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**TA100 8-Pin SOIC Socket Board User Guide**

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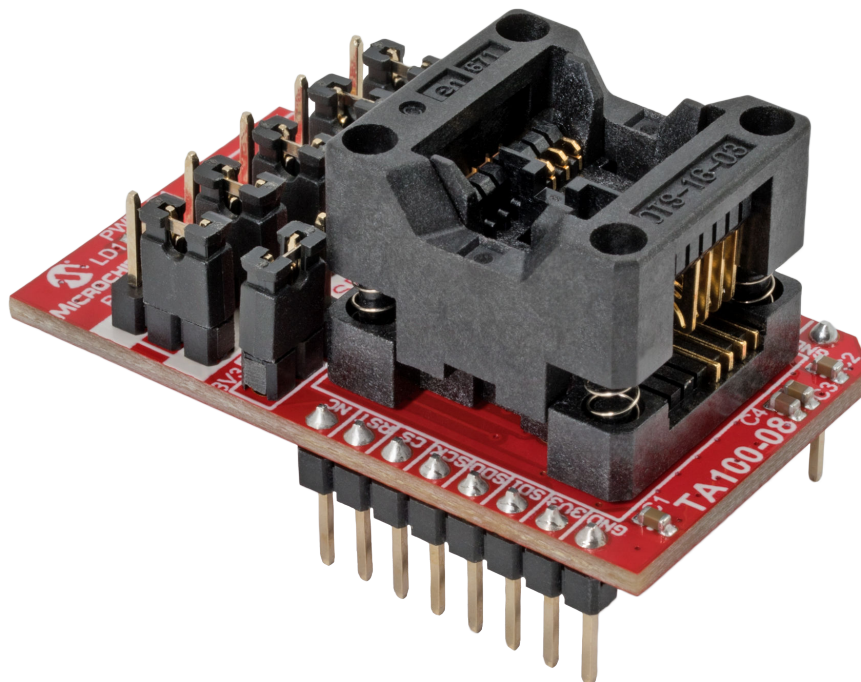
**Introduction**

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The TA100 8-pin SOIC mikroBUS™ compatible socket board has been developed for use with any of Microchip's microcontroller boards that support a MikroElektronika mikroBUS interface. The board's dimensions match the medium-sized 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.

The TA100 secure elements are one-time-programmable devices. Having a socket board allows for a customer to reuse the board with multiple TA100 sample devices for a given application or for multiple different applications. The 8-pin SOIC socket board is capable of being used with both the I<sup>2</sup>C and SPI interface versions of the TA100 device.

**Figure 1. TA100 8-Pin SOIC Socket Board**



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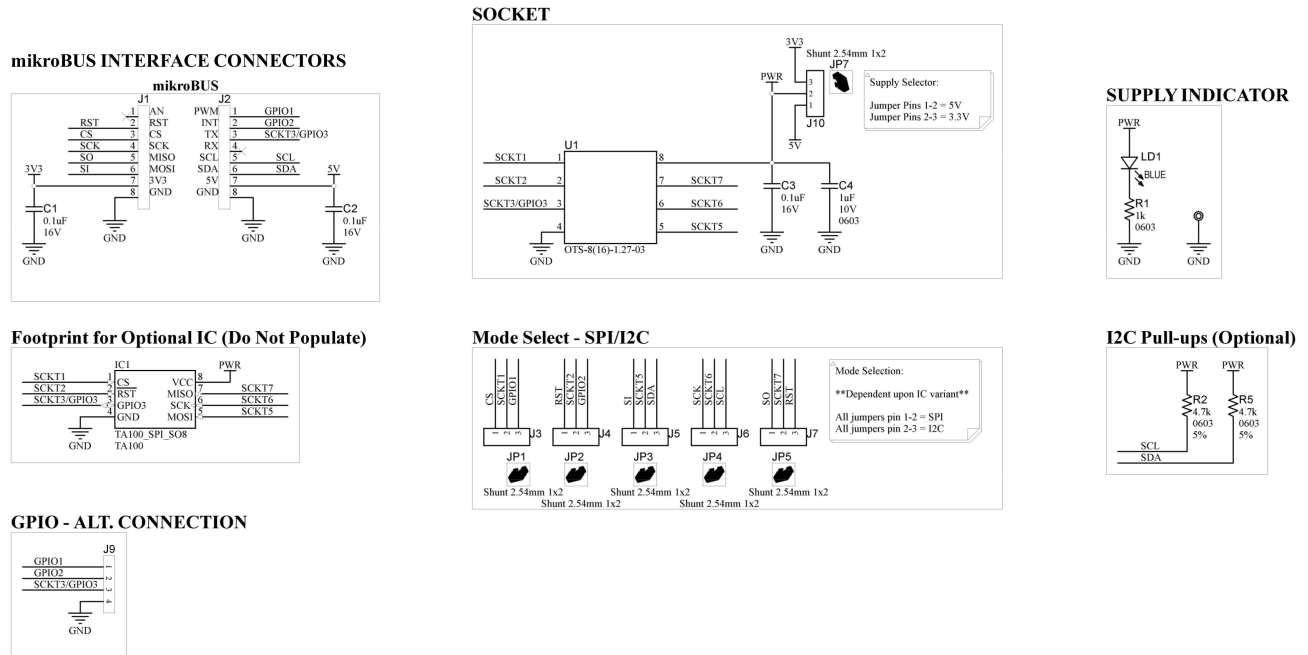
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# 1. Hardware Description

