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# **Technical Literature and Information Guide**

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Effective Date 3rd Quarter 1994



**MOTOROLA**

*Semiconductor Products Sector*



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# Introduction

To complement the industry's broadest line of semiconductor products, Motorola offers a complete library of Data Books which detail the electrical characteristics of its products. These documents are supplemented by User's Manuals and Application Notes describing the capabilities of the products in circuit and system design.

Motorola attempts to fill the need for applications information concerning today's highly complex electronic components. Each year dozens of authors from colleges and universities, and from the industry, add their individual contributions to the collective literature. From these, Motorola has selected a number of texts which add substantially to the comprehension and applications of some of the more complex products. By buying these in large quantities and providing them to customers at lower than retail cost, Motorola hopes to foster a more comprehensive acquaintance with these products at greatly reduced prices.

All literature items can be obtained by mail from the Literature Distribution Center.

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# Data Books

## RF Device Data

Rev 5 Q1/94

The RF Device Data book presents technical information on Motorola's RF products. The RF portfolio includes bipolar, LDMOS, MOSFET RF Power, RF Integrated Circuits, and gallium arsenide chip technologies. This publication also includes a cross reference, selector guide information, case dimensions, and a list of devices not recommended for new design.

<b>Order by: DL110/D</b>	<b>Weight: 3 lbs.</b>
1-9 copies:	<b>\$13.75 ea.</b>
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## Bipolar Power Transistor Data

Rev 6 Q2/92

Motorola produces more than 1100 off-the-shelf power transistors covering a very wide range of applications. Their electrical, thermal and mechanical characteristics are presented here in the form of data sheets, with a competitor cross-reference and a selector guide showing devices by package, product category and major application.

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## Optoelectronics Device Data

Rev 4 Q3/93

In the optoelectronics field, Motorola has concentrated on infrared GaAs and GaAlAs emitters, silicon detectors, high-technology optocouplers/isolators, and an innovative approach to fiber optics. This data book contains up-to-date information on the complete product line. A selector guide and industry cross-reference follow a general introduction and quality/reliability data. Data sheets are grouped in sections covering Discrete Emitters/Detectors, Fiber Optic Components, Optoisolators/Optocouplers, Slotted Optical Switches and Opto Chips. Includes 82 pages of application notes.

<b>Order by: DL118/D</b>	<b>Weight: 1 lb.</b>
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## FAST and LS TTL Data

Rev 5 Q2/92

Low Power Schottky (LSTTL) has become the industry-standard logic in recent years, replacing the original 7400 TTL with lower power and higher operating speeds. In addition to producing the standard LS TTL circuits, Motorola also offers the FAST™ Schottky TTL family. Complete specifications for both LS and FAST families are provided here in data sheet form. Functional selector guide provides an overview of the principal characteristics of the two families.

<b>Order by: DL121/D</b>	<b>Weight: 2 lbs.</b>
1-9 copies:	<b>\$ 3.10 ea.</b>
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## MECL Device Data

Rev 5 Q1/93

Presents full technical data for Motorola's monolithic Emitter Coupled Logic families, including MECL 10H, MECL 10K and MECL III, plus MECL memories and Phase-Locked Loop products. MECL offers very high speeds—with propagation delays down to 1.0 ns—for use in computer systems, high-performance ATE and process control systems, signal processors and navigation systems. The families also offer other advantages which combine to reduce package count and simplify system design. This book includes a technical introduction to MECL and a detailed discussion of system design considerations.

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1–9 copies:	\$ 3.25 ea.
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## Small-Signal Transistors, FETs and Diodes

Rev 4 Q4/93

Presents technical information for the several families that make up Motorola's small-signal semiconductor product range, including bipolars, FETs and diodes. Complete device specifications and typical performance curves are given on individual data sheets, which are grouped by families and by their metal can and plastic/surface mount packages. A selector guide provides a quick comparison of performance characteristics. Additional sections describe package outline drawings and tape and reel specifications, and clarify the Hi-Rel processing and testing procedures.

<b>Order by: DL126/D</b>	<b>Weight: 3 lbs.</b>
1–9 copies:	\$ 4.75 ea.
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## Linear and Interface Integrated Circuits

2 volume set

Rev 4 Q3/93

Presents detailed technical information in the form of data sheets on Motorola's broad range of linear and interface ICs. Products are divided into 10 sections, including Amplifiers and Comparators, Power Supply Circuits, Motor Control, Voltage References, Data Conversion, Interface Circuits, Communications, Consumer and Automotive. Each section includes its own comprehensive selector guide, while an industry cross-reference lists over 3,000 products with their Motorola direct or similar replacements. Full mechanical data is provided, plus a listing of device availability for surface mount.

<b>Order by: DL128/D</b>	<b>Weight: 3 lbs.</b>
1–9 copies:	\$14.00 ea.
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## High Speed CMOS Logic Data

Rev 5 Q2/93

For many years, CMOS devices have been used in applications where low power consumption, wide power supply range and high noise immunity are the important factors. For higher speed applications, designers were forced to sacrifice the CMOS benefits and choose families such as LSTTL. Motorola's High Speed CMOS family is fast enough for such applications, while retaining the CMOS features. The HSCMOS Data Book includes a selector guide by function, a discussion of design and handling considerations, and full electrical and performance data in the form of data sheets.

<b>Order by: DL129/D</b>	<b>Weight: 2 lbs.</b>
1–9 copies:	\$ 3.25 ea.
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25 or more:	\$ 2.75 ea.

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## CMOS Logic Data

Rev 3 Q4/91

Presents technical data for Motorola's broad line of Metal-Gate CMOS Logic ICs. Complete specifications are provided in the form of data sheets. In addition, a product selector guide and a handling and design guidelines chapter are included for further information. Includes data on all the logic circuits from the MC14000 series.

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## TMOS Power MOSFET Transistor Data

Rev 4 Q4/92

Power MOSFETs offer unique characteristics and capabilities that are not available with bipolar power transistors. They have high switching speeds, simpler gate drive requirements, reduced need for snubber circuits, and low ON-voltages. This book provides a comprehensive selector guide by package, and full data on all Motorola's TMOS® Power MOSFETs in the form of data sheets. It contains more than 200 pages of theory and applications information in 15 chapters, including Gate Drive Requirements, Paralleling and Characterization, plus a number of specific designs.

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## Communications Device Data

(Formerly Telecommunications Device Data)

### Rev 3 Q4/93

Motorola is a major supplier of semiconductors to communications equipment manufacturers worldwide. This book includes complete specifications for a wide variety of devices designed for this market, in the form of over 1300 pages of data sheets. A selector guide is included to simplify the task of choosing appropriate devices for a system. Applications information, handling and design guidelines, and quality and reliability overviews provide additional support for users of these circuits.

<b>Order by: DL136/D</b>	<b>Weight: 3 lbs.</b>
1-9 copies:	\$ 8.80 ea.
10-24 copies:	\$ 8.15 ea.
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## Thyristor Device Data

### Rev 5 Q3/93

Thyristors are extremely useful across a broad range of control applications. Compared to a mechanical switch, a thyristor has a long service life and fast switching times; its regenerative action and low ON-resistance allow it to be used to control AC loads as well as for simple switching tasks. Thyristor Device Data presents data sheet information plus a comprehensive selector guide and industry cross-reference on Motorola's thyristor families, including SCRs, Triacs, GTOs and trigger devices. It includes 252 pages of theory and applications information.

<b>Order by: DL137/D</b>	<b>Weight: 2 lbs.</b>
1-9 copies:	\$ 3.80 ea.
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## FACT Data

### Rev 3 Q4/93

FACT utilizes a sub 2 micron silicon gate CMOS process to attain speeds similar to that of Advanced Low Power Schottky while retaining the advantages of CMOS logic, namely, ultra low power and high noise immunity. As an added benefit, FACT offers the system designer superior line driving characteristics and excellent ESD and latchup immunity. This data book describes Motorola's product line with device specifications and a selector guide, plus over 30 pages of design considerations and comparisons with previous technologies.

<b>Order by: DL138/D</b>	<b>Weight: 2 lbs.</b>
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25 or more:	\$ 1.85 ea.

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## ECLinPS Device Data

### Rev 2 Q1/94

This data book contains device specifications in the form of data sheets for Motorola's ECLinPS advanced Emitter Coupled Logic family. ECLinPS (ECL in picoseconds) was developed in response to demand for an even higher performance logic family of standard logic functions, especially for the computer, ATE, instrumentation and communications industries. ECLinPS offers a maximum single gate delay of 500 ps including package delay, and a flip-flop toggle frequency up to 800 MHz. Each function is available with either MECL 10H or 100K compatibility.

<b>Order by: DL140/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 0.90 ea.
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## Commercial Plus and Mil/Aero Applications Memory Products

### Q2/93

This book presents technical data for a broad line of Motorola (**Commercial Plus and Mil/Aero Applications**) Memory products. Complete specifications for the individual circuits are provided in the form of data sheets.

<b>Order by: DL144/D</b>	<b>Weight: 1 lb.</b>
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## Military MECL Family Data

### Q3/91

This data book thoroughly addresses the use of numerous Motorola Military integrated circuits, including MECL, ECLinPS, and phase-locked loop (PLL) devices. The book explores technical and operational data, electrical characteristics, system design considerations, and system basics in detail. Complete specifications for the individual circuits are provided in the form of data sheets.

