TPS65281-1EVM User's Guide

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1 INTRODUCTION

This document presents the information required to operate the TPS65281-1 PMIC as well as the support documentation including schematic and bill of materials.

2 BACKGROUND

The TPS65281-1 PMIC contains a buck converter and one power switch. The buck converter is designed to provide an adjustable output voltage with maximum 3-A continuous current. The power switch is designed to provide precise current limit programmable by an external resistor.

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

Table 1. Summary of Performance

TEST CONDITIONS	PERFORMANCE
V_{IN} = 4.5 V to 18 V f_{SW} = 600 kHz (25°C ambient)	Buck: 5 V, up to 3 A Power switch: 5 V, up to 2.7 A

The evaluation module is designed to provide access to the features of the TPS65281-1. Some modifications can be made to this module to test performance at different input and output voltages, current and switching frequency. Please contact TI Field Applications Group for advice on these matters.

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3 BOARD LAYOUT

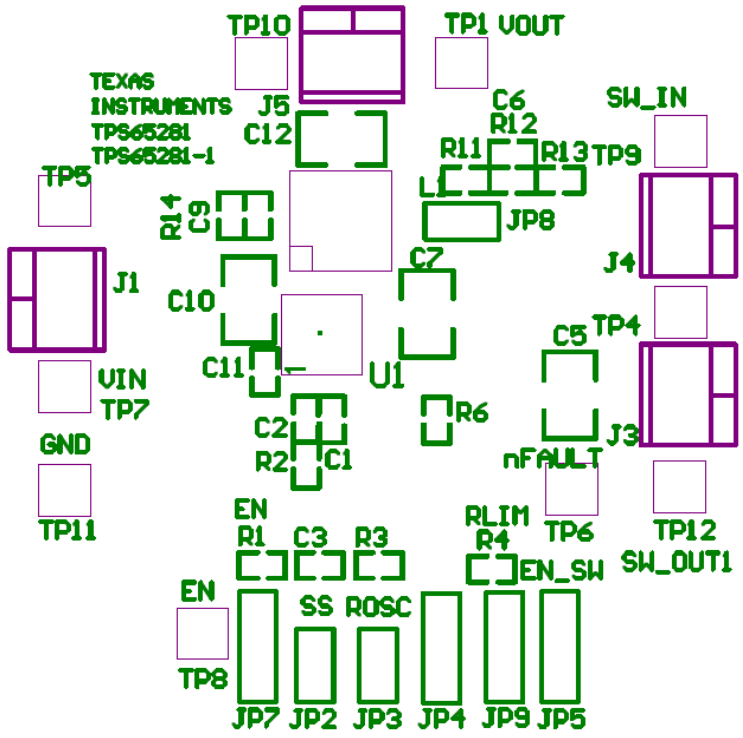


Figure 1. Placement (Top Layer)

