single +5V Supply Voltage</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Video Digitizing</li> <li>Radar Systems</li> <li>Medical Imaging</li> <li>High Speed Data Acquisition</li> </ul>
<b>HI-5701</b> 6 Bit, 30MSPS - Flash A/D Converter	<ul style="list-style-type: none"> <li>For High Speed Converter Applications Where Wide Bandwidth, Low Noise and Low Power are Essential</li> <li>30 MSPS with No Missing Codes Over Temp.</li> <li>20 MHz Input Bandwidth</li> <li>0.5 LSB Linearity Max at 20 MSPS</li> <li>Single +5V Supply Voltage</li> <li>0-5V Input Range Rail to Rail</li> </ul>	<ul style="list-style-type: none"> <li>Imaging Controllers, Video Digitizing</li> <li>Radar Systems</li> <li>Communications Systems</li> <li>Frame Grabbers</li> <li>Hand Scanners, FAX</li> <li>High Speed Data Acquisition Systems</li> </ul>
<b>HI5812</b> - 12 Bit Sampling A/D with Track & Hold	<ul style="list-style-type: none"> <li>20µsec Conversion</li> <li>50KSPS Throughput</li> <li>Single +5V Supply</li> <li>25mW Max. Power Dissipation</li> <li>Lowest Cost 12 Bit with Track &amp; Hold</li> </ul>	<ul style="list-style-type: none"> <li>Remote Low Power Data Acquisition</li> <li>Digital Audio</li> <li>DSP Modems</li> </ul>
<b>HI-7153</b> - 10 Bit Sampling A/D Converter with 8 Channel MUX and Track & Hold Amplifier	<ul style="list-style-type: none"> <li>Reduced External Components (and Cost) Through On-Chip Integration including:                             <ul style="list-style-type: none"> <li>8 Channel CMOS Multiplexer</li> <li>Track and Hold Amplifier</li> <li>Buffers For Signal and Reference Inputs</li> </ul> </li> <li>5 Microsecond A/D Conversion</li> <li>Digitizes Inputs to 80KHz, 200,000 Times a Second</li> </ul>	<ul style="list-style-type: none"> <li>Industrial Process Control                             <ul style="list-style-type: none"> <li>Measure: Temperature, Pressure, Flow, Vibration, Sonic, etc.</li> </ul> </li> <li>Instrumentation                             <ul style="list-style-type: none"> <li>Automatic Test Equipment</li> <li>System Monitors/Analyzers</li> </ul> </li> <li>µp Controlled Data Acquisition Systems</li> </ul>

# New Product Information

Harris Part Number	Product Features & Benefits	Target Market/Applications
<b>Data Conversion Cont'd.</b>		
<b>HI-7159A</b> - 5 1/2 Digit $\mu$ P Compatible A/D Converter	<ul style="list-style-type: none"> <li>• New Product for the High Precision A/D Market                             <ul style="list-style-type: none"> <li>- Resolve Input Changes as Small as 1 Part in 200,000</li> <li>- Designed for Single Input of Multiplexed Systems</li> </ul> </li> <li>• Easy Microprocessor Interface                             <ul style="list-style-type: none"> <li>- Parallel and Serial Interface Modes</li> <li>- Four Common Baud Rates</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Industrial Process Control, Weighing Systems, Process Control and Monitoring, Part/Item Counting</li> <li>• Precision Instrumentation Scientific Measurement and Monitors, Laboratory Instruments</li> </ul>
<b>Digital Signal Processing</b>		
<b>HSP43168</b> - Dual FIR Filter	<ul style="list-style-type: none"> <li>• Two Independent 8-Tap FIR Filters Configurable as a Single 16-Tap FIR</li> <li>• 33MHz, 45MHz Versions</li> <li>• On-Board Storage For 32 Programmable Coefficient Sets</li> <li>• Up to: 256 FIR Taps, 16 x 16 2-D Kernels, or 10 x 20 Bit Data and Coefficients</li> <li>• 10 Bit Data &amp; Coefficients</li> <li>• Programmable Decimation to 16</li> <li>• 85-Pin PGA, 84-Pin PLCC Packages</li> </ul>	<ul style="list-style-type: none"> <li>• Quadrature Filtering</li> <li>• Correlation</li> <li>• Image Processing</li> <li>• Complex Filtering</li> <li>• Polyphase Filtering</li> <li>• Adaptive Filtering</li> </ul>
<b>HSP43220</b> - Decimating Digital Filter	<ul style="list-style-type: none"> <li>• Chosen "Best of 90" by Electronic Design Magazine</li> <li>• World's Most Accurate Digital Filter</li> <li>• Provides Decimation to 16,384</li> <li>• Equivalent to 512,000 Taps</li> </ul>	<ul style="list-style-type: none"> <li>• Communication - Digital Receivers, Channelized Receivers, Satellite Ground Stations, Sample Rate Conversion</li> <li>• Instrumentation - Spectrum Analyzers, Digital Oscilloscopes, Simulators, High Speed Dig. Test</li> </ul>
<b>HSP45102</b> - 12-Bit Numerically Controlled Oscillator	<ul style="list-style-type: none"> <li>• 32-Bit Frequency Control</li> <li>• 12-Bit Sine Output</li> <li>• 33MHz, 40MHz Versions</li> <li>• Binary FSK Modulation</li> <li>• Quadrature Phase Modulation</li> <li>• Serial Frequency Load</li> </ul>	<ul style="list-style-type: none"> <li>• Direct Digital Synthesis</li> <li>• Modulation-QPSK and FSK Modem</li> </ul>
<b>HSP45106</b> - Numerically Controlled Oscillator	<ul style="list-style-type: none"> <li>• 16 Bit NCO</li> <li>• High Precision 0.01 Hz Tuning, 90 Decibels Dynamic Range</li> <li>• Parallel or Serial Outputs</li> <li>• Standard Microprocessor Interface</li> <li>• Fast Frequency Switching</li> </ul>	Communications/Instrumentations <ul style="list-style-type: none"> <li>• Digital Radio</li> <li>• Frequency Hop Radio</li> <li>• Modem</li> <li>• Modulation</li> <li>• Direct Digital Synthesis</li> </ul>
<b>HSP45116</b> - NCOM	<ul style="list-style-type: none"> <li>• Chosen "Best of 90" by Electronic Design Magazine</li> <li>• Performs Most Popular Modulation Techniques such as AM, FM, FSK, and PSK</li> <li>• Performs Complex Down Conversion</li> </ul>	<ul style="list-style-type: none"> <li>• AM Transmitters</li> <li>• QAM Modem (Modulator Side)</li> <li>• Digital Receivers</li> </ul>
<b>HSP45240</b> - Address Sequencer	<ul style="list-style-type: none"> <li>• Configurable as one 24-Bit or two 12-Bit Sequencer(s)</li> <li>• 24 x 24 Bit Crosspoint Switch Allows Addressing Used in FFT's, 1D and 2D Filtering, and Matrix Math Ops</li> <li>• Device has a Microprocessor Interface, Ability to Vary the Start Address, Block Size, Number of Address Blocks Selected, Step Size Within a Block, and Step Size Between Address Blocks</li> <li>• The Sequencer Can Generate Addresses at Rates Faster Than is Currently Possible with Digital Signal Processors (i.e. Texas Instruments' TMS320)</li> </ul>	<ul style="list-style-type: none"> <li>• Data Acquisition/ID</li> <li>• Machine Vision Part Sorting</li> <li>• Optical Recognition</li> <li>• Special Effects Video</li> <li>• High End Modems</li> <li>• Telemetry and Guidance</li> <li>• Medical Imaging</li> <li>• Test and Measurement</li> </ul>
<b>HSP45256</b> - Binary Correlator	<ul style="list-style-type: none"> <li>• Correlates 8-Bit Input Data with an 8-Bit Reference Input</li> <li>• Reconfigurable 256 Stage Binary Correlator</li> <li>• 1-Bit Reference x 1, 2, 4, or 8-Bit Data</li> <li>• 25.6, 33MHz Versions</li> <li>• Configurable for 1-D and 2-D Operation</li> <li>• Programmable Output Delay</li> <li>• 85-Pin PGA, 84-Pin PLCC</li> </ul>	<ul style="list-style-type: none"> <li>• Radar/Sonar</li> <li>• Spread Spectrum Communications</li> <li>• Pattern/Character Recognition</li> <li>• Error Correction Coding</li> </ul>

# New Product Information

Harris Part Number	Product Features & Benefits	Target Market/Applications
<b>Digital Signal Processing Cont'd.</b>		
HSP48410 - Histogrammer/ Accumulating Buffer	<ul style="list-style-type: none"> <li>• 1024 x 24 Bit Delay Memory</li> <li>• 10 Bit Pixel Data</li> <li>• 4Kx4K Frame Sizes</li> <li>• Asynchronous Flash Clear Pin</li> <li>• Generates and Stores Cumulative Distribution Function</li> <li>• Available in 84 Pin PGA and PLCC Packages</li> <li>• DC to 40MHz Clock Rate</li> </ul>	<ul style="list-style-type: none"> <li>• Histogramming Equalization</li> <li>• Image and Signal Analysis</li> <li>• Image Enhancement</li> <li>• RGB Video Delay Line</li> </ul>
HSP48901 - 3 x 3 Image Filter	<ul style="list-style-type: none"> <li>• Two On-Chip Coefficient Storage Banks</li> <li>• Monolithic solution for 3X3 Kernels</li> <li>• Can Be configured as a 9-Tap Fir Filter</li> </ul>	<ul style="list-style-type: none"> <li>• Robotics - Video Filters</li> <li>• Medical - Vision Systems</li> <li>• Video - Medical Imaging and Machine Vision</li> </ul>
HSP48908 - 2D Convolver	<ul style="list-style-type: none"> <li>• On-Chip Row Buffers Eliminate Need For External Memory</li> <li>• On-Chip ALU for Image Preprocessing</li> <li>• Two Chip Coefficient Storage Banks</li> <li>• Cascadable for Larger Kernels without Additional Logic</li> </ul>	<ul style="list-style-type: none"> <li>• Medical Imaging - Ultrasound, Image Enhancement</li> <li>• Robotics - Machine Vision</li> <li>• Video - Video Filters, Special Effects Video, Broadcast Video, Accelerator Boards</li> <li>• Military - Target Acquisition, Surveillance Systems</li> <li>• Industrial - Automatic Inspection, Template Matching, Feature Extraction</li> </ul>
HSP9501JC - Programmable Data Buffer	<ul style="list-style-type: none"> <li>• Monolithic Row Buffer</li> <li>• Convenient to Use</li> <li>• Programmable Length</li> <li>• Recirculate Mode</li> </ul>	<ul style="list-style-type: none"> <li>• Image Processing</li> <li>• Video Processing</li> </ul>
<b>Rad Hard</b>		
HS-26C31RH - Radiation Hardened CMOS Quad Differential Line Driver	<ul style="list-style-type: none"> <li>• EIA RS-422 Compatible Outputs</li> <li>• Digital Data Transmission Over Balanced Lines</li> <li>• Meets the Requirements of EIA Standard RS-422</li> <li>• Radiation Hardened CMOS</li> <li>• TTL/CMOS Compatible Inputs</li> <li>• High Impedance Outputs when Disabled or Powered Down</li> <li>• 2.75mW Standby (Max) Low Power Dissipation</li> </ul>	<ul style="list-style-type: none"> <li>• Radiation Environments</li> </ul>
HS-26C32RH - Radiation Hardened CMOS Quad Differential Line Receiver	<ul style="list-style-type: none"> <li>• EIA RS-422 Compatible Inputs</li> <li>• Digital Data Transmission Over Balanced Lines</li> <li>• Meets the Requirements of EIA Standard RS-422</li> <li>• Radiation Hardened CMOS</li> <li>• CMOS/TTL Compatible Outputs</li> <li>• High Impedance Inputs when VDD=OV</li> <li>• 110mW Standby (Max) Low Power Dissipation</li> </ul>	<ul style="list-style-type: none"> <li>• Radiation Environments</li> </ul>
HS-65647RH - Radiation Hardened 8K x 8 SOS CMOS Static RAM	<ul style="list-style-type: none"> <li>• 1.2 Micron Radiation Hardened SOS CMOS</li> <li>• Latch-Up Free</li> <li>• 10mA (Max) Low Standby Supply Current</li> <li>• 100mA (2MHz) Low Operating Supply Current</li> <li>• 50ns (Max) 35ns (Typ) Fast Access Time</li> </ul>	<ul style="list-style-type: none"> <li>• Radiation Environments</li> </ul>
<b>Rectifiers</b>		
RUR15XXX RURD15XXX RURDG15XXX, RUR30XXX, RURD30XXX, RURDG30XXX, RURU50XX, RURG50XX, RURU80XX - Rectifiers	<ul style="list-style-type: none"> <li>• Low Cost Packaging</li> <li>• New Single Leaded Packaging</li> <li>• High Current</li> <li>• High Voltage</li> <li>• Ultra Fast Reverse Recovery</li> <li>• Soft Recovery</li> </ul>	<ul style="list-style-type: none"> <li>• Flywheel/Clamping Diodes</li> <li>• Switch Mode Power Supplies</li> <li>• Power Switching Applications</li> </ul>
<b>Transient Protection</b>		
VX.5MLA1206A23 VXXMLA1206A23 VXXMLA1210A23 - Multi-Layer Varistors	<ul style="list-style-type: none"> <li>• Space and Size Reduction</li> <li>• Ease of Assembly</li> <li>• Designed for Protection</li> <li>• Peak Current Capability</li> <li>• Designed for Reliability</li> <li>• Designed for High Stress Environment</li> </ul>	<ul style="list-style-type: none"> <li>• Computer Transient Protection</li> <li>• Automotive Transient Protection</li> <li>• 5V Logic Over Voltage Protection</li> <li>• Telecom Over Voltage Protection</li> <li>• Power Supplies Voltage Protection</li> <li>• Microprocessor Systems Transient Protection</li> </ul>

## 2 - Analog

2A • Amplifiers

2B • Intelligent Power/Power Processing

2C • Special Analog Circuits



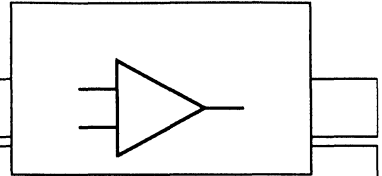
## 2 - Analog

2A • Amplifiers

2B • Intelligent Power/Power Processing

2C • Special Analog Circuits

# Amplifiers



## Feature Products

### Wide Bandwidth Op Amps

- Gain Bandwidth Product (typical) up to 1000 MHz,
- 3dB Bandwidths to 870 MHz

### High Slew Rate Op Amps

- Op Amps with slew rate up to 2500V/ $\mu$ s ( $V_{CC} = \pm 5V$ )
- Op Amps with slew rate up to 600 V/ $\mu$ s ( $V_{CC} = \pm 15V$ )

### Precision Op Amps

- Offset voltage starting as low as 0.005 millivolts
- Offset & bias current starting as low as 0.005 nano amps and 0.01 nano amps respectively

### Low Power Op Amps

- Supply current as low as 17 micro amps
- Operation voltage starting as low as 2.0V

### Single Supply Op Amps

- Low power
- Rail-to-rail output drive

### Low Bias Current Op Amps

- Bias current starting at 1 pico amp

### High Voltage Op Amps

- Supply range  $\pm 10V$  to  $\pm 40$  volts
- Output voltage range  $\pm 35$  volts

### General Purpose Op Amps

- Low Cost, good performance

### Current Feedback Amplifiers

- Better accuracy and lower distortion than span loop buffers
- Bandwidth and rise time are nearly independent of closed loop gains
- Significant improvement in speed power product vs Op amps

### Multi-Channel Addressable Amplifiers

- 2 digital control lines; select 1 of 4 amplifiers to be on at a time
- Applications include: Signal Selection/ Multiplex and Variable Gain Stages

### Current Buffer/Driver Amplifiers

- Key features: High slew rate of 2500V/ $\mu$ s, -3dB Bandwidths to 700 MHz
- High output current up to 200 mA
- Wide supply range  $\pm 5V$  to  $\pm 16V$

### Differential Amplifiers

- Balanced differential amplifier configuration with controlled constant current source
- RF, IF and video frequency capability

2A

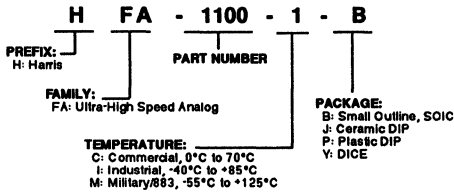
Amplifiers

# Amplifiers

## Ordering Information

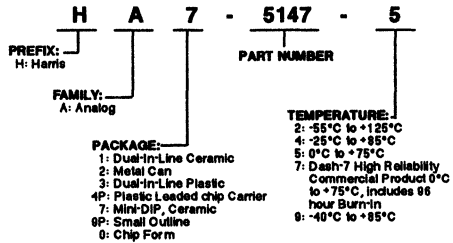
### HFA

#### HARRIS PRODUCT CODE EXAMPLE



### HA

#### HARRIS PRODUCT CODE EXAMPLE



The products are available fully screened to MIL-Std-883C. Contact a Harris Sales Office for a copy of the /883 data sheet.

### CA

#### Linear (CA Series)

Linear ICs are available in a wide variety of package designs. These packages are identified by suffix letters indicated in the chart below. When ordering Linear devices, it is important that the appropriate suffix letter be affixed to the type number as indicated on the price schedule.

PACKAGE	CA SERIES
Dual-In-Line Ceramic	D
Dual-In-Line Plastic	E
Frit-Seal Dual-In-Line Ceramic	F
Quad-In-Line Plastic	O
Dual-In-Line Formed Lead TO 5	S
TO-5 Style Package	T
Small Outline (SO) Plastic	M

#### Extra Value Screening

Linear product with extra value screening as an X added to the standard type number in the price list, and is also branded as such. A white dot will indicate location of Pin 1.

Example:  
 A CA3080E with Extra Value screening is designated CA3080EX in the price list. It is branded CA3080EX plus a white dot at pin number 1.

#### Tape & Reel For Small-Outline Packages

With the introduction of small-outline packages, Harris now offers its customers the convenient tape and reel style packaging. Small-outline devices, which can be tape and reeled, are denoted with the suffix "M98" or "AM98" in the linear and high speed logic product lines. Devices must be ordered in multiples of quantities listed below. Any returns must be full and unopened reels.

LEAD COUNT	TAPE WIDTH IN mm	REEL SIZE INCHES	DEVICES PER REEL
8	12	13	2500
14	16	13	2500
16	16	13	2500
20	24	13	1000
24	24	13	1000

### ICL/ICM

#### Device Family Prefixes

PREFIX	DEVICE FAMILY
ICL	Linear IC
ICM	Microperipheral IC
LM	National Semiconductor Alternate Source

#### Temperature Range Designators

SUFFIX	TEMPERATURE RANGE
C	Commercial: 0°C to +70°C
I	Industrial: Either -25°C to +85°C or -40°C to +85°C (Specified on Datasheet)
M	Military: -55°C to +125°C

#### Package Type Designators

SUFFIX	PACKAGE
B	Small Outline IC (SOIC)
J	Ceramic Dual-In-Line
P	Plastic Dual-In-Line
T	TO-98, TO-100

#### Pin Count Designator

SUFFIX	PIN COUNT	DIAMETER
A	8	
B	10	
C	12	
D	14	
E	16	
V	8	(0.200" pin circle, isolated case)
W	10	(0.230" pin circle, isolated case)
X	10	(0.230" pin circle, case to pin 5)
Y	8	(0.200" pin circle, case to pin 4)
Z	8	(0.230" pin circle, case to pin 5)

1, 2 OR 3 DIGIT  
PREFIX  
**XXX**

3, 4 OR 5 DIGIT UNIQUE  
DEVICE NUMBER  
**XXX X**

3 OR 4 DIGIT  
OPTION SUFFIX  
**X X X X**

HIGH RELIABILITY  
DESIGNATOR  
**/XXXX**

Pin Count Designator  
 Package type Designator  
 Temperature Range Designator  
 Electrical Option Designator Only. Used if more than one electrical option is available.  
 Variation of basic device type designator. Only used if more than one basic device is available.  
 3 or 4 digit basic device type part number  
 Device family prefix

# Feature Products

## HFA1100/1120/1130 - World's Fastest Amplifiers

These amplifiers are the fastest available. The HFA-1130 offers a user-defined output clamping level making it ideal for high speed video (HDTV) and imaging applications.

### Features:

- Unity Gain Bandwidth 850 MHz
- High Slew Rate 2500 V/us
- Gain Flatness to 100 MHz - 0.1 dB
- Fast Settling Time 11 ns .1%

## HFA0001 - Wideband Voltage Feedback

Bipolar op amps combining high speed with fast setting.

### Features:

- High Slew Rate 2500V/ $\mu$ s
- High Output Current 60 mA

## HFA0002 - Low Noise Wideband

Enhanced pin compatible version of the OPA621 at a lower cost.

### Features:

- Input Voltage Noise 2.7nV/ $\sqrt$ Hz
- Gain Bandwidth Product 1 GHz

## HA-5020 - 100 MHz Current Feedback Video

Enhanced pin compatible version of the EL2020 at a lower cost. Replaces the EL2030 in most applications.

### Features:

- Unity Gain Bandwidth 100 MHz
- Differential Gain <0.02%
- Differential Phase <0.03 deg.
- Slew Rate 800 V/us
- Gain Flatness 0.1 dB

# Feature Products

## HA2839/40 - Very High Slew Rate Wideband

Low power version of the HA-2539/40. Enhanced replacement for the AD840 at a lower cost. Available in CDIP, PDIP, and SOIC packages.

### Features:

- High Slew Rate 625 V/us
- Wide Gain Bandwidth 600 MHz
- Differential Gain/Phase 0.03%/0.03 deg.
- Low Offset Voltage 0.6mV

## HA-2850 - Low Power High Slew Rate Wideband

Low power enhanced replacement for AD840 and EL2040. Available in CDIP, PDIP, and SOIC packages.

### Features:

- Low Supply Current 7.5 mA
- High Slew Rate 340 V/us
- Wide Gain Bandwidth 470 MHz
- Differential Gain/Phase 0.04%/0.04 deg.
- Low Offset Voltage 0.6 mV

## HA-2842 - Wideband High Output Current Video

Low power version of the HA-2542 and an enhanced replacement for the AD842 at a lower cost. Available in PDIP and SOIC packages.

### Features:

- High Slew Rate 375 V/us
- Gain Bandwidth Product 80 MHz
- High Output Current +/-100 mA
- Differential Gain/Phase 0.02%/0.03 deg.
- Low Offset Voltage 1 mV

## HA-2841 - Unity Gain Stable Wideband Video

Low power version of the HA-2541. Enhanced replacement for the AD841 at a lower cost. Available in PDIP and SOIC packages.

### Features:

- High Slew Rate 240 V/us
- Unity Gain Bandwidth 54 MHz
- Low Offset Voltage xx mV
- Differential Phase/Gain 0.03%/0.03 deg.
- Low Distortion >83 dB

# Feature Products

## CA3256 - Video Multiplexer and Amplifier

The CA3256 has five channels of CMOS multiplex switching for general purpose video-signal control.

### Features:

- 5 Multiplex Video Channels
- 1 Independent Channel
- 4 Channels with Enable
- 4 LED Channel Indicator Outputs
- Unity Gain Bandwidth 25 MHz
- Programmable Video Amplifier Gain
- High Signal Drive Capability

## HA-2444 - Selectable 4 Channel Video Op Amp

Replaces a quad video op amp and a four channel wideband multiplexer. Digital channel selection includes a high Z output state for additional multiplexing.

### Features:

- Unity Gain Bandwidth 45 MHz
- Differential Gain 0.03 dB
- Differential Phase 0.03 deg.
- Gain Flatness to 10 MHz - 0.1 dB
- Low Crosstalk Rejection >60 dB
- Fast Channel Selection 60 ns

# Wideband Operational Amplifiers

Min/Max Limits @ +25°C, Unless Otherwise Specified

DEVICE	GBWP (typ) (MHz)	FPBW (MHz)	SLEW RATE (typ) (V/ $\mu$ s)	AVOL (dB) AZOL (V/mA)*	MINIMUM STABLE GAIN	OFFSET VOLTAGE (mV)	BIAS CURRENT (nA)	CMRR (dB)	PSRR (dB)	SUPPLY CURRENT (mA)
<b>SINGLE</b>										
HFA-0002	1000	4.50	250	98	10	0.7	700	105	90	15.0
HFA-1100/20/30	850	200.0	2500		1	2.0	12000	46	50	21.0
HA-2539	600	8.70	600	80	10	10.0	20000	60	60	25.0
HA-2839	500	10.0	625	86	10	2.0	14500	75	75	15
HA-2840	500	10.0	625	86	10	2.0	14500	75	75	15
HA-2850	400	5.4	340	86	10	2.0	14500	75	75	7.5
HA-2540	400	5.50	400	80	10	10.0	20000	60	60	25.0
HFA-0001	350	53.00	1000	43	1	15.0	50000	45	35	75.0
HFA-0005	300	22.00	420	43	1	15.0	50000	45	40	40.0
CA3450	170	6.56	330	60	1	15.0	350	50	60	35.0
HA-2548	150	1.91	120	114	5	0.9	50	80	86	18.0
HA-5190/5	150	5.00	200	83	5	5.0	15000	74	70	28.0
HA-5147	140	0.45	35	117	10	0.1	80	100	96	3.5
HA-5147A	120	0.45	35	120	10	0.03	40	114	100	3.5
HA-5004	100	100	1200	100	1	5.0	5000	58	50	16
HA-5020	100	9.6	800	3500	1	8.0	8000	60	65	10
HA-2620	100	0.40	35	100	5	4.0	15	80	80	3.7
HA-2622/5	100	0.32	35	98	5	5.0	25	74	74	4.0
HA-5101	100	0.10	10	120	1	3.0	200	80	80	6.0
HA-5160	100	1.60	120	97	10	3.0	0.05	74	74	8.0
HA-5162	100	1.10	70	90	10	15.0	0.065	70	70	8.0
HA-5221	100	0.24	25	106	1	0.75	80	86	86	8.0
HA-2842	80	6.0	375	94	2	3.0	10000	85	70	14
HA-2841	50	4.0	250	90	1	3.0	10000	80	70	11
<b>DUAL</b>										
HA-5222	100.0	0.24	25	106	1	0.8	80.0	86	86	8.0
HA-5102	60.0	0.02	3	100	1	2.0	200.0	86	86	5.0
HA-5112	60.0	0.19	20	100	10	2.0	200.0	86	86	5.0
CA3280	9.0	1.99	125	94	1	3.0	5000.0	80	86	4.8
CA3280A	9.0	1.99	125	94	1	0.5	5000.0	94	94	4.8
CA3240	4.5	0.14	9	86	1	15.0	0.05	70	76	12.0
CA3240A	4.5	0.14	9	86	1	5.0	0.04	70	76	12.0
CA3260	4.0	0.16	10	94	1	15.0	0.05	70	70	15.5
CA3260A	4.0	0.16	10	94	1	5.0	0.03	80	76	15.5
CA5260	3.0	0.10	5	80	1	15.0	0.02	70	70	2.0
CA5260A	3.0	0.10	5	83	1	4.0	0.02	80	75	2.0
<b>QUAD</b>										
HA-5104	60.0	0.02	3.0	100	1	2.5	200.0	86	86	6.5
HA-5114	60.0	0.19	20.0	100	10	2.5	200.0	86	86	6.5
HA-2444	45.0	5.1	160	71	1	7.0	15000	70	65	25
HA-2400/4	40.0	0.20	30.0	94	1	9.0	200.0	80	74	6.0
HA-2405	40.0	0.20	30.0	94	1	9.0	250.0	74	74	6.0
HA-2406	30.0	0.24	20.0	92	1	10.0	250.0	74	74	7.0
CA5470	14.0	0.01	5.0	80	1	22.0	0.01	55	60	10.0
HA-5134A	4.0	0.02	0.8	123	1	0.1	25.0	115	110	8.0

\*AZOL applies to current feedback amplifiers only (HA-5004, HA-5020)

NOTE: Bold type designates a new product from Harris.

# High Slew Rate Operational Amplifiers

Min/Max Limits @ +25°C, Unless Otherwise Specified

DEVICE	SLEW RATE (typ) (V/ $\mu$ s)	GBWP (typ) (MHz)	FPBW (MHz)	A <sub>VOL</sub> (dB)/ A <sub>ZOL</sub> (V/mA)*	MINIMUM STABLE GAIN	OFFSET VOLTAGE (mV)	BIAS CURRENT (nA)	CMRR (dB)	PSRR (dB)	SUPPLY CURRENT (mA)
<b>SINGLE</b>										
HFA-1100/20/30	2500	850	200		1	2.0	12000	46	50	21
HA-5004	1200	100	100	100	1	5.0	5000	58	50	16
HFA-0001	1000	350	4.5	43	1	15.0	50000	45	35	75.0
HA-5020	800	100	9.6	3500	1	8.0	8000	60	64	10
HA-2839	625	500	10.0	86	10	2.0	14500	75	75	15
HA-2840	625	500	10.0	86	10	2.0	14500	75	75	15
HA-2539	600	600	8.7	80	10	10.0	20000	60	60	25.0
HFA-0005	420	300	22.0	43	1	15.0	50000	45	40	40.0
HA-2540	400	400	5.5	80	10	10.0	20000	60	60	25.0
HA-2842	375	80	6.0	94	2	3.0	10000	85	70	14
HA-2542	350	70	4.7	80	2	10.0	35000	70	70	35.0
HA-2850	340	400	5.4	86	10	2.0	14500	75	75	7.5
CA3450	330	170	6.6	60	1	15.0	350	50	60	35.0
HA-2841	250	50	4.0	90	1	3.0	10000	80	70	11
HA-2541	250	40	3.0	80	1	2.0	25000	70	70	40.0
HFA-0002	250	1000	4.5	98	10	0.7	700	105	90	15.0
HA-5190	200	150	5.0	83	5	5.0	15000	74	70	28.0
HA-5195	200	150	5.0	83	5	5.0	15000	74	70	28.0
HA-2529	150	20	2.1	80	3	5.0	200	80	80	6.0
HA-2544	150	50	3.2	71	1	15.0	15000	75	70	12.0
HA-2520	120	20	1.5	80	3	8.0	200	80	80	6.0
HA-2522/5	120	20	1.2	78	3	10.0	250	74	74	6.0
HA-2548	120	150	1.91	114	5	0.9	50	80	86	18.0
HA-5160	120	100	1.600	97	10	3	0.05	74	74	8
HA-5221	25	100	0.24	106	1	0.75	80	86	86	4
<b>DUAL</b>										
CA3280	125	9.0	1.99	94	1	3.0	5000	80	86	4.8
CA3280A	125	9.0	1.99	94	1	0.5	5000	94	94	4.8
HA-5222	25	100	0.24	106	1	0.75	80	86	86	8.0
HA-5112	20	60	0.19	100	10	2.0	200	86	86	5.0
CA3260	10	4.0	0.16	94	1	15.0	0.05	70	70	15.5
CA3260A	10	4.0	0.16	94	1	5.0	0.03	80	76	15.5
CA3240	9.0	4.5	0.14	86	1	15.0	0.05	70	76	12.0
CA3240A	9.0	4.5	0.14	86	1	5.0	0.04	70	76	12.0
CA5260A	5.0	3.0	0.10	83	1	4.0	0.015	80	75	2.0
<b>QUAD</b>										
HA-2444	160	45	5.1	71	1	7.0	15000	70	65	25
HA-2400	30	40	0.20	94	1	9.0	200	80	74	6
HA-2404	30	40	0.20	94	1	9.0	200	80	74	6
HA-2405	30	40	0.20	94	1	9.0	250	74	74	6
HA-2406	20	30	0.24	92	1	10.0	250	74	74	7
HA-5114	20	60	0.191	100	10	2.5	200	86	86	6.5
CA5470	5.0	14	0.01	80	1	22.0	0.01	55	60	10

\* A<sub>ZOL</sub> applies to current feedback amplifiers only (HA-5004, HA-5020)

2A

Amplifiers



# Precision Operational Amplifiers

Min/Max Limits @ +25°C, Unless Otherwise Specified

DEVICE	OFFSET VOLTAGE (mV)	V <sub>IO</sub> DRIFT (typ) ( $\mu\text{V}/^\circ\text{C}$ )	BIAS CURRENT (nA)	OFFSET CURRENT (nA)	CMRR (dB)	PSRR (dB)	GBWP (MHz)	SLEW RATE (V/ $\mu\text{s}$ )	A <sub>VOL</sub> (dB)	SUPPLY CURRENT (mA)
<b>SINGLE</b>										
ICL7650S	0.005	0.02	0.01	0.005	120	120	2.0	2.5	135	3.0
HA-5127A	0.025	0.20	40.0	35.0	114	86	8.5	10.0	120	3.5
HA-5130	0.025	0.40	2.0	2.0	110	100	2.5	0.8	120	1.3
HA-5137A	0.025	0.20	40.0	35.0	114	100	63.0	20.0	120	3.5
HA-5147A	0.025	0.20	40.0	35.0	114	100	120.0	35.0	120	3.5
HA-5177A	0.025	0.10	2.0	2.0	120	110	2.0	0.8	134	1.7
HA-5177	0.060	0.20	6.0	6.0	10	110	1.4	0.8	126	1.7
HA-5135	0.075	0.40	4.0	4.0	106	94	2.5	0.8	120	1.7
HA-5137	0.100	0.40	80.0	75.0	100	96	63.0	20.0	117	3.5
HA-5147	0.100	0.40	80.0	75.0	100	96	140.0	35.0	117	3.5
CA3193A	0.200	1.00	20.0	5.0	110	100	1.2	0.25	110	3.5
HA-5221	0.30	0.5	80	15	95	100	100	25	128	8
HA-2548	0.30	4.0	5	5	90	95	150	120	130	12
HA-5170	0.300	2.0	0.01	0.03	85	85	8.0	8.0	109	2.5
<b>DUAL</b>										
HA-5232	0.500	5.0	10	10	100	100	0.5	0.15	108	1.45
HA-5222	0.75	0.5	80	50	86	86	100.0	25.0	108	8.00
CA158A	2.0	7.0	50	10	70	65	1.0	0.5	94	1.20
HA-5102	2.0	3.0	200	75	86	86	60.0	3.0	100	5.00
HA-5112	2.0	3.0	200	75	86	86	60.0	20.0	100	5.00
ICL7621	2.0	10.0	0.05	0.03	76	80	1.4	1.6	80	2.50
CA3280	3.0	5.0	5000	700	80	86	9.0	125.0	94	4.80
CA258A	3.0	7.0	80	15	70	65	1.0	0.5	94	1.20
CA358A	3.0	7.0	100	30	65	65	1.0	0.5	88	1.20
<b>QUAD</b>										
HA-5134A	0.1	0.3	25.0	25.0	115	110	4.0	0.75	123	8.00
HA-5234A	0.2	5.0	10	10	100	100	0.5	0.15	120	2.9
HA-5234	0.750	5.0	10	10	100	100	0.5	0.15	108	2.9
HA-5114	2.5	3.0	200.0	75.0	86	86	60.0	20.0	100	6.50
HA-5104	2.5	3.0	200.0	75.0	86	86	60.0	3.0	100	6.50
HA-5144	6.0	3.0	100.0	10.0	77	77	0.4	0.8	86	0.15
CA224	7.0	7.0	250.0	50.0	65	65	1.0	0.5	88	2.00
CA324	7.0	7.0	250.0	50.0	65	65	1.0	0.5	86	2.00

# Low Power Operational Amplifiers

Min/Max Limits @ +25°C, Unless Otherwise Specified

DEVICE	SUPPLY CURRENT (mA)	MAX V+, V- (±V)	SLEW RATE (typ) (V/μs)	GBWP (typ) (MHz)	CM RANGE (±V)	OFFSET VOLTAGE SWING (mV)	OUTPUT CURRENT (mA)	OFFSET VOLTAGE (mV)	BIAS CURRENT (nA)	PSRR (dB)
<b>SINGLE</b>										
CA3440	0.017	12.5	0.03	0.063	3.5	3.0	15.0	10.0	0.050	70
CA3440A	0.017	12.5	0.03	0.063	3.5	3.0	15.0	5.0	0.040	70
CA3078A	0.02	18.0	1.5	0.002	5.5	5.1	12.0	3.5	12.0	70
ICL7611A	0.02	9.0	0.02	0.044	4.4	4.9	8.0	2.0	0.05	80
ICL7612A	0.02	9.0	0.02	0.044	5.3	4.9	8.0	2.0	0.05	80
CA5130	0.10	8.0	10.0	4.0	2.5	2.5	4.0	10.0	0.015	55
CA5130A	0.10	8.0	10.0	4.0	2.5	2.5	4.0	4.0	0.010	60
CA5160	0.10	8.0	10.0	4.0	2.5	2.5	4.0	10.0	0.015	55
CA5160A	0.10	8.0	10.0	4.0	2.5	2.5	4.0	4.0	0.010	60
CA3078	0.13	7.0	1.5	0.002	5.5	5.1	12.0	4.5	170.0	70
CA3094	0.40	12.0	50.0	30.0	12.0	14.9	100.0	5.0	5000.0	70
CA3094A	0.40	18.0	50.0	30.0	12.0	14.9	100.0	5.0	5000.0	70
CA3094B	0.40	22.0	50.0	30.0	12.0	14.9	100.0	5.0	5000.0	70
<b>DUAL</b>										
ICL7621A	0.25	9.0	0.2	0.5	4.2	4.9	8.0	2.0	0.05	80
CA158A	1.2	13.0	0.5	1.0	13.0	13.0	20.0	2.0	50.0	65
CA258A	1.2	6.5	0.5	1.0	13.0	13.0	20.0	3.0	80.0	65
CA2904	1.2	6.5	0.5	1.0	13.0	13.0	20.0	7.0	250.0	50
CA258	1.2	6.5	0.5	1.0	13.0	13.0	20.0	5.0	150.0	65
CA358	1.2	13.0	0.5	1.0	13.0	13.0	20.0	7.0	250.0	65
CA158	1.2	16.0	0.5	1.0	13.0	13.0	20.0	5.0	150.0	65
CA358A	1.2	13.0	0.5	1.0	13.0	13.0	20.0	3.0	100.0	65
HA-5232	1.45	18	0.15	0.5	12	12	20	0.500	10	100
CA124	2.0	16.0	0.5	1.0	13.0	26.0	10.0	5.0	150.0	65
CA5260	2.0	8.0	5.0	3.0	2.5	3.0	1.75	15.0	0.015	70
<b>QUAD</b>										
ICL7642	0.02	9.0	0.02	0.04	4.2	4.5	8.0	10.0	0.05	80
HA-5144	0.15	17.5	0.8	0.4	10.0	10.0	4.5	6.0	100.0	77
CA224	2.00	16.0	0.5	1.0	13.0	13.0	10.0	7.0	250.0	65
CA324	2.00	16.0	0.5	1.0	13.0	13.0	10.0	7.0	250.0	65
ICL7641	2.50	9.0	1.6	1.4	4.2	4.5	8.0	10.0	0.05	80
HA-5234	2.90	18	0.15	0.5	12	12	20	0.750	10	100

# Single-Supply Operational Amplifiers

Min/Max Limits @ +25°C, Unless Otherwise Specified

DEVICE	SUPPLY CURRENT mA (MAX)	INPUT OFFSET VOLTAGE mV (MAX)	DOES INPUT INCLUDE GROUND?	RAIL-TO RAIL OUTPUT	INPUT BIAS CURRENT nA (MAX)	GAIN BANDWIDTH PRODUCT MHz (TYP)	SLEW RATE (V/ $\mu$ s) (TYP)	LARGE SIGNAL VOLTAGE GAIN dB (MIN)	OUTPUT CURRENT mA (MIN)
<b>SINGLE</b>									
CA3440A	0.017	5	YES	NO	0.04	0.063	0.03	80	15
CA3440	0.017	10	YES	NO	0.05	0.063	0.03	80	15
ICL7612A	0.02	2	YES	YES	0.05	0.04	0.016	86	8
ICL7611A	0.02	2	NO	YES	0.05	0.04	0.016	86	8
ICL7612D	0.02	15	YES	YES	0.05	0.04	0.016	80	8
ICL7611D	0.02	15	NO	YES	0.05	0.04	0.016	80	8
CA5160A	0.1	4	YES	YES	0.01	4	10	90	4
CA5130A	0.1	4	YES	YES	0.01	4	10	90	4
CA5160	0.1	10	YES	YES	0.015	4	10	85	4
CA5130	0.1	10	YES	YES	0.015	4	10	85	4
CA3130A	0.3	5	YES	YES	0.03	15	10	100	12
CA3130	0.3	15	YES	YES	0.05	15	10	100	12
CA5420A	0.5	5	YES	YES	0.001	0.5	0.5	85	1.2
CA5420	0.5	10	YES	YES	0.002	0.5	0.5	85	1.2
CA3420A	0.65	5	YES	YES	0.005	0.5	0.5	86	2.6
CA3420	0.65	10	YES	YES	0.005	0.5	0.5	80	2.6
CA3140A	2.5	5	YES	NO	0.04	3.7	9	86	12
CA3140	2.5	15	YES	NO	0.05	3.7	9	86	12
CA3160A	15	5	YES	YES	0.03	4	10	94	12
CA3160	15	15	YES	YES	0.05	4	10	94	12
<b>DUAL</b>									
HA-5142	0.16	6	YES	NO	100	0.4	1.5	86	4.5
ICL7621A	0.25	2	NO	YES	0.05	0.5	0.16	86	8
ICL7621D	0.25	15	NO	YES	0.05	0.5	0.16	80	8
CA158A	1.2	3	YES	NO	100	1	0.5	88	20
CA358	1.2	7	YES	NO	250	1	0.5	88	20
CA5260A	2	4	YES	YES	0.015	3	5	83	1.75
CA3260A	2	5	YES	YES	0.03	4	10	94	12
CA5260	2	15	YES	YES	0.015	3	5	80	1.75
CA3260	2	15	YES	YES	0.05	4	10	94	12
CA3240A	2.5	5	YES	NO	0.04	3.7	9	86	12
CA3240	2.5	15	YES	NO	0.05	3.7	9	86	12
<b>QUAD</b>									
ICL7642C	0.022	10	NO	YES	0.05	0.044	0.016	80	8
ICL7642E	0.022	20	NO	YES	0.05	0.044	0.016	80	8
HA-5144	0.32	6	YES	NO	100	0.4	1.5	86	4.5
CA324	2	7	YES	NO	250	1	0.5	86	10
CA124	2	5	YES	NO	150	1	0.5	94	10
ICL7641C	2.5	10	NO	YES	0.05	1.4	1.6	80	8
ICL7641E	2.5	20	NO	YES	0.05	1.4	1.6	80	8
CA5470	10	22	YES	NO	0.01	14	5	80	4

# Low Bias Current Operational Amplifiers

Min/Max Limits @ +25°C, Unless Otherwise Specified

DEVICE	BIAS CURRENT (nA)	OFFSET CURRENT (nA)	OFFSET VOLTAGE (mV)	CM RANGE (dB)	AVOL (dB)	GBWP (typ) (MHz)	SLEW RATE (typ) (V/μs)	CMRR (dB)	PSRR (dB)	CURRENT SUPPLY (mA)
<b>SINGLE</b>										
CA5420A	0.001	0.0005	5.0	3.7	85	0.5	0.5	75	75	0.50
CA5420	0.002	0.0010	10.0	3.7	85	0.5	0.5	70	70	0.50
CA3420	0.005	0.004	10.0	1.0	80	0.5	0.5	55	60	0.65
CA3420A	0.005	0.004	5.0	1.0	86	0.5	0.5	60	70	0.65
CA5130A	0.010	0.005	4.0	2.5	90	4.0	10.0	75	60	0.10
CA5160A	0.010	0.005	4.0	2.5	90	4.0	10.0	75	60	0.10
ICL7650S	0.010	0.005	0.005	3.5	135	2.0	2.5	120	120	3.00
CA5130	0.015	0.010	10.0	2.5	85	4.0	10.0	70	55	0.10
CA5160	0.015	0.010	10.0	2.5	85	4.0	10.0	70	55	0.10
CA3130A	0.030	0.020	5.0	10.0	94	15.0	9.0	80	80	15.00
<b>DUAL</b>										
CA5260	0.015	0.01	15.0	11.0	80	3.0	5.0	70	70	2.0
CA5260A	0.015	0.01	4.0	2.5	83	3.0	5.0	80	75	2.0
CA3260A	0.03	0.02	5.0	13.0	94	4.0	10.0	80	76	15.5
CA3240A	0.04	0.02	5.0	13.0	86	4.5	9.0	70	76	12.0
CA3240	0.05	0.03	15.0	12.0	86	4.5	9.0	70	76	12.0
CA3260	0.05	0.03	15.0	10.0	94	4.0	10.0	70	70	15.5
ICL7621	0.05	0.03	2.0	12.0	80	1.4	1.6	76	80	2.5
HA-5232	10.0	10	0.50	12.0	108	0.5	0.15	100	100	1.45
CA158A	50.0	10.0	2.0	13.0	94	1.0	0.5	70	65	1.2
<b>QUAD</b>										
CA5470	0.01	0.005	22.0	3.5	80	14.0	5.0	55	60	10.0
ICL7641	0.05	0.03	10.0	4.2	80	1.4	1.60	70	80	2.5
ICL7642	0.05	0.03	10.0	4.2	80	1.4	1.60	70	80	2.5
HA-5234	10.0	10	0.750	12	108	0.5	0.15	100	100	2.90
HA-5134A	25.0	25.0	0.1	10.0	123	4.0	0.75	115	110	8.0

2A  
Amplifiers

## High Voltage

PART NUMBER	FEATURES	APPLICATIONS
HA-2640/5	<ul style="list-style-type: none"> <li>Slew Rate ..... 1 V/ms</li> <li>Bandwidth ..... 4MHz</li> <li>Input Offset Voltage ..... 4mV</li> <li>Offset Current ..... 5nA</li> <li>Output Voltage Swing ..... ±35V</li> <li>Input Voltage Range ..... ±35V</li> <li>Supply Range ..... ±10V to ±40V</li> <li>Output Overload Protection</li> </ul>	<ul style="list-style-type: none"> <li>Industrial Control Systems</li> <li>Power Supplies</li> <li>High Voltage Regulations</li> <li>Resolver Excitation</li> <li>Signal Conditioning</li> </ul>
HC2000H	<ul style="list-style-type: none"> <li>7 Ampere Max. Output</li> <li>30Khz at 60W</li> <li>±32 Volt Output Swing</li> <li>Built-in Load Line Limiting Circuit</li> <li>Reactive Load Fault Protection</li> <li>±37.5 Volt Supply Range</li> <li>Hybrid Construction, 10 Terminal 1.31" x 2.33" Package</li> </ul>	<ul style="list-style-type: none"> <li>Servo Amplifiers (AC, DC, PWM)</li> <li>Deflection Amplifiers</li> <li>Power Operational Amplifiers</li> <li>Voltage Regulators</li> <li>Driven Inverters</li> </ul>

# General Purpose Op Amps

Sorted by Gain Bandwidth

DEVICE	GBWP (MHz)	SLEW RATE	VIO (mV)	lib (na)	CMRR (db)	STABLE GAIN	AVOL DB	Vout SWING	Ips (ma)	Vcc max
<b>SINGLE</b>										
CA3078	0.002	1.5	4.5	170	80	1	88	5.1	0.13	7
CA3440A	0.063	0.03	5	0.04	70	1	80	3	0.017	12.5
CA3440	0.063	0.03	10	0.05	70	1	80	3	0.017	12.5
CA5420	0.5	0.5	10	0.002	70	1	85	3.5	0.5	11
CA3420	0.5	0.5	10	0.005	55	1	80	0.9	0.65	11
CA741	1	0.5	6	500	70	1	86	12	2.8	18
CA3193	1.2	0.25	0.5	40	100	1	100	13	3.5	18
ICL7611B	1.4	1.6	5	0.05	76	1	80	4.5	0.02	9
ICL7612D	1.4	1.6	15	0.05	76	1	80	4.5	0.02	9
ICL7611D	1.4	1.6	15	0.05	76	1	80	4.5	0.02	9
ICL7650S	2	2.5	0.005	0.01	120	1	135	4.7	3	9
CA5160A	4	10	4	0.01	75	1	90	2.5	0.1	8
CA5130A	4	10	4	0.01	75	1	90	2.5	0.1	8
CA3160A	4	10	5	0.03	80	1	94	12	15	8
CA5160	4	10	10	0.015	70	1	85	2.5	0.1	8
CA5130	4	10	10	0.015	70	1	85	2.5	0.1	8
CA3160	4	10	15	0.05	70	1	94	12	15	8
CA3140A	4.5	9	5	0.04	70	1	86	12	6	18
CA3140	4.5	9	15	0.05	70	1	86	12	6	18
CA3130A	15	9	5	0.03	80	1	94	12	15	8
CA3130	15	9	15	0.05	70	1	94	12	15	8
<b>DUAL</b>										
CA158A	1	0.5	2	50	70	1	94	13	1.2	13
CA258A	1	0.5	3	80	70	1	94	13	1.2	6.5
CA358A	1	0.5	3	100	65	1	88	13	1.2	13
CA1558	1	0.5	5	150	70	1	94	13	1.2	6.5
CA158	1	0.5	5	150	70	1	94	13	1.2	16
CA2904	1	0.5	5	500	70	1	94	12	2.8	22
CA358	1	0.5	6	500	70	1	86	12	2.8	18
CA1458	1	0.5	7	250	50	1	100	13	1.2	6.5
CA258	1	0.5	7	250	65	1	88	13	1.2	13
CA5260	3	5	15	0.015	70	1	80	3	2	8
CA3260A	4	10	5	0.03	80	1	94	12	15.5	8
CA3260	4	10	15	0.05	70	1	94	12	15.5	8
CA3240A	4.5	9	5	0.04	70	1	86	12	12	18
CA3240	4.5	9	15	0.05	70	1	86	12	12	18
<b>QUAD</b>										
CA124	1	0.5	5	150	70	1	94	26	2	16
CA324	1	0.5	7	250	65	1	86	13	2	16
CA224	1	0.5	7	250	65	1	88	13	2	16
ICL7642E	1.4	1.6	20	0.05	70	1	80	4.5	0.09	9
ICL7641E	1.4	1.6	20	0.05	70	1	80	4.5	10	9
HA4741	3.5	1.6	3	200	80	1	94	12	5	20
CA5470	14	5	22	0.01	55	1	80	4	10	8

# Current Feedback Amplifiers

## Current Feedback Amplifiers

DEVICE	UNITY GAIN BANDWIDTH (MHz)	SLEW RATE (V/μs)	OUTPUT CURRENT (mA)	DRIVES	SUPPLY RANGE (V)
HFA1100/20/30	850	2500	± 60		± 5V
HA-5004	100	800	± 100	± 9V into 100W	± 5V to ± 18
HA-5020	100	1200	± 30	3.5V into 75W	± 5V to ± 15

### Applications

- Unity Gain Video/Wideband Buffer
- Video Gain Block
- High Speed Peak Detector
- Fiber Optic Transmitter
- Zero Insertion Loss Transmission Line Drivers
- Current to Voltage Converter: D/A Output Buffer
- Radar Systems
- Imaging Systems
- Video Distribution Amp/Coax Cable Driver
- Flash A/D Driver
- Waveform generator Output Driver

### Description

Devices such as the HFA1100/20/30, HA-5004 and HA-5020 avoid the "gain-bandwidth" trade off necessary with conventional operational amplifiers. These current feedback amplifiers deliver nearly equal bandwidth over a wide range of gains.

# Multi-Channel Addressable Amplifiers

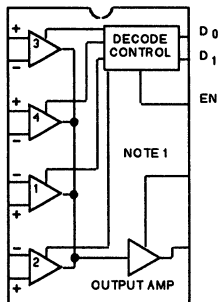
## HA-24XX Selectable Four Channel Amplifiers

### Features:

- 4 Differential Inputs, Single Ended Output
- 2 Digital Inputs to Activate 1 of 4 Differential Inputs

DEVICE	SLEW RATE (V/μs TYP)	WIDE GAIN BANDWIDTH (MHz)	AVOL MIN (dB)	CROSSTALK (dB TYP)	OFFSET CURRENT	OFFSET VOLTAGE
HA-2400/04	30	40	94	110	5nA	4mV
HA-2405	30	40	94	110	5nA	4mV
HA-2406	20	30	92	110	5nA	7mV
HA-2444	120	50	71	60	2μA	4mV

### Functional Diagram



D1	D0	EN	SELECTED CHANNEL
L	L	H	1
L	H	H	2
H	L	H	3
H	H	H	4
X	X	L	NONE

### NOTE:

1. HA-2444 no external compensation needed, HA-2400/04/06, gains <10 need external compensation.

NOTE: Bold type designates a new product from Harris.

# Multi-Channel Addressable Amplifiers

## CA3256

CMOS/BICMOS Analog Video 4 Channel Switch and Amplifier

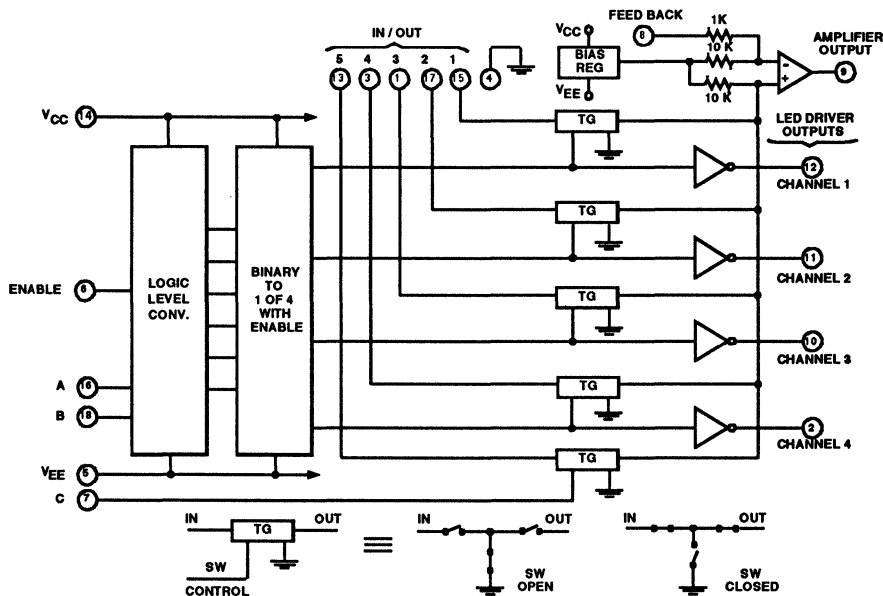
### Features

- 5 Multiplex Video Channels
  - 1 Independent Channel
  - 4 Channels with Enable
- 4 led Channel Indicator Outputs
- Wideband Video Amplifier
  - 26MHz Unity Gain
- Programmable video Amplifier Gain
- High Signal-Drive Capability

### Applications

- Video Multiplex Switch
- 75Ω Video Amplifier/Line Driver
- Video Signal-Level Control
- Monitor Switching Control
- TV/CATV Audio/Video Switch
- Video Signal Adder/Fader Control

### CA3256 Block Diagram



### Switch Control Logic

CHANNEL NO.	C	A	B	ENABLE
1	O	O	O	I
2	O	O	I	I
3	O	I	O	I
4	O	I	I	I
5 + (1-4)*	I	Channel 1-4		I
5	I	Channel 5 Only		O
None	O	X	X	O

\*For maximum video bandwidth, use single channel selections.

# Current Buffers/Drivers

PART NUMBER	FEATURES	APPLICATIONS
HA-5033	<ul style="list-style-type: none"> <li>Differential Phase Error ..... 0.1°</li> <li>Differential Gain Error ..... 0.1%</li> <li>High Slew Rate ..... 1300V/μs</li> <li>Wide Power Bandwidth ..... 80MHz</li> <li>Fast Rise Time ..... 3ns</li> <li>Wide Power Supply Range ..... ± 5V/± 16V</li> </ul>	<ul style="list-style-type: none"> <li>Video Buffers</li> <li>HF Buffers</li> <li>Op Amp Isolation Buffers</li> <li>High Speed Line Drivers</li> <li>Impedance matching</li> </ul>
HA-5002	<ul style="list-style-type: none"> <li>High Slew Rate ..... 1300V/μs</li> <li>High Output Current ..... 200mA</li> <li>Low Quiescent Current ..... 9mA</li> </ul>	<ul style="list-style-type: none"> <li>Precision Buffers</li> <li>Op Amp Isolation Buffers</li> <li>High Speed Line Drivers</li> </ul>
HA-2542	<ul style="list-style-type: none"> <li>A<sub>v</sub> &gt; -1, +2 Stable with No Compensation</li> <li>High Output Current ..... 100mA</li> <li>Wide Power Bandwidth ..... 5.5MHz</li> <li>High Slew Rate ..... 350V/μs</li> </ul>	<ul style="list-style-type: none"> <li>Video Cable Drivers</li> <li>Pulse Amplifiers</li> <li>Wideband Signal Conditioners</li> </ul>

2A

Amplifiers

# Differential Amplifiers

TYPE	DESCRIPTION	FEATURES	FREQ. RANGE DC TO MHz	A (TYP) dB	BW (3dB) POINT (TYP) kHz	I/F, NF (TYP) dB	AGC RANGE (TYP) dB	PKG NO. OF PINS
CA30263	Dual Independent	<ul style="list-style-type: none"> <li>Balanced Differential-Amplifier Configuration with Controlled Constant-Current Source</li> <li>RF, IF and Video Frequency Capability</li> <li>Balanced AGC Capability</li> <li>Operation from DC to 500MHz</li> <li>CA3028B is Controlled for Input Offset Voltage, Current and Input Bias Current and is Intended for "Balance" Requirements</li> <li>Push-Pull Inputs and Outputs</li> <li>CA3055 and CA3006 are Identical Except for Input Offset Voltage</li> <li>CA3028 and CA3052 are Identical Except for 100MHz Noise Specification</li> <li>CA3051 and CA3050 are Identical Except for Package</li> <li>CA3054 and CA3026 are Identical Except for Package and Substrate Connection</li> <li>CA30263 - Mil Std 883 Rev C Non-Compliant Version Only</li> </ul>	120	32□	550Δ	3.26	75	12T
CA3028A	Differential/Cascade Amplifiers		120	40□	-	7.2#	62	8C,S,T
CA3028B			120	40	8	7.2#	62	
CA3049	Dual High Frequency		500	22	1.35■	53	75	12T
CA3053	Differential/Cascade Amplifier		120	40	Recommended for IF Amplifier Applications			8E,S,T
CA3054	Dual Independent		120	32	550Δ	3.25	75	14E
CA3102	Dual High-Frequency		500	22	1.35■	1.5	7.5	14E

# Noise Figure Δ f<sub>T</sub> (MHz) ■ GHz □ Gp Min. at 100MHz Cascade, 16db. Differential Amplifier 14dB  
 V<sub>OUT</sub>(p-pV): CA3028B, 11.5; TA Range: -55°C to +125°C Except for CA3054 -40°C to +85°C



# Operational Amplifiers Glossary

**AVERAGE INPUT OFFSET CURRENT DRIFT** - The average change in offset current between room (+25°C) and high temperature (+125°C, +85°C or +75°C) or between room temperature and low temperature (0°C, -25°C or -55°C) divided by the temperature difference.

**AVERAGE OFFSET VOLTAGE DRIFT** - The average change in offset voltage between room (+25°C) and high temperature (+125°C, +85°C or +75°C) or between room temperature and low temperature (0°C, -25°C or -55°C) divided by the temperature difference.

**CHANNEL SEPARATION** - The ratio of the output of a driven amplifier to the output (referred to input) of an adjacent undriven amplifier.

**COMMON MODE INPUT VOLTAGE ( $V_{IC}$ )** - The average of the voltages present at the differential input terminals.

**COMMON MODE INPUT VOLTAGE RANGE ( $V_{ICR}$ )** - The range of voltage that if exceeded at either input terminal will cause the amplifier to cease operating properly.

**COMMON MODE REJECTION RATIO (CMRR)** - The ratio of change in input offset voltage to change in input common-mode voltage, expressed in dB.

$$CMRR = 20 \times \log_{10} \left( \frac{V_{IO}}{V_{CM}} \right)$$

**COMMON MODE RESISTANCE ( $r_{IC}$ )** - The ratio of change in input common-mode voltage to the resulting change in input current.

**DIFFERENTIAL INPUT RESISTANCE ( $r_{IC}$ )** - The ratio of change in input differential voltage (small-signal, assumes amplifier operating linearly) to the resulting change in differential input current.

**FULL POWER BANDWIDTH (FPBW)** - The maximum frequency at which a full scale undistorted (THD < 1%) sine wave can be obtained at the output of the amplifier.

**GAIN BANDWIDTH (GBW)** - The open-loop gain of an op amp (in V/V) at a mid-band, linear-region frequency (usually between 1KHz and 10KHz) times that frequency (in Hz).  $GBW = [AVOL] \cdot f$

**INPUT BIAS CURRENT ( $I_{BIAS}$ )** - The average of the currents flowing into or out of the input terminals when the output is at zero volts.

**INPUT NOISE CURRENT ( $I_n$ )** - The input noise current that would reproduce the noise seen at the output if all amplifier noise sources were set to zero and the source impedances were large compared to the optimum source impedance.

**INPUT OFFSET CURRENT ( $I_{OS}$ )** - The difference in the currents flowing into the two input terminals when the output is at zero volts.

**INPUT OFFSET VOLTAGE ( $V_{OS}$ )** - The differential D.C. voltage required to zero the output voltage with no input signal or load. Input offset voltage may also be defined for the case where two equal resistances are inserted in series with the input leads.

**INPUT OFFSET VOLTAGE ( $V_{OS}$ )** - The differential D.C. voltage required to zero the output voltage with no input signal or load. Input offset voltage may also be defined for the case where two equal resistances are inserted in series with the input leads.

**INPUT NOISE VOLTAGE ( $e_n$ )** - The input noise voltage that would reproduce the noise seen at the output if all the amplifier noise sources and source resistances were set to zero.

**LARGE SIGNAL VOLTAGE GAIN ( $A_V$ )** - The ratio of the peak to peak output voltage swing (over a specified range) to the change in input voltage required to drive the output.

**OUTPUT CURRENT ( $I_{OUT}$ )** - The ratio of the change in output voltage to the change in output current.

**OUTPUT RESISTANCE ( $R_O$ )** - The ratio of the change in output voltage to the change in output current.

**OUTPUT SHORT CIRCUIT CURRENT ( $I_{SC}$ )** - The output current available from the amplifier with the output shorted to ground (or other specified potential).

**OUTPUT VOLTAGE SWING ( $V_{OUT}$ )** - The maximum output voltage swing, referred to ground, that can be obtained under specified loading conditions.

**OVERSHOOT** - Peak excursion above final value of an output step response.

**POWER SUPPLY REJECTION RATIO (PSRR)** - The ratio of the change in input offset voltage to the change in power supply voltage producing it.

**RISE TIME ( $t_r$ )** - The time required for an output voltage step to change from 10% to 90% of its final value, when the input is subjected to a small-signal voltage pulse.

**SETTLING TIME ( $t_{set.}$ )** - The time required, after application of a step input signal, for the output voltage to settle and remain within a specified error band around the final value.

**SLEW RATE (SR)** - The rate of change of the output under large-signal conditions. Slew rate may be specified separately for both positive and negative going changes.

**SUPPLY CURRENT ( $I_S$ )** - The current required from the power supply to operate the amplifier with no load and the output at zero volts.

**SUPPLY VOLTAGE RANGE** - The range of power supply voltage over which the amplifier may be safely operated.

**UNITY GAIN BANDWIDTH** - The frequency range from D.C. to that frequency where the amplifiers open loop gain is unity.

# Intelligent Power

## Feature Products

### Power Converters

#### AC to DC

- Converts an AC input into a regulated DC output
- Wide input frequency range (48 Hz - 440Hz)
- Line and load regulation (5%)

#### DC to DC

- Converts a DC input voltage to a higher, lower, or sign changed output voltage
- 98% typical power efficiency
- Easy to use (only 2 passive external components)

### Drivers

#### Half Bridge

- Provides flexible control and management of power MOSFETs or IGBTs in a half bridge format
- 500 Volt maximum rating
- Peak drive to ZA
- Switching speeds to 100KHz

#### Power MOSFET

- Provides interface circuitry between digital control circuitry and power MOSFETs
- High Peak output current (2A)
- Fast switching times (200nS)

#### High Side Switches

- Provides supervisory functions and control between loads and supply voltages
- Overvoltage shutdown
- Load currents up to 1.2 amps

#### Low Side Switches

- Provides supervisory functions and control between loads and ground
- Over current and over temperature limiting
- Load currents to 700mA

#### Zero Voltage Switch/Driver for Triacs

- Generates output pulses when an AC input voltage crosses through zero volts.
- 24V, 120V, 208/230V 50/60 or 400Hz operation.

### Electronic Protection Array

- Provides ESD & overvoltage protection
- 1A current capability
- +5V to +28V supply range
- 6ns rise time

### Voltage Detectors

- Senses high and low presettable DC voltage values and provides an output when they are exceeded
- Threshold accuracy (2%)
- Individually programmable upper and lower trip points

### Pulse Width Modulators

- Provides control circuitry for regulated switching power supplies
- Line/Load regulation (0.02%)
- Switching Frequency (>100KHz)

### Battery Back Up Switch

- Automatically connects battery to equipment when power is lost and drops battery when power is restored
- Wide supply range (2.5V to 15V)
- Low power consumption (1.5A)

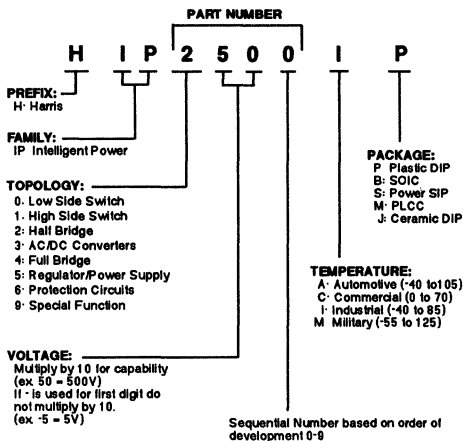
### Voltage Regulators

- Changes unfiltered raw supply voltage to an improved/regulated DC voltage.
- Output current to 10 mA with pass transistor
- Line regulation (.03%), load regulation (3)

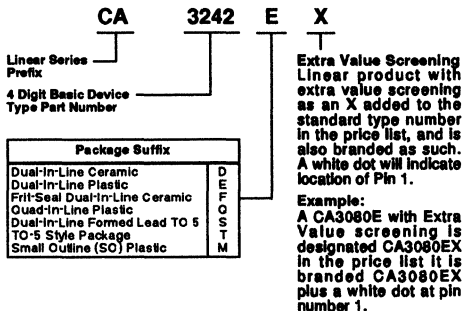
# Intelligent Power

## Ordering Information

### HIP



### CA



**Tape & Reel For Small-Outline Packages**  
With the introduction of small-outline packages, Harris now offers its customers the convenient tape and reel style packaging. Small-outline devices, which can be tape and reeled, are denoted with the suffix "M96" or "AM96" in the linear and high speed logic product lines. Devices must be ordered in multiples of quantities listed below. Any returns must be full and unopened reels.

LEAD COUNT	TAPE WIDTH IN mm	REEL SIZE INCHES	DEVICES PER REEL
8	12	13	2500
14	16	13	2500
16	16	13	2500
20	24	13	1000
24	24	13	1000

### HV/ICL/ICM

#### Device Family Prefixes

PREFIX	DEVICE FAMILY
ICL	Linear IC
ICM	Microperipheral IC
HV	High Voltage
LM	National Semiconductor Alternate Source

#### Temperature Range Designators

SUFFIX	TEMPERATURE RANGE
C	Commercial: 0°C to +70°C
I	Industrial: Either -25°C to +85°C or -40°C to +85°C (Specified on Datasheet)
M	Military: -55°C to +125°C

#### Package Type Designators

SUFFIX	PACKAGE
B	Small Outline IC (SOIC)
J	Ceramic Dual-In-Line
P	Plastic Dual-In-Line
T	TO-99, TO-100

#### Pin Count Designator

SUFFIX	PIN COUNT	DIAMETER
A	8	
B	10	
C	12	
D	14	
E	16	
V	8	(0.200" pin circle, isolated case)
W	10	(0.230" pin circle, isolated case)
X	10	(0.230" pin circle, case to pin 5)
Y	8	(0.200" pin circle, case to pin 4)
Z	8	(0.230" pin circle, case to pin 5)

1, 2 OR 3 DIGIT PREFIX  
**XXX**

3, 4 OR 5 DIGIT UNIQUE DEVICE NUMBER  
**XXX X**

3 OR 4 DIGIT OPTION SUFFIX  
**X X X X**

HIGH RELIABILITY DESIGNATOR  
**/XXXX**

Pin Count Designator  
Package type Designator  
Temperature Range Designator  
Electrical Option Designator Only. Used if more than one electrical option is available.  
Variation of basic device type designator. Only used if more than one basic device is available.  
3 or 4 digit basic device type part number  
Device family prefix

# Feature Products

## MOSFET Drivers

The "HV" family of MOSFET drivers utilize the benefits of Dielectric Isolation Technology to achieve cost effective SCR topologies with high voltage and high speed performance. These products compliment Harris' full line of power discrete MOSFETs and IGBTs.

### HV-400 - MOSFET Driver

#### Features:

- Peak Source/Sink Current of 6A/30A
- 70 ns Rise, 30 ns Fall Times
- 300 kHz Frequency Range
- No Supply current in Quiescent State
- 8 Pin PDIP/SOIC

## Half Bridge Drivers

Harris' half bridge driver circuits are manufactured in a high voltage process capable of sustaining greater than 500 Volts. The following products offer the design engineer improved alternatives to existing solutions.

### SP600/601

#### Features:

- >.5A Output Drive
- DC to 20KHz PWM Frequency Range
- Shoot Through Protection
- Independent Gate Control (SP600)
- Single Input Gate Control (SP601)
- Internal Refresh for DC Operation

### HIP 2500

#### Features:

- 2.0A Output Drive
- 100KHz PWM Frequency Range
- Independent Gate Control
- IR 2110 Alternate Source

## Offline Power Supplies

Utilizing Harris Dielectric Isolation Technology and proprietary design, this product and future products provide direct offline to regulated DC conversion integrating the functions of rectifier, transformer, and 3 terminal regulator into a single cost saving IC.

### HV-2405E - Single Chip AC/DC Power Supply

#### Features:

- 18 V to 264 Vrms Input Range
- 5 V to 24 Vdc at 50 mA Output
- 150 mA Output Current with App. Note AN9101
- Output Accuracy Maintained at <5%
- UL Recognized = File #E130808
- Low Cost Compact Form
- 8 Pin PDIP

# Feature Products

## Electronic Protection Array

For ESD & Overvoltage Protection Using SCR/Diode Circuit Structures.

### SP720

#### Features:

- 1.0 A Current capability
- +5V to +28V supply Range
- Fast Switching 6ns Rise Time
- An Array of 14 Diode Pairs
- -40°C to +125°C Operating Temperature Range

## DC/DC Converters and Regulators

Produced on low power CMOS, these product offer superior performance over other second source devices while providing latch-free operation at very competitive prices.

### ICL7644/5/6/7 - Low Voltage Step-Up Converters (New)

#### Features:

- +3 V or 5 V Output from a Single 1.5V Cell
- 0.9 V Start-Up
- 200 mA (Int. MOSFET), 350 mA (Ext. MOSFET)
- 5 $\mu$ A Quiescent Current
- 14 Pin PDIP/SOIC

# Power Converter - AC to DC

## HV-2405E

Worldwide single chip Power Supply

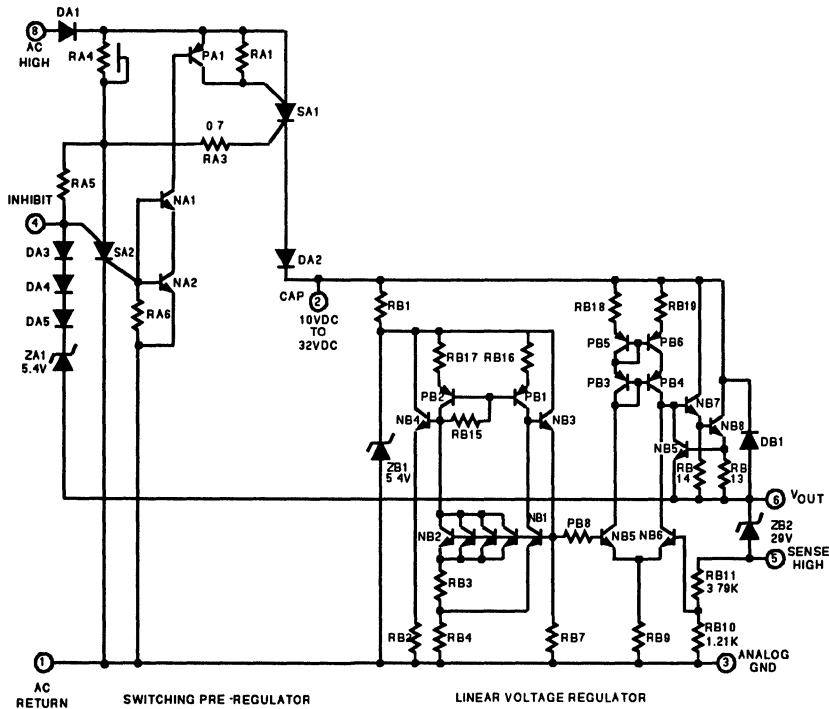
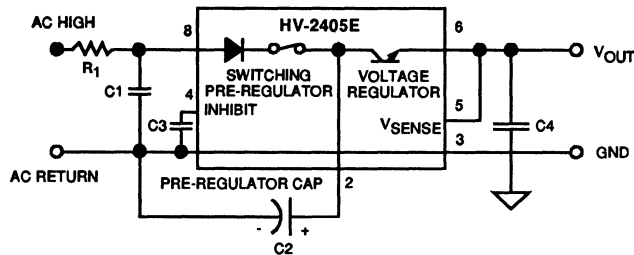
### Features

- Direct AC to DC Conversion
- Wide Input Range (18Vrms - 264Vrms: HV-2405E)
- Output Current to 50mA (150mA, App Note 9101)
- Adjustable Output Voltage: 5 to 24V
- UL Recognized
- Line/load Regulation <5%

### Applications

- Non-isolated Power Supplies
- Battery Back Up Systems
- Housekeeping Supply for Switch Mode Power Supplies
- Dual Output supply for Off-Line Motor Controls

Package Availability - 8 Pin Plastic MiniDIP



# Power Converters - DC to DC

## ICL7644/5/6/7

Converts 1.5V Single Cell Battery Voltage to +3V or +5V Output

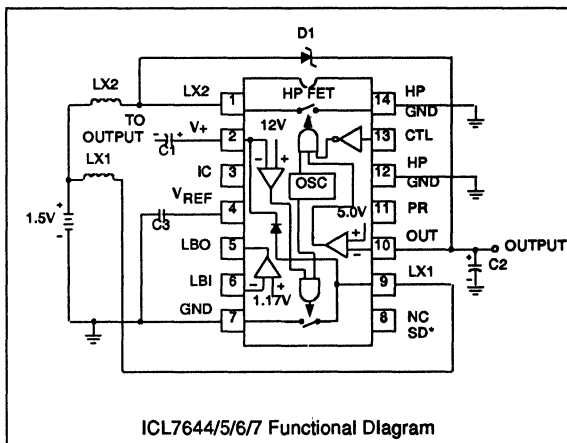
### Features:

- 0.9V Start-Up
- +3V or +5V Output From A Single 1.5V Cell
- $I_{out} = 200mA$  (Internal MOSFET)
- Standby Current: ICL 7644/5/6/7 (80 $\mu A$ )
- Shut Down Current: 5 $\mu A$

### Applications:

- Pagers/RC Receivers
- Portable Instruments
- Battery Powered Devices

Package Availability - 14 pin plastic DIP  
14 pin SOIC



## ICL7660, ICL7660S, ICL7662

Converts +DC Input Voltage to -DC Output Voltage, Positive Voltage Doubler

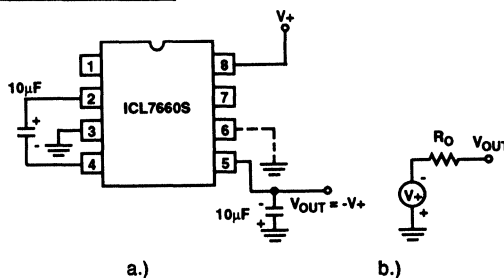
### Features:

DEVICE NO.	ICL7660	ICL7660S	ICL7662
Supply Voltage Range	Hi 3.0-10V Lo 1.5-3.5V	Hi 3.0-12V Lo 1.5-3.5V	Hi 9.0-20V Lo 4.5-11V
OSC-Frequency	10KHz	10KHz	10KHz
Power Efficiency	95%	95%	95%
Voltage Conversion Efficiency	97%	99%	97%
Output Source/Resistance	100 $\Omega$	100 $\Omega$	100 $\Omega$
Supply Current	500 $\mu A$	160 $\mu A$	600 $\mu A$

### Applications:

Inexpensive Negative Supplies For Data Acquisition Systems

Package Availability - 8 pin SOIC (7660, 7660S)  
8 pin MiniDIP (ALL)  
8 pin TO-99 (ALL)



Simple Negative Converter and its Output Equivalent

# Drivers - Half Bridge

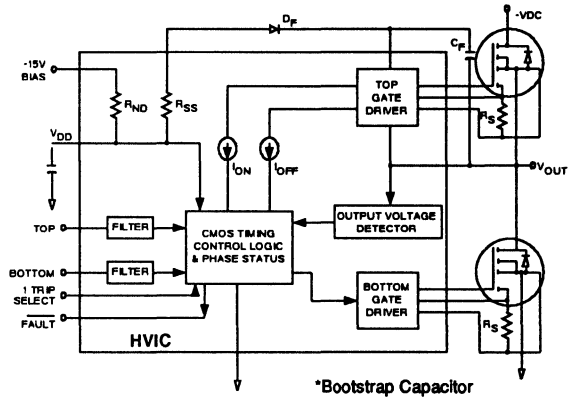
## SP600/601, HIP2500

Intelligent Power™ Circuitry Provides Interface Between Low Voltage Logic and High Power/Voltage Half Bridge Configuration.

### Features:

Device No.	SP600	SP601	HIP2500
Logic to High Voltage Interface	Yes	Yes	Yes
Upper Rail Drive Supply on Chip	Yes	Yes	Yes
Single Supply Latch Free CMOS	Yes	Yes	Yes
Output Drive	>.5A	>.5A	2.0A
Simultaneous Conduction Lockout	Yes	Yes	No
PWM Frequency	DC to 20KHz	DC to 20KHz	100KHz
Shoot-Through Protection	Yes	Yes	No

### SP600



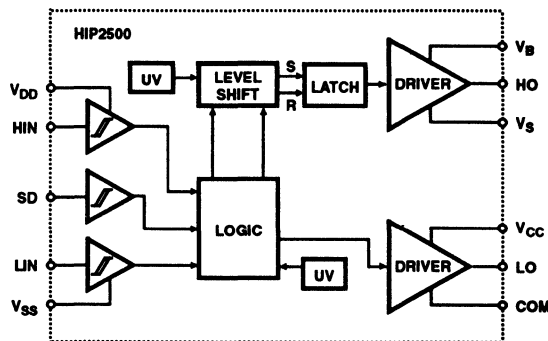
### Applications

- Power Supplies/UPS - Ballast Supplies
- PWM Motor Drives
- Motor Controls

\*IR2110 Alternate Source (HIP2500)

Package Availability - 22 pin DIP (SP600/601)  
14 pin DIP (HIP2500)

### HIP2500



Simplified 1/2 Bridge Resonant Mode Controller  
For Power Supply Applications



# Drivers - Half Bridge

## CA3169

Logic Driven "Intelligent" Automotive Solenoid/Lamp Driver

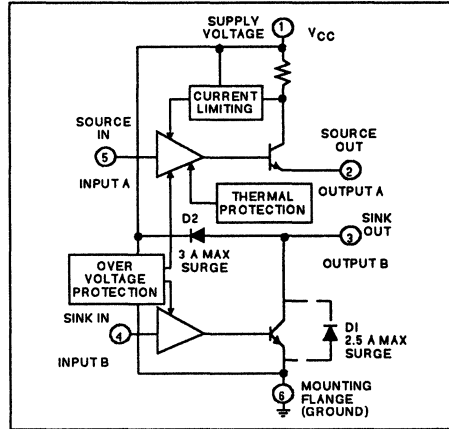
### Features:

- Input TTL/CMOS Compatible
- $I_{out} = 600mA$  (Typ.)
- Supply Voltage Range 10.5V to 18V
- Thermal Overload Plus Output Short Circuit Protection
- Inductive "Kick" Protection

### Applications:

- Solenoid Driver
- Relay/Lamp Driver
- Motor Controller
- Triac/SCR Driver

Package Availability - 5 LEAD to -220  
Vertical and Horizontal Mount



# Drivers - Power MOSFET

## HV400/ICL7667

Provides Interface Circuitry Between Logic and Power MOSFETS

### Features:

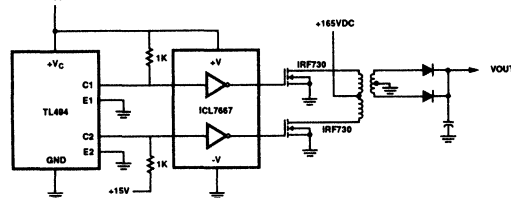
Part No.	HV400	ICL7667
Peak Output Source Current	6A	800mA
Peak Output Sink Current	30A	800mA
Switching Frequency	300KHz	1.0MHz
Supply Current in Quiescent State	0A	2.5mA
Fall Time	22ns	30ns
TTL/CMOS Input Compatible	Yes	Yes
Supply Range	20V	15V

### Applications:

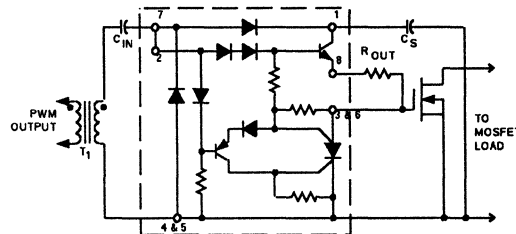
- Switching Power Supplies
- DC/DC Converters
- Motor Controllers
- Uninterruptible Power Supplies

Package Availability - 8 pin plastic SOIC  
8 pin plastic Mini-DIP  
TO-99 CAN (ICL7667)

### ICL7667



### HV400



# High Side Switches

## CA3273

Provides Drive and Control Functions in "ON" and "OFF" Modes

### Features

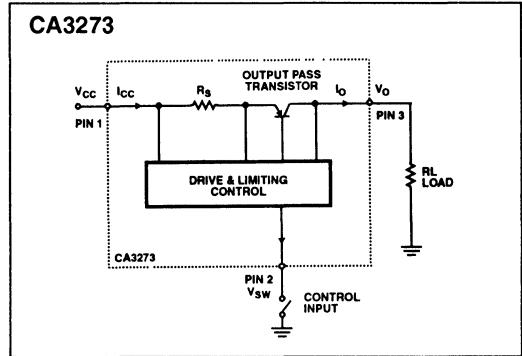
- Current limit (1.2A)
- Supply range (4-24V)
- $R_{ON} = 40\Omega$
- Overvoltage shutdown (25-40V)
- Thermal shutdown (150°C)

### Applications

- Power Supplies/UPS - Ballast Supplies
- PWM Motor Drives
- Motor Controls

\*IR2110 Alternate Source (HIP2500)

Package Availability - 22 pin DIP (SP600/601)  
14 pin DIP (HIP2500)



# Low Side Switches

## CA3274

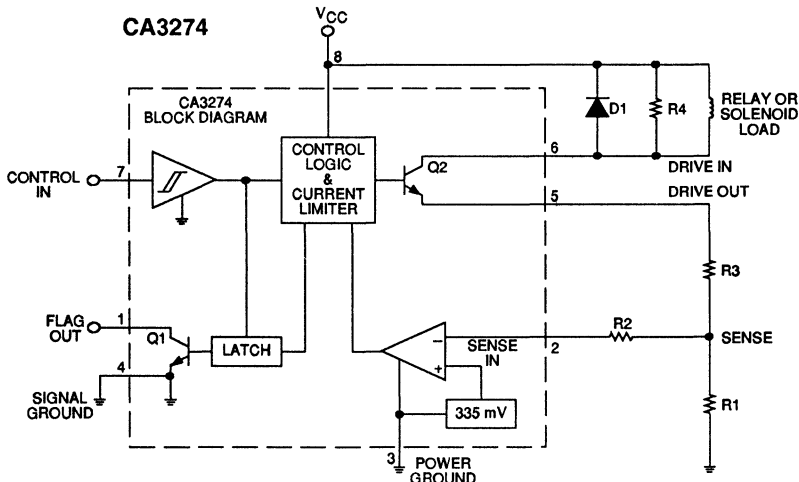
Provides Drive, Control with Over Current Sensing Functions between Loads and Power

### Features

- Current Limit (200mA)
- Control Input Logic Compatible
- Overcurrent Flag Output
- Switching Time (5µS)

### Applications

- Solenoid/Relay Driver
- Lamp Driver
- Ignition Coil Driver



# Low Side Switches

## CA3242/62/A/72

Quad Power Drivers Supply Drive Plus Supervisory Functions for Ground Reference Loads

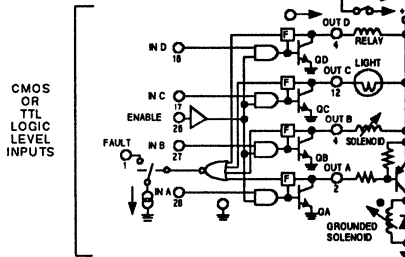
### Features:

TYPE NO.	CA3242	CA3262	CA3262A	CA3272
Type Of Output	Inverting	Inverting	Inverting	Inverting
Output Current Rating Vsat @ Current Rating	0.6A 0.8V	0.7A 0.6V	0.7A 0.5V	0.4A 0.4V
Voltage Rating (V <sub>CC</sub> ) sus	35Vdc	35Vdc	40Vdc	40Vdc
Load Dump Voltage (V <sub>peak</sub> )	80Vpk	80Vpk	80Vpk	80Vpk
Output Current Limiting	No	@ 1.4A	@ 1.2A	@ 1.0A
Short-Circuit Protection	Yes	No	No	No
Thermal Limiting	No	@T <sub>J</sub> =+155°C	@T <sub>J</sub> =+155°C	No
Thermal Shutdown	No	No	No	@T <sub>J</sub> =+165°C
Fault Indicator Flag	No	No	No	Yes
Temperature Range				
-40°C to +85°C	X	X		
-40°C to +125°C			X	X
Package Options:				
16 DIP (std)	X	X	X	
15 SIP	X			
28 PLCC			X	X

### Applications:

- Relay/Solenoid Drivers
- Motor Drivers
- Heater Control

Package Availability - 16 pin DIP Plastic



# Low Side Switches

## CA3059/3079

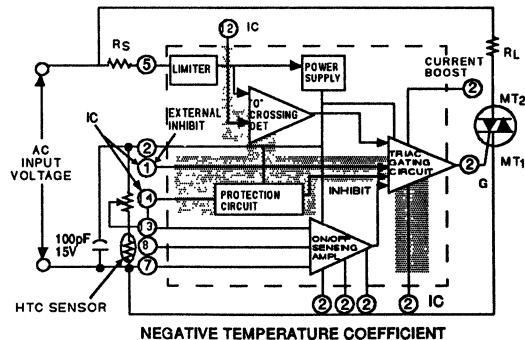
Provides Triac Drive Signals when AC Power Input Crosses OV

### Features:

- Wide Operating Range - 24V, 120V, 208/230V, 277V (50, 60 or 400Hz)
- On Chip Owner Supply (Self Powered from AC Input)
- High Power Current up to 240mA
- RFI Interference Eliminated

### Applications:

- Relay/Valve Control
- Heater Control
- Photosensitive Control
- Lamp Control



# Electronic Protection Array

## SP720 - Electronic Protection Array

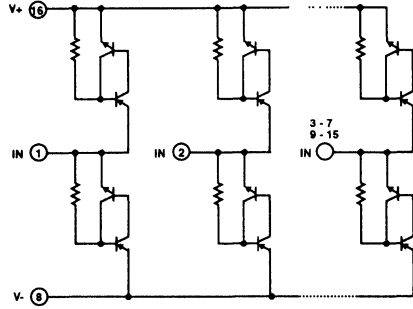
Provides ESD & Overvoltage Protection Using SCR/Diode Circuit Structures

### Features

- 1A Current Capability
- Low "ON" Resistance
- +5V to +28V Supply Range
- Designed to Provide Over Voltage Protection
- Fast Switching - 6ns Risetime
- An Array of 14 Diode Pairs
- Proven Interface Protection for ESD
- -40°C to +125°C Operating Temperature Range

### Applications

- Microprocessor/Logic Input Protection
- Data Bus Protection
- Analog Device Input Protection
- Voltage Clamp



# Voltage Detectors

## ICL7665S - Voltage Detector

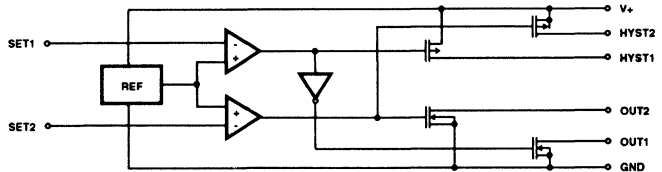
Detects Under And Over Voltage Condition. User Programmable Trip Points Prevent Oscillation

### Features

- Low Power CMOS Construction (10µA)
- Wide Operating Range (1.6V to 16V)
- On Chip Precision Reference
- Improved Direct Replacement for Other Second Source Devices

### Applications

- Battery Powered System
- Portable Computers
- Charging Systems



## ICL8211/8212 - Voltage Detector

Provides Precision Voltage Detection

### Features

- Precision Internal Reference
- Wide Operating Supply Range (1.8-30V)
- Output Current: ICL 8211 - 12mA  
ICL 8212 - 35mA
- Stable Operation Under Temperature and Supply Variation
- Easy to Set Hysteresis Range

### Applications

- Low or High Sensor/Indicator
- Programmable Voltage Reference or Zener
- Series or Shunt Power Supply Regulator

Package Availability - 8 pin Mini DIP  
8 lead SOIC  
TO - 99 Can

# Pulse Width Modulators

## CA1524, CA2524, CA3524

Control Circuitry For Use In Switching Regulator (Power Supply) Circuits

### Features:

		V <sub>+</sub> Range V	V <sub>O</sub> Range V	Load Regulation % V <sub>O</sub> (Typ)	Ripple Rejection dB (Typ)	Total Standby Current os (mA) (Max)	V <sub>CE SAT</sub> V (Typ)
CA1524 CA2524 CA3524	Regulating pulse-width modulators	8 to 40	4.8 to 5.2	0.2	66	10	0.8
		8 to 40	4.8 to 5.2	0.2	66	10	0.8
		8 to 40	4.6 to 5.4	0.2	66	10	0.8
Electrical characteristics at V <sub>+</sub> = 20V, f = 20kHz. T <sub>A</sub> = -55 to +125°C for CA1524; 0 to +70°C for CA2524, CA3524. 16-lead dual-in-line (E) & (F) packages. Short-circuit current limit: 100mA typ. Temperature stability: 1% max.							

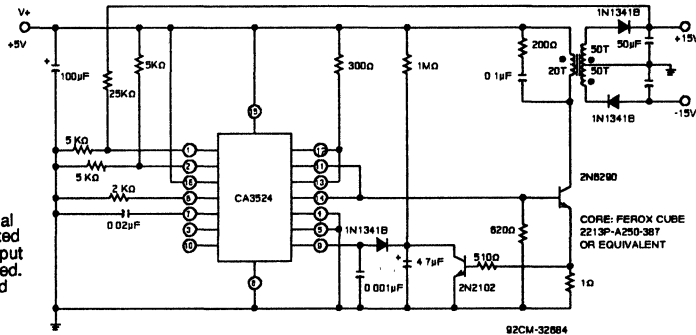
### Applications:

- Positive and Negative Regulated Supplies
- Dual Output Regulators
- Flyback Converters
- Variable Power Supplies

### Package Availability - 16 Pin DIP

### Flyback Converter

Flyback converter circuit for generating a dual 15-volt output at 20 mA from a 5-volt regulated line. Reference voltage is provided by the input and the internal reference generator is unused. Current limiting in this circuit is accomplished by sensing current in the primary line and resetting the soft-start circuit.



## CA1523

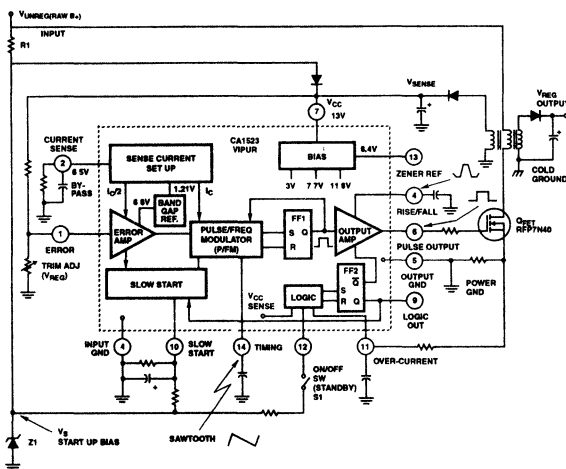
Control Circuit Variable-Interval Pulse Regulator (VIPUR) for Switch Mode Power Supplies

### Features:

- Combines Variable-Pulse Interval (PIM) and Variable-Pulse Width (PWM) Control
- Reduced Losses and Low Ripple at Minimum Frequency with Improved Efficiency and Regulation
- Operates up to 200Khz
- Overcurrent Sensing
- Lower Peak Currents than PWM Regulator - Less Prone to Magnetic Saturation (See App Note ICAN-8614)

### Applications:

- Positive and Negative Regulated Supplies
- Flyback Converters
- VCO Pulse Generator and Driver



# Battery Back-Up Switch

## ICL7673

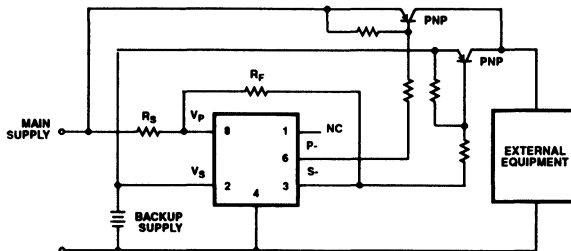
Automatically Connects Battery or Supply to Output Whichever is Greater

### Features:

- Wide Supply Range (2.5 To 15V)
- Status Indicator of Mainpower
- Low Internal Power Consumption (5 $\mu$ A)
- Low Impedance Switches

### Applications:

- Battery Backup For Realtime Clocks  
Timers or Volatile Rams
- Over/Under Voltage Detector
- Peak Voltage Detector



# Voltage Regulators

## ICL7663S (Low Power) - CA3085/A/B - CA723

Provides Regulated Output DC Voltages from Raw Input DC Voltages

### Features:

Type	Description	V <sub>I</sub> Range V	V <sub>O</sub> Range V	I <sub>O</sub> (Max) mA	Load Regulation % V <sub>O</sub> (Max)	V <sub>I</sub> - V <sub>O</sub> V (Min)	Short-Circuit Current Limit mA (Typ)
CA3085	Voltage Regulators	7.5 to 30	1.8 to 26	12*	0.1	4	96
CA3085A		7.5 to 40	1.7 to 36	100	0.15	4	96
CA3085B		7.5 to 50	1.7 to 46	100	0.15	3.5	96
CA723		9.5 to 40	2 to 37	150**	0.03	3	65
CA723C		9.5 to 40	2 to 37	150**	0.03	3	65
ICL7663S	Low Power	1.5 to 16	1.3 to 16	40	10 $\Omega$	N/A	40

\* This value may be extended to 100 mA; however, regulation is not specified beyond 12 mA.

\*\* Output current can be increased beyond 10A with suitable external transistor (see application circuit below).

### Applications

- Pagers (ICL 7663S)
- Portable Instrumentation (ICL 7663S)
- Battery Powered Systems
- Shunt Voltage Regulator
- Current Regulator
- Dual Tracking Regulator

Package Availability - 8 Pin Mini-DIP/SOIC - ICL7663S  
8 Pin Mini-DIP/To-99 CAN - CA3085  
14 Pin DIP/TO-5 CAN - CA723

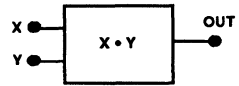


# Special Analog Circuits

## Analog Multipliers

Multiplies analog input voltages X and Y to obtain an output

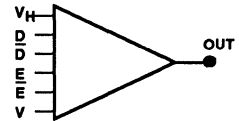
- Wide signal bandwidth: 100 MHz current and 30 MHz voltage output
- Low multiplication error: 1.6% typ.
- Two and four quadrant type available.
- Applications: MIXERS AGC (Automatic Gain Control), division, root sum square and analog computation



## Pin Driver

Switches between two DC input voltage levels at high data rates providing variable amplitude digital pulse

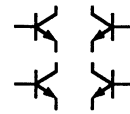
- 350MHz digital data rate
- Wide output range of +7V to -2V
- Target application: IC tester PIN electronic



## Transistor and Diode Arrays

Multiple, uncommitted transistors or diodes on a common monolithic substrate

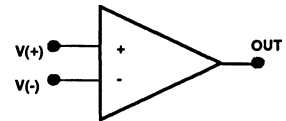
- NPNs, PNP's and differential pair configurations available
- Gain Bandwidth product ( $f_T$ ) up to 8 GHz typical
- Applications: Custom amplifier design, bandgap circuits, translinear circuits and more.



## Comparators

Compares the amplitude of the analog input voltages at the (+) and (-) terminal to obtain an output. If  $V(+)>V(-)$ , then  $V_{out}$  is High; If  $V(-)<V(+)$ , then  $V_{out}$  is Low

- Propagation delays down to 3.1nsec maximum
- Applications: Voltage detection, interpreters

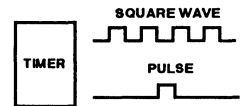


## Timers (Square-Wave Generators & Pulse One-Shots)

Generates square-waves up to 2 MHz typical (astable operation)

Generates a one-shot pulse for triggering events (monostable)

- Low power CMOS and long-range timing options available
- Applications: Switching supplies, clockboards, output triggers



## Waveform Generator

Generates sine, square or triangle waveforms

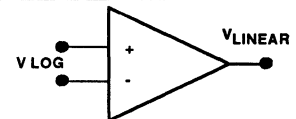
- Frequency range from .001 Hz to 100 KHz maximum
- Variable duty cycle from 2% to 98%
- Applications: Telecom ring generator, function generator and more.



## Log/Anti-Log Amplifiers

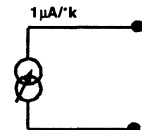
Compresses a wide input-voltage dynamic range (10mV-10V) to a linear, narrow range output voltage (0-3V) for a log amp. Anti-log amplifiers do the inverse.

- Input current range of six decades and input voltage range of three decades
- Applications: Wide range transducer input command



## Temperature Transducer

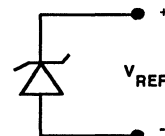
- Produces an output current proportional to absolute temperature
- Linear current output:  $1\mu A/^{\circ}K$
- Small, two terminal TO-52 package
- Applications: Temperature compensation and monitor circuits



## Voltage Reference

Produces a 1.2V voltage reference band-gap type

- Low bias current: 50uA
- Small, two terminal TO-52, TO92 or SOIC package
- Applications: Reference for ICL 71XX A/D converter panel meters





# Special Analog Circuits

## Ordering Information

**HFA**

**HARRIS PRODUCT CODE EXAMPLE**

**H FA - 1100 - 1 - B**

**PREFIX:** H Harris

**FAMILY:** FA Ultra-High Speed Analog

**PART NUMBER:** 1100

**PACKAGE:** B Small Outline, SOIC  
J Ceramic DIP  
P Plastic DIP  
Y DICE

**TEMPERATURE:** C Commercial, 0°C to +70°C  
I Industrial, -40°C to +85°C  
M Military/883, -55°C to +125°C

**HA**

**HARRIS PRODUCT CODE EXAMPLE**

**H A 7 - 5147 - 5**

**PREFIX:** H Harris

**FAMILY:** A Analog

**PART NUMBER:** 5147

**PACKAGE:** 1 Dual-In-Line Ceramic  
2 Metal Can  
3 Dual-In-Line Plastic  
4P Plastic Leaded chip Carrier  
7 Mini-DIP, Ceramic  
9P Small Outline  
0 Chip Form

**TEMPERATURE:** 2: -55°C to +125°C  
4 -25°C to +85°C  
5 0°C to +75°C  
7 Dash-7 High Reliability Commercial Product 0°C to +75°C, includes 96 hour Burn-In  
9: -40°C to +85°C

**CA**

**Linear (CA Series)**

PACKAGE	CA SERIES
Dual-In-Line Ceramic	D
Dual-In-Line Plastic	E
Frit-Seal Dual-In-Line Ceramic	F
Quad-In-Line Plastic	G
Dual-In-Line Formed Lead TO 5	S
TO-5 Style Package	T
Small Outline (SO) Plastic	M

**Example:** A CA3080E with Extra Value screening is designated CA3080EX in the price list it is branded CA3080EX plus a white dot at pin number 1.

