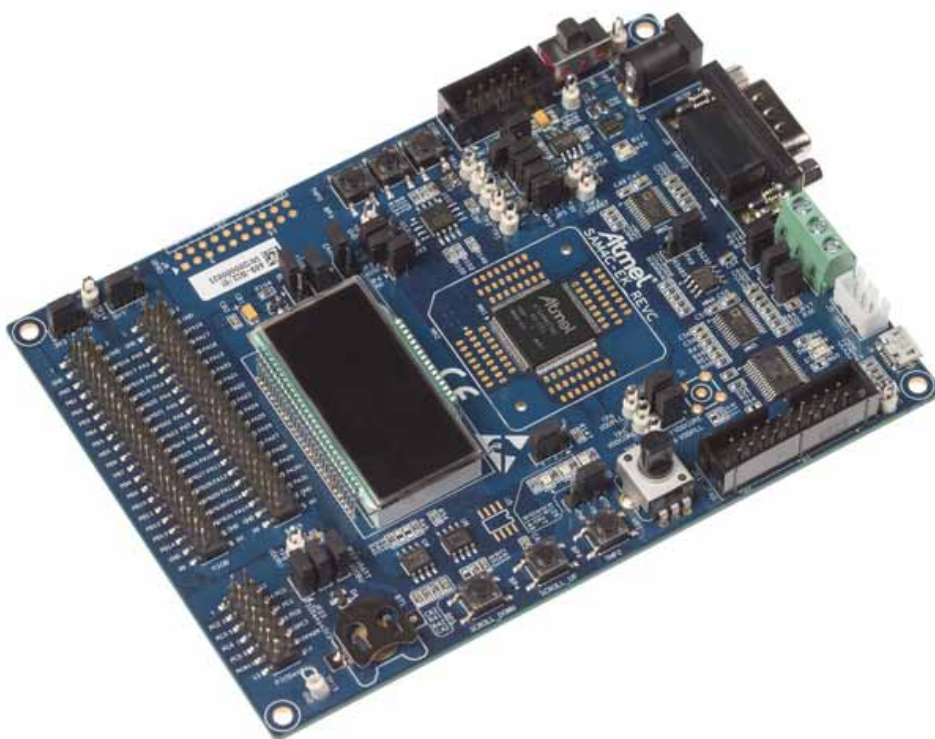




## Introduction

The ATSAM4C-EK is an evaluation kit for the 32-bit ARM® Cortex®-M4 SAM4C microcontroller from Atmel® Corporation.

The ATSAM4C-EK can be used with the following SAM4C series microcontrollers:

- SAM4C16C
- SAM4C8C

This document describes the kit contents and architecture, and provides guidelines on how to use the kit.

## Contents

---

- Board
  - One SAM4C Evaluation Kit Board (EK)
- Power Supply
  - One universal input AC/DC power supply with US, Europe and UK plug adapters
  - One 3V Lithium Battery type CR1225
- Cables
  - One serial RS232 cable
  - One micro A/B-type USB cable
- Welcome letter

## Reference documents

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- Atmel SAM4C Series Datasheet  
([http://www.atmel.com/images/atmel\\_11102\\_smartenergy\\_sam4c16-c8\\_datasheet.pdf](http://www.atmel.com/images/atmel_11102_smartenergy_sam4c16-c8_datasheet.pdf))

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# 1. Evaluation Kit Specifications

Table 1-1. Evaluation Kit Specifications

| Characteristic            | Specifications                                                                            |
|---------------------------|-------------------------------------------------------------------------------------------|
| PCB                       | 6 layers, 140 mm x 100 mm                                                                 |
| PCB Material              | Standard FR4 in 1.6 mm thickness                                                          |
| Clock Speed               | Crystal 8 MHz<br>Piezoelectric Ceramic Resonator 8.192 MHz<br>32.768 kHz external clock   |
| Ports                     | RS232<br>RS485<br>USB                                                                     |
| Memory                    | TWI EEPROM<br>Serial Data Flash                                                           |
| Board Supply Voltage      | 5V DC from main connector power supply<br>5V DC from USB<br>3V Battery for Backup and RTC |
| ROHS                      | Compliant                                                                                 |
| CE and FCC Part 15 status | Compliant                                                                                 |

## 1.1 Electrostatic Warning

**Warning:** ESD-Sensitive Electronic Equipment!



The evaluation kit is shipped in a protective anti-static package. The board system must not be subjected to high electrostatic discharge.

We strongly recommend using a grounding strap or similar ESD protective device when handling the board in hostile ESD environments (offices with synthetic carpet, for example). Avoid touching the component pins or any other metallic element on the board.

## 1.2 Battery

The ATSAM4C-EK ships with a 3V coin battery. This battery is not required for the board to start up as long as Jumper JP8 is closed.

The coin battery is provided for user convenience in case the user would like to exercise the date and time backup function of the SAM4C devices when the board is switched off.

## 1.3 Recovery Procedure

The demo software is stored in internal Flash memory. If the content of the internal Flash has been erased, it can be reprogrammed recovered to the state as it was when shipped by Atmel using Atmel SAM-BA<sup>®</sup> In-system Programmer available on the Atmel website ([www.atmel.com/tools/atmelsam-bain-systemprogrammer.aspx](http://www.atmel.com/tools/atmelsam-bain-systemprogrammer.aspx)). The binary file of the demo software is available on the Atmel website in the ATSAM4C-EK Evaluation Kit Section (<http://www.atmel.com/tools/SAM4C-EK.aspx>).

## **2. Power Up**

### **2.1 Power up the Board**

Unpack the board taking care to avoid electrostatic discharge. Unpack the power supply, select the right power plug adapter corresponding to that of your country, and insert it in the power supply.

Connect the power supply DC connector to the board and plug the power supply to an AC power plug. The board LCD should light up and display a graphic demo program.

### **2.2 Sample Code and Technical Support**

After boot up, designers can run sample code or their own application, on the development kit. Users can download sample code and get technical support from the Atmel website. The ATSAM4C-EK is supported by the Atmel Software Framework (ASF) (<http://www.atmel.com/tools/AVRSOFTWAREFRAMEWORK.aspx>).

## 3. Evaluation Kit Hardware

### 3.1 Overview

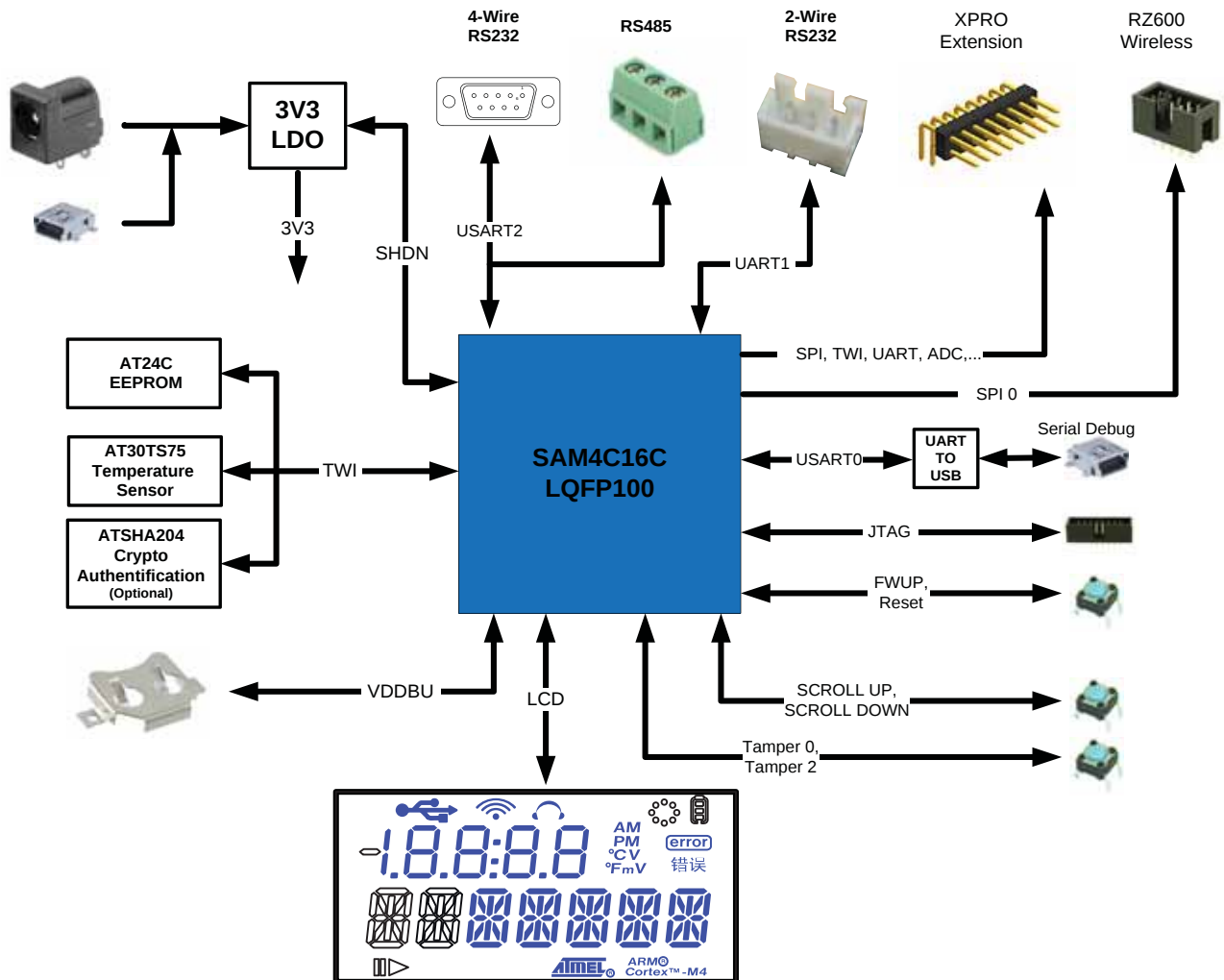
This section introduces the Atmel SAM4C Evaluation Kit design. It introduces system-level concepts, such as power distribution, memory, and interface assignments.

The Atmel SAM4C16C and SAM4C8C microcontrollers are system-on-chip solutions for smart energy applications, built around two high-performance 32-bit ARM Cortex-M4 RISC processors. These devices operate at a maximum speed of 120 MHz and feature up to 1 Mbyte of embedded Flash, 152 Kbytes of SRAM and on-chip cache for each core.

The dual ARM Cortex-M4 architecture allows for integration of application layer, communications layers and security functions in a single device, with the ability to extend program and data memory via a 16-bit external bus interface. The peripheral set includes an advanced cryptographic engine, two anti-tamper pins with time-stamping function, floating point unit (FPU), five USARTs, two UARTs, two TWIs, up to seven SPIs, as well as a PWM timer, two 3-channel general-purpose 16-bit timers, temperature compensable low-power RTC running on backup area down to 0.5  $\mu$ A, and a 50 x 6 segmented LCD controller.

The SAM4C series is a scalable platform providing, alongside Atmel's industry leading SAM4 standard microcontrollers, unprecedented cost structure, performance and flexibility to smart meter designers worldwide.

Figure 3-1. ATSAM4C-EK Board Architecture



## 3.2 Equipment List

### 3.2.1 Features List

The CM board components are listed as follows:

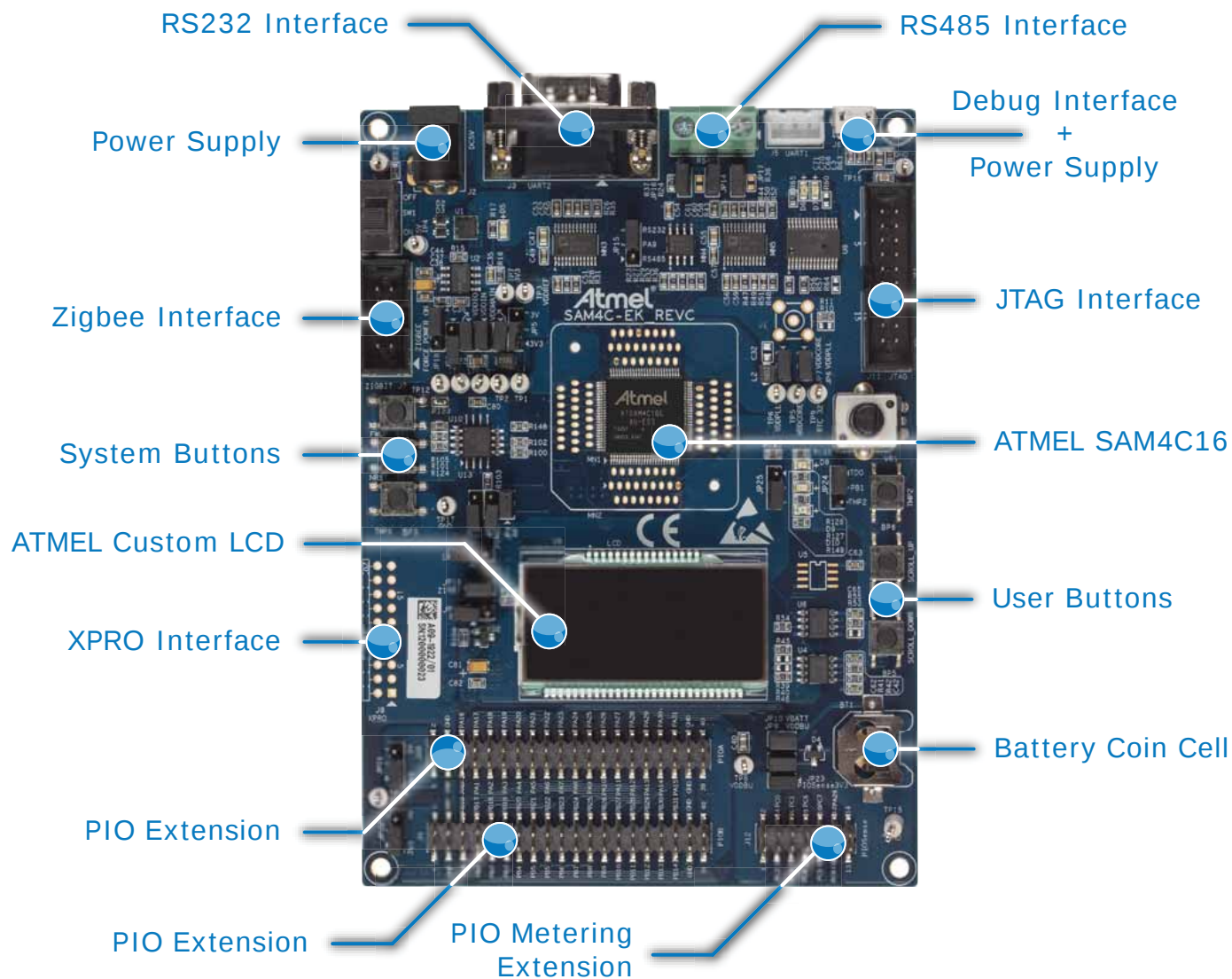
- CPU SAM4C with its embedded resources
  - 8 MHz and 32.768 kHz Quartz Crystal, SMB connector for external source
  - Main regulator 5V/3.3V with red LED indicator
  - 1 Lithium Coin Cell Battery
- Main board with:
  - 1 custom segmented LCD
  - 1 shared interface RS232 / RS485
  - 1 Serial data Flash SPI
  - 1 Two-Wire Serial EEPROM
  - 1 Two-Wire Temperature Sensor
  - 1 Two-Wire CryptoAuthentication™ Memory (*optional*)
- Debug solution:
  - 2 peripheral Input/Output extension connectors HE10 (PIO A, B)
  - 1 peripheral Input/Output extension connector HE10 (PIO Sense)
  - 1 JTAG/ICE interface
  - 1 UART/USB bridge Device Communication interface
- Analog
  - 1 Analog 3V reference
  - 1 Potentiometer connected on ADC input
- Buttons
  - 4 system push buttons: Reset, Force Wake-Up, Tamper 0, Tamper 2
  - 2 user push buttons: Scroll Up and Scroll Down
- LEDs
  - 1 amber LED
  - 1 blue LED
  - 1 green LED

