Atmel AVR 8-bit Microcontroller

ATmega256RFR2 Xplained Pro

USER GUIDE

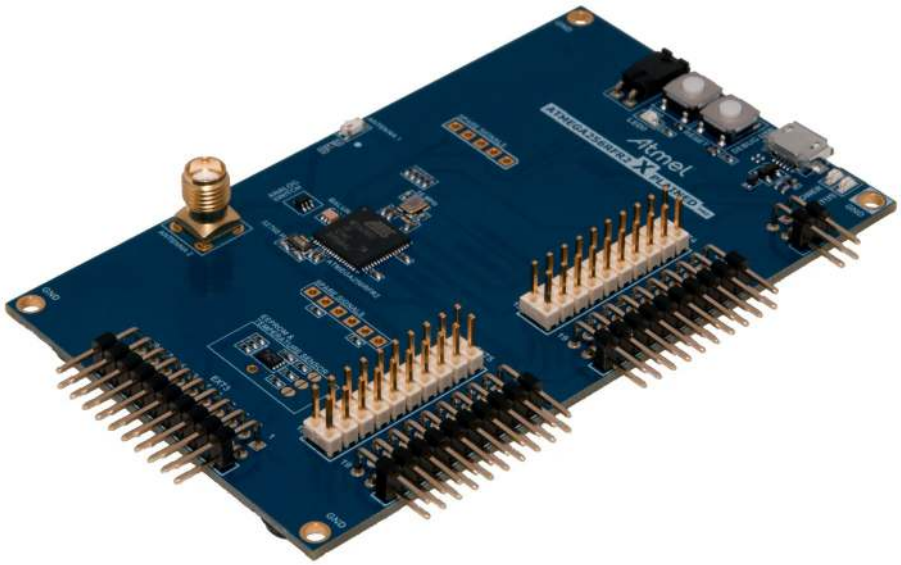
Introduction

The Atmel® ATMEGA256RFR2 Xplained Pro evaluation kit is a hardware platform to evaluate the ATmega256RFR2 microcontroller.

Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the Atmel ATmega256RFR2 and explains how to integrate the device in a customer design.

The Xplained Pro MCU series evaluation kits include an on-board Embedded Debugger, and no external tools are necessary to program or debug the ATmega256RFR2.

The Xplained Pro extension series evaluation kits offers additional peripherals to extend the features of the board and ease the development of customer designs.



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1. Introduction

1.1. Features

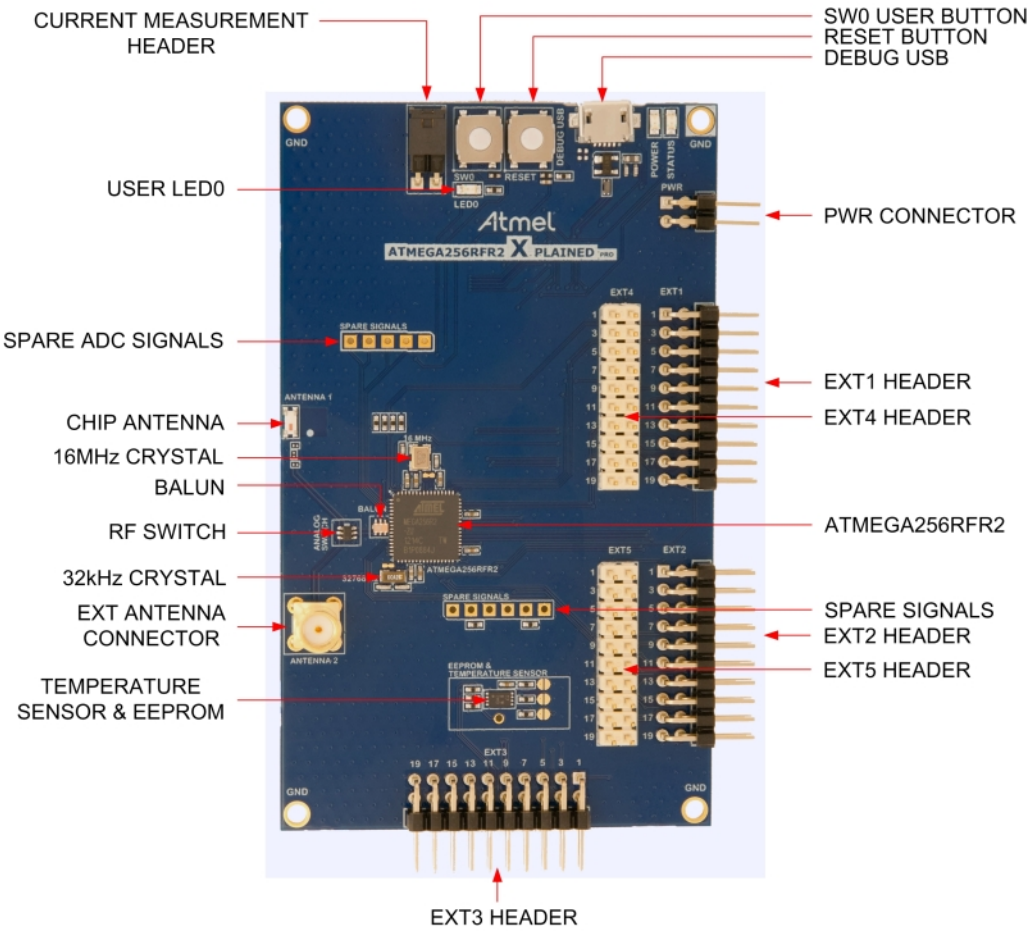
- Atmel® ATmega256RFR2 microcontroller
- Embedded Debugger (EDBG)
  - USB interface
  - Programming and debugging (target) through JTAG
  - Virtual COM-port interface to target via UART
  - Atmel Data Gateway Interface (DGI) to target via SPI or TWI
  - Four GPIOs connected to target for code instrumentation
- Digital I/O
  - Two mechanical buttons (user and reset button)
  - One user LED
  - Five extension headers
- Antenna
  - One ceramic chip antenna (2450BM15A0015E)
  - One SMA connector for external antenna
- Temperature sensor and EEPROM (AT30TSE758)
- Two possible power sources
  - External power
  - Embedded debugger USB
- 16MHz crystal
- 32kHz crystal

