



32-bit **AVR**<sup>®</sup>  
Microcontrollers

Application Note

# AVR32918: UC3-A3 XPLAINED Hardware User's Guide

## Features

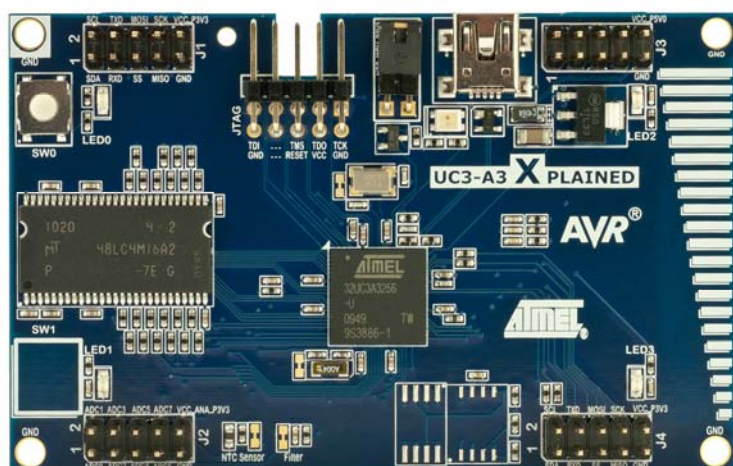
- Atmel<sup>®</sup> AT32UC3A3256 microcontroller
- 64Mbit SDRAM
- Analog input (to ADC)
  - Temperature sensor
  - RC filter
- I/O
  - One mechanical button
  - Four LEDs
  - Four expansion headers
- Footprints for external memory
  - Atmel AT45DB series DataFlash<sup>®</sup> serial flash
  - Atmel AT25DF series industry standard serial flash
- Touch
  - One Atmel QTouch<sup>®</sup> slider
  - One Atmel QTouch button

## 1 Introduction

The Atmel UC3-A3 XPLAINED evaluation kit is a hardware platform to evaluate the Atmel AT32UC3A3256 microcontroller.

The kit offers a large range of features that enables the Atmel AVR<sup>®</sup> UC3 user to get started using UC3 peripherals right away and understand how to integrate the UC3 device in their own design.

**Figure 1-1.** UC3-A3 XPLAINED evaluation kit.



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## 2 Related items

**Atmel AVR32 Studio®** (free Atmel 32-bit IDE)

[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=4116](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=4116)

**Atmel AVR JTAGICE mkII** (on-chip programming and debugging tool)

[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=3353](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=3353)

**Atmel AVR ONE!** (on-chip programming and debugging tool)

[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=4279](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=4279)

