MCP16701 Programming Board User's Guide
EV75W27A

Introduction

The MCP16701 Programming Board (EV75W27A) is designed to simplify the programming process of the MCP16701 Power Management Integrated Circuit (PMIC) using a socket connector.

The board can be powered either through a single USB Type-C connector or by using an external programmer, such as the MCP2221A Breakout Module. The MCP16701 can be programed using the I^{2}C Monitor Graphical User Interface (GUI).

An on-board MCP2221, which is an USB 2.0 to I^{2}C/UART Protocol Converter with GPIO, is used to configure the PMIC when the USB Type-C connector is used.

The board has a straightforward design, equipped with LEDs that indicate if the board is powered, if the input voltage (VDD) is connected to the PMIC or if an external programmer is used.

Features

The MCP16701 Programming Board (EV75W27A) has the following features:

- Input Voltage (VDD): 5V
- Built-in Socket, Used to Program a Large Number of Devices
- Single USB Type-C for Communication and Power
- On-Board MCP2221: No External Programmers Needed
- Indicator LEDs, Used to Show if the Board is Powered, if the VDD is Connected to the PMIC, or if an External Programmer is Used
- Test Points for all the Necessary Signals Used to Program the MCP16701.
- Slide-Switch (SW2) to Power the PMIC From the USB Type-C Connector
- Slide-Switch (SW1) Used When an External Programmer is Connected to the Board

Contents of The MCP16701 Programming Board (EV75W27A) Kit

The MCP16701 Programming Board (EV75W27A) kit includes:
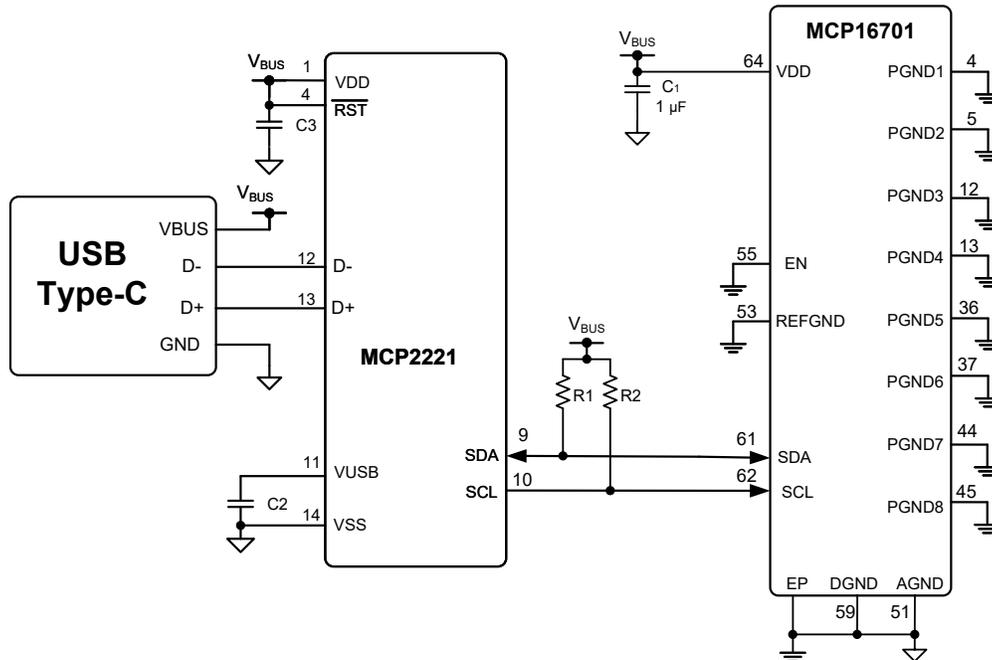
- MCP16701 Programming Board (EV75W27A)

Table of Contents

1. Setup and Configuration

The MCP16701 Programming Board (EV75W27A) was developed to program the MCP16701 PMIC through the USB interface (via the I^{2}C Monitor GUI).

Figure 1-1. MCP16701 Programming Board (EV75W27A) with MCP2221 I^{2}C Bridge

1.1. Getting Started

The MCP16701 Programming Board (EV75W27A) is delivered fully assembled and requires only a standard USB Type-C connector for device programming.

This board does not require a dedicated power supply, as it can be powered directly from the USB connector or from the external programmer connector (for example, MCP2221A Breakout Module). Additionally, users have the option to power the device externally using the dedicated test points (GND-TP3 and VDD-TP4), if necessary.

If the USB Type-C connector is used, follow the steps below:

1. Insert an MCP16701 PMIC into the socket, taking into consideration the orientation of the device, as indicated in the following figure.

2. Connect a USB Type-C cable to J1. If the green LED (D2) is on, the USB supplies power to the board.

3. The slide-switches SW1 and SW2 will be in the ON position, as indicated in the following figure. If the red LED (D1) is on, the VDD is supplied to the PMIC.

4. Configure the PMIC using the I^{2}C Monitor GUI provided on the Microchip website. After configuring the PMIC, the user can save the custom configuration by selecting **Save register to file** from the **File** tab. The configuration file can then be easily transferred to any PC, allowing the user to load the saved configuration into the next PMIC by selecting **Load registers from file** from the **File** tab.

Note: When a WRITE operation is performed to NVM registers, a password procedure to get write permission is required. Another password procedure is required to enable write operations to xxVSETx volatile register addresses. Special command effects are located in the volatile memory. Every time VDD is cycled, the granted permissions are lost. See 2.10.6 I^{2}C Special Commands for details.

