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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



New 8FX 8-bit Microcontrollers

The MB95560H/570H/580H Series is a series of general-purpose, single-chip microcontrollers. In addition to a compact instruction set, the microcontrollers of this series contain a variety of peripheral resources.

Features

- F²MC-8FX CPU core
 - Instruction set optimized for controllers
 - Multiplication and division instructions
 - 16-bit arithmetic operations
 - Bit test branch instructions
 - Bit manipulation instructions, etc.
 - Clock (The main oscillation clock and the suboscillation clock are only available on MB95F562H/F562K/F563H/F563K/F564H/F564K/F582H/F582K/F583H/F583K/F584H/F584K.)
 - Selectable main clock source
 - Main oscillation clock (up to 16.25 MHz, maximum machine clock frequency: 8.125 MHz)
 - External clock (up to 32.5 MHz, maximum machine clock frequency: 16.25 MHz)
 - Main CR clock (4 MHz ± 2%)
 - The main CR clock frequency becomes 8 MHz when the PLL multiplication rate is 2.
 - The main CR clock frequency becomes 10 MHz when the PLL multiplication rate is 2.5.
 - The main CR clock frequency becomes 12 MHz when the PLL multiplication rate is 3.
 - The main CR clock frequency becomes 16 MHz when the PLL multiplication rate is 4.
 - Selectable subclock source
 - Suboscillation clock (32.768 kHz)
 - External clock (32.768 kHz)
 - Sub-CR clock (Typ: 100 kHz, Min: 50 kHz, Max: 150 kHz)
 - Timer
 - 8/16-bit composite timer × 2 channels (only one channel on MB95F572H/F572K/F573H/F573K/F574H/F574K/F582H/F582K/F583H/F583K/F584H/F584K)
 - Time-base timer × 1 channel
 - Watch prescaler × 1 channel
 - LIN-UART (only available on MB95F562H/F562K/F563H/F563K/F564H/F564K/F582H/F582K/F583H/F583K/F584H/F584K)
 - Full duplex double buffer
 - Capable of clock synchronous serial data transfer and clock asynchronous serial data transfer
 - External interrupt
 - Interrupt by edge detection (rising edge, falling edge, and both edges can be selected)
 - Can be used to wake up the device from different low power consumption (standby) modes
 - 8/10-bit A/D converter
 - 8-bit or 10-bit resolution can be selected.
 - Low power consumption (standby) modes
 - There are four standby modes as follows:
 - Stop mode
 - Sleep mode
 - Watch mode
 - Time-base timer mode
 - In standby mode, the device can be made to enter either normal standby mode or deep standby mode.
 - I/O port
 - MB95F562H/F563H/F564H (maximum no. of I/O ports: 16)
 - General-purpose I/O ports (CMOS I/O): 15
 - General-purpose I/O ports (N-ch open drain): 1
 - MB95F562K/F563K/F564K (maximum no. of I/O ports: 17)
 - General-purpose I/O ports (CMOS I/O): 15
 - General-purpose I/O ports (N-ch open drain): 2
 - MB95F572H/F573H/F574H (maximum no. of I/O ports: 4)
 - General-purpose I/O ports (CMOS I/O): 3
 - General-purpose I/O ports (N-ch open drain): 1
 - MB95F572K/F573K/F574K (maximum no. of I/O ports: 5)
 - General-purpose I/O ports (CMOS I/O): 3
 - General-purpose I/O ports (N-ch open drain): 2
 - MB95F582H/F583H/F584H (maximum no. of I/O ports: 12)
 - General-purpose I/O ports (CMOS I/O): 11
 - General-purpose I/O ports (N-ch open drain): 1
 - MB95F582K/F583K/F584K (maximum no. of I/O ports: 13)
 - General-purpose I/O ports (CMOS I/O): 11
 - General-purpose I/O ports (N-ch open drain): 2
 - On-chip debug
 - 1-wire serial control
 - Serial writing supported (asynchronous mode)
 - Hardware/software watchdog timer
 - Built-in hardware watchdog timer
 - Built-in software watchdog timer
 - Power-on reset
 - A power-on reset is generated when the power is switched on.
 - Low-voltage detection reset circuit (only available on MB95F562K/F563K/F564K/F572K/F573K/F574K/F582K/F583K/F584K)
 - Built-in low-voltage detector
 - Clock supervisor counter
 - Built-in clock supervisor counter function
 - Dual operation Flash memory
 - The program/erase operation and the read operation can be executed in different banks (upper bank/lower bank) simultaneously.
 - Flash memory security function
 - Protects the content of the Flash memory.

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1. Product Line-up

• MB95560H Series

Part number	MB95F562H	MB95F563H	MB95F564H	MB95F562K	MB95F563K	MB95F564K
Parameter						
Type	Flash memory product					
Clock supervisor counter	It supervises the main clock oscillation.					
Flash memory capacity	8 Kbyte	12 Kbyte	20 Kbyte	8 Kbyte	12 Kbyte	20 Kbyte
RAM capacity	240 bytes	496 bytes	496 bytes	240 bytes	496 bytes	496 bytes
Power-on reset	Yes					
Low-voltage detection reset	No			Yes		
Reset input	Dedicated			Selected through software		
CPU functions	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • I/O ports (Max) : 16 • CMOS I/O : 15 • N-ch open drain: 1 			<ul style="list-style-type: none"> • I/O ports (Max) : 17 • CMOS I/O : 15 • N-ch open drain: 2 		
Time-base timer	Interval time: 0.256 ms to 8.3 s (external clock frequency = 4 MHz)					
Hardware/software watchdog timer	<ul style="list-style-type: none"> • 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 3 bytes of data.					
LIN-UART	<ul style="list-style-type: none"> • A wide range of communication speed can be selected by a dedicated reload timer. • It has a full duplex double buffer. • Both clock synchronous serial data transfer and clock asynchronous serial data transfer are enabled. • The LIN function can be used as a LIN master or a LIN slave. 					
8/10-bit A/D converter	6 channels 8-bit or 10-bit resolution can be selected.					
8/16-bit composite timer	2 channels <ul style="list-style-type: none"> • The timer can be configured as an "8-bit timer × 2 channels" or a "16-bit timer × 1 channel". • It has the following functions: interval timer function, PWC function, PWM function and input capture function. • Count clock: it can be selected from internal clocks (7 types) and external clocks. • It can output square wave. 					
External interrupt	6 channels <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 1-wire serial control • It supports serial writing (asynchronous mode). 					

