

## ACT81460EVK1-101 User's Guide

### Description

This document describes the characteristic and operation of the Active Semi ACT81460EVK1-101 evaluation kit (EVK). It provides setup and operation instructions, schematic, layout, BOM, and test data. This EVK demonstrates the ACT81460VM101 ActivePMU power management IC. Other ACT81460VMxxx 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 ACT81460EVK1-101 is specifically configured for the ACT81460VM101.

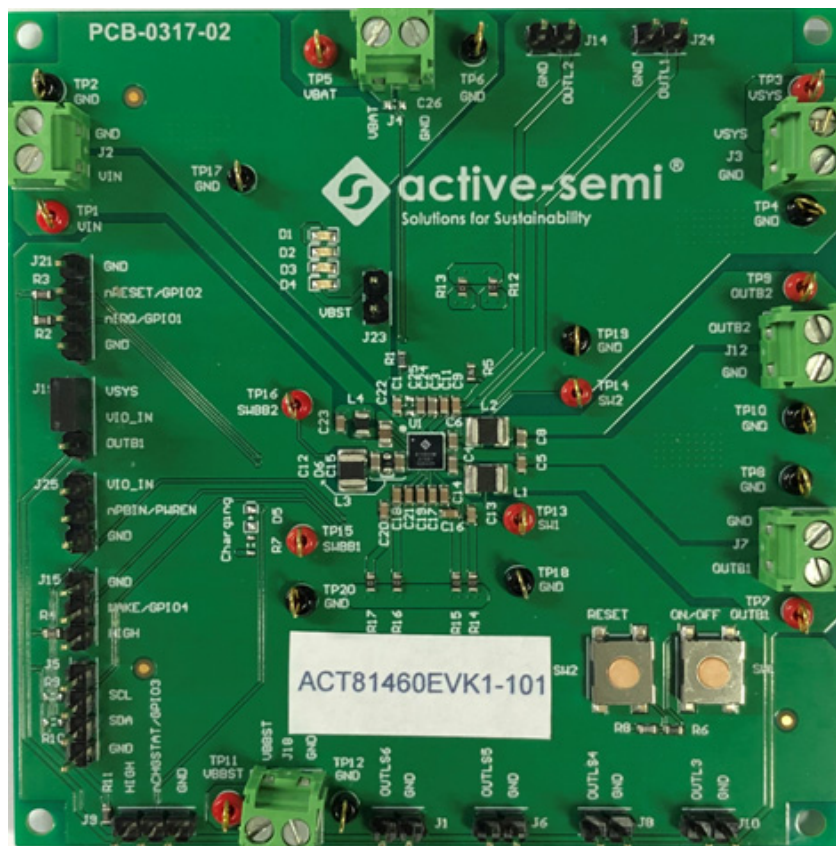


Figure 1 – EVK Picture

## Setup

### Required Equipment

ACT81460 EVK

USB-TO-I2C Dongle

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

Oscilloscope – >100MHz, >2 channels

Loads – Electronic or resistive. 1A minimum current capability.

Digital Multimeters (DMM)

Windows compatible computer with spare USB port.

