AC164166

TA100 14-Pin SOIC Socket Board User Guide

Introduction

The TA100 14-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 14-pin SOIC socket board and TA100 secure element support both an I^{2}C and SPI Interface.

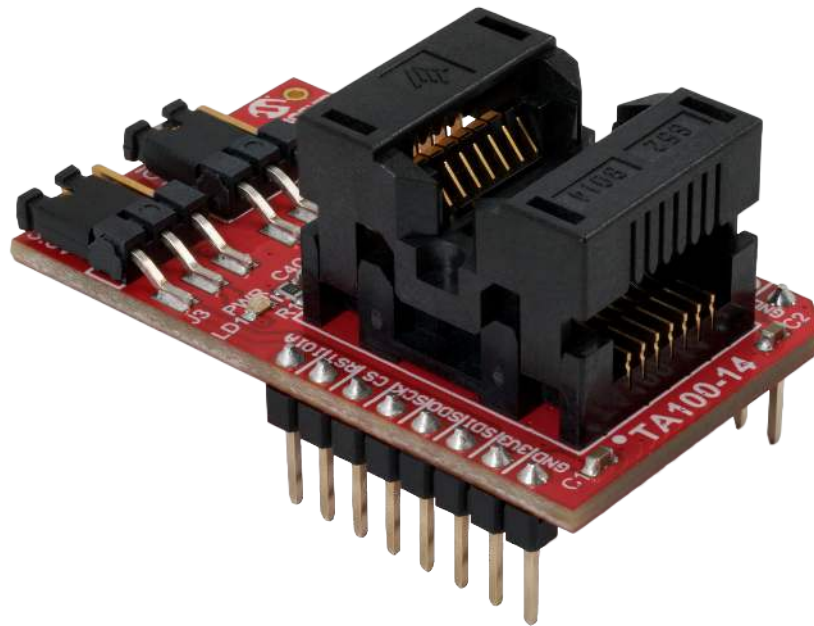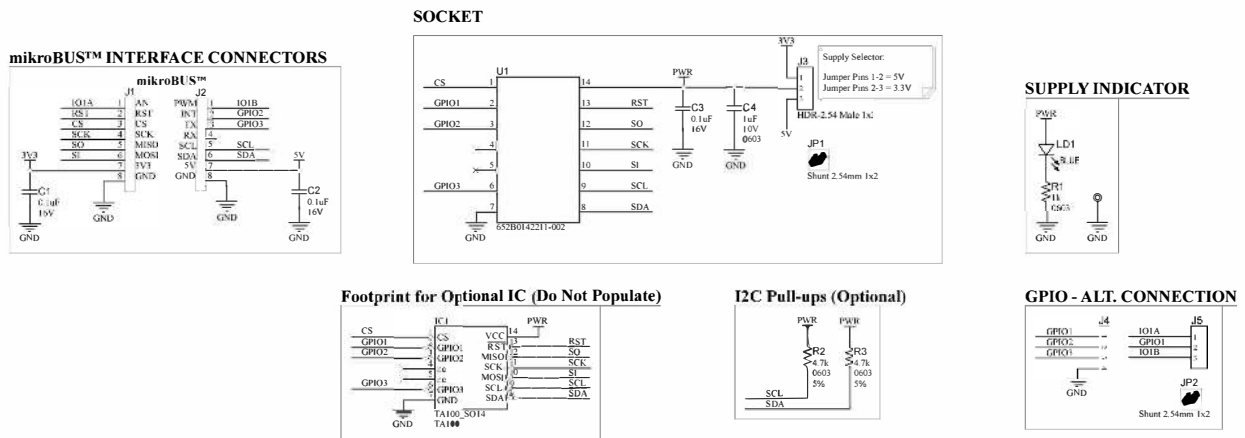**Figure 1. TA100 14-Pin SOIC Socket Board**

Table of Contents

1. Hardware Description

1.1 Schematic and Key Features

- One 14-Pin SOIC Socket (U1)
- One mikroBUS Connector (J1, J2)
- On-Board 4.7 kΩ I^2C Resistors (R2, R3)
- On-Board LED Power Indicator (LD1)
- Power Jumper for selecting 3.3V or 5V power (J3)
- Jumper for selecting which mikroBUS pin is connected to GPIO1 (J5)
- Optional GPIO Header (J4) Not populated
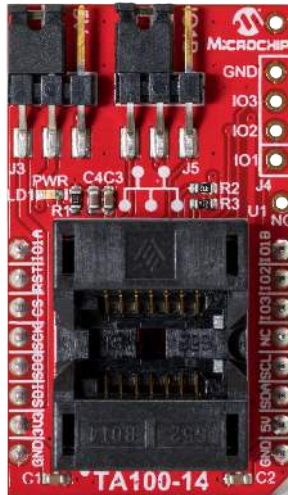
Figure 1-1. TA100 14-Pin SOIC Socket Board Schematic

