SONY

CXP81120/81124

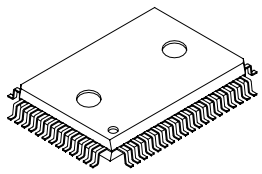
CMOS 8-bit Single Chip Microcomputer

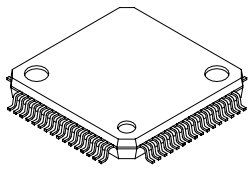
Description

The CXP81120/81124 is a CMOS 8-bit microcomputer which consists of A/D converter, serial interface, timer/counter, time base timer, PWM output, as well as basic configurations like 8-bit CPU, ROM, RAM and I/O port. They are integrated into a single chip.

Also the CXP81120/81124 provides power-on reset function, sleep/stop function which enables to lower power consumption.

64 pin QFP (Plastic) 64 pin LQFP (Plastic)





Features

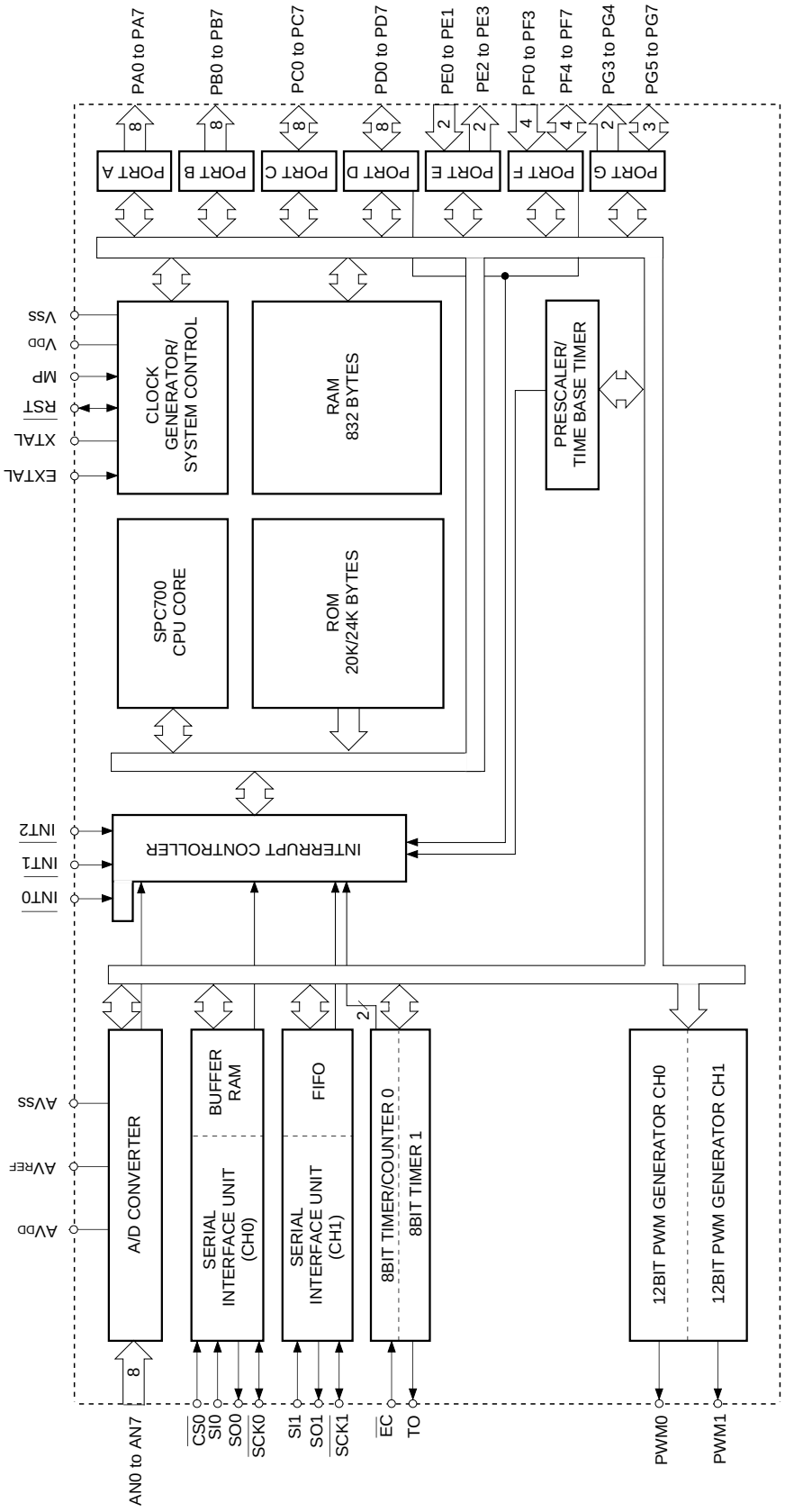
- A wide instruction set (213 instructions) which covers various types of data
  - — 16-bit operation/multiplication and division/Boolean bit operation instructions
- Minimum instruction cycle 250ns at 16MHz operation (4.5 to 5.5V)
  333ns at 12MHz operation (3.0 to 5.5V)
- Incorporated ROM capacity 20K bytes (CXP81120)
  24K bytes (CXP81124)
- Incorporated RAM capacity 832 bytes
- Peripheral functions
  - — A/D converter 8-bit, 8-channel, successive approximation system
    (Conversion time: 20µs at 16MHz)
  - — Serial interface Incorporated buffer RAM (1 to 32 bytes auto transfer), 1 channel
    Incorporated 8-bit and 8-stage FIFO
    (1 to 8 bytes auto transfer), 1 channel
  - — Timer 8-bit timer, 8-bit timer/counter, 19-bit time base timer
  - — PWM output 12 bits, 2 channels
- Interruption 10 factors, 10 vectors, multi-interruption possible
- Standby mode Sleep/stop
- Package 64-pin plastic QFP/LQFP
- Piggyback/evaluator CXP81100 64-pin ceramic PQFP

