EV97M19A

SHA104, SHA105 mikroBUS Evaluation Board User Guide

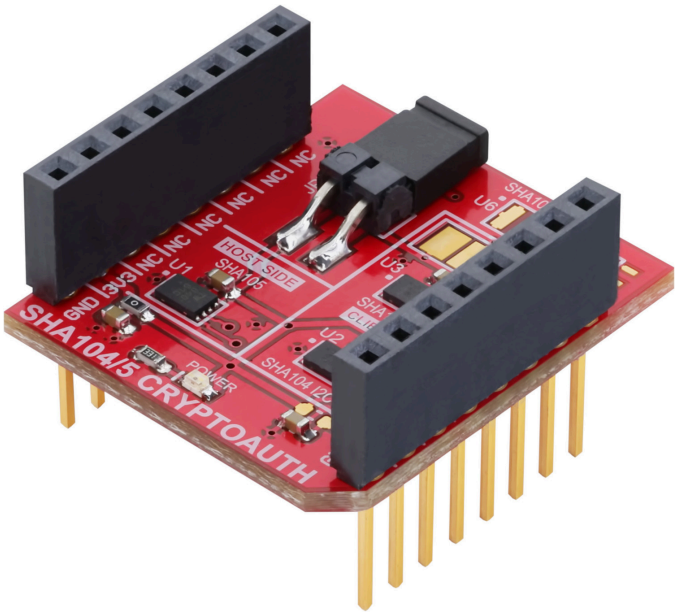
Introduction

The EV97M19A is a mikroBUS™ extension board that demonstrates the capabilities of the Microchip SHA104 and SHA105. The SHA104 is intended for accessory side applications especially in the consumable and disposable applications. The SHA105 is a similar device, but is intended for host side applications where mutual authentication is desirable. The two devices provide a complete mutual symmetric authentication for commercial and industrial applications.

The board is designed to be used with the CryptoAuth Trust Platform and other Microchip development platforms that contain a MikroElektronica mikroBUS header. The EV97M19A can also connect to any board that has the XPRO header by using the ATMBUSADAPTER-XPRO to ease development efforts. The on-board Microchip host and accessory devices simplify the development of your authentication system.

The EV97M19A contains the following Microchip devices: SHA105 host device with an I^2C interface, SHA104 accessory device with an I^2C interface, and SHA104 accessory device using Microchip's proprietary SWI-PWM interface.

Figure 1. EV97M19A Board



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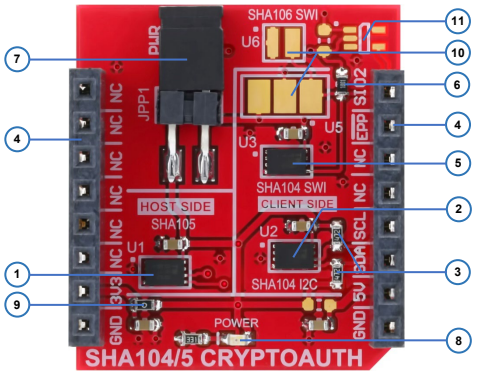
1. Hardware Description

This section details the key features of the EV97M19A and provides detailed board schematics and a list of other useful documentation.

1.1 Key Features

The most important features of the EV97M19A are highlighted in this section.

