

EVM User's Guide: BQ25176KEVM

BQ25176K Evaluation Module



Description

The BQ25176K EVM contains the BQ25176K IC, LDO TPS7B8133 and support circuits needed operate the evaluation board. Only an external 5V power supply is needed to power the EVM and charge a 1-cell battery. Charge Voltage VREG can be set to seven values using switch S1. Charge current is set by R22 (ISET) value from 60mA to 750mA. A fix value of 400mA is selected by JP4.

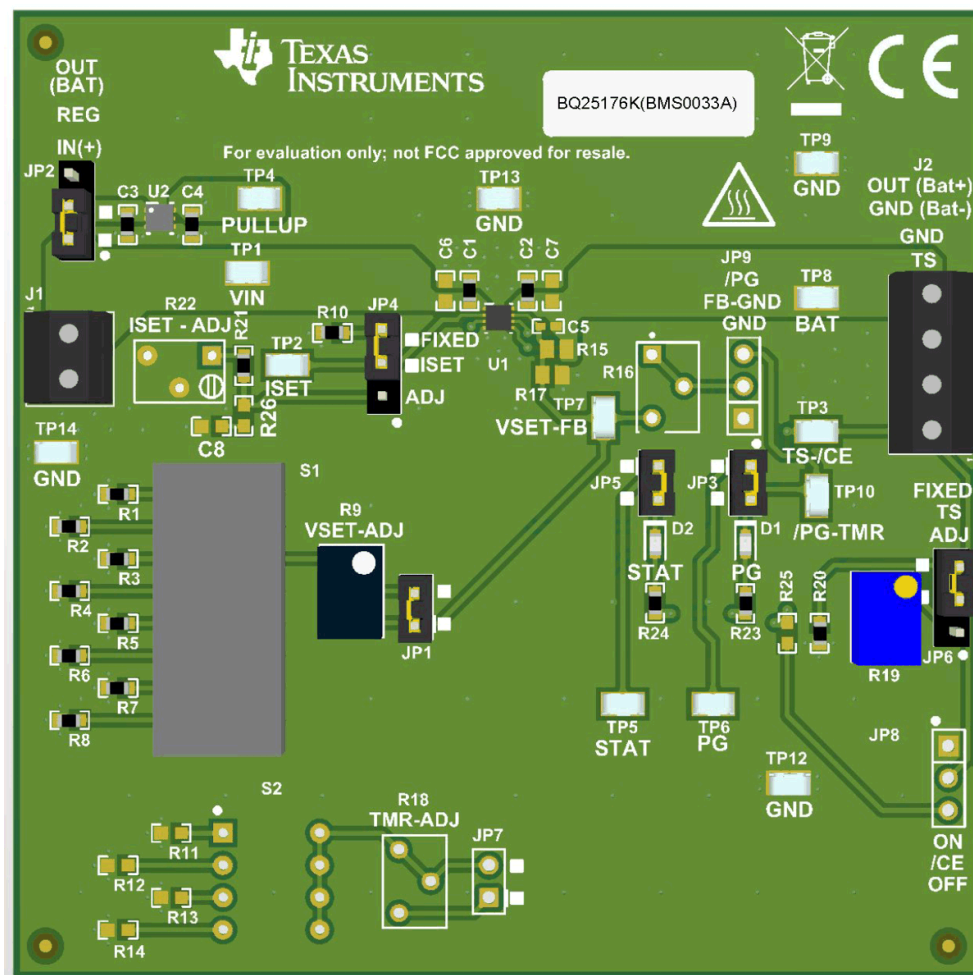
LDO U2 (TPS7B8133) provides 3.3V for housekeeping voltage, powering LED and providing voltage for CE. The NTC is simulated by a 10k resistor and has the option to be adjusted by a trim pot.

Features

- Support 1-Cell Li-Ion, Li-Poly, and LiFePO4
- Input voltage based dynamic power management
- Input voltage up-to-30V tolerant
- External resistor programmable operation
 - Li-Ion: 4.35V, 4.4V, 4.53V, 4.58V
 - LiFePO4: 3.5V, 3.6V, 3.7V
- ISET to set charge current from 60 mA to 750 mA

Applications

- [True wireless headsets](#)
- [Wearable accessories, smart band](#)
- [Beauty and grooming](#)
- [Electric toothbrush](#)



1 Evaluation Module Overview

1.1 Introduction

The Texas Instruments BQ25176EVM is a Li-Ion, Li-Poly and LiFePO₄ chemistry battery charger IC for single cell. Charging voltage can be adjusted using external resistors on VSET. Charging current can be set from 60mA to 750mA with external resistor on ISET.

