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What is "<u>Embedded - Microcontrollers</u>"?

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

Details

Product Status	Obsolete
Core Processor	F²MC-8FX
Core Size	8-Bit
Speed	16MHz
Connectivity	I²C, SIO, UART/USART
Peripherals	LCD, LVD, POR, PWM, WDT
Number of I/O	71
Program Memory Size	60KB (60K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	1.98K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 3.6V
Data Converters	A/D 4x8/10b
Oscillator Type	External
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	80-LQFP
Supplier Device Package	80-LQFP (12x12)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/mb95f318epmc-g-sne2

■ PRODUCT LINE-UP

• MB95310L Series

Part number / Parameter	MB95F314E	MB95F316E	MB95F318E	MB95F314L	MB95F316L	MB95F318L
Type	Flash memory product					
Clock supervisor counter	It supervises the main clock oscillation.					
Flash memory capacity	20 Kbyte	36 Kbyte	60 Kbyte	20 Kbyte	36 Kbyte	60 Kbyte
RAM capacity	496 bytes	1008 bytes	2032 bytes	496 bytes	1008 bytes	2032 bytes
Low-voltage detection reset	Yes			No		
Reset input	Dedicated					
CPU functions	• Number of basic instructions : 136 • Instruction bit length : 8 bits • Instruction length : 1 to 3 bytes • Data bit length : 1, 8 and 16 bits • Minimum instruction execution time : 61.5 ns (machine clock frequency = 16.25 MHz) • Interrupt processing time : 0.6 μs (machine clock frequency = 16.25 MHz)					
General-purpose I/O	• I/O ports (Max) : 71 • CMOS I/O : 68 • N-ch open drain: 3					
Time-base timer	Interval time: 0.256 ms - 8.3 s (external clock frequency = 4 MHz)					
Hardware/ software watchdog timer	• Reset generation cycle Main oscillation clock at 10 MHz: 105 ms (Min) • The sub-CR clock can be used as the source clock of the hardware watchdog timer.					
Wild register	It can be used to replace three bytes of data.					
I²C	1 channel					
	• Master/Slave sending and receiving • Bus error function and arbitration function • Detecting transmitting direction function • Start condition repeated generation and detection functions • Built-in wake-up function					
UART/SIO	2 channels					
	• Data transfer with UART/SIO is enabled. • It has a full duplex double buffer, variable data length (5/6/7/8 bits), a built-in baud rate generator and an error detection function. • It uses the NRZ type transfer format. • LSB-first data transfer and MSB-first data transfer are available to use. • Clock-asynchronous (UART) serial data transfer and clock-synchronous (SIO) serial data transfer is enabled.					
8/10-bit A/D converter	4 channels					
	8-bit or 10-bit resolution can be selected.					

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Part number / Parameter	MB95F314E	MB95F316E	MB95F318E	MB95F314L	MB95F316L	MB95F318L
8/16-bit composite timer	2 channels • Each timer can be configured as an "8-bit timer × 2 channels" or a "16-bit timer × 1 channel". • It has built-in timer function, PWC function, PWM function and input capture function. • Count clock: it can be selected from internal clocks (seven types) and external clocks. • It can output square wave.					
LCD controller (LCDC)	• COM output: 4 (Max) • SEG output: 40 (Max) • LCD drive power supply (bias) pin: 4 (Max) • 40 SEG × 4 COM: 160 pixels can be displayed • Duty LCD mode • Operate in LCD standby mode • Blinking function • Internal divider resistor for LCD drive					
16-bit reload timer	1 channel • Two clock modes and two counter operating modes can be selected • Square waveform output • Count clock: it can be selected from internal clocks (seven types) and external clocks. • Counter operating mode: reload mode or one-shot mode can be selected					
Event counter	By configuring the 16-bit reload timer and the 8/16-bit composite timer ch. 1, event counter function can be implemented. When the event counter function is used, the 16-bit reload timer and the 8/16-bit composite timer ch. 1 are unavailable.					
8/16-bit PPG	2 channels • Each channel of the PPG can be used as "8-bit PPG × 2 channels" or "16-bit PPG × 1 channel" • Counter operating clock: Eight selectable clock sources					
Watch counter	• Count clock: Four selectable clock sources (125 ms, 250 ms, 500 ms or 1 s) • Counter value can be set from 0 to 63. (Capable of counting for 1 minute when selecting clock source of 1 second and setting counter value to 60)					
External interrupt	8 channels • Interrupt by edge detection (The rising edge, falling edge, or both edges can be selected.) • It can be used to wake up the device from the standby mode.					
On-chip debug	• 1-wire serial control • It supports serial writing. (asynchronous mode)					
Watch prescaler	Eight different time intervals can be selected. (62.5 ms, 125 ms, 250 ms, 500 ms, 1 s, 2 s, 4 s, 8 s)					
Flash memory	• It supports automatic programming, Embedded Algorithm, program/erase/erase-suspend/erase-resume commands. • It has a flag indicating the completion of the operation of Embedded Algorithm. • Number of program/erase cycles: 100000 • Data retention time: 20 years • Flash security feature for protecting the content of the Flash memory					
Standby mode	Sleep mode, stop mode, watch mode, time-base timer mode					
Package	FPT-80P-M37					

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■ PIN DESCRIPTION (MB95310L Series)