Part number	MB95F562H	MB95F563H	MB95F564H	MB95F562K	MB95F563K	MB95F564K
Parameter						
Watch prescaler	Eight different time intervals can be selected.					
Flash memory	<ul style="list-style-type: none"> It supports automatic programming (Embedded Algorithm), and program/erase/erase-suspend/erase-resume commands. It has a flag indicating the completion of the operation of Embedded Algorithm. Flash security feature for protecting the content of the Flash memory 					
	Number of program/erase cycles		1000	10000	100000	
	Data retention time		20 years	10 years	5 years	
Standby mode	Sleep mode, stop mode, watch mode, time-base timer mode					
Package	LCC-32P-M19 FPT-20P-M09 FPT-20P-M10					

• MB95570H Series

Part number	MB95F572H	MB95F573H	MB95F574H	MB95F572K	MB95F573K	MB95F574K
Parameter						
Type	Flash memory product					
Clock supervisor counter	It supervises the main clock oscillation.					
Flash memory capacity	8 Kbyte	12 Kbyte	20 Kbyte	8 Kbyte	12 Kbyte	20 Kbyte
RAM capacity	240 bytes	496 bytes	496 bytes	240 bytes	496 bytes	496 bytes
Power-on reset	Yes					
Low-voltage detection reset	No			Yes		
Reset input	Dedicated			Selected through software		
CPU functions	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> I/O ports (Max) : 4 CMOS I/O : 3 N-ch open drain: 1 			<ul style="list-style-type: none"> I/O ports (Max) : 5 CMOS I/O : 3 N-ch open drain: 2 		
Time-base timer	Interval time: 0.256 ms to 8.3 s (external clock frequency = 4 MHz)					
Hardware/software watchdog timer	<ul style="list-style-type: none"> 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 3 bytes of data.					
LIN-UART	No LIN-UART					
8/10-bit A/D converter	2 channels 8-bit or 10-bit resolution can be selected.					

Part number	MB95F572H	MB95F573H	MB95F574H	MB95F572K	MB95F573K	MB95F574K								
Parameter														
8/16-bit composite timer	1 channel <ul style="list-style-type: none"> The timer can be configured as an "8-bit timer × 2 channels" or a "16-bit timer × 1 channel". It has the following functions: interval timer function, PWC function, PWM function and input capture function. Count clock: it can be selected from internal clocks (7 types) and external clocks. It can output square wave. 													
External interrupt	2 channels <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 1-wire serial control It supports serial writing (asynchronous mode). 													
Watch prescaler	Eight different time intervals can be selected.													
Flash memory	<ul style="list-style-type: none"> It supports automatic programming (Embedded Algorithm), and program/erase/erase-suspend/erase-resume commands. It has a flag indicating the completion of the operation of Embedded Algorithm. Flash security feature for protecting the content of the Flash memory <table border="1" data-bbox="337 873 1239 961"> <tr> <td>Number of program/erase cycles</td> <td>1000</td> <td>10000</td> <td>100000</td> </tr> <tr> <td>Data retention time</td> <td>20 years</td> <td>10 years</td> <td>5 years</td> </tr> </table>						Number of program/erase cycles	1000	10000	100000	Data retention time	20 years	10 years	5 years
Number of program/erase cycles	1000	10000	100000											
Data retention time	20 years	10 years	5 years											
Standby mode	Sleep mode, stop mode, watch mode, time-base timer mode													
Package	DIP-8P-M03 FPT-8P-M08													

• MB95580H Series

Part number	MB95F582H	MB95F583H	MB95F584H	MB95F582K	MB95F583K	MB95F584K
Parameter						
Type	Flash memory product					
Clock supervisor counter	It supervises the main clock oscillation.					
Flash memory capacity	8 Kbyte	12 Kbyte	20 Kbyte	8 Kbyte	12 Kbyte	20 Kbyte
RAM capacity	240 bytes	496 bytes	496 bytes	240 bytes	496 bytes	496 bytes
Power-on reset	Yes					
Low-voltage detection reset	No			Yes		
Reset input	Dedicated			Selected through software		
CPU functions	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> I/O ports (Max) : 12 CMOS I/O : 11 N-ch open drain: 1 			<ul style="list-style-type: none"> I/O ports (Max) : 13 CMOS I/O : 11 N-ch open drain: 2 		

