User's Guide

LMR50410QEVM User's Guide

ABSTRACT

The Texas Instruments LMR50410QEVM evaluation module (EVM) helps designers evaluate the operation and performance of the LMR50410-Q1 wide-input synchronous buck regulator. This document describes the setup, input/output connections of the EVM, board layout, schematic, and bill of materials.

Table of Contents

Trademarks

1 Introduction

The Texas Instruments LMR50410QEVM evaluation module (EVM) helps designers evaluate the operation and performance of the LMR50410-Q1 wide-input buck regulator.

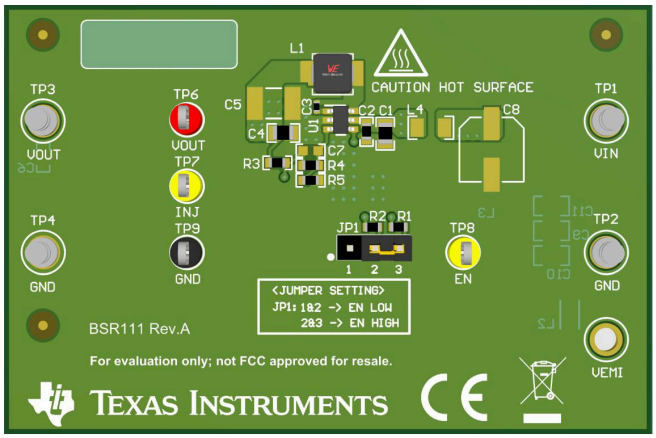

Figure 1-1. LMR50410QEVM Board

EVM Features

- 4-V to 36-V input voltage range
- Default 3.3-V output
- Up to 1-A output current
- 2100-kHz switching frequency
- Hiccup mode short current protection
- Internal compensation

The EVM contains one DC/DC converter (see Table 1-1).

Table 1-1. Device and Package Configurations

CONVERTER	EVM	DEVICE	PACKAGE
U1	LMR50410QEVM	LMR50410-Q1	SOT23-6

2 Setup

This section describes the jumpers and connectors on the EVM and how to properly connect, set up, and use the LMR50410QEVM.

2.1 Input/Output Connector Description

VIN — Terminal TP1 – 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 – Regulated output voltage for the converter. Adjacent to it is the GND reference ground.

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

ENABLE SETTING — Jumper JP1 – Used to enable the switch-mode converter. The device will be enabled when the EN pin is high, and disabled when low.

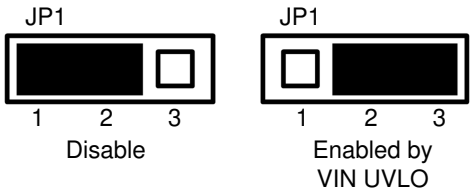

Figure 2-1. Vout Jumper Setting Enable Jumper Setting

Testpoint — TP6, TP7, TP9 – Test points used for loop response measurements

2.2 Adjusting the Output Voltage

If other outputs need to be configured, adjust the feedback resistors using the Equation 1.