Structure

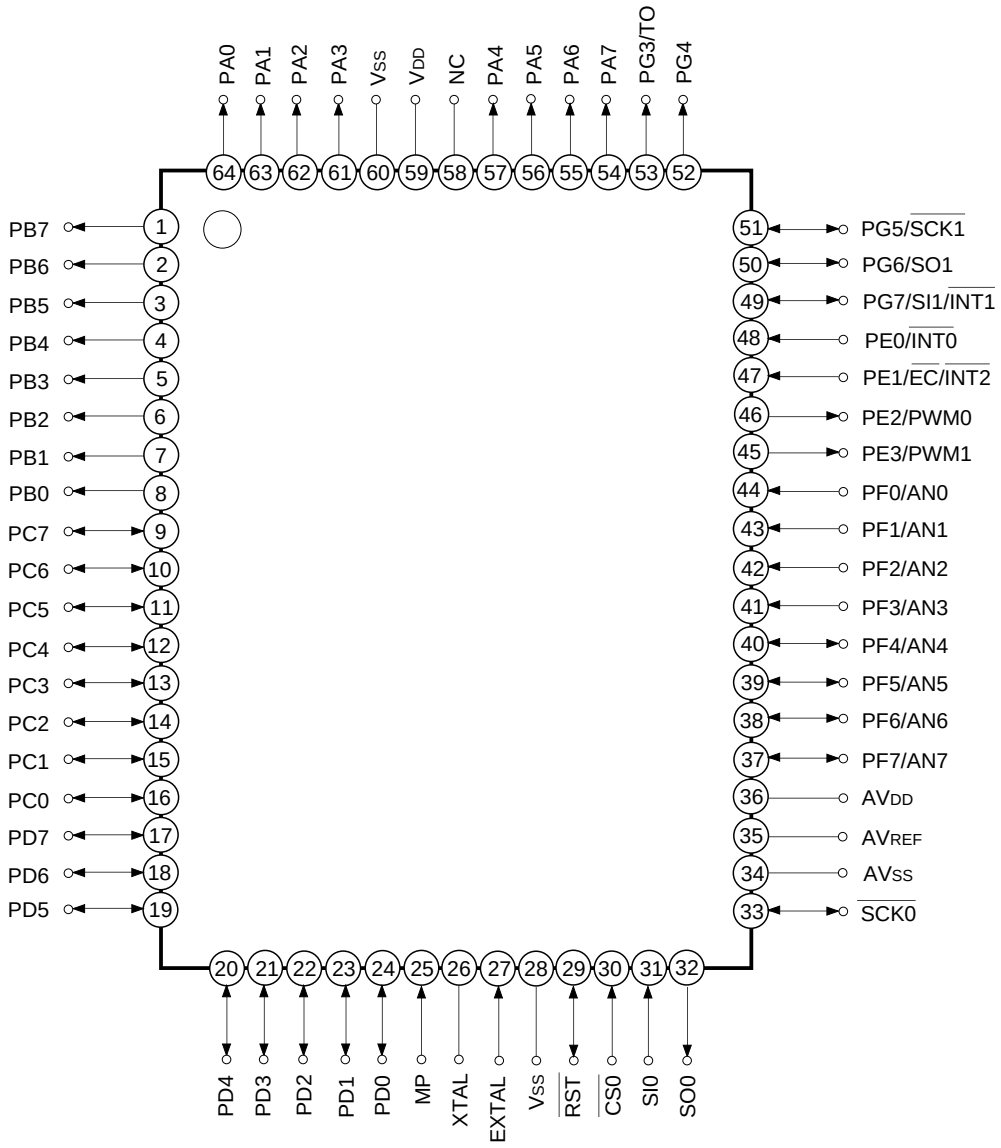
Silicon gate CMOS IC

E94414B16-PS

Block Diagram

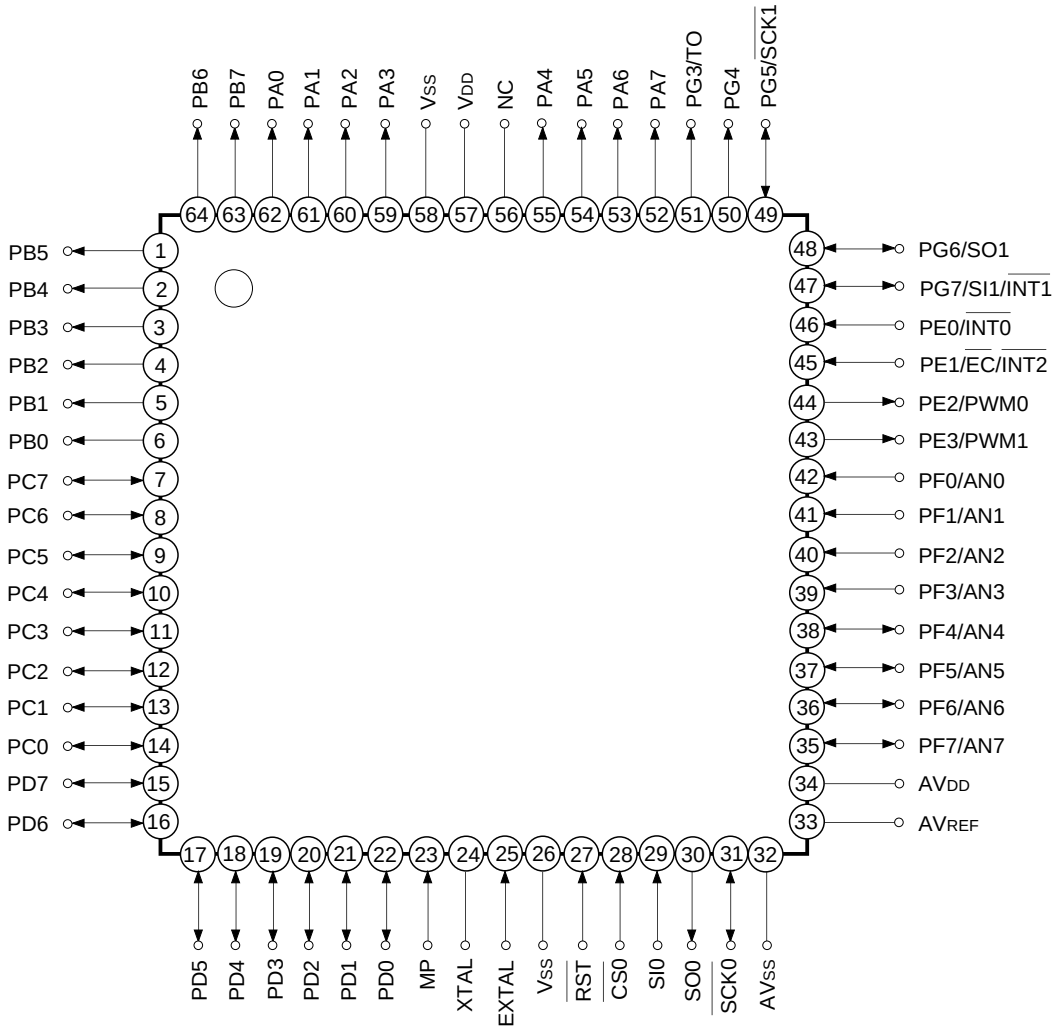


Pin Configuration (Top View) **64-pin QFP**



Note) 1. NC (Pin 58) is always connected to V_{DD}.
2. Vss (Pins 28 and 60) are both connected to GND.
3. MP (Pin 25) is always connected to GND.

Pin Configuration (Top View) **64-pin LQFP**



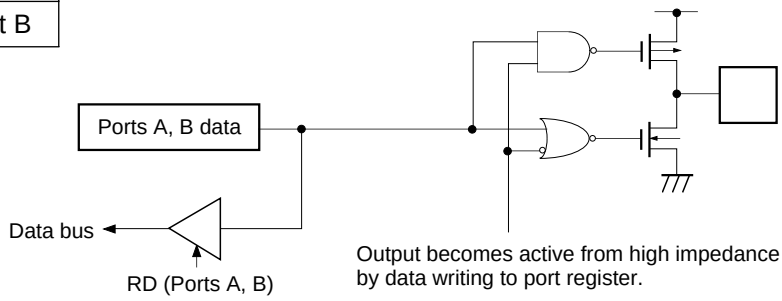
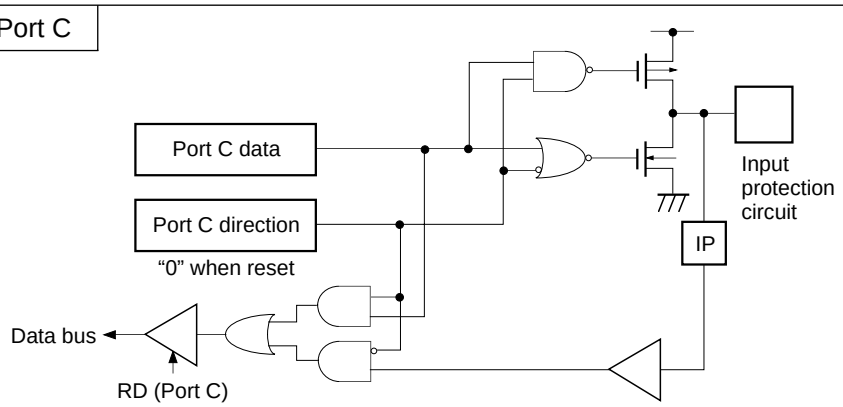
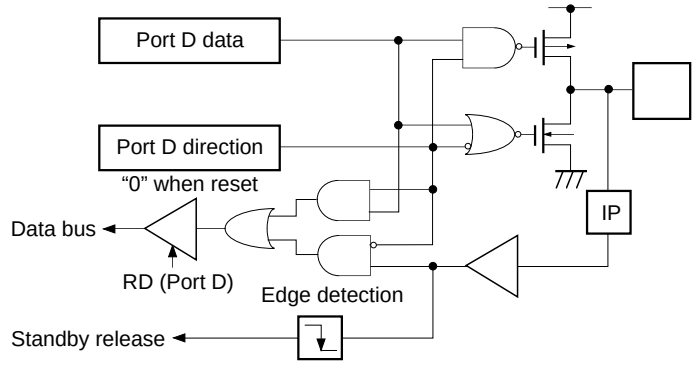
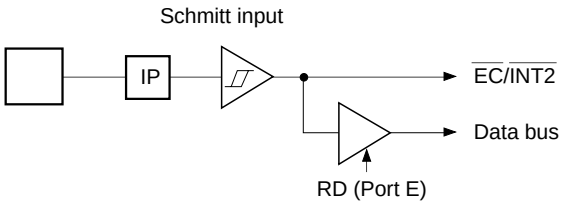
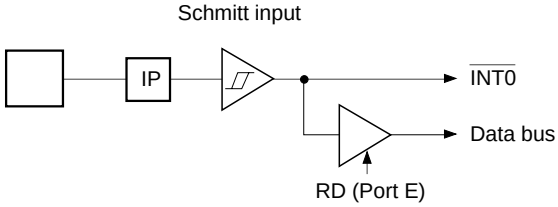
Note) 1. NC (Pin 56) is always connected to V_{DD}.
2. Vss (Pins 26 and 58) are both connected to GND.
3. MP (Pin 23) is always connected to GND.

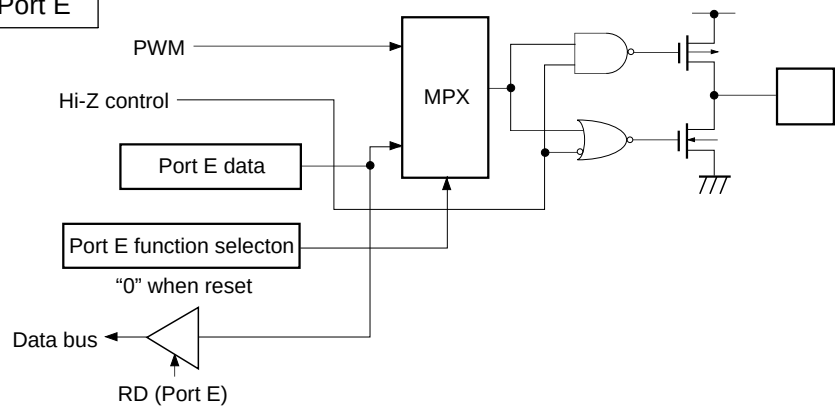
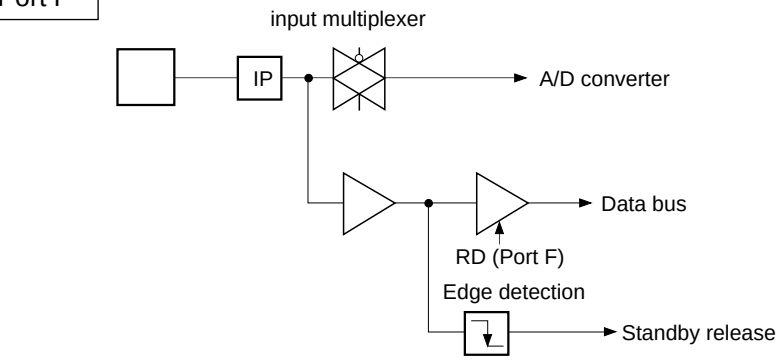
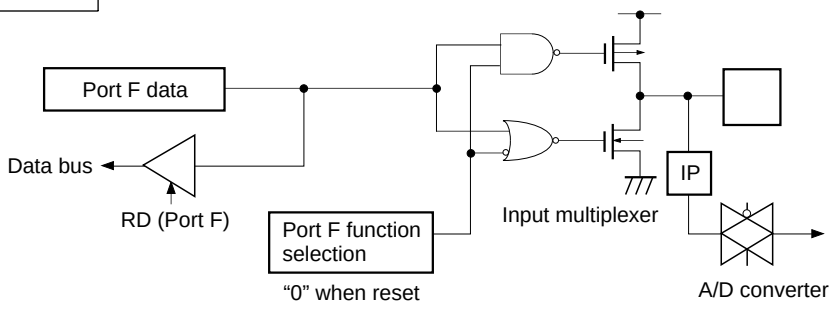
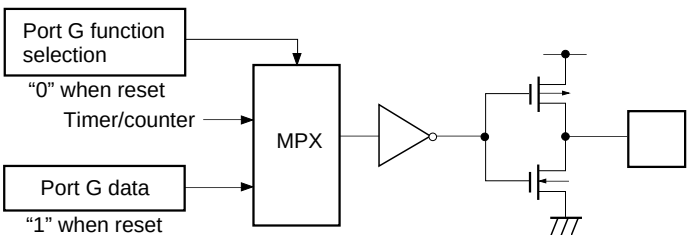
Pin Description