### EVK Setup

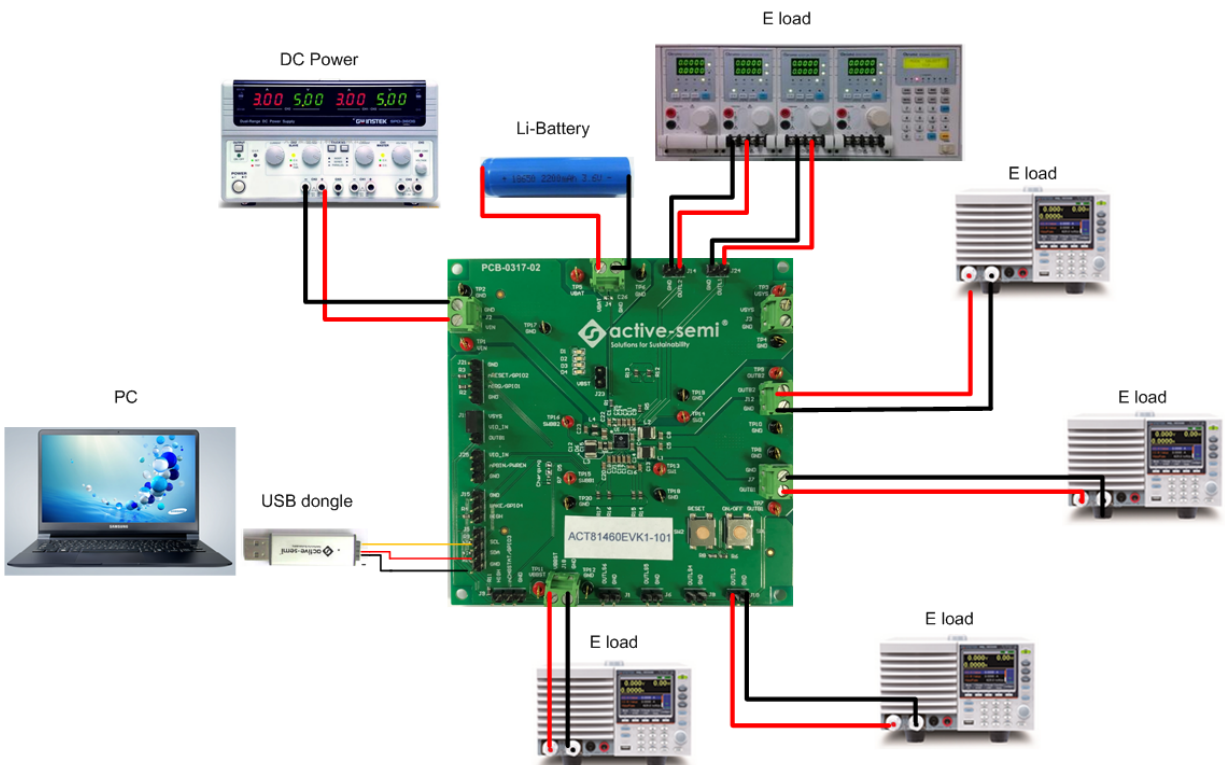


Figure 2 – EVK Setup

## Hardware Setup

1. Decide which voltage will power VIO\_IN. Active Semi recommends powering VIO\_IN from the VSYS input. Connect a shorting jumper between J19-1 and J19-2 header to power VIO\_IN from the VSYS input voltage.
2. Connect a shorting jumper between J23-1 and J23-2 header to power the LEDs, D1-D4, if desired.

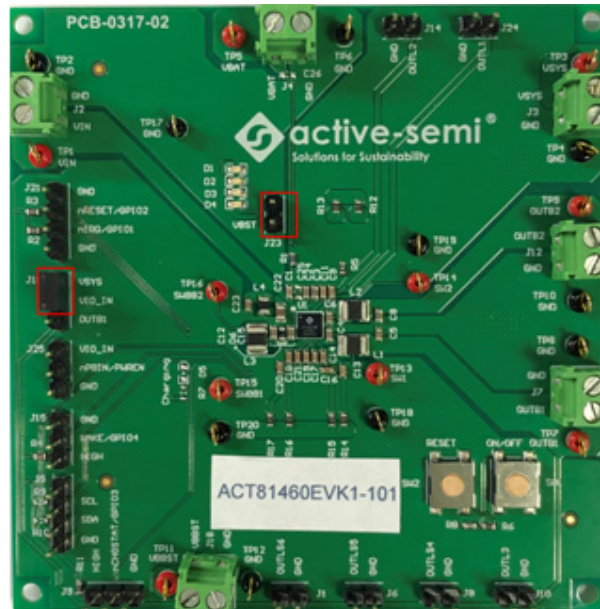
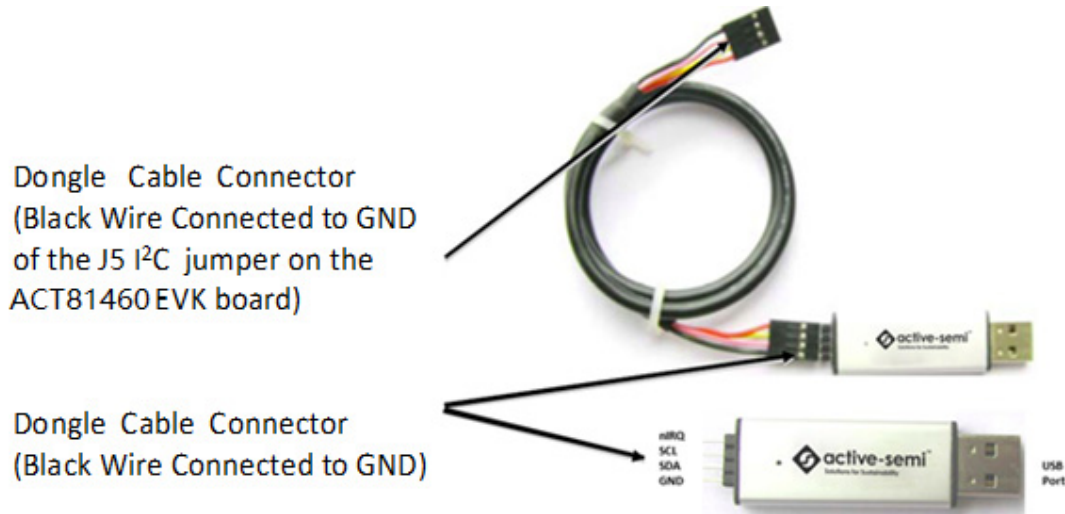


Figure 3 – Shorting Jumper Settings

3. Connect a lab supply between J2-1 and J2-2 to power VIN.
4. Connect an appropriate load to each power supply output.
5. Note that the typical setup is to apply the same 5V input voltage to all inputs. Using different input voltage sources requires careful consideration of startup sequencing.

## GUI Setup (optional)

1. Refer to the end of this document for detailed instructions to install the ACT81460 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 J5 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 toward the lower left corner of the Dongle.


**Figure 4 – USB-TO-I2C Dongle Connection**

## Recommended Operating Conditions

The ACT81460EVK1-101 is designed for a 5V 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.

