User's Guide

ISOW1044 Isolated CAN Transceiver with Integrated DC-DC Converter Evaluation Module

ABSTRACT

This user's guide describes the ISOW1044 isolated CAN transceiver with integrated DC-DC converter evaluation module (EVM). This EVM lets designers evaluate device performance for fast development and analysis of isolated systems. The EVM supports evaluation of the isolated CAN transceiver with integrated DC-DC converter ISOW1044 family in a 20-pin WB SOIC package (DFM-20).

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 supply to LDO inputs must be maintained within 0 V to 12 V range and any voltage applied to device supply or data input pins must be maintained within 0 V to 5.5 V range as specified in datasheet section "Recommonded Operating Conditions".

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1 Introduction

This user's guide describes EVM operation with respect to the ISOW1044 isolated CAN transceiver with integrated DC-DC converter in 20-pin WB SOIC package (DFM-20). This user guide also includes the EVM BoM, EVM schematic, EVM PCB layout, and typical laboratory setup.

2 Overview

The ISOW1044 device is a galvanically-isolated controller area network (CAN) transceiver with a built-in isolated DC-DC converter that meets the specifications of the ISO11898-2 (2016) standard. This device offers ±58 V DC bus fault protection and ±12 V common-mode voltage range. The device supports CAN FD data rates allowing much faster transfer of payload compared to classic CAN. Both signal and power paths are 5 kV_{RMS} isolated per UL1577 and are qualified for reinforced isolation per VDE, CSA and CQC. The bus pins of these devices can endure up to 8 kV of IEC 61000-4-2 electrostatic discharge (ESD). The low-emissions, isolated DC-DC converter ensures the final system is capable of meeting CISPR 32 radiated emissions Class B limit lines with just two ferrite beads and with simple layout on a two-layer PCB. The device can operate from a single supply voltage of 4.5 V to 5.5 V by connecting V_{IO} and V_{DD} together on PCB. If lower logic levels are required, these devices support 1.71 V to 5.5 V logic supply (V_{IO}) that can be independent from the power converter supply (V_{DD}) of 4.5 V to 5.5 V. This device supports a wide operating ambient temperature range from –40°C to +125°C and are available in 20-pin DFM (SOIC-20 footprint compatible package) offering a minimum of 8-mm creepage and clearance.

The EVM enables a user to evaluate ISOW1044 device thoroughly before incorporating the device into their design. To facilitate the EVM to be powered from various power sources including regulated power supplies, standard DC adaptors and batteries, EVM includes two adjustable output LDOs (LM317M) that are connected to V_{IO} and V_{DD} pins of ISOW1044. 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 9 V to 12 V. The EVM also includes an on-board oscillator (LTC6908-1) that can be connected to the input pins (TXD and IN) of ISOW1044 through 0 Ω 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.

The EVM can be used to verify many of ISOW1044 datasheet parameters like input threshold voltages, current consumption and others. Some of the datasheet specifications require a different test setup configuration with necessary terminations than the ISOW1044DFMEVM and hence, they might not be verifiable from the EVM as-is. The example parameters include propagation delay and other timing specifications.

3 Pin Configuration of the ISOW1044 Isolated CAN Transceiver with Integrated DC-DC Converter

Figure 3-1 shows the ISOW1044 Isolated CAN Transceiver with Integrated DC-DC Converter pin configuration.

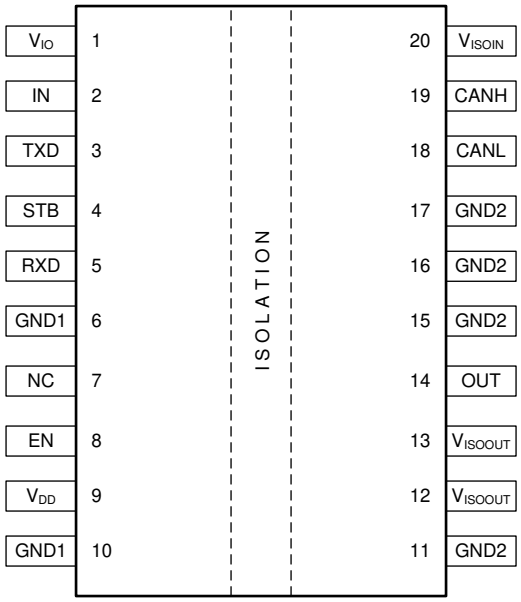

Figure 3-1. ISOW1044 Isolated CAN Transceiver with Integrated DC-DC Converter Pin Configuration

4 EVM Setup and Operation

This section describes the typical test setup and operation of the EVM for device evaluation. Figure 4-1 shows a typical test configuration for operating the ISOW1044DFMEVM using two power supplies.

