User's Guide

SLUUBP2A–January 2018–Revised August 2018

bq2588x Boosting Battery Chargers Evaluation Module

This user's guide provides detailed testing instructions for the bq2588x evaluation module (EVM). Also included are descriptions of the necessary equipment, equipment setup, procedures, the printed-circuit board layouts, schematics, and the bill of materials (BOM).

Throughout this user's guide, the abbreviations *EVM*, *bq2588xEVM-001*, *BMS007*, and the term *evaluation module* are synonymous with the bq2588x evaluation module, unless otherwise noted.

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1 Introduction

As industry improvements continue to make portable electronics more powerful, their power requirements increase. Using two series Li-Ion polymer cells is one way to achieve this power increase. Charging these 8.4-V battery packs from a legacy 5-V USB port requires a boost charger. The bq2588x family is a highly-integrated 2-A boosting, 1.5-MHz switch-mode battery charge management and system power path management device for a dual-cell Li-Ion and Li-polymer battery. The I^2C serial interface with charging and system settings makes the device a truly flexible solution.

1.1 EVM Features

The bq2588x evaluation module (EVM) is a complete charger module for evaluating the I^2C-controlled, dual-cell NVDC charger (bq2588x) in the WCSP package. Key features of this EVM include:

- Easily evaluate the high-efficiency 2-A, 1.5-MHz integrated field-effect-transistor (FET), switch-mode boost charger in the WCSP package
- Use of an onboard USB input adapter for connecting to a USB source and either communication through D+/D– or using the PSEL pin header to set the default input current limit
- Use the EV2300/2400 interface to switch between charge and USB On-the-Go (OTG) as well as monitor voltages and current with an integrated analog-to-digital converter (ADC)
- Onboard test points, sense resistors, and jumpers facilitate measurement of high-efficiency- and high-accuracy voltage and current regulation

See the device data sheet (Table 1) for detailed features and operation of the integrated circuit (IC).

Table 1. Device Data Sheets

Device	Data Sheet	EVM Label	Variant
bq25880	SLVSE40	bq25880EVM-001	001
bq25882	SLVSE40	bq25882EVM-001	002

This EVM does **not** include the EV2300/EV2400 interface board. To evaluate the EVM, order an EV2300/EV2400 interface board separately.

1.2 I/O Descriptions

Table 2 lists the jumper connections available on this EVM.

Table 2. EVM Connections

Jack	Description
J1(2)–VBUS	Connection for positive terminal of charger power source
J1(1)–GND	Connection for negative terminal (ground terminal) of charger power source
J2(1)–PMID	PMID pin connection
J2(2)–GND	Ground
J3(1)–SYS	Connection to system load
J3(2)–GND	Ground
J4(4)–BAT+	Connection for battery pack positive node to BAT pin
J4(3)-BATP	Connection for off board positive battery sense connection to BATP pin (see JP2)
J4(2)–BATN	Connection for off board negative battery sense connection to BATN pin (see JP4)
J4(1)–BAT–	Connection to battery pack negative node = EVM ground
J5	Input mini-USB port
J6	I^2C 4-pin connector for EV2300/2400

Table 3 lists the EVM jumper connections.

Table 3. EVM Jumper Connections and Shunt Installation

Jack	Description	BQ2588X Setting
JP1	STAT, $\overline{PG}$, $\overline{CE}$, INT, SDA, and SCL pins 3.3-V LDO pullup source of either SYS (pin 1 to 2) or BAT (pin 2 to 3)	Shunt pins 2 and 3
JP2	BATP sense connection to either PCB near J4 connector (pin 1 to 2) or to J4 pin 3 BATP connection (pins 2 to 3)	Shunt pins 1 to 2
JP3	Connects D+ pin to pin 3 of J5 mini-USB port	'882 - installed; '880 - open
JP4	BATN sense connection to either PCB GND plane (pin 2 to 3) or to J4 pin 2 BAT connection (pins 1 to 2)	Shunt pins 2 and 3
JP5	TS resistor divider pullup source (REGN) connection	Installed
JP6	Connects D– pin to pin 2 of J5 mini-USB port	'882 - installed; '880 - open
JP7	Connects an onboard 10 kΩ from TS pin to GND	Installed
JP8	Connects TS to GND	Open
JP9	Connects PSEL to either REGN (pins 2 to 3) or GND (pins 1 to 2) for setting default input current limit to 500 mA or 2.4 A, respectively, at start-up; may be clamped lower due to resistor on ILIM pin	'880 - Short pins 1 to 2; '882 - open
JP10	Pulls up STAT on '880 or $\overline{PG}$ on '882 through diode and resistor to pullup source	Installed
JP11	Pulls up $\overline{PG}$ on '880 through diode and resistor to pullup source	'882 - not installed; '880 - installed
JP12	Connect $\overline{CE}$, which is pulled up to GND to enable charge	Installed
JP13	Pull up SDA through 10-kΩ resistor; optional if I2C line has internal pullup.	Installed
JP14	Pull up SCL through 10-kΩ resistor; optional if I2C lin has internal pullup.	Installed
JP15	Pull up INT through 10-kΩ resistor	Installed
JP16	Pull up $\overline{CE}$ through 10-kΩ resistor	Open

Table 4 lists the recommended operating conditions for this EVM.

Table 4. Recommended Operating Conditions

Symbol	Description	MIN	TYP	MAX	Unit
Supply voltage, V_{VBUS}	Input voltage from AC adapter	3.9	5	6.5	V
Battery voltage, V_{BAT} in charge mode	Voltage applied at V_{BAT} terminal	0 or floating	8.7	9.2	V
Battery voltage, V_{BAT} in OTG mode	Voltage applied at V_{BAT} terminal	5.85	—	9.2	V
I_{BAT}	Fast charging current	0	—	2.2	A
	Discharging current through internal MOSFET	6	—	—	A
Supply current, I_{IN}	Maximum input current from AC adapter input	0	—	3.0	A

2 Test Summary

2.1 Equipment

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

1. *Power supply (PS#1)* : The power supply must be capable of supplying up to 6.5 V at 3.3 A. While this part can handle larger voltage and current, it is not necessary for this procedure.
2. *Battery simulator (BS#1)* : Four-quadrant supply set to constant voltage ≤ 9.2 V
   Example: Kepco Bipolar Power Supply: BOP 20–5M, DC 0 to ±20 V, 0 to ±5 A (or higher) and Keithley 2420 Sourcemeter
3. *Load #1:* Electronic or resistive load capable of sinking up to 3 A at 9.2 V
4. *Meters:* Six Fluke 75 multimeters (equivalent or better)
   - Alternatively; four equivalent voltage meters and two equivalent current meters. The current meters must be capable of measuring greater than 3 A of current. A current meter in series with the battery or battery simulator must have auto-ranging disabled and should only be used for DC measurements (no start-up, transients, and so forth).
5. *Computer:* A computer with at least one USB port and a USB cable
6. *PC communication interface:* EV2300/EV2400 USB-based PC interface board
7. *Software:* Download bqStudio from Texas Instruments
   Double click the *Battery management studio* installation file and then follow the installation steps. The software supports Microsoft® Windows® 7 and Windows 10 operating systems.

