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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	65
Program Memory Size	304KB (304K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	32K x 8
Voltage - Supply (Vcc/Vdd)	1.65V ~ 3.6V
Data Converters	A/D 16x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	80-LQFP
Supplier Device Package	80-LQFP (12x12)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/s6e1b84ehagf20000

- I^2C
  - Standard-mode (Max: 100 kbps) supported / Fast-mode (Max 400 kbps) supported.
- I^2S
  - Using CSIO (ch.5, ch.6) and I^2S clock generator
  - Supports two transfer protocol
    - I^2S
    - MSB-justified
  - Master mode only

Descriptor System Data Transfer Controller (DSTC) (64 Channels)

- The DSTC can transfer data at high-speed without going via the CPU. The DSTC adopts the Descriptor
- system and, following the specified contents of the Descriptor that has already been constructed on the
- memory, can access directly the memory / peripheral device and performs the data transfer operation.
- It supports the software activation, the hardware activation, and the chain activation functions

A/D Converter (Max: 24 Channels)

- 12-bit A/D Converter
  - Successive approximation type
  - Conversion time: 2.0 µs @ 2.7 V to 3.6 V
  - Priority conversion available (2 levels of priority)
  - Scan conversion mode
  - Built-in FIFO for conversion data storage (for scan conversion: 16 steps, for priority conversion: 4 steps)

Base Timer (Max: 8 Channels)

The operation mode of each channel can be selected from one of the following.

- 16-bit PWM timer
- 16-bit PPG timer
- 16/32-bit reload timer
- 16/32-bit PWC timer

General-Purpose I/O Port

This series can use its pin as a general-purpose I/O port when it is not used for an external bus or a peripheral function. All ports can be set to fast general-purpose I/O ports or slow general-purpose I/O ports. In addition, this series has a port relocate function that can set to which I/O port a peripheral function can be allocated.

- All ports are Fast GPIO which can be accessed by 1cycle
- Capable of controlling the pull-up of each pin
- Capable of reading pin level directly
- Port relocate function
- Up to 102 fast general-purpose I/O ports @120-pin package
- Certain ports are 5 V tolerant.
  See 4. List of Pin Functions and 5. I/O Circuit Type for the corresponding pins.

Dual Timer (32-/16-bit Down Counter)

The Dual Timer consists of two programmable 32-/16-bit down counters. The operation mode of each timer channel can be selected from one of the following.

- Free-running mode
- Periodic mode (= Reload mode)
- One-shot mode

Multi-Function Timer

The Multi-function Timer consists of the following blocks.

- 16-bit free-run timer × 3 channels
- Input capture × 4 channels
- Output compare × 6 channels
- ADC start compare × 6 channel
- Waveform generator × 3 channels
- 16-bit PPG timer × 3 channels

  IGBT mode is contained.

The following function can be used to achieve the motor control.

- PWM signal output function
- DC chopper waveform output function
- Dead time function
- Input capture function
- ADC start function
- DTIF (motor emergency stop) interrupt function

Real-Time Clock (RTC with Vbat)

The Real-time Clock counts year/month/day/hour/minute/second/day of the week from year 01 to year 99.

- The RTC can generate an interrupt at a specific time (year/month/day/hour/minute/second/day of the week) and can also generate an interrupt in a specific year, in a specific month, on a specific day, at a specific hour or at a specific minute.
- It has a timer interrupt function generating an interrupt upon a specific time or at specific intervals.
- It can keep counting while rewriting the time.
- It can count leap years automatically.

Peripheral Clock Gating
The system can reduce the current consumption of the total system with gating the operation clocks of peripheral functions not used.

VBAT
The consumption power during the RTC operation can be reduced by supplying the power supply independent VBAT pin. RTC (calendar circuit) / 32 kHz oscillation circuit. The following circuit can also be used.

- RTC
- 32 kHz oscillation circuit
- Power-on circuit
- Back up register: 32 bytes
- Port circuit

Debug
- Serial Wire Debug Port (SW-DP)
- Micro Trace Buffer (MTB)

Unique ID
A 41-bit unique value of the device has been set.

