ACT88325EVK1-101 User's Guide

Description

This document describes the characteristic and operation of the Active Semi ACT88325EVK1-101 evaluation kit (EVK).It provides setup and operation instructions, schematic, layout, BOM, and test data. This EVK demonstrates the ACT88325VA101ActivePMU power management IC. Other ACT88325VAxxx options can be evaluated on this EVK by replacing the IC and any other necessary components.

Features

The EVK can be used as a standalone board if desired. However, to access the internal registers and to take full advantage of the IC's capability, the user must connect the EVK kit to a PC with Active Semi's USB-TO-I2C interface dongle and use the GUI software. The EVK provides full access to the each converter's input and output voltage, as well as all the digital control signals. This gives the user the flexibility to configure the EVK to match their real world system.

Note that the ACT88325EVK1-101 is specifically configured for the ACT88325VA101. This CMI option is configured to power the Silicon Motion 2263 and SM2263XT processors with a 3.3V input.

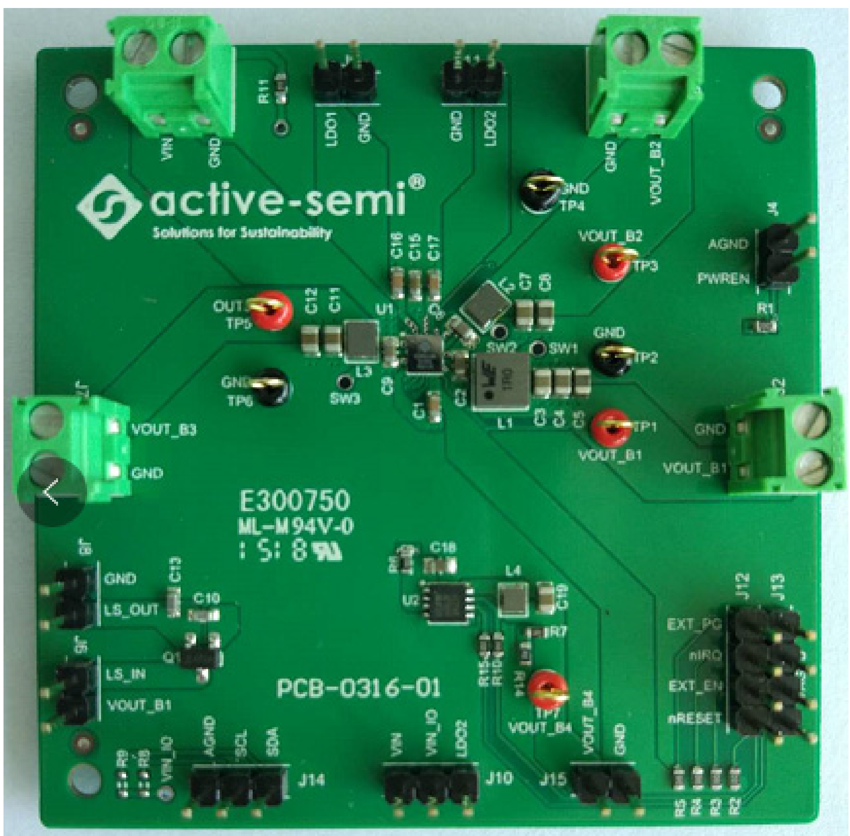


Figure 1 – EVK Picture

EVK Contents

The ACT88325EVK1-101 evaluation kit comes with the following items?

1. EVK Assembly
2. USB-TO-I2C dongle
    a. Dongle
    b. Custom 4-pin connector that connects the USB-TO-I2C dongle to the EVK assembly.

Required Equipment

ACT88325EVK1-101

USB-TO-I2C Dongle

Power supply – 3.5V @ 4A for full power operation

Oscilloscope – >100MHz, >2 channels

Loads – Electronic or resistive. 3A minimum current capability.

Digital Multi-meters (DMM)

Windows compatible computer with spare USB port.

Hardware Setup

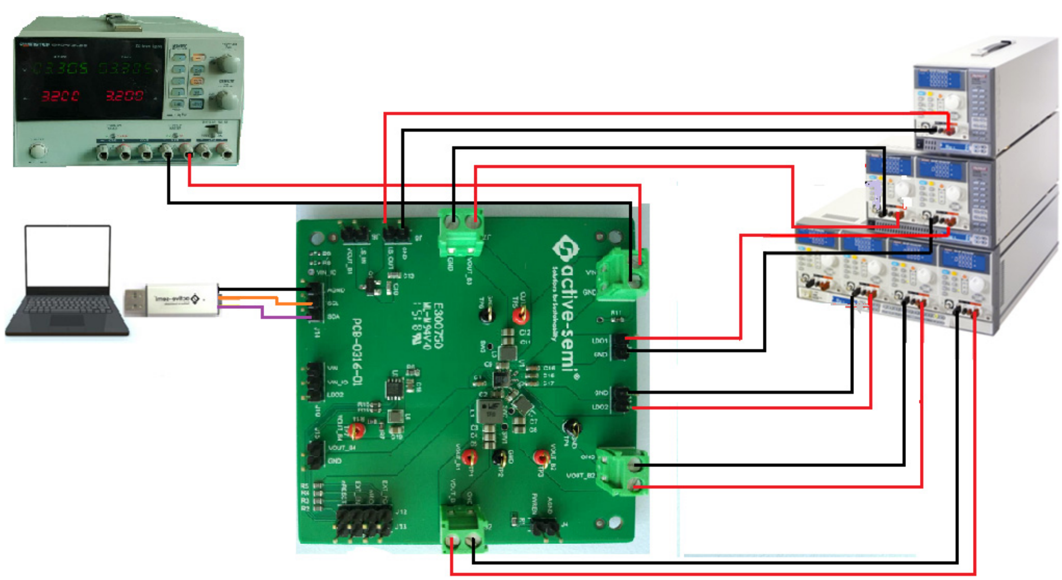


Figure 2 – EVK Setup

Quick Start

Hardware Connections

Refer to Figure 2 for hardware connections.

1. Decide which voltage will power VIN_IO. Active Semi recommends powering VIN_IO from the VIN input voltage. Connect a shorting jumper between J10-2 and J10-3 header to power VIN_IO from the VIN input voltage.