**Tape & Reel For Small-Outline Packages**  
With the introduction of small-outline packages, Harris now offers its customers the convenient tape and reel style packaging. Small-outline devices, which can be tape and reeled, are denoted with the suffix "M96" or "AM96" in the linear and high speed logic product lines. Devices must be ordered in multiples of quantities listed below. Any returns must be full and unopened reels

LEAD COUNT	TAPE WIDTH IN mm	REEL SIZE INCHES	DEVICES PER REEL
8	12	13	2600
14	16	13	2600
16	16	13	2600
20	24	13	1000
24	24	13	1000

**Extra Value Screening**

Linear product with extra value screening as an X added to the standard type number in the price list, and is also branded as such. A white dot will indicate location of Pin 1.

**ICL/ICM**

**Device Family Prefixes**

PREFIX	DEVICE FAMILY
ICL	Linear IC
ICM	Microperipheral IC
LM	National Semiconductor Alternate Source

**Temperature Range Designators**

SUFFIX	TEMPERATURE RANGE
C	Commercial 0°C to +70°C
I	Industrial Either -25°C to +85°C or -40°C to +85°C (Specified on Datasheet)
M	Military -55°C to +125°C

**Package Type Designators**

SUFFIX	PACKAGE
B	Small Outline IC (SOIC)
J	Ceramic Dual-In-Line
P	Plastic Dual-In-Line
T	TO-99, TO-100

**Pin Count Designator**

SUFFIX	PIN COUNT	DIAMETER
A	8	
B	10	
C	12	
D	14	
E	16	
V	8	(0 200" pin circle, isolated case)
W	10	(0 230" pin circle, isolated case)
X	10	(0 230" pin circle, case to pin 5)
Y	8	(0 200" pin circle, case to pin 4)
Z	8	(0 230" pin circle, case to pin 5)

**1, 2 OR 3 DIGIT PREFIX**  
**XXX**

**3, 4 OR 5 DIGIT UNIQUE DEVICE NUMBER**  
**XXX X**

**3 OR 4 DIGIT OPTION SUFFIX**  
**X X X X**

**HIGH RELIABILITY DESIGNATOR**  
**/XXXX**

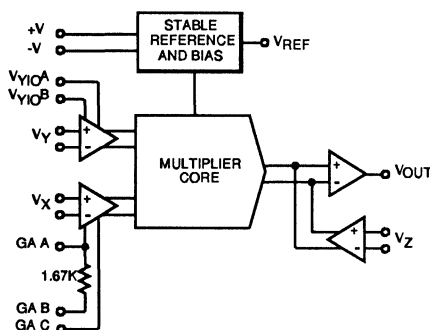
Pin Count Designator  
Package type Designator  
Temperature Range Designator  
Electrical Option Designator Only. Used if more than one electrical option is available.  
Variation of basic device type designator. Only used if more than one basic device is available.  
3 or 4 digit basic device type part number  
Device family prefix

# Analog Multipliers

PART NUMBER	TYPE	INPUT BAND-WIDTH	POWER SUPPLY REQUIREMENT	PACKAGE TYPES	TEMP RANGE	FEATURES
ICL8013	4-Quadrant Voltage Output	1MHz	± 15V @ 6mA (Max)	10-Pin TO-100	Com Mil	<ul style="list-style-type: none"> <li>Scale Factor = 10V</li> <li>Full Scale Error = 2% Max</li> <li>Feedthrough = 200mV Max</li> </ul>
HA-2546	2-Quadrant Voltage Output	30MHz	± 15V @ 29mA (Max)	16-Pin Ceramic DIP	Com Ind Mil	<ul style="list-style-type: none"> <li>Scale Factor = 2V Adjustable</li> <li>Full Scale Error = 3% Max</li> <li>Feedthrough = 52dB @ 5MHz</li> </ul>
HA-2556	4-Quadrant Voltage Output	30MHz	± 15V @ 29mA (Max)	16-Pin Ceramic DIP	Com Ind Mil	<ul style="list-style-type: none"> <li>Scale Factor = 2V Adjustable</li> <li>Full Scale Error = 3% Max</li> </ul>
HA-2547	2-Quadrant Current Output	100MHz	± 15V @ 29mA (Max)	16-Pin Ceramic DIP	Com Ind Mil	<ul style="list-style-type: none"> <li>HA-2546 Without Buffer</li> <li>Highest Signal Bandwidth</li> </ul>
HA-2557	4-Quadrant Current Out	100MHz	± 15V @ 29mA (Max)	16-Pin Ceramic DIP	Com Ind Mil	<ul style="list-style-type: none"> <li>HA-2556 Without Buffer</li> <li>Highest Signal Bandwidth</li> </ul>

2C  
Special Analog

## HA-2546/56



The open loop transfer equation for the HA-2546/56 is:

$$V_{OUT} = A \left[ \frac{(V_{S+} - V_{X-})(V_{Y+} - V_{Y-}) - (V_{Z+} - V_{Z-})}{SF} \right]$$

where

A = Output Amplifier Open Loop Gain  
 SF = Scale Factor  
 VX, VY, VZ = Differential Inputs

## HFA5250 - Pin Driver

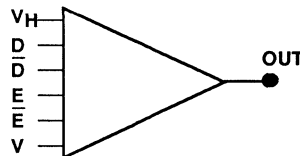
Switches Between Two DC Input Voltage Levels at High Data Rates Providing Variable Amplitude Digital Pulses

### Features

- High Digital Data Rate (SOIC) .....350MHz
- (DIE) .....500MHz
- Very Fast Slew Rate (SOIC).....2000V/μs
- (DIE) .....3000V/μs
- Very Fast Rise/Fall Times .....1.5ns
- Wide Output Range .....+7V to -2V
- Excellent Rise/Fall Time Matching .....65ps
- Precise 50Ω Output Impedance

### Applications

- IC Tester Pin Electronics
- Pattern Generators
- Pulse Generators
- Emulators/Development Systems
- Built-In Test Equipment (BITE)



Available in 28 pin SOIC and DIE form

# Transistor Arrays

PART NUMBER	FIG.	DESCRIPTION	BREAKDOWN VOLTAGE		COLLECTOR CURRENT I <sub>C</sub>	GAIN h <sub>fe</sub>	FREQ. f <sub>T</sub>	PACKAGE
			V <sub>CEO</sub>	V <sub>CBO</sub>				
CA3096 Each n-p-n Each p-n-p	1	Three, independent, n-p-n transistors and two, independent, p-n-p transistors	35V Min -40V Min	45V Min -40V Min	50mA Max -10mA Max	150 Min 40 Min	330MHz 6.8MHz	16 PDIP
CA3138E	2	Four, independent, high current, n-p-n transistors	40V Min 50V Min 15V Min	70V Min 80V Min 20V Min	1.0A Max 1.0A Max 1.0A Max	35 Min 35Min 80Min		14 PDIP 14 PDIP 14 PDIP
CA3084	3	Six, general-purpose, p-n-p transistors, including two, independent transistors, a Darlington connected pair, and a current mirror pair with a shared diode	-40V Min	-40V Min	-10mA Max	15 Min		14 PDIP
CA3083 CA3183 CA3183A	4	Five, independent, n-p-n transistors	15V Min 30V Min 40V Min	20V Min 40V Min 50V Min	100mA Max 75mA Max 75mA Max	40 Min 40 Min 40 Min	450MHz	16 PDIP
CA3082	5	Seven, common-collector connected, n-p-n transistors	16V Min		100mA Max	40 Min	450MHz	16 PDIP
CA3081	6	Seven, common-emitter connected, n-p-n transistors	16V Min		100mA Max	40 Min	450MHz	16 PDIP
CA3018 CA3018A	7	Two, isolated, n-p-n transistors and a Darlington connected, n-p-n transistor pair	15V Min 40V Min	30V Min 50V Min	50mA Max 50mA Max	60 Min 30 Min	550MHz 500MHz	12 LTO-5 12 LTO-5
CA3045/6 CA3086 CA3146	8	Three, isolated, n-p-n transistors and one, differentially connected, n-p-n transistor pair	15V Min 15V Min 30V Min	20V Min 20V Min 40V Min	50mA Max 50mA Max 50mA Max	40 Min 40 Min 30 Min	550MHz 550MHz 500MHz	14 PDIP 14 PDIP
CA3246	8	3GHz array. Three, isolated, n-p-n transistors and one, differentially-connected, n-p-n transistor pair	8V Min	12V Min	20mA Max	60 Min	3.0GHz	14 PDIP
CA3097E	9	One, independent, n-p-n transistor, an n-p-n/p-n-p transistor pair, a sensitive gate SCR input, and a Zener diode	30V Min (NPN) 40V Min (PNP)	50V Min (NPN) 50V Min (PNP)	100mA (npr) 10mA (pnp)		300MHz 6.8MHz	16 PDIP
CA3127	10	Five, independent, high-frequency, n-p-n transistors	15V Min 8V Min	20V Min 12V Min	20mA Max 20mA Max	40 Min 40 Min	1.15GHz 3.0GHz	16 PDIP

# Amplifier Arrays

PART NUMBER	FIG	DESCRIPTION/ SUGGESTED APPLICATION	PACKAGE
CA3054	11	Dual independent general-purpose differential amplifiers Application: RF Mixer-Amplifier-Balanced Modulator (120MHz)	14 PDIP
CA3049	12	Dual independent high-frequency differential amplifiers Application: RF Mixer-Amplifier-Balanced Modulator (500MHz)	12 LTO-5 14 PDIP

# Diode Arrays

PART NUMBER	FIG	DESCRIPTION/ SUGGESTED APPLICATION	PACKAGE
CA3039	13	Six, independent, ultra-fast, low-capacitance, matched diodes Application: Mixer Modulator	12 LTO-5
CA3141E	14	Three common cathode diode pairs and two common anode pairs Application: Balanced modulator	16 PDIP

# Transistor Arrays Terminal Diagrams

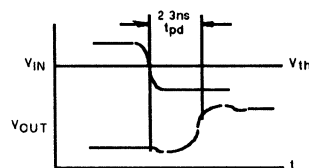
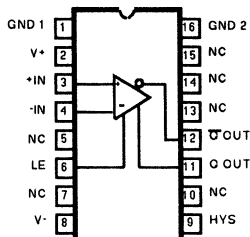
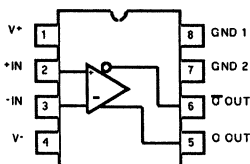
<p><b>1 CA3096E CA3096AE</b></p>	<p><b>2 CA3138E</b></p>	<p><b>3 CA3084</b></p>	<p><b>4 CA3083 CA3183 CA3183A</b></p>
<p><b>5 CA3082</b></p>	<p><b>6 CA3081</b></p>	<p><b>7 CA3018 CA3018A</b></p>	<p><b>8 CA3045 CA3146 CA3046 CA3146A CA3086 CA3246</b></p>
<p><b>9 CA3097E</b></p>	<p><b>10 CA3127 CA3227</b></p>	<p><b>11 CA3054</b></p>	<p><b>12 CA3049</b></p>
<p><b>13 CA3039</b></p>	<p><b>14 CA3141E</b></p>		

# General Purpose Comparators

PART NUMBER	# DEVICES PER PACKAGE	RESPONSE $t_R/t_f$ TIME	$V_{IO}$ (MAX)	$I_B$ (MAX)	POWER SUPPLY REQUIREMENTS	TEMP RANGE	PACKAGE TYPES
CA311	1	200ns/200ns	7.5mV	250nA	+5V to 15V @ +7.5mA/-5mA	Com	8-Pin TO-5 8-Pin DIL Can 8-Pin Plastic DIP
CA3290	2	1.2µs/200ns	20mV	50pA	+5V to ±15V @ ±3mA	Com	8-Pin TO-5 8-Pin DIL Can 8/14-Pin Plastic DIP
CA3290A	2	1.2µs/200ns	10mV	40pA	+5V to ±15V @ ±3mA	Com	8-Pin TO-5 8-Pin DIL Can 8/14-Pin Plastic DIP
CA139	4	1.3µs/300ns	5mV	100nA	+5V to ±15V @ 2mA	Com Ind Mil	14-Pin Plastic DIP 14-Pin Ceramic DIP
CA139A	4	1.3µs/300ns	2mV	100nA	+5V to ±15V @ 2mA	Com Ind Mil	14-Pin Plastic DIP 14-Pin Ceramic DIP
CA239	4	1.3µs/300ns	5mV	250nA	+5V to ±15V @ 2mA	Com Ind Mil	14-Pin Plastic DIP 14-Pin Ceramic DIP
CA239A	4	1.3µs/300ns	2mV	250nA	+5V to ±15V @ 2mA	Com Ind Mil	14-Pin Plastic DIP 14-Pin Ceramic DIP
CA339	4	1.3µs/300ns	5mV	250nA	+5V to ±15V @ 2mA	Com Ind Mil	14-Pin Plastic DIP 14-Pin Ceramic DIP
CA339A	4	1.3µs/300ns	2mV	250nA	+5V to ±15V @ 2mA	Com Ind Mil	14-Pin Plastic DIP 14-Pin Ceramic DIP
HA-4900	4	130ns/130ns	3mV	75nA	±15V @ +20mA/-8mA and +5V @ 4mA	Com Mil	16-Pin Ceramic DIP
HA-4902	4	130ns/130ns	5mV	150nA	±15V @ +20mA/-8mA and +5V @ 4mA	Com Mil	16-Pin Ceramic DIP
HA-4905	4	130ns/130ns	7.5mV	150nA	±15V @ +20mA/-8mA and +5V @ 4mA	Com Mil	16-Pin Ceramic DIP

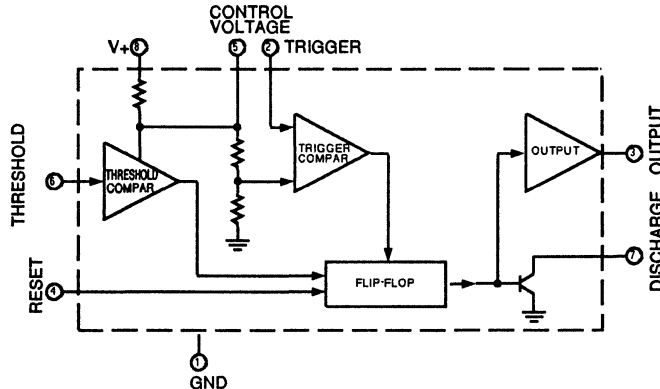
# High Speed Comparators

PART NUMBER	# DEVICES PER PACKAGE	RESPONSE $t_R/t_f$	$V_{IO}$ (MAX)	$I_B$ (MAX)	POWER SUPPLY REQUIREMENTS	TEMP RANGE	PACKAGE TYPES
HFA-0003	1	2.4ns Max	2mV	8µA	±5V @ +13mA/-22mA	Com Ind Mil	8-Pin Ceramic DIP 8-Pin Plastic DIP 8-Pin SOIC
HFA-0003L (Latchable)	1	2.6ns Max	2mV	8µA	±5V @ +13mA/-22mA	Com Ind Mil	10-Pin TO-100 16-Pin Ceramic DIP 16-Pin Plastic DIP 16-Pin SOIC



# Timers

PART NUMBER	DESCRIPTION	MAX OUTPUT FREQ. (ASTABLE)	TEMP RANGE	POWER SUPPLY REQUIREMENT	PACKAGE TYPES
CA555	Industry standard bipolar timer replaces: • SE555 • NE555 • MC1555 • MC1455	10kHz (typ)	Com Ind Mil	+4.5V to +18V @ 15mA	8-Pin TO-5 8-Pin DIL Can 8-Pin Plastic DIP
ICM7555	Low power CMOS equivalent of industry standard 555 timer-only 80µA supply current. Does not have the large supply current transients of the bipolar 555 and does not require the large bypassing capacitors needed by the 555. Low leakage threshold and trigger inputs allow use of higher impedance RC timing components for extra long time delay.	1MHz (typ)	Com Ind Mil	+2V to +18V @ 300µA	8-Pin TO-99 8-Pin SOIC 8-Pin Plastic DIP
ICM7556	A dual ICM7555, CMOS, low power equivalent of the Bipolar 556 timer.	1MHz (typ)	Com Ind Mil	+2V to +18V @ 600µA	14-Pin Plastic DIP 14-Pin Ceramic DIP
ICM7242	Long-range fixed timer. RC oscillator +8-bit counter. Fixed 256 count. Used for extremely long time delays. Cascadable. Can be used for delay times in excess of several days.	2MHz (typ)	Com Ind	+2V to +16V @ 800µA	



## ICL8038 Precision Waveform Generator/VCO

Provides high accuracy sine, square, triangular, sawtooth and pulse waveforms.

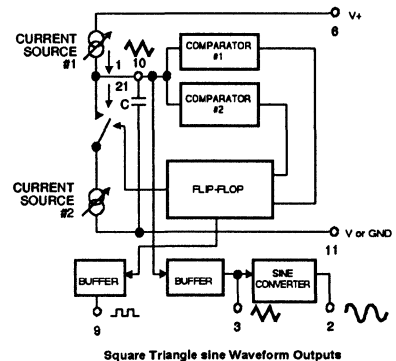
### Features

- Wide Operating Frequency Range (0.001Hz - 300kHz)
- Low Frequency Drift (250ppm/°C)
- Low Distortion (1% - Sinewave, 0.1% Tri-Wave)
- Simultaneous Outputs

### Applications

- Ring Generation (Telecom)
- Frequency Synthesis

14 Pin CERDIP and Plastic DIP



Square Triangle sine Waveform Outputs

# Timers

## ICL 8048/8049 Log/Antilog Amplifiers

Compresses a wide dynamic range at input voltage/current to a linear narrow range output voltage (0V - 3V). Antilog amplifier does the inverse.

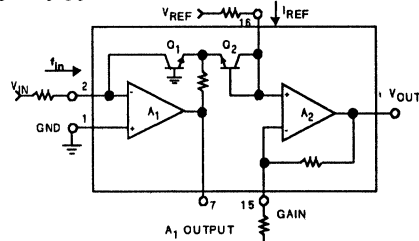
### Features:

- 1/2% Full Scale Accuracy
- 120dB Dynamic Current Range (8048)
- 60dB Dynamic Voltage Range (8048 & 8049)
- Scale Factor 1V/Decade (Adjustable)
- 50kHz Input Bandwidth With 1mA Input Current

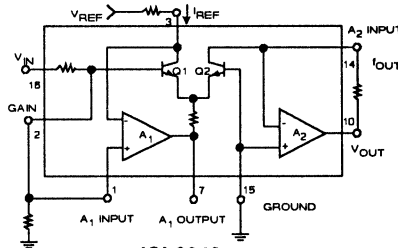
### Applications:

- Logarithmic Signal Compression/Expansion
- Analog Computation

16 Pin Cerdip



ICL8048



ICL8049

## AD590 2-Wire, Current Output Temperature Transducer

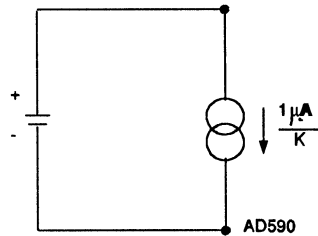
Produces an output current proportional to absolute temperature ( $1\mu\text{A}/\text{K}$ )

### Features:

- Current Output for Noise Immunity
- Wide Supply Range (+4V to +30V)
- Easy to Use
- Wide Temperature Range (-55°C to +125°C)

### Applications:

- General Purpose Temperature Sensing
- Remote Temperature Sensing



AD590

## ICL8069 Low Voltage Reference (1.2V)

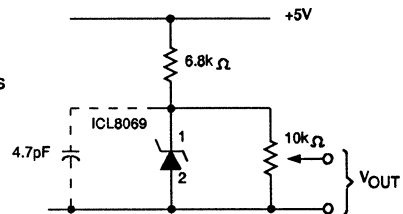
Produces a stable, temperature compensated voltage output (1.2V)

### Features:

- Bandgap Principle Achieves Low Noise, Excellent Stability
- Low Bias Current (50μA Min) - Good for Battery Powered Applications
- Low Cost

### Applications:

- A/D and D/A Reference Voltages
- Threshold Detectors
- Voltage Regulators



ICL8069

## **3 - Data Acquisition**

**3A • Sample and Hold**

**3B • Data Converters**

**3C • Switches and Multiplexers**



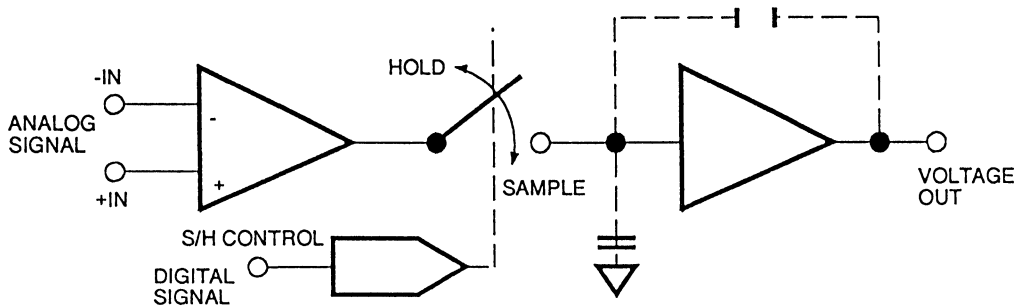
## **3 - Data Acquisition**

**3A •Sample and Hold**

**3B •Data Converters**

**3C •Switches and Multiplexers**

# Sample & Hold/Track & Hold



## Definition:

Looks at an analog signal at some point in time (sample) and holds that value of analog voltage upon command from the sample/hold digital input signal

## Key Parameters:

Acquisition Time:	Time to acquire "sample" signal
Aperture Time:	Time required to go from sample to hold
Aperture Uncertainty:	Determines accuracy of held voltage
Drift Current:	Leakage of hold capacitor
Hold Step Error:	Offset error caused by S/H switching

## Features:

	HA-2420/5	HA-5320	HA-5330	HA-5340
Internal Hold Cap		X	X	X
External Hold Cap	X	X		X
Advantage	Low Cost	0.1 mV at 1000pf Low Hold Step Error	500ns (0.01%) Fastest	-72dBc at 200 kHz Low Distortion

## Applications:

Precedes A/D converter in data acquisition system  
Peak detector  
Deglitcher  
Auto zero systems



# Sample-and-Hold Amplifiers

TYPE	SAMPLE/HOLD TYPE	TEMPERATURE RANGE	PACKAGE*	ACQUISITION TIME 12 Bit (0.01%) TYP, +25°C	CHARGE TRANSFER TYP, +25°C	APERTURE TIME TYP, +25°C	GAIN BANDWIDTH PRODUCT TYP, +25°C
HA1-2420-2 HA1-2425-5 HA3-2425-5 HA4P2425-5	General Purpose	-55°C to +125°C 0°C to +75°C 0°C to +75°C 0°C to +75°C	14-Pin Cerdip 14-Pin Cerdip 14-Pin Epoxy 20-Pin PLCC Epoxy	3.2µs (C <sub>H</sub> = 1,000pF)	10pC	30ns	2.5MHz
HA1-5320-2 HA1-5320-5 HA1-5320-8 HA4-5320-8	Industry Standard	-55°C to +125°C 0°C to +75°C -55°C to +125°C -55°C to +125°C	14-Pin Cerdip 14-Pin Cerdip 14-Pin Cerdip 20-Pin LCC Ceramic	1µs (C <sub>H</sub> = Internal)	0.1pC	25ns	2.0MHz C <sub>H</sub> = 100pF
HA1-5330-5 HA1-5330-4 HA1-5330-2	High Speed	0°C to +75°C -25°C to +85°C -55°C to +125°C	14-Pin Cerdip 14-Pin Cerdip 14-Pin Cerdip	500ns	0.05pC	20ns	4.5MHz
HA1-5340-5 HA1-5340-4 HA1-5340-9	Low Distortion	0°C to +75°C -25°C to +85°C -40°C to +85°C	14-Pin Cerdip 14-Pin Cerdip 14-Pin Cerdip	0.7µs	0.5pC	15ns	10MHz

3A

Sample/Hold

	HA-2420/25	HA-5320	HA-5330	HA-5340
INTERNAL HOLD CAP	-	X	X	X
EXTERNAL HOLD CAP	X	X	-	X
SEE FIGURE	3	1	2	1

All Harris Sample and Hold's are monolithic and are specified at 12-bit accuracy for Settling Time (0.01%)

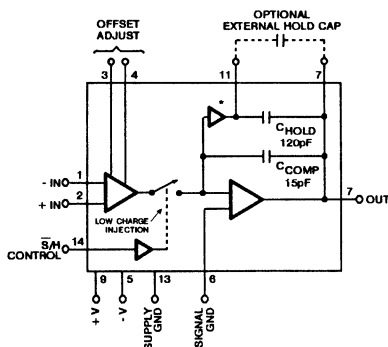


FIGURE 1. HA-5340 AND HA-5320

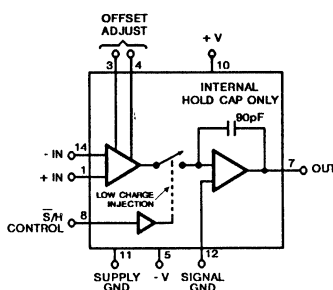


FIGURE 2. HA-5330

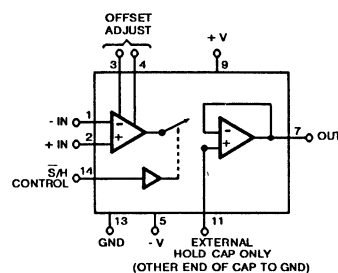


FIGURE 3. HA-2420/25

# Sample-and-Hold/Track-and-Hold Amplifiers

## HA-5340 - LOW DISTORTION, HIGH SPEED

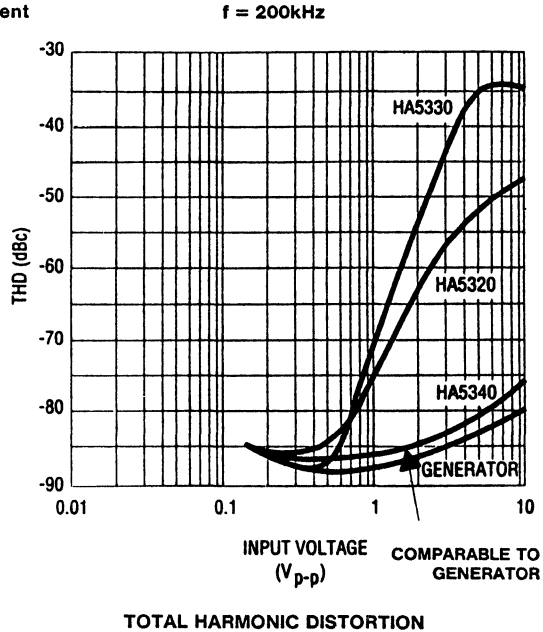
- Includes Internal Hold Capacitor
- Provision for External Hold Capacitor to Reduce Drift Current
- Amplify Signals as Well as Sample-and-Hold

### KEY FEATURES

- Low Distortion (Sample Mode) ..... -76dB  
 $V_{IN} = 200\text{KHz}, 10\text{Vp-p}$
- Fast Acquisition Time (12-Bit 0.01%) ..... 700ns
- Fast Hold Mode Settling Time (0.01%) ..... 200ns
- Bandwidth (Internal Hold Capacitor) ..... 10MHz
- Droop Rate (Internal Hold Capacitor) .....  $0.1\mu\text{V}/\mu\text{s}$
- Aperture Uncertainty ..... 0.2ns

### APPLICATIONS

- Wideband/Precision Data Acquisition
- Signal Processing and Conversion
- Computer Add-On Boards
- Navigation and Guidance Systems
- Precision Peak Detector
- Auto-Zero Systems



**THD** - Distortion at the Output due to nonlinear characteristics of the device when a pure sine wave of a specific frequency and amplitude is applied to input.

Measure in dB as the ratio of sum of the power of all harmonics to the power of the fundamental.

HA-5340		
$V_{IN}$ FUNDAMENTAL (kHz)	$V_{IN}$ AMPLITUDE (Vp-p)	SAMPLE MODE THD WORSE CASE (dB)
200	5	-90
200	10	-76
200	20	-70
500	5	-66

# Data Converters

## Analog to Digital converters (A/Ds or ADCs)

Produces a digital output code that is proportional to the magnitude of the analog input signal at the time of the conversion.

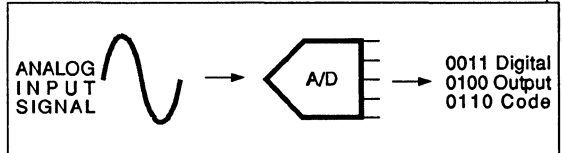
### Key Parameters:

**Resolution** - Precision by which the digital code represents the analog signal's magnitude.

- Specified as:
- # bits (Binary Format)
  - # digits (Decimal Format)
  - # counts (Integrating Types)
  - Minimum Resolvable Input Voltage

**Speed** - Maximum number of conversions per second

- Specified as:
- Hz (Hertz) = cycles per second
  - XSPS = samples per second
  - Throughput = samples per second
  - tconv. in units of time



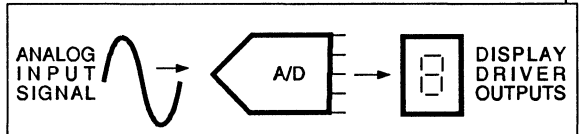
Architecture	Internal Structures	Harris Features
Flash Subranging Successive Approximation Integrating	Fastest, limited resolution Fast, two-step Flash Med. speed, med. resolution Slow, high resolution	4 to 8 bits; up to 25M 10 bits; internal track & hold 8 to 14 bits; up to 25 KSPS Up to 5.5 digits (18 + bits)

## A/D Converters with Display Outputs

Special purpose integrating ADC's for use with LED, LCD, and LCD-bargraph displays

### Features:

- Directly drives display
- Integrating architecture - up to 4 1/2 digit resolution; 30 SPS

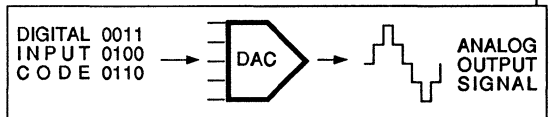


## Digital to Analog Converters (DACs or D/As)

Produces a discrete analog output level proportional to the digital input code

### Key Parameters:

- Resolution** - Converter Precision (#bits) - see definition above
- Settling Time** ( $t_s$ ) - time for analog output to reach its final value
- Output Types** -  $I_{out}$  (Current Output) or  $V_{out}$  (voltage output)
- Type** - Multiplying: Needs external reference
- Non-multiplying: Has internal reference

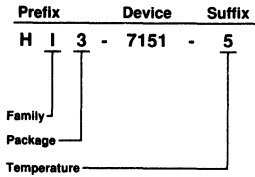


### Features:

- Wide selection of speeds (to  $t_s < 20ns$ ) and resolutions (up to 16 bits)
- Many second sources to industry standard devices

# Data Converters

## H SERIES



### Family:

A Analog  
C Communications  
D Digital  
I Interface  
M Memory  
PL Programmable Logic  
S Military/Aerospace  
V High Voltage

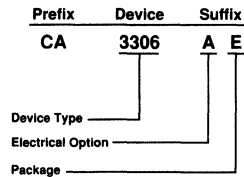
### Package:

1 Ceramic DIP  
1B Brazed Seal  
2 TO-5  
3 Epoxy DIP  
4 Leadless Carriers  
4P Plastic Leaded Chip Carrier  
5 Ceramic Substrate  
7 Mini DIP  
9 Flat Pack  
9P Small Outline  
0 Chip Form

### Temperature:

1 -55°C to +200°C  
2 -55°C to +125°C  
4 -25°C to +85°C  
5 0°C to +75°C  
6 100% 25°C Probe (Dice Only)  
7 0°C to +75°C with 96 hour burn-in  
8 Dash 8 Program, hi-rel processing with burn-in  
9 -40°C to +85°C  
9+ -40°C to +85°C with burn-in

## CA SERIES



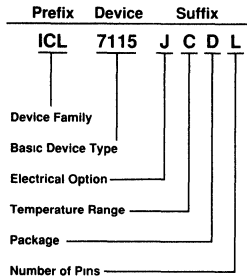
### Prefix:

CA Linear ICs

### Package:

D Ceramic DIP  
E Plastic DIP  
F CERDIP  
H Chip  
J 3-Layer Ceramic Leadless Chip Carrier  
K Ceramic Flat Package  
L Single Layer Ceramic Leadless Chip Carrier  
M Small-Outline Plastic Package  
Q Plastic-Chip-Carrier Package

## ICL SERIES



### Pin-Count Designators

Suffix	Number of Pins
A	8
B	10
C	12
D	14
E	16
F	22
G	24
H	42
I	28
J	32
K	35
L	40
N	18
P	20
R	3
W	10 (0.230" pin circle, isolated case)
44	44

### Prefix:

AD Analog Devices Alternate Source  
ADC National Semiconductor Alternate Source  
DG Siliconix Alternate Source  
ICL Linear IC  
ICM Microperipheral IC  
IH Analog Switch Family  
IM Microcontroller IC

### Temperature Range

C Commercial 0°C to 70°C  
I Industrial -25°C to 85°C or -40°C to 85°C (Specified on Datasheet)  
M Military -55°C to +125°C

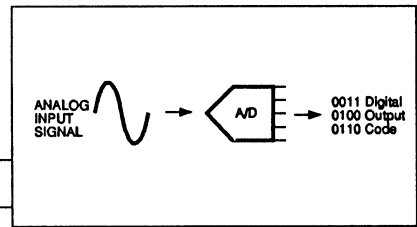
### Package:

B SOIC  
D Ceramic (Side-Brazed) Dual-In-Line  
F Ceramic Flat-Pack  
I 16-Pin (6 x 7 Pin Spacing) Hermetic Hybrid DIP  
J CERDIP Dual-In-Line  
L Leadless Ceramic Quad-Pack  
M Plastic Quad-Pack (PQFP)  
P Plastic Dual-In-Line  
S TO-52  
T TO-5 (Also TO-78, TO-99, TO-100)  
U TO-72 (Also TO-18, TO-71)  
Z TO-92  
/W Wafer  
/D Dice

### Exceptions to Package-Type Designators

Prefix	Package-Type Designator
H	AD (D/A Converter) Series TO-52
D	CERDIP Ceramic Dual-In-Line Package
N	Epoxy Dual-In-Line Package
R	TO-92

# Analog to Digital Converters

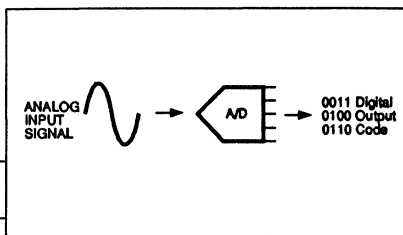


Part Number	Resolution (bits)	Conversion Time (Sample Rate)	Power Supply Requirements	Package Types	Temp Range	Features
CA3304	4	40 ns (25MSPS)	+5V @ 10 mA	16-pin ceramic DIP 16-pin plastic DIP	IND MIL	Low power - 25 mW typ @25MSPS SOS Flash
CA3306	6	67 ns (15MSPS)	+5V @ 20 mA	18-pin ceramic DIP 18-pin plastic DIP LCC SOIC	IND MIL	Low power - 70 mW typ @15MSPS 1k $\Omega$ ladder resistance Replaces micropower MP76 SOS Flash
HI-5700	8	50 ns (20MSPS)	+5V @ 110 mA	28-pin plastic DIP	COM IND	Flash, improved MP7684 9 MHz input bandwidth
CA3318	8	67 ns (15MSPS)	+5V @ 60 mA	24-pin ceramic DIP 24-plastic DIP	IND	Lowest power 8 bit flash 2.5 MHz input bandwidth
ADC0802L	8	110 $\mu$ s (9KSPS)	+5V @ 2.5 mA	20-pin Cerdip 20-pin plastic DIP	COM IND MIL	Single 5V supply, differential inputs $V_{REF}/2 = 2.50$ VDC 1/4 LSB unadjusted error
ADC0803L	8	110 $\mu$ s (9KSPS)	+5V @ 2.5 mA	20-pin Cerdip 20-pin plastic DIP	COM IND MIL	Single 5V supply, differential inputs $V_{REF}/2$ adjusted for correct F.S. reading 1/2 LSB unadjusted error
ADC0804	8	110 $\mu$ s (9KSPS)	+5V @ 2.5 mA	20-pin Cerdip 20-pin plastic DIP	COM IND MIL	Single 5V supply, differential inputs $V_{REF}/2 = 2.50$ VDC. 1/2 LSB unadjusted error
HI-7152	10	5 $\mu$ s (200KSPS)	+5V @ 30 mA -5V @ 15 mA	28-pin plastic DIP	COM IND	200 KSPS throughput rate Internal track and hold amplifier 1.5 MHz T/H bandwidth 2 step flash
HI-7153	10	5 $\mu$ s (200KSPS)	+5V @ 30 mA -5V @ 15 mA	40-pin plastic DIP	COM IND	8 input mux, internal track & hold 200 KSPS throughput rate 2 step flash
HI-7151	10	10 $\mu$ s (100KSPS)	+5V @ 30 mA -5V @ 15 mA	28-pin plastic DIP	COM IND	100 KSPS throughput rate Internal track and hold amplifier 1.5 MHz T/H bandwidth 2 step flash
CA3310	10	13 $\mu$ s (77KSPS)	+5V @ 8 mA	24-pin ceramic DIP 24-pin plastic DIP SOIC	IND MIL	Low power - 15 mW typ Internal clock, 1.5 MHz input bandwidth S.A.R. w/ track & hold
CDP68-HC68AZ	10	14 $\mu$ s (71KSPS)	+5V @ 2 mA	16-pin plastic DIP 20-pin SOIC	IND	Low cost, low power CMOS SAR type serial output 8 input MUX
HI-774	12	8 $\mu$ s (125KSPS)	$\pm 15$ V @ 17 mA/28 mA +5V @ 17 mA	28-pin sidebrazed	COM MIL	Internal reference, low noise Faster version of HI674
HI-674	12	12 $\mu$ s (83KSPS)	$\pm 15$ V @ 15 mA/28 mA +5V @ 15 mA	28-pin ceramic DIP LCC	COM MIL	Low noise, faster version of HI574
HI-574	12	25 $\mu$ s (40KSPS)	$\pm 15$ V @ 15 mA/28 mA +5V @ 15 mA	28-pin sidebrazed LCC	COM MIL	Low noise, improved AD574A, Faster interface logic
ICL7112	12	40 $\mu$ s (25KSPS)	+5V @ 4 mA	40-pin ceramic DIP	COM IND MIL	1: 1.85 radix, error correcting, calibration PROM, low drift
ICL7109	12	133 ms (7.5SPS)	+5V @ 1.5 mA	40-pin ceramic DIP 40-pin Cerdip 40-pin plastic DIP	COM IND MIL	Integrating type Rollover error $\pm 1$ count Differential inputs

3B  
Data Converters

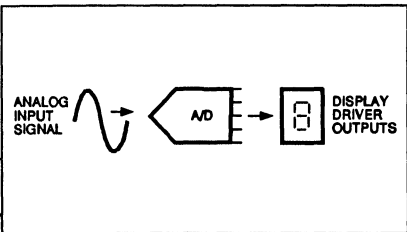


# Analog to Digital Converters (continued)



Part Number	Resolution (bits)	Conversion Time (Sample Rate)	Power Supply Requirements	Package Types	Temp Range	Features
ICL7115	14	40 $\mu$ s (25KSPS)	$\pm$ 5V @ 4 mA/6 mA	40-pin ceramic DIP LCC	COM IND MIL	S.A.R. No missing codes to 14 bits No gain or offset adjust PROM corrected
ICL7104 and ICL8052	14	164 ms (6SPS)	$\pm$ 15V @ 13 mA +5V @ 600 $\mu$ A	2 chip set 14-pin plastic DIP 14-pin ceramic DIP 14-pin CERDIP and 40-pin plastic DIP	COM	Integrating type Low leakage 30 pA max 30 $\mu$ V typical noise
ICL7104 and ICL8068	14	164 ms (6SPS)	$\pm$ 15V @ 15 mA +5V @ 600 $\mu$ A	2 chip set 14-pin ceramic DIP 14-pin CERDIP and 40-pin plastic DIP	COM	Integrating type Low noise 2 $\mu$ V typ, 165 pA max leakage
ICL7135	4 1/2 Digits (15 bits)	250 ms (4SPS)	$\pm$ 5V @ 3 mA	28-pin plastic DIP 28-pin CERDIP	COM	100 $\mu$ V resolution Differential inputs Muxed BCD output
ICL7104-16 and ICL8052	16	655 ms (1.5SPS)	$\pm$ 15V @ 13 mA +5V @ 600 $\mu$ A	2 chip set 14-pin plastic DIP 14-pin ceramic DIP 14-pin CERDIP and 40-pin plastic DIP	COM	Integrating type Low leakage 30 pA max 30 $\mu$ V typical noise
ICL7104-16 and ICL8068	16	655 ms (1.5SPS)	$\pm$ 15V @ 15 mA +5V @ 600 $\mu$ A	2 chip set 14-pin ceramic DIP 14-pin CERDIP 40-pin plastic DIP	COM	Integrating type Low noise 2 $\mu$ V typ, 165 pA max. leakage
HI-7159	5.5/4.5 Digits (18/15 bits)	67 ms (5.5 digit) (15SPS) 17ms (4.5 digit) (60SPS)	$\pm$ 5V @ 10 mA/4.5 mA	28-pin plastic DIP	COM	Integrating type 5.5 or 4.5 digit modes 10 $\mu$ V resolution in 5 1/2 digit mode Parallel/serial output

# Analog to Digital Converters with Display Outputs



Part Number	Output Type	Resolution	Conversion Time (Sample Rate)	Package Types	Features
ICL7182	LCD, 3X	101 Bargraph Segments Plus Zero	40 ms (25 SPS)	40-pin plastic DIP 44-pin SOIC	1% resolution, 0.2 to 1.1V input range ICL7182 Display Kit available
CA3162 and CA3161	LED, CA BCD	3 Digits	10 ms/250 ms (96SPS/4SPS)	16-pin plastic DIP and 16-pin plastic DIP	BCD to 7 Segment Converter, 2 chip set makes a complete DPM A-D Converter, 3 digit output, "EEE": positive over-range indication, "-": negative over-range display.
ICL7106	LCD, DD	3 1/2 Digits	333 ms (3SPS)	40-pin plastic DIP 44-pin SOIC	Low cost Low noise (15µV p-p) Direct Display Drive Auto-Zero integrating
ICL7107	LED, CA	3 1/2 Digits	333 ms (3SPS)	40-pin plastic DIP 40-pin ceramic DIP 40-pin CERDIP 44-pin SOIC	Low cost Low noise (15µV p-p) Direct Display Drive Auto-Zero integrating
ICL7116	LCD, DD	3 1/2 Digits	333 ms (3SPS)	40-pin plastic DIP 44-pin SOIC	ICL7106 with Display Hold function
ICL7117	LED, CA	3 1/2 Digits	333 ms (3SPS)	40-pin plastic DIP	ICL7107 with Display Hold function
ICL7126	LCD, DD	3 1/2 Digits	333 ms (3SPS)	40-pin plastic DIP 40-pin ceramic DIP 40-pin CERDIP	Low power version of ICL7106 *Not recommended for new designs (see ICL7136)
ICL7136	LCD, DD	3 1/2 Digits	333 ms (3SPS)	40-pin plastic DIP 40-pin ceramic DIP 40-pin CERDIP 44-pin SOIC	Low power version of ICL7106 *Improved version of ICL7126 ok for new designs
ICL7137	LED, CA	3 1/2 Digits	333 ms (3SPS)	40-pin plastic DIP 40-pin ceramic DIP 40-pin CERDIP	Low power version of ICL7107
ICL7139	LCD, 2X	3 3/4 Digits	400 ms (2.5SPS)	40-pin plastic DIP 40-pin SOIC	13 Ranges, Autoranging Multimeter ICL7139 EVKit, ICL7139 Display Kit available
ICL7149	LCD, 2X	3 3/4 Digits	400 ms (2.5SPS)	40-pin plastic DIP 44-pin SOIC	18 Ranges, Autoranging Multimeter ICL7149 Display Kit available (Use ICL7139 EV Kit to evaluate)
ICL7135	MUXED BCD	4 1/2 Digits	250 ms (4SPS)	28-pin plastic DIP 28-pin CERDIP	100 µVolt resolution, differential inputs
ICL71C03 and ICL8052	MUXED BCD	4 1/2 Digits	333 ms (3SPS)	28-pin plastic DIP and 14-pin plastic DIP 14-pin ceramic DIP 14-pin CERDIP	2 chip set Low leakage 50 pA max
ICL71C03 and ICL8068	MUXED BCD	4 1/2 Digits	333 ms (3SPS)	28-pin plastic DIP and 14-pin ceramic DIP 14-pin CERDIP	2 chip set Low noise 2 µV typ
ICL7129	LCD, 3X	4 1/2 Digits	500 ms (2SPS)	40-pin plastic DIP 44-pin SOIC	10 µV resolution, 1X, 10X range selection Evaluation Kit ICL7129/EVKit available
HI-7159	MUXED BCD	5 1/2 & 4 1/2 Digits (18 bits)	67 ms (5 1/2 Digit) (15SPS) 17 ms (4 1/2 Digit) (60SPS)	28-pin plastic DIP	Integrating type 5 1/2 or 4 1/2 Digit Modes 10 µV resolution

# Digital to Analog Converters

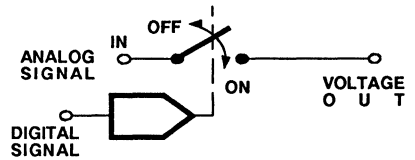


Part Number	Resolution (bits)	Conversion Time (Sample Rate)	Power Supply Requirements	Package Types	Temp Range	Features
CA3338	8	20ns (typ) (50MSPS)	+5V @ 25 mA (dynamic)	16-pin plastic DIP 16-pin ceramic DIP	IND MIL	Video speed, voltage output 2 performance grades External reference
AD7523	8	200ns (max) (5MSPS)	+5V to +16V @ 2.5 mA (excl 1 ladder)	16-pin plastic DIP 16-pin Cerdip	COM MIL	Second source 3 performance grades External reference Current output
AD7520/30	10	500ns (typ) (2MSPS)	+5V to +15V @ 2 mA (excl 1 ladder)	16 pin plastic DIP 16 pin Cerdip	COM MIL	Second source 3 performance grades External reference Current output
AD7533	10	800ns (max) (1.25MSPS)	+5V to +15V @ 2.5 mA (excl 1 ladder)	16 pin plastic DIP	COM	Second source Low cost External reference Current output
HI-565A	12	250ns (max) (4MSPS)	±15V @ +12 mA/ -15 mA	24 pin ceramic DIP	COM MIL	Industry standard DI process Internal reference Current output
HI-562A	12	400ns (max) (2.5MSPS)	+5V @ 15 mA -15V @ 23 mA	24 pin ceramic DIP	COM IND MIL	Industry standard DI process External reference Current output
AD7521/31	12	500ns (typ) (2MSPS)	+5V to +15V @ 2 mA (excl 1 ladder)	18 pin plastic DIP 18 pin ceramic DIP	COM MIL	12 bit versions of AD7520/30
AD7541	12	1µs (max) (1MSPS)	+5V to +16V @ 2 mA (excl 1 ladder)	18 pin plastic DIP 18 pin ceramic DIP	COM IND MIL	Second source External reference Current output
HI-DAC80V	12	1.5µs (typ) (667KSPS)	±12V to ±15V @ +15 mA/ -20mA	24 pin ceramic DIP	COM	Second source Low cost DI process Voltage output Internal reference
HI-DAC85V	12	1.5µs (typ) (667KSPS)	±12V to ±15V @ +15 mA/ -20 mA	24 pin ceramic DIP	IND	Second source Low cost DI process Voltage output Internal reference
AD7545	12	2µs (max) (500KSPS)	+5V to +16V @ 2 mA	20 pin plastic DIP 20 pin Cerdip	COM IND MIL	Second source External reference Current output
ICL7134	14, 13, 12	1µs (typ) (1MSPS)	+5V @ 2.5 mA (excl 1 ladder)	28 pin Cerdip	COM IND MIL	Bipolar and unipolar version External reference Current output
HI-DAC16	16	1µs (typ) (1MSPS)	±15V @ 18 mA	40 pin ceramic DIP	COM	Extension of HI-562 DI process External reference Current output
ICL7121	16, 15, 14	3µs (max) (333KSPS)	+5V @ 1.5 mA	28 pin Cerdip	COM MIL	PROM corrected External reference Current output

# Analog Switches and Multiplexers

## Analog Switches:

An Analog Switch will pass or block an analog signal. It is commanded by a digital signal to pass (turn-on) or block (turn-off) the signal.



### Key Parameters:

$R_{ds(on)}$ or $R_{on}$ :	Resistance of Switch when closed
$T_{off/on}$ or $T_{access}$ :	Time to open/close switch
$I_d$ or $I_s$ or $I_{off}$ :	Leakage current when switch is open
$V_s$ or $V_{analog}$ :	Analog input signal range

### Features:

Fast Switching - 30ns - HI-201HS  
 High Off Isolation - 65 dB at 10 MHz - HI-222  
 Low On Resistance - HI-201HS, HI-30X, DG-30X

### Types, Configurations ( i.e. Single Pole Single Throw)

SPST - Single Dual, Quad  
 4PST, SPDT - Single, Dual  
 DPST, DPDT - Single, Dual  
 Video Switches  
 Virtual Ground Switch, Switch Driver

## Analog Multiplexers (MUX)

An Analog Multiplexer is a group of analog switches with their analog outputs tied together.

### Key Parameters

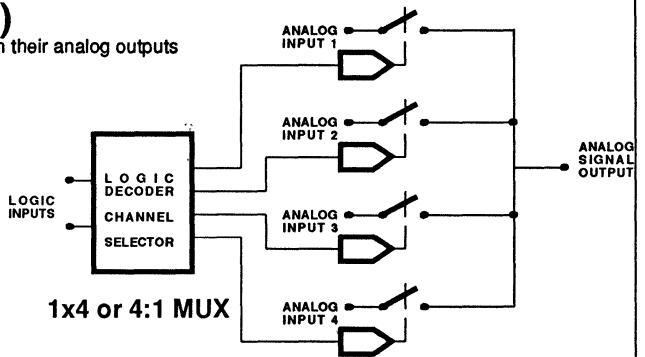
Same as above

### Features

70 Volt Peak-to-Peak Overvoltage Protection - HI-54X  
 High Channel Impedance in Fault Condition - IH51XX  
 Digital Input Latches - DG52X

### Types, Configurations

1x8, 1x16, Dual 1x4  
 Dual 1x8, Latchable, Programmable Configuration  
 Overvoltage Protected, Fault Protected, Video



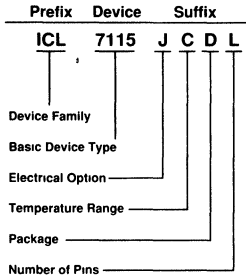
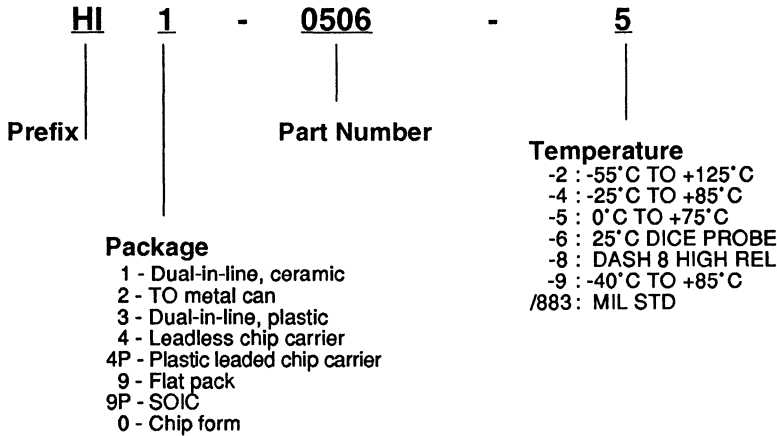
## Applications of Switches and Muxes

Route analog signals in:

- Data Acquisition systems
- Video Equipment
- Instrumentation and Control Circuitry
- Signal Processing
- Data Processing and Control Systems

# Analog Switches and Multiplexers

## Part Description:



### Prefix:

- AD Analog Devices Alternate Source
- ADC National Semiconductor Alternate Source
- DG Siliconix Alternate Source
- ICL Linear IC
- ICM Microperipheral IC
- IH Analog Switch Family
- IM Microcontroller IC

### Temperature Range

- C Commercial 0°C to 70°C
- I Industrial -25°C to 85°C or -40°C to 85°C (Specified on Datasheet)
- M Military -55°C to +125°C

### Package

- B SOIC
- D Ceramic (Side-Brazed) Dual-In-Line
- F Ceramic Flat-Pack
- I 16-Pin ( 6 x 7 Pin Spacing) Hermetic Hybrid DIP
- J CERDIP Dual-In-Line
- L Leadless Ceramic Quad-Pack
- M Plastic Quad-Pack (PQFP)
- P Plastic Dual-In-Line
- S TO-52
- T TO-5 (Also TO-78, TO-99, TO-100)
- U TO-72 (Also TO-18, TO-71)
- Z TO-92
- W Wafer
- /D Dice

### Pin-Count Designators

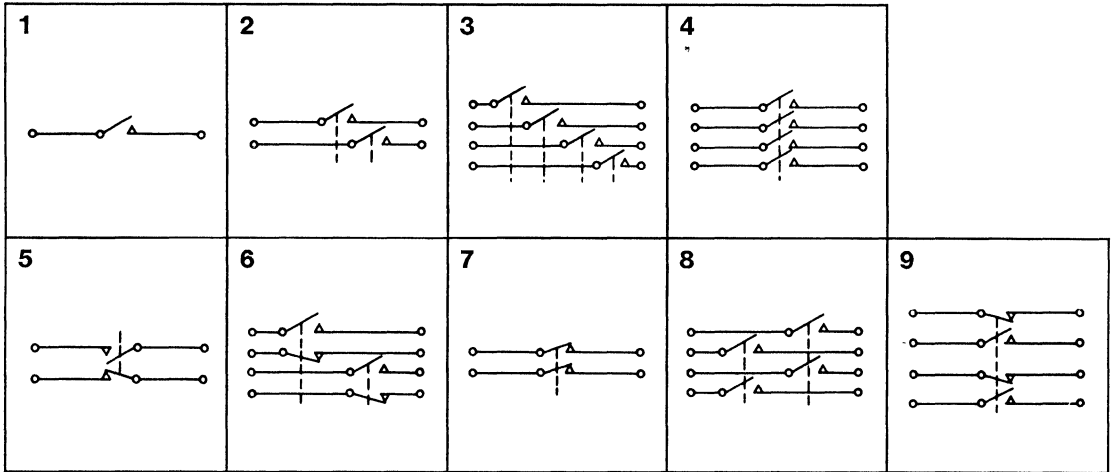
Suffix	Number of Pins
A	8
B	10
C	12
D	14
E	16
F	22
G	24
H	42
I	28
J	32
K	35
L	40
N	18
P	20
R	3
W	10 (Ø 230µ pin circle isolated case)
44	44

### Exceptions to Package-Type Designators

Exceptions to Package-Type Designators	
	<b>DG (Analog Switch &amp; MUX) Series</b>
A	10-Pin Metal Can
L	14-Pin Flat Pack
P	Ceramic (Dual-In-Line Package (Special Order Only)
K	CERDIP
Y	SOIC
	<b>AD (D/A Converter) Series</b>
H	TO-52
D	CERDIP Ceramic Dual-In-Line Package
N	Epoxy Dual-In-Line Package
R	TO-92

# Analog Switches

All Switches with Prefix "HI" are Dielectrically Isolated (DI)



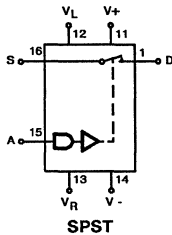
3C  
Switches/Muxes

SPST (1)	DUAL SPST (2)	QUAD SPST (3)	4PST (4)	SPDT (5)	DUAL DPST (6)	DPST (7)	DUAL DPST (8)	DPDT (9)
<b>JFET SWITCHES</b>								
	DG180 DG181 DG182	IH401A		DG186 DG187 DG188	DG189 DG190 DG191		DG183 DG184 DG185	
<b>CMOS SWITCHES</b>								
HI-5040 IH5040 IH5140	DG200 DG300A HI-200 HI-222 HI-300 HI-304 HI-381 HI-5041 HI-5048 IH5041 IH5148 IH5341	DG201A DG202 DG211 DG212 DG308A DG309 HI-201 HI-201HS IH5052 IH5053 IH5352	HI-5047 HI-5047A IH5047	DG301A HI-301 HI-305 HI-387 HI-5042 HI-5050 IH5042 IH5142 IH5150	DG303A HI-303 HI-307 HI-390 HI-5043 HI-5051 IH5043 IH5143 IH5151	HI-5044 IH5044 IH5144	DG302A HI-302 HI-306 HI-384 HI-5045 HI-5049 IH5045 IH5145 IH5149	HI-5046 HI-5046A IH5046

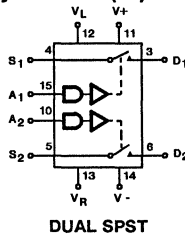
<b>P-CHANNEL JFET SWITCH CONFIGURATION</b>			
SINGLE	DUAL	TRIPLE	QUAD
	IH5017		IH5009
IH5022	IH5018	IH5014	IH5010
	IH5019		IH5011
IH5024	IH5020	IH5016	IH5012

# Analog Switches (Continued)

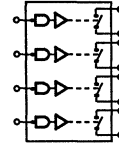
All Switches with Prefix "HI" are Dielectrically Isolated (DI)



SPST



DUAL SPST

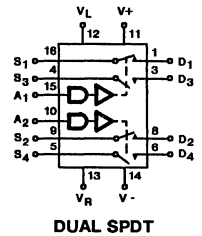
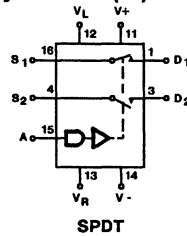
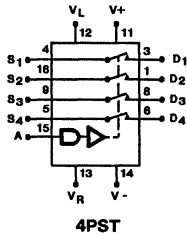


QUAD SPST

Device	Suffix Codes	MIL Spec	R <sub>ds(ON)</sub> Ω Max (1)	Switch "ON" V	Switch "OFF" V	Analog Sig. Range V	I <sub>S</sub> Max 25°C nA	I <sub>S</sub> Max 70/ 75/85°C nA	T ON nSec	T OFF nSec	Features
<b>SINGLE POLE SINGLE THROW (SPST)</b>											
HI1-5040	-2, -5, -7	HI1-5040/883	50 Typ.	3.0	0.8	V- to V+	0.8 Typ.	500	370	280	
IH5140	MJE, CJE, CPE	IH5140MJE/883B	50	2.4	0.8	±11	5.0	100	175	150	
<b>DUAL SINGLE POLE SINGLE THROW (DUAL SPST)</b>											
DG180	AA, BA AP, BP	DG180AA/883B DG180AP/883B	10	0.8	2.0	(V-)+7.5 to V+	1	300	300	350	Lowest R <sub>ds(ON)</sub>
DG181	AA, BA AP, BP	DG181AA/883B DG181AP/883B	30	0.8	2.0	(V-)+5 to V+	1	100	150	180	Low R <sub>ds(ON)</sub>
DG182	AA, BA AP, BP	DG182AA/883B DG182AP/883B	75	0.8	2.0	(V-)+7.5 to V+	1	100	250	300	
DG200	AA, BA AK, BK, CJ	DG200AA/883B DG200AK/883B	100	2.4	0.8	V- to V+	5	100	1000	500	
HI1-0200 HI2-0200 HI13-0200	-2, -4, -5, -7 -2, -4, -5, -7 -5	HI1-0200/883 HI2-0200/883	80	0.8	2.4	V- to V+	50	500	240	500	
HI1-0222 HI3-0222 HI4P0222	-5, -9 -5 -5	HI1-0222/883	50	0.8	2.4	V- to V+	2.5	200	100	70	RF Video T-Switch  PLCC
DG300A	AA, BA, CA BK, CK, CJ	DG300AAK/883B	50	4	0.8	V- to V+	5	100	150	130	
HI1-0304 HI2-0304	-2, -5 -2, -5	HI1-0304/883	50	11	3.5	V- to V+	5	100	210	160	CMOS Logic, Very Low Leakage
HI1-0381 HI2-0381	-2, -5 -2, -5	HI1-0381/883 HI2-0381/883	50	4	0.8	V- to V+	5	100	210	160	Very Low Leakage
HI1-5041 HI3-5041	-2, -5, -7 -5	HI1-5041/883	50 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	10Ω R <sub>ds(ON)</sub> Matching
HI1-5048 HI3-5048	-2, -5, -7 -5	HI1-5048/883	25 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	5Ω R <sub>ds(ON)</sub> Matching
IH5141	MJE, CJE, CPE	IH5141MJE/883B	75	2.4	0.8	±10	5	100	150	125	
IH5341	MTW, ITW, CPD	IH5341MTW/883B	75	2.4	0.8	V- to V+	1	100	150	80	RF Video T-Switch
<b>QUAD SINGLE POLE SINGLE THROW</b>											
DG201	AK, BK, CJ	DG201AK/883B	125	2.4	0.8	V- to V+	5	100	480	370	Very Low Leakage
DG201A	AK, BK, CK, CJ	DG201AAK/883B	75	0.8	2.4	V- to V+	5		480	370	Very Low Leakage
HI1-0201 HI3-0201 HI4P0201 HI9P0201	-2, -4, -5, -7 -5 -5 -5		80	0.8	2.4	V- to V+	50	250	185	220	
		HI4-0201/883									PLCC SOIC LCC
HI3-0201HS HI4P0201HS HI9P0201HS	-4, -5 -5 -5, -9	HI1-0201HS/883	50	0.8	2.4	V- to V+	1	50	30	50	High Speed
		HI4-0201HS/883									PLCC SOIC LCC
DG202	AK, BK, CK, CJ	DG202AK/883B	175	2.4	0.8	V- to V+	5		480	370	
DG211	CJ CY		175	0.8	2.4	V- to V+	5		460	360	Low Cost
											SOIC
DG212	CJ CY		175	2.4	0.8	V- to V+	5		460	360	Low Cost
											SOIC
DG308A	AK, BK, CK, CJ CY	DG308AAK/883B	100	11	3.5	V- to V+	5	100	130	90	CMOS Logic, Single or Dual Supply Oper.
											SOIC
DG309	AK, BK, CK, CJ CY	DG309AK/883B	100	3.5	11	V- to V+	5	100	130	90	CMOS Logic, Single or Dual Supply Oper.
											SOIC
IH401A			30 Typ.	4	0.8	±11	0.5	50	50	150	Quad VarAFET™ Switch. Use IH6201 Driver
IH5052	MDE, CDE	IH5052MDE/883B	80	0.8	2.4	±10	5	100	1000	500	
IH5053	MDE, CDE	IH5053MDE/883B	80	2.4	0.8	±10	5	100	1000	500	
IH5352	MJE, IJE, CPE	IH5352MJE/883B	75	2.4	0.8	V- to V+	2	100	150	80	RF Video T-Switch

# Analog Switches (Continued)

All Switches with Prefix "HI" are Dielectrically Isolated (DI)



Device	Suffix Codes	MIL Spec	Rds(ON) Ω Max (1)	Switch "ON" V	Switch "OFF" V	Analog Sig. Range V	I <sub>C</sub> Max 25°C nA	I <sub>C</sub> Max 70/ 75/85°C nA	T ON nSec	T OFF nSec	Features
<b>FOUR POLE SINGLE THROW (4PST)</b>											
HI1-5047 HI3-5047	-2, -5, -7 -5	HI1-5047/883	50	3	0.8	V- to V+	0.8 Typ.	500	370	280	10Ω Max Rds(ON) Matching
HI1-5047A HI3-5047A	-2, -5, -7 -5	HI1-5047A/883	25 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	5Ω Max Rds(ON) Matching

Device	Suffix Codes	MIL Spec	Rds(ON) Ω Max (1)	V <sub>INH</sub> Min V	V <sub>INL</sub> Max V	Analog Sig. Range V	I <sub>C</sub> Max 25°C nA	I <sub>C</sub> Max 70/ 75/85°C nA	T ON nSec	T OFF nSec	Features
<b>SINGLE POLE DOUBLE THROW (SPDT)</b>											
DG186	AA, BA AP, BP	DG186AA/883B DG186AP/883B DG186AL/883B	10	2	0.8	(V-)+7.5 to V+	15	300	350	300	Channel 1 "ON", Channel 2 "OFF"
DG187	AA, BA AP, BP	DG187AA/883B DG187AP/883B DG187AL/883B	30	2	0.8	(V-)+7.5 to V+	5	100	150	180	Channel 1 "ON", Channel 2 "OFF"
DG188	AA, BA AP, BP	DG188AA/883B DG188AP/883B	75	2	0.8	(V-)+5 to V+	5	100	250	300	Channel 1 "ON", Channel 2 "OFF"
DG301A	AA, BA, CA AK, BK, CK, CJ	DG301AAA/883B	50	2.4	0.8	V- to V+	5	100	150	130	Channel 1 "ON", Channel 2 "OFF"
HI1-0305 HI2-0305	-2, -5 -2, -5	HI1-0305/883	50	11	3.5	V- to V+	5	100	210	160	CMOS Logic, Very Low Leakage
HI1-0387 HI2-0387	-2, -5 -2, -5		50	4	0.8	V- to V+	5	100	210	160	Channel 1 "ON", Channel 2 "OFF"
HI1-5042 HI3-5042	-2, -5, -7 -5	HI1-5042/883	50 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	Channel 1 "ON", Channel 2 "OFF" 10Ω Max Rds(ON) Matching
HI1-5050 HI3-5050	-2, -5, -7 -5, -7	HI1-5050/883	25 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	Channel 1 "ON", Channel 2 "OFF" 5Ω Max Rds(ON) Matching
IH5142	MJE, CJE, CPE	IH5142MJE/883	75 Typ.	2.4	0.8	±10	5	100	370	250	Channel 1 "ON", Channel 2 "OFF"

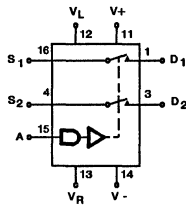
Device	Suffix Codes	MIL Spec	Rds(ON) Ω Max (1)	V <sub>INH</sub> Min V	V <sub>INL</sub> Max V	Analog Sig. Range V	I <sub>C</sub> Max 25°C nA	I <sub>C</sub> Max 70/ 75/85°C nA	T ON nSec	T OFF nSec	Features	
<b>DUAL SINGLE POLE DOUBLE THROW (DUAL SPDT)</b>												
DG189	AP, BP	DG189AP/883B	10	2	0.8	(V-)+7.5 to V+	15	300	350	300	Channel 1 "ON", Channel 2 "OFF", Lowest Rds(ON)	
DG190	AP, BP	DG190AP/883B DG190AL/883B	30	2	0.8	(V-)+7.5 to V+	5	100	180	150	Channel 1 "ON", Channel 2 "OFF", Low Rds(ON)	
DG191	AP, BP	DG191AP/883B DG191AL/883B	75	2	0.8	(V-)+5 to V+	5	100	300	150	Channel 1 "ON", Channel 2 "OFF"	
DG303A	AK, BK, CK, CJ	DG303AAK/883B	50	4	0.8	V- to V+	5	100	150	130	Channel 1 "ON", Channel 2 "OFF"	
HI1-0307	-2, -5		50	11	3.5	V- to V+	5	100	160	100	Channel 1 "ON", Channel 2 "OFF" CMOS Logic	
HI1-0390	-2, -5		50	4	0.8	V- to V+	5	100	210	160	Channel 1 "ON", Channel 2 "OFF"	
HI1-5043 HI3-5043 HI4P5043	-2, -5, -7 -5 -5	HI1-5043/883  HI4-5043/883	50 Typ.	2.4	0.8	V- to V+	0.8 Typ.	500	370	280	Channel 1 "ON", Channel 2 "OFF" 10Ω Max Rds(ON) Matching	PLCC LCC
IH5043	MJE, CJE, CPE CY	IH5043MJE/883B	75	3	0.8	±10	5	100	1000	500	Channel 1 "ON", Channel 2 "OFF"	SOIC
HI1-5051 HI3-5051 HI4P5051	-2, -5, -7 -5 -5	HI1-5051/883  HI4-5051/883	25 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	Channel 1 "ON", Channel 2 "OFF" 5Ω Max Rds(ON) Matching	PLCC LCC
IH5143	MJE, CJE, CPE	IH5143MJE/883B	75	2.4	0.8	±10	5	100	250	150	Channel 1 "ON", Channel 2 "OFF"	
IH5151	MJE, CJE, CPE	IH5151MJE/883B	30	2.4	0.8	V- to V+	2	100	500	250	Channel 1 "ON", Channel 2 "OFF"	

3C  
Switches/Muxes

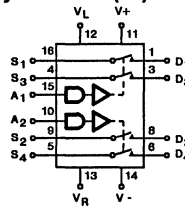


# Analog Switches (Continued)

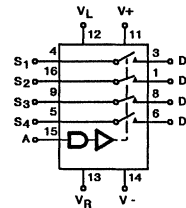
All Switches with Prefix "HI" are Dielectrically Isolated (DI)



DPST



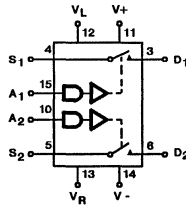
DUAL DPST



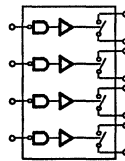
DPDT

Device	Suffix Codes	MIL Spec	Rds(ON) $\Omega$ Max (1)	Switch "ON" V	Switch "OFF" V	Analog Sig. Range V	I <sub>g</sub> Max 25°C nA	I <sub>g</sub> Max 70/ 75/85°C	T ON nSec	T OFF nSec	Features
<b>DOUBLE POLE SINGLE THROW (DPST)</b>											
HI1-5044 HI3-5044	-2, -5, -7 -5	HI1-5044/883	50 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	10 $\Omega$ Max Rds(ON) Matching
IH5144	MJE, CJE, CPE	IH5144MJE/883B	75	2.4	0.8	$\pm 10$	5	100	250	150	
<b>DUAL DOUBLE POLE SINGLE THROW (DUAL DPST)</b>											
DG183	AP, BP	DG183AP/883B DG183AL/883B	10	2	0.8	(V-)+7.5 to V+	15	300	300	350	Lowest Rds(ON)
DG184	AP, BP	DG184AP/883B DG184AL/883B	30	0.8	2	(V-)+7.5 to V+	5	100	300	350	Low Rds(ON)
DG185	AP, BP	DG185AP/883B	50	0.8	2.4	(V-)+5 to V+	5	100	100	70	RF Video T-Switch
DG302A	BK, CK, CJ	DG302AAK/883B	50	4	0.8	V- to V+	5	100	150	130	
HI1-0306	-2, -5		50	4	0.8	V- to V+	5	100	150	130	
HI1-0384	-2, -5		50	11	3.5	V- to V+	5	100	210	160	CMOS Logic, Very Low Leakage
HI1-5045 HI3-5045 HI4P5045	-2, -5, -7 -5 -5	HI1-5045/883  HI4-5045/883	50	4	0.8	V- to V+	0.8 Typ.	500	210	160	Very Low Leakage
HI1-5048 HI3-5048 HI4P5048	-2, -5, -7 -5 -5	HI1-5048/883  HI4-5048/883	25 Typ.	3	0.8	V- to V+	0.8 Typ.	500	370	280	5 $\Omega$ Rds(ON) Matching
IH5145	MJE, CJE, CPE	IH5145MJE/883B	75	2.4	0.8	$\pm 10$	5	100	150	125	

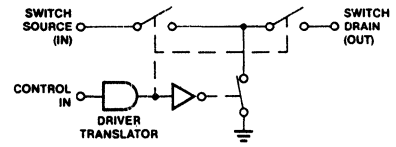
Device	Suffix Codes	MIL Spec	Rds(ON) $\Omega$ Max (1)	V <sub>inH</sub> Min V	V <sub>inL</sub> Max V	Analog Sig. Range V	I <sub>g</sub> Max 25°C nA	I <sub>g</sub> Max 70/ 75/85°C	T ON nSec	T OFF nSec	Features
<b>DOUBLE POLE DOUBLE THROW (DPDT)</b>											
HI1-5046 HI3-5046	-2, -5, -7 -5	HI1-5046/883	5	0.8	2.4	-V to +V	0.8 Typ.	500	370	280	Channel 1 "ON", Channel 2 "OFF" 10 $\Omega$ Max Rds(ON) Matching
HI1-5046A HI3-5046A	-2, -5, -7 -5	HI1-5046A/883	25	3	0.8	$\pm 10$	0.8 Typ.	500	370	280	Channel 1 "ON", Channel 2 "OFF" 5 $\Omega$ Max Rds(ON) Matching



DUAL SPST  
HI-222, IH-5341



QUAD SPST  
IH-5352

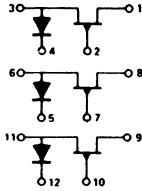


"T" SCHEMATIC

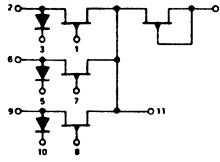
Device	Suffix Codes	MIL Spec	Rds(ON) $\Omega$ Max (1)	Switch "ON" V	Switch "OFF" V	Analog Sig. Range V	I <sub>g</sub> Max 25°C nA	I <sub>g</sub> Max 70/ 75/85°C	T ON nSec	T OFF nSec	Features
<b>RF/VIDEO "T" SWITCHES</b>											
HI1-0222 HI3-0222 HI4P0222	-5, -9 -5 -5	HI1-0222/883	5	0.8	2.4	-V to +V	2.5	200	100	70	Dual SPST
IH5341 IH5341	MTW, ITW CPD	IH5341MTW/883B	75	2.4	0.8	-V to +V	1	100	150	80	Dual SPST
IH5352 IH5352	MJE, IJE CPE	IH5352MJE/883B	75	2.4	0.8	-V to +V	2	100	150	80	Quad SPST

# Analog Switches (Continued)

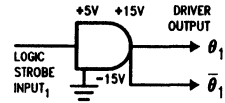
All Switches with Prefix "HI" are Dielectrically Isolated (DI)



**VIRTUAL GROUND SEPARATE OUTPUTS**



**VIRTUAL GROUND COMPENSATION FET**



**DUAL CMOS DRIVER (ONE OF 2 SHOWN)**

Device	Suffix Codes	MIL Spec	Rds(ON) Ω Max (1)	Switch "ON" V	Switch "OFF" V	Analog Sig. Range V	I <sub>D</sub> Max 25°C nA	I <sub>D</sub> Max 70°C nA	T ON nSec	T OFF nSec	Features
<b>VIRTUAL GROUND SWITCHES SEPARATE OUTPUTS</b>											
IH5011 IH5011	MDE, CDE CPE		100	1.5	11	±10	0.5	20	500	500	4 Channels, CMOS Logic
IH5012 IH5012	MDE, CDE CPE	IH5012MDE/883B	150	0.5	4.5	±10	0.5	20	500	500	4 Channels
IH5016 IH5016	MDE, CDE CPE		150	0.5	4.5	±10	0.5	20	500	500	3 Channels
IH5019 IH5019	MDE, CDE CPE		100	1.5	11	±10	0.5	20	500	500	2 Channels, CMOS Logic
IH5020 IH5020	MDE, CDE CPA		150	0.5	4.5	±10	0.5	20	500	500	2 Channels
IH5021	CPA		100	1.5	11	±10	0.5	20	500	500	1 Channel, CMOS Logic
IH5022 IH5022	MDD, CDD CPA		150	0.5	4.5	±10	0.5	20	500	500	1 Channel
IH5024 IH5024	MDE, CDE CPA		150	0.5	4.5	±10	0.5	20	500	500	1 Channel, Compensating FET
<b>COMMON OUTPUTS WITH COMPENSATION FET</b>											
IH5009 IH5009	MDD, CDD CPD	IH5009MDD/883B	100	1.5	11	±10	0.5	20	500	500	4 Channels, CMOS Logic
IH5010 IH5010	MDD, CDD CPD	IH5010MDD/883B	150	0.5	4.5	±10	0.5	20	500	500	4 Channels
IH5014 IH5014	MDD, CDD CPD		150	0.5	4.5	±10	0.5	20	500	500	3 Channels
IH5017 IH5017	MDD, CDD CPA		100	1.5	11	±10	0.5	20	500	500	2 Channels, CMOS Logic
IH5018 IH5018	MDD, CDD CPA		150	0.5	4.5	±10	0.5	20	500	500	2 Channels

Device	Suffix Codes	MIL Spec	Outputs	V <sub>inH</sub> Min V	V <sub>inL</sub> Max V	Analog Sig. Range V	I <sub>S</sub> Off ±nA	T ON nSec	T OFF nSec	Features
<b>DUAL CMOS DRIVER/VOLTAGE TRANSLATOR</b>										
IH6201	MJE, CJE, CPE		V+, V-	2.4	0.8	N/A	N/A	400	300	Dual Complementary Outputs, Drives IH401A

3C  
Switches/Muxes

# Analog Multiplexers

All MUX's with Prefix "HI" are Dielectrically Isolated (DI)

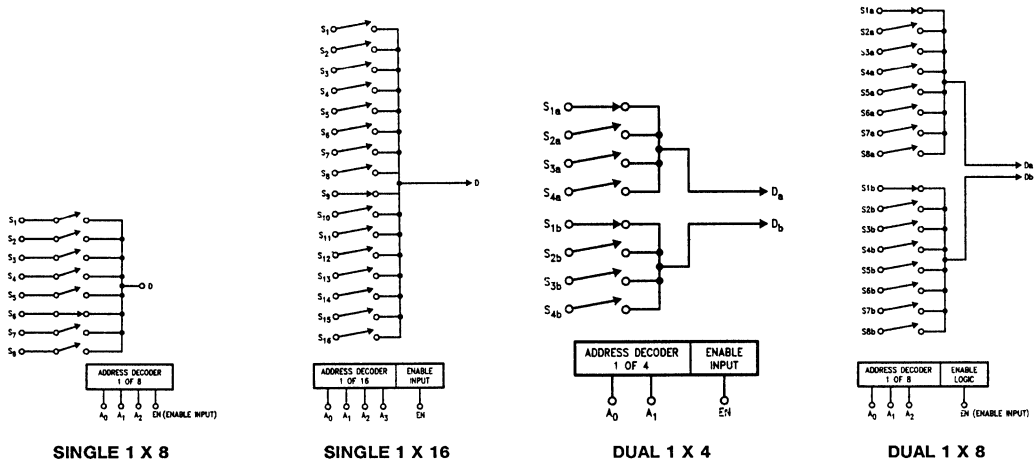
GENERAL PURPOSE DEVICE NUMBER (S)	CONFIGURATION	Rds(ON)-OHMS
DG508A, IH6108	8-Channel Single Ended	450
DG506A	16-Channel Single Ended	450
DG509A, IH6208	4-Channel Differential	450
DG507A	8-Channel Differential	450
ACTIVE OVERVOLTAGE PROTECTION	CONFIGURATION	Rds(ON)-OHMS
HI508A	8-Channel Single Ended	1800
HI-506A	16-Channel Single Ended	1800
HI-509A	4-Channel Differential	1800
HI-507A	8-Channel Differential	1800
FAULT PROTECTED DEVICE NUMBER (S)	CONFIGURATION	Rds(ON)-OHMS
IH5108	8-Channel Single Ended	1800
IH5116	16-Channel Single Ended	1800
IH5208	4-Channel Differential	1800
IH5216	8-Channel Differential	1800
LATCHABLE DEVICE NUMBER (S)	CONFIGURATION	Rds(ON)-OHMS
DG526	16-Channel Single Ended	450
DG527	8-Channel Differential	450
DG528	8-Channel Single Ended	450
DG529	4-Channel Differential	450
MODE PROGRAMMABLE DEVICE NUMBER (S)	CONFIGURATION	Rds(ON)-OHMS
HI-516	16-Channel/Dual 8-Channel	750
HI-518	8-Channel/Dual 4-Channel	750
SPECIAL PURPOSE DEVICE NUMBER	CONFIGURATION	Rds(ON)-OHMS
HI-524	4-Channel Video, Low Crosstalk	1500*
HI-539	Differential, 4-Channel, Low Level Matched	900

NOTE: Most Rds(ON) Values are Maximum at +25°C.

\* This is the Maximum Value Over the Entire 0° to +70°C Temperature Range.

# Analog Multiplexers (Continued)

All MUX's with Prefix "HI" are Dielectrically Isolated (DI)



Device	Suffix Codes	MIL Spec	R <sub>ds(ON)</sub> Ω Max (1)	V <sub>INH</sub> Min V	V <sub>INL</sub> Max V	Analog Sig. Range V	I <sub>Q</sub> OFF 25°C ±nA	T <sub>ON</sub> nSec	T <sub>OFF</sub> nSec	Features
<b>ANALOG MULTIPLEXERS (SINGLE 1 X 8)</b>										
DG506A	AK, BK, CK, CJ	DG506AAK/883B	450	2.4	0.8	V- to V+	0.01	250	250	
HI1-0506	-2, -4, -5, -7	HI1-0506/883	450	2.4	0.8	V- to V+	0.3	1,000	400	PLCC SOIC LCC
HI3-0506	-5									
HI4P0506	-5, -9	HI4-0506/883								
HI1-0506A	-2, -5, -7		1800	4.0	0.8	V- to V+	0.1	300	300	70 Volt Active Overvoltage Protection. See Table 2-6 (5)
HI3-0506A										
HI0-0518	-6		750	2.4	0.8	V- to V+	0.015	120	140	Programmable 1 of 8, Differential 2 of 4. See Table 2-7
HI1-0518	-2, -5									DICE
HI3-1518	-5									PLCC
HI4P0518	-5									
DG528	AK, BK, CK, CJ	DG528AAK/883B	450	2.4	0.8	V- to V+	0.015	1000	400	Microprocessor Compatible
HI1-0548	-2, -4, -5	HI1-0548/883	1800	4.0	0.8	V- to V+	0.1	300	300	Active Overvoltage Protection 7% R <sub>ds(on)</sub> Matching. See Table 2-8 (5)
HI3-0548	-5									PLCC SOIC LCC
HI4P0548	-5	HI4-0548/883								
HI1-1818A	-2, -5, -7	HI1-1818A/883	400	4.0	0.4	V- to V+	0.1	500	500	LCC
HI3-1818A	-5									
HI4P1818A	-5									
IH5108	MJE, IJE, CJE, CPE	IH5108MJE/883B	1200	2.4	0.8	±13	.05	600	400	50 Volt Fault Protection. See Table 2-9 (6)
IH6108	MJE, CJE, CPE	IH6108MJE/883B	350	2.4	0.8	±14	0.03	1500	1000	DG508A pin for pin, ENable strobe
<b>ANALOG MULTIPLEXER (SINGLE 1 X 16)</b>										
HI1-0506	-2, -4, -5	HI1-0506/883	400	2.4	0.8	V- to V+	0.3	250	250	
HI3-0506	-5									PLCC SOIC LCC
HI4P0506	-5, -9	HI4-0506/883								
HI9P0506										
DG506A	AK, BK, CK, CJ		450	2.4	0.8	V- to V+	0.02	250	250	
HI1-0506A	-2, -5, -7		1800	4.0	0.8	V- to V+	0.1	300	300	Active Overvoltage Protection See Table 2-6 (5)
HI3-0506A	-5									
HI1-0516	-2, -5		750	2.4	0.8	V- to V+	0.03	120	140	Programmable, 1 of 16, Differential 2 of 8. See Table 2-8 (5)
HI3-0516	-5									PLCC SOIC
HI4P0516	-5, -9									
HI9P0516										
DG526	AK, BK, CK, CJ		400	2.4	0.8	V- to V+	0.2	700	400	Microprocessor Compatible
HI1-0546	-2, -4, -5	HI1-0546/883	1800	4.0	0.8	V- to V+	0.1	500	500	Active Overvoltage Protection See Table 2-8 (5) 7% R <sub>ds(on)</sub> Matching
HI3-0546	-5									PLCC SOIC LCC
HI4P0546	-5, -9	HI4-0546/883								
HI9P0546										
IH5116	MJI, CJI, CPI	IH5116MJI/883B	1200	2.4	0.8	±13	0.05	600	400	Fault Protection. See Table 2-9 (6)

# Analog Multiplexers (Continued)

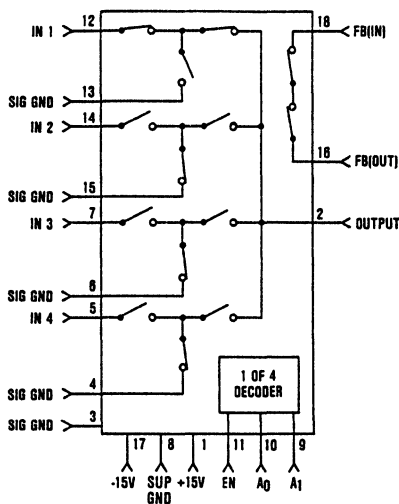
NOTE: All MUX's with Prefix "HI" are Dielectrically Isolated (DI)

Device Notes: (2, 3)	Suffix Codes	MIL Spec	Rds(ON) Ω Max (1)	VinH Min V	VinL Max V	Analog Sig. Range V	I <sub>Q</sub> Off 25°C ± nA	T ON nSec	T OFF nSec	Features	
<b>ANALOG MULTIPLEXER (DUAL 1 X 4)</b>											<b>TABLE 2-3</b>
DG509A	AK, BK, CK, CJ		400	2.4	0.8	V- to V+	0.01	250	250		
HI1-0509 HI3-0509 HI4P0509	-2, -4, -5, -7 -5 -5	HI1-0509/883 HI4-0509/883	450	2.4	0.8	V- to V+	0.3	300	300		LCC
HI1-0509A HI3-0509A	-2, -5, -7 -5		1800	4.0	0.8	V- to V+	0.1	300	300	Active Overvoltage Protection See Table 2-8 (5)	
HI0-0518 HI1-0518 HI3-0518 HI4P0518	-6 -2, -5 -5 -5		750	2.4	0.8	V- to V+	0.015	120	140	Programmable 1 of 8, Differential 2 of 4. See Table 2-7	DICE PLCC
DG529	AK, BK, CK	DG529AK/883B	450	2.4	0.8	V- to V+	0.006	1000	400	Microprocessor Compatible	
HI1-0539 HI3-0539 HI4P0539	-2, -4, -5 -5 -5		850	4.0	0.8	±10	0.001	250	160	Low Level Signals 3% Max Rds(on) Matching	PLCC
HI1-0549 HI3-0549 HI4P0549 HI9P0549	-2, -4, -5 -5 -5 -5, -9	HI1-0549/883 HI4-0549/883	1800	4.0	0.8	V- to V+	0.1	300	300	70 Volt Active Overvoltage Protection. 7% Rds(on) Matching. See Table 2-8 (5)	LCC SOIC
HI1-1826A HI3-1826A HI4P1826A	-2, -5, -7 -5 -5	HI1-1826A/883	400	4.0	0.4	V- to V+	0.05	300	300		PLCC
IH5206	MJE, IJE, CJE, CPE	IH5206MJE/883B	1200	2.4	0.8	±13	0.02	600	400	50 Volt Fault Protection See Table 2-9 (6)	
IH6206	MJE, CJE, CPE	IH6206MJE/883B	300	2.4	0.8	±14	0.03	1500 max	1000 max		
<b>ANALOG MULTIPLEXER (DUAL 1 X 8)</b>											<b>TABLE 2-4</b>
HI1-0507 HI3-0507 HI4P0507 HI9P0507	-2, -4, -5, -7 -5 -5 -5, -9	HI1-0507/883 HI4-0507/883	400	2.4	0.8	V- to V+	0.3	250	250		PLCC SOIC LCC
DG507A	AK, BK, CK, CJ		450	2.4	0.8	V- to V+	0.02	250	250		
HI1-0507A HI3-0507A	-2, -5, -7 -5		1800	4.0	0.8	V- to V+	0.1	300	300	Active Overvoltage Protection	
HI1-0516 HI3-0516 HI4P0516 HI9P0516	-2, -5 -5 -5 -5, -9		750	2.4	0.8	V- to V+	0.03	120	140	Programmable, 1 of 16, Differential 2 of 8.	PLCC SOIC
DG527	AK, BK, CK, CJ		400	2.4	0.8	V- to V+	0.2	700	400	Microprocessor Compatible	
HI1-0547 HI3-0547 HI4P0547 HI9P0547	-2, -4, -5 -5 -5 -5, -9	HI1-0547/883 HI4-0547/883	1800	4.0	0.8	V- to V+	0.1	300	300	Active Overvoltage Protection 7% Rds(ON) Matching.	PLCC SOIC LCC
IH5216	MJI, CJI, CPI	IH5216MJI/883B	1200	2.4	0.8	±13	0.05	600	400	50 Volt Fault Protection	
<b>LATCHABLE MULTIPLEXERS, MICROPROCESSOR COMPATIBLE, SELECT LATCHES</b>											<b>TABLE 2-5</b>
DG526	AK, BK, CK, CJ		400	2.4	0.8	V- to V+	0.2	700	400	1 of 16 Channels, Micro- processor Compatible. See Table 2-2	
DG527	AK, BK, CK, CJ		400	2.4	0.8	V- to V+	0.2	700	400	Differential 1 of 8 Channels, Microprocessor Compatible. See Table 2-4	
DG528	AK, BK, CK, CJ	DG528AK/883B	450	2.4	0.8	V- to V+	0.015	1,000	400	1 of 16 Channels, Micro- processor Compatible. See Table 2-1	
DG529	AK, BK, CK, CJ	DG529AK/883B	450	2.4	0.8	V- to V+	0.006	1,000	400	Dual 1 of 4 Channels, Micro- processor Compatible. See Table 2-3	
<b>ANALOG MULTIPLEXER PROGRAMMABLE CONFIGURATION 1 OF 16 OR 2 OF 8</b>											<b>TABLE 2-6</b>
HI1-0516 HI3-0516 HI4P0516 HI9P0516	-2, -5 -5 -5 -5, -9		750	2.4	0.8	V- to V+	0.03	120	140	Programmable 1 of 16, Differential 2 of 8. See Tables 2-2 and 2-4	PLCC SOIC
<b>PROGRAMMABLE 1 OF 8 OR 2 OF 4</b>											<b>TABLE 2-7</b>
HI0-0518 HI1-0518 HI3-1518 HI4P0518	-6 -2, -5 -5 -5		750	2.4	0.8	V- to V+	0.015	120	140	Programmable 1 of 8, Differential 2 of 4. See Tables 2-1 and 2-3	DICE PLCC

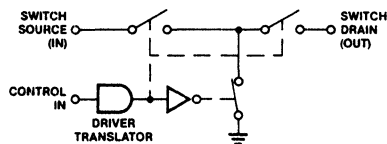
# Analog Multiplexers (Continued)

All MUX's with Prefix "HI" are Dielectrically Isolated (DI)

Device Notes: (2, 3)	Suffix Codes	MIL Spec	Rds(ON) $\Omega$ Max (1)	VinH Min V	VinL Max V	Analog Sig. Range V	I <sub>OFF</sub> 25°C $\pm$ nA	T ON nSec	T OFF nSec	# of Channels	Tab	Features	
<b>ANALOG MULTIPLEXER 70 VOLT PEAK TO PEAK OVERVOLTAGE PROTECTED MULTIPLEXERS</b>													<b>TABLE 2-8</b>
HI1-0506A HI3-0506A	-2, -5, -7 -5		1800	4.0	0.8	V- to V+	0.1	300	300	1 x 16	2-2		
HI1-0507A HI3-0507A	-2, -5, -7 -5		1800	4.0	0.8	V- to V+	0.1	300	300	2 x 8	2-4		
HI1-0508A HI3-0508A	-2, -5, -7 -5		1800	4.0	0.8	V- to V+	0.1	300	300	1 x 8	2-1		
HI1-0509A HI3-0509A	-2, -5, -7 -5		1800	4.0	0.8	V- to V+	0.1	300	300	2x 4	2-3		
HI1-0546 HI3-0546 HI4P0546 HI9P0546	-2, -4, -5 -5 -5 -5, -9	HI1-0546/883  HI4-0546/883	1800	4.0	0.8	V- to V+	0.1	500	500	1 x 16	2-2	7% Rds(on) Matching	PLCC SOIC LCC
HI1-0547 HI3-0547 HI4P0547 HI9P0547	-2, -4, -5 -5 -5 -5, -9	HI1-0547/883  HI4-0547/883	1800	4.0	0.8	V- to V+	0.1	300	300	2 x 8	2-4	7% Rds(on) Matching	PLCC SOIC LCC
HI1-0548 HI3-0548 HI4P0548 HI9P0548	-2, -4, -5 -5 -5 -5, -9	HI1-0548/883  HI4-0548/883	1800	4.0	0.8	V- to V+	0.1	300	300	1 x 8	2-1	7% Rds(on) Matching	PLCC SOIC LCC
HI1-0549 HI3-0549 HI4P0549 HI9P0549	-2, -4, -5 -5 -5 -5, -9	HI1-0549/883  HI4-0549/883	1800	4.0	0.8	V- to V+	0.1	300	300	2 x 4	2-3	7% Rds(on) Matching	PLCC SOIC LCC
<b>ANALOG MULTIPLEXER 50 VOLT PEAK TO PEAK FAULT PROTECTED MULTIPLEXERS</b>													<b>TABLE 2-9</b>
IHS108	MJE, IJE, CJE, CPE	IHS108MJE/883B	1200	2.4	0.8	$\pm$ 13	0.05	600	400	1 x 8	2-1		
IHS116	MJI, CJI, CPI	IHS116MJI/883B	1200	2.4	0.8	$\pm$ 13	0.05	600	400	1 x 16	2-2		
IHS208	MJE, IJE, CJE, CPE	IHS208MJE/883B	1200	2.4	0.8	$\pm$ 13	0.05	600	400	2 x 4	2-3	Differential Input	
IHS216	MJI, CJI, CPI	IHS216MJI/883B	1200	2.4	0.8	$\pm$ 13	0.05	600	400	2 x 8	2-4	Differential Input	



"T" MUX



"T" SCHEMATIC

Device Notes: (2, 3)	Suffix Codes	MIL Spec	Rds(ON) $\Omega$ Max (1)	VinH Min V	VinL Max V	Analog Sig. Range V	I <sub>OFF</sub> 25°C $\pm$ nA	T ON nSec	T OFF nSec	Features		
<b>RF/VIDEO "T" MULTIPLEXER</b>												<b>TABLE 2-10</b>
HI1-0524 HI3-0524 HI4P0524	-2, -5 -5 -5		1500	2.4	0.8	$\pm$ 10	0.02	500	500	1 of 4 Video, -60dB OFF Channel Isolation @ 10MHz	PLCC	



## 4 - Digital

4A •Microprocessors, Microcontrollers  
and Memory

4B •Peripherals

4C •Logic



## 4 - Digital

4A •Microprocessors, Microcontrollers  
and Memory

4B •Peripherals

4C •Logic

# Microcontrollers, Microprocessors & Memory

## 6805 8-Bit Microcontroller Family

### 6805 Devices

3 Micron  
4 Transistor Ram Cells  
4 MHz Only

### 68HC05 Devices

1.2 Micron  
6 Transistor RAM Cells  
HC Devices- 4 MHz  
HSC Devices- 9 MHz  
HCL Devices- Low Power Version

### General 6805 Core Features

#### Hardware

- 8-bit architecture
- Fully static operation
- Self-check mode
- Master reset and power-on reset
- Single 3-6V power supply
- Power-saving stop and wait modes

#### Software

- Software compatible with entire 6805 family
- 61 instructions and 10 addressing modes
- Indexed addressing for tables
- True bit manipulation
- Memory-mapped I/O
- Efficient use of program space
- Versatile interrupt handling
- 8 x 8 multiply instruction in C4, C8 and D2 versions

## 80C86/88/286 Microprocessors

- Pin-and function-compatible with NMOS equivalents
- Fully static CMOS designs
- Bus hold devices eliminate pull up resistors on bus and control lines
- Available in /883 compliant versions

80C86	5 & 8 MHz Commercial	5 MHz Military
80C88	5 & 8 MHz Commercial	5 MHz Military
80C286	12.5 & 16, 20, 25 MHz Commercial	10 & 12.5 MHz Military

## CDP-1800 8 Bit Microprocessor/Microcomputer Family

- 7 Micron
- Fully static low power CMOS
- Six transistor RAM
- 16x16 register array for use as program counters, data pointers, or data registers
- On chip DMA, interrupt, and flag inputs
- One output and four input bits

## Memories

### RAMs

Densities 1K-64K  
Commercial - /883-DESC-JAN  
Low Power CMOS  
Six Transistor Arrays

### Modules

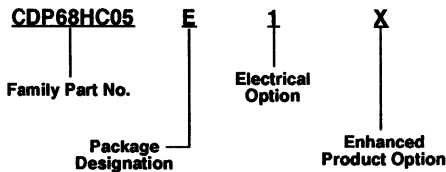
Densities 64K - 1MEG  
Mil Temp Range

### PROMs

512 x 8    2K x 8

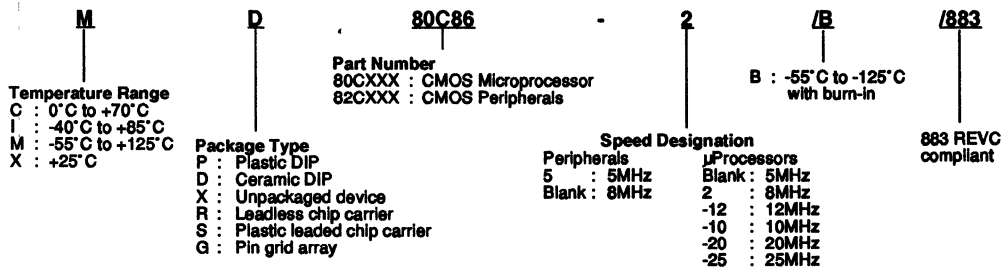
# Microcontrollers, Microprocessors & Memory

## 68HC05 Microcontrollers

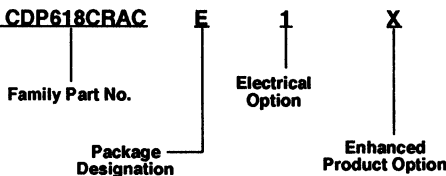


PACKAGE/OPTION	SUFFIX LETTER
Dual-in-line sidebraced ceramic DIP	D
Dual-in-line plastic DIP	E
Small outline plastic SOP	M
Plastic leaded chip carrier PLCC	N
Metric plastic quad flatpack MPQFP	Q
Chip (when applicable)	H
Enhanced product screening i.e., burn-in (optional for D, E package types)	X
Single-in-line package (SIP)	Z
Electrical option	1, 2, 4

## 80CXXX Microprocessors



## 1800-Series Microprocessors & Microcomputers



PACKAGE/OPTION	SUFFIX LETTER
Dual-in-line sidebraced ceramic DIP	D
Dual-in-line plastic DIP	E
Small outline plastic SOP	M
Plastic leaded chip carrier PLCC	N
Metric plastic quad flatpack MPQFP	Q
Chip (when applicable)	H
Enhanced product screening i.e., burn-in (optional for D, E package types)	X
Single-in-line package (SIP)	Z

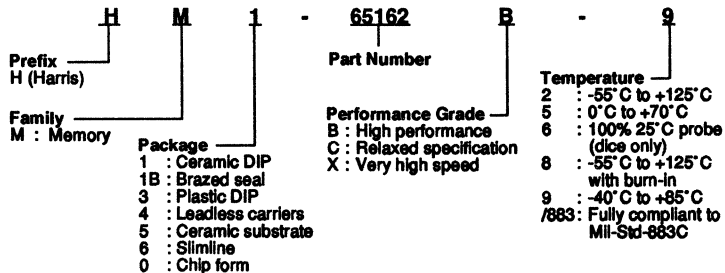
## Memories

### Synchronous

- Latched address bus
- Address must be valid prior to chip select

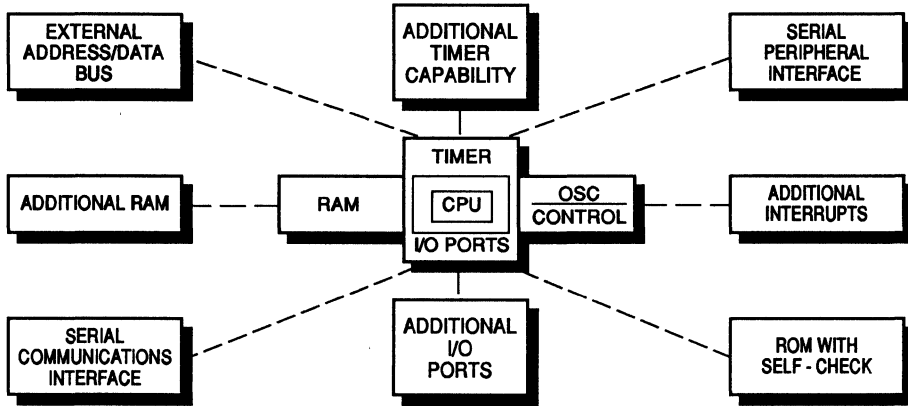
### Asynchronous

- No address set up time



# 6805/68HC05 Microcomputer Family

All members of the 6805 family are designed around a common core which consists of CPU, timer, oscillator, control, bidirectional I/O, RAM and ROM. This common core is expanded to provide versions of the 6805 with additional memory, I/O lines, interrupt capability, timer counters, and serial interfaces.



