

# **User Guide**

MP5515 Evaluation Kit (EVKT-5515)



## **Table of Contents**

Overview	3
Introduction	3
Kit Contents	3
Features and Benefits	
Kit Specifications	4
Section 1. Hardware Specifications	5
1.1 Personal Computer Requirements	5
1.2 EV5515-U-00A Specifications	
1.3 EVKT-USBI2C-02 Specifications	5
Section 2. Software Requirements	
2.1 Software Installation Procedure	6
Section 3. Evaluation Kit Test Set-Up	
3.1 Hardware Set-Up	7
3.2 Powering up the EVB	
3.3 Software Set-Up	7
3.4 Troubleshooting Tips Erro	r! Bookmark not defined.
Section 4. Ordering Information	13



## **Overview**

#### Introduction

The EVKT-5515 is an evaluation kit for the MP5515, an input-power-conditioning PMIC targeting enterprise solid-state drives, NVDIMM, and other applications with back-up system requirements. The MP5515 consists of input current limiting, input reverse-current blocking, and an MPS-patented, high-efficiency, bidirectional, boost-buck converter with only one inductor for energy storage and system back-up power when there is an input power failure. This kit allows for quick evaluation of the MP5515. By using the I<sup>2</sup>C communication interface, users can set the input current limit, slew rate, and perform cap health tests.

#### **Kit Contents**

EVKT-5515 kit contents: (items below can be ordered separately).

#	Part Number	Item	Quantity
1	EV5515-U-00A	MP5515GU evaluation board	1
2	EVKT-USBI2C-02	Includes one USB to I <sup>2</sup> C communication interface, one USB cable, one ribbon cable	1
3	Tdrive-5515	USB flash drive that stores the GUI installation file and supplemental documents	1
	GUI	USB Cable USB to I2C Communication Interface EVKT-USB12C-02 USB Cable Load	valuation Board

Figure 1: EVKT-5515 Evaluation Kit Set-Up



#### **Features and Benefits**

The MP5515 is highly customizable. Users can program the PMIC 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.

Features adjustable under each method are outlined below.

#### **I2C**

- Back-up capacitor health test
- 10-bit A/D converter to measure the input voltage, input current, backup voltage, and TEMP pin temperature sensor voltage discharge (DISCHG)
- Back-up boost enable
- Adjustable input current limit and ISOFET current limit
- Adjustable VB ramp-up slew rate
- Adjustable buck switching frequency
- VIN recover control
- Status indication via 10-bit A/D converter (VIN to the VB current limit, input over voltage, storage voltage, power good, high temperature and over temperature warning)
- Interrupt mask control
- Adjustable temperature warn threshold

#### **Kit Specifications**

Features	Specification
Supply for Board (VIN)	12V
Operating Input Voltage	2.7V - 18V
Storage Voltage (Vstrg)	28V
Input Pfail Threshold (VPFI)	8V
Bus Back-Up Voltage (VRLs)	7.5V
Bus Back-Up Max Load (IRELEASE)	5A
Operating Systems Supported	Windows XP, 7, or Later
System Requirements	Minimum 22.2 MB Free
GUI Software	4 Register Controls: System, Interrupt, ADC, Cap Test
EVB Size (L x W)	6.3 cm x 6.3 cm



## **Section 1. Hardware Specifications**

#### **1.1 Personal Computer Requirements**

The following must be minimally met to use the EVKT-5515:

- 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 EV5515-U-00A Specifications

The EV5515-U-00A is an evaluation board for the MP5515GU. For more information, please refer to the EV5515-U-00A datasheet.



Figure 2:EV5515-U-00A Evaluation Board

1	.3	EVKT-	USBI2C-	-02 Spe	ecifications	

Feature	Specification
Supply for Evaluation Board	12V
Operating Input Voltage	2.7V - 18V
Storage Voltage (Vstrg)	28V
Input Pfail Threshold (VPFI)	8V
Bus Back-Up Voltage (VRLs)	7.5V
Bus Back-Up Max Load (IRELEASE)	5A
EVB Size (L x W)	6.3 cm x 6.3 cm

The EVKT-USBI2C-02 refers to the communication interface, which connects the EVB, the PC, and its supporting accessories. It provides I<sup>2</sup>C 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.







## **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 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 thumb drive.

- 1. Plug the thumb drive into the computer using any available USB port.
- 2. Locate 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 the status screen to verify that installation is complete (see Figure 5).

