
Atmel AVR2033: SAM-ICE Adapter – Hardware User Manual

8-bit Atmel Microcontrollers

Features

- 10-pin connector for Atmel® RF231USB USB radio stick
- 20-pin connector for ARM® JTAG programmer
- 6-pin connector for ARM Debug-Unit
- RS232 connector with onboard RS232 level shifter for ARM Debug-Unit

Introduction

This application note provides a detailed hardware description of the Atmel SAM-ICE™ adapter. The adapter is typically used as service adapter to enable programming, debugging and testing right in the circuit of a RF231USB radio stick.

For programming via JTAG the female 10-pin connector has to be plugged onto the RF231USB stick's 10-pin connector. The connection to the Atmel SAM-ICE programmer is implemented with the assembled 20-pin JTAG header. A RS232 connection is additionally available.

Figure 1. SAM-ICE adapter.

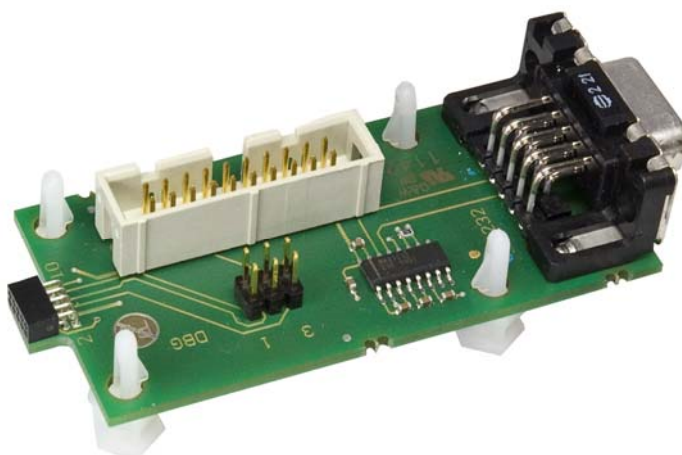


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1. Disclaimer

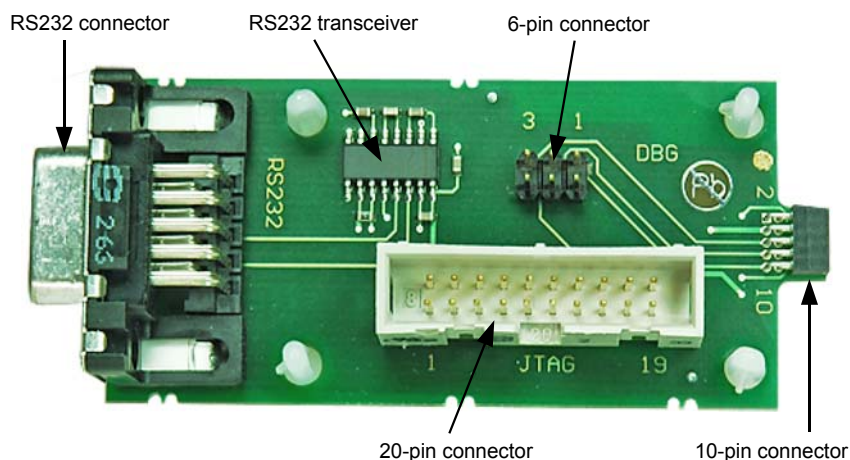
Typical values contained in this application note are based on simulations and testing of individual examples.

Any information about third-party materials or parts is included in this document for convenience. The vendor may have changed the information since then. Check the individual part information for the latest changes.