CDP6805 CMOS Family Core Architecture Block Diagram

## Harris 68HC05 Quick Reference

PART NUMBER	RAM BYTES	ROM BYTES	EXTERNAL ADDRESS SPACE	I/O LINES	OTHER FEATURES
CDP6805E2	112		8K	16	8 Bit Timer
CDP6805E3	112		64K	13	8 Bit Timer
CDP6805F2	64	1089		16	8 Bit Timer
CDP6805G2	112	2106		32	8 Bit Timer Counter
CDP68HC/HCL/HSC05C4	176	4160		24	16 Bit Timer, SCI, SPI
CDP68HC/HCL/HSC05C8	176	7744		24	16 Bit Timer, SCI, SPI
CDP68HC05D2	96	2176		28	16 Bit Timer, SPI

E suffix denotes DIP, Q suffix denotes PLCC, X suffix denotes 10 hour burn-in.  
Standard part is -40°C to +85°C, /3 suffix denotes -55°C to +125°C

### Additional I/O Features Available

- 8 & 16 Bit Timers with Prescalers
- UART
- Serial Peripheral Interface (SPI) Provides Interface to Expanded Off Chip I/O.  
See Peripheral Section for Available Functions
- Keyboard Interfaces
- Pulse Width Modulators
- Watch Dog Timer

# 6805/68HC05 Microcomputer Family (Continued)

## 68HC05

FEATURES	68HC05C4 68HCL05C4 68HSC05C4	68HC05C8 68HCL05C8 68HSC05C8	68HC05J3
Technology Package(s)	CMOS E Q N	CMOS E Q N	CMOS E Q N
Pins On-Chip RAM (Bytes)	40 44 44 176	40 44 44 176	40 44 44 96
External Address Space On-Chip User ROM (Bytes)	- 4160	- 7744	- 2176
Bidirectional I/O Lines Unidirectional I/O Lines	24 7 in	24 7 in	28 3 in
Memory Mapped I/O Timer Size (bits)	Yes 16	Yes 16	Yes 16
Prescaler Size (bits) External Timer Oscillator	- No	- No	- Yes
Serial Peripheral Interface Serial Comm. Interface	Yes Yes	Yes Yes	Yes No
Keypad Scan Interface I/O Port Handshaking	No No	No No	Yes No
Interrupts: ↓	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SPI Port B SWI
Computer Operating Property (COP) Illegal Opcode Trap (IOT)	No No	No No	No No
8 x 8 Unsigned Mult. Instruc PWM	Yes No	Yes No	Yes No
Self-Check Mode Oscillator Mode	Yes RC or Quartz	Yes RC or Quartz	Yes RC or Quartz
Oscillator Startup Delay Msk Option	No	No	Yes

\*Prescaler fixed as divide by 4

FEATURES	HC05C4 HC05C8	HCL05C4 HCL05C8	HSC05C4 HSC05C8
Typical Power Dissipation at $T_A = 25^\circ\text{C}$ Max Freq & 5V: (HCL shown at 2.4V & $F_{OSC} = 1\text{MHz}$ )			
Run	17.5mW	1.2mW	33.5mW
Wait Mode	8.0mW	0.5mW	15.0mW
Stop Mode	10.0 $\mu$ W	<2.4 $\mu$ W	10 $\mu$ W

### Additional Features

- 1.2 Micron
- 6 Transistor RAM Cells
- HC Devices 4MHz
- HSC Devices 8MHz
- HCL Device Low Power Version

## 6805

FEATURES	6805E2	6805E3	6805F2	6805G2
Technology Package(s)	CMOS E Q	CMOS E Q	CMOS E Q	CMOS E
Pins On-Chip RAM (Bytes)	40 44 112	40 44 112	28 28 64	40 112
External Address Space On-chip User ROM (Bytes)	8K 0	64K 0	- 1089	- 2106
Bidirectional I/O Lines Unidirectional I/O Lines	16 0	13 0	16 4 in	32 0
Memory Mapped I/O Timer Size (bits)	Yes 8	Yes 8	Yes 8	Yes 8
Prescaler Size (bits) External Timer Oscillator	7 No	7 No	7 No	7 No
Serial Peripheral Interface Serial Comm. Interface	No No	No No	No No	No No
Keypad Scan Interface I/O Port Handshaking	No No	No No	No No	No No
Interrupts: ↓	Extrnl Timer SWI	Extrnl Timer SWI	Extrnl Timer SWI	Extrnl Timer SWI
Computer Operating Property (COP) Illegal Opcode Trap (IOT)	No No	No No	No No	No No
8 x 8 Unsigned Mult. Instruc PWM	No No	No No	No No	No No
Self-Check Mode Oscillator Mode	No Quartz	No Quartz	Yes RC or Quartz	Yes RC or Quartz
Oscillator Startup	-	-	No	No

FEATURES	6805E2	6805E3	6805F2	6805G2
Typical Power Dissipation at $T_A = 25^\circ\text{C}$ Max Freq & 5V: (HCL shown at 2.4V & $F_{OSC} = 1\text{MHz}$ )				
Run	35mW	35mW	10mW	12mW
Wait Mode	5mW	5mW	3mW	4mW
Stop Mode	25 $\mu$ W	25 $\mu$ W	5 $\mu$ W	5 $\mu$ W

### Additional Features

- 3 Micron
- 4 Transistor RAM Cells
- 4MHz Only

# 80C86/88 and 80C286 CMOS Static Microprocessors

## 80C286

### Features:

- Compatible With NMOS 80286
- Static CMOS Design for Low Power Operation
  - ICCSB ..... 5mA Maximum
  - ICCOP ..... 220mA Maximum (80C286-12)
- High Performance Processor (up to 19 times the Throughput 8086)
- Large Address Space
  - 16 Megabytes Physical
  - 1 Gigabyte Virtual per Task
- Integrated Memory Management, Four-Level Memory Protection and Support for Virtual Memory and Operating Systems
- Two 80C286 Real Address Mode
  - 80C286 Real Address Mode
  - Protected Virtual Address Mode
- Compatible with 80287 Numeric Data Co-Processor
- Wide Range of Clock Rates
  - DC to 25MHz (80C286-25)
  - DC to 20MHz (80C286-20)
  - DC to 16MHz (80C286-16)
  - DC to 12.5MHz (80C286-12)
  - DC to 10MHz (80C286-10)
- High Bandwidth Bus Interface (25 Megabyte/Sec)
- Available in a 68 Pin PGA and PLCC Packages

## 80C86

### Features:

- Compatible With NMOS 8086
- Completely Static CMOS Design
  - DC to 5MHz (80C86)
  - DC to 8MHz (80C86-2)
- Low Power Operation
  - ICCSB ..... 500µA Maximum
  - ICCOP ..... 10mA/MHz Typical
- 1M Byte of Direct Memory Addressing Capability
- 24 Operand Addressing Modes
- Bit, Byte, Word and Block Move Operations
- 8 Bit and 16 Bit Signed/Unsigned Arithmetic
- Bus Hold Circuitry Eliminates Pull-Up Resistors
- Available in 40 Pin DIP and 44 Pin PLCC/LCC

## 80C88

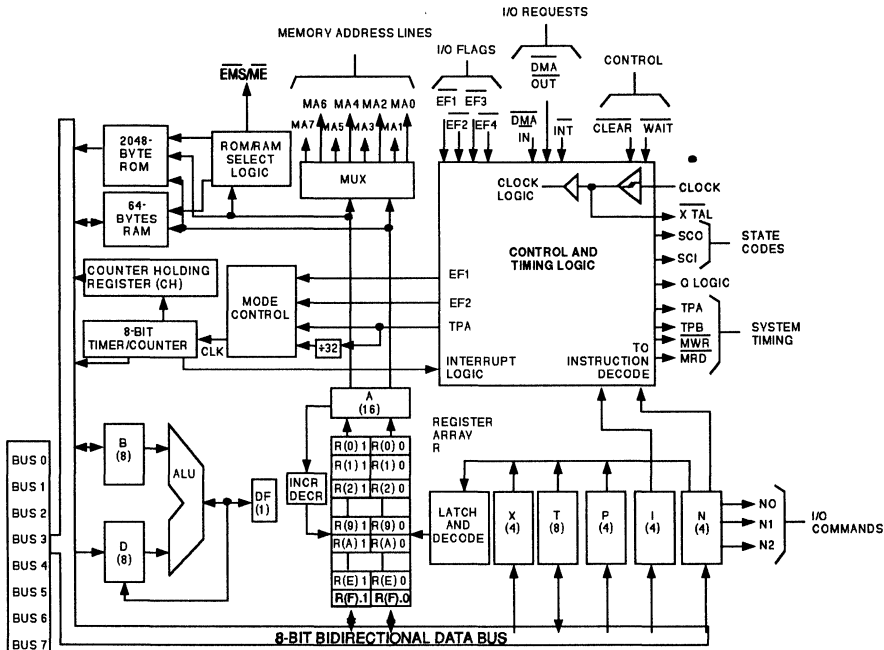
### Features:

- Compatible with NMOS 8088
- Direct Software Compatibility with 80C86, 8086, 8088
- 8-Bit Data Bus Interface: 16 Bit Internal Architecture
- Completely Static CMOS Design
  - DC 5MHz (80C86)
  - DC 8MHz (80C86-2)
- Low Power Operation
  - ICCSB ..... 500µA Maximum
  - ICCOP ..... 10mA/MHz Maximum
- 1 Megabyte of Direct Memory Addressing Capability
- 24 Operand Addressing Modes
- Bit, Byte, Word and Block Move Operations
- 8 Bit and 16 Bit Signed/Unsigned Arithmetic
- Bus Hold Circuitry Eliminates Pull Up Resistors
- Available in 40 Pin DIP and 44 Pin PLCC/LCC

# CDP1800-Series Microprocessors and Microcomputers

## Features:

- 16 x 16 Matrix of Registers for Use as Multiple Program counters, Data Pointers or Data Registers
- Single-Phase clock; Optional On-Chip Crystal-Controlled Oscillator
- Flexible Programmed I/O Mode
- Four Flag Inputs Directly Tested by Branch Instructions
- Programmable Single-Bit Output Port
- Static Circuitry - No Minimum Clock Frequency
- 8-Bit Parallel Organization with Bidirectional Data Bus and Multiplexed Address Bus



## Specifications

TYPE	MEMORY ADD (BYTES)	ON-CHIP RAM (BYTES)	ON-CHIP ROM (BYTES)	MAX CLOCK FREQ (MHz)	INSTRUC. TIME MIN/MAX (µs)	TIMER/COUNTER BITS	PRE-SCALERS	BUS STRUCTURE	INTER-RUPTS	LATCH I/O	MAX OPER TEMP (°C)	PKG NO. OF PINS	INSTRUC-TIONS	ADDITIONAL FEAT-URES
CDP1802A CDP1802AC	64K	-	-	3.2	5.0/7.5	-	-	Multiplexed Address Lines	✓	Off-Chip	-55°C to +125°C	40D 40E 40Q	91	
CDP1802BC	64K	-	-	5.0	3.2/4.8	-	-	Multiplexed Address Lines	✓	Off-Chip	-55°C to +125°C	40D 40E 40Q	91	
CDP1804AC	64K	64	2K	5.0	3.2/16.0	8	+32	Multiplexed Address Lines	✓	Off-Chip	-55°C to +125°C	40D 40E	123 Includes Cal/Return	
CDP1805AC	64K	64	-	5.0	3.2/16.5	8	+32	Multiplexed Address Lines	✓	Off-Chip	-55°C to +125°C	40D 40E 40Q	123 Includes Cal/Return	8-Bit Timer/Counter
CDP1806AC	64K	-	-	5.0	3.2/16.0	8	+32	Multiplexed Address Lines	✓	Off-Chip	-55°C to +125°C	40D 40E 40Q	123 Includes Cal/Return	8-Bit Timer/Counter

# CMOS Static RAMs

PART NUMBER	SIZE	SPEED DESIGNATION	ACCESS TIME	STANDBY CURRENT ICCSB	DATA RET. CURRENT ICCDR	OPERATING CURRENT ICCOP	PACKAGES
<b>≤ 1K - SYNCHRONOUS</b>							
CDP68HC68R1	128 x 8	Serial	100ns	15µA	1µA	10mA	8-Pin PDIP
CDP68HC68R2	256 x 8	Serial	100ns	50µA	1µA	10mA	8-Pin PDIP
<b>≤ 1K - SYNCHRONOUS</b>							
CDP1821C	1K x 1	13	255ns	1000µA	200µA	10mA	16-Pin Cerdip
CDP1822	256 x 1	13	450ns 500ns	500µA 1000µA	100µA 380µA	8mA 10mA	22-Pin PDIP 22-Pin Cerdip
CDP1823	128 x 8	13	450ns 505ns	500µA 1000µA	100µA 400µA	8mA 10mA	24-Pin PDIP 24-Pin Cerdip
CDP1824	32 x 8	13	710ns 825ns	200µA 500µA	40µA 40µA	8mA 10mA	18-Pin PDIP 18-Pin Cerdip
CDP1826C	64 x 8		1000ns	50µA	25µA	10mA	22-Pin PDIP 22-Pin Cerdip
MWS5101	256 x 4	L2 L3	250ns 350ns	50µA 200µA	10µA 50µA	8mA 8mA	22-Pin PDIP 22-Pin Cerdip
<b>1K - SYNCHRONOUS</b>							
HM-6508	1K x 1	B	180ns 250ns	10µA 10µA	5µA 10µA	4mA/MHz 4mA/MHz	18-Pin PDIP 18-Pin Cerdip
HM-6518	1K x 1	B	180ns 250ns	10µA 10µA	5µA 10µA	4mA/MHz 4mA/MHz	18-Pin PDIP 18-Pin Cerdip
HM-6551	256 x 4	B	220ns 300ns	10µA 10µA	10µA 10µA	4mA/MHz 4mA/MHz	22-Pin PDIP 22-Pin Cerdip
HM-6561	256 x 4	B	220ns 300ns	10µA 10µA	10µA 10µA	4mA/MHz 4mA/MHz	18-Pin PDIP 18-Pin Cerdip
<b>4K - ASYNCHRONOUS</b>							
MWS5114	1K x 4	3 2 1	200ns 250ns 300ns	100µA 100µA 250µA	50µA 50µA 125µA	8mA 8mA 8mA	18-Pin PDIP 18-Pin Cerdip
<b>4K - SYNCHRONOUS</b>							
HM-6504	4K x 1	S S/883 B B/883 /883	120ns 120ns 200ns 200ns 300ns 300ns	25µA 50µA 25µA 50µA 25µA 50µA	15µA 25µA 15µA 25µA 15µA 25µA	7mA/MHz 7mA/MHz 7mA/MHz 7mA/MHz 7mA/MHz 7mA/MHz	18-Pin PDIP 18-Pin Cerdip 18-Pin LCC
HM-6514	1K x 4	S S/883 B B/883 /883	120ns 120ns 200ns 200ns 300ns 300ns	25µA 50µA 25µA 50µA 25µA 50µA	15µA 25µA 15µA 25µA 15µA 15A	7mA/MHz 7mA/MHz 7mA/MHz 7mA/MHz 7mA/MHz 7mA/MHz	18-Pin PDIP 18-Pin Cerdip 18-Pin LCC
<b>16K - SYNCHRONOUS</b>							
HM-6516	2K x 8	B	120ns 200ns	50µA 100µA	25µA 50µA	10mA/MHz 10mA/MHz	24-Pin Cerdip 32-Pin LCC
<b>16K - ASYNCHRONOUS</b>							
HM-65162	2K x 8	S B C	55ns 70ns 90ns 90ns	100µA 50µA 100µA 900µA	40µA 20µA 40µA 300µA	70mA 70mA 70mA 70mA	24-Pin Cerdip 32-Pin LCC
HM-65262	16K x 1	S B C	65ns 70ns 85ns 85ns	50µA 50µA 50µA 900µA	20µA 20µA 20µA 400µA	50mA 50mA 50mA 50mA	20-Pin Cerdip 32-Pin LCC
<b>64K - ASYNCHRONOUS</b>							
HM-65642	8K x 8	B C	150ns 150ns 200ns	100µA 250µA 400µA	75µA 150µA 250µA	20mA 20mA 20mA	28-Pin Cerdip 32-Pin LCC



# CMOS Static RAM Modules

PART NUMBER	SIZE	SPEED DESIGNATION	ACCESS TIME	STANDBY CURRENT ICCSB	DATA RET. CURRENT ICCDR	OPERATING CURRENT ICCOP	PACKAGES
<b>64K - SYNCHRONOUS</b>							
HM-6564	8K x 8 or 16K x 4	-8	350ns	800µA	400µA	28/58mA/MHz,	40 Pin Substrate
<b>64K - ASYNCHRONOUS</b>							
HM-8808	8K x 8	5 /B	100ns 120ns 150ns	250µA 250µA 900µA	125µA 125µA 400µA	70mA 70mA 70mA	28 Pin Substrate
HM-8808A	8K x 8 (2 Enables)	5 /B	100ns 120ns 150ns	250µA 250µA 900µA	125µA 125µA 400µA	70mA 70mA 70mA	28 Pin Substrate
<b>128K - ASYNCHRONOUS</b>							
HM-8816H	16K x 8	/B	70ns 85ns	800µA 800µA	320µA 320µA	400mA 400mA	48 Pin Substrate
<b>256K - SYNCHRONOUS</b>							
HM-92560	32K x 8 16K x 8		150ns	500µA	350µA	15mA/MHz	48 Pin Substrate
HM-92570	32K x 8 or 16K x 16 (Buffered)		250ns	600µA	450µA	15mA/MHz	48 Pin Substrate
<b>256 - ASYNCHRONOUS</b>							
HM-8832	32K x 8	B -8	180ns 180ns	250µA 900µA	200µA 750µA	15mA 15mA	28 Pin Substrate
<b>1 MEG - ASYNCHRONOUS</b>							
HM-91M2	128K x 8 or 64K x 16	8	180ns 200ns	2.0mA 2.0mA	1.0mA 1.0mA	20mA 20mA	48 Pin Substrate

# CMOS Proms

PART NUMBER	SIZE	SPEED DESIGNATION	ACCESS TIME	STANDBY CURRENT ICCSB	DATA RET. CURRENT ICCDR	OPERATING CURRENT ICCOP	PACKAGES
<b>4K - SYNCHRONOUS - FUSE LINK</b>							
HM-6642	512 x 8	B	120ns 200ns	100µA 100µA	- -	20mA/MHz 20mA/MHz	24 Pin Mini-CERDIP 24 Pin CERDIP 28 Pin LCC
<b>16K - SYNCHRONOUS - FUSE LINK</b>							
HM-6617	2K x 8	B	90ns 120ns	100µA 100µA	- -	20mA/MHz 20mA/MHz	24 Pin Mini-CERDIP 24 Pin CERDIP 32 Pin LCC
<b>4K - UV EPROM</b>							
IM6654	512 x 8		300ns@10V 450ns@5V	90ns 120ns	-	6mA/MHz	24 Pin CERDIP

# Peripherals

## Real-Time Clock/Clock Generators

- Keeps track of time from 1/100 second to 128 years
- Starts system or application programs at specific times
- Generates clocks, reset, & synchronization for processors and peripherals
- Events can be time and date stamped

## Bus Drivers/Latches

- Dual RS232 transmitter/receiver with single +5V supply
- Address, data bus latch, driver & decoder functions with tri-state output control
- 300 pF drive capability
- Differential driver/receiver for small area networks

## Timer/Counters/Display Drivers

- Generates accurate time delays under software control
- Provides delay timers, + N counters, square wave generator, and retriggerable one-shot
- 10 MHz count frequency
- 7, 14, & 16 segment display drivers for LCD or LED Alphanumeric displays
- 10 digit or 8 alphanumeric character display

## Parallel I/O 4-Wire Interface

- Programmable parallel I/O ports for interfacing peripheral equipment to the microprocessor system
- Provides printer, keyboard, and display interfaces

## UARTS/Baud Rate Generators

- Full duplex serial communication channel between microprocessor and external peripheral equipment
- Parallel-to-Serial & Serial-to-Parallel conversion of data at 1 Mbaud data rate
- Programmable word length, stop bits, parity, and modem controls
- Low power operation of 1 mA/MHz

## Bus Controllers

- Generates all control, command, & arbitration signals for 80C86/88 & 80C286
- 16-bit, 4 channel, 12.5 Mbit (data transfer rate) DMA
- Services prioritized interrupts from peripheral components in polled or interrupt driven fashion

## Special Functions

### Keyboard Encoders

- 53 key ASCII + 32 HEX

### SPI Bus Peripherals

- 4wire 6805 SPI serial bus peripherals (RAM, A/D, CLK, PWM, Port)

### Manchester Encoder Decoders

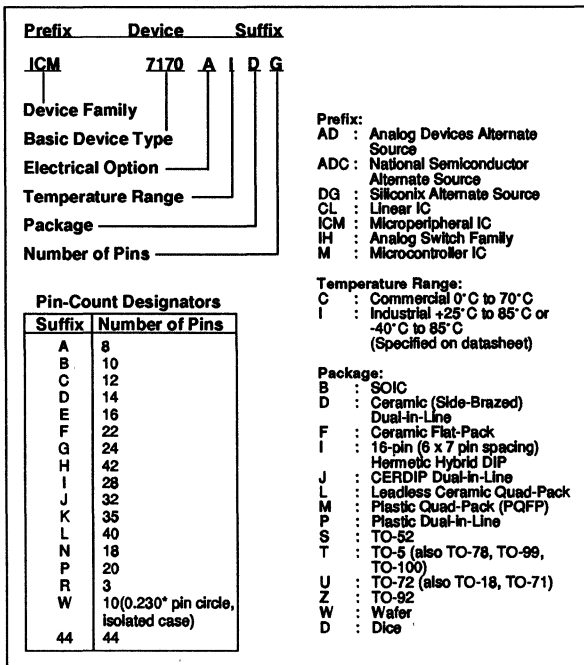
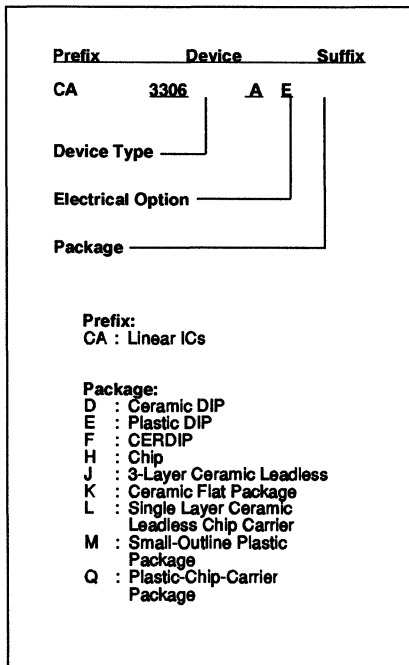
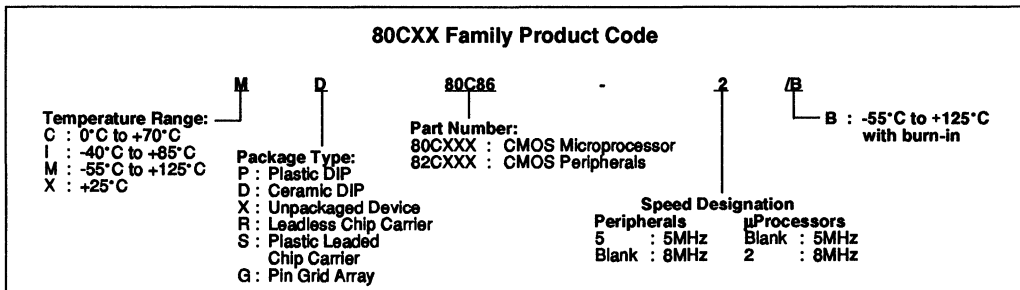
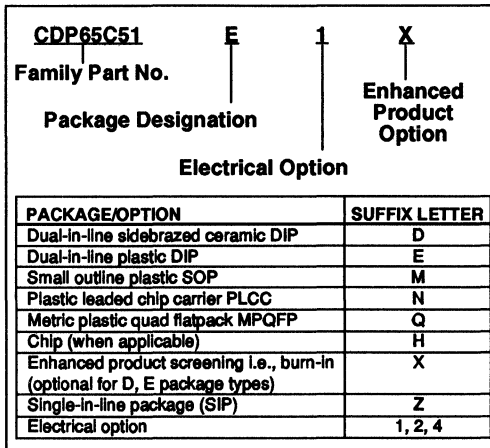
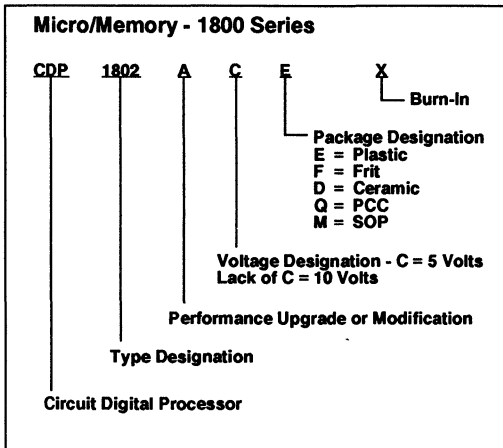
- Bi-Phase serial data protocol with error detection, self clocking & bit synchronization
- Variable data length at 2.5 Mbits per second
- No DC or low frequency component generated from serial data

## ARINC Interface

- ARINC Specification 429 Compatible
- Dual Receiver, One Transmitter on One Chip
- Up to 100K Bits/Sec

# Peripherals

## Ordering Information



# Clock Generators - 80C86/88/286 Family

## 82C84A - Clock Generator Driver

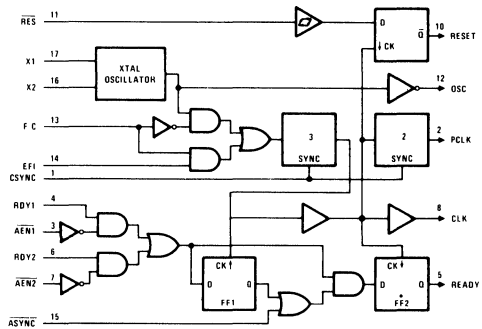
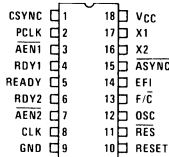
Generates system clock, reset, & ready synchronization for 80C86/88 systems.

### Features:

- 8 MHz system clock (33% Duty Cycle)
- Parallel crystal inputs
- Iccop: 40 mA @ 8 MHz

### Applications:

- System/Peripheral clock generator



## 82C85 - Static Clock Controller/Generator

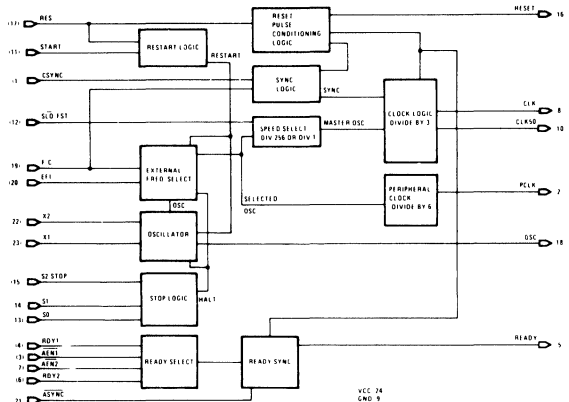
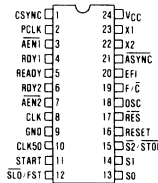
Generates complete static clock control, reset, & ready synchronization for 80C86/88 systems.

### Features:

- Up to 8 MHz system clock
- Supports stop-clock, stop-oscillator & low freq. operation
- Generates both 50% & 33% duty cycle clocks
- 100 uA standby mode

### Applications:

- System/peripheral clock generator
- System power control



## 82C284 - Clock Generator/Driver

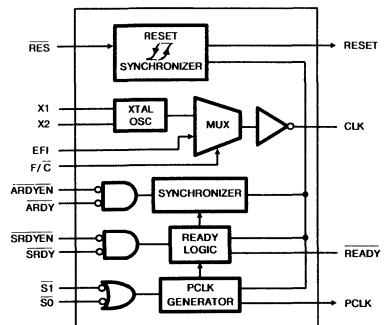
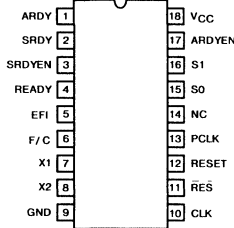
Generates system clock, reset, & ready synchronization for 80C286 systems.

### Features:

- DC to 12 MHz system clock
- XTAL or EFI source (dynamically switchable)
- 2 mA/MHz ICCOP

### Applications:

- Systems/peripheral clock generator
- Multibus clock generator/Sync



# Timebase Generators

## ICM 7207/A - Timebase Generator

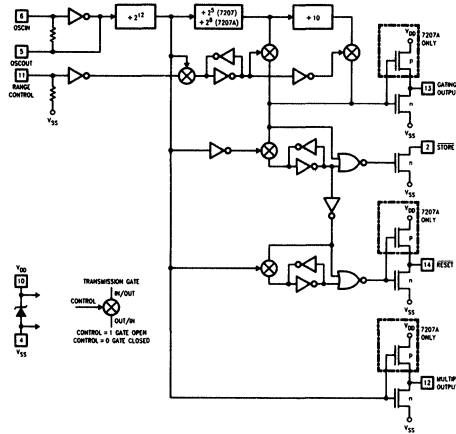
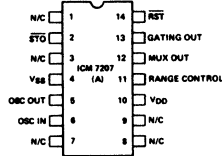
Oscillator & frequency divider providing 4 control outputs for frequency counter timebases.

### Features:

- Low power dissipation of <math>< 2 \text{ mW}</math>
- Counter outputs of  $+2^{12}$ ,  $+2^8$ ,  $+2^4$  (10)
- Low impedance output drivers ; 100
- 10 MHz, 1 PPM/V frequency range

### Applications:

- System timebases
- Frequency counters
- Calibration generators



## ICM 7209 - Timebase Generator

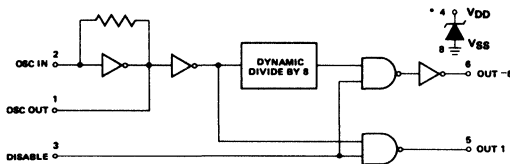
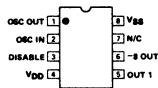
Oscillator clock generator with two outputs

### Features:

- Output frequencies of OSC & OSC/8
- Disable controls for both outputs
- 10 MHz, 50 mW frequency range
- 5X TTL fanout with 10 ns rise/fall time

### Applications:

- Oscillator clock circuit



## ICM 7213 - Timebase Generator

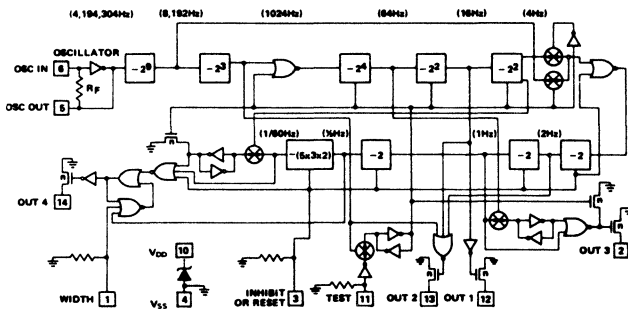
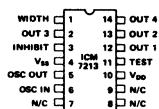
Oscillator and frequency divider with four outputs.

### Features:

- Guaranteed 2 volt operation
- 10 MHz, 100 uA frequency range
- 4 outputs: 1 pulse/sec, 1 pulse/min, 16 Hz and composite 1024 + 16 + 2 Hz
- Output inhibit function

### Applications:

- Real time clock Generator
- System timebase



# Real-Time Clocks

Type	Comments and Applications	µP Interface				Oscillator		Time Keeping Functions					Alarm Functions		Power Down Modes												
		# Of Pins	Standard µP Interface	Multiplex Bus Option	Programmable Square Wave Output Signal	Interrupts	Bytes Of General Purpose RAM	On Board Oscillator	60 Hz Line	4.197 MHz, 1.049 MHz, 32.768 KHz Xtal	2.97 MHz Xtal	Reads Sec, Min., Hr., Day, Month	Reads Year, Date	Daylight Savings Time	Automatic End Of Month Recognition	Automatic Leap Year Compensation	12 Or 24 Hour Clock With AM/PM	BCD Format Available	1/10 Sec., 1/100 Sec. Alarm	Sec., Min., Hr. Alarm	Day, Month, Year, Date Alarm	Power sense Input/Detection	Battery Input Pin	Standby Time Keeping	Power-Down Mode (µA)		
<b>1800 Series</b>																											
CDP1879	Real-Time Clock 4 to 10.5 V Operation	24	•	•	•	•	•	•	•	•						•	•		•								50
<b>6805 Series</b>																											
CDP6818	Real-Time Clock PWS RAM Moter Bus for Connection to Any µP	24	•	•	•	•	50	•	•	•	•	•	•	•	•	•	•		•								50
68HC68T1	Real-Time Clock with RAM and Power Sense/Control 3-wire SPI Bus Peripheral	16			•	•	32	•	•	•	•	•							•								12
<b>General</b>																											
ICM7170	Real-Time Clock - Time Keeping & Date Stamping for Personal Computers, Communications, Robotics, Auto, etc.	24	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	5

# Timer/Counters

Type	Comments and Applications	I/P I/F		Counter Modes							Counters						
		Standard 8-Bit $\mu$ P Interface (RD, WR)	Interrupt on Terminal Count	Timeout Output Changes when Counter Decrements to '0'	Timeout Strobe One Clock-Wide Output Pulse when Counter Decrements to '0'	Gate-Controlled One-Shot Output Changes when Counter Decrements to '0'. Retriggerable	Software-Controlled One-Shot Output Changes when Counter Decrements to '0'. Retriggerable	Rate Generator Repetitive Clock-Wide Output Pulse	Variable Duty Cycle Repetitive Output with Programmed Frequency and Duty Cycle	Count Frequency (MHz)	# Clock Inputs	Gate Enabled Counting	# Gates	# Outputs	Binary Counting	BCD Counting	# of 16-Bit Down Counters
<b>1800 Series</b>																	
CDP1878	Dual Timer/Counter Power Supply, Motor Control, Square Wave Generator, One-Shot 4V to 10.5V Operation CDP1800 Series Peripheral	•	•	•	•	•	•	•	•	1	2	•	2	2	•	•	2
<b>80C86/88 Series</b>																	
82C54	Programmable Interval Timer/Counter for Generation of Accurate Time Delays Under Software Control in 80C86/88 System, Real-Time Clock, Motor Control, Watchdog Timer, Square Wave Gen.	•	•	•	•	•	•	•	note 1	10	3	•	3	3	•	•	3
<b>6805 Series</b>																	
68HC68W1	Digital Pulse Width Modulator Modulates a Clock Input to Supply a Variable Freq. and Duty-Cycle Output Signal. 8-Pin Mni-DIP 6805 SPI Bus Serial I/F Motor Control									•	8	1		1	•		2

Note 1: Reloading of count register will allow variable duty cycle. Otherwise this mode generates a square wave output.

# Timer/Counters with Display Drivers

Type	Comments and Applications	Display			Functions																				
		LED	LCD	VF	Unit Count				Universal Counters																
		Common Anode, Non-MUX	Common Cathode, MUX	Common Anode, MUX	Direct Drive, Non-MUX	Non-MUX	Up/Down	Up Only	Decade	Modulo 60(Hr/Min/Sec)	Frequency	Period	Frequency Ratio	Time Interval	MUX BCD Outputs	Display Latch	Display Blanking	Count Enable	Leading Zero Blanking	Preset Count	Comparison Register	Equal and Zero Output	Max Count Speed (Mhz)	Evaluation Kit Available	
<b>4 DIGIT</b>																									
ICM7217	Industrial control: preset predetermining counters, sequencers, on off delay timers, batch counters. Presets and loads compare register from thumbwheel switches.			•					•	•														2	
ICM7217A			•						•	•														2	
ICM7217B				•						•	•													2	
ICM7217C				•						•	•													2	
<b>4.5 DIGIT</b>																									
ICM7224	10µA operating current. Can be cascaded for more digits.				•					•	•													15	•
ICM7225	Has brightness adjustment. 10µA current with display blanked, cascadable.	•								•	•													15	•
<b>5.5 DIGIT</b>																									
ICM7249	Event timer counter, hour meter. 14 programmable modes. Selectable input filtering.				•						•														
<b>7 DIGIT</b>																									
ICM7208	Use with ICM7207A for a 7-digit frequency counter.		•								•	•												2.5	
<b>8 DIGIT</b>																									
ICM7216A	Universal frequency counter with display drivers. 4 internal gate times, auto decimal point, leading zero blanking, overflow indication. Display off, hold, and reset inputs.			•							•	•	•	•	•									10	
ICM7216B				•								•	•	•	•	•								10	
ICM7216C					•								•	•	•	•	•							10	
ICM7216D					•									•	•	•	•	•						10	
ICM7226A	Same as ICM7216 plus period & time interval averaging. BDC outputs, µP PIA compatible.			•									•	•	•	•	•						10	•	
ICM7226B				•											•	•	•	•	•					10	

☐ These counters will measure frequency when used with the ICM7207 (0.01 and 0.1 second timebase) or the ICM7207A (0.1 and 1 second timebase)



# Display Drivers

Type	Comments and Applications	# Of Characters Or Digits						Display Type	Font	Interface			Cycle Time (ns)
		# of 7-Segment Digits	# of Decimal Points or Annunciators	# of Alphanumeric 14 Segments + D.P.	# of Alphanumeric 16 Segments + D.P.	# of Alphanumeric 18 Segments	# of Dot Matrix			MUX, BCD (BCD + Digit Select Strobes)	Random Access (Data + Address + WR)	Bit Parallel, Digit Serial	
ICM7211	Drives conventional LCD displays. Includes RC oscillator, divider chain, latches, interface and LCD drivers.	4						•		•			1000
ICM7211A		4						•		•			1000
ICM7211M		4						•		•			200
ICM7211AM		4						•		•			200
ICM7212	Drives common anode LED displays. 28 current controlled outputs. Includes latches, interface and brightness control.	4					•		•		•		1000
ICM7212A		4					•		•		•		1000
ICM7212M		4						•		•			200
ICM7212AM		4						•		•			200
ICM7218A	3 decode formats drives up to 64 independent LED's. Includes 8 x 8 memory, multiplexed LED drivers, decoders, interface and control. applications include bar graphs.	8	8					•		•		•	550
ICM7218B		8	8					•		•		•	550
ICM7218C		8	8					•		•		•	500
ICM7218D		8	8					•		•		•	500
ICM7218E		8	8					•		•		•	500
ICM7228A		8	8					•		•		•	550
ICM7228B		8	8					•		•		•	550
ICM7228C		8	8					•		•		•	500
ICM7228D	8	8					•		•		•	500	
ICM7231A	8 digits, 16 annunciators on COM, hexadecimal	8	16					3	•		•		500
ICM7231B	8 digits, 16 annunciators on COM 3, code B	8	16					3	•		•		500
ICM7231C	8 digits, 16 annunciators on COM 1 +3, code B	8	16					3	•		•		500
ICM7232A	10 digits, 20 annunciators on COM 3, hexadecimal	10	20					3	•		•		350
ICM7232B	10 digits, 20 annunciators on COM 3, code B	10	20					3	•		•		350
ICM7232C	10 digits, 20 annunciators on COM 1 +3, code B	10	20					3	•		•		350
ICM7233A	4 alphanumeric characters.			4				3		•	•		500
ICM7233B	4 alphanumeric characters. Full-width numbers			4				3		•	•		500
ICM7243A	8 alphanumeric characters + decimal pt. can be daisy chained or cascaded.			8						•	•	•	250
ICM7243B			8							•	•	•	250
CA3161	BCD-TO-Saver segment decoder driver	1							•		•		2600
CA3168	2 digit BCD-TO-Saver segment decoder driver	2							•		•		2600

# Bus Drivers/Latches

## CDP1853 - N-Bit 1 of 8 decoder

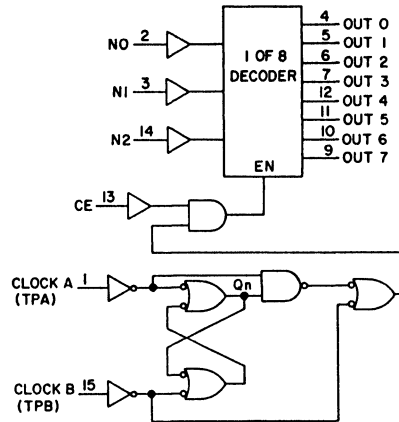
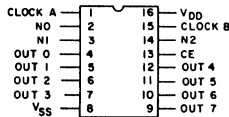
1800 series 3 to 8 decoder for I/O and memory systems

### Features:

- Direct I/O command decoder for 1800  $\mu$ P's
- 4 to 10.5 V operation
- 1.6 mA drive/200 ns prop delay

### Applications:

- I/O & memory address decoder
- Chip select decoder



## CDP1881/1882/1883 - 6-Bit/7-Bit Latch and Decoder

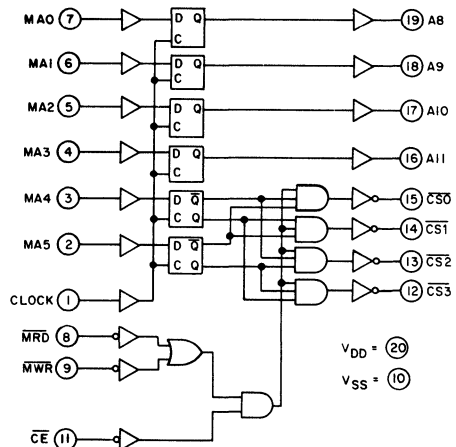
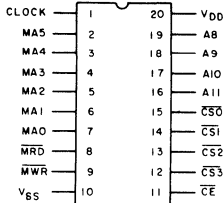
Memory system address latches & chip select decoder for 1800 series.

### Features:

- 4-bit latch/2 to 4 decoder (1881/82)
- 5-bit latch/2 to 4 decoder (1883)
- Decodes 16K/32K of memory (1881, 1882)/ 1883
- 175 ns prop delay

### Applications:

- I/O & memory address latch & decoder
- Chip select decoder



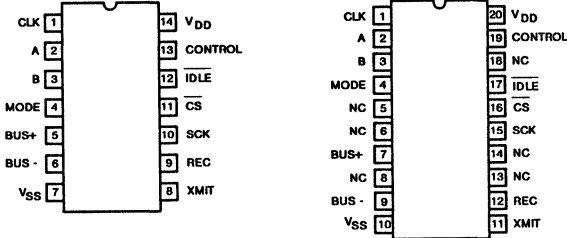
# Bus Drivers/Latches - 6805 Series

## CDP68HC68P2 - Octal Serial Solenoid Driver

Octal open collector high current output driver.

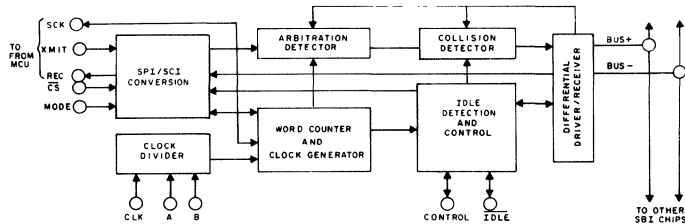
### Features:

- 6805 SPI bus serial peripheral
- 0.5 A per output with overvoltage/overcurrent protection
- Current limiting & transient protection
- Fault feedback & unlatch feature



### Applications:

- Lamp, relay, or solenoid driver
- Automotive
- High breakdown voltage/high output current

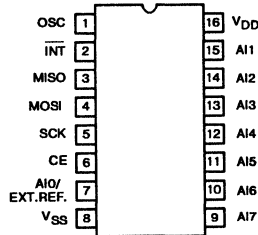


## CDP68HC68S1 - Serial Bus Interface

Differential driver/receiver for small area networks.

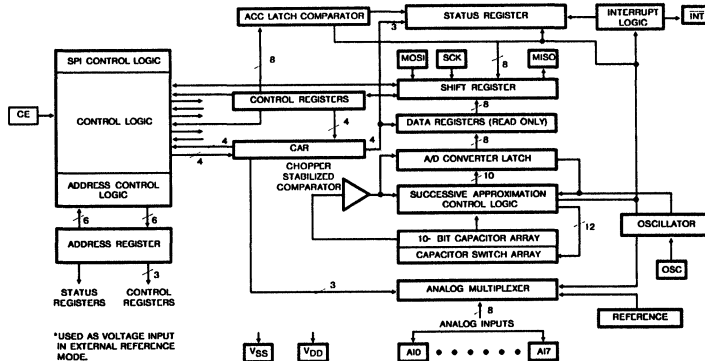
### Features:

- Differential bus for minimum EMI
- Data-collision/idle detection
- Bus arbitration
- Power-on reset



### Applications:

- Small area networks
- High speed serial communications
- Multiple 6805 bus system



\*USED AS VOLTAGE INPUT IN EXTERNAL REFERENCE MODE.

# Bus Drivers/Latches - 80C86/88/286 Series

## 82C82/83 - Octal Latching Bus Driver

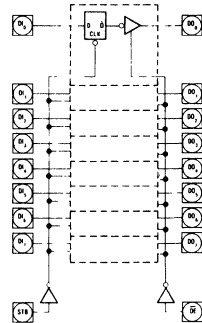
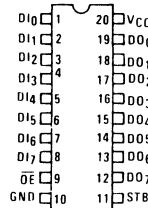
High drive octal latching buffer.

### Features:

- Tri-state non-inverting/inverting outputs
- 25/35ns prop delay, 300pf/20 mA drive
- 2.0 volt operation
- Gated inputs for low power operation

### Applications:

- Address latch for 80C86/88 system
- Data storage



## 82C86/87 - Octal Bus Transceiver

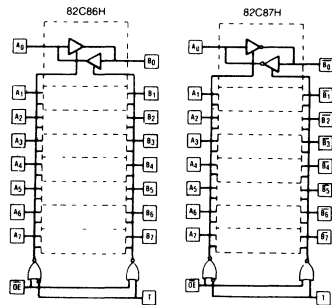
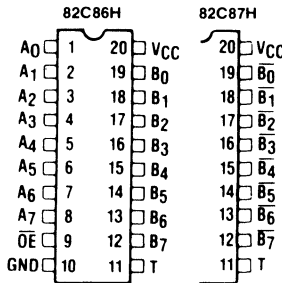
High drive octal bi-directional bus transceiver non-latching.

### Features:

- Tri-state non-inverting/inverting outputs
- 30 ns prop delay, 300pf/20 mA drive
- 2.0 volt operation
- Gated inputs eliminates bus pullups & greatly reduces power consumption

### Applications:

- Multimaster  $\mu$ P systems
- Isolated bus systems, local/remote



# Bus Drivers/Latches - General

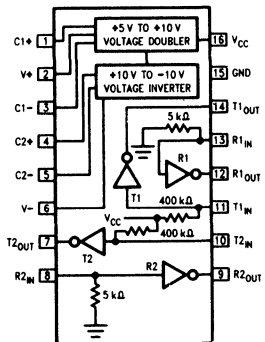
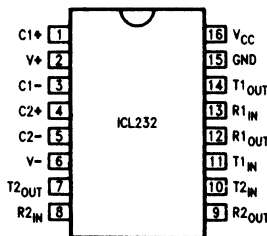
## ICL 232 - Dual RS-232 Transmitter/Receiver

### Features:

- Single +5v power supply,  $\pm 10$ v outputs
- 2 drivers with 300 ohm power off impedance
- 2 receivers with  $\pm 30$ v input range and 0.5 v hysteresis

### Applications:

- Computers, modems
- Printers, terminals, peripherals



# Bus Controllers - 1800 Series

## CDP1877 - Programmable Interrupt Controller

Expands interrupts in CDP-1800  $\mu$ P series to 8 priority interrupts relieving the 1800 from polling.

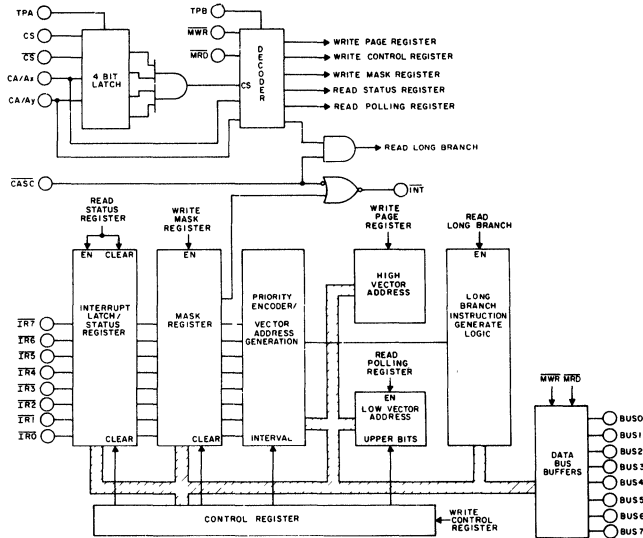
### Features:

- 8 programmable/prioritized interrupt levels
- Edge sensitive interrupt inputs
- Individual interrupt masking
- Interrupt vector address generated

### Applications:

- Alarm systems
- Communication systems
- Industrial control

CASCADE	1	25	VDD
IR7	2	27	BUS 7
IR6	3	26	BUS 6
IR5	4	25	BUS 5
IR4	5	24	BUS 4
IR3	6	23	BUS 3
IR2	7	22	BUS 2
IR1	8	21	BUS 1
IR0	9	20	BUS 0
TPA	10	19	CS/A <sub>1</sub>
TPB	11	18	CS/A <sub>2</sub>
MWR	12	17	CS
MRO	13	16	CS
VSS	14	15	INT



# 80C86/88/286 Series

## 82C59A - Priority Interrupt Controller

Expands interrupts to 8 priorities relieving the system of polling.

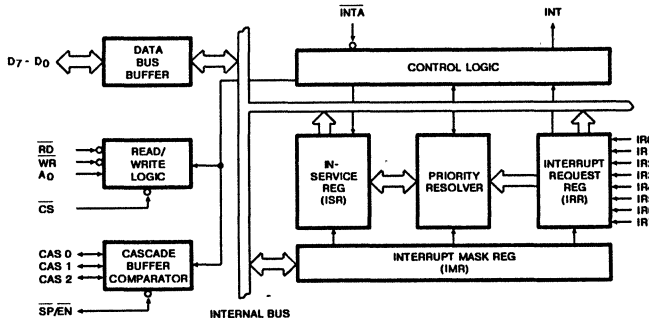
### Features:

- 12.5 MHz bus
- 8 programmable/prioritized interrupts expandable to 64 in master/slave configuration
- Edge or level sensitive IR inputs
- 8085/86/88 INT vectors generated
- 8 prioritized modes of operation

### Applications:

- Alarm systems
- Industrial control
- Telemetry systems

CS	11	28	VCC
WR	12	27	A0
RD	13	26	INTA
D7	14	25	IR7
D6	15	24	IR6
D5	16	23	IR5
D4	17	22	IR4
D3	18	21	IR3
D2	19	20	IR2
D1	10	19	IR1
D0	11	18	IR0
CAS 0	12	17	INT
CAS 1	13	16	SP/EN
GND	14	15	CAS 2



# Bus Controllers - 80C86/88/286 Series

## 82C37A - DMA Controller

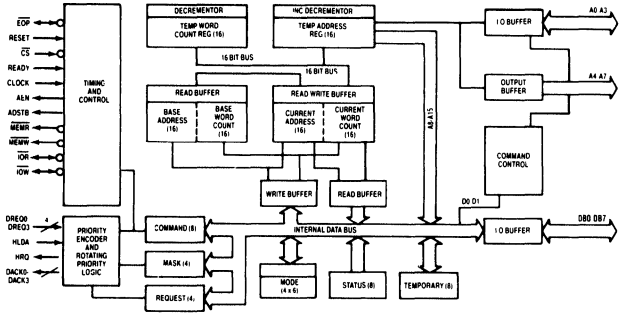
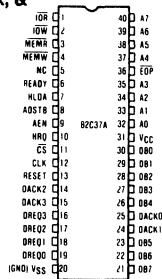
Allows external devices to transfer data directly to/from system memory at a very high rate.

### Features:

- 6 Mbytes/sec data transfer rate
- 8 or 16 bit data transfer mode
- Four independent maskable channels
- Memory-to-memory, block, & demand transfers

### Applications:

- Disk drive systems
- High speed peripherals
- Multimaster systems



## 82C88 - Bus Controller

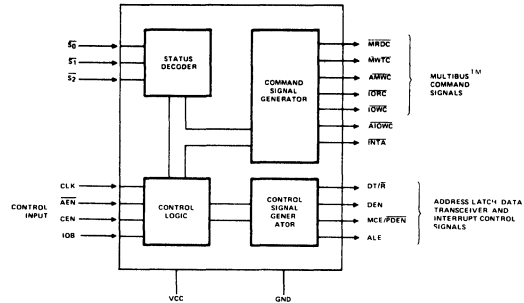
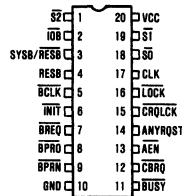
Provides control & command timing signals for 80C86/88, 80186/188 systems in MAX mode.

### Features:

- Three-state command outputs
- 8 MHz Multibus™ compatible
- 20mA command output drive

### Applications:

- Multimaster bus systems
- Max mode 80C86/88 system



## 82C89 - Bus Arbiter

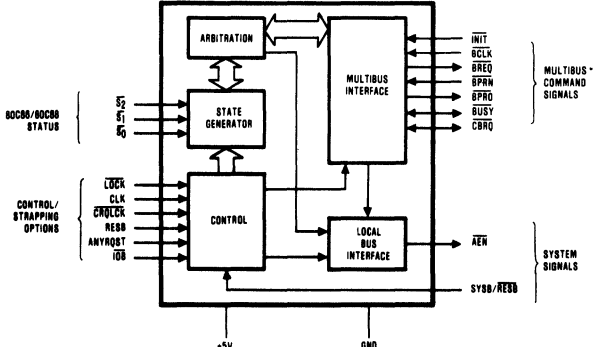
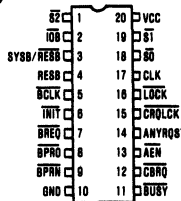
Provides full bus arbitration and control for multi-processor 80C86/88 system

### Features:

- Parallel/serial/rotating priority resolving
- Synchronization with Multi-Master bus
- Bus locking capability
- Supports I/O μP's (ie 8089)

### Applications:

- Multi-Master systems



# Parallel I/O Interface

Type	Comments and Applications	μP Interface			Port Configuration				Input/Output Ports							
		Standard 8-Bit μP I/F	Multiplexed Bus Compatible	Interrupts	Total # of 8-Bit Ports	Input Ports Programmable	Output Ports Programmable	Bidirectional Ports Programmable	Individual Bits Programmable	Bit Set/Reset	Latched Inputs	Latched Outputs	Tri-Statable Outputs	Darlington Output Drive	Direct Read of Outputs	Strobed Input/Output
CDP1851	Programmable I/O Interface Interfaces Peripheral Equipment to the 1800 μP Keyboard & Display Interface, Printer or CRT Interface, LED Driver. 40 to 10.5V Operating Range.	•	•		2	2	1	20		•	•				•	•
CDP1852 CDP1872 CDP1874 CDP1875	8-Bit Input/Output Port Interfaces 8-Bit Parallel Peripheral Equipment to the 1800 μP. Address latched, Keypad Interface, Printer Interface. 4V to 10.5V Operating Range				1 1 1 1	1 1 1 1				• • • •	• • • •	• • • •			•	
CDP6823	Parallel Interface Peripheral Equipment Interface for 6805 μP. Motel Interface Circuit. Keyboard/Display I/F, Floppy Disc Interface, Printer/CRT Interface.	•	•	•	3	3	3	24	•	•	•	•			•	
68HC68P1	Single Port Input/Output 6805 SPI Bus Serial Interface. 3-6V Operating Range. On Board Capacitor (PR & Port Pins) Port Expander, Keyboard/Printer Interface.				1	1	1	8	•	•	•	•				
82C55A	Programmable Peripheral Interface Bus Hold Circuitry Eliminates Pull Up Resistors For Switch and LED Configuration.	•	•		3	3	3	1	•	•	•	•	•	•	•	•

# UARTS/Baud Rates Generators

Type	Comments and Applications	Pkg	I/P Interface					Serial Interface					Data Set/Modem Controls				Clk/Baud Rates						
			# Of Pins	RD /NR Pin	RD and WR Pins	Multiplexed Bus Compatible	Non-Multiplexed Bus	# of Registers	Programmable Interrupts	Buffered Transmit/Receive	Overrun, Parity, Framing Error	Programmable Data (5-9 Bits), Stop (1-2 Bits)	Full Duplex	Echo Modem Loop Back	Line Break Generation/Detection	RTS, CTS, DR, TRF	DTR, DSR	DCD	RI	Xtal/Clock	Baud Rate (K Bits/Sec)	Clock Divisor (-H)	On Chip Baud Rate Generator
CDP1854	Programmable UART with False Start-Bit Detection 4 V - 10 V Operation	40	•			•	4	•	•	•	•	•		•						200	16	•	
CDP65C51	15 Programmable Baud Rates (250K Baud w/External Clk) Data Set/Modem Control Functions	28	•			•	6	•	•	•	•	•		•	•	•		•	4.16	16	•	•	
CDP6853	Programmable UART with Moter Bus (250K Baud w/External Clk) Data Set/Modem Control Functions	28	•	•	•	•	6	•	•	•	•	•	•	•	•	•		•	4.16	16	•	•	
82C50A	IBM PC Compatible Modem Interface	40		•	•	•	11	•	•	•	•	•	•	•	•	•	•	•	625	16	•	•	
82C52	1M Baud Easy-to-Program UART/Brg. 72 Selectable Baud Rates	28		•		•	8	•	•	•	•	•	•	•	•			•	1M	1	•		
HD6406	Programmable UART/Brg w/Complete Modem I/F DMA Capability	40		•	•	•	8	•	•	•	•	•	•	•	•	•	•	•	1M	1	•		
HD6402R CDP6402	Industry Standard Stand-Alone UART 6402R - TTL Compatible Inputs	40 40					3 3	•	•	•	•	•							500 200	16 16	•	•	
HD4702	Programmable Bit Rate Generator Provides 13 Commonly Used Baud Rates	16																•	195	16	•		

4B  
Peripherals



# Manchester Encoder/Decoders

## HD-6408,6409,1550,15531 - CMOS Manchester Encoder/Decoder

Manchester (BI-phase) encoding and decoding of a serial data stream intended to service the requirements of MIL-STD-1553 and similar Manchester II self clocking, encoded, time division multiplexed serial data protocols.

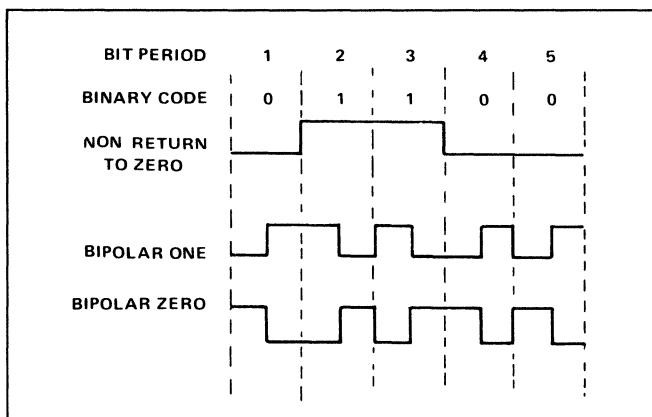
### Features:

- Independent encoder and decoder
- No DC component allowing transformer coupling
- High noise immunity
- Complete clock recovery and phase lock-in
- Encoder converts NRZ data to Manchester II data adding a command or Data sync pulse and parity. (6408,15530,15531)
- Encoder converts NRZ data to Manchester II data adding eight Manchester zeroes and a command sync pulse (6409)
- Decoder recognizes sync pulse as a command or data sync, decodes the data into NRZ, checks for parity (except 6409), and checks for Manchester errors.
- On-chip oscillator (6409 only)
- Repeater mode reconstructs Manchester code input with a recovered clock (6409 only)

Part Number	Pin Config.	Data Frame Length	Data Rate	Temperature Range
HD-6408	24-Pin	16 Bits	1.0 Mbit/sec	-40°C to +85°C
HD-15530	24-Pin	16 Bits	1.25 Mbit/sec	-40°C to +85°C -55°C to +125°C
HD-15531	40-Pin	2-32 Bits	1.25 Mbit/sec	-40°C to +85°C -55°C to +125°C
HD-1553B	40-Pin	2-32 Bits	2.5 Mbit/sec	-40°C to +85°C -55°C to +125°C
HD-6409	20-Pin	Complete Variable	1.0 Mbit/sec	-40°C to +85°C -55°C to +125°C

### Applications:

- Military aircraft data bus standard
- Telemetry systems
- Magnetic tape recording
- Fiber optic communications
- Security systems
- High speed modems



# Keyboard Encoder

## CDP1871 - CMOS Keyboard Encoder

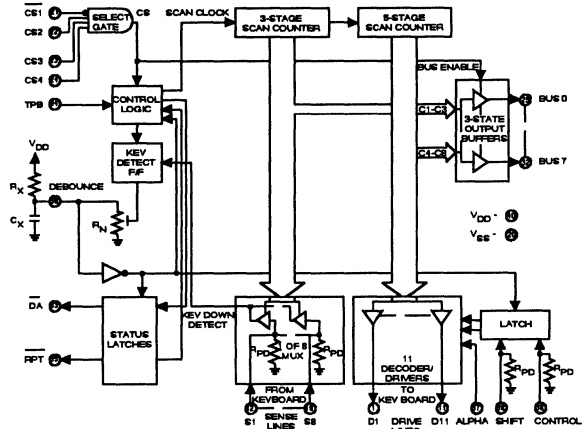
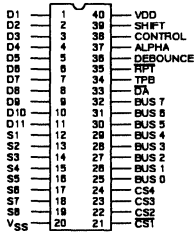
Interfaces Between a CDP-1800 Series  $\mu$ P and a Keyboard Array.

### Features:

- Scans and Generates Code For 53 Key ASCII Keyboard Plus 32 HEX Keys (SPST Mechanical Contact Switches)
- RC-Controlled Debounce Circuitry
- N-Key Lockout
- 4 to 10.5 Volt Operating, 50 $\mu$ A

### Applications:

- Keyboard Encoder
- Keypad Encoder



# SPI Bus Peripherals

## CDP68HC68A2 - CMOS Serial 10-Bit A/D Converter

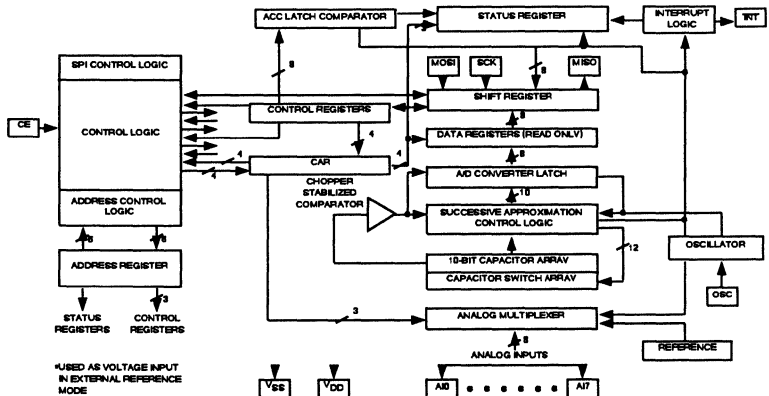
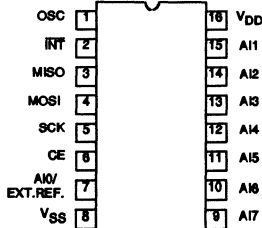
Interfaces External Analog Signals to 6805-Series  $\mu$ P via 4-Wire SPI Serial Bus

### Features:

- 10-Bit Switched Capacitor, Successive Approximation A/D
- 14  $\mu$ S 10-Bit Conversion Time
- 8 Multiplexed Analog Input Channels
- Intrinsic Sample and Hold

### Applications:

- Sensor Interfaces
- Communication Systems
- Telemetry Systems



# SPI Peripherals

- CDP68HC68P1 - CMOS Single Port Input/Output
- CDP68HC68P2 - CMOS Octal Serial Solenoid Driver
- CDP68HC68R1 - CMOS 128 Word by 8-Bit Static RAM
- CDP68HC68R2 - CMOS 256 Word by 8-Bit Static RAM
- CDP68HC68S1 - Serial Bus Interface
- CDP68HC68T1 - CMOS Real-Time Clock with RAM & Power Sense/Control
- CDP68HC68W1 - Digital Pulse Width Modulator

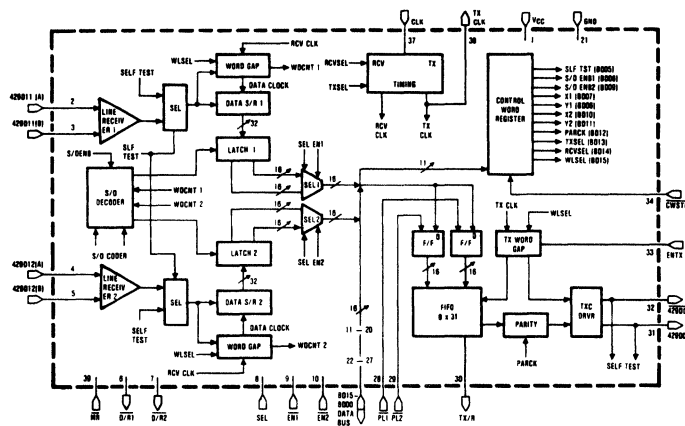
# ARINC Interface

## HS-3282 - CMOS ARINC Bus Interface Circuit

Programmable Bus Interface Circuit for ARINC Specification 429 and Similarly Encoded Serial Data Protocols

### Features:

- Data Rates Up to 100K Bits/Sec
- Dual and Independent Receivers, Connecting Directly to ARINC Bus
- Separate Receiver and Transmitter Sections
- 16-Bit Parallel Data Bus
- 32 or 25 Bit Serial Word Length
- FIFO Holds Up to 8 ARINC Data Words for Transmission
- Single 5V Supply
- 40-Pin CERDIP and 44-Pin LCC
- Full Military Temperature Range



HS-3282 Functional Diagram

## HS-3182 - ARINC Line Driver

### Features:

- Converts HS-3282 Transmit Outputs to ARINC Bus Levels
- Adjustable Rise/Fall Times
- Programmable Output Differential Voltage
- 16-Pin CERDIP and 28-Pin LCC
- Full Military Temperature Range

### Applications:

- Commercial Aircraft Data Bus Standard

# CMOS Logic

## Logic Families

### FCT Bus Interface Devices

#### Features:

- 8, 9 and 10 bit high current drive bus interface devices
- 1.5 micron, low power BiCMOS process
- Drop-in replacement for bipolar FAST and AS logic
- Typical gate propagation delay = 3ns @ 5V
- JEDEC standard 64/48 mA sink current capability
- 4.75 to 5.25 volt operation
- No input/output diodes to  $V_{CC}$  - eliminates bus contention
  - allows hot card insertion
- Low groundbounce -  $V_{olp} = 1V$  typical

### Advanced CMOS (AC/ACT) Logic - SSI, MSI logic functions and medium current bus interface devices

#### Features:

- 1.5 micron CMOS process
- ACT provides drop-in replacement for bipolar FAST
- AC provides direct interface to CMOS
- Typical gate propagation delay = 3ns @ 5V
- JEDEC standard 24 mA sink/source drive current capability
- 1.5 to 5.5 volt operation for AC devices
- 4.5 to 5.5 volt operation for ACT devices
- Low groundbounce -  $V_{olp} = 1V$  typical

### High Speed CMOS (HC/HCT) Logic - SSI, MSI logic functions and low current bus interface devices

#### Features:

- 3 micron CMOS process
- HCT provides drop-in replacement for LSTTL
- HC provides direct interface to CMOS
- Typical gate propagation delay = 8ns @ 5V
- JEDEC standard 4/6 mA sink/source drive current capability
- 2 to 6 volt operation for HC devices
- 4.5 to 5.5 volt operation for HCT devices

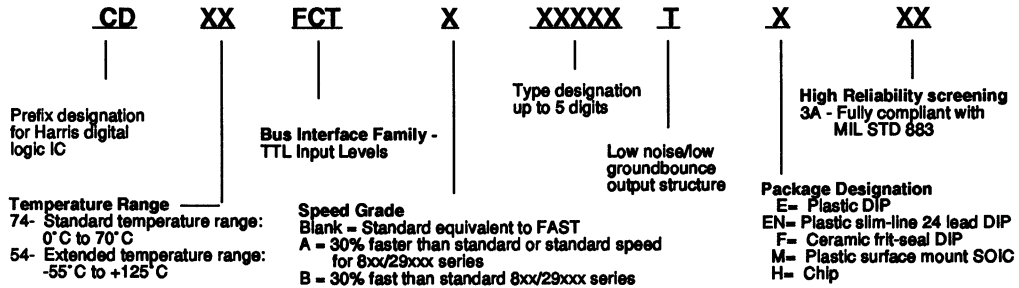
### CD4000 Logic - SSI and MSI logic functions

#### Features:

- 7 micron CMOS process
- CMOS input compatibility
- Typical gate propagation delay = 60ns @ 5V
- JEDEC standard 0.4 mA sink/source drive current capability
- High voltage operation:
  - 3 to 18 volt operation for B series
  - 3 to 12 volt operation for A series
- High noise immunity at 10-15V; ideal for noisy environments

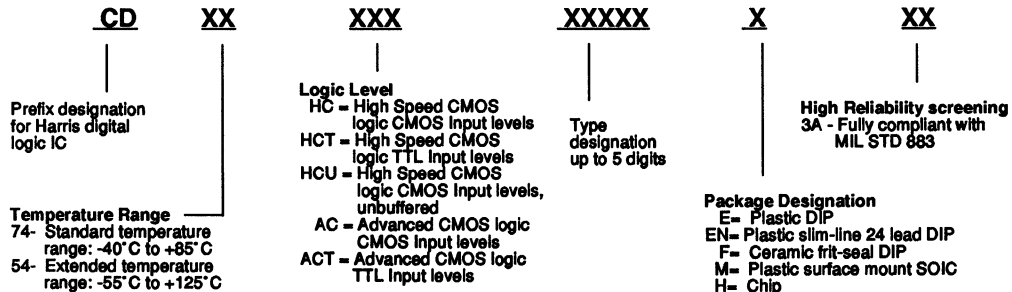
# CMOS Logic

## FCT Nomenclature (Example: 74 FCT 245 ATE)

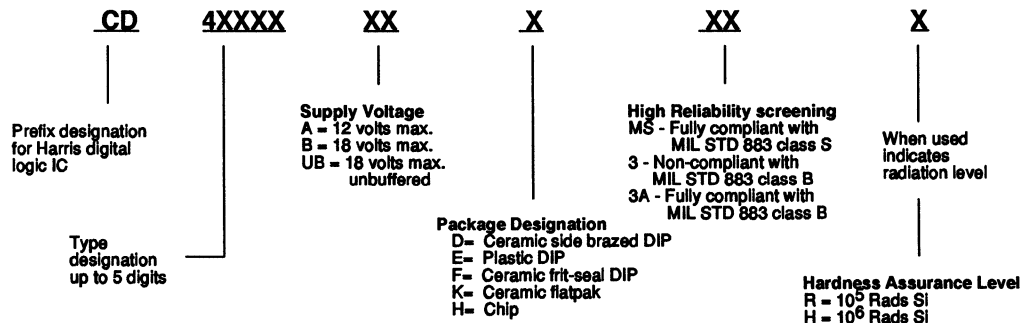


## High Speed CMOS/Advanced CMOS Nomenclature

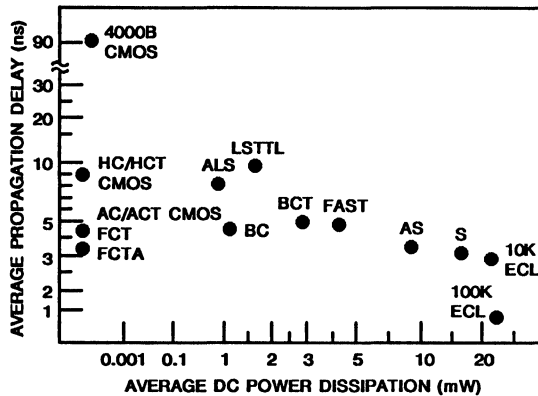
(Example: CD 74 ACT 245E, CD 54 HC 245E)



## CD4000 Nomenclature (Example: CD4011BE)



# FCT Bus Interface Logic Family



NOTE: FCT, BC AND BCT ARE BiCMOS

## Focus

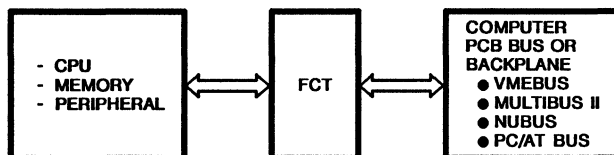
Replace FAST and AS bipolar logic in existing and new bus interface applications

- ▶ Similar speeds as AC/ACT
- ▶ Drive capability meets VME and MULTIBUS requirements

## FCT Family Description

Harris FCT is a broad family of 8, 9, 10-bit computer-bus interface logic ICs. Harris FCT BiCMOS Bus-Interface ICs are designed to satisfy four major requirements of modern bus-oriented computer systems, namely:

1. High speed/low propagation delay
2. High drive, to meet specified bus-interface requirements for clock and data lines
3. Low power consumption (CMOS-like)
4. Minimization of switching noise



# FCT Family Description (Continued)

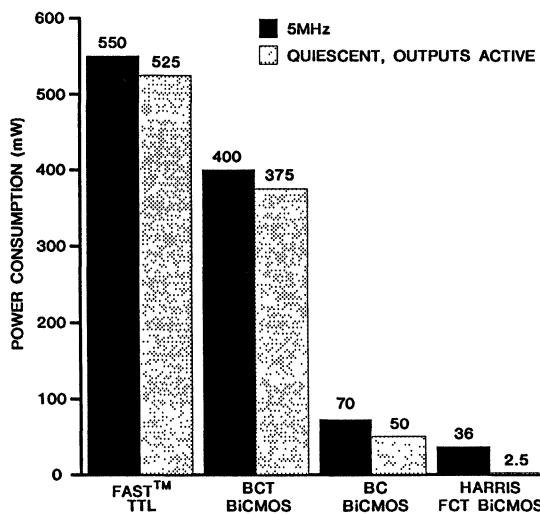
## Features of the Harris FCT Family

- High Speed, Typical Delay = 3.5ns
  - ▶ FCTXXXAT AND FCTXXXBT are faster than FAST™
- Low Power;
 

	Typical Power/Function
▶ Quiescent .....	0
▶ 5MHz .....	5.6mW
▶ 10MHz .....	11.2mW
- Output Sink Current; Buffers - 64mA, 70°C  
FF/Latches - 48mA, 70°C
- Limited Output Voltage Swing (for Reduced Noise Generation); 3.5V Typical
- No Diode Clamps From Inputs or Outputs to V<sub>CC</sub>
- Minimized Switching Noise Design, Layout, and Packaging
  - ▶ Low Ground Bounce - Typically 1.2V (vs. > 2V with IDT FCT)
  - ▶ Reduced EMI Due to Slowed Output Edges
  - ▶ Good Input Dynamic Noise Immunity (via Isolated Ground System and Input Hysteresis)
- ESD: ±2kV (HBM)
- Variety of Bus-Interface Functions:
 

▶ Buffers .....	5 Octal
	2 10-Bit
▶ Flip-Flops/Registers ....	6 Octal
	2 9-Bit
	2 10-Bit
	2 Special Registers
▶ Transceivers .....	17 Octal
	2 9-Bit
	2 10-Bit
▶ Latches .....	4 Octal
	2 9-Bit
	2 10-Bit
	TOTAL 48 Device Types

## Power Comparison



NOTE: D = 50% FOR D < 50% (JLJL) POWER OF BC > 65mW

# FCT Product Selection Guide

## TYPE CD54/74

### INVERTERS/BUFFERS/BUS DRIVERS

FCT240/AT	Octal Buffer/Line Driver; 3-State; Inverting
FCT241/AT	Octal Buffer/Line Driver; 3-State
FCT244/AT	Octal Buffer/Line Driver; 3-State
FCT540/AT	Octal Buffer/Line Driver; 3-State; Inverting
FCT541/AT	Octal Buffer/Line Driver; 3-State
FCT827A/BT	10-Bit Buffer/Line Driver; 3-State
FCT828A/BT	10-Bit Buffer/Line Driver; 3-State; Inverting

### FLIP-FLOPS/REGISTERS

FCT273/AT	Octal D-Type Flip-Flop with Reset; Positive-Edge Trigger
FCT374/AT	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State
FCT377/AT	Octal D-Type Flip-Flop; Positive-Edge Trigger with Data Enable
FCT534/AT	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting
FCT564/AT	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting
FCT574/AT	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State
FCT821A/BT	10-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State
FCT822A/BT	10-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting
FCT823A/BT	9-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State
FCT824A/BT	9-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting
FCT29520A/BT	Multilevel Pipeline Register
FCT29521A/BT	Multilevel Pipeline Register

### BUS TRANSCEIVERS

FCT245/AT	Octal Bus Transceiver; 3-State
FCT543/AT	Octal Register-Transceiver; 3-State
FCT544/AT	Octal Register-Transceiver; 3-State; Inverting
FCT623/AT	Octal Bus Transceiver; 3-State
FCT640/AT	Octal Register Transceiver; 3-State; Inverting
FCT643/AT	Octal Register Transceiver; 3-State; True/Inverting
FCT646/AT	Octal Register Transceiver; 3-State
FCT647/AT	Octal Bus Transceiver/Register with Open Drain
FCT648/AT	Octal Bus Transceiver/Register; 3-State; Inverting
FCT649/AT	Octal Bus Transceiver/Register with Open Drain; Inverting
FCT651/AT	Octal Bus Transceiver/Register; 3-State; Inverting
FCT652/AT	Octal Bus Transceiver/Register; 3-State
FCT653/AT	Octal Bus Transceiver/Register; Open-Drain (A Side); 3-State (B Side); Inverting
FCT654/AT	Octal Bus Transceiver/Register; Open-Drain (A Side); 3-State (B Side)
FCT861A/BT	10-Bit Bus Transceiver; 3-State
FCT862A/BT	10-Bit Bus Transceiver; 3-State; Inverting
FCT863A/BT	9-Bit Bus Transceiver; 3-State
FCT864A/BT	9-Bit Bus Transceiver; 3-State; Inverting
FCT2952A/BT	Octal Register-Transceiver; 3-State
FCT2953A/BT	Octal Register-Transceiver; 3-State; Inverting
FCT7623/AT	Octal Bus Transceiver; 3-State (B Side); Open-Drain (A Side)

### LATCHES

FCT373/AT	Octal Transparent Latch; 3-State
FCT533/AT	Octal Transparent Latch; 3-State; Inverting
FCT563/AT	Octal Transparent Latch; 3-State; Inverting
FCT573/AT	Octal Transparent Latch; 3-State
FCT841A/BT	10-Bit Transparent Latch; 3-State
FCT842A/BT	10-Bit Transparent Latch; 3-State; Inverting
FCT843A/BT	9-Bit Transparent Latch; 3-State
FCT844A/BT	9-Bit Transparent Latch; 3-State; Inverting



# FCT Performance Comparisons

## Vender Comparisons

	HARRIS		IDT				NATIONAL	
	BASE FCT	SF AT	BASE FCT	SF A	SF T	SF AT	BASE FCT	SF A
FAST Speed Compatible	X		X		X		X	
Approximately 30% Higher Speed than FAST		X		X		X		X
Controlled Switching Noise; Under 1.5V Ground Bounce	X	X			X	X		
Limited Output Swing; 3.6V Maximum	X	X			X	X		
No Output Clamp Diode to V <sub>CC</sub>	X	X						

## Comparing FCT, BCT, BC ABT

CRITERIA	FCT	BCT	BC	ABT
Zero (Typical) Static Power	X			
Controlled Switching Noise	X (All Harris) (IDT Suffix T)	X	X	X
Speed > FAST	X (Suffix A/AT)			X
Economical CMOS Based Process	X			

# The Advanced CMOS Logic Family (AC/ACT)

- **FOCUS:** Replace Fast Logic in Old or New Designs
  - ▶ 75MHz Flip Flops (typical)
  - ▶ 3ns Gates (typical)
- **COMPETITION:**
  - ▶ Motorola
  - ▶ National
  - ▶ Toshiba
  - ▶ TI (center pin)
  - ▶ Signetics (center pin)
- **MAIN ATTRIBUTES:**
  - ▶ Corner pin power and ground allows direct TTL drop-in compatibility
  - ▶ Modifications to the output structure and package provide devices with **low ground bounce** (approximately 1 volt)
  - ▶ Functional, performance, and drop-in replacement for FAST TTL

## Performance Comparison of AC/ACT and FAST Logic Functions:

CHARACTERISTICS	74 SERIES AC/ACT	74 SERIES FAST
1. Power Consumption (mW) Four-stage counter (191) Octal transceiver (245)	Frequency (MHz)	
	0      1      10	0      1      10
	0.44    5.5    55	204    224    306
	0.44    39    390	468    514    702
2. Operating Voltage (volts):	AC: 1.5 to 5.5 ACT: 4.5 to 5.5	4.75 to 5.25
3. Operating Temperature Range (°C):	-55°C to +125°C	0°C to +70°C
4. Noise Margin (volts): (V <sub>CC</sub> = 4.5V, rated load) FAST to FAST AC to AC (High/Low) ACT to ACT	—	0.4/0.3
	1.25/1.25	—
	1.8/0.36	—
5. Input Switching Voltage Variation Over the Operating Temperature Range (mV)	V <sub>S</sub> ± 50	V <sub>S</sub> ± 200
6. Output Drive Current (mA): (V <sub>CC</sub> = 4.5V) SSI/MSI Logic 3-State Buffers Bus Drivers	±24	(I <sub>OL</sub> /I <sub>OH</sub> ) +20/-1
	±24	+24/-3
	±24	+64/-15
7. Propagation Delay (ns): (t <sub>PHL</sub> /t <sub>PLH</sub> ) Octal Buffer (240) Flip-Flop (74)	7.8/7.8	6/9
	9.4/9.4	10.5/8.5
8. Input Current (µA): I <sub>IL</sub> I <sub>IH</sub>	+1	+1600
	-1	-20
9. Three-State Output Current (µA):	±5	±50

4C  
Logic

## CD54/74AC/ACT Series Function Selection Chart

TYPE CD54/74	FUNCTION/DESCRIPTION	CLASSIFICATION	NO. OF PINS
AC/ACT00 AC/ACT02 AC/ACT10 AC/ACT20	<b>NAND/NOR Gates</b>		
	Quad 2-Input NAND Gate	SSI	14
	Quad 2-Input NOR Gate	SSI	14
	Triple 3-Input NAND Gate	SSI	14
	Dual 4-Input NAND Gate	SSI	14
AC/ACT08 AC/ACT32 AC/ACT86	<b>AND/OR/Exclusive-OR Gates</b>		
	Quad 2-Input AND Gate	SSI	14
	Quad 2-Input OR Gate	SSI	14
	Quad 2-Input Exclusive-OR Gate	SSI	14
AC/ACT04 AC/ACT05 AC/ACT240 AC/ACT244 AC/ACT540 AC/ACT541	<b>Inverters/Buffers/Bus Drivers</b>		
	Hex Inverter/Buffer	SSI	14
	Hex Inverter/Buffer with Open-Drain Outputs	SSI	14
	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
	Octal Buffer/Line Driver; 3-State	MSI	20
	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
	Octal Buffer/Line Driver; 3-State	MSI	20
AC/ACT373 AC/ACT533 AC/ACT563 AC/ACT573	<b>Latches</b>		
	Octal Transparent Latch; 3-State	MSI	20
	Octal Transparent Latch; 3-State; Inverting	MSI	20
	Octal Transparent Latch; 3-State	MSI	20
	Octal Transparent Latch; 3-State	MSI	20
AC/ACT14	<b>Schmitt Trigger</b> Hex Inverting Schmitt Trigger	SSI	14
AC/ACT297	<b>Phase-Locked Loop</b> Digital Phase-Locked Loop	MSI	16

# CD54/74AC/ACT Series (Continued)

## Function Selection Chart (Continued)

Type CD54/74	Function/Description	Classification	No. of Pins
	<b>Flip-Flops/Latches</b>		
AC/ACT74	Dual D-Type Flip-Flop with SET and RESET; Positive-Edge Trigger	FF	14
AC/ACT109	Dual JK Flip-Flop with SET and RESET; Positive-Edge Trigger	FF	16
AC/ACT112	Dual JK Flip-Flop with SET and RESET	FF	16
AC/ACT174	Hex D-Type Flip-Flop with RESET	MSI	16
AC/ACT175	Quad D-Type Flip-Flop with RESET	MSI	16
AC/ACT273	Octal D-Type Flip-Flop with RESET	FF	20
AC/ACT374	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Non-Inverting	FF	20
AC/ACT534	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	FF	20
AC/ACT564	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	FF	20
AC/ACT574	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State	FF	20
	<b>Shift/FIFO Buffer/Multiport Registers</b>		
AC/ACT164	8-Bit Serial-In Parallel-Out Shift Register	MSI	14
AC/ACT299	8-Bit Universal Shift Register; 3-State	MSI	20
AC/ACT323	8-Bit Universal Shift Register; 3-State (w/Synchronous RESET)	MSI	20
AC/ACT7202	1024 x 9 Bit Parallel In-Out FIFO	MSI	28
AC/ACT7201	512 x 9 Bit Parallel FIFO	MSI	28
	<b>Arithmetic Circuits</b>		
AC/ACT280	8-Bit Odd/Even Parity Generator/Checker	MSI	14
AC/ACT283	4-Bit Full Adder with Fast Carry	MSI	16
	<b>Counters</b>		
AC/ACT161	Presetable Synchronous 4-Bit Binary Counter; Asynchronous RESET	MSI	16
AC/ACT163	Presetable Synchronous 4-Bit Counter; Synchronous RESET	MSI	16
AC/ACT191	Presetable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
AC/ACT193	Presetable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
AC/ACT7060	14-Stage Binary Ripple Counter with Oscillator	MSI	20
AC/ACT7061	14-Stage Binary Ripple Counter with Oscillator	MSI	20
	<b>Analog and Digital Multiplexers/Demultiplexers</b>		
AC/ACT138	3-to-8-Line Decoder/Demultiplexer, Inverting	MSI	16
AC/ACT139	Dual 2-of-4-Line Decoder/Demultiplexer	MSI	16
AC/ACT151	8-Input Multiplexer	MSI	16
AC/ACT153	Dual 4-Input Multiplexer	MSI	16
AC/ACT157	Quad 2-Input Multiplexer	MSI	16
AC/ACT158	Quad 2-Input Multiplexer, Inverting	MSI	16
AC/ACT238	3-to-8-Line Decoder/Demultiplexer	MSI	16
AC/ACT251	8-Input Multiplexer; 3-State	MSI	16
AC/ACT253	Dual 4-Input Multiplexer; 3-State	MSI	16
AC/ACT257	Quad 2-Input Multiplexer; 3-State; Non-Inverting Outputs	MSI	16
AC/ACT258	Quad 2-Input Multiplexer; 3-State; Inverting Outputs	MSI	16
	<b>Decoders/Encoders</b>		
AC/ACT138	3-to-8-Line Decoder/Demultiplexer Inverting	MSI	16
AC/ACT139	Dual 2-of-4-Line Decoder/Demultiplexer	MSI	16
AC/ACT238	3-to-8-Line Decoder/Demultiplexer	MSI	16
	<b>Bus Transceivers</b>		
AC/ACT245	Octal Bus Transceiver; 3-State	MSI	20
AC/ACT623	Octal Bus Transceiver; 3-State; Non-Inverting	MSI	20
AC/ACT646	Octal Bus Transceiver/Register; 3-State	MSI	24
AC/ACT647	Octal Bus Transceiver/Register with Open Drain, Non-Inverting	MSI	24
AC/ACT648	Octal Bus Transceiver/Register; 3-State; Inverting	MSI	24
AC/ACT649	Octal Bus Transceiver/Register with Open Drain, Inverting	MSI	24
AC/ACT651	Octal Bus Transceiver/Register with Open Drain, Inverting	MSI	24
AC/ACT652	Octal Bus Transceiver/Register; 3-State; Non-Inverting	MSI	24
AC/ACT653	Octal Bus Transceiver/Register; 3-State (B Side), Open-Drain (A Side); Inverting	MSI	24
AC/ACT654	Octal Bus Transceiver/Register; 3-State (B-Side), Open-Drain (A-Side); Non-Inverting	MSI	24
AC/ACT7623	Octal Bus Transceiver; 3-State (B-Side), Open-Drain (A-Side); Non-Inverting	MSI	20
AC/ACT7651	Octal Bus Transceiver/Register; 3-State; Inverting	MSI	24

# High-Speed CMOS Logic ICs

## CD54/74HC/HCT Series

### Function Selection Chart

Type CD54/74	Function/Description	Classification	No. of Pins
	<b>NAND/NOR Gates</b>		
HC/HCT00	Quad 2-Input NAND Gate	SSI	14
HC/HCT02	Quad 2-Input NOR Gate	SSI	14
HC/HCT03	Quad 2-Input NAND Gate with Open Drain	SSI	14
HC/HCT10	Triple 3-Input NAND Gate	SSI	14
HC/HCT20	Dual 4-Input NAND Gate	SSI	14
HC/HCT27	Triple 3-Input NOR Gate	SSI	14
HC/HCT30	8-Input NAND Gate	SSI	14
HC/HCT4002	Dual 4-Input NOR Gate	SSI	14
	<b>AND/OR/EXCLUSIVE-OR Gates</b>		
HC/HCT08	Quad 2-Input AND Gate	SSI	14
HC/HCT11	Triple 3-Input AND Gate	SSI	14
HC/HCT21	Dual 4-Input AND Gate	SSI	14
HC/HCT32	Quad 2-Input OR Gate	SSI	14
HC/HCT86	Quad 2-Input EXCLUSIVE-OR Gate	SSI	14
HC/HCT4075	Triple 3-Input OR Gate	SSI	14
HC7266	Quad Exclusive NOR Gate	SSI	14
	<b>Inverters/Buffers/Bus Drivers</b>		
HC/HCT04	Hex Inverter/Buffer	SSI	14
HCU04	Hex Inverter (Unbuffered)	SSI	14
HC/HCT125*	Quad 3-State Buffer	MSI	14
HC/HCT126*	Quad 3-State Buffer	MSI	14
HC/HCT240*	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
HC/HCT241*	Octal Buffer/Line Driver; 3-State	MSI	20
HC/HCT244*	Octal Buffer/Line Driver; 3-State	MSI	16
HC/HCT365*	Hex Buffer/Line Driver; 3-State	MSI	16
HC/HCT366*	Hex Buffer/Line Driver; 3-State; Inverting	MSI	16
HC/HCT367*	Hex Buffer/Line Driver; 3-State	MSI	16
HC/HCT368*	Hex Buffer/Line Driver; 3-State; Inverting	MSI	16
HC/HCT540*	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
HC/HCT541*	Octal Buffer/Line Driver; 3-State	MSI	20
HC4049	Hex Inverting HIGH-to-LOW Level Shifter	SSI	16
HC4050	Hex HIGH-to-LOW Level Shifter	SSI	16
	<b>Flip-Flops</b>		
HC/HCT73	Dual JK Flip-Flop with Reset; Negative-Edge Trigger	FF	14
HC/HCT74	Dual D-Type Flip-Flop with Set and Reset; Positive-Edge Trigger	FF	14
HC/HCT107	Dual JK Flip-Flop with Reset; Negative-Edge Trigger	FF	14
HC/HCT109	Dual JK Flip-Flop with Set and Reset; Positive-Edge Trigger	FF	16
HC/HCT112	Dual JK Flip-Flop with Set and Reset; Negative-Edge Trigger; 3-State	FF	16
HC/HCT173*	Quad D-Type Flip-Flop with Set and Reset; Positive-Edge Trigger; 3-State	MSI	16
HC/HCT174	Hex D-Type Flip-Flop with Reset; Positive-Edge Trigger	MSI	16
HC/HCT175	Quad D-Type Flip-Flop with Reset; Positive-Edge Trigger	MSI	16
HC/HCT273	Octal D-Type Flip-Flop with Reset; Positive-Edge Trigger	MSI	20
HC/HCT374*	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State	MSI	20
HC/HCT377	Octal D-Type Flip-Flop with Data Enable; Positive-Edge Trigger	MSI	20
HC/HCT534*	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	MSI	20
HC/HCT564*	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	MSI	20
HC/HCT574*	Octal D-Type Flip-Flop; Positive-Edge; 3-State	MSI	20
	<b>Shift/FIFO Buffer/Multiport Registers</b>		
HC/HCT164	8-Bit Serial-In/Parallel-Out Shift Register	MSI	14
HC/HCT165	8-Bit Parallel-In/Serial-Out Shift Register	MSI	16
HC/HCT166	8-Bit Parallel/Serial-In Serial Out Shift Register	MSI	16
HC/HCT194	4-Bit Bidirectional Universal Shift Register	MSI	16
HC/HCT195	4-Bit Parallel Access Shift Register	MSI	16
HC/HCT299*	8-Bit Universal Shift Register; 3-State	MSI	20

\* Types with a bus driver output stage.

# High-Speed CMOS Logic ICs

## CD54/74HC/HCT Series (Continued)

### Function Selection Chart (Continued)

Type CD54/74	Function/Description	Classification	No. of Pins
	<b>Shift/FIFO Buffer/Multiport Registers (Continued)</b>		
HC/HCT597	8-Bit Shift Register With Input Latch	MSI	16
HC/HCT670*	4 x 4 Register File; 3-State	MSI	16
HC/HCT4015	Dual 4-Stage Static Shift Register	MSI	16
HC/HCT4094	8-Stage Shift-and-Store Bus Register; 3-State	MSI	16
HC/HCT7030*	9-Bit x 64 Word FIFO Register; 3-State	MSI	28
HC/HCT40104*	4-Bit Bidirectional Universal Shift Register; 3-State	MSI	16
HC/HCT40105	4 Bits x 16 Words FIFO Register	MSI	16
	<b>Arithmetic Circuits</b>		
HC/HCT85	4-Bit Magnitude Comparator	MSI	16
HC/HCT181	4-Bit Arithmetic Logic Unit	MSI	24
HC/HCT182	Look-Ahead Carry Generator	MSI	16
HC/HCT280	9-Bit Odd/Even Parity Generator/Checker	MSI	14
HC/HCT283	4-Bit Binary Full Adder With Fast Carry	MSI	16
HC/HCT583	4-Bit BCD Full Adder with Fast Carry	MSI	16
HC/HCT688	8-Bit Magnitude Comparator	MSI	20
	<b>Counters</b>		
HC/HCT93	4-Binary Ripple Counter	MSI	14
HC/HCT160	Presettable Synchronous BCD Decade Counter; Asynchronous Reset	MSI	16
HC/HCT161	Presettable Synchronous 4-Bit Binary Counter; Asynchronous Reset	MSI	16
HC/HCT162	Presettable Synchronous BCD Decade Counter; Synchronous Reset	MSI	16
HC/HCT163	Presettable Synchronous 4-Bit Binary Counter; Synchronous Reset	MSI	16
HC/HCT190	Presettable Synchronous BCD Decade Up/Down Counter	MSI	16
HC/HCT191	Presettable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
HC/HCT192	Presettable Synchronous BCD Decade Up/Down Counter	MSI	16
HC/HCT193	Presettable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
HC/HCT390	Dual Decade Ripple Counter	MSI	16
HC/HCT393	Dual 4-Bit Binary Ripple Counter	MSI	14
HC/HCT4017	Decade Counter/Divider with 10 Decoded Outputs	MSI	16
HC/HCT4020	14-Stage Binary Ripple Counter	MSI	16
HC/HCT4024	7-Stage Binary Ripple Counter	MSI	16
HC/HCT4040	12-Stage Binary Ripple Counter	MSI	16
HC/HCT4059	Programmable Divide by "N" Counter	MSI	24
HC/HCT4060	14-Stage Binary Ripple Counter with Oscillator	MSI	16
HC/HCT4510	Presettable BCD Up/Down Counter	MSI	16
HC/HCT4516	Presettable Binary Up/Down Counter	MSI	16
HC/HCT4518	Dual Synchronous BCD Counter	MSI	16
HC/HCT4520	Dual 4-Bit Synchronous Binary Counter	MSI	16
HC/HCT40102	Synchronous 2-Decade BCD Down Counter	MSI	16
HC/HCT40103	8-Bit Synchronous Binary Down Counter	MSI	16
	<b>One-Shot Multivibrators</b>		
HC/HCT123	Dual Retriggerable Monostable Multivibrator with Reset	MSI	16
HC/HCT221	Dual Monostable Multivibrator with Reset	MSI	16
HC/HCT423	Dual Retriggerable Monostable Multivibrator with Reset	MSI	16
HC/HCT4538	Dual Retriggerable Precision Monostable Multivibrator	MSI	16
	<b>Analog and Digital Multiplexers/Demultiplexers</b>		
HC/HCT151	8-Input Multiplexer	MSI	16
HC/HCT153	Dual 4-Input Multiplexer	MSI	16
HC/HCT157	Quad 2-Input Multiplexer	MSI	16
HC/HCT158	Quad 2-Input Multiplexer; Inverting	MSI	16
HC/HCT251	8-Input Multiplexer; 3-State	MSI	16
HC/HCT253*	Dual 4-Input Multiplexer; 3-State	MSI	16
HC/HCT257*	Quad 2-Input Multiplexer; 3-State; Non-Inverting Outputs	MSI	16
HC/HCT258	Quad 2-Input Multiplexer; 3-State; Inverting Outputs	MSI	16
HC/HCT354*	8-Input Multiplexer/Register; 3-State	MSI	20
HC/HCT356*	8-Input Multiplexer/Register; 3-State	MSI	20

\* Type with a bus-driver output stage.