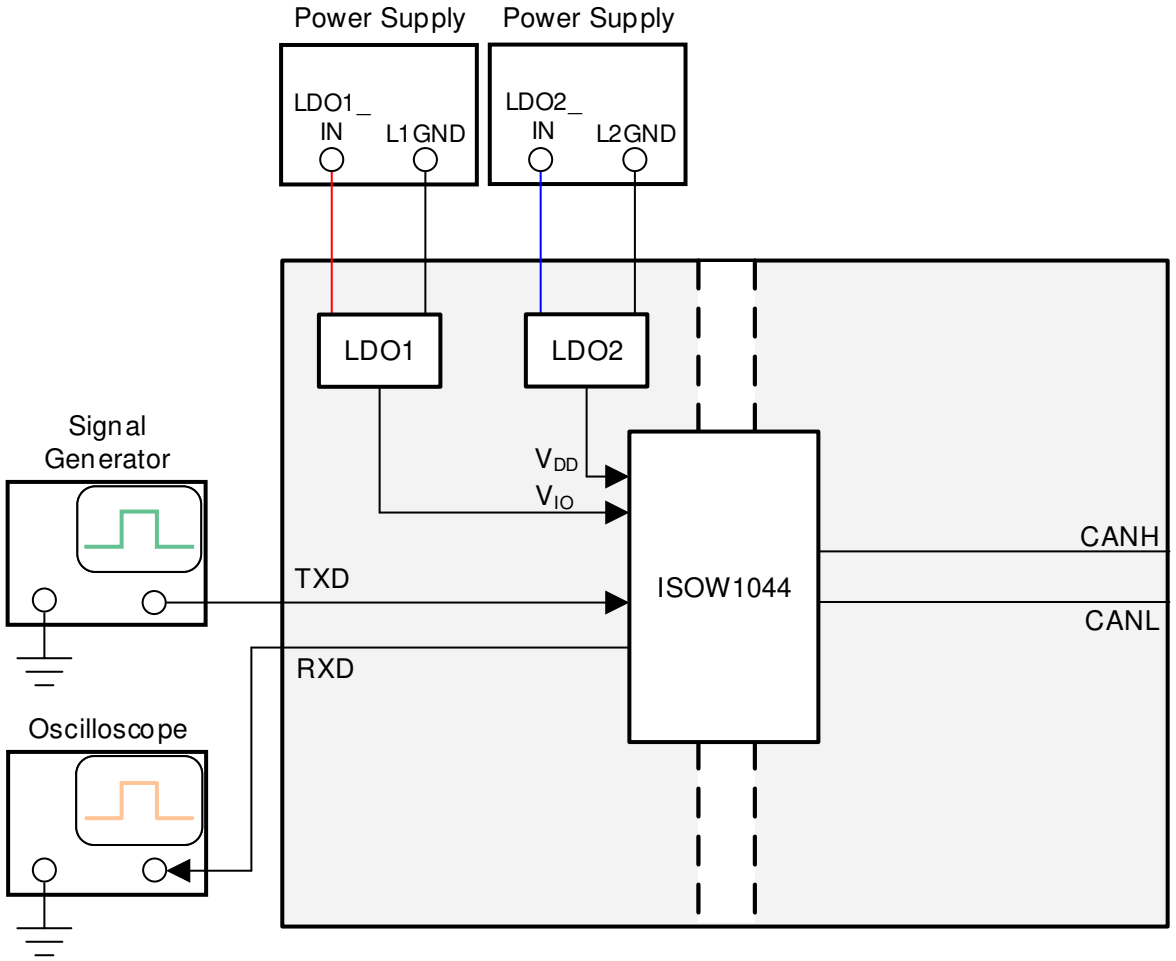

Figure 4-1. Typical EVM Test Setup

ISOW1044DFMEVM has many DNP resistors which can be populated or unpopulated to setup the EVM to desired operating test conditions. Table 4-1 lists and describes all the possible test configurations that can be acheived by populating jumpers, resistors or other components.

