

ACT82120EVK1 User's Guide

Description

This document describes the characteristics and operation of the Qorvo ACT82120EVK1 evaluation kit (EVK). It provides setup and operation instructions, schematic, layout, BOM, and test data. This EVK demonstrates the ACT82120-101T Active PMU power management IC.

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 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.



Figure 1– EVK Picture

Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

EVK Contents

The ACT82120EVK1 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

ACT82120EVK1

USB-TO-I2C Dongle

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

- Optional USB-C power supply

Oscilloscope – >100MHz, >4 channels

Loads – Electronic or resistive. 1.0A minimum current capability.

Digital Multi-meters (DMM)

Battery Emulator or small capacity 1S Li-ion battery.

Windows compatible computer with spare USB port.

Hardware Setup

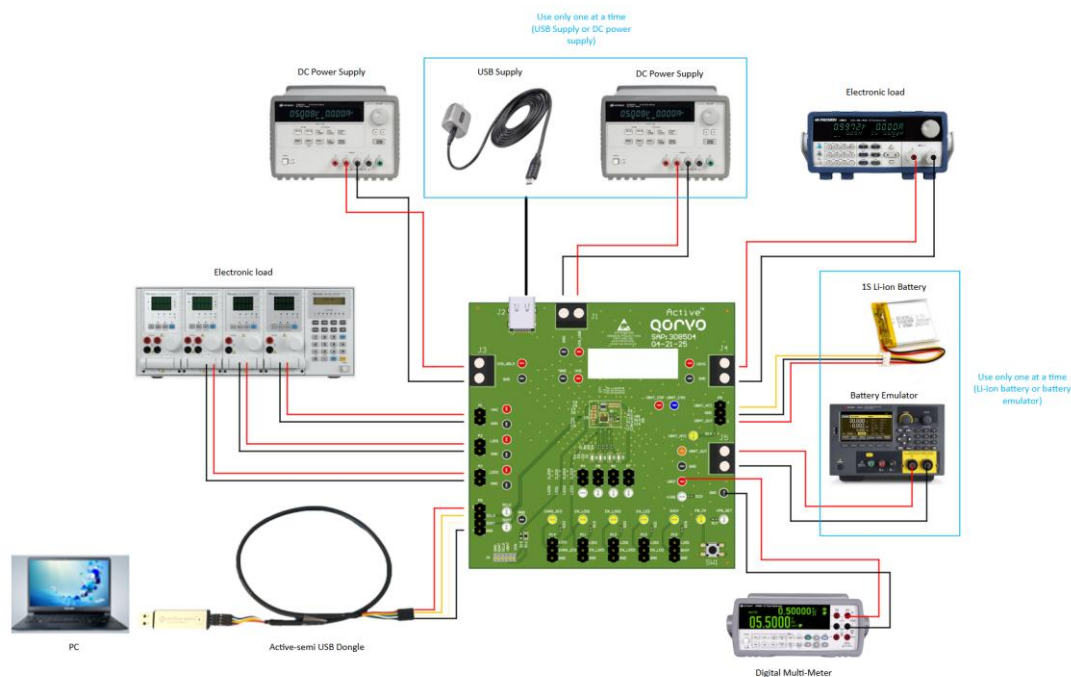


Figure 2 – EVK Setup

Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

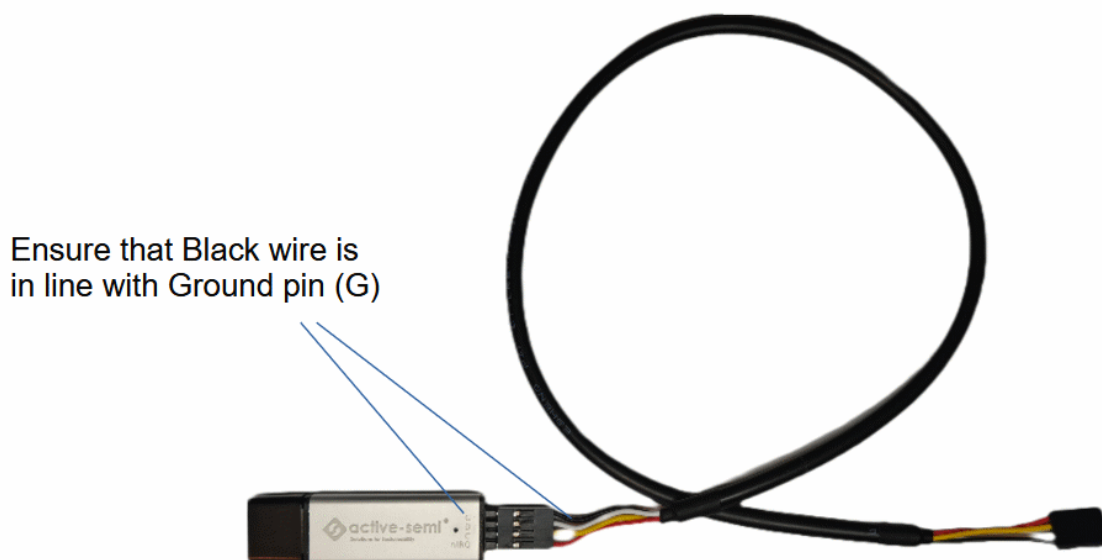
Quick Start

Hardware Setup/Connections

1. The EVK is configured to support VIN_USB through 2 inputs. Use only 1 input at a time.
 - a. Connect 5V to J1 or
 - b. Connect USB-C cable to J2
2. Connect 5V-10V power supply to VIN_WRLS through J3.
3. Connect jumper on P10, P11, P12, P13 & P14 depending on desired configuration
4. Optionally connect an appropriate load to each power supply output. (VSYS, LDO1, LDO2, VAO)
5. Connect a Battery emulator or battery pack
 - a. Use J5 for battery emulator with discrete NTC resistor
 - b. Use P8 for battery packs with embedded NTC resistor, depopulate R14

GUI Requirements (optional)

1. Install the ACT82120 GUI. Please reference the ACT82120 GUI installation guide for further instructions and usage of the 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 P9 connector. Refer to Figure 3 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.



Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

Figure 3 – USB-TO-I2C Dongle Connection

EVK Design Parameters

The ACT82120EVK1 is designed for a 5V input voltage. Table1 shows the Regulators' output voltage and the current supply capability.

Table 1. EVK Design Parameters

Parameter	Description	Min	Typ	Max	Unit
VIN_USB	Input range of USB power supply	4.0	5	5.75	V
VIN_WRLS	Input range of wireless power supply	4.0	9	13.0	V
VSYS	VSYS output voltage		4.2		V
LDO1	LDO1 output voltage		1.8		V
LDO2	LDO2 output voltage		3.3		V
VAO	VAO output voltage		5		V
Io_VSYS	VSYS load current		2.5		A
Io_LDO1	LDO1 load current		0.08		A
Io_LDO2	LDO2 load current		0.08		A

EVK Operation

Power ON

Apply the VIN_USB and/or VIN_WRLS to the PMIC and/or connect a battery/emulator to the VBAT header. The PMIC is now powered and can communicate via I2C. The various features of the part can now be used either through the GPIO pins or the I2C bus.

