Welcome to E-XFL.COM

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®-M4
Core Size	32-Bit Single-Core
Speed	48MHz
Connectivity	I²C, IrDA, LINbus, SPI, UART/USART, USB
Peripherals	Brown-out Detect/Reset, DMA, I²S, POR, PWM, WDT
Number of I/O	48
Program Memory Size	128KB (128K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	32K x 8
Voltage - Supply (Vcc/Vdd)	1.68V ~ 3.6V
Data Converters	A/D 7x12b; D/A 1x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-TQFP
Supplier Device Package	64-TQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/atsam4ls2ba-au

Figure 3-4. ATSAM4LC TQFP64/QFN64 Pinout

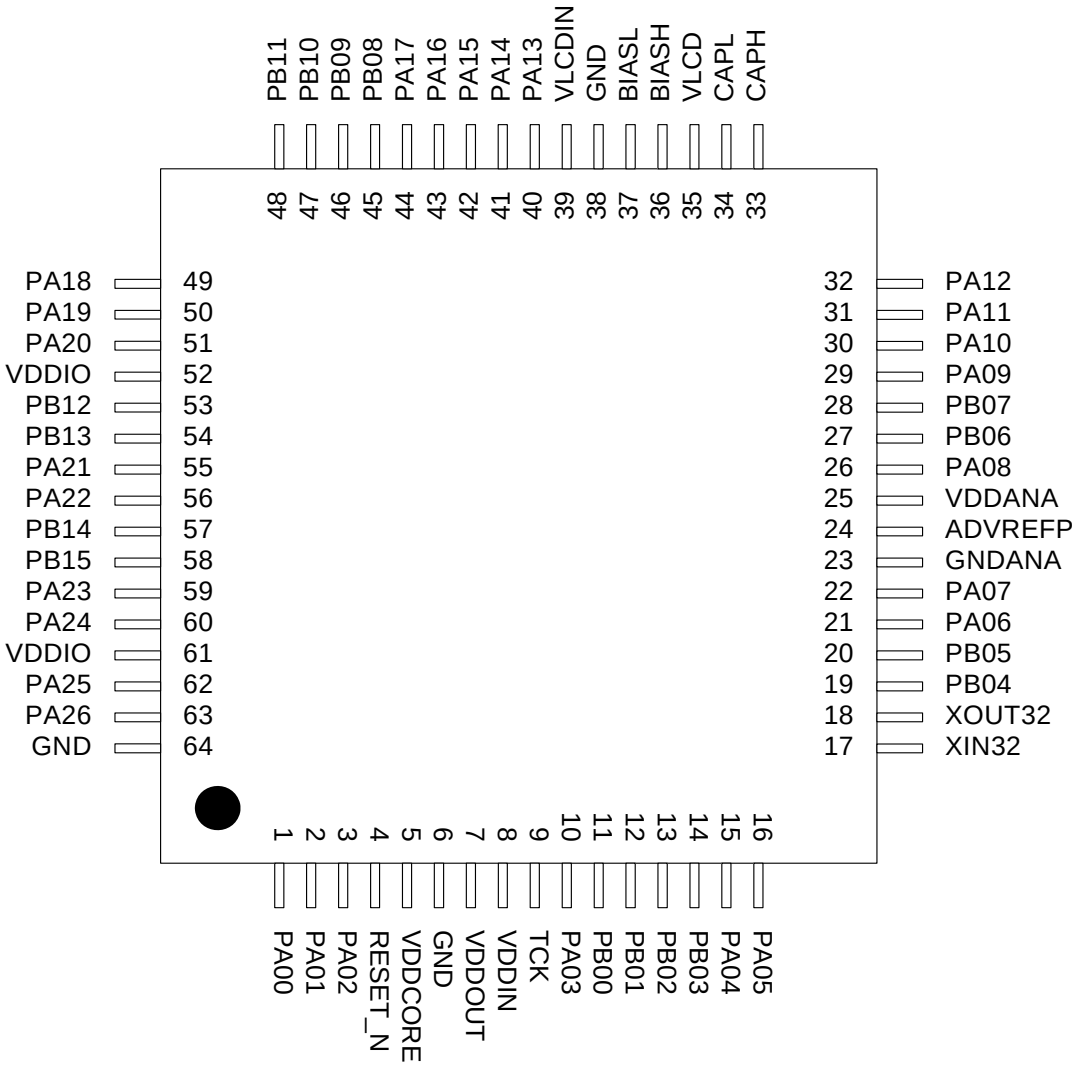


Figure 3-5. ATSAM4LC TQFP48/QFN48 Pinout

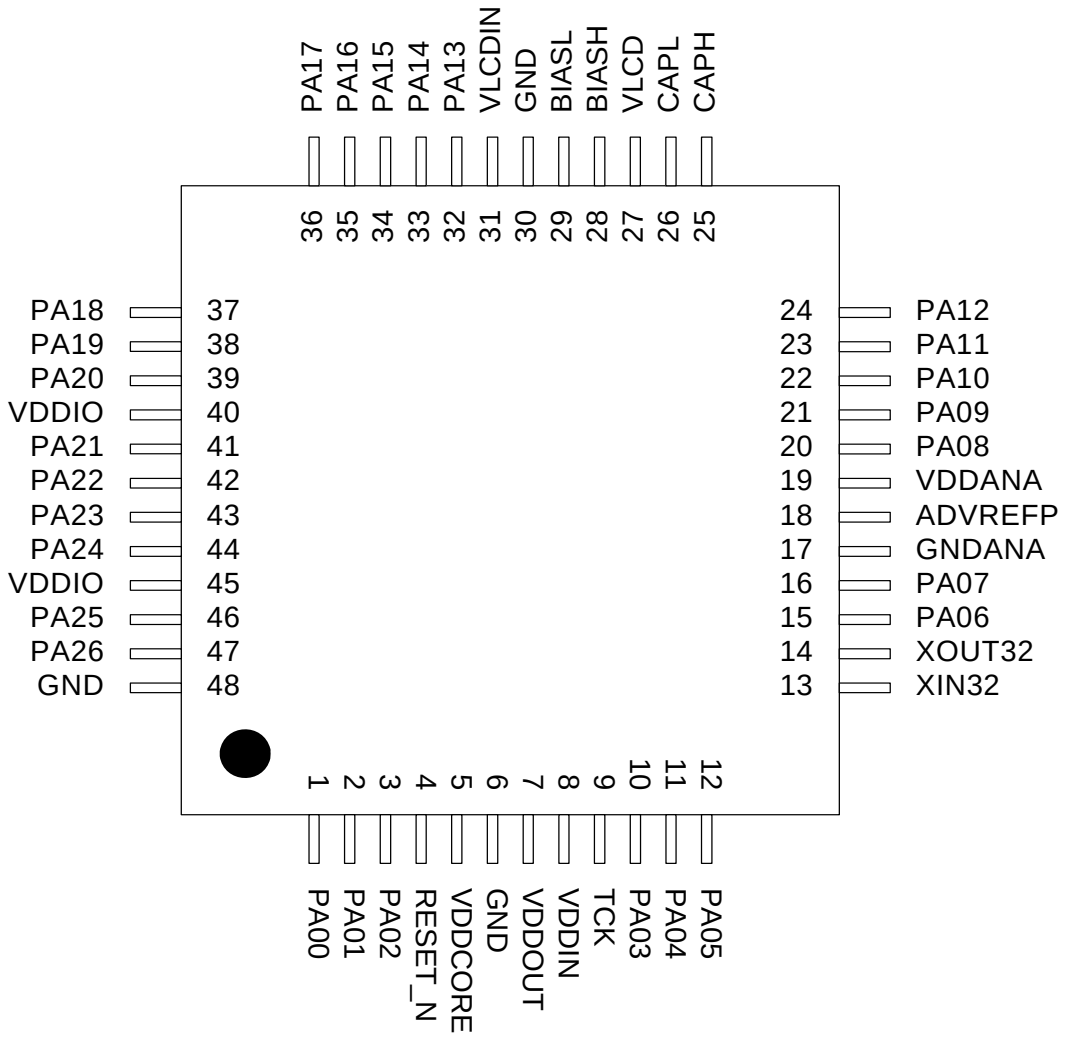
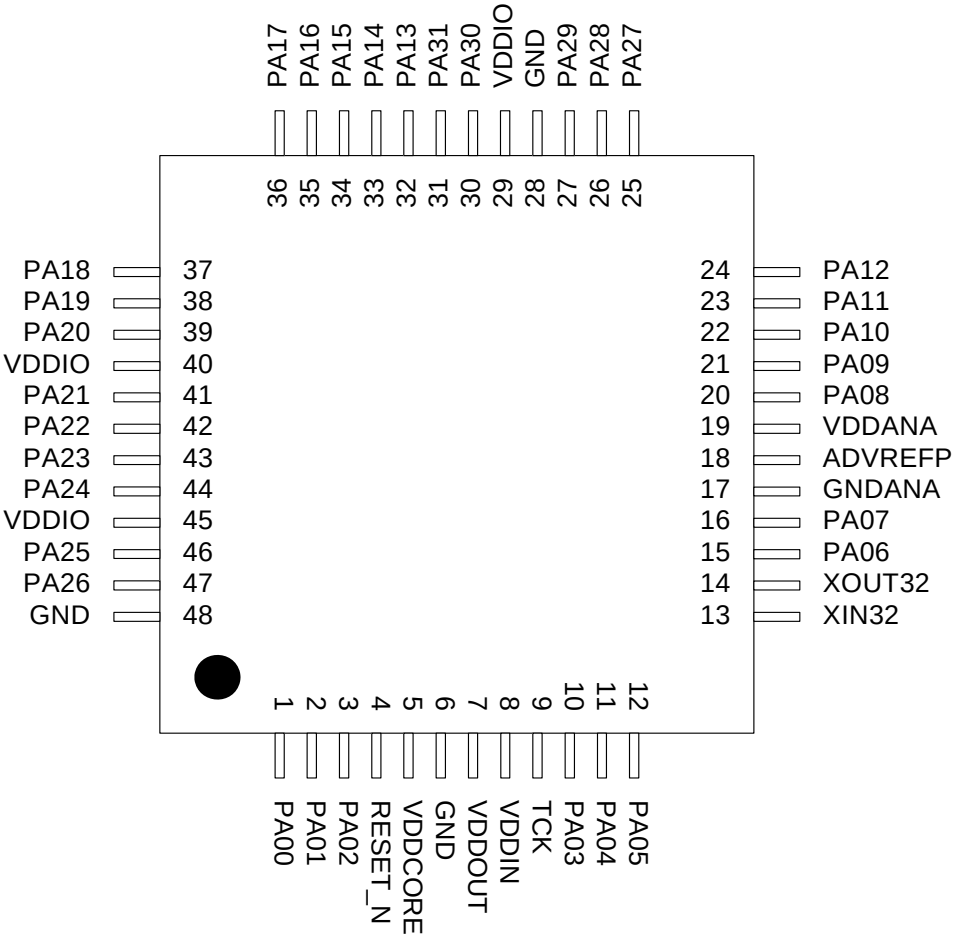


Figure 3-10. ATSAM4LS TQFP48/QFN48 Pinout



See Section 3.3 ”Signals Description” on page 31 for a description of the various peripheral signals.

Refer to ”Electrical Characteristics” on page 99 for a description of the electrical properties of the pin types used.

Table 3-1. 100-pin GPIO Controller Function Multiplexing (Sheet 2 of 4)