Part number	MB95F582H	MB95F583H	MB95F584H	MB95F582K	MB95F583K	MB95F584K								
Parameter														
Time-base timer	Interval time: 0.256 ms to 8.3 s (external clock frequency = 4 MHz)													
Hardware/software watchdog timer	<ul style="list-style-type: none"> 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 3 bytes of data.													
LIN-UART	<ul style="list-style-type: none"> A wide range of communication speed can be selected by a dedicated reload timer. It has a full duplex double buffer. Both clock synchronous serial data transfer and clock asynchronous serial data transfer are enabled. The LIN function can be used as a LIN master or a LIN slave. 													
8/10-bit A/D converter	5 channels 8-bit or 10-bit resolution can be selected.													
8/16-bit composite timer	1 channel <ul style="list-style-type: none"> The timer can be configured as an "8-bit timer × 2 channels" or a "16-bit timer × 1 channel". It has the following functions: interval timer function, PWC function, PWM function and input capture function. Count clock: it can be selected from internal clocks (7 types) and external clocks. It can output square wave. 													
External interrupt	6 channels <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 1-wire serial control It supports serial writing (asynchronous mode). 													
Watch prescaler	Eight different time intervals can be selected.													
Flash memory	<ul style="list-style-type: none"> It supports automatic programming (Embedded Algorithm), and program/erase/erase-suspend/erase-resume commands. It has a flag indicating the completion of the operation of Embedded Algorithm. Flash security feature for protecting the content of the Flash memory <table border="1" data-bbox="337 1327 1239 1413"> <tr> <td>Number of program/erase cycles</td> <td>1000</td> <td>10000</td> <td>100000</td> </tr> <tr> <td>Data retention time</td> <td>20 years</td> <td>10 years</td> <td>5 years</td> </tr> </table>						Number of program/erase cycles	1000	10000	100000	Data retention time	20 years	10 years	5 years
Number of program/erase cycles	1000	10000	100000											
Data retention time	20 years	10 years	5 years											
Standby mode	Sleep mode, stop mode, watch mode, time-base timer mode													
Package	LCC-32P-M19 FPT-16P-M08 FPT-16P-M23													

2. Packages And Corresponding Products

• MB95560H Series

Part number / Package	MB95F562H	MB95F562K	MB95F563H	MB95F563K	MB95F564H	MB95F564K
LCC-32P-M19	O	O	O	O	O	O
FPT-20P-M09	O	O	O	O	O	O
FPT-20P-M10	O	O	O	O	O	O
FPT-16P-M08	X	X	X	X	X	X
FPT-16P-M23	X	X	X	X	X	X
DIP-8P-M03	X	X	X	X	X	X
FPT-8P-M08	X	X	X	X	X	X

• MB95570H Series

Part number / Package	MB95F572H	MB95F572K	MB95F573H	MB95F573K	MB95F574H	MB95F574K
LCC-32P-M19	X	X	X	X	X	X
FPT-20P-M09	X	X	X	X	X	X
FPT-20P-M10	X	X	X	X	X	X
FPT-16P-M08	X	X	X	X	X	X
FPT-16P-M23	X	X	X	X	X	X
DIP-8P-M03	O	O	O	O	O	O
FPT-8P-M08	O	O	O	O	O	O

• MB95580H Series

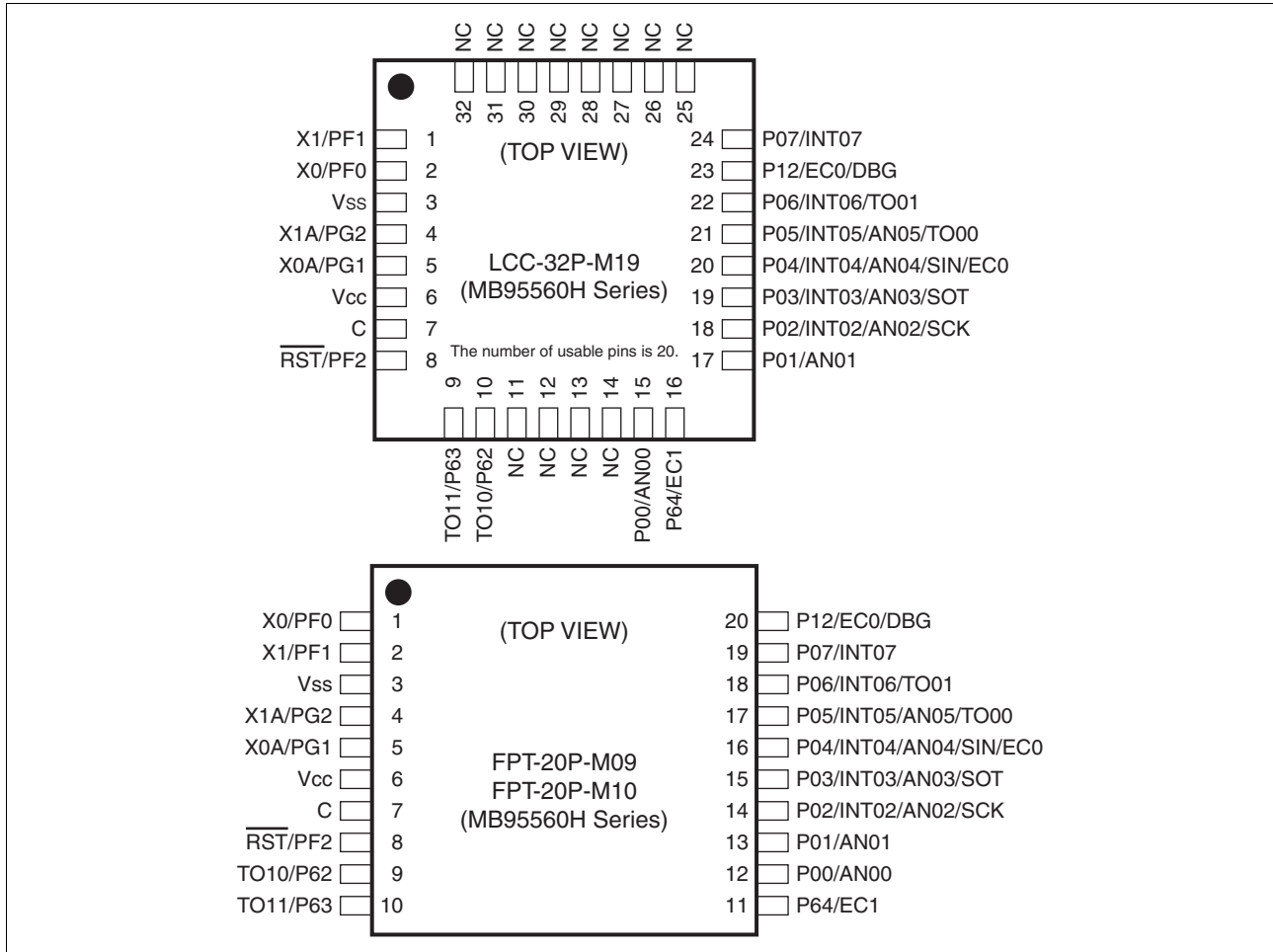
Part number / Package	MB95F582H	MB95F582K	MB95F583H	MB95F583K	MB95F584H	MB95F584K
LCC-32P-M19	O	O	O	O	O	O
FPT-20P-M09	X	X	X	X	X	X
FPT-20P-M10	X	X	X	X	X	X
FPT-16P-M08	O	O	O	O	O	O
FPT-16P-M23	O	O	O	O	O	O
DIP-8P-M03	X	X	X	X	X	X
FPT-8P-M08	X	X	X	X	X	X

