Evaluation Kit Description

Rev. 1.00 / February 2013

ZSPM4523

High-Efficiency Solar PV MPPT Regulator for
Super Capacitor Systems

Power and Precision

ZMDI

The Analog Mixed Signal Company

ZSPM4523
Evaluation Kit Manual

Restrictions:

Zentrum Mikroelektronik Dresden AG's ZSPM4523 Evaluation Kit is designed for evaluation of the ZSPM4523, laboratory setup, and module development only. This kit must not be used for module production and production test setups.

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Contents

For more information, contact ZMDI via Analog@zmdi.com.

List of Figures

List of Tables

1   Kit Contents

- ZSPM4523 Evaluation Board (EVB)
- USB to I^2C™* Cable
- Startup Instructions

2   Introduction

The ZSPM4523 Evaluation Board (EVB) contains the ZSPM4523 High-Efficiency Super Capacitor Charger integrated circuit with recommended external components and test points (see Figure 2.1). The ZSPM4523 enables a complete super capacitor charging system using a photovoltaic cell.

Key parameters of the super capacitor charger are

- Super capacitor: Output voltage of the ZSPM4523 does not exceed the maximum voltage rating of the super capacitor
- Photovoltaic voltage input: 4V to 7.2V

Important: Ensure that the power switch is in the off position (move to lower position when board is oriented as shown in Figure 2.1) when connecting hardware as labeled on the ZSPM4523 EVB.

Figure 2.1   Overview of ZSPM4523 Evaluation Board
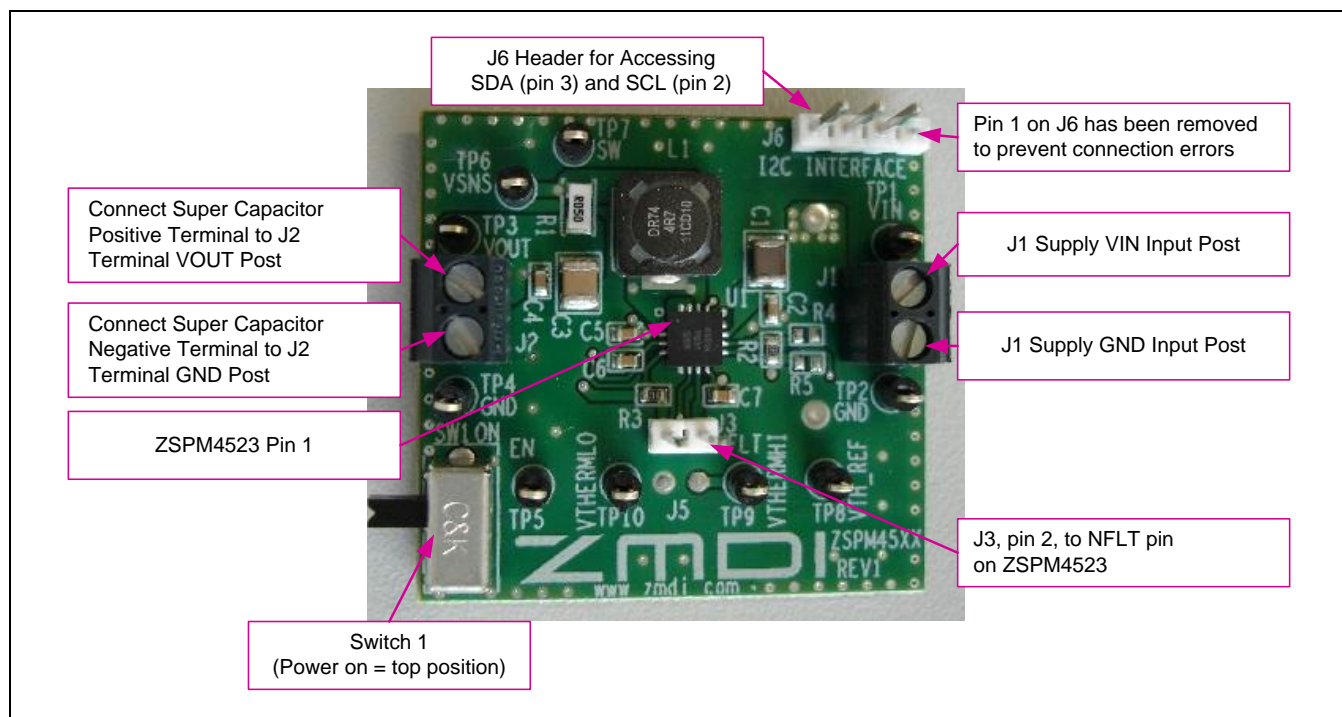
* I^2C™ is a trademark of NXP.

3 General Overview

3.1. Default Settings

The EVB is preset to have a 1.5A maximum charging current. The termination voltage and maximum charge current can be customized to a specific system optimization and stored in EEPROM memory through the I^2C™[*] interface. Details of the I^2C™ interface and register programming can be found in the ZSPM4523 datasheet.

The SDA and SCL nodes for I^2C™ communication are accessible via the J6 header pins (see Figure 2.1). If the EVB's default ZSPM4523 configuration settings are desired, no I^2C™ operation is needed.

Operating the ZSPM4523 EVB is straightforward. Once the super capacitor and input voltage are properly connected as described in section 4.1, simply set switch SW1 to the ON position (see Figure 2.1), which starts the charging of the super capacitor.