### 3.2.2 Interface Connection

The ATSAM4C-EK board includes hardware interfaces such as:

- 1 RS232/RS485 (USART0 RX, TX, RTS, CTS) connected to:
  - 9-way male D-type RS232 connector
  - 3-pin connector
- 1 JTAG/SWD 20-pin IDC connector
- 1 USB 5-pin type Micro AB connector (bridge UART)
- 3 PIOs connected to HE10 connectors

Figure 3-2. Annotated ATSAM4C-EK Board Layout





### 3.3.3 Reset and Wake-Up Circuitry

The reset sources for the EK board are:

- Power on reset
- Push button reset (refer to [Section 3.11.2 “Push Buttons”](#))
- JTAG reset from an in-circuit emulator

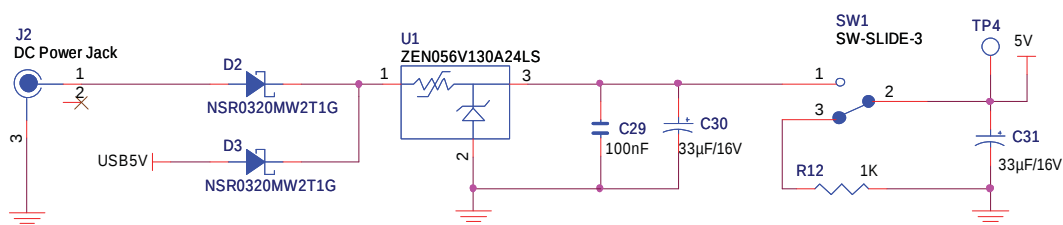
### 3.3.4 Power Supplies

The ATSAM4C-EK board evaluation and development platform embeds all the necessary power rails required for the SAM4C processor and peripherals.

The ATSAM4C-EK board can be supplied by either a 5V DC block through input J2 (see [Figure 3-5](#)) or a USB connection via J6 (refer to [“DBGU/USB Bridge Schematic” on page 16](#)).

A manual power supply selection switch (SW1) is provided to power on/off the main power line.

**Figure 3-5. Power Supply Schematic**



### 3.3.5 Power Rails

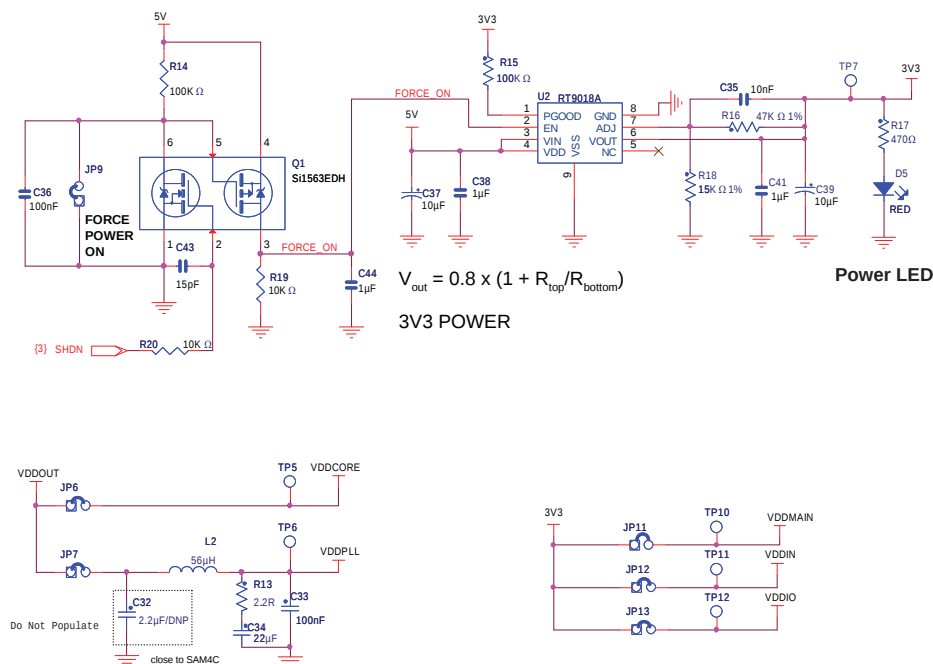
The SAM4C supports 1.6V–3.6V single supply mode (VDDIN). An internal regulator input is connected to the source and its output feeds VDDCORE (VDDOUT connected to VDDCORE).

When the 3.3V supply is present, the Power LED D5 is lit. Test points TP2 to TP5 are used to perform testing.

**Table 3-2. Power Supply Voltage Ranges**

| Power Supply | Ranges      | Comments                                                                                                                                                    |
|--------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VDDIO        | 1.6V–3.6V   | Flash Memory Charge Pumps Supply for Erase and Program Operations, and Read operation<br>Input Output buffers Supply                                        |
| VDDBU        | 1.6V–3.6V   | Backup Area power supply. VDDBU is automatically disconnected when VDDIO is present (> 1.9V)                                                                |
| VDDIN        | 1.6V–3.6V   | 1.6V min. if LCD and ADC not used, 2.5V otherwise                                                                                                           |
| VDDLCD       | 2.5V–3.6V   | LCD Voltage Regulator Output<br>External LCD power supply input (LCD regulator not used)<br>VDDIO/VDDIN need to be supplied when the LCD Controller is used |
| VDDOUT       | 1.2V Output | 120 mA Output Current                                                                                                                                       |
| VDDPLL       | 1.08V–1.32V | –                                                                                                                                                           |
| VDDCORE      | 1.08V–1.32V | –                                                                                                                                                           |

**Figure 3-6. Power Rails Schematic**

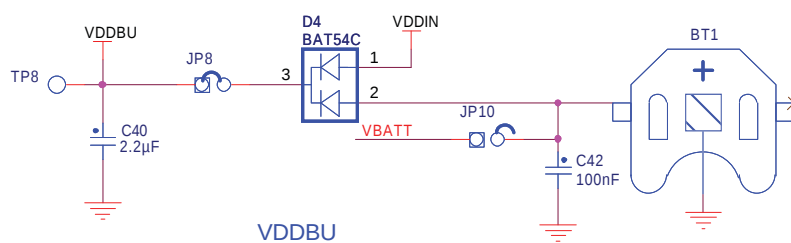


Note: Test points and jumpers are provided for easy access to each of the regulated power lines and measure the current on each line.

### 3.3.6 Battery Backup

The VDDBU pin is powered from the 3.3V rail or from a backup battery BT1 via a dual Schottky diode D4. Test points TP8 and jumper JP8/JP10 are used to perform voltage and current measurements.

**Figure 3-7. Backup Battery Schematic**



## 3.4 Embedded Memories

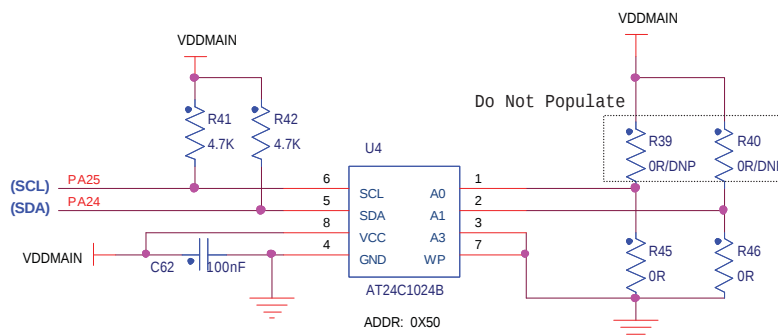
- I2C for data storage in EEPROM (Atmel AT24C1024B)
- SPI Serial Flash AT45 or AT25F

### 3.4.1 TWI EEPROM

The AT24C1024B provides 1,048,576 bits of serial electrically erasable and programmable read-only memory (EEPROM) organized as 131,072 words of 8 bits each.

Device slave address byte: 0x50.

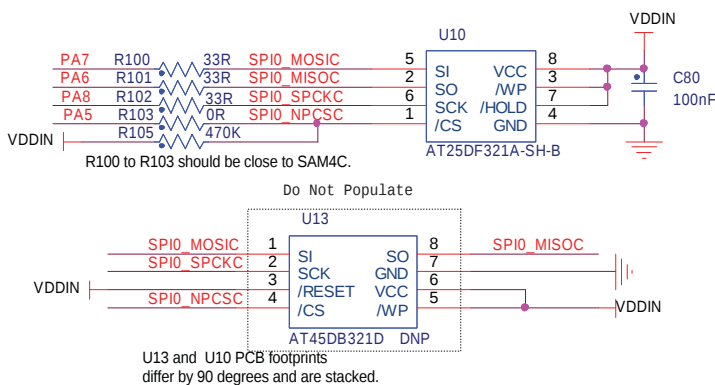
Figure 3-8. TWI EEPROM Schematic



### 3.4.2 SPI Serial Flash

The ATSAM4C-EK embeds one serial Flash device AT25DFxx or AT45DBxx connected through the SPI. (The AT25DF321A is mounted by default.)

Figure 3-9. SPI Serial Flash Schematic



### 3.4.3 Compatible Devices

Table 3-3. Compatible Devices

| Adesto AT45DB Series Devices | Adesto AT25DF Series Devices |
|------------------------------|------------------------------|
| AT45DB64D2-CNU               | AT25DF641A-SH                |
| AT45DB321D-MWU               | AT25DF321A-SH                |
| AT45DB131D-SS                | AT25DF161-SH                 |
| AT45DB081D-SS                | AT25DF081-SSH                |
| AT45DB041D-SS                | AT25DF021-SH                 |
| AT45DB021D-SS                | —                            |
| AT45DB011D-SS                | —                            |



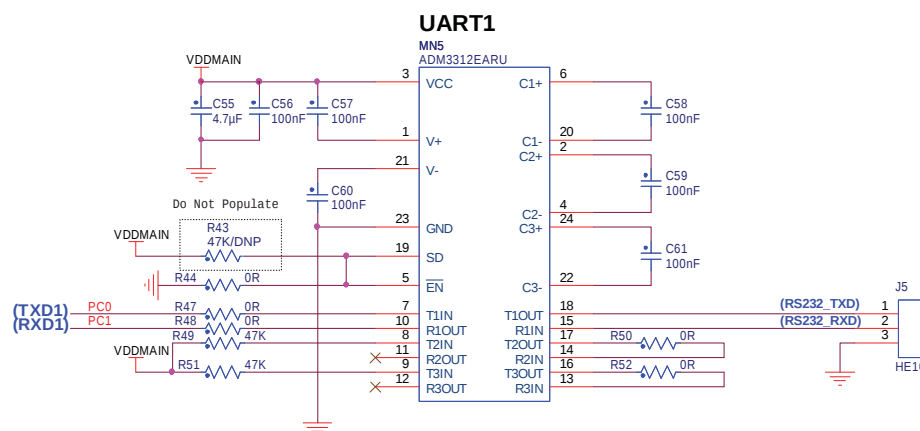
### 3.5.3 Serial Port UART1 RS232

The UART1 is buffered with an Analog Devices ADM3312E RS-232 transceiver and is connected to the HE10 PIO port C. A classic implementation RS232 transceiver selection should include double source capability.

### Features:

- One RS232 transceiver connected to RXD (PC1) and TXD (PC0) only
- One HE10 male connector (PIO port C)
- Required resistors and capacitors

**Figure 3-12. Serial Port Schematic**



### 3.6 Debug Interfaces

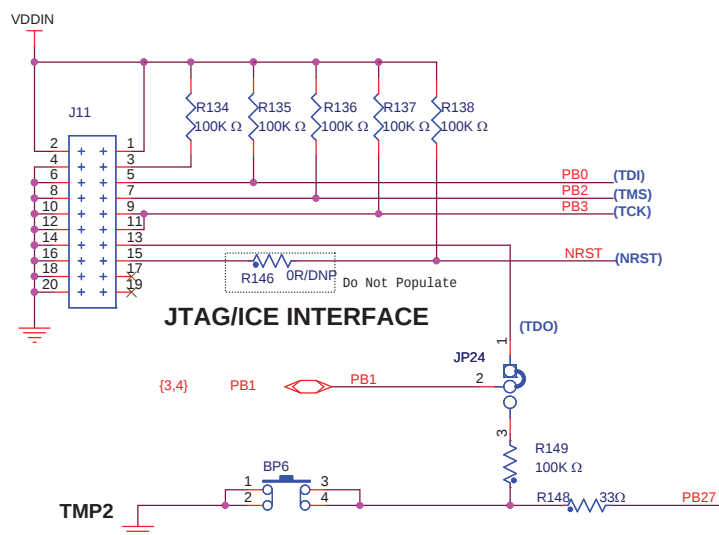
### 3.6.1 JTAG/ICE

The ATSAM4C-EK includes a JTAG interface port to provide debug level access to the system-on-chip. The JTAG port is a 20-pin, dual-row, 0.1-inch male connector. This port provides the required interface for in-circuit emulators such as the ARM Multi-ICE<sup>®</sup> and Atmel SAM-ICE<sup>™</sup>.

### Features:

- One HE10 20-pin male connector
- Required resistors

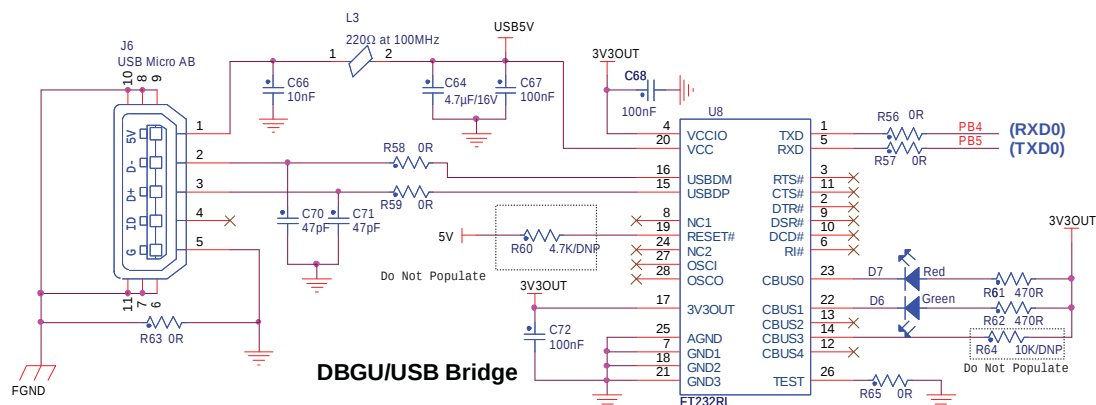
**Figure 3-13. JTAG/ICE Interface Schematic**



### 3.6.2 UART/USB Bridge Interface

The UART is connected to an interface USB through an FTDI FT232R (TTL to USB converter) device. RX and TX DBGU only are connected to the USB connector Micro AB.