2. Overview

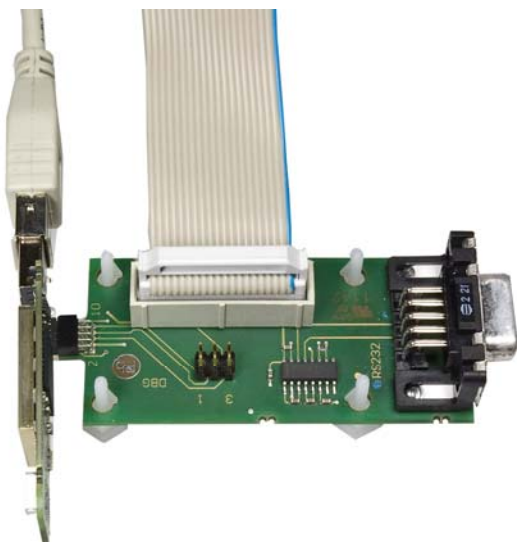
The Atmel SAM-ICE adapter is an integral part of the Atmel RF231USB Reference Design. It is designed to interface directly to a RF231USB board. [Figure 2-1](#) shows the Atmel SAM-ICE adapter. See [\[1\]](#) for details on the RF231USB board.

Figure 2-1. Main component parts.



The primary physical interface for programming and debugging the RF231USB board's MCU is JTAG. For programming via JTAG the RF231USB board has to be attached with its JTAG connector to the SAM-ICE adapter and finally to the SAM-ICE programmer and the host PC with the appropriate wiring established as shown in [Figure 2-2](#). For details on programming and debugging, please refer to [Chapter 4](#).

Figure 2-2. SAM-ICE adapter, USB radio sticks wiring.



3. Mechanical description

The SAM-ICE adapter is manufactured using a two-layer printed circuit board (PCB). All connectors and user I/Os are mounted on the top side using through-hole components. In delivery condition, the board comes with four spacers enclosed but not mounted. They shall be affixed through holes from the bottom side.

Figure 3-1. Mechanical outline.

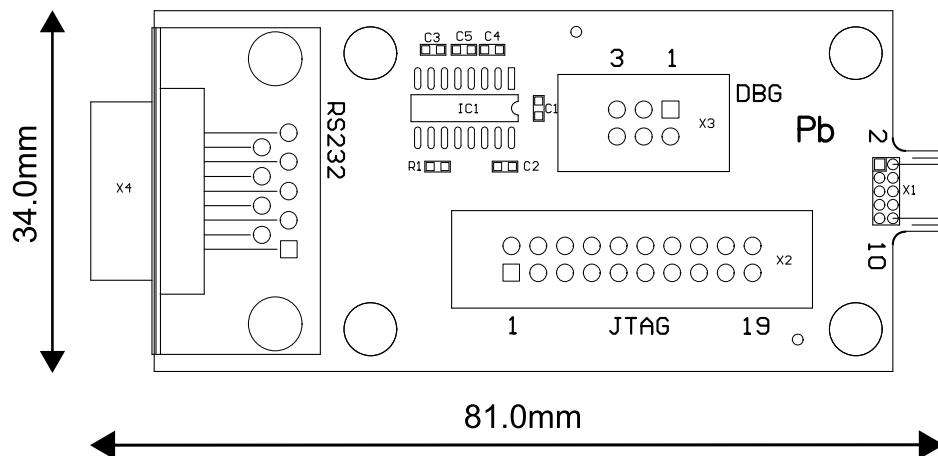


Table 3-1. SAM-ICE adapter mechanical dimensions.

Dimension	Value
Length x	81.0mm
Width y	34.0mm
Height z	17.0mm (without spacers) 22.0mm (with spacers)

Table 3-2. Connectors and features.

Connector	Specification
X1, 10-pin	2-row, 1.27mm (50mil) pitch
X2, 20-pin	2-row, 2.54mm (100mil) pitch
X3, 6-pin	2-row, 2.54mm (100mil) pitch
X4, RS232	DE-9 socket, 2.77mm (109mil) pitch

4. Functional description

The SAM-ICE adapter enables programming and debugging of the RF231USB PCBA. It is required to connect the RF231 USB stick to the SAM-ICE programmer via JTAG interface. This setup communicates with the host PC preferably via USB lines. Additional connections from the SAM-ICE adapter may be chosen. [Figure 4-1](#) shows the hardware assembly and [Figure 4-2](#) the schematic of the complete setup.

Figure 4-1. SAM-ICE adapter with programmer and USB radio stick (left-hand).