🕼 Setup - MPS MP5515 GUI V1.1
Select Additional Tasks Which additional tasks should be performed?
Select the additional tasks you would like Setup to perform while installing MPS MP5515 GUI V1.1, then click Next. Additional shortcuts: Create a desktop shortcut
Next > Cancel

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







## 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 VB and GND pins, respectively.
- 2. Preset the power supply output to 12V, and 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 MP5515 will charge the storage capacitor to 28V.

#### 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).



										- 0 😣
Part Numbers										
MP5515 3S:										
0x33	The Future of /	Analog R	C Techn	ology						
Search	Register	Hex	D7	D6	D5	D4	D3	D2	D1	D0
Register Control:										
								$\subset$	Rea	
<u> </u>	1									

Figure 7: Appearance of Address Shows Successful Connection

- If a connection is not successful, a warning will appear at the bottom. There are two warnings users can expect.
  - 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 I<sup>2</sup>C communication interface is not connected (see Figure 9).



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



me										- 0 8
Part Numbers										
Slave Address:		TE		=						
	The Future 4	of Analog I	C Techn	ology						
Search	Register	Hex	D7	D6	D5	D4	D3	D2	D1	D0
Register Control:										
										_
		Device is	not av	ailable	. Pleas	e chec	k the C	onnect	ion!	
	<b>-</b>									•
Device is not available. Please check the conne	ction!									
								$\subset$	Rea	ad All
No Slave Found, Please check the connection!										

Figure 9: Warning Indicates Unsuccessful Connection – USBI2C Communication Interface not Connected

- 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.
- Select the MP5515 under Part Numbers. The Register Control menu will appear on the left side. The I<sup>2</sup>C register values will be read and displayed on the right side after clicking the Read All button (see Figure 10).

art Numbers												
Slave Address:		T	-		-							
)x33	The Future of			C Ter	brook							
			-									RTEST Pin Resister(KΩ):
Search	Register	Hex	D7	D6	D5	D4	D3	D2	D1	DO		5.1
	Sys Control1		0	0	0	0	0	0	0	1	^	ILIM Pin Resister(KΩ):
egister Control:	Interrupt1 Sta		0	0	0	0	0	1	0	0		12
Sys Control	Interrupt2 Sta		0	0	1	0	0	0	0	0		STRG Initial Voltage(V):
· ·	Interrupt1 Ma		0	0	1	0	0	1	0	0	-	0
Interrupt	Intterrupt 2 m		0	0	1	0	0	1	0	1		STRG Final Voltage(V):
ADC Control	Backup Cap		0	0	1	1	1	1	1	1	-	0
	Temp Pin Wa		0	0	0	1	1	1	1	1		Discharge Timer(s):
Cap Test Control	ADC Source		0	0	0	0	0	0	0	0	-	0
	ADC Input Vo		0	0	0	0	0	0	0	0	-	STRG Capacitance(µF):
	ADC Input Vo		0	0	0	0	0	0	0	0	-	NaN
	ADC Input Cu		0	0	0	0	0	0	0	0	-	V IN(V):
	ADC Input Cu		0	0	0	0	0	0	0	0	-	0
	ADC Temp V		0	0	0	0	0	0	0	0	-	I IN(A):
	ADC Temp V		0	0	0	0	0	0	0	0	-	-0.03
	ADC Backup		0	0	0	0	0	0	0	0	-	TEMP Pin Voltage(V):
	ADC Backup		0	0	0	0	0	0	0	0		0
	ADC Backup		0	0	0	-	0	0	0	0	-	VSTRG ADC Voltage(V)
	ADC Backup		0	0	0	0	0	0	0	0		0
	Cap Test Tim		-	-	-	-	-	-	-	-	-	
	Cap Test Tim		0	0	0	0	0	0	0	0		
	Vin Power Re	U	0	0	0	0	U	0	0	0	~	
												Read All





- 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).