## 1.1 Schematic and Key Features

- One 8-Pin SOIC Socket (U1)
- One mikroBUS Connector (J1, J2)
- Five Selection Jumpers for selecting either an I<sup>2</sup>C or SPI Interface (J3 to J7)
- On-Board 4.7 kΩ I<sup>2</sup>C Resistors (R2, R3)
- On-Board LED Power Indicator (LD1)
- Power Jumper for selecting 3.3V or 5V power (J3)
- Optional GPIO Header (J9) Not populated

**Figure 1-1. TA100 8-Pin SOIC Socket Board Schematic**



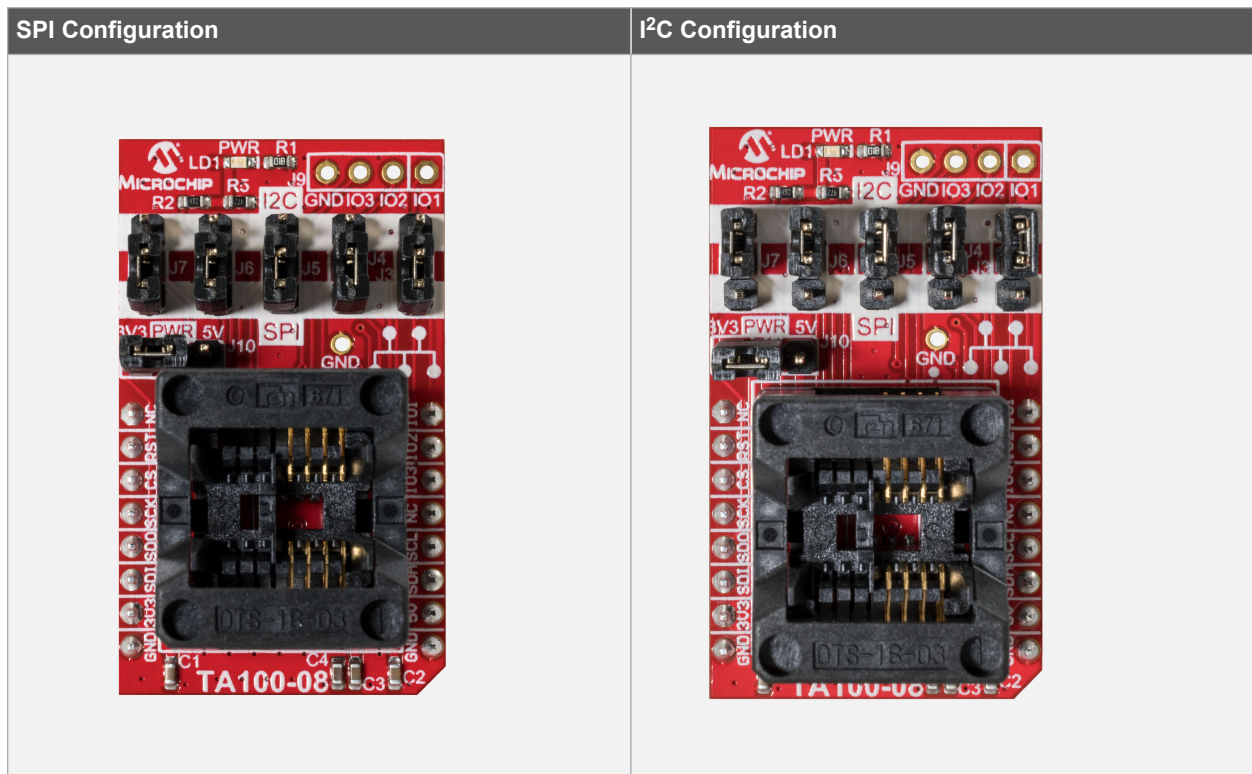
## 1.2 Board Configuration

### TA100 8-Pin SOIC Socket Board Jumper Configurations

- SPI Connections: J3, J4, J5, J6 and J7 in position closest to socket (white band labeled with SPI)<sup>(1)</sup>
- I<sup>2</sup>C Connections: J3, J4, J5, J6 and J7 in position furthest from socket (white band labeled with I<sup>2</sup>C)<sup>(1)</sup>
- 3.3V Power: J10 with shunt across 3V3 and PWR positions<sup>(2)</sup>
- 5.0V Power: J10 with shunt across 5V and PWR positions<sup>(2)</sup>

#### Notes:

1. Jumpers J3, J4, J5, J6 and J7 must all be set with position pins 1 and 2 shorted (SPI) or all set with position pins 2 and 3 shorted (I<sup>2</sup>C) for proper operation in a given interface mode.
2. The I/O levels of the GPIO, SPI and I<sup>2</sup>C signals will track with the supply voltage.



### 1.3 Supply Current Measurement

The current consumption of the TA100 device can be measured by using the AC164167 8-pin socket board. The only devices on the board that will consume power are the TA100 socketed device, the Power LED and the I<sup>2</sup>C pull-up resistors. Follow these steps to measure the current:

1. Modify the board to remove the resistor R1 which is in series with the LED. This will remove the current through the LED from the total measured current.<sup>(1)</sup>