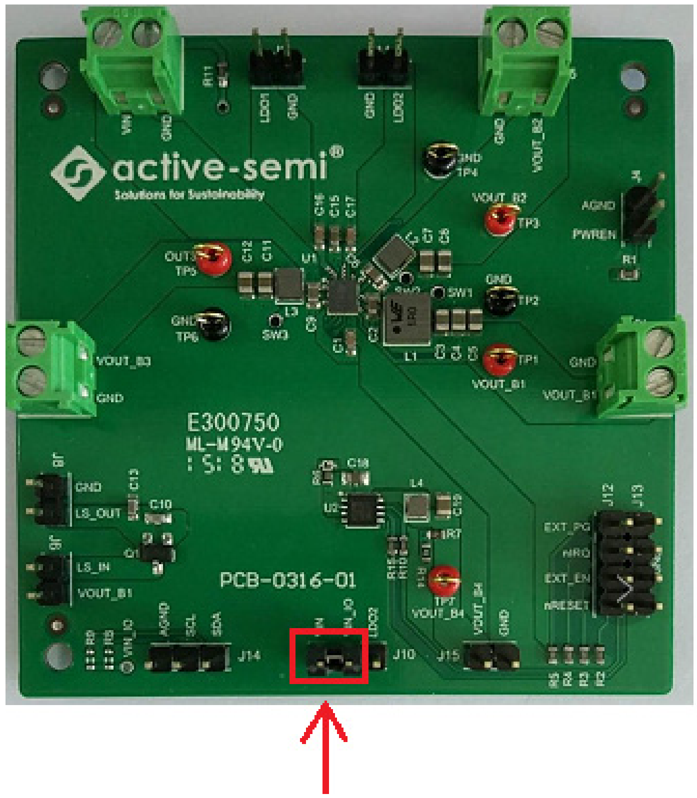


Figure 3 – Shorting Jumper Settings

2. Connect a lab supply betweenJ1-1 and J1-2 to power VIN for the buck power supplies. Note that this is the same input voltage to the LDOs. Separating the buck and LDO input voltage sources requires careful consideration of startup sequencing.
3. Be careful to keep the input voltage within the specifications.
4. Connect an appropriate load to each power supply output.
5. Optional - Connect the EVK to the PC with the USB dongle.
6. Connect Digital Multi-Meters to the voltages of interest.
7. Apply 3.3V input power.

GUI Setup (optional)

1. Refer to the end of this document for detailed instructions to install the ACT88325 GUI.
2. Connect the USB-TO-I2C dongle to the computer.
3. Connect the USB-TO-I2C dongle to the EVK J14 connector. Refer to Figure 4 to ensure the correct polarity of the connection. As a guide, use the “Active-Semi” logo on the top of the dongle so the black wire is connected to the Dongle GND pin.

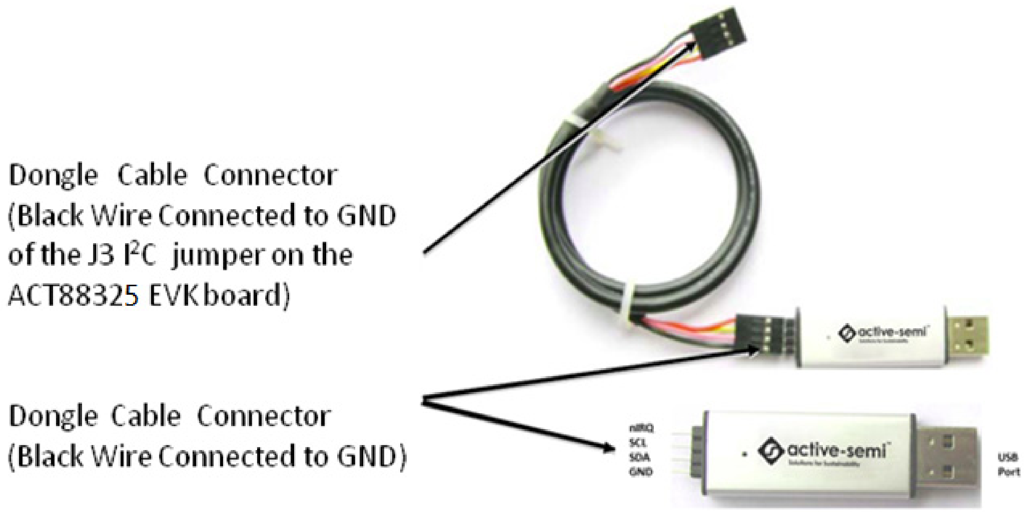


Figure 4 – USB-TO-I2C Dongle Connection

Recommended Operating Conditions

The ACT88325EVK1-101 is designed for a 3.3V input voltage. The maximum operating voltage is determined by the IC's maximum input voltage rating. The minimum operating voltages are determined by the buck converters' minimum input voltage and by the LDOs' dropout voltages. Maximum currents are determined by the IC's CMI settings, which can be changed via I²C after startup.

Table1. Recommended Operating Conditions

Parameter	Description	Min	Typ	Max	Unit
VIN	All buck input voltages	2.7		5.5	V
I_{B1_max}	Maximum Buck 1 load current	4.0			A
I_{B2_max}	Maximum Buck 2 load current	3.0			A
I_{B3_max}	Maximum Buck 3 load current	2.0			A
I_{LDO1_max}	Maximum LDO 1 load current		0.3		A
I_{LDO2_max}	Maximum LDO 2 load current		0.3		A

Hardware Configuration

Input Voltage: Note that the ACT88325EVK1-101 uses the ACT88325VA101 IC. This IC can accept up to a 5.5V input voltage. However, the ACT88325VA101 IC is designed for a 3.3V input and shuts off if VIN goes higher than 3.7V. Use the GUI to increase the SYSMON voltage to evaluate input voltages higher than 3.7V.

BUCK1: The ACT88325 BUCK1 output can be operated as a buck converter or in bypass mode. The CMI 101 is configured for bypass mode and passes the input voltage straight through to the output. Even though BUCK1 is in bypass mode, the EVK still populates the BUCK1 inductor, L1, so other CMI options can be easily evaluated on the PCB.

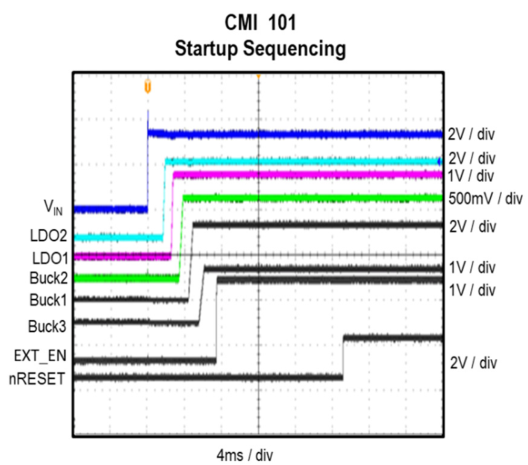
ACT8310 External Supply: The EVK includes an external power supply, ACT8310, to demonstrate the ICs sequencing capability. The ACT88325 EXT_EN output enables the ACT8310 at the proper time in the turn-on sequencing. This external supply can be used to evaluate the flexible sequencing options in other CMI options.