Table 4-1. Jumper, Reseistor and other Test Configurations

Resistor	Description
J3 [5:6]	Populating a jumper on pins 5 and 6 of connector J3 will connect STB pin to V_{IO} and pull it HIGH thereby making the device go to standby mode. Depopulating the jumper or leaving the pins 5 and 6 of J3 OPEN will keep device in active mode.
J3 [9:10]	Populating a jumper on pins 9 and 10 of connector J3 will connect EN pin to GND and pull it LOW thereby disabling the DC-DC converter and all the circuit powered by the DC-DC converter. Depopulating the jumper or leaving the pins 5 and 6 of J3 OPEN will keep the DC-DC converter enabled and operating.
R1	It connects LDOs U1, U2 inputs together allowing only one power supply to be used instead of two power supplies.
R2, R5, R6, R9	Sets LDO U2 output voltage to 5 V, 3.3 V, 2.5 V or 1.8 V, respectively. Only one of the four resistors needs to be populated.
L1, L2, L5	Either ferrtie beads (L1 & L5, default) or common-mode choke (L2, ACT45B-510-2P-TL003) can be populated to test the EVM for EMC, especially for radiated emissions. Both ferrite beads and common-mode choke should not be populated at the same time.
R10, R3, R14	Populating R10 bypasses LDO U1 allowing V_{DD} to be powered directly from external power supply. When R10 is populated, R3 and R14 need to be unpopulated to disconnect the LDO. When LDO is not bypassed, the recommended input voltage to LDO should be between 9 V and 12 V.

Table 4-1. Jumper, Reseistor and other Test Configurations (continued)

Resistor	Description
R12, R4, R15	Populating R12 bypasses LDO U2 allowing V_{IO} to be powered directly from external power supply. When R12 is populated, R4 and R15 need to be unpopulated to disconnect the LDO. When LDO is not bypassed, the recommended input voltage to LDO should be between 9 V and 12 V.
R13	This resistor connects TXD pin to IN pin allowing only one external input signal to be applied to both channels.
R21	It connects oscillator U3 output signal to U4 TXD input allowing EVM to be tested using a test signal without needing any external test signal input.
R23	Default resistance value of 200 kΩ on R23 sets U3 output signal frequency to 0.5 MHz (1 Mbps) and changing this default value to 40 kΩ sets the output signal frequency to 2.5 MHz (5 Mbps).
L11, R28, R29	Provision for common-mode choke (L11, ACT45B-510-2P-TL003) has been provided to allow some EMC testing and evaluation, like radiated emissions testing. When L11 is populated, R28 and R29 should be depopulated.
R30, R31, R32, C21	R30 is a single termination resistor while R31 and R32 provide split termination along with C21 that filters unwanted high frequency noise. Either R30 alone or R31, R32 & C21 should be populated at any point of time.
C22, C23	These capacitors can be populated for additional noise filtering.
D1	D1 (PESD2CAN, 215) can be populated to provide additional EMC protection to CAN bus of device ISOW1044
R33	This resistor can be populated to facilate additional external load to V_{ISOOUT} other than the loading by CAN bus.

5 EVM Schematic

Figure 5-1 shows the ISOW1044DFMEVM schematic.