Figure 1-1. Part Identification

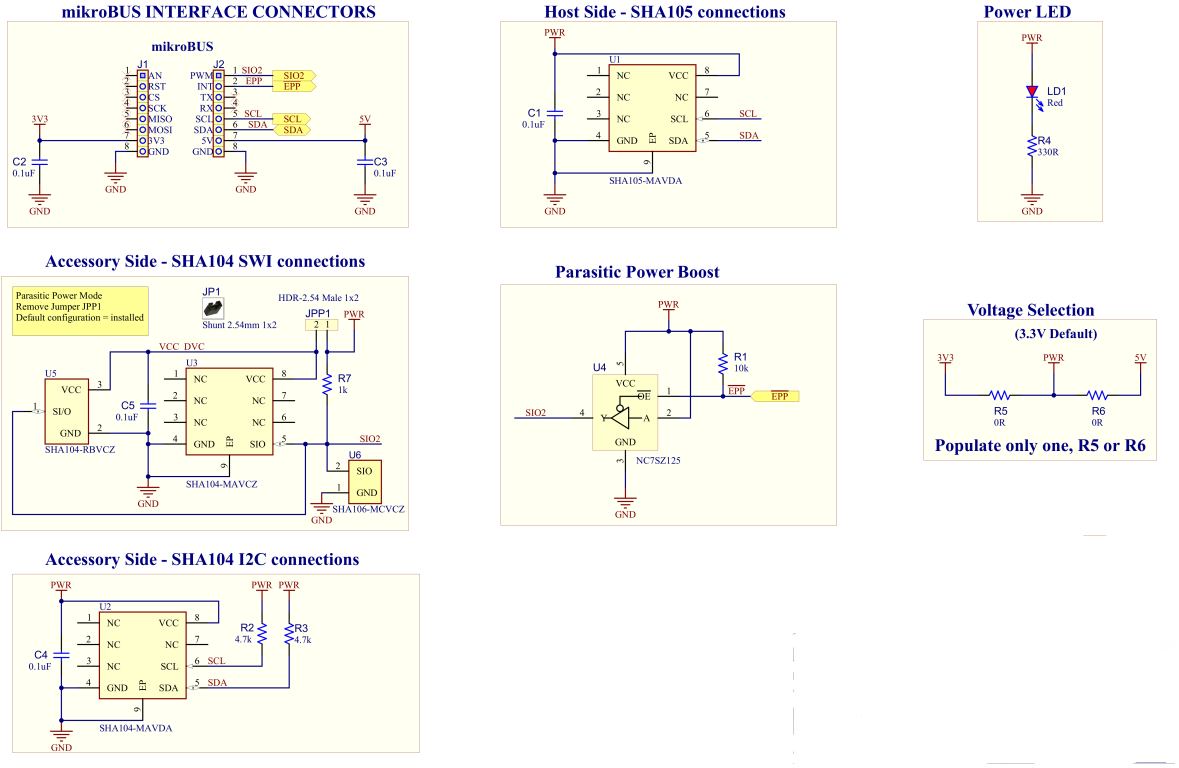


1. One SHA105 I²C Host Device (U1)
2. One SHA104 I²C Accessory Device (U2)
3. On-Board 4.7 kΩ I²C Pull-Up Resistors (R2, R3)
4. One mikroBUS Connector (J1, J2)
5. One SHA104 SWI-PWM Accessory Device (U3)
6. On-Board 1.0 kΩ SWI-PWM Pull-Up Resistor (R7)
7. Jumper to select Parasitic Power mode (JPP1)
8. On-Board LED Power Indicator (LD1)
9. Zero-Ohm Resistor Jumpers to Select 3.3V or 5V Power (3.3V Enabled by Default via R5)
10. 3-Lead Contact SHA104 (U5) and 2-Lead VSFN SHA106 (U6) - Unpopulated
11. Parasitic Power boost circuitry (U4, R1) - Unpopulated

Note: To enable 5V power, remove R5 and solder a zero-ohm resistor into R6.

1.2 Schematic

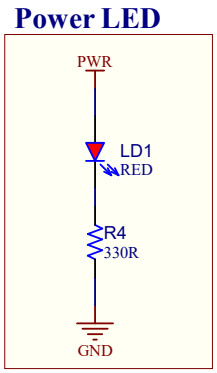
Figure 1-2. Top-Level Schematic



1.2.1 Power Indication

The red LED (LD1) illuminates when power is present on the circuit board.

