



ABSTRACT

This user's guide describes the characteristics, operation, and use of the BQ25171EVM evaluation module (EVM). This EVM is designed to help the user evaluate and test the various operating modes of the BQ25171. This user's guide includes setup instructions for the hardware and software, a schematic diagram, a bill of materials (BOM), and PCB layout drawings for the evaluation module.

Throughout this user's guide, the abbreviations *EVM*, *BQ25171EVM*, *BMS032*, and the term *evaluation module* are synonymous with the BMS032 evaluation module, unless otherwise noted.

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WARNING



Hot surface! Contact may cause burns. Do not touch!

Some components may reach high temperatures $>55^{\circ}\text{C}$ when the board is powered on. The user must not touch the board at any point during operation or immediately after operating, as high temperatures may be present.

1 Introduction

The Texas Instruments BQ25171EVM is a multi-chemistry battery charger IC for 1-2 cell Li-Ion/LiFePO₄/Li-Polymer or 1-6 cell NiMH. Battery chemistry is programmed using the CHM_TMR pin with external resistor. Charging voltage can be adjusted using external resistors on VSET. Charging current can be set from 60mA to 600mA with external resistor on ISET.

1.1 Printed Circuit Board Assembly

The BQ25171EVM PCB contains the BQ25171 IC, LDO TPS7B8133 and support circuits. This board contains several jumpers and connectors. S1 (VSET) allows selected output voltages to be programmed. R9 resistor allows a wide range of adjustment of VSET. S2 (CHM_TMR) allows selection of select chemistry / timer. R10 is used to select wider range of options. R22 can be used to change ISET value, fast charge current. R19 can be used to adjust TS, battery temp sensor to simulate hot and cold fault.

1.2 I/O Descriptions

Table 1-1 lists the input and output connections available on this EVM and their respective descriptions.

Table 1-1. EVM I/O Connections

I/O Connector	Description
J1 – VIN / GND	Input voltage from external power supply, recommended 5 V to 12 V depending on output configuration. Max input voltage is 18 V, OVP trip point and above this the device is off. Max input voltage is 40 V while in OVP.
J2 – OUT (BAT+) / GND (BAT-) / GND / TS	Interface with battery, can be up to 8.4 V out at 800 mA. TS should be 10k NTC but not needed.
JP1 – REG / IN / OUT	Source voltage for housekeeping regulator, U2. Default Input voltage IN.
JP2 – CE	Charge Enable Low=On, Hi=Off. Default Low.
JP3 – ISET	Sets Fast Charge Current. Fixed 400 mA ADJ = R22 range 60 mA to 600 mA. Default Fixed.
JP4 – STAT1	LED, default setting is ON.
JP5 - STAT2	LED, default setting is ON.
JP6 – TS	NTC temp sensor. Fixed = 10k (safe) ADJ=R19 range from 0 to 50k Ω . Default Fixed.
JP7 – CHM/TMR ADJ	Disable R10 Default is installed.
JP8 – VSET ADJ	Disable R9 Default is installed.

Table 1-2 lists the S1 switch positions for VSET and their respective descriptions. Use only one position ON, do not combine.

Table 1-2. VSET S1 Switch Positions

Position / RX / Value	Li+Voltage / Configuration	NiMH Voltage / Configuration
#1 / R1 / 82k Ω	3.6V / 1-Cell LiFePO ₄	No Charge (Open Circuit)
#2 / R2 / 47k Ω	3.8V / 1-Cell Li-Ion	1-Cell / Intermittent Charge
#3 / R3 / 24k Ω	4.1V / 1-Cell Li-Ion	3-Cell
#4 / R4 / 18k Ω	4.2V / 1-Cell Li-Ion	3-Cell / Intermittent Charge
#5 / R5 / 8.2k Ω	7.2V / 2 -Cell LiFePO ₄	5-Cell
#6 / R6 / 6.2k Ω	7.4V / 2 -Cell LiFePO ₄	5-Cell / Intermittent Charge
#7 / R7 / 3.6k Ω	8.4V / 2 -Cell Li-Ion	6-Cell / Intermittent Charge
#8 / R8 / 0 Ω	Short Circuit – No Charge	Short Circuit – No Charge

Table 1-3 lists the S2 switch positions for CHM_TMR and their respective descriptions. Use only one position ON, do not combine.

