

TPS715EVM-074 Evaluation Module

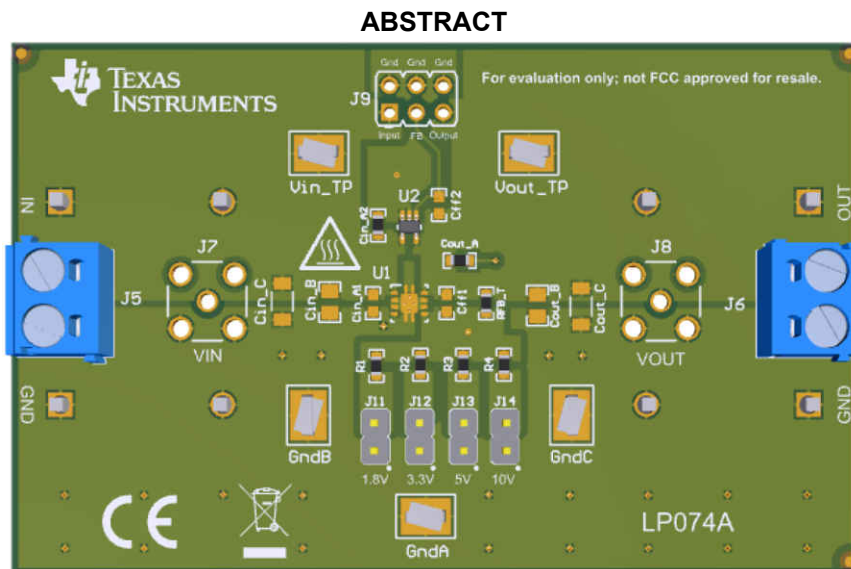


Figure 1-1. TPS715EVM-074 Evaluation Module

This user guide describes the operational use of the TPS715EVM-074 evaluation module (EVM) as a reference design for engineering demonstration and evaluation of the TPS71501DCKR, low-dropout linear regulator (LDO). Included in this user guide are setup and operating instructions, layout guidelines, a printed circuit board (PCB) layout, a schematic diagram, and a bill of materials (BOM). Throughout this document, the terms *demonstration kit*, *evaluation board*, *evaluation module*, and *EVM* are synonymous with the TPS715EVM-074.

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1 Introduction

Texas Instruments' TPS715EVM-074 helps design engineers evaluate the operation and performance of the TPS71501DCKR linear regulator for possible use in their own circuit application. This particular EVM configuration contains a single 50-mA, mid-voltage, low- I_Q , low-dropout regulator (LDO) for general applications. The regulator is capable of delivering up to 50 mA and has a V_{IN} range of up to 24 V. For stability for the TPS71501DCKR, use a 1- μ F (or larger) output capacitor (C_{out}).

1.1 Before You Begin

The following warnings are noted for the safety of anyone using or working close to the TPS715EVM-074. Observe all safety precautions.

WARNING

Failure to adhere to these steps or to not heed the safety requirements at each step may lead to shock, injury, and damage to the hardware. Texas Instruments is not responsible or liable in any way for shock, injury, or damage caused by negligence or failure to heed advice. If you are not trained in the proper safety of handling and testing power electronics please do not test this evaluation module.

CAUTION:



Caution! Do not leave EVM powered when unattended.

HOT SURFACE:



Caution Hot Surface! Contact may cause burns. Do not touch.
Please take the proper precautions when operating.

2 Schematic

Figure 2-1 shows the schematic for the TPS715EVM-074.