Figure 1-2. MCP16701 Programming Board (EV75W27A)
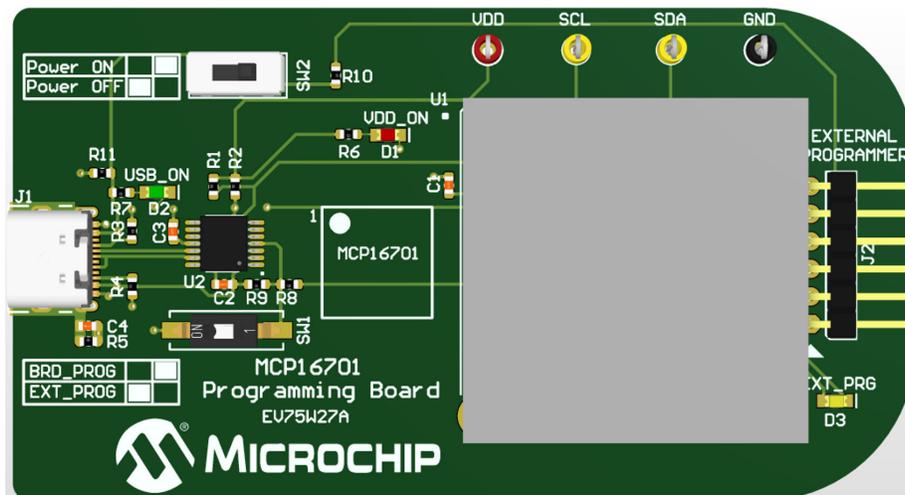
If the external programmer is used, follow the steps below:

1. Insert an MCP16701 PMIC into the socket, taking into consideration the orientation of the device, as indicated in the figure above.

2. Connect the external programmer to the board ensuring that all the connections match the pinout from the J2 header.
   Note: The MCP2221A Breakout Module is a pin-to-pin compatible programmer.

3. Ensure that the slide-switch SW1 is in the OFF position, while the slide-switch SW2 is in the ON position.

4. Configure the PMIC using the I^{2}C Monitor GUI provided on the Microchip website. After configuring the PMIC, the user can save the custom configuration by selecting **Save register to file** from the **File** tab. The configuration file can then be easily transferred to any PC, allowing the user to load the saved configuration into the next PMIC by selecting **Load registers from file** from the **File** tab.

Note: When a WRITE operation is performed to NVM registers, a password procedure to get write permission is required. Another password procedure is required to enable write operations to xxVSETx volatile register addresses. Special command effects are located in the volatile memory. Every time VDD is cycled, the granted permissions are lost. See 2.10.6 I^{2}C Special Commands for details.

2. GUI Installation and Operation

2.1. Getting Started

To install, use and evaluate the product, several software and hardware tools are required.

2.1.1. Required Software

- I^{2}C Monitor Graphical User Interface version 9.1 or higher
- Microsoft®.NET Framework 4.5 or higher
- Adobe® Reader®
- Windows® 10 or later

2.1.2. Required Hardware

- MCP16701 Programming Board (EV75W27A)
- USB-to-USB Type-C Cable

2.2. GUI Installation

The following steps describe how to install the I^{2}C Monitor GUI:

1. If Microsoft .NET Framework is already installed, go to Step 3. If not, download Microsoft .NET Framework from www.microsoft.com and follow the installation instructions.
2. If Adobe Reader is already installed, go to Step 3. If not, download Adobe Reader from http://get.adobe.com/reader/ and follow the installation instructions.
3. Download the I^{2}C Monitor GUI archive from the product web page under "Documentation".
4. Unzip the I^{2}C Monitor Graphical User Interface archive, which contains the `setup.exe` file. **Note:** If an older version or a corrupted version of the current I^{2}C Monitor GUI is already installed on the computer, see I2C Monitor Graphical User Interface Uninstall before proceeding with the installation.
5. Double-click the `setup.exe` file to open the Install Shield Wizard and wait for the extraction to complete. If required, the installation can be stopped by clicking **Cancel**.
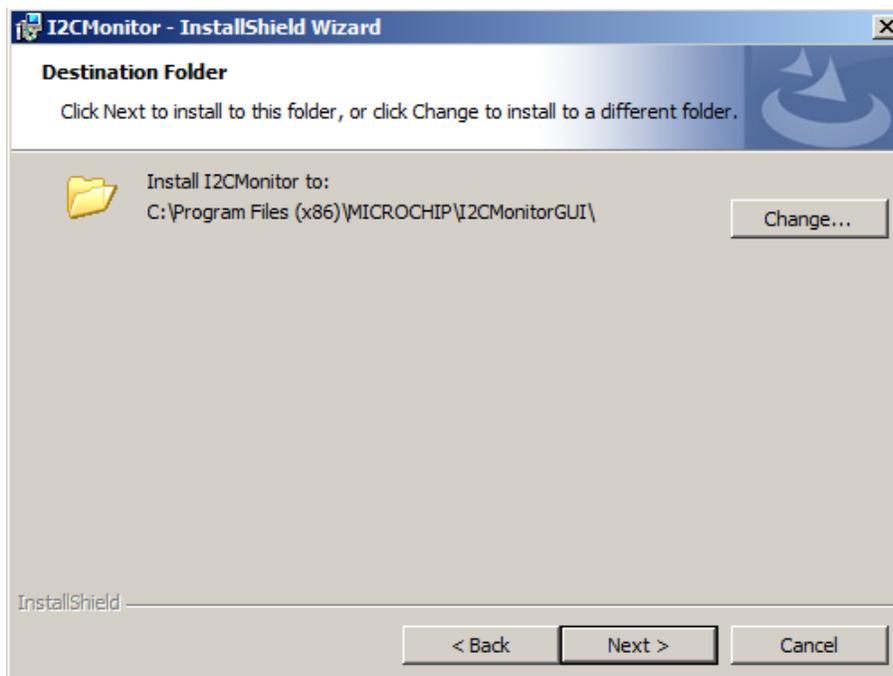
6. In the Welcome to the Install Shield Wizard for I2CMonitor window, click **Next** to start the installation.

