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Technical and Applications Literature

Selector Guide and Cross References

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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.

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Applications Documents

Introduction

Motorola's Applications Literature provides guidance to the effective use of its semiconductor families across a broad range of practical applications. Many different topics are discussed – in a way that is not possible in a device data sheet – from detailed circuit designs complete with PCB layouts, through matters to consider when embarking on a design, to complete overviews of a microprocessor family and its design philosophy.

Information is presented in the form of Application Notes and Article Reprints (originally published[1] in the electronics press), plus detailed Engineering Bulletins, Benchbriefs[2], Design Concepts and APRs[3]. This section provides a guide to these items; it includes an abstract of each document, a Selector Guide listing documents under subject or device-type headings, and a Device Cross Reference listing them by featured devices. Documents new to this issue are highlighted.

The Application Notes, Article Reprints, Engineering Bulletins, and Design Concepts are included to enhance the user's knowledge and understanding of Motorola's products. However, before attempting to design-in a device referenced in these documents, contact the local Motorola supplier for product availability and available application support.

Each section of the Applications Literature Selector Guide also includes cross references to a selection from Motorola's extensive range of Data Books, Brochures, Technical Bulletins and Selector Guides which may provide further relevant information.

Information in this document is given in good faith and no liability is accepted for errors or omissions. Includes literature available as of August 1, 1999.

1 Article Reprints are reproduced with the permission of the original publisher.

2 A Benchbrief is an Engineering Bulletin produced by Motorola Asia-Pacific Group.

3 APRs are applications documents relating specifically to Digital Signal Processing.

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MC68HC05C0	AN1286/D	MC68HC05C0 Bus Structure Design
MC68HC05C4	AN991/D	Using the Serial Peripheral Interface to Communicate Between Multiple…
	AN1067/D	Pulse Generation and Detection with Microcontroller Units
MC68HC05C5	AN1066/D	Interfacing the MC68HC05C5 SIOP to an I2C Peripheral
MC68HC05Cx	*AN1298/D	Variations in the Motorola MC68HC(7)05Cx Family
MC68HC05F2	AN-HK-17/H	MC68HC05F2 DTMF Output Low Voltage Active Filter
MC68HC05F6	AN-HK-12/H	MC68HC05F6 Tone Pulse Dialer
MC68HC05J1	AN1067/D	Pulse Generation and Detection with Microcontroller Units

MC68HC05JB2	AN1732/D	A Universal Serial Bus Gamepad Device using the MC68HC05JB2
MC68HC05JJ	AN1738/D	Instruction Cycle Timing of MC68HC05JJ/JP Series Microcontrollers
	AN1740/D	Applications Using the Analog Subsystem of MC68HC05JJ/JP Series…
	AN1741/D	In-Circuit and Emulation Considerations for MC68HC05JJ/JP Series…
MC68HC05JJ6	*AN1662/D	Low Cost Universal Motor Phase Angle Drive System
MC68HC05JP	AN1738/D	Instruction Cycle Timing of MC68HC05JJ/JP Series Microcontrollers
	AN1740/D	Applications Using the Analog Subsystem of MC68HC05JJ/JP Series…
	AN1741/D	In-Circuit and Emulation Considerations for MC68HC05JJ/JP Series…
MC68HC05K1	AN465/D	Secure Remote Control using the 68HC05K1 and the 68HC05P3
MC68HC05L10	AN-HK-13A/H	MC68HC05L10 Handheld Equipment Applications
MC68HC05L11	AN-HK-15/H	MC68HC05L11 Hand-Writing Applications
MC68HC05L6	AN442/D	Driving LCDs with M6805 Microprocessors
MC68HC05L9	AN-HK-10/H	MC68HC05L9 Microcomputer Applications Demo Board
MC68HC05MC4	AN1606/D	ITC132 High Voltage Micro to Motor Interface
	AN1607/D	ITC122 Low Voltage Micro to Motor Interface
MC68HC05P3	AN465/D	Secure Remote Control using the 68HC05K1 and the 68HC05P3
MC68HC05P9	AN1586/D	Designing a Homemade Digital Output for Analog Voltage Output Sensors
MC68HC05V7	AN1257/D	Using the M68HC05 Family On-Chip Voltage Regulator
MC68HC05X16	EB421/D	The Motorola MCAN Module
MC68HC05X32	EB421/D	The Motorola MCAN Module
MC68HC05X4	AN464/D	Software Driver Routines for the Motorola MC68HC05 CAN Module
	EB421/D	The Motorola MCAN Module
MC68HC08	AN1224/D	Example Software Routines for the Message Data Link Controller Module…
MC68HC08KH12	*AN1748/D	Building a Universal Serial Bus Keyboard Hub Using the Motorola MC68HC(9)08KH12
MC68HC08MP16	AN1606/D	ITC132 High Voltage Micro to Motor Interface
	AN1607/D	ITC122 Low Voltage Micro to Motor Interface
MC68HC11	AN495/D	RDS Decoding for an HC11-Controlled Radio
	AN1552/D	MPX7100AP: The Sensor at the Heart of Solid-State Altimeter Applications
	*AN1597/D	Longwave Radio Data Decoding Using an HC11 and an MC3371
	*EB195/D	How to Configure the Reset Pin on the MC68HC11
MC68HC11A0	EB286/D	C Macro Defenitions for the MC68HC11A8/A7/A1/A0
MC68HC11A1	EB286/D	C Macro Defenitions for the MC68HC11A8/A7/A1/A0
MC68HC11A7	EB286/D	C Macro Defenitions for the MC68HC11A8/A7/A1/A0
MC68HC11A8	AN1067/D	Pulse Generation and Detection with Microcontroller Units
	EB286/D	C Macro Defenitions for the MC68HC11A8/A7/A1/A0
MC68HC11C0	EB283/D	C Macro Definitions for the MC68HC11C0
MC68HC11D0	EB284/D	C Macro Definitions for the MC68HC(7)11D3/D0
MC68HC11D3	EB284/D	C Macro Definitions for the MC68HC(7)11D3/D0
MC68HC11E0	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
MC68HC11E1	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
MC68HC11E20	EB285/D	C Macro Definitions for the MC68HC(7)11E20
MC68HC11E32	EB419/D	ROMed HC11E32 and HC11PH8 Including Buffalo Monitor and PCbug11 Talker
	EB422/D	Enhanced M68HC11 Bootstrap Mode
MC68HC11E8	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
MC68HC11E9	AN1285/D	Stepper Motor Control with an MC68HC11E9 Microcontroller
	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
MC68HC11ED0	EB288/D	C Macro Definitions for the MC68HC11ED0
	EB422/D	Enhanced M68HC11 Bootstrap Mode

MC68HC11EVBU	*EB197/D	Using Pseudo-Interrupt Vectors on the M68HC11EVBU
MC68HC11F1	EB289/D	C Macro Definitions for the MC68HC11F1
MC68HC11G5	AN432/D	128K byte Addressing with the M68HC11
MC68HC11K4	AN1215/D	PID Routines for MC68HC11K4 and MC68HC11N4 Microcontrollers
MC68HC11KAx	*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
MC68HC11KW1	*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
MC68HC11Kx	*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
MC68HC11N4	AN1215/D	PID Routines for MC68HC11K4 and MC68HC11N4 Microcontrollers
MC68HC11P2	*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
MC68HC11PH8	*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
	EB419/D	ROMed HC11E32 and HC11PH8 Including Buffalo Monitor and PCbug11 Talker
	EB422/D	Enhanced M68HC11 Bootstrap Mode
MC68HC16	*EB259/D	Why MC68300 and MC68HC16 MCUs May Halt after Release of Reset
	*EB260/D	Why an MC68300 or MC68HC16 Microcontroller May Fail to Release Reset
	*EB261/D	Autovector Generation Using Chip Select Logic on MC68300 and MC68HC16…
MC68HC16W1	AN476/D	CPU16 and the Configurable Timer Module (CTM) in Engine Control
MC68HC16Y1	AN461/D	An Introduction to the HC16 for HC11 Users
MC68HC16Z1	AN461/D	An Introduction to the HC16 for HC11 Users
	AN1213/D	16-bit DSP Servo Control with the MC68HC16Z1
	AN1233/D	Using M68HC16 Digital Signal Processing to Build an Audio Frequency Analyzer
	AN1249/D	Brushed DC Motor Control Using the MC68HC16Z1
	AN1254/D	Using the MC68HC16Z1 for Audio Tone Generation
	*EB273/D	Which Pins on the MC68331/332 and MC68HC16Z1 Need Pullup Resistors
MC68HC16Z1EVB	*EB309/D	Using Exercise 8 on the MC68HC16Z1EVB
MC68HC68T1	ANE425/D	Use of the MC68HC68T1 RTC with M6805 Microprocessors
MC68HC705	AN499/D	Let the MC68HC705 Program Itself
MC68HC705B16	AN1638/D	Offset Calibration of Gauge Pressure Sensor Using Parallel I/O Ports
	EB166/D	System Design Considerations: Converting from the MC68HC805B6 to the…
MC68HC705B16N	EB180/D	Differences between the MC68HC705B16 and the MC68HC705B16N
MC68HC705B5	AN1305/D	An Evaluation System for Direct Interface of the MPX5100 Pressure Sensor…
MC68HC705C8	AN1067/D	Pulse Generation and Detection with Microcontroller Units
	AN1226/D	Use of the 68HC705C8A in Place of a 68HC705C8
	AN1228/D	Interfacing the HC05 MCU to the MC145051 A/D Converter
MC68HC705C8A	AN1226/D	Use of the 68HC705C8A in Place of a 68HC705C8
	AN1256/D	Interfacing the HC05 MCU to a Multichannel Digital-to-Analog Converter…
	AN1734/D	Pulse Width Modulation Using the 16-Bit Timer
	AN1745/D	Interfacing the HC705C8A to an LCD Module
	*AN1755/D	Interfacing the MC68HC705C8A to the DS2430A 256-bit 1-Wire EEPROM
	*AN1761/D	Interfacing the MC68HC705C8A to the X76F041 PASS SecureFlash
MC68HC705Cx	*AN1298/D	Variations in the Motorola MC68HC(7)05Cx Family
MC68HC705J1A	AN1238/D	HC05 MCU LED Drive Techniques Using the MC68HC705J1A
	AN1239/D	HC05 MCU Keypad Decoding Techniques Using the MC68HC705J1A
	AN1240/D	HC05 MCU Software-Driven Asynchronous Serial Communication Techniques…
	AN1241/D	Interfacing the MC68HC705J1A to 9356/9366 EEPROMs
	AN1256/D	Interfacing the HC05 MCU to a Multichannel Digital-to-Analog Converter…
	AN1730/D	Digital Amplification of an Analog Signal Using the MC68HC705J1A
	AN1742/D	Programming the 68HC705J1A In-Circuit
	*AN1754/D	Interfacing the MC68HC705J1A to the DS1620 Digital Thermometer
	*AN1758/D	Add Addressable Switches to the HC05
	*AN1759/D	Add a Non-Volatile Clock to the MC68HC705J1A
	*AN1760/D	Interfacing the AD8402 Digital Potentiometer to the MC68HC705J1A

MC68HC705J2	AN477/D	Simple A/D for MCUs without Built-In A/D Converters
	*AN1737/D	Migrating from the MC68HC705J2 to the MC68HC705JJ7
MC68HC705JJ7	*AN1662/D	Low Cost Universal Motor Phase Angle Drive System
	*AN1737/D	Migrating from the MC68HC705J2 to the MC68HC705JJ7
MC68HC705JP7	AN1655/D	ASB200 – Motorola Sensor Development Controller Board
MC68HC705K1	AN1228/D	Interfacing the HC05 MCU to the MC145051 A/D Converter
	*AN1747/D	Migrating from the MC68HC705K1 to the MC68HC805K3
MC68HC705KJ1	*AN1747/D	Migrating from the MC68HC705K1 to the MC68HC805K3
MC68HC705L16	AN1743/D	Scrolling Message Software
	*AN1763/D	Driving LCD Displays Using the MC68HC705L16 Microcontroller
MC68HC705MC4	*AN1661/D	Low Cost Universal Motor Chopper Drive System
	AN1702/D	Brushless DC Motor Control Using the MC68HC705MC4
MC68HC705P6A	*AN1775/D	Expanding Digital Input with an A/D Converter
MC68HC705P9	AN1551/D	Low-Pressure Sensing with the MPX2010 Pressure Sensor
	AN1584/D	“Very Low Pressure” Smart Sensing Solution with Serial Communications…
	AN1585/D	High-Performance, Dynamically-Compensated Smart Sensor System
	AN1733/D	Implementing Caller ID Functionality in MC68HC(7)05 Applications
MC68HC705V8	AN1224/D	Example Software Routines for the Message Data Link Controller Module…
	AN1257/D	Using the M68HC05 Family On-Chip Voltage Regulator
MC68HC708LN56	AN1287/D	MC68HC708LN56 LCD Utilities
	*AN1762/D	Automatic Contrast Control of LCD Displays Using the MC68HC708LN56…
MC68HC708MP16	AN1624/D	ITC137 68HC708MP16 Motion Control Development Board
	AN1712/D	“Get Your Motor Running” with the MC68HC708MP16
	AN1728/D	Making Low-Distortion Waveforms with the MC68HC708MP16
MC68HC711	AN499/D	Let the MC68HC705 Program Itself
	*AN1597/D	Longwave Radio Data Decoding Using an HC11 and an MC3371
MC68HC711D0	EB284/D	C Macro Definitions for the MC68HC(7)11D3/D0
MC68HC711D3	EB284/D	C Macro Definitions for the MC68HC(7)11D3/D0
MC68HC711E0	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
MC68HC711E1	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
MC68HC711E20	EB285/D	C Macro Definitions for the MC68HC(7)11E20
	EB422/D	Enhanced M68HC11 Bootstrap Mode
MC68HC711E32	EB422/D	Enhanced M68HC11 Bootstrap Mode
MC68HC711E8	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
MC68HC711E9	AN1536/D	Digital Boat Speedometers
	*AN1753/D	Implementing a FLASH Memory System in an MC68HC711E9 Design
	*APR31/D	Booting and Simple Usage of the DSP56004/007/009 SHI Port in SPI Mode
	*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
	*EB298/D	Programming the BUFFALO Monitor into an MC68HC711E9
MC68HC711EA9	EB422/D	Enhanced M68HC11 Bootstrap Mode
MC68HC711P2	*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
MC68HC711PH8	*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
	EB422/D	Enhanced M68HC11 Bootstrap Mode
MC68HC805B6	EB166/D	System Design Considerations: Converting from the MC68HC805B6 to the…
MC68HC805C4	ANE425/D	Use of the MC68HC68T1 RTC with M6805 Microprocessors
MC68HC805K3	*AN1747/D	Migrating from the MC68HC705K1 to the MC68HC805K3
MC68HC805L6	ANE425/D	Use of the MC68HC68T1 RTC with M6805 Microprocessors
MC68HC811A2	ANE415/D	MC68HC11 Implementation of IEEE-488 Interface for DSP56000 Monitor
MC68HC811E2	*EB301/D	Programming EEPROM on the MC68HC811E2 During Program Execution
MC68HC908GP20	*AN1770/D	In-Circuit Programming of FLASH Memory in the MC68HC908GP20

MC68HC908KH12	*AN1748/D	Building a Universal Serial Bus Keyboard Hub Using the Motorola MC68HC(9)08KH12
MC68HC912B32	AN1718/D	A Serial Bootloader for Reprogramming the MC68HC912B32 Flash EEPROM
	*AN1774/D	Interfacing the MC68HC912B32 to an LCD Module
	EB183/D	Erasing and Programming the FLASH EEPROM on the MC68HC912B32
MC68HSC705C8A	AN1734/D	Pulse Width Modulation Using the 16-Bit Timer
MC74F1803	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC74F803	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC74HC4538A	*AN1558/D	Characterization of Retrigger Time in the HC4538A Dual Precision Monostable…
MC74HC595	EB415/D	Extend SPI Addressing with the MC74HC595
MC100E	*AN1672/D	The ECL Translator Guide
MC100E111	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC100ELT2xD	AN1596/D	ECLinPS Lite Translator ELT Family SPICE I/O Model Kit
MC100H	*AN1672/D	The ECL Translator Guide
MC100H60x	AN1402/D	MC10/100H00 Translator Family I/O SPICE Modelling Kit
MC100H640	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC100H641	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC100H642	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC100H643	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC100H644	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC100H645	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC100SX1451	AN1582/D	Board and Interface Design for AutoBahn and Spanceiver
MC109XX	AR128/D	Array-Based Logic Boosts System Performance
MC1658	AN1207/D	The MC145170 in Basic HF and VHF Oscillators
MC1723	EB27A/D	Get 300 Watts PEP Linear Across 2 to 30MHz from this Push-Pull Amplifier
MC2831A	AN-HK-02/H	Low Power FM Transmitter System MC2831A
MC3337x	*AN1680/D	Design Considerations for Clamping Networks for Very High Voltage Monolithic…
MC3371	*AN1597/D	Longwave Radio Data Decoding Using an HC11 and an MC3371
MC6805L3	ANE405/D	Bi-Directional Data Transfer Between MC68HC11 and MC6805L3 Using SPI
MC13020	AN-HK-07/H	A High Performance Manual-Tuned Receiver for Automotive Application Using…
MC13021	AN-HK-07/H	A High Performance Manual-Tuned Receiver for Automotive Application Using…
MC13041	AN-HK-07/H	A High Performance Manual-Tuned Receiver for Automotive Application Using…
MC13077	AN492/D	A Video Display Board for CD-i Development
MC13156	AN1539/D	An IF Communication Circuit Tutorial
MC14046	AN1543/D	Electronic Lamp Ballast Design
MC14489	EB153/D	Driving a Seven Segment Display with the Neuron Chip
MC14576	EB411/D	A Digital Video Prototyping System
MC33033	AN1307/D	A Simple Pressure Regulator Using Semiconductor Pressure Transducers
	EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
MC33035	AN1321/D	Brushless DC Motor Drive Incorporates Small Outline Integrated Circuit…
	AR341/D	Power MOSFET 1HP Brushless DC Motor Drive Withstands Commutation Stresses
MC33039	AN1321/D	Brushless DC Motor Drive Incorporates Small Outline Integrated Circuit…
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MC33073	AN1536/D	Digital Boat Speedometers
MC33079	AN1100/D	Analog to Digital Converter Resolution Extension Using a Motorola Pressure…
MC33120	AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development…

MC33121	AN1603/D	Providing a POTS Phone in an ISDN or Similar Environment
MC33153	AN1626/D	Noise Management in Motor Drives
MC33161	AN1322/D	Applying Semiconductor Sensors to Bar Graph Pressure Gauges
MC33169	*AN1599/D	Power Control with the MRFIC0913 GaAs Integrated Power Amplifier and…
	AN1602/D	3.6V and 4.8V GSM/DCS1800 Dual Band PA Application with DECT Capability…
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	AN1608/D	Guidlines for the Speaker in a Line-Powered Speakerphone
MC33263	*AN1677/D	Get Your Best From Your LDO Designs
MC33272	AN1324/D	A Simple Sensor Interface Amplifier
	AN1325/D	Amplifiers for Semiconductor Pressure Sensors
MC33274	AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to…
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MC33345	AR620/D	Quest for the Perfect Battery
MC33347	AR620/D	Quest for the Perfect Battery
MC33348	AR620/D	Quest for the Perfect Battery
MC33362	AR620/D	Quest for the Perfect Battery
MC33363	*AN1679/D	How to Deal with Leakage Elements in FLYBACK Converters
	AR620/D	Quest for the Perfect Battery
MC33363A	AR620/D	Quest for the Perfect Battery
MC33364	*AN1594/D	Critical Conduction Mode, Flyback Switching Power Supply Using the MC33364
	*AN1681/D	How to Keep a FLYBACK Switch Mode Supply Stable with a Critical-Mode Controller
MC33502	AR619/D	Op Amp Supply Squeezed Down to 1V Rail-to-Rail
MC34017	AN1603/D	Providing a POTS Phone in an ISDN or Similar Environment
MC34018	AN1608/D	Guidlines for the Speaker in a Line-Powered Speakerphone
MC34060A	EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
MC34063	AN920/D	Theory and Applications of the MC34063 and μA78S40 Switching Regulator…
MC34064	AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to…
MC34160	*AN1597/D	Longwave Radio Data Decoding Using an HC11 and an MC3371
MC34262	AN1543/D	Electronic Lamp Ballast Design
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MC44011	AN1548/D	Guidelines for Debugging the MC44011 Video Decoder
	EB411/D	A Digital Video Prototyping System
MC44200	AN492/D	A Video Display Board for CD-i Development
	EB411/D	A Digital Video Prototyping System
MC44250	EB411/D	A Digital Video Prototyping System
MC44603	*AN1669/D	MC44603 in a 110W Output SMPS Application (80-140Vrms and 180-280Vrms…
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MC68175	*APR34/D	MC68328 Microprocessor Application: FLEX Alphanumeric Chip MC68175…
MC68230	ANE426/D	An MC68030 32-bit High Performance Minimum System
MC68300	*EB259/D	Why MC68300 and MC68HC16 MCUs May Halt after Release of Reset
	*EB260/D	Why an MC68300 or MC68HC16 Microcontroller May Fail to Release Reset
	*EB261/D	Autovector Generation Using Chip Select Logic on MC68300 and MC68HC16…
MC68302	AR350/D	Adapt Non-ISDN Terminals to ISDN Data Rates

MC68306	AN1264/D	JTAG Flash Memory Programmer
MC68307	AN1264/D	JTAG Flash Memory Programmer
MC68328	*APR34/D	MC68328 Microprocessor Application: FLEX Alphanumeric Chip MC68175…
MC68331	AN473/D	A Minimum Evaluation System for the MC68331 and MC68332
	AN1724/D	Implementing SCI Receive and Transmit Buffers in C
	*EB273/D	Which Pins on the MC68331/332 and MC68HC16Z1 Need Pullup Resistors
MC68332	AN473/D	A Minimum Evaluation System for the MC68331 and MC68332
	AN1062/D	Using the QSPI for Analog Data Acquisition
	AN1724/D	Implementing SCI Receive and Transmit Buffers in C
	*EB270/D	Problems with the PPWA Function on Revision P MC68332 Devices
	*EB273/D	Which Pins on the MC68331/332 and MC68HC16Z1 Need Pullup Resistors
	*EB279/D	Low Output Levels on Output Pins
MC68336	AN1724/D	Implementing SCI Receive and Transmit Buffers in C
MC68360	DC414/D	An 8-bit EPROM Interface for an MC68EC040/MC68360 System
MC68681	ANE426/D	An MC68030 32-bit High Performance Minimum System
MC68701	AN906A/D	Self-Programming the MC68701 and the MC68701U4
MC68701U4	AN906A/D	Self-Programming the MC68701 and the MC68701U4
MC68705R3	AN991/D	Using the Serial Peripheral Interface to Communicate Between Multiple…
MC88100	AN1125/D	DRAM Interface to the MC88200 M Bus
MC88110	EB163/D	Running the MC88110 in Lockstep
	EB164/D	Interrupt Latency in the MC88110
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MC88200	AN1125/D	DRAM Interface to the MC88200 M Bus
MC88913	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC88914	AN1125/D	DRAM Interface to the MC88200 M Bus
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MC88915FN100	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC88915FN55	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC88915FN70	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC88916	AR519/D	Low-Skew Clock Drivers: Which Type is Best?
MC144115P	AN442/D	Driving LCDs with M6805 Microprocessors
MC144143	AN1235/D	A Set Top Closed-Caption Decoder
MC145000	AN442/D	Driving LCDs with M6805 Microprocessors
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MC145004	AN442/D	Driving LCDs with M6805 Microprocessors
MC145026	AN-HK-02/H	Low Power FM Transmitter System MC2831A
MC145028	AN-HK-02/H	Low Power FM Transmitter System MC2831A
MC145040	AN1062/D	Using the QSPI for Analog Data Acquisition
MC145041	AN1062/D	Using the QSPI for Analog Data Acquisition
MC145050	AN1062/D	Using the QSPI for Analog Data Acquisition
MC145051	AN1062/D	Using the QSPI for Analog Data Acquisition
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MC145157	ANE416/D	MC68HC05B4 Radio Synthesizer
MC145160	AN-HK-02/H	Low Power FM Transmitter System MC2831A
MC145170	AN1207/D	The MC145170 in Basic HF and VHF Oscillators
	*AN1671/D	MC145170 PSpice Modeling Kit
MC145220	AN1277/D	Offset Reference PLLs for Fine Resolution or Fast Hopping
MC145407	AN1240/D	HC05 MCU Software-Driven Asynchronous Serial Communication Techniques…

MC145407 (contd.)	EB419/D	ROMed HC11E32 and HC11PH8 Including Buffalo Monitor and PCbug11 Talker
MC145412	AN-HK-02/H	Low Power FM Transmitter System MC2831A
MC145422	AN948/D	Data Multiplexing Using the Universal Digital Loop Transceiver and the…
MC145426	AN948/D	Data Multiplexing Using the Universal Digital Loop Transceiver and the…
MC145428	AN948/D	Data Multiplexing Using the Universal Digital Loop Transceiver and the…
MC145429	AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development…
MC145436A	AN1603/D	Providing a POTS Phone in an ISDN or Similar Environment
MC145440	AN-HK-01/H	300 Baud Smart Modem with Intelligent MCU Controller
MC145441	AN-HK-01/H	300 Baud Smart Modem with Intelligent MCU Controller
MC145445	AN-HK-01/H	300 Baud Smart Modem with Intelligent MCU Controller
MC145453	AN1326/D AN1536/D	Barometric Pressure Measurement Using Semiconductor Pressure Sensors Digital Boat Speedometers
MC145474	AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development…
MC145484	AN1603/D	Providing a POTS Phone in an ISDN or Similar Environment
MC145488	AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development…
MC145490EVK	AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development…
MC145554	AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development…
MCD210	AN492/D	A Video Display Board for CD-i Development
MCD1460	AN492/D	A Video Display Board for CD-i Development
MCM63Z736	*AN1729/D *AN1773/D	BurstRAM to ZBT RAM ZBT Primer
MCM63Z737	*AN1773/D	ZBT Primer
MCM63Z818	*AN1773/D	ZBT Primer
MCM63Z819	*AN1773/D	ZBT Primer
MCM67B518	AN1223/D	A Zero Wait State Secondary Cache for Intel's Pentium
MCM67B618	AN1223/D	A Zero Wait State Secondary Cache for Intel's Pentium
MCM69C232	AN1296/D AN1726/D	Using the MCM69C232/MCM69C432 Content-Addressable Memory on an ATM… Using Motorola's Fast Static RAM CAMs on a Media Independent Interface
MCM69C432	AN1296/D AN1726/D	Using the MCM69C232/MCM69C432 Content-Addressable Memory on an ATM… Using Motorola's Fast Static RAM CAMs on a Media Independent Interface
MCM69D536	AN1704/D *AN1779/D	Switch Fabric Implementation Using Shared Memory Using the MCM69D536/MCM69D618 NetRAMs with Different Speed Computing…
MCM69D618	AN1704/D *AN1707/D *AN1779/D	Switch Fabric Implementation Using Shared Memory Dual Port Memory for Multiprocessor Applications Using the MCM69D536/MCM69D618 NetRAMs with Different Speed Computing…
MCM69F536	AN1261/D	Use of 32K x 36 FSRAM in Non-Parity Applications
MCM69F536C	*AN1777/D	MPC8xx to BurstRAM Interfacing
MCM69F618C	*AN1777/D	MPC8xx to BurstRAM Interfacing
MCM69P536	AN1261/D	Use of 32K x 36 FSRAM in Non-Parity Applications
MCM69P737	*AN1729/D	BurstRAM to ZBT RAM
MCM6164	ANE426/D	An MC68030 32-bit High Performance Minimum System
MCM6206	AN1582/D	Board and Interface Design for AutoBahn and Spanceiver
MCM6287	AR241/D	Building Fast SRAMs with no Process 'Tricks'
MCM6288	AR241/D	Building Fast SRAMs with no Process 'Tricks'
MCM6292	AR256/D AR258/D AR260/D	Motorola's Radical SRAM Design Speeds Systems 40% High Frequency System Operation Using Synchronous SRAMs Enhancing System Performance Using Synchronous SRAMs
MCM6293	AR256/D	Motorola's Radical SRAM Design Speeds Systems 40%

MCM6293 (contd.)	AR258/D	High Frequency System Operation Using Synchronous SRAMs
	AR260/D	Enhancing System Performance Using Synchronous SRAMs
MCM6294	AR256/D	Motorola's Radical SRAM Design Speeds Systems 40%
	AR258/D	High Frequency System Operation Using Synchronous SRAMs
	AR260/D	Enhancing System Performance Using Synchronous SRAMs
MCM6295	AR256/D	Motorola's Radical SRAM Design Speeds Systems 40%
	AR258/D	High Frequency System Operation Using Synchronous SRAMs
	AR260/D	Enhancing System Performance Using Synchronous SRAMs
MCM54400	APR405/D	Minimal Logic DRAM Interface for the DSP56156
MCM62486	AN1209/D	The Motorola BurstRAM
MCM91000	AN1125/D	DRAM Interface to the MC88200 M Bus
MCM514256	APR11/D	DSP56001 Interface Techniques and Examples
MCR22-3	*AN1601/D	Efficient Safety Circuit for Electronic Ballast
MDC1000A	AR341/D	Power MOSFET 1HP Brushless DC Motor Drive Withstands Commutation Stresses
	EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
MDC1000B	EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
MDC1000C	EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
MEVB16	*EB252/D	MOVB, MOVW, PSHM, and PULM Syntax Differences on MC68HC16 Assemblers
MGP7N60E	*AN1661/D	Low Cost Universal Motor Chopper Drive System
MGRB2025CT	AR607/D	Modular DC-DC Converter Sends Power Density Soaring
MHPM6B10A60D	AN1626/D	Noise Management in Motor Drives
MHW612	EB107/D	Mounting Considerations for Motorola RF Power Modules
MHW613	EB107/D	Mounting Considerations for Motorola RF Power Modules
MHW709	EB107/D	Mounting Considerations for Motorola RF Power Modules
MHW710	EB107/D	Mounting Considerations for Motorola RF Power Modules
MHW720	EB107/D	Mounting Considerations for Motorola RF Power Modules
MHW808	EB107/D	Mounting Considerations for Motorola RF Power Modules
MHW820	EB107/D	Mounting Considerations for Motorola RF Power Modules
MHW10000	AR333/D	RF Modems Simplified
MJD18002D2	AN1577/D	Motorola's D2 Series Transistors for Fluorescent Converters
MJE1123	AR514/D	Build Ultra-Low Dropout Regulator
MJE13002	AR180/D	Electronic Ballasts
MJE18002D2	AN1577/D	Motorola's D2 Series Transistors for Fluorescent Converters
MJE18004D2	AN1577/D	Motorola's D2 Series Transistors for Fluorescent Converters
MJE18604D2	AN1577/D	Motorola's D2 Series Transistors for Fluorescent Converters
MJF18206	*AN1669/D	MC44603 in a 110W Output SMPS Application (80-140Vrms and 180-280Vrms…
MKP9V240	AR450/D	Characterizing Overvoltage Transient Suppressors
MMA1000P	AN1632/D	MMA1000P Product Overview and Interface Considerations
	AN1635/D	Baseball Pitch Speedometer Featuring Motorola's 250g Accelerometers
	AN1640/D	Reducing Accelerometer Susceptibility to BCI
MMA1001P	AN1635/D	Baseball Pitch Speedometer Featuring Motorola's 250g Accelerometers
MMAS40G	AN1559/D	Application Considerations for a Switched Capacitor Accelerometer
MMAS40G10D	AN1612/D	Shock and Mute Pager Applications Using Accelerometer
	AN4004/D	±2g Acceleration Sensing Module Based on a ±40g Integrated Accelerometer
MMAS40G10S	AN1611/D	Impact and Tilt Measurement Using Accelerometer
MMBT3904L	AR560/D	Simple Pressure Switches Comprise Transducers, Comparators and Op Amps
MMDF2C02E	AN1520/D	HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications
MMDF2C05E	AN1321/D	Brushless DC Motor Drive Incorporates Small Outline Integrated Circuit…

MMDF2P02HD	AN1520/D	HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications
MMG05N60E	AN1576/D	Reduce Compact Fluorescent Cost with Motorola's PowerLux IGBT
MMSF3P02HD	AN1520/D	HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications
MMSF5N03HD	AN1520/D	HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications
MOC2A60	AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
MOC8102	AN1327/D	Very Wide Input Voltage Range, Off-line Flyback Switching Power Supply
	AR341/D	Power MOSFET 1HP Brushless DC Motor Drive Withstands Commutation Stresses
MPC105	AN1269/D	PowerPC Microprocessor Clock Modes
MPC106	AN1265/D	Configuring the MPC2604GA Integrated L2 Cache with the MPC106
	AN1269/D	PowerPC Microprocessor Clock Modes
	AN1722/D	SDRAM System Design Using the MPC106
	AN1725/D	Initializing SDRAM Parameters for Motorola MPC106-Based Systems
	AN1727/D	Designing PCI 2.1-Compliant MPC106 Systems
	*AN1768/D	Using Registered SDRAM DIMMs with the MPC106
MPC505	AN1281/D	MPC505 Interrupts
	AN1282/D	Board Strategies for Ensuring Optimum Frequency Synthesizer Performance
MPC509	AN1282/D	Board Strategies for Ensuring Optimum Frequency Synthesizer Performance
MPC601	AN486/D	Low Cost MPC601 EVM
	AN1271/D	PowerPC 60x Microprocessor to AD1848 CODEC Interface
	AN1272/D	Spreadsheet Estimation of CPU-DRAM Subsystem Power Consumption
	AN4000/D	Visual Debug for MPC60x
MPC602	AN1269/D	PowerPC Microprocessor Clock Modes
MPC603	AN1269/D	PowerPC Microprocessor Clock Modes
	AN1271/D	PowerPC 60x Microprocessor to AD1848 CODEC Interface
	AN1272/D	Spreadsheet Estimation of CPU-DRAM Subsystem Power Consumption
	AN4000/D	Visual Debug for MPC60x
	AR359/D	The Making of the PowerPC
MPC603e	AN1269/D	PowerPC Microprocessor Clock Modes
	AN1294/D	Multiprocessor Systems and the PowerPC 603e Microprocessor
	*AN1769/D	Designing a Minimal PowerPC System
MPC603ev	*AN1769/D	Designing a Minimal PowerPC System
MPC604	AN1269/D	PowerPC Microprocessor Clock Modes
	AN1271/D	PowerPC 60x Microprocessor to AD1848 CODEC Interface
	AN1272/D	Spreadsheet Estimation of CPU-DRAM Subsystem Power Consumption
	AN1291/D	Avoiding Multiprocessing Paradoxes with the PowerPC 604 Microprocessor
	*AN1769/D	Designing a Minimal PowerPC System
	AN4000/D	Visual Debug for MPC60x
MPC604e	AN1269/D	PowerPC Microprocessor Clock Modes
MPC620	AR360/D	PowerPC 620 Soars
MPC740	*AN1769/D	Designing a Minimal PowerPC System
MPC750	*AN1769/D	Designing a Minimal PowerPC System
MPC801	*AN1777/D	MPC8xx to BurstRAM Interfacing
MPC823	*AN1777/D	MPC8xx to BurstRAM Interfacing
MPC850	*AN1777/D	MPC8xx to BurstRAM Interfacing
MPC860	*AN1777/D	MPC8xx to BurstRAM Interfacing
MPC951	*AN1545/D	Thermal Data for MPC Clock Drivers
MPC2604GA	AN1265/D	Configuring the MPC2604GA Integrated L2 Cache with the MPC106
MPC8260	*AN1777/D	MPC8xx to BurstRAM Interfacing
MPE603e	*AN1769/D	Designing a Minimal PowerPC System
MPE603ev	*AN1769/D	Designing a Minimal PowerPC System

MPE604	*AN1769/D	Designing a Minimal PowerPC System
MPF960	AN1543/D	Electronic Lamp Ballast Design
MPIC21xx	EB206/D	Solving Noise Problems in High Power, High Frequency Control IC Driven…
	EB208/D	Design Check List for MPIC21XX Control ICs
MPIC2113	EB207/D	High Current Buffer for Control ICs
MPIC2151	AN1546/D	High Voltage, High Side Driver for Electronic Lamp Ballast Applications
	AN1576/D	Reduce Compact Fluorescent Cost with Motorola's PowerLux IGBT
MPX10	AN935/D	Compensating for Nonlinearity in the MPX10 Series Pressure Transducer
	AN1556/D	Designing Sensor Performance Specifications for MCU-based Systems
	AN1557/D	A Cookbook Approach to Designing a Differential-Signal Amplifier for Sensor…
	AN1585/D	High-Performance, Dynamically-Compensated Smart Sensor System
	*AN1651/D	ASB201 – Uncompensated Series Sensor Module
	*AN1668/D	Washing Appliance Sensor Selection
MPX11	AN935/D	Compensating for Nonlinearity in the MPX10 Series Pressure Transducer
MPX12	AN935/D	Compensating for Nonlinearity in the MPX10 Series Pressure Transducer
	*AN1668/D	Washing Appliance Sensor Selection
MPX50	AN935/D	Compensating for Nonlinearity in the MPX10 Series Pressure Transducer
MPX100	AN935/D	Compensating for Nonlinearity in the MPX10 Series Pressure Transducer
	*AN1651/D	ASB201 – Uncompensated Series Sensor Module
MPX200	AN935/D	Compensating for Nonlinearity in the MPX10 Series Pressure Transducer
MPX700	AN1105/D	A Digital Pressure Gauge Using the Motorola MPX700 Series Differential…
MPX2000	AN1097/D	Calibration-Free Pressure Sensor System
	AN1309/D	Compensated Sensor Bar Graph Pressure Gauge
	AN1322/D	Applying Semiconductor Sensors to Bar Graph Pressure Gauges
	AN1325/D	Amplifiers for Semiconductor Pressure Sensors
	AN1513/D	Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure…
	AN1586/D	Designing a Homemade Digital Output for Analog Voltage Output Sensors
	AN1660/D	Compound Coefficient Pressure Sensor PSPICE Models
MPX2010	AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to…
	AN1324/D	A Simple Sensor Interface Amplifier
	AN1325/D	Amplifiers for Semiconductor Pressure Sensors
	AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
	AN1551/D	Low-Pressure Sensing with the MPX2010 Pressure Sensor
	AN1556/D	Designing Sensor Performance Specifications for MCU-based Systems
	AN1557/D	A Cookbook Approach to Designing a Differential-Signal Amplifier for Sensor…
	AN1584/D	"Very Low Pressure" Smart Sensing Solution with Serial Communications…
	*AN1652/D	ASB202 – MPX2000 Series Sensor Module
	*AN1654/D	ASB210 – 10" H2O Sensor Module
	*AN1668/D	Washing Appliance Sensor Selection
MPX2050	AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to…
	AN1324/D	A Simple Sensor Interface Amplifier
	AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
	*AN1652/D	ASB202 – MPX2000 Series Sensor Module
MPX2100	AN1082/D	Simple Design for a 4-20mA Transmitter Interface Using a Motorola Pressure…
	AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to…
	AN1316/D	Frequency Output Conversion for MPX2000 Series Pressure Sensors
	AN1318/D	Interfacing Semiconductor Pressure Sensors to Microcomputers
	AN1324/D	A Simple Sensor Interface Amplifier
	AN1513/D	Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure…
	AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
	AN1517/D	Pressure Switch Design with Semiconductor Pressure Sensors
	*AN1652/D	ASB202 – MPX2000 Series Sensor Module

MPX2100A	AN1326/D	Barometric Pressure Measurement Using Semiconductor Pressure Sensors
MPX2100DP	AR560/D	Simple Pressure Switches Comprise Transducers, Comparators and Op Amps
MPX2200	AN1100/D	Analog to Digital Converter Resolution Extension Using a Motorola Pressure…
	AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to…
	AN1324/D	A Simple Sensor Interface Amplifier
	AN1513/D	Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure…
	AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
	*AN1652/D	ASB202 – MPX2000 Series Sensor Module
MPX2700	AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to…
	AN1324/D	A Simple Sensor Interface Amplifier
	AN1513/D	Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure…
MPX5000	AN1660/D	Compound Coefficient Pressure Sensor PSPICE Models
MPX5006	AN1646/D	Noise Considerations for Integrated Pressure Sensors
	*AN1653/D	ASB205 – MPX5000 Series Sensor Module
	*AN1668/D	Washing Appliance Sensor Selection
MPX5010	*AN1653/D	ASB205 – MPX5000 Series Sensor Module
MPX5050	*AN1653/D	ASB205 – MPX5000 Series Sensor Module
MPX5050GP	AN1571/D	Digital Blood Pressure Meter
MPX5100	AN1304/D	Integrated Sensor Simplifies Bar Graph Pressure Gauge
	AN1305/D	An Evaluation System for Direct Interface of the MPX5100 Pressure Sensor…
	AN1307/D	A Simple Pressure Regulator Using Semiconductor Pressure Transducers
	AN1322/D	Applying Semiconductor Sensors to Bar Graph Pressure Gauges
	AN1513/D	Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure…
	AN1518/D	Using a Pulse Width Modulated Output with Semiconductor Pressure Sensors
	*AN1653/D	ASB205 – MPX5000 Series Sensor Module
MPX5700	*AN1653/D	ASB205 – MPX5000 Series Sensor Module
MPX5999	*AN1653/D	ASB205 – MPX5000 Series Sensor Module
MPX7100	AN1513/D	Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure…
MPX7100AP	AN1552/D	MPX7100AP: The Sensor at the Heart of Solid-State Altimeter Applications
MPXT5006D	AN1638/D	Offset Calibration of Gauge Pressure Sensor Using Parallel I/O Ports
MR2520L	AR450/D	Characterizing Overvoltage Transient Suppressors
MRF154	AR347/D	A Compact 1kW 2-50MHz Solid-State Linear Amplifier
MRF184	*AN1670/D	60 watts, GSM 900MHz, LDMOS Two-Stage Amplifier
MRF260	EB90/D	Low-Cost VHF Amplifier Has Broadband Performance
MRF262	EB90/D	Low-Cost VHF Amplifier Has Broadband Performance
MRF264	EB93/D	60 Watt VHF Amplifier Uses Splitting/Combining Techniques
MRF286	*AN1673/D	Solder Reflow Mounting Method for the MRF286 and Similar Packages
MRF422	EB27A/D	Get 300 Watts PEP Linear Across 2 to 30MHz from this Push-Pull Amplifier
MRF630	EB109/D	Low Cost UHF Device Gives Broadband Performance at 3.0 Watts Output
MRF873	AN1526/D	RF Power Device Impedances: Practical Considerations
MRF1027T1	*AN1675/D	A Low Noise Amplifier with High IP3 for the 900MHz Band Using the MRF1057T1…
MRF1047T1	*AN1675/D	A Low Noise Amplifier with High IP3 for the 900MHz Band Using the MRF1057T1…
	*AN1676/D	A Cascade 2 Stage Low Noise Amplifier Using the MRF1047T1 Low Noise Transistor
MRF1057T1	*AN1675/D	A Low Noise Amplifier with High IP3 for the 900MHz Band Using the MRF1057T1…
MRF1507	EB209/D	Mounting Method for RF Power Leadless Surface Mount Transistors
MRF6522-10	*AN1670/D	60 watts, GSM 900MHz, LDMOS Two-Stage Amplifier
MRFIC917	AN1602/D	3.6V and 4.8V GSM/DCS1800 Dual Band PA Application with DECT Capability…
MRFIC1502	*AN1610/D	Using Motorola's MRFIC1502 in Global Positioning System Receivers
MRFIC1817	AN1602/D	3.6V and 4.8V GSM/DCS1800 Dual Band PA Application with DECT Capability…

MRFIC2401	AR597/D	GaAs RF ICs Target 2.4GHz Frequency Band
MRFIC2403	AR597/D	GaAs RF ICs Target 2.4GHz Frequency Band
MRFIC2404	AR597/D	GaAs RF ICs Target 2.4GHz Frequency Band
MRFIC0913	*AN1599/D	Power Control with the MRFIC0913 GaAs Integrated Power Amplifier and…
MSR860	*AN1661/D	Low Cost Universal Motor Chopper Drive System
MTB3N120E	AN1327/D	Very Wide Input Voltage Range, Off-line Flyback Switching Power Supply
MTB30P06V	AN1607/D AN1626/D	ITC122 Low Voltage Micro to Motor Interface Noise Management in Motor Drives
MTB36N06V	AN1607/D AN1626/D	ITC122 Low Voltage Micro to Motor Interface Noise Management in Motor Drives
MTD1N50E	AN1576/D	Reduce Compact Fluorescent Cost with Motorola's PowerLux IGBT
MTD1N60	*AN1594/D	Critical Conduction Mode, Flyback Switching Power Supply Using the MC33364
MTD1N60E	*AN1681/D	How to Keep a FLYBACK Switch Mode Supply Stable with a Critical-Mode Controller
MTD5N10E	EB207/D	High Current Buffer for Control ICs
MTD6P10E	EB207/D	High Current Buffer for Control ICs
MTD20N03HDL	AN1547/D	A DC to DC Converter for Notebook Computers Using HDTMOS and Synchronous…
MTH5N100	AR326/D	High-Voltage MOSFETs Simplify Flyback Design
MTP2N50E	AN1546/D	High Voltage, High Side Driver for Electronic Lamp Ballast Applications
MTP6N60E	*AN1669/D	MC44603 in a 110W Output SMPS Application (80-140Vrms and 180-280Vrms…
MTP8N50E	AN1543/D	Electronic Lamp Ballast Design
MTP10N10M	AR160/D	Lossless Current Sensing with SENSEFETs Enhances Motor Drive
MTP10N25	EB141/D	Boost MOSFETs Drive Current in Solid State AC Relay
MTP10N40E	*AN1669/D EB206/D	MC44603 in a 110W Output SMPS Application (80-140Vrms and 180-280Vrms… Solving Noise Problems in High Power, High Frequency Control IC Driven…
MTP23N25E	AR341/D	Power MOSFET 1HP Brushless DC Motor Drive Withstands Commutation Stresses
MTP50N05E	EB201/D	High Cell Density MOSFETs
MTP75N05HD	EB201/D	High Cell Density MOSFETs
MURS160T3	*AN1594/D	Critical Conduction Mode, Flyback Switching Power Supply Using the MC33364
P6KE30	AR450/D	Characterizing Overvoltage Transient Suppressors
PAL16R6	APR405/D	Minimal Logic DRAM Interface for the DSP56156
PBGA	AN1231/D AN1232/D	Plastic Ball Grid Array (PBGA) Thermal Performance of Plastic Ball Grid Array (PBGA) Packages for Next…
PCF8573	AN1066/D	Interfacing the MC68HC05C5 SIOP to an I2C Peripheral
SX1451	AN1582/D	Board and Interface Design for AutoBahn and Spanceiver
TDA3048	AN465/D	Secure Remote Control using the 68HC05K1 and the 68HC05P3
TPV375	AN1028/D	35/50 Watt Broadband (160-240MHz) Push-Pull TV Amplifier Band III
TZA120	AN1082/D	Simple Design for a 4-20mA Transmitter Interface Using a Motorola Pressure…
X76F041	*AN1761/D	Interfacing the MC68HC705C8A to the X76F041 PASS SecureFlash
XGR2018CT	AR564/D	Dual 180V GaAs Schottky Diode Rectifies 10A/leg

Applications Documents Literature Selector Guide

This selector guide lists applications documents under subject and device-type headings. It also includes cross references to some of Motorola's other literature which may provide further relevant information.

A/D and D/A Conversion

AN477/D	Simple A/D for MCUs without Built-In A/D Converters
AN1058/D	Reducing A/D Errors in Microcontroller Applications
AN1062/D	Using the QSPI for Analog Data Acquisition
AN1222/D	Arithmetic Waveform Synthesis with the HC05/08 MCUs
AN1228/D	Interfacing the HC05 MCU to the MC145051 A/D Converter
AN1256/D	Interfacing the HC05 MCU to a Multichannel Digital-to-Analog Converter using the MC68HC705C8A and the MC68HC705J1A
AN1740/D	Applications Using the Analog Subsystem of MC68HC05JJ/JP Series Microcontrollers
*AN1775/D	Expanding Digital Input with an A/D Converter
EB155/D	Analog to Digital Conversion with the Neuron Chip

Additional information relevant to A/D and D/A Conversion may be found in the following Motorola documents:

ADCRM/AD	Analog-to-Digital Converter Reference Manual
BR1137/D	The Motorola Explorer's Guide to the World of Embedded Control Solutions
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
QADCRM/AD	Queued Analog-to Digital Converter Reference Manual
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference

ASICs (Application Specific ICs)

AN1095/D	Clock Distribution Techniques for HDC Series Arrays
AN1096/D	Guidelines for Using the Mustang™ ATPG System
AN1099/D	Test Methodology and Release Issues for HDC Series Gate Arrays
AN1500/D	IEEE Std. 1149.1 Boundary Scan for H4C Arrays
AN1502/D	Embedded RAM BIST
AN1508/D	High Frequency Design Techniques and Guidelines for Bipolar Gate Arrays
AN1509/D	ASIC Clock Distribution using a Phase-Locked Loop (PLL)
AN1512/D	TestPAS Primer
AN1514/D	H4CPlus Series 3.3V/5V Design Considerations
AN1521/D	High-Performance CMOS Interfaces for the H4CPlus Series Gate Arrays
AN1522/D	Analog Phase-Locked Loop for H4CPlus and M5C Series Arrays
AN1534/D	Design Considerations of Plastic Ball Grid Arrays for CMOS Gate Arrays
AN1553/D	Minimizing Skew Across Multiple Clock Trees in Gate Arrays
AN1554/D	SRAM Built-in Self Test
AN1568/D	Interfacing Between LVDS and ECL
AR108/D	Macrocell Arrays: An Alternative to Custom LSI
AR128/D	Array-Based Logic Boosts System Performance
AR306/D	Densest Gate Arrays Ever from LSI Logic, Motorola
AR307/D	Jumbo High-Density Gate Arrays Score a Round of Industry Firsts

ASICs (Application Specific ICs) continued

AR308/D	Motorola's Arrays Hit a New High: 80% Gate Utilization
AR309/D	High-Density ASIC Family Achieves 100k-Cell Arrays
AR310/D	Software for Sea-of-Gates Arrays Places and Routes Over 70% of Available Gates
AR518/D	Gate Arrays Simplify Translation between High Speed Logic Families
AR520/D	Application Specific MultiChip Modules
AR522/D	Ranking of Gate Array and Cell-Based ASIC Vendors by Customers

Additional information relevant to ASICs (Application Specific ICs) may be found in the following Motorola documents:

BR466/D	Submicron CMOS Gate Arrays
BR916/D	Packaging Manual for ASIC Arrays
BR1400/D	OACS (ASIC) – Open Architecture CAD System
BR1417/D	OACS 3.1M – Changing the World of ASIC Design
BR1427/D	PC Brochure
BR1435/D	Application Specific Multichip Modules – MCML Series
BR1473/D	The Individual Solution: ASIC
BR1481/D	Predix Floorplanner and Physical Design System for Gate Array and Cell–Based ASIC Architectures
BR1500/D	Motorola's Field Programmable Analog Arrays
BR3006/D	Wireless Communications Resource Guide
H4CDM/D	H4C Series Design Reference Guide
H4CPDM/D	H4CPlus Series Design Reference Guide
H4EPDM/D	H4EPlus Series Design Reference Guide
HDCDM/D	HDC Series Design Reference Guide
M5CDM/D	M5C Series Design Reference Guide
MPAA3UM/D	EasyAnalog Design Software User's Manual

Audio Amplifiers and Systems

AN1292/D	Adding a Voice User Interface to M68HC05 Applications
AN1730/D	Digital Amplification of an Analog Signal Using the MC68HC705J1A
*AN1764/D	DSP56300 Enhanced Synchronous Serial Interface (ESSI) Programming
*APR36/D	Interfacing the DSP560xx/DSP563xx Families to the Crystal CS4226 Multichannel Codec

Additional information relevant to Audio Amplifiers and Systems may be found in the following Motorola documents:

DL111/D	Bipolar Power Transistor Data
DL126/D	Small-Signal Transistors, FETs and Diodes Device Data
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
DSP56009UM/AD	DSP56009 User's Manual
MPAA3UM/D	EasyAnalog Design Software User's Manual
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
* SG184/D	Wireless Infrastructure Systems Division: DSP Products
* SG185/D	Digital Audio Solutions

Automotive Applications

AN464/D	Software Driver Routines for the Motorola MC68HC05 CAN Module
AN465/D	Secure Remote Control using the 68HC05K1 and the 68HC05P3
AN476/D	CPU16 and the Configurable Timer Module (CTM) in Engine Control
AN1067/D	Pulse Generation and Detection with Microcontroller Units
AN1224/D	Example Software Routines for the Message Data Link Controller Module on the MC68HC705V8
AN1257/D	Using the M68HC05 Family On-Chip Voltage Regulator
AN1259/D	System Design and Layout Techniques for Noise Reduction in MCU-Based Systems
AN1593/D	Low Cost 1.0A Current Source for Battery Chargers
AN1620/D	A Monolithic Integrated Solution for MAP Applications
AN1621/D	An Integrated Silicon Bulk Micromachined Barometric Pressure Sensor for Engine Control Unit and External Mount
AN1622/D	EMC Considerations for Automotive Sensors
AN1632/D	MMA1000P Product Overview and Interface Considerations
AN1640/D	Reducing Accelerometer Susceptibility to BCI
AN1645/D	Micromachined Electromechanical Sensors for Automotive Applications

*AN1731/D	VPW J1850 Multiplexing and Motorola's Byte Data Link Controller (BDLC) Module
*AN1771/D	Precision Sine-Wave Tone Synthesis Using 8-bit MCUs
AN4004/D	±2g Acceleration Sensing Module Based on a ±40g Integrated Accelerometer
AR618/D	Three Large Markets Drive for Low Power
EB181/D	Frequently Asked Questions and Answers: M68HC05 Family MCAN Module
EB421/D	The Motorola MCAN Module
TPUPN14/D	Position-Synchronised Pulse Generator (PSP)
TPUPN15A/D	Period Measurement with Additional Transition Detection TPU Function (PMA)
TPUPN15B/D	Period Measurement with Missing Transition Detection TPU Function (PMM)

Additional information relevant to Automotive Applications may be found in the following Motorola documents:

BDLCRM/AD	Byte Data Link Controller Reference Manual
BR470/D	Motorola Discretes – The Complete Solution
BR477/D	Smart Mover – Stepper Motors with Integrated Serial Bus Controller
BR484/D	68302
BR934/D	Sensing Solutions from Motorola – Sensors for the Automotive Industry
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1424/D	Sensing the Needs of the Future – Automotive Sensor Solutions
BR1465/D	8-bit Microcontrollers for Multiplex Wiring
BR1704/D	68HC08: High Performance, 8-bit Microcontrollers with CAN, J1850 and Flash Memory Options
BR1714/D	RTEK Real-Time Kernel for Motorola Microcontrollers
*BR1781/D	Occupant Safety Systems Solutions
BR3005/D	Intelligent Sensor Solutions
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
DL151/D	Rectifier Device Data
DL202/D	IGBT – Insulated Gate Bipolar Transistor Device Data
HC908AT32GRS/D	MC68HC908AT32 General Release Specification
HC908AT60GRS/D	MC68HC908AT60 General Release Specification
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference

Computer Systems

AN1050/D	Designing for Electromagnetic Compatibility (EMC) with HCMOS Microcontrollers
AN1051/D	Transmission Line Effects in PCB Applications
AN1207/D	The MC145170 in Basic HF and VHF Oscillators
AN1209/D	The Motorola BurstRAM
AN1210/D	A Protocol Specific Memory for Burstable Fast Cache Memory Applications
AN1223/D	A Zero Wait State Secondary Cache for Intel's Pentium
AN1265/D	Configuring the MPC2604GA Integrated L2 Cache with the MPC106
AN1272/D	Spreadsheet Estimation of CPU-DRAM Subsystem Power Consumption
AN1282/D	Board Strategies for Ensuring Optimum Frequency Synthesizer Performance
AN1288/D	Programming the MC68HC(8)05K3's Personality EEPROM on the MMDS and MMEVS
AN1547/D	A DC to DC Converter for Notebook Computers Using HDTMOS and Synchronous Rectification
AN1579/D	Understanding the Multivibrator Based Crystal Oscillator Circuit Used on the BiCMOS MPC Family of Clock Drivers
*AN1707/D	Dual Port Memory for Multiprocessor Applications
*AN1723/D	Interfacing MC68HC05 Microcontrollers to the IBM AT Keyboard Interface
*AN1748/D	Building a Universal Serial Bus Keyboard Hub Using the Motorola MC68HC(9)08KH12
*AN1752/D	Data Structures for 8-bit Microcontrollers
*AN1757/D	Add a Unique Silicon Serial Number to the HC05
*AN1769/D	Designing a Minimal PowerPC System
APR10/D	DSP96002 Interface Techniques and Examples
AR519/D	Low-Skew Clock Drivers: Which Type is Best?

