LMR16020PEVM User's Guide

The Texas Instruments LMR16020PEVM evaluation module (EVM) helps designers evaluate the operation and performance of the LMR16020 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 LMR16020 is a 60 V, 2 A step-down regulator with 40 µA quiescent current. With a wide-input range from 4.3 V to 60 V, it is suitable for a wide range of applications from automotive to industry for power conditioning from unregulated sources. The LMR16020PEVM evaluation board is designed to provide the design engineer with a fully functional power converter based on the buck topology to evaluate the LMR16020 series operation and performance.

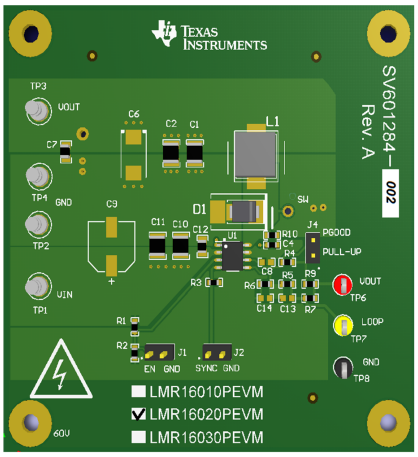

Figure 1. LMR16020PEVM Board

EVM Features

- 7 V to 60 V Input Voltage Range
- 5 V Output Voltage
- Up to 2 A Output Current
- Switching Frequency 600 kHz
- Power Good Flag Output
- Internal Compensation

NOTE: Risk of Electric Shock for Voltage Exceeding 50 VDC

Table 1. Device and Package Configurations

CONVERTER	EVM	IC	PACKAGE
U1	LMR16020PEVM	LMR16020PDDAR	SO-8

2 Setup

This section describes the jumpers and connectors on the EVM and how to properly connect, set up and use the LMR16020PEVM.

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 on trip point also can be programmed by changing R1 or R2. Refer to LMR16020 datasheet for enable and adjustable under-voltage lockout.

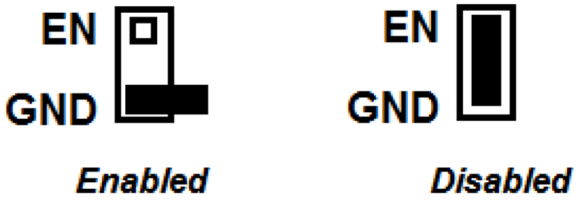

Figure 2. Enable Jumper Setting

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 outputvoltage has reached its regulation point. The U1 PGOOD pin is an open-drain output that requires a pullup resistor to the appropriate logic voltage (any voltage less than 7 V). A pre-installed resistor R4 of 10.2 kΩ is tied to the PGOOD pin and R9 of 49.9 Ω brought output 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.

If other outputs need to be configured, then 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 LMR16020PEVM. 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.