1.2 Board Configuration

TA100 14-Pin SOIC Socket Board Jumper Configurations

- 3.3V Power: J3 with shunt across 3V3 and PWR positions
- 5.0V Power: J3 with shunt across 5V and PWR positions
- GPIO1 Connected to IO1A: J5 with Shunt across GPIO1 and IO1A
- GPIO1 Connected to IO1B: J5 with Shunt across GPIO1 and IO1B

1.3   Supply Current Measurement

The current consumption of the TA100 device can be measured by using the AC164166 14-pin socket board. The only devices on the board that will consume power are the TA100 socketed device, the Power LED and the I^2C 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.[1]
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.[2]
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. [3]

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^2C devices, the measurement will include the I^2C 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 AC164166.

This includes:

1. Board Design Documentation including Schematics and 3D Views.
2. Gerber Files.

3. TA100 14-Pin SOIC Socket Board User Guide (AC164166).

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® Microcontroller.

Related Hardware Kits

Microchip also offers the AC164167 8-Pin SOIC Socket Kit for the TA100. This developers kit supports an 8-pin version of the TA100 device with either a SPI or I^{2}C interface.
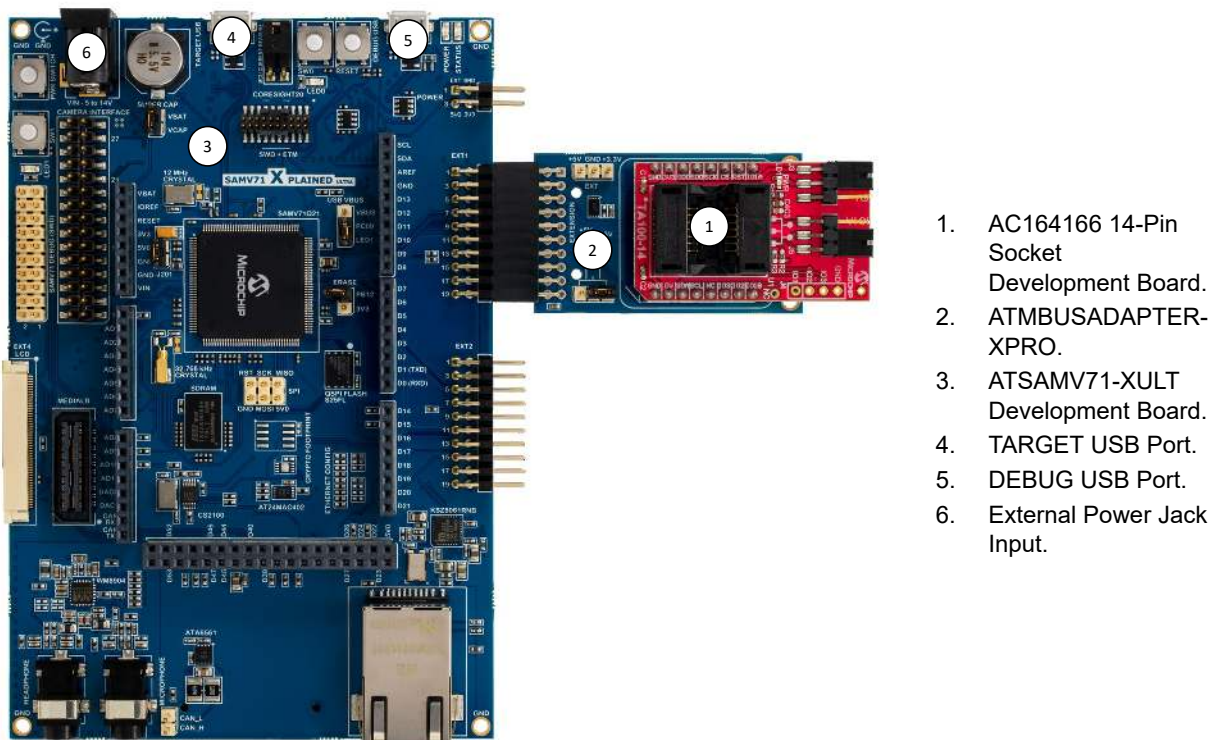
2. Connecting the Board

The form factor of the AC164166 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 AC164166 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 AC164166 TA100 14-Pin SOIC Socket board, the ATMBUSADAPTER-XPRO and an ATSAMV71-XULT Development Board.