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## Discrete Military Operations Data

### Rev 1 Q1/92

Defines Motorola's current line of semiconductor or components available for military and other high-reliability applications. The components include MIL-Qualified products as well as standardized MIL-Processed components and chips which are not QPL approved but are, nevertheless, processed to corresponding JAN, JANTX, JANTXV and JANS specifications for equivalent reliability.

<b>Order by: DL148/D</b>	<b>Weight: 2 lbs.</b>
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10-24 copies:	\$ 3.10 ea.
25 or more:	\$ 2.85 ea.

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## TVS/Zener Device Data

### Rev 1 Q2/94

Presents technical data for Motorola Transient Voltage Suppressors and Zener Diodes. Complete specifications for the individual devices are provided in the form of data sheets. A comprehensive selector guide and industry cross-reference are included to simplify the task of choosing the best of components required for a specific application. For the first time, this data book includes theory and applications information in addition to the actual product-specific data. The actual layout has been revised to be more user friendly with sections on the three major categories of Zener Diodes — Regulation, Temperature Compensation, and Transient Voltage Protection.

<b>Order by: DL150/D</b>	<b>Weight: 1 lb.</b>
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## Rectifier Device Data

### Rev 1 Q3/93

This book presents technical data for Motorola's broad line of rectifiers. Complete specifications are provided in the form of data sheets, and accompanying selection guides provide a quick comparison of characteristics to simplify the task of choosing the best device for a circuit. Continuing investment in research and development for discrete products has led to a rectifier manufacturing facility that matches the precision and versatility of the most advanced integrated circuits. As a result, Motorola's silicon rectifiers span all application categories with quality levels capable of passing the most stringent environment tests — including those for automotive under-hood applications.

<b>Order by: DL151/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 2.45 ea.
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## MDA15 CMOS Standard Cell Data

### Q4/90

Motorola's MDA 15 Standard Cell family features a common set of cells and design rules for 1.5 micron geometries. This book provides data sheet information on all the digital and analog cells in the library. It discusses the factors that affect production costs and describes the development cycle. Technical chapters consider timing, design matter, standard input and output configurations, and designing for testability.

<b>Order by: DL152/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 1.70 ea.
10-24 copies:	\$ 1.50 ea.
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## MDA08 CMOS Standard Cell Data

### Q3/91

Motorola's MDA12 Standard Cell family features a common set of cells and design rules for 1.2 micron geometries. This book provides data sheet information on all the digital and analog cells in the library. It discusses the factors that affect production costs and describes the development cycle. Technical chapters consider timing, design matter, standard input and output configurations, and designing for testability.

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## Dynamic RAM Data

### Q1/93

Motorola offers a broad range of reliable dynamic RAMs and DRAM modules for virtually any digital data processing system application. Complete specifications for the individual circuits are provided in the form of data sheets. A selector guide and a cross-reference are included.

<b>Order by: DL155/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 6.30 ea.
10-24 copies:	\$ 5.65 ea.
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## FAST Static RAM

### BiCMOS, CMOS and Module Data

#### Rev 1 Q4/93

Motorola offers a broad range of fast SRAMs for virtually any digital data processing system application. This data book contains complete specifications for individual FSRAM circuits in data sheet form, as well as an explanation of Motorola's reliability and quality program and an applications section.

<b>Order by: DL156/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 4.50 ea.
10-24 copies:	\$ 4.20 ea.
25 or more:	\$ 3.85 ea.

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## Pressure Sensor Device Data

Rev 1 Q1/94

Motorola is pleased to introduce their first Pressure Sensor Data Book. This data book provides technical information on Motorola's Pressure and Temperature Sensor products. Specifications are provided in the form of data sheets for individual devices and application notes describe interface circuitry to assist the end user. Additional sections provide reliability information, advanced new product information, package outline drawings, and information on sensor evaluation boards.

<b>Order by: DL200/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 3.35 ea.
10-24 copies:	\$ 3.00 ea.
25 or more:	\$ 2.75 ea.

## 8-Bit MCU Application Manual

Rev 1

This manual is a compilation of Application Notes, Article Reprints and other applications literature relating to Motorola's range of 8-bit Microcomputer Units (MCUs). The documents were published originally by Motorola under the references shown in the contents list. Specific data on all Motorola products, including the 8-bit MCU devices mentioned in this manual, can be obtained through Motorola's Franchised Distributors and Sales Offices.

<b>Order by: DL408/D</b>	<b>Weight: 2 lbs.</b>
1-9 copies:	\$14.85 ea.
10-24 copies:	\$13.25 ea.
25 or more:	\$12.20 ea.

## 16/32-Bit Applications Manual

Rev 1

This manual is a compilation of Application Notes, Article Reprints and other applications literature relating to Motorola's range of 16- and 32-bit microprocessors and peripherals. The documents were published originally by Motorola under the references shown in the contents list. Specific data on all Motorola products, including the power devices mentioned in this manual, can be obtained through Motorola's Franchised Distributors and Sales Offices.

<b>Order by: DL409/D</b>	<b>Weight: 2 lbs.</b>
1-9 copies:	\$14.85 ea.
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25 or more:	\$12.20 ea.

## Power Applications Manual

Rev 1

This manual is a compilation of 60 Application Notes, Article Reprints and other applications literature relating to Motorola's range of power semiconductors. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual; in addition to the index, an abstract of each document is provided as an aid to the location of particular topics.

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## Communications Applications Manual

Rev 1

This manual is a compilation of 44 Application Notes, Article Reprints and other applications literature relating to Motorola's semiconductors for Communications and related applications. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics range from Speakerphones and Key Systems to FM Receivers, from Fiber Optics to DSP, from RS232 to MAP and ISDN.

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## Industrial Control Applications Manual

This manual is a compilation of 42 Application Notes and other applications literature relating to Motorola's semiconductors for Industrial Control Applications. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics include temperature and pressure measurement, A/D conversion for industrial applications, motor control and industrial interfacing.

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## Radio, RF and Video Applications Manual

This manual is a compilation of 37 Application Notes and other applications literature relating to Motorola's semiconductors for Radio, RF and Video applications. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics include RF amplifier designs, the application of Motorola's TV ICs, designing for very high speed logic, and PLL fundamentals.

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## FET Applications Manual

A compilation of 34 applications documents concerned with Motorola's FETs for small signal, audio and power applications. A Device Cross-Reference indicates where specific components are featured in the applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics include MOSFET/bipolar comparisons, the application of MOSFETs in motor control and switching power supplies, driving MOSFETs from logic and other sources, and audio and VHF MOSFET-based amplifiers.

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## DSP56100, Digital Signal Processor Family Manual

Q3/93

The DSP56100 Family Manual provides a description of the components that are common to all DSP56100 family processors and includes a detailed description of the basic DSP56100 family instruction set.

**Order by: DSP56100FM/AD**              **Weight: 2 lbs.**  
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## ECLinPS Lite

Rev 1

ECLinPS Lite™ is a family of single, essential logic primitives — gates, muxes, flops etc. — housed in a space-efficient, cost effective standard package, the 8-lead SOIC. Packaged gates switch in 250 ps typ., with flops toggling at over 2 GHz. Being a single gate family, ECLinPS Lite offers better AC specs and tighter skews than even the ECLinPS™ family. At the same time the family provides superior isolation over multiple gate logic. Its small package size makes it ideal for pin cards and other applications that require density, but not at the expense of signal integrity. This book contains device specifications in the form of data sheets as well as applications information for Motorola's ECLinPS Lite family.

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## Timing Solutions

Rev 3

With frequencies regularly reaching 33 MHz and approaching 40-50 MHz in today's CISC and RISC microprocessor systems, well controlled and precise clock signals are required to maintain a synchronous system. Many microprocessors also require input clock duty cycles very close to 50%. These stringent timing requirements mandate the use of specially designed, low skew clock distribution circuits or clock drivers. This book contains device specifications in the form of data sheets as well as applications information for Motorola's low skew timing circuits.

**Order by: BR1333/D**                      **Weight: 1 lb.**  
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## Hipercomm

Rev 1

This book contains device specifications in the form of data sheets as well as applications information for Motorola's high performance frequency control products. Motorola's portfolio of state-of-the-art low power prescaler includes over 40 different combinations of frequency, divide ratio and power to meet the needs of most designs. Information is also included about Motorola's integrated single chip synthesizers which provide significant savings in power dissipation, making them ideal for hand-held, battery-operated applications. Of course, the world of RF does not depend on prescalers and synthesizers alone. Motorola's current and future efforts include integrated communication VCOs, as well as higher levels of integration for the transmit and receive sections of various wireless applications.

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# Selector Guides and Application Literature

## Applications Literature Catalog

Rev 12

Application Notes, Engineering Bulletins and Article Reprints are part of a total information system to define the characteristics and applications of semiconductor devices. Motorola's library consists of more than 300 such documents dealing with the applications of all types of semiconductors from discrete power transistors to the most complex microprocessors.