This user's guide describes the characteristics, operation, and use of the BQ25176KEVM evaluation module (EVM). This EVM is designed to help the user evaluate and test the various operating modes of the BQ25176K. This user's guide includes setup instructions for the hardware, a schematic diagram, a bill of materials (BOM), and PCB layout drawings for the evaluation module.

Throughout this user's guide, the abbreviations *EVM*, *BQ25176KEVM*, *BMS033-005*, and the term *evaluation module* are synonymous with the BQ25176K evaluation module, unless otherwise noted.

1.2 Kit Contents

The package includes:

1. BQ25176K evaluation module (EVM) that has BQ25176K and supporting circuits.

1.3 Specification

This board contains several jumpers and connectors.

Parameter	Specifications
Input voltage (operating)	5V
Output voltage	3.5V to 4.58V
Output current	60mA to 750mA
Housekeeping voltage	3.3V

1.4 Device Information

The BQ25176K is an integrated 800-mA linear charger for 1-Cell Li-Ion, Li-Polymer, and LiFePO₄ batteries targeted at space-limited portable applications. The device has a single power output that charges the battery.

In all charge phases, an internal control loop monitors the IC junction temperature and reduces the charge current if an internal temperature threshold, TREG, is exceeded.

The charger power stage and charge current sense functions are fully integrated. The charger function has high accuracy current and voltage regulation loops, charge status display, and automatic charge termination.

2 Hardware

2.1 I/O Descriptions

Table 2-1 lists the input and output connections available on this EVM and their respective descriptions.

Table 2-1. EVM I/O Connections

I/O Connector	Description
J1 – VIN / GND	Max operating input voltage is 25V, OVP trip point. Max input voltage is 30V while in OVP.
J2 – OUT (BAT+) / GND (BAT-) / GND / TS	Battery connection, TS is 10k NTC but is not needed.
JP1 – VSET ADJ	Disable R9, default is installed.
JP2 – REG / IN / OUT	Source voltage for housekeeping regulator, U2. Default Input voltage IN.
JP3 – PG (Power Good) LED	Default setting is ON.
JP4 – ISET	Sets fast charge current. Fixed = 400 mA ADJ= R22 range 60mA to 600mA.
JP5 - STAT LED	Default setting is ON.
JP6 – TS	NTC temp sensor. Fixed=10k (safe) ADJ=R19 range from 0 to 50kΩ. Default Fixed.
JP7	Not used, do not install
JP8	Not used, do not install
JP9	Not used, do not install

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

Table 2-2. VSET S1 Switch Positions

Position / RX / Value	Li+Voltage / Configuration
#1 / R1 / 100kΩ	3.5V / 1-Cell LiFePO4
#2 / R2 / 82.5kΩ	3.6V / 1-Cell LiFePO4
#3 / R3 / 61.9kΩ	3.7V / 1-Cell LiFePO4
#4 / R4 / 35.7kΩ	4.58V / 1-Cell Li-Ion
#5 / R5 / 27.4kΩ	4.53V / 1-Cell Li-Ion
#6 / R6 / 24.3kΩ	4.35V / 1-Cell Li-Ion
#7 / R7 / 18.2kΩ	4.4V / 1-Cell Li-Ion
#8 / R8 / 0Ω	Short Circuit – No Charge

2.2 Printed Circuit Board Assembly

The BQ25176KEVM PCB contains the BQ25176K 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. 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.

2.3 Best Practices



WARNING

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

Some components can reach high temperatures >55°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 can be present.

2.4 Test Summary

This section describes the jumpers and connectors on the EVM as well as how to properly connect, setup, and use the BQ25176KEVM. Note that the default jumper setting of headers and switches are marked with two dots to indicate the shorting jumper position. This puts the unit into a single cell Li-Ion configuration, 4.2V at 400mA.

2.4.1 Equipment

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

1. Battery simulator such as Keithley 2400 or equivalent. Or a single-cell battery.
2. Power supply, 5V 1A input. Note that unit can operate up to 25V input.
3. Voltage meter and current meter.