2.2 Charge Mode

2.2.1 Charge Mode Test Setup

Use the following list to set up the equipment for charge mode operation:

1. Figure 1 shows the test setup for bq25882 and Figure 2 shows the test setup for bq25880 when in charge (boosting) mode including jumper settings per Table 2. Ensure that the power supply and battery simulator are turned off before connecting to the EVM.

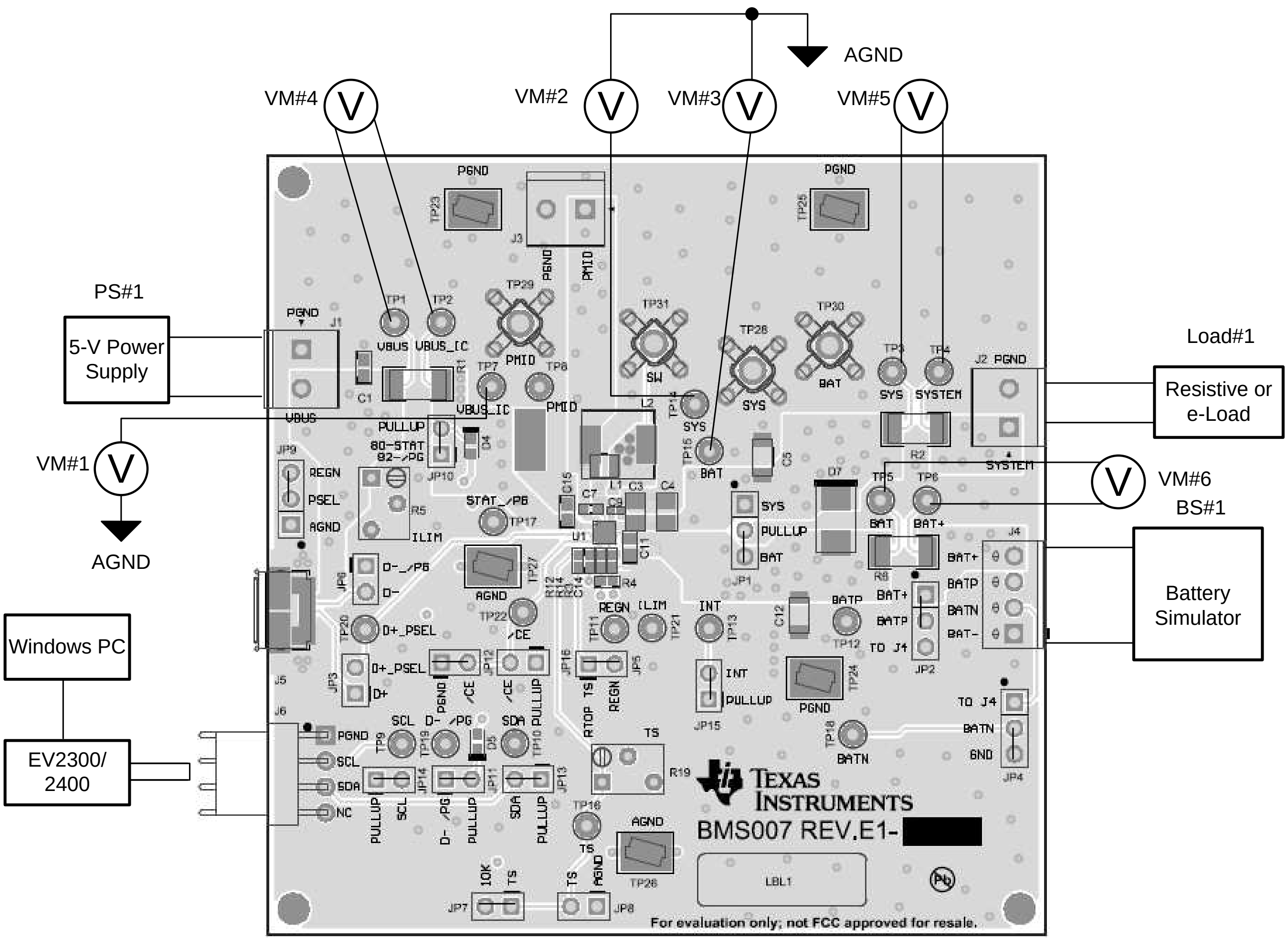


Figure 1. bq25880 Charge Mode Test Setup

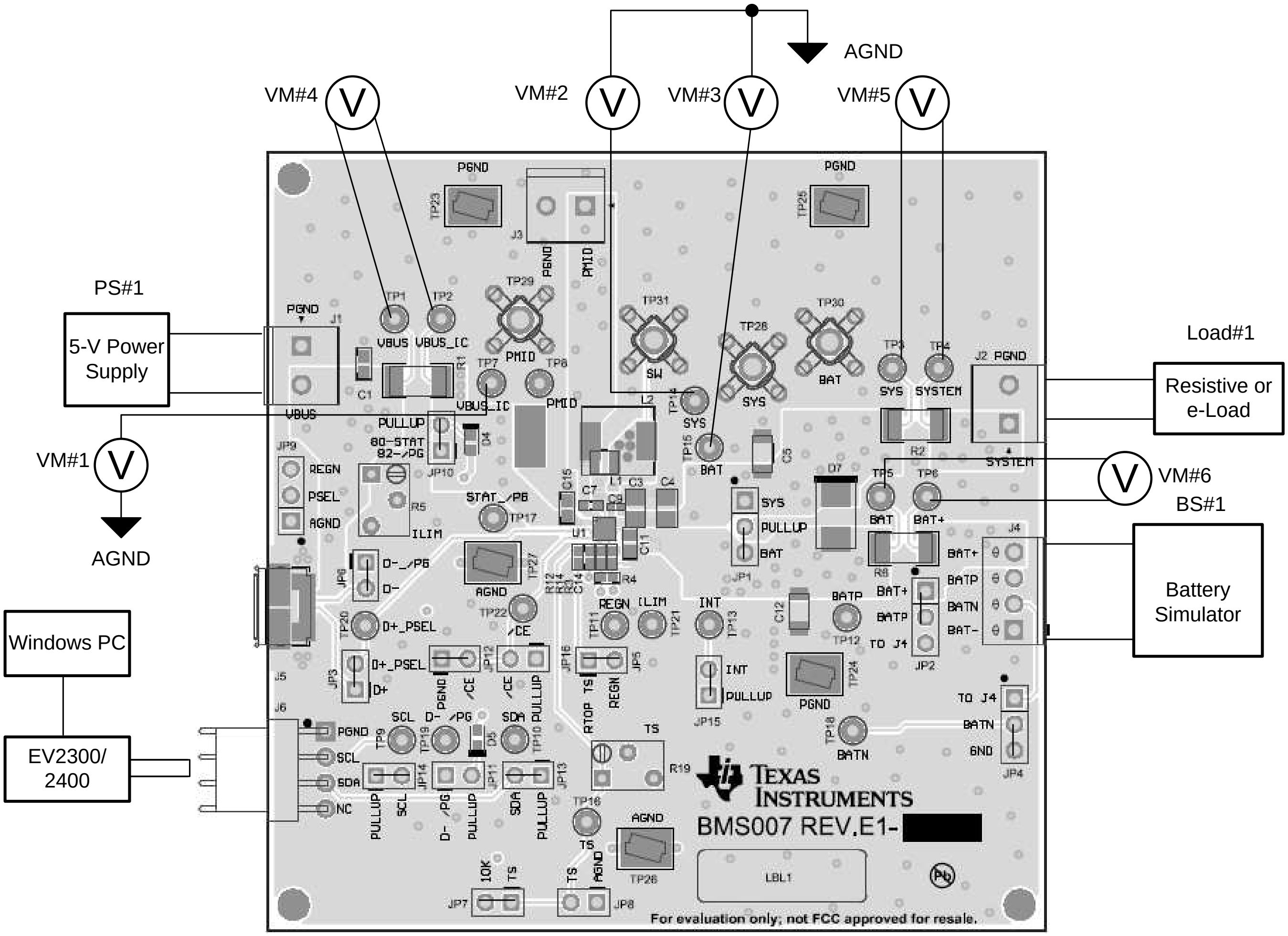


Figure 2. bq25882 Charge Mode Test Setup

2. Voltmeters 1 through 3 (VM1, VM2, and VM3) connect to Kelvin test points for measuring VBUS, SYS, and BAT as close to the IC pins as possible. Voltmeters 4 through 6 measure the voltage across 0.01 Ω, which gives the current.
3. Before attaching to the EVM, set battery simulator 1 (BS#1) no higher than 7.6 V and at a 2.5-A current limit and set power supply 1 (PS#1) for 5.5 V and a 3.5-A current limit.
4. Turn off BS#1 and PS#1 then attach BS#1 to the J4 (BAT, GND) terminal of the EVM and attach PS#1 to J1 (VBUS, GND) of the EVM.
5. Optionally, turn off an electronic load and attach to the J2 (SYS, GND) terminal of the EVM.
6. With the EV2300/2400 connected to the PC and the EVM, launch *Battery Management Studio* (bqStudio). Select *Charger* and the bq2588x evaluation software.

2.2.2 Charge Mode I2C Register Setup

1. Turn on BS#1 and set for 7.6 V.
2. In the EVM software, specify the “I2C Address” as *D6 (6B)*.

3. Click the *Read* button.

4. In the EVM GUI software *Field View*, ensure that the following I^2C registers have the following settings:
   - Chose “Disabled” in the drop-down box for the *Watchdog Timer*
   - *Input Voltage Limit*= "4.4V" (default)
   - *Input Current Limit*= "3.3A"
   - *Charge Voltage Limit*= "8.70V" (default)
   - *Fast Charge Current Limit*= "1.00A"
