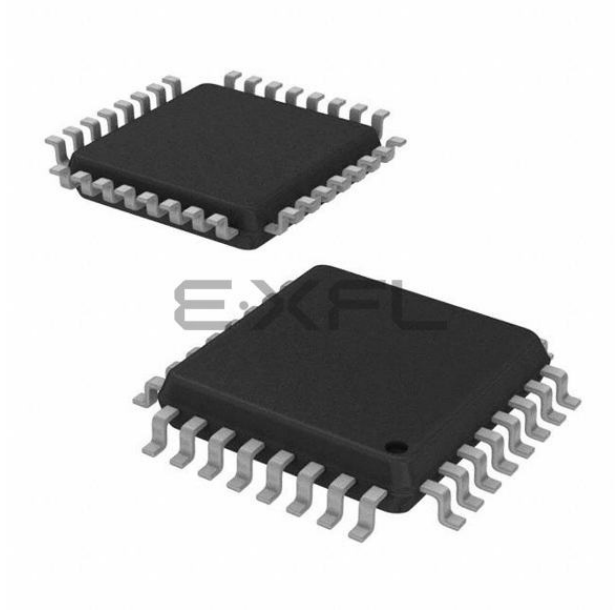

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What is "Embedded - Microcontrollers"?

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

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-M0+
Core Size	32-Bit Single-Core
Speed	40MHz
Connectivity	CSIO, I²C, LINbus, SmartCard, UART/USART
Peripherals	I²S, LVD, POR, PWM, WDT
Number of I/O	24
Program Memory Size	64KB (64K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	12K x 8
Voltage - Supply (Vcc/Vdd)	1.65V ~ 3.6V
Data Converters	A/D 6x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	32-LQFP
Supplier Device Package	32-LQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/s6e1c11b0agn20000

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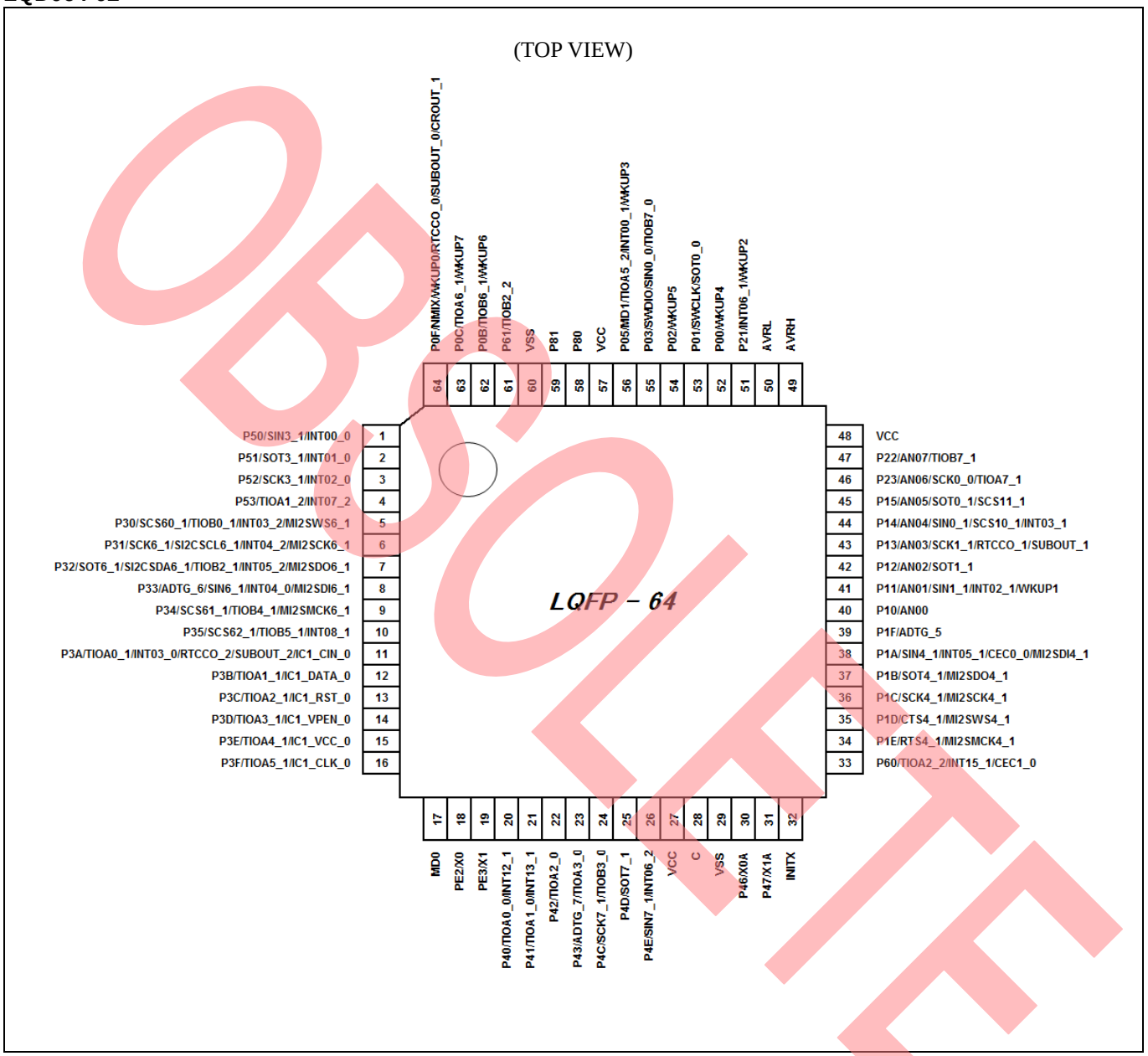
3. Pin Assignment

