LMR14050QDPREVM User's Guide

The Texas Instruments LMR14050QDPREVM evaluation module (EVM) helps designers evaluate the operation and performance of the LMR14050-Q1 wide-input Simple Switcher® buck regulator. This document describes the setup and the input / output connections of the EVM. Included are the board layout, schematic, and bill of materials.

1 Introduction

The LMR14050-Q1 is a 40 V 5 A step-down regulator with 40 µA quiescent current. With a wide-input range from 4 V to 40 V, it is suitable for a wide range of applications from automotive to industry for power conditioning from unregulated sources. The LMR14050QDPREVM evaluation board is designed to provide the design engineer with a fully functional power converter based on the buck topology to evaluate the LMR14050-Q1 series operation and performance.

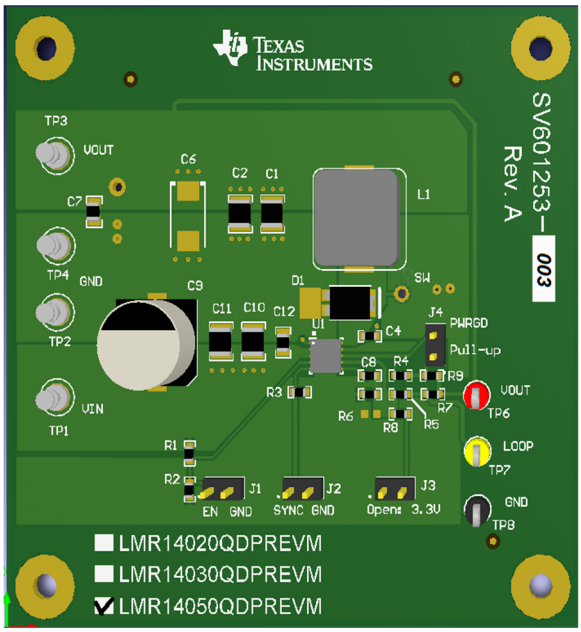

Figure 1. LMR14050QDPREVM Board

EVM Features

- 7 V to 40 V Input Voltage Range
- Jumper Selectable Output Options (5.0 V or 3.3 V)
- Up to 5 A Output Current
- Switching Frequency 400 kHz
- Internal Compensation

The EVM contains one DC / DC converter (See Table 1)

Table 1. Device and Package Configurations

CONVERTER	EVM	IC	PACKAGE
U1	LMR14050QDPREVM	LMR14050QDPRRQ1	WSON-10

2 Setup

This section describes the jumpers and connectors on the EVM and how to properly connect, set up and use the LMR14050QDPREVM.

2.1 Input/Output Connector Description

VIN — Terminal TP1 – is the power input terminal for the converter. Adjacent to it is the GND reference ground. Use this terminal to attach the EVM to a cable harness.

VOUT — Terminal TP3 – is the regulated output voltage for the converter. Adjacent to it is the GND reference ground.

GND — Terminal TP2, TP4 – are the ground reference for the converter. Use these terminals to attach the EVM to a cable harness.

EN — Jumper J1 – is used to enable the switch-mode converter. The device will be enabled when the respective jumper is high or floating, and disabled when low. EN turn off trip point also can be programmed by changing R1 or R2. Refer to LMR14050-Q1 datasheet for enable and adjustable under-voltage lockout.

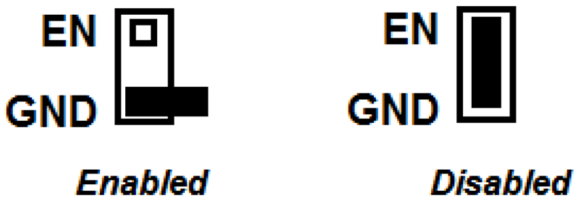

Figure 2. Enable Jumper Setting

SYNC — Jumper J2 – is used to synchronize the switching frequency to external clock. Refer to data sheet for detail application information.

