

The JTAGICE3 Debugger



The Atmel JTAGICE3 is a powerful development tool for debugging and programming ARM® Cortex®-M based Atmel® SAM and Atmel AVR® microcontrollers with On-Chip Debug capability.

- Programming and on-chip debugging of all Atmel AVR 32-bit microcontrollers on both JTAG and aWire interfaces.
- Programming and on-chip debugging of all Atmel AVR XMEGA family devices on both JTAG and PDI 2-wire interfaces.
- Programming (JTAG and SPI) and debugging of all Atmel AVR 8-bit microcontrollers with OCD support on both JTAG or debugWIRE interfaces.
- Programming and debugging of all Atmel SAM ARM® Cortex®-M based microcontrollers on both SWD and JTAG interfaces. (Firmware version 3.0 and later)

Introduction to the Atmel JTAGICE3

The Atmel JTAGICE3 is a powerful development tool for debugging and programming ARM® Cortex®-M based Atmel® SAM and Atmel AVR® microcontrollers with On-Chip Debug capability.

It supports:

- Programming and on-chip debugging of all Atmel AVR UC3 microcontrollers on both JTAG and aWire interfaces.
- Programming and on-chip debugging of all AVR XMEGA family devices on both JTAG and PDI 2-wire interfaces.
- Programming (JTAG and SPI) and debugging of all AVR 8-bit microcontrollers with OCD support on both JTAG or debugWIRE interfaces.
- Programming and debugging of all Atmel SAM ARM® Cortex®-M based microcontrollers on both SWD and JTAG interfaces. (Firmware version 3.0 and later)

Atmel JTAGICE3 Features

- Fully compatible with Atmel Studio
- Supports programming and debugging of all Atmel AVR UC3 32-bit microcontrollers
- Supports programming and debugging of all 8-bit AVR XMEGA devices
- Supports programming and debugging of all 8-bit Atmel megaAVR and tinyAVR devices with OCD
- Supports programming and debugging of all SAM ARM Cortex-M based microcontrollers.
- Target operating voltage range of 1.65V to 5.5V
- Draws less than 3mA from target VTref during operation
- Supports JTAG clock frequencies from 32kHz to 15MHz
- Supports PDI clock frequencies from 32kHz to 10MHz
- Supports debugWIRE baud rates from 4 kbit/s to 0.5 Mbit/s
- Supports aWire baud rates from 7.5 kbit/s to 7.5 Mbit/s
- Supports SPI clock frequencies from 8 kHz to 1.875 MHz
- Supports SWD clock frequencies from 32 kHz to 2 MHz
- USB 2.0 high-speed host interface
- ITM serial trace capture at up to 1MB/s
- Supports 10-pin 50-mil JTAG connector, as well as 10-pin 100mil JTAG, 6-pin 50-mil SPI and 6-pin 100-mil SPI interfaces using adapters.



System Requirements

The Atmel JTAGICE3 unit requires that a front-end debugging environment Atmel Studio or AVR Studio 5.0 or later is installed on your computer.

The JTAGICE3 should be connected to the host computer using the USB cable provided.

Kit Contents

The Atmel JTAGICE3 kit contains these items:

- JTAGICE3 unit
- USB cable (1.8m, high-speed, mini-B)
- Adapter board containing 50-mil SPI, 100-mil SPI and 100-mil JTAG adapters
- 50-mil JTAG cable
- 50-mil 10-pin mini squid cable
- AVR Technical Library DVD