2.4.2 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 shuts off.

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

2.4.3 Test Instructions

For this EVM to operate properly, the following components must be connected and properly configured.

1. Set input power supply to 5V and Battery Simulator to 3.6V with compliance to support 800mA. Turn off Supply and Battery Simulator.
2. Connect input voltages to J1 and Battery Simulator to J2 on the EVM.
3. Configure all EVM jumpers to factory setting and refer to [Table 2-3](#).
4. Turn on all supplies and loads.
 - a. 5V Input supply current must be greater than 500mA.
 - b. Out voltage must be 3.6V and charge current 400mA.
 - c. LED D1 and D2 is ON.
5. Simulate battery completing charge by increasing Battery Simulator voltage to 4.2V.
 - a. Current decreases to 0mA.
 - b. LED D2 switches to OFF.

Table 2-3. Jumper Factory Setting

I/O Connector	Factory Setting
JP1 (2 pin header)	Installed
JP2 (3 pin Header)	Installed REG to IN
JP3 (2 pin header)	Installed
JP4 (3 pin header)	Installed ISET to Fixed
JP5 (2 pin header)	Installed
JP6 (3 pin header)	Installed TS to Fixed
JP7 (not installed)	N/A
JP8 (not installed)	N/A
JP9 (not installed)	N/A
S1 (8 Position Switch)	Position 5 (4.53V Li-Ion)
S2 (not installed)	N/A

3 Hardware Design Files

3.1 Schematic

The BQ25176KEVM schematic is shown in Figure 3-1.