4 Connectors and Test Points

4.1. Board Connectors

The board contains the following connectors for external signals and supplies:

J1: The input supply voltage for the board, which is controlled by the ZSPM4523 to charge the super capacitor.

J2: Output voltage from the charger to the super capacitor.

J3: Pin 2 – Open drain output for the ZSPM4523's NFLT pin (see ZSPM4523 data sheet for details).

J6: I^2C™ connector. Pin 4 is next to "J6 I2C" on ZSPM4523 Evaluation Board (Figure 2.1)

VDD – pin 1 (Note this pin has been removed to avoid erroneous connections that could damage the board.)

SCL – pin 2

SDA – pin 3

GND – pin 4

4.2. Test and Probe Points

The board contains the following test/probe points:

TP3 (VOUT): Kelvin test point for VOUT to the positive super capacitor terminal.

TP4 (GND): Kelvin test point for the negative super capacitor terminal and ground for the EVB.

TP7 (SW): Switching node test point (SW pin on the ZSPM4523).

TP6 (VSNS): Sense voltage test point (VSENSE pin on the ZSPM4523).

TP5 (EN): Enable pin test point (EN pin on the ZSPM4523).

Kit Description	© 2013 Zentrum Mikroelektronik Dresden AG — Rev. 1.00	5 of 16
February 12, 2013		

5 Setup

Important: Follow these guidelines when connecting a photovoltaic DC input and super capacitor to the ZSPM4523 EVB (see Figure 2.1).

- **Capacitor:** Connect the terminals of the super capacitor to the EVB's J2 terminal so that the "+" capacitor terminal is connected to the J2 post marked "VOUT" and the "–" capacitor terminal is connected to GND of J2 (post nearest test point TP4).

- **Supply:** Connect the photovoltaic supply voltage to the Evaluation Board's J1 terminal so that the positive rail is connected to the J1 post marked "VIN" and the ground or negative rail is connected to GND of J1 (post nearest test point TP2).

- **Important:** Be sure to apply power to the ZSPM4523 EVB and set the EVB power switch to the "ON" position prior to using the GUI.

6 Installing the Graphical User Interface (GUI) for the ZSPM4523

Follow these steps to create a user account on ZMDI's website and download the GUI:

- Go to www.ZMDI.com, and create a user name and login following instructions given on the site.

- Place the cursor over the "PRODUCTS" tab, and select Smart Power Management from the drop-down menu.

- Click on ZSPM4523 on the secondary drop-down menu.

- Under the "SOFTWARE" heading, click on "ZSPM45xx Programmer" to download the GUI as a zip file.

Next, extract the files in the downloaded ZIP file, and click on *ZSPM45xx_Programmer.exe*. Please follow the installation wizard to complete the installation.

7 Installing Drivers for FTDI USB/ I^{2}C™ Cable

If using Windows® 7 or later, install the drivers for the FTDI USB/ I^{2}C™ cable by simply connecting the cable to the USB port on the computer and allowing the operating system to use Windows® Update to download and install the required drivers.

If using an older version of Windows® or if the method above is unsuccessful for automatically installing the drivers, refer to section 2.1 of the cable manufacturer's datasheet for supported drivers and download instructions:
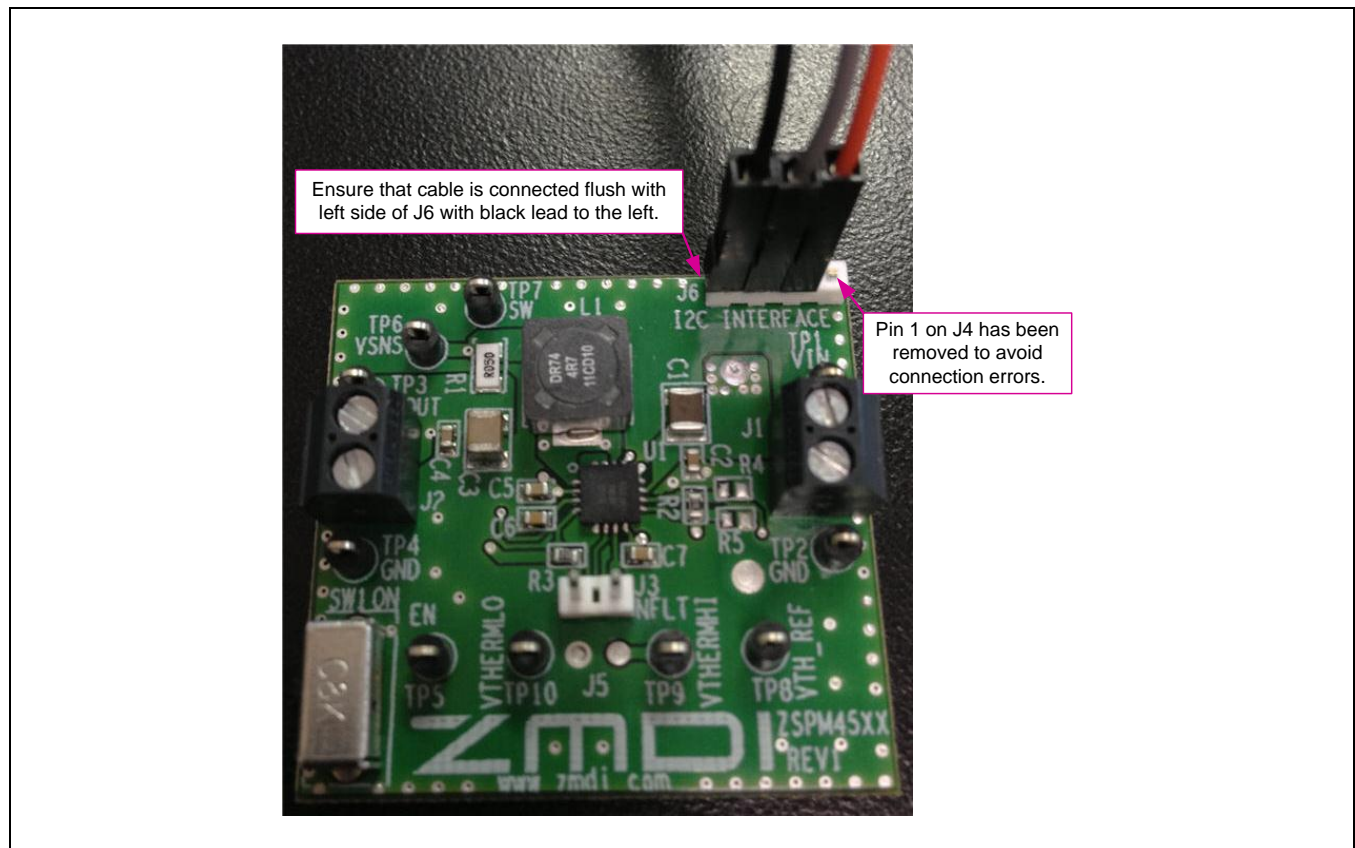http://www.ftdichip.com/Support/Documents/DataSheets/Cables/DS_C232HM_MPSSE_CABLE.PDF. This document also provides a user guide for the cable.

