EVM User's Guide: TPS61382AQEVM-158

TPS61382A-Q1 Evaluation Module

Description

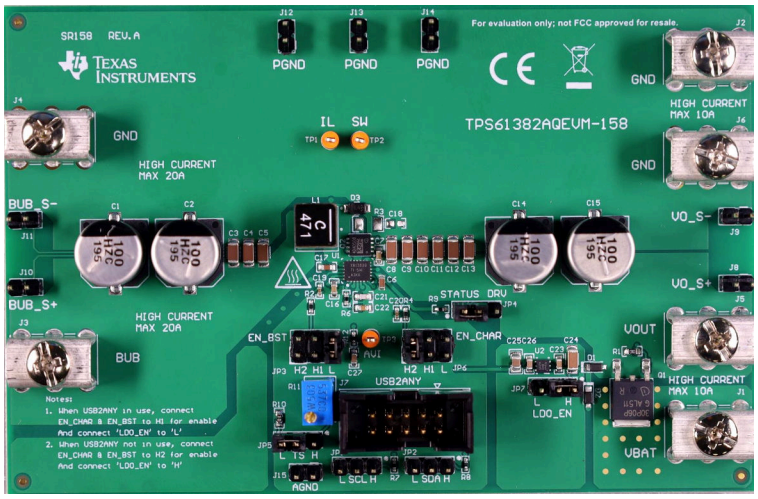
The TPS61382AQEVM-158 operates over a back up battery voltage range of 0V to 12V and main battery voltage up to 40V to achieve a bi-directional operation. The EVM supports an output up to 5.5A at 3.6V BUB and 6.2V output in boost mode, and supports 50-500mA charging current in charger mode. The device functions are adjustable using I2C interface.

Features

- Back-up battery (BUB) voltage in boost mode: 0.5V to 12V, 3V minimum voltage for start up
- Support absmax (VOUT pin) up to 40V
- Boost output voltage up to 12V
- Fault or operation status indication by STATUS pin and I2C
- Backup battery State-of-Health(SOH) detection
- Frequency: 2.2MHz for automotive applications

Applications

- Emergency call (eCall)
- Door handle module
- Fault indicator (FI)



TPS61382AQEVM-158

1 Evaluation Module Overview

1.1 Introduction

The TPS61382A-Q1 is a 40V, 15A, bi-directional boost converter and Buck/LDO charger that integrates battery state of health detection function. This user's guide describes the characteristics, operation, and the use of the TPS61382A-Q1 evaluation module (EVM). The EVM contains the TPS61382A-Q1, bi-directional boost converter with integrated charger, boost and state of health (SOH) detection function. The user's guide includes EVM specifications, recommended test setup, test result, schematic diagram, bill of materials, and the board layout.

1.2 Kit Contents

- One EVM to evaluate TPS61382A-Q1
- EVM disclaimer Read Me

1.3 Specification

A summary of the TPS61382A-Q1 EVM performance specifications is provided in Table 1-1. The ambient temperature is 25°C for all measurement, unless otherwise noted.

Table 1-1. Boost Mode Performance Specification Summary

PARAMETER	TEST CONDITION	VALUE	UNIT
Back up Battery (BUB) voltage	N/A	1 – 12	V
Output voltage	N/A	5 – 12	V
Maximum output current	BUB3V, VOUT6.2V	4.5	A
	BUB 3.6V, VOUT6.2V	5.5	
	BUB 4.5V, VOUT6.2V	7	
Default switching frequency	N/A	2.2	MHz

Table 1-2. Charger Mode Performance Specification Summary

PARAMETER	TEST CONDITION	VALUE	UNIT
Back up Battery (BUB) voltage	N/A	0 – 12	V
Output voltage	N/A	V_{BUB}+0.1V – 40	V
Charging current	N/A	50-500	mA

1.4 Device Information

The purpose of TPS61382AQEVM-158 is to showcase the typical application of the TPS61382A-Q1 device. This EVM requires an appropriate I2C interface, such as the TI USB2ANY. This evaluation module is designed to evaluate TPS61382A-Q1, which is an I2C compatible, low Iq, AEC-Q100 qualified bi-directional boost converter and buck/LDO charger integrated with battery health detection function. This device provides an integrated power design in back-up power systems like e-Call. The TPS61382A-Q1 supports a high absolute max voltage up to 40V on the VOUT pin to support load-dump condition and allow direct connection on 12V car battery system. The TPS61382A-Q1 monitors system voltage and automatically switches to boost mode when car battery malfunction occurs and voltage drop on the system side is detected.

2 Hardware

2.1 Connector, Test Point, and Jumper Descriptions

This section describes how to properly connect, set up, and use the TPS61382AQEVM-158.

2.1.1 Connector and Test Point Descriptions

This EVM includes I/O connectors and test points as shown in Table 2-1. The back up battery must be connected to BUB connectors, J3 and J4. The load must be connected to output connectors, J5 and J6. Car main battery must be connected to V_{BAT} connectors, J1 and J2.

Table 2-1. Connectors and Test Points

REFERENCE DESIGNATOR	DESCRIPTION
J1	Car main battery positive connection
J2	Car main battery return connection
J3	Back up battery positive connection
J4	Back up battery return connection
J5	Boost output positive connection
J6	Boost output return connection
J7	USB2ANY interface connector
J8	Boost output voltage positive sensing point
J9	Boost output voltage negative sensing point
J10	Back up battery voltage positive sensing point
J11	Back up battery voltage negative sensing point
J12, J13, J14	PGND sensing point
J15	AGND sensing point
TP1	IL pin test point
TP2	SW pin test point
TP3	AVI pin output test point

2.1.2 Jumper Configuration

2.1.2.1 JP1 and JP2 (I2C Interface Enable)

The JP1 jumper is used to configure SCL for the I2C interface. By default, this jumper is left open and the device uses the USB2ANY adapter internal pull up. Set this jumper to H position to enable pull-up circuit on the EVM. Put this jumper in the L position to disable the SCL.

The JP2 jumper is used to enable SDA for the I2C interface. By default, this jumper is left open and the device uses the USB2ANY adapter internal pull up. Set this jumper to H position to enable pull-up circuit on the EVM. Put this jumper in the L position to disable the SDA.

2.1.2.2 JP3 (Boost Enable)

The J5 jumper is used to enable boost function. By default, this jumper is set to the H2 position, which uses the LDO on the EVM to pull up the EN_BST pin and enable the boost function. Put this jumper in the H1 position to use the USB2ANY adapter to pull up the EN_BST pin and enable boost function. Put this jumper in the L position to disable boost function.

2.1.2.3 JP4 (Status or DRV Pin)

The JP4 jumper is used to configure Status or DRV pin. By default, this jumper is set to the STATUS position, which enables the pull-up circuit for the STATUS indicator function. Put this jumper in the DRV position to connect the PMOS driver.

2.1.2.4 JP5 (TS Pin)

The JP5 jumper is used to test the TS pin. By default, this jumper is set to the L position, which connects the TS pin with 10kΩ to GND to disable the TS pin monitoring function. Put this jumper in the H position to connect the TS pin to a potentiometer so that the TS pin resistance can be set and tested. Remove the jumper and connect the middle pin to the NTC network to use for temperature sense.

