



Integrated Device Technology

Getting Started Guide
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ZSPM8000-KIT

Evaluation Kit for the ZSPM1000 Single-Rail,
Single-Phase True Digital PWM Controller and the
ZSPM9000 DrMOS

SMART DC/DC POL Demonstrator Setup Guide

This guide provides step-by-step instructions on how to setup the IDT ZSPM8000-KIT for DC/DC point-of-load (POL) applications. The ZSPM8000-KIT incorporates IDT's ZSPM1000 digital power controller and the ZSPM9000 DrMOS power output stage.

Kit Contents



- Demo Board
- PMBus™ Communication Interface
- USB Cable
- CD with Pink Power Designer™ environment
- Pink Power Designer™ Download Information

Requirements for Using the Kit:

- PC system with USB port
- DC power supply (12V, 3A)
- Oscilloscope
- Electronic load (optional)
- Windows® XP or Windows® 7
- Keyboard, mouse and monitor
- Internet access
- IDT customer account to download latest GUI

Step 1 – Download Latest GUI Version

The ZSPM8000-KIT Evaluation Kit contains everything required to use the Demonstration Board except the Pink Power Designer™ tool, IDT's graphical user interface (GUI) to program ZSPM1000 controller. The GUI software must be downloaded from the IDT website to ensure receiving the latest release.

The software can be downloaded from the ZSPM1000 product page: www.idt.com/ZSPM1000

Note that users must be registered and logged onto the IDT website in order to download the software.

Step 2 – Board Settings

Evaluation Board

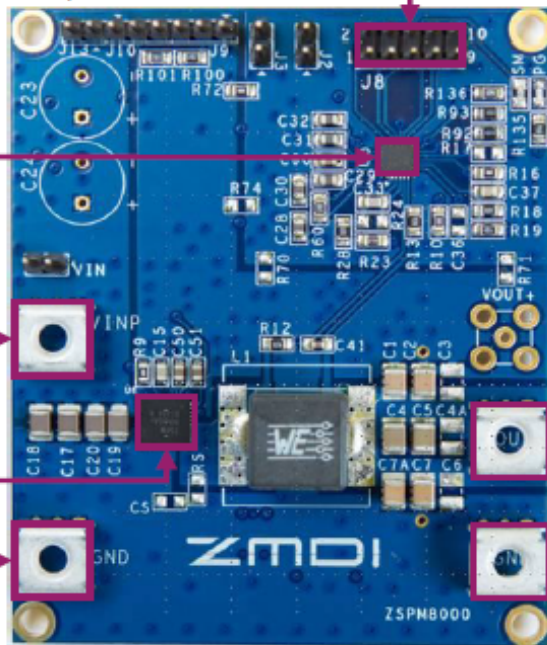
10-pin Connector
(for PMBus™ Interface)

Controller
(ZSPM1000)

V_{IN+}

DrMOS
(ZSPM9000)

V_{IN-}



$V_{IN} = 12\text{ V}$
 $V_{OUT} = 1.2\text{ V}$
 $I_{OUT} = 20\text{ A}$
 $FSW = 500\text{ kHz}$
 $L = 470\text{ nH}$
 $C = 400\text{ }\mu\text{F}$