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8   Connecting the FTDI Cable to ZSPM4523 Evaluation Board:

Connect the female connector of the FTDI USB/ I^{2}C™ cable to J6 of ZSPM4523 Evaluation Board being careful to use the orientation shown in Figure 8.1. The order of the leads in the cable from left to right is black, gray, and then orange. Note that the last pin on the right on J6 has been removed to ensure that no accidental connections can be made, which would damage the board.

Figure 8.1   Connecting the FTDI USB/ I^{2}C™ Cable to J6

Ensure that cable is connected flush with left side of J6 with black lead to the left.

Pin 1 on J4 has been removed to avoid connection errors.

9 I²C™ Programming GUI Overview

ZSPM4523 GUI enables the user to communicate with the ZSPM4523 Evaluation Board, monitor status bits, and change settings. Upon activating the software, select "ZSPM4523 PV Super Cap Charger" from the drop down menu under "PRODUCT SELECTION" (see Figure 9.1).

This GUI has five additional sections as shown in Figure 9.1:

- The "Status" section allows reading the status registers for monitoring the ZSPM4523.
- The "Configuration," "CONFIG1," and "CONFIG2" sections allow programming different parameters in the ZSPM4523.
- The "Reference" section provides information from the datasheet showing definitions for programming values for configurable registers in "Configuration" section. See section 9.3 for an explanation of which register definitions will be displayed.

Note: At the bottom left of the GUI window, the status of communication of the USB to I²C™ interface is indicated. The status should indicate "Connected" as shown in Figure 9.1 if the cable is connected to the computer. If the GUI shows "Disconnected," ensure that the I²C™/USB cable is connected to the computer and the driver is installed; then try again. If there is a problem reading values from the GUI, verify that ZSPM4523 Evaluation Board is powered on.