Pin no.	Pin name	I/O circuit type*	Function
1	AV$_{CC}$	—	A/D converter power supply pin
2	P16	H	General-purpose I/O port
	PPG10		8/16-bit PPG ch. 1 output pin
3	P15	H	General-purpose I/O port
	PPG11		8/16-bit PPG ch. 1 output pin
4	P14	H	General-purpose I/O port
	UCK0		UART/SIO ch. 0 clock I/O pin
5	P13	H	General-purpose I/O port
	ADTG		A/D trigger input (ADTG) pin
6	P12	C	General-purpose I/O port
	DBG		DBG input pin
7	P11	H	General-purpose I/O port
	UO0		UART/SIO ch. 0 data output pin
8	P10	G	General-purpose I/O port
	UI0		UART/SIO ch. 0 data input pin
9	P53	H	General-purpose I/O port
	TO0		16-bit reload timer ch. 0 output pin
10	P52	H	General-purpose I/O port
	TI0		16-bit reload timer ch. 0 input pin The pin can also be used as the event counter input pin when the event counter function is used.
11	P51	H	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
12	P50	H	General-purpose I/O port
	TO01		8/16-bit composite timer ch. 0 output pin
13	P24	I	General-purpose I/O port
	SDA0		I²C data I/O pin
14	P23	I	General-purpose I/O port
	SCL0		I²C clock I/O pin
15	P22	H	General-purpose I/O port
	TO00		8/16-bit composite timer ch. 0 output pin
16	P21	H	General-purpose I/O port
	PPG01		8/16-bit PPG ch. 0 output pin
17	P20	H	General-purpose I/O port
	PPG00		8/16-bit PPG ch. 0 output pin
18	X0	A	Main clock oscillation pin
19	X1	A	Main clock oscillation pin

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Pin no.	Pin name	I/O circuit type*	Function
59	P67	M	General-purpose I/O port
	SEG23		LCDC SEG output pin
60	PE0	M	General-purpose I/O port
	SEG24		LCDC SEG output pin
61	PE1	M	General-purpose I/O port
	SEG25		LCDC SEG output pin
62	PE2	M	General-purpose I/O port
	SEG26		LCDC SEG output pin
63	PE3	M	General-purpose I/O port
	SEG27		LCDC SEG output pin
64	PE4	M	General-purpose I/O port
	SEG28		LCDC SEG output pin
65	PE5	M	General-purpose I/O port
	SEG29		LCDC SEG output pin
66	PE6	N	General-purpose I/O port
	SEG30		LCDC SEG output pin
67	PE7	M	General-purpose I/O port
	SEG31		LCDC SEG output pin
68	P43	M	General-purpose I/O port
	SEG32		LCDC SEG output pin
69	P42	M	General-purpose I/O port
	SEG33		LCDC SEG output pin
	TO11		8/16-bit composite timer ch. 1 output pin
70	P41	M	General-purpose I/O port
	SEG34		LCDC SEG output pin
	TO10		8/16-bit composite timer ch. 1 output pin
71	P40	M	General-purpose I/O port
	SEG35		LCDC SEG output pin
	EC1		8/16-bit composite timer ch. 1 clock input pin
72	P07	Q	General-purpose I/O port
	INT07		External interrupt input pin
	SEG36		LCDC SEG output pin
73	P06	Q	General-purpose I/O port
	INT06		External interrupt input pin
	SEG37		LCDC SEG output pin

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Pin no.	Pin name	I/O circuit type*	Function
74	P05	Q	General-purpose I/O port
	INT05		External interrupt input pin
	SEG38		LCDC SEG output pin
75	P04	Q	General-purpose I/O port
	INT04		External interrupt input pin
	SEG39		LCDC SEG output pin
76	P03	J	General-purpose I/O port
	INT03		External interrupt input pin
	AN03		A/D analog input pin
77	P02	J	General-purpose I/O port
	INT02		External interrupt input pin
	AN02		A/D analog input pin
78	P01	J	General-purpose I/O port
	INT01		External interrupt input pin
	AN01		A/D analog input pin
79	P00	J	General-purpose I/O port
	INT00		External interrupt input pin
	AN00		A/D analog input pin
80	AV$_{ss}$	—	A/D converter power supply pin (GND)

*: For the I/O circuit types, see "■ I/O CIRCUIT TYPE".

MB95310L/370L Series

■ PIN DESCRIPTION (MB95370L Series)

Pin no.	Pin name	I/O circuit type*	Function
1	AV$_{CC}$	—	A/D converter power supply pin
2	P16	H	General-purpose I/O port
	PPG10		8/16-bit PPG ch. 1 output pin
3	P15	H	General-purpose I/O port
	PPG11		8/16-bit PPG ch. 1 output pin
4	P14	H	General-purpose I/O port
	UCK0		UART/SIO ch. 0 clock I/O pin
	EC0		8/16-bit composite timer ch. 0 clock input pin The pin can also be used as the event counter input pin when the event counter function is used.
	TI0		16-bit reload timer ch. 0 input pin
5	P13	H	General-purpose I/O port
	ADTG		A/D trigger input (ADTG) pin
	TO01		8/16-bit composite timer ch. 0 output pin
6	P12	C	General-purpose I/O port
	DBG		DBG input pin
7	P11	H	General-purpose I/O port
	UO0		UART/SIO ch. 0 data output pin
8	P10	G	General-purpose I/O port
	UI0		UART/SIO ch. 0 data input pin
9	P24	I	General-purpose I/O port
	SDA0		I²C data I/O pin
10	P23	I	General-purpose I/O port
	SCL0		I²C clock I/O pin
11	P22	H	General-purpose I/O port
	TO00		8/16-bit composite timer ch. 0 output pin
12	P21	H	General-purpose I/O port
	PPG01		8/16-bit PPG ch. 0 output pin
13	P20	H	General-purpose I/O port
	PPG00		8/16-bit PPG ch. 0 output pin
14	X0	A	Main clock oscillation pin
15	X1	A	Main clock oscillation pin
16	V$_{ss}$	—	Power supply pin (GND)
17	V$_{CC}$	—	Power supply pin
18	P90	R	General-purpose I/O port
	V3		LCDC drive power supply pin

