

MP8867 Evaluation Kit (EVKT-8867)



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## **Overview**

## Introduction

The EVKT-8867 is an evaluation kit for the MP8867. The MP8867 is a high-frequency, synchronous, rectified, step-down, switch-mode converter with an I<sup>2</sup>C control interface. The MP8867 achieves 8A of output current with excellent load and line regulation over a wide input supply range. This kit allows for quick evaluation of the MP8867. By using the I<sup>2</sup>C, users can set the output voltage, slew rate, switching frequency, and work mode.

### Kit Contents

EVKT-88647 kit contents (items below can be ordered separately):

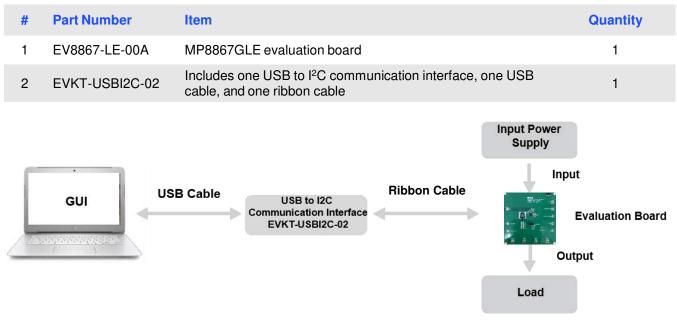


Figure 1: EVKT-8867 Evaluation Kit Set-Up



### **Features and Benefits**

The MP8867 is highly customizable. Users can program the MP8867 via the MPS I<sup>2</sup>C GUI.

 $\triangle$  All changes made in I<sup>2</sup>C mode will NOT be retained once the EVB is powered down.

Adjustable features:

#### I<sup>2</sup>C

- Adjustable output voltage
- Selectable slew rate
- Selectable switching frequency
- Selectable PFM mode
- System enable (EN bit)
- Status indication: OC, OTEW, OT, PG

#### **Kit Specifications**

| Features                    | Specification                      |
|-----------------------------|------------------------------------|
| Supply for Board            | 4.5V to 17V                        |
| Operating Input Voltage     | 4.5V to 17V                        |
| Output Voltage (Vout)       | 1V                                 |
| Output Current (Iout)       | 8A                                 |
| Operating Systems Supported | Windows XP, 7, or later            |
| System Requirements         | Minimum 22.2MB free                |
| GUI Software                | 2 register controls: VSEL, System1 |
| EVB Size (LxW)              | 8.5cmx8.5cm                        |



## **Section 1. Hardware Specifications**

### **1.1 Personal Computer Requirements**

The following must be met to use the EVKT-8867:

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

### 1.2 EV8867-LE-00A Specifications

The EV8867-LE-00A is an evaluation board for the MP8867GLE. For more information, refer to the EV8867-LE-00A datasheet.



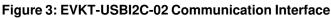
| Feature                            | Specification |
|------------------------------------|---------------|
| Supply for Board                   | 4.5V to 17V   |
| Operating Input Voltage            | 4.5V to 17V   |
| Output Voltage (Vour)              | 1V            |
| Output Current (I <sub>OUT</sub> ) | 8A            |
| EVB Size (LxW)                     | 8.5cmx8.5cm   |

Figure 2: EV8867-LE-00A Evaluation Board

### 1.3 EVKT-USBI2C-02 Specifications

The EVKT-USBI2C-02 communication interface connects the EVB, the PC, and its supporting accessories. It provides I<sup>2</sup>C and PMBus capabilities. Together with the 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.







## **Section 2. Software Requirements**

#### 2.1 Software Installation Procedure

Programming occurs through the MPS I<sup>2</sup>C GUI. Follow the instructions below to download and install the software:

Note: This software can be downloaded directly from the MPS website.

- 1. Visit the MP88xx I<sup>2</sup>C GUI page at https://www.monolithicpower.com/en/i2c-tool.html.
- 2. Click the "Download" button in the upper right-hand corner.
- 3. Once the download has completed, double-click the .exe file to open the set-up guide (see Figure 4). If a protection window comes up, click "More info," then click "Run anyway."
- 4. Follow the prompts in the set-up guide.
- 5. Wait for the status screen to verify that installation is complete (see Figure 5).

| 15 Setup - MPS IIC Interface   | - • •     |
|--|-----------|
| Select Destination Location<br>Where should MPS IIC Interface be installed?    |           |
| Setup will install MPS IIC Interface into the following folder.                |           |
| To continue, click Next. If you would like to select a different folder, click | k Browse. |
| C:\Program Files (x86)\MPS IIC Interface                                       | Browse    |
| At least 13.1 MB of free disk space is required.                               |           |
| Next >   | Cancel    |

Figure 4: MPS I<sup>2</sup>C GUI Set-Up Guide



## Figure 5: MPS I<sup>2</sup>C GUI Set-Up Success

# Section 3. Evaluation Kit Test Set-Up

### 3.1 Hardware Set-Up

The hardware must be configured properly prior to use. Use the USB cable to connect the EVKT-USBI2C-02 communication interface to the PC, and follow the instructions below to set up the EVB:

- 1. Locate the proper wires to connect the EVB to the EVKT-USBI2C-02 communication interface.
- 2. Connect SCL, SDA, and GND (see Figure 6). If needed, refer to the datasheet for further clarification.