Figure 1. JTAGICE3 kit contents

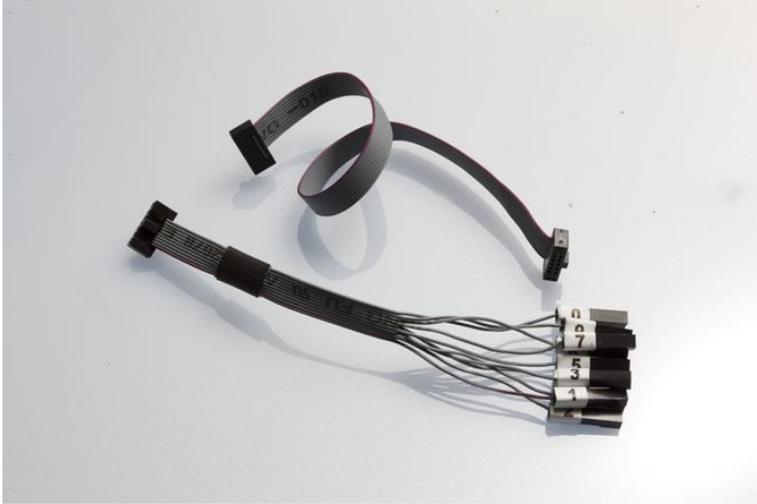


Assembling the Atmel JTAGICE3

The Atmel JTAGICE3 unit is shipped with no cables attached. Two cable options are provided in the accessory kit:

- 50-mil 10-pin IDC flat cable
- 50-mil 10-pin mini-squid cable with 10 x 100-mil sockets

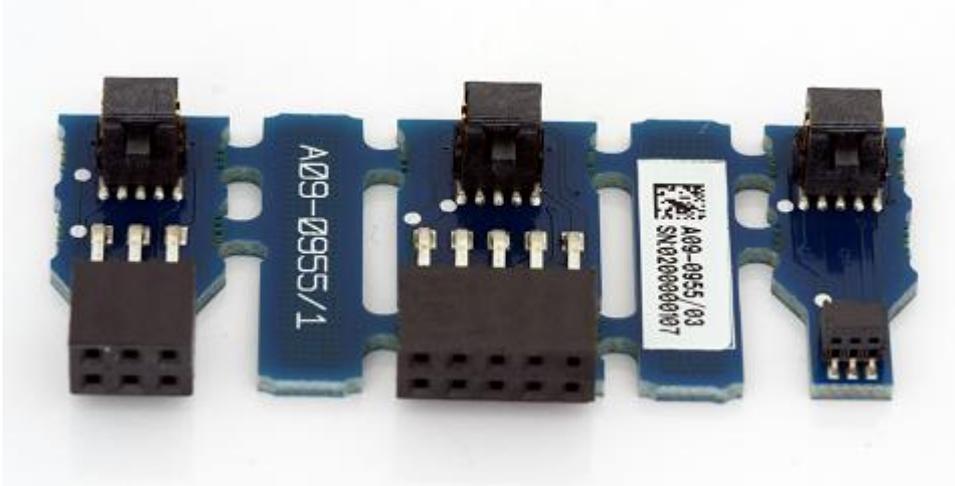
Figure 2. JTAGICE3 cables



For most purposes, the 50-mil 10-pin IDC flat cable can be used along with one of the adapters provided in the accessory kit. Three adapters are provided in one small PCB panel section. To separate the adapters, simply break off each one by gently bending the panel backwards and forwards. Take care to avoid any sharp edges which may result from the separation process. The following adapters are included:

- A09-0955 - A 100-mil 10-pin JTAG adapter
- A09-0955 - B 100-mil 6-pin SPI/debugWIRE/PDI/aWire adapter
- A09-0955 - C 50-mil 6-pin SPI/debugWIRE/PDI/aWire adapter

Figure 3. JTAGICE3 adapters



Note that a 50-mil JTAG adapter has not been provided - this is because the 50-mil 10-pin IDC cable can be used to connect directly to a 50-mil JTAG header. For the part number of the component used for the 50-mil 10-pin connector, see [target connectors part numbers](#)