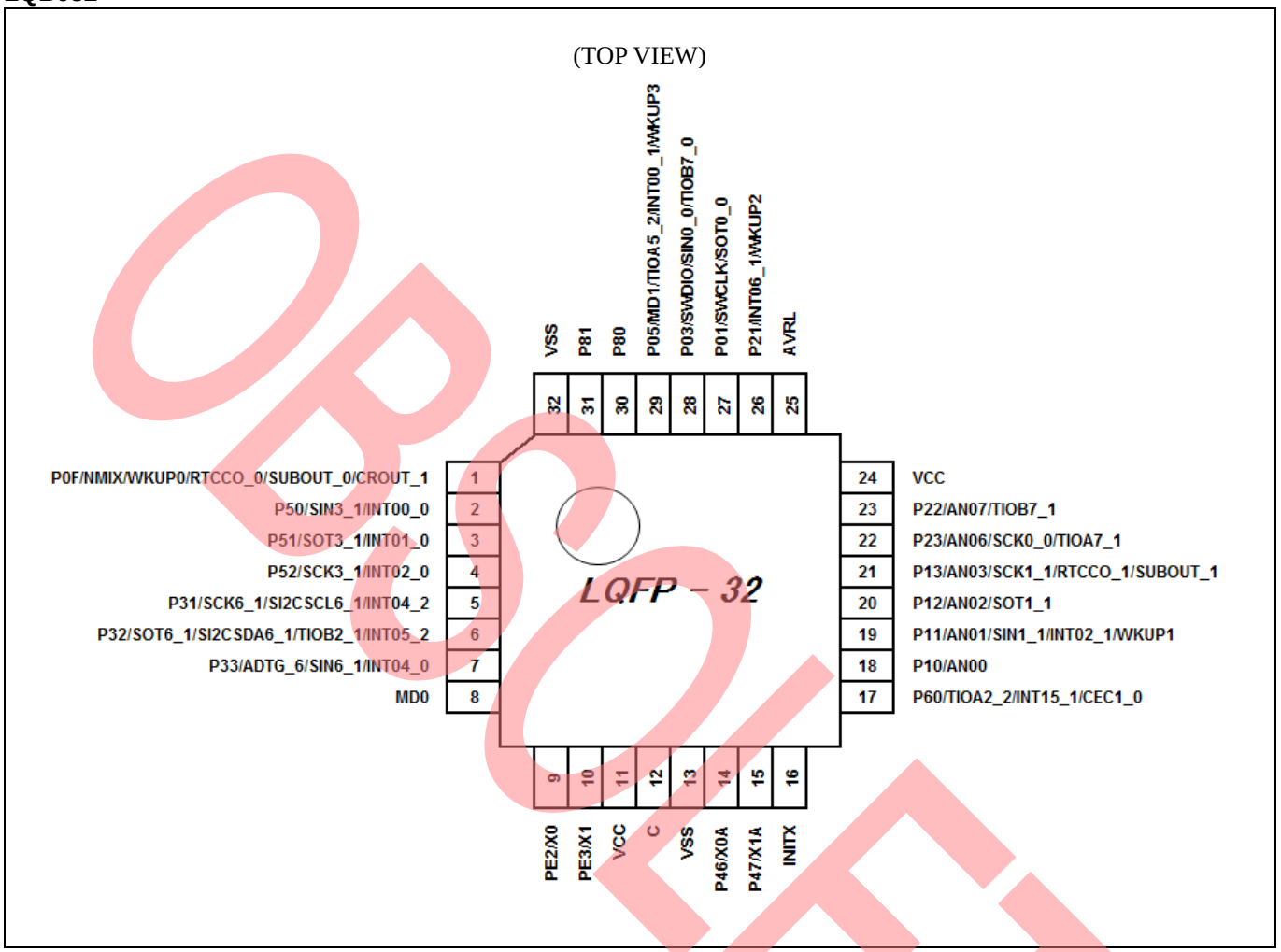
LQD064-02



Note:

- *The number after the underscore ("_") in a pin name such as XXX_1 and XXX_2 indicates the relocated port number. The channel on such pin has multiple functions, each of which has its own pin name. Use the Extended Port Function Register (EPFR) to select the pin to be used.*

LQB032



Note:

- *The number after the underscore ("_") in a pin name such as XXX_1 and XXX_2 indicates the relocated port number. The channel on such pin has multiple functions, each of which has its own pin name. Use the Extended Port Function Register (EPFR) to select the pin to be used.*

4. List of Pin Functions

List of Pin Numbers

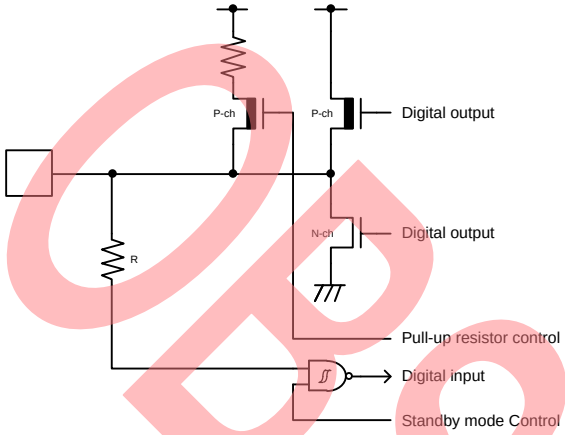
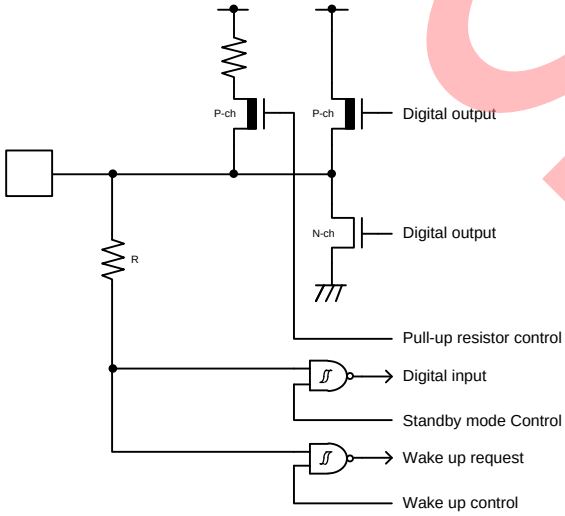
The number after the underscore ("_") in a pin name such as XXX_1 and XXX_2 indicates the relocated port number. The channel on such pin has multiple functions, each of which has its own pin name. Use the Extended Port Function Register (EPFR) to select the pin to be used.

Pin no.			Pin Function	I/O circuit type	Pin state type
LQFP-64 QFN-64	LQFP-48 QFN-48	LQFP-32 QFN-32			
1	1	2	P50	D	K
			SIN3_1		
			INT00_0		
2	2	3	P51	D	K
			SOT3_1		
			INT01_0		
3	3	4	P52	D	K
			SCK3_1		
			INT02_0		
4	4	-	P53	D	K
			TIOA1_2		
			INT07_2		
5	5	-	P30	D	K
			SCS60_1		
			TIOB0_1		
			INT03_2		
			MI2SWS6_1		
6	6	-	P31	H	K
			SCK6_1		
			SI2CSCL6_1		
			INT04_2		
			MI2SCK6_1		
-	-	5	P31	H	K
			SCK6_1		
			SI2CSCL6_1		
			INT04_2		
7	7	-	P32	H	K
			SOT6_1		
			SI2CSDA6_1		
			TIOB2_1		
			INT05_2		
			MI2SDO6_1		
-	-	6	P32	H	K
			SOT6_1		
			SI2CSDA6_1		
			TIOB2_1		
			INT05_2		