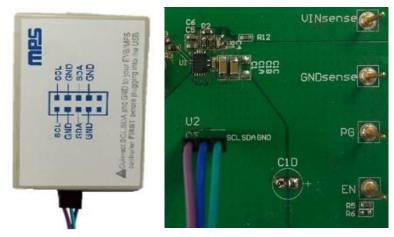


Figure 6: EVB to MPS I<sup>2</sup>C Communication Interface Wire Connection

### 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 4.5V to 17V, 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. The MP8867 will enter the power-on sequence automatically.

### 3.3 Software Set-Up

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

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



| ile             | PartSelect | Help                |              |                |      |       |      |          |        |       |        |    |
|-----------------|------------|---------------------|--------------|----------------|------|-------|------|----------|--------|-------|--------|----|
| yste            | MP8843     |                     |              |                |      |       |      |          |        |       |        |    |
|                 | MP8845     |                     |              |                | -    |       |      | ®        |        |       |        |    |
| -               | MP8869     | 11)                 |              |                | -    |       | -    |          |        |       |        |    |
|                 | MP8861     | - 2-                |              | Monolithic     | Powe | r Svs | tems | M        | P88    | 61 II | CG     | UI |
|                 | MP8869     | W (00)              | •            |                |      |       |      |          |        |       |        |    |
|                 | MP8869     | S ed Soft Stop      | •            | SlaveAddr      | 62   |       |      |          | Scan   |       | VAL    | 0  |
| 2               | MP8868     | ey 8.4A             |              | SlaveAuui.     | 02   |       | ~    |          |        |       |        | -  |
|                 | MP8867     | Anita a             |              | ReadBox        |      |       |      |          |        |       |        |    |
|                 | MP8865     |                     |              | System Control |      |       |      |          |        |       |        |    |
| 1               | MP8864     |                     |              | regName        | D7   | D6    | D5   | D4       | D3     | D2    | D1     | D0 |
| 0               | MP8846     | e                   |              | VSEL           |      | NA    | NA   | NA<br>NA | NA     | NA    | NA     | NA |
| MP8847<br>Write |            |                     | SysCntlreg1  | NA             | NA   | NA    | NA   | NA       | NA     | NA    | NA     |    |
|                 |            | vvnite              |              | SysCntlreg2    | NA   | NA    | NA   | NA       | NA     | NA    | NA     | NA |
| s               | ysCntireg1 |                     |              | Output Current | NA   | NA    | NA   | NA       | NA     | NA    | NA     | NA |
| E               | nable      | Enabled             | 8 <b>4</b> 1 | Output Voltage | NA   | NA    | NA   | NA       | NA     | NA    | NA     | NA |
| c               | io_Bit     | Go Bit = 0          | -            | ID1            | NA   | NA    | NA   | NA       | NA     | NA    | NA     | NA |
|                 | lew Rate   |                     |              | Status         | NA   | NA    | NA   | NA       | NA     | NA    | NA     | NA |
|                 | New Rate   | 5mV/us (100)        | •            |                |      |       | 1    |          | Lances |       |        |    |
| C               | VP Mode    | Auto Recovery Mode( | 1 🗸          |                |      |       |      | Read     | 1      | E     | dit Re | qs |
| 0               | CP Mode    | Hiccup Mode (1)     |              |                |      |       |      |          |        |       |        | 4  |
| 2.              | lode       | Auto PFM/PWM Mode   | ( -          |                |      |       |      |          |        |       |        |    |
|                 |            |                     |              |                |      |       |      |          |        |       |        |    |
|                 |            | Write               |              |                |      |       |      |          |        |       |        |    |
|                 |            |                     |              |                |      |       |      |          |        |       |        | -  |

Figure 7: Appearance of Address Indicates Successful Connection

- If not, a warning will appear at the bottom. There are two warnings users can expect (see Figure 8). Each warning means there is an invalid connection.
  - 1) "EVB is Disconnected" means that the evaluation board is not connected.
  - 2) "Communication Board is Disconnected" means that the USB I<sup>2</sup>C communication interface is not connected.