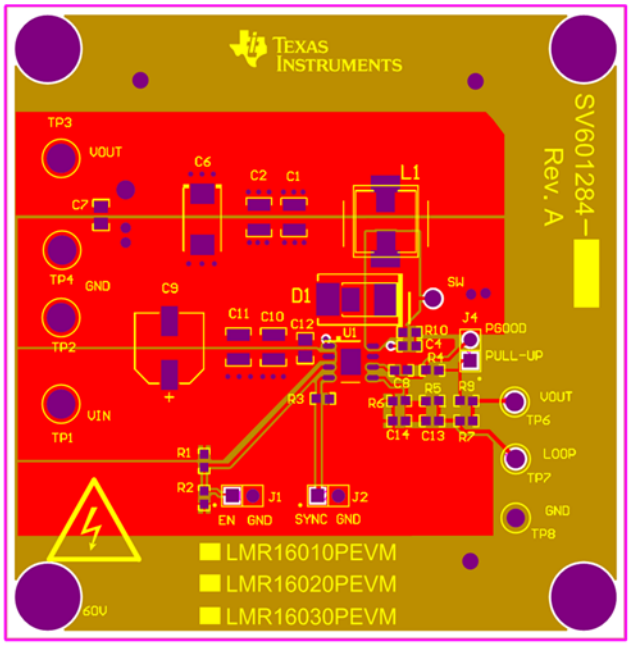

Figure 3. Top Layer

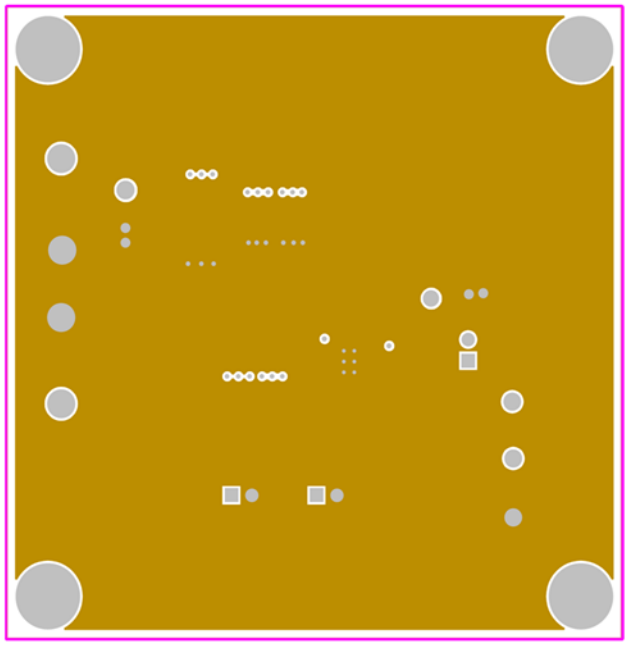

Figure 4. Middle Layer 1

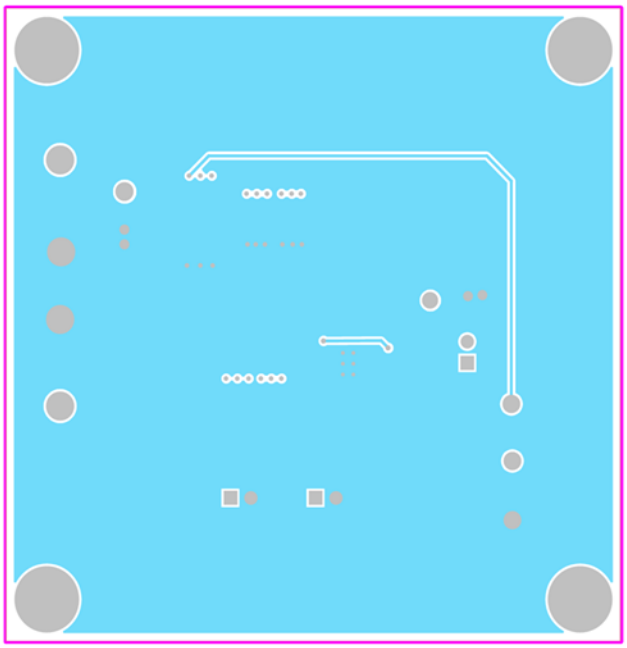

Figure 5. Middle Layer 2

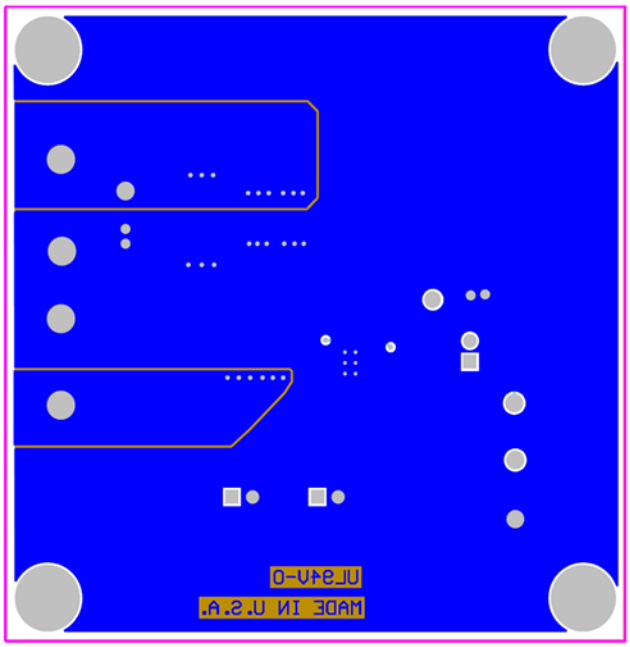

Figure 6. Bottom Layer

4 Schematic and Bill of Materials

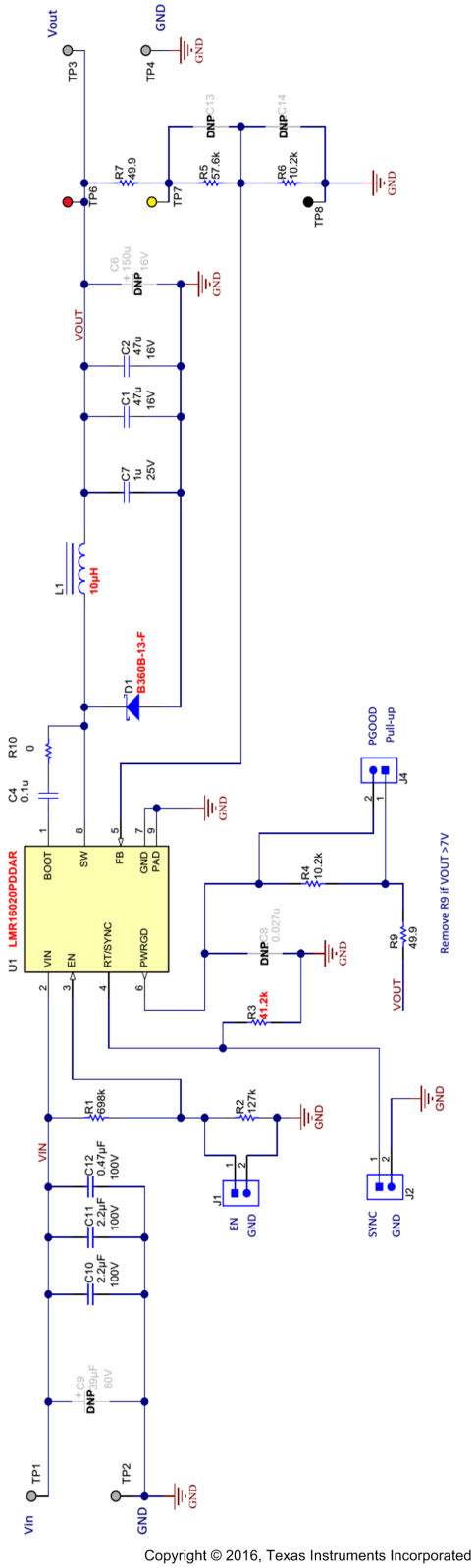

Figure 7. LMR16020PEVM Schematic

Table 2. LMR16020PEVM Bill of Materials (BOM)

Designator	Description	Part Number	Footprint	Quantity
C1, C2	CAP, CERM, 47 µF, 16V, +/-20%, X5R, 1210	GRM32ER61C476ME15L	1210	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
C10, C11	CAP, CERM, 2.2 uF, 100 V, +/-10%, X7R, 1210	GRM32ER72A225KA35L	1210	2
C12	CAP, CERM, 0.47 µF, 100 V, +/- 10%, X7R, 0805	GRM21BR72A474KA73L	0805	1
D1	Diode, Schottky, 60 V, 3 A, SMB	B360B-13-F	SMB	1
J1, J2, J4	Header, 100 mil, 2x1, Gold, TH	TSW-102-07-G-S	TSW-102-07-G-S	3
L1	Inductor, 10 uH, 3.5 A, 0.033 ohm	744314101	WE-HCI	1
R1	RES, 698 k, 1%, 0.1 W, 0603	CRCW0603698KFKEA	0603	1
R2	RES, 127 k, 1%, 0.1 W, 0603	CRCW0603127KFKEA	0603	1
R3	RES, 41.2 k, 1%, 0.1 W, 0603	CRCW060341K2FKEA	0603	1
R5	RES, 57.6k, 1%, 0.1W, 0603	CRCW060357K6FKEA	0603	1
R4, R6	RES, 10.2 k, 1%, 0.1 W, 0603	CRCW060310K2FKEA	0603	2
R7, R9	RES, 49.9 ohm, 1%, 0.1W, 0603	CRCW060349R9FKEA	0603	2
R10	RES, 0 ohm, 5%, 0.1 W, 0603	CRCW06030000Z0EA	0603	1
SH-J1	Shunt, 100 mil, Flash Gold, Black	SPC02SYAN	SPC02SYAN	1
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, 60 V, 2 A, Low I_Q, Current Mode, Buck Regulator	LMR16020PDDAR	SO-8	1
PCB	PCB, FR4, 4 Layers, Size 3000 x 3000 mil, Thickness 62 mil	SV601284A		1

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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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3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

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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
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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 as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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