Power Supply
- Wide voltage range:
  VCC = 1.65V to 3.6 V
  VCC = 3.0V to 3.6V (when USB is used)
  VCC = 2.2V to 3.6V (when LCDC is used)
- Power supply for VBAT: VBAT = 1.65 V to 3.6 V

1. Product Lineup

Memory Size

Product Name		S6E1B84E/F/G	S6E1B86E/F/G
On-chip Flash memory	Upper Bank	256 Kbytes	512 Kbytes
	Lower Bank	48 Kbytes	48 Kbytes
On-chip SRAM		32 Kbytes	64 Kbytes

Function

Product Name			S6E1B84E0A S6E1B86E0A S6E1B84EHA S6E1B86EHA	S6E1B84F0A S6E1B86F0A S6E1B84FHA S6E1B86FHA	S6E1B84G0A S6E1B86G0A S6E1B84GHA S6E1B86GHA
Pin count			80	100	120
CPU			Cortex-M0+		
	Frequency		40.8 MHz		
Power supply voltage range			1.65 V to 3.6 V		
USB 2.0 (Device/Host)			1 unit		
DSTC			64ch		
Multi-function Serial Interface (UART/CSIO (SPI)/I^{2}C/I^{2}S)			8ch (Max) with 128 bytes FIFO I^{2}S: ch.5, ch.6		
Base Timer (PWC/Reload timer/PWM/PPG)			8ch (Max)		
LCD controller			20SEG x 8COM(Max) / 24SEG x 4COM(Max)	32SEG x 8COM(Max) / 36SEG x 4COM(Max)	40SEG x 8COM(Max) / 44SEG x 4COM(Max)
Multi-function Timer	A/D activation compare	6ch	1 unit		
	Input capture	4ch			
	Free-run timer	3ch			
	Output compare	6ch			
	Waveform generator	3ch			
	PPG	3ch			
Dual Timer			1 unit		
HDMI-CEC/ Remote Control Receiver			2ch (max)		
Smart Card Interface			2ch (max)		
Real-time Clock			1 unit (with battery power)		
Watch Counter			1 unit		
CRC Accelerator			Yes		
Watchdog timer			1ch (SW) + 1ch (HW)		
External Interrupt			24 pins (Max), NMI × 1		
I/O port			65 pins (Max)	82 pins (Max)	102 pins (Max)
12-bit A/D converter			16ch (1 unit)	23ch (1 unit)	24ch (1 unit)
CSV (Clock Supervisor)			Yes		
LVD (Low-voltage Detection)			2ch		
Built-in CR	High-speed		4 MHz		
	Low-speed		100 kHz		
Debug Function			SW-DP		
Unique ID			Yes		
AES Calculator			-	Yes*1	-	Yes*1	-	Yes*1