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Pin no.	Pin name	I/O circuit type*	Function
19	X1A	A	Subclock oscillation pin (32 kHz)
20	X0A		Subclock oscillation pin (32 kHz)
21	$\overline{RST}$	B	Reset pin
22	P91	R	General-purpose I/O port
	V2		LCDC drive power supply pin
23	P92	R	General-purpose I/O port
	V1		LCDC drive power supply pin
24	PA0	M	General-purpose I/O port
	COM0		LCDC COM output pin
25	PA1	M	General-purpose I/O port
	COM1		LCDC COM output pin
26	PA2	M	General-purpose I/O port
	COM2		LCDC COM output pin
27	PA3	M	General-purpose I/O port
	COM3		LCDC COM output pin
28	PB0	M	General-purpose I/O port
	SEG00		LCDC SEG output pin
29	PB1	M	General-purpose I/O port
	SEG01		LCDC SEG output pin
30	PB2	M	General-purpose I/O port
	SEG02		LCDC SEG output pin
31	PB3	M	General-purpose I/O port
	SEG03		LCDC SEG output pin
32	PB4	M	General-purpose I/O port
	SEG04		LCDC SEG output pin
33	PB5	M	General-purpose I/O port
	SEG05		LCDC SEG output pin
34	PB6	M	General-purpose I/O port
	SEG06		LCDC SEG output pin
35	PB7	M	General-purpose I/O port
	SEG07		LCDC SEG output pin
36	PC0	M	General-purpose I/O port
	SEG08		LCDC SEG output pin
37	PC1	M	General-purpose I/O port
	SEG09		LCDC SEG output pin
38	PC2	M	General-purpose I/O port
	SEG10		LCDC SEG output pin

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Pin no.	Pin name	I/O circuit type*	Function
56	P07	Q	General-purpose I/O port
	INT07		External interrupt input pin
	SEG28		LCDC SEG output pin
	UCK1		UART/SIO ch. 1 clock I/O pin
57	P06	Q	General-purpose I/O port
	INT06		External interrupt input pin
	SEG29		LCDC SEG output pin
	TO11		8/16-bit composite timer ch. 1 output pin
58	P05	Q	General-purpose I/O port
	INT05		External interrupt input pin
	SEG30		LCDC SEG output pin
	TO10		8/16-bit composite timer ch. 1 output pin
59	P04	Q	General-purpose I/O port
	INT04		External interrupt input pin
	SEG31		LCDC SEG output pin
	EC1		8/16-bit composite timer ch. 1 clock input pin
60	P03	J	General-purpose I/O port
	INT03		External interrupt input pin
	AN03		A/D analog input pin
61	P02	J	General-purpose I/O port
	INT02		External interrupt input pin
	AN02		A/D analog input pin
62	P01	J	General-purpose I/O port
	INT01		External interrupt input pin
	AN01		A/D analog input pin
63	P00	J	General-purpose I/O port
	INT00		External interrupt input pin
	AN00		A/D analog input pin
64	AV_{ss}	—	A/D converter power supply pin (GND)

*: For the I/O circuit types, see "■ I/O CIRCUIT TYPE".

■ RECOMMENDED LAYOUT

• GND wire should be placed around X0, X1, X0A and X1A
  The recommended layout method illustrated in following diagram aims to avoid noise coupled between the oscillator pins and GPIO, which may cause the main oscillator or the suboscillator to malfunction.
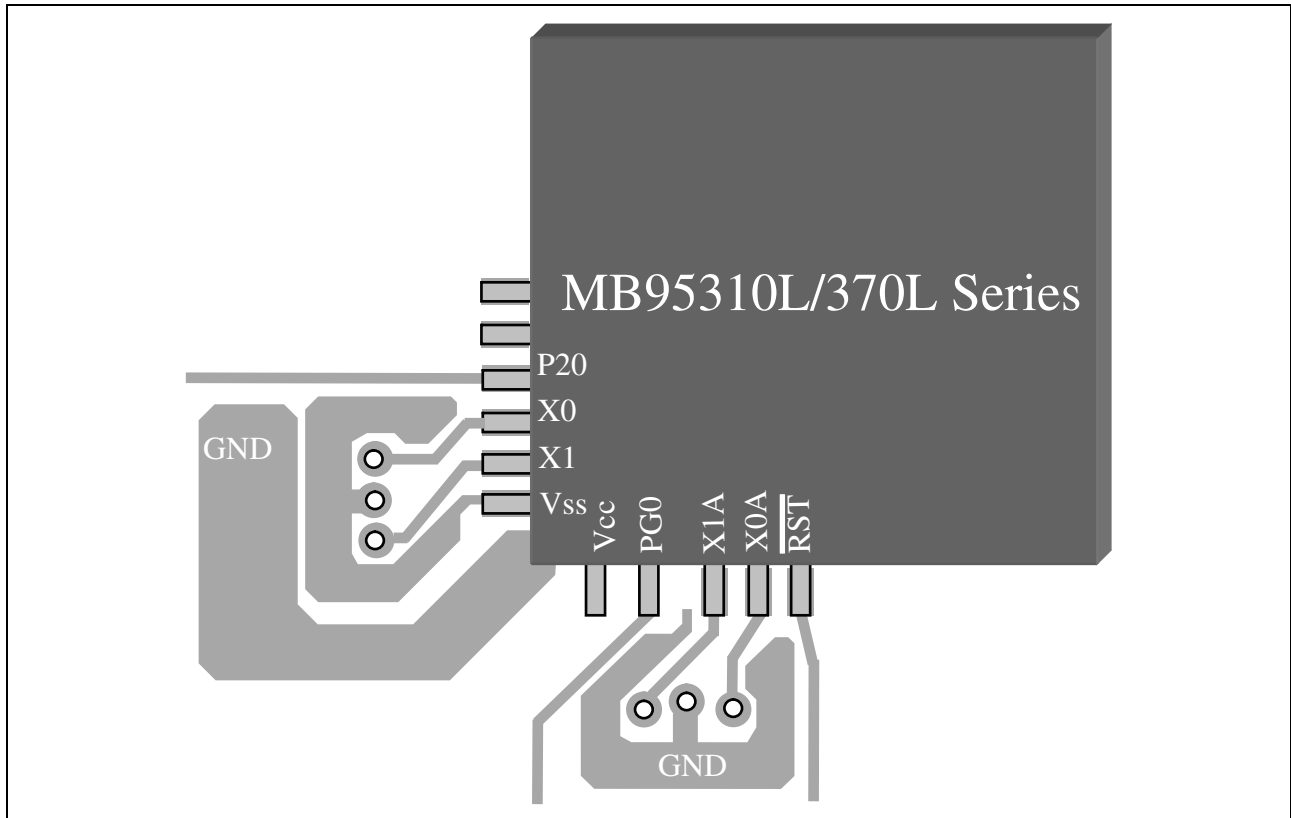
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Address	Register abbreviation	Register name	R/W	Initial value
0FEB$_H$	WDTH	Watchdog timer selection ID register (upper)	R	XXXXXXXX$_B$
0FEC$_H$	WDTL	Watchdog timer selection ID register (lower)	R	XXXXXXXX$_B$
0FED$_H$	—	(Disabled)	—	—
0FEE$_H$	ILSR	Input level select register	R/W	00000000$_B$
0FEF$_H$	WICR	Interrupt pin control register	R/W	01000000$_B$
0FF0$_H$ to 0FFF$_H$	—	(Disabled)	—	—

• R/W access symbols

   R/W   : Readable / Writable

   R   : Read only

• Initial value symbols

   0   : The initial value of this bit is "0".

