

Atmel AVR32850: ATSAM4L-EK User Guide

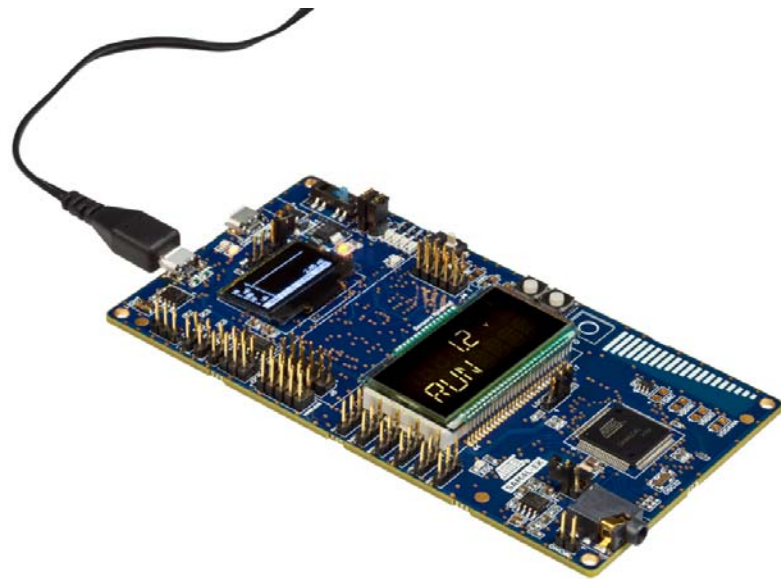
Atmel SAM4L

Features

- ATSAM4L-EK kit
- Board description
- Using the demonstration firmware

Introduction

The ATSAM4L-EK is a reference design and development system for the 32-bit ARM® Cortex™ -M4 ATSAM4LC4C microcontroller from Atmel® Corporation. The kit is equipped with a rich set of peripherals that make the ATSAM4L-EK a perfect evaluation platform. This guide shows the user how to quickly get started with this kit.