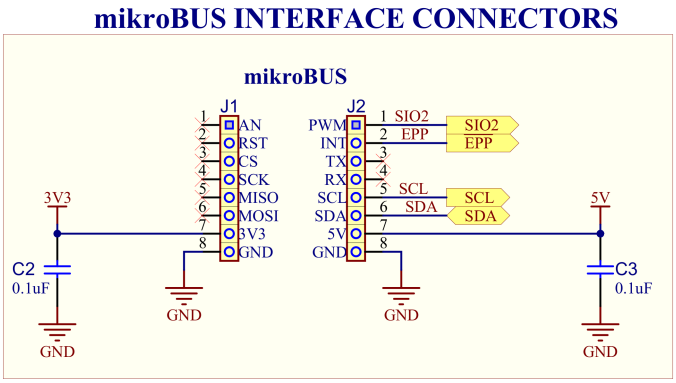
Figure 1-3. Power Indicator Schematic



1.2.2 MikroBUS Header

The EV97M19A development board supports the standard mikroBUS header, which provides power, I^{2}C and SWI-PWM connections.

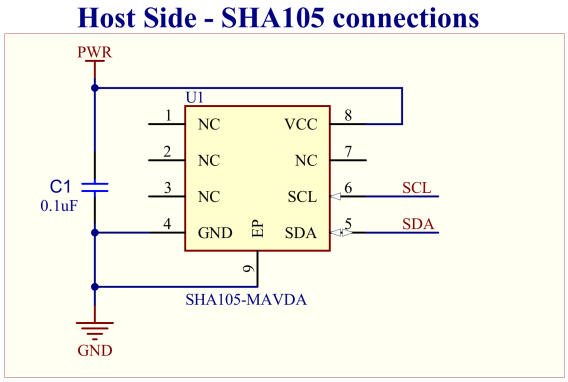
Figure 1-4. mikroBUS Header Connection



1.2.3 Host Side Device

The EV97M19A evaluation kit is populated with a Microchip SHA105 host device. This device is non-configured and can provide host-side symmetric authentication for an application. For the highest security level, it is recommended to use a security device on both the host and accessory side of an application. The SHA105 is specifically designed to be complimentary to the SHA104 accessory side device.

Figure 1-5. Host Side Connection

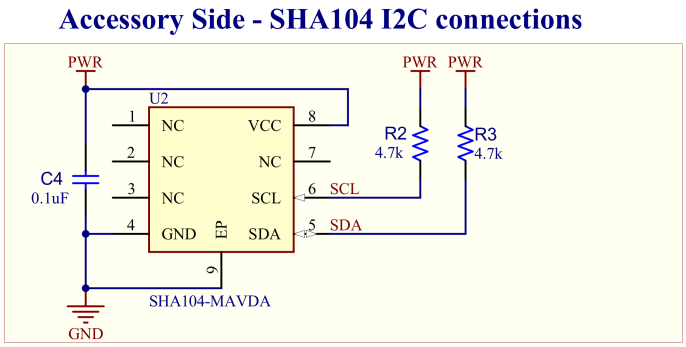


1.2.4 I²C Interface

Communication with the SHA104 and the SHA105 I²C interface will use the standard I²C protocol. Both devices support a bit rate of up to 400 Kbps and are connected to a common I²C interface. Through configuration, the I²C address values can be modified. They must never be programmed to be the same value.

- SHA105 7-bit address 0x32 (8-bit byte values: Write 0x64, Read 0x65)
- SHA104 7-bit address 0x31 (8-bit byte values: Write 0x62, Read 0x63)

Figure 1-6. I²C Connection

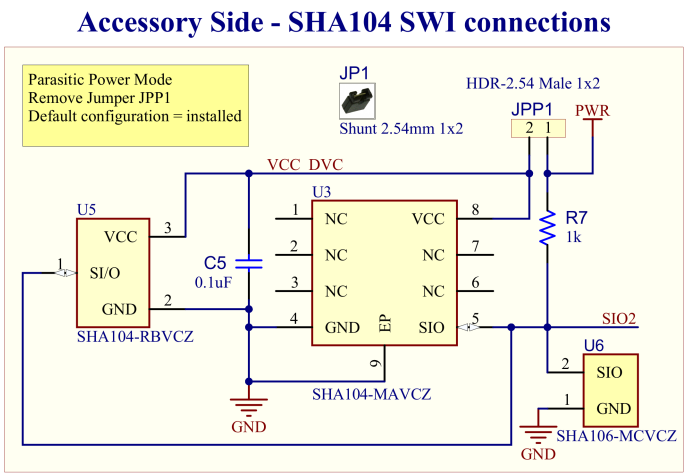


1.2.5 SWI-PWM Interface

Communication with Microchip's SHA104 in SWI-PWM mode is at 125 Kbps. The default address is provided below but this address can be modified when configuring the device.