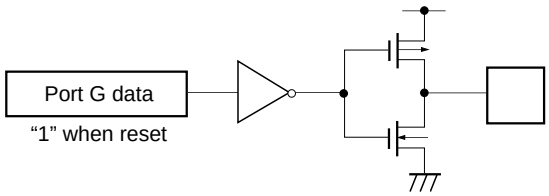
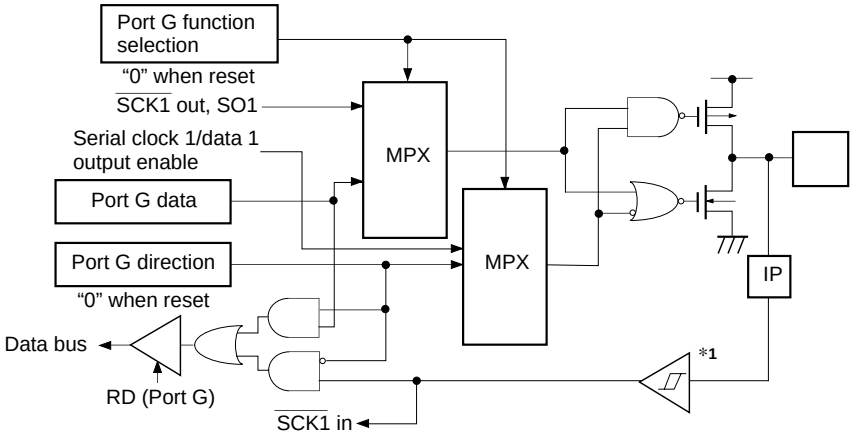
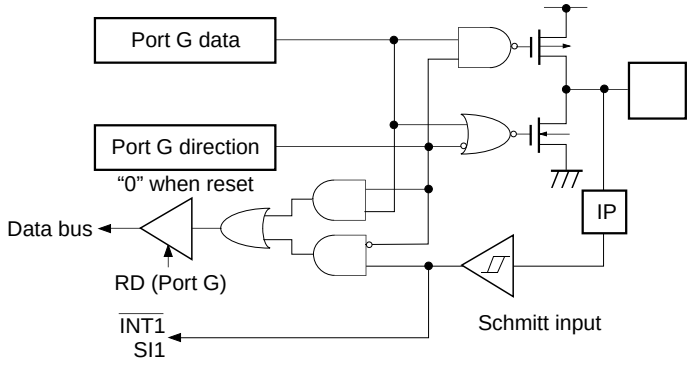
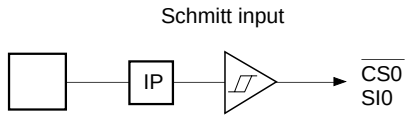
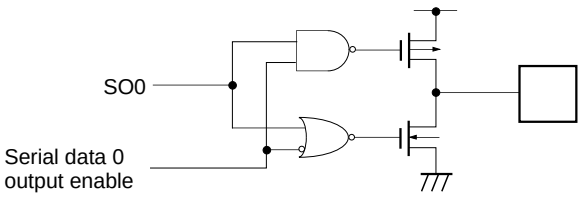
Symbol	I/O	Description		
PA0 to PA7	Output	(Port A) 8-bit output port. (8 pins)		
PB0 to PB7	Output	(Port B) 8-bit output port. (8 pins)		
PC0 to PC7	I/O	(Port C) 8-bit I/O port. I/O can be set in a unit of single bits. (8 pins)		
PD0 to PD7	I/O	(Port D) 8-bit I/O port. I/O and function as standby release input can be set in a unit of single bits. (8 pins)		
PE0/$\overline{INT0}$	Input/Input	(Port E) 4-bit port. Lower 2 bits are for input; upper 2 bits are for output. (4 pins)	Input to request external interruption. Active at the falling edge. (2 pins)	
PE1/$\overline{EC}$/$\overline{INT2}$	Input/Input/ Input		External event input for timer/counter.	
PE2/PWM0	Output/Output		12-bit PWM output. (2 pins)	
PE3/PWM1	Output/Output			
PF0/AN0 to PF3/AN3	Input/Input	(Port F) 8-bit port. Lower 4 bits are for input; upper 4 bits are for output. Lower 4 bits also serve as standby release input. (8 pins)		Analog input to A/D converter. (8 pins)
PF4/AN4 to PF7/AN7	Output/Input			
$\overline{SCK0}$	I/O	Serial clock (CH0) I/O.		
SO0	Output	Serial data (CH0) output.		
SI0	Input	Serial data (CH0) input.		
$\overline{CS0}$	Input	Serial interface (CH0) chip select input.		
PG3/TO	Output/Output	(Port G) 5-bit port. Lower 2 bits are for output; upper 3 bits are for I/O. I/O can be set in a unit of single bits. (5 pins)	Timer/counter rectangular wave output.	
PG4	Output			
PG5/$\overline{SCK1}$	I/O/I/O		Serial clock (CH1) I/O.	
PG6/SO1	I/O/Output		Serial data (CH1) output.	
PG7/SI1/$\overline{INT1}$	I/O/Input Input		Serial data (CH1) input.	Input to request external interruption. Active at the falling edge.
EXTAL	Input	Connects a crystal oscillator for system clock. When supplying the external clock, input the external clock to EXTAL pin and input opposite phase clock to XTAL pin.		
XTAL	Output			
$\overline{RST}$	I/O	System reset; active at Low level. $\overline{RST}$ pin is I/O pin, which outputs “Low” level by incorporated power-on reset function when power turns on. (Mask option)		

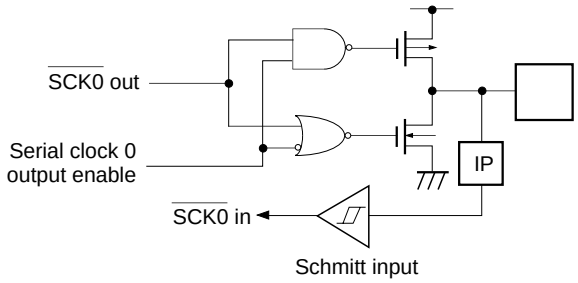
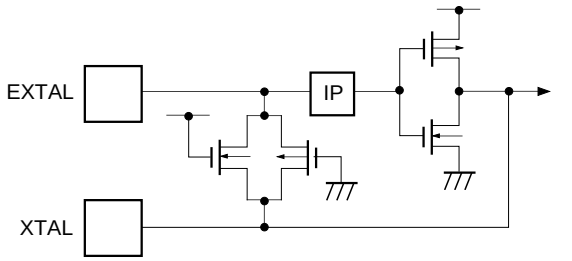
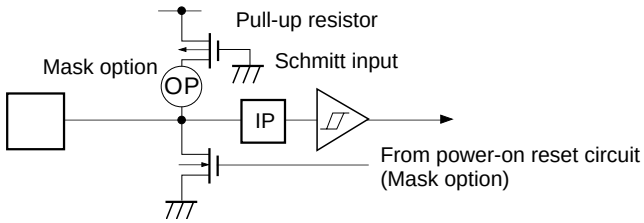
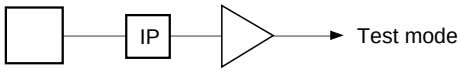
Symbol	I/O	Description
NC		NC pin. Connect to V_{DD} for normal operation.
MP	Input	Test mode pin. Always connect to GND.
AV_{DD}		Positive power supply of A/D converter.
AV_{REF}	Input	Reference voltage input of A/D converter.
AV_{SS}		GND of A/D converter.
V_{DD}		Positive power supply.
V_{SS}		GND. Connect both Vss pins to GND.