1.2. Kit Overview

The Atmel ATMEGA256RFR2 Xplained Pro evaluation kit is a hardware platform to evaluate the Atmel ATmega256RFR2.

The kit offers a set of features that enables the ATmega256RFR2 user to get started using the ATmega256RFR2 peripherals right away and to get an understanding of how to integrate the device in their own design.

Figure 1-1. ATMEGA256RFR2 Xplained Pro Evaluation Kit Overview



2. Getting Started

2.1. Xplained Pro Quick Start

Three steps to start exploring the Atmel Xplained Pro platform:

1. Download Atmel Studio.
2. Launch Atmel Studio.
3. Connect a USB cable (Standard-A to Micro-B or Micro-AB) between the PC and the DEBUG USB port on the kit.

When the Xplained Pro MCU kit is connected to your computer for the first time, the operating system will perform a driver software installation. The driver file supports both 32- and 64-bit versions of Microsoft® Windows® XP, Windows Vista®, Windows 7, and Windows 8.

Once the Xplained Pro MCU board is powered the green power LED will be lit and Atmel Studio will auto detect which Xplained Pro MCU- and extension board(s) are connected. Atmel Studio will present relevant information like datasheets and kit documentation. The kit landing page in Atmel Studio also has the option to launch Atmel Software Framework (ASF) example applications for the kit. The ATmega256RFR2 device is programmed and debugged by the on-board Embedded Debugger and therefore no external programmer or debugger tool is needed.

2.2. Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for the ATMEGA256RFR2 Xplained Pro.

- **Xplained Pro products** - Atmel Xplained Pro is a series of small-sized and easy-to-use evaluation kits for Atmel microcontrollers and other Atmel products. It consists of a series of low-cost MCU boards for evaluation and demonstration of features and capabilities of different MCU families.
- **Atmel Studio** - Free Atmel IDE for development of C/C++ and assembler code for Atmel microcontrollers.
- **Atmel sample store** - Atmel sample store where you can order samples of devices.
- **EDBG User Guide** - User guide containing more information about the on-board Embedded Debugger.
- **IAR Embedded Workbench® for Atmel AVR®** - This is a commercial C/C++ compiler that is available for 8-bit AVR. There is a 30 day evaluation version as well as a 4KB code size limited kick-start version available from their website.
- **Atmel Data Visualizer** - Atmel Data Visualizer is a program used for processing and visualizing data. Data Visualizer can receive data from various sources such as the Embedded Debugger Data Gateway Interface found on Xplained Pro boards and COM ports.
- **Design Documentation** - Package containing CAD source, schematics, BOM, assembly drawings, 3D plots, layer plots etc.
- **Hardware Users Guide in PDF format** - PDF version of this User Guide.
- **ATMEGA256RFR2 Xplained Pro on Atmel website** - Atmel website link.

3. Xplained Pro

Xplained Pro is an evaluation platform that provides the full Atmel microcontroller experience. The platform consists of a series of Microcontroller (MCU) boards and extension boards, which are integrated with Atmel Studio, have Atmel Software Framework (ASF) drivers and demo code, support data streaming, and more. Xplained Pro MCU boards support a wide range of Xplained Pro extension boards, which are connected through a set of standardized headers and connectors. Each extension board has an identification (ID) chip to uniquely identify which boards are connected to an Xplained Pro MCU board. This information is used to present relevant user guides, application notes, datasheets, and example code through Atmel Studio.

3.1. Embedded Debugger

The ATMEGA256RFR2 Xplained Pro contains the Atmel Embedded Debugger (EDBG) for on-board debugging. The EDBG is a composite USB device of three interfaces; a debugger, Virtual COM Port, and a Data Gateway Interface (DGI).

Together with Atmel Studio, the EDBG debugger interface can program and debug the ATmega256RFR2. On ATMEGA256RFR2 Xplained Pro, the JTAG interface is connected between the EDBG and the ATmega256RFR2.

The Virtual COM Port is connected to a UART on the ATmega256RFR2 and provides an easy way to communicate with the target application through terminal software. It offers variable baud rate, parity, and stop bit settings. Note that the settings on the ATmega256RFR2 must match the settings given in the terminal software.