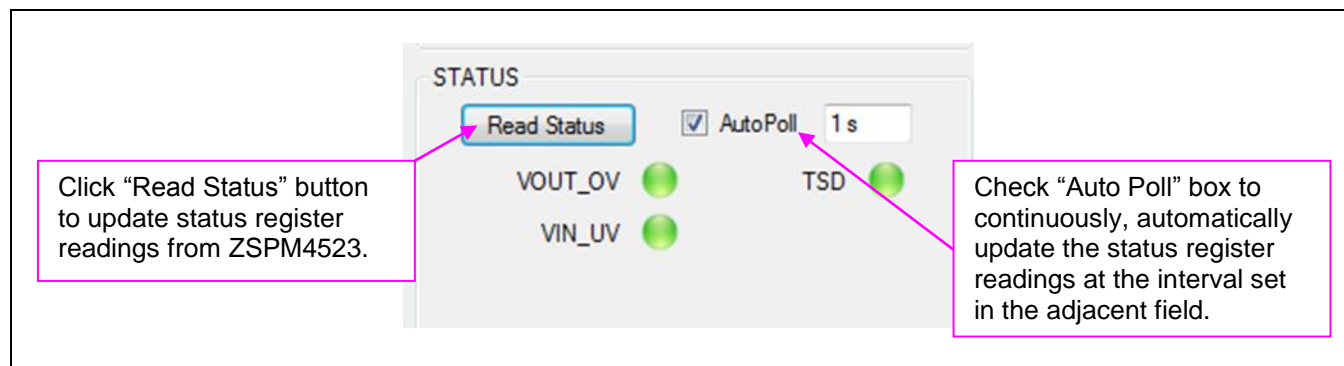*Figure 9.1   The ZSPM4523 Graphic User Interface (GUI)*
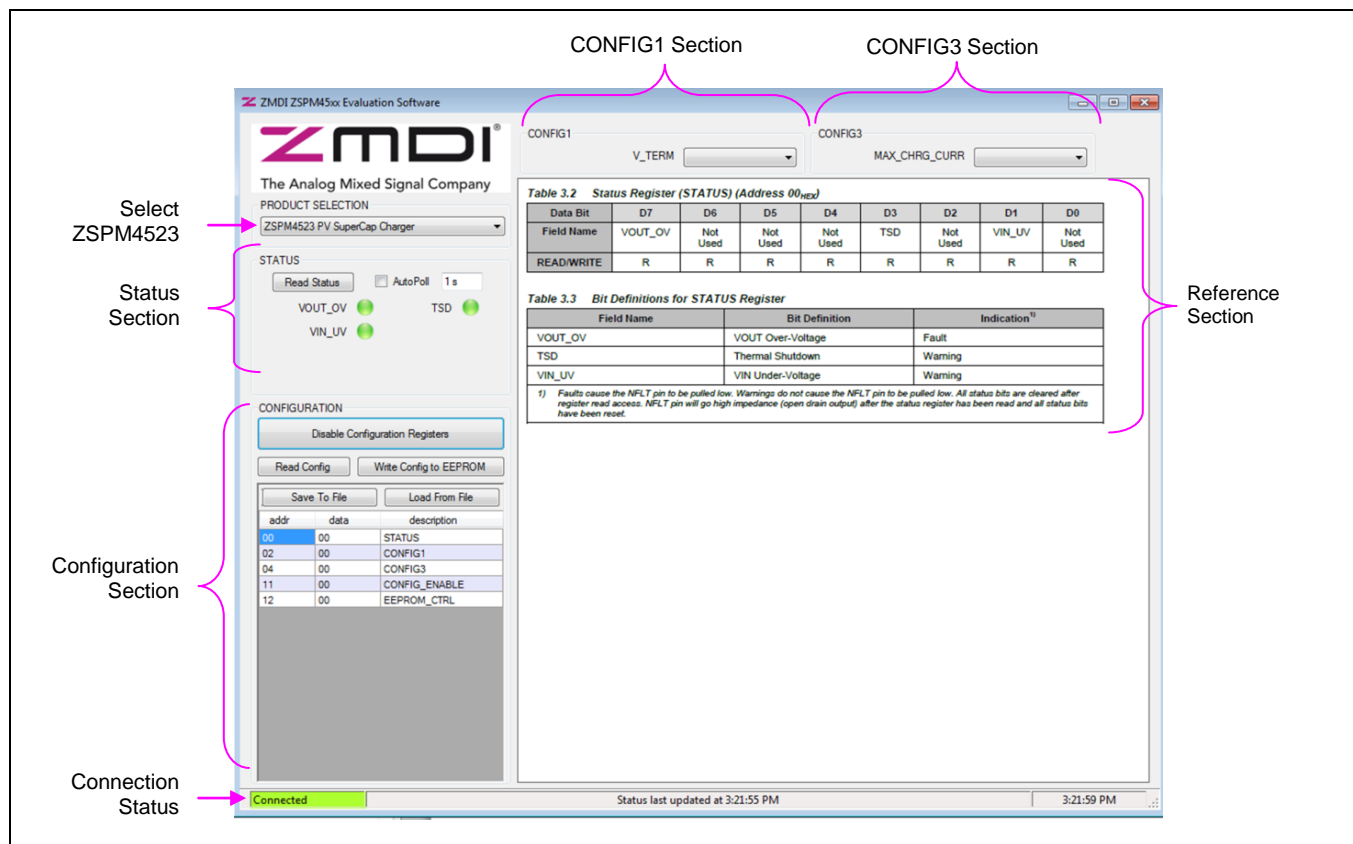
9.1. Status Section

After opening the GUI, click on the "Read Status" button to read the current values of monitor registers of the ZSPM4523 on the Evaluation Board.

Enabling the "Auto Poll" feature will automatically read the status bits at the time interval specified in the adjacent field.

Figure 9.2   Reading Status Registers

Click "Read Status" button to update status register readings from ZSPM4523.

Check "Auto Poll" box to continuously, automatically update the status register readings at the interval set in the adjacent field.

Note: If any of the Status register bits shows a fault condition, the adjacent indicator is displayed as red as shown in the figure below.

Figure 9.3   Fault Indication for Status Register Bits
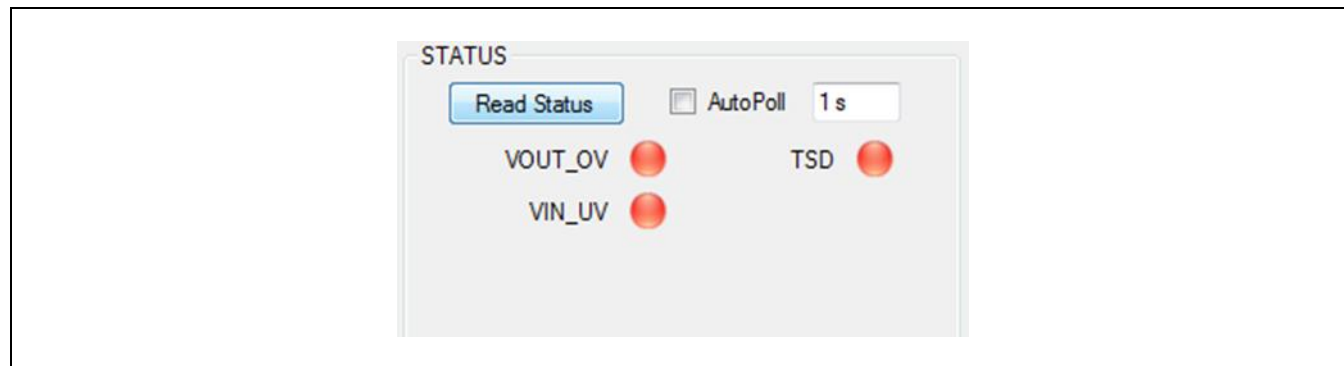
## 9.2. Configuration, CONFIG1, and CONFIG3 Sections