Table 1-3. CHM_TMR S2 Switch Positions

Position/RX/Value	Chemistry/Timer
#1 / R11 / 75k Ω	Li-Ion / 10 hr
#2 / R12 / 56k Ω	Li-Ion / Timer Disabled
#3 / R13 / 18k Ω	NiMH / 10 hr
#4 / R14 / 0	Short Circuit / No Charge

2 Test Summary

This section describes the jumpers and connectors on the EVM as well as how to properly connect, setup, and use the BQ25171EVM. Note that the default jumper setting of headers are marked with two dots to indicate the shorting jumper position. This will put the unit into a single cell Li-Ion configuration, 4.2 V at 400 mA.

2.1 Equipment

This section includes a list of supplies required to perform tests on this EVM.

1. Battery simulator such as kiethly 2400 or equivalent. Or a single/dual-cell battery.
2. Power supply, for single cell 5V 1A input, for dual cell 12V 1A input . Note that unit can operate up to 18V input.
3. Voltage meter and current meter.

2.2 Cautions

To prevent possible damage to battery under test verify that charging conditions of the cell are not exceeded. Check max charge voltage and current.

Power dissipation of the device can be exceeded with too high an input to output voltage drop and current. Thermal regulation begins reducing current at 125 °C, at 150 °C device will shut off.

Device can get hot during high input-to-output voltage drop and high current conditions. Use caution when handling the board.

2.3 Test Instructions

In order for this EVM to operate properly, the following components must be connected and properly configured. The configuration below will put the EVM in a single cell Li-Ion charger configuration.

1. Set input power supply to 5 V and Battery Simulator to 3.6 V with compliance to support 400 mA. Turn off Supply and Batter Simulator.
2. Connect input voltages to J1 and Battery Simulator J2 to the EVM.
3. Configure all EVM jumpers to factory setting, see [Table 2-1](#).
4. Turn on all supplies and loads
 - a. 5 V Input supply current limit should be greater than 500 mA
 - b. Out voltage should be 3.6 V and charge current 400 mA
 - c. LED D1 will be ON, Normal charge. D3 is OFF
5. Simulate battery completing charge by increasing Battery Simulator voltage to 4.2 V.
 - a. Current will decrease to 0 mA.
 - b. LED D2 will switch to OFF.

Table 2-1. Jumper Factory Setting

I/O Connector	Factory Setting
JP1	IN
JP2	ON
JP3	Fixed
JP4	Installed
JP5	Installed
JP6	Fixed
JP7	Installed
JP8	Installed
S1	Position 4
S2	Position 1

Note

IN, ON, Fixed are positions of a 3 pin header. If it is a 2 pin header then it is installed or not installed.

3 Board Layout, Schematic, and Bill of Materials

3.1 Board Layout

The board layout is shown in [Figure 3-1](#) to [Figure 3-6](#).