|          | System Control<br>VSEL<br>V_BOOT<br>Output | I2C Control Loop Mode 👻<br>0.60 V 👻 | Monolithic F        | owe      | ) <b>(</b><br>r Sys | <b>B</b><br>tems | M        | P <mark>88</mark> | 6 <mark>7   </mark> | C G      | UI |                     |
|----------|--|-------------------------------------|---------------------|----------|---------------------|------------------|----------|-------------------|---------------------|----------|----|---------------------|
|          |  | Write                               | SlaveAddr:          | 00       |                     |                  |          | Scan              |                     | INVAL    |    | Invalid Slave Addre |
|          | SysCntireg1                                |                                     |                     |          |                     |                  |          |                   |                     |          |    |                     |
|          | Enable                                     | Enabled -                           | ReadBox             |          |                     |                  |          |                   |                     |          |    |                     |
|          | Go_Bit                                     | Go_Bit = 0                          | System Control      |          | 2012                | 1.2.2.1          | 1.2.2    | 101               |                     | 22       |    |                     |
|          | Slew Rate                                  | 4mV/us (100) 🗸                      | regName             | D7       | D6                  | D5               | D4<br>NA | D3                | D2                  | D1<br>NA | DO |                     |
|          | Switch                                     | 500kHz -                            | VSEL<br>SysCntlreg1 | NA<br>NA | NA<br>NA            | NA<br>NA         | NA       | NA                | NA                  | NA       | NA |                     |
|          | Mode                                       |                                     | ID1                 | NA       | NA                  | NA               | NA       | NA                | NA                  | NA       | NA |                     |
|          | Mode                                       |                                     | Status              | NA       | NA                  | NA               | NA       | NA                | NA                  |          | NA |                     |
|          |  | Write                               |                     |          |                     |                  | Rea      | 3                 | E                   | dit Reg  | 15 |                     |
|          |  |                                     |                     |          |                     |                  |          |                   | 372                 |          | *  |                     |
|          |  |                                     |                     |          |                     |                  |          |                   |                     |          |    |                     |
|          |  |                                     |                     |          |                     |                  |          |                   |                     |          |    |                     |
|          |  |                                     |                     |          |                     |                  |          |                   |                     |          | +  |                     |
| nication |  |                                     |                     |          | _                   | _                | _        | _                 |                     |          |    |                     |





- 2. If the connection is successful, proceed to Step 3. Otherwise, check connections between the EVB, communication interface, and PC. Re-plug the USB into the computer and restart the GUI.
- Click the "Part Select" button to select the MP8867 (see Figure 7). The default GUI window is for the MP8861. The Register Control menu will appear on the left side. I<sup>2</sup>C register values will be read and displayed on the right side after clicking the "Read" button (see Figure 9).

| le PartSelect                             | Help                           |                           |    |       |      |      |     |       |        |    |
|---|--------------------------------|---------------------------|----|-------|------|------|-----|-------|--------|----|
| vstem Control<br>VSEL<br>V_BOOT<br>Output | FB Control Loop Mode<br>0.60 V | Monolithic                |    | r Sys | tems |      | P88 | 67 II | C G    | -2 |
| SysCntireg1<br>Enable                     | Enabled -                      | ReadBox<br>System Control |    |       |      |      |     |       |        |    |
| Go_Bit                                    | Go_Bit = 0                     | regName                   | D7 | D6    | D5   | D4   | D3  | D2    | D1     | D0 |
| Slew Rate                                 | 4mV/us (100) -                 | VSEL                      | 1  | 0     | 0    | 0    | 0   | 0     | 0      | 0  |
| Switch                                    | 500kHz -                       | SysCntlreg1               | 1  | 0     | 1    | 0    | 0   | 0     | 0      | 1  |
| Mode                                      | PWM Mode -                     | ID1                       | 1  | 0     | 0    | 0    | 0   | 0     | 1      | 1  |
|   | Write                          | Status                    | 0  | 0     | 0    | 0    | 0   | 0     | 0      | 1  |
|   | Wille                          |                           |    |       |      | Read | ł   | E     | dit Re | gs |
|   |                                |                           |    |       |      |      |     |       |        |    |

Figure 9: Values from I<sup>2</sup>C 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 10).