1. SAM4L-EK Description

1.1 SAM4L-EK board features

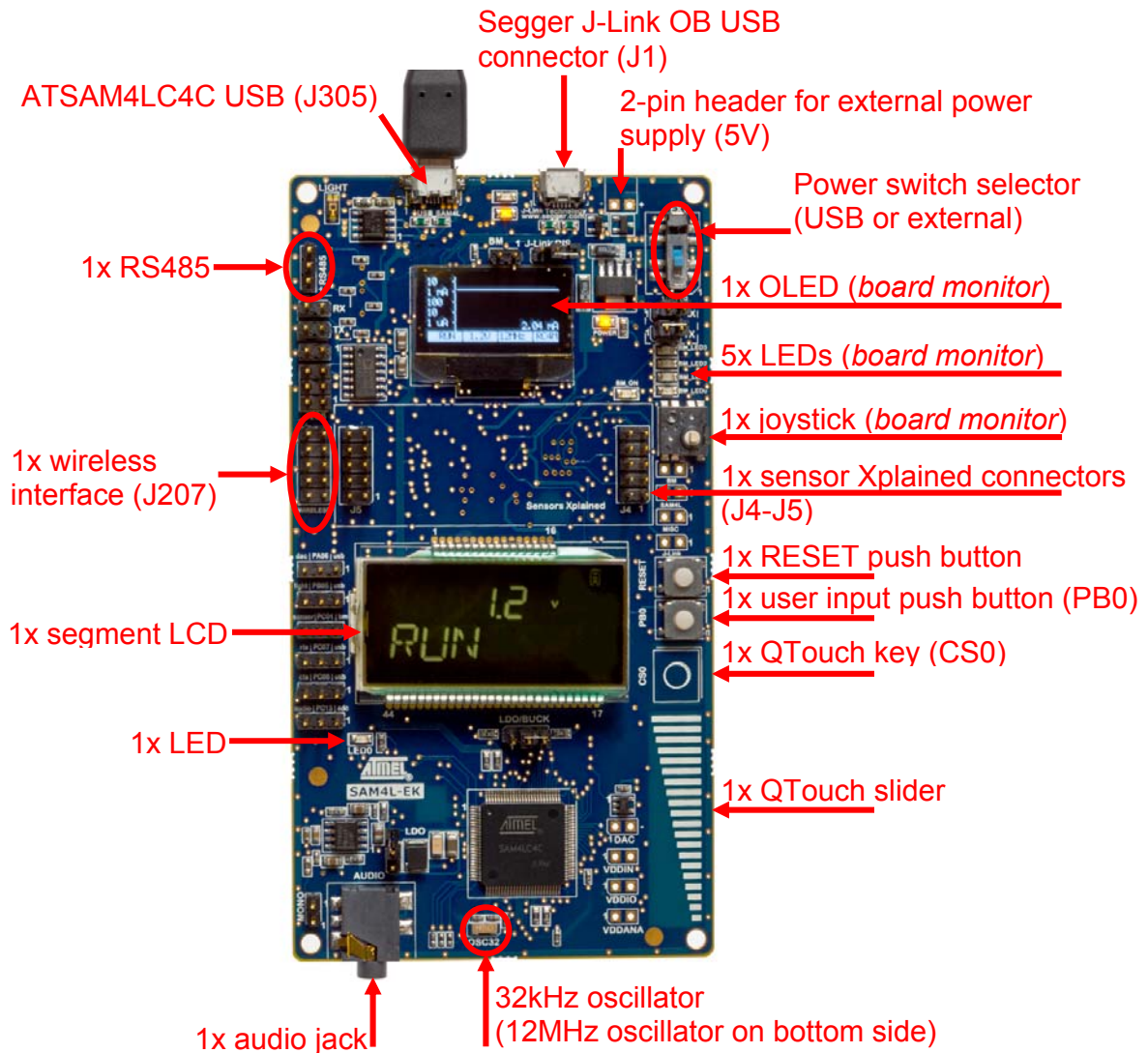
Characteristics	Specifications
MCU	ATSAM4LC4C (256KB flash, 32KB RAM), powered in 3.3V
Clock	12MHz crystal 32.768kHz crystal
Connector	1x USB Micro AB for the main CPU ATSAM4LC4C 1x USB Micro B for emdedded debugger Segger J-Link-OB 1x Audio jack connector (3.5mm) 1x Sensors Xplained board connector (2x 10-pin headers) 1x RS485 header (3-pin)
Board power supply	5V DC from ATSAM4LC4C USB 5V DC from Segger J-Link-OB USB 5V DC from a 2-pin header
Board monitor	Dedicated MCU for power measurement of the ATSAM4LC4C (VDDIN, VDDIO, VDDANA) 1x OLED Display (128x64) 5x LEDs 1x joystick 1x USART connected to the ATSAM4LC4C MCU 1x TWI connected to the ATSAM4LC4C MCU
4x40 segment LCD	Connected to the ATSAM4LC4C LCD interface
Memory	1x serial flash AT25DF641A
User interface for the ATSAM4LC4C	1x QTouch® button 1x QTouch slider 1x RESET button 1x push button (PB0) 1x LED (LED0) 1x light sensor

1.2 Board interface connection

The following connections are supported by the board:

- USB Micro B connector for the embedded debugger and serial debug COM port interface Segger J-Link OB (*USB connector J1*)
- USB Micro AB connector for the ATSAM4LC4C USB interface (*USB connector J305*)
- 1x Wireless 10-pins interface (with support of both ATEXTBT and RF2xx interfaces) (*10-pin headers J207*)
- 1x audio jack connector
- 1x RS485 connector for industrial transmitter (RS485)
- 2-pin header for external power supply (5V DC)