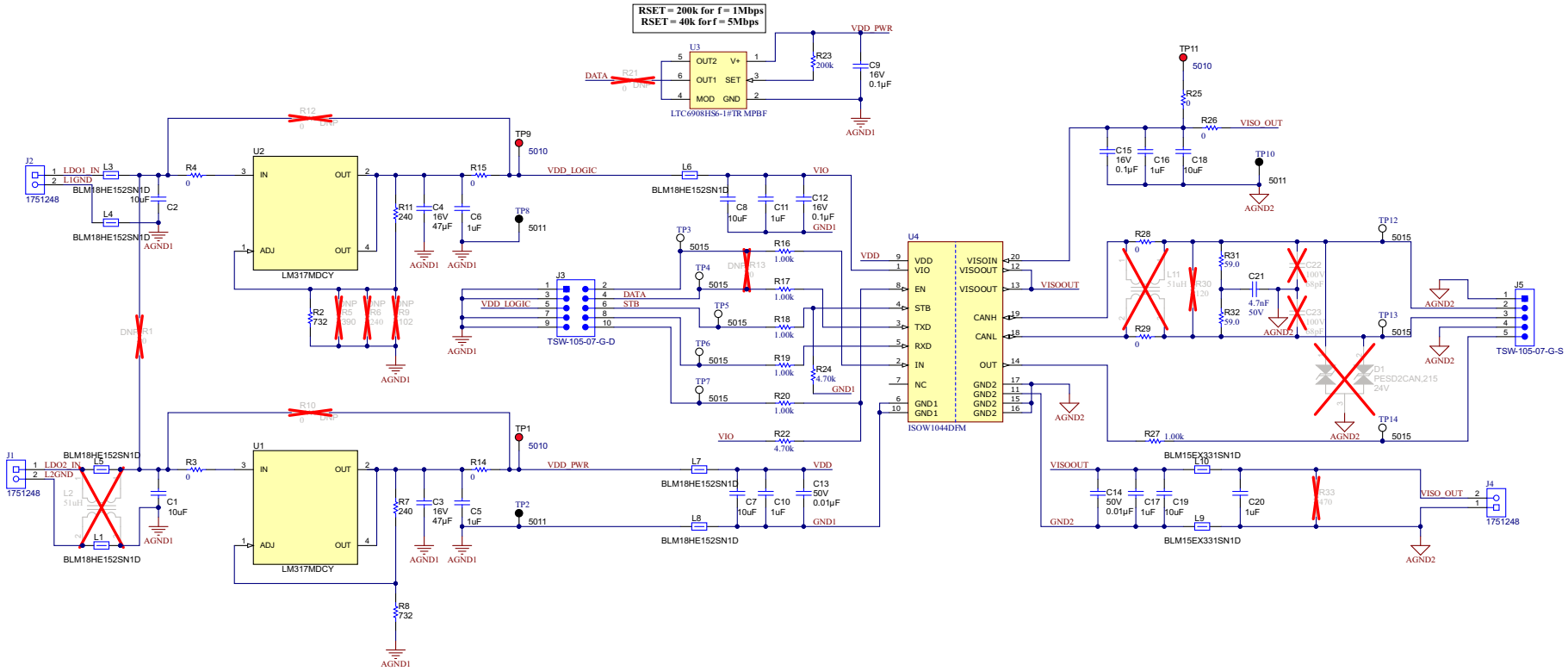

Figure 5-1. ISOW1044DFMEVM Schematic

6 PCB Layout and 3D Diagram

Figure 6-1 and Figure 6-2 show the printed-circuit board (PCB) layout top and bottom layers, respectively, and Figure 6-3 shows a 3D diagram of the PCB indicating how a finished board will look.