   - *Pre-charge Current Limit* to "0.15A" (default)
   - *Minimum System Voltage* to "7.0V" (default)
   - Deselect *Enable Charge* to disable charge
   - Deselect *Enable ILIM pin* to disable the ILIM pin
   - Deselect *Enable HiZ*, if selected
5. Click *Read Register* to confirm that register changes were made.

2.2.3 Charge Mode Test Procedure

Use the following steps for charge mode verification and testing:

1. Turn on PS#1 and click the *Read Register* button twice.
   - *Observe* → everything "Normal" at the *Fault* box
   - For bq25880EVM, *Observe* → D4 (STAT) is off because charge is disabled.
   - For bq25882EVM, *Observe* → D4 ($\overline{\text{PG}}$) is on indicating power is good.
   - *Measure on VM2* → V(TP14 (SYS), TP26 (AGND)) = 7.7 V ±50 mV
2. Use the GUI to select *Enable Charge* to start charging at 1.0 A. To correct for cable resistance, adjust PS#1 until VM1 [TP7 (VBUS_IC), TP26 (AGND)] measures 5.5 V ±50 mV and adjust BS#1 until VM3 [TP15 (BAT), TP26 (AGND)] measures 7.6 V ±50 mV.
   - *Measure on VM6* → V(TP5 (BAT), TP6 (BAT+)) = 10 mV ±0.7 mV which corresponds to ICHG = 1.0 A ±5% through a 0.010-Ω ±1% resistor. Voltage of 0.1 mV is added to account for DMM accuracy.
   - *Measure on VM4* → V(TP1 (VBUS), TP2 (VBUS_IC)) = 16 mV ±0.7 mV which corresponds to IVBUS = 1.65 A ±5% (accounting for efficiency variation across ICs and inductors) through a 0.010-Ω ±1% resistor. Voltage of 0.1 mV is added to account for DMM accuracy.
3. Optionally, in the GUI, select *Enable ILIM pin*. Adjust the RLIM potentiometer (R5) until:
   - *Measure on VM4* → V(TP1 (VBUS), TP2 (VBUS_IC)) = 10 mV ±0.7 mV which corresponds to IVBUS = 1.0 A ±5% through a 0.010-Ω ±1% resistor. Voltage of 0.1 mV is added to account for DMM accuracy.
   - *Obverse in bqStudio after Read Register* → IINDPM Status: In IINDPM
4. Turn off and disconnect PS#1, BS#1, Load#1, and voltmeters.

