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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 "<u>Embedded -</u> <u>Microcontrollers</u>"

Details

Product Status	Active
Core Processor	ARM® Cortex®-M0+
Core Size	32-Bit Single-Core
Speed	40MHz
Connectivity	CSIO, I ² C, LINbus, UART/USART
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	37
Program Memory Size	56KB (56K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	6K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
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/s6e1a11c0agv20000

Email: info@E-XFL.COM

Address: Room A, 16/F, Full Win Commercial Centre, 573 Nathan Road, Mongkok, Hong Kong



A/D Converter (Max: 8 channels)

■12-bit A/D Converter

- □ Successive approximation type
- □ Conversion time: 0.8 µs @ 5 V (S6E1A1xC0A) / 2.0 µs (S6E1A1xB0A)
- □ 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: 4 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 37 fast general-purpose I/O ports @48pin package
- ■Certain ports are 5 V tolerant.

See "3. Pin Assignment" and "5. I/O Circuit Type" for details of such 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

Quadrature Position/Revolution Counter (QPRC)

The Quadrature Position/Revolution Counter (QPRC) is used to measure the position of the position encoder. In addition, it can be used as an up/down counter.

- The detection edge for the three external event input pins AIN, BIN and ZIN is configurable.
- 16-bit position counter
- ■16-bit revolution counter
- Two 16-bit compare registers

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)

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.



1. Product Lineup

Memory Size

Product name	S6E1A11B0A S6E1A11C0A	S6E1A12B0A S6E1A12C0A
On-chip Flash memory	56 Kbyte	88 Kbyte
On-chip SRAM	6 Kbyte	6 Kbyte

Function

	Product name		S6E1A11B0A S6E1A12B0A	S6E1A11C0A S6E1A12C0A					
Pin count			32	48/52					
CDU			Cortex-M0+						
CPU	Frequency		40 MHz						
Power supply	voltage range		2.7 V to 5.5 V						
DMAC			2 ch.						
Multi-function (UART/CSIO/I	Serial Interface ² C)		3 ch. (Max) ch.0/ch.1/ch.3: FIFO						
Base Timer (PWC/Reload	timer/PWM/PPG)	_	4 ch. (Max)						
	A/D start compare	6 ch.							
Multi-functio	Input capture	4 ch.							
n	Free-run timer	3 ch.	1 unit						
Timer	Output compare	6 ch.							
-	Waveform generator	3 ch.							
	PPG	3 ch.							
QPRC			1 ch.						
Dual Timer			1 unit						
Real-time Cloo	ck		1 unit						
Watch Counte	r		1 unit						
Watchdog time	er		1 ch. (SW) + 1 ch. (HW)						
External Interr	upt		8 pins (Max) + NMI × 1						
I/O port			23 pins (Max)	37 pins (Max)					
12-bit A/D converter			5 ch. (1 unit)	8 ch. (1 unit)					
CSV (Clock Supervisor)			Yes						
LVD (Low-voltage Detection)			2 ch.						
Built-in CR	High-speed		4 MHz						
	Low-speed		100 kHz						
Debug Functio	n		SW-DP						
Unique ID			Yes						

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 "14. ELECTRICAL CHARACTERISTICS 14.4 AC Characteristics 14.4.3 Built-in CR Oscillation Characteristics" for accuracy of built-in CR.





Note:

• The number after the underscore ("_") in pin names such as XXX_1 and XXX_2 indicates the relocated port number. For these pins, there are multiple pins that provide the same function for the same channel. Use the extended port function register (EPFR) to select the pin.



Pin no.						
LQFP-52	LQFP-48 QFN-48	LQFP-32 QFN-32	Pin name	I/O circuit type	Pin state type	
			PE0			
22	20	13	ADTG_1		.1	
	20		DTTI0X_1		°	
			INT02_2		_	
23	21	14	MD0	J	D	
24	22	15	PE2	- A	А	
			X0			
25	23	16	PE3	- A	В	
			X1			
26	24	17	VSS	-		
27	25	-	P10	G	к	
			AN00			
			P11	-		
	26		AN01	-	L	
28		18	SIN1_1	- H*		
			INT02_1			
			FRCK0_2			
			IC02_0			
	27		P12	-	L	
		19	AN02	-		
29			SOT1_1	H*		
			IC00_2	-		
			INT01_1			
			P13	-		
			AN03	-		
			SCK1_1	-		
30	28	20	SUBOUT_1	H*	L	
			IC01_2			
			RTCCO_1			
			INT00_1			
			P14			
			AN04			
31	29		SIN0_1	_ н*	,	
	23		SCS10_1		L	
			INT03_1			
				IC02_2		



List of pin functions

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.

