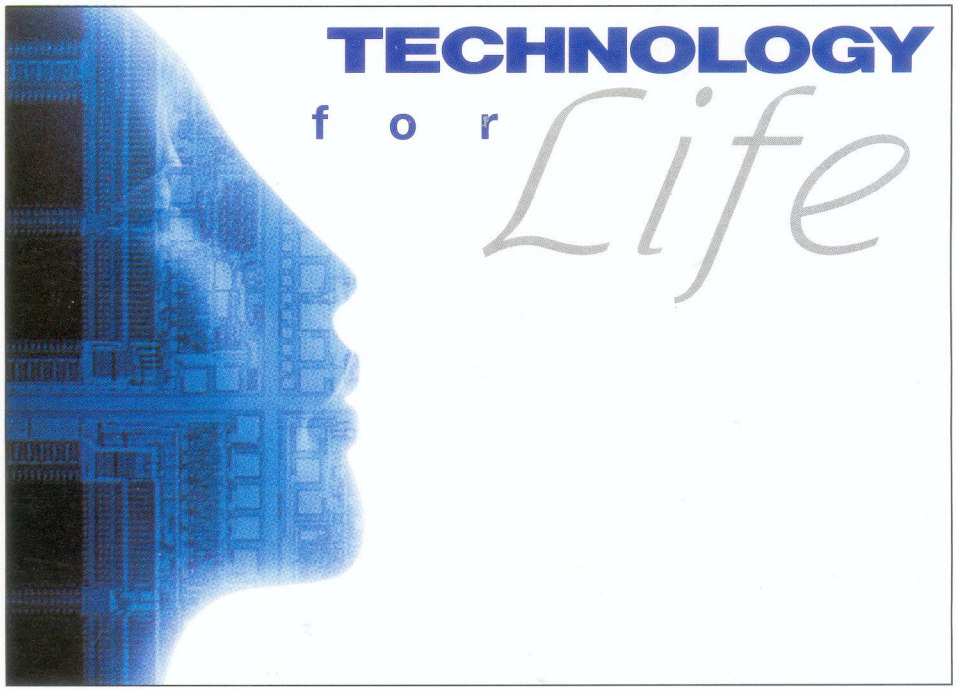
SHORTFORM CATALOGUE

MICROCOMPUTER



MITSUBISHI ELECTRIC
SEMICONDUCTOR

Mitsubishi Electric Semiconductors

CONTENTS

Introduction

Given the abundance of microcontroller (MCUs) available today from Mitsubishi Electric, this brochure is intended to start you off on the right route to deciding which MCU-type meets your particular application requirement. At a later stage, a more detailed examination of the chosen device should be done using the relative specific data sheet.

Mitsubishi's philosophy is to understand the project requirement therefore being in the best position to help guide our customers in the choice of the right MCU to achieve the goal.

When selecting the right MCU for the application several important criteria must be considered as the outcome will influence the project success.

Our state of the art design and manufacturing capability guarantees that whatever Mitsubishi MCU that you choose will give good performance with low power consumption, design flexibility and all at an excellent price-/performance ratio.

On top of this we are supporting our customers with state of the art development tools including C-compiler, simulator, real-time trace and a wide variety of accessories (e. g. programming adapters, pitch-converters, sockets etc.), also from well established 3rd party companies like Hewlett Packard, IAR, Ashling etc.

Using our microcontrollers means also excellent quality, wide range of peripheral functions, high ROM/RAM-capacity, OTP/EPROM-versions and a partner you can rely on.

Sincerely,

Mitsubishi Electric Semiconductor

Mitsubishi in Europe

With an investment of some 750 Million DM, Mitsubishi has established one of Europe's most advanced semiconductor production unit in Alsdorf near Aachen, Germany. Within this facility in the heart of Europe, ideally located for optimum customer service, there is also a microcomputer design centre dedicated to provide MCUs to meet European application needs.

European Semiconductor Headquarter (ESHQ) in Ratingen

In Ratingen, near Düsseldorf, there is the European Semiconductor Headquarter (ESHQ) supporting technically and commercially the sales offices throughout the various capitals of Europe. Next to ESHQ is the European Distribution Centre (EDC), ideally located in the centre of Europe for logistics. As a clear commitment to quality, Mitsubishi Semiconductor Europe (MSE), ESHQ and EDC are all certified according to ISO9000.

Technology for Life

Electronics play an integral part in modern life, and we have become so used to them that we don't think about their workings anymore, yet electrical components direct and control almost everyday appliances from children's toys to household and office equipment as well as telephones and cars.

Mitsubishi Electric provides Microcontrollers for many areas of daily life as well as a varied range of industrial applications.

Mitsubishi Semiconductor Europe (MSE) at Aachen

As an international leader in electronics, our objectives are clear: our work should benefit all the people in the world we live. We are committed to using the Earth's resources responsibly, improving living standards and encouraging social and cultural involvement wherever we are.

Mitsubishi Electric will face the challenges of the 21st century by meeting customers requirements with high tech, high quality products, whose manufacture and use are balanced with the needs of the environment.

TECHNOLOGY ROADMAP

MCU / MPU LINE-UP

General

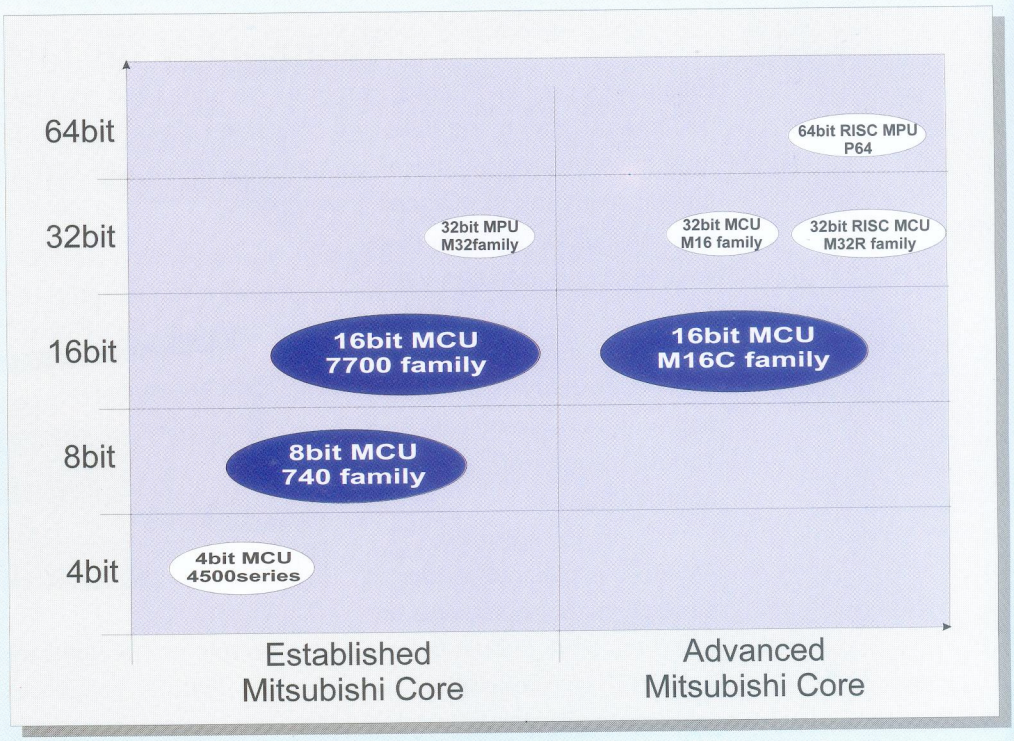
All Mitsubishi microcomputer families are continuously enlarged. Mitsubishi's family concept is based upon a wide range of general purpose products in each family.

Due to the increasing demand of 16-Bit microcomputers Mitsubishi developed the new 16-Bit, M16C family.

In order to further progress, Mitsubishi intends to develop application specific memory capacity variations, flash memory contained products and high speed products.

With the MCU family concept, Mitsubishi devices can be easily adapted and used in wide industrial and home used areas, telecommunication, including advanced information - communication fields of the multimedia age, such as CD-ROMs, HDDs, audio equipment and home electrical appliances.

Mitsubishi MCU / MPU Line-UP



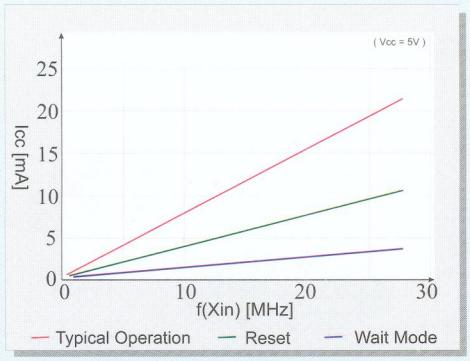
Low-Power Chip Design

CMOS silicon gate technology together with advanced chip design techniques enables Mitsubishi to establish low power consumption characteristics across all microcomputer families.

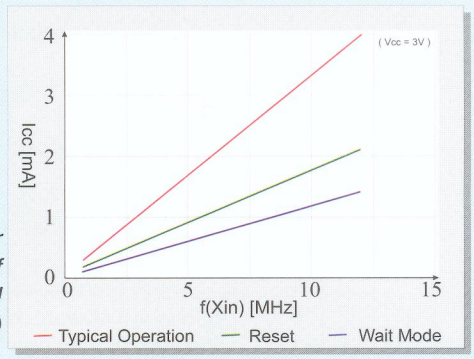
The combination of low power consumption and supply voltage (e.g. 3.0 Volt) already established Mitsubishi microcomputer in a wide range of portable and battery powered equipment.

Especially the "MELPS 7700" Series of 16-bit MCUs has found its way in various handheld battery powered applications.

Additionally, the newest members of this product family M37733/35 microcomputers will decrease again power consumption. Due to optimised internal circuits and wiring power, consumption will be decreased by around 50% under operating and non operating conditions compared with conventional products.