Active Patch Switching Charger

If a battery pack/emulator is connected and there is a VIN_USB or VIN_WRLS supply present the PMIC will automatically begin its charging profile. The charging current is dependent on several factors including the battery voltage, battery temperature and input voltage. Charging can be disabled by pulling the CHRG_DIS pin high, this can be done by populating a jumper on P14.

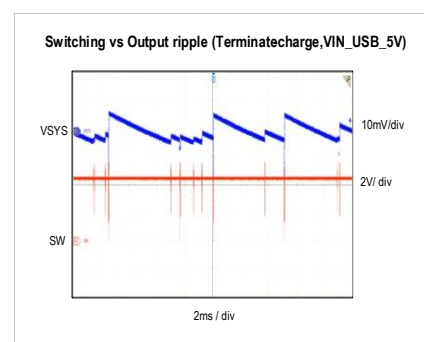
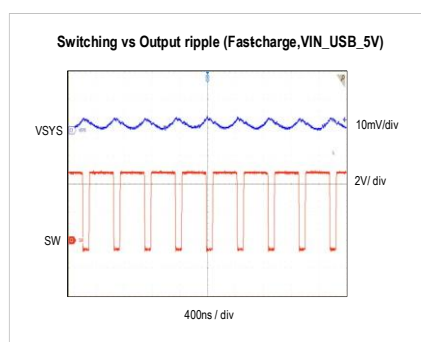
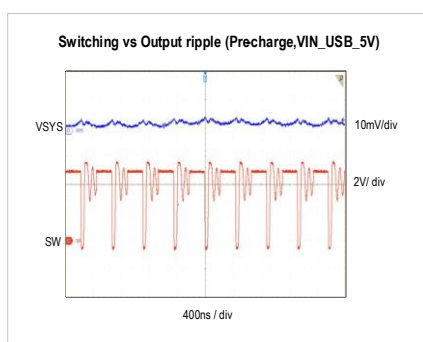
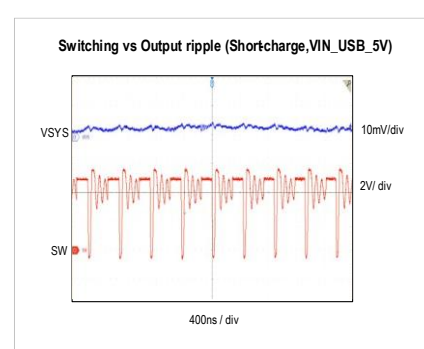
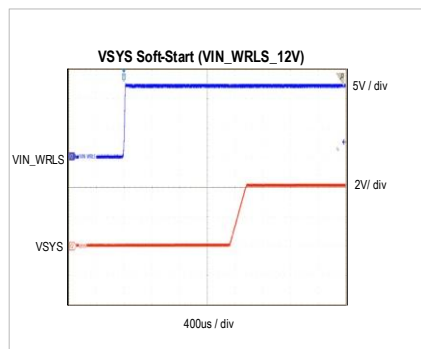
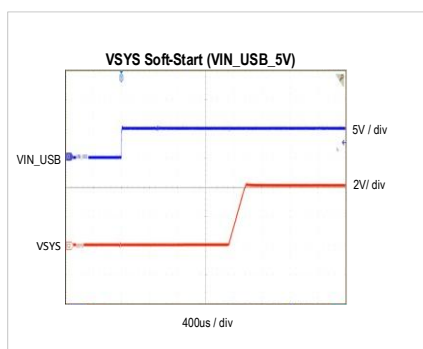
Internal Regulators LDO1, LDO2

Once the PMIC is in the active state the Internal regulators LDO1 & LDO2 can be enabled/disabled with the LDO1_EN & LDO2_EN signals. This can be achieved by populating a jumper on P11/P12.

Vsys Buck Regulator

Once the PMIC is in the active state the Vsys buck regulator is enabled by default. The nominal output voltage is 4.2V but can vary depending on the battery charge status.

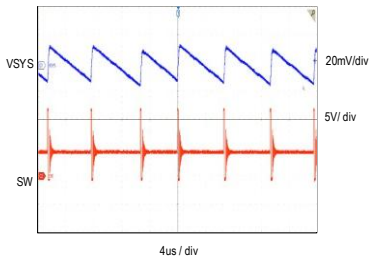
Test Result



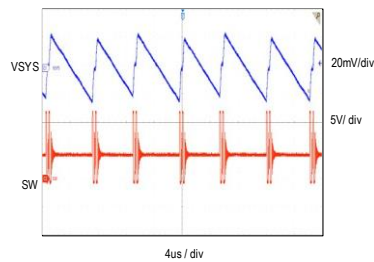
Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

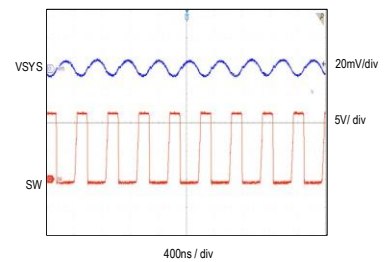
Switching vs Output ripple (Shortcharge,VIN_WRLS_12V)



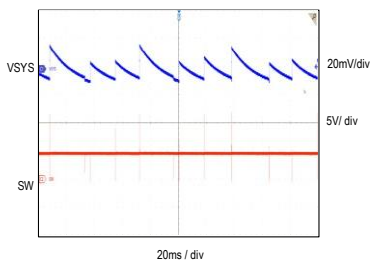
Switching vs Output ripple (Precharge,VIN_WRLS_12V)



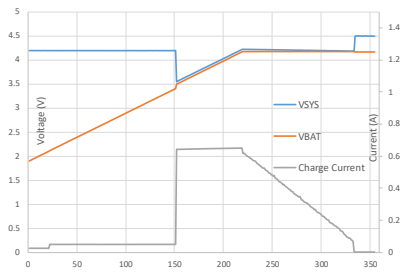
Switching vs Output ripple (Fastcharge,VIN_WRLS_12V)



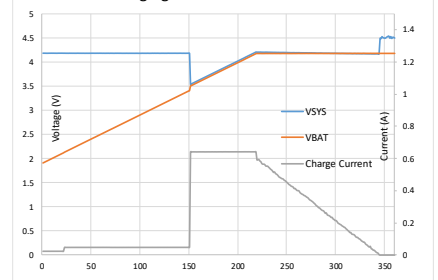
Switching vs Output ripple (Terminatecharge,VIN_WRLS_12V)



