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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	Obsolete
Core Processor	ARM® Cortex®-M0+
Core Size	32-Bit Single-Core
Speed	40MHz
Connectivity	CSIO, I²C, LINbus, SmartCard, UART/USART, USB
Peripherals	I²S, LCD, LVD, POR, PWM, WDT
Number of I/O	82
Program Memory Size	560KB (560K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	64K x 8
Voltage - Supply (Vcc/Vdd)	1.65V ~ 3.6V
Data Converters	A/D 23x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	100-LQFP
Supplier Device Package	100-LQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/s6e1b86f0agv20000

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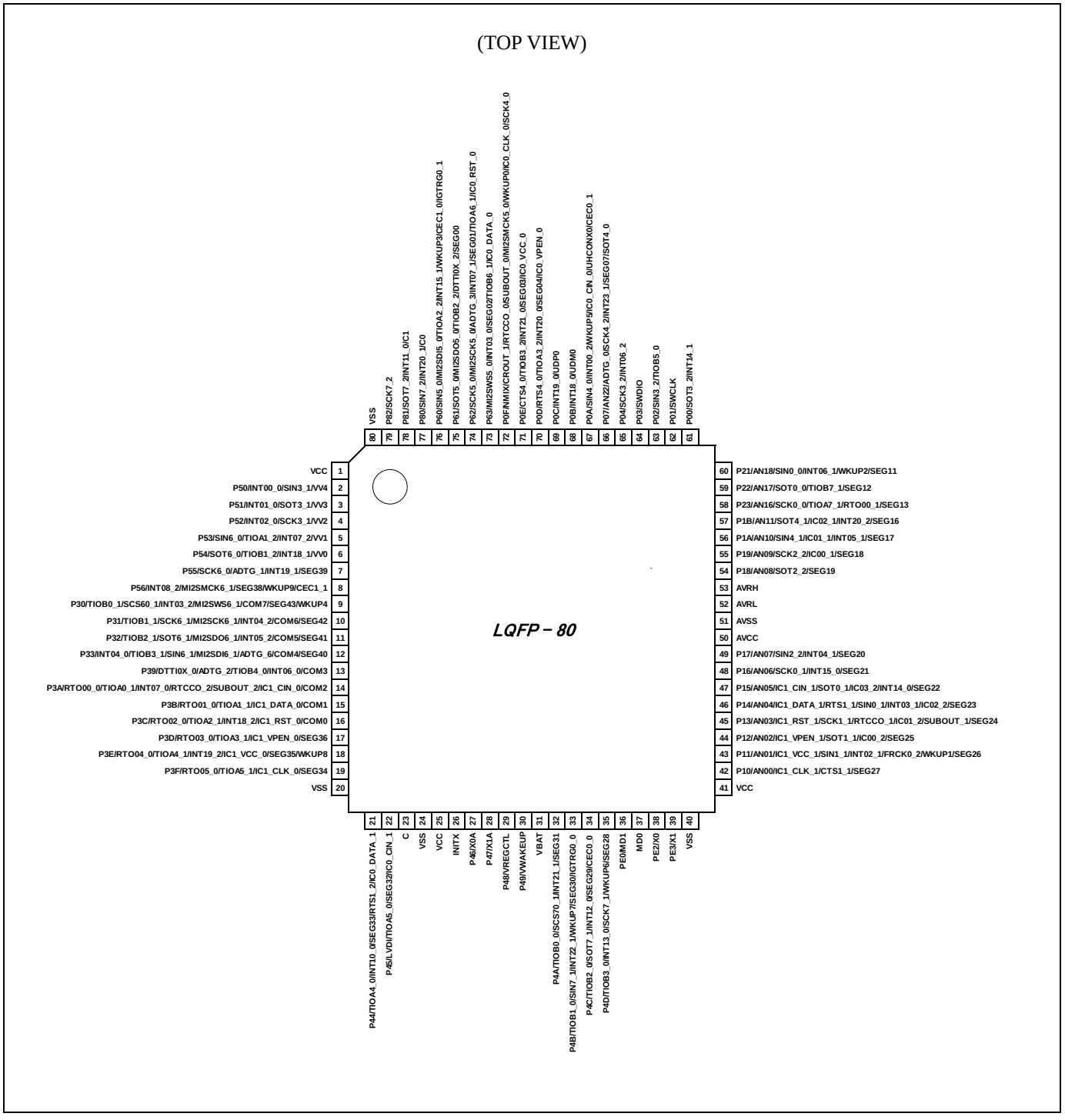
3. Pin Assignment

FPT-80P-M21



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 Name	I/O Circuit Type	Pin State Type
LQFP-120	LQFP-100	LQFP-80			
1	1	1	VCC	-	
2	2	2	P50	Q	X
			SIN3_1		
			INT00_0		
			VV4		
3	3	3	P51	Q	X
			SOT3_1		
			INT01_0		
			VV3		
4	4	4	P52	Q	X
			SCK3_1		
			INT02_0		
			VV2		
5	5	5	P53	Q	X
			SIN6_0		
			TIOA1_2		
			INT07_2		
			VV1		
6	6	6	P54	Q	X
			SOT6_0		
			TIOB1_2		
			INT18_1		
			VV0		
7	7	7	P55	L	S
			SCK6_0		
			ADTG_1		
			INT19_1		
			SEG39		
8	8	8	P56	L	U
			MI2SMCK6_1		
			CEC1_1		
			INT08_2		
			WKUP9		
			SEG38		
	-	-	SIN1_0		
9	-	-	P57	F	I
			SOT1_0		
10	-	-	P58	F	I
			SCK1_0		
11	-	-	P59	F	J
			SIN7_0		
			INT16_1		