**Order by: BR135/D**  
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**\$ 0.20 ea.**

## Reliability and Quality Handbook

Rev 6

This handbook reviews the reliability and quality aspects of the semiconductor products supplied by Motorola worldwide. It is a compilation of both long and short term reliability test results, plus quality data from all of Motorola's semiconductor operations including ASICs, Discretes, MOS Memories, MPU/MCU, Logic and Analog products. The summaries are the result of many tests and evaluations performed throughout Motorola's design and manufacturing locations.

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## 88open Sourcebook, Edition 4

The 88open Consortium is a collection of hardware and software vendors and computer users who are dedicated to creating an open computing environment based on Motorola's M88000 RISC processor. The Consortium has developed specifications governing the binary and object level interface between the operating system and the application software. All software that complies with the specification will run without modification on all computer systems that comply with the specification. This book is a reference for products that are certified, or are in the process of being certified, as complying.

**BR724/D**  
1-9 copies:

**Weight: 2 lbs.**  
**\$ 3.02 ea.**

## The 68K Source — Third Party Vendor Catalog

Lists vendors of hardware and software products supporting the M68000 MPU family. This latest edition includes hardware and software development tools as well as operating systems. Products are grouped into language-specific products; software development tools that are not language-specific; operating systems; and hardware-related development tools such as evaluation boards, educational boards and in-circuit emulators.

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**\$ 3.20 ea.**  
**\$ 2.95 ea.**  
**\$ 2.70 ea.**

## MIL-Processed Devices: Technical Data

A product selector guide with data sheet information on Motorola's discrete semiconductors processed and tested to MIL standard specifications. These selected products are intended to provide the same assurance of high-reliability as their fully MIL-qualified counterparts but to allow the latest and most advanced products to be incorporated in new designs without the inevitable delay in waiting for full MIL approval.

**Order by: BR904/D**  
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**Weight: 1 lb.**  
**\$ 2.05 ea.**

## Packaging Manual for ASIC Arrays

Rev 1

This manual is intended to be used as a supplement to previously published design manuals and data sheets for Motorola's ASICs. It includes a summary of packages available for commercial arrays; detailed mechanical data on each package; reliability and handling information; and thermal performance data for the 62A, HDC, MCA2 and MCA3 series.

**Order by: BR916/D**  
1-9 copies:

**Weight: 1 lb.**  
**\$ 1.00 ea.**

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## Communications, Power and Signal Technologies Group — Reliability Audit Report

Rev 15

This report provides product reliability information concerning key technologies, test procedures and product characteristics for Motorola's broad range of discrete devices, a range that includes optoelectronics, pressure sensors and RF modules in addition to the more conventional discrete products. Includes "The Navigator" to help locate information on specific devices.

Order by: BR923/D  
1-9 copies:

Weight: 1 lb.  
\$ 2.85 ea.

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## Semiconductor Products Sector Reliability and Quality Report

Rev 11 4Q93

Motorola's Quality System maintains continuous product improvement goals in all phases of the operation. Statistical Process Control (SPC), quality control sampling, reliability audit and accelerated stress testing techniques monitor the performance of all products. This report provides data on trends and the current levels of quality and reliability for Motorola's portfolio of memory devices. It includes an overview of reliability and quality philosophy, and short sections on reliability data analysis and process control techniques.

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## M68HC05 & M68HC08 Family Customer Specified Integrated Circuit (CSIC) Microcontroller Unit (MCU) Literature

Rev 6

This document has been prepared as an aid in selecting and ordering technical information for the M68HC05 and M68HC08 family CSIC MCU's. Available M6804, M6805HMOS, and M146805CMOS family device literature is also listed. Included is a list of Motorola authorized distributors, sales offices, and a literature order form.

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## High-Performance Internal Product Portfolio Overview

Rev 4

This document has been prepared as a quarterly guide to the broad range of 16- and 32-bit microprocessors available from Motorola. It is intended to be a handy reference guide to Motorola's MPU portfolio that complements the other sources of technical product information.

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## The Motorola Explorer's Guide to the World of Embedded Control Solutions

The Explorer's Guide provides a comprehensive overview of Motorola's embedded control solutions under the headings of consumer Electronics, Office Automation, Communications, Instrumentation & Control and Automotive Loose-leaf sheets summaries the devices in the M68HC05 and '08 MCU families; the M68HC11 MCU family; the M68000 and M68300 MPU families; the PowerPC and M88000 RISC MPUs; Motorola's Date Communications products; Neuron chips for LonWorks networking, and the DSP56000, DSP56100 and DSP96000 DSP families. A product/application cross reference is provided in the form of a poster-sized selector guide.

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## FASTATICS

### Fast Static RAM Cross Reference Guide

1QTR94

This cross reference is a matrix consisting of all FSRAM products. It is a quick overview of competition for each Fast Static RAM part. The cross reference is divided into BiCMOS/CMOS, Application Specific Memories, and Modules sections for easy identification. All of Motorola's most recently introduced devices are listed, including our high performance microprocessor specific second level cache component and module solutions. Also included are the industry's fastest BiCMOS devices — 6 ns 256 Kbyte and 8ns 1 Megabit.

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## Motorola Quality System Review Guidelines

Rev 2

Motorola's Quality System Review (QSR) is a means by which the company evaluates the continuing health of the Quality System in each of its major business units and suppliers. It defines a vision of how Motorola's business should be conducted, sets a common goal of perfection and provides an awareness of Quality System requirements across the whole organization. The QSR guidelines are provided to train the reviewers, aid the understanding of each review question and assist in the scoring process. They may also be of interest to Motorola's quality conscious customers.

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An introduction to Motorola's Customer Analysis Tracking System, developed to ensure that customers' queries and concerns are routed rapidly to the responsible area — worldwide — and to provide a timely response.

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## OACS System Brochure

### Rev 1

Describes how Motorola's Open Architecture CAD System™ Rev 2.0 addresses new trends in ASIC design. Higher densities, more complex architectures and cell and array topologies are being combined onto single chips with CMOS and ECL technologies. OACS provides a unique design environment where universal tools function together, independent of technology, to perform ASIC verification at the system level. The integration of tools from Mentor Graphics, Cadence Design Systems and Synopsis is illustrated together with some specialized tools developed by Motorola.

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## MultiChip Module Solutions

This MultiChip Module color brochure offers information on MCM technology definitions, module advantages, design choices, design strategy and MCM development expertise.

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## 8–Bit MCU Application Manual

### Rev 1

This manual is a compilation of Application Notes, Article Reprints and other applications literature relating to Motorola's range of 8-bit Microcomputer Units (MCUs). The documents were published originally by Motorola under the references shown in the contents list. Specific data on all Motorola products, including the 8-bit MCU devices mentioned in this manual, can be obtained through Motorola's Franchised Distributors and Sales Offices.

**Order by: DL408/D** **Weight: 2lbs.**  
1–9 copies: **\$14.85 ea.**  
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## 16/32–Bit Applications Manual

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This manual is a compilation of Application Notes, Article Reprints and other applications literature relating to Motorola's range of 16- and 32-bit microprocessors and peripherals. The documents were published originally by Motorola under the references shown in the contents list. Specific data on all Motorola products, including the power devices mentioned in this manual, can be obtained through Motorola's Franchised Distributors and Sales Offices.

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## Power Applications Manual

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This manual is a compilation of 60 Application Notes, Article Reprints and other applications literature relating to Motorola's range of power semiconductors. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual; in addition to the index, an abstract of each document is provided as an aid to the location of particular topics.

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## Communications Applications Manual

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This manual is a compilation of 44 Application Notes, Article Reprints and other applications literature relating to Motorola's semiconductors for Communications and related applications. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics range from Speakerphones and Key Systems to FM Receivers, from Fiber Optics to DSP, from RS232 to MAP and ISDN.

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## Industrial Control Applications Manual

This manual is a compilation of 42 Application Notes and other applications literature relating to Motorola's semiconductors for Industrial Control Applications. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics include temperature and pressure measurement, A/D conversion for industrial applications, motor control and industrial interfacing.

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This manual is a compilation of 37 Application Notes and other applications literature relating to Motorola's semiconductors for Radio, RF and Video applications. A Device Cross-Reference indicates where specific components are featured in applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics include RF amplifier designs, the application of Motorola's TV ICs, designing for very high speed logic, and PLL fundamentals.

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## FET Applications Manual

A compilation of 34 applications documents concerned with Motorola's FETs for small signal, audio and power applications. A Device Cross-Reference indicates where specific components are featured in the applications documents in the manual, and an abstract of each document is provided in addition to the index. Topics include MOSFET/bipolar comparisons, the application of MOSFETs in motor control and switching power supplies, driving MOSFETs from logic and other sources, and audio and VHF MOSFET-based amplifiers.

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## RF Products Selector Guide and Cross Reference

Rev 11

This publication presents RF products of Motorola Phoenix, Motorola Toulouse (France), and Motorola Hong Kong. The RF products are categorized by Power FETs, Power Bipolar, Small Signal Bipolar, Integrated Circuits, and Amplifiers. Cross reference information and a list of devices not recommended for new design are also included.