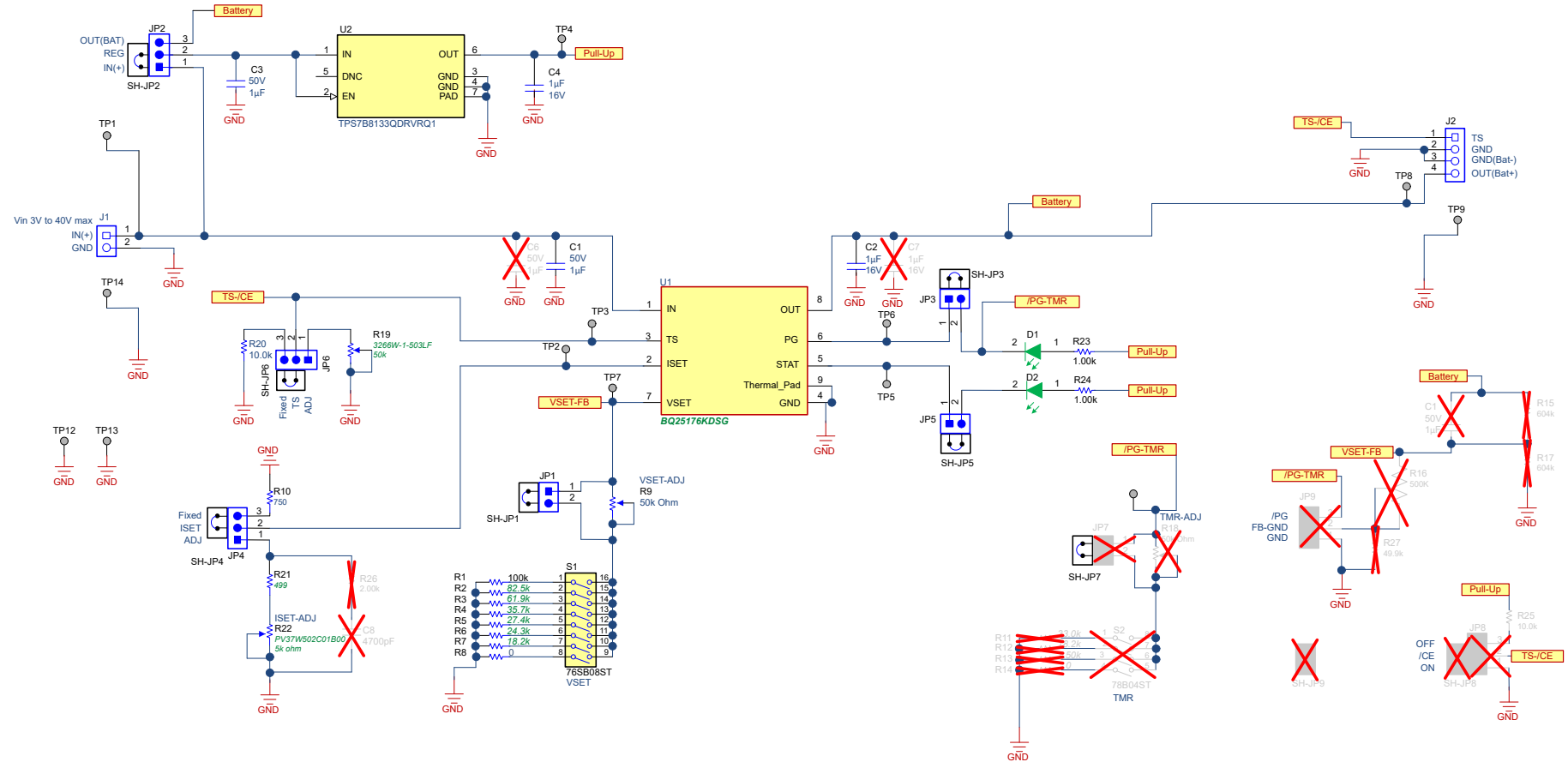


Figure 3-1. BQ25176KEVM Schematic

3.2 Board Layout

The board layout is shown in [Figure 3-2](#) to [Figure 3-8](#).

