TPS65253 High Current, Synchronous Step Down Two Buck Switcher Evaluation Module

User's Guide

Literature Number: SLVU469A
June 2011–Revised November 2015

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1 Introduction

This document presents the information required to power the TPS65253 PMIC as well as the support documentation including schematic and bill of materials.

2 Background

The TPS65253 PMIC is designed to provide 3.5-A and 2.5-A continuous outputs with an operational range of 4.5 V to 16 V and an externally set switching frequency ranging from 300 kHz to 1.2 MHz. When the PMIC is not fully loaded, buck1 can be loaded to 4 A and buck 2 to 3 A.

As there are many possible options to set the converters, Table 1 presents the performance specification summary for the EVM.

Table 1. Input Voltage and Output Current Summary

EVM	TEST CONDITIONS	OUTPUT CURRENT RANGE
TPS65253EVM	V_{IN} = 4.5 V to 16 V f_{sw} = 500 kHz	Buck1, 1.2 V, 3.5 A Buck2, 3.3 V, 2.5 A (25°C ambient)

This evaluation module is designed to provide access to the features of the TPS65253. Some modifications can be made to this module to test performance at different input and output voltages, current and frequency operation. Please contact TI Field Applications Group for advice on these matters.

3 Schematic

Figure 1 illustrates the TPS65253 EVM schematic.

The resistor and capacitor values have been chosen according to the guidelines presented on the TPS65253 spec available at http://focus.ti.com/docs/prod/folders/print/TPS65253.html.

Note that for the purpose of gains-phase measurements R9 and R11 (0 Ω on the EVM) need to be replaced by suitable low value resistors as per the network analyzer setup required. Test points are provided on either end of the resistors to allow for easy measurement. Also, R3, R4, C10, and C12 can be populated if users desire to reduce overshoot at LX pins due to parasitic L and C resonance.

