CryptoAuth Trust Manager User's Guide

EV10E69A

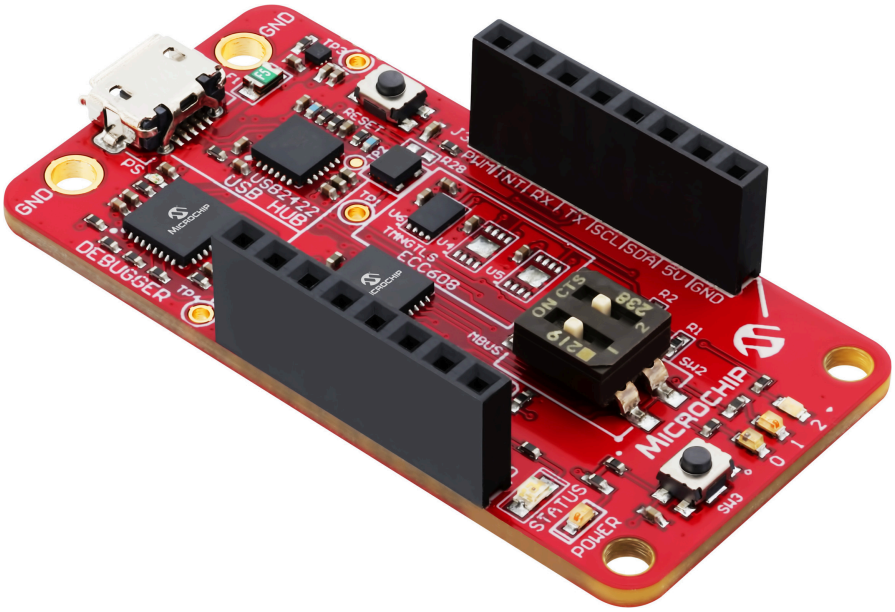
Introduction

The Microchip CryptoAuth Trust Manager is a variant of the CryptoAuth Trust Platform Board and part of the CryptoAuthentication™ evaluation kits portfolio.

The CryptoAuth Trust Manager kit was developed to work with the Kudelski IoT SaaS to offer PKI service and in-field provisioning. The board contains the ECC608-TMNGTLS Trust Manager device, which is a pre-provisioned variant of the ECC608. The ECC608-TMNGTLS device will work in combination with the keySTREAM™ Software-as-a-Service (SaaS) powered by Kudelski IoT. The device comes pre-provisioned with a birth certificate and associated private key. When deployed in the marketplace, the IoT device containing the ECC608-TMNGTLS will connect to the keySTREAM SaaS, which will give ownership of the IoT device to the intended owner by provisioning the device “in-field” with its custom PKI, symmetric keys and/or data.

This user guide provides a physical overview of the connections, components and features associated with the CryptoAuth Trust Manager development kit.

Figure 1. CryptoAuth Trust Manager



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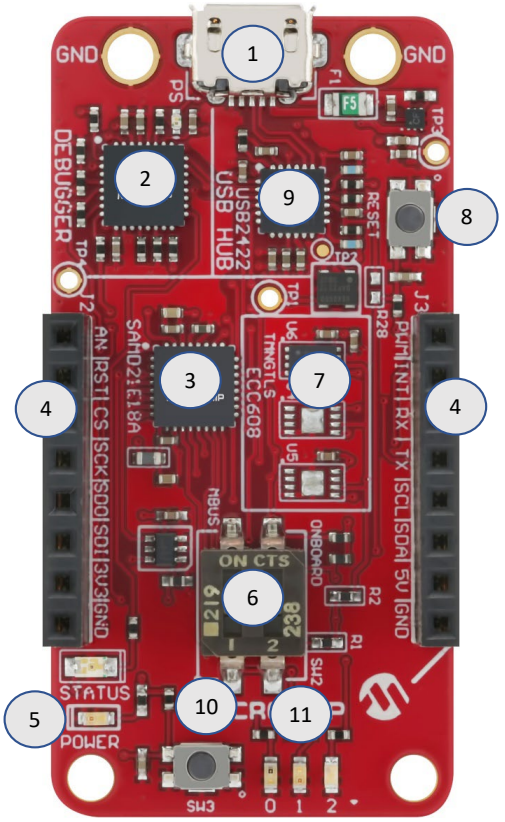
1. Hardware Overview