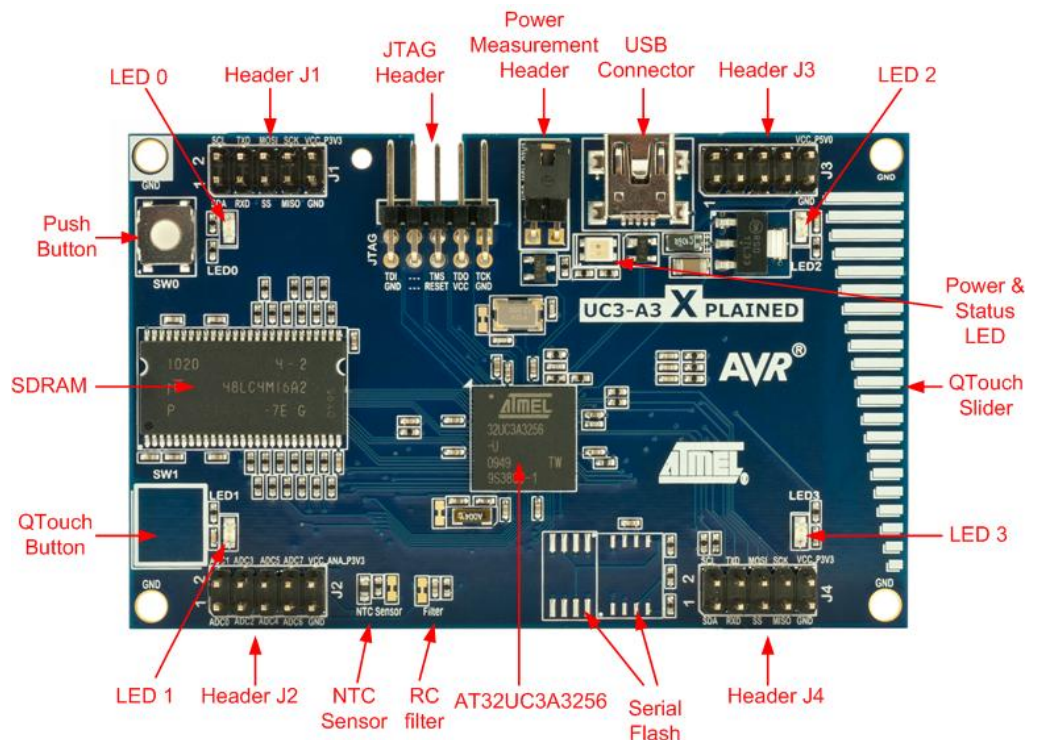
**Atmel AVR Software Framework (ASF)**

<http://asf.atmel.no/selector/show.php?device=uc3&store=app>

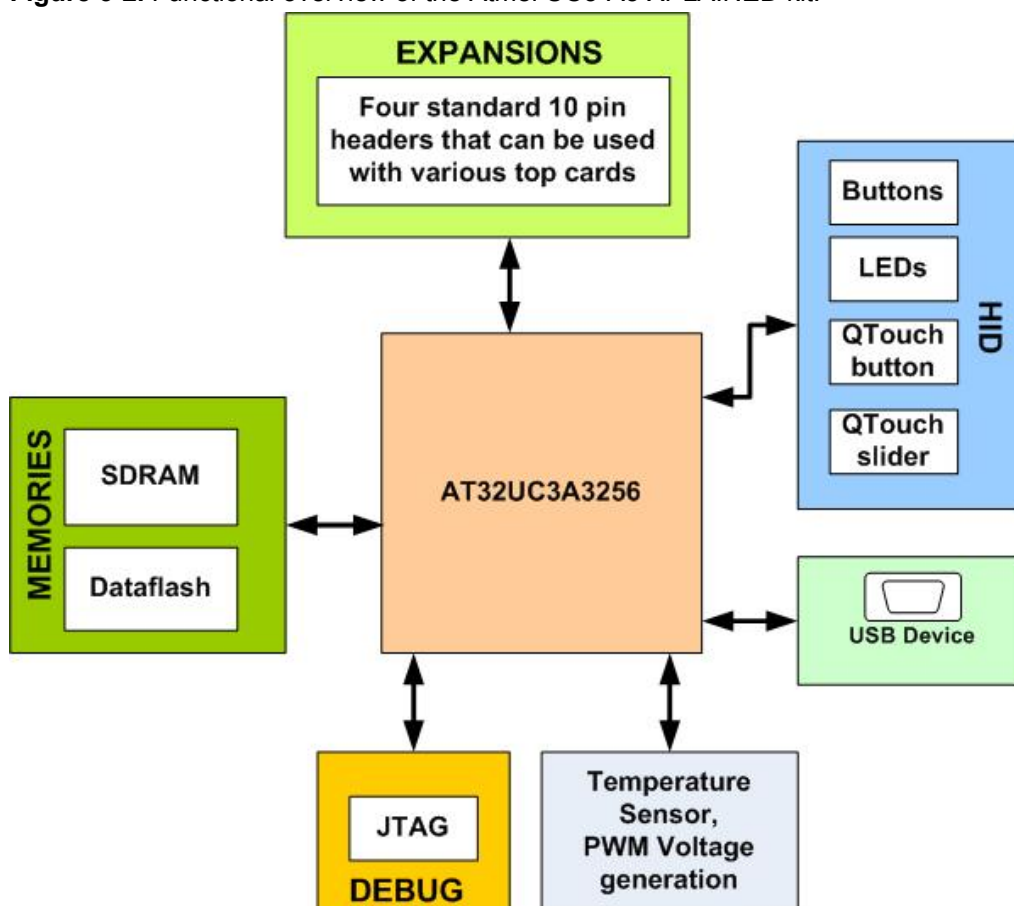
## 3 General information

The Atmel UC3-A3 XPLAINED kit is intended to demonstrate the Atmel AT32UC3A3256 microcontroller. Figure 3-1 shows the available feature on the board.

**Figure 3-1.** Overview of the UC3-A3 XPLAINED kit.



**Figure 3-2.** Functional overview of the Atmel UC3-A3 XPLAINED kit.



## 3.1 Preprogrammed firmware

The Atmel AT32UC3A3256 on the Atmel UC3-A3 XPLAINED kit is preprogrammed with a USB bootloader and a default firmware. The preprogrammed firmware in the AT32UC3A3256 is a simple demonstration of the QTouch button and QTouch slider.

## 3.2 Power supply

The kit needs an external power supply that can deliver 5V and up to 500mA. The actual current requirement for the board is much less than 500mA but in order to be able to power possible expansion boards this margin is needed.