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## Master Selection Guide

Rev 7 Q3/94

For the design engineer, the Motorola Master Selection Guide is perhaps the most important single document for the identification and preliminary selection of components for circuit and system designs. Within its pages is a complete listing and description of Motorola semiconductor devices currently in general use, and those recommended for new designs. It serves two purposes:

1. It lists all standard products in the vast Motorola semiconductor inventory for rapid identification.
2. It divides this total product offering into a variety of major product categories, with sufficient technical information to permit an intelligent first-order evaluation as to the most suitable devices for a specific application.

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## Switchmode — A Designer's Guide for Switching Power Supply Circuits and Components

Rev 5

This guide is intended to provide the designer with an overview of the more popular inverter circuits, their basic theory of operation and some of the subtle characteristics involved in selecting a circuit and the appropriate components. Also included are valuable design tips on both the major passive and active components needed for a successful design. Finally, a complete set of selector guides to Motorola's Switchmode components is provided, which gives a detailed listing of the industry's most comprehensive line of semiconductor products for switching power supplies.

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## Linear and Interface Integrated Circuits Selector Guide and Cross Reference

Rev 5

The selector guide summarizes over 1500 Motorola Standard Analog ICs. The technical summaries list key specs and/or block diagrams for over 650 device types in a variety of packages. The information is organized into easy-to-identify chapters.

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## Commercial Plus and Mil/Aero Application IC and Discrete Selector Guide

Rev 5

Commercial Plus Technologies Operation is 100% dedicated to the manufacture and supply of standard military/aerospace integrated circuit and discrete products, with controlled engineering, manufacturing and administrative resources. Products are manufactured, screened and tested worldwide, on lines certified to the requirements of the pertinent military/aerospace requirements.

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## DSP Quarterly Update

Rev 12

This selector guide describes Motorola's architecturally-compatible Digital Signal Processing Chips, including 16- and 24-bit fixed point and 32-bit floating point families, peripheral chips, and development tools.

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## Sensor Operations Signal Products Division Quarter 2, 1994

This selector guide summarizes the pressure and temperature sensor product families. Additionally, it provides information on sample kits, evaluation boards, new products, a cross reference table and package drawings.

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## CSIC Microcontroller Quarterly Update

Rev 12

This selector guide provides a concise overview of the large, and still fast-growing M68HC05 Family of MCUs, as well as the HMOS M6805 and M6804 Families.

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## Advanced Microcontroller Quarterly Update

Rev 7

This selector guide overviews the 32-bit M68300 Family, the 16-bit M68HC16 Family, and the 8-bit M68HC11 and M6801 Families of MCUs, as well as associated evaluation and development products.

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## Mixed-Signal Solutions From MOS Digital — Analog IC Quarterly Update

Rev 9

This selector guide covers new products, recent changes to existing products, and products worthy of special consideration in the broad product portfolio from the MOS Digital - Analog Integrated Circuits Division.

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## FAST Static RAM Quarterly Update

Rev 8 3Q94

This selector guide provides an overview of Motorola's fast-growing FSRAM product line. Included are BiCMOS, CMOS, and Application Specific Fast Static RAMs and FSRAM modules.

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## Dynamic RAM Quarterly Update

Rev 6 3Q94

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## CSIC Modular Development Tools Quarterly Update

Rev 1 3Q94

This selector guide overviews Motorola's family of modular development tools that are available for designing, debugging and evaluating Motorola 68HC(7)05 microcontrollers (MCU) in a user's target system.

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This selector guide provides an overview of Motorola's Power Products Division's new high power products. Included are the TO-264, SOT-227B and TO-247 packages.

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## TTL, ECL, CMOS, & Special Logic Circuits Selector Guide

Rev 3

This selector guide is a quick reference to Motorola's vast offering of standard logic integrated circuits. In TTL, popular due to its ease of use, low cost, medium-to-high speed operation and good output drive capability, Motorola offers both LS and FAST. Motorola's CMOS portfolio includes MC14000B standard CMOS series devices, High-Speed CMOS consisting of a full line of products that are pinout-compatible with many LSTTL and MC14000B standard CMOS devices, and Motorola FACT, an advanced family of CMOS logic devices which offers designers a solution to the long-standing combined barrier — high speed and low power. Motorola's Emitter Coupled Logic (MECL) is a non-saturated form of digital logic which eliminates transistor storage time permitting very high speed operation. Motorola offers five versions of MECL: MECL 10 K, MECL 10 H, MECL III and the recently introduced families ECLinPS (ECL in picoseconds) and ECLinPS Lite. Also included is a listing of Motorola's complete line of Prescalers and Translators along with Timing Solutions such as Clock Drivers and Programmable Delay Chips.

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## ASIC Overview Guide

Contains highlights of high speed bipolar (ECL & ETL) and CMOS (1-micron and sub-micron) gate arrays in densities ranging from 800 to over 300,000 gates. The Customer Defined Array™ concept which mixes gate array and standard cell architectures on the same chip is described. An overview of advanced packaging includes multichip modules, tapes, automated bonding and molded carrier ring technology. The Open Architecture CAD System™ design automation software Rev 2.0 is described and a comprehensive listing of ASIC literature is included.

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## Discrete Surface Mount Products Selector Guide

Rev 1

Surface Mount technology offers the opportunity to continue to advance the state-of-the-art designs that cannot be accomplished with insertion technology. Surface mount packages allow more optimum device performance with smaller surface mount configuration. The low profile of surface mount packages allows more boards to be utilized in a given amount of space. The technology is cost effective, allowing the manufacturer the opportunity to provide smaller units and offer increased functions with the same size product.

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## Commercial Plus and Mil/Aero Application RF Products Selector Guide

This selector guide includes a complete list of RF products offered by Commercial Plus Technologies Operation for mil/aerospace applications, and includes information on discrete transistors, amplifiers, GaAs products, and package outlines, as well as screening requirements and device ordering information.

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# User's Manuals

## Modular Microcontroller Family Analog-to-Digital Converter (ADC) Reference Manual

The ADC is a standardized module used in the M68300 and M68HC16 modular microcontroller families. It is designed for rapid manufacture of custom devices. The ADC is interconnected to other modules in the MCU via the intermodule bus (IMB). The ADC is a unipolar, successive-approximation converter with eight modes of operation and selectable 8- or 10-bit resolution. This manual describes the capabilities, operation, and functions of the ADC.

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## MCA800ECL/MCA2500ECL, Macrocell Array Design Manual

**Rev 1**

This 83-page manual presents complete design procedures and performance specifications for the MCA800ECL and MCA2500ECL arrays. These products are essentially identical—the MCA800ECL being a smaller version of the MCA2500ECL. Both arrays are compatible with ECL 10H and 100K logic families. Information is provided to transform a system into logic designs utilizing the arrays. Topics include guidelines for package characteristics, simultaneous switching, signal skew and other issues necessary to high performance design. CAD procedures and package selection is described. An extensive library of macro functions is provided with worst case propagation delays, power ratings, and DC electrical characteristics.

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## MCA2800RAM and MCA2800ALS Macrocell Array Design Manual

**Rev 2**

This 73-page manual presents complete design procedures and performance specifications for the MCA2800ALS and MCA2800RAM TTL compatible arrays. These products are essentially the same except the MCA2800RAM contains an embedded 16 x 8 RAM block. The arrays are specified around industry standard ALS logic DC limits. Functional logic design considerations describe pinouts, internal array connections and min/max power dissipation calculations. AC performance guidelines consider package delay, simultaneous switching noise, clock distribution and delay variations versus temperature and voltage. An extensive library of functions is provided with worst case propagation delays, power ratings and DC electrical characteristics.

**Order by: BR312/D**

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## M68HC08 Central Processor Unit Reference Manual

The CPU08 is the central processing unit (CPU) of the Motorola M68HC08 Family of microcontroller units (MCUs). The fully object code compatible CPU08 offers M68HC05 users increased performance with no loss of time or software investment in their HC05-based applications. The CPU08 also appeals to users of other MCU architectures who need the CPU08 combination of speed, low power, processing capabilities, and cost effectiveness.

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## Modular Microcontroller Family Central Processor Unit (CPU16) Reference Manual

Rev 2

The CPU16 is a standardized module used in the M68HC16 modular microcontroller family. It is designed for rapid manufacture of custom devices. The CPU16 is interconnected to other modules in the MCU via the intermodule bus (IMB). The CPU16 provides compatibility with the M68HC11, and additional capabilities associated with 16- and 32-bit data sizes, 20-bit addressing, and digital signal processing. This manual describes the capabilities, operation, and functions of the CPU16.

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10-24 copies:	\$ 3.00 ea.
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## Modular Microcontroller Family Central Processor Unit (CPU32) Reference Manual

Rev 1

The CPU32 is a standardized module used in the M68300 modular microcontroller family. It is designed for rapid manufacture of custom devices. The CPU32 is interconnected to other modules in the MCU via the intermodule bus (IMB). The CPU32 is based on the industry-standard MC68000 processor, and has many features of the MC68010 and MC68020, as well as unique features suited for high-performance controller applications. This manual describes the capabilities, operation, and functions of the CPU32.

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25 or more:	\$ 2.65 ea.