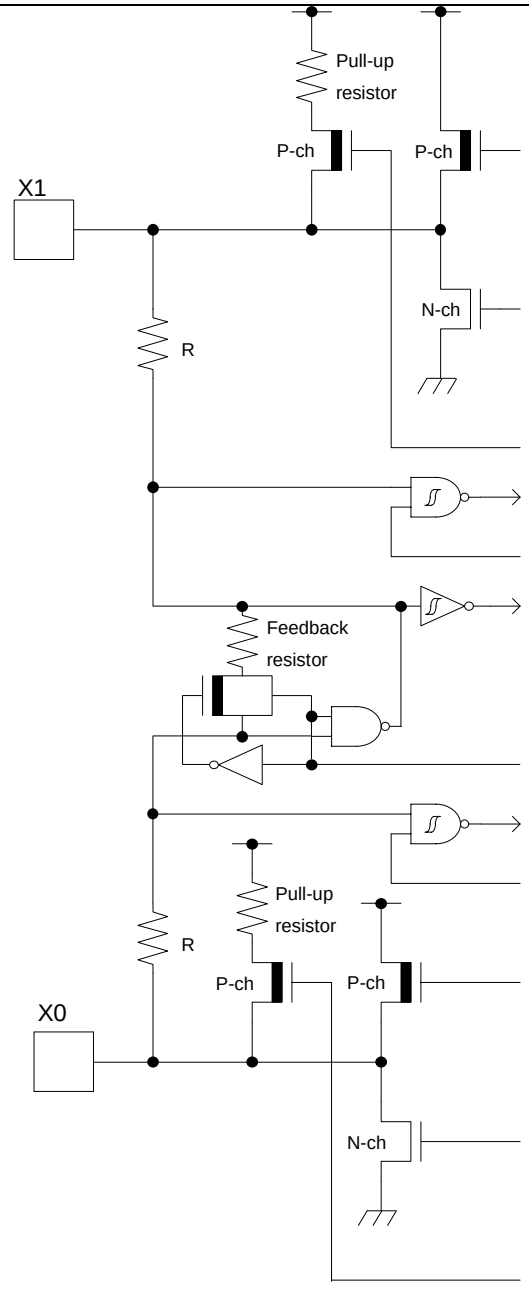
Pin No.			Pin Name	I/O Circuit Type	Pin State Type
LQFP-120	LQFP-100	LQFP-80			
33	28	-	P41 TIOA1_0 SOT1_2 IC0_VCC_1 INT13_1	F	J
34	29	-	P42 TIOA2_0 SCK1_2 IC0_VPEN_1 INT08_0	F	J
35	30	-	P43 TIOA3_0 CTS1_2 ADTG_7 IC0_RST_1 INT09_0	F	J
36	31	21	P44 TIOA4_0 IC0_DATA_1 INT10_0 RTS1_2 SEG33	L	S
37	32	22	P45 TIOA5_0 IC0_CIN_1 LVDI SEG32	L	P
38	33	23	C	-	-
39	34	24	VSS	-	-
40	35	25	VCC	-	-
41	36	26	INITX	B	C
42	37	27	P46 X0A	D	E
43	38	28	P47 X1A	E	F
44	39	29	P48 VREGCTL	I	I
45	40	30	P49 VWAKEUP	I	I
46	41	31	VBAT	-	-
47	42	32	P4A TIOB0_0 SCS70_1 INT21_1 SEG31	L	S
48	43	33	P4B TIOB1_0 SIN7_1 INT22_1 WKUP7 SEG30 IGTRG0_0	L	T

Pin Function	Pin Name	Function Description	Pin No.		
			LQFP-120	LQFP-100	LQFP-80
Real-time Clock	RTCCO_0	0.5-seconds pulse output pin of Real-time clock	107	92	72
	RTCCO_1		65	55	45
	RTCCO_2		24	19	14
	SUBOUT_0	Sub clock output pin	107	92	72
	SUBOUT_1		65	55	45
	SUBOUT_2		24	19	14
HDMI-CEC/ Remote Control Reception	CEC0_0	HDMI-CEC/Remote Control Reception ch.0 input/output pin	49	44	34
	CEC0_1		102	87	67
	CEC1_0	HDMI-CEC/Remote Control Reception ch.1 input/output pin	116	96	76
	CEC1_1		8	8	8
LCD Controller	VV0	LCD controller power supply I/O pin	6	6	6
	VV1		5	5	5
	VV2		4	4	4
	VV3		3	3	3
	VV4		2	2	2
	C0	LCD controller flying capacitor output pin	117	97	77
	C1		118	98	78
	COM0	LCD controller common output pin	26	21	16
	COM1		25	20	15
	COM2		24	19	14
	COM3		23	18	13
	COM4		17	12	12
	COM5		16	11	11
	COM6		15	10	10
	COM7		14	9	9
	SEG00	LCD controller segment output pin	115	95	75
	SEG01		114	94	74
	SEG02		113	93	73
	SEG03		106	91	71
	SEG04		105	90	70
	SEG05		101	86	-
	SEG06		100	85	-
	SEG07		99	84	66
	SEG08		98	83	-
	SEG09		97	82	-
	SEG10		89	74	-
	SEG11		88	73	60
	SEG12		87	72	59
	SEG13		86	71	58
	SEG14		79	69	-
	SEG15		78	68	-
	SEG16		77	67	57