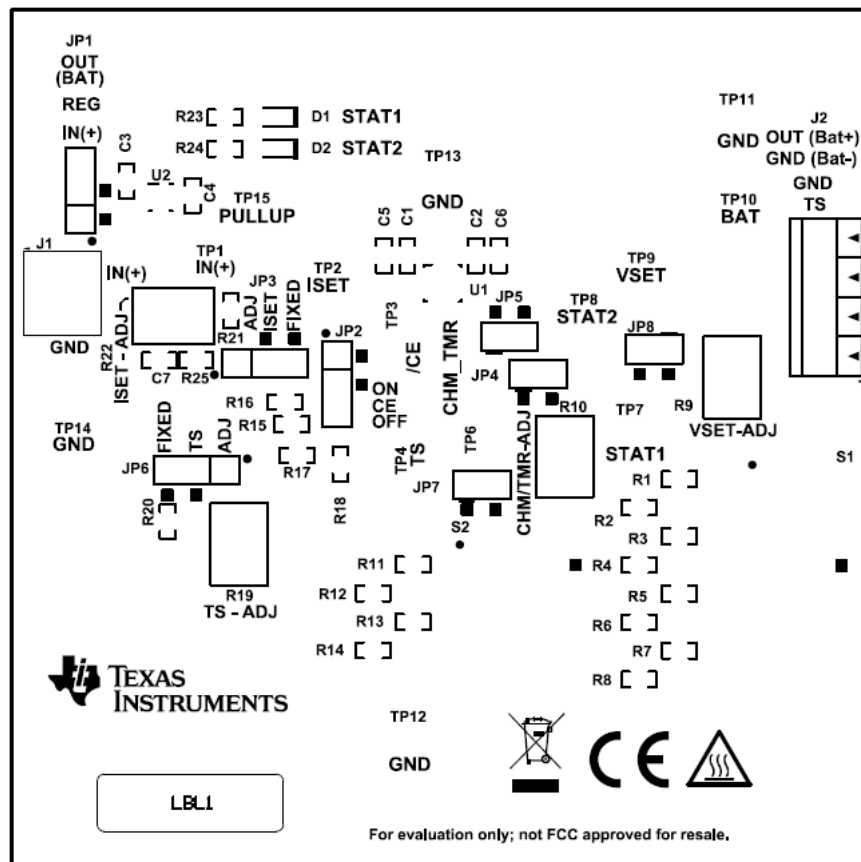


Figure 3-1. Top Overlay

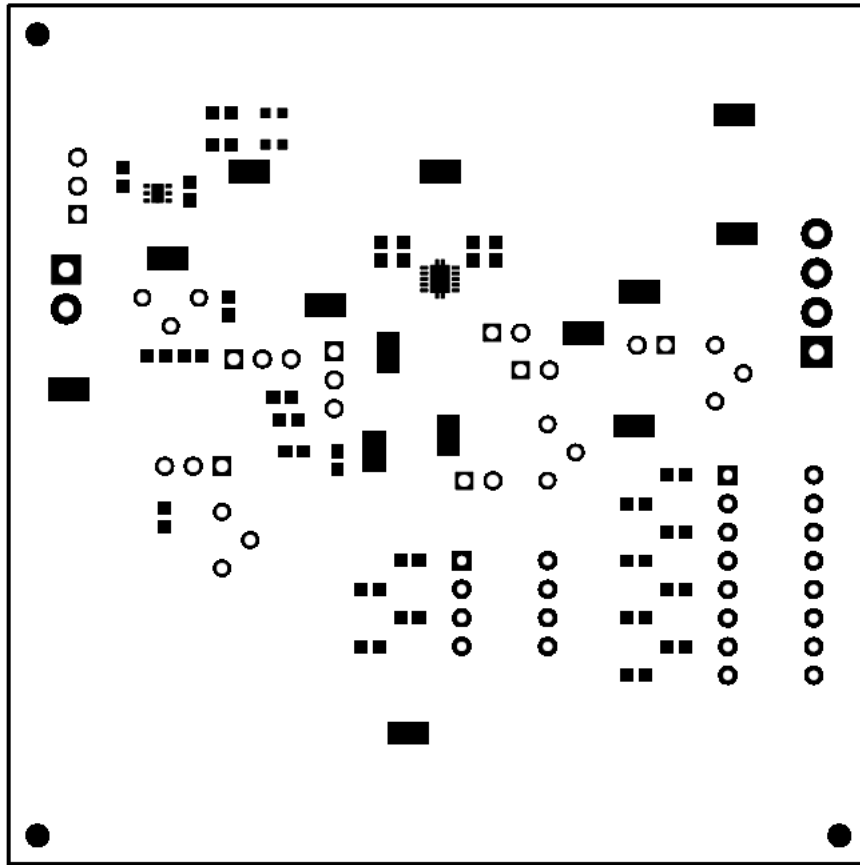