# High-Speed CMOS Logic ICs

CD54/74HC/HCT Series (Continued)

Function Selection Chart (Continued)

Type CD54/74	Function/Description	Classification	No. of Pins
	<b>Analog and Digital Multiplexers/Demultiplexers (Continued)</b>		
HC/HCT4051	8-Channel Analog Multiplexer/Demultiplexer	MSI	16
HC/HCT4052	Dual 4-Channel Analog Multiplexer/Demultiplexer	MSI	16
HC/HCT4053	Triple 2-Channel Analog Multiplexer/Demultiplexer	MSI	16
HC/HCT4067	16-Channel Analog Multiplexer/Demultiplexer	MSI	24
HC/HCT4351	Dual 4-Channel Analog Multiplexer/Demultiplexer with Latch	MSI	20
HC/HCT4352	Triple 2-Channel Analog Multiplexer/Demultiplexer with Latch	MSI	20
HC/HCT4353	16-Channel Analog Multiplexer/Demultiplexer with Latch	MSI	20
	<b>Decoders/Encoders</b>		
HC/HCT42	BCD to Decimal Decoder (1-of-10)	MSI	16
HC/HCT137	3-to-8-Line Decoder with Latch; Inverting	MSI	16
HC/HCT138	3-to-8-Line Decoder/Demultiplexer; Inverting	MSI	16
HC/HCT139	Dual 2-to-4-Line Decoder/Demultiplexer	MSI	16
HC/HCT147	10-to-4-Line Priority Encoder	MSI	16
HC/HCT154	4-to-16-Line Decoder/Demultiplexer	MSI	24
HC/HCT237	3-to-8-Line Decoder/Demultiplexer with Address Latches	MSI	16
HC/HCT238	3-to-8-Line Decoder/Demultiplexer Non-Inverting	MSI	16
HC/HCT4511	BCD-to-7-Segment Latch/Decoder/Driver	MSI	16
HC/HCT4514	4-to-16-Line Decoder/Demultiplexer with Input Latches	MSI	24
HC/HCT4515	4-to-16-Line Decoder/Demultiplexer with Input Latches	MSI	24
HC/HCT4543	BCD-to-7-Segment Latch/Decoder/Driver for LCDs	MSI	16
	<b>Analog Switches</b>		
HC/HCT4016	Quad Bilateral Switch	SSI	14
HC/HCT4066	Quad Bilateral Switch	SSI	14
HC/HCT4316	Quad Analog Switch	MSI	16
	<b>Bus Transceivers</b>		
HC/HCT242*	Quad Bus Transceiver; 3-State; Inverting	MSI	14
HC/HCT243*	Quad Bus Transceiver; 3-State	MSI	14
HC/HCT245*	Octal Bus Transceiver; 3-State	MSI	20
HC/HCT640*	Octal Bus Transceiver; 3-State; Inverting	MSI	20
HC/HCT643*	Octal Bus Transceiver; 3-State; True/Inverting	MSI	20
HC/HCT646*	Octal Bus Transceiver; 3-State	MSI	24
HC/HCT648*	Octal Bus Transceiver; 3-State; Inverting	MSI	24
HC/HCT7038*	9-Bit Bus Transceiver with Latch	MSI	24
	<b>Schmitt Triggers</b>		
HC/HCT14	Hex Inverting Schmitt Trigger	SSI	14
HC/HCT132	Quad 2-Input NAND Schmitt Trigger	SSI	14
	<b>Latches</b>		
HC/HCT75	Dual 2-Input Bistable Transparent Latch	FF	16
HC/HCT259	8-Bit Addressable Latch	MSI	16
HC/HCT373*	Octal Transparent Latch; 3-State	MSI	20
HC/HCT533*	Octal Transparent Latch; 3-State; Inverting	MSI	20
HC/HCT563*	Octal Transparent Latch; 3-State; Inverting	MSI	20
HC/HCT573*	Octal Transparent Latch; 3-State	MSI	20
	<b>Phase-Locked Loops (PLL)</b>		
HC/HCT297	Digital Phase-Locked Loop Filter	MSI	16
HC/HCT4046A	Phase-Locked Loop with VCO	MSI	16
HC/HCT7046A	Phase-Locked Loop with In-Lock Detection	MSI	16

\* Type with a bus-driver output stage.

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Logic

## CD4000A/B Facts

CD4000A commercial devices have been discontinued (military devices are still available). CD4000B is superior for:

- Speed
- ESD Protection (>2KV vs. 1KV for CD4000A)
- Breakdown Voltage >24V

CD4000A/B types are available only in DIP or flatpack; no surface mount plastic packages are available.

## CD4000B Series

CD4000B-series types have a maximum DC supply voltage rating of -0.5V to 20V, and a recommended operating voltage range of 3V to 18V. The major features of this series are as follows:

- Maximum Input Current (Leakage) of 1 $\mu$ A at 18V Over Full Package-Temperature Range; 100nA at 18V at +25 $^{\circ}$ C
- Standardized Symmetrical Output Characteristics
- 5V, 10V and 15V Parametric Ratings
- Noise Margin (Over Full Package-Temperature Range)
  - ▶ 1V at  $V_{DD} = 5V$
  - ▶ 2V at  $V_{DD} = 10V$
  - ▶ 2.5V at  $V_{DD} = 15V$
- Meets All Requirements of JEDEC Standard No. 13B, (Standard Specifications for Description of 'B' Series CMOS Devices")

# Function Selection Chart

Function	Type No.	No. of Pins	Function	Type No.	No. of Pins
<b>Gates</b>			<b>Gates (cont'd)</b>		
<b>NOR/NAND</b>			<b>Decoders/Encoders (cont'd)</b>		
2-input NOR, 2-input NAND	CD4572UB	16	4-bit latch/4-to-16 line decoder (outputs low)	CD4515B	24
Dual 4-input NOR	CD4002B	14	Dual 1-of-4 decoder/demultiplexer (outputs high)	CD4555B	16
Dual 4-input NAND	CD4012B	14	Dual 1-of-4 decoder/demultiplexer (outputs low)	CD4556B	16
Triple 3-input NOR	CD4025B	14	<b>Schmitt Trigger</b>		
Triple 3-input NAND	CD4023B	14	Quad 2-input NAND	CD4093B	14
Quad 2-input NOR	CD4001B	14	Hex	CD40106B	14
	CD4001UB	14	<b>Interface</b>		
Quad-2 input NAND	CD4011B	14	Quad low-to-high voltage	CD40109B	16
	CD4011UB	14	Hex high-to-low voltage (inverting)	CD4009UB	16
8-input NOR/OR	CD4078B	14		CD4049UB	16
8-input NAND/AND	CD4068B	14	Hex high-to-low voltage (non-inverting)	CD4010B	16
Dual 2-input NAND buffer/driver	CD40107B	8,14	Hex voltage level shifter for TTL-to-CMOS or CMOS-to-CMOS operation	CD4504B	16
<b>OR/AND</b>			Dual 2-input NAND buffer/driver	CD40107B	8,14
Dual 4-input OR	CD4072B	14	8-bit bidirectional CMOS-to-TTL level converter	CD40116▽	22
Dual 4-input AND	CD4082B	14	Programmable dual 4-bit terminator	CD40117B▽	14
Triple 3-input OR	CD4075B	14	<b>Multivibrators</b>		
Triple 3-input AND	CD4073B	14	Monostable/astable	CD4047B	14
Quad 2-input OR	CD4071B	14	Dual monostable	CD4098B	16
Quad 2-input AND	CD4081B	14	Dual precision monostable	CD4538B	16
				CD14538B	16
<b>Buffers and Inverters</b>			<b>Flip-Flops</b>		
Dual complementary pair plus inverter	CD4007UB	14	Dual "D" with set/reset capability	CD4013B	14
Quad inverter	CD4572UB	16	Dual "J-K" with set/reset capability	CD4027B	16
Hex inverter	CD4069UB	14	Gated "J-K" (non-inverting)	CD4095B	14
Hex inverter/buffer (3-state)	CD4502B	16	Gated "J-K" (inverting and non-inverting)	CD4096B	14
Hex buffer (3-state non-inverting)	CD4503B	16	Hex "D"	CD40174B	16
Hex buffer/converter (inverting)	CD4009UB	16	4-bit "D" with 3-state outputs	CD4076B	14
Hex buffer/converter (inverting)	CD4049UB	16	Quad "D"	CD40175B	16
Hex buffer/converter (non-inverting)	CD4010B	16	<b>Latches</b>		
Hex buffer/converter (non-inverting)	CD4050B	16	Quad clocked "D"	CD4042B	16
Quad true/complement buffer	CD4041UB	14	Quad NOR R/S (3-state outputs)	CD4043B	16
Dual 2-input NAND buffer/driver	CD40107B	8,14	Quad NAND R/S (3-state outputs)	CD4044B	16
<b>Multifunction/AOI</b>			Dual 4-bit 8-bit addressable	CD4508B	24
Triple AND-OR bi-phase pairs				CD4099B	16
Quad exclusive-OR	CD4030B	14		CD4724B	16
Quad exclusive-OR	CD4070B	14	<b>Registers</b>		
Quad exclusive-NOR	CD4077B	14	<b>Shift Registers-Static</b>		
	CD4519B	16	Dual 4-stage with serial input/parallel output	CD4015B	16
Quad AND/OR Select	CD4019B	16	18-stage	CD4006B	14
4-Bit AND/OR Select	CD4519B	16	64-stage	CD4031B	16
Dual 2-wide, 2-input AND/OR invert (AOI)	CD4085B	14	Dual 64-bit	CD4517B	16
Expandable 4-wide, 2-input AND/OR invert (AOI)	CD4086B	14	8-stage with synchronous parallel or serial input/serial output	CD4014B	16
Multifunctional expandable 8-input (3-state output)	CD4048B	16			
Hex gate	CD4572UB	16			
<b>Decoders/Encoders</b>					
BCD-to-decimal decoder	CD4028B	16			
8-input priority encoder	CD4532B	16			
10-line to 4-line BCD priority encoder	CD40147B	16			
4-bit latch/4-to-16 line decoder (outputs high)	CD4514B	24			

▽ Indicates types designed for special applications. Ratings and characteristics data for these types differ in some aspects from the standardized data for B-series types. Refer to data pages on these types for specific differences.



# Function Selection Chart (Continued)

Function	Type No.	No. of Pins	Function	Type No.	No. of Pins
<b>Registers (cont'd)</b>			<b>Registers (cont'd)</b>		
<b>Shift Registers-Static (cont'd)</b>			<b>Synchronous (cont'd)</b>		
8-stage with asynchronous parallel input or synchronous serial input/serial output	CD4021B	16	Decade counter/asynchronous clear	CD40160B	16
4-stage parallel-in/parallel-out with J-K input and true/complement output	CD4035B	16	Binary counter/asynchronous clear	CD40161B	16
4-bit universal bidirectional with asynchronous master reset	CD40194B	16	Decade counter/synchronous clear	CD40162B	16
8-stage bidirectional parallel or serial input/parallel output	CD4034B	24	Binary counter/synchronous clear	CD40163B	16
32-bit left/right	CD40100B	16	<b>Display Drivers</b>		
8-stage shift-and-store bus	CD4094B	16	<b>With Counter</b>		
<b>Storage Registers</b>			Decade counter/divider with 7-segment display outputs and display enable	CD4026B	16
8-bit addressable latch	CD4099B	16	Decade counter/divider with 7-segment display outputs and ripple blanking	CD4033B	16
	CD4724B	16	Up/Down Counter-Latch-Decoder-Driver	CD40110B	16
4-bit "D"-type with 3-state outputs	CD4076B	16	<b>For Liquid-Crystal-Display Drive</b>		
<b>FIFO Buffer Registers</b>			4-segment display driver	CD4054B	16
4-bit x 16 word	CD40105B	16	BCD-to-7-segment decoder/driver with "display-frequency" output	CD4055B	16
<b>Binary Ripple</b>			BCD-to-7-segment decoder/driver with strobed-latch function	CD4056B	16
7-stage	CD4024B	14		CD4543B	16
12-stage	CD4040B	16	4-digit decoder/driver with hexadecimal display	CD7211▽	40
14-stage	CD4020B	16	4-digit decoder/driver with decimal display	CD7211A▽	40
14-stage counter/divider and oscillator	CD4060B	16	4-digit decoder/driver with hexadecimal display	CD7211M▽	40
24-stage frequency divider	CD4521B	16	4-digit decoder/driver with decimal display	CD7211AM▽	40
<b>Timers</b>			<b>For Light-Emitting-Diode Drive</b>		
21-stage	CD4045B	14	BCD-to-7-segment latch decoder/driver	CD4511B	16
Programmable	CD4536B	16	<b>Multiplexers/Demultiplexers</b>		
Industrial time-base generator	CD4566B	16	<b>Analog</b>		
<b>Synchronous</b>			Triple 2-channel	CD4053B	16
Decade counter/divider plus 10 decoded decimal outputs	CD4017B	16	Differential 4-channel	CD4052B	16
Divide-by-8 counter/divider with 8 decimal outputs	CD4022B	16	Single 8-channel	CD4051B	16
Presetable divide-by-"N" counter, fixed or programmable	CD4018B	16	Differential 8-channel	CD4097B	24
Programmable-divide-by-"N" counter	CD4059A	24	Single 16-channel	CD4067B	24
Programmable BCD Divide-by-"N" counter	CD4522B	16	Quad bilateral switch	CD4016B	14
Presetable up/down counter, binary or BCD-decade	CD4029B	16	Quad bilateral switch	CD4066B	14
Presetable 4-bit BCD up/down counter	CD4510B	16	<b>Digital (Data Selectors)</b>		
	CD40192B	16	Quad AND/OR select	CD4019B	16
Presetable 4-bit binary up/down counter	CD4516B	16	4-Bit AND/OR select	CD4519B	16
	CD40193B	16	Dual 1-of-4 decoder/demultiplexer (outputs high)	CD4555B	16
Presetable 2-decade BCD down counter	CD40102B	16	Dual 1-of-4 decoder/demultiplexer (outputs low)	CD4556B	16
Presetable 8-bit binary down counter	CD40103B	16	Quad 2-line-to-1-line	CD40257B	16
Dual BCD up counter	CD4518B	16	8-channel	CD4512B	16
Dual binary up counter	CD4520B	16	Quad 2-channel	CD4519B	16
			Dual 4-channel analog	CD4529B	16
			<b>Phase-Locked Loop</b>		
			Micropower	CD4046B	16

## **5 - Application Specific**

5A • Digital Signal Processing

5B • Telecommunications

5C • Consumer (Auto, TV, Radio)

## **5 - Application Specific**

5A •Digital Signal Processing

5B •Telecommunications

5C •Consumer (Auto, TV, Radio)

# Digital Signal Processing

## Signal Synthesizers

**NCOM - 16 Bit Numerically Controlled Oscillator Modulator (HSP45116)**

- Digital Equivalent of a VCO (Voltage Controlled Oscillator) & Double Balanced Mixer
- Applications Include Digital Radio Transceivers, High Speed Modems, Digital Frequency Synthesis (With 90db of Spectral Purity), Ultrasound Signal Generation, FFT Processing & PLL's, and Digital Down Conversion

**NCOM's - Numerically Controlled Oscillators - HSP45106 (16 Bit, HSP45102 - 12 Bit)**

- Digital Equivalent of Analog VCO (Voltage Controlled Oscillator)
- HSP45106 - 16 Bit SIN & COS Parallel Outputs, Plus 2 Serial SIN & COS Outputs
- HSP45102 - Low Cost, Features 12 Bit Parallel SIN Output, 28 Pin DIP Package or SOIC

## Multipliers

**16 x 16 Bit Multipliers (HMU16, HMU17) 16 x 16 Bit Multiplier/Accumulator (HMA510)**

- HMU16 is Pin Compatible With the AM29516, LMU16, IDT7216 & the CY7C516
- HMU17 is Pin Compatible With the AM29517, LMU17, IDT 7217 & the CY7C517
- HMA510 is Pin Compatible With the IDT7210 & the CY7C510

## Image Processing

**3 x 3 Image Filter (HSP48901)**

- 8 - Bit Data & Coefficient Inputs. Available in 20 & 30 MHz Clock Speeds
- Two Dimensional Convolver (HSP48908) Programmable 1024 Byte Row Buffers, 32 & 20 MHz Clock Speeds
- Applications Include Image Enhancement, Inspection Systems

## One Dimensional Filters

**DDF - 16 Bit Digital Decimation Filter (HSP43220) and 2D Convolver - HSP48908**

- Single Chip Narrow Band Filter With Up To 96db Attenuation
- Programmable Decimation Up To 16,384 & Up To 512 Equivalent Taps
- Applications Include: Channelized Receivers, Sample Rate Converter, Spectral Analysis
- DECIMATE Development Software- Generates Filter Coefficients & Simulation, IBM PC, XT, AT & PS2 Compatible

**Digital FIR Filters (HSP43481/881/891)**

- 8 Bit - 4 Tap (HSP43481), 8 Bit - 8 Tap (HSP43881), 9 Bit - 8 Tap (HSP43891)
- Decimation By 2, 3 or 4, Pin & Function Compatible to Zoran 481/881/891
- Applications Include Radar, Sonar, HDTV, Echo Cancellation, 1 & 2-D Filtering

**Dual 10 Bit FIR Filter (HSP43168)**

- World's Fastest FIR Filter at 45MHz Sample Rates
- 10 Bit Data & Coefficients, 32 Programmable Coefficient Sets
- Two Internally Cascadable 8 Tap FIR Filters, Programmable Decimation Up To 16
- Applications Include Adaptive Filtering, Complex Filtering, Echo Cancellation, 1 & 2-D Filtering

## Special Functions

**24 Bit Address Sequencer (HSP45240)**

- 24 Bit Address Sequencing, 24 x 24 Crosspoint Switching Allows FFT Addressing Schemes
- Applications Include Image Panning & Zooming, 1 & 2-D Filtering, FFT Addressing
- Up To 50MHz Sequencing

**1 x 256 Configurable Binary Correlator (HSP45256)**

- Reconfigurable 256 Stage Binary Correlator, 1 x 256, 2 x 128, 3 x 64, 4 x 32
- Applications Include Spread Spectrum Communications, Synchronization, Pattern Matching, Code Encryption, and Radar

**Multilevel Pipeline Register (ISP9520/21, HSP9520/21)**

- Pin for Pin Compatible Replacements for AM29520 & AM29521
- Available in 28 Pin DIP, Ceramic DIP & 28 Pin SOIC

**Programmable Length 10 Bit Wide Data Buffer (HSP9501)**

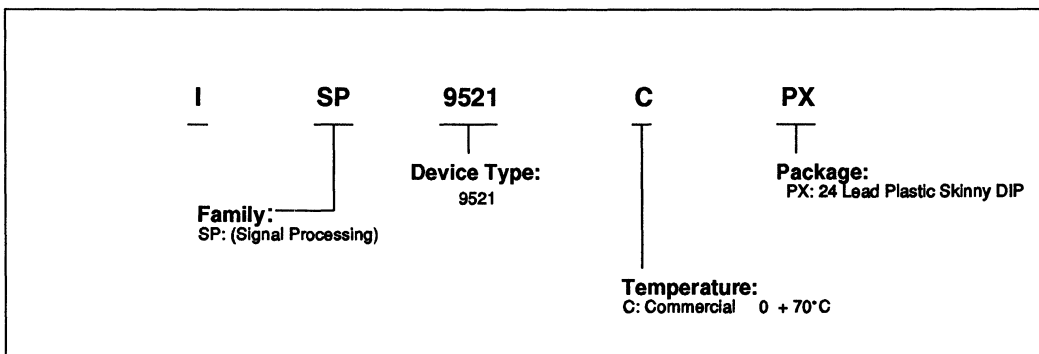
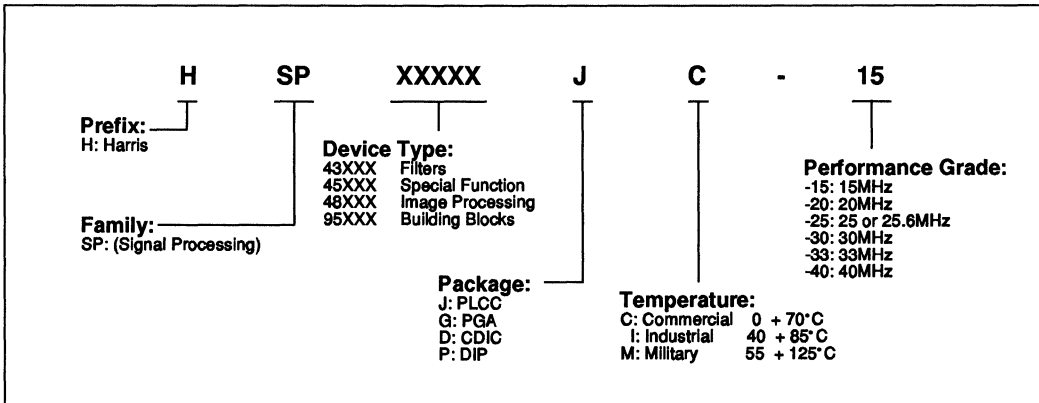
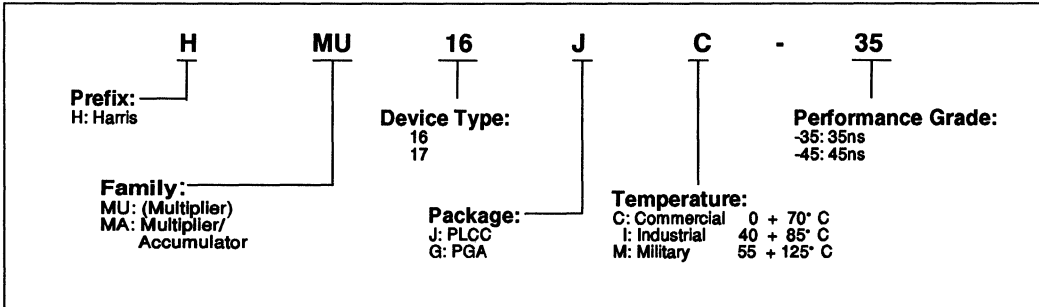
- DC to 30 MHz Operating Frequency
- Data Buffer Length Programmable in One-Word Increments from 2 to 1281 Words

**Histogrammer (HSP 48410)**

- Generates and Stores Cumulative Distribution Function
- 1024 x 24-Bit Delay Memory Which Translates to a Pixel Resolution at 10 Bits
- For Use in Histogram Equalization Applications

# Digital Signal Processing

## Ordering Information



# Signal Synthesizers

## NCOM - 16 Bit Numerically Controlled Oscillator Modulator HSP45116

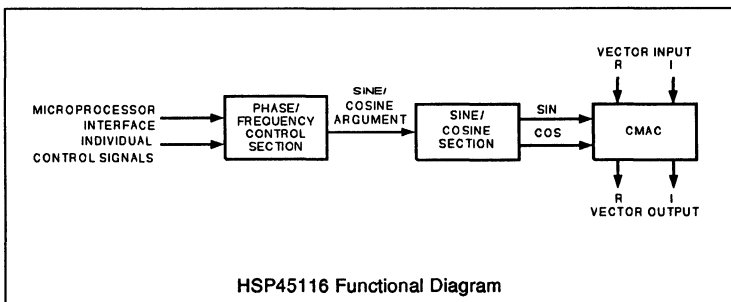
- Contains NCO & CMAC on a Single Chip
- Digital Equivalent of a VCO (Voltage Controlled Oscillator) & Double Balanced Mixer
- Performs FSK, PSK, BPSK, AM, FM, MSK QAM Modulation, Complex Down Conversion (I & Q), DDS (Direct Digital Synthesis), and Demodulation

### Key Features:

- 32 Bit Center & Offset Frequency Control, 16 bit Phase Control
- 16 Bit Complex Inputs With 20 Bit Complex Outputs
- 0.008Hz Tuning Resolution at 33 MHz Clock Rate
- Spurious Frequency Components Of Complex Sinusoid < -90 db
- Standby Current < 500  $\mu$ A, Operating Current 150 mA max @ f=15 MHz
- Standard microprocessor interface
- Available in 33, 25.6 & 15 (Comm.), 25.6 & 15 MHz (Mil/883) Clock Rates
- Available in 145 Pin Ceramic PGA Package

### Applications:

- Digital Radio Transceivers
- Digital Frequency Synthesis
- FFT Processing
- Frequency Hopping Transceivers
- Digital Cellular Telephone
- Satellite Modems
- Radar & Sonar Systems
- AM & FM Modulation Systems
- High Speed Modems
- Ultrasound Signal Generation
- Digital Phase Lock Loops
- Spread Spectrum Radio
- Fax Modems
- PCM Telemetry Receivers
- Demodulation
- Spectrum Analysis



## NCO - 16 Bit Numerically Controlled Oscillator HSP45106

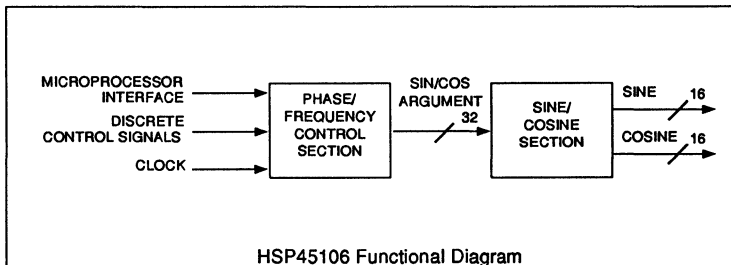
- Digital Equivalent Of Analog VCO (Voltage Controlled Oscillator)
- Performs FSK, PSK, BPSK, SPSK, FM, MSK Modulation, DDS (Direct Digital Synthesis), & Quadrature Signal Generation

### Key Features:

- 32 Bit Center & Offset Frequency Control, 16 bit Phase Control
- 16 Bit SIN & COS Parallel Outputs, or Serial SIN & COS Outputs
- 0.008Hz Tuning at 33MHz
- Spurious Frequency Components Of Complex Sinusoid < -90 db
- Standby Current < 500  $\mu$ A, Operating Current 256 mA max @ f=25.6 MHz
- Standard Microprocessor Interface
- Available in 33, & 25.6 (Comm.), 25.6 & 15 MHz (Mil/883) Clock Rates
- Available in 84 Pin Plastic PLCC or 85 Pin Ceramic PGA Package

### Applications:

- High Speed Modems
- Ultrasound Signal Generation
- Frequency Hopping Transceivers
- Digital Cellular Telephone
- Satellite Modems
- Radar & Sonar Systems
- Digital Frequency Synthesis
- Digital Phase Lock Loops
- Spread Spectrum Radio
- Fax Modems
- PCM Telemetry Receivers
- FM Modulation Systems



# Signal Synthesizers

## NCO - 12 Bit Numerically Controlled Oscillator HSP45102

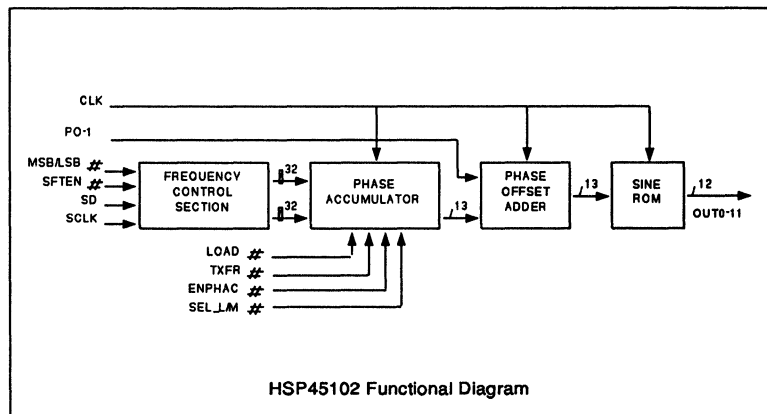
- Equivalent of Analog VCO (Voltage Controlled Oscillator)
- Performs FSK (CLK/12), PSK, BPSK, FM, QPSK Modulation and Direct Digital Synthesis

### Key Features:

- 32 Bit Frequency Control
- Features 12 Bit SIN Parallel Outputs
- 0.012 Hz Tuning Resolution at 40 MHz
- Spurious Frequency Components < -69 db
- Standby Current < 500  $\mu$ A, Operating Current 330 mA max @ f=33 MHz
- Available in 40, 30, & 33 MHz, (Comm.), 40 & 33 MHz (Industrial) Clock Rates
- Available in 28 Pin Plastic Dip & SOIC Packages
- Smallest NCO Available

### Applications:

- Modems
- Ultrasound Signal Generation
- Digital Cellular Telephone
- Satellite Modems
- Digital Frequency Synthesis
- Digital Phase Lock Loops
- PCM Telemetry Receivers
- Radar & Sonar Systems



# Multipliers

## 16 X 16 Bit Multipliers HMU16, HMU17

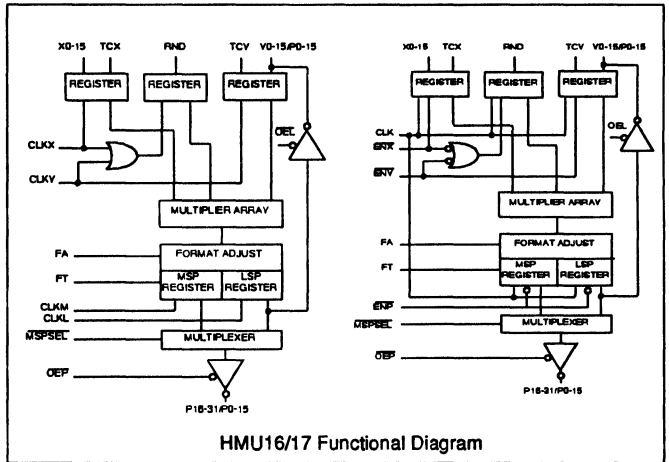
- 16 X 16 Bit Parallel Multiplier With Full 32 Bit Product
- HMU16 is Pin & Function Compatible to the AM29516, LMU16, IDT7216 & CY7C516
- HMU17 is Pin & Function Compatible to the AM29517, LMU17, IDT7217 & CY7C517

### Key Features:

- Three-State Outputs
- Standby Current < 500  $\mu$ A, Operating Current 7.0 mA max @  $f=1$  MHz
- 35 ns (Commercial), 45 ns (Military/883) Clocked Multiply Time
- Available in 68 Pin Plastic PLCC & 68 Pin Ceramic PGA Packages

### Applications:

- Digital Filtering
- Image Processing
- FFT's (Fast Fourier Transforms)
- Graphic Display Systems
- Radar & Sonar Systems



## 16 X 16 Bit Multiplier/Accumulator HMA510

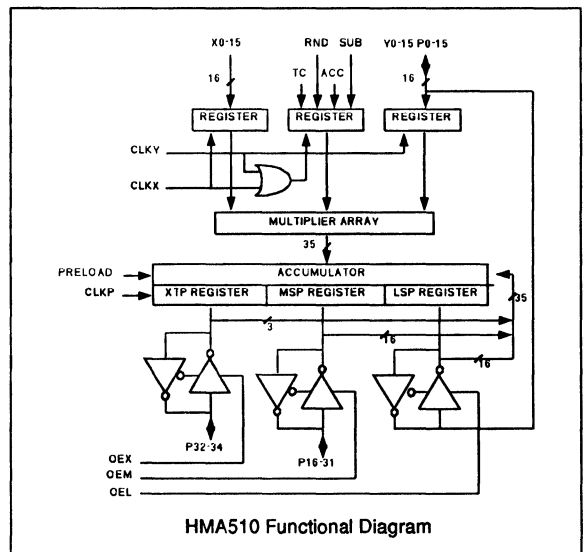
- 16 X 16 Bit Parallel Multiplier/Accumulator With Full 35 Bit Product
- HMA510 is Pin & Function Compatible with the IDT7210 and the CY7C510

### Key Features:

- Three-State Outputs
- Standby Current < 500  $\mu$ A, Operating Current 7.0 mA max @  $f=1$  MHz
- 45 ns (Commercial), 55 ns (Military/883) Clocked Multiply/Accumulate Time
- Available in 68 Pin Plastic PLCC & 68 Pin Ceramic PGA Packages

### Applications:

- Digital Filtering
- Image Processing
- FFT's (Fast Fourier Transforms)
- Graphic Display Systems
- Radar & Sonar Systems





# One Dimensional Filters

## Digital FIR Filters - HSP43481/881/891

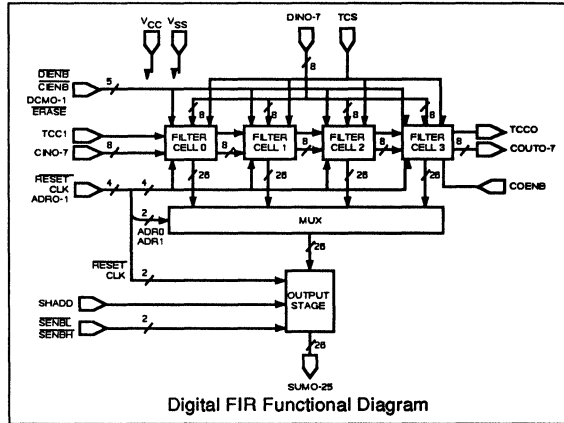
- 8 Bit - 4 Tap - HSP43481
- 8 Bit - 8 Tap - HSP43881
- 9 Bit - 8 Tap - HSP43891
- Pin & Function Compatible to Zoran 481/881/891

### Features:

- 8 Bit Coefficients & Data (HSP43481, 881), 9 Bit Coefficients & Data (HSP43891), 96 Bit Accumulator Stage
- Decimation By 2, 3 or 4
- Shift & Add Output Stage for Combining Filter Outputs
- Cascadable to Over 1000 Filter Taps
- Standby Current < 500 $\mu$ A
- Operating Current < 160 mA (HSP 43891, 881), < 110 mA (HSP43481) @ 20 MHz Clock
- HSP43881, 891 Available in 84 Pin Plastic PLCC, 85 Pin Ceramic PGA & 84 Pin CQFP Packages
- HSP43481 Available in 84 Pin Plastic PLCC & 85 Pin Ceramic PGA Packages

### Applications:

- Radar & Sonar Systems
- Echo Cancellation
- Digital Video & Audio
- Sample Rate Converters
- Machine Vision
- HDTV (High Definition Television)
- 1 & 2-D Filtering
- Adaptive Filters
- Imaging Systems
- Image Enhancement



## Dual 10 Bit FIR Filter - HSP43168

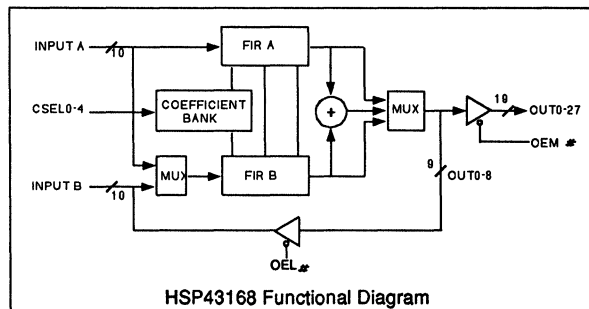
- Two Internally Cascadable 8 Tap FIR Filters
- Programmable Decimation Up To 16
- Configurable As Two Independent FIRs

### Features:

- 10 Bit Data & Coefficients, 32 Programmable Coefficient Sets
- Up to 256 FIR Taps, 16 x 16 2-D Kernels, 10 x 20 Data & Coefficients
- Programmable Rounding on Output
- Mixed Mode Arithmetic & Saturation Logic
- Standby Current < 500 $\mu$ A, Operating Current < 200 mA @ 20 MHz
- Standard Microprocessor Interface
- Available in 45, 33 MHz Clock Speeds
- Available in 84 Pin Plastic PLCC & 85 Pin Ceramic PGA Packages

### Applications:

- Adaptive Filtering
- Echo Cancellation
- Polyphase Filtering
- Equalization
- Convolution
- Digital Audio
- Complex Filtering
- 1-D & 2-D Filtering
- Radar & Sonar Systems
- Image Processing
- PCM Telemetry Systems
- HDTV (High Definition Television)



# One Dimensional Filters

## DDF - 16 Bit Digital Decimation Filter HSP43220

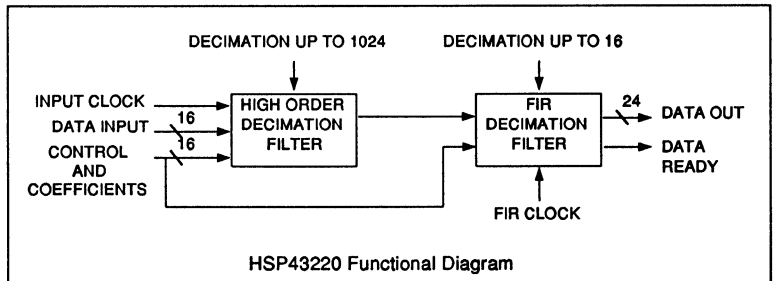
- Single Chip 16 Bit Narrow Band Filter with Decimation
- Programmable Decimation Up To 16,384 & Up To 512K Equivalent Taps
- Up To 512000 Equivalent Taps

### Features:

- Up to 96 db Attenuation
- 16 Bit 2's Complement Inputs
- 24 Bit Extended Precision Outputs
- 20 Bit FIR Coefficients
- DECI\*MATE Filter Design Software Available
- Standby Current < 500µA
- Operating Current 120 mA Max @ 15 MHz
- Standard 16 Bit Microprocessor Interface
- Available in 33, 25 & 15 MHz (Comm.), 25 & 15 MHz (Mil/883) Clock Speeds
- Available in 84 Pin Plastic PLCC & 85 Pin Ceramic PGA Packages

### Applications:

- Channelized Receivers
- Spectral Analysis
- Digital Tuners
- Digital Radios
- 512 Tap Symmetric FIR Filtering
- Sample Rate Converters
- Instrumentation
- Radar & Sonar Systems
- Satellite Modems
- Narrow Band Filtering



## DECI\*MATE Development Software for the HSP43220 Decimating Digital Filter

Interfaces External Analog Signals to 6805-Series µP via 4-Wire SPI Serial Bus

### Features:

- Simulates HSP43220 Providing Input Signals for Filter Simulator
- Generates PROM File of Filter Coefficients
- DECI\*MATE is Fully Integrated with Monarch 2.0 DSP Software from the Athena Group

DESIGN MODULE	SIMULATION MODULE	PROM MODULE
<b>HSP43220 DDF FILTER SPECIFICATION</b>		
<b>D E C I * M A T E</b>	Filter File : PRES.DDF	Design Mode : AUTO
	Input Sample Rate : 33 MHz	Generate Report : YES
	Output Rate : 100 kHz	Display Response : LOG
	Passband : 5 kHz	Save Freq Response : YES
	Transition Band : 700 Hz	Save FIR Response : YES
	Passband Atten : 1 dB	
	Stopband Atten : 96 dB	
	FIR Type : STANDARD	
	HDF Order : 4	FIR Input Rate : 100 kHz
	HDF Decimation : 330	FIR Clock (min) : 33 MHz
HDF Scale Factor : 0.6903	FIR Order : 509	
	FIR Decimation : 1	

Filter Specification Menu

# Two Dimensional Filters

## 3 X 3 Image Filter HSP48901

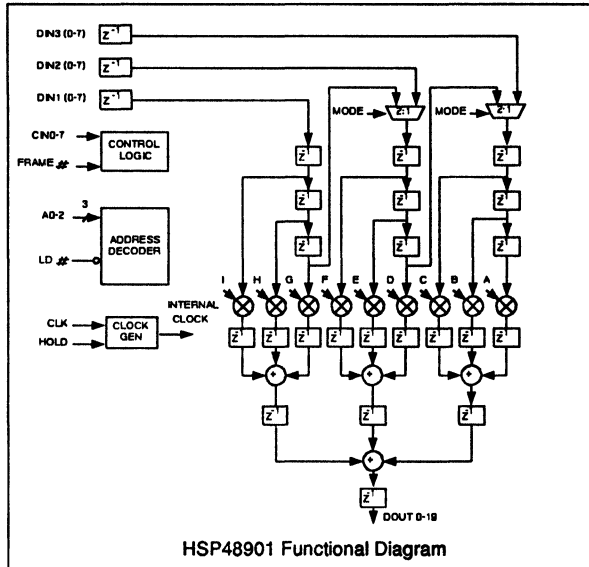
- Configurable for 1D & 2D Filtering with a 3 x 3 Matrix

### Key Features:

- 8 Bit Data & Coefficient Inputs
- 20 Bit Extended Precision Output
- Dual Coefficient Mask Registers, Switchable In A Single Clock Cycle
- Standard Microprocessor Interface
- Standby Current < 500  $\mu$ A, Operating Current 120 mA max @ 20 MHz
- Available in 20 & 30 MHz Clock Speeds
- Available in 68 Pin Plastic PLCC Package

### Applications:

- Radar & Sonar Systems
- Inspection Systems
- Pattern Matching
- Image Scanners
- Image Enhancement
- Real Time Video Filters
- Edge Detection/Enhancement



## 2-Dimensional Convolver HSP48908

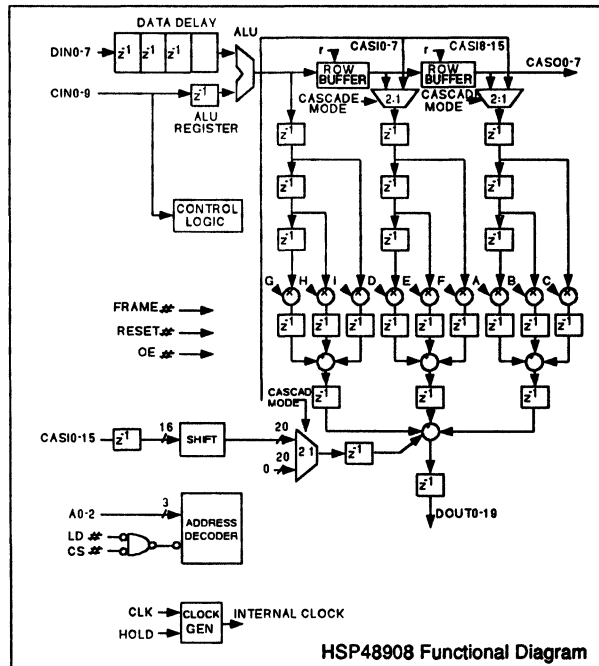
- 3 x 3 Convolver with Programmable 1024 Byte Row Buffers

### Key Features:

- 8 bit signed or unsigned data & coefficient inputs
- 20 bit extended precision output
- Dual coefficient mask registers, switchable in a single clock cycle
- Cascadable for larger kernels & images
- Standby current < 500  $\mu$ A, operating current 120 mA max @ 20 MHz
- Standard microprocessor interface
- Available in 32 & 20 MHz (commercial) & 27 & 20 MHz (mil/883)
- Available in 84 pin plastic PLCC & 85 pin PGA package

### Applications:

- Radar & Sonar Systems
- Inspection Systems
- Pattern Matching
- Image Scanners
- Image Enhancement
- Real Time Video Filters
- Edge Detection/Enhancement



# Special Functions

## 24 Bit Address Sequencer HSP45240

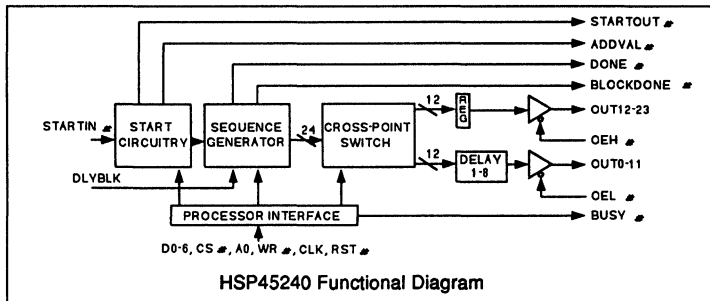
- Performs Addressing Schemes for FFT's, 1-D, 2-D Filtering, Image Manipulation (Panning, Zooming) & Matrix Operations
- Controls Addressing of R/W Lines of Frame Buffers or RAM Arrays

### Key Features:

- 24 Bit Address Sequencing, or 2 x 12 Bit Sequencing
- 24 x 24 Crosspoint Switching Allows FFT Addressing Schemes
- Programmable Delay on 12 Outputs
- Multi-Chip Synchronization Signals for Cascading
- Standby Current < 500µA, Operating Current < 99mA @ 33 MHz Clock Speeds
- Standard Microprocessor Interface, with 100 pf Drive on Outputs
- Available in 50, 40 & 25 MHz (Commercial) & 40, 30, 25 (mil/883) Clock Rates
- Available in 68 Pin Plastic PLCC & 68 Pin Ceramic PGA Packages

### Applications:

- Image Panning & Zooming
- FFT Addressing
- 24 Bit Graphics Board
- Special Effects Generators
- 1-D & 2-D Filtering
- Matrix Operations
- Laser Typesetters
- Video Processing



## 256 Stage Binary Correlator HSP45256

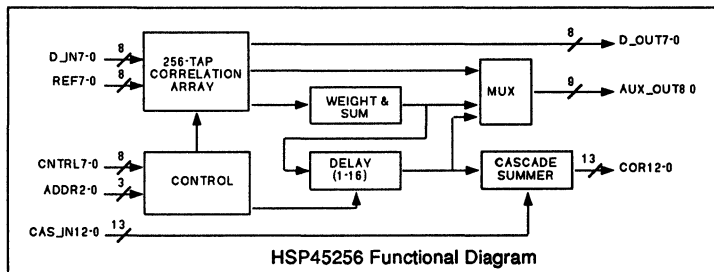
- Reconfigurable 256 stage binary correlator, 1 x 256, 2 x 128, 8 x 64, & 4 x 32
- Performs both 1-D & 2-D correlations with selectable precision & window size

### Key Features:

- 13 Bit Cascade Input
- Configurable as 2 Separate Correlators
- Separate Data, Control & Reference Inputs & Data Offset Register
- Programmable Output Delay, Double Buffered Mask & Reference Register
- 1 Bit Reference x 1, 2, 4, or 8 Bit Data
- Standby Current < 500µA, Operating Current < 330 mA @ 33 MHz
- Standard Microprocessor Interface
- Available in 33, 25.6, & 20 MHz (comm.), 25.6 & 20 MHz (mil/883) Clock Speeds
- Available in 84 Pin Plastic PLCC & 85 Pin Ceramic PGA Packages

### Applications:

- Spread Spectrum Communications
- Pattern Matching
- Frequency Hopping Radios
- Error Correction
- Radar & Sonar Systems
- Synchronization
- Code Encryption
- Scanner Character Recognition
- High Speed Modems
- PCM Telemetry Systems



# Special Functions

## Programmable Length 10 Bit Data Buffer HSP9501

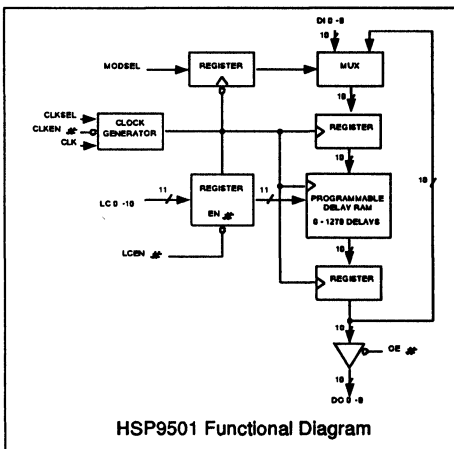
- Data Buffer Length Programmable in One-Word Increments from 2 to 1281 words
- Expandable Data Word Width or Buffer Length
- Can be Used as a Programmable Length FIFO

### Key Features:

- Supports Data Words to 10 Bits Wide
- Data Recirculate (Rollover) or Delay Modes of Operation
- Clock Select Logic For Positive or Negative Edge System Clocks
- Standby Current < 500µA, Operating Current < 125 mA @ 25 MHz Clock
- Available in 25 or 32 MHz Clock Speeds
- Available in 44 Pin Plastic PLCC Package with 30 or 25 MHz Clock Speeds

### Applications:

- Programmable Length Data Shifter
- Digital COMB Filters
- Image Processing
- Audio/Speech Processing
- Pulse Compression
- Programmable Delay Lines
- 1-H Delay Line for NTSC, PAL or HDTV
- Digital Video
- Video Delay Lines
- Graphics Boards



## Multilevel Pipeline Register ISP9520/21, HSP9520/21

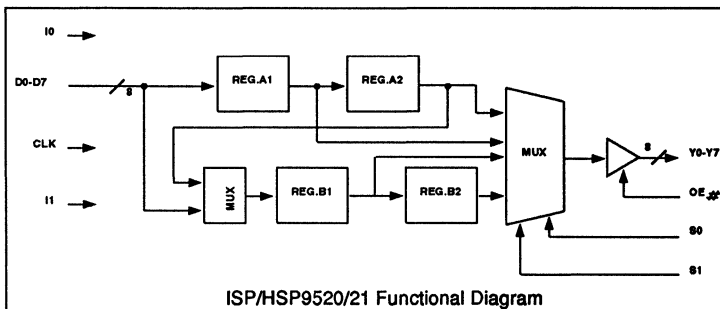
- Single 4 stage or dual 2 stage pipelining
- HSP9520/9521 are pin for pin compatible replacements for AM29520/21, WS59520/21, L29C520/21

### Key Features:

- Four 8 Bit Registers
- Hold, Transfer, & Load Instructions
- Standby Current < 500µA, Operating Current < 12 mA @ 5 MHz Clock
- Available in 28 Pin Plastic DIP, & 28 Pin SOIC

### Applications:

- Sample Rate Conversion
- Pulse Compression
- Radar & Sonar Systems
- Standards Conversion
- Graphics Boards



## Histogrammer/Accumulating Buffer HSP48410

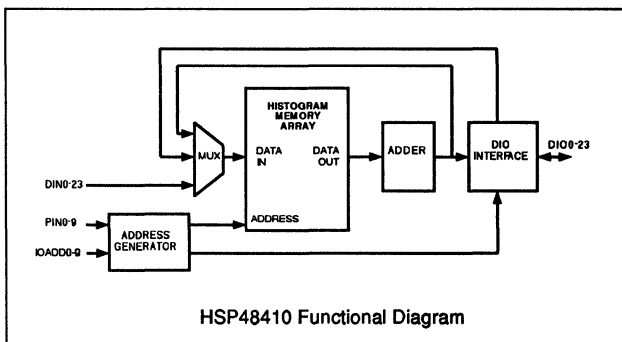
- In Addition to Histogramming, Generates and Stores Cumulative Distribution Function
- Capabilities Include Bin Accumulation, Look Up Table, 24 bit Delay Memory and Delay & Subtract Mode.

### Key Features:

- 10 Bit Pixel Data
- 4kx4k Frame Sizes
- Asynchronous Flash Clear Pin
- Single cycle Memory Clear
- Fully Asynchronous 16 or 24 Bit Host Interface
- Look Up Table Mode
- 1024 x 24 Bit Delay Memory
- 24 Bit Three State I/O bus
- TTL compatible Inputs/Outputs
- Available in 84 Pin PGA and PLCC Packages
- DC to 40 MHz Clock Rate

### Applications:

- Sample Rate Conversion
- Pulse Compression
- Radar & Sonar Systems
- Standards Conversion
- Graphics Boards



# Telecom

## Telecommunications

### Analog Interface at Central Office or PBX Switch End

#### SLIC - Subscriber Line Interface Circuit

- Interfaces voice/status signals between residential/business telephone and PBX/Central Office (CO) switch
- Every telephone requires a SLIC to monitor it
- Provides BORSHT functions to subscriber loop
- Monolithic solution to transformer based application

#### CODEC - CODer/DECoder

- Non-linear analog to digital (encode) and digital to analog (decode) converter for voice
- Converts telephone voice signals, via the SLIC, to/from digital PCM format for transmission on digital PCM bus
- Assigns protocol for timing multiple telephone calls

#### Crosspoint switches - CD22100, CD22101, CD22102, CD22M2493/94

- Matrix of analog switches which digitally interconnect audio, voice, computer, PBX, central office telephone signals

### Analog Interface at Subscriber End

#### DTMF circuits - Dual Tone Multi Frequency

##### Tone generator

- Generates standard DTMF sinusoidal audio tones for the standard telephone pushbutton keypad

##### Tone receivers

- Detects/decodes standard DTMF sinusoidal audio tones for call routing by the central office computer or for subscriber end instrument control, ie answering machine, fax

### Digital Interface

#### PCM repeater - Pulse Code Modulation

- Digital-digital converter for signal equalization, pulse shaping, clock extraction, timing, and threshold detection
- For T1(1.54 MHz), T148(2.37 MHz), and CCITT(European 2.048 MHz), digital PCM transmission lines

#### PCM transcoders - Pulse Code Modulation

- Converts digital PCM signal to special digital codes to maintain signal integrity over long transmission distances
- For T1(1.544 MHz), T1C(3.152 MHz), T2(6.3212 MHz) and CCITT(2.048 MHz) "PCM highway" transmission lines

### General Interface

#### CVSD - Continuously Variable Slope Deltamodulation - HC-55564

- Analog-digital (encoder) and Digital-Analog (decoder) converter for voice
- Converts voice signals to serial non-return to zero (NRZ) format and vice versa
- Use in telephone systems, radios and secure communications

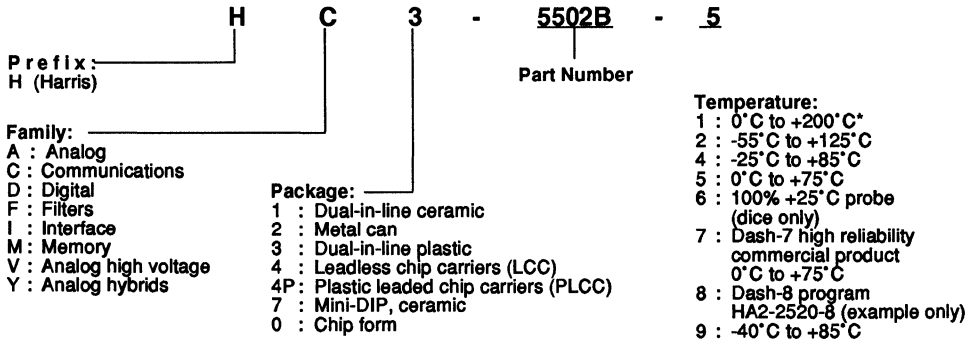
#### Surgeectors

- See transient voltage suppression for details

# Telecom

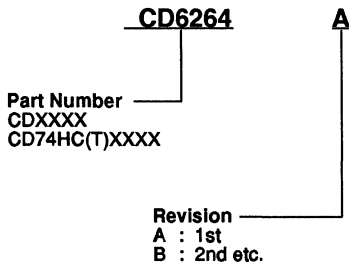
## Ordering Information

### Harris Product Code Example



\* Special high temperature testing available on certain product types. Consult factory for availability.

### CD, CD74HC(T) Nomenclature Guides

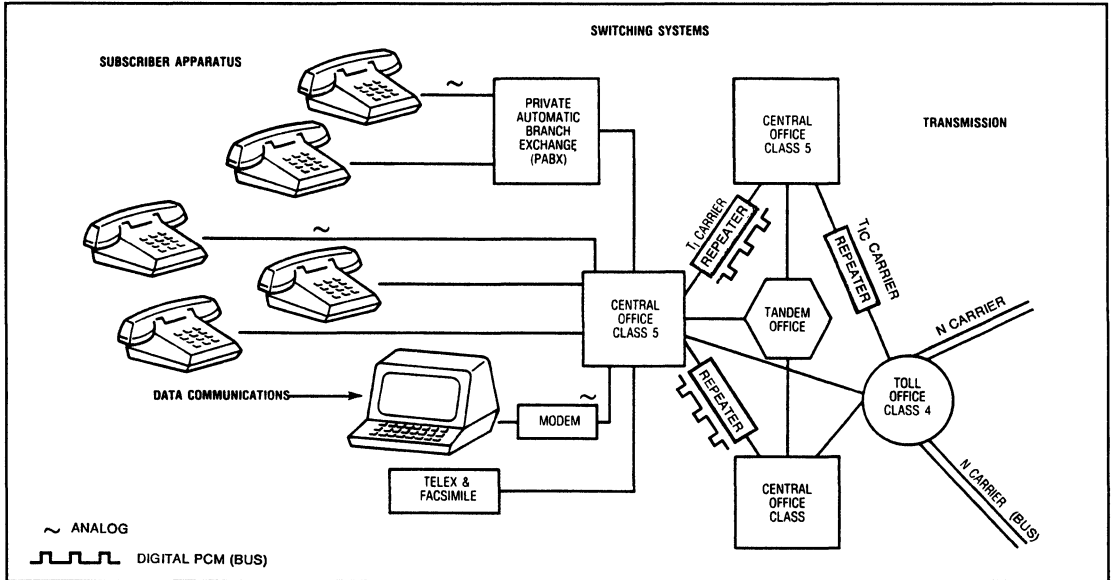


**D**

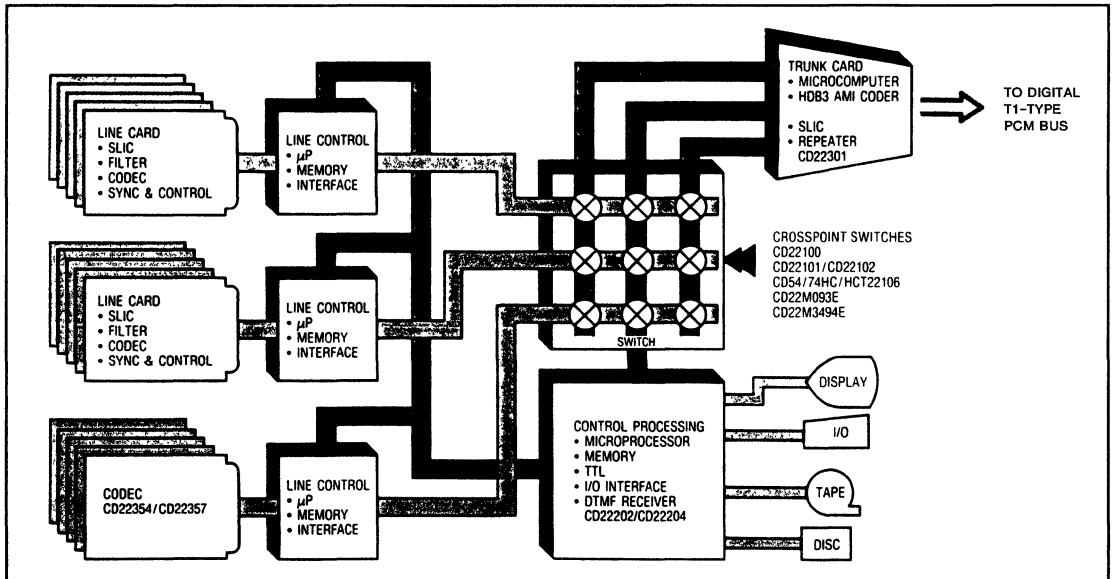
PACKAGE/OPTION	SUFFIX LETTER
Dual-in-line sidebraced ceramic DIP	D
Dual-in-line plastic DIP	E
Leadless chip carrier	J
Small outline plastic SOP	M
Plastic leaded chip carrier PLCC	N
Metric plastic quad flatpack MPQFP	Q
Chip (when applicable)	H
Enhanced product screening i.e., burn-in (optional for D, E package types)	X
Single-in-line package (SIP)	Z
Electrical option	1, 2, 4

# Telecommunications

## Typical Telecom System Macro View



## Typical Telecom Switching System Micro View (Inside the switching system)





# Telecommunications

## Analog Interface at Central Office Switch or PBX Switch End

### SLIC

A Subscriber Line Interface Circuit that integrates the traditional transformer-based discrete telephone line interface functions, ie BORSHT functions, on a single chip.

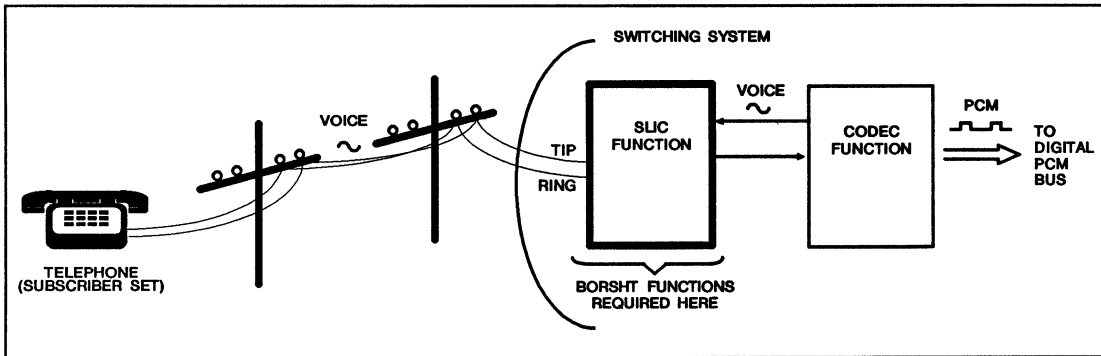
### BORSHT FUNCTIONS

Acronym for interface functions required between subscriber telephone and the switch.

- B** = Battery feed; sets up DV bias voltage across Tip and Ring lines.
- O** = Overvoltage protection; provides transient protection
- R** = Ringing; controls ringing signal to subscriber telephone
- S** = Supervisory; monitors telephone line status for on/off hook
- H** = Hybrid; differential to single-ended conversion and vice versa
- T** = Test; provides access to telephone line via relay for testing

### APPLICATIONS

- Any Analog or Digital PBX Switching System
- Voice Messaging PBX Systems
- Direct Inward Dial (DID) Trunks
- Hotel/Motel Switching Systems
- Digital Loop Carrier Systems
- Central Office (CO) Switching Systems



# Telecommunications

## Analog Interface at Central Office Switch or PBX Switch End (Continued)

### SLIC

**Subscriber Line Interface Circuits** Common Features to all SLICs; (HC-5502B, HC-5504B, HC-5509B, HC-5524, HC-5504DLC)

- Monolithic Integrated Device
- DI High Voltage Process
- Compatible with Worldwide PBX Performance Requirements
- Controlled Supply of Battery Feed Current for Short Loops
- Internal Ring Relay Driver
- Low Power Consumption During Standby
- Switch Hook, Ground Key and Ring Trip Detection Functions
- Selective Denial of Power to Subscriber Loops

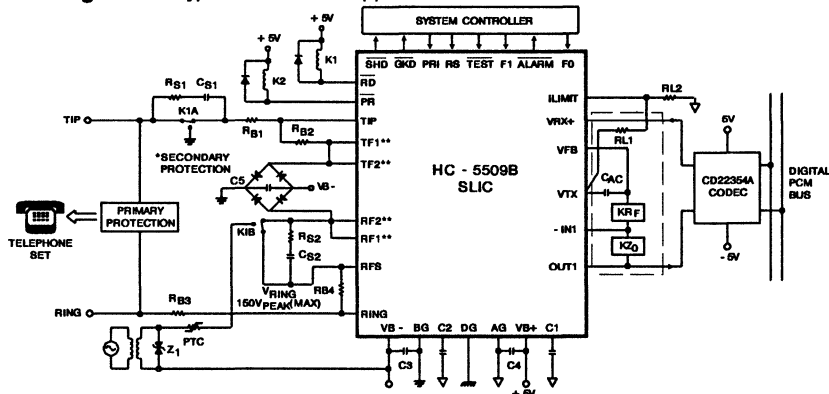
PART NUMBER	FEATURES	LOOP CURRENT mA DC	RINGING TYPE TYPE	TYPICAL SUPPLY VOLTAGES	PACKAGE
HC-5502B	<ul style="list-style-type: none"> <li>• Low Voltage +5V (VB+) Capability</li> <li>• Pin for Pin replacement for the HC-5502A</li> </ul>	30	Single-Ended Ground Reference	-48V, +12V or +5V	24-Pin DIP E or C
HC-5504B	<ul style="list-style-type: none"> <li>• Allows interfacing to negative superimposed ringing systems</li> </ul>	40	Single-Ended Battery or Gnd Reference or Balanced Ringing	-48V, +12V or +5V	24 Pin DIP E or C 28 Pin PLCC
HC-5509B	<ul style="list-style-type: none"> <li>• Compatible with worldwide PBX AND Central Office performance requirements</li> <li>• Contains two internal relay drivers</li> <li>• Programmable loop current limit</li> <li>• High temperature alarm output</li> </ul>	20 to 50	Single-Ended Battery or Gnd Reference or Balanced Ringing	-48V, +12V	28 Pin DIP E or C 44 Pin PLCC
HC-5524	<ul style="list-style-type: none"> <li>• HC-5509B version operating at -24V battery and +5V</li> </ul>	20 to 60	Single-Ended Battery or Gnd Reference or Balanced Ringing	-24V, +5V	28 Pin DIP E or C 44 Pin PLCC
HC-5504DLC	<ul style="list-style-type: none"> <li>• Switch hook detect threshold allows multi-phone operation</li> </ul>	40	Single-Ended Battery or Gnd Reference or Balanced Ringing	-48V, +12V or +5V	24 Pin DIP E or C 28 Pin PLCC

### CMOS CODECS

Non-linear analog to digital and digital to analog converter for voice and PCM (Pulse Cove Modulation) signals

PART NUMBER	FEATURES	CLOCK RATES	SUPPLY VOLTAGE	PACKAGE
CD22354A (μ-Law)	<ul style="list-style-type: none"> <li>• Meets or exceeds all AT&amp;T D3/D4 specs CCITT recommendations</li> <li>• Complete CODEC and filtering systems:                             <ul style="list-style-type: none"> <li>- No external components for sample-and-hold and auto-zero</li> <li>- Receive output filter with SIN X/X correction and additional 8kHz suppression</li> </ul> </li> </ul>	64kHz to 2.1MHz	±5V ±5% at 90mW (Max)	16 Pin DIP-E
CD22357A (A-Law)	<ul style="list-style-type: none"> <li>• Variable data clocks - from 64kHz to 2.1MHz</li> <li>• Synchronous and asynchronous operation</li> <li>• TTL or CMOS compatible logic</li> <li>• ESD protection on all inputs and outputs</li> <li>• Adjustable gain for transmit input</li> </ul>			

### Applications Diagram Typical Line Circuit Application with the HC-5509B and CD22354A



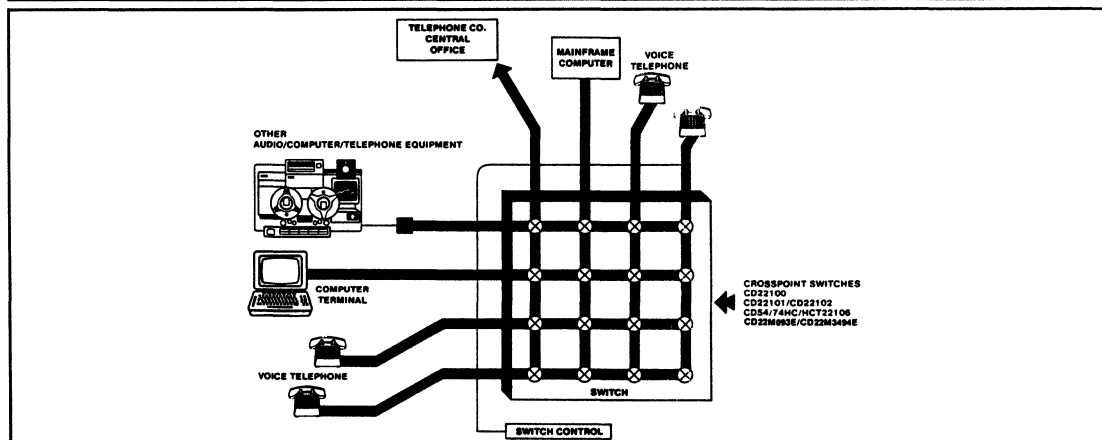
# Telecommunications

## Analog Interface at Central Office Switch or PBX Switch End (Continued)

### Crosspoint Switches

High-performance analog switches matrix for PBX, studio, audio switching, and multisystem bus interconnects

TYPE	FEATURES	CONFIGURATION	RON (TYP.) @ 12V	RON (TYP.) @ 12V	FQ. RESPONSE (TYP.) -3dB, $R_L = 1K, 10V$	CROSSTALK (TYP.) -40dB (FQ.), 10V	SUPPLY VOLTAGE	PACKAGE
<b>BiMOS-E Crosspoint Switches with Control Input Memory</b>								
CD22M3493 CD22M3494	<ul style="list-style-type: none"> <li>Optional on-chip strobe-independent address latches</li> <li>Manual and automatic power-on resets</li> <li>Crosstalk: -90dB (min) @ 10kHz</li> <li>BiMOS-E Technology</li> <li>Parallel input addressing</li> <li>HC/HCT ground-referenced inputs available</li> <li>2kV minimum ESD protection</li> <li>Latch-up current: 50mA (min)</li> <li>Pin and functionally compatible with the SGS M3494</li> </ul>	16 x 8 x 1	36 $\Omega$	6 $\Omega$	45MHz	3MHz	4V to 14V	40-Pin DIP-E 44-Pin PLCC
<b>CMOS Crosspoint Switches with Control Memory</b>								
CD22100	<ul style="list-style-type: none"> <li>"Built-in" control latches</li> <li>Large analog signal capability <math>\pm V_{DD}/2</math></li> <li>10MHz switch bandwidth</li> <li>High linearity - 0.5% distortion (typ.) at <math>f = 1kHz, V_{IN} = 5Vp-p, V_{DD} = 10V, \text{ and } R_L = 1k\Omega</math></li> <li>Standard CMOS noise immunity</li> <li>100% tested for maximum quiescent current at 20V</li> </ul>	4 x 4 x 1	75 $\Omega$	18 $\Omega$	40MHz	1.5MHz	3V to 18V	16-Pin DIP E, F
CD22101	<ul style="list-style-type: none"> <li>Strobed control input</li> <li>"Built-in" latched inputs</li> <li>Large analog signal capability <math>\pm V_{DD}/2</math></li> <li>10MHz switch bandwidth</li> <li>High linearity - 0.25% distortion (typ.) at <math>f = 1kHz, V_{IN} = 5Vp-p, V_{DD}-V_{SS} = 10V, \text{ and } R_L = 1k\Omega</math></li> <li>Standard CMOS noise immunity</li> </ul>	4 x 4 x 2	75 $\Omega$	8 $\Omega$	40MHz	2.5MHz	3V to 18V	24-Pin DIP E, F
CD22102	<ul style="list-style-type: none"> <li>Same as CD22101, but has Set/Reset flip-flop control input instead of strobed control input</li> </ul>	4 x 4 x 2	75 $\Omega$	8 $\Omega$	40MHz	2.5MHz	3V to 18V	24 Pin DIP E, F
CD54/74HC(T) 22106	<ul style="list-style-type: none"> <li>64 analog switches in an 8 x 8 x 1 array</li> <li>On-chip line decoder &amp; control latches</li> <li>Automatic power-up reset by using a 0.1<math>\mu</math>F capacitor at the MR pin</li> <li><math>R_{ON}</math> resistance 95<math>\Omega</math> max. @ <math>V_{CC} = 4.5V</math></li> <li>Analog signal capability <math>V_{CC}/2</math></li> </ul>	8 x 8 x 1	64 $\Omega$	25 $\Omega$	6MHz	7MHz	2V to 10V	28-Pin DIP E

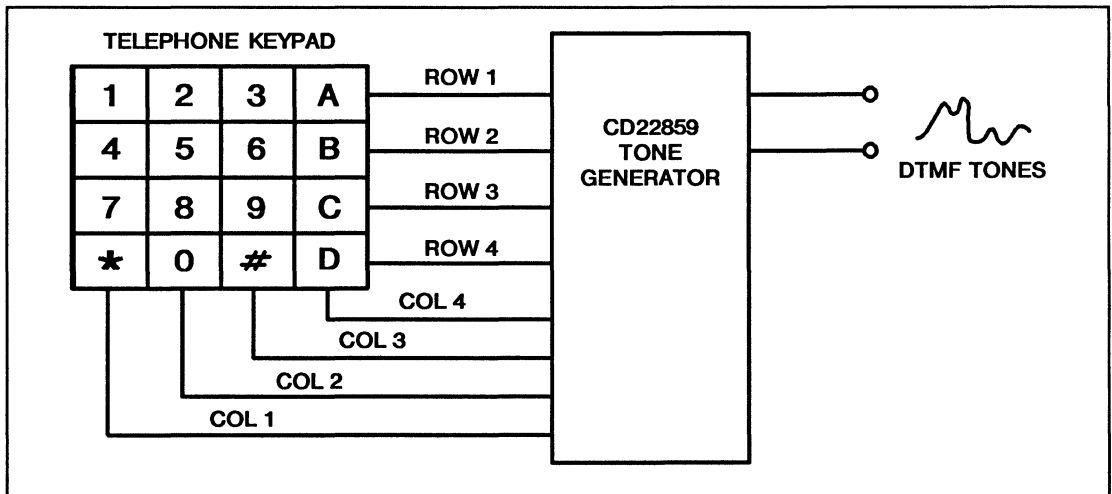


# Analog Interface at Subscriber End

Detects and generates special tones for standard telephone touch tone dialing keypad

CMOS DTMF Receivers				
TYPE	FEATURES	OUTPUT 3-STATE OUTPUT CODE	SUPPLY VOLTAGE	PACKAGE
CD22202	<ul style="list-style-type: none"> <li>• Detects either 12 or 16 standard DTMF signals</li> <li>• Central-office quality</li> <li>• No front-end band splitting filters required</li> <li>• Single, low-tolerance, 5V supply</li> <li>• Uses inexpensive 3.579545MHz crystal for reference</li> <li>• Excellent speech immunity</li> <li>• Synchronous or handshake interface</li> <li>• Three-state outputs</li> </ul>	4-bit Hexa-decimal or binary coded 2-of-8	5V ± 10%	18-Pin DIP-E
CD22203	<ul style="list-style-type: none"> <li>• Same as CD22202, but also has early defect output</li> </ul>	4-bit Hexa-decimal or binary coded 2-of-8	5V ± 10%	18-Pin DIP-E
CD22204	<ul style="list-style-type: none"> <li>• No front-end band splitting filters required</li> <li>• Single, low-tolerance, 5V supply</li> <li>• Three-state outputs for microprocessor-based systems</li> <li>• Detects all 16 standard DTMF digits</li> <li>• Uses inexpensive 3.579545MHz crystal</li> <li>• Excellent speech immunity</li> <li>• Output in 4-bit hexadecimal code</li> </ul>	4-bit Hexa-decimal Only	5V ± 10%	14-Pin DIP-E

CMOS DTMF Transmitters				
TYPE	FEATURES	OUTPUT	SUPPLY VOLTAGE	PACKAGE
CD22859	<ul style="list-style-type: none"> <li>• Mute drivers on chip</li> <li>• Device power can either be regulated dc or phone loop current</li> <li>• Use of an inexpensive 3.579545MHz TV crystal provides high accuracy and stability for all frequencies</li> </ul>	350mV into 82 Ω	2.5V to 10V	16-Pin DIP D, E

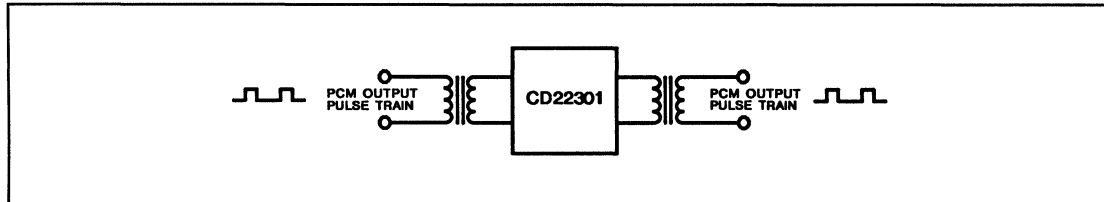


# Digital Interface

## PCM Line Repeaters

Digital to digital converter to bolster and reshape digital PCM signals distorted by long transmission over PCM bus lines

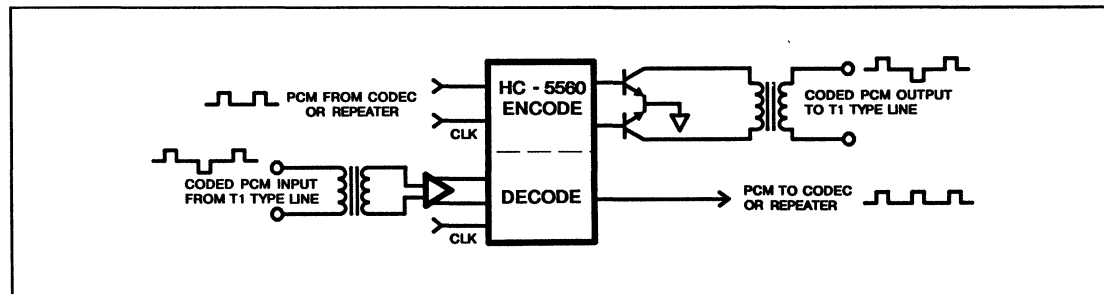
TYPE	FEATURES	OUTPUT	SUPPLY VOLTAGE	PACKAGE
Bipolar				
CD22301	<ul style="list-style-type: none"> <li>Automatic line buildout</li> <li>For T1 1.544 Mbits/s bipolar carrier system</li> <li>For T148 2.37 Mbits/s ternary carrier system</li> <li>For CCITT 2.048 Mbits/s bipolar carrier system</li> </ul>	Buffered	5.1 V $\pm$ 5%, 30 mA (max.)	18-Pin DIP-E



## PCM Transcoders

Unipolar to bipolar digital to digital converter for more efficient long line transmission of digital PCM signals

TYPE	FEATURES	OUTPUT	CODES	SUPPLY VOLTAGE	PACKAGE
HC-5560	<ul style="list-style-type: none"> <li>Mode selectable coding</li> <li>North American and European compatibility</li> <li>Simultaneous encoding and decoding</li> <li>Asynchronous operation</li> <li>Loop-back control</li> <li>Transmission error detection</li> <li>Alarm indication signal</li> <li>Replaces MJ1440, MJ1471, and TCM2201 transcoders</li> </ul>	3.2mA @ 0.4 V	AMI (T1 and T1C) B6ZS (T2) B8ZS (T1) HDB3 (PCM30)	5V @ 10 mA (typ.)	20 Pin DIP-E
CD22103A	<ul style="list-style-type: none"> <li>Simultaneous encoding and decoding</li> <li>HDB3 coding and decoding for data rates from 50 kbits/s to 10 Mbits/s in a manner consistent with CCITT G703 recommendations</li> <li>HDB3/AMI transmission coding/reception decoding with code error detection is performed in independent coder and decoder sections</li> <li>All transmitter and receiver inputs/outputs are TTL compatible</li> <li>Internal loop test capability</li> </ul>	1.6mA @ 0.5 V	HDB3/AMI per CCITT G703 Annex Recommendation	5 V $\pm$ 10% @ 100 mA (max.)	16-Pin DIP-E, D

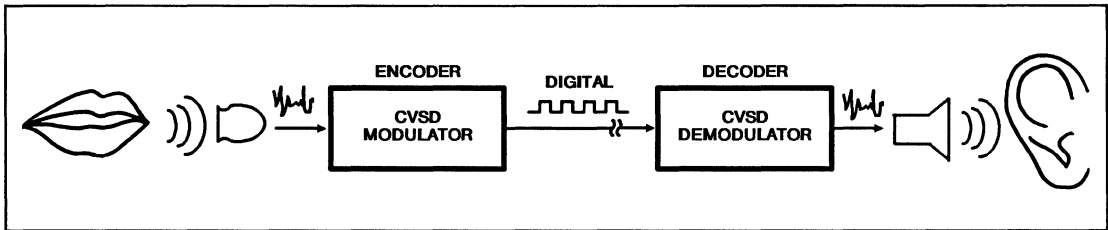


# General Interface

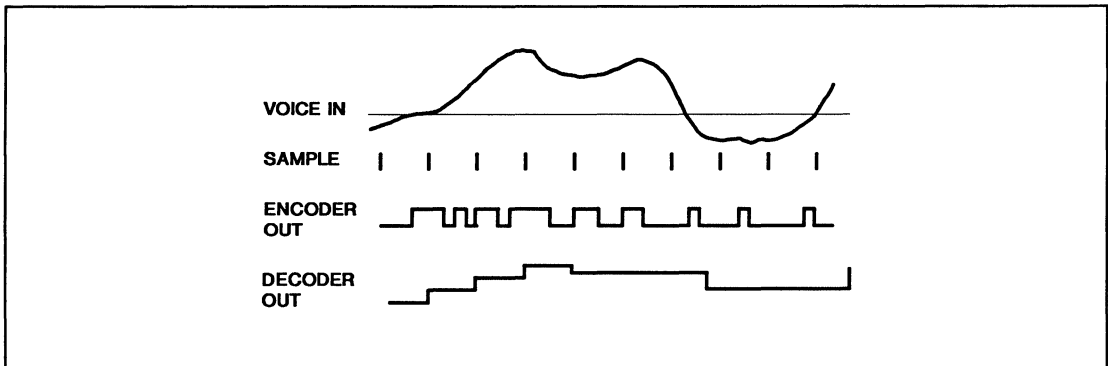
## CVSD – Continuous Variable Slope Delta Modulator

A real time voice to digital (encoder) and digital to voice (decoder) converter

TYPE	FEATURES	CLOCK RATES	SUPPLY VOLTAGE	PACKAGE
HC-55564	<ul style="list-style-type: none"> <li>• Modulator/Demodulator Functions</li> <li>• All digital</li> <li>• Requires few external parts</li> <li>• Low power drain: 1.5 mW typical from single 3V-7V supply</li> <li>• Time constants determined by clock frequency; no calibration or drift problems; automatic offset adjustment</li> <li>• Half duplex operation under digital control</li> <li>• Filter reset under digital control</li> <li>• Automatic overload recovery</li> <li>• Automatic "Quiet" pattern generation</li> <li>• AGC control signal available</li> </ul>	9kHz to 64kHz	5V @ 1.5mA (max)	14-Pin DIP-C
HC-55536	<ul style="list-style-type: none"> <li>• Demodulator Only Functions</li> <li>• All Digital</li> <li>• Requires fewer external parts</li> <li>• Low power drain: 1.5 mW from single 3-7V supply</li> <li>• Time constants determined by clock frequency; no calibration or drift problems; automatic offset adjustment</li> <li>• Filter reset by digital control</li> <li>• Automatic overload recovery</li> <li>• Automatic "Quiet" pattern generation</li> </ul>	9kHz to 64kHz	3V to 7V @ 1.5mA (max)	14-Pin DIP-C



The transmitter data stream consists of a series of "words", each representing the voice signal level at the instant of sampling:





# Consumer

## IF Amplifier and Detector

- FM IF amplifiers with limiters and detectors
- Wide band amplifiers
- Wide band discriminator/amplifiers
- Electronic attenuators
- Quadrature detect, AGC, and log output devices
- FM IF's with channel detection
- TV picture IF's

## Horizontal/Vertical Countdown and Sync Processors

- Horizontal oscillator/drivers
- Horizontal processors with 64, 32, 16 or 8 divide ratios
- CMOS sync generator with genlock and alternate field output
- Pal and NTSC compatible
- Useful as sync or clock regenerators

## Chroma/Luma Processors and Demodulators

- VCO with phase control and shunt regulator
- 3.58 MHz demodulator and carrier regenerator
- Pal chroma processor
- Single chip pal luma/chroma; video to RGB converter
- Single chip chroma/luma; video to RGB converter
- Video/chroma processor

## Tuner Control, Prescalers, and Band Switches

- Tuner freq. synthesizer, IR demod, 9 D/A, 8 x 20 character OSD
- Divide by 20 prescaler to 200 MHz
- Divide by 64/256 prescaler to 1 GHz
- Divide by 64/256 prescaler to 1.25 GHz
- Band switch with amplifier for varactor control

## Miscellaneous Radio/TV Functions

- Automatic CRT bias circuit
- IR receiver preamp and demodulator
- AM receiver
- TV sound demodulator and audio amp

## Security and Surveillance

- Vidicon bias and amp
- RS-170 sync generator for camera applications
- Pal or NTSC versions
- Universal detection and alarm circuit

## Automotive

- Reluctance proximity detector/demodulator
- .5 Hz clock time base and motor driver
- 16 channel precision timer/driver



# Consumer

## Package Options

Because of the wide variety of package options combinations available in the CA series, please consult the listing of available types on page xx and compare with the code below:

CAxxxx

No  
design

Dual inline plastic

E

Dual inline plastic

Q

Quad inline plastic

M

SOIC available

Temp ranges and package lead counts vary with device type. See your data sheet for package details

# IF Amplifiers and Detectors

## CA2111A FM IF Amplifier-Limiter and Quadrature Detector

For FM IF and TV Sound IF Applications

### Features

- Direct Replacement for ULN2111A and MC1357
- Good Sensitivity: Input Limiting Voltage (knee) (400 $\mu$ V Typ. at 10.7MHz; 250 $\mu$ V Typ. at 4.5 MHz and 5.5MHz)
- Excellent AM Rejection (45dB Typ. at 10.7MHz)
- Provision for Output From 3-Stage IF Amplifier Section

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## CA3011, CA3102 Wide-Band Amplifiers

### Features

- Exceptionally High Amplifier Gain
  - ▶ Power Gain at 4.5MHz/s - 75dB Typ.
- Excellent Limiting Characteristics
  - ▶ Input Limiting Voltage (Knee) - 600 $\mu$ V Typ. at 10.7MHz/s
- Wide Frequency Capability
  - ▶ 100kHz/s to > 20MHz/s

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## CA3013, CA3014 Wide-Band Amplifier Discriminators

### Features & Applications

- Exceptionally High Gain
  - ▶ Power Gain at 4.5MHz - 75dB Typ.
- Excellent Limiting Characteristics
  - ▶ Input Limiting Voltage (Knee) = 300 $\mu$ V Typ. at 4.5MHz
- Excellent AM Rejection
  - ▶ >50dB at 4.5MHz
- High Audio-Voltage Recovery
  - ▶ 220mV Typ at 4.5MHz, 25kHz deviation

---

## CA3065 IF Amplifier-Limiter, FM Detector, Electronic Attenuator, Audio Driver

### Features

- Electronic Attenuator - Replaces Conventional Volume Control
- Differential Peak Detector - Requires on Single Tuned Coil
- Internal Zener Diode Regulated Supply
- Inherent High Stability

## IF Amplifiers and Detectors (Continued)

### CA3089 FM IF System

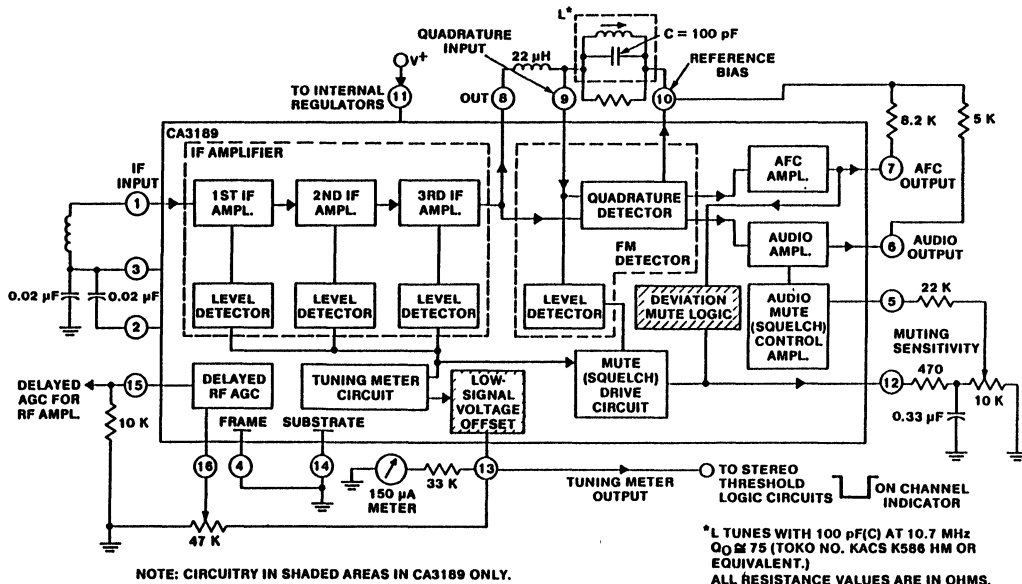
### CA3189 FM IF System With ON Channel Detector

For FM IF Amplifier Applications in High-Fidelity, Automotive, and Communications Receivers

Includes - IF Amplifier, Quadrature Detector, AF Pre-amplifier, and Specific Circuits for AGC, AFC, Muting (Squelch), and Tuning Meter

#### Features

- Exceptional Limiting Sensitivity
  - ▶ 12 $\mu$ V Typ. at -3dB Point
- Low Distortion
  - ▶ 0.1% Typ. (With Double Tuned Coil)
- Single Coil Tuning Capability
- Improved S + N/N Ratio
- Externally Programmable Recovered Audio Level
- Provides Specific Signal for Control of Interchannel Muting (Squelch)
- Provides Specific Signal for Direct Drive of a Tuning Meter
- On Channel Step for Search Control
- Provides Programmable AGC Voltage for RF Amplifier
- Provides a Specific Circuit for Flexible Audio Output
- Internal Supply Voltage Regulators
- Externally Programmable "On" Channel Step Width, and Deviation at which Muting Occurs



## Horizontal/Vertical Countdown and Sync Processors

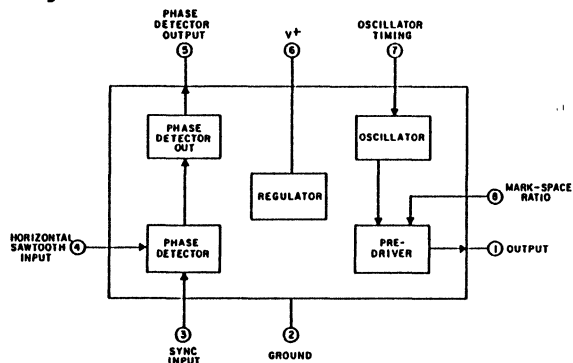
### CA1391, CA1394 TV Horizontal Processors

CA1391E - Positive Horizontal Sawtooth Input

CA1394E - Negative Horizontal Sawtooth Input

#### Features

- Internal Shunt Regulator
- Linear Balanced Phase Detector
- Preset Hold Control Capability
- $\pm 300$ Hz Pull-in (Typ.)
- Low Thermal Frequency Drift
- Small Static Phase Error
- Variable Output Duty Cycle
- Adjustable DC Loop Gain

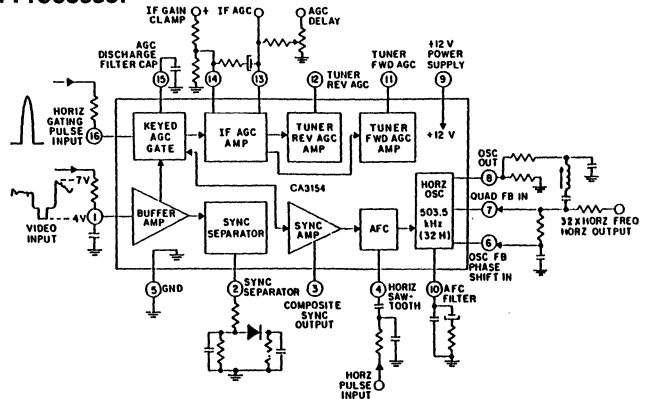


# Horizontal/Vertical Countdown and Sync Processors (Continued)

## CA3154 TV Sync/AGC/Horizontal Signal Processor

### Features

- Horizontal Oscillator With AFC
- Sync Separator With Noise Immunity
- Strobed AGC System
- IF AGC Output
- Delayed Outputs for Forward or Reverse AGC Tuners
- Internal Noise Threshold
- High Impedance Video Input
- Choice of Dual External Time Constants for Sync Separator Noise Immunity
- RF AGC Delay Externally Controlled
- Output Short-Circuit Protection



## CA3202 TV Horizontal/Vertical Countdown Digital Sync System

### Features

- Automatic Forced Asynchronous Mode to Remove Jitter
- Lower Zero-State Horizontal-Drive Output
- Improved Low Voltage Start-up Operation
- Improved Symmetry for Horizontal-Drive Output

## CA3210, CA3223 TV Horizontal/Vertical Countdown Digital Sync System

For 525-Line (CA3210E) or  
625-Line (CA3223E) Operation

### Features

- Horizontal Driver
- Horizontal Oscillator
- Two Phase-Lock Loops
- Vertical Countdown

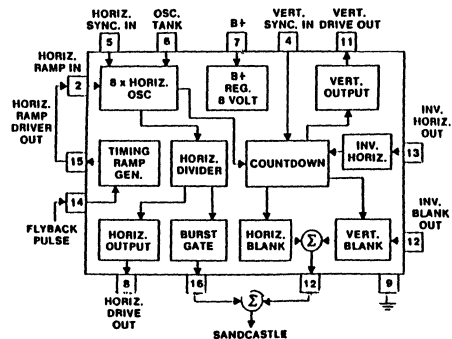
## CA3236 The CA3210 With Modification

## CA3241 PAL Version of the CA3210

## CA3218 TV Horizontal/Vertical Countdown Digital Sync System

### Features

- Horizontal Oscillator
- Vertical Countdown
- Composite Blanking Output
- Burst-Gate Output
- Horizontal Ramp Generator
- Internal Shunt Regulator



# Horizontal/Vertical Countdown and Sync Processors (Continued)

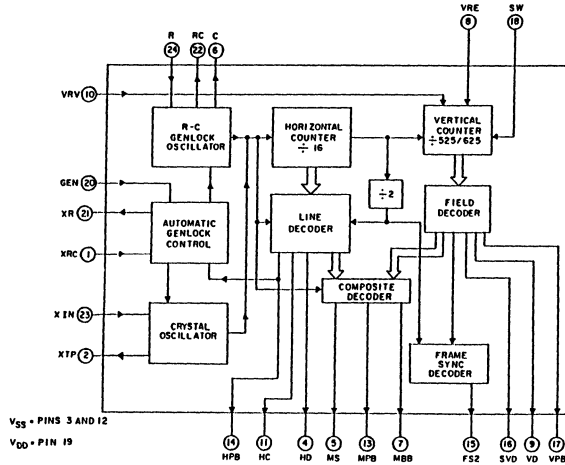
## CD22402 CMOS LSI Sync Generator

### Features

- Interlaced Composite Sync Output
- Automatic Genlock Capability
- Crystal Oscillator Operation
- 525 or 625 Line Operation
- Vertical Reset Option
- Wide Power Supply Operating Voltage . . . 4V-15V

### Applications

- Cameras
- Monitors and Displays
- CATV
- Teletext
- Video Games
- Sync Restorer
- Video Service Instruments
- Scrambling/Descrambling Equipment



## Chroma/Luma Systems

### CA3070 Television Chroma System

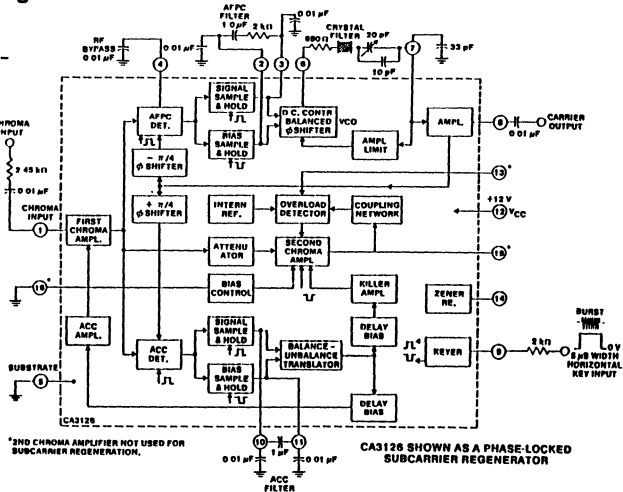
#### Features

- Voltage Controlled Oscillator
- Keyed APC & ACC Detectors
- DC Hue Control
- Shunt Regulator

### CA3126 TV Chroma Processor and Carrier Regenerator

#### Features

- Phase-Locked Subcarrier Regeneration Utilizes Sample-and-Hold Techniques
- Automatic Chrominance Control (ACC)/Killer Detector Employs Sample-and-Hold Techniques
- Supplementary ACC with an Overload Detector to Prevent Oversaturation of this Picture Tube
- Sinusoidal Subcarrier Output
- Keyed Chroma Output
- Emitter-Follower Buffered Outputs for Low Output Impedance
- Linear DC Saturation Control



### CA3128Q TV Chroma Processor for PAL Systems

#### Features

- Phase-Locked Subcarrier Regeneration Utilizes Sample-and-Hold Techniques in the Automatic Frequency Phase Control (AFPC) Servo Loop
- Automatic Chrominance Control (ACC)/Killer Detector Employs Sample-and-Hold Techniques
- Supplementary ACC with an Overload Detector to Prevent Oversaturation of this Picture Tube
- Sinusoidal Subcarrier Output

# Chroma/Luma Systems (Continued)

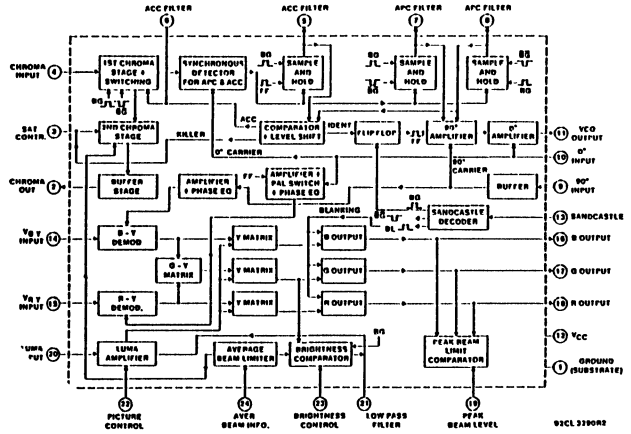
## CA3194 Single Chip PAL Luminance/Chroma Processor

### Features

- All PAL Luminance and Chrominance Processing Circuitry on a Single Chip in a 24 Lead Plastic Package
- Phase Locked Subcarrier Regeneration Utilizing Sample-and-Hold
- DC Controls for Brightness, Contrast, and Color Saturation Functions
- Input for Average Beam-Current Limiting
- Contrast Control Having Excellent Tracking of Luma and Chroma Channels
- Low Impedance RGB Outputs with Excellent Tracking for Direct Coupling to Video Driver Circuitry

### Applications

- PAL to RGB Conversion



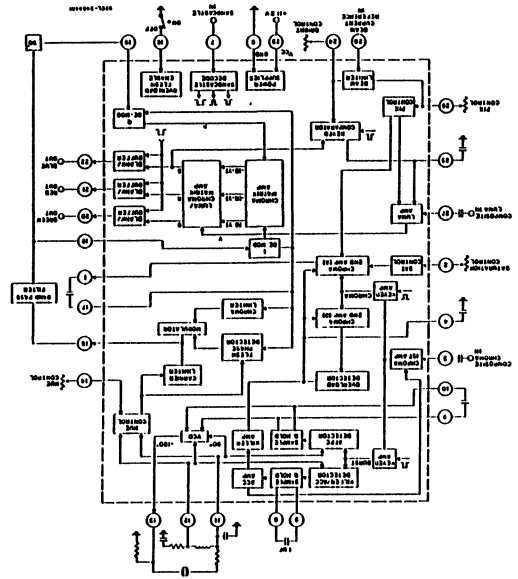
## CA3217 Single Chip NTSC TV Chroma/Luminance Processor

### Features

- All Chroma Processing and Demodulating Circuitry on a Single Chip in a 28 Lead Plastic Package
- Phase-Locked Subcarrier Regeneration Utilizing Sample-and-Hold Techniques
- Supplementary ACC with Overload Detector to Prevent Over Saturation of the Picture Tube
- Linear DC Controls for Chroma Gain and Tint
- Dynamic "Flesh Correction" Corrects Purple and Green Flesh Colors Without Affecting Primary Colors
- Balanced Chroma Demodulators with Low Output Impedance for Direct Coupling
- Internal RF Filtering
- Requires Few External Components
- Automatic Beam Limiter
- Chroma Luminance Tracking Picture Control

### Applications

- NTSC to RGB Conversion



## CA3234E Luminance/Chroma Processor

### Features

- Complete Chroma Processing and Demodulating Circuitry with RGB Outputs on a Single Chip in a 28 Pin Plastic Package
- DC Peaking with Noise Processing
- DC Picture Control with Automatic Beam Limiter
- DC Controlled Black Level (Brightness)