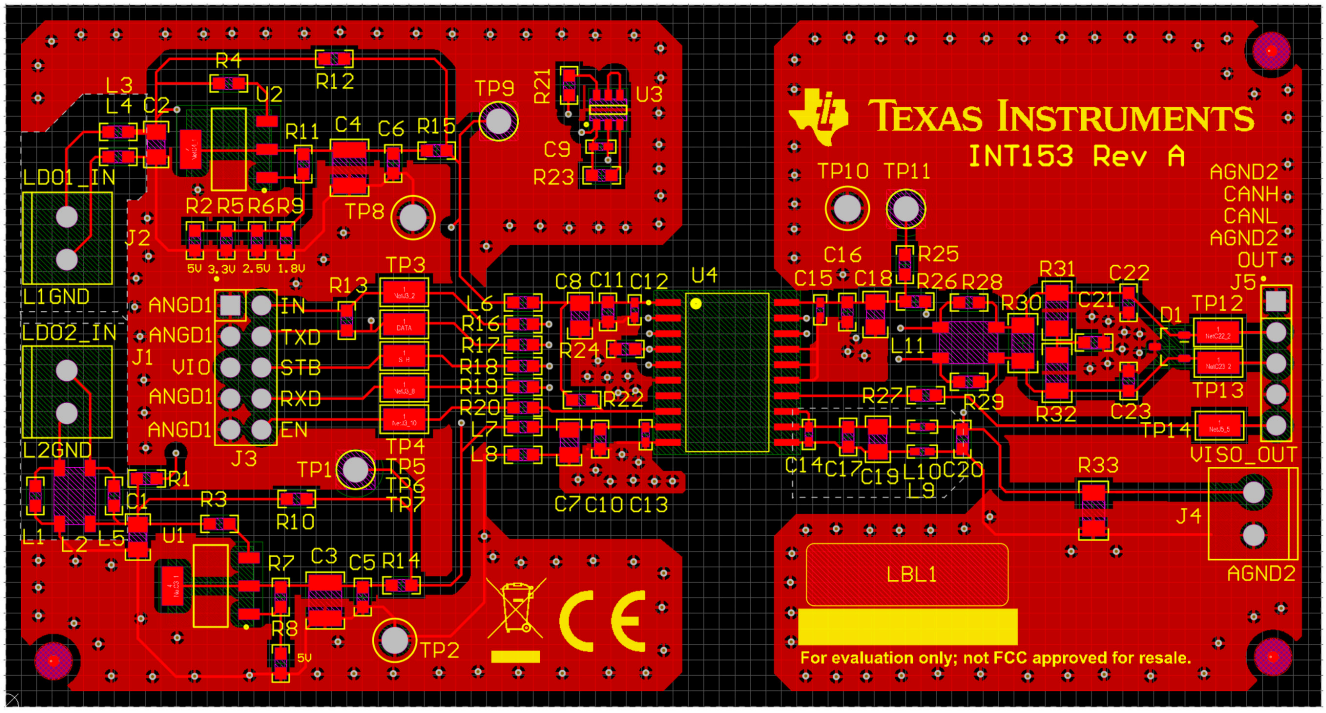

Figure 6-1. ISOW1044DFMEVM PCB Layout - Top Layer

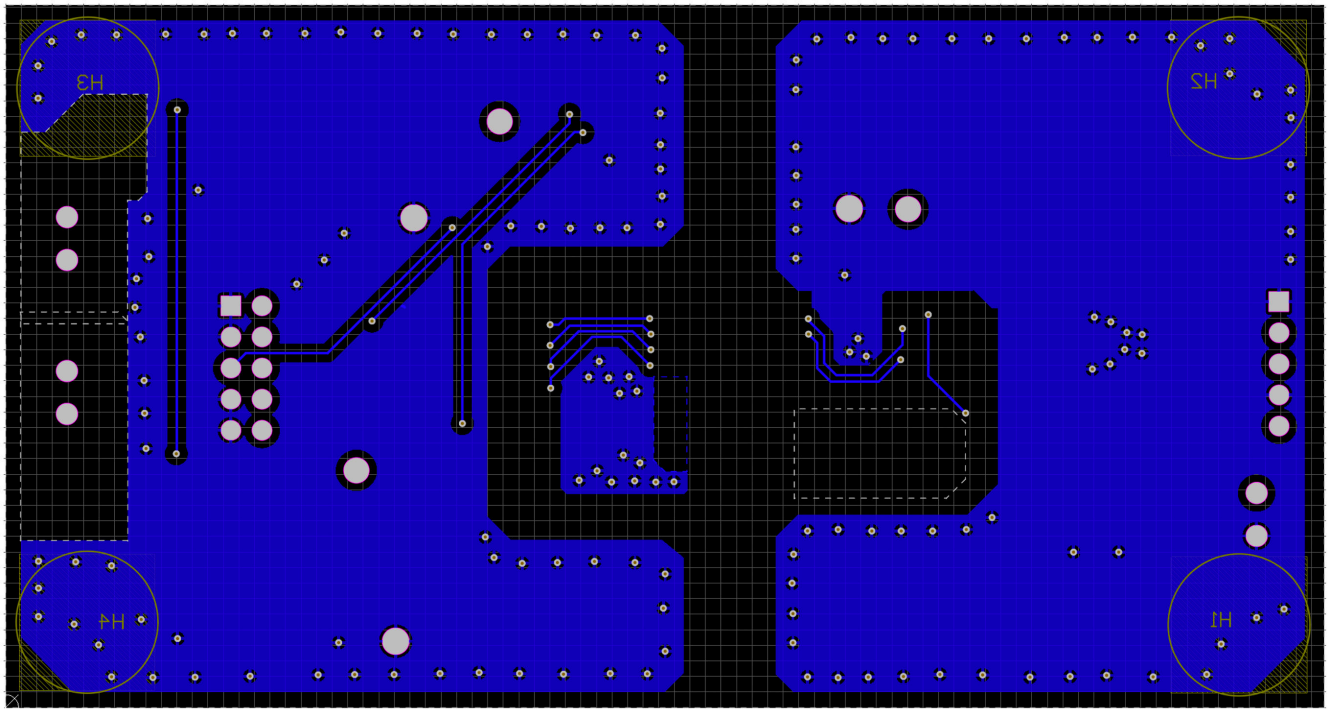

Figure 6-2. ISOW1044DFMEVM PCB Layout - Bottom Layer