The power can be applied to the board either via the USB connector or on pin 10 on the header J3. The USB connector is the preferred input because then it is possible to connect expansion boards on top of the J3 header.

The 5V is regulated down to 3.3V with an on board LDO regulator, which provides power to the entire board. Expansion top boards that require 5V will get this from the header J3 pin 10.

## 3.3 Measuring the AT32UC3A3256 power consumption

As part of an evaluation of the AT32UC3A3256, it can be of interest to measure its power consumption. The two-pin header with a jumper mounted on it is the only



connection between the common power plane VCC\_P3V3 and the VCC\_MCU\_P3V3 power plane. By replacing the jumper with an amperemeter it is possible to determine the current consumption of the Atmel AT32UC3A3256. To locate the power measurement header, please refer to [Figure 3-1](#).

## WARNING

*Do not power the board without having the jumper or an amperemeter mounted. Otherwise, the device may be damaged.*

## 3.4 Programming the kit

The kit can be programmed either from an external programming tool or through a USB bootloader which is pre-programmed on the device.

The bootloader is evoked by pushing the push button (SW0) during power-on. I.e. push button and then connect an USB cable to the kit. Programming can be performed through the DFU target (bootloader programmer target) in the Atmel AVR32 Studio.

How a programmer can be connected to the kit is described in Chapter [4.1](#).

## 4 Connectors

The Atmel UC3-A3 XPLAINED kit has five 10-pin, 100mil headers. Two headers have a fixed communication interface (J1 and J4). One header has analog functionality (J2), and the last header (J3) has general purpose digital I/O.

The 90° angled header is the JTAG programming and debugging header for the AT32UC3A3256.

For the location of the respective headers, refer to [Figure 3-1](#).

## 4.1 Programming header

The AT32UC3A3256 can be programmed and debugged by connecting an external programming/debugging tool to the JTAG header. The header has a standard JTAG programmer pinout (refer to online help in AVR32 Studio), and tools such as JTAGICE mkII or AVR ONE! can thus be connected directly to the header.

NOTE

The grey female 10-pin header on JTAGICE mkII has to be used when connecting to the kit. A scoring in the board is made to fit the orientation tab on the header.

NOTE

A standoff adapter (no. 1) is needed when using AVR ONE!.

NOTE

Pin 1 on the JTAG header is at the top right corner and is marked with a square pad.

**Table 4-1.** UC3 programming and debugging interface – JTAG.

Pin	JTAG <sup>(1)</sup>
1	TCK
2	GND
3	TDO
4	VCC
5	TMS
6	nSRST
7	-
8	-

Pin	JTAG <sup>(1)</sup>
9	TDI
10	GND

Note: 1. Standard pinout for JTAGICE mkII and other Atmel programming tools.

## 4.2 I/O expansion headers

There are four available I/O expansion headers on the kit. Some pins have shared functionality with onboard functionality. If “clean” expansion ports are needed, there are available cut-straps on some of the ADC inputs to remove onboard functionality. [Table 4-2](#) to [Table 4-5](#) show what is shared on the header pins.

**Table 4-2.** UC3 I/O expansion header – J1.

Pin	J1	UC3 pin	Shared with onboard functionality
1	TWI0 SDA	PA25	-
2	TWI0 SCL	PA26	-
3	USART3 RXD	PX57	-
4	USART3 TXD	PX58	-
5	SPI1 CS0	PB09	-
6	SPI1 MOSI	PB10	-
7	SPI1 MISO	PB08	-
8	SPI1 SCK	PB07	-
9	GND	-	-
10	VCC_P3V3	-	-

**Table 4-3.** UC3 I/O expansion header – J2.

Pin	J2	UC3 pin	Shared with onboard functionality
1	ADC0 <sup>(1)</sup>	PA21	RC filter output
2	ADC1 <sup>(1)</sup>	PA22	NTC
3	ADC2	PA23	-
4	ADC3	PA24	-
5	ADC4	PA20	-
6	ADC5	PA19	-
7	ADC6	PA18	-
8	ADC7	PA17	-
9	GND	-	-
10	VCC_ANA_P3V3	-	-

Note: 1. ADC channels can be disconnected from onboard functions by cutting the available cut-straps on the bottom side of the board.



**Table 4-4.** UC3 I/O expansion header – J3.

Pin	J3	UC3 pin	Shared with onboard functionality
1	GPIO0	PA31	-
2	GPIO1	PA30	-
3	GPIO2	PA29	-
4	GPIO3	PA28	-
5	GPIO4	PA27	-
6	GPIO5	PB00	-
7	GPIO6	PB04	-
8	GPIO7	PX19	-
9	GND	-	-
10	VCC_P5V0 <sup>(1)</sup>	-	-

Note: 1. The VCC pin on this header has 5V and is connected to the USB power.