Pin no.			Pin Function	I/O circuit type	Pin state type
LQFP-64 QFN-64	LQFP-48 QFN-48	LQFP-32 QFN-32			
34	-	-	P1E	D	K
			RTS4_1		
			MI2SMCK4_1		
35	-	-	P1D	D	K
			CTS4_1		
			MI2SWS4_1		
36	-	-	P1C	D	K
			SCK4_1		
			MI2SCK4_1		
37	-	-	P1B	D	K
			SOT4_1		
			MI2SDO4_1		
-	26	-	P1B	D	K
			SOT4_1		
38	-	-	P1A	H	K
			SIN4_1		
			INT05_1		
			CEC0_0		
			MI2SDI4_1		
-	27	-	P1A	H	K
			SIN4_1		
			INT05_1		
			CEC0_0		
39	-	-	P1F	D	K
			ADTG_5		
40	28	18	P10	F	J
			AN00		
41	29	19	P11	G	J
			AN01		
			SIN1_1		
			INT02_1		
			WKUP1		
42	30	20	P12	F	J
			AN02		
			SOT1_1		
43	31	21	P13	F	J
			AN03		
			SCK1_1		
			RTCCO_1		
			SUBOUT_1		
44	32	-	P14	F	J
			AN04		
			SIN0_1		
			SCS10_1		
			INT03_1		

Pin function	Pin name	Function description	Pin no.		
			LQFP-64 QFN-64	LQFP-48 QFN-48	LQFP-32 QFN-32
GPIO	P30	General-purpose I/O port 3	5	5	-
	P31		6	6	5
	P32		7	7	6
	P33		8	8	7
	P34		9	9	-
	P35		10	-	-
	P3A		11	10	-
	P3B		12	11	-
	P3C		13	12	-
	P3D		14	-	-
	P3E		15	-	-
	P3F		16	-	-
GPIO	P40	General-purpose I/O port 4	20	-	-
	P41		21	-	-
	P42		22	-	-
	P43		23	-	-
	P46		30	22	14
	P47		31	23	15
	P4C		24	16	-
	P4D		25	17	-
	P4E		26	18	-
GPIO	P50	General-purpose I/O port 5	1	1	2
	P51		2	2	3
	P52		3	3	4
	P53		4	4	-
GPIO	P60	General-purpose I/O port 6	33	25	17
	P61		61	47	-
GPIO	P80	General-purpose I/O port 8	58	44	30
	P81		59	45	31
GPIO	PE2	General-purpose I/O port E	18	14	9
	PE3		19	15	10
Multi-function Serial 0	SIN0_0	Multi-function serial interface ch.0 input pin	55	41	28
	SIN0_1		44	32	-
	SOT0_0 (SDA0_0)	Multi-function serial interface ch.0 output pin. This pin operates as SOT0 when used as a UART/CSIO/LIN pin (operation mode 0 to 3) and as SDA0 when used as an I2C pin (operation mode 4).	53	40	27
	SOT0_1 (SDA0_1)		45	33	-
	SCK0_0 (SCL0_0)	Multi-function serial interface ch.0 clock I/O pin. This pin operates as SCK0 when used as a CSIO pin (operation mode 2) and as SCL0 when used as an I2C pin (operation mode 4).	46	34	22

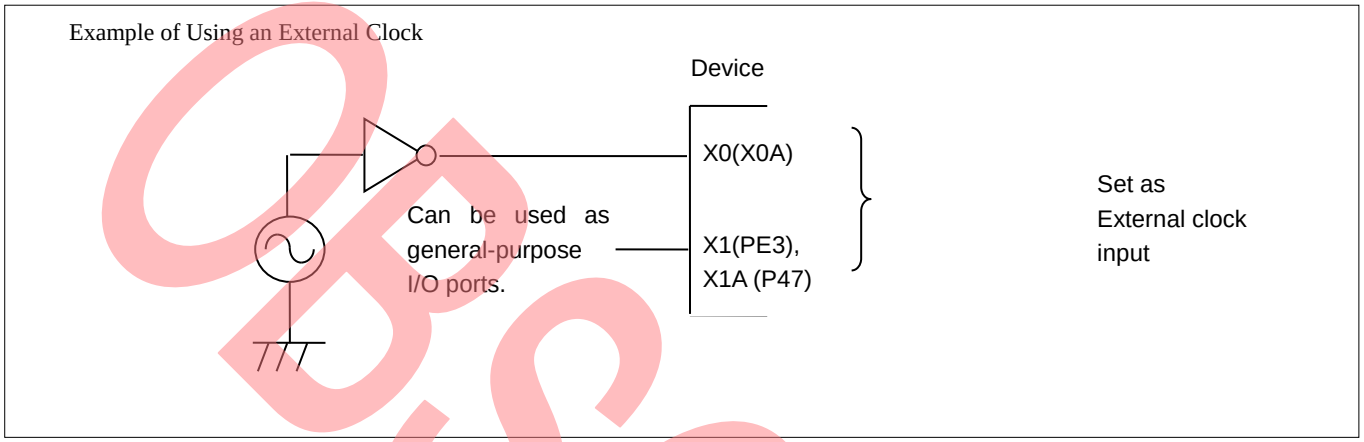
Pin function	Pin name	Function description	Pin no.		
			LQFP-64 QFN-64	LQFP-48 QFN-48	LQFP-32 QFN-32
I2S(MFS)	MI2SDI4_1	I2S Serial Data Input pin (operation mode 2).	38	-	-
	MI2SDO4_1	I2S Serial Data Output pin (operation mode 2).	37	-	-
	MI2SCK4_1	I2S Serial Clock Output pin (operation mode 2).	36	-	-
	MI2SWS4_1	I2S Word Select Output pin (operation mode 2).	35	-	-
	MI2SMCK4_1	I2S Master Clock Input/output pin (operation mode 2).	34	-	-
	MI2SDI6_1	I2S Serial Data Input pin (operation mode 2).	8	8	-
	MI2SDO6_1	I2S Serial Data Output pin (operation mode 2).	7	7	-
	MI2SCK6_1	I2S Serial Clock Output pin (operation mode 2).	6	6	-
	MI2SWS6_1	I2S Word Select Output pin (operation mode 2).	5	5	-
	MI2SMCK6_1	I2S Master Clock Input/output pin (operation mode 2).	9	9	-
Smart Card Interface	IC1_CIN_0	Smart Card insert detection output pin	11	-	-
	IC1_CLK_0	Smart Card serial interface clock output pin	16	-	-
	IC1_DATA_0	Smart Card serial interface data input pin	12	-	-
	IC1_RST_0	Smart Card reset output pin	13	-	-
	IC1_VCC_0	Smart Card power enable output pin	15	-	-
	IC1_VPEN_0	Smart Card programming output pin	14	-	-
Real-time Clock	RTCCO_0	0.5 seconds pulse output pin of real-time clock	64	48	1
	RTCCO_1		43	31	21
	RTCCO_2		11	10	-
	SUBOUT_0	Sub clock output pin	64	48	1
	SUBOUT_1		43	31	21
	SUBOUT_2		11	10	-
HDMI-CEC/Remote Control Reception	CEC0_0	HDMI-CEC/Remote Control Reception ch.0 input/output pin	38	27	-
	CEC1_0	HDMI-CEC/Remote Control Reception ch.1 input/output pin	33	25	17