- SHA104 7-Bit Address 0x31 (Write 0x62, Read 0x63)

Figure 1-7. SWI-PWM Connection

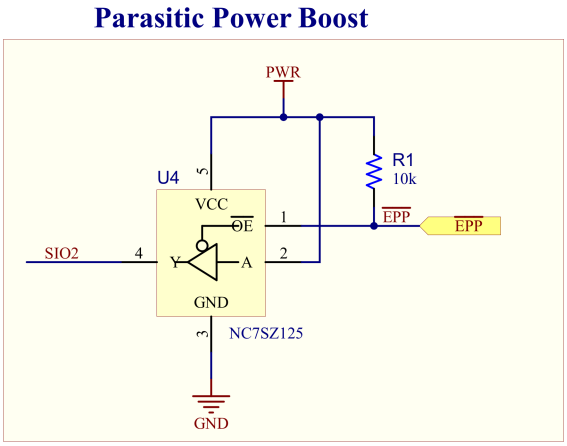


1.2.5.1 Parasitic Power

The SHA104 has the capability to use parasitic power on the SWI-PWM device. The Parasitic Power mode removes the need for a dedicated power source to the crypto device. Power is supplied to the device by capacitor C5. The capacitor is charged when SIO_2 (SIO-PWM mode) is higher than VCC_DVC. 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. To enable Parasitic Power mode remove the JP1 Jumper cap from the JPP1 header.

For the EV97M19A, optional footprints are included for a 3-lead contact package version of the SHA104 and a 2-lead VSFN footprint for the SHA106 device. The SHA106 is a parasitic power-only version of the SHA104. The SHA106 includes an internal decoupling capacitor and is only available in a parasitic power mode. If so desired, the existing SHA104 can be removed from the board and either a 3-lead contact SHA104 or a SHA106 device can be added in its place. Note that the behavior of the devices are identical and any software developed for one of the devices will work with the other devices also.

Figure 1-8. Parasitic Power Boost Circuitry



The parasitic power boost circuitry is optional and is not populated on the EV97M19A development board. Information provided here is for completeness.

Follow these guidelines for proper circuitry usage:

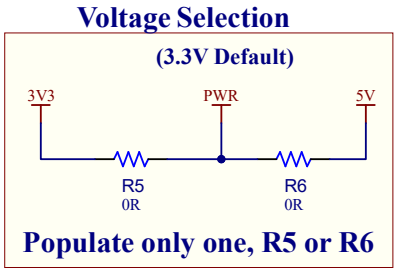
1. The device must be in Parasitic Power mode (remove jumper JPP1).
2. The EPP# signal must be initially asserted HIGH.
3. Issue a cryptography command.
4. Assert the EPP# signal LOW for the duration of the command.
5. Assert the EPP# signal HIGH.
6. Read back the command response.

Tip: The Parasitic Power Boost circuitry, in general, will not be needed. It is recommended that the EPP# signal be driven HIGH or allowed to float to disable the parasitic power circuitry if present. Special software will need to be written to incorporate control of the boost circuitry.

1.2.6 Voltage Selection

The EV97M19A features the capability to choose the voltage for the board (3.3V or 5V) by installing the correct resistor configuration in the R5 or R6 positions. By default, R5 is installed for 3.3V power.

Figure 1-9. Voltage Selection



Note: Populate only one resistor, either R5 or R6, to select the input voltage for the board (3.3V or 5V).

1.3 Hardware Documentation

Additional documentation for the kit can be found on the Microchip website for the ECC204 Crypto Authentication (EV97M18A) development kit.

