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**3-Lead Contact mikroBUS™ Socket User's Guide**

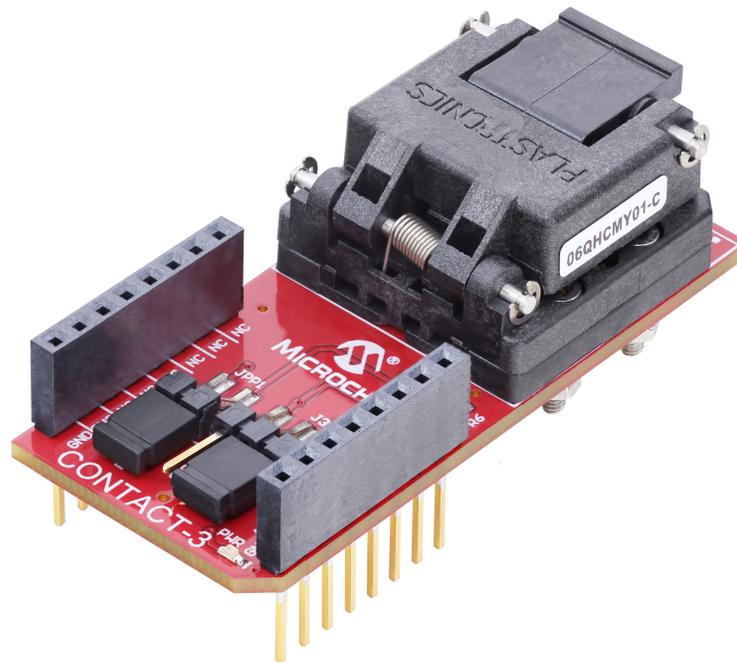
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**Introduction**

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The EV27Y72A 3-lead Contact mikroBUS™ compatible socket board is developed for the use of the Microchip 3-lead Contact package with a variety of ICs. 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 3-lead Contact sample devices for a given application or for multiple different applications. The 3-Lead Contact 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 the SWI and SWI-PWM interfaces. 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. Each interface can be run with a direct connection to power or by using parasitic power.

**Figure 1. 3-Lead Contact Socket Board**

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## 1. Hardware Description

The EV27Y72A 3-lead Contact mikroBUS compatible socket board has multiple configuration options to accommodate a variety of products that support a 3-lead Contact package. The circuitry for this board is described in the following subsections.

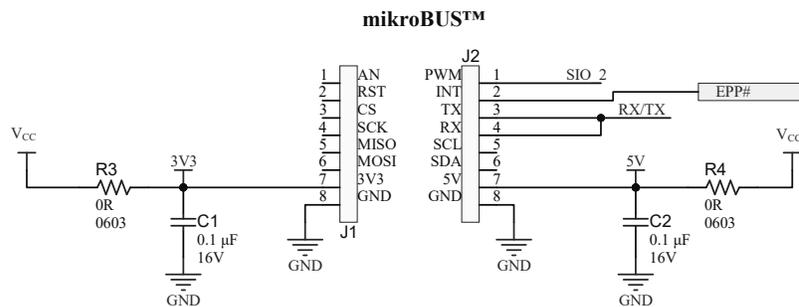
### 1.1 Key Features

- One mikroBUS Pass-Through Interface Connector (J1, J2)
- One 3-Lead Contact Socket (U1) for a 6.5 mm x 2.5 mm Package
- 0Ω Resistor for Selecting a 3.3V (R3) or 5V (R4) Power (Default Setup Uses 3.3V, R3). Only One Can Be Populated at a Given Time.
- Jumper (J3) for Selecting Between SWI and SWI-PWM Modes
- Jumper (JPP1) for Selecting Between Direct V<sub>CC</sub> Power and Parasitic Power Modes of Operation
- One Red LED (PWR) to Indicate V<sub>CC</sub> Power is Applied to the Board

### 1.2 mikroBUS Header

Headers J1 and J2 create the standard mikroBUS extension board header interface. The EV27Y72A 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 EV27Y72A development board. Extension boards stacked on top are limited to the mikroBUS small size extension boards.