Input/Output Circuit Formats for Pins

Pin	Circuit format	When reset
PA0 to PA7 PB0 to PB7 16 pins	Port A Port B 	Hi-Z
PC0 to PC7 8 pins	Port C 	Hi-Z
PD0 to PD7 8 pins	Port D 	Hi-Z
PE0/$\overline{\text{INT0}}$ 1 pin	Port E 	Hi-Z
PE1/$\overline{\text{EC}}$/$\overline{\text{INT2}}$ 1 pin	Port E 	Hi-Z

Pin	Circuit format	When reset
PE2/PWM0 PE3/PWM1 2 pins	Port E 	Hi-Z
PF0/AN0 to PF3/AN3 4 pins	Port F 	Hi-Z
PF4/AN4 to PF7/AN7 4 pins	Port F 	Hi-Z
PG3/TO 1 pin	Port G 	High level

Pin	Circuit format	When reset
PG4 1 pin	Port G 	H level
PG5/$\overline{\text{SCK1}}$ PG6/SO1 2 pins	Port G  *1 PG6 is not Schmitt input	Hi-Z
PG7/SI1/$\overline{\text{INT1}}$ 1 pin	Port G 	Hi-Z
$\overline{\text{CS0}}$ SI0 2 pins		Hi-Z
SO0 1 pin		Hi-Z

Pin	Circuit format	When reset
$\overline{\text{SCK0}}$ 1 pin		Hi-Z
EXTAL XTAL 2 pins	 • Diagram shows the circuit composition during oscillation. • Feedback resistor is removed during stop. XTAL becomes “High” level.	Oscillation
$\overline{\text{RST}}$ 1 pin		Low level
MP 1 pin		Hi-Z

Absolute Maximum Ratings (Vss = 0V reference)

Item	Symbol	Rating	Unit	Remarks
Supply voltage	V_{DD}	–0.3 to +7.0	V	
	AV_{DD}	AV_{SS} to +7.0	V	
	AV_{SS}	–0.3 to +0.3	V	
	AV_{REF}	AV_{SS} to +7.0	V	
Input voltage	V_{IN}	–0.3 to +7.0*1	V	
Output voltage	V_{OUT}	–0.3 to +7.0*1	V	
High level output current	I_{OH}	–5	mA	
High level total output current	$\sum I_{OH}$	–50	mA	Total of output pins
Low level output current	I_{OL}	15	mA	
Low level total output current	$\sum I_{OL}$	130	mA	Total of output pins
Operating temperature	Topr	–20 to +75	°C	
Storage temperature	Tstg	–55 to +150	°C	
Allowable power dissipation	P_D	600	mW	QFP-64P-L01
		380	mW	LQFP-64P-L01

*1 V_{IN} and V_{OUT} should not exceed V_{DD} + 0.3V. ($\overline{CS0}$ and SI0 excluded.)

Note) Usage exceeding absolute maximum ratings may permanently impair the LSI. Normal operation should be conducted under the recommended operating conditions. Exceeding those conditions may adversely affect the reliability of the LSI.

Recommended Operating Conditions (Vss = 0V reference)

Item	Symbol	Min.	Max.	Unit	Remarks
Supply voltage	V_{DD}	3.0	5.5	V	Guaranteed operation range for 1/2 and 1/4 frequency dividing mode
		2.7	5.5	V	Guaranteed operation range for 1/16 frequency dividing mode
		2.5	5.5	V	Guaranteed data hold range during stop mode
Analog voltage	AV_{DD}	3.0	5.5	V	*1
High level input voltage	V_{IH}	$0.7V_{DD}$	V_{DD}	V	*2
	V_{IHS}	$0.8V_{DD}$	V_{DD}	V	CMOS Schmitt input*3
			5.5	V	CMOS Schmitt input*4
	V_{IHEX}	$V_{DD} - 0.4$	$V_{DD} + 0.3$	V	EXTAL pin*5
Low level input voltage	V_{IL}	0	$0.3V_{DD}$	V	*2, *7
			$0.2V_{DD}$	V	*2, *6
	V_{ILS}	0	$0.2V_{DD}$	V	CMOS Schmitt input*3, *4
	V_{ILEX}	–0.3	0.4	V	EXTAL pin*5
Operating temperature	Topr	–20	+75	°C	

*1 AV_{DD} should be the same voltage as V_{DD}.

*2 Normal input port (PC, PD, PF0 to PF3 and PG6 pins), MP pin.

*3 $\overline{SCK0}$, $\overline{RST}$, $\overline{INT0}$, $\overline{EC}/\overline{INT2}$, $\overline{SCK1}$ and SI1/$\overline{INT1}$ pins.

*4 $\overline{CS0}$ and SI0 pins.

*5 Specified only when the external clock is input.

*6 In case of 3.0 to 3.6V supply voltage (V_{DD}).

*7 In case of 4.5 to 5.5V supply voltage (V_{DD}).

DC Characteristics

Supply voltage (V_{DD} = 4.5 to 5.5V) (Ta = –20 to +75°C, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Typ.	Max.	Unit
High level output voltage	V_{OH}	PA to PE, PF4 to PF7, SO0, SCK0, RST*1 (V_{OL} only) PG3 to PG7	V_{DD} = 4.5V, I_{OH} = –0.5mA	4.0			V
			V_{DD} = 4.5V, I_{OH} = –1.2mA	3.5			V
Low level output voltage	V_{OL}		V_{DD} = 4.5V, I_{OL} = 1.8mA			0.4	V
			V_{DD} = 4.5V, I_{OL} = 3.6mA			0.6	V
Input current	I_{IHE}	EXTAL	V_{DD} = 5.5V, V_{IH} = 5.5V	0.5		40	µA
	I_{ILE}		V_{DD} = 5.5V, V_{IL} = 0.4V	–0.5		–40	µA
	I_{ILR}	$\overline{RST}$*2	V_{DD} = 5.5V, V_{IL} = 0.4V	–1.5		–400	µA
I/O leakage current	I_{IZ}	PA to PG, MP, CS0, SI0, SO0, SCK0, RST*2	V_{DD} = 5.5V, V_I = 0, 5.5V			±10	µA
Supply current*3	I_{DD1}	V_{DD}	1/2 frequency dividing mode V_{DD} = 5V ± 0.5V, 16MHz crystal oscillation (C_1 = C_2 = 15pF)		20	40	mA
	I_{DDS1}		Sleep mode V_{DD} = 5V ± 0.5V, 16MHz crystal oscillation (C_1 = C_2 = 15pF)		1	5	mA
	I_{DDS3}		Stop mode V_{DD} = 5.5V, termination of 16MHz oscillation			10	µA
Input capacity	C_{IN}	PC, PD, PE0, PE1, PF, PG5 to PG7, RST, CS0, SI0, SCK0, EXTAL	Clock 1MHz 0V other than the measured pins		10	20	pF

*1 $\overline{RST}$ pin is specified only when the power-on reset circuit is selected with mask option.

*2 For $\overline{RST}$ pin, specifies the input current when the pull-up resistance is selected, and specifies leakage current when non-resistance is selected.

*3 When all output pins are open.

DC Characteristics

Supply voltage (V_{DD} = 3.0 to 3.6V) (Ta = –20 to +75°C, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Typ.	Max.	Unit
High level output voltage	V_{OH}	PA to PE, PF4 to PF7, SO0, SCK0, RST*1 (V_{OL} only) PG3 to PG7	V_{DD} = 3.0V, I_{OH} = –0.15mA	2.7			V
			V_{DD} = 3.0V, I_{OH} = –0.5mA	2.3			V
Low level output voltage	V_{OL}		V_{DD} = 3.0V, I_{OL} = 1.2mA			0.3	V
			V_{DD} = 3.0V, I_{OL} = 1.6mA			0.5	V
Input current	I_{IHE}	EXTAL	V_{DD} = 3.6V, V_{IH} = 3.6V	0.3		20	µA
	I_{ILE}		V_{DD} = 3.6V, V_{IL} = 0.3V	–0.3		–20	µA
	I_{ILR}	$\overline{RST}$*2	V_{DD} = 3.6V, V_{IL} = 0.3V	–0.9		–200	µA
I/O leakage current	I_{IZ}	PA to PG, MP, CS0, SI0, SO0, SCK0, $\overline{RST}$*2	V_{DD} = 3.6V, V_I = 0, 3.6V			±10	µA
Supply current*3	I_{DD2}	V_{DD}	1/2 frequency dividing mode V_{DD} = 3.3V ± 0.3V, 12MHz crystal oscillation (C_1 = C_2 = 15pF)		10	20	mA
	I_{DDS2}		Sleep mode V_{DD} = 3.3V ± 0.3V, 12MHz crystal oscillation (C_1 = C_2 = 15pF)		0.5	2.5	mA
	I_{DDS3}		Stop mode V_{DD} = 5.5V, termination of 12MHz oscillation			10	µA
Input capacity	C_{IN}	PC, PD, PE0, PE1, PF, PG5 to PG7, $\overline{RST}$, CS0, SI0, SCK0, EXTAL	Clock 1MHz 0V other than the measured pins		10	20	pF

*1 $\overline{RST}$ pin is specified only when the power-on reset circuit is selected with mask option.

*2 For $\overline{RST}$ pin, specifies the input current when the pull-up resistance is selected, and specifies leakage current when non-resistance is selected.

*3 When all output pins are open.

AC Characteristics

(1) Clock timing

(Ta = –20 to +75°C, V_{DD} = 3.0 to 5.5V, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Max.	Unit
System clock frequency	f_C	XTAL EXTAL	Fig. 1, Fig. 2 V_{DD} = 4.5 to 5.5V	1	16	MHz
			Fig. 1, Fig. 2	1	12	
System clock input pulse width	t_{XL}, t_{XH}	XTAL EXTAL	Fig. 1, Fig. 2 (External clock drive) V_{DD} = 4.5 to 5.5V	28		ns
				37.5		
System clock input rise and fall times	t_{CR}, t_{CF}	EXTAL	Fig. 1, Fig. 2 (External clock drive)		200	ns
Event count input clock pulse width	t_{EL}, t_{EH}	$\overline{EC}$	Fig. 3	4tsys*1		ns
Event count input clock rise and fall times	t_{ER}, t_{EF}	$\overline{EC}$	Fig. 3		20	ms

*1 tsys indicates three values according to the contents of the clock control register (CLC; 00FE$_H$) upper 2 bits (CPU clock selection).
tsys [ns] = 2000/fc (Upper 2 bits = “00”), 4000/fc (Upper 2 bits = “01”), 16000/fc (Upper 2 bits = “11”)