**Figure 2-1.** Starting the I^{2}C Monitor Graphical User Interface Installation

7. The installation path can be changed, although it is recommended to keep the default path. Click **Next** to continue.

Figure 2-2. Selecting the Destination Folder

8. In the Ready to Install the Program window, click **Install** and wait for the application to proceed with the installation.

Figure 2-3. Installing the I^{2}C Monitor Graphical User Interface
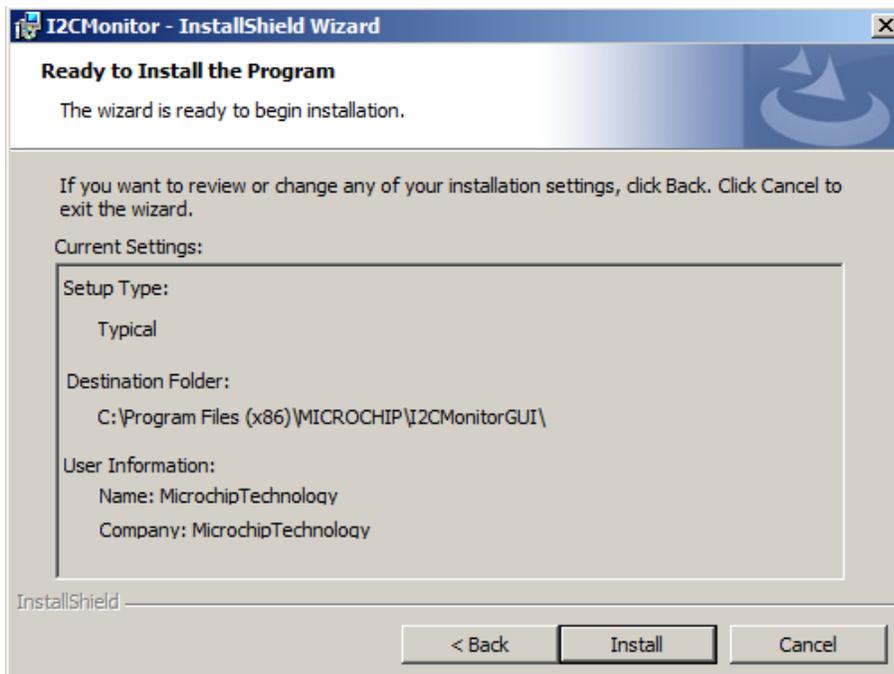
9. Once the installation is complete, click **Finish** to end the installation. To start the GUI, either click the desktop icon or browse to *Windows Start>All Programs>Microchip>I2C Monitor*.

**Figure 2-4.** InstallShield Wizard Completed Window

2.3. I^{2}C Monitor Graphical User Interface Uninstall

To install a new version of the I^{2}C Monitor Graphical User Interface, any previous or corrupted version must be removed from the computer.

To uninstall it, go to _Windows Start>Control Panel>Uninstall a program>I2C Monitor_. The I^{2}C Monitor will automatically close once the process is complete.

Figure 2-5. Uninstalling the I^{2}C Monitor Graphical User Interface
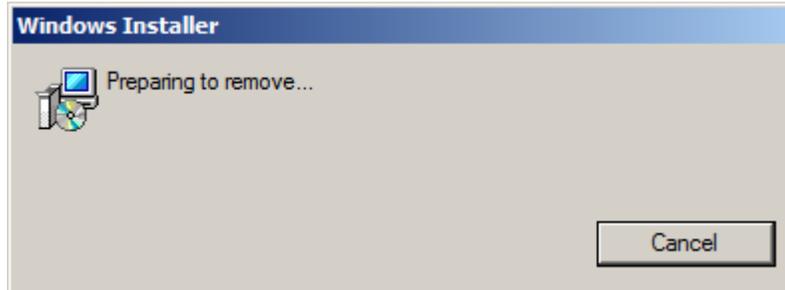
3. GUI Description

This chapter describes how to use the I^{2}C Monitor GUI with the MCP16701 Programming Board (EV75W27A).

NOTICE This chapter provides information on how to use the GUI with the MCP16701. For other devices using the I^{2}C Monitor GUI, see their specific Data Sheets and User's Guides.

Figure 3-1. I^{2}C Monitor Graphical User Interface Main Window - MCP16701 View

All the changes to register values are made in the Volatile Register Map. For these changes to be present after a re-power of the PMIC, follow the following steps:

1. Enable I2C Write to VSET and Enable I2C Write to NVM by clicking the corresponding buttons.
2. Copy the Values (Volatile to Non-Volatile) by clicking the corresponding button.
3. Write all registers values by clicking the corresponding button.

3.1. Graphical User Interface

3.1.1. Device Menu

The Device drop-down menu allows the user to select the device to be evaluated.

3.1.2. I^{2}C Monitor Status and Control

The **Status and Control** bar contains the items described in the following table.

Figure 3-2. I^{2}C Monitor Status and Control Bar

Table 3-1. Monitor Status and Control Bar

Item	Description
Addr	This drop-down menu shows the address of the available devices.
Connector	This drop-down menu shows the type of connector used to connect the board.
ScanAddr	This button scans for a valid address.
Connect/Disconnect	These buttons are used to connect/disconnect the currently selected device.
Voltage	This drop-down menu is used to select the voltage level of the communication when using the PICkit™ Serial Analyzer.
Rate	This drop-down menu is used to select the corresponding communication rate for the device.
Pullups	This drop-down menu is used to activate the internal pull-ups from the PICkit Serial Analyzer.