2.1.2.5 JP6 (Charger Enable)

The JP6 jumper is used to enable charger function. By default, this jumper is set to the H2 position, which uses the LDO on the EVM to pull up the EN_CHGR pin and enable the charger function. Put this jumper in the H1 position to use the USB2ANY adapter to pull up the EN_BST pin and enable charger function. Put this jumper in the L position to disable charger function.

2.1.2.6 JP7 (LDO Enable)

The JP1 jumper enables the LDO ,which can be used to supply EN pins of the device. By default, this jumper is set to the H position. Put this jumper in the L position to disable the LDO.

2.2 Test Procedure

The TPS61382A-Q1 integrates charger, boost and SOH functions for back up power applications. Verify the device through these three functions.

2.2.1 Verifying Boost Function

1. Prepare 1 power supply, 1 battery simulator and an e-load.
2. Set the power supply current limit to 2A. Set the power supply to 12V. Turn off the power supply output, and connect the positive output of the power supply to J1 and connect the negative output to J2.
3. Set the battery simulator current limit to +10A, -5A. Set the battery voltage to 3V. Turn off the power supply output, and connect the positive output of the power supply to J3 and the negative output to J4.
4. Set the e-load to CC mode, set CC current to 1A, close the load, connect the positive output of the load to J5 and the negative output to J6.
5. Configure the jumpers as Figure 2-1.
6. Turn on the power supply first, connect the USB2ANY adapter J7 and connect the TPS61382A-Q1 GUI on your PC. Then open the battery simulator and the e-load.
7. Close the power supply output and verify if Vout voltage is approximately 6.2V when Vbat drops below 6.2V.

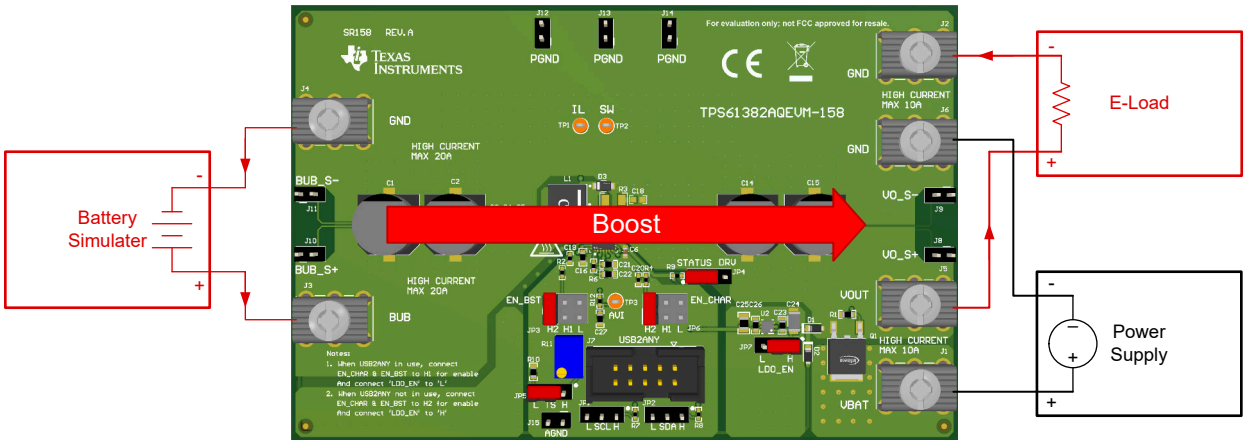


Figure 2-1. Verifying Boost Function

2.2.2 Verifying Charger Function

1. Keep the setup as similar to step 1-6 in Section 2.2.1.
2. Go to GUI *Charger Settings* page, select Li-ion in *Choose the Battery type* bar, set *Battery CV* as 4.20V and set *Charger, SOH* on the top bar as *Enable Charger*.
3. Verify if the battery simulator is charged by approximately 50mA
4. Close the power supply output. Verify if the battery simulator stops charging and starts outputting current when Vout drops below 6.2V . The Vout voltage need to be held at approximately 6.2V when Vout drops below 6.2V if the device is working normally.

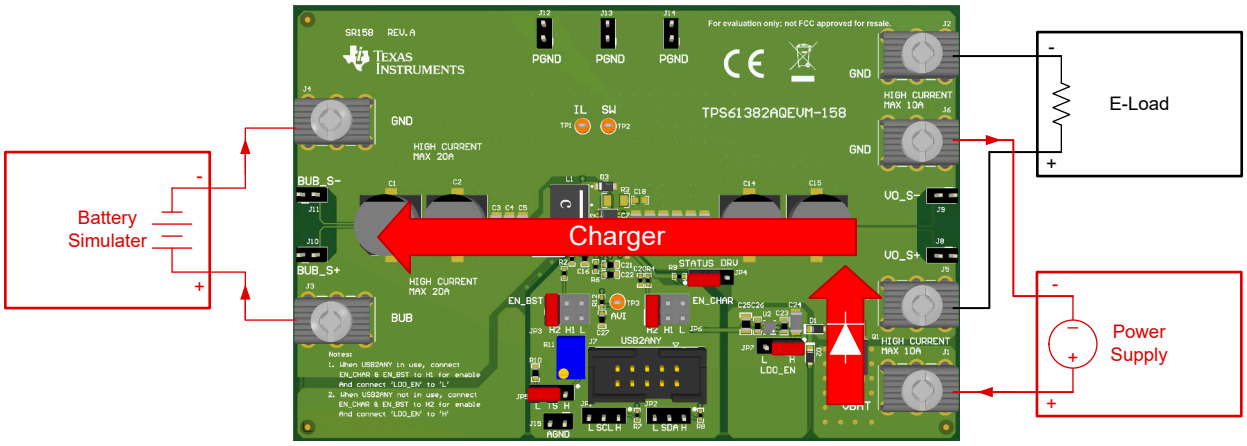


Figure 2-2. Verifying Charger Function

2.2.3 Verifying SOH Function

1. Keep the setup as similar to steps 1-6 in Section 2.2.1.
2. Go to GUI *SOH Settings* page, set *Enable AVI Pin Output* to *Battery voltage* and set *AVI Pin Ratio To The Backup Battery Voltage* as 1/2 with GUI.
3. Set *Charger, SOH* as *Enable SOH*. Check if the AVI pin voltage is approximately 1.5V.
4. Set *SOH Discharge Current* to 500mA with GUI and check if the battery simulator is discharged by approximately 500mA.
5. Set *Enable AVI Pin Output* to *Discharge Current* and check if the AVI pin voltage is approximately 0.5V.

