

TPS65261 Buck Converter Evaluation Module User's Guide



ABSTRACT

This document presents the information required to operate the TPS65261 PMIC as well as the support documentation including schematic, layout, hardware setup, and bill of materials (BOM).

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Trademarks

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1 Background

The TPS65261 PMIC is a triple 3-A, 2-A, 2-A output current, synchronous step-down (buck) converter with an operational range of 4.5 V to 18 V. The TPS65261 features an automatic power sequence with connecting MODE pin to V7V and configuring EN1/2/3 pins. The device also features an open drain RESET signal to monitor power down. The TPS65261 operates in pulse skipping mode (PSM) light load.

As there are many possible options to set the converters, [Table 1-1](#) presents the performance specification summary for the EVM.

Table 1-1. Summary of Performance

Test Conditions	Performance
VIN = 4.5 V to 18 V f _{SW} = 600 kHz (25°C ambient)	BUCK1, 1.2 V, up to 3 A BUCK2, 3.3 V, up to 2 A BUCK3, 1.8 V, up to 2 A RESET, pull low when VDIV lower than 1.23 V

This evaluation module is designed to provide access to the features of the TPS65261. Some modifications can be made to this module to test performance at different input and output voltages, current and switching frequency. Contact the TI Field Applications group for advice on these matters.

2 TPS65261 Schematic

Figure 2-1 shows the EVM schematic.