In the **Status and Control** bar, users can select the hardware tool for communicating with the device and configure its settings.

To connect to a device, the user must follow the first three steps described in Getting Started. After connecting the USB-USB Type-C cable, the user must scan for a valid address. Once a valid address is detected, clicking **Connect** initializes the connection with the device, making the registers available for read and write operations.

3.1.3. I^{2}C Generic Register View

The I^{2}C Generic Register View area contains the items described in the following table. This section of the I^{2}C Monitor GUI is common for any device evaluated.
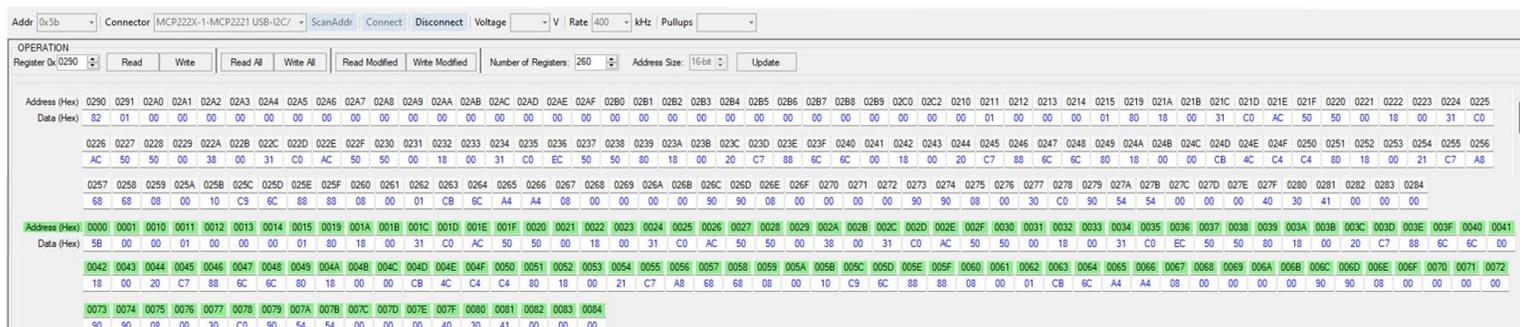
Figure 3-3. Generic Register View Area

Table 3-2. I^{2}C Generic Register View Items

Panel	Item	Description
Operation	Register	This section shows the registers available for read/write operations.
	Read/Write	These buttons are used for single register read/write operations.
	Read All/Write All	These buttons are used for reading/writing all the available registers.
	Number of Registers	In this section, the user can set the number of available registers for read/write operations.
	Address Size	In this section, the user can set the registers' address size.
	Update	This button sets the number of available registers for read/write operations in the Register Area.
Register Area		This section shows the current status of the registers' address and the content.

The MCP16701 specific registers are described in the MCP16701 Data Sheet.

3.1.4. MCP16701 Special Commands

Figure 3-4. Special Commands
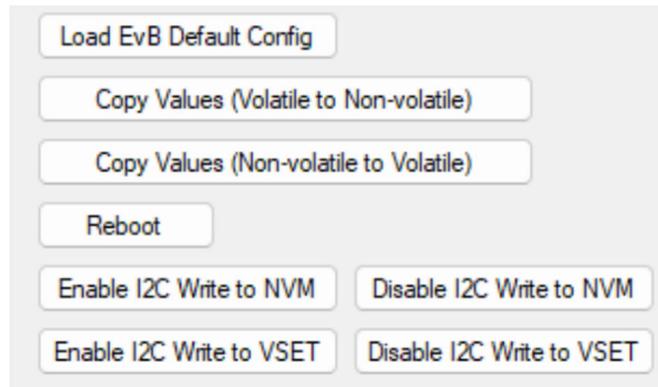
The MCP16701 has a list of special commands:

- **Load EvB Default Config** loads the typical application registry settings for the evaluation board, if needed. Click **Write All** to make the changes effective.
- **REBOOT** is equivalent to a device turn-off. It reloads all values from the EEPROM content to volatile registers, followed by a new start-up sequence.
- **Enable I2C Write to NVM** is required to change the settings of the registers located in the non-volatile memory. **Disable I2C Write to NVM** revokes write access in the non-volatile memory.
- To change the output voltages, **Enable I2C Write to VSET** is required; otherwise, any changes to VSET settings will not be taken into account. **Disable I2C Write to VSET** revokes write access to VSET settings to avoid accidental changes in the VOUT settings.