   1   : The initial value of this bit is "1".

   X   : The initial value of this bit is indeterminate.

Note: Do not write to an address that is "(Disabled)". If a "(Disabled)" address is read, an indeterminate value is returned.

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$(V_{CC} = 3.0\ V\pm10\%,\ V_{SS} = 0.0\ V,\ T_A = -40°C\ to\ +85°C)$

Parameter	Symbol	Pin name	Condition	Value			Unit	Remarks
				Min	Typ[5]	Max		
Input leakage current (Hi-Z output leakage current)	I_{LI}	Ports other than P12, P23, P24	$0.0\ V<V_I<V_{CC}$	−5	—	+5	µA	When pull-up resistance is disabled
Open-drain output leakage voltage	I_{LIOD}	P12, P23, P24	$0.0\ V<V_I<V_{SS} + 5.5\ V$	—	—	5	µA	
Pull-up resistance	R_{PULL}	P00 to P03, P10, P11, P13 to P16, P20 to P22, P50 to P53[1], P94, P95[1], PG0[1]	$V_I = 0.0\ V$	25	50	100	kΩ	When pull-up resistance is enabled
Input capacitance	C_{IN}	Other than V_{CC} and V_{SS}	f = 1 MHz	—	5	15	pF	
Power supply current[4]	I_{CC}	V_{CC} (External clock operation)	F_{CH} = 32 MHz F_{MP} = 16 MHz Main clock mode (divided by 2)	—	16.5	27.7	mA	Except during Flash memory programming and erasing
				—	38.1	44.9	mA	During Flash memory programming and erasing
	I_{CCS}		F_{CH} = 32 MHz F_{MP} = 16 MHz Main sleep mode (divided by 2)	—	9	15.9	mA	
	I_{CCL}		F_{CL} = 32 kHz F_{MPL} = 16 kHz Subclock mode (divided by 2) T_A = +25°C	—	22.6	37.9	µA	

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- Operating voltage - Operating frequency (When $T_A = -10°C$ to $+85°C$)
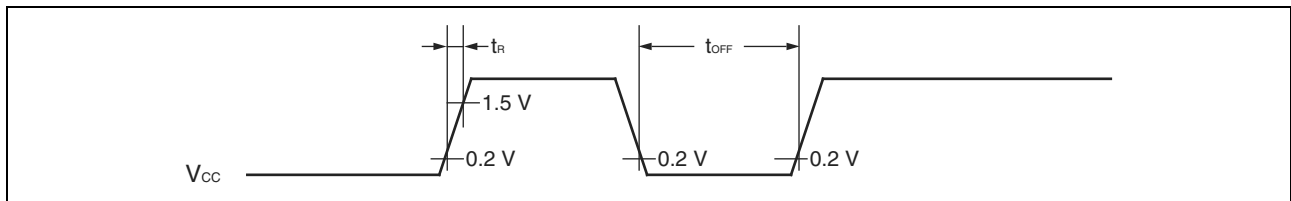 Without the on-chip debug function
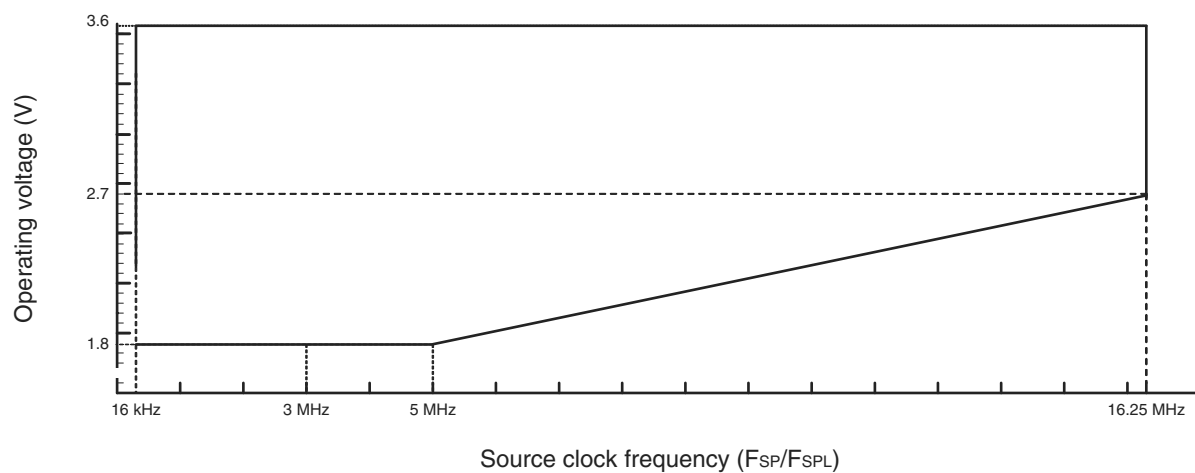
- Operating voltage - Operating frequency (When $T_A = -40°C$ to $+85°C$)
 Without the on-chip debug function