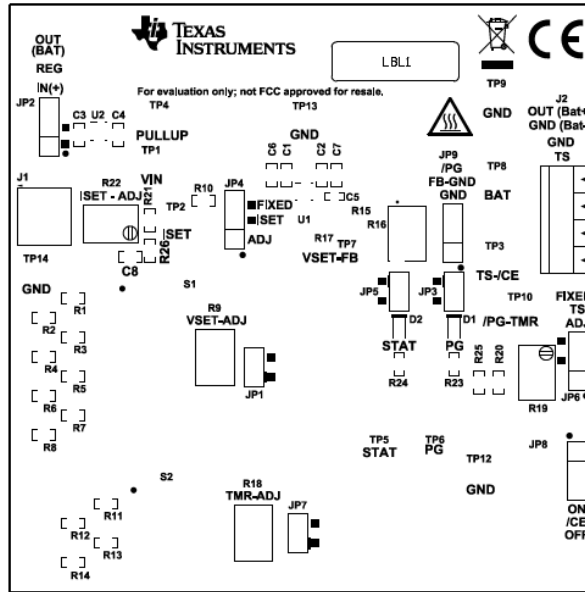


Figure 3-2. Top Overlay

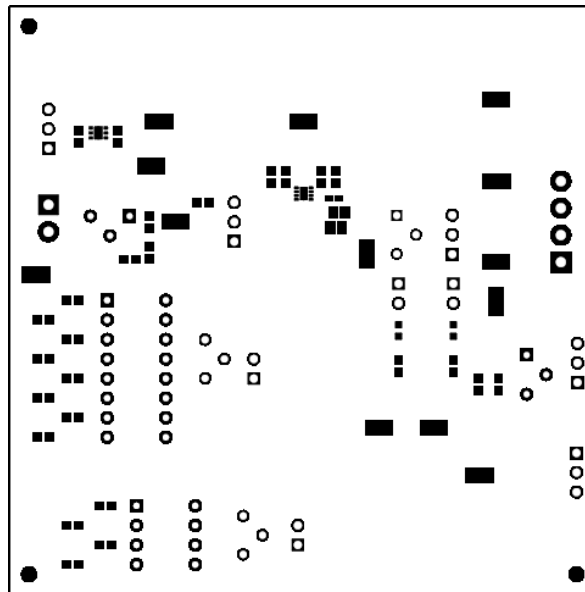


Figure 3-3. Top Solder

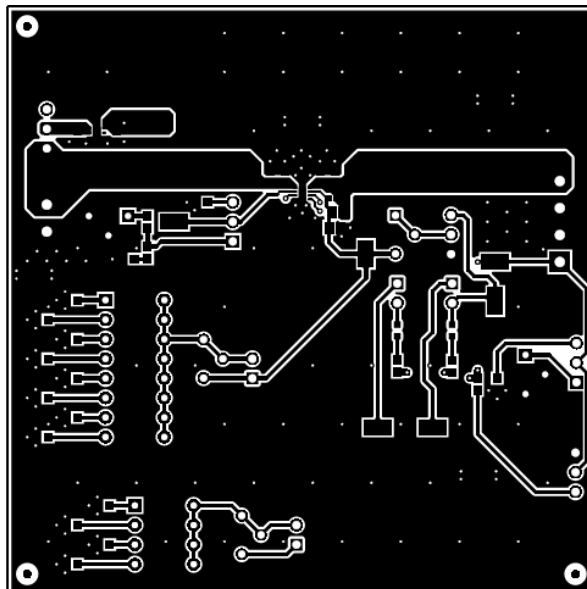


Figure 3-4. Top Layer

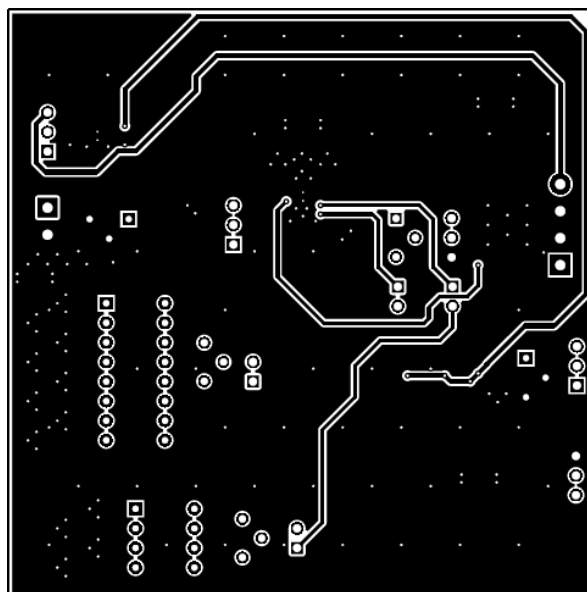


Figure 3-5. Bottom Layer

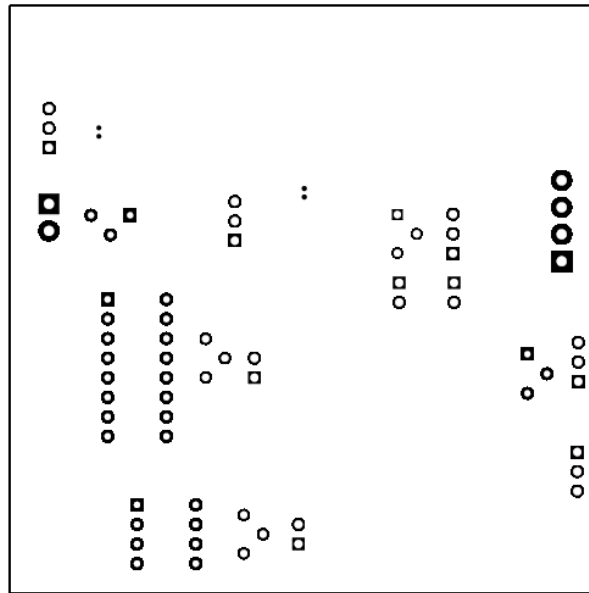


Figure 3-6. Bottom Solder

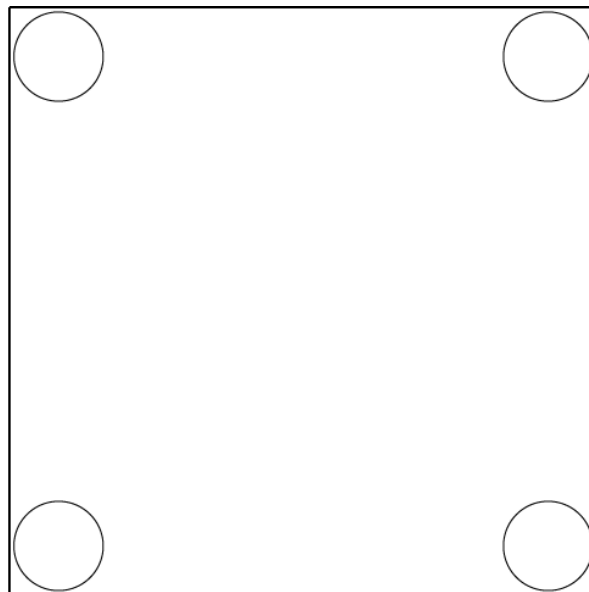
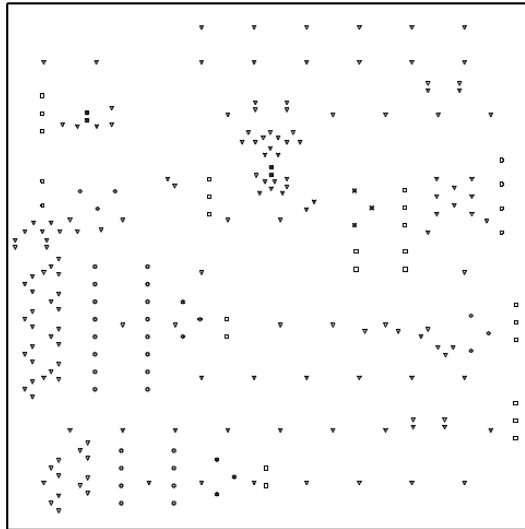


Figure 3-7. Bottom Overlay



Symbol	Count	Hole Size	Plated	Hole Type	Drill Layer Pair	Via/Pad	Pad Shape
⊠	4	7.87mil (0.200mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Via	Rounded
▽	159	12.00mil (0.305mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Via	Rounded
◇	6	29.53mil (0.750mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Pad	(Mixed)
○	24	31.00mil (0.787mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Pad	(Mixed)
⊠	3	35.43mil (0.900mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Pad	(Mixed)
☆	6	35.43mil (0.900mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Pad	Rounded
□	23	40.00mil (1.016mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Pad	(Mixed)
⊕	6	50.00mil (1.270mm)	PTH	Round	Layer 1 - Top Layer - Layer 2 - Bottom Layer	Pad	(Mixed)
	231 Total						

Figure 3-8. Drill Drawing

3.3 Bill of Materials

Table 3-1 lists the bill of materials.

Table 3-1. Bill of Materials ⁽¹⁾

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB?	1		Printed Circuit Board		BMS033	Any
C1, C3	2	1uF	CAP, CERM, 1 μ F, 50 V, +/- 20%, X5R, AEC-Q200 Grade 3, 0603	603	GRT188R61H105ME13D	MuRata
C2, C4	2	1uF	CAP, CERM, 1 μ F, 16 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCM188R71C105KA64D	MuRata
D1, D2	2	Green	LED, Green, SMD	Body1.6x0.8mm	LTST-C193TGKT-5A	Lite-On