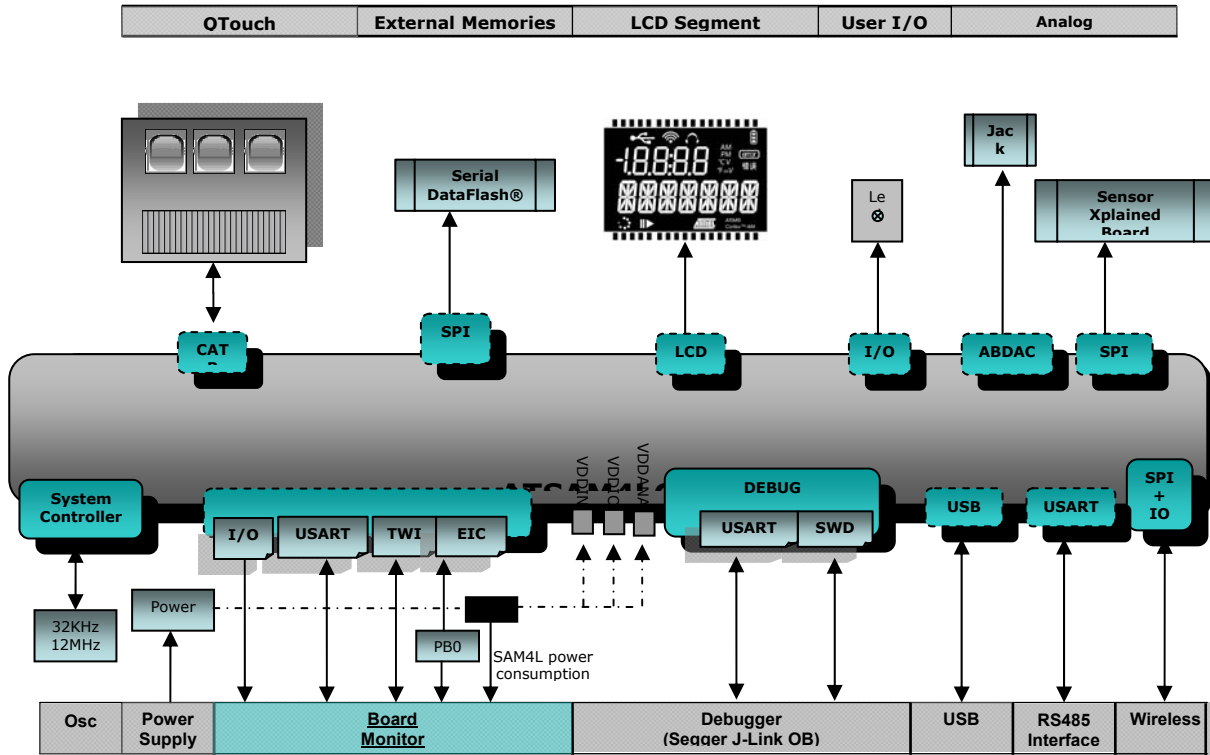
Figure 1-1. ATSAM4L-EK features overview.



2. Board description

2.1 Hardware

Figure 2-1. ATSAM4L-EK block diagram.