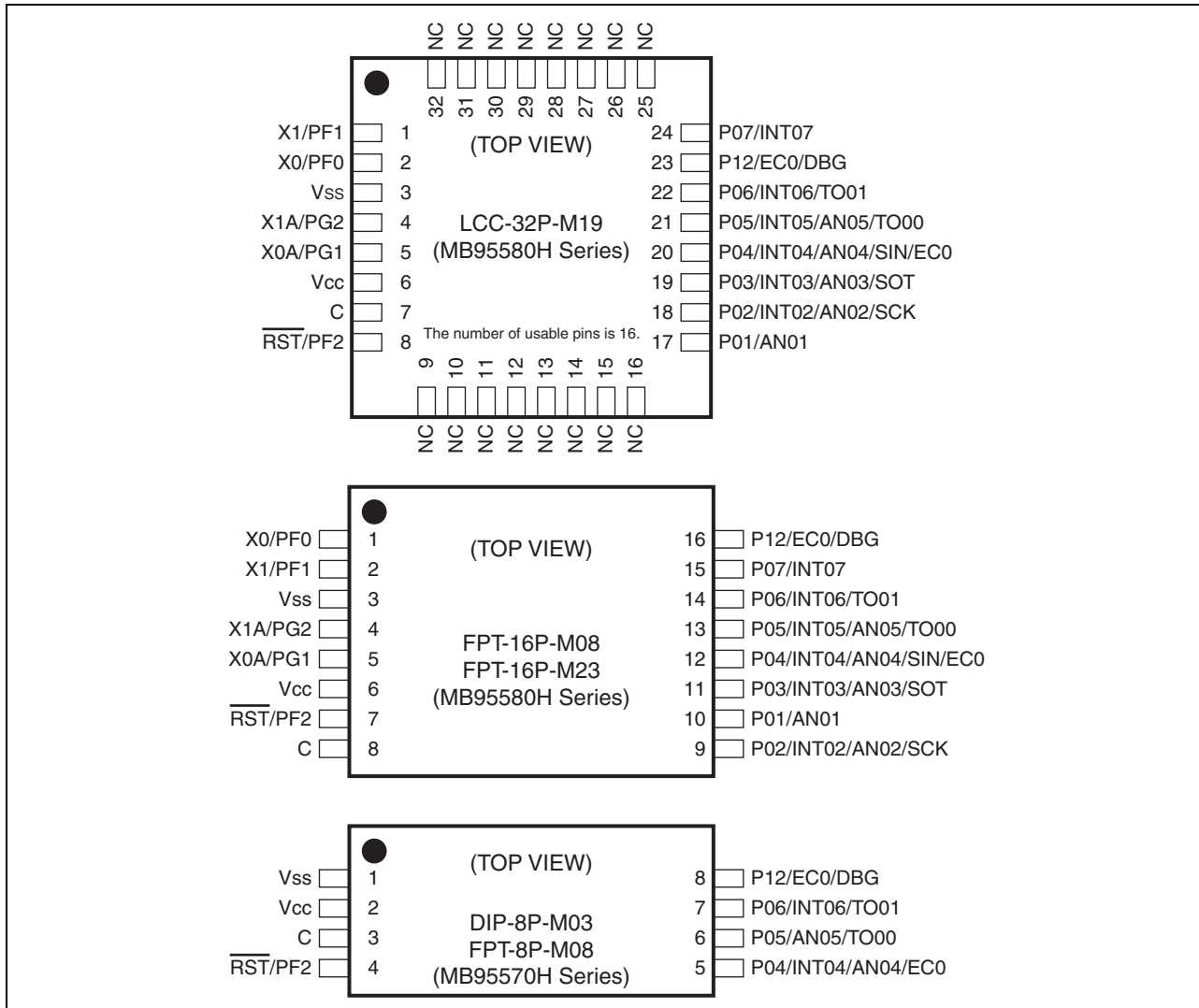
O: Available
X: Unavailable

3. Differences Among Products And Notes On Product Selection

- **Current consumption**
When using the on-chip debug function, take account of the current consumption of Flash memory program/erase.
For details of current consumption, see “Electrical Characteristics”.
- **Package**
For details of information on each package, see “Packages And Corresponding Products” and “Package Dimension”.
- **Operating voltage**
The operating voltage varies, depending on whether the on-chip debug function is used or not.
For details of the operating voltage, see “Electrical Characteristics”.
- **On-chip debug function**
The on-chip debug function requires that V_{CC} , V_{SS} and one serial wire be connected to an evaluation tool. For details of the connection method, refer to “CHAPTER 21 EXAMPLE OF SERIAL PROGRAMMING CONNECTION” in “New 8FX MB95560H/570H/580H Series Hardware Manual”.

