



Atmel AVR32926: UC3-C2 Xplained Hardware User's Guide

Features

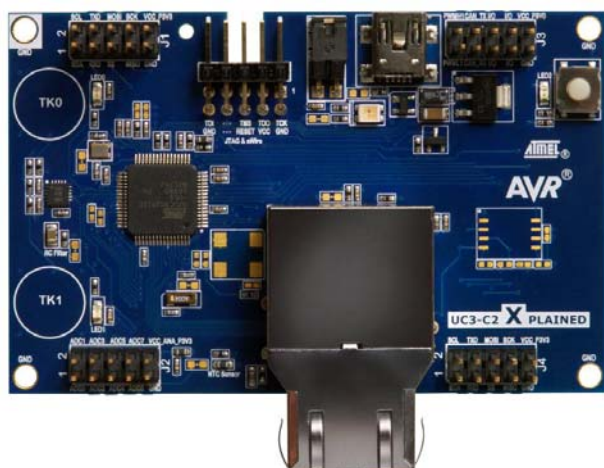
- Atmel® AT32UC3C2512 microcontroller
- Ethernet
 - RJ45 connector with built-in magnetics and PHY chip (RTL8201)
- Analog input (to ADC)
 - Temperature sensor
 - RC filter
- I/O
 - One microswitch button
 - Three LEDs
 - Four expansion headers
- Footprints for external memory
 - AT45DB series DataFlash® serial flash
- Touch
 - Two Atmel QTouch® buttons

1 Introduction

The Atmel AVR® UC3-C2 Xplained evaluation kit is a hardware platform to evaluate the AT32UC3C2512.

The kit offers a larger range of features that enables the UC3 user to get started using the UC3's peripherals right away and to get an understanding of how to integrate the UC3 in their own design.

Figure 1-1. UC3-C2 Xplained evaluation kit.



Rev. 32175A-AVR-10/11





2 Related items

Atmel AVR Studio® 5 (free Atmel AVR IDE)

http://www.atmel.com/microsite/avr_studio_5/default.asp?source=redirect

Atmel AVR32 Studio (free Atmel 32-bit IDE)

http://www.atmel.com/dyn/products/tools_card.asp?tool_id=4116

Atmel AVR JTAGICE 3 (On-chip programming and debugging tool)

http://www.atmel.com/dyn/products/tools_card.asp?tool_id=17213

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

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

Atmel AVR Software Framework (ASF)

<http://atmel.com/asf>

3 General information

The Atmel AVR UC3-C2 Xplained kit is intended to demonstrate the Atmel AT32UC3C2512 microcontroller. [Figure 3-1](#) shows the available features on the board.

Figure 3-1. Overview of the UC3-C2 Xplained kit.