**Figure 1-1. Header Interface**



**Note:** Only install R3 (3.3V) or R4 (5V), 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

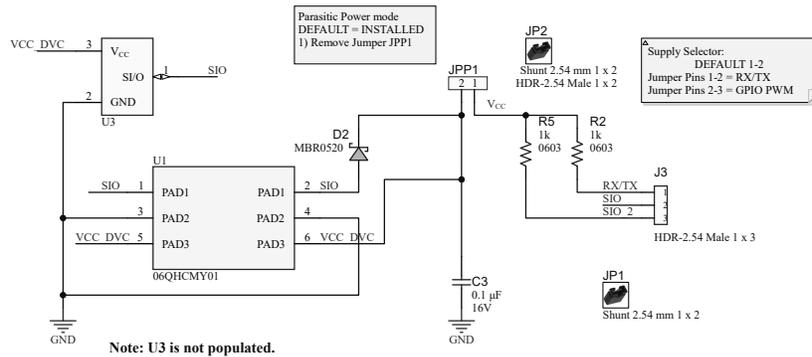
- J2 pin 1, SIO\_2 is the data signal for the SWI-PWM mode
- J2 pin 2, INT (EPP#) is used to enable optional Parasitic Power boost mode (default, leave this floating)
- J2 pin 3, 4, TX/RX are tied together and are used for the SWI mode of operation
- J2 pin 7, 5V supply to board with R4 installed (uninstalled by default)
- J2 pin 8, GND
- All other signals not specified are unused

### 1.3 3-Lead Contact Socket Interface

The basic circuitry needed to use a device in a 3-lead Contact socket includes:

- Socket U1 has pogo pins to connect the 3-lead Contact device to the socket and the board.
  - Pins 1 and 2 (PAD1) provide the SIO signal connection.
  - Pins 3 and 4 (PAD2) provide the connection to GND.
  - Pins 5 and 6 (PAD3) provide the connection to VCC\_DVC.
- U3 provides a footprint for 3-lead Contact devices and is not populated. The footprint is beneath the socket. If so desired, the socket can be removed and a device can be soldered directly to 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.
- JPP1 is a parasitic power jumper that either connects the power directly to the socket or enables the Parasitic Power mode.
  - JPP closed: V<sub>CC</sub> power is applied directly to the socket.
  - JPP open: The device is powered parasitically through the SIO signal and diode D2.
- Diode D2 is used to allow charging of the C3 capacitor when in Parasitic Power mode. The C3 capacitor provides power to the device in Parasitic Power mode. When the SIO voltage is higher than the VCC\_DVC voltage by the forward bias voltage of the diode, the C3 capacitor will charge. D2 also acts to prevent SIO from discharging VCC\_DVC when the signal is driven LOW. Note that some devices have an internal diode that will be in parallel with diode D2. In Direct Power mode, diode D2 is always reverse biased and will have minimal impact on performance.