Fig. 1. Clock timing

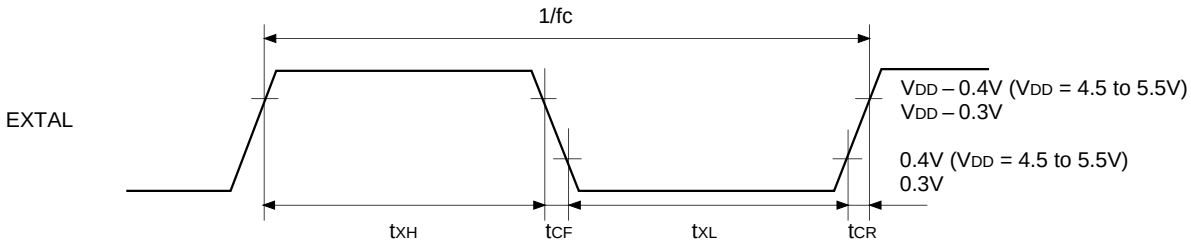


Fig. 2. Clock applied condition

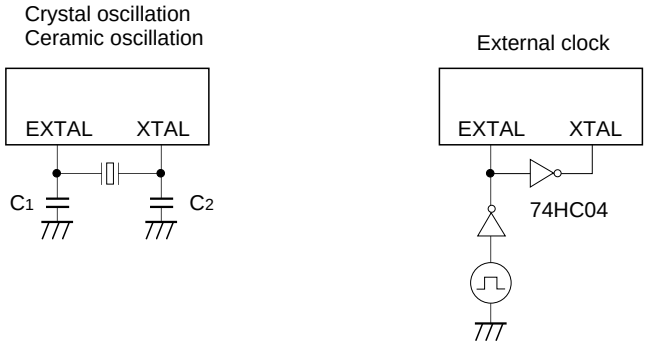
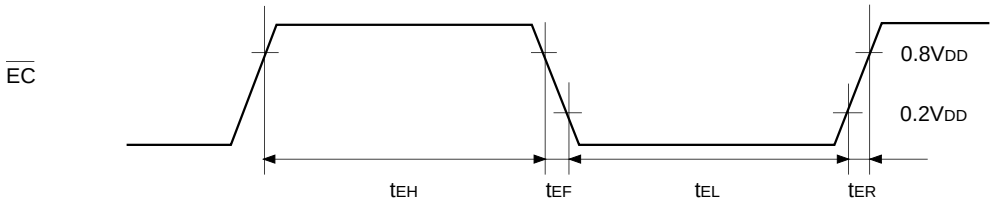


Fig. 3. Event count clock timing



(2) Serial transfer (CH0) (Ta = –20 to +75°C, V_{DD} = 4.5 to 5.5V, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Max.	Unit
$\overline{CS} \downarrow \rightarrow \overline{SCK}$ delay time	t_{DCSK}	$\overline{SCK0}$	Chip select transfer mode ($\overline{SCK}$ = output mode)		tsys + 200	ns
$\overline{CS} \uparrow \rightarrow \overline{SCK}$ floating delay time	t_{DCSKF}	$\overline{SCK0}$	Chip select transfer mode ($\overline{SCK}$ = output mode)		tsys + 200	ns
$\overline{CS} \downarrow \rightarrow$ SO delay time	t_{DCSO}	SO0	Chip select transfer mode		tsys + 200	ns
$\overline{CS} \downarrow \rightarrow$ SO floating delay time	t_{DCSOF}	SO0	Chip select transfer mode		tsys + 200	ns
$\overline{CS}$ high level width	t_{WHCS}	$\overline{CS0}$	Chip select transfer mode	tsys + 200		ns
$\overline{SCK}$ cycle time	t_{KCY}	$\overline{SCK0}$	Input mode	2tsys + 200		ns
			Output mode	8000/fc		ns
$\overline{SCK}$ high and low level widths	t_{KH} t_{KL}	$\overline{SCK0}$	Input mode	tsys + 100		ns
			Output mode	8000/fc – 100		ns
SI input setup time (for $\overline{SCK} \uparrow$)	t_{SIK}	SI0	$\overline{SCK}$ input mode	–tsys + 100		ns
			$\overline{SCK}$ output mode	200		ns
SI input hold time (for $\overline{SCK} \uparrow$)	t_{KSI}	SI0	$\overline{SCK}$ input mode	2tsys + 100		ns
			$\overline{SCK}$ output mode	100		ns
$\overline{SCK} \downarrow \rightarrow$ SO delay time	t_{KSO}	SO0	$\overline{SCK}$ input mode		2tsys + 200	ns
			$\overline{SCK}$ output mode		100	ns

Note 1) tsys indicates three values according to the contents of the clock control register (CLC; $00FE_H$) upper 2 bits (CPU clock selection).
tsys [ns] = 2000/fc (Upper 2 bits = “00”), 4000/fc (Upper 2 bits = “01”), 16000/fc (Upper 2 bits = “11”)

Note 2) $\overline{CS}$, $\overline{SCK}$, SI and SO represents $\overline{CS0}$, SCK0, SI0, and SO0, respectively.

Note 3) The load of $\overline{SCK}$ output mode and SO output delay time is 50pF + 1TTL.

Serial transfer (CH0) (Ta = –20 to +75°C, V_{DD} = 3.0 to 3.6V, Vss = 0V reference)

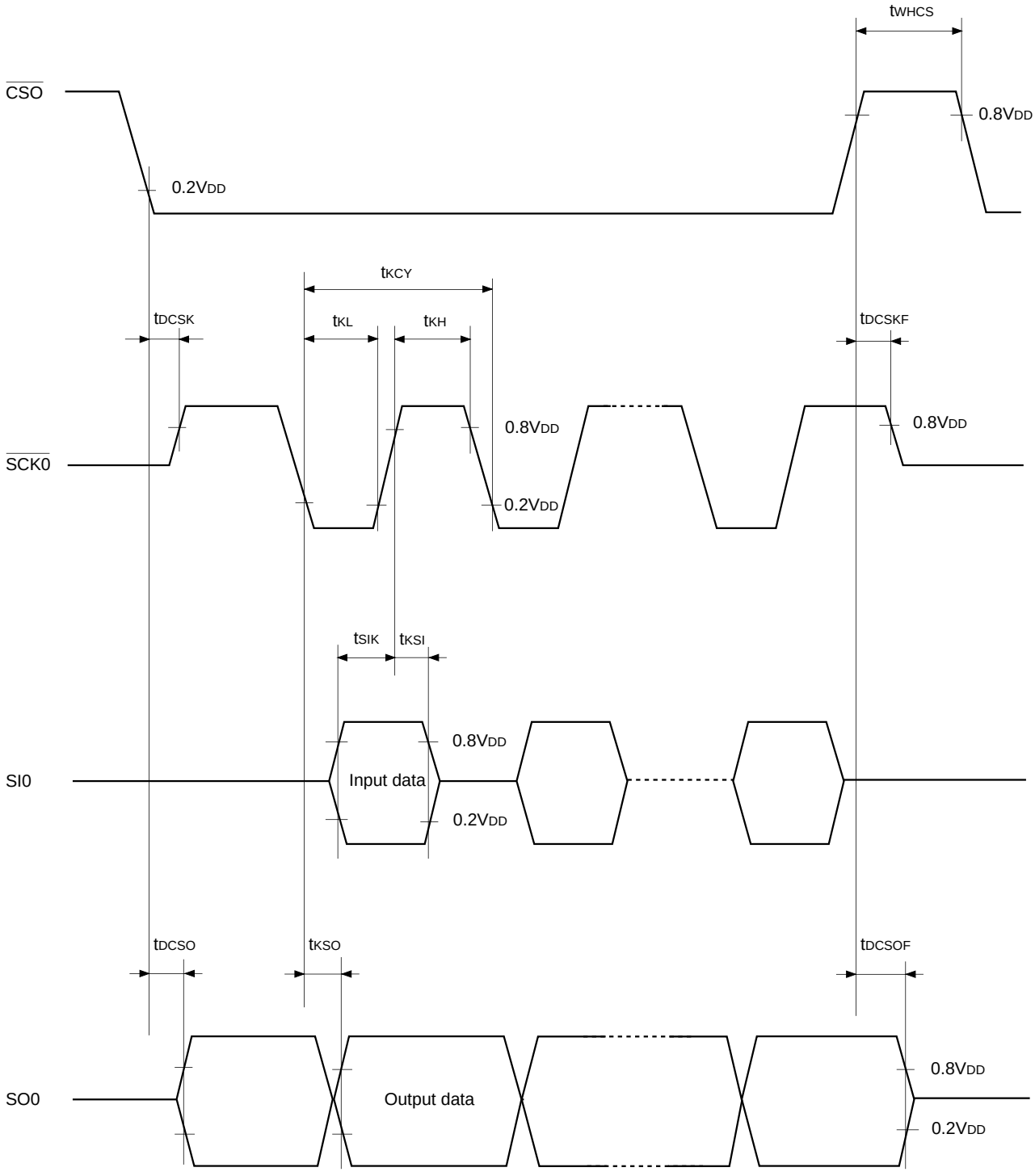
Item	Symbol	Pin	Condition	Min.	Max.	Unit
$\overline{CS} \downarrow \rightarrow \overline{SCK}$ delay time	t_{DCSK}	$\overline{SCK0}$	Chip select transfer mode ($\overline{SCK}$ = output mode)		tsys + 250	ns
$\overline{CS} \uparrow \rightarrow \overline{SCK}$ floating delay time	t_{DCSKF}	$\overline{SCK0}$	Chip select transfer mode ($\overline{SCK}$ = output mode)		tsys + 200	ns
$\overline{CS} \downarrow \rightarrow$ SO delay time	t_{DCSO}	SO0	Chip select transfer mode		tsys + 250	ns
$\overline{CS} \downarrow \rightarrow$ SO floating delay time	t_{DCSOF}	SO0	Chip select transfer mode		tsys + 200	ns
$\overline{CS}$ high level width	t_{WHCS}	$\overline{CS0}$	Chip select transfer mode	tsys + 200		ns
$\overline{SCK}$ cycle time	t_{KCY}	$\overline{SCK0}$	Input mode	2tsys + 200		ns
			Output mode	8000/fc		ns
$\overline{SCK}$ high and low level widths	t_{KH} t_{KL}	$\overline{SCK0}$	Input mode	tsys + 100		ns
			Output mode	8000/fc – 150		ns
SI input setup time (for $\overline{SCK} \uparrow$)	t_{SIK}	SI0	$\overline{SCK}$ input mode	–tsys + 100		ns
			$\overline{SCK}$ output mode	200		ns
SI input hold time (for $\overline{SCK} \uparrow$)	t_{KSI}	SI0	$\overline{SCK}$ input mode	2tsys + 100		ns
			$\overline{SCK}$ output mode	100		ns
$\overline{SCK} \downarrow \rightarrow$ SO delay time	t_{KSO}	SO0	$\overline{SCK}$ input mode		2tsys + 250	ns
			$\overline{SCK}$ output mode		125	ns

Note 1) tsys indicates three values according to the contents of the clock control register (CLC; $00FE_H$) upper 2 bits (CPU clock selection).
tsys [ns] = 2000/fc (Upper 2 bits = “00”), 4000/fc (Upper 2 bits = “01”), 16000/fc (Upper 2 bits = “11”)

Note 2) $\overline{CS}$, $\overline{SCK}$, SI and SO represents $\overline{CS0}$, SCK0, SI0, and SO0, respectively.

