EVM User's Guide: BQ25820EVM

BQ25820 Evaluation Module

Description

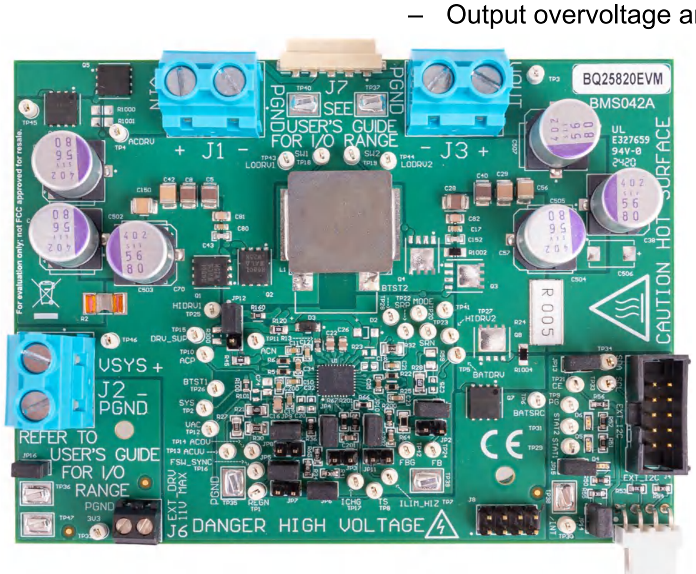
The BQ25820EVM evaluation module (EVM) is an evaluation system for the BQ25820 IC. The BQ25820 IC is a buck battery charge controller with direct power path control. The BQ25820 has a wide input range of 4.2V – 70V, a wide output voltage range of up to 70V, and bi-directional capabilities. The BQ25820EVM has a max input and output of 55V and a max charge current of 10A.

Get Started

1. Order the EVM on ti.com
2. Order the EV2400 to communicate with the EVM using bqStudio, or order the USB2ANY. interface device to communicate with the EVM using TI charger online GUI
3. Download the BQ25820 BQZ file
4. Download the BQ25820 EVM design files on ti.com

Features

- Wide input voltage operating range: 4.2V–55V
- Wide output operating range: up to 55V with CC/CV support for:
  - 1– to 13–Cell Li-Ion
  - 1– to 14–Cell LiFePO4
- Synchronous buck DC/DC charge controller with NFET drivers
  - Adjustable switching frequency from 200kHz to 600kHz
  - Optional synchronization to external clock
  - Optional gate driver supply input for optimized efficiency
- Resistor-programmable standalone with added I2C mode
- Built in MPPT to maximize power from solar panel arrays
- Power up from battery (reverse mode) output 4V to 55V
- High safety integration
  - Adjustable input overvoltage and undervoltage protection
  - Output overvoltage and overcurrent protection



1 Evaluation Module Overview

1.1 Introduction

The BQ25820EVM can be evaluated for up to 13 cell Li-Ion battery charging implementing CC/CV profile. Typical applications include medical equipment, solar backup chargers, energy storage systems, drones, cordless power and garden tools.

This EVM does not include the EV2400 or USB2ANY interface device and does not provide any electrical isolation for the digital interfaces. EV2400 or USB2ANY must be ordered separately to evaluate the BQ25820EVM and electrical safety considerations must be considered when interfacing between the PC and the EVM board. When interfacing the EVM to the PC through the digital interfaces, digital isolators with isolation boundary is recommended.

The BQ25820EVM has smaller clearance and creepage than normally used on high voltage boards as well as not having an isolation boundary. If you apply high voltage to this board, all terminals must be considered high voltage and hazardous live. Electric shock is possible when connecting the board to live wire. The board must be handled with care by a professional. For safety, use of isolated test equipment with various protection features (such as overvoltage and overcurrent) is recommended.

1.2 Kit Contents

This EVM kit includes:

- 1 BQ25820 EVM

1.3 Specification

Table 1-1. Recommended Operating Conditions for BQ25820EVM

	Description	MIN	TYP	MAX	UNIT
VIN (J1)	Input voltage to the EVM	4.2		55(1)	V
VOUT (J3)	Output voltage of the EVM	3.3		50(1)	V
IIN (J1)	Input current of the EVM			10(3) (4)	A
IOUT (J3)	Output current of the EVM			10(3)	A
Regulator output power	Output power of the EVM			400(3)	W
EXT_DRV (J6)	Voltage applied to DRV_SUP pin of the regulator	4		11	V
IAC sense resistor	Input current sense resistor	2	2(5)	10	mΩ
EVM operating ambient temperature (TA)			25(2)		°C

(1) Due to the high di/dt and dv/dt electrical flow associated with switch-mode power supplies, nodes on the EVM can have high spike above input voltage (in buck mode) or output voltage (in boost mode) level. Switch node voltage can swing up to *input or output + inductive spike* level. High side gate drives can swing up to *switch node voltage + 11V (DRV_SUP supply voltage dependent) + gate drive inductive spike* level. Safety precautions must be observed at all times.
(2) Connectors, bump-ons, jumpers on the EVM are not a good choice for evaluation under temperature greatly deviated from room temperature of 25°C. Please refer to BOM for temperature rating of board components.
(3) Thermal monitoring (for example, using a thermal camera) is recommended if power stage output current > 5A or total output power > 100W.
(4) Default EVM input current limit is set to 8A through the IIN pin. The current limiting feature can be disabled by setting EN_IIN_PIN bit to '0', changing IIN pin resistor, or shorting IIN pin to PGND through JP11.
(5) The input sense resistor is optional and the sense resistor can be removed. For an USB-C EPR operation, a 5mΩ sense resistor is needed.

1.4 Device Information

The device offers high-efficiency battery charging over a wide voltage range with output CC-CV control. The device integrates all the loop compensation for the buck converter, thereby providing a high density method with ease of use.

Besides the I2C host-controlled charging mode, the device also supports programmable hardware limits. Input current, and output current regulation targets can be set with single resistor on the IIN, and IOUT pins, respectively.

1.5 General Texas Instruments High Voltage Evaluation (TI HV EMV) User Safety Guidelines

WARNING

Always follow TI's set-up and application instructions, including use of all interface components within the recommended electrical rated voltage and power limits. Always use electrical safety precautions to help verify your personal safety and those working around you. Contact TI's Product Information Center http://ti.com/customer support for further information.

Save all warnings and instructions for future reference.

> **WARNING**
> Failure to follow warnings and instructions can result in personal injury, property damage or death due to electrical shock and burn hazards.

The term TI HV EVM refers to an electronic device typically provided as an open framed, unenclosed printed circuit board assembly. It is *intended strictly for use in development laboratory environments, solely for qualified professional users having training, expertise and knowledge of electrical safety risks in development and application of high voltage electrical circuits. Any other use and/or application are strictly prohibited by Texas Instruments.* If you are not suitably qualified, then immediately stop from further use of the HV EVM.

1. Work Area Safety:
   a. Keep work area clean and orderly.
   b. Qualified observers must be present anytime circuits are energized.
   c. Effective barriers and signage must be present in the area where the TI HV EVM and the interface electronics are energized, indicating operation of accessible high voltages can be present, for the purpose of protecting inadvertent access.
   d. All interface circuits, power supplies, evaluation modules, instruments, meters, scopes, and other related apparatus used in a development environment exceeding 50Vrms/75VDC must be electrically located within a protected Emergency Power Off EPO protected power strip.
   e. Use stable and non-conductive work surface.
   f. Use adequately insulated clamps and wires to attach measurement probes and instruments. No freehand testing whenever possible.
2. Electrical Safety:
   a. As a precautionary measure, a good engineering practice to assume is that the entire EVM can have fully accessible and active high voltages.
   b. De-energize the TI HV EVM and all the inputs, outputs and electrical loads before performing any electrical or other diagnostic measurements. Revalidate that TI HV EVM power has been safely de-energized.
   c. With the EVM confirmed de-energized, proceed with required electrical circuit configurations, wiring, measurement equipment hook-ups and other application needs, while still assuming the EVM circuit and measuring instruments are electrically live.
   d. Once EVM readiness is complete, energize the EVM as intended.

> **WARNING**
> While the EVM is energized, never touch the EVM or the electrical circuits, as the electrical circuits and EVM can be at high voltages capable of causing electrical shock hazard.

3. Personal Safety
   a. Wear personal protective equipment e.g. latex gloves or safety glasses with side shields or protect EVM in an adequate lucent plastic box with interlocks from accidental touch.

Limitation for safe use:

EVMs are not to be used as all or part of a production unit.

1.5.1 General Safety Information

The following warnings and cautions are noted for the safety of anyone using or working close to the BQ25820 EVM. Observe all safety precautions.

Warning	The BQ25820EVM circuit module can become hot during operation due to dissipation of heat. Avoid contact with the board. Follow all applicable safety procedures applicable to your laboratory. **CAUTION** Hot surface. Contact can cause burns. Do not touch!
Warning	The BQ25820EVM has smaller clearance and creepage than normally used on high voltage boards as well as not having an isolation boundary. If the user applies high voltage to this board, then all terminals are considered high voltage and hazardous live. Electric shock is possible when connecting the board to live wire. The board needs to be handled with care by a professional. For safety, use of isolated test equipment with various protection features (such as overvoltage and overcurrent) is recommended.
Warning	High voltages that can cause injury exist on this evaluation module (EVM). Please verify all safety procedures are followed when working on this EVM. Never leave a powered EVM unattended.
Warning	High voltage can be present on board capacitors after power down. Properly check and discharge all on-board energy reservoir after EVM power down.
Caution	Do not leave EVM powered when unattended.

CAUTION

The communication interfaces are not isolated on the EVM. The use of digital isolators is recommended. Verify all high voltage safety precautions are observed during testing.

CAUTION

Connections for rated current must be made at the terminal block. Test points are not rated for the board current.

CAUTION

The circuit module can be damaged by over temperature. To avoid damage, monitor the temperature during evaluation and provide cooling, as needed, for your system environment. Do not operate beyond the current and voltage limits in Table 1-1.

CAUTION

Test equipment can be damaged by application of external voltages. Check your equipment requirements and use blocking diodes or other isolation techniques, as needed, to prevent damage to your equipment.

CAUTION

The circuit module has signal traces, components, and component leads on the bottom of the board. This can result in exposed voltages, hot surfaces or sharp edges. Do not reach under the board during operation.

CAUTION

The default settings of the BQ25820 is possibly not designed for the user's application. Verify the EVM settings are set appropriately for test setup before device power up. Set all protections appropriately and limit current for safe operation.

CAUTION

The board does not have a fuse installed and relies on the external voltage source current limit to verify circuit protection.