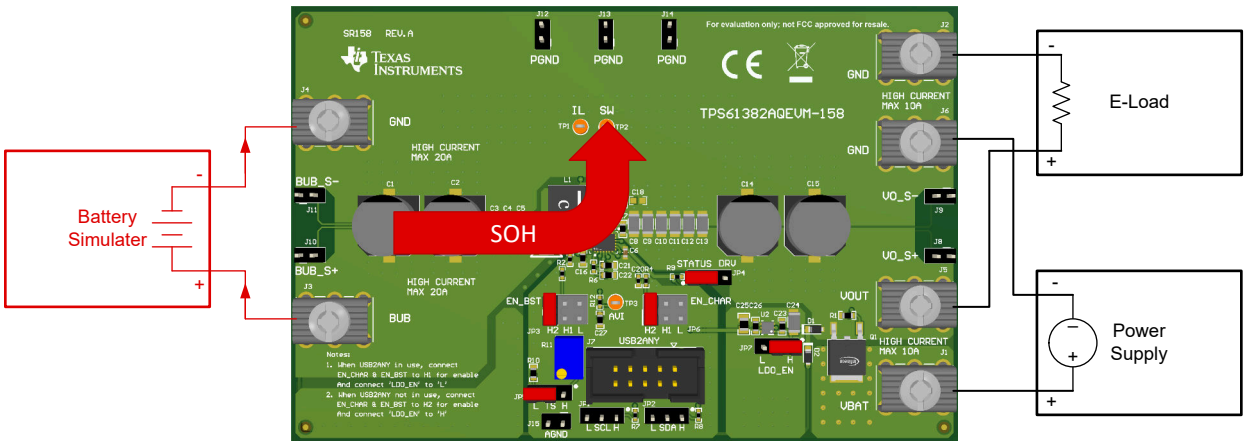


Figure 2-3. Verifying SOH Function

3 Software

3.1 Software User Interface

3.1.1 Install USB2ANY Explorer

Download and install the USB2ANY explorer from: http://www.ti.com/tool/USB2ANY. Upgrade the firmware version to 2.8.2.0.

3.1.2 GUI Installation

A graphical user interface (GUI) is available from on GUI. The GUI allows simple and convenient programming of the device through the TI USB2ANY device.

- Download the zip file for the desired platform.
- Extract the zip folder and install the GUI.
- Run through the installation steps. The installation wizard prompts for GUI Composer Runtime. This is done automatically.
- Open the GUI → TPS61382A-Q1.

3.1.3 Interface Hardware Setup

Connect the USB2ANY adapter to your PC using the supplied USB cable. Connect the TPS61382AQEVM-158 connector J6 to the USB2ANY adapter using the supplied 10-pin ribbon cable. The connectors on the ribbon cable are keyed to prevent incorrect installation.

Figure 3-1 shows a quick connection overview.

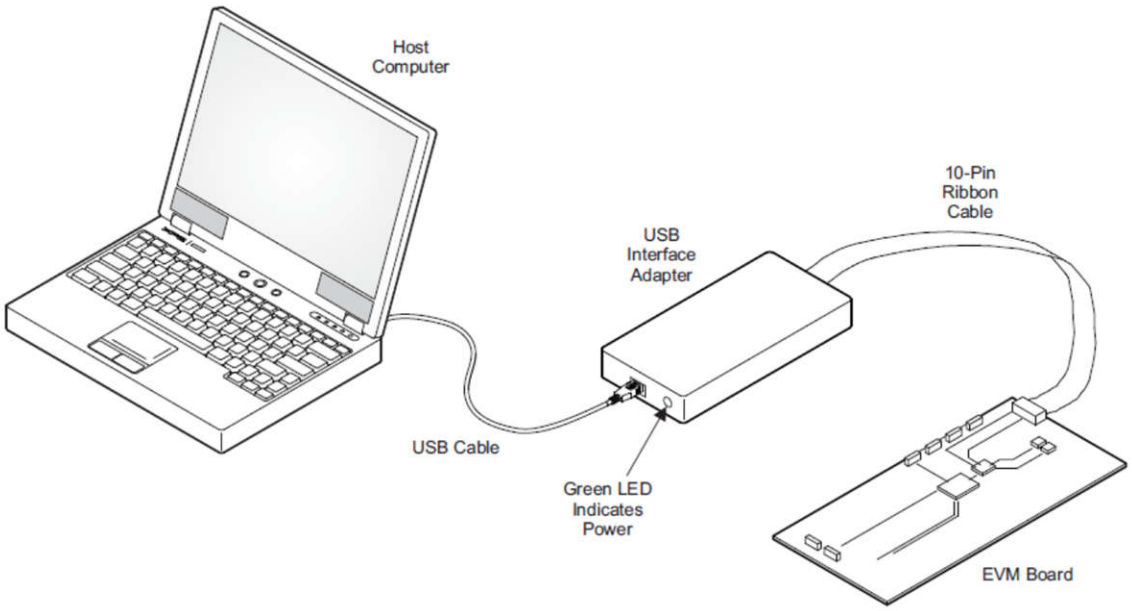


Figure 3-1. Quick Connection Overview

3.1.4 User Configuration Screen

The TPS61382AQEVM-158 board can be enabled by following the steps below:

1. Set the EVM hardware as described in step 1-6 in Section 2.2.1. Turn on the power supply.
2. Open the TPS61382A-Q1 GUI.
3. Click the connect button on the bottom bar, as shown in Figure 3-2. After the GUI and device are connected, the GUI reads all registers and shows a notification.

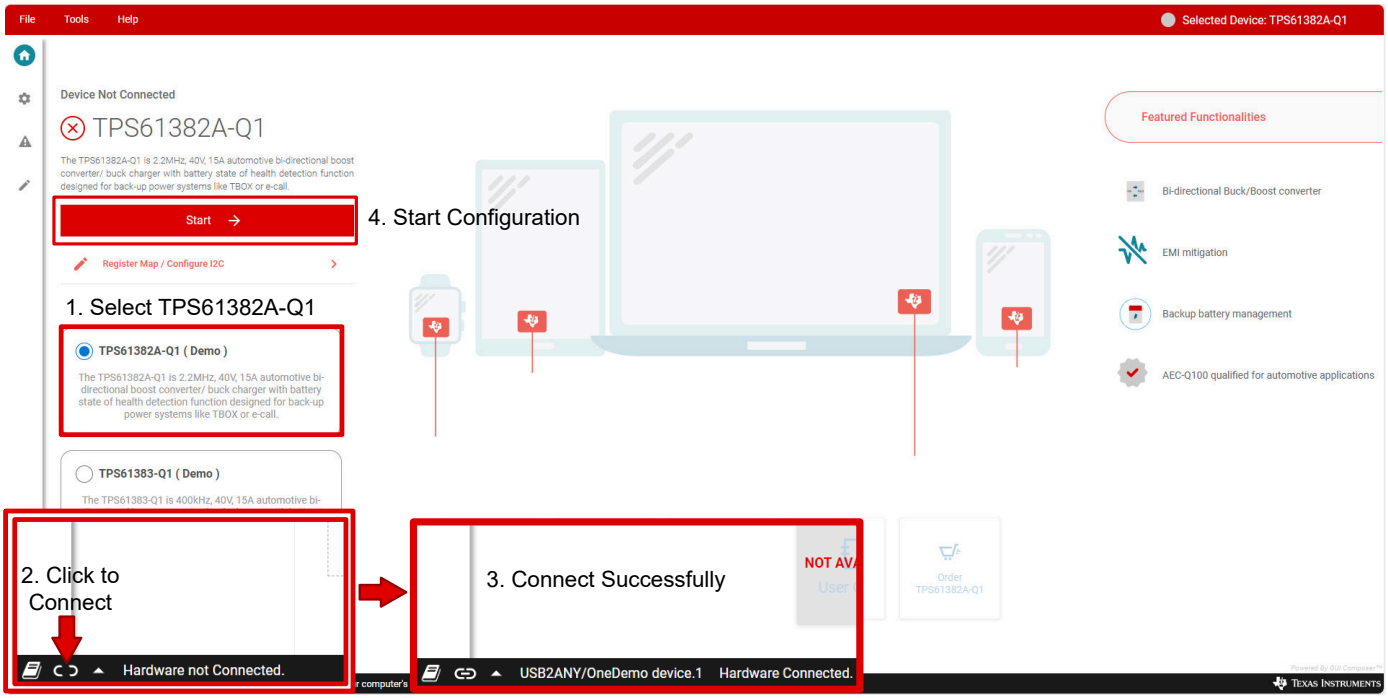


Figure 3-2. GUI Connect and Start

4. Click the *Start* button and the GUI automatically turns on to the Configuration Screen (see Figure 3-3). The TPS61382A-Q1 is set to boost enable by default. The default output voltage is 6.2V. Set the boost mode output voltage, current limit point, and so forth according to the design target.