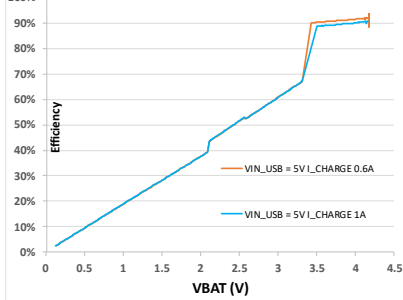
Charging Profile - VIN USB 5V



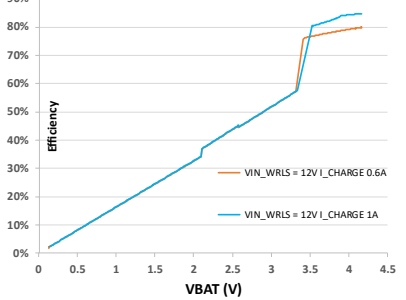
Charging Profile - VIN WRLS 12V



APSC Efficiency VS. VBAT - VIN USB 5V



APSC Efficiency VS. VBAT - VIN WRLS 12V



Schematic

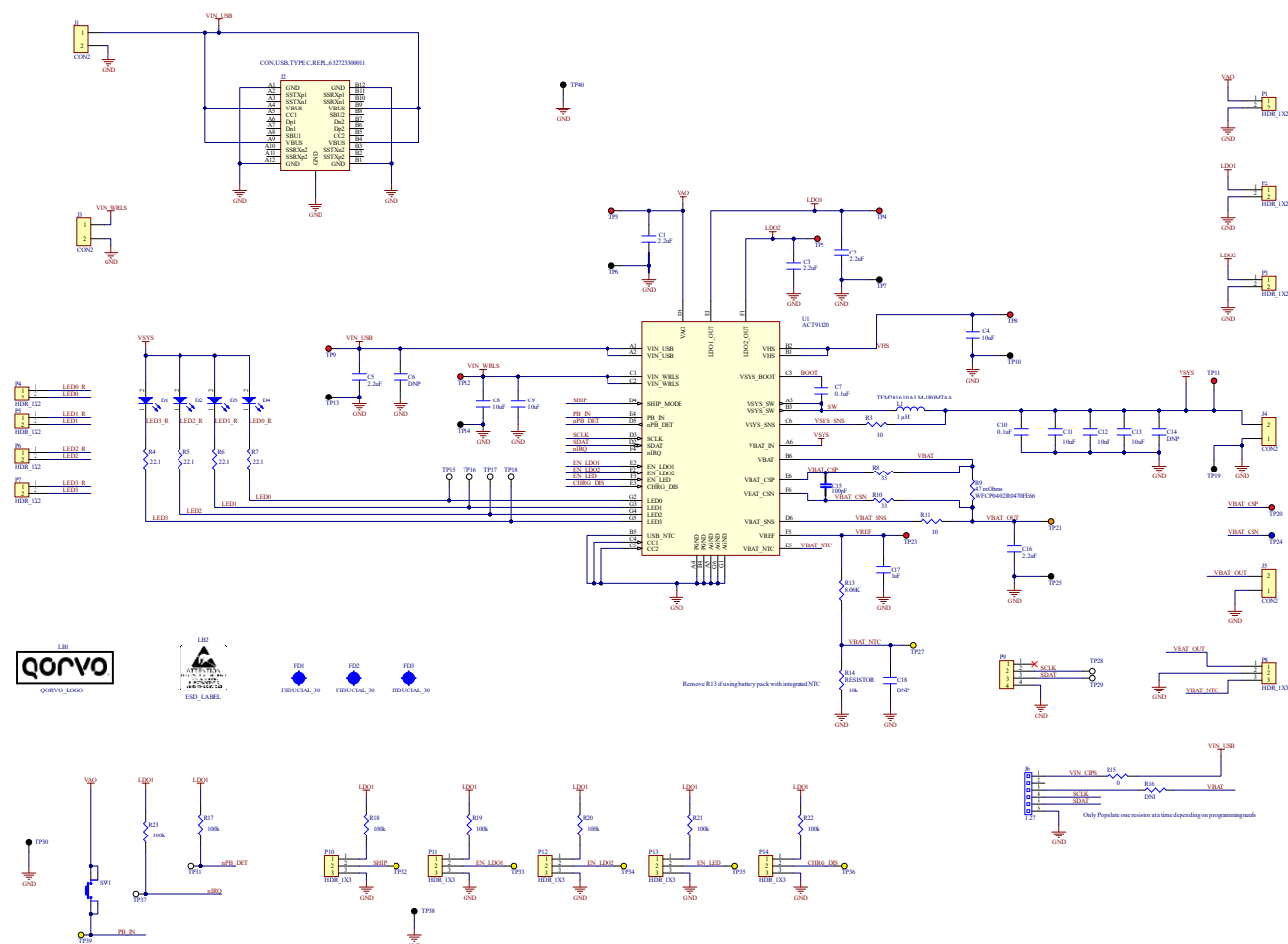


Figure 4 – ACT82120EVK1 Schematic

Bill of Materials

Table 2 – BOM

Item	Designator	Quantity	Description	Manufacturer	Part Number
1	C1, C3, C5	3	Capacitor, Ceramic, 2.2uF, 16V, 0402	TDK	C1005X5R1C225M050B C
2	C2, C16	2	Capacitor, Ceramic, 2.2uF, 10V, 0201	Murata	GRM033R61A225KE47J
3	C4, C8, C9	3	Capacitor, Ceramic, 10uF, 25V, 0603	Würth	885012106031
4	C7, C10	2	Capacitor, Ceramic, 0.1uF, 50V, 0402	Würth	885012205092
5	C11, C12, C13	3	Capacitor, Ceramic, 10uF, 10V, 0402	Samsung	CL05A106MP5NRNC
6	C15	1	Capacitor, Ceramic, 100pF, 50V, 0201	Murata	GRM0335C1H101GA01D
7	C17	1	Capacitor, Ceramic, 1uF, 10V, 0201	Kyocera	KGM03CR51A105MH
8	C6, C14, C18	3	Not populated	N/A	N/A
9	D1, D2, D3, D4	4	LED uni-color, white, 0603	Dialight	5973901830F
10	J1, J3, J4, J5	4	Terminal Block 0.2"	Würth	691213510002
11	J2	1	USB-C terminal	Würth	632723100011
12	J6	1	Header, 6 Pin, 0.05"	Harwin	M50-3530642
13	P1, P2, P3, P4, P5, P6, P7	7	Header, 2 Pin, 0.1"	Würth	61300211121
14	P8, P10, P11, P12, P13, P14	6	Header, 3 Pin, 0.1"	Würth	61300311121
15	P9	1	Header, 4 Pin, 0.1"	Würth	61300411121
16	R3, R11	2	Resistor, 10 ohm, 5%, 0201	Vishay	CRCW020110R0JNED
17	R4, R5, R6, R7	4	Resistor, 20 ohm, 1%, 0402	Walsin	WR04X20R0FTL
18	R8, R10	2	Resistor, 33 ohm, 1%, 0201	Panasonic	ERJ-1GNF33R0C
19	R9	1	Resistor, 47 mohm, 1%, 0402	Vishay	WFCP0402R0470FE66
20	R14	1	Resistor, NTC, 10 kohm, 1% 0402	TDK	NTCG103JF103FT1
21	R13	1	Resistor, 8.06 kohm, 1%, 0201	Vishay	CRCW02018K06FKED
22	R15	1	Resistor, 0 ohm, 0603	Yageo	AC0603FR-070RL
23	R17, R18, R19, R20, R21, R22, R23	7	Resistor, 100 kohm, 0.1%, 0402	Yageo	AT0402BRD07100KL
24	R16	1	Not populated	N/A	N/A
25	SW1	1	Tactile Switch, SPST-NO,	Würth	430181038816
26	TP27, TP32, TP33, TP34, TP35, TP36, TP39	7	Test point, Mini, Yellow, TH	Keystone	5004

Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

27	TP3, TP4, TP5, TP8, TP9, TP11, TP12, TP20, TP21, TP23	10	Test point, Mini, Red, TH	Keystone	5000
28	TP6, TP7, TP10, TP13, TP14, TP19, TP24, TP25, TP26, TP30, TP38, TP40	12	Test point, Mini, Black, TH	Keystone	5001
29	TP15, TP16, TP17, TP18, TP28, TP29, TP31, TP37	8	Test point, Mini, White, TH	Keystone	5002
30	U1	1	1S battery charger power management IC	Qorvo	ACT82120-101

Layout

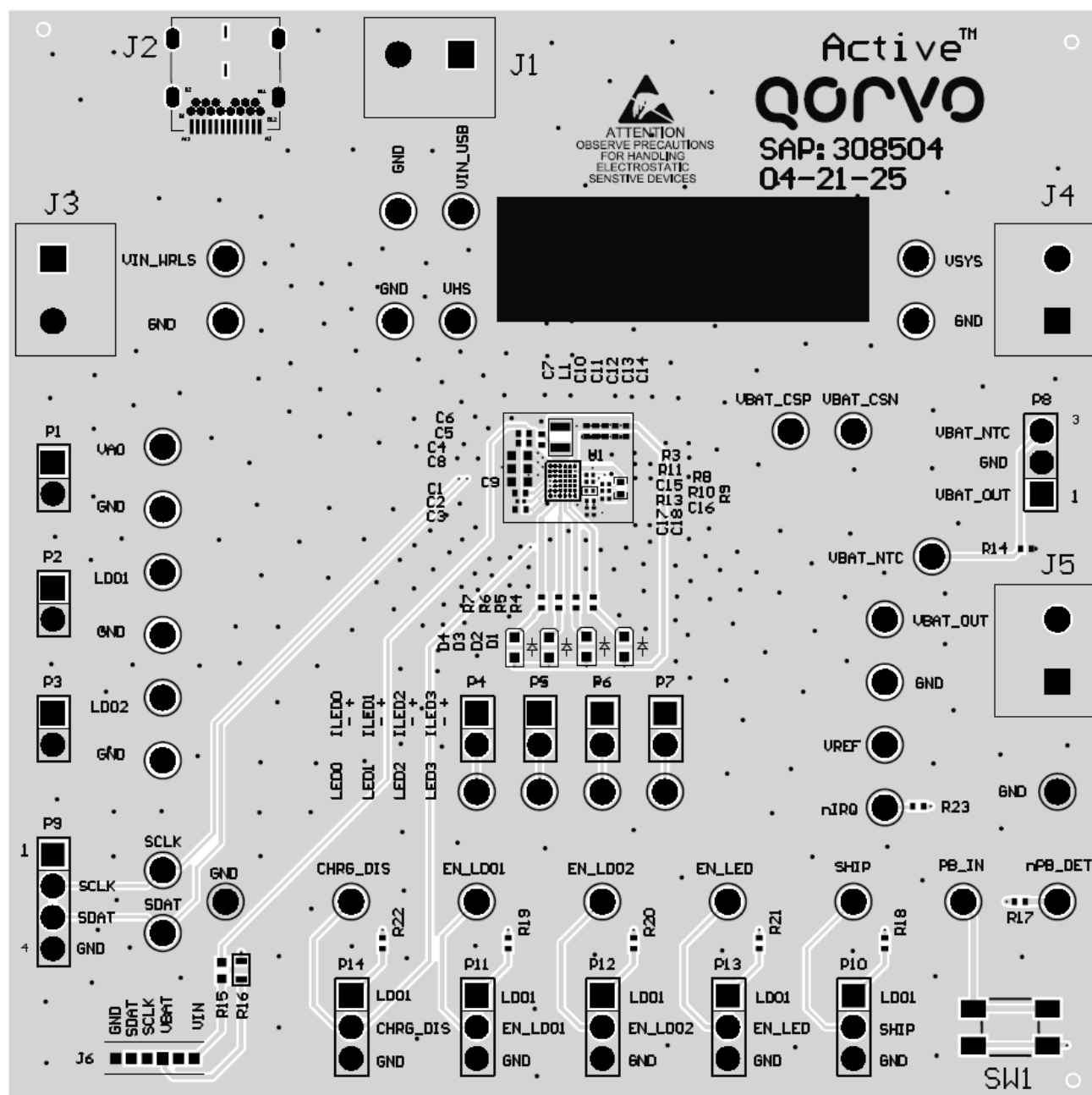


Figure 4 – Top Layer

Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

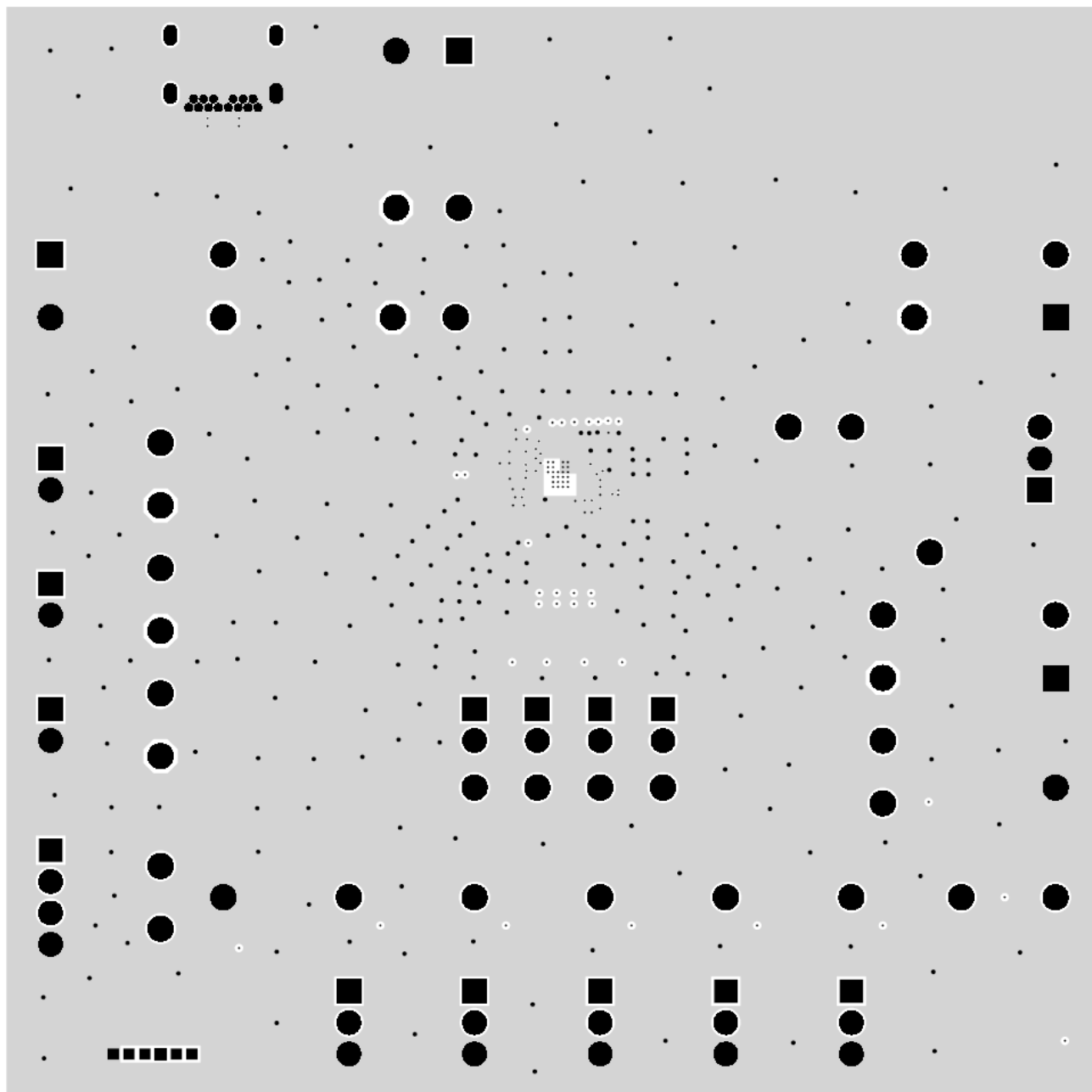


Figure 5 – Layer 2 GND

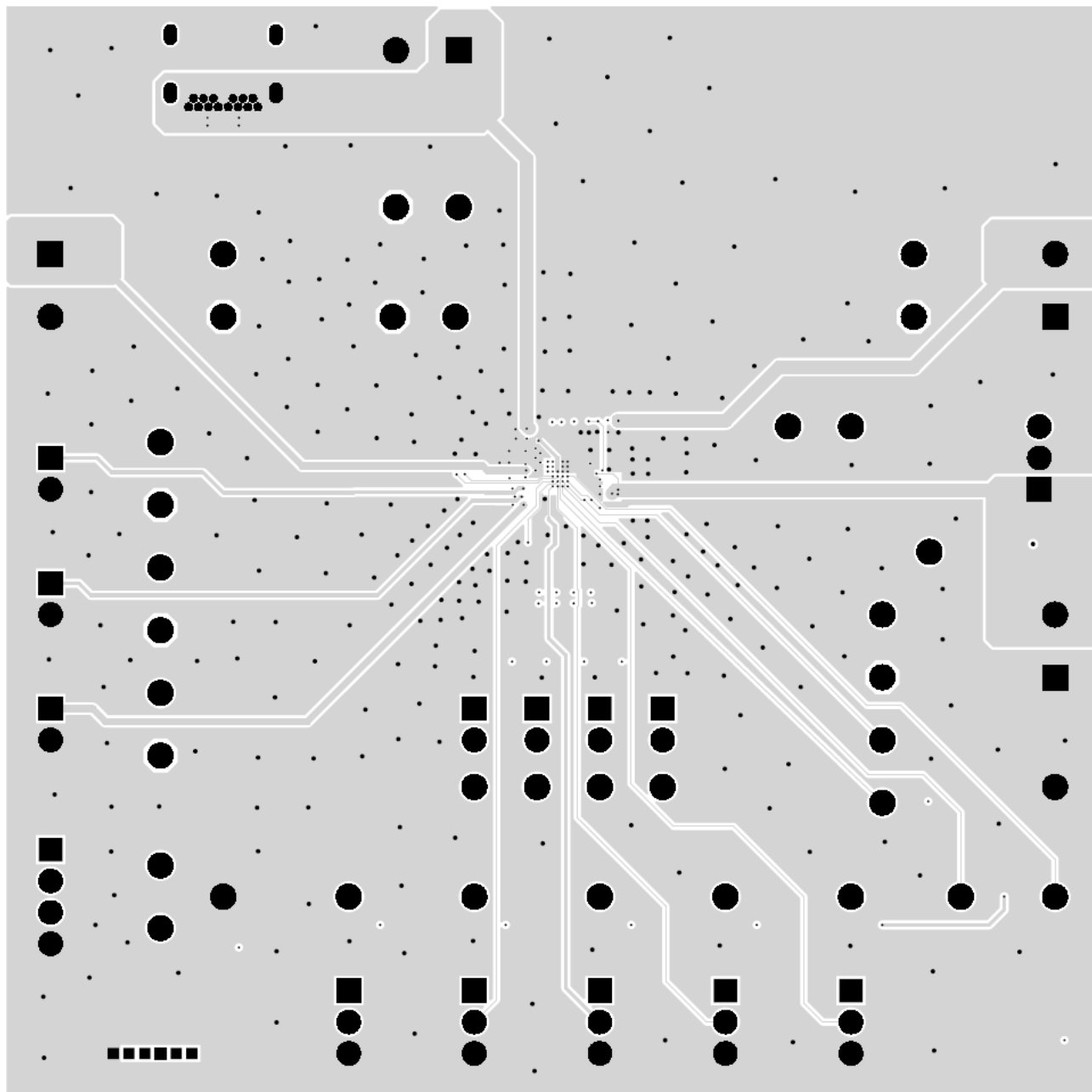


Figure 6 – Layer 3