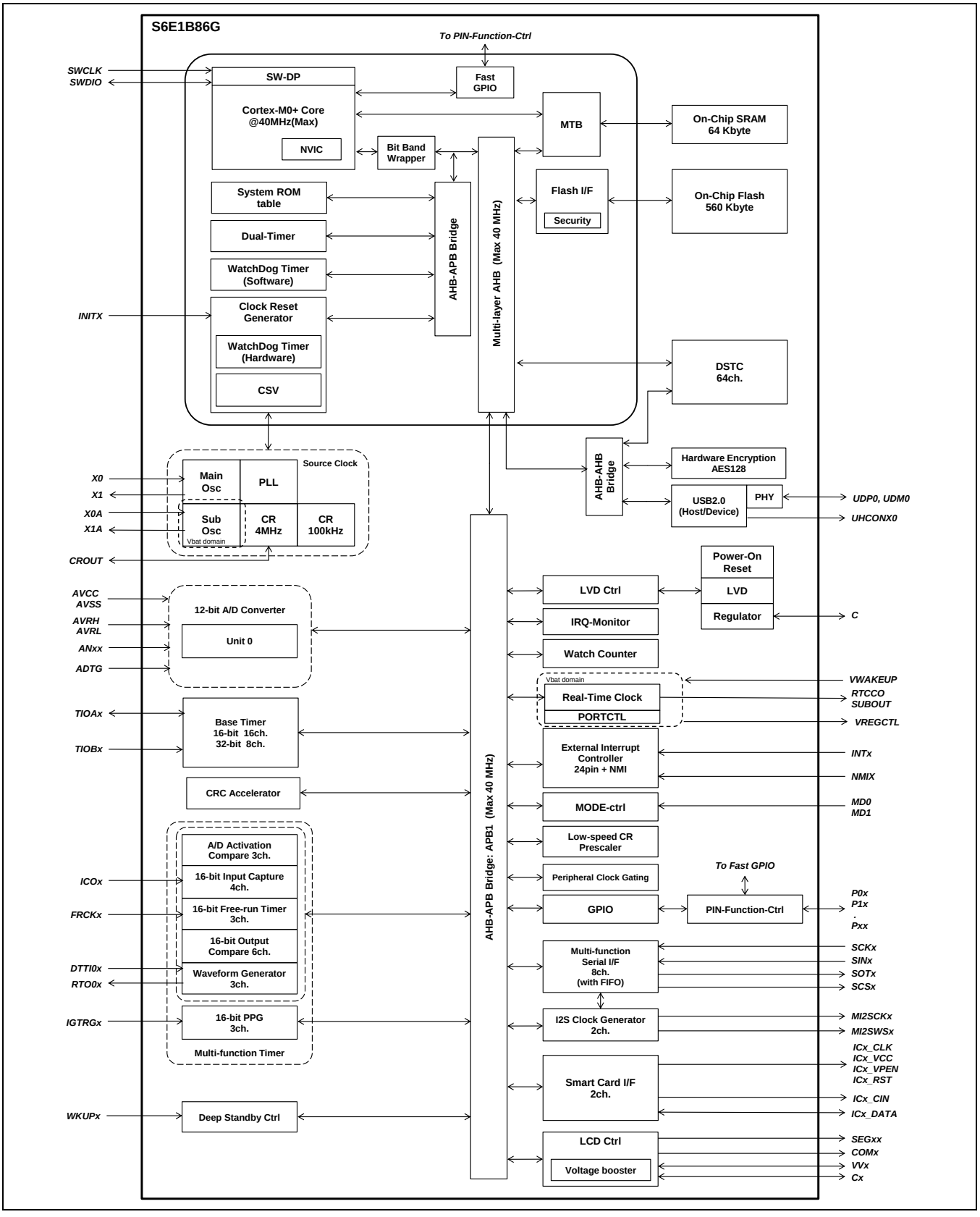
Pin Function	Pin Name	Function Description	Pin No.		
			LQFP-120	LQFP-100	LQFP-80
VBAT	LVDI	Input pin to monitor the external voltage.	37	32	22
	VWAKEUP	The return signal input pin from a hibernation state	45	40	30
	REGCTL	On-board regulator control pin	44	39	29
Reset	INITX	External Reset Input pin. A reset is valid when INITX="L".	41	36	26
Mode	MD0	Mode 0 pin. During normal operation, input MD0="L". During serial programming to Flash memory, input MD0="H".	57	47	37
	MD1	Mode 1 pin. During normal operation, input is not needed. During serial programming to Flash memory, MD1 = "L" must be input.	56	46	36
Power	VCC	Power supply pin	1	1	1
			31	26	-
			40	35	25
			61	51	41
			91	76	-
VBAT power	VBAT	VBAT power supply pin Backup power supply (battery etc.) and system power supply	46	41	31
GND	VSS	GND pin	30	25	20
			39	34	24
			60	50	40
			90	75	-
			120	100	80
Clock	X0	Main clock (oscillation) input pin	58	48	38
	X0A	Sub clock (oscillation) input pin	42	37	27
	X1	Main clock (oscillation) I/O pin	59	49	39
	X1A	Sub clock (oscillation) I/O pin	43	38	28
	CROUT_0	Built-in high-speed CR oscillation clock output port	89	74	-
	CROUT_1	Built-in high-speed CR oscillation clock output port	107	92	72
Analog Power	AVCC	A/D converter analog power supply pin	70	60	50
	AVRH	A/D converter analog reference voltage input pin	73	63	53
Analog GND	AVSS	A/D converter analog reference voltage input pin	71	61	51
C pin	C	Power supply stabilization capacitance pin	38	33	23

*: PE0 is an open drain pin, cannot output high.