2. Install the TA100 device into the socket.
3. Install the socket board into the host system with the appropriate power settings.
4. Select either 3.3V or 5V power for the measurement.<sup>(2)</sup>
5. Connect the high side of the ammeter to the 3.3V or 5V supply.
6. Connect the low side of the ammeter to the common PWR signal of the header.
7. Current measurements can now be taken by running various TA100 commands and measuring the current. <sup>(3)</sup>

#### Notes:

1. For lower accuracy current measurements this resistor may be kept in the circuit. A separate measurement of the current through just the LED path should be made prior to measuring the TA100 device currents. This value can then be subtracted from the total current measured.
2. The host board provides the power to the mikroBUS extension board so whichever supply is selected must match the capabilities and setting used on the host board.
3. When measuring the current of I<sup>2</sup>C devices, the measurement will include the I<sup>2</sup>C pull-up currents used to pull up the bus. For SPI signals the pull-ups are internal to the device and will also factor into the total current consumed.

### 1.4 Hardware Documentation

Additional documentation for the kit can be found on the Microchip Website for the [AC164167](#).

This includes:

1. Board Design Documentation including Schematics and 3D Views.
2. Gerber Files.
3. TA100 8-Pin SOIC Socket Board User Guide (AC164167).

For other kits referenced in this document please check website information associated with those kits. This includes:

1. [ATSAMV71-XULT](#) SAMV71 Xplained Ultra Evaluation Kit.
2. [ATMBUSADAPTER-XPRO](#) XPRO to mikroBUS Adapter.
3. [Explorer 16/32 Development Kit \(DM240001-2\)](#).
4. [dsPIC33CK](#) 16-Bit PIC<sup>®</sup> Microcontroller.