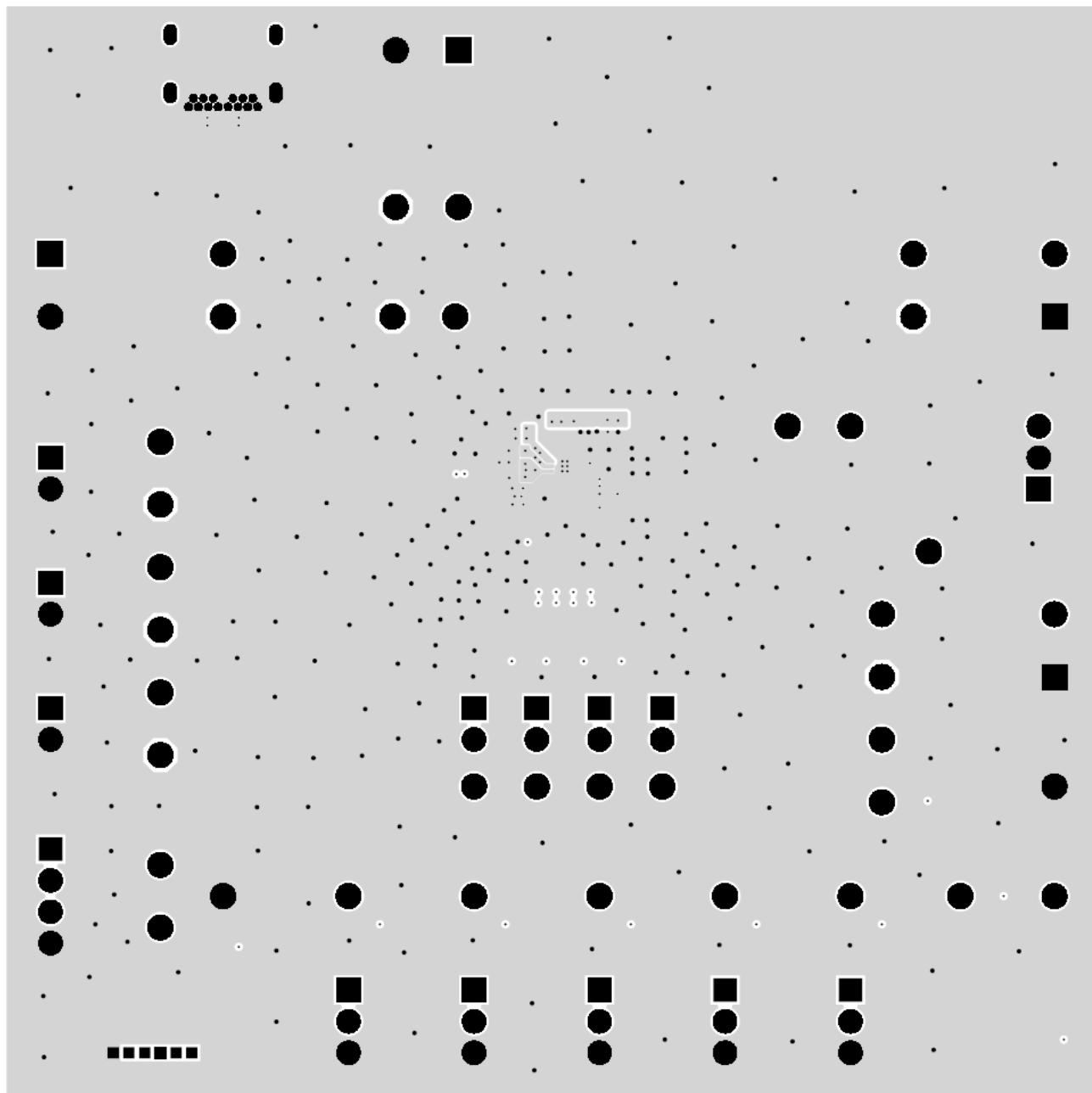


Figure 7 – Layer 4

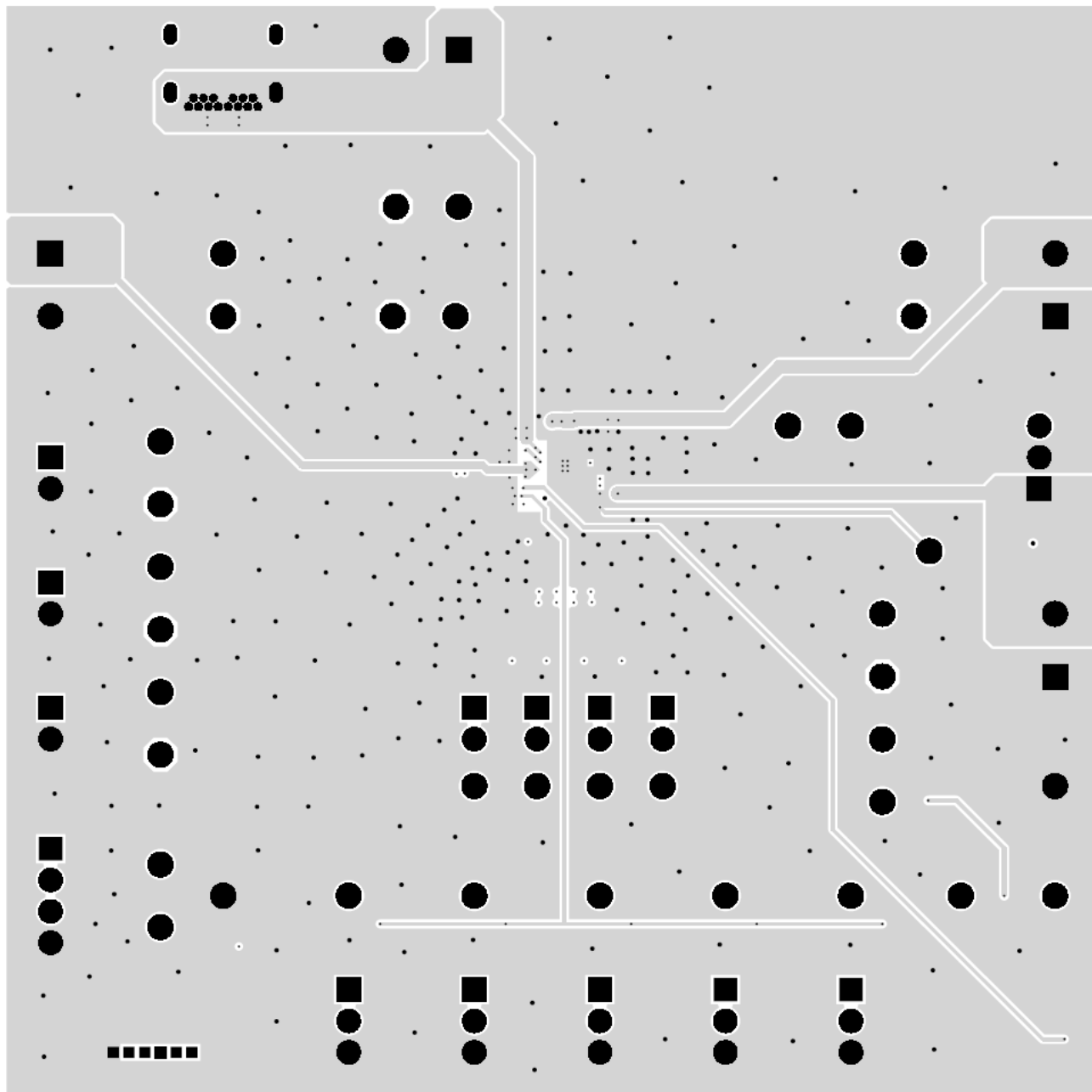


Figure 9 – Layer 5

Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

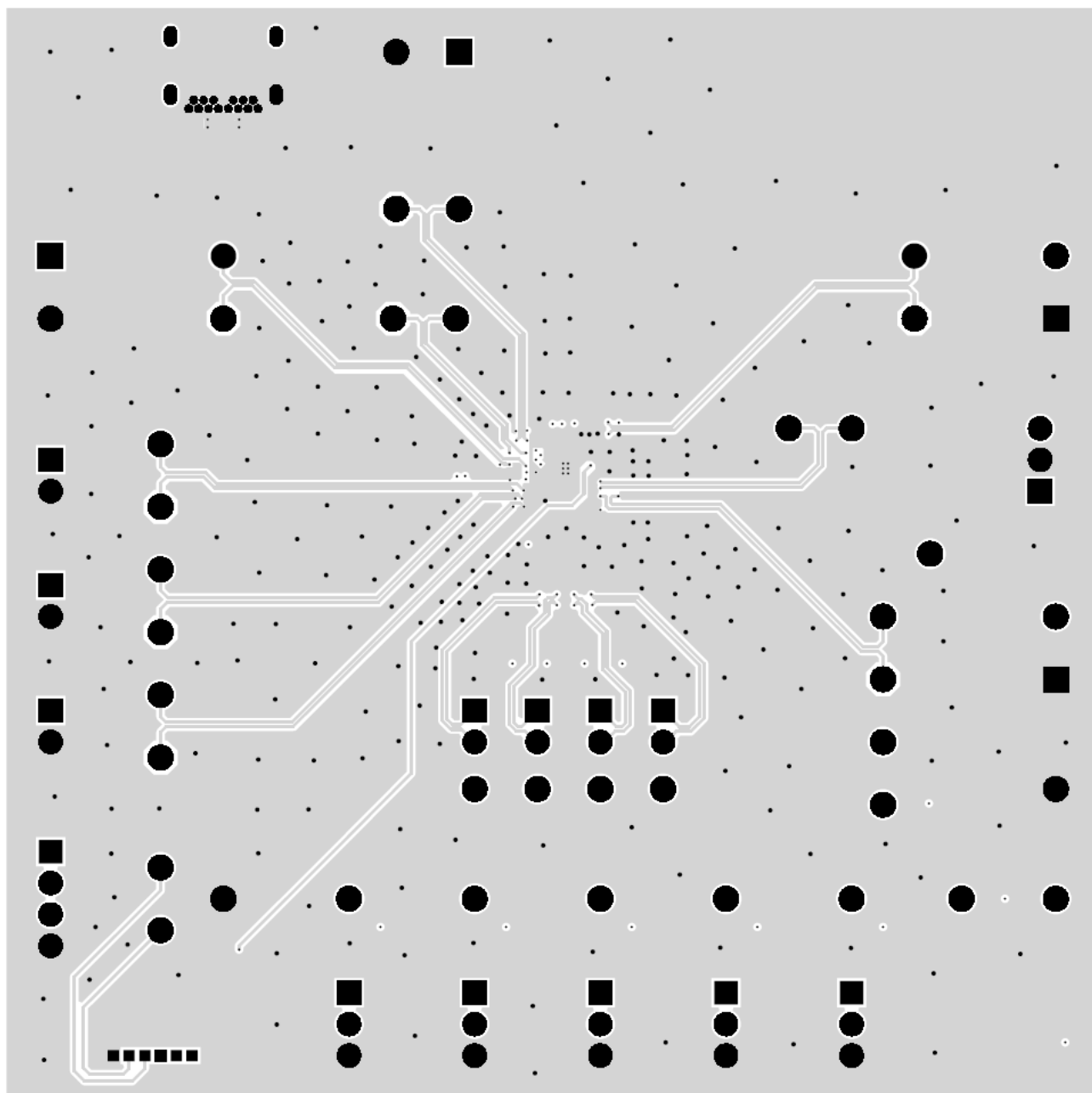


Figure 10 – Bottom Layer

Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

GUI Installation

1. Download the GUI files from Qorvo's website and save them on your computer.
2. Plug the USB-TO-I2C dongle into a free USB port.
3. Double click on the ACT82120 GUI.exe to start the ACT82120 GUI.

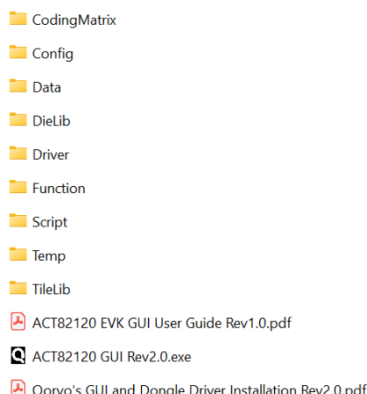


Figure 10 – Dongle Driver

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: Configuration Mode and Regulator Mode. In Configuration Mode screen it displays each