MSP430 JTAG / BSL connectors

(PD010A05 Rev-4: 23-Nov-2007)

FAQ:

Q: I have a board with the standard TI-JTAG pinhead. Can I use your programmer to flash my MSP430Fxx device?

A: Yes. You can use any of our programmers to flash your device via standard 14-pin TI-JTAG connector. Our programmers use 14-pin connectors with the STANDARD TI-JTAG pinhead. In addition you can use the same connector to facilitate communication via BSL interface.

Q: How can I connect the Fast MSP430 JTAG/BSL Flash Programmer to the BSL (Bootstrap) interface.

A: We have two programmer models with the standard BSL pinhead connector (10-pins). You can use one of these programmers to communicate with the BSL interface. Our 14-pins JTAG connectors also support the BSL communication.

Q: How can I use the BSL interface on the Texas Instruments evaluation board with your Flash Programmers when only one 14-pin cable is provided?

A: Our Flash Programmers can utilize the 14-pin connector to facilitate both JTAG and BSL communication. To enable the BSL communication on the Texas Instruments evaluation board via the JTAG connector make the following wire connections on the evaluation board:

BSL pin-1	to	JTAG pin-12	- (BSL-Tx)
BSL pin-3	to	JTAG pin-14	- (BSL-Rx)

This modification DOES NOT affect the JTAG adapter, as the pins assigned to the BSL-Tx and BSL-Rx signals are unused by the JTAG Interface. This modification will allow you to communicate via JTAG or BSL interface using a single JTAG connector. Also you can still use any adapter with the standard BSL or JTAG pinhead cable using the:

1. BSL connector with the standard TI-BSL pinhead cable
2. JTAG connector with the standard TI-JTAG pinhead cable
3. JTAG connector with the Elprotronic's JTAG/BSL pinhead cable.

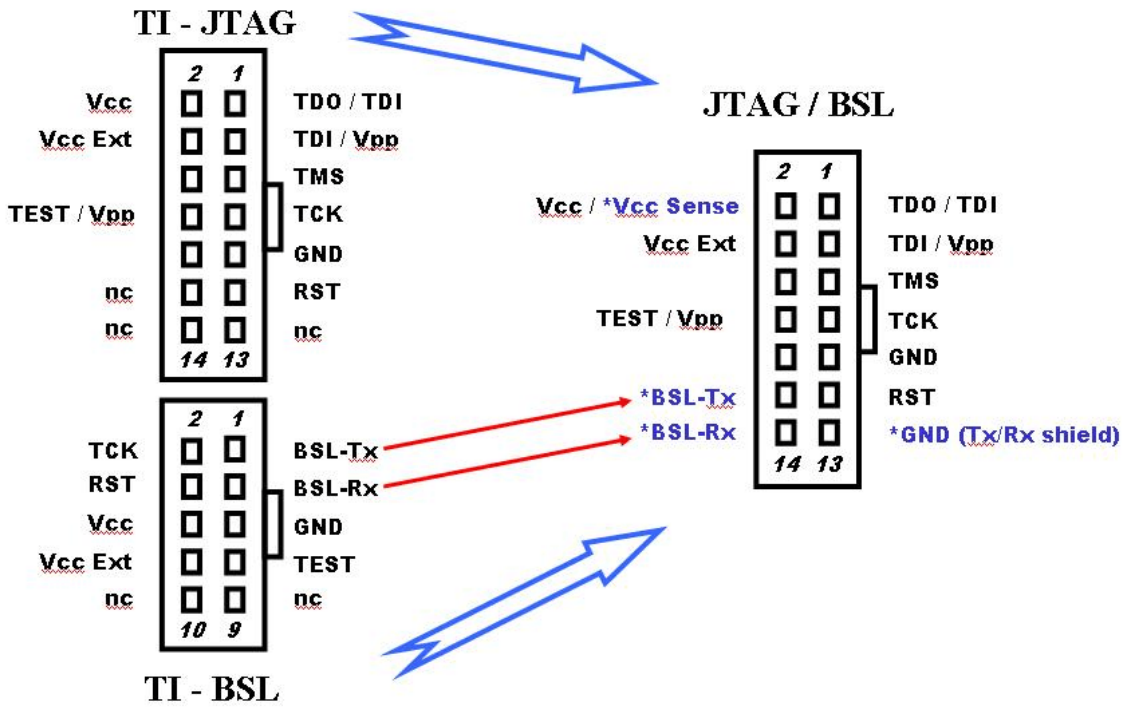
Joint JTAG and BSL connector

The Fast MSP430 Flash Programmers (USB and Parallel Port versions) with the JTAG and the BSL Interfaces use the **STANDARD 14-pin TI-JTAG** connector's pinout to facilitate the JTAG communication. Some of the unused pins on this connector are utilized to facilitate Bootstrap Loader (BSL) communication.

