ACT88430EVK1-109 User's Guide

Description

This document describes the characteristics and operation of the Qorvo ACT88430EVK1-109 evaluation kit (EVK). It provides setup and operation instructions, schematic, layout, BOM, and test data. This EVK demonstrates the ACT88430VM109 Active PMU power management IC. Other ACT88430VMxxx 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 Qorvo's USB-TO-I2C interface dongle and use the GUI software. The EVK provides full access to 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 system.

Note that the ACT88430EVK1-109 is specifically configured for the ACT88430VM109.

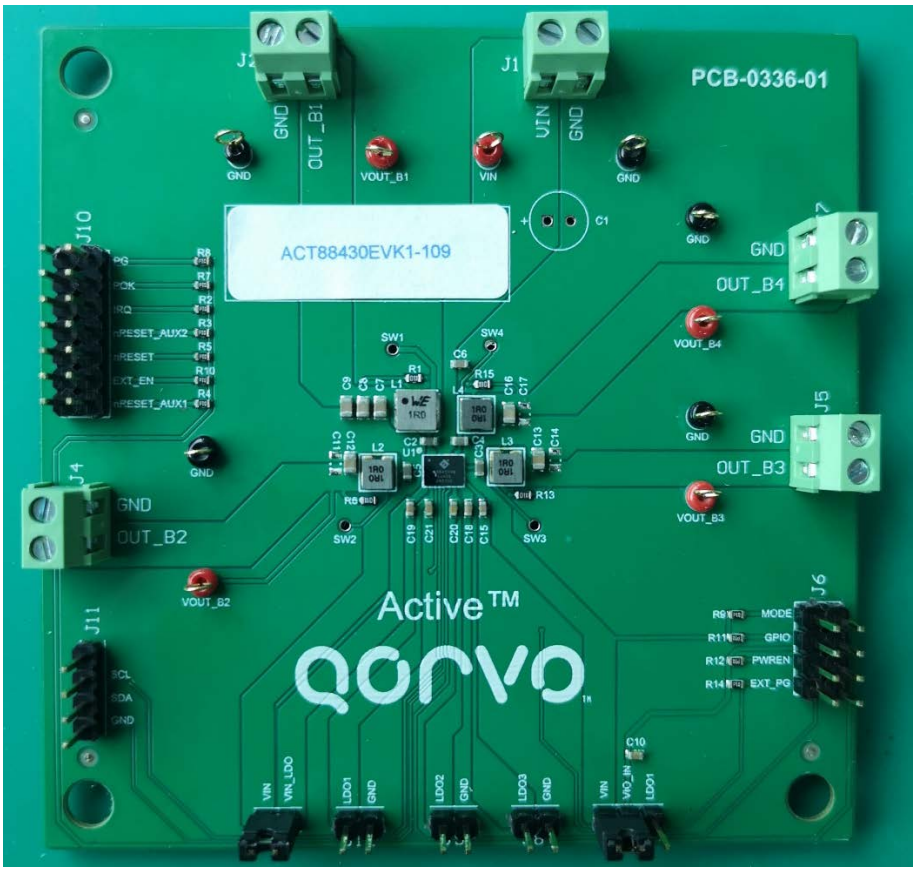


Figure 1– EVK Picture

EVK Contents

The ACT88430EVK1-109 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

ACT88430EVK1-109

USB-TO-I2C Dongle

Power supply – 5V @ 4A for full power operation

Oscilloscope – >100MHz, >2 channels

Loads – Electronic or resistive. 4.0A minimum current capability.

Digital Multi-meters (DMM)

Windows compatible computer with spare USB port.

Hardware Setup

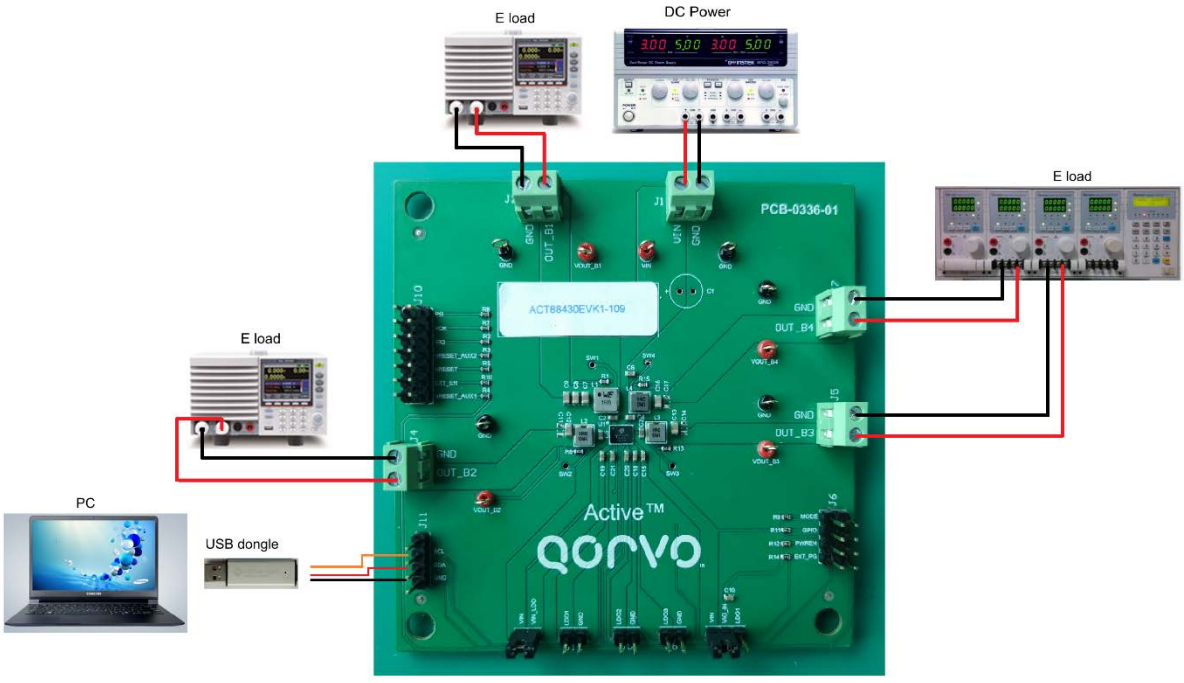


Figure 2 – EVK Setup

Quick Start

Hardware Setup

1. Decide which voltage will power VIO. Qorvo recommends powering VIO from VIN. Connect a shorting jumper between J3-1 and J3-2 to power VIO from VIN. Or connect a shorting jumper between J3-2 and J3-3 to power VIO from the LDO1 output voltage.
2. Connect a lab supply between J1-1 and J1-2 to power VIN.
3. Connect a shorting jumper between J13-1 to J13-2 to power the LDO input voltages from VIN.
4. Note that the typical setup is to apply the same 3.3V input voltage to all inputs. Using different input voltage sources requires careful consideration of startup sequencing.
5. Connect an appropriate load to each power supply output.
6. Turn on the lab supplies.
7. The outputs turn on automatically when voltage is applied to VIN.