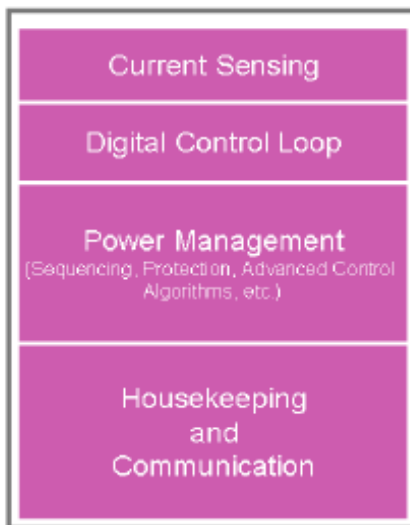
V_{OUT+}

V_{OUT-}

SMART Buck Converter

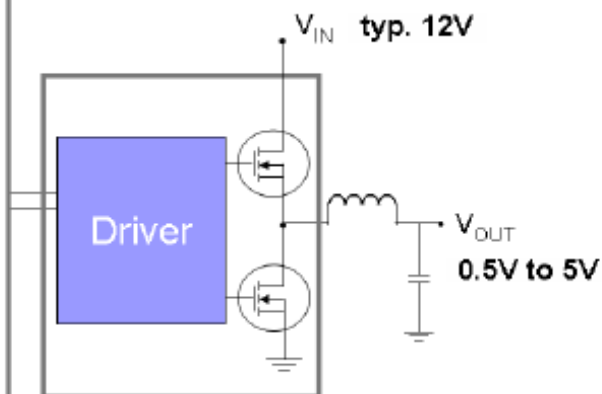
ZSPM1000

QFN 4mm x 4mm



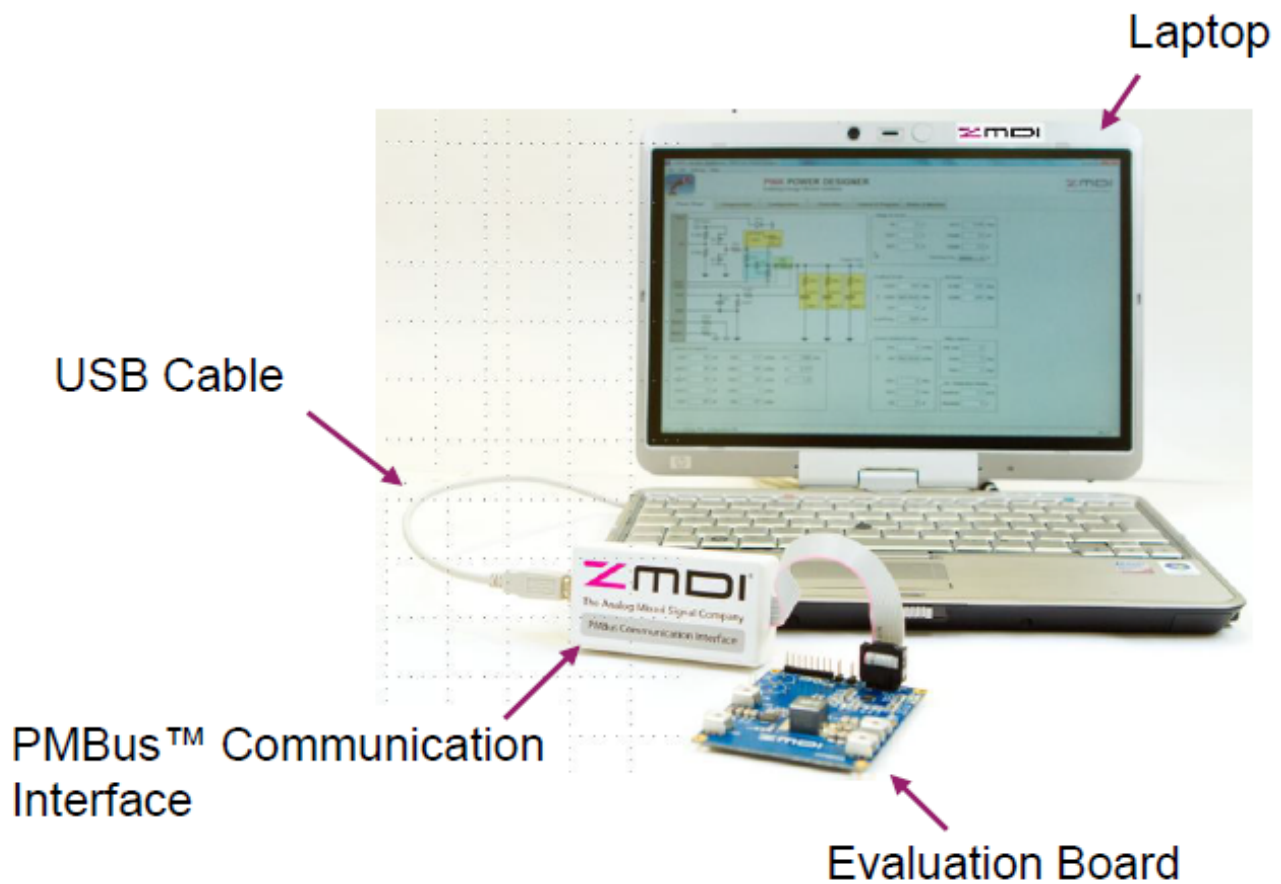
ZSPM9000

PQFN 6mm x 6mm



Step 3 – Instructions Board Setup

The Evaluation Board must be connected to the PMBus™ Communication Interface via the 10-pin connector (J8). Use the USB