User Guide

MP5416 Evaluation Kit (EVKT-5416)

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Overview

Introduction

The EVKT-5416 is an evaluation kit for the MP5416, a complete power management IC, which integrates four high-efficiency, step-down, DC/DC converters, five low dropout regulators, and flexible system configurations via I2C. The kit allows for quick evaluation of the PMIC and offers One-Time Programming (OTP) capabilities, which allows users to program custom configurations, supporting a wide range of designs.

Kit Contents

EVKT-5416 Kit contents: (Items below can be ordered separately)

#	Part Number	Item	Quantity
1	EV5416-R-00D	MP5416GR-CCCC Evaluation Board	1
2	EVKT-USBI2C-02	Includes one USB to I2C Dongle, one USB Cable, one ribbon cable	1
3	MP5416GR-CCCC	MP5416 IC which can be used for OTP programming	2
4	Tdrive-5416	USB Flash drive that stores the GUI installation file and supplemental documents	1

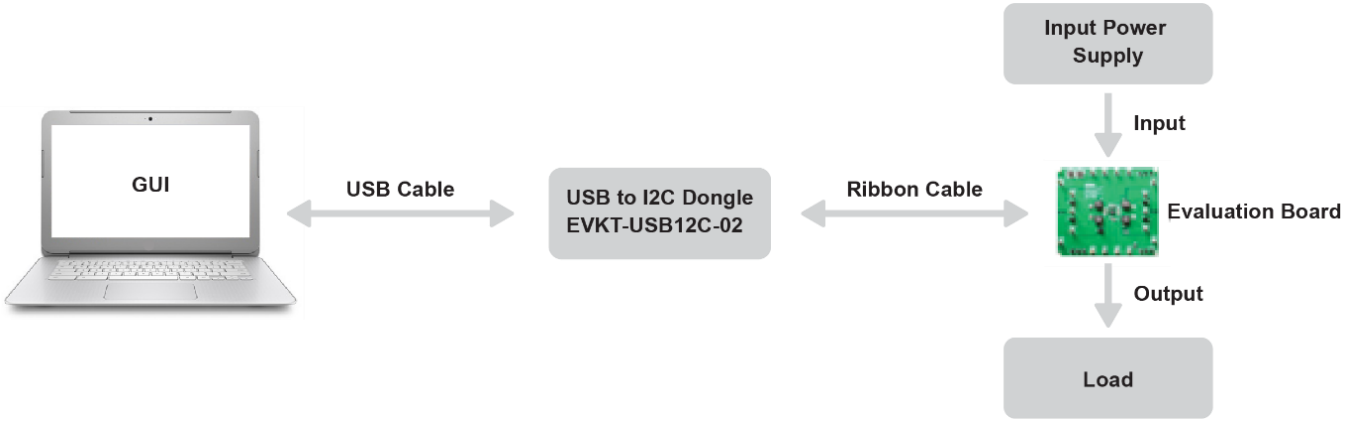


Figure 1: EVKT-5416 Evaluation Kit Set-Up

Features and Benefits

The MP5416 is highly customizable. Users can program the PMIC via the MPS I2C GUI and One-Time Programming (OTP).

⚠ All changes made in I2C mode will NOT be retained once the EVB is powered down.
⚠ Information written in OTP mode CANNOT be changed.

Features adjustable under each method are outlined below.

I2C	OTP
• Current limit of buck 2 and 4 • Slew rate (DVS Slew rate) • Discharge (DISCHG) • System enable (SYSEN) • Software reset (SFRST) • Read status and ID2 registers	• Current limit of buck 1 and 3 • Switching frequency • LDORTC Output voltage • Initial on/off • Push-button timer • Mode • Power-on delay (RSTO delay) • Automatic turn-on • I2C slave address • Soft start time • Manual reset timer • Phase shift delay • Shorter key on/off • Ramp cap • Suffix number • OTP version

Kit Specifications

Features	Specification
Supply for Board	3.5V - 5V
Operating Input Voltage	2.8V - 5.5V
Operating Systems Supported	Windows XP, 7 or later
System Requirements	Minimum 22.2 MB free
GUI Software	3 Register Controls: Buck, LDO, System
EVB Size (L x W)	9.4 cm x 8.6 cm

Section 1. Hardware Specifications

1.1 Personal Computer Requirements

The following must be minimally met to use the EVKT-5416.

- Operating system of Windows XP, 7, or later
- Net Framework 4.0
- PC with a minimum of one available USB port
- At least 22.2 MB of free space

1.2 EV5416-R-00D Specifications

The EV5416-R-00D is an evaluation board for the MP5416GR-CCCC. For more information, please refer to the EV5416-R-00D datasheet.

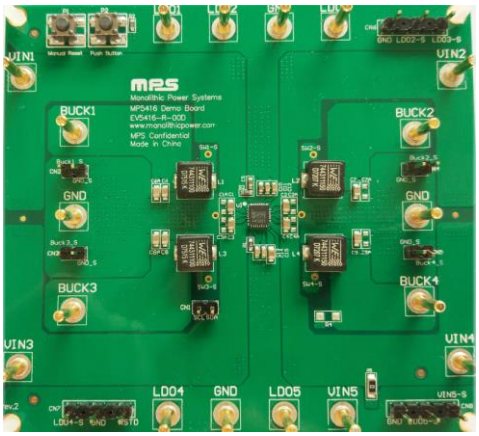


Figure 2: EV5416-R-00D Evaluation Board

Feature	Specification
Supply for Evaluation Board	3.5V - 5V
Operating Input Voltage	2.8V - 5.5V
EVB Size (L x W)	9.4cm x 8.6cm

1.3 EVKT-USBI2C-02 Specifications

The EVKT-USBI2C-02 refers to the dongle, which connects the EVB and the PC, and its supporting accessories. It provides I2C and PMBus capabilities. Together with MPS Virtual Bench Pro and GUI tools, it provides a quick and easy way to evaluate the performance of MPS digital products. For more details, refer to the EVKT-USBI2C-02 datasheet.

