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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	38
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 8x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	48-LQFP
Supplier Device Package	48-LQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/s6e1c11c0agv20000

2. Packages

Package \ Product name	S6E1C12B0A/ S6E1C11B0A	S6E1C12C0A/ S6E1C11C0A	S6E1C12D0A/ S6E1C11D0A
LQFP: FPT-32P-M30 (0.80 mm pitch)	❍	-	-
QFN: LCC-32P-M73 (0.50 mm pitch)	❍		
LQFP: FPT-48P-M49 (0.50 mm pitch)	-	❍	-
QFN: LCC-48P-M74 (0.50 mm pitch)	-	❍	-
LQFP: FPT-64P-M38 (0.50 mm pitch)	-	-	❍
QFN: LCC-64P-M25 (0.50 mm pitch)	-	-	❍

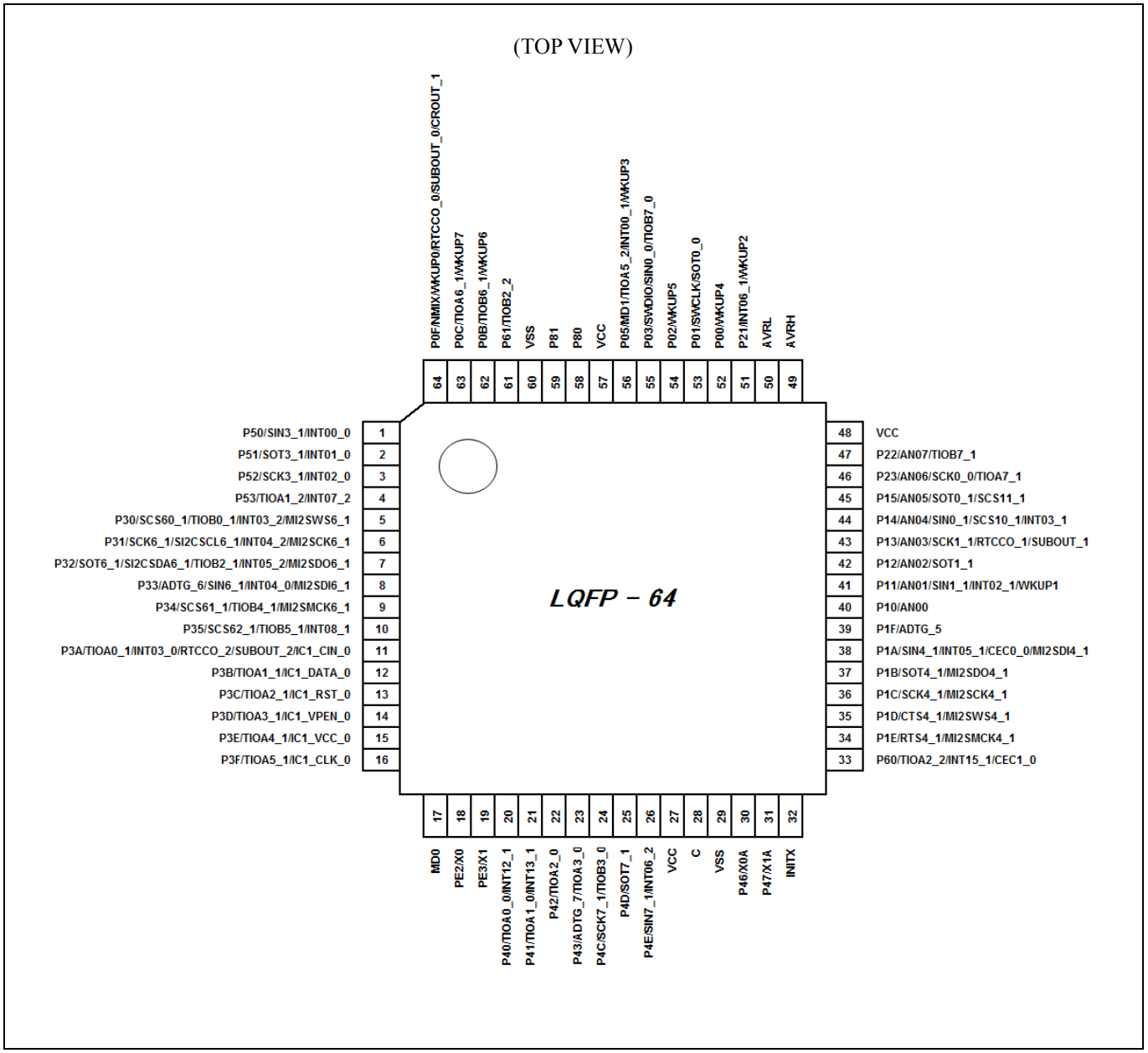
❍: Available

Note:

