TEXAS INSTRUMENTS

Using the bq241xx (bqSWITCHER™)

User's Guide

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DYNAMIC WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 4.5 V to 16 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 50°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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Portable Power

Contents

1 Introduction

This user's guide describes the bq241xxEVM (bqSWITCHER) Evaluation Module. The EVM provides a convenient method for evaluating the performance of a charge management solution for portable applications using the bq241xx product family. A complete designed and tested charger is presented. The charger is designed to deliver up to 2.0 A of continuous output current. The charger is programmed from the factor to deliver 1.33 A of charging current. Follow the instructions in this user's guide that pertain to the specific bq241xxEVM to be evaluated (one-, two- or three-cell). Please refer to the bqSWITCHER data sheet (SLUS606) prior to evaluation for detailed information on the bqSWITCHER device.

1.1 Background

The bqSWITCHER™ series are highly integrated Li-Ion and Li-Pol switch-mode charge management devices targeted at a wide range of portable applications. The bqSWITCHER series offer integrated synchronous PWM Controller and PowerFETs, high-accuracy current and voltage regulation, charge conditioning, charge status, and charge termination, in a small thermally enhanced QFN package. The system-controlled version provides additional input for full charge management under system control.

The bqSWITCHER charges the battery in three phases: conditioning, constant current and constant voltage. Charge is terminated based on user-selectable minimum current level. A programmable charge timer provides a backup safety for charge termination. The bqSWITCHER automatically restarts the charge if the battery voltage falls below an internal threshold. The bqSWITCHER automatically enters sleep mode when V_{CC} supply is removed.

1.2 Performance Specification Summary

This section summarizes the performance specifications of the EVM. Table 1 gives the performance specifications of the EVM. The TS pin has been disabled, for easier charging evaluation, by fixing its voltage to a set value. See EVM schematic and data sheet for information on how to change R10 and R11 values to use with an external thermistor

Table 1. Performance Specification Summary(1)

SPECIFICATION		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input DC voltage, $V_{I(DC)}$			V_{REG} + 0.6	5.0	16	V
Battery charge current(1), $I_{O(CHG)}$				1.33	2.0(1)	A
Power dissipation	bq24100 (1 cell)	5 V ≤ V_{IN} ≤ 16 V, $V_{(BAT)}$ = 4.2 V, I_{OUT} = 1.33 A		0.6		W
	bq24103 bq24113 (1 cell)	5 V ≤ V_{IN} ≤ 16 V, $V_{(BAT)}$ = 4.2 V, I_{OUT} = 1.33 A		0.6		
	bq24103 bq24113 (2 cell)	9 V ≤ V_{IN} ≤ 16 V, $V_{(BAT)}$ = 8.4 V, I_{OUT} = 1.33 A		0.85		
	bq24105 bq24115 (1 cell)	5 V ≤ V_{IN} ≤ 16 V, $V_{(BAT)}$ = 4.2 V, I_{OUT} = 1.33 A		0.6		
	bq24105 bq24115 (2 cell)	9 V ≤ V_{IN} ≤ 16 V, $V_{(BAT)}$ = 8.4 V, I_{OUT} = 1.33 A		0.85		
	bq24105 bq24115 (3 cell)	13.5 V ≤ V_{IN} ≤ 16 V, $V_{(BAT)}$ = 12.6 V, I_{OUT} = 1.33 A		1.17		

2 Test Summary

This chapter covers the test setups and tests performed, in evaluating the EVM.

2.1 Equipment

- **Power Source**: Current limited 15-V lab supply with its current limit set to 25% above the programmed charging current (1.7 A for setup from factory). This is basically a safety limit. The actual DC input current should be less than the charging current.
- **Two Fluke 75**: (optional) To measure input and output voltage and drop across current sense resistor.

2.2 Setup

The bq241xx EVM board requires a regulated supply approximately 0.3 V minimum above the regulated voltage of the battery pack (1-cell pack: 4.2 V; 2-cell pack: 8.4 V; 3-cell pack: 12.6 V) to a maximum input voltage of 16 V_{DC}.

A one- to three-cell battery pack is needed for EVM evaluation. The EVM should be chosen and set up to charge the same numbers of cells as the battery pack to be evaluated. See Table 2.