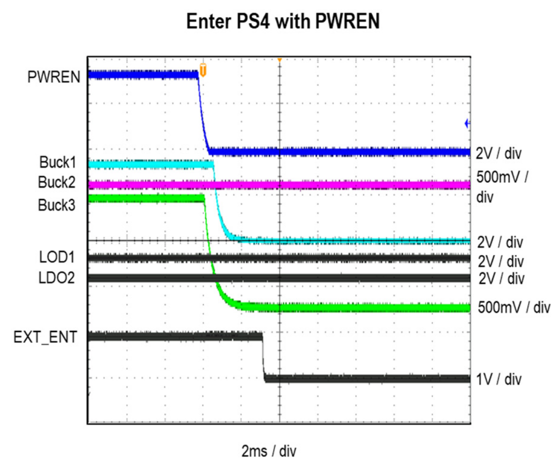
DPSLP Function: The PWREN pin is configured to put the IC into DPSLP Mode to provide the SM2263 processor the PS4 power mode. Pull PWREN to ground by placing a shorting jumper on J4 to enter DPSLP mode. This turns off outputs BUCK1, BUCK3, and EXT_EN.

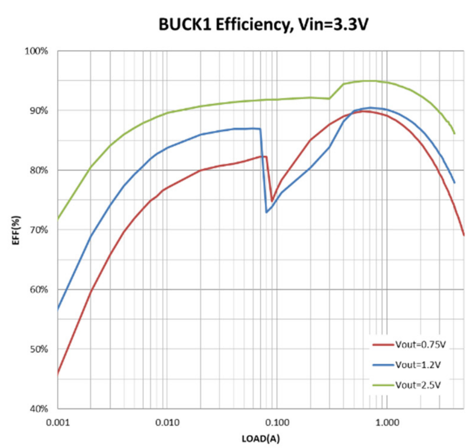
BUCK3 Output Voltage Select: Select BUCK3=1.2V by leaving nIRQ, GPIO3, high. Select BUCK3=1.8V by shorting nIRQ to ground.

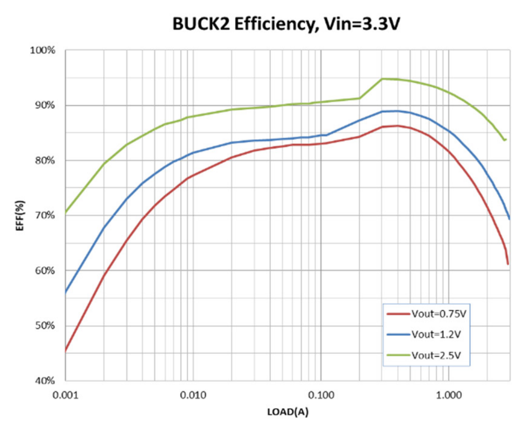
DVS: BUCK2 is 0.9V in normal operation and 0.75V in DVS mode. Pull EXT_PG, GPIO4 to ground to enable DVS mode.