Figure 3: EVKT-USBI2C-02 Dongle

Section 2. Software Requirements

2.1 Software Installation Procedure

Programming occurs through the MPS I2C GUI. Follow the instructions below to install the software.

Note: In the near future, this software can be downloaded from the MPS website. For now, it is provided on a USB flash drive.

1. Plug the USB flash drive into the computer using any available USB port.
2. Browse to the folder containing the thumb drive contents.
3. Double click the .exe file to open the set-up guide (see Figure 4).
4. Follow the prompts in the set-up guide.
5. Wait for status screen to verify that installation is complete (see Figure 5).

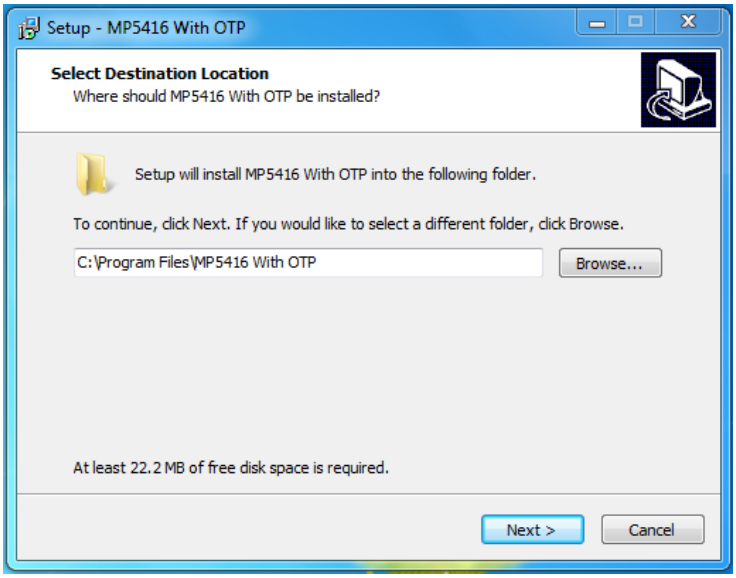


Figure 4: MPS I²C GUI Set-Up Guide

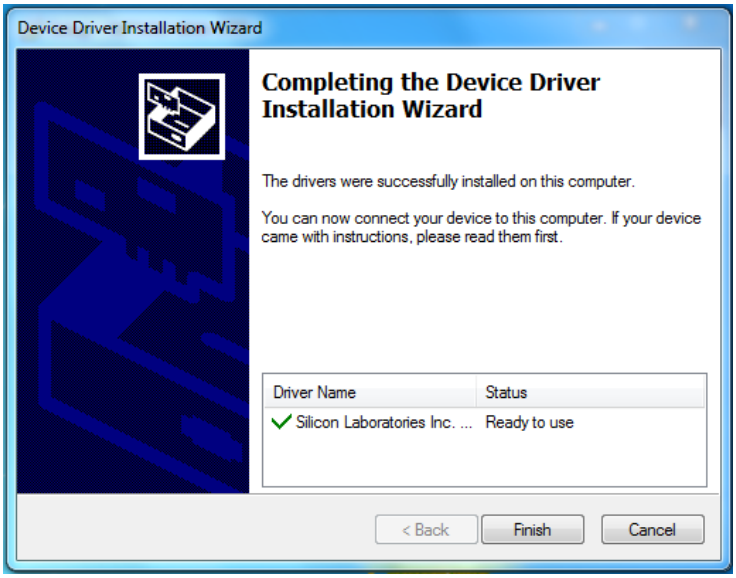


Figure 5: Driver Set-Up Success

Section 3. Evaluation Kit Test Set-up

3.1 Hardware Set-Up

The hardware must be properly configured prior to use. Follow the instructions below to set up the EVB.

1. Locate the proper wires to connect the EVB to the EVKT-USBI2C-02 dongle.
2. Connect SCL, SDA, and GND (see Figure 6). If needed, refer to the datasheet for further clarification.
3. Use the USB cable to connect the EVKT-USBI2C-02 dongle to the PC and follow the instructions below to set up the EVB.

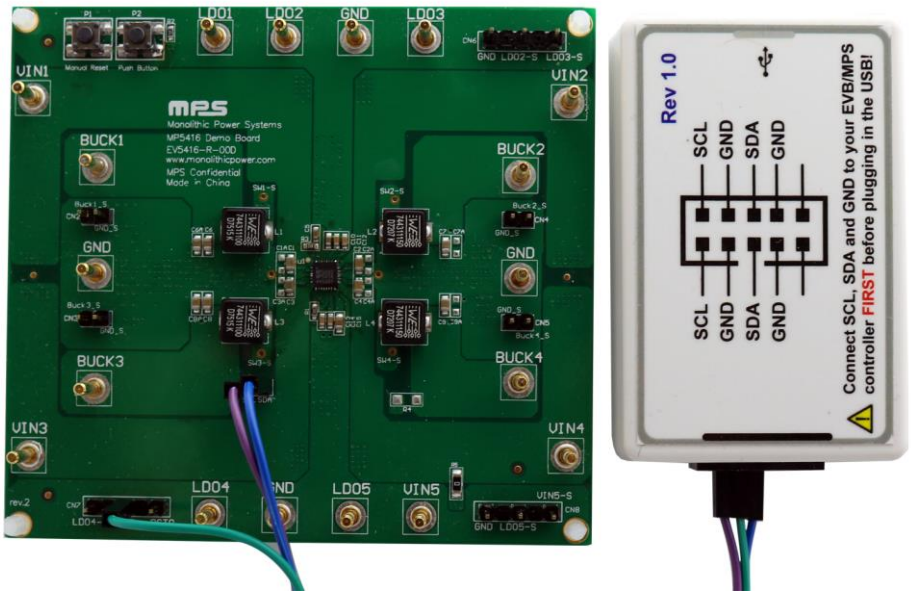


Figure 6: EVB to MPS I²C Dongle Wire Connection

3.2 Powering up the EVB

1. Connect the positive and negative terminals of the load to the VOUT and GND pins, respectively.
2. Preset the power supply output between 3.5V and 5V, then turn off the power supply.
3. Connect the positive and negative terminals of the power supply output to the VIN and GND pins, respectively.
4. Turn the power supply on.
5. Press the P1 button on the EVB. The PMIC will enter the power on sequence automatically.