Setup the EVM as shown in Table 2. Preset the input supply to the desired voltage, turn off supply and then connect supply to J1. Set the supply's current limit 25% above the programmed charging current. The test setup connections and jumper setting selections are configured for a stand-alone evaluation but can be changed to interface with external hardware such as a microcontroller. Refer to schematic and data sheet for additional functional information on other optional connections.

Table 2. I/O and Jumper Connections (Factory Jumper Selections are shown in BOLD):

ASSEMBLY		−001	−002	−003	−004	−005
U1	Device	bq24100	bq24105(1)	bq24113(2)	bq24115(1)	bq24103(2)
J1	DC+/DC−:Input voltage range (V)	**5 to 16**	**V_{REG}+0.8 to 16**(1)	**5 to 16**	**V_{REG}+0.8 to 16**(1)	**5 to 16**(2)
J2	BAT+/BAT−No. cell in series	**1**	**1**	**1**	**1**	**1**
	Output regulation voltage (V)	**4.2**	**4.2**(1)	**4.2**(2)	**4.2**(1)	**4.2**(2)
J5	$\overline{PG}$	**LED** or EXT	**LED** or EXT	**LED** or EXT	**LED** or EXT	**LED** or EXT
J6	STAT1	**LED** or EXT	**LED** or EXT	**LED** or EXT	**LED** or EXT	**LED** or EXT
J7	STAT2	**LED** or EXT	**LED** or EXT	**N/C no jumper**	**N/C no jumper**	**LED** or EXT
J8	TTC or CMOD	**TTC no jumper**	**TTC no jumper**	**CMOD jumper HI**	**CMOD jumper HI**	**TTC no jumper**
J9	$\overline{CE}$	**$\overline{CE}$ jumper LO**	**$\overline{CE}$ jumper LO**	**$\overline{CE}$ jumper LO**	**$\overline{CE}$ jumper LO**	**$\overline{CE}$ jumper LO**
J10	Cells or FB	**No jumper**	**No jumper**	**Cells jumper LO**	**No jumper**	**Cells jumper low**

(1) R5 and R7 can be changed to regulate output between approximately 3.2 V to 15.5 V. Adjust the input voltage as required. Output set to operate at 4.2 V_{DC} from the factory.

(2) To operate as a two cell version (8.4V), replace battery with a two-series cell pack, set J10 to High and adjust the Input voltage between 9.2 V to 16 V.

2.3 Test Procedure

Setup the evaluation board as described above, by making the necessary I/O connections and jumper selections. **Prior to test and evaluation, it is important to verify that the EVM selected is setup correctly for the battery pack to be charged (several evaluation modules have a CELLs option that can be programmed for two different size − number of series cells). It is highly recommended that the battery pack to be charged has internal proteciton as a safety backup.**

1. Turn on the power supply, preset to the suggested value in Table 2, and approximately 1.7 A for the current limit setting.
2. The $\overline{PG}$ LED should turn on along with STAT1, if the battery is charging.
3. The bq241xx enters pre-conditioning mode if the battery is below the $V_{(LOWV)}$ threshold. In this mode, the bq241xx pre−charges the battery with a low current programmed by the ISET2 pin. If the R_{SET1} and R_{SET2} resistors are the same value then the precharge is one tenth the fast charge current ($I_{PRE-CHG}$ = 1.33 A/10 = 133 mA) until the battery voltage reaches the $V_{(LOWV)}$ threshold or until the precharge timer expires. If the timer expires then the charge current is terminated and the bq241xx enters fault mode. STAT1 and STAT2 (if available) LEDs turns off when in fault mode. Note that there are several non-charging modes that share this status state. Toggling input power or battery replacement resets fault mode.
4. Once the battery voltage is above the $V_{(LOWV)}$ threshold, the battery enters fast charge mode. This EVM is programmed for approximately 1.3 A of fast charging current. The $\overline{PG}$ and STAT1 LEDs should be on.
5. Once the battery reaches voltage regulation (4.2 V) the current tapers down as the battery reaches its full capacity. The $\overline{PG}$ and STAT1 LEDs should be on.
6. When the current reaches the taper termination threshold, set by the R_{SET2} resistor, the charge is terminated. The $\overline{PG}$ LED should still be on and the STAT1 LED should turn off and STAT2 LED turn on.
7. If the battery discharges down to the recharge threshold, the charger starts fast charging. The $\overline{PG}$ LED should still be on and the STAT2 LED should turn off and STAT1 LED turn on.

