TLV7163318PEVM-535 Evaluation Module

This User's Guide describes the operational use of the TLV7163318PEVM-535 Evaluation Module (EVM) as a reference design for engineering demonstration and evaluation of the TLV7163318P, dual low dropout linear regulator (LDO). Included in this user's guide are setup instructions, a schematic diagram, layout, thermal guidelines, a bill of materials, and test results.

1 Introduction

The Texas Instruments TLV716xxxxEVM-535 EVM helps design engineers to evaluate the operation and performance of the TLV716xxxx family of dual linear regulators for possible use in their own circuit application. This particular EVM configuration contains a dual linear regulator with low I_Q, and possible cap free operation in a small 1.2 mm x 1.2 mm DPQ package. Each regulator is capable of delivering up to 150 mA to the load depending on the input-output power dissipation across the part which can be minimized because of the low dropout voltage.

2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, setup, and use the TLV7163318EVM-535.

2.1 Input/Output Connectors and Jumper Descriptions

2.1.1 J1 – VIN

Input power supply voltage connector. Twist the positive input lead and ground return lead from the input power supply and keep them as short as possible to minimize EMI transmission. Add additional bulk capacitance between J1 and J2 if the supply leads are greater than six inches. For example, an additional 47 µF electrolytic capacitor connected from J1 to ground can improve the transient response of the TLV7163318 while eliminating unwanted ringing on the input due to long wire connections.

2.1.2 J2 – GND

Return connector for the input power supply.

2.1.3 J3 – VOUT1

Regulated output voltage connector of LDO1.

2.1.4 J4 – GND

Output ground return connector of LDO1.

2.1.5 J5 – VOUT2

Regulated output voltage connector of LDO2.

2.1.6 J6 – GND

Output ground return connector of LDO2.

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2.1.7 J7 – VOUT1_SNS/GND_SNS

VOUT1_SNS/GND_SNS are the sense connection for the output of LDO1. Connect a voltmeter, sense connection of an electronic load, or oscilloscope to this header.

2.1.8 J8 – VOUT2_SNS/GND_SNS

VOUT2_SNS/GND_SNS are the sense connection for the output of LDO2. Connect a voltmeter, sense connection of an electronic load, or oscilloscope to this header.

2.1.9 J9 – VIN_SNS/GND_SNS

VIN_SNS/GND_SNS are the sense connection for the input of LDO1 and LDO2. Connect a voltmeter, sense connection of an electronic load, or oscilloscope to this header.

2.1.10 JP1 – EN1

Output enable of LDO1. To enable the output, connect a jumper to short the VIN pin 3 to the EN center pin 2. To disable the output, connect a jumper to short EN pin 2 to GND pin1. EN is pulled up to VIN through resistor R1 when JP1 is not connected.

2.1.11 JP1 – EN2

Output enable of LDO2. To enable the output, connect a jumper to short the VIN pin 3 to the EN center pin 2. To disable the output, connect a jumper to short EN pin 2 to GND pin1. EN is pulled up to VIN through resistor R1 when JP2 is not connected.

2.2 Soldering Guidelines

Any solder re-work to modify the EVM for the purpose of repair or other application reasons must be performed using a hot-air system to avoid damaging the integrated circuit (IC).

2.3 Equipment Interconnect

- Set the input power supply to 5.5V(max). Turn the power supply off. Connect the positive voltage lead from input power supply to VIN, at the J1 connector of the EVM. Connect the ground lead from the input power supply to GND at the J2 connector of the EVM.
- Connect a 0 - 150 mA load between VOUT1, at connector J3, and GND, at connector J4.
- Connect a 0 - 150 mA load between VOUT2, at connector J5, and GND, at connector J6.
- Disable the output by jumping JP1 and JP2, the EN pin to the OFF pin.

3 Operation

- Turn on the power supply.
- Enable the output by jumping JP1 and JP2, the EN pin to the ON pin.
- Vary the respective load and input voltage as necessary for test purposes.

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4 Thermal Guidelines and Layout Recommendations

Thermal management is a key component of design of any power converter and is especially important when the power dissipation in the LDO is high. Use the following formulas to approximate the maximum power dissipation for the particular ambient temperature:

$$T_J = T_A + P_D \times \theta_{JA} \quad (1)$$

$$P_D = (V_{IN} - V_{OUT1}) \times I_{OUT1} + (V_{IN} - V_{OUT2}) \times I_{OUT2} \quad (2)$$

Where T_J is the junction temperature, T_A is the ambient temperature, P_D is the power dissipation in the device (Watts), and θ_{JA} is the thermal resistance from junction to ambient. All temperatures are in degrees Celsius. The maximum operating junction temperature, $T_{J,}$ must not be allowed to exceed 125°C. The layout design must be copper trace and plane areas smartly, as thermal sinks, in order not to allow T_J to exceed the absolute maximum rating under all temperature conditions and voltage conditions across the part.

Table 1 repeats information from the Dissipation Ratings Table of the TLV7163318 series data sheet for comparison with the thermal resistance, θ_{JA}, for High-K JEDEC standard boards. The maximum input voltage can be calculated for full loads at different ambient temperatures. The input voltage must be less than these values in order to maintain a safe junction temperature.