5. I/O Circuit Type

Type	Circuit	Remarks
A		It is possible to select the main oscillation / GPIO function When the main oscillation is selected. Oscillation feedback resistor : Approximately 1 MΩ With standby mode control When the GPIO is selected. CMOS level output. CMOS level hysteresis input With pull-up resistor control With standby mode control Pull-up resistor : Approximately 33 kΩ I_{OH} = -4mA, I_{OL}= 4 mA

8. Block Diagram



Peripheral Address Map

Start Address	End Address	Bus	Peripheral
0x4000_0000	0x4000_0FFF	AHB	Flash memory I/F register
0x4000_1000	0x4000_FFFF		Reserved
0x4001_0000	0x4001_0FFF	APB0	Clock/Reset Control
0x4001_1000	0x4001_1FFF		Hardware Watchdog Timer
0x4001_2000	0x4001_2FFF		Software Watchdog Timer
0x4001_3000	0x4001_4FFF		Reserved
0x4001_5000	0x4001_5FFF		Dual-Timer
0x4001_6000	0x4001_FFFF		Reserved
0x4002_0000	0x4002_0FFF	APB1	Multi-function Timer unit0
0x4002_1000	0x4002_3FFF		Reserved
0x4002_4000	0x4002_4FFF		PPG
0x4002_5000	0x4002_5FFF		Base Timer
0x4002_6000	0x4002_6FFF		Reserved
0x4002_7000	0x4002_7FFF		A/D Converter
0x4002_8000	0x4002_DFFF		Reserved
0x4002_E000	0x4002_EFFF		Built-in CR trimming
0x4002_F000	0x4002_FFFF		Reserved
0x4003_0000	0x4003_0FFF		External Interrupt Controller
0x4003_1000	0x4003_1FFF		Interrupt Request Batch-Read Function
0x4003_2000	0x4003_2FFF		LCD Controller
0x4003_3000	0x4003_3FFF		GPIO
0x4003_4000	0x4003_4FFF		HDMI-CEC/ Remote Control Receiver
0x4003_5000	0x4003_5FFF		Low-Voltage Detection / DS mode / Vref Calibration
0x4003_6000	0x4003_6FFF		USB Clock Generator
0x4003_7000	0x4003_7FFF		Reserved
0x4003_8000	0x4003_8FFF		Multi-function Serial Interface
0x4003_9000	0x4003_9FFF		CRC
0x4003_A000	0x4003_AFFF		Watch Counter
0x4003_B000	0x4003_BFFF		Real-time clock
0x4003_C000	0x4003_C0FF		Low-speed CR Prescaler
0x4003_C100	0x4003_C7FF		Peripheral Clock Gating
0x4003_C800	0x4003_FFFF		Reserved
0x4003_C900	0x4003_C9FF		Smart Card Interface
0x4003_CA00	0x4003_CAFF		I^2S Clock Generator
0x4003_CB00	0x4003_FFFF		Reserved
0x4004_0000	0x4005_FFFF	AHB	USB ch.0
0x4006_0000	0x4006_0FFF		Reserved
0x4006_1000	0x4006_1FFF		DSTC
0x4006_2000	0x41FF_FFFF		Reserved

Pin Status Type	Function Group	State Upon Power-on Reset or Low-Voltage Detection	State at INITX Input	State Upon Device Internal Reset	State in Run Mode or Sleep Mode	State in Timer Mode, RTC Mode, or Stop Mode		State in Deep Standby RTC Mode or Deep Standby Stop Mode State		State when Return from Deep Standby Mode State
		Power Supply Unstable	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	-
E	GPIO selected	Setting disabled	Setting disabled	Setting disabled	Maintain previous state	Maintain previous state	Hi-Z / Internal input fixed at 0	Input enabled	Input enabled	Input enabled
	Sub crystal oscillator input pin / External sub clock input selected	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled	GPIO selected	Hi-Z / Input enabled	GPIO selected
F	GPIO selected	Setting disabled	Setting disabled	Setting disabled	Maintain previous state	Maintain previous state	Hi-Z / Internal input fixed at 0	GPIO selected / Internal input fixed at 0	Hi-Z / Internal input fixed at 0	GPIO selected
	External sub clock input selected	Setting disabled	Setting disabled	Setting disabled	Maintain previous state	Maintain previous state	Hi-Z / Internal input fixed at 0	Maintain previous state	Hi-Z / Internal input fixed at 0	Maintain previous state
	Sub crystal oscillator output pin	Hi-Z / Internal input fixed at 0/ Input enabled	Hi-Z / Internal input fixed at 0	Hi-Z / Internal input fixed at 0	Maintain previous state	Maintain previous state/When oscillation stops*2, Hi-Z / Internal input fixed at 0	Maintain previous state/When oscillation stops*2, Hi-Z / Internal input fixed at 0	Maintain previous state / When oscillation stops*2, Hi-Z/ Internal input fixed at 0	Maintain previous state / When oscillation stops*2, Hi-Z/ Internal input fixed at 0	Maintain previous state / When oscillation stops*2, Hi-Z/ Internal input fixed at 0
G	NMIX selected	Setting disabled	Setting disabled	Setting disabled	Maintain previous state	Maintain previous state	Maintain previous state	WKUP input enabled	Hi-Z / WKUP input enabled	GPIO selected
	Resource other than the above selected	Hi-Z	Hi-Z / Input enabled	Hi-Z / Input enabled			Hi-Z / Internal input fixed at 0			
	GPIO selected									