An alternative method of testing the EVM is with a source meter, that can sink or source current. This can easily be adjusted to test each mode, in place of a battery.

3 Schematic

Figure 1 shows the schematic diagram for the EVM.

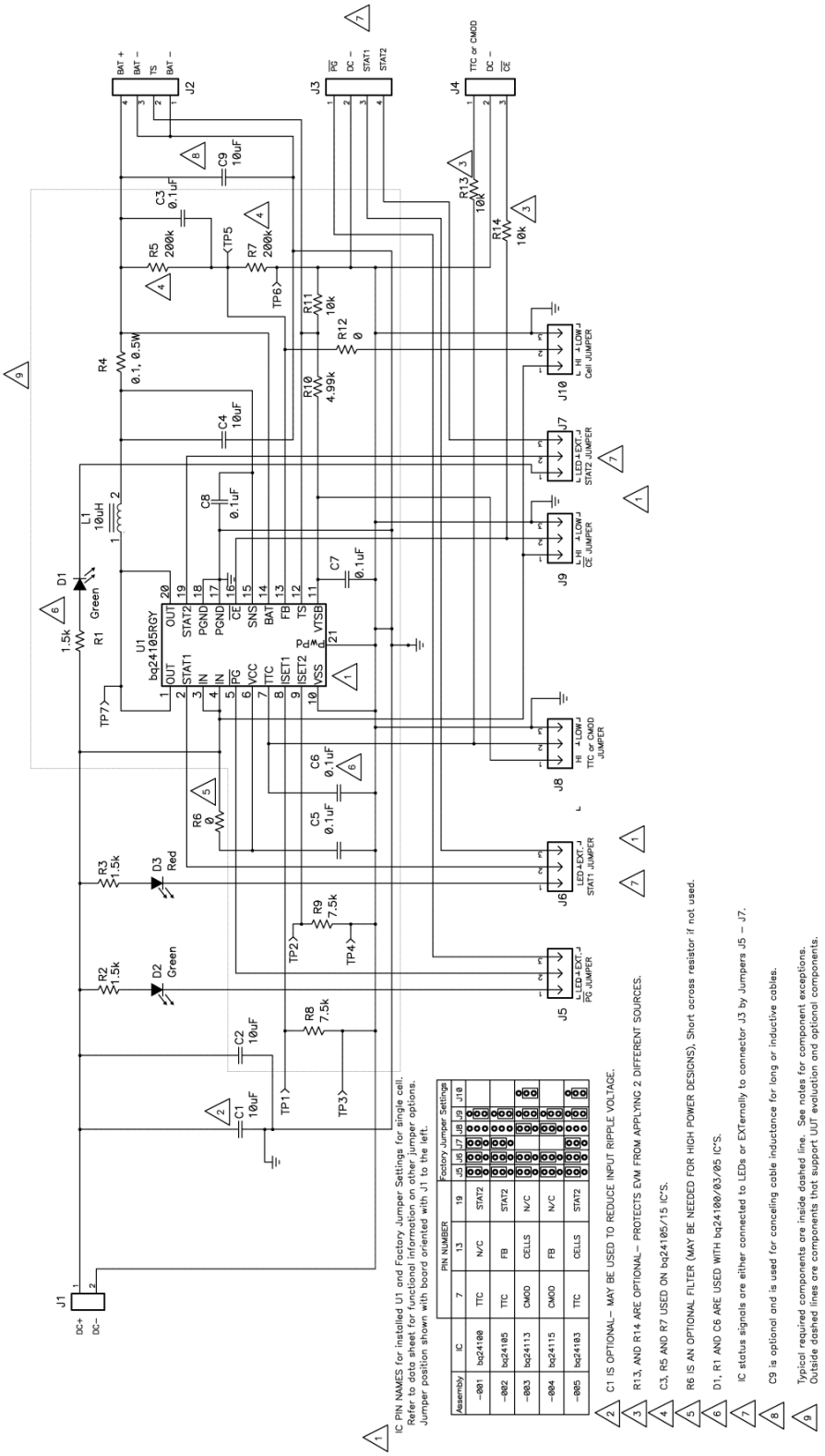

Figure 1. bq241xxEVM Top Layer

4 Physical Layouts

This chapter contains the board layout and assembly drawings for the EVM.