Figure 3-14. DBGU/USB Bridge Schematic



## 3.7 Extend Interfaces

The SAM4C-EK embeds two connectors to interface Atmel IEEE 802.15.4-compliant wireless transceivers for ZigBee®-based applications.

Features:

- Atmel RZ600 module
- Atmel REB233-XPRO module

### 3.7.1 RZ600 Interface

- The RZ600 interface connects with Atmel modules used for ZigBee communication platforms that are equipped with a 10-pin HE10 male connector.

Figure 3-15. RZ600 Interface Schematic

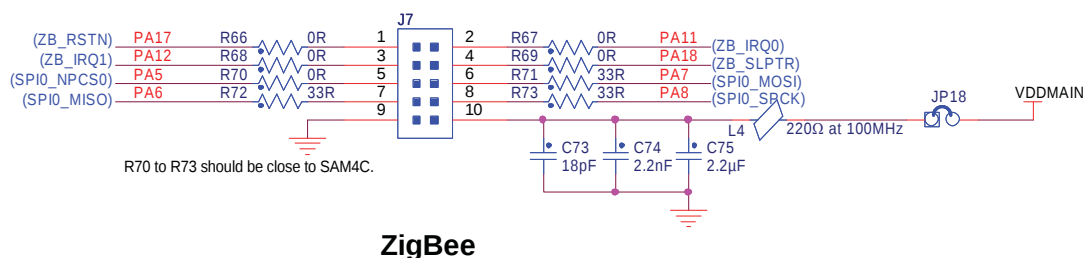


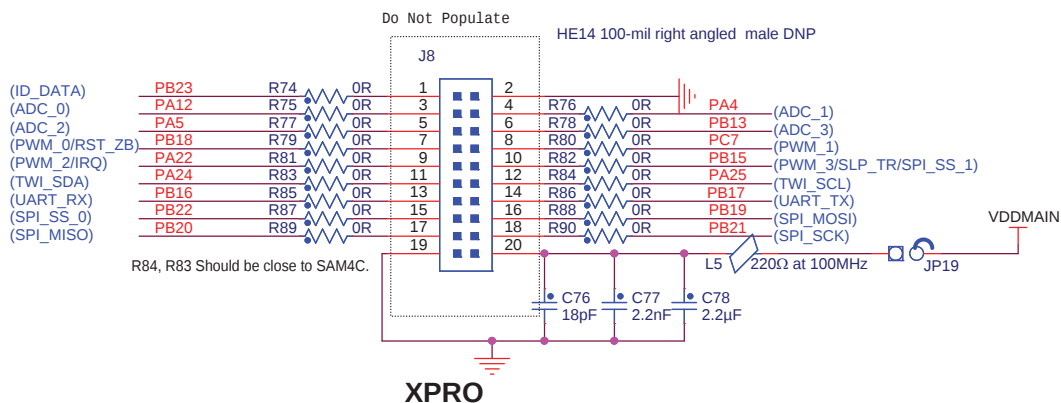
Table 3-4. RZ600 HE10 Pin Functions

| Function          | Pin | Pin | Function     |
|-------------------|-----|-----|--------------|
| Reset             | 1   | 2   | IRQ0         |
| Interrupt Request | 3   | 4   | SLP_TR       |
| SPI Chip Select   | 5   | 6   | SPI MOSI     |
| SPI MISO          | 7   | 8   | SPI CLK      |
| Power Ground      | 9   | 10  | Power Supply |

### 3.7.2 REB233-XPRO Interface

The XPRO interface connects with new Atmel modules used for XPRO platforms that are equipped with a 20-pin HE14 male connector.

**Figure 3-16. XPRO Interface Schematic**



**Table 3-5. XPRO HE10 Pin Functions**

| Function                                    | Pin | Pin | Function                        |
|---------------------------------------------|-----|-----|---------------------------------|
| Module Identity                             | 1   | 2   | Ground                          |
| ADC Input                                   | 3   | 4   | ADC Input                       |
| ADC Input                                   | 5   | 6   | ADC Input                       |
| ZigBit™ Reset                               | 7   | 8   | PWM Output                      |
| IRQ Interrupt from ZigBit to Host Processor | 9   | 10  | SLP_TR wake-up signal to ZigBit |
| Two-Wire Data Line                          | 11  | 12  | Two-Wire Clock Line             |
| UART RX Line                                | 13  | 14  | UART TX Line                    |
| SPI Chip Select                             | 15  | 16  | SPI MOSI                        |
| SPI MISO                                    | 17  | 18  | SPI Clock                       |
| Power Ground                                | 19  | 20  | Power Supply                    |

### 3.8 LCD Display

The ATSAM4C-EK board is equipped with one LCD segment interfaced with the SAM4C device through the LCD controller. Note that only certain segments (highlighted in blue in Figure 3-17 on page 18) are usable without using U11 and U12 analog switches or unpopulated 0 ohm resistors.

Features:

- LCD segment YMCC42364AAANDCL (Anshan Yes Optoelectronics Display Co., Ltd.)

Figure 3-17. LCD Display Schematic

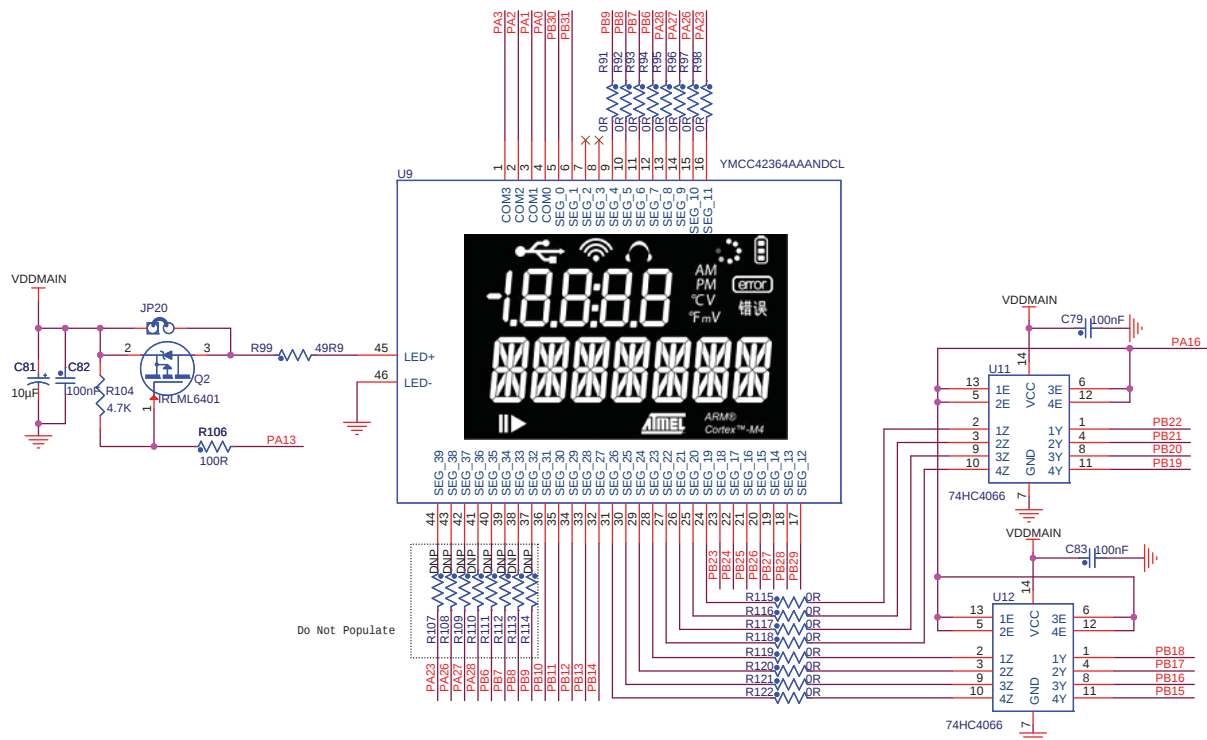
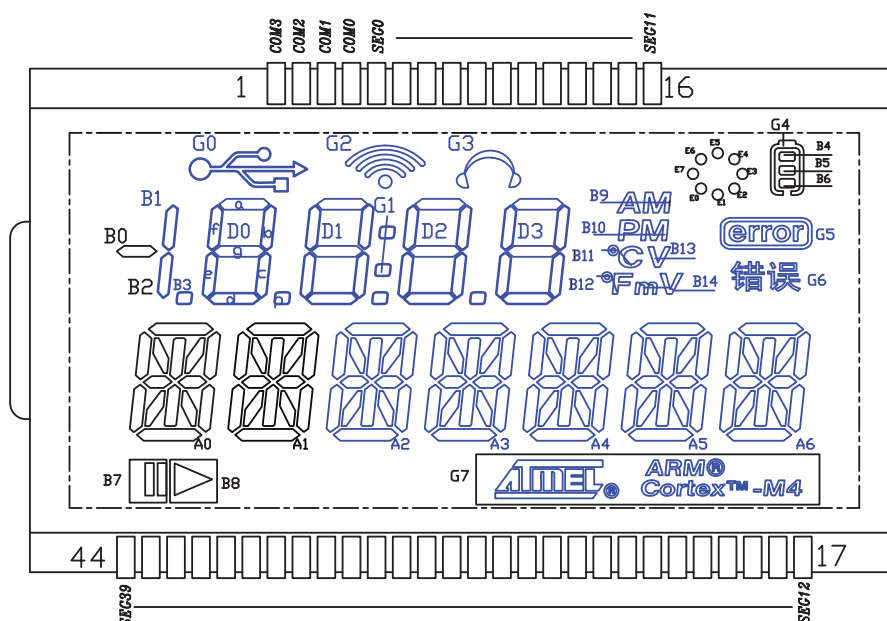


Figure 3-18. LCD Layout



**Table 3-6. LCD pinout vs Segment**

| Pin | COM0 | COM1 | COM2 | COM3 |
|-----|------|------|------|------|
| 1   | –    | –    | –    | COM3 |
| 2   | –    | –    | COM2 | –    |
| 3   | –    | COM1 | –    | –    |
| 4   | COM0 | –    | –    | –    |
| 5   | G1   | G0   | G2   | G3   |
| 6   | G4   | G5   | G6   | G7   |
| 7   | E0   | E2   | E4   | E6   |
| 8   | E1   | E3   | E5   | E7   |
| 9   | D3-a | D3-b | D3-c | B9   |
| 10  | D3-f | D3-g | D3-e | D3-d |
| 11  | D2-a | D2-b | D2-c | D2-p |
| 12  | D2-f | D2-g | D2-e | D2-d |
| 13  | D1-a | D1-b | D1-c | D1-p |
| 14  | D1-f | D1-g | D1-e | D1-d |
| 15  | D0-a | D0-b | D0-c | D0-p |
| 16  | D0-f | D0-g | D0-e | D0-d |
| 17  | A6-h | A6-i | A6-k | A6-n |
| 18  | B14  | A6-f | A6-e | A6-d |
| 19  | A6-a | A6-b | A6-c | B13  |
| 20  | A6-g | A6-j | A6-L | A6-m |
| 21  | A5-h | A5-i | A5-k | A5-n |
| 22  | B5   | A5-f | A5-e | A5-d |

| Pin | COM0 | COM1 | COM2 | COM3 |
|-----|------|------|------|------|
| 23  | A5-a | A5-b | A5-c | B12  |
| 24  | A5-g | A5-j | A5-L | A5-m |
| 25  | A4-h | A4-i | A4-k | A4-n |
| 26  | B6   | A4-f | A5-e | A5-d |
| 27  | A4-a | A4-b | A4-c | B11  |
| 28  | A4-g | A4-j | A4-L | A4-m |
| 29  | A3-h | A3-i | A3-k | A3-n |
| 30  | B4   | A3-f | A3-e | A3-d |
| 31  | A3-a | A3-b | A3-c | B10  |
| 32  | A3-g | A3-j | A3-L | A3-m |
| 33  | A2-h | A2-i | A2-k | A2-n |
| 34  | B3   | A2-f | A2-e | A2-d |
| 35  | A2-a | A2-b | A2-c | B1   |
| 36  | A2-g | A2-j | A2-L | A2-m |
| 37  | A1-h | A1-i | A1-k | A1-n |
| 38  | B2   | A1-f | A1-e | A1-d |
| 39  | A1-a | A1-b | A1-c | B8   |
| 40  | A1-g | A1-j | A1-L | A1-m |
| 41  | A0-h | A0-i | A0-k | A0-n |
| 42  | B0   | A0-f | A0-e | A0-d |
| 43  | A0-a | A0-b | A0-c | B7   |
| 44  | A0-g | A0-j | A0-L | A0-m |

**Table 3-7. LCD PIO Mapping**

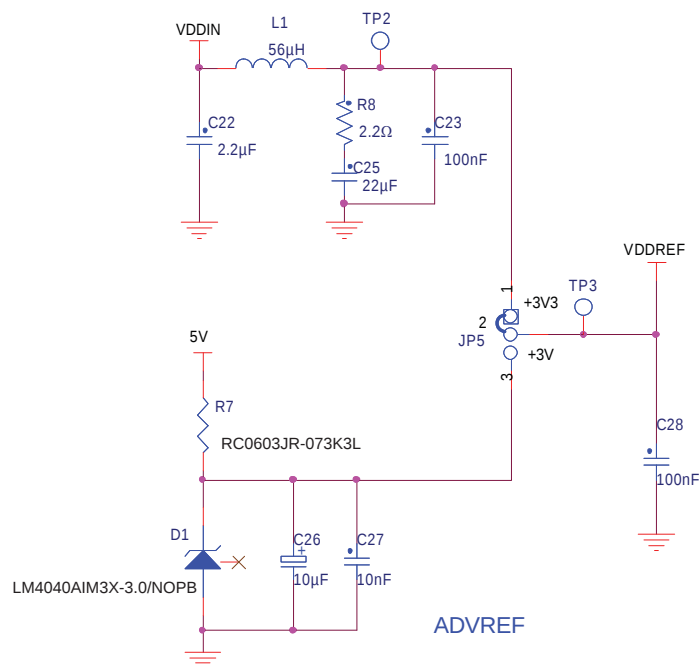
| Pin Name | LCD Pin | PIO      |  | PIO      | LCD Pin | Pin Name |
|----------|---------|----------|--|----------|---------|----------|
| COM0     | 4       | PA0      |  | PA1      | 3       | COM1     |
| COM2     | 2       | PA2      |  | PA3      | 1       | COM3     |
| SEG0     | 5       | PB30     |  | PB31     | 6       | SEG1     |
| SEG2     | 7       | Not used |  | Not used | 8       | SEG3     |
| SEG4     | 9       | PB9      |  | PB8      | 10      | SEG5     |
| SEG6     | 11      | PB7      |  | PB6      | 12      | SEG7     |
| SEG8     | 13      | PA28     |  | PA27     | 14      | SEG9     |
| SEG10    | 15      | PA26     |  | PA23     | 16      | SEG11    |
| SEG12    | 17      | PB29     |  | PB28     | 18      | SEG13    |
| SEG14    | 19      | PB27     |  | PB26     | 20      | SEG15    |
| SEG16    | 21      | PB25     |  | PB24     | 22      | SEG17    |
| SEG18    | 23      | PB23     |  | PB22     | 24      | SEG19    |
| SEG20    | 25      | PB21     |  | PB20     | 26      | SEG21    |
| SEG22    | 27      | PB19     |  | PB18     | 28      | SEG23    |
| SEG24    | 29      | PB17     |  | PB16     | 30      | SEG25    |
| SEG26    | 31      | PB15     |  | PB14     | 32      | SEG27    |
| SEG28    | 33      | PB13     |  | PB12     | 34      | SEG29    |
| SEG30    | 35      | PB11     |  | PB10     | 36      | SEG31    |
| SEG32    | 37      | PB9      |  | PB8      | 38      | SEG33    |
| SEG34    | 39      | PB7      |  | PB6      | 40      | SEG35    |
| SEG36    | 41      | PA28     |  | PA27     | 42      | SEG37    |
| SEG38    | 43      | PA26     |  | PA23     | 44      | SEG39    |

## 3.9 Analog I/O

### 3.9.1 Analog Reference

The SAM4C features a LM4040 precision micropower curvature-corrected bandgap shunt voltage reference with a several fixed reverse breakdown voltages. The device voltage reference on the board is 3.0V.

