

**MOTOROLA**

# SEMICONDUCTORS

3501 ED BLUESTEIN BLVD., AUSTIN, TEXAS 78721

**8-Bit MPUs**  
**8-Bit MCUs**  
**8-Bit Peripherals**

## THE M6800 FAMILY

The MC6800 microprocessor was the first MPU of the M6800 Family and still remains a highly cost-effective processor for a great many process-control and data-communications applications. Seventy-two powerful instructions and six different addressing modes give it unexcelled capability, and a full range of compatible peripheral chips offer the widest possible latitude in system implementation. After years of field experience, the MC6800 has earned an enviable reputation as one of the easiest-to-use processors available.

Moreover, to tailor the system to your specific needs at the lowest cost, the MC6800 (and its peripherals) is available in three different packages, two different temperature ranges and three speed ranges.

The table to the right lists devices in the M6800 Family. The following microprocessor and microcomputer families are derivations and enhancements of the MC6800 architecture to provide easy migration within the M6800 Family as processing-power requirements change.

Device	Function
MC6800	MPU
MC6802	MPU (with Clock, RAM)
MC6808	MPU (with Clock)
MCM6810	128 x 8 Static RAM
MC6821	Peripheral Interface Adapter
MC6822	Industrial Interface Adapter
MC6828 <sup>1</sup>	Priority Interrupt Controller
MC6829	Memory Management Unit
MC6835	CRT Controller with ROM
MC6839	Floating Point ROM (IEEE Standard Draft 6.0)
MC6840	Programmable Timer
MC6843	Floppy-Disk Controller
MC6844	Direct Memory Access Controller
MC6845	CRT Controller
MC6846	ROM-I/O-Timer
MC6847, Y	Video Display Generator
MC6850	Asynchronous Interface Adapter
MC6852	Synchronous Serial Data Adapter
MC6854	Advanced Data Link Controller
MC6859	Data Security Device
MC6860 <sup>2</sup>	Digital Modem
MC6862 <sup>2</sup>	Digital Modulation
MC68488	General-Purpose Interface Adapter

<sup>1</sup>Motorola Digital Bipolar <sup>2</sup>Motorola Logic and Special Functions

## THE M6801 FAMILY PROCESSORS: HIGH-PERFORMANCE MCUs

Frequency				Memory
1 MHz	1.25 MHz	1.5 MHz	2 MHz	
MC6801	MC6801-1	MC68A01	MC68B01	2K ROM, 128 Bytes RAM, Expansion Bus
MC68701	MC68701-1	—	—	2K EPROM, 128 Bytes RAM, Expansion Bus
MC6803	MC6803-1	MC68A03	MC68B03	No ROM, 128 Bytes RAM, Expansion Bus
MC6803E	MC6803E-1	—	—	No ROM, 128 Bytes RAM, External Clock, Expansion Bus
MC6801U4	MC6801U4-1	—	—	4K ROM, 192 Bytes RAM, Expansion Bus
MC6803U4	MC6803U4-1	—	—	No ROM, 192 Bytes RAM, Expansion Bus
MC68120	MC68120-1	—	—	2K ROM, 128 Bytes Dual-Port RAM, Expansion Bus
MC68121	MC68121-1	—	—	No ROM, 128 Bytes Dual-Port RAM, Expansion Bus

## THE HMOS M6805 FAMILY PROCESSORS: MEDIUM-PERFORMANCE MCUs

Device	No. of Pins	Memory (Bytes)			I/O Lines	Special Features
		ROM	EPROM	RAM		
MC6805P2	28	1K	—	64	20 Programmable Bidirectional	Self-Check
MC6805P4	28	1K	—	112	20 Programmable Bidirectional	Self-Check, Standby RAM
MC6805R2	40	2K	—	64	2 to 5 Inputs, 24 Programmable Bidirectional	1 to 4 Channel 8-Bit A/D, Self Check
MC6805T2	28	2.5K	—	64	2 Special Function, 19 Programmable Bidirectional	PLL, Self-Check
MC6805U2	40	2K	—	64	8 Inputs, 24 Programmable Bidirectional	Self-Check
MC68705P3	28	—	1.8K	112	20 Programmable Bidirectional	Self-Programming Bootstrap
MC68705R3	40	—	3.8K	112	2 to 5 Inputs, 24 Programmable Bidirectional	1 to 4 Channel 8-Bit A/D, Self-Programming Bootstrap
MC68705U3	40	—	3.8K	112	8 Inputs, 24 Programmable Bidirectional	Self-Programming Bootstrap
MC6805U3	40	3.8K	—	112	8 Inputs, 24 Programmable Bidirectional	Self-Check
MC6805R3	40	3.8K	—	112	2 to 5 Inputs, 24 Programmable Bidirectional	1 to 4 Channel 8-Bit A/D, Self Check