- *See "13. Package Dimensions" for detailed information on each package.*

3. Pin Assignment

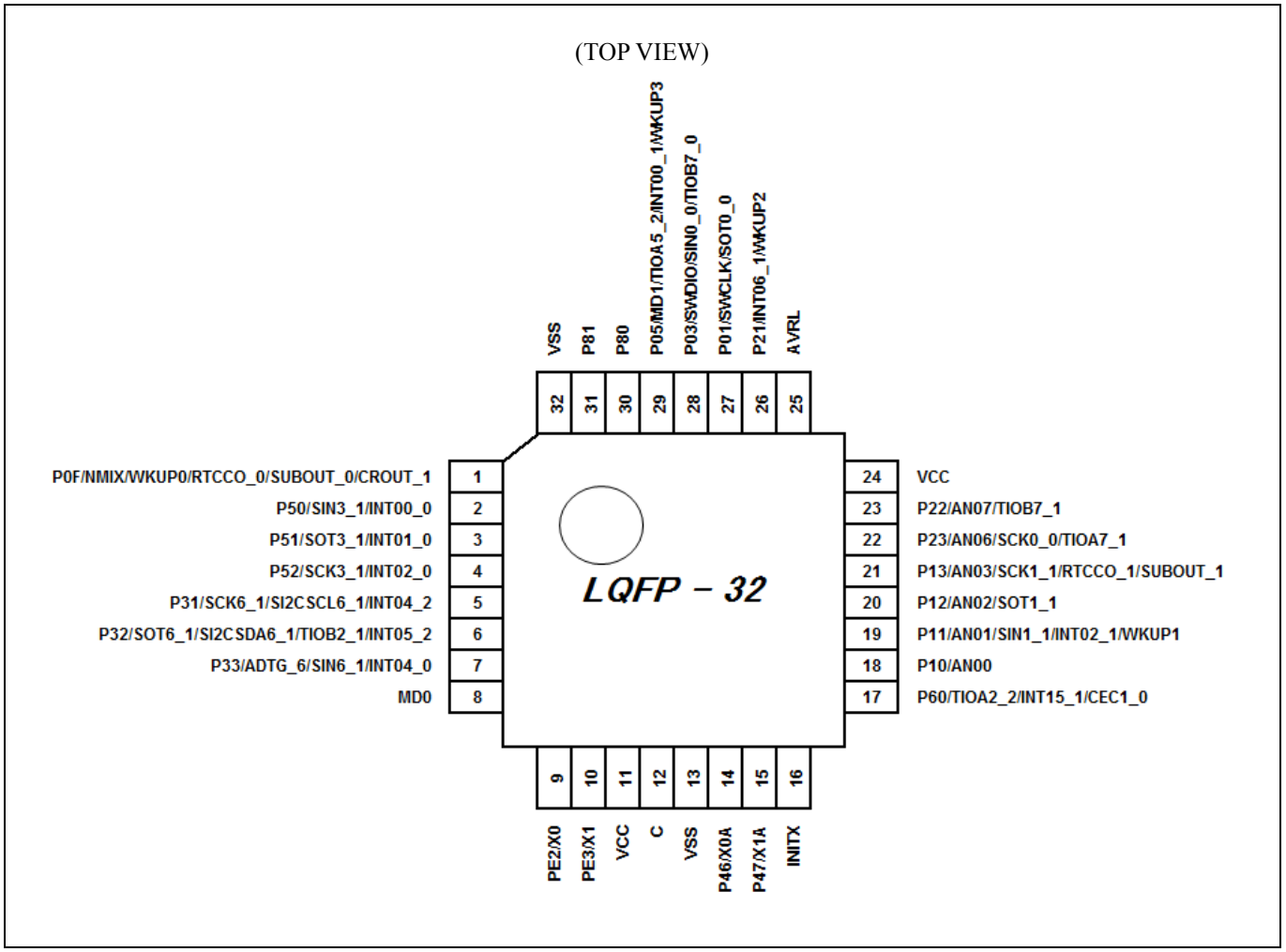
FPT-64P-M38



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.*

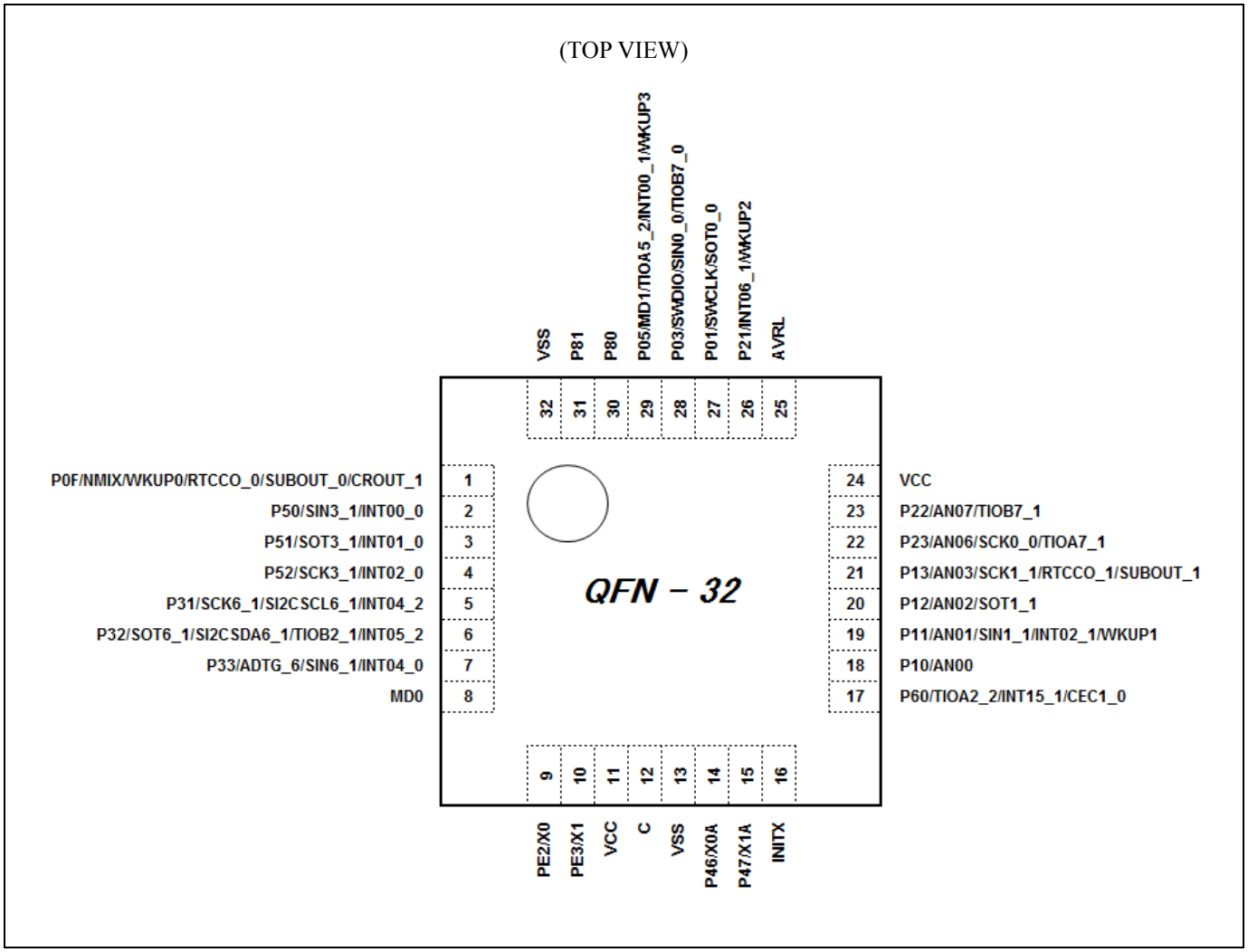