Table 1. Thermal Resistance, θ_{JA}, and Maximum Power Dissipation

IC	Board	Package	θ_{JA}	Max V_{IN} at 150 mA (T_A = 25°C)	Max V_{IN} at 150 mA (T_A = 70°C)
TLV7163318	High-K	DPQ	149.3	4.78V	3.8V

5 Board Layout

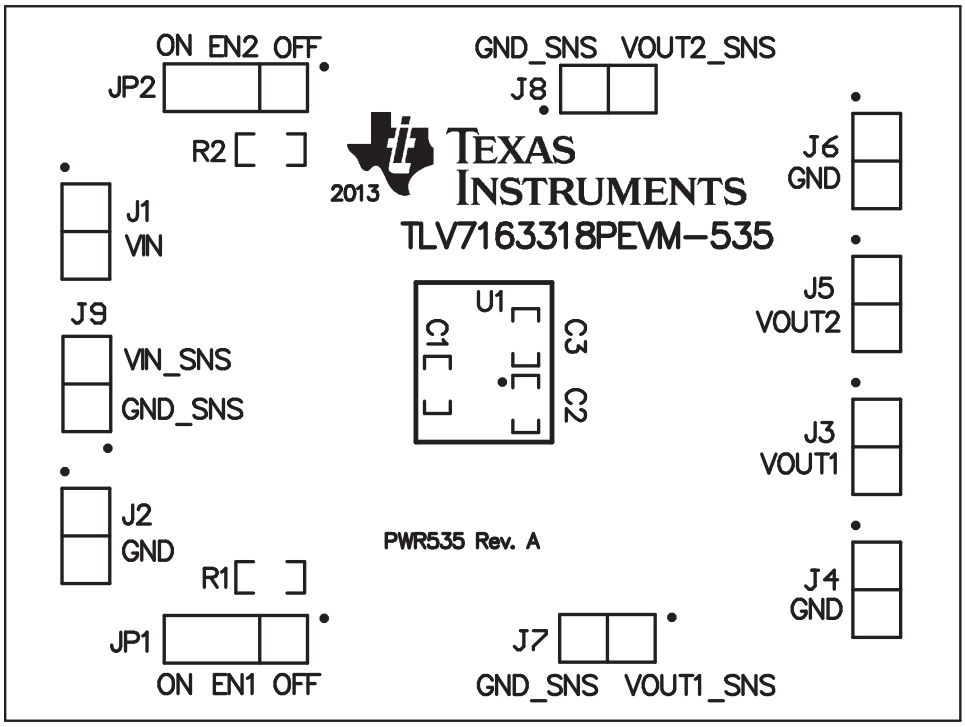


Figure 1. Assembly Layer

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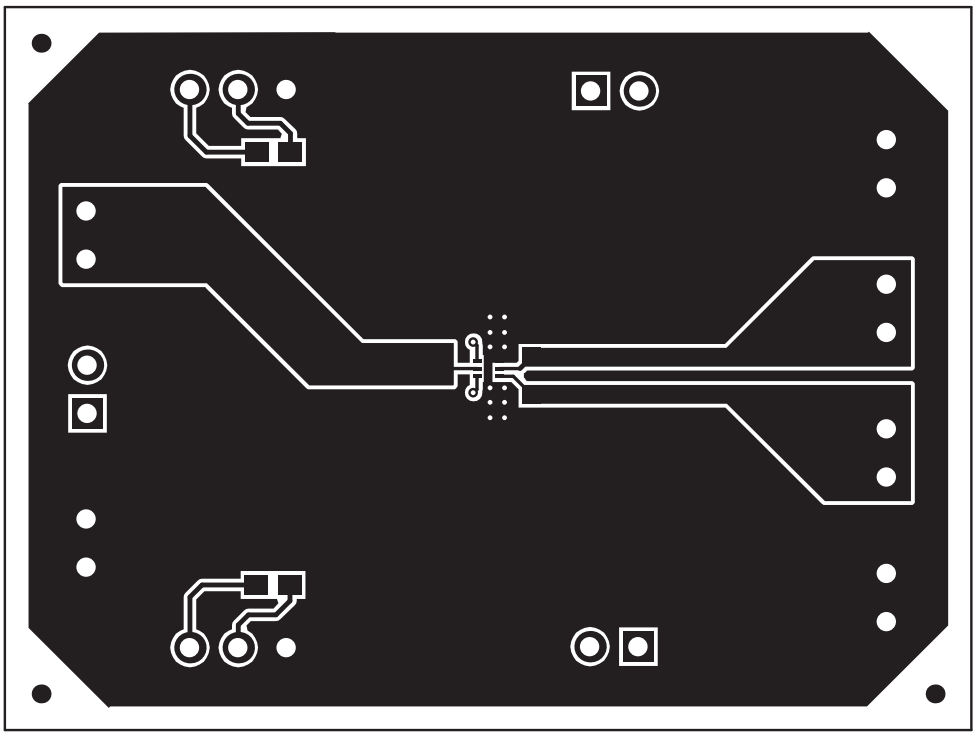