3.1.5. MCP16701 Functionalities Tabs

This area of the GUI allows the user to modify important features from the **General Settings** tab, the Bucks and LDOs configuration.
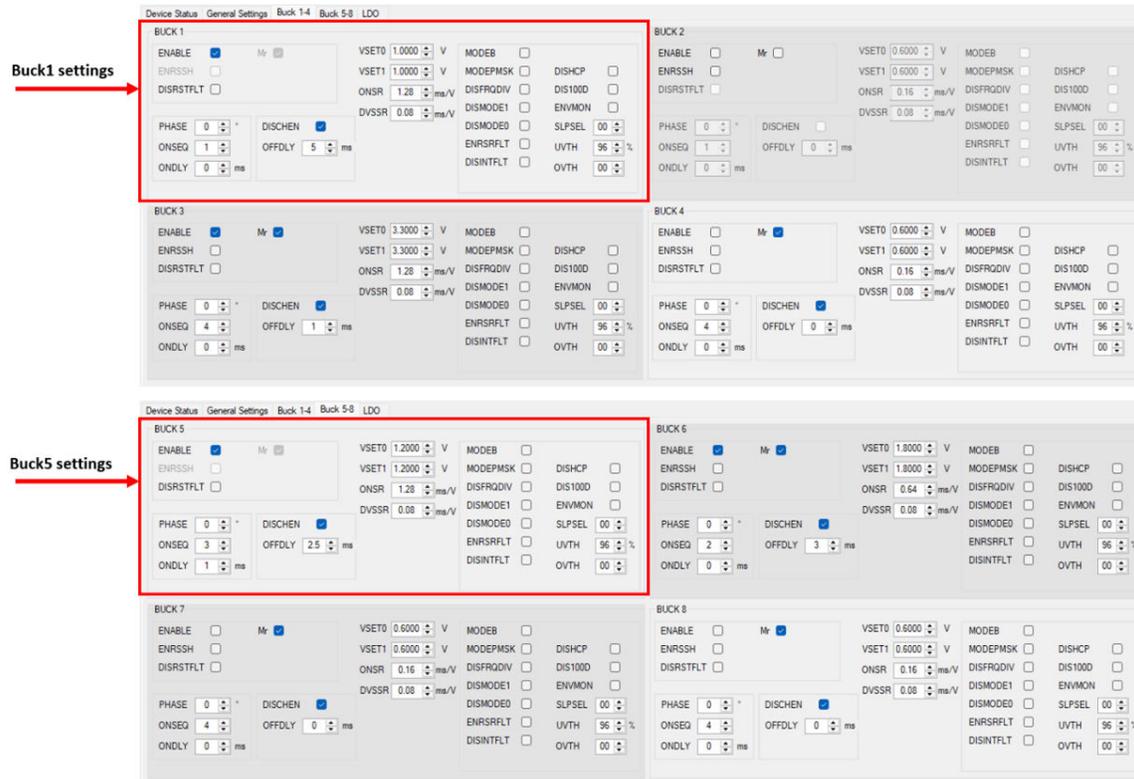
Figure 3-5. Functionalities Tabs
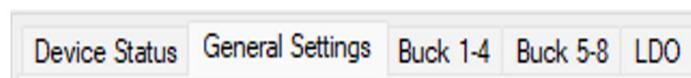
3.1.6. MCP16701 I^{2}C Buck Channel Settings

This area of the GUI allows the user to modify the Buck-related features individually for each of the eight Buck channels. There are two tabs for the Buck Channels, the first is for Bucks 1 through 4 and the second for Bucks 5 through 8.
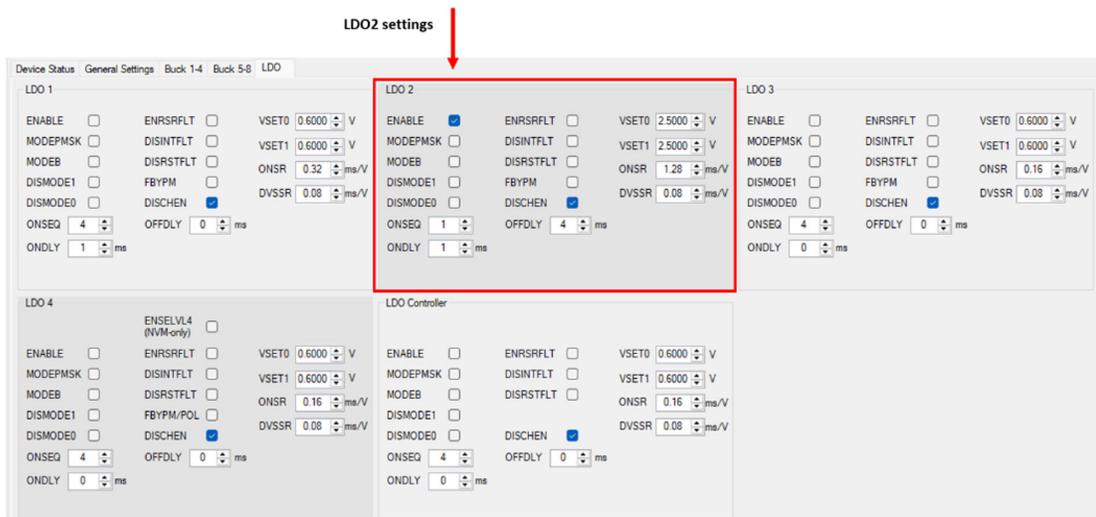
Figure 3-6. I^{2}C Buck Channel Settings

3.1.7. MCP16701 I^{2}C LDO Channel Settings

This area of the GUI allows the user to modify the LDO related features individually for each of the four LDO channels and LDO Controller.

Figure 3-7. I^{2}C LDO Channel Settings

Note: All the features related to the configuration of the PMIC are described in the MCP16701 Data sheet and the Evaluation Board User's Guide.

3.1.8. Status Bar

The status bar provides information on the status of the device connected to the PC.

Figure 3-8. Status Bar

Table 3-3. Status Bar Items

Item	Description
Status Label	The label shows if there is any device connected to the board. Refer to the following table for a list of possible labels.
Progress Bar	This bar shows the level of completion for a given command.

Table 3-4. Status Labels

| Status Label	Description
STATUS: Connected!	This message is shown when the GUI connects to a device.
STATUS: Disconnected!	This message is shown when the GUI does not detect a connected device.

The specific settings for all control areas are detailed in the register map available in the MCP16701 data sheet.