**Table 1. Recommended Operating Conditions**

| Parameter             | Description                           | Min | Typ | Max  | Unit |
|-----------------------|---------------------------------------|-----|-----|------|------|
| VIN                   | System control input voltages         | 4   | 5   | 5.8  | V    |
| Ichg_max              | Linear Charger Maximum charge current |     |     | 800  | mA   |
| I <sub>B1_max</sub>   | Maximum Buck 1 load current           | 400 |     |      | mA   |
| I <sub>B2_max</sub>   | Maximum Buck 2 load current           | 400 |     |      | mA   |
| I <sub>BB_max</sub>   | Maximum Buck-Boost load current       |     |     | 250  | mA   |
| I <sub>BST_max</sub>  | Maximum Boost load current            |     |     | 39.3 | mA   |
| I <sub>LDO1_max</sub> | Maximum LDO 1 load current            | 100 |     |      | mA   |
| I <sub>LDO2_max</sub> | Maximum LDO 2 load current            | 100 |     |      | mA   |
| I <sub>LDO3_max</sub> | Maximum LDO 3 load current            | 100 |     |      | mA   |

## EVK Operation

### Turnon

Apply the 5V input voltage. Press the pushbutton (SW1) for longer than 32ms to automatically turn on all outputs with the programmed startup sequence.

## Schematic

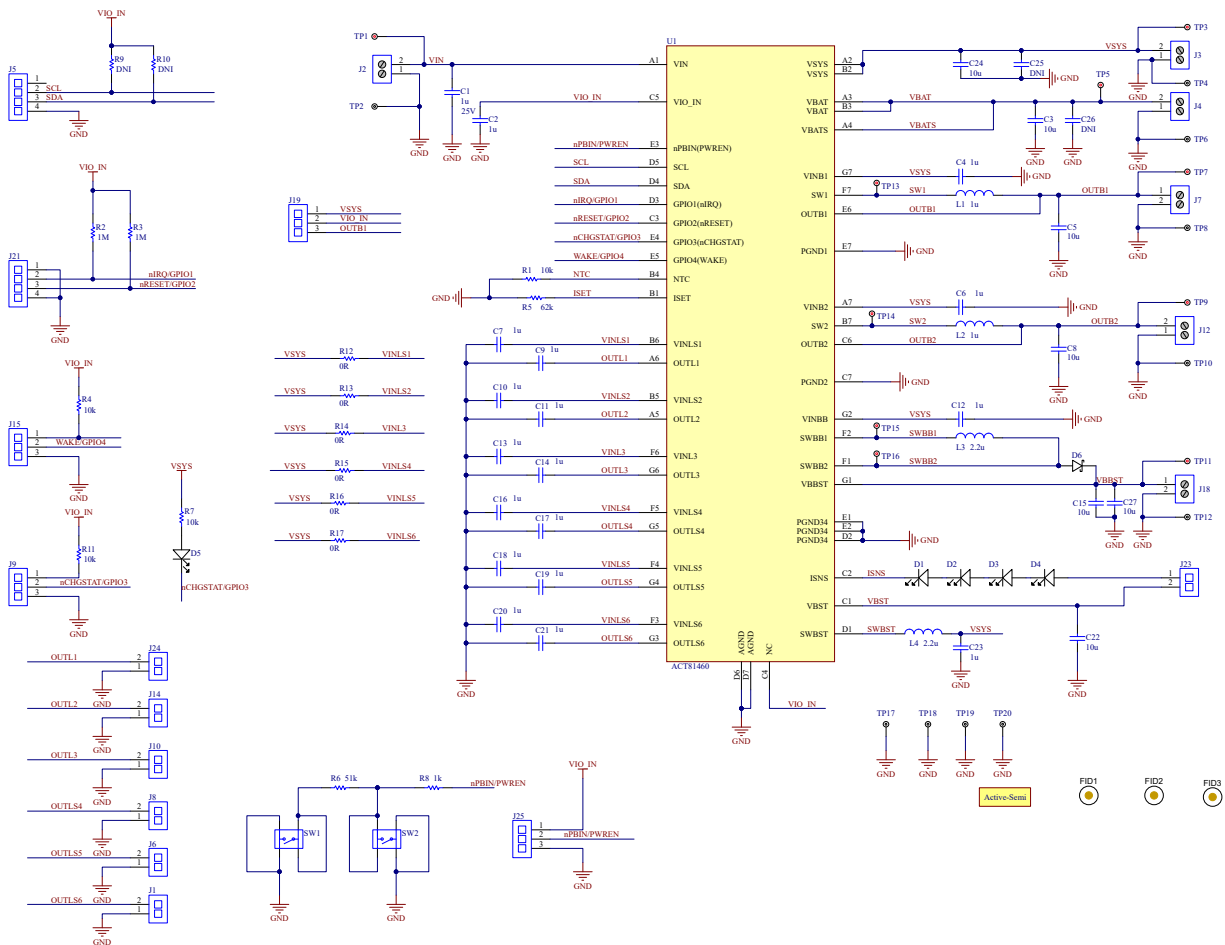
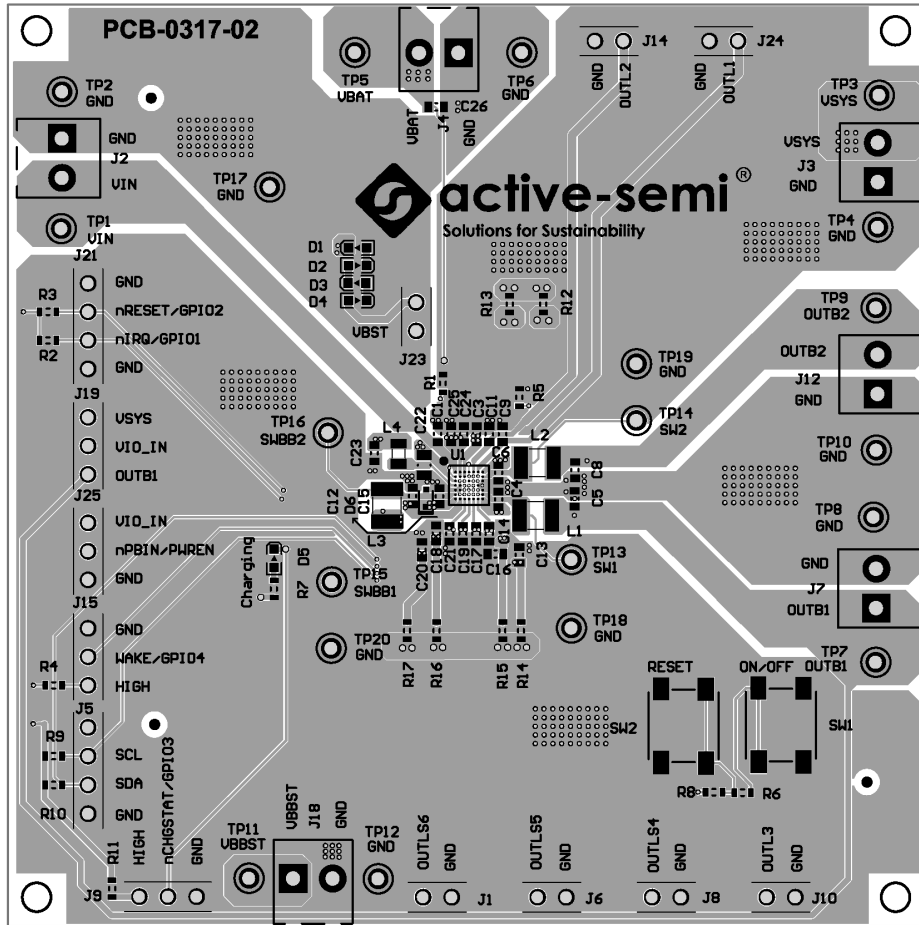