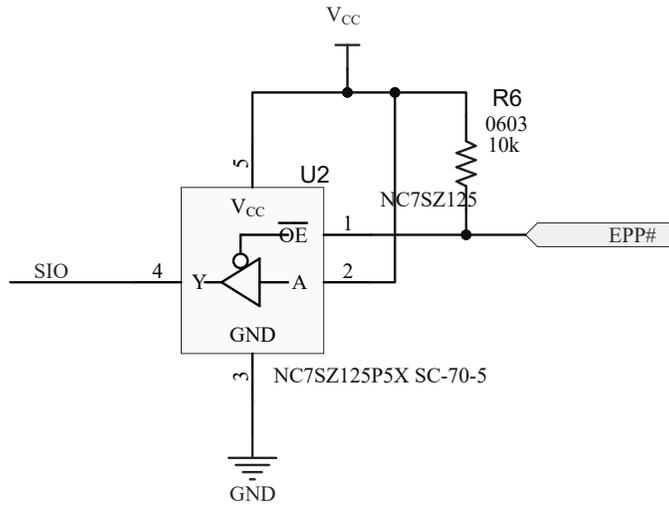
**Figure 1-2. 3-Lead Contact Socket**



### 1.4 Parasitic Power Boost Circuitry

The parasitic power boost circuitry is an optional circuitry used to provide additional current to the crypto device when executing a command in Parasitic Power mode. It works for both the SWI and the SWI-PWM interface modes. This circuitry is only required when the current demands of the command exceed the power capability of the I/O driving the SWI interface. By default, the Enable Parasitic Power (EPP#) pin will default HIGH disabling this circuitry. This circuitry is not required when V<sub>CC</sub> is applied directly. 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 1-3. Parasitic Power Boost Circuitry**



**Proper Circuitry Usage**

1. Make sure the device is in Parasitic Power mode.
2. The EPP# signal must be initially asserted HIGH.
3. Issue a cryptography command.
4. Assert the EPP# signal LOW for the duration of the command.
5. Assert the EPP# signal HIGH.
6. Read back the command response.

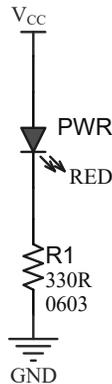


**Restriction:** The software required to implement this feature is left up to the developer. It is not built into the current kit protocol firmware.

**1.5 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 1-4. Supply Indicator**



## 1.6 Hardware Documentation

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

### Device Documentation

- [ATSHA204A](#)
- [ATECC508A](#) – Not recommended for new designs
- [ATECC608B](#)

### EV27Y72A Board Design Files

- [EV27Y72A Web Page](#)
- [Board Design Documentation](#)
- [Gerber Files](#)

### Host Boards and Adapters

- [DM320118](#) – CryptoAuthentication™ Trust Platform Development Kit
- [ATSAMD21-XPRO](#) – SAM D21 Xplained PRO Evaluation Kit
- [ATMBUSADAPTER-XPRO](#) – mikroBUS Xplained PRO

## 1.7 Software Requirements

For proper detection and recognition of all 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 the CryptoAuthLib, both C code and Python versions are available. Version 3.3.3 or later is the recommended version to install on your computer.

For the CryptoAuth SOIC Starter Kit and the Trust Platform Kit, the latest version of the kit protocol firmware can always be found on the kit page along with installation instructions. For proper operation, version 3.0.5 or greater is required. Direct links to these packages are provided below.

### Direct Links to Software

- [CryptoAuthLib - GitHub](#)
- [CryptoAuthLib - Python](#)
- [Firmware for CryptoAuth Trust Platform](#)
- [Firmware for CryptoAuth SOIC Starter Kit](#)

## 2. Modes of Operation

The EV27Y72A 3-lead Contact 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.



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

### Modes of Operation

There are four possible modes of operation depending on the SWI interface selected and the power mode selected. The following table indicates how the EV27Y72A development board must be configured for each mode.

**Table 2-1. Modes of Operation**

Interface Mode	V <sub>CC</sub> Powered		Parasitic Powered		Devices Supported
	J3	JPP1	J3	JPP1	
SWI <sup>(1)</sup>	SIO-RX/TX	Closed	SIO-RX/TX	Open	ATSHA204A, ATECC508A, ATECC608B
SWI-PWM <sup>(2)</sup>	SIO-SIO_2	Closed	SIO-SIO_2	Open	Future Devices

#### Notes:

1. The ATECC608A was never implemented in the 3-lead Contact package but supports the SWI interface in 8-lead SOIC and 8-pad UDFN packages.
2. Microchip will release information on devices that support this interface as they are released to the market.

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.