# Prescalers/Band Switches

## CA3247 Analog Interface Unit (AIU)

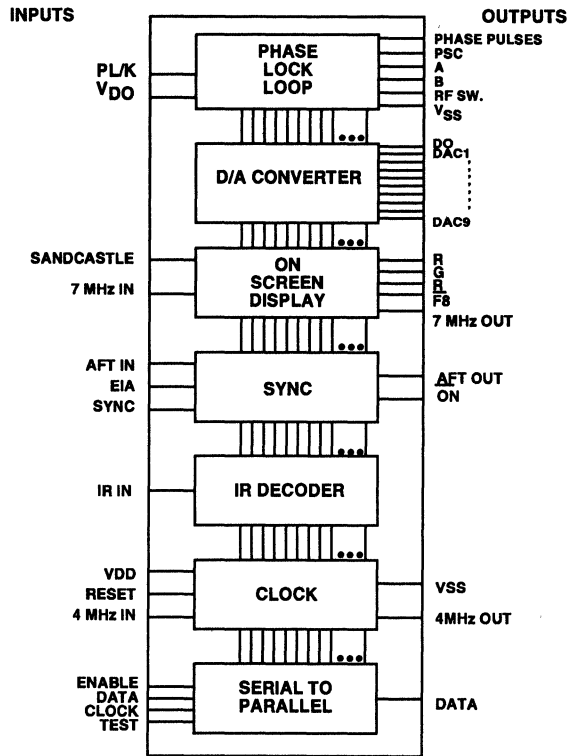
For Television & CATV Tuning/Interface Control

### Features

- Frequency Synthesizer for TV and CATV Channels (With 4MHz Crystal Oscillator for Reference)
- Interfaces to Microprocessor & Tuner for Receiver Controls
- Circuit to Decode Remote Control Transmissions
- On Screen Display (OSD) with RGB Signal Output
- 9 D/A Converters for Analog Control Functions
- PLL Control of Tuner Interface Circuits
- Three Wire Serial Bus Interface

### Applications

- Tuner Test Equipment
- Remote



## CA3232 ÷20 Prescaler

### Features

- Operation to 200MHz
- TTL and CMOS Compatible
- 5V Power Supply
- Open Collector Output Stage

### Applications

- Digital Synthesizers
- Counters
- AM/FM Communications Circuit

## CA3163E VHF/UHF Prescaler ÷64/256

### Features

- Broadband Operation - 90 to 1000MHz
- High Sensitivity
- Standard 5V Power Supply
- Dual Mode Operation - VHF/UHF

## CA3179 1.25GHz Prescaler

### Features

- Broadband Operation
  - DC to 1.25GHz
- High Sensitivity
- Standard T<sup>2</sup>L or ECL Power Supply
- Dual Mode Operation
  - VHF/UHF (+64/+256)

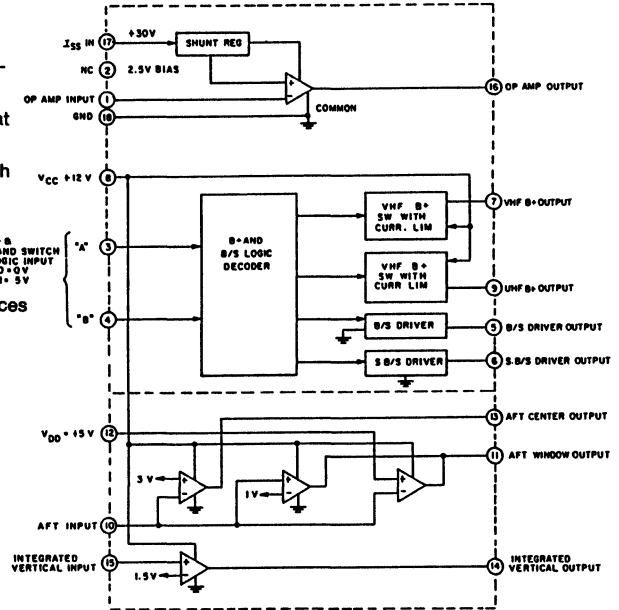
# Prescalers/Band Switches (Continued)

## CA3238E BiMOS Input Op-Amp, Frequency Band-Select Switch and Quad Comparator

For Television Tuning Interfacing

### Features

- Input Op-Amp - High Impedance PMOS Input Transistors and Internal Reference Bias
- Low Input Bias Current and Internal Diode Protection at Op-Amp Inputs
- High Op-Amp Output Voltage Swing (0.2-28V DC) with 3mA Source or Sink Capability
- Logic Controlled Bandswitching with Four Separate Outputs
- Two Bandswitch Output Current Sinks
- Two Bandswitch Current-Limited Output Current Sources
- Internally Referenced Quad Comparator
- Low Drive Current Input Requirement
- Low Output Leakage
- High Output Current Sink Capability
- Bipolar and PMOS Processes on a Single Chip

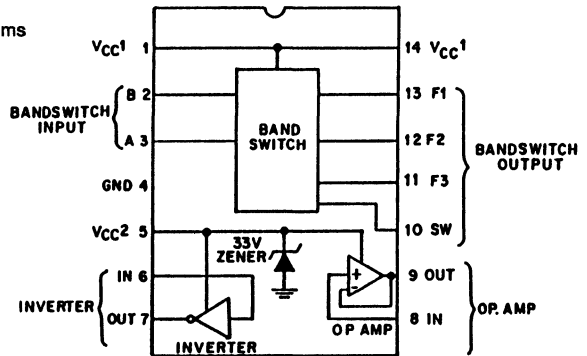


## CA3263 TV Tuner Control Circuit Inverter, Operational Amplifier, Frequency and Band-Select Switch

For Frequency or Voltage Synthesizer Television Tuning Systems

### Features

- 2 Input - 4 Output Bandswitch
- High-Output Current Drive - Low Saturation Voltage
- For TV and CATV Use
- For Frequency or Voltage Synthesizers



## Miscellaneous Radio/TV Functions

### CA3224 Automatic Picture Tube Bias Circuit

For TV Picture Tube and CRT Cutoff Bias Control Applications

### Features

- Automatic Picture Tube Bias Cutoff Control
- Automatic Background Color Balance
- Eliminates Grey Scale Adjustments
- Compensates for Cathode-to-Heater Leakage

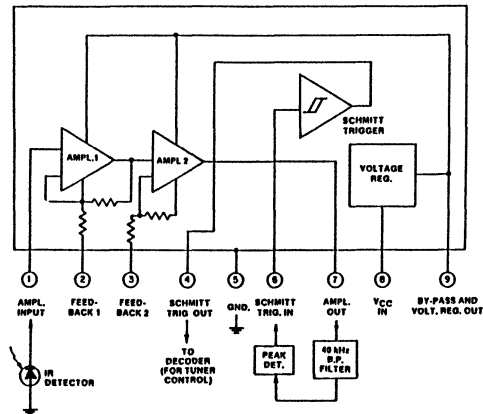


## Miscellaneous Radio/TV Functions (Continued)

### CA3237 IR Remote-Control Amplifier

#### Features

- Integrated Circuit Package - 9 Pin SIP
- Excellent Overload Characteristics
- High Gain Amplifiers
- Schmitt Trigger Switching
- 12 Volt Power Supply
- Low Power Dissipation
- Internal Regulation
- Nominal 100 $\mu$ V Sensitivity
- Nominal 50K Input Impedance



### CA3088 AM Receiver Subsystem and General Purpose Amplifier Array

Includes - AM Converter, IF Amplifiers, Detector and Audio Preamplifier

For Applications in a Variety of AM Broadcast and Communications Receivers and Applications Requiring an Array of Amplifiers

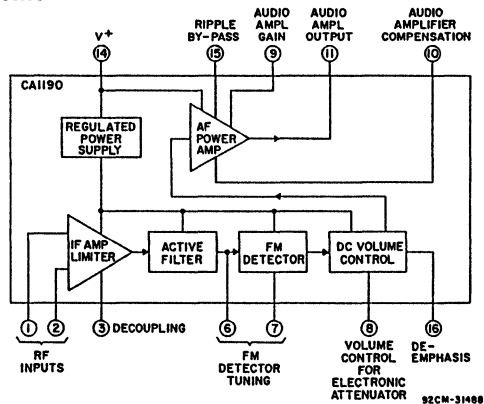
#### Features

- Excellent Overload Characteristics
- AGC for IF Amplifier
- Buffered Output Signal for Tuning Meter
- Internal Zener Diode Provides Voltage Regulation

### CA1191 TV Sound IF and Audio Output Subsystems

#### Features

- Nominal Power Output
  - ▶ 4W at V+ = 24V, RL = 16 $\Omega$ , Dist. = 10%
  - ▶ 2W at V+ = 12V, RL = 8 $\Omega$ , Dist. = 10%
- Wide Power Supply Range ..... 9V to 28V
- Low Quiescent Current ..... 25mA Typ.
- 5kHz Deviation Sensitivity .... 1W Output Typ.
- 3dB Limiting Sensitivity ..... 50 $\mu$ V Typ.
- Excellent AM Rejection ..... 50dB Typ.
- Differential Peak Detector - Requires One Tuned Coil
- Electronic Volume Control with Improved Taper and Single Wire Control



# Security and Surveillance

## CA3253 Video Processor

For Video Camera Applications

### Features

- Video Amplifier
- AGC Amplifier
- Blanking Pulse and Sync Pulse Addition
- Black Clipping

### Applications

- All RS-170 Sync Systems
- Security Cameras
- CCTV Systems
- Cable Systems
- Text Encoder Sync
- Computer Display Systems
- Graphic Systems

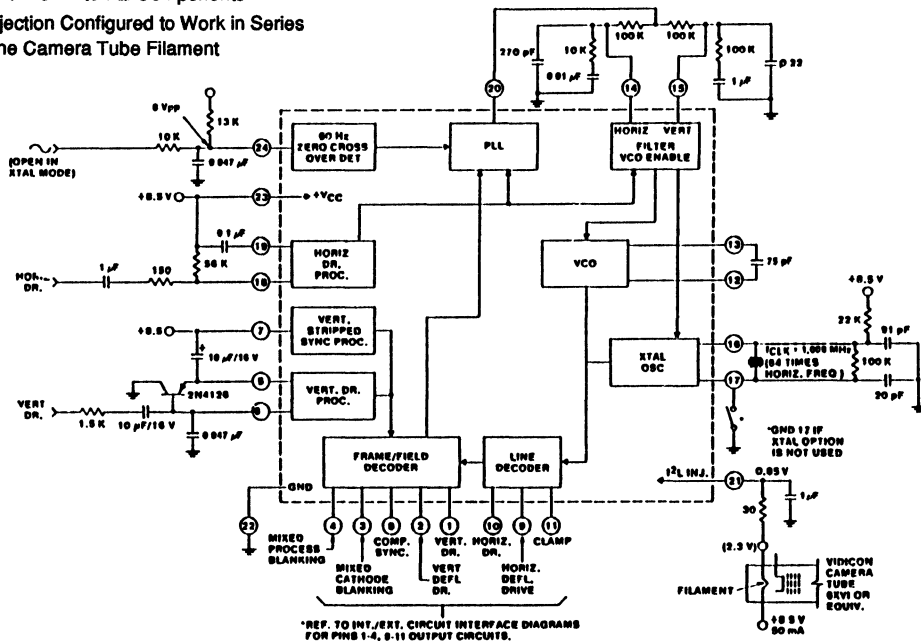
## CA3254, CA3255 RS-170 Sync Generator (CA3254)

### Features

- Single LSI IC with Multiple Genlock Capability
- EIA RS-170 Sync with 2:1 Interlace
- PLL for Lock to Power Line Zero Crossing
- Genlocks to RS-170, RS-330 or Random Interlace
- Crystal Control Mode Sync Option
- Four Modes of Genlock Control
- Maximum of External Components
- I<sup>2</sup>L Injection Configured to Work in Series with the Camera Tube Filament

### Applications

- All RS-170 Sync Systems
- Security Cameras
- CCTV Systems
- Cable Systems
- Text Encoder Sync
- Computer Display Systems
- Graphics Systems



## CA3164A BiMOS Single-Chip Detector/Alarm System

With Integral Drivers for Mechanical and Piezoelectric Horn Alarms

### Features

- Interfaces Directly with High Z Sensors - No External Buffer FET Required
- Low Input Current ..... 1pA Max.
- Gate Protected Input Terminals
- On-Chip Beep Oscillator for Low Battery Indication

### Applications

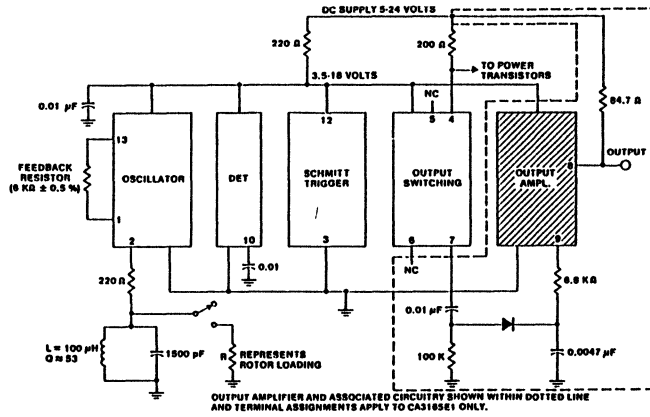
- Burglar Alarms
- Proximity Detectors
- Level Detectors
- Ion Chamber Particle Detection

# Automotive Special Function

## CA3165 Electronic Switching Circuit

### Features

- Switching Initiated by Damping of Internal Oscillator
- Proximity Sensing of Rotational Motion
- Repeatable Timing of Switching States
- Five Outputs - Two Complementary Pairs and One Non-Inverting Output (CA3165E1)
- Two Outputs - One Complementary Pair (CA3165E)



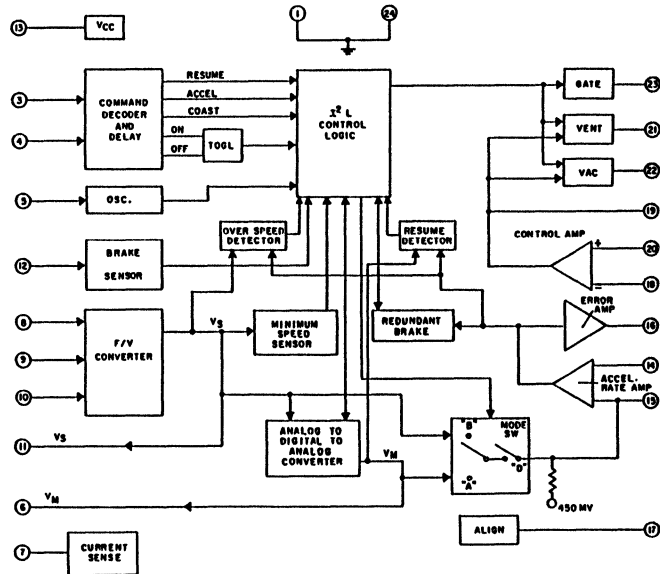
## CA3228 Speed-Control System

### Features

- Low Power Dissipation
- I<sup>2</sup>L Control Logic
- Power-ON Reset
- On-Chip Oscillator for System Time Reference
- Single Input Line for Operator Commands
- Amplitude Encoded Control Signals
- Transient Compensated Input Commands
- Controlled Acceleration Mode
- Internal Redundant Brake and Low Speed Disable
- Braking Disable

### Applications

- Automotive Speed Control
- Residential and Industrial Heating and Cooling Controls
- Industrial AC and DC Motor Speed Control
- Applications Requiring Acceleration and Deceleration Control



## 6 - Power

6A • MOSFET

6B • IGBT

6C • Bipolar

6D • Rectifier

6E • Transient Protection

## 6 - Power

6A • MOSFET

6B • IGBT

6C • Bipolar

6D • Rectifier

6E • Transient Protection

# MOSFETs

## Advanced Power MOS

### Features:

- Current Limiting, Voltage Limiting
- ESD Protection
- Logic Level

### Applications:

- Fault Tolerant Motor Drives
- Stall Protection
- Current Inrush Limiting
- Automotive Headlamp Drivers
- Diagnostic Motor Controls

## Logic Level MOSFETs

### Features:

- Full Drain Current Rating with 5V Gate Drive
- Microprocessor And Logic Compatible
- Electrostatic Discharge Protected Gates Available
- Avalanche Energy Capability Available
- Both N and P Channel Devices
- BV<sub>DSS</sub> Ratings of 50 to 200V
- Surface Mount D-pak to TO-218/TO-247 Packages

### Applications:

- Direct Logic Control of 50A Loads
- No Static Drive Current Required on The Gate
- Solid State DC Relays
- Lamp Drivers
- Stepper Motor Drives
- Small Motor Controls
- High Side Drivers
- SMPS MOSFET Predrivers

## Standard RFX, IRFX and MegaFET MOSFETs - N and P Channel

### Features:

- Hex-1 thru 5 Die Sizes
- All IRF Types Avalanche Capable
- BV<sub>DSS</sub> up to 1000 V
- MegaFETs offer the lowest R<sub>dson</sub>

### Applications:

- Offline and DC/DC Converters
- Power Supplies
- Pulse Generators
- Super Efficient DC/DC Converters
- Solid State DC Relays
- Low Loss DC Switch
- Lamp Drivers
- Operational Amplifier Buffer Stage
- Stepper Motor Drives
- Small Motor Controls
- Laser Diode Pulse Generators
- SMPS Drivers

## JEDEC MOSFETs

### Features:

- JEDEC Approved MOSFETs for Military and High Rel Applications
- BV<sub>DSS</sub> 60 to 500 Volts
- N and P Channel Devices

### Applications:

- Military
- High Reliability
- Hermetic

# MOSFETs

## Ordering Information

### R MOSFETs

1. R X X XX X XX XXX

#### Feature Suffix:

- R = Rugged Capabilities Guaranteed
- L = Logic Level, 5V Gate
- SM = Surface Mount Leadform (TO-252)
- E = ESD Protected Device
- CS = Current Sensing
- C = Voltage Clamping

#### Voltage Rating:

- 05 = 50V, 10 = 100V, 20 = 200V, etc.

#### Polarity:

- N = N Channel
- P = P Channel

#### Current Rating:

- 1 = 1A, 10 = 10A, 25 = 25A, etc.

#### Package Designation:

- A = 5 LEAD TO-218
- B = 5 LEAD TO-220
- D = TO-251, TO-252 (D-PAK)
- G = TO-247
- H = TO-218AC
- K = TO-204AE (TO-3 with 60 MIL leads)
- L = TO-205AF (TO-39/TO-205AF)
- M = TO-204AA (TO-3 with 40 MIL leads)
- P = TO-220AB

#### Device Type:

- F = Standard MOSFET
- L = Current limited MOSFET

**Example:** RLP1N08LE ESD Protected, Current Limited, TO-220, 1 AMP, N Channel, 80V, Logic Level MOSFET

RFD15N05SM D-PAK, 15A, N Channel, 50V, Surface Mount Leadform MOSFET

RFP12N06RLE TO-220, 12A, N Channel, 60V, Rugged, Logic Level, ESD Protected MOSFET

### IRF MOSFETs

I R XX XXX X

R = Ruggedized (Early Indicator For Avalanche Capability. All Devices Now have EAS Ratings)

HEX DIE SIZE, Voltage Polarity and Electrical Selection

#### Package Designation

- C : 5 PIN TO-220, Current Sensing
- FA : TO-204AA
- FD : 4-PIN DIP
- FF : TO-205 AF (TO-39)
- FP : TO-247
- FR : TO-252
- FU : TO-251
- F1-F4 : TO-204AA
- F5-F8 : TO-220

TO-205



TO-204



4-PIN DIP



TO-218



TO-251AA



MO-093



TO-252AA



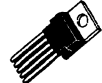
TO-247



TO-220



TS-001



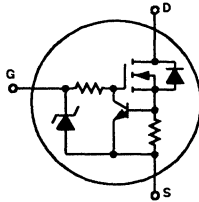
# Advanced Power MOS

## Current Limiting MOSFETs

### Features:

- Current Limits to a Pre-Set Level in a Shorted Load Condition
- Monolithic Device Incorporates a Bipolar Transistor, 2 Resistors, a Zener Diodes and a Power MOSFET
- ESD Protected to 2kV
- "Logic-Level" Gate Input Allows Fully on Condition at 5V

### Terminal Diagram



Maximum Ratings				Package
$BV_{DSS}$ (V)	$I_{DS(LIM)}$ (A)	$r_{DS(ON)}$ ( $\Omega$ )	ESD (kV)	TO-220
80	1	0.75	2	RLP1N08LE
80	5.5	0.12	2	RLP5N08LE

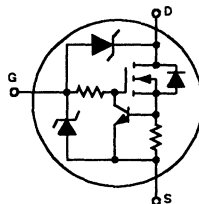


## Voltage Clamping, Current Limiting MOSFETs

### Features:

- Current Limits to a Pre-Set Level in a Shorted Load Condition
- Monolithic Device Incorporates a Bipolar Transistor, 2 Resistors, 2 Zener Diodes and a Power MOSFET
- Excessive Drain-Source Voltage Clamped by Active Region Turn-On

### Terminal Diagram



Maximum Ratings				Package
$BV_{DSS}$ (V)	$I_{DS(LIM)}$ (A)	$r_{DS(ON)}$ ( $\Omega$ )	ESD (kV)	TO-220
60	1	0.75	2	RLP1N06CLE

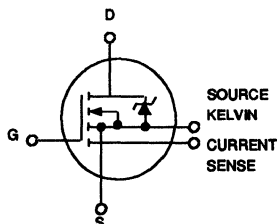


## Current Sensing MOSFETs

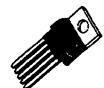
### Features:

- Built-In Current Sensing Function to be Used as a Feed-Back Signal for Control and/or Protection
- Low  $R_{DS(ON)} = 0.1\Omega$
- Current Sensing Ratio =  $1560 \pm 2.5\%$
- Avalanche Energy Rated for Ruggedness

### Terminal Diagram





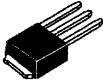




Maximum Ratings				Package
$BV_{DSS}$ (V)	$I_{DS}$ (A)	$r_{DS(ON)}$ ( $\Omega$ )	ESD (kV)	TS-001
100	18A	0.10	-	RFB18N10CS





# MOSFETs

## Logic Level Product Series

Package				      							
				Maximum Ratings				TO-205AF	TO-204AA	TO-251	TO-252
$BV_{DSS}$ (V)	$I_{DS}$ (A)	$R_{DS(ON)}$ ( $\Omega$ )	$E_{AS}$ (mJ)								
<b>N-Channel</b>											
50	2	0.750	N.R.	RFL2N05L	RFM15N05L	RFD14N05L	RFD14N05LSM	RFP4N05L	RFP14N05L	RFP15N05L	RFG50N05L
	4	0.800	N.R.								
	14	0.100	100								
	15	0.140	N.R.								
	16	0.047	200								
	25	0.047	200								
50	0.022	*									
60	2	0.750	N.R.	RFL2N06L	RFM15N06L	RFD12N06RLE	RFD12N06LESM	RFP4N06L	RFP12N06RLE	RFP3055RLE	RFP15N06L
	2	0.160	*								
	4	0.600	N.R.								
	12	0.135	*								
	12	0.160	*								
	15	0.140	N.R.								
	17	0.100	N.R.								
25	0.070	N.R.									
80	1	1.200	N.R.	RFL1N08L	RFM12N08L	RFD3N08L	RFD3N08LSM	RFP2N08L	RFP12N08L	RFP15N08L	
	2	1.050	N.R.								
	3	0.800	N.R.								
	12	0.200	N.R.								
	15	0.140	N.R.								
100	1	1.200	N.R.	RFL1N10L	RFM12N10L			RFP2N10L	RFP12N10L		
	1.5	1.400	N.R.								
	2	1.050	N.R.								
	12	0.200	N.R.								
	12	0.200	N.R.								
120	1	1.900	N.R.	RFL1N12L	RFM10N12L			RFP2N12L	RFP10N12L		
	2	1.750	N.R.								
	10	0.300	N.R.								
150	1	1.900	N.R.	RFL1N15L	RFM10N15L			RFP2N15L	RFP10N15L		
	2	1.750	N.R.								
	10	0.300	N.R.								
180	1	3.650	N.R.	RFL1N18L	RFM8N18L			RFP2N18L	RFP8N18L		
	2	3.500	N.R.								
	8	0.500	N.R.								
200	1	3.650	N.R.	RFL1N20L	RFM8N20L			RFP2N20L	RFP8N20L		
	1.5	3.650	N.R.								
	2	3.500	N.R.								
	8	0.650	N.R.								
	8	0.500	N.R.								
<b>P-Channel</b>											
30	8	0.300	*			RFD6P03L	RFD6P03LSM	RFP6P03L			

\*More complete ruggedness capability now specified; UIS current vs time in avalanche graph on data sheet

**SHADING** indicates Developmental Products - N.R. Not Rated for UIS capability - \*\* QPL Approved Types

# Power MOSFETs

## Rugged and Standard IRF-Series Power MOSFETs

The Rugged Series of Power MOSFETs are designed, tested and guaranteed to withstand a specified level of circuit induced electrical stress in the breakdown avalanche mode of operation. These are n-channel enhancement mode polysilicon gate power field effect transistors designed for applications such as switching regulators, switching converters, motor and relay drivers and drivers for high power bipolar switching transistors requiring high speed and low gate drive power.

Using state-of-the-art integrated circuit processing techniques these Rugged MOSFETs provide superior performance in inductive switching applications. The design is optimized to suppress the parasitic bipolar transistor and improve system reliability. These types can be driven directly from integrated circuits.

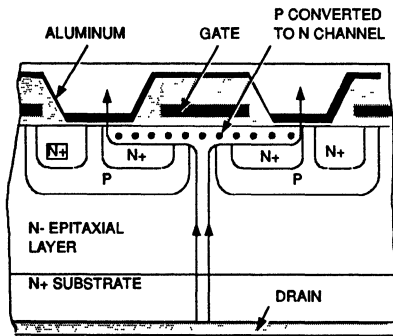
Rugged Series devices are identified by the suffix letter R following the type number.

### Features:

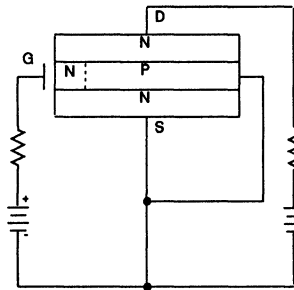
- Single Pulse Avalanche Energy Rated
- SOA is Power Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Allows Reduced Protection Circuitry
- Reduced Drive Requirements
- Increased System Reliability

## N-Channel Power MOSFET

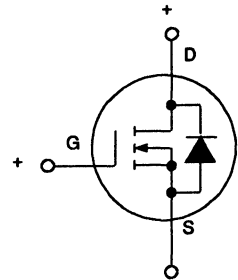
Cross Section of Chip Structure



Junction Diagram Showing Biasing Arrangements



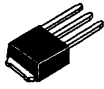



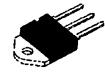




Schematic Symbol














**MOSFETS**  
N-Channel (Continued)

Package		Maximum Ratings												
		BV <sub>DSS</sub> (V)	I <sub>DS</sub> (A)	R <sub>DS(ON)</sub> (Ω)	E <sub>AS</sub> (mJ)	TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP
<b>N-Channel</b>														
80V (cont)	8.4	0.27	36					IRFU121	IRFR121					
	9.2	0.27	36						IRF521(R)					
	12.0	0.20	NR			RFM12N08			RFP12N08					
	12.0	0.23	50			IRF133(R)								
	12.0	0.23	69						IRF533(R)					
	14.0	0.16	50			IRF131(R)								
	14.0	0.16	69						IRF531(R)					
	18.0	0.10	NR			RFM18N08			RFP18N08					
	25.0	0.10	100			IRF143(R)								
	25.0	0.10	230						IRF543(R)					
	27.0	0.099	100							IRFP143R				
	28.0	0.077	100			IRF141(R)								
	28.0	0.077	230						IRF541(R)					
	31.0	0.077	100							IRFP141R				
	35.0	0.055	NR			RFK35N08						RFH35N08		
100V	0.4	3.2	NR											IRFD122
	0.5	2.4	NR											IRFD120
	0.8	0.8	19											IRFD112(R)
	1.0	0.6	19											IRFD110(R)
	1.0	1.2	NR		RFL1N10									
	1.1	0.4	36											IRFD122(R)
	1.3	0.3	36											IRFD120(R)
	2.0	1.05	NR						RFP2N10					
	3.0	0.8	19			IRFF112(R)								
	3.5	0.6	19			IRFF110(R)								
	4.9	0.74	19						IRF512(R)					
	5.0	0.4	36			IRFF122(R)								
	5.6	0.54	19						IRF510(R)					
	6.0	0.3	36			IRFF120(R)								
	7.0	0.25	69			IRFF132(R)								
	8.0	0.36	36						IRF522(R)					
	8.0	0.18	69			IRFF130(R)								
	8.0	0.36	NR			IRF122								
	8.4	0.27	36				IRFU120	IRFR120						
	9.0	0.25	NR						BUZ72A					
	9.2	0.27	36						IRF520(R)					
9.2	0.27	NR			IRF120									
12.0	0.2	NR			RFM12N10				RFP12N10					
12.0	0.2	NR							BUZ20					
12.0	0.23	50			IRF132(R)									
12.0	0.23	69						IRF532(R)						

6A05












Package		        																		
		TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP										
Maximum Ratings																				
$BV_{DSS}$ (V)	$I_{DS}$ (A)	$R_{\theta(jc)}$ ( $^{\circ}$ C)	$E_{AS}$ (mJ)	N-Channel																
150V (cont)	4.6	0.8	85			IRFU221	IRFR221													
	5.0	0.8	NR			IRF221														
	5.0	0.8	85							IRF621(R)										
	5.5	0.4	85		IRFF231(R)															
	8.0	0.6	150			IRF233(R)				IRF633(R)										
	9.0	0.4	150			IRF231(R)				IRF631(R)										
	10.0	0.3	NR			RFM10N15				RFP10N15										
	15.0	0.15	NR			RFM15N15				RFP15N15										
	16.0	0.22	510								IRFP243R									
	16.0	0.22	580			IRF243(R)				IRF643(R)										
	18.0	0.18	510								IRFP241(R)									
	18.0	0.18	580			IRF241(R)				IRF641(R)										
	25.0	0.12	910			IRF253(R)														
	27.0	0.12	810								IRFP253(R)									
	30.0	0.075	NR			RFK30N15							RFH30N15							
30.0	0.085	910			IRF251(R)															
33.0	0.085	810								IRFP251(R)										
180V	1.0	3.65	NR		RFL1N18															
	2.0	3.5	NR							RFP2N18										
	8.0	0.5	NR			RFM8N18				RFP8N18										
	12.0	0.25	NR			RFM12N18				RFP12N18										
	25.0	0.15	NR			RFK25N18							RFH25N18							
200V	0.30	6.5	NR																IRFD2Z2	
	0.32	5.0	NR																IRFD2Z0	
	0.45	2.4	30																IRFD212(R)	
	0.60	1.5	30																IRFD210(R)	
	0.70	1.2	85																IRFD222(R)	
	0.80	0.8	85																IRFD220(R)	
	1.0	3.65	NR		RFL1N20															
	1.8	2.4	30		IRFF212(R)															
	2.0	3.5	NR								RFP2N20									
	2.2	1.5	30		IRFF210(R)															
	2.6	2.4	46								IRF612(R)									
	3.0	1.2	85		IRFF222(R)															
	3.3	1.5	46								IRF610(R)									
	3.5	0.8	85		IRFF220(R)															
	3.8	1.2	85																	
4.0	1.2	NR				IRF222		IRFU222	IRFR222											
4.0	1.2	85																		
4.5	0.6	85		IRFF232(R)						IRF622(R)										
4.6	0.8	85						IRFU220	IRFR220											










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**MOSFETS**  
N-Channel (Continued)



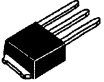


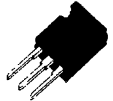



Package													
				TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP	
Maximum Ratings				N-Channel									
$BV_{DSS}$ (V)	$I_{DS}$ (A)	$R_{\theta(jc)}$ ( $^{\circ}C/W$ )	$E_{AS}$ (mJ)										
350V	0.3	5.0	45										IRFD313(R)
	0.4	3.6	45										IRFD311(R)
	0.4	2.5	100										IRFD323(R)
	0.5	1.8	100										IRFD321(R)
	1.15	5.0	150	IRFF313(R)									
	1.35	3.6	150	IRFF311(R)									
	1.7	5.0	120						IRF713(R)				
	2.0	3.6	120						IRF711(R)				
	2.0	2.5	100	IRFF323(R)									
	2.5	1.8	100	IRFF321(R)									
	2.8	2.5	190						IRF723(R)				
	2.8	2.5	NR		IRF323								
	3.0	1.5	300	IRFF333(R)									
	3.1	1.8	190			IRFU321	IRFR321						
	3.3	1.8	190						IRF721(R)				
	3.3	1.8	NR		IRF321								
	3.5	1.0	300	IRFF331(R)									
	4.0	2.0	NR		RFM4N35				RFP4N35				
	4.5	1.5	300		IRF333(R)				IRF733(R)				
	5.5	1.0	300		IRF331(R)				IRF731(R)				
7.0	0.75	NR		RFM7N35				RFP7N35					
8.0	0.8	520						IRF743(R)					
8.3	0.8	520		IRF343(R)									
8.7	0.8	480							IRFP343R				
10.0	0.55	520		IRF341(R)				IRF741(R)					
11.0	0.55	480							IRFP341R				
12.0	0.5	NR		RFM12N35						RFH12N35			
13.0	0.4	700		IRF353(R)									
14.0	0.4	700							IRFP353(R)				
15.0	0.3	700		IRF351(R)					IRFP351(R)				
16.0	0.3	700											
400V	0.3	5.0	45										IRFD312(R)
	0.4	3.6	45										IRFD310(R)
	0.4	2.5	100										IRFD322(R)
	0.5	1.8	100										IRFD320(R)
	1.15	5.0	150	IRFF312(R)									
	1.35	3.6	150	IRFF310(R)									
	1.7	5.0	120						IRF712(R)				
	2.0	3.6	120						IRF710(R)				
	2.0	2.5	100	IRFF322(R)									
	2.5	1.8	100	IRFF320(R)									





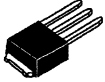


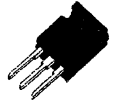



Package		Maximum Ratings												
		$V_{DSS}$ (V)	$I_{DS}$ (A)	$R_{DS(ON)}$ ( $\Omega$ )	$E_{AS}$ (m)	TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP
<b>N-Channel</b>														
400V (cont)	2.6	2.5	190					IRFU322	IRFR322					
	2.6	2.5	NR							BUZ76A				
	2.8	2.5	190							IRF722(R)				
	2.8	2.5	NR			IRF322								
	3.0	1.8	NR							BUZ76				
	3.0	1.5	300		IRFF332(R)									
	3.1	1.8	190					IRFU320	IRFR320					
	3.3	1.8	190							IRF720(R)				
	3.3	1.8	NR			IRF320								
	3.5	1.0	300		IRFF330(R)									
	4.0	2.0	NR			RFM4N40					RFP4N40			
	4.5	1.5	300			IRF332(R)					IRF732(R)			
	4.5	1.5	NR								BUZ80B			
	5.5	1.0	300			IRF330(R)					IRF730(R)			
	5.5	1.0	NR								BUZ60			
	7.0	0.75	NR			RFM7N40					RFP7N40			
	8.0	0.8	520								IRF742(R)			
	8.3	0.8	520			IRF342(R)					IRFP342R			
	8.7	0.8	480											
	10.0	0.55	520			IRF340(R)					IRF740(R)			
	11.0	0.55	480									IRFP340R		
	11.5	0.4	NR										BUZ351	
	12.0	0.5	NR			RFM12N40							RFH12N40	
	13.0	0.4	700			IRF352(R)								
	14.0	0.4	700									IRFP352(R)		
15.0	0.3	700			IRF350(R)									
16.0	0.3	700									IRFP350(R)			
20.0	0.25	1200									IRFP362			
22.0	0.25	980			IRF362									
23.0	0.2	1200									IRFP360			
25.0	0.2	980			IRF360									
450V	1.4	4.0	210		IRFF423(R)									
	1.6	3.0	210		IRFF421(R)									
	2.2	4.0	210							IRF823(R)				
	2.2	4.0	NR			IRF423								
	2.25	2.0	300		IRFF433(R)									
	2.5	3.0	210					IRFU421	IRFR421	IRF821(R)				
	2.5	3.0	NR			IRF421								
	2.75	1.5	300		IRFF431(R)									
	3.0	3.0	NR			RFM3N45					RFP3N45			
	4.0	2.0	300			IRF433(R)					IRF833(R)			

# MOSFETs

N-Channel (Continued)

Package													
				TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP	
Maximum Ratings													
BV <sub>DSS</sub> (V)	I <sub>DS</sub> (A)	R <sub>DS(on)</sub> ( $\Omega$ )	E <sub>AS</sub> (mJ)										
<b>N-Channel</b>													
450V (cont)	4.5	1.5	300										
	6.0	1.25	NR		IRF431(R)					IRF831(R)			
					RFM6N45					RFP6N45			
	7.0	1.1	510		IRF443(R)					IRF843(R)			
	7.0	1.1	480							IRFP443R			
	8.0	0.85	510		IRF441(R)					IRF841(R)			
	8.0	0.85	480							IRFP441R			
	10.0	0.6	NR		RFM10N45						RFH10N45		
	11.0	0.5	860		IRF453(R)								
	12.0	0.5	860							IRFP453(R)			
	13.0	0.4	860		IRF451(R)								
	14.0	0.4	860							IRFP451(R)			
	500V	1.4	4.0	210	IRFF422(R)								
		1.6	3.0	210	IRFF420(R)								
2.2		4.0	210			IRFU422	IRFR422	IRF822(R)					
2.2		4.0	NR		IRF422								
2.25		2.0	300	IRFF432(R)									
2.5		3.0	210			IRFU420	IRFR420	IRF820(R)					
2.5		3.0	NR		IRF420								
2.75		1.5	300	IRFF430(R)									
3.0		3.0	NR		RFM3N50					RFP3N50			
4.0		2.0	300		IRF432(R)					IRF832(R)			
4.0		2.0	NR							BUZ42			
4.5		1.5	300		IRF430(R)					IRF830(R)			
4.5		1.5	NR							BUZ41A			
6.0		1.25	NR		RFM6N50					RFP6N50			
7.0		1.1	510		IRF442(R)					IRF842(R)			
7.0		1.1	480							IRFP442(R)			
8.0		0.85	510		IRF440(R)					IRF840(R)			
8.0		0.85	480							IRFP440(R)			
8.3		0.8	NR		BUZ45A								
9.6		0.6	NR		BUZ45								
10.0		0.6	NR		RFM10N50						RFH10N50		
10.0		0.5	NR		BUZ45B								
11.0		0.5	860		IRF452(R)								
12.0		0.5	860							IRFP452(R)			
13.0		0.4	860		IRF450(R)								
14.0		0.4	860							IRFP450(R)			
17.0		0.35	960							IRFP462			
19.0	0.35	1220		IRF462									
20.0	0.27	960							IRFP460				
21.0	0.27	1200		IRF460									



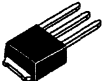






6A11

Package												
				TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP
<b>Maximum Ratings</b>												
<b>BV<sub>DSS</sub></b> (V)	<b>I<sub>DS</sub></b> (A)	<b>R<sub>DS(on)</sub></b> (Ω)	<b>EAS</b> (mJ)									
<b>N-Channel</b>												
600V	5.4	1.6	570		IRFAC42R			IRFBC42R				
	5.9	1.6	410					IRFPC42R				
	6.2	1.2	570		IRFAC40R			IRFBC40R				
	6.6	1.2	410					IRFPC40R				
1000V	3.9	4.2	490					IRFPG42				
	4.3	3.5	490					IRFPG40				
	4.3	3.5	NR					RFP4N100				










\* More complete ruggedness capability now specified; UIS current vs time in avalanche graph data sheet

**SHADING** indicates Developmental Products - N.R. Not Rated for UIS capability - \*\*QPL Approved Types

# MOSFETS P-Channel



Package :		        													
		Maximum Ratings				TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP	
BV <sub>DSS</sub> (V)	I <sub>DS</sub> (A)	R <sub>DS(on)</sub> ( $\Omega$ )	E <sub>AS</sub> (mJ)	P-Channel											
50V	8.0	0.3	NR					RFD8P05	RFD8P05SM	RFP8P05					
	15.0	0.15	NR					RFD15P05	RFD15P05SM	RFP15P05					
	30.0	0.085	NR							RFP30P05	RFG30P05				
	60.0	0.026	NR								RFG60P05E				
60V	0.6	1.6	190											IRFD9113	
	0.8	0.8	370											IRFD9123	
	2.5	1.9	190							IRF9513					
	3.0	1.2	190							IRF9511					
	3.5	0.8	370	IRFF9123											
	4.0	0.6	370	IRFF9121											
	5.0	0.8	370							IRF9523					
	5.5	0.4	500	IRFF9133											
	6.0	0.6	370							IRF9521					
	6.5	0.3	500	IRFF9131											
	10.0	0.4	500		IRF9133					IRF9533					
	12.0	0.3	500		IRF9131					IRF9531					
	15.0	0.3	960		IRF9143					IRF9543					
	16.0	0.3	960								IRFP9143				
	19.0	0.2	960		IRF9141					IRF9541	IRFP9141				
	25.0	0.15	1300		IRF9151						IRFP9151				
30.0	0.075	NR								RFP30P06	RFG30P06				
60.0	0.030	NR									RFG60P06E				
80V	1.0	3.65	NR	RFL1P08											
	2.0	3.5	NR							RFP2P08					
	6.0	0.6	NR		RFM6P08					RFP6P08					
	8.0	0.4	NR		RFM8P08					RFP8P08					
	12.0	0.3	NR		RFM12P08					RFP12P08					
	25.0	0.15	NR		RFK25P08							RFH25P08			
100V	0.7	1.2	190											IRFD9110	
	1.0	0.6	370											IRFD9120	
	1.0	3.65	NR	RFL1P10											
	2.0	3.5	NR							RFP2P10					
	2.5	1.6	190												
	3.0	1.2	190							IRF9512					
	3.5	0.8	370	IRFF9122						IRF9510					
	4.0	0.6	370	IRFF9120											
	5.0	0.8	370							IRF9522					
	5.5	0.4	500	IRFF9132											
	6.0	0.6	370							IRF9520					

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Package												
				TO-205AF	TO-204	TO-251	TO-252	TO-220AB	TO-247	TO-218	MO-093	4 PIN DIP
Maximum Ratings				P-Channel								
$V_{DSS}$ (V)	$I_{DS}$ (A)	$R_{DS(ON)}$ ( $\Omega$ )	$E_{AS}$ (mJ)									
100V (cont)	6.0	0.6	NR		RFM6P10			RFP6P10				
	8.0	0.3	500	IRFF9130								
	8.0	0.4	NR		RFM8P10			RFP8P10				
	10.0	0.4	500		IRF9132			IRF9532				
	12.0	0.3	500		IRF9130			IRF9530				
	12.0	0.3	NR		RFM12P10			RFP12P10				
	15.0	0.3	960		IRF9142			IRF9542				
	16.0	0.3	960						IRFP9142			
	19.0	0.2	960		IRF9140			IRF9540	IRFP9140			
	25.0	0.15	1300		IRF9150				IRFP9150			
120V	25.0	0.15	NR		RFK25P10					RFH25P10		
	5.0	1.0	NR		RFM5P12			RFP5P12				
	10.0	0.5	NR		RFM10P12			RFP10P12				
150V	0.45	2.4	290									IRFD9223
	2.0	2.4	290	IRFF9223								
	2.5	1.5	290	IRFF9221								
	3.0	2.4	290					IRF9623				
	3.5	1.5	290					IRF9621				
	3.5	1.2	500	IRFF9233								
	4.0	0.8	500	IRFF9231								
	5.0	1.0	NR		RFM5P15			RFP5P15				
	5.5	1.2	500		IRF9233			IRF9633				
	6.5	0.8	500		IRF9231			IRF9631				
	9.0	0.7	790		IRF9243			IRF9643				
	10.0	0.5	NR		RFM10P15			RFP10P15				
	10.0	0.7	790						IRFP9243			
	11.0	0.5	790		IRF9241			IRF9641				
	12.0	0.5	790						IRFP9241			
200V	0.6	1.5	290									IRFD9220
	2.0	2.4	290	IRFF9222								
	2.5	1.5	290	IRFF9220								
	3.0	2.4	290					IRF9622				
	3.5	1.5	290					IRF9620				
	3.5	1.2	500	IRFF9232								
	4.0	0.8	500	IRFF9230								
	5.5	1.2	500		IRF9232			IRF9632				
	6.5	0.8	500		IRF9230			IRF9630				
	9.0	0.7	790		IRF9242			IRF9642				
	10.0	0.7	790						IRFP9242			
	11.0	0.5	790		IRF9240			IRF9640				
12.0	0.5	790						IRFP9240				



# MOSFETs

## JEDEC N-Channel

Package				
			Maximum Ratings	
BV <sub>DSS</sub> (V)	I <sub>DS</sub> (A)	R <sub>DS(ON)</sub> (Ω)	TO-205AF	TO-204
60	12.0 31.0	0.25 0.08		2N6755 2N6763
100	3.5 6.0 8.0 14.0 38.0	0.6 0.3 0.18 0.18 0.055	2N6782* 2N6788* 2N6796*	2N6756* 2N6764*
150	8.0 25.0	0.6 0.12		2N6757 2N6765
200	2.25 3.5 5.5 9.0 30.0	1.5 0.8 0.4 0.4 0.085	2N6784* 2N6790* 2N6798*	2N6758* 2N6766*
350	4.5 12.0	1.5 0.4		2N6759 2N6767
400	1.25 2.0 3.0 5.5 14.0	3.6 1.8 1.0 1.0 0.3	2N6786* 2N6792* 2N6800*	2N6760* 2N6768*
450	4.0 11.0	2.0 0.5		2N6761 2N6769
500	1.5 3.5 4.5 12.0	3.0 1.5 1.5 0.4	2N6794* 2N6802*	2N6762* 2N6770*

\* QPL Approved Types

## JEDEC P-Channel

Package				
			Maximum Ratings	
BV <sub>DSS</sub> (V)	I <sub>DS</sub> (A)	R <sub>DS(ON)</sub> (Ω)	TO-205AF	TO-204
100	1.16 6.0 6.5 11.0 12.0 25.0	3.65 0.6 0.3 0.3 0.3 0.2	2N6895 2N6849	2N6896 2N6804 2N6897 2N6898
200	4.0	0.8	2N6851	



# IGBTs\*

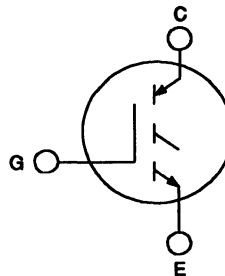
## IGBTs for Switching Applications and Motor Control

### Features:

- Better Die Area Efficiency than MOSFETs in High Voltage Applications
- No Body Diode
- Gate Drive: Voltage Driven, Not Current
- On-State Voltage Drop not Temperature Dependent
- Surface Mount Packages

### Applications:

- Off Line SMPS
- High Voltage Motor Drives
- Synchronous Converters
- Deflection Circuits
- AC Switches



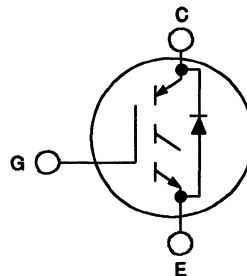
## IGBTs with Integral Reverse Diode

### Features:

- Identical IGBT Specifications
- Ultra Fast Diode Added In Same Package
- 35ns to 100ns Recovery
- Soft Recovery Minimizes RFI
- Up to 1000V Breakdown

### Applications:

- Motor Drives
- Motor Brake
- SMPS



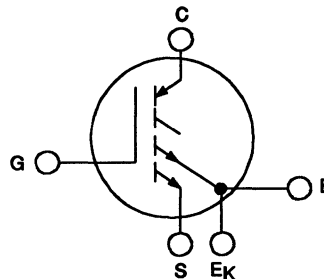
## IGBTs with Current Sense

### Features:

- Sense Current Output a Ratio Of Total Emitter Current
- Kelvin Contact To Minimize Control Loop Inductance
- 5 Lead TO-218 and TO-220 Packages

### Applications:

- Feedback Motor Controls
- Current Sources
- Power Amplifiers



\* Insulated Gate Bipolar Transistors



# IGBTs

## Ordering Information

**HGT- G - 12 - N - 60 - D - 1 - D**

Harris IGBT

**Package**

- A : 5 LEAD TO-218
- P : 3 LEAD TO-220
- G : 3 LEAD TO-247
- H : 3 LEAD TO-218
- M : 3 LEAD TO-204
- D : TO-251/TO-252 D-PACK

Continuous Current Rating at  $T_C = +90^\circ\text{C}$

N Channel or P Channel

**Options**

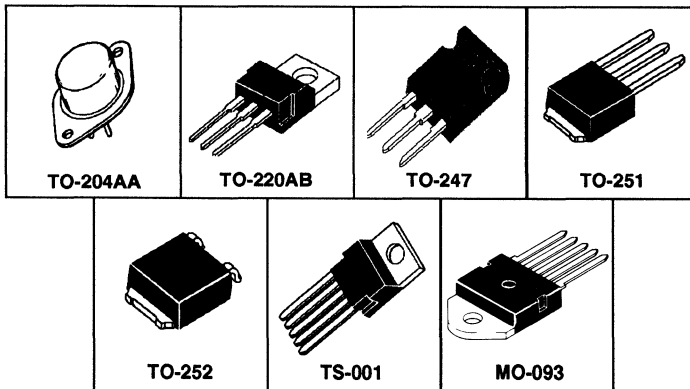
- L : Logic level Gate
- D : Integral Reverse Diode
- S : Surface mount
- C : Current sense

- 1 : First Generation
- 2 : Second Generation

**Max Fall Time at**

- $T_J = +125^\circ\text{C}$
- A : 100ns
- B : 200ns
- C : 500ns
- D : 750ns
- E : 1 $\mu\text{s}$
- F : 2 $\mu\text{s}$

Voltage Breakdown/10  
i.e. (40, 50, 60, 100, 120)



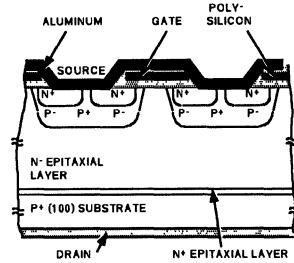
# IGBTs

Combines the characteristics of a power MOSFET, a bipolar transistor.

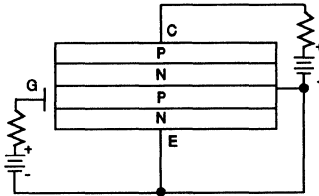
### Features:

- **Voltage Gated** Requires small gate power. Similar to standard power MOSFET
- **Turn Off** Turns off when gate drive is removed
- **On-State Voltage Drop** Nonlinear. Temperature independent. Unlike the typical 2X variation of a power MOSFET
- **Turn-On Speed** Fast! Comparable to a standard power MOSFET
- **Turn-Off Speed** Comparable to a bipolar transistor.

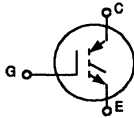
### Cross Section of Chip Structure



### Junction Diagram Showing Biasing Arrangements

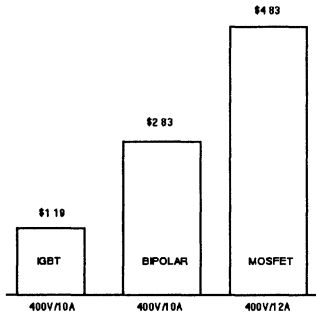


### Schematic Symbol

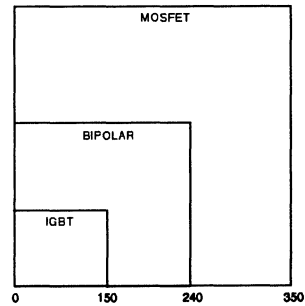


## Comparisons

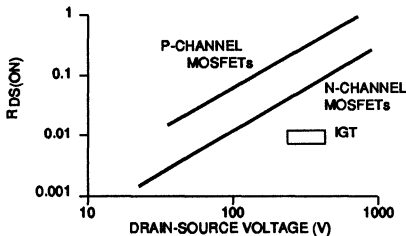
Cost Comparison - 1K Price Less Than Half the MOSFET Price!



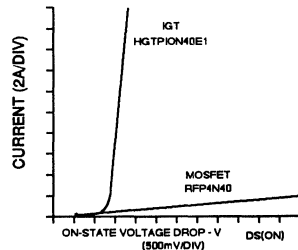
Size Comparison - 500V, 15A Capability





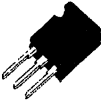

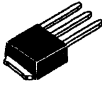


### R<sub>DS(ON)</sub> Performance Comparison






### Performance; I/V Characteristic-N-Channel MOSFET vs. IGT (Same Size Dies)



# IGBTs

Package											
				Maximum Ratings				TO-204AA	TO-220AB	TO-247	TO-218AC
$BV_{CES}$ (V)	$I_{CBO}$ (A)	$I_{CM}$ (A)	$t$ ( $\mu$ S)								
400	5	10	1.0	2N6975							
			0.5	2N6977							
	6	7.5	1.0						HGTD6N40E1	HGTD6N40E1S	
									HGTD10N40F1	HGTD10N40F1S	
	10	12	1.2								
	10	17.5	1.0			HGTP10N40E1					
						HGTP10N40C1					
	12	17.5	1.0		HGTM12N40E1				HGTH12N40E1		
						HGTM12N40C1			HGTH12N40C1		
	15	35	1.0			HGTP15N40E1					
						HGTP15N40C1					
20	35	1.0		HGTM20N40E1				HGTH20N40E1			
					HGTM20N40C1			HGTH20N40C1			
500	5	10	1.0	2N6976							
			0.5	2N6978							
	6	7.5	1.0						HGTD6N50E1	HGTD6N50E1S	
									HGTD10N50F1	HGTD10N50F1S	
	10	12	1.2								
	10	17.5	1.0			HGTP10N50E1					
						HGTP10N50C1					
	12	17.5	1.0		HGTM12N50E1				HGTH12N50E1		
						HGTM12N50C1			HGTH12N50C1		
	15	35	1.0			HGTP15N50E1					
						HGTP15N50C1					
20	35	1.0		HGTM20N50E1				HGTH20N50E1			
					HGTM20N50C1			HGTH20N50C1			
600	12	48	0.6	HGTM12N60D1	HGTP12N60D1						
	24	96	0.6	HGTM24N60D1		HGTG24N60D1					
	32	200	0.8	HGTM32N60E2		HGTG32N60E2					
1000	20	100	0.68	HGTM20N100D2		HGTG20N100D2				HGTA32N60E2	
	34	200	0.87	HGTM34N100E2		HGTG34N100E2					
1200	20	100				HGTG20N120D2					
	30	200	0.75			HGTG30N120E2					


# IGBTs w/ Integral Reverse Diode

Package								
Maximum Ratings					TO-220AB	TO-218AC	TO-247	
$V_{CES}$ (V)	$I_{C90}$ (A)	$I_{CM}$ (A)	$t_f$ ( $\mu$ S)					
400	6	7.5	1.0	HGTP6N40E1D				
	10	12	1.2	HGTP10N40F1D				
	10	17.5	1.0	HGTP10N40E1D				
			0.5	HGTP10N40C1D				
	12	17.5	1.0		HGTH12N40E1D			
			0.5		HGTH12N40C1D			
	20	35	1.0		HGTH20N40E1D			
			0.5		HGTH20N40C1D			
	500	6	7.5	1.0	HGTP6N50E1D			
		10	12	1.2	HGTP10N50F1D			
10		17.5	1.0	HGTP10N50E1D				
			0.5	HGTP10N50C1D				
12		17.5	1.0		HGTH12N50E1D			
			0.5		HGTH12N50C1D			
20		35	1.0		HGTH20N50E1D			
			0.5		HGTH20N50C1D			
600		12	48	0.6				HGTG20N50C1D
		24	96	0.6				HGTG24N60D1D

**NOTES:**

1.  $I_{C90}$  = maximum continuous current rating at  $T_C = 90^\circ\text{C}$
2.  $I_{CM}$  = maximum pulsed current rating
3.  $t_f$  measured at  $T_C = 150^\circ\text{C}$

# IGBTs w/ Current Sensing

Package					
Maximum Ratings					TS-001
$V_{CES}$ (V)	$I_{C90}$ (A)	$I_{CM}$ (A)	$t_f$ ( $\mu$ S)		
600	12	40	1.0	HGTB12N60D1C	
	24	80	1.6		

**NOTES:**

1.  $I_{C90}$  = maximum continuous current rating at  $T_C = 90^\circ\text{C}$
2.  $I_{CM}$  = maximum pulsed current rating
3.  $t_f$  measured at  $T_C = 150^\circ\text{C}$

# IGBTs

TYPE	P/L	DESCRIPTION
HGTA24N50D1C HGTA32N60E2 HGTB12N50D1C	MOS MOS MOS	IGBT WITH CURRENT SENSING 32A/600V TO-218 5L IGBT WITH CURRENT SENSING
HGTD10N40F1 HGTD10N40F1S HGTD10N50F1 HGTD10N50F1S HGTD6N40E1 HGTD6N40E1S HGTD6N50E1 HGTD6N50E1S HGTG12N60D1D HGTG20N100E2	MOS MOS MOS MOS MOS MOS MOS MOS MOS MOS	PWR IGBT 5A 400V TO -251 PWR IGBT 3A 400V TO -252 IGT IGT PWR IGBT 3A 400V TO -251 PWR IGBT 3A 400V TO -252 PWR IGBT 3A 500V TO -251 PWR IGBT 3A 500V TO -252 12A 600V IGBT WITH ANTI-PARALLEL DIODE IN A TO-247 PKG 20A, 1000V IGBT TO-247 PKG
HGTG20N50C1D HGTG24N60D1 HGTG24N60D1D HGTG30N100E2 HGTG32N60E2 HGTH12N40E1 HGTH12N40E1D HGTG12N50C1 HGTH12N50C1D HGTH12N50E1	MOS MOS MOS MOS MOS MOS MOS MOS MOS MOS	20 AMP 500V IGBT WITH ANTI-PARALLEL DIODE IN A TO-247 PKG 600V VERSION OF EXISTING PART 24A 600V IGBT AN ANTI-PARALLEL DIODE IN THE SAME PKG 30A/1KV TO-247 IGBT 32A/600V TO-247 PKG PWR IGBT 10A 400V N-CHANNEL TO-218 10 AMP IGBT/DIODE 10 AMP IGBT/DIODE 10 AMP IGBT/DIODE PWR IGBT 10A 500V N-CHANNEL TO-218
HGTH12N50E1D HGTH20N40C1 HGTH20N40C1D HGTH20N40E1 HGTH20N40E1D HGTH20N50C1 HGTH20N50C1D HGTH20N50E1 HGTH20N50E1D HGTM12N40C1	MOS MOS MOS MOS MOS MOS MOS MOS MOS MOS	10 AMP IGBT/DIODE PWR IGBT 20A 400V TO-218 20 AMP IGBT/DIODE PWR IGBT 20A 400V TO-218 20 AMP IGBT/DIODE PWR IGBT 20A 500V TO-218 20 AMP IGBT/DIODE PWR IGBT 20A 500V TO-218 20 AMP IGBT/DIODE PWR IGBT 20A 500V TO-218 20 AMP IGBT/DIODE PWR IGBT 10A 400V N-CHANNEL TO-3
HGTM12N40E1 HGTM12N50C1 HGTM12N50E1 HGTM12N60D1 HGTM20N100E2 HGTM20N40C1 HGTM20N40E1 HGTM20N50C1 HGTM20N50E1 HGTM24N60D1	MOS MOS MOS MOS MOS MOS MOS MOS MOS MOS	PWR IGBT 10A 400V N-CHANNEL TO-3 PWR IGBT 10A 500V N-CHANNEL TO-3 PWR IGBT 10A 500V N-CHANNEL TO-3 600 VOLT VERSION OF EXISTING FAMILY 20A, 1000V IGBT TO-204 PKG PWR IGBT 20A 400V TO-3 PWR IGBT 20A 400V TO-3 PWR IGBT 20A 500V TO-3 PWR IGBT 20A 500V TO-3 PWR IGT TO-3
HGTP10N40C1 HGTP10N40C1D HGTP10N40E1 HGTP10N40E1D HGTP10N50C1 HGTP10N50C1D HGTP10N50E1 HGTP10N50E1D HGTP10N50F1D HGTP12N60D1	MOS MOS MOS MOS MOS MOS MOS MOS MOS MOS	PWR IGBT 10A 400V N-CHANNEL TO-220 PWR IGBT WITH DIODE 10A 400V TO 200 PWR IGBT 10A 400V N-CHANNEL TO-220 PWR IGBT WITH DIODE 10A 400V TO 200 PWR IGBT 10A 500V N-CHANNEL TO-220 PWR IGBT WITH DIODE 10A 500V TO 200 PWR IGBT 10A 500V N-CHANNEL TO-220 PWR IGBT WITH DIODE 10A 500V TO 200 10 AMP 500V IGBT WITH ANTI-PARALLEL DIODE IN A TO-220 PKG 600V VERSION OF EXISTING TYPE
HGTP15N40C1 HGTP15N40E1 HGTP15N50C1 HGTP15N50E1 HGTP6N50E1D	MOS MOS MOS MOS MOS	PWR IGBT 20A 400V TO-220 PWR IGBT 20A 400V TO-220 PWR IGBT 20A 500V TO-220 PWR IGBT 20A 400V TO-220 6 AMP 500V IGBT WITH ANTI-PARALLEL DIODE IN A TO-220 PKG

# Bipolar

## Harris Bipolar Transistor Families (4)

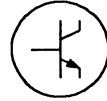
### Switching Bipolar Transistors

**Features:**

Excellent switching performance at High Voltage and Current, (to 1000V  
Breakdown voltage, 15 amps Collector Current (sat))  
High Safe Operating Area (SOA) ratings

**Applications:**

Off line switching power supplies  
Converters  
High voltage inverters  
Pulse width modulated regulators  
Switching regulators



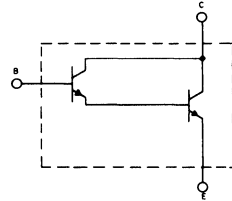
### Darlington Bipolar Transistors (Two transistors configured to boost gain)

**Features:**

DC current gain ( $h_{fe}$ ) typically range from 1000 to 20000 at Collector Current from 3 to 5 amps. Operation at Collector Current up to 20 amps and supply voltages ranging from 40 to 450 volts

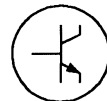
**Applications:**

Audio power amplifiers  
Series and shunt regulators  
Solenoid and hammer drivers



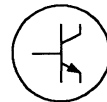
### General Purpose Bipolar Transistors ( $f_t < 40$ MHz)

Transistors with  $P_t$  (Total Power Rating) starting at 8.75 watts to 250 watts




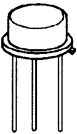
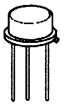


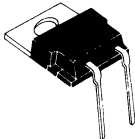
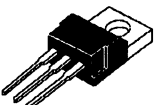
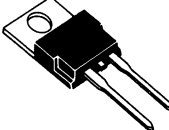
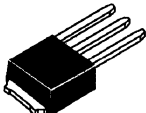

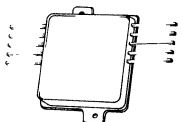
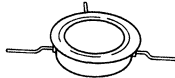
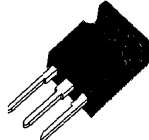
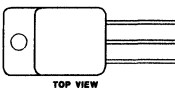
### Small Signal Bipolar Transistors

Transistors with  $I_{c(max)}$  (Collector Current) starting at 100 milliamps to 800 milliamps &  $V_{ce0}$  (Breakdown Voltage) ranging from 18 volts to 40 volts



# Bipolar

## Package Types

<p>TO-204AE(TO-3)</p>  <p>(0.060 in.-Dia. Pins)</p>	<p>TO-205AD (TO-39)</p> 	<p>TO-205AD</p> 	<p>TO-204AA (TO-3)</p> 
<p>TO-218AC</p> 	<p>TO-220AA</p> 	<p>TO-220AB</p> 	<p>TO-220AC</p> 
<p>TO-251AA</p> 	<p>TO-252AA</p> 	<p>Metal Hermetic Package</p> 	<p>Radial</p> 
	<p>TO-247</p> 	<p>TO-254</p>  <p>TOP VIEW</p>	

### Harris Bipolar Transistor Prefixes

2N	D	PC
BD	GE	PN
BDX	GES	RCA
BDY	GET	RJH
BFT	GS	TIP
BUW	MJ	
BUX	MJE	
BUZ	MJH	
BYW	MPS	

# General-Purpose Power Transistors

Sorted by ascending Breakdown Voltage (V<sub>ceo</sub>), Secondary Sort by Pt

Part No.	n-p-n p-n-p	V <sub>ceo</sub> (sus) V	V <sub>cev</sub> (sus) V	Pt W	Hfe		V <sub>ce(sat)</sub> -V			Ft(Typ.) MHz	File No.	Package
					Ic A	Vce V	Ic A	Ib A				
40321	n-p-n	---	300	5	25-200	0.02	10	---	---	---	25	962 TO-205AD/TO-39
40327	n-p-n	---	300	5	40-250	0.02	10	---	---	---	25	962 TO-205AD/TO-39
40412	n-p-n	---	250	10	40 min.	0.03	20	0.5	0.01	0.001	25	211 TO-205AD/TO-39
40346	n-p-n	---	175	10	25 min.	0.01	10	0.5	0.01	0.001	25	211 TO-205AD/TO-39
40346V1	n-p-n	---	175	10	25 min.	0.01	10	0.5	0.01	0.001	25	211 TO-205AD/TO-39
BUX87C	n-p-n	---	400	35	10-150	1	5	2.5	1	0.15	25	871 TO-213AA/TO-66
BUX87	n-p-n	---	200	35	10-150	1	5	2.5	1	0.15	25	871 TO-213AA/TO-66
40322	n-p-n	---	300	35	75 min.	0.5	10	---	---	---	25	962 TO-213AA/TO-66
BUX87A	n-p-n	---	300	35	10-150	1	5	2.5	1	0.15	25	871 TO-213AA/TO-66
BUX87B	n-p-n	---	350	35	10-150	1	5	2.5	1	0.15	25	871 TO-213AA/TO-66
40318	n-p-n	---	300	35	50 min.	0.5	10	---	---	---	25	962 TO-213AA/TO-66
2N6214	p-n-p	-450	-450	35	10-100	-1	-5	-2.5	-1	-0.12	30	507 TO-213AA/TO-66
2N6213	p-n-p	-400	-400	35	10-100	-1	-4	-2	-1	-0.12	30	507 TO-213AA/TO-66
BUX88C	p-n-p	-350	-400	35	10-150	-1	-5	-2.5	-1	-0.15	30	870 TO-213AA/TO-66
2N5416S	p-n-p	-300	-350	10	30-120	-50	-10	-2	-50	-5	35	338 TO-205AD/TO-39
2N6422	p-n-p	-300	---	20	25-100	-1	-10	-0.75	-1	-0.12	30	1100 TO-213AA/TO-66
2N6423	p-n-p	-300	---	20	30-150	-0.75	-10	-1	-0.75	-0.07	30	1100 TO-213AA/TO-66
BUX88B	p-n-p	-300	-350	35	10-150	-1	-5	-2.5	-1	-0.15	30	870 TO-213AA/TO-66
2N6212	p-n-p	-300	-350	35	10-100	-1	-3.2	-1.6	-1	-0.12	30	507 TO-213AA/TO-66
2N6421	p-n-p	-250	---	20	25-100	-1	-10	-0.75	-1	-0.12	30	1100 TO-213AA/TO-66
BUX88A	p-n-p	-250	-300	35	10-150	-1	-5	-2.5	-1	-0.15	30	870 TO-213AA/TO-66
2N6211	p-n-p	-225	-275	35	10-100	-1	-2.8	-1.4	-1	-0.12	30	507 TO-213AA/TO-66
2N5415S	p-n-p	-200	---	10	30-150	-50	-10	-2.5	-50	-5	35	338 TO-205AD/TO-39
2N6420	p-n-p	-175	---	20	40-200	-0.5	-10	-5	-1	-0.12	30	1100 TO-213AA/TO-66
BUX86	p-n-p	-150	-200	35	10-150	-1	-5	-2.5	-1	-0.15	30	870 TO-213AA/TO-66
2N6609	p-n-p	-140	-160	150	15-60	-8	-4	-1.4	-8	-0.8	4	1061 TO-204AA/TO-3
MJ15002	p-n-p	-140	---	200	25-150	-4	-2	-1	-4	-0.4	4	1093 TO-204AA/TO-3
RCA9116C	p-n-p	-140	-150	200	25-150	-5	-2	-1	-5	-0.5	4	1061 TO-204AA/TO-3
MJ15004	p-n-p	-140	-150	250	25-150	-5	-2	-1	-5	-0.5	4	1060 TO-204AA/TO-3
BD750C	p-n-p	-130	-140	250	25-100	-5	-2	-1	-5	-0.5	4	1251 TO-204AA/TO-3
2N6468	p-n-p	-120	-130	40	15-150	-1.5	-4	-1.2	-1.5	-0.15	10	888 TO-213AA/TO-66
2N6476	p-n-p	-120	-130	40	15-150	-1.5	-4	-1.2	-1.5	-0.15	10	676 TO-220
BD750A	p-n-p	-120	-130	200	25-100	-5	-2	-1	-5	-0.5	4	1251 TO-204AA/TO-3
RCA9116D	p-n-p	-120	-130	200	25-150	-5	-2	-1	-5	-0.5	4	1061 TO-204AA/TO-3
BFT28	p-n-p	-100	-150	5	20 min.	-10	-10	-0.6	-10	-1	35	815 TO-205AD/TO-39
BD240C	p-n-p	-100	-115	30	40 min.	-0.2	-4	-0.7	-1	-0.2	10	670 TO-220
TIP30C	p-n-p	-100	---	30	15-150	-1	-4	-0.7	-1	-0.12	10	988 TO-220
TIP32C	p-n-p	-100	---	40	10-50	-3	-4	-1.2	-3	-0.37	10	987 TO-220
BD242C	p-n-p	-100	-115	40	25 min.	-1	-4	-1.2	-3	-0.6	10	672 TO-220
2N6475	p-n-p	-100	-110	40	15-150	-1.5	-4	-1.2	-1.5	-0.15	10	676 TO-220
2N6467	p-n-p	-100	-110	40	15-150	-1.5	-4	-1.2	-1.5	-0.15	10	888 TO-213AA/TO-66
TIP42C	p-n-p	-100	---	65	15-150	-3	-4	-2	-6	-0.6	8	996 TO-220AB
BD244C	p-n-p	-100	-115	65	30 min.	-0.3	-4	-1.5	-6	-1	8	674 TO-220AB
2N6248	p-n-p	-100	-110	125	20-100	-5	-4	-1.3	-5	-0.5	16	677 TO-204AA/TO-3
RCA9116E	p-n-p	-100	-110	200	25-100	-7.5	-2	-0.8	-7.5	-0.75	4	1061 TO-204AA/TO-3
BD750B	p-n-p	-100	-110	250	15-60	-7.5	-2	-1.5	-7.5	-0.75	4	1251 TO-204AA/TO-3
BD750	p-n-p	-90	-100	200	15-60	-7.5	-2	-1.5	-7.5	-0.75	4	1251 TO-204AA/TO-3
2N4900	p-n-p	-80	---	25	20-100	-0.5	-1	-0.6	-1	-0.1	10	1150 TO-213AA/TO-66
TIP30B	p-n-p	-80	---	30	15-150	-1	-4	-0.7	-1	-0.12	10	988 TO-220
BD240B	p-n-p	-80	-90	30	40 min.	-0.2	-4	-0.7	-1	-0.2	10	670 TO-220
2N5954	p-n-p	-80	-90	40	20-100	-2	-4	-1	-2	-0.2	10	675 TO-213AA/TO-66
TIP32C	p-n-p	-80	---	40	10-50	-3	-4	-1.2	-3	-0.37	10	987 TO-220
2N6126	p-n-p	-80	---	40	20-80	-1.5	-2	-0.6	-1.5	-0.15	10	1149 TO-220
BD242B	p-n-p	-80	-90	40	25 min.	-1	-4	-1.2	-3	-0.6	10	672 TO-220
D45H10	p-n-p	-80	-80	50	20 min.	4	1	1	8	0.8	40	15.18 TO-220AB
2N6134	p-n-p	-80	-80	50	7 min.	-7	-4	-1.8	-7	-3	8	1233 TO-220AB
BD538	p-n-p	-80	---	50	25 min.	-2	-2	-0.8	-2	-0.2	10	1236 TO-220
BD244B	p-n-p	-80	-90	65	30 min.	-0.3	-4	-1.5	-6	-1	8	674 TO-220AB
TIP42B	p-n-p	-80	---	65	15-150	-3	-4	-2	-6	-0.6	8	996 TO-220AB
BD800	p-n-p	-80	---	65	15 min.	-3	-2	-1	-3	-0.3	10	1242 TO-220
2N6491	p-n-p	-80	-90	75	20-150	-5	-4	-1.3	-5	-0.5	8	678 TO-220AB
2N6314	p-n-p	-80	-80	75	25-100	-1.5	-4	-0.7	-1.5	-0.5	4	1102 TO-213AA/TO-66
BD500B	p-n-p	-80	-85	75	15-90	-3.5	-4	-1	-3.5	-0.35	8	1108 TO-220AB
2N6247	p-n-p	-80	-90	125	20-100	-6	-4	-1.3	-6	-0.6	16	677 TO-204AA/TO-3
2N3792	p-n-p	-80	---	150	50-150	-1	-2	-1	-5	-0.5	16	1059 TO-204AA/TO-3
2N6107	p-n-p	-70	-80	40	30-150	-2	-4	-1	-2	-0.2	10	676 TO-220
2N6106	p-n-p	-70	-80	40	30-150	-2	-4	-1	-2	-0.2	10	676 TO-220
2N5781	p-n-p	-65	-80	10	20-100	-1	-2	-0.5	-1	-0.1	20	413 TO-205AA/TO-5
2N4899	p-n-p	-60	---	25	20-100	-0.5	-1	-0.6	-1	-0.1	10	1150 TO-213AA/TO-66
TIP30A	p-n-p	-60	---	30	40 min.	-0.2	-4	-0.7	-1	-0.12	10	988 TO-220
BD240A	p-n-p	-60	-70	30	40 min.	-0.2	-4	-0.7	-1	-0.2	10	670 TO-220
2N6125	p-n-p	-60	---	40	25-100	-1.5	-2	-0.6	-1.5	-0.15	10	1149 TO-220
BD242A	p-n-p	-60	-70	40	25 min.	-1	-4	-1.2	-3	-0.6	10	672 TO-220
TIP32A	p-n-p	-60	---	40	25 min.	-1	-4	-1.2	-3	-0.37	10	987 TO-220
2N5955	p-n-p	-60	-70	40	20-100	-2.5	-4	-1	-2.5	-0.25	10	675 TO-213AA/TO-66
D45H8	p-n-p	-60	-60	50	40 min.	4	1	1	8	0.4	40	15.18 TO-220AB
D45H7	p-n-p	-60	-60	50	20 min.	4	1	1	8	0.8	40	15.18 TO-220AB

6C  
Bipolar



# General-Purpose Power Transistors

Sorted by ascending Breakdown Voltage (V<sub>ceo</sub>), Secondary Sort by P<sub>t</sub>

Part No.	n-p-n p-n-p	V <sub>ceo(sus)</sub> V	V <sub>cev(sus)</sub> V	P <sub>t</sub> W		H <sub>fe</sub>		V <sub>ce(sat)</sub> -V			F <sub>t</sub> (Typ.) MHz	File No.	Package
						I <sub>c</sub> A	V <sub>ce</sub> V	I <sub>c</sub> A	I <sub>b</sub> A	I <sub>b</sub> A			
BD536	p-n-p	-60	--	50	25 min.	-2	-2	-0.8	-2	-0.2	10	1236	TO-220
2N6133	p-n-p	-60	-60	50	7 min.	-7	-4	-1.4	-7	-3	8	1233	TO-220AB
BD244A	p-n-p	-60	-70	65	30 min.	-0.3	-4	-1.5	-6	-1	8	674	TO-220AB
TIP42A	p-n-p	-60	--	65	15-150	-3	-4	-2	-6	-0.6	8	996	TO-220AB
2N6490	p-n-p	-60	-70	75	20-150	-5	-4	-1.3	-5	-0.5	8	678	TO-220AB
2N6313	p-n-p	-60	-60	75	25-100	-1.5	-4	-0.7	-1.5	-0.15	4	1102	TO-213AA/TO-66
BDX18	p-n-p	-60	-70	115	20-70	-4	-4	-1.1	-4	-0.4	16	994	TO-204AA/TO-3
2N6246	p-n-p	-60	-70	125	20-100	-7	-4	-1.3	-7	-0.7	16	677	TO-204AA/TO-3
2N3791	p-n-p	-60	--	150	30-150	-1	-2	-1	-5	-0.5	16	1059	TO-204AA/TO-3
MJ2955	p-n-p	-60	-70	150	20-70	-4	-4	-1.1	-4	-0.4	16	994	TO-204AA/TO-3
2N5782	p-n-p	-50	-65	10	20-100	-1.2	-2	-0.75	-1.2	-0.12	20	413	TO-205AA/TO-5
2N6109	p-n-p	-50	-60	40	30-150	-2.5	-4	-1	-2.5	-0.25	10	676	TO-220
2N6108	p-n-p	-50	-60	40	30-150	-2.5	-4	-1	-2.5	-0.25	10	676	TO-220
BD500	p-n-p	-50	-55	75	15-90	-5	-4	-1	-5	-0.5	8	1108	TO-220AB
BD240	p-n-p	-45	-55	30	40 min.	-0.2	-4	-0.7	-1	-0.2	10	670	TO-220
BD242	p-n-p	-45	-55	40	25 min.	-1	-4	-1.2	-3	-0.6	10	672	TO-220
2N6124	p-n-p	-45	--	40	25-100	-1.5	-2	-0.6	-1.5	-0.15	10	1149	TO-220
D45H5	p-n-p	-45	-45	50	40 min.	4	1	1	8	0.4	40	15.18	TO-220AB
BD534	p-n-p	-45	--	50	25 min.	-2	-2	-0.8	-2	-0.2	10	1236	TO-220
D45H4	p-n-p	-45	-45	50	20 min.	4	1	1	8	0.8	40	15.18	TO-220AB
BD244	p-n-p	-45	-55	65	30 min.	-0.3	-4	-1.5	-6	-1	8	674	TO-220AB
BD277	p-n-p	-45	--	70	30-150	-1.75	-2	-0.5	-1.75	-0.1	10	687	TO-220
2N5783	p-n-p	-40	-45	10	20-100	-1.6	-2	-1	-1.6	-0.16	20	413	TO-205AA/TO-5
2N4898	p-n-p	-40	--	25	20-100	-0.5	-1	-0.6	-1	-0.1	10	1150	TO-213AA/TO-66
TIP30	p-n-p	-40	--	30	15-150	-1	-4	-0.7	-1	-0.12	10	988	TO-220
2N5956	p-n-p	-40	-50	40	20-100	-3	-4	-1	-3	-0.3	10	675	TO-213AA/TO-66
TIP32	p-n-p	-40	--	40	10-50	-3	-4	-1.2	-3	-0.37	10	987	TO-220
2N6132	p-n-p	-40	-40	50	7 min.	-7	-4	-1.4	-7	-3	8	1233	TO-220AB
TIP42	p-n-p	-40	--	65	15-150	-3	-4	-2	-6	-0.6	8	996	TO-220AB
2N6312	p-n-p	-40	-40	75	25-100	-1.5	-4	-0.7	-1.5	-0.15	4	1102	TO-213AA/TO-66
2N6489	p-n-p	-40	-50	75	20-150	-5	-4	-1.3	-5	-0.5	8	678	TO-220AB
2N6594	p-n-p	-40	-45	100	5-100	-12	-4	-4	-12	-2.4	16	994	TO-204AA/TO-3
2N6469	p-n-p	-40	-50	125	20-125	-5	-4	-1.3	-5	-0.5	16	677	TO-204AA/TO-3
2N6111	p-n-p	-30	-40	40	30-150	-3	-4	-1	-3	-0.3	10	676	TO-220
2N6110	p-n-p	-30	-40	40	30-150	-3	-4	-1	-3	-0.3	10	676	TO-220
D45H1	p-n-p	-30	-30	50	20 min.	4	1	1	8	0.8	40	15.18	TO-220AB
D45H2	p-n-p	-30	-30	50	40 min.	4	1	1	8	0.4	40	15.18	TO-220AB
2N6289	n-p-n	30	40	40	30-150	3	4	1	3	0.3	8	676	TO-220
2N6288	n-p-n	30	40	40	30-150	3	4	1	3	0.3	8	676	TO-220
40347V1	n-p-n	40	60	4	25-100	0.45	4	1	0.45	0.045	1.5	88	TO-205AA/TO-5
2N1479	n-p-n	40	60	5	20-60	0.2	4	1.4	0.2	0.02	1.5	135	TO-205AA/TO-5
2N1700	n-p-n	40	60	5	20-80	0.1	4	1	0.1	0.01	1.5	141	TO-205AA/TO-5
2N1481	n-p-n	40	60	5	35-100	0.2	4	1.4	0.2	0.02	1.5	135	TO-205AA/TO-5
40347	n-p-n	40	60	8.75	25-100	0.45	4	1	0.45	0.045	1.5	88	TO-205AA/TO-5
2N5786	n-p-n	40	45	10	20-100	1.6	2	1	1.6	0.16	1.5	413	TO-205AA/TO-5
BD239	n-p-n	40	55	30	40 min.	0.2	4	0.7	1	0.2	8	669	TO-220
TIP29	n-p-n	40	--	30	15-150	1	4	0.7	1	0.125	8	990	TO-220
TIP31	n-p-n	40	--	40	10-50	3	4	1.2	3	0.375	8	991	TO-220
2N5494	n-p-n	40	60	50	20-100	3	4	1	3	0.3	1	353	TO-220
2N5490	n-p-n	40	60	50	20-100	2	4	1	2	0.2	1	353	TO-220
2N5491	n-p-n	40	60	50	20-100	2	4	1	2	0.2	1	353	TO-220
2N5495	n-p-n	40	60	50	20-100	3	4	1	3	0.3	1	353	TO-220
2N6129	n-p-n	40	40	50	7 min.	7	4	1.4	7	3	1	1233	TO-220
TIP41	n-p-n	40	--	65	15-150	3	4	2	6	0.6	8	992	TO-220AB
2N6486	n-p-n	40	50	75	20-150	5	4	1.3	5	0.5	8	678	TO-220AB
2N5301	n-p-n	40	--	200	15-60	15	3	0.75	10	1	8	1029	TO-204AA/TO-3
BD241	n-p-n	45	55	40	25 min.	1	4	1.2	3	0.6	8	671	TO-220
2N6121	n-p-n	45	--	40	25-100	1.5	2	0.6	1.5	0.15	8	1149	TO-220
BD533	n-p-n	45	--	50	25 min.	2	2	0.8	2	0.2	8	1236	TO-220
BD243	n-p-n	45	55	65	30 min	0.3	4	1.5	6	1	8	673	TO-220AB
2N5785	n-p-n	50	65	10	20-100	1.2	2	0.75	1.2	0.12	1.5	413	TO-205AA/TO-5
2N6290	n-p-n	50	60	40	30-150	2.5	4	1	2.5	0.25	8	676	TO-220
2N6291	n-p-n	50	60	40	30-150	2.5	4	1	2.5	0.25	8	676	TO-220
2N1480	n-p-n	55	100	5	20-60	0.2	4	1.4	0.2	0.02	1.5	135	TO-205AA/TO-5
2N1482	n-p-n	55	100	5	35-100	0.2	4	1.4	0.2	0.02	1.5	135	TO-205AA/TO-5
2N5493	n-p-n	55	75	50	20-100	2.5	4	1	2.5	0.25	1	353	TO-220
2N5492	n-p-n	55	75	50	20-100	2.5	4	1	2.5	0.25	1	353	TO-220
BD239A	n-p-n	60	70	30	40 min.	0.2	4	0.7	1	0.2	8	669	TO-220
TIP29A	n-p-n	60	--	30	15-150	1	4	0.7	1	0.125	8	990	TO-220
2N6122	n-p-n	60	--	40	25-100	1.5	2	0.6	1.5	0.15	8	1149	TO-220
BD241A	n-p-n	60	70	40	25 min.	1	4	1.2	3	0.6	8	671	TO-220
TIP31A	n-p-n	60	--	40	10-50	3	4	1.2	3	0.375	8	991	TO-220
BD535	n-p-n	60	--	50	25 min.	2	2	0.8	2	0.2	8	1236	TO-220
2N6130	n-p-n	60	60	50	7 min.	7	4	1.4	7	3	1	1233	TO-220
BD797	n-p-n	60	--	65	25 min.	3	2	1	3	0.3	8	1242	TO-220
TIP41A	n-p-n	60	--	65	15-150	3	4	2	6	0.6	8	992	TO-220AB
BD243A	n-p-n	60	70	65	30 min.	0.3	4	1.5	6	1	8	673	TO-220AB

# General-Purpose Power Transistors

Sorted by ascending Breakdown Voltage (V<sub>ceo</sub>), Secondary Sort by P<sub>T</sub>

Part No.	n-p-n p-n-p	V <sub>ceo(sus)</sub> V	V <sub>ce(sus)</sub> V	P <sub>T</sub> W	Hfe		V <sub>ce(sat)</sub> -V			F <sub>t</sub> (Typ.) MHz	File No.	Package
					I <sub>c</sub> A	V <sub>ce</sub> V	I <sub>c</sub> A	I <sub>b</sub> A	I <sub>b</sub> A			
2N6487	n-p-n	60	70	75	20-150	5	4	1.3	5	0.5	8	678 TO-220AB
RCA3055	n-p-n	60	70	75	20-70	4	4	1.1	4	0.4	1	618 TO-220
2N6326	n-p-n	60	--	200	6-30	30	4	3	30	7.5	8	1040 TO-204AA/TO-3
2N5302	n-p-n	60	--	200	16-60	15	3	0.75	10	1	8	1029 TO-204AA/TO-3
2N5885	n-p-n	60	--	200	20-100	10	4	1	15	1.5	8	1041 TO-204AA/TO-3
40348V1	n-p-n	65	90	4.4	30-125	0.3	4	0.75	0.3	0.03	1.5	88 TO-205AA/TO-5
40348	n-p-n	65	90	8.75	30-125	0.3	4	0.75	0.3	0.03	1.5	88 TO-205AA/TO-5
2N5784	n-p-n	65	80	10	20-100	1	2	0.5	1	0.1	1.5	413 TO-205AA/TO-5
2N6292	n-p-n	70	80	40	30-150	2	4	1	2	0.2	8	676 TO-220
2N6293	n-p-n	70	80	40	30-150	2	4	1	2	0.2	8	676 TO-220
2N5497	n-p-n	70	90	50	20-100	3.5	4	1	3.5	0.35	1	353 TO-220
2N5496	n-p-n	70	90	50	20-100	3.5	4	1	3.5	0.35	1	353 TO-220
BD239B	n-p-n	80	90	30	40 min.	0.2	4	0.7	1	0.2	8	669 TO-220
TIP29B	n-p-n	80	--	30	15-150	1	4	0.7	1	0.125	8	990 TO-220
TIP31B	n-p-n	80	--	40	10-50	3	4	1.2	3	0.375	8	991 TO-220
2N6123	n-p-n	80	--	40	20-80	1.5	2	0.6	1.5	0.15	8	1149 TO-220
BD241B	n-p-n	80	90	40	25 min.	1	4	1.2	3	0.6	8	671 TO-220
2N6131	n-p-n	80	80	50	7 min.	7	4	1.8	7	3	1	1233 TO-220
BD537	n-p-n	80	--	50	25 min.	2	2	0.8	2	0.2	8	1236 TO-220
BD799	n-p-n	80	--	65	15 min.	3	2	1	3	0.3	8	1242 TO-220
BD243B	n-p-n	80	90	65	30 min.	0.3	4	1.5	6	1	8	673 TO-220AB
TIP41B	n-p-n	80	--	65	15-150	3	4	2	6	0.6	8	992 TO-220AB
BD501B	n-p-n	80	90	75	20 min.	3.5	4	1	3.5	0.35	1	1108 TO-220
2N6488	n-p-n	80	90	75	20-150	5	4	1.3	5	0.5	8	678 TO-220AB
2N5886	n-p-n	80	--	200	20-100	10	4	1	15	1.5	8	1041 TO-204AA/TO-3
2N6327	n-p-n	80	--	200	6-30	30	4	3	30	7.5	8	1040 TO-204AA/TO-3
2N5303	n-p-n	80	--	200	15-60	10	2	1.5	15	1.5	8	1029 TO-204AA/TO-3
BD751	n-p-n	90	100	200	15-60	7.5	2	1.5	7.5	0.75	4	1251 TO-204AA/TO-3
TIP29C	n-p-n	100	--	30	15-150	1	4	0.7	1	0.125	4	990 TO-220
BD239C	n-p-n	100	115	30	40 min.	0.2	4	0.7	1	0.2	4	669 TO-220
TIP31C	n-p-n	100	--	40	10-50	3	4	1.2	3	0.375	4	991 TO-220
2N6473	n-p-n	100	110	40	15-150	1.5	4	1.2	1.5	0.15	4	676 TO-220
BD241C	n-p-n	100	115	40	25 min.	1	4	1.2	3	0.6	4	671 TO-220
BD501	n-p-n	100	--	65	15 min.	3	2	1	3	0.3	4	1242 TO-220
BD243C	n-p-n	100	115	65	30 min.	0.3	4	1.5	6	1	8	673 TO-220AB
TIP41C	n-p-n	100	--	65	15-150	3	4	2	6	0.6	8	992 TO-220AB
BD550	n-p-n	100	130	150	15-75	4	4	2	4	0.5	4	1109 TO-204AA/TO-3
RCA8638E	n-p-n	100	110	200	25-100	10	2	0.8	7.5	0.75	4	1060 TO-204AA/TO-3
2N5629	n-p-n	100	--	200	25-100	8	2	1	10	1	4	1141 TO-204AA/TO-3
BD751B	n-p-n	100	110	250	15-60	7.5	2	1.5	7.5	0.75	4	1251 TO-204AA/TO-3
2N6263	n-p-n	120	140	20	20-100	0.5	4	1.2	0.5	0.05	0.8	529 TO-213AA/TO-66
2N6474	n-p-n	120	130	40	15-150	1.5	4	1.2	1.5	0.15	4	676 TO-220
2N6477	n-p-n	120	140	50	25-150	1	4	1	1	0.1	0.8	680 TO-220AB
2N4347	n-p-n	120	140	100	15-60	2	4	1	2	0.2	0.4	528 TO-204AA/TO-3
BD751A	n-p-n	120	130	200	25-100	5	2	1	5	0.5	4	1251 TO-204AA/TO-3
2N5630	n-p-n	120	--	200	20-80	8	2	1	10	1	4	1141 TO-204AA/TO-3
RCA8638D	n-p-n	120	130	200	25-100	5	2	1	5	0.5	4	1060 TO-204AA/TO-3
BD751C	n-p-n	130	140	250	25-100	5	2	1	5	0.5	4	1251 TO-204AA/TO-3
2N3441	n-p-n	140	160	25	25-100	0.5	4	1	0.5	0.05	0.8	529 TO-213AA/TO-66
2N6478	n-p-n	140	160	50	25-150	1	4	1	1	0.1	0.8	680 TO-220AB
2N3442	n-p-n	140	160	117	20-70	3	4	1	3	0.3	0.4	528 TO-204AA/TO-3
2N5631	n-p-n	140	--	200	15-60	8	2	1	10	1	4	1141 TO-204AA/TO-3
MJ15001	n-p-n	140	--	200	25-150	4	2	1	4	0.4	4	1093 TO-204AA/TO-3
RCA8638C	n-p-n	140	--	200	25-150	5	2	1	5	0.5	4	1060 TO-204AA/TO-3
2N6264	n-p-n	150	170	50	20-60	1	2	0.5	1	0.1	0.8	529 TO-213AA/TO-66
BUX17	n-p-n	150	250	150	7 min.	10	3	2	10	2	20	818 TO-204AA/TO-3
2N3583	n-p-n	175	250	35	40 min.	0.1	10	5	1	0.125	25	138 TO-213AA/TO-66
BUY69C	n-p-n	200	500	100	15	2.5	10	3.3	8	2.5	20	1237 TO-204AA/TO-3
BUX16	n-p-n	200	250	100	15-130	0.4	10	2.5	2	0.25	5	800 TO-204AA/TO-3
RCA1B04	n-p-n	200	225	150	15-75	2	5	2	2	0.255	5	908 TO-204AA/TO-3
2N6249	n-p-n	200	225	175	10-50	10	3	1.5	10	1	6	523 TO-204AA/TO-3
RCA9166B	n-p-n	200	225	250	30 min.	3	4	1	3	0.3	7	1293 TO-204AA/TO-3
MJ15022	n-p-n	200	225	250	15-60	8	4	1.4	8	0.8	7	1293 TO-204AA/TO-3
2N5239	n-p-n	225	250	100	20-80	2	10	2.5	2	0.25	5	321 TO-204AA/TO-3
2N3440	n-p-n	250	300	10	40-160	0.02	10	0.5	0.05	0.004	25	64 TO-205AD/TO-39
2N4064	n-p-n	250	--	10	40-160	0.02	10	0.5	0.05	0.004	25	64 TO-205AD/TO-39
2N3584	n-p-n	250	300	35	40 min.	0.1	10	0.75	1	0.125	25	138 TO-213AA/TO-66
TIP47	n-p-n	250	--	40	10 min.	1	10	1	1	0.2	25	978 TO-220AB
2N6078	n-p-n	250	275	45	12-70	1.2	1	0.5	1.2	0.2	7	492 TO-213AA/TO-66
2N5838	n-p-n	250	275	100	8-40	3	2	1	3	0.375	5	410 TO-204AA/TO-3
BUX16A	n-p-n	250	325	100	15-130	0.4	10	2.5	2	0.25	5	800 TO-204AA/TO-3
BUX42	n-p-n	250	300	120	15-45	4	4	1.2	4	0.4	20	1218 TO-204AA/TO-3
BD550B	n-p-n	250	275	150	10-50	2	4	2	2	0.25	5	1109 TO-204AA/TO-3
BUX17A	n-p-n	250	350	150	7 min.	10	3	2	10	2	20	818 TO-204AA/TO-3
RCA1B05	n-p-n	250	275	150	15-75	2	5	2	2	0.255	5	908 TO-204AA/TO-3
BUX12	n-p-n	250	300	150	10 min.	10	4	1.5	10	1.25	20	1229 TO-204AA/TO-3
RCA9166A	n-p-n	250	275	250	30 min.	3	4	1	3	0.3	7	1293 TO-204AA/TO-3

# General-Purpose Power Transistors

Sorted by ascending Breakdown Voltage (V<sub>ceo</sub>), Secondary Sort by P<sub>t</sub>

Part No.	n-p-n p-n-p	V <sub>ceo(sus)</sub> V	V <sub>ceo</sub> (sus) V	P <sub>t</sub> W	H <sub>fe</sub>			V <sub>ce(sat)</sub> -V			F <sub>t</sub> (Typ.) MHz	File No.	Package
					I <sub>c</sub> A	V <sub>ce</sub> V		I <sub>c</sub> A	I <sub>b</sub> A				
MJ15024	n-p-n	250	275	250	15-60	8	4	1.4	8	0.8	7	1293	TO-204AA/TO-3
2N6077	n-p-n	275	300	45	12-70	1.2	1	0.5	1.2	0.2	7	492	TO-213AA/TO-66
2N5839	n-p-n	275	300	100	10-50	2	3	1.5	2	0.2	5	410	TO-204AA/TO-3
2N6250	n-p-n	275	300	175	8-50	10	3	1.5	10	1.25	6	523	TO-204AA/TO-3
2N4240	n-p-n	300	400	35	30-150	1	10	1	0.75	0.075	25	138	TO-213AA/TO-66
2N3585	n-p-n	300	400	35	40 min.	0.1	10	0.75	1	0.125	25	138	TO-213AA/TO-66
BUW40	n-p-n	300	450	40	10-50	1	3	1	1	0.2	25	1308	TO-220AB
2N6771	n-p-n	300	450	40	10-50	1	3	1	1	0.2	25	1292	TO-220AB
TIP48	n-p-n	300	--	40	10 min.	1	10	1	1	0.2	25	978	TO-220AB
D44TD3	n-p-n	300	400	50	5 min.	2	3	1	2	0.4	15 min.	15.21	TO-220AB
MJE13004	n-p-n	300	600	75	8 min.	2	5	0.6	2	0.5	4 min.	15.87	TO-220AB
BUX16B	n-p-n	300	375	100	15-130	0.4	10	2.5	2	0.25	5	800	TO-204AA/TO-3
2N6738	n-p-n	300	450	100	10-40	5	3	1	5	1	30	1291	TO-220AB
BUW41	n-p-n	300	450	100	10-40	5	--	--	--	--	30	1275	TO-220AB
2N5240	n-p-n	300	350	100	20-80	2	10	2.5	2	0.25	5	321	TO-204AA/TO-3
2N6542	n-p-n	300	650	100	12-60	1.5	2	1	3	0.6	20	1096	TO-204AA/TO-3
TIP562	n-p-n	300	--	100	20 min.	1	4	2	15	5	20	1212	TO-204AA/TO-3
2N6544	n-p-n	300	650	125	12-60	2.5	3	1.5	5	1	20	1096	TO-204AA/TO-3
2N6671	n-p-n	300	450	150	10 min.	5	3	1	5	1	20	1090	TO-204AA/TO-3
BUX17B	n-p-n	300	400	150	7 min.	8	3	3	8	1.5	20	818	TO-204AA/TO-3
2N6676	n-p-n	300	450	175	8 min.	15	3	1	15	3	20	1165	TO-204AA/TO-3
2N6674	n-p-n	300	450	175	8-20	10	2	1	10	2	20	1164	TO-204AA/TO-3
2N6546	n-p-n	300	650	175	12-60	5	2	1.5	10	2	20	1096	TO-204AA/TO-3
BUY69B	n-p-n	325	800	100	15-60	2.5	10	3.3	8	2.5	20	1237	TO-204AA/TO-3
BUX43	n-p-n	325	400	120	15-60	3	4	1.6	5	1	20	1214	TO-204AA/TO-3
BUX13	n-p-n	325	400	150	8 min.	8	4	1.5	8	1.6	20	1230	TO-204AA/TO-3
2N3439	n-p-n	350	400	10	40-160	0.02	10	0.5	0.05	0.004	25	64	TO-205AD/TO-39
2N4063	n-p-n	350	--	10	40-160	0.02	10	0.5	0.05	0.004	25	64	TO-205AD/TO-39
2N6772	n-p-n	350	550	40	10-50	1	3	1	1	0.2	25	1292	TO-220AB
TIP49	n-p-n	350	--	40	10 min.	1	10	1	1	0.2	25	978	TO-220AB
BUW40A	n-p-n	350	550	40	10-50	1	3	1	1	0.2	25	1308	TO-220AB
2N6079	n-p-n	350	375	45	12-50	1.2	1	0.5	1.2	0.2	7	492	TO-213AA/TO-66
D44TD4	n-p-n	350	500	50	5 min.	2	3	1	2	0.4	15 min.	15.21	TO-220AB
BUX41A	n-p-n	350	550	100	10-40	5	--	--	--	--	30	1275	TO-220AB
2N5840	n-p-n	350	375	100	10-50	2	3	1.5	2	0.2	5	410	TO-204AA/TO-3
2N6739	n-p-n	350	550	100	10-40	5	3	1	5	1	30	1291	TO-220AB
BUX16C	n-p-n	350	425	100	15-130	0.4	10	2.5	2	0.25	5	800	TO-204AA/TO-3
2N6672	n-p-n	350	550	150	10 min.	5	3	1	5	1	20	1090	TO-204AA/TO-3
BUX17C	n-p-n	350	450	150	7 min.	8	3	3	8	1.5	20	818	TO-204AA/TO-3
2N6677	n-p-n	350	550	175	8 min.	15	3	1	15	3	20	1165	TO-204AA/TO-3
2N6251	n-p-n	350	375	175	6-50	10	3	1.5	10	1.67	6	523	TO-204AA/TO-3
TIP50	n-p-n	400	--	40	10 min.	1	10	1	1	0.2	25	978	TO-220AB
BUW40B	n-p-n	400	650	40	10-50	1	3	1	1	0.2	25	1308	TO-220AB
2N6773	n-p-n	400	650	40	10-50	1	3	1	1	0.2	25	1292	TO-220AB
D44TD5	n-p-n	400	600	50	5 min.	2	3	1	2	0.4	15 min.	15.21	TO-220AB
MJE13005	n-p-n	400	700	75	8 min.	2	5	0.6	2	0.5	4 min.	15.88	TO-220AB
MJE13070	n-p-n	400	650	80	8 min.	3	5	1	3	0.6	--	15.93	TO-220AB
BUY69A	n-p-n	400	1000	100	15	2.5	10	3.3	8	2.5	20	1237	TO-204AA/TO-3
2N6547	n-p-n	400	450	100	6-30	10	2	1.5	10	2	20	15109	TO-204AA/TO-3
2N6740	n-p-n	400	650	100	10-40	5	3	1	5	1	30	1291	TO-220AB
BUW41B	n-p-n	400	650	100	10-40	--	--	--	--	--	30	1275	TO-220AB
TIP563	n-p-n	400	--	100	20 min.	1	4	2	15	5	20	1212	TO-204AA/TO-3
BUX47	n-p-n	400	850	107	--	--	--	1.5	6	1.2	20	1284	TO-204AA/TO-3
BUX44	n-p-n	400	450	120	15-45	2	4	1	2	0.2	20	1210	TO-204AA/TO-3
MJH13090	n-p-n	400	650	125	8 min	10	3	1	10	2		15.94	TO-218AC
2N6545	n-p-n	400	850	125	12-60	2.5	3	1.5	5	1	20	1096	TO-204AA/TO-3
BUX32	n-p-n	400	800	150	8-40	6	3	1	6	1.2	20	1285	TO-204AA/TO-3
2N6751	n-p-n	400	800	150	8-40	5	3	1	5	1	20	1244	TO-204AA/TO-3
BUX31	n-p-n	400	800	150	8-40	4	3	2	8	2	20	1283	TO-204AA/TO-3
BUX14	n-p-n	400	450	150	15-60	3	4	1.5	6	1.2	20	1203	TO-204AA/TO-3
2N6673	n-p-n	400	650	150	10 min.	5	3	1	5	1	20	1090	TO-204AA/TO-3
2N6678	n-p-n	400	650	175	8 min.	15	3	1	15	3	20	1165	TO-204AA/TO-3
2N6675	n-p-n	400	650	175	6-20	10	2	1	10	2	20	1164	TO-204AA/TO-3
MJE13071	n-p-n	450	750	80	8 min.	3	5	1	3	0.6	--	15.93	TO-220AB
BUX32A	n-p-n	450	900	150	8-40	6	3	1	6	1.2	20	1285	TO-204AA/TO-3
BUX31A	n-p-n	450	900	150	8-40	4	3	2	8	2	20	1283	TO-204AA/TO-3
2N6752	n-p-n	450	850	150	8-40	5	3	1	5	1	20	1244	TO-204AA/TO-3
BUX45	n-p-n	500	500	120	14-45	1	4	2	2	0.4	20	1231	TO-204AA/TO-3
BUX31B	n-p-n	500	1000	150	8-40	4	3	2	8	2	20	1283	TO-204AA/TO-3
2N6754	n-p-n	500	1000	150	8-40	5	3	1	5	1	20	1244	TO-204AA/TO-3
BUX15	n-p-n	500	500	150	8 min.	4	4	1	4	0.8	20	1227	TO-204AA/TO-3
2N6753	n-p-n	500	900	150	8-40	5	3	1	5	1	20	1244	TO-204AA/TO-3
BUX32B	n-p-n	500	1000	150	8-40	6	3	1	6	1.2	20	1285	TO-204AA/TO-3