Info: If not set automatically, data terminal ready (DTR) must be set in the terminal software.

The DGI consists of several physical interfaces for communication with the host computer. Communication over the interfaces is bidirectional. It can be used to send events and values from the ATmega256RFR2 or as a generic printf-style data channel. Traffic over the interfaces can be timestamped on the EDBG for more accurate tracing of events. Note that timestamping imposes an overhead that reduces maximal throughput. Atmel Data Visualizer is used to send and receive data through DGI.

The EDBG controls two LEDs on ATMEGA256RFR2 Xplained Pro; a power LED and a status LED. The table below shows how the LEDs are controlled in different operation modes.

Table 3-1. EDBG LED Control

Operation mode	Power LED	Status LED
Normal operation	Power LED is lit when power is applied to the board.	Activity indicator, LED flashes when any communication happens to the EDBG.
Bootloader mode (idle)	The power LED and the status LED blinks simultaneously.	
Bootloader mode (firmware upgrade)	The power LED and the status LED blinks in an alternating pattern.	

For further documentation on the EDBG, see the EDBG User Guide.

3.2. Hardware Identification System

All Xplained Pro compatible extension boards have an Atmel ATSHA204 CryptoAuthentication™ chip mounted. This chip contains information that identifies the extension with its name and some extra data. When an Xplained Pro extension is connected to an Xplained Pro MCU board the information is read and sent to Atmel Studio. The Atmel Kits extension, installed with Atmel Studio, will give relevant information, code examples, and links to relevant documents. The table below shows the data fields stored in the ID chip with example content.

Table 3-2. Xplained Pro ID Chip Content

Data field	Data type	Example content
Manufacturer	ASCII string	Atmel'\0'
Product Name	ASCII string	Segment LCD1 Xplained Pro'\0'
Product Revision	ASCII string	02'\0'
Product Serial Number	ASCII string	1774020200000010'\0'
Minimum Voltage [mV]	uint16_t	3000
Maximum Voltage [mV]	uint16_t	3600
Maximum Current [mA]	uint16_t	30

3.3. Power Sources

The ATMEGA256RFR2 Xplained Pro kit can be powered by several power sources as listed in the table below.

Table 3-3. Power Sources for ATMEGA256RFR2 Xplained Pro

Power input	Voltage requirements	Current requirements	Connector marking
External power	5V ±2% (±100mV) for USB host operation. 4.3V to 5.5V if USB host operation is not required.	Recommended minimum is 1A to be able to provide enough current for connected USB devices and the board itself. Recommended maximum is 2A due to the input protection maximum current specification.	PWR
Embedded debugger USB	4.4V to 5.25V (according to USB spec.)	500mA (according to USB spec.)	DEBUG USB

The kit will automatically detect which power sources are available and choose which one to use according to the following priority:

1. External power.
2. Embedded Debugger USB.

Info: External power is required when 500mA from a USB connector is not enough to power the board with possible extension boards.

3.4. Xplained Pro Headers and Connectors

3.4.1. Xplained Pro Standard Extension Header

All Xplained Pro kits have one or more dual row, 20-pin, 100mil extension header. Xplained Pro MCU boards have male headers, while Xplained Pro extensions have their female counterparts. Note that all pins are not always connected. All connected pins follow the defined pin-out description in the table below.

The extension headers can be used to connect a variety of Xplained Pro extensions to Xplained Pro MCU boards or to access the pins of the target MCU on Xplained Pro MCU boards directly.

Table 3-4. Xplained Pro Standard Extension Header

Pin number	Name	Description
1	ID	Communication line to the ID chip on an extension board
2	GND	Ground
3	ADC(+)	Analog to digital converter, alternatively positive part of differential ADC
4	ADC(-)	Analog to digital converter, alternatively negative part of differential ADC
5	GPIO1	General purpose I/O
6	GPIO2	General purpose I/O
7	PWM(+)	Pulse width modulation, alternatively positive part of differential PWM
8	PWM(-)	Pulse width modulation, alternatively negative part of differential PWM
9	IRQ/GPIO	Interrupt request line and/or general purpose I/O
10	SPI_SS_B/ GPIO	Slave select for SPI and/or general purpose I/O
11	I^2C_SDA	Data line for I^2C interface. Always implemented, bus type.
12	I^2C_SCL	Clock line for I^2C interface. Always implemented, bus type.
13	UART_RX	Receiver line of target device UART
14	UART_TX	Transmitter line of target device UART
15	SPI_SS_A	Slave select for SPI. Should preferably be unique.
16	SPI_MOSI	Master out slave in line of serial peripheral interface. Always implemented, bus type.

Pin number	Name	Description
17	SPI_MISO	Master in slave out line of serial peripheral interface. Always implemented, bus type.
18	SPI_SCK	Clock for serial peripheral interface. Always implemented, bus type.
19	GND	Ground
20	VCC	Power for extension board

3.4.2. Xplained Pro Power Header

The power header can be used to connect external power to the ATMEGA256RFR2 Xplained Pro kit. The kit will automatically detect and switch to any external power if supplied. The power header can also be used as supply for external peripherals or extension boards. Care must be taken not to exceed the total current limitation of the on-board regulator when using the 3.3V pin.