The CryptoAuth Trust Manager consists of a Microchip SAM D21 microcontroller configured as the main MCU. It comes pre-programmed with Microchip`s Secure Computing Group (SCG) kit protocol. This protocol facilitates the communication between the CryptoAuthentication device(s) and the host MCU over the USB HID interface. The data transfer between the secure element(s) and the host MCU is indicated by the Status LED.

The Trust Manager has one secure element: ECC608-TMNGTLS.

Figure 1-1. CryptoAuth Trust Manager Board Components



1. USB Connector
2. nEDBG On-board Debugger
3. ATSAMD21E18A Host MCU
4. mikroBUS™ Headers
5. Power and Status LEDs
6. Dual SPST DIP Switch
7. ECC608 Secure Element
8. Reset Switch
9. USB2422 Dual Port Hub
10. User-Defined Switch
11. User-Defined LEDs

1.1 Kit Ordering Code and Components

Ordering Information

Kit Name: CryptoAuth Trust Manager Development Kit

Ordering Code: EV10E69A

Availability: The kit will be available from Microchip Direct and multiple distributors.

CryptoAuth Trust Manager Kit Contents and Requirements

The CryptoAuth Trust Manager Kit contains:

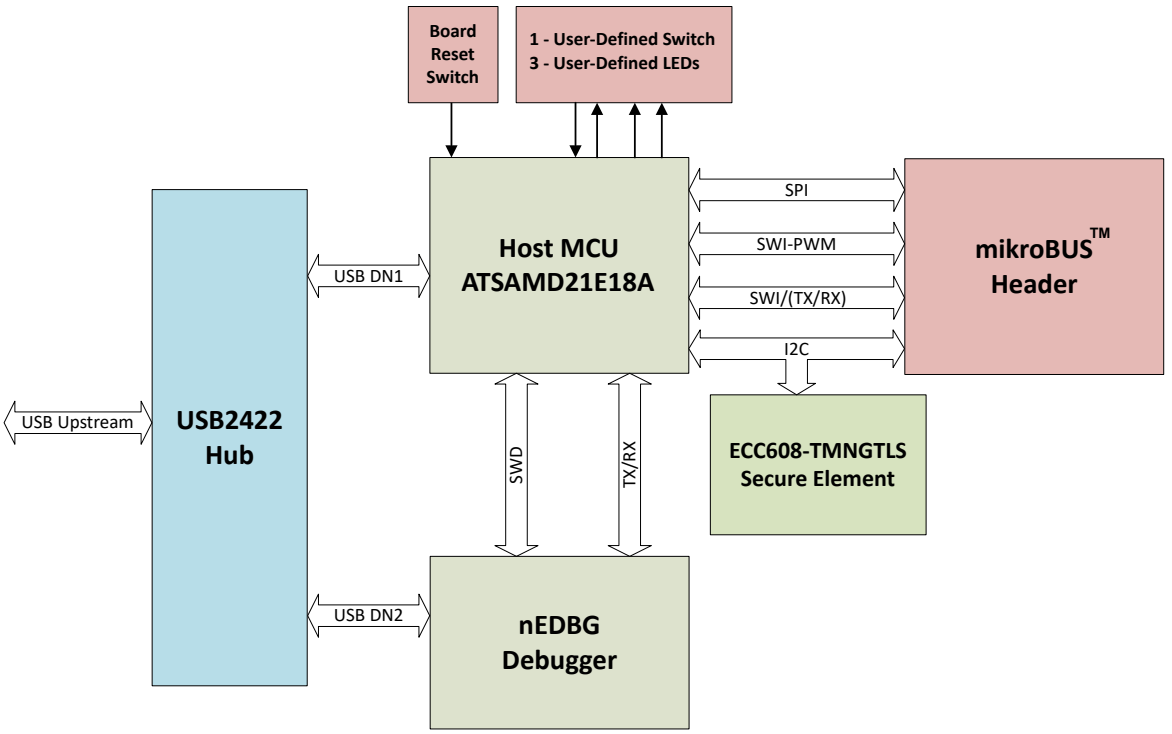
- CryptoAuth Trust Manager board

A micro USB cable (not included) is required to operate the board.

1.2 Functional Description

The block diagram below illustrates the major connections of the CryptoAuth Trust Manager. For additional details, refer to the board schematics referenced in 1.3. Hardware Documentation.

Figure 1-2. Block Diagram



Main Board Components

- **ATSAMD21E18A:** The Microchip SAM D21 is an ARM® Cortex M0+ based microcontroller. The MCU connects to the secure element via I²C. The mikroBUS™ header has I²C, SPI, UART, GPIO and analog connections to the microcontroller. This enables the possibility of using the CryptoAuth Trust Manager with many types of MikroElektronika Click boards™.
- **Secure Elements:**
  The CryptoAuth Trust Manager has one security IC, as listed in the table below. Refer to the data sheet associated with each of these devices for more details.

Device	Default 7-bit I²C Address	8-bit Programmed I²C Address Value(1)
ECC608-TMNGTLS	0x38	0x70

Note:

1. This is the I2C_Address byte value programmed into the secure element device.

- **mikroBUS Header:** The mikroBUS header is a pre-defined header connection for all the MikroElektronika boards. This lets the user connect many types of Click sensors and add-on boards to the Trust Platform. The Trust Platform supports the following interfaces:

a. Serial Peripheral Interface (SPI) – Needed to support the TA100 and TA101 cryptography devices but can also support any mikroBUS board with a SPI interface.

b. I^2C – Supports any mikroBUS or click board with an I^2C Interface. Boards that are often combined with the Trust Manager are other Microchip mikroBUS cryptography boards, socket boards from mikroElektronica and Microchip and sensor boards used for IoT devices.

c. SWI-UART – Supports the proprietary Single Wire Interface (SWI) for devices such as the ATECC608 family of devices and the ATSHA204A.

d. SWI-PWM – Supports the SWI Interface with the Pulse Width Modulated signaling for the Microchip Authentication ICs for the SHA104, SHA105, SHA106, ECC204, ECC206, TA010

- **GPIO Signals:** GPIO signals not used for any other purpose can be used as appropriate.
- **DIP Switch:** The switch is used to select between the on-board Trust Platform devices and the mikroBUS header. The switches disconnect the SDA lines of the I^2C interface to prevent conflict in case two I^2C addresses are the same. Both switches can be enabled if all I^2C addresses are unique on all devices connected to the board.

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

- **nEDBG Debugger:** The debugger is used to program and flash the host MCU. Debug information can also be read back from the host MCU through the debugger interface. When plugged into the system and opened with MPLAB® X IDE, the nEDBG debugger will display with a serial number of MCHP348402xxxxxxxx.
- **USB Hub:** The Microchip USB2422 is a dual-port USB hub. The hub passes data between the upstream port and the downstream devices. The downstream devices are the debugger and the host MCU.
- **User-Defined Switch:** One user-defined switch is provided on the board. The switch is connected to PA27 of the SAMD21 microcontroller and has an external pull-up resistor on the signal. When this switch is pressed, it will short the signal to GND. The PA27 pin must be be configured as an input to detect a transition from a logic HIGH to a logic LOW.
- **User-Defined LEDs:** Three user-defined LEDs are available on the board. The red, green and blue LEDs are connected to PA11, PA14 and PA15, respectively. Any combination of LEDs can be driven at any one time. The signal pin connected to the LED must be configured as an output to use that LED. The signal must be driven HIGH for the LED to light and can either be driven LOW or floated for the LED to turn off.