cable to connect the PMBus™ Communication Interface to the USB port of your PC system as illustrated below:



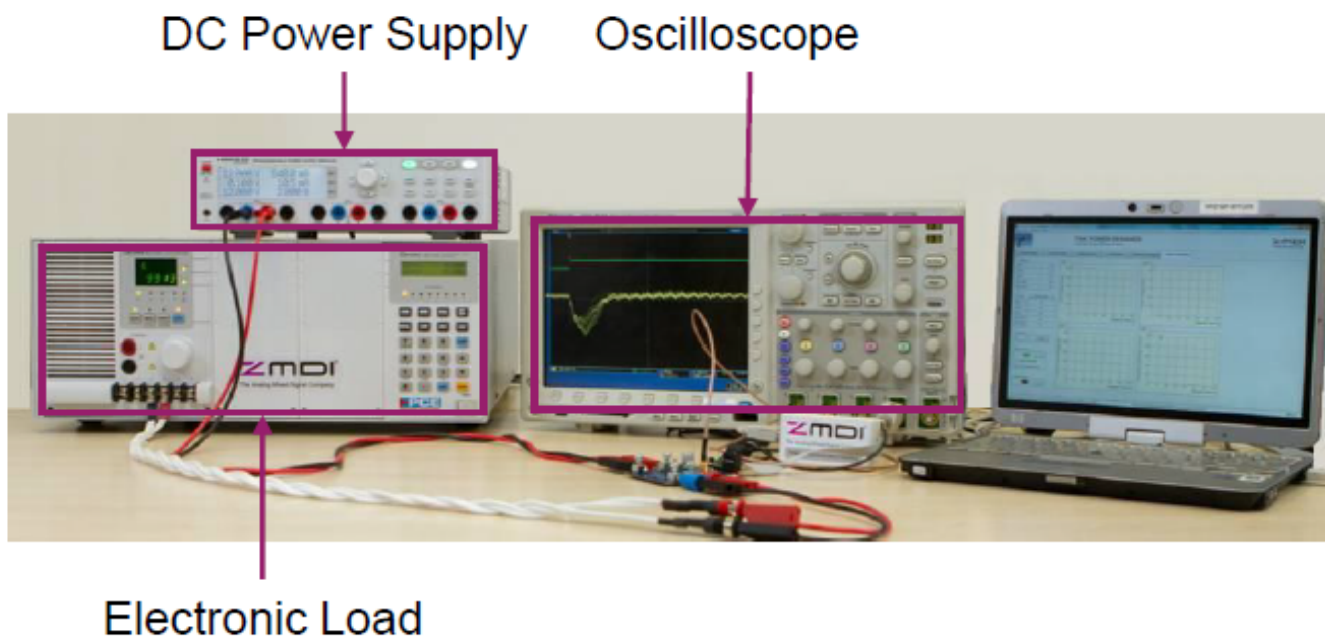
Step 4 – Connect External Equipment



Important Safety Reminder: These procedures can result in high currents, which can cause severe injury or death. Only trained professional staff should connect external equipment.