### Related Hardware Kits

Microchip also offers the [AC164166](#) 14-Pin SOIC Socket Kit for the TA100. This developers kit offers a single TA100 device with both a SPI and I<sup>2</sup>C Interface.

## 2. Connecting the Board

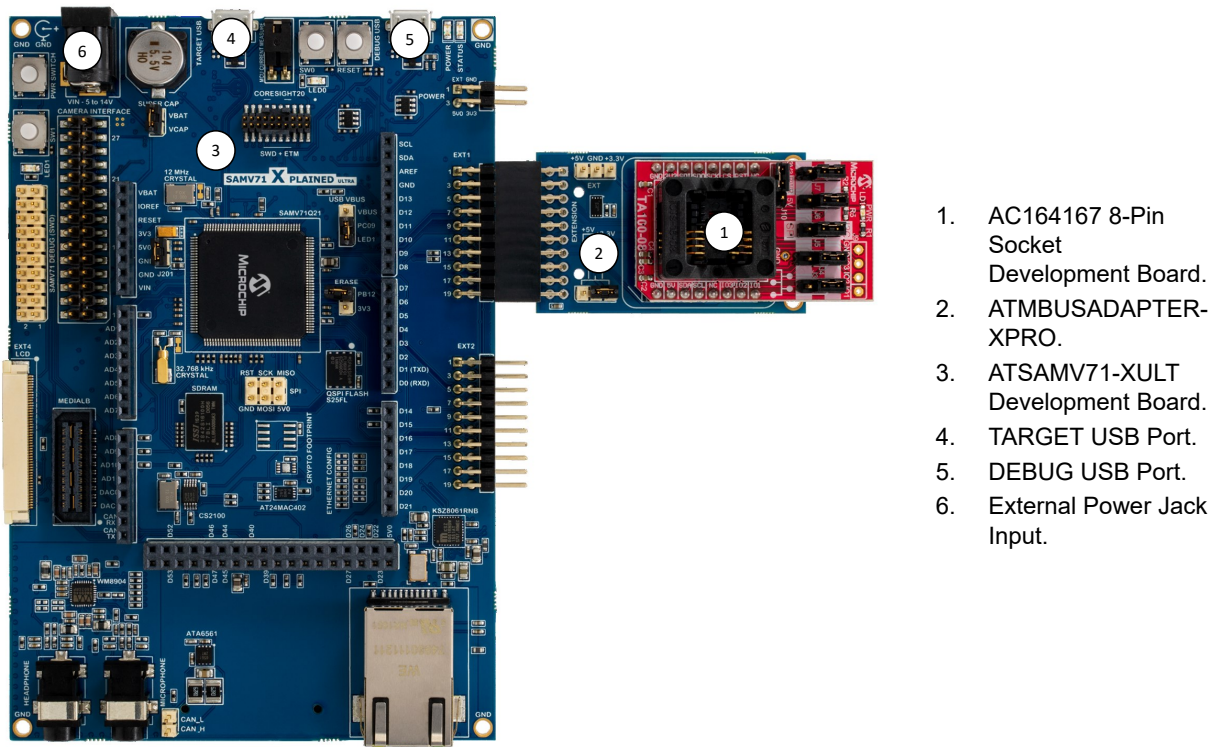
The form factor of the AC164167 development board was chosen because Microchip has heavily adopted the use of the mikroBUS connector on host boards. Many of Microchip's development platforms will support one or more mikroBUS interfaces. These include:

- 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
- SAM Xplained-Pro microcontroller development boards when used with an ATMBusAdapter

### 2.1 Xplained Pro Connections

By using an adapter board, the AC164167 development board can still be used with Microchip development boards that only support the Xplained Pro interface. [Figure 2-1](#) shows the full assembly of the [AC164167 TA100 8-Pin SOIC Socket Board](#), the [ATMBUSADAPTER-XPRO](#) and an [ATSAMV71-XULT](#) Development Board.

**Figure 2-1. Connections to an Xplained Pro Development Platform**



1. AC164167 8-Pin Socket Development Board.
2. ATMBUSADAPTER-XPRO.
3. ATSAMV71-XULT Development Board.
4. TARGET USB Port.
5. DEBUG USB Port.
6. External Power Jack Input.