FPT-32P-M30



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.*

LCC-32P-M73

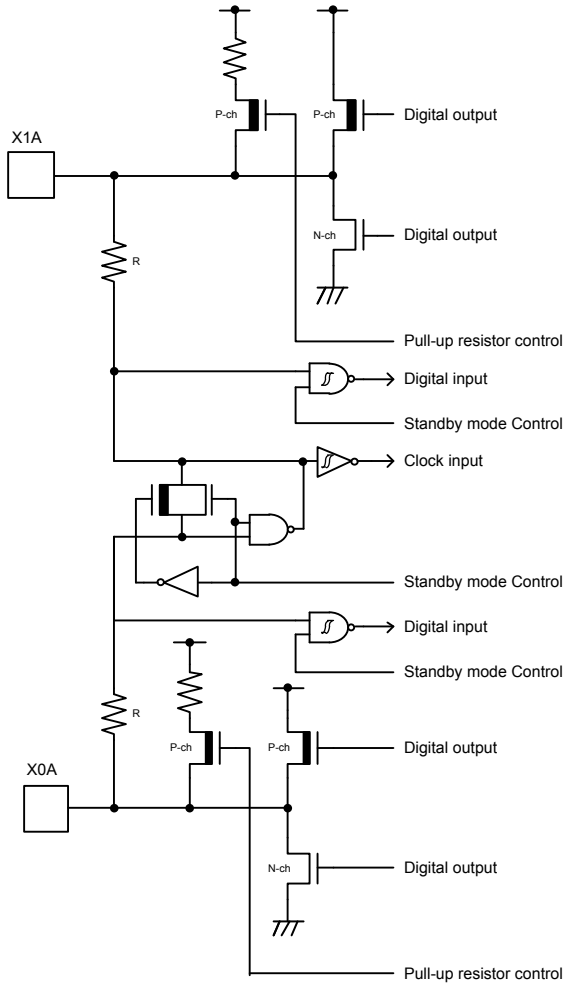


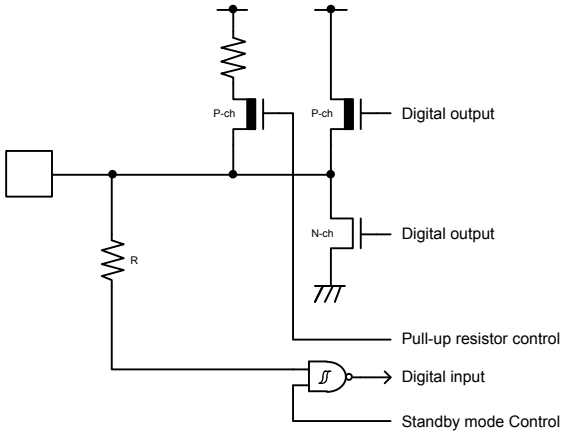
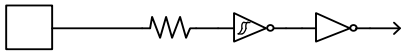
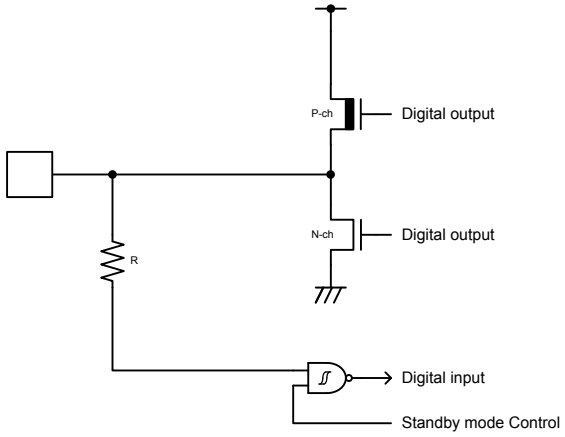
Note:

- *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.*

Pin no.			Pin Function	I/O circuit type	Pin state type
LQFP-64 QFN-64	LQFP-48 QFN-48	LQFP-32 QFN-32			
8	8	-	P33 ADTG_6 SIN6_1 INT04_0 MI2SDI6_1	H	K
-	-	7	P33 ADTG_6 SIN6_1 INT04_0	H	K
9	-	-	P34 SCS61_1 TIOB4_1 MI2SMCK6_1	D	K
-	9	-	P34 SCS61_1 MI2SMCK6_1	D	K
10	-	-	P35 SCS62_1 TIOB5_1 INT08_1	D	K
11	-	-	P3A TIOA0_1 INT03_0 RTCCO_2 SUBOUT_2 IC1_CIN_0	D	K
-	10	-	P3A TIOA0_1 INT03_0 RTCCO_2 SUBOUT_2	D	K
12	-	-	P3B TIOA1_1 IC1_DATA_0	D	K
-	11	-	P3B TIOA1_1	D	K
13	-	-	P3C TIOA2_1 IC1_RST_0	D	K
-	12	-	P3C TIOA2_1	D	K
14	-	-	P3D TIOA3_1 IC1_VPEN_0	D	K

Pin function	Pin name	Function description	Pin no.		
			LQFP-64 QFN-64	LQFP-48 QFN-48	LQFP-32 QFN-32
Multi-function Serial 4	SIN4_1	Multi-function serial interface ch.4 input pin	38	27	-
	SOT4_1 (SDA4_1)	Multi-function serial interface ch.4 output pin. This pin operates as SOT4 when used as a UART/CSIO/LIN pin (operation mode 0 to 3) and as SDA4 when used as an I2C pin (operation mode 4).	37	26	-
	SCK4_1 (SCL4_1)	Multi-function serial interface ch.4 clock I/O pin. This pin operates as SCK4 when used as a CSIO (operation mode 2) and as SCL4 when used as an I2C pin (operation mode 4).	36	-	-
	CTS4_1	Multi-function serial interface ch4 CTS input pin	35	-	-
	RTS4_1	Multi-function serial interface ch4 RTS output pin	34	-	-
Multi-function Serial 6	SIN6_1	Multi-function serial interface ch.6 input pin	8	8	7
	SOT6_1 (SDA6_1)	Multi-function serial interface ch.6 output pin. This pin operates as SOT6 when used as a UART/CSIO/LIN pin (operation mode 0 to 3) and as SDA6 when used as an I2C pin (operation mode 4).	7	7	6
	SCK6_1 (SCL6_1)	Multi-function serial interface ch.6 clock I/O pin. This pin operates as SCK6 when used as a CSIO (operation mode 2) and as SCL6 when used as an I2C pin (operation mode 4).	6	6	5
	SCS60_1	Multi-function serial interface ch.6 serial chip select 0 input/output pin.	5	5	-
	SCS61_1	Multi-function serial interface ch.6 serial chip select 1 output pin.	9	9	-
	SCS62_1	Multi-function serial interface ch.6 serial chip select 2 output pin.	10	-	-
Multi-function Serial 7	SIN7_1	Multi-function serial interface ch.7 input pin	26	18	-
	SOT7_1 (SDA7_1)	Multi-function serial interface ch.7 output pin. This pin operates as SOT7 when used as a UART/CSIO/LIN pin (operation mode 0 to 3) and as SDA7 when used as an I2C pin (operation mode 4).	25	17	-
	SCK7_1 (SCL7_1)	Multi-function serial interface ch.7 clock I/O pin. This pin operates as SCK7 when used as a CSIO (operation mode 2) and as SCL7 when used as an I2C pin (operation mode 4).	24	16	-

Type	Circuit	Remarks
C		It is possible to select the sub oscillation / GPIO function When the sub oscillation is selected. • Oscillation feedback resistor : Approximately 5MΩ • 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 33kΩ I_{OH}= -4mA, I_{OL}= 4mA

Type	Circuit	Remarks
H		・CMOS level output ・CMOS level hysteresis input ・5V tolerant ・With pull-up resistor control ・With standby mode control ・Pull-up resistor : Approximately 33kΩ ・IOH= -4mA, IOL= 4mA ・Available to control PZR registers ・When this pin is used as an I2C pin, the digital output P-ch transistor is always off
I		・CMOS level hysteresis input
J		・CMOS level output ・CMOS level hysteresis input ・With standby mode control

6. Handling Precautions

Any semiconductor devices have inherently a certain rate of failure. The possibility of failure is greatly affected by the conditions in which they are used (circuit conditions, environmental conditions, etc.). This page describes precautions that must be observed to minimize the chance of failure and to obtain higher reliability from your Spansion semiconductor devices.

6.1 Precautions for Product Design

This section describes precautions when designing electronic equipment using semiconductor devices.

Absolute Maximum Ratings

Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of certain established limits, called absolute maximum ratings. Do not exceed these ratings.

Recommended Operating Conditions

Recommended operating conditions are normal operating ranges for the semiconductor device. All the device's electrical characteristics are warranted when operated within these ranges.

Always use semiconductor devices within the recommended operating conditions. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their sales representative beforehand.

Processing and Protection of Pins

These precautions must be followed when handling the pins which connect semiconductor devices to power supply and input/output functions.