Computer Systems continued

AR563/D	Active SCSI Terminators Confront Critics and Gain Acceptance
AR618/D	Three Large Markets Drive for Low Power

Additional information relevant to Computer Systems may be found in the following Motorola documents:

BR488/D	68306 68307 68322
BR1180/D	Motorola Fast SRAM: Level 2 Cache Modules
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1333/D	Timing Solutions
BR1427/D	PC Brochure
BR1486/D	SCSI Terminators
BR1491/D	TSOP-6
BR1701/D	Fast Static RAMS and The Cache Memory Market
BR1756/D	PCI Controller-less Modem Chip Set and Software
DL156/D	Fast Static RAM – Component and Module Data
DL160/D	Display Products Device Data
EMDVPOC/D	Embedded Developer Pocket Guide
* HC705JB2GRS/H	68HC705JB2 General Release Specification
MPC821UM/AD	MPC821 PowerPC Portable Systems Microprocessor User's Manual
SG169/D	Mixed-Signal Solutions from Communication Transmission & Access Systems Division
SG171/D	Fast Static RAM Division Product Update

Digital Signal Processing

AN1051/D	Transmission Line Effects in PCB Applications
AN1213/D	16-bit DSP Servo Control with the MC68HC16Z1
AN1233/D	Using M68HC16 Digital Signal Processing to Build an Audio Frequency Analyzer
AN1289/D	DSP5630x FSRAM Module Interfacing
*AN1751/D	DSP563xx Port A Programming
*AN1764/D	DSP56300 Enhanced Synchronous Serial Interface (ESSI) Programming
*AN1772/D	Efficient Compilation of Bit-Exact Applications for DSP563xx
*AN1779/D	Using the MCM69D536/MCM69D618 NetRAMs with Different Speed Computing Elements
*AN1780/D	DSP563xx HI32 as a PCI Agent
*AN1781/D	Booting DSP563xx Devices Through the Serial Communication Interface (SCI)
*AN1782/D	Converting DSP56303 Designs to DSP56307 Designs
APR1/D	Digital Sine-Wave Synthesis Using the DSP56001/DSP56002
APR2/D	Digital Stereo 10-Band Graphic Equalizer Using the DSP56001
APR3/D	Fractional and Integer Arithmetic Using the DSP56000 Family of General-Purpose Digital Signal Processors
APR4/D	Implementation of Fast Fourier Transforms on Motorola's DSP56000/ DSP56001 and DSP96002 Digital Signal Processors
APR5/D	Implementation of PID Controllers on the Motorola DSP56000/DSP56001
APR6/D	Convolutional Encoding and Viterbi Decoding Using the DSP56001 with a V.32 Modem Trellis Example
APR7/D	Implementing IIR/FIR Filters with Motorola's DSP56000/DSP56001
APR8/D	Principles of Sigma-Delta Modulation for Analog-to-Digital Converters
APR9/D	Full-Duplex 32 kbit/s CCITT ADPCM Speech Coding on the Motorola DSP56001
APR10/D	DSP96002 Interface Techniques and Examples
APR11/D	DSP56001 Interface Techniques and Examples
APR12/D	Twin CODEC Expansion Board for the DSP56000 Application Development System
APR14/D	Conference Bridging in the Digital Telecomms Environment Using the Motorola DSP56000
APR15/D	Implementation of Adaptive Controllers on the Motorola DSP56000/DSP56001
APR16/D	Calculating Timing Requirements of External SRAM for the 24-bit DSP56000 Family
APR20/D	Application Optimization for the DSP56300/DSP56600 Digital Signal Processors

APR21/D	Software UART on the DSP56L811 Using GPIO Port B
APR22/D	Application Conversion from the DSP56100 Family to the DSP56300/600 Families
*APR30/D	DSP56300 Assembly Code Development Using the Motorola Toolsets
*APR31/D	Booting and Simple Usage of the DSP56004/007/009 SHI Port in SPI Mode
*APR33/D	ROM Software Patching on the Motorola DSP56304
*APR34/D	MC68328 Microprocessor Application: FLEX Alphanumeric Chip MC68175 Interface for One-Way Pager
*APR35/D	Designing Motorola DSP56xxx Software for Nonrealtime Tests File I/O Using SIM56xxx and ADS56xxx
*APR36/D	Interfacing the DSP560xx/DSP563xx Families to the Crystal CS4226 Multichannel Codec
*APR37/D	Implementing AC-link with ESAI
*APR38/D	Interfacing Serial EEPROM to DSP563xx
*APR39/D	Programming the DSP56307 Enhanced Filter Coprocessor (EFCOP)
*APR40/D	Implementing Viterbi Decoder Using the VSL Instruction on DSP Families DSP56300 and DSP56600
APR404/D	G.722 Audio Processing on the DSP56100 Microprocessor Family
APR405/D	Minimal Logic DRAM Interface for the DSP56156
DCE406/D	Interface for MC68000 to DSP56001 Host Port
EB420/D	Converting DSP56001-Based Designs to the DSP56002

Additional information relevant to Digital Signal Processing may be found in the following Motorola documents:

BR297/D	Dr. Bub — DSP Electronic Bulletin Board
BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR517/D	DSP56000ADSx & DSP56KEMULTRCABL for DSP56000 Family Products
BR526/D	DSP56000CLASx Software Summary
BR541/D	DSP56KCCx DSP56000/DSP56001 C Cross Compiler – Software Summary
BR718/D	DSP56ADC16EVB Evaluation Board and Software
BR725/D	DSP96000CLASx Software Summary
BR749/D	DSP96000ADSx Application Development System
BR786/D	DSP56156ADSx Application Development System
BR1126/D	DSP96KCCx: DSP96002 C Cross Compiler Software Summary
BR1128/D	DSP56100CLASx DSP Development Software: Software Tool Summary
BR1133/D	68K and ColdFire Family Product Portfolio Overview
BR1137/D	The Motorola Explorer's Guide to the World of Embedded Control Solutions
BR1193/D	Introducing the DSP56800 Family
BR3006/D	Wireless Communications Resource Guide
DL156/D	Fast Static RAM – Component and Module Data
DSP002EVMSG/D	DSP56002EVM – Test Drive the Future
DSP56KFAMUM/AD	DSP56000 Digital Signal Processor Family Manual
DSP56L811EMUM/AD	DSP56L811 Evaluation Module User's Manual
DSP56L811UM/AD	DSP56L811 User's Manual
DSP56002PIX/D	Motorola's DSP56002 24-bit General Purpose Digital Signal Processor
DSP56002UM/AD	DSP56002 Digital Signal Processor User's Manual
DSP56004PIX/D	Motorola's DSP56004 24-bit Digital Signal Processor
DSP56004UM/AD	DSP56004 Digital Signal Processor User's Manual
DSP56007PIX/D	Motorola's DSP56007 24-bit Digital Processor
DSP56009UM/AD	DSP56009 User's Manual
DSP56100FM/AD	DSP56100 Digital Signal Processor Family Manual
DSP56300FM/AD	DSP56300 24-Bit Digital Signal Processor Family Manual
DSP56301UM/AD	DSP56301 24-Bit Digital Signal Processor User's Manual
DSP56302EMUM/AD	DSP56302 Evaluation Module User's Manual
DSP56302UM/AD	DSP56302 User's Manual
DSP56303EMUM/AD	DSP56303 Evaluation Module User's Manual
DSP56303UM/AD	DSP56303 User's Manual
DSP56304UM/AD	DSP56304 User's Manual
DSP56603EMUM/AD	DSP56603 Evaluation Module User's Manual
DSP56800FM/AD	DSP56800 Family Manual
DSP56800WP1/D	Novel Digital Signal Processing Architecture with Microcontroller Features
MC68356UM/AD	MC68356 Signal Processing Communications Engine User's Manual
PSTR3003/D	The Motorola Silicon Community

Digital Signal Processing continued

SG171/D	Fast Static RAM Division Product Update
SG182/D	Wireless Messaging Systems Solutions Device Selector Guide
* SG184/D	Wireless Infrastructure Systems Division: DSP Products
* SG185/D	Digital Audio Solutions
SG423/D	TIGER: The Integrated Guide to European RAMs

FETs and Power MOSFETs

AN1321/D	Brushless DC Motor Drive Incorporates Small Outline Integrated Circuit Packaged MOSFETs
AN1327/D	Very Wide Input Voltage Range, Off-line Flyback Switching Power Supply
AN1520/D	HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications
AN1541/D	Introduction to Insulated Gate Bipolar Transistors
AN1631/D	Using PSPICE to Analyze Performance of Power MOSFETs in Step-Down, Switching Regulators Employing Synchronous Rectification
AR160/D	Lossless Current Sensing with SENSEFETs Enhances Motor Drive
AR175/D	A Power FET SPICE Model From Data Sheet Specs
AR326/D	High-Voltage MOSFETs Simplify Flyback Design
AR346/D	RF Power FETs: Their Characteristics and Applications
AR617/D	Next Generation Power MOSFETs Slash On-Resistance, Manufacturing Cost
AR618/D	Three Large Markets Drive for Low Power
EB141/D	Boost MOSFETs Drive Current in Solid State AC Relay
EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
EB201/D	High Cell Density MOSFETs
EB206/D	Solving Noise Problems in High Power, High Frequency Control IC Driven Power Stages
EB207/D	High Current Buffer for Control ICs
EB208/D	Design Check List for MPIC21XX Control ICs

Additional information relevant to FETs and Power MOSFETs may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR1442/D	HDTMOS FETs – Step Up to the Next Level of Power Efficiency
BR1463/D	TMOS V: Better Design Efficiency Has Arrived
BR1480/D	Silicon Solutions for Off Line Motor Drives
BR1491/D	TSOP-6
BR3003/D	Planet Earth is “On” – GreenLine
CR108/D	Low Voltage MOSFET Cross Reference
DL126/D	Small-Signal Transistors, FETs and Diodes Device Data
DL135/D	TMOS Power MOSFET Transistor Data
PPDNEWS/D	Power Scene – Fall 1995
SG46/D	RF Products Selector Guide
SG370/D	Discrete & RF ICs Surface Mount Selector Guide
SG371/D	DPAK Surface Mount Selector Guide

Instrumentation and Control

AN477/D	Simple A/D for MCUs without Built-In A/D Converters
AN1050/D	Designing for Electromagnetic Compatibility (EMC) with HCMOS Microcontrollers
AN1058/D	Reducing A/D Errors in Microcontroller Applications
AN1067/D	Pulse Generation and Detection with Microcontroller Units
AN1215/D	PID Routines for MC68HC11K4 and MC68HC11N4 Microcontrollers
AN1239/D	HC05 MCU Keypad Decoding Techniques Using the MC68HC705J1A
AN1241/D	Interfacing the MC68HC705J1A to 9356/ 9366 EEPROMs
AN1259/D	System Design and Layout Techniques for Noise Reduction in MCU-Based Systems
AN1292/D	Adding a Voice User Interface to M68HC05 Applications
AN1304/D	Integrated Sensor Simplifies Bar Graph Pressure Gauge
AN1305/D	An Evaluation System for Direct Interface of the MPX5100 Pressure Sensor with a Microprocessor
AN1316/D	Frequency Output Conversion for MPX2000 Series Pressure Sensors

AN1322/D	Applying Semiconductor Sensors to Bar Graph Pressure Gauges
AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
AN1517/D	Pressure Switch Design with Semiconductor Pressure Sensors
AN1518/D	Using a Pulse Width Modulated Output with Semiconductor Pressure Sensors
*AN1525/D	The A-B-Cs of Signal-Conditioning Amplifier Design for Sensor Applications
*AN1754/D	Interfacing the MC68HC705J1A to the DS1620 Digital Thermometer
*AN1755/D	Interfacing the MC68HC705C8A to the DS2430A 256-bit 1-Wire EEPROM
*AN1759/D	Add a Non-Volatile Clock to the MC68HC705J1A
*AN1760/D	Interfacing the AD8402 Digital Potentiometer to the MC68HC705J1A
APR15/D	Implementation of Adaptive Controllers on the Motorola DSP56000/DSP56001
AR511/D	Biasing Solid State Amplifiers to Linear Operation
AR560/D	Simple Pressure Switches Comprise Transducers, Comparators and Op Amps
AR619/D	Op Amp Supply Squeezed Down to 1V Rail-to-Rail
EB146/D	Neuron Chip Quadrature Input Function Interface
EB151/D	Scanning a Keypad with the Neuron Chip
EB152/D	How to Use SNVTs in LonWorks Applications
EB157/D	Creating Applications with the LonBuilder Multi-Function I/O Kit

Additional information relevant to Instrumentation and Control may be found in the following Motorola documents:

BR484/D	68302
BR489/D	68360 Quad Integrated Communications Controller (QUICC)
BR1188/D	LonWorks Networks for Industrial and Process Control
BR1422/D	Power Opto Isolators
BR1704/D	68HC08: High Performance, 8-bit Microcontrollers with CAN, J1850 and Flash Memory Options
BR1714/D	RTEK Real-Time Kernel for Motorola Microcontrollers
BR3005/D	Intelligent Sensor Solutions
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
MPAA3UM/D	EasyAnalog Design Software User's Manual
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG169/D	Mixed-Signal Solutions from Communication Transmission & Access Systems Division

Interfacing

see also Telecommunications

AN442/D	Driving LCDs with M6805 Microprocessors
AN991/D	Using the Serial Peripheral Interface to Communicate Between Multiple Microcomputers
AN1066/D	Interfacing the MC68HC05C5 SIOP to an I^2C Peripheral
AN1082/D	Simple Design for a 4-20mA Transmitter Interface Using a Motorola Pressure Sensor
AN1239/D	HC05 MCU Keypad Decoding Techniques Using the MC68HC705J1A
AN1240/D	HC05 MCU Software-Driven Asynchronous Serial Communication Techniques Using the MC68HC705J1A
AN1256/D	Interfacing the HC05 MCU to a Multichannel Digital-to-Analog Converter using the MC68HC705C8A and the MC68HC705J1A
AN1292/D	Adding a Voice User Interface to M68HC05 Applications
AN1316/D	Frequency Output Conversion for MPX2000 Series Pressure Sensors
AN1568/D	Interfacing Between LVDS and ECL
AN1582/D	Board and Interface Design for AutoBahn and Spanceiver
*AN1667/D	Software SCI Implementation to the MISC Communication Protocol
*AN1672/D	The ECL Translator Guide
*AN1723/D	Interfacing MC68HC05 Microcontrollers to the IBM AT Keyboard Interface
AN1724/D	Implementing SCI Receive and Transmit Buffers in C
AN1725/D	Initializing SDRAM Parameters for Motorola MPC106-Based Systems
AN1727/D	Designing PCI 2.1-Compliant MPC106 Systems
AN1732/D	A Universal Serial Bus Gamepad Device using the MC68HC05JB2

Interfacing continued

*AN1748/D	Building a Universal Serial Bus Keyboard Hub Using the Motorola MC68HC(9)08KH12
*AN1754/D	Interfacing the MC68HC705J1A to the DS1620 Digital Thermometer
*AN1758/D	Add Addressable Switches to the HC05
*AN1760/D	Interfacing the AD8402 Digital Potentiometer to the MC68HC705J1A
*AN1774/D	Interfacing the MC68HC912B32 to an LCD Module
*AN1775/D	Expanding Digital Input with an A/D Converter
*AN4002/D	Using the 16-bit Timer of an HC05 for an Interrupt Driven Software SCI
ANE405/D	Bi-Directional Data Transfer Between MC68HC11 and MC6805L3 Using SPI
ANE415/D	MC68HC11 Implementation of IEEE-488 Interface for DSP56000 Monitor
APR21/D	Software UART on the DSP56L811 Using GPIO Port B
AR518/D	Gate Arrays Simplify Translation between High Speed Logic Families
AR563/D	Active SCSI Terminators Confront Critics and Gain Acceptance
*EB281/D	Halting and Re-Starting the Queued Serial Peripheral Interface on Modular Microcontrollers
EB406/D	Getting Started with the FDDI ADS Board
EB421/D	The Motorola MCAN Module
TPUPN07/D	Asynchronous Serial Interface TPU Function (UART)

Additional information relevant to Interfacing may be found in the following Motorola documents:

BR477/D	Smart Mover – Stepper Motors with Integrated Serial Bus Controller
BR1133/D	68K and ColdFire Family Product Portfolio Overview
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1486/D	SCSI Terminators
BR3020/D	Remote Access: ISDN Solutions Kit
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
MC68EN302RM/AD	MC68EN302 Integrated Multiprotocol Processor with Ethernet Reference Manual (Supplement to MC68302UM/AD)
MC68360UM/AD	MC68360 Quad Integrated Communications Controller User's Manual
QMCSUPPLEMENT/AD	MC68MH360, MPC860MH and MPC860DH: A Supplement to the MC68360 and MPC860 User's Manuals
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG169/D	Mixed-Signal Solutions from Communication Transmission & Access Systems Division

Logic

CMOS

AN759/D	A CMOS Keyboard Data Entry System for Bus Oriented Memory Systems
AN1402/D	MC10/100H00 Translator Family I/O SPICE Modelling Kit
AN1406/D	Designing with PECL (ECL at +5.0V)
*AN1545/D	Thermal Data for MPC Clock Drivers
*AN1672/D	The ECL Translator Guide
AR300/D	The Hidden Dangers of Electrostatic Discharge – ESD
AR519/D	Low-Skew Clock Drivers: Which Type is Best?
AR620/D	Quest for the Perfect Battery

Additional information relevant to CMOS may be found in the following Motorola documents:

BR1335/D	Low Voltage Products
BR1339/D	LCX Data Low-Voltage CMOS Logic
BR1492/D	LVX Data: Low-Voltage CMOS Logic
BR3006/D	Wireless Communications Resource Guide
DL129/D	High Speed CMOS Data
DL131/D	CMOS Logic Data
DL138/D	FACT Data
DL203/D	Advanced High-Speed CMOS Data

ECL

AN1051/D	Transmission Line Effects in PCB Applications
AN1402/D	MC10/100H00 Translator Family I/O SPICE Modelling Kit
AN1406/D	Designing with PECL (ECL at +5.0V)
AN1560/D	Low Voltage ECLinPS SPICE Modeling Kit
AN1578/D	MECL 10H SPICE Kit for Berkeley SPICE (PSPICE)

AN1596/D	ECLinPS Lite Translator ELT Family SPICE I/O Model Kit
AN1598/D	H124, 125, 350-352 Translator I/O SPICE Modelling Kit
*AN1650/D	Using Wire-OR Ties in ECLinPS Designs
*AN1672/D	The ECL Translator Guide
AR519/D	Low-Skew Clock Drivers: Which Type is Best?

Additional information relevant to ECL may be found in the following Motorola documents:

BR1333/D	Timing Solutions
BR1335/D	Low Voltage Products
DL122/D	MECL Data
DL140/D	High Performance ECL Data – ECLinPS and ECLinPS Lite
HB205/D	MECL System Design Handbook

TTL

AN1051/D	Transmission Line Effects in PCB Applications
AN1402/D	MC10/100H00 Translator Family I/O SPICE Modelling Kit
AN1403/D	FACT I/O Model Kit
AN1406/D	Designing with PECL (ECL at +5.0V)
*AN1558/D	Characterization of Retrigger Time in the HC4538A Dual Precision Monostable Multivibrator
*AN1672/D	The ECL Translator Guide
AR519/D	Low-Skew Clock Drivers: Which Type is Best?

Additional information relevant to TTL may be found in the following Motorola documents:

BR1335/D	Low Voltage Products
DL121/D	FAST and LS TTL Data
DL138/D	FACT Data

Low Power/Battery Applications

*AN1677/D	Get Your Best From Your LDO Designs
*AN1762/D	Automatic Contrast Control of LCD Displays Using the MC68HC708LN56 Microcontroller
EB414/D	Low Power Write Enable Generation for M68300 Family Microprocessors

Additional information relevant to Low Power/Battery Applications may be found in the following Motorola documents:

BR1339/D	LCX Data Low-Voltage CMOS Logic
DL129/D	High Speed CMOS Data
DL138/D	FACT Data
MCORERM/AD	M•CORE Reference Manual
MCORESALES/D	M•CORE Architecture
MC68LC302RM/AD	MC68LC302 Low Power Integrated Multiprotocol Processor Reference Manual
MC68PM302RM/AD	Integrated Multiprotocol Processor with PCMCIA Interface Reference Manual
MMC2001RM/D	M•CORE MMC2001 Reference Manual
MPC821UM/AD	MPC821 PowerPC Portable Systems Microprocessor User's Manual
MPC823UM/D	PowerPC MPC823 User's Manual

Memory

AN432/D	128K byte Addressing with the M68HC11
AN1051/D	Transmission Line Effects in PCB Applications
AN1125/D	DRAM Interface to the MC88200 M Bus
AN1209/D	The Motorola BurstRAM
AN1210/D	A Protocol Specific Memory for Burstable Fast Cache Memory Applications
AN1223/D	A Zero Wait State Secondary Cache for Intel's Pentium
AN1227/D	Using 9346 Series Serial EEPROMs with 6805 Series Microcontrollers
AN1231/D	Plastic Ball Grid Array (PBGA)
AN1232/D	Thermal Performance of Plastic Ball Grid Array (PBGA) Packages for Next Generation FSRAM Devices
AN1241/D	Interfacing the MC68HC705J1A to 9356/ 9366 EEPROMs
AN1243/D	Output Loading Effects on Fast Static RAMS
AN1255/D	MC68F333 Flash EEPROM Programming Utilities
AN1261/D	Use of 32K x 36 FSRAM in Non-Parity Applications
AN1265/D	Configuring the MPC2604GA Integrated L2 Cache with the MPC106
AN1289/D	DSP5630x FSRAM Module Interfacing
AN1296/D	Using the MCM69C232/MCM69C432 Content-Addressable Memory on an ATM Line Card

Memory continued

*AN1299/D	ATM Switch with Shared Memory – A Simple Model
AN1502/D	Embedded RAM BIST
AN1704/D	Switch Fabric Implementation Using Shared Memory
*AN1707/D	Dual Port Memory for Multiprocessor Applications
AN1718/D	A Serial Bootloader for Reprogramming the MC68HC912B32 Flash EEPROM
AN1722/D	SDRAM System Design Using the MPC106
AN1726/D	Using Motorola's Fast Static RAM CAMs on a Media Independent Interface
*AN1729/D	BurstRAM to ZBT RAM
*AN1751/D	DSP563xx Port A Programming
*AN1753/D	Implementing a FLASH Memory System in an MC68HC711E9 Design
*AN1755/D	Interfacing the MC68HC705C8A to the DS2430A 256-bit 1-Wire EEPROM
*AN1761/D	Interfacing the MC68HC705C8A to the X76F041 PASS SecureFlash
*AN1768/D	Using Registered SDRAM DIMMs with the MPC106
*AN1770/D	In-Circuit Programming of FLASH Memory in the MC68HC908GP20
*AN1773/D	ZBT Primer
*AN1777/D	MPC8xx to BurstRAM Interfacing
*AN1779/D	Using the MCM69D536/MCM69D618 NetRAMs with Different Speed Computing Elements
APR11/D	DSP56001 Interface Techniques and Examples
*APR38/D	Interfacing Serial EEPROM to DSP563xx
APR405/D	Minimal Logic DRAM Interface for the DSP56156
AR241/D	Building Fast SRAMs with no Process 'Tricks'
AR256/D	Motorola's Radical SRAM Design Speeds Systems 40%
AR258/D	High Frequency System Operation Using Synchronous SRAMs
AR260/D	Enhancing System Performance Using Synchronous SRAMs

Additional information relevant to Memory may be found in the following Motorola documents:

BR490/D	Breakthrough in EEPROM Performance
BR1143/D	Fast Static RAM Cross Reference Guide
BR1150/D	7 x 17 PBGA Sample Preview
BR1180/D	Motorola Fast SRAM: Level 2 Cache Modules
BR1701/D	Fast Static RAMS and The Cache Memory Market
BR1702/D	Fast Static RAMS and The Communications Market
BR1716/D	Motorola Fast SRAMs: World Class Solutions
DL156/D	Fast Static RAM – Component and Module Data
MRQSY96/D	Microcontroller Technologies Group: Reliability and Quality – 1996 Annual Report
MC88200UM/AD	MC88200 Cache/Memory Management Unit User's Manual
SG171/D	Fast Static RAM Division Product Update
SG423/D	TIGER: The Integrated Guide to European RAMs

Microprocessors

8-bit MPU/MCU

AN427/D	MC68HC11 EEPROM Error Correction Algorithms in C
AN432/D	128K byte Addressing with the M68HC11
AN442/D	Driving LCDs with M6805 Microprocessors
AN464/D	Software Driver Routines for the Motorola MC68HC05 CAN Module
AN465/D	Secure Remote Control using the 68HC05K1 and the 68HC05P3
AN477/D	Simple A/D for MCUs without Built-In A/D Converters
AN495/D	RDS Decoding for an HC11-Controlled Radio
AN499/D	Let the MC68HC705 Program Itself
AN906A/D	Self-Programming the MC68701 and the MC68701U4
AN974/D	MC68HC11 Floating-Point Package
AN991/D	Using the Serial Peripheral Interface to Communicate Between Multiple Microcomputers
AN997/D	CONFIG Register Issues Concerning the M68HC11 Family

AN1010/D	MC68HC11 EEPROM Programming from a Personal Computer
AN1050/D	Designing for Electromagnetic Compatibility (EMC) with HCMOS Microcontrollers
AN1057/D	Selecting the Right Microcontroller Unit
AN1058/D	Reducing A/D Errors in Microcontroller Applications
AN1060/D	MC68HC11 Bootstrap Mode
AN1064/D	Use of Stack Simplifies M68HC11 Programming
AN1066/D	Interfacing the MC68HC05C5 SIOP to an I^2C Peripheral
AN1067/D	Pulse Generation and Detection with Microcontroller Units
AN1097/D	Calibration-Free Pressure Sensor System
AN1215/D	PID Routines for MC68HC11K4 and MC68HC11N4 Microcontrollers
AN1218/D	HC05 to HC08 Optimization
AN1219/D	M68HC08 Integer Math Routines
AN1222/D	Arithmetic Waveform Synthesis with the HC05/08 MCUs
AN1224/D	Example Software Routines for the Message Data Link Controller Module on the MC68HC705V8
AN1226/D	Use of the 68HC705C8A in Place of a 68HC705C8
AN1227/D	Using 9346 Series Serial EEPROMs with 6805 Series Microcontrollers
AN1228/D	Interfacing the HC05 MCU to the MC145051 A/D Converter
AN1238/D	HC05 MCU LED Drive Techniques Using the MC68HC705J1A
AN1239/D	HC05 MCU Keypad Decoding Techniques Using the MC68HC705J1A
AN1240/D	HC05 MCU Software-Driven Asynchronous Serial Communication Techniques Using the MC68HC705J1A
AN1241/D	Interfacing the MC68HC705J1A to 9356/ 9366 EEPROMs
AN1256/D	Interfacing the HC05 MCU to a Multichannel Digital-to-Analog Converter using the MC68HC705C8A and the MC68HC705J1A
AN1257/D	Using the M68HC05 Family On-Chip Voltage Regulator
AN1259/D	System Design and Layout Techniques for Noise Reduction in MCU-Based Systems
AN1262/D	Simple Real-Time Kernels for M68HC05 Microcontrollers
AN1263/D	Designing for Electromagnetic Compatibility with Single-Chip Microcontrollers
AN1274/D	HC08 SCI Operation with Various Input Clocks
AN1283/D	Transporting M68HC11 Code to M68HC16 Devices
AN1284/D	Transporting M68HC11 Code to M68HC12 Devices
AN1285/D	Stepper Motor Control with an MC68HC11E9 Microcontroller
AN1286/D	MC68HC05C0 Bus Structure Design
AN1287/D	MC68HC708LN56 LCD Utilities
AN1288/D	Programming the MC68HC(8)05K3's Personality EEPROM on the MMDS and MMEVS
AN1292/D	Adding a Voice User Interface to M68HC05 Applications
*AN1298/D	Variations in the Motorola MC68HC(7)05Cx Family
AN1305/D	An Evaluation System for Direct Interface of the MPX5100 Pressure Sensor with a Microprocessor
AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to a Microprocessor
AN1316/D	Frequency Output Conversion for MPX2000 Series Pressure Sensors
AN1322/D	Applying Semiconductor Sensors to Bar Graph Pressure Gauges
AN1326/D	Barometric Pressure Measurement Using Semiconductor Pressure Sensors
AN1518/D	Using a Pulse Width Modulated Output with Semiconductor Pressure Sensors
AN1536/D	Digital Boat Speedometers
AN1551/D	Low-Pressure Sensing with the MPX2010 Pressure Sensor
AN1571/D	Digital Blood Pressure Meter
AN1584/D	"Very Low Pressure" Smart Sensing Solution with Serial Communications Interface
AN1585/D	High-Performance, Dynamically-Compensated Smart Sensor System

Microprocessors: 8-bit MPU/MCU continued

AN1586/D	Designing a Homemade Digital Output for Analog Voltage Output Sensors
*AN1597/D	Longwave Radio Data Decoding Using an HC11 and an MC3371
AN1606/D	ITC132 High Voltage Micro to Motor Interface
AN1607/D	ITC122 Low Voltage Micro to Motor Interface
AN1611/D	Impact and Tilt Measurement Using Accelerometer
AN1612/D	Shock and Mute Pager Applications Using Accelerometer
AN1638/D	Offset Calibration of Gauge Pressure Sensor Using Parallel I/O Ports
AN1655/D	ASB200 – Motorola Sensor Development Controller Board
*AN1661/D	Low Cost Universal Motor Chopper Drive System
*AN1662/D	Low Cost Universal Motor Phase Angle Drive System
*AN1667/D	Software SCI Implementation to the MISC Communication Protocol
AN1702/D	Brushless DC Motor Control Using the MC68HC705MC4
AN1705/D	Noise Reduction Techniques for Microcontroller-Based Systems
AN1706/D	Microcontroller Oscillator Circuit Design Considerations
AN1711/D	DMA08 Systems Compatibilities
AN1712/D	“Get Your Motor Running” with the MC68HC708MP16
AN1716/D	Using M68HC12 Indexed Indirect Addressing
*AN1723/D	Interfacing MC68HC05 Microcontrollers to the IBM AT Keyboard Interface
AN1728/D	Making Low-Distortion Waveforms with the MC68HC708MP16
AN1730/D	Digital Amplification of an Analog Signal Using the MC68HC705J1A
*AN1731/D	VPW J1850 Multiplexing and Motorola’s Byte Data Link Controller (BDLC) Module
AN1732/D	A Universal Serial Bus Gamepad Device using the MC68HC05JB2
AN1733/D	Implementing Caller ID Functionality in MC68HC(7)05 Applications
AN1734/D	Pulse Width Modulation Using the 16-Bit Timer
AN1736/D	Variations in the Motorola MC68HC05Px Family
*AN1737/D	Migrating from the MC68HC705J2 to the MC68HC705JJ7
AN1738/D	Instruction Cycle Timing of MC68HC05JJ/JP Series Microcontrollers
AN1740/D	Applications Using the Analog Subsystem of MC68HC05JJ/JP Series Microcontrollers
AN1741/D	In-Circuit and Emulation Considerations for MC68HC05JJ/JP Series Microcontrollers
AN1742/D	Programming the 68HC705J1A In-Circuit
AN1743/D	Scrolling Message Software
AN1744/D	Resetting Microcontrollers During Power Transitions
AN1745/D	Interfacing the HC705C8A to an LCD Module
*AN1747/D	Migrating from the MC68HC705K1 to the MC68HC805K3
*AN1748/D	Building a Universal Serial Bus Keyboard Hub Using the Motorola MC68HC(9)08KH12
*AN1752/D	Data Structures for 8-bit Microcontrollers
*AN1753/D	Implementing a FLASH Memory System in an MC68HC711E9 Design
*AN1754/D	Interfacing the MC68HC705J1A to the DS1620 Digital Thermometer
*AN1755/D	Interfacing the MC68HC705C8A to the DS2430A 256-bit 1-Wire EEPROM
*AN1757/D	Add a Unique Silicon Serial Number to the HC05
*AN1758/D	Add Addressable Switches to the HC05
*AN1759/D	Add a Non-Volatile Clock to the MC68HC705J1A
*AN1760/D	Interfacing the AD8402 Digital Potentiometer to the MC68HC705J1A
*AN1761/D	Interfacing the MC68HC705C8A to the X76F041 PASS SecureFlash
*AN1762/D	Automatic Contrast Control of LCD Displays Using the MC68HC708LN56 Microcontroller
*AN1763/D	Driving LCD Displays Using the MC68HC705L16 Microcontroller
*AN1770/D	In-Circuit Programming of FLASH Memory in the MC68HC908GP20

*AN1771/D	Precision Sine-Wave Tone Synthesis Using 8-bit MCUs
*AN1775/D	Expanding Digital Input with an A/D Converter
*AN1783/D	Determining MCU Oscillator Start-up Parameters
*AN4002/D	Using the 16-bit Timer of an HC05 for an Interrupt Driven Software SCI
AN-HK-10/H	MC68HC05L9 Microcomputer Applications Demo Board
AN-HK-12/H	MC68HC05F6 Tone Pulse Dialer
AN-HK-13A/H	MC68HC05L10 Handheld Equipment Applications
AN-HK-15/H	MC68HC05L11 Hand-Writing Applications
AN-HK-17/H	MC68HC05F2 DTMF Output Low Voltage Active Filter
ANE405/D	Bi-Directional Data Transfer Between MC68HC11 and MC6805L3 Using SPI
ANE416/D	MC68HC05B4 Radio Synthesizer
ANE425/D	Use of the MC68HC68T1 RTC with M6805 Microprocessors
*APR31/D	Booting and Simple Usage of the DSP56004/007/009 SHI Port in SPI Mode
AR103/D	Compilation and Pascal on the New Microprocessors
EB166/D	System Design Considerations: Converting from the MC68HC805B6 to the MC68HC705B16 Microcontroller
EB180/D	Differences between the MC68HC705B16 and the MC68HC705B16N
EB181/D	Frequently Asked Questions and Answers: M68HC05 Family MCAN Module
*EB191/D	Programming EPROM and EEPROM on the M68HC11EVM
*EB192/D	A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers
*EB195/D	How to Configure the Reset Pin on the MC68HC11
*EB197/D	Using Pseudo-Interrupt Vectors on the M68HC11EVBU
*EB262/D	DSACK Generation on the System Integration and Single-Chip Integration
EB283/D	C Macro Definitions for the MC68HC11C0
EB284/D	C Macro Definitions for the MC68HC(7)11D3/D0
EB285/D	C Macro Definitions for the MC68HC(7)11E20
EB286/D	C Macro Defenitions for the MC68HC11A8/A7/A1/A0
*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
EB288/D	C Macro Definitions for the MC68HC11ED0
EB289/D	C Macro Definitions for the MC68HC11F1
*EB294/D	How to Write the 64-Cycle Time-Protected Registers on M68HC11 Development Tools
*EB298/D	Programming the BUFFALO Monitor into an MC68HC711E9
*EB301/D	Programming EEPROM on the MC68HC811E2 During Program Execution
EB410/D	PASM05 to INTROL M68HC05 Assembler Conversion
EB413/D	Resetting MCUs
EB415/D	Extend SPI Addressing with the MC74HC595
EB416/D	Modular Target Cables for Motorola Development Systems
EB419/D	ROMed HC11E32 and HC11PH8 Including Buffalo Monitor and PCbug11 Talker
EB421/D	The Motorola MCAN Module
EB422/D	Enhanced M68HC11 Bootstrap Mode
M68HC16PN01/D	Transporting M68HC11 Code to M68HC16 Devices

Additional information relevant to 8-bit MPU/MCU may be found in the following Motorola documents:

ADCRM/AD	Analog-to-Digital Converter Reference Manual
BDLCRM/AD	Byte Data Link Controller Reference Manual
BR266/D	M68HC11EVM Evaluation Module
BR278/D	M68HC11EVB Evaluation Board
BR291/D	M68705EVM Evaluation Module
BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR478/D	MC68L11 Family Extended Voltage Microcontrollers
BR479/D	M68HC11 Microcontroller – EEPROM
BR706/D	M68HC11F1EVM Evaluation Module

Microprocessors: 8-bit MPU/MCU continued

BR736/D	M68HC11EVBU Universal Evaluation Board
BR748/D	M68HC711D3PGMR Programmer Board
BR1111/D	M68HC705J2/P9PGMR Programmer Board
BR1112/D	M68HC05 & M68HC08 Family Customer Specified Integrated Circuit (CSIC) Microcontroller Unit (MCU) Literature
BR1113/D	M68HC705B5PGMR Programmer Board
BR1116/D	Advanced Microcontroller Division Literature Guide
BR1137/D	The Motorola Explorer's Guide to the World of Embedded Control Solutions
BR1161/D	Infinite Solutions – Motorola's CSIC Family of Microcontrollers: The 68HC05 and 68HC08
BR1168/D	The M68HC11 Family of 8-Bit Microcontrollers
BR1170/D	Hardware Development Tools
BR1179/D	Motorola CSIC Microcontrollers – Extraordinary Flexibility
BR1182/D	Motorola Modular Evaluation Systems (MMEVS)
BR1183/D	Motorola Modular Development Systems (MMDS)
BR1184/D	Emulation Modules (EM)
BR1185/D	Target Cable Accessories
BR1186/D	68HC705 Parallel Programmers (PGMR) and 68HC708 Universal Serial Programmer (SPGMR08)
BR1187/D	Motorola CAN – The Total Solution for CAN Microcontrollers
BR1190/D	In-Circuit Simulators (ICS)
BR1465/D	8-bit Microcontrollers for Multiplex Wiring
BR1480/D	Silicon Solutions for Off Line Motor Drives
BR1484/D	Energy-Efficient Semiconductor Solutions for the Appliance Industry
BR1704/D	68HC08: High Performance, 8-bit Microcontrollers with CAN, J1850 and Flash Memory Options
BR3006/D	Wireless Communications Resource Guide
CMRQS/D	Microcontroller Technologies Group: Reliability and Quality Monitor Report – Quarter 2, 1997
CPU08RM/AD	M68HC08 Central Processor Unit Reference Manual
* CPU12RG/D	CPU12 Reference Guide
DL160/D	Display Products Device Data
DMA08RM/AD	DMA08 Direct Memory Access Reference Manual
FLYR14/D	Computer-Controlled DC Motor Drives: System Development Tool Set
HC05C0GRS/D	68HC05C0 General Release Specification
HC05C12AGRS/D	MC68HC05C12A, MC68HCL05C12A, MC68HSC05C12A General Release Specification
HC05C4AGRS/D	MC68HC05C4A, MC68HCL05C4A, MC68HSC05C4A General Release Specification
HC05C8AGRS/D	MC68HC05C8A, MC68HCL05C8A, MC68HSC05C8A General Release Specification
HC05C9AGRS/D	MC68HC05C9A, MC68HCL05C9A, MC68HSC05C9A General Release Specification
HC05CT4GRS/D	MC68HC05CT4 General Release Specification
HC05H12GRS/D	MC68HC(7)05H12 General Release Specification
* HC05J5AGRS/H	68HC05J5A/68HC705J5A General Release Specification
HC05L16GRS/D	MC68HC05L16/MC68HC705L16 General Release Specification
* HC05L5GRS/D	68HC05L5/68HC705L5 General Release Specification
HC05PL4GRS/H	MC68HC05PL4A, MC68HC05PL4B, MC68HC705PL4B General Release Specification
HC05RC18GRS/D	MC68HC05RC9/MC68HC05RC18 General Release Specification
HC08AS32GRS/D	68HC08AS32 General Release Specification
HC08KL8GRS/D	MC68HC08KL8 General Release Specification
HC68VBIGRS/D	MC68HC68VBI General Release Specification
HC705CT4GRS/D	MC68HC705CT4 General Release Specification
* HC705JB2GRS/H	68HC705JB2 General Release Specification
HC705MC4GRS/D	MC68HC705MC4 General Release Specification
HC705RC17GRS/D	68HC705RC17 General Release Specification
HC708KL8GRS/D	68HC708KL8 General Release Specification
HC708MP16GRS/D	MC68HC708MP16 General Release Specification
HC908AT32GRS/D	MC68HC908AT32 General Release Specification
HC908AT60GRS/D	MC68HC908AT60 General Release Specification
HC908MR24GRS/D	68HC908MR24 General Release Specification
MRQSY96/D	Microcontroller Technologies Group: Reliability and Quality – 1996 Annual Report
M68EM05C0UM/D	M68EM05C0 Emulation Module User's Module
M68HC05AG/AD	M68HC05 Applications Guide
M68HC08RG/AD	HC08 Family Reference Guide

M68HC11EVBU/D	M68HC11EVBU Universal Evaluation Board User's Manual
M68HC11RM/AD	M68HC11 Reference Manual
M68PRM/D	M6800 Programming Reference Manual
M6805UM/AD3	M6805 HMOS / M146805 CMOS Family User's Manual
M6809PM/AD	MC6809-MC6809E Microprocessor Programming Manual (1981)
MC68HC05CxRG/AD	MC68HC05Cx HCMOS Single-Chip Microcontrollers Programming Reference Guide
MC68HC11A8RG/AD	MC68HC11A8 Programming Reference Guide
MC68HC11C0RG/AD	MC68HC11C0 Programming Reference Guide
MC68HC11D3RG/AD	MC68HC11D3/MC68HC711D3 Programming Reference Guide
MC68HC11ERG/AD	MC68HC11E Programming Reference Guide
MC68HC11F1RG/AD	MC68HC11F1 Programming Reference Guide
MC68HC11K4RG/AD	MC68HC11K4/MC68HC711K4 Programming Reference Guide
MC68HC11KA4RG/AD	MC68HC11KA4/MC68HC711KA4 Programming Reference Guide
MC68HC11L6RG/AD	MC68HCL6/MC68HC711L6 Programming Reference Guide
MC68HC11MRG/AD	M68HC11 M Series Programming Reference Guide
MC68HC11NRG/AD	MC68HC11N Series Programming Reference Guide
MCCIRM/AD	Multichannel Communication Interface Reference Manual
MCUASM/D	MCUasm Assembly Language Development Toolset
MCUDEVTLDIR/D	Motorola Microcontroller Development Tools Directory
PSTR3003/D	The Motorola Silicon Community
SG180/D	Microcontroller Technologies Group: Development Tools Selector Guide
SG182/D	Wireless Messaging Systems Solutions Device Selector Guide
SG419/D	EMU: European Microcontroller Update
TIM08RM/AD	TIM08 Timer Interface Module Reference Manual

16-bit MPU/MCU

AN461/D	An Introduction to the HC16 for HC11 Users
AN476/D	CPU16 and the Configurable Timer Module (CTM) in Engine Control
AN1050/D	Designing for Electromagnetic Compatibility (EMC) with HCMOS Microcontrollers
AN1213/D	16-bit DSP Servo Control with the MC68HC16Z1
AN1230/D	A Background Debugging Mode Driver Package for Modular Microcontrollers
AN1233/D	Using M68HC16 Digital Signal Processing to Build an Audio Frequency Analyzer
AN1249/D	Brushed DC Motor Control Using the MC68HC16Z1
AN1254/D	Using the MC68HC16Z1 for Audio Tone Generation
AN1259/D	System Design and Layout Techniques for Noise Reduction in MCU-Based Systems
AN1263/D	Designing for Electromagnetic Compatibility with Single-Chip Microcontrollers
AN1280/D	Using and Extending D–Bug 12 Routines
AN1280A/D	Using the Callable Routines in D-Bug12
AN1283/D	Transporting M68HC11 Code to M68HC16 Devices
AN1284/D	Transporting M68HC11 Code to M68HC12 Devices
AN1295/D	Demonstration Model of fuzzyTECH Implementation on M68HC12
AN1705/D	Noise Reduction Techniques for Microcontroller-Based Systems
AN1706/D	Microcontroller Oscillator Circuit Design Considerations
AN1718/D	A Serial Bootloader for Reprogramming the MC68HC912B32 Flash EEPROM
*AN1774/D	Interfacing the MC68HC912B32 to an LCD Module
AR362/D	Whipping Up Real-Time Designs – Programming Motorola's TPU
DCE406/D	Interface for MC68000 to DSP56001 Host Port
EB183/D	Erasing and Programming the FLASH EEPROM on the MC68HC912B32
*EB252/D	MOVB, MOVW, PSHM, and PULM Syntax Differences on MC68HC16 Assemblers
*EB259/D	Why MC68300 and MC68HC16 MCUs May Halt after Release of Reset

Microprocessors: 16-bit MPU/MCU continued

*EB260/D	Why an MC68300 or MC68HC16 Microcontroller May Fail to Release Reset
*EB261/D	Autovector Generation Using Chip Select Logic on MC68300 and MC68HC16 Devices
*EB262/D	DSACK Generation on the System Integration and Single-Chip Integration
*EB263/D	How to Program Chip Selects on Modular Microcontrollers with a System Integration Module or a Single-Chip Integration Module
*EB264/D	Disabling All Interrupts on Power-On for MC683xx and MC68HC16 Devices Using the Single-Chip Integration Module or System Integration Module
*EB265/D	Generating Edge-Sensitive Interrupts on the MC683xx and MC68HC16 Families of MCUs
*EB269/D	Using the SCI on Modular MCUs: An Example
*EB273/D	Which Pins on the MC68331/332 and MC68HC16Z1 Need Pullup Resistors
*EB275/D	Example Using the Queued Serial Peripheral Interface on Modular MCUs
*EB277/D	Coherency in the Time Processor Unit (TPU)
*EB279/D	Low Output Levels on Output Pins
*EB280/D	Programming the Channel Control Registers on the Time Processor Unit
*EB281/D	Halting and Re-Starting the Queued Serial Peripheral Interface on Modular Microcontrollers
*EB305/D	Startup Problems When Using a Software Background Mode Debugger and Booting from RAM or an Empty ROM Socket
*EB306/D	Using Exercise 7 on the M68HC16Z1EVB and the Necessity of Word Alignment
*EB309/D	Using Exercise 8 on the MC68HC16Z1EVB
M68HC16PN01/D	Transporting M68HC11 Code to M68HC16 Devices
TPUPN04/D	Table Stepper Motor TPU Function (TSM)
TPUPN05/D	Multichannel PWM TPU Function (MCPWM)
TPUPN06/D	Programmable Time Accumulator TPU Function (PTA)
TPUPN07/D	Asynchronous Serial Interface TPU Function (UART)
TPUPN08/D	New Input Capture/Input Transition Counter TPU Function (NITC)
TPUPN09/D	Multiphase Motor Commutation TPU Function (COMM)
TPUPN10/D	Hall Effect Decode TPU Function (HALLD)
TPUPN11/D	Period/Pulse Width Accumulator TPU Function (PPWA)
TPUPN12/D	Output Compare TPU Function (OC)
TPUPN13/D	Stepper Motor TPU Function (SM)
TPUPN14/D	Position-Synchronised Pulse Generator (PSP)
TPUPN15A/D	Period Measurement with Additional Transition Detection TPU Function (PMA)
TPUPN15B/D	Period Measurement with Missing Transition Detection TPU Function (PMM)
TPUPN17/D	Pulse Width Modulation TPU Function (PWM)
TPUPN18/D	Discrete Input/Output TPU Function (DIO)
TPUPN19/D	Synchronized Pulse-Width Modulation (SPWM)
TPUPN20/D	Quadrature Decode TPU Function (QDEC)

Additional information relevant to 16-bit MPU/MCU may be found in the following Motorola documents:

BDLCRM/AD	Byte Data Link Controller Reference Manual
BR231/D	High Performance Embedded Systems Technical Literature
BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR1116/D	Advanced Microcontroller Division Literature Guide
BR1133/D	68K and ColdFire Family Product Portfolio Overview
BR1137/D	The Motorola Explorer's Guide to the World of Embedded Control Solutions
BR1169/D	The M68HC16 and M68300 Families of Modular Microcontrollers
BR1170/D	Hardware Development Tools
BR1187/D	Motorola CAN – The Total Solution for CAN Microcontrollers
BR1480/D	Silicon Solutions for Off Line Motor Drives

BR3006/D	Wireless Communications Resource Guide
CPU12RM/AD	CPU12 Reference Manual
CPU16RM/AD	M68HC16 Family Reference Manual
MRQSY96/D	Microcontroller Technologies Group: Reliability and Quality – 1996 Annual Report
M6809PM/AD	MC6809-MC6809E Microprocessor Programming Manual (1981)
M68000UM/AD	M68000 8-/16-/32-bit Microprocessors User's Manual, Ninth Edition
MC68HC16Y1UM/AD	MC68HC16Y1 User's Manual
MC68HC16ZUM/AD	M68HC16 Z Series User's Manual
MCUASM/D	MCUasm Assembly Language Development Toolset
MCUDEVTLDIR/D	Motorola Microcontroller Development Tools Directory
SCIMRM/AD	Single-Chip Integration Module Reference Manual
SG180/D	Microcontroller Technologies Group: Development Tools Selector Guide
SG182/D	Wireless Messaging Systems Solutions Device Selector Guide
SG419/D	EMU: European Microcontroller Update
SIMRM/AD	System Integration Module Reference Manual

32-bit MPU/MCU

AN473/D	A Minimum Evaluation System for the MC68331 and MC68332
AN1051/D	Transmission Line Effects in PCB Applications
AN1062/D	Using the QSPI for Analog Data Acquisition
AN1125/D	DRAM Interface to the MC88200 M Bus
AN1200/D	Configuring the M68300 Family Time Processing Unit (TPU)
AN1230/D	A Background Debugging Mode Driver Package for Modular Microcontrollers
AN1236/D	Timing Performance of TPU I/O Hardware
AN1255/D	MC68F333 Flash EEPROM Programming Utilities
AN1259/D	System Design and Layout Techniques for Noise Reduction in MCU-Based Systems
AN1263/D	Designing for Electromagnetic Compatibility with Single-Chip Microcontrollers
AN1264/D	JTAG Flash Memory Programmer
AN1705/D	Noise Reduction Techniques for Microcontroller-Based Systems
AN1706/D	Microcontroller Oscillator Circuit Design Considerations
AN1724/D	Implementing SCI Receive and Transmit Buffers in C
ANE426/D	An MC68030 32-bit High Performance Minimum System
AR350/D	Adapt Non-ISDN Terminals to ISDN Data Rates
AR362/D	Whipping Up Real-Time Designs – Programming Motorola's TPU
DC414/D	An 8-bit EPROM Interface for an MC68EC040/MC68360 System
EB163/D	Running the MC88110 in Lockstep
EB164/D	Interrupt Latency in the MC88110
EB165/D	Hardware Implications of xmem as a st followed by a ld
*EB253/D	How to Use the Lookup and Interpolate Instruction on the CPU32
*EB256/D	Use of the Lock Bit on Modular Microcontrollers with FLASH EEPROM
*EB257/D	Detecting Loss of Clock on Modular Microcontrollers
*EB258/D	Sources of Reset on Modular Microcontrollers
*EB259/D	Why MC68300 and MC68HC16 MCUs May Halt after Release of Reset
*EB260/D	Why an MC68300 or MC68HC16 Microcontroller May Fail to Release Reset
*EB261/D	Autovector Generation Using Chip Select Logic on MC68300 and MC68HC16 Devices
*EB263/D	How to Program Chip Selects on Modular Microcontrollers with a System Integration Module or a Single-Chip Integration Module
*EB264/D	Disabling All Interrupts on Power-On for MC683xx and MC68HC16 Devices Using the Single-Chip Integration Module or System Integration Module
*EB265/D	Generating Edge-Sensitive Interrupts on the MC683xx and MC68HC16 Families of MCUs
*EB268/D	Starting and Stopping the Time Processor Clock Using the Background Debug Mode
*EB269/D	Using the SCI on Modular MCUs: An Example

Microprocessors: 32-bit MPU/MCU continued

*EB270/D	Problems with the PPWA Function on Revision P MC68332 Devices
*EB273/D	Which Pins on the MC68331/332 and MC68HC16Z1 Need Pullup Resistors
*EB275/D	Example Using the Queued Serial Peripheral Interface on Modular MCUs
*EB277/D	Coherency in the Time Processor Unit (TPU)
*EB278/D	Latency on the Time Processor Unit
*EB279/D	Low Output Levels on Output Pins
*EB280/D	Programming the Channel Control Registers on the Time Processor Unit
*EB281/D	Halting and Re-Starting the Queued Serial Peripheral Interface on Modular Microcontrollers
*EB305/D	Startup Problems When Using a Software Background Mode Debugger and Booting from RAM or an Empty ROM Socket
EB414/D	Low Power Write Enable Generation for M68300 Family Microprocessors
TPUPN00/D	Using the TPU Function Library and TPU Emulation Mode
TPUPN01/D	Queued Output Match TPU Function (QOM)
TPUPN02/D	Fast Quadrature Decode TPU Function (FQD)
TPUPN03/D	Frequency Measurement TPU Function (FQM)
TPUPN04/D	Table Stepper Motor TPU Function (TSM)
TPUPN05/D	Multichannel PWM TPU Function (MCPWM)
TPUPN06/D	Programmable Time Accumulator TPU Function (PTA)
TPUPN07/D	Asynchronous Serial Interface TPU Function (UART)
TPUPN08/D	New Input Capture/Input Transition Counter TPU Function (NITC)
TPUPN09/D	Multiphase Motor Commutation TPU Function (COMM)
TPUPN10/D	Hall Effect Decode TPU Function (HALLD)
TPUPN11/D	Period/Pulse Width Accumulator TPU Function (PPWA)
TPUPN12/D	Output Compare TPU Function (OC)
TPUPN13/D	Stepper Motor TPU Function (SM)
TPUPN14/D	Position-Synchronised Pulse Generator (PSP)
TPUPN15A/D	Period Measurement with Additional Transition Detection TPU Function (PMA)
TPUPN15B/D	Period Measurement with Missing Transition Detection TPU Function (PMM)
TPUPN17/D	Pulse Width Modulation TPU Function (PWM)
TPUPN18/D	Discrete Input/Output TPU Function (DIO)
TPUPN19/D	Synchronized Pulse-Width Modulation (SPWM)
TPUPN20/D	Quadrature Decode TPU Function (QDEC)

Additional information relevant to 32-bit MPU/MCU may be found in the following Motorola documents:

BR231/D	High Performance Embedded Systems Technical Literature
BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR484/D	68302
BR729/D	Embedded Systems Source, 1997
BR1114/D	The 68300 Family Integrated Microprocessors and Microcontrollers
BR1116/D	Advanced Microcontroller Division Literature Guide
BR1118/D	Motorola's 68LC040 Microprocessor
BR1119/D	Motorola's 68EC040 Microprocessor
BR1133/D	68K and ColdFire Family Product Portfolio Overview
BR1137/D	The Motorola Explorer's Guide to the World of Embedded Control Solutions
BR1153/D	The 68060 Family
BR1169/D	The M68HC16 and M68300 Families of Modular Microcontrollers
BR1170/D	Hardware Development Tools
BR1187/D	Motorola CAN – The Total Solution for CAN Microcontrollers
BR1427/D	PC Brochure
BR1480/D	Silicon Solutions for Off Line Motor Drives
BR3006/D	Wireless Communications Resource Guide
BR3020/D	Remote Access: ISDN Solutions Kit
COLDFIREFAM/D	ColdFire: Variable-Length RISC Processors
CPU32RM/AD	CPU32 Central Processor Unit Reference Manual
CTMRM/D	Configurable Timer Module Reference Manual

EMDVPOC/D	Embedded Developer Pocket Guide
GPTRM/AD	Modular Microcontroller Family General Purpose Timer Reference Manual
MRQSY96/D	Microcontroller Technologies Group: Reliability and Quality – 1996 Annual Report
M68000PM/AD	M68000 Family Programmer's Reference Manual
M68020UM/AD	MC68020/MC68EC020 Microprocessors User's Manual
M68040UM/AD	MC68040, MC68040V, MC68LC040, MC68EC040, MC68EC040V Microprocessors User's Manual
M68060UM/AD	MC68060, MC68LC060, MC68EC060 Microprocessors User's Manual
MC68EN302RM/AD	MC68EN302 Integrated Multiprotocol Processor with Ethernet Reference Manual (Supplement to MC68302UM/AD)
* MC68EZ328UM/D	MC68EZ328 DragonBall-EZ Integrated Processor User's Manual
MC68F333UM/AD	MC68F333 User's Manual
MC68LC302RM/AD	MC68LC302 Low Power Integrated Multiprotocol Processor Reference Manual
MC68PM302RM/AD	Integrated Multiprotocol Processor with PCMCIA Interface Reference Manual
MC68QH302SUPL/AD	MC68QH302: Supplement to the MC68302 Integrated Multiprotocol Processor User's Manual
MC68SC302UM/AD	MC68SC302 Passive ISDN Protocol Engine User's Manual
MC68030UM/AD	MC68030 Enhanced 32-bit MPU User's Manual, third edition
MC68302UM/AD	MC68302 Integrated Multiprotocol Processor User's Manual
MC68306UM/AD	MC68306 Integrated EC000 Processor User's Manual
MC68322UM/AD	Bandit: MC68322 Integrated Printer Processor User's Manual
MC68328UM/AD	MC68328 (Dragonball) Integrated Processor User's Manual
MC68330UM/AD	MC68330 Integrated CPU32 Processor Users Manual
MC68332UM/AD	MC68332 User's Manual
MC68340UM/AD	MC68340 Integrated Processor User's Manual
MC68356UM/AD	MC68356 Signal Processing Communications Engine User's Manual
MC68360UM/AD	MC68360 Quad Integrated Communications Controller User's Manual
MC68840UM/AD	MC68840 Integrated Fiber Distributed Data Interface User's Manual
MC88410UM/AD	MC88410 Secondary Cache Controller User's Manual
MCF5102UM/AD	MCF5102 ColdFire User's Manual
MCF5200PRM/AD	ColdFire Microprocessor Family Programmer's Reference Manual
MCF5202UM/AD	ColdFire MCF5202 User's Manual
MCF5307UM/AD	MCF5307 ColdFire Integrated Microprocessor User's Manual
MCUDEVTLDIR/D	Motorola Microcontroller Development Tools Directory
PSTR3003/D	The Motorola Silicon Community
QADCRM/AD	Queued Analog-to Digital Converter Reference Manual
QMCSUPPLEMENT/D	QUICC Multichannel Controller User's Manual Supplement
QMCSUPPLEMENT/AD	MC68MH360, MPC860MH and MPC860DH: A Supplement to the MC68360 and MPC860 User's Manuals
QSMRM/AD	Queued Serial Module Reference Manual
SCIMRM/AD	Single-Chip Integration Module Reference Manual
SG171/D	Fast Static RAM Division Product Update
SG175/D	Networking Systems Division and Personal Computing Division: Product Information
SG180/D	Microcontroller Technologies Group: Development Tools Selector Guide
SG182/D	Wireless Messaging Systems Solutions Device Selector Guide
SG419/D	EMU: European Microcontroller Update
SG423/D	TIGER: The Integrated Guide to European RAMs
SIMRM/AD	System Integration Module Reference Manual
TPURM/AD	M68300 Family Time Processor Unit Reference Manual

8-bit Peripherals

AN1552/D	MPX7100AP: The Sensor at the Heart of Solid-State Altimeter Applications
*AN1759/D	Add a Non-Volatile Clock to the MC68HC705J1A
ANE425/D	Use of the MC68HC68T1 RTC with M6805 Microprocessors

Additional information relevant to 8-bit Peripherals may be found in the following Motorola documents:

BR1116/D	Advanced Microcontroller Division Literature Guide
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference

16/32-bit Peripherals

ANE426/D	An MC68030 32-bit High Performance Minimum System
DC414/D	An 8-bit EPROM Interface for an MC68EC040/MC68360 System

Microprocessors: 16/32-bit Peripherals continued

Additional information relevant to 16/32-bit Peripherals may be found in the following Motorola documents:

BR231/D	High Performance Embedded Systems Technical Literature
BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR488/D	68306 68307 68322
BR489/D	68360 Quad Integrated Communications Controller (QUICC)
BR1104/D	Motorola's FDDI Chip Set
MC68HC901UM/AD	MC68HC901 Multi-Function Peripheral User's Manual
MC68605UM/AD	MC68605 X.25 Protocol Controller User's Manual
MC68824UM/AD	MC68824 Token Bus Products User's Manual
MC68836UM/AD	MC68836 FDDI User's Manual
MC68837UM/AD	MC68837 FDDI User's Manual
MC68838UM/AD	MC68838 FDDI User's Manual
MC68847UM/AD	MC68847 Quad ELM FDDI User's Manual
MC88200UM/AD	MC88200 Cache/Memory Management Unit User's Manual
PSTR3003/D	The Motorola Silicon Community
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG175/D	Networking Systems Division and Personal Computing Division: Product Information
SG419/D	EMU: European Microcontroller Update

PowerPC

AN486/D	Low Cost MPC601 EVM
AN1265/D	Configuring the MPC2604GA Integrated L2 Cache with the MPC106
AN1267/D	PowerPC 603 Hardware Interrupt Latency in Embedded Applications
AN1269/D	PowerPC Microprocessor Clock Modes
AN1271/D	PowerPC 60x Microprocessor to AD1848 CODEC Interface
AN1272/D	Spreadsheet Estimation of CPU-DRAM Subsystem Power Consumption
AN1281/D	MPC505 Interrupts
AN1282/D	Board Strategies for Ensuring Optimum Frequency Synthesizer Performance
AN1291/D	Avoiding Multiprocessing Paradoxes with the PowerPC 604 Microprocessor
AN1294/D	Multiprocessor Systems and the PowerPC 603e Microprocessor
AN1579/D	Understanding the Multivibrator Based Crystal Oscillator Circuit Used on the BiCMOS MPC Family of Clock Drivers
AN1722/D	SDRAM System Design Using the MPC106
AN1725/D	Initializing SDRAM Parameters for Motorola MPC106-Based Systems
AN1727/D	Designing PCI 2.1-Compliant MPC106 Systems
*AN1768/D	Using Registered SDRAM DIMMs with the MPC106
*AN1769/D	Designing a Minimal PowerPC System
*AN1777/D	MPC8xx to BurstRAM Interfacing
AN4000/D	Visual Debug for MPC60x
AR359/D	The Making of the PowerPC
AR360/D	PowerPC 620 Soars

Additional information relevant to PowerPC may be found in the following Motorola documents:

BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR1154/D	MPC500 Family: RISC PowerPC Microcontrollers
BR1155/D	MPC500 Family: Software Development Tools
BR1165/D	MPC500 Family: RTEK Real-Time Embedded Kernel
BR1166/D	MPC500 Family: Evaluation Board
BR1180/D	Motorola Fast SRAM: Level 2 Cache Modules
BR1427/D	PC Brochure
BR1701/D	Fast Static RAMS and The Cache Memory Market
BR1723/D	PowerPC Microprocessors: Embedded Focus
BR1724/D	PowerPC Resource Guide
DL156/D	Fast Static RAM – Component and Module Data
EMDVPOC/D	Embedded Developer Pocket Guide
MCUDEVTLDIR/D	Motorola Microcontroller Development Tools Directory
MPCBUSIF/AD	PowerPC Microprocessor Family: the Bus Interface for 32-bit Microprocessors
MPCPRG/D	PowerPC Microprocessor Family: The Programmer's Reference Guide
MPCPRGREF/D	PowerPC Microprocessor Family: The Programmer's Pocket Reference Guide
MPC105UM/AD	PowerPC PCI Bridge/Memory Controller User's Manual
MPC603eUM/AD	PowerPC 603e RISC Microprocessor User's Manual

MPC750UM/AD	MPC750 RISC Microprocessor User's Manual
MPC821UM/AD	MPC821 PowerPC Portable Systems Microprocessor User's Manual
MPC823RG/D	PowerPC MPC823 Pocket Guide
MPC823UM/D	PowerPC MPC823 User's Manual
MPC860UM/AD	MPC860 PowerQUICC User's Manual
PPCSIM603/D	PowerPC Microarchitectural Timing Simulator (MATSim)
PPCSWINSERT/D	Software Vendors Supporting Native-Mode Applications on PowerPC Microprocessors
PPCTOOLSFACT/D	PowerPC Development Tools
PPCUPDATE/D	PowerPC Microprocessor Update
PPC620/D	PowerPC 620 Microprocessors
PPC620FACT/D	PowerPC 620 Microprocessor Fact Sheet
PSTR3003/D	The Motorola Silicon Community
QMCSUPPLEMENT/AD	MC68MH360, MPC860MH and MPC860DH: A Supplement to the MC68360 and MPC860 User's Manuals
RCPURM/AD	MPC500 Family: RCPU Reference Manual
SG171/D	Fast Static RAM Division Product Update
SG175/D	Networking Systems Division and Personal Computing Division: Product Information
SG180/D	Microcontroller Technologies Group: Development Tools Selector Guide
SG423/D	TIGER: The Integrated Guide to European RAMs
SIURM/AD	MPC500 Family: System Integration Unit Reference Manual

M•CORE

Information relevant to M•CORE may be found in the following Motorola documents:

MCORERM/AD	M•CORE Reference Manual
MCORESALES/D	M•CORE Architecture
MMC2001RM/D	M•CORE MMC2001 Reference Manual