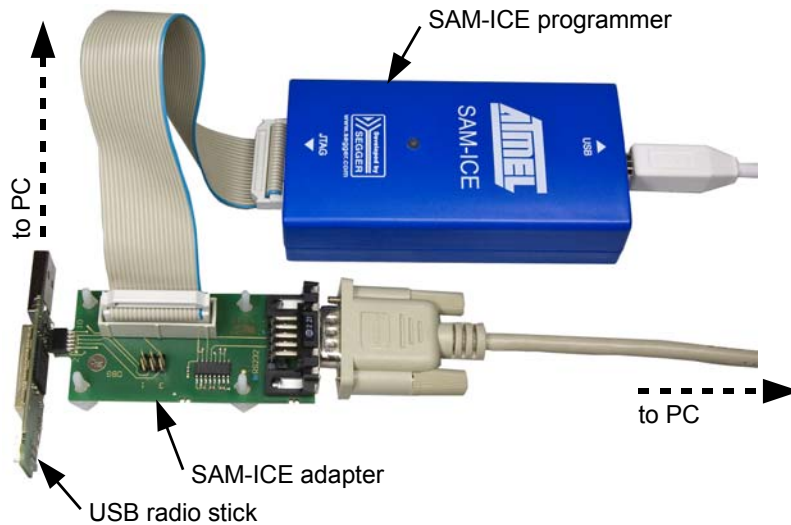
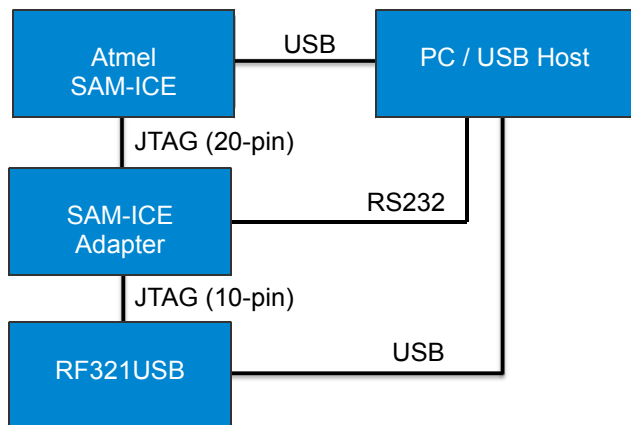


Figure 4-2. Hardware setup schematic.



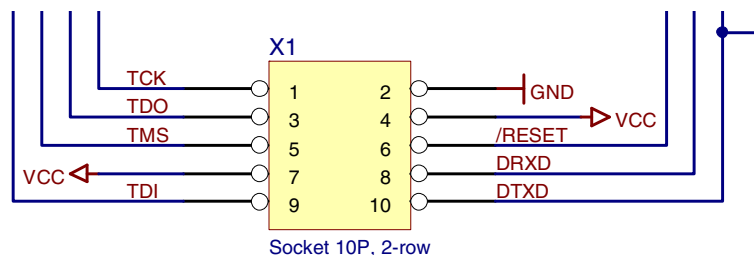
The following sections provide detailed information about the individual component parts and their functionality.

4.1 10-pin connector

The (female) 10-pin connector, X1, is designed on the top side of the PCB at one side to facilitate connecting a USB radio stick in a plane rectangular to the SAM-ICE adapter PCB. The 2-row (2x5) connector has a pitch of 1.27mm (50mil).

X1 serves as JTAG/Trace interconnection to the RF231USB. For in-circuit programming, debugging and testing a RF231USB radio stick has to be plugged in with its appropriate programming/debugging header.

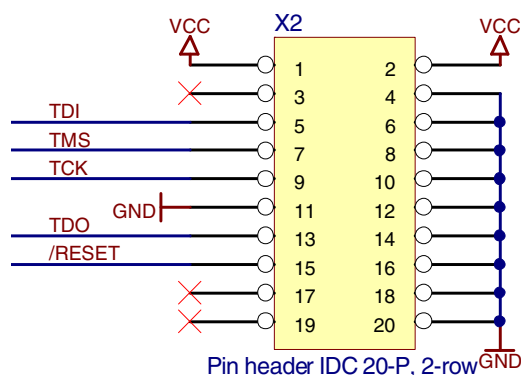
Figure 4-3. 10-pin connector.