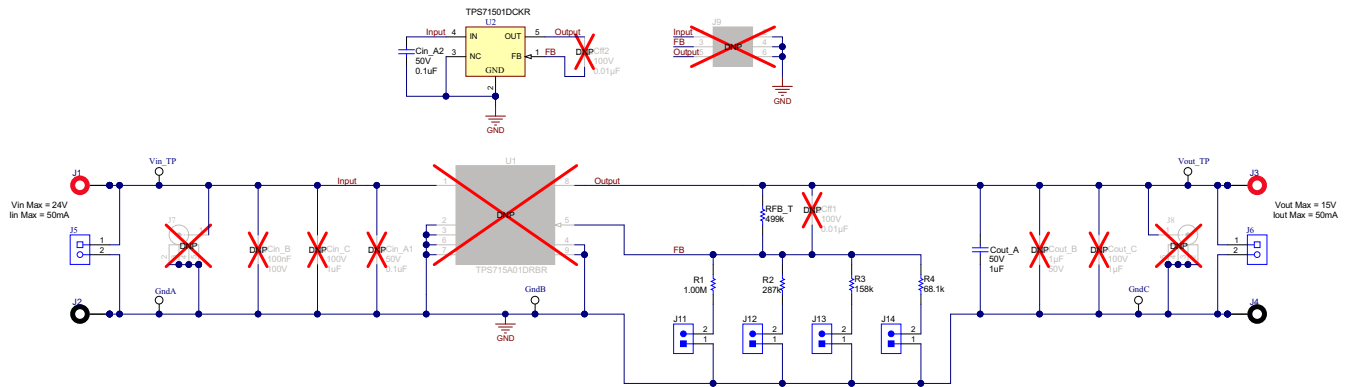


Figure 2-1. TPS715EVM-074 Schematic

3 EVM Setup

This section describes how to properly connect and setup the TPS715EVM-074, including the jumpers and connectors on the EVM board. See [Section 4](#) for the proper connections of test equipment.

3.1 Jumper Connections

3.1.1 J11-14: Output Voltage Select

Connect a shunt across the pins to set the output voltage. [Table 3-1](#) lists the VOUT settings.

Table 3-1. Selecting VOUT

VOUT	Jumper to Short
1.8 V	J11
3.3 V	J12
5 V	J13
10 V	J14

3.2 Test Points

[Table 3-2](#) lists the test points for the TPS715EVM-074.

Table 3-2. Test Point Functions

TEST POINTS	NAME	DESCRIPTION
Vout_TP	VOUT	Regulated DC output.
Vin_TP	VIN	Unregulated DC input.
GND A	GND	Device GND.
GND B	GND	
GND C	GND	

3.3 Soldering Guidelines

To avoid damaging the LDO, use a hot-air system for any solder rework to modify the EVM for the purpose of repair or other application reasons.

4 Equipment Connection and Operation

Connect test equipment as described in this section and follow the listed steps to properly take measurements.

1. Configure the onboard shunts to set the main output voltage VOUT
2. Verify that the input voltage power supply is set from 0 V to 24 V
3. Connect the anode of the power supply to J1 (VIN) and the cathode to J2 (GND)
4. Connect the anode of the load for the output to J3 and the cathode to J4
5. Turn on the power supply
6. Vary VIN and the load as necessary for testing purposes

5 PCB Layout

Figure 5-1 through Figure 5-4 depict the layout of the TPS715EVM-074.

