

TPIC74101EVM User's Guide

User's Guide



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TPIC74101EVM User's Guide

1 Introduction

The Texas Instruments TPIC74101EVM evaluation module (EVM) helps designers evaluate the operation and performance of the TPIC74101 Switch Mode Power Supply – Buck Regulator. The EVM contains one DC / DC converter (See [Table 1](#)).

Table 1. Device and Package Configurations

CONVERTER	IC	PACKAGE
U1	TPIC74101QPWPRQ1	PWP-20

2 Setup

This section describes the jumpers and connectors on the EVM as well and how to properly connect, set up, and use the TPIC74101EVM.

2.1 Input/Output Connector Description

J1 – VBAT is the power input terminal for the converter. The terminal provides power (Vbat).

J2 – GND is the ground terminal for the EVM.

J3 – 5Vg is the power output terminal for the 5Vg regulator output.

J4 – VOUT is the regulated output voltage for the converter.

J5 – GND is a ground terminal for the EVM.

JP1, JP2 – SCR1, SCR0 are jumpers used to set the slew rate of the switching transistor for the L1 terminal switch pin. Jumpers allow the slew rate to be set to four set points.

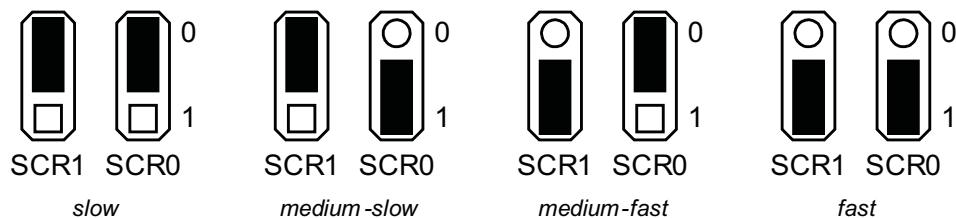


Figure 1. Slew Rate Jumper Settings

JP3 – LPM is the jumper used to enable Low Power Mode (LPM). The jumper allows LPM to be enabled or disabled. The device will operate in Normal mode when LPM is disabled.

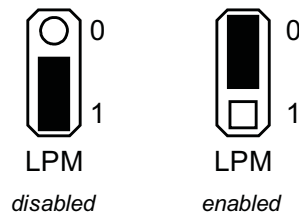


Figure 2. Low Power Mode Jumper Settings

JP4 – Enable is the jumper used to enable the converter. The converter is enabled when the Enable is high and disabled when low. The jumper placement allows the converter to be enabled or disabled.

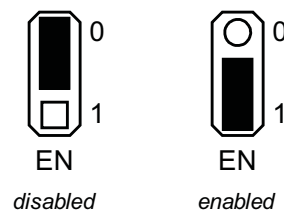


Figure 3. Enable Jumper Settings

JP5 – 5VgEN is the jumper used to enable switched 5 V regulated output. The output is enabled when the Enable is high and disabled when low. The jumper placement allows the converter to be enabled or disabled.

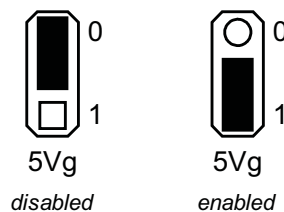


Figure 4. 5Vg Regulated Output Jumper Settings

JP6 – Bypass is the jumper used to bypass the low pass filter inductor on the power supply input to the device. This allows the user to remove the filter from the circuit. The jumper placement allows the inductor to be active or shorted.

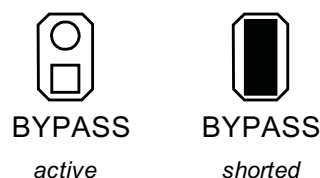


Figure 5. Low Pass Filter Inductor Bypass Jumper Settings

2.2 Setup

The input voltage range for the converter is 1.5 V to 40 V. The input voltage must be at least 5 V during start up.