Table 3-5. Xplained Pro Power Header

Pin number	Pin name	Description
1	VEXT_P5V0	External 5V input
2	GND	Ground
3	VCC_P5V0	Unregulated 5V (output, derived from one of the input sources)
4	VCC_P3V3	Regulated 3.3V (output, used as main power supply for the kit)

4. Hardware User Guide

4.1. Connectors

This chapter describes the implementation of the relevant connectors and headers on ATMEGA256RFR2 Xplained Pro and their connection to the ATmega256RFR2. The tables of connections in this chapter also describes which signals are shared between the headers and on-board functionality.

4.1.1. Xplained Pro Standard Extension Headers

The ATMEGA256RFR2 Xplained Pro headers EXT1, EXT2, EXT3, EXT4, and EXT5 offers access to the I/O of the microcontroller in order to expand the board e.g. by connecting extension modules to the board. These headers all comply with the standard extension header specified in Table 3-4 Xplained Pro Standard Extension Header on page 9. All headers have a pitch of 2.54mm.

Table 4-1. Extension Header EXT1

Pin on EXT1	ATmega256RFR2 pin	Function	Shared functionality
1		Communication line to ID chip on extension board	
2		GND	
3	PF0	ADC0	
4	PF1	ADC1	
5	PE2	GPIO	
6	PE3	GPIO	
7	PB5	OC1A	EXT4 header
8	PB6	OC1B	
9	PE5	GPIO / INT5	EXT4 header
10	PD5	GPIO / SPI chip select B	EXT4 header
11	PD1	TWI SDA	All EXT headers
12	PD0	TWI SCL	All EXT headers
13	PE0	UART0 RXD	All EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
14	PE1	UART0 TXD	All EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
15	PG0	GPIO / SPI chip select A	EXT4 header
16	PB2	SPI MOSI	All EXT headers
17	PB3	SPI MISO	All EXT headers
18	PB1	SPI SCK	All EXT headers

Pin on EXT1	ATmega256RFR2 pin	Function	Shared functionality
19		GND	
20		VCC	

Table 4-2. Extension Header EXT2

Pin on EXT2	ATmega256RFR2 pin	Function	Shared functionality
1		Communication line to ID chip on extension board	
2		GND	
3			
4			
5			
6			
7			
8			
9	PE6	GPIO / INT6	EXT5 header
10	PD6	GPIO / SPI chip select B	EXT5 header
11	PD1	TWI SDA	All other EXT headers
12	PD0	TWI SCL	All other EXT headers
13	PE0(1)	UART0 RXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
14	PE1(1)	UART0 TXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
15	PD4	GPIO / SPI chip select A	EXT5 header
16	PB2	SPI MOSI	All other EXT headers
17	PB3	SPI MISO	All other EXT headers
18	PB1	SPI SCK	All other EXT headers
19		GND	
20		VCC	

Note:

1. Connected through cut-strap.

Table 4-3. Extension Header EXT3

Pin on EXT3	ATmega256RFR2 pin	Function	Shared functionality
1		Communication line to ID chip on extension board	
2		GND	
3	PF3	GPIO	
4	PG5	GPIO	
5	PB7	GPIO	
6			
7			
8			
9	PE7	GPIO / INT7	
10	PD7	GPIO / SPI chip select B	
11	PD1	TWI SDA	All other EXT headers
12	PD0	TWI SCL	All other EXT headers
13	PE0(1)	UART0 RXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
14	PE1(1)	UART0 TXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
15	PG2	GPIO / SPI chip select A	
16	PB2	SPI MOSI	All other EXT headers
17	PB3	SPI MISO	All other EXT headers
18	PB1	SPI SCK	All other EXT headers
19		GND	
20		VCC	

Note:

1. Connected through cut-strap.

Table 4-4. Extension Header EXT4

Pin on EXT4	ATmega256RFR2 pin	Function	Shared functionality
1		Communication line to ID chip on extension board	
2		GND	
3			
4			

Pin on EXT4	ATmega256RFR2 pin	Function	Shared functionality
5			
6			
7	PB5	OC1A	EXT1 header
8			
9	PE5	GPIO / INT5	EXT1 header
10	PG0	GPIO / SPI chip select B	EXT1 header
11	PD1	TWI SDA	All other EXT headers
12	PD0	TWI SCL	All other EXT headers
13	PE0	UART0 RXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
14	PE1	UART0 TXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
15	PD5	GPIO / SPI chip select A	EXT1 header
16	PB2	SPI MOSI	All other EXT headers
17	PB3	SPI MISO	All other EXT headers
18	PB1	SPI SCK	All other EXT headers
19		GND	
20		VCC	

Table 4-5. Extension Header EXT5

Pin on EXT5	ATmega256RFR2 pin	Function	Shared functionality
1		Communication line to ID chip on extension board	
2		GND	
3			
4			
5			
6			
7			
8			
9	PE6	GPIO / INT6	EXT2 header
10	PD4	GPIO / SPI chip select B	EXT2 header
11	PD1	TWI SDA	All other EXT headers