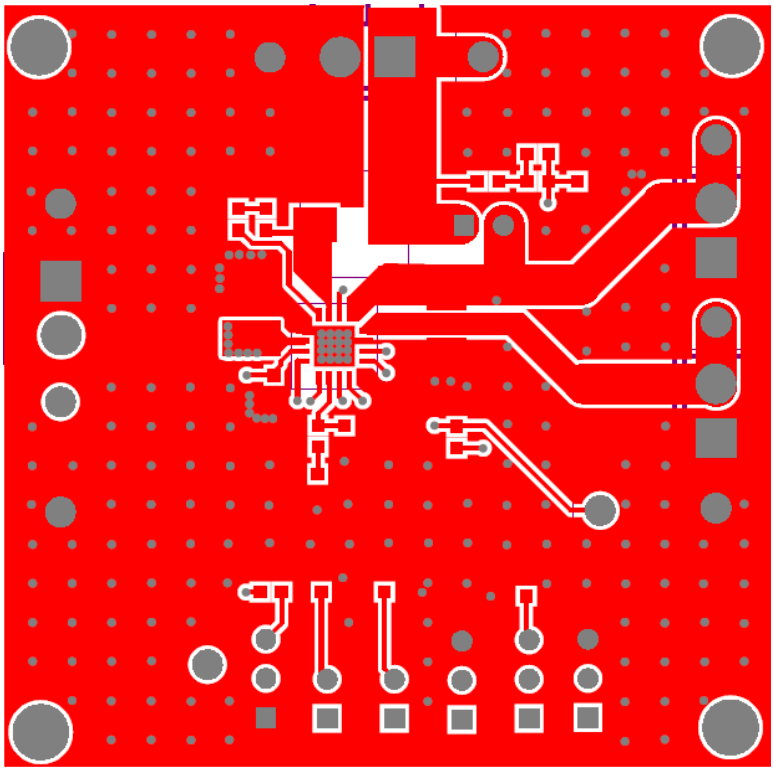


Figure 2. Board Layout (Top Layer)

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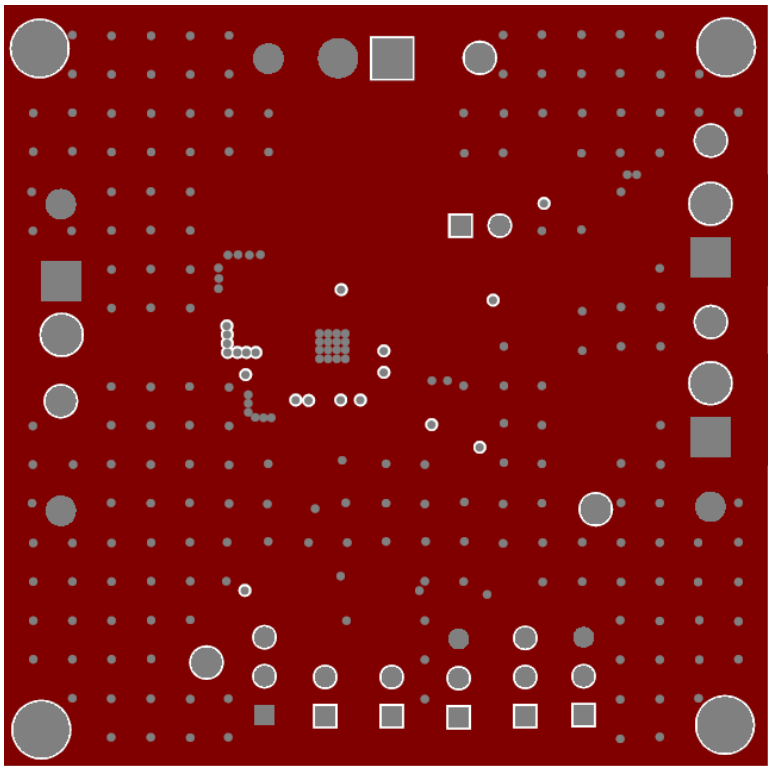


Figure 3. Board Layout (Second Layer – Ground Plane)