4.2 20-pin connector

The (male) 20-pin connector, X2, is assembled on the top side of the PCB. It provides the traditional JTAG interface for ARM MCUs which is a 20-pin, 100mil connector. The four JTAG signals (TDI, TDO, TCK and TMS) are routed to the 10-pin connector X1 (see Section 4.1).

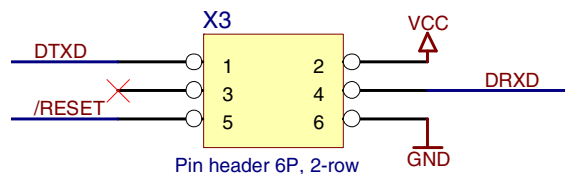
Figure 4-4. 20-pin connector.



4.3 6-pin connector

The (male) 6-pin connector, X3, is assembled on the top side of the PCB. It carries a UART (RX, TX signals, TTL level), supply voltage and the MCU reset line. Internally all these signals are routed to the 10-pin connector X1 (see Section 4.1).

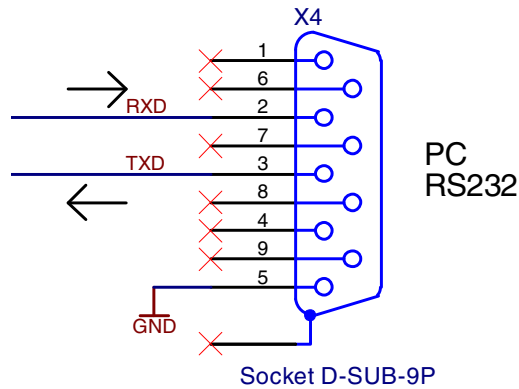
Figure 4-5. 6-pin connector.



4.4 RS-232 connector

The RS232 connector, X4, is designed on the top side of the PCB opposite to the X1 connector to communicate with the host PC via a common RS232 D-sub connection. RX as well as TX signals are provided V.24-compliant by an intermediate RS232 transceiver, see Section 4.5.1.

Figure 4-6. RS232 connector.

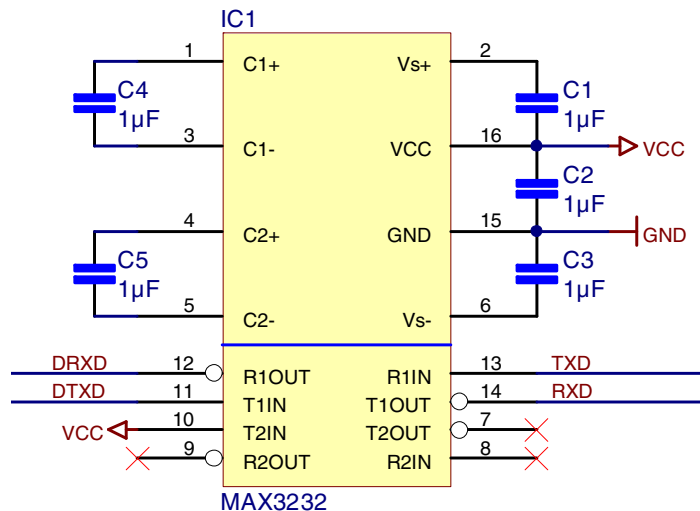


4.5 Other assembly parts

4.5.1 RS232 transceiver

A RS232 transceiver, IC1 [2], is designed on the PCBA next to the RS232 connector to transform the received and transmitted data (RXD, TXD) as described above. If it shall be used, power must be supplied by a RF231USB target device plugged onto the SAM-ICE adapter.

Figure 4-7. RS232 transceiver.



4.5.2 Spacers

From the bottom side of the PCB four spacers are assembled in the vicinity of the PCB corners to enable a practicable and safe positioning in the working environment. Due to the spacer's 6.4mm base at the bottom side the PCB can be placed in a convenient position to be able to connect plugs to the PCB and arrange the wiring around.