2 Hardware

2.1 Board Parameters

Table 2-1. Default board setup for BQ25820VM

	Description	Value	Unit
ACUV	Input undervoltage	10	V
ACOV	Input overvoltage	55	V
IIN	Input current of the EVM	8	A
IOUT	Output current of the EVM	10	A
FSW_SYNC	Switching frequency of the power stage	250	KHz
VBAT_REG	Battery charge voltage	29.4	V
IAC Sense Resistor	Input current sense resistor	2	mΩ

Table 2-2. PCB and Mechanical Parameters

	Value	Unit
Board Size (X dimension, or length)	112	mm
Board Size (Y dimension, or width)	84	mm
IC + power stage max height	5	mm
Total Copper Layers	6	layer
Copper weight per layer	2	oz
Total board thickness	62	mil

2.2 IO and Jumper Descriptions

Table 2-3. Connector/Port Description

Jack	Description
J1-VIN	Input: positive terminal.
J1-PGND	Input: negative terminal (ground terminal).
J3-VOUT	Connected to battery pack output.
J3-PGND	Ground.
J4-EXT_I2C	Communication port for the USB2ANY.
J5-I2C	Communication port for the EV2400.
J6-EXT_DRV	Connection for external gate drive.
J7-Power Connector	Connection for VAC and BAT.
J8-Communication Port	Connection for EXT_DRV, /INT, I2C, /PG, and 3.3V.

Table 2-4. Jumper Description

Jumper	Description	Factory Default
JP1	Use JP1 to connect the default feedback resistor and set the charger to the default 7 cell battery	Installed
JP2	Use JP2 to connect a new feedback resistor to program a different cell count	Not installed
JP3	Use JP3 to connect external IOUT resistor. JP3 can be shorted to PGND to disable hardware output current limiting.	Not installed
JP4	Shunt JP4 to use default IOUT resistor. By closing JP4, the default IOUT current is set to 10A.	Installed
JP5	Shunt JP5 to bias TS.	Installed
JP6	With JP5 shunted (REGN connected for voltage divider). Shunt JP6 to set TS status to normal.	Installed
JP7	With JP5 shunted (REGN connected for voltage divider). Use JP7 to connect external resistor to change TS status.	Not installed
JP8	Use JP8 to connect external FSW_SYNC resistor.	Not installed
JP9	Shunt JP9 to use default FSW_SYNC resistor. By closing JP9, the default switching frequency is set to 250kHz.	Installed
JP10	Shunt JP10 to use default IIN resistor. By closing JP10, the maximum input current is set to 8A.	Installed
JP11	Use JP11 to connect external IIN resistor. JP11 can be shorted to PGND to disable hardware input current limiting.	Not installed
JP12	Use JP12 to select the gate driver source. Shunt pin1 to pin2 to use IC internal LDO REGN output. Shunt pin2 to pin3 to use external gate drive supply. Maximum external gate drive supply can be up to 11V.	Pin1 and pin2 shunted
JP13	Shunt JP13 to enable controller in forward mode. Open JP13 to disable controller. The /CE pin can also be used as a general purpose indicator.	Installed
JP14	Shunt JP14 to connect /INT to a pullup rail.	Installed
JP15	Shunt JP15 to connect STAT1 to a pullup rail. The STAT1 pin can also be used as a general purpose indicator.	Installed
JP16	Shunt JP16 to generate on board 3.3V pullup rail.	Installed

2.3 Communication Interface Setup

The charger is controlled by a state machine that uses I2C registers and the state machine makes decisions based off of the I2C registers. Software only helps with reading and writing to those registers.

2.3.1 BQSTUDIO using EV2400

Download the latest version of BQSTUDIOTEST. Double click the *Battery Management Studio* installation file and follow the installation steps. The software supports Microsoft® Windows® XP, 7, and 10 operating systems. Launch BQSTUDIO and select *Charger*. If the EVM configuration file for BQSTUDIO does not appear in the Charger, close BQSTUDIO and either download the .BQZ file from the EVM product folder at www.ti.com or request the file via e2e.ti.com. The file must be saved into C:\XXX\BatteryManagementStudio\config, where XXX is the directory you selected to install BQSTUDIO.

2.3.2 TI Charger GUI for USB2ANY

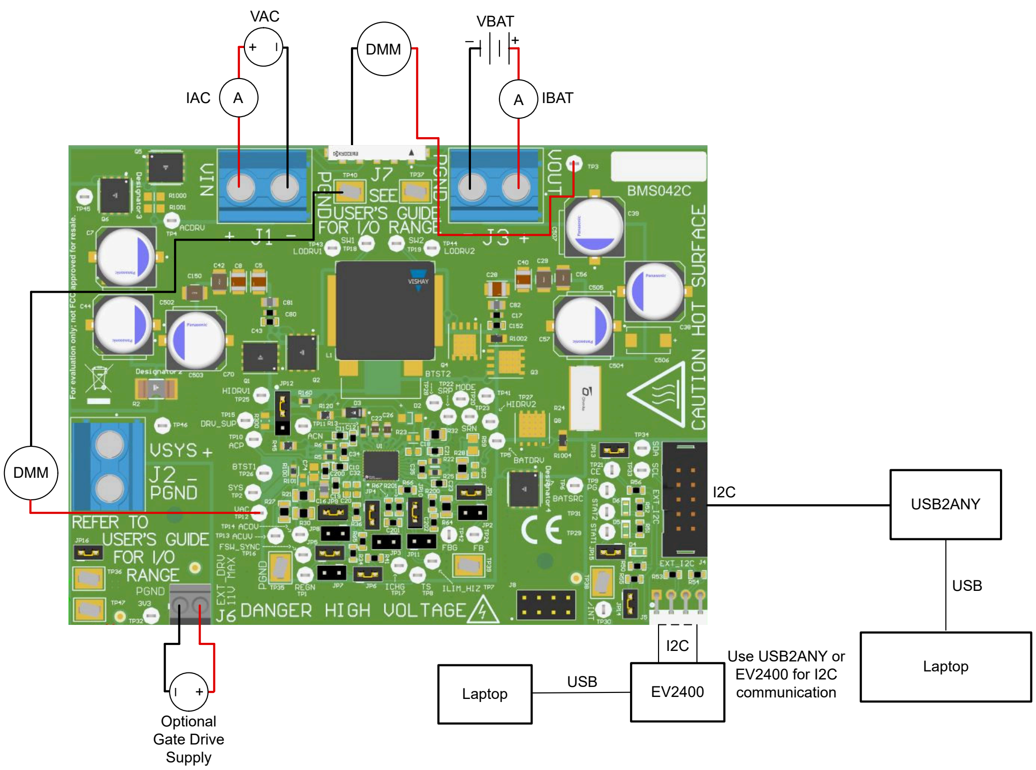
Navigate to the TI-CHARGER-GUI tool folder. Once at the tool page, click on the *Evaluate in the cloud* button. The browser automatically redirects to the TI Charger GUI landing page. From the landing page, locate the device desired for evaluation and click *Select Device*. Note that the EVM must be powered and the USB2ANY must be connected to both the EVM and the PC for a connection to be established. Also, update the USB2ANY to the latest version with the USB2ANY Explorer Software.

2.4 Equipment

There are two recommended ways to test the EVM. The first and preferred way to test the EVM is to use a four-quadrant power supply. The second is to use a electronic load in constant voltage mode. Testing with a constant voltage load is covered in a later section. The following list of equipment is recommended when testing with a four-quadrant power supply.

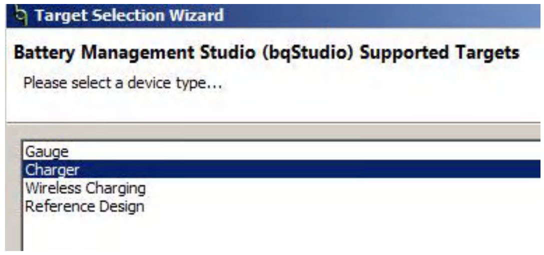
1. **Power Supplies:** A power supply capable of supplying 40V at 8A is required. While this part can handle larger voltage and current, larger power levels are not necessary for this procedure.
2. **Load #1:** A Kepco load: BOP36-6M, DC 0 to ±36 V, 0 to ±6 A (or higher), or equivalent. When testing without a real battery, connect 2000 uF of capacitance across the input.
3. **Meters:** Six Fluke 75 multimeters, (equivalent or better) or: Three equivalent voltage meters and three equivalent current meters.
4. **Computer:** A computer with at least one USB port and a USB cable.
5. **EV2400 Communication Kit or USB2ANY Communication Kit**
6. **Software:** For software setup, refer to Section 2.3.

2.4.1 Equipment Set Up

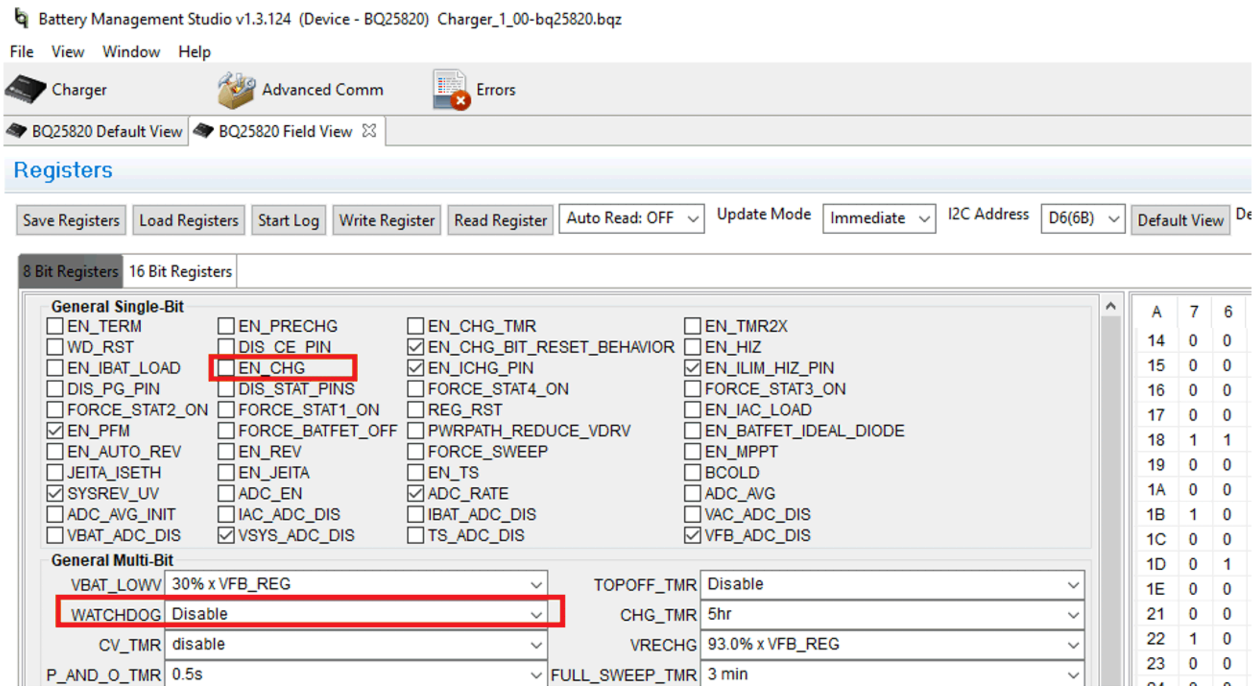


Use the following guidelines to set up the equipment:

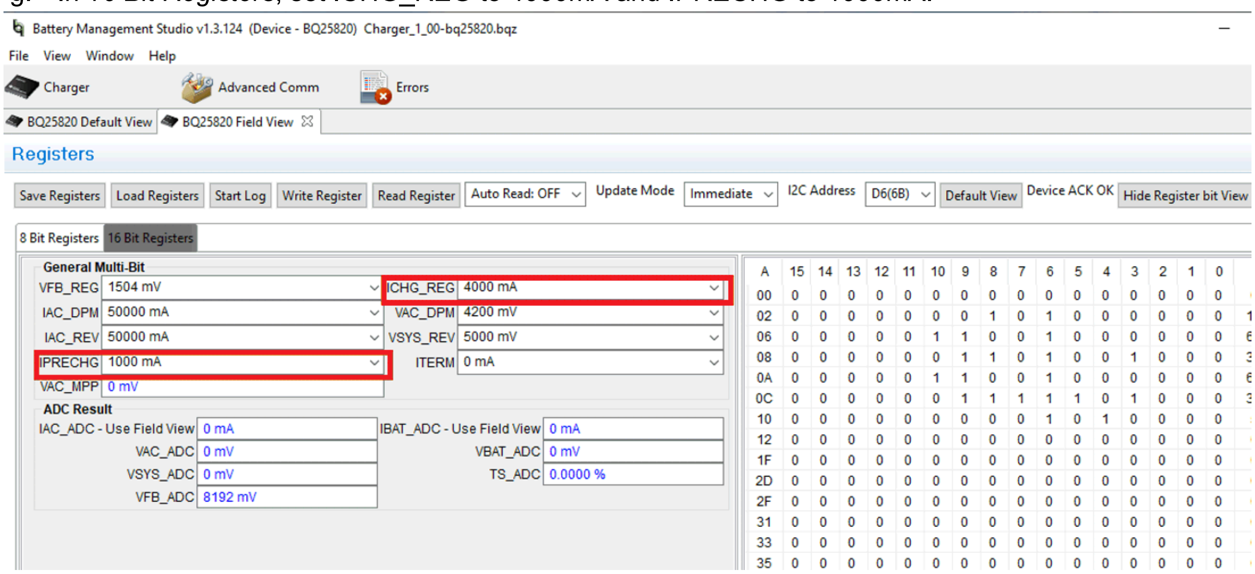
1. Set power supply 1 for 40V DC, 8A current limit and then turn off the supply.
2. Connect the output of power supply 1 in series with a current meter to J1 (VIN and PGND).
3. Connect a voltage meter across J1 (VIN) and J1 (PGND).
4. Connect load 1 in series with a current meter to J3 (VBAT and PGND).
5. Connect a voltage meter across J5 (VBAT and PGND).
6. Set 23V at KEPCO load output. Limit KEPCO to 6A. Use load 2 to power EVM from the VOUT output.
7. Make sure the jumpers are installed as indicated in IO and Jumper Descriptions.
8. If using Battery Management Studio, use the following steps:
    a. Connect J5 to the EV2400. Connect J5 to the I^2C PORT 2 on the EV2400
    b. Turn on the computer and load 2. Open the bqStudio software.
    c. Select *Charger* and click the *Next* button.



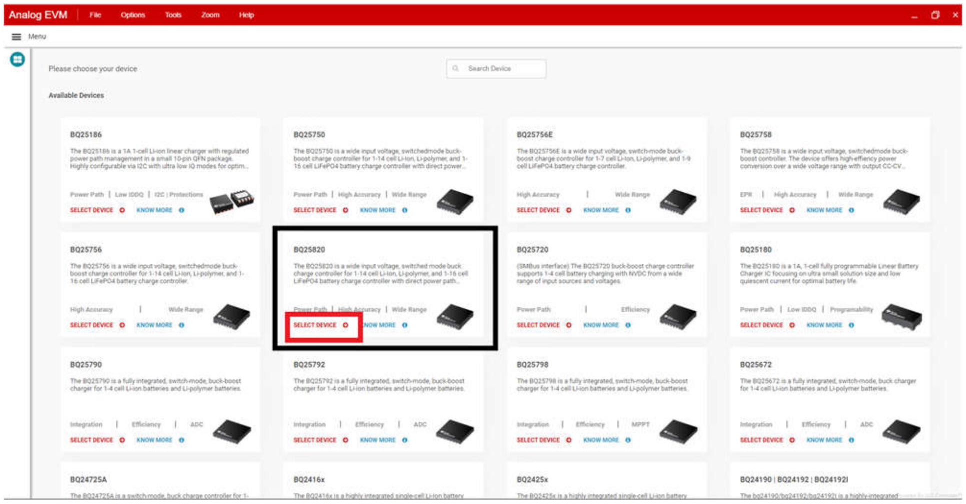
d. Select *Charger_1_00_BQ25820.bqz* on the *Select a Target Page*.
e. After selecting the target device, click *Field View.* and then click the *Read Register* button.
f. Set WATCHDOG and EN_CHG to disabled.



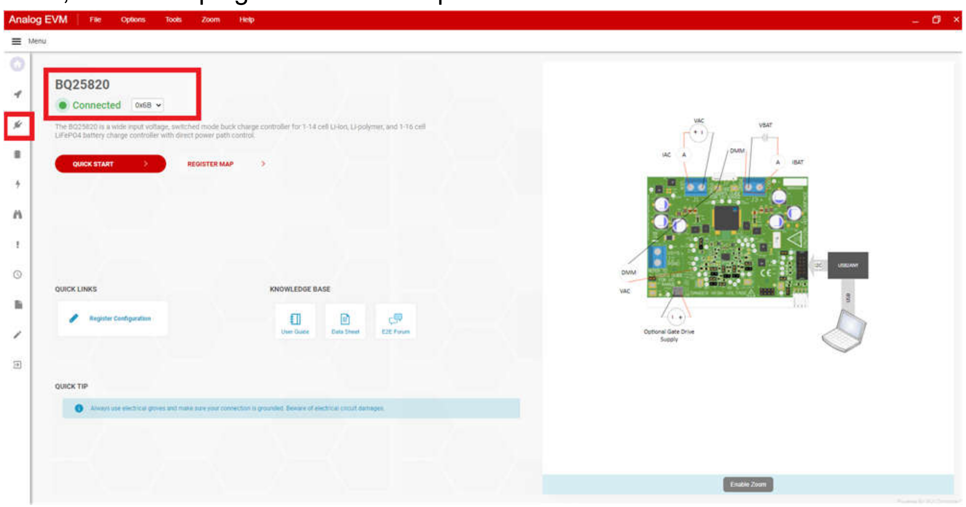
g. In *16 Bit Registers*, set ICHG_REG to 4000mA and IPRECHG to 1000mA.



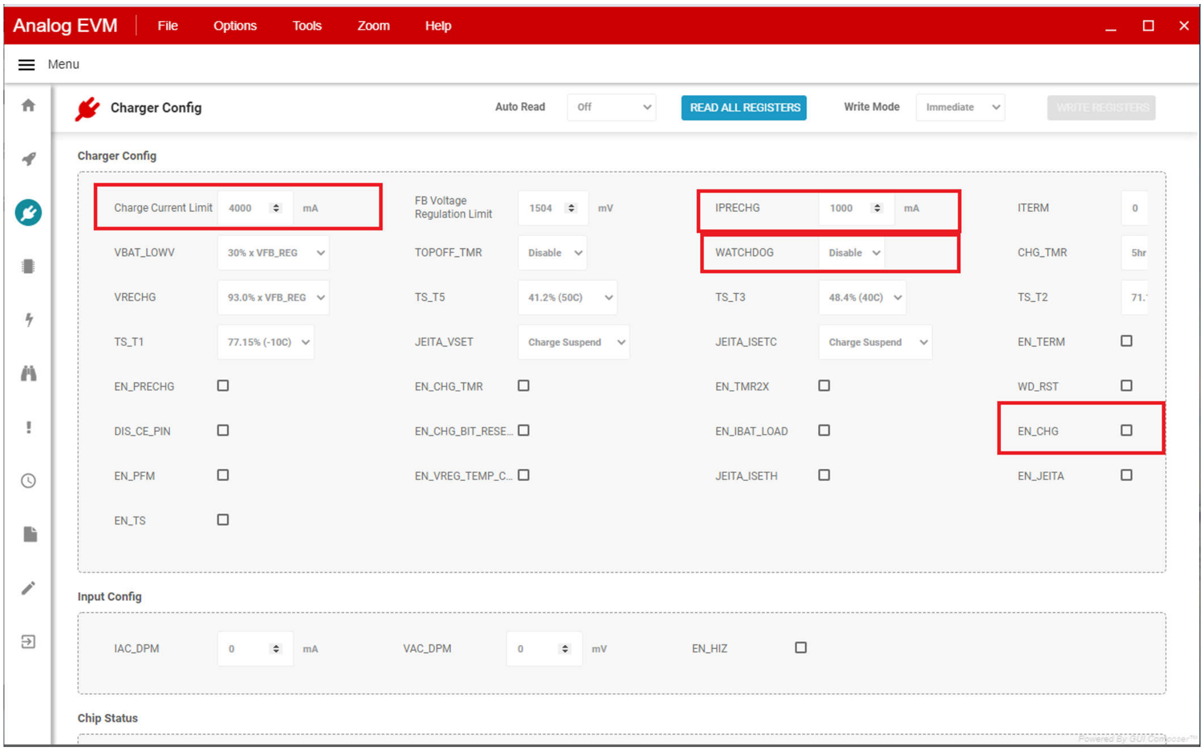
9. If using TI Charger GUI, then use the following steps:
   a. Connect J4 to the USB2ANY. Turn on the computer and load 2.
   b. Navigate to the TI Charger GUI website and select the charger to use:



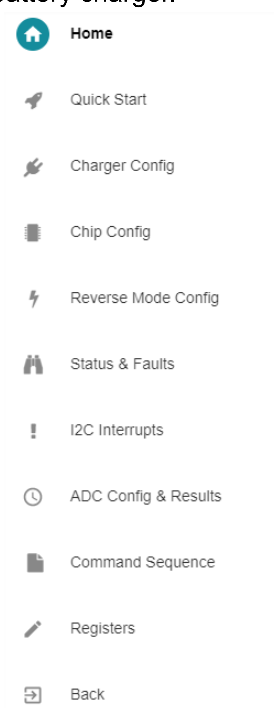
   c. At the top left of the screen, users will see the *Hardware Connected* icon. After users see the hardware is connected, select the plug icon on the left panel.



   d. This is the Charger Configuration window. Click the Read All Register button at the top, then set WATCHDOG and EN_CHG to disabled. Set ICHG_REG to 4000mA and IPRECHG to 1000mA.



e. Here is a brief description of what the other icons on the left side panel are. Select through these icons to configure other operations of the battery charger.