2.2 Powering the board

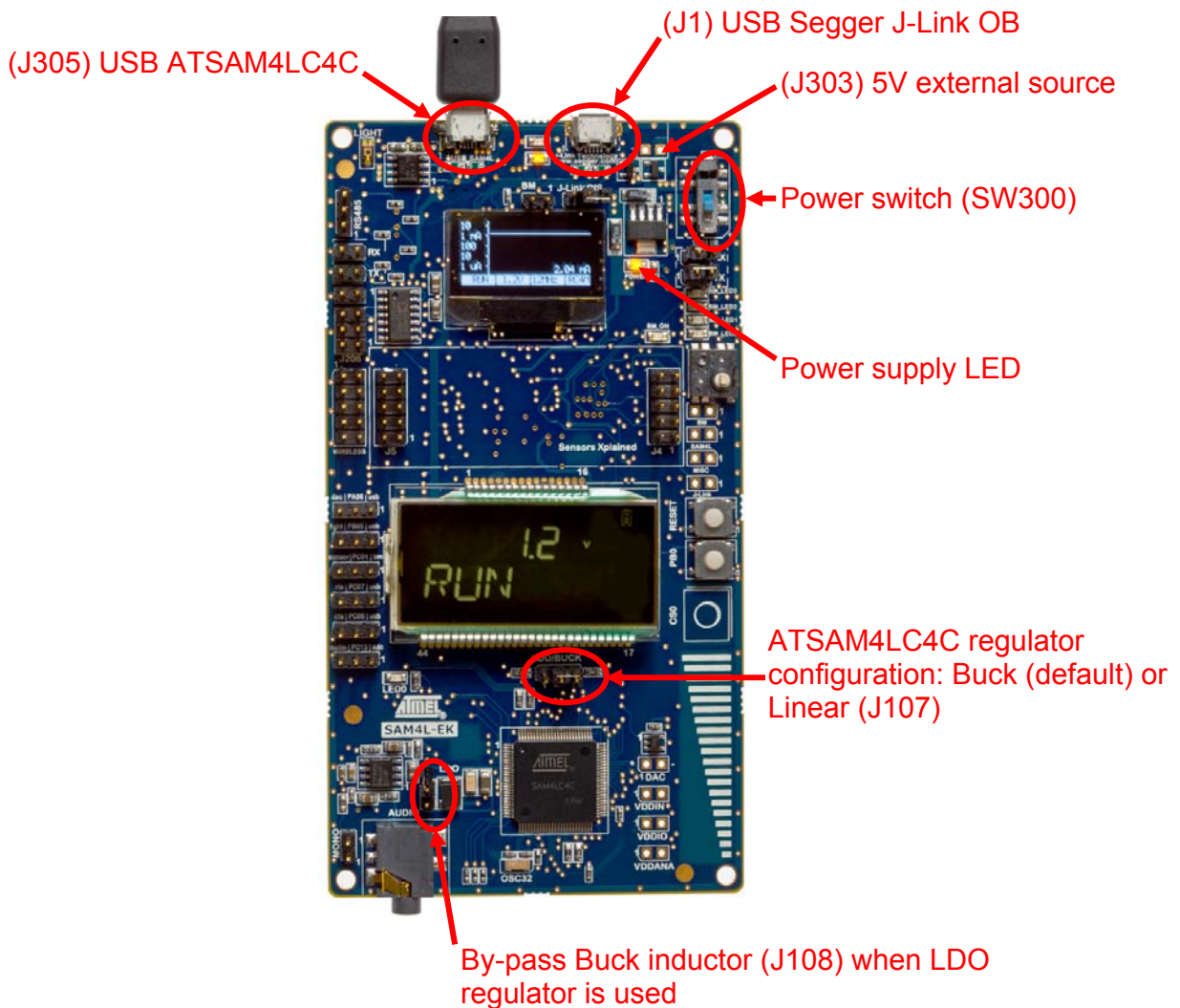
The ATSAM4L-EK offers three interfaces to power the board:

- USB embedded debugger Segger J-Link OB (J1)
- USB ATSAM4LC4C (J305)
- External 5V (DC) source connected to the J303 2-pin header

To select the USB or external power supply, a mechanical switch is used (SW300).

The default kit configuration is using ATSAM4LC4C buck regulator configuration, where ATSAM4LC4C is powered at 3.3V (VDDIN, VDDIO, VDDANA).

Figure 2-2. Power supply sources.



2.3 Buttons / LED

The ATSAM4L-EK is equipped with one user push button and one LED. The push buttons consist of momentary push button switches mounted directly to the board. When any switch is pressed it will cause a low (zero) to appear at the associated input pin.

Table 2-1. User I/O mapping.

GPIO	Feature
PC03	LED0
PC10	Push button PB0

2.4 QTouch

The ATSAM4L-EK is equipped with one QTouch button and one QTouch slider using three channels.

Table 2-2. QTouch I/O mapping.

GPIO	Feature
PB04	QTouch Button
PB02	QTouch Slider Channel 0
PA04	QTouch Slider Channel 1
PA05	QTouch Slider Channel 2
PB03	QTouch Discharge Pin

2.5 RS485

The ATSAM4L-EK is equipped with a RS485 interface. To enable the RS485 connector:

- Close J200 and J203 jumpers
- Open J600 and J601 jumpers

Table 2-3. RS485 I/O mapping.

GPIO	Feature	Jumper
PA06	USART_RTS	J100.2 to J103.3
PC08	USART_CTS	J104.2 to J104.3
PC02	USART_RXD	Close J200 and J203
PA07	USART_TXD	Open J600 and J601

2.6 Light Sensor (ADC)

The ATSAM4L-EK is equipped with one light sensor connected to one of the ADC channel. To enable it, close the jumper J101.2 to J101.3.

Table 2-4. Light sensor I/O mapping.

GPIO	Feature	Jumper
PB05	ADC Channel	Close J101.2 to J101.3

2.7 Serial Flash

The ATSAM4L-EK is equipped with one serial flash AT25DF641, connected through SPI.

Table 2-5. Serial Flash I/O mapping.