GUI Setup (optional)

1. Refer to the end of this document for detailed instructions to install the ACT88430 GUI.
2. Connect the USB-TO-I2C dongle to the computer via a USB cable.
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 "Qorvo" logo or ("Active-Semi") logo on the top of the dongle so the black wire is connected to the Dongle GND pin.

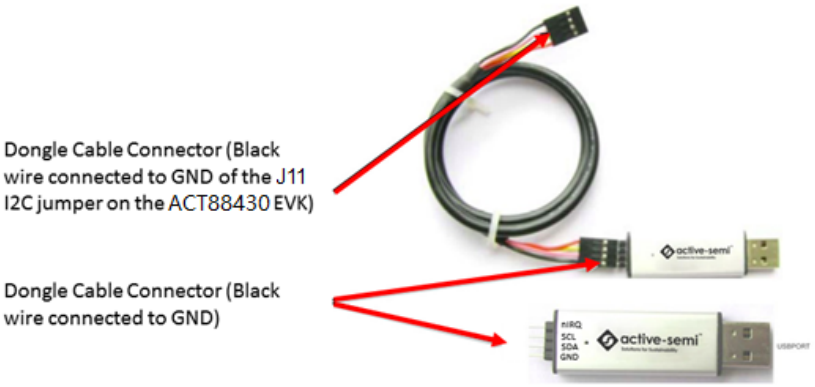


Figure 3 – USB-TO-I2C Dongle Connection

EVK Design Parameters

The ACT88430EVK1-109 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 converter's minimum input voltage and by the LDO's dropout voltages. Maximum currents are determined by the IC's CMI settings, which can be changed via I2C after startup.

Table 1. EVK Design Parameters

Parameter	Description	Min	Typ	Max	Unit
VIN	All buck input voltages	3	3.3	3.6	V
VIN_LDO1	LDO1 input voltage	3	3.3	3.6	V
VIN_LDO23	LDO23 input voltage	3	3.3	3.6	V
I_{B1_max}	Maximum Buck 1 load current		4.0		A
I_{B2_max}	Maximum Buck 2 load current		2		A
I_{B3_max}	Maximum Buck 3 load current		2		A
I_{LDO1_max}	Maximum LDO 1 load current		0.15		A
I_{LDO2_max}	Maximum LDO 2 load current		0.15		A
I_{LDO3_max}	Maximum LDO 3 load current		0.15		A

EVK Operation

Turn On

Apply the 3.3V input voltage. All outputs automatically turn on with the programmed startup sequence.

Sleep Mode

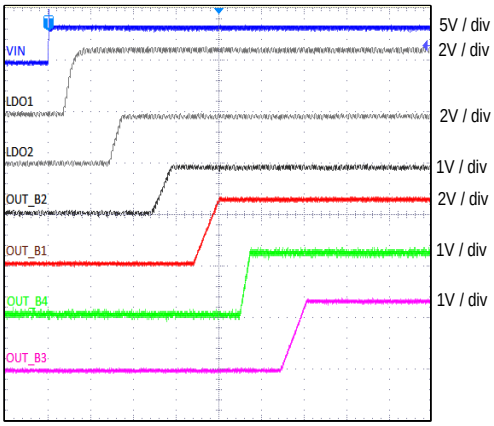
After all outputs are turned on, enter Sleep Mode by pulling PWREN low. In Sleep Mode, Buck1/3/4 and LDO3 outputs turn off, Buck2 and LDO1/2 output stay on.

MODE

Setting MODE = 1 configures Buck1 as an integrated bypass switch.
Setting MODE = 0 configures Buck1 as a standard integrated buck regulator. Buck1 outputs 2.5V when MODE=0 for ACT88430VM109.