2.3 Operation

For proper operation of the TPIC74101, JP1, JP2, JP3, JP4, JP5, and JP6 should be properly configured. The recommended setting, using shorting blocks:

JP1 and JP2 to Fast

JP3 to Enabled

JP4 to Enabled

JP5 to Enabled, if 5Vg is used

JP6 to Shorted

In this configuration, the device powers up when power is applied.

JP1, JP2 SCR0, SCR1 select how switch pin slew rate is set: slow, medium-slow, medium-fast, or fast.

JP3 LPM selects how Low Power Mode is set: Enabled or Disabled. JP4 EN turns the device on or off.

JP5 5Vg turns the regulated 5-V output on or off. JP6 Bypass disables the low-pass filter located on the input supply to the device.

3 Board Layout

Figure 6, Figure 7, Figure 8, and Figure 9 show the board layout for the TPIC74101EVM PWB. The EVM offers resistors, capacitors, and jumpers to program the switch pin slew rate and regulator turn-on Delay. Jumpers are also provided to enable the device and to enable the low-power mode option.

The TPIC74101 offers high efficiency but does dissipate power. The PowerPAD™ package offers an exposed thermal pad to enhance thermal performance. This must be soldered to the copper landing on the PCB for optimal performance. The PCB provides 1-oz copper planes on the top and bottom to dissipate heat.