10. Turn on power supply #1, measure

    V(J1(VAC)) = 40V ± 0.5V

    I(J1(IAC)) = 2.4A ± 0.5A

    V(J3(VBAT)) = 23V ± 0.5V

    I(J3(IBAT)) = 3.9A ± 0.5A

Use the following guidelines to test the BQ25820 EVM power path:

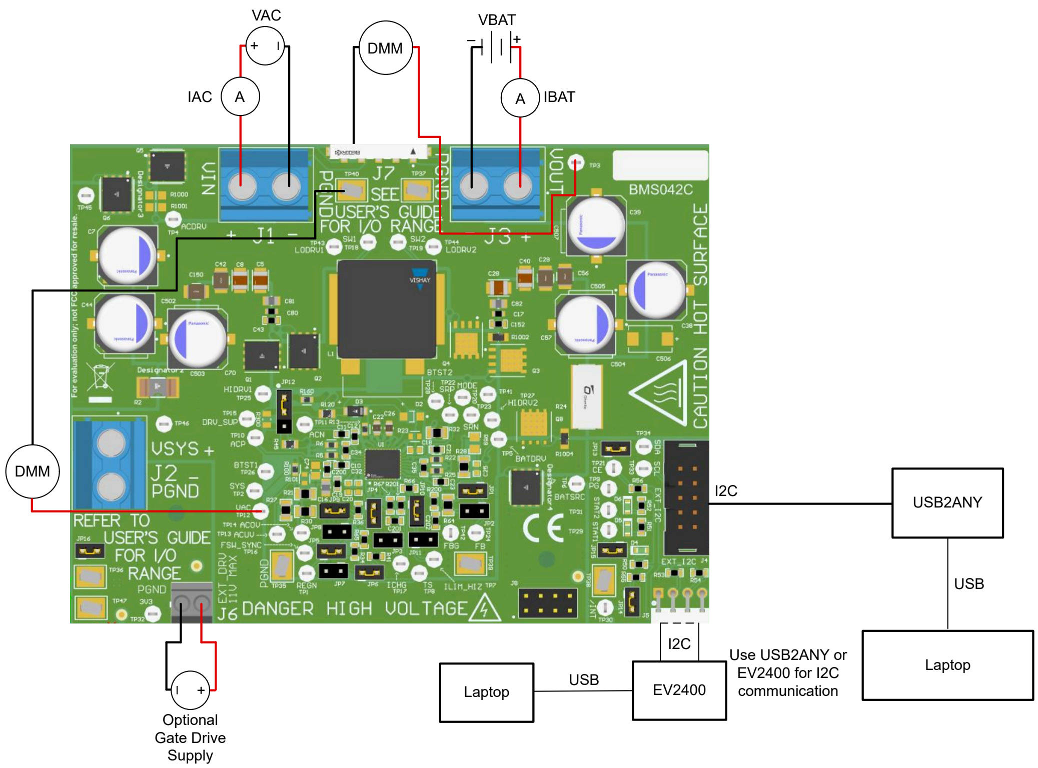
1. Disconnect the power supply from J1 (VIN and PGND) and disconnect Load 1 from J3 (VOUT and PGND).
2. Connect the output of power supply 1 to J3 (VOUT and PGND).
3. Set power supply 1 for 20V DC, 8A current limit and then turn off power supply.
4. Connect a voltage meter across J2 (VSYS) and J2 (PGND).
5. Turn on power supply 1, measure V(J2(VSYS)) = 20V ± 0.5V.

2.4.2 Equipment - Using a CV Load

The following list of equipment is recommended when testing with a constant voltage electronic load.

1. **Power Supplies:** A power supply capable of supplying 40V at 4A is required. While this part can handle larger voltage and current, larger power levels are not necessary for this procedure.
2. **Load #1:** Kikusui PLZ164WA 0-150V, 0-33A When testing without a real battery, connect 2000 uF of capacitance across the input.
3. **Meters:** Six Fluke 75 multimeters, (equivalent or better) or: Four equivalent voltage meters and two equivalent current meters.
4. **Computer:** A computer with at least one USB port and a USB cable.
5. **EV2400 Communication Kit or USB2ANY Communication Kit**
6. **Software:** For software setup, refer to Section 2.3.

2.4.3 Equipment Setup - Using a CV Load



Use the following guidelines to set up the equipment:

1. Set power supply 1 for 40V DC, 8A current limit and then turn off the supply.
2. Connect the output of power supply 1 in series with a current meter to J1 (VIN and PGND).
3. Connect a voltage meter across J1 (VIN) and J1 (PGND).
4. Connect load 1 in series with a current meter to J3 (VOUT and PGND).
5. Connect a voltage meter across J3 (VOUT and PGND).
6. Set electronics load to CV mode and 23.5V. Turn off load 1.

Note

Add a 3000uF capacitor on BAT pin when testing without real battery.

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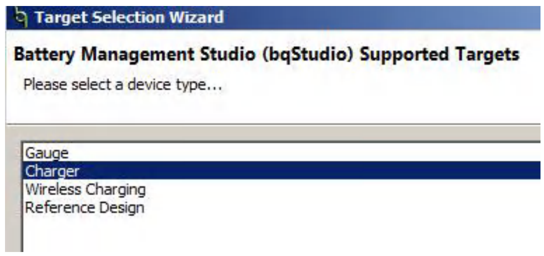
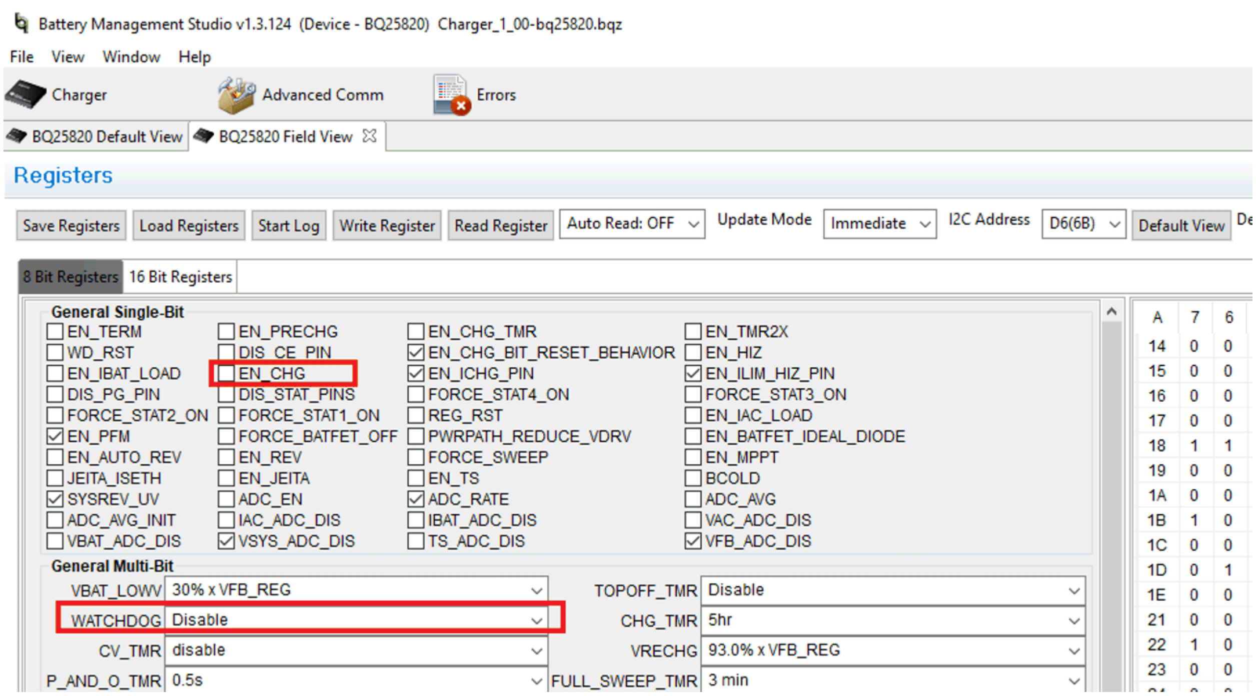
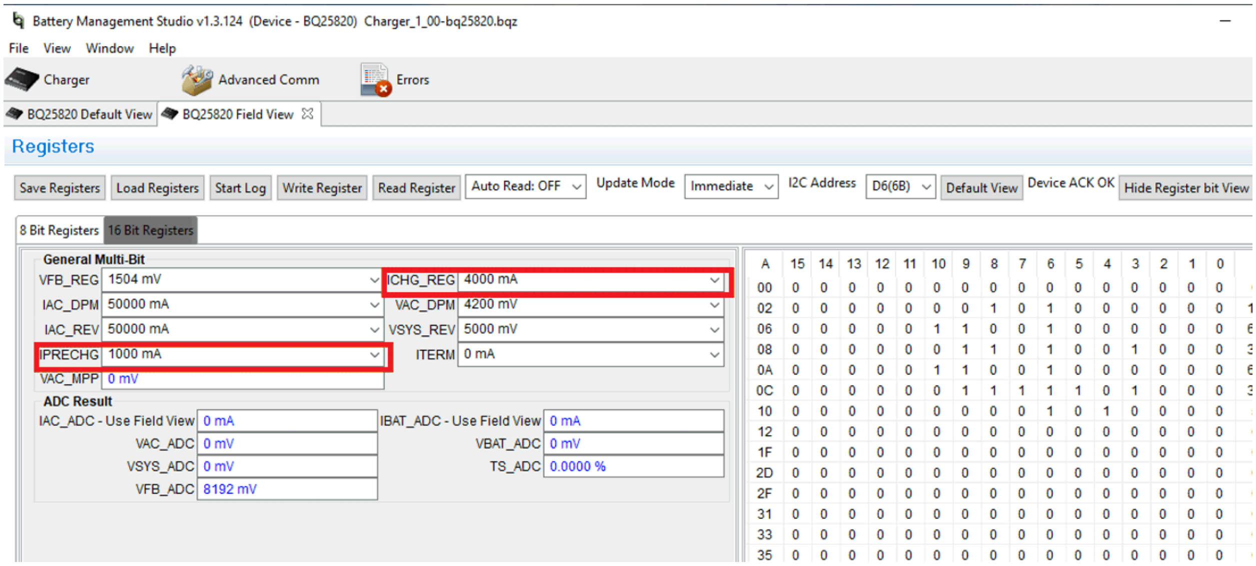
7. Connect J5 to the EV2400. Connect J5 to the I²C PORT 2 on the EV2400.
8. Make sure the jumpers are installed as indicated in IO and Jumper Descriptions.
9. Unplug Jumper 13.
10. If using Battery Management Studio, then use the following steps:
    a. Connect J5 to the EV2400. Connect J5 to the I²C PORT 2 on the EV2400
    b. Turn on the computer and load 2. Open the bqStudio software.
    c. Select *Charger* and click the *Next* button.