Din			Pin no.			
function	Pin name	Function description	LQFP-52	LQFP-48 QFN-48	LQFP-32 QFN-32	
	ADTG_1	A/D converter external trigger	22	20	13	
	ADTG_2	input pin	6	5	-	
	AN00		27	25	-	
	AN01		28	26	18	
	AN02		29	27	19	
ADC	AN03	A/D converter analog input pin.	30	28	20	
	AN04	ANxx describes ADC ch.xx.	31	29	-	
	AN05		32	30	-	
	AN06		37	34	23	
	AN07		38	35	24	
	TIOA0_0	Pass timer of 0 TIOA sin	11	10	5	
Base Timer	TIOA0_1	Base limer ch.0 HOA pin	7	6	1	
0	TIOB0_0	Pass timer of 0 TIOP pin	19	18	-	
	TIOB0_1		45	41	28	
	TIOA1_0	Page timer of 1 TIOA pin	12	11	6	
Base Timer	TIOA1_1	base timer ch. 1 TIOA pin	8	7	2	
1	TIOB1_0	Page timer of 1 TIOP pin	20	19	-	
	TIOB1_1		39	36	25	
	TIOA2_0		37	34	23	
	TIOA2_1	Base timer ch.2 TIOA pin	9	8	3	
Base Timer 2	TIOA2_2		48	44	31	
-	TIOB2_0	Page times of 2 TIOP nin	38	35	24	
	TIOB2_2		47	43	30	
Base Timer 3	TIOA3_1	Base timer ch.3 TIOA pin	10	9	4	
	SWCLK	Serial wire debug interface clock input pin	42	38	26	
Debugger	SWDIO	Serial wire debug interface data input / output pin	44	40	27	







9. Memory Size

See Memory size in 1. Product Lineup to confirm the memory size.

10. Memory Map

Memory Map (1)



0x4000_0000



11. Pin Status in Each CPU State

The terms used for pin status have the following meanings.

■INITX=0

This is the period when the INITX pin is the L level.

■INITX=1

This is the period when the INITX pin is the H level.

■SPL=0

This is the status that the standby pin level setting bit (SPL) in the standby mode control register (STB_CTL) is set to 0.

■SPL=1

This is the status that the standby pin level setting bit (SPL) in the standby mode control register (STB_CTL) is set to 1.

■Input enabled

Indicates that the input function can be used.

■Internal input fixed at 0

This is the status that the input function cannot be used. Internal input is fixed at L.

■Hi-Z

Indicates that the pin drive transistor is disabled and the pin is put in the Hi-Z state.

Setting disabled

Indicates that the setting is disabled.

■Maintain previous state

Maintains the state that was immediately prior to entering the current mode. If a built-in peripheral function is operating, the output follows the peripheral function. If the pin is being used as a port, that output is maintained.

■Analog input is enabled

Indicates that the analog input is enabled.



tus 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 TI RTC m STOP	MER mode, node, or 9 mode
^{>} in stat	i unotion group	Power supply unstable	Power su	pply stable	Power supply stable	Power su	pply stable
-		-	INITX = 0 INITX = 1		INITX = 1	INITX = 1	
		-	-	-	-	SPL = 0	SPL = 1
	External interrupt enabled selected						Maintain previous state
	Resource other than the above selected	Setting disabled	ting Setting S abled disabled d		Maintain previous state	Maintain previous state	Hi-Z / Internal input fixed at
	GPIO selected						"0"

*1:Oscillation stops in Sub timer mode, Low-speed CR timer mode, STOP mode, RTC mode.

*2:Oscillation stops in STOP mode.



12.2 Recommended Operating Conditions

Parameter	Symbol Conditions		Va	ue	Unit	Pomarke
Faialletei	Symbol	Conditions	Min	Max	Unit	Remarks
Power supply voltage	Vcc	-	2.7* ²	5.5	V	
Analog power supply voltage	AV _{CC}	-	2.7	5.5	V	$AV_{CC} = V_{CC}$
Analog reference voltage	AVRH	-	2.7	AV _{CC}	V	Only S6E1A1xC0A
Smoothing capacitor	Cs	-	1	10	μF	For regulator*1
Operating temperature	Та	-	- 40	+ 105	°C	

"1: See "C Pin" in "6. Handling Precautions" for the connection of the smoothing capacitor.

*2: In between less than the minimum power supply voltage and low 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.

