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What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "<u>Embedded -</u> <u>Microcontrollers</u>"

Details

Product Status	Active
Core Processor	F ² MC-8L
Core Size	8-Bit
Speed	10MHz
Connectivity	EBI/EMI, Serial I/O, UART/USART
Peripherals	POR, PWM, WDT
Number of I/O	53
Program Memory Size	16KB (16K x 8)
Program Memory Type	Mask ROM
EEPROM Size	-
RAM Size	512 x 8
Voltage - Supply (Vcc/Vdd)	2.2V ~ 6V
Data Converters	A/D 8x10b
Oscillator Type	External
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-BQFP
Supplier Device Package	64-QFP (14x20)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/mb89635rpf-g-1473

Email: info@E-XFL.COM

Address: Room A, 16/F, Full Win Commercial Centre, 573 Nathan Road, Mongkok, Hong Kong

8-bit Proprietary Microcontroller

CMOS

F²MC-8L MB89630R Series

MB89635R/636R/637R/P637/PV630

The MB89630R series has been developed as a general-purpose version of the F²MC*-8L family consisting of proprietary 8-bit, single-chip microcontrollers.

In addition to a compact instruction set, the microcontrollers contain a variety of peripheral functions such as dual-clock control system, five operating speed control stages, a UART, timers, a PWM timer, a serial interface, an A/D converter, an external interrupt, and a watch prescaler.

* : F²MC is the abbreviation for Fujitsu Flexible Microcontroller.

■ FEATURES

- · High-speed operating capability at low voltage
- Minimum execution time: 0.4 $\mu s@3.5$ V, 0.8 $\mu s@2.7$ V
- F²MC-8L family CPU core

Instruction set optimized for controllers

Multiplication and division instructions 16-bit arithmetic operations Test and branch instructions Bit manipulation instructions, etc.

Five types of timers
8-bit PWM timer: 2 channels (Also usable as a reload timer)
8-bit pulse-width count timer (Continuous measurement capable, applicable to remote control, etc.)
16-bit timer/counter
21-bit timebase timer

(Continued)

For the information for microcontroller supports, see the following web site.

http://edevice.fujitsu.com/micom/en-support/



- UART
 - CLK-synchronous/CLK-asynchronous data transfer capable (6, 7, and 8 bits)
- Serial interface Switchable transfer direction to allows communication with various equipment.
- 10-bit A/D converter Start by an external input capable
- External interrupt: 4 channels Four channels are independent and capable of wake-up from low-power consumption modes (with an edge detection function).
- Low-power consumption modes
 Stop mode (Oscillation stops to minimize the current consumption.)
 Sleep mode (The CPU stops to reduce the current consumption to approx. 1/3 of normal.)
 Subclock mode
 Watch mode
- Bus interface function With hold and ready function



• Pin assignment on package top (MB89PV630 only)

Pin no.	Pin name						
65	N.C.	73	A2	81	N.C.	89	OE
66	Vpp	74	A1	82	O4	90	N.C.
67	A12	75	A0	83	O5	91	A11
68	A7	76	N.C.	84	O6	92	A9
69	A6	77	O1	85	07	93	A8
70	A5	78	O2	86	O8	94	A13
71	A4	79	O3	87	CE	95	A14
72	A3	80	Vss	88	A10	96	Vcc

N.C.: Internally connected. Do not use.

Pin no.				Circuit				
SH-DIP ^{*1} MDIP ^{*2}	QFP2 ^{*3}	QFP1 ^{*4} MQFP ^{*5}	Pin name	type	Function			
33	25	26	P27/ALE	Н	General-purpose output port When an external bus is used, this port functions as an address latch signal output.			
2	58	59	P30/UCK1	G	General-purpose I/O port Also serves as the clock I/O 1 for the UART. This port is a hysteresis input type.			
1	57	58	P31/UO1	F	General-purpose I/O port Also serves as the data output 1 for the UART.			
63	55	56	P32/UI1	G	General-purpose I/O port Also serves as the data input 1 for the UART. This port is a hysteresis input type.			
62	54	55	P33/SCK1	G	General-purpose I/O port Also serves as the data input for the 8-bit serial I/O. This port is a hysteresis input type.			
61	53	54	P34/SO1	F	General-purpose I/O port Also serves as the data output for the 8-bit serial I/O.			
60	52	53	P35/SI1	G	General-purpose I/O port Also serves as the data input for the 8-bit serial I/O. This port is a hysteresis input type.			
59	51	52	P36/PWC	G	General-purpose I/O port Also serves as the measured pulse input for the 8-bit pulse width counter. This port is a hysteresis input type.			
58	50	51	P37/WTO	F	General-purpose I/O port Also serves as the toggle output for the 8-bit pulse width counter.			
6	62	63	P40/UCK2	G	General-purpose I/O port Also serves as the clock I/O 2 for the UART. This port is a hysteresis input type.			
5	61	62	P41/UO2	F	General-purpose I/O port Also serves as the data output 2 for the UART.			
4	60	61	P42/UI2	G	General-purpose I/O port Also serves as the data input 2 for the UART. This port is a hysteresis input type.			
3	59	60	P43/PTO1	F	General-purpose I/O port Also serves as the toggle output for the 8-bit PWM timer.			
10	2	3	P50/ADST	К	General-purpose I/O port Also serves as an A/D converter external activation. This port is a hysteresis input type.			