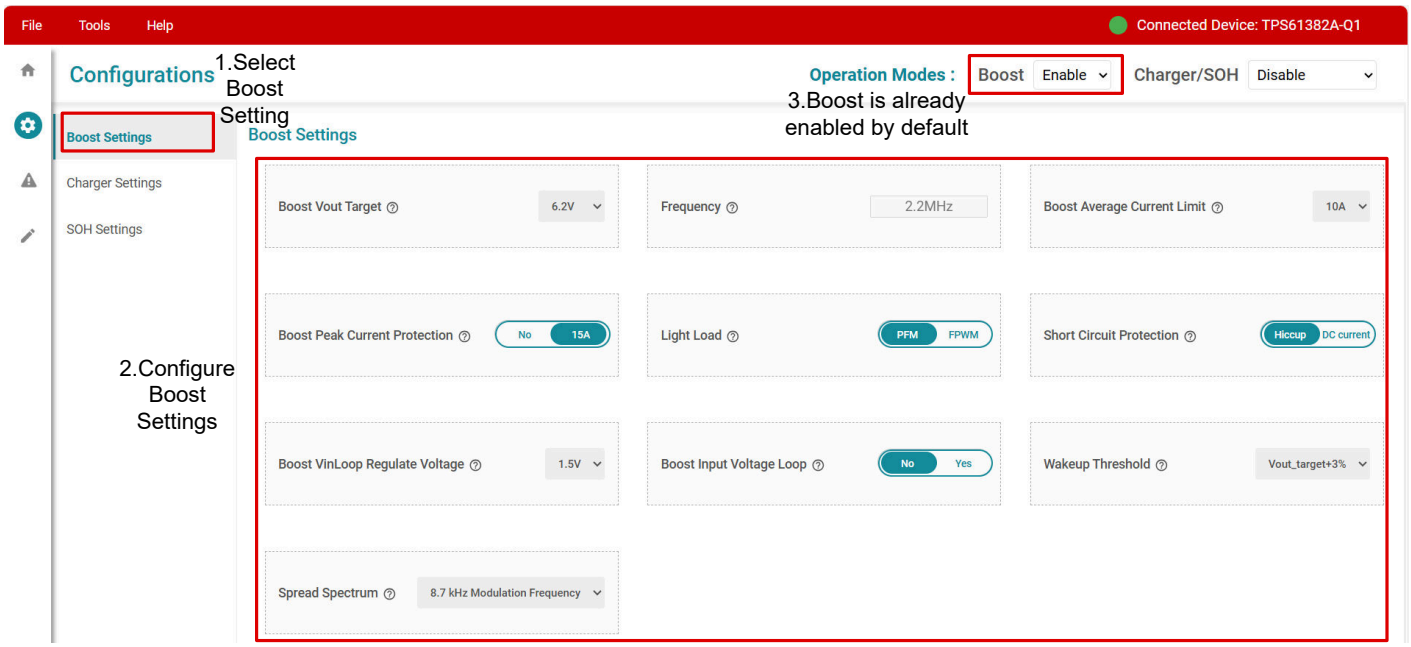


Figure 3-3. Boost Settings Sheet

5. Click the *Charger Settings* button and switch to Charger Settings Sheet (see Figure 3-4). The charger is set to Li-ion mode by default. Set the charger mode battery type, cell number, CC current, and so forth according to the design target.

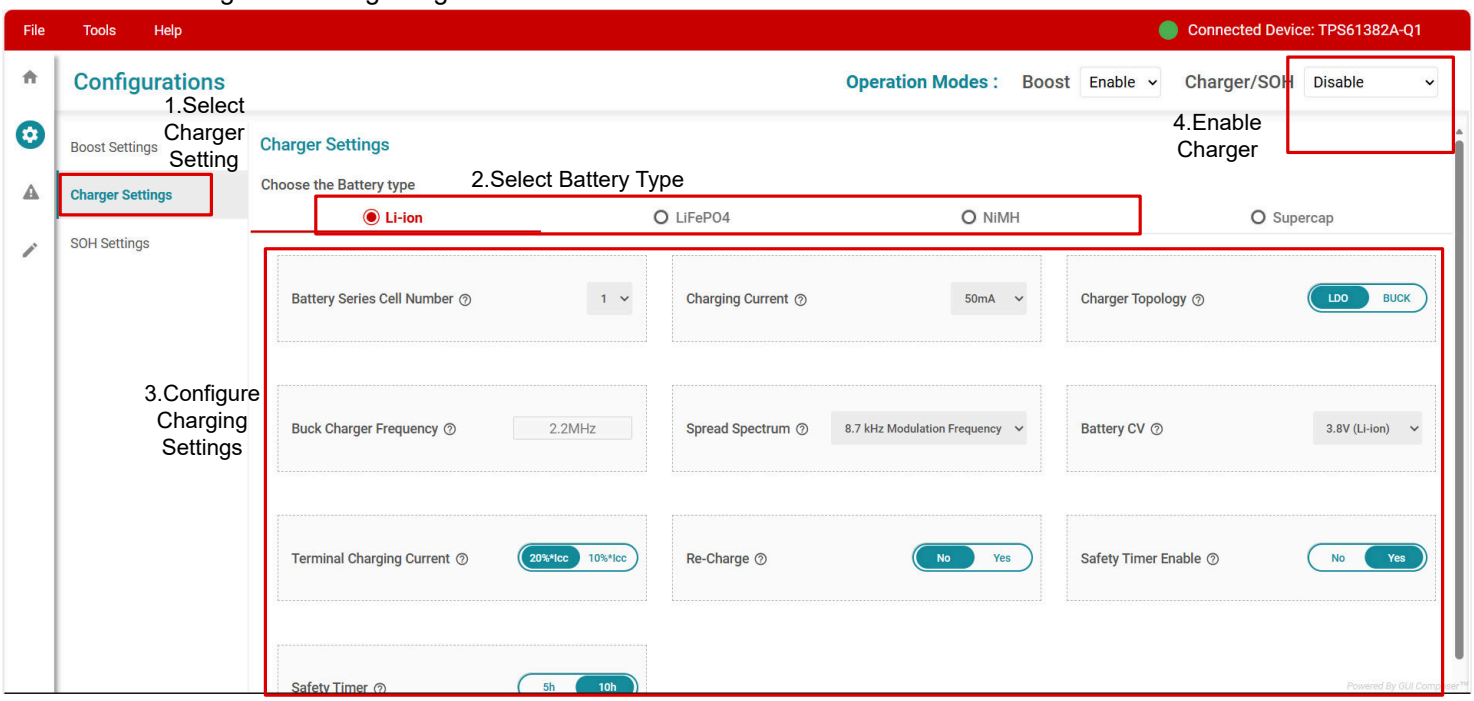


Figure 3-4. Charger Settings Sheet

6. Click the *SOH Settings* button and switch to the SOH Settings Sheet (see Figure 3-5). Set the SOH discharge current, AVI pin output ratio, AVI output, and so forth according to the design target.