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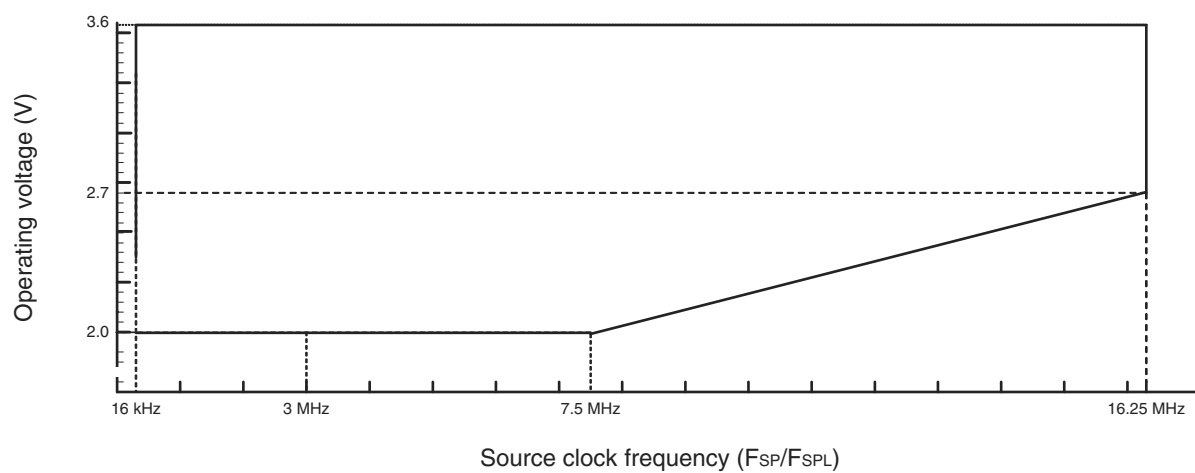
(4) Power-on Reset

(V$_{SS}$ = 0.0 V, T$_A$ = −40°C to +85°C)

Parameter	Symbol	Condition	Value		Unit	Remarks
			Min	Max		
Power supply rising time	t$_R$	—	—	50	ms	
Power supply cutoff time	t$_{OFF}$	—	1	—	ms	Wait time until power-on

Note: A sudden change of power supply voltage may activate the power-on reset function. When changing the power supply voltage during the operation, set the slope of rising to a value below within 20 mV/ms as shown below.
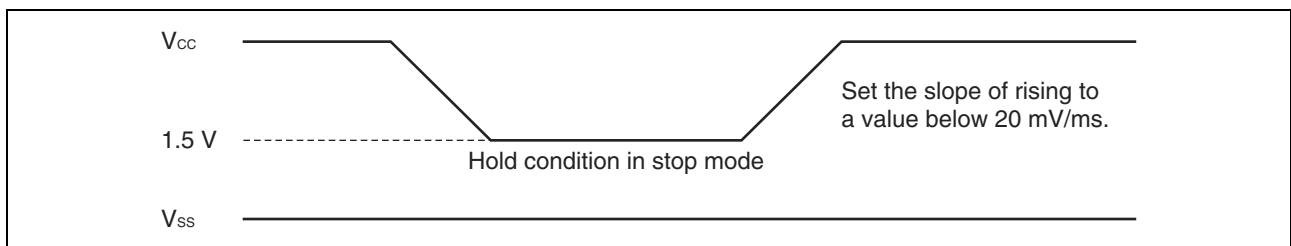
(6) UART/SIO, Serial I/O Timing

$(V_{CC} = 3.0\ V \pm 10\%, AV_{SS} = V_{SS} = 0.0\ V, T_A = -40°C\ to\ +85°C)$

Parameter	Symbol	Pin name	Condition	Value Min	Value Max	Unit
Serial clock cycle time	t_{SCYC}	UCK0, UCK1	Internal clock operation output pin: $C_L = 80\ pF + 1\ TTL$	4 t_{MCLK}*	—	ns
UCK $\downarrow \rightarrow$ UO time	t_{SLOVI}	UCK0, UCK1, UO0, UO1		−190	+190	ns
Valid UI $\rightarrow$ UCK $\uparrow$	t_{IVSHI}	UCK0, UCK1, UI0, UI1		2 t_{MCLK}*	—	ns
UCK $\uparrow \rightarrow$ valid UI hold time	t_{SHIXI}	UCK0, UCK1, UI0, UI1		2 t_{MCLK}*	—	ns
Serial clock "H" pulse width	t_{SHSL}	UCK0, UCK1	External clock operation output pin: $C_L = 80\ pF + 1\ TTL$	4 t_{MCLK}*	—	ns
Serial clock "L" pulse width	t_{SLSH}	UCK0, UCK1		4 t_{MCLK}*	—	ns
UCK $\downarrow \rightarrow$ UO time	t_{SLOVE}	UCK0, UCK1, UO0, UO1		—	190	ns
Valid UI $\rightarrow$ UCK $\uparrow$	t_{IVSHE}	UCK0, UCK1, UI0, UI1		2 t_{MCLK}*	—	ns
UCK $\uparrow \rightarrow$ valid UI hold time	t_{SHIXE}	UCK0, UCK1, UI0, UI1		2 t_{MCLK}*	—	ns

