BQ2571x Evaluation Module

The BQ25710EVM-017 and BQ25713EVM-017 evaluation modules (EVM) are SMBus or I²C-controlled NVDC-1 buck boost charger. The input voltage range is between 3.5 V and 24 V, with a programmable output of 1–4 cells and a charge output current range of 64 mA to 8.128 A. This EVM does not include the EV2400 interface device; the EV2400 must be ordered separately to evaluate the BQ2571x EVM.

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1 Introduction

1.1 EVM Features

This EVM supports the following features:

- Evaluation module for the BQ2571x devices
- Supports 3.5- to 24-V input source
  - 3.5- to 24-V, 0- to 6-A input operating range and 1–4 cell battery configuration
  - Supports USB2.0, USB 3.0, USB 3.1 (USB Type-C™) and USB_PD
  - Supports USB OTG with 3- to 20.8-V adjustable output
  - *Maximum Power Tracking* by *Input Voltage* and *Current Regulation*
- Narrow VDC (NVDC) power path management
  - Instant-on works with no battery or deeply discharged battery (PG1.0 needs charge-enable command)
  - Battery supplements system when adapter is fully-loaded
- 800-kHz or 1.2-MHz switching frequency for low profile inductor
- SMBus (BQ25710) or I^2C (BQ25713) port for optimal system performance and status reporting
- Power and Current Monitor for CPU Throttling
- Safety
  - Thermal shutdown
  - Input and system overvoltage protection
  - MOSFET overcurrent protection
- Accelerate charge time by battery path impedance compensation
- Charge status outputs for LED or host processor
- Maximum power tracking capability by input voltage regulation
- Test points for key signals available for testing purposes. Easy probe hook-up.
- Jumpers available. Easy-to-change connections.

1.2 General Description

The BQ2571x evaluation modules are complete charger modules for evaluating an SMBUS or I^2C-controlled buck boost charge using the BQ2571x devices.

The BQ2571x EVM does not include the EV2400 interface board. To evaluate the BQ2571x EVM, order an EV2400 interface board separately.

The BQ2571x is a synchronous NVDC-1 battery buck boost charge controller, offering a low component count, high efficiency solution for space-constrained, multi-chemistry battery charging applications.

The NVDC-1 configuration allows the system to be regulated at the battery voltage, but not drop below the system minimum voltage. The system keeps operating even when the battery is completely discharged or removed. When load power exceeds the input source rating, the battery supplement mode prevents the input source from being overloaded.

The BQ2571x charges the battery from a wide range of input sources including a 5-V USB adapter to a high-voltage USB PD source and traditional adapters.

During power up, the charger sets the converter to buck, boost, or buck-boost configuration based on the input source and battery conditions. During the charging cycle, the charger automatically transits among buck, boost, and buck-boost configuration without host control.

The BQ2571x monitors adapter current, battery current, and system power. The flexibly programmed $\overline{\text{PROCHOT}}$ output goes directly to the CPU for throttle back, when needed.

For more details on register functions, see the data sheets – BQ25710 (SLUSD20) and BQ25713 (SLUSD83).

Table 1 lists the I/O descriptions.

Table 1. I/O Description

Jack	Description
J1–VIN	Input: positive terminal
J1–GND	Input: negative terminal (ground terminal)
J2-ILIM_control	External converter disable; logic high to pull the ILIM pin down
J2-CHRG_OK	CHRG_OK output
J2-ENZ_OTG	External OTG disable pin
J2-CELL_control	External battery removal control; logic high to pull the CELL pin down
J3–3V3	Onboard 3.3-V output
J3–SDA	SMBUS or I^2C SDA
J3-SCL	SMBUS or I^2C SCL
J3-GND	Ground
J4-CMPOUT	CMPOUT pin output
J4-GND	Ground
J4-CMPIN	External CMPIN pin input
J5-BAT	Connected to battery pack output
J5-GND	Ground
J6-SYS	Connected to system output
J6-GND	Ground

Table 2 displays the controls and key parameters settings.

Table 2. Controls and Key Parameters Setting

Jack	Description	Factory Setting
JP1 JP7	Inrush control setting: 1. Bypass inrush control circuit JP1 on: bypasses input FETs Q9 and Q10 external selector JP7 top two connection (pin 2 is connected to pin 3): VBUS pin on ACP 2. Enable inrush control circuit JP1 off: CHRG_OK controls Q9 and Q10 external selector JP7 bottom two connection: VBUS pin on V_{IN}	Bypass inrush control circuit: JP1 installed JP7 top two position installed (pin2 is connected pin3)
JP2 JP3 JP4	CELL setting: 1S: JP2, JP3, JP4 all open, measure CELL pin voltage 1.2 V 2S: JP2 closed, JP3 and JP4 open, measure CELL pin voltage 2.7 V 3S: JP3 closed, JP2 and JP4 open, measure CELL pin voltage 3.5 V 4S: JP2, JP3 closed, JP4 open, measure CELL pin voltage 4.2 V Bat removal, short JP4	2S setting: JP2 installed JP3, JP4 all open
JP5	Jumper on: Pre-bias ILIM_HIZ Jumper off: Ground ILIM_HIZ	Installed
JP6	For input current setting: Jumper on: ILIM_HIZ LOW. Jumper off: Allow pre-bias ILIM_HIZ	Not installed
JP8	Jumper on: On-board LDO to drive the EVM 3V3 Jumper off: disconnect on-board LDO to drive the EVM 3V3	Installed

Table 3 lists the recommended operating conditions.

Table 3. Recommended Operating Conditions

Symbol	Description	MIN	TYP	MAX	Unit
Supply voltage, V_{IN}	Input voltage from ac adapter input	3.5	5/12/19	24	V
Battery voltage, V_{BAT}	Voltage applied at VBAT terminal	0		19.2	V
Supply current, I_{AC}	Maximum input current from ac adapter input	0		3	A
Output current, I_{out}	Output current	0		8	A
Operating junction temperature range, T_J		0		125	°C

2 Test Summary

2.1 Definitions

This procedure details how to configure the BMS017 evaluation board. For the test procedure, the following naming conventions are followed. Refer to the PWR732 schematic for details.

VXXX:	External voltage supply name (VADP, VBT, VSBT)
LOADW:	External load name (LOADR, LOADI)
V(TPyyy):	Voltage at internal test point TPyyy. For example, V(TP12) means the voltage at TP12.
V(Jxx):	Voltage at jack terminal Jxx.
V(TP(XXX)):	Voltage at test point “XXX”. For example, V(ACDET) means the voltage at the test point which is marked as “ACDET”.
V(XXX, YYY):	Voltage across point XXX and YYY.
I(JXX(YYY)):	Current going out from the YYY terminal of jack XX.
Jxx(BBB):	Terminal or pin BBB of jack xx
Jxx ON :	Internal jumper Jxx terminals are shorted
Jxx OFF:	Internal jumper Jxx terminals are open
Jxx (-YY-) ON:	Internal jumper Jxx adjacent terminals marked as “YY” are shorted
Measure: → A,B	Check specified parameters A, B. If measured values are not within specified limits, the unit under test has failed.
Observe → A,B	Observe if A, B occurs. If they do not occur, the unit under test has failed.