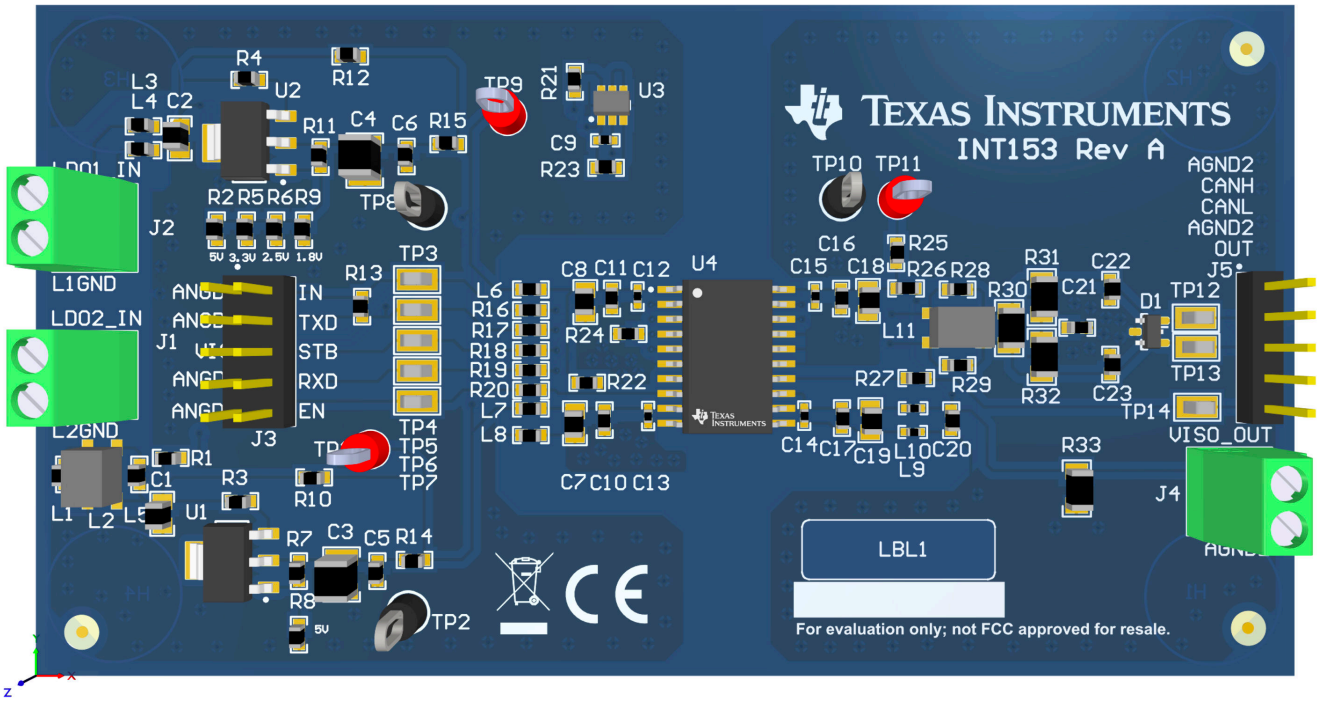

Figure 6-3. ISOW1044DFMEVM PCB 3D Diagram

7 Bill of Materials

Table 7-1 lists the bill of materials (BOM) for this EVM.