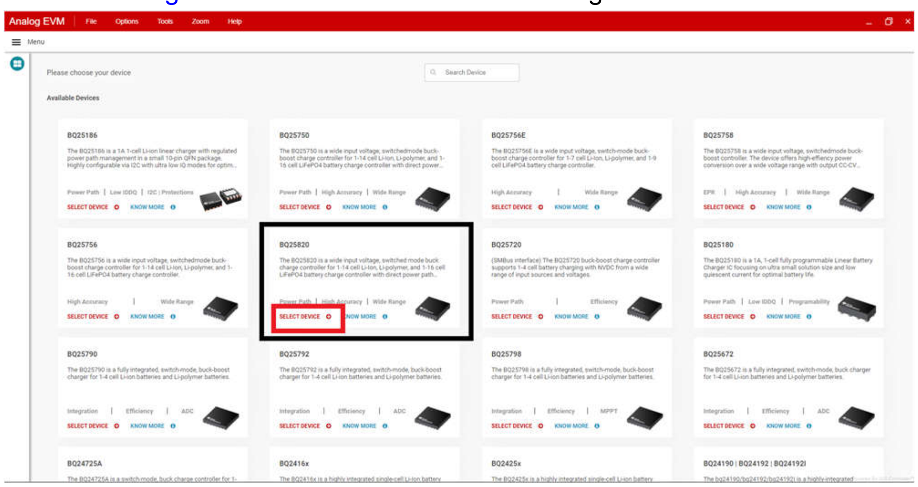
    d. Select *Charger_1_00_BQ25820.bqz* on the *Select a Target Page*.
    e. After selecting the target device, click *Field View.* and then click the Read Register button.
    f. Set WATCHDOG and EN_CHG to disabled.



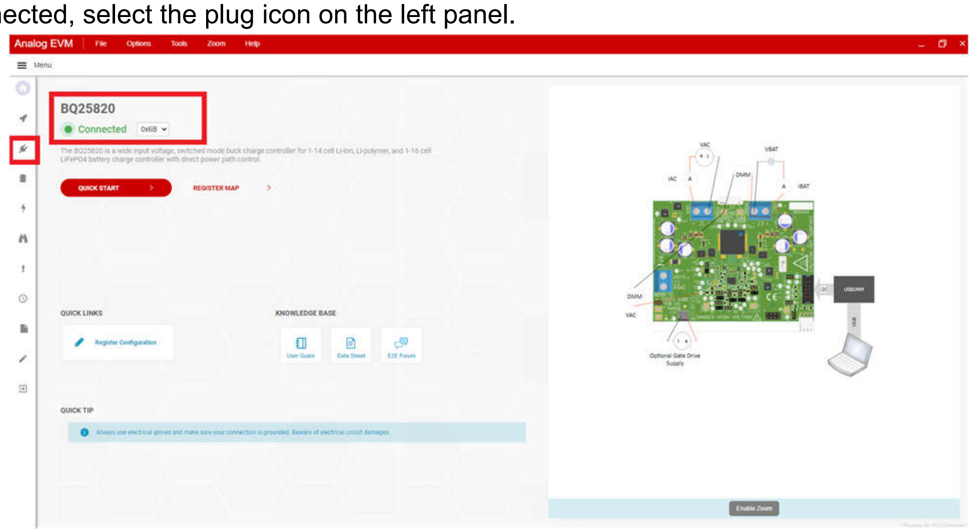
g. In *16 Bit Registers*, set ICHG_REG to 4000mA and IPRECHG to 1000mA.



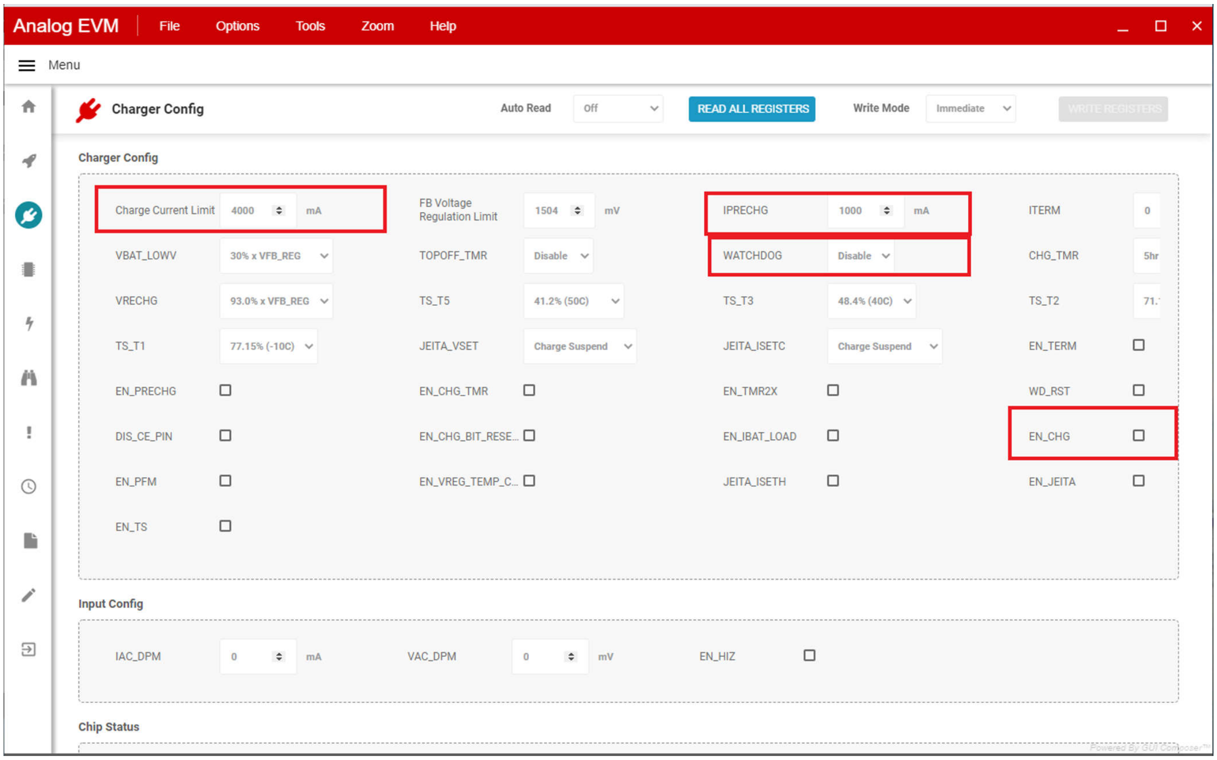
11. If using TI Charger GUI, then use the following steps:
    a. Connect J4 to the USB2ANY. Turn on the computer and load 2.
    b. Navigate to the TI Charger GUI website and select the charger to use:



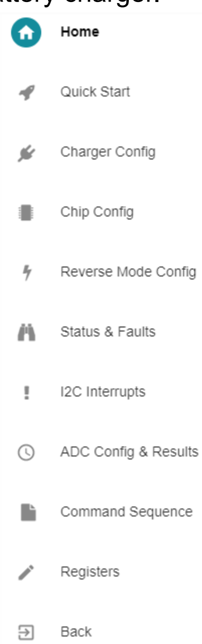
c. At the top left of the screen, users will see the *Hardware Connected* icon. After users see the hardware is connected, select the plug icon on the left panel.



d. This is the Charger Configuration window. Click the *Read All Register* button at the top, then set WATCHDOG and EN_CHG to disabled. Set ICHG_REG to 4000mA and IPRECHG to 1000mA.



e. Here is a brief description of what the other icons on the left side panel are. Select through these icons to configure other operations of the battery charger.



12. Set EN_CHG to enabled. Plug in jumper 13.
13. Set power supply 1 to 40V, measure

    V(J1(VAC)) = 40V ± 0.5V

    I(J1(IAC)) = 1.2A ± 0.5A

    V(J3(VBAT)) = 23. V ± 0.5V

    I(J3(IBAT)) = 2A ± 0.5A

Use the following guidelines to test the BQ25820 EVM power path:

1. Disconnect the power supply from J1 (VIN and PGND) and disconnect Load 1 from J3 (VOUT and PGND).
2. Connect the output of power supply 1 to J3 (VOUT and PGND).
3. Set power supply 1 for 20V DC, 8A current limit and then turn off power supply.
4. Connect a voltage meter across J2 (VSYS) and J2 (PGND).
5. Turn on power supply 1, measure V(J2(VSYS)) = 20V ± 0.5V.

3 Hardware Design Files

The following sections includes the hardware design files for BQ25820EVM. This section includes the schematics, board layouts, and Bill of Materials (BOM).