ATSAM4LC		ATSAM4LS		Pin	GPIO	Supply	GPIO Functions						
QFN	VFBGA	QFN	VFBGA				A	B	C	D	E	F	G
66	J7	66	J7	PA16	16	LCDA	USART1 TXD	TC0 CLK2	EIC EXTINT1	PARC PCDATA7		LCDCA SEG8	CATB SENSE11
67	H6	67	H6	PA17	17	LCDA	USART2 RTS	ABDACB DAC0	EIC EXTINT2	PARC PCCK		LCDCA SEG9	CATB SENSE12
76	K10	76	K10	PA18	18	LCDA	USART2 CLK	ABDACB DACN0	EIC EXTINT3	PARC PCEN1		LCDCA SEG18	CATB SENSE13
77	J10	77	J10	PA19	19	LCDA	USART2 RXD	ABDACB DAC1	EIC EXTINT4	PARC PCEN2	SCIF GCLK0	LCDCA SEG19	CATB SENSE14
78	H10	78	H10	PA20	20	LCDA	USART2 TXD	ABDACB DACN1	EIC EXTINT5	GLOC IN0	SCIF GCLK1	LCDCA SEG20	CATB SENSE15
91	E9	91	E9	PA21	21	LCDC	SPI MISO	USART1 CTS	EIC EXTINT6	GLOC IN1	TWIM2 TWD	LCDCA SEG34	CATB SENSE16
92	E10	92	E10	PA22	22	LCDC	SPI MOSI	USART2 CTS	EIC EXTINT7	GLOC IN2	TWIM2 TWCK	LCDCA SEG35	CATB SENSE17
95	D6	95	D6	PA23	23	LCDC	SPI SCK	TWIMS0 TWD	EIC EXTINT8	GLOC IN3	SCIF GCLK IN0	LCDCA SEG38	CATB DIS
96	D10	96	D10	PA24	24	LCDC	SPI NPCS0	TWIMS0 TWCK		GLOC OUT0	SCIF GCLK IN1	LCDCA SEG39	CATB SENSE18
98	D9	98	D9	PA25	25	VDDIO	USBC DM	USART2 RXD					CATB SENSE19
99	C9	99	C9	PA26	26	VDDIO	USBC DP	USART2 TXD					CATB SENSE20
		51	K1	PA27	27	LCDA	SPI MISO	IISC ISCK	ABDACB DAC0	GLOC IN4	USART3 RTS		CATB SENSE0
		52	J1	PA28	28	LCDA	SPI MOSI	IISC ISDI	ABDACB DACN0	GLOC IN5	USART3 CTS		CATB SENSE1
		53	K2	PA29	29	LCDA	SPI SCK	IISC IWS	ABDACB DAC1	GLOC IN6	USART3 CLK		CATB SENSE2
		56	K4	PA30	30	LCDA	SPI NPCS0	IISC ISDO	ABDACB DACN1	GLOC IN7	USART3 RXD		CATB SENSE3
		57	K5	PA31	31	LCDA	SPI NPCS1	IISC IMCK	ABDACB CLK	GLOC OUT1	USART3 TXD		CATB DIS
20	J3	20	J3	PB00	32	VDDIN	TWIMS1 TWD	USART0 RXD					CATB SENSE21
21	D5	21	D5	PB01	33	VDDIN	TWIMS1 TWCK	USART0 TXD	EIC EXTINT0				CATB SENSE22
22	E5	22	E5	PB02	34	VDDANA	ADCIFE AD3	USART1 RTS	ABDACB DAC0	IISC ISCK	ACIFC ACBN0		CATB SENSE23
23	C4	23	C4	PB03	35	VDDANA	ADCIFE AD4	USART1 CLK	ABDACB DACN0	IISC ISDI	ACIFC ACBP0		CATB DIS
28	C1	28	C1	PB04	36	VDDANA	ADCIFE AD5	USART1 RXD	ABDACB DAC1	IISC ISDO	DACC EXT TRIG0		CATB SENSE24
29	B1	29	B1	PB05	37	VDDANA	ADCIFE AD6	USART1 TXD	ABDACB DACN1	IISC IMCK			CATB SENSE25
45	G3	45	G3	PB06	38	LCDA	USART3 RTS		GLOC IN4	IISC IWS		LCDCA SEG22	CATB SENSE26
46	H1	46	H1	PB07	39	LCDA	USART3 CTS		GLOC IN5	TC0 A0		LCDCA SEG21	CATB SENSE27

4.6 Cortex-M4 implementations options

This table provides the specific configuration options implemented in the SAM4L series

Option	Implementation
Inclusion of MPU	yes
Inclusion of FPU	No
Number of interrupts	80
Number of priority bits	4
Inclusion of the WIC	No
Embedded Trace Macrocell	No
Sleep mode instruction	Only WFI supported
Endianness	Little Endian
Bit-banding	No
SysTick timer	Yes
Register reset values	No

Table 4-1. Cortex-M4 implementation options

4.7 Cortex-M4 Interrupts map

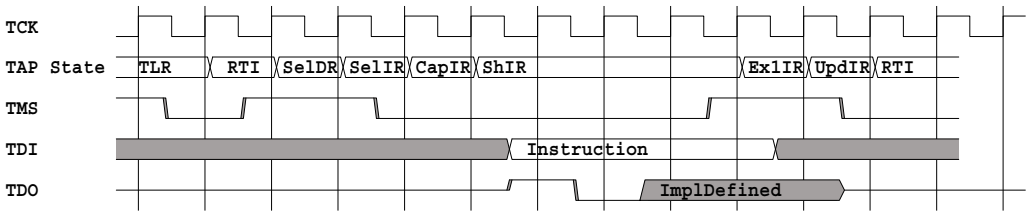
The table below shows how the interrupt request signals are connected to the NVIC.

Table 4-2. Interrupt Request Signal Map (Sheet 1 of 3)

Line	Module	Signal
0	Flash Controller	HFLASHC
1	Peripheral DMA Controller	PDCA 0
2	Peripheral DMA Controller	PDCA 1
3	Peripheral DMA Controller	PDCA 2
4	Peripheral DMA Controller	PDCA 3
5	Peripheral DMA Controller	PDCA 4
6	Peripheral DMA Controller	PDCA 5
7	Peripheral DMA Controller	PDCA 6
8	Peripheral DMA Controller	PDCA 7
9	Peripheral DMA Controller	PDCA 8
10	Peripheral DMA Controller	PDCA 9
11	Peripheral DMA Controller	PDCA 10

Apply the TMS sequence 1, 1, 0 to re-enter the Run-Test/Idle state. The instruction is latched onto the parallel output from the shift register path in the Update-IR state. The Exit-IR, Pause-IR, and Exit2-IR states are only used for navigating the state machine.

Figure 8-10. Scanning in JTAG instruction



8.11.5.2 Scanning in/out data

At the TMS input, apply the sequence 1, 0, 0 at the rising edges of TCK to enter the Shift Data Register - Shift-DR state. While in this state, upload the selected Data Register (selected by the present JTAG instruction in the JTAG Instruction Register) from the TDI input at the rising edge of TCK. In order to remain in the Shift-DR state, the TMS input must be held low. While the Data Register is shifted in from the TDI pin, the parallel inputs to the Data Register captured in the Capture-DR state is shifted out on the TDO pin.

Apply the TMS sequence 1, 1, 0 to re-enter the Run-Test/Idle state. If the selected Data Register has a latched parallel-output, the latching takes place in the Update-DR state. The Exit-DR, Pause-DR, and Exit2-DR states are only used for navigating the state machine.

As shown in the state diagram, the Run-Test/Idle state need not be entered between selecting JTAG instruction and using Data Registers.