### Powering the SAMV71-XULT Board

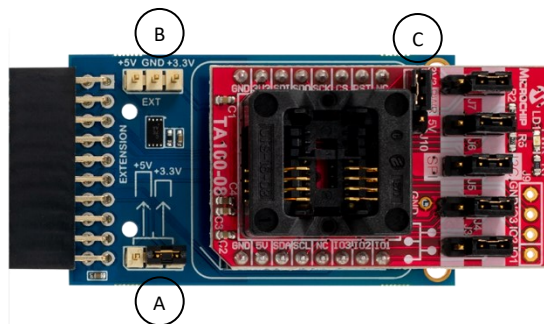
Multiple options exist for powering the SAMV71-XULT Development Board. Depending on the total current requirements different options are allowed. Please see the [SAMV71-XULT User Guide](#) for more information.

1. External Power Jack Input.
  - 2.1 mm barrel connector
  - 5-14V input supply Maximum current of 2.0A
  - 12V 18W Power Adapter Option: Triad Magnetics [WSU120-1500](#)
2. Embedded Debugger USB Connection. Max. of 500 mA.
3. Target USB Connection. Max. of 500 mA.
4. External Power Header.
  - 2-pin 100 mil Header
  - Direct 5V Supply
  - Max. 2A of current

### ATMBUSAdapter Power Settings

The ATMBUSAdapter allows power to be connected to the MikroBus Host adapter either directly through the XPRO interface or by providing external power through the EXT header. It is important that all jumpers are connected correctly before connecting to the SAMV71-XULT or other boards with an XPRO interface in order to prevent possible damage to the system.

**Figure 2-2. ATMBUSAdapter Plus AC164167**



1. **Option 1: Direct Power from the XPRO Extension**
  - Determine if the XPRO Board outputs a 3.3V or 5.0V supply voltage.
  - Connect the J10 shunt “C” of the AC164167 to the appropriate 3.3V or 5.0V supply.
  - Connect the ATMBUSAdapter power shunt “A” to the same voltage as the XPRO Supply.
2. **Option 2: External Power Connected to the ATMBUSAdapter.**
  - Remove the Power Shunt “A” from the ATMBUSAdapter. This disconnects power from the XPRO Header.
  - Connect either 3.3V or 5.0V external power to the Ext Header “B” on the ATMBUSAdapter
  - Make sure the J10 shunt on the AC164167 is placed across the correct connections for the External Power Supply chosen.

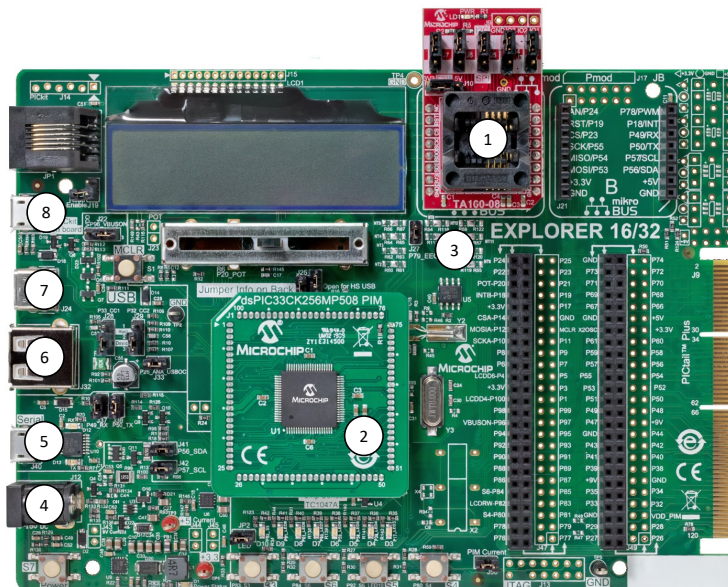
### Additional Resources

- [SAMV71 Kit Information](#)
- [SAMV71- Xplained Ultra User Guide](#)
- [SAMV71 Microcontroller](#)
- Additional Tools available via [myMicrochip](#)

### 2.2 Microchip Explorer 16/32 Connections

The AC164167 extension board can be connected to any microcontroller board that contains a mikroBUS Host Header. The 8-pin socket board can either be configured for the I<sup>2</sup>C or SPI interface as shown in section 1.2 Board Configuration. The diagram below shows a configuration using the [Microchip Explorer 16/32 Development Board](#) and the [dsPIC33CK](#) 16-bit microcontroller. Note that the Explorer 16/32 board allows for a variety of 100-pin Microchip microcontrollers to be used.

