EV98D91A

2-Lead µVSFN mikroBUS™ Socket Board User Guide

Introduction

The EV98D91A 2-lead µVSFN mikroBUS™ compatible socket board is developed to be used with both serial EEPROM memory devices and security devices that are parasitically powered and are available in the 2-lead µVSFN package. The socket board can be used with any of the Microchip's microcontroller boards that support a Mikroelektronika mikroBUS interface. The board's dimensions match the large-size add-on board as defined in the mikroBUS specification. Through use of an adapter board, the socket board can also be used with Microchip microcontroller development boards that support an Xplained Pro interface. Having a socket board allows a customer to reuse the board with multiple 2-lead µVSFN sample devices for a given application or for multiple different applications. The 2-lead µVSFN mikroBUS socket board offers a less expensive option to configure and test the device and its features before mass production.

The board supports two different Single Wire Interfaces (SWI). These will be referred to as SWI and SWI-PWM. Any given Microchip cryptographic device will support either one or the other interface but never both. A jumper is provided on the board to select between these two interfaces.

Figure 1. 2-Lead µVSFN Socket Board

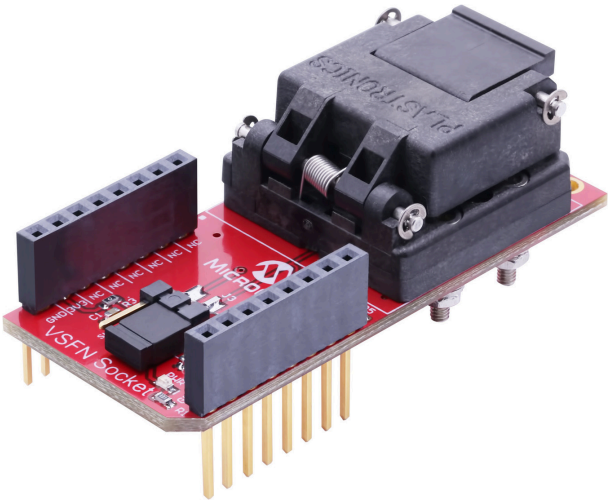


Table of Contents

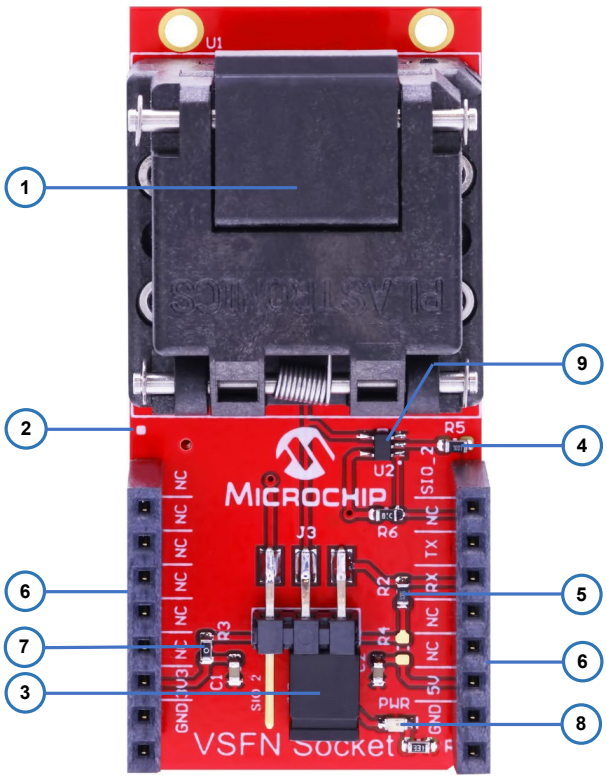
1. Hardware Description

The EV98D91A 2-lead µVSFN mikroBUS compatible socket board has multiple configuration options to accommodate a variety of products that are manufactured in a 2-lead µVSFN package. The circuitry for this board is described in the following subsections.

1.1 Key Features

The most important features of the EV98D91A are highlighted in this section.