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

1. AC164166 14-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 AC164166
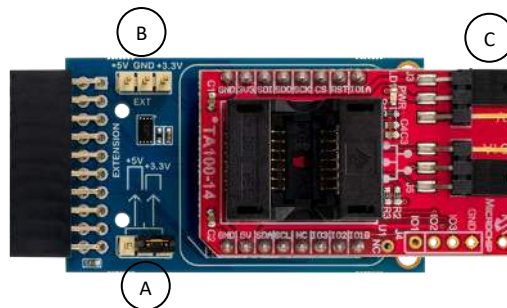
1. *Option 1: Direct Power from the XPRO Extension*
   – Determine if the XPRO Board outputs a 3.3V or 5.0V supply voltage.
   – Connect the J3 shunt "C"of the AC164166 to the appropriate 3.3V or 5.0V supply.
   – Connect the ATMBUSAdapter power shunt "A" to the same voltage as the XPRO Supply.
2. *Option 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 J3 shunt on the AC164166 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 AC164166 extension board can be connected to any microcontroller board that contains a mikroBUS Host Header. The 14-pin socket board contains both the I^{2}C and the 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
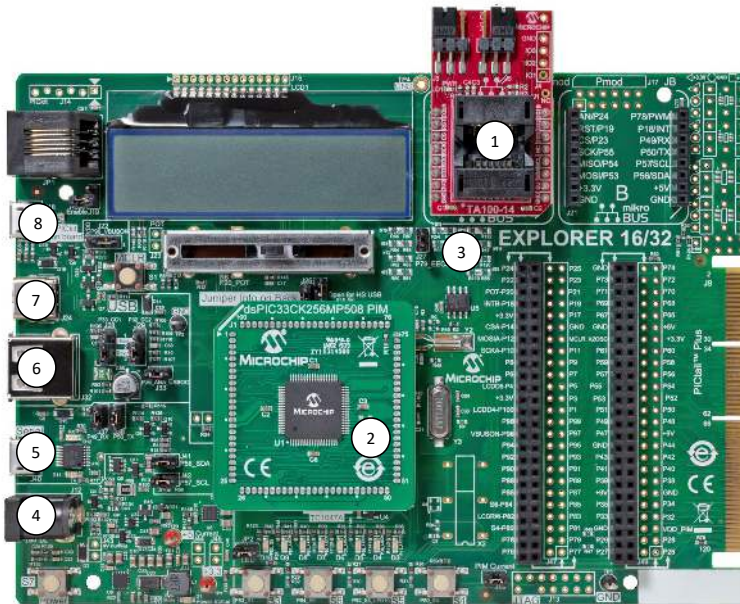
1. AC164166 14-Pin Socket Development Board.
2. dsPIC33CK 16-Bit Microcontroller.
3. Microchip Explorer 16/32 Bit development Board.
4. External Power Connection.
5. Micro-USB Connection.
6. Type-A USB Connection.
7. USB Type-C™ Connection.
8. PICkit™ On-Board debugger micro-USB Connection.