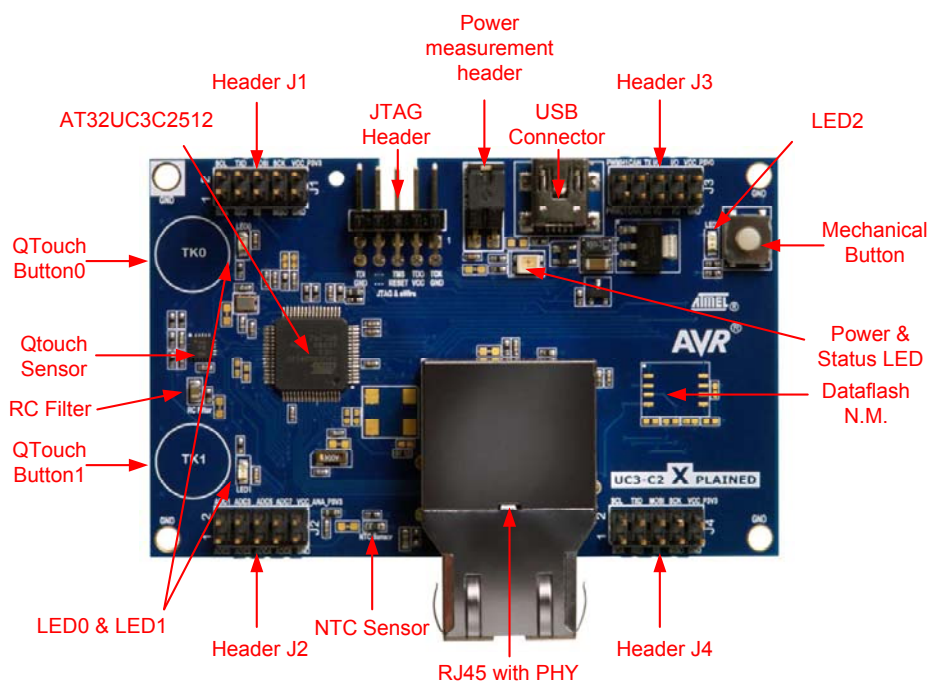
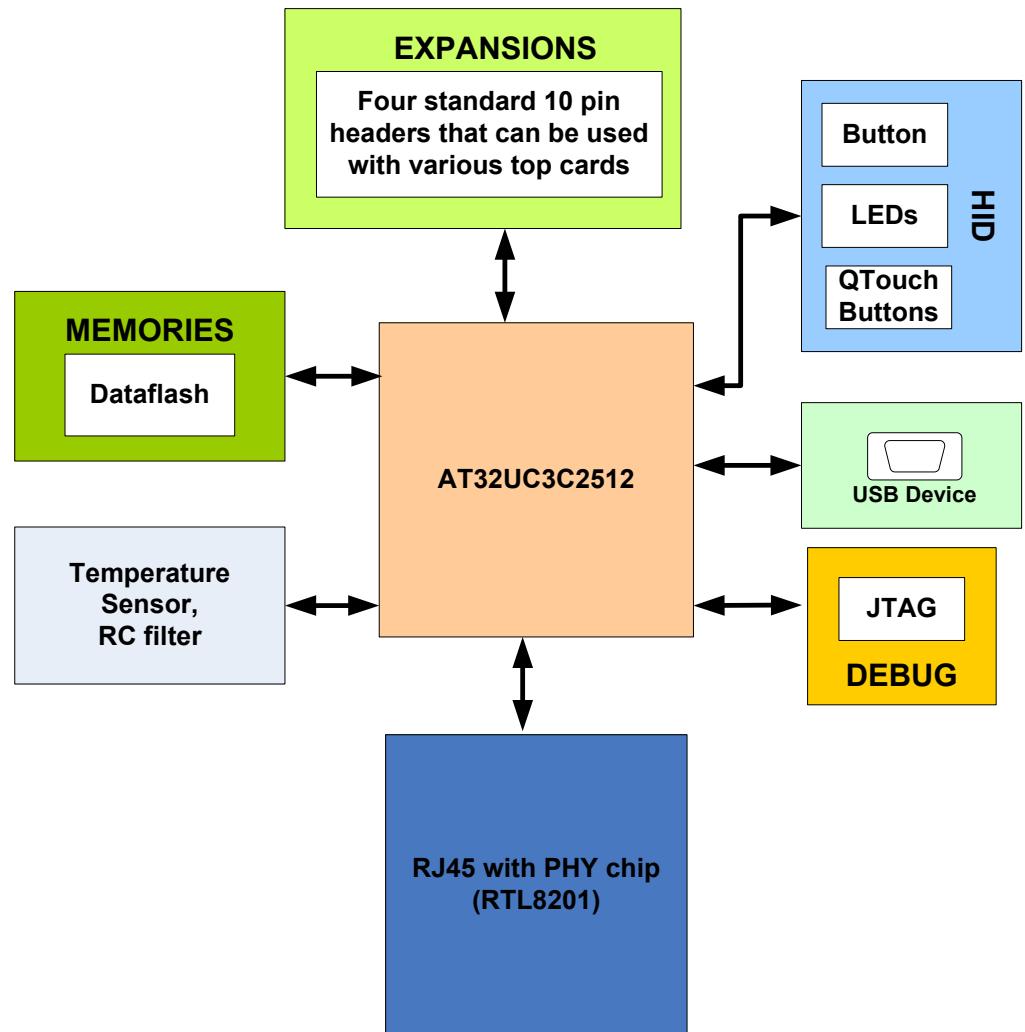


Figure 3-2. Functional overview of the Atmel AVR UC3-C2 Xplained kit.