4.   Board Design

This chapter contains the following schematic and layouts for the MCP16701 Programming Board (EV75W27A):

- Board – Schematic
- Board – Top Silk
- Board – Top Copper and Silk
- Board – Top Copper
- Board – Bottom Copper
- Board – Bottom Copper and Silk
- Board – Bottom Silk

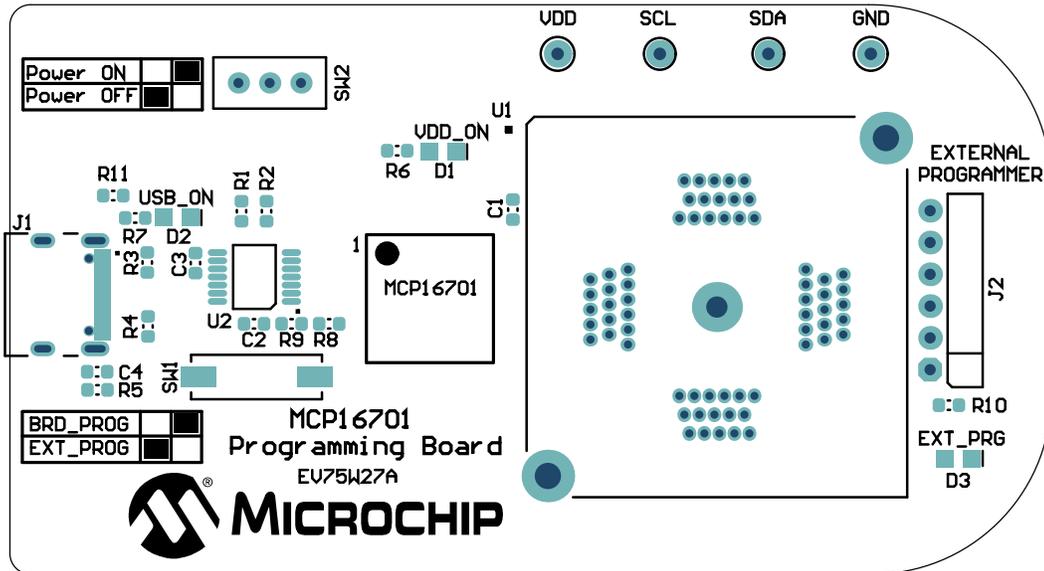## 4.1.   Schematic
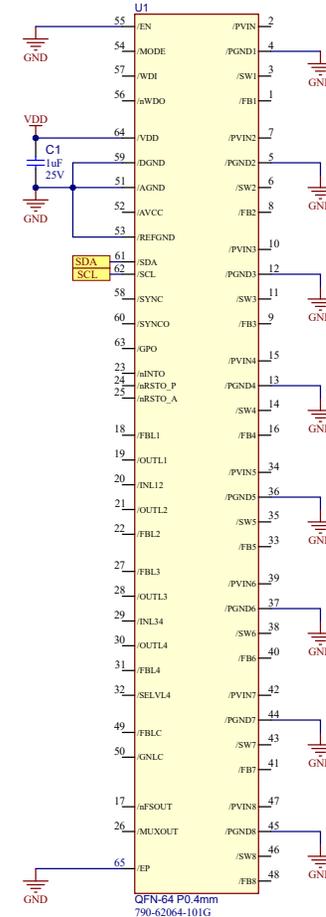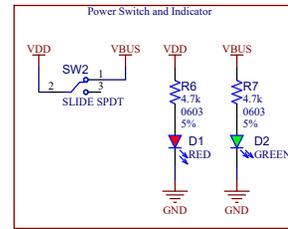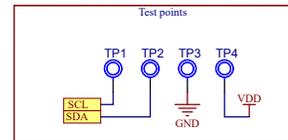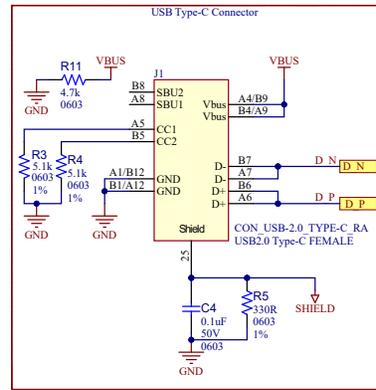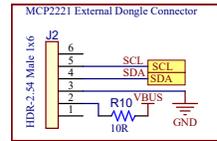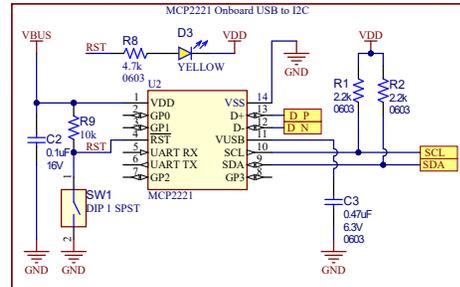
4.2.   Layout