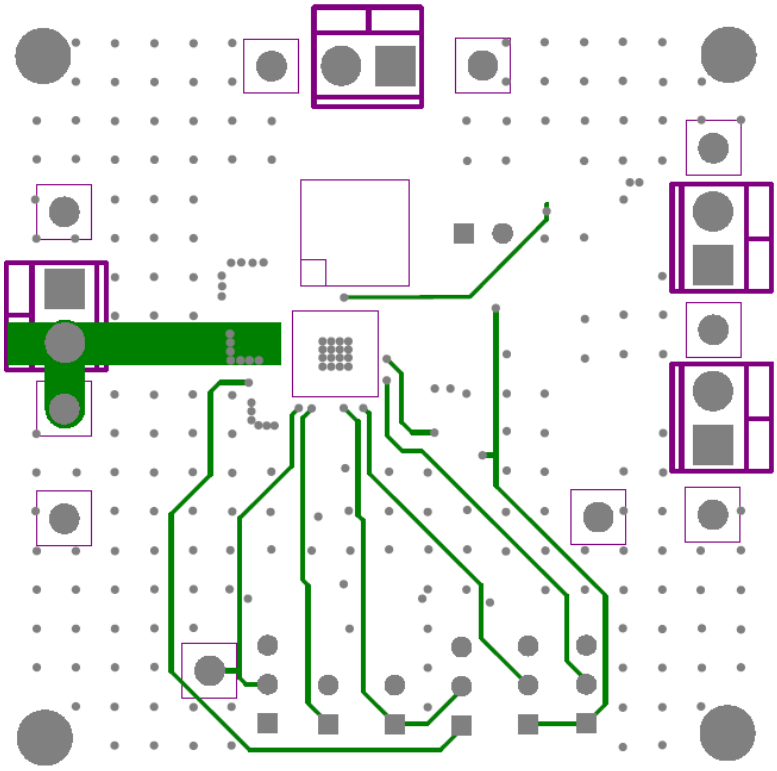


Figure 4. Board Layout (Third Layer – V_{IN} and Signal Routing)

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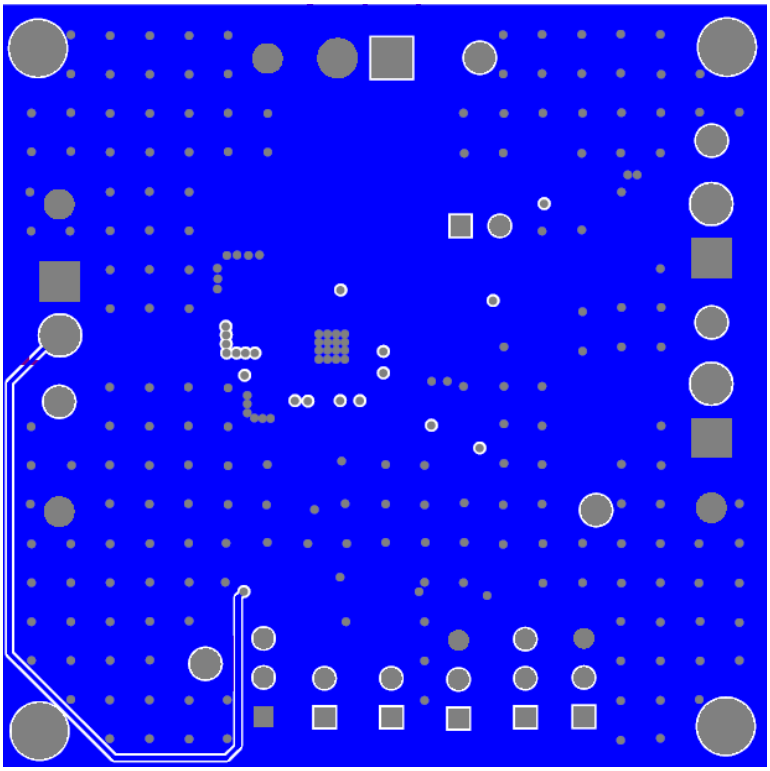


Figure 5. Board Layout (Bottom Layer – Ground Plane)

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4 BENCH TEST SETUP CONDITIONS