Motor & Lighting Control

see also Thyristors

AN1249/D	Brushed DC Motor Control Using the MC68HC16Z1
AN1285/D	Stepper Motor Control with an MC68HC11E9 Microcontroller
AN1307/D	A Simple Pressure Regulator Using Semiconductor Pressure Transducers
AN1321/D	Brushless DC Motor Drive Incorporates Small Outline Integrated Circuit Packaged MOSFETs
AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
AN1541/D	Introduction to Insulated Gate Bipolar Transistors
AN1543/D	Electronic Lamp Ballast Design
AN1546/D	High Voltage, High Side Driver for Electronic Lamp Ballast Applications
AN1576/D	Reduce Compact Fluorescent Cost with Motorola's PowerLux IGBT
AN1577/D	Motorola's D2 Series Transistors for Fluorescent Converters
*AN1601/D	Efficient Safety Circuit for Electronic Ballast
AN1606/D	ITC132 High Voltage Micro to Motor Interface
AN1607/D	ITC122 Low Voltage Micro to Motor Interface
AN1624/D	ITC137 68HC708MP16 Motion Control Development Board
AN1626/D	Noise Management in Motor Drives
*AN1661/D	Low Cost Universal Motor Chopper Drive System
*AN1662/D	Low Cost Universal Motor Phase Angle Drive System
AN1702/D	Brushless DC Motor Control Using the MC68HC705MC4
AN1712/D	"Get Your Motor Running" with the MC68HC708MP16
AN1728/D	Making Low-Distortion Waveforms with the MC68HC708MP16
AN1734/D	Pulse Width Modulation Using the 16-Bit Timer
AR160/D	Lossless Current Sensing with SENSEFETs Enhances Motor Drive
AR180/D	Electronic Ballasts
AR181/D	Bipolar Transistors Excel in Off-Line Resonant Converters
AR301/D	Solid-State Devices Ease Task of Designing Brushless DC Motors
AR341/D	Power MOSFET 1HP Brushless DC Motor Drive Withstands Commutation Stresses
AR609/D	Trouble Shooting Halogen Electronic Transformers
AR617/D	Next Generation Power MOSFETs Slash On-Resistance, Manufacturing Cost
AR618/D	Three Large Markets Drive for Low Power

Motor & Lighting Control continued

ARE402/D	The Electronic Control of Fluorescent Tubes
EB141/D	Boost MOSFETs Drive Current in Solid State AC Relay
EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
EB206/D	Solving Noise Problems in High Power, High Frequency Control IC Driven Power Stages
EB207/D	High Current Buffer for Control ICs
TPUPN04/D	Table Stepper Motor TPU Function (TSM)
TPUPN09/D	Multiphase Motor Commutation TPU Function (COMM)
TPUPN10/D	Hall Effect Decode TPU Function (HALLD)
TPUPN13/D	Stepper Motor TPU Function (SM)
TPUPN17/D	Pulse Width Modulation TPU Function (PWM)
TPUPN19/D	Synchronized Pulse-Width Modulation (SPWM)
TPUPN20/D	Quadrature Decode TPU Function (QDEC)

Additional information relevant to Motor & Lighting Control may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR477/D	Smart Mover – Stepper Motors with Integrated Serial Bus Controller
BR480/D	Electronic Lamp Ballasts
BR1193/D	Introducing the DSP56800 Family
BR1422/D	Power Opto Isolators
BR1480/D	Silicon Solutions for Off Line Motor Drives
BR1484/D	Energy-Efficient Semiconductor Solutions for the Appliance Industry
BR3016/D	Motorola GaAs Rectifiers
DL111/D	Bipolar Power Transistor Data
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
DL202/D	IGBT – Insulated Gate Bipolar Transistor Device Data
DSP56800WP1/D	Novel Digital Signal Processing Architecture with Microcontroller Features
FLYR14/D	Computer-Controlled DC Motor Drives: System Development Tool Set
HC05H12GRS/D	MC68HC(7)05H12 General Release Specification
HC705MC4GRS/D	MC68HC705MC4 General Release Specification
PPDNEWS/D	Power Scene – Fall 1995
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG425/D	Lamp Ballast Selector Guide

Mounting Techniques & Surface Mount

AN936/D	Mounting Techniques, Lead Forming and Testing of Motorola's MPX Series Pressure Transducers
AN1051/D	Transmission Line Effects in PCB Applications
AN1231/D	Plastic Ball Grid Array (PBGA)
AN1232/D	Thermal Performance of Plastic Ball Grid Array (PBGA) Packages for Next Generation FSRAM Devices
AN1534/D	Design Considerations of Plastic Ball Grid Arrays for CMOS Gate Arrays
*AN1545/D	Thermal Data for MPC Clock Drivers
AN1580/D	Mounting and Soldering Recommendations for the Motorola Power Flat Pack Package
AN1617/D	Mounting Recommendations for Copper Tungsten Flanged Transistors
*AN1673/D	Solder Reflow Mounting Method for the MRF286 and Similar Packages
AN1705/D	Noise Reduction Techniques for Microcontroller-Based Systems
AN4005/D	Thermal Management and Mounting Method for the PLD 1.5 RF Power Surface Mount Package
*APR42/D	15 x 15mm PBGA Daisy-Chain Application Report
AR145/D	DPAK: The Power Package for Surface Mount Applications
AR302/D	Thermal Management of Surface Mount Power Devices
AR523/D	An Overview of Surface Mount Technology (SMT) for Power Supply Applications
AR617/D	Next Generation Power MOSFETs Slash On-Resistance, Manufacturing Cost
EB107/D	Mounting Considerations for Motorola RF Power Modules
EB109/D	Low Cost UHF Device Gives Broadband Performance at 3.0 Watts Output
EB209/D	Mounting Method for RF Power Leadless Surface Mount Transistors

Additional information relevant to Mounting Techniques & Surface Mount may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR1150/D	7 x 17 PBGA Sample Preview
BR1176/D	Motorola & Ball Grid Array Technology
BR1437/D	Multichip Module Solutions
BR1487/D	Thermal Modeling and Management of Discrete Surface Mount Packages
BR1491/D	TSOP-6
CR100/D	Communications, Power and Signal Technologies Group: Through-Hole to Surface Mount Cross Reference
DL111/D	Bipolar Power Transistor Data
DL126/D	Small-Signal Transistors, FETs and Diodes Device Data
PPDNEWS/D	Power Scene – Fall 1995
SG370/D	Discrete & RF ICs Surface Mount Selector Guide
SG371/D	DPAK Surface Mount Selector Guide

Multimedia

AN492/D	A Video Display Board for CD-i Development
AN1254/D	Using the MC68HC16Z1 for Audio Tone Generation
AN1271/D	PowerPC 60x Microprocessor to AD1848 CODEC Interface
EB411/D	A Digital Video Prototyping System

Additional information relevant to Multimedia may be found in the following Motorola documents:

BR1171/D	Motorola Multimedia Communications
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1712/D	CopperGold ADSL Silicon Solutions
DSP56302UM/AD	DSP56302 User's Manual
DSP56303UM/AD	DSP56303 User's Manual
DSP56800WP1/D	Novel Digital Signal Processing Architecture with Microcontroller Features
MPC823UM/D	PowerPC MPC823 User's Manual
* SG184/D	Wireless Infrastructure Systems Division: DSP Products

Networking

AN464/D	Software Driver Routines for the Motorola MC68HC05 CAN Module
AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development Kits
AN1224/D	Example Software Routines for the Message Data Link Controller Module on the MC68HC705V8
AN1296/D	Using the MCM69C232/MCM69C432 Content-Addressable Memory on an ATM Line Card
*AN1299/D	ATM Switch with Shared Memory – A Simple Model
AN1704/D	Switch Fabric Implementation Using Shared Memory
AN1726/D	Using Motorola's Fast Static RAM CAMs on a Media Independent Interface
AN1732/D	A Universal Serial Bus Gamepad Device using the MC68HC05JB2
*AN1758/D	Add Addressable Switches to the HC05
AR333/D	RF Modems Simplified
AR350/D	Adapt Non-ISDN Terminals to ISDN Data Rates
EB146/D	Neuron Chip Quadrature Input Function Interface
EB147/D	LonWorks Installation Overview
EB148/D	Enhanced Media Access Control with Echelon's LonTalk Protocol
EB149/D	Optimizing LonTalk Response Time
EB151/D	Scanning a Keypad with the Neuron Chip
EB152/D	How to Use SNVTs in LonWorks Applications
EB153/D	Driving a Seven Segment Display with the Neuron Chip
EB155/D	Analog to Digital Conversion with the Neuron Chip
EB157/D	Creating Applications with the LonBuilder Multi-Function I/O Kit
EB161/D	LonTalk Protocol
EB406/D	Getting Started with the FDDI ADS Board

Additional information relevant to Networking may be found in the following Motorola documents:

BDLCRM/AD	Byte Data Link Controller Reference Manual
BR480/D	Electronic Lamp Ballasts
BR1104/D	Motorola's FDDI Chip Set
BR1134/D	LonWorks Technology: the Smart Choice for Intelligent Distributed Control!
BR1137/D	The Motorola Explorer's Guide to the World of Embedded Control Solutions

Networking continued

BR1139/D	LonWorks Support Tools – Advance Information
BR1187/D	Motorola CAN – The Total Solution for CAN Microcontrollers
BR1188/D	LonWorks Networks for Industrial and Process Control
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1712/D	CopperGold ADSL Silicon Solutions
BR1729/D	MC92500 Asynchronous Transfer Mode Cell Processors
BR1731/D	Integrated Solutions for ATM Systems
BR3020/D	Remote Access: ISDN Solutions Kit
DL122/D	MECL Data
DL159/D	LonWorks Technology Device Data
LONUG/AD	LonBuilder User's Guide
MC68EN302RM/AD	MC68EN302 Integrated Multiprotocol Processor with Ethernet Reference Manual (Supplement to MC68302UM/AD)
MC68LC302RM/AD	MC68LC302 Low Power Integrated Multiprotocol Processor Reference Manual
MC68PM302RM/AD	Integrated Multiprotocol Processor with PCMCIA Interface Reference Manual
MC68302UM/AD	MC68302 Integrated Multiprotocol Processor User's Manual
MC68360UM/AD	MC68360 Quad Integrated Communications Controller User's Manual
MC68824UM/AD	MC68824 Token Bus Products User's Manual
MC68836UM/AD	MC68836 FDDI User's Manual
MC68837UM/AD	MC68837 FDDI User's Manual
MC68838UM/AD	MC68838 FDDI User's Manual
MC68839UM/AD	MC68839 FDDI System Interface User's Manual
MC68840UM/AD	MC68840 Integrated Fiber Distributed Data Interface User's Manual
MC68847UM/AD	MC68847 Quad ELM FDDI User's Manual
MC92500UM/D	ATM Cell Processor Design Reference Manual
* MC92501UM/D	MC92501 ATM Cell Processor User's Manual
MPC860UM/AD	MPC860 PowerQUICC User's Manual
QMCSUPPLEMENT/D	QUICC Multichannel Controller User's Manual Supplement
QMCSUPPLEMENT/AD	MC68MH360, MPC860MH and MPC860DH: A Supplement to the MC68360 and MPC860 User's Manuals
SG169/D	Mixed-Signal Solutions from Communication Transmission & Access Systems Division
SG175/D	Networking Systems Division and Personal Computing Division: Product Information

Optoelectronics and Displays

AN1238/D	HC05 MCU LED Drive Techniques Using the MC68HC705J1A
AN1743/D	Scrolling Message Software
AN1745/D	Interfacing the HC705C8A to an LCD Module
*AN1762/D	Automatic Contrast Control of LCD Displays Using the MC68HC708LN56 Microcontroller
*AN1763/D	Driving LCD Displays Using the MC68HC705L16 Microcontroller
*AN1774/D	Interfacing the MC68HC912B32 to an LCD Module
EB406/D	Getting Started with the FDDI ADS Board

Additional information relevant to Optoelectronics and Displays may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR1201/D	Global Optoisolators
BR1421/D	Solutions to your Custom Sensing Needs
BR1422/D	Power Opto Isolators
BR1480/D	Silicon Solutions for Off Line Motor Drives
BR1484/D	Energy-Efficient Semiconductor Solutions for the Appliance Industry
DL160/D	Display Products Device Data
MC68837UM/AD	MC68837 FDDI User's Manual
MC68847UM/AD	MC68847 Quad ELM FDDI User's Manual

Phase-Locked Loop

AN535/D	Phase-Locked Loop Design Fundamentals
AN1207/D	The MC145170 in Basic HF and VHF Oscillators
AN1253/D	An Improved PLL Design Method Without ω_n and ζ
AN1277/D	Offset Reference PLLs for Fine Resolution or Fast Hopping
AN1282/D	Board Strategies for Ensuring Optimum Frequency Synthesizer Performance
AN1509/D	ASIC Clock Distribution using a Phase-Locked Loop (PLL)
AN1579/D	Understanding the Multivibrator Based Crystal Oscillator Circuit Used on the BiCMOS MPC Family of Clock Drivers
*AN1671/D	MC145170 PSpice Modeling Kit

Additional information relevant to Phase-Locked Loop may be found in the following Motorola documents:

BR3006/D	Wireless Communications Resource Guide
DL122/D	MECL Data
MC145220EVK/D	MC145220 Evaluation Board Manual
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference

Power

Power Supplies & Voltage Regulators

AN920/D	Theory and Applications of the MC34063 and µA78S40 Switching Regulator Control Circuits
AN1257/D	Using the M68HC05 Family On-Chip Voltage Regulator
AN1327/D	Very Wide Input Voltage Range, Off-line Flyback Switching Power Supply
AN1520/D	HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications
AN1547/D	A DC to DC Converter for Notebook Computers Using HDTMOS and Synchronous Rectification
AN1593/D	Low Cost 1.0A Current Source for Battery Chargers
*AN1594/D	Critical Conduction Mode, Flyback Switching Power Supply Using the MC33364
AN1631/D	Using PSPICE to Analyze Performance of Power MOSFETs in Step-Down, Switching Regulators Employing Synchronous Rectification
*AN1669/D	MC44603 in a 110W Output SMPS Application (80-140Vrms and 180-280Vrms Mains Voltages)
*AN1677/D	Get Your Best From Your LDO Designs
*AN1679/D	How to Deal with Leakage Elements in FLYBACK Converters
*AN1680/D	Design Considerations for Clamping Networks for Very High Voltage Monolithic Off-line PWM Controllers
*AN1681/D	How to Keep a FLYBACK Switch Mode Supply Stable with a Critical-Mode Controller
AR181/D	Bipolar Transistors Excel in Off-Line Resonant Converters
AR326/D	High-Voltage MOSFETs Simplify Flyback Design
AR340/D	The Low Forward Voltage Schottky
AR514/D	Build Ultra-Low Dropout Regulator
AR523/D	An Overview of Surface Mount Technology (SMT) for Power Supply Applications
AR564/D	Dual 180V GaAs Schottky Diode Rectifies 10A/leg
AR607/D	Modular DC-DC Converter Sends Power Density Soaring
AR617/D	Next Generation Power MOSFETs Slash On-Resistance, Manufacturing Cost
AR619/D	Op Amp Supply Squeezed Down to 1V Rail-to-Rail
AR620/D	Quest for the Perfect Battery
EB142/D	The MOSFET Turn-Off Device – A New Circuit Building Block
EB206/D	Solving Noise Problems in High Power, High Frequency Control IC Driven Power Stages
EB207/D	High Current Buffer for Control ICs
EB208/D	Design Check List for MPIC21XX Control ICs

Additional information relevant to Power Supplies & Voltage Regulators may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1480/D	Silicon Solutions for Off Line Motor Drives
BR3003/D	Planet Earth is “On” – GreenLine
BR3006/D	Wireless Communications Resource Guide
BR3016/D	Motorola GaAs Rectifiers
DL111/D	Bipolar Power Transistor Data
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
DL151/D	Rectifier Device Data
DL202/D	IGBT – Insulated Gate Bipolar Transistor Device Data
PPDNEWS/D	Power Scene – Fall 1995
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG378/D	Linear Voltage Regulators

Power Device Characteristics

AN930/D	High Voltage, High Current, Non-Destructive FBSOA Testing
AN1526/D	RF Power Device Impedances: Practical Considerations

Power Device Characteristics continued

AN1541/D	Introduction to Insulated Gate Bipolar Transistors
AN1628/D	Understanding Power Transistors Breakdown Parameters
AN1631/D	Using PSPICE to Analyze Performance of Power MOSFETs in Step-Down, Switching Regulators Employing Synchronous Rectification
AR120/D	Speeding Up the Very High Voltage Transistor
AR179/D	RF Power Transistors Catapult into High-Power Systems
AR340/D	The Low Forward Voltage Schottky
AR345/D	Switches for High-Definition Displays
AR346/D	RF Power FETs: Their Characteristics and Applications
AR608/D	New Float-Zone Process Ups Switching Rate of IGBTs and Also Cuts Their Fabrication Cost
EB201/D	High Cell Density MOSFETs

Additional information relevant to Power Device Characteristics may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
CR100/D	Communications, Power and Signal Technologies Group: Through-Hole to Surface Mount Cross Reference
DL110/D	RF Device Data
DL111/D	Bipolar Power Transistor Data
DL135/D	TMOS Power MOSFET Transistor Data
DL150/D	TVS/Zener Device Data
DL151/D	Rectifier Device Data
HB214/D	Rectifier Applications Handbook
SG134/D	VARO to Motorola Rectifier Cross Reference
SG371/D	DPAK Surface Mount Selector Guide

Protection & Thermal Considerations

*AN1545/D	Thermal Data for MPC Clock Drivers
AN1570/D	Basic Semiconductor Thermal Measurement
*AN1680/D	Design Considerations for Clamping Networks for Very High Voltage Monolithic Off-line PWM Controllers
AN4005/D	Thermal Management and Mounting Method for the PLD 1.5 RF Power Surface Mount Package
AR450/D	Characterizing Overvoltage Transient Suppressors
AR510/D	VSWR Protection of Solid State RF Power Transistors
AR563/D	Active SCSI Terminators Confront Critics and Gain Acceptance
AR564/D	Dual 180V GaAs Schottky Diode Rectifies 10A/leg

Additional information relevant to Protection & Thermal Considerations may be found in the following Motorola documents:

BR1487/D	Thermal Modeling and Management of Discrete Surface Mount Packages
DL150/D	TVS/Zener Device Data
DL151/D	Rectifier Device Data
HB214/D	Rectifier Applications Handbook
SG370/D	Discrete & RF ICs Surface Mount Selector Guide

Pressure, Gas & Acceleration Sensors

AN935/D	Compensating for Nonlinearity in the MPX10 Series Pressure Transducer
AN936/D	Mounting Techniques, Lead Forming and Testing of Motorola's MPX Series Pressure Transducers
AN1082/D	Simple Design for a 4-20mA Transmitter Interface Using a Motorola Pressure Sensor
AN1097/D	Calibration-Free Pressure Sensor System
AN1100/D	Analog to Digital Converter Resolution Extension Using a Motorola Pressure Sensor
AN1105/D	A Digital Pressure Gauge Using the Motorola MPX700 Series Differential Pressure Sensor
AN1304/D	Integrated Sensor Simplifies Bar Graph Pressure Gauge
AN1305/D	An Evaluation System for Direct Interface of the MPX5100 Pressure Sensor with a Microprocessor
AN1307/D	A Simple Pressure Regulator Using Semiconductor Pressure Transducers
AN1309/D	Compensated Sensor Bar Graph Pressure Gauge

AN1315/D	An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to a Microprocessor
AN1316/D	Frequency Output Conversion for MPX2000 Series Pressure Sensors
AN1318/D	Interfacing Semiconductor Pressure Sensors to Microcomputers
AN1322/D	Applying Semiconductor Sensors to Bar Graph Pressure Gauges
AN1324/D	A Simple Sensor Interface Amplifier
AN1325/D	Amplifiers for Semiconductor Pressure Sensors
AN1326/D	Barometric Pressure Measurement Using Semiconductor Pressure Sensors
AN1513/D	Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure Sensors
AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor
AN1517/D	Pressure Switch Design with Semiconductor Pressure Sensors
AN1518/D	Using a Pulse Width Modulated Output with Semiconductor Pressure Sensors
*AN1525/D	The A-B-Cs of Signal-Conditioning Amplifier Design for Sensor Applications
AN1536/D	Digital Boat Speedometers
AN1551/D	Low-Pressure Sensing with the MPX2010 Pressure Sensor
AN1552/D	MPX7100AP: The Sensor at the Heart of Solid-State Altimeter Applications
AN1556/D	Designing Sensor Performance Specifications for MCU-based Systems
AN1557/D	A Cookbook Approach to Designing a Differential-Signal Amplifier for Sensor Applications
AN1559/D	Application Considerations for a Switched Capacitor Accelerometer
AN1571/D	Digital Blood Pressure Meter
AN1573/D	Understanding Pressure and Pressure Measurement
AN1583/D	Motorola's Next Generation Piston Fit Pressure Sensor Packages
AN1584/D	"Very Low Pressure" Smart Sensing Solution with Serial Communications Interface
AN1585/D	High-Performance, Dynamically-Compensated Smart Sensor System
AN1586/D	Designing a Homemade Digital Output for Analog Voltage Output Sensors
AN1611/D	Impact and Tilt Measurement Using Accelerometer
AN1612/D	Shock and Mute Pager Applications Using Accelerometer
AN1620/D	A Monolithic Integrated Solution for MAP Applications
AN1621/D	An Integrated Silicon Bulk Micromachined Barometric Pressure Sensor for Engine Control Unit and External Mount
AN1622/D	EMC Considerations for Automotive Sensors
AN1632/D	MMA1000P Product Overview and Interface Considerations
AN1635/D	Baseball Pitch Speedometer Featuring Motorola's 250g Accelerometers
AN1636/D	Implementing Auto Zero for Integrated Pressure Sensors
AN1638/D	Offset Calibration of Gauge Pressure Sensor Using Parallel I/O Ports
AN1640/D	Reducing Accelerometer Susceptibility to BCI
AN1645/D	Micromachined Electromechanical Sensors for Automotive Applications
AN1646/D	Noise Considerations for Integrated Pressure Sensors
*AN1651/D	ASB201 – Uncompensated Series Sensor Module
*AN1652/D	ASB202 – MPX2000 Series Sensor Module
*AN1653/D	ASB205 – MPX5000 Series Sensor Module
*AN1654/D	ASB210 – 10" H_2O Sensor Module
AN1655/D	ASB200 – Motorola Sensor Development Controller Board
AN1660/D	Compound Coefficient Pressure Sensor PSPICE Models
*AN1668/D	Washing Appliance Sensor Selection
*AN1754/D	Interfacing the MC68HC705J1A to the DS1620 Digital Thermometer
AN4004/D	±2g Acceleration Sensing Module Based on a ±40g Integrated Accelerometer
AR560/D	Simple Pressure Switches Comprise Transducers, Comparators and Op Amps

Additional information relevant to Pressure, Gas & Acceleration Sensors may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution

Pressure, Gas & Acceleration Sensors continued

BR1477/D	Sensor Products Division: Competitive Product Cross Reference
*BR1512/D	Sensor Device Information Matrix – Quarter 1, 1999
BR3005/D	Intelligent Sensor Solutions
BR3009/D	Senseon Intelligent Sensor Solutions
BR3012/D	Next Generation Packaging for SENSEON Pressure Sensors
BR3015/D	The SENSEON Family of Advanced Acceleration Sensors
BR3019/D	The SENSEON Chemical Sensor Family
DL200/D	Pressure Sensor Device Data
HB218/D	Senseon: Pressure Sensor Distributor Handbook
SG162/D	Sensor Products Division

Quality and Reliability

Information relevant to Quality and Reliability may be found in the following Motorola documents:

BR518/D	Reliability & Quality Handbook
BR1202/D	Motorola Quality System Review Guidelines
BR1427/D	PC Brochure
CMRQS/D	Microcontroller Technologies Group: Reliability and Quality Monitor Report – Quarter 2, 1997
MRQSY96/D	Microcontroller Technologies Group: Reliability and Quality – 1996 Annual Report

Radio Applications

AN495/D	RDS Decoding for an HC11-Controlled Radio
AN1207/D	The MC145170 in Basic HF and VHF Oscillators
AN1231/D	Plastic Ball Grid Array (PBGA)
AN1539/D	An IF Communication Circuit Tutorial
*AN1597/D	Longwave Radio Data Decoding Using an HC11 and an MC3371
*AN1599/D	Power Control with the MRFIC0913 GaAs Integrated Power Amplifier and MC33169 Support IC
*AN1610/D	Using Motorola's MRFIC1502 in Global Positioning System Receivers
*AN1670/D	60 watts, GSM 900MHz, LDMOS Two-Stage Amplifier
*AN1675/D	A Low Noise Amplifier with High IP3 for the 900MHz Band Using the MRF1057T1 Low Noise Transistor
*AN1676/D	A Cascade 2 Stage Low Noise Amplifier Using the MRF1047T1 Low Noise Transistor
AN-HK-02/H	Low Power FM Transmitter System MC2831A
AN-HK-07/H	A High Performance Manual-Tuned Receiver for Automotive Application Using Motorola ICs MC13021, MC13020 and MC13041
ANE416/D	MC68HC05B4 Radio Synthesizer
AR511/D	Biasing Solid State Amplifiers to Linear Operation
EB27A/D	Get 300 Watts PEP Linear Across 2 to 30MHz from this Push-Pull Amplifier

Additional information relevant to Radio Applications may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1467/D	Extend Your Scope in Wireless Systems – The New Hipercomm Generation
BR3006/D	Wireless Communications Resource Guide
HB219/D	Introduction to the Oncore ChipSet
SG46/D	RF Products Selector Guide
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG417/D	Semiconductor Products for Wireless Communications

RF

AN535/D	Phase-Locked Loop Design Fundamentals
AN779/D	Low-Distortion 1.6 to 30MHz SSB Driver Designs
AN1028/D	35/50 Watt Broadband (160-240MHz) Push-Pull TV Amplifier Band III
AN1526/D	RF Power Device Impedances: Practical Considerations
AN1539/D	An IF Communication Circuit Tutorial
AN1580/D	Mounting and Soldering Recommendations for the Motorola Power Flat Pack Package
*AN1599/D	Power Control with the MRFIC0913 GaAs Integrated Power Amplifier and MC33169 Support IC

AN1602/D	3.6V and 4.8V GSM/DCS1800 Dual Band PA Application with DECT Capability Using Standard Motorola RFICs
*AN1610/D	Using Motorola's MRFIC1502 in Global Positioning System Receivers
AN1617/D	Mounting Recommendations for Copper Tungsten Flanged Transistors
*AN1670/D	60 watts, GSM 900MHz, LDMOS Two-Stage Amplifier
*AN1673/D	Solder Reflow Mounting Method for the MRF286 and Similar Packages
*AN1675/D	A Low Noise Amplifier with High IP3 for the 900MHz Band Using the MRF1057T1 Low Noise Transistor
*AN1676/D	A Cascade 2 Stage Low Noise Amplifier Using the MRF1047T1 Low Noise Transistor
AR179/D	RF Power Transistors Catapult into High-Power Systems
AR305/D	Building Push-Pull, Multioctave, VHF Power Amplifiers
AR333/D	RF Modems Simplified
AR347/D	A Compact 1kW 2-50MHz Solid-State Linear Amplifier
AR510/D	VSWR Protection of Solid State RF Power Transistors
AR597/D	GaAs RF ICs Target 2.4GHz Frequency Band
AR606/D	PCS and RF Components
AR612/D	Plastic Packages Hold Power RF MOSFETs
AR614/D	Advantages of LDMOS in High Power Linear Amplification
EB27A/D	Get 300 Watts PEP Linear Across 2 to 30MHz from this Push-Pull Amplifier
EB90/D	Low-Cost VHF Amplifier Has Broadband Performance
EB93/D	60 Watt VHF Amplifier Uses Splitting/ Combining Techniques
EB107/D	Mounting Considerations for Motorola RF Power Modules
EB109/D	Low Cost UHF Device Gives Broadband Performance at 3.0 Watts Output
EB209/D	Mounting Method for RF Power Leadless Surface Mount Transistors

Additional information relevant to RF may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1429/D	Wideband Linear Amplifiers – CATV, CRT Drivers, General Purpose
BR1443/D	Communications – State-of-the-Art is Never Stationary
BR1444/D	Communications – 1994 Motorola Resource Guide
BR1467/D	Extend Your Scope in Wireless Systems – The New Hipercomm Generation
BR3006/D	Wireless Communications Resource Guide
BR3023/D	In Step With Your Success (RF Semiconductor Division)
DL110/D	RF Device Data
DL126/D	Small-Signal Transistors, FETs and Diodes Device Data
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
HB215/D	RF Application Reports
HB219/D	Introduction to the Oncore ChipSet
SG46/D	RF Products Selector Guide
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG370/D	Discrete & RF ICs Surface Mount Selector Guide
SG382/D	Motorola RF CATV Distribution Amplifiers
SG384/D	Motorola RF LDMOS Product Family
SG417/D	Semiconductor Products for Wireless Communications

Small Signal Transistors & Diodes

Information relevant to Small Signal Transistors & Diodes may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
CR100/D	Communications, Power and Signal Technologies Group: Through-Hole to Surface Mount Cross Reference
DL126/D	Small-Signal Transistors, FETs and Diodes Device Data
SG370/D	Discrete & RF ICs Surface Mount Selector Guide

Smart Card/Conditional Access

see also Microprocessors: 8-bit MPU/MCU

Information relevant to Smart Card/Conditional Access may be found in the following Motorola documents:

BR491/D	Smartcard Microcontroller Family: Setting the Standards
BR492/D	ISO Modules: Supplied by Motorola
BR1469/D	Growing to Meet Your Needs
BR1734/D	Smart Chip: The Smartcard brain at your Fingertips

Software & Programming

AN427/D	MC68HC11 EEPROM Error Correction Algorithms in C
AN499/D	Let the MC68HC705 Program Itself
AN974/D	MC68HC11 Floating-Point Package
AN1010/D	MC68HC11 EEPROM Programming from a Personal Computer
AN1060/D	MC68HC11 Bootstrap Mode
AN1064/D	Use of Stack Simplifies M68HC11 Programming
AN1200/D	Configuring the M68300 Family Time Processing Unit (TPU)
AN1215/D	PID Routines for MC68HC11K4 and MC68HC11N4 Microcontrollers
AN1218/D	HC05 to HC08 Optimization
AN1219/D	M68HC08 Integer Math Routines
AN1224/D	Example Software Routines for the Message Data Link Controller Module on the MC68HC705V8
AN1230/D	A Background Debugging Mode Driver Package for Modular Microcontrollers
AN1255/D	MC68F333 Flash EEPROM Programming Utilities
AN1262/D	Simple Real-Time Kernels for M68HC05 Microcontrollers
AN1263/D	Designing for Electromagnetic Compatibility with Single-Chip Microcontrollers
AN1264/D	JTAG Flash Memory Programmer
AN1280/D	Using and Extending D–Bug 12 Routines
AN1280A/D	Using the Callable Routines in D-Bug12
AN1283/D	Transporting M68HC11 Code to M68HC16 Devices
AN1284/D	Transporting M68HC11 Code to M68HC12 Devices
AN1287/D	MC68HC708LN56 LCD Utilities
AN1291/D	Avoiding Multiprocessing Paradoxes with the PowerPC 604 Microprocessor
*AN1667/D	Software SCI Implementation to the MISC Communication Protocol
AN1711/D	DMA08 Systems Compatibilities
AN1716/D	Using M68HC12 Indexed Indirect Addressing
AN1718/D	A Serial Bootloader for Reprogramming the MC68HC912B32 Flash EEPROM
AN1724/D	Implementing SCI Receive and Transmit Buffers in C
AN1732/D	A Universal Serial Bus Gamepad Device using the MC68HC05JB2
AN1738/D	Instruction Cycle Timing of MC68HC05JJ/JP Series Microcontrollers
AN1741/D	In-Circuit and Emulation Considerations for MC68HC05JJ/JP Series Microcontrollers
AN1742/D	Programming the 68HC705J1A In-Circuit
*AN1752/D	Data Structures for 8-bit Microcontrollers
*AN1772/D	Efficient Compilation of Bit-Exact Applications for DSP563xx
ANE425/D	Use of the MC68HC68T1 RTC with M6805 Microprocessors
*APR30/D	DSP56300 Assembly Code Development Using the Motorola Toolsets
*APR33/D	ROM Software Patching on the Motorola DSP56304
*APR35/D	Designing Motorola DSP56xxx Software for Nonrealtime Tests File I/O Using SIM56xxx and ADS56xxx
AR103/D	Compilation and Pascal on the New Microprocessors
AR362/D	Whipping Up Real-Time Designs – Programming Motorola's TPU
EB166/D	System Design Considerations: Converting from the MC68HC805B6 to the MC68HC705B16 Microcontroller
EB183/D	Erasing and Programming the FLASH EEPROM on the MC68HC912B32
*EB191/D	Programming EPROM and EEPROM on the M68HC11EVM
*EB252/D	MOVB, MOVW, PSHM, and PULM Syntax Differences on MC68HC16 Assemblers

*EB253/D	How to Use the Lookup and Interpolate Instruction on the CPU32
*EB263/D	How to Program Chip Selects on Modular Microcontrollers with a System Integration Module or a Single-Chip Integration Module
*EB264/D	Disabling All Interrupts on Power-On for MC683xx and MC68HC16 Devices Using the Single-Chip Integration Module or System Integration Module
*EB268/D	Starting and Stopping the Time Processor Clock Using the Background Debug Mode
*EB277/D	Coherency in the Time Processor Unit (TPU)
*EB287/D	C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0
*EB301/D	Programming EEPROM on the MC68HC811E2 During Program Execution
*EB306/D	Using Exercise 7 on the M68HC16Z1EVB and the Necessity of Word Alignment
*EB309/D	Using Exercise 8 on the MC68HC16Z1EVB
EB410/D	PASM05 to INTROL M68HC05 Assembler Conversion
EB419/D	ROMed HC11E32 and HC11PH8 Including Buffalo Monitor and PCbug11 Talker
EB422/D	Enhanced M68HC11 Bootstrap Mode
M68HC16PN01/D	Transporting M68HC11 Code to M68HC16 Devices
TPUPN00/D	Using the TPU Function Library and TPU Emulation Mode
TPUPN02/D	Fast Quadrature Decode TPU Function (FQD)
TPUPN03/D	Frequency Measurement TPU Function (FQM)
TPUPN04/D	Table Stepper Motor TPU Function (TSM)
TPUPN05/D	Multichannel PWM TPU Function (MCPWM)
TPUPN06/D	Programmable Time Accumulator TPU Function (PTA)
TPUPN07/D	Asynchronous Serial Interface TPU Function (UART)
TPUPN08/D	New Input Capture/Input Transition Counter TPU Function (NITC)
TPUPN09/D	Multiphase Motor Commutation TPU Function (COMM)
TPUPN10/D	Hall Effect Decode TPU Function (HALLD)
TPUPN11/D	Period/Pulse Width Accumulator TPU Function (PPWA)
TPUPN12/D	Output Compare TPU Function (OC)
TPUPN13/D	Stepper Motor TPU Function (SM)
TPUPN14/D	Position-Synchronised Pulse Generator (PSP)
TPUPN15A/D	Period Measurement with Additional Transition Detection TPU Function (PMA)
TPUPN15B/D	Period Measurement with Missing Transition Detection TPU Function (PMM)
TPUPN17/D	Pulse Width Modulation TPU Function (PWM)
TPUPN18/D	Discrete Input/Output TPU Function (DIO)
TPUPN19/D	Synchronized Pulse-Width Modulation (SPWM)
TPUPN20/D	Quadrature Decode TPU Function (QDEC)

Additional information relevant to Software & Programming may be found in the following Motorola documents:

BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR729/D	Embedded Systems Source, 1997
BR748/D	M68HC711D3PGMR Programmer Board
BR1111/D	M68HC705J2/P9PGMR Programmer Board
BR1113/D	M68HC705B5PGMR Programmer Board
BR1116/D	Advanced Microcontroller Division Literature Guide
BR1126/D	DSP96KCCx: DSP96002 C Cross Compiler Software Summary
BR1155/D	MPC500 Family: Software Development Tools
BR1165/D	MPC500 Family: RTEK Real-Time Embedded Kernel
BR1714/D	RTEK Real-Time Kernel for Motorola Microcontrollers
*CPU12RG/D	CPU12 Reference Guide
EMDVPOC/D	Embedded Developer Pocket Guide
M68HC08RG/AD	HC08 Family Reference Guide
M6809PM/AD	MC6809-MC6809E Microprocessor Programming Manual (1981)
M68000PM/AD	M68000 Family Programmer's Reference Manual

Software & Programming continued

M68000UM/AD	M68000 8-/16-/32-bit Microprocessors User's Manual, Ninth Edition
MC68HC11A8RG/AD	MC68HC11A8 Programming Reference Guide
MC68HC11C0RG/AD	MC68HC11C0 Programming Reference Guide
MC68HC11D3RG/AD	MC68HC11D3/MC68HC711D3 Programming Reference Guide
MC68HC11ERG/AD	MC68HC11E Programming Reference Guide
MC68HC11F1RG/AD	MC68HC11F1 Programming Reference Guide
MC68HC11K4RG/AD	MC68HC11K4/MC68HC711K4 Programming Reference Guide
MC68HC11KA4RG/AD	MC68HC11KA4/MC68HC711KA4 Programming Reference Guide
MC68HC11L6RG/AD	MC68HCL6/MC68HC711L6 Programming Reference Guide
MC68HC11MRG/AD	M68HC11 M Series Programming Reference Guide
MC68HC11NRG/AD	MC68HC11N Series Programming Reference Guide
MCUASM/D	MCUasm Assembly Language Development Toolset
MCUDEVTLDIR/D	Motorola Microcontroller Development Tools Directory
MPAA3UM/D	EasyAnalog Design Software User's Manual
MPCPRG/D	PowerPC Microprocessor Family: The Programmer's Reference Guide
PPCTOOLSFACT/D	PowerPC Development Tools
RCPURM/AD	MPC500 Family: RCPU Reference Manual
SG180/D	Microcontroller Technologies Group: Development Tools Selector Guide
SIURM/AD	MPC500 Family: System Integration Unit Reference Manual
TPURM/AD	M68300 Family Time Processor Unit Reference Manual

Telecommunications

see also Interfacing

AN948/D	Data Multiplexing Using the Universal Digital Loop Transceiver and the Data Set Interface
AN1054/D	ISDN System Development Using MC145490EVK/MC145491EVK Development Kits
AN1207/D	The MC145170 in Basic HF and VHF Oscillators
AN1231/D	Plastic Ball Grid Array (PBGA)
AN1241/D	Interfacing the MC68HC705J1A to 9356/ 9366 EEPROMs
AN1254/D	Using the MC68HC16Z1 for Audio Tone Generation
AN1274/D	HC08 SCI Operation with Various Input Clocks
AN1296/D	Using the MCM69C232/MCM69C432 Content-Addressable Memory on an ATM Line Card
*AN1299/D	ATM Switch with Shared Memory – A Simple Model
AN1574/D	A Group Listening-In Application for the MC33215
*AN1575/D	Worldwide Cordless Telephone Frequencies
AN1593/D	Low Cost 1.0A Current Source for Battery Chargers
*AN1599/D	Power Control with the MRFIC0913 GaAs Integrated Power Amplifier and MC33169 Support IC
AN1602/D	3.6V and 4.8V GSM/DCS1800 Dual Band PA Application with DECT Capability Using Standard Motorola RFICs
AN1603/D	Providing a POTS Phone in an ISDN or Similar Environment
AN1608/D	Guidlines for the Speaker in a Line-Powered Speakerphone
AN1612/D	Shock and Mute Pager Applications Using Accelerometer
*AN1670/D	60 watts, GSM 900MHz, LDMOS Two-Stage Amplifier
*AN1675/D	A Low Noise Amplifier with High IP3 for the 900MHz Band Using the MRF1057T1 Low Noise Transistor
AN1704/D	Switch Fabric Implementation Using Shared Memory
AN1724/D	Implementing SCI Receive and Transmit Buffers in C
AN1733/D	Implementing Caller ID Functionality in MC68HC(7)05 Applications
*AN1755/D	Interfacing the MC68HC705C8A to the DS2430A 256-bit 1-Wire EEPROM
*AN1771/D	Precision Sine-Wave Tone Synthesis Using 8-bit MCUs
*AN1772/D	Efficient Compilation of Bit-Exact Applications for DSP563xx
AN-HK-01/H	300 Baud Smart Modem with Intelligent MCU Controller

AN-HK-08/H	A Medium Scale PABX
AN-HK-12/H	MC68HC05F6 Tone Pulse Dialer
AN-HK-17/H	MC68HC05F2 DTMF Output Low Voltage Active Filter
APR1/D	Digital Sine-Wave Synthesis Using the DSP56001/DSP56002
APR9/D	Full-Duplex 32 kbit/s CCITT ADPCM Speech Coding on the Motorola DSP56001
APR12/D	Twin CODEC Expansion Board for the DSP56000 Application Development System
APR14/D	Conference Bridging in the Digital Telecomms Environment Using the Motorola DSP56000
*APR34/D	MC68328 Microprocessor Application: FLEX Alphanumeric Chip MC68175 Interface for One-Way Pager
*APR37/D	Implementing AC-link with ESAI
*APR39/D	Programming the DSP56307 Enhanced Filter Coprocessor (EFCOP)
*APR40/D	Implementing Viterbi Decoder Using the VSL Instruction on DSP Families DSP56300 and DSP56600
AR606/D	PCS and RF Components
AR619/D	Op Amp Supply Squeezed Down to 1V Rail-to-Rail
TPUPN07/D	Asynchronous Serial Interface TPU Function (UART)

Additional information relevant to Telecommunications may be found in the following Motorola documents:

BR348/D	The Worldwide Technical Training Course Reference Guide & Schedule: January-June 1998
BR470/D	Motorola Discretes – The Complete Solution
BR484/D	68302
BR488/D	68306 68307 68322
BR489/D	68360 Quad Integrated Communications Controller (QUICC)
BR1116/D	Advanced Microcontroller Division Literature Guide
BR1133/D	68K and ColdFire Family Product Portfolio Overview
BR1137/D	The Motorola Explorer's Guide to the World of Embedded Control Solutions
BR1193/D	Introducing the DSP56800 Family
BR1195/D	VeComp: Vector Communications Processors – Technology Overview
BR1196/D	CODEC. Plug In. WorldWide.
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1443/D	Communications – State-of-the-Art is Never Stationary
BR1444/D	Communications – 1994 Motorola Resource Guide
BR1467/D	Extend Your Scope in Wireless Systems – The New Hipercomm Generation
BR1491/D	TSOP-6
BR1702/D	Fast Static RAMS and The Communications Market
BR1712/D	CopperGold ADSL Silicon Solutions
BR1729/D	MC92500 Asynchronous Transfer Mode Cell Processors
BR1730/D	Qorus Video Conferencing: Where the Quality and Value are Clear to See
BR1731/D	Integrated Solutions for ATM Systems
BR1752/D	Qorus Development Kit: Get a Clear Picture of What Qorus Video Conferencing Technology Can Do
BR1753/D	Motorola Analog Modem Systems
BR1754/D	External/Embedded Modem Chip Set and Software
BR1755/D	ISA Controller-less Modem Chip Set and Software
BR1756/D	PCI Controller-less Modem Chip Set and Software
*BR1767/D	CopperGold Data Pump
BR3006/D	Wireless Communications Resource Guide
BR3020/D	Remote Access: ISDN Solutions Kit
CR100/D	Communications, Power and Signal Technologies Group: Through-Hole to Surface Mount Cross Reference
DL128/D	Analog/Interface Integrated Circuits (vol. 1 and 2)
DL160/D	Display Products Device Data
DSP56302UM/AD	DSP56302 User's Manual
DSP56303UM/AD	DSP56303 User's Manual
DSP56800WP1/D	Novel Digital Signal Processing Architecture with Microcontroller Features
HC05CT4GRS/D	MC68HC05CT4 General Release Specification
HC05PL4GRS/H	MC68HC05PL4A, MC68HC05PL4B, MC68HC705PL4B General Release Specification
HC705CT4GRS/D	MC68HC705CT4 General Release Specification
MRQSY96/D	Microcontroller Technologies Group: Reliability and Quality – 1996 Annual Report
MC68EN302RM/AD	MC68EN302 Integrated Multiprotocol Processor with Ethernet Reference Manual (Supplement to MC68302UM/AD)
MC68LC302RM/AD	MC68LC302 Low Power Integrated Multiprotocol Processor Reference Manual

Telecommunications continued

MC68PM302RM/AD	Integrated Multiprotocol Processor with PCMCIA Interface Reference Manual
MC68QH302SUPL/AD	MC68QH302: Supplement to the MC68302 Integrated Multiprotocol Processor User's Manual
MC68SC302UM/AD	MC68SC302 Passive ISDN Protocol Engine User's Manual
MC68302UM/AD	MC68302 Integrated Multiprotocol Processor User's Manual
MC68356UM/AD	MC68356 Signal Processing Communications Engine User's Manual
MC68360UM/AD	MC68360 Quad Integrated Communications Controller User's Manual
MC68605UM/AD	MC68605 X.25 Protocol Controller User's Manual
* MC92501UM/D	MC92501 ATM Cell Processor User's Manual
MPC821UM/AD	MPC821 PowerPC Portable Systems Microprocessor User's Manual
MPC860UM/AD	MPC860 PowerQUICC User's Manual
QMCSUPPLEMENT/D	QUICC Multichannel Controller User's Manual Supplement
QMCSUPPLEMENT/AD	MC68MH360, MPC860MH and MPC860DH: A Supplement to the MC68360 and MPC860 User's Manuals
SG46/D	RF Products Selector Guide
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
SG169/D	Mixed-Signal Solutions from Communication Transmission & Access Systems Division
SG171/D	Fast Static RAM Division Product Update
SG175/D	Networking Systems Division and Personal Computing Division: Product Information
SG182/D	Wireless Messaging Systems Solutions Device Selector Guide
* SG184/D	Wireless Infrastructure Systems Division: DSP Products
SG417/D	Semiconductor Products for Wireless Communications

Thyristors and Triacs

AN1516/D	Liquid Level Control Using a Motorola Pressure Sensor

Additional information relevant to Thyristors and Triacs may be found in the following Motorola documents:

BR1422/D	Power Opto Isolators
BR1484/D	Energy-Efficient Semiconductor Solutions for the Appliance Industry
DL137/D	Thyristor Device Data
HB214/D	Rectifier Applications Handbook
SG371/D	DPAK Surface Mount Selector Guide

TV and Video

AN492/D	A Video Display Board for CD-i Development
AN1028/D	35/50 Watt Broadband (160-240MHz) Push-Pull TV Amplifier Band III
AN1235/D	A Set Top Closed-Caption Decoder
AN1241/D	Interfacing the MC68HC705J1A to 9356/ 9366 EEPROMs
AN1548/D	Guidelines for Debugging the MC44011 Video Decoder
AN1730/D	Digital Amplification of an Analog Signal Using the MC68HC705J1A
* AN1755/D	Interfacing the MC68HC705C8A to the DS2430A 256-bit 1-Wire EEPROM
AR333/D	RF Modems Simplified
AR345/D	Switches for High-Definition Displays
EB411/D	A Digital Video Prototyping System

Additional information relevant to TV and Video may be found in the following Motorola documents:

BR470/D	Motorola Discretes – The Complete Solution
BR1305/D	Analog Integrated Circuits: New Product Calendar
BR1429/D	Wideband Linear Amplifiers – CATV, CRT Drivers, General Purpose
BR1730/D	Qorus Video Conferencing: Where the Quality and Value are Clear to See
BR1752/D	Qorus Development Kit: Get a Clear Picture of What Qorus Video Conferencing Technology Can Do
DL111/D	Bipolar Power Transistor Data
DL151/D	Rectifier Device Data
DSP56800WP1/D	Novel Digital Signal Processing Architecture with Microcontroller Features
HC05RC18GRS/D	MC68HC05RC9/MC68HC05RC18 General Release Specification
HC68VBIGRS/D	MC68HC68VBI General Release Specification
SG46/D	RF Products Selector Guide
SG96/D	Analog/Interface Integrated Circuits Selector Guide & Cross Reference
* SG184/D	Wireless Infrastructure Systems Division: DSP Products
SG382/D	Motorola RF CATV Distribution Amplifiers

All Products and Application Areas

BR101/D	Technical Literature and Information Catalog
BR380/D	SPS Bar Code Label Specifications
BR474/D	European Bar Code Specifications
BR481/D	Setting New Standards for Quality and Technical Excellence in Everything We Do
BR518/D	Reliability & Quality Handbook
BR925/D	Six Sigma Roadmap
BR1202/D	Motorola Quality System Review Guidelines
BR1306/D	CATS – Customer Analysis Tracking System
BR1410/D	MAP – Metric Awareness Program
BR1437/D	Multichip Module Solutions
BR1460/D	Combinational Technologies
BR1469/D	Growing to Meet Your Needs
BR1494/D	Semiconductor Sales and Product Training Solutions Self Study Guide
BR3021/D	IMAGINE Semiconductor Solutions
SG73/D	Master Selection Guide
SG379/D	North America Sales and Distribution Price List

Applications Documents
Abstracts

MC68HC11 EEPROM Error Correction Algorithms in C

A modified Hamming code is used to correct one-bit errors and detect two-bit errors in data blocks of up to 11 bits – avoiding the problem of erroneous correction of two-bit errors. The technique is implemented entirely in 'C', and additional functions are provided to program and read MC68HC11 EEPROM using the encoding/decoding algorithms.

Order by: AN427/D

128K byte Addressing with the M68HC11

The 64K byte direct addressing capability of the M68HC11 family is insufficient for some applications. This note describes two methods of memory paging – one software only, the other hardware plus software – that allow the MCU to address a 1Mbit EPROM (128K bytes) by manipulation of the address lines. The two methods illustrate the concept of paging and the inherent compromises; the technique may be expanded to other memory combinations. Includes full software listings.

Order by: AN432/D

Driving LCDs with M6805 Microprocessors

The MC68HC05L series of MCUs include circuitry for direct LCD drive. Other MCUs in the M6805 and M68HC05 families have a variety of I/O and display drive capabilities. This comprehensive note describes alternative LCD drive arrangements for applications with different numbers of backplanes and display drive capabilities, including software-based and display driver chip solutions. Circuits and software listings are provided. The techniques apply equally to other MCU families such as the M6801 and M68HC11.

Order by: AN442/D

An Introduction to the HC16 for HC11 Users

The HC16 provides a software upgrade path for HC11 users while providing full hardware compatibility with the asynchronous address and data buses used in Motorola's 32-bit MPUs. It is a highly modular family based on the CPU16 core, a true 16-bit design with an architecture that will be very familiar to HC11 users. However many of its features are new, and this document explains the differences that will be encountered by an experiences HC11 user moving to the HC16. It covers CPU architecture, software compatibility and HC16 hardware.

Order by: AN461/D

Software Driver Routines for the Motorola MC68HC05 CAN Module

The Controller Area Network (CAN) protocol describes a serial communications protocol for interrupt-driven, real-time control applications, primarily in the automotive sector. This note describes driver routines which provide an interface between application software in the MCU ROM and the CAN module. The routines allow for the initialisation of the module, the transmission of messages previously stored in RAM, and the automatic handling of received messages. They have been written to run on the MC68HC05X4 but can easily be adapted to run on any M68HC05 MCU supporting the CAN protocol.

Order by: AN464/D

Secure Remote Control using the 68HC05K1 and the 68HC05P3

This application note shows how the 68HC05K1 and the 68HC05P3 can be used together to form a multi-user secure remote-control system. Every time the single key

on the transmitter is pressed it sends an infrared signal to the receiver; in order to make the system secure against attempts to capture the signal and retransmit it later for unauthorised purposes, the transmitter transmits a different signal every transmission. The system is especially suitable for enabling or disabling car alarms and for operating car central locking. Includes software code for both MCUs.

Order by: AN465/D

A Minimum Evaluation System for the MC68331 and MC68332

The MC68331 and MC68332 are based on the 68000-compatible, CPU32 microprocessor core coupled with highly functional on-chip peripheral modules. This note describes the design of a minimum evaluation system based on either device. The system is intended to be a low cost method of evaluation and also to be a starting point for engineers wishing to implement a development interface for their own designs. The design takes advantage of Background Debug Mode (BDM), a new development feature implemented on CPU32-based microprocessors.

Order by: AN473/D

CPU16 and the Configurable Timer Module (CTM) in Engine Control

Special timer modules have been developed to simplify the task of controlling ever more complex engines within the constraints of ever tightening emissions regulations. The configurable timer module (CTM) was developed for automotive applications which require flexibility and high performance from an M68HC16 family MCU, plus the ability to be designed very quickly for a customer's specific requirements. This note describes the use of the CTM in a hypothetical engine management system, and provides demonstration code for the MC68HC16W1.

Order by: AN476/D

Simple A/D for MCUs without Built-In A/D Converters

Non-critical resistance measurement is often needed, for example in temperature, light, pressure and position measurements using devices where the sensor is a variable resistance. Such measurements can be made at minimal cost using existing MCUs if a simple analog-to-digital converter is added. This application note describes a method of measuring an unknown resistance with an M68HC05 family MCU that does not have a built-in A/D converter. Both the theoretical and the practical aspects of the method are covered. The MCU used in the example is the MC68HC705J2. Includes a software listing for a practical application.

Order by: AN477/D

Low Cost MPC601 EVM

Contains a detailed design for a low cost Evaluation Module (EVM) for the MPC601 PowerPC microprocessor. It includes a summary of the EVM features, a detailed description of the design with block diagrams and state diagrams, hardware schematics, listings for the PLDs, timing diagrams, memory map and PCB component layout.

Order by: AN486/D

A Video Display Board for CD-i Development

Aimed mainly at the consumer market, CD-i allows users to interact with high quality audio-visual presentations for entertainment, education or business. The worldwide CD-i standard – known as the Green Book – defines the system hardware, software and encoding methods. There are two CD-i video standards: MPEG ISO-11172, and the Green Book 'Base Case' standard which defines the minimum functionality required of a player. This note provides a discription, circuit diagrams and software listings for a Base Case Video board forming part of Motorola's CD-i Development System (MCDS). MCDS is a multi-board system based on the VME double-extended Eurocard specification.

Order by: AN492/D

RDS Decoding for an HC11-Controlled Radio

This note describes the RDS (Radio Data System) aspects of the HC11 radio controller described in AN494/D. RDS adds a digital data capability to the FM VHF transmissions on band II (87.5 to 108MHz), as defined in CENELEC EN 50067. This application can use EON (Enhanced Other Networks) to retune the radio when a traffic announcement is taking place on another frequency. Provides an overview of the RDS features, a description of the RDS software and the way that it handles incoming data, and a full listing of the RDS and date calculation software modules (the main radio control software is listed in AN494/D).

Order by: AN495/D

Let the MC68HC705 Program Itself

Programming the EPROM versions of Motorola's MCUs is normally achieved using an on-chip program stored in ROM; this program is executed in 'bootloader mode'. There are, however, occasions when it would be useful to custom program all or part of the EPROM in the normal user mode – to add program routines; to store serial numbers, calibration values or information about external equipment; or to remove test programs. This note describes the normal method of programming, presents hardware and software that allows the MCU to program itself, and discusses some ideas for enhancing the software. Includes full source code for the software described.

Order by: AN499/D

Phase-Locked Loop Design Fundamentals

The fundamental design concepts for phase-locked loops implemented with integrated circuits are outlined. The necessary equations required to evaluate the basic loop performance are given in conjunction with a brief design example.

Order by: AN535/D

A CMOS Keyboard Data Entry System for Bus Oriented Memory Systems

This note describes a keypad to binary data entry system for use with CMOS or NMOS memories, either in a mini-computer/microprocessor application or as a part of any logic system containing random access memory. Manual data entry using a keypad avoids the use of a binary format offering increased speed and accuracy of manual direct memory accessing.

Order by: AN759/D

Low-Distortion 1.6 to 30MHz SSB Driver Designs

A general discussion for broadband drivers and their requirements for linear operation. Design examples are given using Motorola plastic transistors and high-gain hybrid modules designed for operation in the 1.0 to 250MHz range. The amplifiers range in power gain from 25 to 55dB and are capable of driving power amplifiers to levels up to several hundred watts.

Order by: AN779/D

Self-Programming the MC68701 and the MC68701U4

The MC68701 and MC68701U4 are EPROM versions of the M6801 mictocomputer family. The MC68701 on-chip resources include a 2 kByte EPROM, a three-function timer, a serial communication interface (SCI), up to 29 parallel lines, 128 bytes of RAM and an oscillator. These resources give it extensive power and flexibility for ease of design. The enhanced features of the MC68701U4 include a 4 kByte EPROM, two input capture functions, three output compare functions, a counter alternate address and 192 bytes of RAM.

Order by: AN906A/D

Theory and Applications of the MC34063 and μA78S40 Switching Regulator Control Circuits

Rev 2

This paper describes in detail the principle of operation of the MC34063 and μA78S40 switching regulator subsystems. Several converter design examples and numerous applications circuits with test data are included.

Order by: AN920/D

High Voltage, High Current, Non-Destructive FBSOA Testing

This application note provides specifications for a test instrument which can be used to perform non-destructive testing of the Second Breakdown (SB) limits of the Forward Bias Safe Operating Area (FBSOA) curve. In addition this note illustrates typical SB portions of the FBSOA and temperature derating curves for various technologies.

Order by: AN930/D

Compensating for Nonlinearity in the MPX10 Series Pressure Transducer

This application note describes a technique to improve the linearity of Motorola's MPX10 series pressure transducers when they are interfaced to a microprocessor system. The linearization technique allows the user to obtain both high sensitivity and good linearity in a cost-effective system.

Order by: AN935/D

Mounting Techniques, Lead Forming and Testing of Motorola's MPX Series Pressure Transducers

This document discusses assembly and testing techniques for Motorola MPX series pressure sensors in the chip-carrier package. Several design ideas are offered for pressure sensing applications.

Order by: AN936/D

Data Multiplexing Using the Universal Digital Loop Transceiver and the Data Set Interface

This application note will describe the design of a short-haul multiplexer for asynchronous data at rates up to 9600 baud. The mux combines eight full-duplex data channels along with eight end-to-end RS–232 control signals onto a single pair of telephone wires for distances up to 2km.

Order by: AN948/D

MC68HC11 Floating-Point Package

While most MC68HC11 applications can be implemented using 16-bit integer precision, certain algorithms may be difficult or impossible without floating-point. This application note details an efficient floating-point package that includes basic trig functions and square root in addition to add, subtract, multiply and divide. It requires just over 2k bytes of memory, with only 10 bytes of page zero RAM in addition to stack RAM.

Order by: AN974/D

Using the Serial Peripheral Interface to Communicate Between Multiple Microcomputers

Communication between multiple processors can be difficult when different types are used. One solution is the SPI, an interface intended for communication between ICs on the same board. It can be implemented in software, allowing communication between two MCUs where one has SPI hardware and the other does not. Costly expansion buses and UARTs are eliminated. The scheme is illustrated with a temperature/time display circuit using an MC68HC05C4 and an MC68705R3.

Order by: AN991/D

CONFIG Register Issues Concerning the M68HC11 Family

The M68HC11 is the first MCU family to offer semi-permanent configuration options, by means of the CONFIG register. Users experienced some initial difficulties, due partly to problems with early mask sets, partly to a lack of understanding about this new function. The mask problems are now resolved; this note explains the early fault mechanisms, and presents important application guidlines to ensure proper operation.

Order by: AN997/D

MC68HC11 EEPROM Programming from a Personal Computer

Describes a simple and reliable method of programming the MC68HC11's internal EEPROM (or EEPROM connected to its external bus) by downloading data in Motorola S-record format from a standard personal computer (PC) fitted with a serial communications port. Includes BASIC program for the PC (to Program External EEPROM/RAM, Program Internal EEPROM, or Verify internal or External EEPROM/RAM) and the source listing of MC68HC11 code for downloading to RAM to receive S records.

Order by: AN1010/D

35/50 Watt Broadband (160-240MHz) Push-Pull TV Amplifier Band III

The main design aim for this broadband ultra-linear push-pull amplifier was to keep the design as simple as possible, in order to obtain the best performance from the two TPV375 transistors and to minimise the cost. A further target was to obtain the maximum gain by reducing input matching circuit losses. Includes circuit, background description, Smith charts and PCB layout.

Order by: AN1028/D

Designing for Electromagnetic Compatibility (EMC) with HCMOS Microcontrollers

As the operating speeds of the latest HCMOS devices increase, the MCU system designer must take more account of the electromagnetic compatibility (EMC) of the finished product. This discussion relates mainly to emission control, but most of the techniques also reduce electromagnetic susceptibility. Subjects include Legal Requirements, RFI

Problems, types of radiation, Supply Decoupling, Grounding Techniques and PCB Layouts. Incorporates an article reprint from EMC Technology describing an EMI/RFI diagnostic probe.

Order by: AN1050/D

Transmission Line Effects in PCB Applications

As rise and fall times become faster in order to achieve high operating speeds, transmission line effects on PCBs can be very significant, with the possibility of unpredictable behaviour. This note presents a guideline as to when to analyse, discusses the characteristics of different types of PCB trace, describes Lattice Diagram and Bergeron Plot analysis, and summarises termination methods. Includes 10 worked examples.