Figure 3-2. Top Solder

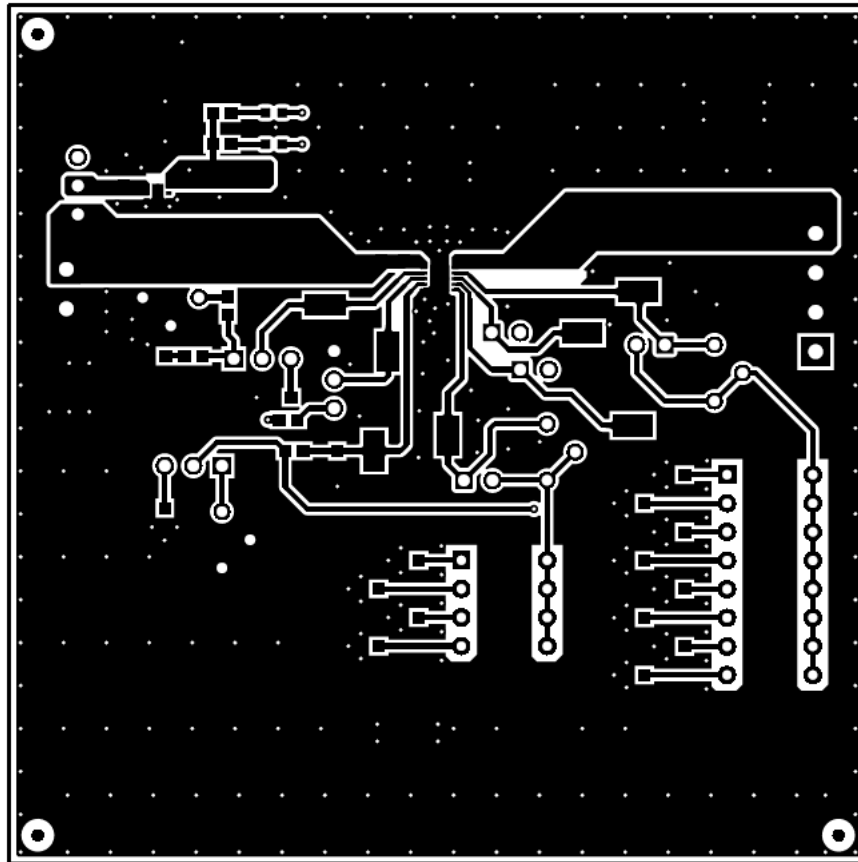


Figure 3-3. Top Layer

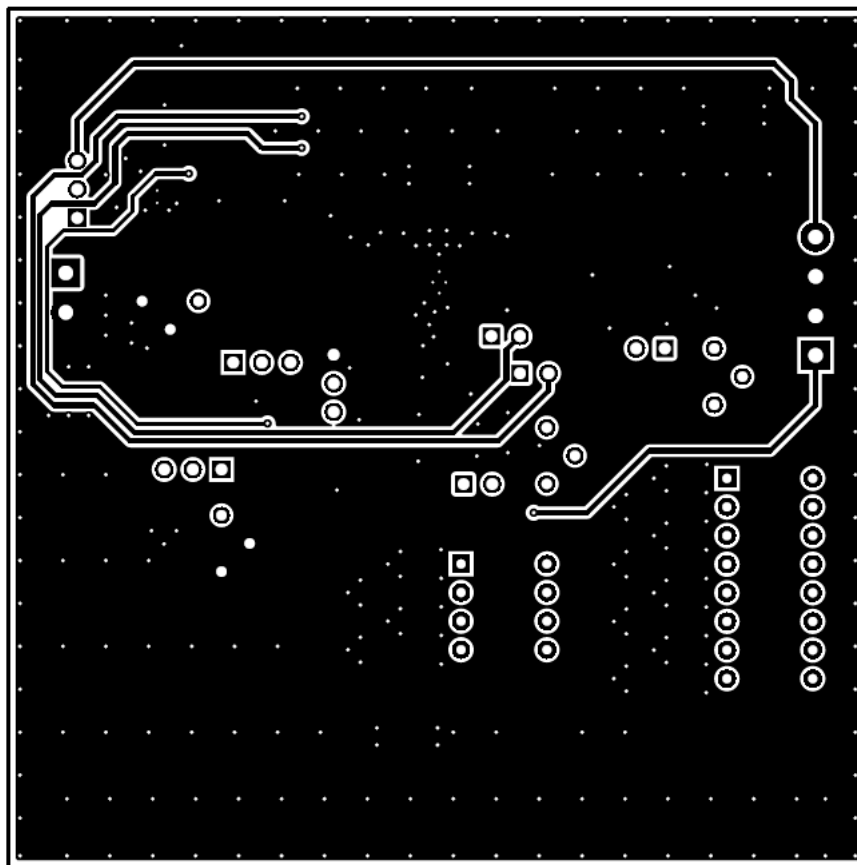