1.3 Hardware Documentation

Additional documentation for the kit can be found on the Microchip website for the EV10E69A.

This includes:

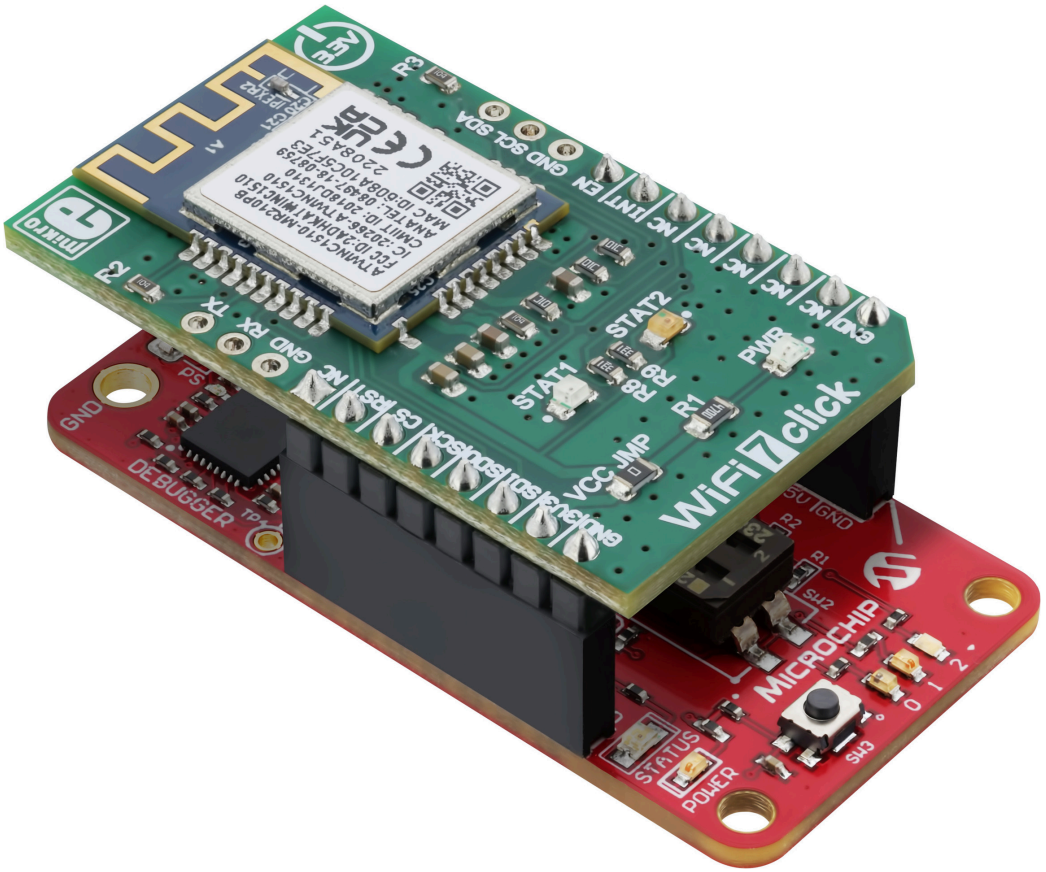
1. Board Design Documentation including Schematics and 3D Views
2. Gerber Files
3. CryptoAuth Trust Manager User's Guide (EV10E69A)
4. Trust Platform Design Suite Tools

2. WINC1510 mikroBUS board

To connect to WiFi with the CryptoAuth Trust Manager kit, it is recommended that you combine the mikroElektronica WiFi 7 click board with the CryptoAuth Trust Manager. The WiFi 7 click board contains the Microchip ATWINC1510-MR210PB module that supports IEEE® 802.11 b/g/n protocols. The Click board connects to the Trust Manager board via the mikroBUS extension header and communicates with the on board SAMD21E18A microcontroller through the SPI interface.