3.1 Schematic

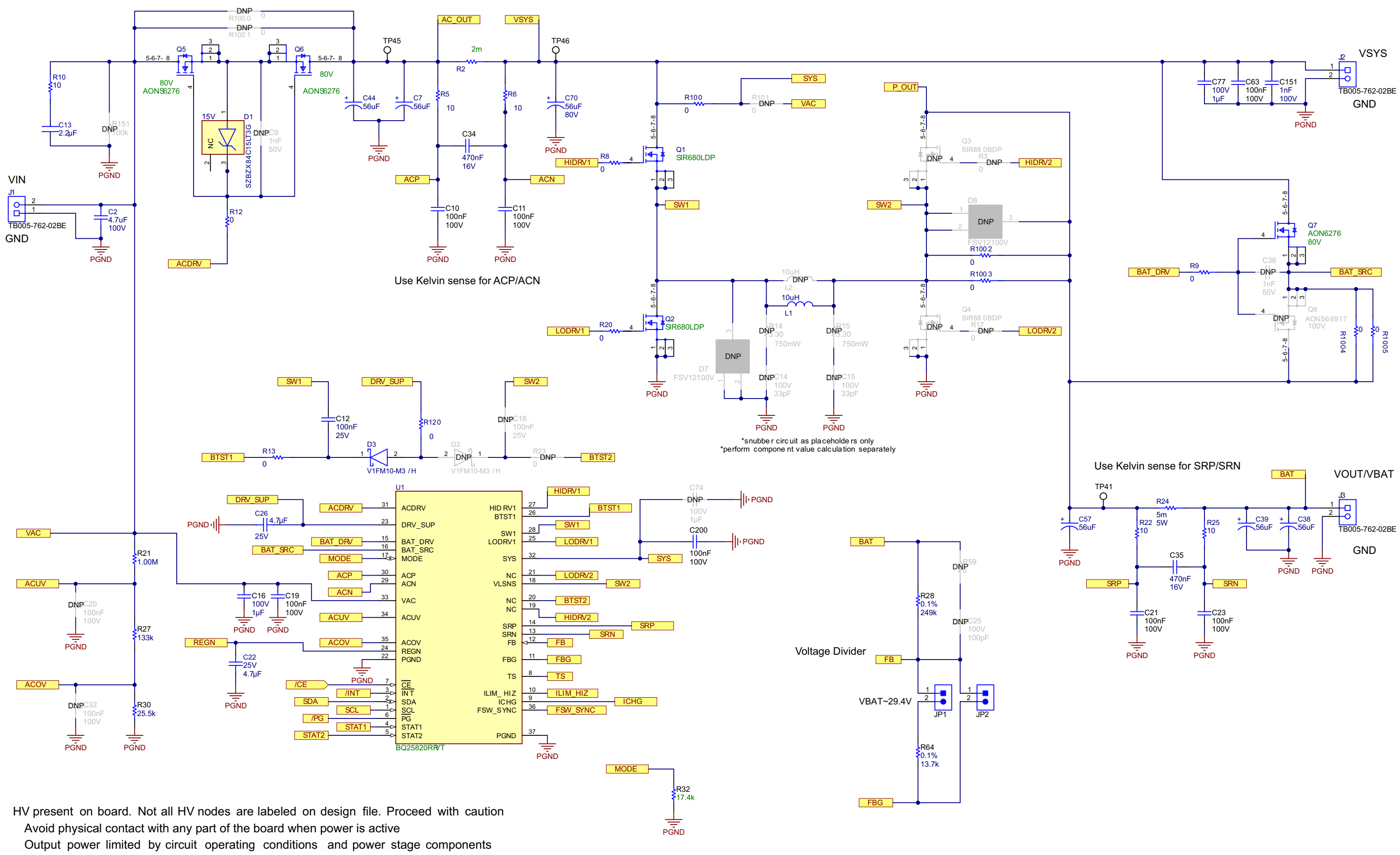
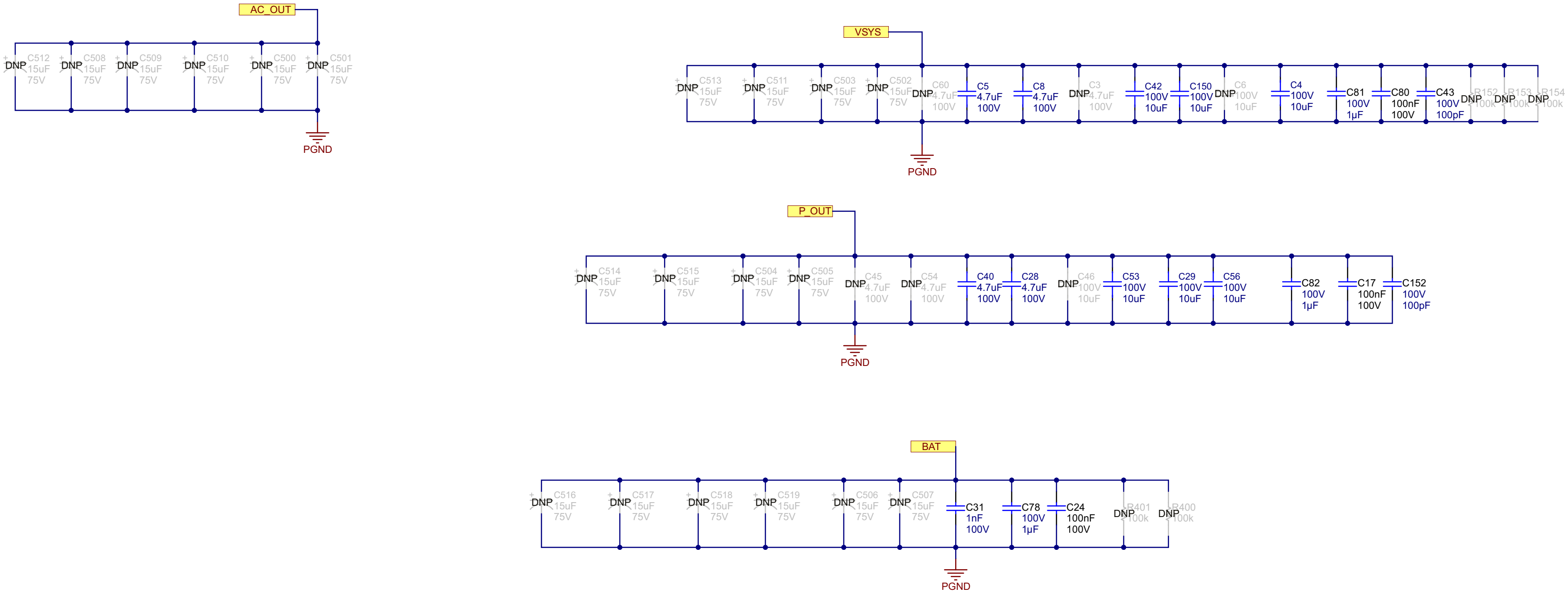


Figure 3-1. BQ25820EVM Schematic


AC_OUT
C512
C508
C509
C510
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15uF
75V
DNP
PGND
VSYS
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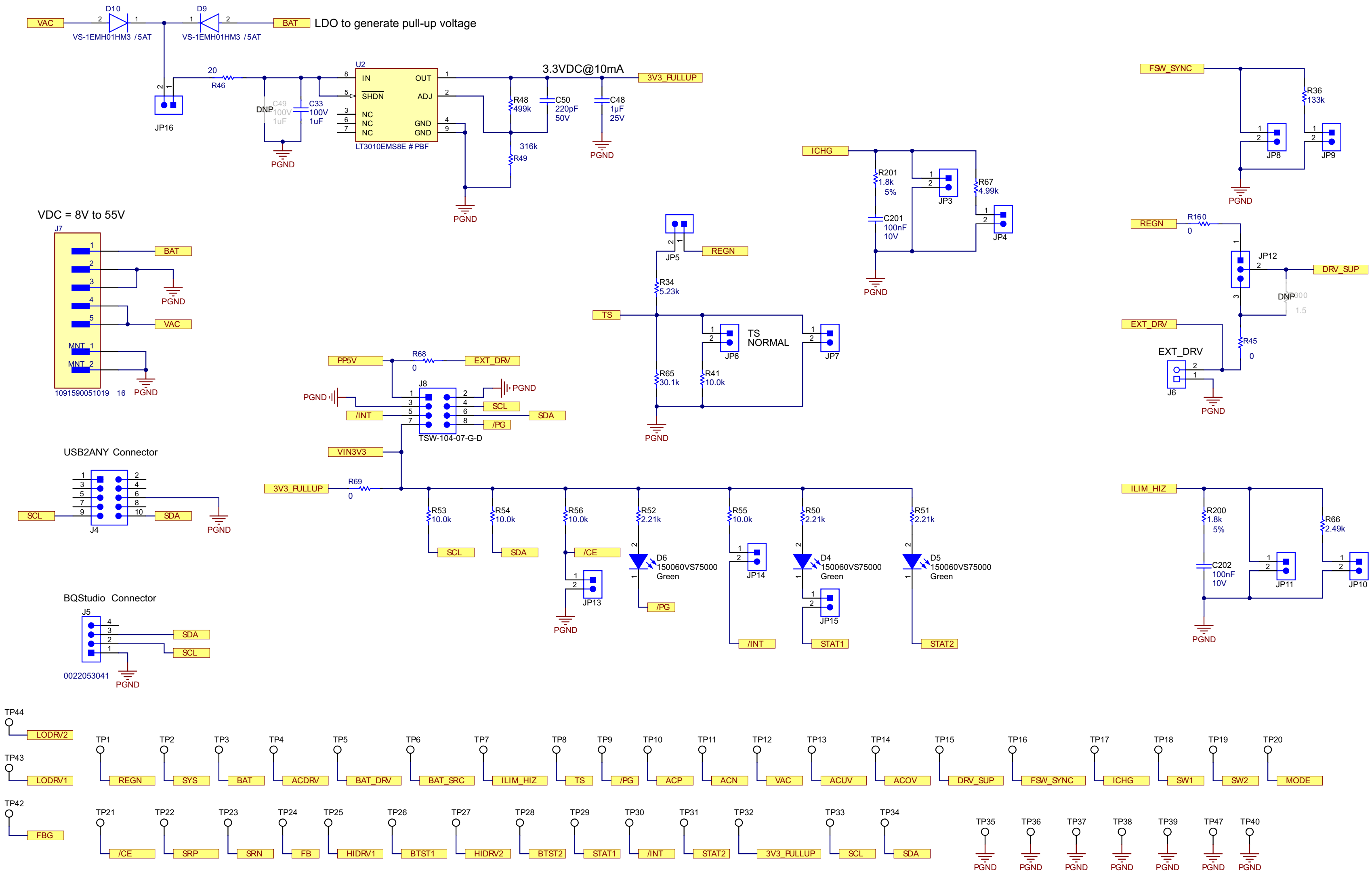
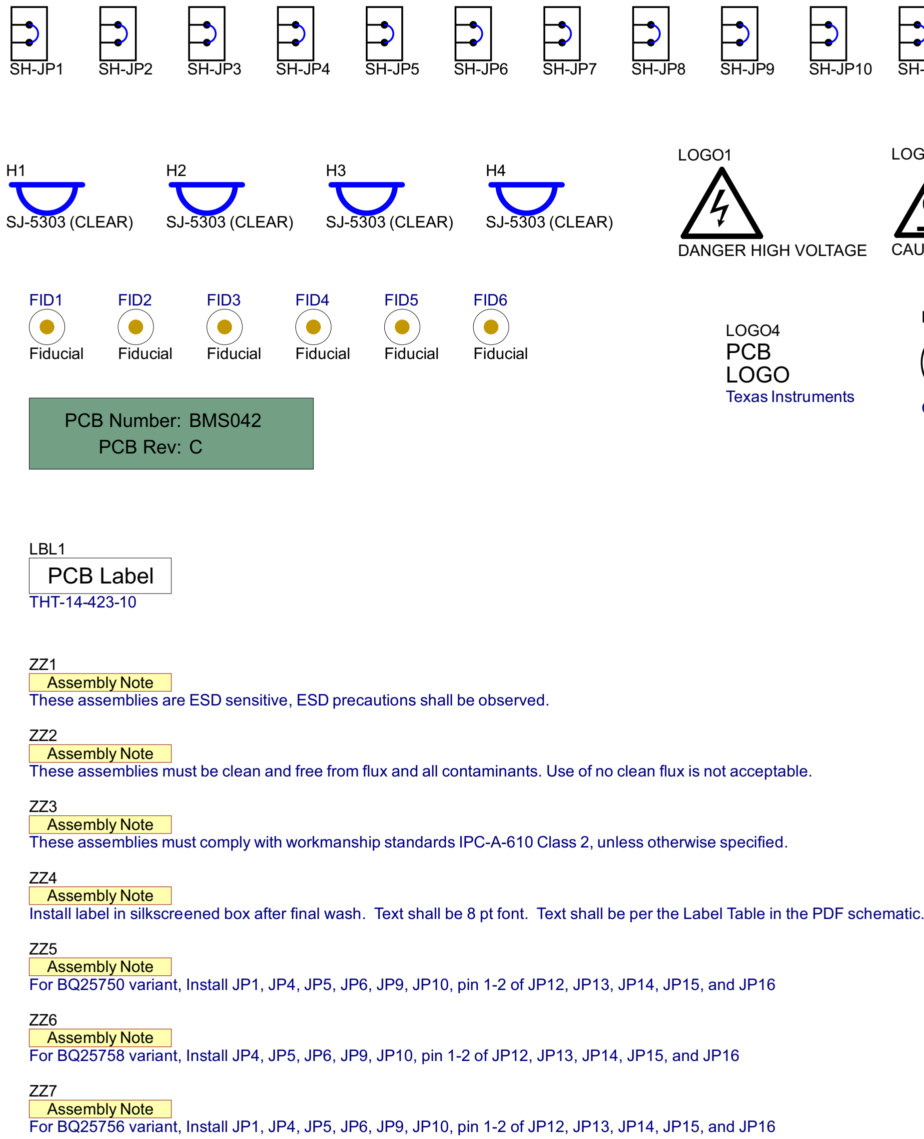
C511
C503
C502
C60
C5
C8
C3
C42
C150
C6
C4
C81
C80
C43
R152
R153
R154
4.7uF
100V
10uF
1µF
100nF
100pF
100k
P_OUT
C514
C515
C504
C505
C45
C54
C40
C28
C46
C53
C29
C56
C82
C17
C152
BAT
C516
C517
C518
C519
C506
C507
C31
C78
C24
R401
R400
1nF