Figure 1-1. Key Feature Identification

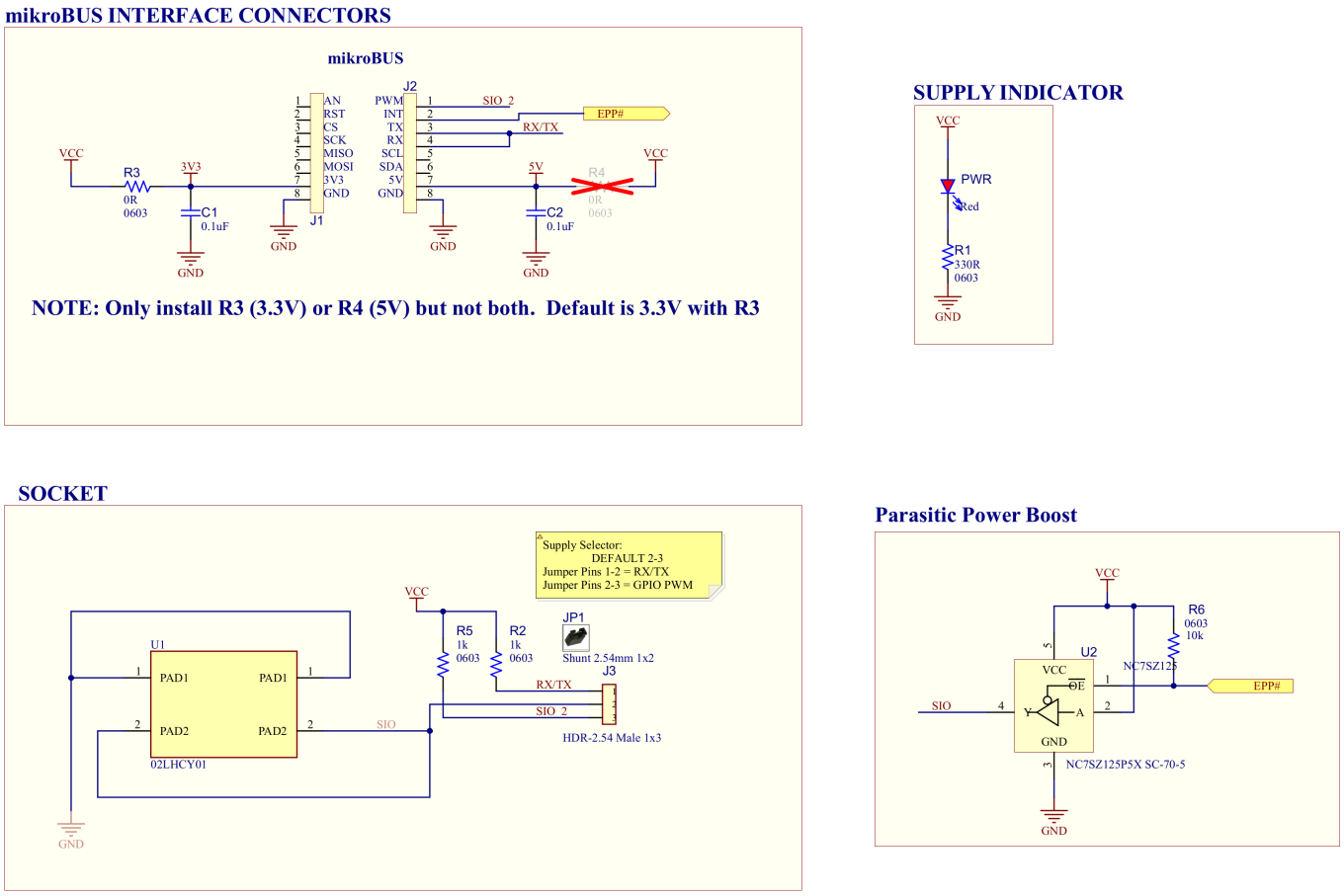


1. 2-Lead µVSFN Socket (U1)
2. Pin 1 Indicator
3. Interface Selection Jumper (J3)
4. SWI-PWM Pull-up Resistor (R5)
5. SWI Pull-Up Resistor (R2)
6. mikroBUS™ Connector (J1, J2)
7. Zero-ohm Resistor Jumpers to Select 3.3V or 5VPower (3.3V Enabled by Default via R3)
8. On-Board LED Power Indicator (LD1)
9. Parasitic Power Boost Circuitry (U2, R6)

Note: To enable 5V power, remove R3 and solder a zero-ohm resistor into R4.