This includes:

- EV97M19A-Design-Documentation: Includes schematics, BOM and 3D views
- EV97M19A-Gerber-files: Includes Gerber files and assembly information files
- SHA104, SHA105 CryptoAuthentication Board User's Guide

Other useful documentation can be found at:

- CryptoAuth Trust Platform (DM320118)
- Crypto Authentication Starter Kit (DM320109)

2. Connecting the Board

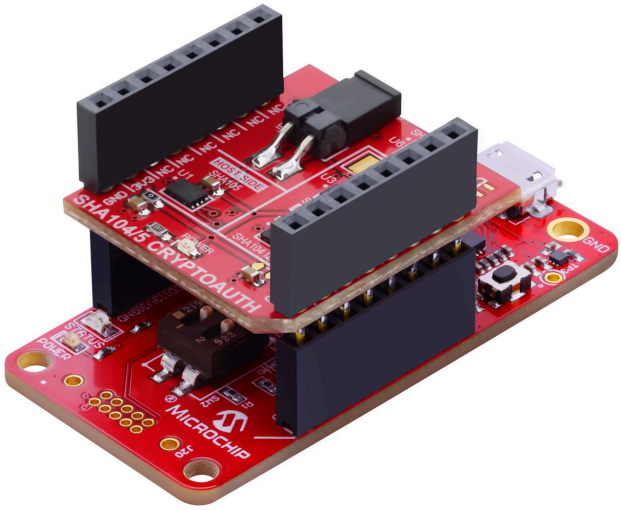
The form factor of the EV97M19A is consistent with Microchip's adoption of the mikroBUS connector on host boards. Many of Microchip's development platforms will support one or more mikroBUS interfaces. These include:

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

2.1 mikroBUS Header

The EV97M19A development board has an I^2C interface and the SWI-PWM connection through the mikroBUS header. This enables communication to the host present on the Trust Platform or any of the PIC/AVR/SAM MCU host development boards with a mikroBUS header. Microchip's DM320118 Trust Platform board is designed to be a host platform to ease development for the EV97M19A. Using the USB port, the user can write host applications using Python scripts and access debug information. The DM320118 comes pre-loaded with Microchip's kit protocol. Additional documentation for the DM320118 kit can be found on the Microchip Website (DM320118).

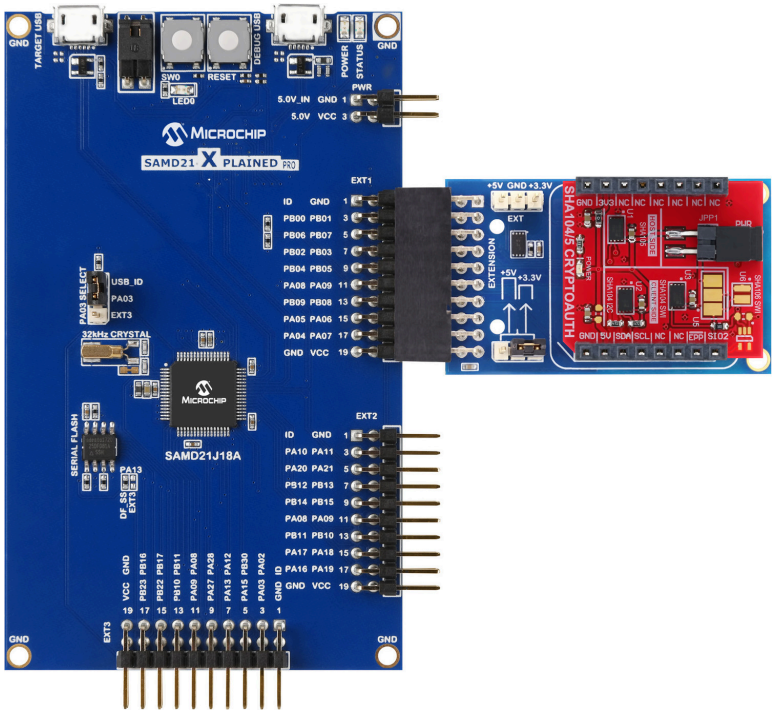
Figure 2-1. The EV97M19A Connected to the DM320118



2.2 Xplained Pro Connections

Some Microchip development boards support only the Xplained Pro extension headers. By using Microchip's ATMBUSADAPTER-XPRO adapter board, the EV97M19A can be connected to any development board that has the XPRO header. Microchip's DM320109 Starter kit provides the easiest way for configuring and using the EV97M19A. The on-board SAMD21-XPRO is pre-programmed with Microchip's Security Products Group (SPG) kit protocol. This protocol handles the communication between the CryptoAuthentication devices and the host system regardless of the device interface. The data transfer between the kit and the PC is indicated by the Status LED on the SAMD21 board. Additional documentation for the DM320109 kit can be found on the Microchip Website (DM320109).

