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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®-M4F
Core Size	32-Bit Single-Core
Speed	200MHz
Connectivity	CSIO, EBI/EMI, Ethernet, I ² C, LINbus, SD, UART/USART, USB
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	120
Program Memory Size	2MB (2M x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	256K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 24x12b; D/A 2x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	144-LQFP
Supplier Device Package	144-LQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/s6e2c2ah0agv2000a

Product Name		S6E2C28H0A S6E2C29H0A S6E2C2AH0A S6E2C28HHA S6E2C29HHA S6E2C2AHHA		S6E2C28J0A S6E2C29J0A S6E2C2AJ0A S6E2C28JHA S6E2C29JHA S6E2C2AJHA		S6E2C28L0A S6E2C29L0A S6E2C2AL0A S6E2C28JHA S6E2C29JHA S6E2C2AJHA	
Built-in CR	High-speed	4 MHz					
	Low-speed	100 kHz					
Debug function		SWJ-DP/ETM/HTM					
Unique ID		Yes					
Crypto Assist Function		-	Yes*	-	Yes*	-	Yes*

*: Crypto Assist Function is built in following products.

S6E2C28HHA, S6E2C29HHA, S6E2C2AHHA,
 S6E2C28JHA, S6E2C29JHA, S6E2C2AJHA,
 S6E2C28LHA, S6E2C29LHA, S6E2C2ALHA

Notes:

- All signals of the peripheral function in each product cannot be allocated by limiting the pins of package. It is necessary to use the port relocate function of the I/O port according to your function use.
- See 12.4.3 Built-In CR Oscillation Characteristics for the accuracy of the built-in CR.

2. Packages

Product Name Package	S6E2C28H0A S6E2C29H0A S6E2C2AH0A S6E2C28HHA S6E2C29HHA S6E2C2AHHA	S6E2C28J0A S6E2C29J0A S6E2C2AJ0A S6E2C28JHA S6E2C29JHA S6E2C2AJHA	S6E2C28L0A S6E2C29L0A S6E2C2AL0A S6E2C28LHA S6E2C29LHA S6E2C2ALHA
LQFP: LQS144 (0.5-mm pitch)	○	-	-
LQFP: LQP176 (0.5-mm pitch)	-	○	-
BGA : LBE192 (0.8-mm pitch)	-	○	-
LQFP: LQQ216 (0.4-mm pitch)	-	-	○

○: Supported

Note:

- See 14. Package Dimensions for detailed information on each package.

Pin Number				Pin Name	I/O Circuit Type	Pin State Type
LQQ216	LQP176	LQS144	LBE192			
87	72	-	N9	PF4	L	K
				RTO12_1 (PPG12_1)		
				TIOA7_1		
				INT06_1		
				MSDWEX_0		
88	73	-	P9	PF5	L	K
				RTO13_1 (PPG12_1)		
				TIOB7_1		
				INT07_1		
				MCSX8_0		
89	74	-	M9	PF6	L	K
				RTO14_1 (PPG14_1)		
				TIOA14_1		
				INT20_1		
				MSDCKE_0		
90	75	-	L9	PF7	L	K
				RTO15_1 (PPG14_1)		
				TIOB14_1		
				INT21_1		
				MSDCLK_0		
91	76	60	K9	P75	E	K
				SIN8_0		
				TIOB3_0		
				AIN1_0		
				INT20_0		
92	77	61	P10	MAD04_0		
				P76	E	I
				SOT8_0 (SDA8_0)		
				TIOB4_0		
				BIN1_0		
93	78	62	N10	MAD05_0		
				P77	E	I
				SCK8_0 (SCL8_0)		
				TIOB5_0		
				ZIN1_0		
94	-	-	-	MAD06_0		
				PF8	E	I
				SCS70_1		
				DTT11X_1		
95	-	-	-	AIN1_1	E	I
				PF9		
				SCS71_1		
				IC10_1		
96	79	63	L10	BIN1_1	E	K
				P78		
				SIN6_0		
				IC10_0		
				INT21_0		
				MAD07_0		

Pin Number				Pin Name	I/O Circuit Type	Pin State Type
LQQ216	LQP176	LQS144	LBE192			
115	95	79	K13	P11	F	L
				AN01		
				SOT10_0 (SDA10_0)		
				TIOB0_2		
				BIN0_2		
116	96	80	K12	P12	F	L
				AN02		
				SCK10_0 (SCL10_0)		
				TIOA1_2		
				ZIN0_2		
117	97	81	K14	P13	F	M
				AN03		
				SIN6_1		
				INT25_1		
118	98	82	K11	P14	F	L
				AN04		
				SOT6_1 (SDA6_1)		
119	-	-	-	PB8	E	O
				ADTG_6		
				SCS63_1		
				INT08_2		
120	-	-	-	TRACED8	E	O
				PB9		
				SIN9_1		
				AIN2_2		
121	-	-	-	INT09_2	E	N
				TRACED9		
				PBA		
				SOT9_1 (SDA9_1)		
122	-	-	-	BIN2_2	E	N
				TRACED10		
				PBB		
				SCK9_1 (SCL9_1)		
123	99	83	J13	ZIN2_2	F	M
				TRACED11		
				P15		
				AN05		
				SIN11_0		
124	100	84	J12	TIOB1_2	F	L
				AIN1_2		
				INT09_0		
				P16		
				AN06		
124	100	84	J12	SOT11_0 (SDA11_0)	F	L
				TIOA2_2		
				BIN1_2		

Pin Number				Pin Name	I/O Circuit Type	Pin State Type
LQQ216	LQP176	LQS144	LBE192			
180	148	118	E9	PC3	K	V
				TIOB7_0		
				E_RX01		
181	149	119	F9	PC4	K	V
				TIOA7_0		
				E_RX00		
182	150	120	C8	PC5	K	V
				TIOB14_0		
				E_RXDV		
183	151	121	D8	PC6	K	V
				TIOA14_0		
				E_MDIO		
184	152	122	E8	PC7	E	W
				INT13_0		
				E_MDC		
				CROUT_1		
185	153	123	A10	PC8	K	V
				E_RXCK_REFCK		
186	154	124	F8	PC9	K	V
				TIOB15_0		
				E_COL		
187	155	125	B7	PCA	K	V
				TIOA15_0		
				E_CRS		
188	156	126	A9	ETHVCC	-	-
189	157	127	A8	VSS	-	-
190	158	128	A7	PCB	L	W
				INT28_0		
				E_COUT		
191	159	129	C7	PCC	K	V
				E_TCK		
192	160	130	A6	PCD	L	W
				SOT4_1 (SDA4_1)		
				INT14_0		
				E_TXER		
193	161	131	D7	PCE	L	W
				SIN4_1		
				INT15_0		
				E_TX03		
194	162	132	E7	PCF	L	W
				RTS4_1		
				INT12_0		
				E_TX02		
195	163	133	F7	PD0	L	W
				INT30_1		
				E_TX01		
196	164	134	B6	PD1	L	W
				INT31_1		
				E_TX00		
197	165	135	C6	PD2	L	V
				CTS4_1		
				FRCK2_1		
				E_TXEN		