Pin on EXT5	ATmega256RFR2 pin	Function	Shared functionality
12	PD0	TWI SCL	All other EXT headers
13	PE0[1]	UART0 RXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
14	PE1[1]	UART0 TXD	All other EXT headers. EXT2, EXT3 and EXT5 connected through cut-strap.
15	PD6	GPIO / SPI chip select A	EXT2 header
16	PB2	SPI MOSI	All other EXT headers
17	PB3	SPI MISO	All other EXT headers
18	PB1	SPI SCK	All other EXT headers
19		GND	
20		VCC	

Note:

1. Connected through cut-strap.

4.1.2. Other Headers

In addition to the Xplained Pro Standard Extension Headers on page 11, ATmega256RFR2 Xplained Pro has additionally two headers with spare signals which offers access to the I/O of the microcontroller which are otherwise not easily available elsewhere or might be favorable to have collected together. All headers have a pitch of 2.54mm.

Table 4-6. SPARE ADC Signals Header

Pin on header	ATmega256RFR2 pin	Function	Shared functionality
1	-	VCC (3.3V)	
2	PF4	ADC4[1]	JTAG Interface, TCK
3	PF5	ADC5[1]	JTAG Interface, TMS
4	PF6	ADC6[1]	JTAG Interface, TDO
5	PF7	ADC7[1]	JTAG Interface, TDI

Note:

1. These lines are connected to the JTAG interface, and ADC will not work properly while debugging or programming the kit.

Table 4-7. SPARE Signals Header 2

Pin on header	ATmega256RFR2 pin	Function	Shared functionality
1	AREF	Analog reference	
2	TST	Test pin for RF test mode	
3	RSTN	Reset	EDBG and RESET button
4	RSTON	Reset status	
5	CLKI	Alternative main clock input	
6		GND	

4.1.3. Current Measurement Header

An angled 1x2, 100mil pin-header marked with MCU current measurement is located at the upper edge of the ATMEGA256RFR2 Xplained Pro. All power to the ATmega256RFR2 is routed through this header. To measure the power consumption of the device remove the jumper and replace it with an ammeter.

Caution: Removing the jumper from the pin-header while the kit is powered may cause the ATmega256RFR2 to be powered through its I/O pins. This may cause permanent damage to the device.

4.2. Peripherals

4.2.1. Crystals

The ATMEGA256RFR2 Xplained Pro kit contains two crystals that can be used as clock sources for the ATmega256RFR2 device. Each crystal has a cut-strap next to it that can be used to measure the oscillator allowance. This is done by cutting the strap and adding a resistor across the strap. More information about oscillator allowance and safety factor can be found in appnote AVR4100.

Table 4-8. External 32.768kHz Crystals

Pin on ATmega256RFR2	Function
PG3	TOSC2, crystal output
PG4	TOSC1, crystal input

Table 4-9. External 16MHz Crystals

Pin on ATmega256RFR2	Function
XTAL1	Crystal input
XTAL2	Crystal output

4.2.2. Mechanical Buttons

ATmega256RFR2 Xplained Pro contains two mechanical buttons. One button is the RESET button connected to the ATmega256RFR2 reset line and the other is a generic user configurable button. When a button is pressed it will drive the I/O line to GND.

Table 4-10. Mechanical Buttons

Pin on ATmega256RFR2	Silkscreen text
RSTN	RESET
PE4	SW0

4.2.3. LED

There is one yellow LED available on the ATmega256RFR2 Xplained Pro board that can be turned on and off. The LED can be activated by driving the connected I/O line to GND.

Table 4-11. LED Connections

Pin on ATmega256RFR2	LED
PB4	Yellow LED

4.2.4. RF

The main feature of ATmega256RFR2 Xplained Pro is to show the RF capability of the ATmega256RFR2 device. This device has bidirectional differential antenna pins, which are fed through a balun (Johanson Technology, 2450BM15A0015) to create a single unbalanced output/input. This kit has a passive analog RF switch (Skyworks Solutions Inc, AS222-92LF) connected to the unbalanced output of the balun. The switch is driven by the DIG1 and DIG2 pins of the ATmega256RFR2, which feature Antenna Diversity to enable the device to automatically select the best signal from two antennas (can also be selected manually). The output of the switch is connected to a ceramic chip antenna (Johanson Technology, 2540AT18D0100) and a SMA connector for external antennas.

Table 4-12. RF Connections

Pin on ATmega256RFR2	
RFP	RF balanced output (Positive)
RFN	RF balanced output (Negative)

4.2.5. Temperature Sensor

ATmega256RFR2 Xplained Pro features an Atmel AT30TSE758 temperature sensor chip with an 8kbit serial EEPROM inside. The sensor includes programmable high and low temperature alarms, user-selectable temperature resolution up to 12 bits, and an I^2C/SMBus™ compatible serial interface.