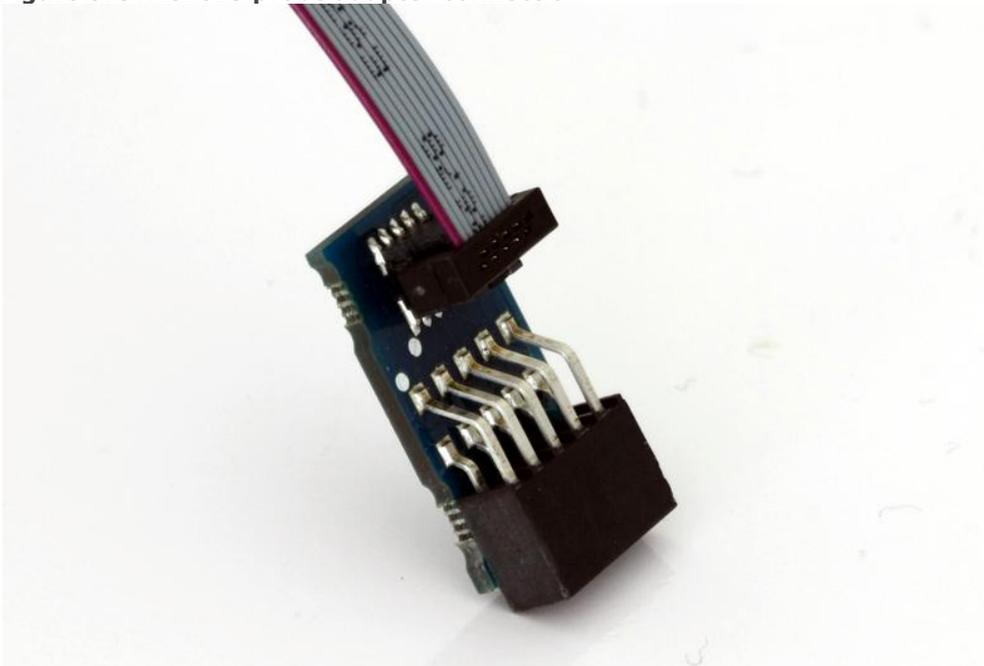
To assemble your JTAGICE3 into its 'default' configuration, connect the 10-pin 50-mil IDC cable to the unit as shown below. Be sure to orient the cable so that the red wire (pin 1) on the cable aligns with the triangular indicator on the blue belt of the enclosure. The cable should connect upwards from the unit.

Figure 4. Atmel JTAGICE3 cable connection



Next, snap off the 100-mil 10-pin JTAG adapter from the adapter panel, and connect it to the other side of the IDC cable. Your Atmel JTAGICE3 is now ready to use in its basic JTAG configuration.

Figure 5. JTAGICE3 probe adapter connection



Opening the Atmel JTAGICE3

Note: For normal operation, the Atmel JTAGICE3 unit must not be opened. Opening the unit is done at your own risk. Anti-static precautions should be taken.

The JTAGICE3 enclosure consists of three separate plastic components - top cover, bottom cover and blue belt - which are snapped together during assembly. To open the unit, simply insert a large flat screwdriver into the openings in the blue belt, apply some inward pressure and twist gently. Repeat the process on the other snapper holes, and the top cover will pop off.

Figure 6. Opening the JTAGICE3 (1)



Figure 7. Opening the JTAGICE3 (2)



Figure 8. Opening the JTAGICE3 (3)



To close the unit again, simply align the top and bottom covers correctly, and press together firmly.

Powering the Atmel JTAGICE3

The Atmel JTAGICE3 is powered by the USB bus voltage. It requires less than 100mA to operate, and can therefore be powered through a USB hub. The power LED will illuminate when the unit is plugged in. When not connected in an active programming or debugging session, the unit will enter low-power consumption mode to preserve your computer's battery. The JTAGICE3 cannot be powered down - it should be unplugged when not in use.

Connecting to the host computer

Before plugging in the Atmel JTAGICE3 for the first time, be sure to install the USB driver on the host computer. This is done automatically when installing the front-end software provided free by Atmel. See www.atmel.com for further information or to download the latest front-end software.

The JTAGICE3 must be connected to an available USB port on the host computer using the USB cable provided. The JTAGICE3 contains a USB 2.0 compliant controller, and can operate in both full-speed and high-speed modes. For best results, connect the JTAGICE3 directly to a USB 2.0 compliant high-speed hub on the host computer using the cable provided.

USB driver installation

Windows

When installing the Atmel JTAGICE3 on a computer running Microsoft Windows, the USB driver is loaded when the JTAGICE3 is first plugged in.

Note: Be sure to install the front-end software packages before plugging the unit in for the first time!



Proceed with the default ("recommended") options through the New Hardware Wizard.





If it is not detected automatically, point the wizard to the device driver (provided by Jungo) called jtagice3.inf which is stored in the <windows_root>\inf folder.