2.2.4 Charge Mode Evaluation Results

Figure 3 shows the *Charge Mode Startup* graph.

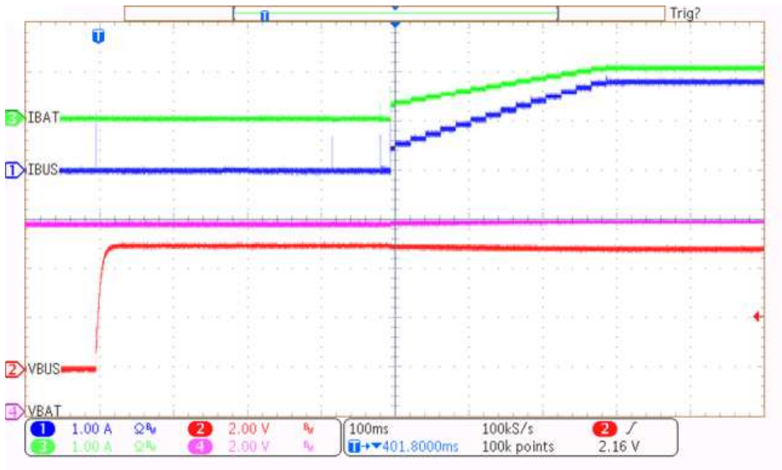


Figure 3. Charge Mode Startup

2.3 OTG Mode

2.3.1 OTG Mode Test Setup

Use the following list to set up the equipment for boost mode operation:

1. Ensure that the electronic load and battery simulator are turned off when connecting to the EVM. Figure 4 shows the test setup for bq2588x when in OTG mode, including the jumper settings per Table 2.

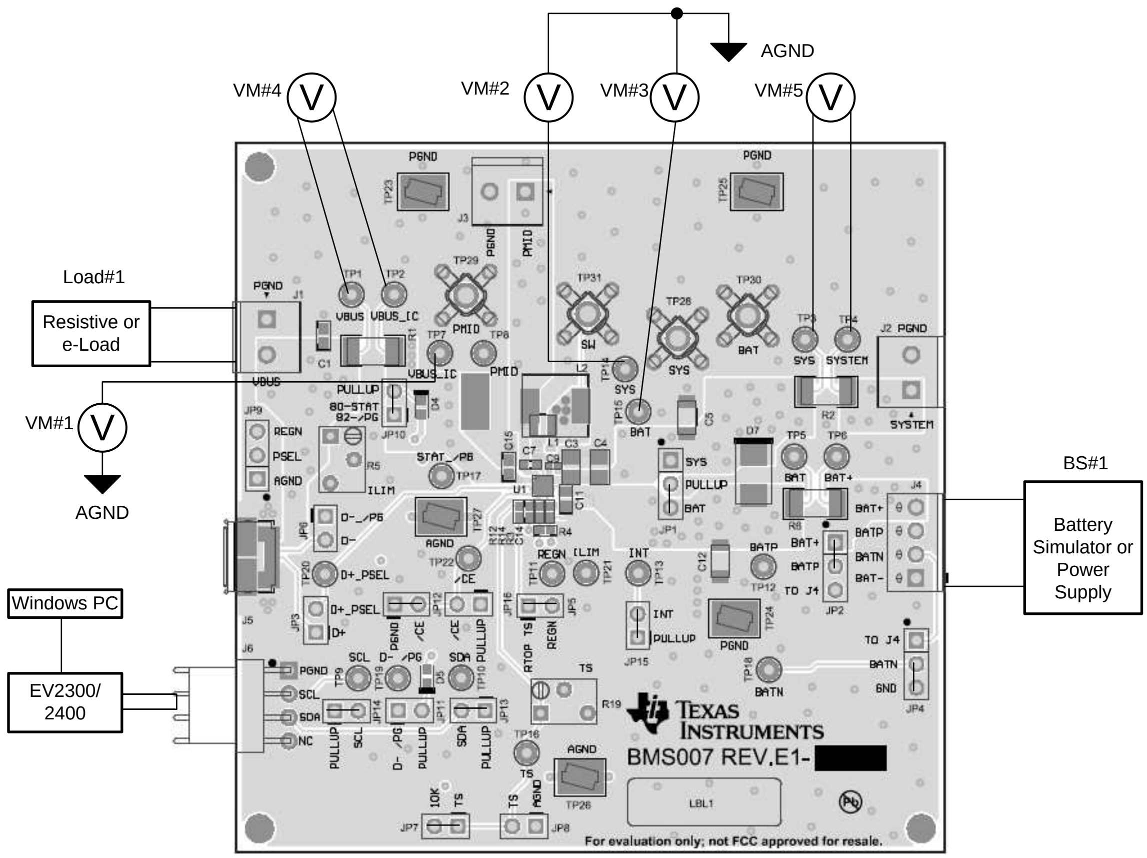
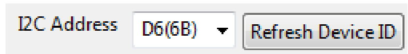


Figure 4. bq2588x OTG Mode Test Setup

2. Voltmeters 1 through 3 (VM1, VM2, and VM3) connect to Kelvin test points for measuring VBUS, SYS, and BAT as close to the IC pins as possible. Voltmeters 4 through 6 measure the voltage across 0.01 Ω, which gives the current.
3. Set BS#1 to 7.6 V and at a 6-A current limit, then turn off BS#1 and attach to the J4 (BAT, GND) terminal of the EVM.
4. With electronic load disabled, attach to the J1 (VBUS, GND) terminal of the EVM.
5. With the EV2300/2400 connected to the PC and the EVM, launch *Battery Management Studio* (bqStudio). Select *Charger* and the bq2588x evaluation software.