Assembly drawings have locations for jumpers, test points, and individual components.

2.2 Equipment

The following list of equipment is required for fully testing the EVM:

1. **Power Supplies**

   A power supply capable of supplying 24 V at 6 A is required. While this part can handle larger voltage and current, it is not necessary for this procedure.
2. **Load #1**

   A 0- to 20-V/0- to 6-A, system DC electronic load and setting as constant voltage load mode.
3. **Load #2**

   A Kepco load: BOP36-6M, DC 0 to ±36 V, 0 to ±6 A (or higher), or equivalent.
4. **Meters**

   Six Fluke 75 multimeters, (equivalent or better) or: Four equivalent voltage meters and two equivalent current meters.
5. **Computer**

   A computer with at least one USB port and a USB cable.
6. **EV2400 Communication Kit**
7. **Software**

   Download and properly install BQstudio from http://www.ti.com/tool/BQstudio.

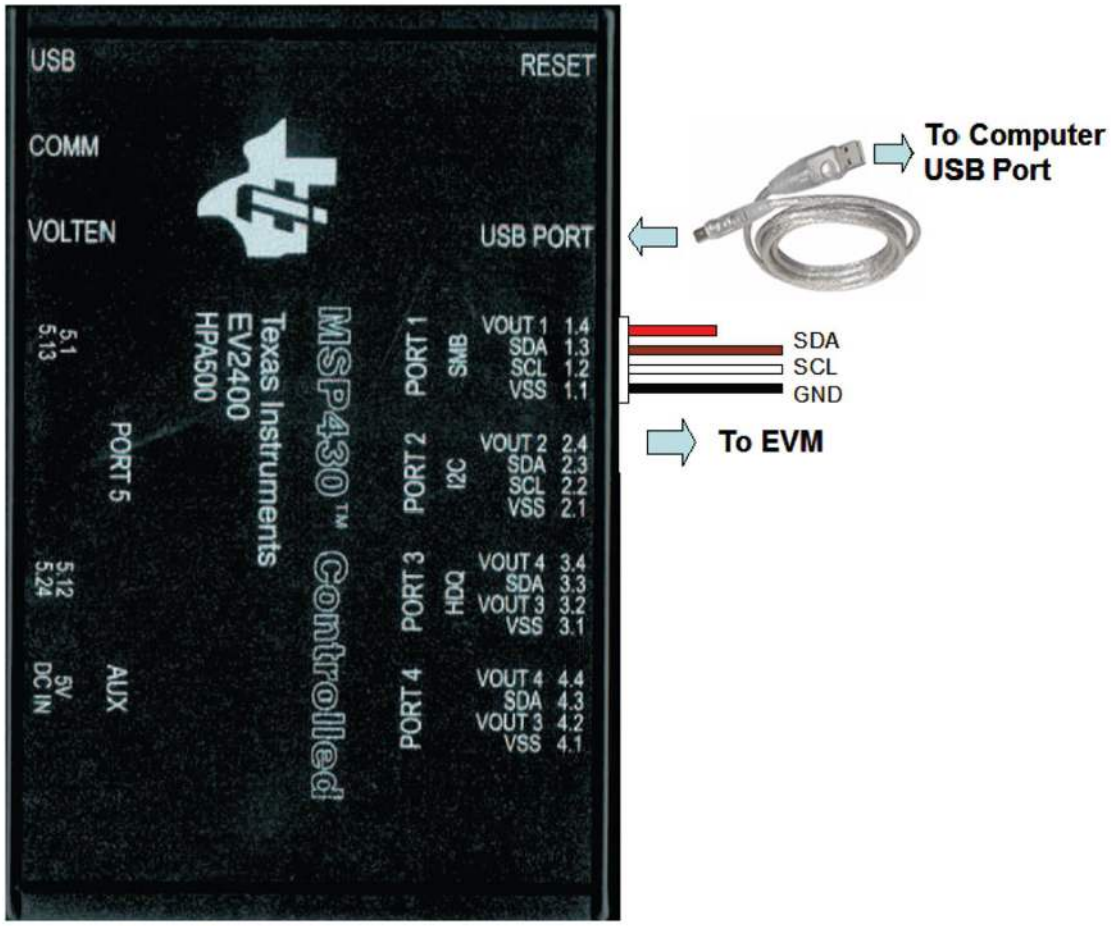
2.3 Equipment Setup

Use the following guidelines to set up the equipment:

1. Set power supply #1 for 10-V DC, 5-A 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 GND).
3. Connect a voltage meter across J1 (VIN) and J1 (GND).
4. Connect load #1 in series with a current meter to J6 (VSYS and GND). Connect a voltage meter across J6 (VSYS and GND). Set 1 A at the constant current mode. Turn off load #1.
5. Connect Load #2 in series with a current meter to J5 (VBAT and GND). Connect a voltage meter across J5 (VBAT and GND). Set 7 V at KEPCO load output. Turn off Load #2.

NOTE: Add a 47-µF capacitor on the BAT pin when testing without real battery.

6. Connect J3 to the EV2400. Connect J3 to the SMBus PORT 1 (BQ25710) or I²C PORT 2 (BQ25713) on the EV2400. The connections are shown in Figure 1.



The picture shows the SMBus version EVM connection. If using the BQ25713EVM-017, move the connector to the I²C port.

Figure 1. EV2400 Connections

7. Install jumpers as “JUMPER SET UP”.
   After completing these steps , the test setup for BMS017 is as shown in Figure 2.