## DSP56000 Digital Signal Processor Family Manual

Motorola's DSP56000 Family of 24-bit general purpose Digital Signal Processors features a modular chip layout based around a standard central processing module. This manual describes this module in detail and provides practical information for designers. After an introduction to digital signal processing, sections include DSP56000 Central Architecture Overview, Data Arithmetic Logic Unit, Address Generation Unit, Program Control Unit, Instruction Set Description, Processing States, External Memory Port, PLL Clock Oscillator and On Chip Emulator. A 338 page alphabetic appendix describes each instruction in detail.

<b>DSP56KFAMUM/AD</b>	<b>Weight: 2 lbs.</b>
1-9 copies:	\$ 3.25 ea.
10-24 copies:	\$ 2.90 ea.
25 or more:	\$ 2.65 ea.

## DSP56000/DSP56001 Digital Signal Processor User's Manual

Rev 2

Digital Signal Processing is the arithmetic processing of real-time signals sampled and digitized at regular intervals. Motorola's DSP56000 and DSP56001 programmable CMOS DSPs are optimized to execute algorithms in as few operations as possible while maintaining a high degree of accuracy. The architecture is designed to maximize throughput in data-intensive applications. This book provides full functional and programming information, including instruction set details arranged in mnemonic order, allowing the user to design DSP-based systems and to code DSP and data manipulation algorithms.

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25 or more:	\$ 4.85 ea.

## DSP56004 Digital Signal Processor User's Manual

This manual describes the DSP56004 24-bit digital signal processor, its memory and operating modes, and its peripheral modules. It is intended to be used with either the *DSP56K Central Processing Unit Manual (DSP56KFAMUM/AD)* or the *DSP56000 Digital Signal Processor Family Manual (DSP56KFAMUM/AD)*, which both describe the central processing unit, programming models, and the instruction set. The *Central Processing Unit Manual* is simply a renamed *Family Manual*. This manual refers to the *Central Processing Unit Manual*, which can be used interchangeably with the *Family Manual*.

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## DSP56100, Digital Signal Processor Family Manual

The DSP56100 Family Manual provides a description of the components that are common to all DSP56100 family processors and includes a detailed description of the basic DSP56100 family instruction set.

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## DSP56156 Digital Signal Processor User's Manual

This manual is intended to be used with the *DSP56100 Family Manual*. The *DSP56100 Family Manual* provides a description of the components of the DSP56100 CORE processor, which is common to all DSP56100 family processors, and includes a detailed description of the basic DSP56100 CORE instruction set. The *DSP56156 User's Manual* provides a brief overview of the core processor and detailed descriptions of the memory and peripherals that are chip specific.

<b>Order by: DSP56156UM/AD</b>	<b>Weight: 1 lb</b>
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## DSP56166 Digital Signal Processor User's Manual

This manual is intended to be used with the *DSP56100 Family Manual*. The *DSP56100 Family Manual* provides a description of the components of the DSP56166 core that are common to all DSP56100 family processors and includes a detailed description of the basic DSP56100 family instruction set. The *DSP56166 User's Manual* provides a brief overview of the core processor and a detailed description of the memory and peripherals that are specific to the DSP56166.

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1-9 copies:	\$ 3.70 ea.
10-24 copies:	\$ 3.30 ea.
25 or more:	\$ 3.05 ea.

## DSP96002 IEEE Floating-Point Dual-Port Processor User's Manual

This manual describes the first member of Motorola's family of dual-port IEEE floating-point CMOS Digital Signal Processors. Topics covered include signal descriptions, bus operation, chip and software architectures, data organization, addressing modes, the instruction set, expansion ports and I/O peripherals, exception processing, operating modes, memory maps and the OnCE™ on-chip emulator. Full details of each instruction are provided one-per-page in alphabetic order of mnemonic; appendices provide 204 pages of standard benchmarks and describe the handling of IEEE floating-point arithmetic by the DSP960002.

<b>Order by: DSP96002UM/AD</b>	<b>Weight: 3 lbs.</b>
1-9 copies:	\$ 6.00 ea.
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## Modular Microcontroller Family General Purpose Timer (GPT) Reference Manual

The GPT is a standardized module used in the M68300 and M68HC16 modular microcontroller families. It is designed for rapid manufacture of custom devices. The GPT is interconnected to other modules in the MCU via the intermodule bus (IMB). The GPT is a simple yet flexible 11-channel timer for use in systems where a moderate level of CPU control is required. This manual describes the capabilities, operation, and functions of the GPT.

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## H4C Series Design Reference Guide

Rev 1

This 600 page book sets an industry standard for high-performance CMOS gate array design documentation. Written specifically for Motorola's H4C™ Series of sub-micron CMOS gate arrays, the book describes the benefits of triple-layer metal routing, JTAG boundary scan, timing driven layout and phase locked loop control of clock skew. Embedded memory and other special functions are explained in detail. A comprehensive packaging section provides thermal information and guidelines for choosing a package to meet system power and performance goals. This book is a valuable resource for state of the art ASIC designs using high density CMOS gate arrays.

<b>Order by: H4CDM/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 7.10 ea.
10-24 copies:	\$ 6.55 ea.
25 or more:	\$ 6.05 ea.

## H4CPlus Series Design Reference Guide

This 350 page databook provides comprehensive guidelines for mixed 3.3 V/5 V designs using Motorola's H4CPlus™ Series of sub-micron CMOS gate arrays. These devices represent the transition solution from standard 5 V power supplies to the 3.3 V environment of low-power systems. The book describes mixed-voltage capabilities, high speed interface macros, and analog PLL functions for chip-to-chip clock skew management. Flexibility in choice of core and I/O power rails are described to allow optimum trade-off of power dissipation against speed for networking and communication products. A packaging section provides guidelines for selection including the new plastic ball grid array (BGA). Additional sections outline Motorola's OACST™ design system for top-down, timing driven designs.

<b>Order by: H4CPDM/D</b>	<b>Weight: 1 lb.</b>
1-9 copies:	\$ 3.00 ea.
10-24 copies:	\$ 2.65 ea.
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## Supplement to H4CPlus Series Design Reference Guide

See description for H4CPDM/D above.

**Order by: H4CPDMAD/D**                      **Weight: 1 lb.**  
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## MECL System Design Handbook

**Rev 1**

Engineers look increasingly at ECL families such as MECL III, MECL 10 K and MECL 10 H to meet demands for higher performance systems. Designing with MECL is no more difficult than designing with slower logic, but an understanding of factors affecting system performance is essential for optimum design — MECL features such as transmission line driving, complementary outputs, wired-OR and versatile functions contribute as much as short propagation delays and high toggle rates. This book provides complete information about MECL operation, to allow design rules for specific systems to be established.

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## Discrete Military Operation Handbook

**Rev 1**

Manufacturers of high-reliability/military equipment build complex systems which require components that exhibit long service life under severe operating conditions; the reliability of these components usually determines the accuracy of missile systems and the long operational life required of spacecraft. This handbook is intended as a preliminary guide to assist understanding of the product requirements for the military marketplace and of Motorola's capabilities as a key supplier to this market. Includes an overview of JAN-series testing and a summary of procurement procedures.

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## M68HC11711D3PGMR Programmer Board User's Manual

An operating handbook for the M68HC11711D3PGMR Programmer Board, including hardware preparation and installation instructions, operating instructions, and full hardware description with circuit diagram and parts layout. The Programmer Board provides a cost-effective means of programming MC68HC11711D3 devices; an RS-232C compatible personal computer such as an IBM PC™ or Apple Macintosh™ is used to download user assembled code.

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The MC6809 and MC6809E are greatly enhanced, upward-compatible and faster extensions of the MC6800MPU. This programming manual provides details of the additional features, the addressing modes and programming considerations, and assumes some familiarity with the MC6800. Detailed information about each instruction is given in an instruction-per-page format, arranged in alphabetical order of mnemonic. The commands and code of the ASSIST09 Monitor Program are also included.

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The M68CPU32BUG Debug Monitor allows users to evaluate and debug systems based on the M6833xBCC 'Business Card Computer'. This manual gives an introduction and general description of the software, lists and describes the command set with examples of the use of each command, and describes the Assembler/Disassembler. Separate chapters are devoted to the TRAP #15 handler, which allows system calls from user programs, and to the Diagnostic Firmware Package. Appendices cover the Motorola S-Record format, the self-test error messages, and customization of CPU32Bug to the user's particular situation.

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## M68HC11EVM Evaluation Module User's Manual

The manual provides a product overview, details of hardware preparation, installation and operating instructions and a functional description of the M68HC11EVM Evaluation Module. It also includes comprehensive support information in the form of connector signal descriptions, a parts list with location diagram, and full schematic diagrams. An appendix gives Motorola S-Record information.

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Assumes no knowledge of microcontrollers and no MCU applications experience. Provides a basic but thorough introduction to the features and operation of microcontrollers, followed by a chapter describing the architecture, addressing modes, instruction set, communications and timer of the MC68HC705C8. The final section traces the development of the hardware and software for a practical application (a home thermostat project) with circuit diagram and full software listing. Full M68HC05 instruction set details are given in an appendix, and the book ends with 50 review questions based on the guide.