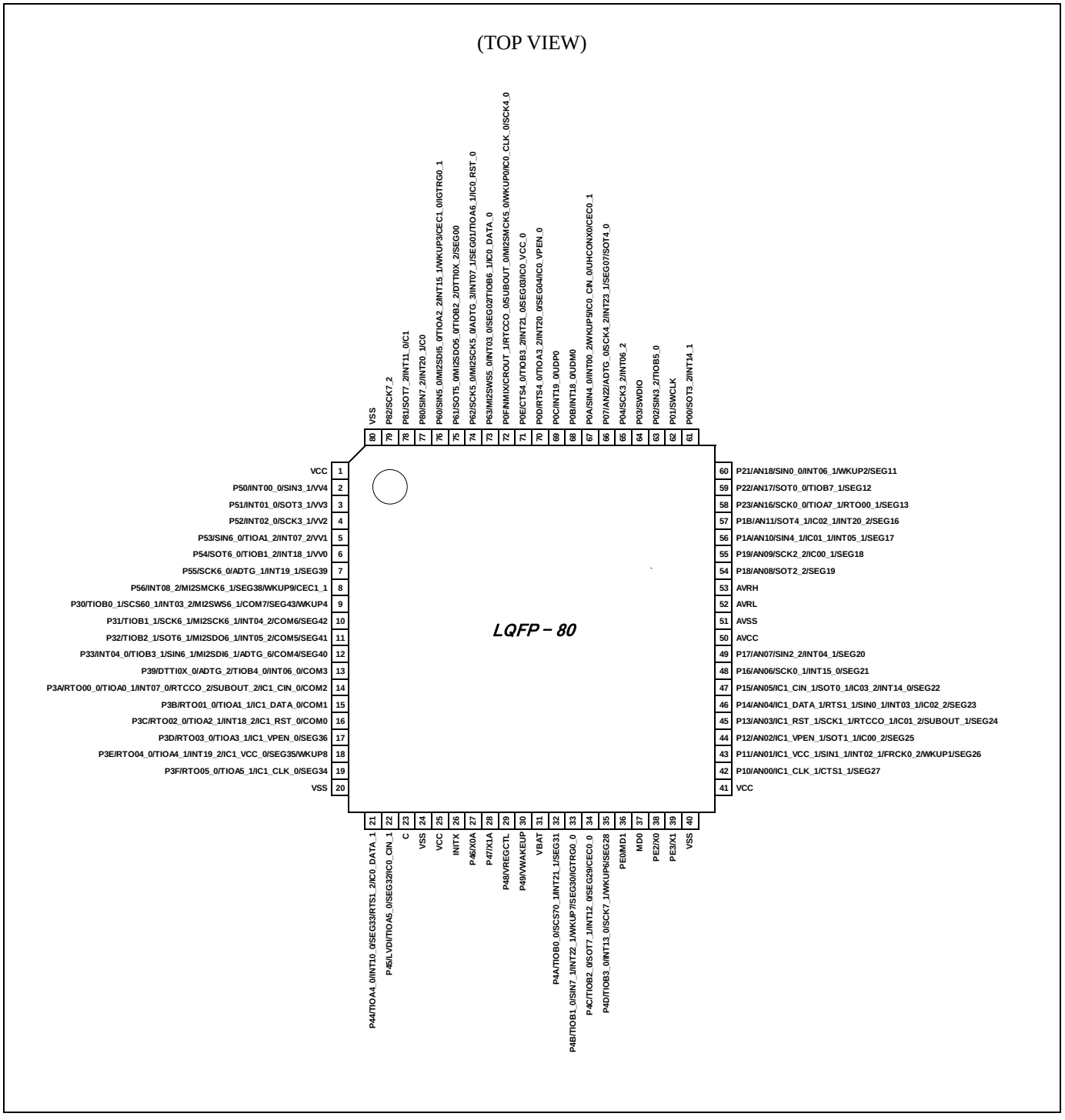
*1: AES Calculator is built in following products.
S6E1B86GHA, S6E1B84GHA, S6E1B86FHA, S6E1B84FHA, S6E1B86EHA, S6E1B84EHA

Note:

- *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 "11 Electrical Characteristics 11.4 AC Characteristics 11.4.3 Built-in CR Oscillation Characteristics" for accuracy of built-in CR.