Order by: AN1051/D

ISDN System Development Using MC145490EVK/MC145491EVK Development Kits

An introduction to the design of an ISDN (Integrated Services Digital Network) Terminal Adapter based on the MC145490/91 Evaluation Kit. Overviews the board and the software required to implement its features. Provides a detailed description of each element of the system, plus example software written in a Pascal-like pseudo-code language. Includes an introduction to the ISDN concept and protocols.

Order by: AN1054/D

Selecting the Right Microcontroller Unit

Selecting the proper MCU for an application is one of the critical decisions which can control the success or failure of the project. There are numerous criteria to consider; many of them are presented here along with the thought processes guiding their selection. The reader should attach an appropriate grading scale before evaluating the total and making the correct decision.

Order by: AN1057/D

Reducing A/D Errors in Microcontroller Applications

The MCU with integrated Analogue to Digital Converter provides a highly cost-effective solution for many mixed analogue/digital applications. However, combining a wide bandwidth ADC system on the same die as a high-speed CPU can lead to noise problems in the analogue measurements. This comprehensive note lays down basic system guidelines for the design phase of an MCU-based product, to avoid ADC problems. Includes an examination of a real-world system.

Order by: AN1058/D

MC68HC11 Bootstrap Mode

The M68HC11 Bootstrap Mode allows a user program to be loaded into internal RAM through the Serial Communications Interface (SCI). In addition to operating normally, this program can do anything a factory test program can do since the protected control bits become accessible; Expanded Mode resources are available because the control bits can be changed by the bootstrap program. Although the basic concepts are simple, some subtle implications of this mode need careful consideration, both to avoid problems and to find useful applications. Includes commented listings for selected M68HC11 bootstrap ROMs.

Order by: AN1060/D

Using the QSPI for Analog Data Acquisition

Analogue to digital conversion is required in many MCU applications – it must be fast, accurate and inexpensive. While the MC68332 32-bit Integrated Microcontroller lacks direct A/D capability, an inexpensive solution is achieved using an external A/D Converter interfaced through the QSPI. The hardware and software examples described here use the MC145040 and MC145050 8 and 10-channel A/D converters. The discussion includes design methodology for maximum A/D throughput, simultaneous use of other peripherals with the QSPI and determination of overall system performance.

Order by: AN1062/D

Use of Stack Simplifies M68HC11 Programming

Architectural extensions to the M6800 family built in to the MC68HC11 allow easy manipulation of data on the stack. The CPU uses the stack for subroutine and interrupt return addresses. This note discusses two additional uses – the storage of local variables and subroutine parameter passing – that can simplify programming and debugging. It describes the basic operation of the MC68HC11 stack, the concept of local and global variables, subroutine parameter passing, and the use of the instruction set to achieve the additional uses. Includes example listings illustrating the techniques.

Order by: AN1064/D

Interfacing the MC68HC05C5 SIOP to an I^2C Peripheral

A standard MCU may not have all the peripherals required in a system on chip. The problem can be solved by interfacing the MCU to off-chip peripherals, ideally using a synchronous serial communication port. Unfortunately these peripherals may not have an interface that is compatible with Motorola's simple synchronous Serial I/O Port (SIOP). This note describes how the SIOP on the MC68HC05C5 can be interfaced to an I^2C peripheral, in this case the PCF8573 Clock/Timer. Includes circuit and software listings for a timer/calendar application that can interface with a terminal.

Order by: AN1066/D

Pulse Generation and Detection with Microcontroller Units

MCUs are often required to generate timed output pulses, and to detect and measure input pulses. Output pulses might strobe a display latch, transmit a code or meter an action in a process control system. Input pulses can range from microseconds to hours, and include detecting push-button closures, receiving codes or measuring engine rotation. This note describes various methods of generation and detection using several families of Motorola MCUs with differing timer structures. Includes program listings.

Order by: AN1067/D

Simple Design for a 4-20mA Transmitter Interface Using a Motorola Pressure Sensor

Pressure is an important parameter in many industrial applications such as air conditioning, liquid level sensing and flow control. The sensor is often located in a noisy environment and may be several hundred metres from its associated electronic system. If the signal is transmitted as a voltage it is susceptible to electromagnetic interference. If it is transmitted as a current, it is easier to recover at the receiver and is less affected by the length of the transmission line; this note describes a simple but high performance circuit.

Order by: AN1082/D

Clock Distribution Techniques for HDC Series Arrays

Clock distribution strategies have become increasingly important design issues especially when applied to high density, high performance CMOS processes. If not properly constructed, clock distribution networks may detract from on-chip and system level performance and contribute to unreliable operation and lower manufacturing yields. This is of particular concern for very large gate arrays with thousands of flip-flops and latches operating synchronously. A discussion of clock skew, its measurement, some design trade-offs, and skew-tolerant circuit design.

Order by: AN1095/D

Guidelines for Using the Mustang™ ATPG System

Testability must be considered early in the ASIC design cycle so that appropriate system and chip-level strategies can be adopted. One approach is Scan Design, which allows test generation to be automated with predictably high fault coverage. Motorola's Mustang Automatic Test Pattern Generation (ATPG) system supports a full-scan design methodology with design rules checking, fully automatic test generation, and fault simulation. In exchange for some constraints on the implementation of the design, this tool set assumes the burden of developing a comprehensive manufacturing test.

Order by: AN1096/D

Calibration-Free Pressure Sensor System

The MPX2000 Series of pressure transducers give an output signal proportional to applied pressure. They are available as both ported and unported assemblies for pressure, vacuum and differential measurement. By using the on-chip A/D converter of the MC68HC05B6 MCU, an accurate, reliable and versatile pressure measurement system can be designed which needs no external calibration.

Order by: AN1097/D

Test Methodology and Release Issues for HDC Series Gate Arrays

When designing a gate array a clear understanding is required of many test issues. Motorola recommends and supports structured design-for-test methodologies, especially scan ESSD (flop based) and LSSD (latch based) techniques. This note discusses the creation of test specifications meeting both the customer's needs and Motorola's manufacturing requirements, including test vector compliance with the tester hardware and software, test capability offered, and test vestor release flow.

Order by: AN1099/D

Analog to Digital Converter Resolution Extension Using a Motorola Pressure Sensor

Describes a method of obtaining more than 8 bits of resolution with an 8-bit A/D, when interfacing a Motorola pressure sensor to a microprocessor. The electronic design is relatively simple and uses standard components.

Order by: AN1100/D

A Digital Pressure Gauge Using the Motorola MPX700 Series Differential Pressure Sensor

This solid state digital pressure gauge is built with a Motorola MPX series pressure transducer, instrumentation amplifier and LCD display. Differential, gauge and vacuum readings from 0 to 100 p.s.i with a resolution of 1 p.s.i. can be made with the MPX700 sensor. Full scale readings down to 1 p.s.i. are possible with alternative MPX sensors and displays. Includes circuit diagram, parts list and calibration details.

Order by: AN1105/D

DRAM Interface to the MC88200 M Bus

Describes the design and operation of a 25 to 33.3MHz Dynamic RAM interface to the M Bus of the MC88200 Cache/Memory Management (CMMU). The memory interface is divided into two sub-systems; the CPU sub-system includes one MC88100 CPU and two MC88200 CMMUs, while the memory sub-system contains two non-interleaved 32-bit wide banks of SIMMs with byte parity and a DRAM controller. The DRAM controller is implemented with Programmable Array Logic (PAL), a gate array and discrete hardware. Assumes some knowledge of the M88000 family and DRAMs.

Order by: AN1125/D

Configuring the M68300 Family Time Processing Unit (TPU)

The TPU is a sophisticated embedded peripheral in the M68300 family of 32-bit MCUs handling the time-intensive tasks associated with embedded controllers with minimum processor intervention. Advanced functions incorporated in the TPU microcode may be executed through any of its 16 channels. Communication with the TPU is through dual-port RAM; a number of memory mapped registers must be configured initially, together with some channel parameters. This note discusses basic TPU operation, registers and parameters, with an example application and sample program.

Order by: AN1200/D

The MC145170 in Basic HF and VHF Oscillators

Rev 2

Frequency synthesisers such as the MC145170 use digital dividers which are typically under MCU control. Tuning in less than a millisecond can be achieved, and the device can generate many frequencies from a single reference source; the overall frequency capability ranges from a few Hertz to 185MHz. Typical applications include the carrier oscillator in transmitters, local oscillator in receivers, cellular phones, and multiple synchronised clocks in computers and other systems.

Order by: AN1207/D

The Motorola BurstRAM

Describes the operation of the MCM62486 32K x 9 Synchronous BurstRAM, designed to provide a high performance secondary cache for the Intel i486 microprocessor, and for future processors with burst protocol. Four of these devices can supply a 128 Kbyte direct-mapped bursting cache with parity support.

Order by: AN1209/D

A Protocol Specific Memory for Burstable Fast Cache Memory Applications

Cache memory design has evolved rapidly in recent years, taking full advantage of application-specific fast static RAMs that have become available. Faster processor clock rates, larger on-chip processor caches, larger and faster FSRAMs, more efficient processor bus protocols and more efficient DRAM interfaces have all contributed. This note presents an overview of developments, and describes the operation of a high density, very fast Synchronous SRAM with on-chip burst counter and interface logic for the i486 processor, which is currently under development.

Order by: AN1210/D

16-bit DSP Servo Control with the MC68HC16Z1

Microcontrollers have come a long way. Once reserved strictly for computer applications, they have steadily encroached on areas previously dominated by analogue technology; closed-loop control systems are among the most recent bastions to fall. This application note discusses digital filter implementation of Proportional, Integral, Differential (PID) control algorithms. The implementation takes advantage of the control-orientated digital signal processing capabilities of the M68HC16 MCU family.

Order by: AN1213/D

PID Routines for MC68HC11K4 and MC68HC11N4 Microcontrollers

PID (Proportional, Integral, Derivative) compensation is one of the most common forms of closed-loop control, and a growing application area for embedded microprocessors. This note provides two working examples of PID control-loop software. The first, written primarily in C, shows a PID algorithm in a straightforward way using floating-point maths. The second example implements a PID algorithm in assembly language. Both examples are complete and ready to run on a Motorola M68HC11EVS evaluation board.

Order by: AN1215/D

HC05 to HC08 Optimization

Rev 2

The HC08 Family is a performance extension to the HC05 Family of low cost MCUs. This application note describes the differences and advantages of the HC08 Family CPU (CPU08), including the new addressing modes, the many new instructions, and the performance improvements to existing instructions that result from the introduction of pipelining. Many examples are given to illustrate the use of the new instructions. Written for the engineering manager and design engineer, and assumes the reader has a background in MCU software and hardware design and is familiar with the HC05.

Order by: AN1218/D

M68HC08 Integer Math Routines

Rev 1

The M68HC08 MCU is a fully upward-compatible performance extension of the M68HC05 Family, and users familiar with the M68HC05 should find little difficulty implementing the M68HC08's architectural enhancements. The six integer math subroutines in this application note take advantage of one of the main CPU enhancements – stack relative addressing. Storage space for local variables needed by a subroutine can now be allocated on the stack when a routine is entered and released on exit. These integer math routines are implemented using only 10 bytes of global RAM space.

Order by: AN1219/D

Hamming Error Control Coding Techniques with the HC08 MCU

The MC68HC08 MCU is used here to illustrate the code development precess for error control coding (ECC) in a digital transmission system. A message frame consisting of a 4-bit data field with three parity bits will be encoded to allow the original four bits to be recovered, even if any single bit is corrupted during the transmission and reception processes. This process is based upon the class of linear

error-correcting codes called Hamming codes. The process of time diversity is also discussed as a means of controlling burst errors in a transmission system.

Order by: AN1221/D

Arithmetic Waveform Synthesis with the HC05/08 MCUs

Arithmetic Synthesis (AS) produces waveforms using an accumulated value that points to the next output time sample in a table (in contrast to direct digital synthesis where the “distance” between each sample in the table is constant). Given an accumulation constant predefined in memory a very precise waveform can be produced. This application note demonstrates the use of AS to create sinusoidal waveforms using an MCU. It is written for the HC08; although cycle execution time will be different, the program listing for the HC08 is also applicable to the HC05.

Order by: AN1222/D

A Zero Wait State Secondary Cache for Intel’s Pentium

In the next generation of desktop computers, first level (L1) on-chip cache memory hit rates will suffer as a result of users’ migration from DOS to Windows to Windows NT™. To keep chip size down, the CPU designer can only afford relatively small increases in L1 cache size. Second level (L2) cache must help to avoid time consuming DRAM accesses. This note explains some of the system level, electrical, and timing issues associated with the design of a zero wait state secondary cache for Intel’s Pentium, based on Motorola’s new families of 64Kx18 and 32Kx18 Fast SRAMs.

Order by: AN1223/D

Example Software Routines for the Message Data Link Controller Module on the MC68HC705V8

The Message Data Link Controller (MDLC) is a communication module designed for use with an automotive serial multiplex bus. It handles all communication duties, including message buffering, bus access and arbitration, and error detection. It interrupts the CPU only when a complete message has been received error-free or following a successful transmission. This note describes a basic set of MDLC driver routines for communicating on an SAE J1850-Class B bus using the MC68HC705V8 MCU. The methods also apply to any Motorola MC68HC05 or MC68HC08 microcontroller that contains the MDLC module.

Order by: AN1224/D

Use of the 68HC705C8A in Place of a 68HC705C8

Rev 4

The MC68HC705C8A is an enhanced version of the MC68HC705C8 and is designed as a drop-in replacement. This note describes the small differences between the two devices, including the new customer-requested features of the ‘A’ version. Includes an example of a 4 x 4 keypad implementation, with software listing.

Order by: AN1226/D

Using 9346 Series Serial EEPROMs with 6805 Series Microcontrollers

Serial EEPROMs have become an inexpensive way of maintaining small amounts of non-volatile data in MCU systems during power off. This note describes how M68HC05 Family microcontrollers can be used with 93x6 series serial EEPROMs made by a number of manufacturers; the series includes base numbers 9346, 9347, 9357, 9366, 9367, 32C101 and 33C102. Includes simple schematics, a list of commonly encountered problems, flow charts for the various functions, and source code listings for three different EEPROM algorithms.

Order by: AN1227/D

Interfacing the HC05 MCU to the MC145051 A/D Converter

Rev 1.1

The MC145051 is a ratiometric 10-bit A/D converter providing 11 analogue conversion channels with an internal sample and hold. External communication for the channel address and converted data is through a serial interface. This note describes the interface between the A/D converter and an M68HC05 family MCU – in this case the MC68HC705C8 – using the SPI; it includes a schematic, flow chart and software listing. It also describes how to interface the ADC to MCUs which do not have an SPI module, using a software driver to ‘bit bang’ a port of the MCU; an HC705K1, one of the smallest M68HC05 MCUs, is used as an example.

Order by: AN1228/D

A Background Debugging Mode Driver Package for Modular Microcontrollers

Motorola's 16 and 32-bit modular microcontrollers include an operating mode called Background Debugging Mode (BDM). When enabled, BDM allows an external host processor to control a target MCU and to access both memory and I/O devices through a simple serial interface. BDM is a useful feature for initial debugging of both hardware and software, and can also simplify production line testing and configuration. This note shows how to enable and control BDM using an IBM-compatible PC. Drivers and demonstration programs in C are included to allow the rapid implementation of a custom test fixture or debugging facility.

Order by: AN1230/D

Plastic Ball Grid Array (PBGA)

Rev 2

The Plastic Ball Grid Array (PBGA) package is the industry description of the package sometimes referred to as the Overmolded Pad Array Carrier (OMPAC). Developed by Motorola in the late 1980s for use in space-limited Motorola products such as radios, pagers and cellular telephones, it has grown in popularity and is now adopted by JEDEC and soon by EIAJ. This note provides general information about the package including mechanical data, and discusses its use with surface mount processes. Topics include Package Construction, Motherboard Layout, Surface Mount Assembly, Solder Joint Inspection, Rework and Repair, Solder Joint Reliability and Reliability Stress Tests.

Order by: AN1231/D

Thermal Performance of Plastic Ball Grid Array (PBGA) Packages for Next Generation FSRAM Devices

The use of the traditional Theta JA expression to describe the thermal performance of a Plastic Ball Grid Array (PBGA) package obscures its actual performance characteristics. Because the package is thermally closely coupled to its printed circuit board, its thermal performance is dominated by the temperature of the board. The performance is modelled here as the junction to board and junction to case thermal resistances. Practical measurements were taken on the 119 lead PBGA package on a variety of board types in natural and forced convection environments.

Order by: AN1232/D

Using M68HC16 Digital Signal Processing to Build an Audio Frequency Analyzer

The MC68HC16Z1 is a high performance 16-bit MCU whose CPU16 instruction set simplifies the use of digital signal processing (DSP) algorithms and makes it easy to implement low-bandwidth filter and control-oriented applications. This tutorial-style application note provides concrete hardware/software applications that are used in the design of an MCU-based Audio Frequency Analyzer using DSP algorithms. It assumes a basic knowledge of the MC68HC16Z1 hardware and the CPU16 instruction set.

Order by: AN1233/D

A Set Top Closed-Caption Decoder

Closed captioning is designed principally for the hearing impaired, but also has other applications such as enabling the TV service to be available in noisy environments and assisting the young and illiterate to learn to read. The inclusion of closed caption decoding circuitry is now compulsory in certain US TVs. The note describes the design of a set top decoder based on the MC144143 Closed Caption Decoder IC, including schematic, PCB artwork, component layout, parts list and a full description of its operation.

Order by: AN1235/D

Timing Performance of TPU I/O Hardware

Describes the timing relationships between the Time Processor Unit (TPU) I/O pins and the system clock used to drive the TPU. These relationships, rather than event scheduling software latencies, define actual hardware performance. A working example shows how an output pulse from one TPU pin can be triggered by an input edge applied to another pin with no software overhead.

Order by: AN1236/D

HC05 MCU LED Drive Techniques Using the MC68HC705J1A

The MC68HC705J1A has four I/O pins rated to sink 10mA, compared to the 1.6mA of the normal HCMOS I/O pins. This note describes how to use these pins to drive an LED directly, without the need for an external amplifying transistor. The calculations used to determine the value of the current

limiting resistor is valid for any HC05 MCU port pin regardless of the pin's output low current rating – only the current specification need be changed in the equations.

Order by: AN1238/D

HC05 MCU Keypad Decoding Techniques Using the MC68HC705J1A

A matrix keypad allows a designer to implement a large number of inputs with a small number of port pins. The note demonstrates the use of a matrix keypad with M68HC05 J- and K-series MCUs, including wake-up from STOP mode. The code is divided into a main routine handling STOP mode and interrupt servicing, and two subroutines handling the keypad decode and debouncing. The MC68HC705J1A is used in the example – in common with several other Motorola MCUs it has built-in pulldown resistors required by the keypad.

Order by: AN1239/D

HC05 MCU Software-Driven Asynchronous Serial Communication Techniques Using the MC68HC705J1A

The Serial Communication Interface (SCI) is available in many Motorola MCUs, and provides full-duplex, UART communication between the MCU and other devices. It handles all transmission and reception duties and can detect error conditions such as framing errors, noise and overrun. Low cost, low pin count MCUs such as the MC68HC705J1A do not include an SCI. To perform serial communication a software routine must drive I/O port pins to emulate an SCI. This note describes such a routine, which includes noise and framing error detection, in an interface application between the MCU and the MC145407 RS232-C Transmitter/Receiver.

Order by: AN1240/D

Interfacing the MC68HC705J1A to 9356/ 9366 EEPROMs

The 9356 and 9366 EEPROMs are an industry standard widely used to store non-volatile information in applications such as security systems, telephones, consumer electronics and test equipment. This note describes an interface between the 9356/66 and an MC68HC705J1A MCU. Communication between the MCU and the EEPROM is via a serial interface – since the MC68HC705J1A does not have a serial interface a software driver is used to program an I/O port. With some modification this software will work with other configurations in the 93xx series. Includes schematic, flowchart and program listing.

Order by: AN1241/D

Output Loading Effects on Fast Static RAMS

As Fast SRAM access times decrease, so do output transition times. With faster rise and fall times come additional problems associated with output and signal path impedances. In any system running at frequencies where the propagation delay of a signal path is greater than one half the total transition time, transmission line effects will be seen on the signal. This results in overshoot and undershoot at the load end of a conductor which can cause problems both in testing and in actual use. This note discusses the factors contributing to these effects and the measures that can be used to predict or eliminate them.

Order by: AN1243/D

Brushed DC Motor Control Using the MC68HC16Z1

The MC68HC16Z1 is a 16-bit high performance MCU incorporating a number of on-chip modules. One such module is the General Purpose Timer, which provides several timing functions including Pulse Width Modulation (PWM). This note describes a DC motor control system based on the PWM function. The design monitors the motor speed as a function of shaft rotation period and changes the PWM output duty cycle to maintain constant speed. The interface between the MC68HC16Z1 and the motor is through the DEVB103 board described in AN1300/ D (Interfacing Microcomputer to Fractional Horsepower Motors). Includes schematic, flow charts and program listing.

Order by: AN1249/D

An Improved PLL Design Method Without ω_n and ζ

Rev 1

A design guide for PLL synthesisers used in wireless products, focusing on compact, low current and low cost synthesisers. Natural frequency and damping are not used in the calculations. A simple measurement of charge pump spurious current at the reference frequency has been developed and will be included on future data sheets – the

note presents formulae relating the spurious current at a reference frequency to other frequencies. Other topics include PLL-related limitations on receiver and transmitter performance; optimal loop filter component values; and circuit and charge pump design compromises. Includes a worked and tested example.

Order by: AN1253/D

Using the MC68HC16Z1 for Audio Tone Generation

In many applications a microcontroller is required to generate audio frequency tones. These may be simple square waves or complex waveforms for computer-generated music. The advantages of using a microcontroller are that hardware costs can be reduced elsewhere as the MCU already exists in the product, and that software offers a very flexible solution. This note examines software techniques for generating an arbitrary waveform, and explains how to generate DTMF tones for use on the telephone network.

Order by: AN1254/D

MC68F333 Flash EEPROM Programming Utilities

Rev 1

The MC68F333 MCU is a member of the M68300 modular microcontroller family. Two of its modules are flash EEPROM modules (FLASH), one of 16 kbytes, the other 48 kbytes. This note describes software utilities to program and erase the FLASH modules in the MC68F333 – they may be modified and used with other members of the M68300 family containing flash EEPROM. The utilities are drivers for the CPU32 background debugger program BD32 – this allows a simple PC interface to be supported without excessive increase in code size, and enables the MCU to be programmed using only an external programming voltage source.

Order by: AN1255/D

Interfacing the HC05 MCU to a Multichannel Digital-to-Analog Converter using the MC68HC705C8A and the MC68HC705J1A

The MAX528/MAX529 (529) digital-to-analog converter by Maxim is an 8-bit, 8-channel DAC with programmable output buffers and a serial interface. This note describes an interface between the 529 and the MC68HC705C8A MCU that uses the serial peripheral interface (SPI). It also demonstrates a software I/O driver that can be used by HC05 family MCUs that do not have an SPI (in this case the MC68HC705J1A). Includes circuits, flowcharts and assembly code listings.

Order by: AN1256/D

Using the M68HC05 Family On-Chip Voltage Regulator

The MC68HC705V8 and MC68HC05V7 MCUs are manufactured with a combination of Ultra High Voltage CMOS and bipolar analog technologies, and include an on-chip 5V voltage regulator. This is optimised for operation over the nominal 8-16V automotive range, but will also cope with jump-start and severe transient situations. This note provides an overview of the voltage regulator architecture and describes the external components and software required for correct operation. Includes a circuit example, PCB layout considerations to minimize EMI problems, and software flowcharts for handling initialization and standby mode.

Order by: AN1257/D

System Design and Layout Techniques for Noise Reduction in MCU-Based Systems

Electromagnetic interference (EMI) issues are becoming more of a problem for system designers as semiconductors generally become faster, more integrated and often noisier. However most EMI problems can be avoided in advance by using an appropriate system design approach coupled with proper PCB layout. This note focuses on proven practical layout techniques to control EMI on MCU-based mixed-signal systems. Topics include a brief overview of EMI, general lout guidelines, and a noise reduction checklist.

Order by: AN1259/D

Use of 32K x 36 FSRAM in Non-Parity Applications

The MCM69F536 and MCM69P536 are synchronous Fast Static BurstRAMs organized as 32K words of 36 bits. The JEDEC standard pin assignment for synchronous SRAMs defines the corner I/O pins of the 100-pin QFP/TQFP package as either parity I/O or no-connect. The MCM69F536,

MCM69P536 and future x36 BurstRAMs can be used in non-parity applications by making one of two design choices, which are described here.

Order by: AN1261/D

Simple Real-Time Kernels for M68HC05 Microcontrollers

A kernel is similar to an operating system in that it offers very fast software development and allows new modules to be added without interfering with existing modules. A real-time kernel is easy to debug, and encourages the user to develop software in an organized manner. This note demonstrates the operation of two different types of simple real-time kernel for the M68HC05 family of MCUs – a priority-based kernel and a time-based kernel. Assembly source code is provided for each.

Order by: AN1262/D

Designing for Electromagnetic Compatibility with Single-Chip Microcontrollers

Almost every consumer, automotive and industrial application today contains an MCU. MCU producers are under constant pressure to reduce manufacturing costs, and one way of doing this is to reduce the geometries of the on-chip transistors and gates. As the gate size is reduced the transition time decreases and fast edges on signals produce harmonics which can cause emission problems if amplified. Also, devices with faster transition times can react to fast incoming signals. This note discusses the design of single-chip microcontroller applications taking Electromagnetic Compatibility (EMC) into account, including 'defensive programming'.

Order by: AN1263/D

JTAG Flash Memory Programmer

During manufacture of embedded processor systems there is no firmware in the on-board memory. Masking software into ROM during device fabrication is generally expensive and restricts new software releases. A more flexible approach is for the system manufacturer to upload the software during production, typically using the built-in serial debug interface in the case of the MC683xx, MPC5xx and MCF52xx families. An alternative which is often overlooked is the JTAG interface, considered by many manufacturers as mandatory, and therefore more generally available. This note describes a JTAG Flash EPROM programmer designed to run on an IBM compatible PC.

Order by: AN1264/D

Configuring the MPC2604GA Integrated L2 Cache with the MPC106

Rev 9

Adding L2 cache to a system is one of the easiest ways to significantly increase the performance. It is fast becoming a requirement for all computers, especially for RISC architectures such as the PowerPC. The optimum cache is not really possible at reasonable cost, but good design can achieve a close approximation. The MPC2604GA is an integrated secondary cache for PowerPC-based designs and is the fastest L2 cache available for the PowerPC 60x bus. Integration of logic, tag and data on the same silicon allows it respond to a read hit with a 2-1-1-1 burst at 66MHz, with subsequent bursts as fast as 1-1-1-1. This short note explains how to configure it.

Order by: AN1265/D

PowerPC 603 Hardware Interrupt Latency in Embedded Applications

The PowerPC 603 is a RISC design achieving a high level of performance using instruction pipelining and a superscalar architecture. In addition to branch folding, two instructions may complete in a single cycle, and as many as five instructions may execute simultaneously. This parallelism complicates how quickly the processor can service external interrupts. This note examines the 603's instruction flow, interrupt recognition method and latency factors. It demonstrates that instruction-caused exceptions do not affect the latency response of most embedded applications, suggests ways that designers can minimize latency, and describes how to use the decrementer exception to measure it.

Order by: AN1267/D

PowerPC Microprocessor Clock Modes

The PowerPC microprocessors offer numerous clocking options to allow the designer to use low speed, low cost memory with low cost processors; low speed memory systems isolated from high speed processor cores and internal cache; high performance memory systems with maximum processor and cache frequencies; or embedded

systems with unusual bus speeds. This note describes operation of the internal phase-locked loop and discusses how to set up particular frequencies.

Order by: AN1269/D

PowerPC 60x Microprocessor to AD1848 CODEC Interface

This note describes how to interface the Analog Devices AD1848 SoundPort Stereo CODEC to the PowerPC 60x local bus. The AD1848 integrates key audio data conversion and control functions onto a single integrated circuit, and is intended to provide a complete single-chip audio solution for audio and multimedia applications. It provides a direct and near-glueless interface to the Industry Standard Architecture (ISA) AT bus – however there are a number of market areas in which non-ISA based systems are required, and this PowerPC design is a possible solution in these areas.

Order by: AN1271/D

Spreadsheet Estimation of CPU-DRAM Subsystem Power Consumption

Energy efficiency of computers is becoming increasingly important to consumers, and it is therefore vital to obtain an accurate estimate of system power consumption early in the design phase. This note describes the use of a Microsoft® Excel 4.0 spreadsheet – referred to as DRAMP – which is available via the World Wide Web. DRAMP supports the 601, 603 and 604 microprocessors, and calculates both the total energy consumed and the average power dissipation for a wide range of operating conditions. Useful system information is generated as a byproduct of the calculation.

Order by: AN1272/D

HC08 SCI Operation with Various Input Clocks

Describes the operation of the Serial Communication Interface if the MC68HC708XL36 with Clock Generation Module A (CGMA). Specifically the information provides an analysis of the effects of the input clock on the SCI baud rate. SCI communication in various hardware applications is also examined (equal and unequal input clock frequencies), as well as code segments and listings.

Order by: AN1274/D

Offset Reference PLLs for Fine Resolution or Fast Hopping

Frequency synthesis using two PLLs with reference frequencies offset from each other can provide much finer resolution or faster hopping than a single loop, and dual PLL ICs such as the MC145220 are available to make compact low-current synthesizers. This note discusses the technique and provides design equations, worked examples and a summary of design tradeoffs. Alternative techniques are described and their performance compared to the dual PLL method.

Order by: AN1277/D

Using and Extending D–Bug 12 Routines

One of the simplest and most economical environments for developing and debugging microcontroller software is a monitor/debugger program residing in ROM and executing in the target environment. This note provides information to allow software developers to utilize internal D-Bug12 routines and shows how to substitute user interrupt service routines for default D-Bug12 exception handlers. It provides six example listings, and source code is available on-line.

Order by: AN1280/D

Using the Callable Routines in D-Bug12

All microcontrollers need some form of operating environment for the development and debugging of user software. One of the least expensive is a monitor/debugger program executing in the target environment. A ROM monitor can provide access to many internal utility routines and exception handlers that would otherwise have to be written by the developer. This note provides complete descriptions of the D-Bug12 user-callable utility functions, and details of how to use them. In addition it shows how to substitute user interrupt service routines for D-Bug12's default exception handlers.

Order by: AN1280A/D

MPC505 Interrupts

The MPC505 interrupt controller receives interrupt requests from multiple interrupt sources and generates a single interrupt signal to the RCPU. This application note describes

the function of the interrupt controller and related interrupt registers, and also provides example initialization and handler routines.

Order by: AN1281/D

Board Strategies for Ensuring Optimum Frequency Synthesizer Performance

Microcontroller-based applications can be delayed or jeopardized by poor phase locked loop (PLL) performance. This may be due to the design of the circuit board. This note describes common problems and suggests key practices to avoid PLL problems and performance degradation. Factors considered include board leakage, capacitor charactaristics, phase noise from the reference signal, reference spurs and board noise.Discussion centers on the MPC505/MPC509 PLL.

Order by: AN1282/D

Transporting M68HC11 Code to M68HC16 Devices

Devices in the M68HC16 MCU family are built from standard modules that interface via a common internal bus – modularity allows the rapid development of devices tailored to specific applications. The standard CPU in the M68HC16 Family is the 16-bit CPU16 module, and both its programming model and instruction set are designed to be compatible with the M68HC11 CPU. M68HC11 applications can be ported to the CPU16 with only moderate effort, however because the CPU16 has additional capabilities the functions of certain instructions have been modified or replaced. This note compares the capabilities of the two processors, provides information on differences in their instructions sets, and discusses cases that need special attention.

Order by: AN1283/D

Transporting M68HC11 Code to M68HC12 Devices

The CPU12 is generally a proper superset of the M68HC11 CPU. Significant chnages have been made to improve the efficiency and capabilities of the CPU without sacrificing compatibility with the popular M68HC11 Family. Every M68HC11 instruction mnemonic and source code statement can be assembled directly with a CPU12 assembler. However it is inevitable that some primary objectives could not be achieved without some differences in the object code. This note provides information that will allow the large number of programmers familiar with the M68HC11 to evaluate moving from an M68HC11 system to an MC68HC12 system.

Order by: AN1284/D

Stepper Motor Control with an MC68HC11E9 Microcontroller

Provides basic design and implementation information for the construction of a stepper motor system – the controller used here is the MC68HC11E9. A general description of the system is given, together with a step-by-step hardware assembly section which is included to simplify practical construction. Includes a listing of basic software, suitable for modification to support a variety of control applications.

Order by: AN1285/D

MC68HC05C0 Bus Structure Design

Explains the basics of designing a system with the MC68HC05C0 – a ROM-less, expanded bus MCU. The document begins by providing answers to frequently asked questions from designers accustomed to working with single-chip MCUs, such as “What can the Chip Selects do?” and “How do I minimize Stop Mode current?”. The rest of the application note presents two example schematics illustrating the use of multiplexed and non-multiplexed modes, plus the source code for an MC68HC05C0 to 27C256 interface test program.

Order by: AN1286/D

MC68HC708LN56 LCD Utilities

Describes a set of software utilities to bring functionality to the LCD module of the MC68HC708LN56 MCU. Includes information about some LCD software subroutines that – with minimal effort – can be called to write text to the display. All of this information can be used as a basis for the development of more complex graphics subroutines. The note provides a dsecription of each subroutine, together with code listings and flow charts.

Order by: AN1287/D

Programming the MC68HC(8)05K3's Personality EEPROM on the MMDS and MMEVS

Motorola's MMDS and MMEVS development systems enable designers to emulate members of the M68HC05 Family of MCUs. Host software provides access to the on-chip registers and peripherals of the emulated MCU. However the design of some HC05 peripherals does not allow them to be accessed directly; an example is the Personality EEPROM (PEEPROM) of the MC68HC(8)05K3 MCUs, whose data can only be accessed serially. Currently the only means of programming the PEEPROM – apart from user application software – is to use a standalone programmer. This note discusses the design and implementation of a DOS software utility that allows the PEEPROM to be programmed via an MMDS or MMEVS.

Order by: AN1288/D

DSP5630x FSRAM Module Interfacing

As the complexity of executable code increases, some DSP-based applications demand higher and higher execution speed. To accommodate these requirements Motorola has developed the 24-bit DSP56300 family and a number of support chips to provide cost-effective, high-performance solutions. The DSP56300 core incorporates a versatile memory interface providing glueless connection to a variety of memory types such as DRAMs, SRAMs and SSRAMs. This note describes several options for interfacing different asynchronous Fast Static RAM modules to the DSP5630x family.

Order by: AN1289/D

Avoiding Multiprocessing Paradoxes with the PowerPC 604 Microprocessor

This document describes three paradoxes that may occur infrequently in a multiprocessing implementation using the PowerPC 604 microprocessor, and how they can be avoided: the lwarx/stwcx. instructions may allow a kill bus operation without modifying the cache block; an lwarx reservation set bus operation may be broadcast without a valid cache entry; and a write-with-kill bus operation may cause a loss of memory coherency.

Order by: AN1291/D

Adding a Voice User Interface to M68HC05 Applications

As embedded MCU-based products become more sophisticated, more emphasis is being placed on their user interfaces. Visual interfaces can be controlled directly by the MCU without additional components. Voice-based user interfaces, on the other hand, are often implemented with speech synthesizers, speech processors, sound generators and DSPs operating in conjunction with the main processor. This note discusses the addition of a voice-based interface to an application based on the MC68HC(7)05J1A MCU, and highlights the use of members of the Information Storage Devices (ISD) 1000 and 2500 family of voice record/playback devices. It presents the design for an audible thermometer.

Order by: AN1292/D

Multiprocessor Systems and the PowerPC 603e Microprocessor

This note describes some of the issues that need to be taken into accout by the systems designer when implementing a multiprocessor system using the 603e or PowerPC 603 processors. Although these processors do not generally provide the hardware support for multiprocessor systems that is available on the PowerPC 604, many of the hardware mechanisms of the 604 that allow efficient multiprocessor operation can in fact be provided by operating system software routines. This document discusses the 603e attributes that require operating system support in multiprocessor systems.

Order by: AN1294/D

Demonstration Model of fuzzyTECH Implementation on M68HC12

The MC68HC12 MCU was introduced in mid-1996 as an upgrade to the M68HC11, one of the most widely used MCUs in the world. It is the first standard MCU to include a complete fuzzy logic instruction set, and this note presents a demonstration model illustrating its use. Inform Software Corp and Motorola have created the fuzzyTECH MCU-68HC12 Edition, which supports both the M68HC12's fuzzy logic instruction set and its background debug mode. The demonstration model here is an autonomously guided tank, and this note discusses its fuzzy logic controller design and the fuzzyTECH implementation on the M68HC12 MCU.

Order by: AN1295/D

Using the MCM69C232/MCM69C432 Content-Addressable Memory on an ATM Line Card

Rev 1

Because of their connection-based protocol, Asynchronous Transfer Mode (ATM) switches must translate each cell's address at every point along the routing path. The speed at which the address information can be translated is a function of several variables including line speed, number of lines connected and the speed of other circuitry on the card. Different approaches are used, of which Content-Addressable Memory (CAM) is the best. Motorola's introduction of the high-capacity, lower-cost MCM69C232 and MCM69C432 CAMs now makes the CAM method a cost-effective option.

Order by: AN1296/D

Variations in the Motorola MC68HC(7)05Cx Family

There are many variations in the devices in Motorola's MC68HC05 C Family of 8-bit microcontrollers, and this note clarifies the important differences. It is particularly useful for designers familiar with one member of the Family who wish to move to another. Topics include Similarities, Comparisons, MC68HC705C9A and MC68HC705C12A, Changing from non-A to A Versions, Changing from OTP to ROM Versions, Changing from the 705C8A to the 705C9A, Voltage Frequency and Temperature Tables, and Development Tools.

Order by: AN1298/D

ATM Switch with Shared Memory – A Simple Model

Asynchronous Transfer Mode (ATM) telecommunications are the mainstay of communication systems today, transmitting data with high throughput across large networks by the high speed transfer of small data payloads. This note uses an airport analogy as a model to explain the features and operation of an ATM switch based on Motorola's NetRAM memory.

Order by: AN1299/D

Integrated Sensor Simplifies Bar Graph Pressure Gauge

Rev 1

Integrated semiconductor sensors such as the MPX5100 greatly simplify electronic measurement of pressure. Their linear 0.5V to 4.5V outputs are designed to interface directly with MCU A/D inputs. They can also be used with devices such as the LM3914 Bar Graph IC to create a simple Bar Graph Pressure Gauge. This note describes the operation and calibration of the DEVB129 evaluation board, which has an on-board LED bar graph display and is designed to operate on an unregulated +12V supply.

Order by: AN1304/D

An Evaluation System for Direct Interface of the MPX5100 Pressure Sensor with a Microprocessor

Rev 1

Recent design advances in pressure sensor technology now allow the direct interface of a pressure sensor to a microprocessor with on-chip A/D converter. This has been made possible by integrating a temperature compensated pressure sensor element and active linear circuitry on the same die. The DEVB114 evaluation board described here shows how simple the interface can be. Includes, circuit, parts list and source/assembly code for an MC68HC705B5.

Order by: AN1305/D

A Simple Pressure Regulator Using Semiconductor Pressure Transducers

Rev 1

Semiconductor pressure transducers offer an economical means of achieving high reliability and performance in pressure sensing applications. The completely integrated MPX5100 (0-15p.s.i.) series provides a temperature compensated, high-level linear output suitable for interfacing directly with many linear control systems. This circuit illustrates how the MPX5100 can be used with a simple pressure feedback system based on the MC33033 Brushless Motor Controller to establish pressure regulation. Includes circuit diagram and PCB artwork.

Order by: AN1307/D

Compensated Sensor Bar Graph Pressure Gauge

Rev 1

Compensated semiconductor-based pressure sensors such as Motorola's MPX2000 family are relatively easy to interface with digital systems. Using the circuit described here, pressure is translated into a 0.5 to 4.5 volt output range that is directly compatible with MCU A/D inputs. This range is also suitable for the LM3914 Bar Graph Display Driver. This note provides information on the use and operation of the DEVB147 evaluation board.

Order by: AN1309/D

An Evaluation System Interfacing the MPX2000 Series Pressure Sensors to a Microprocessor

Outputs from compensated and calibrated pressure sensors such as Motorola's MPX2000 series are easily amplified and interfaced to a microprocessor. This application is based on the DEVB158 evaluation board which implements a simple analogue interface. The sensor output is amplified using a quad operational amplifier. No potentiometers are used to adjust the span and offset – these adjustments are made in software, the offset voltage being computed empirically each time power is applied to the system, and the result stored in RAM.

Order by: AN1315/D

Frequency Output Conversion for MPX2000 Series Pressure Sensors

Rev 1

Sensing remotely and/or in noisy environments is particularly challenging for low-level (mV) voltage output sensors such as the MPX2000 Series pressure sensors. But converting the MPX2000 output to frequency is relatively easy to accomplish, and provides the noise immunity required for accurate sensing. The DEVB160 evaluation board presented here is an excellent tool either for "stand-alone" evaluation of the MPX2000 Series or as a building block for system prototyping. The output of the DEVB160 circuit is ideally conditioned for interfacing to MCU timer inputs that can measure the sensor frequency.

Order by: AN1316/D

Interfacing Semiconductor Pressure Sensors to Microcomputers

Rev 1

The output voltage for Motorola's piezoresistive pressure sensors is generally 25 to 50mV full scale. Interfacing to a microcomputer, therefore, involves amplifying the relatively small output voltage, performing a differential to single-ended conversion, and scaling the signal into an appropriate range for A/D conversion. Alternately, it can be converted to a frequency modulated 5V waveform or 4-20mA current loop, either of which is relatively immune to noise on long interconnect lines. Sensing amplifiers, analogue to digital conversion, frequency modulation and 4-20mA current loops are considered.

Order by: AN1318/D

Brushless DC Motor Drive Incorporates Small Outline Integrated Circuit Packaged MOSFETs

Product miniaturization demands smaller components, including semiconductors. Surface mount components now include power MOSFETs in SOIC (Small Outline Integrated Circuit) surface mount packages. In particular the MMDF2C05E, an S0-16 packaged complementary half-bridge, is relatively easy to implement into a motor drive system. This application note describes a brushless DC motor drive design similar in size to those found in hard disk drives. The evaluation board DEVB156 resulted from the design; it is partitioned into control, power, feedback and motor sections.

Order by: AN1321/D

Applying Semiconductor Sensors to Bar Graph Pressure Gauges

Bar graph displays are particularly useful in process monitoring applications where quick communication of a relative value may be more important than providing specific data – they quickly convey a sense of how much of something is present. Designing bar graph pressure gauges based on semiconductor sensors is relatively straightforward, and can make use of bar graph display drive ICs, microcomputers and MC33161 voltage monitors. Design examples of all three types are given here, with consideration of the trade-offs.

Order by: AN1322/D

A Simple Sensor Interface Amplifier

Rev 1

Compensated semiconductor pressure sensors such as the MPX2000 family are relatively easy to interface to digital systems. With these sensors and the circuitry described here, pressure is translated into a 0.5 to 4.5V signal that is directly compatible with MCU A/D inputs. This simple circuit is implemented in the DEVB173 development board. It consists of one dual op amp and a few resistors, and can accept MPX2010, MPX2050, MPX2100, MPX2200 and MPX2700 sensors to cover different pressure ranges.

Order by: AN1324/D

Amplifiers for Semiconductor Pressure Sensors

Rev 2

Amplifiers interfacing semiconductor pressure sensors to electronic systems have typically been based upon classic instrumentation amplifier designs – well understood standard building blocks that also work reasonably well. But other circuits can do a better job of interfacing pressure sensors to today's mostly digital systems. This note presents an evolution of amplifier designs, beginning with a classic instrumentation amplifier and ending with a simpler circuit that is better suited to sensor interfacing.

Order by: AN1325/D

Barometric Pressure Measurement Using Semiconductor Pressure Sensors

The digital barometer system described here is an excellent example of a sensing system using solid state components and software to measure barometric pressure accurately. The system serves as a foundation from which more complex systems can be developed. It is based on an MPX2100A series device, and also uses an M68HC11 MCU to convert the output of the signal conditioning circuit to a digital value, convert this measurement to inches of mercury, and output the data serially to an MC145453 LCD interface. The software is listed and is also available from the Motorola bulletin board.

Order by: AN1326/D

Very Wide Input Voltage Range, Off-line Flyback Switching Power Supply

One of the problems for power supply designers is coping with the very wide input voltage range presented by the international marketplace. Forward mode switching power supplies operate typically over a single system's range, such as 90-130V AC or 200-270V AC. Creating products for specific markets or using jumpers can be costly or at least inconvenient. This design for a discontinuous mode flyback converter can operate over a 6.6:1 input voltage range without affecting its reliability. This is done by changing its mode of operation and by using new power MOSFETs with breakdown voltage ratings of 1200V.

Order by: AN1327/D

MC10/100H00 Translator Family I/O SPICE Modelling Kit

The difficulties of designing high-speed, controlled-impedance PC boards – and the expense of reworking them – makes it essential for designers to model circuit performance prior to committing to a layout. This note provides sufficient information for basic SPICE analysis on the interconnect traces driving or being driven by the 'H600, 'H601, 'H602, 'H603, 'H604, 'H605, 'H606 and 'H607 translator chips. It includes schematics of the input, output and ESD structures, and package models which may affect the waveforms. A SPICE parameter set for the referenced devices is provided.

Order by: AN1402/D

FACT I/O Model Kit

This note provides SPICE information to allow users to perform system level interconnect modelling for the Motorola FACT™ logic family. It contains representative circuit schematics of the different I/O structures and a worst case package model schematic used in the FACT family. A list of SPICE parameters for the referenced transistors is included. (The information is not intended for the purpose of extensive device modelling).

Order by: AN1403/D

Designing with PECL (ECL at +5.0V)

Positive Emitter Coupled Logic (PECL) provides a high speed solution for the CMOS/TTL designer. The technique involves standard ECL devices running of a positive power supply. ECL, and so PECL, has long been the 'black magic' of the logic world; by breaking down the miscon-

ceptions concerning its use, CMOS and TTL designers can gain a powerful solution to the most difficult of high speed problems. This note has the details.

Order by: AN1406/D

IEEE Std. 1149.1 Boundary Scan for H4C Arrays

This note describes how IEEE standard boundary scan – commonly referred to as 'JTAG' – has been implemented on Motorola's H4C family of sub-micron CMOS gate arrays. It assumes a working knowledge of the JTAG boundary scan principles. Sections discuss the macros added to the H4C library to facilitate designing JTAG circuitry into an H4C array, the distribution of the JTAG clock and control signals, and the addition of boundary scan to a chip whose system logic has been designed using conventional scan techniques. Includes a worked example and a description of the CAD design flows.

Order by: AN1500/D

Embedded RAM BIST

Motorola's HDC and H4C gate array families offer many metalised RAM macros in a wide variety of sizes and types. But it is difficult to create a test for embedded RAM – the result of access problems, the need for independent RAM tests, and the high complexity of established tests. This note discusses the problems including failure modes, methodologies and test overhead. Emphasis is placed on Built-In Self Test (BIST) – the customer's responsibility for memories over 2K – and presents a recommended implementation.

Order by: AN1502/D

High Frequency Design Techniques and Guidelines for Bipolar Gate Arrays

Until recently, system clock rates have rarely exceeded 600MHz; ECL gate arrays can easily meet their requirements. Now optical fibre transmission systems have created a need for very high speed (1 to 10 Gb/s) multiplexers, demultiplexers and line drivers. Such digital circuits operating over 1 GHz have typically been implemented as custom circuits using semicustom gate arrays to achieve lowest development cost and shortest design cycle. Bipolar process improvements now make it possible to operate ECL gate arrays efficiently up to 2.5GHz. This note discusses design techniques and guidelines for high frequency digital bipolar gate arrays.

Order by: AN1508/D

ASIC Clock Distribution using a Phase-Locked Loop (PLL)

Transferring data between ASIC chips at frequencies above 40MHz requires special on-chip circuitry. Phase-locked loops can provide skew management to help compensate for clock tree insertion delays, and for process, temperature and voltage variations. This note is written to help designers of multi-chip ASIC systems maximize their system performance by properly managing clock distribution and by optimizing clock skew and data path relationships. It contains equations relating measurable timing and skew parameters to maximum operating frequencies, and explains techniques to minimize critical parameters that contribute to clock skew.

Order by: AN1509/D

TestPAS Primer

This application note introduces the new user to Motorola's OACS 2.12/2.13 Test Pattern Analysis System – TestPAS™. When defining an ASIC for manufacture by Motorola, the designer must specify a design netlist containing instances of macrocells, and a set of test vectors that will be used to verify operation of the parts. This note covers ATE concepts, defines the test requirements needed to release an option to Motorola, and discusses the actual execution of the TestPAS tools.

Order by: AN1512/D

Mounting Techniques and Plumbing Options of Motorola's MPX Series Pressure Sensors

Rev 1

Motorola offers a wide variety of ported pressure sensing devices incorporating a hose barb and mounting tabs. This application note provides some recommendations on types of fasteners for mounting and how to use them with Motorola sensors. It also recommends a variety of hoses and hose clamps, and includes a review of recommended

mounting hardware, mounting torque specifications, hose applications and hose clamps. Includes a list of (US) suppliers of these parts.

Order by: AN1513/D

H4CPlus Series 3.3V/5V Design Considerations

The H4CPlus Series technology provides the ability to implement designs with one of two possible core voltages in combination with all-3V, all-5V or mixed 3V/5V systems. This note discusses design considerations, power bus macro selection, propagation delays and I/O rules. It assumes a working knowledge of the Motorola OACS Design Tools.

Order by: AN1514/D

Liquid Level Control Using a Motorola Pressure Sensor

Rev 1

This circuit provides a complete, low cost solution for the direct control of liquid level using a pump or solenoid valve. It is based on an MPX2000 series temperature compensated pressure sensor, and an MOC2A60 power opto isolator. Both devices are described, and a practical example is given which includes the theory and a full schematic. As well as being a practical circuit this application may be used to evaluate the two principal devices.

Order by: AN1516/D

Pressure Switch Design with Semiconductor Pressure Sensors

Rev 1

This pressure switch design uses a comparator to provide a logic level output by comparing the output of a Motorola pressure sensor with a reference voltage. After an introduction to the sensor and amplifier sections of the circuit, the application note is concerned mainly with a discussion of the important comparator section, presenting circuits based on different op amp types and evaluating their performance in terms of switching speed and voltage levels. Includes a window comparator design.

Order by: AN1517/D

Using a Pulse Width Modulated Output with Semiconductor Pressure Sensors

A Frequency Modulated (FM) or Pulse Width Modulated (PWM) output is better than an analogue voltage for remote sensing applications in noisy environments. This note discusses a simple PWM circuit for use with the MPX5100 pressure sensor that generates a signal with a duty cycle proportional to applied pressure. It is intended for use with a microcontroller, which generates the pulse train to drive the circuit's ramp generator – the use of the same timebase to both generate and measure the PWM signal gives a stable and accurate result. Since the PWM output calibration is controlled by software any component tolerances can be compensated.

Order by: AN1518/D

HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications

The new HDTMOS technology combines VLSI techniques with the ruggedness of vertical power structures to obtain increased cell density and to provide devices with lower overall on-resistance. The reverse recovery characteristic of the parasitic body diode is also faster than in MOSFETs that use conventional technologies. This note examines the advantages of using HDTMOS transistors as synchronous rectifiers in a high power buck converter, and in a 5V DC to 3.3V DC buck converter, in order to increase circuit performance and efficiency while minimising parts count.

Order by: AN1520/D

High-Performance CMOS Interfaces for the H4CPlus Series Gate Arrays

High speed bus and point-to-point interfaces between CMOS ASICs are no longer limited to conventional CMOS-level signals. Data rates over 500 Mb/s have been demonstrated with low voltage interfaces. Motorola's H4CPlus Series CMOS gate arrays accommodate off-chip differential and single-ended signalling in a transmission line environment for a variety of interfaces at supply voltages of 5.0 and 3.3 volts. This note presents CMTL, GTL, PECL and LVDS interfaces as implemented in the H4CPlus Series, discussing transmission line concepts, termination techniques, voltage requirements and circuit requirements.

Order by: AN1521/D

Analog Phase-Locked Loop for H4CPlus and M5C Series Arrays

Rev 1

Describes the implementation and use of an Analogue Phase-Locked Loop (APLL) which is available on the H4CPlus and M5C Series CMOS gate array families. Sections discuss the diferent versions of the APLL offered as different library macros; performance data and signal descriptions; physical placement on the arrays; the APLL Verilog simulation model; and Motorola's test strategy for arrays containing an APLL. An appendix shows the built-in test circuitry with a table of operating modes.

Order by: AN1522/D

The A-B-Cs of Signal-Conditioning Amplifier Design for Sensor Applications

There are many pressure sensor applications where the flexibility of a custom designed signal conditioning circuit is beneficial, despite the availability of fully conditioned, calibrated and temperature compensated sensor ICs. The signal conditioning circuits described here are applicable to low-level, differential voltage output sensors in general, but the emphasis is on interfacing pressure sensors to amplifier circuits. Includes a general description of the two operational amplifier circuit, plus theoretical analysis.

Order by: AN1525/D

RF Power Device Impedances: Practical Considerations

Many first-time RF power designers assume that small-signal techniques are also applicable to bipolar Class C and Class AB power amplifier design. In fact, higher power gain and better efficiency are achieved if the output is purposely mismatched. The note defines large-signal series equivalent input and output device impedances for RF power transistors, together with the techniques for measuring them. It examines how these parameters change under varying load and bias conditions, and demonstrates the impact of the variations in a practical broadband test fixture design.

Order by: AN1526/D

Design Considerations of Plastic Ball Grid Arrays for CMOS Gate Arrays

Several Ball Grid Array (BGA) packages are available for a variety of semiconductor products. Ceramic pad array packages have been in use for more than 20 years, and more recently Motorola has extended its pad array carrier technology by, among other things, adding solderballs to form substrate connection points. This application note provides information on characteristics, usage, attachment and PC board designs for the OMPAC (Over-Molded Pad Array Carrier), which is also known as the Plastic Ball Grid Array (PGBA) package. Much of the information applies to all BGAs, but specific attention is given here to plastic packages for CMOS ASICs.

Order by: AN1534/D

Digital Boat Speedometers

This boat speedometer design is based on an MPX2200GP silicon pressure sensor, analog signal-conditioning circuitry, an M69HC11-family MCU and a liquid crystal display. The sensing system converts water head pressure to boat speed, and has a range of 5 to 45 m.p.h. Motorola's silicon pressure sensors use a single piezoresistive element coupled to on-chip temperature compensation circuitry, ensuring simpler designs and improved performance and reliability. Includes a full description, circuit diagrams and program listing for the MC68HC711E9.

Order by: AN1536/D

An IF Communication Circuit Tutorial

A tutorial on the use of IF communication integrated circuits, based on the ISM band channel and the Motorola MC13156. Examines the device's topology and discusses the classical parameters critical to the proper operation of a typical RF device – impedance matching the mixer, selecting the quad tank and filters, plus bit error rate testing for digital applications. The reader should end up with a better understanding of IF communications basics, and be able to specify the support components required.

Order by: AN1539/D

Introduction to Insulated Gate Bipolar Transistors

The ideal switch for use in power conversion applications would have zero voltage drop in the ON state, infinite resistance in the OFF state, would switch with infinite

speed and not need any power to make it operate. In practice, the designer must make a compromise and choose a device that suits the application with minimal loss of efficiency. Combining the low conduction losses of a BJT with the switching speed of a power MOSFET would create an optimal solid state switch. The Insulated Gate Bipolar Transistor (IGBT) offers a combination of these attributes. This note explains how it is made, how it works, and how it compares with BJTs and power MOSFETs.

Order by: AN1541/D

Electronic Lamp Ballast Design

Although the light output of a fluorescent tube has a discontinuous spectrum, the higher efficiency brought about by electronic control makes it the best choice for energy-saving lighting systems. Until recently the lack of reliable and efficient power transistors made the design of electronic ballasts difficult – now there are transistors designed specifically for lighting applications. This comprehensive application note discusses the design criteria for electronic ballast design, including safety circuits and power factor correction, and presents demonstration circuits for a full featured electronic ballast and for a dimmable version.

Order by: AN1543/D

Thermal Data for MPC Clock Drivers

The Motorola Timing Solutions products are offered in a variety of plastic surface mount packages, with most of the newer products being introduced in SOIC and TQFP. The packages were selected to give the optimum combination of performance, physical size and thermal handling in a low cost standard package. This note provides general information on thermal and related reliability issues with respect to the MPC family of clock drivers. In addition, it presents methods of estimating their power dissipation and junction temperatures.

Order by: AN1545/D

High Voltage, High Side Driver for Electronic Lamp Ballast Applications

Electronic ballasts continue to displace their core and coil predecessors, with increasing emphasis on cost reduction, lower parts count and simpler designs. Motorola's MPIC2151 Self Oscillating Half-Bridge Driver was developed to simplify electronic ballast designs, and uses MOS gated output switches in a half-bridge configuration. Its floating channel high-side driver is designed for bootstrap operation in applications with a positive rail up to 600V, and a low-side driver is also included. This note presents a lamp ballast design based on the MPIC2151, including circuit, parts list and PCB layout.

Order by: AN1546/D

A DC to DC Converter for Notebook Computers Using HDTMOS and Synchronous Rectification

A prime issue for low output voltage power supplies is power loss in the power semiconductors. This is especially true for notebook computers which need High Cell Density TMOS (HDTMOS) – the latest technology – to meet their high efficiency PSU requirements. Logic supplies are currently standardizing on 3.3V, forcing power supply designers to look at devices other than junction diodes for rectification. Low on-resistance power MOSFETs using HDTMOS technology can overcome the problems of poor performance, low PIV and slow reverse recovery times. This note discusses the theory and practice of a 5V to 3.3V, 4A DC to DC converter with up to 92% efficiency.

Order by: AN1547/D

Guidelines for Debugging the MC44011 Video Decoder

The implementation of the MC44011 Multistandard Video Decoder is normally quite simple as there are no critical components or external adjustments. However the device contains several interrelated functions and a substantial amount of programmability, so that debugging an improperly working circuit can be daunting. This note provides a procedure for debugging and checking the operation of the MC44011, and an indication of the signals to expect at some of the pins.

Order by: AN1548/D

Low-Pressure Sensing with the MPX2010 Pressure Sensor

Low-cost semiconductor pressure sensors are typically designed to measure full-scale pressures down to 10kPa (1.5 psi or around 1000mm of water) with reasonable accuracy. But some applications, such as heating and ventilating (HVAC) and washing machines, may need to measure full-scale pressure as low as 40mm of water. This 'smart sensing' system demonstrates a method of sensing full-scale pressures below 250mm of water with

1% full-scale resolution and 2% full-scale accuracy. An MCU is used for signal averaging, software calibration and software-based power supply rejection.

Order by: AN1551/D

MPX7100AP: The Sensor at the Heart of Solid-State Altimeter Applications

This system demonstrates how the MPX7100AP pressure sensor can be used for altimeter applications. This simple design serves as a building block from which other more sophisticated systems can be developed. The MPX7100AP is the low-power version of the established MPX2100AP, having an input impedance around five times greater and offering benefits for battery powered applications (such as the altimeter). The simplicity and low cost of this design is possible because of the integration of temperature compensation, calibration and signal conditioning circuitry onto the sensor chip, coupled with the decreasing cost of MCUs for embedded applications.

Order by: AN1552/D

Minimizing Skew Across Multiple Clock Trees in Gate Arrays

As gate array designs become larger and more complex there is a growing need for internal scan testing. It is desirable to use a single clock when testing, but most array designs use multiple clocks during normal operation and this presents the problem of balancing all the clocks when in scan mode in order to achieve minimum overall skew. This note describes a solution.

Order by: AN1553/D

SRAM Built-in Self Test

Built-in Self Test (BIST) uses on-chip test circuitry to test memories and other devices automatically and efficiently for various types of fault. In the case of SRAM, BIST provides a number of advantages including reduced test cycle time, high test coverage and lower test equipment costs. Motorola ASIC has developed two SRAM BIST implementations, offering either 100% fault detection with the penalty of greater circuit complexity and high gate count, or adequate fault coverage with minimum complexity and low gate count. This cpmprehensive note is intended to provide a general understanding of the capabilities of the two implementations.

Order by: AN1554/D

Designing Sensor Performance Specifications for MCU-based Systems

Using fixed-value components in the design of a sensor signal conditioning circuit makes the system easier and cheaper to produce in high volume. However in attempting to achieve the largest possible output voltage range for subsequent processing, there is a danger that device-to-device variations coupled with circuit variations and temperature effects can saturate the amplifier or exceed the limits of the following process (an A/D converter for example). This note discusses a methodology that optimizes a sensor system's performance while ensuring that the amplified output will always remain within the limits.

Order by: AN1556/D

A Cookbook Approach to Designing a Differential-Signal Amplifier for Sensor Applications

Sensors with millivolt outputs need signal conditioning amplification to customize the output for the intended application, and to compensate for device-to-device variations in offset and span. This practical application note focuses on the mechanics of the necessary simple calculations, resistor selection and calibration of the final circuit in a step-by-step manner. It is based on sound engineering design principles which are explained in a separate appendix. The examples presented are concerned with pressure sensors in two situations: applications where the variations are taken from a data sheet, and those where the device characteristics can be measured before assembly.