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## M68HC11 Reference Manual

Rev 3

A valuable aid in the development of M68HC11 applications. Detailed descriptions of all internal subsystems have been developed and checked against Motorola internal design documentation, making it perhaps the most comprehensive reference manual available for the M68HC11 family; it complements the data sheet but does not replace it. Practical applications demonstrate the operation of each subsystem; they are treated as complete systems, including hardware/software interactions and trade-offs. Discusses interfacing techniques to prevent component damage, and efficient use of the instruction set.

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## M68HC11, PCBUG11 User's Manual

PCBUG11 is a software package for easy access to M68HC11 MCUs. It allows a user to program any member of the M68HC11 family and examine the behavior of internal peripherals. Users may also run their own programs on the MCU—breakpoint and trace processing are available. This spiral-bound manual explains how to install and run PCBUG11, and how to correct common problems. PCBUG11 is distributed free of charge by Motorola and is available either from the bulletin board in Texas, or from selected Motorola distributors and sales offices.

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## M6800 Programming Reference Manual

Motorola's M6800 development tools are designed to simplify the development of systems based on the M6800 family of MCUs and peripherals. This manual—first published in 1976—provides descriptions of the M6800 Program-visible Registers, Interrupts and Stack Operations, Addressing Modes, and Instruction Set.

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## M68000 Family Programmer's Reference Manual

Rev 1

Contains detailed information, in an instruction-per-page format, on each of the instructions used by the MPUs and coprocessors in the M68000 family. Includes MPUs from the MC68000 to the MC68040, the MC68851 PMMU, the MC68881 and MC68882 Floating-Point Coprocessors, and the CPU32 processor core used in the M68300 family. The manual is divided into Integer Instructions, Floating-Point Instructions, Supervisor (Privileged) Instructions, and CPU32 Instructions and Addressing Modes. A format summary lists all the instructions in binary format, and a processor/instruction cross-reference is included.

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## M68000 8-/16-/32-Bit Microprocessors User's Manual

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Provides hardware details and programming information for the MC68000, MC68008, MC68010 and MC68HC000 microprocessors. The MC68008 has an 8-bit data bus and smaller addressing range. The MC68010 introduced virtual memory to the family and has a few different instructions. The MC68HC000 uses about 10% of the power of the MC68000; otherwise the devices are very similar. The manual fully describes their electrical and operating characteristics, noting any differences. Includes a summary of the instruction set. Refer to *MC68000PM/AD Programmer's Reference Manual* for complete details on the instruction set.

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## M68020 32-Bit Microprocessor User's Manual

This manual describes the capabilities, operation and programming of the MC68020 second-generation, 32-bit enhanced microprocessor and the MC68EC020 enhanced embedded microprocessor. Refer to *M68000PM/AD, Programmer's Reference Manual*, for complete details on the instruction set.

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## M68040 32-Bit Third-Generation Microprocessor User's Manual

### Rev 1

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## MC68EC030 32-Bit Embedded Controller User's Manual

The MC68EC030 is a 32-bit embedded controller that streamlines the functionality of an MC68030 for the requirements of embedded control applications. This manual describes its capabilities, operation, and programming. Refer to *M6800PM/AD, Programmer's Reference Manual* for complete details on the instruction set.

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## MC68HC16Y1 User's Manual

The MC68HC16Y1 is a high-speed 16-bit MCU in the M68HC16 family. It incorporates a true 16-bit CPU, single-chip integration module (SCIM), an 8/10-bit ADC, multi-channel communication interface (MCCI), general purpose timer (GPT), a 2 kByte standby RAM module with TPU emulation capability (TPURAM) and a 48K masked ROM. These modules are interconnected by an intermodule bus (IMB). This manual includes comprehensive information on all these modules, with timing diagrams and an instruction set summary. Appendices cover electrical and mechanical characteristics, a comprehensive register summary and development support.

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## Modular Microcontroller Family MC68HC16Z1 User's Manual

The MC68HC16Z1 is a member of the M68HC16 modular microcontroller family. Modular microcontrollers are built up from standardized modules interconnected by an intermodule bus (IMB). The MC68HC16Z1 incorporates a 16-bit central processing unit (CPU16), a system integration module (SIM), an 8-/10-bit analog-to-digital converter (ADC), a queued serial module (QSM), a general-purpose timer (GPT), and a 2048-byte standby RAM (SRAM). This manual provides sufficient information for normal operation of the MC68HC16Z1. Supplemental reference manuals for specific modules provide more detailed information, should a need arise.

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## MC68HC16Z2 User's Manual

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## MC68030 Enhanced 32-Bit MPU User's Manual, Third Edition

### Rev 2

The MC68030 is a second-generation 32-bit MPU in Motorola's M68000 family. It combines a CPU core, instruction and data caches, bus controller and memory management unit in a single VLSI device. This manual describes its capabilities, operation and programming. Sections include data organization and addressing, instruction set summary, processing states, signal description, on-chip caches, bus operation, exception processing, memory management unit, coprocessor interface, instruction timing, applications information, electrical specifications and mechanical data. Refer to *M68000PM/AD, Programmer's Reference Manual* for complete details on the instruction set.

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## MC68040 Designer's Handbook

This manual provides application examples and other support information for the system designer using the MC68040 32-bit microprocessor. It currently includes information on instruction timing, floating-point emulation, thermal considerations, transmission lines, bus adapter design for applications with the MC68020/68030, IEEE/P1149.1 test access port, and bus interface considerations. It uses a loose-leaf format so additional sections can be sent, as issued, to those who return the registration card.

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## MC68302 Integrated Multi-Protocol Processor User's Manual

### Rev 2

The MC68302 IMP is a VLSI device incorporating the main building blocks needed to design a wide variety of powerful communications controllers. It may be configured to support 5 different protocols, any 3 operating simultaneously. This manual describes its architecture; the MC68000 processor core on which it is based; the System Integration Block which provides basic timing and interfacing functions required by virtually every application; the Communications Processor which includes 3 independent serial channels with 6 DMA controllers; plus signal descriptions and electrical characteristics.

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## MC68306UM Integrated EC000 Processor User's Manual

The *MC68306 EC000 Integrated Processor User's Manual* describes the programming, capabilities, registers, and operation of the MC68306; the *MC6800 Family Programmer's Reference Manual* provides instruction details for the MC68306; and the *MC68306 EC000 Integrated Processor Product Brief* provides a brief description of the MC68306 capabilities.

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## Modular Microcontroller Family MC68330 Integrated CPU Processor User's Manual

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## Modular Microcontroller Family MC68340 Integrated Processor with DMA User's Manual

Rev 1

The MC68340 is a member of the M68300 modular microcontroller family. Modular microcontrollers are built up from standardized modules interconnected by an intermodule bus (IMB). The MC68340 incorporates a 32-bit central processing unit (CPU32) and the system integration module (SIM40). This manual describes the programming, capabilities, registers, and operation of the MC68340. Instruction details are in manual *M68000PM/AD*, described earlier in this brochure.

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## Dragon 1 High Performance Integrated Processor User's Manual

The MC68349 Dragon 1 is the highest performance member of the Motorola M68300 family if integrated processors. The MC68349 is designed to serve as the central processor of personal intelligent communicators and similar products requiring an optimal balance of performance, integration, cost and power consumption. The MC68349 is the first in a series of M68300 family integrated processors designed specifically to support rigorous requirements of consumer-oriented intelligent personal electronics.

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## MC68360 Quad Integrated Communications Controller User's Manual

The MC68360 Quad Integrated Communication Controller (QUICC) is a development of the MC68302, but with higher performance, increased flexibility and major extensions to capability. It incorporates four Serial Communications Controllers (SCC), two serial Management Controllers (SMC) and a Serial Peripheral Interface (SPI). This manual provides full details concerning the use and operation of the QUICC, including signal descriptions, memory map, bus operation, an overview of the CPU32+, System Integration Module (SIM60), Communication Processor Module (CPM), Test Access Port and electrical characteristics. Includes a section discussing practical applications.

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## MC68488 General Purpose Interface Adapter User's Manual

The MC68488 is a single-chip implementation of the GPIB protocol. This manual describes the IEEE-488 Standard and discusses the MC68488. It is intended for the prospective user as well as the experienced instrumentation designer, and can be used as a tutorial presentation, a detailed user's manual or a reference guide.

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## MC68605 X.25 Protocol Controller User's Manual

The MC68605 X.25 Protocol Controller (XPC) is an intelligent HCMOS communications protocol controller that implements the 1984 CCITT X.25 Recommendation, data link access procedure (LAPB). This manual provides full user information including operating modes, a description of the internal registers and the shared memory structures that provide communication with the host processor, details of the command set and the external signals, and the operation of the bus. Timing and state diagrams are given on foldout sheets for ease of reference.

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## MC68606 Multi-Link LAPD Protocol Controller User's Manual

The link-access procedure (LAPD) is the proposed protocol for use at the link layer of ISDN configurations, for both signalling and data transfer. The MC68606 MLAPD simplifies interfacing a microprocessor to a packet network by providing sequencing, error control, flow control and multiplexing services. An on-chip DMA controller transfers data packets to and from memory with minimal CPU assistance. The user's manual provides full details of memory structures, commands, LAPD operation and electrical specifications.