8.11.6 Boundary-Scan

The Boundary-Scan chain has the capability of driving and observing the logic levels on the digital I/O pins, as well as the boundary between digital and analog logic for analog circuitry having off-chip connections. At system level, all ICs having JTAG capabilities are connected serially by the TDI/TDO signals to form a long shift register. An external controller sets up the devices to drive values at their output pins, and observe the input values received from other devices. The controller compares the received data with the expected result. In this way, Boundary-Scan provides a mechanism for testing interconnections and integrity of components on Printed Circuits Boards by using the 4 TAP signals only.

The four IEEE 1149.1 defined mandatory JTAG instructions IDCODE, BYPASS, SAMPLE/PRELOAD, and EXTEST can be used for testing the Printed Circuit Board. Initial scanning of the data register path will show the ID-code of the device, since IDCODE is the default JTAG instruction. It may be desirable to have the device in reset during test mode. If not reset, inputs to the device may be determined by the scan operations, and the internal software may be in an undetermined state when exiting the test mode. Entering reset, the outputs of any Port Pin will instantly enter the high impedance state, making the HIGHZ instruction redundant. If needed, the BYPASS instruction can be issued to make the shortest possible scan chain through the device. The device can be set in the reset state by pulling the external RESET_N pin low.

The EXTEST instruction is used for sampling external pins and loading output pins with data. The data from the output latch will be driven out on the pins as soon as the EXTEST instruction is loaded into the JTAG IR-register. Therefore, the SAMPLE/PRELOAD should also be used for setting initial values to the scan ring, to avoid damaging the board when issuing the EXTEST

instruction for the first time. SAMPLE/PRELOAD can also be used for taking a snapshot of the external pins during normal operation of the part.

When using the JTAG interface for Boundary-Scan, the JTAG TCK clock is independent of the internal chip clock, which is not required to run.

NOTE: For pins connected to 5V lines care should be taken to not drive the pins to a logic one using boundary scan, as this will create a current flowing from the 3,3V driver to the 5V pullup on the line. Optionally a series resistor can be added between the line and the pin to reduce the current.

8.11.7 Flash Programming typical procedure

Flash programming is performed by operating Flash controller commands. The Flash controller is connected to the system bus matrix and is then controllable from the AHP-AP. The AHB-AP cannot write the FLASH page buffer while the core_hold_reset is asserted. The AHB-AP cannot be accessed when the device is in protected state. It is important to ensure that the CPU is halted prior to operating any flash programming operation to prevent it from corrupting the system configuration. The recommended sequence is shown below:

1. At power up, RESET_N is driven low by a debugger. The on-chip regulator holds the system in a POR state until the input supply is above the POR threshold. The system continues to be held in this static state until the internally regulated supplies have reached a safe operating.
2. PM starts, clocks are switched to the slow clock (Core Clock, System Clock, Flash Clock, and any Bus Clocks that do not have clock gate control). Internal resets are maintained due to the external reset.
   – The Debug Port (DP) and Access Ports (AP) receives a clock and leave the reset state,
3. The debugger maintains a low level on TCK and release RESET_N.
   – The SMAP asserts the core_hold_reset signal
4. The Cortex-M4 core remains in reset state, meanwhile the rest of the system is released.
5. The debugger then configures the NVIC to catch the Cortex-M4 core reset vector fetch. For more information on how to program the NVIC, refer to the ARMv7-M Architecture Reference Manual.
6. The debugger writes a one in the SMAP SCR.HCR to release the Cortex-M4 core reset to make the system bus matrix accessible from the AHB-AP.
7. The Cortex-M4 core initializes the SP, then read the exception vector and stalls
8. Programming is available through the AHB-AP
9. After operation is completed, the chip can be restarted either by asserting RESET_N or switching power off/on or clearing SCR.HCR. Make sure that the TCK pin is high when releasing RESET_N not to halt the core.

– All other peripheral clocks stopped
- I/Os are inactive with internal pull-up
- CPU is running on flash with 1 wait state
- Low power cache enabled
- BOD18 and BOD33 disabled

Table 9-8. ATSAM4L4/2 Current consumption and Wakeup time for power scaling mode 1

Mode	Conditions	T_A	Typical Wakeup Time	Typ	Max (1)	Unit
RUN	CPU running a Fibonacci algorithm Linear mode	25°C	N/A	205	224	µA/MHz
		85°C		212	231	
	CPU running a CoreMark algorithm Linear mode	25°C	N/A	213	244	
		85°C		230	270	
	CPU running a Fibonacci algorithm Switching mode	25°C	N/A	95	112	
		85°C		100	119	
	CPU running a CoreMark algorithm Switching mode	25°C	N/A	100	128	
		85°C		107	138	
SLEEP0	Switching mode	25°C	9 * Main clock cycles	527	627	µA
		85°C		579	739	
SLEEP1	Switching mode	25°C	9 * Main clock cycles + 500ns	369	445	
		85°C		404	564	
SLEEP2	Switching mode	25°C	9 * Main clock cycles + 500ns	305	381	
		85°C		334	442	
SLEEP3	Linear mode	25°C		46	55	
WAIT	OSC32K and AST running Fast wake-up enable		1.5µs	4.7	7.5	
	OSC32K and AST stopped Fast wake-up enable			3.5	6.3	
RETENTION	OSC32K running AST running at 1kHz		1.5µs	2.6	4.8	
	AST and OSC32K stopped			1.5	4	
BACKUP	OSC32K running AST running at 1kHz			1.5	3.1	
	AST and OSC32K stopped			0.9	1.7	

1. These values are based on characterization. These values are not covered by test limits in production.

- Operating conditions, internal core supply (Figure 9-2)
  - V_{VDDIN} = 3.3V
  - $V_{VDDCORE}$ = 1.2 V, supplied by the internal regulator in switching mode
- T_A = 25°C
- Oscillators
  - OSC0 (crystal oscillator) stopped
  - OSC32K (32KHz crystal oscillator) running with external 32KHz crystal
  - RCFAST running @ 12MHz
- Clocks
  - RCFAST used as main clock source
  - CPU, AHB, and PB clocks undivided
- I/Os are inactive with internal pull-up
- Flash enabled in normal mode
- CPU in SLEEP0 mode
- BOD18 and BOD33 disabled

Consumption active is the added current consumption when the module clock is turned on