*: See "(2) Source Clock/Machine Clock" for t_{MCLK}.
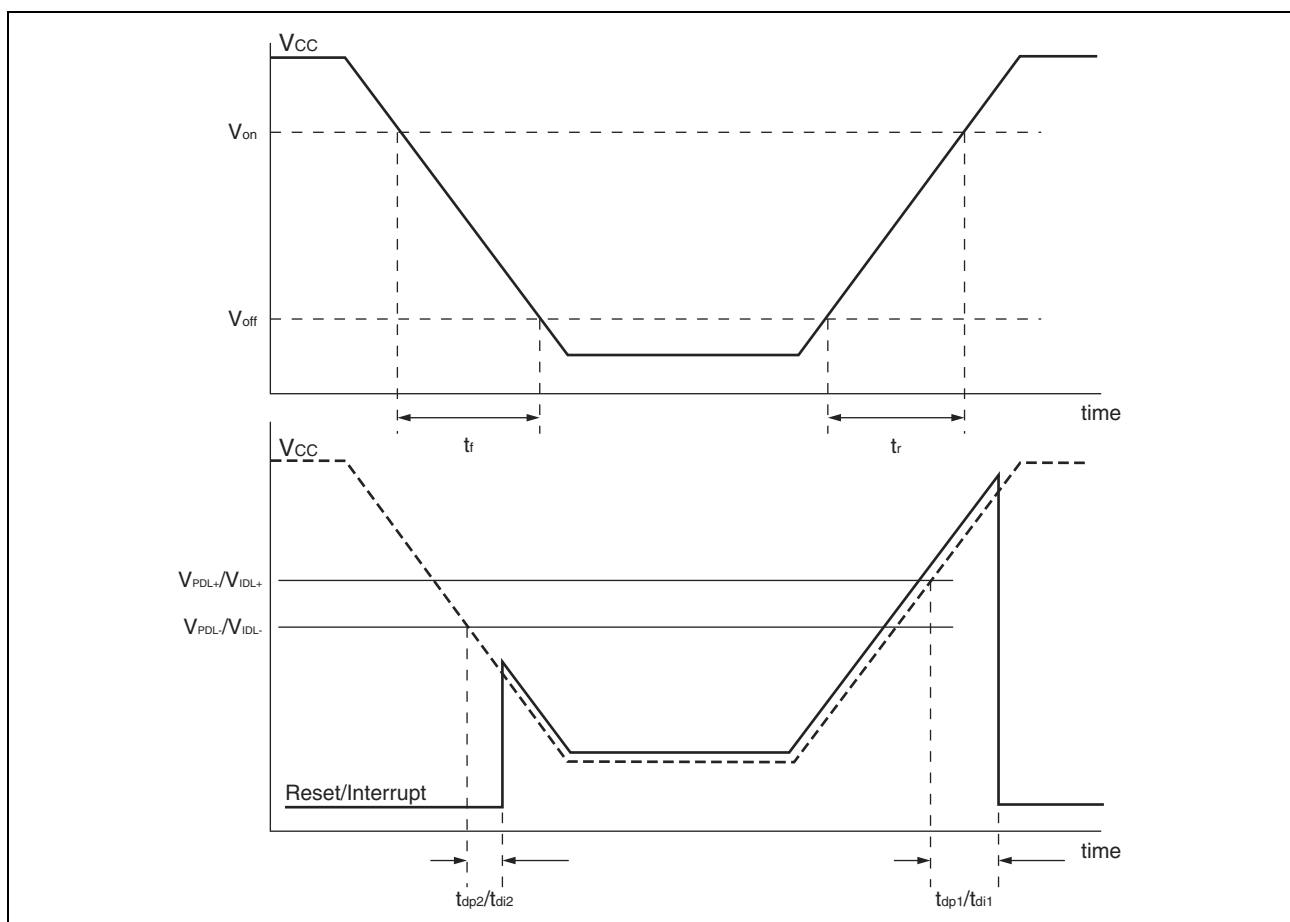
• Internal shift clock mode
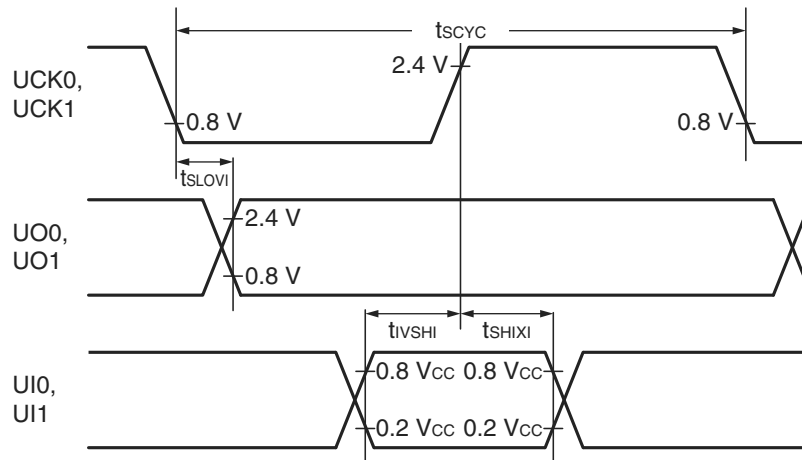
• External shift clock mode
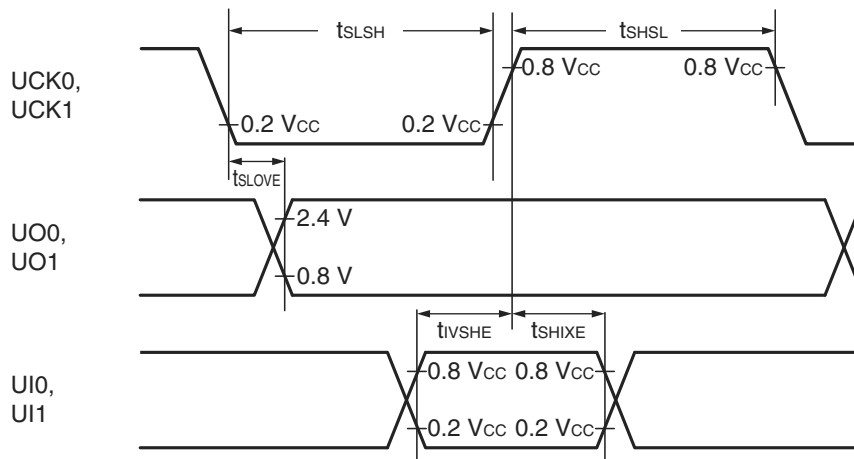
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$(V_{SS} = 0.0\ V,\ V_{CC} = 1.8\ V\ to\ 3.6\ V,\ T_A = -40°C\ to\ +85°C)$

Parameter	Symbol	Value			Unit	Remarks
		Min	Typ	Max		
Power reset release delay time	t_{dp1}	10	—	300	μs	
Power reset detection delay time	t_{dp2}	—	—	150	μs	
Interrupt reset release delay time	t_{di1}	10	—	200	μs	
Interrupt reset detection delay time	t_{di2}	—	—	150	μs	

5. A/D Converter

(1) A/D Converter Electrical Characteristics

(Vcc = 1.8 V to 3.6 V, Vss = 0.0 V, TA = −40°C to +85°C)