3. Pin Assignment

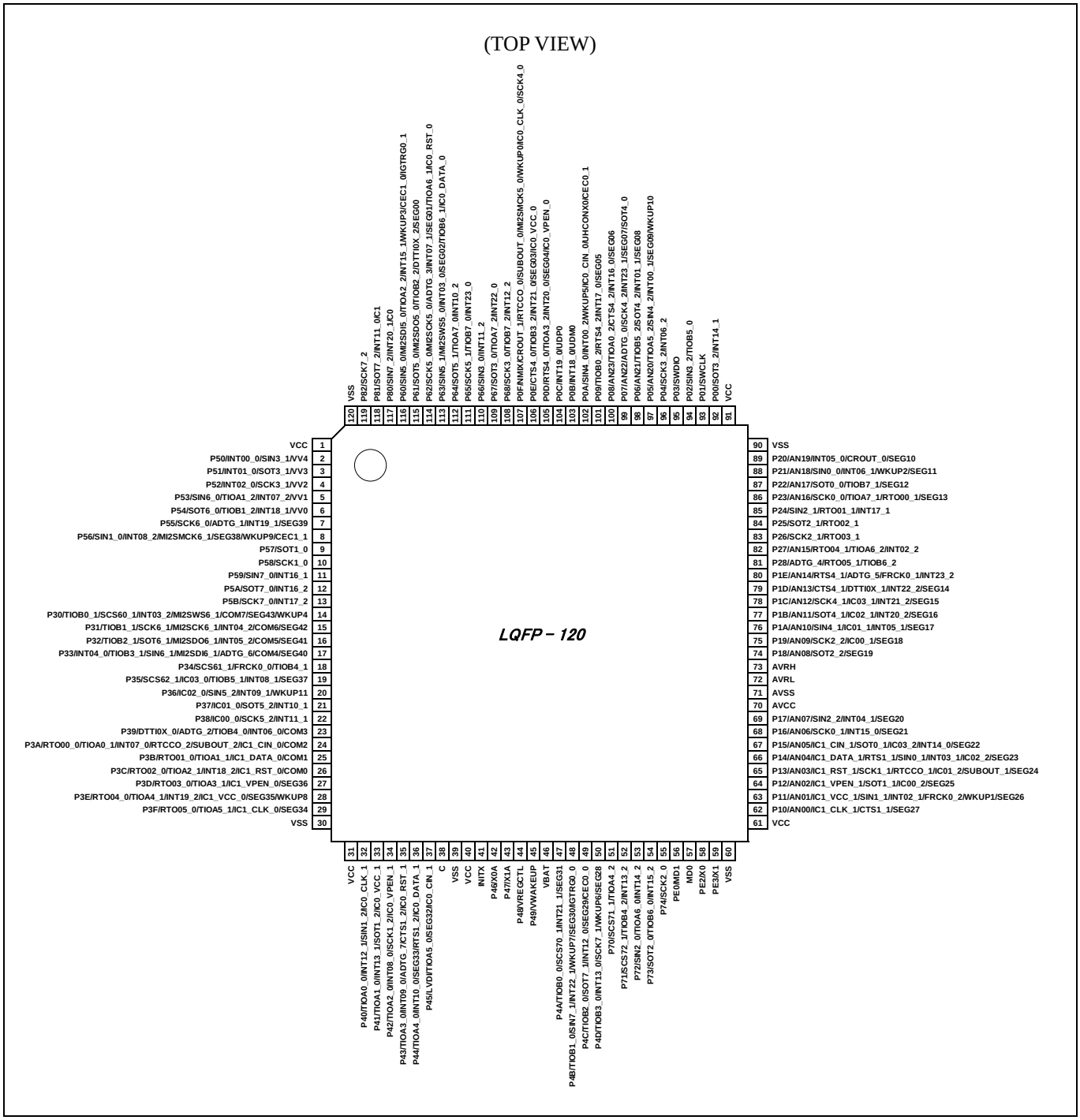
FPT-80P-M21



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.*

FPT-120P-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			
22	17	-	P38 IC00_0 SCK5_2 INT11_1	F	J
23	18	13	P39 DTTI0X_0 TIOB4_0 ADTG_2 INT06_0 COM3	N	S
24	19	14	P3A RTO00_0 TIOA0_1 RTCCO_2 SUBOUT_2 IC1_CIN_0 INT07_0 COM2	N	S
25	20	15	P3B RTO01_0 TIOA1_1 IC1_DATA_0 COM1	N	P
26	21	16	P3C RTO02_0 TIOA2_1 INT18_2 IC1_RST_0 COM0	N	S
27	22	17	P3D RTO03_0 TIOA3_1 IC1_VPEN_0 SEG36	L	P
28	23	18	P3E RTO04_0 TIOA4_1 IC1_VCC_0 INT19_2 WKUP8 SEG35	L	T
29	24	19	P3F RTO05_0 TIOA5_1 IC1_CLK_0 SEG34	L	P
30	25	20	VSS	-	-
31	26	-	VCC	-	-
32	27	-	P40 TIOA0_0 IC0_CLK_1 INT12_1 SIN1_2	F	J

Pin No.			Pin Name	I/O Circuit Type	Pin State Type
LQFP-120	LQFP-100	LQFP-80			
76	66	56	P1A SIN4_1 IC01_1 INT05_1 AN10 SEG17	P	V
77	67	57	P1B SOT4_1 IC02_1 INT20_2 AN11 SEG16	P	V
78	68	-	P1C SCK4_1 IC03_1 INT21_2 AN12 SEG15	P	V
79	69	-	P1D CTS4_1 DTTI0X_1 INT22_2 AN13 SEG14	P	V
80	70	-	P1E RTS4_1 FRCK0_1 ADTG_5 INT23_2 AN14	H	L
81	-	-	P28 RTO05_1 TIOB6_2 ADTG_4	F	I
82	-	-	P27 RTO04_1 TIOA6_2 INT02_2 AN15	G	L
83	-	-	P26 SCK2_1 RTO03_1	F	I
84	-	-	P25 SOT2_1 RTO02_1	F	I
85	-	-	P24 SIN2_1 RTO01_1 INT17_1	F	J
86	71	58	P23 SCK0_0 TIOA7_1 RTO00_1 AN16 SEG13	P	K