4.1 Board Layout

Figure 2 shows the top assembly of the EVM. Figure 3 shows the top silk screen. The bq24103 may also be evaluated on this evaluation board. Figure 4 shows the top layer. Figure 5 shows the bottom layer view.

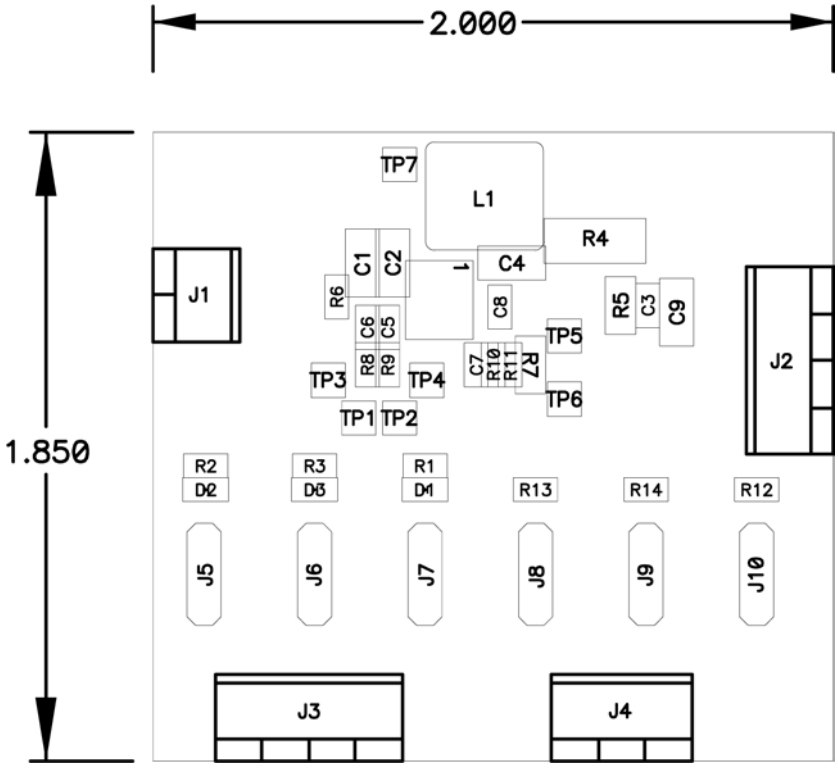

Figure 2. bq241xxEVM Top Assembly

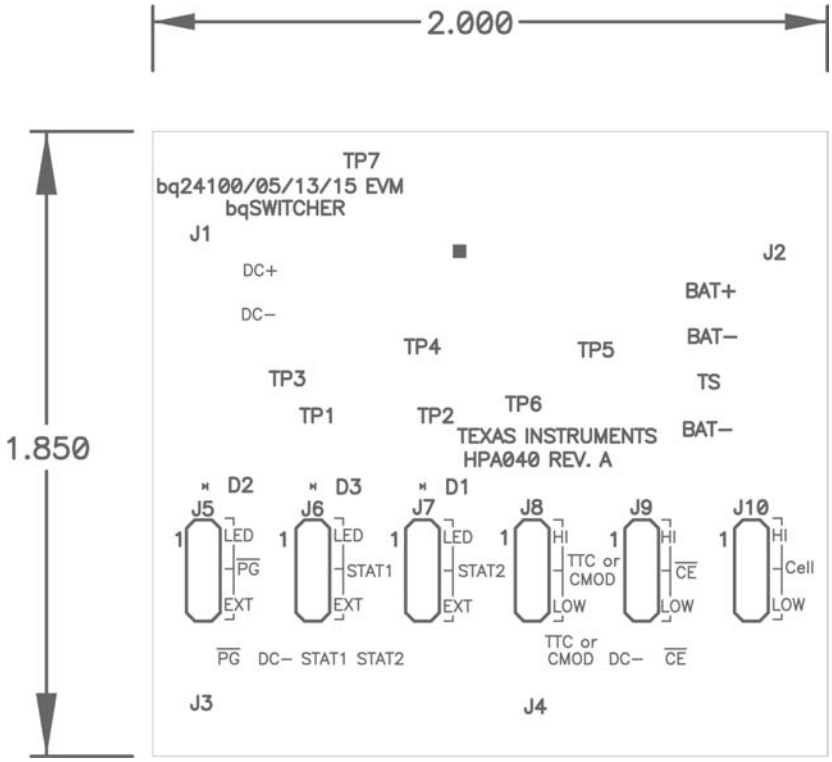