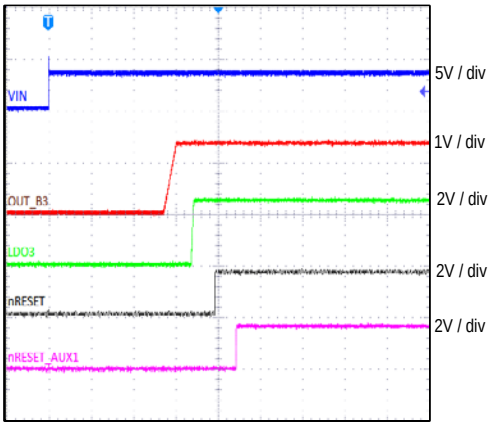
Test Results

CMI 109
Startup with Hot Plug



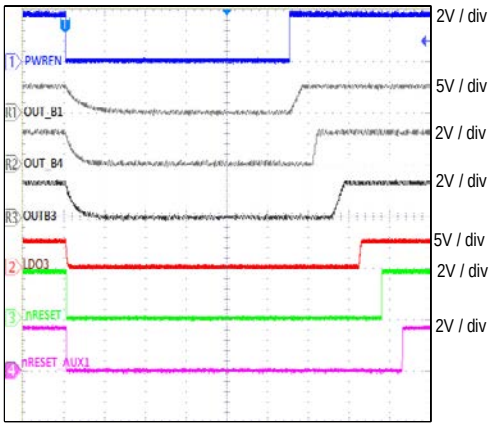
1ms / div

CMI 109
Startup with Hot Plug



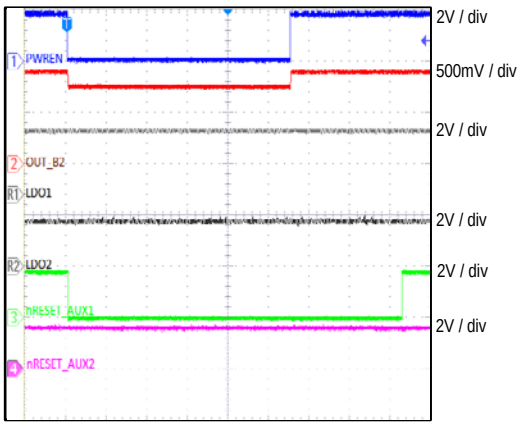
2ms / div

CMI 109
Entry and Exit Sleep Mode



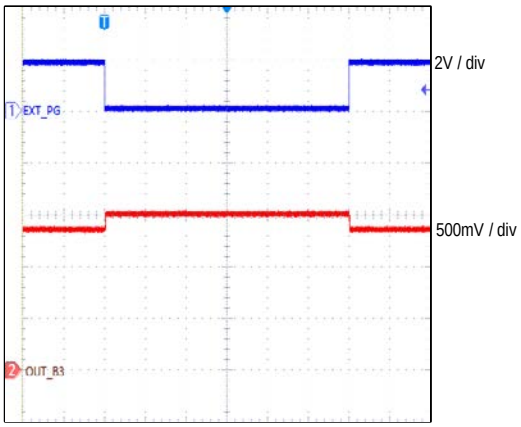
2ms / div

CMI 109
Entry and Exit Sleep Mode



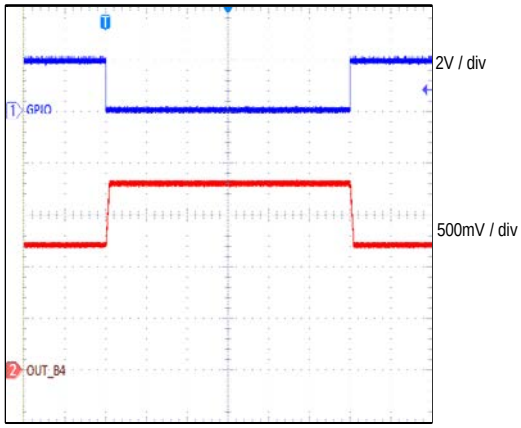
2ms / div

CMI 109
Buck3 Boot up Voltage



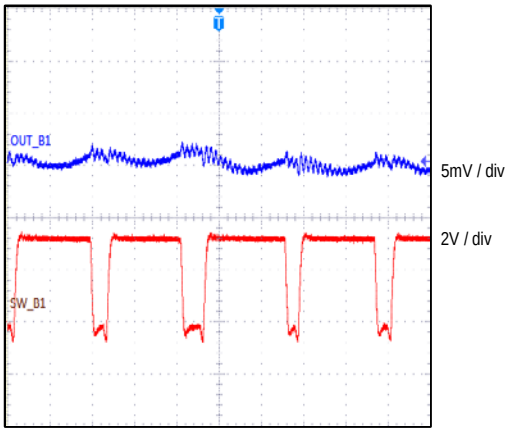
2ms / div

CMI 109
Buck4 Boot up Voltage



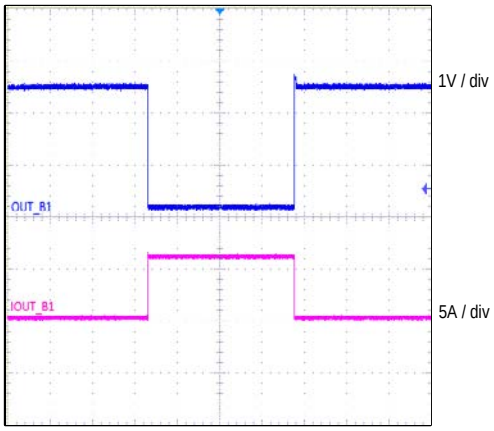
2ms / div

CMI 109
Buck1 Ripple and SW@4A,MODE=L



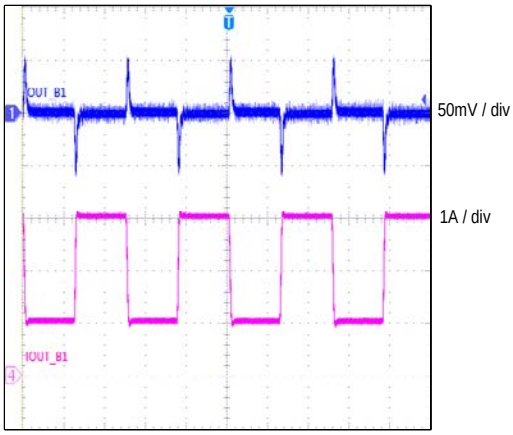
200ns / div

CMI 109