Type	Circuit	Remarks
D		・CMOS level output ・CMOS level hysteresis input ・With pull-up resistor control ・With standby mode control ・Pull-up resistor : Approximately 33kΩ ・IOH= -4mA, IOL= 4mA ・When this pin is used as an I2C pin, the digital output P-ch transistor is always off
E		・CMOS level output ・CMOS level hysteresis input ・With pull-up resistor control ・With standby mode control ・Pull-up resistor : Approximately 33kΩ ・IOH= -4mA, IOL= 4mA ・When this pin is used as an I2C pin, the digital output P-ch transistor is always off

Using an External Clock

When using an external clock as an input of the main clock, set X0/X1 to the external clock input, and input the clock to X0. X1(PE3) can be used as a general-purpose I/O port.
Similarly, when using an external clock as an input of the sub clock, set X0A/X1A to the external clock input, and input the clock to X0A. X1A (P47) can be used as a general-purpose I/O port.

However in the Deep Standby mode, an external clock as an input of the sub clock cannot be used.



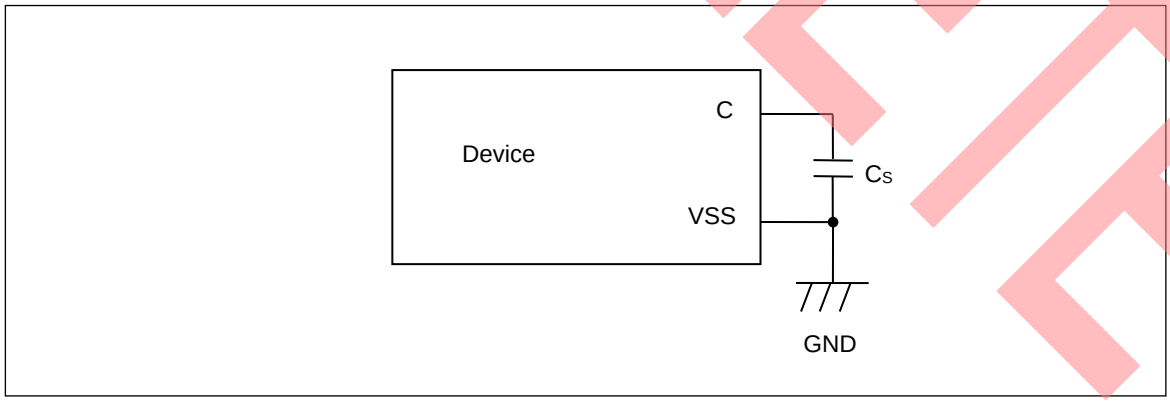
Handling when Using Multi-Function Serial Pin as I²C Pin

If it is using the multi-function serial pin as I²C pins, P-ch transistor of digital output is always disabled. However, I²C pins need to keep the electrical characteristic like other pins and not to connect to the external I²C bus system with power OFF.

C Pin

This series contains the regulator. Be sure to connect a smoothing capacitor (C_S) for the regulator between the C pin and the GND pin. Please use a ceramic capacitor or a capacitor of equivalent frequency characteristics as a smoothing capacitor.
However, some laminated ceramic capacitors have the characteristics of capacitance variation due to thermal fluctuation (F characteristics and Y5V characteristics). Please select the capacitor that meets the specifications in the operating conditions to use by evaluating the temperature characteristics of a capacitor.
A smoothing capacitor of about 4.7 µF would be recommended for this series.

Incidentally, the C pin becomes floating in Deep standby mode.



Mode Pins (MD0)

Connect the MD pin (MD0) directly to VCC or VSS pins. Design the printed circuit board such that the pull-up/down resistance stays low, as well as the distance between the mode pins and VCC pins or VSS pins is as short as possible and the connection impedance is low, when the pins are pulled-up/down such as for switching the pin level and rewriting the Flash memory data. It is because of preventing the device erroneously switching to test mode due to noise.

10. Pin Status in Each CPU State

The following table shows pin status in each CPU state.

Type	Selected Pin function		CPU state							
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A	Main osillation circuit selected *1	Main osillation circuit selected	OS	OS	OE	OE	OE	OS	OS	OS
	Digital I/O slected *2	Main clock external input selected	-	-	IE/IS	IE/IS	IE/IS	IS	IS	IS
		GPIO selected	-	-	PC	HC	IS	HS	IS	HS
B	Main osillation circuit selected *1	Main osillation circuit selected	OS	OS	OE	OE	OE	OS	OS	OS
	Digital I/O slected *2	GPIO selected	-	-	PC	HC	IS	GS	IS	GS
C	Sub osillation circuit selected *1	Sub osillation circuit selected	OS	OE	OE	OE	OE	OE	OE	OE
	Digital I/O slected *2	Sub clock external input selected	-	-	IE/IS	IE/IS	IE/IS	IS	IS	IS
		GPIO selected	-	-	PC	HC	IS	HS	IS	HS
D	Sub osillation circuit selected *1	Sub osillation circuit selected	OS	OE	OE	OE	OE	OE	OE	OE
	Digital I/O slected *2	GPIO selected	-	-	PC	HC	IS	HS	IS	HS
E	Digital I/O slected	INITX input	This pin is digital input pin, pull up register is on, and digital input is not shut off in all CPU state..							
F	Digital I/O slected	MD0 input	This pin is digital input pin, pull up register is none, digital input is not shut off in all CPU state..							
G	Digital I/O slected *6	GPIO selected	IS	IE	CP	HC	IS	HS	IS	HS
H	Digital I/O slected	SW selected	IS	IP *5	PC	IP	IP	IP	IP	IP
		GPIO selected	-	-	PC	HC	IS	HS	IS	HS
I	Digital I/O slected	NMI selected	-	-	IP	IP	IP	-	-	-
		WKUP0 enable and input selected	-	-	IP	IP	IP	IP	IP	IP
		GPIO selected	IS	IE	PC	HC	IS	-	-	-
J	Analog input selected *3	Analog input selected	Analog input is enalbe in all CPU state							
	Digital I/O slected *4	WKUP enable and input selected	-	-	IP	IP	IP	IP	IP	IP
		Exterrnal interrupt enable and input selected	-	-	IP	IP	IP	GS	IS	GS
		GPIO selected	-	-	PC	HC	IS	HS	IS	HS
		Resource other than above selected	-	-	PC	HC	IS	GS	IS	GS
K	Digital I/O slected	CEC pin selected	-	-	CP	CP	CP	CP	CP	CP
		WKUP enable and input selected	-	-	IP	IP	IP	IP	IP	IP
		I2CSLAVE enable selected	-	-	PC	HC	IP	GS	IS	GS
		Exterrnal interrupt enable and input selected	-	-	PC	HC	IP	GS	IS	GS
		GPIO selected	IS	IE	PC	HC	IS	HS	IS	HS
		Resource other than above selected	-	-	PC	HC	IS	GS	IS	GS

Each term in above table have the following meanings.