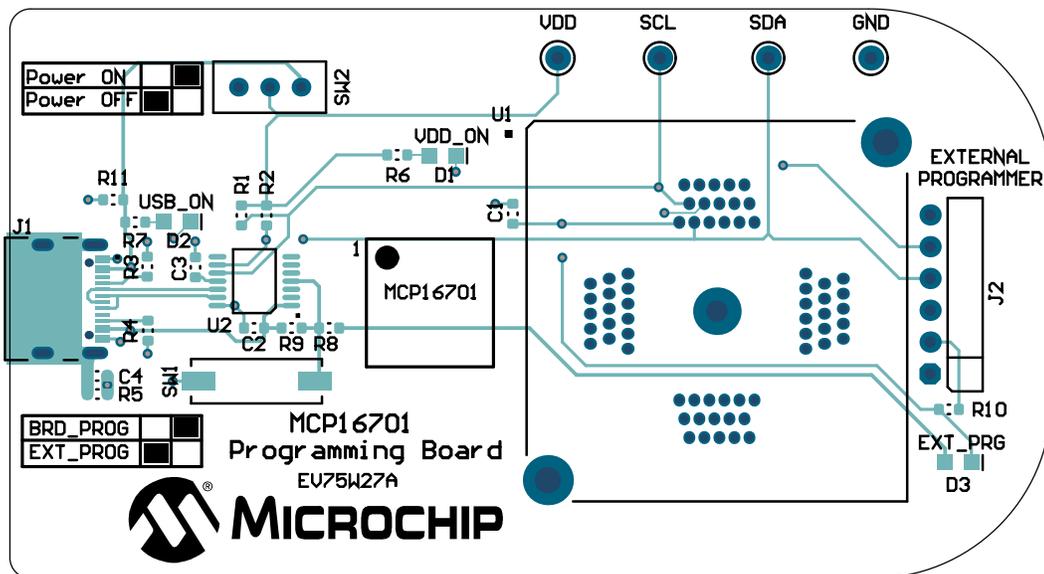**Figure 4-1.** Top Silk

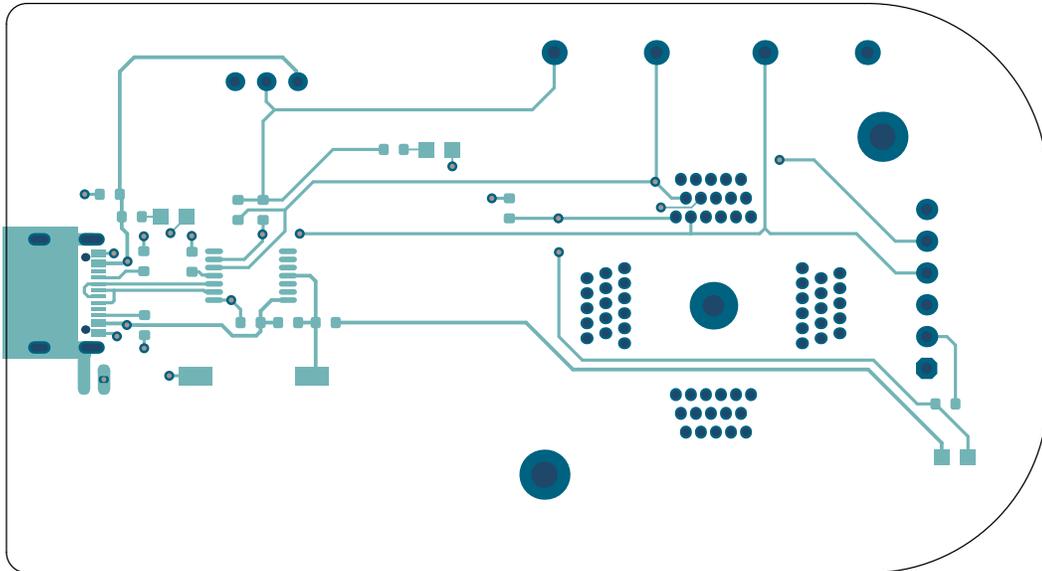**Figure 4-2.** Top Copper and Silk

Figure 4-3. Top Copper

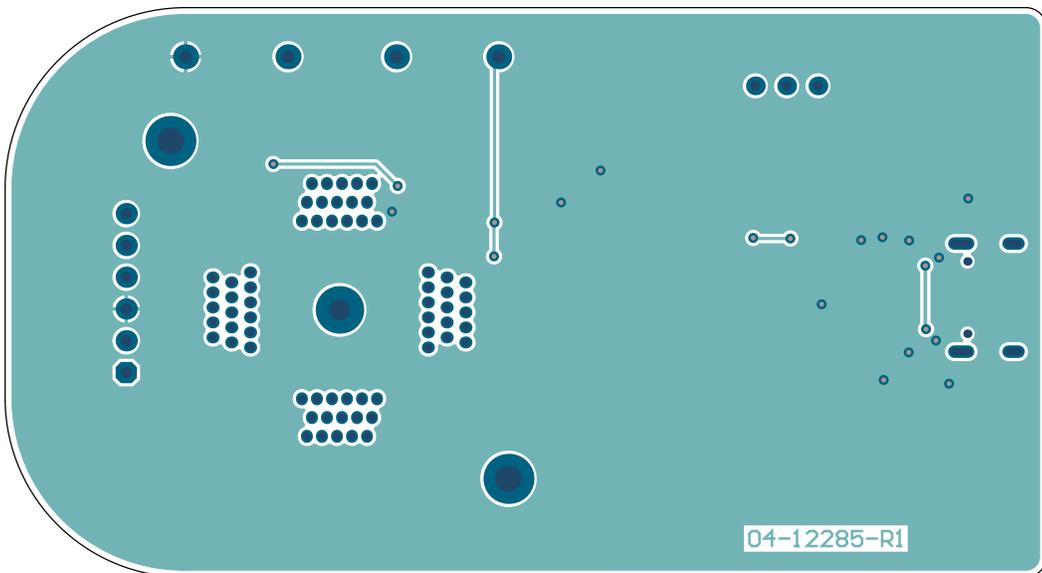**Figure 4-4.** Bottom Copper

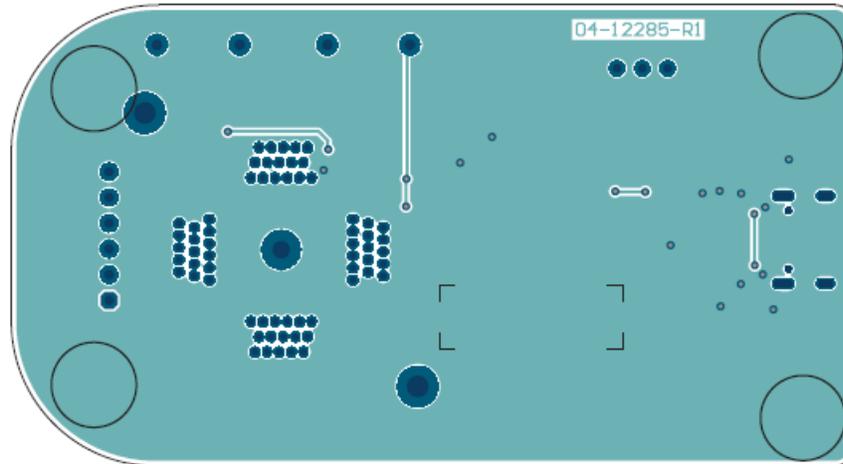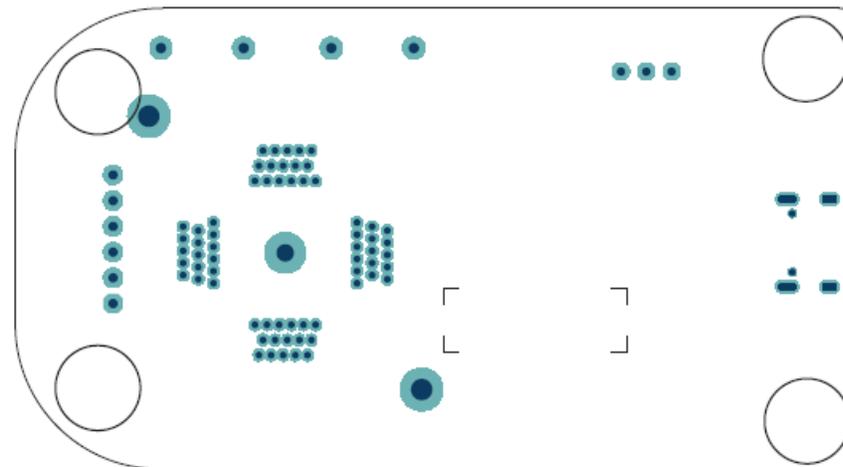**Figure 4-5.** Bottom Copper and Silk

Figure 4-6. Bottom Silk

5. Bill of Materials (BOM)

Table 5-1. Bill of Materials (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
1	C1	Capacitor, Ceramic, 1 µF, 25V, 10%, X7R, SMD, 0603	Yageo Corporation	CC0603KRX7R8BB105
1	C2	Capacitor, Ceramic, 0.1 µF, 16V, 10%, X7R, SMD, 0603	Wurth Elektronik	885012206046
1	C3	Capacitor, Ceramic, 0.47 µF, 6.3V, 10%, X5R, SMD, 0603	Murata Electronics®	GRM188R60J474KA01D
1	C4	Capacitor, Ceramic, 0.1 µF, 50V, 10%, X7R, SMD, 0603	TDK Corporation	C1608X7R1H104K080AA
1	D1	Diode, LED, Red, 2.2V, 20 mA, 40 mcd, Clear, SMD, 0805	Dialight Corporation	598-8110-107F
1	D2	Diode, LED, Green, 2V, 20 mA, 40 mcd, Clear, SMD, 0805	Wurth Elektronik	150080VS75000
1	D3	Diode, LED, Yellow, 2.1V, 30 mA, 10 mcd, Diffuse, SMD, 0805	Lumex® Inc.	SML-LXT0805YW-TR
1	J1	Connector, USB2.0 Type-C Female, SMD/TH R/A	GCT	USB4105-GF-A
1	J2	Connector, Header, 2.54 Male, 1x6 Gold 5.84MH TH R/A	FCI	68016-106HLF
2	R1, R2	Resistor, Thick Film, 2.2 kΩ, 1%, 1/10W, SMD, 0603	Panasonic	ERJ-3EKF2201V
2	R3, R4	Resistor, Thick Film, 5.1 kΩ, 1%, 1/10W, SMD, 0603	Panasonic®	ERJ-3EKF5101V