1.2 Schematic

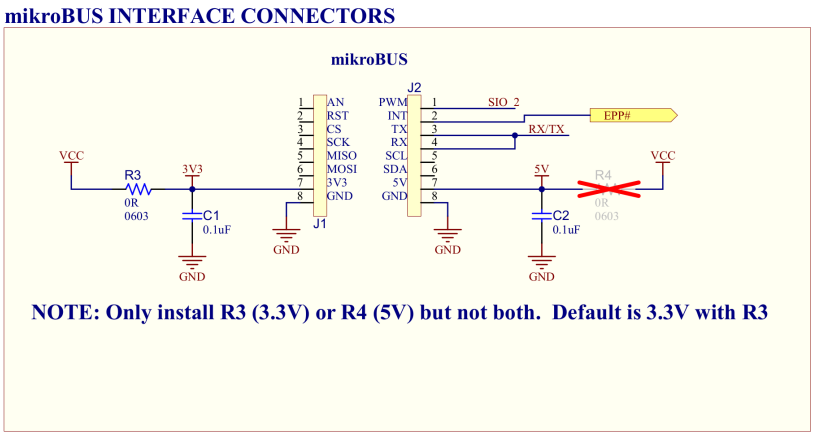
Figure 1-2. 2-Lead µVSFN Top-Level Schematic



1.2.1 mikroBUS Header

Headers J1 and J2 create the standard mikroBUS extension board header interface. The EV98D91A board complies with the large size of the mikroBUS extension. Pass-through headers are implemented on the board to allow for additional boards to be stacked on top of the EV98D91A development board. Extension boards stacked on top are limited to the mikroBUS small size extension boards.

Figure 1-3. Header Interface



Note: Only install R3 (3.3V) or R4 (5V) but not both. Default is 3.3V with R3.

J1 Signal Names/Pin Descriptions

- J1 pin 7, 3.3V supply to board with R3 installed (default)
- J1 pin 8, GND
- All other signals not specified are unused

J2 Signal Names/Pin Descriptions

- J2 pin 1, SIO_2 is the data signal for the SWI-PWM mode
- J2 pin 2, INT (EPP#) is used to enable optional Parasitic Power boost mode (default, leave this floating)
- J2 pin 3, 4, TX/RX are tied together and are used for the SWI mode of operation
- J2 pin 7, 5V supply to board with R4 installed (uninstalled by default)
- J2 pin 8, GND
- All other signals not specified are unused

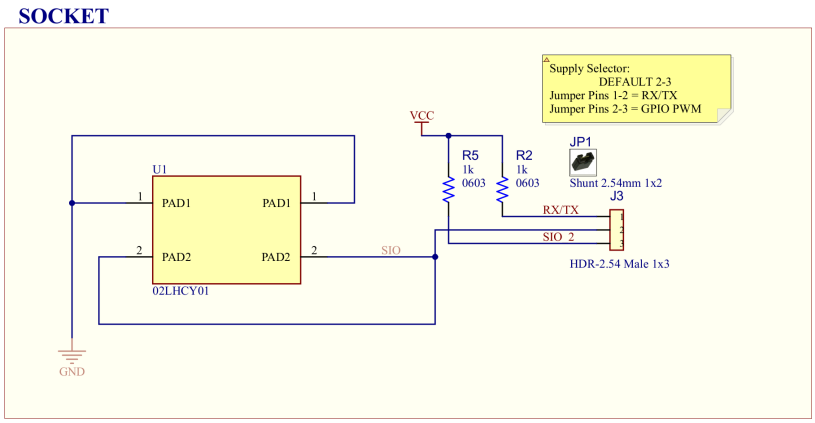
1.2.2 2-Lead µVSFN Socket Interface

The basic circuitry needed to use a device in a 2-lead µVSFN socket includes:

- Socket U1 has pogo pins to connect the 2-lead µVSFN to the socket and the board.
- Jumper J3 connects the SIO signal to either RX/TX (SWI mode) or SIO_2 (SWI-PWM mode) header pins on header J2. R2 and R5 are pull-up resistors connected to the respective signal lines for each mode of operation. These resistors are required for correct operation. By default, the Jumper cap JP1 is connected to signal SIO_2.

Tip: For correct configuration based on part number, see Table 4-1.