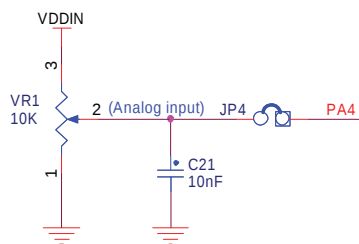
Figure 3-19. Analog Reference Schematic



### 3.9.2 Analog Input

One potentiometer VR1 multi-turn 10K  $\Omega$  is connected to the jumper JP4. If JP4 is closed, this analog reference is available on analog input PA4.

Figure 3-20. Analog Input Schematic

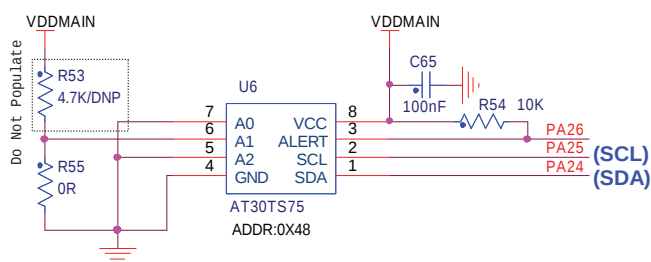


### 3.9.3 Temperature Sensor

The Atmel AT30TS75 temperature sensor converts temperatures from -40°C to +125°C to a digital word and provides a typical accuracy of  $\pm 0.5^{\circ}\text{C}$  over the operating temperature range of 0°C to +85°C. The device is factory calibrated and requires no external components to help provide a cost effective solution. To reduce current consumption and save power, the AT30TS75 features a shutdown mode that turns off all internal circuitry except for the internal power-on reset and serial interface circuits. In addition, the device features a power saving one-shot mode that allows the device to make a temperature measurement and update the temperature register and then return to shutdown mode.

Device slave address byte: 0x48.

Figure 3-21. Temperature Sensor Schematic



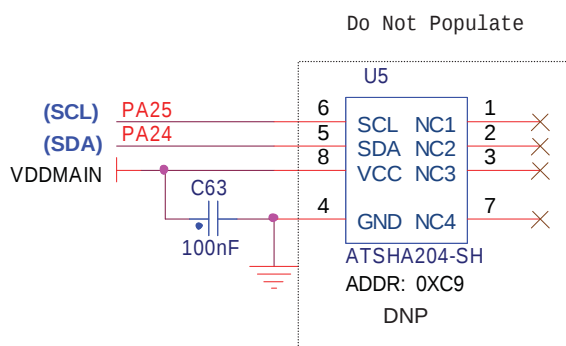
### 3.10 CryptoAuthentication (optional)

The Atmel ATSHA204 is a member of the Atmel CryptoAuthentication family of high-security hardware authentication devices.

It has a flexible command set that allows use for many applications, such as Anti-counterfeiting, Protection for Firmware or Media, Session Key Exchange, Secure Data Storage or User Password Checking.

Device slave address byte: 0xC9.

Figure 3-22. CryptoAuthentication Schematic



## 3.11 LEDs and Buttons

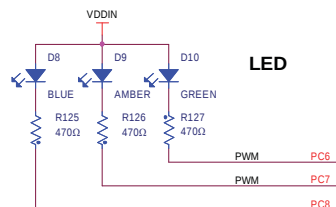
The ATSAM4C-EK is equipped with two user push buttons and three LEDs.

### 3.11.1 Discrete LEDs

Indicators on the main board include three discrete LEDs:

- 1 blue LED connected to a PIO
- 1 amber LED connected to a PWM output
- 1 green LED connected to a PWM output

Figure 3-23. Debug Discrete LED Schematic

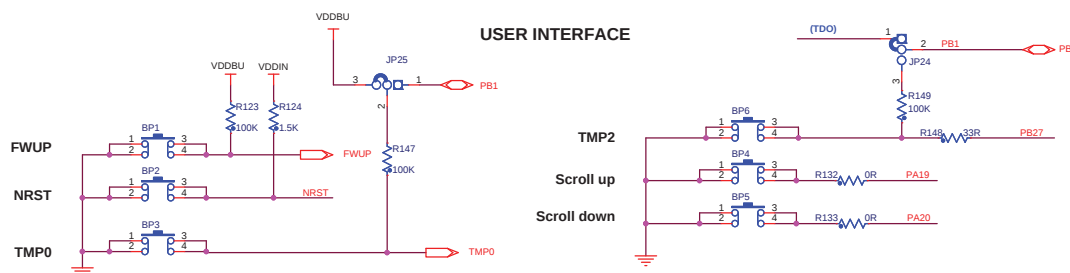


### 3.11.2 Push Buttons

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

- System push buttons:
  - NRST (Reset, perform system reset)
  - FWPU (Force Wake-Up)
  - TMP0 (Tamper)
  - TMP2 (Tamper)
- User push buttons:
  - SCROLL\_UP
  - SCROLL\_DOWN

Figure 3-24. Push Buttons Schematic



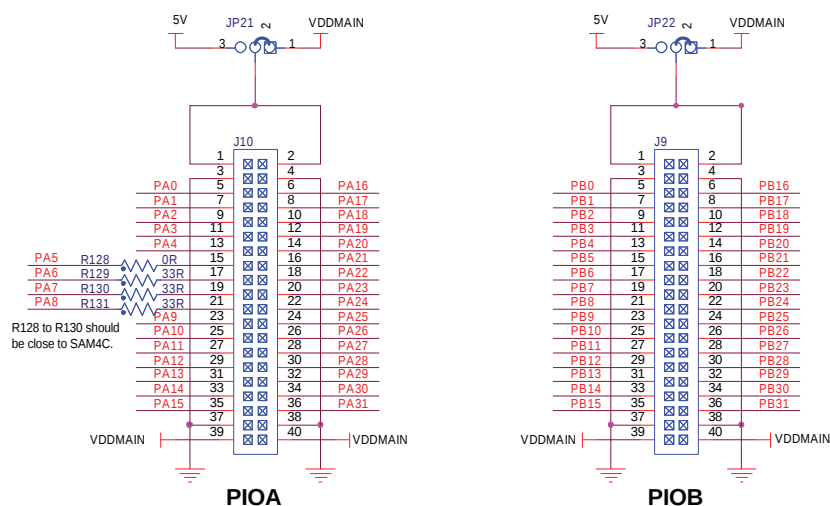
It is possible to select the pull-up level for Tamper TMP0 pin. By selecting PB1 instead of VDDBU, it allows to end user a dynamic tampering synchronized with RTCOUT pin. It allows a diminution of the power consumption when the button is pressed (divided by the Duty Cycle applied on RTCOUT Output signal).

It is possible to use the TMP2 Push Button as another Tamper input. By using this feature, the end user must use JTAG in 2-wire mode (SWIO and SWD) due to the loss of the TDO pin. In this case TMP2 is pull-up at RTCOUT Level (PB1 pin) and can be managed dynamically synchronized with the RTCOUT pin.

## 3.12 Miscellaneous I/O

This board is equipped with additional I/O connectors which allow the measurements of specific points are allow the connection of an additional extension board.

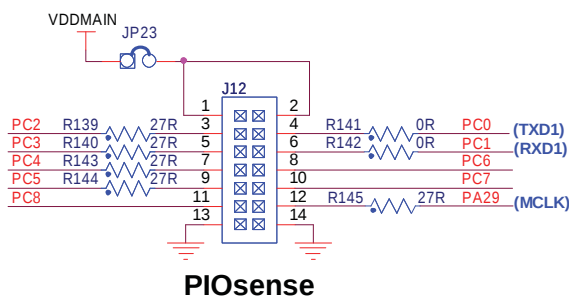
Figure 3-25. PIO A and PIO B Extension I/O Connectors Schematic



## 3.13 Metrology Core Serial Interface

This board includes an additional connector which allows connecting to an external board through the SPI 1 port.

Figure 3-26. Connector Schematic



## 3.14 PIO Usage

### 3.14.1 PIO Port A Pin Assignments

Table 3-8. PIO Port A Pin Assignments

| I/O Line | Peripheral |       |          | Extra Function | System Function | Reset State    | Using            |
|----------|------------|-------|----------|----------------|-----------------|----------------|------------------|
|          | A          | B     | C        |                |                 |                |                  |
| PA0      | RTS3       | PCK2  | A10      | COM0           | WKUP5           | PIO, I, PU, ST | LCD Com          |
| PA1      | CTS3       | NCS1  | A9       | COM1           | –               |                | LCD Com          |
| PA2      | SCK3       | NCS2  | A8       | COM2           | –               |                | LCD Com          |
| PA3      | RXD3       | NCS3  | A7       | COM3           | WKUP6           |                | LCD Com          |
| PA4      | TXD3       | –     | A6       | COM4/AD1       | –               |                | Analog input     |
| PA5      | SPI0_NPCS0 | –     | A5       | COM5/AD2       | –               |                | SerFlash / NPCS  |
| PA6      | SPI0_MISO  | –     | A4       | SEG0           | –               |                | ZigBee           |
| PA7      | SPI0_MOSI  | –     | A3       | SEG1           | –               |                | ZigBee           |
| PA8      | SPI0_SPCK  | –     | A2       | SEG2           | –               |                | ZigBee           |
| PA9      | RXD2       | –     | A1       | SEG3           | WKUP2           |                | RS232/485        |
| PA10     | TXD2       | –     | A0/NBS0  | SEG4           | –               |                | RS232/485        |
| PA11     | RXD1       | –     | A23      | SEG5           | WKUP9           |                | ZigBee / IRQ0    |
| PA12     | TXD1       | –     | A22-NCLE | SEG6/AD0       | –               |                | ZigBee/IRQ1/IRTC |
| PA13     | SCK2       | TIOA0 | A21-NALE | SEG7           | –               |                | Backlight On/off |
| PA14     | RTS2       | TIOB0 | A20      | SEG8           | WKUP3           |                | RS232/485        |
| PA15     | CTS2       | TIOA4 | A19      | SEG9           | –               |                | RS232/485        |
| PA16     | SCK1       | TIOB4 | A18      | SEG10          | –               |                | MuxLCD           |
| PA17     | RTS1       | TCLK4 | A17      | SEG11          | WKUP7           |                | ZigBee / RST     |
| PA18     | CTS1       | TIOA5 | A16      | SEG12          | –               |                | ZigBee / SLPTR   |
| PA19     | RTS0       | TCLK5 | A15      | SEG13          | WKUP4           |                | PB ScrUp         |
| PA20     | CTS0       | TIOB5 | A14      | SEG14          | –               |                | PB ScrDwn        |
| PA21     | SPI0_NPCS1 | –     | A13      | SEG15          | –               |                | ZigBee / NPCS    |
| PA22     | SPI0_NPCS2 | –     | A12      | SEG16          | –               |                | ZigBit / IRQ     |
| PA23     | SPI0_NPCS3 | –     | A11      | SEG17          | –               |                | –                |
| PA24     | TWD0       | –     | A10      | SEG18          | WKUP1           |                | TWI / ZigBit     |
| PA25     | TWCK0      | –     | A9       | SEG19          | –               |                | TWI / ZigBit     |
| PA26     | CTS4       | –     | A8       | SEG20          | –               |                | –                |
| PA27     | –          | –     | NCS0     | SEG21          | –               |                | –                |
| PA28     | –          | –     | NRD      | SEG22          | –               |                | –                |
| PA29     | PCK1       | –     | NWAIT    | SEG23          | –               | –              | MCLK (ATSense)   |
| PA30     | PCK1       | –     | A15      | –              | XOUT            | XOUT           | –                |
| PA31     | PCK0       | –     | A14      | –              | XIN             | XIN            | –                |

### 3.14.2 PIO Port B Pin Assignments

Table 3-9. PIO Port B Pin Assignments

| I/O Line | Peripheral |        |           | Extra Function | System Function | Reset State    | Using          |
|----------|------------|--------|-----------|----------------|-----------------|----------------|----------------|
|          | A          | B      | C         |                |                 |                |                |
| PB0      | TWD1       | –      | –         | –              | TDI             | JTAG, I, ST    | –              |
| PB1      | TWCK1      | –      | –         | RTCOUT0        | TDO/TRACESWO    |                | –              |
| PB2      | –          | –      | –         | –              | TMS/SWDIO       |                | –              |
| PB3      | –          | –      | –         | –              | TCK/SWCLK       |                | –              |
| PB4      | URXD0      | TCLK0  | A17       | –              | WKUP8           | PIO, I, PU, ST | DBGU           |
| PB5      | UTXD0      | –      | A16       | –              | –               |                | DBGU           |
| PB6      | –          | –      | D0        | SEG24          | –               |                | –              |
| PB7      | TIOA1      | –      | D1        | SEG25          | –               |                | –              |
| PB8      | TIOB1      | –      | D2        | SEG26          | –               |                | –              |
| PB9      | TCLK1      | –      | D3        | SEG27          | –               |                | –              |
| PB10     | TIOA2      | –      | D4        | SEG28          | –               |                | –              |
| PB11     | TIOB2      | –      | D5        | SEG29          | –               |                | –              |
| PB12     | TCLK2      | –      | D6        | SEG30          | –               |                | –              |
| PB13     | PCK0       | –      | D7        | SEG31/AD3      | –               |                | –              |
| PB14     | –          | –      | NWR0–NWE  | SEG32          | –               |                | –              |
| PB15     | –          | –      | NWR1–NBS1 | SEG33          | –               |                | ZigBit / SLPTR |
| PB16     | RXD0       | –      | D8        | SEG34          | WKUP10          | PIO, I, PD, ST | ZigBit / RXD   |
| PB17     | TXD0       | –      | D9        | SEG35          | –               |                | ZigBit / TXD   |
| PB18     | SCK0       | PCK2   | D10       | SEG36          | –               |                | ZigBit / RST   |
| PB19     | RXD4       | –      | D11       | SEG37          | –               |                | ZigBit / MOSI  |
| PB20     | TXD4       | –      | D12       | SEG38          | –               |                | ZigBit / MISO  |
| PB21     | SCK4       | NANDOE | D13       | SEG39          | WKUP11          |                | ZigBit / SPCK  |
| PB22     | RTS4       | NANDWE | D14       | SEG40          | –               | PIO, I, PD, ST | ZigBit / NPCS  |
| PB23     | ADTRG      | –      | D15       | SEG41/AD4      | –               |                | –              |
| PB24     | TIOA3      | –      | A7        | SEG42          | –               |                | –              |
| PB25     | TIOB3      | –      | A6        | SEG43          | –               |                | –              |
| PB26     | TCLK3      | –      | A5        | SEG44          | WKUP13          |                | –              |
| PB27     | –          | –      | A4        | SEG45          | WKUP14          |                | –              |
| PB28     | –          | –      | A3        | SEG46          | WKUP15          |                | –              |
| PB29     | –          | –      | A2        | SEG47          | –               |                | –              |
| PB30     | –          | –      | A1        | SEG48          | –               |                | –              |
| PB31     | –          | –      | A0–NBS0   | SEG49/AD5      | –               |                | –              |