Buck1 Short and Recovery



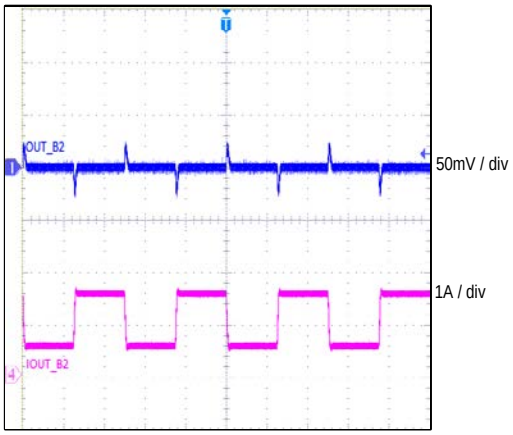
400ms / div

CMI 109
Buck1 Load Transient



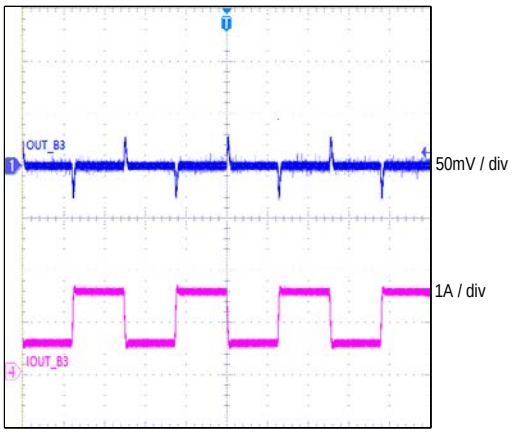
400us / div

CMI 109
Buck2 Load Transient



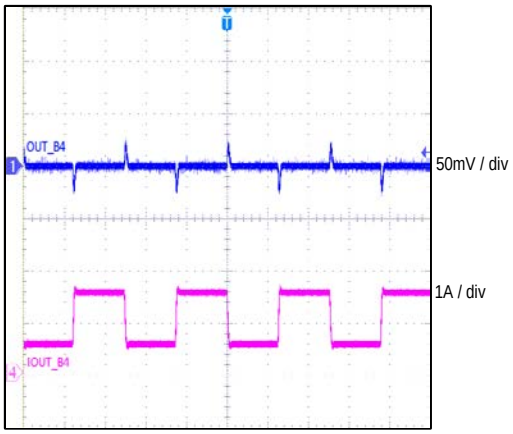
400us / div

CMI 109
Buck3 Load Transient



400us / div

CMI 109
Buck4 Load Transient



400us / div

Schematic

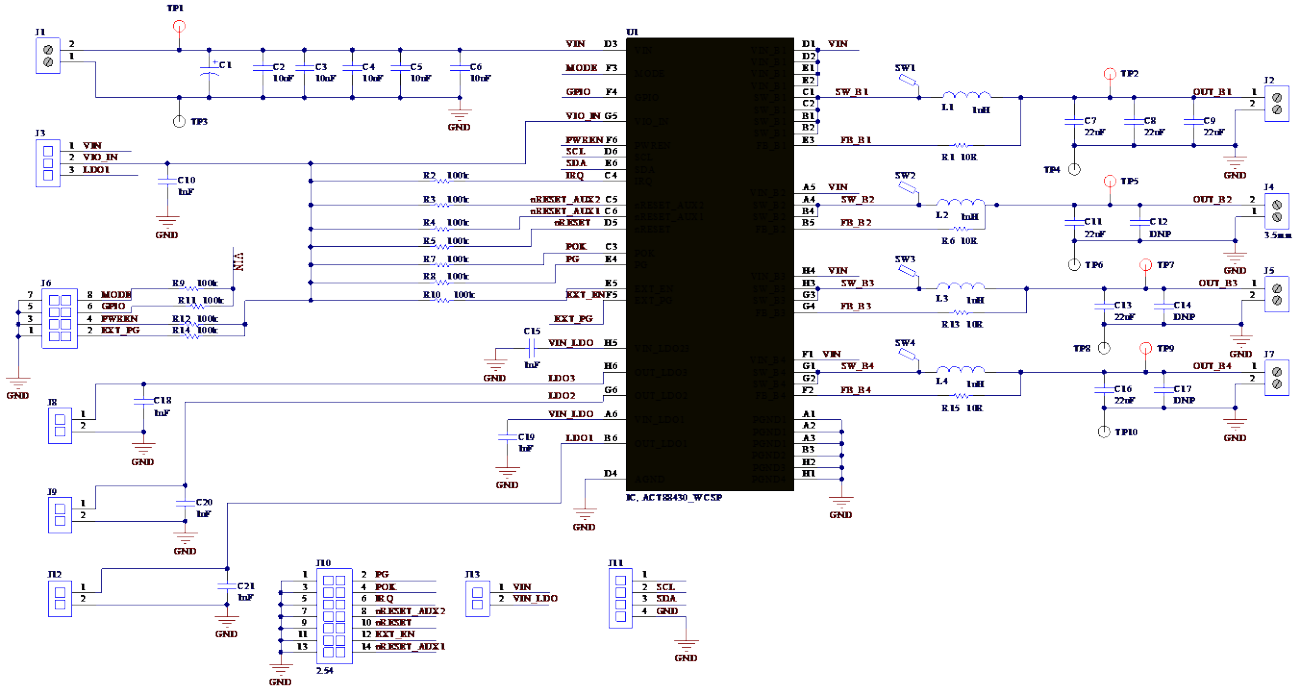


Figure 4 – ACT88430 EVK1-109 Schematic

Layout

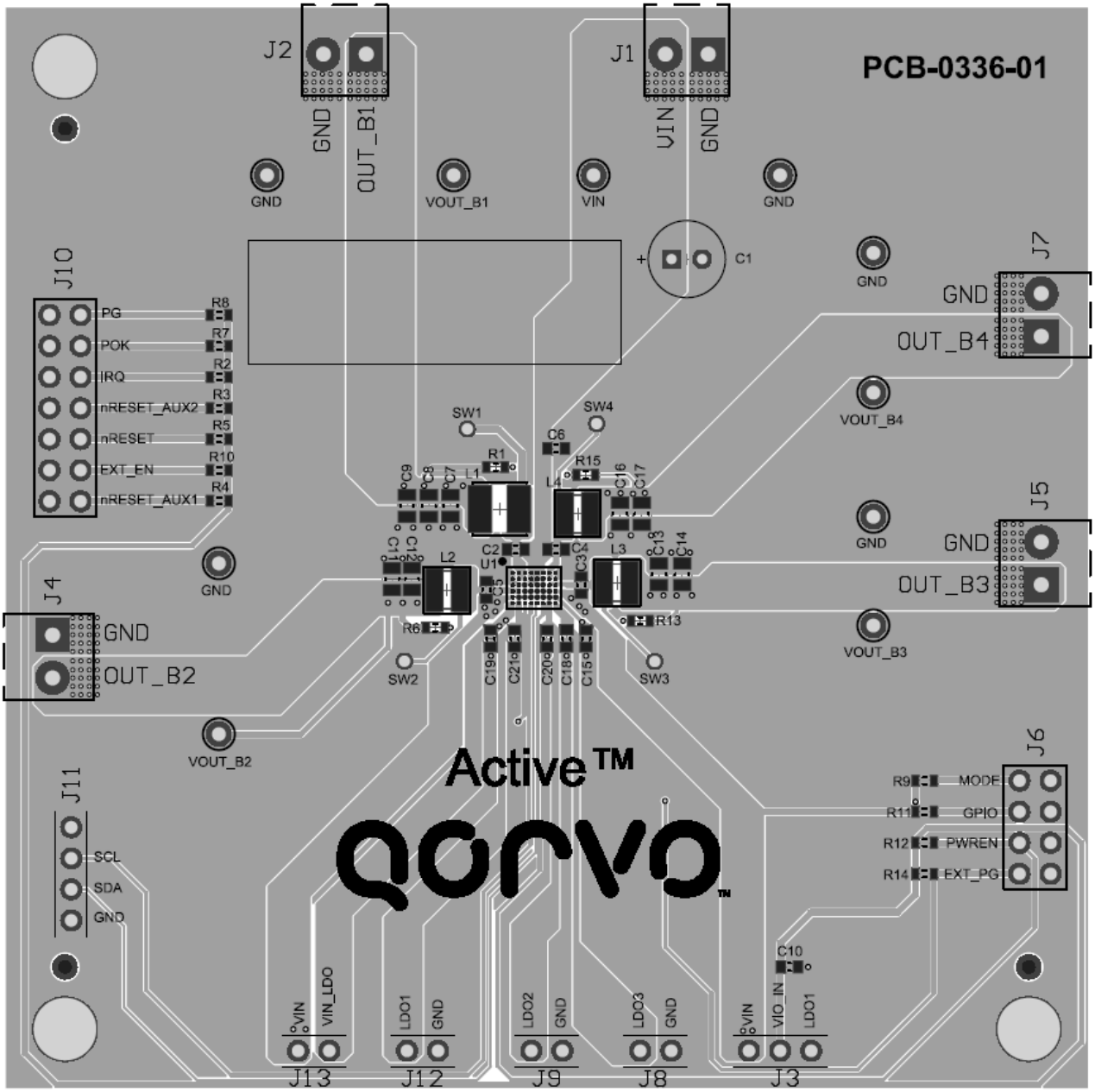


Figure 5 – Layout Top Layer

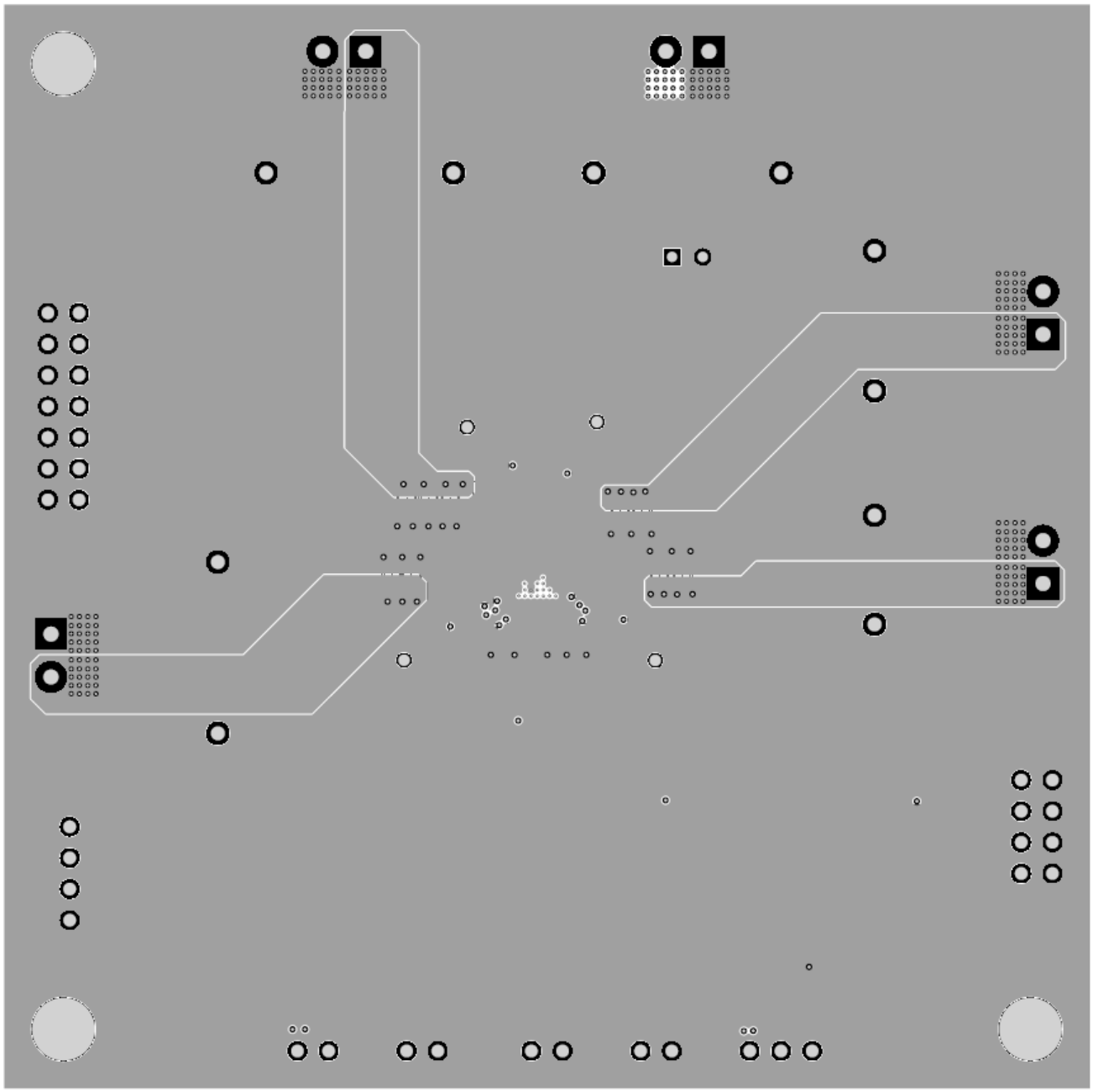


Figure 6 – Layout Layer 2

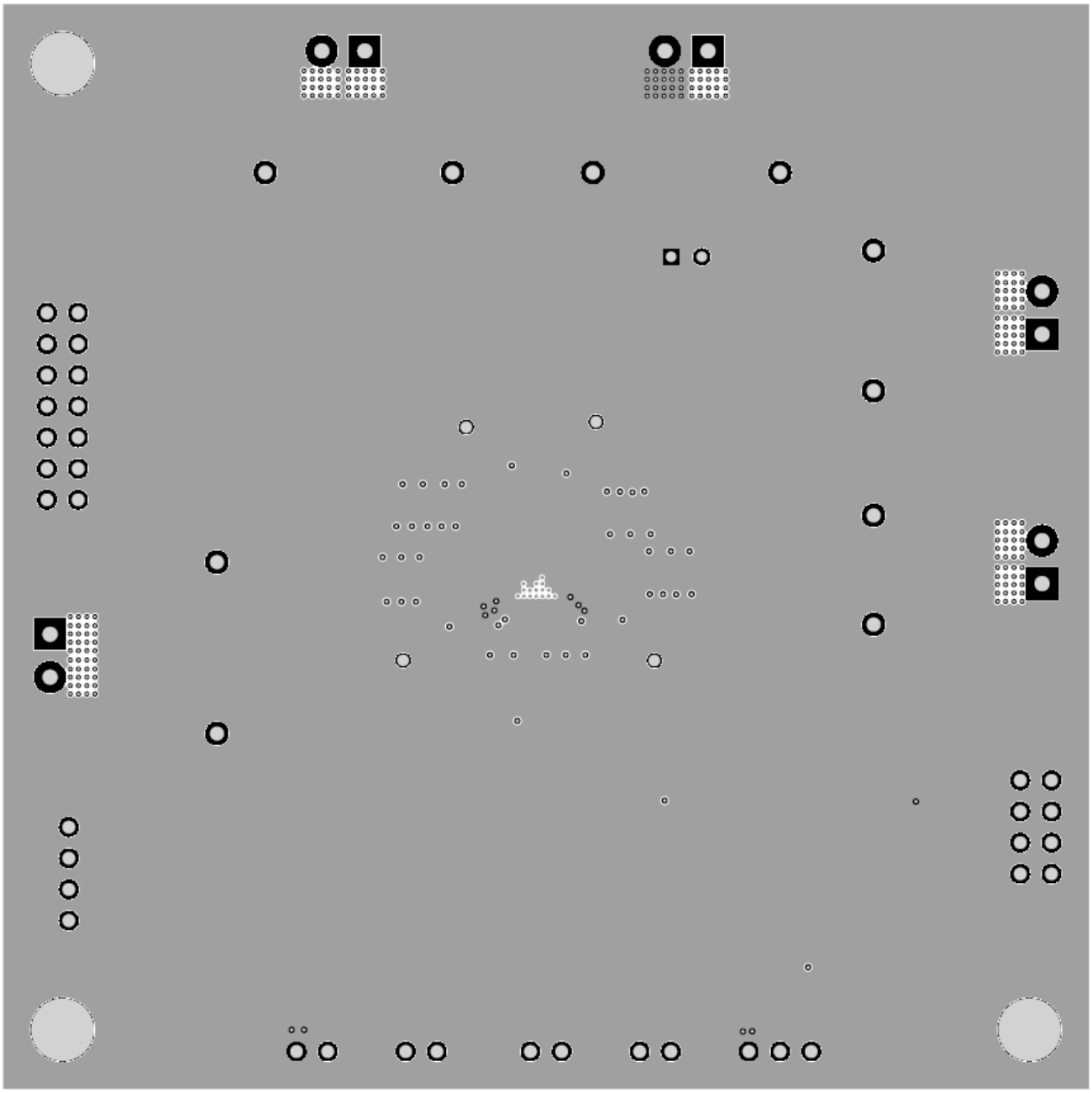


Figure 7 – Layout Layer 3