Note 3) The load of $\overline{SCK}$ output mode and SO output delay time is 50pF.

Fig. 4. Serial transfer timing (CH0)



Serial transfer (CH1) (SIO mode) (Ta = –20 to +75°C, V_{DD} = 4.5 to 5.5V, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Max.	Unit
$\overline{SCK1}$ cycle time	t_{KCY}	SCK1	Input mode	2tsys + 200		ns
			Output mode	16000/fc		ns
$\overline{SCK1}$ high and low level widths	t_{KH} t_{KL}	SCK1	Input mode	tsys + 100		ns
			Output mode	8000/fc – 50		ns
SI1 input setup time (for $\overline{SCK1}$ ↑)	t_{SIK}	SI1	$\overline{SCK1}$ input mode	100		ns
			$\overline{SCK1}$ output mode	200		ns
SI1 input hold time (for $\overline{SCK1}$ ↑)	t_{KSI}	SI1	$\overline{SCK1}$ input mode	tsys + 200		ns
			$\overline{SCK1}$ output mode	100		ns
SCK1 ↓ → SO1 delay time	t_{KSO}	SO1	$\overline{SCK1}$ input mode		tsys + 200	ns
			$\overline{SCK1}$ output mode		100	ns

Note 1) tsys indicates three values according to the contents of the clock control register (CLC; 00FE$_H$) upper 2 bits (CPU clock selection).

tsys [ns] = 2000/fc (Upper 2 bits = “00”), 4000/fc (Upper 2 bits = “01”), 16000/fc (Upper 2 bits = “11”)

Note 2) The load of $\overline{SCK1}$ output mode and SO1 output delay time is 50pF + 1TTL.

Serial transfer (CH1) (SIO mode) (Ta = –20 to +75°C, V_{DD} = 3.0 to 3.6V, Vss = 0V reference)

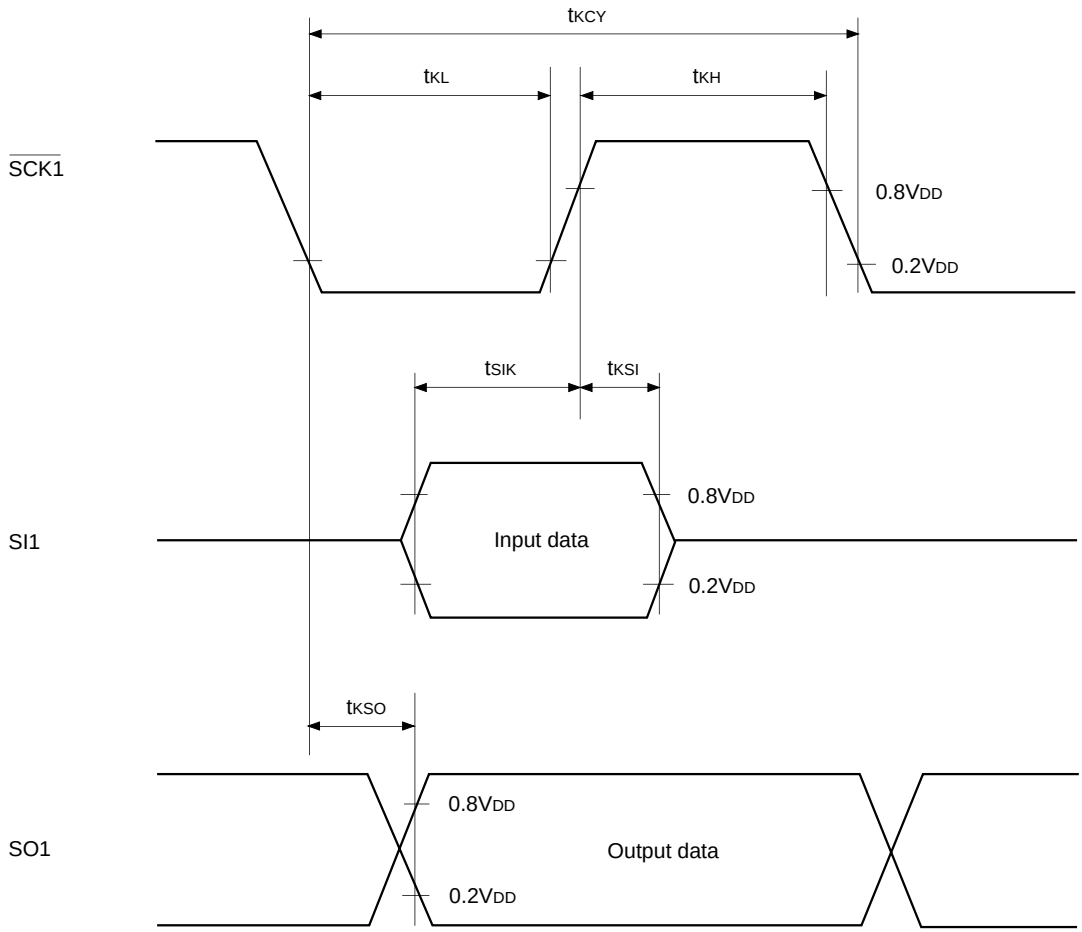
Item	Symbol	Pin	Condition	Min.	Max.	Unit
$\overline{SCK1}$ cycle time	t_{KCY}	SCK1	Input mode	2tsys + 200		ns
			Output mode	16000/fc		ns
$\overline{SCK1}$ high and low level widths	t_{KH} t_{KL}	SCK1	Input mode	tsys + 100		ns
			Output mode	8000/fc – 150		ns
SI1 input setup time (for $\overline{SCK1}$ ↑)	t_{SIK}	SI1	$\overline{SCK1}$ input mode	100		ns
			$\overline{SCK1}$ output mode	200		ns
SI1 input hold time (for $\overline{SCK1}$ ↑)	t_{KSI}	SI1	$\overline{SCK1}$ input mode	tsys + 200		ns
			$\overline{SCK1}$ output mode	100		ns
SCK1 ↓ → SO1 delay time	t_{KSO}	SO1	$\overline{SCK1}$ input mode		tsys + 250	ns
			$\overline{SCK1}$ output mode		125	ns

Note 1) tsys indicates three values according to the contents of the clock control register (CLC; 00FE$_H$) upper 2 bits (CPU clock selection).

tsys [ns] = 2000/fc (Upper 2 bits = “00”), 4000/fc (Upper 2 bits = “01”), 16000/fc (Upper 2 bits = “11”)

Note 2) The load of $\overline{SCK1}$ output mode and SO1 output delay time is 50pF.

Fig. 5. Serial transfer CH1 timing (SIO mode)



Serial transfer (CH1) (Special mode) (Ta = –20 to +75°C, V_{DD} = 4.5 to 5.5V, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Typ.	Max.	Unit
SO1 cycle time	t_{LCY}	SO1 SI1	*1		104		µs
SI1 data setup time	t_{LSU}	SI1		2			µs
SI1 data hold time	t_{LHD}	SI1		2			µs

*1 t_{LCY} is specified only when serial mode register (CH1) (SIOM1: 01FA$_H$) lower 2 bits (SO1 clock selection) is set at 104µs according to the system clock frequency.

Note) The load of SO1 pin is 50pF + 1TTL.

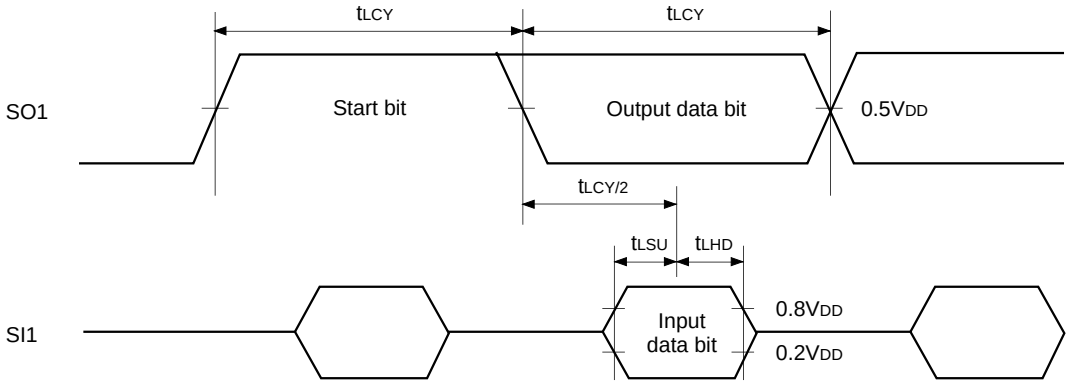
Serial transfer (CH1) (Special mode) (Ta = –20 to +75°C, V_{DD} = 3.0 to 3.6V, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Typ.	Max.	Unit
SO1 cycle time	t_{LCY}	SO1 SI1	*1		104		µs
SI1 data setup time	t_{LSU}	SI1		2			µs
SI1 data hold time	t_{LHD}	SI1		2			µs

*1 t_{LCY} is specified only when serial mode register (CH1) (SIOM1: 01FA$_H$) lower 2 bits (SO1 clock selection) is set at 104µs according to the system clock frequency.