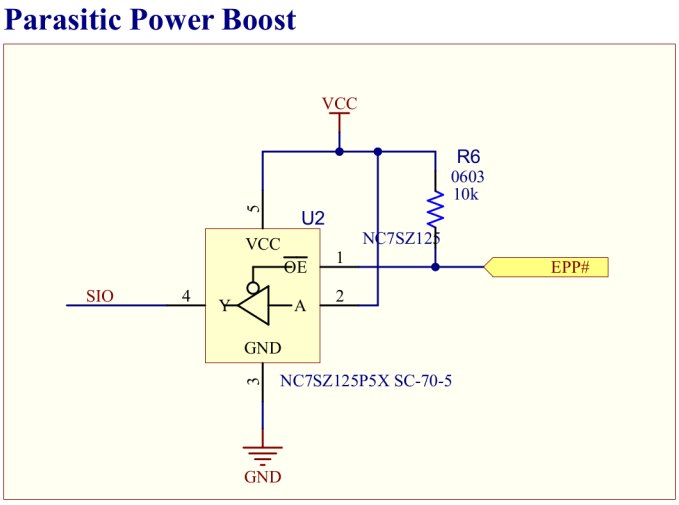
Figure 1-4. 3-Lead Contact Socket



1.2.3 Parasitic Power Boost Circuitry

The parasitic power boost circuitry is optional circuitry used to provide additional current to a device when executing a command. It works for both the SWI and the SWI-PWM modes. This circuitry is only required when the current demands of the command exceed the power capability of the I/O driving the SWI. By default, the Enable Parasitic Power (EPP#) pin will default HIGH disabling this circuitry. This circuitry is not needed when sending a command or receiving a response from the crypto device. It is only needed during the execution phase of a command.

Figure 1-5. Parasitic Power Boost Circuitry



Proper Circuitry Usage

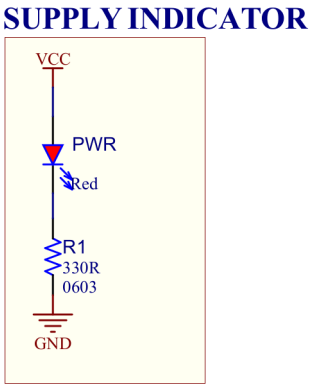
1. The EPP# signal must be initially asserted HIGH.
2. Issue a cryptography command.
3. Assert the EPP# signal LOW for the duration of the command.
4. Assert the EPP# signal HIGH.
5. Read back the command response.

Restriction: The software required to implement this feature is left up to the developer. It is not built into the current kit protocol firmware.

1.2.4 Power Indication

The supply power indicator is a red LED (PWR) that illuminates when the board has power. This will work for both 3.3V or 5V supply options and will light over the full range of power supply voltage for all devices.

Figure 1-6. Supply Indicator



2. Hardware Documentation

Additional documentation on the devices that are used with this board can be found on the Microchip website.

CryptoAuthentication Device Documentation

- ECC206 – Secure asymmetric key storage and crypto acceleration
- SHA106 – Secure symmetric key storage and crypto acceleration

Serial EEPROM Device Documentation

- AT21CS01 – 1 Kbit (V_{CC} = 1.7 to 3.6V)
- AT21CS11 – 1 Kbit (V_{CC} = 2.7 to 4.5V)

EV98D91A Board Design Files

- EV98D91A Web Page
- Board Design Documentation
- Gerber Files

Host Boards and Adapters

- DM320118 – CryptoAuthentication™ Trust Platform Development Kit(1)
- ATSAMD21-XPRO – SAM D21 Xplained PRO Evaluation Kit(1)
- ATMBUSADAPTER-XPRO – mikroBUS Xplained PRO
- Curiosity Development Boards(2)

Tip:

1. Recommended for use with CryptoAuthentication Devices and TPDS Tools.
2. Can be used with any of the devices, but specific software may need to be developed.

3. Software Requirements

For proper detection and recognition of all CryptoAuthentication security devices, installing the latest version of Microchip's CryptoAuthLib and the latest version of the Kit Protocol for the CryptoAuth Starter Kit and the Trust Platform Kit is recommended. For memory devices, contact Microchip's Serial EEPROM Memory group for more information.

C-code and Python versions of the CryptoAuthentication Library (CAL) are available. The minimum recommended versions are shown in the Crypto Authentication Software section below, along with links to the software libraries. Python version 3.8 or higher is required for proper operation.

The latest versions of firmware for the CryptoAuth SOIC Starter Kit and the Trust Platform Development Kit can always be found on the respective kit pages along with installation instructions. The minimum recommended firmware versions are shown in the Crypto Authentication Software section below, along with links to the latest firmware.

