EVM User's Guide: ISOW6441DWEEVM

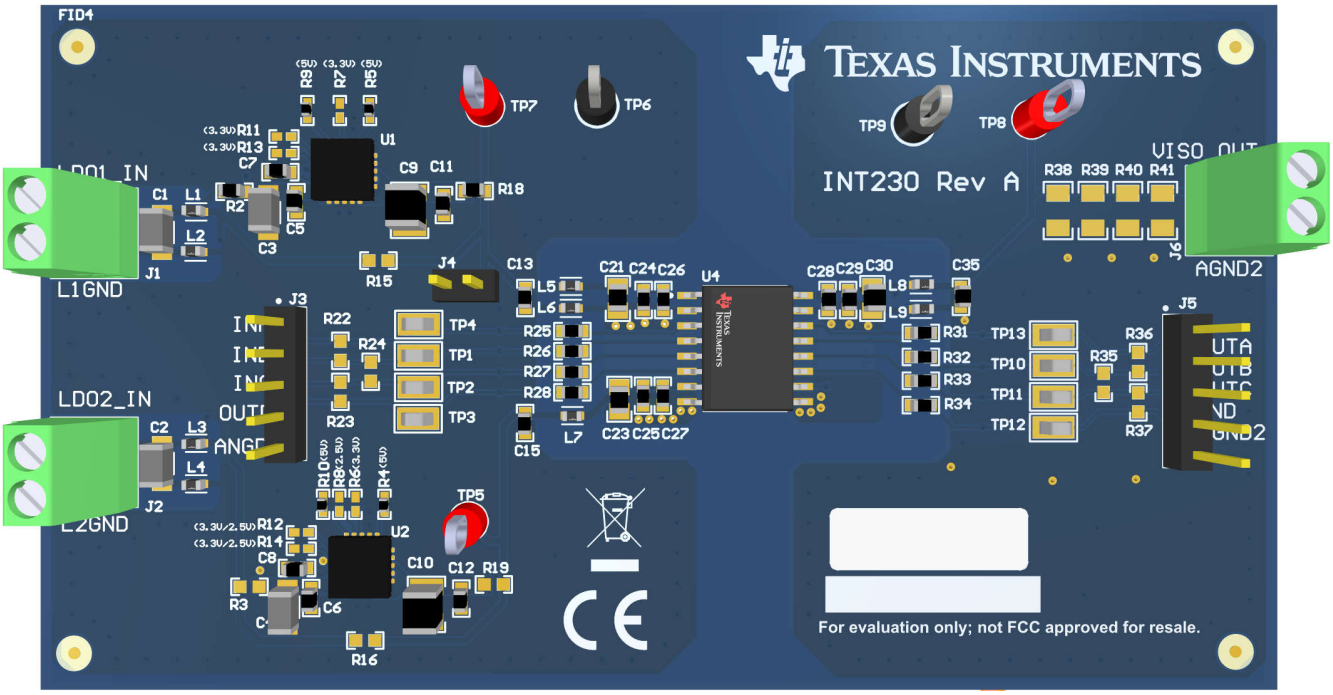
ISOW6441 Quad-Channel Digital Isolator With Integrated DC-DC Converter Evaluation Module

Description

The ISOW644x family of devices are galvanically isolated quad-channel digital isolator with an integrated high-efficiency power converter with best in class emissions. The integrated DC-DC converter provides up to 550mW of isolated power. This EVM lets designers evaluate device performance for fast development and analysis of isolated systems. The EVM supports evaluation of any of the quad-channel device variants of the ISOW644x family in a 16-pin WB SOIC package (DWE-16).

Features

- Platform for complete evaluation of ISOW644x family of devices.
- On-board LDOs which provide configurable voltage output for device supply.
- Two separate configurable LDOs for VDD pin and VDDL pin(VDDL for ISOW644xV variant only).
- On-board oscillator option for dynamic data input to input channels on primary side.
- Test points for probing data lines and supply voltage.
- VISO voltage configurable to 5V and 3.3V using SEL pin.
- Other resistor and jumper options to configure data rate and device supply voltages.