### 3.14.3 PIO Port C Pin Assignments

Table 3-10. PIO Port C Pin Assignments

| I/O Line | Peripheral |            |        | Extra Function | System Function | Reset State | Using        |
|----------|------------|------------|--------|----------------|-----------------|-------------|--------------|
|          | A          | B          | C      |                |                 |             |              |
| PC0      | UTXD1      | PWM0       | –      | –              | –               | –           | –            |
| PC1      | URXD1      | PWM1       | WKUP12 | –              | –               | –           | –            |
| PC2      | SPI1_NPCS0 | PWM2       | –      | –              | –               | –           | –            |
| PC3      | SPI1_MISO  | PWM3       | –      | –              | –               | –           | –            |
| PC4      | SPI1_MOSI  | –          | –      | –              | –               | –           | –            |
| PC5      | SPI1_SPCK  | –          | –      | –              | –               | –           | –            |
| PC6      | PWM0       | SPI1_NPCS1 | –      | –              | –               | –           | LED Green    |
| PC7      | PWM1       | SPI1_NPCS2 | –      | –              | –               | –           | LED Amber    |
| PC8      | PWM2       | SPI1_NPCS3 | –      | –              | –               | –           | LED Blue     |
| PC9      | PWM3       | –          | –      | –              | ERASE           | –           | Jumper Erase |

### 3.15 Connectors

#### 3.15.1 Power Supply Connector

The ATSAM4C-EK is equipped with an ACDC wall adapter that can be connected to a J2 connector (described below). The maximum input voltage that can be applied on this connector must be lower than 6V.

Figure 3-27. Power Supply Connector



Table 3-11. Power Supply Connector Pinout

| Pin | Signal Name | Description               |
|-----|-------------|---------------------------|
| 1   | +5V         | Wall Adapter Main Voltage |
| 2   | NC          | Floating Point            |
| 3   | GND         | Ground                    |

### 3.15.2 JTAG/ICE Connector

Figure 3-28. JTAG/ICE Connector

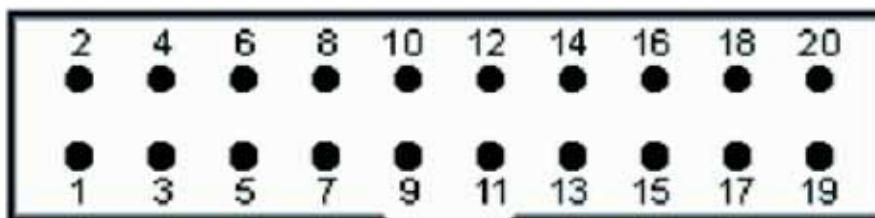


Table 3-12. JTAG/ICE Connector Pinout

| Pin                             | Signal Name               | Description                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4, 6, 8, 10, 12, 14, 16, 18, 20 | GND                       | Common ground                                                                                                                                                                                                                                                                                                                                                                                               |
| 1                               | VTref 3.3V power          | This is the target reference voltage. It is used to check if the target has power, to create the logic-level reference for the input comparators, and to control the output logic levels to the target. It is normally fed from VDD on the target board and must not have a series resistor.                                                                                                                |
| 2                               | Vsupply 3.3V power        | This pin is not connected in SAM-ICE. It is reserved for compatibility with other equipment. Connect to VDD or leave open in target system.                                                                                                                                                                                                                                                                 |
| 3                               | nTRST TARGET RESET        | JTAG Reset (active-low output signal that resets the target). Output from SAM-ICE to the Reset signal on the target JTAG port. Typically connected to nTRST on the target CPU. This pin is normally pulled HIGH on the target to avoid unintentional resets when there is no connection.                                                                                                                    |
| 5                               | TDI TEST DATA INPUT       | JTAG data input of target CPU (serial data output line, sampled on the rising edge of the TCK signal). It is recommended that this pin is pulled to a defined state on the target board. Typically connected to TDI on target CPU.                                                                                                                                                                          |
| 7                               | TMS TEST MODE SELECT      | JTAG mode set input of target CPU. This pin should be pulled up on the target. Typically connected to TMS on target CPU. Output signal that sequences the target's JTAG state machine, sampled on the rising edge of the TCK signal.                                                                                                                                                                        |
| 9                               | TCK TEST CLOCK            | JTAG clock signal to target CPU (output timing signal, for synchronizing test logic and control register access). It is recommended that this pin is pulled to a defined state on the target board. Typically connected to TCK on target CPU.                                                                                                                                                               |
| 11                              | RTCK                      | Input Return test clock signal from the target.<br>Some targets must synchronize the JTAG inputs to internal clocks. To assist in meeting this requirement, a returned and retimed TCK can be used to dynamically control the TCK rate. SAM-ICE supports adaptive clocking which waits for TCK changes to be echoed correctly before making further changes. Connect to RTCK if available, otherwise to GND |
| 13                              | TDO JTAG TEST DATA OUTPUT | JTAG data output from target CPU (serial data input from the target). Typically connected to TDO on target CPU.                                                                                                                                                                                                                                                                                             |
| 15                              | nSRST RESET               | Active-low reset signal. Target CPU reset signal                                                                                                                                                                                                                                                                                                                                                            |
| 17                              | RFU                       | This pin is not connected in SAM-ICE                                                                                                                                                                                                                                                                                                                                                                        |
| 19                              | RFU                       | This pin is not connected in SAM-ICE                                                                                                                                                                                                                                                                                                                                                                        |

### 3.15.3 RS232 Connector

Figure 3-29. RS232 Connector

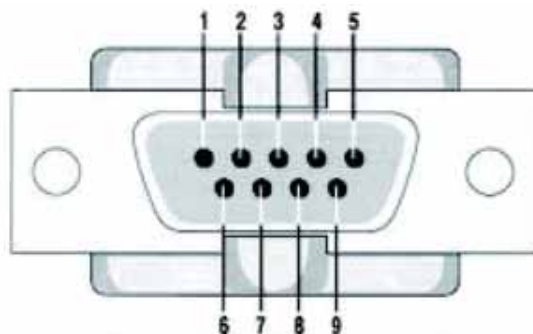


Table 3-13. RS232 Connector Pinout

| Pin        | Signal Name | Description                     |
|------------|-------------|---------------------------------|
| 1, 4, 6, 9 | NC          | Not Connected                   |
| 2          | RXD         | RS232 Serial Data Output Signal |
| 3          | TXD         | RS232 Serial Data Input Signal  |
| 5          | GND         | Common Ground                   |
| 7          | RTS         | Request To Send - Not Used      |
| 8          | CTS         | Clear To Send - Not Used        |

3.15.4 UART/USB Micro AB

Figure 3-30. Micro AB USB Connector

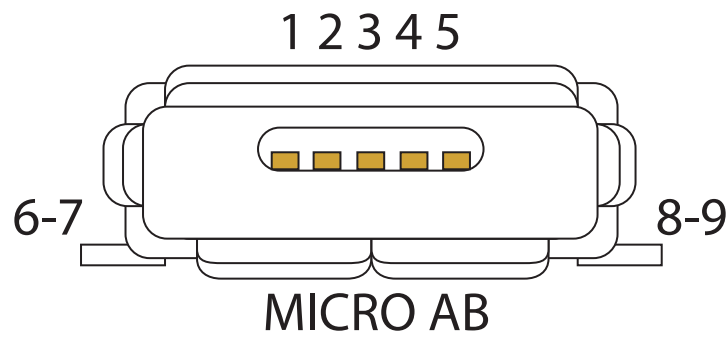


Table 3-14. Micro AB USB Connector Pinout

| Pin        | Signal Name | Description              |
|------------|-------------|--------------------------|
| 1          | VBUS        | 5V Power                 |
| 2          | DM          | Data Minus               |
| 3          | DP          | Data Plus                |
| 4          | ID          | On The Go Identification |
| 5          | GND         | Common Ground            |
| 6, 7, 8, 9 | Shield      | Mechanical Pins          |

3.15.5 RZ600 IEEE 802.15.4 Wireless Transceiver Socket J12

Figure 3-31. Socket J12

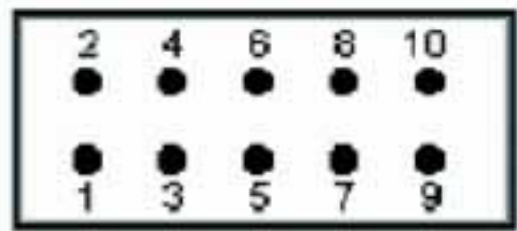


Table 3-15. Socket Pinout

| Function          | Signal Name | Pin |  | Pin | Signal Name | Function          |
|-------------------|-------------|-----|--|-----|-------------|-------------------|
| Reset             | /RST        | 1   |  | 2   | IRQ0        | Interrupt Request |
| Interrupt Request | IRQ1        | 3   |  | 4   | SLP_TR      | SLP_TR            |
| SPI Chip Select   | /CS         | 5   |  | 6   | MOSI        | SPI MOSI          |
| SPI MISO          | MISO        | 7   |  | 8   | SCLK        | SPI CLK           |
| Power Supply      | GND         | 9   |  | 10  | VCC         | VCC               |

### 3.15.6 I/O Expansion Port

Figure 3-32. Expansion Port J9 & J10

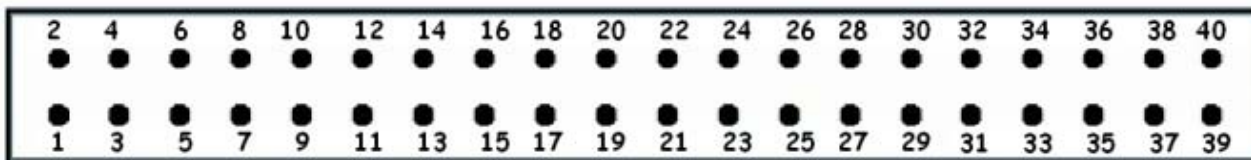


Table 3-16. Expansion Port J9 Pinout

| Function     | Signal Name | Pin |  | Pin | Signal Name | Function     |
|--------------|-------------|-----|--|-----|-------------|--------------|
| 3.3V or 5V   | –           | 1   |  | 2   | –           | 3.3V or 5V   |
| Ground       | GND         | 3   |  | 4   | GND         | Ground       |
| –            | PB0         | 5   |  | 6   | PB16        | –            |
| –            | PB1         | 7   |  | 8   | PB17        | –            |
| –            | PB2         | 9   |  | 10  | PB18        | –            |
| –            | PB3         | 11  |  | 12  | PB19        | –            |
| –            | PB4         | 13  |  | 14  | PB20        | –            |
| –            | PB5         | 15  |  | 16  | PB21        | –            |
| –            | PB6         | 17  |  | 18  | PB22        | –            |
| –            | PB7         | 19  |  | 20  | PB23        | –            |
| –            | PB8         | 21  |  | 22  | PB24        | –            |
| –            | PB9         | 23  |  | 24  | PB25        | –            |
| –            | PB10        | 25  |  | 26  | PB26        | –            |
| –            | PB11        | 27  |  | 28  | PB27        | –            |
| –            | PB12        | 29  |  | 30  | PB28        | –            |
| –            | PB13        | 31  |  | 32  | PB29        | –            |
| –            | PB14        | 33  |  | 34  | PB30        | –            |
| –            | PB15        | 35  |  | 36  | PB31        | –            |
| Ground       | GND         | 37  |  | 38  | GND         | Ground       |
| Power Supply | VDDMAIN     | 39  |  | 40  | VDDMAIN     | Power Supply |

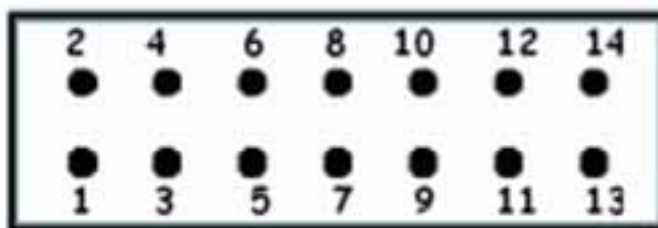
Table 3-17. Expansion Port J10 Pinout

| Function   | Signal Name | Pin |  | Pin | Signal Name | Function   |
|------------|-------------|-----|--|-----|-------------|------------|
| 3.3V or 5V | –           | 1   |  | 2   | –           | 3.3V or 5V |
| Ground     | GND         | 3   |  | 4   | GND         | Ground     |
| –          | PA0         | 5   |  | 6   | PA16        | –          |
| –          | PA1         | 7   |  | 8   | PA17        | –          |

**Table 3-17. Expansion Port J10 Pinout (Continued)**

| Function     | Signal Name | Pin |  | Pin | Signal Name | Function     |
|--------------|-------------|-----|--|-----|-------------|--------------|
| –            | PA2         | 9   |  | 10  | PA18        | –            |
| –            | PA3         | 11  |  | 12  | PA19        | –            |
| –            | PA4         | 13  |  | 14  | PA20        | –            |
| –            | PA5         | 15  |  | 16  | PA21        | –            |
| –            | PA6         | 17  |  | 18  | PA22        | –            |
| –            | PA7         | 19  |  | 20  | PA23        | –            |
| –            | PA8         | 21  |  | 22  | PA24        | –            |
| –            | PA9         | 23  |  | 24  | PA25        | –            |
| –            | PA10        | 25  |  | 26  | PA26        | –            |
| –            | PA11        | 27  |  | 28  | PA27        | –            |
| –            | PA12        | 29  |  | 30  | PA28        | –            |
| –            | PA13        | 31  |  | 32  | PA29        | –            |
| –            | PA14        | 33  |  | 34  | PA30        | –            |
| –            | PA15        | 35  |  | 36  | PA31        | –            |
| Ground       | GND         | 37  |  | 38  | GND         | Ground       |
| Power Supply | VDDMAIN     | 39  |  | 40  | VDDMAIN     | Power Supply |

**Figure 3-33. Expansion Port J12**



**Table 3-18. Expansion Port J12 Pinout**

| PIO | Power | Pin |  | Pin | Power | PIO  |
|-----|-------|-----|--|-----|-------|------|
| –   | 3.3V  | 1   |  | 2   | 3.3V  | –    |
| PC2 | –     | 3   |  | 4   | –     | PC0  |
| PC3 | –     | 5   |  | 6   | –     | PC1  |
| PC4 | –     | 7   |  | 8   | –     | PC6  |
| PC5 | –     | 9   |  | 10  | –     | PC7  |
| PC8 | –     | 11  |  | 12  | –     | PA29 |
| –   | GND   | 13  |  | 14  | GND   | –    |

## 4. Evaluation Kit Firmware Demonstration

### 4.1 ATSAM4C-EK Default Application

The ATSAM4C-EK is delivered with a preprogrammed default application in SAM4C Flash memory. This application implements SAM4C embedded peripherals and external (on-board) peripherals as detailed in the table below.