Table 4-13. Temperature Sensor Connections

AT30TSE758 temperature sensor pin	Pin name	Pin on ATmega256RFR2	Comment
1	SDA	PD1	Data line of serial interface
2	SCL	PD0	Clock line of serial interface
3	ALERT	NC(1)	Temperature alarm signaling pin

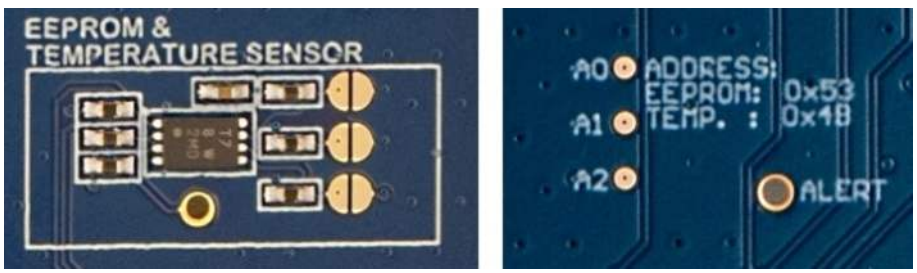
AT30TSE758 temperature sensor pin	Pin name	Pin on ATmega256RFR2	Comment
4	GND	GND	
5	A2	-	Address line for serial interface, by default pulled low
6	A1	-	Address line for serial interface, by default pulled high
7	A0	-	Address line for serial interface, by default pulled high
8	VCC	VCC	

Note:

1. Alert pin is available on a test point hole close to the sensor.

The temperature sensor has two TWI addresses, one for the temperature sensor and one for the EEPROM. The addresses are "0b1001 A2 A1 A0" for the temperature sensor and "0b1010 A2 A1 A0" for the EEPROM. The address selection lines (A2, A1 and A0) of the temperature sensor chip is by default pulled high for A0 and A1, and low for A2, through 100kΩ resistors, which makes the default addresses 0b1001011 and 0b1010011. Soldering the straps on the front of the ATmega256RFR2 Xplained Pro board for An will alter that bit in the address to low or high. Each strap is marked in silkscreen with A0, A1, and A2 as shown in Figure 4-1 Temperature Sensor TWI Address on page 18. When communicating with the EEPROM, part of the TWI address is used as a page address, for more details see the device datasheet.

Figure 4-1. Temperature Sensor TWI Address



4.3. Embedded Debugger Implementation

The ATmega256RFR2 Xplained Pro contains an Embedded Debugger (EDBG) that can be used to program and debug the ATmega256RFR2 using JTAG. The Embedded Debugger also include a Virtual Com port interface over UART, an Atmel Data Gateway Interface over SPI, and TWI and it monitors four of the ATmega256RFR2 GPIOs. Atmel Studio can be used as a front end for the Embedded Debugger.

4.3.1. JTAG

The JTAG use five pins to communicate with the target. For further information on how to use the programming and debugging capabilities of the EDBG, see Embedded Debugger on page 7.

Table 4-14. JTAG Connections

Pin on ATmega256RFR2	Function
PF4	JTAG TCK
PF5	JTAG TMS
PF6	JTAG TDO
PF7	JTAG TDI
RSTN	RESET

4.3.2. Virtual COM port

The Embedded Debugger act as a Virtual Com Port gateway by using one of the ATmega256RFR2 UARTs. For further information on how to use the Virtual COM port, see Embedded Debugger on page 7.

Table 4-15. Virtual COM Port Connections

Pin on ATmega256RFR2	Function
PD2	UART RXD (ATmega256RFR2 RX line)
PD3	UART TXD (ATmega256RFR2 TX line)

4.3.3. Atmel Data Gateway Interface

The Embedded Debugger features an Atmel Data Gateway Interface (DGI) by using either an SPI or TWI port. The DGI can be used to send a variety of data from the ATmega256RFR2 to the host PC. For further information on how to use the DGI interface, see Embedded Debugger on page 7.

Table 4-16. DGI Interface Connections When Using SPI

Pin on ATmega256RFR2	Function
PB0	Slave select (ATmega256RFR2 is Master)
PB1	SPI SCK (Clock Out)
PB2	SPI MOSI (Master Out, Slave in)
PB3	SPI MISO (Master In, Slave Out)

Table 4-17. DGI Interface Connections When Using TWI

Pin on ATmega256RFR2	Function
PD0	SCL (Clock line)
PD1	SDA (Data line)

Four GPIO lines are connected to the Embedded Debugger. The EDBG can monitor these lines and time stamp pin value changes. This makes it possible to accurately time stamp events in the ATmega256RFR2 application code. For further information on how to configure and use the GPIO monitoring features, see Embedded Debugger on page 7.

Table 4-18. GPIO Lines Connected To the EDBG

Pin on ATmega256RFR2	Function
PE2	GPIO0
PE3	GPIO1
PE5	GPIO2
PE6	GPIO3

4.4. Factory Programmed Data

ATmega256RFR2 Xplained Pro has preprogrammed data in the ATmega256RFR2's user signature data page 1 with address 0x0100. User signature data is isolated from the main flash and will not be cleared by a chip erase command. Special commands are available to read, write and erase the user signature data pages through a JTAG interface and from firmware. Refer to the ATmega256RFR2's datasheet for details on how to read the user signature data pages.

The preprogrammed data in the user signature data page 1 is documented in Persistent Memory on page 21, ATmega256RFR2 Xplained Pro does not feature an XTAL calibration value.