ISOW6441DWEEVM

1 Evaluation Module Overview

1.1 Introduction

The ISOW6441DWEEVM user's guide describes the functionality of the ISOW6441 quad-channel digital isolator with integrated DC-DC converter. This user's guide describes EVM operation for ISOW6441 device under VDD=5V and VISO=5V operation. However, the EVM can be reconfigured for evaluation of any of quad-channel device variants of ISOW644x family in a 16-pin WB SOIC package (DWE-16) under any voltage conditions. This guide also describes the EVM BOM, EVM schematic, EVM PCB layout, and typical laboratory setup.

CAUTION

This evaluation module is made available for isolator parameter performance evaluation only and is not intended for isolation voltage testing. To prevent damage to the EVM, any voltage applied as a supply or digital input/output must be maintained within the recommended operating conditions of the device.

1.2 Kit Contents

This evaluation module contains one PCB evaluation board containing one ISOW6441 device. The major components of the ISOW6441 evaluation board are:

- ISOW6441DWER quad-channel digital isolator with integrated power.
- TPS7A4701RGWR 36V, 1A, 4.17μVRMS, RF Low-Dropout (LDO) Voltage Regulator, RGW0020A (VQFN-20).
- Multiple test points.

To demonstrate functionality of the ISOW6441DWER, TI recommends the following (not included):

- 9V or 12V Battery for supply inputs.
- Signal generator for external dynamic data input
- Oscilloscope for probing data channels

1.3 Specification

The EVM enables a user to evaluate ISOW6441 device thoroughly before incorporating the device into a design. To facilitate the EVM to be powered from various power sources including regulated power supplies, standard DC adapters and batteries, EVM includes two adjustable output LDOs (TPS7A4701) that are connected to VDD and VDDL pins (VDDL only for 'V' variant) where for ISOW6441, only VDD is connected by default on the EVM. This allows the LDO inputs to be connected to a wider range of supply voltages and the optimum voltage for normal operation of the EVM is between 9V to 12V. The EVM also includes an onboard oscillator (LTC6908-1) that can be connected to the inputs of ISOW6441 through 0Ω resistors. The oscillator helps to provide a quick test signal to verify device operation. The EVM can be configured to operate in various power supply voltages and test configurations the details of which are provided in following sections.

1.4 Device Information

The ISOW644x family of devices are galvanically isolated quad-channel digital isolator with an integrated high-efficiency power converter with best in class emissions. The integrated DC-DC converter provides up to 550mW of isolated power, eliminating the need for a separate isolated power supply in space-constrained isolated designs. The high-efficiency of the power converter allows for operation at a wide operating ambient temperature range of –55°C to 125°C. The ISOW644x has been designed with enhanced protection features in mind, including soft-start to limit inrush current, over-voltage and under-voltage lock out, overload and short-circuit protection, and thermal shutdown.

If the input signal is lost, the default output is high for the ISOW644x devices without the F suffix and low for the ISOW644x devices with the F suffix. ISOW644xV can operate with different supply voltages on VDDL and VDD pins. These devices support 2.25V to 5.5V logic supply on VDDL pin, that can be independent from the power converter supply (VDD) of 3V to 5.5V

2 Hardware

2.1 Pin Configuration of the ISOW6441 Quad-Channel Digital Isolator With Integrated DC-DC Converter

Figure 2-1 and Figure 2-2 shows the ISOW6441 and ISOW6441V Quad-Channel Digital Isolator with Integrated DC-DC Converter pin configuration respectively. The V variant has Pin7 as VDDL which enables user to select primary side logic supply voltage. For non-V variant, logic supply is same as VDD.

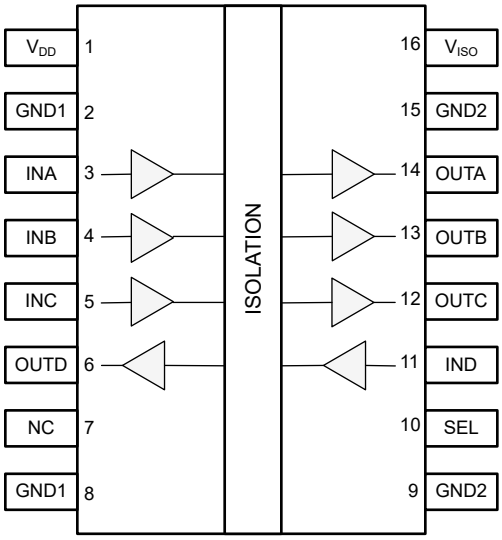


Figure 2-1. ISOW6441 Quad-Channel Digital Isolator With Integrated DC-DC Converter Pin Configuration