Typical Power Consumption of a 16-Bit MCU (Vcc=5V)



Typical Power Consumption of a 16-Bit MCU (VCC = 3V)

TECHNOLOGY ROADMAP

PACKAGE TECHNOLOGY LINE-UP

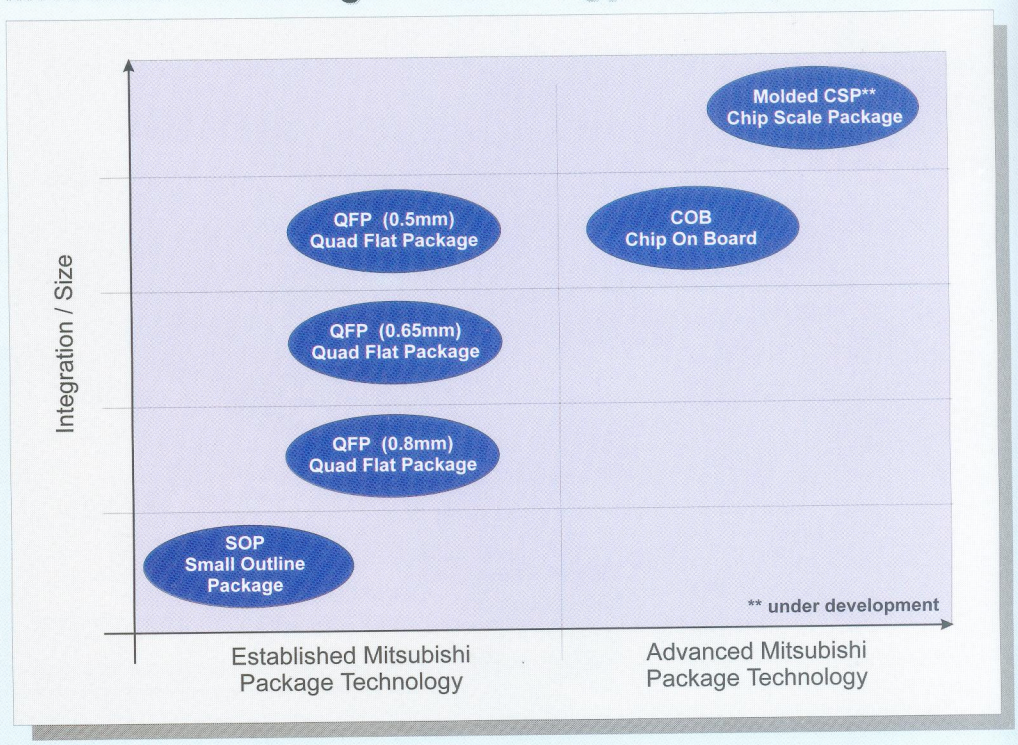
Mitsubishi Package Technology Line-Up

The history of electronic components is one of miniaturisation and of increasing component-mounting densities.

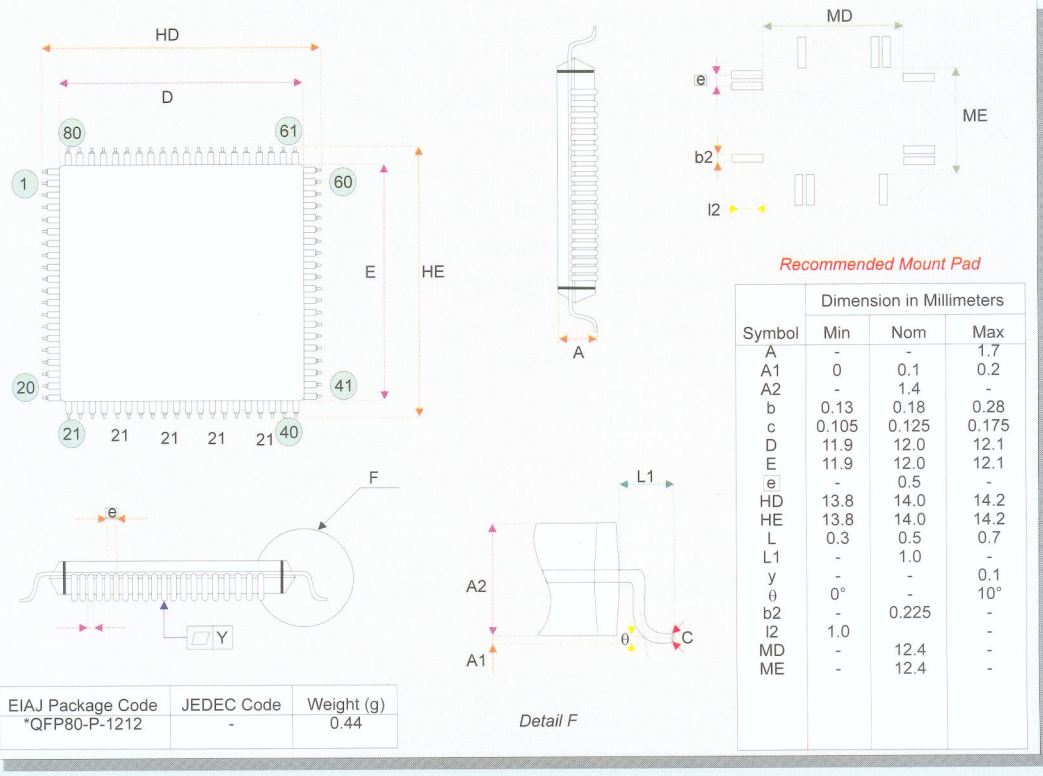
Mitsubishi Electric offers a complete line of standard packages that fulfil the vast majority of commercial application requirements and customised packages to meet specialised needs.
Due to the recent evolution of the electronics industry, Mitsubishi provides package key features as follows:

- higher I/O pin counts
- smaller and thinner package outlines
- packages for high density mounting
- packages for automatic mounting
- high resistance to soldering temperatures
- low internal stress and preventive measures to limit soft errors in sensitive devices
- electrical characteristics, which do not affect device performance

Mitsubishi Package Technology Line-Up



Package Example: 80P6D



Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	-	-	1.7
A1	0	0.1	0.2
A2	-	1.4	-
b	0.13	0.18	0.28
c	0.105	0.125	0.175
D	11.9	12.0	12.1
E	11.9	12.0	12.1
e	-	0.5	-
HD	13.8	14.0	14.2
HE	13.8	14.0	14.2
L	0.3	0.5	0.7
L1	-	1.0	-
y	-	-	0.1
θ	0°	-	10°
b2	-	0.225	-
l2	1.0		-
MD	-	12.4	-
ME	-	12.4	-

EIAJ Package Code	JEDEC Code	Weight (g)
*QFP80-P-1212	-	0.44

Plastic 80pin 12x12mm body QFP (FP)

QFP Package Overview

Body Size	Lead Pitch / Pin No.	0.80mm	Lead Pitch / Pin No.	0.65mm	Lead Pitch / Pin No.	0.50mm
10 x 14	56	56P6N				
12 x 12					80	80P6D
14 x 14	60 64	64P6N / 60P6N	80	80P6S	100	100P6D
14 x 20	80	80P6N	100	100P6S		
24 x 24					160 176	160P6E 176P6D

TELECOM APPLICATIONS

CORDLESS TELEPHONE

DECT - SYSTEM CONTROLLER

Introduction

The radio communication market such as DECT, Cellular Phone, PHS is expected to expand in future. In this area the Mitsubishi 16-Bit Microcontroller series "MELPS 7700" has conventionally been well reputed for low-voltage operation, low power consumption and small package.

The newly developed M37735 microcontroller group contains devices to be used for controlling functions of portable applications. For microcontroller of this type, it is essential to dissipate less power and have a large memory to accommodate systems with sophisticated functions (e.g. DECT-GAP, GIP implementation).

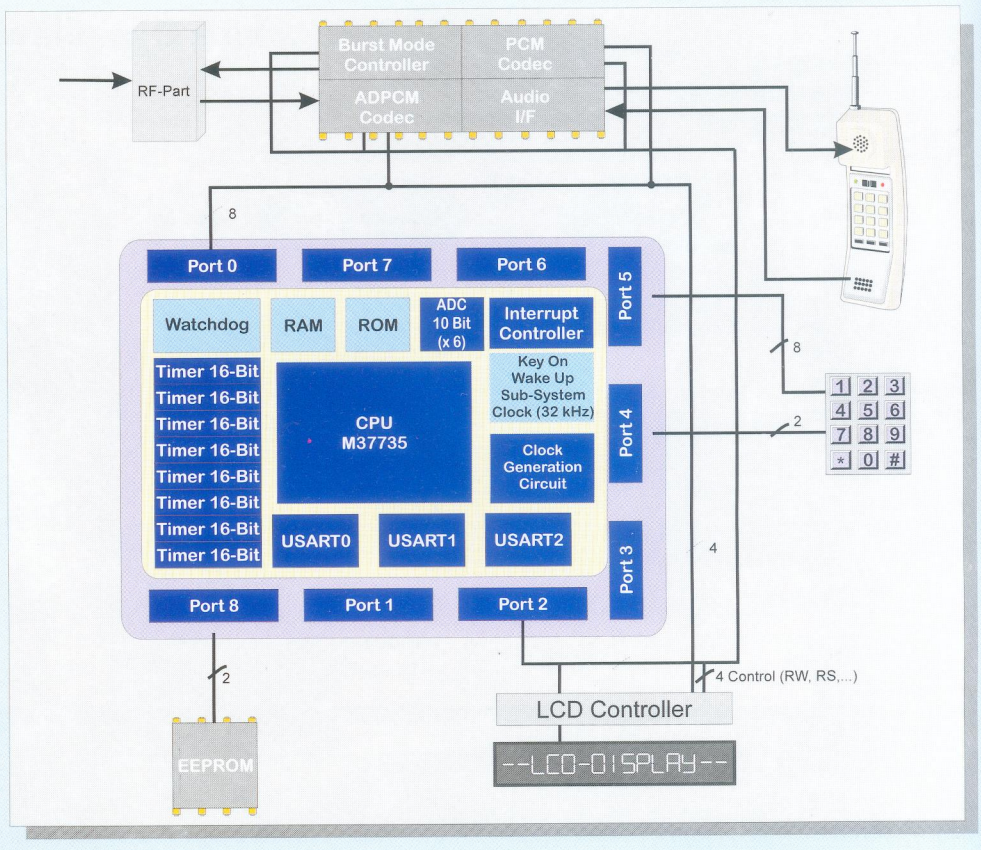
Key Features

On-Chip Memory:

- ROM: 124 Kbytes (Memory expansion up to 1Mbytes)
- RAM: 3968 bytes

Package:

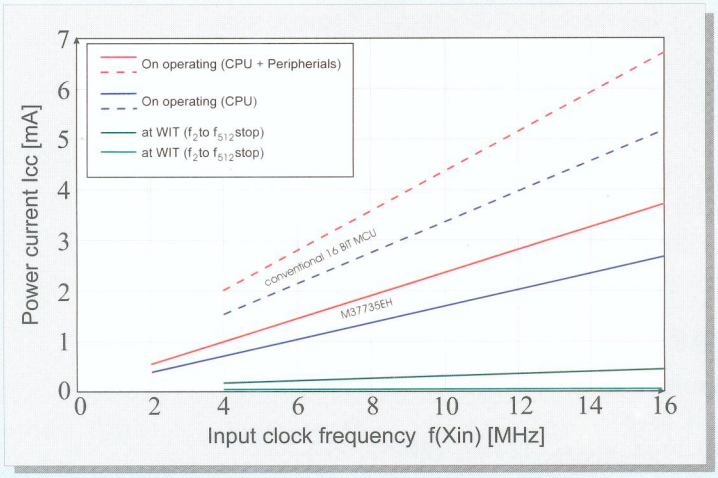
- 80- pin plastic mold fine pitch QFP



Application example for M37735 Group

Current consumption (typical value at 3 V suppy voltage):

- 3 mA (f(Xin) = 12 MHz ext. square wave input, under operating conditions)
- 6 µA (f(Xin) = 12 MHz ext. square wave input, in wait mode)
- 3 µA (f(Xin): STOP; f(Xcin) = 32 kHz)



M37735EH Icc - f (Xin) characteristics (Vcc = 3.0V, Ta = 25°C)

Device Type	M37735S4L	M37735S8L	M37735MCL	M37735MHL
Clock Frequency (max)	12 MHz			
Instruction Execution Time	0.333 µs			
Memory Size	- 2K RAM	- 4K RAM	96 K ROM 3.9K RAM	124 K ROM 3.9K RAM
Memory Expansion	max. 1MB			
CMOS I/O Ports	37			
Serial I/O, UART	3			
AD-Converter	8 x 10-bit			
Watchdog Timer	12-bit			
Timers	8 x 16-bit			
Interrupts	19 types 7 levels			
Clock generating circuit	2 circuits built-in (32 kHz sub-system clock)			
Package	80 pin VQFP (0.5 mm lead pitch)			
Power Dissipation	10.8 mW (Typ. at 3V supply voltage; 12 MHz frequency)			

TELECOM APPLICATIONS

COMFORT TELEPHONE

FEATURE PHONE INCL. CALLER-ID FUNCTION

Introduction

Recent market trends require large Dot-Matrix LCD's for Comfort Telephone sets to display the phone number of the caller.

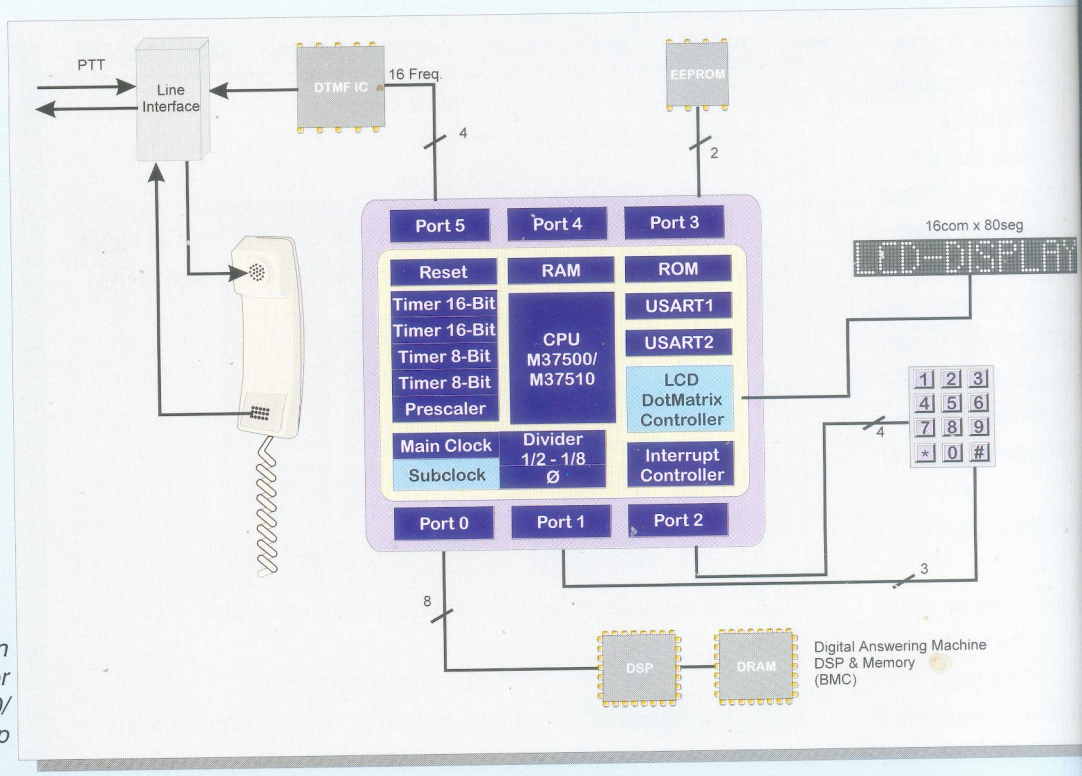
Mitsubishi's 8 bit MCU Series M375XX is a family concept, offering on chip Dot Matrix LCD controller/ driver combined with several ROM/RAM- configurations.

These single chip solutions are minimizing the power consumption, which is a key factor for equipment power supplied by normal telephone line - and system costs are reduced drastically.

Currently Caller-ID data demodulation is done by a separate IC. In future it will be possible to generate the DTMF signal and to handle the FSK demodulation by firmware.

Key Features

- High LCD Controller / driver capability (i.e. 2 lines / 16 characters 5 x 80 dots)
- Low power consumption — 32 mW (8MHz, 5V); 60 µW (32 KHz, 3V); 9 µW (waitmode)
- Key-on wake up function



Application example for M37500/ M37510 Group

Applications

Mitsubishi Electric Semiconductors

COMFORT TELEPHONE

FEATURE PHONE INCL. CALLER-ID FUNCTION

Device Type	M37500M5	M37500M8	M37510M6	M37510MF	M37520M5
Clock Frequency (max)	8 MHz				
Instruction Execution Time	0.5 µs				
Memory Size	20 KB ROM 640 BRAM	32 KB ROM 1 KB RAM	24 KB ROM 512 B RAM	60 KB ROM 2 KB RAM	20 KB ROM 512 B RAM
CMOS I/O Ports	42		41		45
Serial I/O, UART	2				
RAM for LCD	160 B				
LCD Controller	Common16 Segment 80				Common16/32 Segment 36/52
Timers	3 x 8-bit / 2 x 16-bit				
Interrupts (incl. key-on wake up)	5x ext./9x int. 1x SW cause				
Clock generating circuit	2 circuits built-in (32 kHz sub-system clock)				
Package	160 pin VQFP (0.65/0.5 mm pitch)		176 pin VQFP (0.5 mm pitch)		100 pin VQFP (0.65 mm pitch)
Power Dissipation	32 mW (8MHz; 5V); 60µW (32KHz; 3V); 9µW (Wait mode)				
Low Power Detection					yes
LCD Contrast Control			yes (32 steps)		
Supply Voltage	2.5V - 5.5V				

Mitsubishi Electric Semiconductors

AUTOMOTIVE APPLICATIONS

INTERCOMMUNICATION

CAN (CONTROLLER AREA NETWORK)

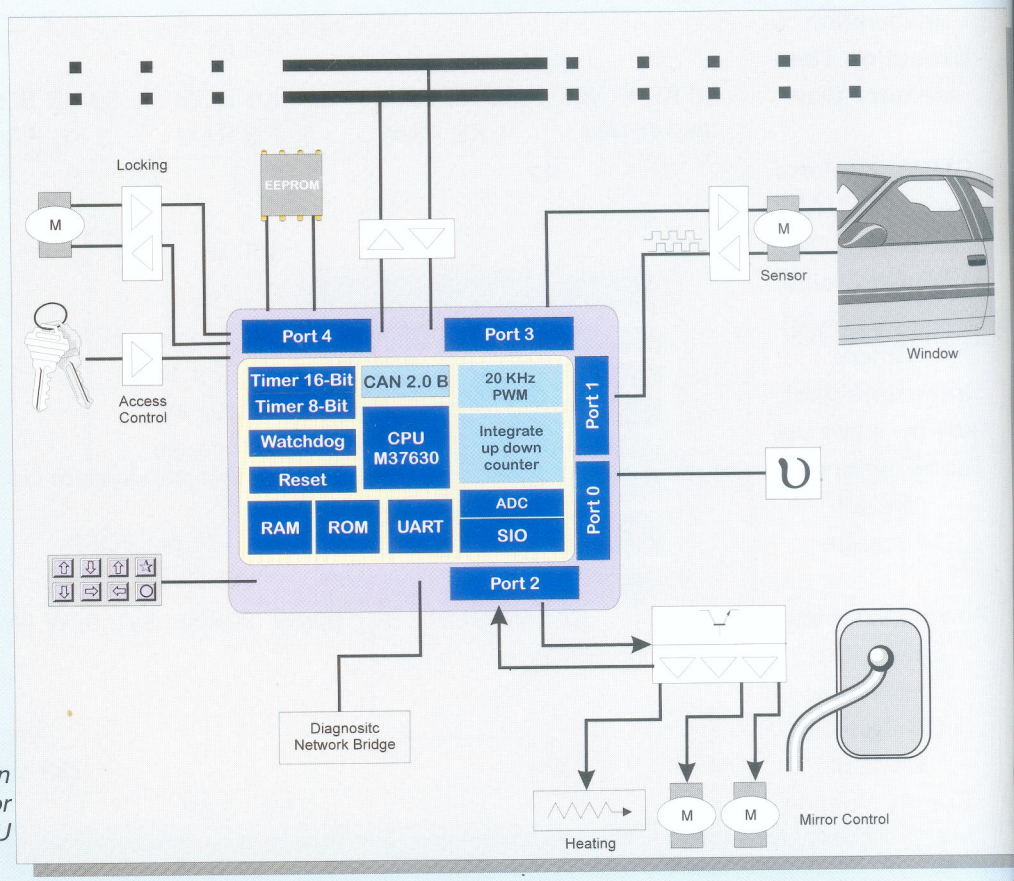
Introduction

The latest development from the design center at Mitsubishi Semiconductors in Alsdorf is the M37630M4. Together with the CAN controller module (2.0b active), various other on-chip peripherals fulfil specific automotive requirements.

Upwardly compatible to the well established 38k microcontroller family, the M37630M4 is designed in full static CMOS technology. Special design methods were applied to optimize the electromagnetic compatibility.