The "Configuration" section of the GUI enables changing the configurable registers of the ZSPM4523 (except STATUS, which is read-only). To change the registers, click on the "Enable Configuration Registers" button as shown in Figure 9.4. To prevent further changes to the configuration registers, click "Disable Configuration Registers."

After enabling configuration of the registers, click on the "Read Config" button to read the current configuration of the ZSPM4523.

Recommendation: Record the existing configuration register settings before changing any settings and writing the new configuration to the ZSPM4523. Refer to the "Reference" section (see section 9.3) for definitions for the register bits and valid settings.

Option: The "Load from File" button can be used to select a pre-defined set of values for the configuration registers from a previously saved configuration file (see Figure 9.5).

Figure 9.4   Enabling/Disabling
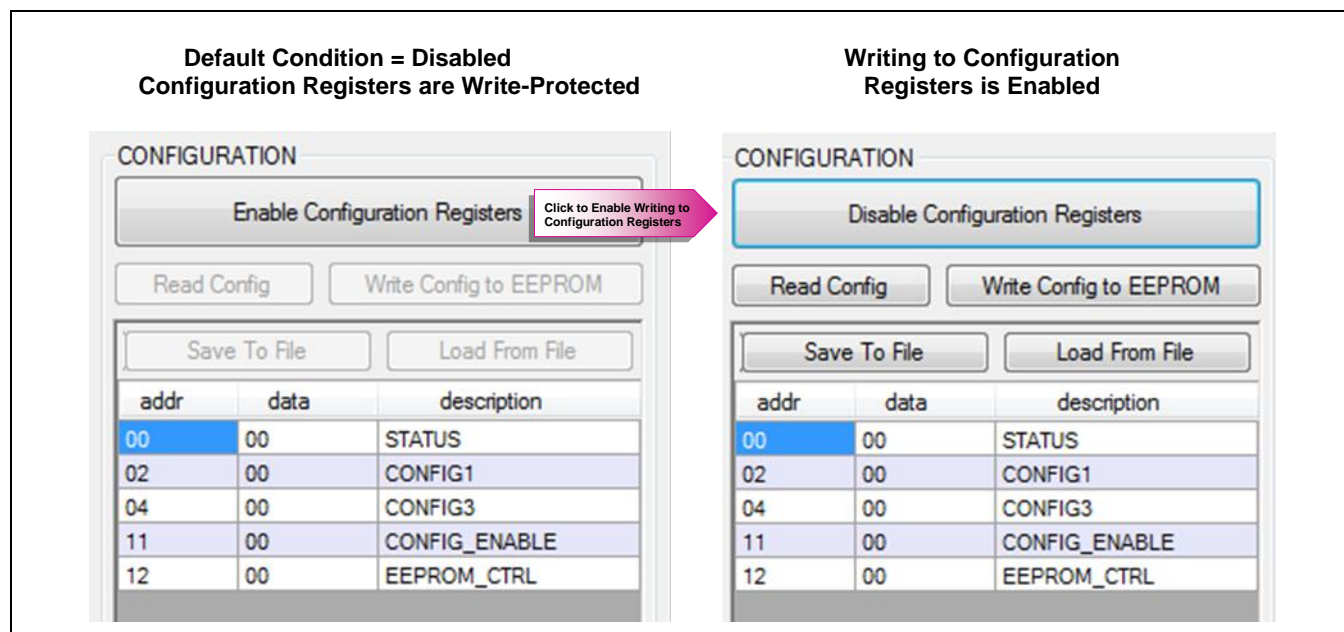
To change the terminal voltage and maximum charge current values, select the required values from the pull down menus under CONFIG1 and CONFIG3 respectively (see Figure 9.3). The terminal voltage and maximum charge current can also be changed via configuration registers.

To directly change configuration registers, click on the row for the register and enter the new value for the register in hexadecimal. Note: the "STATUS" register is read-only.

Important: After changing the configuration of the registers as needed, the values entered will take effect immediately, but values will not be stored in the EEPROM. The values will be lost after a power cycle. In order to write the configuration to the EEPROM, click the "Write Config to EEPROM" button to write the new values to ZSPM4523's EEPROM configuration registers.

The GUI provides the "Save to File" button for saving the current configuration to a file, so that the user has the option to load the file in the future using the "Load From File" button.

Figure 9.5   Buttons for Saving Current Configuration Settings or Loading Previously Saved Configurations


9.3.   Reference Section

The right panel of the GUI provides a reference from the datasheet showing the definitions for register bits.

By default, the Status register definitions are shown as illustrated in Figure 9.1.

When access to the configuration registers has been enabled (see section 9.2), the "Reference" section provides defined values for configuration options for the register selected in the "Configuration" section.