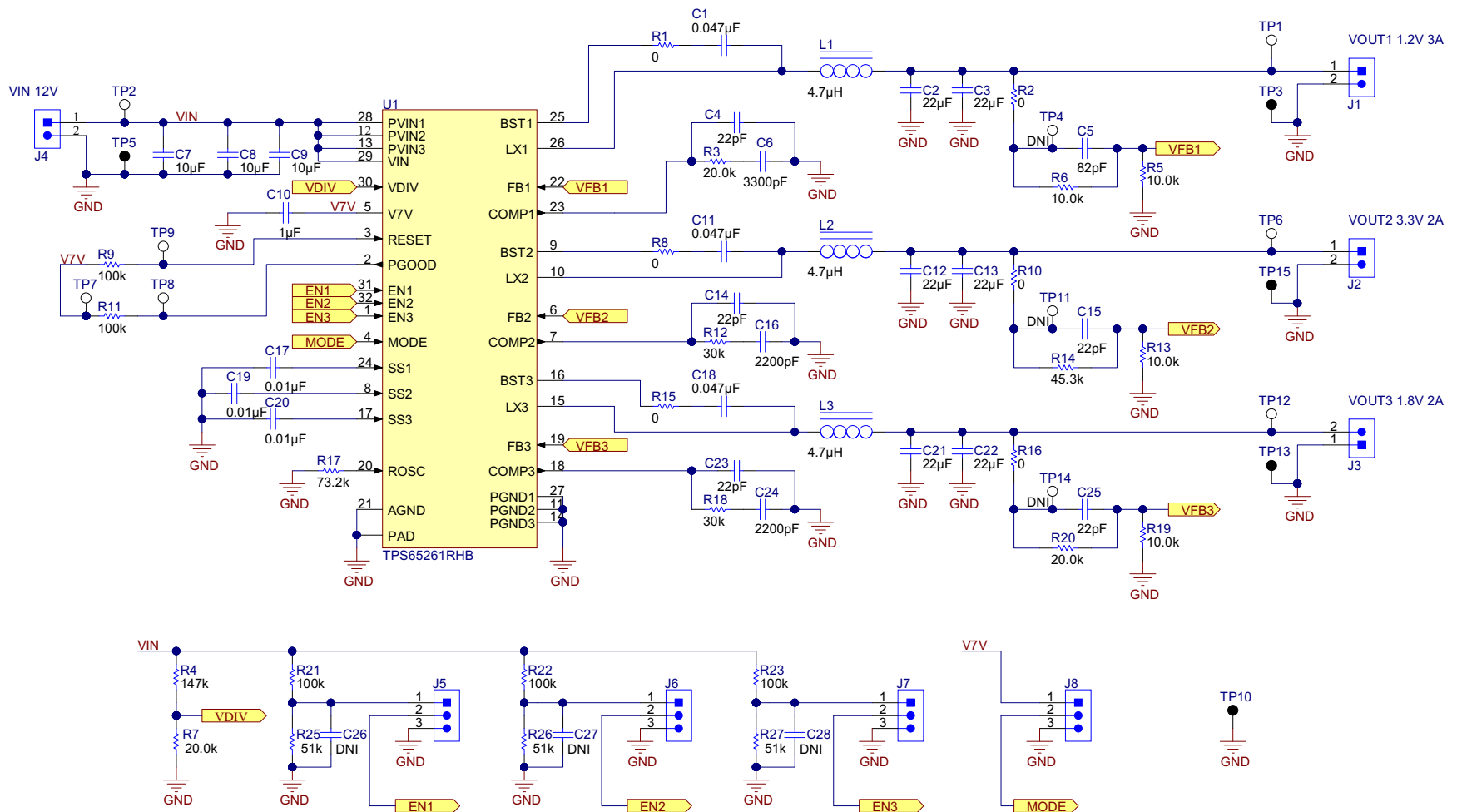


Figure 2-1. TPS65261 Schematic

3 Board Layout

Figure 3-1 illustrates the PCB layout for this EVM.