Parameter	Symbol (Pin Name)	Conditions		Value		Unit	Remarks
				Typ	Max		
Power supply current	I_{CCH} (VCC)	Stop mode	T_A=25°C V_{CC}=3.3 V	10	TBD	µA	*1
			T_A=25°C V_{CC}=1.65 V	9	TBD	µA	*1
			T_A=105°C V_{CC}=3.6 V	-	TBD	µA	*1
	I_{CCT} (VCC)	Sub timer mode	T_A=25°C V_{CC}=3.3 V 32 kHz Crystal oscillation	13	TBD	µA	*1
			T_A=25°C V_{CC}=1.65 V 32 kHz Crystal oscillation	12	TBD	µA	*1
			T_A=105°C V_{CC}=3.6 V 32 kHz Crystal oscillation	-	TBD	µA	*1
	I_{CCR} (VCC)	RTC mode	T_A=25°C V_{CC}=3.3 V 32 kHz Crystal oscillation	10.5	TBD	µA	*1
			T_A=25°C V_{CC}=1.65 V 32 kHz Crystal oscillation	9.5	TBD	µA	*1
			T_A=105°C V_{CC}=3.6 V 32 kHz Crystal oscillation	-	TBD	µA	*1

*1: All ports are fixed. LVD off. Flash off.

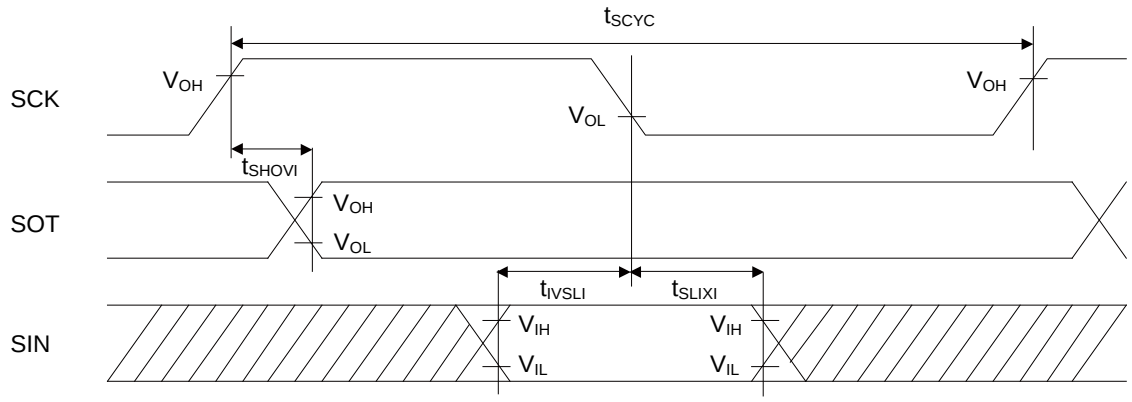
CSIO (SPI=0, SCINV=1)

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

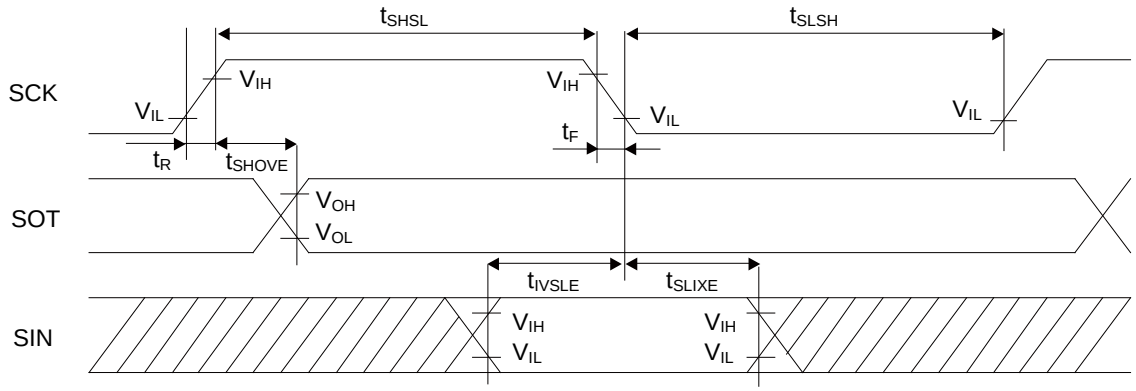
Parameter	Symbol	Pin Name	Conditions	V_{CC} < 2.7 V		V_{CC} ≥ 2.7 V		Unit
				Min	Max	Min	Max	
Serial clock cycle time	t_{SCYC}	SCKx	Master mode	4 t_{CYCP}	-	4 t_{CYCP}	-	ns
SCK ↑ → SOT delay time	t_{SHOVI}	SCKx, SOTx		- 30	+ 30	- 20	+ 20	ns
SIN → SCK ↓ setup time	t_{IVSLI}	SCKx, SINx		60	-	50	-	ns
SCK ↓ → SIN hold time	t_{SLIXI}	SCKx, SINx		0	-	0	-	ns
Serial clock L pulse width	t_{SLSH}	SCKx	Slave mode	2 t_{CYCP} - 10	-	2 t_{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		-	65	-	52	ns
SIN → SCK ↓ setup time	t_{IVSLE}	SCKx, SINx		10	-	10	-	ns
SCK ↓ → SIN hold time	t_{SLIXE}	SCKx, SINx		20	-	20	-	ns
SCK falling time	t_F	SCKx		-	5	-	5	ns
SCK rising time	t_R	SCKx		-	5	-	5	ns