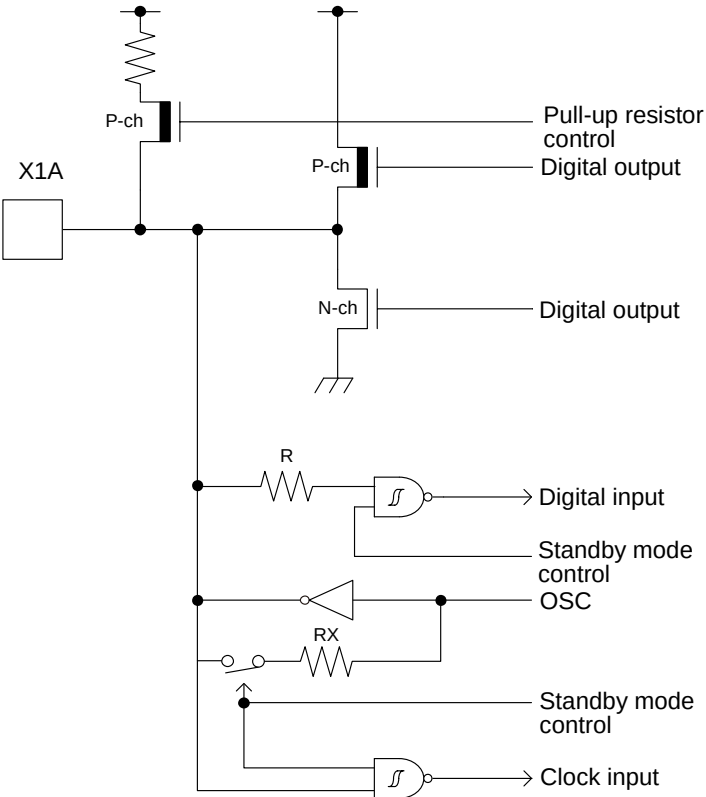
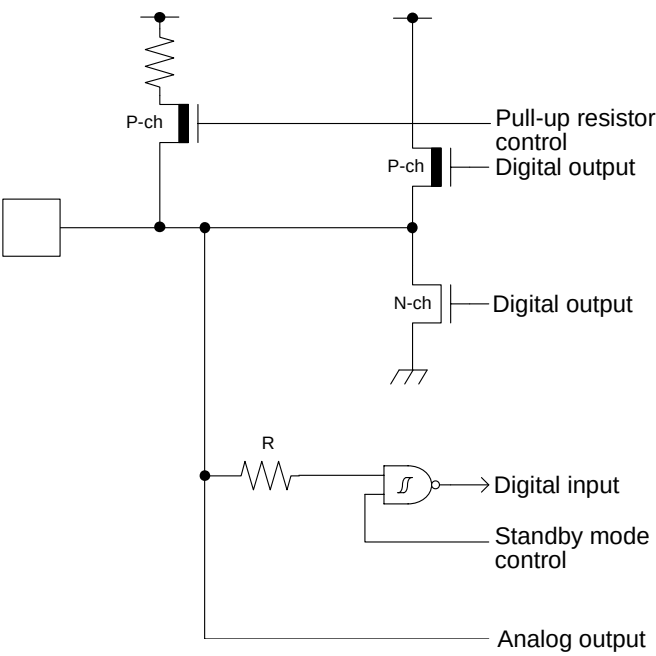
Module	Pin Name	Function	Pin Number			
			LQQ 216	LQP 176	LQS 144	LBE 192
Base Timer 0	TIOA0_0	Base Timer ch 0 TIOA pin	56	46	38	N2
	TIOA0_1		45	35	30	J2
	TIOA0_2		114	94	78	L11
	TIOB0_0	Base Timer ch 0 TIOB pin	82	67	57	L8
	TIOB0_1		21	-	-	-
	TIOB0_2		115	95	79	K13
Base Timer 1	TIOA1_0	Base Timer ch 1 TIOA pin	57	47	39	N3
	TIOA1_1		46	36	31	K1
	TIOA1_2		116	96	80	K12
	TIOB1_0	Base Timer ch 1 TIOB pin	83	68	58	K8
	TIOB1_1		22	-	-	-
	TIOB1_2		123	99	83	J13
Base Timer 2	TIOA2_0	Base Timer ch 2 TIOA pin	58	48	40	M3
	TIOA2_1		47	37	32	K2
	TIOA2_2		124	100	84	J12
	TIOB2_0	Base Timer ch 2 TIOB pin	84	69	59	J8
	TIOB2_1		26	-	-	-
	TIOB2_2		125	101	85	J11
Base Timer 3	TIOA3_0	Base Timer ch 3 TIOA pin	59	49	41	L4
	TIOA3_1		48	38	33	K3
	TIOA3_2		130	106	86	H9
	TIOB3_0	Base Timer ch 3 TIOB pin	91	76	60	K9
	TIOB3_1		27	-	-	-
	TIOB3_2		131	107	87	H12
Base Timer 4	TIOA4_0	Base Timer ch 4 TIOA pin	60	50	42	M4
	TIOA4_1		49	39	34	K4
	TIOA4_2		132	108	88	H14
	TIOB4_0	Base Timer ch 4 TIOB pin	92	77	61	P10
	TIOB4_1		28	-	-	-
	TIOB4_2		133	109	89	G14
Base Timer 5	TIOA5_0	Base Timer ch 5 TIOA pin	61	51	43	N4
	TIOA5_1		50	40	35	L1
	TIOA5_2		134	110	90	H13
	TIOB5_0	Base Timer ch 5 TIOB pin	93	78	62	N10
	TIOB5_1		29	-	-	-
	TIOB5_2		135	111	91	H11
Base Timer 6	TIOA6_0	Base Timer ch 6 TIOA pin	179	147	117	D9
	TIOA6_1		85	70	-	N8
	TIOA6_2		200	-	-	-
	TIOB6_0	Base Timer ch 6 TIOB pin	178	146	116	B8
	TIOB6_1		86	71	-	M8
	TIOB6_2		199	-	-	-