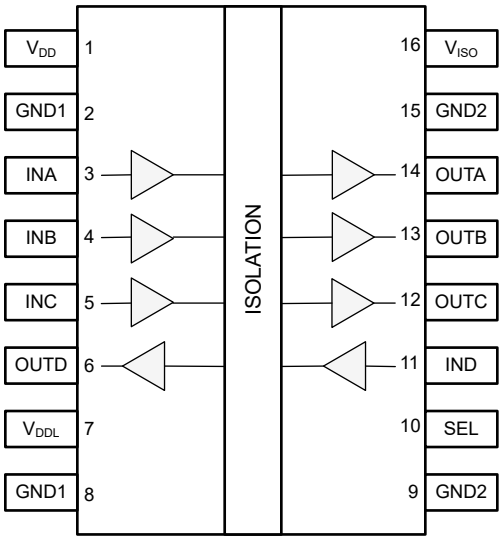


Figure 2-2. ISOW6441V Quad-Channel Digital Isolator With Integrated DC-DC Converter Pin Configuration

2.2 EVM Setup and Operation

2.2.1 EVM Setup

This section describes the typical setup and operation of the EVM for device evaluation. Figure 2-3 shows a typical test configuration for operating the ISOW6441DWEEVM using two power supplies. VDDL

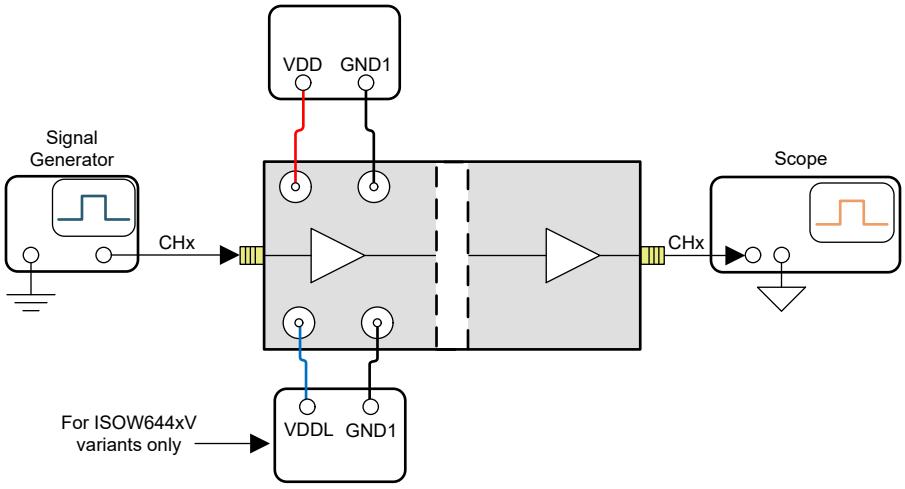


Figure 2-3. Typical EVM Test Setup

ISOW6441DWEEVM has many DNP resistors which can be populated or unpopulated to setup the EVM to desired operating test conditions. Table 2-1 lists and describes all the possible test configurations that can be achieved by populating various resistors and jumper options.