Figure 2-2. The EV97M19A Connected to an Xplained Pro Development Platform (DM320109)



3. Software Requirements

The EV97M19A development board does not have a microcontroller on board and, therefore, does not require firmware. The board was, however, defined and developed in conjunction with other Microchip development boards that do have firmware requirements. The specific boards highlighted in 2. Connecting the Board define those boards that can be used with this development board. Other boards may also be capable of being used with the EV97M19A development kit.

Additional software tools were also created by Microchip and are made available either for free or under NDA. These include C-language libraries, Python libraries and the Trust Platform Design Suite (TPDS) of tools for rapid application development.

3.1 Firmware Requirements

For each new device type added to Microchip's family of secure products, the firmware of the host application board or boards that it is used with must be updated. This firmware is typically referred to as “Kit Protocol” and allows for identification of the device or devices on the board. It provides the basic infrastructure to communicate to the boards with higher-level software tools.

It is recommended that the host application boards be kept up-to-date with the latest version of the firmware to take advantage of any enhancements or bug fixes that may have been implemented. The latest version of the software can be downloaded from the kit website along with the procedure on how to upgrade the Kit Protocol firmware on the board.

Firmware Requirements

- DM320118 – Trust Platform Development Board
  - Firmware Revision: 3.1.0 or Higher
- DM32109 – CryptoAuthentication Starter Kit
  - Firmware Revision: 3.1.0 or Higher

3.2 Software Tools

Microchip provides additional software tools that aid in the rapid development of applications. These include software libraries, development tools and example applications. Whenever new versions of CryptoAuthentication devices are developed, the library has to be upgraded to implement the new capabilities of the device. It is recommended that the latest version of these tools always be downloaded and implemented to take advantage of any enhancements and bug features.

CryptoAuthLibrary (CAL) – C Language

CryptoAuthLib is a software support library for the majority of Microchip security devices, including the SHA104 devices, written in C code. It is a portable, extensible, powerful and easy-to-use library for working with devices in the CryptoAuthentication device families by providing common APIs and command structures.

The library is designed with a Hardware Abstraction Layer (HAL) so that it can be readily ported for use with both Microchip and non-Microchip microcontrollers. The library can be readily included into MPLAB X or Microchip Studio projects and is integrated into the MPLAB Harmony framework.

Important: CAL Requirements:

- Check the EV97M19A kit web page for the recommended and latest version of CAL.

CryptoAuthLibrary (CAL) – Python

A Python version of CAL is also available to allow for the development of system-level applications from a PC environment without having to reprogram a microcontroller. Applications can, thus, be developed in a generic way

prior to porting to a specific microcontroller. The Python version of the library has all the capabilities of the C-version of the library, and the commands were made syntax-consistent with the C-version of the library.

Important: CAL Python Requirements:

- Check the EV97M19A kit web page for the recommended and latest Python version of CAL.
- Python Version 3.10 or higher is recommended.

Trust Platform Design Suite

To simplify the implementation process, Microchip offers the web-based Trust Platform Design Suite (TPDS) tools that will allow developers to go from concept to production via a guided flow. The Trust Platform tools allow you to develop and construct the transaction diagrams and provide the code necessary to implement a particular application within the constraints of the configuration and defined access policies. Specific Trust variants of the SHA104 and SHA105 will be developed over time. The devices on this board are generic, non-configured devices.

More information on these tools can be found under Microchip's Security ICs section of the webpage Security ICs.

4. Revision History

Revision A (March 2023)

- Initial release of this document

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