3.3 Software Set-Up

After connecting the hardware according to steps above, follow the steps below to use the GUI software.

1. Start the software. It will automatically check the EVB connection.
   - If connection is successful, the address will be listed in the “Slave Address” (see Figure 7).

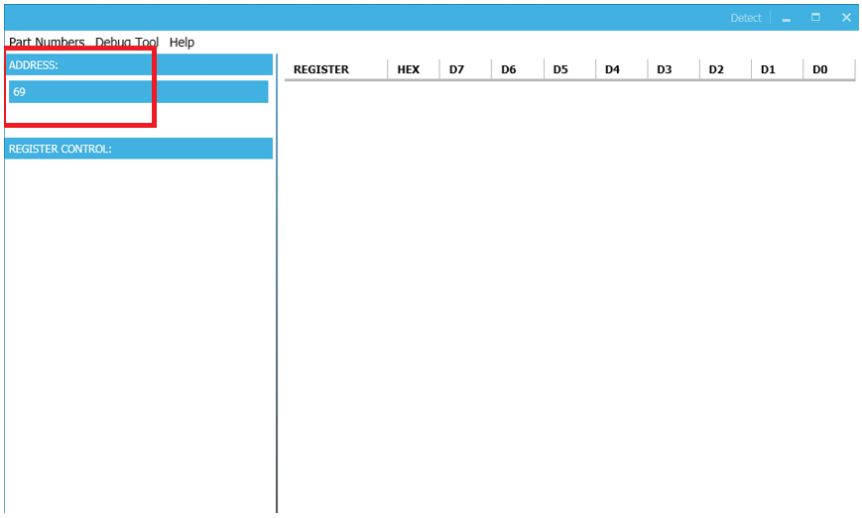


Figure 7: Appearance of Address Shows Successful Connection

- If not, one of two warnings will appear at the bottom:
  1) "No Slave Found. Please Check the Connection!" This means that the evaluation board is not connected (see Figure 8).
  2) "Device is not available. Please check the Connection!" This means that the USB I2C dongle is not connected (see Figure 9).

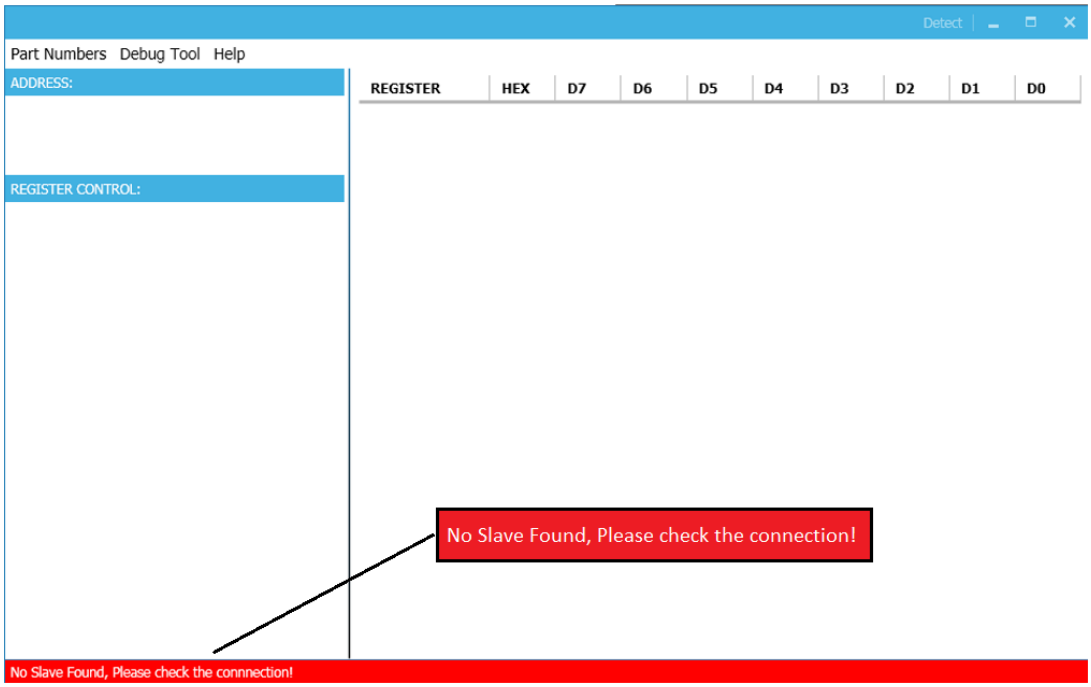


Figure 8: Warning Indicates Unsuccessful Connection – Evaluation Board Not Connected