Figure 9.6   Using the Reference Section in Conjunction with the Configuration Section
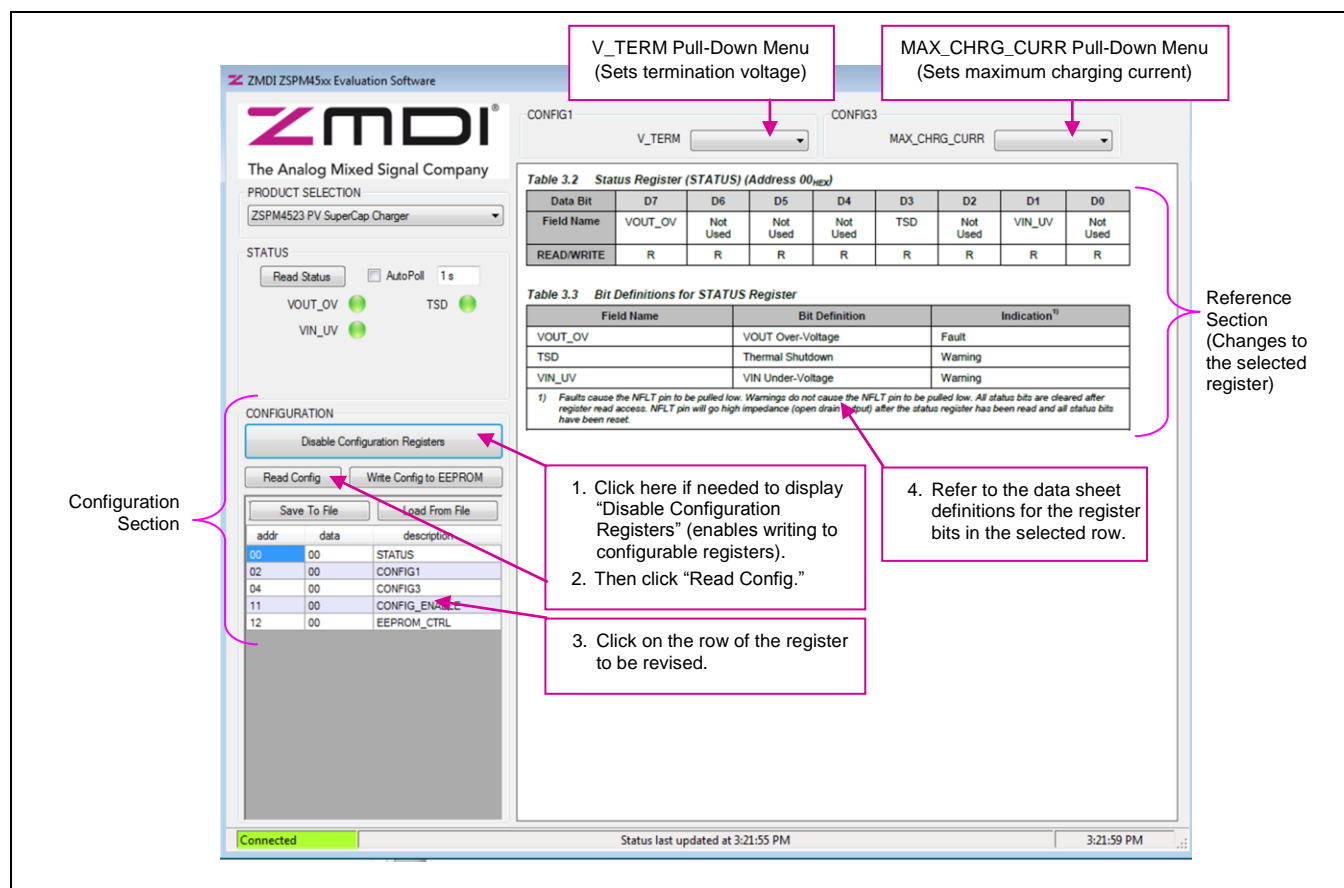
10 Board Options

Refer to the bill of materials in section 11.2 for recommended values and sources for the following optional components.

10.1. Schottky Diode

While D1 is not required, it can be populated to increase efficiency and provide a better load regulation. Care should be taken to select a diode that is rated to handle the output current supplied by the regulator.

10.2. Zener Diode

Zener diodes, D2 and D3, are not populated. However, adding D2 or D3 is highly recommended to protect the ZSPM4523 by clamping the input voltage to the maximum input voltage of 7.2V.

11 Evaluation Board Schematic and Layout

Note: The ZSPM4523 Evaluation Board is shared with the ZSPM4521 and ZSPM4551 Evaluation Kits. Some of the test points are not applicable to the ZSPM4523.