4. Pin Assignment





5. Pin Functions (MB95560H Series, 32 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
2	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
3	V _{ss}	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	V _{cc}	—	Power supply pin
7	C	—	Decoupling capacitor connection pin
8	PF2	A	General-purpose I/O port
	$\overline{\text{RST}}$		Reset pin Dedicated reset pin on MB95F562H/F563H/F564H
9	P63	E	General-purpose I/O port
	TO11		High-current pin 8/16-bit composite timer ch. 1 output pin
10	P62	E	General-purpose I/O port
	TO10		High-current pin 8/16-bit composite timer ch. 1 output pin
11	NC	—	It is an internally connected pin. Always leave it unconnected.
12			
13			
14			
15	P00	D	General-purpose I/O port
	AN00		High-current pin A/D converter analog input pin
16	P64	E	General-purpose I/O port
	EC1		High-current pin 8/16-bit composite timer ch. 1 clock input pin
17	P01	D	General-purpose I/O port
	AN01		High-current pin A/D converter analog input pin
18	P02	D	General-purpose I/O port
	INT02		High-current pin External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin

Pin no.	Pin name	I/O circuit type*	Function
19	P03	D	General-purpose I/O port High-current pin
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin
20	P04	D	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
21	P05	D	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
22	P06	E	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
23	P12	F	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin
24	P07	E	General-purpose I/O port High-current pin
	INT07		External interrupt input pin
25	NC	—	It is an internally connected pin. Always leave it unconnected.
26			
27			
28			
29			
30			
31			
32			

*: For the I/O circuit types, see "I/O Circuit Type".

6. Pin Functions (MB95560H Series, 20 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
2	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
3	V _{ss}	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	V _{cc}	—	Power supply pin
7	C	—	Decoupling capacitor connection pin
8	PF2	A	General-purpose I/O port
	$\overline{\text{RST}}$		Reset pin Dedicated reset pin on MB95F562H/F563H/F564H
9	P62	E	General-purpose I/O port
	TO10		High-current pin 8/16-bit composite timer ch. 1 output pin
10	P63	E	General-purpose I/O port
	TO11		High-current pin 8/16-bit composite timer ch. 1 output pin
11	P64	E	General-purpose I/O port
	EC1		High-current pin 8/16-bit composite timer ch. 1 clock input pin
12	P00	D	General-purpose I/O port
	AN00		High-current pin A/D converter analog input pin
13	P01	D	General-purpose I/O port
	AN01		High-current pin A/D converter analog input pin
14	P02	D	General-purpose I/O port
	INT02		High-current pin External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin
15	P03	D	General-purpose I/O port
	INT03		High-current pin External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin

Pin no.	Pin name	I/O circuit type*	Function
16	P04	D	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
17	P05	D	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
18	P06	E	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
19	P07	E	General-purpose I/O port High-current pin
	INT07		External interrupt input pin
20	P12	F	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin

*: For the I/O circuit types, see "I/O Circuit Type".

7. Pin Functions (MB95570H Series, 8 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	V _{ss}	—	Power supply pin (GND)
2	V _{cc}	—	Power supply pin
3	C	—	Decoupling capacitor connection pin
4	PF2	A	General-purpose I/O port
	$\overline{\text{RST}}$		Reset pin Dedicated reset pin on MB95F572H/F573H/F574H
5	P04	D	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
6	P05	D	General-purpose I/O port High-current pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
7	P06	E	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
8	P12	F	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin

*: For the I/O circuit types, see “I/O Circuit Type”.

8. Pin Functions (MB95580H Series, 32 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
2	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
3	V _{ss}	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	V _{cc}	—	Power supply pin
7	C	—	Decoupling capacitor connection pin
8	PF2	A	General-purpose I/O port
	$\overline{\text{RST}}$		Reset pin Dedicated reset pin on MB95F582H/F583H/F584H
9	NC	—	It is an internally connected pin. Always leave it unconnected.
10			
11			
12			
13			
14			
15			
16			
17	P01	D	General-purpose I/O port High-current pin
	AN01		A/D converter analog input pin
18	P02	D	General-purpose I/O port High-current pin
	INT02		External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin
19	P03	D	General-purpose I/O port High-current pin
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin

Pin no.	Pin name	I/O circuit type*	Function
20	P04	D	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
21	P05	D	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
22	P06	E	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
23	P12	F	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin
24	P07	E	General-purpose I/O port High-current pin
	INT07		External interrupt input pin
25	NC	—	It is an internally connected pin. Always leave it unconnected.
26			
27			
28			
29			
30			
31			
32			

*: For the I/O circuit types, see "I/O Circuit Type".