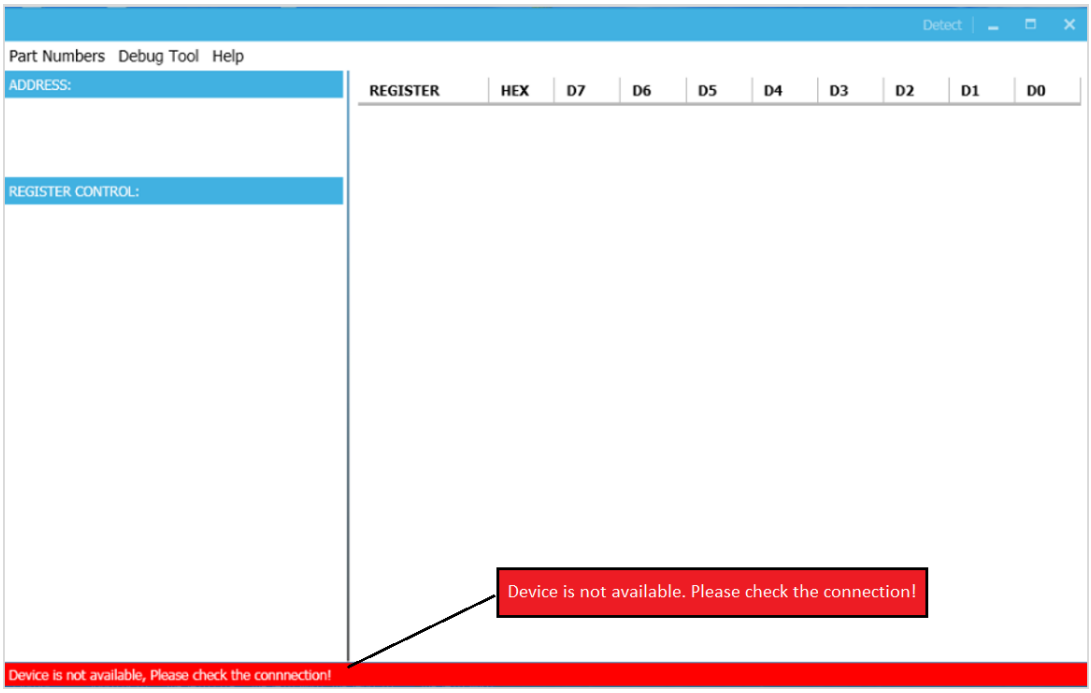


Figure 9: Warning Indicates Unsuccessful Connection – USBI2C Dongle is Not Connected

2. If connection is successful, proceed to Step 3. Otherwise, check connections between the EVB, dongle, and PC. Re-plug the USB into the computer and restart the GUI.
3. Select MP5416 UNLOCK from under Part Numbers. The Register Control menu will appear on the left side. I2C register values will be read automatically and displayed on the right (see Figure 10).

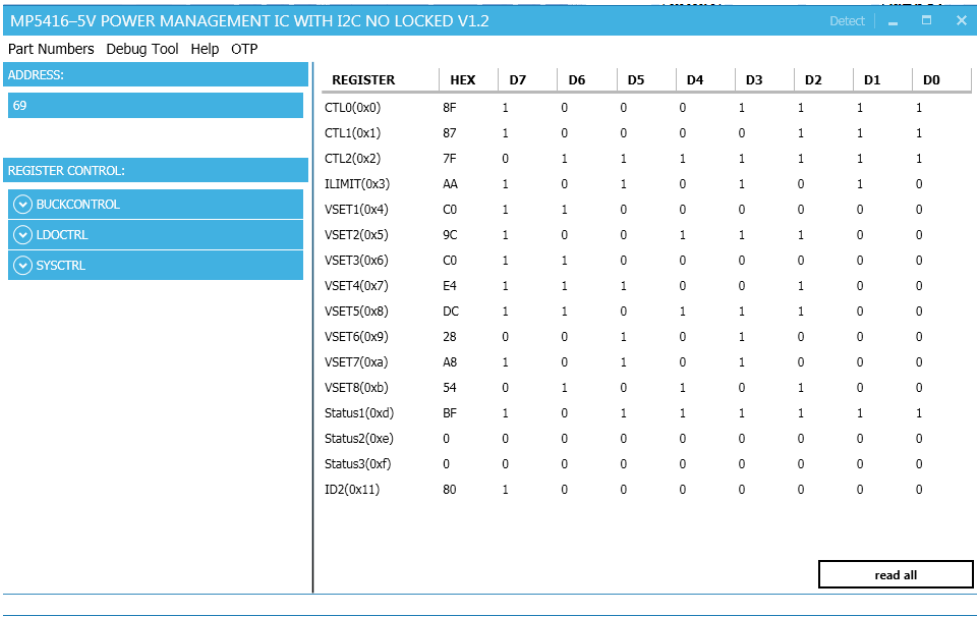


Figure 10: Values from I2C Shown in Table

4. Find the item you want to change and select the desired value from the drop down menu.
5. Click the “Read All” button to update values. The changed information of the item will appear on the right side (see Figure 11).