4.1 Headers Description and Jumper Placement

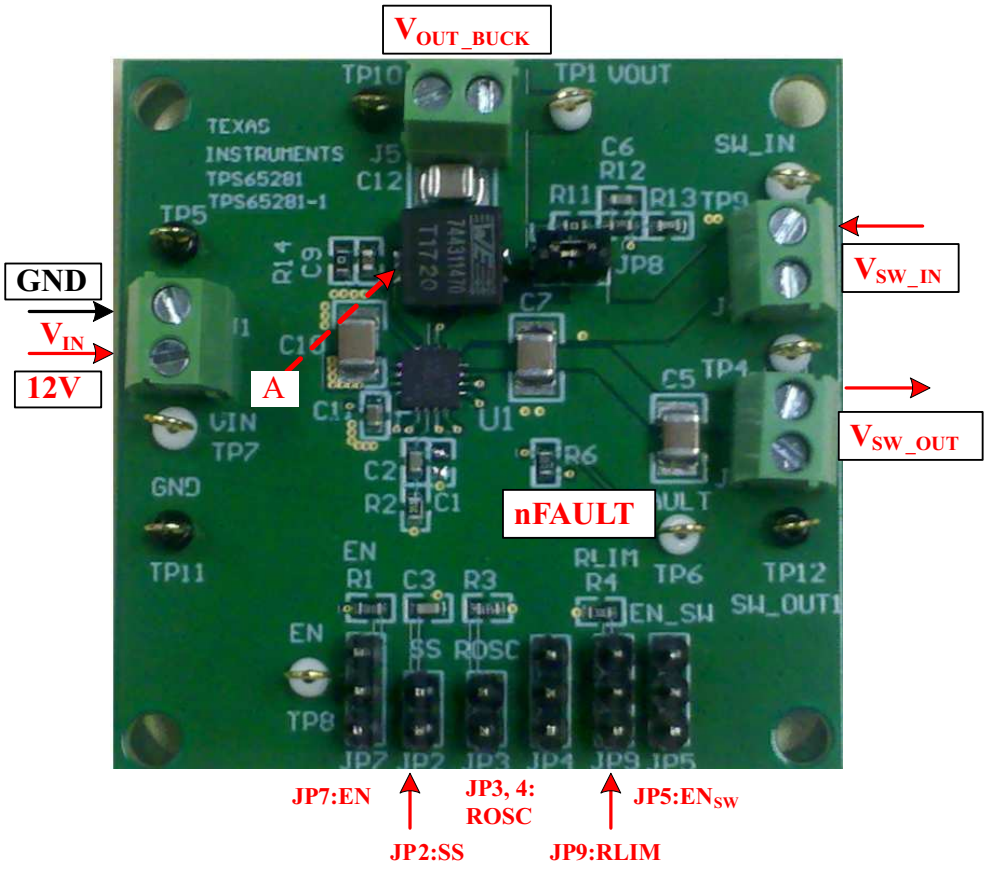


Figure 6. Headers Description and Jumper Placement

Test points:

(A) LX of V_{OUT}

(B) V_{OUT_BUCK}

(C) V_{SW_OUT}

4.2 Power Connectors, Jumpers and Switches

Table 2. Power Connectors

NO.	FUNCTION	DESCRIPTION
J1	V_{IN} Connector	Apply power supply to this connector
J3	SW_OUT Connector	Output of power switch
J4	SW_IN Connector	Input of power switch
J5	V_{OUT_BUCK} Connector	Output of buck converter

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Table 3. Jumpers and Switches

NO.	FUNCTION	PLACEMENT	COMMENT
JP2	Soft Start (SS)	Connect an external capacitor to this pin to program the soft start time of the buck converter; leave this pin open to have default 1-ms soft start time.	
JP3, JP4	Switching Frequency	Connect a resistor to this pin to set the switching frequency; leave it open to set f_{SW} to 600 kHz; connect it to ground to set f_{SW} to 300 kHz.	
JP5	Power Switch Enable	Connect this pin to high enable power switch 2; connect it to ground to disable power switch 2; Leave it open to enable power switch through an internal 1.25-MΩ pull-up resistor.	Not recommend to leave open
JP7	Buck Enable (EN)	Connect EN1 to GND to disable V_{OUT1}, connect EN1 to V_{IN} through a 100-kΩ resistor to enable V_{OUT_BUCK}; Leave open to enable $V_{OUT_BUCK.}$	Not recommend to leave open
JP8	Short Connector	Short these pins to connect Vout_buck to SW_IN.	
JP9	Current Limit	Power switch current limit control pin. An external resistor used to set current limit threshold of power switch. Recommended 15 kΩ ≤ RLIM ≤ 232 kΩ. Leave this pin open or connect to SW_IN to set current limit 1.2 A.	