## Small-Signal Bipolar Transistors

Sorted by ascending Breakdown Voltage ( $V_{ce0}$ ), Secondary Sort by Pt

PART NO.	n-p-n p-n-p	Ic (Max.) mA	$V_{(br)ce0}$ (Min.) V	BETA RANGE Hfe	PACKAGE
2N5365	p-n-p	-300	-40	40-120	TO-98

# Darlington Power Transistors

Sorted by ascending Breakdown Voltage (Vce), Secondary Sort by Pt

Part No.	n-p-n p-n-p	Ic(A)	Vceo(V)	Hfe@	Ic(A)	Vce(V)	Pt(W)	File No.	Package
BDX34D	p-n-p	-10	-120	750 min.	-3	-3	70	694	TO-220AB
RCA9229D	p-n-p	-50	-120	2000 min.	-25	-3	300	1448	TO-204AE/TO-3
TIP117	p-n-p	-2	-100	1000 min.	-1	-4	50	1387	TO-220AB
TIP127	p-n-p	-8	-100	1000 min.	-3	-3	65	997	TO-220AB
BDX34C	p-n-p	-10	-100	750 min.	-3	-3	70	694	TO-220AB
2N6052	p-n-p	-12	-100	750 min.	-6	-3	150	1185	TO-204AA/TO-3
2N6287	p-n-p	-20	-100	750 min.	-10	-4	160	1001	TO-204AA/TO-3
RCA9229C	p-n-p	-50	-100	2000 min.	-25	-3	300	1448	TO-204AE/TO-3
D73FY4D1,2	p-n-p	-4	-80	1000 min.	-3	-2	15	15.57	TO-251/2
D45D5,6	p-n-p	-6	-80	2000 min.	-1	-2	30	15.14	TO-220AB
D45E3	p-n-p	-10	-80	1000 min.	-5	-5	50	15.16	TO-220AB
TIP116	p-n-p	-2	-80	1000 min.	-1	-4	50	1387	TO-220AB
TIP126	p-n-p	-8	-80	1000 min.	-3	-3	65	997	TO-220AB
2N6668	p-n-p	-10	-80	1000 min.	-5	-3	65	1069	TO-220AB
2N6650	p-n-p	-10	-80	1000-20,000	-5	-3	70	1013	TO-204AA/TO-3
BDX34B	p-n-p	-10	-80	750 min.	-3	-3	70	694	TO-220AB
2N6051	p-n-p	-12	-80	750 min.	-6	-3	150	1185	TO-204AA/TO-3
2N6286	p-n-p	-20	-80	750 min.	-10	-4	160	1001	TO-204AA/TO-3
RCA9229B	p-n-p	-50	-80	2000 min.	-25	-3	300	1448	TO-204AE/TO-3
D45D3,4	p-n-p	-6	-60	2000 min.	-1	-2	30	15.14	TO-220AB
D45E2	p-n-p	-10	-60	1000 min.	-5	-5	50	15.16	TO-220AB
TIP115	p-n-p	-2	-60	1000 min.	-1	-4	50	1387	TO-220AB
TIP125	p-n-p	-8	-60	1000 min.	-3	-3	65	997	TO-220AB
2N6667	p-n-p	-10	-60	1000 min.	-5	-3	65	1069	TO-220AB
2N6649	p-n-p	-10	-60	1000-20,000	-5	-3	70	1013	TO-204AA/TO-3
BDX34A	p-n-p	-10	-60	750 min.	-4	-3	70	694	TO-220AB
2N6050	p-n-p	-12	-60	750 min.	-6	-3	150	1185	TO-204AA/TO-3
2N6285	p-n-p	-20	-60	750 min.	-10	-4	160	1001	TO-204AA/TO-3
RCA9229A	p-n-p	-50	-60	2000 min.	-25	-3	300	1448	TO-204AE/TO-3
D41K2	p-n-p	-2	-50	1000 min.	-1.5	-5	10	15.7	TO-202
D41K4	p-n-p	-2	-50	1000 min.	-1	-5	10	15.7	TO-202
BDX34	p-n-p	-10	-45	750 min.	-4	-3	70	694	TO-220AB
D73K3D1,2	p-n-p	-3	-40	1000 min.	-3	-2	15	15.58	TO-251/2
D45D1,2	p-n-p	-6	-40	2000 min.	-1	-2	30	15.14	TO-220AB
D45E1	p-n-p	-10	-40	1000 min.	-5	-5	50	15.16	TO-220AB
2N6666	p-n-p	-8	-40	1000 min.	-3	-3	65	1069	TO-220AB
2N6648	p-n-p	-10	-40	1000-20,000	-5	-3	70	1013	TO-204AA/TO-3
D41K3	p-n-p	-2	-30	1000 min.	-1	-5	10	15.7	TO-202
D41K1	p-n-p	-2	-30	1000 min.	-1.5	-5	10	15.7	TO-202
D40C1	n-p-n	0.5	30	1000 min.	0.2	5	6.25	15.1	TO-202
D40K3	n-p-n	2	30	1000 min.	1	5	10	15.6	TO-202
D40K1	n-p-n	2	30	1000 min.	1.5	5	10	15.6	TO-202
D40C4	n-p-n	0.5	40	1000 min.	0.2	5	6.25	15.1	TO-202
D44D1,2	n-p-n	6	40	2000 min.	1	2	30	15.13	TO-220AB
D44E1	n-p-n	10	40	1000 min.	5	5	50	15.15	TO-220AB
2N6386	n-p-n	8	40	1000 min.	3	3	65	610	TO-220AB
2N6383	n-p-n	10	40	1000 min.	5	3	100	609	TO-204AA/TO-3
BDX53	n-p-n	8	45	750 min.	3	3	60	1213	TO-220AB
BD643	n-p-n	8	45	750 min.	3	3	62.5	1241	TO-220AB
BD895,A	n-p-n	8	45	750 min.	3	3	70	1240	TO-220AB
BDX33	n-p-n	10	45	750 min.	4	3	70	693	TO-220AB
BDX83	n-p-n	10	45	1000 min.	5	3	125	955	TO-204AA/TO-3
D40C7	n-p-n	0.5	50	1000 min.	0.2	5	6.25	15.1	TO-202
D40K2	n-p-n	2	50	1000 min.	1.5	5	10	15.6	TO-202

# Darlington Power Transistors

Sorted by ascending Breakdown Voltage (Vceo), Secondary Sort by Pt

Part No.	n-p-n p-n-p	Ic(A)	Vceo(V)	Hfe@	Ic(A)	Vceo(V)	Pt(W)	File No.	Package
D40K4	n-p-n	2	50	1000 min.	1	5	10	15.6	TO-202
D44D3,4	n-p-n	6	60	2000 min.	1	2	30	15.13	TO-220AB
TIP110	n-p-n	2	60	1000 min.	1	4	50	1336	TO-220AB
D44E2	n-p-n	10	60	1000 min.	5	5	50	15.15	TO-220AB
BDX53A	n-p-n	8	60	750 min.	3	3	60	1213	TO-220AB
2N6387	n-p-n	10	60	1000 min.	5	3	65	610	TO-220AB
TIP120	n-p-n	8	60	1000 min.	3	3	65	998	TO-220AB
BDX33A	n-p-n	10	60	750 min.	4	3	70	693	TO-220AB
BD897,A	n-p-n	8	60	750 min.	3	3	70	1240	TO-220AB
2N6043	n-p-n	8	60	1000 min.	4	4	75	1151	TO-220AB
TIP100	n-p-n	8	60	1000 min.	3	4	80	1152	TO-220AB
RCA1000	n-p-n	5	60	1000 min.	3	3	90	594	TO-204AA/TO-3
2N6384	n-p-n	10	60	1000 min.	5	3	100	609	TO-204AA/TO-3
2N6055	n-p-n	8	60	750 min.	4	3	100	563	TO-204AA/TO-3
2N6576	n-p-n	15	60	2000 min.	4	3	120	1152	TO-204AA/TO-3
BDX83A	n-p-n	10	60	1000 min.	5	3	125	955	TO-204AA/TO-3
2N6057	n-p-n	12	60	750 min.	6	3	150	1185	TO-204AA/TO-3
2N6282	n-p-n	20	60	750 min.	10	4	160	1001	TO-204AA/TO-3
RCA9228A	n-p-n	50	60	2000 min.	25	3	300	1448	TO-204AE/TO-3
D72FY4D1,2	n-p-n	4	80	1000 min.	3	2	15	15.52	TO-251/2
D44D5,6	n-p-n	6	80	2000 min.	1	2	30	15.13	TO-220AB
TIP111	n-p-n	2	80	1000 min.	1	4	50	1336	TO-220AB
D44E3	n-p-n	10	80	1000 min.	5	5	50	15.15	TO-220AB
BDX53B	n-p-n	8	80	750 min.	3	3	60	1213	TO-220AB
BD647	n-p-n	8	80	750 min.	3	3	62.5	1241	TO-220AB
2N6388	n-p-n	10	80	1000 min.	5	3	65	610	TO-220AB
TIP121	n-p-n	8	80	1000 min.	3	3	65	998	TO-220AB
2N6530	n-p-n	8	80	1000-10,000	5	3	65	873	TO-220AB
BD899,A	n-p-n	8	80	750 min.	3	3	70	1240	TO-220AB
BDX33B	n-p-n	10	80	750 min.	3	3	70	693	TO-220AB
2N6044	n-p-n	8	80	1000 min.	4	4	75	1151	TO-220AB
TIP101	n-p-n	8	80	1000 min.	3	4	80	1153	TO-220AB
RCA1001	n-p-n	5	80	1000 min.	3	3	90	594	TO-204AA/TO-3
2N6056	n-p-n	8	80	750 min.	4	3	100	563	TO-204AA/TO-3
2N6385	n-p-n	10	80	1000 min.	5	3	100	609	TO-204AA/TO-3
BDX83B	n-p-n	10	80	1000 min.	5	3	125	563	TO-204AA/TO-3
2N6058	n-p-n	12	80	750 min.	6	3	150	1185	TO-204AA/TO-3
2N6283	n-p-n	20	80	750 min.	10	4	160	1001	TO-204AA/TO-3
RCA9228B	n-p-n	50	80	2000 min.	25	3	300	1448	TO-204AE/TO-3
2N6577	n-p-n	15	90	2000 min.	4	3	120	1152	TO-204AA/TO-3
TIP112	n-p-n	2	100	1000 min.	1	4	50	1336	TO-220AB
BDX53C	n-p-n	8	100	750 min.	3	3	60	1213	TO-220AB
2N6532	n-p-n	8	100	1000-10,000	5	3	65	873	TO-220AB
TIP122	n-p-n	8	100	1000 min.	3	3	65	998	TO-220AB
2N6531	n-p-n	8	100	500-10,000	3	3	65	873	TO-220AB
BD901	n-p-n	8	100	750 min.	3	3	70	1240	TO-220AB
BDX33C	n-p-n	10	100	750 min.	3	3	70	693	TO-220AB
2N6045	n-p-n	8	100	1000 min.	4	4	75	1151	TO-220AB
TIP102	n-p-n	8	100	1000 min.	3	4	80	1153	TO-220AB
BDX83C	n-p-n	10	100	1000 min.	5	3	125	563	TO-204AA/TO-3
2N6059	n-p-n	12	100	750 min.	6	3	150	1185	TO-204AA/TO-3
2N6284	n-p-n	20	100	750 min.	10	4	160	1001	TO-204AA/TO-3
RCA9228C	n-p-n	50	100	2000 min.	25	3	300	1448	TO-204AE/TO-3
2N6533	n-p-n	8	120	1000-10,000	3	3	65	873	TO-220AB

6C

Bipolar

# Darlington Power Transistors

Sorted by ascending Breakdown Voltage (Vce), Secondary Sort by Pt

Part No.	n-p-n p-n-p	Ic(A)	Vceo(V)	Hfe@	Ic(A)	Vce(V)	Pt(W)	File No.	Package
BDX33D	n-p-n	10	120	750 min.	3	3	70	693	TO-220AB
2N6578	n-p-n	15	120	2000 min.	4	3	120	1152	TO-204AA/TO-3
RCA9228D	n-p-n	50	120	2000 min.	25	3	300	1448	TO-204AE/TO-3
RCA9202A	n-p-n	4	300	750 min.	2	3	65	1414	TO-220AB
RCA9202B	n-p-n	4	350	750 min.	2	3	65	1414	TO-220AB
RCA8766	n-p-n	10	350	100 min.	6	3	150	973	TO-204AA/TO-3
RCA8766A	n-p-n	10	350	100 min.	4	3	150	973	TO-204AA/TO-3
BUX37	n-p-n	15	400	50 min.	15	5	35	1273	TO-204AA/TO-3
RCA9202C	n-p-n	4	400	750 min.	2	3	65	1414	TO-220AB
RCA8766C	n-p-n	10	400	100 min.	4	3	150	973	TO-204AA/TO-3
RCA8766B	n-p-n	10	400	100 min.	6	3	150	973	TO-204AA/TO-3
D64DV5	n-p-n	50	400	50 min.	50	5	180	15.35	TO-204AE/TO-3
D64EV5	n-p-n	50	400	50 min.	50	5	180	15.35	TO-204AE/TO-3
GE5062	n-p-n	20	450	15 min.	20	5	125	15.84	TO-204AA
RCA8766E	n-p-n	10	450	100 min.	4	3	150	973	TO-204AA/TO-3
RCA8766D	n-p-n	10	450	100 min.	6	3	150	973	TO-204AA/TO-3
D64DV6	n-p-n	50	450	50 min.	50	5	180	15.35	TO-204AE/TO-3
D64EV6	n-p-n	50	450	50 min.	50	5	180	15.35	TO-204AE/TO-3
D64EV7	n-p-n	50	500	50 min.	50	5	180	15.35	TO-204AE/TO-3
D64DV7	n-p-n	50	500	50 min.	50	5	180	15.35	TO-204AE/TO-3

# High-Speed Switching Power Transistors

Sorted by ascending Breakdown Voltage (V<sub>ce0</sub>), Secondary Sort by P<sub>T</sub>

Part No.	n-p-n p-n-p	V <sub>ce0</sub> (sus) V	P <sub>T</sub> W	H <sub>fe</sub>		V <sub>ce(sat)</sub> -V				T <sub>f</sub> us	T <sub>r</sub> us	File No.	Package	F <sub>t</sub>	
				I <sub>c</sub> A	V <sub>ce</sub> V	I <sub>c</sub> A	I <sub>b</sub> A	I <sub>c</sub> A	I <sub>b</sub> A						
2N0699	n-p-n	80	2	0.15	10	5	0.15	0.015	--	--	16	TO-205AD/TO-39	120 MHz *		
2N0697	n-p-n	50	2	40-120	0.15	10	1.5	0.15	0.015	--	--	16	TO-205AD/TO-39	120 MHz *	
2N1613	n-p-n	50	3	40-120	0.15	10	1.5	0.15	0.015	30	--	106	TO-205AD/TO-39	120 MHz *	
40362	p-n-p	-70	5	35-200	-50m	-4	-1.4	-150m	-0.015m	--	--	962	TO-205AD/TO-39	60 MHz *	
D41E7	p-n-p	-80	8	10 min.	-1	-2	-1	-1	-0.1	--	--	15.5	TO-202	175 MHz	
D43C10	p-n-p	-80	12.5	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.10	TO-202	40 MHz	
D43C11	p-n-p	-80	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D43C12	p-n-p	-80	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D45C12	p-n-p	-80	30	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45C10	p-n-p	-80	30	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.12	TO-220AB	40 MHz	
D45C11	p-n-p	-80	30	20 min.	-1	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45H11	p-n-p	-80	50	40 min.	4	1	1	8	0.4	--	--	15.18	TO-220AB	40 MHz	
D45H10	p-n-p	-80	50	20 min.	4	1	1	8	0.8	--	--	15.18	TO-220AB	40 MHz	
D45VM10	p-n-p	-80	50	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	15.26	TO-220AB		
D45VH10	p-n-p	-80	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	15.24	TO-220AB		
2N5322	p-n-p	-75	100	10	30-130	-500m	-4	-0.7	-500m	-50m	100	1000	325	TO-205AD/TO-39	60 MHz *
2N4314	p-n-p	-65	85	7	50-250	-150m	-10	-1.4	-150m	-0.015m	--	--	216	TO-205AD/TO-39	60 MHz *
2N4036	p-n-p	-65	85	7	40-140	-150m	-10	-0.65	-150m	-0.015m	0.07	0.1	216	TO-205AD/TO-39	60 MHz *
D41D7	p-n-p	-60	6.25	10 min.	-1	-2	-1	-0.5	-0.05	--	--	15.3	TO-202	150 MHz	
D41D8	p-n-p	-60	6.25	10 min.	-1	-2	-1	-0.5	-0.05	--	--	15.3	TO-202	150 MHz	
D41E5	p-n-p	-60	70	8	10 min.	-1	-2	-1	-1	-0.1	--	15.5	TO-202	175 MHz	
D43C8	p-n-p	-60	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D43C7	p-n-p	-60	12.5	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.10	TO-202	40 MHz	
D43C9	p-n-p	-60	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D45C8	p-n-p	-60	30	20 min.	-1	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45C7	p-n-p	-60	30	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.12	TO-220AB	40 MHz	
D45C9	p-n-p	-60	30	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45H7	p-n-p	-60	50	20 min.	4	1	1	8	0.8	--	--	15.18	TO-220AB	40 MHz	
D45H8	p-n-p	-60	50	40 min.	4	1	1	8	0.4	--	--	15.18	TO-220AB	40 MHz	
D45VM7	p-n-p	-60	50	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	15.26	TO-220AB		
D45VH7	p-n-p	-60	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	15.24	TO-220AB		
40406	p-n-p	-50	--	1	30-200	-0.1m	-10	--	--	--	--	219	TO-205AD/TO-39	60 MHz *	
2N5323	p-n-p	-50	75	10	40-250	-500m	-4	-1.2	-500m	-50m	100	1000	325	TO-205AD/TO-39	60 MHz *
D73F5T1	p-n-p	-50	60	20	30 min.	-3	-1	-0.4	-3	-0.15	0.1	0.1	15.56	TO-251/2	
D41D4	p-n-p	-45	6.25	10 min.	-1	-2	-0.5	-0.5	-0.05	--	--	15.3	TO-202	150 MHz	
D41D5	p-n-p	-45	6.25	10 min.	-1	-2	-0.5	-0.5	-0.05	--	--	15.3	TO-202	150 MHz	
D43C6	p-n-p	-45	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D43C5	p-n-p	-45	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D43C4	p-n-p	-45	12.5	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.10	TO-202	40 MHz	
D45C6	p-n-p	-45	30	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45C4	p-n-p	-45	30	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.12	TO-220AB	40 MHz	
D45C5	p-n-p	-45	30	20 min.	-1	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45H4	p-n-p	-45	50	20 min.	4	1	1	8	0.8	--	--	15.18	TO-220AB	40 MHz	
D45H5	p-n-p	-45	50	40 min.	4	1	1	8	0.4	--	--	15.18	TO-220AB	40 MHz	
D45VM4	p-n-p	-45	70	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	15.26	TO-220AB		
D45VH4	p-n-p	-45	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	15.24	TO-220AB		
2N4037	p-n-p	-40	60	7	50-250	-150m	-10	-1.4	-150m	-0.015m	--	--	216	TO-205AD/TO-39	60 MHz *
D41D1	p-n-p	-30	45	6.25	10 min.	-1	-2	-0.5	-0.5	-0.05	--	--	15.3	TO-202	150 MHz
D41D2	p-n-p	-30	45	6.25	20 min.	-1	-2	-0.5	-0.5	-0.05	--	--	15.3	TO-202	150 MHz
D41E1	p-n-p	-30	8	10 min.	-1	-2	-1	-1	-0.1	--	--	15.5	TO-202	175 MHz	
D43C1	p-n-p	-30	12.5	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.10	TO-202	40 MHz	
D43C3	p-n-p	-30	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D43C2	p-n-p	-30	12.5	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.10	TO-202	40 MHz	
D45C2	p-n-p	-30	30	20 min.	-1	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45C3	p-n-p	-30	30	20 min.	-2	-1	-0.5	-1	-0.05	--	--	15.12	TO-220AB	40 MHz	
D45C1	p-n-p	-30	30	10 min.	-1	-1	-0.5	-1	-0.1	--	--	15.12	TO-220AB	40 MHz	
D45H1	p-n-p	-30	50	20 min.	4	1	1	8	0.8	--	--	15.18	TO-220AB	40 MHz	
D45VM1	p-n-p	-30	50	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	15.26	TO-220AB		
D45H2	p-n-p	-30	50	40 min.	4	1	1	8	0.4	--	--	15.18	TO-220AB	40 MHz	
D45VH1	p-n-p	-30	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	15.24	TO-220AB		
D40D2	n-p-n	30	45	6.25	20 min.	1	2	0.5	0.5	0.05	--	--	15.2	TO-202	200 MHz
D40D1	n-p-n	30	45	6.25	10 min.	1	2	0.5	0.5	0.05	--	--	15.2	TO-202	200 MHz
D40E1	n-p-n	30	45	8	10 min.	1	2	1	1	0.1	--	--	15.4	TO-202	230 MHz
D42C3	n-p-n	30	40	12.5	20 min.	2	1	0.5	1	0.05	--	--	15.9	TO-202	50 MHz
D42C2	n-p-n	30	40	12.5	20 min.	2	1	0.5	1	0.05	--	--	15.9	TO-202	50 MHz
D42C1	n-p-n	30	40	12.5	10 min.	1	1	0.5	1	0.1	--	--	15.9	TO-202	50 MHz
D44C3	n-p-n	30	40	30	20 min.	2	1	0.5	1	0.05	--	--	15.11	TO-220AB	50 MHz
D44C1	n-p-n	30	40	30	10 min.	1	1	0.5	1	0.1	--	--	15.11	TO-220AB	50 MHz
D44C2	n-p-n	30	40	30	20 min.	2	1	0.5	1	0.05	--	--	15.11	TO-220AB	50 MHz
D44H2	n-p-n	30	50	40 min.	4	1	1	8	0.4	--	--	15.17	TO-220AB	50 MHz	



# High-Speed Switching Power Transistors

Sorted by ascending Breakdown Voltage (V<sub>ceo</sub>), Secondary Sort by Pt

Part No.	n-p-n p-n-p	V <sub>ceo</sub> (sus)	V <sub>ces</sub> (sus) V	Pt W		Hfe		V <sub>ce(sat)</sub> -V		Tf us	Tf us	File No.	Package	Ft	
						Ic A	V <sub>ce</sub> V	Ic A	Ib A						
D44H1	n-p-n	30	30	50	20 min.	4	1	8	0.8	---	---	15.17	TO-220AB	50 MHz	
D44VH1	n-p-n	30	50	83	20 min.	4	1	8	0.4	0.25	0.18	15.23	TO-220AB		
2N3053	n-p-n	40	50	5	50-250	0.15	10	1.4	0.15	0.015	---	---	960	TO-205AD/TO-39	120 MHz *
2N2270	n-p-n	45	60	5	50-200	0.15	10	0.9	0.15	0.015	---	---	24	TO-205AD/TO-39	120 MHz *
D40D5	n-p-n	45	60	6.25	10 min.	1	2	0.5	0.5	0.05	---	---	15.2	TO-202	200 MHz
D40D4	n-p-n	45	60	6.25	10 min.	1	2	0.5	0.5	0.05	---	---	15.2	TO-202	200 MHz
D42C6	n-p-n	45	55	12.5	20 min.	2	1	0.5	1	0.05	---	---	15.9	TO-202	50 MHz
D42C4	n-p-n	45	55	12.5	10 min.	1	1	0.5	1	0.1	---	---	15.9	TO-202	50 MHz
D42C5	n-p-n	45	55	12.5	20 min.	2	1	0.5	1	0.05	---	---	15.9	TO-202	50 MHz
D44C4	n-p-n	45	55	30	10 min.	1	1	0.5	1	0.1	---	---	15.11	TO-220AB	50 MHz
D44C6	n-p-n	45	55	30	20 min.	2	1	0.5	1	0.05	---	---	15.11	TO-220AB	50 MHz
D44C5	n-p-n	45	55	30	20 min.	2	1	0.5	1	0.05	---	---	15.11	TO-220AB	50 MHz
D44H4	n-p-n	45	45	50	20 min.	4	1	1	8	0.8	---	---	15.17	TO-220AB	50 MHz
D44H5	n-p-n	45	45	50	40 min.	4	1	1	8	0.4	---	---	15.17	TO-220AB	50 MHz
D44VH4	n-p-n	45	65	83	20 min.	4	1	0.4	8	0.4	0.25	0.18	15.23	TO-220AB	
40407	n-p-n	50	---	1	40-200	0.10	10	---	---	---	---	---	219	TO-205AD/TO-39	120 MHz *
2N5321	n-p-n	50	75	10	40-250	500m	4	0.8	500m	50m	80	800	315	TO-205AD/TO-39	50 MHz *
D72F5T1	n-p-n	50	60	20	30 min.	3	1	0.4	3	0.15	0.1	0.1	15.51	TO-251/2	
2N3878	n-p-n	50	65	35	40-200	0.50	2	2	4	0.400	---	---	766	TO-213AA/TO-66	60 MHz *
2N5202	n-p-n	50	75	35	10-100	4.00	1.2	1.2	4	0.400	0.4	0.4	766	TO-213AA/TO-66	60 MHz *
1N3053A	n-p-n	60	70	5	50-250	0.15	10	0.3	0.15	0.015	---	---	960	TO-205AD/TO-39	120 MHz *
D40D8	n-p-n	60	75	6.25	10 min.	1	2	1	0.5	0.05	---	---	15.2	TO-202	200 MHz
D40D7	n-p-n	60	75	6.25	10 min.	1	2	1	0.5	0.05	---	---	15.2	TO-202	200 MHz
D40E5	n-p-n	60	70	8	10 min.	1	2	1	1	0.1	---	---	15.4	TO-202	230 MHz
D42C7	n-p-n	60	70	12.5	10 min.	1	1	0.5	1	0.1	---	---	15.9	TO-202	50 MHz
D42C9	n-p-n	60	70	12.5	20 min.	2	1	0.5	1	0.05	---	---	15.9	TO-202	50 MHz
D42C8	n-p-n	60	70	12.5	20 min.	2	1	0.5	1	0.05	---	---	15.9	TO-202	50 MHz
D44C8	n-p-n	60	70	30	20 min.	2	1	0.5	1	0.05	---	---	15.11	TO-220AB	50 MHz
D44C7	n-p-n	60	70	30	10 min.	1	1	0.5	1	0.1	---	---	15.11	TO-220AB	50 MHz
D44C9	n-p-n	60	70	30	20 min.	2	1	0.5	1	0.05	---	---	15.11	TO-220AB	50 MHz
BODY92	n-p-n	60	80	40	30-120	5	5	0.5	5	0.5	---	0.2	1289	TO-204AA/TO-3	80 MHz *
D44H8	n-p-n	60	60	50	40 min.	4	1	1	8	0.4	---	---	15.17	TO-220AB	50 MHz
D44H7	n-p-n	60	60	50	20 min.	4	1	1	8	0.8	---	---	15.17	TO-220AB	50 MHz
D44VH7	n-p-n	60	80	83	20 min.	4	1	0.4	8	0.4	0.25	0.18	15.23	TO-220AB	
BODY55	n-p-n	60	100	117	20-70	4	4	1.1	4	0.4	0.5	2	1215	TO-204AA/TO-3	80 MHz *
2N2102	n-p-n	65	80	5	40-120	0.15	10	0.5	0.15	0.015	30	---	106	TO-205AD/TO-39	120 MHz *
2N5320	n-p-n	75	100	10	30-130	500m	4	0.5	500m	50m	80	800	315	TO-205AD/TO-39	50 MHz *
2N3879	n-p-n	75	90	35	20-80	4.00	5	1.2	4	0.400	0.4	0.4	766	TO-213AA/TO-66	60 MHz *
2N5039	n-p-n	75	120	140	20-100	10	5	1	10	1	0.5	698	TO-204AA/TO-3	80 MHz *	
2N1893	n-p-n	80	100	3	40-120	0.15	10	5	0.15	0.015	---	---	34	TO-205AD/TO-39	120 MHz *
D42C11	n-p-n	80	90	12.5	20 min.	2	1	0.5	1	0.05	---	---	15.9	TO-202	50 MHz
D42C12	n-p-n	80	90	12.5	20 min.	2	1	0.5	1	0.05	---	---	15.9	TO-202	50 MHz
D42C10	n-p-n	80	90	12.5	10 min.	1	1	0.5	1	0.1	---	---	15.9	TO-202	50 MHz
D44C12	n-p-n	80	90	30	20 min.	2	1	0.5	1	0.05	---	---	15.11	TO-220AB	50 MHz
D44C10	n-p-n	80	90	30	10 min.	1	1	0.5	1	0.1	---	---	15.11	TO-220AB	50 MHz
D44C11	n-p-n	80	90	30	20 min.	2	1	0.5	1	0.05	---	---	15.11	TO-220AB	50 MHz
BODY91	n-p-n	80	100	40	30-120	5	5	0.5	5	0.5	---	0.2	1289	TO-204AA/TO-3	80 MHz *
D44H11	n-p-n	80	80	50	40 min.	4	1	1	8	0.4	---	---	15.17	TO-220AB	50 MHz
D44H10	n-p-n	80	80	50	20 min.	4	1	1	8	0.8	---	---	15.17	TO-220AB	50 MHz
D44VH10	n-p-n	80	100	83	20 min.	4	1	0.4	8	0.4	0.25	0.18	15.23	TO-220AB	
40408	n-p-n	90	---	1	40-200	0.10	10	---	---	---	---	---	219	TO-205AD/TO-39	120 MHz *
2N2405	n-p-n	90	140	5	60-200	0.15	10	0.5	0.15	0.015	---	---	34	TO-205AD/TO-39	120 MHz *
2N6500	n-p-n	90	110	35	15-60	3.00	2	1.5	3	0.300	0.4	0.5	766	TO-213AA/TO-66	80 MHz *
2N6702	n-p-n	90	140	50	20	5	2	0.8	5	0.5	0.25	0.5	1187	TO-220AB	50 MHz *
BUW64A	n-p-n	90	140	50	20	5	2	0.8	5	0.5	0.25	0.5	1199	TO-220AB	50 MHz *
BUX39	n-p-n	90	120	120	15-45	12	4	1.6	20	2.5	1.5	0.3	1211	TO-204AA/TO-3	50 MHz *
2N5038	n-p-n	90	150	140	20-100	12	5	1	12	1.2	0.5	0.5	698	TO-204AA/TO-3	80 MHz *
2N5671	n-p-n	90	120	140	20-100	15	2	0.8	15	1.2	0.5	0.5	383	TO-204AA/TO-3	50 MHz *
2N6032	n-p-n	90	120	140	10-50	50	2.6	1.3	50	5	1	0.5	462	TO-204AE/TO-3	50 MHz *
BODY90	n-p-n	100	120	40	30-120	5	5	0.5	5	0.5	---	0.2	1289	TO-204AA/TO-3	80 MHz *
2N6703	n-p-n	110	160	50	20	5	2	0.8	5	0.5	0.25	0.5	1187	TO-220AB	50 MHz *
BUW64B	n-p-n	110	160	50	20	5	2	0.8	5	0.5	0.25	0.5	1199	TO-220AB	50 MHz *
2N6496	n-p-n	110	130	140	12-100	8	2	1	8	0.8	0.5	0.5	698	TO-204AA/TO-3	80 MHz *
BODY56	n-p-n	120	150	117	20-70	4	4	1.1	4	0.4	0.5	2	1215	TO-204AA/TO-3	80 MHz *
2N6354	n-p-n	120	130	140	10-100	10	2	1	10	1	0.3	0.2	582	TO-204AA/TO-3	80 MHz *
2N5672	n-p-n	120	150	140	20-100	15	2	0.8	15	1.2	0.5	0.5	383	TO-204AA/TO-3	50 MHz *
2N6033	n-p-n	120	150	140	10-50	40	2	1	40	4	1	0.5	462	TO-204AE/TO-3	50 MHz *
BUX40A	n-p-n	125	150	120	15-80	10	4	1.2	10	1	1.2	0.4	1217	TO-204AA/TO-3	80 MHz *
BUX20A	n-p-n	125	140	140	20-60	20	2	0.8	20	2	0.7	0.5	1264	TO-204AA/TO-3	50 MHz *
BUX10A	n-p-n	125	160	150	20-60	10	2	1.5	20	2	1.5	0.2	1216	TO-204AA/TO-3	50 MHz *

# High-Speed Switching Power Transistors

Sorted by ascending Breakdown Voltage (V<sub>ceo</sub>), Secondary Sort by P<sub>t</sub>

Part No.	n-p-n p-n-p	V <sub>ceo</sub> (sus) V	V <sub>ceX</sub> (sus) V	P <sub>t</sub> W		H <sub>fe</sub>		V <sub>ce(sat)</sub> -V			T <sub>f</sub> us	T <sub>r</sub> us	File No.	Package	F <sub>t</sub>
						I <sub>c</sub> A	V <sub>ce</sub> V	I <sub>c</sub> A	I <sub>b</sub> A	I <sub>b</sub> A					
D44Q1	n-p-n	127	200	31.25	30 min.	2	10	1	2	0.2	--	--	15.19	TO-220AB	50 MHz
2N6704	n-p-n	130	180	50	20	4	2	0.7	4	0.4	0.25	0.5	1187	TO-220AB	50 MHz *
BUW64C	n-p-n	130	180	50	20	4	2	0.7	4	0.4	0.25	0.5	1199	TO-220AB	50 MHz *
RCA6340	n-p-n	140	--	200	12 min.	25	2.5	1.8	25	2.5	0.3	0.25	1205	TO-204AA/TO-3	
RCA6341	n-p-n	150	--	200	12 min.	25	2.5	1.8	25	2.5	0.3	0.25	1205	TO-204AA/TO-3	
BDY58R	n-p-n	160	250	175	20-60	10	4	1.4	10	1	1	2	1206	TO-204AA/TO-3	
RJH6686	n-p-n	160	210	200	15 min.	25	2	1.5	25	2.5	0.6	0.8	1171	TO-218AC	
2N6686@	n-p-n	160	260	200	15 min.	25	2	1.5	25	2.5	0.35	0.25	1171	TO-204AA/TO-3	
D44Q3	n-p-n	175	250	31.25	30 min.	2	10	1	2	0.2	--	--	15.19	TO-220AB	50 MHz
2N6687@	n-p-n	180	280	200	15 min.	25	2	1.5	25	2.5	0.35	0.25	1171	TO-204AA/TO-3	
BUX11A	n-p-n	190	250	200	20-60	8	2	0.6	8	0.8	1	0.4	1352	TO-204AA/TO-3	
RJH6688	n-p-n	200	250	200	15 min.	20	2	1.5	20	2	0.6	0.8	1171	TO-218AC	
2N6688@	n-p-n	200	300	200	15 min.	20	2	1.5	20	2	0.35	0.25	1171	TO-204AA/TO-3	
BUX21	n-p-n	200	250	250	20-60	12	2	0.6	12	1.2	1.2	0.4	1172	TO-204AA/TO-3	
D40V2	n-p-n	250	300	9	30 min.	0.04	10	1	0.02	0.002	--	--	15.8	TO-202	50 MHz *
D40V1	n-p-n	250	300	9	20 min.	0.04	10	1	0.02	0.002	--	--	15.8	TO-202	50 MHz *
D44T1	n-p-n	250	300	31.2	30 min.	0.5	10	1	0.5	0.05	--	--	15.20	TO-220AB	45 MHz
D44T2	n-p-n	250	300	31.2	75 min.	0.5	10	1	0.5	0.05	--	--	15.20	TO-220AB	45 MHz
D40V3	n-p-n	300	350	9	20 min.	0.04	10	1	0.02	0.002	--	--	15.8	TO-202	50 MHz *
D44T4	n-p-n	300	400	31.2	75 min.	0.5	10	1	0.5	0.05	--	--	15.20	TO-220AB	45 MHz
D44T3	n-p-n	300	400	31.2	30 min.	0.5	10	1	0.5	0.05	--	--	15.20	TO-220AB	45 MHz

\* Minimum



# Rectifiers

## Harris Rectifier Families (3)

### Definitions

**Rectifier:** A rectifier allows current flow in one direction only. The difference between a Diode and a Rectifier is that a Rectifier is usually rated at a breakdown voltage of greater than 50 volts and has a power rating that is greater than 0.5 watts.

**Bridge rectifier:** Also known as a full wave rectifier, the bridge rectifier generates a DC output equal to the average value of the rectified sine wave. Beside power supplies Bridge Rectifiers are used in AC Voltmeters where they convert AC inputs to direct current suitable for driving DC meters.

### Ultra Fast Recovery Rectifiers

#### Features:

25 to 75ns reverse recovery time (trr)  
Reverse voltage range between 50 to 1200 volts  
Current peak (Ifsm) handling capability up to 325 amps  
Single or dual rectifier style available  
Various package style including axial & radial type of devices

#### Applications:

Power supplies in the 100-500 KHz switching range

### Fast Recovery Rectifiers

#### Features:

200ns reverse recovery time (trr)  
Reverse voltage range between 50 to 600 volts  
Current peak handling capability up to 5 amps

#### Applications:

Power supplies in the 20-40 KHz switching range

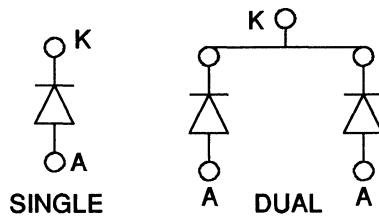
### General Purpose Rectifiers

#### Features:

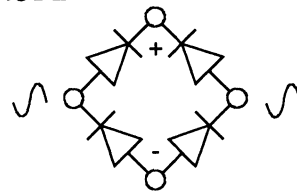
5 to 6us reverse recovery time (trr)  
Reverse voltage range between 50 to 1000 volts  
Current peak handling capability up to 5 amps  
Bridge rectifiers with 50 amps forward peak surge & reverse voltage between 50 to 1000 volts

#### Applications:

Power supplies




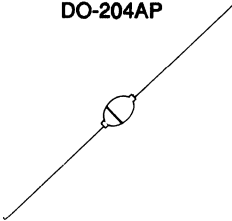
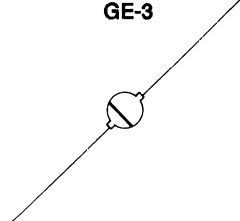
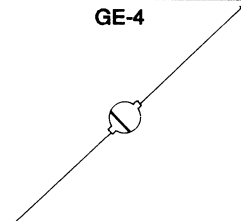

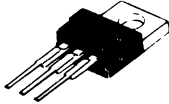
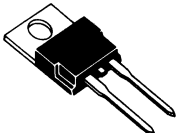
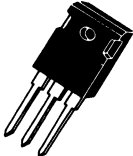
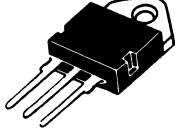
A = ANODE  
K = CATHODE



BRIDGE

# Rectifiers

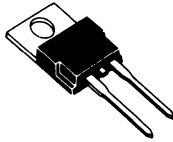
## Package Styles

<b>BR-4</b> 	<b>DO-204AP</b> 	<b>GE-3</b> 
<b>GE-4</b> 	<b>TO-204AA (TO-3)</b> 	<b>TO-220AB</b> 
<b>TO-220AC</b> 	<b>TO-247</b> 	<b>TO-218</b> 

### Harris Rectifier Prefixes

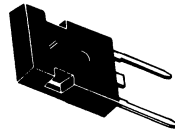
1N  
A  
BYW  
DB  
GE  
GER  
MUR  
PCR  
RUR  
RURD

# Ultra-Fast Recovery Rectifiers



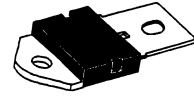
TO-220AC

$I_F(AVG)$



2 leaded TO-247

$I_F(AVG)$



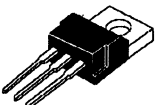

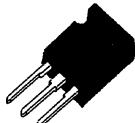

Single Lead TO-218

$I_F(AVG)$

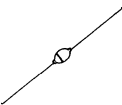
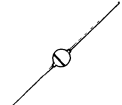
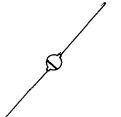

$V_{RRM}$	8A	15A	30A	30A	50A	80A	50A	80A	100A	150A
100V	MUR810 RUR810	MUR1510 RUR1510	RUR3010	RURG3010						
150V	MUR815 RUR815	MUR1515 RUR1515	RUR3015	RURG3015						
200V	MUR820 RUR820	MUR1520 RUR1520	RUR3020	RURG3020						
400V	MUR840 RUR840	MUR1540 RUR1540	RUR3040	RURG3040	RURG5040	RURG8040	RURU5040	RURU8040	RURU10040	RURU15040
500V	MUR850 RUR850	MUR1550 RUR1550	RUR3050	RURG3050	RURG5050	RURG8050	RURU5050	RURU8050	RURU10050	RURU15050
600V	MUR860 RUR860	MUR1560 RUR1560	RUR3060	RURG3060	RURG5060	RURG8060	RURU5060	RURU8060	RURU10060	RURU15060
700V	MUR870E RUR870	RUR1570	RUR3070	RURG3070	RURG5070	RURG8070	RURU5070	RURU8070	RURU10070	RURU15070
800V	MUR880E RUR880	RUR1580	RUR3080	RURG3080	RURG5080	RURG8080	RURU5080	RURU8080	RURU10080	RURU15080
900V	MUR890E RUR890	RUR1590	RUR3090	RURG3090	RURG5090	RURG8090	RURU5090	RURU8090	RURU10090	RURU15090
1000V	MUR8100E RUR8100	RUR15100	RUR30100	RURG30100	RURG50100	RURG80100	RURU50100	RURU80100	RURU100100	RURU150100
1200V									RURU100120	

**SHADING** = Future Product Offerings

# Ultra-Fast Recovery Rectifiers

						
	TO-220AB	TO-218		TO-247		TO-204AA
	$I_F(AVG)$	$I_F(AVG)$		$I_F(AVG)$		$I_F(AVG)$
$V_{RRM}$	8Ax2	15Ax2	30Ax2	15Ax2	30Ax2	16Ax2
100V	MUR1610CT RUR1610CT BYW51100 RURD810	MUR3010PT RURD1510	RURD3010	RURDG1510	RURDG3010	RURD1610
150V	MUR1615CT RUR1615CT BYW51150 RURD815	MUR3015PT RURD1515	RURD3015	RURDG1515	RURDG3015	RURD1615
200V	MUR1620CT RUR1620CT BYW51200 RURD820	MUR3020PT RURD1520	RURD3020	RURDG1520	RURDG3020	RURD1620
400V		MUR3040PT RURD1540	RURD3040	RURDG1540	RURDG3040	
500V		MUR3050PT RURD1550	RURD3050	RURDG1550	RURDG3050	
600V		MUR3060PT RURD1560	RURD3060	RURDG1560	RURDG3060	
700V		RURD1570	RURD3070	RURDG1570	RURDG3070	
800V		RURD1580	RURD3080	RURDG1580	RURDG3080	
900V		RURD1590	RURD3090	RURDG1590	RURDG3090	
1000V		RURD15100	RURD30100	RURDG15100	RURDG30100	

# Axial Lead and Bridge Rectifiers

	 DO-204APC $I_F(\text{AVG})$							 GE-3 $I_F(\text{AVG})$		 GE-4 $I_F(\text{AVG})$		 4-DIP $I_F(\text{AVG})$
$V_{RRM}$	1A	1A	1A	1A	1A	2A	2.5A/2.0A	3A	3A	3A	6A/5A	1A
50V	A14F		GER4001	A114F	GE1001	A214F	2.5A/2.0A	A15F	A115F	A315F	GE1301	DB1F
100V	A14A		GER4002	A114A	GE1002	A214A	GE1101	A15A	A115A	A315A	GE1302	DB1A
150V					GE1003	A214G	GE1102			A315G	GE1303	
200V	1N5059	1N4245	GER4003	A114B	GE1004	A214B	GE1103	1N5624	A115B	A315B	GE1304	DB1B
300V	A14C			A114C			GE1104		A115C			
400V	1N5060	1N4246	GER4004	A114D				1N5625	A115D			DB1D
500V	A14E			A114E					A115E			
600V	1N5061	1N4247	GER4005	A114M				1N5626	A115M			DB1M
800V	1N5062	1N4248	GER4006					1N5627				DB1N
1000V	A14P	1N4249	GER4007									DB1P
$t_{RR}(\mu\text{sec})$	5/6	5		0.2	0.025/0.040	0.035/	0.025/0.050	5	0.15/0.25	0.035	0.030/0.050	

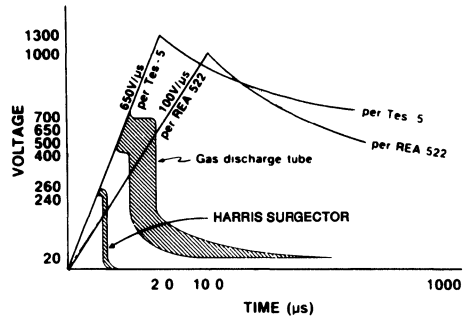
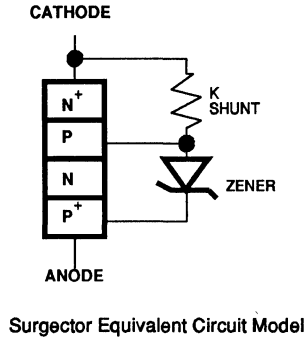




# Transient Voltage Suppression Devices

## Surgeprotectors

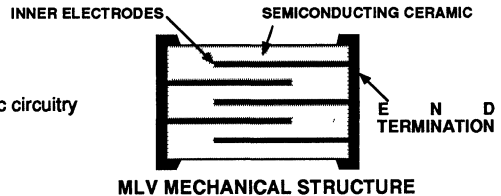
- Protects electronics and people that may be exposed to high energy transients
- Shunts high current and clamps voltage induced by power crosses, lightning and induced high voltages away from sensitive electronic circuitry
- SCR-type npnp semiconductor device with embedded zener across gate region
- Used exclusively for telecom or datacomm protection
- UL Approved under file #E135010



## Varistors

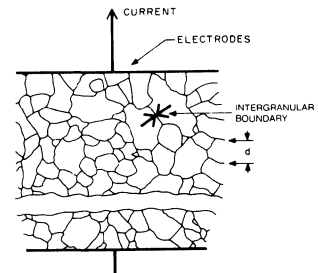
### MLVs - Multi Layer Varistors

- Passive ceramic dielectric-based device for protecting electronic circuitry and people from dangerous automotive high voltage transients
- More efficient than MOVs, no lead inductance, surface mount
- Specifically designed for automotive applications



### MOVs - Metal Oxide Varistors

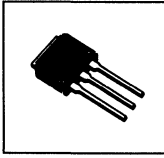
- Passive zinc oxide-based device for protecting electronic circuitry and people from dangerous high voltage transients
- Every electronic circuit has a need for transient voltage protection, ie TVS
- Harris has a device for every application
- Used in virtually any application; AC DC, telecom, datacom, power supplies, automotive, motor control.
- Clamps high voltage transients and absorbs excess energy produced by transients.



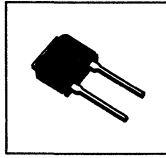
# Transient Voltage Suppression Devices

## Surgeor Packages

Modified TO-202 Package Style



Package A



Package B

SGT 03 U 13

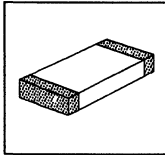
Holding current in millamps divided by 10

Type of Surgeor:  
 U = Unidirectional  
 B = Bidirectional  
 S = SCR

Off-State Voltage Rating divided by 10

Surgeor

## Multi-Layered Varistor (MLV) Series Packages



MLV Series

V 220 MLA 1206 A23

Packing Quantity  
 A22 = <100 pc  
 H23 = 2000 pc  
 T23 = 8000 pc

Device Size:  
 i.e., 120mil x 60 mil

Product Series

$V_N$ (dc) Nominal Varistor Voltage

MLV Varistor

CH 	RA 
ZA 	MA 
DB 	BA, BB 
CP 	LA 
PA 	DA 
CA 	

V 130 LA 20 A

Selection - Clamping Voltage (A or B)

Relative Energy Indicator

Product Series

Max RMS Applied Voltage

MOV Varistor

V 220 MA 4 A

Selection - Clamping Voltage (A or B)

Relative Energy Indicator

Product Series

$V_N$ (dc) Nominal Varistor Voltage

MOV Varistor

# Transient Voltage Suppression Devices

SURGECTORS™, Multi-Layered Varistors (MLVs) and Metal-Oxide Varistors (MOVs) are designed to protect voltage-sensitive circuit components against damage from high-energy transient-voltage spikes. The protection afforded

by these devices not only guards expensive and voltage-sensitive equipment from physical damage, but also improves functional reliability in components that can encounter temporary upset due to transient voltages of lower amplitudes.

## Typical Transient Surge Suppressor Applications

Transient Surge Suppression Devices	Data Lines	Telecom (Primary)	Telecom (Secondary)	AC Power Lines	DC Power & Automotive
<b>SURGECTOR</b>	✓	✓	✓		✓
<b>MOV</b>	✓	✓	✓	✓	✓
<b>AVALANCHE DIODE</b>	✓		✓		✓
<b>GAS TUBE</b>		✓			
<b>MLV</b>	✓				✓

## Comparison of Surge Suppression Devices

Transient Surge Suppression Devices	Major Advantages/Uses	Major Limitations
<b>SURGECTOR</b>	<ul style="list-style-type: none"> <li>+ Ideal for datacom and telecom</li> <li>+ Leakage - &lt;50 nanoamps</li> <li>+ Shunt capacitance - &lt;50 pF</li> <li>+ Subnanosecond response</li> <li>+ Lifetime unlimited @ 200 Amps, 8x20 μS pulse shape</li> <li>+ Failure mode - Short circuit</li> </ul>	<ul style="list-style-type: none"> <li>- Cannot be used in DC circuits where available current exceeds holding current</li> <li>- Surge current capability - 200 Amps @ 8x20 μS pulse shape</li> <li>- Limited AC line protection capability</li> </ul>
<b>METAL-OXIDE VARISTOR (MOV)</b>	<ul style="list-style-type: none"> <li>+ Ideal for AC power lines; suitable for low-voltage logic protection</li> <li>+ Subnanosecond response</li> <li>+ Units available up to 70,000 Amps surge</li> <li>+ Lifetime @ 1000 Amps, 8x20 μS pulse shape - 1000 surges</li> <li>+ Failure mode - Short circuit</li> </ul>	<ul style="list-style-type: none"> <li>- Shunt capacitance - &gt;500 pF</li> <li>- Leakage - approximately 10 microamps</li> <li>- Clamp voltage goes up with current</li> </ul>
<b>AVALANCHE DIODE</b>	<ul style="list-style-type: none"> <li>+ Ideal for low-voltage logic protection</li> <li>+ Subnanosecond response</li> <li>+ Lifetime @ 50 Amps, 8x20 μS pulse shape - unlimited</li> <li>+ Shunt capacitance - 50 pF</li> <li>+ Failure mode - Short circuit</li> </ul>	<ul style="list-style-type: none"> <li>- Low-surge capability - 50 Amps @ 8x20 μS pulse shape</li> <li>- Leakage - approximately 10 microamps</li> <li>- Clamp voltage goes up with current</li> </ul>
<b>GAS TUBE</b>	<ul style="list-style-type: none"> <li>+ Wide use in telecom for primary protection</li> <li>+ High surge capability - &gt;20,000 Amps</li> <li>+ Leakage - subpicoamps</li> <li>+ Shunt capacitance - &lt;1 pF</li> <li>+ Lifetime @ 500 Amps, 8x20 μS pulse width - 200 surges</li> </ul>	<ul style="list-style-type: none"> <li>- Response time - &lt;5 microseconds</li> <li>- Failure mode - Open circuit</li> <li>- Follow-on current because of "crowbar"</li> <li>- Trigger voltage changes with time</li> <li>- Limited Life</li> </ul>
<b>MULTI-LAYER VARISTOR (MLV)</b>	<ul style="list-style-type: none"> <li>+ Ideal for automotive, CMOS, and computer applications up to 68V</li> <li>+ Zero lead inductance surface mount</li> <li>+ 508A, 8120μs non-repetitive surge current</li> <li>+ Instantaneous response</li> <li>+ Failure mode short circuit</li> </ul>	<ul style="list-style-type: none"> <li>- Only available to 68 volts</li> <li>- Shunt capacitance - 2000pF @ 1MHz</li> </ul>

# Transient Voltage Suppression Devices

## SURGECTORS

- Zener (avalanche) diode and SCR-type thyristor
- Zener provides continuous low voltage protection
- Thyristor provides instantaneous protection against fast rising transients

## SURGECTOR Characteristics

- High input impedance until breakdown (i.e., low leakage)
- Repeatable breakdown/threshold voltage
- High surge current handling capability
- Withstand and respond to rapidly recurring surges
- Fast recovery to high impedance state (turn off)
- Dual polarity protection
- No degradation of essential characteristics with use

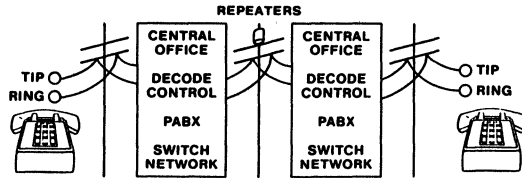
## Glossary

**Varistor Clamp** – Provides external pin to turn surge protector on or off.

**Unidirectional** – Handles positive OR negative going transient waveforms.

**Bidirectional** – Handles positive AND negative going transient waveforms.

**Clamping Voltage (Vz)** – Off state voltage at a specified current.



## SURGECTORS Provide Transient Protection for:

- **Central Office Equipment**
- **Supervisory Equipment**
- **Switchgear Equipment**
- **Data Transmission**
- **Handsets**
- **EPABX, PABX, PBX**
- **Repeaters**
- **Line Concentrator**
- **Receivers**
- **Headsets**
- **Modem**
- **PCM**

**Breakdown Voltage (Vba)** – Voltage at which the surge protector switches from the off state to the on state.

**Holding Current (Ih)** – Minimum on state current that will hold the surge protector in the on state after it has been latched on.

**Max Peak Surge Current (I<sub>tSM</sub>)** – Maximum non-repetitive current which may be allowed to flow for the time state.

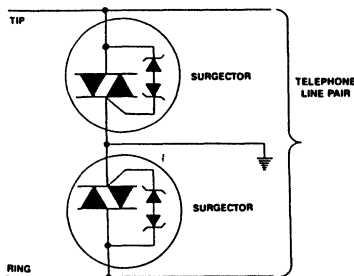
TYPE NO.	FUNCTION	V <sub>2</sub> MIN V	V <sub>BO</sub> MAX (100V/μs)	I <sub>TSM</sub> (1 x 2μs)	I <sub>TSM</sub> (10 x 1000μs)	I <sub>H</sub> mA/	PACKAGE STYLE
SGT10S10†	VAR CLAMP	100	†	300	100	> 100	A
SGT27S10†	VAR CLAMP	270	†	300	100	> 100	A
SGT27S23†	VAR CLAMP	270	†	300	100	> 230	A
SGT03U13	UNI-DIRECT	30	< 50	300	100	> 130	B
SGT06U13	UNI-DIRECT	60	< 85	300	100	> 130	B
SGT23U13	UNI-DIRECT	230	< 275	300	100	> 130	B
SGT23BC13	BI-DIRECT	230	< 285	300	100	> 130	B
SGT27BC13	BI-DIRECT	270	< 345	300	100	> 130	B
SGT23BC32*	BI-DIRECT	230	< 290	300	100	> 320	B
SGT27BC32*	BI-DIRECT	270	< 350	300	100	> 320	B
SGT23BH27	BI-DIRECT	230	< 290	600	200	> 270	B
SGT27BH27	BI-DIRECT	270	< 350	600	200	> 270	B
SGT23DC13*	DUAL BI-DIRECT	230	< 285	300	100	> 130	A
SGT27DC13*	DUAL BI-DIRECT	270	< 345	300	100	> 130	A
SGT23DC32*	DUAL BI-DIRECT	230	< 290	300	100	> 320	A
SGT27DC32*	DUAL BI-DIRECT	270	< 350	300	100	> 320	A

† Dependent on trigger circuit.

\* Preliminary Data Sheets.

All finalized devices UL recognized to 497B - File Number E135010.

## TYPICAL APPLICATIONS CIRCUIT

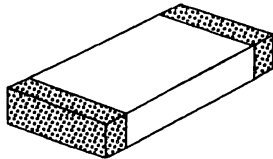


Two bidirectional SURGECTOR devices are placed between the tip and ring lines just after these lines enter the telephone to protect delicate telecommunications equipment.

# Transient Voltage Suppression Devices

## Multi-Layer Varistors (MLVs)

MLV's clamp incoming surge voltages to a protective level. Particularly suitable for automotive surface mount applications. More energy handling capability than MOV's per unit volume. Faster clamping response than leaded devices.



MLV SERIES

## Features

- Leadless Chip Form – Surface Mount – Zero Lead Inductance
- Available in Tape and Reel for Automatic Pick and Place
- +125°C Operating Temperature
- Low Profile, Compact Chip Size
- Compatible with Most Surface Mounting Assembly Equipment and Mounting Techniques

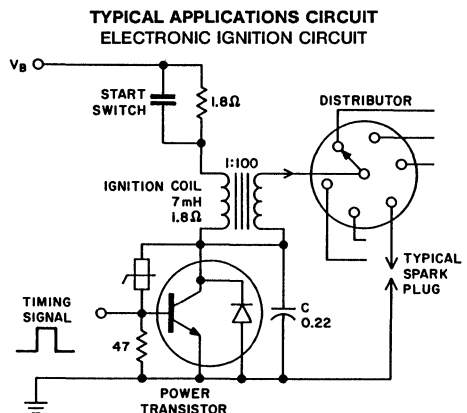
MODEL PART NO.	MAXIMUM RATINGS (+125°C)					
	MAXIMUM CONTINUOUS WORKING VOLTAGE		MAXIMUM REPETITIVE SURGE CURRENT (8/20µs)	MAXIMUM NON-REPETITIVE SURGE ENERGY (10/1000µs)	MAXIMUM CLAMPING VOLTAGE AT 1A	MAXIMUM CLAMPING VOLTAGE AT 10A
	DC VOLTAGE	AC VOLTAGE				
	V <sub>M(DC)</sub>	V <sub>M(AC)RMS</sub>	I <sub>tm</sub>	W <sub>tm</sub>	V <sub>C</sub>	V <sub>C</sub>
VOLTS	VOLTS	AMPS	JOULES	VOLTS	VOLTS	
V3.5MLA1206	3.5	2.5	150	0.3	12	14.0
V5.5MLA1206	5.5	4.0	150	0.4	13	15.5
V14MLA1206	14	10	150	0.4	27	30
V18MLA1206	18	14	150	0.4	36	40
V18MLA1210	18*	14	300	0.8**	33	36
V26MLA1206	26	20	150	0.6	52	56
V26MLA1210	26	20	300	1.2	49	54
V33MLA1206	33	23	180	0.8	57	62
V42MLA1206	42	30	200	0.8	70	76
V56MLA1206	56	40	200	1.0	90	100
V68MLA1206	68	50	200	1.0	105	120

Average power dissipation of transients not to exceed 0.25 watts.

\* Rated to withstand 24.5 volts Jump Start for 5 minutes



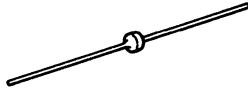
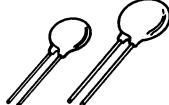

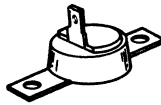
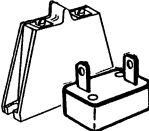
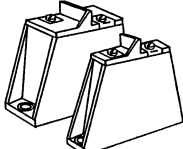

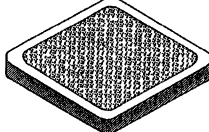

\*\* Energy rating impulse duration of 30 milliseconds to one half of current peak value (Load Dump = 1.5 Joules)

TERM	DEFINITION
DC Voltage, V <sub>M(dc)</sub>	Maximum allowable steady state dc applied voltage.
RMS Voltage, V <sub>M(ac)</sub>	Maximum allowable steady state sinusoidal voltage (RMS) at 50–60Hz.
Energy, W <sub>tm</sub>	Maximum allowable energy for a single impulse of 10/1000µs current waveform.
Peak Current, I <sub>tm</sub>	Maximum allowable peak current for a single impulse of 8/20µs waveform with rated continuous voltage applied.
Varistor Voltage, V <sub>N(dc)</sub>	Varistor peak terminal voltage measured with a specified current applied.
Clamping Voltage, V <sub>C</sub>	Maximum terminal voltage measured with an applied 8/20µs impulse of a given peak current.
Capacitance	Typical values measured at a test frequency of 1.0MHz.



# Transient Voltage Suppression Devices

## Metal-Oxide Varistor (MOV)

<p><b>CH SERIES</b></p>  A rectangular component with a series of vertical ridges on its top surface.	<p><b>CP SERIES</b></p>  Three cylindrical components with wire leads extending from their ends.	<p><b>MA SERIES</b></p>  A long, thin cylindrical component with a small circular feature in the center of its length.
<p><b>LA, ZA SERIES</b></p>  Two components with rounded, dome-like tops and wire leads extending from the base.	<p><b>RA SERIES</b></p>  Three small, rectangular components with wire leads extending from their sides.	<p><b>PA SERIES</b></p>  A cylindrical component with a central vertical pin and a mounting bracket on one side.
<p><b>DA/DB SERIES</b></p>  Two components with a trapezoidal shape and wire leads extending from the bottom.	<p><b>BA/BB SERIES</b></p>  Two components with a trapezoidal shape and wire leads extending from the top and bottom.	<p><b>CA SERIES</b></p>  A simple cylindrical component.
<p><b>NA SERIES</b></p>  A large, square component with a dense grid of small rectangular elements on its top surface.	<p><b>HA SERIES</b></p>  A dark, rounded component with two wire leads extending from the top.	

# Transient Voltage Suppression Devices

## Metal-Oxide Varistor (MOV)

- MOV's clamp incoming surge voltages to a protective level
- Used in virtually any commercial or industrial application
- Current, voltage and energy capability determined by package size
- Wide selection of voltage and energy ratings

Voltage			CH Series	CP Series			MA Series*	LA, ZA Series				
Vm** (ac)	Vm** (dc)	Vn** (dc)	CH8 5 x 8 mm	CP16 16 Gauge	CP20 20 Gauge	CP22 22 Gauge	3 mm	5 mm	7 mm	10 mm	14 mm	20 mm
4	5.5	8.2						V8ZA05	V8ZA1	V8ZA2		
6	8	12						V12ZA05	V12ZA1	V12ZA2		
10	14	18	V18CH8				V18MA1B, S	V18ZA05	V18ZA1	V18ZA2	V18ZA3	V18ZA40
14	18	22	V22CH8				V22MA1B, S	V22ZA05	V22ZA1	V22ZA2	V22ZA3	
14	18	24										V24ZA50
17	22	27	V27CH8				V27MA1B, S	V27ZA05	V27RA1	V27ZA2	V27ZA4	V27ZA60
20	26	33	V33CH8				V33MA1B, S	V33ZA05	V33ZA1	V33ZA2	V33ZA5	
21	27	33										V33ZA70
23	31	36										V36ZA80
25	31	39	V39CH8		V39CP20	V39CP22	V39MA2B, S	V39ZA05	V39ZA1	V39ZA3	V39ZA6	
30	38	47	V47CH8	V47CP16	V47CP20	V47CP22	V47MA2B, S	V47ZA05	V47ZA1	V47ZA3	V47ZA7	
35	45	56	V56CH8				V56MA2B, S	V56ZA05	V56ZA2	V56ZA3	V56ZA8	
40	56	68	V68CH8				V68MA3B, S	V68ZA05	V68ZA2	V68ZA3	V68ZA10	
50	66	82	V82CH8				V82MA3B, S	V82ZA05	V82ZA2	V82ZA4	V82ZA12	
60	81	100	V100CH8				V100MA4B, S	V100ZA05	V100ZA3	V100ZA4	V100ZA15	
75	102	120	V120CH8				V120MA2B, S	V120ZA05	V120ZA1	V120ZA4	V120ZA6	
92	127	150					V150MA2B	V150ZA05				
95	127	150	V150CH8						V150ZA1	V150ZA4	V150ZA8	
110	152	180					V180MA3B	V180ZA05				
115	153	180	V180CH8						V180ZA1	V180ZA5	V180ZA10	
130	175	200		V200CP16	V200CP20	V200CP22						
130	175	200	V200CH8						V130LA1, 2	V130LA5	V130LA10A	V130LA20A, B
140	180	220	V220CH8					V220ZA05	V140LA2	V140LA5	V140LA10A	
150	150	240	V240CH8	V240CP16	V240CP20	V240CP22						
150	200	240							V150LA1, 2	V150LA5	V150LA10A	V150LA20A, B
175	225	270						V270ZA05	V175LA2		V175LA10A	
210	275	330						V330ZA05				
230	300	360	V360CH8						V230LA4	V230LA10	V230LA20A	
250	330	390	V390CH8					V390ZA05	V250LA2, 4	V250LA10	V250LA20A	V250LA40A, B
275	369	430	V430CH8					V430ZA05	V275LA2, 4	V275LA10	V275LA20A	V275LA40A, B
300	405	470						V470ZA05	V300LA2, 4			
320	420	510									V320LA20A	V320LA40B
420	560	680						V680ZA05		V420LA10	V420LA20A	V420LA20B
480	640	750						V750ZA05			V480LA40A	V480LA80B
510	675	820									V510LA40A	V510LA80B
575	730	910									V575LA40A	V575LA80B
660	850	1050									V660LA50A	V660LA100B
750	970	1200										
880	1150	1500										
1000	1200	1600									V1000LA80A	V1000LA160B
1100	1400	1800										
1400	1750	2200										
1700	2150	2700										
2000	2500	3300										
2400	3000	3900										
2800	3500	4700										

\* Additional voltage selections are available for the MA series.

\*\* Vm (ac) = max steady state AC voltage allowable

Vm (dc) = max steady state DC voltage allowable

Vn (dc) = varistor peak voltage measured with 1mA current applied

### Features:

#### CH Series

##### Surface-Mount Varistors

- Better Performance
- Higher Reliability
- Lower Equipment Cost
- Saves on Board Height/Bulk/Weight

#### CP Series

##### Connector-Pin Varistors

- Provides Transient Protection in Connectors
- Available in 22-, 20-, and 16-Gauge Sizes

#### MA Series

- Axial Package
- Wide Voltage Range
- Automatic Insertion

#### LA Series

- Radial Package
- Line-Voltage Operation
- UL Recognized

#### ZA Series

- Radial Package
- Low-Voltage Operation



# Transient Voltage Suppression Devices

## Metal-Oxide Varistor (MOV) (continued)

Voltage			RA Series			PA Series	DA/DB Series		BA/BB Series	CA Series		
Vm (ac)	Vm (dc)	Vn (dc)	RA8	RA16	RA22	20 mm	DA 40 mm	DB 40 mm	60 mm	32 mm	40 mm	60 MM
4	5.5	8.2	V8RA8									
6	8	12	V12RA8									
10	14	18	V18RA8	V18RA16								
14	18	22	V22RA8	V22RA16								
14	18	24			V24RA22							
17	22	27	V27RA8	V27RA16								
20	26	33	V33RA8	V33RA16								
21	27	33										
23	31	36			V36RA22							
25	31	39	V39RA8	V39RA16								
30	38	47	V47RA8	V47RA16								
35	45	56	V56RA8	V56RA16								
40	56	68	V68RA8	V68RA16								
50	66	82	V82RA8	V82RA16								
60	81	100	V100RA8	V100RA16								
75	102	120	V120RA8	V120RA16								
92	127	150										
95	127	150	V150RA8	V150RA16								
110	152	180										
115	153	180	V180RA8	V180RA16								
130	175	200										
130	175	200	V200RA8	V200RA16	V200RA22	V130PA20A, C	V131DA40	V131DB40	V131BA60	V131CA32	V131CA40	
140	180	220	V220RA8	V220RA16								
150	150	240										
150	200	240	V240RA8	V240RA16	V240RA22	V150PA20A, C	V151DA40	V151DB40	V151BA60	V151CA32	V151CA40	
175	225	270	V270RA8	V270RA16	V270RA22							
210	275	330										
230	300	360	V360RA8	V360RA16								
250	330	390	V390RA8	V390RA16	V390RA22	V250PA40A, C	V251DA40	V251DB40	V251BA60	V251CA32	V251CA40	V251CA60
275	369	430	V430RA8	V430RA16	V430RA22	V275PA40A, C	V271DA40	V271DB40	V271BA60	V271CA32	V271CA40	V271CA60
300	405	470										
320	420	510				V320PA40A, C	V321DA40	V321DB40	V321BA60	V321CA32	V321CA40	V321CA60
420	560	680				V420PA40A, C	V421DA40	V421DB40	V421BA60	V421CA32	V421CA40	V421CA60
480	640	750				V480PA80A, C	V481DA40	V481DB40	V481BA60	V481CA32	V481CA40	V481CA60
510	675	820				V510PA80A, C	V511DA40	V511DB40	V511BA60	V511CA32	V511CA40	V511CA60
575	730	910				V575PA80A, C	V571DA40	V571DB40	V571BA60	V571CA32	V571CA40	V571CA60
660	850	1050				V660PA100A, C	V661DA40	V661DB40	V661BA60	V661CA32	V661CA40	V661CA60
750	970	1200					V751DA40	V751DB40	V751BA60	V751CA32	V751CA40	V751CA60
880	1150	1500							V881BA60			V881CA60
1000	1200	1600										
1100	1400	1800							V112BB60			V112CA60
1400	1750	2200							V142BB60			V142CA60
1700	2150	2700							V172BB60			V172CA60
2000	2500	3300							V202BB60			V202CA60
2400	3000	3900							V242BB60			V242CA60
2800	3500	4700							V282BB60			V282CA60

### Features:

#### RA Series

- Low Height Profile
- High-Temperature Capability
- Precise Seating Plane
- In-Line Leads

#### PA Series

- Rigid Mountdown
- NEMA Creep-and-Strike Distance
- Quick-Connect Terminal
- UL Recognized

#### DA/DB & BA Series

- High-Energy Capability
- Rigid Terminals
- Isolated
- Low Inductance
- Improved Creep and Strike
- UL Recognized

#### CA Series

- Industrial Discs
- High Reliability Series**
  - 100% Prescreened
  - 100% Process Conditioning
  - Meets Military Specifications

# Transient Voltage Suppression Devices

## Metal-Oxide Varistor (MOV) (Continued)

Voltage			NA Series	HA Series				
V <sub>m</sub> (ac)	V <sub>m</sub> (dc)	V <sub>n</sub> (dc)	34mm	32mm	40mm	50mm	60mm	
4	5.5	8.2						
6	8	12						
10	14	18						
14	18	22						
14	18	24						
17	22	27						
20	26	33						
21	27	33						
23	31	36						
25	31	39						
30	38	47						
35	45	56						
40	56	68						
50	66	82						
60	81	100						
75	102	120						
92	127	150						
95	127	150						
110	152	180						
115	153	180						
130	175	200						
130	175	200	V131NA34	V131HA32	V131HA40			
140	180	220						
150	150	240	V151NA34					
150	200	240		V151HA32	V151HA40			
175	225	270						
210	275	330						
230	300	360						
250	330	390	V251MA34	V251HA32	V251HA40	V251HA50	V251HA60	
275	369	430	V271NA34	V271HA32	V271HA40	V271HA50	V271HA60	
300	405	470						
320	420	510	V321NA34	V321HA32	V321HA40	V321HA50	V321HA60	
420	560	680	V421NA34	V421HA32	V421HA40	V421HA50	V421HA60	
480	640	750	V481NA34	V481HA32	V481HA40	V481HA50	V481HA60	
510	675	820	V511NA34	V511HA32	V511HA40	V511HA50	V511HA60	
575	730	910	V571NA34	V571HA32	V571HA40	V571HA50	V571HA60	
660	850	1050	V661NA34	V661HA32	V661HA40	V661HA50	V661HA60	
750	970	1200	V751NA34	V751HA32	V751HA40	V751HA50	V751HA60	
880	1150	1500						
1000	1200	1600						
1100	1400	1800						
1400	1750	2200						
1700	2150	2700						
2000	2500	3300						
2400	3000	3900						
2800	3500	4700						

### Features

#### NA Series

#### Square Un-Packaged Varistors

- High Energy
- Stackable
- Solderable Electrode Finish

#### HA Series

- Industrial Packaging
- Available in 32, 40, 50 and 60mm Sizes
- Rigid Terminal Contacts

# Transient Voltage Suppression Devices

## CA Series



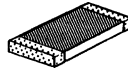
### Device Ratings and Characteristics

Model Number	Maximum Ratings (85°C)					Characteristics (25°C)				
	Size	Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>c</sub> @ 200 Amps (8/20μs)	Typical Capacitance
		RMS Voltage	DC Voltage	Energy (10/1000μs)	Peak Current (8/20μs)					
	mm	V <sub>mtac</sub>	V <sub>midc</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>Ndc1</sub>	Max.	V <sub>c</sub>	f = 1 MHz
	Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Picofarads	
V131CA32	32	130	175	200	20000	184	200	228	350	4700
V131CA40	40			270	30000				345	10000
V151CA32	32	150	200	220	20000	212	240	268	410	4000
V151CA40	40			300	30000				405	8000
V251CA32	32	250	330	330	20000	354	390	429	680	2500
V251CA40	40			370	30000				650	5000
V251CA60	60			880	50000				620	10000
V271CA32	32	275	369	360	20000	389	430	473	750	2200
V271CA40	40			400	30000				730	4500
V271CA60	60			950	50000				680	9000
V321CA32	32	320	420	390	20000	462	510	539	850	1900
V321CA40	40			460	30000				830	3800
V321CA60	60			1100	50000				760	7500
V421CA32	32	420	560	400	25000	610	680	748	1200	1500
V421CA40	40			600	40000				1130	3000
V421CA60	60			1500	70000				1060	6000
V481CA32	32	480	640	450	25000	670	750	825	1300	1300
V481CA40	40			650	40000				1240	2700
V481CA60	60			1600	70000				1160	5500
V511CA32	32	510	675	500	25000	735	820	910	1440	1200
V511CA40	40			700	40000				1350	2500
V511CA60	60			1800	70000				1300	5000
V571CA32	32	575	730	550	25000	805	910	1000	1600	1100
V571CA40	40			770	40000				1480	2200
V571CA60	60			2100	70000				1420	4500
V661CA32	32	660	850	600	25000	940	1050	1160	1820	1000
V661CA40	40			900	40000				1720	2000
V661CA60	60			2300	70000				1640	4000
V751CA32	32	750	970	700	25000	1080	1200	1320	2050	800
V751CA40	40			1050	40000				2000	1800
V751CA60	60			2600	70000				1880	3500
V881CA60	60	880	1150	3200	70000	1290	1500	1650	2340	2700
V112CA60	60	1100	1400	3200	70000	1620	1800	2060	2940	2200
V142CA60	60	1400	1750	5000	70000	2020	2200	2550	3600	1800
V172CA60	60	1700	2150	6000	70000	2500	2700	3030	4300	1500
V202CA60	60	2000	2500	7500	70000	2970	3300	3630	5200	1200
V242CA60	60	2400	3000	8600	70000	3510	3900	4290	6200	1000
V282CA60	60	2800	3500	10000	70000	4230	4700	5170	7400	800

# Transient Voltage Suppression Devices

## CH Series

### Device Ratings and Characteristics



Model Number	Maximum Ratings (125° C)				Characteristics (25° C)					
	Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>C</sub> @ Test Current (8/20μs)		Typical Capacitance
	RMS Voltage	DC Voltage	Energy (10/1000μs)	Peak Current (8/20μs)						
	V <sub>m(ac)</sub>	V <sub>m(dc)</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>N(dc)</sub>	Max.	V <sub>C</sub>	I <sub>p</sub>	f=1 MHz
Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads	
V18CH8	10	14	0.80	250	14.4	18.0	21.6	42	5	2000
V22CH8	14	**18	*10.0	250	18.7	22.0	26.0	47	5	1600
V27CH8	17	22	1.0	250	23.0	27.0	31.1	57	5	1300
V33CH8	20	26	1.2	250	29.5	33.0	36.5	68	5	1100
V39CH8	25	31	1.5	250	35.0	39.0	43.0	79	5	900
V47CH8	30	38	1.8	250	42.0	47.0	52.0	92	5	800
V56CH8	35	45	2.3	250	50.0	56.0	62.0	107	5	700
V68CH8	40	56	3.0	250	61.0	68.0	75.0	127	5	600
V82CH8	50	66	4.0	500	74.0	82.0	91.0	135	10	500
V100CH8	60	81	5.0	500	90.0	100.0	110.0	165	10	400
V120CH8	75	102	6.0	500	108.0	120.0	132.0	200	10	300
V150CH8	95	127	8.0	500	135.0	150.0	165.0	250	10	250
V180CH8	115	153	10.0	500	162.0	180.0	198.0	295	10	200
V200CH8	130	175	11.0	500	184.0	200.0	228.0	340	10	180
V220CH8	140	180	12.0	500	198.0	220.0	242.0	360	10	160
V240CH8	150	200	13.0	500	212.0	240.0	268.0	395	10	150
V360CH8	230	300	20.0	500	324.0	360.0	396.0	595	10	100
V390CH8	250	330	21.0	500	354.0	390.0	429.0	650	10	90
V430CH8	275	369	23.0	500	389.0	430.0	473.0	710	10	80

NOTE: Power dissipation of transients not to exceed 0.25 watt

\*Energy rating for impulse duration of 30 milliseconds minimum to one half of peak current value.

\*\*Also rated to withstand 24 volts for 5 minutes.

# Transient Voltage Suppression Devices

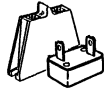
## CP Series



### Device Ratings and Characteristics

MODEL NUMBER	PART SIZE	MAXIMUM RATINGS (+125°)				CHARACTERISTICS (+25°C)						
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE @ 1mA DC TEST CURRENT			MAX. CLAMPING VOLTAGE V <sub>C</sub> @ TEST CURRENT (8/20µs)		CAPACITANCE f = 1MHz	
		RMS VOLT.	DC VOLT.	ENERGY (10/1000µs)	PEAK CURRENT (8/20µs)							
		V <sub>M(AC)</sub>	V <sub>M(DC)</sub>	W <sub>TM</sub>	I <sub>TM</sub>	MIN.	V <sub>N(DC)</sub>	MAX.	V <sub>C</sub>	I <sub>p</sub>	MIN.	MAX.
		VOLTS	VOLTS	JOULES	AMPS	VOLTS	VOLTS	VOLTS	VOLTS	AMPS	PICOFARADS	PICOFARADS
V12CP22	22B	6.0	8.0	1.5	250	12.5	18.0	19.5	34.0	10	1600	2750
V18CP22	22B	10.0	14.0	1.5	250	18.5	22.0	25.5	42.0	10	1600	2750
V39CP22	22B	25.0	31.0	1.5	250	35.0	39.0	43.0	85.0	5	450	1350
V47CP22	22B	30.0	38.0	1.5	250	42.0	47.0	52.0	100.0	5	450	1250
V200CP22	22A	130.0	130.0	2.4	300	184.0	200.0	228.0	375.0	5	150	350
V240CP22	22A	150.0	150.0	2.4	300	212.0	240.0	268.0	430.0	5	100	300
V39CP20	20B	25.0	31.0	2.0	300	35.0	39.0	43.0	85.0	10	700	2000
V47CP20	20B	30.0	38.0	2.0	300	42.0	47.0	52.0	100.0	10	650	1800
V200CP20	20A	130.0	130.0	3.0	400	184.0	200.0	228.0	375.0	10	150	400
V240CP20	20A	150.0	150.0	3.0	400	212.0	240.0	268.0	430.0	10	100	350
V47CP16	16A	30.0	38.0	3.0	350	42.0	47.0	52.0	100.0	20	1000	2500
V200CP16	16A	130.0	130.0	5.0	500	184.0	200.0	228.0	375.0	20	250	700
V240CP16	16A	150.0	150.0	5.0	500	212.0	240.0	268.0	430.0	20	200	650

## DA/DB Series



### Device Ratings and Characteristics

Series DA and DB Varistors are listed under UL file #E75961 as a recognized component.

Model Number		Maximum Ratings (85°C)				Characteristics (25°C)					
		Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>C</sub> @ 200 Amps Current (8/20µs)		Typical Capacitance
		RMS Voltage	DC Voltage	Energy (10/1000µs)	Peak Current (8/20µs)						
DA	DB	V <sub>M(AC)</sub>	V <sub>M(DC)</sub>	W <sub>TM</sub>	I <sub>TM</sub>	Min.	V <sub>N(DC)</sub>	Max.	V <sub>C</sub>	f = 1 MHz	
		Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Picofarads	
V131DA40	V131DB40	130	175	270	30000	184	200	228	345	10000	
V151DA40	V151DB40	150	200	300	30000	212	240	268	405	8000	
V251DA40	V251DB40	250	330	370	30000	354	390	429	650	5000	
V271DA40	V271DB40	275	369	400	30000	389	430	473	730	4500	
V321DA40	V321DB40	320	420	460	30000	462	510	539	830	3800	
V421DA40	V421DB40	420	560	600	40000	610	680	748	1130	3000	
V481DA40	V481DB40	480	640	650	40000	670	750	825	1240	2700	
V511DA40	V511DB40	510	675	700	40000	735	820	910	1350	2500	
V571DA40	V571DB40	575	730	770	40000	805	910	1000	1480	2200	
V661DA40	V661DB40	660	850	900	40000	940	1050	1160	1720	2000	
V751DA40	V751DB40	750	970	1050	40000	1080	1200	1320	2000	1800	

NOTE: Average power dissipation of transients not to exceed 2.0 watts.

# Transient Voltage Suppression Devices

HA Series



## Device Ratings and Characteristics

Model Number	Maximum Ratings (85°C)					Characteristics (25°C)				
	Continuous		Transient			Varistor Voltage @ 1 mA DC Test Current			Maximum Clamping Voltage V <sub>c</sub> @ 200 Amps (8/20 us)	Typical Capacitance
	RMS Voltage	DC Voltage	Energy (10/1000us)	Peak Current (8/20us)						
	Size	V <sub>m(ec)</sub>	V <sub>m(dc)</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>N(dc)</sub>	Max.	V <sub>c</sub>	f=1 MHz
mm	Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Picofarads	
V131HA32	32	130	175	200	25000	184	200	228	340	4700
V131HA40	40	130	175	270	40000	184	200	228	330	10000
V151HA32	32	150	200	220	25000	212	240	268	395	4000
V151HA40	40	150	200	300	40000	212	240	268	380	8000
V251HA32	32	250	330	330	25000	354	390	429	650	2500
V251HA40	40	250	330	370	40000	354	390	429	625	5000
V271HA32	32	275	369	360	25000	389	430	473	710	2200
V271HA40	40	275	369	400	40000	389	430	473	685	4500
V321HA32	32	320	420	390	25000	462	510	539	845	1900
V321HA40	40	320	420	460	40000	462	510	539	790	3800
V421HA32	32	420	560	400	25000	610	680	748	1120	1500
V421HA40	40	420	560	600	40000	610	680	748	1100	3000
V481HA32	32	480	640	450	25000	670	750	825	1290	1300
V481HA40	40	480	640	650	40000	670	750	825	1220	2700
V511HA32	32	510	675	500	25000	735	820	902	1355	1200
V511HA40	40	510	675	700	40000	735	820	902	1300	2500
V571HA32	32	575	730	550	25000	805	910	1000	1570	1100
V571HA40	40	575	730	770	40000	805	910	1000	1500	2200
V661HA32	32	660	850	600	25000	940	1050	1160	1820	1000
V661HA40	40	660	850	900	40000	940	1050	1160	1720	2000
V751HA32	32	750	970	700	25000	1080	1200	1320	2050	800
V751HA40	40	750	970	1050	40000	1080	1200	1320	2000	1800

6E

TVS

# Transient Voltage Suppression Devices

## LA Series

### Device Ratings and Characteristics

Series LA Varistors are listed under UL file #E75961 and E56529 as a recognized component.

V130RMS to V320RMS CSA approved File Number LR91788.

Model Number	Model Size Disc Dia. (mm)	Device Marking	Maximum Ratings (85°C)				Characteristics (25°C)					
			Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>C</sub> @ Test Current (8/20µs)		Typical Capacitance
			RMS Voltage	DC Voltage	Energy (10/1000µs)	Peak Current (8/20µs)				V <sub>C</sub>	I <sub>p</sub>	
			V <sub>m(ac)</sub>	V <sub>m(dc)</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>N(dc)</sub>	Max.	V <sub>C</sub>	I <sub>p</sub>	Picofarads
Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps				
V130LA1	7	1301	130	175	11	1200	184	200	255	390	10	180
V130LA2	7	1302	130	175	11	1200	184	200	228	340	10	180
V130LA5	10	1305	130	175	20	2500	184	200	228	340	25	450
V130LA10A	14	130L10	130	175	38	4500	184	200	228	340	50	1000
V130LA20A	20	130L20	130	175	70	6500	184	200	228	340	100	1900
V130LA20B	20	130L20B	130	175	70	6500	184	200	220	325	100	1900
V140LA2	7	1402	140	180	12	1200	198	220	242	360	10	160
V140LA5	10	1405	140	180	22	2500	198	220	242	360	25	400
V140LA10A	14	140L10	140	180	42	4500	198	220	242	360	50	900
V150LA1	7	1501	150	200	13	1200	212	240	284	430	10	150
V150LA2	7	1502	150	200	13	1200	212	240	268	395	10	150
V150LA5	10	1505	150	200	25	2500	212	240	268	395	25	360
V150LA10A	14	150L10	150	200	45	4500	212	240	268	395	50	800
V150LA20A	20	150L20	150	200	80	6500	212	240	268	395	100	1600
V150LA20B	20	150L20B	150	200	80	6500	212	240	243	360	100	1600
V175LA2	7	1752	175	225	15	1200	247	270	303	455	10	130
V175LA5	10	1755	175	225	30	2500	247	270	303	455	25	350
V175LA10A	14	175L10	175	225	55	4500	247	270	303	455	50	700
V230LA4	7	2304	230	300	20	1200	324	360	396	595	10	100
V230LA10	10	230L	230	300	35	2500	324	360	396	595	25	250
V230LA20A	14	230L20	230	300	70	4500	324	360	396	595	50	550
V250LA2	7	2502	250	330	21	1200	354	390	473	730	10	90
V250LA4	7	2504	250	330	21	1200	354	390	429	650	10	90
V250LA10	10	250L	250	330	40	2500	354	390	429	650	25	220
V250LA20A	14	250L20	250	330	72	4500	354	390	429	650	50	500
V250LA40A	20	250L40	250	330	130	6500	354	390	429	650	100	1000
V250LA40B	20	250L40B	250	330	130	6500	354	390	413	620	100	1000
V275LA2	7	2752	275	369	23	1200	389	430	515	775	10	80
V275LA4	7	2754	275	369	23	1200	389	430	473	710	10	80
V275LA10	10	275L	275	369	45	2500	389	430	473	710	25	200
V275LA20A	14	275L20	275	369	75	4500	389	430	473	710	50	450
V275LA40A	20	275L40	275	369	140	6500	389	430	473	710	100	900
V275LA40B	20	275L40B	275	369	140	6500	389	430	453	680	100	900
V300LA2	7	3002	300	405	25	1200	420	470	565	870	10	70
V300LA4	7	3004	300	405	25	1200	420	470	517	775	10	70
V320LA20A	14	320L20	320	420	90	4500	462	510	565	850	50	380
V320LA40B	20	320L40	320	420	160	6500	462	510	540	810	100	750
V420LA10	10	420L	420	560	45	2500	610	680	748	1120	25	140
V420LA20A	14	420L20	420	560	90	4500	610	680	748	1120	50	300
V420LA40B	20	420L40	420	560	160	6500	610	680	720	1060	100	600
V480LA40A	14	480L40	480	640	105	4500	670	750	825	1240	50	270
V480LA80B	20	480L80	480	640	180	6500	670	750	790	1160	100	550
V510LA40A	14	510L40	510	675	110	4500	735	820	910	1350	50	250
V510LA80B	20	510L80	510	675	190	6500	735	820	860	1280	100	500
V575LA40A	14	575L40	575	730	120	4500	805	910	1000	1500	50	220
V575LA80B	20	575L80	575	730	220	6500	805	910	960	1410	100	450
V660LA50A	14	660L50	660	850	140	4500	940	1050	1210	1820	50	200
V660LA100B	20	660L100	660	850	250	6500	940	1050	1100	1650	100	400
V1000LA80A	14	1000L80	1000	1200	220	4500	1425	1600	1800	2700	50	130
V1000LA160B	20	1000L160	1000	1200	360	6500	1425	1600	1600	2420	100	250

NOTE: Average power dissipation of transients not to exceed 0.25, 0.4, 0.6, 1 watt for model sizes 7, 10, 14, and 20 mm respectively.

# Transient Voltage Suppression Devices

## MA Series

### Device Ratings and Characteristics



Model Number	Device Marking	Maximum Ratings (85°C)				Characteristics (25°C)				
		Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage @ I <sub>p</sub> Value Current (8/20μs)	Typical Capacitance
		RMS Voltage	DC Voltage	Energy (10/1000μs)	Peak Current (8/20μs)					
		V <sub>(max)</sub>	V <sub>(dc)</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>(dc)</sub>	Max.	I <sub>p</sub> =2.0A	f=1 MHz
Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Picofarads		
V18MA1A	18A	9	13	0.06	40	14	18	23	49	550
V18MA1B	18B	10	14	0.07	40	15	18	21	44	550
V18MA1S	18S	10	14	0.06	40	15	18	21	49	550
V22MA1A	22A	10	15	0.09	40	16	22	28	55	410
V22MA1B	22B	14	18	0.10	40	19	22	26	51	410
V22MA1S	22S	14	18	0.09	40	19	22	26	55	410
V27MA1A	27A	13	19	0.10	40	21	27	34	67	370
V27MA1B	27B	17	22	0.11	40	24	27	31	59	370
V27MA1S	27S	17	22	0.10	40	24	27	31	67	370
V33MA1A	33A	18	23	0.13	40	26	33	40	73	300
V33MA1B	33B	20	26	0.15	40	29.5	33	36.5	67	300
V33MA1S	33S	20	26	0.14	40	29.5	33	36.5	73	300
V39MA2A	39A	22	28	0.16	40	31	39	47	86	250
V39MA2B	39B	25	31	0.18	40	35	39	43	79	250
V39MA2S	39S	25	31	0.17	40	35	39	43	86	250
V47MA2A	47A	27	34	0.19	40	37	47	57	99	210
V47MA2B	47B	30	38	0.21	40	42	47	52	90	210
V47MA2S	47S	30	38	0.19	40	42	47	52	99	210
V56MA2A	56A	32	40	0.23	40	44	56	68	117	180
V56MA2B	56B	35	45	0.25	40	50	56	62	108	180
V56MA2S	56S	35	45	0.23	40	50	56	62	117	180
V68MA3A	68A	38	48	0.26	40	54	68	82	138	150
V68MA3B	68B	40	56	0.30	40	61	68	75	150	150
V68MA3S	68S	40	56	0.27	40	61	68	75	138	150
V82MA3A	82A	45	60	0.33	40	65	82	99	163	120
V82MA3B	82B	50	66	0.37	40	73	82	91	150	120
V82MA3S	82S	50	66	0.34	40	73	82	91	163	120
V100MA4A	100	57	72	0.40	40	80	100	120	200	100
V100MA4B	101	60	81	0.45	40	90	100	110	185	100
V100MA4S	102	60	81	0.42	40	90	100	110	200	100
V120MA1A	120	72	97	0.40	100	102	120	138	220	40
V120MA2B	121	75	101	0.50	100	108	120	132	205	40
V120MA2S	122	75	101	0.46	100	108	120	132	220	40
V150MA1A	150	88	121	0.50	100	127	150	173	255	32
V150MA2B	151	92	127	0.60	100	135	150	165	240	32
V180MA1A	180	105	144	0.60	100	153	180	207	310	27
V180MA3B	181	110	152	0.70	100	162	180	198	290	27
V220MA2A	220	132	181	0.80	100	187	220	253	380	21
V220MA4B	221	138	191	0.90	100	198	220	242	360	21
V270MA2A	270	163	224	0.90	100	229	270	311	460	17
V270MA4B	271	171	235	1.00	100	243	270	297	440	17
V330MA2A	330	188	257	1.00	100	280	330	380	570	14
V330MA5B	331	200	274	1.10	100	297	330	363	540	14
V390MA3A	390	234	322	1.20	100	331	390	449	670	12
V390MA6B	391	242	334	1.30	100	351	390	429	640	12
V430MA3A	430	253	349	1.50	100	365	430	495	740	11
V430MA7B	431	264	365	1.70	100	387	430	473	700	11

NOTE: Average power dissipation of transients not to exceed 200 milliwatts.



# Transient Voltage Suppression Devices

## NA Series



### Device Ratings and Characteristics

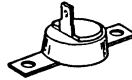
MODEL NUMBER	SIZE mm	MAXIMUM RATINGS (+85°C)				CHARACTERISTICS (+25°C)				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE @ 1mA DC TEST CURRENT			MAXIMUM CLAMPING VOLTAGE $V_c$ @ 200A (8/20 $\mu$ s)	TYPICAL CAPACITANCE
		RMS VOLTAGE	DC VOLTAGE	ENERGY (10/1000 $\mu$ s)	PEAK CURRENT (8/20 $\mu$ s)					
		$V_{m(ac)}$	$V_{m(dc)}$	$W_{tm}$	$I_{tm}$	MIN	$V_{N(dc)}$	MAX	$V_c$	f = 1MHz
V	V	J	A	V	V	V	V	pF		
V131NA34	34	130	175	270	40,000	184	200	228	345	10000
V151NA34	34	150	200	300	40,000	212	240	268	405	8000
V251NA34	34	250	330	370	40,000	354	390	429	650	5000
V271NA34	34	275	369	400	40,000	389	430	473	730	4500
V321NA34	34	320	420	460	40,000	462	510	539	830	3800
V421NA34	34	420	560	600	40,000	610	680	748	1130	3000
V481NA34	34	480	640	650	40,000	670	750	825	1240	2700
V511NA34	34	510	675	700	40,000	735	820	910	1350	2500
V571NA34	34	575	730	770	40,000	805	910	1000	1480	2200
V661NA34	34	660	850	900	40,000	940	1050	1160	1720	2000
V751NA34	34	750	970	1050	40,000	1080	1200	1320	2000	1800

NOTE: Average power dissipation of transients not to exceed 2W

# Transient Voltage Suppression Devices

## PA Series

### Device Ratings and Characteristics



Series PA Varistors are listed under UL file #E75961 as a UL recognized component. CSA approved File Number LR91788.

Model Number & Device Marking	Maximum Ratings (85°C)				Characteristics (25°C)					
	Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>c</sub> @ Test Current (8/20μs)		Typical Capacitance
	RMS Voltage	DC Voltage	Energy (10/1000μs)	Peak Current (8/20μs)				V <sub>c</sub>	I <sub>p</sub>	
	V <sub>m(ac)</sub>	V <sub>m(dc)</sub>	W <sub>lm</sub>	I <sub>lm</sub>	Min.	V <sub>N(dc)</sub>	Max.	V <sub>c</sub>	I <sub>p</sub>	f=1 MHz
Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads	
V130PA20A	130	175	70	6500	184	200	243	360	100	1900
V130PA20C	130	175	70	6500	184	200	220	325	100	1900
V150PA20A	150	200	80	6500	212	240	284	420	100	1600
V150PA20C	150	200	80	6500	212	240	243	360	100	1600
V250PA40A	250	330	130	6500	354	390	453	675	100	1000
V250PA40C	250	330	130	6500	354	390	413	620	100	1000
V275PA40A	275	369	140	6500	389	430	494	740	100	900
V275PA40C	275	369	140	6500	389	430	453	680	100	900
V320PA40A	320	420	160	6500	462	510	565	850	100	750
V320PA40C	320	420	160	6500	462	510	540	800	100	750
V420PA40A	420	560	160	6500	610	680	790	1160	100	600
V420PA40C	420	560	160	6500	610	680	690	1050	100	600
V480PA80A	480	640	180	6500	670	750	860	1280	100	550
V480PA80C	480	640	180	6500	670	750	790	1160	100	550
V510PA80A	510	675	190	6500	735	820	963	1410	100	500
V510PA80C	510	675	190	6500	735	820	860	1280	100	500
V575PA80A	575	730	220	6500	805	910	1050	1560	100	450
V575PA80C	575	730	220	6500	805	910	960	1410	100	450
V660PA100A	660	850	250	6500	940	1050	1210	1820	100	400
V660PA100C	660	850	250	6500	940	1050	1100	1650	100	400

NOTE: Average power dissipation of transients not to exceed 1 watt.

# Transient Voltage Suppression Devices

## RA Series

### RA8 Device Ratings and Characteristics



Series RA8 Varistors of 130 VRMS or greater are listed under UL File No. E56529 as a recognized component. CSA approved File Number LR91788.