Table 4-1.

| SAM4C Embedded Peripheral | Connected to External (on-board) Peripheral                         |
|---------------------------|---------------------------------------------------------------------|
| Real-Time Clock (RTC)     | —                                                                   |
| Anti-Tamper               | BP3 Push Button                                                     |
| Two-wire Interface        | Temperature Sensor AT30TS75                                         |
| Segmented LCD             | Custom Atmel Display                                                |
| SAM4C Core 1              | —                                                                   |
| 10-bit ADC                | Internal ADC channel connected to Battery Backup Power Rail (VDDBU) |

After the first power-up without the backup battery, the time (hour and minute) of the RTC can be configured. The Hour and Minute settings are entered using the following push buttons:

- BP4 (SCROLL-UP)—sets the Hour (24H mode entries must be made)
- BP5 (SCROLL-DOWN)—sets the Minute
- BP6 (TMP2)—saves the Hour and Minute settings

Once the time settings have been saved, BP4 (SCROLL-UP) can be used to toggle the Hour display between 12H or 24H mode.

Note: RTC time configuration can be skipped by pressing BP6.

Once the Hour and Minute have been configured, the main application on core 0 runs in an infinite loop, repeating the following steps:

- Every second, the time is displayed with colon (:) icon blinking
- Every fifteen (15) seconds, the VDDBU pin voltage is measured and displayed <sup>(1)</sup>
- Every thirty (30) seconds, the temperature (using the AT30TS75) is measured and displayed in °C and in °F.

Note: 1. On the ATSAM4C-EK, the voltage measured is the VDDIO voltage minus the forward voltage of the diode in the BAT54C (D4).

At startup, the main application configures the core 1 subsystem to run a CoreMark algorithm from the core 1 SRAM memories (SRAM1 and SRAM2). Once the CoreMark is finished, the result of the CoreMark (number of CoreMark/MHz) is passed to the main application using the inter-processor communication embedded in the SAM4C. Once the result is retrieved by the main application, the result of the CoreMark is displayed and the CoreMark algorithm running on core 1 is restarted. An ammeter connected either on JP12 (VDDIN) or on JP6 (VDDCORE) can measure the active current consumption of both cores.

### 4.2 Measuring the Backup mode current consumption on VDDBU

The SAM4C has an ultra-low-power mode RTC and Supply controller allowing less than 1µA (typical) on VDDBU, with the following functions/peripherals configuration:

- 32.768 kHz Crystal Oscillator enabled
- POR backup on VDDBU disabled
- RTC running
- RTT enabled on 1 Hz mode
- Force wake-up (FWUP) enabled
- Anti-tamper Input (TMP0) enabled

To measure the current consumption on VDDBU when in backup mode, JP9 (Shutdown control) must be opened and an ammeter connected on JP8 (VDDBU) as described in the following procedure:

1. Power off the board using SW1
2. Insert the 3V lithium battery provided in the battery holder
3. Place an ammeter (with sufficient capacity to measure current lower than 1μA) on JP8
4. Power on the board using SW1
5. (*optional*) Set the RTC as described above
6. Press the push button BP5 (SCROLL-DOWN) to place the board in low-power mode

Before shutdown, the following messages are displayed on the LCD:

“ENTERING BACKUP MODE”

“PRESS FWUP BP1 TO WAKE UP”

“USE BP3 TO GENERATE TAMPER EVENTS”

Blinking “BYE”

At this point, the current consumption on the ammeter should be less than 1μA @ 25°C @ 3V.

Once in backup mode, the Anti-tamper pin 0 (TMP0) is enabled. BP3 (TMP0) push button can be used to generate tamper events before waking up the board. Tamper events are registered without waking up the board. Up to 15 tamper events can be registered. To wake up the board, press BP1 (FWUP). Upon start-up, the number of tamper events and time-stamping of the tamper events are displayed on the LCD.

## 5. ATSAM4C-EK Design Files

### 5.1 ATSAM4C-EK Schematics

This section contains the schematics for the SAM4C Evaluation Kit (Rev. C).

- Main page with Block Diagram
- Information regarding the design
- SAM4C Microcontroller and its crystals, decoupling capacitors and analog inputs
- Power Supplies Distribution
- RS232, RS485 and DBGU Interfaces, TWI Memories, and Temperature Sensor
- Custom Glass LCD and ZigBee, XPRO interfaces
- User Buttons, I/O expansion headers and JTAG Interfaces



**Figure 5-2. ATSAM4C-EK Schematic (Page 2 of 7)**

| REVISION HISTORY |         |                                | SCHEMATICS CONVENTIONS                                                                                        |  |  |
|------------------|---------|--------------------------------|---------------------------------------------------------------------------------------------------------------|--|--|
| REV              | DATA    | NOTE                           | (1)Resistance Unit: "K" is "Kohm"; "R" is "Ohm".<br>(2)"DNP" means the component is not populated by default. |  |  |
| A                | 2012.10 | Original released              |                                                                                                               |  |  |
| B                | 2013.1  | Modify LCD circuit             |                                                                                                               |  |  |
| C                | 2013.4  | Update XPRO interface/Add TMP2 |                                                                                                               |  |  |

| TABLE OF CONTENTS |                                          |  |
|-------------------|------------------------------------------|--|
| PAGE              | DESCRIPTION                              |  |
| 1                 | Block Diagram                            |  |
| 2                 | Reference guide                          |  |
| 3                 | Microcontroller,AD                       |  |
| 4                 | Power,RTC                                |  |
| 5                 | RS232,RS485,USB,EEPROM,                  |  |
| 6                 | Temperature Sensor,Crypto Authentication |  |
| 7                 | LCD,FLASH,ZIGBEE,ZIGBIT                  |  |
|                   | LED,Button,I/O Expansion,JTAG            |  |

| TEST POINT |              |          |
|------------|--------------|----------|
| PAGE       | REFERENCE    | FUNCTION |
| 3          | TP1          | VDDLCD   |
|            | TP2          | VDDREF_P |
|            | TP3          | VDDREF   |
| 4          | TP4          | 5V       |
|            | TP5          | VDDCORE  |
|            | TP6          | VDDPLL   |
|            | TP7          | 3V3      |
|            | TP8          | VDDBU    |
|            | TP9          | RTC_32   |
|            | TP10         | VDDMAIN  |
|            | TP11         | VDDIN    |
|            | TP12         | VDDIO    |
|            | TP13 to TP17 | GND      |

| PIO MUXING |              |      |
|------------|--------------|------|
| PIOA       | USAGE        | PIOB |
| PA0        | LCD_COM      | PB0  |
| PA1        | LCD_COM      | PB1  |
| PA2        | LCD_COM      | PB2  |
| PA3        | LCD_COM      | PB3  |
| PA4        | AD Input     | PB4  |
| PA5        | Serial Flash | PB5  |
| PA6        | ZBISerFlash  | PB6  |
| PA7        | ZBISerFlash  | PB7  |
| PA8        | ZBISerFlash  | PB8  |
| PA9        | RS232/485    | PB9  |
| PA10       | RS232/485    | PB10 |
| PA11       | ZigBee       | PB11 |
| PA12       | ZigBee/RTC   | PB12 |
| PA13       | BackLight    | PB13 |
| PA14       | RS232/485    | PB14 |
| PA15       | RS232/485    | PB15 |

| PIO MUXING |              |      |
|------------|--------------|------|
| PIOA       | USAGE        | PIOB |
| PA0        | LCD_COM      | PB0  |
| PA1        | LCD_COM      | PB1  |
| PA2        | LCD_COM      | PB2  |
| PA3        | LCD_COM      | PB3  |
| PA4        | AD Input     | PB4  |
| PA5        | Serial Flash | PB5  |
| PA6        | ZBISerFlash  | PB6  |
| PA7        | ZBISerFlash  | PB7  |
| PA8        | ZBISerFlash  | PB8  |
| PA9        | RS232/485    | PB9  |
| PA10       | RS232/485    | PB10 |
| PA11       | ZigBee       | PB11 |
| PA12       | ZigBee/RTC   | PB12 |
| PA13       | BackLight    | PB13 |
| PA14       | RS232/485    | PB14 |
| PA15       | RS232/485    | PB15 |

| JUMPER AND SOLDERDROP |             |          |
|-----------------------|-------------|----------|
| PAGE                  | REFERENCE   | FUNCTION |
| 3                     | JP1         | OPEN     |
|                       | JP2         | OPEN     |
|                       | JP3         | OPEN     |
|                       | JP4         | CLOSE    |
|                       | JP5         | 1-2      |
| 4                     | JP6,JP7,JP8 | CLOSE    |
|                       | JP9         | CLOSE    |
|                       | JP10        | OPEN     |
|                       | JP11,JP12   | CLOSE    |
|                       | JP13        | CLOSE    |
| 5                     | JP14        | OPEN     |
|                       | JP15        | 2-3      |
|                       | JP16        | CLOSE    |
|                       | JP17        | OPEN     |
|                       | JP18        | CLOSE    |
| 6                     | JP19        | OPEN     |
|                       | JP20        | CLOSE    |
|                       | JP21        | 1-2      |
| 7                     | JP22        | 1-2      |
|                       | JP23        | CLOSE    |
|                       | JP24        | 1-2      |
|                       | JP25        | 2-3      |
|                       | JP26        | 2-3      |

| DEFAULT NO POPULATE PARTS |           |                                        |
|---------------------------|-----------|----------------------------------------|
| PAGE                      | REFERENCE | FUNCTION                               |
| 3                         | R1,R2     | Expansion IO Interface.                |
|                           | R10       | External clock resource input.         |
| 4                         | R24,R38   | RS485 Pull-up and Pull-down Resistor.  |
|                           | R39,R40   | Change EEPROM I2C Address.             |
| 5                         | R53       | Change Temperature Sensor I2C Address. |
|                           | R60       | PowerUp to Reset FT232RL.              |
|                           | R64       | When USB suspend is HIGH level         |
|                           | R64       | When USB suspend is HIGH level         |

| LIST OF CHANGES |                                                                      |      |
|-----------------|----------------------------------------------------------------------|------|
| REV             | DESCRIPTION                                                          | DATE |
| 1               | Update XPRO interface (Change J8 ZigBit HE14 right angled male DNP ) |      |
| 2               | R3 DNP                                                               |      |
| 3               | A4d TMP2                                                             |      |
| 4               | Push button TMP0, add pull up VDDBU                                  |      |

| JUMPER AND SOLDERDROP |             |          |
|-----------------------|-------------|----------|
| PAGE                  | REFERENCE   | FUNCTION |
| 3                     | JP1         | OPEN     |
|                       | JP2         | OPEN     |
|                       | JP3         | OPEN     |
|                       | JP4         | CLOSE    |
|                       | JP5         | 1-2      |
| 4                     | JP6,JP7,JP8 | CLOSE    |
|                       | JP9         | CLOSE    |
|                       | JP10        | OPEN     |
|                       | JP11,JP12   | CLOSE    |
|                       | JP13        | CLOSE    |
| 5                     | JP14        | OPEN     |
|                       | JP15        | 2-3      |
|                       | JP16        | CLOSE    |
|                       | JP17        | OPEN     |
|                       | JP18        | CLOSE    |