PGOOD — Jumper J4 – is used to monitor the Power-Good flag. This flag indicates whether the output voltage has reached its regulation point. The U1 PGOOD pin is an open-drain output that requires a pull-up resistor to the appropriate logic voltage (any voltage less than 7 V). A pre-installed resistor R4 of 15.8 kΩ is tied to the PGOOD pin and R9 of 49.9 Ω brought out to J4 Pull-up pin.

Testpoint — TP6, TP7, TP8 – these are test points used for loop response measurements.

2.2 Adjusting the Output Voltage

The default setting output voltage is 5.0 V. Open J3 will change output voltage from 5.0 V to 3.3 V.

If other outputs need to be configured, then: open J3 and adjust the feedback resistors using the following equation.

$$V_{OUT} = V_{FB} (1 + (R5 / R6)) \quad (1)$$

Where V_{FB} is 0.75 V

CAUTION: R9 must be removed if the output voltage is changed higher than 7 V.

3 Board Layout

Figure 3 to Figure 6 show the board layout for the LMR14050QDPREVM. The PCB consists of a 4-layer design. 2-oz copper planes are applied on all four layers to dissipate heat with an array of thermal vias under the thermal pad to connect to all four layers.

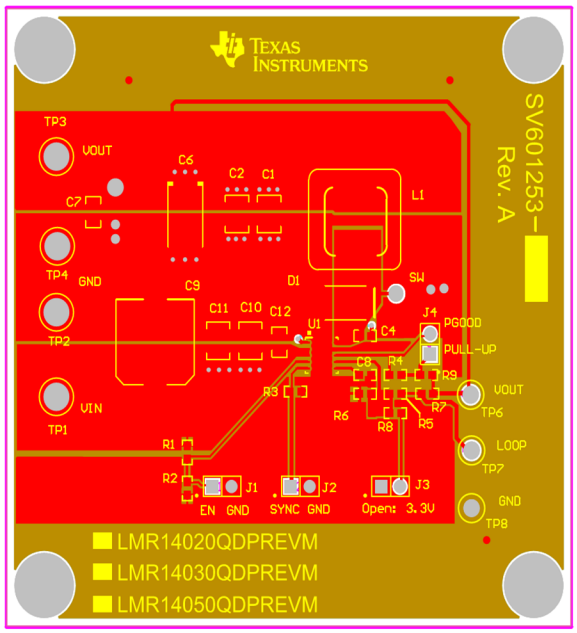

Figure 3. Top Layer