Table 2-1. Component Configurations

Component	Description
R1	The pin connects LDOs U1, U2 inputs together allowing only one power supply to be used instead of two power supplies.
R2, R15, R18	Populating R15 bypasses LDO U1 allowing VDD to be powered directly from external power supply. When R15 is populated, R2 and R18 needs to be unpopulated to disconnect the LDO. When LDO is not bypassed, the recommended input voltage to LDO must be between 9V and 12V
R5, R7, R9, R11, R13	Sets LDO U1 output voltage to 5V or 3.3V for VDD. Populate only R5 and R9 with 0Ω resistors to set LDO U1 output voltage to 5V (Default Configuration). Populate only R7, R11 and R13 with 0Ω resistors to set LDO U1 output voltage to 3.3V.
R3, R16, R19	To be used for 'V' variant devices only. Populating R16 bypasses LDO U2 allowing VDDL to be powered directly from external power supply. When R16 is populated, R3 and R19 needs to be unpopulated to disconnect the LDO. When LDO is not bypassed, the recommended input voltage to LDO must be between 9V and 12V.
R4, R6, R8, R10, R12, R14	To be used for 'V' variant devices only. Sets LDO U2 output voltage to 5V or 3.3V or 2.5V for VDDL. Populate only R4 and R10 with 0Ω resistors to set LDO U2 output voltage to 5V (Default Configuration). Populate only R6, R12 and R14 with 0Ω resistors to set LDO U2 output voltage to 3.3V. Populate only R8, R12 and R14 with 0Ω resistors to set LDO U2 output voltage to 2.5V.
R22, R23, R24	These resistors allow one input signal connection to multiple input channels.
R17	The pin connects oscillator U3 output signal to U4 inputs allowing EVM to be tested using a test signal without needing any external test signal input.
R20, R21	Populating only R20 sets U3 output signal frequency to 2.5MHz (5Mbps) and populating both R20 and R21 sets the frequency to 5MHz (10Mbps).
R35, R36, R37	These resistors allow one output signal connection to multiple input channels.
R29, R30	Populating R29 sets VISO to 5V and populating R30 sets the pin to 3.3V. Only one of the two resistors needs to be populated.
R38, R39, R40, R41	One or more of these resistors can be populated to facilitate external load to VISO.
C16, C17, C19, C14	Optional capacitors for noise filtering on data lines of primary side.
C33. C31, C32, C34	Optional capacitors for noise filtering on data lines of secondary side.
J4	Jumper option to power ON or OFF the U3 oscillator.

3 Hardware Design Files

3.1 Schematics

The ISOW6441DWEEVM is designed to accommodate any of the ISOW644x quad-channel devices in a 16-pin WB SOIC package (DWE-16). To evaluate any of the ISOW644x quad-channel devices in a 16-pin WB SOIC package (DWE-16), replace ISOW6441 with the device of interest on the ISOW6441DWEEVM board. No other component requires any modification for channel variants. To evaluate any of the ISOW644xV devices, Pin7(VDDL) needs to be connected to a supply voltage for which there are many options provided for user's flexibility Figure 3-1 shows the ISOW6441DWEEVM schematic.