THE CMOS M146805 FAMILY PROCESSORS: MEDIUM-PERFORMANCE MCUs

Device	No. of Pins	Memory (Bytes)		I/O Lines	Special Features
		ROM	RAM		
MC146805E2	40	—	112	16 Programmable Bidirectional	External Bus
MC146805F2	28	1K	64	16 Programmable Bidirectional	Self-Check
MC146805G2	40	2K	112	32 Programmable Bidirectional	Self-Check

SPECIAL PERIPHERALS

Device	Function
MC146818	CMOS Real-Time Clock
MC146823	CMOS Peripheral Interface Adapter (Similar to MC6821)

THE M6809 FAMILY PROCESSORS: HIGH-PERFORMANCE MPUs

PROCESSORS

Device	Features
MC6809	On-Chip Oscillator
MC6809E	External Clocking for Synchronization of Multiprocessor Systems

MPUs/EXPANDABLE MCUs SUPPORTED BY ALL M6800-FAMILY PERIPHERALS

MC6800	MC6801	MC6803U4
MC6802	MC6801U4	MC68120
MC6808	MC68701	MC68121
MC6809	MC6803	MC146805E2
MC6809E	MC6803E	

PART MARKING

**SPEED DESIGNATION** — The following letters identify the speed of the corresponding device.

MC68XX	1.0 MHz
MC68AXX	1.5 MHz
MC68BXX	2.0 MHz

In cases where a -1 follows the package designator, the device operates at 1.25 MHz (example: MC68XXL-1).

PRE-PROGRAMMED ROM-BASED MICROCOMPUTERS

Device	Source	Function
MC6801L1	MC6801	LILbug Monitor
MC6801G1	MC6801	LILbug Monitor
MC6805P2P2	MC6805P2	Monitor and Keyboard Encoder
MC6805P2P3	MC6805P2	Monitor and Game Plus
MC6805P2P4	MC6805P2	Monitor and Game (XTAL Osc)
MC6805R2L1	MC6805R2	Monitor and DVM
MC6805U2P2	MC6805U2	Monitor and Keyboard Encoder
MC6805P4P1*	MC6805P4	Mini-Monitor and Custom
MC6805T2P1	MC6805T2	Monitor and TV-Demo
MC6805T2P2	MC6805T2	Monitor and Ham Radio
MC146805G2P1	MC146805G2	Monitor and Bicycle Component
MC146805F2P1	MC146805F2	Monitor and Keyless Entry Demo.
MC68120L1	MC68120	UNICORN Monitor
MC6801U4L1	MC6801U4	UNICORN Monitor
MC6801U4G1	MC6801U4	UNICORN Monitor

\*Mini-monitor has only two commands: execute and memory examine/charge.

**PACKAGE DESIGNATION** — The part is marked with the following descriptors to identify the package type.

MC68XXP	Plastic
G	Plastic
L	Ceramic
S	Cerdip
Z	Leadless Chip Carrier

For further information on higher-speed extended-temperature devices, please contact your local Motorola Sales Office.

**BETTER LEVEL** — The part is marked with a suffix letter(s) as shown to indicate the level of testing that the part received.

MC68XX	CP	S
Part Identification	Standard Package Suffix	"BETTER" Processing
	C = Ext. Temp. (-40°C to +85°C)	Level I = Suffix S
		Level II = Suffix D
		Level III = Suffix DS



## THE "BETTER" PROGRAM

Motorola standard commercial integrated circuits are manufactured under stringent in-process controls and quality inspections combined with the industry's finest outgoing quality inspections. The "BETTER" program offers three levels of extra processing, each tailored to meet different user needs at nominal costs.

The program is designed to:

- Eliminate Incoming Electrical Inspection
- Eliminate Need for Independent Test Labs and Associated Extra Time and Costs
- Reduce Field Failures
- Reduce Service Calls
- Reduce Equipment Downtime
- Reduce Board and System Rework
- Reduce Infant Mortality
- Save Time and Money
- Increase End-Customer Satisfaction

### BETTER PROCESSING — STANDARD PRODUCT PLUS:

Level I (Suffix S)

- 100% temperature cycling per MIL-STD-883B, Method 1010, ten cycles from  $-25^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$ .
- 100% high temperature functional test at  $t_{\text{max}}$ .