$$V_{OUT} = V_{REF} \times (1 + (R4 / R5)) \quad (1)$$

where

- V_{REF} is 1.0 V

3 LMR50410QEVM Schematic

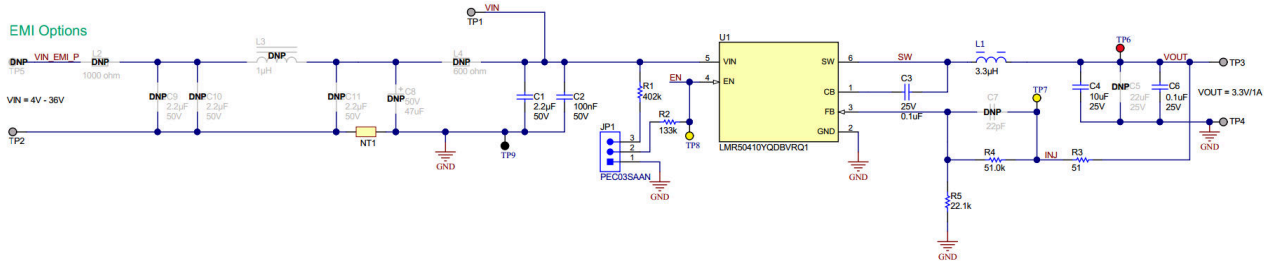

Figure 3-1. LMR50410QEVM Schematic

4 Board Layout

Figure 4-1 to Figure 4-4 show the board layout for the LMR50410QEVM. The PCB consists of a 4-layer design. The board size is 46-mm x 69-mm, 2-oz copper planes are applied on top and bottom layers, 1-oz copper planes are applied on middle layers.