2.3.2 OTG Mode I2C Register Setup

1. Turn on BS#1, set for 7.6 V.
2. In the EVM software, specify the “I2C Address” as *D6 (6B)*.



3. Click the *Read* button.
4. In the EVM GUI software *Field View* ensure that the following I^2C registers have the following settings:
   - Chose “Disabled” for the *Watchdog Timer*
   - *OTG Voltage Limit*= "5.0 V"
   - *OTG Current Limit*= "600 mA"
   - Deselect *Enable Charge*
   - Deselect *Enable HiZ* if selected
   - Select *Enable OTG*

2.3.3 OTG Mode Test Procedure

Use the following steps for boost mode verification:

1. *Observe* → everything "Normal" at the *Fault* box
2. *Measure on VM2* → V(TP1 (VBUS), TP26 (AGND)) = 5.0 V ±160 mV. Voltage of 10 mV is added to account for DMM accuracy.
3. Set electronic load in CC mode to 500 mA, or resistive load to 10 Ω.
4. *Measure on VM2* → V(TP1 (VBUS), TP26 (AGND)) = 5.0 V ±160 mV. Voltage of 10 mV is added to account for DMM accuracy.
5. Turn off and disconnect BS#1, Load#1, and voltmeters.

2.3.4 OTG Mode Evaluation Results

Figure 5 shows the *OTG Mode Startup* graph.

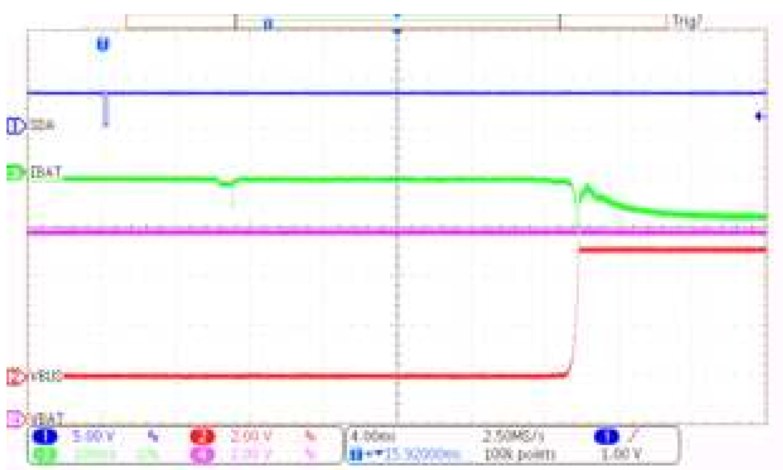


Figure 5. OTG Mode Startup

2.4 Helpful Tips

The following list provides a few helpful tips:

- The leads and cables to the various power supplies, batteries, and loads have resistance. The current meters also have series resistance. The charger dynamically reduces charge current depending on the voltage sensed at its VBUS pin (using the VINDPM feature), BAT pin (as part of normal termination), and TS pin (through its battery temperature monitoring feature through the battery thermistor). Therefore, the designer must use voltmeters to measure the voltage as close to the IC pins (TP7, TP14, and TP15) as possible instead of relying on the digital readouts of the power supply.
- When using a source meter that can source and sink current as the battery simulator, TI highly recommends adding a large (1000 μF or greater) capacitor at the EVM, BAT, and GND connectors to prevent oscillations at the BAT pin, which are due to mismatched impedances of the charger output and source meter input within their respective regulation loop bandwidths. Configuring the source meter for four-wire sensing eliminates the requirement for a separate voltmeter to measure the voltage at the BAT pin. When using four-wire sensing, always ensure that the sensing leads are connected to prevent accidental overvoltage by the power supply.
- For precise measurements of efficiency and charge current or battery regulation (or both) near termination, a current meter in series with the battery or battery simulator must not be set to auto-range and may require removal, entirely. This EVM offers an alternate method for measuring currents by measuring the voltage across a 1%, thermally-capable (for example, 0.010 Ω in a 1210 or larger footprint) resistor in series between the power sources and power pins.

3 PCB Layout Guidelines

Minimize the switching node rise and fall times for minimum switching loss. Proper layout of the components that minimize the high-frequency current path loop is important to prevent electrical and magnetic field radiation and high-frequency resonant problems. To ensure proper layout, follow the priority list for this printed-circuit board (PCB) in the order presented:

1. Place the output capacitor as close as possible to the SYS pin and GND pin connections and use the shortest copper trace connection or GND plane.
2. Put the input capacitors near to the VBUS and PMID pins. Tie ground connections to the IC ground with a short copper trace connection or GND plane.
3. Place the inductor input terminal as close to the SW pin as possible. Minimize the copper area of this trace to lower electrical and magnetic field radiation but make the trace wide enough to carry the charging current. Do not use multiple layers in parallel for this connection. Minimize parasitic capacitance from this area to any other trace or plane.
4. Route analog ground separately from power ground. Connect analog ground and connect power ground separately. Connect analog ground and power ground together using the power pad as the single ground connection point or use a 0-Ω resistor to tie analog ground to power ground.
5. Use a single ground connection to tie the charger power ground to the charger analog ground just beneath the IC. Use ground copper pour but avoid power pins to reduce inductive and capacitive noise coupling.
6. Place decoupling capacitors next to the IC pins and make the trace connection as short as possible.
7. One critical note regarding the layout is that the exposed power pad on the backside of the IC package must be soldered to the PCB ground. Ensure that there are sufficient thermal vias directly under the IC connecting to the ground plane on the other layers.
8. The via size and number must be sufficient for a given current path.

See the EVM design for the recommended component placement with trace and via locations..

4 Board Layout, Schematic, and Bill of Materials

4.1 Board Layout

Figure 6 through Figure 9 show the PCB board layouts.