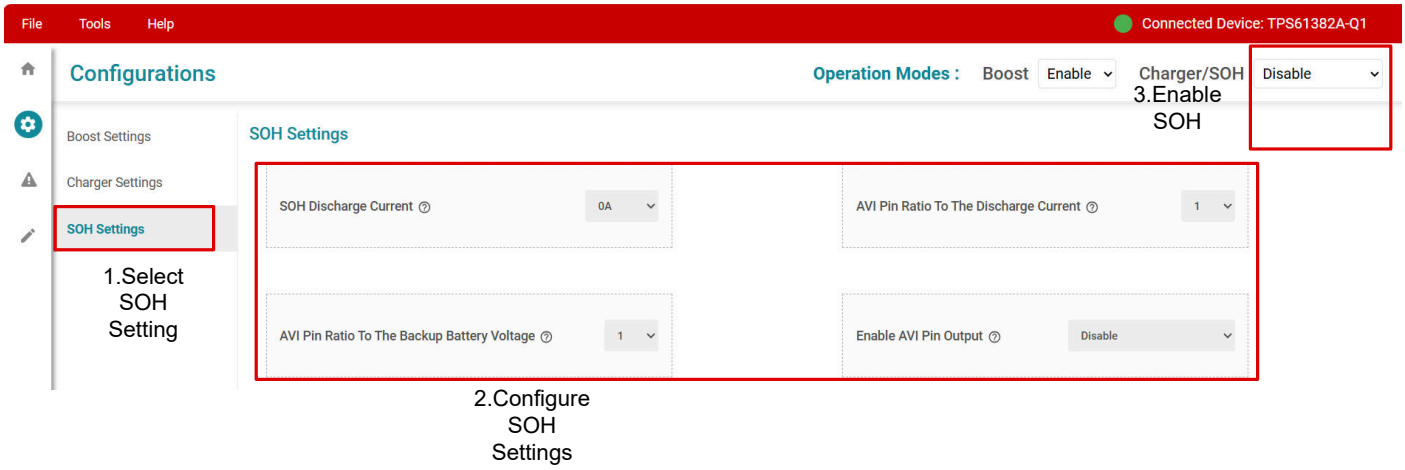


Figure 3-5. SOH Settings Sheet

3.1.5 Status and Fault Indications Screen

TPS61382A-Q1 GUI offers multiple device status and fault indications function. Enter the Status and Fault Indications Screen (Figure 3-6) to check the device' status and fault condition.

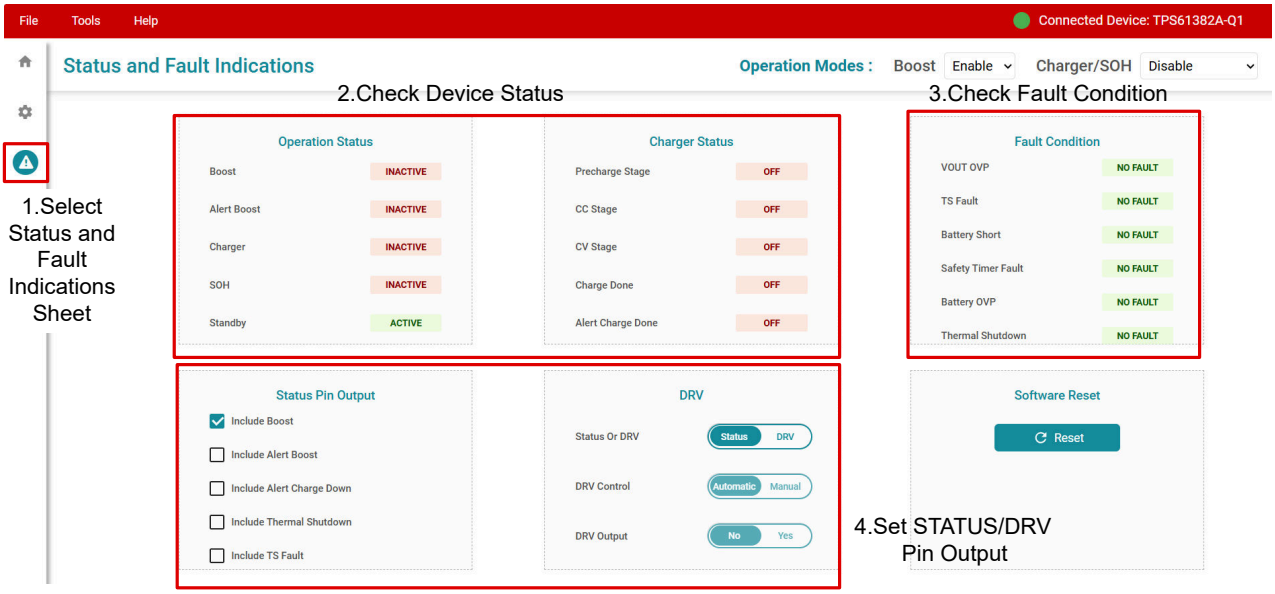


Figure 3-6. GUI Status and Fault Indications Screen

3.1.6 Register Map Screen

The Register Map Screen (see Section 3.1.6) shows a register-wise view of all parameters. A detailed description of each register bit can be found in this screen. Enter this screen to read and update the register bits to check.