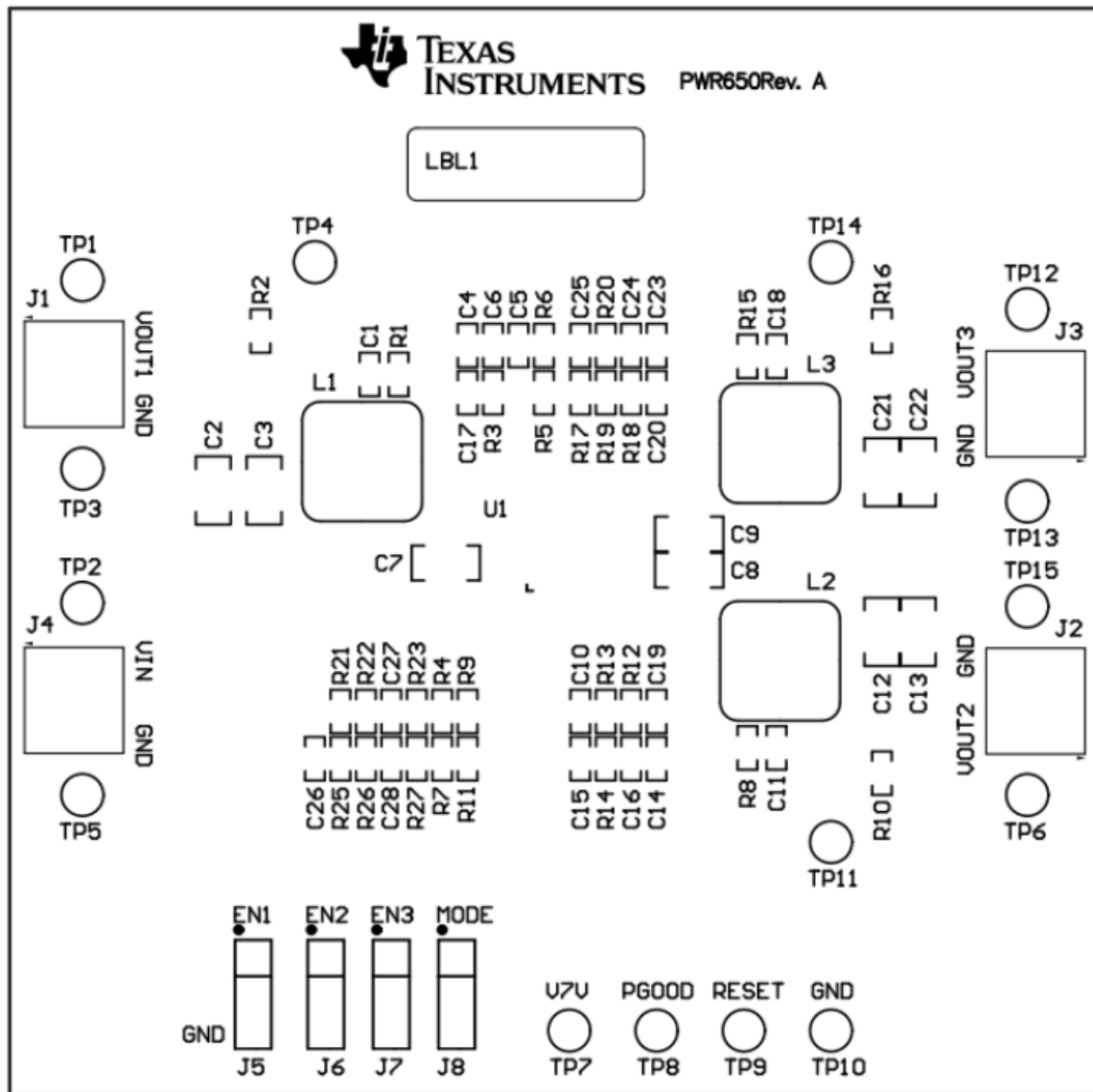


Figure 3-1. Component Placement (Top Layer)

3.1 EVM Layout

Figure 3-2 through Figure 3-5 illustrate the PCB layout for this EVM.

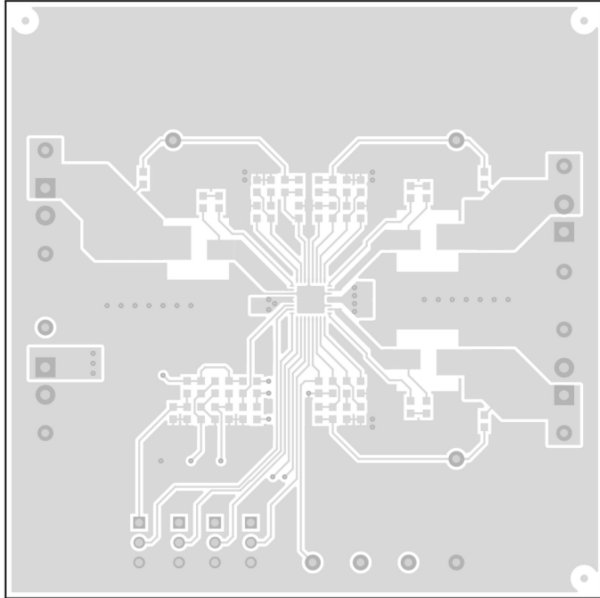


Figure 3-2. Board Layout (Top Layer)

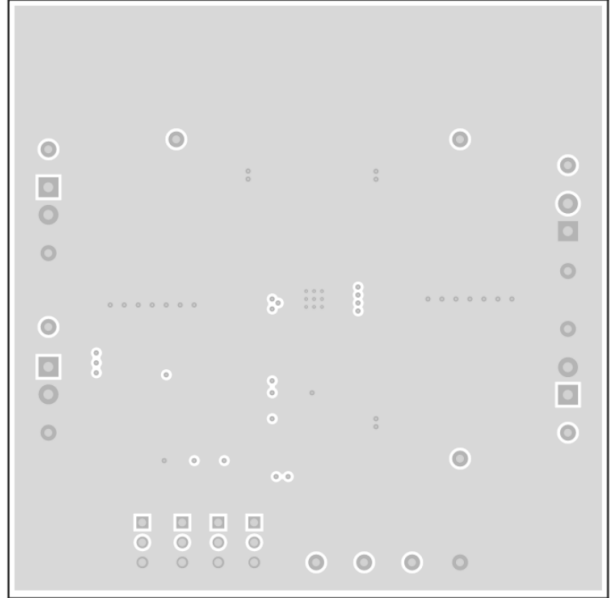


Figure 3-3. Board Layout (Second Layer)