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1	1		Terminal Block, 3.5mm Pitch, 2x1, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology
J2	1		Terminal Block, 3.5mm Pitch, 4x1, TH	14x8.2x6.5mm	ED555/4DS	On-Shore Technology
JP1, JP3, JP5	3		Header, 100mil, 2x1, Tin, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN	Sullins Connector Solutions
JP2, JP4, JP6	3		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	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	1	100k	RES, 100 k, 1%, 0.1 W, 0603	603	RC0603FR-07100KL	Yageo
R2	1	82.5k	RES, 82.5 k, 1%, 0.1 W, 0603	603	RC0603FR-0782K5L	Yageo
R3	1	61.9k	RES, 61.9 k, 1%, 0.1 W, 0603	603	RC0603FR-0761K9L	Yageo
R4	1	35.7k	RES, 35.7 k, 1%, 0.1 W, 0603	603	RC0603FR-0735K7L	Yageo
R5	1	27.4k	RES, 27.4 k, 1%, 0.1 W, 0603	603	RC0603FR-0727K4L	Yageo
R6	1	24.3k	RES, 24.3 k, 1%, 0.1 W, 0603	603	RC0603FR-0724K3L	Yageo
R7	1	18.2k	RES, 18.2 k, 1%, 0.1 W, 0603	603	RC0603FR-0718K2L	Yageo
R8	1	0	RES, 0, 5%, 0.1 W, 0603	603	RC0603JR-070RL	Yageo
R9	1	50k Ohm	Trimmer Potentiometer, Lead Sealed Type Multiturn PV37 Series, TH	6.71x4.5mm	PV37W503C01B00	Bourns
R10	1	750	RES, 750, 1%, 0.1 W, 0603	603	RC0603FR-07750RL	Yageo
R19	1	50k	Trimmer, 50k ohm, 0.25W, TH	4.5x8x6.7mm	3266W-1-503LF	Bourns
R20	1	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	CRCW060310K0FKEA	Vishay-Dale
R21	1	499	RES, 499, 1%, 0.1 W, 0603	603	CRCW0603499RFKEAC	Vishay-Dale
R22	1	5k Ohm	Trimmer Potentiometer, Lead Sealed Type Multiturn PV37 Series, TH	6.71x4.5mm	PV37W502C01B00	Bourns
R23, R24	2	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	603	RC0603FR-071KL	Yageo
S1	1		Switch, SPST 8Pos, Rocker, TH	9.65X8X22.4mm	76SB08ST	Grayhill
SH-JP1, SH-JP2, SH-JP3, SH-JP4, SH-JP5, SH-JP6, SH-JP7	7	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP12, TP13, TP14	13		Test Lead clips and hooks, SMT	Test Point, Body 3.25x1.65mm	S1751-46	Harwin