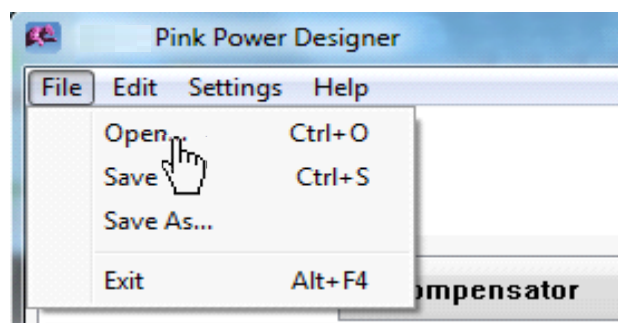
- Connect the test equipment as shown below.
- Use a DC power supply set to 12V with an output current rating of at least 3A. Do not turn it on until indicated in step 5. Connect it to the V_{IN+} and V_{IN-} (GND) connectors on the Evaluation Board.
- Connect an electronic load with a rating of up to 20A to the output connectors V_{OUT+} and V_{OUT-} (GND).
- Connect the probe of the oscilloscope to V_{OUT+} to display the output voltage. For multi-channel oscilloscopes, you can monitor more than one parameter for evaluation.

Test Setup:



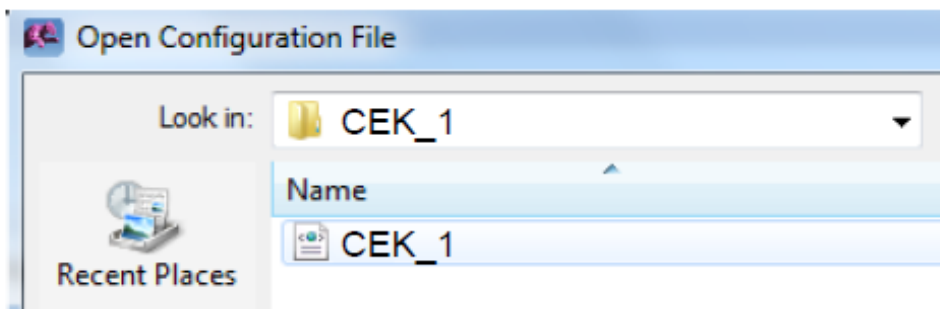
Step 5 – GUI Setup Instructions

1. Load the product CD included with the ZSPM8000-KIT, and install the Matlab® runtime environment on your PC system.
2. Plug in the PMBus™ Communication Interface.
3. Download the latest release of the Pink Power Designer™ GUI from the IDT website (see step 3) and execute the software by clicking on the file or the shortcut on your desktop.
4. Turn on the 12V DC supply.
5. The ZSPM1000 controller requires a configuration setting or previously saved configuration file to operate. This file contains the information about the power stage components ("Power Stage" tab), the digital compensator coefficients ("Compensator" tab), the start-up behavior ("Configuration" tab), and the POL protection and fault limits ("Protection" tab). To load the default configuration settings for the Evaluation Board, open the configuration file as shown below:



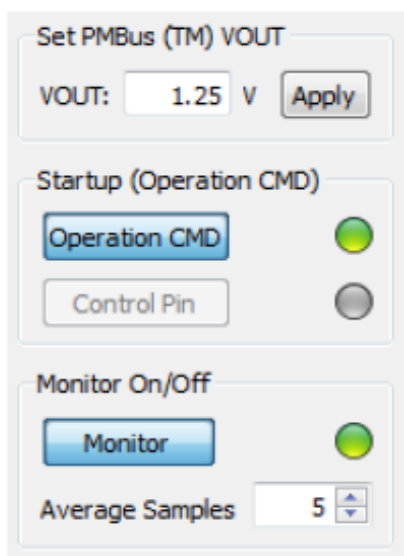
Step 5 – GUI Setup Instructions (Continued)

6. Open the following file downloaded in Step 1:



This will load all of the default settings for your ZSPM8000-KIT. You are now ready to turn on your POL regulator.

7. Open the “Status and Monitor” tab on your GUI and select the “Monitor” and “Operation CMD” buttons. The associated status icons will turn green.