Model Number	Device Marking	Maximum Ratings (125° C)				Characteristics (25°C)					
		Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>c</sub> @ Test Current (8/20μs)		Typical Capacitance
		RMS Voltage	DC Voltage	Energy (10/1000μs)	Peak Current (8/20μs)						
		V <sub>mt(ac)</sub>	V <sub>mt(dc)</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>Nt(dc)</sub>	Max.	V <sub>c</sub>	I <sub>p</sub>	f=1 MHz
Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads		
V8RA8	8R	4	5.5	0.4	100	6	8.2	11.2	22	5	3000
V12RA8	12R	6	8	0.6	250	9	12	16	34	5	2500
V18RA8	18R	10	14	0.8	250	14.4	18	21.6	42	5	2000
V22RA8	22R	14	18‡	10*	250	18.7	22	26	47	5	1600
V27RA8	27R	17	22	1.0	250	23	27	31.1	57	5	1300
V33RA8	33R	20	26	1.2	250	29.5	33	36.5	68	5	1100
V39RA8	39R	25	31	1.5	250	35	39	43	79	5	900
V47RA8	47R	30	38	1.8	250	42	47	52	92	5	800
V56RA8	56R	35	45	2.3	250	50	56	62	107	5	700
V68RA8	68R	40	56	3.0	250	61	68	75	127	5	600
V82RA8	82R	50	66	4.0	1200	74	82	91	135	10	500
V100RA8	100R	60	81	5.0	1200	90	100	110	165	10	400
V120RA8	120R	75	102	6.0	1200	108	120	132	205	10	300
V150RA8	150R	95	127	8.0	1200	135	150	165	250	10	250
V180RA8	180R	115	153	10.0	1200	162	180	198	295	10	200
V200RA8	200R	130	175	11.0	1200	184	200	228	340	10	180
V220RA8	220R	140	180	12.0	1200	198	220	242	360	10	160
V240RA8	240R	150	200	13.0	1200	212	240	268	395	10	150
V270RA8	270R	175	225	15.0	1200	247	270	303	455	10	130
V360RA8	360R	230	300	20.0	1200	324	360	396	595	10	100
V390RA8	390R	250	330	21.0	1200	354	390	429	650	10	90
V430RA8	430R	275	369	23.0	1200	389	430	473	710	10	80

NOTE: Average power dissipation of transients not to exceed 0.25 watt for RA8 Series.

\*Energy ratings for impulse duration of 30 milliseconds minimum to one half of peak current value

‡Also rated to withstand 24V for 5 minutes.

# Transient Voltage Suppression Devices

## RA Series (Continued)

### RA16 Device Ratings and Characteristics

Series RA16 and RA22 Varistors of 130 VRMS or greater are listed under UL File No. E56529 as a recognized component. CSA approved File Number LR91788.

Model Number	Device Marking	Maximum Ratings (125°C)				Characteristics (25°C)					
		Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>c</sub> @ Test Current (8/20μs)		Typical Capacitance
		RMS Voltage	DC Voltage	Energy (10/1000μs)	Peak Current (8/20μs)						
		V <sub>m(ac)</sub>	V <sub>m(dc)</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>N(dc)</sub>	Max.	V <sub>c</sub>	I <sub>p</sub>	f=1 MHz
Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads		
V18RA16	18R16	10	14	3.5	1000	14.4	18	21.6	39	10	11000
V22RA16	22R16	14	18‡	50*	1000	18.7	22	26	43	10	9000
V27RA16	27R16	17	22	5.0	1000	23	27	31.1	53	10	7000
V33RA16	33R16	20	26	6.0	1000	29.5	33	36.5	64	10	6000
V39RA16	39R16	25	31	7.2	1000	35	39	43	76	10	5000
V47RA16	47R16	30	38	8.8	1000	42	47	52	89	10	4500
V56RA16	56R16	35	45	10.0	1000	50	56	62	103	10	3900
V68RA16	68R16	40	56	13.0	1000	61	68	75	123	10	3300
V82RA16	82R16	50	66	15.0	4500	74	82	90	145	50	2500
V100RA16	100R16	60	81	20.0	4500	90	100	110	175	50	2000
V120RA16	120R16	75	102	22.0	4500	108	120	132	205	50	1700
V150RA16	150R16	95	127	30.0	4500	135	150	165	255	50	1400
V180RA16	180R16	115	153	35.0	4500	162	180	198	300	50	1100
V200RA16	200R16	130	175	38.0	4500	184	200	228	340	50	1000
V220RA16	220R16	140	180	42.0	4500	198	220	242	360	50	900
V240RA16	240R16	150	200	45.0	4500	212	240	268	395	50	800
V270RA16	270R16	175	225	55.0	4500	247	270	303	455	50	700
V360RA16	360R16	230	300	70.0	4500	324	360	396	595	50	550
V390RA16	390R16	250	330	72.0	4500	354	390	429	650	50	500
V430RA16	430R16	275	369	75.0	4500	389	430	473	710	50	450

### RA22 Device Ratings and Characteristics

V24RA22	24R22	14	18‡	100.0*	2000	19.2	24‡	26	43	20	18000
V36RA22	36R22	23	31	160.0*	2000	32	36‡	40	63	20	12000
V200RA22	200R22	130	175	70.0	6500	184	200	228	340	100	1900
V240RA22	240R22	150	200	80.0	6500	212	240	268	395	100	1600
V270RA22	270R22	175	225	90.0	6500	247	270	303	455	100	1400
V390RA22	390R22	250	330	130.0	6500	354	390	429	650	100	1000
V430RA22	430R22	275	369	140.0	6500	389	430	473	710	100	900

NOTE: Average power dissipation of transients not to exceed 0.60 watt for RA16 Series, or 1.0 watt for RA22 Series.

\*Energy rating for impulse duration of 30 milliseconds minimum to one half of peak current value

‡Also rated to withstand 24V for 5 minutes.

†10mA DC Test Current.

# Transient Voltage Suppression Devices

## ZA Series

### Device Ratings and Characteristics



Model Number	Model Size Disc Dia. (mm)	Device Marking	Maximum Ratings (85°C)				Characteristics (25°C)						
			Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>c</sub> @ Test Current (8/20μs)		Typical Capacitance	
			RMS Voltage	DC Voltage	Energy (10/1000μs)	Peak Current (8/20μs)				V <sub>c</sub>	I <sub>p</sub>		
			V <sub>m(ac)</sub>	V <sub>m(dc)</sub>	W <sub>m</sub>	I <sub>m</sub>	Min.	V <sub>N(dc)</sub>	Max.	V <sub>c</sub>	I <sub>p</sub>	f=1 MHz	
			Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads	
V8ZA05	5	Z08	4	5.5	0.1	50	6.0	8.2	11.0	30	2	1400	
V8ZA1	7	08Z1	4	5.5	0.4	100	6.0	8.2	11.0	22	5	3000	
V8ZA2	10	08Z2	4	5.5	0.8	250	6.0	8.2	11.0	20	5	7500	
V12ZA05	5	Z12	6	8	0.14	100	9.0	12	16.0	37	2	1200	
V12ZA1	7	12Z1	6	8	0.6	250	9.0	12	16.0	34	5	2500	
V12ZA2	10	12Z2	6	8	1.2	250	9.0	12	16.0	30	5	6000	
V18ZA05	5	Z18	10	14	0.17	100	14.4	18	21.6	44	2	1000	
V18ZA1	7	18Z1	10	14	0.8	250	14.4	18	21.6	42	5	2000	
V18ZA2	10	18Z2	10	14	1.5	500	14.4	18	21.6	39	5	5000	
V18ZA3	14	18Z3	10	14	3.5	1000	14.4	18	21.6	39	10	11000	
V18ZA40	20	18Z40	10	14	80.0*	2000	14.4	18†	21.6	37	20	22000	
V22ZA05	5	Z22	14	18‡	0.2	100	18.7	22	26.0	51	2	800	
V22ZA1	7	22Z1	14	18‡	0.9	250	18.7	22	26.0	47	5	1600	
V22ZA2	10	22Z2	14	18‡	2.0	500	18.7	22	26.0	43	5	4000	
V22ZA3	14	22Z3	14	18‡	4.0	1000	18.7	22	26.0	43	10	9000	
V24ZA50	20	24Z50	14	18‡	100.0*	2000	19.2	24†	26.0	43	20	18000	
V27ZA05	5	Z27	17	22	0.25	100	23.0	27	31.1	59	2	600	
V27ZA1	7	27Z1	17	22	1.0	250	23.0	27	31.1	57	5	1300	
V27ZA2	10	27Z2	17	22	2.5	500	23.0	27	31.1	53	5	3000	
V27ZA4	14	27Z4	17	22	5.0	1000	23.0	27	31.1	53	10	7000	
V27ZA60	20	27Z60	17	22	120.0*	2000	23.0	27†	31.1	50	20	15000	
V33ZA05	5	Z33	20	26	0.3	100	29.5	33	38.0	67	2	500	
V33ZA1	7	33Z1	20	26	1.2	250	29.5	33	36.5	68	5	1100	
V33ZA2	10	33Z2	20	26	3.0	500	29.5	33	36.5	64	5	2700	
V33ZA5	14	33Z5	20	26	6.0	1000	29.5	33	36.5	64	10	6000	
V33ZA70	20	33Z70	21	27	150.0*	2000	29.5	33†	36.5	58	20	13000	
V36ZA80	20	36Z80	23	31	160.0*	2000	32.0	36†	40.0	63	20	12000	
V39ZA05	5	Z39	25	31	0.35	100	35.0	39	46.0	79	2	440	
V39ZA1	7	39Z1	25	31	1.5	250	35.0	39	43.0	79	5	900	
V39ZA3	10	39Z3	25	31	3.5	500	35.0	39	43.0	76	5	2200	
V39ZA6	14	39Z6	25	31	7.2	1000	35.0	39	43.0	76	10	5000	

NOTE: Average power dissipation of transients not to exceed 0.2, 0.25, 0.4, 0.6, 1 watt for model sizes 5, 7, 10, 14, and 20 mm respectively.

\*Energy rating for impulse duration of 30 milliseconds minimum to one half of peak current value.

†10 mA dc test current.

‡Also rated to withstand 24 V for 5 minutes.

# Transient Voltage Suppression Devices

## ZA Series (Continued)

### Device Ratings and Characteristics

Model Number	Model Size Disc Dia. (mm)	Device Marking	Maximum Ratings (85° C)				Characteristics (25° C)						
			Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V <sub>C</sub> @ Test Current (8/20µs)		Typical Capacitance f=1 MHz	
			RMS Voltage	DC Voltage	Energy (10/ 1000µs)	Peak Current (8/20µs)				V <sub>C</sub>	I <sub>P</sub>		
			V <sub>max(c)</sub>	V <sub>mid(c)</sub>	W <sub>tm</sub>	I <sub>tm</sub>	Min.	V <sub>N(c)</sub>	Max.	V <sub>C</sub>	I <sub>P</sub>	f=1 MHz	
			Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads	
V47ZA05	5	Z47	30	38	0.4	100	42	47	55	90	2	400	
V47ZA1	7	47Z1	30	38	1.8	250	42	47	52	92	5	800	
V47ZA3	10	47Z3	30	38	4.5	500	42	47	52	89	5	2000	
V47ZA7	14	47Z7	30	38	8.8	1000	42	47	52	89	10	4500	
V56ZA05	5	Z56	35	45	0.5	100	50	56	66	108	2	360	
V56ZA2	7	56Z2	35	45	2.3	250	50	56	62	107	5	700	
V56ZA3	10	56Z3	35	45	5.5	500	50	56	62	103	5	1800	
V56ZA8	14	56Z8	35	45	10.0	1000	50	56	62	103	10	3900	
V68ZA05	5	Z68	40	56	0.6	100	61	68	80	127	2	300	
V68ZA2	7	68Z2	40	56	3.0	250	61	68	75	127	5	600	
V68ZA3	10	68Z3	40	56	6.5	500	61	68	75	123	5	1500	
V68ZA10	14	68Z10	40	56	13.0	1000	61	68	75	123	10	3300	
V82ZA05	5	Z82	50	66	2.0	400	73	82	97	135	5	240	
V82ZA2	7	82Z2	50	66	4.0	1200	73	82	91	135	10	500	
V82ZA4	10	82Z4	50	66	8.0	2500	73	82	91	135	25	1100	
V82ZA12	14	82Z12	50	66	15.0	4500	73	82	91	145	50	2500	
V100ZA05	5	Z100	60	81	2.5	400	90	100	117	165	5	180	
V100ZA3	7	100Z	60	81	5.0	1200	90	100	110	165	10	400	
V100ZA4	10	100Z4	60	81	10.0	2500	90	100	110	165	25	900	
V100ZA15	14	100Z15	60	81	20.0	4500	90	100	110	175	50	2000	
V120ZA05	5	Z120	75	102	3.0	400	108	120	138	205	5	140	
V120ZA1	7	120Z	75	102	6.0	1200	108	120	132	205	10	300	
V120ZA4	10	120Z4	75	102	12.0	2500	108	120	132	200	25	750	
V120ZA6	14	120Z6	75	102	22.0	4500	108	120	132	210	50	1700	
V150ZA05	5	Z150	92	127	4.0	400	135	150	173	250	5	120	
V150ZA1	7	Z051	95	127	8.0	1200	135	150	165	250	10	250	
V150ZA4	10	150Z4	95	127	15.0	2500	135	150	165	250	25	600	
V150ZA8	14	150Z8	95	127	30.0	4500	135	150	165	255	50	1400	
V180ZA05	5	Z180	110	153	5.0	400	162	180	207	295	5	100	
V180ZA1	7	180Z	115	153	10.0	1200	162	180	198	295	10	200	
V180ZA5	10	180Z5	115	153	18.0	2500	162	180	198	300	25	500	
V180ZA10	14	180Z10	115	153	35.0	4500	162	180	198	300	50	1100	
V220ZA05	5	Z220	140	180	6.0	400	198	220	253	360	5	90	
V270ZA05	5	Z270	175	225	7.5	400	243	270	311	440	5	70	
V330ZA05	5	Z330	210	275	9.0	400	297	330	380	540	5	60	
V390ZA05	5	Z390	250	330	10.0	400	351	390	449	640	5	50	
V430ZA05	5	Z430	275	369	11.0	400	387	430	495	700	5	45	
V470ZA05	5	Z470	300	385	12.0	400	420	470	517	775	5	35	
V680ZA05	5	Z680	420	560	14.0	400	610	680	748	1120	5	32	
V750ZA05	5	Z750	460	615	17.0	400	675	750	825	1240	5	30	

NOTE: Average power dissipation of transients not to exceed 0.2, 0.25, 0.4, 0.6, 1 watt for model sizes 5, 7, 10, 14, and 20 mm respectively.

Higher voltages available—contact Harris Semiconductor Power Marketing.



## **7 - Hi-Rel & Rad-Hard**

7A •High Reliability  
7B •Rad-Hard



## **7 - Hi-Rel & Rad-Hard**

7A •High Reliability

7B •Rad-Hard

# High Reliability Products

Harris Semiconductor products are designed to meet the needs of military and aerospace users. Harris provides high reliability semiconductors that are fully compliant with the following standards:

## Integrated Circuits

### MIL-STD-883 Standard military integrated circuits

- High reliability products that are processed to Harris data sheet requirements
- MIL-STD-883 class B compliant process flows: /3A, /883 suffixes
- MIL-STD-883 class S compliant process flows: /MS suffix and per customer drawing
- MIL-STD-883 class B non-compliant process flows: /3, -8 suffixes, /3W suffixes
- MIL-STD-883 class S non-compliant process flows: /1RZ, -Q, /1
- Process flows/testing altered to customer specification

### SMD/DESC Integrated circuits

- All specifications issued and controlled by DESC
- Fully compliant to requirements of MIL-STD-883 class B

### JAN MIL-M-38510 Integrated circuits

- Fully compliant to requirements of MIL-M-38510 and MIL-STD-883
- JAN qualified parts list (QPL) maintained by DESC
- All specification changes must be approved by DESC
- Fabricated, assembled, and processed completely within the United States

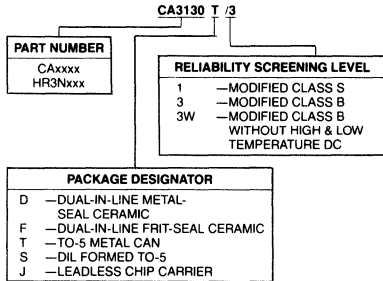
### MIL-S-19500 - Discretes

- Specification for JAN type discrete semiconductor devices (ie: transistors, diodes, etc)
- Qualified parts list (QPL-19500) maintained by DESC

# High Reliability

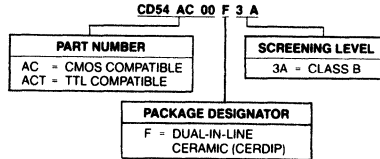
## Ordering Information

### CA3000 LINEAR SERIES NOMENCLATURE GUIDE



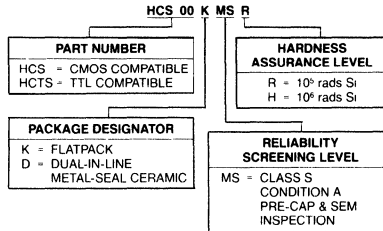
- 1—Slash 1 ( / ) device options are available as follows upon special request  
SEM PIND testing Condition A visual and Conformance B C & D tests  
2—Dual Gate FETS are in TO-72 packages  
3—CA3089F is screened to commercial limits only

### ADVANCED CMOS LOGIC NOMENCLATURE GUIDE



NOTE 1 — 3A devices are dual marked with the DESC or Standard Military Drawing

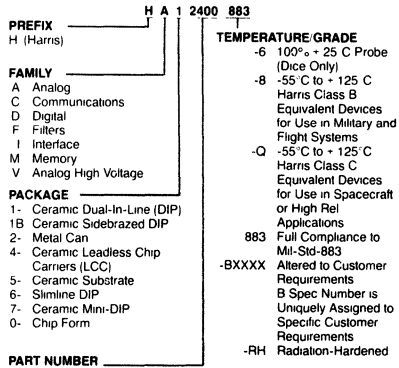
### HIGH-SPEED CMOS/SOS LOGIC NOMENCLATURE GUIDE



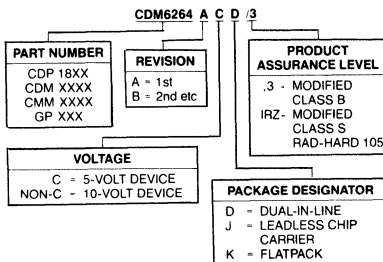
- NOTE 1 — The CD54 prefix is dropped for Class S HCS HCTS device types  
NOTE 2 — Both the K and D packages have gold plated lead finish (38510 lead finish C)

### "H" SERIES NOMENCLATURE GUIDE

Harris products are designated by 'Harris Product Code'. These products will always begin with the letter 'H' and specific device numbers are isolated by hyphens. An example product code is shown below. When ordering, please refer to products by the full code identification.

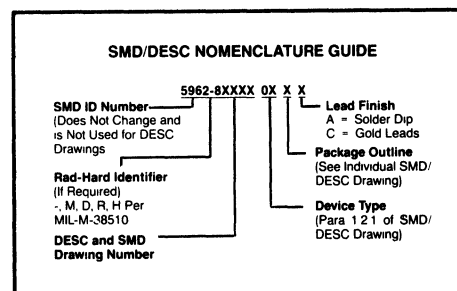
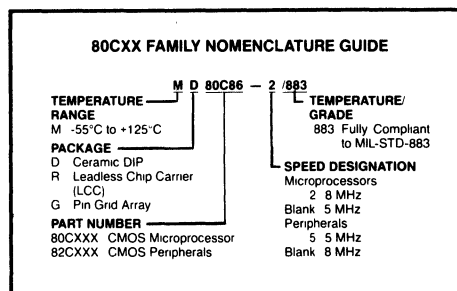
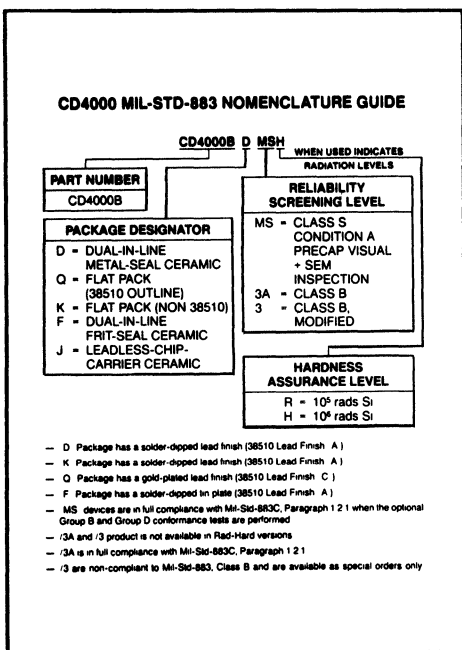
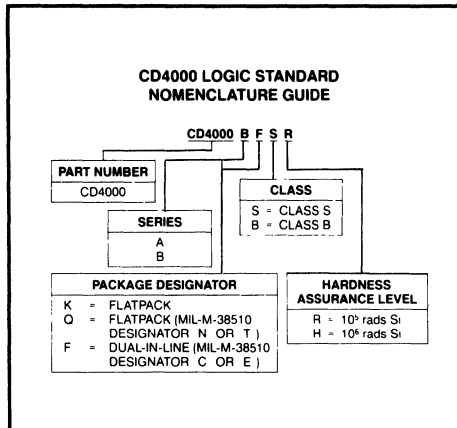
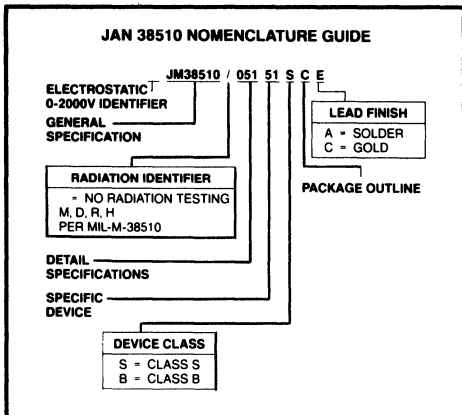


### CDM, CDP, CMM, GP CMOS LSI NOMENCLATURE GUIDES



# High Reliability

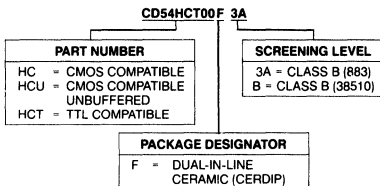
## Ordering Information



# High Reliability

## Ordering Information

### CD54HC/HCT NOMENCLATURE GUIDE

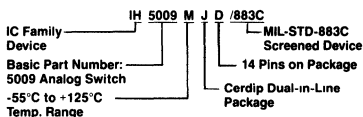


NOTE 1 — 3A is 883 Revision C full compliant Para 1 2 1

NOTE 2 — 3A devices are dual marked with the SMD DESC drawing or standard military drawing

NOTE 3 — B is JAN38510 Class B Device

### I-SERIES NOMENCLATURE GUIDE



#### Package Type Designators

A — TO-237  
 C — TO-220  
 D — Ceramic Sidebrazed Dual-in-Line  
 E — Small TO-8  
 F — Ceramic Flat Pack  
 H — TO-66  
 I — 16 Pin (6 x 7 Pin Spacing) Hermetic Hybrid Dip  
 J — CERDIP Dual-in-Line  
 K — TO-3  
 L — Leadless Ceramic  
 S — TO-52  
 T — TO-5 Type (also TO-78, TO-99, TO-100)  
 U — TO-72 Type (also TO-18, TO-71)  
 V — TO-39  
 Z — TO-92

#### \*Exceptions To Package Type Designators

**DG SERIES**

A — 10 Pin Metal Can  
 L — 14 Pin Flatpack  
 P — Ceramic DIP (Special Order Only)  
 K — CERDIP

**AD SERIES**

H — TO-52  
 D — CERDIP, Ceramic DIP  
 R — TO-92

#### Pin Count Designator

A — 8 M — 48  
 B — 10 N — 18  
 C — 12 P — 20  
 D — 14 Q — 2  
 E — 16 R — 3  
 F — 22 S — 4  
 G — 24 T — 6  
 H — 42 U — 7  
 I — 28 V — 8 (0 200° Pin Circle Isolated Case)  
 J — 32  
 K — 35 W — 10 (0 230° Pin Circle Isolated Case)  
 L — 40  
 Y — 8 (0 200° Pin Circle Case to Pin 4)  
 Z — 10 (0 230° Pin Circle Case to Pin 5)

#### \*Exceptions To Pin Count Designators

##### DG SERIES

A — 10 Pin Metal Can  
 L — 14 Pin Flatpack  
 P — Ceramic DIP (Special Order Only)  
 K — CERDIP

##### AD SERIES

D — 20, 18, 16 or 14  
 H — 3 Pin  
 N — 20, 18, 16 or 14

#### High Reliability Designator

JM38510 XXXXX-XXX — Mil-M-38510 Device  
 883C — MIL-STD-883C Screened Device  
 HR — High Reliability Device  
 BR — Cost Effective High Reliability Device  
 BI — Burn-In Only Process Flow

#### Temperature Range Designators

M — Military -55°C to +125°C

# Process Flows by Product Family

PRODUCT FAMILY	MIL-STD-883 CLASS B						MIL-STD-883 CLASS S			
	COMPLIANT			NON-COMPLIANT			COM-PLIANT	NON-COMPLIANT		
	/3A	/883	/883C	/3	/3W	-8	/MS	-Q	/1RZ	/1
CD4000 Series CMOS Logic	X			X			X			
High Speed CMOS Logic CD54HC/HCT	X									
Advanced CMOS Logic CD54 AC/ACT	X									
Rad-Hard SOS Logic HCS/HCTS							X			
80C222 Family MD, MG, MR		X					X	X		
Harris Digital LSI HD, HM, HSP		X				X		X		
RCA Digital LSI CDM, CDP, CMM				X					X	
Harris Rad-Hard LSI HS						X		X		
Harris Linear HA, HC, HI, HFA, HV, H		X				X		X		
RCA Linear CA				X	X					X
Intersil Linear/Digital			X							

## High Reliability/Military

### MIL-STD Standard Military Integrated Circuits

Harris offers high-reliability products that are processed to Harris data-sheet requirements. These products are identified by a unique suffix depending on the product type and may be fully compliant to MIL-STD-883 or MIL-STD "equivalent" product for Class B or S type applications. In addition, Harris will alter process flows and testing to meet unique customer requirements. A unique part number is assigned to each customer circuit.

### MIL-STD-883 Class B Compliant Process Flows

The following process flows are in full accordance with MIL-STD-883 Revision C:

- /3A
- /883
- /883C

### MIL-STD-883 Class S Compliant Process Flows

The following process flows are in full accordance with

MIL-STD-883 Revision C:

- /MS

### MIL-STD-883 Class B Non-Compliant Process Flows

- /3 : Meets most requirements of MIL-STD-883 (See Figure 2)
- /3W : Same as /3 without high and low temperature DC tests (See Figure 3)
- 8 : Meets most requirements of MIL-STD-883 (see Figure 4)

### MIL-STD-883 Class S Non-Compliant Process Flows

- Q : Meets most requirements of MIL-STD-883 (See Figure 4)
- /1RZ : Meets most requirements of MIL-STD-883 (See Figure 5)
- /1 : Meets most requirements of MIL-STD-883 (See Figure 3) /1 device options are available as follows on special request: SEM, PIND testing, Condition A visual and Conformance B, C, and D tests.

## Comparison of Class S/Class B Screening Tests

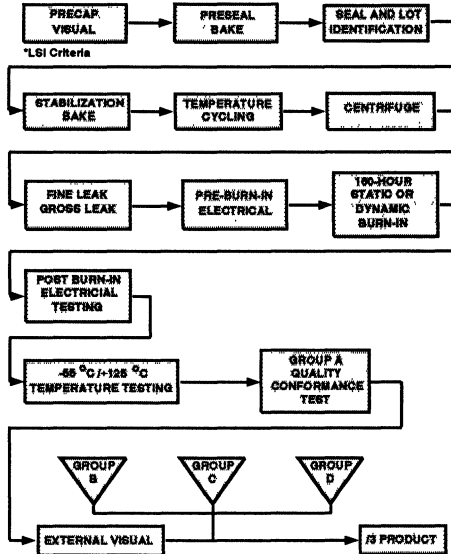
SCREENING TEST	CLASS S	CLASS B
Glassivation Thickness	Yes	-
SEM Inspection	Yes	-
Thermal Stability	Yes	-
Metallization Thickness	Yes	-
Non-Destructive Bond Pull	Yes	-
Precap Visual Inspection	Yes	Yes
Stability Bake	Yes	Yes
Temperature Cycling	Yes	Yes
Constant Acceleration	Yes	Yes
Serialization	Yes	-
Fine and Gross Leak Test	-	Yes
Preburn Electrical	Yes	Yes
24 Hr. Static Burn-In, Inputs Low at 135°C	Yes	-
24 Hr. Static Burn-In, Inputs Low at 135°C	Yes	-
120 Hr Static Burn-In at 135°C	-	Yes
180 Hr Dynamic Burn-In at 135°C	Yes	-
Final Electricals	Yes	Yes
Fine & Gross Leak Tests	Yes	-
Radiographic Inspection	Yes	-

7A

Hi-Rel

# Product Flow Charts

## /3 Flow

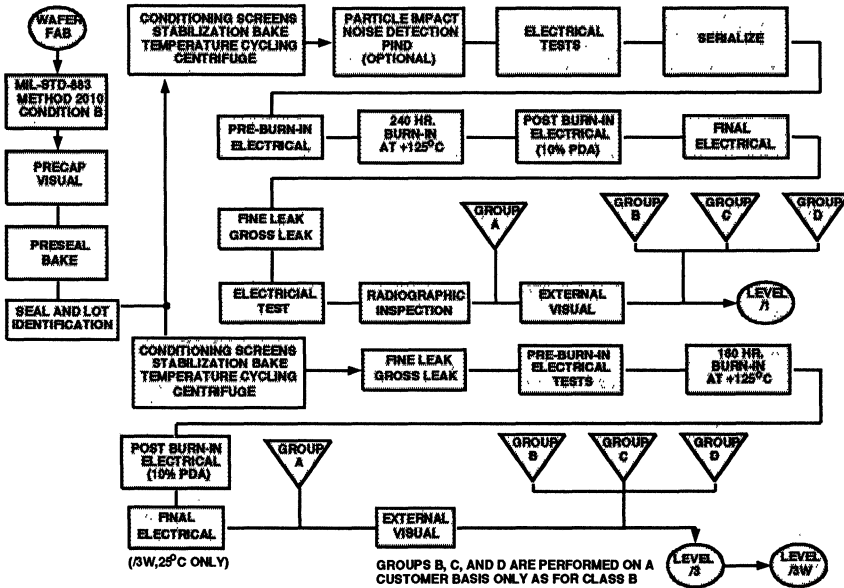


### Data Supplied

Data supplied with /3 Product Consists of:

- a certificate of processing and screening compliance
  - an attribute summary of Group A results
  - Group B, C and D attribute test results (when ordered)
- C of C is provided for Generic Data

## /3W, /1 Flows



# Product Flow Chart

## Typical Product Flow: -8, -Q Flows

OPERATION SEQUENCE	OPERATION DESCRIPTION	DASH 8	DASH Q
	Silicon Chemicals	Yes	Yes
	Quality Control Incoming Inspection	Yes	Yes
	Wafer Fabrication	Yes	Yes
	Quality Control Process Inspection • SEM Inspection • Wafer Lot Accept	Yes Rad-Hard Only Rad-Hard Only	Yes Yes Yes
	Wafer Electrical Probe	Yes	Yes
	Wafer Scribe, Break	Yes	Yes
	Dice Visual Screen	2010 Condition B	2010 Condition A
	Quality Control Sample Dice Inspection	Yes	Yes
	Package Piece Parts	Yes	Yes
	Quality Control Incoming Inspection	Yes	Yes
	Die Mount	Yes	Yes
	Bond Wire	Yes	Yes
	Quality Control Incoming Inspection	Yes	Yes
	Wire Bonding	Yes	Yes
	Quality Control Bond Inspection	2010 Condition B No	2010 Condition A Yes
	100% Bond Pull Test Method 2023	2010 Condition B	2010 Condition A
	Pre-Seal Visual Screen	Yes	Yes
	Quality Control Pre-Seal Visual Lot Acceptance	Yes	Yes
	Pre-Seal Bake Method 1008, Condition C	Yes	Yes
	Package List (Piece Parts)	Yes	Yes
	Quality Control Incoming Inspection	Yes	Yes
	Package Seal	Yes	Yes
	Quality Control Seal Inspection	Yes	Yes
	Stabilization Bake Method 1008, Condition C	Yes	Yes
	Temperature Cycle Method 1010. Condition C. 10 Cycle	Yes	Yes
	Centrifuge Method 2001. Y <sub>1</sub> Axis	Yes	Yes
	PIND Test	No	Yes
	Fine Leak Method 1014	Yes	Yes
	Gross Leak Method 1014	Yes	Yes
	Frame Removal, Load Carrier or Tubes	Yes	Yes
	Quality Control Package Assembly Lot Acceptance	Yes	Yes
	Serialization	No	Yes
	X-Ray	No	Yes
	Initial Electrical Test	Yes	Yes
	Burn-In	Yes	Yes
	Final Electrical Test*	Yes	Yes
	Fine Leak Method 1014	Yes	Yes
	Gross Leak Method 1014	Yes	Yes
	Quality Control Lot Acceptance	Yes	Yes
	Part Marking	Yes	Yes
QCI Group B,C,D, OR E	As Required	As Required	

\*NOTE: See Factory Representative for PDA Information

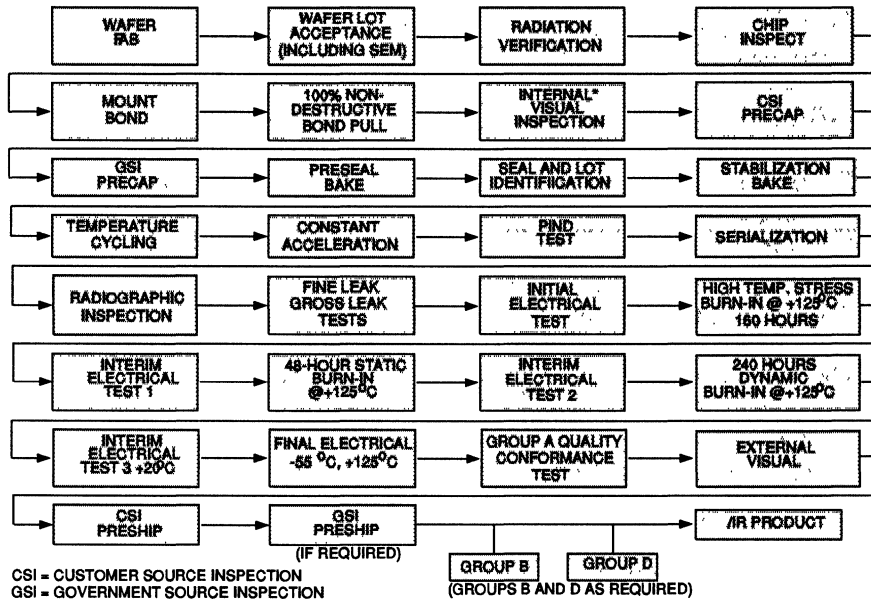
▽ - Incoming Material    ○ - Quality Inspection    □ - Production

7A  
Hi-Rel



# Product Flow Charts

## /1RZ Flow



### Data Supplied

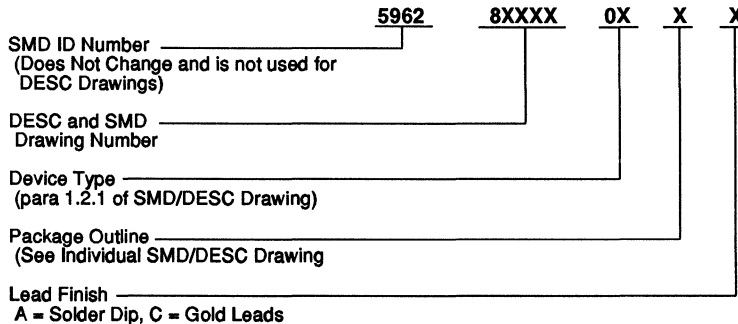
Data supplied with /1RZ Product Consists of:

- a certificate of processing and screening compliance
- an attribute summary of Group A results
- Group B and D attribute test results (when ordered) C of C is provided for Generic Data
- a complete wafer level RAD Test results

# Integrated Circuits

## SMD/DESC

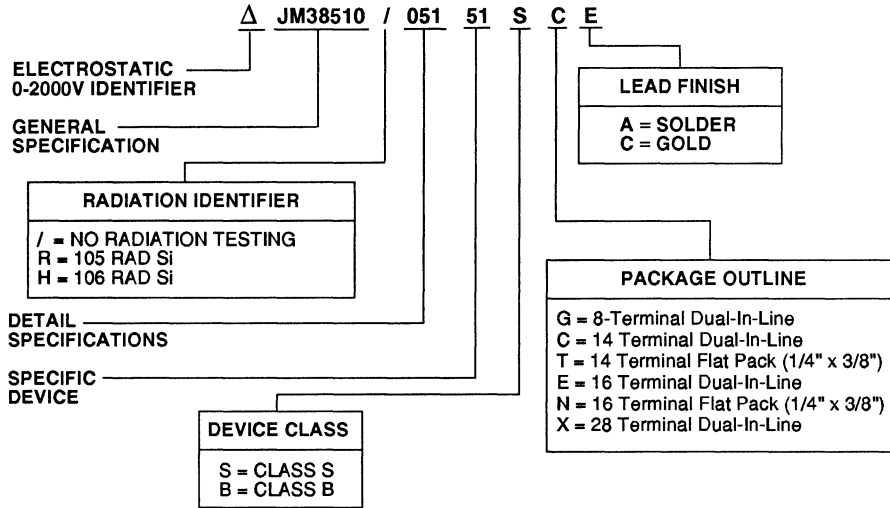
Harris offers a broad range of Standard Military Drawing (SMD) products that were previously referred to as "DESC Drawings." These devices are processed in full compliance to MIL-STD-883 Class B and are tested to electrical specifications that are issued and controlled by DESC. The SMD/DESC NOMENCLATURE GUIDE is shown below.



# Integrated Circuits

## JAN MIL-M-38510

JAN products are fabricated, assembled, and processed completely within the United States. They are fully compliant to all requirements listed in MIL-M-38510 and MIL-STD-883 for Class B devices. The JAN Qualified Parts List (QPL) for MIL-M-38510 devices is maintained by DESC and any changes in these specifications must be approved by DESC. The JAN 38510 NOMENCLATURE GUIDE is shown below.

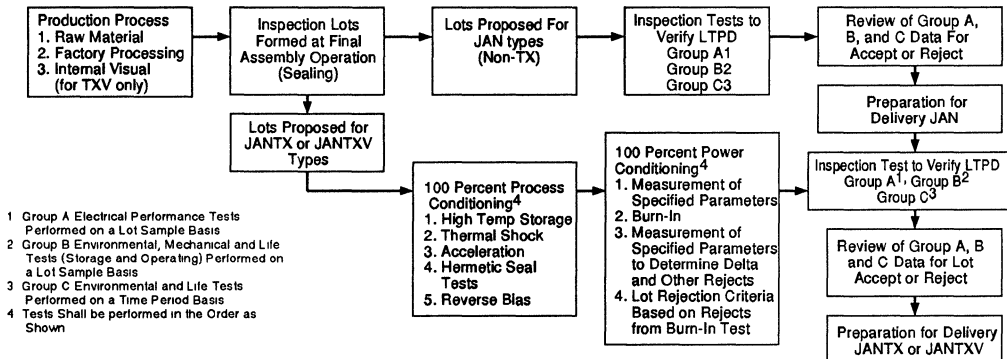


# Power Transistors

## JAN/JANTX/JANTXV

MIL-S-19500 is the specification for the familiar "JAN" type discrete semiconductor devices. Detailed electrical specifications are prepared as needed by the three military services and coordinated by the Defense Electronic Supply Center (DESC). Levels of reliability are defined by MIL-S-19500. JAN types receive Group A, Group B, and Group C lot sampling only, and are the least expensive. JANTX types receive 100 percent process conditioning, and power conditioning, and are subjected to lot rejection based on delta parameter criteria in addition to Group A, Group B, and Group C lot sampling. JANTXV types are subjected to 100 percent (JTXV) internal visual inspection in addition to all of the JANTX tests in accordance with MIL-STD-750 test methods and MIL-S-19500.

DESC publishes "QPL-19500," a Qualified Products List of all types and suppliers approved to produce and brand devices in accordance with MIL-S-19500.



Order of Procedure Diagram for JAN, JANTX, and JANTXV Semiconductor Power Devices

# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
2N3439	MIL-S-19500/368	350V/1A, N-P-N
2N3440	MIL-S-19500/368	250V/1A, N-P-N
2N3584	MIL-S-19500/384	250V/2A, N-P-N
2N3585	MIL-S-19500/384	300V/2A, N-P-N
2N3679	MIL-S-19500/526	75V/7A, N-P-N hi-speed
2N5038	MIL-S-19500/439	90V/20A, N-P-N hi-speed
2N5039	MIL-S-19500/439	75V/20A, N-P-N
2N5302	MIL-S-19500/456	60V/30A, N-P-N
2N5303	MIL-S-19500/456	80V/30A, N-P-N
2N5415S	MIL-S-19500/485	-200V/-1A, P-N-P
2N5416S	MIL-S-19500/485	-300V/-1A, P-N-P
2N5671	MIL-S-19500/488	90V/30A, N-P-N
2N5672	MIL-S-19500/488	120V/30A, N-P-N hi-speed
2N6032	MIL-S-19500/528	90V/50A, N-P-N
2N6033	MIL-S-19500/528	120V/50A, N-P-N
2N6211	MIL-S-19500/461	-275V/-2A, P-N-P
2N6212	MIL-S-19500/461	-300V/-2A, P-N-P
2N6213	MIL-S-19500/461	-350V/-2A, P-N-P
2N6283	MIL-S-19500/504	80V/20A, N-P-N
2N6284	MIL-S-19500/504	100V/20A, N-P-N
2N6286	MIL-S-19500/505	-80V/-20A, P-N-P
2N6287	MIL-S-19500/505	-100V/-20A, P-N-P
2N6383	MIL-S-19500/523	40V/10A, N-P-N
2N6384	MIL-S-19500/523	60V/10A, N-P-N
2N6385	MIL-S-19500/523	80V/10A, N-P-N
2N6546	MIL-S-19500/525	300V/15A, N-P-N
2N6547	MIL-S-19500/525	400V/15A, N-P-N
2N6648	MIL-S-19500/527	-40V/-10A, P-N-P
2N6649	MIL-S-19500/527	-60V/-10A, P-N-P
2N6650	MIL-S-19500/527	-80V/-10A, P-N-P
2N6674	MIL-S-19500/537	300V/20A, N-P-N hi-speed
2N6675	MIL-S-19500/537	400V/20A, N-P-N hi-speed
2N6676	MIL-S-19500/538	300V/20A, N-P-N hi-speed
2N6678	MIL-S-19500/538	400V/20A, N-P-N hi-speed
2N6756	MIL-S-19500/542A	100V/14A, N-CH MOSFET
2N6758	MIL-S-19500/542A	200V/9A, N-CH MOSFET
2N6760	MIL-S-19500/542A	400V/5.5A, N-CH MOSFET
2N6762	MIL-S-19500/542A	500V/4.5A, N-CH MOSFET
2N6764	MIL-S-19500/543A	100V/38A, N-CH MOSFET
2N6766	MIL-S-19500/543A	200V/30A, N-CH MOSFET
2N6768	MIL-S-19500/543A	400V/14A, N-CH MOSFET
2N6770	MIL-S-19500/543A	500V/12A, N-CH MOSFET
2N6782	MIL-S-19500/556	100V/3.5A, N-CH MOSFET
2N6784	MIL-S-19500/556	200V/2.25A, N-CH MOSFET
2N6786	MIL-S-19500/556	200V/2.25A, N-CH MOSFET
2N6788	MIL-S-19500/555	100V/6A, N-CH MOSFET
2N6790	MIL-S-19500/555	200V/3.5A, N-CH MOSFET
2N6792	MIL-S-19500/555	400V/2A, N-CH MOSFET
2N6794	MIL-S-19500/555	500V/1.5A, N-CH MOSFET
2N6796	MIL-S-19500/557	100V/8A, N-CH MOSFET
2N6798	MIL-S-19500/557	100V/5.5A, N-CH MOSFET
2N6800	MIL-S-19500/557	400V/3A, N-CH MOSFET
2N6849	MIL-S-19500/563	100V/6.5A, P-CH MOSFET
2N6849	MIL-S-19500/564	100V/2.5A, P-CH MOSFET
2N6851	MIL-S-19500/563	200V/4A, P-CH MOSFET
2N6851	MIL-S-19500/564	200V/4A, P-CH MOSFET
2N6802	MIL-S-19500/557	500V/2.5A, N-CH MOSFET
2N6895	MIL-S-19500/565	100V/1.5A, P-CH MOSFET
2N6896	MIL-S-19500/565	100V/6A, P-CH MOSFET
2N6897	MIL-S-19500/565	100V/12A, P-CH MOSFET
2N6898	MIL-S-19500/565	100V/25A, P-CH MOSFET
2N6901	MIL-S-19500/566	100V/1.5A, N-CH MOSFET
2N6902	MIL-S-19500/566	100V/-12A, N-CH MOSFET
2N6903	MIL-S-19500/566	200V/1.5A, N-CH MOSFET
2N6904	MIL-S-19500/566	200V/-8A, N-CH MOSFET
2N6966	MIL-S-19500/569	100V/15A, N-CH MOSFET
2N6967	MIL-S-19500/569	200V/13A, N-CH MOSFET
2N6968	MIL-S-19500/569	400V/7.5A, N-CH MOSFET
2N6969	MIL-S-19500/569	500V/16A, N-CH MOSFET
2N7119	JAN89009	100V/14A, N-CH MOSFET
2N7120	JAN89009	200V/9A, N-CH MOSFET
2N7121	JAN89009	400V/5.5A, N-CH MOSFET
2N7122	JAN89009	500V/4.5A, N-CH MOSFET
2N7123	JAN89007	100V/38A, N-CH MOSFET
2N7124	JAN89007	200V/30A, N-CH MOSFET
2N7125	JAN89007	400V/14A, N-CH MOSFET
2N7126	JAN89007	500V/12A, N-CH MOSFET
2N7224	JAN89026	100V/30A, N-CH MOSFET
2N7225	JAN89026	200V/27A, N-CH MOSFET
2N7227	JAN89026	400V/12A, N-CH MOSFET
2N7228	JAN89026	500V/13A, N-CH MOSFET

# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
2N7241	JAN89025	100V/14A, N-CH MOSFET
2N7242	JAN89025	200V/9A, N-CH MOSFET
2N7243	JAN89025	400V/5.5A, N-CH MOSFET
2N7244	JAN89025	500V/4.5A, N-CH MOSFET
CD4000A	JM38510/05201BCA	Dual 3 input NOR gate plus inverter
CD4001A	JM38510/05202BCA	Quad 2 input NOR gate
CD4001B	JM38510/05252BCA	Quad 2 input NOR gate
CD4002A	JM38510/05203BCA	Dual 4 input NOR gate
CD4002B	JM38510/05253BCA	Dual 4 input NOR gate
CD4006A	JM38510/05701BCA	18-stage static shift register
CD4007A	JM38510/05301BCA	Dual complementary pair plus inverter
CD4007UB	JM38510/05351BCA	Dual complementary pair plus inverter
CD4008B	JM38510/05451BEA	4 Bit full adder with parallel carry out
CD4011A	JM38510/05001BCA	Quad 2-input NAND gate
CD4011B	JM38510/05051BCA	Quad 2-input NAND gate
CD4012A	JM38510/05002BCA	Dual 4-input NAND gate
CD4012B	JM38510/05052BCA	Dual 4-input NAND gate
CD4013A	JM38510/05101BCA	Dual D flip-flops with set/reset capability
CD4013B	JM38510/05151BCA	Dual D flip-flops with set/reset capability
CD4014A	JM38510/05702BEA	8-stage static shift register
CD4014B	JM38510/05752BEA	8-stage static shift register
CD4015A	JM38510/05703BEA	Dual 4 stage static shift register
CD4015B	JM38510/05753BEA	Dual 4 stage static shift register
CD4016B	5962-9064001CA	Quad bilateral switch
CD4017A	JM38510/05601BEA	Decade counter/divider
CD4017B	JM38510/05651BEA	Decade counter/divider
CD4018B	JM38510/05652BEA	Presetable divide by N counter
CD4019A	JM38510/05302BEA	Quad AND/OR select gate
CD4019B	JM38510/05352BEA	Quad AND/OR select gate
CD4020A	JM38510/05603BEA	14-stage binary ripple counter
CD4020B	JM38510/05653BEA	14-stage binary ripple counter
CD4021A	JM38510/05704BEA	8-stage static shift register
CD4021B	JM38510/05754BEA	8-stage static shift register
CD4022A	JM38510/05604BEA	Octal counter/divider
CD4022B	JM38510/05654BEA	Octal counter/divider
CD4023A	JM38510/05003BCA	Triple 3-input NAND gate
CD4023B	JM38510/05053BCA	Triple 3-input NAND gate
CD4024A	JM38510/05605BCA	7-stage binary ripple counter
CD4024B	JM38510/05655BCA	7-stage binary ripple counter
CD4025A	JM38510/05204BCA	Triple 3-input NOR gate
CD4025B	JM38510/05254BCA	Triple 3-input NOR gate
CD4027A	JM38510/05102BEA	Dual J-K flip-flop with set/reset capability
CD4027B	JM38510/05152BEA	Dual J-K flip-flop with set/reset capability
CD4028B	JM38510/05951BEA	BCD-to-decimal decoder
CD4029B	8101602EA	Presetable up/down counter
CD4030B	JM38510/05353BCA	Quad Exclusive-OR gate
CD4031A	JM38510/05705BEA	64 stage static shift register
CD4041UB	JM38510/05555BCA	Quad true/complement buffer
CD4047B	8102001CA	Monostable/A-stable multivibrator
CD4049A	JM38510/05503BEA	Hex buffer/converter (inverting)
CD4049UB	JM38510/05553BEA	Hex buffer/converter (inverting)
CD4050A	JM38510/05504BEA	Hex buffer/converter (non-inverting)
CD4050B	JM38510/05554BEA	Hex buffer/converter (non-inverting)
CD4053B	8101801EA	Triple 2 channel analog multiplexer/demultiplexer
CD4066B	JM38510/05852BCA	Quad bilateral switch
CD4069UB	JM38510/17401BCA	Hex inverter
CD4070B	JM38510/17203BCA	Quad exclusive-OR gate
CD4071B	JM38510/17101BCA	Quad 2-input OR gate
CD4072B	JM38510/17102BCA	Dual 4-input OR gate
CD4073B	JM38510/17003BCA	Triple 3-input AND gate
CD4075B	JM38510/17103BCA	Triple 3-input OR gate
CD4077B	JM38510/17204BCA	Quad exclusive-NOR gate
CD4078B	7704402CA	8-input NOR/OR gate
CD4081B	JM38510/17001BCA	Quad 2-input AND gate
CD4082B	JM38510/17002BCA	Dual 4-input AND gate
CD4085B	JM38510/17201BCA	Dual 2-wide, 2-input AND/OR/INVERT (AOI) gate
CD4086B	JM38510/17202BCA	Expandable 4-wider 2-input AND/OR/INVERT (AOI) gate
CD4094B	7702501EA	8-stage shift-and-store bus register
CD4098B	JM38510/17504BEA	Dual monostable multivibrator
CD4099B	JM38510/17601BEA	8-bit addressable latch
CD4502B	JM38510/17403BEA	Hex inverter/buffer (3 state)
CD4515B	7703201JA	4-bit latch/4-to-16 line decoder (outputs low)
CD4520B	7702301EA	Dual binary up counter
CD4538B	9053701EA	Dual precision monostable multivibrator
CD4555B	7704701EA	Dual 1-of-4 decoder/demultiplexer (outputs high)
CD4556B	7704801EA	Dual 1-of-4 decoder/demultiplexer (outputs low)
CD4585B	7703702EA	4-bit magnitude comparator
CD54HC00	8403701CA	Quad 2-input NAND gate
CD54HC02	8404101CA	Quad 2-input NOR gate
CD54HC03	5962-8764701CA	Quad 2-input NAND gate w/open collector
CD54HC04	8409801CA	Hex inverter

# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
CD54HC08	8404701CA	Quad 2-input AND gate
CD54HC10	8403801CA	Triple 3-input NAND gate
CD54HC107	5962-8515401CA	Dual J-K flip-flop w/reset
CD54HC109	8415001EA	Dual J-K flip-flop w/set and reset
CD54HC11	8404801CA	Triple 3-input AND gate
CD54HC112	8408801EA	Dual J-K flip-flop w/set and reset
CD54HC123	5962-8684701EA	Dual retriggerable monostable multivibrator w/reset
CD54HC125	5962-8772101CA	Quad 3-state buffer
CD54HC126	5962-8684801CA	Quad 3-state buffer
CD54HC138	8406201EA	3-to-8-line decoder/demultiplexer, inverting
CD54HC139	8409201EA	Dual 2-of-4-line decoder/demultiplexer
CD54HC14	8409101CA	Hex inverting Schmitt Trigger
CD54HC147	8406401EA	10-to-4-line priority encoder
CD54HC151	8412801EA	8-input multiplexer
CD54HC153	8409301EA	Dual 4-input multiplexer
CD54HC154	5962-8682201JA	4-to-16-line decoder/demultiplexer
CD54HC157	5962-8606101EA	Quad 2-input multiplexer
CD54HC158	5962-8682301EA	Quad 2-input multiplexer inverting
CD54HC160	5962-8682401EA	Synchronous BCD decade counter, asynchronous reset
CD54HC161	8407501EA	Synchronous 4-bit binary counter, asynchronous reset
CD54HC162	8509401EA	Synchronous BCD decade counter, asynchronous reset
CD54HC163	8607601EA	Synchronous 4-bit binary counter, synchronous reset
CD54HC164	8416201CA	8-bit serial-in/parallel-out shift register
CD54HC165	8409501EA	8-bit parallel-in/serial-out shift register
CD54HC173	5962-8682501EA	Quad D-type flip-flop, 3-state
CD54HC174	8407301EA	Hex D-type flip-flop w/reset
CD54HC175	8408901EA	Quad D-type flip-flop w/reset
CD54HC190	5962-8994601EA	Presetable SYN BCD up/down counter
CD54HC191	5962-8689101EA	Synchronous 4-bit binary up/down counter
CD54HC192	5962-8780801EA	Synchronous BCD decade up/down counter
CD54HC193	5962-8772401EA	Synchronous 4-bit binary up/down counter
CD54HC194	5962-8682601EA	4-bit bidirectional universal shift register
CD54HC195	5962-8682701EA	4-bit parallel access shift register
CD54HC20	8403901CA	Dual 4-input NAND gate
CD54HC21	5962-86857601CA	Dual 4-input AND gate
CD54HC221	5962-8780501EA	Dual monostable multivibrator w/reset
CD54HC237	5962-86860601EA	3-to-8 line decoder with latch
CD54HC238	5962-8688401EA	3-to-8 line decoder/demultiplexer
CD54HC240	8407401RA	Octal buffer/line driver, 3-state, inverting
CD54HC243	8409001CA	Quad bus transceiver, 3-state
CD54HC244	8409601RA	Octal buffer/line driver, 3-state
CD54HC245	8408501RA	Octal bus transceiver, 3-state
CD54HC251	8512501EA	8-input multiplexer, 3-state
CD54HC257	85512401EA	8-bit addressable latch
CD54HC259	8551901EA	Triple 3-input NOR gate
CD54HC27	8404201CA	Octal D-type flip-flop w/reset
CD54HC273	8409901RA	9-bit odd/even parity generator/checker
CD54HC280	8607701CA	4-bit binary full adder w/fast carry
CD54HC283	5962-8976501EA	8-bit universal shift register, 3-state
CD54HC299	5962-8780601RA	8-input NAND gate
CD54HC30	8404001CA	Quad 2-input OR gate
CD54HC32	8404501CA	Hex buffer/line driver, 3-state
CD54HC365	8500101EA	Hex buffer/line driver, 3-state, inverting
CD54HC366	5962-8682801EA	Hex buffer/line driver, 3-state
CD54HC367	8500201EA	Hex buffer/line driver, 3-state, inverting
CD54HC368	5962-8681201EA	Octal transparent latch, 3-state
CD54HC373	8407201RA	Octal D-type flip-flop, 3-state
CD54HC374	8407101RA	Octal D-type flip-flop with data enable
CD54HC377	5962-8780701RA	Dual 4-bit binary ripple counter
CD54HC393	8410001CA	Dual 4-input NOR gate
CD54HC4002	8404401CA	8-bit binary down counter
CD54HC40103	5962-9055301EA	Johnson decade counter w/10 decoded outputs
CD54HC4017	8601101EA	14 stage binary ripple counter
CD54HC4020	8500301EA	7-stage binary ripple counter
CD54HC4024	8601201CA	12-bit binary ripple counter
CD54HC4040	8500401EA	Phase-locked loop with VCO
CD54HC4046A	5962-8960901EA	Hex inverting HIGH-to-LOW level shifter
CD54HC4049	5962-8681901EA	Hex HIGH-to-LOW level shifter
CD54HC4050	5962-8682001EA	Dual 4-channel analog multiplexer/demultiplexer
CD54HC4052	5962-8855601EA	Triple 2 channel analog multiplexer/demultiplexer
CD54HC4053	5962-8775401EA	Prog, divide by N counter
CD54HC4059	5962-8944501JA	14-stage binary ripple counter w/oscillator
CD54HC4060	5962-8766001EA	Quad bilateral switch
CD54HC4066	5962-8950701CA	Triple 3-input OR gate
CD54HC4075	5962-8772201CA	
CD54HC42	5962-8682101EA	
CD54HC4511	5962-8773301EA	
CD54HC4538	5962-8688601EA	BCD-to-7 segment latch/decoder/driver
CD54HC533	5962-8681301RA	Dual retrig prec monostable multivibrator
CD54HC534	5962-8681401RA	Octal transparent latch, 3-state, inverting

# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
CD54HC563	5962-8606201RA	Octal transparent latch, 3-state, inverting
CD54HC564	5962-8681501RA	Octal D-type flip-flop, 3-state, inverting
CD54HC573	8512801RA	Octal transparent latch, 3-state
CD54HC597	5962-8681701EA	8-bit shift register with I/P latch
CD54HC640	5962-8780901RA	Octal bus transceiver, 3-state inverting
CD54HC646	5962-8688501JA	Octal bus transceiver/register, 3-state
CD54HC688	5962-8681801RA	8-bit magnitude comparator
CD54HC7266	8404302CA	Quad exclusive NOR
CD54HC73	5962-8515301CA	Dual J-K flip-flop w/reset
CD54HC74	8405601CA	Dual D flip-flop w/set and reset
CD54HC75	8407001EA	Quad bistable transparent latch
CD54HC85	8601301EA	4-bit magnitude comparator
CD54HC86	8404601CA	Quad 2-input exclusive OR gate
CD54HCT00	5962-8683101CA	Quad 2-input NAND gate
CD54HCT02	5962-8975101CA	Quad 2-input NOR gate
CD54HCT04	5962-8974701CA	Hex inverter
CD54HCT08	5962-8688301CA	Quad 2-input AND gate
CD54HCT10	5962-8984301CA	Triple 3-input NAND gate
CD54HCT107	5962-9084901MCA	Dual J-K flip-flop w/reset
CD54HCT109	5962-9070101MEA	Dual J-K flip-flop w/set and reset
CD54HCT11	5962-8970901CA	Triple 3-input AND gate
CD54HCT112	5962-8970201EA	Dual J-K flip-flop w/set and reset
CD54HCT123	5962-8970001EA	Dual rattriggerable monostable multivibrator w/set and reset
CD54HCT126	5962-9065101MCA	Quad 3-state buffer
CD54HCT132	5962-8984501CA	Quad 2-input NAND Schmitt Trigger
CD54HCT138	8550401EA	3-to-8-line decoder/demultiplexer, inverting
CD54HCT14	5962-8689001CA	Hex inverting Schmitt Trigger
CD54HCT151	5962-9065201MEA	8-input multiplexer
CD54HCT153	5962-9050501MEA	Dual 4-input multiplexer
CD54HCT154	5962-8670101JA	4-to-16 line decoder/demultiplexer
CD54HCT157	5962-9070201MEA	Quad 2-input multiplexer
CD54HCT158	5962-9070301MEA	Quad 2-input multiplexer, inverting
CD54HCT160	5962-9070501MEA	Synchronous BCD decade counter, asynchronous reset
CD54HCT161	5962-8685401EA	Synchronous 4-bit binary counter, asynchronous reset
CD54HCT162	5962-8970701EA	Synchronous BCD decade counter, synchronous reset
CD54HCT164	5962-8970401CA	8-bit serial-in parallel-out shift register
CD54HCT165	5962-8685501EA	8-bit parallel-in serial-out shift register
CD54HCT173	5962-8875901EA	Quad D-type flip-flop, 3-state
CD54HCT174	5962-8974301EA	Hex D-type flip-flop w/reset
CD54HCT175	5962-8970101EA	Quad D-type flip-flop w/reset-not in data base
CD54HCT191	5962-8687101EA	Synchronous 4-bit binary up/down counter
CD54HCT238	5962-8974501EA	3-to-8 line decoder/demultiplexer
CD54HCT240	8550501RA	Octal buffer/line driver, 3-state, inverting
CD54HCT244	8513001RA	Octal buffer/line driver, 3-state
CD54HCT245	8550601RA	Octal buffer transceiver, 3-state
CD54HCT251	5962-9052401MEA	8-input multiplexer, 3-state
CD54HCT257	5962-8970501EA	Quad 2-input multiplexer, 3-state
CD54HCT258	5962-8970801EA	Quad 2-line-to-4-line data selector
CD54HCT27	5962-8970301CA	Triple 3-input NOR gate
CD54HCT273	5962-8772501RA	Octal D-type flip-flop w/reset
CD54HCT30	5962-8974601CA	8-input NAND
CD54HCT32	5962-8685201CA	Quad 2-input OR gate
CD54HCT367	5962-9070601MEA	Hex buffer/line driver, 3-state
CD54HCT373	5962-8686701RA	Octal transparent latch, 3-state
CD54HCT374	8550701RA	Octal D-type flip-flop, 3-state
CD54HCT377	5962-8976901RA	Octal D-type flip-flop with data enable
CD54HCT393	5962-8989001CA	Dual 4-bit binary ripple counter
CD54HCT40102	5962-9057401EA	8-bit synchronous BCD down counter
CD54HCT4017	5962-9059701MEA	Johnson decade counter with 10 decoded outputs
CD54HCT4020	5962-8945801EA	14-stage binary ripple counter
CD54HCT4040	5962-8994701MEA	12-bit binary ripple counter
CD54HCT4046	5962-8875701EA	Phase-lock loop with VCO
CD54HCT4059	5962-8862401JA	Programmable divided-by-N counterC352
CD54HCT4060	5962-8977101EA	14-stage binary ripple counter w/oscillator
CD54HC1534	5962-8984901RA	Octal D-type flip-flop, 3-state, inverting
CD54HCT573	5962-8685601RA	Octal transparent latch, 3-state
CD54HCT640	5962-8974001RA	Octal bus transceiver, 3-state, inverting
CD54HCT688	5962-8685701RA	8-bit magnitude comparator
CD54HCT74	5962-8685301CA	Dual D flip-flop w/set and reset
CD54HCT75	5962-9075801MEA	Quad bistable transparent latch
CD54HCT85	5962-8687201EA	4-bit magnitude comparator
CD54HCT86	5962-8984401CA	Quad 2-input exclusive OR gate
CD54HCU04	8601001CA	Hex inverter (unbuffered)
DG180AA	5962-8767301IA	Dual SPST switch
DG180AP	5962-8767301CA	Dual SPST switch
DG201AAP	JM38510/12302BEA	Quad SPST CMOS analog SW
DG300AAP	JM38510/11601BCA	TTL compatible CMOS analog SW
DG301AAP	JM38510/11602BCA	TTL compatible CMOS analog SW
DG302AAP	JM38510/11603BCA	TTL compatible CMOS analog SW
DG303AAP	JM38510/11604BCA	TTL compatible CMOS analog SW

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# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
HA1-2400	5962-8778301EA	4 channel prog. op-amp
HA1-2420	8001601CA	High speed sample and hold
HA1-2539	5962-8778701CA	High slew rate wideband op-amp
HA1-2540	5962-8964801CA	Wideband fast settling op-amp
HA1-4902	5962-8686001EA	Precision quad comparator
HA1-5104	5962-8850201CA	Quad low noise hi-perf op-amp
HA1-5114	5962-8963401CA	Quad low noise hi-perf op-amp
HA1-5144	5962-8965603CA	Quad ultra low power op-amp
HA1-5190	5962-8778401CA	Wideband fast settling op-amp
HA1-5330	5962-8767701CA	High speed sample and hold
HA2-2500	JM38510/12204BGC	Precision high slew rate amp
HA2-2500	JM38510/12204BGA	Precision high slew rate amp
HA2-2510	JM38510/12205BGA	High slew rate amp
HA2-2510	JM38510/12205BGC	High slew rate amp
HA2-2520	JM38510/12206BGA	High slew rate (uncomp) amp
HA2-2520	JM38510/12206BGC	High slew rate (uncomp) amp
HA2-2541	5962-8778501XA	Wideband fast settling unity gain stable op-amp
HA2-2542	5962-8964301XA	High output current op-amp
HA2-2544	5962-8950201GC	Video op-amp
HA2-2600	JM38510/12202BGA	Wideband high impedance amp
HA2-2600	JM38510/12202BGC	Wideband high impedance amp
HA2-2620	JM38510/12203BGC	Wideband (uncomp) amp
HA2-2620	JM38510/12203BGA	Wideband (uncomp) amp
HA2-2640	7800302GC	High voltage op-amp
HA2-5002	5962-8963601GC	Current driver op-amp
HA2-5101	5962-8963501GC	Low noise hi-performance op-amp
HA2-5102	5962-8954801GC	Dual low noise hi-perf op-amp
HA2-5111	5962-8963101GA	Low noise hi-performance op-amp
HA2-5112	5962-8963201GA	Dual low noise hi-perf op-amp
HA2-5127	5962-8962701GC	Ultra low noise precision op-amp
HA2-5137	5962-8962702GC	Ultra low noise precision op-amp
HA2-5142	5962-8965602GC	Dual ultra low power op-amp
HA2-5147	5962-8962703GC	Ultra low noise wideband op-amp
HA2-5190	5962-8778401XA	Wideband fast settling op-amp
HA4-2400	5962-87783012A	4 channel prog. op-amp
HA4-2420	80016012A	High speed sample and hold
HA4-2539	5962-87787012A	High slew rate wideband op-amp
HA4-2540	5962-89648012A	Wideband fast settling op-amp
HA4-2544	5962-89502012A	Video op-amp
HA4-2640	78003022A	High voltage op-amp
HA4-4902	5962-86860012A	Precision quad comparator
HA4-5002	5962-89636012A	Current driver op-amp
HA4-5101	5962-89635012A	Low noise hi-performance op-amp
HA4-5102	5962-89548012A	Dual low noise hi-perf op-amp
HA4-5104	5962-88502012A	Quad low noise hi-perf op-amp
HA4-5111	5962-89631012A	Low noise hi-performance op-amp
HA4-5112	5962-89632012A	Dual low noise hi-perf op-amp
HA4-5114	5962-89634012A	Quad low noise hi-perf op-amp
HA4-5127	5962-89627012A	Ultra low noise precision op-amp
HA4-5137	5962-89627002A	Ultra low noise precision op-amp
HA4-5142	5962-89656022A	Dual ultra low power op-amp
HA4-5144	5962-89656032A	Quad ultra low power op-amp
HA4-5147	5962-89627032A	Ultra low noise wideband op-amp
HA4-5190	5962-87784012A	Wideband fast settling op-amp
HA4-5330	5962-87677012A	High speed sample and hold
HA7-2500	JM38510/12204BPA	Precision high slew rate amp
HA7-2510	JM38510/12205BPA	High slew rate amp
HA7-2520	JM38510/12206BPA	High slew rate (uncomp) amp
HA7-2544	5962-8950201PA	Video op-amp
HA7-2600	JM38510/12202BPA	Wideband high impedance amp
HA7-2620	JM38510/12203BPA	Wideband (uncomp) amp
HA7-2640	7800302PA	High voltage op-amp
HA7-5002	5962-8963601PA	Current driver op-amp
HA7-5101	5962-8963501PA	Low noise hi-performance op-amp
HA7-5102	5962-8954801PA	Dual low noise hi-perf op-amp
HA7-5111	5962-8963101PA	Low noise hi-performance op-amp
HA7-5112	5962-8963201PA	Dual low noise hi-perf op-amp
HA7-5127	5962-8962701PA	Ultra low noise precision op-amp
HA7-5137	5962-8962702PA	Ultra low noise precision op-amp
HA7-5142	5962-8965602PA	Dual ultra low power op-amp
HA7-5147	5962-8962703PA	Ultra low noise wideband op-amp
HD1-15530	7802901JA	Manchester encoder-decoder
HDI-6402B	5962-9052502MQA	UART 8MH
HDI-6402R	5962-9052501MQA	UART 2MH
HI1-0201HS	5962-8671601EA	High speed quad SPST CMOS analog switch
HI1-0506	JM38510/19001BXA	Single 16-Ch CMOS analog mux
HI1-0508	770520-12A	8 channel CMOS analog mux
HI1-0508	7705201EC	8 channel CMOS analog mux
HI1-0508	JM38510/19007BEA	8 channel CMOS analog mux
HI1-0509	JM38510/19008BEA	4 channel CMOS differential analog mux

# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
HI1-0546	5962-8513101XA	16 channel CMOS analog mux w/o.v. Protection
HI1-0546	JM38510/19002BXA	Single 16-Ch CMOS analog mux w/o.v. Protection
HI1-0547	5962-8513102XA	8 channel CMOS differential analog mux w/o.v. Protection
HI1-0547	JM38510/19004BXA	Differential 8-Ch CMOS analog mux w/o.v. Protection
HI1-0548	7705202EA	8-channel CMOS analog mux w/o.v. Protection
HI1-0548	JM38510/19005BEA	Single 8-Ch CMOS analog mux w/o.v. Protection
HI1-0549	5962-8513103EA	4 channel CMOS differential analog mux w/o.v. Protection
HI1-0549	JM38510/19006BEA	Differential 4-Ch CMOS analog mux w/o.v. Protection
HI1-5048	8100619EA/MLB	Dual SPST CMOS analog switch
HI1-5040	8100609EA/MLB	Single SPST CMOS analog switch
HI1-5041	8100610EA/MLB	Dual SPST CMOS analog switch
HI1-5042	8100611EA/MLB	Single SPDT CMOS analog switch
HI1-5043	8100612EA/MLB	Dual SPDT CMOS analog switch
HI1-5044	8100613EA/MLB	Single SPST CMOS analog switch
HI1-5045	8100614EA/MLB	Dual SPST CMOS analog switch
HI1-5046	8100615EA/MLB	Single DPDT CMOS analog switch
HI1-5046A	8100616EA/MLB	Single DPDT CMOS analog switch
HI1-5047	8100617EA/MLB	DPDT CMOS analog switch
HI1-5047A	8100618EA/MLB	DPDT CMOS analog switch
HI1-5049	8100620EA/MLB	Dual DPST CMOS analog switch
HI1-5050	8100621EA/MLB	SPDT CMOS analog switch
HI1-5051	8100622EA/MLB	Dual SPDT CMOS analog switch
HI1-574A	5962-8512704XA	12 bit A to D converter
HI4-0201HS	5962-86716012A	High speed quad SPST CMOS analog switch
HI4-0546	5962-85131013A	16 channel CMOS analog mux w/o.v. Protection
HI4-0547	5962-85131023A	8-channel CMOS differential analog mux w/o.v. Protection
HI4-0548	77052022A	8-channel CMOS analog mux w/o.v. Protection
HI4-0549	5962-85131032A	4 channel CMOS differential analog mux w/o.v. Protection
HI4-5043	81006122A	Dual SPDT CMOS analog switch
HI4-5045	81006142A	Dual DPST CMOS analog switch
HI4-5049	81006202A	Dual DPST CMOS analog switch
HI4-5051	81006222A	Dual SPDT CMOS analog switch
HI4-574A	5962-8512704YA	12 bit A to D converter
HM1-6504	8102405VA	4K x 1 synchronous RAM
HM1-6504	JM38510/24501BVA	4K x 1 synchronous RAM
HM1-6504B	8102403VA	4K x 1 synchronous RAM
HM1-6504S	8102401VA	4K x 1 synchronous RAM
HM1-6514	8102406VA	1K x 4 synchronous RAM
HM1-6514	JM38510/24502BVA	1K x 4 synchronous RAM
HM1-6514B	8102404VA	1K x 4 synchronous RAM
HM1-6514S	8102402VA	1K x 4 synchronous RAM
HM1-6516	8403601JA	2K x 8 synchronous RAM
HM1-6516	JM38510/29102BJA	2K x 8 synchronous RAM
HM1-65162	JM38510/29104BJA	2K x 8 asynchronous RAM
HM1-65162	8403602JA	2K x 8 asynchronous RAM
HM1-65162B	8403606JA	2K x 8 asynchronous RAM
HM1-65162B	JM38510/29110BJA	2K x 8 asynchronous RAM
HM1-65162C	8403603JA	2K x 8 asynchronous RAM
HM1-6516B	8403607JA	2K x 8 asynchronous RAM
HM1-65262	8413201RA	2K x 8 synchronous RAM
HM1-65262	JM38510/29103BRA	16K x 1 asynchronous RAM
HM1-65262B	8413203RA	2K x 8 SCRAM CDIP
HM1-65262B	JM38510/29109BRA	16K x 1 asynchronous RAM
HM1-65642B	JM38510/29205BXA	8K x 8 asynchronous RAM
HM1-6617	5962-8954001JA	2K x 8 fuse link PROM
HM1-6617B	5962-8954002JA	2K x 8 fuse link PROM
HM1-6642	5962-8869001JA	512 x 8 fuse link PROM
HM1-6642B	5962-8869002JA	512 x 8 fuse link PROM
HM4-6516	8403601ZA	2K x 8 synchronous RAM
HM4-6516	JM38510/29102BXA	2K x 8 synchronous RAM
HM4-65162	8403602ZA	2K x 8 asynchronous RAM
HM4-65162	JM38510/29104BXA	2K x 8 asynchronous RAM
HM4-65162B	8403606ZA	2K x 8 asynchronous RAM
HM4-65162C	8403603ZA	2K x 8 asynchronous RAM
HM4-6516B	8403607ZA	2K x 8 synchronous RAM
HM4-65262	8413201YA	2K x 8 SRAM LCC
HM4-65262B	JM38510/29103BYA	16K x 1 asynchronous RAM
HM4-65262B	8413203YA	2K x 8 SCRAM LCC
HM4-65262B	JM38510/29109BYA	16K x 1 asynchronous RAM
HM4-65642B	JM38510/29205BYA	8K x 8 asynchronous RAM
HM4-6617	5962-8954001XA	2K x 8 fuse link PROM
HM4-6617B	5962-8954002XA	2K x 8 fuse link PROM
HM4-6642	5962-88690013A	512 x 8 fuse link PROM
HM4-6642B	5962-88690023A	512 x 8 fuse link PROM
HM6-6617	5962-8954001LA	2K x 8 fuse link PROM
HM6-6617B	5962-8954002LA	2K x 8 fuse link PROM
HM6-6642	5962-8869001LA	512 x 8 fuse link PROM
HM6-6642B	5962-8869002LA	512 x 8 fuse link PROM
HS1-3282	5962-8688001QA	ARINC 429 bus interface
HS4-3282	5962-8688001XA	ARINC 429 bus interface



# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
ICL7667MJA	5962-8766001PA	Dual power MOS driver-cerdp
ICL7667MTV	5962-8766001GA	Dual power MOS driver-can
ICL8038AMJD	5962-8877201CA	Waveform generator
ICL8211MTY	5962-8984201GA	Voltage reference/indicator
ICL8212MTY	5962-8984202GA	Voltage reference/indicator
ICM7170MDG	5962-8785301JA	Micro P-compatible real time clock
ICM7170MDG	5962-8785301JC	Micro P-compatible real time clock
ICM7555MTV	5962-8950303GA	CMOS general purpose timer
ICM7556MJD	5962-8950304CA	CMOS Dual general pupose timer
IH5040MDE	JM38510/10501BEA	SPST 75 ohm high-level CMOS analog switch
IH5041MDE	JM38510/10502BEA	Dual SPST 75 ohm high-level CMOS analog switch
IH5042MDE	JM38510/10503BEA	SPDT 75 ohm high-level CMOS analog switch
IH5043MDE	JM38510/10504BEA	Dual SPDT 75 ohm high-level CMOS analog switch
IH5043MJE	8100604EA	Dual SPDT 75 ohm high-level CMOS analog switch
IH5044MDE	JM38510/10505BEA	DPST 75 ohm high-level CMOS analog switch
IH5045MDE	JM38510/10506BEA	Dual DPST 75 ohm high-level CMOS analog switch
IH5108MJE	7705203EA	8-channel Fault Protected CMOS analog multiplexer
IH5116MJJ	5962-8513104XA	16-channel Fault Protected CMOS analog
IH5140MJE	8100609EA/INT	SPST high-level CMOS analog switch
IH5141MJE	8100610EA/INT	Dual SPST high-level CMOS analog switch
IH5142MJE	8100611EA/INT	SPDT high-level CMOS analog switch
IH5143MJE	8100612EA/INT	Dual SPDT high-level CMOS analog switch
IH5145MJE	8100614EA/INT	Dual DPST high-level CMOS analog switch
IH5151MJE	8100622EA/INT	CMOS analog switch
IH5208MJE	5962-8513106EA	4-channel differential Fault Protected CMOS analog
IH5322MJE	5962-8875001EA	Quad video switch
IH5144MJE	8100613EA/INT	DPST high-level CMOS analog switch
IH6108MJE	7705201EA	8-channel CMOS analog multiplexer
MD80C86	8405201QA	Static 16-bit microprocessor-5MHZ
MD80C86-2	8405202QA	Static 16-bit microprocessor-8MHZ
MD80C88	5962-8601601QA	8/16 bit microprocessor-5MHZ
MD82C52	8501501XA	Serial controller interface
MD82C54	8406501JA	Programmable interval-timer
MD82C55A	8406602QA	Programmable peripheral interface
MD82C55A-5	8406601QA	Programmable peripheral interface
MD82C59A	5962-8501602YA	Priority interrupt controller
MD82C59A-5	5962-8501601YA	Priority interrupt controller
MD82C82	8406701RA	Octal latching bus driver
MD82C83H	8406702RA	Octal latching inverting bus driver
MD82C84A	8406801VA	Clock generator driver
MD82C86H-5	5962-8757701RA	Octal bus transceivers
MD82C87H-5	5962-8757702RA	Octal bus transceivers
MD82C88	8406901RA	Bus controller
MD82C89	5962-8552801RA	Bus arbiter
MR80C86	8405201XA	Static 16-bit microprocessor-5MHZ
MR80C88	5962-8601601XA	8/16 bit microprocessor-5MHZ
MR82C52	85015013A	Serial controller interface
MR82C54	84065013A	Programmable interval timer
MR82C55A	8406602XA	Programmable peripheral interface
MR82C55A-5	8406601XA	Programmable peripheral interface
MR82C59A	5962-85016023A	Priority interrupt controller
MR82C59A-5	5962-85016013A	Priority interrupt controller
MR82C82	84067012A	Octal latching bus driver
MR82C83H	84067022A	Octal latching inverting bus driver
MR82C84A	84068012A	Clock generator driver
MR82C86H-5	5962-87577012A	Octal bus transceivers
MR82C87H-5	5962-87577022A	Octal bus transceivers
MR82C88	84069012A	Bus controller
MR82C89	5962-85528012A	Bus arbiter
V100ZA05	87063-037	100V MOV varistor
V100ZA3	87063-038	100V MOV varistor
V100ZA4	87063-039	100V MOV varistor
V120ZA05	87063-041	12V MOV varistor
V120ZA1	87063-042	12V MOV varistor
V120ZA4	87063-043	12V MOV varistor
V120ZA6	87063/044	12V MOV varistor
V130LA20B	MIL-R-83530/1-2000B	130V MOV varistor
V150LA20B	MIL-R-83530/1-2200B	150V MOV varistor
V150ZA05	87063-045	150V MOV varistor
V150ZA1	87063-046	150V MOV varistor
V150ZA4	87063-047	150V MOV varistor
V150ZA8	87063-048	150V MOV varistor
V180ZA05	87063-049	180V MOV varistor
V180ZA1	87063-050	180V MOV varistor
V180ZA10	87063-052	180V MOV varistor
V180ZA5	87063-051	180V MOV varistor
V22ZA05	87063-001	122V MOV varistor
V22ZA1	87063-002	122V MOV varistor
V22ZA2	87063-003	122V MOV varistor
V22ZA3	87063-004	122V MOV varistor

# Military Cross Reference - BY HARRIS PART NUMBER

HARRIS DEVICE	MILITARY REFERENCE	DESCRIPTION
V24ZA50	87063-005	122V MOV varistor
V275LA40B	MIL-R-83530/1-4300E	250V MOV varistor
V27ZA05	87063-006	27V MOV varistor
V27ZA1	87063-007	27V MOV varistor
V27ZA2	87063-008	27V MOV varistor
V27ZA4	87063-009	27V MOV varistor
V27ZA60	87063-010	27V MOV varistor
V320LA40B	MIL-R-83530/1-5100E	320V MOV varistor
V33ZA05	87063-011	33V MOV varistor
V33ZA1	87063-012	33V MOV varistor
V33ZA2	87063-013	33V MOV varistor
V33ZA5	87063-014	33V MOV varistor
V33ZA70	87063-015	33V MOV varistor
V36ZA80	87063-016	36V MOV varistor
V39ZA05	87063-017	39V MOV varistor
V39ZA1	81063-018	39V MOV varistor
V39ZA3	87063-019	39V MOV varistor
V39ZA6	87063-020	39V MOV varistor
V47ZA05	87063-021	47V MOV varistor
V47ZA1	87063-022	47V MOV varistor
V47ZA3	87063-023	47V MOV varistor
V47ZA7	87063-024	47V MOV varistor
V56ZA05	87063-025	56V MOV varistor
V56ZA2	87063-026	56V MOV varistor
V56ZA3	87063-027	56V MOV varistor
V56ZA8	87063-028	56V MOV varistor
V68ZA05	87063-029	68V MOV varistor
V68ZA10	87063-032	68V MOV varistor
V68ZA2	87063-030	68V MOV varistor
V68ZA3	87063-031	68V MOV varistor
V82ZA05	87063-033	82V MOV varistor
V82ZA12	87063-036	82V MOV varistor
V82ZA2	87063-034	82V MOV varistor
V82ZA4	87063-035	82V MOV varistor
HD4-15530	78029013A	Manchester encoder-decoder
H11-0507	JM35510/19003BXA	Differential 8-Ch CMOS analog mux
MR80C86-2	8405202XA	Static 16-bit microprocessor-8 MHZ
V100ZA15	87063-040	100V MOV varistor
40MMDB	90065-001	Hi-Rel MOV
40MMDB	90065-004	Hi-Rel MOV
40MMDB	90065-005	Hi-Rel MOV
40MMDB	90065-007	Hi-Rel MOV
40MMDB	90065-008	Hi-Rel MOV
40MMDB	90065-013	Hi-Rel MOV
40MMDB	90065-014	Hi-Rel MOV
40MMDB	90065-016	Hi-Rel MOV
40MMDB	90065-018	Hi-Rel MOV
40MMDB	90065-019	Hi-Rel MOV
40MMDB	90065-020	Hi-Rel MOV
40MMDB	90065-022	Hi-Rel MOV

# Military Cross Reference - BY MIL REF NUMBER

MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
5962-85016013A	MR82C59A-5	Priority interrupt controller
5962-8501601YA	MD82C59A-5	Priority interrupt controller
5962-85016023A	MR82C59A	Priority interrupt controller
5962-8501602YA	MD82C59A	Priority interrupt controller
5962-8512704XA	H11-574A	12 bit A to D converter
5962-8512704YA	H14-574A	12 bit A to D converter
5962-85131013A	H14-0546	16 channel CMOS analog mux w/o.v. Protection
5962-8513101XA	H11-0546	16 channel CMOS analog mux w/o.v. Protection
5962-8513101YA	H11-0546	16 channel CMOS analog mux w/o.v. Protection
5962-85131023A	H14-0547	8-channel CMOS differential analog mux w/o.v. Protection
5962-8513102XA	H11-0547	8 channel CMOS differential analog mux w/o.v. Protection
5962-85131032A	H14-0549	4 channel CMOS differential analog mux w/o.v. Protection
5962-8513103EA	H11-0549	4 channel CMOS differential analog mux w/o.v. Protection
5962-8513104XA	IH5116MJ1	16-channel Fault Protected CMOS analog
5962-8513106EA	IH5208MJ3	4-channel differential Fault Protected CMOS analog
5962-8515301CA	CD54HC73	Dual J-K flip-flop w/reset
5962-8515401CA	CD54HC107	Dual J-K flip-flop w/reset
5962-85528012A	MR82C89	Bus arbiter
5962-8552801RA	MD82C89	Bus arbiter
5962-8601601QA	MD80C88	8/16 bit microprocessor-5MHZ
5962-8601601XA	MR80C88	8/16 bit microprocessor-5MHZ
5962-8606101EA	CD54HC157	Quad 2-input multiplexer
5962-8606201RA	CD54HC563	Octal transparent latch, 3-state, inverting
5962-8670101JA	CD54HCT154	4-to-16 line decoder/demultiplexer
5962-86716012A	H14-0201HS	High speed quad SPST CMOS analog switch
5962-8671601EA	H11-0201HS	High speed quad SPST CMOS analog switch
5962-8681201EA	CD54HC368	Hex buffer/line driver, 3-state, inverting
5962-8681301RA	CD54HC533	Octal transparent latch, 3-state, inverting
5962-8681401RA	CD54HC534	Octal D-type flip-flop, 3-state, inverting
5962-8681501RA	CD54HC564	Octal D-type flip-flop, 3-state, inverting
5962-8681701EA	CD54HC597	8-bit shift register with VP latch
5962-8681801RA	CD54HC688	8-bit magnitude comparator
5962-8681901EA	CD54HC4049	Hex inverting HIGH-to-LOW level shifter
5962-8682001EA	CD54HC4050	Hex HIGH-to-LOW level shifter
5962-8682101EA	CD54HC42	
5962-8682201JA	CD54HC154	4-to-16-line decoder/demultiplexer
5962-8682301EA	CD54HC158	Quad 2-input multiplexer inverting
5962-8682501EA	CD54HC173	Quad D-type flip-flop, 3-state
5962-8682601EA	CD54HC194	4-bit bidirectional universal shift register
5962-8682701EA	CD54HC195	4-bit parallel access shift register
5962-8682801EA	CD54HC366	Hex buffer/line driver, 3-state, inverting
5962-8683101CA	CD54HC700	Quad 2-input NAND gate
5962-8684701EA	CD54HC123	Dual retriggerable monostable multivibrator w/reset
5962-8684801CA	CD54HC126	Quad 3-state buffer
5962-8685201CA	CD54HCT32	Quad 2-input OR gate
5962-8685301CA	CD54HCT74	Dual D flip-flop w/set and reset
5962-8685401EA	CD54HCT161	Synchronous 4-bit binary counter, asynchronous reset
5962-8685501EA	CD54HCT165	8-bit parallel-in serial-out shift register
5962-8685601RA	CD54HCT573	Octal transparent latch, 3-state
5962-8685701RA	CD54HCT688	8-bit magnitude comparator
5962-86860012A	HA4-4902	Precision quad comparator
5962-8686001EA	HA1-4902	Precision quad comparator
5962-8686701RA	CD54HCT373	Octal transparent latch, 3-state
5962-8688001QA	HS1-3282	ARINC 429 bus interface
5962-8688001XA	HS4-3282	ARINC 429 bus interface
5962-8688301CA	CD54HCT08	Quad 2-input AND gate
5962-8688401EA	CD54HC238	3-to-8 line decoder/demultiplexer
5962-8688501JA	CD54HC646	Octal bus transceiver/register, 3-state
5962-8688601EA	CD54HC4538	Dual retrig prec monostable multivibrator
5962-8689001CA	CD54HCT14	Hex inverting Schmitt Trigger
5962-8689101EA	CD54HC191	Synchronous 4-bit binary up/down counter
5962-87577012A	MR82C86H-5	Octal bus transceivers
5962-8757701RA	MD82C86H-5	Octal bus transceivers
5962-87577022A	MR82C87H-5	Octal bus transceivers
5962-8757702RA	MD82C87H-5	Octal bus transceivers
5962-8764701CA	CD54HC03	Quad 2-input NAND gate w/open collector
5962-8765301JA	ICM7170MDG	Micro P-compatible real time clock
5962-8765301JC	ICM7170MDG	Micro P-compatible real time clock
5962-8766001GA	ICL7667MTV	Dual power MOS driver-can
5962-8766001PA	ICL7667MJA	Dual power MOS driver-cerdip
5962-8767301CA	DG180AP	Dual SPST switch
5962-87673011A	DG180AA	Dual SPST switch
5962-87677012A	HA4-5330	High speed sample and hold
5962-8767701CA	HA1-5330	High speed sample and hold
5962-8768001EA	CD54HC4060	14-stage binary ripple counter w/oscillator
5962-8772101CA	CD54HC125	Quad 3-state buffer
5962-8772201CA	CD54HC4075	Triple 3-input OR gate
5962-8772401EA	CD54HC193	Synchronous 4-bit binary up/down counter
5962-8772501RA	CD54HCT273	Octal D-type flip-flop w/reset
5962-8773301EA	CD54HC4511	BCD-to-7 segment latch/decoder/driver

# Military Cross Reference - BY MIL REF NUMBER

MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
5962-8775401EA	CD54HC4053	Triple 2 channel analog multiplexer/demultiplexer
5962-87783012A	HA4-2400	4 channel prog. op-amp
5962-8778301EA	HA1-2400	4 channel prog. op-amp
5962-87784012A	HA4-5190	Wideband fast settling op-amp
5962-8778401CA	HA1-5190	Wideband fast settling op-amp
5962-8778401XA	HA2-5190	Wideband fast settling op-amp
5962-8778501XA	HA2-2541	Wideband fast settling unity gain stable op-amp
5962-87787012A	HA4-2539	High slew rate wideband op-amp
5962-8778701CA	HA1-2539	High slew rate wideband op-amp
5962-8780501EA	CD54HC221	Dual monostable multivibrator w/reset
5962-8780601RA	CD54HC299	8-bit universal shift register, 3-state
5962-8780701RA	CD54HC377	Octal D-type flip-flop with data enable
5962-8780801EA	CD54HC192	Synchronous BCD decade up/down counter
5962-8780901RA	CD54HC640	Octal bus transceiver, 3-state inverting
5962-88502012A	HA4-5104	Quad low noise hi-perf op-amp
5962-8850201CA	HA1-5104	Quad low noise hi-perf op-amp
5962-8855601EA	CD54HC4052	Dual 4-channel analog multiplexer/demultiplexer
5962-8857601CA	CD54HC21	Dual 4-input AND gate
5962-8860601EA	CD54HC237	3-to-8 line decoder with latch
5962-8862401JA	CD54HCT4059	Programmable divided-by-"N" counterC352
5962-8867101EA	CD54HCT191	Synchronous 4-bit binary up/down counter
5962-8867201EA	CD54HCT85	4-bit magnitude comparator
5962-88690013A	HM4-6642	512 x 8 fuse link PROM
5962-8869001JA	HM1-6642	512 x 8 fuse link PROM
5962-8869001LA	HM6-6642	512 x 8 fuse link PROM
5962-88690023A	HM4-6642B	512 x 8 fuse link PROM
5962-8869002JA	HM1-6642B	512 x 8 fuse link PROM
5962-8869002LA	HM6-6642B	512 x 8 fuse link PROM
5962-8875001EA	IH5352MJE	Quad video switch
5962-8875701EA	CD54HCT4046	Phase-lock loop with VCO
5962-8875901EA	CD54HCT173	Quad D-type flip-flop, 3-state
5962-8877201CA	ICL8038AMJD	Waveform generator
5962-8944501JA	CD54HC4059	Prog. divide by N counter
5962-8945801EA	CD54HCT4020	14 stage binary ripple counter
5962-89502012A	HA4-2544	Video op-amp
5962-8950201GC	HA2-2544	Video op-amp
5962-8950201PA	HA7-2544	Video op-amp
5962-8950303QA	ICM7555MTV	CMOS general purpose timer
5962-8950304CA	ICM7556MJD	CMOS Dual general purpose timer
5962-8950701CA	CD54HC4066	Quad bilateral switch
5962-8954001JA	HM1-6617	2K x 8 fuse link PROM
5962-8954001LA	HM6-6617	2K x 8 fuse link PROM
5962-8954001XA	HM4-6617	2K x 8 fuse link PROM
5962-8954002JA	HM1-6617B	2K x 8 fuse link PROM
5962-8954002LA	HM6-6617B	2K x 8 fuse link PROM
5962-8954002XA	HM4-6617B	2K x 8 fuse link PROM
5962-89548012A	HA4-5102	Dual low noise hi-perf op-amp
5962-8954801GC	HA2-5102	Dual low noise hi-perf op-amp
5962-8954801PA	HA7-5102	Dual low noise hi-perf op-amp
5962-8960901EA	CD54HC4046A	Phase-locked loop with VCO
5962-89627002A	I A4-5137	Ultra low noise precision op-amp
5962-89627012A	HA4-5127	Ultra low noise precision op-amp
5962-8962701GC	HA2-5127	Ultra low noise precision op-amp
5962-8962701PA	HA7-5127	Ultra low noise precision op-amp
5962-8962702GC	HA2-5137	Ultra low noise precision op-amp
5962-8962702PA	HA7-5137	Ultra low noise precision op-amp
5962-89627032A	HA4-5147	Ultra low noise wideband op-amp
5962-8962703GC	HA2-5147	Ultra low noise wideband op-amp
5962-8962703PA	HA7-5147	Ultra low noise wideband op-amp
5962-89631012A	HA4-5111	Low noise hi-performance op-amp
5962-8963101GA	HA2-5111	Low noise hi-performance op-amp
5962-8963101PA	HA7-5111	Low noise hi-performance op-amp
5962-89632012A	HA4-5112	Dual low noise hi-perf op-amp
5962-8963201GA	HA2-5112	Dual low noise hi-perf op-amp
5962-8963201PA	HA7-5112	Dual low noise hi-perf op-amp
5962-89634012A	HA4-5114	Quad low noise hi-perf op-amp
5962-8963401CA	HA1-5114	Quad low noise hi-perf op-amp
5962-89635012A	HA4-5101	Low noise hi-performance op-amp
5962-8963501GC	HA2-5101	Low noise hi-performance op-amp
5962-8963501PA	HA7-5101	Low noise hi-performance op-amp
5962-89636012A	HA4-5002	Current driver op-amp
5962-8963601GC	HA2-5002	Current driver op-amp
5962-8963601PA	HA7-5002	Current driver op-amp
5962-8964301XA	HA2-2542	High output current op-amp
5962-89648012A	HA4-2540	Wideband fast settling op-amp
5962-8964801CA	HA1-2540	Wideband fast settling op-amp
5962-89656022A	HA4-5142	Dual ultra low power op-amp
5962-8965602GC	HA2-5142	Dual ultra low power op-amp
5962-8965602PA	I A7-5142	Dual ultra low power op-amp
5962-89656032A	HA4-5144	Quad ultra low power op-amp

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MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
5962-8965603CA	HA1-5144	Quad ultra low power op-amp
5962-8970001EA	CD54HCT123	Dual retriggerable monostable multivibrator w/set and reset
5962-8970101EA	CD54HCT175	Quad D-type flip-flop w/reset-not in data base
5962-8970201EA	CD54HCT112	Dual J-K flip-flop w/set and reset
5962-8970301CA	CD54HCT27	Triple 3-input NOR gate
5962-8970401CA	CD54HCT164	8-bit serial-in parallel-out shift register
5962-8970501EA	CD54HCT257	Quad 2-input multiplexer, 3-state
5962-8970701EA	CD54HCT162	Synchronous BCD decade counter, synchronous reset
5962-8970801EA	CD54HCT258	Quad 2-line-to-4-line data selector
5962-8970901CA	CD54HCT11	Triple 3-input AND gate
5962-8974001RA	CD54HCT640	Octal bus transceiver, 3-state, inverting
5962-8974301EA	CD54HCT174	Hex D-type flip-flop w/reset
5962-8974501EA	CD54HCT238	3-to-8 line decoder/demultiplexer
5962-8974601CA	CD54HCT30	8-input NAND
5962-8974701CA	CD54HCT04	Hex inverter
5962-8975101CA	CD54HCT02	Quad 2-input NOR gate
5962-8976501EA	CD54HC283	4-bit binary full adder w/fast carry
5962-8976901RA	CD54HCT377	Octal D-type flip-flop with data enable
5962-8977101EA	CD54HCT4060	14-stage binary ripple counter w/oscillator
5962-8984201GA	ICL8211MTY	Voltage reference/indicator
5962-8984202GA	ICL8212MTY	Voltage reference/indicator
5962-8984301CA	CD54HCT10	Triple 3-input NAND gate
5962-8984401CA	CD54HCT86	Quad 2-input exclusive OR gate
5962-8984501CA	CD54HCT132	Quad 2-input NAND Schmitt Trigger
5962-8984901RA	CD54HCT534	Octal D-type flip-flop, 3-state, inverting
5962-8989001CA	CD54HCT393	Dual 4-bit binary ripple counter
5962-8994601EA	CD54HC190	Presetable SYN BCD up/down counter
5962-8994701MEA	CD54HCT4040	12-bit binary ripple counter
5962-9050501MEA	CD54HCT153	Dual 4-input multiplexer
5962-9052401MEA	CD54HCT251	8-input multiplexer, 3-state
5962-9052501MQA	HDI-6402R	UART 2MH
5962-9052502MQA	HDI-6402B	UART 8MH
5962-9055301EA	CD54HC40103	8-bit binary down counter
5962-9057401EA	CD54HCT40012	8-bit synchronous BCD down counter
5962-9059701MEA	CD54HCT4017	Johnson decade counter with 10 decoded outputs
5962-9064001CA	CD4016B	Quad bilateral switch
5962-9065101MCA	CD54HCT126	Quad 3-state buffer
5962-9065201MEA	CD54HCT151	8-input multiplexer
5962-9070101MEA	CD54HCT109	Dual J-K flip-flop w/set and reset
5962-9070201MEA	CD54HCT157	Quad 2-input multiplexer
5962-9070301MEA	CD54HCT158	Quad 2-input multiplexer, inverting
5962-9070501MEA	CD54HCT160	Synchronous BCD decade counter, asynchronous reset
5962-9070601MEA	CD54HCT367	Hex buffer/line driver, 3-state
5962-9075801MEA	CD54HCT75	Quad bistable transparent latch
5962-9084901MCA	CD54HCT107	Dual J-K flip-flop w/reset
5962-8682401EA	CD54HC160	Synchronous BCD decade counter, asynchronous reset
7702301EA	CD4520B	Dual binary up counter
7702501EA	CD4094B	8-stage shift-and-store bus register
7703201JA	CD4515B	4-bit latch/4-to-16 line decoder (outputs low)
7703702EA	CD4585B	4-bit magnitude comparator
7704402CA	CD4078B	8-input NOR/OR gate
7704701EA	CD4555B	Dual 1-of-4 decoder/demultiplexer (outputs high)
7704801EA	CD4556B	Dual 1-of-4 decoder/demultiplexer (outputs low)
770520-12A	H11-0508	8 channel CMOS analog mux
7705201EA	IH6108MJE	8-channel CMOS analog multiplexer
7705201EC	H11-0508	8 channel CMOS analog mux
77052022A	H14-0548	8-channel CMOS analog mux w/o.v. Protection
7705202EA	H11-0548	8-channel CMOS analog mux w/o.v. Protection
7705203EA	IH5108MJE	8-channel Fault Protected CMOS analog multiplexer
78003022A	HA4-2640	High voltage op-amp
7800302GC	HA2-2640	High voltage op-amp
7800302PA	HA7-2640	High voltage op-amp
78029013A	HD4-15530	Manchester encoder-decoder
7802901JA	HD1-15530	Manchester encoder-decoder
80016012A	HA4-2420	High speed sample and hold
8001601CA	HA1-2420	High speed sample and hold
8100604EA	IH5043MJE	Dual SPDT 75 ohm high-level CMOS analog switch
8100609EA/INT	IH5140MJE	SPST high-level CMOS analog switch
8100609EA/MLB	H11-5040	Single SPST CMOS analog switch
8100610EA/INT	IH5141MJE	Dual SPST high-level CMOS analog switch
8100610EA/MLB	H11-5041	Dual SPST CMOS analog switch
8100611EA/INT	IH5142MJE	SPDT high-level CMOS analog switch
8100611EA/MLB	H11-5342	Single SPDT CMOS analog switch
81006122A	H14-5043	Dual SPDT CMOS analog switch
8100612EA/INT	IH5143MJE	Dual SPDT high-level CMOS analog switch
8100612EA/MLB	H11-5043	Dual SPDT CMOS analog switch
8100613EA/INT	IH5144MJE	DPST high-level CMOS analog switch
8100613EA/MLB	H11-5044	Single SPST CMOS analog switch
81006142A	H14-5045	Dual DPST CMOS analog switch
8100614EA/INT	IH5145MJE	Dual DPST high-level CMOS analog switch
8100614EA/MLB	H11-5045	Dual SPST CMOS analog switch