Notes:

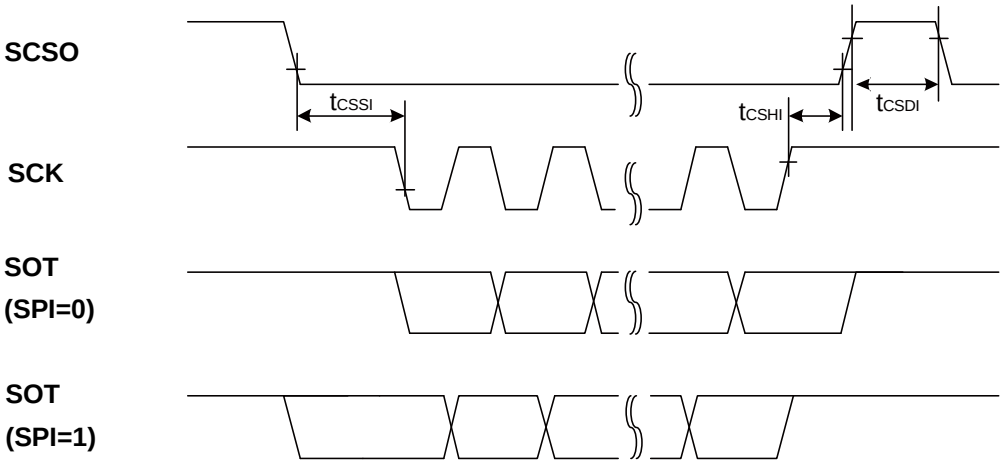
- *The above AC characteristics are for clock synchronous mode.*
- *t_{CYCP} represents the APB bus clock cycle time.*
  For the number of the APB bus to which Multi-function Serial has been connected, see "8. Block Diagram ".
- *The characteristics are only applicable when the relocate port numbers are the same.*
  For instance, they are not applicable for the combination of SCKx_0 and SOTx_1.
- *External load capacitance C_L=30 pF*



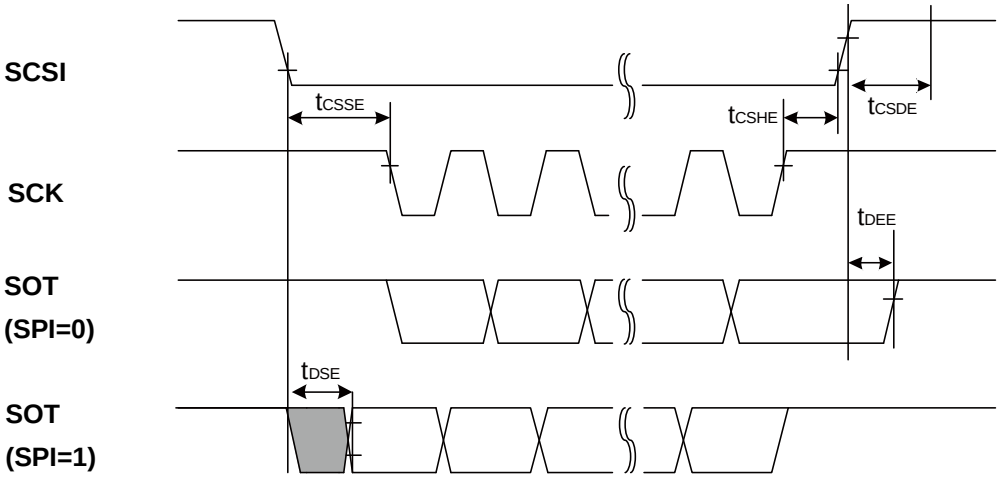
Master mode



Slave mode



Master mode



Slave mode

11.4.13 Smart Card Interface Characteristics

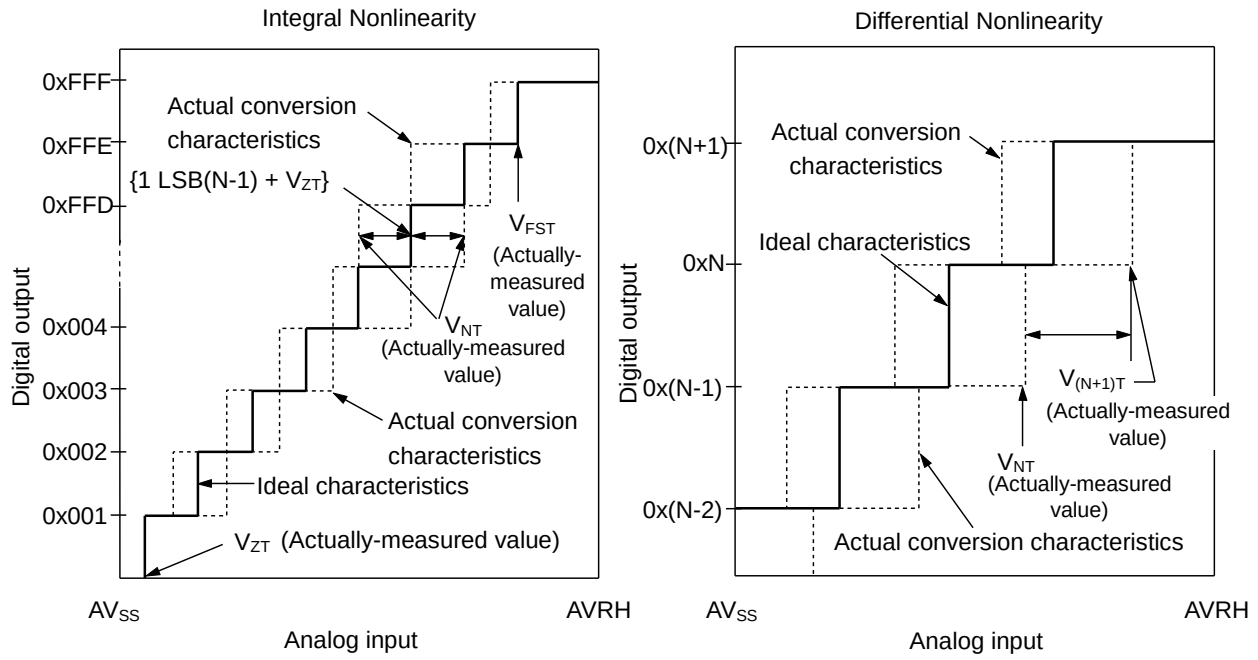
(V_{CC}=1.65 V to 3.3 V, V_{SS}=0 V, T_A=- 40°C to +105°C)