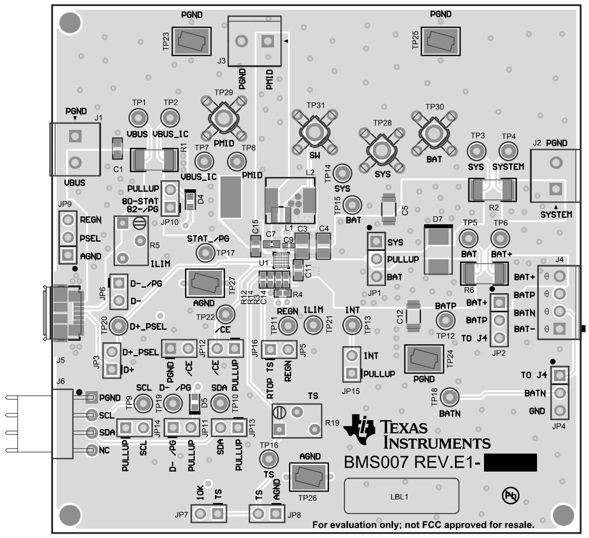


Figure 6. bq2588xEVM-001 Top Overlay

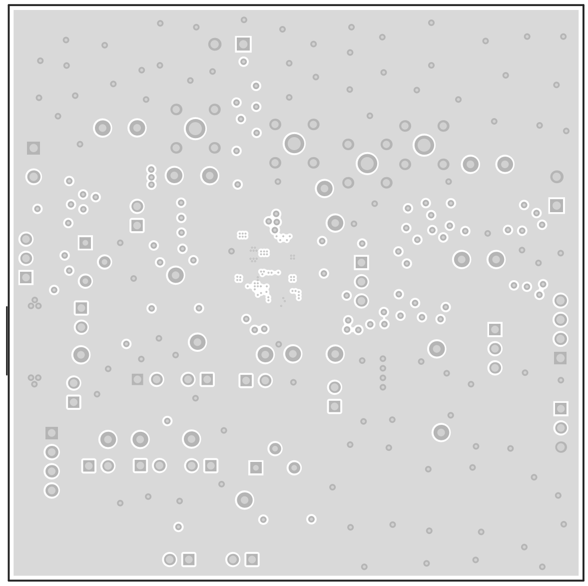


Figure 7. bq2588xEVM-001 Layer 2

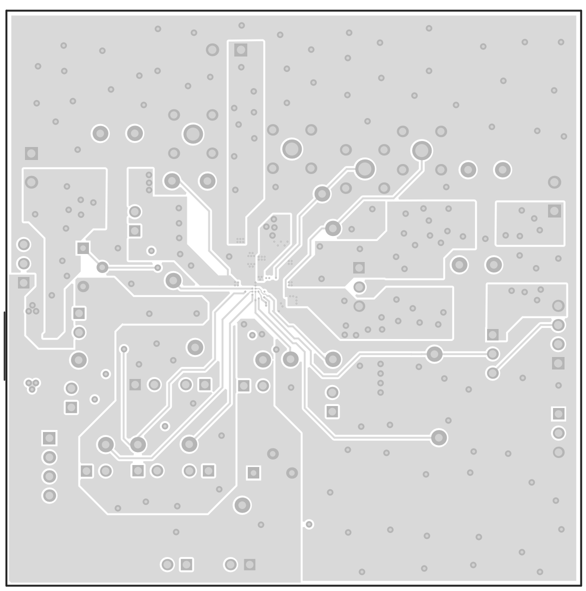


Figure 8. bq2588xEVM-001 Layer 3

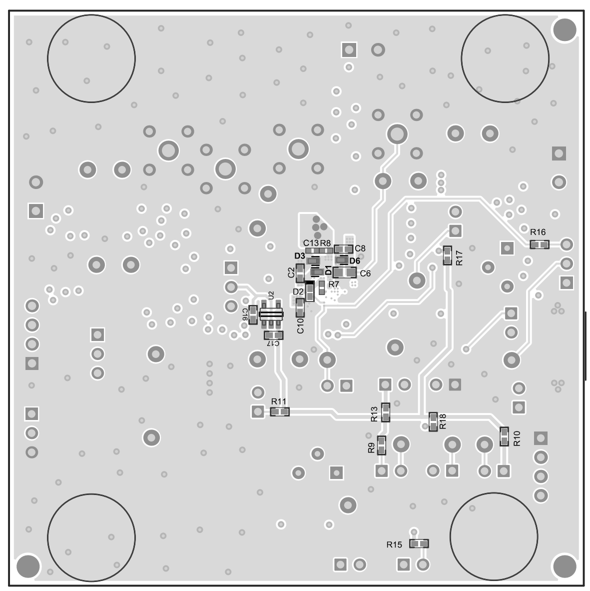


Figure 9. bq2588xEVM-001 Bottom Overlay

4.2 Schematic

Figure 10 and Figure 11 show the schematics for both bq2588x EVMs.