Additional note

Additional note is described below.

*1 In this type, when internal oscillation function is selected, digital output is disabled. (Hi-Z) pull up register is off, digital input is shut off by fixed 0.

*2 In this type, when Digital I/O function is selected, internal oscillation function is disabled.

*3 In this type, when analog input function is selected, digital output is disabled, (Hi-Z). pull up register is off, digital input is shut off by fixed 0.

*4 In this type, when Digital I/O function is selected, analog input function is not available.

*5 In this case, PCR register is initialized to “1”. Pull up register is on.

*6 This pin does not have pull up register.

11.2 Recommended Operating Conditions

(V_{SS}= 0.0 V)

Parameter	Symbol	Conditions	Value		Unit	Remarks
			Min	Max		
Power supply voltage	V_{CC}	-	1.65 *2	3.6	V	
Analog reference voltage	AVRH	-	2.7	V_{CC}	V	V_{CC} ≥ 2.7 V
			V_{CC}	V_{CC}	V	V_{CC} < 2.7 V
	AVRL	-	VSS	VSS	V	
Smoothing capacitor	C_S	-	1	10	µF	For regulator*1
Operating temperature	Ta	-	- 40	+ 105	°C	

*1: See "C Pin" in "7. Handling Devices" for the connection of the smoothing capacitor.

*2: In between less than the minimum power supply voltage reset / interrupt detection voltage or more, instruction execution and low voltage detection function by built-in High-speed CR (including Main PLL is used) or built-in Low-speed CR is possible to operate only.

<WARNING>

1. *The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.*
2. *Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.*
3. *No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet.*
4. *Users considering application outside the listed conditions are advised to contact their representatives beforehand.*

LVD Current

(V_{CC}=1.65 V to 3.6 V, V_{SS}= 0 V, T_A=- 40°C to +105°C)

Parameter	Symbol	Pin Name	Conditions	Value		Unit	Remarks
				Typ	Max		
Low-Voltage detection circuit (LVD) power supply current	I_{CCLVD}	VCC	At operation	0.15	0.3	µA	For occurrence of reset
				0.10	0.3	µA	For occurrence of interrupt

Bipolar Vref Current

(V_{CC}=1.65 V to 3.6 V, V_{SS}= 0 V, T_A=- 40°C to +105°C)

Parameter	Symbol	Pin Name	Conditions	Value		Unit	Remarks
				Typ	Max		
Bipolar Vref Current	I_{CCBGR}	VCC	At operation	100	200	µA	

Flash Memory Current

(V_{CC}=1.65 V to 3.6 V, V_{SS}= 0 V, T_A=- 40°C to +105°C)

Parameter	Symbol	Pin Name	Conditions	Value		Unit	Remarks
				Typ	Max		
Flash memory write/erase current	$I_{CCFLASH}$	VCC	At Write/Erase	4.4	5.6	mA	

A/D converter Current

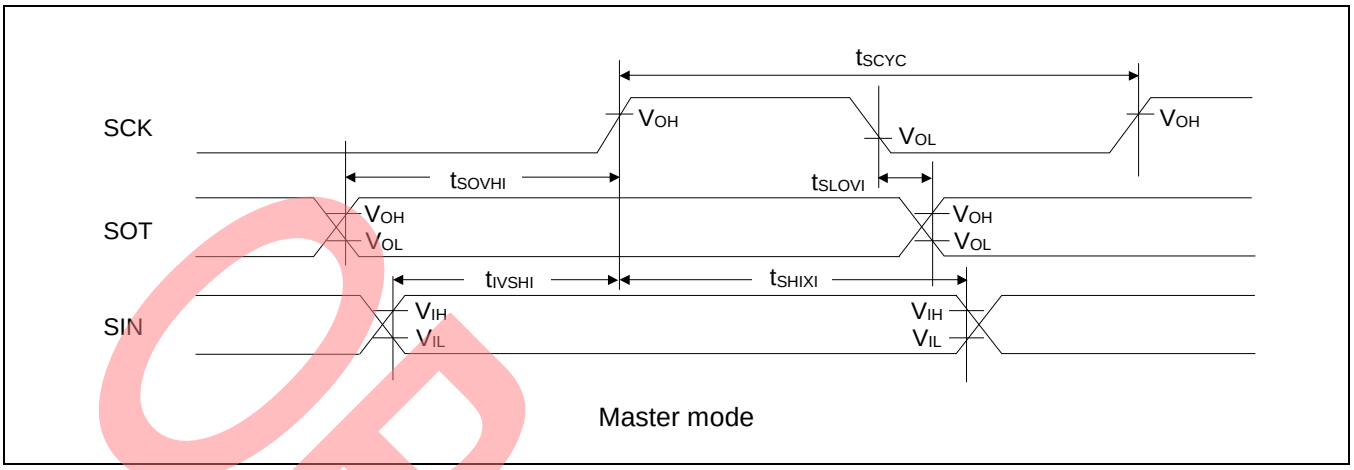
(V_{CC}=1.65 V to 3.6 V, V_{SS}= 0 V, T_A=- 40°C to +105°C)

Parameter	Symbol	Pin Name	Conditions	Value		Unit	Remarks
				Typ	Max		
Power supply current	I_{CCAD}	VCC	At operation	0.5	0.75	mA	
Reference power supply current (AVRH)	I_{CCAVRH}	AVRH	At operation	0.69	1.3	mA	AVRH=3.6 V
			At stop	0.1	1.3	µA	