Specific TPDS use cases were developed to support the development of applications operating with the Kudelski SaaS IoT infrastructure and tools. The power for the WiFi 7 board is provided through the mikroBUS extension header and the power to the overall system only requires the USB power connector. A view of the Trust manager board with the WiFI 7 click board connected is shown below.

Figure 2-1. CryptoAuth Trust Manager + WiFi 7 Click Board



WiFi 7 Information

mikroBUS™ board Name:	WiFi 7 click
mikroElectronika Ordering Code	MIKROE-2046
WiFi 7 Click Website:	www.mikroe.com/wifi-7-click
Microchip Website Info	ATWINC1510-MR210B Module ATWINC1510 IC
Microchip Data Sheets:	ATWINC1510-MR210B Module Data Sheet ATWINC1510 Device Data Sheet

3. mikroBUS and Click Add-On Boards

The mikroBUS connector has emerged as a de facto industry-standard add-on board form factor. The CryptoAuth Trust Manager board has a single mikroBUS host connector. Having this capability dramatically expands the usefulness of this board for developing and prototyping new applications. All of the boards listed below were developed by Microchip or MikroElektronika with support from Microchip.

Table 3-1. mikroBUS™ Add-On Boards

Board Name	Devices Supported	Manufacturer	Description
ATECC608_TRUST DT100104(2)	ATECC608B-TNGTLS ATECC608B-TFLXTLS ATECC608B-MAHDA	Microchip	The ECC608-TMNGTLS Trust board provides additional sample units for doing development work. This board was developed as an alternative to using socketed boards. Each of the devices can be individually selected using the on-board DIP switches.
TA010 CRYPTOAUTO EV74C12A	TA010	Microchip	The TA010 CryptoAuto board
ECC204 CRYPTOAUTH EV92R58A	ECC204	Microchip	The ECC204 CryptoAuth board
TA100-24 EV39Y17A	TA100	Microchip	The TA100-24 socket board for the 24 VQFN device
TA100-08 AC164167	TA100 and TA010	Microchip	The TA100-08 was developed as an 8-pin SOIC socketed solution for configuring and provisioning CryptoAuto™ devices. These devices may be used to mount to early prototype or production boards.
Contact 3 EV27Y72A	RBH parts	Microchip	The 3 Lead Contact board was developed as an 3 Lead RBH socketed solution for configuring and provisioning CryptoAuth™ devices. These devices may be used to mount to early prototype or production boards.
VSFN socket EV98D91A	SHA106	Microchip	The uVSFN 2 Lead Contact board was developed as a 2 Lead uVSFN socketed solution for configuring and provisioning the SHA106. These devices may be used to mount to early prototype or production boards.
Secure UDFN Click	All Microchip CryptoAuthentication devices	MikroElektronika	The secure UDFN Click board™ was developed as an 8-pin UDFN socketed solution for configuring and provisioning CryptoAuthentication™ devices. These devices may be used to mount to early prototype or production boards.
Secure SOIC Click	All Microchip CryptoAuthentication devices	MikroElektronika	The secure SOIC click board was developed as an 8-pin SOIC socketed solution for configuring and provisioning CryptoAuthentication devices. These devices may be used to mount to early prototype or production boards.
WiFi 7 Click	ATWINC1510	MikroElektronika	This is the WiFi® module utilizing the ATWINC510. The board supports IEEE® 802.11 b/g/n protocols and communicates over the SPI interface.
Secure 4 Click(1)	ATECC608A	MikroElektronika	This has a generic ATECC608A secure element with an I^2C interface. This device is a previous version of the ATECC608B TrustCustom device that is mounted on the CryptoAuth Trust Manager board.
Secure Click(1)	ATECC508A	MikroElektronika	This has a generic ATECC508A secure element with an I^2C interface.
Secure 3 Click	ATSHA204A	MikroElektronika	This has a generic ATSHA204A secure element with an I^2C interface. The device has a cryptographic coprocessor with symmetric secure hardware-based key storage.
Secure 6 Click	ATSHA204A	MikroElektronika	This has a generic ATSHA204A secure element with a SWI interface. The device has a cryptographic coprocessor with symmetric secure hardware-based key storage.