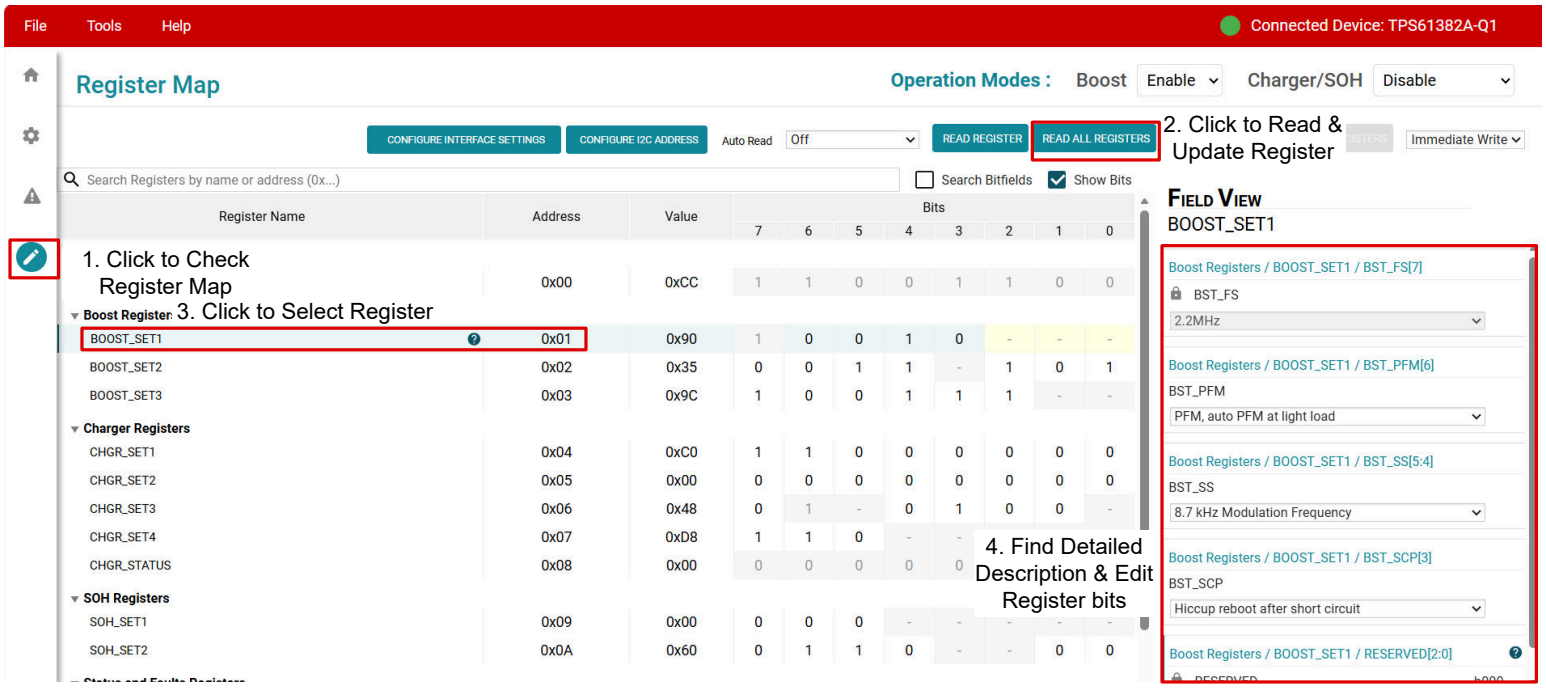


Figure 3-7. GUI Register Map Screen

3.2 Modification

This EVM requires an appropriate I^2C interface, such as the TI USB2ANY, to configure the TPS61382A-Q1.