Figure 3-4. Bottom Layer

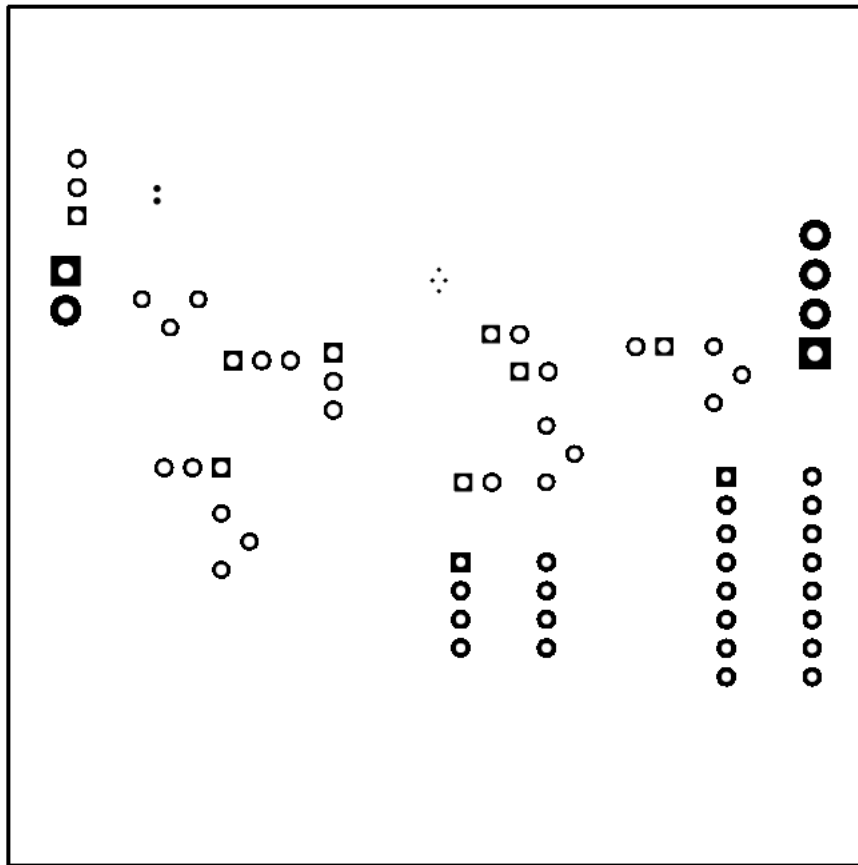


Figure 3-5. Bottom Solder