Figure 2-3. Connections to a Microchip Explorer 16/32 Development Board



1. AC164167 14-Pin Socket Development Board.
2. dsPIC33CK 16-Bit Microcontroller.
3. Microchip Explorer 16/32 development Board.
4. External Power Connection.
5. Micro-USB Connection.
6. Type-A USB Connection.
7. USB Type-C™ Connection.
8. PICKit™ On-Board debugger micro-USB Connection.

#### Powering the Board

Multiple options exist for powering the Explorer 16/32 Development board. Depending on the total current requirements different options are allowed.

1. External Power Supply Connection.
  - 8-15V Power Supply maximum current 1.3A
  - Universal 9V Supply Adapter: [AC002014](#)
2. USB Connections allow up to 400 mA.

#### Additional Resources

- [Microchip Explorer 16/32 Kit Information](#)
- [Microchip Explore16/32 User Guide](#)
- [dsPIC33CK](#)
- Additional software tools available via [myMICROCHIP](#)

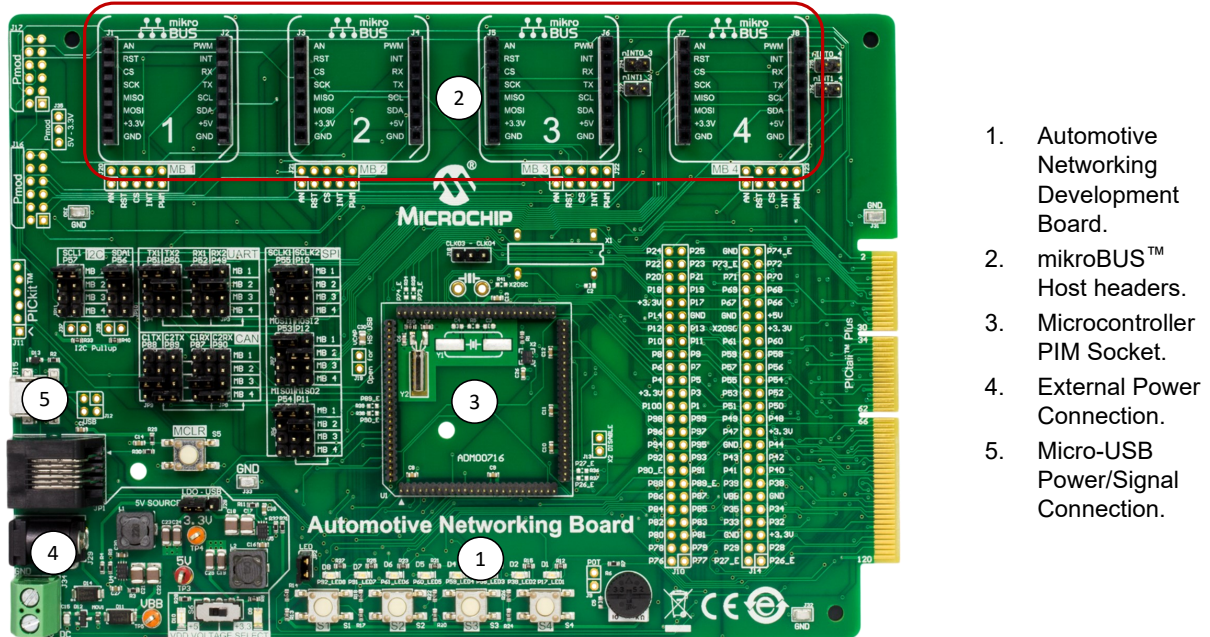
### 2.3 Automotive Networking Development Board Connections

The AC164167 extension board can be connected to any microcontroller board that contains a mikroBUS Host Header. The 8-pin socket board can either be configured for the I<sup>2</sup>C or SPI interface as shown in section 1.2 Board Configuration. The diagram below shows the [Automotive Networking Development Board](#). This board is a low-cost modular development system for Microchip's 8-bit, 16-bit, and 32-bit microcontrollers targeting CAN and LIN network related applications.