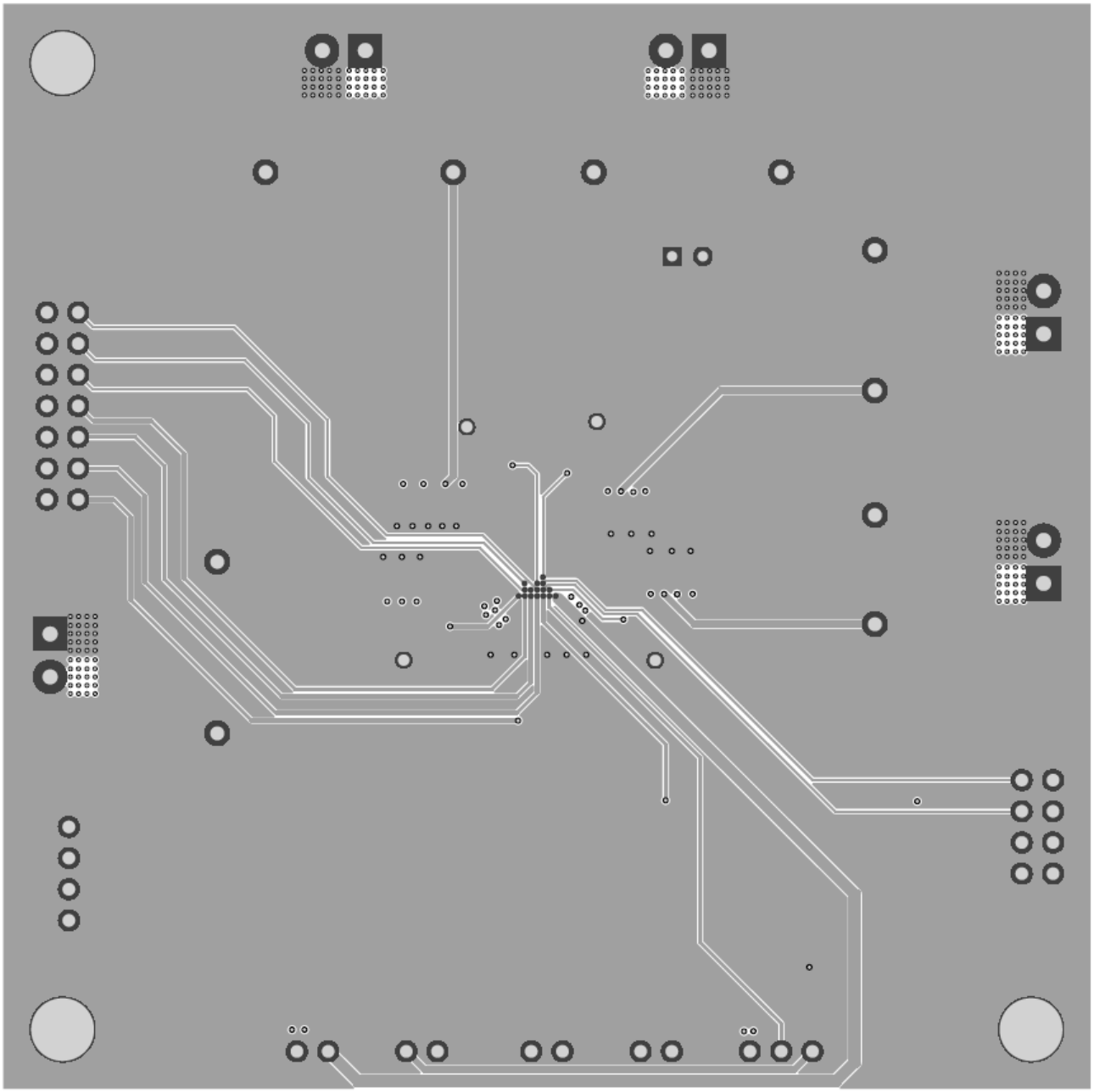


Figure 8 – Layout Bottom Layer

Bill of Materials

Table 2 – BOM

Item	Designator	Quantity	Description	Package	Manufacturer	Part Number
1	C1	0	Cap, Aluminum,100uF, 16V	6.3*11mm	Wurth Elektronik	860040373002
2	C2, C3, C4, C5, C6,	5	Cap, Ceramic, 10uF, 16V, 20%, X5R	0603	std	std
3	C7, C8, C9, C12, C13, C16,	6	Cap, Ceramic, 22uF, 16V, 20%, X5R	0805	std	std
4	C11, C14, C17	0	Cap, Ceramic, 22uF, 16V, 20%, X5R	0805	std	std
5	C10, C15, C18, C19, C20, C21	6	Cap, Ceramic, 1uF, 16V, 20%, X5R	0603	std	std
6	J1, J2, J4, J5, J7	5	CON, Screw Terminal, 3.50, 2P, KF350	n/a	Wurth Elektronik	691214110002
7	J3	1	Header, Unshrouded, 2.54, Male, 3P	CON3	Wurth Elektronik	61300211121