Test Results

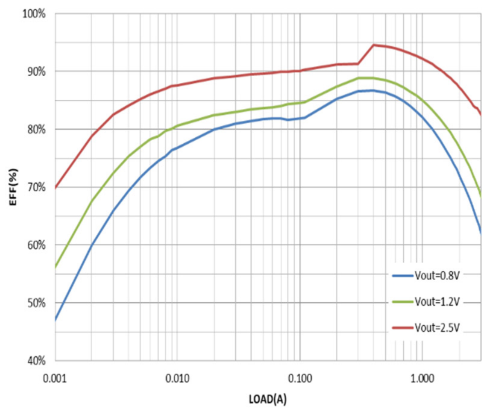




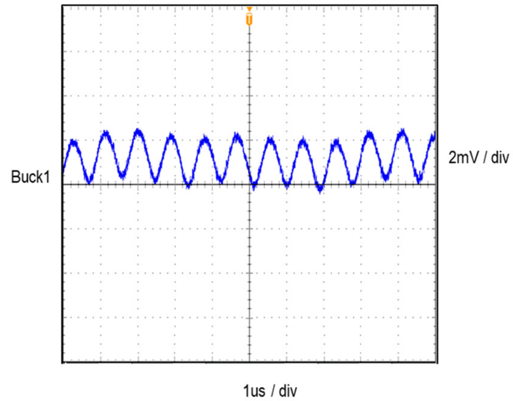




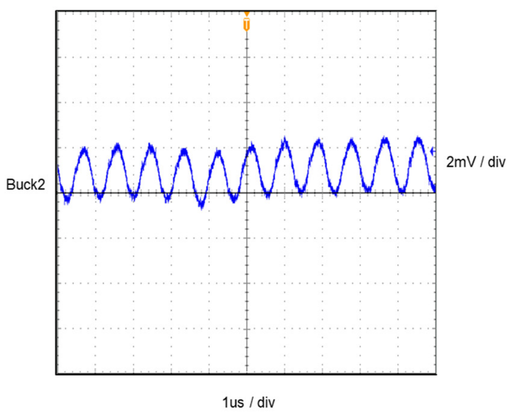
BUCK3 Efficiency, Vin=3.3V



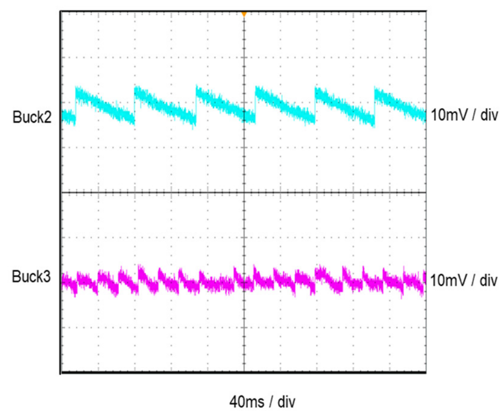
Buck1 Voltage Ripple
PWM Mode



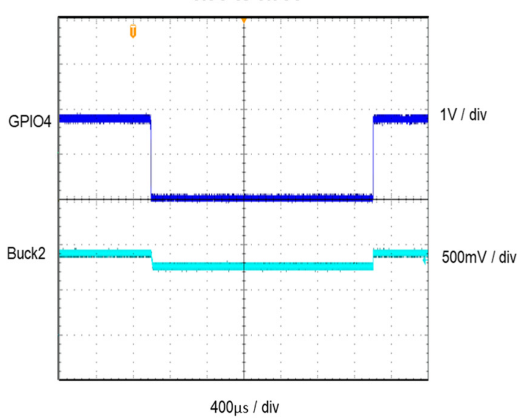
Buck2 Voltage Ripple
PWM Mode



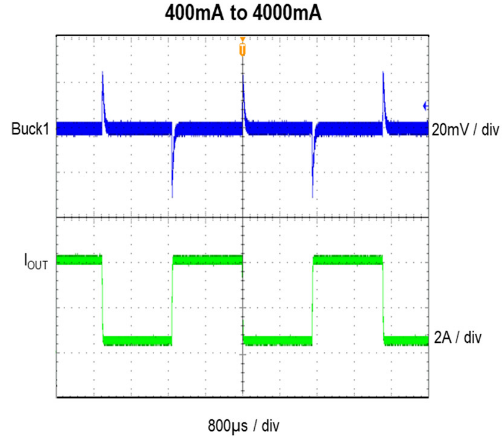
Output Voltage Ripple
PFM Mode



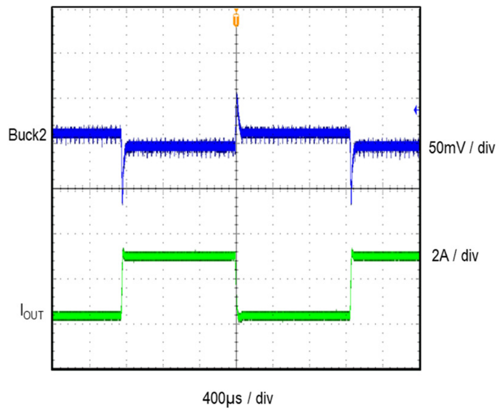
DVS Transition
Buck2
0.9V to 0.75V



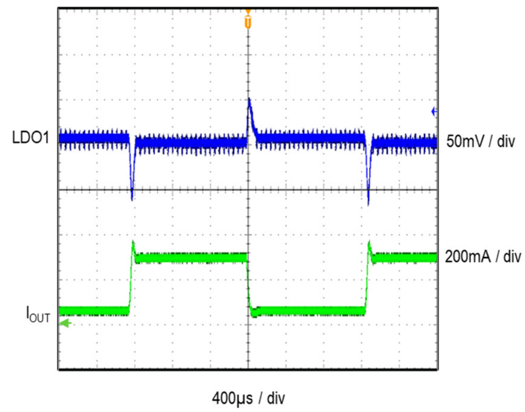
Load Transient
Buck1 Vout=0.8V
400mA to 4000mA



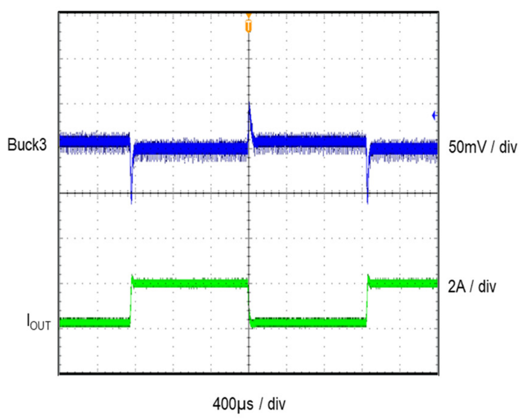
Load Transient
Buck2 Vout=0.9V
300mA to 3000mA