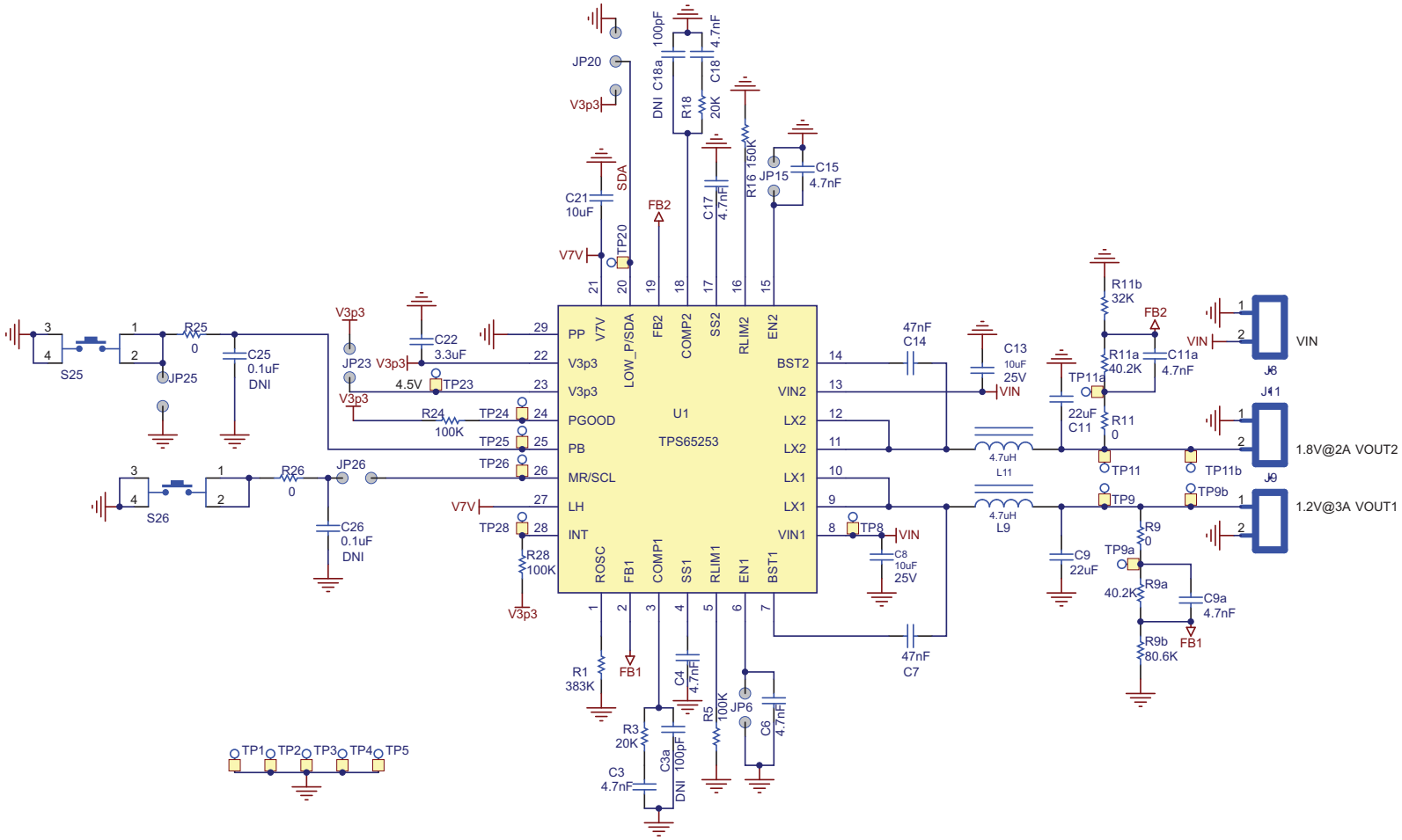

Figure 1. TPS65253 Schematic

4 Placement

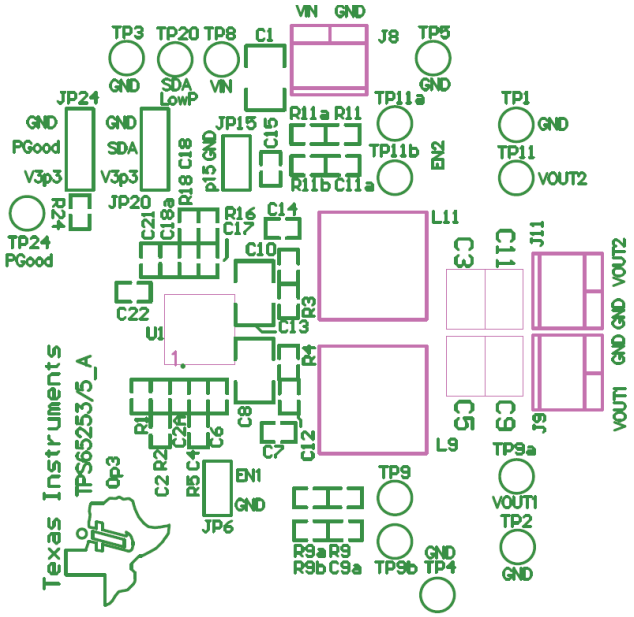

Figure 2. Part Placement

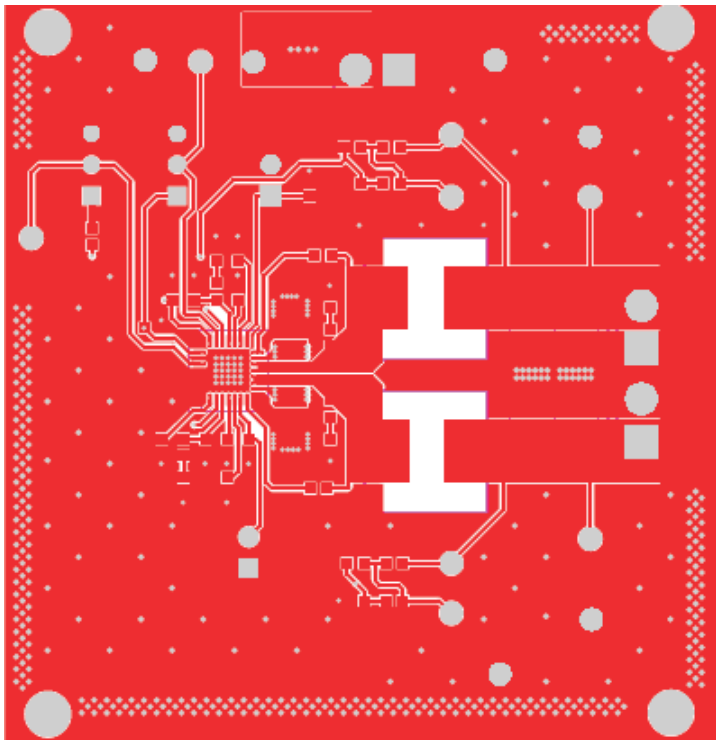

Figure 3. Top Layer

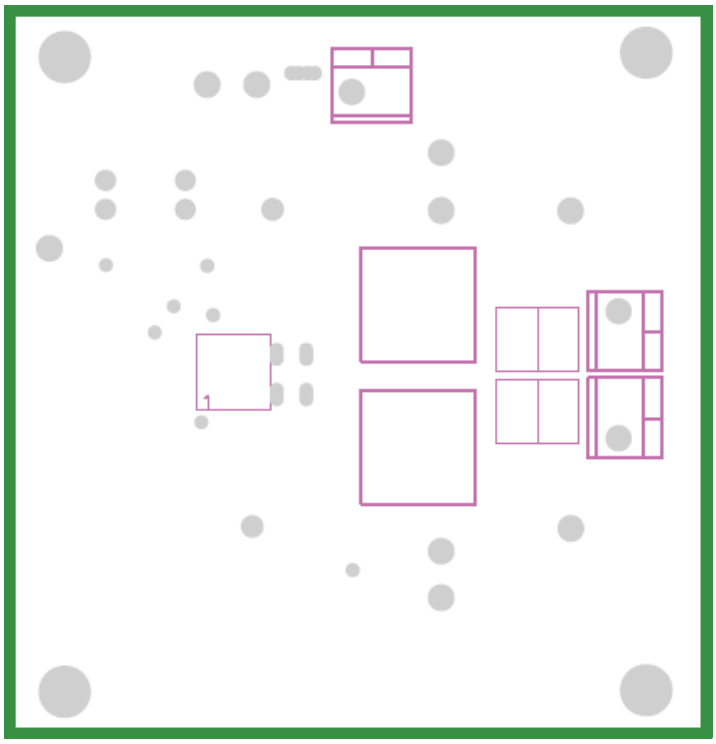

Figure 4. Mid-Layer 1

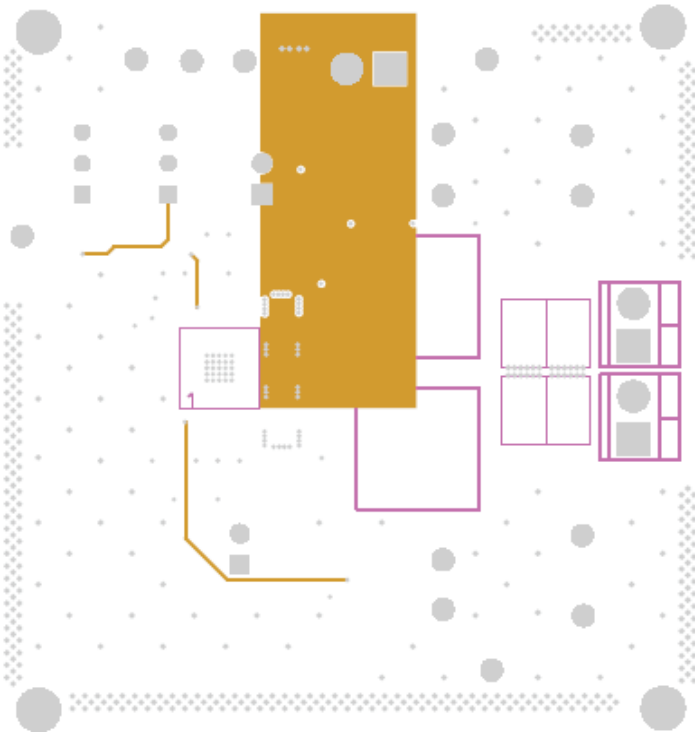

Figure 5. Mid-Layer 2

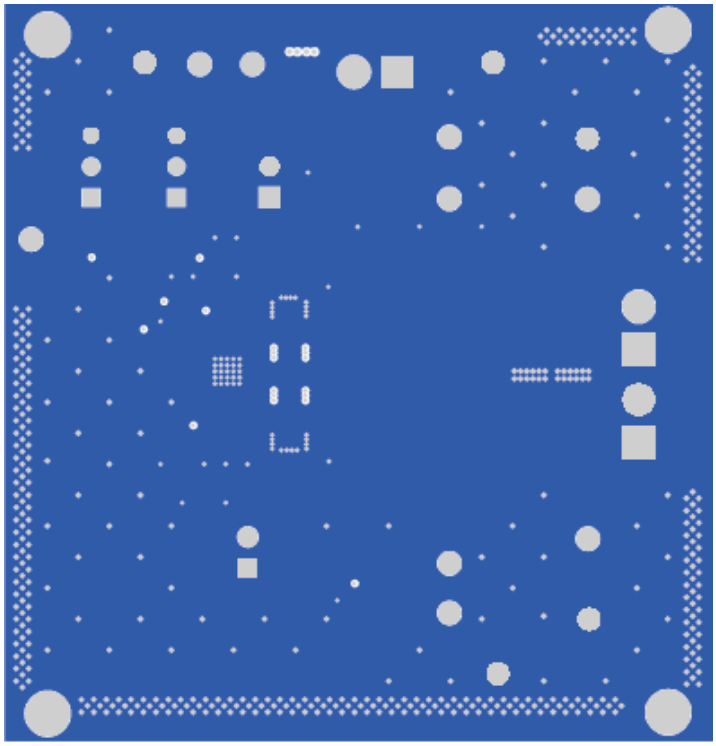

Figure 6. Bottom Layer

5 Bench Test Setup Conditions

5.1 Headers Description and Jumper Placement

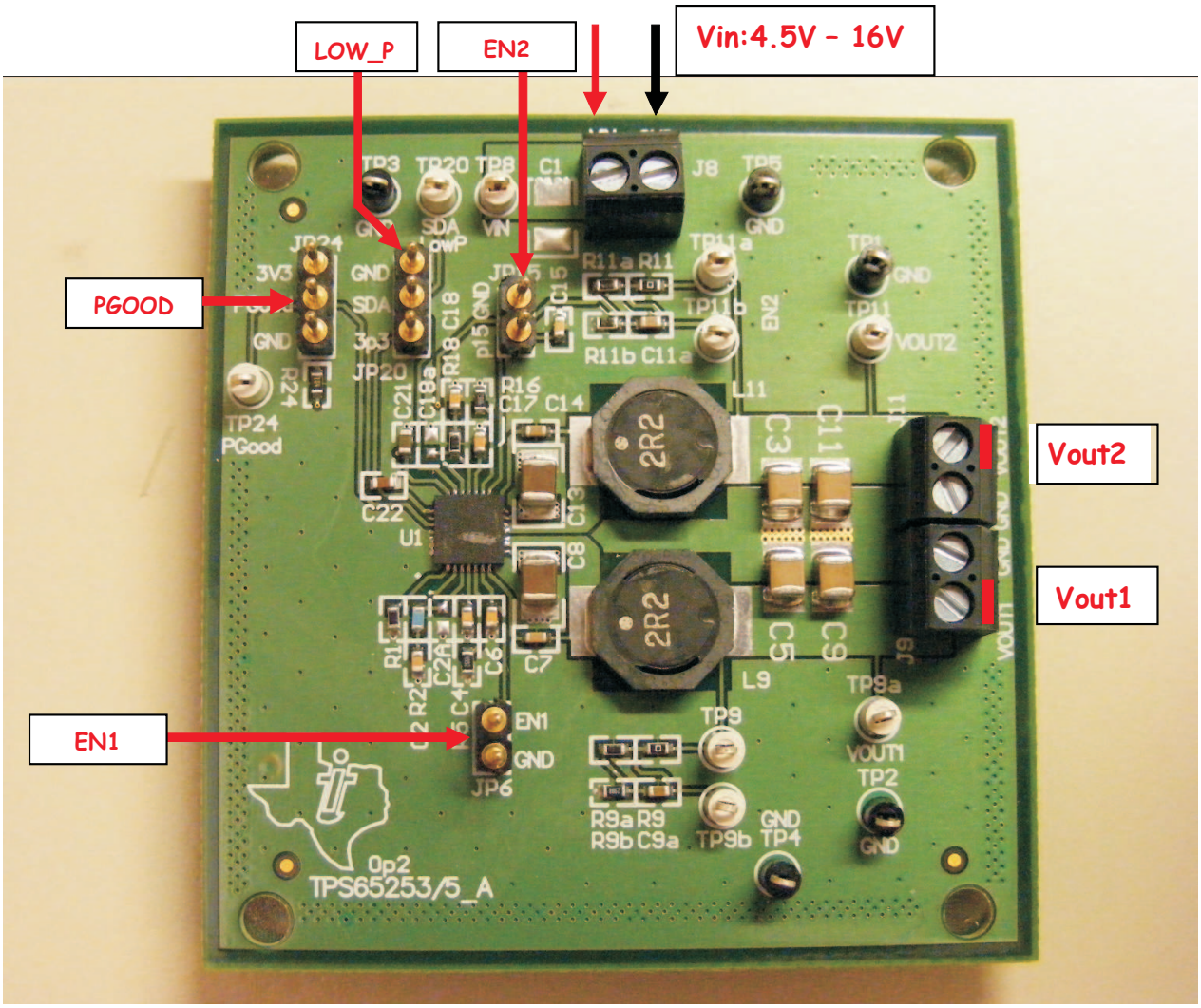

Figure 7. Headers Description and Jumper Placement

Test points:

Black – GND