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

The Parasitic Power mode removes the need for a dedicated power source to the crypto device. Power is supplied to the device by capacitor C3. The capacitor is charged when SIO is higher than VCC\_DVC plus the forward bias drop of diode D2. Diode D2 prevents VCC\_DVC from pulling LOW when the SIO signal is driven LOW. For proper operation, VCC\_DVC must always be greater than the minimum supply operating voltage of the device. See the specific device data sheet for more details and recommendations.



**Tip:** For the ATSHA204A, diode D2 can be removed as the device contains an internal diode that takes the place of D2. Removing diode D2 will more closely emulate how an actual Parasitic Power mode application must be implemented with the ATSHA204A.

**Related Links**

- [1.4. Parasitic Power Boost Circuitry](#)
- [1.6. Hardware Documentation](#)

### 3. Connecting the Board

The form factor of the 3-Lead Contact mikroBUS Socket Board 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

#### 3.1 CryptoAuth Trust Platform Connections

The 3-Lead Contact mikroBUS Socket Board has dedicated SWI and SWI-PWM connections through the mikroBUS header that enable 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. Both SWI and SWI-PWM connections are always connected to the host micro on the Trust Platform board.

##### Connecting the 3-Lead Contact mikroBUS Socket Board to the CryptoAuth Trust Platform

1. Configure the EV27Y72A to the desired mode as specified in [2. 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
<b><i>N/A</i></b>	<b><i>OFF</i></b>	<b><i>Yes</i></b>	<b><i>No</i></b>

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

**Figure 3-1. EV27Y72A Connected to a CryptoAuth Trust Platform Development Board**





**Remember:** The angled notch on the 3-Lead Contact mikroBUS Socket Board 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.

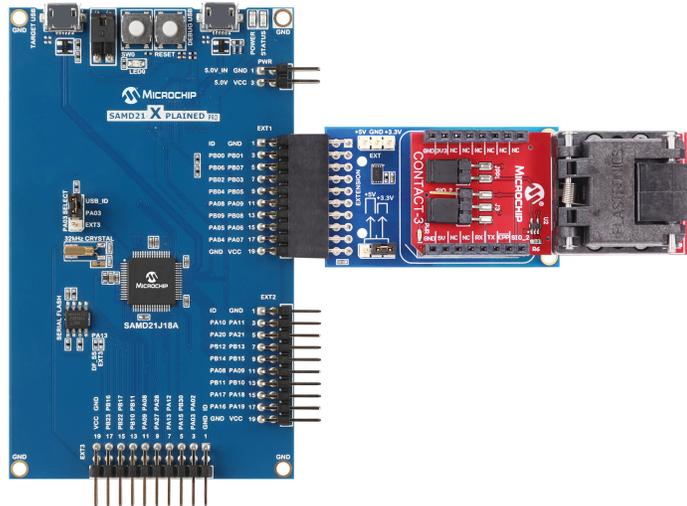
### Related Links

- [1.6. Hardware Documentation](#)
- [2. Modes of Operation](#)

## 3.2 Xplained Pro Connections

Some Microchip development boards support only the Xplained Pro extension headers. Through use of an adapter board, the 3-lead Contact socket board can still be used. [Figure 3-1](#) shows the full assembly of the 3-lead Contact socket board, the ATMBUSADAPTER-XPRO and an ATSAMd21-XPRO Development Board.

**Figure 3-2. XPRO Connections to the 3-Lead Contact Board**



### How to Connect the 3-Lead Contact mikroBUS Socket Board to an Xplained Pro Host Board

1. Configure the EV27Y72A to the desired mode as specified in [2. Modes of Operation](#).
2. Connect the ATMBUSADAPTER to the 3-Lead Contact mikroBUS Socket Board as shown in [Figure 3-2](#).
3. Connect the combined ATMBUSADAPTER and 3-Lead Contact mikroBUS Socket Board to one of the XPRO extension connectors on the host board. EXT1 is used in [Figure 3-2](#).
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.

### Related Links

- [1.6. Hardware Documentation](#)
- [2. Modes of Operation](#)

## **4. Revision History**

### **Revision A (January 2022)**

- Initial release of this document

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