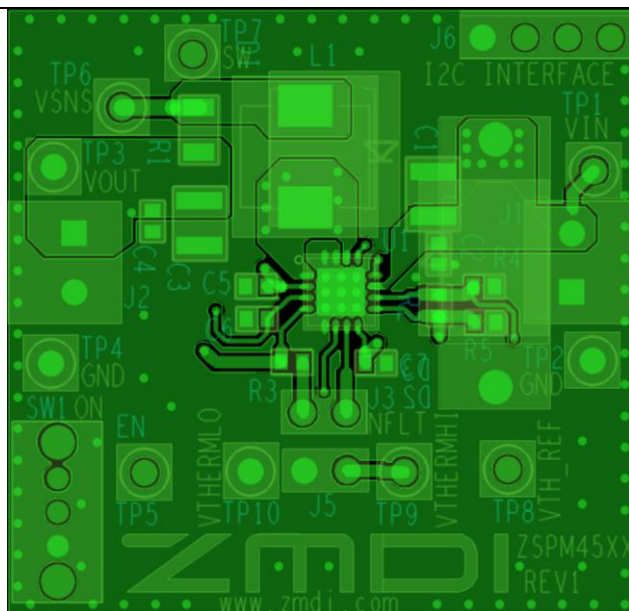*Figure 11.1 Schematic for the ZSPM4523 Evaluation Board Revision 1.0*
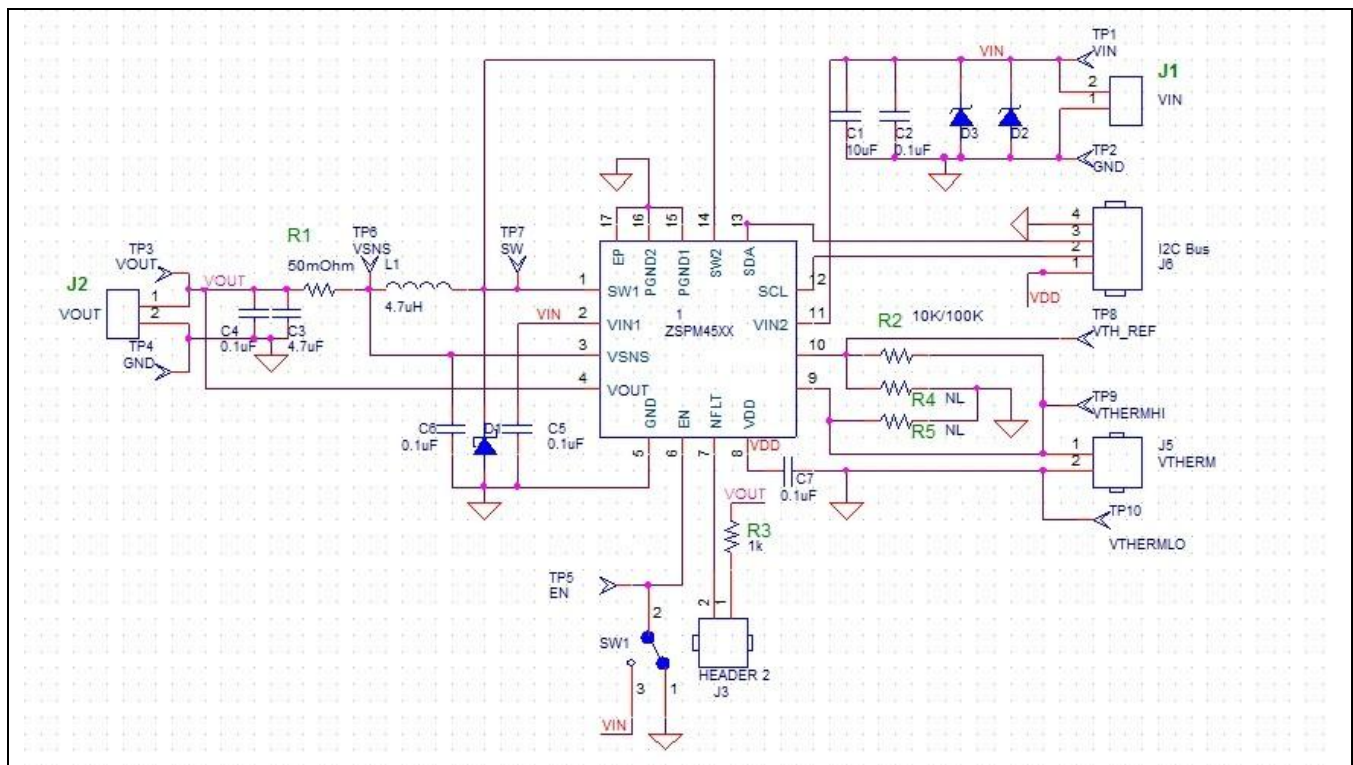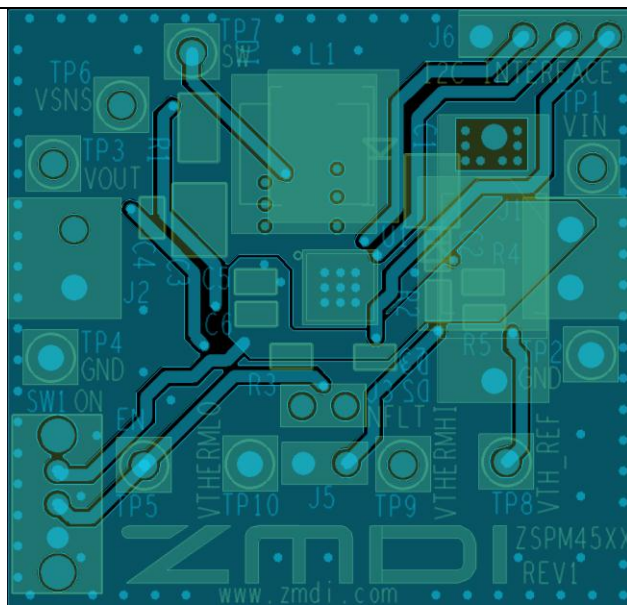
11.1. Evaluation Board Layout