(1) Preventing Over-Voltage and Over-Current Conditions

Exposure to voltage or current levels in excess of maximum ratings at any pin is likely to cause deterioration within the device, and in extreme cases leads to permanent damage of the device. Try to prevent such overvoltage or over-current conditions at the design stage.

(2) Protection of Output Pins

Shorting of output pins to supply pins or other output pins, or connection to large capacitance can cause large current flows. Such conditions if present for extended periods of time can damage the device.

Therefore, avoid this type of connection.

(3) Handling of Unused Input Pins

Unconnected input pins with very high impedance levels can adversely affect stability of operation. Such pins should be connected through an appropriate resistance to a power supply pin or ground pin.

Surface Mount Type

Surface mount packaging has longer and thinner leads than lead-insertion packaging, and therefore leads are more easily deformed or bent. The use of packages with higher pin counts and narrower pin pitch results in increased susceptibility to open connections caused by deformed pins, or shorting due to solder bridges.

You must use appropriate mounting techniques. Spansion recommends the solder reflow method, and has established a ranking of mounting conditions for each product. Users are advised to mount packages in accordance with Spansion ranking of recommended conditions.

Lead-Free Packaging

CAUTION: When ball grid array (BGA) packages with Sn-Ag-Cu balls are mounted using Sn-Pb eutectic soldering, junction strength may be reduced under some conditions of use.

Storage of Semiconductor Devices

Because plastic chip packages are formed from plastic resins, exposure to natural environmental conditions will cause absorption of moisture. During mounting, the application of heat to a package that has absorbed moisture can cause surfaces to peel, reducing moisture resistance and causing packages to crack. To prevent, do the following:

(1) Avoid exposure to rapid temperature changes, which cause moisture to condense inside the product.
Store products in locations where temperature changes are slight.

(2) Use dry boxes for product storage. Products should be stored below 70% relative humidity, and at temperatures between 5 ˚C and 30 ˚C.
When you open Dry Package that recommends humidity 40% to 70% relative humidity.

(3) When necessary, Spansion packages semiconductor devices in highly moisture-resistant aluminum laminate bags, with a silica gel desiccant. Devices should be sealed in their aluminum laminate bags for storage.

(4) Avoid storing packages where they are exposed to corrosive gases or high levels of dust.

Baking

Packages that have absorbed moisture may be de-moisturized by baking (heat drying). Follow the Spansion recommended conditions for baking.

Condition: 125°C/24 h

Static Electricity

Because semiconductor devices are particularly susceptible to damage by static electricity, you must take the following precautions:

(1) Maintain relative humidity in the working environment between 40% and 70%.
Use of an apparatus for ion generation may be needed to remove electricity.

(2) Electrically ground all conveyors, solder vessels, soldering irons and peripheral equipment.

(3) Eliminate static body electricity by the use of rings or bracelets connected to ground through high resistance (on the level of 1 MΩ).
Wearing of conductive clothing and shoes, use of conductive floor mats and other measures to minimize shock loads is recommended.

(4) Ground all fixtures and instruments, or protect with anti-static measures.

(5) Avoid the use of styrofoam or other highly static-prone materials for storage of completed board assemblies.

11. Electrical Characteristics

11.1 Absolute Maximum Ratings

Parameter	Symbol	Rating		Unit	Remarks
		Min	Max		
Power supply voltage*1, *2	V_{CC}	V_{SS} - 0.5	V_{SS} + 4.6	V	
Analog reference voltage*1, *3	AVRH	V_{SS} - 0.5	V_{SS} + 4.6	V	
Input voltage*1	V_I	V_{SS} - 0.5	V_{CC} + 0.5 (≤ 4.6 V)	V	
		V_{SS} - 0.5	V_{SS} + 6.5	V	5 V tolerant
Analog pin input voltage*1	V_{IA}	V_{SS} - 0.5	V_{CC} + 0.5 (≤ 4.6 V)	V	
Output voltage*1	V_O	V_{SS} - 0.5	Vcc + 0.5 (≤ 4.6 V)	V	
L level maximum output current*4	I_{OL}	-	10	mA	4 mA type
L level average output current*5	I_{OLAV}	-	4	mA	4 mA type
L level total maximum output current	$\sum I_{OL}$	-	100	mA	
L level total average output current*6	$\sum I_{OLAV}$	-	50	mA	
H level maximum output current*4	I_{OH}	-	- 10	mA	4 mA type
H level average output current*5	I_{OHAV}	-	- 4	mA	4 mA type
H level total maximum output current	$\sum I_{OH}$	-	- 100	mA	
H level total average output current*6	$\sum I_{OHAV}$	-	- 50	mA	
Power consumption	P_D	-	200	mW	
Storage temperature	T_{STG}	- 55	+ 150	°C	

*1: These parameters are based on the condition that V_{SS}= 0 V.

*2: V_{CC} must not drop below V_{SS} - 0.5 V.

*3: Ensure that the voltage does not to exceed V_{CC} + 0.5 V at power-on.

*4: The maximum output current is the peak value for a single pin.

*5: The average output is the average current for a single pin over a period of 100 ms.

*6: The total average output current is the average current for all pins over a period of 100 ms.