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 AC164166 extension board can be connected to any microcontroller board that contains a mikroBUS Host Header. The 14-pin socket board contains both the I^{2}C and the 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 AC164166 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
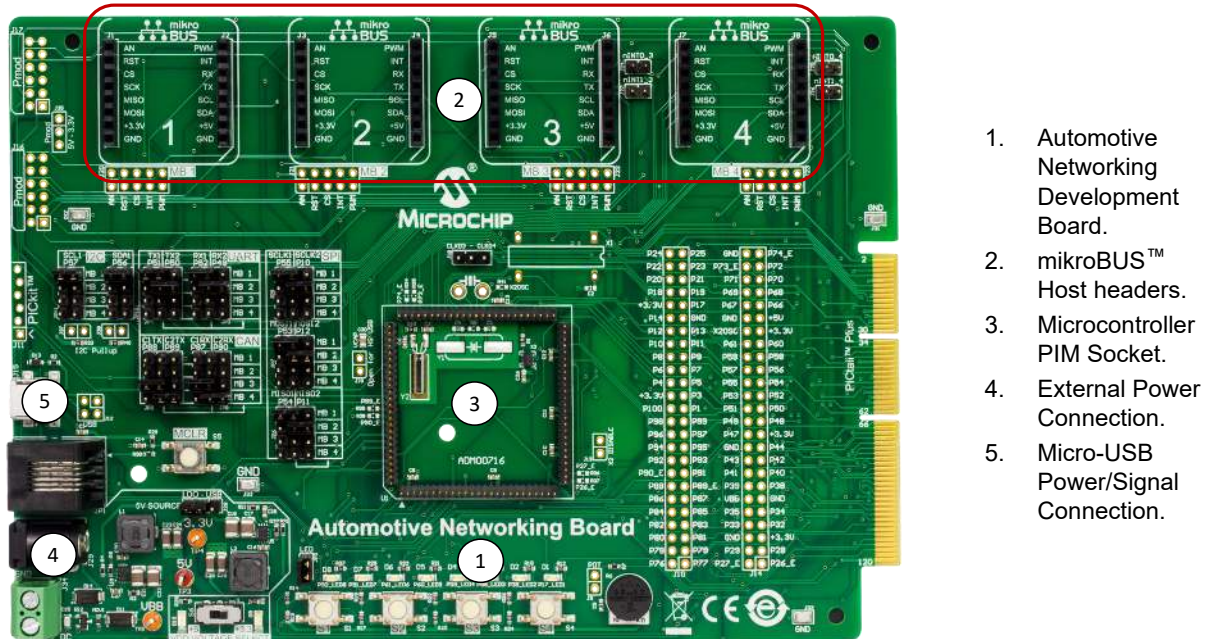
1. Automotive Networking Development Board.
2. mikroBUS™ Host headers.
3. Microcontroller PIM Socket.
4. External Power Connection.
5. Micro-USB Power/Signal Connection.

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.

- 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.[1]	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[1]	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[1]	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.

Figure 3-1. myMicrochip Login and Registration page
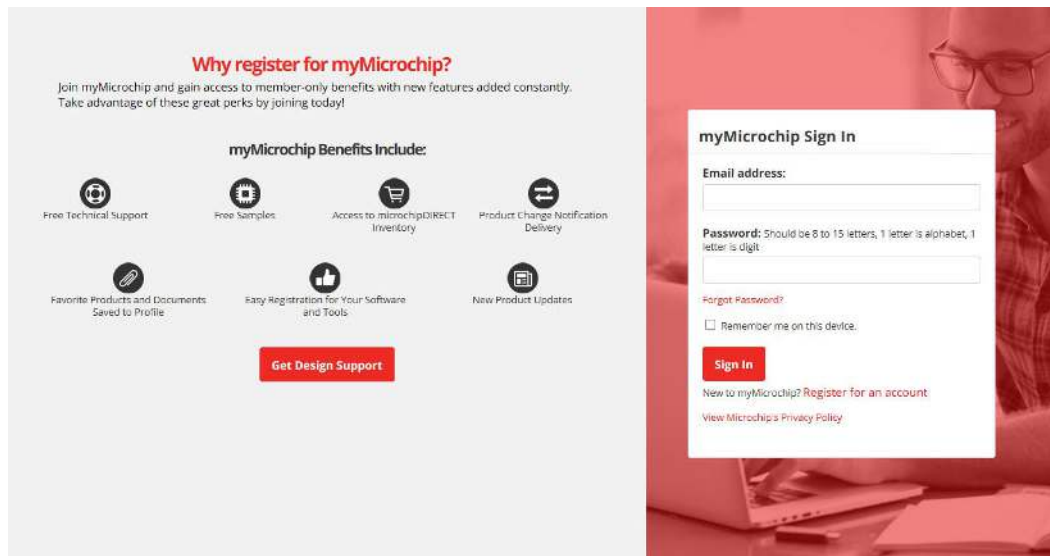
2. If you do not have an account, click on the "Register for an account" link, fill out the information, then save your profile.
3. Once you are fully registered then you can log in through the access page in step 1.
4. After you log in, go to the "Update Account" link and set your preferences for the 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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    – Selected by editing your preferences
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    – Provides updates to documents and software and access to new tools automatically that are in the same repository
    – Access is granted on a product by product family basis (decided by the specific Business Unit)
3. My Products.
    – Provides a direct link to products or product families that you deem important
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4. Revision History

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

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