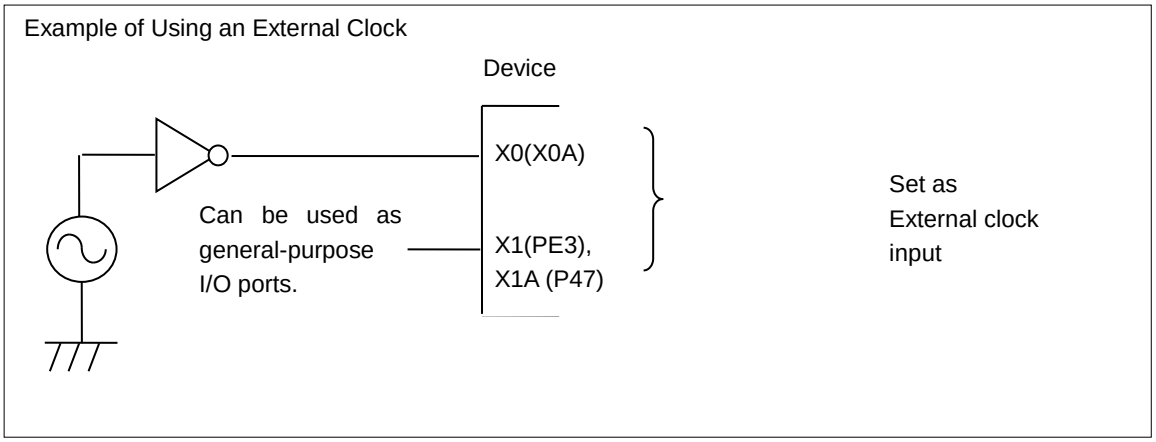
Pin Function	Pin Name	Function Description	Pin No.		
			LQFP-120	LQFP-100	LQFP-80
External Interrupt	INT15_0	External interrupt request 15 input pin	68	58	48
	INT15_1		116	96	76
	INT15_2		54	-	-
	INT16_0	External interrupt request 16 input pin	100	85	-
	INT16_1		11	-	-
	INT16_2		12	-	-
	INT17_0	External interrupt request 17 input pin	101	86	-
	INT17_1		85	-	-
	INT17_2		13	-	-
	INT18_0	External interrupt request 18 input pin	103	88	68
	INT18_1		6	6	6
	INT18_2		26	21	16
	INT19_0	External interrupt request 19 input pin	104	89	69
	INT19_1		7	7	7
	INT19_2		28	23	18
	INT20_0	External interrupt request 20 input pin	105	90	70
	INT20_1		117	97	77
	INT20_2		77	67	57
	INT21_0	External interrupt request 21 input pin	106	91	71
	INT21_1		47	42	32
	INT21_2		78	68	-
	INT22_0	External interrupt request 22 input pin	109	-	-
	INT22_1		48	43	33
	INT22_2		79	69	-
	INT23_0	External interrupt request 23 input pin	111	-	-
	INT23_1		99	84	66
	INT23_2		80	70	-
	NMIX	Non-Maskable Interrupt input pin	107	92	72
GPIO	P00	General-purpose I/O port 0	92	77	61
	P01		93	78	62
	P02		94	79	63
	P03		95	80	64
	P04		96	81	65
	P05		97	82	-
	P06		98	83	-
	P07		99	84	66
	P08		100	85	-
	P09		101	86	-
	P0A		102	87	67
	P0B		103	88	68
	P0C		104	89	69
	P0D		105	90	70
	P0E		106	91	71
	P0F		107	92	72