5 POWER-UP PROCEDURE

1. Apply 12 V to J1.
2. Toggle JP7 to enable V_{OUT1}.
3. Toggle JP5 to enable power switch.
4. Apply load to the connectors, J3 or J5.

6 SCHEMATIC AND BILL OF MATERIALS

The following pages contain the TPS65281-1EVM schematic and bill of materials.

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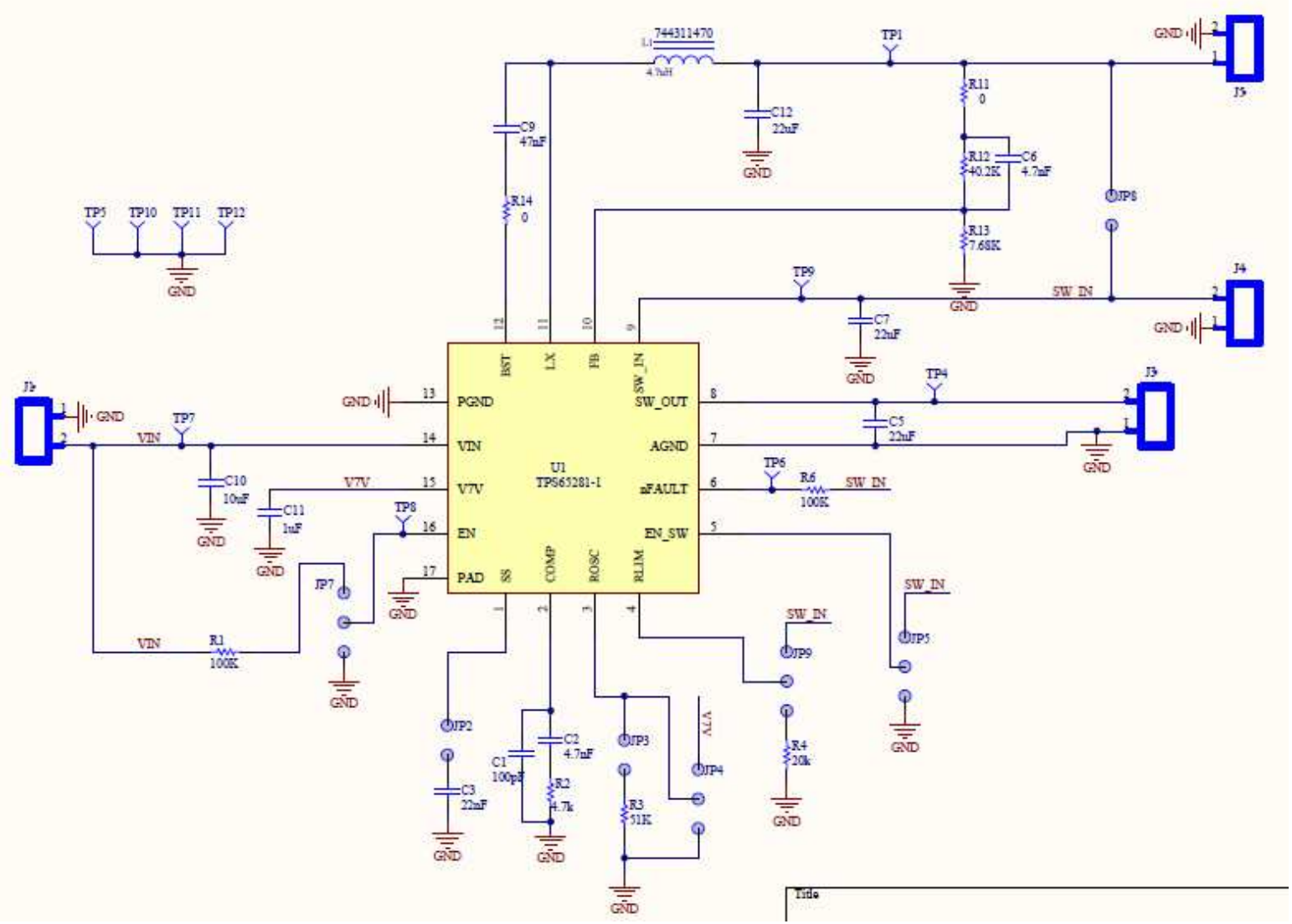