Note) The load of SO1 pin is 50pF.

Fig. 6. Serial transfer CH1 timing (Special mode)



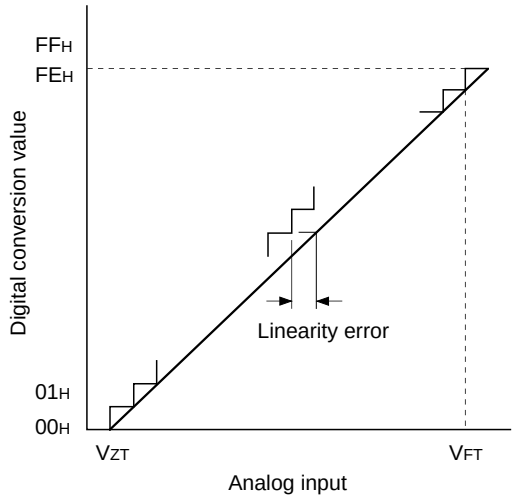
(3) A/D converter characteristics (Ta = –20 to +75°C, V_{DD} = AV_{DD} = 4.5 to 5.5V, AV_{REF} = 4.0 to AV_{DD}, V_{SS} = AV_{SS} = 0V reference)

Item	Symbol	Pin	Condition	Min.	Typ.	Max.	Unit
Resolution						8	Bits
Linearity error			Only for A/D converter operation Ta = 25°C V_{DD} = AV_{DD} = AV_{REF} = 5.0V V_{SS} = AV_{SS} = 0V			±1	LSB
Absolute error						±2	LSB
Conversion time	t_{CONV}			160/f_{ADC}*1			µs
Sampling time	t_{SAMP}			12/f_{ADC}*1			µs
Reference input voltage	V_{REF}	AV_{REF}	V_{DD} = AV_{DD} = 4.5 to 5.5V	AV_{DD} – 0.5		AV_{DD}	V
Analog input voltage	V_{IAN}	AN0 to AN7		0		AV_{REF}	V
AV_{REF} current	I_{REF}	AV_{REF}	Operating mode AV_{REF} = 4.0 to 5.5V		0.6	1.0	mA
			Sleep mode Stop mode			10	µA

A/D converter characteristics (Ta = –20 to +75°C, V_{DD} = AV_{DD} = 3.0 to 3.6V, AV_{REF} = 2.7 to AV_{DD}, V_{SS} = AV_{SS} = 0V reference)

Item	Symbol	Pin	Condition	Min.	Typ.	Max.	Unit
Resolution						8	Bits
Linearity error			Only for A/D converter operation Ta=25°C V_{DD} = AV_{DD} = AV_{REF} = 3.3V V_{SS} = AV_{SS} = 0V			±1	LSB
Absolute error						±2	LSB
Conversion time	t_{CONV}			160/f_{ADC}*1			µs
Sampling time	t_{SAMP}			12/f_{ADC}*1			µs
Reference input voltage	V_{REF}	AV_{REF}	V_{DD} = AV_{DD} = 3.0 to 3.6V	AV_{DD} – 0.3		AV_{DD}	V
Analog input voltage	V_{IAN}	AN0 to AN7		0		AV_{REF}	V
AV_{REF} current	I_{REF}	AV_{REF}	Operating mode AV_{REF} = 2.7 to 3.6V		0.4	0.7	mA
			Sleep mode Stop mode			10	µA

Fig. 7. Definitions of A/D converter terms



*1 The value of f_{ADC} is as follows by interruption selection/ ADC operation clock selection regeister (MSC: 01FFH) bit 0 (ADCCK).

When PS2 is selected, f_{ADC} = fc/2

When PS1 is selected, f_{ADC} = fc

(4) Interruption, reset input (Ta = –20 to +75°C, V_{DD} = 3.0 to 5.5V, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Max.	Unit
External interruption high and low level widths	t_{IH} t_{IL}	$\overline{INT0}$ $\overline{INT1}$ $\overline{INT2}$ PJ0 to PJ7		1		µs
Reset input low level width	t_{RSL}	$\overline{RST}$		32/fc		µs

Fig. 8. Interruption input timing

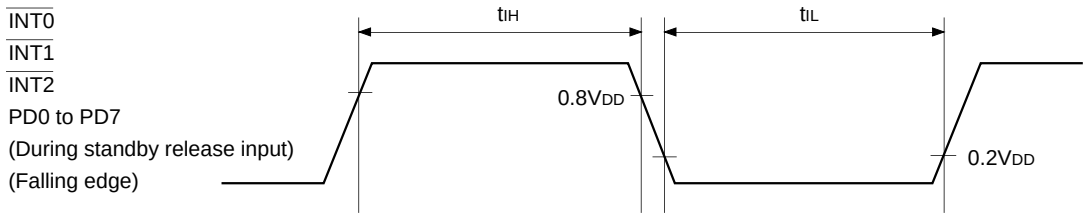
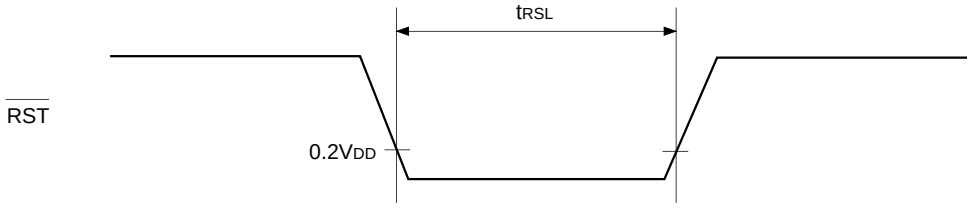


Fig. 9. Reset input timing

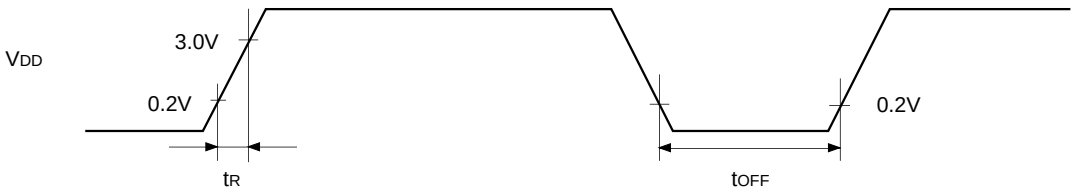


(5) Power-on reset[*1] (Ta = –20 to +75°C, V_{DD} = 3.0 to 5.5V, Vss = 0V reference)

Item	Symbol	Pin	Condition	Min.	Max.	Unit
Power supply rising time	t_R	V_{DD}	Power-on reset	0.05	30	ms
Power supply cut-off time	t_{OFF}		Repetitive power-on reset	1		ms

[*1] Specifies only when power-on reset function is selected.

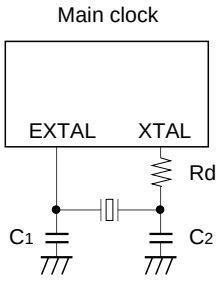
Fig. 10. Power-on reset



The power supply should be turned on smoothly.

Appendix

Fig. 11. SPC 700 Series recommended oscillation circuit



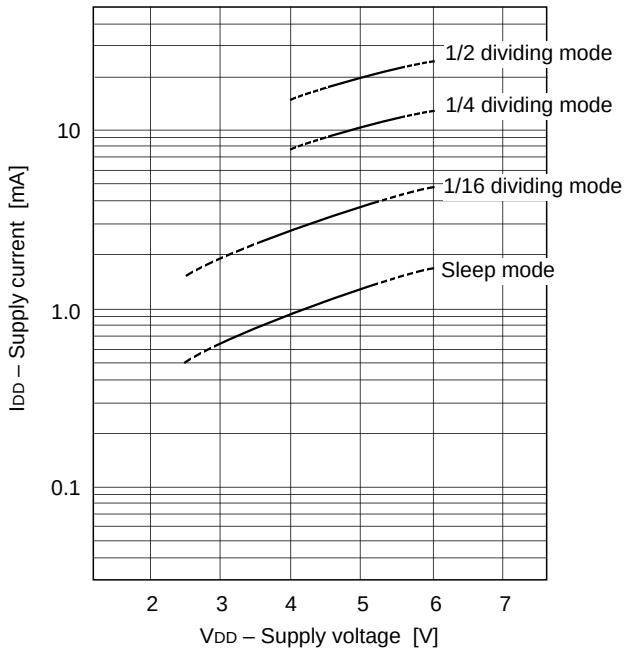
Manufacturer	Model	fc (MHz)	C_1 (pF)	C_2 (pF)	Rd (Ω)	Circuit example
RIVER ELETEC CO., LTD.	HC-49/U03	8.00	10	10	0	(i)
		10.00	5	5		
		12.00				
		16.00				
KINSEKI LTD.	HC-49/U (-S)	8.00	22 (15)	22 (15)	0	(i)
		10.00				
		12.00	15	15		
		16.00	12	12		