Level II (Suffix D)

- 100% burn-in to MIL-STD-883B test conditions equivalent to 160 hours at  $+125^{\circ}\text{C}$ .
- 100% post burn-in DC parametric test at  $25^{\circ}\text{C}$ .

Level III (Suffix DS)

- Combination of Levels I and II above.

Test	Condition	AQL		
		Level I	Level II	Level III
High Temperature Functional	$T_A = t_{\text{max}}$	0.15	0.15*	0.10
DC Parametric	$T_A = 25^{\circ}\text{C}$	0.28	0.28	0.28
AC Parametric	$T_A = 25^{\circ}\text{C}$	0.65	0.65	0.65
External Visual and Mechanical	Major	0.11	0.11	0.11
	Minor	2.50	2.50	2.50
Hermeticity (Not applicable to plastic package)	Gross	0.46	0.46	0.46

$t_{\text{max}}$  = Maximum Operating Temperature of Device Under Test

\* $25^{\circ}\text{C}$

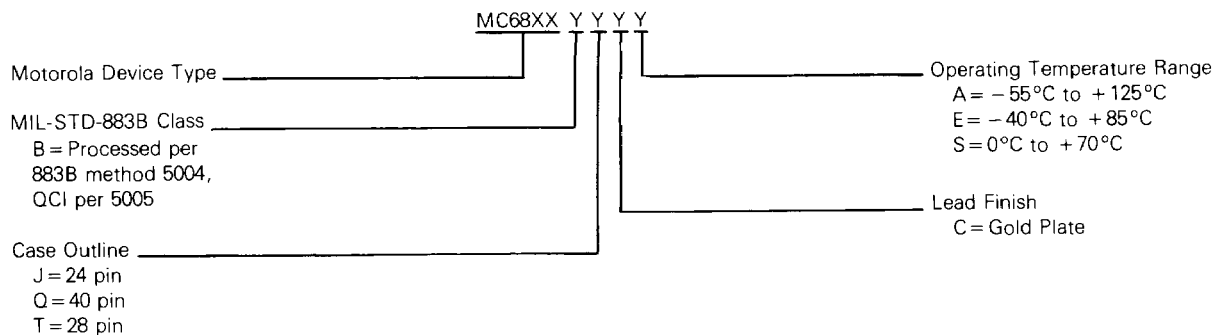
NOTES: 1. Major Defects — Affects Form, Fit, or Function

Minor Defects — Cosmetic

2. General Inspection Level II

## MIL-STD-883B SCREENED MICROPROCESSORS AND PERIPHERALS

Basic Numbering Parameters — Example: MC68XX YYYY



# 8-BIT MPUs/MCUs/PERIPHERALS (Continued)

Source Device	Hi-Rel Offering		
	0°C to +70°C	-40°C to +85°C	-55°C to +125°C
MC6800	MC68B00BQCS	MC68A00BQCE	MC6800BQCA
*MC6801	MC68B01BQCS	MC68A01BQCE	No
MC68701	MC68701BQCS	No	No
MC6802	MC68B02BQCS	MC68A02BQCE	MC6802BQCA
MC6803	MC68B03BQCS	MC68A03BQCE	No
MC6809	MC68B09BQCS	MC68A09BQCE	MC6809BQCA
MC6809E	MC68B09EBQCS	MC68A09EBQCE	MC6809EBQCA
MCM6810	MCM68B10BJCS	MCM68A10BJCE	MCM6810BJCA
MC6821	MC68B21BQCS	MC68A21BQCE	MC6821BQCA
MC6840	MC68B40BTCS	MC68A40BTCE	MC6840BTCA
MC6845	MC68B45BQCS	MC68A45BQCE	MC6845BQCA
MC6850	MC68B50BJCS	MC68A50BJCE	MC6850BJCA
MC6852	MC68B52BJCS	MC68A52BJCE	MC6852BJCA
MC6854	MC68B54BTCS	MC68A54BTCE	MC6854BTCA
MC68488	MC68B488BQCS	MC68A488BQCE	MC68488BQCA
*MC6805P2	MC6805P2BTCE	MC6805P2BTCE	No
MC146805E2	MC146805E2BQCE	MC146805E2BQCE	No
*MC146805G2	MC146805G2BQCE	MC146805G2BQCE	No

\*ROM base parts (source only)



# MOTOROLA DEVELOPMENT SYSTEMS 8-BIT PRODUCT LINE

NOTE: For details on these and other Motorola Development Systems Products, please contact your local Sales Office or Distributor.