Table 7-1. Bill of Materials

Item	Designator	Description	Manufacturer	PartNumber	Quantity
1	C1, C2, C7, C8, C18, C19	CAP, CERM, 10 uF, 35 V, +/- 10%, X5R, 0805	MuRata	GRM21BR6YA106KE43L	6
2	C3, C4	CAP, CERM, 47 µF, 16 V,+/- 10%, X5R, 1210	Samsung Electro-Mechanics	CL32A476KOJNNNE	2
3	C5, C6, C10, C11, C16, C17, C20	CAP, CERM, 1 uF, 50 V, +/- 10%, X5R, 0603	Samsung Electro-Mechanics	CL10A105KA8NNNC	7
4	C9, C12, C15	CAP, CERM, 0.1 µF, 16 V,+/- 10%, X7R, 0402	Walsin	CL05B104KO5NNNC	3
5	C13, C14	CAP, CERM, 0.01 µF, 50 V,+/- 10%, X7R, 0402	Walsin	0402B103K500CT	2
6	C21	CAP, CERM, 4700 pF, 50 V, +/- 10%, X7R, 0603	Kemet	C0603C472K5RACTU	1
7	H1, H2, H3, H4	Bumpon, Hemisphere, 0.44 X 0.20, Clear	3M	SJ-5303 (CLEAR)	4
8	J1, J2, J4	Conn Term Block, 2POS, 3.5mm, TH	Phoenix Contact	1751248	3
9	J3	Header, 100mil, 5x2, Gold, TH	Samtec	TSW-105-07-G-D	1
10	J5	Header, 100mil, 5x1, Gold, TH	Samtec	TSW-105-07-G-S	1
11	L1, L3, L4, L5, L6, L7, L8	Ferrite Bead, 1500 ohm @ 100 MHz, 0.5 A, 0603	MuRata	BLM18HE152SN1D	7
12	L9, L10	Ferrite Bead, 330 ohm @ 100 MHz, 1.1 A, 0402	MuRata	BLM15EX331SN1D	2
13	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10	1
14	R2, R8	RES, 732, 1%, 0.1 W, 0603	Yageo	RC0603FR-07732RL	2
15	R3, R4, R14, R15, R25, R26, R28, R29	RES, 0, 5%, 0.1 W, 0603	Yageo	RC0603JR-070RL	8
16	R7, R11	RES, 240, 1%, 0.1 W, 0603	Yageo	RC0603FR-07240RL	2
17	R16, R17, R18, R19, R20, R27	RES, 1.00 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-071KL	6
18	R22, R24	RES, 4.70 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-074K7L	2
19	R23	RES, 200 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-07200KL	1
20	R31, R32	RES, 59.0, 1%, 0.25 W, AEC-Q200 Grade 0, 1206	Vishay-Dale	CRCW120659R0FKEA	2
21	TP1, TP9, TP11	Test Point, Red, Through Hole, RoHS, Bulk	Keystone	5010	3
22	TP2, TP8, TP10	Test Point, Multipurpose, Black, TH	Keystone	5011	3
23	TP3, TP4, TP5, TP6, TP7, TP12, TP13, TP14	Test Point, Miniature, SMT	Keystone	5015	8
24	U1, U2	3/4 Pin 500mA Adjustable Positive Voltage Regulator, DCY0004A (SOT-223-4)	Texas Instruments	LM317MDCY	2
25	U3	Resistor Set SOT-23 Oscillator, 2.7 to 5.5 V, 6-pin SOT23 (S6-6), -40 to 85 degC, Pb-Free	Linear Technology	LTC6908HS6-1#TRMPBF	1
26	U4	Reinforced 5-kVRMS Isolated CAN Transceiver with Integrated lowemissions DC-DC Converter	Texas Instruments	ISOW1044DFM	1
27	C22, C23	CAP, CERM, 68 pF, 100 V, +/- 5%, C0G/NP0, 0603	MuRata	GRM1885C2A680JA01D	0
28	D1	Diode, TVS, Bi, 24 V, 41 Vc, AEC-Q101, SOT-23	NXP Semiconductor	PESD2CAN,215	0
30	L11	Coupled inductor, 51 µH, 0.2 A, 1 ohm, AEC-Q200 Grade 0, SMD	TDK	ACT45B-510-2P-TL003	0
35	R30	RES, 120, 5%, 0.25 W, AEC-Q200 Grade 0, 1206	Vishay-Dale	CRCW1206120RJNEA	0

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