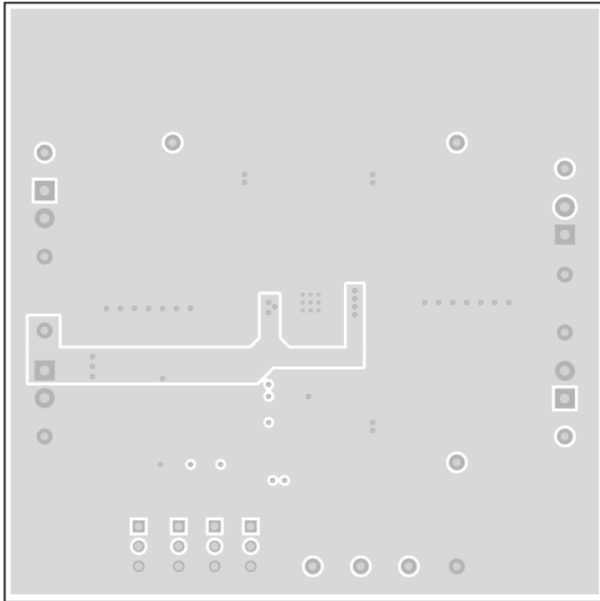


Figure 3-4. Board Layout (Third Layer)

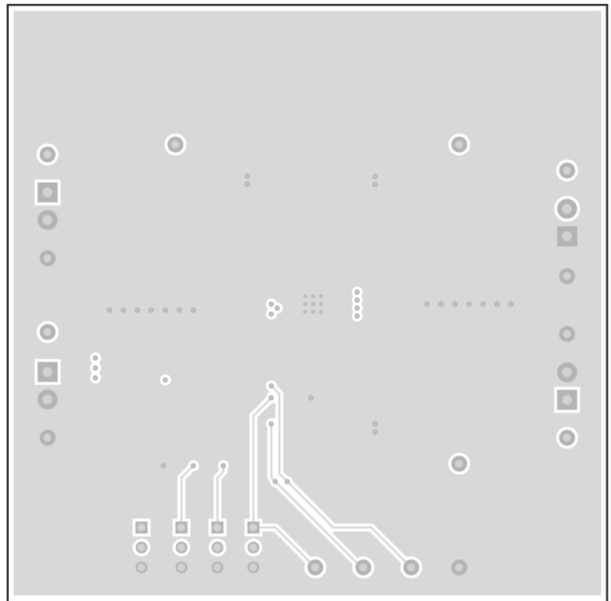


Figure 3-5. Board Layout (Bottom Layer)

4 Bench Test Setup Conditions

4.1 Headers Description and Jumper Placement

Figure 4-1 illustrates the header description and jumper placement on the EVM.