	Devices Supported			Associated System Products
	<b>EXORciser</b>	<b>MC6800/6802</b> MDOS FORTRAN (Real-Time opt.) BASIC, MPL, COBOL Assembler, Editor and Linkage Editor Downline Loader Emulator Module  <b>M6801/68701</b> Cross Macro Assembler Downline Loader Emulator Module Programmer Module	<b>MC6805P2, R2, U2/68705</b> Programmer Module Cross Macro Assembler Emulator Module  <b>M146805</b> Cross Macro Assembler E2, G2, F2 Emulator Modules	<b>M6809</b> MDOS FORTRAN Pascal BASIC-M Compiler MPL Assembler, Editor and Linkage Editor Symbolic Debug Downline Loader Bus State Analyzer Emulator Module
<b>EXORset DS35</b>	<b>M6800</b> Cross Macro Assembler  <b>M6801</b> Cross Macro Assembler	<b>M6805P2, R2, U2/68705</b> Cross Macro Assembler P2, R2, U2 Emulator Module  <b>M146805</b> Cross Macro Assembler E2, G2, F2 Emulator Modules	<b>M6809</b> XDOS Pascal BASIC-M Assembler, Editor and Linkage Editor	EXORdisk III System 180 cps Printer PROM Programmer V EXORset/EXORciser Communications
<b>EVALUATION MODULES</b>	<b>M6800/6802</b> Educational Kit  <b>M6801/68701</b> Evaluation Module  <b>M68120</b> Evaluation Module	<b>M68705P3</b> Evaluation Module  <b>M68705R3, U3</b> Evaluation Module	<b>M6809</b> Educational Kit	EXORciser II System EXORterm 155 Console EXORmacs System Cross Software Systems Analyzer
<b>HARDWARE DEVELOPMENT STATION-200</b>		<b>M6805</b> Assembler/Linkage Editor P2, R2, U2 Emulator Module  <b>M146805</b> Assembler/Linkage Editor E2, G2, F2 Emulator Modules		EXORdisk III System EXORciser II System EXORset DS35 System EXORmacs System Systems Analyzer Cross Software EXORterm 155 Console 180 cps Printer PROM Programmer V

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BASIC-M, EXORdisk, EXORmacs, EXORset, EXORterm, MDOS, and XDOS are trademarks of Motorola Inc.