Due to the modular nature of the Automotive Networking Development Board only a generic photo of the board is shown below. There are multiple LIN and CAN Controllers that can be connected through the mikroBUS connectors along with the AC164167 socket security board. Each of these devices can be connected via any of the mikroBUS headers. A 100-pin plug-in microcontroller module (PIM) is also required for complete system operation. Microchip has a variety of PIM modules that can be used with this development board. Examples of mikroBUS click boards and PIM modules are shown in the [Additional Resources](#) section.

**Figure 2-4. Connections to the Automotive Networking Development Board**



### Powering the Board

Multiple options exist for powering the Automotive Networking Development Board.

1. External Power Supply Connection (7-30V).
  - 9V external power supply adapter: (AC002014) 1.3A current
  - 5 mm output jack with center-positive connection
  - Place jumper across pins 2-3 of header J28 to enable
2. USB Connections.
  - Micro-USB connection
  - Place jumper across pins 1-2 of header J28 to enable

### Additional Resources

The following list of resources should be considered as examples and not an exhaustive list. To identify additional PIM or mikroBUS modules that may work with the Automotive Networking Development Board please go to [www.microchip.com](http://www.microchip.com).

- [Automotive Networking Development Board Kit Information](#)
- [Automotive Networking Development Board User's Guide](#)
- [MCP2003B click for LIN systems](#)
- [MCP25625 click with Microchip CAN controller](#)
- [ATA6563 click with Microchip CAN controller](#)
- [PIC18F66K80 100-pin PIM](#)
- Additional software tools available via [myMicrochip](#)

### 3. Software Tools

The TA100 is supported by a suite of software tools. These tools are only available under NDA. Please contact Microchip to obtain an NDA and request access to the tools. Once an NDA has been signed, these tools will be made available in the My Secure Software section of the customer's myMicrochip account. Enhancements, upgrades and additional tools will automatically be made available to any customer that has been enabled for the TA100 support.

**Table 3-1. TA100 Software Tools**

Item #	Tool Name	Description
1	TA100 Configurator GUI and TA100 Library	The TA100 Configurator GUI provides the ability to configure and pseudo-provision TA100 devices and to illustrate how the TA100 can be used for various applications such as Secure Boot, Device Authentication and CAN-MAC. These applications perform many cryptographic operations using the TA100 library.
2	CryptoAuthLib	A flexible library implemented with a Hardware Abstraction Layer (HAL) that allows the TA100 to be readily ported to other microcontrollers. The library provides commands support for the TA100 and other Microchip CryptoAuthentication™ devices significantly speeding up application development.
3	AUTOSAR™ 4.3.1 CRYPTO driver. <sup>(1)</sup>	CRYPTO driver specifications provides an abstraction layer to integrate external cryptographic device such as the TA100 into the AUTOSAR™ stack. This allows for code to be portable between various applications that use different microcontrollers.



**Important:** (1) For projects that use the AUTOSAR Driver the AUTOSAR™ Reference Stack will also be needed. AUTOSAR™ is an open and standardized automotive software architecture. The TA100 has been integrated into 3rd party AUTOSAR™ software stacks to aid customers in the implementation of automotive applications. Please contact Microchip for a list of 3rd Party AUTOSAR™ stack vendors that support the TA100.

#### Use Case Examples

Use Case examples utilize the TA100 Configurator GUI to demonstrate various sample applications that can be implemented using the TA100 and SAM V71 microcontroller. These sample applications come with the necessary microcontroller firmware, detailed application user guide and other documentation describing the use case in more detail. [Table 3-2](#) provides some of the use case examples that are available from the myMicrochip website. Upgrades to these use case examples and additional use case examples will be provided over time via the same path.