Module	Pin Name	Function	Pin Number			
			LQQ 216	LQP 176	LQS 144	LBE 192
External bus	MCLKOUT_0	External bus interface external clock output pin	32	23	20	G5
	MNALE_0	External bus interface ALE signal to control NAND flash output pin	47	37	32	K2
	MNCLE_0	External bus interface CLE signal to control NAND flash output pin	48	38	33	K3
	MNREX_0	External bus interface read enable signal to control NAND flash	50	40	35	L1
	MNWEX_0	External bus interface write enable signal to control NAND flash	49	39	34	K4
	MOEX_0	External bus interface read enable signal for SRAM	209	169	137	C5
	MWEX_0	External bus interface write enable signal for SRAM	210	170	138	B4
	MSDCLK_0	SDRAM interface SDRAM clock output pin	90	75	-	L9
	MSDCKE_0	SDRAM interface SDRAM clock enable pin	89	74	-	M9
	MRASX_0	SDRAM interface SDRAM column active strobe pin	85	70	-	N8
	MCASX_0	SDRAM interface SDRAM row active strobe pin	86	71	-	M8
	MSDWEX_0	SDRAM interface SDRAM write enable pin	87	72	-	N9
External interrupt	INT00_0	External interrupt request 00 input pin	2	2	2	B2
	INT00_1		38	28	23	H3
	INT00_2		19	-	-	-
	INT01_0	External interrupt request 01 input pin	7	7	7	D1
	INT01_1		41	31	26	H6
	INT01_2		51	41	-	L2
	INT02_0	External interrupt request 02 input pin	14	13	10	E5
	INT02_1		42	32	27	J5
	INT02_2		26	-	-	-
	INT03_0	External interrupt request 03 input pin	17	16	13	F3
	INT03_1		43	33	28	J4
	INT03_2		34	24	-	G6
	INT04_0	External interrupt request 04 input pin	59	49	41	L4
	INT04_1		100	83	67	M11
	INT04_2		65	-	-	-
	INT05_0	External interrupt request 05 input pin	70	55	47	L5
	INT05_1		86	71	-	M8
	INT05_2		68	-	-	-

Module	Pin Name	Function	Pin Number			
			LQQ 216	LQP 176	LQS 144	LBE 192
GPIO	P00	General-purpose I/O port 0	164	134	110	B13
	P01		165	135	111	A12
	P02		166	136	112	C12
	P03		167	137	113	B12
	P04		168	138	114	B11
	P08		30	21	18	G3
	P09		31	22	19	G4
	P0A		32	23	20	G5
	P10	General-purpose I/O port 1	114	94	78	L11
	P11		115	95	79	K13
	P12		116	96	80	K12
	P13		117	97	81	K14
	P14		118	98	82	K11
	P15		123	99	83	J13
	P16		124	100	84	J12
	P17		125	101	85	J11
	P18		130	106	86	H9
	P19		131	107	87	H12
	P1A		132	108	88	H14
	P1B		133	109	89	G14
	P1C		134	110	90	H13
	P1D		135	111	91	H11
	P1E		142	116	92	G10
	P1F		143	117	93	G9
	P20	General-purpose I/O port 2	158	128	104	C13
	P21		157	127	103	D13
	P22		156	126	102	D12
	P23		155	125	101	E13
	P24		154	124	100	E12
	P25		153	123	99	E11
	P26		152	122	98	E10
	P27		147	121	97	F13
	P28		146	120	96	F12
	P29		145	119	95	F11
	P2A		144	118	94	F10

Module	Pin Name	Function	Pin Number			
			LQQ 216	LQP 176	LQS 144	LBE 192
Multi-Function Timer 2	DTTI2X_0	Input signal controlling waveform generator outputs RTO20 to RTO25 of Multi-Function Timer 1.	8	8	8	D3
	DTTI2X_1		202	-	-	-
	FRCK2_0	16-bit free-run timer ch 2 external clock input pin	17	16	13	F3
	FRCK2_1		197	165	135	C6
	IC20_0	16-bit input capture input pin of Multi-Function Timer 2. ICxx describes channel number.	9	9	9	D4
	IC20_1		201	-	-	-
	IC21_0		14	13	10	E5
	IC21_1		200	-	-	-
	IC22_0		15	14	11	F1
	IC22_1		199	-	-	-
	IC23_0		16	15	12	F2
	IC23_1		198	166	136	D6
	RTO20_0 (PPG20_0)	Waveform generator output pin of Multi-Function Timer 2.	2	2	2	B2
	RTO20_1 (PPG20_1)	This pin operates as PPG20 when it is used in PPG2 output modes.	203	-	-	-
	RTO21_0 (PPG20_0)	Waveform generator output pin of Multi-Function Timer 2.	3	3	3	C2
	RTO21_1 (PPG20_1)	This pin operates as PPG20 when it is used in PPG2 output modes.	204	-	-	-
	RTO22_0 (PPG22_0)	Waveform generator output pin of Multi-Function Timer 2.	4	4	4	C3
	RTO22_1 (PPG22_1)	This pin operates as PPG22 when it is used in PPG2 output modes.	205	-	-	-
	RTO23_0 (PPG22_0)	Waveform generator output pin of Multi-Function Timer 2.	5	5	5	D5
	RTO23_1 (PPG22_1)	This pin operates as PPG22 when it is used in PPG2 output modes.	206	-	-	-
	RTO24_0 (PPG24_0)	Waveform generator output pin of Multi-Function Timer 2.	6	6	6	D2
	RTO24_1 (PPG24_1)	This pin operates as PPG24 when it is used in PPG2 output modes.	207	167	-	E6
	RTO25_0 (PPG24_0)	Waveform generator output pin of Multi-Function Timer 2.	7	7	7	D1
	RTO25_1 (PPG24_1)	This pin operates as PPG24 when it is used in PPG2 output modes.	208	168	-	B5