3.1 Preprogrammed firmware

The Atmel AT32UC3C2512 on the UC3-C2 Xplained kit is preprogrammed with a USB bootloader and a default firmware. The preprogrammed firmware in the AT32UC3C2512 is a simple demonstration of the “lightweight IP” (LwIP) open source TCP/IP protocol stack, which is responsible for configuring the hardware ethernet and other service. It also maintains the LwIP timers and processes any packets that are received.

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 Atmel AT32UC3C2512 power consumption

As part of an evaluation of the AT32UC3C2512 it can be of interest to measure its power consumption. The 2-pin header with a jumper mounted is the only connection between the common power plane VCC_P3V3 and the VCC_MCU_P3V3 power plane. By replacing the jumper with an ampere meter it is possible to determine the current consumption of the AT32UC3C2512. To locate the power measurement header, please refer to [Figure 3-1](#).

WARNING

Do not power the board without having the jumper or an ampere meter mounted. Otherwise the device might be damaged.

3.4 Programming the AT32UC3C2512 through the USB gateway

The AT32UC3C2512 can be programmed either from an external programming tool or through a USB bootloader which is preprogrammed on the kit.

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 (boot loader programmer target) in Atmel AVR32 Studio.



4 Connectors

The Atmel AVR UC3-C2 Xplained kit has five 10-pin 100mill headers. Two headers have a fixed communication interface (J1 & 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 Atmel AT32UC3C2512.

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

4.1 Programming headers

The AT32UC3C2512 can be programmed and debugged by connecting an external programming/debugging tool to the “JTAG” pin header. The pin header has a standard JTAG programmer pin out (refer to online help in the Atmel AVR Studio), and Atmel tools such as the JTAGICE mkII or the 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 ⁽¹⁾
1	TCK
2	GND
3	TDO
4	VCC
5	TMS
6	nSRST
7	-
8	-
9	TDI
10	GND

Note: 1. Standard pin-out 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 on board 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](#) shows what is shared on the respective header pins.

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

Pin	J1	UC3 pin	Shared with onboard functionality
1	TWI SDA	PC02	Ethernet(MDC)
2	TWI SCL	PC03	Ethernet(MDIO)

Pin	J1	UC3 pin	Shared with onboard functionality
3	UART RX	PD12	Ethernet(TXD1)
4	UART TX	PD11	Ethernet(TXD0)
5	SPI CS1	PD30	Ethernet(TXEN)
6	SPI MOSI	PD27	Ethernet(RXER)
7	SPI MISO	PD28	Ethernet(RXDV)
8	SPI SCK ⁽¹⁾	PD29	Ethernet(TXCLK)
9	GND	-	-
10	VCC_P3V3	-	-

Note: 1. The SPI SCK shared with Ethernet reference clock, can be connected from onboard function by mounted zero resistor on the top side of the board.

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

Pin	J2	UC3 pin	Shared with onboard functionality
1	ADC0	PA19	
2	ADC1 ⁽¹⁾	PA22	RC filter output
3	ADC2	PA20	
4	ADC3	PA21	
5	ADC4 ⁽¹⁾	PA06	NTC
6	ADC5	PA07	
7	ADC6 ⁽¹⁾	PA08	Double LED (red)
8	ADC7 ⁽¹⁾	PA09	Ethernet(Reset)
9	GND	-	-
10	VCC_ANA_P3V3	-	-

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

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

Pin	J3	UC3 pin	Shared with onboard functionality
1	PWM0	PC15	LED, QTouch Key0
2	PWM1	PC16	DataFlash(CS)
3	CAN-RX	PC21	
4	CAN-TX	PC22	
5	GPIO	PD13	Ethernet(RXD0)
6	GPIO	PD14	Ethernet(RXD1)
7	GPIO ⁽¹⁾	PD21	LED2, mechanical button
8	GPIO	PA23	LED1, QTouch Key1
9	GND	-	-
10	VCC_P5V0 ⁽²⁾	-	-

Notes: 1. Mechanical button and LED0 is sharing I/O. Use input with pull-up to turn off LED, and output low to turn on LED.

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



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

Pin	J4	UC3 pin	Shared with onboard functionality
1	TWI SDA	PC04	
2	TWI SCL	PC05	
3	UART RX	PC18	
4	UART TX	PC17	
5	SPI CS4	PD03	
6	SPI MOSI	PD00	DataFlash
7	SPI MISO	PD01	DataFlash
8	SPI SCK	PD02	DataFlash
9	GND	-	-
10	VCC_P3V3	-	-

Note: 1. The header support Atmel 10-pin WLESS module.