Key Features

- 16 k ROM
- 512 RAM
- A/D Converter
- CAN 2.0b active module
- UART and Serial I/O
- 5 Timer (8/16 bit) incorporating PWM function
- Biphase up/down counter
- Watchdog timer
- CMOS (0.8 µm)
- 44 pin flat package



Application example for CAN MCU

CAN

The M37630M4 CAN module is designed in conformance with the 2.0b active protocol. Equipped with 2 receive buffers plus 1 transmit buffer, full acceptance filtering on standard or extended data format and dedicated CAN interrupt sources, the interface allows communication speeds of up to 500kBaud at 8 MHz.

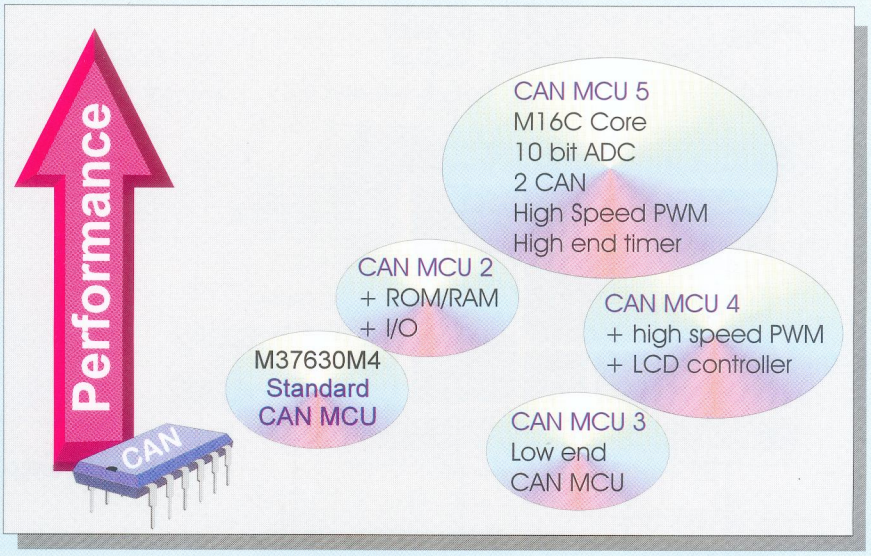
The CAN module, clocked synchronous and asynchronous interfaces provide gateway or standard diagnostic functions. The CAN module can also be woken up via the CAN bus.

Advantages

Several 8/16-bit timer resources provide a flexible count resolution of down to 250 ns including event count, pulse width measurement and timer output modes. A four phase up/down counter simplifies the software overhead for motor control applications. A high speed PWM timer unit offers variable frame frequency and adjustable resolution.

With a view to the special conditions in the automotive field, the M37630M4 guarantees injection current to the ports.

Mitsubishi will continue to develop application specific products to satisfy the needs of the automotive industry.



CAN Roadmap

Industry Applications

Control Systems

AC/DC Motor Control

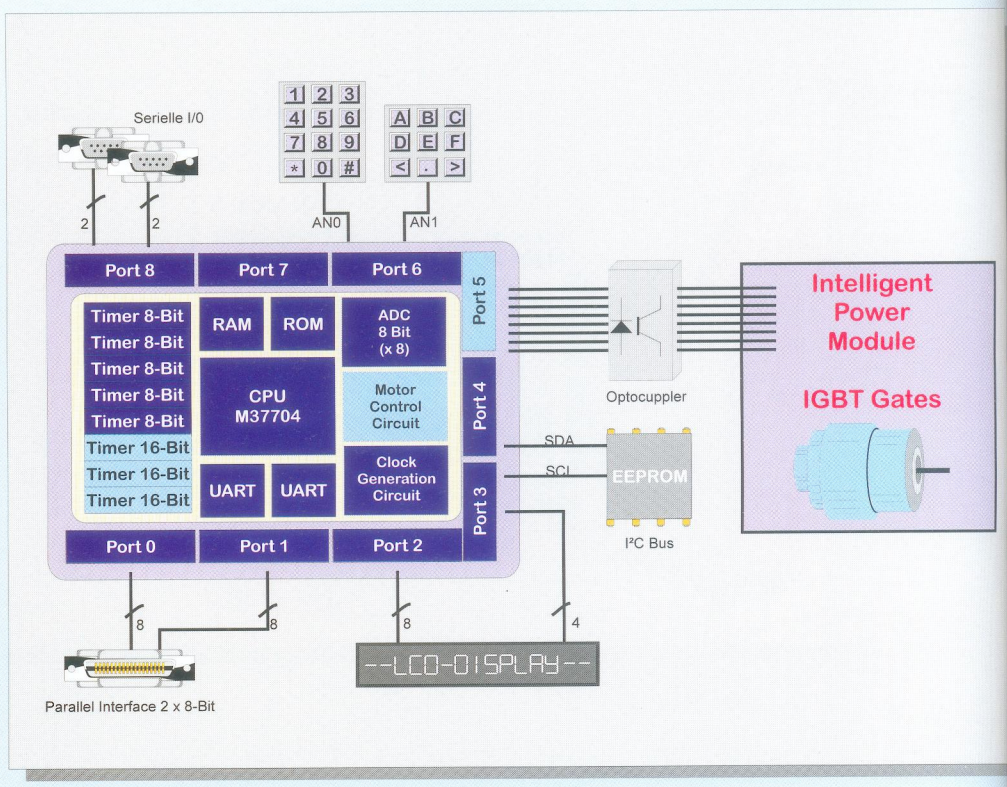
Introduction

Future oriented digital motor control concepts are a key for energy- and environmental oriented systems.

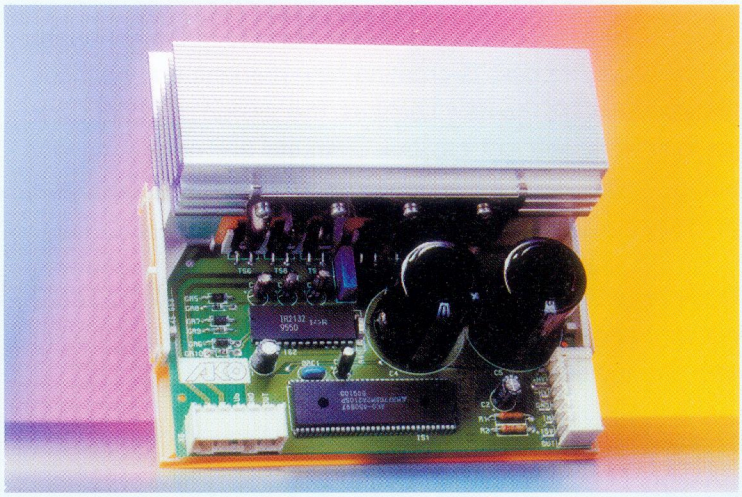
Mitsubishi has developed a new microcontroller series with special peripherals on chip, generating the required signals for full digital controlled stepper- DC- and AC-motor designs. In order to make it easy for system designers, Mitsubishi Electric developed an evaluation board which is very suitable for the practical simulation of motorconcepts

Key Features

- 16 bit MCU in CMOS technology
- 16 Mbyte linear address space (24 bit address bus)
- Motor drive control functions on chip, direct control of IGBTs possible
- Dead-time timer on chip
- Bus Interface to increase data transmission speed
- Three phase motor drive waveform output function
- Pulse motor drive waveform output function (stepper motor control)
- Phase difference detect function
- DC motor two-phase pulse signal processing mode
- Output stop possibility at any time



Application example for M37704 Group



Device Type	M37704M4	M37705M4	M37712M4
Clock Frequence (max)	25 MHz		
Instruction Execution Time	0.16 µs		
Memory Size	32 K ROM 1 K RAM		
Memory Expansion	possible		not possible
CMOS I/O Ports	68	53	67
Serial I/O, UART	2		
AD-Converter	8 x 8-bit		8 x 10-bit
Watchdog Timer	1 x 12-bit		
Timers	4 x 16-bit timer (one shot pulse mode)		
Dead-Time Timer	1 x 8-bit		
Stop Output Waves Interrupt	One Source (when the MCU acceptes the interrupt, 3-phase waves output becomes Hi-z state		
Configuration	Automatic output to vegative pulse; automatic add dead time		1.TB2 timer interrupt occurs when TB timer is overflow 2. Enable to set "zero" into the reload register. (It is easy to output level)
Power Dissipation	95 mW (at 25 MHz / 5V)		
Remark / Others			1. Phase control signal output 2. Zero cross detection with noise filter

CONSUMER

SET TOP BOX/SATELLITE RECEIVER

M32R/D / OSD / MMI-MCU

Introduction

The digitalization and deregulation process in the European broadcasting market is creating new markets and services. In order to utilize the new services, the design of digital satellite receivers and set top box systems are necessary and requiring high CPU power and compression/decompression technology.

Mitsubishi Electric offers a highly integrated 32-bit RISC-concept and for the man-machine interface microcontrollers with direct display control capability.

Key Features

M32R/D

- 32-bit high speed RISC-CPU
- 2 MB DRAM / 2 KB Cache on chip
- low power

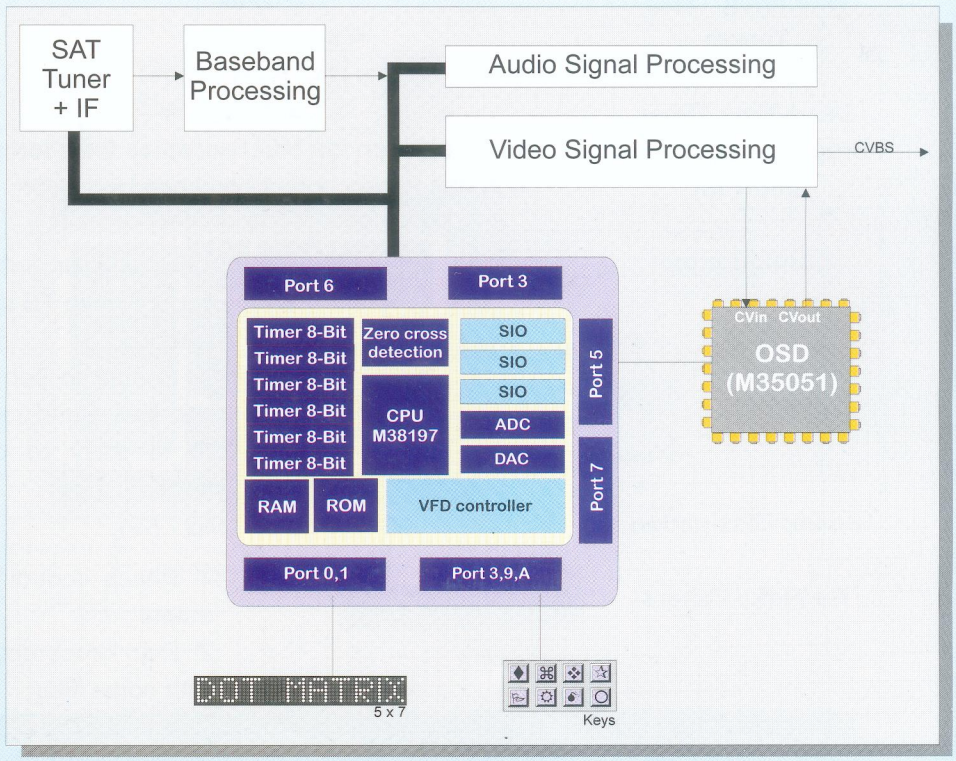
OSD

- 40 characters by 16 lines
- 256 character ROM
- Sync. separation circuit
- PAL, NTSC, M-PAL modes