9.9.4 Analog- to Digital Converter Characteristics

Table 9-45. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Units
	Temperature range		-40		+85	°C
	Resolution (1)	Max		12	12 (2)	Bit
	Sampling clock (3)	Differential modes, Gain=1X	5		300	kHz
		Unipolar modes, Gain=1X	5		250	
f_{ADC}	ADC clock frequency(3)	Differential modes	0.03		1.8	MHz
		Unipolar modes	0.03		1.5	
$T_{SAMPLEHOLD}$	Sampling time(3)	Differential modes	16.5		277	µs
		Unipolar modes	16.5		333	
	Conversion rate(1)	1X gain, differential			300	kSps
	Internal channel conversion rate(3)	V_{VDD}/10, Bandgap and Temperature channels			125	kSps
	Conversion time (latency) Differential mode (no windowing)	1X gain, (resolution/2)+gain (4)			6	Cycles
		2X and 4X gain			7	
		8X and 16X gain			8	
		32X and 64X gain			9	
		64X gain and unipolar			10	

1. These values are based on characterization. These values are not covered by test limits in production
2. Single ended or using divide by two max resolution: 11 bits
3. These values are based on simulation. These values are not covered by test limits in production
4. See Figure 9-5

Figure 9-5. Maximum input common mode voltage

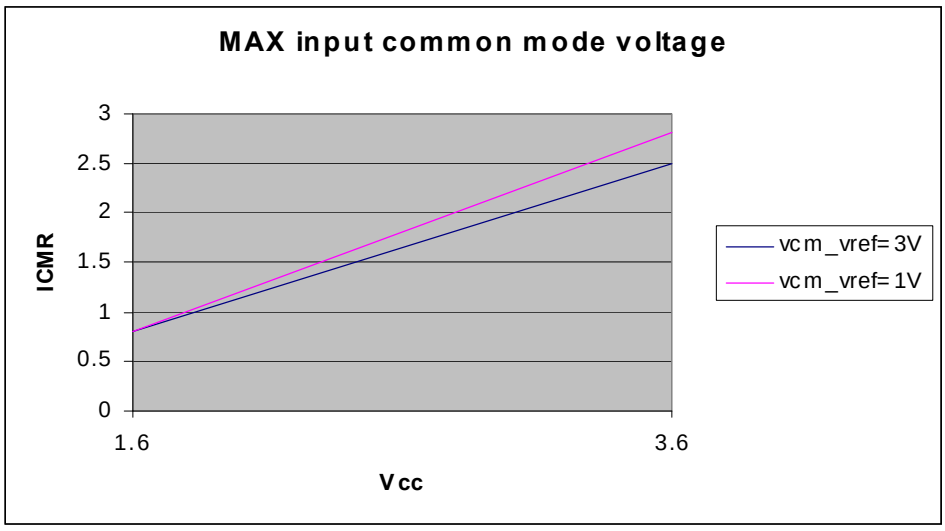


Table 9-47. Differential mode, gain=1

	Offset error drift vs temperature[1]				0.04	mV/°K
	Conversion range [2]	Vin-Vip	-Vref		Vref	V
	ICMR[1]			see Figure 9-5		
	PSRR[1]	fvdd=1Hz, ext ADVREFP=3.0V V_{VDD}=3.6V		100		dB
		fvdd=2MHz, ext ADVREFP=3.0V V_{VDD}=3.6		50		
	DC supply current [2]	VDDANA=3.6V, ADVREFP=3.0V		1.2		mA
		VDDANA=1.6V, ADVREFP=1.0V		0.6		

1. These values are based on simulation only. These values are not covered by test limits in production or characterization
2. These values are based on characterization and not tested in production, and valid for an input voltage between 10% to 90% of reference voltage.

Table 9-48. Unipolar mode, gain=1

Symbol	Parameter	Conditions	Min	Typ	Max	Units
	Accuracy without compensation [1]			7		ENOB
	Accuracy after compensation[1]				11	ENOB
INL	Integral Non Linearity [2]	After calibration Dynamic tests No gain compensation			±3	LSBs
		After calibration Dynamic tests Gain compensation			±3	
DNL	Differential Non Linearity[2]	After calibration			±2.8	LSBs
	Gain error[2]	External reference	-15		15	mV
		VDDANA/1.6	-50		50	
		VDDANA/2.0	-30		30	
		Bandgap After calibration	-10		10	
	Gain error drift vs voltage[1]	External reference	-8		8	mV/V
	Gain error drift temperature[1]	+ bandgap drift If using bandgap			0.08	mV/°K
	Offset error[2]	External reference	-15		15	mV
		VDDANA/1.6	-15		15	
		VDDANA/2.0	-15		15	
		Bandgap After calibration	-10		10	
	Offset error drift[1]		-4		4	mV/V
	Offset error drift temperature[1]			0	0.04	mV/°K
	Conversion range[1]	Vin-Vip	-Vref		Vref	V
	ICMR[1]			see Figure 9-5		

9.9.5 Digital to Analog Converter Characteristics

Table 9-49. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Units
	Analog Supply Voltage (1)	on VDDANA	2.4	3	3.6	V
	Digital Supply Voltage(1)	on VDDCORE	1.62	1.8	1.98	V
	Resolution (2)			10		bits
	Clock frequency(1)	Cload = 50pF ; Rload = 5kΩ			500	kHz
	Load(1)	CLoad			50	pF
		RLoad	5			kΩ
INL	Integral Non Linearity (1)	Best fit-line method			±2	LSBs
DNL	Differential Non Linearity (1)	Best fit-line method	-0.9		+1	LSBs
	Zero Error (offset) (1)	CDR[9:0] = 0		1	5	mV
	Gain Error (1)	CDR[9:0] = 1023		5	10	mV
	Total Harmonic Distortion(1)	80% of VDDANA @ fin = 70kHz	-56		7	dB
	Delay to vout (1)	CDR[9:0] = 512/ Cload = 50 pF / Rload = 5 kΩ	2			µs
	Startup time(1)	CDR[9:0] = 512	5		9	µs
	Output Voltage Range	(ADVREFP < VDDANA – 100mV) is mandatory	0		ADVREFP	V
	ADVREFP Voltage Range(1)	(ADVREFP < VDDANA – 100mV) is mandatory	2.3		3.5	V
	ADVREFN Voltage Range(1)	ADVREFP = GND		0		V
	Standby Current(1)	On VDDANA			500	nA
		On VDDCORE			100	
	DC Current consumption(1)	On VDDANA (no Rload)		485	660	µA
		On ADVREFP (CDR[9:0] = 512)		250	295	

1. These values are based on simulation. These values are not covered by test limits in production or characterization
2. These values are based on characterization. These values are not covered by test limits in production