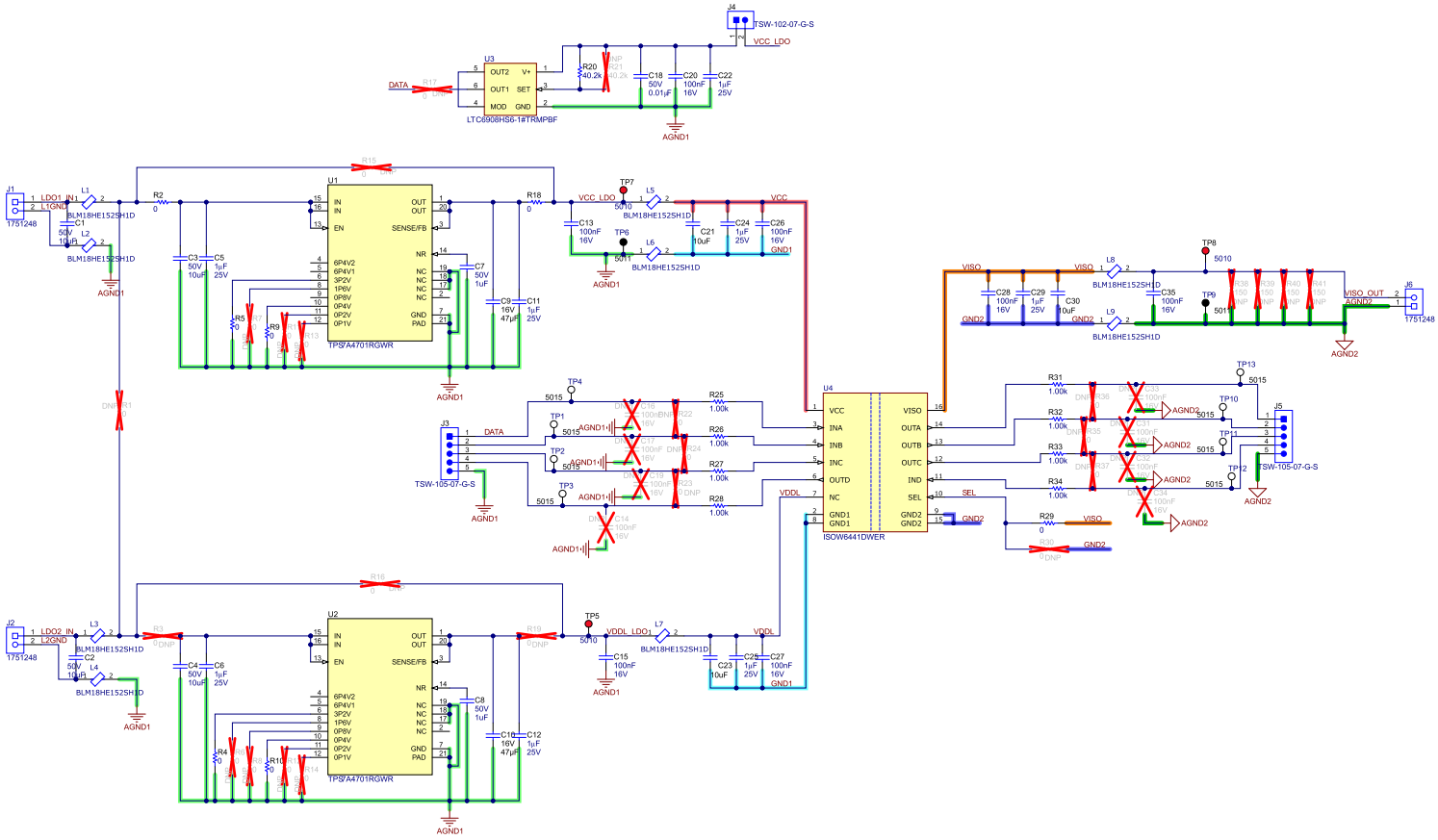


Figure 3-1. ISOW6441DWEEVM Schematic

3.2 PCB Layout and 3D Diagram

Figure 3-2 and Figure 3-3 show the printed-circuit board (PCB) layout top and bottom layers, respectively, and Figure 3-4 shows a 3D diagram of the PCB indicating how a finished board looks like.