Mask Option Table

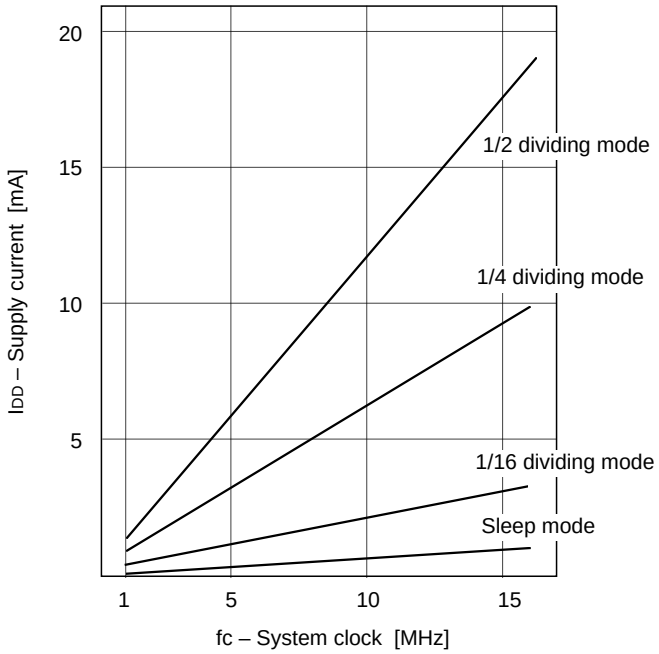
Item	Content	
Reset pin pull-up resistor	Non-existent	Existent
Power-on reset circuit	Non-existent	Existent

Characteristics Curve

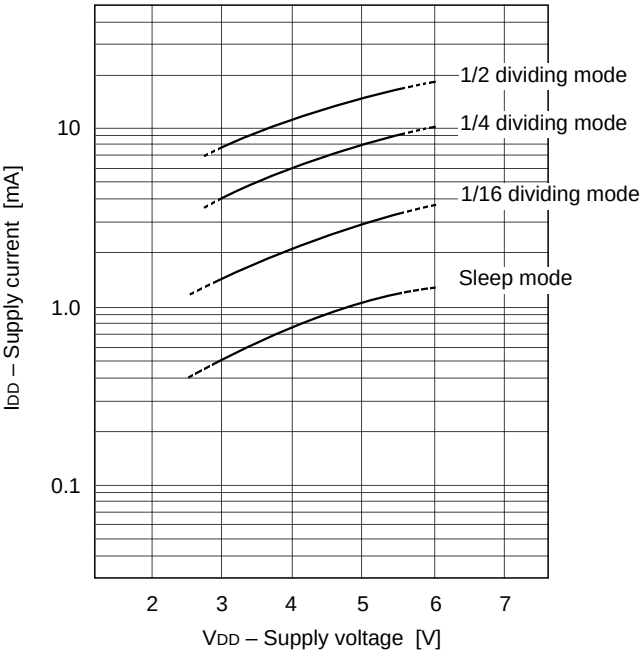
IDD vs. VDD
(fc = 16MHz, Ta = 25°C, Typical)



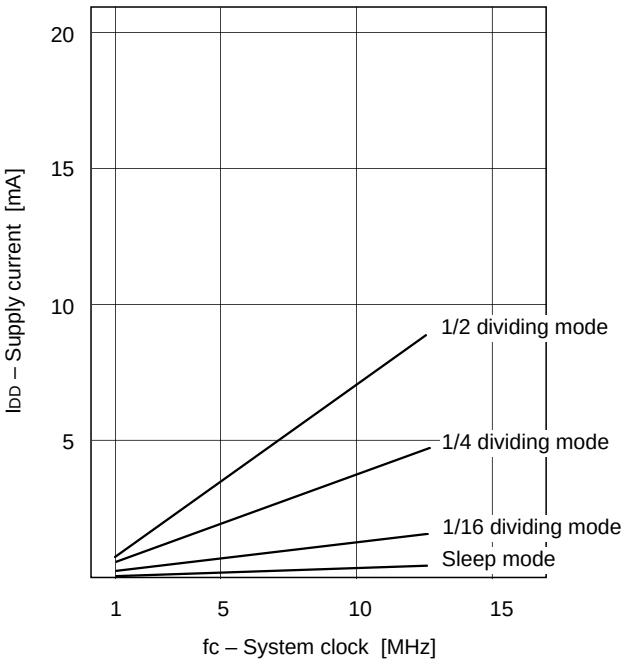
IDD vs. fc
(VDD = 5V, Ta = 25°C, Typical)



IDD vs. VDD
(fc = 12MHz, Ta = 25°C, Typical)

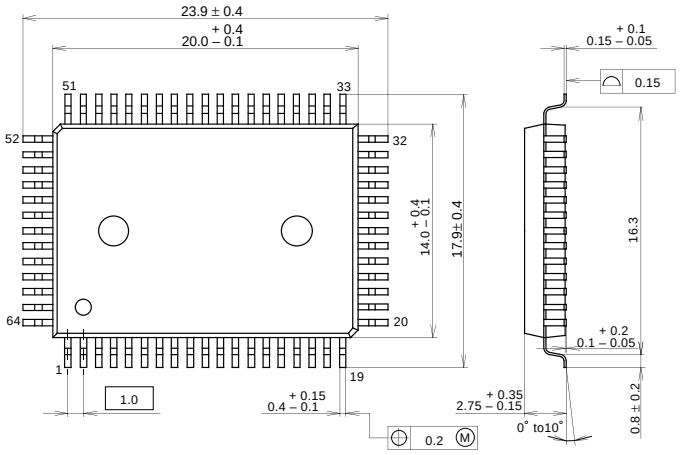


IDD vs. fc
(VDD = 3.3V, Ta = 25°C, Typical)



Package Outline Unit: mm

64PIN QFP (PLASTIC)

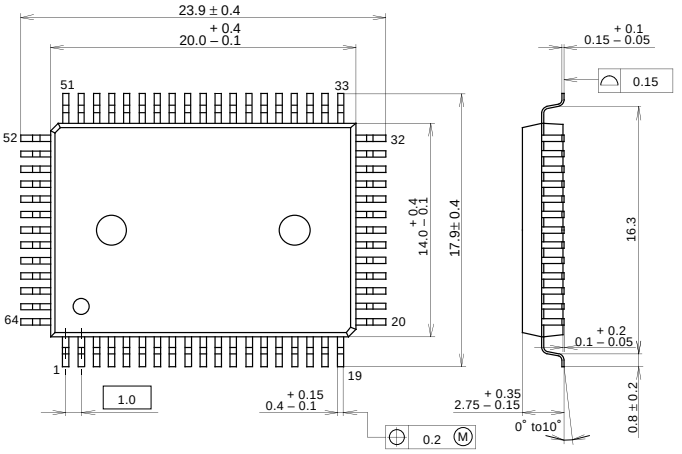


PACKAGE STRUCTURE

SONY CODE	QFP-64P-L01
EIAJ CODE	P-QFP64-14x20-1.0
JEDEC CODE	————

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	1.5g

64PIN QFP (PLASTIC)



PACKAGE STRUCTURE

SONY CODE	QFP-64P-L01
EIAJ CODE	P-QFP64-14x20-1.0
JEDEC CODE	————

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	1.5g

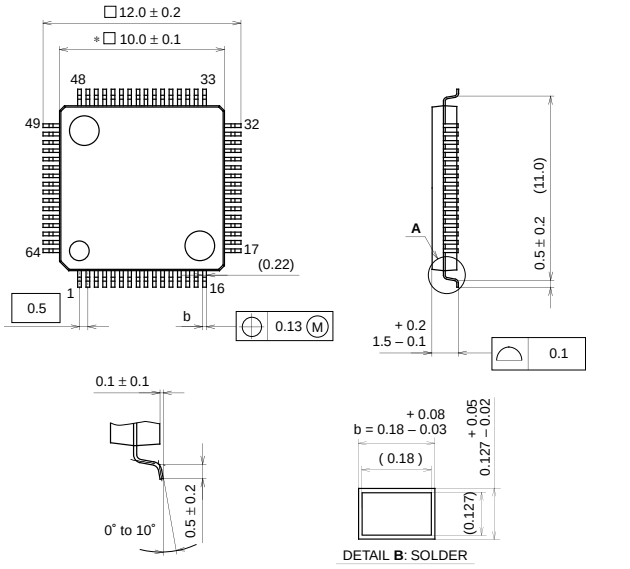
LEAD SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	ALLOY 42
LEAD TREATMENT	Sn-Bi 2.5%
LEAD TREATMENT THICKNESS	5-18µm

Package Outline

Unit: mm

64PIN LQFP (PLASTIC)



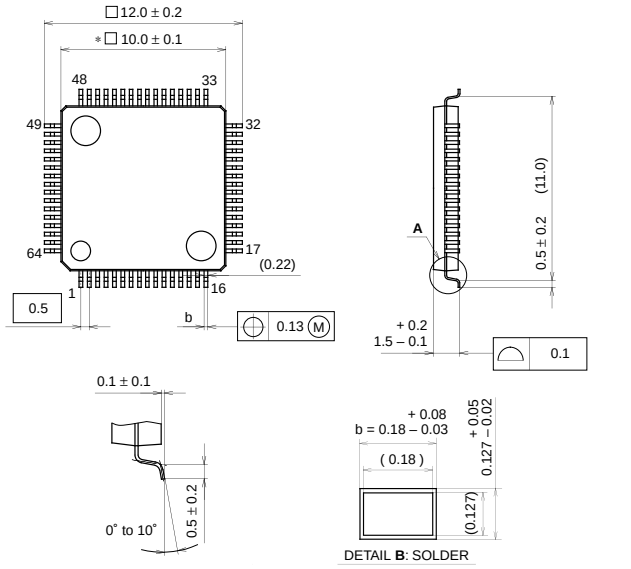
NOTE: Dimension "∗" does not include mold protrusion.

SONY CODE	LQFP-64P-L01
EIAJ CODE	P-LQFP64-10x10-0.5
JEDEC CODE	————

PACKAGE STRUCTURE

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	0.3g

64PIN LQFP (PLASTIC)



NOTE: Dimension "∗" does not include mold protrusion.

SONY CODE	LQFP-64P-L01
EIAJ CODE	P-LQFP64-10x10-0.5
JEDEC CODE	————

PACKAGE STRUCTURE

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	0.3g

LEAD SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	ALLOY 42
LEAD TREATMENT	Sn-Bi 2.5%
LEAD TREATMENT THICKNESS	5-18µm

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