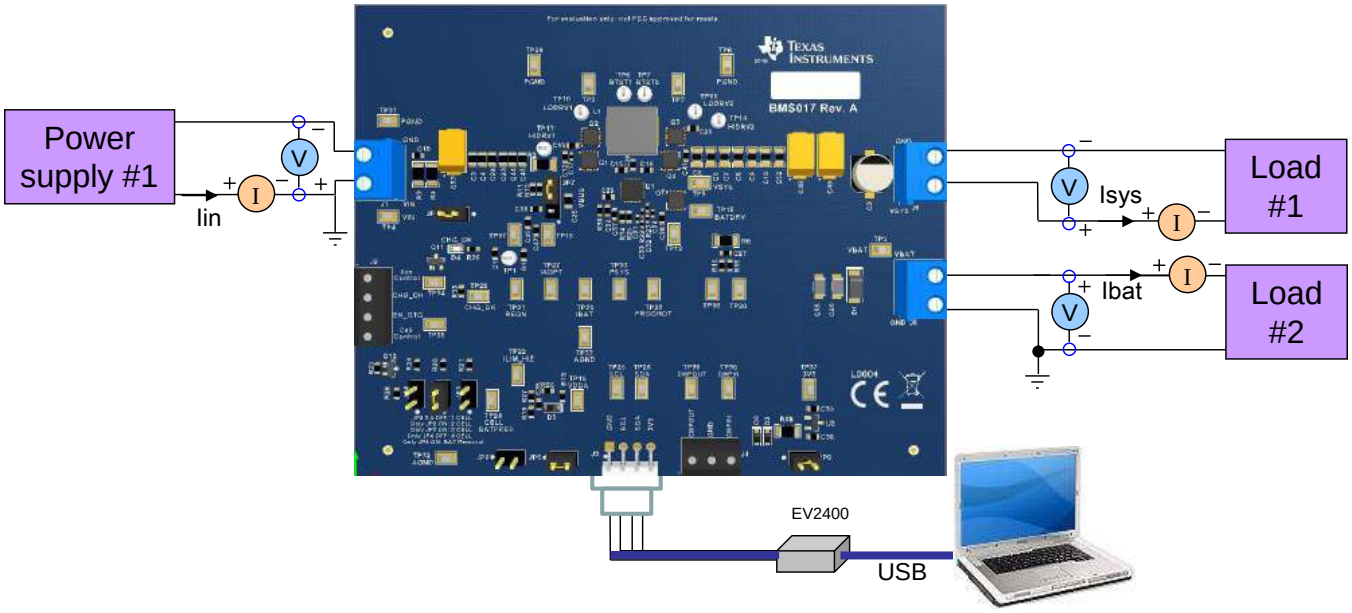
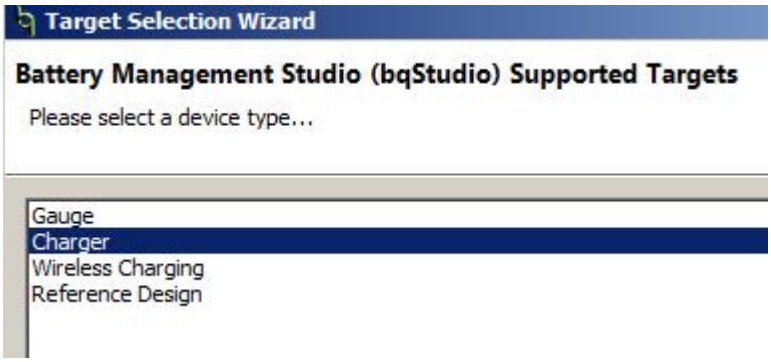


Figure 2. Original Test Setup for BMS017 (BQ2571x EVM)

8. Turn on the computer and power supply #1. Open the BQstudio software.
   a. Select *Charger* and click the **Next** button.



   b. For SMBus BQ25710, select “Charger_1_00_BQ25710.bqz” on the *Select a Target Page*. For I²C BQ25713, select “Charger_1_00_BQ25713.bqz” on the *Select a Target Page*.
   c. After selecting the target device, change “update mode” from “immediate” to “manual”, click “Read Register” and the following interface is presented.