Figure 7. TPS65281-1EVM Schematic

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Table 4. TPS65281-1EVM Bill of Materials

Item No.	Qty	Designator	Footprint	Value	Manufacturer	Part No.	Description	Comment
1	0	C1	603	100pF				Do Not Install
2	2	C2, C6	603	4.7nF	Generic		CAP 4700PF 50V CERAMIC X7R 0603	
3	1	C3	603	22nF	Generic		CAP 22000PF 50V CERAMIC X7R 0603	
4	3	C5, C7, C12	1210	22uF	Generic		CAP CERAMIC 22UF 25V X5R 1210	
5	1	C9	603	47nF	Generic		CAP 47000PF 50V CERM Y5V 0603	
6	1	C10	1210	10uF	Generic		CAP CERAMIC 10UF 25V X5R 1210	
7	1	C11	603	1uF	Generic		CAP CERAMIC 1UF 25V X5R 0603	
8	4	J1, J3, J4, J5	OUT	ED555/2DS	OnShore Technology Inc	ED555/2DS	Terminal Block, 2-pin, 6-A, 3.5mm	
9(1)	3	JP2, JP3, JP8	JMP0.2	JUMPER 2 PIN	Mil-Max	800-10-064-10-001000	Two Pin Jumper	Break SIPs into groups of 2
10(2)	4	JP4, JP5, JP7, JP9	JMP0.3	JUMPER 3 PIN	Mil-Max	800-10-064-10-001000	Three Pin Jumper	Break SIPs into groups of 3
11	1	L1	IND	4.7uH	Wurth Electronics Inc	744311470	Magnetic-Core Inductor	
12	2	R1, R6	603	100K	Generic		RES 100k OHM 1/10W 1% 0603 SMD	
13	1	R2	603	10K	Generic		RES 10k OHM 1/10W 1% 0603 SMD	
14	1	R3	603	51K	Generic		RES 51k OHM 1/10W 1% 0603 SMD	
15	1	R4	603	20k	Generic		RES 20k OHM 1/10W 1% 0603 SMD	
16	2	R11, R14	603	0	Generic		RES 0 OHM 1/10W 1% 0603 SMD	
17	1	R12	603	40.2K	Generic		RES 40.2K OHM 1/10W 1% 0603 SMD	
18	1	R13	603	7.68K	Generic		RES 7.68K OHM 1/10W 1% 0603 SMD	
19	6	TP1, TP4, TP6, TP7, TP8, TP9	TP	Test Point White	Keystone	5002	TEST POINT PC MINI .040"D WHITE	
20	4	TP5, TP10, TP11, TP12	TP	Test Point Black	Keystone	5001	TEST POINT PC MINI .040"D BLACK	
21(3)	2						Jumper, 2.54mm, open top, Applied on , JP5 and JP8	
22(4)	4				3M	SJ-5303 (CLEAR)	BUMPON HEMISPHERE .44X.20 CLEAR	
23	1	U1	RGV16		TI	TPS65281-1		

(1) Item 9: split into 2 pins.
(2) Item 10: split into 3 pins.
(3) Install item 21 on JP5 and JP8.
(4) Install item 22 on bottom at corners.

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REVISION HISTORY

Changes from Original (December 2012) to A Revision	Page
• Changed schematic	8

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

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For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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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This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM’s electronic components and packing materials.

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