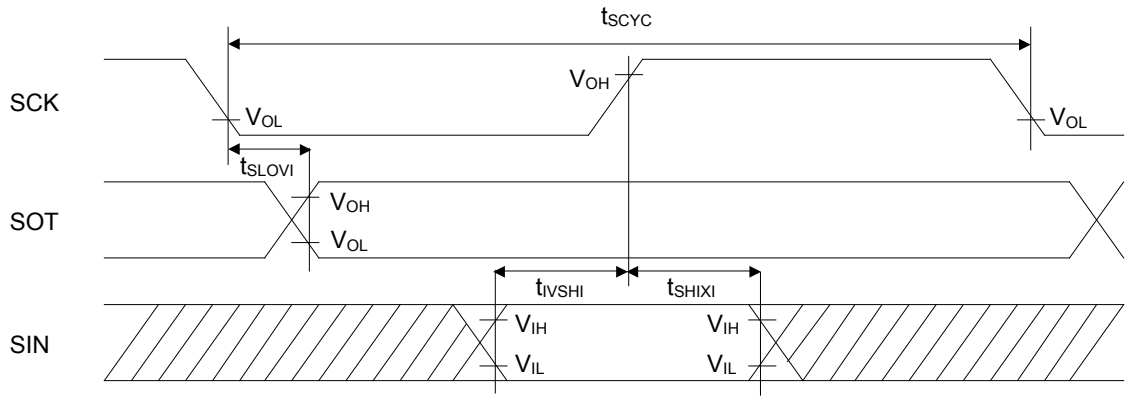
<WARNING>

− *Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.*

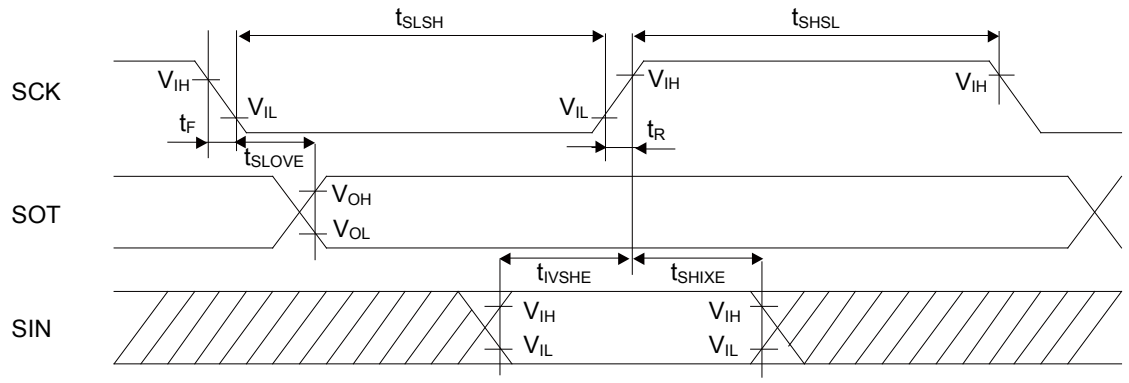
Parameter	Symbol (Pin Name)	Conditions			Value		Unit	Remarks
					Typ	Max		
Power supply current	I_{CCHD} (VCC)	Deep standby Stop mode	RAM off	Ta=25°C Vcc=3.3 V	0.58	1.85	µA	*1, *2
				Ta=25°C Vcc=1.65 V	0.56	1.83	µA	*1, *2
				Ta=105°C Vcc=3.6 V	-	46	µA	*1, *2
			RAM on	Ta=25°C Vcc=3.3 V	0.78	6.6	µA	*1, *2
				Ta=25°C Vcc=1.65 V	0.76	6.6	µA	*1, *2
				Ta=105°C Vcc=3.6 V	-	88	µA	*1, *2
	I_{CCRD} (VCC)	Deep standby RTC mode	RAM off	Ta=25°C Vcc=3.3 V	1.16	2.4	µA	*1, *2
				Ta=25°C Vcc=1.65 V	1.15	2.4	µA	*1, *2
				Ta=105°C Vcc=3.6 V	-	46	µA	*1, *2
			RAM on	Ta=25°C Vcc=3.3 V	1.37	7.2	µA	*1, *2
				Ta=25°C Vcc=1.65 V	1.35	7.2	µA	*1, *2
				Ta=105°C Vcc=3.6 V	-	88	µA	*1, *2

*1: All ports are fixed. LVD off.

*2: When CALDONE bit(CAL_CTL:CALDONE) is “1”. In case of “0”, Bipolar Vref current is added.



Master mode



Slave mode

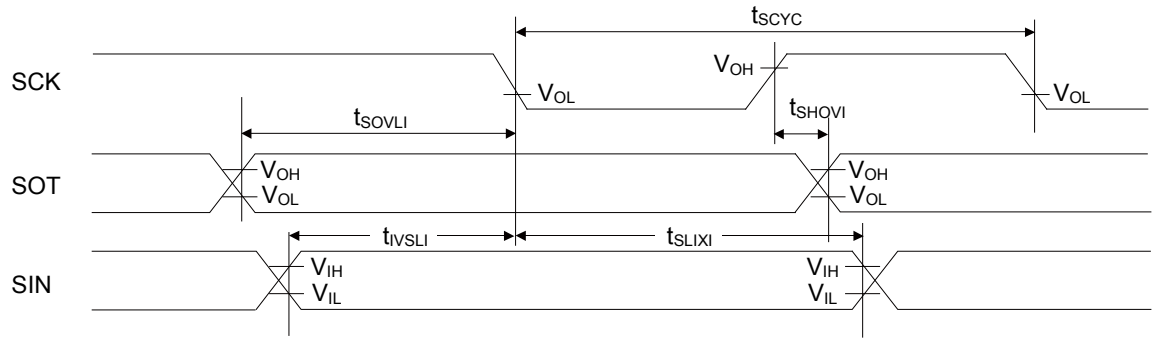
CSIO (SPI=0, SCINV=1)