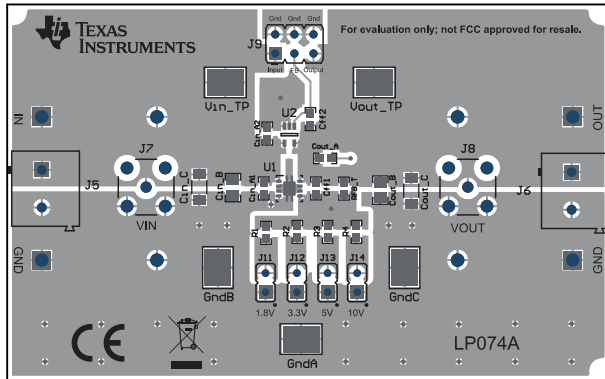


Figure 5-1. TPS715EVM-074 Top Layer Routing

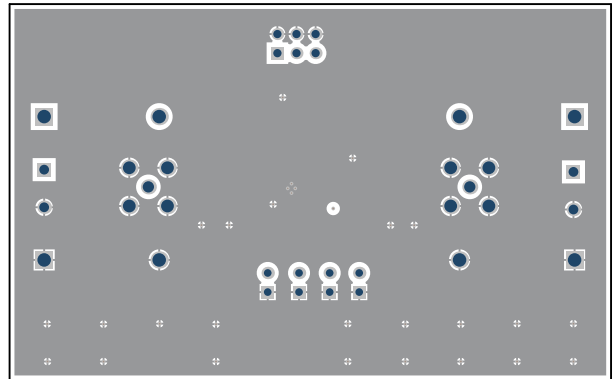


Figure 5-2. TPS715EVM-074 Internal Layer 1 Routing

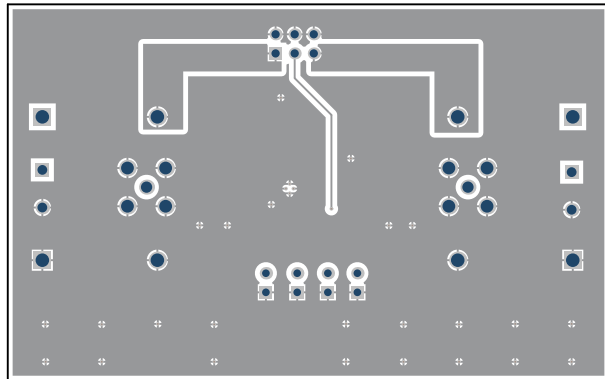


Figure 5-3. TPS715EVM-074 Internal Layer 2 Routing

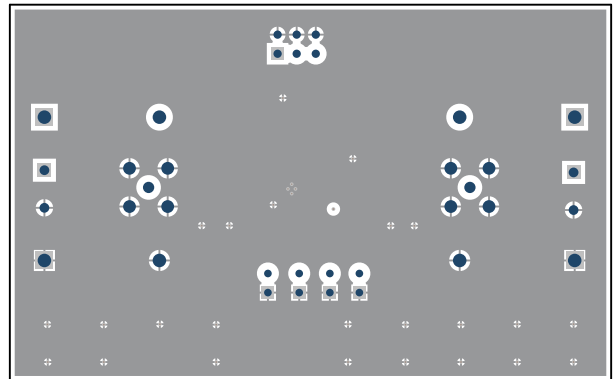


Figure 5-4. TPS715EVM-074 Bottom Layer Routing

6 Bill of Materials (BOM)

Table 6-1 shows the BOM for this EVM.

Table 6-1. TPS715EVM-074 BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		LP074	Any		
Cff1, Cff2	2	0.01uF	CAP, CERM, 0.01 μ F, 100 V,+/- 10%, X8R, AEC-Q200 Grade 0, 0603	0603	CGA3E2X8R2A103K080AD	TDK		
Cin_A1, Cin_A2	2	0.1uF	CAP, CERM, 0.1 μ F, 50 V, +/- 10%, X5R, 0603	0603	C1608X5R1H104K080AA	TDK		
Cin_B	1	0.1uF	CAP, CERM, 0.1 μ F, 100 V, +/- 10%, X7R, 0805	0805	C2012X7R2A104K125AA	TDK		
Cin_C	1	1uF	CAP, CERM, 1 μ F, 100 V, +/- 10%, X7R, 1206	1206	C3216X7R2A105K160AA	TDK		
Cout_A	1	1uF	CAP, CERM, 1 μ F, 50 V, +/- 10%, X5R, 0603	0603	C1608X5R1H105K080AB	TDK		
Cout_B	1	1uF	CAP, CERM, 1 μ F, 50 V,+/- 10%, X7R, 0805	0805	CL21B105KBFNFN E	Samsung		
Cout_C	1	1uF	CAP, CERM, 1 μ F, 100 V,+/- 10%, X7R, 1206	1206	CC1206KKX7R0BB105	Yageo America		
GndA, GndB, GndC, Vin_TP, Vout_TP	5		Test Point, Compact, SMT	Testpoint_Keys tone_Compact	5016	Keystone Electronics		
J1, J3	2		Standard Banana Jack, insulated, 10A, red	571-0500	571-0500	DEM Manufacturing		
J2, J4	2		Standard Banana Jack, insulated, 10A, black	571-0100	571-0100	DEM Manufacturing		
J5, J6	2		Terminal Block, 5 mm, 2x1, Tin, TH	Terminal Block, 5 mm, 2x1, TH	691 101 710 002	Würth Elektronik		
J7, J8	2		SMA Straight Jack, Gold, 50 Ohm, TH	SMA Straight Jack, TH	901-144-8RFX	Amphenol RF		
J9	1		Header, 2.54mm, 3x2, Gold, TH	Header, 2.54mm, 3x2, TH	61300621121	Würth Elektronik		
J11, J12, J13, J14	4		Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator	PBC02SAAN	Sullins Connector Solutions		
R1	1	1.00M eg	RES, 1.00 M, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Header, 2.54mm, 3x1, SMT	RMCF0603FG1M00	Stackpole Electronics Inc		
R2	1	287k	RES, 287 k, 1%, 0.1 W, 0603	0603	RC0603FR-07287K L	Yageo		
R3	1	158k	RES, 158 k, 1%, 0.1 W, 0603	0603	RC0603FR-07158K L	Yageo		
R4	1	68.1k	RES, 68.1 k, 1%, 0.1 W, 0603	0603	RC0603FR-0768K1 L	Yageo		
RFB_T	1	499k	RES, 499 k, 1%, 0.1 W, 0603	0603	RC0603FR-07499K L	Yageo		
U1	1		24-V, 80-mA, Low Iq, Low-Dropout Linear Regulator, DRB0008A (VSON-8)	DRB0008A	TPS715A01DRBR	Texas Instruments		
U2	1		Single Output LDO, 50 mA, Adjustable 1.2 to 15 V Output, 3 to 24 V Input, 5-pin SC70 (DCK), -40 to 125 degC, Green (RoHS & no Sb/Br)	DCK0005A	TPS71501DCKR	Texas Instruments		

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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。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

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.

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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.

-
- 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:*
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 - 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.
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