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<b>ALABAMA</b>		<b>ILLINOIS</b>		<b>NEW MEXICO</b>		<b>Houston</b>	
Huntsville		Bensenville		Albuquerque		Hall-Mark Electronics	(713)781-6100
Hall-Mark Electronics	(205)837-8700	Hall-Mark Electronics	(312)860-3600	Alliance Electronics	(505)292-3360	Hamilton/Avnet Electronics	(713)780-1771
Hamilton/Avnet Electronics	(205)837-7210	Hamilton/Avnet Electronics	(312)860-7700	Hamilton/Avnet Electronics	(505)765-1500	Kierulff Electronics	(713)530-7030
Pioneer/Washington	(205)837-9300	<b>Chicago</b>		<b>NEW YORK</b>		Schweber Electronics	(713)784-3600
Schweber Electronics	(205)882-2200	†Bell Industries	(312)982-9210	<b>East Syracuse</b>		<b>Irving</b>	
<b>ARIZONA</b>		Newark Electronics Corp.	(312)638-4411	Hamilton/Avnet Electronics	(315)437-2641	Hamilton/Avnet Electronics	(214)659-4111
<b>Phoenix</b>		<b>Elk Grove Village</b>		<b>Fairport</b>			
†Kierulff Electronics	(602)243-4100	Kierulff Electronics	(312)640-0200	Schweber Electronics	(716)381-7070	<b>UTAH</b>	
<b>Tempe</b>		Pioneer/Standard	(312)437-9680	<b>Hauppauge</b>		<b>Salt Lake City</b>	
Hamilton/Avnet Electronics	(602)231-5100	Schweber Electronics	(312)364-3750	Lionex Corporation	(516)273-1660	Bell Industries	(801)972-6969
<b>Tucson</b>		<b>Elmhurst Industrial Park</b>		<b>Melville, LI</b>		Hamilton/Avnet Electronics	(801)972-4300
Kierulff Electronics	(602)624-9986	Semiconductor Specialists,		Hamilton/Avnet Electronics	(516)454-6000	Kierulff Electronics	(801)973-6913
<b>CALIFORNIA</b>		Inc./Chicago	(312)279-1000	<b>Port Chester</b>		<b>WASHINGTON</b>	
<b>Anaheim</b>		<b>INDIANA</b>		*Zeus Components	(914)937-7400	<b>Bellevue</b>	
*Zeus Components West	(714)632-6880	<b>Indianapolis</b>		Rochester		Hamilton/Avnet Electronics	(206)643-3950
<b>Canoga Park</b>		Graham Electronics		Hamilton/Avnet Electronics	(716)475-9130	<b>Seattle</b>	
Schweber Electronics	(213)999-4702	Supply, Inc.	(317)634-8202	Schweber Electronics	(716)424-2222	Almac/Stroum Electronics	(206)643-9992
<b>Costa Mesa</b>		Hamilton/Avnet Electronics	(317)844-9333	<b>Vestab</b>		<b>Waukesha</b>	
Avnet	(714)754-6155	Pioneer/Standard	(317)849-7300	Harvey Electronics	(607)748-8211	Kierulff Electronics	(206)575-4420
Hamilton Electro Sales	(714)641-4111	<b>IOWA</b>		<b>Westbury, LI</b>		<b>WISCONSIN</b>	
<b>Culver City</b>		<b>Cedar Rapids</b>		Schweber Electronics	(516)334-7474	<b>Brookfield</b>	
Hamilton Electro Sales/L.A.	(213)558-2000	Schweber Electronics	(319)373-1417	<b>Woodbury, LI</b>		Schweber Electronics	(414)784-9020
Hamilton/Avnet		<b>KANSAS</b>		Harvey Electronics	(516)921-8700	<b>New Berlin</b>	
Corporate Headquarters	(213)558-2000	<b>Overland Park</b>		<b>NORTH CAROLINA</b>		Hamilton/Avnet Electronics	(414)784-4510
<b>Irvine</b>		Hamilton/Avnet Electronics	(913)888-8900	<b>Greensboro</b>		†Hall-Mark Electronics	(414)761-3000
Schweber Electronics	(213)537-4321	<b>Shawnee Mission</b>		Kierulff Electronics	(919)852-9440	Bell Industries	(414)784-0235
Avnet	(714)556-3880	Hall-Mark Electronics	(913)888-4747	Hall-Mark Electronics	(919)832-4465	Kierulff Electronics	(414)784-8160
<b>Los Angeles</b>		<b>MARYLAND</b>		Hamilton/Avnet Electronics	(919)829-8030	<b>CANADA</b>	
Kierulff Electronics	(213)725-0325	<b>Baltimore</b>		<b>OHIO</b>		<b>ALBERTA</b>	
<b>Palo Alto</b>		†Hall-Mark Electronics	(301)796-9300	<b>Beachwood</b>		<b>Calgary</b>	
Kierulff Electronics	(415)968-6292	<b>Gaithersburg</b>		Schweber Electronics	(216)464-2970	†L.A. Varah, Ltd.	(403)276-8818
<b>Roseville</b>		Pioneer/Washington	(301)948-0710	<b>Centerville</b>		Zentronics, Ltd.	(403)230-1422
Bell Industries	(916)969-3100	Schweber Electronics	(301)840-5000	Hamilton/Avnet Electronics	(513)433-0610	<b>Edmonton</b>	
<b>Sacramento</b>		<b>Hanover</b>		Cleveland		Intek Electronics, Ltd.	(403)437-2755
Schweber Electronics	(916)929-9732	Hamilton/Avnet Electronics	(301)621-5410	†Hall-Mark Electronics	(216)473-2907	<b>B.C.</b>	
<b>San Diego</b>		<b>MASSACHUSETTS</b>		Pioneer/Standard	(216)587-3600	<b>Vancouver</b>	
Hamilton/Avnet Electronics	(714)571-7510	<b>Bedford</b>		Schweber Electronics	(216)831-3500	†Intek Electronics, Ltd.	(604)324-6831