Order by: AN1557/D

Characterization of Retrigger Time in the HC4538A Dual Precision Monostable Multivibrator

The MC54/74HC4538A is a monostable multivibrator commonly used as a one-shot, or in applications that require a pulse width of reliable dimensions. The pulse width and the minimum retrigger time are usually well behaved over the recommended pulse-width range. However some users have found that the retrigger time behaved unexpectedly when pulse widths were shorter than the recommended minimum. This note characterizes the retrigger time and explains the problem.

Order by: AN1558/D

Application Considerations for a Switched Capacitor Accelerometer

Rev 1

Low cost accelerometers are highly integrated devices with features such as signal conditioning, filtering, offset compensation and self test. Combining these features with economical plastic packaging requires that the signal conditioning circuitry should be as small as possible. One approach is to implement sampled data system and switched capacitor techniques as used in the MMAS40G accelerometer. As in all sampled data system, precautions should be taken to avoid signal aliasing errors. This note describes the MMAS40G, explaining how aliasing might occur and how to minimise it.

Order by: AN1559/D

Low Voltage ECLinPS SPICE Modeling Kit

Rev 1

This document extends to the low voltage family of ECLinPS and ECLinPS Lite devices the information given in AN1503: ECLinPS I/O SPICE Modelling Kit. The Low Voltage ECLinPS and ECLinPS Lite devices are the newest additions to Motorola's highest performance ECL/PECL family, offering similar performance to the standard ECLinPS and ECLinPS Lite products, but at 3.3V. The kit contains all the input and output schematics for the Low Voltage devices that are available at the time of writing, and allows a system level interconnect simulation to be performed.

Order by: AN1560/D

Interfacing Between LVDS and ECL

Rev 1

Low Voltage Differential Signaling (LVDS) signals are used to interface 3.3V CMOS or BiCMOS ASICs. The signals are differential, with a swing of 250 to 400mV and a DC offset of 1.2V. Low Voltage ECL devices work off a single 3.3V supply voltage – often the only supply available in advanced systems – in the LVPECL mode, which has a 750mV output swing with a 2V offset. This note explains how to interface between LVDS and LVPECL, and also suggests ways of interfacing with 5V-supplied PECL devices or negative-supplied ECL.

Order by: AN1568/D

Basic Semiconductor Thermal Measurement

This application note provides basic information about power semiconductor thermal parameters, how they are measured, and how they are used. The intention is to enable the reader to better describe power semiconductors and to answer many commion questionsrelating to their power handling capability. Four key topics are covered: Understanding basic semiconductor thermal parameters; Semiconductor thermal test equipoment; Thermal parameter test procedures; Using thermal parameters to solve frequently asked thermal questions.

Order by: AN1570/D

Digital Blood Pressure Meter

This note describes the concept of a digital Blood Pressure Meter which combines an integrated pressure sensor, analog signal conditioning circuitry, microcontroller hardware and software, and a liquid crystal display. The sensing system reads the cuff pressure and extracts the pulses for analysis and determination of systolic and diastolic pressure. The design is based on the Motorola MPX5050GP 50kPa integrated pressure sensor which has a pressure range of zero to 300mm Hg. Includes circuit schematic and description, plus an MC68HC05B16 software description and flowchart.

Order by: AN1571/D

Understanding Pressure and Pressure Measurement

Fluid systems, pressure and pressure measurement are complex subjects. This application note defines and explains the basic concepts of fluid mechanics in terms that are easy to understand while retaining the necessary technical accuracy and level of detail. It opens by defining Fluid Pressure and the various types of pressure measurement and units and goes on to discuss the concepts of static and dynamic pressure systems, including both steady-state and transient situations.

Order by: AN1573/D

A Group Listening-In Application for the MC33215

The MC33215 has been developed and optimized for use in fully electronic telephone sets, with both handset and handsfree operation. A mode for group listening-in operation

is not incorporated, but can easily be added. This application note explains how, with block diagram, circuit schematic and discussion of potential problem areas.

Order by: AN1574/D

Worldwide Cordless Telephone Frequencies

Lists cordless telephone frequencies for USA and Asia Pacific (CT-1) and Europe (CT-0). Data includes Channel Number, Tx Channel Frequency, 1st LO Frequency, and Tx and Rx Divider values, for both handset and baseset.

Order by: AN1575/D

Reduce Compact Fluorescent Cost with Motorola's PowerLux IGBT

Compact Fluorescent Lamps (CFL) are becoming more popular in the consumer market because of their energy savings compared to incandescent lamps. Today's focus for manufacturers is to reduce the costs and miniaturize the circuits associated with these low pressure lamps in order to make them more attractive to the comsumer. Although there are many solutions for CFL drive circuits, virtually all the electronic ballasts use the half bridge topology described here. The PowerLux IGBT (Insulated Gate Bipolar Transistor) is designed specifically for CFL applications.

Order by: AN1576/D

Motorola's D2 Series Transistors for Fluorescent Converters

Bipolar switching transistors are popular for use in low cost fluorescent ballast designs. However their use is not straightforward since they are based on minority carrier operation, and switching simulation is difficult and inaccurate. The aim of Motorola's D2 series is to dramatically simplify the ballast design by integrating a freewheeling diode and an anti-saturation network. This note describes the structure of the device, and explains how to get the best out of it when solving the critical issues of ballast design.

Order by: AN1577/D

MECL 10H SPICE Kit for Berkeley SPICE (PSPICE)

Presents SPICE parameters and schematics for a particular set of MC10H MECL devices for use with Berkeley SPICE Type simulators (PSPICE). The devices are MC10H101, MC10H102, MC10H103, MC10H104, MC10H105, MC10H116, MC10H131, MC10H188, MC10H189, MC10H210 and MC10H211.

Order by: AN1578/D

Understanding the Multivibrator Based Crystal Oscillator Circuit Used on the BiCMOS MPC Family of Clock Drivers

When a Phase Locked Loop (PLL) is used in a clock generator it is desirable to use a crystal controlled source as the reference clock – crystals provide accurate frequencies at reasonable cost. To minimise implementation costs many PLL clock generators integrate the crystal oscillator circuitry onto the chip, so that the crystal itself is the only external component. The standard Pierce oscillator, based on an inverter gate, is most commonly used, but many of Motorola's MPC clock drivers use an alternative multivibrator-based design. This note outlines the important differences between the two, and presents guidelines for applications which require very accurate clock frequencies.

Order by: AN1579/D

Mounting and Soldering Recommendations for the Motorola Power Flat Pack Package

Rev 3

Motorola's Power Flat Pack-16 (PFP-16) is a superior package for high-power surface mount applications. It is a thin, space-efficient package offering a variety of soldering options, and can be assembled into PC boards using standard equipment. Unlike most surface mount packages it has very high thermal conductivity, allowing die to dissipate up to 5 watts without needing excessive board space. This note discusses handling and soldering considerations that will allow users to take full advantage of the PFP-16.

Order by: AN1580/D

Board and Interface Design for AutoBahn and Spanceiver

A number of circuits are presented showing different ways to build transmit and receive interfaces to the AutoBahn Spanceiver. Timing details are provided, and the discussion includes Transmit Handshake, Asynchronous Interface with single and dual clocks, External Clock Synchronization, Receive Handshake, Receive Clock Generation, Serial Interconnection schemes, power supply requirements, layout considerations and thermal management.

Order by: AN1582/D

Motorola's Next Generation Piston Fit Pressure Sensor Packages

Availability of the silicon-based pressure sensor has created a wide variety of new system design approaches. More and more users want to integrate pressure sensors into their systems for both measurement and control loop feedback. Assembly costs and leakproof sealing are always major concerns, and Motorola's 'next generation' Piston Fit packages have been designed specifically to address them. The packages have been designed to fit into a customer's housing using a standard O-ring to obtain a leakproof seal. This introduction to the new devices presents their design and mechanical features, and discusses package selection and mounting methods.

Order by: AN1583/D

"Very Low Pressure" Smart Sensing Solution with Serial Communications Interface

This note is an update on recent progress in using local intelligence to improve functionality and performance for low-pressure smart sensing applications. The enhancements build on work documented in an earlier paper presented at Sensors Expo Boston '95. The original MPX2010-based system had been developed to measure 0-2.5 kPa with 1-2% accuracy. While this provides an accurate solution for a range spanning several kPa, it cannot maintain this performance for sub-kPa pressure ranges. It was therefore decided to develop a solution for full-scale pressure ranges as low as 0.375 kPa with 1-2% overall accuracy. Typical applications include liquid-level and gas-flow sensing.

Order by: AN1584/D

High-Performance, Dynamically-Compensated Smart Sensor System

The sensor itself is at the heart of any measuring system that requires a physical condition to be converted to an electrical variable. The system presented in this application note converts a physical pressure to a voltage, and subsequently to a digital value, but the techniques are relevant to all types of sensor. Accuracy and resolution are the critical performance criteria. This system eliminates device-to-device process variations; corrects for temperature dependenciesof the sensor output; and optimizes the available resolution by means of a closed-loop, MCU-based, dynamic compensation system.

Order by: AN1585/D

Designing a Homemade Digital Output for Analog Voltage Output Sensors

A digital sensor output is generally preferred to an analog output in noisy environments and in remote sensing applications, because of its inherently better noise immunity. In addition, MCU-based sytems with no built-in A/D converter have no option but to use a digital signal. The design example in this application note, which is based on an MPX2000-series pressure sensor, demonstrates how to easily convert an analog voltage output sensor to a digital output sensor. Includes sample calculations and example software for the MC68HC05P9 MCU.

Order by: AN1586/D

Low Cost 1.0A Current Source for Battery Chargers

Rev 1

Presents a highly cost-effective design for a low cost current source for battery charger applications, based on the LM2575-ADJ Switching Step-Down Converter and the MC33341 Regulator Control Circuit. It provides a 1.0A current source with 'rectangular' constant-current, constant-voltage charging characteristic; this feature ensures basic protection against battery overcharging. All the functions are provided by the two integrated circuits plus a handful of additional components. A variant allows control under charger short circuit conditions. Includes schematics, parts lists and PC layouts.

Order by: AN1593/D

Critical Conduction Mode, Flyback Switching Power Supply Using the MC33364

Describes a way of designing an AC-DC flyback converter operating in the critical conduction current mode, using Motorola's MC33364. The first section discusses the main differences in operation between fixed frequency and critical conduction mode flyback converters, while the second section describes the design of a typical converter, including its transformer.

Order by: AN1594/D

ECLinPS Lite Translator ELT Family SPICE I/O Model Kit

The Motorola ECLinPS Lite ELT Translator devices MC10ELT2xD and MC100ELT2xD are single or dual supply, 1 or 2-bit translators between the TTL and ECL environments. Single supply devices translate between TTL and PECL, dual supply devices translate to or from negative-supplied ECL. This note includes representative schematics and model files for the I/O circuits used by the ELT devices, and will allow users to perform system level interconnect modeling with the ELT family. A worst case package model schematic is included for more accurate system level modeling.

Order by: AN1596/D

Longwave Radio Data Decoding Using an HC11 and an MC3371

In the UK, the BBC's Radio 4 198kHz Longwave transmitter carries data as well as the audio signal; this has some similarities with the RDS data included in VHF radio signals in many European countries but has a much lower data rate and serves a different purpose. This application is based on an MC68HC(7)11 and an MC3371 super-heterodyne receiver, and allows time and date to be permanently displayed while all incoming data can be displayed in hexadecimal form. It incorporates an alarm clock which can be used to switch on the radio at the required alarm time.

Order by: AN1597/D

H124, 125, 350-352 Translator I/O SPICE Modelling Kit

The ability to model circuit behavior prior to committing to a PC board layout is essential, given the difficulty of designing high speed, controlled impedance boards and the expense of reworking them. This note provides the SPICE information required to accurately model system interconnect situations for designs utilizing the H124, H125, H350, H351 and H352 translator circuits in the MECL10KH family. It includes schematics of the input and output structures, as well as ESD protection structures and package models which may affect the shape of the input and output waveforms.

Order by: AN1598/D

Power Control with the MRFIC0913 GaAs Integrated Power Amplifier and MC33169 Support IC

The transmitted RF power of typical multiple access radio systems is programmable within a given range. The advantages are that the interference level for close receivers is restricted, and that the transmitter power consumption is reduced. In addition to this output power control, on/off switching of the RF power must be tightly controlled to avoid splattering the signal into adjacent channels; this is done by controlling the rise and fall times of the transmitter keying. This note discusses the details of waveform shaping and power control as applied to GSM TDMA systems using the MRFIC0913 GaAs Integrated Power Amplifier (IPA) and the MC33169 support IC.

Order by: AN1599/D

Efficient Safety Circuit for Electronic Ballast

The self oscillating circuit commonly used in low cost, half bridge converters is prone to thermal runaway if the fluorescent tube fails to strike. Usually, either the switches are overrated to survive such a fault condition, or the circuit includes a safety network to avoid the risk. The safety circuit described here is easy to implement and does not affect the normal operation of the converter. Includes full circuit schematics and description.

Order by: AN1601/D

3.6V and 4.8V GSM/DCS1800 Dual Band PA Application with DECT Capability Using Standard Motorola RFICs

The GSM communications standard in Europe is used in both the 900MHz and 1800MHz bands. With the prospect of system interoperability there is growing interest in portable phones capable of being used on both bands. This note describes the design, implementation and performance of a dual band GSM power amplifier for 900MHz and 1800MHz, using currently available standard RF ICs – with some modification the design can also be used for GSM/DCS1800/ DECT applications. Includes circuits, parts lists and component layouts.

Order by: AN1602/D

Providing a POTS Phone in an ISDN or Similar Environment

The circuit presented here provides an auxiliary connection for a POTS phone, or an answering machine or fax, to a digital communication line such as ISDN. Two variations – for single or dual line – assume that there is a 5V supply, a 12V supply and a microprocessor. Two other options offer variations of the ring generation circuit to give lower cost with some compromises. A Motorola MC33121 SLIC provides most of the central office functions to the external line, including DC loop current, off-hook detection, proper AC and DC impedances, 2 to 4-wire conversion, transhybrid rejection and high longitudinal balance. An MC145484 CODEC provides A/D and D/A conversion. Includes detailed schematics and block diagrams.

Order by: AN1603/D

ITC132 High Voltage Micro to Motor Interface

Rev 1

The ITC132 evaluation board described here is an IGBT power stage that complements microprocessor development tools for the HC05MC4 and HC08MP16, and is designed to provide an optically isolated interface between microcomputers and induction motors up to 1 horsepower. Its configuration is applicable to pulse width modulated systems where the PWM signal is generated in a microcomputer, digital signal processor or other digital system. It is suitable for driving induction motors on DC bus voltages up to 380 volts. Current sense, bus voltage and temperature feedback signals are provided.

Order by: AN1606/D

ITC122 Low Voltage Micro to Motor Interface

Rev 1

This MOSFET power stage is designed to provide the interface between fractional horsepower motors and microprocessor development tools for the MC68HC05MC4 (ITC127) and the MC68HC08MP16 (ITC137). It will drive brush or brushless DC motors at up to 4A continuous current from DC bus voltages up to 48V. Includes circuit schematic of the board, parts list and pin-by-pin description.

Order by: AN1607/D

Guidlines for the Speaker in a Line-Powered Speakerphone

The selection and mounting of the speaker in a speakerphone play a major role in the quality of sound in the final product. The current available is limited, and other factors must be optimized to achieve best performance. These guidelines are concerned with choosing the optimum speaker impedance, the drive configuration, and the mounting within the enclosure. Includes test results from an MC33215 Speech Network/Speakerphone IC.

Order by: AN1608/D

Using Motorola's MRFIC1502 in Global Positioning System Receivers

The Global Positioning System is a US Department of Defense operated facility consisting of 24 satellites in orbit at an altitude of 20,183km, which continuously broadcast a navigation message on two L-band frequencies. The coarse acquisition code (C/A) and the precise code (P) are broadcast on Link 1 at 1574.42MHz. Motorola's MRFIC1502 downconverter is targetted for the reception of the C/A code, although it is potentially capable of receiving the P-code also. This note describes its use as the downconverter in a GPS receiver.

Order by: AN1610/D

Impact and Tilt Measurement Using Accelerometer

This note describes a system for the measurement of both tilt and impact using a Motorola MMAS40G10S accelerometer, supported by microcontroller hardware and software, and a liquid crystal display. Due to the wide, DC to 400Hz frequency response of the accelerometer, the

system can measure both the static acceleration of the Earth's gravity and shock or vibration from an impact. Includes circuit schematic, flow chart and program listings for an MC68HC05B16 MCU.

Order by: AN1611/D

Shock and Mute Pager Applications Using Accelerometer

Rev 2

In typical pager designs, whenever there is an incoming call the pager will 'beep' until one of the buttons is physically pressed. This can be inconvenient if the controls are not within easy reach. This note describes the use of a low-cost accelerometer to allow the beep to be muted by lightly tapping the pager, which could be inside a pocket or handbag. The design is based on a 40g MMAS40G10D accelerometer. Includes circuit schematic, parts list, PCB artwork, flow chart and source code for an MC68HC705B16 MCU.

Order by: AN1612/D

Mounting Recommendations for Copper Tungsten Flanged Transistors

Because of mechanical constraints caused by the hardness of the flange material, RF power transistors with a Copper Tungsten (CuW) flange require special care in mounting. This note describes the correct mounting procedures, with emphasis on the surface flatness and the torque required. Packages affected include Case 360B, Case 375A, Case 375B, Case 395B, Case 395C, Case 398, and others.

Order by: AN1617/D

A Monolithic Integrated Solution for MAP Applications

Rev 1

Presents a monolithic sensing solution for manifold absolute pressure (MAP). It includes an examination of the design, fabrication, temperature compensation, packaging and EMC testing of the sensor, which uses integrated bipolar electronics and conventional IC processing. The amplifier consists of three op-amps with seven laser trimmed resistors, plus a few other components. The note also discusses an automotive MAP sensor general specification, including test methods, assembly, packaging, reliability and media testing for a single chip solution.

Order by: AN1620/D

An Integrated Silicon Bulk Micromachined Barometric Pressure Sensor for Engine Control Unit and External Mount

Rev 1

Barometric Absolute Pressure (BAP) sensors are used in automotive transmission and fuel systems to measure the variation of ambient pressure with altitude; the value may be used to modify glow plug timing in turbo-diesel engines, for example, or to limit dynamic parameter changes in certain terrain. This note presents a silicon, bulk micromachined, monolithic pressure sensor solution, and discusses the design, fabrication, temperature compensation and testing aspects. In addition it gives some opinions and information concerning the mounting of the device – two techniques are discussed, including surface mounting the sensor on the engine control unit.

Order by: AN1621/D

EMC Considerations for Automotive Sensors

Rev 1

Electro Magnetic Compatibility (EMC) is a qualification requirement for automotive components, which need to work in an environment that is more and more contaminated with electromagnetic (EM) energy. This note considers the susceptibility to EM signals of plastic-packaged pressure sensors with integrated signal conditioning. Method and results of practical tests (GTEM and Direct RF Injection) are given, and show that the device has good immunity to the surrounding EM field. Discusses a filter technique which further improves performance.

Order by: AN1622/D

ITC137 68HC708MP16 Motion Control Development Board

The ITC137 Motion Control Development Board described here complements the software development tools available for the 68HC708MP16 MCU. It provides motor contol functions on a board that is easy to interface both to power stages and emulators, and its configuration is applicable to AC Induction, Brush DC and Brushless DC motors. This

note includes a description, schematic and parts list for the board, plus an application example in which it is coupled to an ITC132 power stage and an induction motor. It also discusses connection to a host PC.

Order by: AN1624/D

Noise Management in Motor Drives

During motor drive design and development, much time is normally spent dealing with the high noise levels that are present in these systems. A number of techniques are presented here to make the nuts and bolts of noise management easier and so to take a lot of redesign and debugging out of motor drive design. Many of the techniques trade some component cost for noise robustness – the benefits are reduced development cost, faster time to market, and a higher likelihood of trouble-free operation in the field.

Order by: AN1626/D

Understanding Power Transistors Breakdown Parameters

When measuring the electrical parameters of a bipolar power transistor, the breakdown related parameters are the most critical. Since the breakdown voltage can be quite high the instantaneous power dissipated during the test must be accurately controlled to avoid a local hot-spot on the chip. Also, the breakdown mechanisms are prone to high frequency oscillations and care must be taken to measure this parameter accurately. This note defines the breakdown parameters and presents the associated physics of semiconductor devices. It includes equivalent circuits and a section describing test techniques and recommended test methods.

Order by: AN1628/D

Using PSPICE to Analyze Performance of Power MOSFETs in Step-Down, Switching Regulators Employing Synchronous Rectification

Describes an easy method of analyzing the performance of various power MOSFETs in switching regulators, using the PSPICE circuit analysis tool. A comparison is made between circuit simulation results and the measured performance described in AN1520. The benefit of a model which closely simulates switching performance is that the performance of different MOSFETs and diodes can be made against price, size, and so on prior to building breadboards; actual hardware should always be used to confirm the results. PSPICE models are available from the Motorola SPS website.

Order by: AN1631/D

MMA1000P Product Overview and Interface Considerations

Motorola's accelerometer architecture combines a sensing element and a control ASIC in a single package to meet its stringent performance requirements at low cost. This note describes the MMA1000P accelerometer which uses a new control ASIC architecture. It explains important new features that have been incorporated, and presents an overview of the key performance characteristics of the new accelerometer. It also details the minimum supporting circuitry needed to interface the device to an MCU. Finally it discusses the power supply rejection ratio characteristics and presents an aliasing gain model.

Order by: AN1632/D

Baseball Pitch Speedometer Featuring Motorola's 250g Accelerometers

Rev 1

In its simplest form the Baseball Pitch Speedometer consists of a target with acceleration sensors, an MCU to process the sensors' outputs and calculate the ball speed, and a display to show the result. The implementation described here can be used for training, entertainment, or both. The target is a rubber mat backed by an acrylic plate; acceleration sensors and buffers are mounted on the back of the plate. When a ball is thrown against the target the accelerometer senses the impact and produces an analog 'crash signature' output proportional to the acceleration measured. This note discusses the theory of operation of the speedometer, some complex factors that must be taken into account, and the practical implementation.

Order by: AN1635/D

Implementing Auto Zero for Integrated Pressure Sensors

Rev 1

Auto Zero for pressure sensors is a compensation technique based on sampling the offset of the sensor at a reference pressure in order to correct the sensor output for long-term drift or variation. It can be implemented easily when

an integrated pressure sensor is interface to a microcontroller with A to D converter. The main requirement is that a zero pressure reference condition must exist at some point in the operating cycle of the equipment, for example at start up or during idle conditions. Typical systems that can benefit include washing machines, bottle filling and HVAC applications.

Order by: AN1636/D

Offset Calibration of Gauge Pressure Sensor Using Parallel I/O Ports

Rev 1

External stresses an mounting position can affect the 'zero pressure' output reading of a gauge pressure sensor, especially when using low pressure devices. This note describes a method of calibrating the offset of a sensor using the parallel I/O ports of a microcontroller; the demonstration board contains an MPXT5006D sensor, MC68HC705B16 MCU and an LCD display. The offset value can be stored in ROM, EEPROM or RAM, depending on the application.

Order by: AN1638/D

Reducing Accelerometer Susceptibility to BCI

Rev 1

Automobile electronic systems – and airbag systems in particular – must pass stringent electromagnetic compatibility (EMC) tests. One of the toughest tests for the tolerance of the system to high frequency conducted emissions is the Bulk Current Injection (BCI). The entire airbag system must continue to function normally throughout this test. This note discusses how to reduce the susceptibility of the Motorola MMA1000P accelerometer to BCI; the information can also be applied to other electronic components.

Order by: AN1640/D

Micromachined Electromechanical Sensors for Automotive Applications

Rev 1

Typical automotive applications for pressure sensors include MAP, BAP, lumbar seat and air bag; acceleration sensor applications include airbag, yaw rate, active suspension and ABS. This note discusses the function and applications of the two types, their different micromachining techniques and different signal conditioning. It explains electrical characteristics and package styles, and presents the requirements of the MAP/BAP application in some detail.

Order by: AN1645/D

Noise Considerations for Integrated Pressure Sensors

Rev 1

Motorola Integrated Pressure Sensors have trimmed outputs, built-in temperature compensation and an amplified single-ended output, making them compatible with the A/D converters of low cost microcontrollers. Although 8-bit ADCs are most common, higher resolutions are increasingly becoming available. In the higher resolution ADCs the noise that is inherent to piezo-resistive bridges becomes a design consideration. This note presents simple techniques for mitigating the effects of shot noise, flicker noise and external noise to achieve excellent results.

Order by: AN1646/D

Using Wire-OR Ties in ECLinPS Designs

Rev 1

Wired-OR connections are often used in ECL designs to reduce total part count and optimize system speed performance. The limitations of OR-tying have been a combination of increased delay per OR-tie and the negative-going disturbance when one output switches from a high to a low state; as the speed increases the latter problem becomes the primary limitation. This note discusses the use of OR-ties in ECLinPS designs, and includes theoretical descriptions of the problems as well as an evaluation and SPICE simulation results. General guidelines and recommendations are provided.

Order by: AN1650/D

ASB201 – Uncompensated Series Sensor Module

Rev 1

Describes the ASB201 plug-in module that forms part of a systems development tool set for pressure sensors. The module provides an analog signal from an Uncompensated series sensor to a Motorola ASB200 Sensor Development Controller, or it can be used on its own to provide power

and signal connections to the sensor. Includes a schematic, parts list, pin by pin description and summary of design considerations.

Order by: AN1651/D

ASB202 – MPX2000 Series Sensor Module

Rev 1

Describes the ASB202 plug-in module that forms part of a systems development tool set for pressure sensors. The module provides an analog signal from an MPX2000 series sensor to a Motorola ASB200 Sensor Development Controller, or it can be used on its own to provide power and signal connections to the sensor. Includes a schematic, parts list, pin by pin description and a summary of design considerations.

Order by: AN1652/D

ASB205 – MPX5000 Series Sensor Module

Rev 1

Describes the ASB205 plug-in module that forms part of a systems development tool set for pressure sensors. The module provides an analog signal from an MPX5000 series sensor to a Motorola ASB200 Sensor Development Controller, or it can be used on its own to provide power and signal connections to the sensor. Includes a schematic, parts list and pin by pin description.

Order by: AN1653/D

ASB210 – 10" H_2O Sensor Module

Rev 1

Describes the ASB210 plug-in module that forms part of a systems development tool set for pressure sensors. The module provides a pulsed analog signal from an MPX2010 sensor to a Motorola ASB200 Sensor Development Controller – the pulsed architecture improves the sensitivity of MPX2010 sensors to allow a 0 to 10" measurement range. Includes schematic, parts list and a summary of design considerations.

Order by: AN1654/D

ASB200 – Motorola Sensor Development Controller Board

Rev 1

Presents an MC68HC705JP7-based development board that is part of a systems development tool set for pressure sensors. When used with a series of companion plug-in modules the board provides a complete systems solution for measuring pressure and developing code. It receives signal inputs from a series of pressure sensor modules, receives command inputs from a DIP switch or terminal keyboard and sends results to a terminal or LCD. Includes schematics, parts list, full description and software overview.

Order by: AN1655/D

Compound Coefficient Pressure Sensor PSPICE Models

Rev 1

Presents PSPICE models for Uncompensated, MPX2000 series and MPX5000 series pressure sensors. The models use compound coefficients to improve modeling of temperature dependent behavior. The discussion begins with an overview of the structure of the models, and is followed by an explanation of compound coefficients. The emphasis is on how to use the models to estimate sensor performance.

Order by: AN1660/D

Low Cost Universal Motor Chopper Drive System

The universal brushed motor is the most widely used motor in home appliances such as vacuum cleaners, washers, hand tools and food processors. This note describes the design of a low cost, chopper motor control system based on the MC68HC705MC4 microcontroller, the MGP7N60E Insulated Gate Bipolar Transistor (IGBT) and the MSR860 Ultra Fast Soft Diode. Includes schematic, parts list, PCB layout and description of the control algorithm.

Order by: AN1661/D

Low Cost Universal Motor Phase Angle Drive System

The universal brushed motor operating from 1,000 rpm to 15,000 rpm is the most widely used motor in home appliances such as vacuum cleaners, washers, hand tools and food processors. This note describes the design of a low cost, phase angle motor control system based on the

MC68HC05JJ6/MC68HC705JJ7 microcontroller and the MAC4DC snubberless triac. Includes schematic, parts list, PCB layout and description of the control algorithm.

Order by: AN1662/D

Software SCI Implementation to the MISC Communication Protocol

Describes a software implementation of asynchronous serial communication for microcontrollers which do not have a hardware SCI. Use of such MCUs is important in low cost Niche Area Networks. Previous software SCI solutions have only provided very basic communications – in the system described here a complete data link protocol stack is implemented and executed. The MISC communication protocol is used here as an example.

Order by: AN1667/D

Washing Appliance Sensor Selection

North American washing machines currently in production generally use mechanical sensors for water level measurement; either pressure switches with discrete trip points or electromechanical pressure sensors with frequency output. Tests indicate that the accuracy, linearity and repeatability required of high efficiency machines is difficult to achieve by these methods. Manufacturers in Europe, and more recently in North America, are looking at electronic solutions. This note is a guide to the selection of sensors from Motorola's MPX series, especially for high accuracy with few components in high volume applications.

Order by: AN1668/D

MC44603 in a 110W Output SMPS Application (80-140Vrms and 180-280Vrms Mains Voltages)

This note presents a 110W fly-back power supply design using the MC44603 SMPS Controller. The discontinuous mode is chosen in order to limit the stresses on the power switch and the output diodes. The MC44603 offers a wide variety of protection features and three distinct working modes – the fixed frequency mode is used here, and enables more accurate control of power drawn from the mains. Includes an overview of the applications, design equations, and detailed descriptions and circuits for both high and low mains voltages.

Order by: AN1669/D

60 watts, GSM 900MHz, LDMOS Two-Stage Amplifier

Demonstrates the feasibility of a complete RF amplifier for GSM 900MHz base stations using LDMOS transistors in Class AB. The complete design requires only standard parts and components, yet shows superior performance in terms of gain efficiency, power and ruggedness. The target is an output power of 60 Watts continuous wave, with an efficiency as high as possible and gain in region of 30dB.

Order by: AN1670/D

MC145170 PSpice Modeling Kit

Device models and simulators such as PSpice can reduce development time; the key is in developing the proper model. IC design models could be used for simulating a circuit design, but it is a cumbersome, inefficient and often inaccurate method. Far better to devise a model which performs to the specification for the IC and trust the IC designer to produce a device that conforms. This note describes the application of this technique to the MC145170 PLL Frequency Synthesizer. PSpice Analog Behavioral Modeling is used to develop phase detector and VCO models, which are used to simulate open loop and closed loop, and to test purity of the VCO output.

Order by: AN1671/D

The ECL Translator Guide

Subtitled 'ECL, TTL, PECL, LVECL, LVPECL, CMOS, LVTTL – How to Make them Talk to Each Other'. Discrete interfaces could be used to interface between ECL and the TTL/CMOS world, but the switching points are usually uncontrolled and may vary with temperature, device variation or supply voltage. To avoid these problems translating devices with controlled switching levels and specified propagation delays and skews are available. Special translators are also available to link ECL signals operating off different power supplies. This note is a tabular selector guide to both types or translator.

Order by: AN1672/D

Solder Reflow Mounting Method for the MRF286 and Similar Packages

Describes a solder mounting method for the MRF286 60 Watt power device. The methodology is recommended for any ceramic/metal flange device with similar materials and construction (copper tungsten flange with Alloy 42 leads)

and a power range from 20 to 60 Watts. The method was developed after comprehensive simulation which included thermal management and mechanical stress modeling.

Order by: AN1673/D

A Low Noise Amplifier with High IP3 for the 900MHz Band Using the MRF1057T1 Low Noise Transistor

The MRF1057T1 is a low noise bipolar junction transistor, part of a family of sub-micron geometry devices which also includes the MRF1027T1 and the MRF1047T1. The main difference between these devices is their current carrying capability. This note describes the performance of the MRF1057T1 in a Low Noise Amplifier circuit whose requirements are typical of the most recent cellular communication technologies such as CDMA and TDMA.

Order by: AN1675/D

A Cascade 2 Stage Low Noise Amplifier Using the MRF1047T1 Low Noise Transistor

This circuit design demonstrates the performance of the MRF1047T1 low noise bipolar transistor in a cascade LNA for a pager application. It provides a good compromise between low NF (1.6dB), high IP3 and high return losses with unconditional stability. Gain is typically 24dB. Includes print layout, components list, circuit schematic, simulated and measured data, and general information on the LNA circuit.

Order by: AN1676/D

Get Your Best From Your LDO Designs

Low DropOut regulators (LDOs) occupy an important place in battery operated systems. In addition to their main function, output noise, ripple rejection and quiescent current are increasingly important features. Understanding these parameters requires that designers understand they way the LDO is built and how it fits into an application. This note provides detailed information on the design and operation of the latest LDOs, allowing their behavior in the final circuit to be predicted.

Order by: AN1677/D

How to Deal with Leakage Elements in FLYBACK Converters

It is difficult to find a good tradeoff between cost and performance when designing off-line flyback power supplies. The main problem is the presence of leakage inductances in the transformer, which can cause voltage overshoot, divert a portion of the primary current to a clamp, and degrade the voltage regulation in supplies with primary regulation or multiple outputs. This note reviews the magnetic and electrical models of two-winding and three-winding transformers, discusses how to extract the inductance values of the models by measurement and calculation, and how to construct a SPICE model. It also provides guidelines on how to protect the switch from voltage overshoot.

Order by: AN1679/D

Design Considerations for Clamping Networks for Very High Voltage Monolithic Off-line PWM Controllers

New high voltage monolithic switch circuits are starting to play an important role among SMPS components; their internal structure provides features that simplify the design of an efficient off-line supply, including internal clock, pulse-by-pulse current limit and Leading Edge Blanking (LEB). However the internal MOSFET exhibits a low-energy capability body-diode which no longer protects the device against accidental avalanch. This note discusses which circuit is best for protecting these devices and how to predict its efficiency in the application.

Order by: AN1680/D

How to Keep a FLYBACK Switch Mode Supply Stable with a Critical-Mode Controller

Switch Mode Power Supplies (SMPS) can operate in two different conduction modes, each with very different DC and AC conditions at the same power level. This note explains why the vast majority of low power FLYBACK SMPS (for example cellular battery chargers and VCRs) operate in the discontinuous area, and presents a new integrated solution dedicated to these particular applications.

Order by: AN1681/D

Brushless DC Motor Control Using the MC68HC705MC4

Details the design and analysis of a brushless DC motor control system using the MC68HC705MC4 MCU with two Motorola evaluation boards. Brushed DC motors have long been popular, partly because of their minimal need for electronic control. Now, however, the use of reasonably priced, electrically commutated, brushless DC motors is rising, together with the need for greater control. Such motors are found in disk drives, household appliances and automotive applications, where variable speed control, external connection and flexibility are required at little or no extra cost. The MC68HC705MC4 provides a flexible and low cost motor control platform.

Order by: AN1702/D

Switch Fabric Implementation Using Shared Memory

Rev 1

Computers and networks are inextricably linked in modern business, and just as computers continue to increase their performance, users demand ever increasing bandwidth in Mbits or Gbits per second from their networks. Many high speed technologies have emerged, but only Asynchronous Transfer Mode (ATM) can integrate voice, video and data. The switch fabric buffering scheme is of major importance to the flexibility and adaptability of the network. This note discusses two switch fabric implementations using Motorola's NetRAM, a dual-port SRAM designed specifically for the communications market, and compares the improved performance over the Burst SRAM that is sometimes used.

Order by: AN1704/D

Noise Reduction Techniques for Microcontroller-Based Systems

The push towards faster MCUs and peripherals means that new product designs face an increasing threat from electromagnetic interference (EMI), now discussed more positively under the heading of 'electromagnetic compatibility' (EMC). EMI can, and often does, cause delays in product development, but early and continuous attention to EMC issues will give the product the best chance for minimum development costs and delays. This note focuses mainly on reducing emission, but many of the guidelines presented here also affect a system's susceptibility to interference.

Order by: AN1705/D

Microcontroller Oscillator Circuit Design Considerations

The heartbeat of every microcontroller design is an oscillator, and most designs needing precise timing over a wide temperature range use a crystal. PCB designers have the task of integrating crystal and microcontroller functions without the help of mating specifications. This note promotes a systematic approach to good oscillator design, and points out some common pitfalls. It discusses oscillator theory, amplifier gain and crystal drive, potential problem areas and troubleshooting.

Order by: AN1706/D

Dual Port Memory for Multiprocessor Applications

The most common implementation of a multiprocessor system is one where the processors share a common system bus. Because the bus is the sole avenue to access main memory and the system's I/O devices, it becomes a bottleneck which causes performance degradation. The use of external cache memory can help alleviate this problem, and this note discusses the various implementations of external caches and the pros and cons of each. In particular, it illustrates the advantages of using Motorola's dual port SRAM, the MCM69D618, for both the tag and data RAM of an in-line cache.

Order by: AN1707/D

DMA08 Systems Compatibilities

The DMA08 direct memory access module for the HC08 Family provides many system functions. Some of these functions are directly related to DMA, such as the ability to perform efficient block transfers. Others are not so obvious, such as the ability to service module interrupts without having to exit the CPU from low power mode. This note demonstrates the advantages of using the DMA08 by illustrating many of its system capabilities in a single code example in which the DMA simultaneously services three separate module interrupts while the CPU is either doing other work or is in low-power mode.

Order by: AN1711/D

“Get Your Motor Running” with the MC68HC708MP16

Electric motors affect almost every aspect of out lives today. With the focus on environmental issues companies are looking for ways to make motors more energy efficient, and electronic control is a key player. Microcontrollers enable control techniques that would have been difficult or impossible with analog circuitry, but all too often the choice of MCU is a compromise. The MC68HC08MP16 has been designed specifically to meet the requirements of low-cost DC servo and AV open loop systems, with particular emphasis on flexible PWM capability. This note discusses its ability to fit painlessly into a variety of different motor control applications.

Order by: AN1712/D

Using M68HC12 Indexed Indirect Addressing

Rev 1.0

Indexed Indirect Addressing (IIA) adds an additional level of indirection to standard indexed addressing modes, but is not often found in CPU instruction sets. Its inclusion in the M68HC12, with other features, allows the M68HC12 to compete effectively with RISC processors having faster cycle times. Since IIA mode allows a programmer to include more function in a single instruction, the assembly code is efficient. Fewer instructions mean smaller programs and fewer memory accesses. The result is faster execution times and less program in memory.

Order by: AN1716/D

A Serial Bootloader for Reprogramming the MC68HC912B32 Flash EEPROM

The MC68HC912B32 contains 32k bytes of bulk-erasable, byte or word programmable Flash EEPROM memory. Flash EEPROM has significant advantages over EPROM or ROM for both the OEM and the end user, but unlike devices in the M68HC11 family the MC68HC912B32 does not have firmware in bootstrap ROM to allow initial programming of the EEPROM via the SCI port. However it does contain a 2k byte erase-protected bootblock, and this can be used for a bootloader program allowing erasure and programming of the remaining 30k bytes. This note discusses the requirements of a serial bootloader and the implementation of the programming algorithm for the MC68HC912B32.

Order by: AN1718/D

SDRAM System Design Using the MPC106

Rev 1

Discusses the implementation of an SDRAM-based memory system using the MPC106. Topics include System Analysis, the MPC106 Memory Controller, SDRAM Component Selection, Board Technology, ‘Time-of-Flight’, Termination, Clocks, Timing Analysis, The Data Path and Physical Layout. It ends with an overview of an example system.

Order by: AN1722/D

Interfacing MC68HC05 Microcontrollers to the IBM AT Keyboard Interface

Since the inception of the IBM PC platform the keyboard has been its primary input device, and its interface now serves as part of the PC architecture standard. However, in recent years PC hardware engineers have designed other peripheral devices that can be used in place of or in conjunction with the keyboard. This note discusses the hardware and software issues involved in designing applications based on the M68HC05 Family of microcontrollers that can interact with an IBM AT computer via its keyboard interface.

Order by: AN1723/D

Implementing SCI Receive and Transmit Buffers in C

In CPU32 devices with a Queued Serial Module (QSM), synchronous communication is provided by the Serial Communications Interface (SCI) part of the QSM. However the SCI buffers a single transmission or reception of 8 or 9 bits, while some applications need data to be transmitted and received as multiple bytes – text strings for example. If the main CPU software passes data directly to and from the SCI it may have to wait before it can write the next byte for transmission or read a received byte, which is inefficient use of the CPU. One solution, described here, is to implement software buffers for the SCI transmitter and receiver, servicing the SCI module via interrupt.

Order by: AN1724/D

Initializing SDRAM Parameters for Motorola MPC106-Based Systems

Motorola’s MPC106 PCI Bridge/Memory Controller provides a CHRP-compliant bridge between a PowerPC microprocessor family and the PCI (Peripheral Component

Interconnect) bus. This document describes the correlation of the programmable SDRAM interface parameters of the MPC106 with typical SDRAM parameters found in manufacturers' data sheets. Parameters for Rev. 4.0 of the MPC106 are described, but the information is applicable with minor adjustment to earlier revisions.

Order by: AN1725/D

Using Motorola's Fast Static RAM CAMs on a Media Independent Interface

The transition from 10Base to 100Base Ethernet presents some implementation differences: address filtering in 10Base bridge applications was often performed in software by the host CPU, whereas the higher data rate of 100Base Ethernet does not allow enough time for the host CPU in the bridge to accept or reject frames. One solution is the addition of a Content Addressable Memory (CAM) to the Ethernet Media Access Controller (MAC). CAMs have previously been too expensive to justify their common use, but Motorola's MCM69C232 adopts a different approach to reduce costs. This note illustrates the connection of a CAM between the Physical Interface Device (PHY) and the MAC.

Order by: AN1726/D

Designing PCI 2.1-Compliant MPC106 Systems

Some PCI target devices are not compliant with specifications found in the PCI Local Bus Specification (Revision 2.1). This note describes how best to design PCI-based systems using the MPC106. Specifically, it is concerned with the hold time of the PCI clock. Knowledge of the MPC106, the PCI Local Bus Specification and board layout and routing concepts is assumed.

Order by: AN1727/D

Making Low-Distortion Waveforms with the MC68HC708MP16

Rev 1

In designing a drive for AC induction motors the aim is to generate the cleanest possible sine waves. Unfortunately the 6-transistor topology commonly used in voltage sourced inverters requires that a "dead time" must be inserted between the turn-off of one transistor in a half-bridge and the turn-on of its complementary device. As a result a distortion is introduced. Now Motorola has developed a sensorless technique to generate correction waveforms, and has integrated this feature into the MC68HC708MP16 microcontroller. For the first time, the benefits of distortion correction will be available to low-cost motor control applications.

Order by: AN1728/D

BurstRAM to ZBT RAM

The ability to perform back-to-back read/writes without any intermediate deselect cycles, using new products in the ZBT family of synchronous memories, offers a substantial performance improvement for a variety of platforms which currently use standard BurstRAMs. This note describes some of the footprint changes required to adapt a current BurstRAM socket to a ZBT device. Some of the operational differences are also discussed.

Order by: AN1729/D

Digital Amplification of an Analog Signal Using the MC68HC705J1A

This design interfaces an MC68HC705J1A microcontroller to a multiplying digital-to-analog converter (MDAC) to digitally control the gain of an operational amplifier, allowing a mechanical potentiometer to be replaced by a more robust and reliable solution. The MDAC used here is the Analog Devices DAC8043 – a 12-bit, 8-pin serial device. The interface between the MCU and the MDAC is serial; an MCU with Serial Peripheral Interface (SPI) is ideal, but not all M68HC05 MCUs have SPI and a software I/O driver must be used. The MC68HC705J1A is used here to demonstrate the software driver routine.

Order by: AN1730/D

VPW J1850 Multiplexing and Motorola's Byte Data Link Controller (BDLC) Module

With the dramatic increase in the amount of electronics in automobiles, the traditional wiring harness has been replaced by communication buses that allow multiple electronic devices to communicate via shared wiring. The Society of Automotive Engineers has standardized the allowable multiplexing networks within automobiles in three classes, each designed with specific systems in mind. The J1850 architecture is intended for medium speed nodes, and this note discusses its Variable Pulse Width (VPW) multiplexing and Motorola's Byte Data Link Controller (BDLC) module.

Order by: AN1731/D

A Universal Serial Bus Gamepad Device using the MC68HC05JB2

The Universal Serial Bus (USB) is a user-friendly interconnection method designed to support consumer, telephony and productivity peripherals for the PC. The standard is implemented in an open software architecture through a base class and a series of horizontal device classes. Supporting all of the classes can be a tedious process for an embedded developer. This application note describes how the Motorola USB Device Firmware Library can be used to develop a USB application belonging to the Human Interface Device (HID) class, including how to set up the USB device information, and integrate the library with custom external hardware controlling firmware.

Order by: AN1732/D

Implementing Caller ID Functionality in MC68HC(7)05 Applications

Caller ID is a service that transmits information about a telephone caller, such as a telephone number and name, to a called subscriber. The widespread acceptance of this service in both residential and commercial markets has led to the development of several different types of Caller ID devices such as adjunct boxes, computer peripherals and telephones. This note examines hardware and software issues involved in implementing Caller ID functionality in applications based on Motorola's M68HC(7)05 family of MCUs. Includes a design example of a computer peripheral that can capture Caller ID data and display it on an IBM PC or compatible.

Order by: AN1733/D

Pulse Width Modulation Using the 16-Bit Timer

PWM is a technique used to contol devices or to provide a variable DC voltage; common applications include motor, lighting and climate controls. In many cases, the added cost and complexity of dedicated PWM hardware cannot be justified, and the software implementation described here may be a viable alternative. The method uses the Output Compare function of the 16-bit free-running timer counter found in a wide variety of Motorola MCUs. Includes flowcharts and program listings.

Order by: AN1734/D

Variations in the Motorola MC68HC05Px Family

Rev 1

Motorola's M68HC05 P Family of 8-bit microcontrollers is one of the largest and most widely used. This note clarifies the important differences between the various HC05P devices. It is particularly useful for designers who are familiar with one family member but wish to move to another. The discussion includes Similarities and Comparisons; Pinouts; The A Strategy; Changing from OTP/FLASH to ROM; Changing from Non-A to A Versions; Voltage, Frequency and Temperature Tables; and Development Tools.

Order by: AN1736/D

Migrating from the MC68HC705J2 to the MC68HC705JJ7

The MC68HC705JJ7 is less expensive than the MC68HC705J2, yet provides a large number of additional features. This note describes the hardware and software changes required to migrate a design from the MC68HC705JJ7 to the MC68HC705J2.

Order by: AN1737/D

Instruction Cycle Timing of MC68HC05JJ/JP Series Microcontrollers

The MC68HC05JJ and MC68HC05JP series microcontrollers have an asynchronous analog interface, and events can occur which are not specifically synchronized to software operations. For example, when sampling the outputs of the two voltage comparators the actual time when the CMP1 and CMP2 bits are read is dependent on bus speed and the instruction being executed. The timing within an instruction is not normally published; this note describes the hardware timing of the JJ/JP series and provides a method that allows the user to make individual timing measurements – the method can also be applied to other M68HC05 MCUs.

Order by: AN1738/D

Applications Using the Analog Subsystem of MC68HC05JJ/JP Series Microcontrollers

The MC68HC05JJ/JP series of MCUs presents a unique combination of traditional digital peripherals and simple analog components which can be used to implement a

variety of special functions. Features include a pair of analog comparators; input channel multiplexer; a current source; and a temperature sensing diode. Their simple nature requires very little die area yet they provide capability normally found in more expensive MCUs. This note presents a range of applications. Topics include an analog subsystem overview, voltage comparators, current source/discharge, analog multiplexers, analog power-up considerations, A/D conversion, and a design check list.

Order by: AN1740/D

In-Circuit and Emulation Considerations for MC68HC05JJ/JP Series Microcontrollers

The MC68HC05JJ and MC68HC05JP series of MCUs presents a unique combination of traditional digital peripherals and simple analog components which can be used to implement a variety of special functions. However adding the capability of low-level analog signals to a digital IC creates issues not normally considered in MCU designs, for example circuit board design and emulation considerations connected with the level of analog accuracy. This note discusses issues which must be considered both in the end application and while developing software using an emulator such as the MMDS05.

Order by: AN1741/D

Programming the 68HC705J1A In-Circuit

The low-cost MC68HC705J1A microcontroller does not have a built-in function to allow in-circuit programming, which may be necessary when sections of code such as lookup tables or calibration values need to be entered after assembly. This note describes how in-circuit programming can be achieved using previously programmed 'bootloader' code.

Order by: AN1742/D

Scrolling Message Software

Many MCU applications use displays such as LCD or LED panels to present data, and modern displays are an efficient and affordable way for MCUs to communicate to the outside world. However one limitation is the amount of information that can be presented at any one time. To output a message that is longer than its display, MCU software needs a method of scrolling information across the screen. The method should be divided ito independent tasks, allowing for normal paced-loop program execution. This note describes such a technique using a segmented display; it can easily be adapted to other types with a few changes in software.

Order by: AN1743/D

Resetting Microcontrollers During Power Transitions

A simple function such as resetting an MCU during the application or removal of power can cause many problems if not handled properly. Symptoms can range from a slight delay in MCU response, to very erratic and inconsistent behavior, to total system failure. This document discusses the main issues in respect of HC05, HC08 and HC11 devices, and leads to a safe and reliable approach to transitioning power.

Order by: AN1744/D

Interfacing the HC705C8A to an LCD Module

More and more applications use Liquid Crystal Displays (LCDs) to display data. This note describes the hardware and software interface required to display information from the MC68HC705C8A. It uses an Optrex DMC16207 LCD module, incorporating a Hitachi HD44780 LCD driver which provides the LCD segment waveforms and a simple parallel port interface. Circuitry and example code are also given to demonstrate a means of providing pre-defined messages from EPROM memory; the code can be modified easily to take SPI and SCI data and display it on the LCD module.

Order by: AN1745/D

Migrating from the MC68HC705K1 to the MC68HC805K3

Motorola offers two devices that allow easy migration of MC68HC705K1 applications. Depending on the specific design, system enhancements and cost considerations, two different migration paths are open. The MC68HC805K3 is pin for pin compatible with the MC68HC705K1 and is roughly 90% of the cost; the MC68HC705KJ1 is not pin for pin compatible, but is roughly 70% of the cost. This note discusses the differences between the two devices, plus some additional features of the MC68HC805K3.

Order by: AN1747/D

Building a Universal Serial Bus Keyboard Hub Using the Motorola MC68HC(9)08KH12

The 'hot swap' capability of the Universal Serial Bus (USB) allows PC users to plug in peripherals such as keyboards and have them available immediately without having to reboot the computer; the tangle of wires is reduced and there is no need to configure DIP switches or load software drivers. This note reviews the design of a legacy type keyboard, discusses the MC68HC(9)08KH12 and the USB module operation, describes high-speed and low-speed USB connections, provides in-depth instruction on the programming of the 12 Kbytes of FLASH memory, and outlines the steps required to construct a keyboard hub.

Order by: AN1748/D

DSP563xx Port A Programming

The DSP56300 expansion port – Port A – allows the memory space accessible to the DSP core, or the memory-mapped I/O, to be expanded. The interface is straightforward, and external memory is easily and quickly retrieved using DMA or simple MOVE commands. This note describes the hardware and software configurations required to connect the DSP core to external SRAM and DRAM, examples of moves to and from external memory, and examples of DMA accesses.

Order by: AN1751/D

Data Structures for 8-bit Microcontrollers

Data structures describe how information is organized and stored in computer systems. Although they are usually presented in the context of large computers, the same principle can be applied to embedded 8-bit processors, where their efficient use can improve both the dynamic (time based) and static (storage based) performance of microcontroller software. The data structures presented here will be useful in the development of MCU software, and may be applied to an application in many different ways.

Order by: AN1752/D

Implementing a FLASH Memory System in an MC68HC711E9 Design

FLASH technology offers several advantages for an M68HC11 microcontroller design, including field updates, lower power consumption and increased memory density. However there are some significant obstacles in implementation, arising mainly because FLASH requires a programming algorithm. This note describes a single board computer design which uses a FLASH device as its main program and data storage medium. The emphasis is on the hardware and firmware FLASH programming techniques. An example of a retrofit design is also included to show how to convert an existing EPROM-based design.

Order by: AN1753/D

Interfacing the MC68HC705J1A to the DS1620 Digital Thermometer

Most temperature sensors transduce their reading to an electrical signal, providing a voltage level related to the measured temperature; this voltage is typically converted to a digital number by an A/D converter, and processed by an MCU. The Dallas Semiconductor DS1620 is a single-chip solution that reads temperature and converts it to a 9-bit digital value readable via a serial interface. It also provides three thermal alarm outputs for thermostatic control. This note describes the interface between the DS1620 and Motorola's MC68HC705J1A MCU, in an application measuring temperature in the range -55°C to +125°C. A software driver is created to provide the appropriate serial bus signals.

Order by: AN1754/D

Interfacing the MC68HC705C8A to the DS2430A 256-bit 1-Wire EEPROM

Embedded applications increasingly demand non-volatile memory storage for data such as reprogrammable calibration constants, power down information in consumer electronics, ID number storage and telephone number memories. This note describes the interface between an MC68HC705C8A microcontroller and the DS2430 1-Wire™ 256-bit EEPROM from Dallas Semiconductor Corporation; the 1-Wire interface reduces the overhead of control, data, address and power pins. Includes circuitry and example code.

Order by: AN1755/D

Add a Unique Silicon Serial Number to the HC05

Many embedded systems require serial numbers to help track printed circuit boards, identify nodes on a network or provide security access. The Dallas Semiconductor DS2401 Silicon Serial Number provides a unique, factory-lasered, 64-bit ROM number. Its address bus structure uses a 1-Wire™ interface to reduce the pin overhead. The DS2502 is a similar device, but with the addition of 1024 bits of user-programmable EPROM for storage of calibration constants, access codes and so on. This note describes the interface between an HC05 MCU and the DS2401, with circuitry and example code. Application-specific functions can easily be added for use with the DS2502.

Order by: AN1757/D

Add Addressable Switches to the HC05

Describes the interface between an HC05 microcontroller and the DS2405 addressable switch from Dallas Semiconductor Corporation. The address bus structure uses a 1-Wire™ interface to reduce the overhead of control, data, address and power pins. The DS2405 allows an identification to be assigned to a node, with the additional control capability of an open-drain N-channel MOSFET which can be turned on or off via the 1-Wire bus. Includes circuit and example code, based on the MC68HC705J1A.

Order by: AN1758/D

Add a Non-Volatile Clock to the MC68HC705J1A

Many embedded systems need measurement of time. This can be achieved internally by some MCUs that have an on-chip real-time clock; even so, for date, month and leap year measurement, substantial amounts of bandwidth and code space are required. The Dallas Semiconductor DS1307 64x8 real-time clock provides calendar and timekeeping functions, along with 56 bytes of non-volatile RAM. With its 2-wire interface timekeeping can be managed easily. This note describes the interface between the DS1307 and the MC68HC705J1A. Includes circuit and example code.

Order by: AN1759/D

Interfacing the AD8402 Digital Potentiometer to the MC68HC705J1A

The digital potentiometer allows many applications of mechanical trimming potentiometers to be replaced by a solid-state solution. It provides several benefits over the mechanical device, including compact size, freedom from the effects of shock and vibration, and the ability to withstand oil, dust, temperature extremes and moisture. This note describes the interface between the MC68HC705J1A MCU and the AD8402 from Analog Devices, Inc., to create both the rheostat (2 terminal) and potentiometer divider (3 terminal) configurations for various analog circuits. Includes circuits and example code.

Order by: AN1760/D

Interfacing the MC68HC705C8A to the X76F041 PASS SecureFlash

The increased frequency of code pirating and data tampering makes secure access to system code and data a requirement for embedded systems. The X76F041 Password Access Security Supervisor (PASS) from Xicor, Inc., provides the ability to password protect sensitive memory. It also contains non-volatile memory which can be used for system calibration contants, user information such as telephone numbers, and code patches. This note describes the interface between the X76F041 and the MC68HC705C8A, and includes circuitry and example code.

Order by: AN1761/D

Automatic Contrast Control of LCD Displays Using the MC68HC708LN56 Microcontroller

In applications such as battery powered systems, where the power supply voltage can vary, the contrast of a Liquid Crystal Display (LCD) can change over time. This note describes how to implement automatic contrast control of an LCD in order to maintain constant contrast. It is achieved in software on the MC68HC08LN56 microcontroller by using the A/D converter in conjunction with the LCD controller. Source code for implementing the system is included, and the discussion covers factors such as how the amount of multiplexing, type of bias and voltage levels can affect the contrast.

Order by: AN1762/D

Driving LCD Displays Using the MC68HC705L16 Microcontroller

This note describes how to use the MC68HC705L16 microcontroller as a Liquid Crystal Display (LCD) controller/driver. All LCD control and drive functions are performed by a single chip, which also retains all of the normal functionality of an MCU. Includes a description of the voltages and waveforms needed to control the LCD panel, and source code for controlling a multiplexed display.

Order by: AN1763/D

DSP56300 Enhanced Synchronous Serial Interface (ESSI) Programming

Rev 1

The Enhanced Synchronous Serial Interface (ESSI) provides a full-duplex serial port. It consists of independent transmitter and receiver sections and a common ESSI clock generator. Three transmit shift registers enable it to transmit from three different pins simultaneously. Each DSP56300 family device includes two ESSIs, and so can accommodate a total of six ESSI transmitters for 6-channel surround sound applications. This application note describes the pins and registers that control ESSI operation, and describes its operation using small sections of code to illustrate practical programming guidelines.

Order by: AN1764/D

Using Registered SDRAM DIMMs with the MPC106

The use of registered SDRAM modules (registered DIMMs) can eliminate many of the design problems associated with the increased capacitive loads of larger memory arrays. Registered SDRAM modules are a slight variation of JEDEC-standard, unbuffered, 168-pin memory modules, in which a registered driver has been inserted between the DIMM pins and certain control signals. The MPC106 PCI Bridge/Memory Controller was not designed to directly control registered DIMMs, but with some software and hardware modifications it can support these modules with minimum cost. This note explains how.

Order by: AN1768/D

Designing a Minimal PowerPC System

Describes how to design a small, high-speed Motorola PowerPC-based system, using any member of the MPC60x or MPC7xx family. To keep the design as simple as possible, only the most basic features necessary to run a debugger program are included. The design also uses a programmable ASIC to provide the necessary controls for a block of RAM, ROM and access to I/O, in place of the traditional MPC106 memory/PCI/cache controller.

Order by: AN1769/D

In-Circuit Programming of FLASH Memory in the MC68HC908GP20

Describes two methods of programming the 20 Kbytes of on-board FLASH memory in the MC68HC908GP20 microcontroller. It explains how the FLASH is programmed and erased in-circuit in both user and monitor modes; how the control and protection registers are programmed; and additional considerations for this type of memory. A sample program is included which executes programming routines from RAM. The necessary functionality of a host program is also described – the program used here is available as a free download from the Motorola web site.

Order by: AN1770/D

Precision Sine-Wave Tone Synthesis Using 8-bit MCUs

Many products containing microcomputers – including cell phones, base stations, repeaters, SLICs and cordless telephones – also need precision tone generators for functions such as DTMF signalling, call progress tones, CTCSS and user interface chimes. While off-the-shelf components are available for these functions the cost can be greatly reduced by using the MCU to synthesize the tones. This note presents basic tone synthesis techniques and illustrates their implementation using the HC05, HC08, HC11 and HC12 Families of MCUs.

Order by: AN1771/D

Efficient Compilation of Bit-Exact Applications for DSP563xx

Many of the standard algorithms in wireless and wireline communications – such as GSM speech coders and the G.723.1 and G.729a coders – use 16-bit, bit-exact C code and corresponding test vectors. They employ ANSI C

integer data types and implement 16-bit fractional arithmetic operations. To specify the fractional arithmetic model the ANSI C code uses a set of subroutines that implement basic fractional operations. Theoretically it requires little effort to compile an algorithm for any DSP for which an ANSI C compiler is available; in reality, an efficient implementation requires some modifications to the C code before the compiler can compile it effectively.

Order by: AN1772/D

ZBT Primer

The emergence of higher bandwidth networking systems and infrastructures has encouraged the development of SRAM solutions with faster data throughput. The Zero Bus Turnaround (ZBT) architecture has been standardized by Motorola, IDT and Micron, and eliminates bus latency by providing a more efficient use of the system bus. This note introduces the architecture and potential applications of ZBT, including issues associated with frequency, bandwidth, bus contention and temperature effects.

Order by: AN1773/D

Interfacing the MC68HC912B32 to an LCD Module

More and more applications need liquid crystal displays (LCDs) to communicate effectively to the outside world. Some LCD suppliers provide only the LCD glass, so that the waveforms needed to directly drive the LCD segments must be generated by the microcontroller. Others provide an LCD module which has all glass and segment drives packaged in one circuit board. This note describes the hardware and software of an interface between the MC68HC912B32 MCU and an LCD module from Optrex Corporation, using a simple parallel port. Circuitry and example code are also given to demonstrate a facility to send pre-defined messages from memory to the display.