Texas Instruments created the standard for the MSP430 JTAG interface connector and for the Bootstrap Loader (BSL) connector. The JTAG and the BSL connectors share several common signals, such as RST, GND, Vcc, Vcc-Out, TEST and TCK. The BSL connector uses signals BSL-Tx and BSL-Rx that are not found in the JTAG connector. We can notice that the TI-JTAG connector has specified a maximum of 11 pins, and the remaining 3 pins are not used. These three pins can be used for the two BSL signals, namely BSL-Tx and BSL-Rx. By utilizing these unused pins enables us to facilitate both the JTAG and the BSL communication interfaces on a SINGLE 14-pin JTAG connector.

This modification **DOES NOT** affect the JTAG adapter, as the pins assigned to the BSL-Tx and BSL-Rx signals are unused by the JTAG Interface. This can save one connector and can simplify communication with the target device.

The pinout for the standard JTAG connector with added BSL-Tx and BSL-Rx signals is shown in figure 1. BSL-Tx and BSL-Rx signals are connected to the pins 12 and 14 respectively. In addition, a ground line is connected to pin 13. The JTAG signal lines are connected to pins number 1 through 11 in compliance with the standard JTAG specification provided by Texas Instruments. The definition of all pins is given in the table 1.



Stand-alone BSL connector

Figure 2 shows the standard BSL connector signals for the programming adapter. The definition of all pins is given in the table 2.

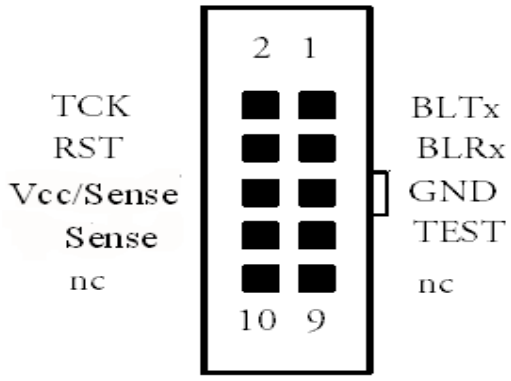


Figure 2. BSL header connector - solder side.

Table 1 JTAG Interface connector

Pin #	Name	Description
1 (Red)	TDO/TDI	Data output
2	Vcc/ Sense	Vcc supplied to the Target Device and Target's Device Vcc Sense
3	TDI-Vpp	Data Input - Blow Fuse voltage Vpp (+6.5V)
4	Sense	Target's Device Vcc Sense (used in the USB-MSP430-FPA - rev.1.1 and up and in the Parallel Port version programmer - PE010X01- 04) (not used in the USB-MSP430-FPA rev.1.0, PE010X01- 01, -02, -03)
5	TMS-In	TMS Input
6	NC	Not connected
7	TCK-In	Bootloader / JTAG TCK Input pin (note-3)
8	TEST-Vpp	Bootloader / JTAG TEST Input pin, Blow Fuse voltage Vpp (+6.5V) (note-4)
9	GND	Ground
10	NC	Not connected
11	\RST	Microcontroller Reset Input pin.
12	BLTx-Out (*)	Bootloader Tx Output from the target (note-1)
13	GND (*)	Ground
14	BLRx-In (*)	Bootloader Rx Input to the target (note-2)

Table 2 BSL Interface connector

Pin #	Name	Description
1 (Red)	BLTX-Out	Bootloader Tx Output from the target (note-1)
2	TCK-In	Bootloader / JTAG TCK Input pin (note-3)
3	BLRx-In	Bootloader Rx Input to the target (note-2)
4	\RST	Microcontroller Reset Input pin.
5	GND	Ground
6	VCC/ Sense	Vcc supplied to the target and Target's Device Vcc Sense
7	TEST-In	Bootloader / JTAG TEST Input pin (note-4)
8	Sense	Vcc Output (max 6V) or Power Off signal from the target. (note-5)
9	nc	Not connected
10	nc	Not connected

NOTE (*): Pins numbers 12,13 and 14 of the JTAG connector has modified connection compared to the standard TI JTAG FET adapter. Typically those pins are not used in TI JTAG FET but has been used in the Fast MSP430 Programming adapter to pass the Tx and Rx signals of the BSL communication port. When this modification is done, then one modified 14-pins JTAG connector can be used to JTAG and BSL communication between target device and programming adapter.

Note-1. BLTX-Output - Transmit data output pin from the bootstrap loader.
Port pin 1.1 for microcontrollers MSP430F1xx.
Port pin 1.0 for microcontrollers MSP430F4xx.

Note-2 BLRx-Input - Receive data input pin to the bootstrap loader.
Port pin 2.2 for microcontrollers MSP430F1xx.
Port pin 1.1 for microcontrollers MSP430F4xx.

Note-3 TCK-Input - for BSL used only for microcontrollers with package over 28 pins.

Note-4 TEST-Input - for BSL used only for microcontrollers with package up to 28 pins.

Note-5 Signal is not mandatory. Can be connected to external power supply with DC voltage between 5V to 6V to power the target devices via adapter's LDO 3.3V regulator and controlled by interface switch (see block diagram). Maximum current supplying target devices in this case can not exceed 200 mA (instead of 15 mA without external power supply).

Refer to the Texas Instruments data sheet for detailed information related to pin numbering of a particular microcontroller.