GPIO	Feature
PC04	SPI_MISO
PC05	SPI_MOSI
PC06	SPI_SCK
PC00	SPI_CS

2.8 Audio

The ATSAM4L-EK is equipped with one audio amplifier. To enable it, close J105.2 to J105.3 jumper.

Table 2-6. Audio I/O mapping.

GPIO	Feature	Jumper
PC09	Audio ABDAC Channel 0	Close J105.2 to J105.3
PC13	Audio ABDAC Channel 1	Close J105.2 to J105.3

2.9 SAM4LC4C USB

The ATSAM4L-EK is equipped with one USB connector for the SAM4LC4C USB.

Table 2-7. USB I/O mapping.

GPIO	Feature	Jumper
PA25	USB DM	
PA26	USB DP	
PB05	USB ID pin (GPIO)	Close J101.1 to J101.2
PC07	USB Over current Detected (GPIO)	Close J103.1 to J103.2
PC08	USB Over current Enabled (GPIO)	Close J104.1 to J104.2

2.10 Wireless

The ATSAM4L-EK is equipped with one 10-pin Wireless extension connector, to connect other Atmel boards like ATEXTBT or AT86RF2xxx.

Table 2-8. Wireless I/O mapping.

GPIO	Feature
PC04	SPI_MISO
PC05	SPI_MOSI
PC06	SPI_SCK
PA02	SPI_CS

2.11 Sensors Xplained connection

The ATSAM4L-EK is equipped with one Sensor Xplained extension connector. To enable it, close J102.2 to J102.3 jumpers.

Table 2-9. Sensors Xplained I/O mapping.

GPIO	Feature	Jumper
PC04	SPI_MISO	
PC05	SPI_MOSI	
PC06	SPI_SCK	
PC01	SPI_CS	Close J102.2 to J102.3

2.12 Embedded Debugger

The embedded debugger J-Link OB Module is provided by Segger, featuring:

- 1x JTAG interface to the ATSAM4LC4C
- 1x UART interface to the ATSAM4LC4C
- 1x USB interface for a PC host

The USART connection between the ATSAM4LC4C and the J-Link OB Module is configured as follow:

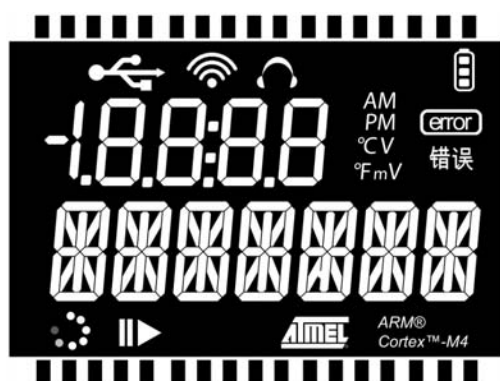
Table 2-10. Embedded Debugger I/O mapping.

GPIO	Feature
PC11	USART_RX
PC12	USART_TX

2.13 Custom Glass Display

This board is equipped with a 4x40 segment LCD, connected to the ATSAM4LC4C device through the LDCA controller.

Figure 2-3. ATSAM4LC4C on-board custom glass display.



2.14 Board Monitor

The board monitor features:

- 1x OLED Display (128x64)
- 5x LEDs
- 1x joystick
- 1x USART connected to the ATSAM4LC4C MCU
- 1x TWI connected to the ATSAM4LC4C MCU

The USART connection between ATSAM4L and the board monitor is configured as:

Table 2-11. Board Monitor I/O mapping.

GPIO	Feature	Jumper
PC02	USART_RX	Close J600.1 to J600.2
PA07	USART_TX	Close J601.1 to J601.2

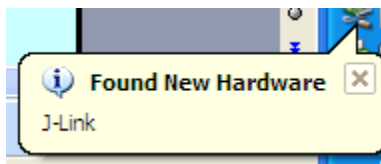
3. Using the preloaded firmware

The SAM4L-EK firmware demo features:

- Low power architecture:
 - Display ATSAM4LC4C power consumption on the board monitor OLED display
 - Use of the sleep mode
 - Use of the power scaling mode (PS0 or PS1)
- Segment LCD controller:
 - Text display text and text scrolling
 - Hardware automatic animations
- Hardware touch (QTouch) support:
 - One capacitive button and one slider

3.1 Power-on the board

- Power the board through the USB connector J1. The board starts the embedded debugger J-Link-OB USB enumerations