| ile PartSelect           | Help                           |   |                  |       |       |                  |      |          |       |        |    |
|--------------------------|--------------------------------|---|------------------|-------|-------|------------------|------|----------|-------|--------|----|
| System Control           |                                |   | _                |       |       |                  |      |          |       |        |    |
| VSEL<br>V_BOOT<br>Output | FB Control Loop Mode<br>0.60 V | • | Monolithic       | Powe  | r Sys | <b>D</b><br>tems | M    | P88      | 67 II | C G    | UI |
|                          | Write                          |   | SlaveAddr        | 62    |       |                  | -    | Scan     |       | VALI   | D  |
| SysCntireg1              |                                |   |                  | SV 10 |       |                  |      |          |       |        |    |
| Enable                   | Disabled                       | - | ReadBox          | r.    |       |                  |      |          |       |        |    |
| Go_Bit                   | Go_Bit = 0                     | - | System Control   |       |       |                  |      |          | 1     |        |    |
| Slew Rate                |                                |   | regName          | D7    | D6    | D5               | D4   | D3       | D2    | D1     | DO |
| Siew Rate                | 4mV/us (100)                   | • | VSEL             | 1     | 0     | 0                | 0    | 0        | 0     | 0      | 0  |
| Switch                   | 500kHz                         | • | SysCntlreg1      | 0     | 0     | 1                | 0    | 0        | 0     | 0      | 1  |
| Mode                     | PWM Mode                       | - | ID1              | 1     | 0     | 0                | 0    | 0        | 0     | 1      | 1  |
|                          | Write                          |   | Status           | 0     | 0     | 0                | 0    | 0        | 0     | 0      | 0  |
|                          |                                |   | -                |       |       |                  | Read | <b>H</b> | E     | dit Re | gs |
|                          |                                |   | The Part is Disa | bled  |       |                  |      | 8        |       |        |    |
|                          |                                |   |                  |       |       |                  |      |          |       |        |    |
|                          |                                |   |                  |       |       |                  |      |          |       |        |    |
|                          |                                |   |                  |       |       |                  |      |          |       |        |    |

### Figure 10: Refer to Datasheet to Translate 0s and 1s

 $\triangle$  All changes made via the  $l^2C$  will be restored to default values once the EVB is powered down.



### 3.4 Troubleshooting Tips

Note: USBI2C-02 and USBI2C-01 drivers are not compatible. USBI2C-02 uses USBXpress and USBI2C-01 uses Cyusb3. USBI2C-02 is the recommended device for MPS PMBus and I<sup>2</sup>C.

### EVKT-USBI2C-01

If the USBI2C-01 driver is not properly installed, manual installation is required. Follow the steps below:

- 1. Open the Device Manager and select "Update Driver Software" (see Figure 11).
- 2. Click "Browse My Computer for Driver Software," find the downloaded driver, and install.

### EVKT-USBI2C-02

If the USBI2C-02 driver is not properly installed, manual installation is required. Follow the steps below:

Note: Check the driver version. Find "USBXpress Device" in the Device Manager under USB controllers.

🛄 🖥 USBXpress Device

Right-click and view properties. Check to make sure the driver version matches the newest version (see Figure 12).

1. Install the correct USBXpress ".exe" file.

Choose either the 32-bit or 64-bit operating system:

32-bit: USBXpressInstaller\_x86.exe

64-bit: USBXpressInstaller\_x64.exe

2. Connect the EVKT-USBI2C-02 communication interface to the PC with the USB cable.

### No Supply

The MP8867's input pin has an under-voltage lockout (UVLO) detection circuit. If the input voltage (AVIN) is lower than the UVLO rising threshold, the MP8867's functions are disabled.

### Shutdown Event

If the MP8867 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 MP8867 switches to no supply state or power-off state, regardless of the current state.

#### Thermal Recovery

If the MP8867 is in a power-off state due to the die temperature exceeding the thermal protection threshold, the MP8867 enters the power-on sequence once 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 MP8867 immediately begins the shutdown sequence.

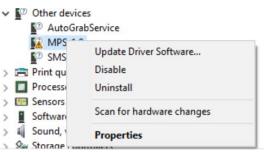


Figure 11: Updating the Driver Software

| USBXpress Device Proper | ties  | $\times$ |
|-------------------------|---|----------|
| General Driver Details  | Events  |          |
| USBXpress Dev           | ice   |          |
| Driver Provider:        | Silicon Laboratories Inc.   |          |
| Driver Date:            | 11/6/2015   |          |
| Driver Version:         | 6.7.Z.U   |          |
| Digital Signer:         | Microsoft Windows Hardware Compatibility<br>Publisher   |          |
| Driver Details          | View details about the installed driver files.  |          |
| Update Driver           | Update the driver for this device.  |          |
| Roll Back Driver        | If the device fails after updating the driver, roll<br>back to the previously installed driver. |          |
| Disable Device          | Disable the device.   |          |
| Uninstall Device        | Uninstall the device from the system (Advanced  | ).       |
|                         | OK Cancel   |          |

Figure 12: Correct Driver Version



# **Section 4. Ordering Information**

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

| Part Number           | Description   |
|-----------------------|---|
| EVKT-8867             | Complete evaluation kit   |
| Contents of EVKT-8867 |   |
| EV8867-LE-00A         | MP8867GLE evaluation board  |
| EVKT-USBI2C-02        | Includes one USB to I <sup>2</sup> C communication interface, one USB cable, and one ribbon cable |

Order directly from MonolithicPower.com.