**Table 4-5.** UC3 I/O expansion header – J4.

Pin	J4	UC3 pin	Shared with onboard functionality
1	TWI1 SDA	PA15	USART1 CTS
2	TWI1 SCL	PA14	USART1 RTS
3	USART1 RXD	PA05	-
4	USART1 TXD	PA06	-
5	SPI0 CS3	PA07	-
6	SPI0 MOSI	PA10	Serial flash/DataFlash
7	SPI0 MISO	PA11	Serial flash/DataFlash
8	SPI0 SCK	PA08	Serial flash/DataFlash
9	GND	-	-
10	VCC_P3V3	-	-

## 5 Memories

The Atmel UC3-A3 XPLAINED has an external SDRAM memory mounted on the board. There are also footprints available for adding either an industrial standard or a proprietary Atmel DataFlash serial flash.

### NOTE

The footprints share the same SPI lines including the chip select, and so it is not possible to mount a device on both footprints at the same time.

**Table 5-1.** Compatible devices for the footprints.

Atmel AT45DB	Atmel AT25DF
AT45DB64D2-CNU	AT25DF641A-SH
AT45DB321D-MWU	AT25DF321A-SH
AT45DB161D-SS	AT25DF161-SH
AT45DB081D-SS	AT25DF081-SSH
AT45DB041D-SS	AT25DF021-SSH
AT45DB021D-SS	
AT45DB011D-SS	



## 6 Miscellaneous I/O

### 6.1 Mechanical button

The board is equipped with one mechanical button. Because the button is used to enter bootloader mode it has a pull-up mounted, this means it is not necessary to use the pull-up in the UC3 to detect the status of the button.

### 6.2 LEDs

The Atmel UC3-A3 XPLAINED has four yellow LEDs which are connected to the Atmel AT32UC3A3256 and all of them are active low.

One dual LED is mounted near the USB connector. It has one green LED which is used to indicate power and one red LED that can be used for other purposes. The green LED will be active when power is applied to the board but it can be disabled by software from the AT32UC3A3256 device if needed. The red LED is active low and the green LED is active high.

### 6.3 Analog I/O

A RC filter and a NTC temperature sensor are connected to ADC0 and ADC1 respectively. These analog sensors are used as input to the ADC but it is also possible to disconnect them by cutting the cut-straps on the bottom side of the board.

The RC filter (1. order low-pass) has an approximate 3dB cut-off frequency of 159Hz. The input to the RC filter is one of the UC3 GPIO pins that can be configured to output a PWM signal to the RC filter. This can be used to generate a DC voltage on the output of the RC filter which can be measured on the ADC. As this is a 1. order filter, the ripple on the DC voltage is proportional to the input frequency. A higher input frequency will give lower ripple on the output.

### 6.4 Touch

The UC3-A3 XPLAINED kit has one QTouch button and one QTouch slider; both are connected to GPIO pins on the AT32UC3A3256.

**Table 6-1.** UC3 touch connections.

Touch sensor onboard reference	QTouch method pin name	UC3 GPIO pin
CH1	SNSK1	98
CH1	SNS1	99
CH2	SNSK2	100
CH2	SNS2	101
CH3	SNSK3	102
CH3	SNS3	103
CH4	SNSK4	104
CH4	SNS4	105



## **7 Included code example**

The example application is based on the Atmel AVR Software Framework found online at <http://asf.atmel.no>. For documentation, help and examples on the drivers used, please take a look at the website.

### **7.1 Compiling and running**

The code examples that can be found in ASF can be compiled by running make on the makefile included in the project or by opening up the project in IAR™ and compiling the project within IAR.



## 8 Revision history

To identify the revision of the Atmel UC3-A3 XPLAINED kit, locate the bar-code sticker on the back side of the board. The first line on the sticker shows the product ID and the revision. For example "A09-1053/10" can be resolved to ID=A09-1053 and revision=10.

### 8.1 Revision 10

Revision 10 of the UC3-A3 XPLAINED kit is the initially released version. This revision of the kit has the following product ID: A09-1053/10.

## **9 EVALUATION BOARD/KIT IMPORTANT NOTICE**

This evaluation board/kit is intended for use for **FURTHER ENGINEERING, DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY**. It is not a finished product, and may not (yet) comply with some or any technical or legal requirements that are applicable to finished products, including, without limitation, directives regarding electromagnetic compatibility, recycling (WEEE), FCC, CE, or UL (except as may be otherwise noted on the board/kit). Atmel supplied this board/kit "AS IS," without any warranties, with all faults, at the buyer's and further users' sole risk. The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies Atmel from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge and any other technical or legal concerns.

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