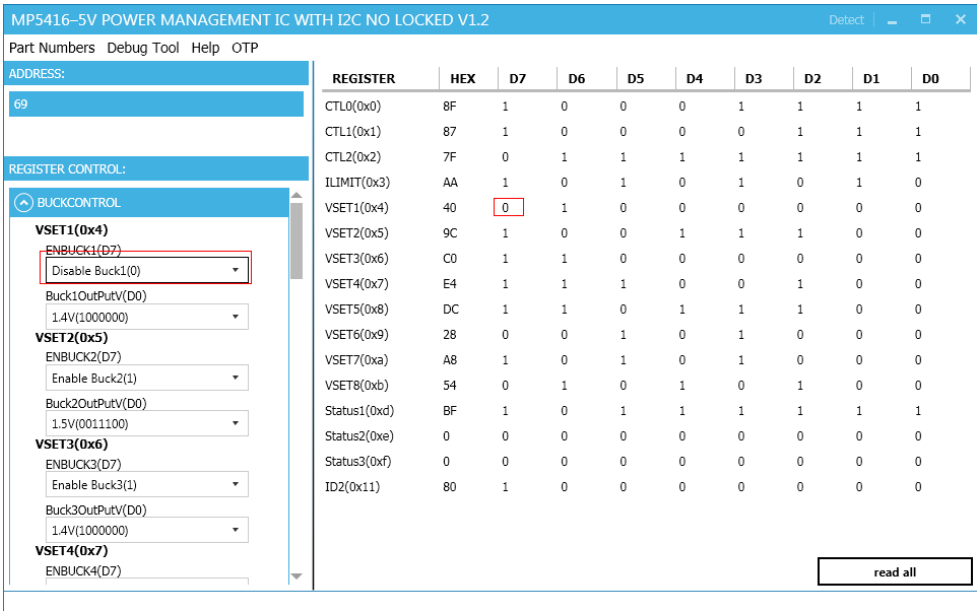


Figure 11: Refer to Datasheet to Translate 0's and 1's

⚠ All changes made via I2C will be restored to default values once the EVB is powered down.

3.4 Device Programming Instructions

The MP5416-CCCC can be custom programmed. Follow the instructions outlined below to create and export customized configurations.

1. Using a computer, open the MPS GUI software. Make sure you have powered on the EVB.
2. Ensure connection between the EVB and computer (see Figure 6).
3. Select the "MP5416Unlocked" from under Part Numbers.
4. Disable buck1/buck2/buck3/buck4 and LDO2-LDO5.
5. Select the OTP option from under GUI (see Figure 12).

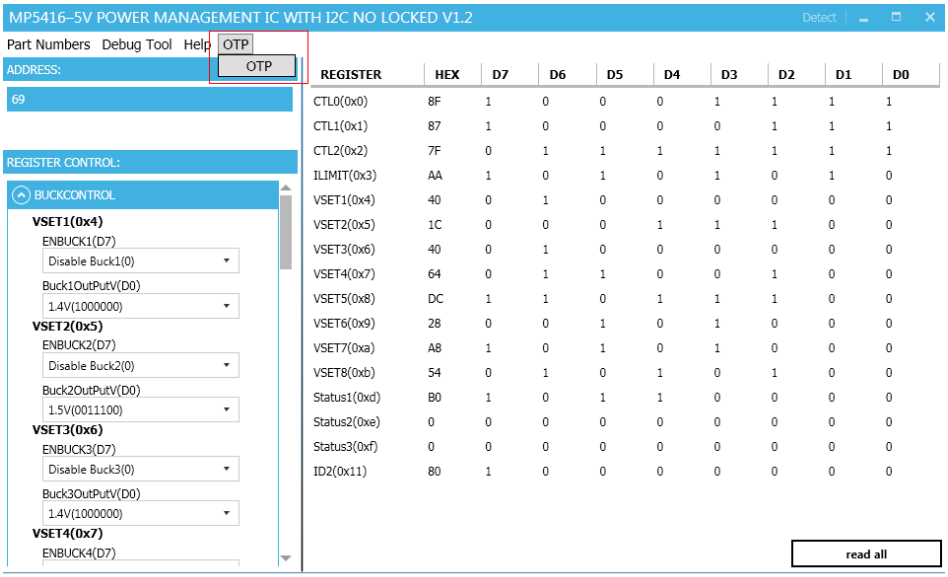


Figure 12: Select OTP, Located in Task Bar

6. Wait for a table to load (see Figure 13). You can change any parameters listed.

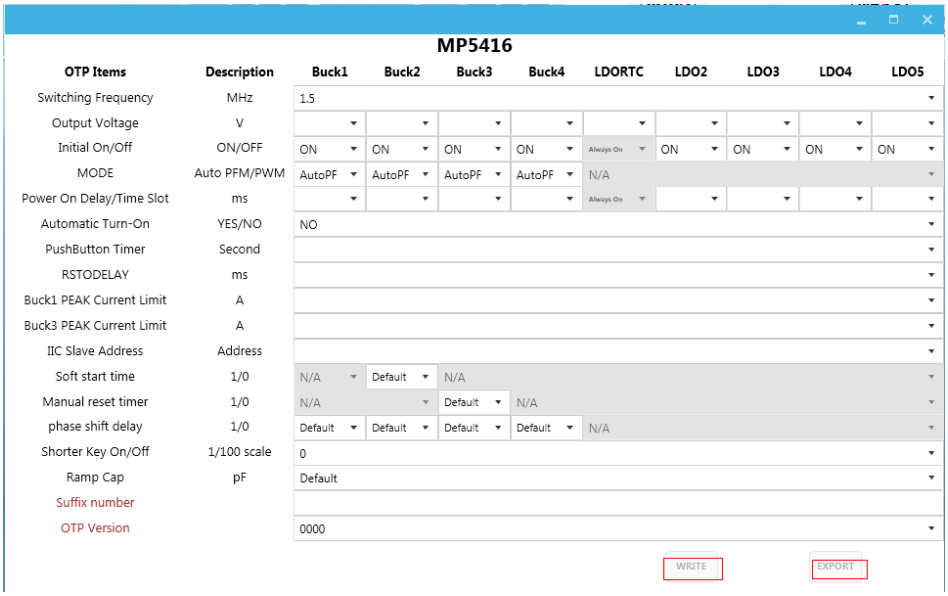


Figure 13: Parameters that can be Adjusted in OTP Mode

7. Select values from the drop-down menus. Note that the WRITE and EXPORT buttons are active only when all the parameters are populated (see Figure 14).