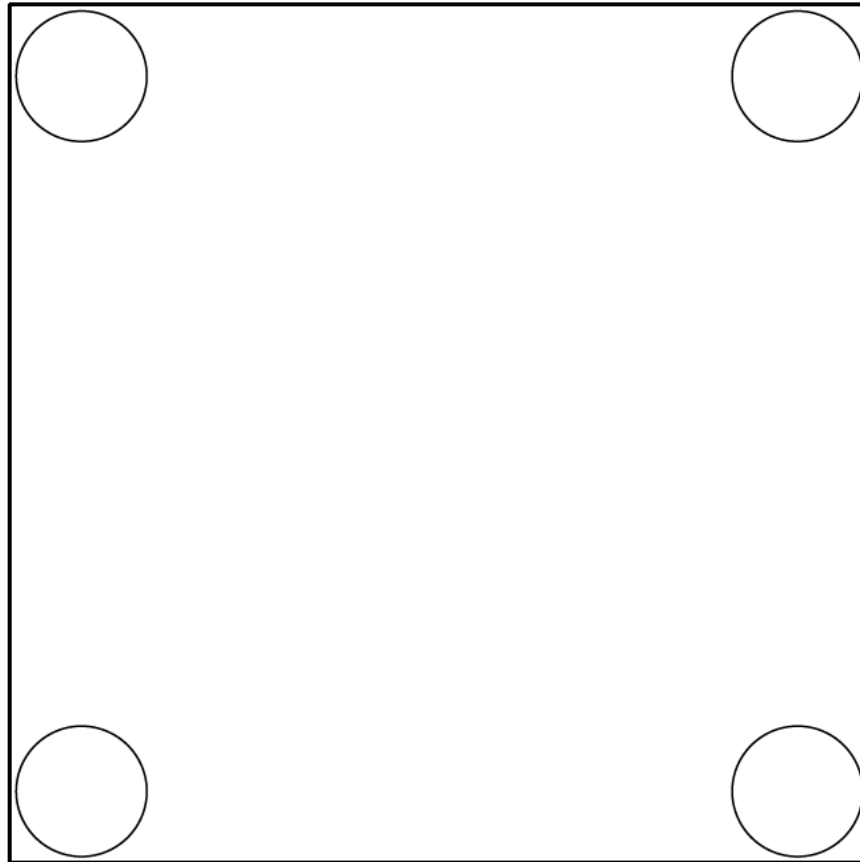


Figure 3-6. Bottom Overlay

3.2 Schematic

The BQ25171EVM schematic is shown in Figure 3-7.