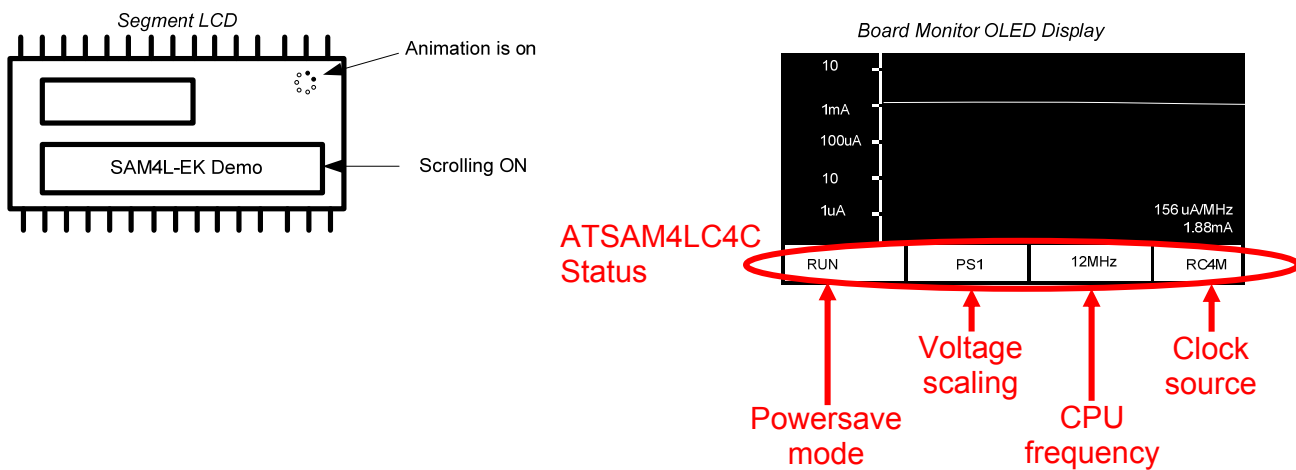


- If you do not have installer Atmel Studio 6, install the Segger J-Link OB driver available here: <http://www.segger.com/jlink-software.html>

3.2 Running the Demonstration Firmware

1.1.1 Mode 1: “startup, RUN mode” (after power-on reset)

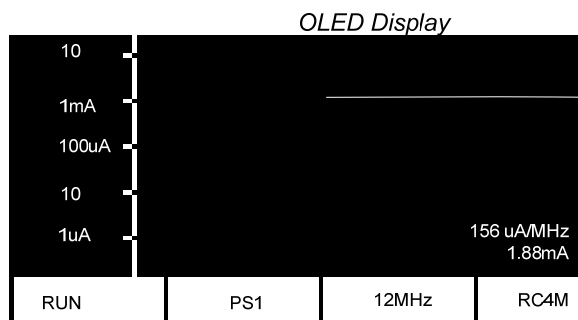
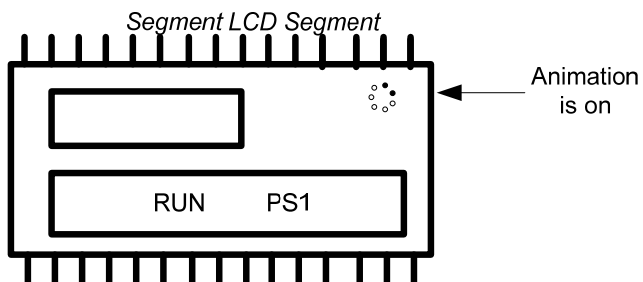
- ATSAM4LC4C is in active mode (12MHz on RC4M) with segment LCD and QTouch enabled. The ATSAM4LC4C starts with power scaling enabled (PS1)
- ATSAM4LC4C displays on the segment LCD:
 - A scrolling text message “SAM4L-EK Demo”
 - Scrolling animation to show SAM4L is in active mode
- ATSAM4LC4C sends through the USART its internal status to the board monitor (power save mode, voltage scaling, CPU frequency and clock source)
- The board monitor displays on the OLED display the power consumption, power save mode, power scaling mode, CPU frequency and clock source of ATSAM4LC4C



- After 5 seconds, the demo moves to mode 2.