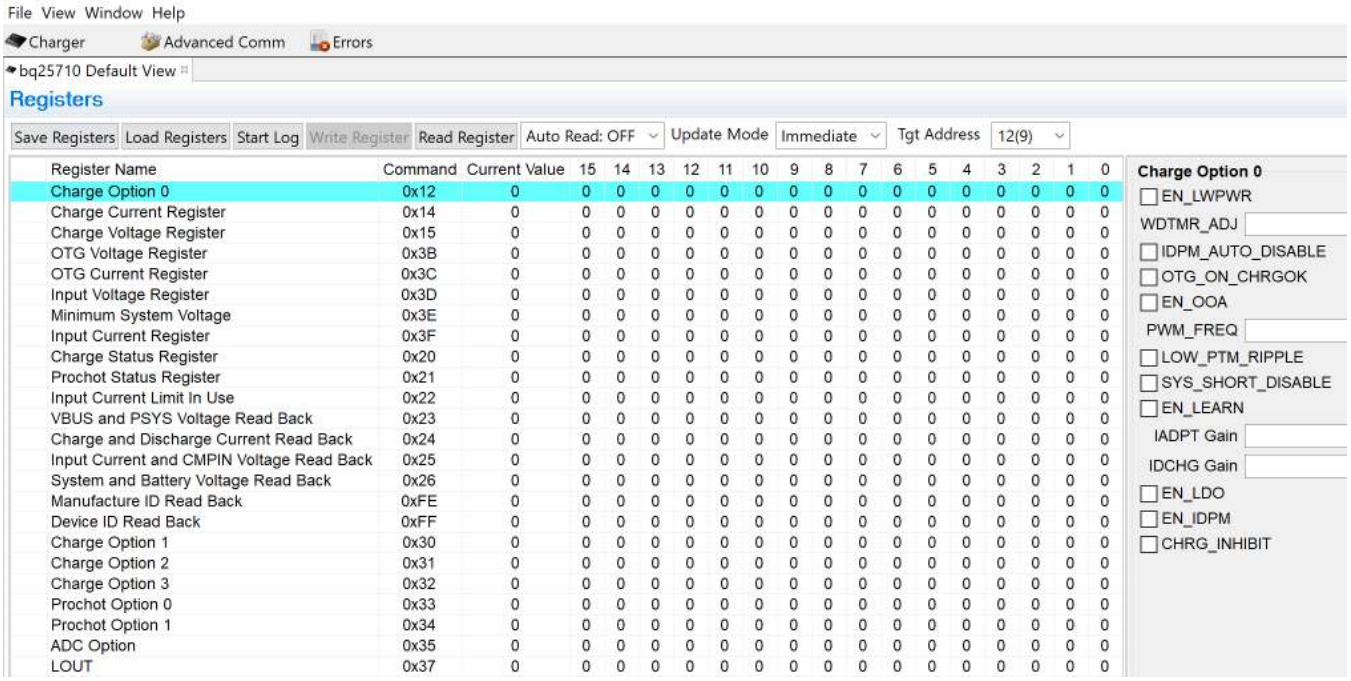


Figure 3. Main Window of the BQ2571x Evaluation Software

2.4 Procedure

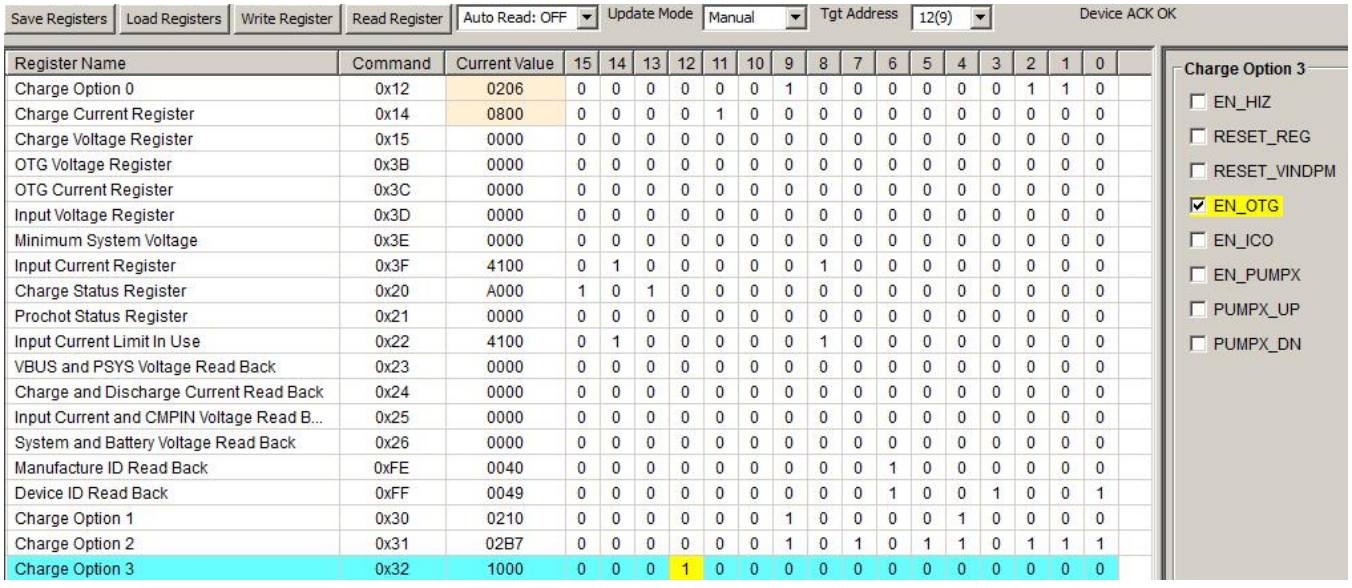
2.4.1 Charge Function

1. Make sure Equipment Setup steps are followed.
2. Set Tgt Address to 12(9) for BQ25710 or D6(6B) for BQ25713
3. Write “020E” to charge option 0 register 0x12H (BQ25710) or 0x00H (BQ25713).
   Measure → V(J1(V_{IN})) = 10 V ±0.5 V
   Measure → V(TP28(CHRG_OK)) = 3 V to 4.5 V
   Measure → V(TP21(REGN)) = 6 V ±1 V
   Measure → V(TP22(ILIM_HIZ)) = 2.2 V
4. Write “0800” to charge current 0x14H (BQ25710) or 0x02H (BQ25713). Turn on load #1.
   Measure → V(J6(SYS)) = 8.4 V ±0.5 V
5. Turn on LOAD #2 (VBAT Load).
   Measure → V(J5(VBAT)) = 7 V ±0.5 V
   Measure → I(J5(VBAT)) = 2 A ±0.5 V

2.4.2 OTG Function

Use the following for OTG function settings:

1. Set *EN_OTG* high on J2 (EN_OTG) or short TP37 to TP35 (EN_OTG).
2. Connect a 7-V power supply to the VBAT load. Remove the V_{IN} power supply from J1. (Connection must be physically removed from board).
3. Write the *Charge Voltage Register* to 0x20D0.
4. Write “0200” to the OTG voltage register. Write “4000” to the OTG current registers.
5. Select *EN_OTG* in *Charge Option 3*.
   Measure → V(J1(V_{IN})) = 5 V ±1 V



Register Name	Command	Current Value	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Charge Option 0	0x12	0206	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0
Charge Current Register	0x14	0800	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Charge Voltage Register	0x15	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTG Voltage Register	0x3B	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTG Current Register	0x3C	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Input Voltage Register	0x3D	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum System Voltage	0x3E	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Input Current Register	0x3F	4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Charge Status Register	0x20	A000	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Prochot Status Register	0x21	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Input Current Limit In Use	0x22	4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
VBUS and PSYS Voltage Read Back	0x23	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Charge and Discharge Current Read Back	0x24	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Input Current and CMPIN Voltage Read B...	0x25	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
System and Battery Voltage Read Back	0x26	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture ID Read Back	0xFE	0040	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Device ID Read Back	0xFF	0049	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1
Charge Option 1	0x30	0210	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Charge Option 2	0x31	02B7	0	0	0	0	0	0	1	0	1	0	1	1	0	1	1	1
Charge Option 3	0x32	1000	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Figure 4. EN_OTG

3 Bill of Materials, Board Layout, and Schematics

This section contains the EVM BOM, board layout images, and schematics.

3.1 Bill of Materials

Table 4 lists the BQ2571x EVM bill of materials.

Table 4. BQ2571x EVM Bill of Materials(1)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		BMS017	Any		
C3, C4, C5, C6, C7, C8, C9, C10, C21, C23, C24, C44, C45	13	10uF	CAP, CERM, 10 uF, 25 V, +/- 10%, X5R, 0805	0805	GRM21BR61E106KA73L	MuRata		
C12, C41	2	0.01uF	CAP, CERM, 0.01 uF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E103KA01D	MuRata		
C15, C16	2	0.047uF	CAP, CERM, 0.047 uF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E473KA01D	MuRata		
C17	1	1000pF	CAP, CERM, 1000 pF, 25 V, +/- 5%, X7R, 0402	0402	C0402C102J3RACTU	Kemet		
C18, C28, C29	3	1uF	CAP, CERM, 1 uF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E105KA12D	MuRata		
C19, C20	2	150pF	CAP, CERM, 150 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	C0603C151J5GACTU	Kemet		
C22, C27, C38, C39	4	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E104KA01D	MuRata		
C25	1	0.47uF	CAP, CERM, 0.47 uF, 16 V, +/- 10%, X7R, 0805	0805	C0805C474K4RACTU	Kemet		
C26	1	10uF	CAP, CERM, 10 uF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E106KA12L	MuRata		
C30	1	2.2uF	CAP, CERM, 2.2 uF, 35 V, +/- 10%, X5R, 0603	0603	GRM188R6YA225KA12D	MuRata		
C31	1	33pF	CAP, CERM, 33 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1H330JA01D	MuRata		
C32	1	680pF	CAP, CERM, 680 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1H681JA01D	MuRata		
C33	1	1800pF	CAP, CERM, 1800 pF, 50 V, +/- 10%, X7R, 0402	0402	GRM155R71H182KA01D	MuRata		
C34	1	15pF	CAP, CERM, 15 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1H150JA01D	MuRata		
C35, C36, C37	3	100pF	CAP, CERM, 100 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	C0603C101J5GAC	Kemet		
C46, C47	2	0.033uF	CAP, CERM, 0.033 uF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E333KA01D	MuRata		
C48, C49, C53	3	33uF	CAP, TA, 33 uF, 35 V, +/- 20%, 0.065 ohm, SMD	7343-31	T521D336M035ATE065	Kemet		
D2, D3, D5	3	30V	Diode, Schottky, 30 V, 0.2 A, SOD-323	SOD-323	BAT54HT1G	ON Semiconductor		
D4	1	Green	LED, Green, SMD	1.6x0.8x0.8mm	LTST-C190GKT	Lite-On		
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M		
J1, J5, J6	3		Terminal Block, 5.08 mm, 2x1, Brass, TH	2x1 5.08 mm Terminal Block	ED120/2DS	On-Shore Technology		
J2	1		Terminal Block, 3.5mm Pitch, 4x1, TH	14x8.2x6.5mm	ED555/4DS	On-Shore Technology		
J3	1		Header, 100mil, 4x1, R/A, TH	4x1 R/A Header	22-05-3041	Molex		
J4	1		Terminal Block, 3.5mm Pitch, 3x1, TH	10.5x8.2x6.5mm	ED555/3DS	On-Shore Technology		
JP1, JP2, JP3, JP4, JP5, JP6, JP8	7		Header, 100mil, 2x1, Gold, TH	Header, 2x1, 100mil	5-146261-1	TE Connectivity		
JP7	1		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions		
L1	1	2.2uH	Inductor, Wirewound, Powdered Iron, 2.2 uH, 8.5 A, 0.0203 ohm, SMD	9.2x8.5mm	74437356022	Wurth Elektronik		