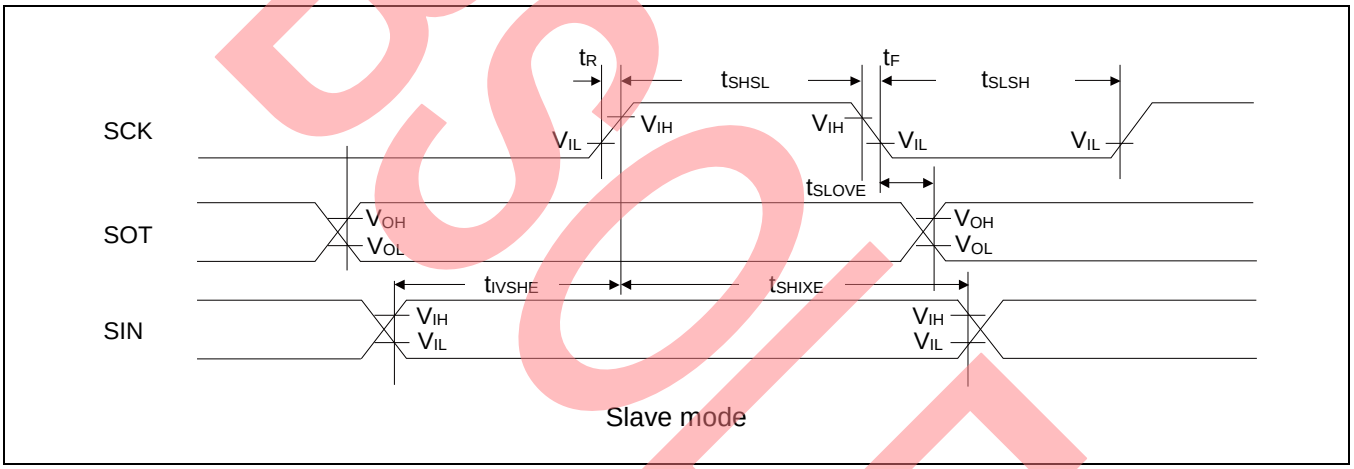
Peripheral Current Dissipation

(V_{CC}=1.65 V to 3.6 V, V_{SS}=0 V, T_A=- 40°C to +105°C)

Clock System	Peripheral	Conditions	Frequency (MHz)			Unit	Remarks
			8	20	40		
HCLK	GPIO	At all ports operation	0.05	0.12	0.23	mA	
	DSTC	At 2ch operation	0.02	0.06	0.10		
PCLK1	Base timer	At 4ch operation	0.02	0.05	0.10	mA	
	ADC	At 1 unit operation	0.04	0.10	0.21		
	Multi-function serial	At 1ch operation	0.01	0.03	0.06		
	MFS-I2S	At 1ch operation	0.02	0.05	0.08		
	Smart Card I/F	At 1ch operation	0.04	0.08	0.18		



Master mode



Slave mode

When Using CSIO/SPI Chip Select (SCINV=1, CSLVL=1)

(V_{CC}= 1.65 V to 3.6 V, V_{SS}= 0 V, T_A=- 40°C to +105°C)

Parameter	Symbol	Conditions	V_{CC} < 2.7 V		V_{CC} ≥ 2.7 V		Unit
			Min	Max	Min	Max	
SCS↓→SCK↑ setup time	t_{CSSI}	Master mode	(*1)-50	(*1)+0	(*1)-50	(*1)+0	ns
SCK↓→SCS↑ hold time	t_{CSHI}		(*2)+0	(*2)+50	(*2)+0	(*2)+50	ns
SCS deselect time	t_{CSDI}		(*3)-50	(*3)+50	(*3)-50	(*3)+50	ns
SCS↓→SCK↑ setup time	t_{CSSE}	Slave mode	$3t_{CYCP}$+30	-	$3t_{CYCP}$+30	-	ns
SCK↓→SCS↑ hold time	t_{CSHE}		0	-	0	-	ns
SCS deselect time	t_{CSDE}		$3t_{CYCP}$+30	-	$3t_{CYCP}$+30	-	ns
SCS↓→SOT delay time	t_{DSE}		-	55	-	40	ns
SCS↑→SOT delay time	t_{DEE}		0	-	0	-	ns

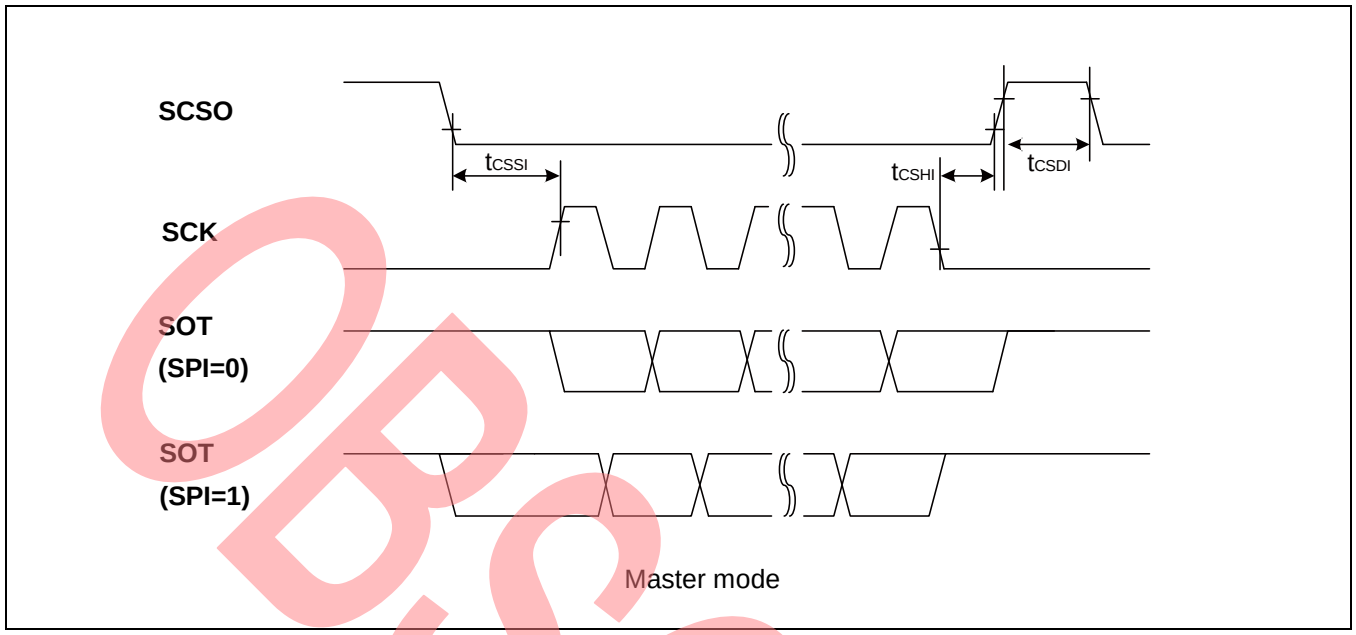
*1: CSSU bit value × serial chip select timing operating clock cycle.

*2: CSHD bit value × serial chip select timing operating clock cycle.