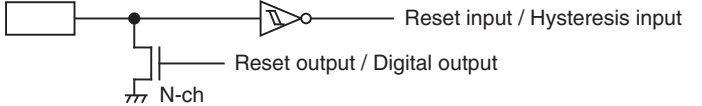
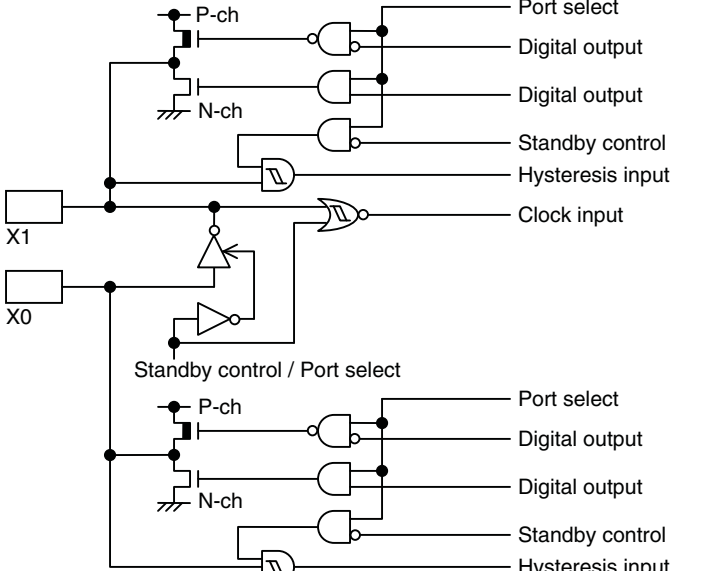
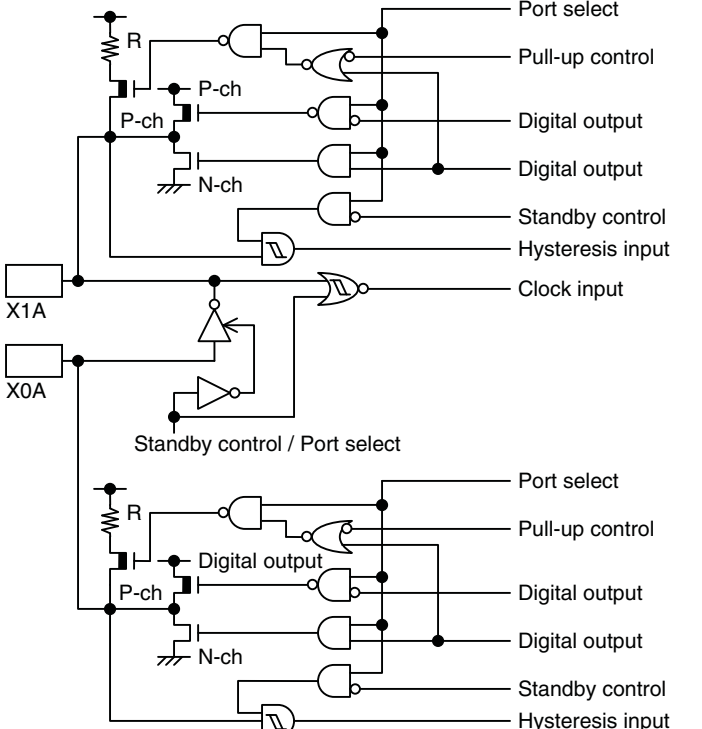
9. Pin Functions (MB95580H Series, 16 pins)

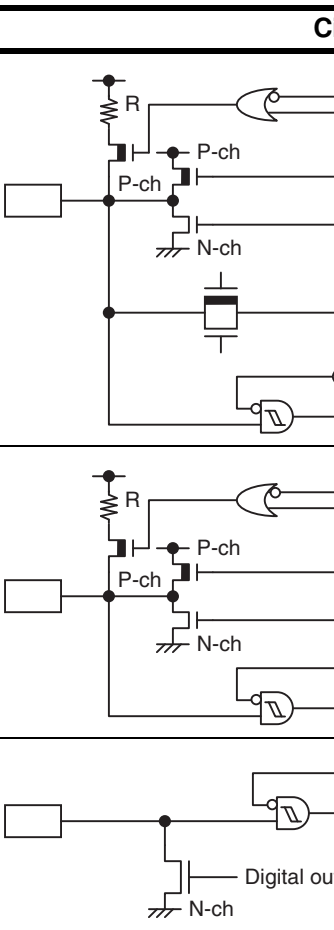
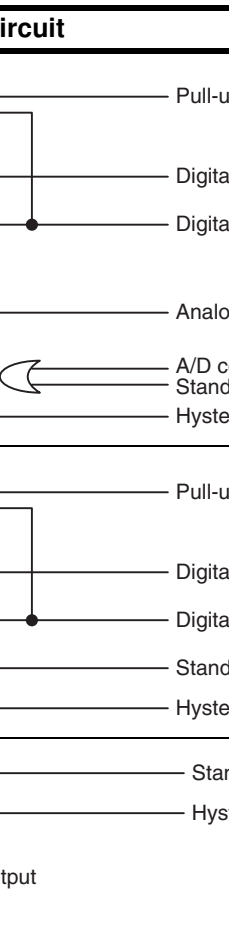
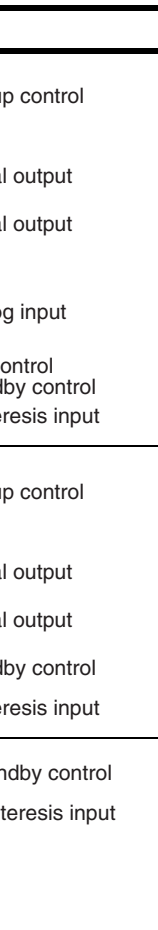
Pin no.	Pin name	I/O circuit type*	Function
1	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
2	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
3	V _{ss}	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	V _{cc}	—	Power supply pin
7	PF2	A	General-purpose I/O port
	$\overline{\text{RST}}$		Reset pin Dedicated reset pin on MB95F582H/F583H/F584H
8	C	—	Decoupling capacitor connection pin
9	P02	D	General-purpose I/O port High-current pin
	INT02		External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin
10	P01	D	General-purpose I/O port High-current pin
	AN01		A/D converter analog input pin
11	P03	D	General-purpose I/O port High-current pin
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin
12	P04	D	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin

Pin no.	Pin name	I/O circuit type*	Function
13	P05	D	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
14	P06	E	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
15	P07	E	General-purpose I/O port High-current pin
	INT07		External interrupt input pin
16	P12	F	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin

*: For the I/O circuit types, see "I/O Circuit Type".