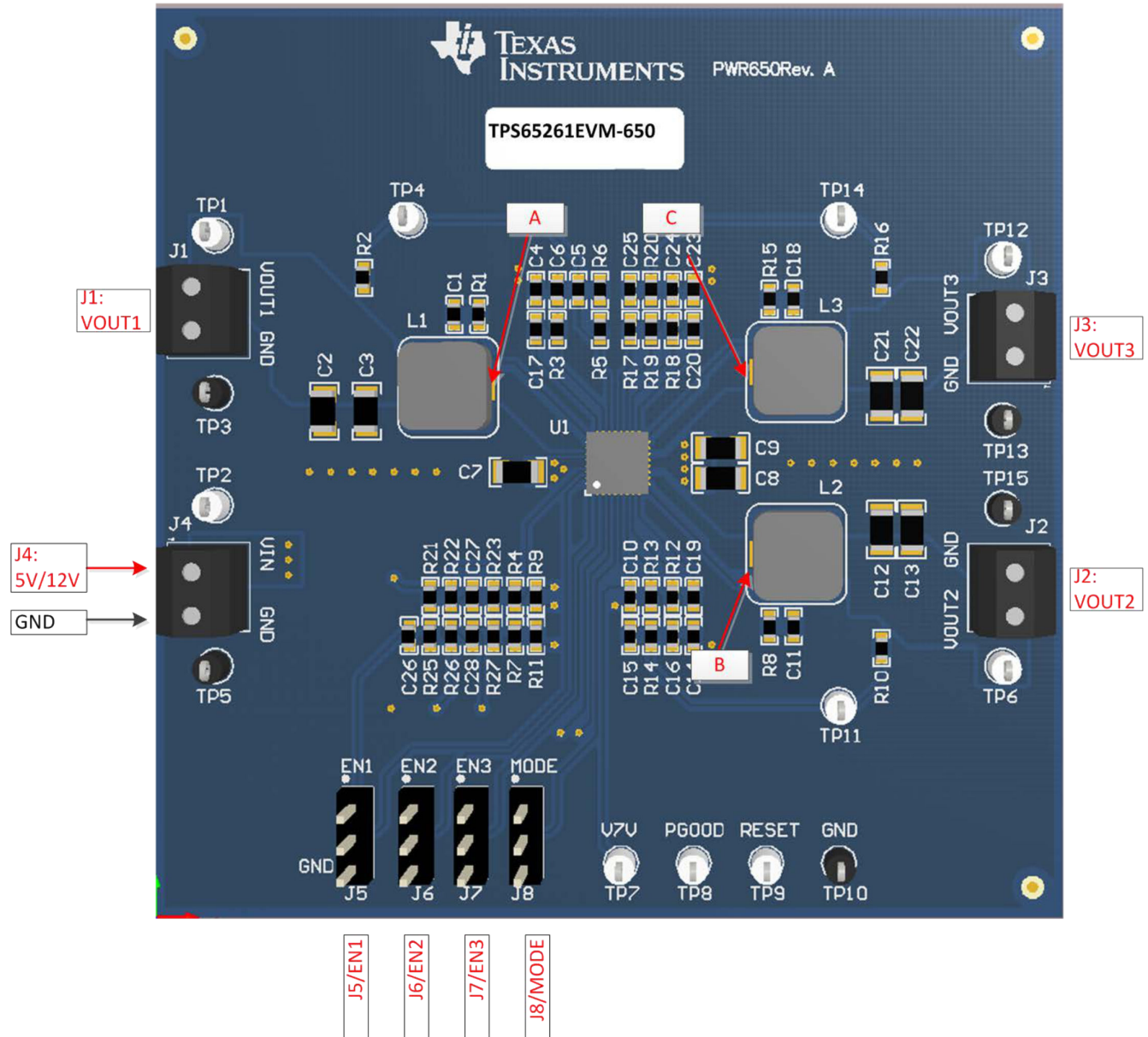


Figure 4-1. Header Descriptions and Jumper Placement

Test points:

A: LX of VOUT1

B: LX of VOUT2

C: LX of VOUT3

VOUT1, VOUT2, VOUT3, VIN, PGOOD, RESET, V7V

Table 4-1 lists the I/O connections.

Table 4-1. Input/Output Connection

Number	Function	Description
J1	BUCK1 connector	Output of BUCK1
J2	BUCK2 connector	Output of BUCK2
J3	BUCK3 connector	Output of BUCK3
J4	VIN connector	Apply power supply to this connector

4.2 Jumpers and Switches

Table 4-2 lists the jumpers on the EVM.

Table 4-2. Jumpers

Jumper	Function	Placement
J5	Buck1 enable (EN1)	Connect EN1 to GND to disable VOUT1, connect EN1 to VIN through a 100-k Ω resistor to enable VOUT1; leave open to enable VOUT1
J6	Buck2 enable (EN2)	Connect EN2 to GND to disable VOUT2, connect EN2 to VIN through a 100-k Ω resistor to enable VOUT2; leave open to enable VOUT2
J7	Buck3 enable (EN3)	Connect EN3 to GND to disable VOUT3, connect EN3 to VIN through a 100-k Ω resistor to enable VOUT3; leave open to enable VOUT3
J8	Mode	Power sequencing mode control pin. Connect this pin to GND to set power sequence with dedicated enable pin; connect this pin to V7V, set the power sequence with the pre-defined power up and power down sequence.

5 Power-Up Procedure

Power sequence with dedicated enable pin:

1. Connect J8 to GND
2. Apply 4.5 V - 18 V to J4
3. Toggle J5, J6, or J7 to enable VOUT1, VOUT2, and VOUT3, respectively
4. Apply loads to the output connectors

Power sequence with the pre-defined power up and power down sequence:

1. Connect J8 to V7V
2. Connect J5 to High (or Low), J6 to High (or Low)
3. Apply 4.5 V - 18 V to J4
4. Toggle J7 to enable VOUT1, VOUT2, and VOUT3
5. Apply loads to the output connectors.

6 Bill of Materials

Table 6-1 lists the BOM for this EVM.