MMI-MCU

- wide ROM/RAM-capacity
- direct LED/LCD/VFD-driver capability
- powerful peripherals

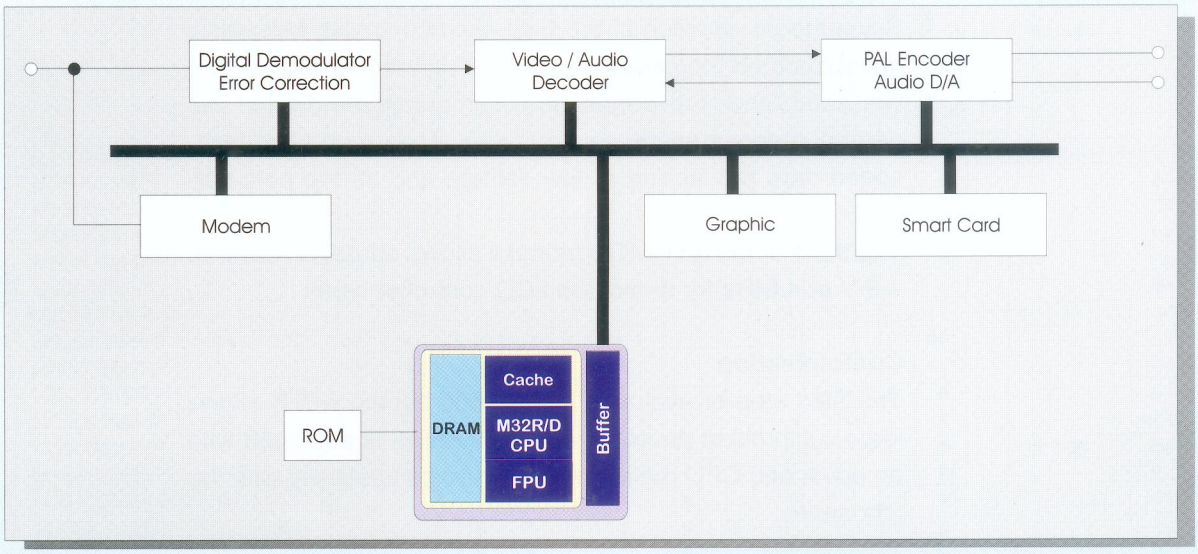
Satellite Receiver



Applications

SET TOP BOX/SATELLITE RECEIVER
M32R/D / OSD / MMI-MCU

Set Top Box



Device Type	M37477M2/4/8	M37530M4/8	M3817x	M38197	M32R
Basic Instructions	69		71		RISC
Instr. exec. time	1µs	0.34µs	0,63 µs	0,48 µs	52.4 MIPS
Clock frequency	4 MHz	(Vcc=4.5-5.5V) 12 MHz	6.3 MHz	8.4 MHz	66 MHz
Subclock	yes				
ROM	4K/8K/16K B	8K/16KB	16K/24K/32K/ 48K B	40K/60K B	
RAM	128/192/384 B	256/384 B	384/512/640/ 1024B	1024/1536	2 MB DRAM 2KB Cache
I/O Ports	29		45	54	128 bit bus
High voltage ports			32	52	
VFD controller			8-24 Seg./4-16 Dig.		
Serial I/O	1 (UART)	1 (clock sync. or UART or USB)	2 S I/O	3 S I/O	
Timers	4 x 8-bit (with latch)	3 x 8-bit (with prescaler 2)	4 x 8-bit	6 x 8-bit	
Watchdog timer		yes			
ADC	8 bit, 8 ch.	10 bit, 8 ch.	8 bit, 8 ch.	8 bit, 16 ch.	
Power supply	2.7 to 5.5V	2.2 - 5.5V	4.0 - 5.5V		3.3 V
Power dissipation	17.5mW (4MHz)	10mA (at 5V/12MHz)0.1u A (at STOP)	38 mW/300µW	38 mW/300µW	275 mW
Package	42-pin S DIP56-pin FP	36-pin FP (36P2R-A)	80-pin FP (80P6N)		176-pin FP

Introduction

The 8-bit Microcomputer family

Since the introduction of the 8-bit microcontroller, Mitsubishi has expanded the series to over 200 different products. The well established 38k series microcomputers are divided into general purpose and dedicated types. Their merits are high-speed data processing at low voltage and strong peripherals.

The state of the art CMOS process allows operation down to 1,8 V at 4 MHz for dedicated LCD controller types.

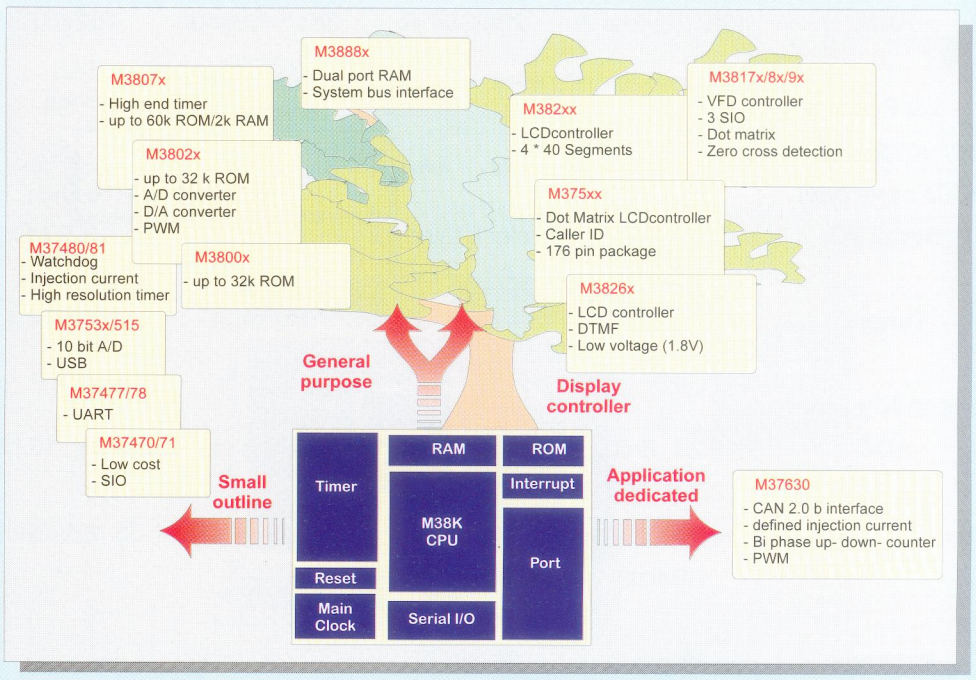
Customisation

The next step of evolution is the 7600 series, which allows ideal customised development. This series is equipped with an advanced CPU maintaining upward compatibility with the 38k series.

Open family concept

The 38k family is divided into four groups - General purpose, LCD, VFD and Special feature, offering a large variation of ROM, RAM and peripherals on chip.

Mitsubishi's MCU Family Concept



General Purpose

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART *or*	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M38002M2FP	8	384	58												●		64P6N
M38002M2SP															●		64P4B
M38002M4FP	16														●		64P6N
M38002M4SP															●		64P4B
M38002SFP																	64P6N
M38002SSP																	64P4B
M38003M6FP	24	512													●(1)		64P6N
M38003M6SP															●(1)		64P4B
M38004M8FP	32	640												3.0 to 5.5	●		64P6N
M38004M8SP															●		64P4B
M38007M8FP		1024													●		64P6N
M38007M8SP															●		64P4B
M38022M2FP	8	384	56	1		●	●				●	8			●		64P6N
M38022M2SP						●	●	4			●				●		64P4B
M38022M4FP	16					●	●				●				●		64P6N
M38022M4SP						●	●				●				●		64P4B
M38024M6FP	24	640				●	●				●				●(2)		64P6N
M38024M6SP						●	●				●				●(2)		64P4B
M38027M8FP	32	1024				●	●				●				●		64P6N
M38027M8SP						●	●				●				●		64P4B
M38062M3FP	12	384	72			●	●								●		80P6N
M38062M3GP						●	●								●		80P6S
M38062M4FP	16				1	●	●								●(3)		
M38062M4AGP						●	●								●(3)		80P6N
M38063M6AFP						●	●								●		
M38063M6AGP	24	512				●	●								●		
M38063M6AHP						●	●							2.7 to 5.5	●		80P6D
M38067M8AFP	32	1024				●	●								●		80P6N
M38067M8AGP						●	●								●		80P6S
M38067MCAFP	48					●	●								●		80P6N
M38067MCAGP						●	●								●		80P6S
M38073M4FP	16	512	68			●	●	3	4				●		●		80P6N
M38078MCFP	48	1536				●	●						●		●(4)		