10. I/O Circuit Type

Type	Circuit	Remarks
A		<ul style="list-style-type: none"> • N-ch open drain output • Hysteresis input • Reset output
B		<ul style="list-style-type: none"> • Oscillation circuit • High-speed side Feedback resistance: approx. 1 MΩ • CMOS output • Hysteresis input
C		<ul style="list-style-type: none"> • Oscillation circuit • Low-speed side Feedback resistance: approx. 10 MΩ • CMOS output • Hysteresis input • Pull-up control available

Type	Circuit	Remarks
D		<ul style="list-style-type: none"> • CMOS output • Hysteresis input • Pull-up control available • Analog input
E		<ul style="list-style-type: none"> • CMOS output • Hysteresis input • Pull-up control available
F		<ul style="list-style-type: none"> • N-ch open drain output • Hysteresis input

11. Handling Precautions

Any semiconductor devices have inherently a certain rate of failure. The possibility of failure is greatly affected by the conditions in which they are used (circuit conditions, environmental conditions, etc.). This page describes precautions that must be observed to minimize the chance of failure and to obtain higher reliability from your Cypress semiconductor devices.

11.1 Precautions for Product Design

This section describes precautions when designing electronic equipment using semiconductor devices.

• Absolute Maximum Ratings

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

• Recommended Operating Conditions

Recommended operating conditions are normal operating ranges for the semiconductor device. All the device's electrical characteristics are warranted when operated within these ranges.

Always use semiconductor devices within the recommended operating conditions. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their sales representative beforehand.

- **Processing and Protection of Pins**

These precautions must be followed when handling the pins which connect semiconductor devices to power supply and input/output functions.

- (1) Preventing Over-Voltage and Over-Current Conditions

Exposure to voltage or current levels in excess of maximum ratings at any pin is likely to cause deterioration within the device, and in extreme cases leads to permanent damage of the device. Try to prevent such overvoltage or over-current conditions at the design stage.

- (2) Protection of Output Pins

Shorting of output pins to supply pins or other output pins, or connection to large capacitance can cause large current flows. Such conditions if present for extended periods of time can damage the device.

Therefore, avoid this type of connection.

- (3) Handling of Unused Input Pins

Unconnected input pins with very high impedance levels can adversely affect stability of operation. Such pins should be connected through an appropriate resistance to a power supply pin or ground pin.

- **Latch-up**

Semiconductor devices are constructed by the formation of P-type and N-type areas on a substrate. When subjected to abnormally high voltages, internal parasitic PNPN junctions (called thyristor structures) may be formed, causing large current levels in excess of several hundred mA to flow continuously at the power supply pin. This condition is called latch-up.

CAUTION: The occurrence of latch-up not only causes loss of reliability in the semiconductor device, but can cause injury or damage from high heat, smoke or flame. To prevent this from happening, do the following:

- (1) Be sure that voltages applied to pins do not exceed the absolute maximum ratings. This should include attention to abnormal noise, surge levels, etc.

- (2) Be sure that abnormal current flows do not occur during the power-on sequence.

- **Observance of Safety Regulations and Standards**

Most countries in the world have established standards and regulations regarding safety, protection from electromagnetic interference, etc. Customers are requested to observe applicable regulations and standards in the design of products.

- **Fail-Safe Design**

Any semiconductor devices have inherently a certain rate of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

- **Precautions Related to Usage of Devices**

Cypress semiconductor devices are intended for use in standard applications (computers, office automation and other office equipment, industrial, communications, and measurement equipment, personal or household devices, etc.).

CAUTION: Customers considering the use of our products in special applications where failure or abnormal operation may directly affect human lives or cause physical injury or property damage, or where extremely high levels of reliability are demanded (such as aerospace systems, atomic energy controls, sea floor repeaters, vehicle operating controls, medical devices for life support, etc.) are requested to consult with sales representatives before such use. The company will not be responsible for damages arising from such use without prior approval.

11.2 Precautions for Package Mounting

Package mounting may be either lead insertion type or surface mount type. In either case, for heat resistance during soldering, you should only mount under Cypress's recommended conditions. For detailed information about mount conditions, contact your sales representative.

• Lead Insertion Type

Mounting of lead insertion type packages onto printed circuit boards may be done by two methods: direct soldering on the board, or mounting by using a socket.

Direct mounting onto boards normally involves processes for inserting leads into through-holes on the board and using the flow soldering (wave soldering) method of applying liquid solder. In this case, the soldering process usually causes leads to be subjected to thermal stress in excess of the absolute ratings for storage temperature. Mounting processes should conform to Cypress recommended mounting conditions.

If socket mounting is used, differences in surface treatment of the socket contacts and IC lead surfaces can lead to contact deterioration after long periods. For this reason it is recommended that the surface treatment of socket contacts and IC leads be verified before mounting.

• Surface Mount Type

Surface mount packaging has longer and thinner leads than lead-insertion packaging, and therefore leads are more easily deformed or bent. The use of packages with higher pin counts and narrower pin pitch results in increased susceptibility to open connections caused by deformed pins, or shorting due to solder bridges.

You must use appropriate mounting techniques. Cypress recommends the solder reflow method, and has established a ranking of mounting conditions for each product. Users are advised to mount packages in accordance with Cypress ranking of recommended conditions.

• Lead-Free Packaging

CAUTION: When ball grid array (BGA) packages with Sn-Ag-Cu balls are mounted using Sn-Pb eutectic soldering, junction strength may be reduced under some conditions of use.

• Storage of Semiconductor Devices

Because plastic chip packages are formed from plastic resins, exposure to natural environmental conditions will cause absorption of moisture. During mounting, the application of heat to a package that has absorbed moisture can cause surfaces to peel, reducing moisture resistance and causing packages to crack. To prevent, do the following:

- (1) Avoid exposure to rapid temperature changes, which cause moisture to condense inside the product. Store products in locations where temperature changes are slight.
- (2) Use dry boxes for product storage. Products should be stored below 70% relative humidity, and at temperatures between 5°C and 30°C.
When you open Dry Package that recommends humidity 40% to 70% relative humidity.
- (3) When necessary, Cypress packages semiconductor devices in highly moisture-resistant aluminum laminate bags, with a silica gel desiccant. Devices should be sealed in their aluminum laminate bags for storage.
- (4) Avoid storing packages where they are exposed to corrosive gases or high levels of dust.