Parameter	Symbol	Value			Unit	Remarks
		Min	Typ	Max		
Resolution	—	—	—	10	bit	
Total error		−3	—	+3	LSB	
Linearity error		−2.5	—	+2.5	LSB	
Differential linear error		−1.9	—	+1.9	LSB	
Zero transition voltage	V_{OT}	AVss − 1.5 LSB	AVss + 0.5 LSB	AVss + 2.5 LSB	V	2.7 V ≤ Vcc ≤ 3.6 V
		AVss − 0.5 LSB	AVss + 1.5 LSB	AVss + 3.5 LSB	V	1.8 V ≤ Vcc < 2.7 V
Full-scale transition voltage	V_{FST}	AVcc − 3.5 LSB	AVcc − 1.5 LSB	AVcc + 0.5 LSB	V	2.7 V ≤ Vcc ≤ 3.6 V
		AVcc − 2.5 LSB	AVcc − 0.5 LSB	AVcc + 1.5 LSB	V	1.8 V ≤ Vcc < 2.7 V
Compare time	—	0.6	—	140	μs	2.7 V ≤ Vcc ≤ 3.6 V
		20	—	140	μs	1.8 V ≤ Vcc < 2.7 V
Sampling time	—	0.4	—	∞	μs	2.7 V ≤ Vcc ≤ 3.6 V, with external impedance < 1.8 kΩ
		30	—	∞	μs	1.8 V ≤ Vcc < 2.7 V, with external impedance < 14.8 kΩ
Analog input current	I_{AIN}	−0.3	—	+0.3	μA	
Analog input voltage	V_{AIN}	AVss	—	AVcc	V	