Example how to provide the JTAG / BSL connection

Figure 3 show typical interconnection between the JTAG (14 pin header connector), the BSL connector (10 pin header connector) and MSP430F149 microcontroller.

Figure 4 show interconnection between modified JTAG connector and MSP430F149 microcontroller. Two lines - BLRx and BLTx have been connected to not used pins 12 and 14 of the standard JTAG connector. This modification allows use of the only one modified JTAG connector to connect the JTAG and BSL communication interface to programming adapter.

Figure 5 show interconnection with MSP430F1122 microcontroller.

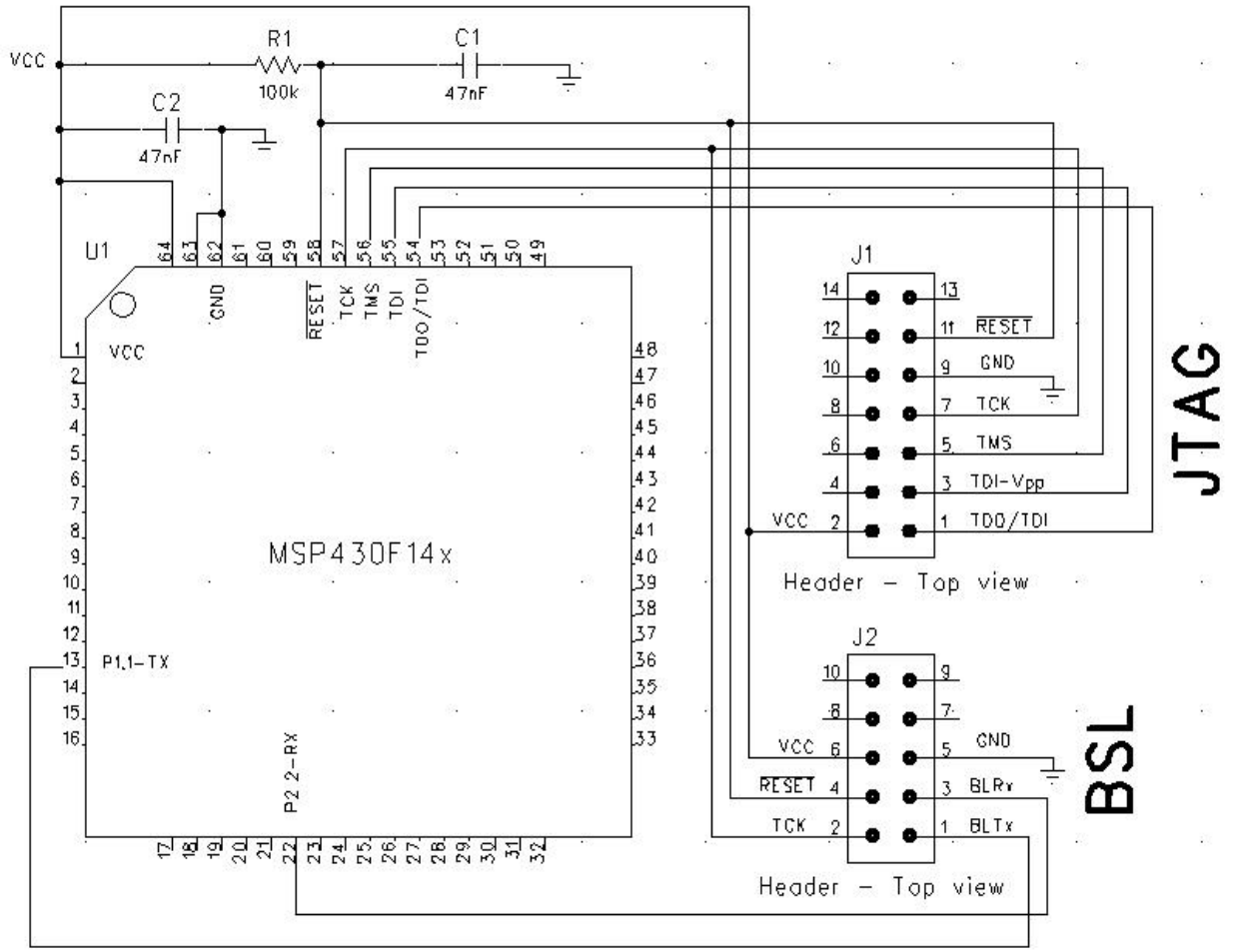


Figure 3

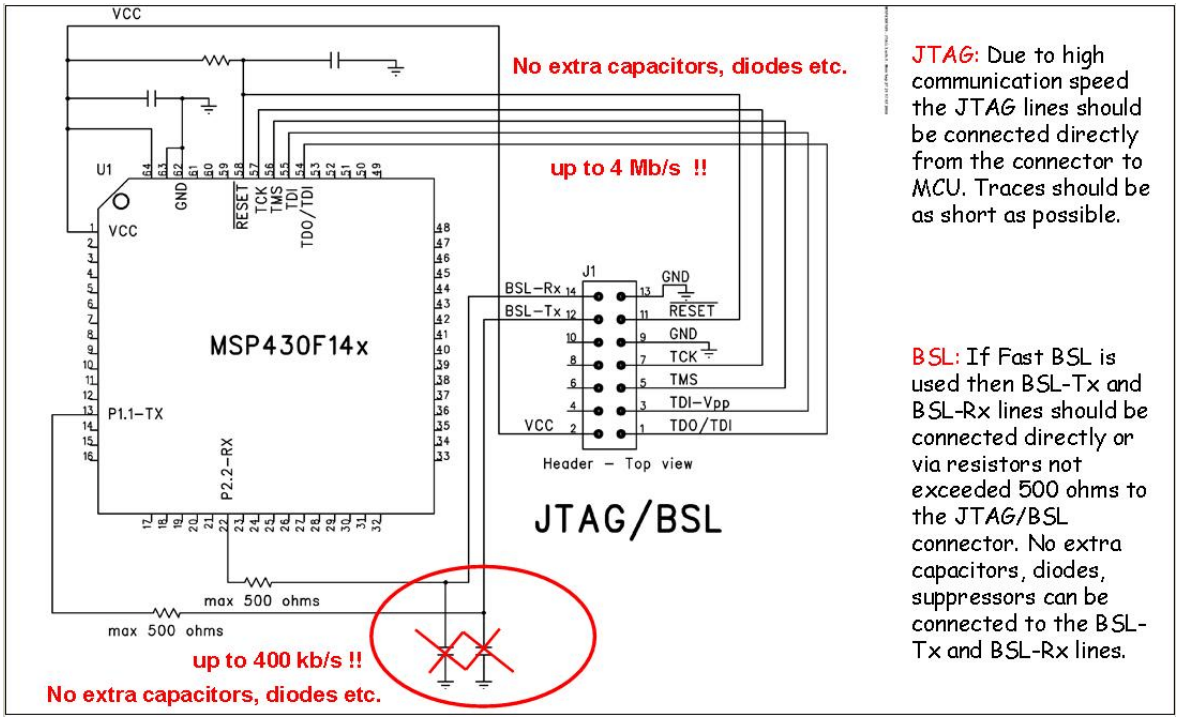


Figure 4

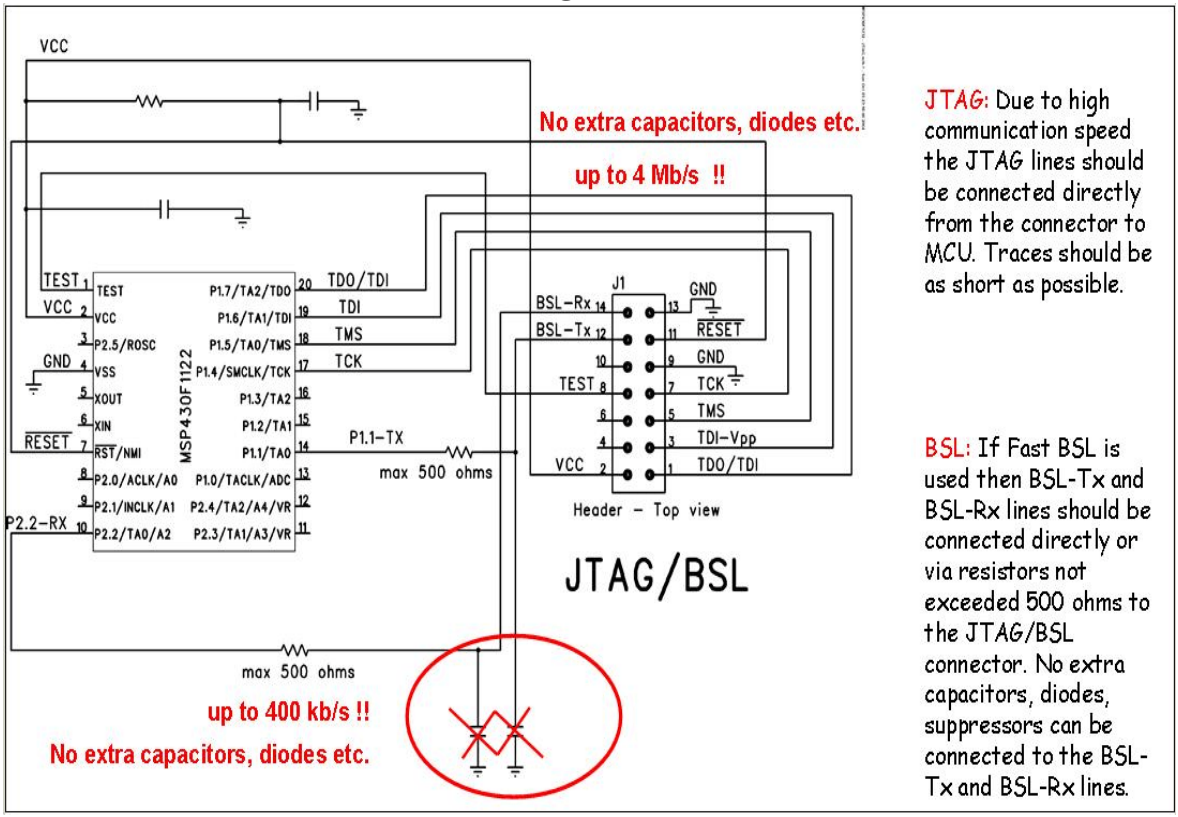


Figure 5

Figure 6 show interconnection between JTAG/SBW connector and the MSP430F2031 microcontroller using the **Spy-Bi-Wire** interface.