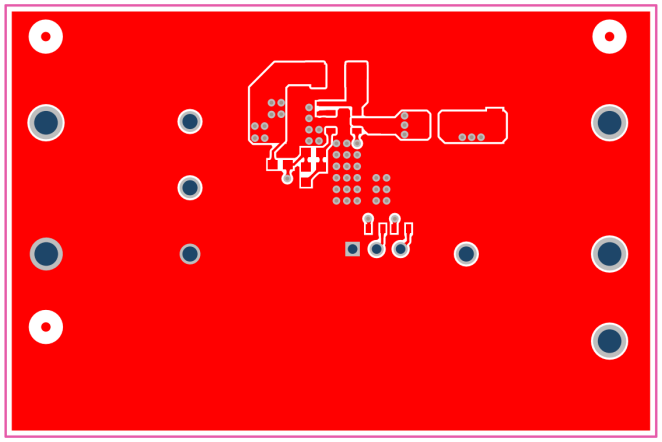

Figure 4-1. Top Layer

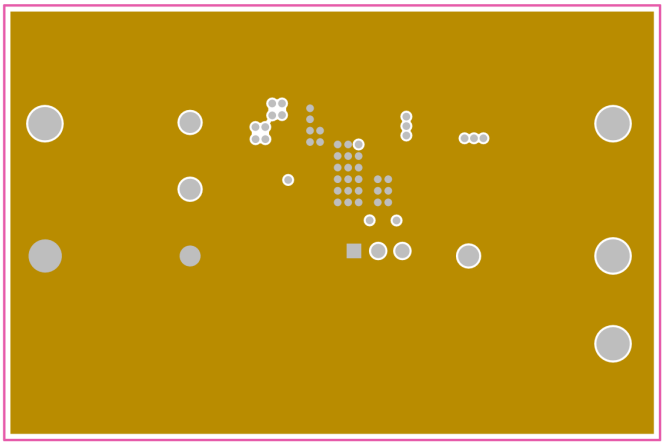

Figure 4-2. Middle Layer One

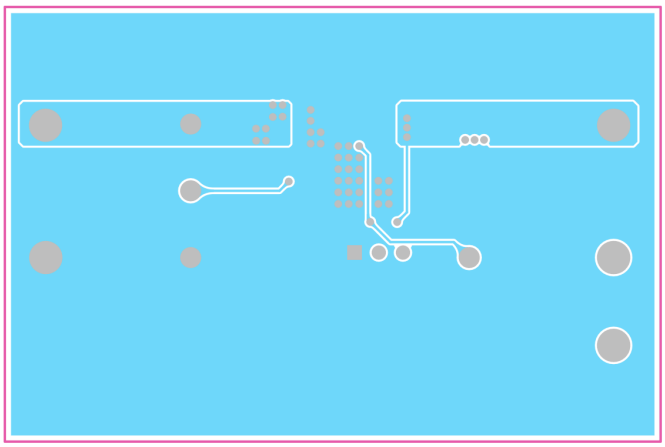

Figure 4-3. Middle Layer Two

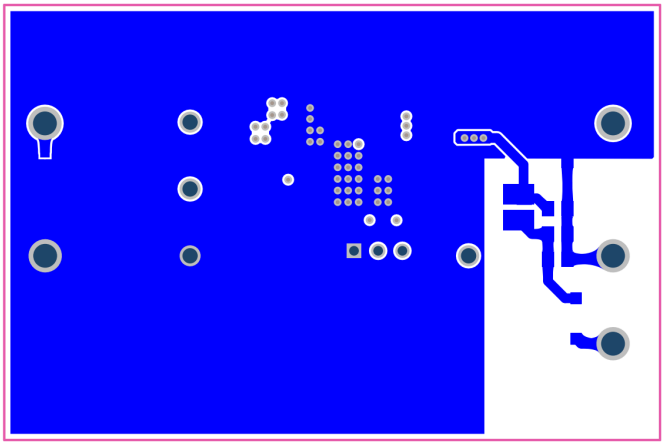

Figure 4-4. Bottom Layer

5 Bill of Materials

Table 5-1. Bill of Materials

DESIGNATOR	QUANTITY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
C1	1	2.2 µF	CAP, CERM, 2.2 µF, 50 V, ±10%, X7R, 0805	0805		
C2	1	0.1 µF	CAP, CERM, 0.1 µF, 50 V, ±10%, X7R, 0603	0603		
C3	1	0.1 µF	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0402	0402		
C4	1	10 µF	CAP, CERM, 10 µF, 25 V, ±10%, X7R, 0805	0805		
C6	1	0.1 µF	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0603	0603		
JP1	1		Header, 100 mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin		
L1	1		3.3-µH Shielded Molded Inductor 2.5-A 76-mΩ Max Nonstandard	SMT_IND_4MM06_4MM06	74437324033	Wurth Electronics
R1	1	402 k	RES, 402 k, 1%, 0.1 W, 0603	0603		
R2	1	133 k	RES, 133 k, 1%, 0.1 W, 0603	0603		
R3	1	51	RES, 51, 5%, 0.1 W, 0603	0603		
R4	1	51.0 k	RES, 51.0 k, 1%, 0.1 W, 0603	0603		
R5	1	22.1 k	RES, 22.1 k, 1%, 0.1 W, 0603	0603		
SH-J1	1	1x2	Shunt, 100 mil, Gold plated, Black	Shunt		
TP1, TP2, TP3, TP4	4		Terminal, Turret, TH, Double	Keystone1502-2		
TP6	1		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint		
TP7, TP8	2		Test Point, Multipurpose, Yellow, TH	Yellow Multipurpose Testpoint		
TP9	1		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint		
U1	1		LMR50410YQDBVRQ1, DBV0006A (SOT-23-6)	DBV0006A	LMR50410YQDBVRQ1	Texas Instruments
C5	0	22 µF	CAP, CERM, 22 µF, 25 V, ±20%, X7R	1812		
C7	0	22 pF	CAP, CERM, 22 pF, 50 V, ±5%, C0G/NP0, 0603	0603		
C8	0	47 µF	CAP, AL, 47 µF, 50 V, ±20%, 0.6 Ω, SMD	F80		
C9, C10, C11	0	2.2 µF	CAP, CERM, 2.2 µF, 50 V, ±10%, X7R, 0805	0805		
L2	0	1000 Ω	Ferrite Bead, 1000 Ω at 100 MHz, 1.5 A, 1806	1806	BLM41PG102SN1L	MuRata
L3	0	1 µH	Inductor, Shielded, Metal Composite, 1 µH, 2.9 A, 0.048 Ω, SMD	2x1.6mm	DFE201612E-1R0M	MuRata
L4	0	600 Ω	Ferrite Bead, 600 Ω at 100 MHz, 1.5 A, 1206	1206	BLM31PG601SH1L	MuRata
TP5	0		Terminal, Turret, TH, Double	Keystone1502-2		

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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.

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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.*

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

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

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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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