4 Hardware Design Files

4.1 Schematic

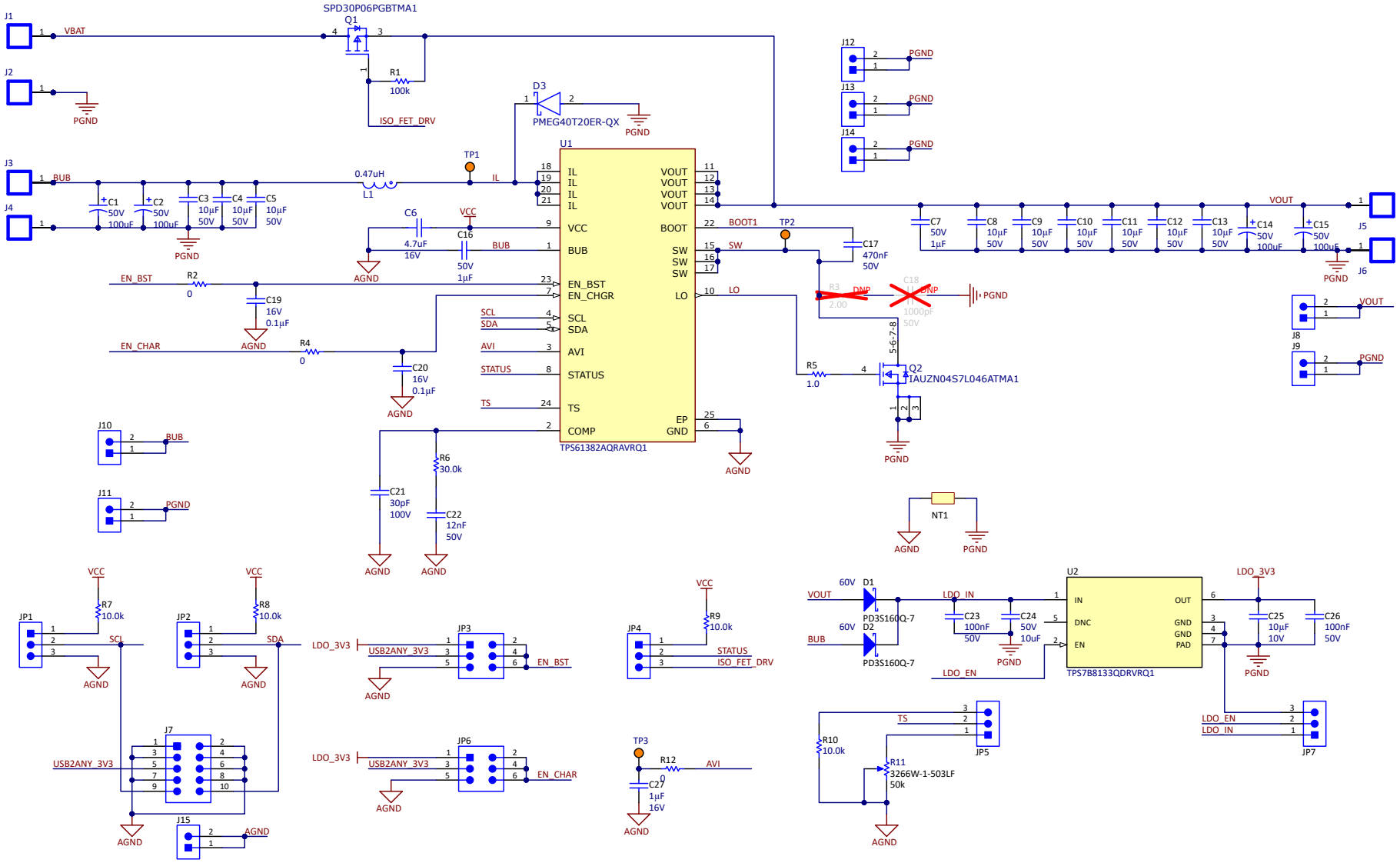


Figure 4-1. TPS61382AQEVM-158 Schematic

4.2 PCB Layout

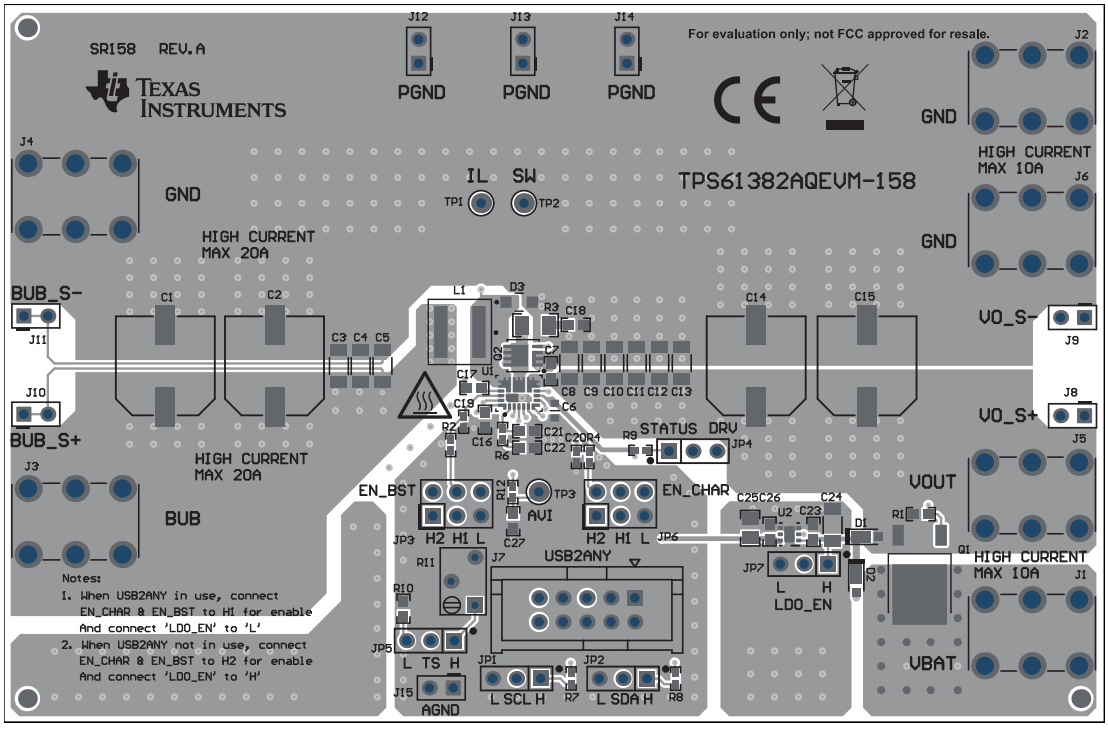


Figure 4-2. TPS61382AQEVM-158 Top-Side Layout

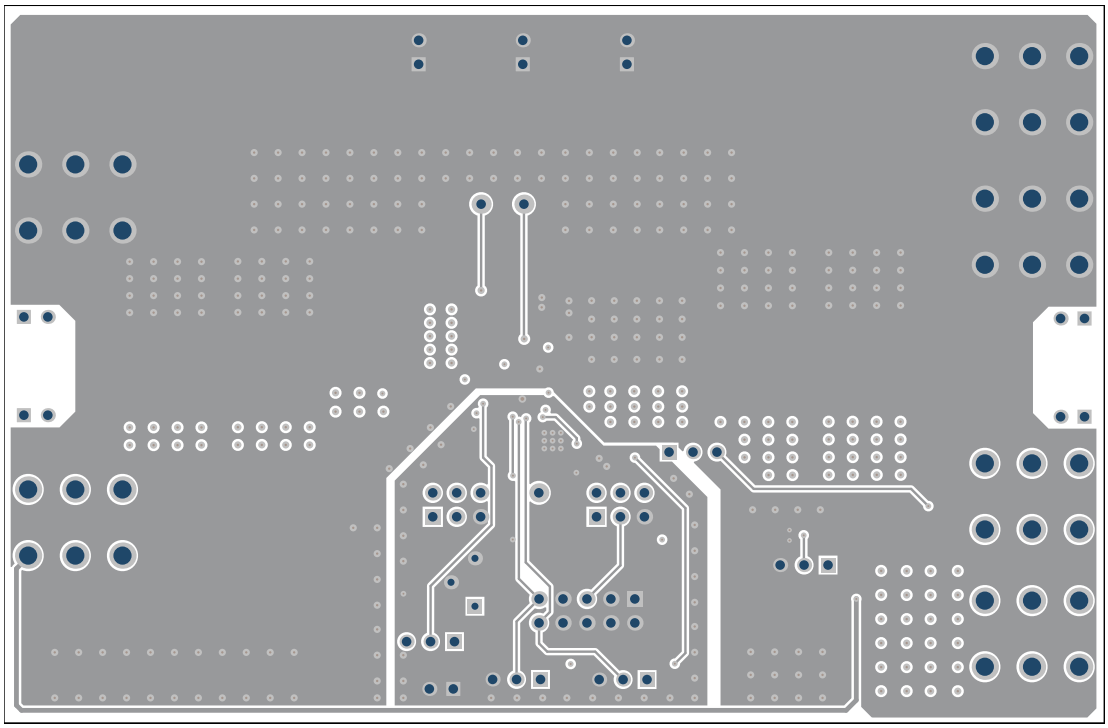


Figure 4-3. TPS61382AQEVM-158 Inner Layer1

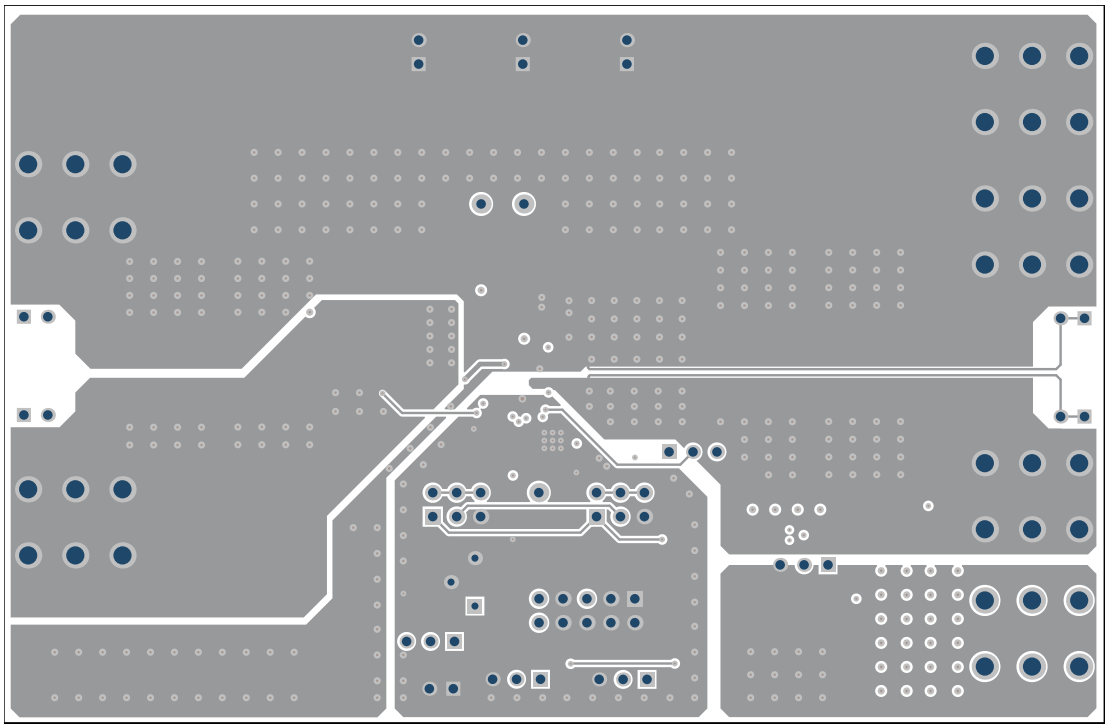


Figure 4-4. TPS61382AQEVM-158 Inner Layer2

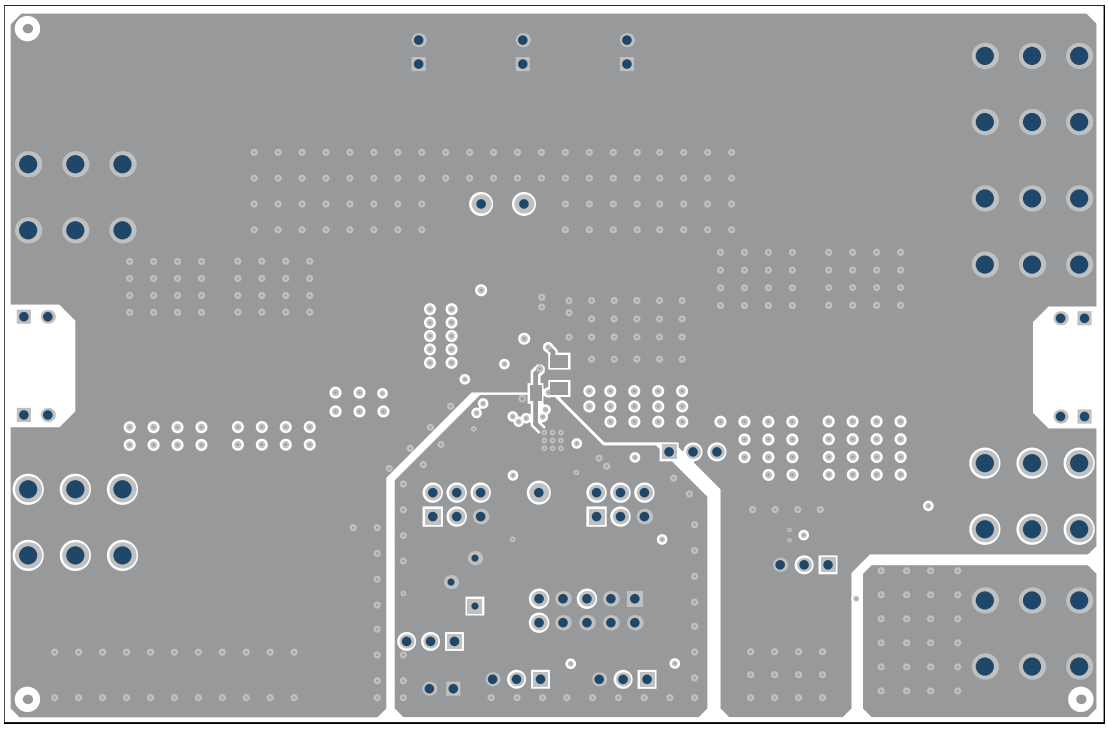


Figure 4-5. TPS61382AQEVM-158 Bottom-Side Layout

4.3 Bill of Materials

Table 4-1. Bill of Materials

Designator	Quantity	Value	Description	Package	Part Number	Manufacturer
C1, C2, C14, C15	4	100uF	CAP, Polymer Hybrid, 100uF, 50V,+/- 20%, 0.028 ohm, AEC-Q200 Grade 1, D10xL10.2mm SMD	Panasonic_G	EEH-ZC1H101P	Panasonic
C3, C4, C5, C8, C9, C10, C11, C12, C13	9	10uF	CAP, CERM, 10µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206_190	CGA5L1X7R1H106K160AC	TDK
C6	1	4.7µF	AEC-Q200 Compliant Chip Multilayer Ceramic Capacitor for Infotainment 4.7uF ±10% 16V X7S SMD 0603	FP-GRT188C71C475KE13D_0603-MFG	GRT188C71C475KE13D	Murata
C7, C16	2	1uF	CAP, CERM, 1µF, 50V,+/- 20%, X5R, AEC-Q200 Grade 3, 0603	0603	GRT188R61H105ME13D	MuRata
C17	1	0.47uF	CAP, CERM, 0.47uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H474K080AB	TDK
C19, C20	2	0.1uF	CAP, CERM, 0.1µF, 16V,+/- 5%, X7R, AEC-Q200 Grade 1, 0402	0402	GCM155R71C104JA55D	MuRata
C21	1	30pF	CAP, CERM, 30pF, 100V,+/- 1%, C0G/NP0, AEC-Q200 Grade 1, 0603	0603	GCM1885C2A300FA16D	MuRata
C22	1	0.012uF	CAP, CERM, 0.012µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	C0603C123K5RACTU	Kemet
C23, C26	2	0.1uF	CAP, CERM, 0.1µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	06035C104KAZ2A	AVX
C24	1	10uF	CAP, CERM, 10uF, 50V, +/- 10%, X5R, AEC-Q200 Grade 1, 1206	1206_180	GRT31CR61H106KE01L	MuRata
C25	1	10uF	CAP, CERM, 10µF, 10V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805_HV	GCJ21BR71A106KE01L	MuRata
C27	1	1uF	CAP, CERM, 1uF, 16V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71C105KA64D	MuRata
D1, D2	2	60V	Diode, Schottky, 60V, 1A, AEC-Q101, PowerDI323	PowerDI323	PD3S160Q-7	Diodes Inc.
D3	1		40V, 2A low VF Trench MEGA Schottky barrier rectifier, SOD123W	SOD123W	PMEG40T20ER-QX	Nexperia
J1, J2, J3, J4, J5, J6	6		TERMINAL SCREW PC 30AMP, TH	SCREW_TERMINAL_8199	8199	Keystone