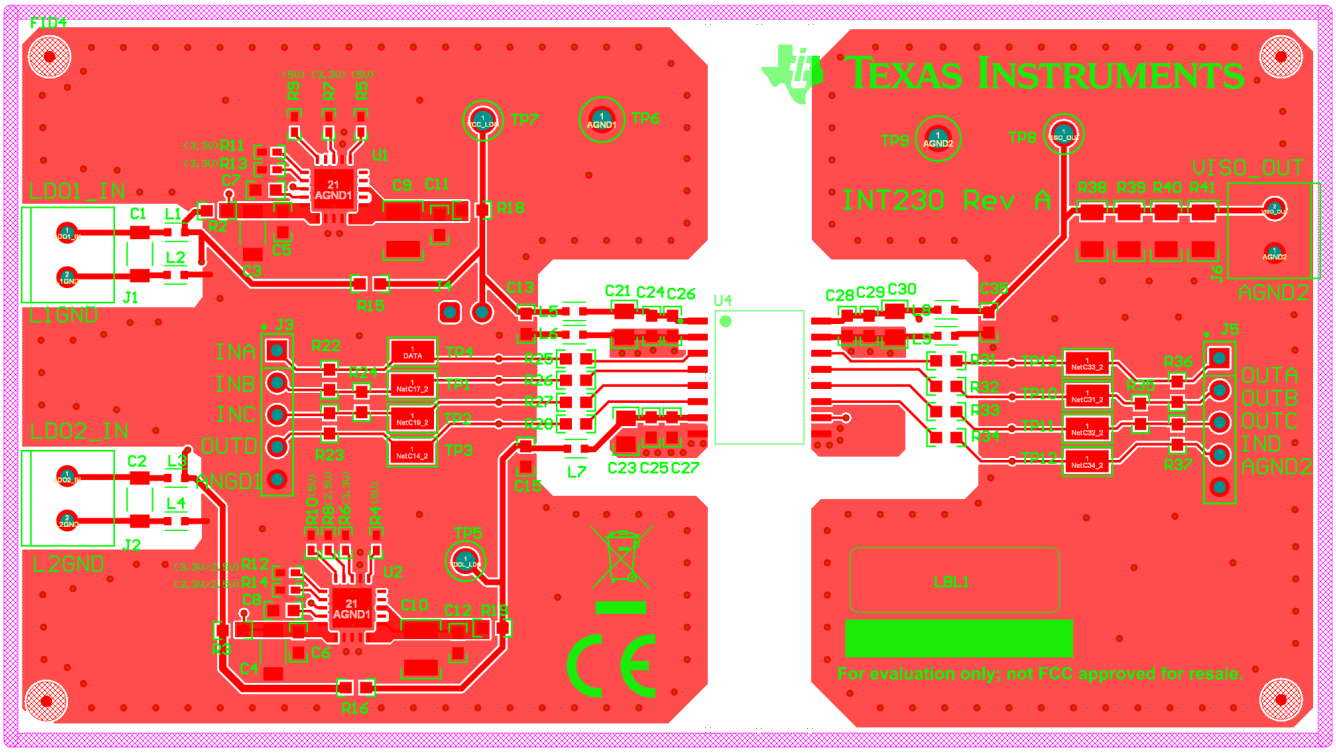


Figure 3-2. ISOW6441DWEEVM PCB Layout - Top

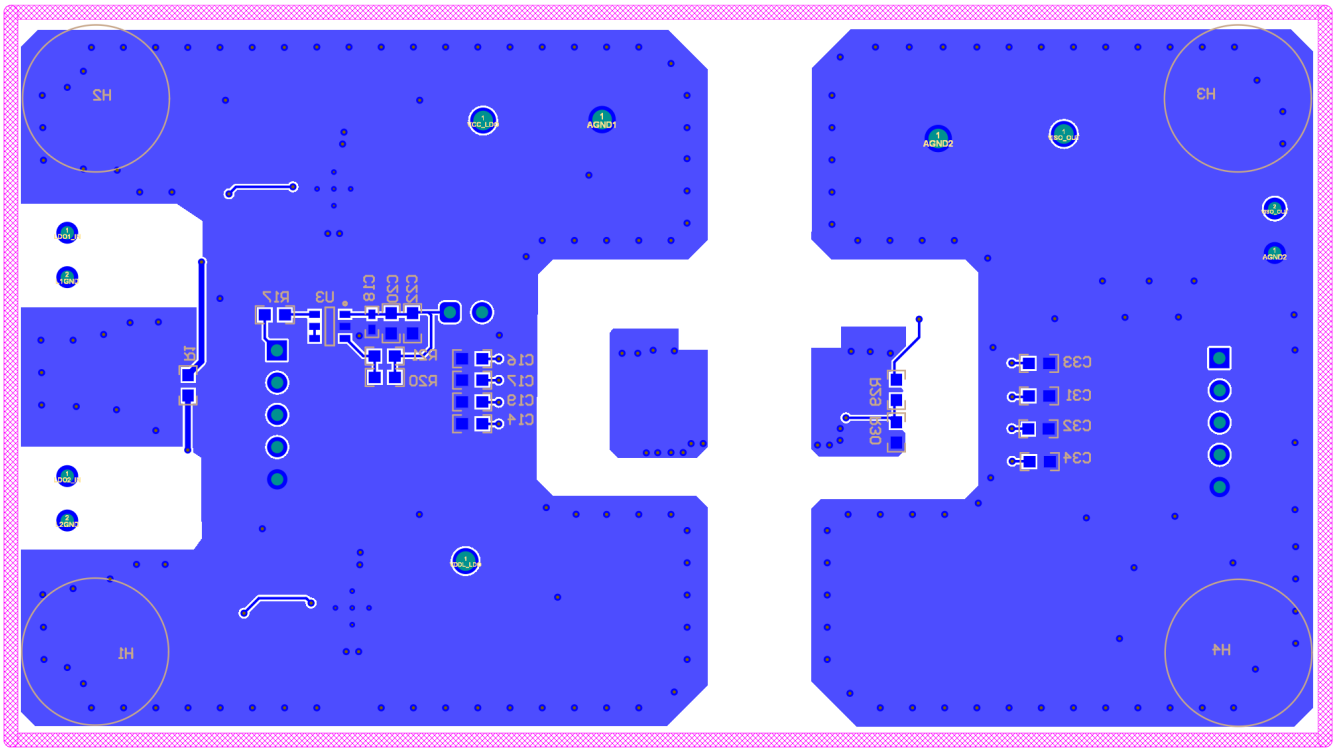


Figure 3-3. ISOW6441DWEEVM PCB Layout - Bottom