5 Memories

The Atmel AVR UC3-C2 Xplained does not have any external memories mounted on the board. Footprints are available for adding either an industrial standard or an Atmel proprietary serial DataFlash.

Table 5-1. Compatible devices for the footprints.

AT45DB
AT45DB64D2-CNU
AT45DB321D-MWU
AT45DB161D-SS
AT45DB081D-SS
AT45DB041D-SS
AT45DB021D-SS
AT45DB011D-SS



6 Ethernet

The Atmel AVR UC3-C2 Xplained has an RJ45 connector with built-in PHY chip RTL8201 and magnetics mounted on the board. The Atmel AT32UC3C2512 connects to the physical chip via RMII interface. The RJ45 connector is able to provide the reference clock for the data transmission and it is therefore not necessary to provide this clock. Nevertheless there is also a footprint available that makes it possible to add an oscillator for the reference clock.

7 Miscellaneous I/O

7.1 Microswitch button

The board is equipped with one mechanical button. The button is shared with LED2 and onboard protection circuitry is added to avoid a short when driving the port high at the same time as pushing the button, which will short it to ground. If it is necessary to use both button and LED, time multiplexing has to be used.

To be able to detect a button press, the firmware has to periodically set the I/O pin to input with pull-up and check if it is low. When doing this fast enough, the human eye will not see any change on the LED.

7.2 LEDs

The Atmel AVR UC3-C2 Xplained has three LEDs mounted onboard, which are connected to the Atmel AT32UC3C2512. These are three standard yellow LEDs and all of them are active low.

LED0 and LED1 are shared with the Atmel QTouch sensor output. When pressing the QTouch button (TK0 or TK1), the LEDs are switched on even though the AT32UC3C2512 tries to turn the LEDs off.

LED2 is shared with the micro switch button. When turning the LED on, set the I/O pin to output low. When turning the LED off, set the I/O pin as input with pull-up. The protection circuitry added to the button will make the LED shine brighter when the button is pressed and the LED is turned on. When the LED is off, any button press will light up the LED.

One dual LED is mounted near the USB connector. It has one green LED which is used to indicate power and one red LED 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 AT32UC3C2512 device if needed. The red LED is active low and the green LED is active high.

7.3 Analog I/O

An RC filter and an NTC are connected to ADC2 and ADC5 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 top side of the board.

The RC filter (1st order low-pass) has an approximate 3dB cut-off frequency of 159Hz. The input to the RC filter is one of the GPIO pins on the Atmel AVR UC3 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 1st 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.

7.4 Touch

The UC3-C2 Xplained kit has two QTouch buttons which are connected to the QTouch sensor Atmel AT42QT1040, and the button outputs of QTouch sensor are connected to the GPIO pins on the AT32UC3C2512.



8 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.

8.1 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 compile the project within IAR.

9 Revision history

To identify the revision of the Atmel AVR UC3-C2 Xplained kit locates 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 “A09-1108/4” can be resolved to ID=A09-1108 and revision = 4.

9.1 Revision 4

Revision of the UC3-C2 Xplained kit is the initially released version. This revision of the kit has the following product ID: A09-1108/4.



10 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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Mailing Address: Atmel Corporation, 2325 Orchard Parkway, San Jose, CA 95131.

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Atmel Corporation
2325 Orchard Parkway
San Jose, CA 95131
USA
Tel: (+1)(408) 441-0311
Fax: (+1)(408) 487-2600
www.atmel.com

Atmel Asia Limited
Unit 01-5 & 16, 19F
BEA Tower, Millennium City 5
418 Kwun Tong Road
Kwun Tong, Kowloon
HONG KONG
Tel: (+852) 2245-6100
Fax: (+852) 2722-1369

Atmel Munich GmbH
Business Campus
Parking 4
D-85748 Garching b. Munich
GERMANY
Tel: (+49) 89-31970-0
Fax: (+49) 89-3194621

Atmel Japan
16F, Shin Osaki Kangyo Bldg.
1-6-4 Osaki Shinagawa-ku
Tokyo 104-0032
JAPAN
Tel: (+81) 3-6417-0300
Fax: (+81) 3-6417-0370

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