Crypto Authentication Software

- CryptoAuthLib – C: Minimum recommended version: 3.5.1
- CryptoAuthLib – Python: Minimum recommended version: 20230326
- Firmware for CryptoAuth Trust Platform: Minimum recommended version: 3.1.0
- Firmware for CryptoAuth SOIC Starter Kit: Minimum recommended version: 3.1.0

Serial EEPROM Memory Products Software

- Interfacing PIC® MCUs with Single-Wire Serial EEPROMs
- Contact Microchip for additional Software Support.

4. Modes of Operation

The EV98D91A 2-lead µVSFN mikroBUS compatible socket board has multiple modes of operation. These are configured via jumpers or 0Ω resistors.

Power Selection

A user can choose between 3.3V or 5V power from the interface header by installing a 0Ω resistor in either the R3 or the R4 locations. When R3 is installed, the 3.3V power source is connected. When R4 is installed, the 5.0V power source is connected. The board is shipped with a default 3.3V supply. If 5V are required, remove the R3 and install the R4. Prior to enabling 5V operation, ensure that the host micro-controller board is capable of supporting 5V operation.

Important: R3 and R4 must never be populated at the same time.

Modes of Operation

There are two possible modes of operation depending on the SWI selected. For both interfaces, only a parasitically-powered device can be used on the board. The following table indicates how the EV98D91A development board must be configured for each mode.

Table 4-1. Modes of Operation

Interface Type	Jumper Connection	Devices
SWI(1)	SIO-RX/TX	n/a
SWI-PWM(2)	SIO-SIO_2	**Security Devices** • ECC206 – Asymmetric Cryptography • SHA106 – Symmetric Cryptogrpahy **Memory Devices** • AT21CS01 – 1 kBit (1.7 to 3.6 V_{CC}) • AT21CS11 – 1 kBit (2.7 to 4.5 V_{CC})(3)

Notes:

1. Currently, there are no CryptoAuthentication devices that are implemented that utilize the SWI in the 2-lead µVSFN package.
2. Additional devices may be released at a future date.
3. Check with Microchip to determine the availability of this device in the 2-lead µVSFN package.

The SWI mode uses the RX/TX signal for communication purposes. Note that the RX/TX signals are shorted together on the development board. A pull-up resistor is used to pull the signal High when the crypto device communicates to the microcontroller. There is a 1-kΩ pull-up resistor R2 connected to the TX/RX signals. Jumper J3 needs to short the RX/TX signal and SIO pins.

The SWI-PWM mode uses the PWM signal for communication. The single-wire communication will be through SIO_2 using J2 pin 1. There is a 1-kΩ pull-up resistor R5 on SIO_2. Jumper J3 needs to short the SIO_2 and SIO pins.

Parasitic Power

Parasitic power devices do not require a dedicated power source. An internal capacitor provides the decoupling and charge storage that the device needs for proper operation. For correct operation, the SIO signal must always be greater than the minimum supply operating voltage of the device. See the specific device data sheet for more details and recommendations.

Related Links

2. Hardware Documentation

1.2.3. Parasitic Power Boost Circuitry

5. Connecting the Board

The form factor of the 2-lead µVSFN was chosen because Microchip has heavily adopted the use of the mikroBUS connector on host boards. Many of Microchip's development platforms will support one or more mikroBus interfaces. These include:

- Microchip Explorer 16/32 Development Board
- MPLAB® Xpress Evaluation Board
- Automotive Networking Development Board
- PIC® Curiosity Boards
- PIC Curiosity Nano Boards
- AVR® Curiosity Nano Boards

5.1 CryptoAuth Trust Platform Connections

The 2-lead µVSFN has a dedicated SWI-PWM connection through the mikroBUS header that enables it to connect to the mikroBUS host header present on the Trust Platform or any of the PIC/AVR/SAM MCU host development boards that have a mikroBUS header. The SWI-PWM connection is always connected to the host micro on the Trust Platform board.