Order by: AN1774/D

Expanding Digital Input with an A/D Converter

Many microcontroller applications require digital input and arbitration. For example, determining which key of a keypad has been pressed is commonly achieved by connecting a switch matrix to a series of digital inputs, and reading a digital input data register. Whilst this method is easily implemented, it requires the use of the MCU's parallel port pins, which may also be needed for other purposes. By using the analog to digital converter (ADC), connected to a resistor ladder, user input can be processed more efficiently. This note includes an example based on the MC68HC705P6A.

Order by: AN1775/D

MPC8xx to BurstRAM Interfacing

In many applications, DRAM provides sufficient performance for MPC8xx PowerPC systems, including the MPC860, MPC823, MPC850, MPC801 and MPC8260. However in cases where performance must be optimized, or where cache performance is poor, it may be desirable to manipulate data in fast external memory. Current MPC8xx parts are available with external bus frequencies up to 50MHz, but future generations will include 66MHz and 100MHz and will require fast static memory to achieve optimum performance. This note describes how to interface an MPC8xx processor to the MCM69F536C (32K x 36) and the MCM69F618C (64K x 18) synchronous Fast Static RAMS.

Order by: AN1777/D

Using the MCM69D536/MCM69D618 NetRAMs with Different Speed Computing Elements

A dual port RAM is often used to allow two computing elements to communicate, even if they are running at different speeds. Motorola's MCM69D536 and MCM69D618 synchronous dual port NetRAMs are well suited to this purpose, if the clock driving the slower computing element is derived from the clock driving the faster device. This note explains the interface.

Order by: AN1779/D

DSP563xx HI32 as a PCI Agent

The Host Interface (HI32) is a fast 32-bit wide parallel host port that can connect directly to the host bus. It is a standard peripheral on DSP563xx family derivatives, and supports a variety of standard buses to provide a glueless connection to a number of industry-standard microcomputers, microprocessors, DSPs and DMA Controllers. HI32 runs in three different modes – this note discusses the PCI mode, and includes a Data Scatter and Gather application using a DSP56301 running on a DSP56301ADM board.

Order by: AN1780/D

Booting DSP563xx Devices Through the Serial Communication Interface (SCI)

The DSP563xx bootloader code allows the DSP to load an application program and data through the Serial Communication Interface (SCI) to X, Y and P memory, and to begin executing the program on reset of the DSP. It also allows various DSP control registers to be programed before executing the downloaded program. This note describes how to use the bootloader code, including resetting the DSP, and downloading and running the bootloader. It contains overviews of the SCI, the DSP mode pins and operation modes, and the internal bootstrap ROM code.

Order by: AN1781/D

Converting DSP56303 Designs to DSP56307 Designs

This application note details the device differences that must be considered when redesigning a system based on the DSP56303 for use on the DSP56307. Required changes are discussed under the headings of Hardware and Layout, Precessor Type ID, Control Registers, Memory Switches, and Bootstrap and Operating Modes. In addition, the new Enhanced Filter Coprocessor of the DSP56307 allows some optional enhancements, which are summarized here.

Order by: AN1782/D

Determining MCU Oscillator Start-up Parameters

Many microcontrollers incorporate an inverting amplifier for use with an external crystal or ceramic resonator in a Pierce oscillator configuration. This application note describes how to calculate the minimum gain (transconductance) of the amplifier that is required to ensure oscillation with specific external components, and how to measure the transconductance to establish whether the minimum gain requirement has been met.

Order by: AN1783/D

Visual Debug for MPC60x

When a new MPC60x system is in the initial debug phase, there is often no simple means of providing feedback to the designer. The circuit described here was implemented to overcome this. It enables two hex digits to be displayed by writing or reading memory locations; no initialisation or setup is required. The design uses only the address phase of the MPC60x bus and requires the target system to terminate the cycle. It consists of three 22v10 PLDs, for which full logic equations are provided, plus two 7-segment displays.

Order by: AN4000/D

Using the 16-bit Timer of an HC05 for an Interrupt Driven Software SCI

In many applications an oversized microcontroller has to be chosen because an asynchronous link to the outside world is required; since most of the smaller MCUs do not have a Serial Communications Interface (SCI) they cannot be used even though they could handle the remainer of the application easily. A software SCI that does not require too much CPU performance is a feasible way to satisfy many such applications. This note explains how, presenting a half duplex design based on the 16-bit timer and using just 2 bytes of RAM.

Order by: AN4002/D

±2g Acceleration Sensing Module Based on a ±40g Integrated Accelerometer

Rev 4

Micromachined accelerometers with buit-in signal conditioning and calibration, such as Motorola's MMAS40G10D, are widely used in automotive systems such as airbag modules. Other automotive applications for accelerometers include active suspension, but for such applications a ±2g device is required and these are generally not available in large quantities and at low cost. This simple and inexpensive circuit demonstrates the use of the ±40g MMAS40G10D for sensing acceleration over a ±2g range. The design is based on the '40G-2G' evaluation board.

Order by: AN4004/D

Thermal Management and Mounting Method for the PLD 1.5 RF Power Surface Mount Package

At power levels less than 2W, thermal management of surface mount components can be achieved through the contact pads on the printed circuit board; dissipation of the device is a function of the pad size. However at power levels in excess of 2W alternative techniques are necessary to remove the heat dissipated in the device, in order to maintain device junction temperature within the range specified for reliable operation. This note discusses the

use of solder-filled thermal vias in the PCB, the recommended method of thermal management for the PLD 1.5 package (case 466-02).

Order by: AN4005/D

300 Baud Smart Modem with Intelligent MCU Controller

A low-speed 300 baud modem, characterized for full duplex operation, with low cost per function and a low bit error rate under any line conditions is required for use in communication links between central mainframe computers, local area network (LAN) and PCs through public switched telephone networks/PABX. In these areas, additional intelligent features are needed to provide inter-modem handshaking as well as operational protocol such as automatic answer, originate only, initiate disconnect and automatic disconnect. These are easily implemented by an 8-bit MCU such as Motorola's MC6805 single chip microcomputer.

Order by: AN-HK-01/H

Low Power FM Transmitter System MC2831A

This application note provides information concerning the MC2831A, a one-chip low-power FM transmitter system designed for FM communication equipment such as FM transceivers, cordless telephones, remote control and RF data link.

Order by: AN-HK-02/H

A High Performance Manual-Tuned Receiver for Automotive Application Using Motorola ICs MC13021, MC13020 and MC13041

This design is intended to provide radio engineers with a good start in automotive manually-tuned AM stereo receiver design. After discussing the most important principles of this type of receiver, a design is presented complete with circuit, PCB artwork and performance curves.

Order by: AN-HK-07/H

A Medium Scale PABX

Order by: AN-HK-08/H

MC68HC05L9 Microcomputer Applications Demo Board

Order by: AN-HK-10/H

MC68HC05F6 Tone Pulse Dialer

Order by: AN-HK-12/H

MC68HC05L10 Handheld Equipment Applications

Order by: AN-HK-13A/H

MC68HC05L11 Hand-Writing Applications

Order by: AN-HK-15/H

MC68HC05F2 DTMF Output Low Voltage Active Filter

Order by: AN-HK-17/H

Bi-Directional Data Transfer Between MC68HC11 and MC6805L3 Using SPI

The powerful Serial Peripheral Interface available on many Motorola MCUs is implemented in 2 forms (the HCMOS families support only Level 1, Level 2 is implemented only on HMOS processors). Both levels communicate easily with each other, but Level 2 has additional capabilities including asynchronous communication. This note describes a method of achieving synchronous communication between levels 1 and 2, and explains the on-chip differences in SPI implementation.

Order by: ANE405/D

MC68HC11 Implementation of IEEE-488 Interface for DSP56000 Monitor

The original purpose of this IEEE-488 (GPIB) interface to the Motorola DSP56000 Digital Signal Processor was to allow development of DSP56000 software and hardware on an HP9836 engineering workstation. The design is based on the MC68HC811A2; component count is minimized, and the MCU's 2K bytes of on-chip EEPROM are sufficient to avoid the need for external memory. The MCU runs in

expanded mode, using the external bus to communicate with the DSP host port which is configured to appear as a group of MC68HC11 external memory locations.

Order by: ANE415/D

MC68HC05B4 Radio Synthesizer

Synthesis of the local oscillator in a superheterodyne radio provides many advantages over mechanical tuning, including accuracy, stability and storing often-used frequencies. In this application, an MC145157 CMOS Synthesizer is controlled by an MC68HC05B4 MCU – the software is mask programmed in parts marked 'MC68HC05B4 DEMO', but could alternatively be programmed into an MC68HC805B6. A 6-digit LCD driver is controlled through the Serial Communications Interface, while the standby mode is used to eliminate interference with the radio.

Order by: ANE416/D

Use of the MC68HC68T1 RTC with M6805 Microprocessors

The MC68HC68T1 Real Time Clock with RAM (20 bytes) communicates through a serial port, making it ideal for use with single-chip MCUs; additional features include Watchdog and Power Fail Detection. This example software and MC68HC805C4-based circuit demonstrate the creation of an LCD alarm clock. The code includes routines to use either the MCU's SPI port or lines of a parallel port – it could be used in any 6805 microprocessor, with a small change for HMOS devices.

Order by: ANE425/D

An MC68030 32-bit High Performance Minimum System

Circuit and description of a high-performance 32-bit system using the fast synchronous bus interface of the MC68030 to access RAM with a two clock-cycle read and write bus-cycle. Uses commercially available memory devices, and standard FAST TTL interface logic for address decode. An MC68681 DUART provides two RS-232 serial ports; an MC68230 PI/T provides parallel I/O and 24-bit timer. Designed for 20MHz operation, with future 25MHz and 30MHz upgrades possible with faster memory devices.

Order by: ANE426/D

Digital Sine-Wave Synthesis Using the DSP56001/DSP56002

Rev 2

With the introduction of high-speed, high-precision digital signal processors, stable and low-distortion sine waves of any frequency can be produced digitally in communication and control applications. This document describes three look-up table methods for sine wave generation using the DSP56001. Total Harmonic Distortion (THD) performance and Maximum Synthesizable Frequency (MSF) are given in each case.

Order by: APR1/D

Digital Stereo 10-Band Graphic Equalizer Using the DSP56001

The theory of the Infinite Impulse Response (IIR) algorithm – used for the bandpass filtering – and its relationship to the analogue passive filter are presented. Exact algebraic expressions are derived relating centre frequency (f0), quality factor (Q), gain (G) and phase angle (f) to the IIR coefficients. A hardware interface to a compact disc player is described. It demonstrates the use of the DSP's SSI port for receiving and transmitting data, the implementation of a set of parallel second-order IIR filters, and the design of a low-cost memory-port bootstrap EPROM/DSP56001 system. This system is all-digital – A/D and D/A converters are not needed.

Order by: APR2/D

Fractional and Integer Arithmetic Using the DSP56000 Family of General-Purpose Digital Signal Processors

Rev 1

The on-chip multiplier of the DSP56000 Family of general-purpose Digital Signal Processors directly supports fractional data formats and indirectly supports integer formats, with hardware and software benefits. This note discusses the use of the processors to perform arithmetic operations on data represented as integers, fractions and combinations of the two (mixed numbers, real numbers, floating-point numbers).

Order by: APR3/D

Implementation of Fast Fourier Transforms on Motorola's DSP56000/DSP56001 and DSP96002 Digital Signal Processors

Rev 3

Frequency domain applications (as opposed to time domain applications) are becoming increasingly important as inexpensive processors become more readily available. The Fourier transform can be used as a mathematical tool for fast-filtering applications provided that sufficiently powerful 'engines' are available to implement the real-time filtering operation. Motorola's DSP56000/1 and DSP96002 digital signal processors provide particularly effective solutions. This report examines the mathematical basis of the FFT and demonstrates how DSP56000/1 features such as hardware DO-loop capability can simplify practical implementation. It examines the effects of round-off errors and the significance of the IEEE Floating-Point Specification.

Order by: APR4/D

Implementation of PID Controllers on the Motorola DSP56000/DSP56001

Rev 1

Demonstrates how the DSP56000/1 may be used to solve real-time digital control problems, concentrating on implementing some general control algorithms which include Proportional-Integral-Derivative (PID) controllers and notch filters. Points out the advantages of Digital Signal Processing over traditional analogue electronics in real-tiime applications.

Order by: APR5/D

Convolutional Encoding and Viterbi Decoding Using the DSP56001 with a V.32 Modem Trellis Example

Rev 1

Coding techniques – such as Hamming, BCH and Reed-Solomon – have long been used to correct errors in data transmission systems by adding redundant data, and in some cases scrambling the original data. This paper considers the use of Convolutional Encoding, a good method for correcting burst errors occurring during data transmission. Viterbi decoding is a maximum-likelihood method which is fast enough to allow real-time decoding for short constraint length codes, when using high speed processors. The DSP56001 is particularly efficient here.

Order by: APR6/D

Implementing IIR/FIR Filters with Motorola's DSP56000/DSP56001

Rev 2

Considers the design of frequency-selective filters – both Infinite Impulse Response (IIR) and Finite Impulse Response (FIR) – which modify the frequency content and phase of input signals according to some specification. Provides some intuitive insight into digital filters, especially the calculation of coefficients in the digital domain to obtain the desired frequency response, and shows how to implement both classes of filter (IIR and FIR) on the DSP56001.

Order by: APR7/D

Principles of Sigma-Delta Modulation for Analog-to-Digital Converters

The performance of digital signal processing and communication systems is limited by the precision of the digital input signal at the analogue/digital interface. Sigma-Delta (Σ-Δ) modulation-based A/D conversion is now a cost-effective technology for high reolution (>12 bits) converters integrated on DSP ICs, though the Σ-Δ modulator has only become important since developments in VLSI technology have allowed practical implementations. This note explains the Σ-Δ technology implemented in the DSP56ADC16, and shows the superior performance compared to conventional converters. Specifically, a third-order noise-shaping oversampling structure is discussed.

Order by: APR8/D

Full-Duplex 32 kbit/s CCITT ADPCM Speech Coding on the Motorola DSP56001

Describes the implementation of an Adaptive Differential Pulse Code Modulation (ADPCM) speech coder on the DSP56001. The algorithm used has been standardised by the CCITT in Recommendation G.721[1] for digital speech coding in a telecommunications environment; the standard specifies the translation of μ-law or A-law PCM encoded speech at 64K bit/s to ADPCM encoded speech at 32K bit/s to provide 2:1 compression with very little loss of quality. Two implementations are described; one adheres completely with the CCITT Recommendation, the other implements the same algorithm in a more efficient manner. Both provide full duplex operation on a single DSP56001.

Order by: APR9/D

DSP96002 Interface Techniques and Examples

Describes DSP96002 interfacing in four situations: Three high performance interconnection techniques for two or more DSP96002s; Connecting the DSP96002 as an Attached Processor on the IBM PC/AT™ bus (ISA bus) to provide an IEEE floating-point numeric accelerator; Interfacing the DSP96002 to the VMEbus by making an ADS96002 board a VMEbus slave; and Interfacing the DSP96002 to two DSP56ADC16 Sigma-Delta A/D converters. Timing diagrams and program listings are provided where necessary. A final section describes a non-intrusive hardware cycle counter for the DSP96002 Application Development System.

Order by: APR10/D

DSP56001 Interface Techniques and Examples

Rev 1

The cost of using SRAM to create a large memory for a DSP system can be prohibitive. Pseudo Static RAM (PSRAM) – which combines a dynamic RAM array with a simple interface and on-chip refresh logic – provides a compromise between high density, low cost, high speed and interface simplicity. This note presents a simple implementation of a PSRAM interface to the DSP56001. It also describes an interface with standard dynamic RAM for systems needing large amounts of memory, such as audio special effects. The final section shows an interface with an ISA Bus host processor that uses only two additional parts.

Order by: APR11/D

Twin CODEC Expansion Board for the DSP56000 Application Development System

This twin CODEC board is designed to simplify the development of telecom applications based on the DSP56000 Family processors. It uses the standard telecom sampling frequency of 8KHz, and the filter has a 300Hz to 3.4KHz band-pass characteristic. The board interfaces directly with the DSP using the SSI interface and is intended for any situation where a DSP module is required to link two analogue lines. Includes PCB artwork and DSP software listings for conversion between data formats.

Order by: APR12/D

Conference Bridging in the Digital Telecomms Environment Using the Motorola DSP56000

Conference Bridging allows telephone calls of three or more subscribers to be set up, and provides arbitration so that conversation can take place in a controlled manner. Digital bridges usually use a 'single speaker' algorithm to preserve good signal to noise ratio, with the loudest speaking subscriber being selected as the current speaker. This scheme is a software implementation written for the DSP56000/1.

Order by: APR14/D

Implementation of Adaptive Controllers on the Motorola DSP56000/DSP56001

An adaptive control system measures a certain performance rating. Based on the difference between desired and measured performance, the adjustment system modifies the parameters of the adaptive controller and the control law in order to maintain performance close to the desired value. This note shows how the DSP56000/DSP56001 digital signal processors can be used to solve real-time digital control problems. After reviewing the basic theory of adaptive control, it describes a number of implementations using serial-parallel reference models.

Order by: APR15/D

Calculating Timing Requirements of External SRAM for the 24-bit DSP56000 Family

When interfacing the DSP56000 family Digital Signal Processors to external SRAM, the behaviour of the internal clock is affected by the external clock and by the configuration of the Phase Locked Loop. This behaviour in turn determines the speed requirement of the external SRAM. Timing parameters are also affected by the configuration of the signals that the DSP uses to access the SRAM. This note is a tutorial on calculating the timing requirements. The examples and discussion are based on the DSP56002, but may also be applied to other members of the DSP56000 family having an external bus.

Order by: APR16/D

Application Optimization for the DSP56300/DSP56600 Digital Signal Processors

The DSP56300 and DSP56600 are high-performance 24-bit and 16-bit cores in Motorola's family of digital signal processors. They are based on the same pipeline structure, which is capable of executing an instruction every clock cycle. At the same time the cores maintain a Harvard architecture and programming model, similar to the older 24-bit DSP56000 core. DSP56300/DSP56600 code may be based on earlier DSP56000 code, or may be written specifically for these processors. This document is a supplement to the detailed DSP56300 and DSP56600 Family Manuals, and describes the new features to enable software engineers to utilize resources fully and to develop optimized applications.

Order by: APR20/D

Software UART on the DSP56L811 Using GPIO Port B

The UART port is a common interface the is used on a vast number of devices and products. However because the serial peripherals available on the DSP56L811 are synchronous devices they do not provide intrinsic UART capability. This application note describes a software module for the DSP56L811 which allows it to emulate a UART by using GPIO Port B in conjunction with timer interrupts. The interrupt-based design keeps core intervention and overhead to a minimum.

Order by: APR21/D

Application Conversion from the DSP56100 Family to the DSP56300/600 Families

The Motorola DSP56100 family and the DSP56300/600 families are similar in many ways, but the parts are not fully compatible. Therefore, using a DSP56300/600 in place of a DSP56100 requires modification of both the hardware and the software. This document summarizes information needed by a user to estimate the effort required to convert an application and the details involved in translating the software. Discusses the differences in architecture (mainly the organization of data memory), examines unsupported DSP56100 instructions and provides a functionally equivalent DSP56300/600 solution.

Order by: APR22/D

DSP56300 Assembly Code Development Using the Motorola Toolsets

Provides integrated supplementary information for the Motorola assembly toolsets used for the DSP56300 family of Digital Signal Processors, beyond that in the user's manuals for the DSP56300 Assembler, Linker, Simulator and dubugger. A detailed example is provided for management of multifile assembly code projects in the UNIX environment. Includes an overview of the Simulator and the Application Development System (ADS), plus helpful tips – beneficial to users new to the toolset – for facilitating software development.

Order by: APR30/D

Booting and Simple Usage of the DSP56004/007/009 SHI Port in SPI Mode

Discusses the procedure for booting the symphony series of digital signal processors through the Serial Host Interface (SHI) in Serial Peripheral Interface (SPI) mode. The target platform used here is the DSP56004/007/009 Evaluation Module, but the procedure is applicable to all Motorola DSPs with SHI ports. After booting, the simple DSP application runs as a slave to the MC68HC711E9 microcontroller on the Evaluation Module, responding to button selections on the MCU interface by toggling a GPIO pin.

Order by: APR31/D

ROM Software Patching on the Motorola DSP56304

Although software is typically very robust before being introduced to ROM, modifications must often be incorporated later. On the DSP56304, incorporation is achieved by enabling the patch mechanism and using the cache to replace, skip or insert portions of code in ROM. This report discusses both simple and complex cases of patching ROM code. In addition, it presents methods that optimize the patching procedure to minimize the impact on cache performance.

Order by: APR33/D

MC68328 Microprocessor Application: FLEX Alphanumeric Chip MC68175 Interface for One-Way Pager

The Motorola MC68328 (Dragonball) is a low-cost, low-power, highly integrated microprocessor designed for consumer portable devices such as PDAs, pagers and cellular phones. FLEX Protocol is Motorola's multispeed, high-performance paging protocol used by 70% of the world's paging service providers, which is becoming the de facto paging standard. This note describes the hardware and software interfaces between the MC68328 (Dragonball) MPU and the MC68175 FLEX Alphanumeric Chip signal decoder to create a powerful solution for personal portable communication devices.

Order by: APR34/D

Designing Motorola DSP56xxx Software for Nonrealtime Tests File I/O Using SIM56xxx and ADS56xxx

Debugging real time digital signal processing systems is inherently challenging due to their complex nature and the high performance they demand. By executing portions of a DSP application in nonrealtime using the Motorola DSP Simuilator or the Application Development System (ADS), many bugs can be eliminated before system integration and test. This report presents the methods for performing File I/O using the Simulator and ADS. Conditional assembly allows quick software reconfiguration for simulation, ADS or realtime execution, and is presented here as a solution to multi-execution environment needs.

Order by: APR35/D

Interfacing the DSP560xx/DSP563xx Families to the Crystal CS4226 Multichannel Codec

Professional and consumer-level audio processing is a common application for Motorola's DSP560xx and DSP563xx digital signal processors, which are a popular choice in products ranging from recording studio effects processors to home surround sound decoders. This application note focuses mainly on the DSP56xxx as a surround sound decoder and on the accompanying hardware such an application requires. Includes interface considerations, communications protocol, and Crystal CS4226 interface examples.

Order by: APR36/D

Implementing AC-link with ESAI

Rev 1.1

The Enhanced Serial Audio Interface (ESAI) of the DSP56300 Family provides full capabilities for interfacing with a general AC'97 CODEC through an AC'97 Digital Serial Interface (the AC-link). This report describes how to implement an AC-link using the ESAI. It includes details of the physical connection, the Data-Flow model, system concept, DSP56300 Family resources used, and the assembly code and equates of the application.

Order by: APR37/D

Interfacing Serial EEPROM to DSP563xx

Describes how to interface DSP56300 Family devices to industry standard, SPI-compatible, Serial Electrically Erasable Programmable Memory (SEEPROM) such as SGS-Thomson's ST95010/020/040 or National's NM25C020. The interface is based on either the Enhanced Synchronous Serial Interface (ESSI) or the Synchronous Communication Interface (SCI), which are available in several derivatives of the DSP5600 Family.

Order by: APR38/D

Programming the DSP56307 Enhanced Filter Coprocessor (EFCOP)

The Enhanced Filter Coprocessor (EFCOP) is a general purpose peripheral module of the DSP56307. It is a fully programmable complex filter whose operations are completed concurrently with the DSP56300 core operations with minimal CPU intervention. The EFCOP has dedicated modes of operation which are optimized for cellular basestation applications. This document describes its programming model, and presents two application examples: a complete IIR filter, and an LMS echo canceller.

Order by: APR39/D

Implementing Viterbi Decoder Using the VSL Instruction on DSP Families DSP56300 and DSP56600

Today's communication systems typically make considerable use of signal processing to improve performance. Two common functions are channel equalization and error correction; for equalization, maximum likelihood sequence estimation is among the most popular schemes, while for error correction, convolutional coding with Viterbi decoding

is a method of choice. This note describes how to generate the assembly code needed for implementation of a Viterbi decoder on the DSP56300 and DSP56600, from a set of convloutional code polynomials.

Order by: APR40/D

15 x 15mm PBGA Daisy-Chain Application Report

Glob-top Plastic Ball Grid Array (PBGA) mechanical sample packages are available from Motorola for use in surface mount assembly process development. They are physically similar to the active devices, being manufactured to the same general material and physical specifications. This report describes the 15 x 15mm PBGA daisy-chain package and its use in developing PGBA surface mount techniques.

Order by: APR42/D

G.722 Audio Processing on the DSP56100 Microprocessor Family

The CCITT standardised G.722 specification details the characteristics of a system for 7kHz audio-coding within 64 kbits/s that may be used for a variety of higher quality speech applications. This note describes the software implementation of a speech codec conforming to G.722 that uses Motorola's DSP56156. The coding system uses Sub-Band Adaptive Differential Pulse Code Modulation (SB-ADPCM) to decimate a signal sampled at 224 kbit/s to digital data for transmission at 64 kbit/s. The note also gives a brief overview of the latest speech coding techniques and the relative position of the G.722 algorithm.

Order by: APR404/D

Minimal Logic DRAM Interface for the DSP56156

Many DSP applications require large amounts of memory. Significant reductions in cost can be achieved by using Dynamic RAM in place of fast Static RAM, though this will always be at the expense of memory access speed. This note describes a minimum glue-logic DRAM interface – designed for maximum performance – for the DSP56156. The scheme differs from conventional DRAM designs in that no latches are used to hold the row and column addresses during DRAM accesses – the DSP address and data lines are connected directly to the DRAM, and a single PAL16R6 is used for memory decoding, read, write and refresh control.

Order by: APR405/D

Compilation and Pascal on the New Microprocessors

With the 8 bit microcomputers like the Motorola 6800 there is little choice but to write in assembler (or interpreter) since the facilities provided by the order code are insufficient to support most high level languages. Compilation is the most attractive alternative for the hybrid 8 and 16 bit microcomputers such as the Motorola 6809. Pascal has facilities that enable a compiler to generate better code for such machines than might be expected from compilers for other languages. (BYTE, 1978)

Order by: AR103/D

Macrocell Arrays: An Alternative to Custom LSI

High technology array-based products offer the advantages of custom LSI circuits, yet overcome the problems of high costs and long design cycles. Recent developments in array technology make use of macrocell building blocks for easier design and higher performance. Additional developments in CAD customer interfaces simplify the job of developing array circuits. This paper examines Motorola's macrocell array concept with special emphasis on the CAD user interface.

Order by: AR108/D

Speeding Up the Very High Voltage Transistor

The challenge of achieving switching speeds consistent with today's operating frequencies is not only from slower switching speeds but primarily from performance that is heavily dependent on drive optimization. The two areas where performance can be improved, in the transistor itself and in the circuit design, are explored here.

Order by: AR120/D

Array-Based Logic Boosts System Performance

Using ECL arrays to build standard logic blocks increases gate speeds by more than a factor of four and offers 100 times the density of standard 10K ECL logic.

Order by: AR128/D

DPAK: The Power Package for Surface Mount Applications

Devices with ratings up to 500 volts or 14 amps can now be integrated efficiently into surface mount assemblies using this new discrete power semiconductor package, developed by Motorola. *(Powertechnics, September 1985)*

Order by: AR145/D

Lossless Current Sensing with SENSEFETs Enhances Motor Drive

New power MOSFETs allow 'lossless' current sensing in fractional horsepower motor drives. Once available only to IC designers, this technique brings significant benefits to servo system designs.

Order by: AR160/D

A Power FET SPICE Model From Data Sheet Specs

The personal computer has brought CAE tools to the designer's desk. Although large circuits cannot always be accommodated, circuit designs can be modelled for individual functional blocks. This article shows a method of developing a model of Motorola's TMOS Power MOSFETs for the SPICE2 circuit simulator program. Included is a table of process dependent design parameters required by the program. *(Powertechnics, August 1986)*

Order by: AR175/D

RF Power Transistors Catapult into High-Power Systems

Back in 1962, RF power transistors were nonexistent, or at best in their infancy. Today the RF power transistor is a mature product that provides solid state sources in kilowatt FM broadcast transmitters, TV transmitters, 120W two-way mobile radios, cellular telephones, aircraft communications, radar and a variety of military applications. RF power has reached today's technology primarily because of advancements in two key areas – die design and packaging. *(Microwaves & RF Magazine, March 1987)*

Order by: AR179/D

Electronic Ballasts

Presents the advantages of the electronic ballast over conventional fluorescent circuits, and discusses the requirements of voltage fed and current fed designs. Includes a design example for a 20W lamp. *(PowerConversion & Intelligent Motion, April 1987)*

Order by: AR180/D

Bipolar Transistors Excel in Off-Line Resonant Converters

Resonant converters place high voltage stresses on their switching devices and are a natural application for the new generation of high-speed bipolar power transistors. Switching power supplies are now commonly used throughout the electronics industry because of their reduced size, weight and cost coupled with increased efficiency. Operating frequencies have increased to more than 60kHz, leading to higher voltage spikes and the need for higher voltage specifications for the RBSOA of the power transistor. *(Powertechnics, March 1986)*

Order by: AR181/D

Building Fast SRAMs with no Process 'Tricks'

Motorola has devised a series of circuit innovations that create true asynchronous Static RAMs capable of 25ns access times, without relying on process improvements like scaled geometries, three levels of interconnection, resistance reduction or bipolar/CMOS combinations. The result is remarkably low power consumption, immunity from skews, small die area and improved reliability. This article has the details. *(Electronics, 7 August 1986)*

Order by: AR241/D

Motorola's Radical SRAM Design Speeds Systems 40%

Engineers designing Motorola's new Static RAMs develop a synchronous architecture that improves system throughput 40% while reducing component count 50%. With the addition of critical I/O latches on-chip, 8 to 10ns of interconnection delay is eliminated, together with external circuits often required to make asynchronous devices appear synchronous in high-speed cache memory systems. *(Electronics, 23 July 1987)*

Order by: AR256/D

High Frequency System Operation Using Synchronous SRAMs

Designers demand faster and faster Static RAMs to support shorter processor cycle times. Fast SRAMs need precise control to achieve their full performance, creating the need for additional logic. The Synchronous Static RAM has on-chip latches for all inputs and outputs, added drive capability and a self-timed write capability. Most external logic is eliminated and the memory runs at higher speeds than standard SRAMs with comparable access times. The paper describes the new architecture and an application example of an MC68030 cache subsystem. *(MIDCON 1987)*

Order by: AR258/D

Enhancing System Performance Using Synchronous SRAMs

The speed of high-performance systems is frequently limited by the performance of available SRAMs. The demand for sub-25ns devices is growing. Fast Static RAMs are already the driving force behind semiconductor technology, but with the smallest circuit features and the need for special processes they are often expensive to produce. Using conventional technology Motorola has developed an alternative 15ns device aimed specifically at meeting the real purpose of Fast SRAMs. *(ECN, October 1987)*

Order by: AR260/D

The Hidden Dangers of Electrostatic Discharge – ESD

You could be zapping your CMOS ICs without knowing it. With some insight and a lot of care you can break the habit! Initially aimed at radio amateurs – but useful for all CMOS users – this article explains ESD, its failure mechanisms, proper handling of sensitive devices, and how to set up a safe workbench. *(QST, March 1987)*

Order by: AR300/D

Solid-State Devices Ease Task of Designing Brushless DC Motors

Brushless fractional-horsepower DC motors are gaining in popularity over brush type motors. Their characteristics are similar but they avoid the practical problems associated with brushes. In the past control complexity has made them less attractive, but dedicated control ICs like the MC33034, plus current-sensing Power MOSFETs, mean that much of the control and protection electronics is available off the shelf. *(EDN, 3 September 1987)*

Order by: AR301/D

Thermal Management of Surface Mount Power Devices

Design requirements for printed wiring boards are changing with the introduction of Smartpower devices and surface-mount power products. Thermal management is of particular concern. A new metal-backed printed circuit substrate using polymer-based thermally-conductive dielectrics does not have the size and brittleness limitations of alumina substrates. It offers engineers the opportunity to expand the use of power surface mount technology. *(Powerconversion & Intelligent Motion, August 1987)*

Order by: AR302/D

Building Push-Pull, Multioctave, VHF Power Amplifiers

Twin FET 'Gemini' packages lie at the heart of a unique push-pull 300W power amplifier. With a 50v power supply this broadband amplifier design – covering 10 to 175MHz – is easy to implement. It has excellent impedance matching characteristics and low DC current levels. Wideband transformers and the right feedback network are important considerations. *(Microwaves & RF, November 1987)*

Order by: AR305/D

Densest Gate Arrays Ever from LSI Logic, Motorola

A brief overview of very high density CMOS gate arrays from two manufacturers. It includes Motorola's 5,000 to 105,000-gate HDC000 series which features a high 80% utilization factor. *(Electronic Products, 15 November 1987)*

Order by: AR306/D

Jumbo High-Density Gate Arrays Score a Round of Industry Firsts

A brief review of the technology of Motorola's high-density HDC000 gate arrays – the 'MAX' Family. The CMOS family offers triple-metal routing, up to 412 I/O sites, 1.0μm gate lengths, 100MHz operation and 80% gate usage. *(Electronic Design, 12 November 1987)*

Order by: AR307/D

Motorola's Arrays Hit a New High: 80% Gate Utilization

Three levels of metal interconnection and a new power bus routing philosophy result in more efficient use of logic compared to competitive channel-less architectures, which use the third metal level only for power distribution. No longer do arrays need huge gate counts in order to achieve a large amount of usable logic. *(Electronics, 12 November 1987)*

Order by: AR308/D

High-Density ASIC Family Achieves 100k-Cell Arrays

By using 1μm drawn gate lengths, 1.2μm design rules and three metal layers for signal and power routing, Motorola has developed the 'MAX' HDC000 CMOS macrocell array family, featuring up to 100,000 cell devices. *(EDN, 10 December 1987)*

Order by: AR309/D

Software for Sea-of-Gates Arrays Places and Routes Over 70% of Available Gates

New place and route algorithms used for Motorola's MAX family of CMOS arrays, with up to 105,000 gates, achieve gate utilization up to 80%. Placement and interconnection show high uniformity across the chip. *(VLSI Systems Design, January 1988)*

Order by: AR310/D

High-Voltage MOSFETs Simplify Flyback Design

Many designers rule out power MOSFETs in flyback converters because of the inherently high on-resistance of high breakdown-voltage devices. But despite increased conduction losses and silicon costs, 1000 volt MOSFETs can simplify the design to the point where they become a cost-effective alternative to bipolar and multi-transistor bridge designs. *(Powertechnics, January 1989)*

Order by: AR326/D

RF Modems Simplified

A few years ago, if a system required an RF modem the engineer had to design it from scratch. Today, if the system needs can be met using FSK modulation, RF modems are available. An example is the MHW10000 family from Motorola, described here. These RF modules provide all the necessary transmitter and receiver functions for full duplex VHF modems capable of interfacing to a single T/R port. *(RF Design, January 1990)*

Order by: AR333/D

The Low Forward Voltage Schottky

As feature sizes are scaled down in very high density circuits, it will be necessary for the standard power supply voltage to be reduced from 5V to 3.3V within the next few years to avoid degrading performance in the new devices. Also, greater power supply efficiency will be required if the power supply is not to occupy a disproportionate amount of the total system volume. Since the major power loss in switching power supplies is in the output rectification circuits, more efficient rectifiers are needed. Schottky rectifier technology shows the greatest potential. *(Powertechnics, May 1990)*

Order by: AR340/D

Power MOSFET 1HP Brushless DC Motor Drive Withstands Commutation Stresses

Power MOSFETs are ideal for brushless DC motor speed control because they can switch at high frequencies. Building a high-power brushless DC motor driver requires a reliable, low-cost high side driver. It also requires an understanding of the more subtle effects of diode snap and PC board layout. These higher-voltage off-line applications can use the same basic MOSFET technology as lower-powered drivers. Includes schematic and background theory. *(PowerConversion & Intelligent Motion, June 1990)*

Order by: AR341/D

Switches for High-Definition Displays

All the proposed High-Definition Television (HDTV) systems would deliver an 'enhanced viewing experience' through greater resolution and a wider aspect ratio, which can be achieved on CRT systems only by increasing the scan frequency. Doing this will require semiconductors for horizontal deflection circuits that offer greater performance than those now available. *(Information Display, June 1990)*

Order by: AR345/D

RF Power FETs: Their Characteristics and Applications

The first article in this two-article reprint places the various FET manufacturing technologies in historical perspective, as a background to a detailed discussion of power FET characteristics and a comparison between FETs and bipolars used in RF designs. The second article considers in detail the effects of FET characteristics on device performance in various typical applications, including noise performance and linearity. *(QEX, January 1989)*

Order by: AR346/D

A Compact 1kW 2-50MHz Solid-State Linear Amplifier

Solid-state high-power linear amplifiers are becoming more and more popular in the field of ham radio as the prices of HF power transistors continue to fall; 250W devices are now available for almost half the price of a few years ago. RF power FETs are still more expensive, but eventually their prices will also fall. This 1kW amplifier is a compact state-of-the-art design using two 600W FETs. It would be difficult, if not impossible, to design an amplifier offering similar performance over four and a half octaves using inexpensive bipolar transistors. Includes PC artwork. *(QEX, July 1990)*

Order by: AR347/D

Adapt Non-ISDN Terminals to ISDN Data Rates

The emergence of the Integrated Services Digital Network (ISDN) raises the question of how to use older, non-ISDN equipment with the new system. The CCITT has proposed the V.110 and V.120 interface standards to solve this problem in two different ways. The standards are known as the Rate Adaption methods because they are concerned mainly with adapting the data rates of terminal equipment to the 64 kbit/s basic rate of ISDN. This article shows how the Motorola MC68302 Integrated Multiprotocol Processor can be used to implement either of the standards. *(Electronic Design, 25 April 1991)*

Order by: AR350/D

The Making of the PowerPC

A primary design goal of the PowerPC 603 microprocessor was to provide sophisticated power management without compromising performance. The system designer can control energy consumption through both hardware and software, and the 603 also includes automatic internal power management. This article reviews the internal Dynamic Power Management, the four power states and the transitions between them. *(Communications of the ACM, June 1994)*

Order by: AR359/D

PowerPC 620 Soars

In October 1994, IBM and Motorola jointly announced first silicon on the PowerPC 620, the first 64-bit implementation of the PowerPC architecture in a processor. Its faster logic, shorter pipelines and high-speed interface give it processing power that raises it to workstation and server status. This article provides a technical overview of the 620, comparing it in particular to the 604. *(BYTE Magazine, November 1994)*

Order by: AR360/D

Whipping Up Real-Time Designs – Programming Motorola's TPU

Motorola's Time Processor Unit can offer tremendous flexibility for designers of embedded systems. This overview of the steps to mastering the timing coprocessor includes a description of the TPU and several examples of custom programming. *(Embedded Systems Programming, March 1995)*

Order by: AR362/D

Characterizing Overvoltage Transient Suppressors

For relatively low cost, expensive circuits can be safely protected by one or more of the overvoltage transient suppressors on the market. Depending on the type and energy of the transient, these suppressors can take several forms. This article describes the operation of the surge current test circuits used in characterizing lower energy transient suppressors, and defines the attributes of the various suppressors available to allow designers to assess the cost/performance tradeoffs.

Order by: AR450/D

VSWR Protection of Solid State RF Power Transistors

Most transistor failures in solid state amplifiers occur at load mismatch phase angles that present a high current mode of operation to the transistor, resulting in an increase in the power dissipated. Since the temperature time constant of a typical RF power transistor die is 0.5 to 1ms, any protection system must react faster than this. *(RF Design, February 1991)*

Order by: AR510/D

Biasing Solid State Amplifiers to Linear Operation

Solid state devices intended for linear operation need a certain amount of "forward bias" to place their operating points in the linear region of the transfer curve. Bipolar devices require a constant voltage source, whereas MOSFETs can be biased with a simple resistor divider network – both are more complex if temperature stability is required. Applications requiring amplifier linearity include amplitude modulated systems for communications and broadcasting, nuclear magnetic resonance, digital cellular telephones, and signal sources for instrumentation.

Order by: AR511/D

Build Ultra-Low Dropout Regulator

Switching power supply post-regulators, battery powered equipment and other applications often need low-dropout voltage linear regulators; battery life may be affected significantly by dropout performance. This simple circuit offers a lower dropout voltage than any available monolithic regulator, with good current limiting performance – dropout is less than 50mV at 1A, increasing to just 450mV at 5A. *(Electronic Design, 14 February 1991)*

Order by: AR514/D

Gate Arrays Simplify Translation between High Speed Logic Families

TTL dominates today's I/0 specifications. However ECL provides increased bandwidth and low noise in a transmission line environment – high performance designs need increasingly to combine ECL and TTL interfaces. This paper presents a flexible approach to mixed signal level translations using a single I/0 cell on a family of ECL gate arrays. The incorporation of Schottky diodes within the bipolar process provides high performance on/off chip logic translations to complement the 2.6Gb/s ECL I/0 interface capability. Versatile high speed system applications are illustrated and described. *(IEEE International ASIC Conference, September 1991)*

Order by: AR518/D

Low-Skew Clock Drivers: Which Type is Best?

As system clock frequencies press towards the 50 to 100MHz range, maintaining control over clock timing becomes progressively more difficult. Not only do new microprocessors require precisely timed input clock waveforms, but multiple inputs as well. Furthermore, system requirements dictate that clocks distributed to system components have minimal edge skew. To help the designer meet these goals, semiconductor manufacturers have introduced a variety of low-skew clock drivers. Gate, divider, phase-locked loop and programmable delay types are available. *(Electronic Products, May 1992)*

Order by: AR519/D

Application Specific MultiChip Modules

Four papers presented at conferences in 1991/92:

- **Multichip Modules Present New Challenges to Place-and-Route CAD Tools** – Growing demand for cost-effective multichip modules places a premium on sophisticated tools for fast, accurate design.
- **Electrical Analysis of a Thin-Film Multichip Module Substrate** – Electrical analysis of a 6-chip module is described and compared with the same circuit function using single chip packages on a PCB.
- **Test Philosophy for Multichip Modules** – Test philosophies should include interfaces to a CAD system so that electrical and thermal properties for each design can be analysed.
- **Multichip Module Die Attach and Substrate Technology Considerations** – Evaluates the die-attach options and substrate alternatives for advanced multichip module packaging.

Order by: AR520/D

Ranking of Gate Array and Cell-Based ASIC Vendors by Customers

A survey of electronic equipment manufacturers, who rate 17 gate array and cell-based ASIC vendors on 11 different criteria. Motorola achieved the highest score; this is attributed to good support of strategic customers, effective use of generic CAD tools, practical testability concepts, innovative packages and competitive products. *(International Business Strategies Inc., 1993)*

Order by: AR522/D

An Overview of Surface Mount Technology (SMT) for Power Supply Applications

Compared to conventional through hole packaging, Surface Mount Technology offers the ability to reduce the size and cost of electronic systems. Once lagging behind in the use of SMT, power devices are now available that allow the production of SMT-based power supplies. This article looks at the different package types for power semiconductors, transistor and diode arrays, thermal performance and passive devices. *(HFPC, May 1993)*

Order by: AR523/D

Simple Pressure Switches Comprise Transducers, Comparators and Op Amps

With the addition of a few components, conditioning circuits for pressure transducer signals can provide a logic-level output that changes state when a pressure crosses a threshold. This article describes such a switch based on the MPX2100DP. It provides background calculations, circuit details and performance comparisons when using different comparator circuits. *(EDN, 14 April 1994)*

Order by: AR560/D

Active SCSI Terminators Confront Critics and Gain Acceptance

Manufacturers and end users are increasingly using active SCSI terminators in place of resistor packs. The silicon devices reduce board space and are not so prone to mechanical damage during insertion or extraction. They are produced in reliable surface mount packages and can be connected or disconnected by a signal transition. However, active terminators have gained a reputation for not being able to handle heat dissipation adequately. This article shows through calculation and waveform illustration that this reputation is unfounded. *(EDN Magazine, 14 April 1994)*

Order by: AR563/D

Dual 180V GaAs Schottky Diode Rectifies 10A/leg

Some years ago, Motorola started to develop a gallium-arsenide (GaAs) technology for power Schottky rectifiers, to overcome the limitations of silicon rectifiers handling high reverse voltages at the higher frequencies. The first device to emerge from the development programme is a 180V dual GaAs Schottky diode handling 20A continuous current. This article describes the background, the technology and some applications. *(Electronic Design, 8 August 1994)*

Order by: AR564/D

GaAs RF ICs Target 2.4GHz Frequency Band

Motorola has introduced its first GaAs RF integrated circuits. Designed for applications in the 2.40GHz to 2.48GHz industrial/scientific/medical band, they support a wide range of modulation formats and include a low noise amplifier and downconverter mixer, a buffer/exciter amplifier, and a

power amplifier. All three devices feature low current operation at low voltages and are housed in plastic SOIC packages. *(Microwaves & RF, July 1994)*

Order by: AR597/D

PCS and RF Components

Suddenly, almost everyone in the electronics business is making products for "wireless" applications. But today's "wireless" is different to the decades of radio communications between fixed points – the market is now defined by two important words: "portable" and "consumer". This article looks at Personal Communications Services (PCS), and its effect on the development of semiconductors and semiconductor technologies. *(Applied Microwave and Wireless, Spring 1995)*

Order by: AR606/D

Modular DC-DC Converter Sends Power Density Soaring

The DJ80 converter from the AMPSS Division of Astec America achieves a power density of 90W per cu. in., and 90% efficiency. Much of its success is due to clever magnetic design and a patent maufacturing process, but efficiency is further improved by the use of Motorola MGRB2025CT GaAs rectifiers in the output circuit. These diodes have a very low reverse recovery charge, and their operation is largely independent of temperature variations, making them ideal for high-frequency power rectification. The diodes contributed a 3 to 4% improvement in efficiency to the power supply design. *(Electronic Design, 21 August 1995)*

Order by: AR607/D

New Float-Zone Process Ups Switching Rate of IGBTs and Also Cuts Their Fabrication Cost

The conventional fabrication process for Insulated Gate Bipolar Transistors (IGBTs) requires the growth of a thick epitaxial layer on the wafer, plus radiation or diffusion of a heavy metal such as gold. The process is therefore very expensive. Motorola uses an alternative 'non-punchthrough' process which is cheaper to produce. Previous attempts at building these devices resulted in poor yields due to breakage of the thin wafers, but Motorola has solved this problem by process simplification and elimination of manual handling. *(Electronic Design, 6 November 1995)*

Order by: AR608/D

Trouble Shooting Halogen Electronic Transformers

Halogen electronic transformers are electronic step-down converters used to supply 12V to low voltage halogen lamps. Because of their high frequency operation they are less bulky than conventional 50/60Hz transformers. In order to achieve low cost they are designed using bipolar transistors instead of MOSFETs, and although typical circuits normally see no undue stress under nominal operating conditions, certain conditions can cause the bipolar transistors to operate very close to their limits. This note discusses the two problem areas, and presents some techniques to deal with them.

Order by: AR609/D

Plastic Packages Hold Power RF MOSFETs

In the past, packages for RF power applications have generally been fabricated using ceramic materials; typically beryllium oxide (BeO). These packages have performed well for power bipolar and vertical FET devices, but at considerable cost compared to the plastic housings used elsewhere. With the increasing use of GaAs and LDMOS devices, as well as the need for high-performance, low-cost products for high-volume commercial applications, Motorola has developed a family of plastic packages that can accommodate a wide range of power devices from predrivers to output stages.

Order by: AR612/D

Advantages of LDMOS in High Power Linear Amplification

Discusses the advantages of LDMOS over Bipolar technology for linear power amplification, especially for high dynamic amplification or high power amplification in the 1.0GHz range. It presents results from a study on recently introduced Motorola LDMOS transistors compared to the same generation of bipolar transistors, both operating at 960MHz in the GSM band. The study focussed on gain, linearity and intermodulation. *(Microwave Engineering, April 1996)*

Order by: AR614/D

Next Generation Power MOSFETs Slash On-Resistance, Manufacturing Cost

A new generation of discrete power MOSFETs is based on the low cost and easy-to-manufacture planar Vertical DMOS technology. A new cell geometry yields a high channel density for extremely low on-resistance. There are particular benefits in low voltage applications such as hard disk drives and synchronous rectification, where designers can use smaller packages, reduce board space and reduce or eliminate heat sinks. *(PowerConversion & Intelligent Motion, October 1996)*

Order by: AR617/D

Three Large Markets Drive for Low Power

Driven by the Automotive, Mobile Computing and Disk Drive markets, Motorola and other MOSFET manufacturers have spent significant resources improving design and cost efficiencies of sub-100V drain-source breakdown voltage MOSFETs. They have had to attack the entire design/process flow. For low-voltage MOSFETs, packaging, design/process integration and substrate are the important factors. This article discusses the new techniques and technologies. *(Electronic Engineering Times, 9 December 1996)*

Order by: AR618/D

Op Amp Supply Squeezed Down to 1V Rail-to-Rail

Until recently, the lowest supply voltage for operational amplifiers has been in the region of 1.8V. The Motorola MC33502 dual op amp provides rail-to-rail operation at both input and output with supplies as low as 1V, opening up a wide range of possible op amp-based portable applications. Other applications may use the capability to extend battery life. The new device can also operate on supplies up to 7.5V, and it achieves unity-gain bandwidth exceeding 4.8MHz. This article describes the device and its technology.

Order by: AR619/D

Quest for the Perfect Battery

Nickel Cadmium batteries have been the preferred choice for portable applications for more than 30 years. However other chemistries such as NiMH and lithium ion, capable of higher voltages and energy densities, have been making strong inroads in a wide variety of portable electronic applications. This article considers the requirements for safety and control electronics for lithium ion battery packs. In particular, it discusses appropriate Motorola products, some of which have been designed specifically for these applications. *(Battery Power Products and Technology)*

Order by: AR620/D

The Electronic Control of Fluorescent Tubes

The 'electronic ballast' provides better quality fluorescent lighting with extended tube life, but the dynamic parameters of ballast transistors are critical for stable operation. Motorola's BUL44 and BUL45 are specifically designed for this application. Different circuit approaches are examined. Artwork and description of BUL45 evaluation board included. *(Electronique de Puissance, December 1988)*

Order by: ARE402/D

An 8-bit EPROM Interface for an MC68EC040/MC68360 System

The MC68360 Quad Integrated Communication Controller (QUICC) has an operating mode where the internal CPU32+ core may be disabled to allow an external processor to use its peripherals, and its MC68040 Companion Mode enables a glueless interface to an external M68040 family MPU. This document outlines a method of booting an MC68EC040/MC68360 combination from a single 8-bit EPROM. Familiarity with both devices is assumed.

Order by: DC414/D

Interface for MC68000 to DSP56001 Host Port

Shows how to interface an MC68000 (up to 16.67MHz) to one or two DSP56001s (20MHz or greater) through their HOST PORT interface. The interface provides read and write handshaking between the devices, reset capability for either DSP56001, 7-level interrupt encoding, and interrupt acknowledge handshaking for both DSP56001s.

Order by: DCE406/D

Get 300 Watts PEP Linear Across 2 to 30MHz from this Push-Pull Amplifier

Includes circuit, PCB artwork and layout for a 300W push-pull linear amplifier based on two MRF422s, designed to operate over the 2 to 30MHz band. An MC1723 voltage regulator is used as a bias supply.

Order by: EB27A/D

Low-Cost VHF Amplifier Has Broadband Performance

This bulletin presents two VHF amplifier designs intended for FM or CW service in the 136-174 MHz band. Both feature the Motorola MRF260 and MRF262 plastic encased VHF transistors which are rated at 5.0 W and 15 W power output respectively. The devices are packaged in a standard T0-220 silicone epoxy case with the emitter wired to the metal tab and centre lead of the device. This common emitter configuration results in good RF performance, improved thermal conductivity, and ease of mounting in an RF amplifier by connecting the transistor mounting flange to RF and DC ground.

Order by: EB90/D

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60 Watt VHF Amplifier Uses Splitting/ Combining Techniques

Proven combining techniques can be used to obtain higher output power and added reliability at VHF. Simple matching networks and power transistors with moderate gain can produce performance comparable to that of a single-stage amplifier with a larger, more expensive device. Though not the ultimate answer, the splitter/combiner method has distinct advantages over designs that force transistors into a parallel configuration. This 60 W amplifier operates from 150 to 175 MHz and features two low-cost MRF264 transistors. The design uses a modified Wilkinson combiner technique to produce 60W output with a drive level of 15W.

Order by: EB93/D

Mounting Considerations for Motorola RF Power Modules

The packaging used for Motorola RF Power Modules consists of a copper flange on which the ceramic substrates are soldered, and a non-conductive cover which is either a snap-on design or attached by epoxy. The substrates are either 96% Alumina, 95.5% Alumina, or 99% Beryllium Oxide, and are attached to the copper flange using lead-tin or indium based soft solders. This bulletin discusses the mechanical factors that should be considered when mounting these modules in equipment.

Order by: EB107/D

Low Cost UHF Device Gives Broadband Performance at 3.0 Watts Output

The package is the major cost in low to medium power RF transistors. Motorola introduced the common emitter TO-39 some years ago to limit cost increases. Good design and construction techniques can extend its use to broadband UHF amplifiers, like this broadband application of the low-cost MRF630, a transistor capable of 3W output power with 10dB gain at 512MHz. Emphasis is placed on mounting techniques.

Order by: EB109/D

Boost MOSFETs Drive Current in Solid State AC Relay

MOSFETs are usually easy to drive because they are voltage controlled, but a problem arises when a power MOSFET is used as a high-side switch – in applications such as AC or DC relays or H-bridge motor control circuits – because it is difficult to reference the gate drive circuit and supply to the MOSFET's Source. A clean and inexpensive solution is to use the voltage available at the Drain to drive the Gate.

Order by: EB141/D

The MOSFET Turn-Off Device – A New Circuit Building Block

Technical developments have led to a variety of discrete devices using circuit integration to reduce system cost and board space, while offering some performance improvement over conventional solutions. The first of these new components – dubbed SMALLBLOCK™ – is a building block that simplifies and reduces the component cost of an active gate-turn-off network for current-source driven MOSFETs. It is available in TO-92, SOT-23 and SOT-223 packages.

Order by: EB142/D

Neuron Chip Quadrature Input Function Interface

Quadrature encoding is used in position sensing applications; only two external characteristics are needed to accurately determine the position of an object relative to its last position – magnitude and direction of change. The Neuron Chip's quadrature inputs provide a simple means of processing external data encoded in quadrature format. Describes the use of the pins and the software implications.

Order by: EB146/D

LonWorks Installation Overview

Local Operating Network (LON) technology offers a powerful means of implementing a variety of distributed systems to perform sensing, monitoring and control. With LonWorks technology, devices are connected to their physical medium in much the same way as conventional products. However the physical attachment only interconnects the devices; it does not specify how the devices interoperate. Giving nodes unique network personalities and specifying how they communicate are additional key steps in LonWorks installation. This engineering bulletin explains the various ways to install a LON.

Order by: EB147/D

Enhanced Media Access Control with Echelon's LonTalk Protocol

This note provides an introduction to the LonTalk media access control (MAC) sublayer, part of the Data Layer of the OSI Reference Model. The MAC algorithm used by the LonTalk protocol belongs to the CSMA (Carrier Sense Multiple Access) family, one of many MAC algorithms. An explanation of the CSMA algorithm used by the LonTalk protocol is presented, and its features are compared with some of the other members of the CSMA family.

Order by: EB148/D

Optimizing LonTalk Response Time

In designing a LonWorks network to meet specified response times, the worst-case offered traffic (the total number of packets per second offered for transmission by all the nodes on a channel) must be considered and designed for. Several tools are available to the network designer to optimize the response time; the LonTalk protocol supports a variety of optional messaging services and collision detect hardware. The features of these services and their effect on LON response time are discussed here.

Order by: EB149/D

Scanning a Keypad with the Neuron Chip

This engineering bulletin describes how the Echelon Neuron Chip can be used to scan a simple 16-key switch matrix to provide a numeric and/or special-function keyboard without the use of a keyboard encoder. Depending on the number of keys to be scanned and the number of free I/O pins, different solutions are possible; this bulletin describes both matrix and direct connection methods, and includes software in the form of an SNVT.

Order by: EB151/D

How to Use SNVTs in LonWorks Applications

Echelon's LonWorks technology is intended for the design of distributed sense and control products. The LonTalk protocol, a communications protocol conforming to the seven-layer OSI Reference Model, has been optimized for intelligent distributed control applications as well as for facilitating interoperability among products using LonWorks technology. Consistency at the application layer is achieved through the use of Standard Network Variable Types (SNVTs). The intent of this engineering bulletin is to focus on the application layer and specifically on the proper use of SNVTs.

Order by: EB152/D

Driving a Seven Segment Display with the Neuron Chip

This engineering bulletin describes how the Echelon Neuron Chip can be used to drive a seven-segment display controller chip, the Motorola MC14489. The MC14489 can control up to five LED digits, each consisting of seven segments and a decimal point. No external current limiting resistors or drive transistors are required. The chip has a Serial Peripheral Interface (SPI), allowing for easy connection to the Neuron Chip's Neurowire port. Includes software drivers written in the Neuron C programming language, to display decimal numbers from binary data.

Order by: EB153/D

Analog to Digital Conversion with the Neuron Chip

Describes some of the more popular A/D conversion schemes available for use with the Echelon Neuron® Chip. This is not an exhaustive summary of the available techniques, but is intended to be an application-orientated reference for the Neuron Chip user. The ideas and solutions discussed are presented with the specific attributes of the Neuron Chip in mind in order to minimise the amount of design work required while enhancing system performance and overall functionality.

Order by: EB155/D

Creating Applications with the LonBuilder Multi-Function I/O Kit

The Neuron® C programming language provides 24 I/O objects supporting a wide variety of devices; the objects range from simple bit I/O to more complex timer-counter objects used to generate and measure various square wave signals. The LonBuilder™ Multi-Function I/O Kit enables rapid development of prototype applications using the I/O objects to solve distributed sense and control problems. Quick prototypes and feasibility studies are possible without developing any I/O hardware. This document describes how to use the Multi-Function I/O Kit and the example programs provided with it.

Order by: EB157/D

LonTalk Protocol

The LonTalk™ protocol is designed to support the needs of applications spanning a range of industries and requirements. It follows the reference model for Open Systems Interconnection (OSI) developed by the International Standards Organisation (ISO). To meet its broad objectives the protocol is presented to programmers and installers as a collection of services that may be chosen as required and fixed at compile time. In addition, many of the service choices may be changed by an installer when a node is installed or reconfigured in a particular application. This bulletin provides a comprehensive overview of the protocol.

Order by: EB161/D

Running the MC88110 in Lockstep

Systems that use two MC88110s running in lockstep must take precautions to guarantee predictable behaviour. First, all inputs must meet the the setup and hold times so that they are recognised on the same clock. Second, the system must ensure that the initial decoding of invalid instructions does not adversely affect the timing of the processors. This note addresses the second problem.

Order by: EB163/D

Interrupt Latency in the MC88110

This bulletin addresses interrupt latency in the MC88110. It provides a brief description of how interrupts are handled and includes examples of short and long interrupt latency cases. It is intended for hardware system designers who are familiar with the MC88110 Second Generation RISC Microprocessor User's Manual.

Order by: EB164/D

Hardware Implications of *xmem* as a *st* followed by a *ld*

The MC88110 supports an Exchange Memory (*xmem*) instruction that is a combination of a Load and Store instruction. The *xmem* instruction is normally a read access followed by a write access (as implemented originally in the MC88100). However, the *xmem* instruction can also function as a write access followed by a read access if the *xmem* bit is set in the data MMU/cache control register (DCTL); the write-before-read option can improve system performance. This note looks at the hardware implications.

Order by: EB165/D

System Design Considerations: Converting from the MC68HC805B6 to the MC68HC705B16 Microcontroller

Production of the MC68HC805B6 has been discontinued as a result of Motorola's corporate decision to eliminate the use of CFCs in manufacturing processes (CFCs were used in the processing of the MC68HC805B6 MCU). The recommended replacement is the MC68HC705B16. Whilst this is pin compatible with the earlier MCU and supports all its resources, it is not a drop-in replacement. This bulletin presents a detailed comparison of the two devices, with emphasis on the differences.

Order by: EB166/D

Differences between the MC68HC705B16 and the MC68HC705B16N

The MC68HC705B16N is a new version of the MC68HC705B16. Both devices are covered in revision 4 of the MC68HC05B6 Family Technical Data Manual, but this bulletin summarises the differences, which affect the bootloader, reset pulse width, the reset twice requirement of the MC68HC705B16, the supply current in Stop mode, and the shrink level.

Order by: EB180/D

Frequently Asked Questions and Answers: M68HC05 Family MCAN Module

Provides straightforward answers to 14 frequently asked questions about the M68HC05 Family MCAN module, with illustrations and assembler listing where appropriate. Questions include “How does the Ping-Pong principle of the two receive buffers work?” and “When and how should the single-line mode be used?”