Table 6-1. TPS65261 Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		PWR650	Any
C1, C11, C18	3	0.047uF	CAP, CERM, 0.047uF, 50V, +/-10%, X7R, 0603	0603	C1608X7R1H473K	TDK
C2, C3, C12, C13, C21, C22	6	22uF	CAP, CERM, 22uF, 16V, +/-20%, X5R, 1206	1206	1206YD226MAT2A	AVX
C4, C14, C15, C23, C25	5	22pF	CAP, CERM, 22pF, 50V, +/-5%, C0G/NP0, 0603	0603	06035A220JAT2A	AVX
C5	1	82pF	CAP, CERM, 82pF, 50V, +/-5%, C0G/NP0, 0603	0603	06035A820JAT2A	AVX
C6	1	3300pF	CAP, CERM, 3300pF, 50V, +/-10%, X7R, 0603	0603	C0603C332K5RACTU	Kemet
C7, C8, C9	3	10uF	CAP, CERM, 10uF, 25V, +/-10%, X5R, 1206	1206	GRM31CR61E106KA12L	MuRata
C10	1	1uF	CAP, CERM, 1uF, 25V, +/-10%, X7R, 0603	0603	C1608X7R1E105K080AB	TDK
C16, C24	2	2200pF	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	0603	C0603C222K5RACTU	Kemet
C17, C19, C20	3	0.01uF	CAP, CERM, 0.01uF, 50V, +/-5%, X7R, 0603	0603	C0603C103J5RACTU	Kemet
C26, C27, C28	0	DNI	CAP, CERM, 0.01uF, 50V, +/-5%, X7R, 0603	0603	C0603C103J5RACTU	Kemet
J1, J2, J3, J4	4		Terminal Block, 6A, 3.5mm Pitch, 2-Pos, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology
J5, J6, J7, J8	4		Header, 100mil, 3x1, Tin plated, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions
L1, L2, L3	3	4.7uH	Inductor, Shielded Drum Core, Superflux, 4.7uH, 6A, 0.02 ohm, SMD	WE-HC4	744311470	Würth Elektronik eiSos
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
R1, R2, R8, R10, R15, R16	6	0	RES, 0 ohm, 5%, 0.1W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R3, R7, R20	3	20.0k	RES, 20.0k ohm, 1%, 0.1W, 0603	0603	CRCW060320K0FKEA	Vishay-Dale
R4	1	147k	RES, 147k ohm, 1%, 0.1W, 0603	0603	CRCW0603147KFKEA	Vishay-Dale
R5, R6, R13, R19	4	10.0k	RES, 10.0k ohm, 1%, 0.1W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
R9, R11, R21, R22, R23	5	100k	RES, 100k ohm, 1%, 0.1W, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
R12, R18	2	30k	RES, 30k ohm, 5%, 0.1W, 0603	0603	CRCW060330K0JNEA	Vishay-Dale
R14	1	45.3k	RES, 45.3k ohm, 1%, 0.1W, 0603	0603	CRCW060345K3FKEA	Vishay-Dale
R17	1	73.2k	RES, 73.2k ohm, 1%, 0.1W, 0603	0603	CRCW060373K2FKEA	Vishay-Dale
R25, R26, R27	3	51k	RES, 51k ohm, 5%, 0.1W, 0603	0603	CRCW060351K0JNEA	Vishay-Dale
SH-J1	1	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2, TP6, TP7, TP8, TP9, TP12	7	White	Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
TP3, TP5, TP10, TP13, TP15	5	Black	Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
TP4, TP11, TP14	0	DNI	Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
U1	1		4.5V to 18V Input Voltage, 3A/2A/2A Output Current Triple Synchronous Step-Down Converter, RHB0032E	RHB0032E	TPS65261RHB	Texas Instruments
	Note:	Unless otherwise noted in the columns, all parts may be substituted with equivalents.				

7 Revision History

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

Changes from Revision * (June 2014) to Revision A (May 2021)	Page
• Updated user's guide title.....	2
• Updated the numbering format for tables, figures, and cross-references throughout the document.	2

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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:

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(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.

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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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-
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8. *Limitations on Damages and Liability:*

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.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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