Figure 3. bq241xxEVM Top Silk Screen

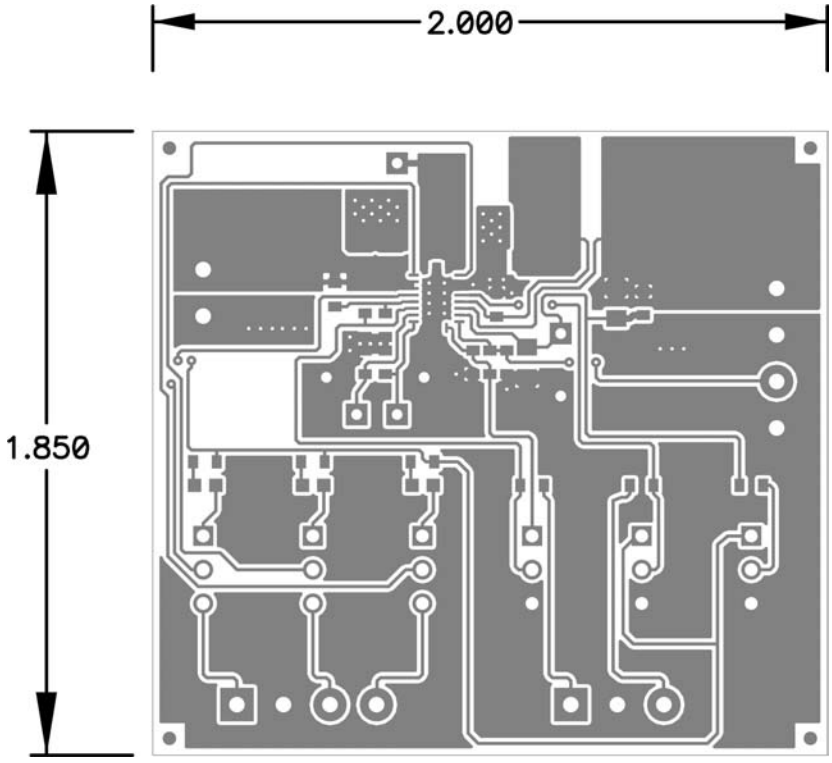

Figure 4. bq241xx Top Layer

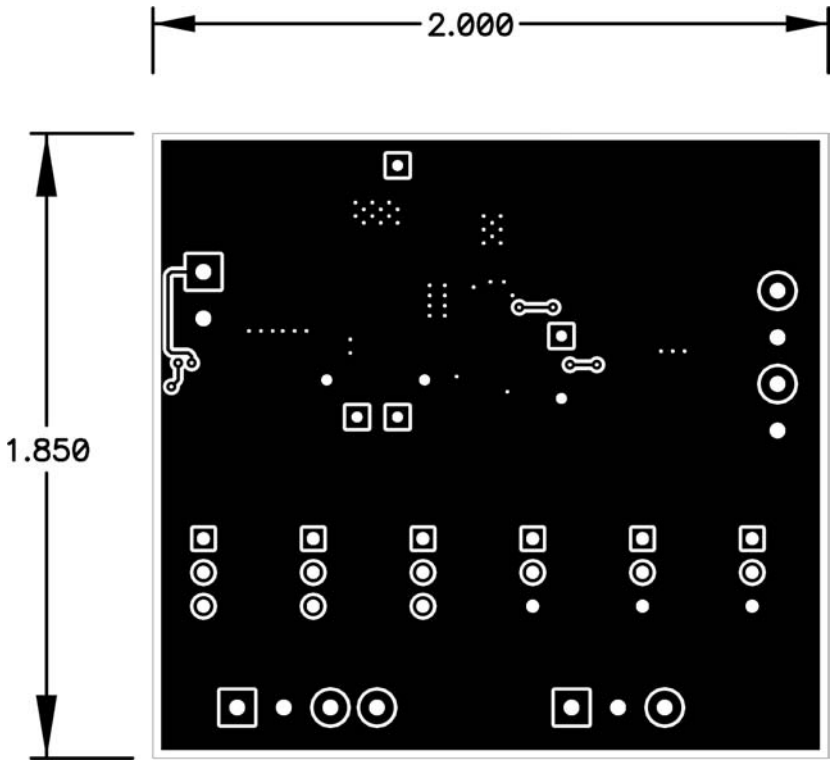

Figure 5. bq241xxEVM Top Asembly

5 List of Materials

Tables 3 through 7 list the components used in this design. With minor component adjustments this design could be modified to meet a wide range of applications.