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



- *1 : Ta=+25°C,V_{CC}=3.0V
- *2 : Ta=+105°C,V_{CC}=5.5V
- *3 : All ports are fixed *4 : PCLK0=HCLK/8

- *5 : The frequency is set to 4MHz by trimming *6 : Flash sync down is set to FRWTR.RWT = 11 and FSYNDN.SD = 1111
- *7 : V_{CC}=2.7V *8 : When HCLK=4MHz, PLL OFF

Symbol			Value		Uni	
(Pin name)		Conditions				Remarks
		Ta=25°C Vcc=3.0V LVD off	5.6	28	μA	*1
I _{ССН} (VCC)	STOP mode	Ta=25°C Vcc=5.0V LVD off	6.7	30	μA	*1
		Ta=105°C Vcc=5.5V LVD off	-	540	μA	*1
I _{ССТ} (VCC) Sub timer mode	Ta=25°C Vcc=3.0V 32kHz crystal oscillation		42	μA	*1	
	Sub timer mode	Ta=25°C Vcc=5.0V 32kHz crystal oscillation LVD off	13	44	μA	*1
		Ta=105 [°] C Vcc=5.5V 32kHz crystal oscillation LVD off	-	730	μA	*1
I _{CCR} (VCC) RTC mode		Ta=25°C Vcc=3.0V 32kHz crystal oscillation LVD off	9	36	μA	*1
	RTC mode	Ta=25°C Vcc=5.0V 32kHz crystal oscillation LVD off	10	38	μA	*1
		Ta=105°C Vcc=5.5V 32kHz crystal oscillation LVD off	-	570	μA	*1

*1:All ports are fixed.



12.4.3 Built-in CR Oscillation Characteristics

Built-in high-speed CR

		(V _C	$_{\rm C} = {\rm AV}_{\rm CC} = 2$	2.7 V to 5	5.5 V, V _{SS}	=AV _{SS} =	0 V, Ta = -40° C to $+10^{\circ}$
Paramatar	Symbol	Conditions		Value		Unit	Bomorko
Parameter	Symbol	Conditions Min		Тур	Max	Unit	Remarks
Clock frequency		Ta = + 25°C, 3.6V < V _{CC} ≤ 5.5V	3.92	4	4.08		
		Ta =0°C to + 85°C, 3.6V < V _{CC} ≤ 5.5V	3.9	4	4.1		
		Ta = - 40°C to + 105°C, 3.6V < V _{CC} ≤ 5.5V	3.88	4	4.12	MHz	
	Есвн	Ta = + 25°C, 2.7V $\leq V_{CC} \leq 3.6V$	3.94	4	4.06		During trimming ^{*1}
	- ONT	Ta = - 20°C to + 85°C, 2.7V $\leq V_{CC} \leq 3.6V$	3.92	4	4.08		
		Ta = - 20°C to + 105°C, 2.7V $\leq V_{CC} \leq 3.6V$	3.9	4	4.1		
		Ta = - 40°C to + 105°C, 2.7V $\leq V_{CC} \leq 3.6V$	3.88	4	4.12		
		Ta = - 40°C to + 105°C	2.8	4	5.2		Not during trimming
Frequency stabilization time	t _{CRWT}	-	-	-	30	μs	*2

*1: In the case of using the values in CR trimming area of Flash memory at shipment for frequency trimming/temperature trimming.

*2: This is time from the trim value setting to stable of the frequency of the High-speed CR clock. After setting the trim value, the period when the frequency stability time passes can use the High-speed CR clock as a source clock.

Built-in low-speed CR

(V_{CC} = AV_{CC} = 2.7 V to 5.5 V, V_{SS} =AV_{SS} = 0 V, Ta = - 40°C to + 105°C)

Parameter	Symbol Conditions			Value		Unit	Pomarks
	Symbol	Conditions	Min	Тур	Мах	Unit	Rellarks
Clock frequency	F _{CRL}	-	50	100	150	kHz	























12.4.13 SW-DP Timing

			$(V_{CC} = AV_{CC})$	c = 2.7 V to	5.5 V, V _{SS} =	= AV _{SS} =	0 V, Ta = - 40°C to + 10
Parameter	Symbol	Pin name	Conditions	Va Min	lue Max	Unit	Remarks
SWDIO setup time	t _{sws}	SWCLK, SWDIO	-	15	-	ns	
SWDIO hold time	t _{SWH}	SWCLK, SWDIO	-	15	-	ns	
SWDIO delay time	t _{SWD}	SWCLK, SWDIO	-	-	45	ns	

Note:

• External load capacitance $C_L = 30 \text{ pF}$





13. Ordering Information

Part number	Package
S6E1A11B0AGP2	Plastic • LQFP (0.80 mm pitch), 32 pins
S6E1A12B0AGP2	(FPT-32P-M30)
S6E1A11B0AGN2	Plastic • QFN (0.50 mm pitch), 32 pins
S6E1A12B0AGN2	(LCC-32P-M73)
S6E1A11C0AGV2	Plastic • LQFP (0.50 mm pitch), 48 pins
S6E1A12C0AGV2	(FPT-48P-M49)
S6E1A11C0AGN2	Plastic • QFN (0.50 mm pitch), 48 pins
S6E1A12C0AGN2	(LCC-48P-M74)
S6E1A11C0AGF2	Plastic • LQFP (0.65 mm pitch), 52 pins
S6E1A12C0AGF2	(FPT-52P-M02)



14. Package Dimensions