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.

Definitions of 12-bit A/D Converter Terms

- Resolution: Analog variation that is recognized by an A/D converter.
- Integral Nonlinearity: Deviation of the line between the zero-transition point (0b000000000000 ⟷ 0b000000000001) and the full-scale transition point (0b111111111110 ⟷ 0b111111111111) from the actual conversion characteristics.
- Differential Nonlinearity: Deviation from the ideal value of the input voltage that is required to change the output code by 1 LSB.



$$\text{Integral Nonlinearity of digital output N} = \frac{V_{NT} - \{1LSB \times (N - 1) + V_{ZT}\}}{1LSB} \text{ [LSB]}$$

$$\text{Differential Nonlinearity of digital output N} = \frac{V_{(N+1)T} - V_{NT}}{1LSB} - 1 \text{ [LSB]}$$

$$1LSB = \frac{V_{FST} - V_{ZT}}{4094}$$

N : A/D converter digital output value.
V_{ZT} : Voltage at which the digital output changes from 0x000 to 0x001.
V_{FST} : Voltage at which the digital output changes from 0xFFE to 0xFFF.
V_{NT} : Voltage at which the digital output changes from 0x(N − 1) to 0xN.

11.7 Low-Voltage Detection Characteristics

11.7.1 Low-Voltage Detection Reset

(T_A=-40°C to +105°C)

Parameter	Symbol	Conditions	Value			Unit	Remarks
			Min	Typ	Max		
Detected voltage	VDL	Fixed*1	1.38	1.50	1.60	V	When voltage drops
Released voltage	VDH		1.43	1.55	1.65	V	When voltage rises
LVD stabilization wait time	t_{LVDW}	-	-	-	8160× t_{CYCP}*2	µs	
LVD detection delay time	t_{LVDDL}	-	-	-	200	µs	

*1: The value of low voltage detection reset is always fixed.

*2: t_{CYCP} indicates the APB1 bus clock cycle time.

11.8 Flash Memory Write/Erase Characteristics

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

Parameter		Value			Unit	Remarks
		Min	Typ*	Max*		
Sector erase time	Large sector	-	1.1	2.7	s	The sector erase time includes the time of writing prior to internal erase.
	Small sector	-	0.3	0.9		
Halfword (16-bit) write time		-	30	528	µs	The halfword (16-bit) write time excludes the system-level overhead.
Chip erase time		-	11.2	28.8	s	The chip erase time includes the time of writing prior to internal erase.

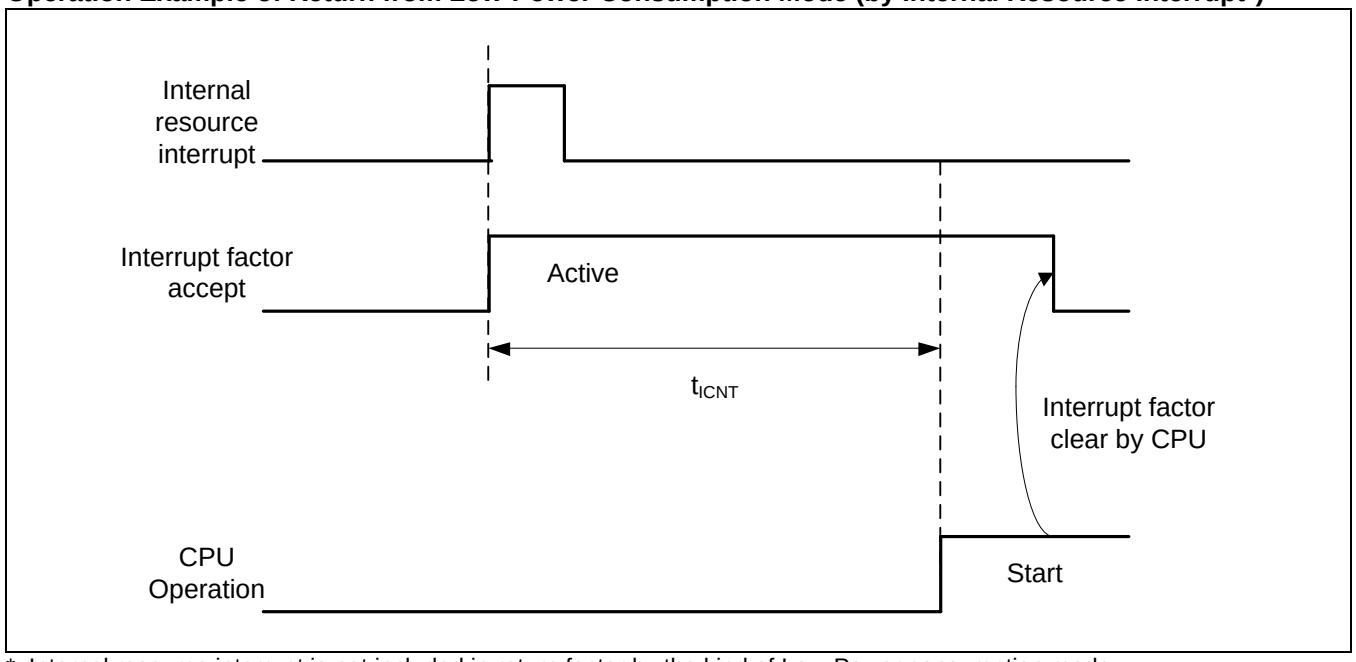
*: The typical value is immediately after shipment, the maximum value is guarantee value under 10,000 cycle of erase/write.