Module	Pin Name	Function	Pin Number			
			LQQ 216	LQP 176	LQS 144	LBE 192
Ethernet	E_COL	Collision detection	186	154	124	F8
	E_COUT	Clock output for Ethernet PHY	190	158	128	A7
	E_CRS	Carrier detection	187	155	125	B7
	E_MDC	Management clock	184	152	122	E8
	E_MDIO	Management data I/O	183	151	121	D8
	E_PPS	PTP counter monitor	198	166	136	D6
	E_RX00	Received data0	181	149	119	F9
	E_RX01	Received data1	180	148	118	E9
	E_RX02	Received data2	179	147	117	D9
	E_RX03	Received data3	178	146	116	B8
	E_RXCK_RE FCK	Received clock input/ Reference clock	185	153	123	A10
	E_RXDV	Received data enable	182	150	120	C8
	E_RXER	Received data error detection	177	145	115	C9
	E_TCK	Transition clock input	191	159	129	C7
	E_TX00	Transition data0	196	164	134	B6
	E_TX01	Transition data1	195	163	133	F7
	E_TX02	Transition data2	194	162	132	E7
	E_TX03	Transition data3	193	161	131	D7
	E_TXEN	Transition data enable	197	165	135	C6
	E_TXER	Transition data error detection	192	160	130	A6
I ² S	I2SMCLK0_0	I ² S external clock pin	51	41	-	L2
	I2SDO0_0	I ² S serial transition data output pin	52	42	-	L3
	I2SWS0_0	I ² S frame synchronization signal pin	53	43	-	M2
	I2SDI0_0	I ² S serial received data input pin	34	24	-	G6
	I2SCK0_0	I ² S bit clock pin	35	25	-	H4
High-speed quad SPI	Q_SCK_0	SPI clock output pin	173	143	-	D10
	Q_IO0_0	SPI data input/output pin	172	142	-	C10
	Q_IO1_0		171	141	-	B10
	Q_IO2_0		170	140	-	D11
	Q_IO3_0		169	139	-	C11
	Q_CS0_0	SPI chip select output pin	174	144	-	B9
	Q_CS1_0		175	-	-	-
	Q_CS2_0		176	-	-	-

Type	Circuit	Remarks
Q	 Pull-up resistor control Digital output Digital output Digital input Standby mode control OSC Standby mode control Clock input	It is possible to select the sub oscillation/GPIO function. When the sub oscillation is selected: - Oscillation feedback resistor: approximately 10 MΩ When the GPIO is selected: - CMOS level output. - CMOS level hysteresis input - Pull-up resistor control - Pull-up resistor: approximately 50 kΩ $I_{OH} = -4 \text{ mA}$, $I_{OL} = 4 \text{ mA}$ - For I/O setting, refer to VBAT Domain in the "FM4 Family Peripheral Manual Main Part (002-04856)."
R	 Pull-up resistor control Digital output Digital output Digital input Standby mode control Analog output	- CMOS level output - CMOS level hysteresis input - Analog output - Pull-up resistor control - Standby mode control - Pull-up resistor: approximately 50 kΩ $I_{OH} = -4 \text{ mA}$, $I_{OL} = 4 \text{ mA}$ (4.5V to 5.5V) $I_{OH} = -2 \text{ mA}$, $I_{OL} = 2 \text{ mA}$ (2.7V to 4.5V)

6.3 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.

List of VBAT Domain Pin Status

VBAT Pin Status Type	Function Group	Power-on reset*1	INITX Input State	Device Internal Reset State	Run mode or Sleep mode State	Timer mode, RTC mode, or Stop mode State		Deep Standby RTC mode or Deep Standby Stop mode State		Return From Deep Standby mode State	VBAT RTC mode State	Return From VBAT RTC mode State
		Power Supply Unstable	Power Supply Stable		Power Supply Stable	Power Supply Stable		Power Supply Stable		Power Supply Stable	Power Supply Stable	Power Supply Stable
		-	INITX=0	INITX=1	INITX=1	INITX=1		INITX=1		INITX=1	-	-
		-	-	-	-	SPL=0	SPL=1	SPL=0	SPL=1	-	-	-
S	GPIO selected	Setting disabled	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Setting prohibition	-
	Sub crystal oscillator input pin/ external sub clock input selected	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled	Maintain previous state	Maintain previous state
T	GPIO selected	Setting disabled	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Setting prohibition	-
	External sub clock input selected	Setting disabled	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state
	Sub crystal oscillator output pin	Hi-Z/ internal input fixed at 0/ or input enable	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state/ When oscillation stops, Hi-Z*2	Maintain previous state/ When oscillation stops, Hi-Z*2	Maintain previous state/ When oscillation stops, Hi-Z*2	Maintain previous state/ When oscillation stops, Hi-Z*2	Maintain previous state	Maintain previous state	Maintain previous state
U	Resource selected	Hi-Z	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state
	GPIO selected		Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state	Maintain previous state

*1: When VBAT and VCC power on.

*2: When the SOS_CNTL bit in the WTOS_CNTL register is 0, the sub crystal oscillator output pin is maintained in the previous state. When the SOS_CNTL bit in the WTOS_CNTL register is 1, oscillation is stopped at Stop mode and Deep Standby Stop mode

Table 12-6 Typical and Maximum Current Consumption in Sleep Operation (PLL), when PCLK0 = PCLK1 = PCLK2 = HCLK

Parameter	Symbol	Pin Name	Conditions	Frequency* ⁴	Value		Unit	Remarks
					Typ* ¹	Max* ²		
Power supply current	I _{CCS}	VCC	Sleep operation* ⁵ (PLL)	72 MHz	45	130	mA	* ³ When all peripheral clocks are on
				60 MHz	38	122	mA	
				48 MHz	31	114	mA	
				36 MHz	24	106	mA	
				24 MHz	18	99	mA	
				12 MHz	11	91	mA	
				8 MHz	8.6	88.3	mA	
				4 MHz	6.3	85.7	mA	
				72 MHz	20	103	mA	* ³ When all peripheral clocks are off
				60 MHz	18	99	mA	
				48 MHz	15	96	mA	
				36 MHz	12	93	mA	
				24 MHz	9.1	89.3	mA	
				12 MHz	6.5	86.1	mA	
				8 MHz	5.5	84.9	mA	
				4 MHz	4.6	83.8	mA	

*1: T_A = +25°C, V_{CC} = 3.3 V

*2: T_J = +125°C, V_{CC} = 5.5 V

*3: When all ports are fixed

*4: Frequency is a value of HCLK when PCLK0 = PCLK1 = PCLK2 = HCLK

*5: When using the crystal oscillator of 4 MHz (including the current consumption of the oscillation circuit)