Table 3. bq24100EVM−001 List of Materials

REFERENCE DESIGNATOR	QTY	DESCRIPTION	SIZE	MFR	PART NUMBER
C1, C2, C4	3	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C9	0	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C3	0	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C5, C7, C8	3	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C6	1	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
D1	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D2	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D3	1	Diode, LED, red, 1.8 V, 20 mA, 20 mcd	603	Liteon	160−1181−1−ND
J1	1	Terminal block, 2-pin, 6 A, 3.5 mm	75525	OST	ED1514
J2, J3	2	Terminal block, 4-pin, 6 A, 3.5 mm	0.55 × 0.25	OST	ED1516
J4	1	Terminal block, 3-pin, 6 A, 3.5 mm	0.41 × 0.25	OST	ED1515
J5, J6, J8, J9	4	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J7	1	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J10	0	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
	5	Shunt, 100 mil, black	0.100	3M	929950−00
L1	1	Inductor, SMT, 10 μH, 1.84 A, 49 mΩ	0.315 × 0.287	Sumida	CDRH74−100
R1	1	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R10	1	Resistor, chip, 4.99 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−4991−F
R11, R13, R14	3	Resistor, chip, 10 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1002−F
R12	0	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−0000−F
R2, R3	2	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R4	1	Resistor, chip, 0.1 Ω, ½ W, 1%	2010	Vishay	CRCW1210−0R10F
R5, R7	0	Resistor, chip, 200 kΩ, 1/8−W, 1%	805	Vishay	CRCW0805−2003−F
R6	1	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−00R0−F
R8, R9	2	Resistor, chip, 7.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−7501−F
U1	1	IC, advanced Li-Ion and Li-Pol charge management	RHL−20	TI	bq24100RHL
−−	1	PCB, 2.0 In x 1.9 In x .031 In		Any	HPA040

(1) These assemblies are ESD sensitive, ESD precautions shall be observed.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC−A−610 Class 2.
(4) C9 can be installed by the customer if using long cables (inductive load)
(5) Place shunts as follows (Jumper pin orientation: pin 1: top (toward RD), pin 2: center, pin 3−bottom). Place shunts on J5, J6, J7−1/2 (LED); J9−2/3 (LOW); J8−2 (optional)

Table 4. bq24105EVM−002 List of Materials

REFERENCE DESIGNATOR	QTY	DESCRIPTION	SIZE	MFR	PART NUMBER
C1, C2, C4	3	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C9	0	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C3	1	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C5, C7, C8	3	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C6	1	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
D1	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D2	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D3	1	Diode, LED, red, 1.8 V, 20 mA, 20 mcd	603	Liteon	160−1181−1−ND
J1	1	Terminal block, 2-pin, 6 A, 3.5 mm	75525	OST	ED1514
J2, J3	2	Terminal block, 4-pin, 6 A, 3.5 mm	0.55 × 0.25	OST	ED1516
J4	1	Terminal block, 3-pin, 6 A, 3.5 mm	0.41 × 0.25	OST	ED1515
J5, J6, J8, J9	4	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J7	1	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J10	0	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
	5	Shunt, 100 mil, black	0.100	3M	929950−00
L1	1	Inductor, SMT, 10 μH, 1.84 A, 49 mΩ	0.315 × 0.287	Sumida	CDRH74−100
R1	1	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R10	1	Resistor, chip, 4.99 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−4991−F
R11, R13, R14	3	Resistor, chip, 10 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1002−F
R12	0	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−0000−F
R2, R3	2	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R4	1	Resistor, chip, 0.1 Ω, ½ W, 1%	2010	Vishay	CRCW1210−0R10F
R5, R7	2	Resistor, chip, 200 kΩ, 1/8−W, 1%	805	Vishay	CRCW0805−2003−F
R6	1	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−00R0−F
R8, R9	2	Resistor, chip, 7.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−7501−F
U1	1	IC, Advanced Li −Ion and Li−Pol Charge Management	RHL−20	TI	bq24105RHL
−−	1	PCB, 2.0 In × 1.9 In × 0.031 In		Any	HPA040