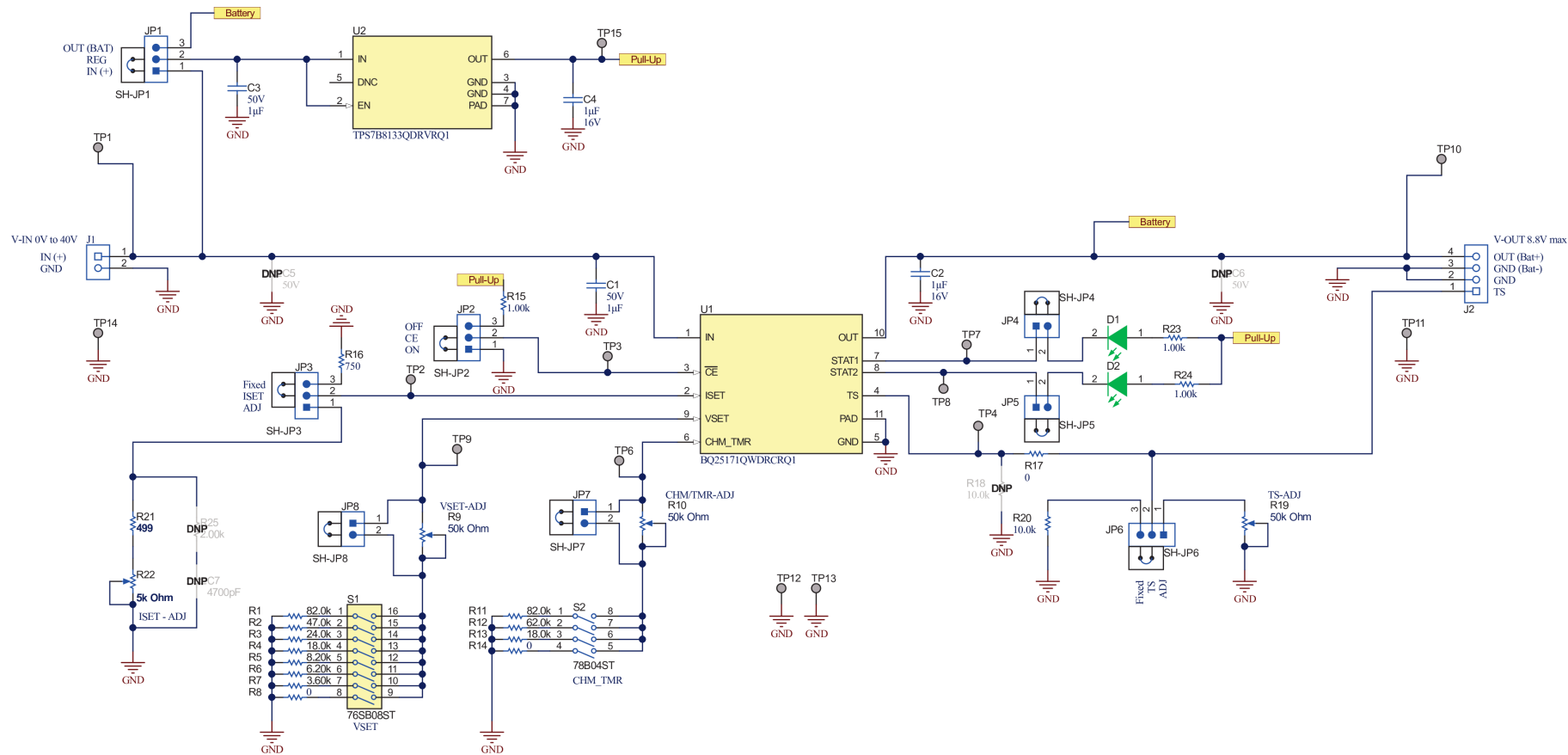


Figure 3-7. Schematic

3.3 Bill of Materials

The bill of materials is shown in [Table 3-1](#).