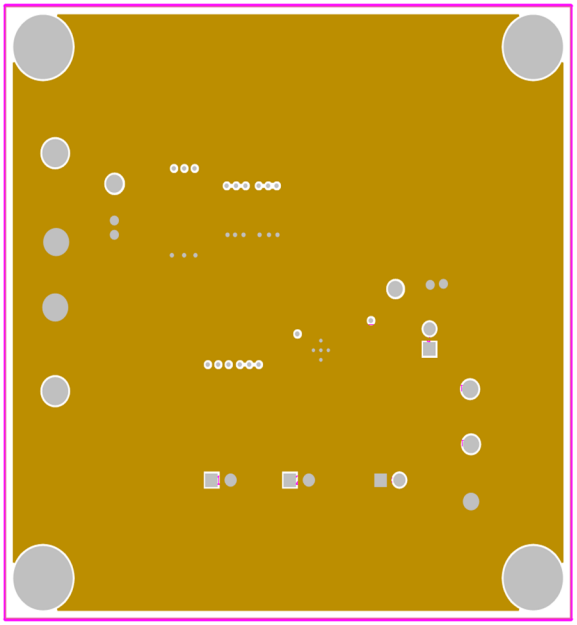

Figure 4. Middle Layer 1

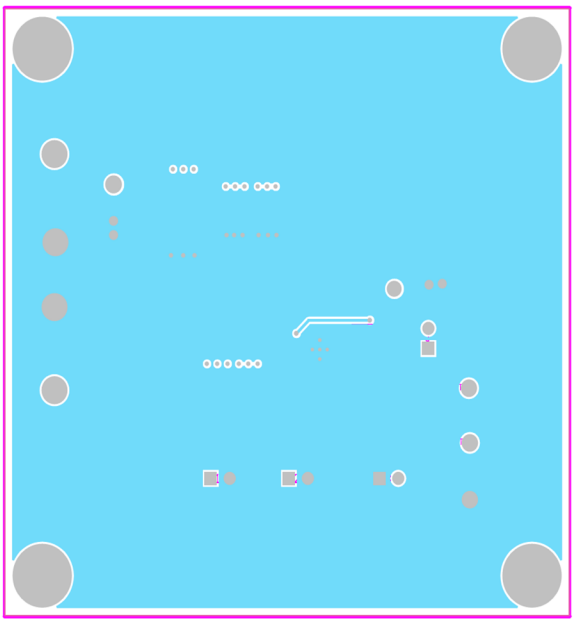

Figure 5. Middle Layer 2

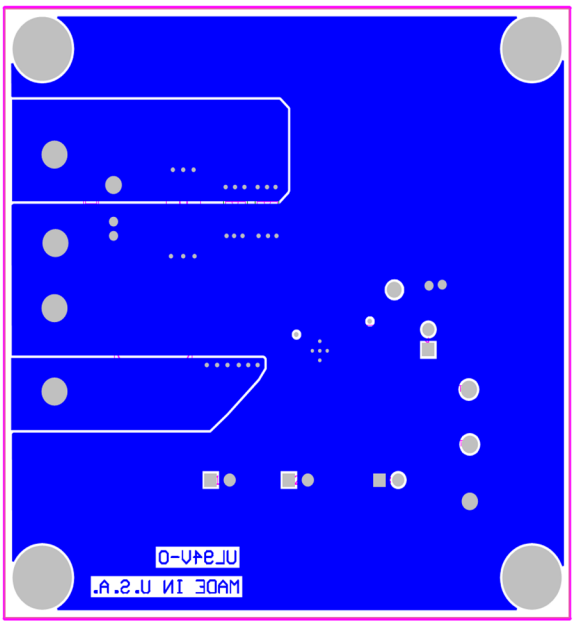

Figure 6. Bottom Layer

4 Schematic and Bill of Materials

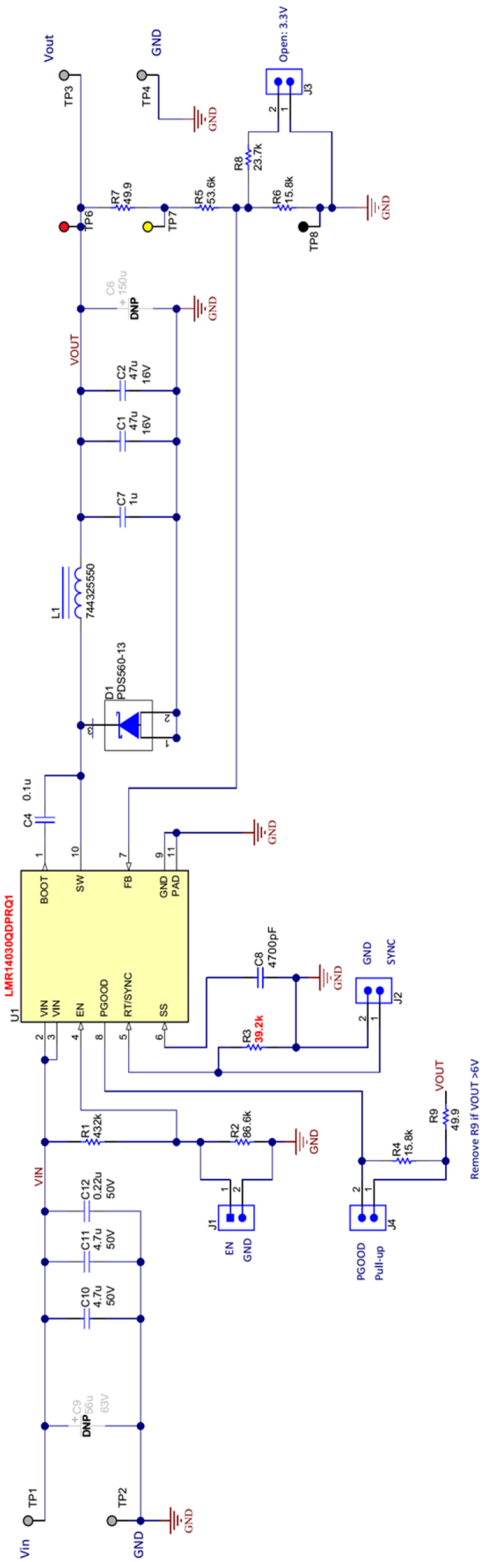

Figure 7. LMR14050QDPREVM Schematic

Table 2. LMR14050QDPREVM Bill of Materials (BOM)

Designator	Description	Part Number	Footprint	Quantity
C1, C2	CAP, CERM, 100 µF, 10V, +/-20%, X5R, 1206	C3216X5R1A107M160AC	1206	2
C4	CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R, 0603	GRM188R71C104KA01D	0603	1
C7	CAP, CERM, 1 µF 25 V, +/- 10%, X7R, 0805	GRM21BR71E105KA99L	0805	1
C8	CAP, CERM, 4700 pF, 100 V, +/- 10%, X7R, 0603	GRM188R71C472KA01D	0603	1
C9	CAP, Alum-Poly, 56 µF, 63 V, +/-20%, 30 mohm, SMD	EEHZA1J560P	SM_RADIAL_10BMM	1
C10, C11	CAP, CERM, 4.7 µF, 50 V, +/-10%, X7R, 1210	GRM32ER71H475KA88L	1210	2
C12	CAP, CERM, 0.22 µF, 50 V, +/- 10%, X7R, 0805	GRM21BR71H224KA01L	0805	1
D1	Diode, Schottky, 60 V, 7 A, PowerDI5	PDS760-13	PowerDI5	1
J1, J2, J3, J4	Header, 100 mil, 2x1, Gold, TH	TSW-102-07-G-S	TSW-102-07-G-S	4
L1	Inductor, 5.5 µF, 10 A, 0.0103 ohm	744325550	WE-HCI	1
R1	RES, 432 k, 1%, 0.1 W, 0603	CRCW0603432KFKEA	0603	1