Parameter	Symbol	Pin Name	Conditions	Value			Unit	Remarks
				Min	Typ	Max		
L level output voltage	V _{OL}	4 mA type	V _{CC} ≥ 4.5 V, I _{OL} = 4 mA	V _{SS}	-	0.4	V	
			V _{CC} < 4.5 V, I _{OL} = 2 mA					
			ETHV _{CC} ≥ 4.5 V, I _{OL} = 4 mA	V _{SS}	-	0.4	V	
			RTHV _{CC} < 4.5 V, I _{OL} = 2 mA					
		8 mA type	V _{CC} ≥ 4.5 V, I _{OL} = 8 mA	V _{SS}	-	0.4	V	
			V _{CC} < 4.5 V, I _{OL} = 4 mA					
			ETHV _{CC} ≥ 4.5 V, I _{OL} = 8 mA	V _{SS}	-	0.4	V	
			RTHV _{CC} < 4.5 V, I _{OL} = 4 mA					
		10 mA type	V _{CC} ≥ 4.5 V, I _{OL} = 10 mA	V _{SS}	-	0.4	V	
			V _{CC} < 4.5 V, I _{OL} = 8 mA					
		12 mA type	V _{CC} ≥ 4.5 V, I _{OL} = 12 mA	V _{SS}	-	0.4	V	
			V _{CC} < 4.5 V, I _{OL} = 8 mA					
		The pin doubled as USB I/O	USBV _{CC} ≥ 4.5 V, I _{OL} = 18.5 mA	V _{SS}	-	0.4	V	*1
			USBV _{CC} < 4.5 V, I _{OL} = 10.5 mA					
		The pin doubled as I ² C Fm+	V _{CC} ≥ 4.5 V, I _{OL} = 4 mA	V _{SS}	-	0.4	V	At GPIO
			V _{CC} < 4.5 V, I _{OL} = 3 mA					At I ² C Fm+
			V _{CC} ≤ 4.5 V, I _{OL} = 20 mA					
Input leak current	I _{IL}	-	-	- 5	-	+ 5	μA	
Pull-up resistor value	R _{PU}	Pull-up pin	V _{CC} ≥ 4.5 V	25	50	100	kΩ	
			V _{CC} < 4.5 V	30	80	200		
Input capacitance	C _{IN}	Other than VCC, USBVCC0, USBVCC1, ETHVCC, VBAT, VSS, AVCC, AVSS, AVRH	-	-	5	15	pF	

*1: USBV_{CC0} and USBV_{CC1} are described as USBV_{CC}.

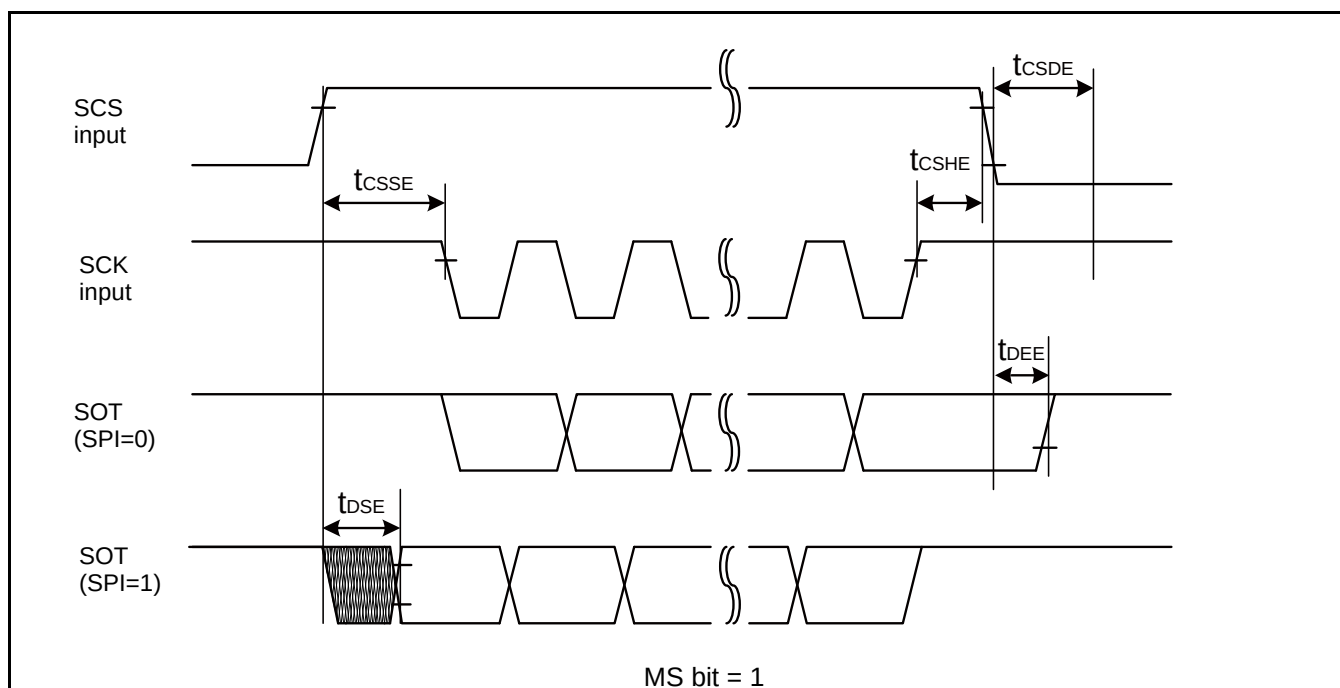
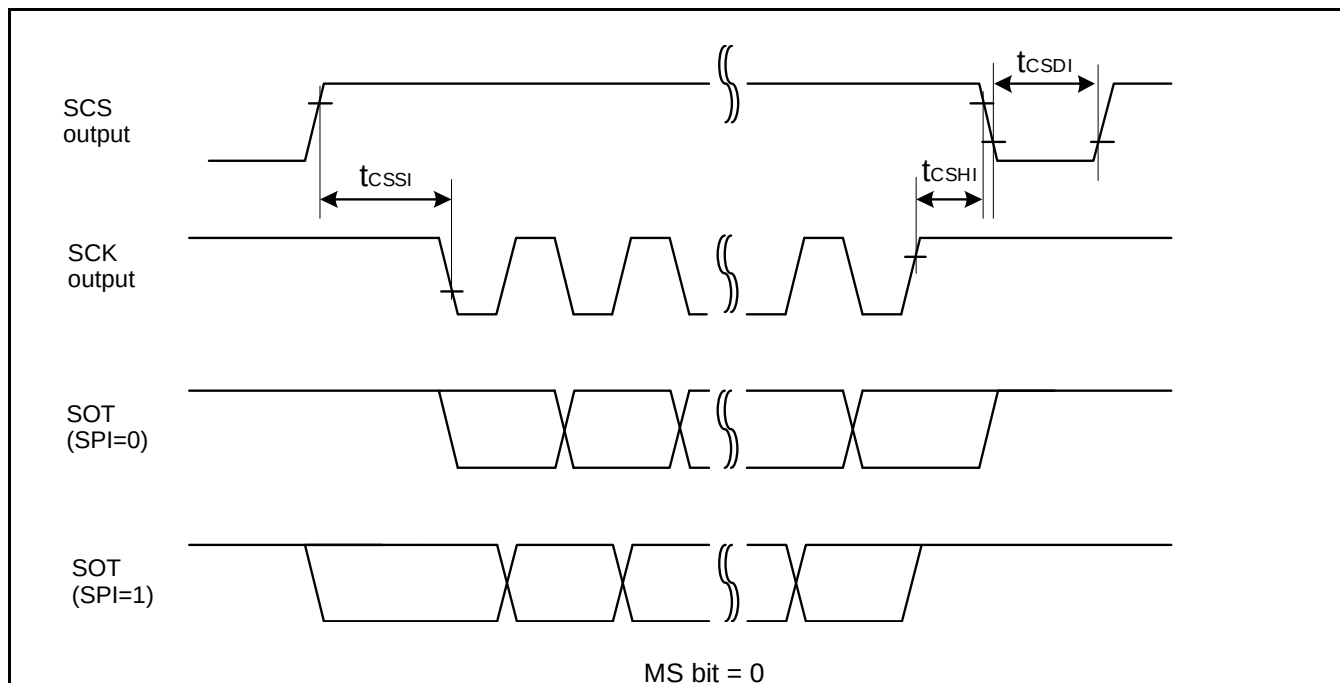
Synchronous Serial (SPI = 1, SCINV = 0)