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

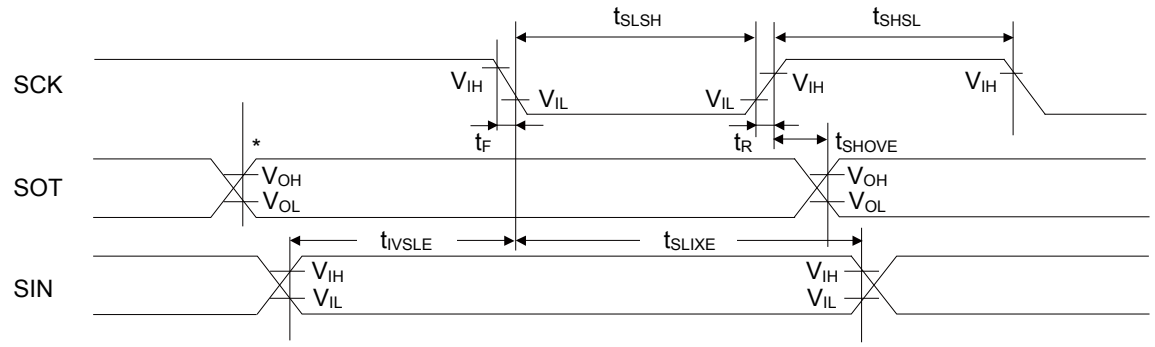
Parameter	Symbol	Pin name	Conditions	V_{CC} < 2.7V		V_{CC} ≥ 2.7V		Unit
				Min	Max	Min	Max	
Serial clock cycle time	t_{SCYC}	SCKx	Master mode	4 t_{CYCP}	-	4 t_{CYCP}	-	ns
SCK ↑ → SOT delay time	t_{SHOVI}	SCKx, SOTx		- 30	+ 30	- 20	+ 20	ns
SIN → SCK ↓ setup time	t_{IVSLI}	SCKx, SINx		50	-	36	-	ns
SCK ↓ → 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		-	50	-	33	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	tF	SCKx		-	5	-	5	ns
SCK rising time	tR	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

*: Changes when writing to TDR register

When Using CSIO/SPI Chip Select (SCINV=0, CSLVL=0)

(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.

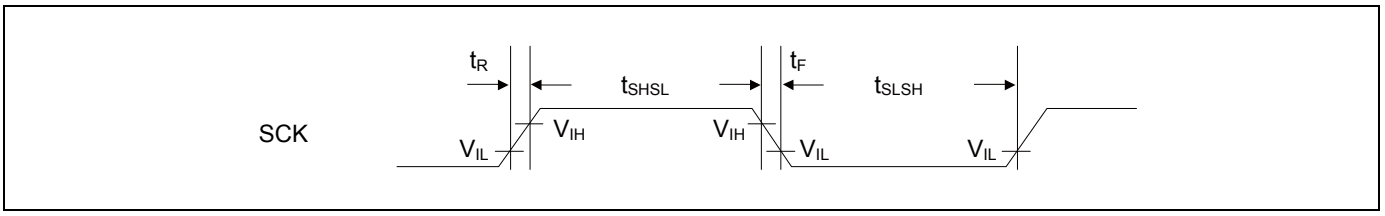
Notes:

- *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.*

UART external clock input (EXT=1)

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

Parameter	Symbol	Conditions	Value		Unit	Remarks
			Min	Max		
Serial clock L pulse width	t_{SLSH}	C_L=30 pF	t_{CYCP} +10	-	ns	
Serial clock H pulse width	t_{SHSL}		t_{CYCP} +10	-	ns	
SCK falling time	t_F		-	5	ns	
SCK rising time	t_R		-	5	ns	



11.4.10 External Input Timing

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

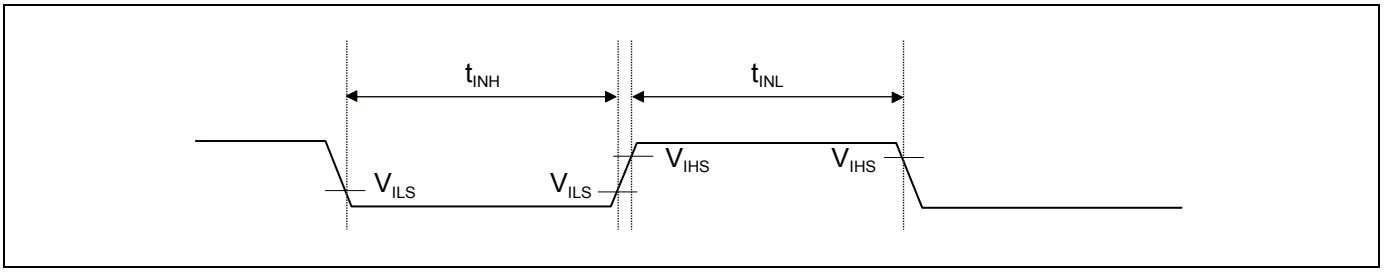
Parameter	Symbol	Pin Name	Conditions	Value		Unit	Remarks
				Min	Max		
Input pulse width	t_{INH}, t_{INL}	ADTGx	-	2 t_{CYCP}*1	-	ns	A/D converter trigger input
		INT00 to INT08, INT12, INT13, INT15, NMIX	*2	2 t_{CYCP} +100*1	-	ns	External interrupt, NMI
			*3	500	-	ns	
		WKUPx	*4	500	-	ns	Deep standby 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, RTC mode and Stop mode