Order by: EB181/D

Erasing and Programming the FLASH EEPROM on the MC68HC912B32

Rev 1.0

The 32 Kbytes of embedded FLASH EEPROM in the MC68HC912B32 serves as electrically programmable and erasable, non-volatile ROM emulation memory. It allows the storage of program code which must be executed frequently, must execute at high speed, or which might need to be upgraded in the field. This document outlines basic routines which can be used to program the FLASH EEPROM through the background debug mode interface (BDM), using a Motorola serial debug interface (SDIL) and the SDBUG12 (version 2.15) software from P & E Microcomputer Systems, Inc.

Order by: EB183/D

Programming EPROM and EEPROM on the M68HC11EVM

The M68HC11EVM is one of the most versatile development tools for the MC68HC11 A and E series microcontrollers. The bulletin applies to revision G boards using the EVMbug monitor version 3.0, and explains how to use the M68HC11EVM to program EPROM and EEPROM of the supported devices. It also has details of how to upgrade an earlier board to revision 3.0 status.

Order by: EB191/D

A Quick Turorial for MC68HC11 K, KA, KW, P and PH Series Microcontrollers

New Pulse Width Modulation (PWM) timer channels are available on certain microcontrollers in the M68HC11 family. Each of the affected MCUs has four 8-bit PWM timer channels; each pair of channels may use one of two different frequency references derived from the E clock. To produce PWM waveforms with longer periods, pairs of channels may be concatenated to form single 16-bit channels. This bulletin provides descriptions and programming examples for both 8-bit and 16-bit PWM generation.

Order by: EB192/D

How to Configure the Reset Pin on the MC68HC11

The ideal way to control the Reset pin on the MC68HC11 is with a low voltage inhibit circuit. However many designers would like to use an RC circuit, and wonder why the MC68HC11 Reference Manual specifically forbids this. This bulletin explains why a capacitor should never be connected to the Reset pin and describes the correct Reset configuration.

Order by: EB195/D

Using Pseudo-Interrupt Vectors on the M68HC11EVBU

The User’s Manual for the MC68HC11EVBU Universal Evaluation Board contains a printing error in respect of the pseudo-interrupt vectors to be used when running the BUFFALO monitor. This bulletin corrects the error, and clarifies the need for the vectors when running the monitor.

Order by: EB197/D

High Cell Density MOSFETs

A few years ago an affordable 60V, 10mΩ power transistor was only a dream (10mΩ is the resistance of about 20cm of #22 gauge wire). Today a sub-10mΩ power MOSFET is available housed in a standard TO-220 package. In addition, Motorola’s high cell density technology, HDTMOS™, brings

other advantages such as greatly improved body diode performance. The technological advances are sufficiently great that they are fundamentally changing low voltage power transistor technology. This bulletin discusses high cell density technology and its benefits for the end user.

Order by: EB201/D

Solving Noise Problems in High Power, High Frequency Control IC Driven Power Stages

The MPIC control IC is one of a family of devices providing a convenient and cost-effective gate drive solution. Electrical design is easy as the device accepts ground-referenced logic level inputs and drives high and low side MOSFETs or IGBTs with an offset voltage up to 500V. But switching high current at high speed is not without problems, and this bulletin explains some of the more subtle design considerations – basically the design effort should be shifted from the circuit to the layout.

Order by: EB206/D

High Current Buffer for Control ICs

Modules and other paralleled MOS-gated power transistors can present difficulties for gate drive circuits. The MPIC21xx family of Control IC drives can provide large peak currents that are acceptable for most applications, but when driving the extremely large loads of many paralleled devices, excess power dissipation in the drive section of the IC may be a problem when switching at frequencies higher than a few tens of kHz. This bulletin describes a current buffer designed to alleviate this problem.

Order by: EB207/D

Design Check List for MPIC21XX Control ICs

A short, illustrated guide highlighting simple but important points to remember when designing withthe MPIC21xx series of control ICs – ground connections and layout, where to put the power bypass capacitor and the bootstrap capacitor, how to control dV/dt, where to probe the circuit.

Order by: EB208/D

Mounting Method for RF Power Leadless Surface Mount Transistors

The use of leadless surface mount RF devices in wireless systems has challenged previously well-accepted assembly techniques and thermal management methods. In mounting these devices, key attention must be given to their Coefficient of Thermal Expansion, terminals, heat sink and the board, as well as to the solder hierarchy within the system. This note addresses issues and solutions for mounting RF power transistors in the range 1-20 watts power dissipation; the 8W MRF1507 is used as an illustration.

Order by: EB209/D

MOVB, MOVW, PSHM, and PULM Syntax Differences on MC68HC16 Assemblers

The architecture of the M68HC16 Family of microcontrollers contains several new instructions compared to the M68HC11 Family, which add more powerful addressing modes to speed execution of certain repetitive operations. Some assemblers differ in the syntax of the instructions, and this bulletin discusses the differences in the MASM16 and IASM16 assemblers. MASM is shipped with the M68HC16Z1EVB, while IASM is shipped with the M68ICD16 dubugger package and all MEVB16 boards.

Order by: EB252/D

How to Use the Lookup and Interpolate Instruction on the CPU32

The Table Lookup and Interpolate instruction approximates a number that lies between two consecutive entries in a lookup table, as a function of one variable or of several variables. This bulletin explains the use of the instruction when only one variable is involved.

Order by: EB253/D

Use of the Lock Bit on Modular Microcontrollers with FLASH EEPROM

Explains the function of the LOCK bit in the FEEMCR register of modular microcontrollers with FLASH EEPROM, and the operation of the shadow registers.

Order by: EB256/D

Detecting Loss of Clock on Modular Microcontrollers

If the voltage controlled oscillator (VCO) of a modular microcontroller is used to generate the system clock frequency, the clock logic can detect a clock failure. This bulletin explains the possible built-in actions if this happens. Loss of clock cannot be detected when an external oscillator is used.

Order by: EB257/D

Sources of Reset on Modular Microcontrollers

Motorola modular microcontrollers have several sources of reset, which are listed and explained here. Synchronous resets are asserted at the end of the current bus cycle, while asynchronous reset signals cause an immediate reset of the system. The reset status register records which type of reset last occurred.

Order by: EB258/D

Why MC68300 and MC68HC16 MCUs May Halt after Release of Reset

A problem can occur with MC68300 and MC68HC16 microcontrollers showing specific symptoms including: the Reset line periodically asserts due to the watchdog timer timing out; all bus activity stops after eight or four pulses on the CSBOOT line; HALT, AS and DS are not asserted; and the FREEZE pin is asserted with a logic 1. This bulletin explains the problem and its solution.

Order by: EB259/D

Why an MC68300 or MC68HC16 Microcontroller May Fail to Release Reset

Under certain conditions a device from either the MC68300 or MC68HC16 families may fail to come out of Reset. This bulletin explains the possible causes and the steps that should be taken to avoid such problems.

Order by: EB260/D

Autovector Generation Using Chip Select Logic on MC68300 and MC68HC16 Devices

In MC68300 and MC68HC16 devices, an AVEC signal can be used to respond to an interrupt acknowledge cycle for one of the external interrupts (IRQ[7:1]), and automatically to choose a particular interrupt vector. IRQ[7:1] use vector numbers 11-17 on the CPU16 and vector numbers 25-31 on the CPU32. It is possible to respond to the interrupt acknowledge cycle with a DSACK signal which requires an external device to supply its own interrupt vector. This bulletin explains how to use the internal chip select logic to generate the AVEC signal.

Order by: EB261/D

DSACK Generation on the System Integration and Single-Chip Integration

The System Integration Module (SIM) and Single-Chip Integration Module (SCIM) provide programmable chip-select logic to help the designer interface a modular microcontroller to external peripherals. A frequently asked question is: What happens if a chip-select is programmed as either discrete output or alternate function in the chip-select pin assignment register, but the chip-select base address and option registers are also programmed? This bulletin provides the answer.

Order by: EB262/D

How to Program Chip Selects on Modular Microcontrollers with a System Integration Module or a Single-Chip Integration Module

Modular MCUs with a System Integration Module (SIM) have 12 chip-select lines, and those with a Single-Chip Integration Module (SCIM) have nine chip-selects. Both types are programmed in the same way, and in addition to enabling a peripheral or memory chip they can be programmed to generate data transfer and size acknowledge (DSACK) signals. Two problems sometimes encountered are that the chip select generates the wrong number of wait states before the DSACK, or that the wrong chip-select is enabled. There are specific reasons for these problems, which are addressed in this bulletin.

Order by: EB263/D

Disabling All Interrupts on Power-On for MC683xx and MC68HC16 Devices Using the Single-Chip Integration Module or System Integration Module

From a power-up condition in either the MC683xx or the MC68HC16 MCU families, program runaway is possible if the IRQ7 line is driven to an active low condition. This bulletin explains how to recover from this situation by properly configuring the Single-Chip Integration Module (SCIM) or System Integration Module (SIM).

Order by: EB264/D

Generating Edge-Sensitive Interrupts on the MC683xx and MC68HC16 Families of MCUs

One way to generate edge-sensitive interrupts is to use an input to a peripheral module such as the General Purpose Timer (GPT) or the Time Processor Unit (TPU). This bulletin presents alternative techniques.

Order by: EB265/D

Starting and Stopping the Time Processor Clock Using the Background Debug Mode

Developers of Time Processor Unit (TPU) microcode may want to halt microcode execution when debugging. One way to do this is to enter the Background Debug Mode (BDM), a special operating mode in which normal instruction execution is suspended. This bulletin details the procedure.

Order by: EB268/D

Using the SCI on Modular MCUs: An Example

The Serial Communication Interface (SCI) is part of the Queued Serial Module (QSM) and the Multi-Channel Communication Interface (MCCI) of modular microcontrollers, and is used to communicate with external devices and other MCUs via an asynchronous serial bus. This example program was assembled with the assembler available from P & E Microsystems, and can be used for simple debugging purposes.

Order by: EB269/D

Problems with the PPWA Function on Revision P MC68332 Devices

The Period/Pulse Width Accumulation (PPWA) function on the Time Processor Unit is an accurate way to accumulate and measure pulse periods and pulse high times – it can accumulate either 16 or 24-bit periods or pulse widths. However some users have experienced problems when using the 24-bit mode on Revision P MC68332 processors, and this bulletin explains the reasons and some workarounds.

Order by: EB270/D

Which Pins on the MC68331/332 and MC68HC16Z1 Need Pullup Resistors

Gives details of which pins on the MC68331, MC68332 and MC68HC16Z1 need pullup resistors, and what the pullup value should be.

Order by: EB273/D

Example Using the Queued Serial Peripheral Interface on Modular MCUs

The Queued Serial Peripheral Interface (QSPI) is compatible with the Serial Peripheral Interface (SPI) used in the M68HC11 and M68HC05 Families of microcontrollers. However it differs in having a queue, with programmable queue pointers, to allow up to 16 transfers without CPU intervention. It also has a wrap-around mode that allows continuous transfers to and from the queue, a feature that is useful in applications such as the control of an A/D converter. This bulletin uses an example program to explain how to initialize the QSPI in wrap-around mode, and how to enable interrupts.

Order by: EB275/D

Coherency in the Time Processor Unit (TPU)

Sometimes two parameters in the Time Processor Unit (TPU) parameter RAM must be updated together – if one is updated the other must also be updated immediately, a condition called Coherency. Some of the current TPU functions have two parameters that must be read or written coherently; this bulletin identifies some examples and explains how to handle them.

Order by: EB277/D

Latency on the Time Processor Unit

Each time function on the Time Processor Unit (TPU) is divided into several states that are executed by the microengine. The states consist of microinstructions that are stored in the TPU, or stored in RAM if the TPU is running in emulation mode. Each state requires a certain amount of time to execute, and the states are not necessarily executed back to back. Thus there is a certain amount of latency in the TPU. This bulletin discusses the factors involved in latency calculations, and some of the effects of TPU latency.

Order by: EB278/D

Low Output Levels on Output Pins

A problem reported occasionally with the MC68332 and related devices is that a pin or group of pins has a logic high level of about 3 volts. This is usually due to poor power pin connections, and this bulletin highlights the areas to watch.

Order by: EB279/D

Programming the Channel Control Registers on the Time Processor Unit

The Time Processor Unit (TPU) has several control registers that are shared by all 16 channels. Some are not always used, but four of them must always be initialized. This bulletin explains their functions.

Order by: EB280/D

Halting and Re-Starting the Queued Serial Peripheral Interface on Modular Microcontrollers

Halting the Queued Serial Peripheral Interface (QSPI) on modular microcontrollers before the end queue pointer is reached requires use of a special sequence, to ensure that the current serial transfer completes and the QSPI halts at a known state on a boundary between two queue entries. This bulletin explains the correct procedure, involving three bits in three different registers, and includes example code for CPU32 and CPU16.

Order by: EB281/D

C Macro Definitions for the MC68HC11C0

With more microcontroller users moving to high level languages like C, macro definition files can speed software development efforts. The file for the MC68HC11C0, reproduced and described in this Bulletin, is available on Motorola's Freeware Data System. It uses Motorola's designated register and bit names for the device, and any user familiar with M68HC11 assembly language and architecture will readily be able to make use of it.

Order by: EB283/D

C Macro Definitions for the MC68HC(7)11D3/D0

With more microcontroller users moving to high level languages like C, macro definition files can speed software development efforts. The file for the MC68HC(7)11D3 and MC68HC(7)11D0, reproduced and described in this Bulletin, is available on Motorola's Freeware Data System. It uses Motorola's designated register and bit names for the device, and any user familiar with M68HC11 assembly language and architecture will readily be able to make use of it.

Order by: EB284/D

C Macro Definitions for the MC68HC(7)11E20

With more microcontroller users moving to high level languages like C, macro definition files can speed software development efforts. The file for the MC68HC(7)11E20, reproduced and described in this Bulletin, is available on Motorola's Freeware Data System. It uses Motorola's designated register and bit names for the device, and any user familiar with M68HC11 assembly language and architecture will readily be able to make use of it.

Order by: EB285/D

C Macro Defenitions for the MC68HC11A8/A7/A1/A0

With more microcontroller users moving to high level languages like C, macro definition files can speed software development efforts. The file for the MC68HC11A8, MC68HC11A7, MC68HC11A1 and MC68HC11A0, reproduced and described in this Bulletin, is available on Motorola's Freeware Data System. It uses Motorola's designated

register and bit names for the device, and any user familiar with M68HC11 assembly language and architecture will readily be able to make use of it.

Order by: EB286/D

C Macro Definitions for the MC68HC(7)11E9/E8/E1/E0

With more microcontroller users moving to high level languages such as C, macro definition files like the one outlined in this bulletin can speed software development. The file reproduced here is available on the web, and the download includes an ASCII text copy of this documentation as well as the file itself. Motorola's designated register and bit names are used, and any user already familiar with M68HC11 assembly language and architecture – a requirement even for those who think they will only program in C – will be able to use the file easily.

Order by: EB287/D

C Macro Definitions for the MC68HC11ED0

With more microcontroller users moving to high level languages like C, macro definition files can speed software development efforts. The file for the MC68HC11ED0, reproduced and described in this Bulletin, is available on Motorola's Freeware Data System. It uses Motorola's designated register and bit names for the device, and any user familiar with M68HC11 assembly language and architecture will readily be able to make use of it.

Order by: EB288/D

C Macro Definitions for the MC68HC11F1

With more microcontroller users moving to high level languages like C, macro definition files can speed software development efforts. The file for the MC68HC11F1, reproduced and described in this Bulletin, is available on Motorola's Freeware Data System. It uses Motorola's designated register and bit names for the device, and any user familiar with M68HC11 assembly language and architecture will readily be able to make use of it.

Order by: EB289/D

How to Write the 64-Cycle Time-Protected Registers on M68HC11 Development Tools

To achieve maximum flexibility, MC68HC11 software can control a number of hardware options which customize the operating environment. However it is necessary to take precautions against runaway software that could change the hardware configuration unintentionally. The result is a set of registers known as the time-protected registers. They are writable in normal operating modes (single-chip and expanded) only during the first 64 clock cycles after reset. This bulletin explains how to write to the registers when under the control of the BUFFALO monitor, which uses all of the first 64 cycles before control is passed to the user.

Order by: EB294/D

Programming the BUFFALO Monitor into an MC68HC711E9

If communication with an EVBU containing an MC68HC711E9 cannot be established using a terminal emulation program such as Procomm or Kermit, the most likely reason is that the EPROM in the MC68HC711E9 has not been programmed with the BUFFALO monitor. This bulletin explains how.

Order by: EB298/D

Programming EEPROM on the MC68HC811E2 During Program Execution

The 2K of EEPROM in the MC68HC811E2, currently the largest EEPROM array in the M68HC11 Family of microcontrollers, can be used for both program code and data. The device also has 256 bytes of RAM; some users may choose to use this RAM for program variables during execution, others may prefer to store data and variables in the non-volatile EEPROM so that data will still be valid after a power-off/power-on sequence. This bulletin explains how to do this.

Order by: EB301/D

Startup Problems When Using a Software Background Mode Debugger and Booting from RAM or an Empty ROM Socket

The method used by many in-circuit debuggers for M68300 and M68HC16 microcontrollers is to invoke the MCU's background mode. There are several methods for entering background mode, and this bulletin addresses some concerns that must be taken into account.

Order by: EB305/D

Using Exercise 7 on the M68HC16Z1EVB and the Necessity of Word Alignment

The M68HC16Z1EVB is shipped with eight examples of working programs that can be run on the board. Exercise 7 uses an output compare to drive three input captures, in the general-purpose timer. The output compare is set to toggle each time the 16-bit counter reaches $1000; one input capture triggers on both edges, one on rising edges only, and the third on falling edges. Various external actions indicate correct operation of the exercise. This bulletin describes the exercise, and explains why executable code must start on an even address.

Order by: EB306/D

Using Exercise 8 on the MC68HC16Z1EVB

The MC68HC16Z1EVB is shipped with eight exercise programs as examples of working programs which can be run on the board. One of these uses the Burr-Brown PCM56P D/A converter. The disk shipped with early packages of the board contains a line of code which will not assemble correctly. This bulletin explains the simple correction.

Order by: EB309/D

Getting Started with the FDDI ADS Board

An introductory tutorial explaining how to use the Motorola FDDI fibre optic Applications Development System M68FDDIADS (comonly known as FADS). It describes the general features of FADS and some of the specific commands. The M68FDDIADS is a demonstration system and basic development platform for the Motorola FDDI chip set; all four chips are present on the board, together with an MC68020 MPU with 1Mbyte of RAM and a ROM-resident debug monitor. A comprehensive system of software-driven menus allows access to all chips and Station Management (SMT) via the user interface.

Order by: EB406/D

PASM05 to INTROL M68HC05 Assembler Conversion

This bulletin describes the most common differences between Motorola's PASM05 V0.05 Assembler and the third party INTROL Assembler V3.06, for MS-DOS Hosts used with M68HC05 development systems. Understanding the differences will help reduce the engineering time required to convert the syntax from PASM05 to INTROL; with the use of an intelligent Editor that supports MACRO EDITING functions, multiple conversions can be achieved with one keypress. The EDITOR used in the conversion described here was "BRIEF V3.0" by UnderWare Inc.

Order by: EB410/D

A Digital Video Prototyping System

This bulletin describes a Digital Video Prototyping System (DVPS) that has been developed using Motorola's latest multimedia devices, together with a PC-based Field Programmable Gate Array (FPGA) development system. It is designed to provide a fast and effective means of prototyping and demonstrating digital video processing functions. A Reference Section lists datasheets and user manuals containing detailed descriptions and information on the devices. The DVPS has been successfully used to implement two TV sub-systems, namely a Picture-In-Picture Processor and a 4:3 to 16:9 Picture Processor, which are also described.

Order by: EB411/D

Resetting MCUs

MCU Reset in its most basic form ensures that the MCU starts executing code in a controlled manner when power is applied. It may also be used to prevent the device running out of specification, and can cause a system reset at the board level if the MCU executes code in an unexpected way (watch-dog). But this simple function can cause problems since different applications impose different start-up and power down conditions. This document covers the main

issues relating to Reset and aims to lead the user of HC05 and HC11 devices to a safe and reliable approach for their particular application.

Order by: EB413/D

Low Power Write Enable Generation for M68300 Family Microprocessors

Dynamic bus sizing support circuitry is normally implemented using PALs. However in battery-powered applications PALs can draw unacceptable amounts of power. The circuit presented here implements byte write enable functions for a 16-bit processor/memory combination, using just two low power 74HCTTL devices.

Order by: EB414/D

Extend SPI Addressing with the MC74HC595

The logic technique described here reduces the number of parallel port lines required for generating SPI chip selects by putting them on the slave end of the SPI bus. In this way, chip select signals can be generated remotely from the SPI master. The main advantage of the technique is the use of a true 5-wire bus, capable of supporting an almost unlimited number of remote slave devices.

Order by: EB415/D

Modular Target Cables for Motorola Development Systems

Target cables connect emulation equipment such as an EVS or MMDS to the user's target system by providing an interface from the emulator to the MCU socket in the user's system. Traditionally each MCU package requires a different cable, adding time and development cost to the project. However a modular strategy allows the use of common parts of target cables, leading to more rapid cable development and a reduction in costs. This bulletin discusses the cable strategy the supports the M68HC05, M68HC08 and M68HC11 families.

Order by: EB416/D

ROMed HC11E32 and HC11PH8 Including Buffalo Monitor and PCbug11 Talker

This bulletin describes the monitor software contained in ROMed versions of the MC68HC11PH8 and the MC68HC11E32, including the Buffalo Monitor and PCbug11 Talker. These ROM codes also include the multiband RDS radio application described in application notes AN494/D and AN495/D. Includes a description of a minimal circuit for running the monitors.

Order by: EB419/D

Converting DSP56001-Based Designs to the DSP56002

Rev 1

This bulletin details the differences between the DSP56001 and the DSP56002 which need to be taken into account when redesigning a DSP56001-based system to use the DSP56002. They fall into two main categories – changes which must be taken into account by the designer, and changes which the designer may choose to implement when appropriate.

Order by: EB420/D

The Motorola MCAN Module

The Control Area Network (CAN) was developed by Robert Bosch GmbH as a serial communications protocol for use in automotive applications. It has been optimised for operation in interrupt-driven, real-time environments, and in addition to its key role in automotive multiplexing applications, it is finding widespread use for industrial control. Motorola has now integrated the MCAN (Motorola CAN) module into several MC68HC05-based MCUs. This bulletin describes the module and its registers, the interface with the CAN bus, and examples of initialisation, transmit and receive software.

Order by: EB421/D

Enhanced M68HC11 Bootstrap Mode

Motorola has enhanced the capability of the Special Bootstrap Mode of many of the M68HC11 family MCUs, following an increase in ROM sizes. This bulletin provides the bootstrap mode listings for the MC68HC11ED0, MC68HC711EA9, MC68HC11PH8, MC68HC711PH8, secured MC68HC711E20, secured MC68HC711E32 and secured MC68HC11E32. Mode

enhancements include the addition of autostart facilities for PLL systems, enhanced security options, and embedded PCbug11 talkers.

Order by: EB422/D

Transporting M68HC11 Code to M68HC16 Devices

Devices in the M68HC16 MCU family are built from standard modules that interface through an internal bus. The standard CPU is the 16-bit CPU16; both its programming model and instruction set are designed for maximum compatibility with the M68HC11 CPU, and only moderate effort is required to port 'HC11 applications to the CPU16. However its additional capabilities mean that some 'HC11 instructions have been modified or replaced, and interrupts are managed differently. This note compares the capabilities of the two processors, discusses differences in the instruction sets and highlights cases that need special attention.

Order by: M68HC16PN01/D

Using the TPU Function Library and TPU Emulation Mode

The Time Processor Unit (TPU) is an on-chip sub-module used in Motorola's M68000 and M68HC16 families of modular microcontrollers. It is dedicated to performing complex timing and I/O tasks to relieve the CPU of most of the timing overhead. This note describes its function library and explains how to use it. It contains sufficient information for a user to select a new suite of functions from the library, assemble them to run in TPU emulation mode, and submit the debugged code as a new TPU micro-ROM code mask. The user should also refer to the TPU Reference Manual (TPURM/AD) for detailed information.

Order by: TPUPN00/D

Queued Output Match TPU Function (QOM)

Rev 2

In the M68300 Family Time Processor Unit, the QOM function generates complex pulse trains without CPU intervention using a sequence of output matches. An output match causes a programmable pin response when a user-defined value is matched by the value of a free-running counter. QOM generates multiple output matches using a queue of offset times and pin responses in Parameter RAM. Various modes of queued operation are supported. This note provides a detailed description of the QOM function, including performance notes and several example pulse trains.

Order by: TPUPN01/D

Fast Quadrature Decode TPU Function (FQD)

The Fast Quadrature Decode (FQD) is a TPU input function that uses two channels to decode a pair of out-of-phase signals to increment or decrement a position counter. It is generally used for decoding position and direction information from a slotted encoder in motion control systems. FQD differs from the QDEC function in operating in either normal or fast modes, switching dynamically between the two according to the encoder speed. In Fast mode, the TPU can decode reliably at more than four times the normal maximum count rate. This Programming Note describes the use of the FQD.

Order by: TPUPN02/D

Frequency Measurement TPU Function (FQM)

Frequency Measurement (FQM) is a TPU function that counts the number of pulses presented to a channel pin within a user-specified time window. Either rising or falling edges can be used at the beginning of a pulse, and pulses can be accumulated for a single window time or in repetitive windows. The pulse count is available to the user as a 16-bit number. This Programming Note describes the parameters, registers, configuration and performance of FQM. It includes four examples demonstrating the use of the function.

Order by: TPUPN03/D

Table Stepper Motor TPU Function (TSM)

Rev 1

Table Stepper Motor provides the TPU with the capability to drive two-phase stepper motors in full- or half-step modes. The TPU can accelerate the motors, run them at constant speed (or slew), and decelerate them independently of the CPU, which need only initialize the function once and then supply a desired position each time a move is required. The acceleration/deceleration profile is freely configurable by the user with a variable length table that

offers up to 82 step rates. The TPU can control up to eight motors in full-step mode, four motors in half-step mode or a combination of both.

Order by: TPUPN04/D

Multichannel PWM TPU Function (MCPWM)

This TPU output function uses externally-gated multiple channels to produce sophisticated pulse-width modulated (PWM) signals which can be used for a variety of applications including motor control. MCPWM allows a user to select edge-aligned or center-aligned timing relationships between multiple PWM waveforms. Center-aligned relationships include dead time and inversion options to support driving H-bridges and inverters. MCPWM can also generate a programmable periodic CPU interrupt request for high time updating.

Order by: TPUPN05/D

Programmable Time Accumulator TPU Function (PTA)

The Programmable Time Accumulator function measures the high time, low time or period of an input signal over a user-defined number of periods, presenting the result to the host CPU in the form of a 32-bit accumulation. PTA does not link to other TPU channels at the end of accumulation – PPWA should be used if this function is required. This note provides a detailed description of parameters and parameter RAM assignment, the TPU host interface, performance and use of the function, and examples of typical applications.

Order by: TPUPN06/D

Asynchronous Serial Interface TPU Function (UART)

Rev 1

The UART function uses two TPU channels to provide a 3-wire (RxD, TxD and GND) asynchronous serial interface. All the standard baud rates and parity settings can be selected. The CPU interface to UART consists of a command register which defines the operation (number of data bits, baud rate, parity); a status register which gives information about the data registerand errors; and a data register which holds the data to be transmitted or data that has been received. These registers are implemented for the UART function using the TPU parameter RAM and host sequence bits.

Order by: TPUPN07/D

New Input Capture/Input Transition Counter TPU Function (NITC)

The NITC function detects rising and/or falling input transitions. When a transition is detected the current TCR timer value or a parameter RAM value is captured. The channel continues to detect and count input transitions until it has counted the maximum programmable number stored in the parameter MAX_COUNT. NITC can count the programmed maximum number of transitions continually, or can count once and then stop. Once the programmed number of transitions is counted, it can send an interrupt request to the host CPU and generate a link to a sequential block of up to eight channels.

Order by: TPUPN08/D

Multiphase Motor Commutation TPU Function (COMM)

Rev 1

COMM uses multiple TPU channels to produce drive-enable signals for commutating brushless motors. Motor types supported include three- and four-phase brushless DC and three-phase switched reluctance motors. It is used in conjunction with other TPU functions to provide a choice of sensored (Hall effect or optical, with HALLD) or sensorless (from an encoder, with QDEC, FQD or DUC) commutation. The signals produced by COMM are gated externally with a PWM, also generated by the TPU, to drive the motor. COMM is a flexible function and may also meet the requirements of other multisignal applications.

Order by: TPUPN09/D

Hall Effect Decode TPU Function (HALLD)

The Hall effect decode function is a TPU input function that uses two or three channels to decode signals from Hall effect sensors into a state number. The function is designed primarily for use with the COMM function in brushless motor applications, in which case the state number represents the current angular position of the rotor, but can also be used in other applications requiring the decoding of multiple digital inputs.

Order by: TPUPN10/D

Period/Pulse Width Accumulator TPU Function (PPWA)

The period/pulse-width accumulator (PPWA) function allows any channel to accumulate up to 255 periods or pulse widths, in TCR clock counts. The hexadecimal value that PPWA returns as the accumulated sum must be multiplied by the appropriate TCR resolution to obtain the actual length of time in seconds. PPWA has four operating modes, and can accumulate a 16-bit sum or a 24-bit sum. In the 16-bit modes it can generate a link to a sequential block of up to eight channels after each accumulation period. In all modes, PPWA can generate an interrupt after each accumulation period.

Order by: TPUPN11/D

Output Compare TPU Function (OC)

Rev 1

The output compare (OC) function can generate a single output transition, a single pulse, or a continuous 50% duty cycle pulse train, on receiving a link from another channel. The first two actions require the CPU to initiate each output edge or pulse. The third action generates a continuous square wave without CPU intervention. OC can also be used to read the most recent TCR1 and TCR2 values.

Order by: TPUPN12/D

Stepper Motor TPU Function (SM)

The stepper motor control function (SM) accelerates and decelerates a stepper motor linearly, using up to 14 step rates. The CPU provides the desired step position as a 16-bit parameter and the TPU steps the motor to this position using an acceleration/deceleration profile. The target position can be changed by the CPU while the TPU is stepping the motor. A 16-bit parameter initialized for each channel by the CPU defines the output state of the pin. The bit pattern defines the method of stepping, such as full or half step.

Order by: TPUPN13/D

Position-Synchronised Pulse Generator (PSP)

Rev 1

PSP generates an output transition referenced to a time determined previously by another channel. Typically it is used with a PMM or PMA function on another channel. There are two operating modes: in angle-angle mode, the rising and falling edges of the output pulse are determined independently of each other; in angle-time mode, the falling edge of the output pulse is determined in reference to the rising edge. Up to 15 PSP function channels may operate with a single input reference channel executing a PMA or PMM function.

Order by: TPUPN14/D

Period Measurement with Additional Transition Detection TPU Function (PMA)

PMA detects additional transitions embedded in a series of input pulses; an additional transition is when the current period is less than the previous period multiplied by a programmable ratio. It has two operating modes: in Count mode it counts the number of extra transitions compared with a programmable maximum value before resetting the TCR2 counter. In Bank mode, the TCR2 counter resets when an extra transition is detected and the flag BANK_SIGNAL is non-zero. PMA is typically used in automotive applications for detecting a reference point in the form of an extra tooth on a flywheel with regularly spaced teeth.

Order by: TPUPN15A/D

Period Measurement with Missing Transition Detection TPU Function (PMM)

Rev 1

PMM detects missing transitions embedded in a series of input pulses; a missing transition is when the current period is greater than the previous period multiplied by a programmable ratio. It has two operating modes: in Count mode it counts the number of missing transitions compared with a programmable maximum value before resetting the TCR2 counter. In Bank mode, the TCR2 counter resets when a missing transition is detected and the flag BANK_SIGNAL is non-zero. PMM is typically used in automotive applications for detecting a reference point in the form of a missing tooth on a flywheel with regularly spaced teeth.

Order by: TPUPN15B/D

Pulse Width Modulation TPU Function (PWM)

The PWM output function generates a PWM waveform in which the period and/or the high time can be changed at any time by the CPU. It has two modes of operation: in

level mode a 0% or a 100% duty-cycle waveform can be generated; in normal mode, waveforms with duty-cycles between 0% and 100% can be generated. Generally any change is used in subsequent waveform synthesis after a low-to-high transition. An immediate update is possible in either mode, after which the new period and/or high time is reflected in the output waveform during the immediate host-service state, instead of waiting for the transition.

Order by: TPUPN17/D

Discrete Input/Output TPU Function (DIO)

DIO allows the user to configure a TPU channel as an input or output. As an input the channel can be read at any time or sampled at a periodic rate. As an output it can be driven high or low on command by the CPU. A parameter RAM location, PIN_LEVEL, is used to record the 16 most recent states of the channel. The parameter may be updated at one of four conditions: when a transition occurs; when the CPU requests to read the logical value driving the pin; when the CPU requests to drive the pin to a specified logical value; or at a periodic rate specified in the MATCH_RATE register.

Order by: TPUPN18/D

Synchronized Pulse-Width Modulation (SPWM)

Rev 1

The Synchronized Pulse-Width Modulation (SPWM) function generates a pulse-width modulated (PWM) waveform in which the CPU can change the period or high time at any time. When synchronized to a time function on a second channel, SPWM low-to-high transitions have a time relationship to transitions on the second channel. Includes examples with diagrams of the initial parameter RAM contents, initial control bit settings and diagrams of the output waveforms.

Order by: TPUPN19/D

Quadrature Decode TPU Function (QDEC)

The Quadrature Decode function (QDEC) is a TPU input function that uses two channels to decode a pair of out-of-phase signals in order to increment or decrement a counter. It is particularly useful for decoding position and direction information from a slotted encoder in motion control systems, so replacing expensive external solutions. This note provides detailed description of parameters and parameter RAM assignment, the TPU host interface, performance and use of the function, and examples of typical applications.

Order by: TPUPN20/D

Applications Documents
Alphanumeric Index

Data Books

Timing Solutions

Rev 6

With frequencies approaching 50MHz in today's RISC and CISC microprocessor systems, precise clock signals are required to maintain a synchronous system. This data book presents Motorola's range of low skew clock drivers, together with a discussion of design considerations to help achieve the best performance.

Order by: BR1333/D

LCX Data Low-Voltage CMOS Logic

Rev 3

Motorola's 3V LCX family features 5V-tolerant inputs and outputs to enable an easy transition to 3V systems or to mixed 3V/5V systems. Low power, low switching noise and fast switching speeds make the family perfect for low power portable applications as well as for high end advanced workstation applications. This data book includes overall specifications for the family, general applications information, a discussion of design considerations, and individual datasheets for all the devices in the family. A Functional Selector Guide includes devices from the LVQ and HC families, as well as the LCX devices.

Order by: BR1339/D

TSOP-6

Cellular telephones, notebook computers and other portable systems are becoming smaller with each new generation. Motorola's JEDEC-registered TSOP-6 power package anticipates this evolution and allows the placement of a MOSFET in spaces that have become too small for any other surface mount power MOSFET package. This document presents data sheets on the Enhancement-Mode MOSFETs currently in the TSOP-6 family.

Order by: BR1491/D

LVX Data: Low-Voltage CMOS Logic

Presents information in data sheet form on Motorola's LVX Family of 74-series Low-Voltage CMOS devices with 5V-tolerant inputs.

Order by: BR1492/D

RF Device Data

Rev 10

Provides data sheet information on Motorola's extensive range of RF products. Products are categorised into three main sections – Discrete Transistors, Monolithic Integrated Circuits and Amplifiers – and a comprehensive Selector Guide lists the devices under a variety of application, frequency band and package classifications. Case dimensions and a competitor cross reference are included – the cross reference lists functionally similar products under a 'closest replacement' heading in order to accommodate the unique products that now exist as a result of new technologies and packaging concepts.

Order by: DL110/D

Bipolar Power Transistor Data

Rev 7

Motorola produces more than 700 off-the-shelf power transistors covering a very wide range of applications; currents range from 0.1 to 80A, voltages from 25 to 1800V, and power dissipations from 5 to 250W. Their electrical,

thermal and mechanical characteristics are presented here in the form of data sheets, with a competitor Cross Reference and a Selector Guide.

Order by: DL111/D

FAST and LS TTL Data

Rev 5

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 Guides provide an overview of current and planned devices. Includes a comparison of the principal characteristics of the two families.

Order by: DL121/D

MECL Data

Rev 6

Presents full technical data for Motorola's monolithic Emitter Coupled Logic families, including MECL 10H, MECL 10K and MECL III, plus Phase-Locked Loop products. MECL offers very high speeds – with propagation delays down to 1.0ns – 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.

Order by: DL122/D

Small-Signal Transistors, FETs and Diodes Device Data

Rev 6

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.

Order by: DL126/D

Analog/Interface Integrated Circuits (vol. 1 and 2)

Rev 6

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.

Order by: DL128/D

High Speed CMOS Data

Rev 6

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.

Order by: DL129/D

CMOS Logic Data

Rev 3

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; non-logic devices in this series are covered in the CMOS Application-Specific Standard ICs data book, reference DL130/D.

Order by: DL131/D

TMOS Power MOSFET Transistor Data

Rev 6

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, Parallelling and Characterization, plus a number of specific designs.

Order by: DL135/D

Thyristor Device Data

Rev 6

Thyristors are 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 220 pages of theory and applications information.

Order by: DL137/D

FACT Data

Rev 3

FACT™ uses a sub 2 micron silicon gate CMOS process to attain speeds similar to Advanced Low Power Schottky, while retaining the ultra low power and high noise immunity of CMOS logic. It also offers 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 design considerations and comparisons with previous technologies.

Order by: DL138/D

High Performance ECL Data – ECLinPS and ECLinPS Lite

Rev 4

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 500ps including package delay, and a flip-flop toggle frequency up to 800MHz. Each function is available with either MECL 10KH or 100K compatibility.

Order by: DL140/D

TVS/Zener Device Data

Rev 1

Presents technical data for Motorola's broad line of Transient Voltage Suppressors (TVS) and Zener Diodes. Complete specifications are given in the form of data sheets, with separate sections for surface mount devices. A comprehensive Selector Guide and Industry Cross Reference are included to assist the choice of devices for specific applications, showing Motorola direct replacement and similar replacement parts. The comprehensive Technical Information section has been edited and updated from the popular Motorola Zener Diode Manual, and includes four Application Notes/Article Reprints.

Order by: DL150/D

Rectifier Device Data

Rev 2

Motorola is the world's leading supplier of rectifiers – including switching power supply types – and offers the biggest stock range of zener diodes. In this book, a 12-page industry Cross Reference is followed by a comprehensive Selector Guide showing Application Specific devices, plus Schottky, Ultrafast, Fast and general purpose products, and automotive transient suppressors. Detailed electrical and mechanical information is provided in the form of data sheets for all devices.

Order by: DL151/D

Fast Static RAM – Component and Module Data

Rev 4

Motorola offers a broad range of Fast SRAMs for virtually any digital data processing application. This book contains complete specifications for individual FSRAM circuits in data sheet form, together with an introduction to Motorola's quality and reliability programme, and an applications section. The book is divided into BiCMOS, CMOS, Application Specific and Module products, and includes a comprehensive selector guide, an industry cross reference, and 126 pages of applications information.

Order by: DL156/D

LonWorks Technology Device Data

Rev 5

Through the LONWORKS program, Motorola offers the MC143120 and MC143150 NEURON chips. These are sophisticated VLSI devices that make it possible to implement low-cost local operating network applications. This book combines specifications for these parts with a large selection of applications literature. Other sections include a Technology/Licensing Overview, a summary of the Neuron Chip Family hardware resources, Communications and Subsystems, I/O Interfaces, Programming Model, the LonTalk Protocol, and details of the data structures.

Order by: DL159/D

Display Products Device Data

Rev 1

Motorola offers a broad range of semiconductor communications products for a wide variety of applications. This new data book provides information in data sheet form on Motorola's display products, including LCD drivers, monitor on-screen display devices and evaluation kits. It includes 126 pages of application notes and other applications information, plus details of reliability and quality assurance. Functional and technical selection guides are also included to help select appropriate parts.

Order by: DL160/D

Pressure Sensor Device Data

Rev 4

Provides basic information on Motorola's pressure sensors, with application ideas and data sheets on this broad product line. Includes an introduction to the principle of operation, a separate data sheet section for the recently introduced Signal Conditioned and High Impedance products, data sheets on all the other devices in the family, Quality and Reliability data, 178 pages of applications information, plus package outlines and handling recommendations.

Order by: DL200/D

IGBT – Insulated Gate Bipolar Transistor Device Data

Motorola's IGBT portfolio includes devices for automotive applications, lighting, motor drives and power conversion. This data book presents information on the devices in the form of data sheets. It also includes an alphanumeric listing, selector guides, symbols and definitions, and more than 100 pages of theory and applications information.

Order by: DL202/D

Advanced High-Speed CMOS Data

Rev 2

Motorola's VHC Advanced High-Speed CMOS logic family is designed for operation on 2V to 5.5V supplies. When operating at supply voltages less than 5V the devices feature 5V-tolerant inputs to aid 3V-5V mixed system designs, and with speeds more than 60% faster than HCMOS, VHC is the perfect family for new, low-cost, low-power designs. Excellent noise performance also makes VHC a good replacement for FACT logic, without sacrificing speed. This data book contains full data sheets on the first 18 devices to be released.

Order by: DL203/D

Senseon: Pressure Sensor Distributor Handbook

Rev 1

Intended to introduce Motorola's pressure sensors to product distributors, this handbook is a guide to the basic what, where, how and why of SENSEON Pressure Sensors. It is comprehensive yet lighthearted, and requires minimal technical background in order to grasp the basic concepts.

Order by: HB218/D

Selector Guides and Application Literature

Reliability & 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 Analogue products. The summaries are the result of many tests and evaluations performed throughout Motorola's design and manufacturing locations.

Order by: BR518/D

Embedded Systems Source, 1997

Rev 5

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 Microprocessors; Emulators and Logic Analyzers; Real-Time Operating Systems; Language Development Tools; Target Board-Level Products and Evaluation Boards; and Peripherals.

Order by: BR729/D

Packaging Manual for ASIC Arrays

Rev 2

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

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 summarise 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 Data 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.

Order by: BR1137/D

Motorola Quality System Review Guidelines

Rev 5

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 organisation. 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.

Order by: BR1202/D

Analog Integrated Circuits: New Product Calendar

4Q97

Summarizes new analog ICs that are becoming available for Power Control, Automotive, Consumer, Communications and Computer applications, with Sampling and Introduction dates.

Order by: BR1305/D

CATS – Customer Analysis Tracking System

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.

Order by: BR1306/D

SCSI Terminators

A collection of complete data sheets on Motorola's broad line of SCSI Terminators, plus power dissipation information (AN1408) and case outlines.

Order by: BR1486/D

Thermal Modeling and Management of Discrete Surface Mount Packages

Rev 1

Thermal management is one of the main challenges facing designers of modern portable electronic equipment. As end users demand more and more features in battery powered devices such as notebook computers and mobile phones, the designer is presented with new issues concerned with 'how to get the heat out'. This publication is a collection of five technical papers, published during 1996, which will give an insight into the latest methods of thermal measurement and modeling of the discrete surface mount packages commonly used in handheld, battery powered equipment.

Order by: BR1487/D

Sensor Device Information Matrix – Quarter 1, 1999

This comprehensive matrix is a selector guide to application notes and related device information on Motorola's pressure sensors and accelerometers. Documents are listed under Uncompensated Pressure Devices, On-Chip Temperature Compensated and Calibrated Devices, Integrated Pressure Sensors, and Accelerometers.

Order by: BR1512/D

PowerPC Resource Guide

A guide to PowerPC hardware and software products from Motorola, IBM and third party developers. Sections include Microprocessors and Peripherals, Hardware and Software Development Tools, Board Level Products & Evaluation Boards, and Consulting Services. Lists worldwide sales and distribution offices.

Order by: BR1724/D

Occupant Safety Systems Solutions

A quick reference selector guide to Motorola's microcontrollers, accelerometers, pressure sensors and SMARTMOS devices relevant to occupant safety systems.

Order by: BR1781/D

IMAGINE Semiconductor Solutions

Autumn 97

This highly informative periodical is available to all semiconductor users on a free subscription basis. Concise, informative articles discuss significant new product capabilities as well as newly introduced services and literature. In short, it represents an overview of the latest and most important events at Motorola that influence the efficient implementation and most cost-effective use of semiconductor devices. For your free IMAGINE subscription, contact your Motorola sales representative or authorized distributor.

Order by: BR3021/D

Microcontroller Technologies Group: Reliability and Quality Monitor Report – Quarter 2, 1997

Rev 11

Motorola's CSIC Microcontroller Reliability and Quality Monitor Program is designed to generate an ongoing database of reliability and quality performance data on the 6805 and 68HC05 family of microcontrollers. The main purpose of the program is to identify any negative trends so that corrective action can be taken. Tests are conducted on sample groups representing a matrix of processing and packaging technologies across major product categories. This document is a summary of data for the third quarter of 1996.

Order by: CMRQS/D

Communications, Power and Signal Technologies Group: Through-Hole to Surface Mount Cross Reference

This cross reference lists recommended surface mount replacement parts for through-hole devices manufactured by Motorola's Communications, Power and Signal Technologies Group (CPSTG). In each case the tables show the replacement part number and its package number. Illustrated outline dimensions for the SMT packages are also included.

Order by: CR100/D

Low Voltage MOSFET Cross Reference

Rev 1

A cross reference listing from industry part numbers to Motorola's MiniMOS SO-8 Power MOSFETs, SOT-23 and TSOP-6 MOSFETs, and Micro8 MOSFETs.

Order by: CR108/D

Novel Digital Signal Processing Architecture with Microcontroller Features

Traditional digital signal processors are designed to execute signal processing algorithms as efficiently as possible. This has led to some serious compromises between developing a good DSP architecture and a good microprocessor architecture. This paper presents Motorola's new 16-bit architecture, used in the DSP56800 family, which is designed to maintain the performance of the DSP while adding microcontroller functionality. Target applications are those demanding low costs with moderate performance, such as wireline and wireless modems, digital wireless messaging, digital answering machines and featurephones, servo and AC motor control, and digital cameras.

Order by: DSP56800WP1/D

Embedded Developer Pocket Guide

Rev 4

This Pocket Guide contains a listing of virtually all Third Party Embedded Developers supporting Motorola's 68K, ColdFire and PowerPC embedded processors through the High Performance Embedded System Division's (HPESD) Developer Program. This program comprises more than 50 third party developers, and makes available the broadest possible portfolio of development tools to enable Motorola's customers to deliver innovative, world-class products. Each page of this Guide provides an overview of the developer, with contact details and a listing of development tools and supported MCUs.

Order by: EMDVPOC/D

MECL System Design Handbook

Rev 1

Engineers look increasingly at ECL families such as MECL III, MECL 10K and MECL 10KH 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.

Order by: HB205/D

Rectifier Applications Handbook

This handbook provides a theoretical and physical background to a broad range of rectifier applications and problems. Topics include Power Rectifier Physics, Basic Properties of Semiconductors, the SPICE Diode Model, Diode Specifications and Ratings, Single-Phase and Polyphase Rectifier Circuits, Rectifier Filter Systems, Voltage Multiplier Circuits, Transient Protection of Rectifier Diodes, Reliability

Considerations, Cooling Principles, Printed Circuit Board Assembly Considerations, and Heatsink Mounting Considerations.

Order by: HB214/D

RF Application Reports

A collection of 92 of Motorola's Application Notes, Article Reprints and Engineering Bulletins concerned with RF products. Topics include RF Power MOSFETs, RF Power Bipolar, RF Integrated Circuits and RF Linear Amplifiers.

Order by: HB215/D

Microcontroller Technologies Group: Reliability and Quality – 1996 Annual Report

Rev 14

An ongoing Reliability Audit Program guarantees the high standards required by Motorola's Microcontroller Technologies Group. Individual product and package monitors are in place to monitor the ongoing process average of each specific family. Test results are made available quarterly, and this report details test results received for the whole of 1996.

Order by: MRQSY96/D

The Motorola Silicon Community

A poster-sized 'town map' providing a visual summary of Motorola's microprocessor and microcontroller families, from 8 to 32-bit, including CISC, RISC and DSP. Also includes an overview of the features and main applications for each of the families.

Order by: PSTR3003/D

RF Products Selector Guide

Rev 18

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 Low and High Power Amplifiers. Includes a list of relevant applications literature, case outlines, and an industry cross reference information with an indication of devices not recommended for new designs.

Order by: SG46/D

Master Selection Guide

Rev 21

The Master Selection Guide lists all of Motorola's semiconductor products – the broadest product line in the industry. It provides the engineer with a means of first-order selection of devices for specific applications. Sections include ASICs; Microcomputer Components; TTL, ECL, CMOS and Special Logic; Linear/Interface Circuits; Discrete and Military Products; the presentation is appropriate to the product families, but generally follows the standard Selector Guide and Cross Reference format. In addition, a Device Index, Subject Cross Reference and comprehensive Contents section allow the efficient location of specific products.

Order by: SG73/D

Analog/Interface Integrated Circuits Selector Guide & Cross Reference

Rev 10

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.

Order by: SG96/D

VARO to Motorola Rectifier Cross Reference

Lists direct and similar Motorola replacements for VARO rectifiers.

Order by: SG134/D

Sensor Products Division

Rev 30, 3Q99

This quarterly publication details the pressure and acceleration sensors and evaluation tools available from the Sensors Products Division.

Order by: SG162/D

Mixed-Signal Solutions from Communication Transmission & Access Systems Division

Rev 29, 2Q99

This selector guide covers new and planned products from the Communication Transmission & Access Systems Division. Sections include ATM Circuits, Distributive Intelligent Controls, DTMF Receiver/Transmitter, High-Speed Modem Chip Sets, Interface Circuits, ISDN, Modem Functions, UDLT, Voice and Data Coding, LonWorks Support Tools and Development Tools.

Order by: SG169/D

Fast Static RAM Division Product Update

Rev 28, 3Q99

This selector guide provides an overview of Motorola's fast-growing FSRAM product line. Included are synchronous, asynchronous and FSRAM modules.

Order by: SG171/D

Networking Systems Division and Personal Computing Division: Product Information

Rev 10, 4Q98

This selector guide lists the devices in Motorola's PowerPC microprocessor family, including devices for embedded applications, plus 68K Networking and Communications devices and development tools. Includes package illustrations, part number breakdown, and a table of available documentation.

Order by: SG175/D

Microcontroller Technologies Group: Development Tools Selector Guide

Rev 1

This guide makes it easy for Motorola's customers, application engineers and salespeople to choose tried and tested microcontroller development environments that precisely match the specific requirements of particular projects, from a broad line of software and development systems. It lists integrated systems under high-performance and lower-cost categories, plus individual software packages with a wide range of functionality. An appendix lists optional applications and development tools from third party suppliers. Solutions are available for MCUs in the M68HC05/08, M68HC11, M68HC12, M68HC16, M68300, and MPC500 families.

Order by: SG180/D

Wireless Messaging Systems Solutions Device Selector Guide

Rev 2, 2Q98

This guide is an easy-to-use directory to the extensive selection of semiconductors and modules for the design and development of the next generation of wireless messaging systems. It includes existing product lines, devices proposed for the immediate future, and a list of Motorola's more popular web sites.

Order by: SG182/D

Wireless Infrastructure Systems Division: DSP Products

Rev 1, 4Q98

A summary of Motorola's DSP products for wireless infrastructure and multimedia applications, including the DSP56000 Family, the DSP56300 Family, Development Tools and DSP563xx application software.

Order by: SG184/D

Digital Audio Solutions

Rev 0, 4Q98

A quarterly selector guide listing Motorola's products for audio applications, including DSP hardware, microcontrollers and software solutios, plus Motorola and third party development tools.

Order by: SG185/D

Discrete & RF ICs Surface Mount Selector Guide

Rev 3

Surface Mount Technology offers the opportunity to continue to advance the state-of-the-art designs that cannot be accomplished with insertion technology. SMT packages allow device performance closer to the optimum, and their lower profile allows more boards in a given amount of space. The technology is cost effective, giving the manufacturers the opportunity to provide smaller units, or

to offer increased functions with the same size product. This selector guide provides outline details of Motorola's broad range of surface mount discretes, with thermal data, tape and reel specifications, package outlines and an industry cross reference.

Order by: SG370/D

DPAK Surface Mount Selector Guide

A quick reference list of Motorola's TMOS Power MOSFETs, Schottky rectifiers, ULTRAFAST rectifiers, thyristors and bipolar power transistors available in the DPAK surface mount package. Includes package outline and footprint details.

Order by: SG371/D

Linear Voltage Regulators

Rev 2

A quick reference selector guide to Motorola's fixed and adjustable linear voltage regulators, showing principal characteristics as an aid to device selection.

Order by: SG378/D

North America Sales and Distribution Price List

Rev 13, 11 July1999

This guide lists North American suggested resale prices for Motorola commercial components and development systems. A Quick Reference lists new devices, deleted devices and lifetime buy products. Includes Motorola Sales Offices, standard policies and disclaimers, and software licenses.

Order by: SG379/D

Motorola RF CATV Distribution Amplifiers

Rev 2

Motorola has excelled as a leading supplier of innovative technical products to the cable TV market since its inception. This selector guide lists outline specifications for Motorola's CATV forward amplifiers, reverse amplifiers and fiber optic receivers; many are state-of-the-art products using transistors with sub-micron geometries.

Order by: SG382/D

Motorola RF LDMOS Product Family

Rev 5

Motorola's LDMOS (Laterally Diffused Metal Oxide Silicon) process is fast becoming the technology of choice in new communications products, making high power, high frequency RF amplifier designs simpler and more cost effective. This selector guide summarizes the devices available in the areas of RF High Power Transistors, Discrete Transmitter Devices for battery applications, RF Amplifier Modules, and RF Monolithic ICs.

Order by: SG384/D

Semiconductor Products for Wireless Communications

Motorola provides a number of unique, state-of-the-art silicon solutions for wireless communications, with particular emphasis on the new digital systems. This document lists a sample of devices from the vast portfolio of products for DECT, GSM, PCN, CT2 and Wireless LAN applications.

Order by: SG417/D

EMU: European Microcontroller Update

Rev 6

Provides timely information and a summary of the features of Motorola's CSIC MCU and AMCU families, together with European training courses, literature lists, voltage/speed/temperature options, development tools and package options.

Order by: SG419/D

TIGER: The Integrated Guide to European RAMs

Rev 3, 2H95

This selector guide is a reference to Motorola's European memory portfolio, including new product information, roadmaps and application notes.

Order by: SG423/D

Lamp Ballast Selector Guide

Rev 1

Continuing research and development of discrete products has led to a family of MOSFET and Bipolar transistors dedicated to the fast growing market of electronic lamp ballasts. The tables in this guide are designed to aid the quick selection of the best devices for specific applications. Includes selector guides by package type/technology, illustrated package dimensions and an industry cross reference.

Order by: SG425/D

User's Manuals

Analog-to-Digital Converter Reference Manual

This manual describes the capabilities, operation and functions of the analogue-to-digital converter (ADC) module incorporated in many of the MCUs in Motorola's modular microcontroller family. The module is a unipolar, successive-approximation converter with eight modes of operation and and selectable 8 or 10-bit resolution. Monotonicity is guaranteed for both 8 and 10-bit conversions. The manual includes a functional overview, an explanation of ADC control through the Intermodule Bus (IMB), and descriptions of the analogue and digital subsystems.

Order by: ADCRM/AD

Byte Data Link Controller Reference Manual

The Byte Data Link Controller (BDLC) is a serial communication module which allows the user to send and receive messages across an SAE J1850 serial communication network. The user's software handles each transmitted or received message on a byte-by-byte basis, while the BDLC performs the network access, arbitration, message framing and error detection. This manual is intended as an aid to the development of software that uses the BDLC to perform SAE J1850 communication; some implementations of the module may provide enhanced capabilities and software designers should also refer to the MCU specification.

Order by: BDLCRM/AD

M68HC08 Central Processor Unit Reference Manual

Rev 1

The CPU08 is the central processing unit of the M68HC08 Family of MCUs. It is fully object code compatible with the M68HC05, offering increased performance with no loss of software investment. It also appeals to users of other MCU architectures who need its speed, low power consumption and processing capabilities. This manual provides an overview of the CPU08 and its architecture, describes its interrupts, reset procedures and addressing modes, and gives detailed Instruction Set information in an instruction-per-page format.

Order by: CPU08RM/AD

CPU12 Reference Guide

Rev 1

A convenient reference guide providing quick access to essential CPU12 information, including the Programming Model, Instruction Set Summary, Postbyte Encoding, Memory Expansion and Opcode Map.

Order by: CPU12RG/D

CPU12 Reference Manual

Rev 1

The CPU12 is a high-speed, 16-bit processing unit that has a programming model identical to that of the industry standard M68HC11 CPU. Its instruction set is a proper superset of the M68HC11 instruction set, and HC11 source code is accepted by CPU12 assemblers without change. It offers an extensive set of indexed addressing capabilities in addition to the addressing modes found in other Motorola MCUs. The main goal of this manual is to provide profes-

sionals and students in electronic design and software development with the information necessary to implement control systems using M68HC12 devices.

Order by: CPU12RM/AD

M68HC16 Family Reference Manual

Rev 2

The CPU16 is a high speed 16-bit processor module that allows modular microcontrollers to provide an upgrade path for M68HC11 users while maintaining compatibility with existing systems. Its architecture is a superset of the M68HC11 architecture. This manual describes register organisation, memory management, bus interfacing, addressing modes and instruction set. Instructions are also described on an instruction-per-page basis in alphanumeric order. Additional sections cover instruction timing, exception processing, on-chip development support and digital signal processing (DSP) capabilities.

Order by: CPU16RM/AD

CPU32 Central Processor Unit Reference Manual

Rev 1

This Reference Manual describes the capabilities, operation and programming of the CPU32 processor module integrated in some members of the M68300 Family of embedded controllers. It is written for systems designers, and systems and applications programmers. The manual provides a full description of the instruction set, with clock cycle timing – instructions are based on the MC68000, with support for many MC68020 extensions plus new instructions for controller applications. It also describes the architecture, addressing modes, data organisation, exception processing and on-chip development support.

Order by: CPU32RM/AD

Configurable Timer Module Reference Manual

The Configurable Timer Module (CTM) is one of the modules used in Motorola's microcontroller family. Modules are connected together by the InterModule Bus (IMB), but the CTM is unusual in that it is in itself modular. This manual introduces the CTM, and details the operation of its internal bus with the IMB, its interrupt functions, and the Counter Prescaler, Free-Running Counter, Modulus Counter, Single Action, Double Action and Pulse Width Modulation submodules. There is a section on electrical specifications and timing information, and appendices provide a register summary and an example of a typical implementation.

Order by: CTMRM/D

DMA08 Direct Memory Access Reference Manual

Direct Memory Access (DMA) is usually associated with larger computer systems, where it allows blocks of data to be moved around the system with mininal processor intervention. DMA is the first example of co-processing associated with Motorola's modular HC08 family. This reference manual introduces version A of the DMA08, the DMA module of the HC08 family. Version B of the module has some differences, and is discussed in an appendix. Sections include an Overview, Module Description, Transfer Operation, Register Description and Application Examples.

Order by: DMA08RM/AD

DSP56000 Digital Signal Processor Family Manual

Rev 1

Motorola's DSP56000 Family of 24-bit general purpose Digital Signal Processors features a modular chip layout based round 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. (Specific details of the DSP56000/1 devices are given in DSP56000UM/AD.)

Order by: DSP56KFAMUM/AD

DSP56L811 Evaluation Module User's Manual

Rev 1

Describes the basic structure and operation of the DSP56L811 Evaluation Module (DSP56L811EVM), and details the additional equipment required to use it, the specifications of the key components, the software provided – including demonstration code, self-test code and software required to develop and debug sophisticated applications

– plus detailed schematic diagrams and a parts list. Includes both a Quick Start guide and detailed information about key components.

Order by: DSP56L811EMUM/AD

DSP56L811 User's Manual

Rev 1

Thee DSP56L811 is a member of the DSP56800 family of core-based DSPs. This general purpose DSP combines processing power with configuration flexibility, making it a cost-effective solution for both signal processing and control applications. It uses an MPU-style, general purpose 16-bit DSP core plus program and data memories. This manual describes the DSP56L811, its memory, operating modes and peripheral modules, and should be read in conjunction with DSP56800FAM/AD, the DSP56800 Family Manual, which describes the CPU, programming models and instruction set details.

Order by: DSP56L811UM/AD

DSP56002 Digital Signal Processor User's Manual

Rev 1

This manual describes the memory, operating modes and peripheral modules of the DSP56002 24-bit Digital Signal Processor (it should be read in conjunction with the DSP56K CPU Manual or Family Manual, which both provide detailed information about the CPU, programming models and instruction set). It includes signal descriptions, memory modules and operating modes, the external memory port, the Port B general purpose I/O and host port, and the multi-function Port C which is used mainly for serial communications. Appendices contain programming sheets to simplify programming the DSP56002 registers, and a listing of the on-chip bootstrap program.