5. Persistent Memory

A persistent memory space is allocated to store product specific information. The persistent memory is organized as follows:

Table 5-1. Persistent Memory

Data	Data Type	Size
Structure Revision	uint 16	2 bytes
MAC address	uint 64	8 bytes
Board information – PCBA Name	ASCII string(1)	30 bytes
Board information – PCBA Serial number	ASCII string(1)	10 bytes
Board information – PCBA Atmel Part Number	ASCII string(1)	8 bytes
Board information – PCBA Revision	uint 8	1 byte
Reserved		3 bytes
XTAL Calibration Value	uint 8	1 byte
Reserved		7 bytes
Reserved		4 bytes
CRC	uint 16	2 bytes

Note:

1. '\0' terminated ASCII string.

The MAC address stored inside the MCU is a uniquely assigned ID for each kit and is owned by Atmel. User applications can use this unique MAC ID to address the kit.

6. Agency Certification

6.1. UNITED STATES (FCC)

This equipment complies with Part 15 of the FCC rules and regulations. To fulfill FCC Certification requirements, an OEM manufacturer must comply with the following regulations:

1. This equipment (ATMEGA256RFR2 Xplained Pro) is for use for evaluation purposes only and must not be incorporated into any other device or system.

Important:
This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation (FCC 15.19).

The internal / external antenna(s) used for this mobile transmitter must provide a separation distance of at least 20 cm from all persons and must not be colocated or operating in conjunction with any other antenna or transmitter.

Installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance. This device is approved as a mobile device with respect to RF exposure compliance, and may only be marketed to OEM installers. Use in portable exposure conditions (FCC 2.1093) requires separate equipment authorization.

Important:
Modifications not expressly approved by this company could void the user's authority to operate this equipment (FCC section 15.21).

Important:
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense (FCC section 15.105).

6.2. European Union (ETSI)

The ATMEGA256RFR2 Xplained Pro Evaluation kits has been certified for use in European Union countries. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive.

Furthermore, the manufacturer must maintain a copy of the modules' documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation

requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

Important:
The 'CE' marking must be affixed to a visible location on the OEM product. The CE mark shall consist of the initials "CE" taking the following form:

- The CE marking must have a height of at least 5mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

More detailed information about CE marking requirements you can find at "DIRECTIVE 1999/5/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL" on 9 March 1999 at section 12.

6.3. List of Antennas Tested with this Product:

Table 6-1. List of Tested Antennas

Antenna number	Make	Model/Part #	Antenna gain (dBi)	Type of antenna
Antenna 1	Johanson Technology	2450AT18D0100	1.5dBi	Ceramic Antenna
Antenna 2	Techfun Co., Ltd	M01-SS2	0dBi	External Antenna

7. Appendix

7.1. Getting Started with IAR

IAR Embedded Workbench® for AVR® is a proprietary high efficiency compiler not based on GCC. Programming and debugging of Xplained Pro kits are supported in IAR™ Embedded Workbench for AVR using the Atmel-ICE interface. Some initial settings have to be set up in the project to get the programming and debugging to work.

The following steps will explain how to get your project ready for programming and debugging:

1. Make sure you have opened the project you want to configure. Open the **OPTIONS** dialog for the project.
2. In the category **General Options**, select the **Target** tab. Select the device for the project or, if not listed, the core of the device.
3. In the category **Debugger**, select the **Setup** tab. Select **Atmel-ICE** as the driver.
4. In the category **Debugger** > **Atmel-ICE**, select the **Atmel-ICE 1** tab. Select **JTAG** as the interface and optionally select the **JTAG** frequency.