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## MC68824 Token Bus Controller User's Manual

Rev 1

The MC68824 Token Bus Controller (TBC) was the first single-chip device to implement the IEEE 802.4 Media Access Control (MAC) sublayer of the Manufacturing Automation Protocol (MAP). It operates as an intelligent peripheral that relieves its host microprocessor of the frame formatting and token management functions, using on-chip DMA to transfer data frames to and from memory. This manual is a detailed functional and electrical description of the device, including programming information and an overview of IEEE 802.4.

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## MC68836 FDDI Clock Generator User's Manual

The MC68836 implements the lower portion of the physical layer functions of the FDDI standard, including clock recovery, data recovery, and NRZI conversions. This manual describes the functions and signals of the MC68836, and provides electrical, mechanical, and applications information.

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## MC68837 FDDI Elasticity Buffer and Link Management User's Manual

The MC68837 implements the PHY functions of the FDDI standard, including data framing, elasticity buffer, encoding, decoding, smoothing, line state detection, and repeat filter. It also contains a number of station management functions. This manual describes the functions and operation of the MC68837, as well as providing electrical and mechanical information.

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## MC68838 FDDI Media Access Controller User's Manual

The MC68838 implements the MAC protocol for a station operating under the ANSI standard for FDDI LANs. This manual describes the functions and operation of the MC68838, as well as providing electrical and mechanical information.

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## Fiber Distributed Data Interface User's Manual

Fiber distributed data interface (FDDI) is a 100 Mbps, fiber-optic-based, token-ring local area network (LAN) standard developed to accommodate rings of up to 1000 stations and a total ring length of 200 km. FDDI is an American National Standards Institute (ANSI) standard. This standard specifies the media access control (MAC) layer, the physical (PHY) layer, the physical medium dependent (PMD) function, and the station management (SMT) function. The MC68840 integrated fiber distributed data interface (IFDDI) implements the MAC and PHY layers as defined in the ANSI X3T9 standard and also includes a non-standardized system interface to easily connect any host system to the FDDI network. Combined with an MC68836 FDDI clock generator (FCG), a single attach station is fully implemented according to the X3T9 standard.

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## FDDI Fiber Distributed Data Interface User's Manual

The MC68847 Quad ELM implements four MC68837 ELM devices on a single chip, providing a low-cost solution for concentrator applications. The MC68847's four ELM's are accessible by three unique data busses. The MC68847 Quad ELM User's Manual fully describes the programming, capabilities, registers, operation, and mechanical information for the MC68847.

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## MC68851 Paged Memory Management Unit User's Manual

Rev 2

The MC68851 is a high-performance PMMU designed to operate as a coprocessor to the MC68020 32-bit microprocessor. It performs very fast logical-to-physical address translations, and provides a comprehensive access control and protection mechanism with extensive support for paged virtual memory systems. This manual fully describes its functional and electrical characteristics, with extensive timing diagrams and detailed descriptions of each instruction. Includes a discussion of hardware and software considerations for designers.

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## MC68881/MC68882 Floating-Point Coprocessor User's Manual

Rev 3

The MC68881 and MC68882 fully implement the ANSI-IEEE754-1985 standard for Binary Floating-Point Arithmetic, and are implemented in VLSI technology to provide the highest possible functionality in a physically small device. They are intended to be used as coprocessors to the MC68020 and MC68030 MPUs; this manual assumes such connection. It is divided into two main parts, the first providing a detailed description of the programmer's model and of each instruction, the second describing the hardware interface to the main processor, with bus cycle timing and register addressing information.

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## MC88100 RISC Microprocessor User's Manual

Rev 1

The MC88100 is the first processor in the M88000 family of Reduced Instruction Set Computing (RISC) MPUs; it uses only simple instructions with extremely fast execution times to achieve very high efficiency and throughout. This manual provides an overview of its features and architecture; details of the programming model, addressing modes and instruction set; and descriptions of bus operation, exception processing and instruction timing. Electrical and mechanical data and signal descriptions are included. Applications information includes discussion of a minimum system configuration.

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## MC88110 Second Generation RISC Microprocessor User's Manual

The MC88110 is a Symmetric Superscalar machine capable of issuing and retiring two instructions per clock without any special alignment, ordering, or type restrictions on the instruction stream. This manual describes the programming, addressing modes, instruction set, implementation of floating point and graphics unit, caches, MMU, timing considerations, and system hardware design.

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## MC88200 Cache/Memory Management Unit User's Manual

Rev 1

The MC88200 CMMU is a high-performance, HCMOS VLSI device combining demand-paged virtual memory with 16K bytes of on-chip cache memory. It is specifically designed to operate with the MC88100 RISC processor. Separate chapters provide full details of the memory management functions and cache operation, and are followed by descriptions of the signals, bus operation, timing and registers. 48 pages of applications information discuss the use of multiple MC88200s, memory bus connections, and power and ground considerations. Contains electrical characteristics and mechanical data.

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## MC88410 Secondary Cache Controller User's Manual

Rev 1

The MC88410 is a highly-integrated secondary cache controller that reduces both memory latency and system bus use while extending multiprocessing capabilities to achieve a higher level of system performance in RISC systems using the MC88110. This manual describes its operation, signals, the processor bus and system bus interfaces, diagnostics and JTAG.

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## MC92005 SBus Slave Interface Controller User's Manual

The manual describes the capabilities, operation, and functions of the MC92005 SBus Slave Interface Controller (SLIC) chip. This comprehensive 60-page guide describes circuit theory and typical applications of the MC92005, a fully-compliant 32-bit SBus slave interface in a 160-lead plastic quad flat package. Many illustrations clarify chip architectural features such as dual buffer memory and the SBus/PBus interfaces. Electrical characteristics and timing information are provided in addition to pin descriptions and mechanical dimensions.

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## MCA3 ECL Series Design Manual

Rev 1

Presents information on the MCA2200ECL and MCA10000ECL Array, the first of the third-generation MCA3 series. The array contains approximately 10,000 equivalent gates and is compatible with Motorola's other ECL families. The first part of the manual considers DC functional design, specifies the various rules for connections on the array, and discusses the AC performance with respect to metal interconnect and loading. Separate sections cover the use of CAD, packaging, and design for testability. The library in the second part specifies the functions and timing associated with each macrocell.

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## MCA3 ETL Design Manual

This manual is the technical design manual for engineers using Motorola's ETL Series of gate arrays. The ETL series offers mixed ECL, PECL (positive ECL) and TTL compatible interfaces in arrays ranging in density from 750 to 6200 gates. The series combines 150 ps typical gate delays with 2500 MHz operating frequencies. The manual contains sections on DC logic design and AC performance guidelines with coverage of delay skew considerations and high frequency applications. The use of CAD tools for design development and package performance characteristics is also covered.

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## Modular Microcontroller Family Multichannel Communication Interface (MCCI) Reference Manual

The MCCI is a standardized module used in the M68300 and M68HC16 modular microcontroller families. It is designed for rapid manufacture of custom devices. The MCCI is interconnected to other modules in the MCU via the intermodule bus (IMB). It contains a serial peripheral interface (SPI) and two serial communication interfaces (SCI). This manual describes the capabilities, operation, and functions of the MCCI.

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## MCU Toolbox — Development Tools for Motorola Microcontrollers

MCU ToolBox shows where to go to find supporting items for Motorola MCUs. Suppliers of hardware and software related to the design of MCU-based systems — including Motorola itself — have provided brief descriptions of their products, and their addresses and phone numbers. The products are organized by MCU family: CSIC (M68HC05) Family, M68HC11 Family, M68HC16 Family and M68300 Family. Within each family they are listed under Logic Analyzers, Emulators, Evaluation Boards and Other Products.

MCUTLBX/D  
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## PowerPC 601 RISC Microprocessor User's Manual

Rev 1

This manual's primary objective is to define the functionality of the MPC601 microprocessor for use by software and hardware developers. The MPC601 processor is the first in the family of PowerPC™ microprocessors, and can provide a reliable foundation for developing products compatible with subsequent processors in the PowerPC family. However, the MPC601 provides a bridge between the POWER architecture and the PowerPC architecture, and as a result there are aspects of the MPC601 processor that are different from the PowerPC architecture. Therefore, the secondary objective of this manual is to describe how the MPC601 processor differs from the PowerPC architecture.

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## PowerPC 603 RISC Microprocessor User's Manual

This manual's primary objective is to define the functionality of the PowerPC 603™ microprocessor for use by software and hardware developers. The MPC603 is the second microprocessor in the PowerPC™ family. Unlike the PowerPC 601™ microprocessor, which provides a bridge between the POWER Architecture™ and PowerPC Architecture™ incorporating aspects of both, the 603 only implements the 32-bit portion of the PowerPC architecture.

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## NEURON C Programmer's Guide

NEURON C is a programming language based on ANSI C, with extensions to support the development of distributed control networks. Motorola manufactures and sells a unique microcontroller that supports Echelon Corporation's LonWorks technology for implementing these systems. This manual outlines a recommended approach to system development, explains key concepts of programming in NEURON C, and gives examples of its use.