Write/Erase Cycle and Data Hold Time (Target Value)

Write/Erase Cycle	Data Hold Time (Year)	Remarks
1,000	20*	
10,000	10*	

*: At average + 85°C

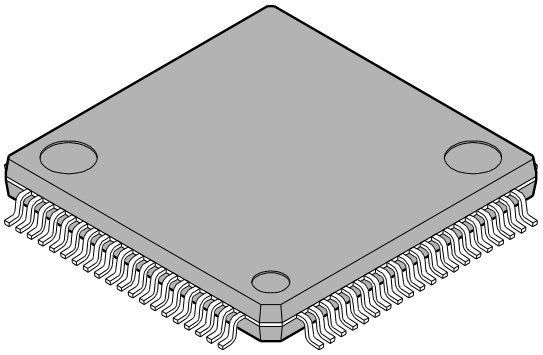
Operation Example of Return from Low-Power Consumption Mode (by Internal Resource Interrupt*)



*: Internal resource interrupt is not included in return factor by the kind of Low-Power consumption mode.

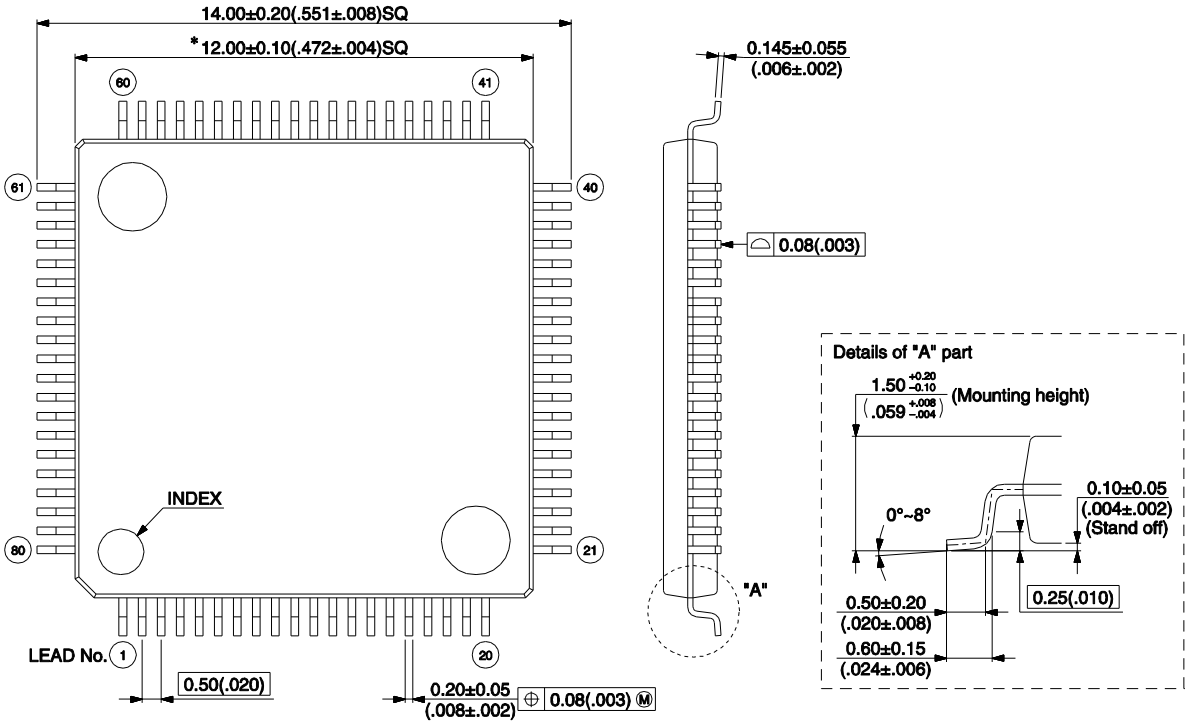
Notes:

- *The return factor is different in each Low-Power consumption modes.*
  See "Chapter: Low Power Consumption Mode" and "Operations of Standby Modes" in FM0+ Family Peripheral Manual.
- *When interrupt recoveries, the operation mode that CPU recoveries depends on the state before the Low-Power consumption mode transition. See "Chapter: Low Power Consumption Mode" in "FM0+ Family Peripheral Manual".*

80-pin plastic LQFP		
	Lead pitch	0.50 mm
	Package width × package length	12 mm × 12 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	1.70 mm Max
	Weight	0.47 g
(FPT-80P-M21)	Code (Reference)	P-LFQFP80-12×12-0.50

80-pin plastic LQFP
(FPT-80P-M21)

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



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