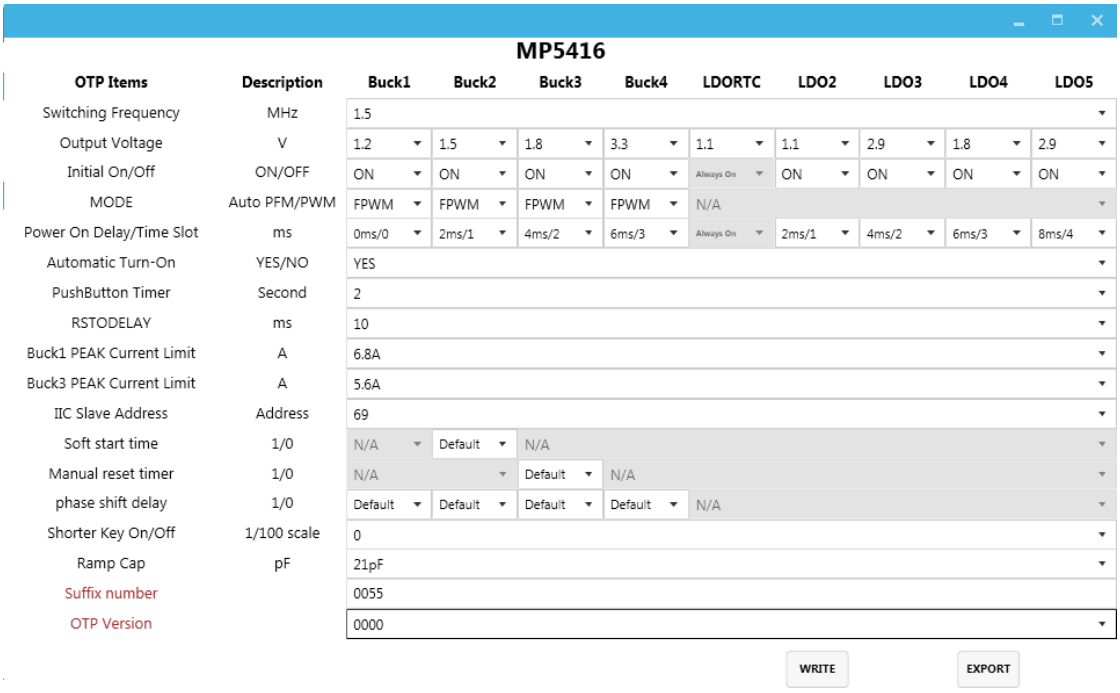


Figure 14: Fully Populated Table and Active "Write" and "Export" Buttons

8. Export the configuration by clicking EXPORT. Find a location for the exported file and click "OK". Your configurations will be saved in a text file (see Figure 15).