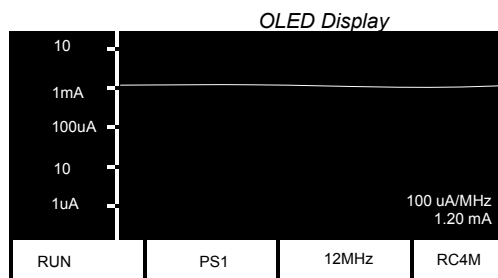
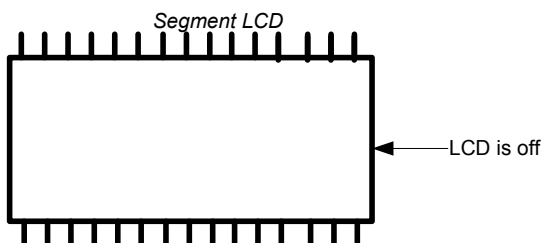
1.1.2 Mode 2 “RUN mode with all features”

- The ATSAM4LC4C is in RUN mode. ATSAM4LC4C displays the voltage scaling mode (PS1 or PS0) on the segment LCD and its active mode (RUN)
- Using QTouch capacitive button CS0 will change voltage scaling configuration (PS1 or PS0)
- The ATSAM4LC4C sends its internal status through USART to the board monitor (power save mode, voltage scaling, CPU frequency and clock source) each time it changes
- Using PB0 button will disable QTouch and segment LCD, the demo moves to mode 3



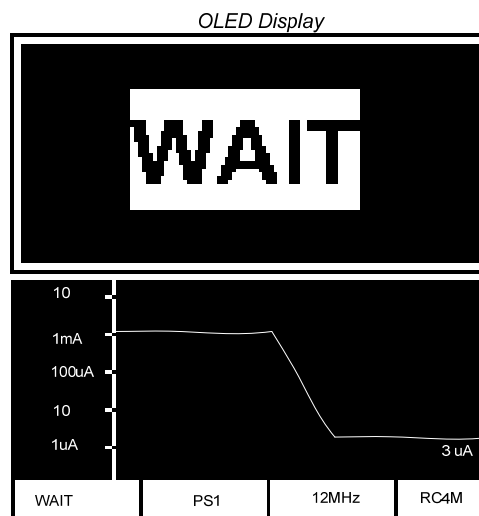
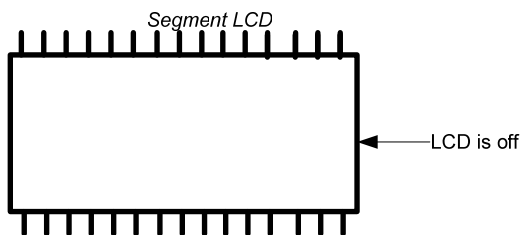
1.1.3 Mode 3 “RUN mode with no features”

- The ATSAM4LC4C is in active mode (12MHz on RC4M) with power scaling mode PS1. QTouch and LCD are disabled
- The ATSAM4LC4C is executing the Fibonacci algorithm
- Using PB0 button will enter the WAIT sleep mode and move the demo to mode 4



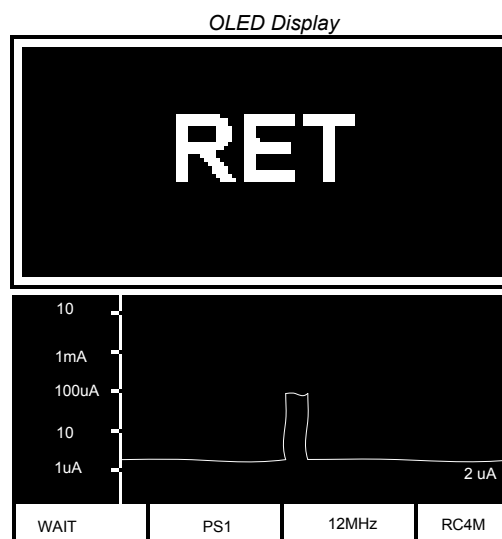
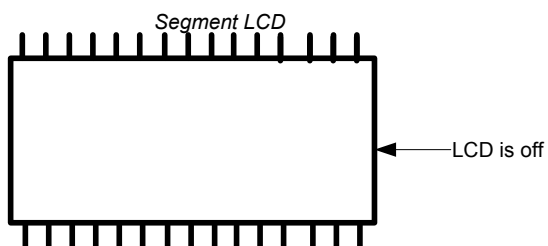
1.1.4 Mode 4 “WAIT mode”