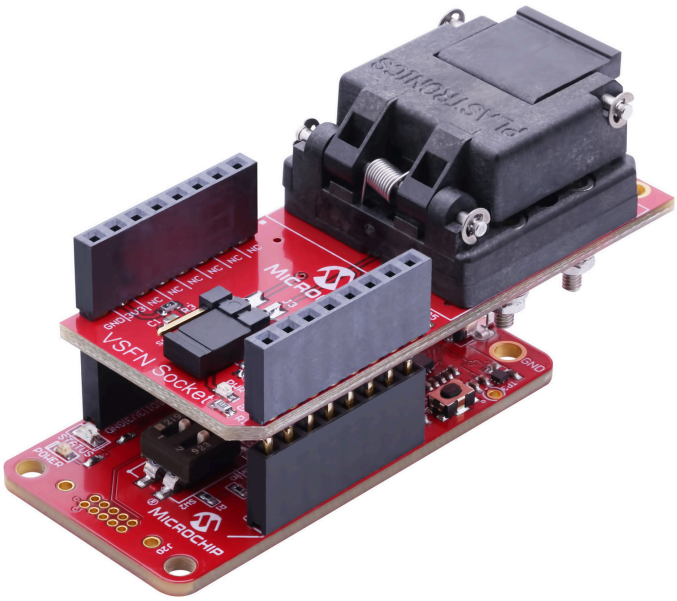
Connecting the 2-Lead µVSFN to the CryptoAuth Trust Platform

1. Configure the EV98D91A to the desired mode as specified in 4. Modes of Operation.
2. Set the switches on the CryptoAuth Trust Platform to disable the on-board devices. Note that the SW2_1 switch will have no effect on this mikroBUS board. This setting is highlighted in bold and italic below:

Switch Settings		What is Enabled	
SW2_1	SW2_2	mikroBUS™ Header	On-Board Devices
N/A	ON	Yes	Yes
N/A	***OFF***	***Yes***	***No***

3. Connect the two boards as shown in the following figure.

Figure 5-1. EV98D91A Connected to a CryptoAuth Trust Platform Development Board



Remember: The angled notch on the 2-lead µVSFN must be aligned with the angled line on the silk screen near the mikroBUS connector.

4. Connect a USB cable between the CryptoAuth Trust Platform on the host system where the software is developed.
5. Invoke the software tools for the given application or the use case that is being developed.

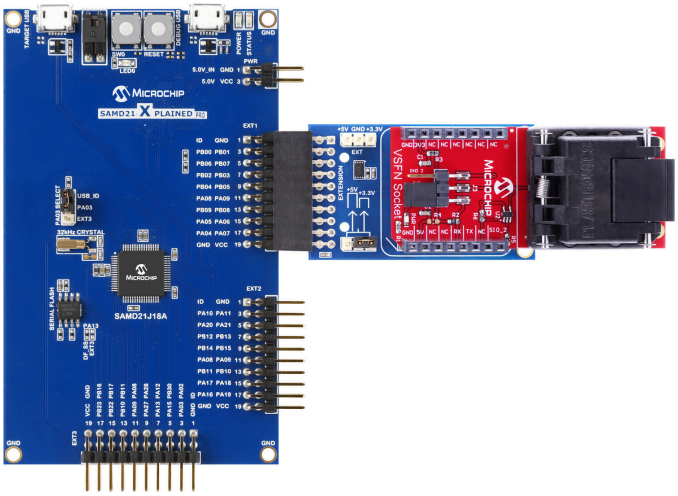
Related Links

4. Modes of Operation
2. Hardware Documentation

5.2 Xplained Pro Connections

Some Microchip development boards support only the Xplained Pro extension headers. Through use of an adapter board, the 2-lead µVSFN socket board can still be used. The figure below shows the full assembly of the 2-lead µVSFN socket board, the ATMBUSADAPTER-XPRO and an ATSAMD21-XPRO Development board.

Figure 5-2. XPRO Connections to the 2-Lead µVSFN Board



How to Connect the 2-Lead µVSFN to an Xplained Pro Host Board

1. Configure the EV98D91A to the desired mode as specified in 4. Modes of Operation.
2. Connect the ATMBUSADAPTER to the 2-lead µVSFN as shown in Figure 5-2.
3. Connect the combined ATMBUSADAPTER and 2-lead µVSFN to one of the XPRO extension connectors on the host board. EXT1 is used in Figure 5-2.
4. Connect the USB cables to the TARGET USB Port and the DEBUG USB Port and the host system.
5. Invoke the appropriate software development tools for the application.

Important: The EV98D91A kit must be connected to EXT1 if the device supports the SWI-PWM protocol or EXT2 or EXT3 for a product that supports the SWI protocol.

Related Links

2. Hardware Documentation
4. Modes of Operation

6. Revision History

Revision A (March 2023)

- Initial release of this document

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