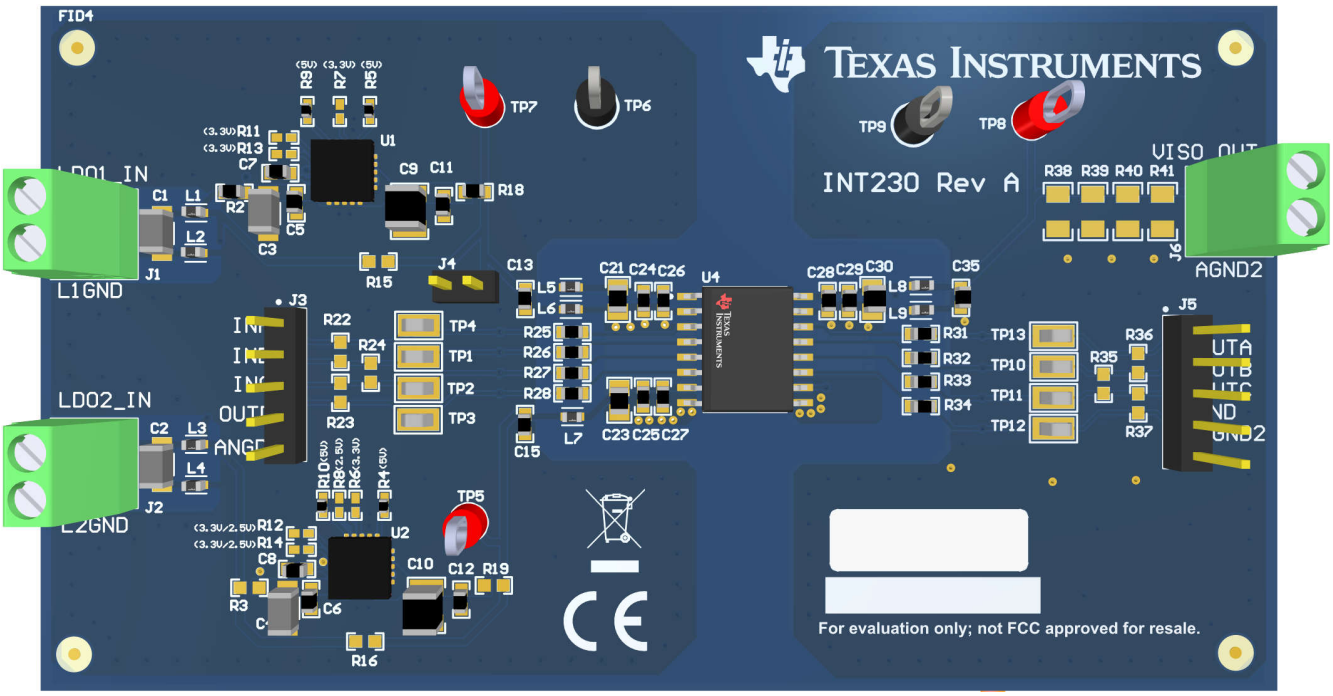


Figure 3-4. ISOW6441DWEEVM PCB 3D Diagram

3.3 Bill of Materials (BOM)

Table 3-1 lists the bill of materials (BOM) for this EVM.