**Table 3-2. Use Case Examples**

Item #	Use Case Examples <sup>(1)</sup>	Description
1	Device Authentication	Provides device authentication by verifying the chain of trust using Signer and Device Certificates and a Random Challenge. Upon successful authentication, a known string is encrypted and written to a data element or read and decrypted from a data element inside TA100.
2	Full Stored Secure Boot with Pre-Boot	Secure Boot use case that upon initial boot calculates the digest of the firmware code and then stores it for faster subsequent secure boots.
3	CAN Bootloader	Secure Boot Use case that allows for secure firmware upgrade via the CAN Bus using the SAMV71 microcontroller, K2L MOCCA-FD tool and PC-based GUI.

.....continued

Item #	Use Case Examples <sup>(1)</sup>	Description
4	CAN-MAC Authentication	This use case demonstrates a mechanism to add an AES C-MAC to authenticate CAN-FD messages. This mechanism can be used to ensure data integrity and authenticity of the transmit node. TA-configurator GUI will import a CAN-database file to populate the CAN-MAC tab of the GUI. The user can use the TA-configurator GUI to select which messages need authentication, assign C-MAC keys, and to configure message payload structure.

**Note:**

1. The listed Use Case examples are based on the TA100Lib and TA Configurator GUI.

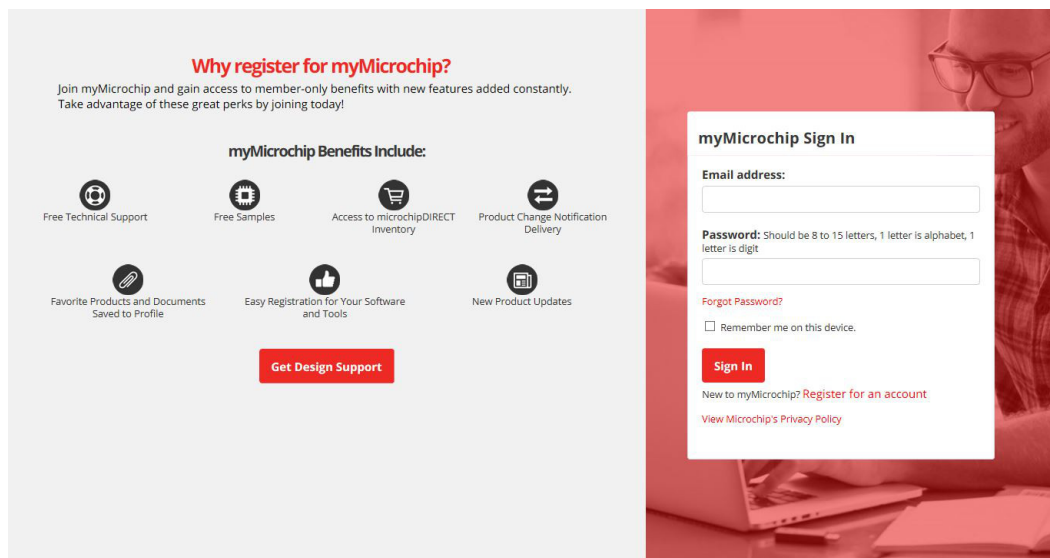
### 3.1 myMicrochip

Microchip provides the ability to customize your user experience and keep up to date on key topics that are of the most relevance and importance to you by registering for a myMicrochip account. In order to have access to many of the TA100 software tools you must have an account. Having access will automatically give you access to tool updates and new tools as they are added.

#### Accessing myMicrochip

1. Go to the myMicrochip Website: [www.microchip.com/mymicrochip](http://www.microchip.com/mymicrochip).

**Figure 3-1. myMicrochip Login and Registration page**



2. If you do not have an account, click on the "Register for an account" link, fill out the information, then save your profile.
3. Once you are fully registered then you can log in through the access page in step 1.
4. After you log in, go to the "Update Account" link and set your preferences for the products you would like access to.



**Important:** The steps above provide access to myMicrochip but do not enable access to the TA100 software which requires a current NDA. Please contact your Microchip Sales or Technical Representative to verify status of, or process an NDA to get access to the TA100 software repository. Once your name has been added to the list it will automatically show up on your myMicrochip page.

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#### 4. Revision History

Revision	Date	Description
A	05/2020	Initial release of this document.

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