(1) These assemblies are ESD sensitive, ESD precautions shall be observed.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC−A−610 Class 2.
(4) C9 can be installed by the customer if using long cables (inductive load)
(5) Place shunts as follows (Jumper pin orientation: pin 1: top (toward RD), pin 2: center, pin 3−bottom). Place shunts on J5, J6, J7−1/2 (LED); J9−2/3 (LOW); J8−2 (optional)

Table 5. bq24113EVM−003 List of Materials

REFERENCE DESIGNATOR	QTY	DESCRIPTION	SIZE	MFR	PART NUMBER
C1, C2, C4	3	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C9	0	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C3	0	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C5, C7, C8	3	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C6	0	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
D1	0	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D2	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D3	1	Diode, LED, red, 1.8 V, 20 mA, 20 mcd	603	Liteon	160−1181−1−ND
J1	1	Terminal block, 2-pin, 6 A, 3.5 mm	75525	OST	ED1514
J2, J3	2	Terminal block, 4-pin, 6 A, 3.5 mm	0.55 × 0.25	OST	ED1516
J4	1	Terminal block, 3-pin, 6 A, 3.5 mm	0.41 × 0.25	OST	ED1515
J5, J6, J8, J9	4	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J7	0	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J10	1	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
	5	Shunt, 100 mil, black	0.100	3M	929950−00
L1	1	Inductor, SMT, 10 μH, 1.84 A, 49 mΩ	0.315 × 0.287	Sumida	CDRH74−100
R1	0	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R10	1	Resistor, chip, 4.99 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−4991−F
R11, R13, R14	3	Resistor, chip, 10 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1002−F
R12	1	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−0000−F
R2, R3	2	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R4	1	Resistor, chip, 0.1 Ω, ½ W, 1%	2010	Vishay	CRCW1210−0R10F
R5, R7	0	Resistor, chip, 200 kΩ, 1/8−W, 1%	805	Vishay	CRCW0805−2003−F
R6	1	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−00R0−F
R8, R9	2	Resistor, chip, 7.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−7501−F
U1	1	IC, Advanced Li-Ion and Li-Pol Charge Management	RHL−20	TI	bq24113RHL
−−	1	PCB, 2.0 In × 1.9 In × 0.031 In		Any	HPA040

(1) These assemblies are ESD sensitive, ESD precautions shall be observed.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC−A−610 Class 2.
(4) C9 can be installed by the customer if using long cables (inductive load)
(5) Place shunts as follows (Jumper pin orientation: pin 1: top (toward RD), pin 2: center, pin 3−bottom). Place shunts on J8−1/2 (Hi), J5 & J6−1/2 (LED), J9−2/3 (LOW). Place shunts on J10−2/3 (LOW)

Table 6. bq24115EVM−004 List of Materials

REFERENCE DESIGNATOR	QTY	DESCRIPTION	SIZE	MFR	PART NUMBER
C1, C2, C4	3	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C9	0	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C3	1	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C5, C7, C8	3	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C6	0	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
D1	0	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D2	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D3	1	Diode, LED, red, 1.8 V, 20 mA, 20 mcd	603	Liteon	160−1181−1−ND
J1	1	Terminal block, 2-pin, 6 A, 3.5 mm	75525	OST	ED1514
J2, J3	2	Terminal block, 4-pin, 6 A, 3.5 mm	0.55 × 0.25	OST	ED1516
J4	1	Terminal block, 3-pin, 6 A, 3.5 mm	0.41 × 0.25	OST	ED1515
J5, J6, J8, J9	4	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J7	0	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J10	0	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
	4	Shunt, 100 mil, black	0.100	3M	929950−00
L1	1	Inductor, SMT, 10 μH, 1.84 A, 49 mΩ	0.315 × 0.287	Sumida	CDRH74−100
R1	0	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R10	1	Resistor, chip, 4.99 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−4991−F
R11, R13, R14	3	Resistor, chip, 10 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1002−F
R12	0	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−0000−F
R2, R3	2	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R4	1	Resistor, chip, 0.1 Ω, ½ W, 1%	2010	Vishay	CRCW1210−0R10F
R5, R7	2	Resistor, chip, 200 kΩ, 1/8−W, 1%	805	Vishay	CRCW0805−2003−F
R6	1	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−00R0−F
R8, R9	2	Resistor, chip, 7.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−7501−F
U1	1	IC, Advanced Li-Ion and Li-Pol Charge Management	RHL−20	TI	bq24115RHL
−−	1	PCB, 2.0 In × 1.9 In × 0.031 In		Any	HPA040