Once successfully installed, the JTAGICE3 will appear in the device manager as a "Jungo" device.



Your JTAGICE3 is now ready to use.



Connecting to a JTAG target

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[Using the JTAG 10-pin connector](#)

The Atmel JTAGICE3 probe has a 50-mil 10-pin JTAG connector accessible on the front of the tool's enclosure. The kit includes a 50-mil 10-pin cable which can be used to connect directly to a 50-mil JTAG header on your target board. Should your target board be fitted with a 100-mil JTAG header (eg: Atmel STK600), the 100-mil adapter provided (A08-0735-A) in the kit can be used. If your target board does not have a compliant 10-pin JTAG header in 50- or 100-mil, you can map to a custom pinout using the 10-pin "mini-squid" cable provided, which gives access to 10 individual 100-mil sockets.

Using the JTAG 10-pin connector

The pinout for the 10-pin JTAG connector is shown in [Figure 10, "JTAG header pinout"](#)

Be sure to use the correct orientation of the 10-pin header when connecting the JTAGICE3 to the target application PCB. The red wire on the probe cable indicates PIN1, as does the 'dot' on the 100-mil adapter.



Connecting to an aWire target

The aWire interface only requires one data line in addition to Vcc and GND. The 10-pin mini-squid cable should be used to connect between the Atmel JTAGICE3 target connector and the target board. Three connections are required, as described in the table below

Table 1. Connecting to aWire using the mini-squid cable

<i>JTAGICE3 pins</i>	<i>Target pins</i>	<i>Mini-squid pin</i>	
Pin 1 (TCK)		1	
Pin 2 (GND)	GND	2	6
Pin 3 (TDO)	DATA	3	1
Pin 4 (VTG)	VTG	4	2
Pin 5 (TMS)		5	
Pin 6 (nSRST)		6	
Pin 7 (Not connected)		7	
Pin 8 (nTRST)		8	
Pin 9 (TDI)		9	
Pin 10 (GND)		0	

Connecting to a PDI target

The pinout for the 6-pin PDI connector is shown in [Figure 13, "PDI header pinout"](#)

The adapters provided in the kit (A08-0735-B and A08-0735-C) can be used to connect to this pinout in either 50-mil or 100-mil options.

Be sure to use the correct orientation of the 6-pin header when connecting the Atmel JTAGICE3 to the target application PCB. A 'dot' on the adapter board indicates pin 1.



When connecting to a target that does not have the standard 6-pin header, you can use the 10-pin mini-squid cable between the JTAGICE3 target connector and the target board. 4 connections are required, and the table below describes where to connect them.

NB: note that there is a difference from the JTAGICE mkII JTAG probe, where PDI_DATA is connected to pin 9. The JTAGICE3 is compatible with the pinout used by the Atmel AVR ONE! and ATMEL AVR Dragon products.

Table 2. Connecting to PDI using the mini-squid cable

<i>JTAGICE3 pin</i>	<i>Target pins</i>	<i>Mini-squid pin</i>	
Pin 1 (TCK)		1	
Pin 2 (GND)	GND	2	6
Pin 3 (TDO)	PDI_DATA	3	1
Pin 4 (VTG)	VTG	4	2
Pin 5 (TMS)		5	
Pin 6 (nSRST)	PDI_CLK	6	5
Pin 7 (Not connected)		7	
Pin 8 (nTRST)		8	
Pin 9 (TDI)		9	
Pin 10 (GND)		0	

Connecting to a debugWIRE target

The pinout for the 6-pin debugWIRE (SPI) connector is shown in [Figure 14, "debugWIRE \(SPI\) header pinout"](#)

The adapters provided in the kit (A08-0735-B and A08-0735-C) can be used to connect to this pinout in either 50-mil or 100-mil options.

Be sure to use the correct orientation of the 6-pin header when connecting the Atmel JTAGICE3 to the target application PCB. A 'dot' on the adapter board indicates pin 1.



Although the debugWIRE interface only requires one signal line (RESET), Vcc and GND to operate correctly, it is advised to have access to the full SPI connector so that the debugWIRE interface can be enabled and disabled using SPI programming.