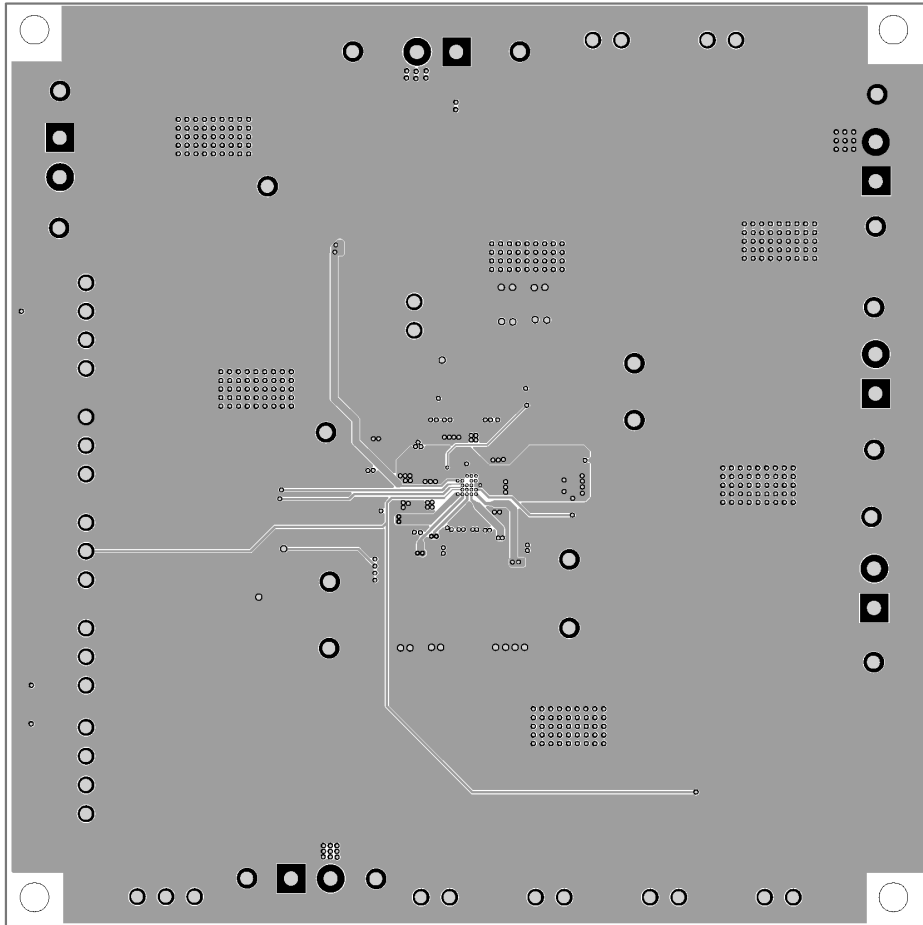
Figure 5 – ACT81460EVK1-101 Schematic

**Layout**

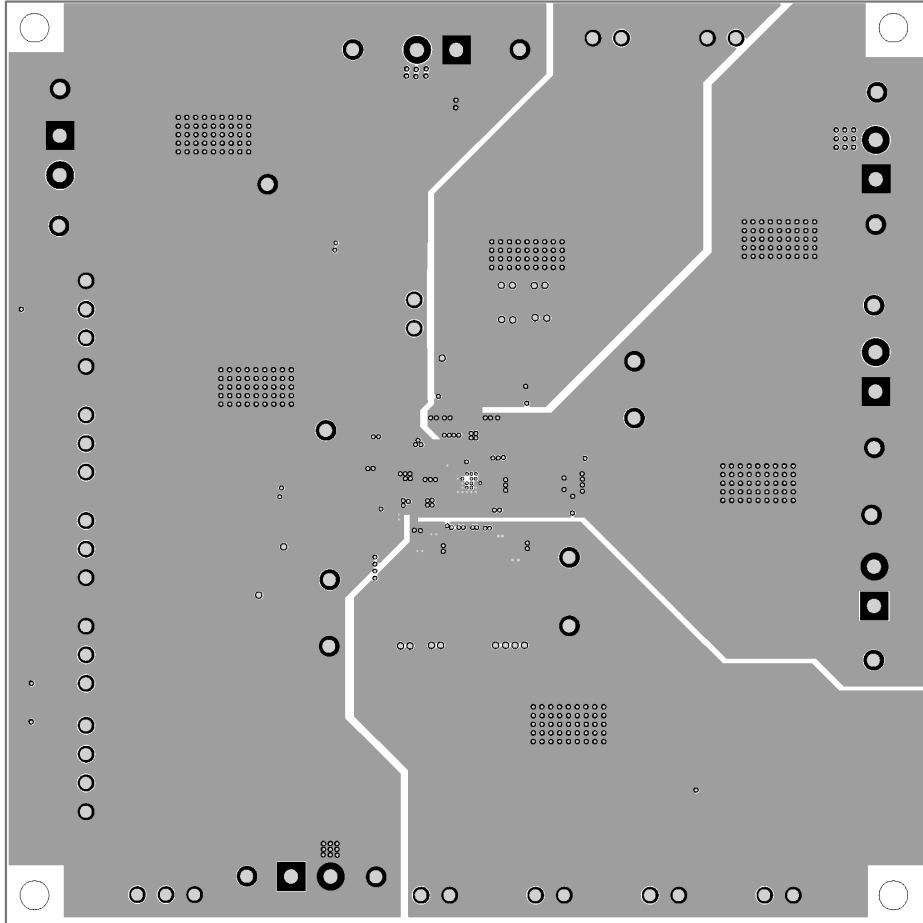


**Figure 6 – Layout Top Assembly**



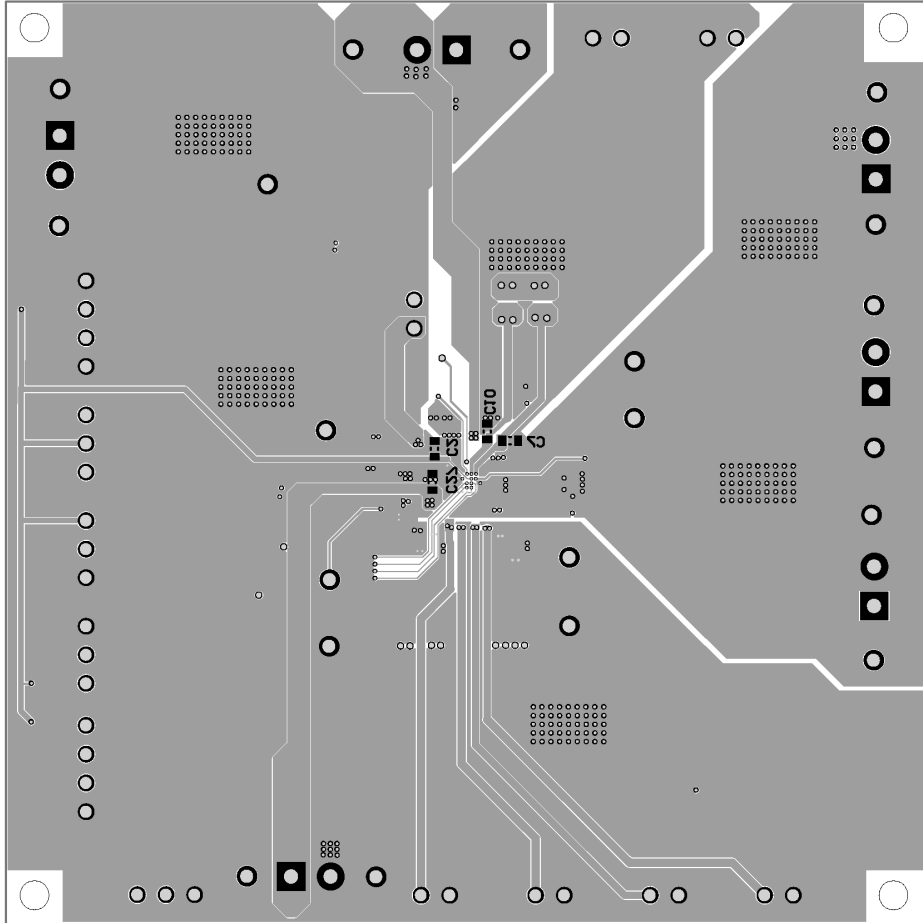


**Figure 7 – Layout Layer2**



**Figure 8 – Layout Layer 3**





**Figure 9 – Layout Bottom Assembly**

**Bill of Materials**
**Table 2 - BOM**

| Item | Ref Des  | Description                       | Package | Part number        |
|------|--|-----------------------------------|---------|--------------------|
| 1    | C1   | Cap, Ceramic, 1uF, 25V, 20%, X7R  | 0603    | std                |
| 2    | C2, C7, C9, C10, C11, C13, C14, C16, C17, C18, C19, C20, C21 | Cap, Ceramic, 1uF, 10V, 20%, X7R  | 0603    | std                |
| 3    | C3, C4, C5, C6, C8, C12, C15, C23, C24, C27                  | Cap, Ceramic, 10uF, 10V, 20%, X7R | 0603    | std                |
| 4    | C22  | Cap, Ceramic, 10uF, 25V, 20%, X7R | 0805    | std                |
| 5    | C25  | DNP                               | 0603    | std                |
| 6    | C26  | DNP                               | 0603    | std                |
| 7    | D1,D2,D3,D4  | LED, BLUE                         | 0603    | 150060VS75000      |
| 8    | D5   | DNP                               | 0603    | 150060VS75000      |
| 9    | D6   | Schottky diode 40V 0.2A           | 0603    | SD0603S040S0<br>R2 |
| 10   | J1, J6, J8, J10, J14, J23, J24                               | Header, 2 pin,100mil              | 2.5mm   | 61300211121        |
| 11   | J2, J3, J4, J7, J11, J12, J18                                | Connector, 2 pin                  | 3.5mm   | 691214110002S      |
| 12   | J5, J21  | Header, 4 pin,100mil              | 2.5mm   | 61300411121        |
| 13   | J9, J15, J19, J25  | Header, 3 pin,100mil              | 2.5mm   | 61300311121        |