J7	1		Header (shrouded), 100mil, 5x2, Gold, TH	CONN_5103308-1	5103308-1	TE Connectivity
J8, J9, J10, J11, J12, J13, J14, J15	8		Header, 100mil, 2x1, Tin, TH	CONN_PEC02SAAN	PEC02SAAN	Sullins Connector Solutions
JP1, JP2, JP4, JP5, JP7	5		Header, 100mil, 3x1, Tin, TH	CONN_PEC03SAAN	PEC03SAAN	Sullins Connector Solutions
JP3, JP6	2		Header, 100mil, 3x2, Tin, TH	SULLINS_PEC03DAAN	PEC03DAAN	Sullins Connector Solutions

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package	Part Number	Manufacturer
L1	1	0.47uH	470 nH Shielded Molded Inductor 26 A 1.8mOhm Max Nonstandard	SMT_IND_6MM51_6MM71	XGL6060-471MEC	Coilcraft
Q1	1		P-Channel 60V 30A (Tc) 125W (Tc) Surface Mount PG-TO252-3	FP-SPD30P06PGBTMA1_TO252-3-MFG	SPD30P06PGBTMA1	Infineon
Q2	1	40V	MOSFET N-Channel 40 V 72A (Tj) 45W (Tc) Surface Mount PG-TSDSON-8-44	TSDSON8	IAUZN04S7L046ATMA1	Infineon
R1	1	100k	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
R2, R4, R12	3	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0ED	Vishay-Dale
R5	1	1.0	RES, 1.0, 5%, 0.5 W, 1206	1206	CRM1206-JW-1R0ELF	Bourns
R6	1	30.0k	RES, 30.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040230K0FKED	Vishay-Dale
R7, R8, R9	1	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0FKED	Vishay-Dale
R10	1	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
R11	1	50k	Trimmer, 50k ohm, 0.25W, TH	4.5x8x6.7mm	3266W-1-503LF	Bourns
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5	5		Shunt, 2.54mm, Gold, Black	Wurth_60900213421	60900213421	Wurth Elektronik
TP1, TP2, TP3	3		Test Point, Miniature, Orange, TH	Keystone5003	5003	Keystone Electronics
U1	1		Bi-directional Boost Converter with LDO CC/CV and Battery Health Detection	WQFN-FCRLF24	TPS61382AQRAVRQ1	Texas Instruments
U2	1		Automotive 150mA high-voltage ultra-low-IQ low-dropout (LDO) linear regulator, DRV0006A (WSON-6)	DRV0006A	TPS7B8133QDRVRQ1	Texas Instruments

5 Additional Information

5.1 Trademarks

All trademarks are the property of their respective owners.

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

DATE	REVISION	NOTES
March 2026	*	Initial Release

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale, TI’s General Quality Guidelines, or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Last updated 10/2025