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MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
8100615E/MLB	HI1-5046	Single DPDT CMOS analog switch
8100616E/MLB	HI1-5046A	Single DPDT CMOS analog switch
8100617E/MLB	HI1-5047	DPDT CMOS analog switch
8100618E/MLB	HI1-5047A	DPDT CMOS analog switch
8100619E/MLB	HI1-5048	Dual SPST CMOS analog switch
81006202A	HI4-5049	Dual DPST CMOS analog switch
8100620E/MLB	HI1-5049	Dual DPST CMOS analog switch
8100621E/MLB	HI1-5050	Dual DPST CMOS analog switch
81006222A	HI4-5051	SPDT CMOS analog switch
8100622E/MLB	HI4-5051	Dual SPDT CMOS analog switch
8100622E/INT	IH5151MJE	CMOS analog switch
8100622E/MLB	HI1-5051	Dual SPDT CMOS analog switch
8101602EA	CD4029B	Presetable up/down counter
8101801EA	CD4053B	Triple 2 channel analog multiplexer/demultiplexer
8102001CA	CD4047B	Monostable/A-stable multivibrator
8102401VA	HM1-6504S	4K x 1 synchronous RAM
8102402VA	HM1-6514S	1K x 4 synchronous RAM
8102403VA	HM1-6504B	4K x 1 synchronous RAM
8102404VA	HM1-6514B	1K x 4 synchronous RAM
8102405VA	HM1-6504	4K x 1 synchronous RAM
8102406VA	HM1-6514	1K x 4 synchronous RAM
81063-018	V39ZA1	39V MOV varistor
8403601JA	HM1-6516	2K x 8 synchronous RAM
8403601ZA	HM4-6516	2K x 8 synchronous RAM
8403602JA	HM1-65162	2K x 8 asynchronous RAM
8403602ZA	HM4-65162	2K x 8 asynchronous RAM
8403603JA	HM1-65162C	2K x 8 asynchronous RAM
8403603ZA	HM4-65162C	2K x 8 asynchronous RAM
8403606JA	HM1-65162B	2K x 8 asynchronous RAM
8403606ZA	HM4-65162B	2K x 8 asynchronous RAM
8403607JA	HM1-6516B	2K x 8 synchronous RAM
8403607ZA	HM4-6516B	2K x 8 synchronous RAM
8403701CA	CD54HC00	Quad 2-input NAND gate
8403801CA	CD54HC10	Triple 3-input NAND gate
8403901CA	CD54HC20	Dual 4-input NAND gate
8404001CA	CD54HC30	8-input NAND gate
8404101CA	CD54HC02	Quad 2-input NOR gate
8404201CA	CD54HC27	Triple 3-input NOR gate
8404401CA	CD54HC4002	Quad 4-input NOR gate
8404501CA	CD54HC32	Quad 2-input OR gate
8404601CA	CD54HC86	Quad 2-input exclusive OR gate
8404701CA	CD54HC08	Quad 2-input AND gate
8404801CA	CD54HC11	Triple 3-input AND gate
8405201QA	MR80C86	Static 16-bit microprocessor-5MHZ
8405201XA	MR80C86	Static 16-bit microprocessor-5MHZ
8405202QA	MR80C86-2	Static 16-bit microprocessor-8MHZ
8405202XA	MR80C86-2	Static 16-bit microprocessor-8 MHZ
8405601CA	CD54HC74	Dual D flip-flop w/set and reset
8406201EA	CD54HC138	3-to-8-line decoder/demultiplexer, inverting
8406401EA	CD54HC147	10-to-4-line priority encoder
84065013A	MR82C54	Programmable interval timer
8406501JA	MD82C54	Programmable interval timer
8406601QA	MR82C55A-5	Programmable peripheral interface
8406601XA	MR82C55A-5	Programmable peripheral interface
8406602QA	MD82C55A	Programmable peripheral interface
8406602XA	MR82C55A	Programmable peripheral interface
84067012A	MR82C82	Octal latching bus driver
8406701RA	MD82C82	Octal latching bus driver
84067022A	MR82C83H	Octal latching inverting bus driver
8406702RA	MD82C83H	Octal latching inverting bus driver
84068012A	MR82C84A	Clock generator driver
8406801VA	MD82C84A	Clock generator driver
84069012A	MR82C88	Bus controller
8406901RA	MD82C88	Bus controller
8407001EA	CD54HC75	Quad bistable transparent latch
8407101RA	CD54HC374	Octal D-type flip-flop, 3-state
8407201RA	CD54HC373	Octal transparent latch, 3-state
8407301EA	CD54HC174	Hex D-type flip-flop w/reset
8407401RA	CD54HC240	Octal buffer/line driver, 3-state, inverting
8407501EA	CD54HC161	Synchronous 4-bit binary counter, asynchronous reset
8408501RA	CD54HC245	Dual bus transceiver, 3-state
8408801EA	CD54HC112	Octal J-K flip-flop w/set and reset
8408901EA	CD54HC175	Quad D-type flip-flop w/reset
8409001CA	CD54HC243	Quad bus transceiver, 3-state
8409101CA	CD54HC14	Hex inverting Schmitt Trigger
8409201EA	CD54HC139	Dual 2-of-4-line decoder/demultiplexer
8409301EA	CD54HC153	Dual 4-input multiplexer
8409501EA	CD54HC165	8-bit parallel-in/serial-out shift register
8409601RA	CD54HC244	Octal buffer/line driver, 3-state
8409801CA	CD54HC04	Hex inverter
8409901RA	CD54HC273	Octal D-type flip-flop w/reset
8410001CA	CD54HC393	Dual 4-bit binary ripple counter

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MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
8412801EA	CD54HC151	8-input multiplexer
8413201RA	HM1-65262	2K x 8 SRAM CDIP
8413201YA	HM4-65262	2K x 8 SRAM LCC
8413203RA	HM1-65262B	2K x 8 SRAM CDIP
8413203YA	HM4-65262B	2K x 8 SRAM LCC
8415001EA	CD54HC109	Dual J-K flip-flop w/set and reset
8416201CA	CD54HC164	8-bit serial-in/parallel-out shift register
8404302CA	CD54HC7266	Quad exclusive NOR
8500101EA	CD54HC365	Hex buffer/line driver, 3-state
8500201EA	CD54HC367	Hex buffer/line driver, 3-state
8500301EA	CD54HC4020	14 stage binary ripple counter
8500401EA	CD54HC4040	12-bit binary ripple counter
85015013A	MR82C52	Serial controller interface
8501501XA	MD82C52	Serial controller interface
8509401EA	CD54HC162	Synchronous BCD decade counter, asynchronous reset
8512401EA	CD54HC257	
8512501EA	CD54HC251	
8512801RA	CD54HC573	8-input multiplexer, 3-state
8513001RA	CD54HCT244	Octal transparent latch, 3-state
8550401EA	CD54HCT138	Octal buffer/line driver, 3-state
8550501RA	CD54HCT240	3-to-8-line decoder/demultiplexer, inverting
8550601RA	CD54HCT245	Octal buffer/line driver, 3-state, inverting
8550701RA	CD54HCT374	Octal buffer transceiver, 3-state
8551901EA	CD54HC259	Octal D-type flip-flop, 3-state
8601001CA	CD54HCU04	8-bit addressable latch
8601101EA	CD54HC4017	Hex inverter (unbuffered)
8601201CA	CD54HC4024	Johnson decade counter w/10 decoded outputs
8601301EA	CD54HC85	7-stage binary ripple counter
8607601EA	CD54HC163	4-bit magnitude comparator
8607701CA	CD54HC280	Synchronous 4-bit binary counter, synchronous reset
87063-001	V22ZA05	9-bit odd/even parity generator/checker
87063-002	V22ZA1	122V MOV varistor
87063-003	V22ZA2	122V MOV varistor
87063-004	V22ZA3	122V MOV varistor
87063-005	V24ZA50	122V MOV varistor
87063-006	V27ZA05	122V MOV varistor
87063-007	V27ZA1	27V MOV varistor
87063-008	V27ZA2	27V MOV varistor
87063-009	V27ZA4	27V MOV varistor
87063-010	V27ZA60	27V MOV varistor
87063-011	V33ZA05	33V MOV varistor
87063-012	V33ZA1	33V MOV varistor
87063-013	V33ZA2	33V MOV varistor
87063-014	V33ZA5	33V MOV varistor
87063-015	V33ZA70	33V MOV varistor
87063-016	V36ZA80	36V MOV varistor
87063-017	V39ZA05	39V MOV varistor
87063-019	V39ZA3	39V MOV varistor
87063-020	V39ZA6	39V MOV varistor
87063-021	V47ZA05	47V MOV varistor
87063-022	V47ZA1	47V MOV varistor
87063-023	V47ZA3	47V MOV varistor
87063-024	V47ZA7	47V MOV varistor
87063-025	V56ZA05	56V MOV varistor
87063-026	V56ZA2	56V MOV varistor
87063-027	V56ZA3	56V MOV varistor
87063-028	V56ZA8	56V MOV varistor
87063-029	V68ZA05	68V MOV varistor
87063-030	V68ZA2	68V MOV varistor
87063-031	V68ZA3	68V MOV varistor
87063-032	V68ZA10	68V MOV varistor
87063-033	V82ZA05	82V MOV varistor
87063-034	V82ZA2	82V MOV varistor
87063-035	V82ZA4	82V MOV varistor
87063-036	V82ZA12	82V MOV varistor
87063-037	V100ZA05	100V MOV varistor
87063-038	V100ZA3	100V MOV varistor
87063-039	V100ZA4	100V MOV varistor
87063-040	V100ZA15	100V MOV varistor
87063-041	V120ZA05	12V MOV varistor
87063-042	V120ZA1	12V MOV varistor
87063-043	V120ZA4	12V MOV varistor
87063-045	V150ZA05	150V MOV varistor
87063-046	V150ZA1	150V MOV varistor
87063-047	V150ZA4	150V MOV varistor
87063-048	V150ZA8	150V MOV varistor
87063-049	V180ZA05	180V MOV varistor
87063-050	V180ZA1	180V MOV varistor
87063-051	V180ZA5	180V MOV varistor
87063-052	V180ZA10	180V MOV varistor
87063/044	V120ZA6	12V MOV varistor

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MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
9055701EA	CD4538B	Dual precision monostable multivibrator
JAN89007	2N7123	100V/38A, N-CH MOSFET
JAN89007	2N7124	200V/30A, N-CH MOSFET
JAN89007	2N7125	400V/14A, N-CH MOSFET
JAN89007	2N7126	500V/12A, N-CH MOSFET
JAN89009	2N7119	100V/14A, N-CH MOSFET
JAN89009	2N7120	200V/9A, N-CH MOSFET
JAN89009	2N7121	400V/5.5A, N-CH MOSFET
JAN89009	2N7122	500V/4.5A, N-CH MOSFET
JAN89025	2N7241	100V/14A, N-CH MOSFET
JAN89025	2N7242	200V/9A, N-CH MOSFET
JAN89025	2N7243	400V/5.5A, N-CH MOSFET
JAN89025	2N7244	500V/4.5A, N-CH MOSFET
JAN89026	2N7224	100V/30A, N-CH MOSFET
JAN89026	2N7225	200V/27A, N-CH MOSFET
JAN89026	2N7227	400V/12A, N-CH MOSFET
JAN89026	2N7228	500V/13A, N-CH MOSFET
JM3851Q/19002BXA	H11-0546	Single 16-Ch CMOS analog mux w/o.v. Protection
JM3851Q/19003BXA	H11-0507	Differential 8-Ch CMOS analog mux
JM3851Q/19004BXA	H11-0547	Differential 8-Ch CMOS analog mux w/o.v. Protection
JM3851Q/19005BEA	H11-0548	Single 8-Ch CMOS analog mux w/o.v. Protection
JM3851Q/05001BCA	CD4011A	Quad 2-input NAND gate
JM3851Q/05002BCA	CD4012A	Dual 4-input NAND gate
JM3851Q/05003BCA	CD4023A	Triple 3-input NAND gate
JM3851Q/05005BCA	CD4011B	Quad 2-input NAND gate
JM3851Q/050052BCA	CD4012B	Dual 4-input NAND gate
JM3851Q/050053BCA	CD4023B	Triple 3-input NAND gate
JM3851Q/05101BCA	CD4013A	Dual D flip-flops with set/reset capability
JM3851Q/05102BEA	CD4027A	Dual J-K flip-flop with set/reset capability
JM3851Q/05151BCA	CD4013B	Dual D flip-flops with set/reset capability
JM3851Q/05152BEA	CD4027B	Dual J-K flip-flop with set/reset capability
JM3851Q/05201BCA	CD4000A	Dual 3 input NOR gate plus inverter
JM3851Q/05203BCA	CD4002A	Dual 4 input NOR gate
JM3851Q/05204BCA	CD4025A	Triple 3-input NOR gate
JM3851Q/05252BCA	CD4001B	Quad 2 input NOR gate
JM3851Q/05253BCA	CD4002B	Dual 4 input NOR gate
JM3851Q/05254BCA	CD4025B	Triple 3-input NOR gate
JM3851Q/05301BCA	CD4007A	Dual complementary pair plus inverter
JM3851Q/05302BEA	CD4019A	Quad AND/OR select gate
JM3851Q/05351BCA	CD4007UB	Dual complementary pair plus inverter
JM3851Q/05352BEA	CD4019B	Quad AND/OR select gate
JM3851Q/05353BCA	CD4030B	Quad Exclusive-OR gate
JM3851Q/054451BEA	CD4008B	4 Bit full adder with parallel carry out
JM3851Q/05503BEA	CD4049A	Hex buffer/converter (inverting)
JM3851Q/05504BEA	CD4050A	Hex buffer/converter (non-inverting)
JM3851Q/05553BEA	CD4049UB	Hex buffer/converter (inverting)
JM3851Q/05554BEA	CD4050B	Hex buffer/converter (non-inverting)
JM3851Q/05555BCA	CD4041UB	Quad true/complement buffer
JM3851Q/05601BEA	CD4017A	Decade counter/divider
JM3851Q/05603BEA	CD4020A	14-stage binary ripple counter
JM3851Q/05605BCA	CD4024A	7-stage binary ripple counter
JM3851Q/05651BEA	CD4017B	Decade counter/divider
JM3851Q/05652BEA	CD4018B	Presetable divide by N counter
JM3851Q/05653BEA	CD4020B	14-stage binary ripple counter
JM3851Q/05654BEA	CD4022B	Octal counter/divider
JM3851Q/05655BCA	CD4024B	7-stage binary ripple counter
JM3851Q/05701BCA	CD4006A	18-stage static shift register
JM3851Q/05702BEA	CD4014A	8-stage static shift register
JM3851Q/05703BEA	CD4015A	Dual 4 stage static shift register
JM3851Q/05704BEA	CD4021A	8-stage static shift register
JM3851Q/05705BEA	CD4031A	64 stage static shift register
JM3851Q/05752BEA	CD4014B	8-stage static shift register
JM3851Q/05753BEA	CD4015B	Dual 4 stage static shift register
JM3851Q/05754BEA	CD4021B	8-stage static shift register
JM3851Q/05852BCA	CD4066B	Quad bilateral switch
JM3851Q/05951BEA	CD4028B	BCD-to-decimal decoder
JM3851Q/05604BEA	CD4022A	Octal counter/divider
JM3851Q/10501BEA	IH5040MDE	SPST 75 ohm high-level CMOS analog switch
JM3851Q/10502BEA	IH5041MDE	Dual SPST 75 ohm high-level CMOS analog switch
JM3851Q/10503BEA	IH5042MDE	SPDT 75 ohm high-level CMOS analog switch
JM3851Q/10504BEA	IH5043MDE	Dual SPDT 75 ohm high-level CMOS analog switch
JM3851Q/10505BEA	IH5044MDE	DPST 75 ohm high-level CMOS analog switch
JM3851Q/10506BEA	IH5045MDE	Dual DPST 75 ohm high-level CMOS analog switch
JM3851Q/11601BCA	DG300AAP	TTL compatible CMOS analog SW
JM3851Q/11602BCA	DG301AAP	TTL compatible CMOS analog SW
JM3851Q/11603BCA	DG302AAP	TTL compatible CMOS analog SW
JM3851Q/11604BCA	DG303AAP	TTL compatible CMOS analog SW
JM3851Q/12202BGA	HA2-2600	Wideband high impedance amp
JM3851Q/12203BGC	HA2-2620	Wideband (uncomp) amp
JM3851Q/12203BGC	HA2-2600	Wideband high impedance amp

7  
MIL REF



# Military Cross Reference - BY MIL REF NUMBER

MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
JM38510/12203BPA	HA7-2600	Wideband high impedance amp
JM38510/12203BGA	HA2-2620	Wideband (uncomp) amp
JM38510/12204BGC	HA2-2500	Precision high slew rate amp
JM38510/12204BPA	HA7-2500	Precision high slew rate amp
JM38510/12205BGA	HA2-2510	High slew rate amp
JM38510/12205BGC	HA2-2510	High slew rate amp
JM38510/12205BPA	HA7-2510	High slew rate amp
JM38510/12206BGA	HA2-2520	High slew rate (uncomp) amp
JM38510/12206BGC	HA2-2520	High slew rate (uncomp) amp
JM38510/12206BPA	HA7-2520	High slew rate (uncomp) amp
JM38510/12302BEA	DG201AAP	Quad SPST CMOS analog SW
JM38510/17001BCA	CD4081B	Quad 2-input AND gate
JM38510/17002BCA	CD4082B	Dual 4-input AND gate
JM38510/17003BCA	CD4073B	Triple 3-input AND gate
JM38510/17101BCA	CD4071B	Quad 2-input OR gate
JM38510/17102BCA	CD4072B	Dual 4-input OR gate
JM38510/17103BCA	CD4075B	Triple 3-input OR gate
JM38510/17201BCA	CD4085B	Dual 2-wide, 2-input AND/OR/INVERT (AOI) gate
JM38510/17202BCA	CD4086B	Expandable 4-wider 2-input AND/OR/INVERT (AOI) gate
JM38510/17203BCA	CD4070B	Quad exclusive-OR gate
JM38510/17204BCA	CD4077B	Quad exclusive-NOR gate
JM38510/17401BCA	CD4069UB	Hex inverter
JM38510/17403BEA	CD4502B	Hex inverter/buffer (3 state)
JM38510/17504BEA	CD4098B	Dual monostable multivibrator
JM38510/17601BEA	CD4099B	8-bit addressable latch
JM38510/19001BXA	HI1-0506	Single 16-Ch CMOS analog mux
JM38510/19006BEA	HI1-0549	Differential 4-Ch CMOS analog mux w/o.v. Protection
JM38510/19007BEA	HI1-0508	8 channel CMOS analog mux
JM38510/19008BEA	HI1-0509	4 channel CMOS differential analog mux
JM38510/24501BVA	HM1-6504	4K x 1 synchronous RAM
JM38510/24502BVA	HM1-6514	1K x 4 synchronous RAM
JM38510/29102BJA	HM1-6516	2K x 8 synchronous RAM
JM38510/29102BXA	HM4-6516	2K x 8 synchronous RAM
JM38510/29103BRA	HM1-65262	16K x 1 asynchronous RAM
JM38510/29103BVA	HM4-65262	16K x 1 asynchronous RAM
JM38510/29104BJA	HM1-65162	2K x 8 asynchronous RAM
JM38510/29104BXA	HM4-65162	2K x 8 asynchronous RAM
JM38510/29109BRA	HM1-65262B	16K x 1 asynchronous RAM
JM38510/29109BVA	HM4-65262B	16K x 1 asynchronous RAM
JM38510/29110BJA	HM1-65162B	2K x 8 asynchronous RAM
JM38510/29205BXA	HM1-65642B	8K x 8 asynchronous RAM
JM38510/29205BVA	HM4-65642B	8K x 8 asynchronous RAM
JM38510/12203BPA	HA7-2620	Wideband (uncomp) amp
MIL-R-83530/1-2000B	V130LA20B	130V MOV varistor
MIL-R-83530/1-2200D	V150LA20B	150V MOV varistor
MIL-R-83530/1-4300E	V275LA40B	250V MOV varistor
MIL-R-83530/1-5100E	V320LA40B	320V MOV varistor
MIL-S-19500/366	2N3440	250V/1A, N-P-N
MIL-S-19500/368	2N3439	350V/1A, N-P-N
MIL-S-19500/384	2N3584	250V/2A, N-P-N
MIL-S-19500/384	2N3585	300V/2A, N-P-N
MIL-S-19500/439	2N5039	75V/20A, N-P-N
MIL-S-19500/439	2N5038	90V/20A, N-P-N hi-speed
MIL-S-19500/456	2N5302	60V/30A, N-P-N
MIL-S-19500/456	2N5303	80V/30A, N-P-N
MIL-S-19500/461	2N6211	-275V/-2A, P-N-P
MIL-S-19500/461	2N6212	-300V/-2A, P-N-P
MIL-S-19500/461	2N6213	-350V/-2A, P-N-P
MIL-S-19500/485	2N5415S	-200V/-1A, P-N-P
MIL-S-19500/485	2N5416S	-300V/-1A, P-N-P
MIL-S-19500/488	2N5672	120V/30A, N-P-N hi-speed
MIL-S-19500/488	2N5671	90V/30A, N-P-N
MIL-S-19500/504	2N6284	100V/20A, N-P-N
MIL-S-19500/504	2N6283	80V/20A, N-P-N
MIL-S-19500/505	2N6287	-100V/-20A, P-N-P
MIL-S-19500/505	2N6286	-80V/-20A, P-N-P
MIL-S-19500/523	2N6383	40V/10A, N-P-N
MIL-S-19500/523	2N6384	60V/10A, N-P-N
MIL-S-19500/523	2N6385	80V/10A, N-P-N
MIL-S-19500/525	2N6546	300V/15A, N-P-N
MIL-S-19500/525	2N6547	400V/15A, N-P-N
MIL-S-19500/526	2N3879	75V/7A, N-P-N hi-speed
MIL-S-19500/527	2N6648	-40V/-10A, P-N-P
MIL-S-19500/527	2N6649	-60V/-10A, P-N-P
MIL-S-19500/527	2N6650	-80V/-10A, P-N-P
MIL-S-19500/528	2N6033	120V/50A, N-P-N
MIL-S-19500/528	2N6032	90V/50A, N-P-N
MIL-S-19500/537	2N6674	300V/20A, N-P-N hi-speed
MIL-S-19500/537	2N6675	400V/20A, N-P-N hi-speed
MIL-S-19500/538	2N6676	300V/20A, N-P-N hi-speed
MIL-S-19500/538	2N6678	400V/20A, N-P-N hi-speed

# Military Cross Reference - BY MIL REF NUMBER

MILITARY REFERENCE	HARRIS DEVICE	DESCRIPTION
MIL-S-19500/542A	2N6756	100V/14A, N-CH MOSFET
MIL-S-19500/542A	2N6758	200V/9A, N-CH MOSFET
MIL-S-19500/542A	2N6760	400V/5.5A, N-CH MOSFET
MIL-S-19500/542A	2N6762	500V/4.5A, N-CH MOSFET
MIL-S-19500/543A	2N6764	100V/38A, N-CH MOSFET
MIL-S-19500/543A	2N6766	200V/30A, N-CH MOSFET
MIL-S-19500/543A	2N6768	400V/14A, N-CH MOSFET
MIL-S-19500/543A	2N6770	500V/12A, N-CH MOSFET
MIL-S-19500/555	2N6788	100V/6A, N-CH MOSFET
MIL-S-19500/555	2N6790	200V/3.5A, N-CH MOSFET
MIL-S-19500/555	2N6792	400V/2A, N-CH MOSFET
MIL-S-19500/555	2N6794	500V/1.5A, N-CH MOSFET
MIL-S-19500/556	2N6782	100V/3.5A, N-CH MOSFET
MIL-S-19500/556	2N6786	200V/2.25A, N-CH MOSFET
MIL-S-19500/556	2N6784	200V/2.25A, N-CH MOSFET
MIL-S-19500/557	2N6796	100V/5.5A, N-CH MOSFET
MIL-S-19500/557	2N6796	100V/8A, N-CH MOSFET
MIL-S-19500/557	2N6800	400V/3A, N-CH MOSFET
MIL-S-19500/557	2N6802	500V/2.5A, N-CH MOSFET
MIL-S-19500/563	2N6849	100V/6.5A, P-CH MOSFET
MIL-S-19500/563	2N6851	200V/4A, P-CH MOSFET
MIL-S-19500/564	2N6849	100V/2.5A, P-CH MOSFET
MIL-S-19500/564	2N6851	200V/4A, P-CH MOSFET
MIL-S-19500/565	2N6895	100V/1.5A, P-CH MOSFET
MIL-S-19500/565	2N6897	100V/12A, P-CH MOSFET
MIL-S-19500/565	2N6898	100V/25A, P-CH MOSFET
MIL-S-19500/565	2N6896	100V/6A, P-CH MOSFET
MIL-S-19500/566	2N6902	100V/-12A, N-CH MOSFET
MIL-S-19500/566	2N6901	100V/1.5A, N-CH MOSFET
MIL-S-19500/566	2N6904	200V/-8A, N-CH MOSFET
MIL-S-19500/566	2N6903	200V/1.5A, N-CH MOSFET
MIL-S-19500/569	2N6966	100V/15A, N-CH MOSFET
MIL-S-19500/569	2N6967	200V/13A, N-CH MOSFET
MIL-S-19500/569	2N6968	400V/7.5A, N-CH MOSFET
MIL-S-19500/569	2N6969	500V/16A, N-CH MOSFET
JM38510/05202BCA	CD4001A	Quad 2 input NOR gate
JM38510/12204BGA	HA2-2500	Precision high slew rate amp
40MMDB	90065-001	Hi-Rel MOV
40MMDB	90065-004	Hi-Rel MOV
40MMDB	90065-005	Hi-Rel MOV
40MMDB	90065-007	Hi-Rel MOV
40MMDB	90065-008	Hi-Rel MOV
40MMDB	90065-013	Hi-Rel MOV
40MMDB	90065-014	Hi-Rel MOV
40MMDB	90065-016	Hi-Rel MOV
40MMDB	90065-018	Hi-Rel MOV
40MMDB	90065-019	Hi-Rel MOV
40MMDB	90065-020	Hi-Rel MOV
40MMDB	90065-022	Hi-Rel MOV



# Rad-Hard Products

## Discrete Devices

Power MOSFETs 10K Rad (Si) Total Dose  
Power MOSFETs 100K Rad (Si) Total Dose

## Operational Amplifiers

Bipolar DI Process

Neutron Fluence  $5 \times 10^{12}$  n/cm<sup>2</sup> (E > 10KeV)  
Gamma Rate  $1 \times 10^2$  Rad (Si)/s  
Gamma Dose  $1 \times 10^5$  Rad (Si)

## Multiplexers & Switches

DI CMOS Process

Gamma Rate  $1 \times 10^8$  Rad (Si)/s  
Gamma Dose  $1 \times 10^5$  Rad (Si)

## Line Transmitters/Receivers

Bipolar DI Process

Total Dose  $2 \times 10^5$  Rad (Si)  
Transient Upset  $1 \times 10^9$  Rad (Si)/s

## Microprocessors & Peripherals

### Microprocessors

80C85 Family  
Sandia </3 CMOS Process

Total Dose 5  $1 \times 10^5$  Rad (Si)  
Transient Upset  $>1 \times 10^8$  Rad (Si)/s  
SEU  $1 \times 10^{-10}$  Errors/Bit-Day  
Latch Up Free  $>1 \times 10^{12}$  Rad (Si)/s

80C86 Family  
SAJI-4H CMOS Process

Total Dose  $>1 \times 10^5$  Rad (Si)  
Transient Upset  $>1 \times 10^8$  Rad (Si)/s  
SEU  $1 \times 10^{-10}$  Errors/Bit-Day  
Latch Up Free EPI CMOS

### Peripherals

80C85 Family  
Sandia </3 CMOS Process

Total Dose  $1 \times 10^5$  Rad (Si)  
Transient Upset  $>1 \times 10^8$  Rad (Si)/s  
SEU  $1 \times 10^{-10}$  Errors/Bit-Day  
Latch Up Free  $>1 \times 10^{12}$  Rad (Si)/s

80C86 Family  
SAJI-4H CMOS Process

Total Dose  $>1 \times 10^5$  Rad (Si)  
Transient Upset  $>1 \times 10^8$  Rad (Si)/s  
SEU  $1 \times 10^{-10}$  Errors/Bit-Day  
Latch Up Free EPI CMOS

## Communication Circuits

16530 Manchester Encoder/Decoder  
SAJI-1H CMOS Process

Functional Total Dose  $1 \times 10^5$  Rad (Si)  
Latch Up Free  $5 \times 10^{11}$  Rad (Si)/s

## Memories

SAJI-1H Process

Densities to 1K  
Functional Total Dose  $2 \times 10^4$  Rad (Si)  
Data Upset  $>1 \times 10^8$  Rad (Si)/s  
Latch Up Free  $>1 \times 10^{11}$  Rad (Si)/s

SAJI-4H CMOS Process

Densities to 16K  
Total Dose  $1 \times 10^5$  Rad (Si)  
Data Upset  $>1 \times 10^8$  Rad (Si)/s  
Latch Up Free  $>1 \times 10^{12}$  Rad (Si)/s

TSOS-4 SOI Process

Densities 64K and UP  
Total Dose  $1 \times 10^6$  Rad (Si)  
Transient Upset  $1 \times 10^{11}$  Rad (Si)/s  
SEU  $1 \times 10^{-12}$  Errors/Bit-Day

## CD4000

Hardened Bulk CMOS

Total Dose  $1 \times 10^5$  Rad (Si) R-Suffix  
SEU  $1 \times 10^6$  Rad (Si) H-Suffix

## HCS/HCTS Logic

LTSOS SOI Process

Total Dose  $1 \times 10^6$  Rad (Si)  
SEU  $1 \times 10^{-10}$  Errors/Bit-Day

## ACS/ACTS Logic

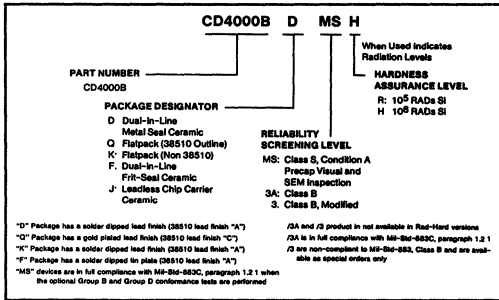
TSOS-4 SOI Process

Total Dose  $1 \times 10^6$  Rad (Si)  
SEU  $1 \times 10^{-12}$  Errors/Bit-Day

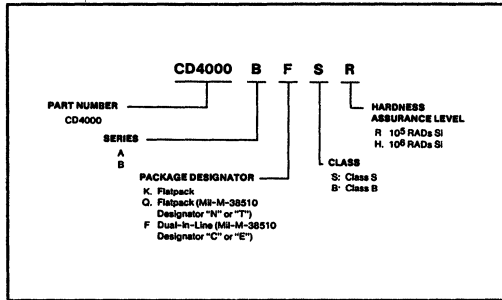
## ASICs (See ASIC Section)

# Rad-Hard

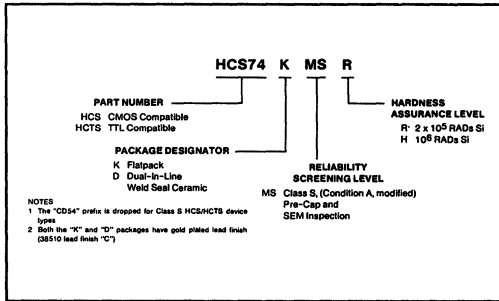
## CD4000 MIL-STD-883 Nomenclature Guide



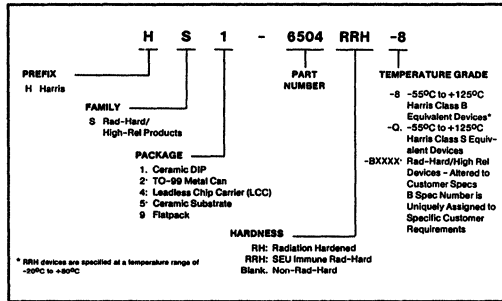
## CD4000 Logic Standard Nomenclature Guide



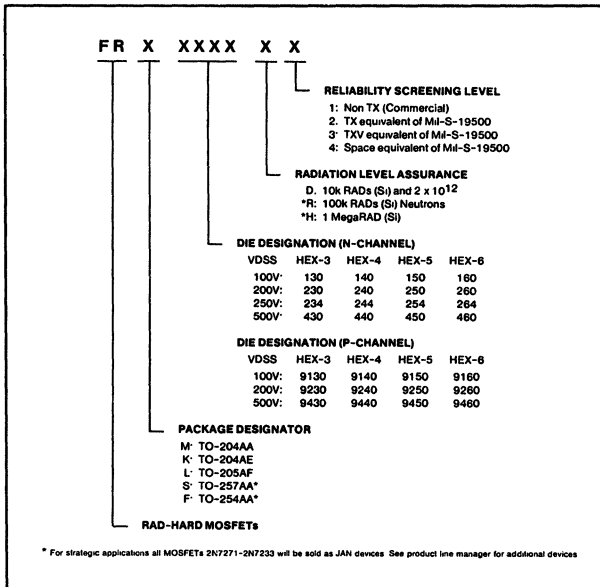
## High Speed CMOS/SOS Logic Nomenclature Guide



## Rad-Hard High Reliability Nomenclature Guide



## Rad-Hard MOSFET Nomenclature Guide For Rad-Hard Assured Program (RHAP) Tactical Applications



# Rad-Hard Power MOSFETs

## Tactical Level Selections

### N-channel devices

PART NO.	DIE SIZE (MILS)	DIE SIZE	INITIAL RATINGS			VGS(TH) (Volts)	POST RAD: 10K RADS		
			MAX RATED BVDSS (VOLTS)	MAX RATED IDS (AMPS)	MAX RATED RDS(ON)		BVDSS Volts	VGS(TH) Volts	RDS(ON) Ohms
FRM130	126 x 182	3	100	14	0.18	2-4	100	2-4	0.18
FRM230	126 x 182	3	200	8	0.50	2-4	200	2-4	0.50
FRM234	126 x 182	3	250	7	0.70	2-4	250	2-4	0.70
FRM430	126 x 182	3	500	3	2.50	2-4	500	2-4	2.50
FRL130	126 x 182	3	100	8	0.18	2-4	100	2-4	0.18
FRL230	126 x 182	3	200	6	0.50	2-4	200	2-4	0.50
FRL234	126 x 182	3	250	4	0.70	2-4	250	2-4	0.70
FRL430	126 x 182	3	500	2	2.50	2-4	500	2-4	2.50
FRM140	170 x 200	4	100	23	0.13	2-4	100	2-4	0.13
FRM240	170 x 200	4	200	16	0.24	2-4	200	2-4	0.24
FRM244	170 x 200	4	250	12	0.40	2-4	250	2-4	0.40
FRM440	170 x 200	4	500	6	1.40	2-4	500	2-4	1.40
FRK150	258 x 265	5	100	40	0.055	2-4	100	2-4	0.055
FRK250	258 x 265	5	200	27	0.10	2-4	200	2-4	0.10
FRK254	258 x 265	5	250	20	0.17	2-4	250	2-4	0.17
FRM450	258 x 265	5	500	10	0.60	2-4	500	2-4	0.60
FRK160	266 x 366	6	100	66	0.04	2-4	100	2-4	0.04
FRK260	266 x 366	6	200	46	0.07	2-4	200	2-4	0.07
FRK264	266 x 366	6	250	34	0.12	2-4	250	2-4	0.12
FRK460	266 x 366	6	500	17	0.40	2-4	500	2-4	0.40

### P-channel devices

PART NO.	DIE SIZE (MILS)	DIE SIZE	INITIAL RATINGS			VGS(TH) (Volts)	POST RAD: 10K RADS		
			MAX RATED BVDSS (VOLTS)	MAX RATED IDS (AMPS)	MAX RATED RDS(ON)		BVDSS Volts	VGS(TH) Volts	RDS(ON) Ohms
FRM9130	126 x 182	3	100	6	0.55	2-4	100	2-4	0.55
FRM9230	126 x 182	3	200	4	1.30	2-4	200	2-4	1.30
FRL9130	126 x 182	3	100	5	0.55	2-4	100	2-4	0.55
FRL9230	126 x 182	3	200	3	1.30	2-4	200	2-4	1.30
FRM9140	170 x 200	4	100	11	0.30	2-4	100	2-4	0.30
FRM9240	170 x 200	4	200	7	0.72	2-4	200	2-4	0.72
FRK9150	258 x 264	5	100	26	0.125	2-4	100	2-4	0.125
FRM9250	258 x 264	5	200	17	0.30	2-4	200	2-4	0.30
FRK9160	266 x 366	6	100	40	0.086	2-4	100	2-4	0.086
FRK9260	266 x 366	6	200	26	0.20	2-4	200	2-4	0.20

D suffix on part number denotes 10K Rad (Si) total dose  
 R suffix on part number denotes 100K Rad (Si) total dose  
 H suffix on part number denotes 1 mega Rad (Si) total dose

# Rad-Hard Power MOSFETs

## Strategic Level Selections

### N-channel devices

TYPE NO.	INITIAL RATINGS				POST 100K Rad (Si)			POST 1M Rad (Si)		
	BVDSS Volts	IDS Amps	RDS(on) Ohms	VGS(th) Volts	BVDSS Volts	RDS(on) Ohms	VGS(th) Volts	BVDSS Volts	RDS(on) Ohms	VGS(th) Volts
FRM130/2N7271	100	14	0.18	2 - 4	100	0.18	2 - 4	95	0.26	1.5 - 4.5
FRL130/2N7272	100	8	0.18	2 - 4	100	0.18	2 - 4	95	0.26	1.5 - 4.5
FRS130/2N7273	100	12	0.195	2 - 4	100	0.195	2 - 4	95	0.28	1.5 - 4.5
FRM230/2N7274	200	8	0.50	2 - 4	200	0.50	2 - 4	190	0.70	1.5 - 4.5
FRL230/2N7275	200	5	0.50	2 - 4	200	0.50	2 - 4	190	0.70	1.5 - 4.5
FRS230/2N7276	200	7	0.515	2 - 4	200	0.515	2 - 4	190	0.72	1.5 - 4.5
FRM234/2N7277	250	7	0.70	2 - 4	250	0.70	2 - 4	235	0.88	1.5 - 4.5
FRL234/2N7278	250	4	0.70	2 - 4	250	0.70	2 - 4	235	0.88	1.5 - 4.5
FRS234/2N7279	250	5	0.715	2 - 4	250	0.715	2 - 4	235	0.90	1.5 - 4.5
FRM430/2N7280	500	3	2.50	2 - 4	500	2.50	2 - 4	TBD	2.75	1.5 - 4.5
FRL430/2N7281	500	2	2.50	2 - 4	500	2.50	2 - 4	TBD	2.75	1.5 - 4.5
FRS430/2N7282	500	3	2.52	2 - 4	500	2.52	2 - 4	TBD	2.77	1.5 - 4.5
FRM140/2N7283	100	23	0.13	2 - 4	100	0.13	2 - 4	95	0.19	1.5 - 4.5
FRS140/2N7284	100	17	0.145	2 - 4	100	0.145	2 - 4	95	0.21	1.5 - 4.5
FRM240/2N7285	200	16	1.24	2 - 4	200	1.24	2 - 4	190	0.34	1.5 - 4.5
FRS240/2N7286	200	12	0.255	2 - 4	200	0.255	2 - 4	190	0.36	1.5 - 4.5
FRM244/2N7287	250	12	0.40	2 - 4	250	0.40	2 - 4	235	0.50	1.5 - 4.5
FRS244/2N7288	250	9	0.415	2 - 4	250	0.415	2 - 4	235	0.52	1.5 - 4.5
FRM440/2N7289	500	6	1.40	2 - 4	500	1.40	2 - 4	TBD	1.55	1.5 - 4.5
FRS440/2N7290	500	5	1.42	2 - 4	500	1.42	2 - 4	TBD	1.57	1.5 - 4.5
FRK150/2N7291	100	40	0.055	2 - 4	100	0.055	2 - 4	95	0.08	1.5 - 4.5
FRM150/2N7292	100	25	0.07	2 - 4	100	0.07	2 - 4	95	0.10	1.5 - 4.5
FRK250/2N7293	200	27	0.10	2 - 4	200	0.10	2 - 4	190	0.14	1.5 - 4.5
FRF250/2N7294	200	23	0.115	2 - 4	200	0.115	2 - 4	190	0.16	1.5 - 4.5
FRK254/2N7295	250	20	0.17	2 - 4	250	0.17	2 - 4	235	0.21	1.5 - 4.5
FRF254/2N7296	250	17	0.185	2 - 4	250	0.185	2 - 4	235	0.23	1.5 - 4.5
FRM450/2N7297	500	10	0.60	2 - 4	500	0.60	2 - 4	TBD	0.66	1.5 - 4.5
FRF450/2N7298	500	9	0.615	2 - 4	500	0.615	2 - 4	TBD	0.68	1.5 - 4.5
FRK160/2N7299	100	66	0.04	2 - 4	100	0.04	2 - 4	95	0.06	1.5 - 4.5
FRK260/2N7301	200	46	0.07	2 - 4	200	0.07	2 - 4	190	0.10	1.5 - 4.5

### P-channel devices

TYPE NO.	INITIAL RATINGS				POST 100K Rad (Si)			POST 1M Rad (Si)		
	BVDSS Volts	IDS Amps	RDS(on) Ohms	VGS(th) Volts	BVDSS Volts	RDS(on) Ohms	VGS(th) Volts	BVDSS Volts	RDS(on) Ohms	VGS(th) Volts
FRM9130/2N7307	100	6	0.55	2 - 4	100	0.55	2 - 4	95	0.80	2 - 6
FRL9130/2N7308	100	5	0.55	2 - 4	100	0.55	2 - 4	95	0.80	2 - 6
FRS9130/2N7309	100	6	0.565	2 - 4	100	0.565	2 - 4	95	0.82	2 - 6
FRM9230/2N7310	200	4	1.30	2 - 4	200	1.30	2 - 4	190	1.80	2 - 6
FRL9230/2N7311	200	3	1.30	2 - 4	200	1.30	2 - 4	190	1.80	2 - 6
FRS9230/2N7312	200	4	1.32	2 - 4	200	1.32	2 - 4	190	1.83	2 - 6
FRM9140/2N7316	100	11	0.30	2 - 4	100	0.30	2 - 4	95	0.44	2 - 6
FRS9140/2N7317	100	11	0.315	2 - 4	100	0.315	2 - 4	95	0.46	2 - 6
FRM9240/2N7318	200	7	0.72	2 - 4	200	0.72	2 - 4	190	1.00	2 - 6
FRS9240/2N7319	200	7	0.735	2 - 4	200	0.735	2 - 4	190	1.02	2 - 6
FRK9150/2N7322	100	26	0.125	2 - 4	100	0.125	2 - 4	95	0.18	2 - 6
FRK9150/2N7323	100	23	0.14	2 - 4	100	0.14	2 - 4	95	0.20	2 - 6
FRM9250/2N7324	200	16	0.30	2 - 4	200	0.30	2 - 4	190	0.42	2 - 6
FRF9250/2N7325	200	14	0.315	2 - 4	200	0.315	2 - 4	190	0.44	2 - 6
FRK9160/2N7328	100	40	0.085	2 - 4	100	0.085	2 - 4	95	0.12	2 - 6
FRK9260/2N7330	200	25	0.20	2 - 4	200	0.20	2 - 4	190	0.26	2 - 6

D suffix on part number denotes 10K Rad (Si) total dose  
R suffix on part number denotes 100K Rad (Si) total dose  
H suffix on part number denotes 1 mega Rad (Si) total dose

# Operational Amplifiers

## HS3516RH - High Slew Rate Op Amp

Bipolar DI process

Neutron fluence..... $5 \times 10^{12}$  n/cm<sup>2</sup> ( $E \geq 10\text{KeV}$ )  
Gamma rate..... $1 \times 10^9$  RAD (Si)/s  
Gamma dose..... $1 \times 10^6$  RAD (Si)  
Slew rate..... $\geq 22\text{V}/\mu\text{s}$   
Settling time.....130ns  
Unity gain bandwidth.....12MHz (typ)  
Offset voltage..... $\pm 3\text{mV}$

## HS3530RH - Low Power Op Amp

Bipolar DI process

Neutron fluence..... $5 \times 10^{12}$  n/cm<sup>2</sup> ( $E \geq 10\text{KeV}$ )  
Gamma rate..... $1 \times 10^9$  RAD (Si)/s  
Gamma dose..... $1 \times 10^6$  RAD (Si)  
Slew rate......06 to  $3\text{V}/\mu\text{s}$  (typ)  
Gain bandwidth.....100KHz to 5MHz (typ)  
Icc.....10uA to 1.2mA

## HS5104RH - Low Noise Op Amp

Bipolar DI process

Neutron fluence..... $5 \times 10^{12}$  n/cm<sup>2</sup> ( $E \geq 10\text{KeV}$ )  
Gamma rate..... $1 \times 10^9$  RAD (Si)/s  
Gamma dose..... $1 \times 10^6$  RAD (Si)  
Slew rate..... $.2\text{V}/\mu\text{s}$  (typ)  
Gain bandwidth.....6.5MHz (typ)  
Noise density......5nV/  $\sqrt{\text{Hz}}$  (typ)  
Noise density.....3.5pA/  $\sqrt{\text{Hz}}$  (typ)



# Multiplexers

## HS-508RH/883 - 8 Channel MUX with Overvoltage Protection

### DI CMOS process

Gama rate..... $1 \times 10^8$  RAD (Si)/s  
Gama dose..... $1 \times 10^5$  RAD (Si)  
Break before make access time..... $1\mu\text{s}$  (max)  
 $R_{on}$ ..... $1.8\text{k}\Omega$  (max)  
Off isolation..... $45\text{dB}$

## HS-1840RH/883 - 16 Channel MUX with High-Z Input Protection

### DI CMOS process

Gama rate..... $1 \times 10^8$  RAD (Si)/s  
Gama dose..... $1 \times 10^5$  RAD (Si)  
Break before make access time..... $1\mu\text{s}$  (max)  
 $R_{on}$ ..... $2\text{k}\Omega$  @ 15V post RAD  
 $R_{off}$ ..... $7.5\text{k}\Omega$  @ -5V post RAD

# Switches

HS-302RH/883.....Dual DPST  
HS-303RH/883.....Dual SPDT  
HS-306RH/883.....Dual DPST  
HS-307RH/883.....Dual SPDT  
HS-384RH/883.....Dual DPST  
HS-390RH/883.....Dual SPDT

### DI CMOS Process

Functional total dose..... $> 1 \times 10^5$  RAD  
 $R_{on}$  post rad..... $35\Omega$  (typ)  
Break before make delay..... $35\text{ns}$  (typ)

# Line Transmitters/Receivers

HS-246RH.....Triple Line Transmitter  
HS-246RH.....Triple Line Receiver  
HS-249RH.....Triple Line Receiver  
HS-248RH.....Triple Party-Line Receiver

### Bipolar DI process

Total dose..... $2 \times 10^5$  RAD (Si)  
Transient upset..... $1 \times 10^9$  RAD (Si)/s  
Neutron fluence..... $5 \times 10^{12}$  n/cm<sup>2</sup>  
Speed 50 ft cable.....15MHz  
Speed 1000 ft cable.....2MHz

HS-26C31RH.....RS422 Line Transmitter  
HS-26C32RH.....RS422 Line Receiver

### AVLSI1R Process

Total dose..... $1 \times 10^6$  RAD (Si)  
Transient upset..... $> 1 \times 10^9$  RAD (Si)/s  
Latchup Free epi CMOS

# Microprocessors and Peripherals

Part Number	Description	Process
HS-80C85RH	Static 8-bit CMOS microprocessor	SANDIA4/3
HS-80C86RH	Static 16-bit CMOS microprocessor	SAJI-4H
HS-3374RH	8-bit bidirectional level converter	SANDIA4/3
HS-54C138RH	3-line to 8-line decoder	SANDIA4/3
HS-81C55RH	256 x 8 CMOS RAM, 22-bit I/O, timer	SANDIA4/3
HS-82C08RH	8-bit bus transceiver	SANDIA4/3
HS-82C12RH	8-bit I/O port	SANDIA4/3
HS-82C37ARH	DMA controller	SAJI-4H
HS-82C54RH	16 bit timer/counter	SAJI-4H
HS-82C55RH	Programmable 24-bit parallel I/O	SAJI-4H
HS-83C55RH	2K x 8 ROM, 14-bit I/O	SANDIA4/3

Total Dose .....1 x 10<sup>5</sup> RAD (Si)

# Communication Circuits

Part Number	Description	Process
HS-15530RH	15530 Manchester encoder-decoder	SAJI-1H

## SANDIA4/3

Total dose.....1 x 10<sup>5</sup> RAD (Si)  
 Transient upset.....>1 x 10<sup>8</sup> RAD (Si)/s  
 SEU.....1 x 10<sup>-10</sup> errors/bit-day  
 Latch up free.....>1 x 10<sup>12</sup> RAD (Si)/s

## SAJI-4H

Total dose.....1 x 10<sup>5</sup> RAD (Si)  
 Transient upset.....>1 x 10<sup>12</sup> RAD (Si)/s  
 SEU.....1 x 10<sup>-10</sup> errors/bit-day  
 Latch up free EPI CMOS

## SAJI-1H

Total dose.....1 x 10<sup>6</sup> RAD (Si)  
 Transient upset.....5 x 10<sup>11</sup> RAD (Si)/s

# Rad-Hard Memories

Part Number	Size	Access Time	ICCSB	ICCOP	Process
HS-6508RH	1024 x 1	300ns	550 $\mu$ w	25mw/MHz	SAJI-1H
HS-6551RH	256 x 4	300ns	550 $\mu$ w	25mw/MHz	SAJI-1H
HS-6504RH	4096 x 1	200ns	1.1mw	38.5mw/MHz	SAJI-4H
HS-6514RH	1024 x 4	225ns	1.1mw	38.5mw/MHz	SAJI-4H
HS-65C162RRH	2048 x 8	160ns	1mw	25mw/MHz	SAJI-4H
HS-65C262RH/RRH	16K x 1	150ns	1mw	30mw/MHz	SAJI-4H
HS-65T262RH	16K x 1	150ns	1mw	30mw/MHz	SAJI-4H
HS-6564RH (1)	8K x 8 (3) 16K x 4 (3)	250ns	4.4mw	308mw/MHz	SAJI-4H
HS-6617RH (2)	2K x 8	100ns	550 $\mu$ w	137.5mw/MHz	SAJI-4H
HS-65643RH	64K x 1	50ns	10mw	15mw/MHz	TSOS-4
HS-65647RH	8K x 8	50ns	10mw	15mw/MHz	TSOS-4
HS-65758	256K x 1	25ns	10mw	30mw/MHz	RHD1
	64K x 4 (3)				
	32K x 8 (3)				

## SAJI-1H

Total dose..... $2 \times 10^4$  RAD (Si) (Functional)

Data upset..... $>1 \times 10^8$  RAD (Si)/s

Latch up free..... $>5 \times 10^{11}$  RAD (Si)/s

## SAJI-4H

Total dose..... $1 \times 10^5$  RAD (Si)

Data upset..... $>1 \times 10^8$  RAD (Si)/s

Latch up free..... $>1 \times 10^{12}$  RAD (Si)/s

## TSOS-4

Total dose..... $3 \times 10^5$  RAD (Si)

Transient upset..... $1 \times 10^{11}$  RAD (Si)/s

SEU..... $1 \times 10^{-12}$  errors/bit-day

Latch up immune

## Notes

(1) - Module, LCC's on ceramic substrate

(2) - Prom

(3) - Optional configurations

(4) - All values are maximum

# Rad-Hard CMOS Logic

## CD-4000

- Hardened Bulk CMOS
- Total Dose 1 x 10<sup>5</sup> RADs (Si) R Suffix
- Total Dose 1 x 10<sup>6</sup> RADs (Si) H Suffix

HARRIS TYPE NUMBER	CIRCUIT FUNCTION
CD4000B	Dual 3-Input NOR Gate Plus Inverter
CD4001B	Quad 2-Input NOR Gate
CD4002B	Dual 4-Input NOR Gate
CD4006B	18-Stage Static Shift Register
CD4007UB	Dual Complementary Pair Plus Inverter
CD4008B	4-Bit Full Adder with Parallel Carry-Out
CD4009UB	Hex Buffer/Converter (Inverting)
CD4010B	Hex Buffer/Converter (Non-Inverting)
CD4011B	Quad 2-Input NAND Gate
CD4012B	Dual 4-Input NAND Gate
CD4013B	Dual "D" Flip-Flop with Set/Reset Capability
CD4014B	8-Stage Static Shift Register
CD4015B	Dual 4-Stage Static Shift Register
CD4016B	Quad Bilateral Switch
CD4017B	Decade Counter/Divider
CD4018B	Presetable Divide-by "N" Counter
CD4019B	Quad AND/OR Select Gate
CD4020B	14-Stage Binary Ripple Counter
CD4021B	8-Stage Static Shift Register
CD4022B	Divide-by-8 Counter/Divider
CD4023B	Triple 3-Input NAND Gate
CD4024B	7-Stage Binary Ripple Counter
CD4025B	Triple 3-Input NOR Gate
CD4026B	Decade Counter/Divider
CD4027B	Dual "J-K" Flip-Flop with Set/Reset Capability
CD4028B	BCD-to-Decimal Decoder
CD4029B	Presetable Up/Down Counter
CD4030B	Quad Exclusive-OR Gate
CD4031B	64-Stage Static Shift Register
CD4033B	Decade Counter/Divider
CD4034B	8-Stage Static Shift Register
CD4035B	4-Stage Parallel-In/Parallel-Out Shift Register
CD404B	12-Stage Binary Ripple Counter
CD4041UB	Quad True/Complement Buffer
CD4042B	Quad Clockd "D" Latch
CD4043B	Quad NOR R/S Latch (3-State Outputs)
CD4044B	Quad NAND R/S Latch (3-State Outputs)
CD4046B	Micropower Phase-Locked Loop
CD4047B	Monostable/Astable Multivibrator
CD4048B	Multifunctional Expandable 8-Input Gate (3-State Output)
CD4049UB	Hex Buffer/Converter (Inverting)
CD4050	Hex Buffer/Converter (Non-Inverting)
CD4051B	8-Channel Analog Multiplexer/Demultiplexer
CD4052B	4-Channel analog Multiplexer/Demultiplexer
CD4053B	Analog Multiplexer/Demultiplexers - Triple 2-Channel
CD4060B	14-Stage Binary Ripple Counter/Divider and Oscillator
CD4063B	4-Bit Magnitude Comparator
CD4066B	Quad Bilateral Switch
CD4067B	16-Channel Analog Multiplexers/Demultiplexers
CD4068B	8-Input NAND/AND Gate
CD4069UB	Hex Inverter
CD4070B	Quad Exclusive-OR Gate
CD4071B	Quad 2-Input OR Gate
CD4072B	Dual 4-Input OR Gate
CD4073B	Triple 3-Input AND Gate
CD4075B	Triple 3-Input OR Gate
CD4076B	4-Bit "D" Flip-Flop (3-State Outputs)
CD4077B	Quad Exclusive-NOR Gate
CD4078B	8-Bit NOR/OR Gate
CD4081B	Quad 2-Input AND Gate
CD4082B	Dual 4-Input AND Gate

HARRIS TYPE NUMBER	CIRCUIT FUNCTION
CD4085B	Dual 2-Wide, 2-Input AND/OR/Invert (AOI) Gate
CD4086B	Expandable 4-Wide, 2-Input AND/OR/Invert (AOI) Gate
CD4089B	Binary Rate Multiplier
CD4093B	Quad 2-Input NAND Schmitt Trigger
CD4094B	8-Stage Shift-and-Store Bus Register
CD4095B	Gated "J-K" Flip-Flop (Non-Inverting)
CD4096B	Gated "J-K" Flip-Flop (Inverting) and (Non-Inverting)
CD4097B	8-Channel Analog Multiplexer/Demultiplexer
CD4098B	Dual Monostable Multivibrator
CD4099B	8-Bit Addressable Latch
CD4502B	Strobed Hex Inverter/Buffer
CD4503B	Hex Buffer (Non-Inverting)
CD4504B	Hex Voltage-Level Shifter for TTL-to-CMOS or CMOS-to-CMOS Operation
CD4508B	Dual 4-Bit Latch
CD4510B	Presetable 4-Bit Latch
CD4511B	BCD-to-7-Segment Latch Decoder/Driver
CD4512B	8-Channel Data Selector (3-State Output)
CD4514B	4-Bit Latch/4-to-16-Line Decoder (Outputs Low)
CD4515B	4-Bit Latch/4-to-16-Line Decoder (Outputs Low)
CD4516B	Presetable 4-Bit Binary Up/Down Counter
CD4517B	Dual 64-Bit Shift Register
CD4518B	Dual BCD Up Counter
CD4520B	Dual Binary Up Counter
CD4527B	BCD Rate Multiplier
CD4532B	8-Input Priority Encoder
CD4536B	Programmable Timer
CD4555B	Dual 1-of-4 Decoder/Demultiplexer (Outputs High)
CD4556B	Dual Binary to 1 of 4 Decoder/Demultiplexers (Outputs Low)
CD4585B	4-Bit Magnitude Comparator
CD4724B	8-Bit Addressable Latch
CD14538B	Dual Precision Monostable Multivibrator
CD40100B	9-Bit Parity Generator/Checker
CD40101B	9-Bit Parity Generator/Checker
CD40102B	Presetable 2-Decade BCD Down Counter
CD40103B	Presetable 8-Bit Binary Down Counter
CD40104B	4-Bit Bidirectional Universal Shift Register
CD40105B	4-Bit x 16 Word FIFO Buffer Register
CD40106B	Hex Schmitt Trigger
CD40107B	Dual 2-Input NAND Buffer/Driver
CD40108B	4 x 4 Multiport Register
CD40109B	Quad Low-to-High Voltage Interface
CD40110B	Decade Up-Down Counter/Decoder/Latch Display Driver
CD40147B	10-Line to 4-Line BCD Priority Encoder
CD40160B	Synchronous Programmable 4-Bit Counters Decade with Asynchronous Clear
CD40162B	Synchronous Programmable 4-Bit Counters Decade with Synchronous Clear
CD40163B	Synchronous Programmable 4-Bit Counters Binary with Synchronous Clear
CD40174B	Synchronous Programmable 4-Bit Counters Binary with Synchronous Clear
CD40175B	Quad "D"-Type Flip-Flop
CD40181B	CMOS 4-Bit Arithmetic Logic Unit
CD40182B	CMOS Look-Ahead Carry Generator
CD40192B	CMOS Look-Ahead Carry Generator
CD40193B	CMOS Presetable Up/Down Counters (Dual Clock with Reset)
CD40194B	4-Bit Bidirectional Universal Shift Register
CD40208B	4 x 4 Multiport Register
CD40257B	Quad 2-Line-to-1-Line Data Selector/Multiplexer

# Rad-Hard CMOS Logic

## HCS/HCTS

- CMOS SOS
- Total Dose 200K RADs (Si) and 1 mega RADs (Si)
- Transient Upset >10<sup>10</sup> RADs (Si)/s
- Latch Up Immune
- SEU <10<sup>-10</sup> upsets/bit/day

### HIGH SPEED HCS/HCTS CMOS/SOS

HCS00	CMOS Compatible Inputs Quad 2D Input NAND Gate
HCTS00	TTL Compatible Inputs Quad 2-Input NAND Gate
HCS02	CMOS Compatible Inputs Quad 2-Input NOR Gate
HCTS02	TTL Compatible Inputs Quad 2-Input NOR Gate
HCS04	CMOS Compatible Inputs Hex Inverter Gate
HCTS04	TTL Compatible Inputs Hex Inverter Gate
HCS08	CMOS Compatible Inputs Quad 2-Input AND Gate
HCTS08	TTL Compatible Inputs Quad 2-Input AND Gate
HCTS10	TTL Compatible Inputs Triple 3-Input NAND Gate
HCTS11	TTL Compatible Inputs Triple 3-Input AND Gate
HCTS14	TTL Compatible Inputs Hex Inverter Schmitt Trigger Gate
HCTS20	TTL Compatible Inputs Dual 4-Input NAND Gate
HCTS21	TTL Compatible Inputs Dual 4-Input AND Gate
HCS27	CMOS Compatible Input Triple 3-Input NOR Gate
HCTS27	TTL Compatible Inputs Triple 3-Input NOR Gate
HCTS30	TTL Compatible Inputs 8-Input NAND Gate
HCS32	CMOS Compatible Inputs Quad 2-Input OR Gate
HCTS32	TTL Compatible Inputs Quad 2-Input OR Gate
HCS10	Triple 3-Input NAND Gate
HCS74	Dual-D Flip Flop with Set and Reset. Positive Edge Trigger
HCTS74	Dual-D Flip Flop with Set and Reset. Positive Edge Trigger
HCTS86	Quad 2-Input Exclusive-OR Gate
HCS109	Dual J-K Flip-Flop
HCTS109	Dual J-R Flip-Flop with Set and Reset. Positive Edge Trigger
HCTS112	Dual J-K Flip-Flop with Set and Reset. Negative Edge Trigger
HCS138	Inverting 3-to-8 Line Decoder/Demultiplexer
HCTS138	Inverting 3-to-8 Line Decoder/Demultiplexer
HCTS139	Dual 2-to-4 Line Decoder/Demultiplexer
HCTS153	Dual 4-Input Multiplexer
HCS154	4-to-6 Line Decoder/Demultiplexer
HCTS157	Quad 2-Input Multiplexer
HCTS160	Synchronous Counter BCD Decade Counter, Asynchronous Reset
HCS161	Presetable Counter 4-Bit Binary Counter, Asynchronous Reset
HCTS161	Presetable Counter 4-Bit Binary Counter, Asynchronous Reset
HCTS163	Synchronous Presetable Counter
HCS164	8-Bit Serial-In/Parallel-Out Shift Register
HCS165	8-Bit Parallel-In/Serial-Out Shift Register
HCS166	8-Bit Parallel-In/Serial-Out Shift Register
HCS190	Sync. Counter Presetable Up/Down BCD Decade Counter, Async. Reset
HCTS190	Sync. Counter Presetable Up/Down BCD Decade Counter, Async. Reset
HCTS191	Sync. Counter Presetable Up/Down 4-Bit Counter, Async. Reset
HCTS240	Octal Buffer/Line Driver, 3-State
HCS244	Octal Buffer/Line Driver, 3-State
HCTS244	Octal Buffer/Line Driver, 3-State
HCS245	Octal Transceiver
HCTS245	Octal Transceiver
HCS273	Octal D Flip-Flop with Master Reset
HCTS273	Octal D Flip-Flop with Master Reset
HCS373	Octal Transparent Latch, 3-State
HCTS373	Octal Transparent Latch, 3-State
HCS374	Octal D-Type Flip-Flop Positive Edge Trigger, 3-State
HCTS374	Octal D-Type Flip-Flop Positive Edge Trigger, 3-State
HCTS390	Dual Decade Ripple Counter
HCTS540	Inverting Octal Buffer/Line Driver, 3-State
HCS573	Octal Transparent Latch 3-State Output
HCTS574	Octal D-Type Flip-Flop, Positive Edge Trigger, 3-State

# Rad-Hard CMOS Logic

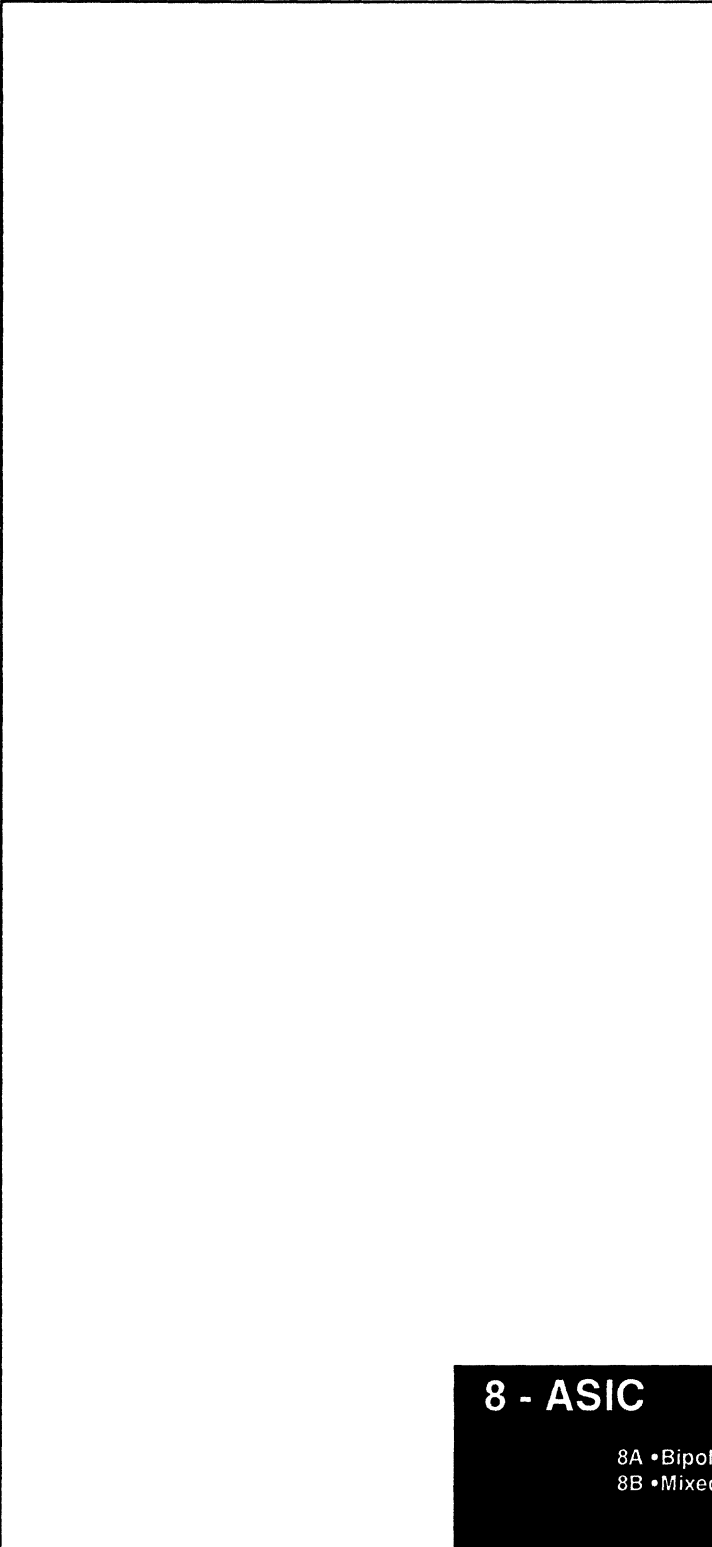
## ACS/ACTS

- TSOS-4 process
- Total dose  $1 \times 10^6$  RAD (Si)
- Transient upset  $>1 \times 10^{10}$  RADs/SEC
- Latch up free
- SEU  $1 \times 10^{-10}$  errors/bit-day

ACTS240 Octal buffer/line driver, 3-state  
ACTS244 Octal buffer/line driver, 3-state  
ACTS245 Octal transceiver, 3-state

Additional part types to follow; consult factory





# 8 - ASIC

- 8A • Bipolar
- 8B • Mixed Signal & Power ASIC



## 8 - ASIC

8A • Bipolar

8B • Mixed Signal & Power ASIC

# ASIC - Bipolar Analog/Digital Rad Hard

## ASIC - Bipolar Analog Semicustom or Customer Designed Using Fastrack

### HDI 1000

#### High Frequency (EBHF) Process

- 40 volt bipolar dielectric isolation process
- Ft = 0.75 Ghz NPN/0.4 Ghz PNP
- Single or dual level metal interconnect
- Transistor level and/or cell design
- 1000 transistor capability (approx. 24 op amps)

### HDI 2000

#### Very High Frequency (VHF) Process

- 20 volt bipolar dielectric isolation process
- Ft = 1.2 Ghz NPN/1.0 Ghz PNP
- Dual level metal interconnect
- Transistor level and/or cell design
- 1500 transistor capability (approx. 36 op amps)

### HDI 3000

#### Ultra High Performance (UHF) Process

- 10 volt bipolar SOI process
- Ft = 8.0 Ghz NPN/4.0 Ghz PNP
- Dual level metal interconnect
- 5000 transistor capability (approx. 120 op amps)

### HTA 1000/2000

#### EBHF/VHF Tile Array

- Bipolar analog "gate array"
- 10 identical tiles (62 transistors per tile)
- 8-10 op amp capability
- High performance macro cell library
- 40 bond pads
- 40 volt/20 volt supply; Ft = 0.75 Ghz/1.2 Ghz

PARAMETER	NPN	PNP	PJFET	SURFACE ZENER	UNITS
BV <sub>CEO</sub>	40	40	-	-	V
BV <sub>DSS</sub>	-	-	35	-	V
H <sub>FE</sub>	200	130	-	-	-
F <sub>T</sub>	0.5*	0.5*	-	-	GHZ
V <sub>P</sub>	-	-	1.5	-	V
V <sub>A</sub>	130	75	-	-	V
V <sub>Z</sub>	-	-	-	5.2	V

\* EBHN4 EBHF4 peak Ft at V<sub>CE</sub> = 5V

PARAMETER	NPN	PNP	PJFET	BURIED ZENER	UNITS
BV <sub>CEO</sub>	20	20	-	-	V
BV <sub>DSS</sub>	-	-	20	-	V
H <sub>FE</sub>	150	120	-	-	-
F <sub>T</sub>	1.0*	0.9*	-	-	GHZ
V <sub>P</sub>	-	-	1.0	-	V
V <sub>A</sub>	90	18	-	-	V
V <sub>Z</sub>	-	-	-	5.4	V

\* VHFLN4 VHFLP4 peak Ft at V<sub>CE</sub> = 5V

PARAMETER	NPN	PNP	NJFET	BURIED ZENER	UNITS
BV <sub>CEO</sub>	10	10	-	-	V
H <sub>FF</sub>	125	60	-	-	-
F <sub>T</sub>	8	4	-	-	GHZ
V <sub>A</sub>	60	30	-	-	V
V <sub>Z</sub>	-	-	-	5.3	V

Quantity	Cell Type	Description/Application
8	Operational Amplifiers	Stabilized for nominal closed loop gain of 1, 2.5 or 10 with choice of bipolar or JFET inputs. Outputs short circuit protected
4	Voltage Comparators	General purpose or low power voltage comparators with choice of bipolar or JFET inputs. Output logic level is set by user
3	Voltage References	5.0 Volt, 2.5 Volt and 1.5 Volt references
2	High Speed Unity Gain Buffers	Choice of bipolar or JFET inputs
2	Sample & Hold Devices	Choice of bipolar or JFET inputs. Self contained S/H capacitor
2	Video Amplifiers	Gain of 10X or 40X. Differential circuits intended for video applications
1	Mixer	Differential circuit intended for video applications
2	Multipliers	Offered with and without internal op amp. Differential circuits intended for video applications

## Custom - Harris Designed

### TAGC40K - AVLSIR Process

- Rad Hard Digital CMOS Gate Array
- 1.2 micron, double level metal interconnect
- 10K usable gates
- Workstation support - Fastrack, Mentor, Valid

### AUA/AUASC - TSOS4 Process

- Rad hard digital CMOS/SOS gate array and standard cell
- 1.2 micron, double level metal interconnect
- 15K usable gates
- Workstation support - Fastrack, Mentor, Valid, Lazar
- Genesis silicon compiler available

PRODUCT	GATES		I/O		SIZE (Mils.)
	TOTAL	USABLE	SIGNAL	PWR/GND	
TAGC40170	1,700	1,280*	60	8	133x213
TAGC40620	6,200	4,650*	104	8	254x254
TAGC41350	13,500	10,120*	172	8	375x375

\*Estimated at 75% usable. Actual value will vary.

PRODUCT	GATES		I/O		Size (Mils.)
	TOTAL	USABLE	SIGNAL	PWR/GND	
10K AUA	10,034	7,500*	164	24	342x321
20K AUA	20,080	15,000*	216	40	437x429

\*Estimated at 75% usable. Actual value will vary.

# Bipolar Analog Design Toolset

<b>Front to Back Design Toolset (Harris Part No. HA-ABF2B)</b>		
<b>Item</b>	<b>Harris Part No.</b>	<b>Description</b>
1	HA-ABF	Analog Bipolar Design Framework/Library
2	HA-SLICE	SLICE Circuit Simulator, Monte Carlo
3	CA-151	Color Design Framework
4	CA-200	Schematics
5	CA-206	Simulation Environment
6	CA-300	Layout
7	CA-310	PD Check, Design Rules Check
8	CA-315	PD Extract, Parasitics
9	CA-320	PD Compare, Layout-to-Schematic
10	CA-975	B/W Versatec Plotter Driver
11	SU-460FGX8	Sun SPARCstation 1, 16" Monitor, and Accelerator
12	SU-X539H	327 MB Standalone Disk w/Tape Drive
13	SU-X301H	USA Keyboard and Mouse
14	SU-SS207	SPARCstation 1, 1/4" Software
15	SU-SS09	SPARCstation 1, Manuals

<b>Front to Back Design Toolset (Harris Part No. HA-ABFE)</b>		
<b>Item</b>	<b>Harris Part No.</b>	<b>Description</b>
1	HA-ABF	Analog Bipolar Design Framework/Library
2	HA-SLICE	SLICE Circuit Simulator, Monte Carlo
3	CA-FE	Front-end Package (151, 200, 206, 97X)
4	SU-460FGX8	Sun SPARCstation 1, 16" Monitor, and Accelerator
5	SU-X539H	327 MB Standalone Disk w/Tape Drive
6	SU-X301H	USA Keyboard and Mouse
7	SU-SS207	SPARCstation 1, 1/4" Software
8	SU-SS09	SPARCstation 1, Manuals

# Semicustom - Customer Designed Using Fastrack

## HDI1000 - High Frequency (EBHF) Process

The EBHF process provides the analog system designer ASIC capabilities for high performance analog (75 MHz bandwidth) applications requiring precision and high speed. An inherent radiation-hardened analog solution with no parasitic substrate effects.

### Features:

- NPN & PNP bipolar transistors

PNP Device Type	NPN Device Type	Device Geometry
EBHP 1	EBHN 1	Single emitter, single base, single collector
EBHP 2	EBHN 2	Single emitter, single base, ring collector
EBHP 3	EBHN 3	Single emitter, dual base, dual collector
EBHP 4	EBHN 4	Single emitter, dual base, ring collector
EBHP 5	EBHN 5	Dual emitter, single base, dual collector
EBHP 6	EBHN 6	Dual emitter, single base, ring collector

### - PJFET

- High input gate impedance
- Low channel resistance
- Low offset voltage
- Low input bias current

### Resistor

- NiCr resistors
- P+ resistors
- N+ resistors
- P base resistors pinched by N+

### Capacitor

- Stable MOS construction
- Voltage independent
- Dielectrically isolated
- Low temperature coefficient.....-1ppm/°C

### Zener diode

- Surface zener diode

### - Cell family

- Operational amplifiers
- Voltage comparators
- Voltage references
- High speed unity gain buffers

- Sample & hold devices
- Video amplifiers
- Mixers
- Multipliers

and more

### Applications:

- Bipolar IC's for analog signal processing and control
- High performance ASICs
- Telemetry

# Semicustom - Customer Designed Using Fastrack

## HDI2000 - Very High Frequency (VHF) Process

The VHF process provides the analog system designer ASIC capabilities for high frequency, very high performance (120 MHz bandwidth) analog applications requiring high precision at high speeds. An inherent radiation-hardened analog solution with no parasitic substrate effects.

### Features:

- NPN & PNP bipolar transistors

PNP Device Type	NPN Device Type	Device Geometry
VHFL P1	VHFL N1	Single emitter, single base, single collector
VHFL P2	VHFL N2	Single emitter, single base, ring collector
VHFL P3	VHFL N3	Single emitter, dual base, ring collector
VHFL P4	VHFL N4	Dual emitter, single base, ring collector

- PJFET

High input gate impedance  
Low channel resistance  
Low offset voltage  
Low input bias current

#### Resistor

NiCr resistors  
P+ resistors  
N+ resistors  
P base resistors  
pinched by N+

#### Capacitor

Stable MOS construction  
Voltage independent  
Dielectrically isolated  
Low temperature  
coefficient.....-1ppm/°C

#### Zener diode

Surface zener diode  
Buried zener diode

- Cell family

Operational amplifiers  
Voltage comparators  
Voltage references  
High speed unity gain buffers

Sample & hold devices  
Video amplifiers  
Mixers  
Multipliers

and more

### Applications:

- Telemetry systems
- Communications
- High performance signal processing and control

# Semicustom - Customer Designed Using Fastrack

## HDI3000 - Ultra High Performance (UHF) Process

The UHF process provides the analog system designer ASIC capabilities for very high performance (800 MHz bandwidth) analog applications requiring real-time response and precision.

### Features:

- NPN & PNP bipolar transistors

PNP Device Type	NPN Device Type	Device Geometry
UHF P1	UHF N1	Single emitter, single base, single collector
UHF P2	UHF N2	Single emitter, single base, ring collector
UHF P3	UHF N3	Single emitter, dual base, ring collector
UHF P4	UHF N4	Dual emitter, single base, ring collector

- NJFET

High input gate impedance  
 Low channel resistance  
 Low offset voltage  
 Low input bias current

### Resistor

NiCr resistors  
 P+ resistors  
 N+ resistors  
 P base resistors  
 pinched by N+

### Capacitor

Stable POS construction  
 Voltage independent  
 Dielectrically isolated  
 Low temperature  
 coefficient

### Zener diode

Surface zener diode  
 Buried zener diode

- Cell family

Current feedback amplifiers  
 Operational amplifiers  
 Voltage comparators  
 Voltage references

Sample & hold devices  
 Video amplifiers  
 Mixers  
 Current output multiplexers

### Applications:

- Data acquisition and processing
- Radar guided missiles
- Ground radar
- Avionics
- Video

# Semicustom - Customer Designed Using Fastrack

## HTA1000/2000 - EBHF/VHF Tile Array

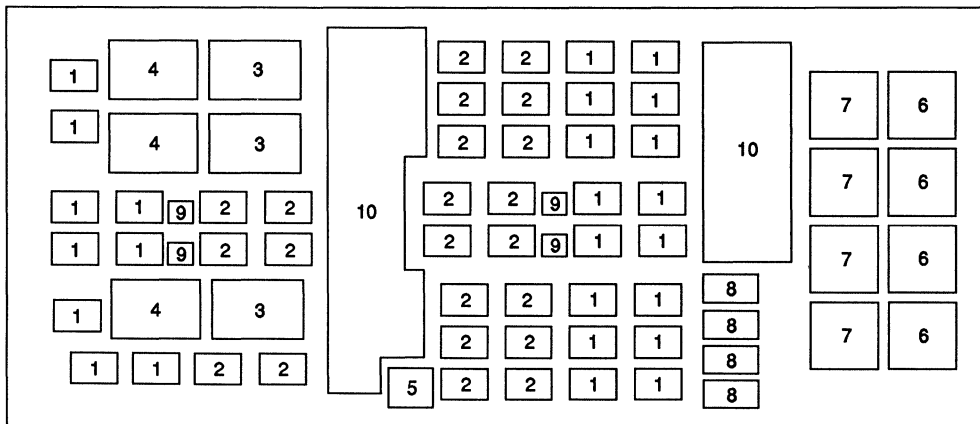
The HTA 1000/2000 tile array provides the analog system designer with a fast turn, low cost tile array methodology for the design of high performance, high speed analog circuits.

### Features:

- Same device characteristics as shown in EBHF/VHF features section respectively
- Personalized by two metal interconnect and one NiCr resistor level
- Tile Array Contents
  - Device Tile (10): each includes 66 active devices and 4 diffused resistors.
  - Small Caps Tile (6): each includes 4 small capacitors (2 - 15pF, 2 - 5pF) and 2 buried zeners.
  - Large Caps Tile (2): each includes 4 - 51pF large capacitors.
  - Large NPN, PNP (24); includes 12 large NPN transistors and 12 large PNP transistors
  - Trim Res (6): includes 6 areas of open poly for trimmable NiCr resistors

Device Tile Contents

Region	Quantity	Device Type	Size
1	25	Small geometry, NPN transistors	10 $\mu$ m x 20 $\mu$ m emitter
2	22	Small geometry, PNP transistors	10 $\mu$ m x 20 $\mu$ m emitter
3	3	PJFET transistors	w = 104 $\mu$ m, l = 12 $\mu$ m
4	3	PJFET transistors	w = 120 $\mu$ m, l = 12 $\mu$ m
5	1	Small geometry, PJFET transistor	w = 19 $\mu$ m, l = 12 $\mu$ m
6	4	Medium geometry, low-Rb, NPN transistors	10 $\mu$ m x 80 $\mu$ m emitter
7	4	Medium geometry, low-Rb, PNP transistors	10 $\mu$ m x 80 $\mu$ m emitter
8	4	P-base resistors	650 $\Omega$
9	4	Surface zeners for input protection	-
10	-	Areas for NiCr resistors	-



Device Tile Architecture

### Applications:

- General analog system implementation
- Quick turn, low cost, IC design verification
- Prototype & system demonstration units
- Low volume production units

# Custom - Harris Designed

## TAGC40K - AVLSIR Process

Family of radiation-hardened high performance CMOS digital gate array specifically designed to operate in demanding military and space environments where extreme radiation levels are present.

### Features:

- Radiation hardened
  - Total dose .....  $> 1 \times 10^6$  rads (Si)
  - Survivability .....  $> 1 \times 10^{12}$  rads (Si)
  - Transient upset .....  $> 3.5 \times 10^9$  rads (Si)/s
  - Latchup ..... none measured
  - Neutron fluence .....  $> 1 \times 10^{14}$  neutrons/cm<sup>2</sup>
  - SEU .....  $< 1 \times 10^{-8}$  errors/bit/day

### - Product outline

Product	Gates		I/O
	Total	Usable*	
TAGC40170	1,700	1,280	60
TAGC40620	6,200	4,650	104
TAGC41350	13,500	10,120	172

\*Estimated at 75% usable. Actual value will vary.

- Extensive library with over 140 elements
- Latchup resistant
- $> 3500$  volt ESD protection
- Boundary scan I/O's and scan flip flops allow for the design of highly testable circuits
- Screening and qualification to Mil-Std-883C method 5004/5005, class B and class S

### Applications:

- Space vehicles/stations
- Missile
- Smart munitions
- Airborne



# Custom - Harris Designed

## AUA/AUASC - TSOS4 Process

Family of radiation-hardened high performance CMOS silicon on sapphire digital gate arrays and standard cells designed to operate in demanding military and space applications requiring extreme radiation hardness and low power consumption.

### Features:

- Radiation hardened
  - Total dose ..... >  $1 \times 10^6$  rads (Si)
  - Survivability ..... >  $1 \times 10^{12}$  rads (Si)/s
  - Transient upset ..... >  $3.5 \times 10^{11}$  rads (Si)/s
  - Latchup ..... none measured
  - Neutron fluence ..... >  $1 \times 10^{14}$  neutrons/cm<sup>2</sup>
  - SEU ..... <  $1 \times 10^{-10}$  errors/bit/day

### - Gate array product outline

Product	Gates		I/O		Size (Mils.)
	Total	Usable	Signal	Pwr/Gnd	
10K AUA	10,034	7,500*	164	24	342 x 321
20K AUA	20,080	15,000*	216	40	437 x 429

\*Estimated at 75% usable. Actual value will vary.

- Extensive cell library with over 184 elements
- Latchup resistant
- Boundary-scan for highly testable circuits
- Screening and qualification to Mil-Std-883C method 5004/5005, class B and class S

### Applications:

- Space equipment
- Smart munitions
- Missile systems
- Airborne

# Mixed Signal ASICs

## Semicustom - Customer Designed Using Fastrack

### HPA 2000 - Power ASIC Library

- 16 digital logic functions
- 8 analog macro functions
- 4.5 to 15 volt logic cells
- 1 MHz output frequency
- 0 to +125°C operating temperature
- 5 I/O functions
- Sizeable output DMOS driver
- 60V up to 20 amp output
- 4 $\mu$  DLM (double level metal) process
- Typical design 300 logic gates with 15 analog cells & 2 power DMOS

### HBC 2500 - BIMOS-E Analog/Digital Library

- 60 analog cells
- 15 volt max. output voltage @ .5 amps
- 12 volt minimum supply voltage
- Up to 50 MHz output frequency
- Typical design 100-2000 logic gates with 30-60 analog cells
- 60 digital cells
- 5 volt & 15 volt logic
- 0 to +125°C operating temperature
- 3 $\mu$  DLM (double level metal) process

## Custom Processes - Harris Designed

### Power BIMOS

- 80 volts up to 5 amp outputs
- 80 volt NPN & PNP devices
- -40 to +150°C operating temperature
- Capable of full load dump @ 80 volts
- P & N channel DMOS output devices
- 4.5 to 80 volt operating voltage
- Applications - high side switches, low side switches, switching regulators, bridges, etc.
- Power freq. > 300K, small signal freq. > 100 MHz

### Power Bipolar

- 60 volts up to 1 amp outputs
- 4.5 to 60 volt operating voltage
- Applications - high side switches, low side switches, switching regulators, bridges, automotive driver circuits, etc.
- 60 volt NPN & PNP devices
- -40 to +125°C operating temperature

### HVIC

- 600 volt up to .1 amp NPN
- 25 volt scalable N & P transistors
- CMOS logic operational from 2.5 to 18 volts with 1.5ns delays
- 2A NMOS output devices
- -40 to +125°C operating temperature

### HV-500

- 500 volt 5 $\mu$  DI (Dielectric Isolation Bipolar) technology
- Used in Harris HV-1205, 2405 & HV-250, 255, 350, 355 mosfet drivers
- -40 to +85°C operating temperature
- SLM (single level metal) with NPN freq. > 320 MHz
- 200 volt variation used in SLIC's (Subscriber Line Interface Circuits) (HV-200)

# Semicustom - Custom Designed Using Fastrack™

## HPA2000 - Power ASIC Library

### Process Features:

- Cost effective 4 $\mu$  junction isolated BiCMOS Process
- Complementary bipolar & MOS devices rated at 15V
- Multiple power DMOS device rated up to 20A, 60V
- Diffused resistors, zeners, capacitors, available
- Double level metal process
- Heavy second level metal for high current
- Macrocells rated to +125°C

## HPA2000 Power ASIC™ Design Library

- Bipolar, CMOS, & power tool sets available
- Cell library supports logic, analog & power functions
- Menu driven user interface
- Hierarchical schematic capture environment
- cdcSpice & VERILOG mixed mode simulator
- Behavioral level models available on standard cells to reduce simulation time
- Statistical simulation support for best, typical, & worst case analysis
- Macro level Monte Carlo analysis

### Applications:

#### Power Supplies:

- DC to DC converters
- Distributed supply
- Switching regulators
- Power amplifiers
- Flyback regulators/converters
- UPS power supplies

#### Motion Control:

- Stepper motors
- DC brush permanent magnet motors
- DC brushless motors
- Voice coils
- Switched reluctance

#### Power Interface:

- Mosfet/IGBT drivers
- Solid state relays
- Solenoid actuators
- Print head drivers
- Display drivers
- Power factor controllers
- Low side switches

## Available Macrocells:

### CMOS Logic:

- Logic functions can operate from 4.5V to 15V
- Propagation delay of minimum inverter with fanout of 1 is 3nS
- Inverter (1X, 3X, 4X)
- NAND (2, 3, or 4 inputs)
- NOR (2, 3, or 4 inputs)
- XOR (exclusive OR)
- Set reset latch
- D-type flip flop with set & reset
- Expandable parallel to serial shift register
- Expandable ripple counter
- Transmission gate

### I/O Functions:

- TTL receiver
- TTL driver
- ESD protection network (1KV min)
- Input Schmitt trigger
- CMOS driver

### Analog Macro Functions:

- Bandgap reference 5.1V
- Thermal detector
- On-chip power supply regulator - 12 volts
- Upper & lower rail sensing comparators, both bipolar & MOS inputs
- Current references
- 12V zener regulated reference
- Transconductance amplifier
- Voltage to current converter
- Inverting & non-inverting gate drivers

### Components:

- Resistors: 16, 5 & 9 $\mu$ /square
- Zeners, zener zap
- Scalable bipolars & MOSFET transistors
- Scalable 60V DMOS power device with (4.4m $\mu$ /cm<sup>2</sup>)

# Semicustom - Custom Designed Using Fastrack™

## HBC2500 - BiMOS-E Analog/Digital ASIC Library

### Process Features:

- Cost effective 3 $\mu$  junction isolated BiCMOS Process
- Low power silicon-gate CMOS technology; 3 to 16 volt operation
- Bipolar & MOS on a single small die
- High quality resistors, zeners, & poly to poly capacitors available
- Double level metal process
- Up to 1 amp current capability
- Macrocells rated from -55°C to +125°C
- 50MHz, 100V/ $\mu$ S op amps
- 20 to 30 nS propagation delay time on comparators

## HBC2500 BiMOS-E Design Library

- More than 150 cell types available
- Cell library supports CMOS logic, primitive & macrocells (op amps, comparators, oscillators, voltage references, A/D & D/A converters, etc.)
- Menu driven user interface
- Hierarchical schematic capture environment
- cdcSpice & VERILOG mixed mode simulator
- Behavioral level models available on standard cells to reduce simulation time
- Statistical simulation support for best, typical, & worst case analysis
- Macro level Monte Carlo analysis

### Applications:

#### Power Supplies:

- DC to DC converter control
- Distributed supplies
- Switching regulators
- Power amplifiers
- Flyback regulators/converters
- UPS power supply control

#### Motion Control:

- Stepper motor controllers
- DC brush permanent magnet motors
- DC brushless motor control
- Voice coil controllers
- Switched reluctance

#### Power Interface:

- MOSFET drivers
- Solid state relay control
- Solenoid actuators
- Print head controllers
- Display drivers
- Power factor controllers
- Power monitoring circuits

#### Signal Processing:

- Data acquisition systems
- Sonar & radar processing
- Medical equipment
- Communications systems
- Audio & video processing

## Available Macrocells:

### CMOS Logic:

- Logic functions can operate from 3V to 15V
- Propagation delay of minimum inverter with fanout of 1 is 3.5nS @ V<sub>cc</sub> = 15V
- Inverters (1X to 17X)
- NAND (2, 3, or 4 inputs)
- AND/OR (9 types available)
- NOR (2, 3, or 4 inputs)
- XOR/XNOR (exclusive OR/NOR)
- Octal counter/divider/decoder (3 types)
- D-type flip flops (3 types)
- TTL to CMOS converters (2 types)
- One-shot multivibrator
- Analog/digital transmission gates

### I/O Functions:

- MOS transistors (open drain n-channel MOS/FETs)
- Input/output pads (no protection)
- Input/output pads with ESD protection >2000KV
- TTL to CMOS logic level converters
- "Star" terminal pad for multiple supplies

### Analog Macro Functions:

- Bandgap references 1.2V & 2.5V
- Analog delay circuits (100 $\mu$ S, 10mS)
- Op-amps (8 types, bipolar or CMOS inputs, CMOS or bipolar outputs, transconductance, programmable gain)
- Comparators (6 types; clocked, latching)
- Oscillators (3 types; Xtal, LC & "555" type)
- Phase lock loop
- Over current protection (P & N MOS devices)
- Over-temperature protection circuit for IC
- 6 & 8 bit DAC (digital to analog) cells
- 8 bit successive approximation A/D cell
- Delta - Sigma A/D converter cell
- Half "H" switch (0.5 amp drivers) cell

### Components:

- Resistors: from 0.025 to 2K $\Omega$ /square
- Zeners (14, 2, 5 & 9.2V), zener zap
- Capacitors (poly to poly, poly to P, N)
- Scalable NMOS & PMOS transistors to I<sub>d</sub> = 0.8 amps
- Scalable NPN & PNP bipolar transistors to I<sub>d</sub> = 0.8 amps, F<sub>T</sub> = 700, 10 MHz NPN, 350 MHz PNP
- Diodes (small signal & parastic)

# Custom - Harris Designed

## Power BiMOS ASIC Technology

### Process Features:

- Cost effective 3 $\mu$  junction isolated BiCMOS process
- Operating voltage 3 to 80V
- NPN & PNP 80V transistors up to 5 amps
- Power N & P DMOS device rated up to 5A, 80V
- Diffused resistors, zeners, capacitors, available
- Double level metal process
- Typical cells; diff pairs, bandgaps, matched capacitor networks, switched capacitor filters
- Process rated -40°C to +125°C
- Isolated diodes allow bridge configurations
- Handles automotive load dump

## Power BiPolar ASIC Technology

### Process Features:

- Cost effective 4 $\mu$  bipolar process
- Operating voltage 2 to 45V
- NPN & PNP 45V transistors up to 5 amps
- Diffused resistors, zeners, capacitors, available
- Double level metal process
- Process rated -40°C to +125°C
- Isolated diodes allow bridge configurations
- Handles automotive load dump

### Applications:

#### Power Supplies:

- DC to DC converters
- Distributed supply
- Switching regulators
- Power amplifiers
- Flyback regulators/converters
- UPS power supplies

#### Motion Control:

- Stepper motors
- DC brush permanent magnet motors
- DC brushless motors
- Voice coils
- Switched reluctance

#### Power Interface:

- Mosfet/IGBT drivers
- Solid state relays
- Solenoid actuators
- Print head drivers
- Display drivers
- Power factor controllers
- Low/high side switches
- Quad drivers
- Automotive LSS & HSS

# Custom - Harris Designed

## HPA1000 - HVIC High Voltage ASIC Technology

### Process Features:

- Cost effective 4 $\mu$  junction isolated BiCMOS process
- Operating voltage 5 to 500V
- Scalable NPN > 100mA @ 500V transistor
- Scalable power N & P DMOS device > 2A @ 30V
- Diffused resistors & capacitors, available
- Double level metal process
- >500V high voltage diode available
- Typical digital gate count <1000 gates
- Process rated -40°C to +125°C
- CMOS logic operational from 2.5 - 20V
- $f_t$  = 5 MHz @ 2A available on NPN transistor

## HV-200, HV-500 High Voltage ASIC Technology

### Process Features:

- 4 $\mu$  dielectrically isolated bipolar process
- Operating voltage 5 to 250V (HV-200)
- Operating voltage 5 to 500V (HV-500)
- NPN & PNP 200V transistors available (HV-200)
- NPN & PNP 500V transistors available (HV-500)
- Resistors, zener, capacitors, available
- > 300V SCR (HV-200) available
- > 580V SCR (HV-500) available
- Process rated -40°C to +125°C
- $f_t$  > 300 MHz low voltage PNP & NPN
- $f_t$  > 1 MHz high voltage NPN
- $f_t$  > 100 KHz high voltage PNP

### Applications:

#### Power Supplies:

- High voltage DC to DC converters
- Distributed supply
- Switching regulators
- High voltage power amplifiers
- Flyback regulators/converters
- UPS power supplies
- AC to DC converters

#### Motion Control:

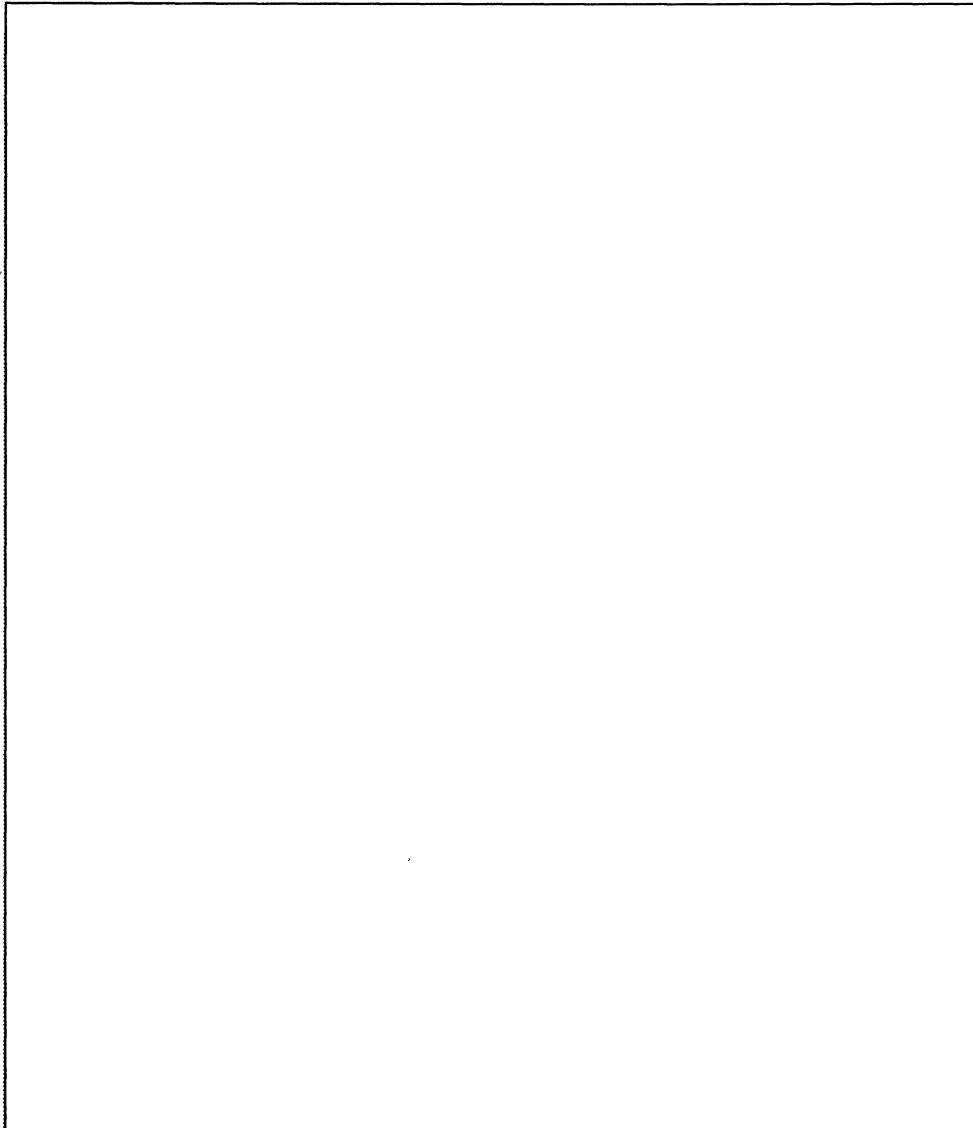
- High voltage motor controllers
- DC brush permanent magnet motors
- DC brushless motors
- Voice coils
- Switched reluctance
- AC motor controllers

#### Power Interface:

- Mosfet/IGBT drivers
- Solid state relays
- Solenoid actuators
- SLIC(Subscriber Line Interface Circuits)
- High voltage switches
- Power factor controllers
- Electronic ballasts
- HVAC controllers
- Electric vehicles



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FAX: 801 264 6601

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FAX: 206 643 9709

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