Table 3-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
C1, C3	2	1 μ F	CAP, CERM, 1 μ F, 50 V, \pm 20%, X5R, AEC-Q200 Grade 3, 0603	0603	GRT188R61H105ME13D	MuRata		
C2, C4	2	1 μ F	CAP, CERM, 1 μ F, 16 V, \pm 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71C105KA64D	MuRata		
D1, D2	2	Green	LED, Green, SMD	Body1.6x0.8 mm	LTST-C193TGKT-5A	Lite-On		
H1, H2, H3, H4	4		Bump, Hemisphere, 0.44 X 0.20, Clear	Transparent Bump	SJ-5303 (CLEAR)	3M		
J1	1		Terminal Block, 3.5 mm Pitch, 2x1, TH	7.0 x 8.2 x 6.5 mm	ED555/2DS	On-Shore Technology		
J2	1		Terminal Block, 3.5 mm Pitch, 4x1, TH	14 x 8.2 x 6.5 mm	ED555/4DS	On-Shore Technology		
JP1, JP2, JP3, JP6	4		Header, 100 mil, 3x1, Tin, TH	Header, 3 PIN, 100 mil, Tin	PEC03SAAN	Sullins Connector Solutions		
JP4, JP5, JP7, JP8	4		Header, 100 mil, 2x1, Tin, TH	Header, 2 pin, 100 mil, Tin	PEC02SAAN	Sullins Connector Solutions		
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady		
R1, R11	2	82.0k	RES, 82.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0782KL	Yageo		
R2	1	47.0k	RES, 47.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0747KL	Yageo		
R3	1	24.0k	RES, 24.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0724KL	Yageo		
R4, R13	2	18.0k	RES, 18.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0718KL	Yageo		
R5	1	8.20k	RES, 8.20 k, 1%, 0.1 W, 0603	0603	RC0603FR-078K2L	Yageo		
R6	1	6.20k	RES, 6.20 k, 1%, 0.1 W, 0603	0603	RC0603FR-076K2L	Yageo		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R7	1	3.60k	RES, 3.60 k, 1%, 0.1 W, 0603	0603	RC0603FR-073K6L	Yageo		
R8, R14, R17	3	0	RES, 0, 5%, 0.1 W, 0603	0603	RC0603JR-070RL	Yageo		
R9, R10, R19	4	50k Ω	Trimmer Potentiometer, Lead Sealed Type Multiturn PV37 Series, TH	6.71 x 4.5 mm	PV37W503C01B00	Bourns		
R12	1	62.0k	RES, 62.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0762KL	Yageo		
R15, R23, R24	3	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	RC0603FR-071KL	Yageo		
R16	1	750	RES, 750, 1%, 0.1 W, 0603	0603	RC0603FR-07750RL	Yageo		
R20	1	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0710KL	Yageo		
R21	1	499	RES, 499, 1%, 0.1 W, 0603	0603	CRCW0603499RFKEAC	Vishay-Dale		
R22	1	5k Ω	Trimmer Potentiometer, Lead Sealed Type Multiturn PV37 Series, TH	6.71 x 4.5 mm	PV37W502C01B00	Bourns		
S1	1		Switch, SPST 8Pos, Rocker, TH	9.65 x 8 x 22.4 mm	76SB08ST	Grayhill		
S2	1		DIP Switch, SPST 4Pos, Slide, TH	DIP Switch, 4 Pos	78B04ST	Grayhill		
SH-JP1, SH-JP2, SH-JP3, SH-JP4, SH-JP5, SH-JP6, SH-JP7, SH-JP8	8	1x2	Shunt, 100 mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15	14		Test Lead clips and hooks, SMT	Test Point, Body 3.25 x 1.65 mm	S1751-46	Harwin		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
U1	1		BQ25171QW-Q1, DRC0010R (VSON-10)	DRC0010R	BQ25171QWDRCRQ1	Texas Instruments	BQ25171QWDRCTQ1	Texas Instruments
U2	1		Automotive 150- mA high-voltage ultra-low-IQ low- dropout (LDO) linear regulator, DRV0006A (WSON-6)	DRV0006A	TPS7B8133QDRVRQ1	Texas Instruments		Texas Instruments
C5, C6	0	1 uF	CAP, CERM, 1 uF, 50 V, ± 20%, X5R, AEC-Q200 Grade 3, 0603	0603	GRT188R61H105ME13D	MuRata		
C7	0	4700 pF	CAP, CERM, 4700 pF, 50 V, ± 10%, X5R, 0603	0603	GRM188R61H472KA01D	MuRata		
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
R18	0	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0710KL	Yageo		
R25	0	2.00k	RES, 2.00 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06032K00FKEA	Vishay-Dale		

Unless otherwise noted in the Alternate Part Number and/or Alternate Manufacturer columns, all parts may be substituted with equivalents.

4 Revision History

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

Changes from Revision A (March 2021) to Revision B (July 2021) Page

- Updates were made in [Table 1-2](#) 2
-

Changes from Revision * (July 2020) to Revision A (March 2021) Page

- Update was made in the Abstract of this document..... 1
 - Updated the numbering format for tables, figures and cross-references throughout the document.....2
 - Update was made in [Section 1](#)2
 - Updates were made in [Section 1.2](#)2
 - Update was made in [Section 3.2](#).....10
 - Update was made in [Section 3.3](#)..... 11
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