When the DWEN fuse is enabled the SPI interface is overridden internally in order for the OCD module to have control over the RESET pin. The debugWIRE OCD is capable of disabling itself temporarily (using the button on the debugging tab in the properties dialog in Atmel Studio), thus releasing control of the RESET line. The SPI interface is then available again (only if the SPIEN fuse is programmed), allowing the DWEN fuse to be un-programmed using the SPI interface. If power is toggled before the DWEN fuse is un-programmed, the debugWIRE module will again take control of the RESET pin. It is HIGHLY ADVISED to simply let Atmel Studio handle setting and clearing of the DWEN fuse!

It is not possible to use the debugWIRE Interface if the lockbits on the target Atmel AVR are programmed. Always be sure that the lockbits are cleared before programming the DWEN fuse and never set the lockbits while the DWEN fuse is programmed. If both the debugWIRE enable fuse (DWEN) and lockbits are set, one can use High Voltage Programming to do a chip erase, and thus clear the lockbits. When the lockbits are cleared the debugWIRE Interface will be re-enabled. The SPI Interface is only capable of reading fuses, reading signature and performing a chip erase when the DWEN fuse is un-programmed.

Table 3. Connecting to debugWIRE using the mini-squid cable

<i>JTAGICE3 pin</i>	<i>Target pins</i>	
Pin 1 (TCK)		1
Pin 2 (GND)	GND	2
Pin 3 (TDO)		3
Pin 4 (VTG)	VTG	4
Pin 5 (TMS)		5
Pin 6 (nSRST)	RESET	6
Pin 7 (Not connected)		7
Pin 8 (nTRST)		8
Pin 9 (TDI)		9
Pin 10 (GND)		0

Connecting to an SPI target

The pinout for the 6-pin SPI connector is shown in [Figure 15, "SPI header pinout"](#)

The adapters provided in the kit (A08-0735-B and A08-0735-C) can be used to connect to this pinout in either 50-mil or 100-mil options.

Be sure to use the correct orientation of the 6-pin header when connecting the Atmel JTAGICE3 to the target application PCB. A 'dot' on the adapter board indicates pin 1.

NB: The SPI interface is effectively disabled when the debugWIRE enable fuse (DWEN) is programmed, even if SPIEN fuse is also programmed. To re-enable the SPI interface, the 'disable debugWIRE' command must be issued while in a debugWIRE debugging session. Disabling debugWIRE in this manner requires that the SPIEN fuse is already programmed. If Atmel Studio fails to disable debugWIRE, it is probable that the SPIEN fuse is NOT programmed. If this is the case, it is necessary to use a high-voltage programming interface to program the SPIEN fuse. It is HIGHLY ADVISED to simply let Atmel Studio handle setting and clearing of the DWEN fuse!

The 10-pin mini-squid cable can also be used to connect between the Atmel JTAGICE3 target connector and the SPI target board. Six connections are required, as described in the table below

Table 4. Connecting to SPI using the mini-squid cable

JTAGICE3 pins	Target pins	Mini-squid pin	
Pin 1 (TCK)	SCK	1	3
Pin 2 (GND)	GND	2	6
Pin 3 (TDO)	MISO	3	1
Pin 4 (VTG)	VTG	4	2
Pin 5 (TMS)		5	
Pin 6 (nSRST)	/RESET	6	5
Pin 7 (Not connected)		7	
Pin 8 (nTRST)		8	
Pin 9 (TDI)	MOSI	9	4
Pin 10 (GND)		0	



Connecting to a SWD target

The ARM SWD interface is a subset of the JTAG interface, making use of TCK and TMS pins, which means that when connecting to an SWD device, the 10-pin JTAG connector can technically be used. The ARM JTAG and AVR JTAG connectors are however not pin-compatible, so this depends upon the layout of the target board in use. When using STK600 or a board making use of the AVR JTAG pinout, the standard JTAG connector can be used. When connecting to a board which makes use of the ARM JTAG pinout, the 10-pin "mini-squid" cable must be used. (There are no adapters available from Atmel to make this mapping.)