Figure 7 and 8 shows **Spy-Bi-Wire** and RESET circuits.

Figure 9 to 12 shows interconnection between JTAG/SBW/BSL connector and the MSP430F22x4 microcontroller using the **BSL only, Spy-Bi-Wire and BSL** and **JTAG and BSL** interfaces (without RESET circuits).

Refer to the Texas Instruments data sheet for detailed information related to pin numbering of a particular microcontroller.

Due to high communication speed (up to 4Mbit/s) via JTAG interface, the JTAG lines should be connected directly from the connector to the target device. PCB lines should be as short as possible. Total cables and PCB lines length from the JTAG programming adapter to the JTAG target device pins (ribbon cable, connectors and traces on the PCB) should not exceed 50 cm (20 inches) to avoid communication problem. If from any reason the target device contains extra components like capacitors or suppressors in the JTAG lines then the slower JTAG communication speed can be selected. The ***FlashPro430*** software allows to select 4Mb/s, 1Mb/s and 400 kb/s JTAG communication speed between programming adapter and target device (software version 1.08 and higher).

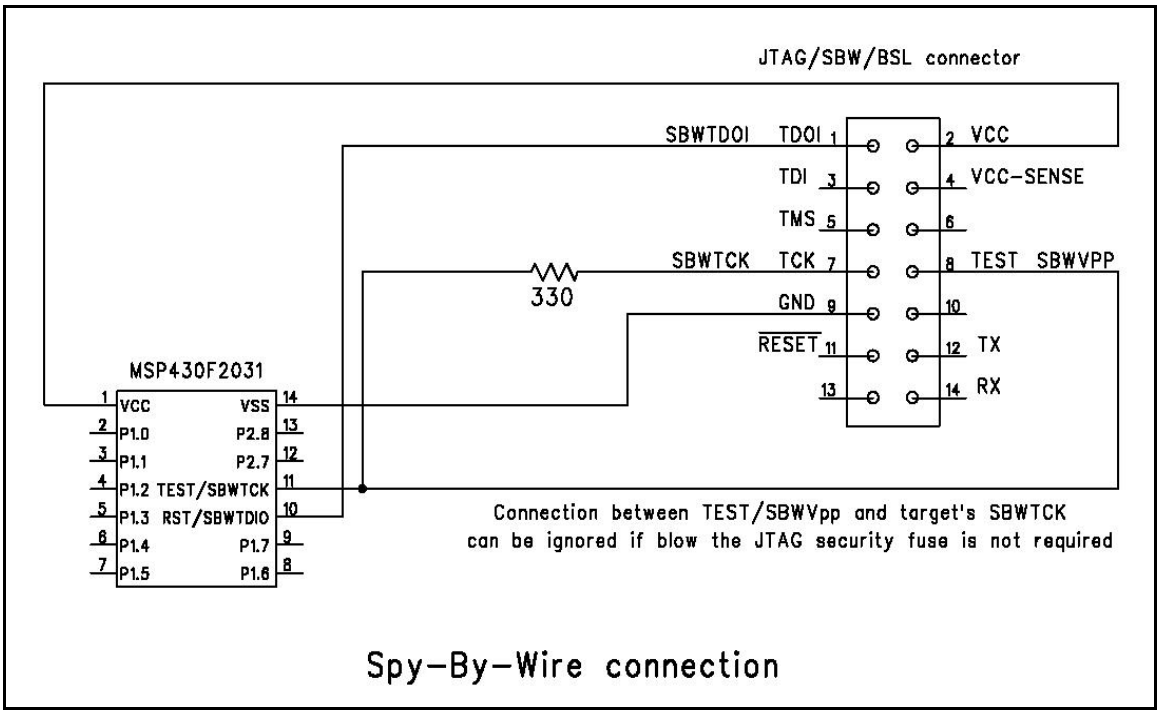


Figure 6

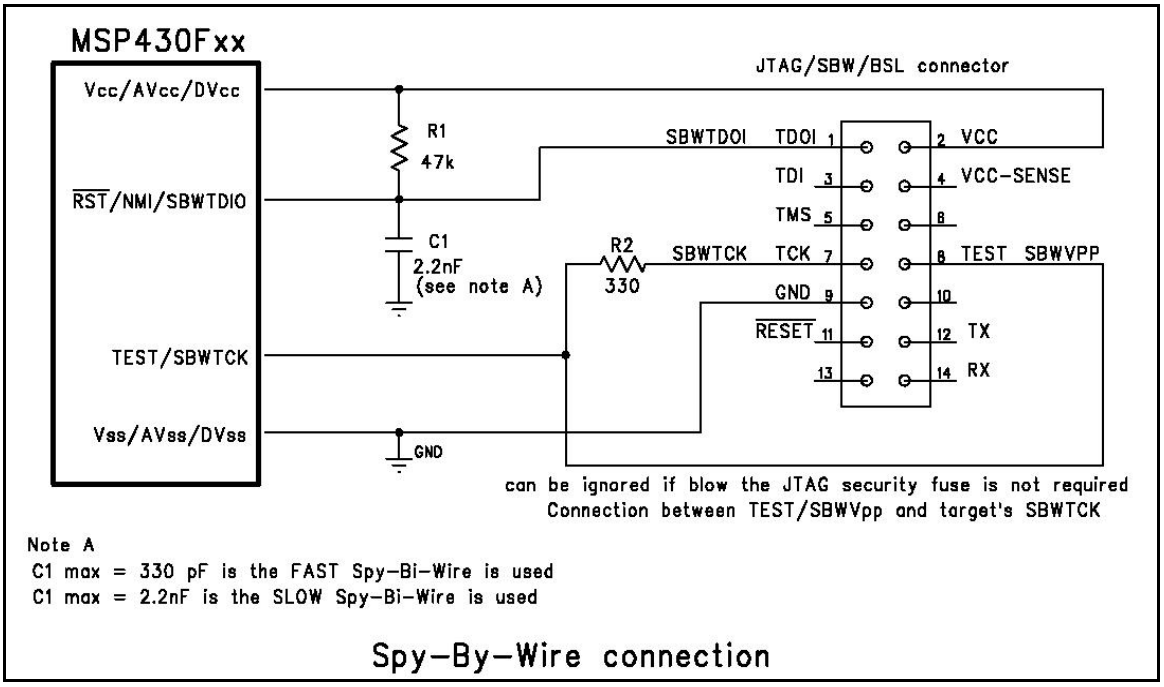


Figure 7

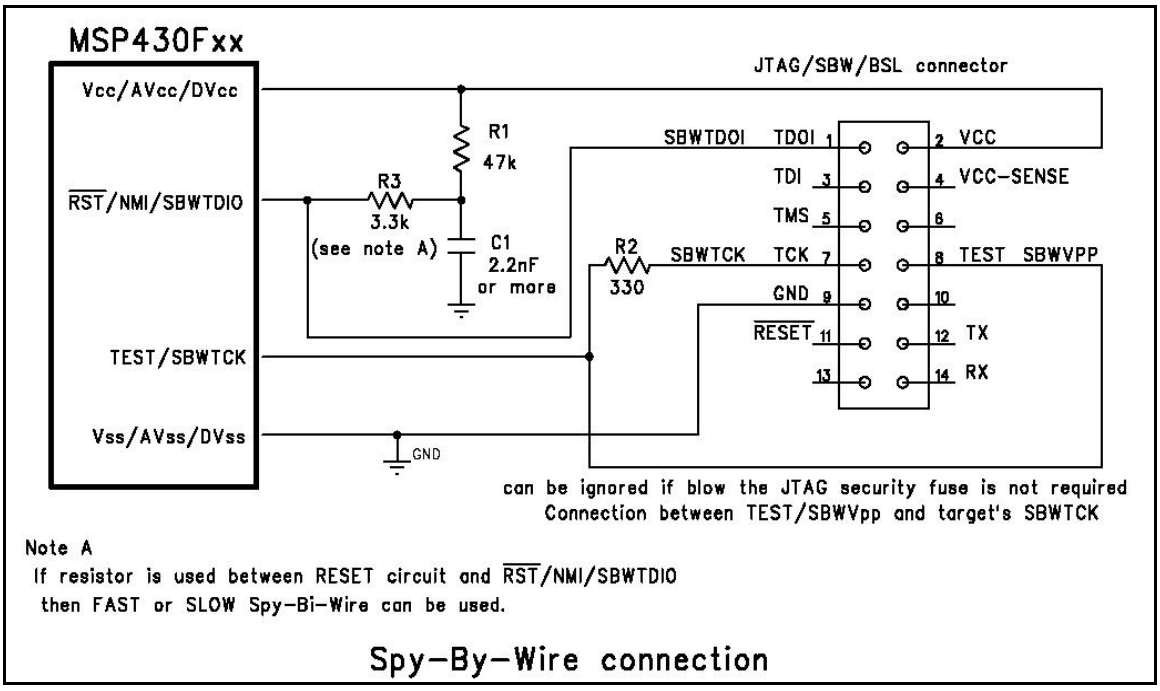


Figure 8

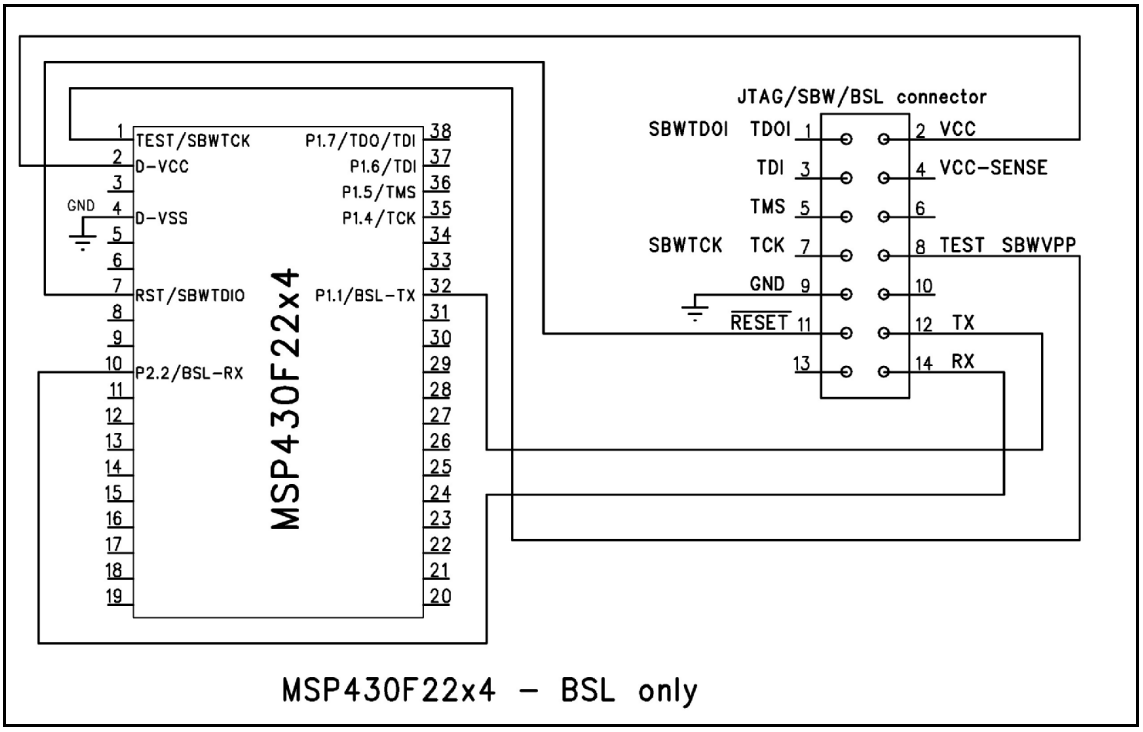


Figure 9

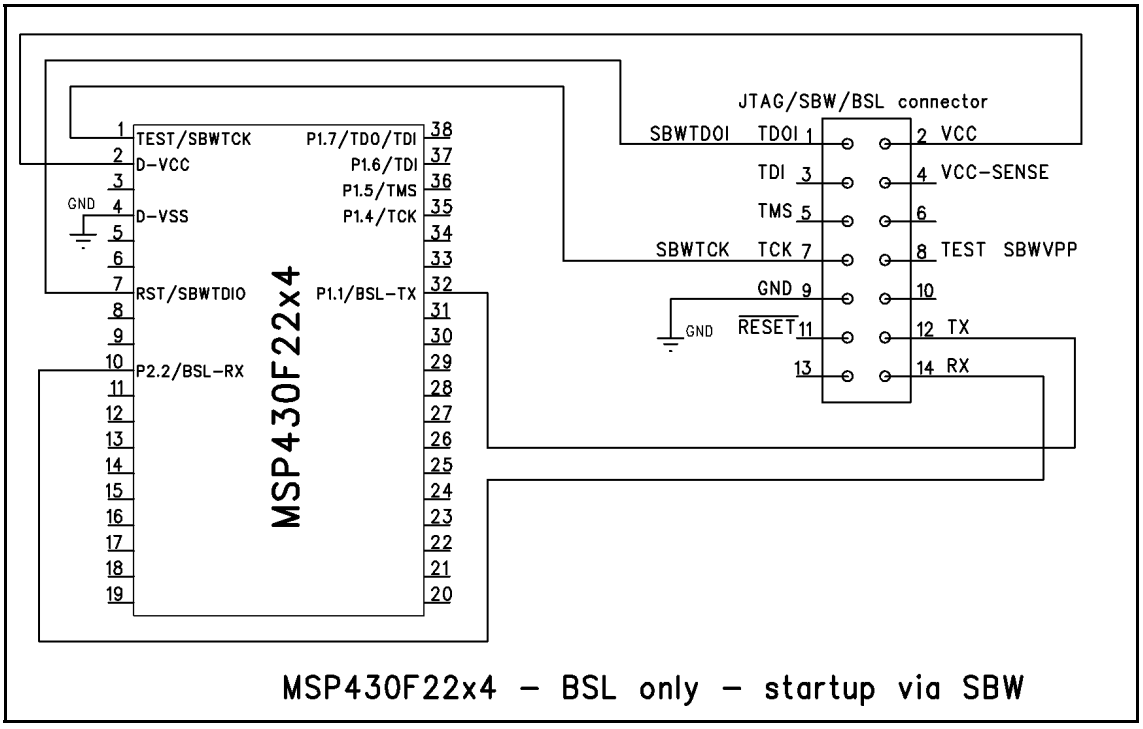


Figure 10

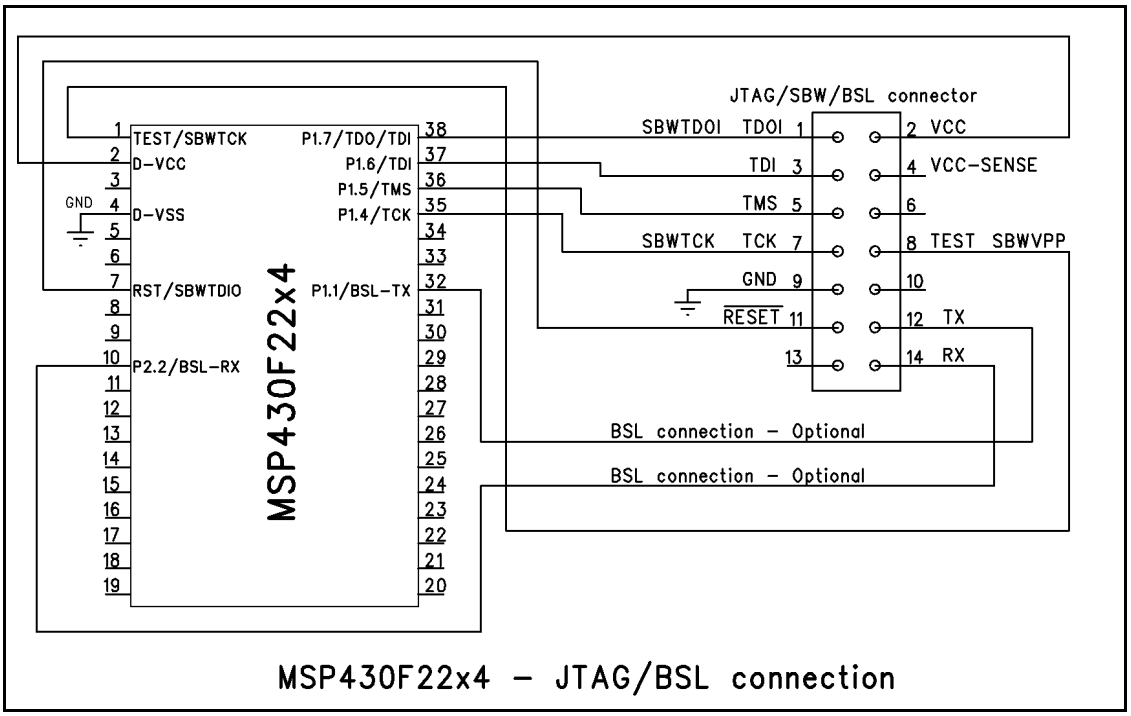


Figure 11

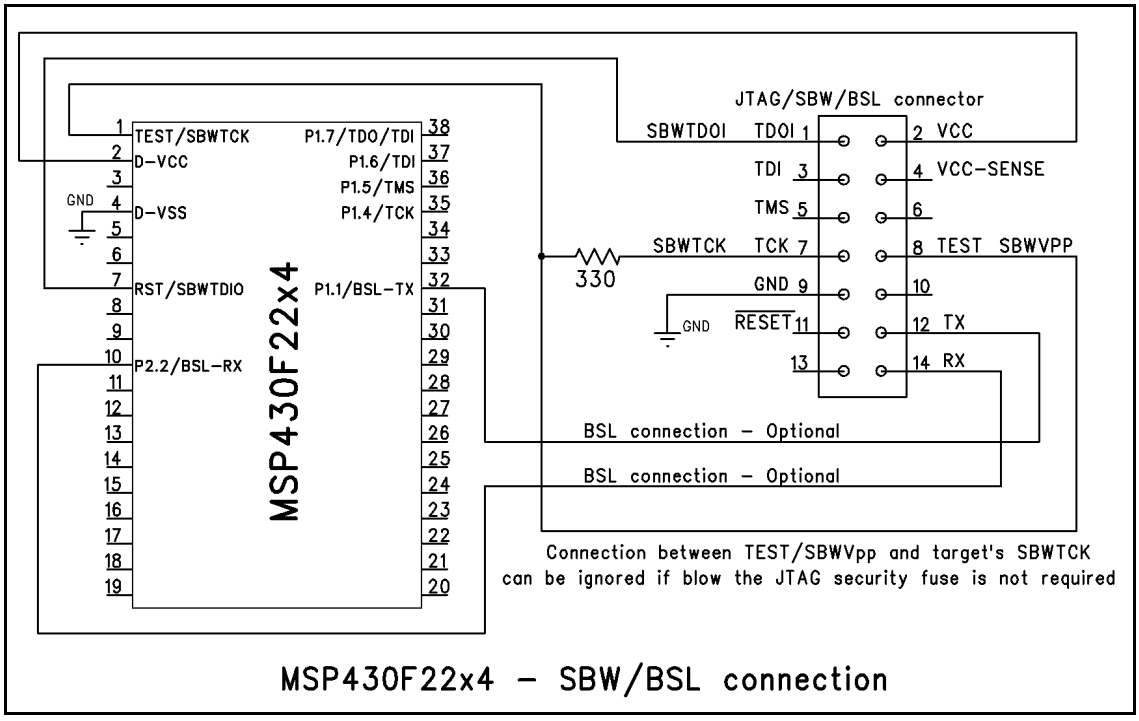


Figure 12