9.9.6 Analog Comparator Characteristics

Table 9-50. Analog Comparator Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
	Positive input voltage range		0.1		VDDIO-0.1	V
	Negative input voltage range		0.1		VDDIO-0.1	
	Offset (1)	V_{ACREFN} =0.1V to VDDIO-0.1V, hysteresis = 0 (2) Fast mode	-12		13	mV
		V_{ACREFN} =0.1V to VDDIO-0.1V, hysteresis = 0(2) Low power mode	-11		12	mV

Table 9-61. USART3 in SPI mode Timing, Slave Mode[1]

Symbol	Parameter	Conditions	Min	Max	Units
USPI6	SPCK falling to MISO delay	V_{VDDIO} from 3.0V to 3.6V, maximum external capacitor = 40pF		593.9	ns
USPI7	MOSI setup time before SPCK rises		45.93 + t_{SAMPLE}[2] + t_{CLK_USART}		
USPI8	MOSI hold time after SPCK rises		47.03 -(t_{SAMPLE}[2] + t_{CLK_USART})		
USPI9	SPCK rising to MISO delay			593.38	
USPI10	MOSI setup time before SPCK falls		45.93 +(t_{SAMPLE}[2] + t_{CLK_USART})		
USPI11	MOSI hold time after SPCK falls		47.03 -(t_{SAMPLE}[2] + t_{CLK_USART})		
USPI12	NSS setup time before SPCK rises		237.5		
USPI13	NSS hold time after SPCK falls		-1.81		
USPI14	NSS setup time before SPCK falls		237.5		
USPI15	NSS hold time after SPCK rises		-1.81		

Notes: 1. These values are based on simulation. These values are not covered by test limits in production.

2. Where: $t_{SAMPLE} = t_{SPCK} - \left(\left\lfloor \frac{t_{SPCK}}{2 \times t_{CLKUSART}} \right\rfloor + \frac{1}{2}\right) \times t_{CLKUSART}$

Maximum SPI Frequency, Slave Input Mode

The maximum SPI slave input frequency is given by the following formula:

$$f_{SPCKMAX} = MIN(\frac{f_{CLKSPI} \times 2}{9}, \frac{1}{SPIn})$$

Where $SPIn$ is the MOSI setup and hold time, USPI7 + USPI8 or USPI10 + USPI11 depending on CPOL and NCPHA. f_{CLKSPI} is the maximum frequency of the CLK_SPI. Refer to the SPI chapter for a description of this clock.

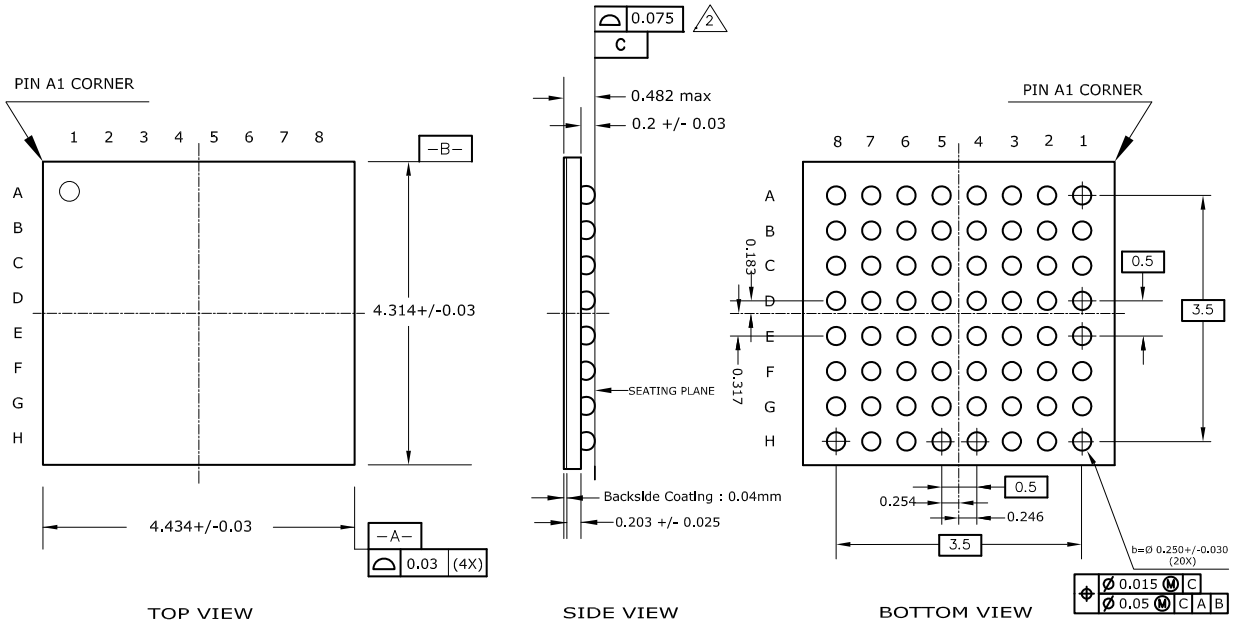
Maximum SPI Frequency, Slave Output Mode

The maximum SPI slave output frequency is given by the following formula:

$$f_{SPCKMAX} = MIN(\frac{f_{CLKSPI} \times 2}{9}, f_{PINMAX}, \frac{1}{SPIn + t_{SETUP}})$$

Where $SPIn$ is the MISO delay, USPI6 or USPI9 depending on CPOL and NCPHA. T_{SETUP} is the SPI master setup time. refer to the SPI master datasheet for T_{SETUP} . f_{CLKSPI} is the maximum frequency of the CLK_SPI. Refer to the SPI chapter for a description of this clock. f_{PINMAX} is the maximum frequency of the SPI pins. refer to the I/O Pin Characteristics section for the maximum frequency of the pins.