Your ZSPM8000-KIT is now running. The electronic load can be turned on, and the load current, output voltage, temperature and input voltage can be monitored in the “Status and Monitor” tab.

Step 6 – Performance Evaluation

Of critical importance for high performance POL converters is the transient response, i.e. the ability of the controller to respond to large, fast-changing load transients. The ZSMP8000-KIT evaluation POL has a built-in transient load: this can be configured to be off or to generate 5A, 10A or 15A load steps by selecting the appropriate jumper settings (as described in the ZSPM8000 datasheet available on the IDT website). This allows the user, by means of an oscilloscope, to observe ZSPM1000 transient performance when operating with load transients having a di/dt in the order of $500A/\mu s$.

Sub-cycle Response™ (SCR) and nonlinear gain (NLG) are unique features of the ZSPM1000 to access optimal transient response. The SCR allows the PWM output to be immediately re-started upon the detection of an output voltage disturbance, thus drastically reducing the overall loop time delay, while the NLG effectively increases the loop gain during transients to reduce the output impedance thus effectively reducing the output voltage change. Enabling of SCR and NLG is found in the “Compensation” tab.



Step 7 – Changing Default Settings

The default settings can be changed, if required, by adjusting the parameters in the “Compensation,” “Configuration” and “Protection” tabs. Values loaded in the “Power Stage” tab refer to the properties of the ZSPM8000-KIT and should not be changed.

IDT’s State Law™ Control allows optimization of loop response for three different operating mode:

- Steady-state mode: robust compensator with conservative bandwidth
- Transient mode: higher bandwidth loop response that becomes automatically active upon the detection of a transient disturbance of the output voltage.
- Light load mode: loop response designed to ensure stability if the POL is operated in the discontinuous conduction mode (DCM) as found if using the diode emulation mode of operation.

To see an example of the effect of the compensator bandwidth on the transient response, the “Transient PID Compensator” bandwidth can be changed. If this is done, the “Calculate” button must be clicked. This enables the automatic compensator design procedure to compute the new PID coefficients. After calculation, these new coefficients must be sent to the ZSPM1000 controller by clicking on the “Write to Chip” button.

Steady-State PID Compensation					Calculate
Damping	GM min [dB]	PM min [deg]	Auto	Crossover [kHz]	
0.707	10.000	55.000	<input type="checkbox"/>	28	

Transient PID Compensation					Calculate
Damping	GM min [dB]	PM min [deg]	Auto	Crossover [kHz]	
0.707	10.000	55.000	<input type="checkbox"/>	56	

DCM PID Compensation					Calculate
Damping	GM min [dB]	PM min [deg]	Auto	Crossover [kHz]	
0.707	10.000	55.000	<input type="checkbox"/>	28	

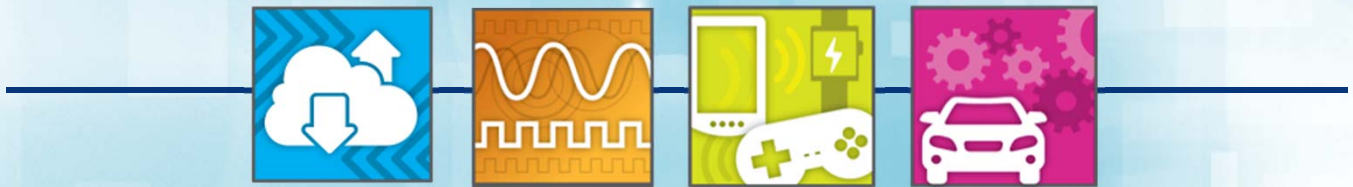
Step 7 – Changing Default Setting (continued)

Similar to configuration settings, the protection settings can be changed. If new settings have been entered in the “Protection” tab, new values are automatically validated by checking whether the changes are within the maximum operating parameters of the ZSPM8000-KIT. The new settings must be sent to the ZSPM1000 controller by clicking on the “Write to Chip” button.

These new protection and configuration settings can be saved to a directory of your choice by using the top menu by “File > Save” option.

You can re-load and modify your project file at any time.

Thank You



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