- The ATSAM4LC4C is in WAIT mode with power scaling mode PS1
- The ATSAM4LC4C sends its new internal status through USART to the board monitor (power save mode, voltage scaling, CPU frequency and clock source). The Board monitors displays a splash screen indicating the new sleep mode (WAIT here)
- Using PB0 button will enter the RETENTION sleep mode and move the demo to mode 5



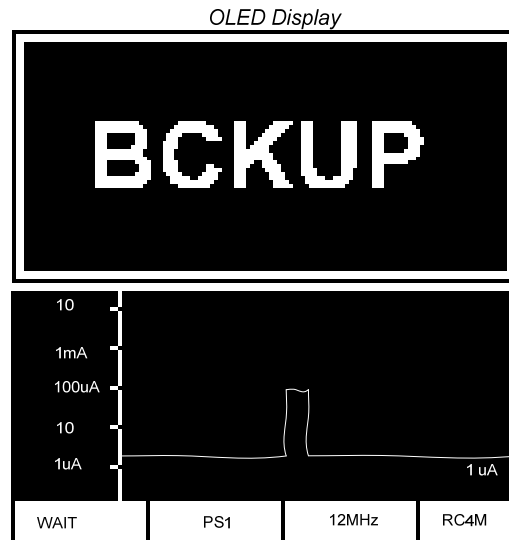
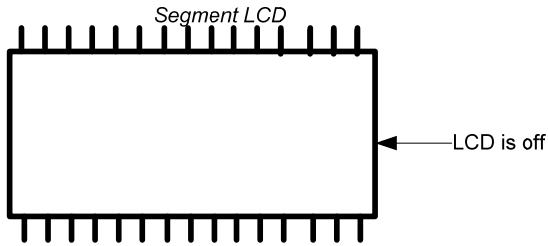
1.1.5 Mode 5 “RETENTION mode”

- The ATSAM4LC4C in RET mode with power scaling configuration PS1
- The ATSAM4LC4C sends its new internal status through USART to the board monitor (power save mode, voltage scaling, CPU frequency and clock source)
- Using PB0 button will enter the BACK-UP sleep mode and move the demo to mode 6



1.1.6 Mode 6 “BACKUP mode”

- The ATSAM4LC4C is in backup mode with power scaling mode PS1
- The ATSAM4LC4C sends its new internal status through USART to the board monitor (power save mode, voltage scaling, CPU frequency and clock source)
- Using PB0 button will go back to mode 1 in RUN mode



4. References and further information

4.1 Device datasheet

The device datasheet contains block diagrams of the peripherals and details about implementing firmware for the device. It also contains the electrical specifications and expected characteristics of the device.

The datasheet is available on <http://www.atmel.com/> in the Datasheets section of the product page.

4.2 Detailed hardware references (and associated errata)

More detailed hardware information for this kit can be found in the file ATSAM4L-EK_Hardware-References.zip available on the Atmel web page dedicated to this kit: www.atmel.com/

The ATSAM4L family of devices is specified in the SAM4L Series datasheet. Always use this document as a reference throughout the development life cycle of an application destined to run on a SAM4L device.

4.3 Tools

To be able to develop applications for 32-bit ARM devices and build binaries for ARM targets and program a 32-bit ARM device, Atmel and its partners provide several tools supported on multiple host targets.

- Atmel Studio 6 is the integrated development environment (IDE) for developing and debugging Atmel ARM Cortex-M and Atmel AVR[®] microcontroller (MCU) based applications. The Atmel Studio 6 IDE gives you a seamless and easy-to-use environment to write, build and debug your applications written in C/C++ or assembly code.
http://www.atmel.com/microsite/atmel_studio6/default.aspx
- IAR Embedded Workbench[®]: IAR[™] Embedded Workbench with its optimizing C and C++ compiler provides full support and generates very compact and efficient code for ARM device.
<http://www.iar.com/en/Products/IAR-Embedded-Workbench/ARM/>

5. Revision history

Doc. Rev.	Date	Comments
42026A	09/2012	Initial document release

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