Load Transient
LDO1-Vout=1.8V
30mA t0 300mA



Load Transient
Buck3 Vout=1.2V
200mA to 2000mA



Schematic

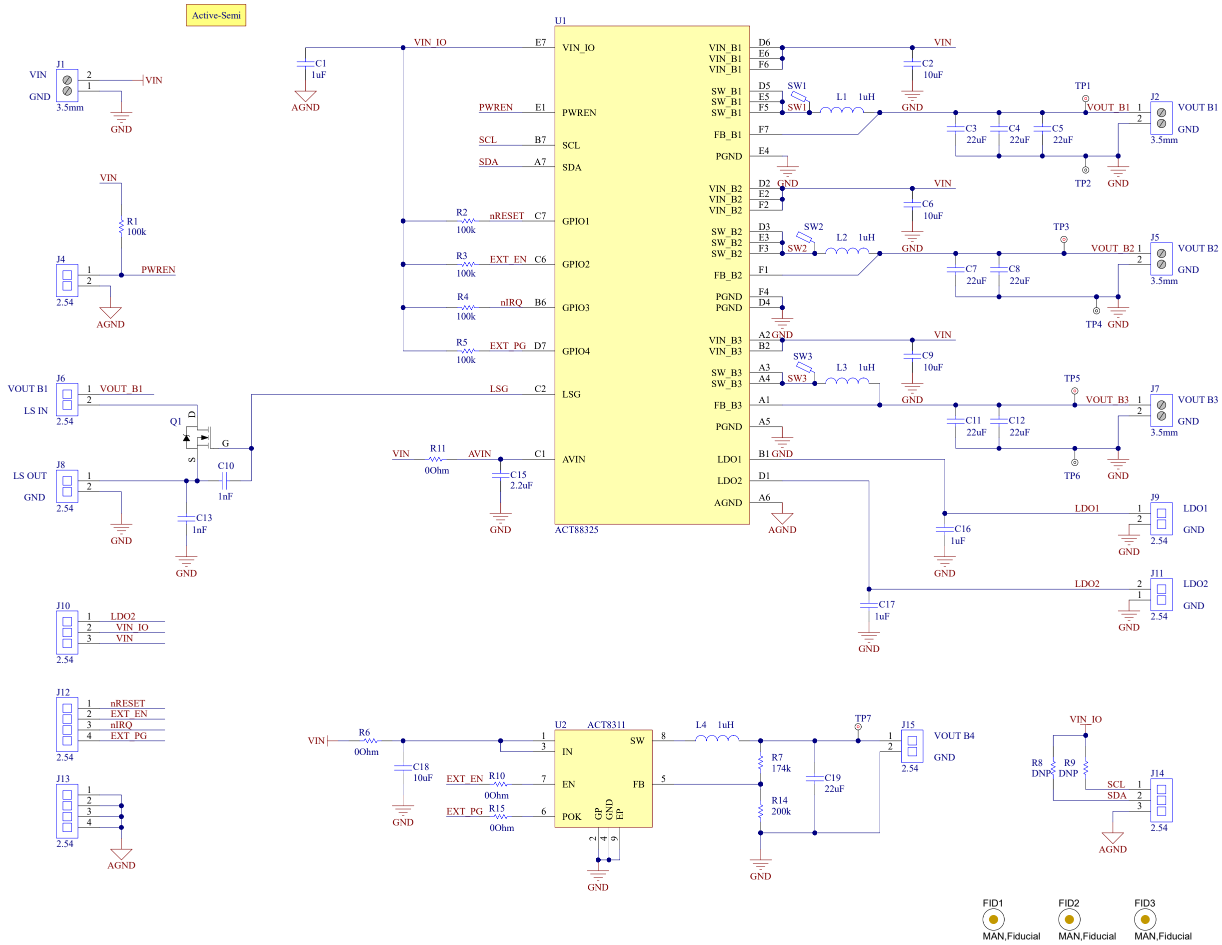


Figure 5 – ACT88325EVK1-101 Schematic

Layout

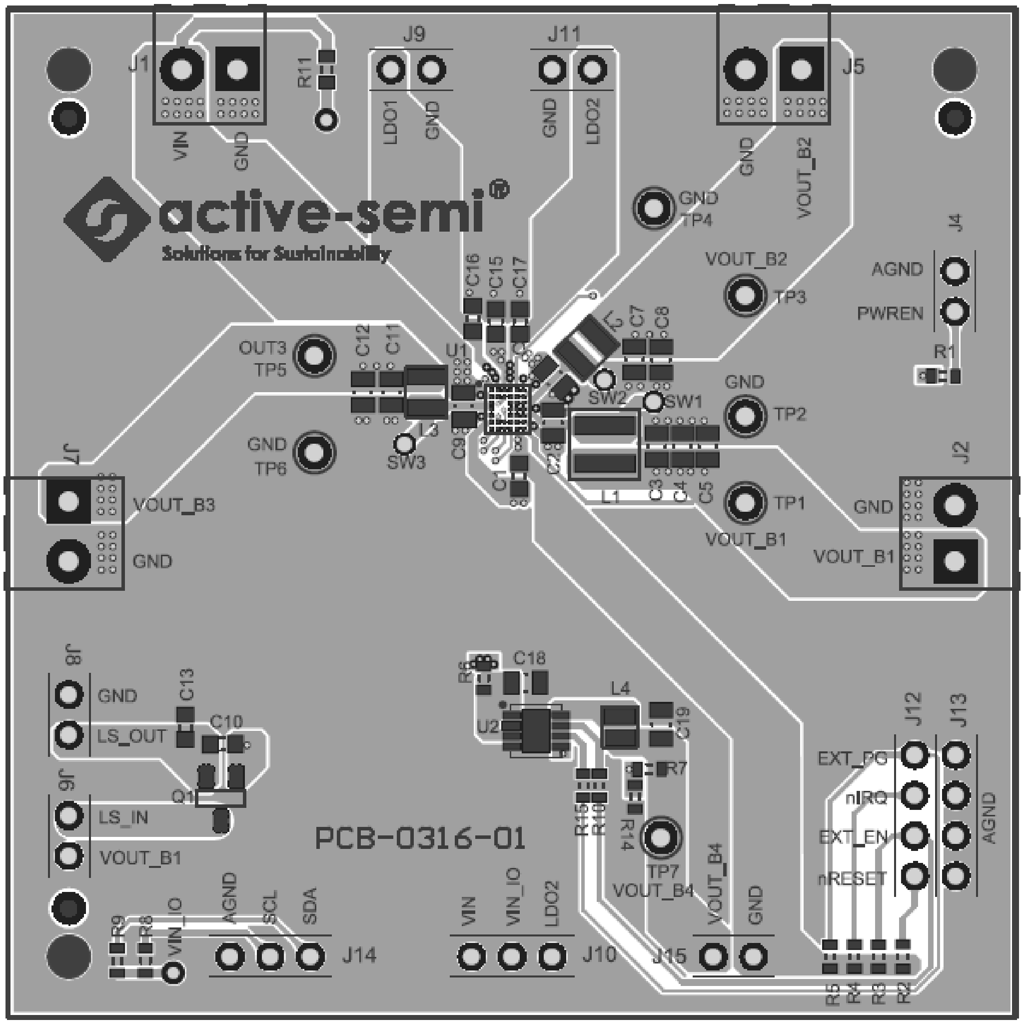


Figure 6 – Layout Top Assembly

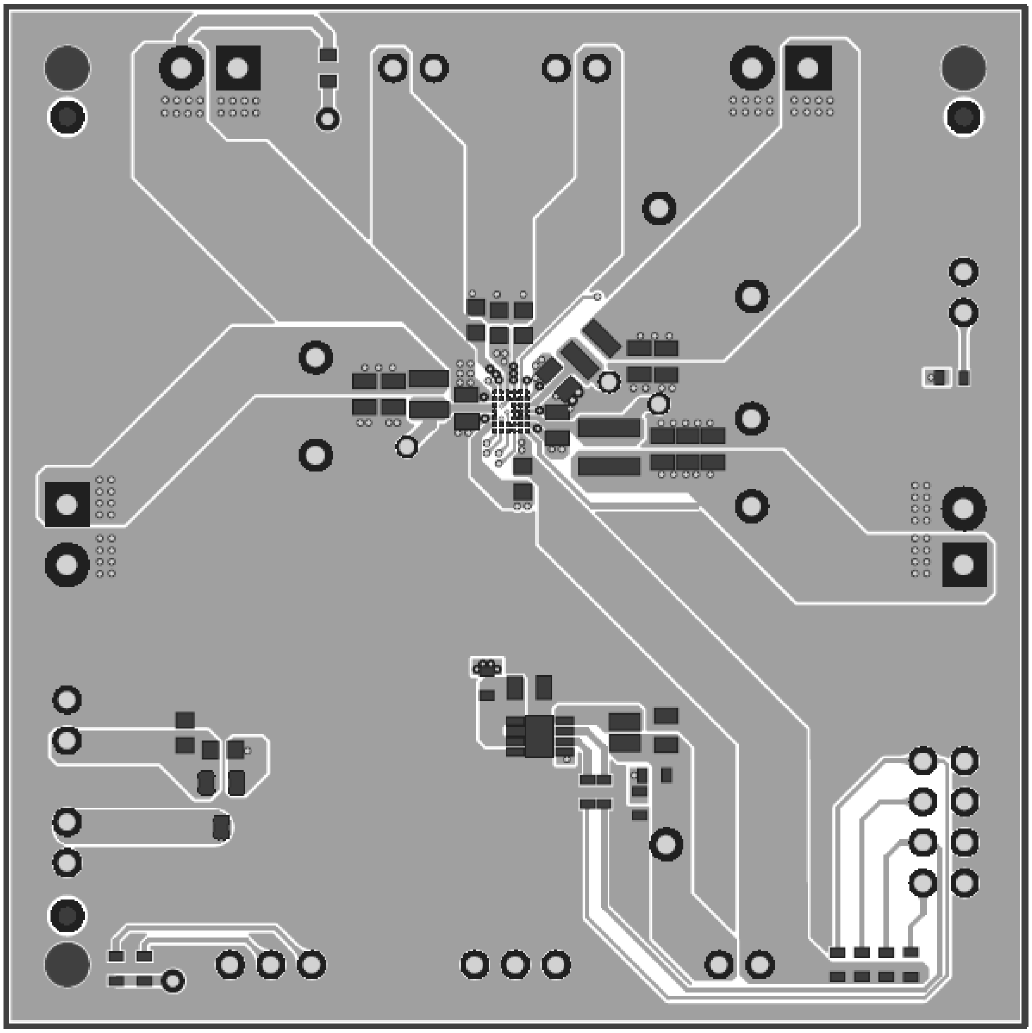


Figure 7 – Layout Top Layer

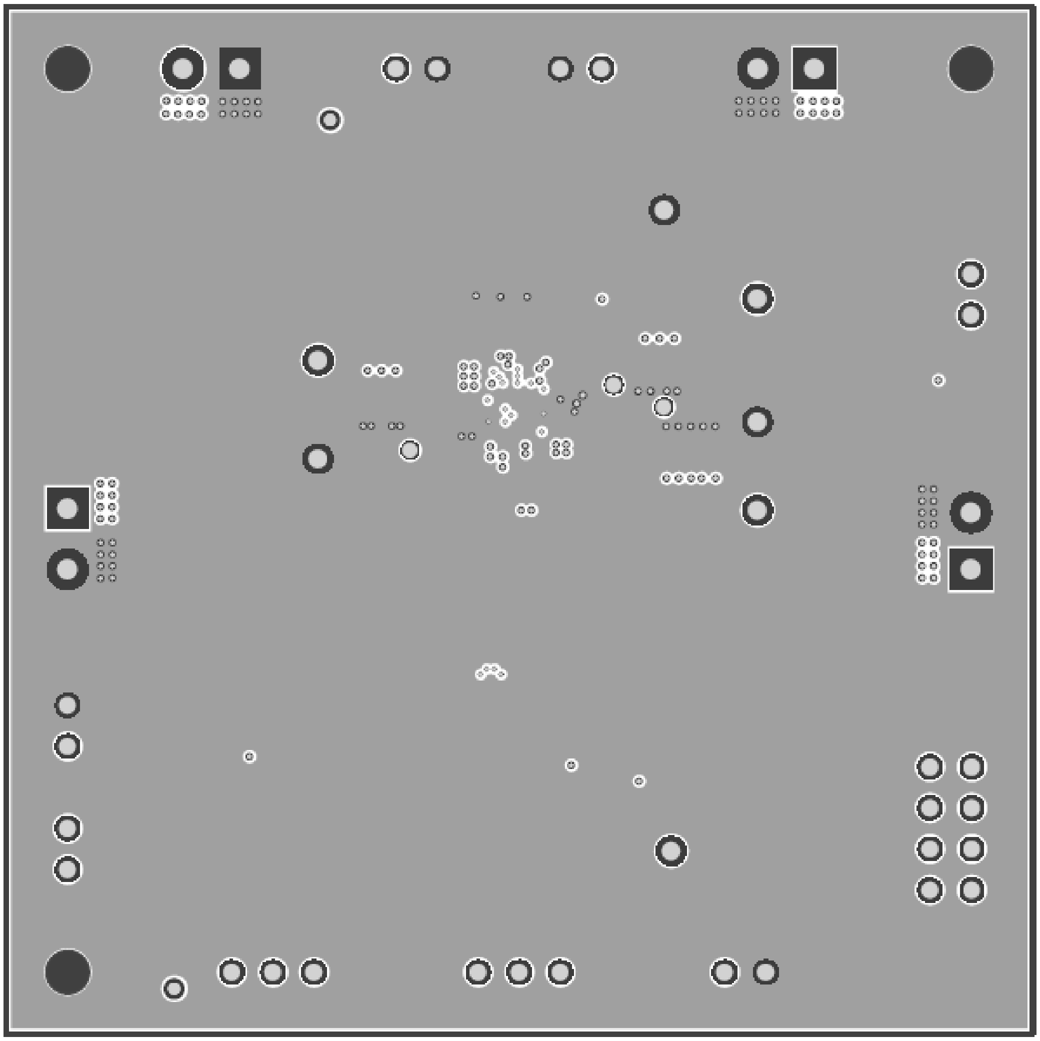


Figure 8 – Layout Layer 2

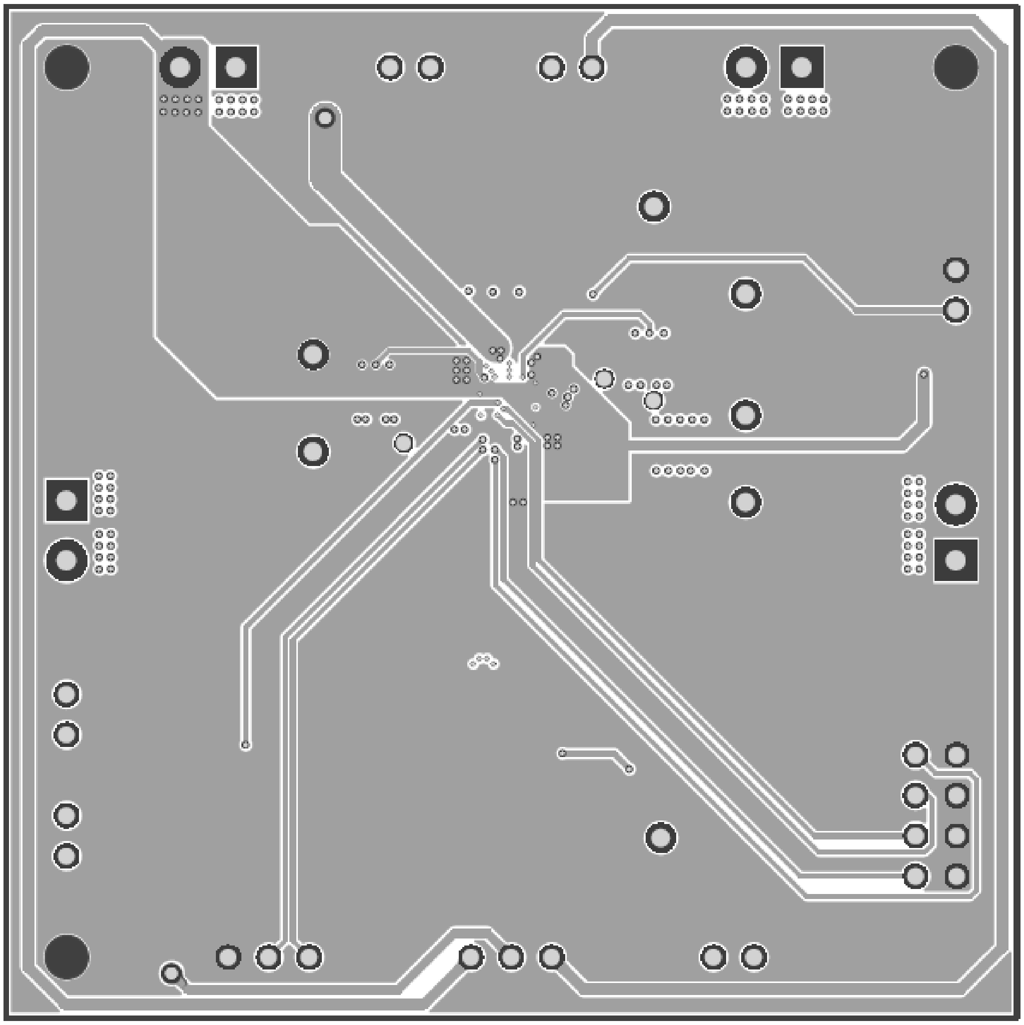


Figure 9 – Layout Layer 3

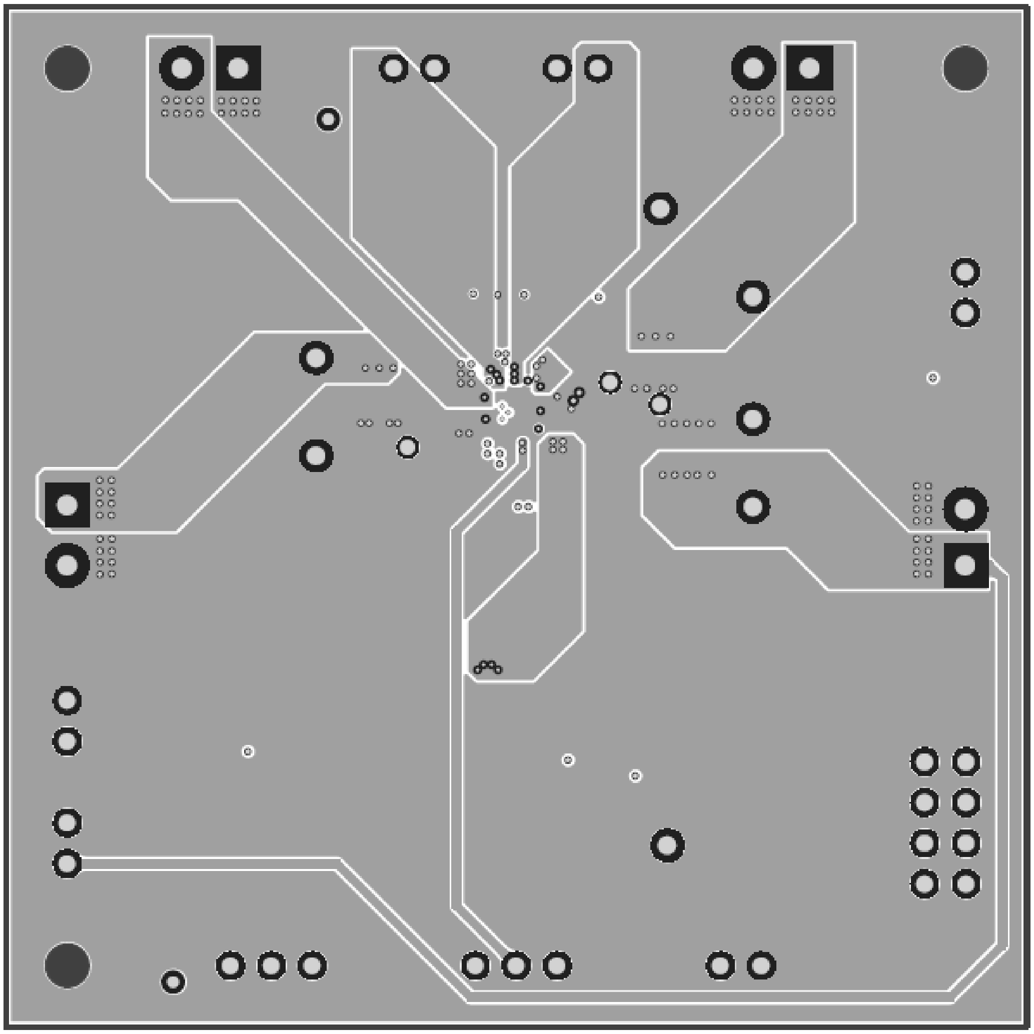


Figure 10 – Layout Bottom Layer

Bill of Materials

Table 2 - BOM

Item	Ref Des	QTY	Description	Package	MFR	Part Number
1	C1	1	Cap, Ceramic, 1uF, 6.3V, 20%, X5R	0603	Yageo	std
2	C2, C6, C9, C18	3	Cap, Ceramic, 10uF, 6.3V, 10%, X7R	0805	Yageo	std