**Figure 5-3. ATSAM4C-EK Schematic (Page 3 of 7)**

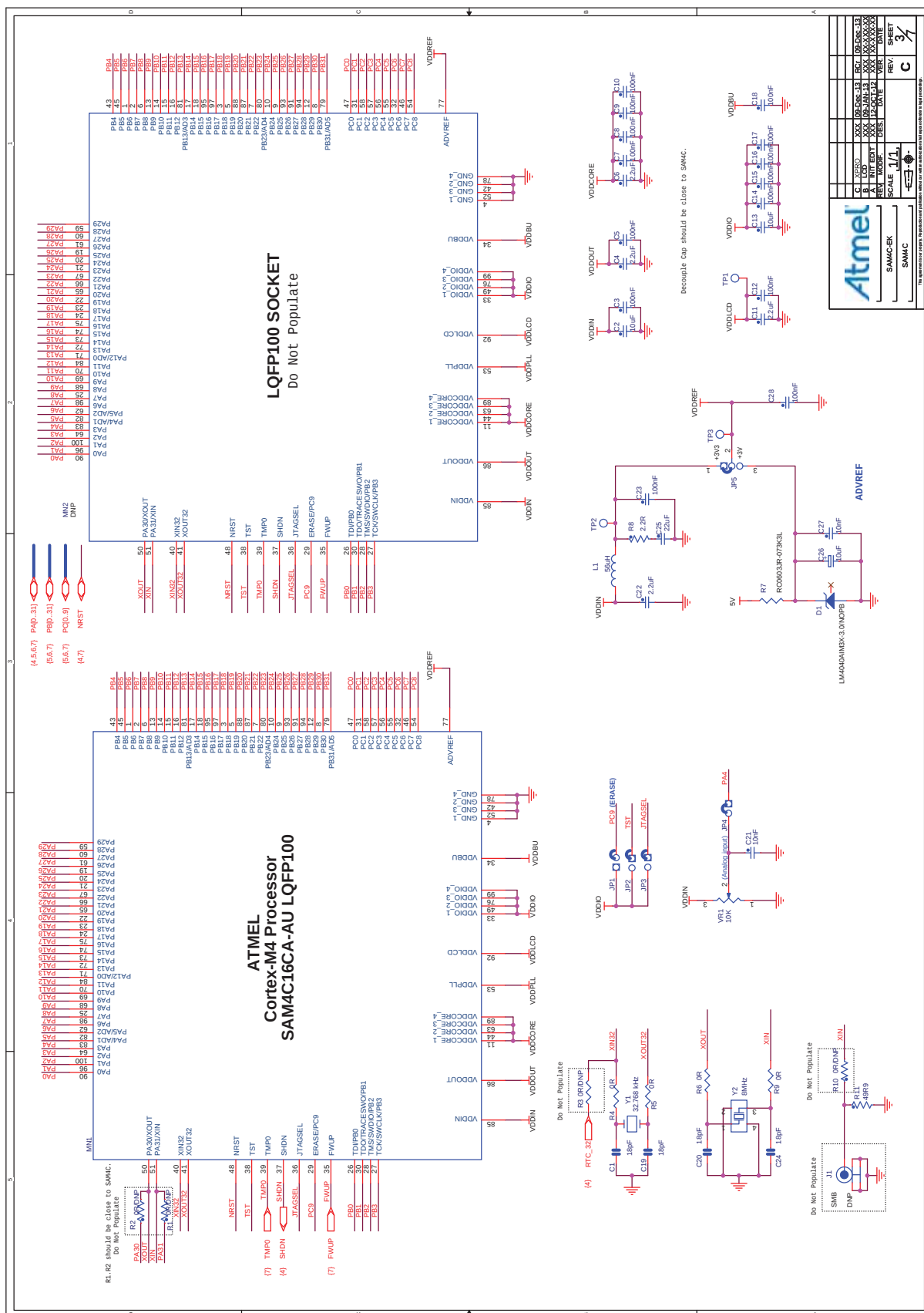
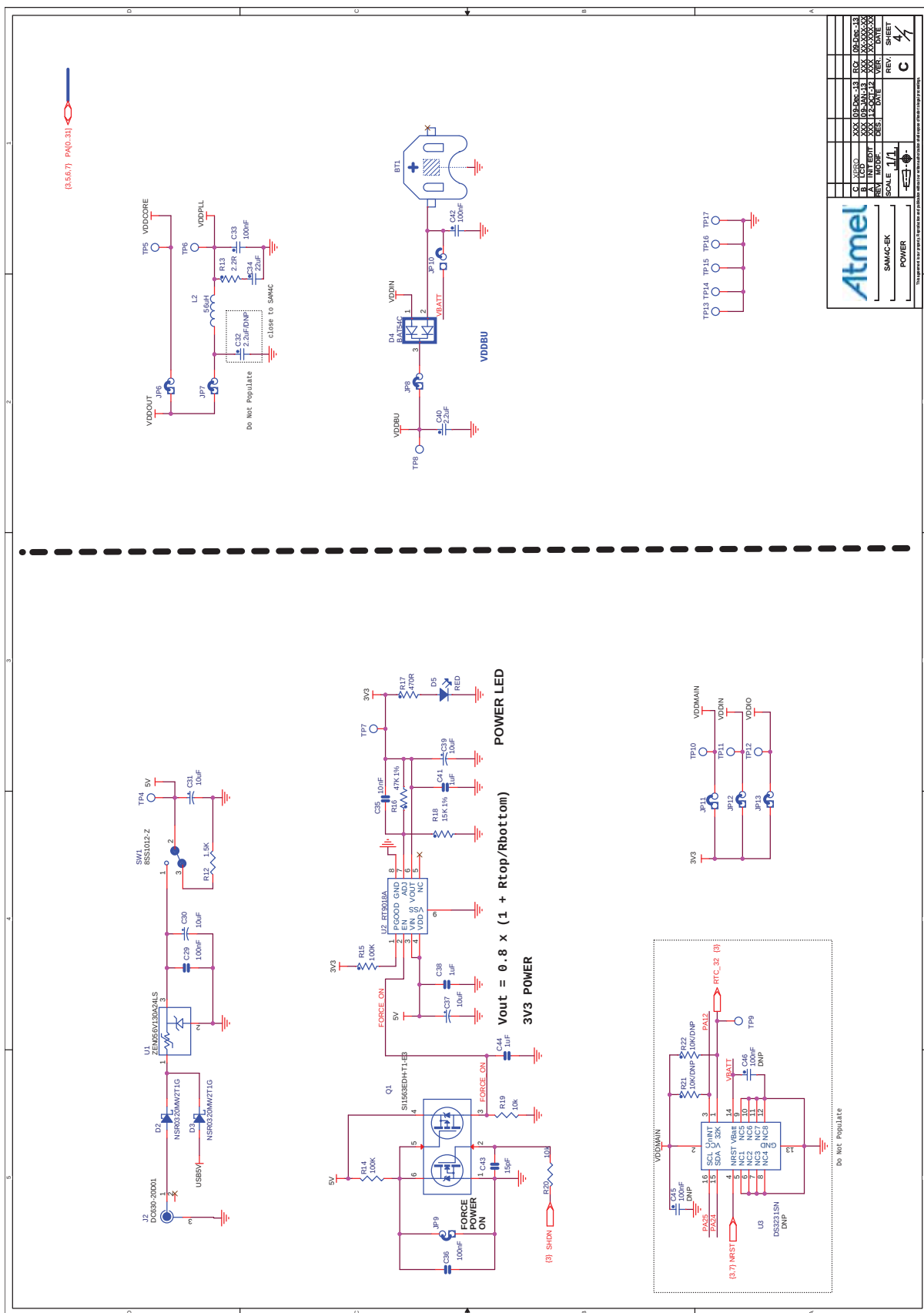


Figure 5-4. ATSAM4C-EK Schematic (Page 4 of 7)



**Figure 5-5. ATSAM4C-EK Schematic (Page 5 of 7)**

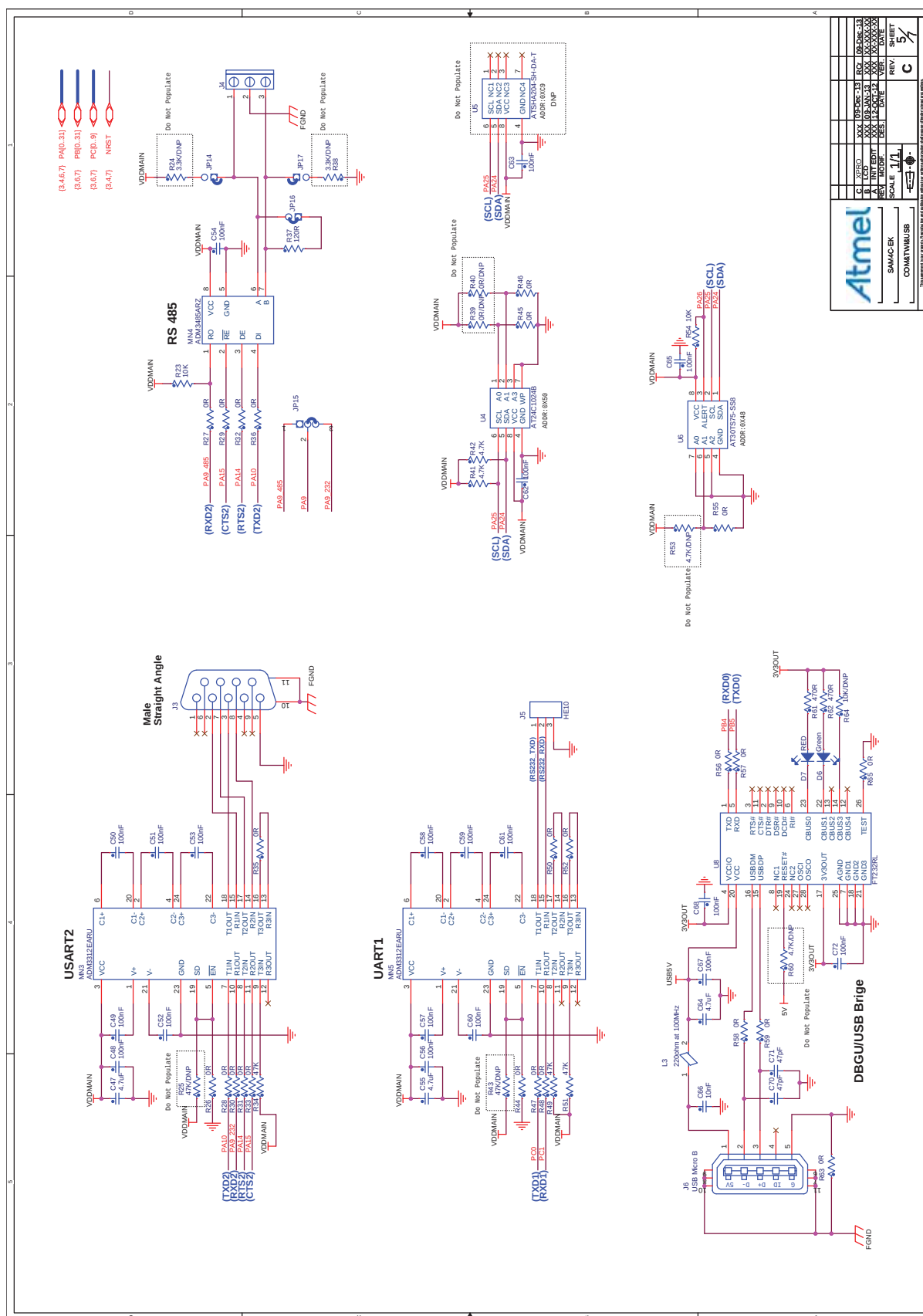
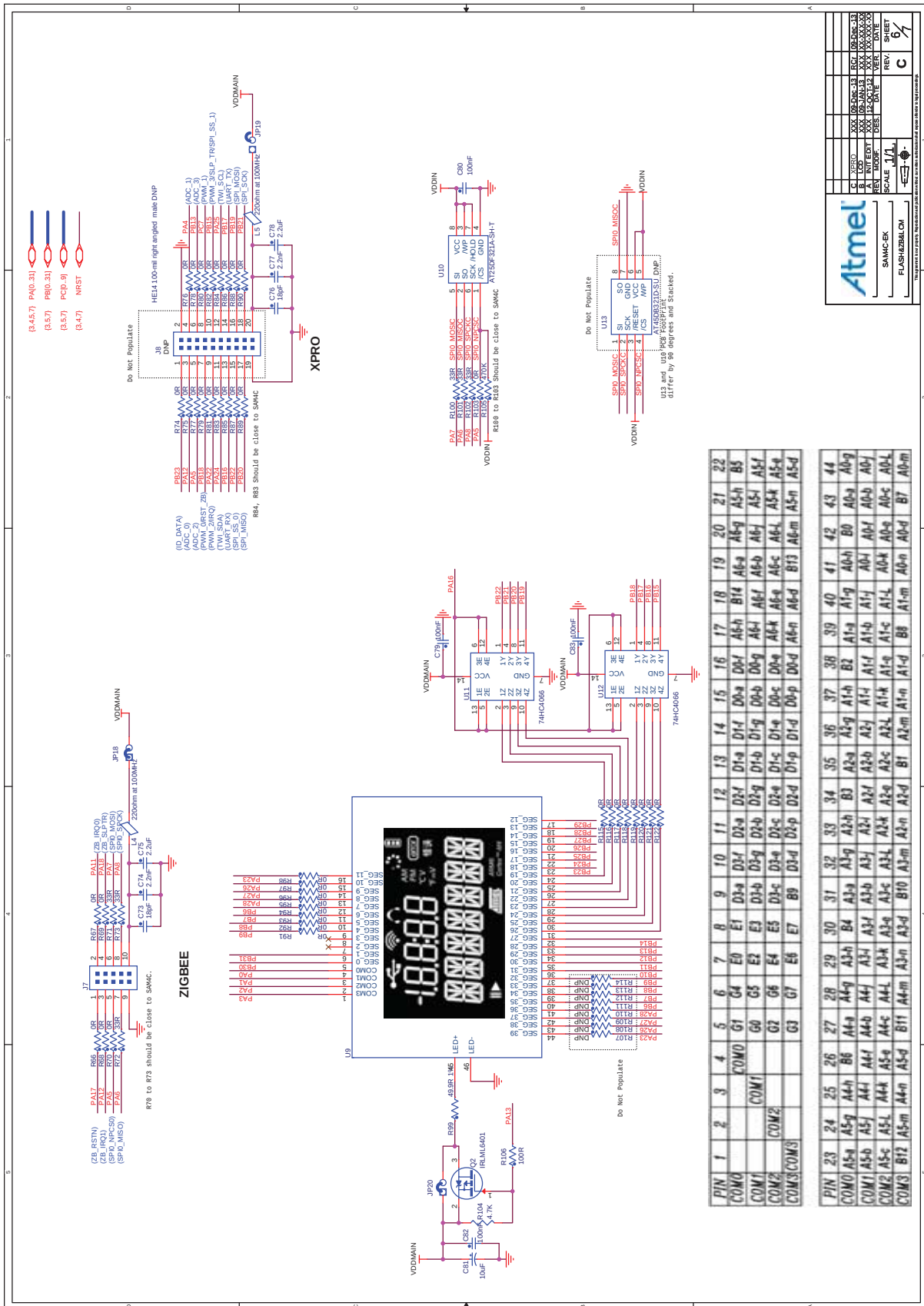
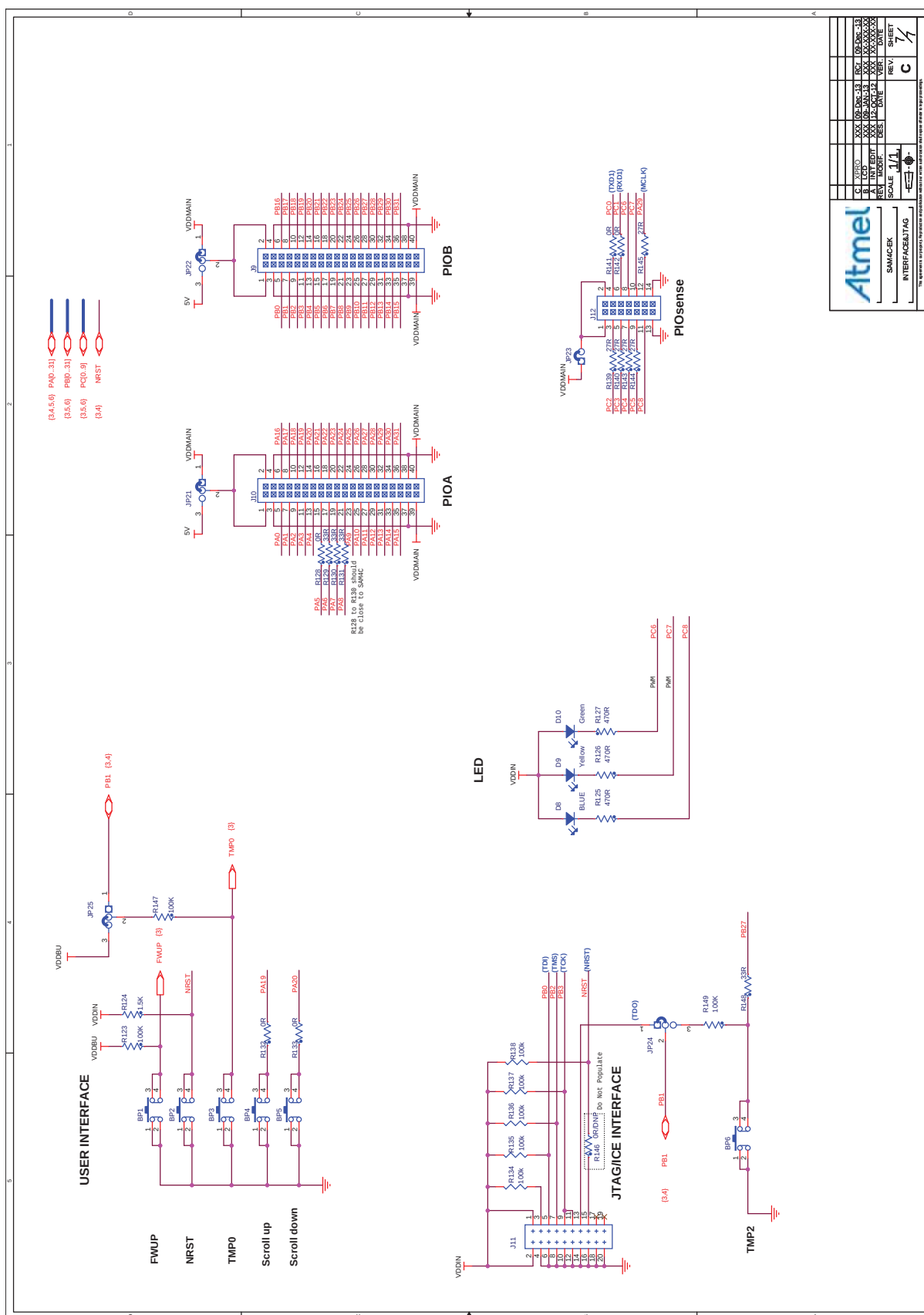