Pin Function	Pin Name	Function Description	Pin No.		
			LQFP-120	LQFP-100	LQFP-80
GPIO	P40	General-purpose I/O port 4	32	27	-
	P41		33	28	-
	P42		34	29	-
	P43		35	30	-
	P44		36	31	21
	P45		37	32	22
	P46		42	37	27
	P47		43	38	28
	P48		44	39	29
	P49		45	40	30
	P4A		47	42	32
	P4B		48	43	33
	P4C		49	44	34
	P4D		50	45	35
	P50	General-purpose I/O port 5	2	2	2
	P51		3	3	3
	P52		4	4	4
	P53		5	5	5
	P54		6	6	6
	P55		7	7	7
	P56		8	8	8
	P57		9	-	-
	P58		10	-	-
	P59		11	-	-
	P5A		12	-	-
	P5B		13	-	-
	P60	General-purpose I/O port 6	116	96	76
	P61		115	95	75
	P62		114	94	74
	P63		113	93	73
	P64		112	-	-
	P65		111	-	-
	P66		110	-	-
	P67		109	-	-
	P68		108	-	-
	P70	General-purpose I/O port 7	51	-	-
	P71		52	-	-
	P72		53	-	-
	P73		54	-	-
	P74		55	-	-
	P80	General-purpose I/O port 8	117	97	77
	P81		118	98	78
	P82		119	99	79
	PE0*	General-purpose I/O port E	56	46	36
	PE2		58	48	38
	PE3		59	49	39

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.

Example of Using an External Clock

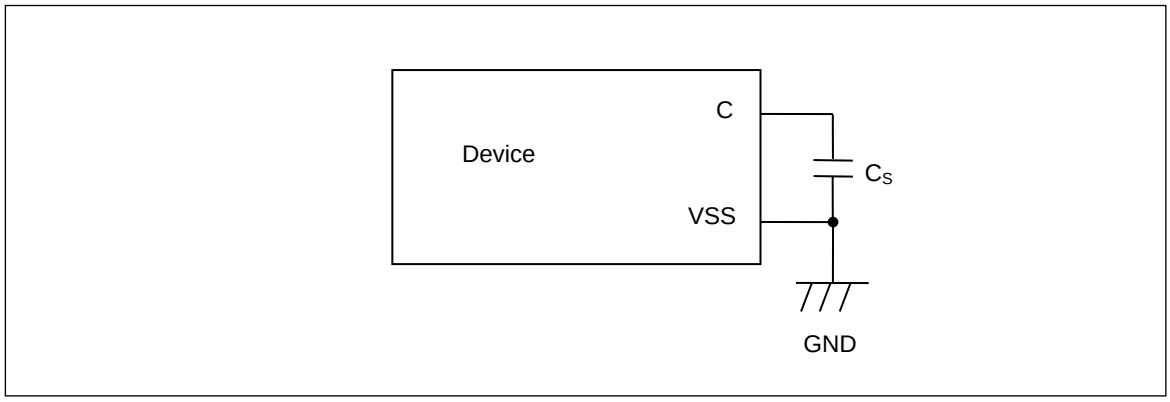


Handling when Using Multi-Function Serial Pin as I²C Pin

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.