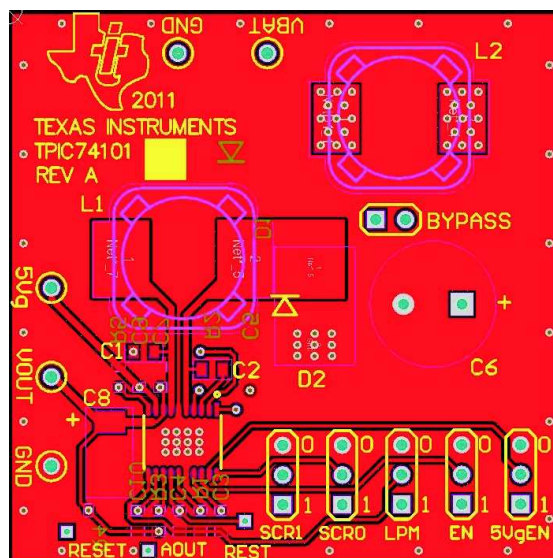


Figure 6. Top Assembly Layer

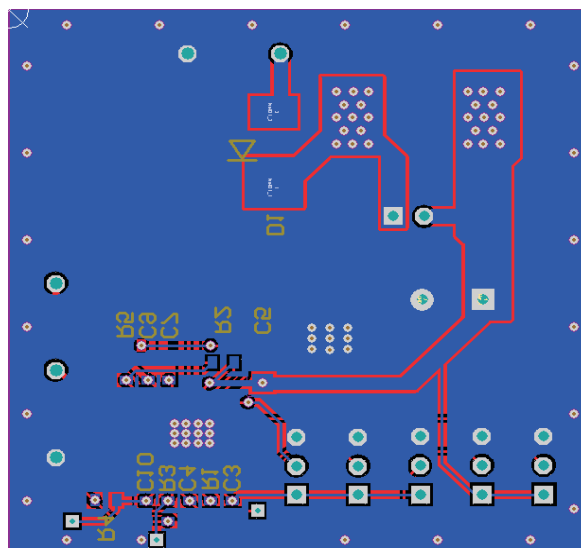


Figure 7. Bottom Assembly Layer

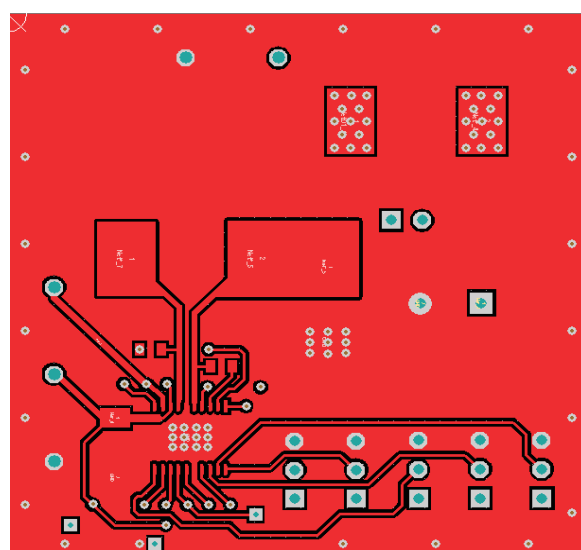


Figure 8. Top Layer Routing

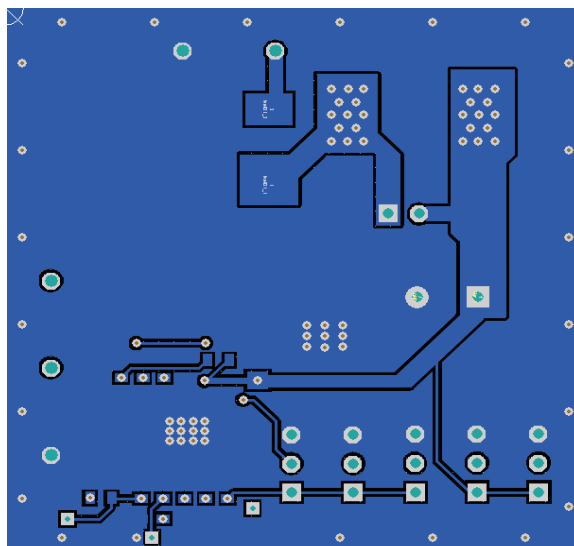


Figure 9. Bottom Layer Routing

4 Schematic

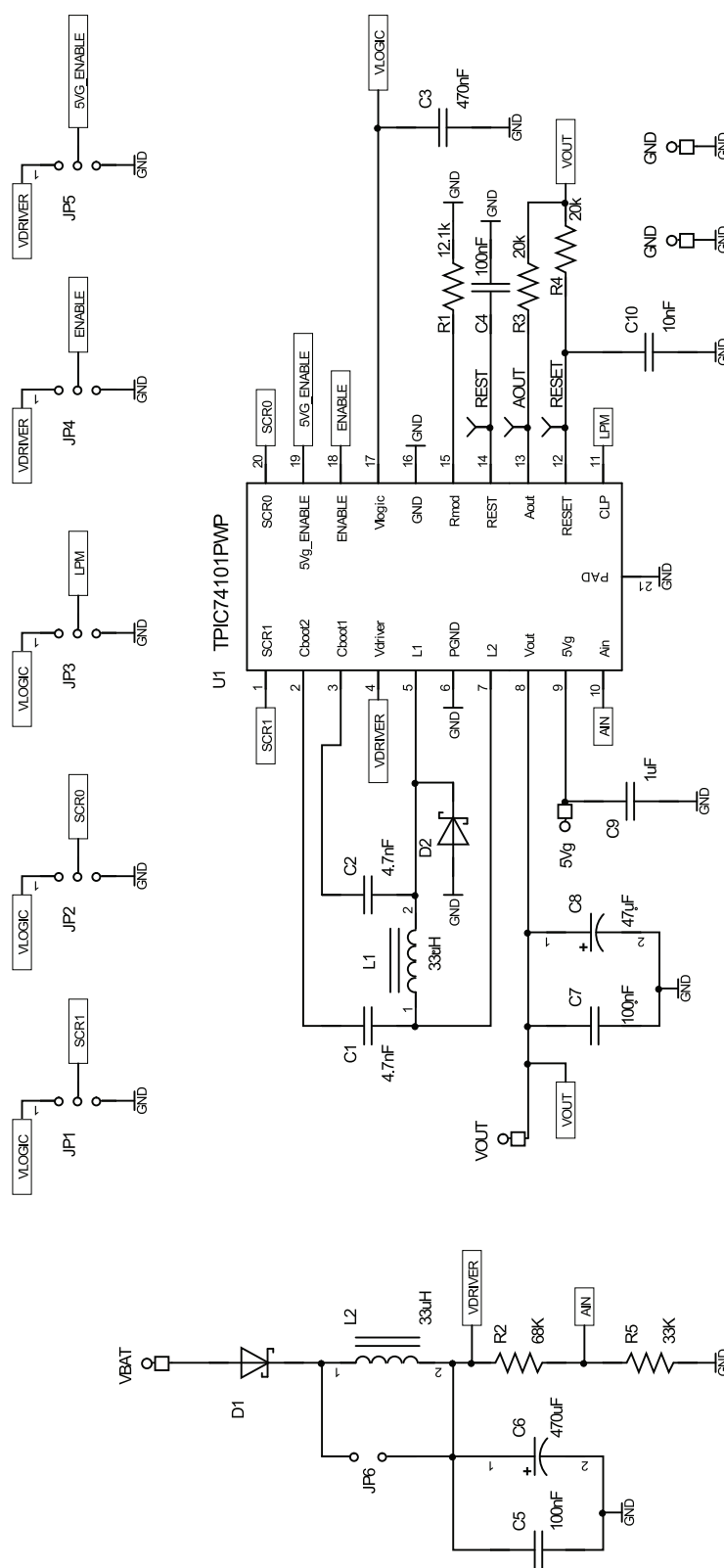


Figure 10. TPIC74101EVM Schematic

Table 2. TPIC74101EVM Bill of Materials

COUNT	REF DES	DESCRIPTION	SIZE	MFR	PART NO.
2	C1, C2	Capacitor, ceramic, 4.7 nF, 50 V, 10%	0603	muRata	GRM188R71H472KA01B
1	C3	Capacitor, ceramic, 470 nF, 16 V, 10%	0603	muRata	GRM188R71C474KA88B
2	C4, C7	Capacitor, ceramic, 100 nF, 16 V, 10%	0603	muRata	GRM188R71C104KA01J
1	C5	Capacitor, ceramic, 100 nF, 50 V, 10%	1206	muRata	GCM319R71H104KA37B
1	C6	Capacitor, electrolytic, 470 uF, 50 V, 10%	10mm	Rubycon	35ZL470M10X20
1	C8	Capacitor, tantalum, 47 uF, 16 V, 20%	6032	Sprague	594D476X0016C2T
1	C9	Capacitor, ceramic, 1 uF, 16 V, 10%	0603	muRata	GRM188R71C105KA12B
1	C10	Capacitor, ceramic, 10 nF, 16 V, 10%	0603	muRata	GRM188R71C103KA01B
2	D1, D2	Diode, Schottky, 3 A, 100 V	SMC	IR	30BQ100
5	J1, J2, J3, J4, J5	Test point, 42-mil	0.042	Std	Std
5	JP1, JP2, JP3, JP4, JP5	Header, 3-pin, 100-mil spacing, (36-pin strip)	0.100 x 3	Sullins	PTC36CAAN
1	JP6	Header, 2-pin, 100-mil spacing, (36-pin strip)	0.100 x 2	Sullins	PTC36CAAN
2	L1, L2	Inductor, SMT, 33-uH, 4.34, 54.9-mΩ	12.3mm x 12.3mm	Coilcraft	MSS1260T-333
1	R1	Resistor, chip, 12.1-kΩ, 1/16W, 1%	0603	Std	Std
1	R2	Resistor, chip, 68.1-kΩ, 1/16W, 1%	0603	Std	Std
2	R3, R4	Resistor, chip, 20-kΩ, 1/16W, 1%	0603	Std	Std
1	R5	Resistor, chip, 33.2-kΩ, 1/16W, 1%	0603	Std	Std
1	U1	IC, TPIC74101QPWPRQ1		TI	TPIC74101QPWP
		PCB, 2.3-inch x 2.3-inch x 0.062		Any	TPIC74101, REV C

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It is important to operate this EVM within the input voltage range of -0.3 V to 48 V and the output voltage range of 0.9 V to 18 V.

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During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 60°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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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.

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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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If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

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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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Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

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