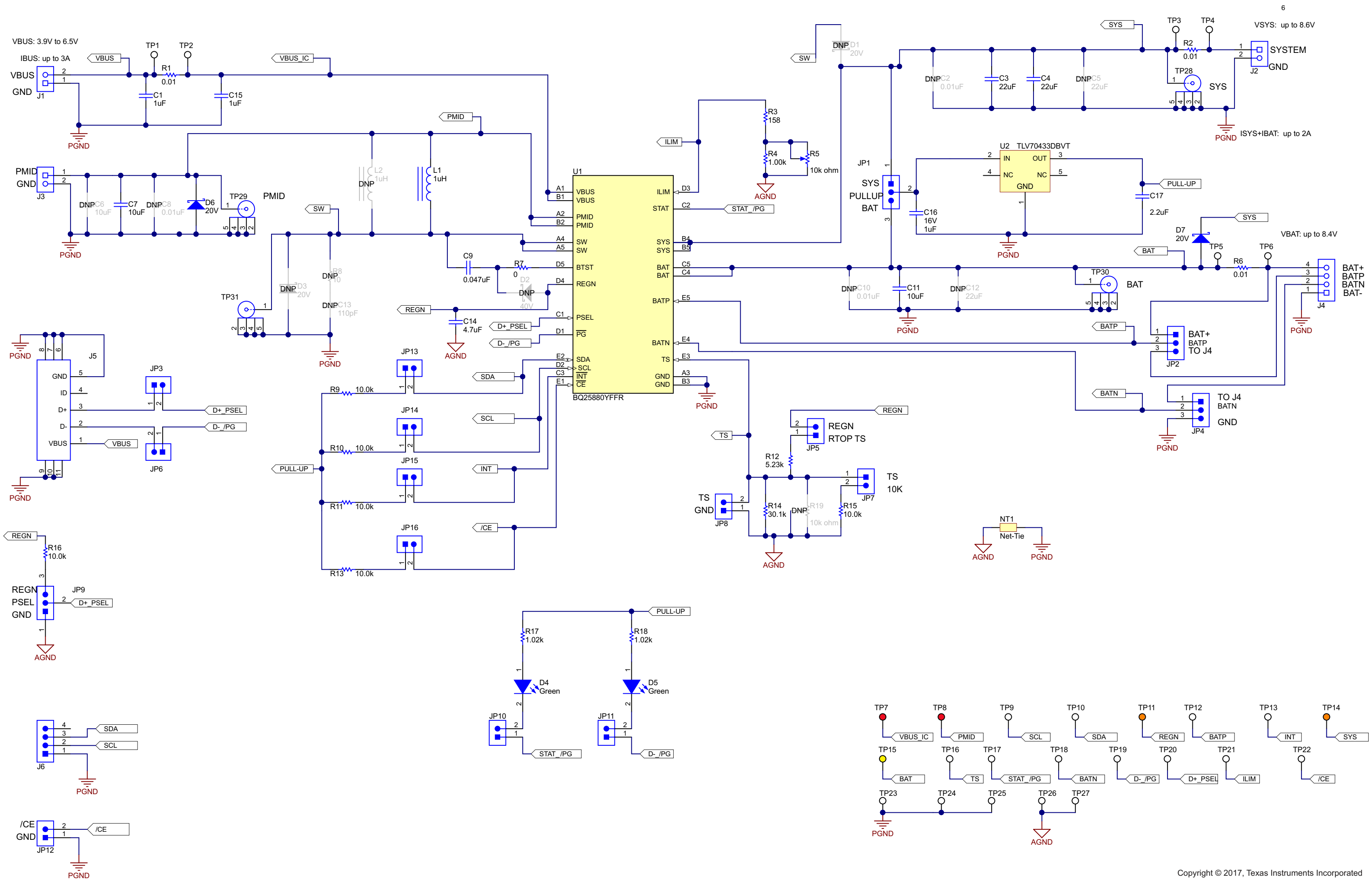


Figure 10. bq25880EVM-001 Schematic

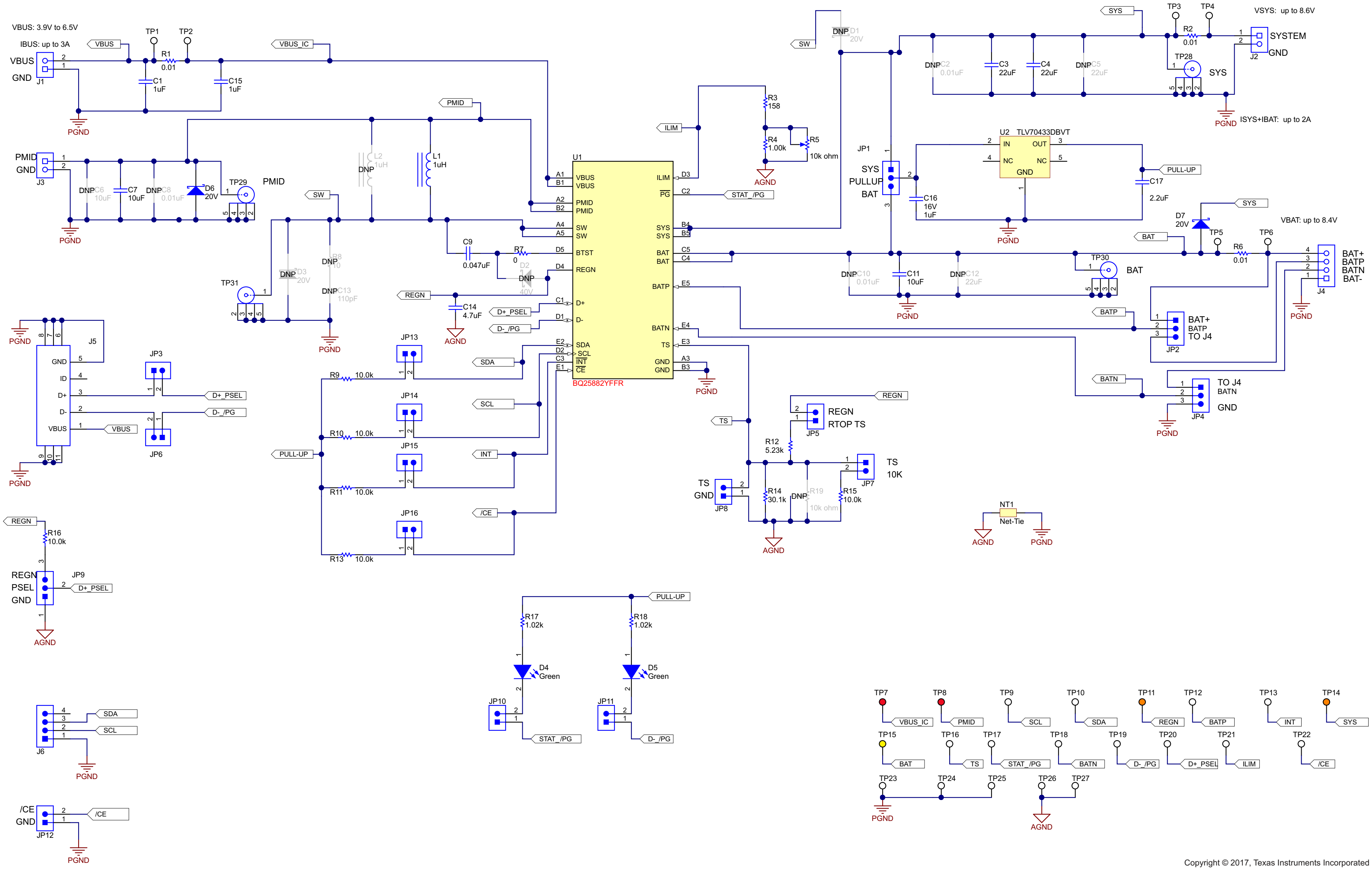


Figure 11. bq25882EVM-001 Schematic

4.3 Bill of Materials

Table 5 lists the bq2588xEVM BOM.