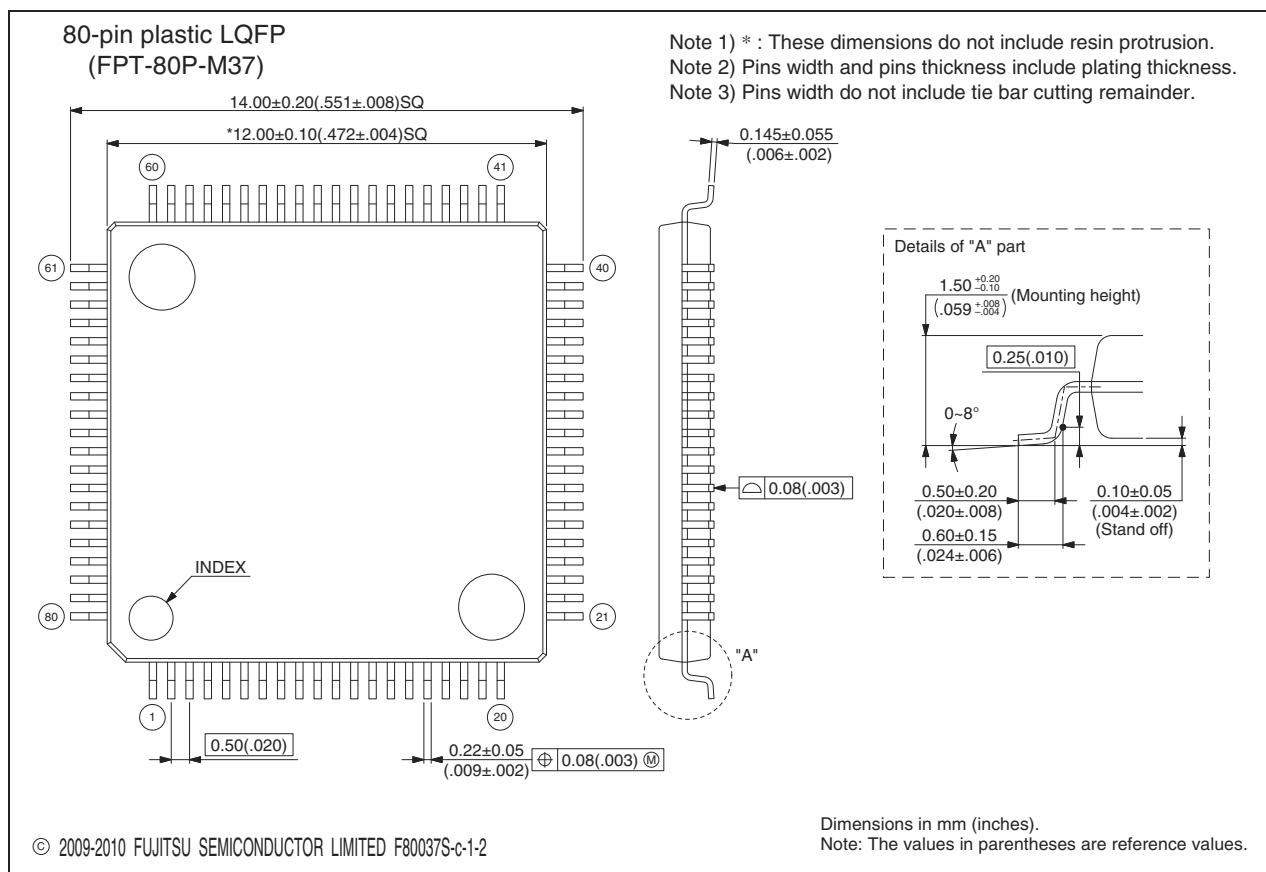• Output voltage characteristics

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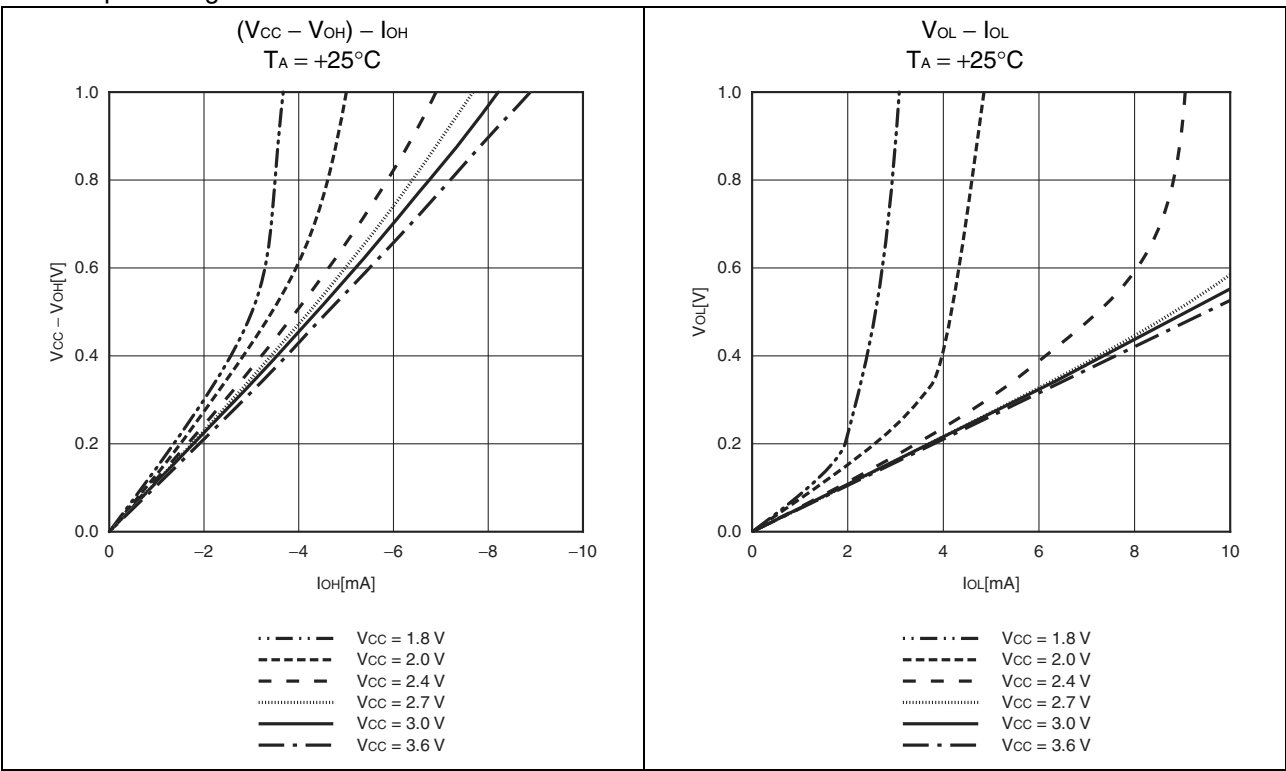
■ MASK OPTIONS

No.	Part Number	MB95F314E MB95F316E MB95F318E MB95F374E MB95F376E MB95F378E	MB95F314L MB95F316L MB95F318L MB95F374L MB95F376L MB95F378L
	Selectable/Fixed	Fixed	
1	Low-voltage detection reset	With low-voltage detection reset	Without low-voltage detection reset

■ PACKAGE DIMENSION

80-pin plastic LQFP		
Lead pitch	0.50 mm	
Package width × package length	12.00 mm × 12.00 mm	
Lead shape	Gullwing	
Lead bend direction	Normal bend	
Sealing method	Plastic mold	
Mounting height	1.70 mm MAX	
(FPT-80P-M37)	Weight	0.47 g

80-pin plastic LQFP
(FPT-80P-M37)

14.00±0.20(.551±.008)SQ

*12.00±0.10(.472±.004)SQ

INDEX

60   41
61   40
80   21
1   20

0.50(.020)

0.22±0.05
(.009±.002)

⊕ 0.08(.003) Ⓜ

Note 1) ∗ : These dimensions do not include resin protrusion.
Note 2) Pins width and pins thickness include plating thickness.
Note 3) Pins width do not include tie bar cutting remainder.

0.145±0.055
(.006±.002)

△ 0.08(.003)

"A"

Details of "A" part

$1.50 ^{+0.20}_{-0.10}$ (Mounting height)
$(.059 ^{+.008}_{-.004})$

0.25(.010)

0~8°

0.50±0.20
(.020±.008)

0.60±0.15
(.024±.006)

0.10±0.05
(.004±.002)
(Stand off)

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Dimensions in mm (inches).
Note: The values in parentheses are reference values.

Please check the latest package dimension at the following URL.
http://edevice.fujitsu.com/package/en-search/

(Continued)

■ MAJOR CHANGES IN THIS EDITION

A change on a page is indicated by a vertical line drawn on the left side of that page.

Page	Section	Details
1	—	Changed the family name. F²MC-8FX → New 8FX
1	■ FEATURES	Changed the main CR clock oscillation frequency. 1/8/10 MHz ±3%, maximum machine clock frequency: 10 MHz → 1/8/10/12.5 MHz ±2%, maximum machine clock frequency: 12.5 MHz
23	■ PIN CONNECTION	Added "• Notes on handling the external clock pins while using the CR clock".
46	■ ELECTRICAL CHARACTERISTICS 3. DC Characteristics	Changed the condition for the power supply current (I_{CCMCR}). F_{CRH} = 10 MHz F_{MP} = 10 MHz Main CR clock mode → F_{CRH} = 12.5 MHz F_{MP} = 12.5 MHz Main CR clock mode Changed the condition for the power supply current (I_{CCSCR}). F_{CL} = 32 kHz F_{MPL} = 16 kHz Sub-CR clock mode (divided by 2) T_A = +25°C → Sub-CR clock mode (divided by 2) T_A = +25°C
47		Changed the condition for the power supply current (I_{CRH}). Current consumption for the main CR oscillator at 10 MHz → Current consumption for the main CR oscillator
48	■ ELECTRICAL CHARACTERISTICS 4. AC Characteristics (1) Clock Timing	Changed the values of the clock frequency (F_{CRH}).
58	■ ELECTRICAL CHARACTERISTICS 4. AC Characteristics (7) Low-voltage Detection	Deleted the following parameters: Power hysteresis width 0, Power hysteresis width 1, Power hysteresis width 2, Interrupt hysteresis width 0, Interrupt hysteresis width 1, Interrupt hysteresis width 2, Interrupt hysteresis width 3, Interrupt hysteresis width 4
59		Deleted V_{PHYS}/V_{IHYS} from the diagram.
64	■ ELECTRICAL CHARACTERISTICS 4. AC Characteristics (8) I²C Timing	Changed the settings related to the machine clock shown in *2.
70 to 75	■ SAMPLE CHARACTERISTICS	Added "■ SAMPLE CHARACTERISTICS".