Kierulff Electronics	(714)278-2118	Schweber Electronics	(617)275-5100	<b>Dayton</b>		†L.A. Varah, Ltd.	(604)875-3211
<b>Santa Clara</b>		<b>Boston</b>		Pioneer/Standard	(513)236-9900	Zentronics, Ltd.	(604)325-3292
Schweber Electronics	(408)496-0200	†Kierulff Electronics	(617)667-8331	Schweber Electronics	(513)439-1800	<b>MANITOBA</b>	
<b>Sunnyvale</b>		Lionex Corporation	(617)272-9400	<b>Worthington</b>		<b>Winnipeg</b>	
Bell Industries	(408)734-8570	<b>Burlington</b>		†Hall-Mark Electronics	(614)846-1882	Zentronics, Ltd.	(204)775-8661
Hamilton/Avnet Electronics	(408)743-3300	*Zeus Components	(617)273-0750	<b>OKLAHOMA</b>		<b>ONTARIO</b>	
<b>Tustin</b>		<b>Needham</b>		<b>Tulsa</b>		<b>Hamilton</b>	
Kierulff Electronics	(714)731-5711	Impact Sales Co., Inc.	(617)444-3971	Hall-Mark Electronics	(919)835-8458	†L.A. Varah, Ltd.	(416)561-9311
<b>COLORADO</b>		<b>Woburn</b>		Kierulff Electronics	(918)252-7537	London	
<b>Denver</b>		Hamilton/Avnet Electronics	(617)935-9700	Schweber Electronics	(918)622-8000	†C.M. Peterson Co., Ltd.	(519)434-3204
Hamilton/Avnet Electronics	(303)740-1017	<b>MICHIGAN</b>		<b>OREGON</b>		<b>Mississauga</b>	
Kierulff Electronics	(303)371-6500	<b>Grand Rapids</b>		<b>Beaverton</b>		Hamilton/Avnet Int'l	
<b>CONNECTICUT</b>		Hamilton/Avnet Electronics	(616)243-8805	Almac/Stroum Electronics	(503)641-9070	Canada Ltd.	(416)677-7432
<b>Danbury</b>		<b>Livonia</b>		Lake Oswego	(503)635-8631	Zentronics, Ltd.	(416)676-9000
Hamilton/Avnet Electronics	(203)797-2800	Hamilton/Avnet Electronics	(313)522-4700	<b>Portland</b>		<b>ONTARIO</b>	
Schweber Electronics	(203)792-3500	Pioneer/Standard	(313)525-1800	Kierulff Electronics	(503)641-9150	<b>Ottawa</b>	
<b>Norwalk</b>		R. S. Electronics	(313)525-1155	†Kierulff Electronics	(503)641-9150	Hamilton/Avnet Int'l	
Harvey Electronics	(203)853-1515	†Schweber Electronics	(313)525-8100	<b>PENNSYLVANIA</b>		Canada Ltd.	(613)226-7700
<b>FLORIDA</b>		<b>MINNESOTA</b>		<b>Horseshoe</b>		Zentronics, Ltd.	(613)238-6411
<b>Altamonte Springs</b>		<b>Bloomington</b>		Pioneer/Washington	(215)674-4000	<b>Willowdale</b>	
Schweber Electronics	(305)331-7555	Hall-Mark Electronics	(612)854-3223	Schweber Electronics	(215)441-0600	†Electro Sonic, Inc.	(416)494-1555
<b>FL. Lauderdale</b>		<b>Eden Prairie</b>		<b>Montgomeryville</b>		<b>QUEBEC</b>	
Hall-Mark Electronics	(305)971-8280	Schweber Electronics	(612)941-5280	Pytronic Industries, Inc.	(215)643-2850	<b>Montreal</b>	
Hamilton/Avnet Electronics	(305)971-2900	<b>Edina</b>		<b>Pittsburgh</b>		†Cesco Electronics Ltd.	(514)735-5511
<b>Hollywood</b>		Kierulff Electronics	(612)941-7500	Pioneer/Standard	(412)782-2300	Zentronics, Ltd.	(514)735-5361
Schweber Electronics	(305)927-0511	<b>Minnetonka</b>		Schweber Electronics	(412)782-1600	<b>Quebec City</b>	
<b>Orlando</b>		Hamilton/Avnet Electronics	(612)932-0664	<b>TEXAS</b>		†Cesco Electronics, Ltd.	(418)524-4641
Hall-Mark Electronics	(305)855-4020	<b>MISSOURI</b>		<b>Austin</b>		St. Laurent	
†Pioneer/Washington	(305)859-3000	<b>Earth City</b>		Hall-Mark Electronics	(512)258-8848	Hamilton/Avnet Int'l	
<b>St. Petersburg</b>		Hall-Mark Electronics	(314)291-1550	Hamilton/Avnet Electronics	(512)837-8911	Canada Ltd.	(514)331-6443
Hamilton/Avnet Electronics	(813)576-3930	Hamilton/Avnet Electronics	(314)344-1200	Kierulff Electronics	(512)835-2090	<b>*Military, Power and RF Products</b>	
Kierulff Electronics	(813)576-1966	<b>NEW JERSEY</b>		Schweber Electronics	(512)458-8253	<b>†Authorized for all Components.</b>	
<b>GEORGIA</b>		<b>Fairfield</b>		<b>Dallas</b>		<b>†Except System Products</b>	
<b>Atlanta</b>		Hamilton/Avnet Electronics	(201)575-3390	Hall-Mark Electronics	(214)341-1147		
†Schweber Electronics	(404)449-9170	Kierulff Electronics	(201)575-8750	Hall-Mark Corporate	(214)343-5000		
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Hall-Mark Electronics	(404)447-8000	Hall-Mark Electronics	(609)424-0880	†Trevino Electronics, Inc.	(214)358-2418		
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			(215)925-6900				
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		Harvey Electronics	(201)575-3510				