*1: DIP-64P-M01

*2: MDP-64C-P02

*4: FPT-64P-M06

*5: MQP-M64C-P01

*3: FPT-64P-M23

Pin no.		Pin name I/O	Function		
MDIP	MQFP		1/0	Function	
65	66	Vpp	0	"H" level output pin	
66 67 68 69 70 71 72 73 74	67 68 69 70 71 72 73 74 75	A12 A7 A6 A5 A4 A3 A2 A1 A0	0	Address output pins	
75 76 77	77 78 79	01 02 03	Ι	Data input pins	
78	80	Vss	0	Power supply (GND) pin	
79 80 81 82 83	82 83 84 85 86	04 05 06 07 08	I	Data input pins	
84	87	CE	0	ROM chip enable pin Outputs "H" during standby.	
85	88	A10	0	Address output pin	
86	89	ŌĒ	0	ROM output enable pin Outputs "L" at all times.	
87 88 89	91 92 93	A11 A9 A8	0	Address output pins	
90	94	A13	0		
91	95	A14	0		
92	96	Vcc	0	EPROM power supply pin	
	65 76 81 90	N.C.		Internally connected pins Be sure to leave them open.	

• External EPROM pins (MB89PV630 only)

■ PROGRAMMING TO THE EPROM WITH PIGGYBACK/EVALUATION DEVICE

1. EPROM for Use

MBM27C256A-20CZ, MBM27C256A-20TV

2. Memory Space

Memory space in each mode, such as 32-Kbyte PROM, option area is diagrammed below.



3. Programming to the EPROM

- (1) Set the EPROM programmer to the MBM27C256A.
- (3) Program to 0000_H to $7FFF_{H}$ with the EPROM programmer.

BLOCK DIAGRAM



CPU CORE

1. Memory Space

The microcontrollers of the MB89630R series offer 64 Kbytes of memory for storing all of I/O, data, and program areas. The I/O area is located at the lowest address. The data area is provided immediately above the I/O area. The data area can be divided into register, stack, and direct areas according to the application. The program area is located at exactly the opposite end of I/O area, that is, near the highest address. Provide the tables of interrupt reset vectors and vector call instructions toward the highest address within the program area. The memory space of the MB89630R series is structured as illustrated below.



2. Registers

The F²MC-8L family has two types of registers; dedicated registers in the CPU and general-purpose registers in the memory. The following dedicated registers are provided:

Program counter (PC):	A 16-bit register for indicating the instruction storage positions
Accumulator (A):	A 16-bit temporary register for storing arithmetic operations, etc. When the instruction is an 8-bit data processing instruction, the lower byte is used.
Temporary accumulator (T):	A16-bit register which performs arithmetic operations with the accumulator When the instruction is an 8-bit data processing instruction, the lower byte is used.
Index register (IX):	A16-bit register for index modification
Extra pointer (EP):	A16-bit pointer for indicating a memory address
Stack pointer (SP):	A16-bit register for indicating a stack area
Program status (PS):	A16-bit register for storing a register pointer, a condition code

 16 bits	Initial value
PC	: Program counter FFFD _H
A	: Accumulator Indeterminate
Т	: Temporary accumulator Indeterminate
IX	: Index register Indeterminate
EP	: Extra pointer Indeterminate
SP	: Stack pointer Indeterminate
PS	: Program status I-flag = 0, IL1, IL0 = 11 The other bit values are indeterminate

The PS can further be divided into higher 8 bits for use as a register bank pointer (RP) and the lower 8 bits for use as a condition code register (CCR). (See the diagram below.)