White – Each output, feed-back, power good and V_{IN}. All marking on PCB.

5.2 Jumpers

Table 2. Jumpers

JUMPER NO.	FUNCTION	PLACEMENT	COMMENT
JP6	BUCK1 enable (EN1)	For sequencing do not fit jumper. To disable converter fit jumper to GND.	Fit according to test requirement
JP15	BUCK2 enable (EN2)	For sequencing do not fit jumper. To disable converter fit jumper to GND.	Fit according to test requirement
JP20	LOW_P	Low power: Power save mode ON/OFF. If need low power mode test, should connect V3V.	Fit according to test requirement. During normal operation jumper must be fitted.
JP24	PGOOD	Pulls PGOOD signal to internal 3V3 rail or grounds pin	Fit according to test requirement

5.3 Test Points and Placement

Buck converter outputs are white and have a label for easy location. Close to any of these test points there are black ground test points to allow for DVM measurement or to use a metal exposed scope probe to reduce common mode noise measurements. All test points are described in Table 3.

Table 3. Test Points and Placement

TEST POINT	NAME	SIGNAL	COLOR	COMMENT
TP1, TPS, TP3, TP4, TP5	GND	Ground	Black	
TP8	VIN	Input supply	White	
TP9, TP9A	VOUT1	Buck1 output	White	
TP9B		Input for gain-phase measurement Buck1	White	Normally not used
TP11, TP11A	VOUT2	Buck2 output	White	
TP11B		Input for gain-phase measurement Buck2	White	Normally not used
TP20	Low_P	Low Power input	White	
TP24	PGOOD	Power Good (open drain connected to Buck1 output)	White	

6 Power-Up Procedure

1. Define which converters are to be enabled or disabled by connecting the correct jumpers accordingly.
2. Apply a DC voltage to jumper J8. Polarity is clearly marked on the silk-screen.
3. Verify that the relevant converters are powered up by the output voltages. The whole start-up process will take less than 100 ms. PGOOD will be asserted high 32 ms after all converter outputs have reached 90% of nominal voltages.
4. Apply loads to the output connectors (J9 and J11).