(1) Unless otherwise noted in the *Alternate Part Number* or *Alternate Manufacturer* columns, all parts may be substituted with equivalents.

Table 4. BQ2571x EVM Bill of Materials[(1)] (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650"H x 0.200"W	THT-14-423-10	Brady		
Q1, Q2, Q3, Q4	4	30V	MOSFET, N-CH, 30 V, 12 A, DNH0008A (VSONP-8)	DNH0008A	CSD17551Q3A	Texas Instruments		None
Q5, Q6	2	-30V	MOSFET, P-CH, -30 V, -8.5 A, AEC-Q101, 8-PowerVDFN	8-PowerVDFN	DMP3035SFG-7	Diodes Inc.		None
Q7	1	-20V	MOSFET, P-CH, -20 V, -15 A, DNH0008A (VSONP-8)	DNH0008A	CSD25402Q3A	Texas Instruments		None
Q9	1	50 V	Transistor, NPN/PNP Pair, 50 V, 0.05 A, SC-74R	SC-74R	DCX124EK-7-F	Diodes Inc.		
Q10, Q11, Q12	3	60V	MOSFET, N-CH, 60 V, 0.26 A, SOT-23	SOT-23	2N7002ET1G	ON Semiconductor		None
R2, R8	2	0.01	RES, 0.01, 1%, 1 W, 1206	1206	WSLP1206R0100FEA	Vishay-Dale		
R3, R4	2	3.9	RES, 3.9, 5%, 0.25 W, AEC-Q200 Grade 0, 1206	1206	CRCW12063R90JNEA	Vishay-Dale		
R7, R29	2	300k	RES, 300 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603300KFKEA	Vishay-Dale		
R9, R28	2	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	RC0603FR-07100KL	Yageo America		
R10, R38	2	10.0	RES, 10.0, 1%, 0.25 W, 1206	1206	ERJ-8ENF10R0V	Panasonic		
R11, R12	2	4.99	RES, 4.99, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06034R99FKEA	Vishay-Dale		
R13	1	1.0	RES, 1.0, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW08051R00JNEA	Vishay-Dale		
R14	1	20k	RES, 20 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060320K0JNEA	Vishay-Dale		
R15, R16	2	10	RES, 10, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310R0JNEA	Vishay-Dale		
R17	1	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0JNEA	Vishay-Dale		
R18	1	10.0	RES, 10.0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310R0FKEA	Vishay-Dale		
R19, R26	2	383k	RES, 383 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603383KFKEA	Vishay-Dale		
R20	1	120k	RES, 120 k, 1%, 0.1 W, 0603	0603	RC0603FR-07120KL	Yageo America		
R21	1	64.9k	RES, 64.9 k, 1%, 0.1 W, 0603	0603	RC0603FR-0764K9L	Yageo America		
R22	1	40.2k	RES, 40.2 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040240K2FKED	Vishay-Dale		
R23	1	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0FKED	Vishay-Dale		
R24	1	280k	RES, 280 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603280KFKEA	Vishay-Dale		
R25, R32, R33, R35, R39	5	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0FKEA	Vishay-Dale		
R27	1	220k	RES, 220 k, 1%, 0.1 W, 0603	0603	RC0603FR-07220KL	Yageo America		
R30	1	137k	RES, 137 k, 1%, 0.1 W, 0603	0603	RC0603FR-07137KL	Yageo America		
R31	1	100	RES, 100, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603100RFKEA	Vishay-Dale		
R34	1	30.1k	RES, 30.1 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060330K1FKEA	Vishay-Dale		
R36	1	2.00k	RES, 2.00 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06032K00FKEA	Vishay-Dale		
R40	1	2.0Meg	RES, 2.0 M, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06032M00JNEA	Vishay-Dale		
SH-JP1, SH-JP2, SH-JP3, SH-JP4, SH-JP5, SH-JP6, SH-JP7, SH-JP8	8	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
TP1, TP6, TP7, TP10, TP11, TP13, TP14	7	White	Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone		

Table 4. BQ2571x EVM Bill of Materials[(1)] (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
TP2, TP3, TP4, TP5, TP8, TP9, TP12, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33, TP34, TP35, TP36, TP37, TP38, TP39	32	SMT	Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone		
U1	1		SMBus or IC Narrow VDC Buck-Boost Battery Charge Controller With System Power Monitor and Processor Hot Monitor, RSN0032B (WQFN-32)	RSN0032B	BQ25713RSNR for BQ25713EVM-017; BQ25710RSNR for BQ25710EVM-017;	Texas Instruments	BQ25710RSNT or BQ25713RSNT	Texas Instruments
U2	1		100 mA, Quasi Low-Dropout Linear Voltage Regulator, 3-pin SOT-23, Pb-Free	DBZ0003A	LM3480IM3-3.3TR-ND	Texas Instruments		
Z1	1	26V	Diode, TVS, Bi, 26 V, SMA	SMA	SMAJ26CA	Littelfuse		
C1	0	15pF	CAP, CERM, 15 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	C0603C150J5GACTU	Kemet		
C2	0	47uF	CAP, Aluminum Polymer, 47 uF, 25 V, +/- 20%, 0.03 ohm, F61 SMD	F61	25SVPF47M	Panasonic		
C11	0	0.01uF	CAP, CERM, 0.01 uF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E103KA01D	MuRata		
C13, C14	0	330pF	CAP, CERM, 330 pF, 50 V, +/- 10%, X7R, 0603	0603	GRM188R71H331KA01D	MuRata		
C40, C42, C43, C51, C52	0	10uF	CAP, CERM, 10 uF, 25 V, +/- 10%, X5R, 0805	0805	GRM21BR61E106KA73L	MuRata		
C50, C54	0	33uF	CAP, TA, 33 uF, 35 V, +/- 20%, 0.065 ohm, SMD	7343-31	T521D336M035ATE065	Kemet		
C55	0	10uF	CAP, CERM, 10 uF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E106KA12L	MuRata		
D1	0	20V	Diode, Schottky, 20 V, 2 A, SMA	SMA	B220A-13-F	Diodes Inc.		
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
R1	0	0	RES, 0 ohm, 5%, 0.1W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale		
R5, R6	0	56	RES, 56, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060356R0JNEA	Vishay-Dale		
R37	0	10.0k	RES, 10.0k ohm, 1%, 0.1W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale		

3.2 Board Assembly Layout

Figure 5 and Figure 10 illustrate the board assembly layout images.