Figure 2. Top Layer Routing

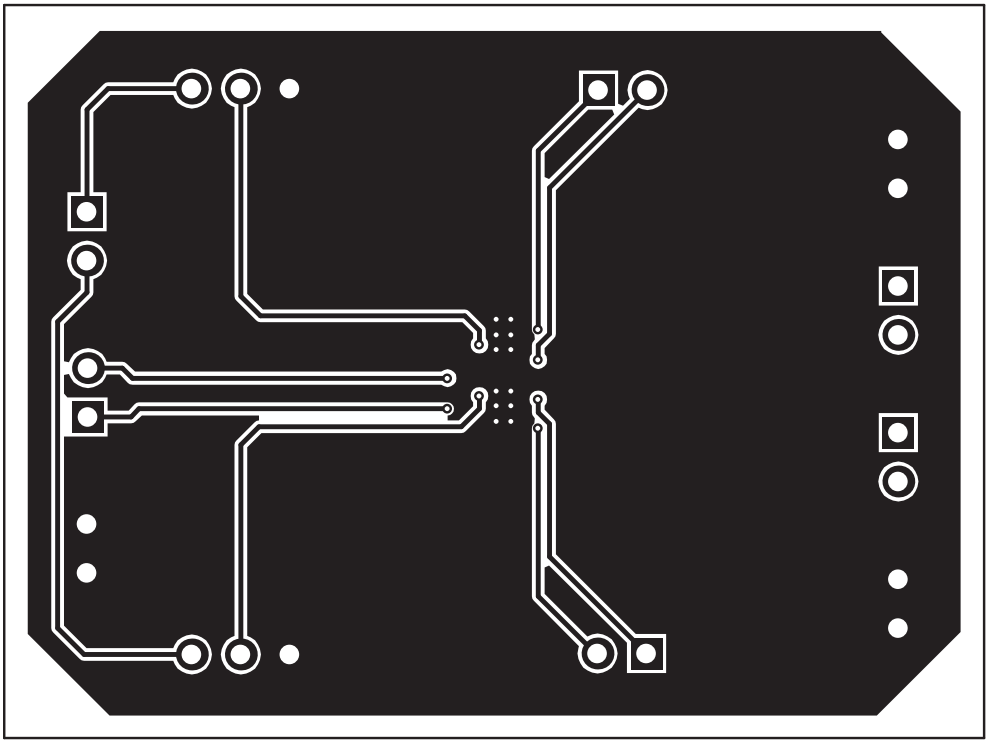


Figure 3. Bottom Layer Routing

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6 Schematic

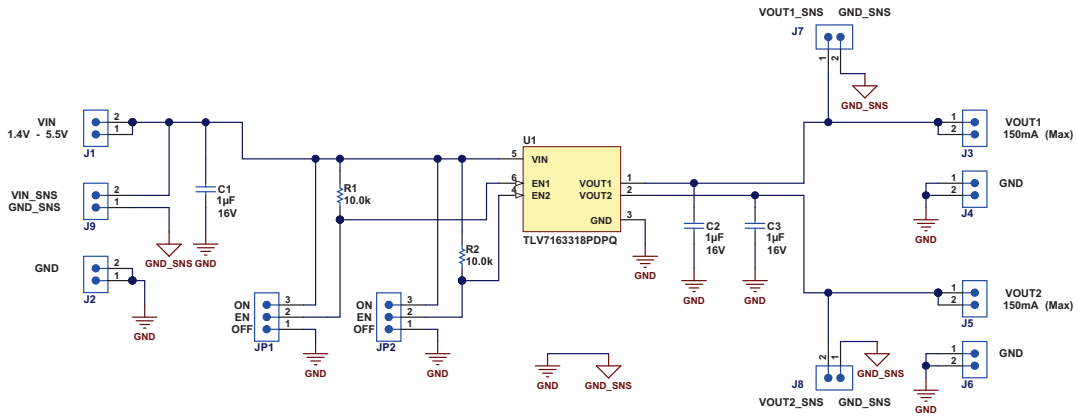


Figure 4. TLV7163318EVM-535 Schematic

7 Bill of Material

Table 2. TLV7163318EVM-535 Bill of Material

Designator	Quantity	Value	Description	Package	Part Number	Manufacturer
C1, C2, C3	3	1uF	CAP, CERM, 1uF, 16V, +/-10%, X5R, 0603	0603	C0603C105K4PACTU	Kemet
J1, J2, J3, J4, J5, J6, J7, J8, J9	9	STD	Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	TSW-102-07-G-S	TSW-102-07-G-S	Samtec, Inc.
JP1, JP2	2	STD	Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator	TSW-103-07-G-S	TSW-103-07-G-S	Samtec, Inc.
R1, R2	2	10.0k	RES, 10.0k ohm, 1%, 0.1W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
SH-JP1, SH-JP2	2	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
U1	1		Dual 150mA, Low Iq LDO regulator, DPQ0006A	DPQ0006A	TLV7163318PDPQ	Texas Instruments

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User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

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1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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С уважением,

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