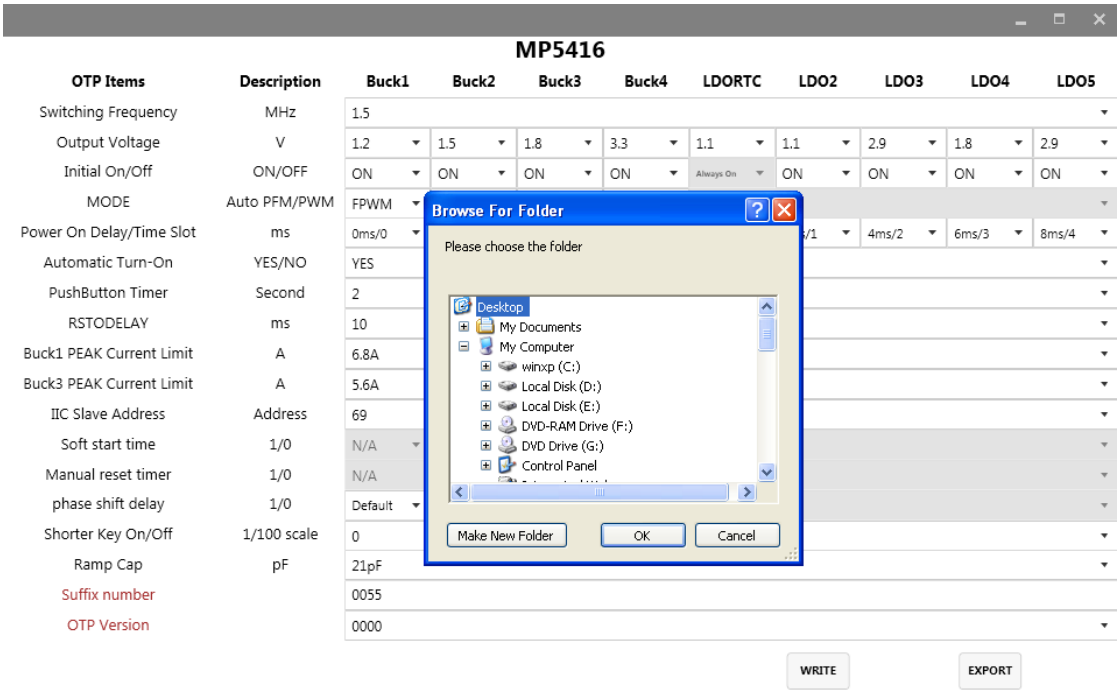


Figure 15: Various Locations Available to Export To

9. Wait for a status screen (see Figure 16).

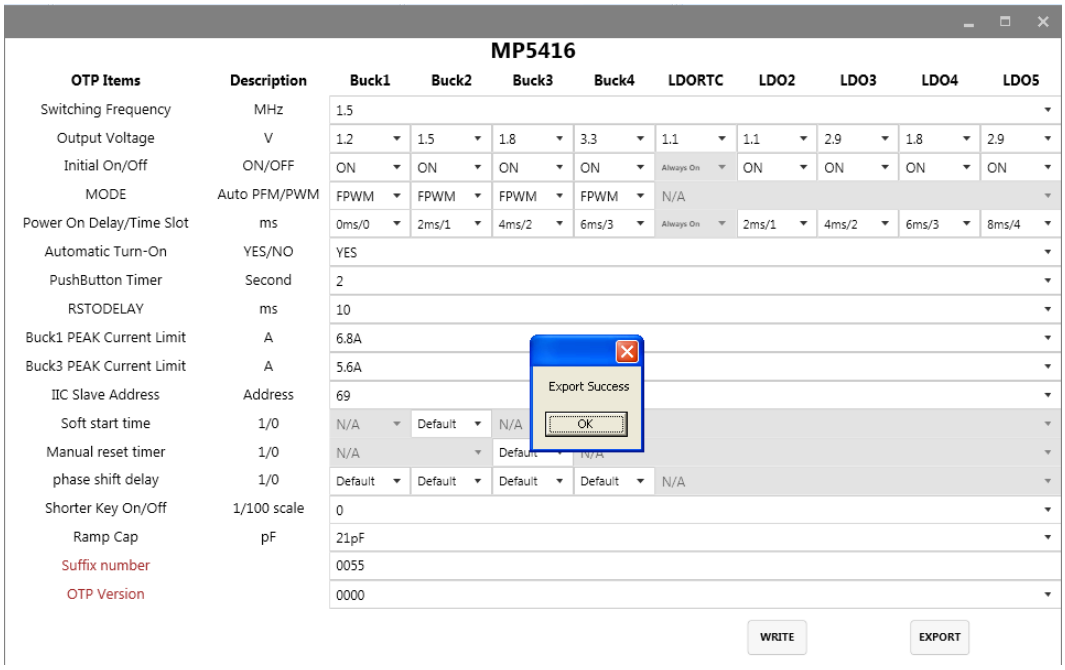


Figure 16: Status Screen Indicates Success

10. Rename the file if you would like to refer to it at a later time. Otherwise, this file will be overwritten the next time you perform OTP and export to the same location.
11. Check parameters carefully.

⚠ Once the information is written to the MP5416-CCCC, it cannot be changed.

12. Click the WRITE button. A window should pop up (see Figure 17).

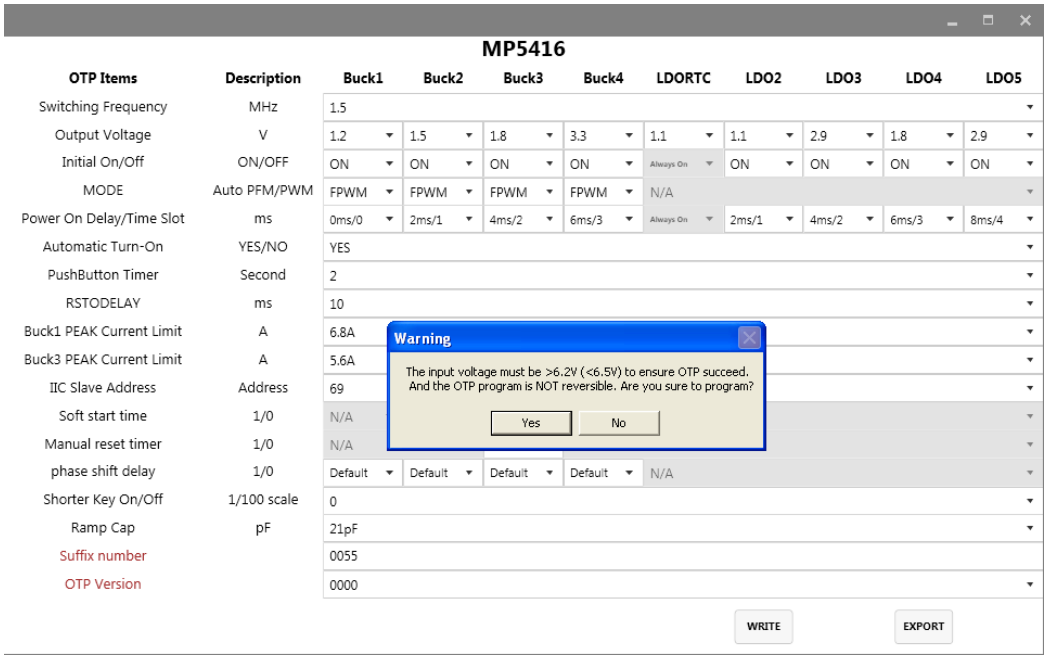


Figure 17: Important Warning – User Must Increase Voltage

13. Increase the input voltage to a value between 6.2V and 6.5V.
14. Click “Yes” to write. Alternatively, click “No” if adjustments are needed.
15. Wait for a status screen (see Figure 18).