5. Electrical characteristics

5.1 Absolute maximum ratings

Stresses beyond those listed in Table 5-1 “Absolute Maximum Ratings” may cause permanent damage to the board. This is a stress rating only; functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this manual are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. For more details about these parameters, refer to individual datasheets of the components used.

Table 5-1. Absolute maximum ratings.

No.	Parameter	Condition	Minimum	Typical	Maximum	Unit
5.1.1	Storage temperature range		-45		+85	°C
5.1.2	Relative humidity	Non-condensing			80	% r.H.
5.1.3	Supply voltage		-0.3		5.5	V
5.1.4	EXT I/O pin voltage		-0.3		$V_{\text{USB}} + 0.3$	V
5.1.5	Supply current	USB powered, outputs short-circuit		35	60	mA

5.2 Recommended operating range

Table 5-2. Recommended operating range.

No.	Parameter	Condition	Minimum	Typical	Maximum	Unit
5.2.1	Operating temperature range (T_{OP})		0		+65	°C
5.2.2	Supply voltage (V_{USB})	USB powered	4.5	5.0	5.5	V

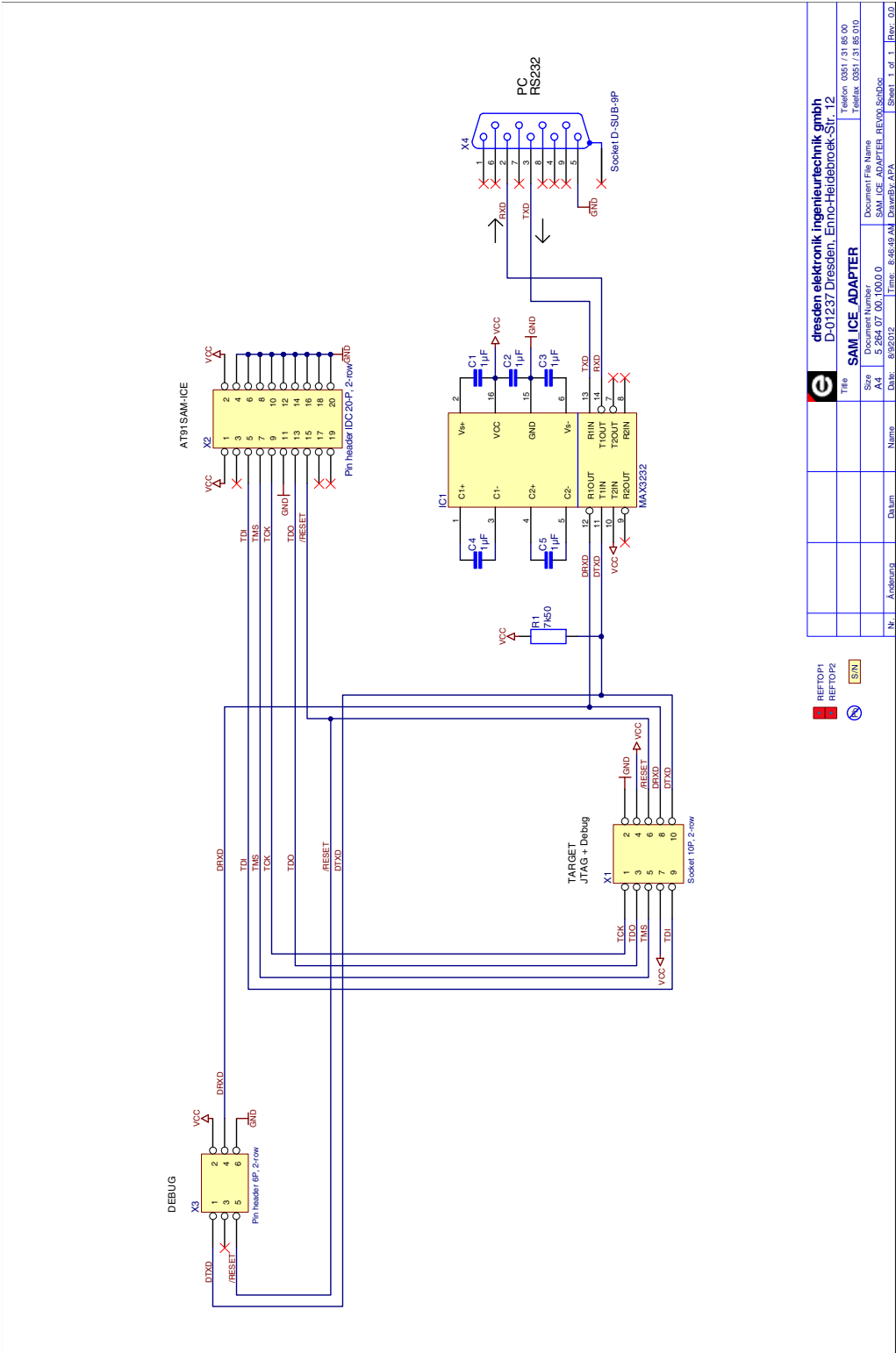
6. Abbreviations

I/O	-	Input/output
ICE	-	In-circuit-emulator
JTAG	-	Digital interface for debugging of embedded device, also known as IEEE® 1149.1 standard interface
MCU	-	Microcontroller unit
PCB	-	Printed circuit board
PCBA	-	Printed circuit board assembly
RS232	-	Traditional name of standards for serial binary data and control signals commonly used in computer serial ports