Address	Read/write	Register name	Register description			
20н	(R/W)	ADC1	A/D converter control register 1			
21н	(R/W)	ADC2	A/D converter control register 2			
22н	(R/W)	ADDH	A/D converter data register (H)			
23н	(R/W)	ADDL	A/D converter data register (L)			
24н	(R/W)	EIC1	External interrupt control register 1			
25н	(R/W)	EIC2	External interrupt control register 2			
26н		Vaca	ncy			
27н		Vaca	ncy			
28н	(R/W)	CNTR1	PWM timer control register 1			
29н	(R/W)	CNTR2	PWM timer control register 2			
2Ан	(R/W)	CNTR3	PWM timer control register 3			
2Вн	(VV)	COMR1	PWM timer compare register 1			
2Сн	(VV)	COMR2	PWM timer compare register 2			
2Dн	(R/W)	SMC	UART serial mode control register			
2Ен	(R/W)	SRC	UART serial rate control register			
2Fн	(R/W)	SSD	UART serial status/data register			
30н	(R) (W)	SIDR SODR	UART serial input data control register UART serial output data control register			
31н to 7Вн		Vacancy				
7Сн	(VV)	ILR1	Interrupt level setting register 1			
7Dн	(W)	ILR2	Interrupt level setting register 2			
7Ен	(W)	ILR3 Interrupt level setting register 3				
7 Fн		Vaca	ncy			

Note: Do not use vacancies.

■ ELECTRICAL CHARACTERISTICS

1. Absolute Maximum Ratings

(AVss = Vss = 0.0 V)

Desembles	Symbol	Va	lue	l Init	Bomorko	
Parameter	Symbol	Min.	Max.	Unit	Remarks	
Power supply veltage	Vcc	Vss-0.3	Vss + 7.0	V	*	
Fower supply voltage	AVcc	Vss-0.3	Vss + 7.0	V	*	
A/D converter reference input voltage	AVR	Vss-0.3	Vss + 7.0	V	AVR must not exceed "AVcc + 0.3 V".	
	Vı	Vss-0.3	Vcc + 0.3	V	Except P50 to P53	
input voltage	V ₁₂	Vss-0.3	Vss + 7.0	V	P50 to P53	
	Vo	Vss-0.3	Vcc + 0.3	V	Except P50 to P53	
Output voltage	V _{O2}	Vss-0.3	Vss + 7.0	V	P50 to P53	
"L" level maximum output current	Iol		20	mA		
"L" level average output current	IOLAV		4	mA	Average value (operating current \times operating rate)	
"L" level total maximum output current	ΣΙΟL		100	mA		
"L" level total average output current	ΣΙοιαν		40	mA	Average value (operating current \times operating rate)	
"H" level maximum output current	Іон		-20	mA		
"H" level average output current	Іонач		-4	mA	Average value (operating current \times operating rate)	
"H" level total maximum output current	ΣΙοн		-50	mA		
"H" level total average output current	ΣΙοήαν		-20	mA	Average value (operating current \times operating rate)	
Power consumption	PD		500	mW		
Operating temperature	TA	-40	+85	°C		
Storage temperature	Tstg	-55	+150	°C		

 * : Use AVcc and Vcc set at the same voltage.

Take care so that AV $_{CC}$ does not exceed V $_{CC}$, such as when power is turned on.

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

Paramotor	Symbol	Pin name		Condition	Value			Unit	Pomarks
Farameter	Symbol			Sonution	Min.	Тур.	Max.	Unit	Neillai KS
Pull-up resistance	Rpull	P00 to P07, P10 to P17, P30 to P37, P40 to P43, P50 to P53, P72 to P74	Vı =	: 0.0 V	25	50	100	kΩ	With pull-up resistor
	Icc1		Fсн Vcc t _{inst} *	= 10 MHz = 5.0 V ² = 0.4 μs	_	12	20	mA	
	Icc2	-	Fсн Vcc	= 10 MHz = 3.0 V	_	1.0	2	mA	MB89635R/ 636R/637R/ PV630
			linst	– 0.4 μ5		1.5	2.5	mA	MB89P637
Deverse	Iccs1	-	node	$F_{CH} = 10 \text{ MHz}$ $V_{CC} = 5.0 \text{ V}$ $t_{inst}^{*2} = 0.4 \mu s$	_	3	7	mA	
	Iccs2		Sleep r	$F_{CH} = 10 \text{ MHz}$ $V_{CC} = 3.0 \text{ V}$ $t_{inst}^{*2} = 6.4 \mu \text{s}$	_	0.5	1.5	mA	
	Iccl			= 32.768 kHz, = 3.0 V		50	100	μA	MB89635R/ 636R/637R/ PV630
current ^{*1}		Vcc	Subclock mode		_	500	700	μA	MB89P637
	Iccls		F_{CL} = 32.768 kHz, V_{CC} = 3.0 V Subclock sleep mode			25	50	μΑ	
	Ісст		F _{CL} = 32.768 kHz, V _{CC} = 3.0 V • Watch mode • Main clock stop mode at dual- clock system		_	3	15	μΑ	
	Іссн		 TA = +25°C Subclock stop mode Main clock stop mode at single-clock system 			_	1	μΑ	