Table 3-1. Bill of Materials

Item	Designator	Description	Manufacturer	Part Number
1	C1, C2, C3, C4	CAP, CERM, 10uF, 50V, +/- 10%, X5R, 1206	TDK	C3216X5R1H106K160AB
2	C5, C6, C11, C12, C22, C24, C25, C29	CAP, CERM, 1uF, 25V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	MuRata	GCM188R71E105KA64D
3	C7, C8	CAP, CERM, 1uF, 50V, +/- 10%, X5R, 0603	TDK	C1608X5R1H105K080AB
4	C9, C10	CAP, CERM, 47 µF, 16V,+/- 10%, X5R, 1210	Samsung Electro-Mechanics	CL32A476KOJNNNE
5	C13, C15, C20, C26, C27, C28, C35	CAP, CERM, 0.1uF, 16V, +/- 10%, X7R, 0603	Samsung Electro-Mechanics	CL10B104KO8NNNC
6	C18	CAP, CERM, 0.01 µF, 50V,+/- 10%, X7R, 0402	Walsin	0402B103K500CT
7	C21, C23, C30	CAP, CERM, 10uF, 35V, +/- 10%, X5R, 0805	MuRata	GRM21BR6YA106KE43L
8	H1, H2, H3, H4	Bumpon, Hemisphere, 0.44X 0.20, Clear	3M	SJ-5303 (CLEAR)
9	J1, J2, J6	Conn Term Block, 2POS, 3.5mm, TH	Phoenix Contact	1751248
10	J3, J5	Header, 100mil, 5x1, Gold, TH	Samtec	TSW-105-07G-S
11	J4	Header, 100mil, 2x1, Gold, TH	Samtec	TSW-102-07G-S
12	L1, L2, L3, L4, L5, L6, L7, L8, L9	Chip Ferrite Bead, 0603, 1500Ω @ 100MHz, 0.5Ω, 25%, 500mA	Murata	BLM18HE152SH1D
13	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10
14	R2, R18, R29	RES, 0, 5%, 0.1W, 0603	Yageo	RC0603JR-070RL
15	R4, R5, R9, R10	RES, 0, 5%, 0.063W, 0402	Vishay-Dale	CRCW04020000Z0ED
16	R20	RES, 40.2k, 1%, 0.1W, 0603	Yageo	RC0603FR-0740K2L
17	R25, R26, R27, R28, R31, R32, R33, R34	RES, 1.00k, 1%, 0.1W, 0603	Yageo	RC0603FR-071KL

Table 3-1. Bill of Materials (continued)

Item	Designator	Description	Manufacturer	Part Number
18	TP1, TP2, TP3, TP4, TP10, TP11, TP12, TP13	Test Point, Miniature, SMT	Keystone	5015
19	TP5, TP7, TP8	Test Point, Red, Through Hole, RoHS, Bulk	Keystone	5010
20	TP6, TP9	Test Point, Multipurpose, Black, TH	Keystone	5011
21	U1, U2	36V, 1A, 4.17µVRMS, RF Low-Dropout (LDO) Voltage Regulator, RGW0020A (VQFN-20)	Texas Instruments	TPS7A4701RGWR
22	U3	Resistor Set SOT-23 Oscillator, 2.7 to 5.5V, 6-pin SOT23 (S6-6), -40 to 85 degC, Pb-Free	Linear Technology	LTC6908HS6-1#TRMPBF
23	U4	ISOW6441DWER	Texas Instruments	ISOW6441DWER
24	C14, C16, C17, C19, C31, C32, C33, C34	CAP, CERM, 0.1uF, 16V, +/- 10%, X7R, 0603	Samsung Electro-Mechanics	CL10B104KO8NNNC
25	R1, R3, R15, R16, R17, R19, R22, R23, R24, R30, R35, R36, R37	RES, 0, 5%, 0.1W, 0603	Yageo	RC0603JR-070RL
26	R6, R7, R8, R11, R12, R13, R14	RES, 0, 5%, 0.063W, 0402	Vishay-Dale	CRCW04020000Z0ED
27	R21	RES, 40.2k, 1%, 0.1W, 0603	Yageo	RC0603FR-0740K2L
28	R38, R39, R40, R41	RES, 0, 5%, 0.25W, 1206	Yageo America	RC1206JR-070RL

4 Additional Information

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   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

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.

FCC Interference Statement for Class B EVM devices

NOTE: 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.*

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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

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1. Use EVMs 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 EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

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.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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