## MOTOROLA SEMICONDUCTOR SALES OFFICES

<b>MOTOROLA SEMICONDUCTOR AMERICAS DISTRICT OFFICES</b>		<b>MISSOURI, St. Louis</b>	(314)872-7681	<b>MOTOROLA SEMICONDUCTOR—CANADA</b>		<b>GERMANY, Munich</b>	(089)92 481
<b>ALABAMA, Huntsville</b>	(205)830-1050	<b>NEW JERSEY, River Edge</b>	(201)488-1200	<b>MANITOBA, Winnipeg</b>	(204)889-0693	<b>GERMANY, Nuremberg</b>	(091)165761
<b>ARIZONA, Phoenix</b>	(602)244-7100	<b>NEW YORK, Poughkeepsie/Fishkill</b>	(914)896-8970	<b>ONTARIO, Downsview/Toronto</b>	(416)661-6400	<b>GERMANY, Sindelfingen</b>	(0703)183074
<b>ARIZONA, Phoenix (General Motors Group)</b>	(602)244-7125	<b>NEW YORK, Long Island</b>	(516)231-9000	<b>ONTARIO, Ottawa</b>	(613)729-4361	<b>GERMANY, Wiesbaden</b>	(062)1716-1921
<b>CALIFORNIA, Encino/Sherman Oaks</b>	(213)872-1504	<b>NEW YORK, Pittsford</b>	(716)248-5494	<b>QUEBEC, Montreal</b>	(514)731-6861	<b>HONG KONG, Hung Hom</b>	
<b>CALIFORNIA, Orange (Orange Exch./L.A. Exch.)</b>	(714)634-2844	<b>NEW YORK, Syracuse</b>	(315)454-9373	<b>MOTOROLA SEMICONDUCTOR INTRA-COMPANY OFFICES</b>		<b>Kowloon</b>	3-632201-8
<b>CALIFORNIA, San Diego</b>	(714)560-4644	<b>NORTH CAROLINA, Raleigh</b>	(919)876-6025	<b>ARIZONA, Scottsdale</b>	(602)949-3811	<b>ISRAEL, Tel Aviv</b>	3-386211-22
<b>CALIFORNIA, San Jose</b>	(408)885-8510	<b>OHIO, Cleveland</b>	(216)461-3160	<b>ARIZONA, Scottsdale/Automotive</b>	(602)994-6831	<b>ITALY, Bologna</b>	(051)533-446
<b>COLORADO, Colorado Springs</b>	(303)599-7404	<b>OHIO, Dayton</b>	(513)294-2231	<b>FLORIDA, Ft. Lauderdale</b>	(305)475-6120	<b>ITALY, Milan</b>	824-2046
<b>COLORADO, Denver</b>	(303)773-6800	<b>OHIO, Columbus</b>	(614)846-9480	<b>ILLINOIS, Franklin Park/Schaumburg</b>	(312)576-2788	<b>ITALY, Rome</b>	(03)831 4746
<b>CONNECTICUT, New Haven/Hamden</b>	(203)281-0771	<b>OKLAHOMA, Tulsa</b>	(918)664-5227	<b>ILLINOIS, Schaumburg</b>	(312)576-5518	<b>JAPAN, Osaka</b>	(06)305 1421
<b>FLORIDA, Pompano Beach/Ft. Lauderdale</b>	(305)491-8141	<b>OREGON, Portland</b>	(503)641-3681	<b>ILLINOIS, Schaumburg</b>	(817)232-6255	<b>JAPAN, Tokyo</b>	03-4403311
<b>FLORIDA, Casselberry/Maitland</b>	(305)831-3422	<b>PENNSYLVANIA, Philadelphia/Ft. Washington</b>	(215)443-9400	<b>TEXAS, Ft. Worth</b>		<b>KOREA, Seoul</b>	261-7137
<b>FLORIDA, St. Petersburg</b>	(813)576-6030	<b>TENNESSEE, Knoxville</b>	(615)690-5592	<b>MOTOROLA SEMICONDUCTOR INTERNATIONAL SALES OFFICES</b>		<b>MEXICO, D.F.</b>	(52)525-0706
<b>GEORGIA, Atlanta</b>	(404) 258-0222	<b>TEXAS, Austin</b>	(512)452-7673	<b>AUSTRALIA, Melbourne</b>	(03)561-3555	<b>NETHERLANDS, Utrecht</b>	(030)443 8008
<b>ILLINOIS, Chicago/Schaumburg</b>	(312)576-7800	<b>TEXAS, Dallas</b>	(214)931-9222	<b>AUSTRALIA, Sydney</b>	439-2242	<b>NORWAY, Oslo</b>	(02)671 467
<b>INDIANA, Fort Wayne</b>	(317)484-0436	<b>TEXAS, Houston</b>	(713)783-6400	<b>AUSTRIA, Vienna</b>	(0222)62-01 26	<b>SINGAPORE</b>	2945438
<b>INDIANA, Indianapolis</b>	(317) 849-7060	<b>UTAH, Salt Lake City</b>	(801)539-1190	<b>BRAZIL, Sao Paulo</b>	707-286	<b>SOUTH AFRICA, Bramley</b>	786 1184
<b>INDIANA, Kokomo</b>	(317)457-6634	<b>VIRGINIA, Charlottesville</b>	(804)917-3691	<b>ENGLAND, Wembley, Middlesex</b>	01-902-8836	<b>SPAIN, Madrid</b>	(01)279 0802
<b>IOWA, Cedar Rapids</b>	(319)374-1328	<b>WASHINGTON, Bellevue</b>	(206)622-9960	<b>FRANCE, Grenoble</b>	(076)90 22 81	<b>SWEDEN, Solna</b>	08/82 02 95
<b>KANSAS, Kansas City/Mission</b>	(913)384-3050	Seattle Access	(206)622-9960	<b>FRANCE, Paris</b>	(01)555-91 81	<b>SWITZERLAND, Geneva</b>	(02)7991 111
<b>MASSACHUSETTS, Berlin</b>	(617)562-3856	<b>WASHINGTON, DC/MARYLAND, Hyattsville</b>	(301)577-2600	<b>FRANCE, Toulouse</b>	(061)41 11 89	<b>SWITZERLAND, Zurich</b>	(01)730 40 74
<b>MASSACHUSETTS, Burlington</b>	(617)273-5020	<b>WISCONSIN, Milwaukee/Wauwatosa</b>	(414)476-5554	<b>GERMANY, Langenhagen/Hannover</b>	(0511)78-20-37	<b>TAIWAN, Taipei</b>	7528944-9
<b>MICHIGAN, Detroit/Westland</b>	(313)261-6200	Field Applications Engineering Available Through All Sales Offices					
<b>MINNESOTA, Minneapolis</b>	(612)545-0251						