 $(AVcc = Vcc = 5.0 V, AVss = Vss = 0.0 V, T_A = -40^{\circ}C to +85^{\circ}C)$



(10) Peripheral Input Timing

Deremeter	Symbol Din name		Value		Unit	Domorko
Farameter	Symbol	Fin name	Min.	Max.	Unit	Remarks
Peripheral input "H" pulse width 1	t ILIH1	PWC INTO to INT3 EC	2 tinst*	—	μs	
Peripheral input "L" pulse width 1	t iHi∟1		2 tinst*	—	μs	
Peripheral input "H" pulse width 2	tilih2	ADST	2 ⁸ tinst*	—	μs	A/D mode
Peripheral input "L" pulse width 2	tiHIL2	ADST	2 ⁸ tinst*	—	μs	A/D mode
Peripheral input "H" pulse width 3	t ilih3	ADST	2 ⁸ tinst*	—	μs	Sense mode
Peripheral input "L" pulse width 3	t iHiL3		2 ⁸ tinst*	—	μs	Sense mode

(Vcc = 5.0 V±10%, AVss = Vss = 0.0 V, $T_A = -40^{\circ}C$ to +85°C)

* : For information on tinst, see "(4) Instruction Cycle".



6. A/D Converter Glossary

Resolution

Analog changes that are identifiable with the A/D converter

- Linearity error
 The deviation of the straight line connecting the zero transition point ("00 0000 0000" ↔ "00 0000 0001") with
 the full-scale transition point ("11 1111 1110" ↔ "11 1111 1111") from actual conversion characteristics
 - Differential linearity error The deviation of input voltage needed to change the output code by 1 LSB from the theoretical value
 - Total error (unit: LSB)

The difference between theoretical and actual conversion values caused by the zero transition error, full-scale transition error, linearity error, quantization error, and noise



(Continued)

7. Notes on Using A/D Converter

· Input impedance of the analog input pins

The output impedance of the external circuit for the analog input must satisfy the following conditions. If the output impedance of the external circuit is too high, an analog voltage sampling time might be insufficient (sampling time = 6 μ s at 10 MHz oscillation.) Therefore, it is recommended to keep the output impedance of the external circuit below 10 k Ω .



• Error

The smaller the | AVR-AVss |, the greater the error would become relatively.

■ MASK OPTIONS

No	Part number	MB89635R MB89636R MB89637R	MB89P637	MB89PV630	
110.	Specifying procedure	Specify when ordering masking	Set with EPROM programmer	Setting not possible	
1	Pull-up resistors P00 to P07, P10 to P17, P30 to P37, P40 to P43, P50 to P53, P72 to P74	Selectable by pin	Can be set per pin*	Fixed to "without pull-up resistor"	
2	Power-on reset selection With power-on reset Without power-on reset	Selectable	Setting possible	Fixed to "with power-on reset"	
3	Selection of the main clock oscillation stabilization time (at 10 MHz) 2 ¹⁸ /Fcн (Approx. 26.2 ms) 2 ¹⁷ /Fcн (Approx. 13.1 ms) 2 ¹⁴ /Fcн (Approx. 1.6 ms) 2 ⁴ /Fcн (Approx. 1.6 μs) Fcн : Main clock frequency	Selectable	Setting possible	Fixed to 2 ¹⁸ /Fсн (Approx. 26.2 ms)	
4	Reset pin output Reset output provided No reset output	Selectable	Setting possible	Fixed to "with reset output"	
5	Single/dual-clock system option	Selectable	Setting possible	MB89PV630-101 Single-clock system	
	Uual clock		Jan Specific	MB89PV630-102 Dual-clock systems	

* : For P50 to P53, fixed to "Without pull-up resistor."





Please confirm the latest Package dimension by following URL. http://edevice.fujitsu.com/package/en-search/



■ MAIN CHANGES IN THIS EDITION

Page	Section	Change Results
49	■ MASK OPTIONS	Changed the explanation for "*" in "■ MASK OPTIONS".

The vertical lines marked in the left side of the page show the changes.