| 14   | L1, L2   | Inductor, 1uH, 2.2A, SMD          | 1210    | 74479299210        |
| 15   | L3   | Inductor, 2.2uH, 1.5A, SMD        | 1210    | 74479299222        |
| 16   | L4   | Inductor, 2.2uH, 1A, SMD          | 0805    | 74479275222        |
| 17   | R1   | Res, 10kOhm, 5%                   | 0603    | std                |
| 18   | R2, R3, R4, R11  | Res, 100kOhm, 5%                  | 0603    | std                |
| 19   | R5   | Res, 60.4kOhm, 5%                 | 0603    | std                |
| 20   | R6   | Res, 51kOhm, 5%                   | 0603    | std                |
| 21   | R7 ,R9, R10  | DNP                               | 0603    | std                |
| 22   | R8   | Res, 1kOhm, 5%                    | 0603    | std                |
| 23   | R12, R13, R14, R15 R16, R17                                  | Res, 00Ohm, 5%                    | 0603    | std                |
| 24   | SW1, SW2   | SMT Tact switch 6mmx6mm           | 6mmx6mm | 430453025836       |

|    |  |                      |        |              |
|----|--|----------------------|--------|--------------|
| 25 | TP1, TP3, TP5, TP7, TP9,<br>TP11, TP13, TP14, TP15,<br>TP16  | Test Point, Red      | 0.063" | Keystone5000 |
| 26 | TP2, TP4, TP6, TP8, TP10,<br>TP12, TP17, TP18, TP19,<br>TP20 | Test Point, Black    | 0.063" | Keystone5001 |
| 27 | U1   | ACT81460VM101-T      | CSP    | ACT81460     |
| 28 | --   | Shunt, 100mil, Black | n/a    | 60900213421  |
| 29 | PCB  | PCB-0317-02          | n/a    | n/a          |

## GUI Installation

1. Contact Active Semi for the GUI files and save them on your computer.
2. Plug the USB-TO-I2C dongle into a free USB port.
3. Follow the instructions in the "Active Semi's GUI and Dongle Driver Installation" file.
4. Double click on the ACT81460 GUI.exe to start the ACT81460 GUI.