LDO to generate pull-up voltage
3.3VDC@10mA
VDC = 8V to 55V
USB2ANY Connector
BQStudio Connector
TS NORMAL
EXT_DRV
LT3010EMS8E # PBF
TSW-104-07-G-D



Label Table

Variant	LBL1 Label Text
BQ25750	BQ25750EVM
BQ25751	
BQ25756	BQ25756EVM
BQ25820	
BQ25758	BQ25758EVM
BQ25758S	BQ25758SEVM
BQ25756E	BQ25756EEVM
BQ25856	BQ25856EVM
BQ25858	BQ25858EVM

3.2 PCB Layout

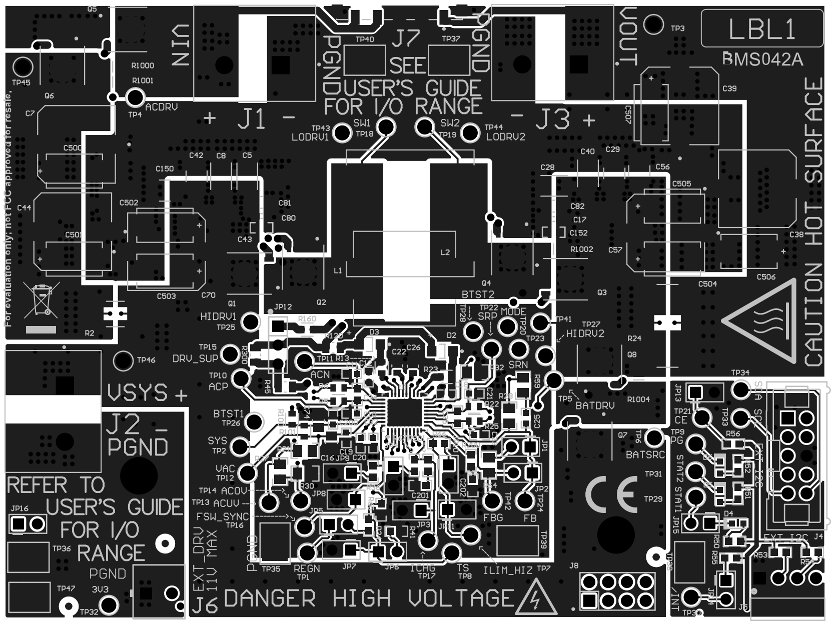


Figure 3-2. Top Layer and Overlay

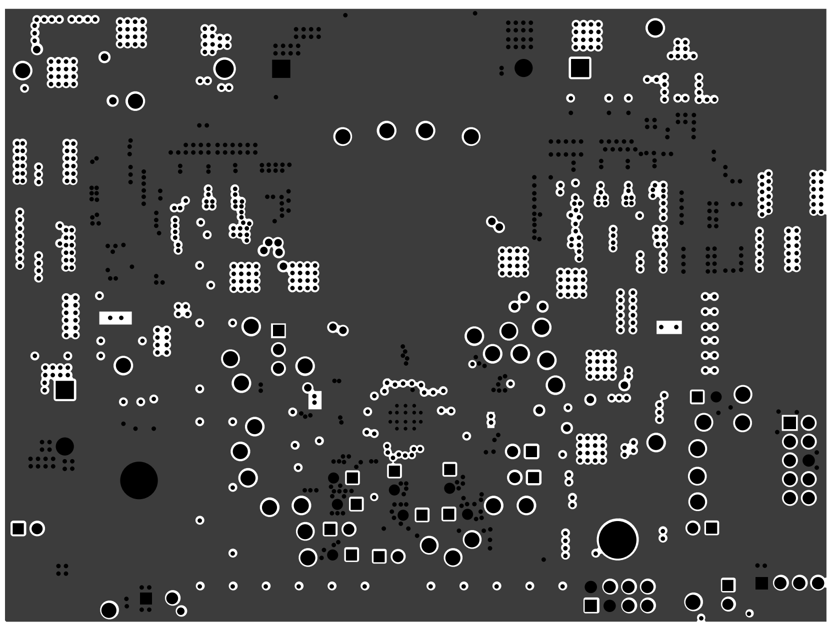


Figure 3-3. Layer 2 -GND

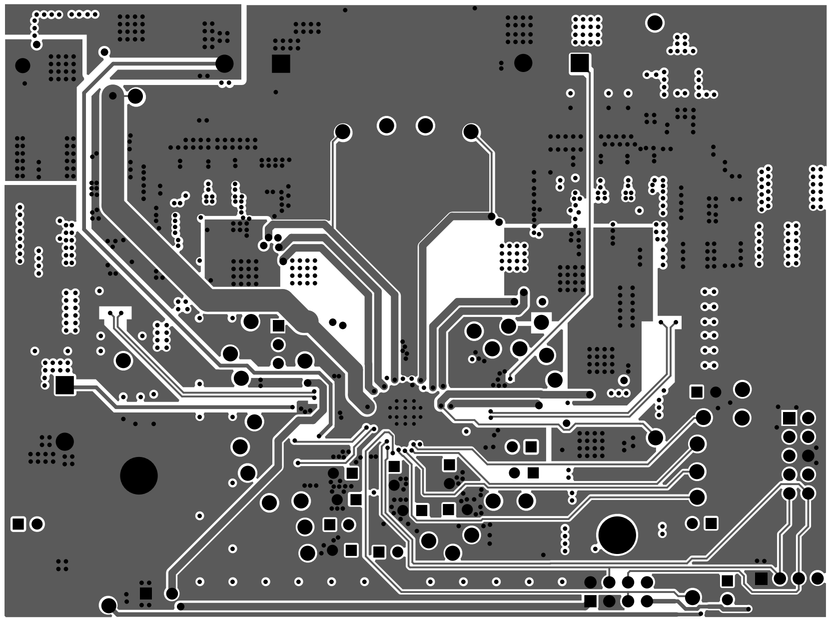


Figure 3-4. Signal Layer 1

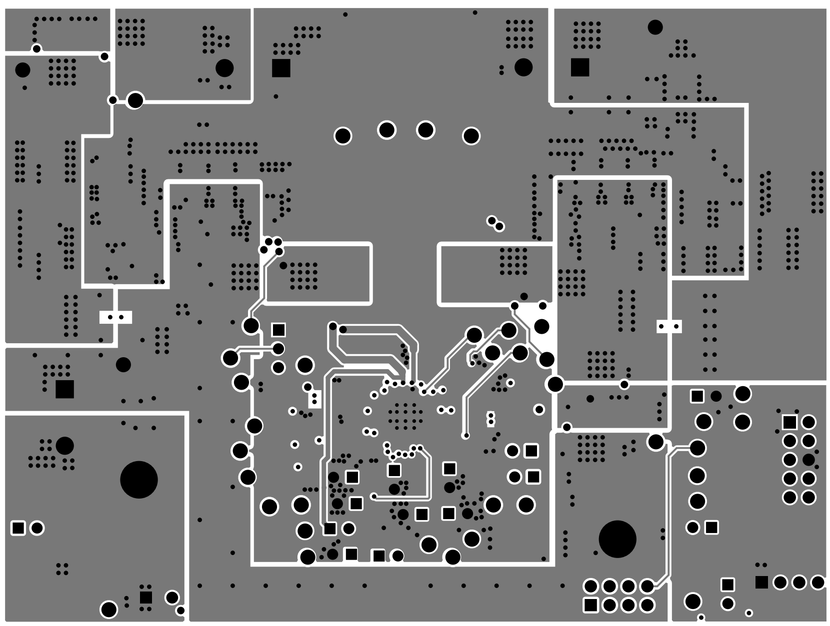


Figure 3-5. Signal Layer 2

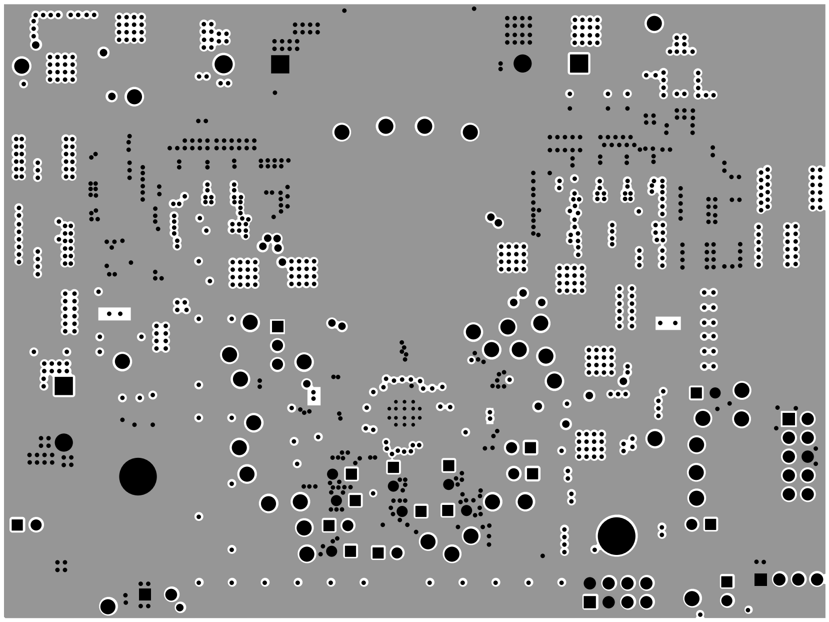


Figure 3-6. Layer 5 - GND

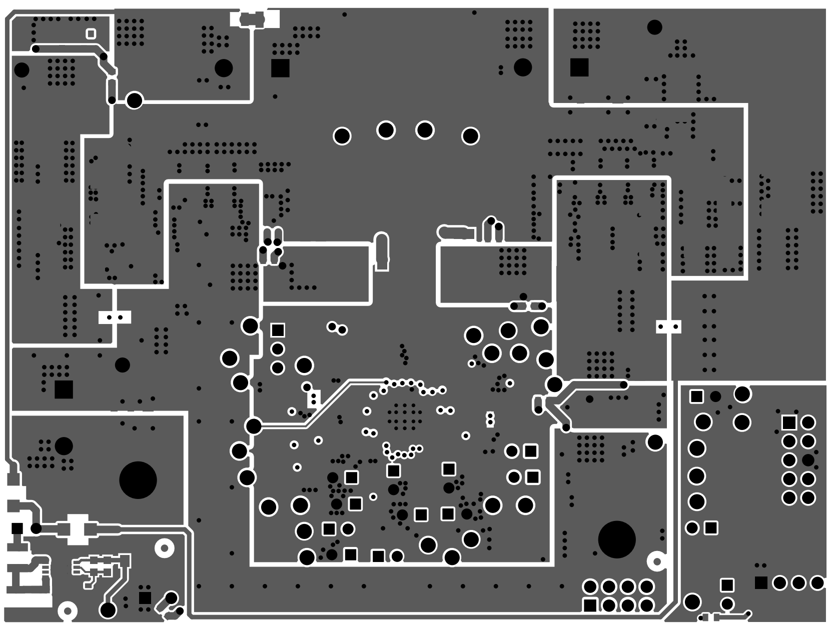


Figure 3-7. Bottom Layer and Overlay

3.3 Bill of Materials

Table 3-1. Bill of Materials

Designator	Quantity	Value	Description	Part Number	Package Reference	Manufacturer
C2, C5, C8, C28, C40	5	4.7µF	4.7uF ±10% 100V Ceramic Capacitor X7S 1210 (3225 Metric)	GCJ32DC72A475KE01L	1210	Murata
C4, C29, C42, C53, C56, C150	6	10µF	10µF ±10% 100V Ceramic Capacitor X7R 1210 (3225 Metric)	C3225X7R2A106K250AC	1210	TDK
C7, C38, C39, C44, C57, C70	6	56µF	56µF 80V Aluminum - Polymer Capacitors Radial, Can - SMD 28mOhm 1000 Hrs at 125°C	80SXV56M	SMT_CAP_10MM3_10MM3	Panasonic
C10, C11, C17, C19, C21, C23, C24, C63, C80, C200	10	0.1uF	CAP, CERM, 0.1µF, 100V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	HMK107B7104KAHT	0603	Taiyo Yuden
C12	1	0.1uF	CAP, CERM, 0.1uF, 25V, +/- 10%, X7R, 0603	06033C104KAT2A	0603	AVX
C13	1		Cap Ceramic 2.2uF 100V X7R 10% SMD 1210 FlexiTerm 125C Plastic T/R	CGA6N3X7R2A225K230AE	1210	TDK Corporation
C16, C77, C78, C81, C82	5	1uF	CAP, CERM, 1µF, 100V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	08051C105K4Z2A	0805	AVX
C22, C26	2	4.7µF	Cap Ceramic 4.7uF 25V X7R 10% Pad SMD 0805 +125°C Automotive T/R	CGA4J1X7R1E475K125AE	0805	TDK Corporation
C31, C151	2	1000pF	Multilayer Ceramic Capacitors MLCC - SMD/SMT CGA 0603 100V 1000pF X7R 10% AEC-Q200	CGA3E2X7R2A102K080AA	0603	TDK
C33	1	1µF	General Purpose Ceramic Capacitor, 1210, 1uF, 10%, X7R, 15%, 100V	12101C105KAT2A	1210	AVX
C34, C35	2	0.47uF	CAP, CERM, 0.47uF, 16V, +/- 10%, X7R, 0603	C0603C474K4RACTU	0603	Kemet
C43, C152	2	100pF	Multilayer Ceramic Capacitors MLCC - SMD/SMT CGA 0603 100V 100pF C0G 5% AEC-Q200	CGA3E2C0G2A101J080AA	0603	TDK
C48	1	1uF	CAP, CERM, 1uF, 25V, +/- 10%, X7R, 0805	C0805C105K3RACTU	0805	Kemet
C50	1	220pF	CAP, CERM, 220pF, 50V, +/- 10%, X7R, 0603	C0603C221K5RACTU	0603	Kemet
C201, C202	2	0.1uF	CAP, CERM, 0.1uF, 10V, +/- 10%, X7R, 0603	C0603C104K8RACTU	0603	Kemet
D1	1		Zener Diode Single 15V 5% 30Ohm 300mW Automotive 3-Pin SOT-23 T/R	SZBZX84C15LT3G	SOT23	On Semiconductor
D3	1		Diode Schottky 1A Surface Mount DO-219AB (SMF)	V1FM10-M3/H	DO-219AB	Vishay
D4, D5, D6	3	Green	LED, Green, SMD	150060VS75000	LED_0603	Wurth Elektronik
D9, D10	2		Diode Standard 100V 1A Surface Mount DO-214AC (SMA)	VS-1EMH01HM3/5AT	DO-214AC	Vishay
FID1, FID2, FID3, FID4, FID5, FID6	6		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Part Number	Package Reference	Manufacturer
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	SJ-5303 (CLEAR)	Transparent Bumpon	3M
J1, J2, J3	3			TB005-762-02BE	TERM_CONN	CUI Devices
J4	1		Header (shrouded), 100mil, 5x2, High-Temperature, Gold, TH	N2510-6002-RB	5x2 Shrouded header	3M
J5	1		Header (friction lock), 100mil, 4x1, R/A, TH	0022053041	4x1 R/A Header	Molex
J6	1		Terminal Block, 3.5mm, 2x1, Tin, TH	0393570002	Terminal Block, 3.5mm, 2x1, TH	Molex
J7	1		Conn Board to Board HDR 5 POS 3mm Solder RA SMD T/R	109159005101916	CONN_SSL_PLUG5	KYOCERA AVX
J8	1		Header, 100mil, 4x2, Gold, TH	TSW-104-07-G-D	4x2 Header	Samtec
JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8, JP9, JP10, JP11, JP13, JP14, JP15, JP16	15		Header, 100mil, 2x1, Tin, TH	PEC02SAAN	Header, 2 PIN, 100mil, Tin	Sullins Connector Solutions
JP12	1		Header, 100mil, 3x1, Tin, TH	PEC03SAAN	Header, 3 PIN, 100mil, Tin	Sullins Connector Solutions