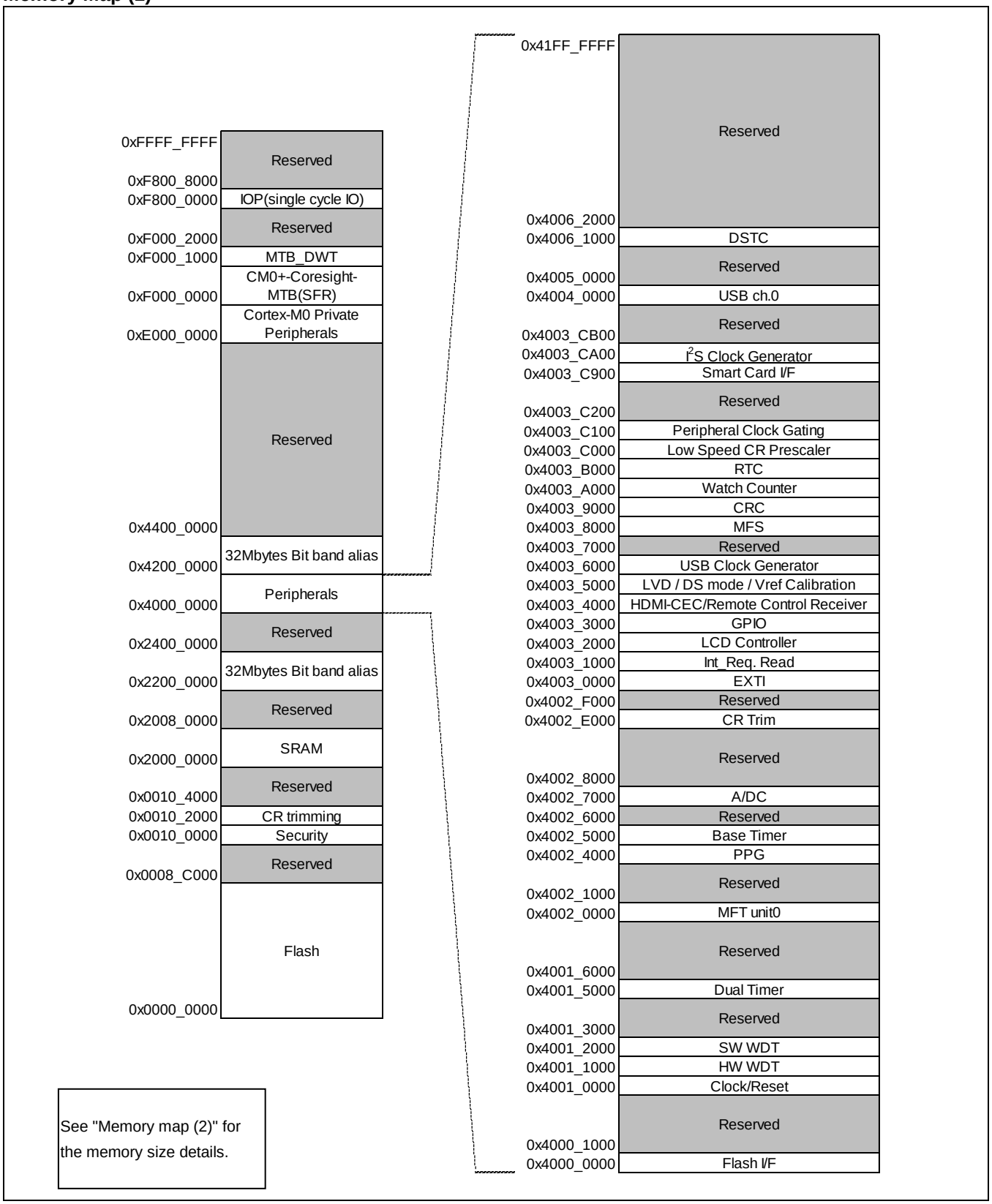


Mode Pins (MD0)

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.

9. Memory Map

Memory Map (1)



11.2 Recommended Operating Conditions

(V_{SS}=AV_{SS}=0.0 V)

Parameter	Symbol	Conditions	Value		Unit	Remarks
			Min	Max		
Power supply voltage	V_{CC}	-	1.65 *5	3.6	V	*1
			2.2	3.6	V	*2
			3.0	3.6	V	*3
LCD input voltage	V_{VV4}	-	2.2	V_{CC}	V	No booster used
		-	2.2	4.7	V	Booster is used
LCD External Capacitor *6	C_f,C_{VV1}, C_{VV2},C_{VV3}, C_{VV4}	-	0.5	1.3	µF	Booster is used
Sub Oscillation frequency *7	Fin	-	-	-	kHz	Typical is 32.768 kHz
Analog power supply voltage	AV_{CC}	-	1.65	3.6	V	AV_{CC}=V_{CC}
Analog reference voltage	AVRH	-	2.7	AV_{CC}	V	AV_{CC} ≥ 2.7 V
			AV_{CC}	AV_{CC}	V	AV_{CC} < 2.7 V
	AVRL	-	AV_{SS}	AV_{SS}	V	
Smoothing capacitor	C_S	-	1	10	µF	For regulator*4
Operating temperature	T_A	-	- 40	+ 105	°C	

*1: When LCD Controller is not used.

*2: When LCD Controller is used.

*3: When P0C/UDP0 and P0B/UDM0 pins are used as USB (UDP0, UDM0).

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

*5: 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.