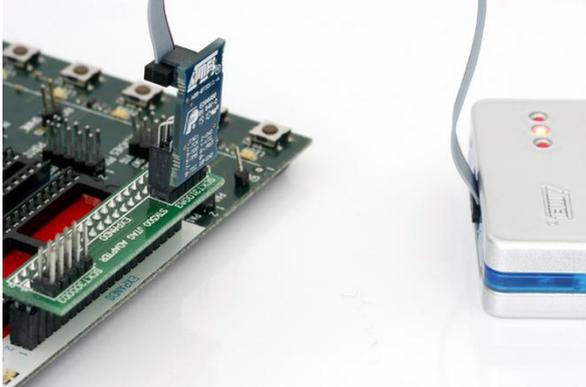
Table 5. Connecting to SWD using the mini-squid cable

<i>JTAGICE3 pin</i>	<i>Target pins</i>	<i>Mini-squid pin</i>	
Pin 1 (TCK)	SWDCLK	1	4 (SWDCLK)
Pin 2 (GND)	GND	2	3, 5, 9 (GND)
Pin 3 (TDO)	SWO (optional)	3	6
Pin 4 (VTG)	VTG	4	1 (VCC)
Pin 5 (TMS)	SWDIO	5	2 (SWDIO)
Pin 6 (nSRST)	RESET	6	10 (nRESET)
Pin 7 (Not connected)		7	
Pin 8 (nTRST)		8	
Pin 9 (TDI)		9	
Pin 10 (GND)		0	3, 5, 9 (GND)

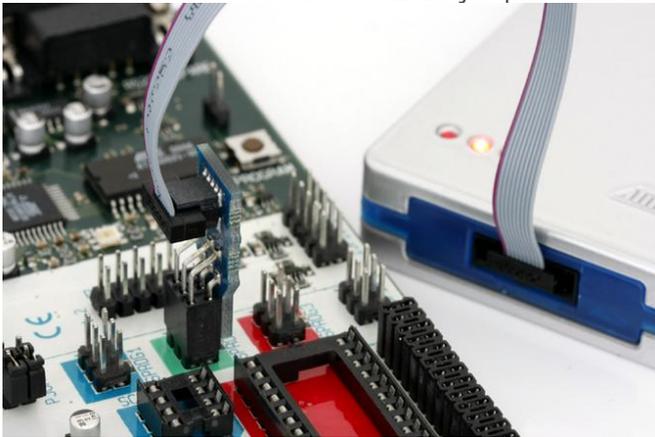
Using the Atmel JTAGICE3 with Atmel STK500

The Atmel STK500 starter kit can be used to house Atmel AVR devices to which the Atmel JTAGICE3 can connect through JTAG, debugWIRE and SPI interfaces.

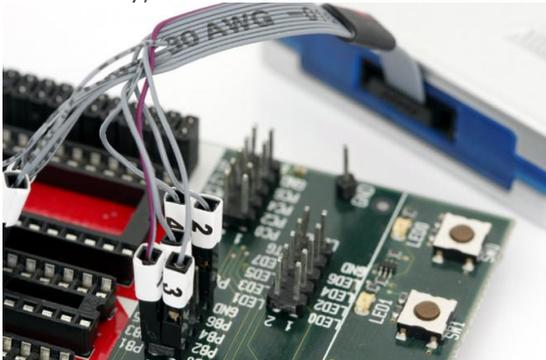
When connecting to a JTAG target, simply use the ATSTK500_JTAG_ADAPTER, which is supplied with the STK500 kit, available from store.atmel.com



Connecting to debugWIRE and SPI targets is done using the 6-pin 100 mil adapter. When using the debugWIRE interface, be sure to remove the STK500's RESET jumper to allow the reset line to be driven as required.



Alternatively, the JTAGICE3 can be connected to any target interface using the 10-pin mini-squid cable provided.



Using the Atmel JTAGICE3 with Atmel STK600

The Atmel STK600 starter kit can be used to house AVR devices to which the Atmel JTAGICE3 can connect through the JTAG, debugWIRE, PDI, SPI and aWire interfaces.



When connecting to a JTAG target, simply use the 10-pin 100mil adapter provided to connect to the JTAG connector on the STK600.



When connecting to a PDI, debugWIRE, SPI or aWire target, simply use the 6-pin 100mil adapter provided to connect to the SPI/PDI header connector.