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## Modular Microcontroller Family Queued Serial Module (QSM) Reference Manual

The QSM is a standardized module used in the M68300 and M68HC16 modular microcontroller families. It is designed for rapid manufacture of custom devices. The QSM is interconnected to other modules in the MCU via the intermodule bus (IMB). The QSM provides a queued serial peripheral interface (QSPI) and a serial communications interface (SCI). This manual describes the functions, capabilities, and operation of the QSM, and provides applications information for using the QSPI for analog data acquisition.

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## Single-Chip Integration Module Reference Manual

The Single-Chip Integration Module (SCIM) is a module on many Motorola 16- and 32-bit modular microcontroller units (MCUs). SCIM-based MCUs contain a SCIM, a CPU, and some combination of memory, input/output, timer, and additional modules. The SCIM supplies a clock signal to the rest of the microcontroller, provides system protection features, and manages the external bus. In addition, the SCIM provides on-chip chip-select signals and (if the pins are not being used for their alternate functions) I/O ports.

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## Modular Microcontroller Family System Integration Module (SIM) Reference Manual

The SIM is a standardized module used in the M68300 and M68HC16 modular microcontroller families. It is designed for rapid manufacture of custom devices. The SIM is interconnected to other modules in the MCU via the intermodule bus (IMB). QSM features include external bus support, 12 programmable chip select outputs, system protection logic, system clock, watchdog timer, clock monitor, bus monitor, and test/debug submodule. This manual describes its capabilities, operation, and functions.

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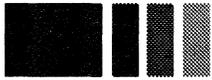
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## Modular Microcontroller Family Time Processor Unit (TPU) Reference Manual

### Rev 1

The TPU is a standardized module used in the M68300 and M68HC16 modular microcontroller families. It is designed for rapid manufacture of custom devices. The TPU is interconnected to other modules in the MCU via the intermodule bus (IMB). The TPU performs simple as well as complex timing tasks, and offers high-resolution timing and multiple time function capability. This manual describes the capabilities, operation, and functions of the TPU module.

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# Textbooks

## Basic Microprocessors and the 6800

*Ron Bishop*

A basic introduction to microprocessors, written in 1979 and based around the M6800 family. Aimed at students in schools, colleges and universities who may or may not have any knowledge of digital systems. Subjects covered include basic electronic principles, logic elements, number systems and binary arithmetic, introduction to microcomputers, programming concepts and addressing modes, M6800 software, and system configuration. Each chapter offers a set of problems for students to solve, and the final chapter is a collection of program examples.

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## Using Microprocessors and Microcomputers: The 6800 Family

*Joseph Greenfield & William Wray*

Whether you're an engineer or a technician, this book will show you how to assume responsibility for a complete real-time microcomputer project — from start to finish — including debugging of both the hardware and software. Assuming no prior programming courses and just basic knowledge of digital electronics, this thorough text takes you on an in-depth tour of the entire M6800 Family. With lucid explanations and easy-to-understand examples, you will decipher the intricacies of assembly language programming, the instruction set, I/O hardware considerations, 6800 development systems (including EXORciser) and several commercial applications of these versatile microcomputers.

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## Pascal Programming Structures for Motorola Microprocessors

*George W. Cherry*

Written in a unique conversational style, this text takes you by the hand and teaches you the complete Pascal programming language. The authors approach is top-down: you see and comprehend whole programs, then proceed systematically into the details. This edition describes the Pascal system available from Motorola for the MC6809 and MC68000 microprocessors. It includes implementation dependencies, the extensions of standard Pascal found in Motorola's Pascal compiler, a sample listing of a Motorola compilation, and a list of Motorola compiler error messages. Exercises conclude the chapters to firmly implant the concepts as you learn them.

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## Programming the 6809

*Rodnay Zaks & William Labiak*

Describes the organization and instruction set of the MC6809, presents the basic elements of assembly language programming, and introduces essential elementary and intermediate programming techniques. Beginning with the basics of programming and number systems, the book provides full details of the MC6809 instruction set and addressing modes, plus I/O devices and techniques. Includes exercises and a chapter of application examples.

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G. J. Lipovski

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## 68000, 68010, 68020 Primer

Stan Kelly-Boote & Bob Fowler

A comprehensive but very readable handbook for the M68000 family instruction set. Intended for both new and experienced programmers, it provides a gentle introduction to the basic instructions and addressing modes that are common to all M68000 devices, through to detailed explanations of the advanced software features of the MC68020. Begins with a historical and design overview of the five M68000 MPUs available at the time of writing; ends with a full summary of all instructions, a list of U.S. suppliers of related products, and a convenient tear-out instruction reference card.

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## Microprocessor Systems Design: 68000 Hardware, Software and Interfacing

*Alan Clements*

Provides a thorough grounding in the practical design of microprocessor systems, based on Motorola's M68000. It is addressed both to engineering and computer science students who need to obtain qualifications, and to practicing engineers in industry who must meet design specifications. Includes a great deal of practical information with emphasis on system timing and the analysis of read/write cycles. Advanced sections cover assembly language programming memory system design, error correction, exception handling, multiprocessor systems and the VMEbus. Most chapters set problems for students.

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## MC68000 Assembly Language and Systems Programming

*William Ford & William Topp*

A very comprehensive hardback manual covering all aspects of assembly language programming on the MC68000, with discussion of additional instructions up to the MC68020. The first 9 chapters provide material suitable for a full college course in assembly language programming. Chapters 10 to 14 cover advanced topics such as high-level language run-time environment, data structures, I/O programming, exception processing and interrupts. Examples and complete programs are used extensively throughout the text to illustrate concepts; exercises are included.

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## The 68000 Family, Volume 1: Architecture, Addressing Modes and Instruction Set

*Werner Hief & Anton Nausch*

Volume 1 of this substantial 2-volume hardback set provides a detailed overview of the M68000 family, including: a history of microprocessors showing M68000 in perspective; explanation of the family architecture; discussion of basic concepts such as registers, data formats, exceptions, interrupts, timing, etc.; a description of the addressing modes; and an individual description of each instruction. Can be used both as an introduction to the M68000 family and as a reference work. Presents very detailed information in a readable, workmanlike manner. Includes all M68000 family MPUs up to the MC68030.

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*Marty Brown*

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## The 68000 Family, Volume 2: Applications and the M68000 Devices

*Werner Hilf & Anton Nausch*

Volume 2 builds upon the industry foundation laid by the first volume and continues the in-depth coverage of the fundamentals and the architecture of the M68000 family. This reference work provides explicit supplementary information and a variety of practical hints on a wealth of subjects — from new programming techniques and operating systems, to support devices for the next generation. You'll find that both volumes are invaluable for working with 16-/32-bit microprocessors and the peripheral interface devices that support them.

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## The 68000 Book

*Bob Southern*

An introductory text on the architecture, assembly language programming and interfacing of the M68000 family of MPUs and peripherals. It is written for use in universities, colleges and in industry, as well as for individuals; most chapters include review questions. A programming background is not required and the only hardware qualification needed is familiarity with logic gates. The book includes practical topics such as bus loading, noise and interface timing, as well as memory mapping, the VMEbus and the MC68020 cache memory.

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## Real Time Digital Signal Processing Applications with Motorola's DSP56000 Family

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## The Motorola MC68332 Microcontroller

*Thomas L. Harman*

Familiarizing readers with the procedures necessary to design and develop hardware and software for applications, author Thomas L. Harman provides a comprehensive introduction to all of the significant aspects of design using the MC68332. You'll find that the topics are divided into three distinct categories: assembly-language programming, product design, and interface design, allowing users to study areas of specific interest and the requirements involved in specific applications.

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## Radio Frequency Transistors — Principles & Practical Applications

*Norm Dye and Helge Granberg*

This book presents a summary of RF transistor characteristics and their applications in RF amplifiers, both non-linear high power and linear low power. It is a non-theoretical treatment of a wide range of topics including unique data sheet specifications, circuit design, impedance matching and tips on circuit construction. Also included is a detailed discussion of RF power field effect transistors (FETs), their advantages and disadvantages with respect to bipolar junction transistors (BJTs).

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## Using Small Microcontrollers

*James M. Sibigroth*

This text is a guide to the world of microcontrollers. It is an aid to understanding the inner workings of these small general-purpose computers, and goes on to explain how to design microcontrollers into useful applications. Special emphasis is given to the smallest microcontrollers in the Motorola M68HC05 Family, although the ideas apply to all microcontrollers, and even to the largest computers.

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# Technical Data Services

## Motorola Data Disk — Specs-in-Secs

### Rev 5

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Winter 1994

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Callers are encouraged to register for their own personal accounts which are available for immediate use — no waiting for verification. Registered users can download files, send e-mail to the sysop or other user, and can join lively discussions about digital signal processing, Motorola DSP products, and other topics. Motorola's DSP hotline has a direct connection to the new Dr. BuB, and expert applications engineers log on every day to monitor and participate in the discussion.

Callers who wish to log-in as guests, just as they did with the old system, can still do so. The guest can navigate through the menus, read a variety of useful postings and messages, and leave e-mail with the sysop upon logging out. Guests who discover information or features that they need but don't have access to, are free to log-in again and open an account which will give them immediate access to additional information.

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### Rev 7

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