• Baking

Packages that have absorbed moisture may be de-moisturized by baking (heat drying). Follow the Cypress recommended conditions for baking.

Condition: 125°C/24 h

• Static Electricity

Because semiconductor devices are particularly susceptible to damage by static electricity, you must take the following precautions:

- (1) Maintain relative humidity in the working environment between 40% and 70%.
Use of an apparatus for ion generation may be needed to remove electricity.
- (2) Electrically ground all conveyors, solder vessels, soldering irons and peripheral equipment.
- (3) Eliminate static body electricity by the use of rings or bracelets connected to ground through high resistance (on the level of 1 M Ω).
Wearing of conductive clothing and shoes, use of conductive floor mats and other measures to minimize shock loads is recommended.
- (4) Ground all fixtures and instruments, or protect with anti-static measures.
- (5) Avoid the use of styrofoam or other highly static-prone materials for storage of completed board assemblies.

11.3 Precautions for Use Environment

Reliability of semiconductor devices depends on ambient temperature and other conditions as described above.

For reliable performance, do the following:

(1) Humidity

Prolonged use in high humidity can lead to leakage in devices as well as printed circuit boards. If high humidity levels are anticipated, consider anti-humidity processing.

(2) Discharge of Static Electricity

When high-voltage charges exist close to semiconductor devices, discharges can cause abnormal operation. In such cases, use anti-static measures or processing to prevent discharges.

(3) Corrosive Gases, Dust, or Oil

Exposure to corrosive gases or contact with dust or oil may lead to chemical reactions that will adversely affect the device. If you use devices in such conditions, consider ways to prevent such exposure or to protect the devices.

(4) Radiation, Including Cosmic Radiation

Most devices are not designed for environments involving exposure to radiation or cosmic radiation. Users should provide shielding as appropriate.

(5) Smoke, Flame

CAUTION: Plastic molded devices are flammable, and therefore should not be used near combustible substances. If devices begin to smoke or burn, there is danger of the release of toxic gases.

Customers considering the use of Cypress products in other special environmental conditions should consult with sales representatives.

12. Notes On Device Handling

• Preventing latch-ups

When using the device, ensure that the voltage applied does not exceed the maximum voltage rating.

In a CMOS IC, if a voltage higher than V_{CC} or a voltage lower than V_{SS} is applied to an input/output pin that is neither a medium-withstand voltage pin nor a high-withstand voltage pin, or if a voltage out of the rating range of power supply voltage mentioned in "24.1 Absolute Maximum Ratings" of "Electrical Characteristics" is applied to the V_{CC} pin or the V_{SS} pin, a latch-up may occur.

When a latch-up occurs, power supply current increases significantly, which may cause a component to be thermally destroyed.

• Stabilizing supply voltage

Supply voltage must be stabilized.

A malfunction may occur when power supply voltage fluctuates rapidly even though the fluctuation is within the guaranteed operating range of the V_{CC} power supply voltage.

As a rule of voltage stabilization, suppress voltage fluctuation so that the fluctuation in V_{CC} ripple (p-p value) at the commercial frequency (50 Hz/60 Hz) does not exceed 10% of the standard V_{CC} value, and the transient fluctuation rate does not exceed 0.1 V/ms at a momentary fluctuation such as switching the power supply.

- Notes on using the external clock
When an external clock is used, oscillation stabilization wait time is required for power-on reset, wake-up from subclock mode or stop mode.

13. Pin Connection

- Treatment of unused pins
If an unused input pin is left unconnected, a component may be permanently damaged due to malfunctions or latch-ups. Always pull up or pull down an unused input pin through a resistor of at least 2 k Ω . Set an unused input/output pin to the output state and leave it unconnected, or set it to the input state and treat it the same as an unused input pin. If there is an unused output pin, leave it unconnected.
- Power supply pins
To reduce unnecessary electro-magnetic emission, prevent malfunctions of strobe signals due to an increase in the ground level, and conform to the total output current standard, always connect the V_{CC} pin and the V_{SS} pin to the power supply and ground outside the device. In addition, connect the current supply source to the V_{CC} pin and the V_{SS} pin with low impedance.
It is also advisable to connect a ceramic capacitor of approximately 0.1 μF as a decoupling capacitor between the V_{CC} pin and the V_{SS} pin at a location close to this device.
- DBG pin
Connect the DBG pin to an external pull-up resistor of 2 k Ω or above.
After power-on, ensure that the DBG pin does not stay at "L" level until the reset output is released.
The DBG pin becomes a communication pin in debug mode. Since the actual pull-up resistance depends on the tool used and the interconnection length, refer to the tool document when selecting a pull-up resistor.
- $\overline{\text{RST}}$ pin
Connect the $\overline{\text{RST}}$ pin to an external pull-up resistor of 2 k Ω or above.
To prevent the device from unintentionally entering the reset mode due to noise, minimize the interconnection length between a pull-up resistor and the $\overline{\text{RST}}$ pin and that between a pull-up resistor and the V_{CC} pin when designing the layout of the printed circuit board.
The PF2/ $\overline{\text{RST}}$ pin functions as the reset input/output pin after power-on. In addition, the reset output of the PF2/ $\overline{\text{RST}}$ pin can be enabled by the RSTOE bit in the SYSC register, and the reset input function and the general purpose I/O function can be selected by the RSTEN bit in the SYSC register.
- C pin
Use a ceramic capacitor or a capacitor with equivalent frequency characteristics. The decoupling capacitor for the V_{CC} pin must have a capacitance equal to or larger than the capacitance of C_s . For the connection to a decoupling capacitor C_s , see the diagram below. To prevent the device from unintentionally entering a mode to which the device is not set to transit due to noise, minimize the distance between the C pin and C_s and the distance between C_s and the V_{SS} pin when designing the layout of a printed circuit board.