 (V_{CC} = 2.7V to 5.5V, V_{SS} = 0V)

Parameter	Symbol	Pin Name	Conditions	V _{CC} < 4.5 V		V _{CC} ≥ 4.5 V		Unit
				Min	Max	Min	Max	
Baud rate	-	-	-	-	8	-	8	Mbps
Serial clock cycle time	t _{SCYC}	SCKx	Internal shift clock operation	4t _{CYCP}	-	4t _{CYCP}	-	ns
SCK↑→SOT delay time	t _{SHOVI}	SCKx, SOTx		- 30	+ 30	- 20	+ 20	ns
SIN→SCK↓ setup time	t _{IVSLI}	SCKx, SINx		50	-	30	-	ns
SCK↓→SIN hold time	t _{SLIXI}	SCKx, SINx		0	-	0	-	ns
SOT→SCK↓ delay time	t _{SOVLI}	SCKx, SOTx		2t _{CYCP} - 30	-	2t _{CYCP} - 30	-	ns
Serial clock L pulse width	t _{LSLH}	SCKx	External shift clock operation	2t _{CYCP} - 10	-	2t _{CYCP} - 10	-	ns
Serial clock H pulse width	t _{SHSL}	SCKx		t _{CYCP} + 10	-	t _{CYCP} + 10	-	ns
SCK↑→SOT delay time	t _{SHOVE}	SCKx, SOTx		-	50	-	30	ns
SIN→SCK↓ setup time	t _{IVSLE}	SCKx, SINx		10	-	10	-	ns
SCK↓→SIN hold time	t _{SLIXE}	SCKx, SINx		20	-	20	-	ns
SCK fall time	t _F	SCKx		-	5	-	5	ns
SCK rise time	t _R	SCKx		-	5	-	5	ns

Notes:

- The above characteristics apply to CLK synchronous mode.
- t_{CYCP} indicates the APB bus clock cycle time. For more information about the APB bus number to which the multi-function serial is connected, see 8. Block Diagram in this data sheet.
- These characteristics only guarantee the same relocate port number; for example, the combination of SCKx_0 and SOTx_1 is not guaranteed.
- When the external load capacitance C_L = 30 pF.



12.4.16 SD Card Interface Timing

Default-Speed Mode

■ Clock CLK (All values are referenced to V_{IH} and V_{IL} transition points)

($V_{CC} = 2.7V$ to $3.6V$, $V_{SS} = 0V$)

Parameter	Symbol	Pin Name	Conditions	Value		Remarks
				Min	Max	
Clock frequency Data Transfer Mode	f_{PP}	S_CLK	$C_{CARD} \leq 10$ pF (1card)	0	25	MHz
Clock frequency Identification Mode	f_{OD}	S_CLK		0/100	400	kHz
Clock low time	t_{WL}	S_CLK		10	-	ns
Clock high time	t_{WH}	S_CLK		10	-	ns
Clock rise time	t_{TLH}	S_CLK		-	10	ns
Clock fall time	t_{THL}	S_CLK		-	10	ns

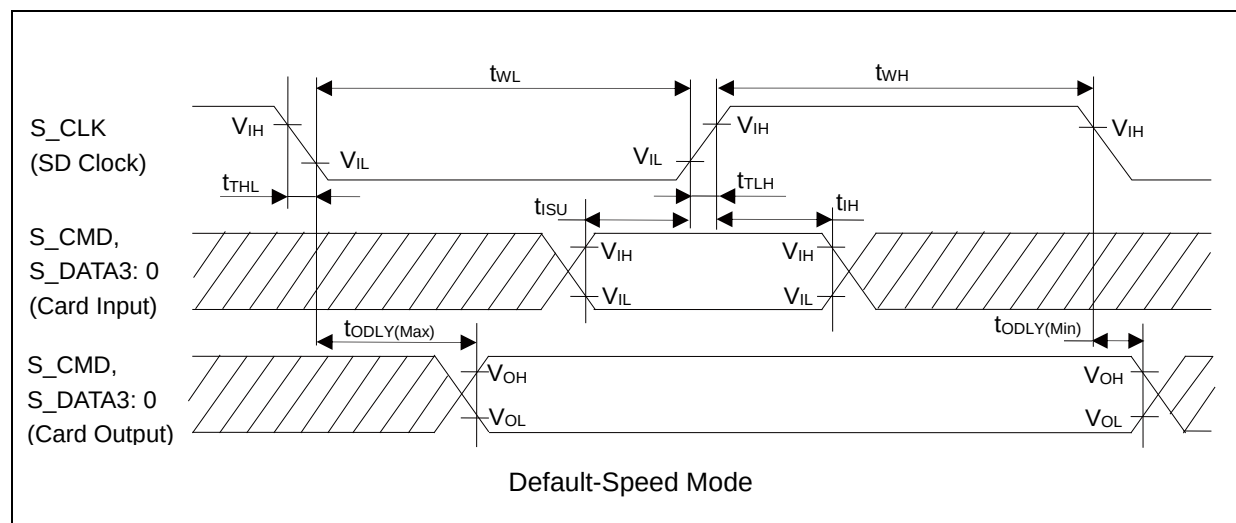
* 0 Hz means to stop the clock. The given minimum frequency range is for cases where a continuous clock is required.