*6: LCD external capacitor between VVx to VSS, and between C0 and C1.

*7: If a Booster is used, Sub OSC should provide operation clock at typically 32.768 kHz.

<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.*

Parameter	Symbol (Pin Name)	Conditions			Value		Unit	Remarks
					Typ	Max		
Power supply current	I_{CCHD} (VCC)	Deep standby Stop mode	RAM off	T_A=25°C V_{CC}=3.3 V	0.75	TBD	µA	*1
				T_A=25°C V_{CC}=1.65 V	0.7	TBD	µA	*1
				T_A=105°C V_{CC}=3.6 V	-	TBD	µA	*1
			RAM on	T_A=25°C V_{CC}=3.3 V	1.1	TBD	µA	*1
				T_A=25°C V_{CC}=1.65 V	1.0	TBD	µA	*1
				T_A=105°C V_{CC}=3.6 V	-	TBD	µA	*1
	I_{CCRD} (VCC)	Deep standby RTC mode	RAM off	T_A=25°C V_{CC}=3.3 V	1.7	TBD	µA	*1
				T_A=25°C V_{CC}=1.65 V	1.6	TBD	µA	*1
				T_A=105°C V_{CC}=3.6 V	-	TBD	µA	*1
			RAM on	T_A=25°C V_{CC}=3.3 V	1.9	TBD	µA	*1
				T_A=25°C V_{CC}=1.65 V	1.7	TBD	µA	*1
				T_A=105°C V_{CC}=3.6 V	-	TBD	µA	*1

*1: All ports are fixed. LVD off.

SPI (SPI=1, SCINV=0)

(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
SOT → SCK ↓ delay time	t_{SOVLI}	SCKx, SOTx		2 t_{CYCP} - 30	-	2 t_{CYCP} - 30	-	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*

When Using CSIO/SPI Chip Select (SCINV=1, CSLVL=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	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	-	43	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.*

11.4.10 External Input Timing

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

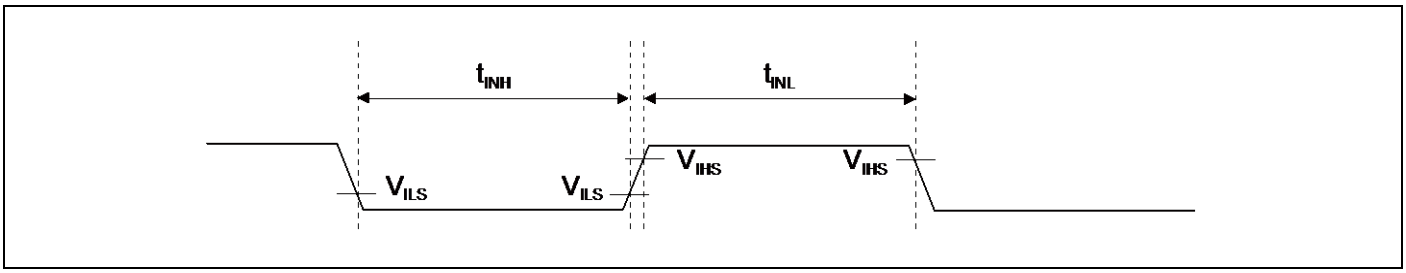
Parameter	Symbol	Pin Name	Conditions	Value		Unit	Remarks
				Min	Max		
Input pulse width	t_{INH}, t_{INL}	ADTGx	-	2 t_{CYCP}*1	-	ns	A/D converter trigger input
		FRCKx					Free-run timer input clock
		ICxx					Input capture
		DTTIxX	-	2 t_{CYCP}*1	-	ns	Wave form generator
		INTxx, NMIX	*2	2 t_{CYCP} +100*1	-	ns	External interrupt, NMI
			*3	500	-	ns	
		WKUPx	*4	500	-	ns	Deep standby wake up

*1: t_{CYCP} represents the APB bus clock cycle time.
For the number of the APB bus to which the Multi-function Timer is connected and that of the APB bus to which the External Interrupt Controller is connected, see "8. Block Diagram".

*2: In Run mode and Sleep mode

*3: In Timer mode and RTC mode and Stop mode

*4: In Deep Standby RTC mode and Deep Standby Stop 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.

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**	4889752	TEKA	08/31/2015	New Spec.