Figure 10-4. WLCSP64 SAM4LS4/2 Package Drawing



COMMON DIMENSIONS
(Unit of Measure = mm)

BALL	SIGNAL	X COORD	Y COORD
A1	PB04	1.746	1.683
A2	GNDANA	1.246	1.683
A3	ADVREFP	0.746	1.683
A4	VDDANA	0.246	1.683
A5	PA09	-0.254	1.683
A6	PA28	-0.754	1.683
A7	PA27	-1.254	1.683
A8	PA12	-1.754	1.683
B1	PB03	1.746	1.183
B2	XIN32	1.246	1.183
B3	XOUT32	0.746	1.183
B4	PA08	0.246	1.183
B5	PB06	-0.254	1.183
B6	PA10	-0.754	1.183
B7	PA11	-1.254	1.183
B8	PA29	-1.754	1.183
C1	VDDIN	1.746	0.683
C2	PB01	1.246	0.683
C3	PA05	0.746	0.683
C4	PA06	0.246	0.683
C5	PA07	-0.254	0.683
C6	PB07	-0.754	0.683

BALL	SIGNAL	X COORD	Y COORD
C7	PA13	-1.254	0.683
C8	GNDIO0	-1.754	0.683
D1	VDDOUT	1.746	0.183
D2	PB00	1.246	0.183
D3	PA04	0.746	0.183
D4	PB05	0.246	0.183
D5	PB12	-0.254	0.183
D6	PB08	-0.754	0.183
D7	PA14	-1.254	0.183
D8	VLCDIN	-1.754	0.183
E1	GNDIN	1.746	-0.317
E2	PA03	1.246	-0.317
E3	PB02	0.746	-0.317
E4	RESET_N	0.246	-0.317
E5	PB13	-0.254	-0.317
E6	PB09	-0.754	-0.317
E7	PA15	-1.254	-0.317
E8	PA30	-1.754	-0.317
F1	VDDCORE	1.746	-0.817
F2	TCK	1.246	-0.817
F3	PA02	0.746	-0.817
F4	PB14	0.246	-0.817

BALL	SIGNAL	X COORD	Y COORD
F5	PA22	-0.254	-0.817
F6	PB10	-0.754	-0.817
F7	PA16	-1.254	-0.817
F8	PA31	-1.754	-0.817
G1	GNDIO1	1.746	-1.317
G2	PA26	1.246	-1.317
G3	PA24	0.746	-1.317
G4	PA00	0.246	-1.317
G5	PA01	-0.254	-1.317
G6	PA19	-0.754	-1.317
G7	PA18	-1.254	-1.317
G8	PA17	-1.754	-1.317
H1	VDDIO1	1.746	-1.817
H2	PA25	1.246	-1.817
H3	PA23	0.746	-1.817
H4	PB15	0.246	-1.817
H5	PA21	-0.254	-1.817
H6	VDDIO0	-0.754	-1.817
H7	PA20	-1.254	-1.817
H8	PB11	-1.754	-1.817

Notes : 1. Dimension "b" is measured at the maximum ball diameter in a plane to the seating plane.

2. Applied to whole wafer.

Table 10-11. Device and Package Maximum Weight

14.8	mg

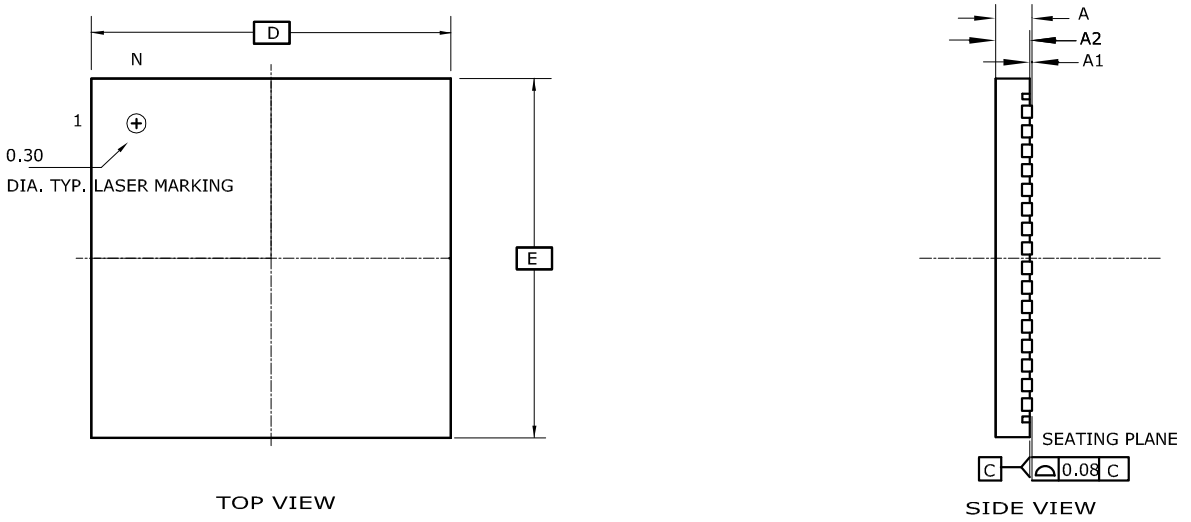
Table 10-12. Package Characteristics

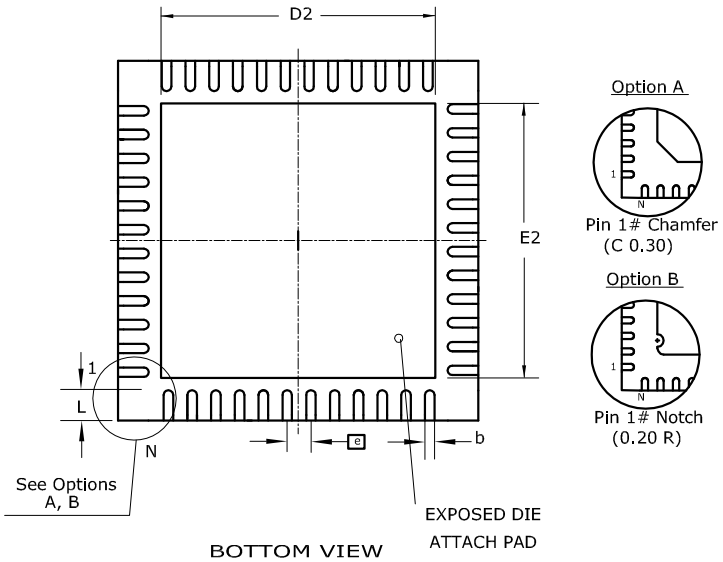
Moisture Sensitivity Level	MSL3

Table 10-13. Package Reference

JEDEC Drawing Reference	MS-026
JESD97 Classification	E1

Figure 10-11. QFN-48 Package Drawing for ATSAM4LC8 and ATSAM4LS8





COMMON DIMENSIONS

(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	0.80	0.85	0.90	
A1	0.00	0.02	0.05	
A2	0.75	-----	1.00	
D/E		7 BSC		
D2/E2	5.50	5.60	5.70	
L	0.30	0.40	0.50	
b	0.17	-----	0.30	2
e		0.50 BSC		
n		48		

Note: The exposed pad is not connected to anything internally, but should be soldered to ground to increase board level reliability.