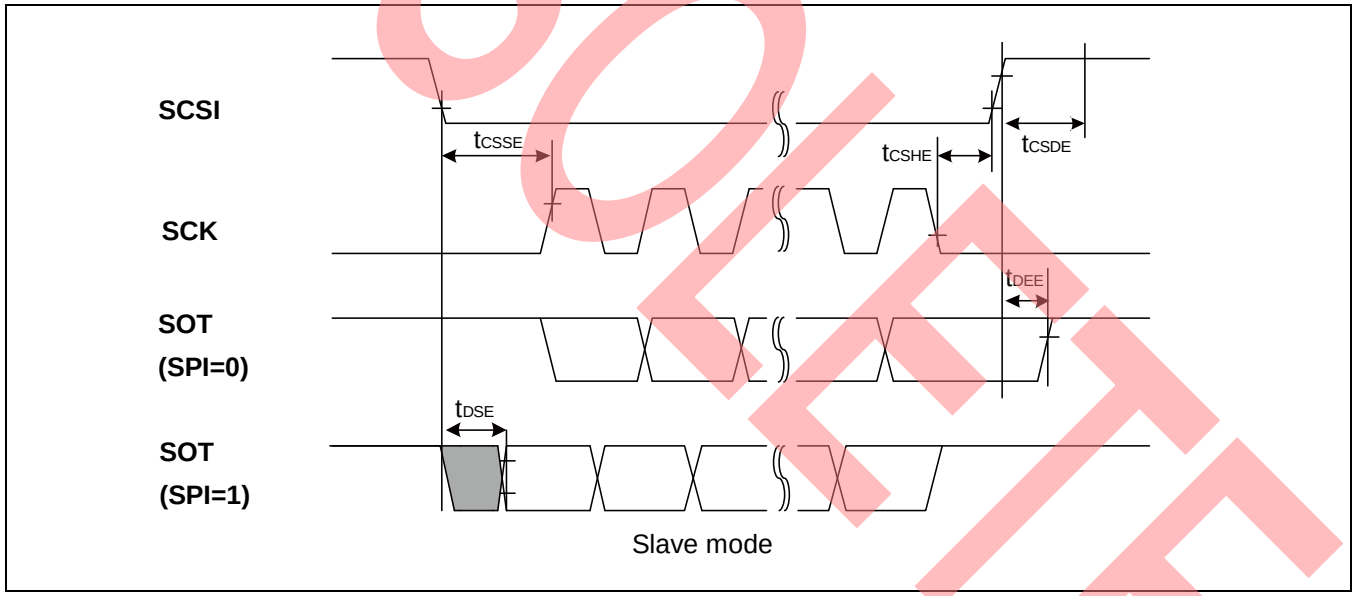
*3: CSDS bit value × serial chip select timing operating clock cycle.
Irrespective of CSDS bit setting, $5t_{CYCP}$ or more are required for the period the time when the serial chip select pin becomes inactive to the time when the serial chip select pin becomes active again.

Notes:

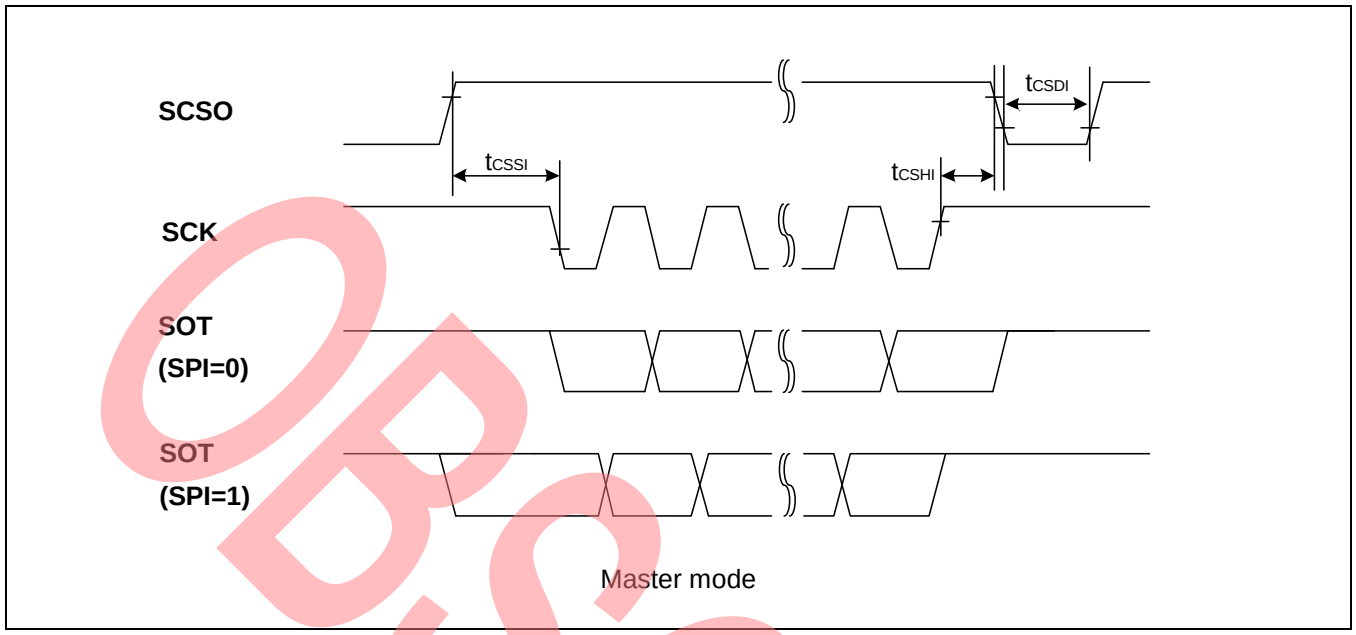
- *t_{CYCP} indicates the APB bus clock cycle time.*
  For information about the APB bus number which Multi-function Serial is connected to, see "8. Block Diagram".
- *For information about CSSU, CSHD, CSDS, serial chip select timing operating clock, see "FM0+ Family Peripheral Manual".*
- *These characteristics only guarantee the same relocate port number.*
  For example, the combination of SCKx_0 and SCSIx_1 is not guaranteed.
- *When the external load capacitance C_L=30 pF.*