Table 3-1. Bill of Materials ⁽¹⁾ (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
U1	1		800-mA JEITA-Compliant Linear Battery Charger For 1-Cell Li-Ion and LiFePO4 With VINDPM	WS0N8	BQ25176KDSG	Texas Instruments
U2	1		Automotive 150-mA high-voltage ultra-low-IQ low-dropout (LDO) linear regulator, DRV0006A (WS0N-6)	DRV0006A	TPS7B8133QDRVRQ1	Texas Instruments
C5	0	100 pF	CAP, CERM, 100 pF, 50 V, +/- 1%, C0G/NP0, 0402	402	04025A101FAT2A	AVX
C6	0	1uF	CAP, CERM, 1 uF, 50 V, +/- 20%, X5R, AEC-Q200 Grade 3, 0603	603	GRT188R61H105ME13D	MuRata
C7	0	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCM188R71C105KA64D	MuRata
C8	0	4700 pF	CAP, CERM, 4700 pF, 50 V, +/- 10%, X5R, 0603	603	GRM188R61H472KA01D	MuRata
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
JP7	0		Header, 100mil, 2x1, Tin, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN	Sullins Connector Solutions
JP8, JP9	0		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions
R11	0	33.0k	RES, 33.0 k, 1%, 0.1 W, 0603	603	RC0603FR-0733KL	Yageo
R12	0	18.2k	RES, 18.2 k, 1%, 0.1 W, 0603	603	RC0603FR-0718K2L	Yageo
R13	0	7.50k	RES, 7.50 k, 1%, 0.1 W, 0603	603	RC0603FR-077K5L	Yageo
R14	0	0	RES, 0, 5%, 0.1 W, 0603	603	RC0603JR-070RL	Yageo
R15, R17	0	604k	RES, 604 k, 0.1%, 0.125 W, 0805	805	RT0805BRD07604KL	Yageo America
R16	0		500 kOhms 0.25W, 1/4W PC Pins Through Hole Trimmer Potentiometer Cermet 12 Turn Top Adjustment	PTH_3	PV37W504C01B00	Bourns
R18	0	50k Ohm	Trimmer Potentiometer, Lead Sealed Type Multiturn PV37 Series, TH	6.71x4.5mm	PV37W503C01B00	Bourns
R25	0	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	CRCW060310K0FKEA	Vishay-Dale
R26	0	2.00k	RES, 2.00 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	CRCW06032K00FKEA	Vishay-Dale
R27	0	49.9k	RES, 49.9 k, 1%, 0.25 W, Axial	Axial	CMF5049K900FHCB	Vishay-Dale
S2	0		DIP Switch, SPST 4Pos, Slide, TH	DIP Switch, 4 Pos	78B04ST	Grayhill
SH-JP8, SH-JP9	0	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec

(1) Unless otherwise noted in the Alternate PartNumber and/or Alternate Manufacturer columns, all parts can be substituted with equivalents.

4 Additional Information

Trademarks

All trademarks are the property of their respective owners.

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 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.

WARNING

Evaluation Kits 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 shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

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/lstds/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。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・イ

ンスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

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 *EVM Use Restrictions and Warnings:*
 - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
 - 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.
 - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
 5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
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 - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
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8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

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