SMD	-	surface-mount device
RX	-	Receive
TX	-	Transmit
USART	-	Universal synchronous/asynchronous receiver transmitter
USB	-	Universal serial bus
V.24	-	A standard similar to RS232

Appendix A. PCB design data

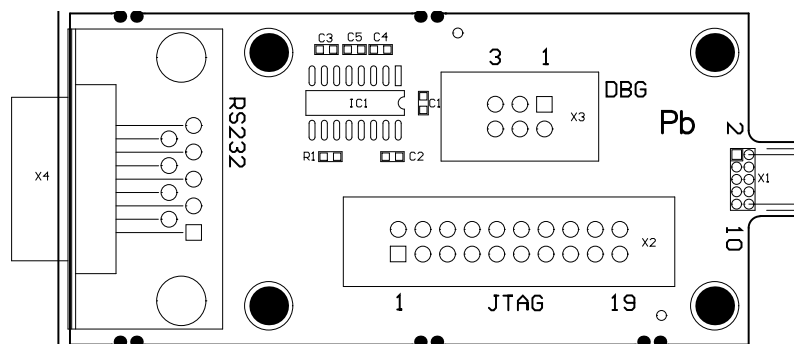
A.1 Schematic

Figure 6-1. Schematic.



A.2 Assembly drawing

Figure 6-2. Assembly top.



A.3 Bill of materials

Table 6-1. Bill of materials.

Qty.	Designator	Description	Footprint	Part#/Value	Comment	Rating
1		SAM-ICE adapter PCB		5 264 07 00.251.00		
5	C1, C2, C3, C4, C5	Capacitor	0603	1 μ F / 10%	SMD	16V / X5R
1	IC1	RS232 transceiver	SO-16	MAX3232ESE+	SMD	3..5V
1	R1	Resistor	0603	7K50 / 1%	SMD	50V / 100mW
1	X1	Socket-10P	2-row/win	853-87-010-20-001101		UL94V-0
1	X2	Pin header IDC-20P	Low profile	09-18-520-6324		DIN41651
1	X3	Pin header-6P	2-row	1002-121-006		UL94V-0
1	X4	Socket D-SUB 9P	win	09-66-152-7611		DIN41652
4		Spacer	6.4mm	TCBS-4		

Appendix B. References

- [1] Atmel AVR2030: RF231USB-RD - Hardware User Manual
- [2] 3.0V to 5.5V, Low-Power RS232 Transceiver
<http://datasheets.maxim-ic.com/en/ds/MAX3222-MAX3241.pdf>

Appendix C. Revision history SAM-ICE adapter PCBA

Version	Description
A09-1497/01	Initial revision

Appendix D. EVALUATION BOARD/KIT 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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