3	C3, C4, C5, C7, C8, C11, C12, C19	8	Cap, Ceramic, 22uF, 10V, 100%, X7R	0805	Yageo	std
4	C10, C13	2	Cap, Ceramic,1nF, 10V, 10%, X5R	0603	Yageo	std
5	C15	1	Cap, Ceramic, 2.2uF, 10V, 10%, X5R	0603	Yageo	std
6	C16, C17	2	Cap, Ceramic, 1uF, 10V, 20%, X5R	0603	Yageo	std
7	J1, J2, J5, J7	4	Entry modular, 2 Pins, 3. 5mm		Wurth Elektronik	691214110002
8	J4, J6, J8, J9, J11, J15	6	Header, 2 pin	CON2	Wurth Elektronik	61300211121
9	J10, J14	2	Header, 3 pin	CON3	Wurth Elektronik	61300311121
10	J12, J13	2	Header, 4 pin	CON4	Wurth Elektronik	61300411121
11	L1	1	Inductor, 1uH, 7.2A, 12mohm	Wurth 4020	Wurth Elektronik	74438356010
12	L2, L3	2	Inductor, 1uH, 2.5A, 63mohm	Wurth 2510	Wurth Elektronik	74438323010
13	L4	1	Inductor, 1uH, 1.4A, 127mohm	Wurth 1610	Wurth Elektronik	74438313010
14	Q1	1	N-MOSFET, 30V/5.7A	SOT23	AOS	AO3404A
15	R1, R2, R3, R4, R5	5	Res, 100k, 1%	0603	Yageo	std
16	R6, R10, R11, R15	4	Res, 0Ω, 1%	0603	Yageo	std
17	R7	1	Res, 174kΩ, 1%	0603	Yageo	std
18	R8, R9	0	Res, 10kΩ, 1%	0603	Yageo	std
19	R14	1	Res, 200kΩ, 1%	0603	Yageo	std
20	TP1, TP3, TP5, TP7	4	Test Point, Red	0.063"	Keystone	5000
21	TP2, TP4, TP6	3	Test Point, Black	0.063"	Keystone	5001
22	U1	1	IC, ACT88325	SCP-36	Active-semi	ACT88325VA101-T
23	U2	1	IC, ACT8311, Buck converter	TDFN33-8	Active-semi	ACT8311NHADJ-T

GUI Installation

1. Get GUI files from the Active Semi website
2. Plug the USB-TO-I2C dongle into a free USB port.
3. Follow the instructions in the "How to install driver for dongle" folder.
4. Double click on the ACT88325 GUI.exe to start the ACT88325 GUI.