1	R5	Resistor, Thick Film, 330Ω, 1%, 1/10W, SMD, 0603	Panasonic®	ERJ-3EKF3300V
4	R6, R7, R8, R11	Resistor, Thick Film, 4.7 kΩ, 5%, 1/10W, SMD, 0603	Panasonic®	ERJ-3GEYJ472V
1	R9	Resistor, Thin Film, 10 kΩ, 1%, 1/8W, SMD, 0603	Stackpole Electronics, Inc.	RNCP0603FTD10K0
1	R10	Resistor, Thick Film, 10Ω, 1%, 1/10W, SMD, 0603, AEC-Q200	Panasonic®	ERJ-3EKF10R0V
2	TP1, TP2	Test Point, PC, Miniature, 0.040" D Yellow	Keystone® Electronics Corp.	5004
1	TP3	Test Point, Multi Purpose, Miniature, Black	Keystone® Electronics Corp.	5001
1	TP4	Test Point, Multi Purpose, Miniature, Red	Keystone® Electronics Corp.	5000
1	U1	Socket IC, QFN-64, P0.4 mm, Through Hole	WELLS-CTI	790-62064-101G
1	U2	Interface USB, I^2C, UART, TSSOP-14	Microchip Technology Inc.	MCP2221-I/ST
1	PCB1	Printed Circuit Board	Microchip Technology Inc.	04-12285-R1

Note: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

Table 5-2. Bill of Materials (BOM) – Mechanical Parts

Qty.	Reference	Description	Manufacturer	Part Number
1	LABEL1	Label, PCBA, 18×6 mm, Datamatrix, Assy#/Rev/Serial/Date	ACT Logimark AS	505462
4	PAD1, PAD2, PAD3, PAD4	Mechanical HW, Rubber PAD, Cylindrical, flat top, D8H2.8 Black	3M	SJ5076BLACK
Note: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.				

6.   Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Section	Description
A	06/2025		Initial Revision

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