regulator's basic information on a single page, all the information is user configurable via the drop-down boxes. Regulator Mode allows the user to view and change the IC's advanced internal registers of each regulator.

Configuration Mode

Click the "Configuration" button in the left of the GUI screen to see the basic user programmable options. This display mode allows user to change some basic settings of each regulator (voltages, current...). User can use either the mouse scroll or the right-side scroll bar to navigate to other regulators. Using drop-boxes, left-click the small arrow next to the value, then a selection pop-up displays all possible options to choose from. Scroll up/down to find the target value and left-click to select it. After the required parameters are changed, click the "Write" button to transfer the changes from the GUI to the IC.

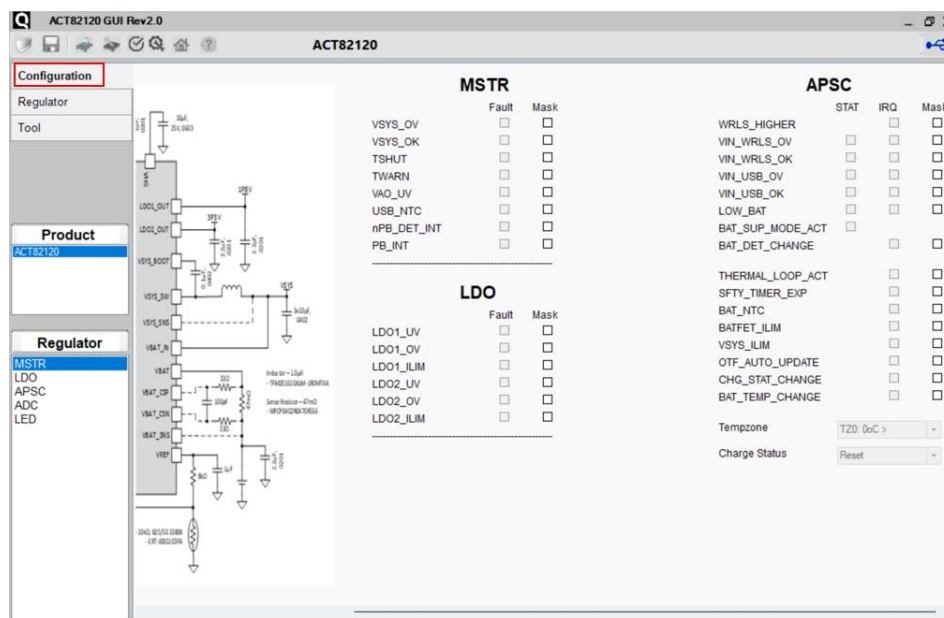


Figure 81 – GUI Configuration Mode

Regulator Mode

Click the “Regulator” button in the left of the GUI screen to see all available user programmable options. In the left side of the screen, click on the Tiles Selector to choose which regulator or LDO’s to show. There are two tabs for each tile, “Setting “and “Register”.

The “Settings” tab is easy to read and has drop down menus that show the available choices. The “Registers” tab shows the actual register values required to achieve a desired setting.