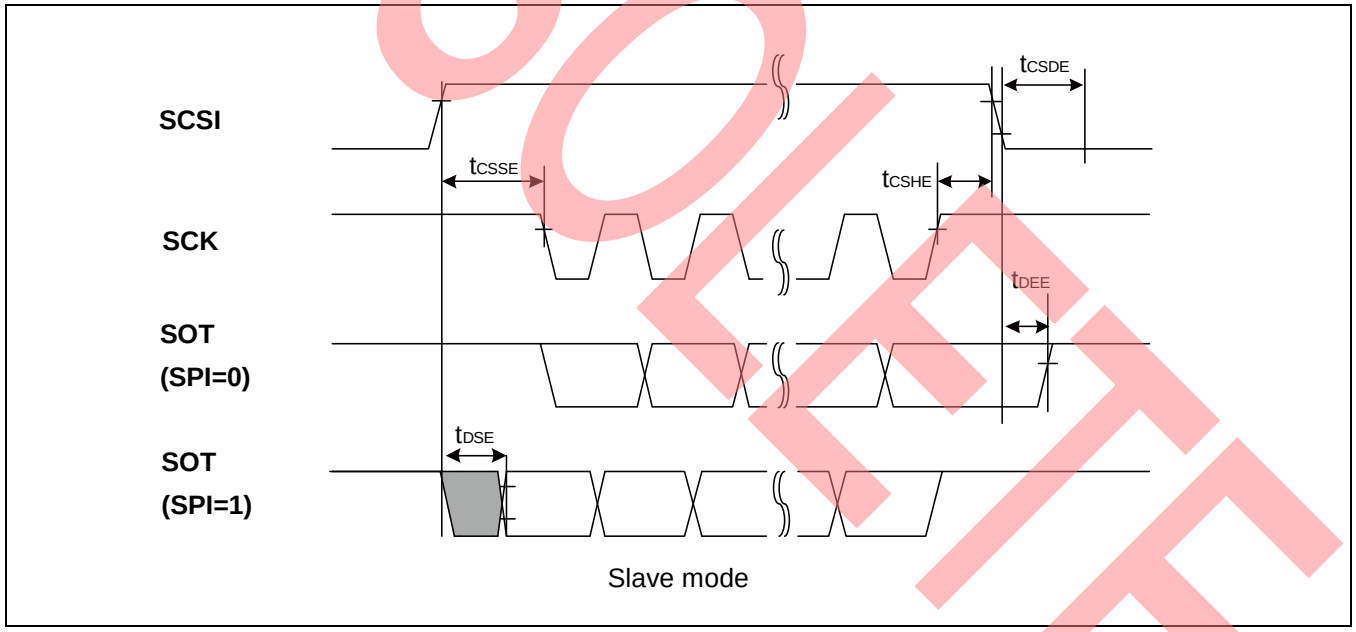
Master mode



Slave mode



Master mode



Slave mode

11.4.13 Smart Card Interface Characteristics

(V_{CC}= 1.65 V to 3.6 V, V_{SS}= 0 V, T_A=- 40°C to +105°C)

Parameter	Symbol	Pin Name	Conditions	Value		Unit	Remarks
				Min	Max		
Output rising time	t_R	ICx_VCC, ICx_RST, ICx_CLK, ICx_DATA	C_L=30 pF	4	20	ns	
Output falling time	t_F			4	20	ns	
Output clock frequency	f_{CLK}	ICx_CLK		-	20	MHz	
Duty cycle	Δ			45%	55%		

■External pull-up resistor (20 kΩ to 50 kΩ) must be applied to ICx_CIN pin when it's used as smart card reader function.

11.8 Return Time from Low-Power Consumption Mode

11.8.1 Return Factor: Interrupt/WKUP

The return time from Low-Power consumption mode is indicated as follows. It is from receiving the return factor to starting the program operation.

Return Count Time

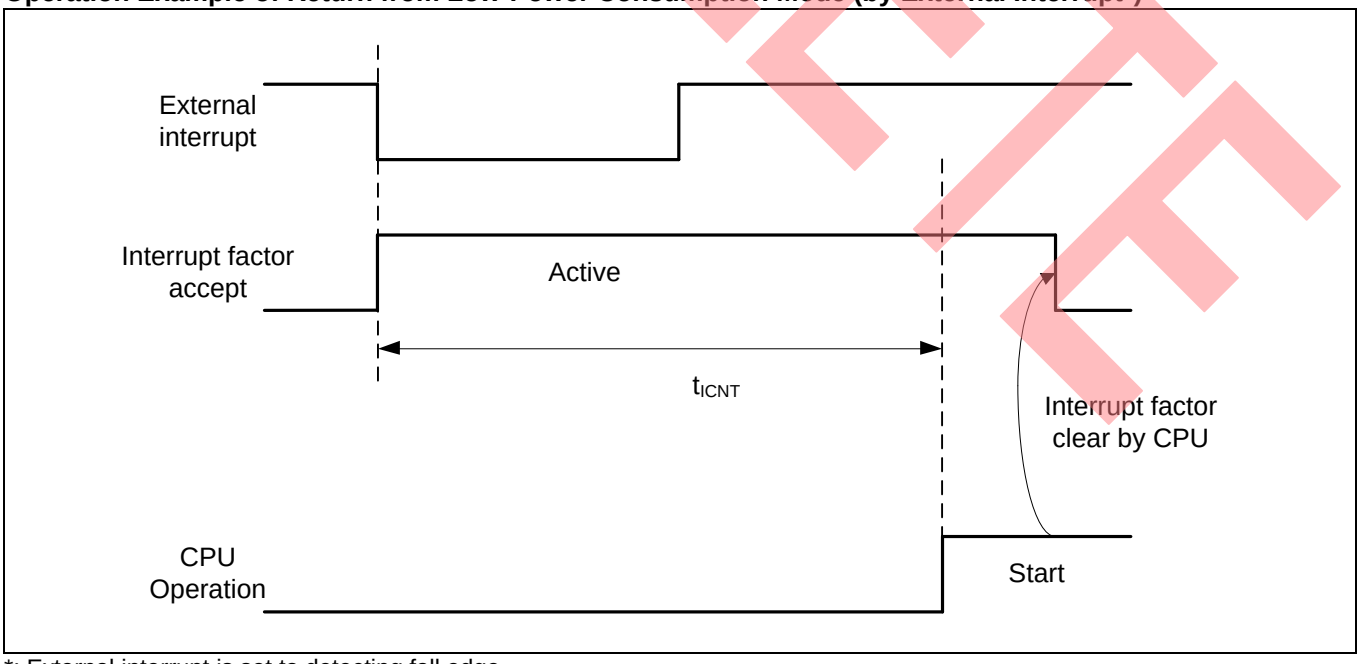
(V_{CC}=1.65 V to 3.6 V, T_A=-40°C to +105°C)

Parameter		Symbol	Value		Unit	Remarks
Current Mode	Mode to return		Typ	Max*1		
Sleep mode	each Run Modes	t_{ICNT}	4*HCLK		µs	When High-speed CR is enabled
Timer mode	High-speed CR Run mode Main Run mode PLL Run mode		12*HCLK	13*HCLK	µs	When High-speed CR is enabled
	Low-speed CR Run mode Sub Run mode		34+12*HCLK	72+13*HCLK	µs	
Stop Mode	High-speed CR Run mode Low-speed CR Run mode		34+12*HCLK	72+13*HCLK	µs	
	Main Run mode Sub Run mode PLL Run mode		34+12*HCLK +t_{OSCWT}	72+13*HCLK +t_{OSCWT}	µs	*2
RTC mode	High-speed CR Run mode Low-speed CR Run mode Sub Run mode		34+12*HCLK	72+13*HCLK	µs	
	Main Run mode PLL Run mode		34+12*HCLK +t_{OSCWT}	72+13*HCLK +t_{OSCWT}	µs	*2
Deep Standby RTC mode Deep Standby Stop mode	High-speed CR Run mode		43	281	µs	

*1: The maximum value depends on the condition of environment.

*2: t_{OSCWT} : Oscillator stabilization time.

Operation Example of Return from Low-Power Consumption Mode (by External Interrupt*)



*: External interrupt is set to detecting fall edge.