(1) = M38004E8
(2) = M38027E8
(3) = M38063E6
(4) = M38079EF

SELECTION GUIDE

8-BIT

LCD

LCD

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART *or*	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M37500M5FP	20	640	40	2	1							8	●	2.5 to 5.5	●	LCD: 16*80	160P6E
M37500M8FP	32	1024													●		
M37500M8GP															●		176P6D
M37510M6FP	24	512													●		
M37510MFFP	60	2048													●		
M37520M5	20	512	45		2										●	LCD: 16*52,RTP	100P6S
M38203M2LFP	8		43		1			3	2							LCD: 4*40	80P6N
M38203M2LGP																	80P6S
M38203M2LHP																	80P6D
M38203M4FP	16																80P6N
M38203M4GP															●(1)		80P6S
M38203M4HP															●(2)		80P6D
M38203M4LFP															●(3)		80P6N
M38203M4LGP																	80P6S
M38203M4LHP																	80P6D
M38207M8FP	32	1024		1													80P6N
M38207M8GP															●		80P6S
M38207M8HP															●		80P6D
M38222M2FP	8	384	49			●									●		80P6N
M38222M2GP						●									●(4)	LCD: 4*32	80P6S
M38222M2HP						●									●(5)		80P6D
M38223M4FP	16	512				●									●(6)		80P6N
M38223M4GP						●									●		80P6S
M38223M4HP						●									●		80P6D
M38254M4FP	24	640	66			●		3	2						●		100P6S
M38254M4GP						●									●(7)		100P6D
M38254M6FP						●									●(8)	LCD: 4*40	100P6S
M38254M6GP						●									●		100P6D
M38257M8FP	32	1024				●									●		100P6S
M38257M8GP						●									●		100P6D
M38267M8LFP			64		1	●	●			●	●		●	1.8 to 5.5	●	LCD: 4*40, DTMF	100P6S
M38267M8LGP						●	●			●	●		●	1.8 to 5.5	●		100P6D

(1) = M38207E8FP
(2) = M38207E8GP
(3) = M38207E8HP

(4) = M38223E4FP
(5) = M38223E4GP
(6) = M38223E4HP

(7) = M38254E6FP
(8) = M38254E6GP

CAN

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART *or*	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M37630M4	16	512	36	1	1	●		3	2	●	●	8		4.0 to 5.5	●	CAN 2.0b, 4 phase count	44P6N

Data Communication or Motor Control

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART or	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M38802M1FP	4	384	45	1				3				8		2.7 to 5.5	●(1)	System bus interface	64P6N
M38802M1HP															●(2)		64P6D
M38802M1SP															●(3)		64P4B
M38802M2FP	8														●		64P6N
M38802M2HP															●		64P6D
M38802M2SP															●		64P4B
M3880BM1FP	4	4096	45												●		64P6N
M38813M4HP	16	512	46												●		64P6D
M38881M2FP	8	240	31	3				4						4.5 to 5.5		Dual Port RAM	64P6N
M38903M4SP	16	512	53		1	●		6	3	●			●	2.7 to 5.5	●	Motor control	64P6N

(1) = M38802E2FP
(2) = M38802E2HP
(3) = M38802E2SP

VFD

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART or	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M38103M6FP	24	512	55		2						●	8	●	2.8 to 5.5	●	VFD controller	64P6N
M38103M6SP											●		●		●		64P4B
M38114M8FP	32	640									●		●		●(1)		64P6N
M38114M8SP											●		●		●(1)		64P4B
M38122M2FP	8	384				●		4			●		●		●(2)		64P6N
M38122M2SP						●					●		●		●(3)		64P4B
M38122M4FP	16					●					●		●		●(2)		64P6N
M38122M4SP						●					●		●		●(3)		64P4B
M38127M8FP	32	1024				●					●		●		●		64P6N
M38127M8SP						●					●		●		●		64P4B
M38172M4FP	16	384	77			●		6			●		●	4.0 to 5.5	●(4)		80P6N
M38174M8FP	32	640				●					●		●		●(4)		
M38177MCFP	48	1024				●					●		●		●(5)		
M38184M8FP	32	640	90			●					●		●		●(6)		100P6S
M38184MAFP	40					●					●		●		●		
M38185MEFP	56	768				●					●		●		●		
M38197MAFP	40	1024	92			●	●				●		●	2.8 to 5.5	●		
M38198MCFP	48	1538				●	●				●		●		●		
M38199MFFP	60	2048				●	●				●		●		●		
M37507M4FP	16	512	56			●		4			●		●	2.2 to 5.5	●(7)		64P6N
M37507M4SP						●					●		●		●(7)		64P4B
M37507M6FP	24	640				●					●		●		●(7)		64P6N
M37507M6SP						●					●		●		●(7)		64P4B
M37507M8FP	32	1024				●					●		●		●(7)		64P6N
M37507M8SP						●					●		●		●(7)		64P4B
M37507MCFP	48					●					●		●		●(7)		64P6N
M37507MFFP	60	2048				●					●		●		●(7)		

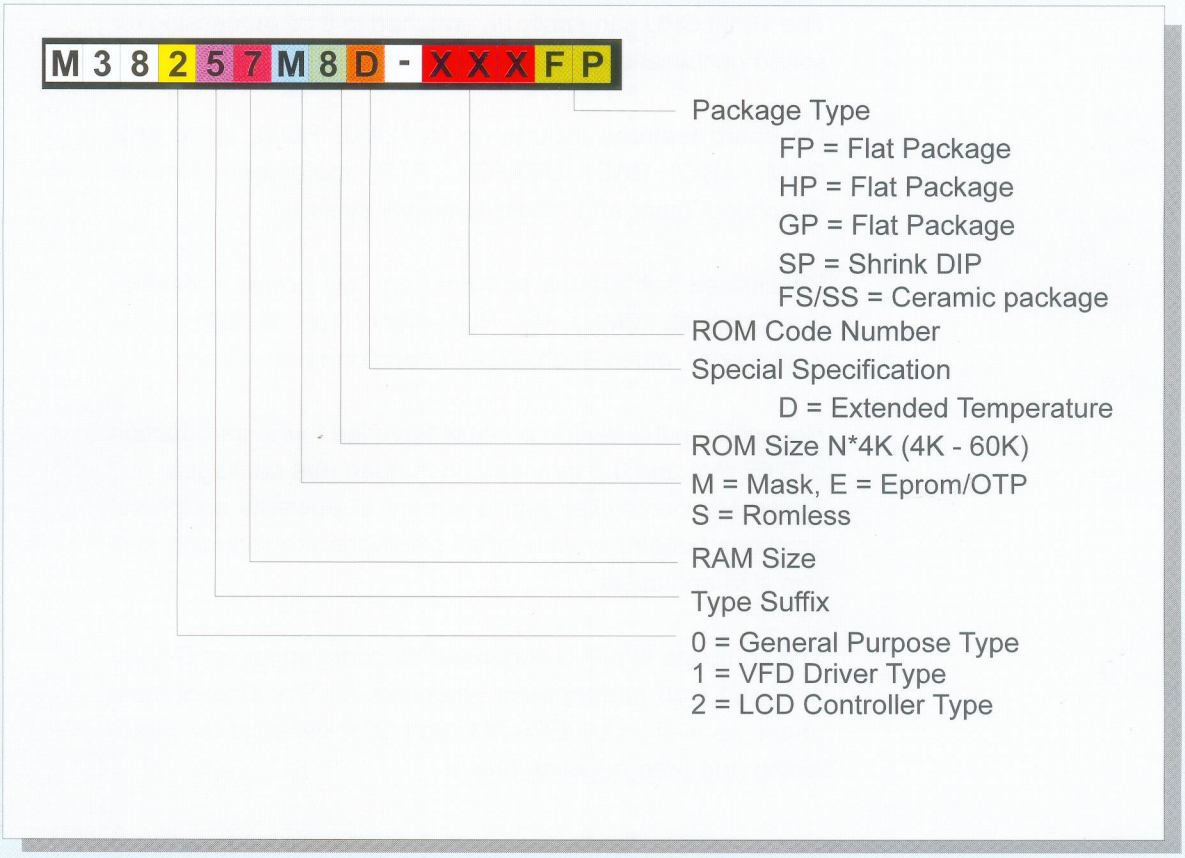
(1) = H Version
(2) = M38123E6FP
(3) = M38123E6SP
(4) = M38174E8HFP
(5) = M38177ECHFP
(6) = M38184EAFP
(7) = M37507MEFP

Small Outline

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART or	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M37470M2SP	4	128	26		1	●		4				8		2.7 to 5.5	●(1)		32P4B
M37470M4SP	8	192				●									●		
M37470M8SP	16	384				●									●		
M37471M2FP	4	128	36			●							●		●(2)		56P6N
M37471M2SP						●							●		●(3)		42P4B
M37471M4FP	8	192				●							●		●		56P6N
M37471M4SP						●							●		●		42P4B
M37471M8FP	16	384				●							●		●		56P6N
M37471M8SP						●							●		●		42P4B
M37477M2FP	4	128	26	1		●									●(4)		32P2W
M37477M2SP						●									●(5)		32P4B
M37477M4FP	8	192				●									●(6)		32P2W
M37477M4SP						●									●(7)		32P4B
M37477M8FP	16	384				●									●		32P2W
M37477M8SP						●									●		32P4B
M37478M2FP	4	128	36			●							●		●(8)		56P6N
M37478M2SP						●							●		●(9)		42P4B
M37478M4FP	8	192				●							●		●(10)		56P6N
M37478M4SP						●							●		●(11)		42P4B
M37478M8FP	16	384				●							●		●		56P6N
M37478M8SP						●							●		●		42P4B
M47480M4FP	8	256	26			●		2	2	●					●		56P6N
M37480M4SP						●				●					●		42P4B
M37480M8FP	16	448				●				●					●		56P6N
M37480M8SP						●				●					●		42P4B
M37481M4FP	8	256	36			●				●					●		56P6N
M37481M4SP						●				●					●		42P4B
M37481M8FP	16	448				●				●					●		56P6N
M37481M8SP						●				●					●		42P4B

(1) = M37470E4SP
(2) = M37E71E4FP
(3) = M37471E4SS
(4) = M37477E8TFP
(5) = M37477E8TSP
(6) = M37477E4FP
(7) = M37477E4SP
(8) = M37478E8TFP
(9) = M37478E8TSP
(10) = M37478E8FP
(11) = M37478E8SP

Ordering Guide for M38k Series (Example)



The example shows how to distinguish the different versions. For available versions please contact your local Mitsubishi Office.

Introduction

The high performance CMOS Microcontroller family "MELPS 7700" features a large linear address space of 16MB, three instruction queue buffer and two byte data buffer for fast operation.

The 16-bit CPU can easily be switched to 8 bit processing for speed optimisation and memory savings.