## MOTOROLA SYSTEMS REPRESENTATIVES

<b>ALABAMA, Huntsville</b>	(205)881-9298	<b>GEORGIA, Marietta</b>	(404)424-1931	<b>NEW YORK, Elmont</b>	(516)488-2100	<b>TEXAS, Houston</b>	(713)965-0060
<b>CALIFORNIA, Inglewood</b>	(213)673-4300	<b>ILLINOIS, Chicago</b>	(312)992-0830	<b>NORTH CAROLINA, High Point</b>	(919)883-9125	<b>UTAH, Salt Lake City</b>	(801)363-8113
<b>CALIFORNIA, San Diego</b>	(714)695-2050	<b>INDIANA, Carmel</b>	(317)844-4175	<b>OHIO, Cleveland</b>	(216)779-5100	<b>VIRGINIA, Richmond</b>	(804)270-1400
<b>CALIFORNIA, Santa Clara</b>	(408)727-1800	<b>KANSAS, Overland Park</b>	(913)341-2645	<b>OHIO, Dayton</b>	(513)222-7700	<b>WASHINGTON, Bellevue</b>	(206)455-9180
<b>COLORADO, Lakewood</b>	(303)989-1900	<b>MARYLAND, Bethesda</b>	(301)856-4535	<b>OREGON, Beaverton</b>	(503)644-5900	<b>WISCONSIN, Milwaukee</b>	(414)546-2033
<b>CONNECTICUT, Hamden</b>	(203)624-7800	<b>MASSACHUSETTS, Winchester</b>	(617)729-5770	<b>PENNSYLVANIA, Monroeville</b>	(412)372-4415		
<b>FLORIDA, Deerfield Beach</b>	(305)421-4989	<b>MICHIGAN, Farmington Hills</b>	(313)477-7700	<b>PENNSYLVANIA, Willow Grove</b>	(215)657-0330		
<b>FLORIDA, Maitland</b>	(305)645-3444	<b>MISSOURI, Manchester</b>	(				