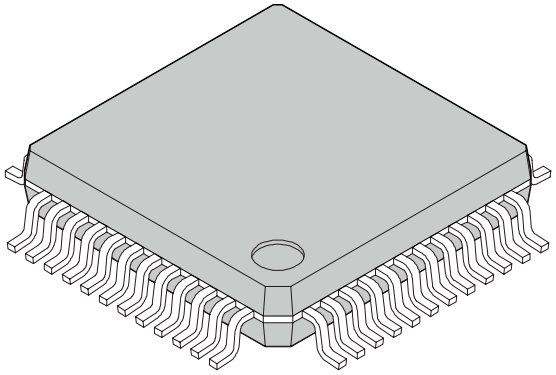
*4: In Deep Standby RTC mode and Deep Standby Stop mode



12. Ordering Information

Part number	On-chip Flash memory [Kbyte]	On-Chip SRAM [Kbyte]	Package	Packing
S6E1C12D0AGV20000	128	16	Plastic • LQFP (0.50 mm pitch), 64 pins (FPT-64P-M38)	Tray
S6E1C11D0AGV20000	64	12		
S6E1C12C0AGV20000	128	16	Plastic • LQFP (0.50 mm pitch), 48 pins (FPT-48P-M49)	Tray
S6E1C11C0AGV20000	64	12		
S6E1C12B0AGP20000	128	16	Plastic • LQFP (0.80 mm pitch), 32 pins (FPT-32P-M30)	Tray
S6E1C11B0AGP20000	64	12		
S6E1C12D0AGN20000	128	16	Plastic • QFN64 (0.50 mm pitch), 64 pins (LCC-64P-M25)	Tray
S6E1C11D0AGN20000	64	12		
S6E1C12C0AGN20000	128	16	Plastic • QFN48 (0.50 mm pitch), 48 pins (LCC-48P-M74)	Tray
S6E1C11C0AGN20000	64	12		
S6E1C12B0AGN20000	128	16	Plastic • QFN32 (0.50 mm pitch), 32 pins (LCC-32P-M73)	Tray
S6E1C11B0AGN20000	64	12		

48-pin plastic LQFP

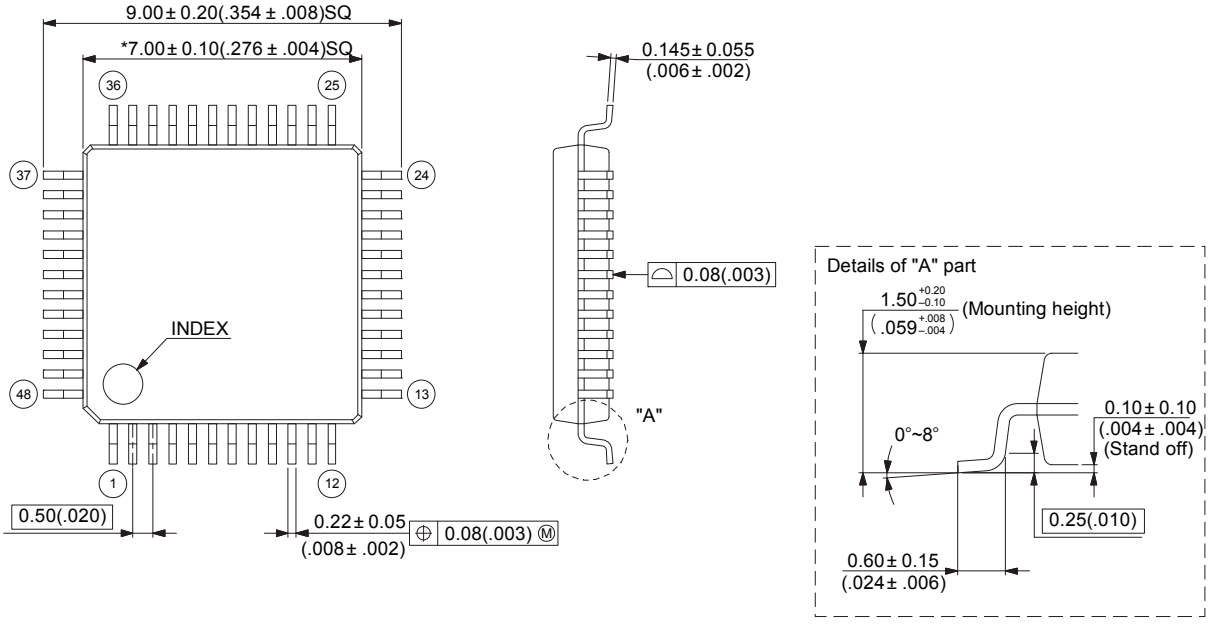


(FPT-48P-M49)

Lead pitch	0.50 mm
Package width × package length	7.00 mm × 7.00 mm
Lead shape	Gullwing
Lead bend direction	Normal bend
Sealing method	Plastic mold
Mounting height	1.70 mm MAX
Weight	0.17 g

48-pin plastic LQFP
(FPT-48P-M49)

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.