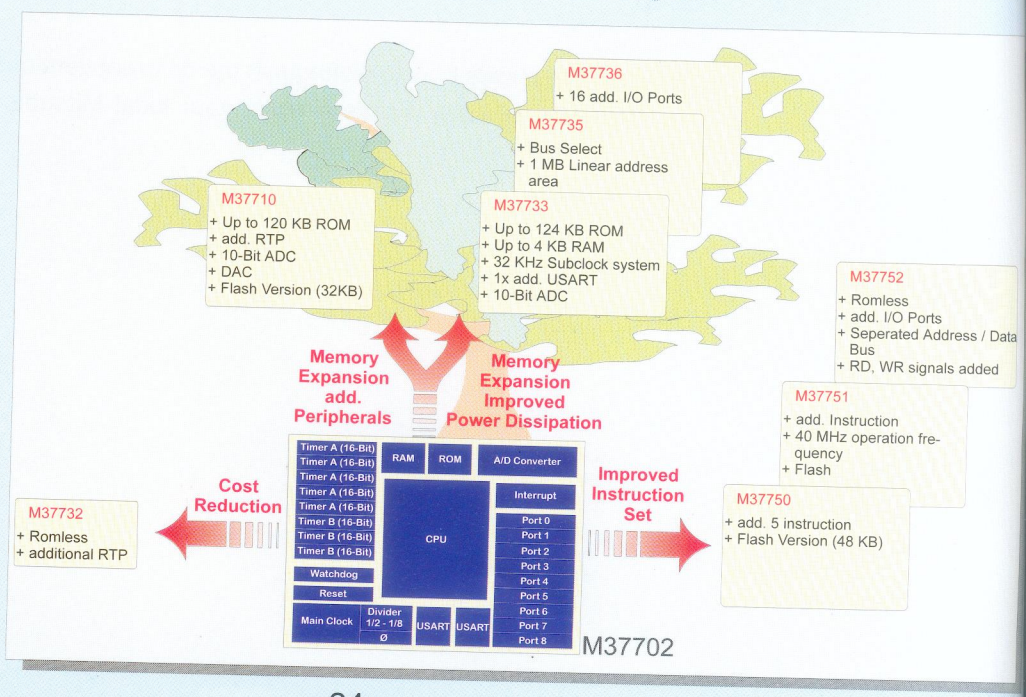
On board features include up to 124KB ROM, up to 4KB RAM, ADC, DAC, USARTs, RTP, multimode Timers, Watchdog Timer and 32kHz subclock system.

Specialised sub-groups perform very low power consumption (3mA @ 12MHz, 3V, RUN-mode/ 1µA @ 32kHz, 3V, Wait-mode), others high speed operation up to 40MHz.

Reduction in the design process have led to the introduction of 0.65 mm and 0.5 mm lead pitch quad Flat packages. These Microcontroller with a variety of powerful peripheral functions housed in ultra small packages are reducing system size and costs.

The complete family is supported by code optimized C-compiler and high performance emulators for SW development phase as well as by EPROM- and OTP-versions for prototyping and preproduction phase.

Mitsubishi's MCU Family Concept



General Purpose

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART or	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M37702M2FP						●				●	●	8			●		
M37702M2AFP						●				●	●	16			●		80P6N
M37702M2BFP	16	512	68			●				●	●	25			●		
M37702M2BHP						●				●	●				●		80P6D
M37702M2LGP						●				●	●			2,7~5,5V	●		80P6S
M37702M2LHP						●				●	●	8			●		80P6D
M37702S1FP						●				●	●				●		
M37702S1AFP						●				●	●	16			●		80P6N
M37702S1BFP		512	37			●				●	●	25			●		
M37702S1LGP						●				●	●	8		2,7~5,5V	●		80P6S
M37702S1LHP						●				●	●				●		80P6D
M37702M3BFP	24	1024				●				●	●	25			●		
M37702MDBFP						●				●	●				●		
M37702M4FP						●				●	●	8			●		80P6N
M37702M4AFP						●				●	●	16			●		
M37702M4BFP	32		68			●				●	●	25			●		
M37702M4LFP						●				●	●			2,7~5,5V	●		
M37702M4LGP						●				●	●	8			●		80P6S
M37702S4FP			37			●				●	●				●		
M37702S4AFP						●				●	●	16			●		
M37702S4BFP						●				●	●	25			●		80P6N
M37702M6BFP	48	2048	68			●				●	●				●		
M37702M6LFP						●				●	●	8		2,7~5,5V	●		
M37702M8BFP	60					●				●	●	25			●		
M37702M8BHP				2	2	●			8	●	●				●		80P6D
M37702M8LHP						●				●	●	8		2,7~5,5V	●		
M37703M2ASP	16	512	53			●				●	●	16			●		
M37703M2BSP						●				●	●	25			●		
M37703S1ASP		512	23			●				●	●	16			●		
M37703S1BSP						●				●	●				●		
M37703M3BSP	24	1024	53			●				●	●	25			●		64P4B
M37703MDBSP	32					●				●	●				●		
M37703M4ASP						●				●	●	16			●		
M37703M4BFP						●				●	●	25			●		
M37703S4ASP			23			●				●	●	16			●		
M37703S4BSP						●				●	●	25			●		
M37732S4AFP		2048	37			●				●	●	16					80P6N
M37732S4BFP						●				●	●	25					
M37732S4BHP						●				●	●					Real Time Port	80P6D
M37732S4LGP						●				●	●	8		2,7~5,5V			80P6S
M37732S4LHP						●				●	●						80P6D
M37710M4BFP						●	●			●	●	25			●		80P6N
M37710M4BGP	32	1024	68			●	●			●	●				●		80P6S
M37710M4LFP						●	●			●	●	8		2,7~5,5V	●		80P6N
M37710M8BFP	60					●	●			●	●	25			●		
M37710M8LHP						●	●			●	●	8		2,7~5,5V	●	10-bit ADC,	80P6D
M37710S4BFP		2048	37			●	●			●	●	25			●	Real Time Port	80P6N
M37710S4LHP						●	●			●	●	8		2,7~5,5V	●		80P6D
M37710MFBFP	120		68			●	●			●	●	25			●		80P6N
M37710MFLHP						●	●			●	●	8		2,7~5,5V	●		80P6D

SELECTION GUIDE

16-BIT

SUBCLOCK / CPU CORE ENHANCEMENT/ FLASH MEMORY

General Purpose with Sub-Clock

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART or	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M37733S4LHP			37			●				●	●	12		2,7~5,5V	●		80P6D
M37733S4BFP						●				●	●	25			●		80P6N
M37733M4LHP	32	2048	68			●				●	●	12		2,7~5,5V	●	10 bit ADC, key on wake up	80P6D
M37733M4BFP						●				●	●	25			●		80P6N
M37733MHLHP	124	3968				●				●	●	12		2,7~5,5V	●		80P6D
M37733MHBFP						●				●	●	25			●		80P6N
M37735S4LHP		2048	37			●				●	●	12	0	2,7~5,5V	●		80P6D
M37735S4BFP						●				●	●	25			●		80P6N
M37735S8LHP(*)		3968		3	3	●		8		●	●	12	~	2,7~5,5V	●		80P6D
M37735M4LHP	32	2048	68			●				●	●	25			●		80P6N
M37735M4BFP						●				●	●	12	50	2,7~5,5V	●		80P6D
M37735MCLHP(*)	96	3968				●				●	●	25			●	10 bit ADC; key on wake up; 1 MB linear address area	80P6D
M37735MCBFP(*)						●				●	●	12		2,7~5,5V	●		80P6N
M37735MHLHP	124					●				●	●	25			●		80P6D
M37735MHBFP						●				●	●	12		2,7~5,5V	●		80P6N
M37736M4LHP(*)	32	2048	84			●				●	●	25			●		80P6D
M37736MHLHP(*)	124	3968				●				●	●	12		2,7~5,5V	●		80P6N
M37736MHBGP(*)						●				●	●				●		100P6D
												25					100P6S

General Purpose MCU with CPU Core Enhancement

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART or	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M37751M4BFP	32	2048	68	2	2	●		8		●	●	25			●(*2)	10 bit ADC;enhanced instruction set	80P6N
M37751M4CFP(*)				2	2	●				●	●	40			●(*2)		
M37751M6BFP	48			2	2	●				●	●				●(*2)		
M37751M8BFP(*)	60			2	2	●				●	●	25			●(*2)		
M37751MFBFP(*)	120	3968		2	2	●				●	●				●(*2)		
M37752S6BFP		3072	50	2	2	●	●			●	●				●	10 bit ADC with comparator function; enhanced instruction set	100P6S
M37752S6CGP				2	2	●	●			●	●				●		
M37752M6CGP(*)	48	2048	84	2	2	●	●			●	●	40			●		
M37752M8CGP(*)	60	3072		2	2	●	●			●	●				●		

16-Bit MCU with Flash Memory

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART or	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M37710F4BFP	32	1024	68	2	2	●	●	8		●	●	25			●(*3)	10-bit ADC	80P6N
M37750F6BFP	48	2048				●				●	●				●(*3)	10-bit ADC; enhanced instruction set	
M37751F6CFP(*)						●				●	●				●(*3)		
M37751F8CFP(*)	60					●				●	●	40			●(*3)		
M37751FFCFP(*)	120	3968				●				●	●				●(*3)		

(*) = under development
(*2) = Supported by pin-compatible OTP- and Flash- versions
(*3) = Supported by pin-compatible OTP- and Mask- versions

16-BIT
M16C

Introduction

An advanced new 16-bit architecture, the M16C was designed to take advantage of both accumulator and register based architectures. The CPU executes the shortest instruction in 100ns at 10MHz. Other special instructions include C language and operating system support functions.

Program Correction an industry first

The larger the program, the greater potential for software bugs. The M16C provides a program correction feature in the internal ROM to fix software bugs found after masking.

Low Voltage Low Power Operation

The M16C offers very low power consumption and the design includes two built in oscillators (10MHz and 32KHz). The M16C's low power dissipation of 18mW at 2.7V, running at 7MHz (1 wait state) saves you power and energy.

Wide Address Space

The M16C provides 1 Mbyte address space without the 64Kbyte border. Additionally given its excellent code efficiency, the M16C can cover in 64Kbytes what conventional MCU's require 70 to 80Kbytes to do.

Future Developments

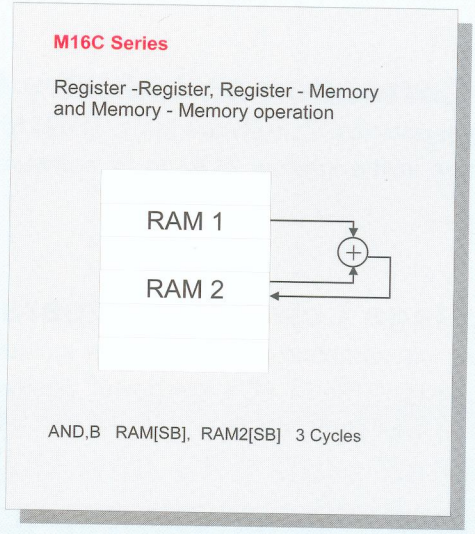
The VHDL design methodology employed in the M16C ensures additional peripherals can be quickly and easily implemented. Additional M16C products are already under development, one for example includes a universal asynchronous receiver/transmitter (UART) that is compliant with the smart-card interface specification.