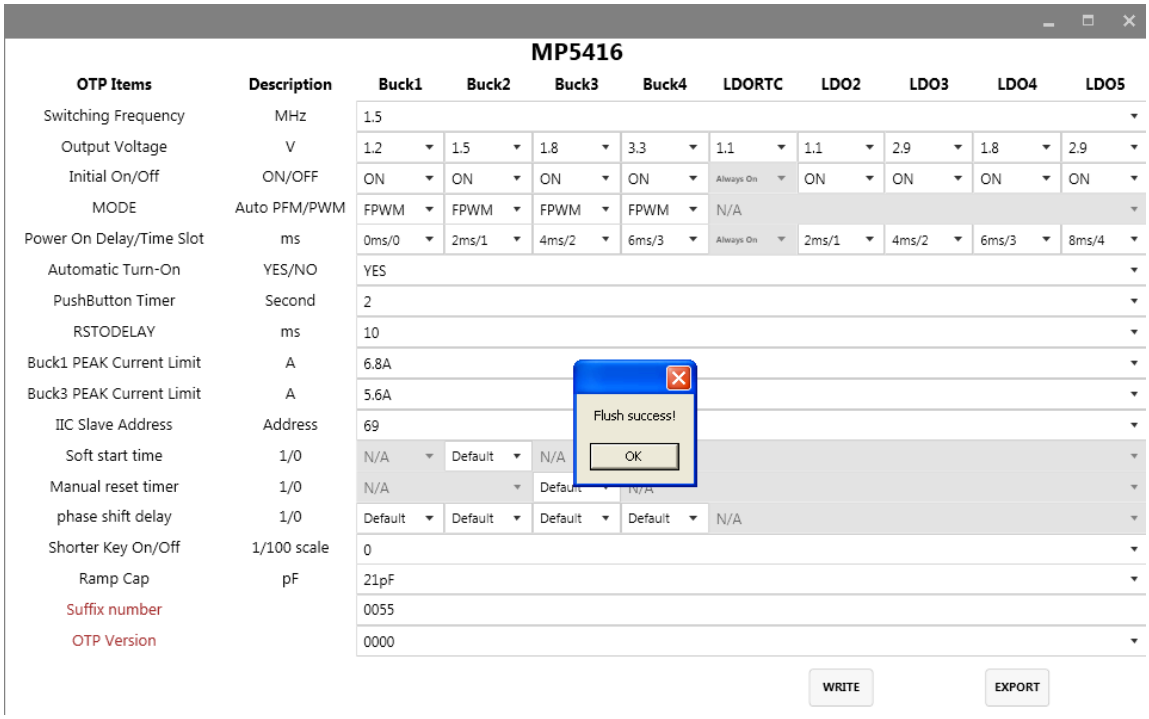


Figure 18: Screen Indicates that Configurations have been Written to MP5416-CCCC

16. Click OK and turn off power.

The remaining steps are optional and instruct how to check that new configurations have been programmed.

Optional:

17. Adjust the input voltage to 3.5 - 5V.
18. Repeat steps 1-3 from this section.
19. If done correctly, new configurations will be shown in the table on the left hand side.

Notes:

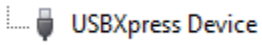
- Unlike in I2C, not all of the configurations you set in OTP mode will be displayed until you write to MP5416-CCCC and power cycle.
- After OTP, you:
  - Are still able to change values using I2C.
  - Do not need to press P1 while powering on the board.
- If you try to perform OTP on a previously programmed device, the GUI software will allow you to proceed normally. However, your configurations will NOT be saved.

3.5 Troubleshooting Tips

- **EVKT-USBI2C-02 Driver Problem**

In case that the USBI2C-02 driver is not properly installed, manual installation is required. Follow the steps below.

1. Install the correct ".exe" file according to the windows operation system.
   32-bit: \EVKT-USBI2C-02 USB Driver\USBXpressInstaller_x86.exe.
   64-bit: \EVKT-USBI2C-02 USB Driver\USBXpressInstaller_x64.exe.
2. Connect the Dongle to the PC with a USB cable.
3. Find "USBXpress Device" in the Device Manager.



If the PC is running Windows 10, check the driver version of USBXpress Device. Windows 10 will automatically install the older USB driver, which is not compatible. The correct driver version is 4.0.0.0 (see Figure 19).

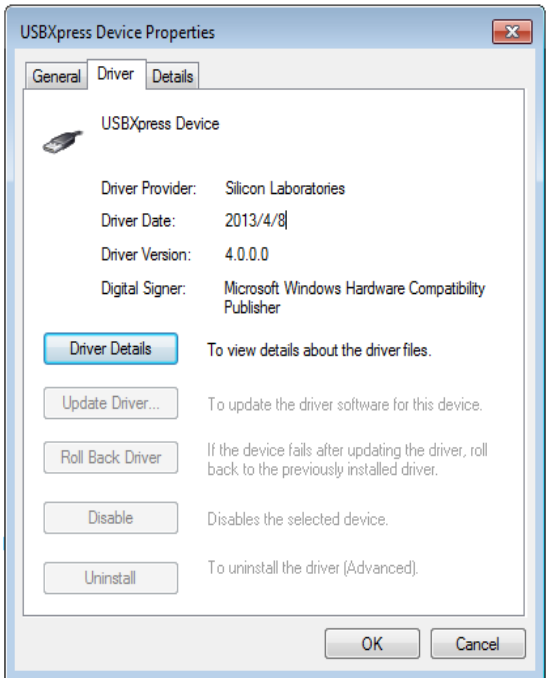


Figure 19: Correct Driver Version is 4.0.0.0

- **No Supply**

The PMIC's input pin has an under-voltage lockout (UVLO) detection circuit. If the input voltage (AVIN) is lower than the UVLO rising threshold, the PMIC's functions are disabled.

- **Shutdown Event**

If the PMIC detects that the input voltage is lower than the UVLO falling threshold (enter no supply state) or over-temperature protection is triggered (enter power off state), the PMIC switches to no supply state or power-off state, regardless of the current state.

- **Thermal Recovery**

If the MP5416 is in a power-off state due to the die temperature exceeding the thermal protection threshold, the PMIC enters a power-on sequence when the die's temperature decreases.

- **Shutdown Sequence**

When the input voltage is lower than the UVLO falling threshold or the IC is over-temperature, the PMIC enters the shutdown sequence directly.

Section 4. Ordering Information

The components of the evaluation kit can be purchased separately depending on user needs.

Part Number	Description
EVKT-5416	Complete evaluation kit
Contents of EVKT-5416	
EV5416-R-00D	MP5416GR-CCCC Evaluation Board allowing users to perform OTP
EVKT-USBI2C-02	Includes one USB to I2C Dongle, one USB Cable, one ribbon cable
MP5416GR-CCCC	2 additional MP5416 ICs which can be used for OTP programming
Tdrive-5416	USB Flash drive that stores the GUI installation file and supplemental documents

Order directly from MonolithicPower.com or our distributors.

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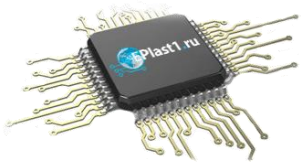

Как с нами связаться

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