8	J6	1	Header, Unshrouded, 2.54, Male, 4x2P	CON4x2	Wurth Elektronik	61300821121
9	J8, J9, J12, J13	4	Header, Unshrouded, 2.54, Male, 2P	CON2	Wurth Elektronik	61300211121
10	J10	1	Header, Unshrouded, 2.54, Male, 7x2P	CON7x2	Wurth Elektronik	61301421121
11	J11	1	Header, Unshrouded, 2.54, Male, 4P	CON4	Wurth Elektronik	61300211121
12	L1	1	Inductor, 1uH	4020	Wurth Elektronik	74438356010
13	L2, L3, L4	3	Inductor, 1uH	3020	Wurth Elektronik	74438336010
14	R1, R6, R13, R15	4	Res, 10Ω, 5%	0603	std	std
15	R2, R3, R4, R5, R7, R8, R9, R10, R11, R12, R14	11	Res, 100kΩ, 5%	0603	std	std
16	TP1, TP2, TP5, TP7, TP9	5	TEST POINT PC MINI .040"D RED	n/a	Key Stone	5000
17	TP3, TP4, TP6, TP8, TP10	5	TEST POINT PC MINI .040"D BLK	n/a	Key Stone	5001
18	U1	1	IC, ACT88430, CSP	CSP	Qorvo	ACT88430VM109-T

GUI Installation

1. You can find the ACT88430 GUI files on the Qorvo website. Save them on your computer.
2. Plug the USB-TO-I^{2}C dongle into a free USB port.
3. Follow the instructions of “Qorvo's GUI and Dongle Driver Installation Rev1.1” in the “Driver” folder.
4. Double click on the ACT88430 GUI Rev2.0.exe to start the ACT88430 GUI.

Figure 9 – GUI Folder

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.

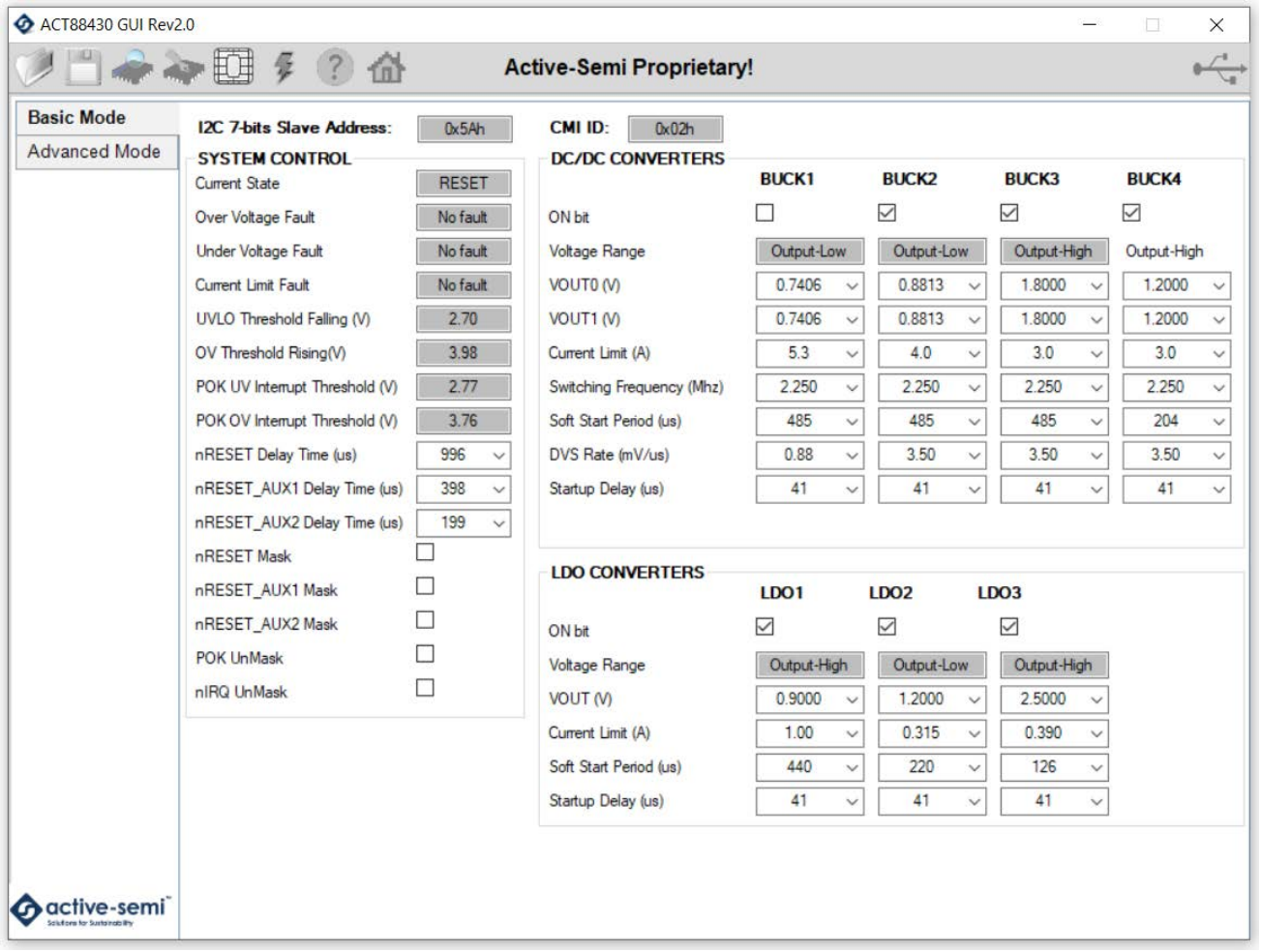


Figure 10 – GUI Basic Mode

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.