L1	1	10uH	Commercial Inductors, High Saturation Series 10uH 16.5A 12mΩ 20%	IHLP6767GZER100M01	SMT_INDUCTOR_17MM 15_17MM15	Vishay
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	THT-14-423-10	PCB Label 0.650 x 0.200 inch	Brady
PCB1	1		Printed Circuit Board	BMS042		Any
Q1, Q2	2		N-Channel 80V 31.8A (Ta), 130A (Tc) 6.25W (Ta), 104W (Tc) Surface Mount PowerPAK® SO-8	SIR680LDP-T1-RE3	SO-8	Vishay
Q5,Q6, Q7	3		N-Channel 80V 100A (Tc) 215W (Tc) Surface Mount 8-DFN-EP (5x6)	AON6276	DFN8	Alpha & Omega Semiconductor
R2	1	2m	2 mOhms ±1% 6W Chip Resistor 2512 (6432 Metric) Automotive AEC-Q200, Current Sense, Moisture Resistant, Pulse Withstanding Metal Element	WSLF25122L000FEA	2512	Vishay
R5, R6, R22, R25	4	10	RES Thick Film, 10Ω, 1%, 0.1W, 100ppm/°C, 0603	CRCW060310R0FKEB	0603	Vishay
R8, R9, R12, R13, R20, R68, R69, R100, R160	9	0	Thick Film Resistors - SMD 1/10watt ZEROohm Jumper	CRCW06030000Z0EA	0603	Vishay
R10	1	10	RES Thick Film, 10Ω, 1%, 0.75W, 100ppm/°C, 1206	CRCW120610R0FKEAHP	1206	Vishay Dale
R21	1	1.00Meg	Thick Film Resistors - SMD 1/8Watt 1Mohms 1% Commercial Use	CRCW08051M00FKEAC	0805	Vishay / Dale

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Part Number	Package Reference	Manufacturer
R24	1	5m	5 mOhms ±1% 5W Chip Resistor Wide 4320 (11050 Metric), 2043 Current Sense, Moisture Resistant Metal Foil	FCSL110R005FER	WIDE_4320	Ohmite
R27	1	133k	RES, 133 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	ERJ-6ENF1333V	0805	Panasonic
R28	1	249k	Thick Film Resistors - SMD 0805 Anti-Surge Res. 0.1%, 249Kohm	ERJ-PB6B2493V	0805	Panasonic
R30	1	25.5k	RES, 25.5 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	ERJ-6ENF2552V	0805	Panasonic
R32	1	17.4k	RES, 17.4 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	ERJ-6ENF1742V	0805	Panasonic
R34	1	5.23k	RES, 5.23 k, 1%, 0.1 W, 0603	RC0603FR-075K23L	0603	Yageo
R36	1	133k	RES, 133 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW0603133KFKEA	0603	Vishay-Dale
R41, R53, R54, R55, R56	5	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	RC0603FR-0710KL	0603	Yageo
R45, R120	2	0	Thick Film Resistors - SMD 1/8watt ZEROohm Jumper	CRCW08050000Z0EA	0805	Vishay
R46	1	20	Thick Film Resistors - SMD 3/4watt 20ohms 1% High Power AEC-Q200	CRCW121020R0FKEAHP	1210	Vishay Dale
R48	1	499k	RES, 499 k, 1%, 0.1 W, 0603	RC0603FR-07499KL	0603	Yageo
R49	1	316k	Thick Film Chip Resistors 0603 316kΩ 0.1W 1% 100ppm/°C	CR0603-FX-3163ELF	0603	Bourns
R50, R51, R52	3	2.21k	RES, 2.21 k, 1%, 0.1 W, 0603	RC0603FR-072K21L	0603	Yageo
R64	1	13.7k	RES, 13.7 k, 0.1%, 0.125 W, 0805	RG2012P-1372-B-T5	0805	Susumu Co Ltd
R65	1	30.1k	RES, 30.1 k, 1%, 0.1 W, 0603	RC0603FR-0730K1L	0603	Yageo
R66	1	2.49k	RES, 2.49 k, 1%, 0.1 W, 0603	RC0603FR-072K49L	0603	Yageo
R67	1	4.99k	RES, 4.99 k, 1%, 0.1 W, 0603	CRCW06034K99FKEAC	0603	Vishay-Dale
R200, R201	2	1.8k	RES, 1.8 k, 5%, 0.1 W, 0603	RC0603JR-071K8L	0603	Yageo
R1002, R1003, R1004, R1005	4	0	0 Ohms Jumper 0.245W Chip Resistor 0805 (2012 Metric) - Metal Element	JR0805X35E	0805	Ohmite
SH-JP1, SH-JP2, SH-JP3, SH-JP4, SH-JP5, SH-JP6, SH-JP7, SH-JP8, SH-JP9, SH-JP10, SH-JP11	11	1x2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Shunt	Samtec

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Part Number	Package Reference	Manufacturer
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33, TP34, TP41, TP42, TP43, TP44, TP45, TP46	40		Test Point, Miniature, White, TH	5002	White Miniature Testpoint	Keystone
TP35, TP36, TP37, TP38, TP39, TP40, TP47	7		Test Point, Compact, SMT	5016	Testpoint_Keystone_Compact	Keystone
U1	1		BQ25820RRVT	BQ25820RRVT	VQFN36	Texas Instruments
U2	1		Linear Voltage Regulator IC Positive Adjustable 1 Output 50mA 8-MSOP-EP	LT3010EMS8E-PBF	MSOP8	Analog Devices

4 Additional Information

4.1 Trademarks

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5 Revision History

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

Changes from Revision * (July 2024) to Revision A (August 2024)	Page
• Added *Communication Interface Setup* section to include GUI selection	6
• Updated board image setup	7