R2	RES, 86.6 k, 1%, 0.1 W, 0603	CRCW060386K6FKEA	0603	1
R3	RES, 61.9 k, 1%, 0.1 W, 0603	CRCW060361K9FKEA	0603	1
R5	RES, 53.6k, 1%, 0.1 W, 0603	CRCW060353K6FKEA	0603	1
R4, R6	RES, 15.8 k, 1%, 0.1 W, 0603	CRCW060315K8FKEA	0603	2
R7, R9	RES, 49.9 ohm, 1%, 0.1 W, 0603	CRCW060349R9FKEA	0603	2
R8	RES, 23.7 k, 1%, 0.1 W, 0603	CRCW060323K7FKEA	0603	1
SH-J1, SH-J3	Shunt, 100 mil, Flash Gold, Black	SPC02SYAN	SPC02SYAN	2
TP1, TP2, TP3, TP4	Terminal, Turret, TH, Double	1502-2	Keystone1502-2	4
TP6	Test Point, TH, Multipurpose, Red	5010	Keystone5010	1
TP7	Test Point, TH, Multipurpose, Yellow	5014	Keystone5014	1
TP8	Test Point, TH, Multipurpose, Black	5011	Keystone5011	1
U1	IC, 40 V, 5 A, Low I_Q, Current Mode, Buck Regulator	LMR14050QDPRRQ1	WSON-10	1
PCB	PCB, FR4, 4 Layers, Size 3000 x 3000 mil, Thickness 62 mil	SV601253A		1

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      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.

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- *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.*

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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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