.....continued			
Board Name	**Devices Supported**	**Manufacturer**	**Description**
mikroBUS Shuttle	Click expansion boards	MikroElektronika	The mikroBUS Shuttle is a small add-on board that can be used to expand the mikroBUS to multiple mikroBUS connectors.
Shuttle Click	Click expansion boards	MikroElektronika	The Shuttle Click is a socket expansion board that provides an elegant solution for stacking up to four Click boards.

Notes:

1. Not recommended for new designs.
2. A previous version of the board used ATECC608A devices.

4. Software Requirements

The CryptoAuth Trust Manager can be used in a variety of ways. These include:

1. As a development tool in conjunction with Microchip's Trust Platform Design Suite of use case tools.
2. As a development and demonstration platform for Microchip predefined applications.
3. As a development platform to develop your own applications using Microchip's Python®-based tools or C-based tools.

Various software tools are available to work with the CryptoAuth Trust Manager.

4.1 Software Application Development

The following tools are useful for developing or modifying applications.

Trust Platform Design Suite

The Microchip Trust Platform Design Suite of use case tools are based on Jupyter Notebooks and Python programs to allow a developer to quickly define and develop applications for the Trust Platform products.

The Microchip Trust Platform Design Suite provides the ability to interoperate with the on-board ECC608-TMNGTLS CryptoAuthentication devices or CryptoAuthentication devices attached through the mikroBUS header. The tool provides an easy way to select from available device options and generate the required configuration files needed for provisioning. The tool can also be used to develop applications utilizing the CryptoAuth Trust Manager.

MPLAB X IDE

MPLAB X is an Integrated Development Environment (IDE) that works on Windows®, macOS® and Linux® environments. The tools can be used to develop new embedded applications using the on-board SAM D21 microcontroller. The tool will automatically make use of the on-board nEDBG debugger to program the SAM D21 microcontroller. The debugger can also be used to provide debug information back from the host microcontroller to a terminal window through a COM port.

Microchip Studio

Microchip Studio is an Integrated Development Environment (IDE) that works on Windows environments. The tools can be used to develop new embedded applications using the on-board SAM D21 microcontroller. The tool will automatically make use of the on-board nEDBG debugger to program the SAM D21 microcontroller. The debugger can also be used to provide debug information back from the host microcontroller to a terminal window through a COM port.

CryptoAuthLib

CryptoAuthLib was developed to make working with Microchip's CryptoAuthentication devices a simple and straightforward process. CryptoAuthLib was designed with a Hardware Abstraction Layer (HAL) to make it easily extensible to other microcontrollers. Both C and Python versions of the library are available. The Python version of the library is maintained by Microchip and available through the PythonPackage Index website (pypi.org). The most recent version of CryptoAuthLib can be found on Microchip's GitHub site.

- CryptoAuthLib – Python
- CryptoAuthLib – GitHub

4.2 Firmware Upgrade

New firmware for the CryptoAuth Trust Manager may be available periodically with new features or enhancements. In addition, specific applications developed by Microchip may be made available for

use with this development board. The latest version of the firmware and information about other applications will be found on the EV10E69A product page.

Two Microchip tools exist for upgrading the firmware of the CryptoAuth Trust Manager development kit. Firmware upgrades are done in the standard way using both tools and are not described in more detail here. Both of these options use the nEDBG on-board debugger. These options are:

- MPLAB X IPE (Integrated Programming Environment) – This tool is provided as part of the MPLAB X IDE download.
- Microchip Studio – Integrated Design Environment

NOTICE Upgrading to the latest version of the tools is recommended. Older versions of the tool may not recognize the nEDBG debugger or the specific kit information.

5. Document Revision History

Revision A (March 2024)

- Initial release of this user's guide

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