Table 10-32. Device and Package Maximum Weight

140	mg

Table 10-33. Package Characteristics

Moisture Sensitivity Level	MSL3

Table 10-34. Package Reference

JEDEC Drawing Reference	MO-220
JESD97 Classification	E3

10.3 Soldering Profile

Table 10-35 gives the recommended soldering profile from J-STD-20.

Table 10-35. Soldering Profile

Profile Feature	Green Package
Average Ramp-up Rate (217°C to Peak)	3°C/s max
Preheat Temperature 175°C ±25°C	150-200°C
Time Maintained Above 217°C	60-150 s
Time within 5·C of Actual Peak Temperature	30 s
Peak Temperature Range	260°C
Ramp-down Rate	6°C/s max
Time 25·C to Peak Temperature	8 minutes max

A maximum of three reflow passes is allowed per component.

Table 11-5. ATSAM4LS4 Sub Serie Ordering Information

Ordering Code	Flash (Kbytes)	RAM (Kbytes)	Package	Conditioning	Package Type	Temperature Operating Range
ATSAM4LS4CA-AU-ES	256	32	TQFP100	ES	Green	N/A
ATSAM4LS4CA-AU				Tray		Industrial -40°C to 85°C
ATSAM4LS4CA-AUR				Reel		
ATSAM4LS4CA-CFU			VFBGA100	Tray		Industrial -40°C to 85°C
ATSAM4LS4CA-CFUR				Reel		
ATSAM4LS4BA-AU-ES			TQFP64	ES		N/A
ATSAM4LS4BA-AU				Tray		Industrial -40°C to 85°C
ATSAM4LS4BA-AUR				Reel		
ATSAM4LS4BA-MU-ES			QFN64	ES		N/A
ATSAM4LS4BA-MU				Tray		Industrial -40°C to 85°C
ATSAM4LS4BA-MUR				Reel		
ATSAM4LS4BA-UUR			WLCSP64	Reel		Industrial -40°C to 85°C
ATSAM4LS4AA-AU-ES			TQFP48	ES		N/A
ATSAM4LS4AA-AU				Tray		Industrial -40°C to 85°C
ATSAM4LS4AA-AUR				Reel		
ATSAM4LS4AA-MU-ES			QFN48	ES		N/A
ATSAM4LS4AA-MU				Tray		Industrial -40°C to 85°C
ATSAM4LS4AA-MUR				Reel		

Table 11-6. ATSAM4LS2 Sub Serie Ordering Information

Ordering Code	Flash (Kbytes)	RAM (Kbytes)	Package	Conditioning	Package Type	Temperature Operating Range
ATSAM4LS2CA-AU	128	32	TQFP100	Tray	Green	Industrial -40°C to 85°C
ATSAM4LS2CA-AUR				Reel		
ATSAM4LS2CA-CFU			VFBGA100	Tray		
ATSAM4LS2CA-CFUR				Reel		
ATSAM4LS2BA-AU			TQFP64	Tray		
ATSAM4LS2BA-AUR				Reel		
ATSAM4LS2BA-MU			QFN64	Tray		
ATSAM4LS2BA-MUR				Reel		
ATSAM4LS2BA-UUR			WLCSP64	Reel		
ATSAM4LS2AA-AU			TQFP48	Tray		
ATSAM4LS2AA-AUR				Reel		
ATSAM4LS2AA-MU			QFN48	Tray		
ATSAM4LS2AA-MUR				Reel		

12. Errata

12.1 ATSAM4L4 /2 Rev. B & ATSAM4L8 Rev. A

12.1.1 General

PS2 mode is not supported by Engineering Samples
PS2 mode support is supported only by parts with calibration version higher than 0.
Fix/Workaround
The calibration version can be checked by reading a 32-bit word at address 0x0080020C. The calibration version bitfield is 4-bit wide and located from bit 4 to bit 7 in this word. Any value higher than 0 ensures that the part supports the PS2 mode

12.1.2 SCIF

PLLCOUNT value larger than zero can cause PLLEN glitch
Initializing the PLLCOUNT with a value greater than zero creates a glitch on the PLLEN signal during asynchronous wake up.
Fix/Workaround
The lock-masking mechanism for the PLL should not be used.
The PLLCOUNT field of the PLL Control Register should always be written to zero.

12.1.3 WDT

WDT Control Register does not have synchronization feedback
When writing to the Timeout Prescale Select (PSEL), Time Ban Prescale Select (TBAN), Enable (EN), or WDT Mode (MODE) fieldss of the WDT Control Register (CTRL), a synchronizer is started to propagate the values to the WDT clcok domain. This synchronization takes a finite amount of time, but only the status of the synchronization of the EN bit is reflected back to the user. Writing to the synchronized fields during synchronization can lead to undefined behavior.
Fix/Workaround
-When writing to the affected fields, the user must ensure a wait corresponding to 2 clock cycles of both the WDT peripheral bus clock and the selected WDT clock source.
-When doing writes that changes the EN bit, the EN bit can be read back until it reflects the written value.

12.1.4 SPI

SPI data transfer hangs with CSR0.CSAAT==1 and MR.MODFDIS==0
When CSR0.CSAAT==1 and mode fault detection is enabled (MR.MODFDIS==0), the SPI module will not start a data transfer.
Fix/Workaround
Disable mode fault detection by writing a one to MR.MODFDIS.

SPI disable does not work in SLAVE mode
SPI disable does not work in SLAVE mode.

13.5 Rev. E – 07/13

1. Added ATSAM4L8 derivatives and WLCSP packages for ATSAM4L4/2
2. Added operating conditions details in Electrical Characteristics Chapter
3. Fixed “Supply Rise Rates and Order”
4. Added number of USART available in sub-series
5. Fixed IO line considerations for USB pins
6. Removed useless information about CPU local bus which is not implemented
7. Removed useless information about Modem support which is not implemented
8. Added information about unsupported features in Power Scaling mode 1
9. Fixed SPI timings

13.6 Rev. F– 12/13

1. Fixed table 3-6 - TDI is connected to pin G3 in WLCSP package
2. Changed table 42-48 -ADCIFE Electricals in unipolar mode : PSRR & DC supply current typical values
3. Fixed SPI timing characteristics
4. Fixed BOD33 typical step size value

13.7 Rev. G– 03/14

1. Added WLCSP64 packages for SAM4LC8 and SAM4LS8 sub-series
2. Removed unsuppported SWAP feature in LCD module
3. Added mnimal value for ADC Reference range

13.8 Rev. H– 11/16

1. Fixed AESA configuration in Overview chapter for SAM4LS sub-series

Table of Contents