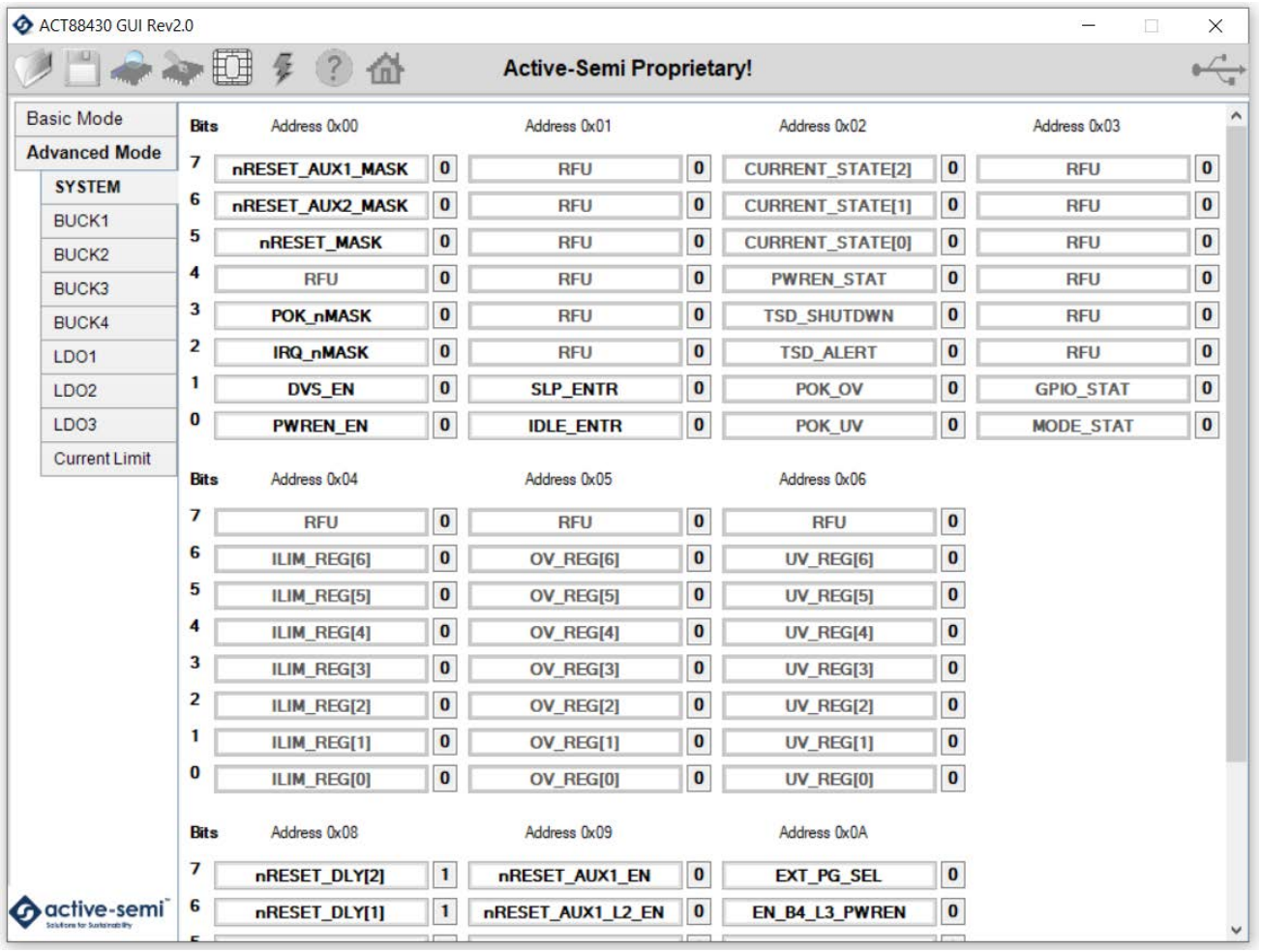


Figure 11 – GUI Advanced Mode

Button Descriptions

Read: Clicking on this button reads the ACT88430 registers and displays them in the GUI. Note that this reads all registers. Active-Semi recommends reading registers each time the ACT88430 powers-up to acquire the initial register settings. Qorvo also recommends reading registers after making changes to them. Immediately reading the registers after a write confirms the changes were properly stored. This also updates the SYSTEM STATUS box to ensure that one of the changes did not generate a fault condition.

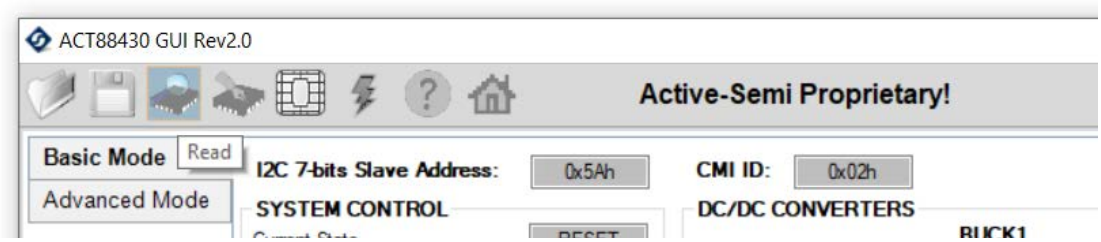


Figure 12 – Read Button

Write: Clicking on this button writes the GUI settings to the ACT88430's registers. All registers are written, regardless of whether or not they were changed.

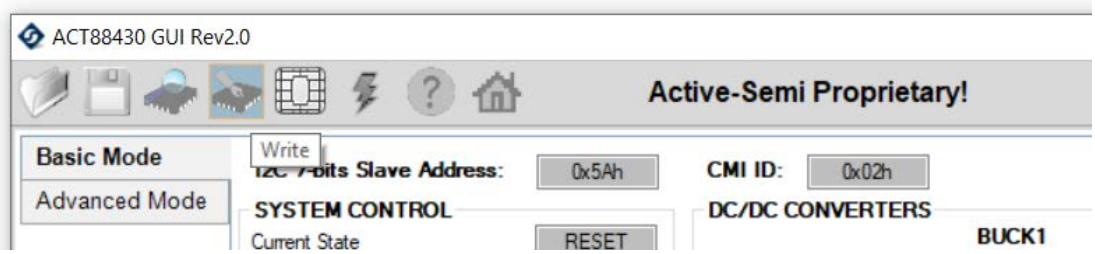


Figure 13 – Write Button

Dongle Connection Status: The GUI also contains a dongle is connected status which indicates that Active-Semi's USB-TO-I2C dongle is connected to the USB port of the driver installed. The figure below shows the two possible indication status graphics.

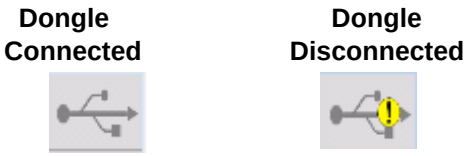


Figure 14– Dongle Connection Status