Driver	Nguyen Thi	Apr 19, 2018	—
How to install driver for dongle	Nguyen Thi	Apr 19, 2018	—
ACT88325 GUI Rev0.1.cpmu	Nguyen Thi	Apr 19, 2018	94 KB
Active Semi GUI and Dongle Driver Installation.pdf	Nguyen Thi	Mar 30, 2017	1 MB
ActiveGUI.exe	Nguyen Thi	Jun 5, 2017	3 MB

Figure 11 – Dongle Driver

GUI Overview

The GUI has 2 basic function buttons allocated in top-left of the Tool Bar which are Read and Write I2C. The GUI contains 2 setting modes: Basic Mode and Advanced Mode. In Basic Mode screen it displays basic user programmable configuration options are programmed using the drop-down boxes or check boxes. Advanced Mode contains the button text for changing setting for every single bit.

Basic Mode

The following figure shows the GUI in basic mode. This mode allows the user to easily change one or more IC settings.

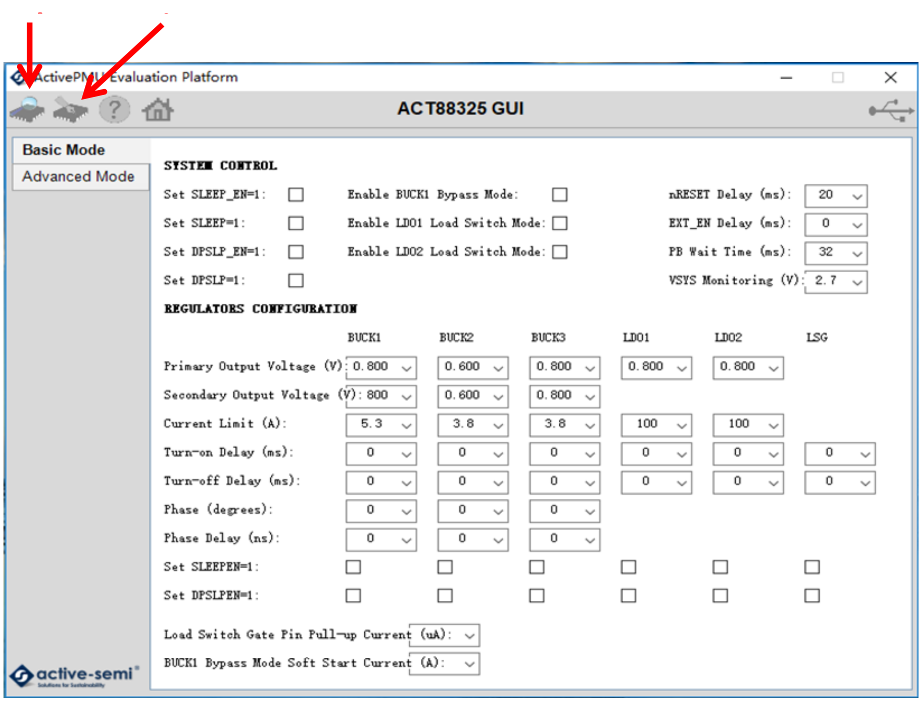


Figure 12 – GUI Basic Mode

Advanced Mode

Click the “Advanced Mode” button in the left of the GUI screen to see all available user programmable options. With Advanced Mode, additional user programmable features can be selected using the button text. In the left side of the Advanced Mode Screen, click on the Tiles Selector to display the register to view or change. Then change a register one bit at a time by clicking on the desired bit. The value of the bit is display right next to the bit-name button.

Note that the far right side of the screen contains a scroll down button to scroll down to additional registers since the Tile Screen can only display up to 8 bytes at once.

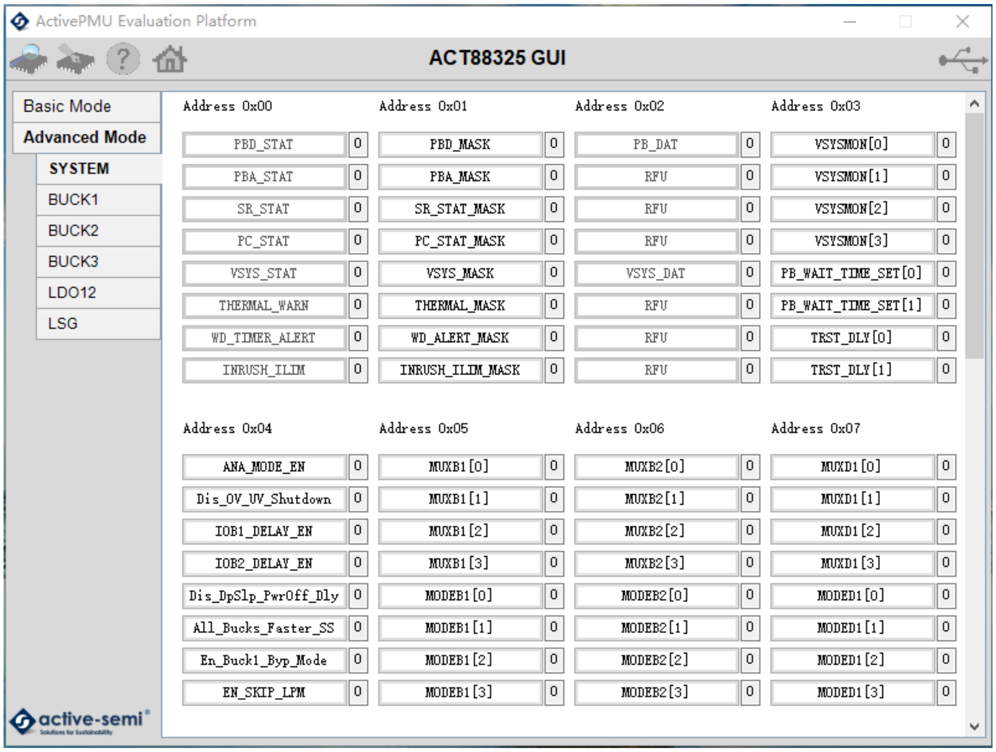


Figure 13 – GUI Advanced Mode

Button Descriptions

Read: Clicking on this button reads the ACT88325 registers and displays them in the GUI. Note that this reads all registers. Active-Semi recommend spreading registers each time the ACT88325 powers-up to acquire the initial register settings. Active-semi also recommends reading registers after making changes to them. Immediately reading the registers after a write confirms the changes were properly stored.

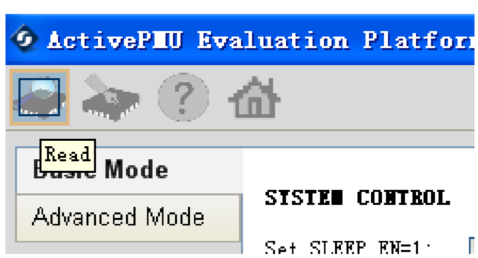


Figure 14 – Read Button