■ Card Inputs CMD, DAT (referenced to Clock CLK)

Parameter	Symbol	Pin Name	Conditions	Value		Remarks
				Min	Max	
Input set-up time	t_{ISU}	S_CMD, S_DATA3: 0	$C_{CARD} \leq 10$ pF (1card)	5	-	ns
Input hold time	t_{IH}	S_CMD, S_DATA3: 0		5	-	ns

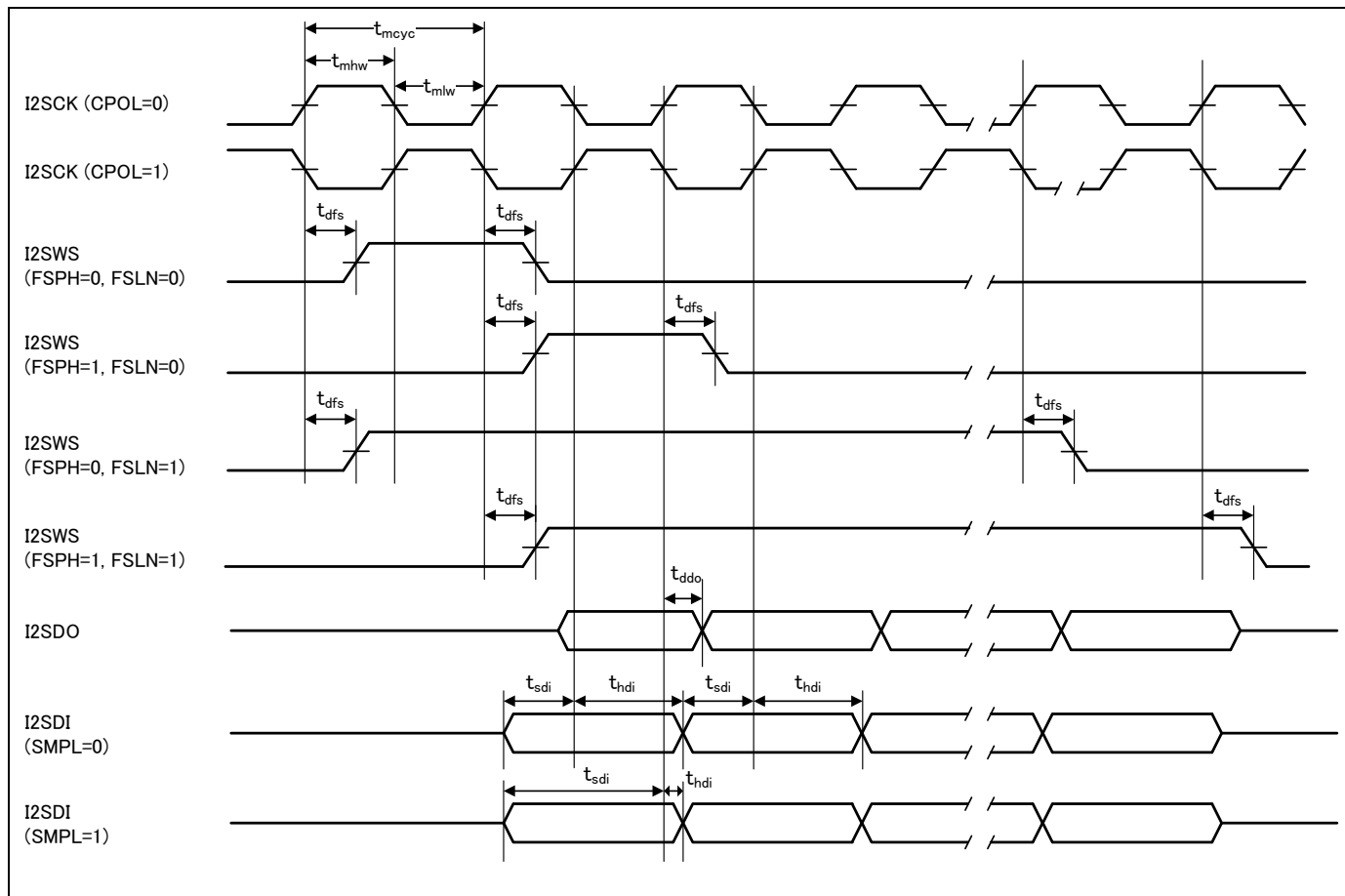
■ Card Outputs CMD, DAT (referenced to Clock CLK)

Parameter	Symbol	Pin Name	Conditions	Value		Remarks
				Min	Max	
Output Delay time during Data Transfer Mode	t_{ODLY}	S_CMD, S_DATA3: 0	$C_{CARD} \leq 40$ pF (1card)	0	14	ns
Output Delay time during Identification Mode	t_{ODLY}	S_CMD, S_DATA3: 0		0	50	ns



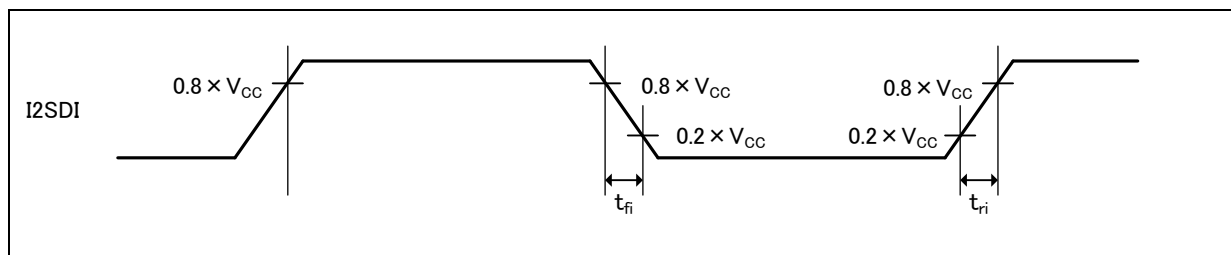
Notes:

- The Card Input corresponds to the Host Output and the Card Output corresponds to the Host Input because this model is the Host.
- For more information about clock frequency (f_{PP}), see Chapter 15: SD card Interface in FM4 Family Peripheral Manual Main Part (002-04856).