## 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 contain 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.

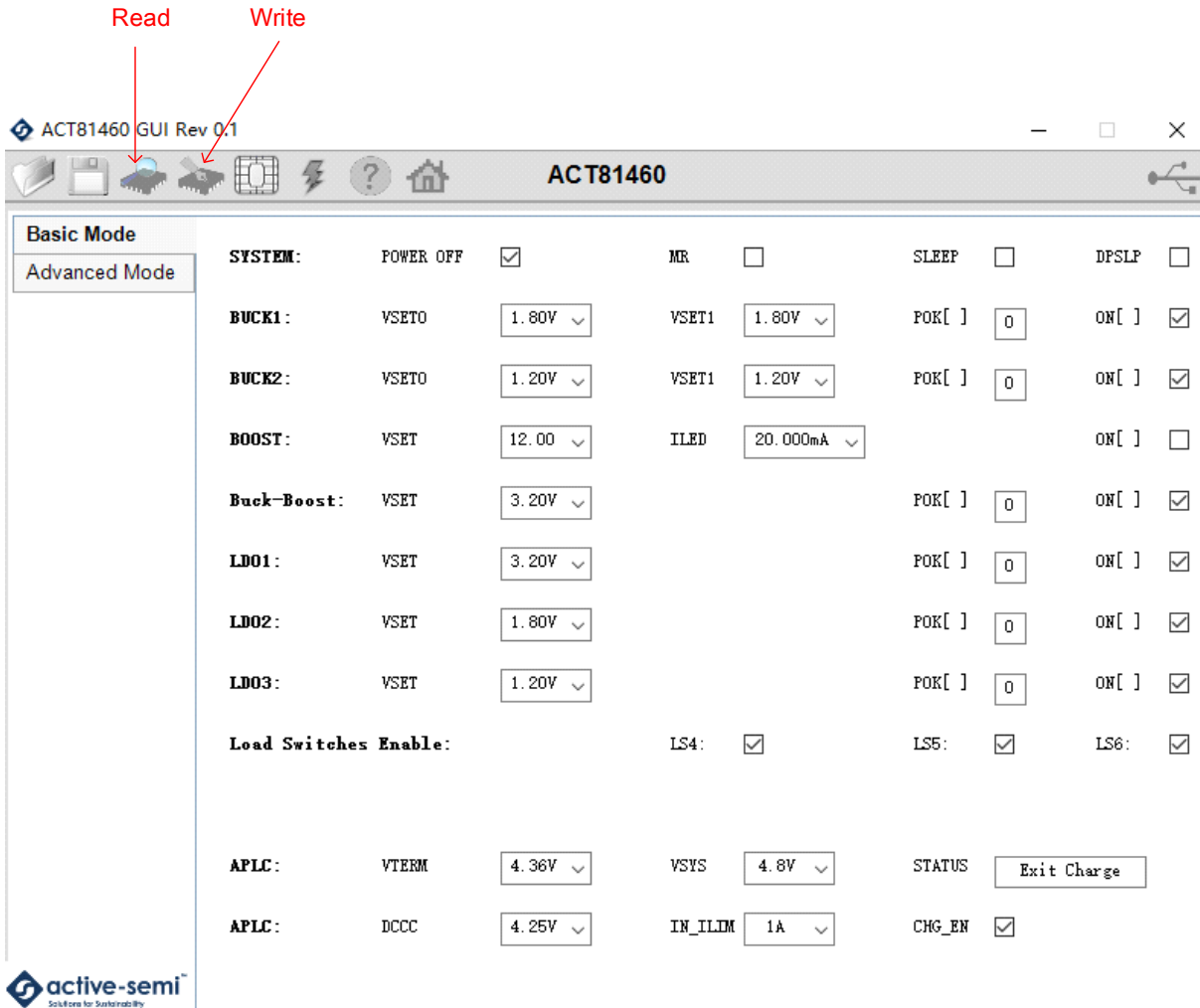


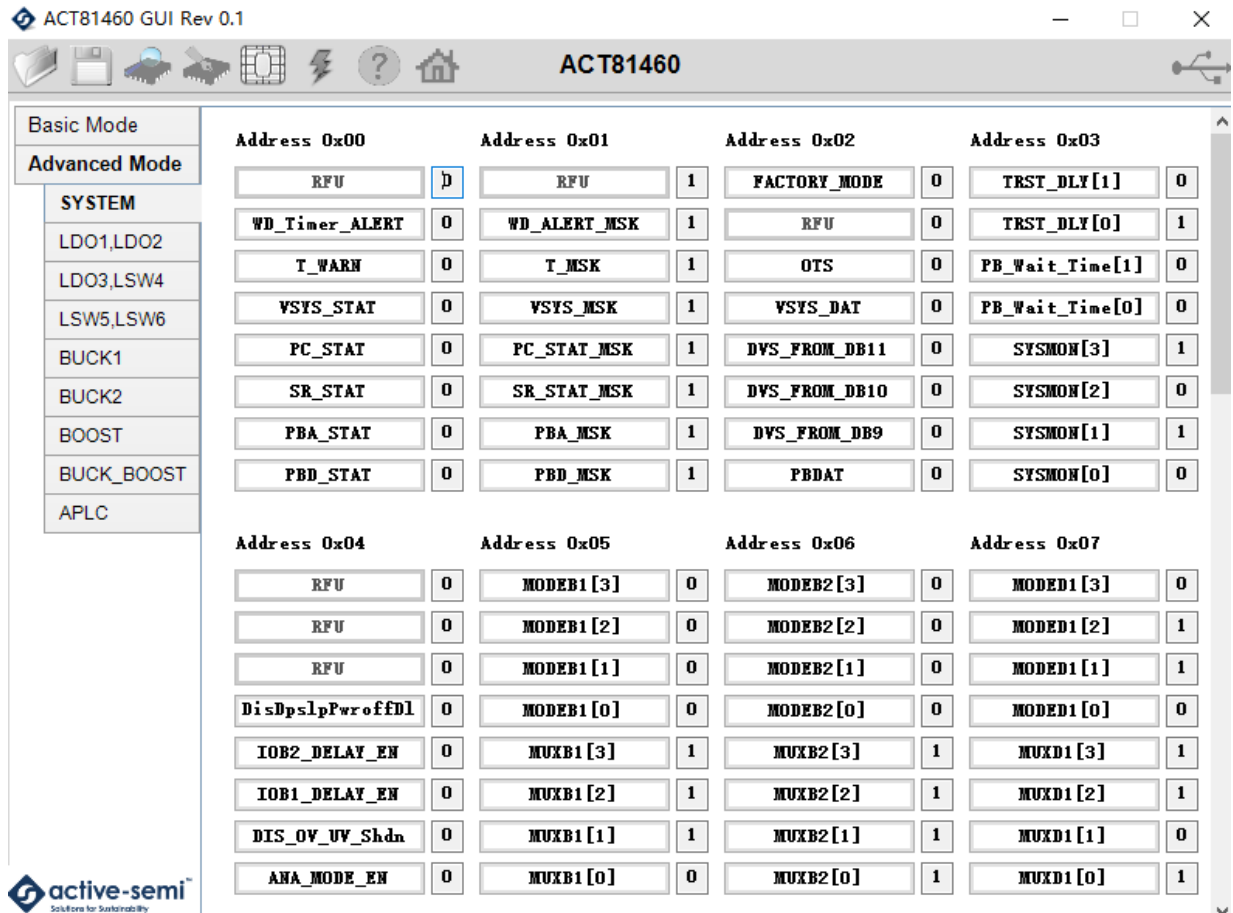
Figure 10 – GUI Basic Mode

## 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.

ACT81460 GUI Rev 0.1



| Address 0x00   | Address 0x01 | Address 0x02  | Address 0x03    |
|----------------|--------------|---------------|-----------------|
| RFU            | RFU          | FACTORY_MODE  | TRST_DLY[1]     |
| WD_Timer_ALERT | WD_ALERT_MSK | RFU           | TRST_DLY[0]     |
| T_WARN         | T_MSK        | OTS           | PB_Wait_Time[1] |
| VSYS_STAT      | VSYS_MSK     | VSYSTAT       | PB_Wait_Time[0] |
| PC_STAT        | PC_STAT_MSK  | DVS_FROM_DB11 | SYSMON[3]       |
| SR_STAT        | SR_STAT_MSK  | DVS_FROM_DB10 | SYSMON[2]       |
| PBA_STAT       | PBA_MSK      | DVS_FROM_DB9  | SYSMON[1]       |
| PBD_STAT       | PBD_MSK      | PBDAT         | SYSMON[0]       |

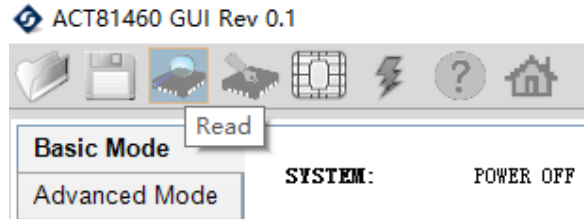
  

| Address 0x04     | Address 0x05 | Address 0x06 | Address 0x07 |
|------------------|--------------|--------------|--------------|