Order by: DSP56002UM/AD

DSP56004 Digital Signal Processor User's Manual

Rev 2

This manual describes the memory, operating modes and peripheral modules of the DSP56004 24-bit Digital Signal Processor (it should be read in conjunction with the DSP56K CPU Manual or Family Manual, which both provide detailed information about the CPU, programming models and instruction set). It includes signal descriptions, the external memory interface, the serial host interface, serial audio interface, and general purpose I/O. Appendices contain a listing of the on-chip bootstrap program, application examples, and programming sheets to simplify programming the DSP56004 registers.

Order by: DSP56004UM/AD

DSP56009 User's Manual

The DSP56009 is a high performance audio DSP based on the DSP56000 core architecture, and implemented in the same scalable architecture as the DSP56002 and other 24-bit DSP56000 family modular products. As a result of its processing power and large memory it supports a variety of digital audio decompression functions such as Dolby AC-3 Surround, MPEG1 Layer 2 and Digital Theater Systems (DTS). This manual describes the DSP56009 in detail, including its memory, operating modes, external memory and audio interfaces, and peripheral modules.

Order by: DSP56009UM/AD

DSP56100 Digital Signal Processor Family Manual

The DSP56100 Family Manual describes the components that are common to all the DSP56100 family members. After an overview of the CPU architecture it provides detailed information on the Data ALU, Address Generation Unit, Program Control Unit and on-chip PLL. There are descriptions of the five processing states, bus operation, OnCE on-chip emulation, application development tools and the Dr. Bub DSP Bulletin Board. The manual includes an overview of the instruction set plus detailed information on each instruction, arranged alphabetically as one instruction per page.

Order by: DSP56100FM/AD

DSP56300 24-Bit Digital Signal Processor Family Manual

Rev 1

The new DSP56300 core in Motorola's family of programmable CMOS Digital Signal Processors is capable of executing an instruction every clock cycle, so yielding a twofold performance increase compared to the 56000 core while maintaining object code compatibility with it. It consists of an Expansion Port and DRAM Controller, Data ALU, Address Generation Unit, Instruction Cache Controller, Program Control Unit, DMA Controller, PLL Clock Oscillator, On-Chip Emulator and the Peripheral and Memory Expansion

Bus. This manual provides full user information on all these items, plus an alphanumeric page-per-instruction description of the instruction set and timing information.

Order by: DSP56300FM/AD

DSP56301 24-Bit Digital Signal Processor User's Manual

Rev 1

The DSP56301 is a member of Motorola's 56300 family of programmable CMOS Digital Signal Processors. Devices in this family are based on the DSP56300 core – capable of executing an instruction every clock cycle – with additional on-chip modules chosen from a library of pre-designed elements. The DSP56301 includes X and Y data RAM, an Instruction Cache and Program RAM, Triple Timer, Host Interface, ESSI Interface and SCI Interface modules. This manual describes these modules, and provides pin descriptions and memory maps.

Order by: DSP56301UM/AD

DSP56302 Evaluation Module User's Manual

Rev 1

Describes the basic structure and operation of the DSP56302 Evaluation Module (DSP56302EVM), and details the additional equipment required to use it, the specifications of the key components, the software provided, detailed schematic diagrams and a parts list. Includes both a Quick Start guide and detailed information about key components.

Order by: DSP56302EMUM/AD

DSP56302 User's Manual

The DSP56302 is a member of Motorola's DSP56300 family of programmable CMOS DSPs. It uses the DSP56300 core – a high performance, single-clock-cycle-per-instruction engine providing up to twice the performance of the popular DSP56000 family while retaining code compatibility. A rich instruction set and low power dissipation enables a new generation of wireless, telecoms and multimedia products. This manual describes its memory, operating modes and peripheral modules, including the General Purpose I/O capability, Host Interface (HI08), Enhanced Synchronous Serial Interface, Timer Module, On-Chip Emulation (OnCE) and JTAG Port.

Order by: DSP56302UM/AD

DSP56303 Evaluation Module User's Manual

Rev 2

Describes the basic structure and operation of the DSP56303 Evaluation Module (DSP56303EVM), and details the additional equipment required to use it, the specifications of the key components, the software provided, detailed schematic diagrams and a parts list. Includes both a Quick Start guide and detailed information about key components.

Order by: DSP56303EMUM/AD

DSP56303 User's Manual

The DSP56303 is a member of Motorola's DSP56300 family of programmable CMOS DSPs.It uses the DSP56300 core – a high performance, single-clock-cycle-per-instruction engine providing up to twice the performance of the popular DSP56000 family while retaining code compatibility. A rich instruction set and low power dissipation enables a new generation of wireless, telecoms and multimedia products. This manual describes its memory, operating modes and peripheral modules, including the General Purpose I/O capability, Host Interface (HI08), Enhanced Synchronous Serial Interface, Timer Module, On-Chip Emulation (OnCE) and JTAG Port.

Order by: DSP56303UM/AD

DSP56304 User's Manual

The DSP 56304 is a member of the DSP56300 family of programmable CMOS DSPs. It retains code compatibility with Motorola's popular DSP56000 core family, but its rich instruction set offers up to twice the performance to open the door to a new generation of wireless, telecommunications and multimedia products. This manual describes the processor, its memory, operating modes and peripheral modules. Includes a reference section for programmers.

Order by: DSP56304UM/AD

DSP56603 Evaluation Module User's Manual

Describes the basic structure and operation of the DSP56603 Evaluation Module (DSP56603EVM), and details the additional equipment required to use it, the specifications of the key components, the software provided – including demonstration code, self-test code and software required to develop and debug sophisticated applications – plus

schematic diagrams and a parts list. A substantial appendix provides a detailed description of Assembler Directives and Structure Control Statements. Intended for users with experience of DSP development tools.

Order by: DSP56603EMUM/AD

DSP56800 Family Manual

Thee DSP56800 Family is based on the DSP56800 16-bit DSP core, to which a range of standard peripherals can be added to create specific devices. This manual describes the core in detail, and will help the user to understand the operation and instruction set of the DSP56800 Family, and to write code for DSP algorithms, general control tasks, communication routines and data manipulation algorithms. It is intended to be used with the appropriate DSP56800 Family member's User's Manual which will explain the specific features of the device. Also includes instruction timing data and instruction-per-page details of each instruction, plus sources of additional technical support.

Order by: DSP56800FM/AD

Modular Microcontroller Family General Purpose Timer Reference Manual

The General Purpose Timer is one of the modules used within Motorola's family of modular microcontrollers. It is a simple but flexible 11-channel timer for use in systems where a moderate level of CPU control is required, and it communicates with other modules through the Intermodule Bus. This manual describes the operation and use of all sections of the module, including Compare/Capture Unit, Pulse Accumulator, Prescaler, PWM Unit, Interrupts and General Purpose I/O. It includes a section of applications information, plus electrical, timing and direct signal descriptions.

Order by: GPTRM/AD

H4C Series Design Reference Guide

Rev 1

The H4C series of high-performance sub-micron CMOS gate arrays offers configurations up to 318,000 gates, 0.7µ effective gate length, support for clock frequencies up to 60MHz and power dissipation of only 3µW/gate/MHz. This guide provides a full product description, discusses design considerations and the Open Architecture CAD System (OACS), and gives details of packages and array floor plans. Separate sections specify Macro Library Composites and Special Funtions in the form of data sheets, with a selector guide style index. There is a summary of DC Electrical Characteristics and a Glossary of Terms.

Order by: H4CDM/D

H4CPlus Series Design Reference Guide

Rev 2

The H4CPlus series arrays feature 3.3V, 5V and mixed voltage capability, high-speed interfaces, and an analogue PLL for chip-to-chip clock skew management. Gate length has been reduced to 0.65µm Leff to provide improved 5V performance and competitive performance at 3.3V. This guide provides a full product description, discusses design considerations and the Open Architecture CAD System (OACS), and gives details of packages and array floor plans. It includes a section specifying Macro Library Composites, with a quick reference guide. There is a summary of DC Electrical Characteristics and a Glossary of Terms.

Order by: H4CPDM/D

H4EPlus Series Design Reference Guide

Rev 1

Motorola's H4EPlus series arrays offer a fully featured 3.3V, 5V and mixed voltage capability, combined with increased core density that provides over 50% more gates than previous H4 arrays using the same die size. It offers a wide range of mixed voltage I/Os, high speed interfaces and analog PLLs for clock skew management. The gate length of 0.65µm nominal Leff gives competitive performance at 3.3V. This guide provides a product description, discusses design considerations and the Open Architecture CAD System (OACS), and gives details of packages and array floor plans. A quick reference guide lists the elements making up the H4EPlus library.

Order by: H4EPDM/D

Introduction to the Oncore ChipSet

Rev 1

The Oncore ChipSet has been developed to allow the GPS (Global Positioning by Satellite) function to be integrated into existing high-volume application platforms. It includes the same three integrated circuits that are found in Motorola's GT Oncore Receiver: the MRFIC1502 RF IC Downconverter, the MCS38140 Digital Correlator IC, and the MC68331 Microprocessor. This system provides high performance in foliage and urban canyon environments, with fast Time

To First Fix (TTFF) and reacquisition. This document contains technical specifications, integration considerations and communications information.

Order by: HB219/D

68HC05C0 General Release Specification

Rev 1.2

The 8-bit MC68HC05C0 microcomputer is suitable for applications which require an external address and data bus. It provides a mode select for either a muxed or non-muxed bus, and a clock stretching capability for slower peripherals. On-chip modules include an oscillator, CPU, RAM, serial and parallel I/O, multi-function timer, 16-bit timer and a low-voltage reset. This specification presents the technical details.

Order by: HC05C0GRS/D

MC68HC05C12A, MC68HCL05C12A, MC68HSC05C12A General Release Specification

Rev 3.0

The MC68HC05C12A is an enhanced version of the MC68HC05C8. It includes keyboard scanning logic, a high-current sink and source pin, a COP watchdog timer, and ROM security. This specification presents the technical details of the device. Appendices detail the differences in the low power MC68HCL05C12A and high speed MC68HSC05C12A versions.

Order by: HC05C12AGRS/D

MC68HC05C4A, MC68HCL05C4A, MC68HSC05C4A General Release Specification

Rev 4.0

The MC68HC05C4A is an enhanced version of the MC68HC05C4. It includes keyboard scanning logic, a high-current sink and source pin, a COP watchdog timer, and ROM security. This specification presents the technical details of the device. Appendices detail the differences in the low power MC68HCL05C4A and high speed MC68HSC05C4A versions.

Order by: HC05C4AGRS/D

MC68HC05C8A, MC68HCL05C8A, MC68HSC05C8A General Release Specification

Rev 3.0

The MC68HC05C8A is an enhanced version of the MC68HC05C8. It includes keyboard scanning logic, a high-current sink and source pin, a COP watchdog timer, and ROM security. This specification presents the technical details of the device. Appendices detail the differences in the low power MC68HCL05C8A and high speed MC68HSC05C8A versions.

Order by: HC05C8AGRS/D

MC68HC05C9A, MC68HCL05C9A, MC68HSC05C9A General Release Specification

Rev 4.0

The MC68HC05C9A HCOMS microcomputer is a member of the M68HC05 family. It includes 15,936 bytes of user ROM, 352 bytes of RAM, a serial communications interface, a serial peripheral interface and a 16-bit capture compare times. Eight mask options are available to select external interrupt capability (including an internal pullup) on each of the port B pins. This specification presents the technical details of the device. Appendices detail the differences in the low power MC68HCL05C9A and high speed MC68HSC05C9A versions.

Order by: HC05C9AGRS/D

MC68HC05CT4 General Release Specification

Rev 2.0

The MC68HC05CT4 is a 44-pin member of the M68HC05 family of microcontrollers and is intended for cordless telephone applications. The memory map includes 5376 bytes of on-chip ROM and 256 bytes of RAM. The MCU has three 8-bit I/O ports, one with pullup options and keyscan capability, and one 7-bit I/O port. Other features include a bird core, bird timer, serial synchronous interface (SSI), 16-bit timer, dual 60MHz PLL, a pulse width modulator and an on-chip COP watchdog circuit. This specification presents the technical details.

Order by: HC05CT4GRS/D

MC68HC05E5 General Release Specification

Rev 1

The 8-bit MC68HC05E5 is a low-cost addition to the M68HC05 Family. The HC05 CPU core has been enhanced with a 15-stage multifunction timer and a programmable PLL. The MCU includes has two 8-bit I/O ports and one 4-bit I/O port, and its 8kbyte of memory includes 384 bytes of RAM and 5120 bytes of user ROM. This specification presents the technical details.

Order by: HC05E5GRS/D

MC68HC(7)05H12 General Release Specification

Rev 0.0

The MC68HC(7)05H12 microcomputer is a member of the 8-bit M68HC05 family. It contains an on-chip oscillator, 256 bytes of user RAM, monitor ROM, user ROM or EPROM, parallel I/O, one core timer, two 16-bit programmable timers, COP watchdog system, SCI and SPI, a 4-channel A/D converter and an 8-channel 8-bit PWM for control of H-bridge drivers, with on-chip power driver circuitry. This specification presents the technical details.

Order by: HC05H12GRS/D

68HC05J5A/68HC705J5A General Release Specification

Rev 1.3

The MC68HC05J5A is a member of the low-cost, high-performance M68HC05 Family of 8-bit MCUs. It is an enhanced version of the MC68HC05J5, with expanded RAM, new ROM sizes, and an additional 16-bit timer with TCAP. It is available in a variety of packages. This specification presents the technical details.

Order by: HC05J5AGRS/H

MC68HC05L16/MC68HC705L16 General Release Specification

Rev 3.0

The MC68HC05L16 is an 80-pin Quad Flat Pack MCU in the M68HC05 Family, offering sophisticated on-chip peripheral functions. It has five parallel ports, a timebase circuit, 8 and 16-bit timers, COP watchdog timer, LCD drivers and a Simple Serial Peripheral Interface (SSPI). The memory map includes 16k bytes of user ROM and 512 bytes of RAM. This specification presents the technical details.

Order by: HC05L16GRS/D

68HC05L5/68HC705L5 General Release Specification

Rev 2.0

The MC68HC05L5 is an 80-pin microcontroller with highly sophisticated on-chip peripherals. It includes five parallel ports, 8 and 16-bit timers, a Computer Operating Properly (COP) watchdog timer, LCD drivers and a Simple Serial Peripheral Interface (SSPI). The memory map includes 8 Kbytes of user ROM and 256 bytes of static RAM. This specification presents the technical details.

Order by: HC05L5GRS/D

MC68HC05PL4A, MC68HC05PL4B, MC68HC705PL4B General Release Specification

Rev 1.1

The MC68HC05PL4A and MC68HC05PL4B are part of the M68HC05 HCMOS MCU family, and are designed specifically for use as a pair in the handset and base set of cost-sensitive CTO and CT1 analog cordless phones. Features include an industry standard M68HC05 core, built-in low frequency RC oscillator, 256 bytes of user RAM, 4k bytes of user ROM, ROM security, 15 bidirectional I/O lines (23 in MC68HC05PL4B) with keyboard interrupts and high current sink pins, and a multiplexed DTMF output with 6-bit D/A converter. This specification presents the technical details.

Order by: HC05PL4GRS/H

MC68HC05RC9/MC68HC05RC18 General Release Specification

Rev 2.0

The MC68HC05RC18 MCU is a low-cost, general purpose member of the M68HC05 family that is designed for remote control applications. On-chip peripherals include a Carrier Modulator Transmitter (CMT). There are 20 I/O lines (eight having keyscan logic and pullups) and a low-power reset pin. This specification provides full technical details.

Order by: HC05RC18GRS/D

68HC08AS32 General Release Specification

Rev 2.0

The MC68HC08AS32 is a member of the low-cost, high-performance M68HC08 family of 8-bit MCUs. Features include 32k bytes of ROM, 512 bytes of EEPROM with data security, a 6-channel 16-bit Timer, an 8-bit 15-channel ADC, and an SAE J1850 Byte Data Link Controller Digital Module. This specification presents the technical details.

Order by: HC08AS32GRS/D

MC68HC08KL8 General Release Specification

Rev 2.0

The MC68HC08KL8 is a member of the low-cost M68HC08 family of high-performance 8-bit microcontrollers. It is fully compatible with the Universal Serial Bus (USB) Specification rev. 1.0, with an on-chip USB transceiver and 3.3V regulator, USB data control logic for packet decoding/generation, CRC checking and generation, and NRZI encoding and decoding. Features include 368 bytes of RAM, 8k bytes of on-chip ROM, ROM data security, 39 general purpose I/O pins, an 8-bit keyboard interrupt port and 8 LED direct drive pins. This specification presents the technical details.

Order by: HC08KL8GRS/D

MC68HC68VBI General Release Specification

Rev 3.0

The Motorola MC68HC68VBI is a low cost HCMOS video peripheral capable of decoding user-definable vertical blanking interval (VBI) data formats from NTSC, PAL or SECAM video signals. A fully duplexed serial peripheral interface (SPI) or Motorola 68HC(7)11 multiplexed expansion bus allows interface with the host processor. Features include data extraction in most formats, specialized PDC mode, internal PLL frequency generator and quasi-horizontal sync detection. This specification presents the technical details.

Order by: HC68VBIGRS/D

MC68HC705CT4 General Release Specification

Rev 2.0

The MC68HC705CT4 MCU is a 44-pin member of the M68HC05 Family that is intended for use in cordless telephone applications. Features include three 8-bit I/O ports, one with pullup options and keyscan capability, and one 7-bit I/O port; 5136 bytes of user EPROM, 240 bytes of boot ROM and 256 bytes of RAM; Synchronous Serial I/O (SSI); and dual 60MHz clock. This specification provides the technical details.

Order by: HC705CT4GRS/D

68HC705JB2 General Release Specification

Rev 1.1

The MC68HC705JB2 is a member of the low-cost, high-performance M68HC05 Family of MCUs, and is specifically designed for use in applications requiring a Universal Serial Bus (USB). It features a fully compliant USB with one control endpoint and two interrupt endpoints, in addition to 2048 bytes of user EPROM, 128 bytes of RAM, a Multi-Function Timer, 16-bit Input Capture/Output Compare Timer, and 11 bi-directional I/O pins. This specification presents the technical details.

Order by: HC705JB2GRS/H

MC68HC705MC4 General Release Specification

Rev 2.0

The MC68HC705MC4 MCU is a low cost member of the M68HC05 Family that is intended for use in industrial motor control and power supply applications. Features include a 2-channel, 8-bit, high speed PWM module, with a commutation multiplexer for brushless permanent magnet motor control; a 6-input, 8-bit A/D controller; and a serial communications interface. This specification provides the technical details.

Order by: HC705MC4GRS/D

68HC705RC17 General Release Specification

Rev 2.0

The 68HC705RC17 is a general purpose, low-cost addition to the M68HC05 family of MCUs, and is intended for remote control applications. Features include the HC05 CPU core with 14-stage core timer with real time interrupt, COP watchdog system and programmable PLL synthesizer. On-chip peripherals include a carrier modulator transmitter. This specification presents the technical details.

Order by: HC705RC17GRS/D

68HC708KL8 General Release Specification

Rev 2.0

The MC68HC708KL8 is a member of the low-cost, high-performance M68HC08 family of 8-bit MCUs. Features include 8k bytes of EPROM or OTPROM with data security, 39 general purpose I/O lines, a 2-channel 16-bit Timer, a Universal Serial Bus (USB) module and 8-bit Keyboard Interrupt port. This specification presents the technical details.

Order by: HC708KL8GRS/D

MC68HC708MP16 General Release Specification

Rev 2

This specification presents the technical details of the MC68HC05PL4.

Order by: HC708MP16GRS/D

MC68HC908AT32 General Release Specification

Rev 2.0

The MC68HC908AT32 is a member of the low-cost M68HC08 family of high-performance 8-bit microcontrollers. It is designed to emulate two separate automotive MCU families, the MC68HC08AZ32 and the MC68HC08AS20. Features include 32 Kbytes of FLASH ROM with data security, 512 bytes of EEPROM with security option, 1 Kbyte of RAM, SPI and SCI, and system protection features. The two versions include different additional timer and ADC modules, plus a Motorola Scalable CAN Controller or an SAE J1850 Byte Data Link Controller Digital module. This specification presents the technical details and demonstrates the unique qualities of both families.

Order by: HC908AT32GRS/D

MC68HC908AT60 General Release Specification

Rev 1.0

The MC68HC908AT60 is a member of the low-cost M68HC08 family of high-performance 8-bit microcontrollers. It is designed to emulate two separate automotive MCU families, the MC68HC08AZxx and the MC68HC08ASxx. Features include 60 Kbytes of FLASH ROM with data security, 1 Kbyte of EEPROM with security option, 2 Kbytes of RAM, SPI and SCI, 8-bit 15-channel A/D converter, 16-bit 6-channel timer interface, periodic interrupt timer and system protection features. This specification presents the technical details and demonstrates the unique qualities of both families.

Order by: HC908AT60GRS/D

68HC908MR24 General Release Specification

Rev 1.0

The 68HC908MR24 is a member of the low-cost, high-performance M68HC08 family of 8-bit MCUs. Features include 8MHz internal bus frequency, 24 Kbytes of FLASH Electrically Erasable ROM with security, on-chip programming firmware for use with host PC, 12-bit 6-channel center or edge-aligned pulse width modulator, Clock Generator Module, SCI, SPI, 16-bit 4-channel and 16-bit 2-channel timer interface modules, and 10-bit 10-channel ADC. This specification presents the technical details.

Order by: HC908MR24GRS/D

HDC Series Design Reference Guide

Rev 2

Provides complete design information for Motorola's 1 micron drawn gate length, triple layer metal, high density CMOS array series. Includes a discussion of design considerations; a 'selector guide' list of available macros, memory blocks and other functions; pin orders and lists;

timing and electrical considerations; packages and array floorplans; quality data; and full data sheet information for each function.

Order by: HDCDM/D

LonBuilder User's Guide

This User's Guide teaches developers how to use the LonBuilder Developer's Workbench to develop and test LonWorks applications. It is intended for both hardware and software developers having some programming or basic digital hardware knowledge. It presents a comprehensive overview of the Developer's Workbench and the application development cycle, and explains the use of all the LonBuilder features. Chapters describe how to create, debug and install nodes, and how to monitor and test a development network. Appendices describe the menus, keyboard shortcuts, a sample memory map and the LonBuilder utility programs.

Order by: LONUG/AD

M•CORE Reference Manual

The architecture of the 32-bit M•CORE microRISC engine has been designed for high performance and cost-sensitive embedded control applications, with particular emphasis on reduced system power comsumption. M•CORE is a streamlined execution engine providing many of the same performance enhancements as mainstream RISC designs, while lowering the memory bandwidth needed to sustain a high rate of instruction execution. This manual provides an overview of the processor, and full details of the registers and instruction set, for system software developers and application programmers developing products for M•CORE-based systems.

Order by: MCORERM/AD

M5C Series Design Reference Guide

The M5C Series arrays feature performance-optimized 3.3V and mixed voltage I/O capability, high speed interfaces, and analog PLLs for chip-to-chip skew management. Their ultra low and mixed-voltage capability allows the M5C arrays to be customized to suit system power and performance needs. All arrays have three power rails for 3.3V, 5V or reduced swing output buffers, or a mix of system voltage levels. In addition, the core may be powered by 3.3V, 2.5V or 1.8V. This guide provides design information for the M5C series, including full details of the macro library.

Order by: M5CDM/D

M68EM05C0 Emulation Module User's Module

The M68EM05C0 Emulation Module provides the MMDS05 and the MMEVS05/08 development systems with the capability to emulate target systems based on the M68EM05C0 MCUs. This hardware user's manual explains connection, configuration and operation information specific to the module.

Order by: M68EM05C0UM/D

M68HC05 Applications Guide

Rev 3

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.

Order by: M68HC05AG/AD

HC08 Family Reference Guide

Rev 1

A convenient pocket-sized guide providing quick access to essential M68HC08 information such as the Instruction Set, full details of instructions that have been added to the M68HC05 set, Address Mode descriptions, Programming Model, Interrupt Stacking Order and an Opcode Map.

Order by: M68HC08RG/AD

M68HC11EVBU Universal Evaluation Board User's Manual

Rev 3

The M68HC11 Universal Evaluation Board (EVBU) provides an economical means of debugging and evaluating the MC68HC11A8, E9, 711E9, 811A8 and 811E2 MCUs. This manual gives general information, hardware preparation and installation instructions, a description of the BUFFALO monitor/debugging program, operating instructions, a hardware description and support information for the board.

Order by: M68HC11EVBU/D

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.

Order by: M68HC11RM/AD

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.

Order by: M68PRM/D

M6805 HMOS / M146805 CMOS Family User's Manual

Rev 3

Provides users with concise information on Motorola's M6805 HMOS and M146805 CMOS microcomputer families. Thorough descriptions and instructions are given, beginning with a general description and introduction to the families, and including details of the hardware and software features illustrated with many 'standard' applications. More advanced applications are covered by reprinted application notes. The manual concludes with detailed definitions of each instruction, arranged in alphanumeric order, with a cycle-by-cycle operation summary.

Order by: M6805UM/AD3

MC6809-MC6809E Microprocessor Programming Manual (1981)

The MC6809 and MC6809E are greatly enhanced, upward-compatible and faster extensions of the MC6800 MPU. This Programming Manual provides details of the additional features, the addressing modes and programming considerations, assuming 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.

Order by: M6809PM/AD

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.

Order by: M68000PM/AD

M68000 8-/16-/32-bit Microprocessors User's Manual, Ninth Edition

Rev 8

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 detailed information about each instruction, arranged in alphabetical order of mnemonic.

Order by: M68000UM/AD

MC68020/MC68EC020 Microprocessors User's Manual

Rev 2

The MC68020 was the first full 32-bit implementation of Motorola's M68000 family. It is joined by the MC68EC020, an economical version designed for embedded controller (EC) applications. This User's Manual describes the capabilities, operation and programming of the two devices, highlighting differences where applicable. An introduction provides an overview of the devices and their instruction sets. Other sections include Processing States, Signal Description, On-Chip Cache, Bus Operation, Exception Processing, Coprocessor Interface, Instruction Timing, Applications Information, and electrical and mechanical data.

Order by: M68020UM/AD

MC68040, MC68040V, MC68LC040, MC68EC040, MC68EC040V Microprocessors User's Manual

Rev 1

The MC68040, MC68040V, MC68LC040, MC68EC040 and MC68EC040V are third-generation, 32-bit MPUs in the M68000 family. They use multiple concurrent execution units and a highly integrated architecture to achieve very high performance. This manual describes the capabilities, operation and programming of the five devices. Sections include Integer Unit, Memory Management, On-Chip Caches, Signal Description, IEEE 1149.1 Test Access Port (JTAG), Bus Operation, Exception Processing, Floating-Point Unit and Instruction Timing.

Order by: M68040UM/AD

MC68060, MC68LC060, MC68EC060 Microprocessors User's Manual

Rev 1

The MC68060, MC68LC060 and MC68EC060 are the first processors in the M68060 product line. All offer superscalar integer performance of more than 100 MIPS at 66MHz while maintaining compatibility with the rest of the M68000 Family. This manual describes their capabilities, operation and programming. Sections include a general introduction, Signal Description, Integer Uhit, Memory Management, the Caches, Floating Point Unit, Bus Operation, Exception Processing, JTAG and Debug Pipe Control Modes, Instruction Timing, Applications, and Electrical and Thermal Characteristics.

Order by: M68060UM/AD

MC68EN302 Integrated Multiprotocol Processor with Ethernet Reference Manual (Supplement to MC68302UM/AD)

The MC68EN302 is a multiprotocol integrated communications controller based on the MC68302. It adds an Ethernet controller which is independent of the three on-chip serial channels, plus a DRAM control and a JTAG interface. This manual describes aspects of the programming, capabilities, registers and operation of the MC68EN302 where they differ from the MC68302. Separate chapters describe the Module Bus Controller, DRAM Control Module (DCM), Ethernet Controller and JTAG Test Access Port.

Order by: MC68EN302RM/AD

MC68EZ328 DragonBall-EZ Integrated Processor User's Manual

Rev 1

The MC68EZ328 (DragonBall-EZ) microprocessor – the second generation DargonBall – is designed to save time, power, cost, board space, pin count and programming steps when designing a product. Its functionality might require 20 separate components in another system. The MC68EZ328 combines an MC68EC000 processor with intelligent peripheral modules and typical system interface logic – all are optimally connected, timed with the same clock, fully tested and uniformly documented. This manual discusses the details of how to initialize, configure and program the MC68EZ328 microprocessor; it assumes basic knowledge of 68K architecture.

Order by: MC68EZ328UM/D

MC68F333 User's Manual

The MC68F333 is a highly integrated 32-bit microcontroller which includes a Single Chip Integration Module, an 8-channel 10-bit ADC, a Time Processor Unit, a 512-byte Standby RAM, 3.5 Kbyte RAM with TPU emulation, and two flash EEPROM modules. This user's manual describes

all the modules in detail, and includes electrical and timing information. Address maps and register diagrams are summarised in an appendix for convenience.

Order by: MC68F333UM/AD

MC68HC05Cx HCMOS Single-Chip Microcontrollers Programming Reference Guide

Rev 1

A convenient pocket-sized guide providing quick access to essential MC68HC05C-series information such as Block Diagrams, Memory Maps, the Programming Model, Registers and Control Bits, Instructions, Addressing Modes, Execution Times and Pin Assignments.

Order by: MC68HC05CxRG/AD

MC68HC11A8 Programming Reference Guide

Rev 1

A convenient pocket-sized guide providing quick access to essential MC68HC11A8 information such as the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignments.

Order by: MC68HC11A8RG/AD

MC68HC11C0 Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential MC68HC11C0 information such as a Block Diagram, the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignment.

Order by: MC68HC11C0RG/AD

MC68HC11D3/MC68HC711D3 Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential MC68HC11D3 and MC68HC711D3 information such as the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignment.

Order by: MC68HC11D3RG/AD

MC68HC11E Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential information for the MC68HC11E series of MCUs, including the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignments. The guide covers the MC68HC11E0, ’E1, ’E8, ’E9 and ’E20, the MC68HC711E9 and ’E20, the MC68S711E9 and the MC68HC811E2.

Order by: MC68HC11ERG/AD

MC68HC11F1 Programming Reference Guide

Rev 2

A convenient pocket-sized guide providing quick access to essential MC68HC11F1 information such as the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignments.

Order by: MC68HC11F1RG/AD

MC68HC11K4/MC68HC711K4 Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential information on the MC68HC11K4 MCU, and on the MC68HC711K4 EPROM version. It includes the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignments.

Order by: MC68HC11K4RG/AD

MC68HC11KA4/MC68HC711KA4 Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential information on the MC68HC11KA4, the reduced pinout version of the MC68HC11K4 MCU, and on the MC68HC711KA4 EPROM version. It includes the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignments.

Order by: MC68HC11KA4RG/AD

MC68HCL6/MC68HC711L6 Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential MC68HC11L6 and MC68HC711L6 information such as the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instructions, Addressing Modes, Execution Times, Registers and Control Bits, and Pin Assignment.

Order by: MC68HC11L6RG/AD

M68HC11 M Series Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential programming information for Motorola's M68HC11 M-series MCUs, including the Programming Model, Crystal Dependent Timing, Interrupt Vectors, Memory Map, Opcode Maps, Instruction Set, Addressing Modes, Execution Times, Special Operations, Registers and Control Bits, and Pin Assignments.

Order by: MC68HC11MRG/AD

MC68HC11N Series Programming Reference Guide

A convenient pocket-sized guide providing quick access to essential M68HC11 N-series information such as the Programming Model, Interrupt Data, Memory Map, Opcode Maps, Instruction Set, Addressing Modes and Timing Information, Registers and Control Data.

Order by: MC68HC11NRG/AD

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.

Order by: MC68HC16Y1UM/AD

M68HC16 Z Series User's Manual

The M68HC16 Z-series microcontrollers are high-speed 16-bit devices in the M68HC16 Family, and are upward compatible with M68HC11 devices. They are built from standard modules, interfacing via a common internal bus, to facilitate rapid development of devices for specific applications. All contain an Analog-to-Digital Converter (ADC) and General Purpose Timer, plus either a Queued Serial Module (QSM) or Multichannel Communications Interface (MCCI). This manual provides a detailed overview of all the devices in the Z-series with design information for each module. Includes a comprehensive Register Summary and Programming Examples.

Order by: MC68HC16ZUM/AD

MC68HC901 Multi-Function Peripheral User's Manual

The MC68HC901 Multi-Function Peripheral (MFP) is a member of the M68000 Family, and interfaces directly to the MC68000 through the asynchronous bus structure. Both vectored and polled interupt schemes are supported, with the MFP providing unique vector number generation for each of 16 interrupt sources. Handshake lines are provided to allow DMA Controller interfacing. This User's Manual describes the operation of the MFP, including signal description, bus operation, interrupt structure, I/O port, timers, USART, and electrical and mechanical characteristics.

Order by: MC68HC901UM/AD

MC68LC302 Low Power Integrated Multiprotocol Processor Reference Manual

The MC68LC302 is a low power version of the MC68302 Integrated Multiprotocol Processor (IMP). In simple terms it is the same device, but minus the third Serial Communications Controller (SCC3), and with a new static 68000 core, new timer and low power modes. It is packaged in a low profile package for reduced board space and makes it suitable for use in applications such as PCMCIA. This manual describes all the differences between the MC68LC302 and the MC68302, full details of which are contained in the MC68302 User's Manual, reference MC68302UM/AD.

Order by: MC68LC302RM/AD

Integrated Multiprotocol Processor with PCMCIA Interface Reference Manual

The MC68PM302 is a derivative of the MC68302 Integrated Multiprotocol Processor (IMP). It can operate in two modes – in one mode it functions as an enhanced MC68302 with a new static 68000 core, new timer and low power modes, and additional parallel I/O pins; in the second mode it offers the same enhanced capability, but with PCMCIA and 16550 UART functionality instead of the additional I/O pins. It is packaged in a low profile package suitable for use in Type II PCMCIA cards. This manual describes all the differences between the MC68PM302 and the MC68302, full details of which are contained in the MC68302 User's Manual, reference MC68302UM/AD.

Order by: MC68PM302RM/AD

MC68QH302: Supplement to the MC68302 Integrated Multiprotocol Processor User's Manual

This supplement to the MC68302 User's Manual highlights implementation-specific features of the MC68QH302 quad HDLC integrated multiprotocol processor. The MC68QH302 supports a total of four independent communication channels, handling two HDLC or transparent channels on SCCI.

Order by: MC68QH302SUPL/AD

MC68SC302 Passive ISDN Protocol Engine User's Manual

The MC68SC302 Passive ISDN Protocol Engine (PIPE) is an ISA 'Plug and Play'/PC card ISDN communication controller optimized for ISDN passive cards. It has been developed from the popular MC68302 Integrated Multiprotocol Processor and features glueless connection to Motorola's MC145572 and MC145574 transceivers. The three serial communication channels have been optimized to support two 64kbit per second B-channels and one 16kbit per second D-channel. This manual describes the programming, capabilities, registers and operation of the MC68SC302, including the Interrupts and Timer, Communications Processor, 'Plug and Play' Interface and PCMCIA Interface.

Order by: MC68SC302UM/AD

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 Organisation and Addressing, Instruction Set, 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.

ISBN 0 13 566969 3

Order by: MC68030UM/AD

MC68302 Integrated Multiprotocol Processor User's Manual

Rev 3

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.

Order by: MC68302UM/AD

MC68306 Integrated EC000 Processor User's Manual

The MC68306 is an integrated processor containing an MC68EC000 processor and elements required in many MC68000 and MC68EC000-based systems, reducing design time especially in systems using serial interfaces and Dynamic RAM. This user's manual introduces the core and the on-chip peripherals, describes the signals and 68000 bus operation, provides detailed information about the core and Serial Module, and discusses the IEEE 1149.1 Test Access Port.

Order by: MC68306UM/AD

Bandit: MC68322 Integrated Printer Processor User's Manual

Rev 1

The MC68322 is a high-performance integrated printer processor combining an MC68000 compatible core processor, a RISC graphics processor, a print engine video controller and system integration features on a single chip. Specialised display list banding techniques performed by the graphics processor allow system memory requirements to be reduced significantly. This manual includes sections on the Core; Bus Operation; Interrupts; System Integration Module; DRAM Controller; DMA, Parallel Port and Print Engine Interfaces; RISC Graphics Processor; Graphic Operations and Orders; and electrical and mechanical information.

Order by: MC68322UM/AD

MC68328 (Dragonball) Integrated Processor User's Manual

As the consumer market for portable devices expands, system requirements become more demanding. Fewer components, smaller board space, lower power consumption and lower system cost are major criteria. Motorola has introduced the MC68328 DragonBall integrated portable system processor to address these needs. It provides key features for portable systems, such as a real-time clock, LCD oscillator, pulse-width modulator, timers, SPI and the SIM28 system integration module. This User's Manual describes the capability, operation and programming of the MC68328.

Order by: MC68328UM/AD

MC68330 Integrated CPU32 Processor Users Manual

The MC68330 is a 32-bit integrated processor linking high-performance data manipulation capability with circuits typically required in embedded controller applications. It combines the CPU32 core processor and the SIM40 system integration module. This User's Manual describes the programming, capabilities, registers and operation of the MC68330. Sections provide signal descriptions, full details of bus operation, and explain the use of the CPU32 and SIM40. The Guide also covers use of the IEEE 1149.1 Test Access Port, and gives applications guidelines.

Order by: MC68330UM/AD

MC68332 User's Manual

Rev 1

The MC68332 is a 32-bit integrated microcontroller in the M68300 Family, combining high-performance data manipulation capabilities with powerful peripheral subsystems. This manual includes sections describing the input and output signals; timing, exception processing and arbitration for the external bus; the submodules of the System Integration Module (SIM); the Queued Serial Module; operation of the 2K Standby RAM; plus overviews of the MC68020-based CPU32 processor, the Time Processor Unit (TPU) and available emulation systems. It includes electrical and mechanical data.

Order by: MC68332UM/AD

MC68340 Integrated Processor User's Manual

Rev 1

The MC68340 is a 32-bit integrated processor in the M68300 Family, combining high-performance data manipulation capabilities with powerful peripheral subsystems. This manual includes sections describing the input and output signals; timing, exceptions and arbitration for the external bus; the submodules of the System Integration Module (SIM); the MC68020-based CPU32 processor; the high-performance DMA Controller module; the serial communications module;

the twin timer modules; and the IEEE 1149.1-standard test port. It includes applications guidelines and electrical and mechanical data.

Order by: MC68340UM/AD

MC68356 Signal Processing Communications Engine User's Manual

The MC68356 is the first commercially available monolithic device to include a general purpose digital signal processor, a CISC microprocessor and a RISC microprocessor on a single chip. The features of its multiprotocol communications processor are a subset of the MC68302, the DSP is DSP56002-based, and its PCMCIA slave interface emulates the UART16550. This manual describes its architecture and external signals, and includes sections on Clock Generation and Low Power Control; the 68000 Core, Memory Map and SIB; the Communications Processor; the PCMCIA Controller; DSP Ports and Memory; and the IEEE 1149.1 Test Access Port.

Order by: MC68356UM/AD

MC68360 Quad Integrated Communications Controller User's Manual

Rev 1

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.

Order by: MC68360UM/AD

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.

Order by: MC68605UM/AD

MC68824 Token Bus Products 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.

Order by: MC68824UM/AD

MC68836 FDDI User's Manual

The Fiber Distributed Data Interface is a Local Area Network (LAN) under the auspices of ANSI. It supports a 100mBits/sec token ring with up to 1000 stations. The MC68836 FDDI Clock Generator implements the lower portion of the physical layer functions of the standard including Clock Recovery, Data Recovery, NRZI Conversions and 5-bit parallel-to-serial/serial-to-parallel conversions. This User's Manual describes its operation, signals, timing and applications.

Order by: MC68836UM/AD

MC68837 FDDI User's Manual

The Fiber Distributed Data Interface is a Local Area Network (LAN) under the auspices of ANSI. It supports a 100mBits/sec token ring with up to 1000 stations. The MC68837 Elasticity Buffer and Link Management (ELM) chip implements the physical layer (PHY) functions of the 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 User's Manual describes its operation, registers, signals and timing.

Order by: MC68837UM/AD

MC68838 FDDI User's Manual

The Fiber Distributed Data Interface (FDDI) is a 125Mbit/sec, fibre-optic based token ring designed to accommodate rings up to 1000 stations, with 2km between stations and 200km total ring length. The ANSI standard for FDDI networks defines a number of protocols including the data link Media Access Control (MAC) layer. Motorola's MC68838 chip implements this protocol. This manual provides an overview and functional description of the device, with details of the 36 control/status registers, signal descriptions, bus and MAC-PHY operation, and transmit and receive data path operation.

Order by: MC68838UM/AD

MC68839 FDDI System Interface User's Manual

The Fiber Distributed Data Interface is a Local Area Network (LAN) under the auspices of ANSI. It supports a 100mBits/sec token ring with up to 1000 stations. Motorola's FDDI chipset consists of an FDDI Clock Generator, an Elasticity and Link Management physical layer circuit, a Media Access Control circuit, and an FDDI System Interface (FSI). This manual describes the FSI. Sections include Functional Block Description; Registers; Signal Descriptions; Commands and Indications; Functional Operation; Initialisation, Programming and Examples; Port Operation; Boundary Scan Details; Electrical Specifications and Mechanical Data. System performance requirements are discussed in an appendix.

Order by: MC68839UM/AD

MC68840 Integrated Fiber Distributed Data Interface User's Manual

Rev 1

FDDI is a fibre-optic-based, token ring local area network standard developed to accommodate rings of up to 1000 stations and a total ring length of 200km, operating at speeds up to 100Mbps. This ANSI standard specifies the Media Access Control (MAC) layer, the Physical (PHY) layer, the Physical Medium Dependent function and the Station Management function. The MC68840 implements the MAC and PHY layers. This manual provides an overview of the device, plus full descriptions of the functional blocks, registers, ports, external signals and test operations. Includes two practical examples to illustrate the design process.

Order by: MC68840UM/AD

MC68847 Quad ELM FDDI User's Manual

The MC68847 Quad ELM implements four MC68837 ELM (Elasticity Buffer and Link Management) devices on a single chip, providing a low cost solution for concentrator applications. Each implements the physical layer (PHY) functions of the FDDI standard including data framing, elasticity buffer, encoding, decoding, smoothing, line state detection and repeat filter. This User's Manual describes its operation, registers, signals and timing.

Order by: MC68847UM/AD

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.

Order by: MC88200UM/AD

MC88410 Secondary Cache Controller User's Manual

The MC88410 is a highly integrated secondary cache controller in the M88110 family that reduces both memory latency and system bus use, while extending multiprocessing capabilities to achieve a higher level of system performance. This User's Manual gives an overview of the MC88110/MC88410 system and the benefits of using the secondary cache, describes the MC88410 operation and its signals in detail, and provides functional descriptions of the processor and system bus interfaces. It includes a chapter on diagnostics and JTAG.

Order by: MC88410UM/AD

ATM Cell Processor Design Reference Manual

Each switching system in an Asynchronous Transfer Mode (ATM) network handles multiple physical links, and transfers each arriving ATM cell between its source and destination links using prearranged routing. ATM standards divide the tasks on either side of the switch into PHY-layer (physical layer) tasks and ATM-layer tasks. The MC92500 is a cell processing device which provides ATM-layer cell processing and routing functions between a PHY-layer device and an ATM switch fabric. This reference manual provides design information for the MC92500, including a Functional Description; Register, External Memory and Signal Descriptions, Data Structures, Ingress and Egress Data Path Operation, System Operation, Support for Operations and Maintenance, interface descriptions and more.

Order by: MC92500UM/D

MC92501 ATM Cell Processor User's Manual

Rev 1

An ATM network is composed mainly of switching elements, each handling multiple physical links. A typical core switch consists of a switch matrix and some line cards, one card for each physical link or group of links. At the edges of the network, access multiplexers route a single link to multiple links. Motorola's MC92501 ATM Cell Processor can be used to provide ATM-layer cell processing and routing functions in both the line cards and in the access multiplexer. This Users' Manual provides detailed information on the operation and use of the MC92501.

Order by: MC92501UM/D

MC145220 Evaluation Board Manual

Rev 2

The MC145220EVK makes it easy to evaluate features of the MC145220 and to build PLLs to meet specific requirements. It is controlled through menu driven software operating on an IBM PC or compatible, and connects to the printer port of the PC. Up to three different EVKs may be connected simultaneously. This manual describes the EVK hardware, the PC interface and software, and provides a full summary of the commands.

Order by: MC145220EVK/D

Multichannel Communication Interface Reference Manual

This manual describes the capabilities, operation and functions of the Multichannel Communication Interface (MCCI), an integral module in Motorola's family of modular microcontrollers. The MCCI contains a Serial Peripheral Interface (SPI) and two Serial Communication Interfaces (SCI). Sections include an Overview of the module, Signal Descriptions, Configuration and Control Registers, and separate chapters describing the SCI and SPI submodules.

Order by: MCCIRM/AD

MCF5102 ColdFire User's Manual

Rev 1

ColdFire is a microprocessor architecture optimized for embedded processing. It combines the architectural simplicity of 32-bit fixed length RISC with a memory-saving variable length instruction set – its higher code density requires less program memory than for fixed length systems and allows the use of lower cost memory for given performance. The MCF5102 if the first chip in the family, and includes the capability to execute existing 68000 code to provide an upgrade bridge. This User's Manual describes the capabilities, operation and programming of the MCF5102. Instruction timing is provided, but full details of the instruction set are given in the M68000 Family Programmer's Reference Manual, M68000PM/AD.

Order by: MCF5102UM/AD

ColdFire Microprocessor Family Programmer's Reference Manual

Rev 1.0

This manual contains information about the software instructions used by the ColdFire 5200 microprocessors. It includes sections on the addressing capabilities, exception processing, timing, and on the instructions themselves in both summary and alphanumeric page-per-instruction format.

Order by: MCF5200PRM/AD

ColdFire MCF5202 User's Manual

ColdFire is a revolutionary microprocessor architecture that is optimized for embedded processing applications, bringing new levels of price and performance to cost-sensitive high-volume products. Based on the concept of variable-length RISC technology, ColdFire combines the

architectural simplicity of conventional 32-bit RISC with a memory-saving, variable length instruction set. This manual describes the programming, capabilities and operation of the MCF5202 processor. Topics include signal descriptions, details of the core and cache, bus operations, debug support, JTAG specification, and an overview of the issues involved in porting embedded development tools from M68000 architecture.

Order by: MCF5202UM/AD

MCF5307 ColdFire Integrated Microprocessor User's Manual

The ColdFire processor core is designed for embedded control applications. Its architecture uses variable-length RISC instruction set technology to give new levels of price and performance to cost-sensitive, high-volume markets; denser binary code requires less memory for a given application. The MCF5307 integrated microprocessor combines a ColdFire core with a Multiply-Accumulate (MAC) unit, DRAM controller, timers, parallel and serial interfaces, and system integration. These on-chip functions greatly reduce the time required for typical system design and implementation. This User's Manual describes the programming, capabilities and operation of the MCF5307.

Order by: MCF5307UM/AD

Motorola Microcontroller Development Tools Directory

Rev 5

A directory of hardware and software development tools – from Motorola and from third party vendors – for the M68HC05, M68HC08, M68HC11, M68HC16, M68300 and MPC500 microcontroller families. Includes a cross reference listing products under Adapters, Emulators, Evaluation Boards, Logic Analyzers, Programmers, Other Hardware Tools, Assemblers, Compilers, Debuggers, Integrated Development Environments, Real-Time Operating Systems, Simulators and Other Software Tools.

Order by: MCUDEVTLDIR/D

M•CORE MMC2001 Reference Manual

The 32-bit M•CORE microRISC engine represents a new family of microprocessor core products. It provides many of the same performance enhancements as mainstream RISC designs, but the processor architecture has been designed for high-performance and cost-sensitive embedded control applications, with particular emphasis on reduced system power consumption. This reference manual describes the CPU, memory map, signals, ROM module, Static RAM module, External Interface Module, Clock Module and low power modes, Timer/Reset Module, Interrupt Controller, UART, SPI, Keypad Port, PWM and OnCE Debug Module. A Programming Reference is provided in an appendix.

Order by: MMC2001RM/D

EasyAnalog Design Software User's Manual

EasyAnalog software allows users quickly and easily to construct complex analog circuits by selecting, placing and connecting macro circuits and downloading them to Motorola's Field Programmable Analog Array (FPAA) chip though the PC's serial port. Results can be seen immediately using a signal generator and oscilloscope. The chip can be reprogrammed to try out different circuits. Some standard macros are provided with the software. This manual provides a tutorial and reference for the EasyAnalog software, and an overview of the MPAA020 array.

Order by: MPAA3UM/D

PowerPC Microprocessor Family: the Bus Interface for 32-bit Microprocessors

Rev 6

The main purpose of this manual is to provide a detailed functional description of the 60x bus interface, the communication channel for the first generation of PowerPC microprocessors, as implemented on the PowerPC 601, 603 and 604 microprocessors. It is intended to help system and chip set developers by being a central reference source for the interface presented by these processors, describing both the basic signals that are common to all the processors and the signals that are not common but which can maximize the performance of a system implementation.

Order by: MPCBUSIF/AD

PowerPC Microprocessor Family: The Programmer's Reference Guide

The main purpose of this guide is to provide a concise method for system developers and application programmers to implement software that is compatible across the PowerPC family of processors and other devices. A Register Summary gives a brief overview of the PowerPC register set, including a programming model and quick reference guide for 32-bit

and 64-bit registers. The Memory Control Model outlines the page table entry and segment table entry. Exception Vectors is a quick reference for exception types and the conditions that cause them. And PowerPC Instruction Set gives detailed information on the entire instruction set.

Order by: MPCPRG/D

PowerPC Microprocessor Family: The Programmer's Pocket Reference Guide

A convenient pocket-sized guide providing an overview of the PowerPC registers, instructions and exceptions for 32-bit implementations. Headings include Programming Model; Memory Management Registers; Encodings for the Branch Options Field; MSR Bit Settings; Floating Point Exception Mode Bits; State of MSR at Power Up; BAT Registers and Area Lengths; Segment Register Bit Definitions and Instructions; PTE Bit Definitions; Exceptions and Conditions; and the PowerPC Instruction Set.

Order by: MPCPRGREF/D

PowerPC PCI Bridge/Memory Controller User's Manual

The MPC105 PCI bridge/memory controller provides a PowerPC reference platform-compliant bridge between the PowerPC microprocessor family and the peripheral component interconnect (PCI) bus. PCI support allows system designers to rapidly design systems using peripherals already designed for PCI and the other standard interfaces available in the personal computer hardware environment.

Order by: MPC105UM/AD

PowerPC 603e RISC Microprocessor User's Manual

Rev 1

The MPC603e is built on the low power, low cost and high performance attributes of the MPC603, while providing enhanced capabilities through higher clock speed, greater system clock flexibility, increases in cache size and set-associativity. Although this manual is concerned with the 603e, all the information applies to both devices except where noted in an appendix. It includes detailed chapters on the Programming Model, Instruction and Data Cache Operation, Exception Processing, Memory Management, Instruction Timing, Signal Descriptions, System Interface Operation, and Power Management. Appendices include an instruction set listing and details of 603 differences.

Order by: MPC603eUM/AD

MPC750 RISC Microprocessor User's Manual

The MPC750 is an implementation of the 32-bit portion of the PowerPC microprocessor architecture, to provide 32-bit effective addresses, 8/16/32-bit integer data types and 32/64-bit floating-point data types. It is a superscalar processor capable of completing two instructions simultaneously. This manual defines the functionality of the MPC750 and MPC740 microprocessors. It is intended for use by system and application hardware and software developers with an understanding of operating systems, MPU system design, basic principles of RISC processing and details of the PowerPC architecture.

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MPC821 PowerPC Portable Systems Microprocessor User's Manual

The MPC821 PowerPC Portable Systems Microprocessor is a versatile one-chip integrated microprocessor and peripheral device that can be used in a variety of controller applications. It is a PowerPC derivative of the MC68360 QUICC, and is intended particularly for use in high performance and portable communications systems where lower power consumption is essential. This comprehensive manual describes the operation of the MPC821, with particular emphasis on the I/O functions and the Communication Processor Module.

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PowerPC MPC823 Pocket Guide

This convenient pocket guide contains design guidelines, the memory map, list of registers, instructions and list of external signals for the MPC823 microprocessor. The lists include cross references to the MPC823 User's Manual.

Order by: MPC823RG/D

PowerPC MPC823 User's Manual

The MPC823 PowerPC microprocessor is a versatile, one-chip integrated microprocessor and peripheral combination that can be used in a variety of portable electronic products; it excels in low-power image capture and personal communication products. It is essentially a low cost version of the MPC821, enhanced with additional communication and display capabilities. These additional features are provided by a specialized RISC processor that can perform signal processing functions for image compression and decompression, and which supports six serial channels. This substantial User's Manual discusses the operation, possible configurations, and specifications of the MPC823.

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MPC860 PowerQUICC User's Manual

The MPC860 PowerPC Quad Integrated Communications Controller (PowerQUICC) is a versatile, one-chip integrated microprocessor and peripheral device that can be used in a variety of controller applications. It is a PowerPC derivative of the MC68360, and is intended particularly for use in both communications and networking systems. This comprehensive manual describes the operation of the MPC860, with particular emphasis on the I/O functions and the Communication Processor Module. An appendix discusses the movement of applications from the MC68360 QUICC environment to the MPC860 PowerQUICC environment.

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Queued Analog-to Digital Converter Reference Manual

The Queued Analog-to-Digital Converter (QADC) is a 10-bit, unipolar, successive approximation converter module. It supports 16 analog channels with internal multiplexing or 44 channels in the expanded, externally multiplexed mode. This manual provides information on the operation and use of the module, including Signal Descriptions, Configuration and Control, External Multiplexing, Pin Connection Considerations, Analog Subsystem, Digital Control, Interrupts, and examples of Queue Priority schemes.

Order by: QADCRM/AD

QUICC Multichannel Controller User's Manual Supplement

This document is a supplement to the MC68360 Quad Integrated Communications Controller User's Manual (MC68360UM/AD) and the MPC860 PowerQUICC User's Manual (MPC860UM/AD). It replaces the MC68MH360 Reference Manual (MC68MH360RM/AD).

Order by: QMCSUPPLEMENT/D

MC68MH360, MPC860MH and MPC860DH: A Supplement to the MC68360 and MPC860 User's Manuals

The standard QUICC family members work in Time Division Multiplexed (TDM) applications but can only support one logical channel per Serial Communication Controller (SCC). The QMC (QUICC Multichannel Controller) protocol emulates up to 64 logical channels within one SCC using the same TDM physical interface. The QMC parts – MC68MH360, MPC860MH and MPC860DH – are pin-compatible with their respective family members and can be used in identical applications with minor adjustments. This manual provides an overview of the protocol and describes the use and operation of the devices.

Order by: QMCSUPPLEMENT/AD

Queued Serial Module Reference Manual

The Queued Serial Module (QSM) is an integral module in Motorola's family of embedded microcontrollers. Its two sub-modules provide the MCU with two independent serial interfaces: the Queued Serial Peripheral Interface (QSPI) is a full-duplex, synchronous serial interface designed for communication with peripherals and other MCUs; the Serial Communications Interface (SCI) is a full-duplex UART. This Manual describes the capabilities, operation and functions of the QSM, including details of registers, operational flow diagrams and signal descriptions.

Order by: QSMRM/AD

MPC500 Family: RCPU Reference Manual

The RCPU is a single-issue, 32-bit implementation of the PowerPC architecture, used in the MPC500 family of microcontrollers. This manual describes the RCPU for system software and hardware developers intending to develop products for RCPU-based systems. Topics include an overview of the architecture and features; Registers;

Operand Conventions; Addressing Modes and Instruction Set Summary; Instruction Cache; Exceptions; Instruction Timing; Development Support; and full descriptions of individual instructions.

Order by: RCPURM/AD

Single-Chip Integration Module Reference Manual

The Single-Chip Integration Module (SCIM) forms part of many of Motorola's 16 and 32-bit modular MCUs. It supplies a clock signal to the other modules, provides system protection features, manages the external bus, and provides on-chip chip-select signals and I/O ports. This manual describes all these functions and gives details of system reset and initialisation. Some MCUs necessarily contain a reduced pin-count version of the SCIM, and these variants are discussed. Separate appendices provide details of electrical and timing characteristics, and a summary of registers.

Order by: SCIMRM/AD

System Integration Module Reference Manual

This manual describes the capabilities, operation and functions of the System Integration Module (SIM), an integral module in many of Motorola's 16 and 32-bit modular microcontrollers. The SIM supplies a clock to the rest of the MCU; provides system protection features, on-chip Chip Select signals and I/O ports; and manages the external bus. This manual highlights CPU differences that affect the SIM; describes the protection features, clock generation, external bus interface, interrupt system, chip selects and reset procedures; and provides electrical and timing characteristics and register descriptions.

Order by: SIMRM/AD

MPC500 Family: System Integration Unit Reference Manual

The System Interface Unit (SIU) and Peripheral Control Unit (PCU) of the MPC500 Family processors are implemented as two separate on-chip units, working together to provide system support and interfaces between external and on-chip memory and peripherals. They handle system protection, clocks, interrupt support, reset control, test support, chip selects and interfaces to external and internal buses. This reference manual defines the functionality of the units, and is intended for software and hardware developers working with MPC500 family systems.

Order by: SIURM/AD

TIM08 Timer Interface Module Reference Manual

Rev 1

The Timer Interface Module is one of the modules in Motorola's M68HC08 family of microcontrollers. This manual describes the 4-channel implementation – the module can also be implemented with 2, 6 or 8 channels. It provides an overview of the timer features, signal descriptions, and detailed information on the prescaler, 16-bit modulo counter, capture compare unit, interrupt generation, and the handling of the different HC08 operating modes. Includes a chapter of applications information, and an appendix containing electrical specifications, memory map and register descriptions.

Order by: TIM08RM/AD

M68300 Family Time Processor Unit Reference Manual

Rev 3

The TPU is an integrated module within the 32-bit M68300 Family. It is a special-purpose MCU performing a variety of both simple and complex timing tasks – including input capture, output compare, PWM, stepper motor control, and many others – to minimise CPU overhead. This Manual gives a practical overview of the module's features; a description of the content and use of the three types of register that configure the TPU and its 16 channels; a detailed explanation of the operation of each time function; and a detailed guide to the TPU architecture. Appendices include algorithm state descriptions and microinstruction formats.

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Technical Data Services

Scattering Parameter Library

Rev 1

Contains Scattering Parameter (S-Parameter) files for most of Motorola's RF linear transistors. The files are presented in Touchstone™ format suitable for use with computer aided design (CAD) programs that operate on IBM compatible computers. The program comes in a 5.25" floppy disk. Over 600 files are contained in the disk representing transistors operating at specific bias conditions.

Order by: DK105/D

Scattering Parameter Plotting Utility

Rev 1

An IBM compatible computer disk (5.25" floppy) that permits the user to view S-Parameter files on a VGA monitor. Two port S-parameters are displayed on a Smith® Chart as a function of frequency. One can also view stability circles, f_t vs frequency and G_{MAX} vs frequency as well as convert S-Parameters to H-, Y- or Z-Parameters.

Order by: DK106/D

Impedance Matching Program

This 5.25" IBM compatible disk contains a specialized form of CAD specifically developed for RF power amplifier circuit design. Its data base contains input and output impedances for most of Motorola's RF power transistors and allows the user to match these impedances manually by means of a variety of matching elements. The impedances and the results of the matching elements are displayed on a Smith® Chart plot that allows the user to see graphically what effects are created by his/her choice of matching components

Order by: DK107/D

Master Selection Guide

Rev 21

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.

Order by: SG73/D

THIS BOOK IS NO LONGER PUBLISHED IN PRINTED FORM BUT IS AVAILABLE ON MOTOROLA'S WEB SITE

Dr. BuB

DSP Electronic Bulletin Board

Dr. BuB, Motorola's 24-hour digital signal processor bulletin board, has just improved his act. Sporting all new hardware and software, the new system promises to bring new features and better service to a community of DSP users that has grown astronomically in the last few years. The new system not only has a lot of new routines available for download for the DSP96002, the DSP56116, as well as the DSP56000/1, but also new features that should make the BBS more interesting and more useful.

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.

To log-in the new system:

- Dial (512) 891-DSP1 (891-3771) for 2400, 1200, or 300 baud modems. For the 1200 baud V.22 European standard, dial (512) 891-3772. Set the character format to 8 data, no parity.
- After the connection has been established, first-time users can either log-in as "guest" or can open a new account by selecting "new".

Now simply follow the prompts. Help is available at most levels but if you have questions, leave mail to the sysop.

Freeware Line

Microcontroller Electronic Bulletin Board

Freeware is your direct line to the latest information and software for Motorola's microcontroller families. With a PC and a modem, you can access a wealth of information, including:

- Support software for EVMs, PCs and Macintosh™ Computers
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  - Small C Compiler for 68HC11
  - EVM and EVB Monitor/Debugger Object Code
- Development software for MCUs
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  - Fast Fourier Transform Routines
  - 16-Bit Math Packages
  - Utility Programs
  - User Group Library Routines and User-Donated Programs
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