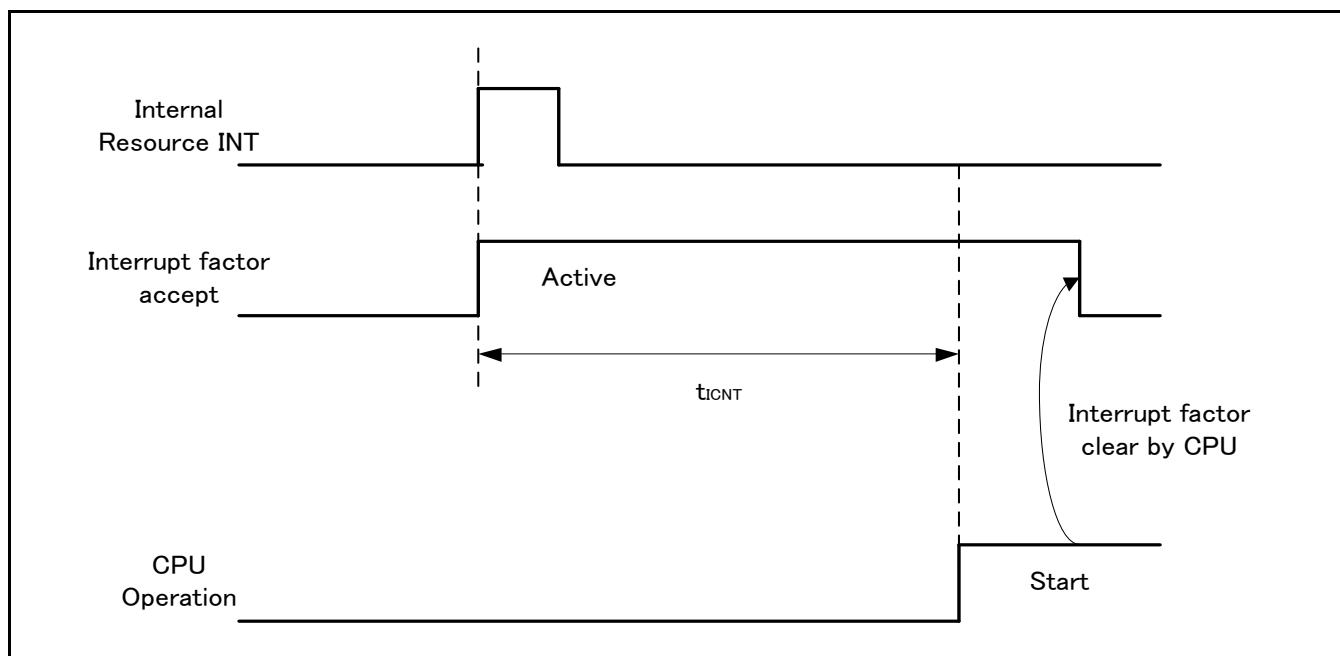


Note:

- See Chapter 7-2: I²S (Inter-IC Sound bus) Interface in FM4 Family Peripheral Manual Communication Macro Part (002-04862) for the details of CPOL, FSPH, FSLN, and SMPL.



Example of Standby Recovery Operation (when in Internal Resource Interrupt Recovery*)



*: Depending on the standby mode, interrupt from the internal resource is not included in the recovery cause.

Notes:

- The return factor is different in each low-power consumption mode. See Chapter 6: Low Power Consumption Mode and Operations of Standby Modes in FM4 Family Peripheral Manual Main Part (002-04856).
- The recovery process is unique for each operating mode. See Chapter 6: Low Power Consumption Mode in FM4 Family Peripheral Manual Main Part (002-04856).

13. Ordering Information

Part Number	Flash	RAM	Crypto	Package
S6E2C28H0AGV2000A	1 MB	128 KB	N/A	Plastic LQFP (0.5 mm pitch), 144 pin (LQS144)
S6E2C29H0AGV2000A	1.5 MB	192 KB	N/A	
S6E2C2AH0AGV2000A	2 MB	256 KB	N/A	
S6E2C28HHAGV2000A	1 MB	128 KB	Yes	
S6E2C29HHAGV2000A	1.5 MB	192 KB	Yes	
S6E2C2AHHAGV2000A	2 MB	256 KB	Yes	
S6E2C28J0AGV2000A	1 MB	128 KB	N/A	Plastic LQFP (0.5 mm pitch), 176 pin (LQP176)
S6E2C29J0AGV2000A	1.5 MB	192 KB	N/A	
S6E2C2AJ0AGV2000A	2 MB	256 KB	N/A	
S6E2C28JHAGV2000A	1 MB	128 KB	Yes	
S6E2C29JHAGV2000A	1.5 MB	192 KB	Yes	
S6E2C2AJHAGV2000A	2 MB	256 KB	Yes	
S6E2C28J0AGB1000A	1 MB	128 KB	N/A	Plastic FBGA (0.8 mm pitch), 192 pin (LBE192)
S6E2C29J0AGB1000A	1.5 MB	192 KB	N/A	
S6E2C2AJ0AGB1000A	2 MB	256 KB	N/A	
S6E2C28JHAGB1000A	1 MB	128 KB	Yes	
S6E2C29JHAGB1000A	1.5 MB	192 KB	Yes	
S6E2C2AJHAGB1000A	2 MB	256 KB	Yes	
S6E2C28L0AGL2000A	1 MB	128 KB	N/A	Plastic LQFP (0.4 mm pitch), 216 pin (LQQ216)
S6E2C29L0AGL2000A	1.5 MB	192 KB	N/A	
S6E2C2AL0AGL2000A	2 MB	256 KB	N/A	
S6E2C28LHAGL2000A	1 MB	128 KB	Yes	
S6E2C29LHAGL2000A	1.5 MB	192 KB	Yes	
S6E2C2ALHAGL2000A	2 MB	256 KB	Yes	