| RFU              | MODEB1[3]    | MODEB2[3]    | MODED1[3]    |
| RFU              | MODEB1[2]    | MODEB2[2]    | MODED1[2]    |
| RFU              | MODEB1[1]    | MODEB2[1]    | MODED1[1]    |
| DisDpSlpPwrOffD1 | MODEB1[0]    | MODEB2[0]    | MODED1[0]    |
| IOB2_DELAY_EN    | MUXB1[3]     | MUXB2[3]     | MUXD1[3]     |
| IOB1_DELAY_EN    | MUXB1[2]     | MUXB2[2]     | MUXD1[2]     |
| DIS_OV_UV_Shdn   | MUXB1[1]     | MUXB2[1]     | MUXD1[1]     |
| ANA_MODE_EN      | MUXB1[0]     | MUXB2[0]     | MUXD1[0]     |

Figure 11 – GUI Advanced Mode

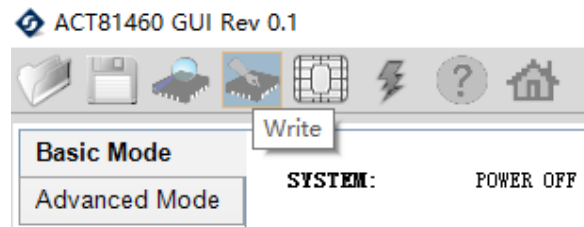
## Button Descriptions

**Read:** Clicking on this button reads the ACT81460 registers and displays them in the GUI. Note that this reads all registers. Active-Semi recommends reading registers each time the ACT81460 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.



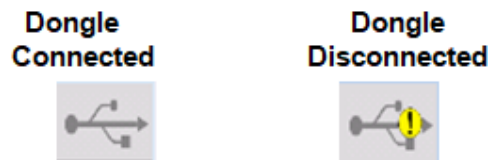
**Figure 12 – Read Button**

**Write:** Clicking on this button writes the GUI settings to the ACT81460'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**

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