Figure 5-6. ATSAM4C-EK Schematic (Page 6 of 7)



**Figure 5-7. ATSAM4C-EK Schematic (Page 7 of 7)**

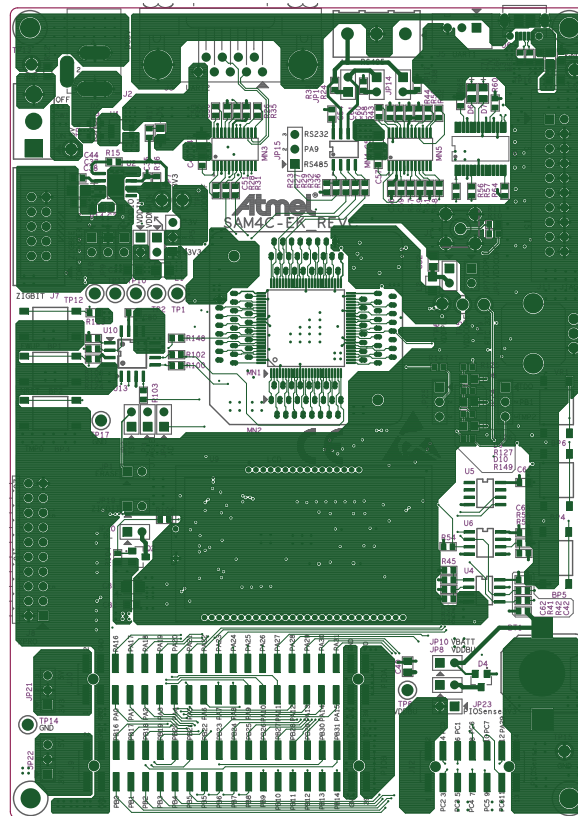


## 5.2 ATSAM4C-EK Layout

This section contains the layout graphics for the SAM4C Evaluation Kit (Rev. C).

- Layer 1: Top Layer ([Figure 5-8 on page 45](#))
- Layer 2: Ground Layer ([Figure 5-9 on page 46](#))
- Layer 3: Internal Signals 1 ([Figure 5-10 on page 47](#))
- Layer 4: Internal Signals 2 ([Figure 5-11 on page 48](#))
- Layer 5: Power Supplies ([Figure 5-12 on page 49](#))
- Layer 6: Bottom Layer ([Figure 5-13 on page 50](#))
- TOP Components Placement ([Figure 5-14 on page 51](#))
- BOTTOM Components Placement ([Figure 5-15 on page 52](#))

**Figure 5-8. ATSAM4C-EK Layout: Top Layer**



**Figure 5-9. ATSAM4C-EK Layout: Ground Layer**

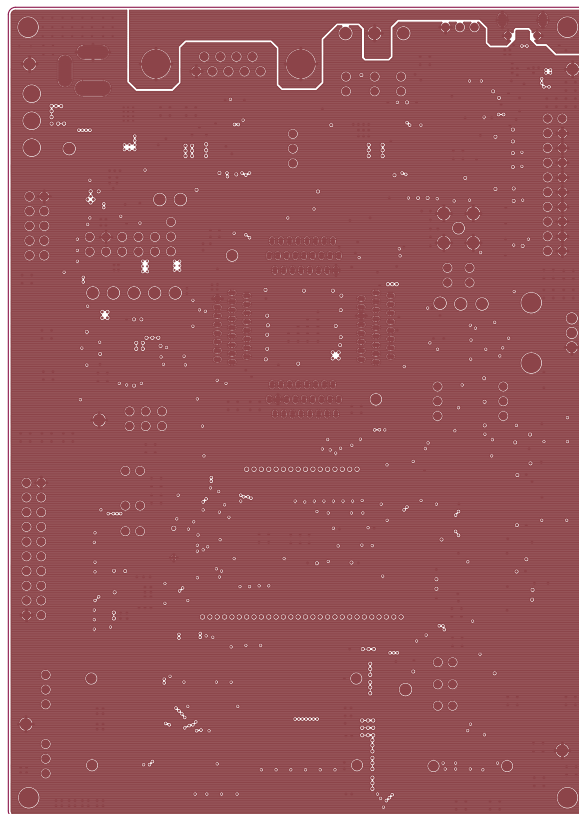
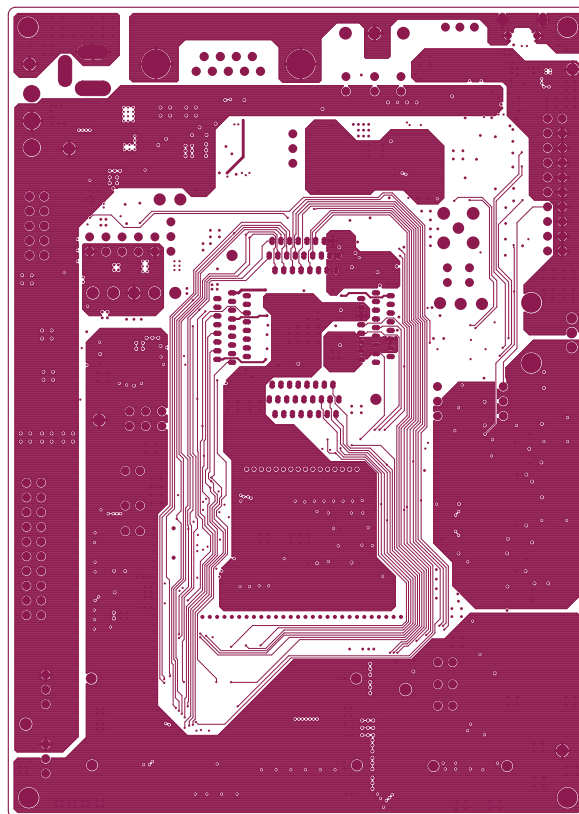
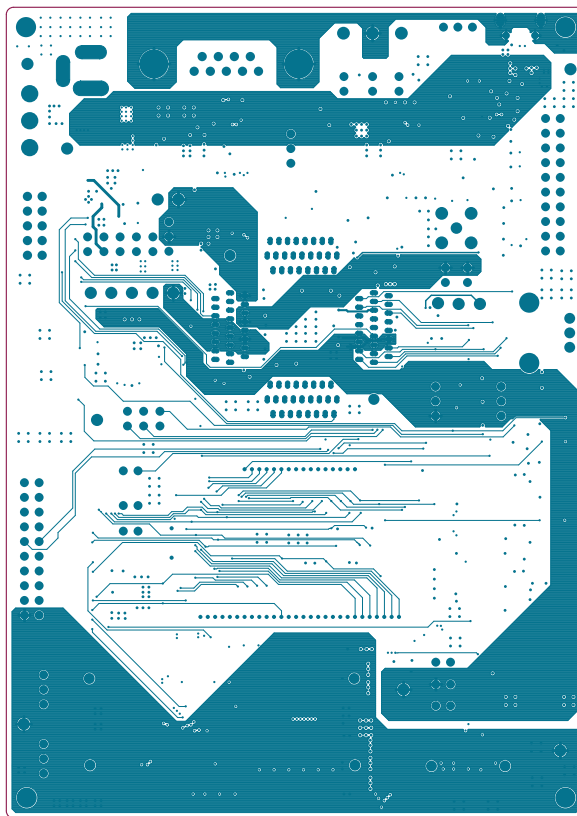


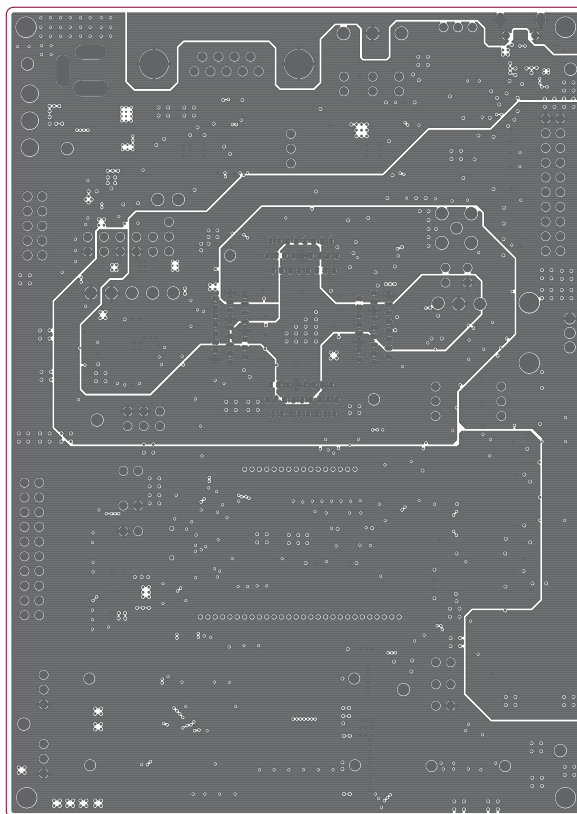
Figure 5-10. ATSAM4C-EK Layout: Internal Signals 1 Layer



**Figure 5-11. ATSAM4C-EK Layout: Internal Signals 2 Layer**



**Figure 5-12. ATSAM4C-EK Layout: Power Supplies Layer**



**Figure 5-13. ATSAM4C-EK Layout: Bottom Layer**

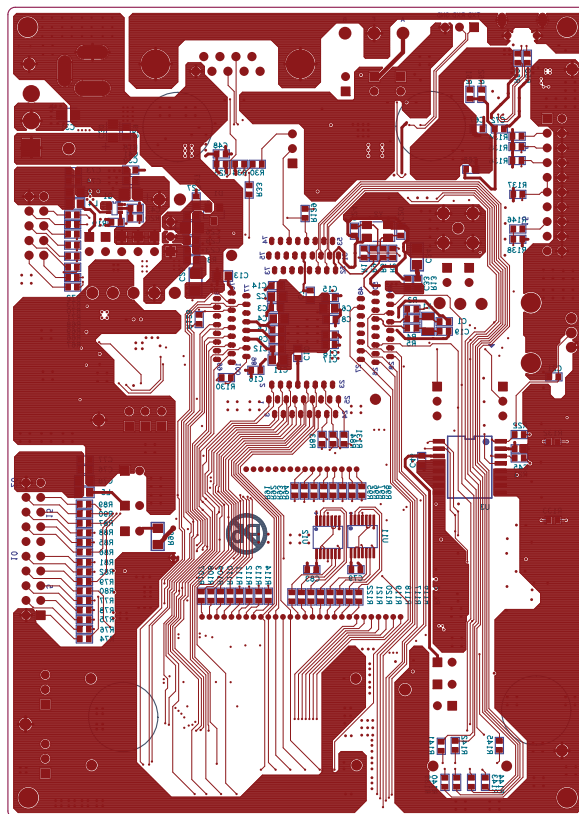


Figure 5-14. ATSAM4C-EK Layout: TOP Components Placement

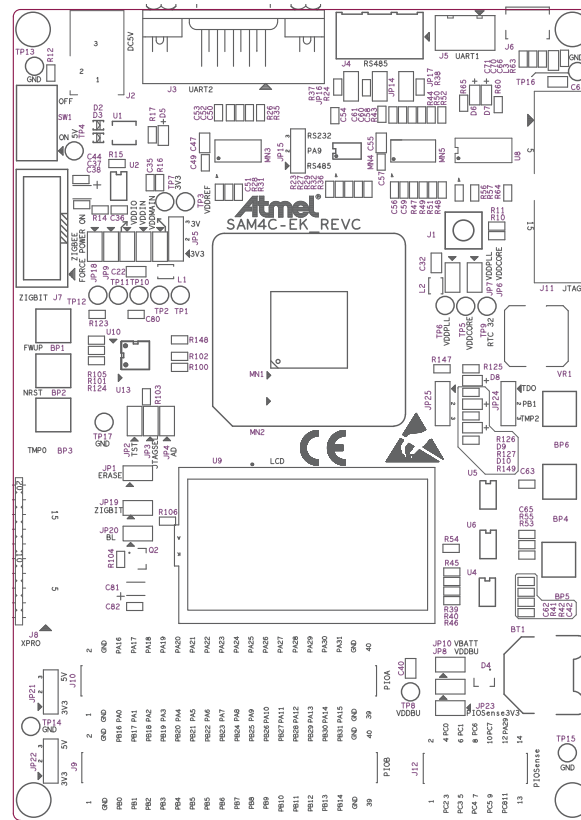
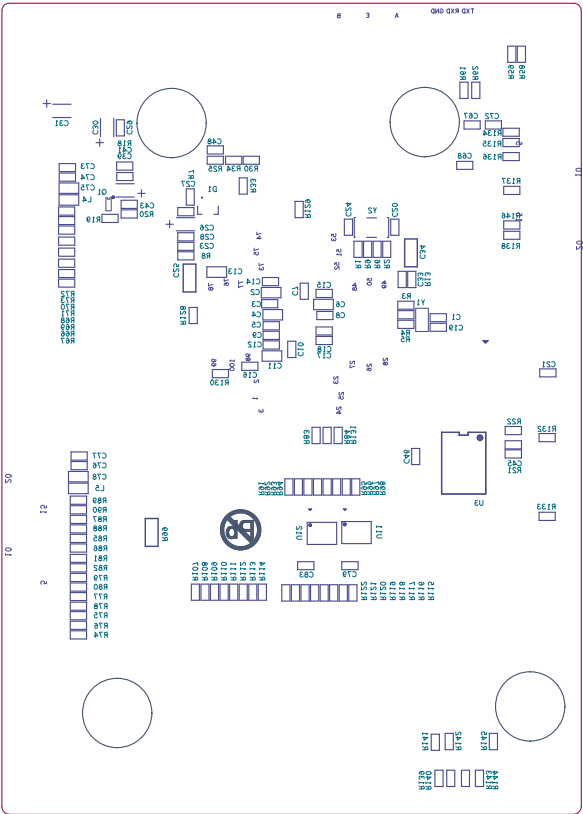


Figure 5-15. ATSAM4C-EK Layout: BOTTOM Components Placement



## 6. Revision History

Table 6-1. Revision History

| Doc. Rev. | Date        | Changes     |
|-----------|-------------|-------------|
| A         | 16-Dec-2013 | First issue |



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