t Numbers											
ave Address:				•	,						
33			_								
	The Future of An		chaol	DOT -							
		-									RTEST Pin Resister(K0
Search	Register	Hex	D7	D6	D5	D4	D3	D2	D1	DO	5.1
Seator	Sys Control1(0x1)	0	0	0	0	0	0	0	0	0	ILIM Pin Resister(KΩ):
jister Control:	Sys Control2(0x20)	88	1	0	0	0	1	0	0	0	12
	Sys Control3(0x21)	1	0	0	0	0	0	0	0	1	STRG Initial Voltage(V
Sys Control	Sys Control4(0x22)	0	0	0	0	0	0	0	0	0	
	Vin Power Recovery(0x1b)	0	0	0	0	0	0	0	0	0	STRG Final Voltage(V)
Sys Control1(0x1)	Temp Pin Warn Threshold(0x7		0	0	0	1	1	1	1	1	
ENCH(D0)	Backup Cap Threshold(0x6)	3F	0	0	1	1	1	1	1	1	Discharge Timer(s):
Disable Boost(0)	Interrupt1 Status(0x2)	4	0	0	0	0	0	1	0	0	Discharge Timer(s).
	Interrupt2 Status(0x3)	20	0	0	1	0	0	0	0	0	STRG Capacitance(µF
Sys Control2(0x20)	Interrupt1 Mask Control(0x4)	24	0	0	1	0	0	1	0	0	NaN
Cys Condole(0x20)	Intterrupt 2 mask control(0x5)	25	0	0	1	0	0	1	0	1	V IN(V):
Input ILIMT Set(D6)	ADC Source Select(0x9)	0	0	0	0	0	0	0	0	0	V_IN(V).
External Resistor Set(0)	Sys Control1(0x1)	1	0	0	0	0	0	0	0	1	
Buck Fsw(D1)	Backup Cap Threshold(0x6)	3F	0	0	1	1	1	1	1	1	I_IN(A):
480kHz(100)	Sys Control1(0x1)	1	0	0	0	0	0	0	0	1	-0.03
	ADC Input Volt Data_H(0xa)	0	0	0	0	0	0	0	0	0	TEMP Pin Voltage(V):
Force Buck Release(D0)	ADC Input Volt Data_L(0xb)	0	0	0	0	0	0	0	0	0	0
No Action(0)	ADC Input Curr Data_H(0xc)	0	0	0	0	0	0	0	0	0	VSTRG ADC Voltage(V
	ADC Input Curr Data L(0xd)	0	0	0	0	0	0	0	0	0	0
Sys Control3(0x21)	ADC Temp Voltage Data H(0x	e) 0	0	0	0	0	0	0	0	0	1
Internal ILIM Threshold(D5)	ADC Temp Voltage Data L(0x		0	0	0	0	0	0	0	0	1
	ADC Backup VOLT Data1_H(0	x12) 0	0	0	0	0	0	0	0	0	1
6.6A(000)	ADC Backup VOLT Data1 L(0		0	0	0	0	0	0	0	0	1
VB DVDT(D3)	ADC Backup VOLT Data2 H(0		0	0	0	0	0	0	0	0	1
7.5V/ms(00)	ADC Backup VOLT Data2 L(0		0	0	0	0	0	0	0	0	1
TPOR(D1)	Cap Test Timer data L(0x16)	0	0	0	0	0	0	0	0	0	
1.6ms(00)	Cap Test Timer data H(0x17)	0	0	0	0	0	0	0	0	0	1
	( <u>uni</u> )	10	-	-	-	-	-	-	-	1-	1
IC En(D0)											
Enable MP5515(1)											

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

 $\triangle$  All changes made via  $l^2$ C 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 the MPS PMBus and I<sup>2</sup>C.

#### EVKT-USBI2C-01

In case 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 12).
- 2. Click "Browse my computer for driver software."
- 3. Find the driver located on the thumb drive.
- 4. Install.

#### EVKT-USBI2C-02

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

Note: Check 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 13).

- 1. Browse the thumb drive contents and open the driver's folder.
- 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

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

#### 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 (it enters a no supply state) or over-temperature protection is triggered (it enters a power-off state), the PMIC switches to no supply state or power-off state, regardless of the current state.

AutoGr	abService
	Update Driver Software
Print qu	Disable
Process	Uninstall
Sensors Software	Scan for hardware changes
Sound,	Properties

USBXpres	s Device	Propert	ies	×					
General	Driver	Details	Events						
USBXpress Device									
	Driver I	Provider:	Silicon Laboratories Inc.						
	Driver I		11/6/2015						
	Driver	Version:	6.7.2.0						
	Digital	Signer:	Microsoft Windows Hardware Compatibility Publisher						
Driv	ver Detail	s	View details about the installed driver files.						
Upd	late Drive	er	Update the driver for this device.						
Roll	Back Driv	/er	If the device fails after updating the driver, roll back to the previously installed driver.						
Disa	ble Devid	ce -	Disable the device.						
Unin	stall Devi	ce	Uninstall the device from the system (Advanced	).					
_			OK Cancel						

Figure 13: Correct Driver Version



#### • Thermal Recovery

If the MP5515 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-5515	Complete evaluation kit
Contents of EVKT-5515	
EV5515-U-00A	MP5515GU evaluation board
EVKT-USBI2C-02	Includes one USB to I2C communication interface, one USB cable, one ribbon cable
Tdrive-5515	USB flash drive that stores the GUI installation file and supplemental documents

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