Top Layer

2nd Layer
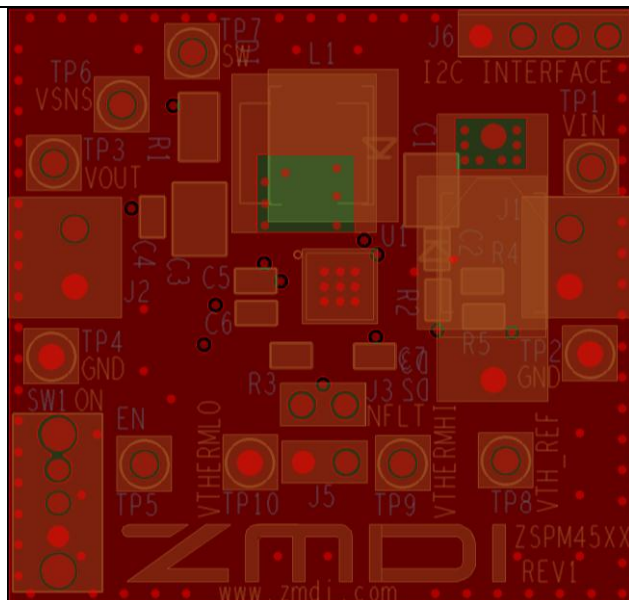
3rd Layer
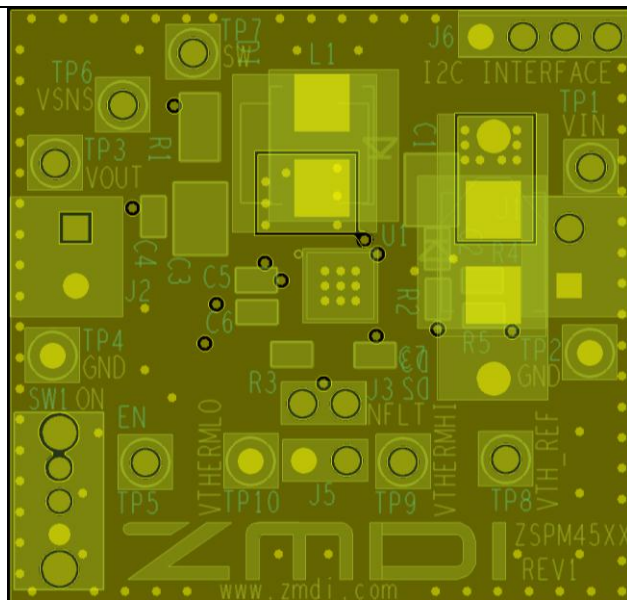
Bottom Layer

Kit Description
February 12, 2013

13 of 16

11.2. ZSPM4523 Evaluation Board Bill of Materials

Table 11.1   ZSPM4523 Evaluation Board Bill of Materials

Reference	Part	Footprint	Manufacturer	Manufacturer P/N
C1	10µF/16V	1210	TDK	C3225Y5V1C106Z/1.15
C2	0.1µF/25V	603	Murata	GRM188R71C104KA01D
C4	0.1µF/25V	603		
C5	0.1µF/25V	603		
C6	0.1µF/25V	603		
C7	0.1µF/25V	603		
C3	4.7µF/25V	1210	TDK	C3225X7R1E475K
D1	DIODE SCHOTTKY	smc_smb	NL	
D2	DIODE ZENER	do201ad	NL	
D3	DIODE ZENER	smc_smb	NL	
J1	VIN	OSTVQ021150	On Shore Technology	ED555/2DS
J2	VOUT	OSTVQ021150	On Shore Technology	ED555/2DS
J3	HEADER 2	jumper2	TE Connectivity	3-644456-2
J5	VTHERM	jumper2	NL	
J6	I^{2}C™ Bus	jumper4	TE Connectivity	3-644456-4
L1	4.7µH	ind	Cooper Bussman	DR74-4R7-R
R1	50mΩ/1W/1%/50ppm	1206	Ohmite	MCS1632R050FER
R2	10K	603	Stackpole	RMCF0603JT10K0
R3	1k	603	Stackpole	RMCF0603JT1K00
R4	NL	603	NL	
R5	NL	603	NL	
SW1	SW_T_SPDT	OS102011MA1QN1	C&K	OS102011MA1QN1
TP1	VIN	TP	Keystone	5001K-ND
TP2	GND	TP	Keystone	5001K-ND
TP4	GND	TP	Keystone	5001K-ND
TP3	VOUT	TP	Keystone	5001K-ND
TP5	EN	TP	Keystone	5001K-ND
TP6	VSNS	TP	Keystone	5001K-ND
TP7	SW	TP	Keystone	5001K-ND

Reference	Part	Footprint	Manufacturer	Manufacturer P/N
TP8	VTH_REF	TP	Keystone	5001K-ND
TP9	VTHERMHI	TP	Keystone	5001K-ND
TP10	VTHERMLO	TP	Keystone	5001K-ND
U1	ZSPM4523	PQFN-16	ZMDI	ZSPM4523

12   Ordering Information

Product Sales Code	Description
ZSPM4523KIT	ZSPM4523 Evaluation Kit for the ZSPM4523 High Efficiency Photovoltaic Charger for Li-ion Battery

13   Related Documents

Note: *X_xy* refers to the latest version of the document.

File Name	File Name
ZSPM4523 Datasheet	*ZSPM4523_Data_Sheet_rev_X_xy.pdf*

Visit ZMDI's website www.zmdi.com or contact your nearest sales office for the latest version of these documents.

14   Glossary

Term	Description
JEITA	Japan Electronics and Information Technology Industries Association

15 Document Revision History

Revision	Date	Description
1.00	February 12, 2013	First release.

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