Device	Memory		I/O	Serial I/O		A/D Converter	D/A Converter	Timer				Clock (MHz)	Subclock	Low Voltage (V)	OTP Version available	Additional Features	Package
	ROM KByte	RAM Byte		UART *or*	Synchr.			8-Bit	16-Bit	Watchdog	PWM						
M30600M8	64	10	87	2	2	●	●		8	●	●	10	0 ~ 50	2,7 - 5,5	●	DMA controller	100P6S/ 100P6D
M30600S			47			●	●			●	●				●		
M30610MA	96					●	●			●	●				●		
M30610MC	128					●	●			●	●				●		
M30612M4	32	4	87	3	3	●	●			●	●				●	DMA controller / SIM I/F	
M30612M8	64					●	●			●	●				●		
M30612MA	96					●	●			●	●				●		
M30612MC	128					●	●			●	●				●		
M30612S			47			●	●			●	●				●		

High Speed Processing

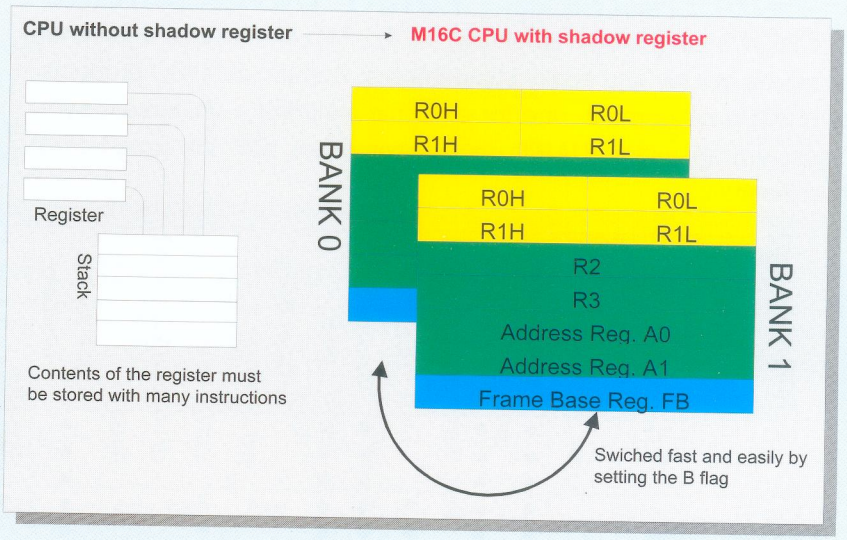
The processing speed of the M16C has been significantly improved by an easy to use instruction set. Many one cycle instructions are supported, and 71% of complex instructions are executed within three cycles (0.3µs at 10MHz). This matches the performance of RISC microcontrollers, that execute simple instructions in one cycle each.

Memory to Memory Operation (example)



With the M16C's shadow register, you can use the stack or the second bank, this will can be done easily by setting up the register bank flag (100ns at 10 MHz). You will benefit in time critical situations.

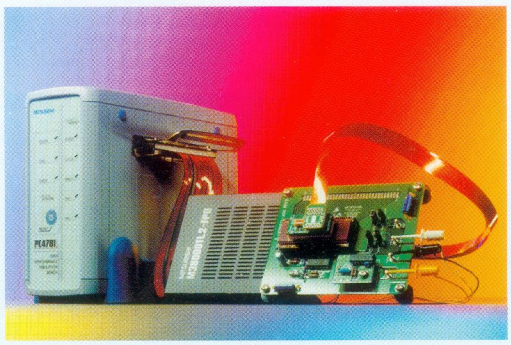
Register Bank for Context Switch



Introduction

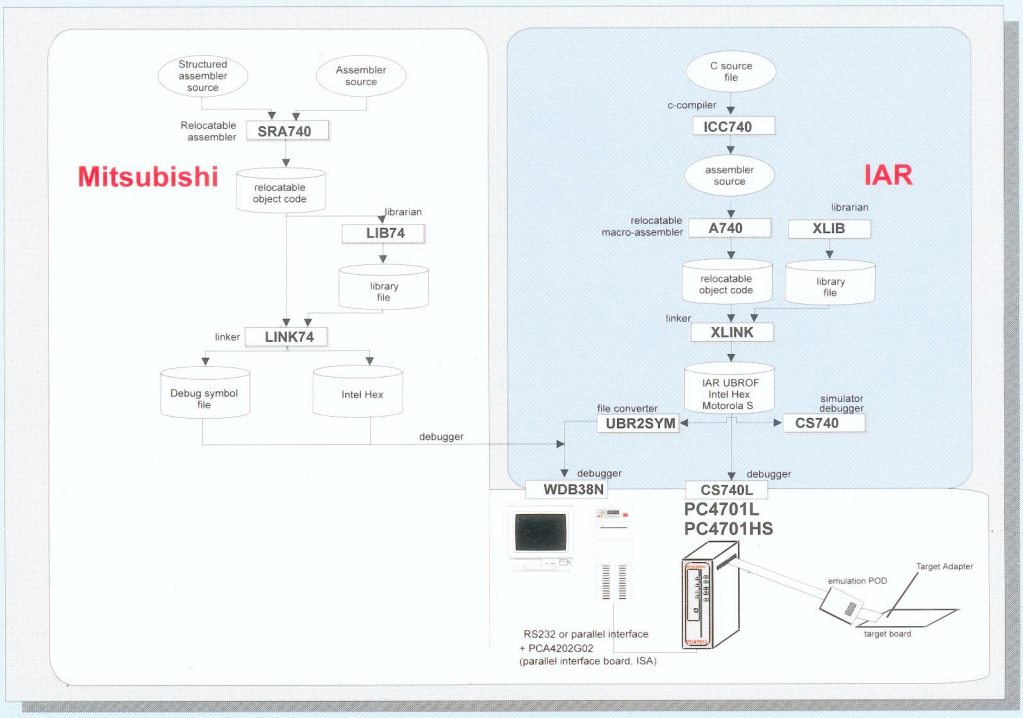
Good development tools are essential to ensure project schedules are kept and that the most efficient use of engineering resources are realised.

Along with Mitsubishi Electric's own tools, software and emulators including LAN interface, real time trace along with other expected features, designer boards, programming adapters, probes etc., a complete suite of state of the art development tools are available from recognised third party suppliers such as IAR for software (C-compiler, debugger, simulator), Ashling and HP(including RTC) for emulators.



Mitsubishi PC4701L Emulator

Tool Environment for 8-Bit MCUs

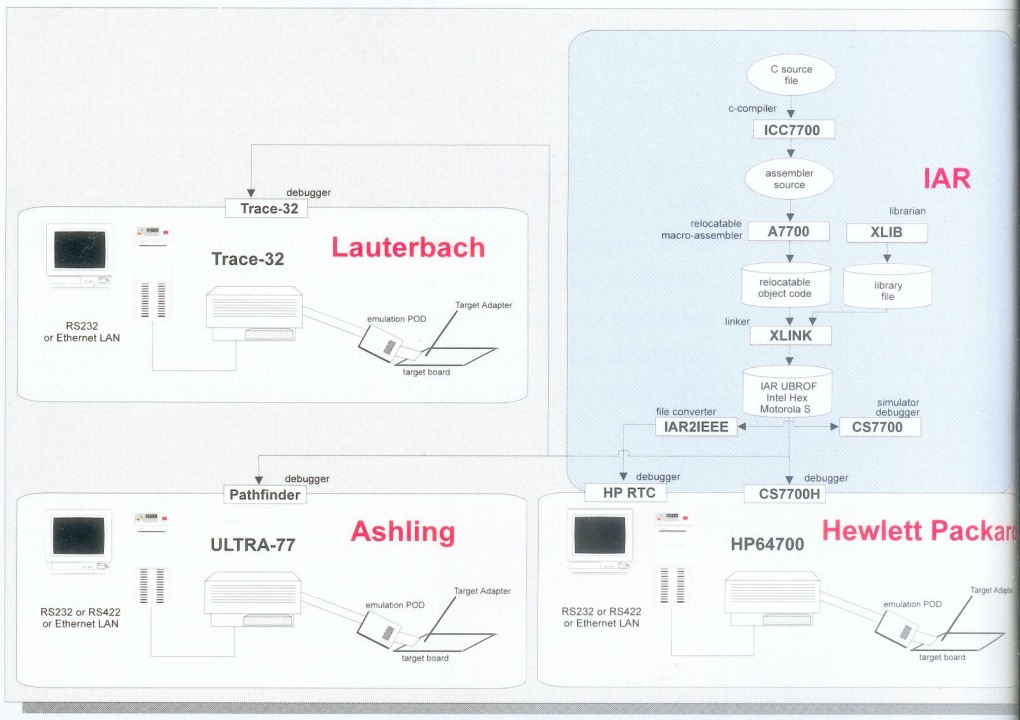


SELECTION GUIDE

DEVELOPMENT TOOLS

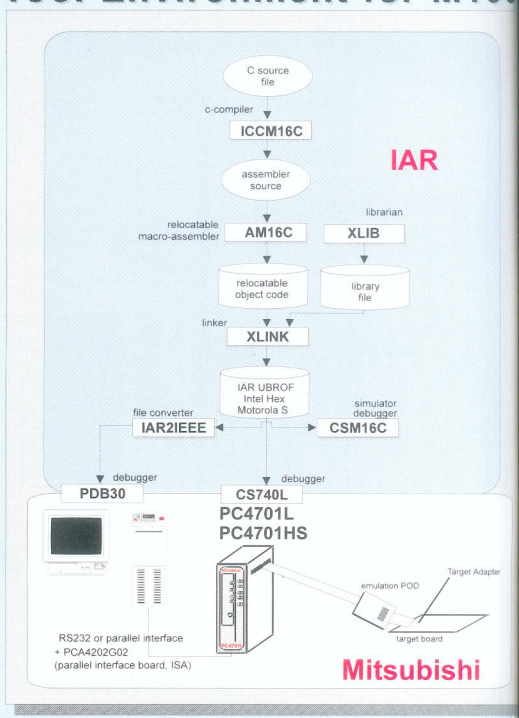
TOOL ENVIRONMENT FOR 16-BIT / M16C

Tool Environment for 16-Bit MCUs



IAR C-Compiler for Mitsubshi MCUs

Tool Environment for M16C



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