7 Bill of Materials

Table 4. Bill of Materials

ITEM	QUANTITY	DESIGNATOR	VALUE	FOOTPRINT	MANUFACTURER	MANUFACTURER PART NO.	VENDER PART NO.	DESCRIPTION
1	2	DNI C2A, C18a	100 pF	603	Panasonic-ECG	ECJ-1VC1H101J	PCC101ACVDKR-ND	CAP CERAMIC 100 pF 50 V 0603 SMD
2	2	C7, C14	47 nF	603	Panasonic-ECG	ECJ-1VB1E473K	PCC1771DKR-ND	CAP 47000 pF 25 V CERM X7R 0603
3	2	C8, C13	10 µF	1210	Murata Electroics North America	GRM32ER7YA1 06KA12L	490-5314-6-ND	CAP CER 10 µF 35 V X7R 10% 1210
4	4	C5, C3, C9, C11	22 µF	1210	Panasonic-ECG	ECJ-4YB1E226M	PCC2333DKR-ND	CAP CERAMIC 22 µF 25 V X5R 1210
5	1	C2	10 µF	603	Panasonic-ECG	ECJ-1VB1A106M	PCC2479DKR-ND	CAP CERAMIC 10 µF 10 V 0603 X5R
6	1	C22	4.7 µF	603	Panasonic-ECG	ECJ-1VB0J475M	PCC2318DKR-ND	CAP CERAMIC 4.7 µF 6.3 V X5R 0603
7	1	C2	2.2 nF	603	TDK Corporation	C1608X7R1H222M	445-5083-6-ND	CAP CERAMIC 2200 pF 50 V X 7R 0603
8	3	J8, J9, J11	ED555/ 2DS	TB_2X3.5MM	On Shore Technology	ED555/2DS	ED1514-ND	TERMINAL BLOCK 3.5 mm 2POS PCB
9	2	JP6, JP15		JMP0.2	Mil-Max	800-10-064-10-001000	ED7264-ND	SIP HEADER 64 POS STRAIGHT PCB
10	2	JP20, JP24		JMP0.3	Mil-Max	800-10-064-10-001000	ED7264-ND	SIP HEADER 64 POS STRAIGHT PCB
11	2	L9, L11	2.2 µH	10X10MM	Wurth Electronics	7440650022	732-1055-2-ND	INDUCTOR POWER 2.2 µH 6.2 A SMD
12	1	R1	383 kΩ	603	Panasonic-ECG	ERJ-3EKF3833V	P383KHDKR-ND	RES 383 kΩ 1/10 W 1% 0603 SMD
13	1	R18	10 kΩ	603	Panasonic-ECG	ERJ-3EKF1002V	P10.0KHCT-ND	RES 10 kΩ 1/10 W 1% 0603 SMD
14	1	R24	100 kΩ	603	Panasonic-ECG	ERJ-3EKF1003V	P100KHCT-ND	RES 100 kΩ 1/10 W 1% 0603 SMD
15	2	R9, R11	0	603	Vishay/Dale	CRCW06030000 Z0EA	541-0.0GDKR-ND	RES 0 Ω 1/10 W 5% 0603 SMD
16	2	R9a, R11a	40.2 kΩ	603	Panasonic-ECG	ERJ-3EKF4022V	P40.2KHDKR-ND	RES 40.2 kΩ 1/10 W 1% 0603 SMD
17	1	R9b	80.6 kΩ	603	Panasonic-ECG	ERJ-3EKF8062V	P80.6KHDKR-ND	RES 80.6 kΩ 1/10 W 1% 0603 SMD
18	1	R11b	32.4 kΩ	603	Yageo	RC0603FR- 0732K4L	311-32.4KHRDKR-ND	RES 32.4 kΩ 1/10 W 1% 0603 SMD
19	2	DNI C10, C12	3.3 nF	603				Reserved for snubber
20	2	DNI R3, R4	4.99	603				Reserved for snubber

Table 4. Bill of Materials (continued)

ITEM	QUANTITY	DESIGNATOR	VALUE	FOOTPRINT	MANUFACTURER	MANUFACTURER PART NO.	VENDER PART NO.	DESCRIPTION
21	10	TP8, TP9, TP9a, TP9b, TP11, TP11a, TP11b, TP20, TP23, TP24		TEST POINT 0.042	Keystone Electronics	5002	5002K-ND	TEST POINT PC MINI .040" D WHITE
22	5	TP1, TP2, TP3, TP4, TP5		TEST POINT 0.042	Keystone Electronics	5001	5001K-ND	TEST POINT PC MINI .040" D BLACK
23	1	U1		QFN28 [RHD]		TPS65253		
24	5	C4, C6, C15, C17, C18	4.7 nF	603	Panasonic-ECG	ECJ-1VB1H472K	PCC1780TR-ND	CAP 4700 pF 50 V CERAMIC X7R 0603
25	1	DNI C1	22 µF	1210	AVX Corp	12103D226KAT2A	478-5999-6-ND	CAP CER 22000 pF 25 V CERM X7R 0603
26	2	C9A, C11A	22 µF	603	Panasonic-ECG	ECJ-1VB1E223K	PCC1767DKR-ND	CAP 4700 pF 50 V CERAMIC X7R 0603
27	1	R2	5 kΩ	603	Vishay/Dale	PNM0603E5001BST5	PNM0603-5.0KBDKR-ND	RES 5.0 kΩ 15W 0.1% 0603 SMD
28	2	R5, R16	49.9 kΩ	603	Panasonic-ECG	ERJ-3EKF4992V	P49.9KHDKR-ND	RES 49.9 kΩ 1/10W 1% 0603 SMD

Revision History

Changes from Original (June 2011) to A Revision **Page**

- Updated schematic image. 5

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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      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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      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.*

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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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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.

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