Table 5. bq2588xEVM Bill of Materials

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
C1, C15	2	1uF	CAP, CERM, 1 uF, 25 V, ±10%, X5R, 0603	0603	GRM188R61E105KA12D	Murata
C3, C4	2	22uF	CAP, CERM, 22 uF, 25 V, ±20%, X5R, 0805	0805	GRM21BR61E226ME44L	Murata
C7, C11	2	10uF	CAP, CERM, 10 uF, 25 V, ±20%, X5R, 0603	0603	GRM188R61E106MA73D	Murata
C9	1	0.047uF	CAP, CERM, 0.047 uF, 25 V, ±10%, X7R, 0402	0402	GRM155R71E473KA88D	Murata
C14	1	4.7uF	CAP, CERM, 4.7 uF, 10 V, ±20%, X5R, 0402	0402	GRM155R61A475MEAAD	Murata
C16	1	1uF	CAP, CERM, 1 uF, 16 V, ±10%, X5R, 0402	0402	C1005X5R1C105K050BC	TDK
C17	1	2.2uF	CAP, CERM, 2.2 uF, 10 V, ±20%, X5R, 0402	0402	GRM155R61A225ME95	Murata
D4, D5	2	Green	LED, Green, SMD	1.6x0.8x0.8mm	LTST-C190GKT	Lite-On
D6	1	20V	Diode, Schottky, 20 V, 1 A, 152AD	152AD	NSR10F20NXT5G	ON Semiconductor
D7	1	20V	Diode, Schottky, 20 V, 3 A, SMB	SMB	B320B-13-F	Diodes Inc.
J1, J2, J3	3		Conn Term Block, 2POS, 3.81mm, TH	2POS Terminal Block	1727010	Phoenix Contact
J4	1		Terminal Block, 4x1, 2.54 mm, Green, TH	Terminal Block, 4x1, 2.54 mm, TH	1725672	Phoenix Contact
J5	1		Connector, Receptacle, Micro-USB Type B, R/A, Bottom Mount SMT	7.5x2.45x5mm	473460001	Molex
J6	1		Header (friction lock), 100mil, 4x1, R/A, TH	4x1 R/A Header	22-05-3041	Molex
JP1, JP2, JP4, JP9	4		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions
JP3, JP5, JP6, JP7, JP8, JP10, JP11, JP12, JP13, JP14, JP15, JP16	12		Header, 100mil, 2x1, Tin, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN	Sullins Connector Solutions
L1	1	1uH	Inductor, Shielded, Metal Composite, 1 uH, 3.3 A, 0.04 ohm, SMD	2.5x1.2x2mm	DFE252012F-1R0M=P2	Murata Toko
R1, R2, R6	3	0.01	RES, 0.01, 1%, 1 W, 2010	2010	WSL2010R0100FEA18	Vishay-Dale
R3	1	158	RES, 158, 1%, 0.063 W, 0402	0402	CRCW0402158RFKED	Vishay-Dale
R4	1	1.00k	RES, 1.00 k, 1%, 0.063 W, 0402	0402	CRCW04021K00FKED	Vishay-Dale
R5	1	10k ohm	Trimmer, 10k ohm, 0.25W, TH	4.5x8x6.7mm	3266W-1-103LF	Bourns
R7	1	0	RES, 0, 5%, 0.063 W, 0402	0402	CRCW04020000Z0ED	Vishay-Dale
R9, R10, R11, R13, R15, R16	6	10.0k	RES, 10.0 k, 1%, 0.063 W, 0402	0402	CRCW040210K0FKED	Vishay-Dale
R12	1	5.23k	RES, 5.23 k, 1%, 0.063 W, 0402	0402	CRCW04025K23FKED	Vishay-Dale
R14	1	30.1k	RES, 30.1 k, 1%, 0.063 W, 0402	0402	CRCW040230K1FKED	Vishay-Dale
R17, R18	2	1.02k	RES, 1.02 k, 1%, 0.063 W, 0402	0402	CRCW04021K02FKED	Vishay-Dale

Table 5. bq2588xEVM Bill of Materials (continued)

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
SH-JP1, SH-JP2, SH-JP3, SH-JP4, SH-JP5, SH-JP6, SH-JP7, SH-JP8, SH-JP9, SH-JP10, SH-JP11, SH-JP12, SH-JP13, SH-JP14, SH-JP15, SH-JP16	16	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP6, TP9, TP10, TP12, TP13, TP16, TP17, TP18, TP19, TP20, TP21, TP22	17		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
TP7, TP8	2		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone
TP11, TP14	2		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone
TP15	1		Test Point, Miniature, Yellow, TH	Yellow Miniature Testpoint	5004	Keystone
TP23, TP24, TP25, TP26, TP27	5		Test Point, Compact, SMT	Testpoint_Keystone_Compact	5016	Keystone
TP28, TP29, TP30, TP31	4		Compact Probe Tip Circuit Board Test Points, TH, 25 per	TH Scope Probe	131-5031-00	Tektronix
U1	1		bq2588x I2C Controlled, 2-Cell, 2A Boost-Mode Battery Charger for USB Input, YFF0025AGAG (DSBGA-25)	YFF0025AGAG	BQ2588XYFFR	Texas Instruments
U2	1		Single Output LDO, 150 mA, Fixed 3.3 V Output, 2.5 to 24 V Input, with Ultra-Low IQ, 5-pin SOT-23 (DBV), -40 to 125 degC, Green (RoHS & no Sb/Br)	DBV0005A	TLV70433DBVT	Texas Instruments
C2, C8, C10	0	0.01uF	CAP, CERM, 0.01 uF, 25 V, ±10%, X7R, 0402	0402	GRM155R71E103KA01D	Murata
C5, C12	0	22uF	CAP, CERM, 22 uF, 25 V, ±10%, X5R, 1206	1206	GRM31CR61E226KE15L	Murata
C6	0	10uF	CAP, CERM, 10 uF, 25 V, ±20%, X5R, 0603	0603	GRM188R61E106MA73D	Murata
C13	0	110pF	CAP, CERM, 110 pF, 25 V, ±5%, C0G/NP0, 0402	0402	GRM1555C1E111JA01D	Murata
D1, D3	0	20V	Diode, Schottky, 20 V, 1 A, 152AD	152AD	NSR10F20NXT5G	ON Semiconductor
D2	0	40V	Diode, Schottky, 40 V, 0.38 A, SOD-523	SOD-523	ZLLS350TA	Diodes Inc.
L2	0	1uH	Inductor, Shielded Drum Core, Powdered Iron, 1 uH, 11 A, 0.009 ohm, SMD	IHLP-2525CZ	IHLP2525CZER1R0M01	Vishay-Dale
R8	0	10	RES, 10, 5%, 0.063 W, 0402	0402	CRCW040210R0JNED	Vishay-Dale
R19	0	10k ohm	Trimmer, 10k ohm, 0.25W, TH	4.5x8x6.7mm	3266W-1-103LF	Bourns

Revision Widget

Date	Revision	Notes
August 2018	A	Changed disclosure