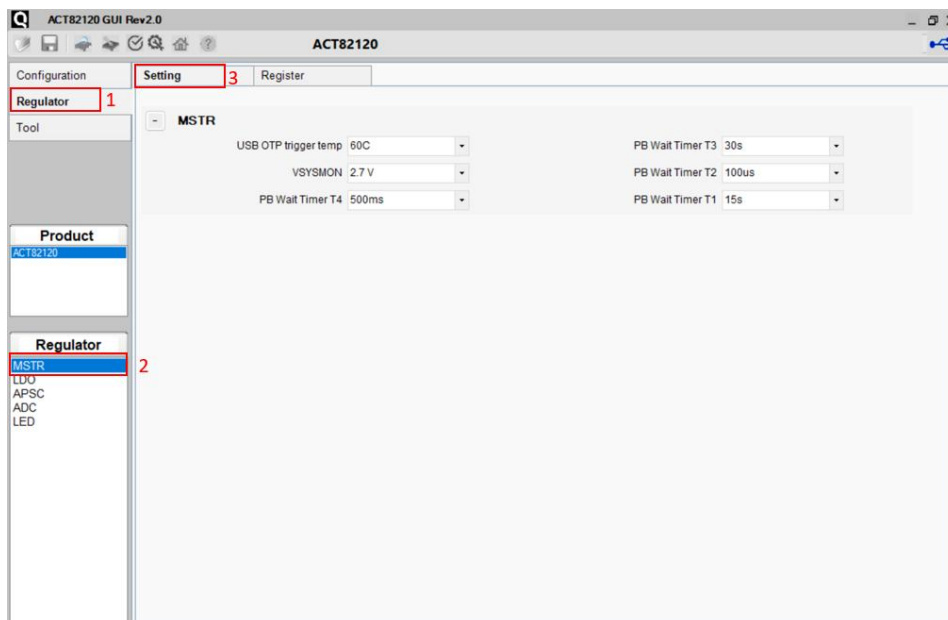


Figure 19 – GUI Setting Tab of Regulator Mode

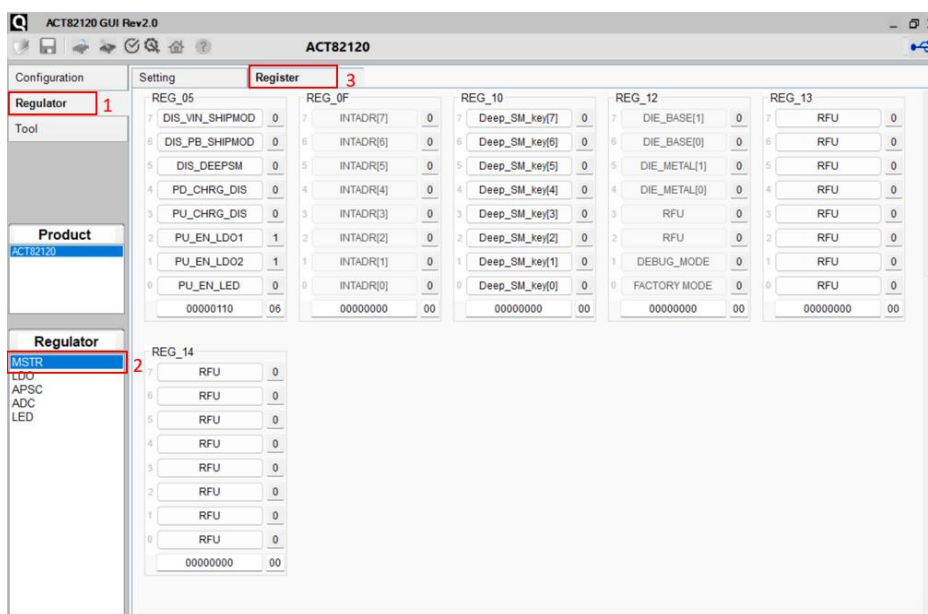


Figure 13 – GUI Register Tab of Regulator Mode

Button Descriptions

Read: Clicking on this button reads the ACT82120 registers and displays them in the GUI. Note that this reads all registers. ActiveSemi recommends reading registers each time the ACT82120 powers-up to acquire the

Innovative Power™

ActiveSwitcher™ is a trademark of Qorvo.

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.

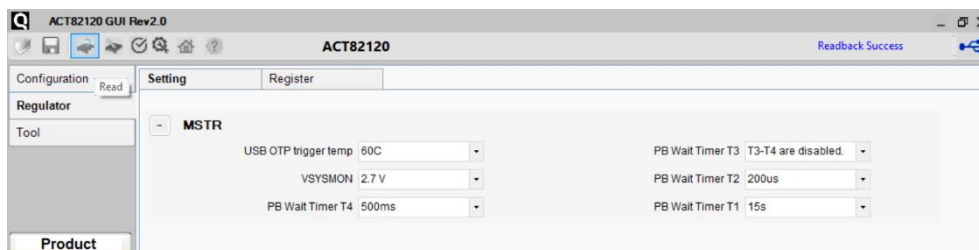


Figure 14 – Read Button

Write: Clicking on this button writes the GUI settings to the ACT82120's registers. All registers are written, regardless of whether or not they were changed.

Note: Remember that changes to the GUI settings are not transferred into the IC until the GUI's "Write" button is pressed.

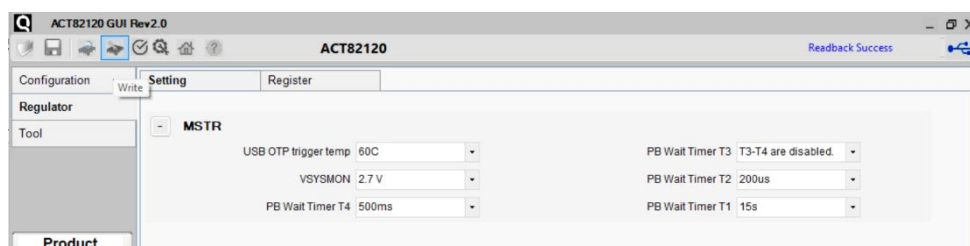


Figure 15 – Write Button

Confirm: Confirm function allows user to compare the ACT82120's registers information on GUI with the values read from IC.

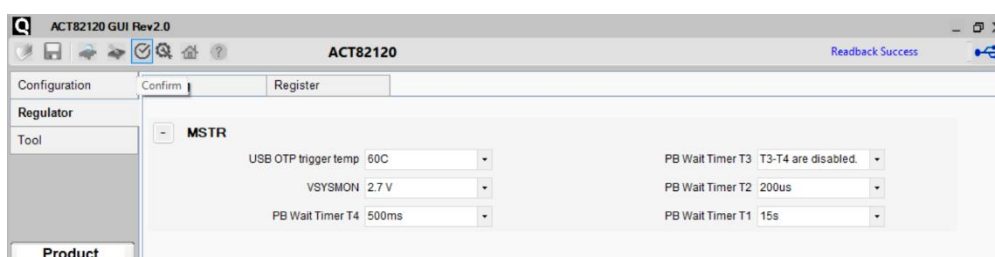


Figure 16 – Confirm Button

I2C Configuration: I2C configuration function allows user to select one of the ACT82120's I2C addresses for Read/Write function.

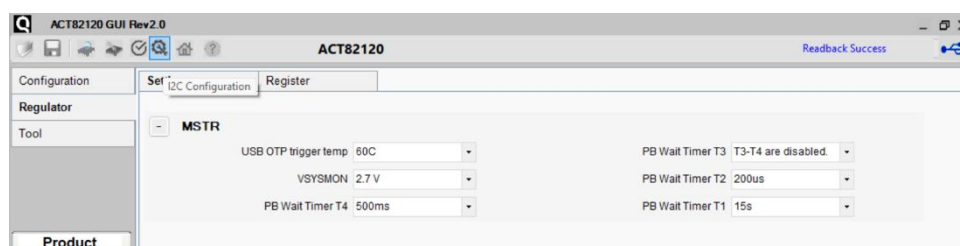


Figure 17 – I2C Configuration Button

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 18 – Dongle Connection Status