Figure 7-1. Select Target Device

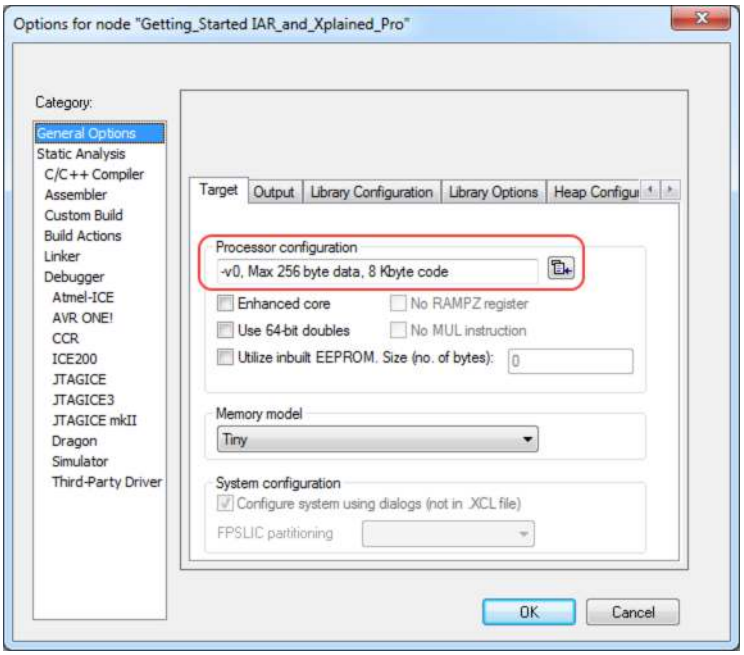


Figure 7-2. Select Debugger

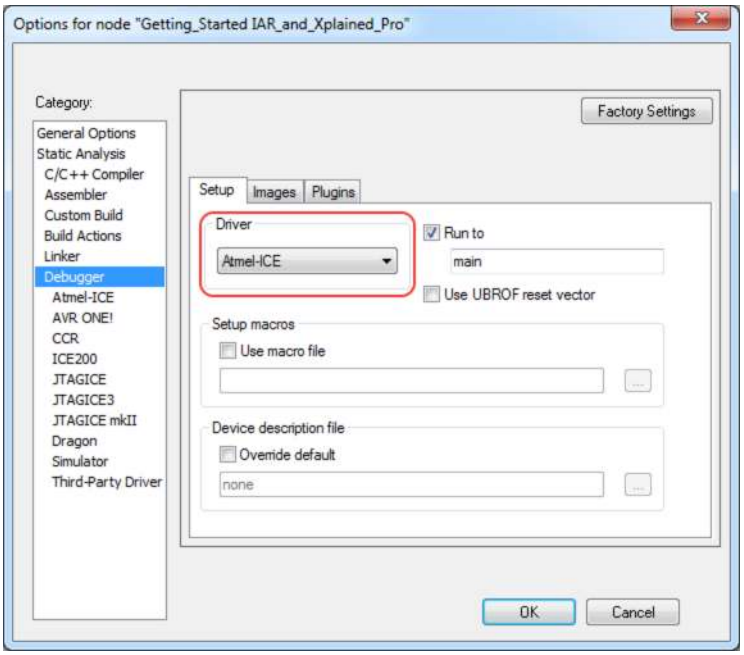
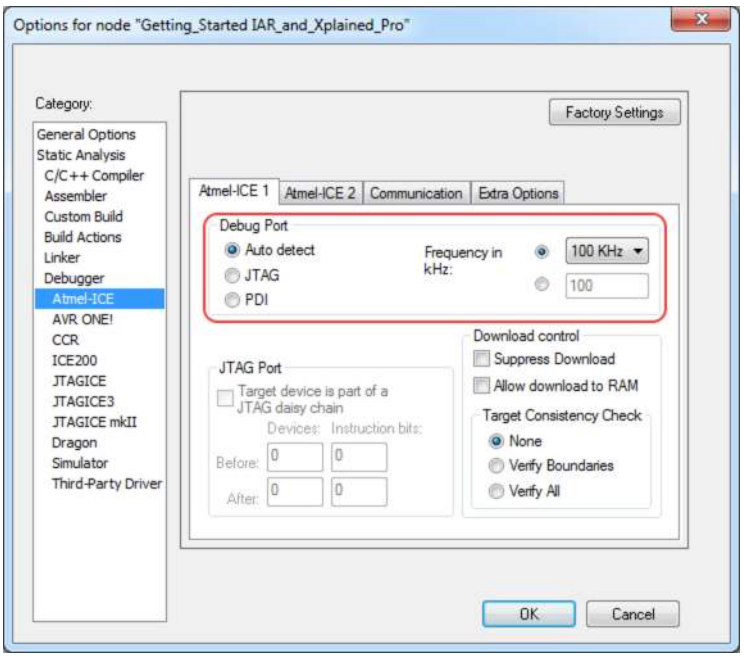


Figure 7-3. Configure Interface



8. Hardware Revision History and Known Issues

8.1. Identifying Product ID and Revision

The revision and product identifier of Xplained Pro boards can be found in two ways; either through Atmel Studio or by looking at the sticker on the bottom side of the PCB.

By connecting an Xplained Pro MCU board to a computer with Atmel Studio running, an information window will pop up. The first six digits of the serial number, which is listed under kit details, contain the product identifier and revision. Information about connected Xplained Pro extension boards will also appear in the Atmel Kit's window.

The same information can be found on the sticker on the bottom side of the PCB. Most kits will print the identifier and revision in plain text as A09-nnnn\rr, where nnnn is the identifier and rr is the revision. Boards with limited space have a sticker with only a QR-code, which contains a serial number string.

The serial number string has the following format:

"nnnnrrssssssssss"

n = product identifier

r = revision

s = serial number

The product identifier for ATMEGA256RFR2 Xplained Pro is A09-1784.

8.2. Revision 3

Revision 3 of ATMEGA256RFR2 Xplained Pro is the initial released version.

Known issues

- The low and high byte of the 16-bit CRC value of the information in the user page might be swapped on serial numbers prior to 1885.

  Workaround: If it is neccssary to use the CRC value to verify the data in the user page, compare the calculated value with both the swapped and non-swapped version of the CRC value present in the user page.
- All kits with a serial number lower than 0200003858 does not have any pre programmed data in the userpage.

9. Document Revision History

Doc. rev.	Date	Comment
42079E	12/2015	Corrected PG4 to PG2 pinout on Table 4-3 Extension Header EXT3 on page 13. Added Getting Started with IAR on page 24.
42079D	11/2013	Added chapter about persistent memory and factory programmed data. Added new errata.
42079C	05/2013	Added list of antennas.
42079B	04/2013	Added section about certification.
42079A	02/2013	Initial document release.

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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