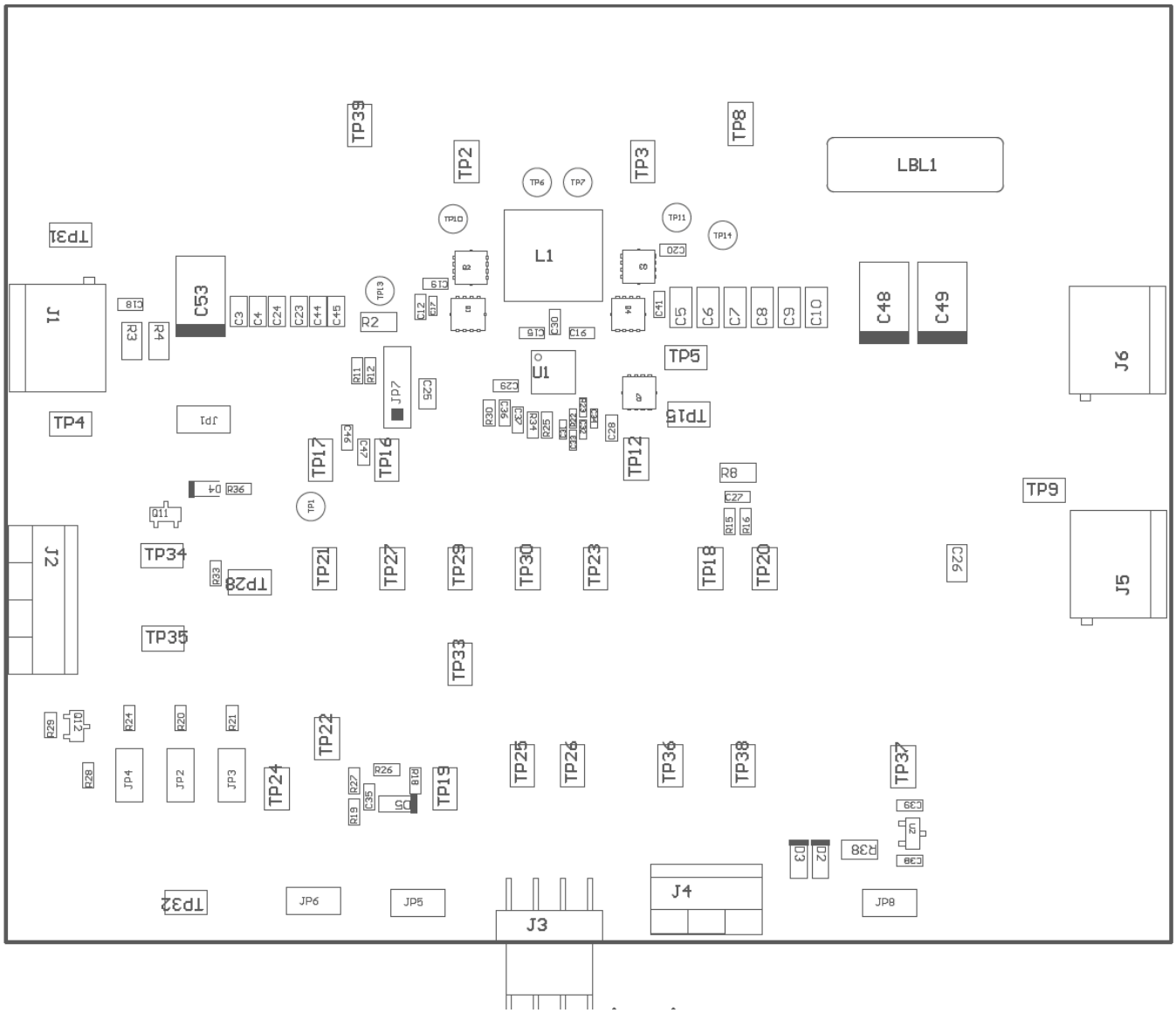


Figure 5. Top Assembly

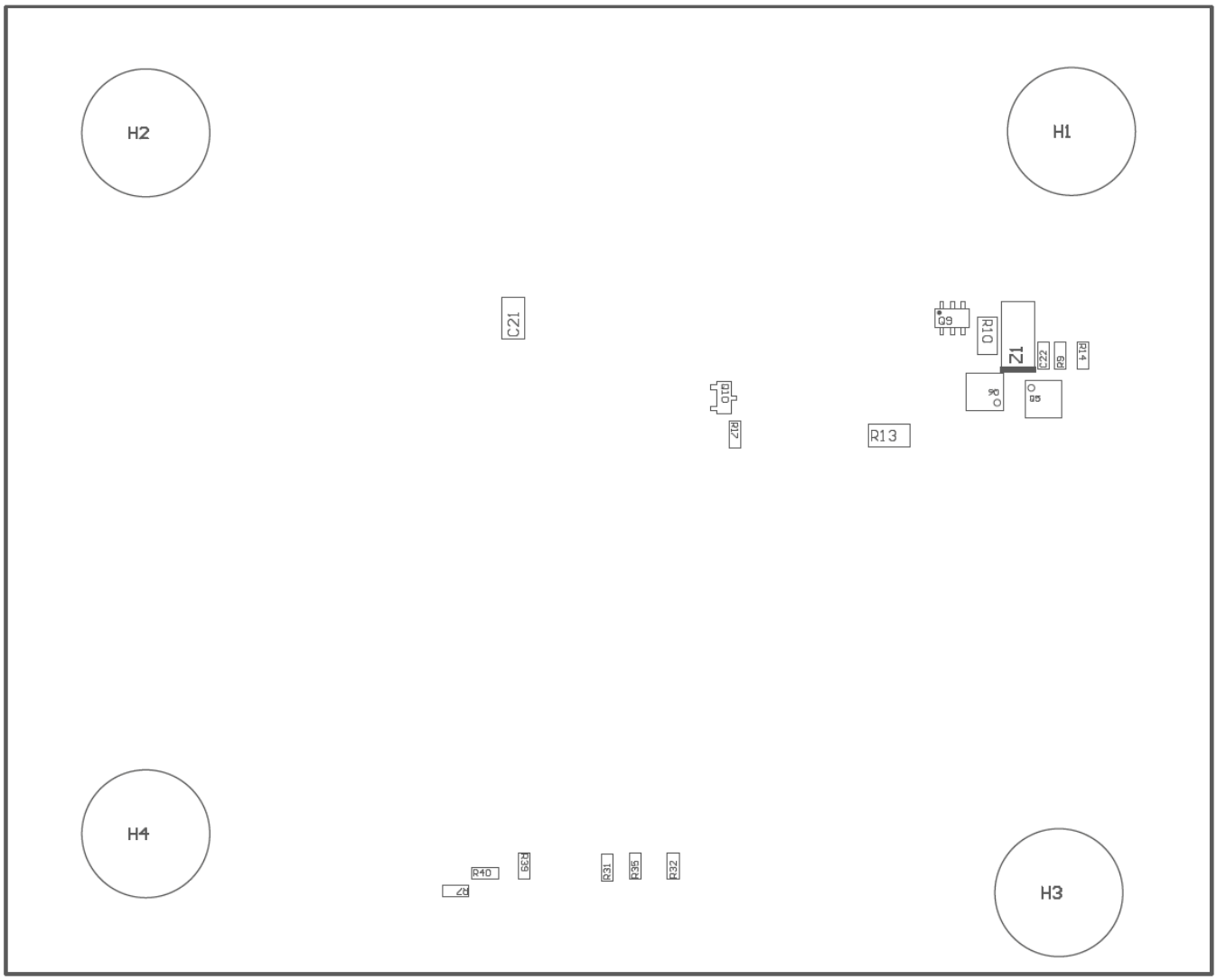


Figure 6. Bottom Assembly

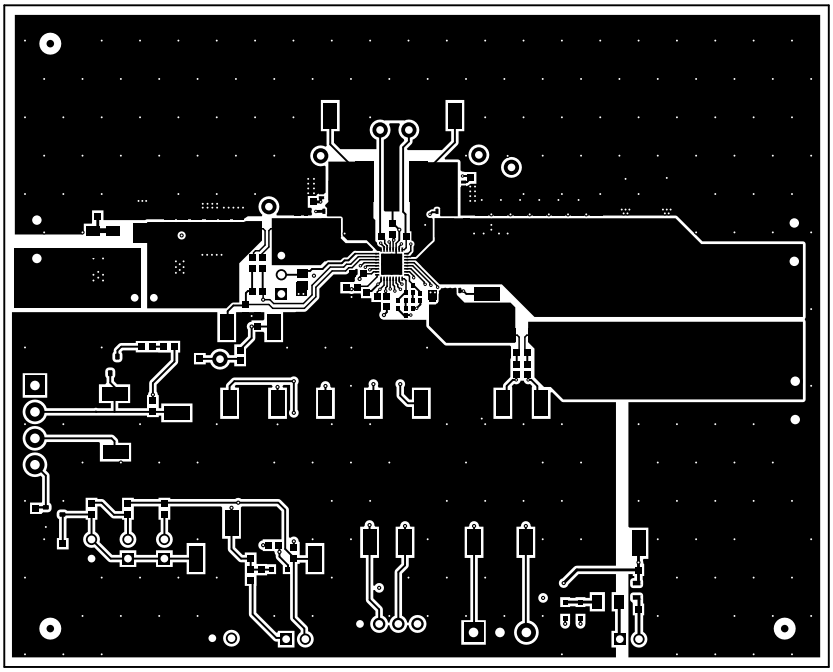


Figure 7. PCB Layer 1

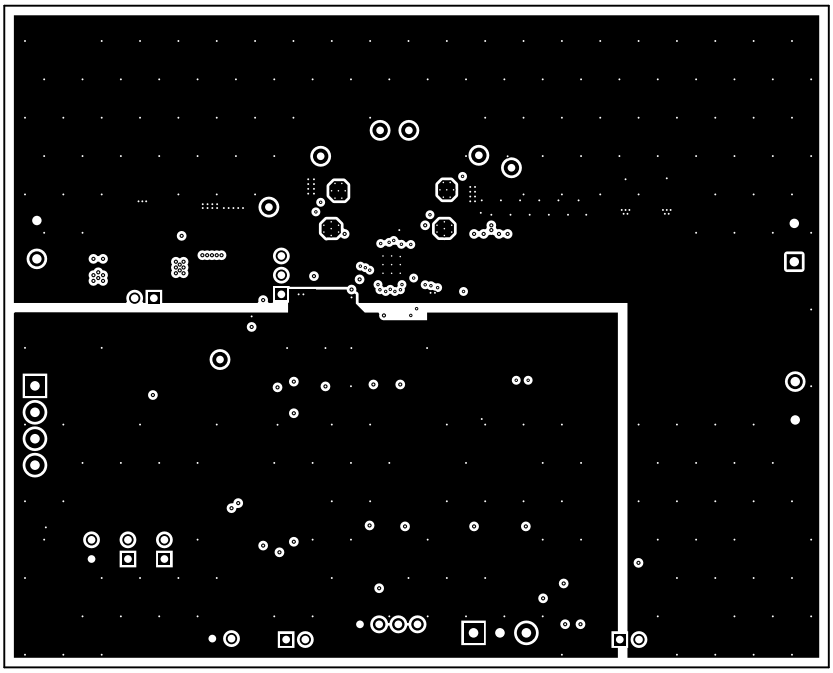


Figure 8. PCB Layer 2

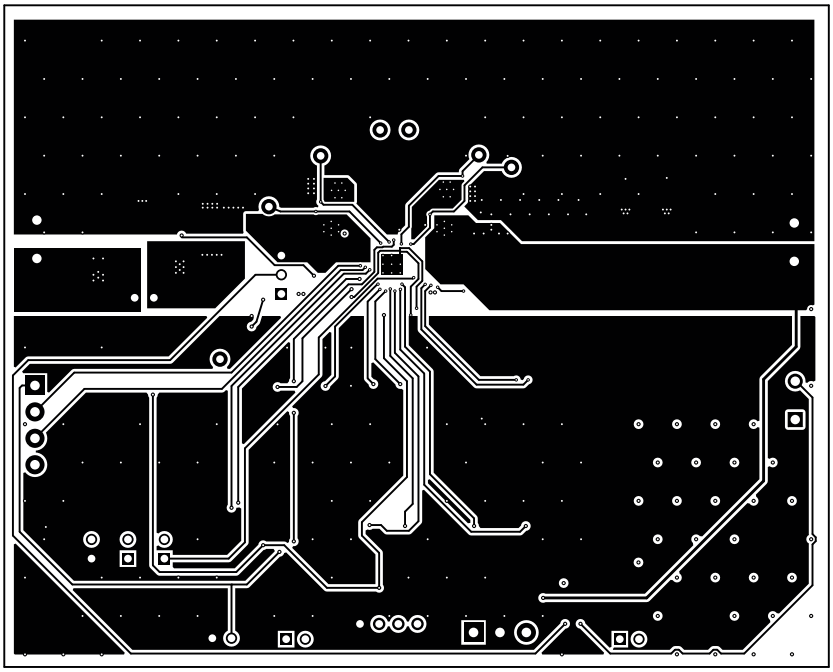


Figure 9. PCB Layer 3

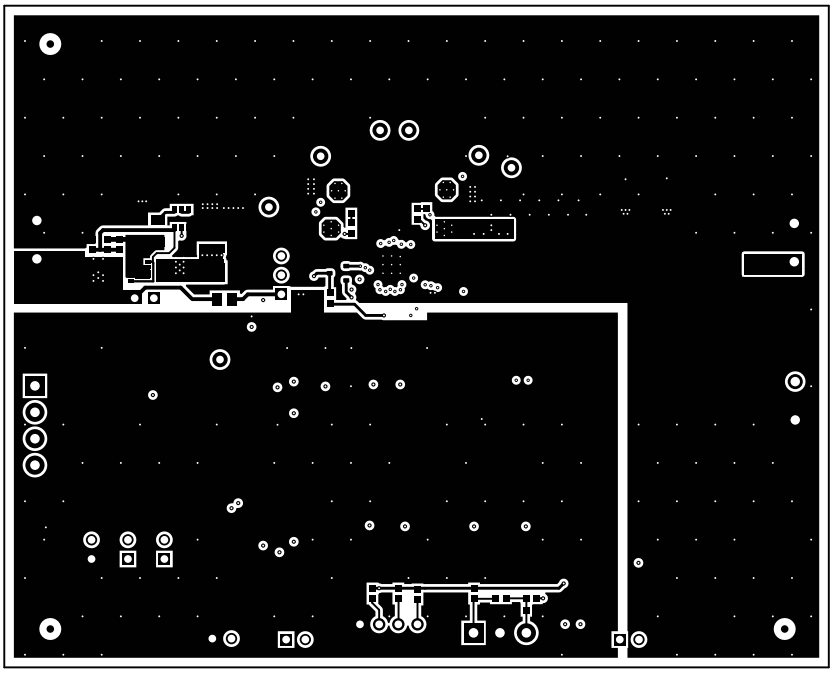


Figure 10. PCB Layer 4

3.3 Schematic

Figure 11 shows the EVM schematic.

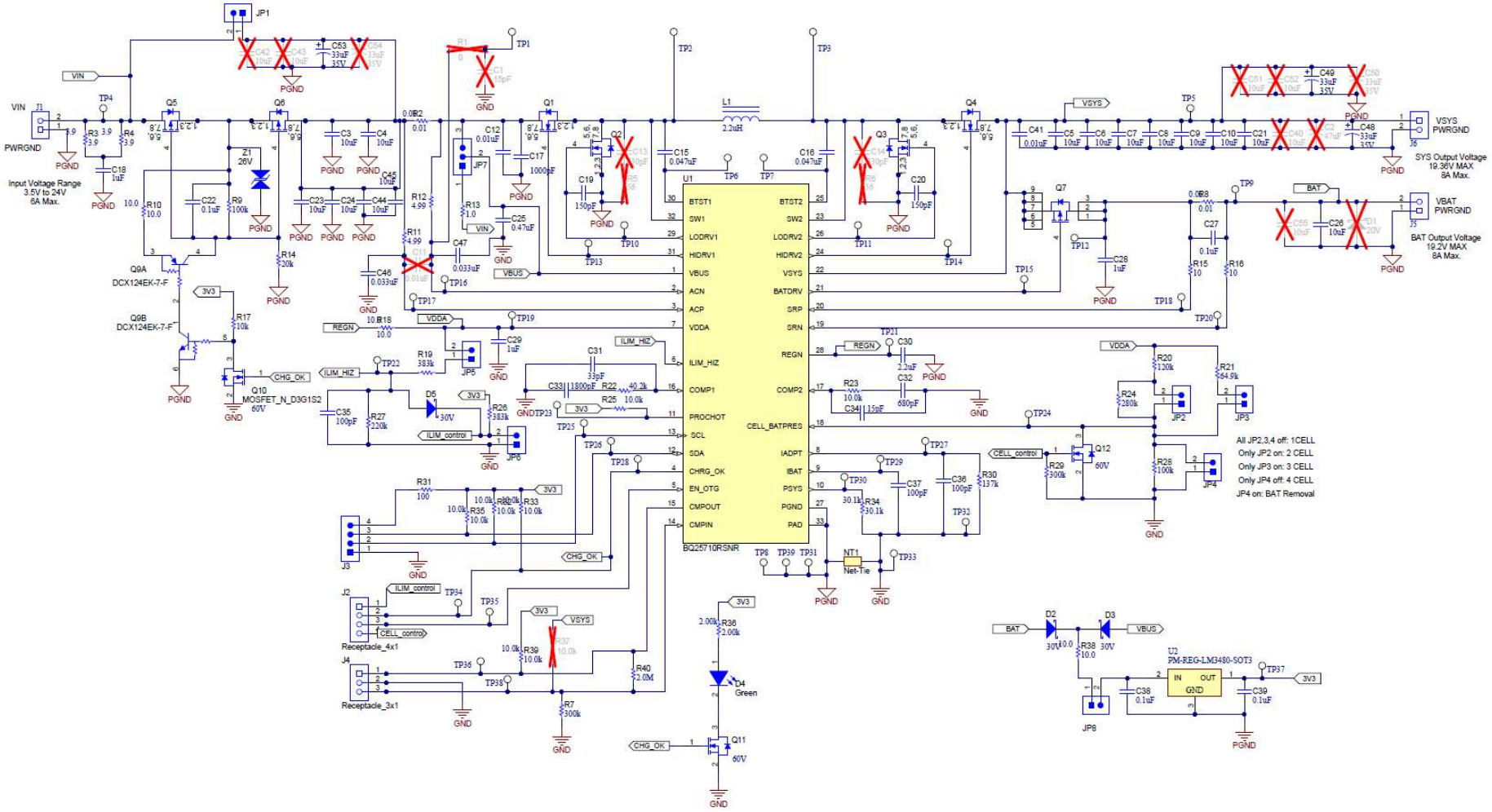


Figure 11. BQ2571x EVM Schematic

Revision History

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

Changes from A Revision (July 2018) to B Revision	Page
• Deleted "(Version: 1.3.85 or newer)" from the Software in Section 2.2	5
• Changed Figure 2	7
• Changed "Charger_1_00-BQ25710SMB.BQz" To: "Charger_1_00_BQ25710.bqz" in step 8 of Section 2.3	8
• Changed "Charger_1_00-BQ25713I2C." To: "Charger_1_00_BQ25713.bqz" in step 8 of Section 2.3	8
• Changed Table 4	10
• Added PCB layers Figure 7 To Figure 10	15

Changes from Original (June 2018) to A Revision	Page
• Deleted Advance Information	1

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   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

   3.1 *United States*

      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      CAUTION

      This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

      Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

      FCC Interference Statement for Class A EVM devices

      NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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