(1) These assemblies are ESD sensitive, ESD precautions shall be observed.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC−A−610 Class 2.
(4) C9 can be installed by the customer if using long cables (inductive load)
(5) Place shunts as follows (Jumper pin orientation: pin 1: top (toward RD), pin 2: center, pin 3−bottom). Place shunts on J8−1/2 (Hi), J5 & J6−1/2 (LED), J9−2/3 (LOW)

Table 7. bq24103EVM−005 List of Materials

REFERENCE DESIGNATOR	QTY	DESCRIPTION	SIZE	MFR	PART NUMBER
C1, C2, C4	3	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C9	0	Capacitor, ceramic, 10 μF, 25 V, X5R, 20%	1206	Panasonic	ECJ−3YB1E106M
C3	0	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C5, C7, C8	3	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
C6	1	Capacitor, ceramic, 0.1 μF, 16 V, X7R, 10%	603	Panasonic	ECJ−1VB1C104K
D1	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D2	1	Diode, LED, green, 2.1 V, 20 mA, 6 mcd	603	Liteon	160−1183−1−ND
D3	1	Diode, LED, red, 1.8 V, 20 mA, 20 mcd	603	Liteon	160−1181−1−ND
J1	1	Terminal block, 2-pin, 6 A, 3.5 mm	75525	OST	ED1514
J2, J3	2	Terminal block, 4-pin, 6 A, 3.5 mm	0.55 × 0.25	OST	ED1516
J4	1	Terminal block, 3-pin, 6 A, 3.5 mm	0.41 × 0.25	OST	ED1515
J5, J6, J8, J9	4	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J7	1	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
J10	1	Header, 3−pin, 100 mil spacing, (36-pin strip)	34100	Sullins	PTC36SAAN
	6	Shunt, 100 mil, black	0.100	3M	929950−00
L1	1	Inductor, SMT, 10 μH, 1.84 A, 49 mΩ	0.315 × 0.287	Sumida	CDRH74−100
R1	1	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R10	1	Resistor, chip, 4.99 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−4991−F
R11, R13, R14	3	Resistor, chip, 10 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1002−F
R12	1	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−0000−F
R2, R3	2	Resistor, chip, 1.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−1501−F
R4	1	Resistor, chip, 0.1 Ω, ½ W, 1%	2010	Vishay	CRCW1210−0R10F
R5, R7	0	Resistor, chip, 200 kΩ, 1/8−W, 1%	805	Vishay	CRCW0805−2003−F
R6	1	Resistor, chip, 0 Ω, 1/16−W, 1%	603	Vishay	CRCW0603−00R0−F
R8, R9	2	Resistor, chip, 7.5 kΩ, 1/16−W, 1%	603	Vishay	CRCW0603−7501−F
U1	1	IC, Advanced Li-Ion and Li-Pol Charge Management	RHL−20	TI	bq24103RHL
−−	1	PCB, 2.0 In × 1.9 In × 0.031 In		Any	HPA040

(1) These assemblies are ESD sensitive, ESD precautions shall be observed.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC−A−610 Class 2.
(4) C9 can be installed by the customer if using long cables (inductive load)
(5) Place shunts as follows (Jumper pin orientation: pin 1: top (toward RD), pin 2: center, pin 3−bottom). Place shunts on J5, J6, J7−1/2 (LED); J9−2/3 (LOW); J8−2 (optional). Place shunts on J10−2/3 (LOW)

6 References

1. bq241xx Synchronous Switchmode Li−Ion and Li−Pol Charge Management IC With Integrated PowerFETs (bqSWITCHER™) datasheet (SLUS606)

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