EVM User's Guide: ISOW3080DWEEVM

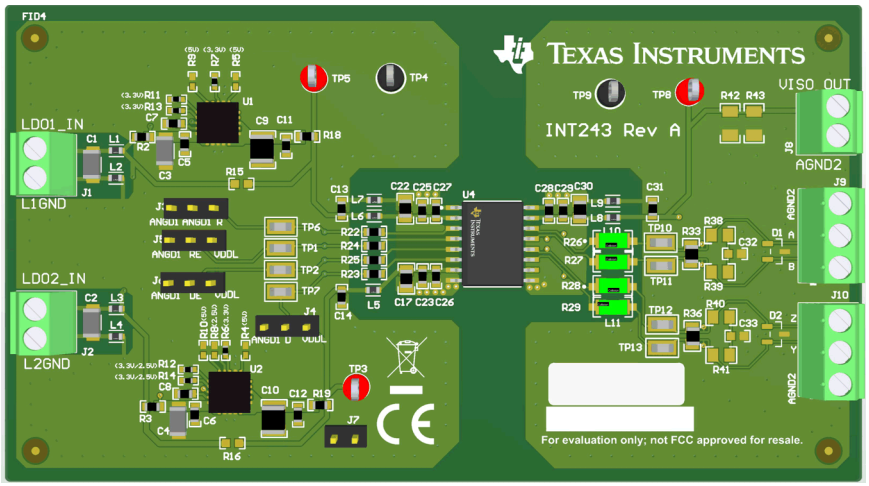
ISOW3080 Isolated RS-485/RS-422 Transceiver With Integrated DC-DC Converter Evaluation Module

Description

The ISOW308x(P) family of devices are galvanically isolated RS-485/RS-422 transceivers with a built-in isolated DC-DC converter, that eliminates the need for a separate isolated power supply in space constrained isolated designs. This EVM lets designers evaluate device performance for fast development and analysis of isolated systems. The EVM supports evaluation of any device variants of the ISOW308x and ISOW308xP family in a 16-pin WB SOIC package (DWE-16).

Features

- Platform for complete evaluation of ISOW308x(P) family of devices.
- On-board LDOs which provide configurable voltage output for device supply.
- Two separate configurable LDOs for VDD1 pin and VDDL pin.
- On-board oscillator option for dynamic data input to input channels on primary side.
- Test points for probing data lines and supply voltage.
- Common Mode Choke option for RS485 bus.
- Other resistor and jumper options to configure data rate and device supply voltages.



ISOW3080DWEEVM

1 Evaluation Module Overview

1.1 Introduction

The ISOW3080DWEEVM user's guide describes the functionality of the ISOW3080 isolated RS-485/RS-422 transceiver with integrated DC-DC converter. This user's guide describes EVM operation for ISOW3080 device under VDD1=3.3V and VDDL=3.3V configuration. VISOOUT gets set to 3.3V internally for ISOW3080. However, the EVM can be reconfigured for evaluation of any of the device variants of ISOW308x and ISOW308xP family in a 16-pin WB SOIC package (DWE-16) under the required voltage conditions of that particular variant. See details of each variant in Device Information. 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 ISOW3080 device. The major components of the ISOW3080 evaluation board are:

- ISOW3080DWER isolated RS-485/RS-422 transceiver 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 ISOW3080DWER, 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 ISOW3080 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 VDD1 and VDDL pins. Both VDD1 and VDDL are set to 3.3V by default on the EVM. This setup also 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 D input of ISOW3080 through 0Ω resistor. 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 ISOW308x(P) family of devices are galvanically isolated RS-485/RS-422 transceivers with a built-in isolated DC-DC converter, that eliminates the need for a separate isolated power supply in space constrained isolated designs. The high-efficiency of the integrate power converter allows for operation at a wide operating ambient temperature range of –55°C to 125°C. The ISOW308x(P) family of device 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.

Two options of data rates are provided: ISOW3080(P) is optimized for maximum 500kbps and ISOW3086(P) is designed for maximum 12Mbps data rate. See details of all variants and orderables in Table 1-1. The ISOW308x(P) can operate from a single supply voltage of 3V to 5.5V by connecting VDDL and VDD1 together on PCB. If lower logic levels are required, 2.25V to 5.5V logic supply (VDDL) can be separated and supplied independent from the power converter supply (VDD) of 3V to 5.5V.

Table 1-1. Device Comparison Table

PART NUMBER	ISOLATION	COMMUNICATION PROTOCOL	DATA RATE	VISOOUT (Set Internally)	PACKAGE	BODY SIZE (NOM)	PACKAGE SIZE
ISOW3080	Reinforced	RS485	500kbps	3.3V	DWE (SOIC, 16)	10.30mm × 7.50mm	10.30mm × 10.30mm
ISOW3080P	Reinforced	Profibus	500kbps	5V	DWE (SOIC, 16)		
ISOW3086	Reinforced	RS485	12Mbps	3.3V	DWE (SOIC, 16)		
ISOW3086P	Reinforced	Profibus	12Mbps	5V	DWE (SOIC, 16)		

2 Hardware

2.1 Pin Configuration of the ISOW308x Isolated RS-485/RS-422 Transceiver With Integrated DC-DC Converter Evaluation Module

Figure 2-1 shows the pin configuration of ISOW308x and ISOW308xP family of devices. ISOW308x has VISOOUT fixed as 3.3V and ISOW308xP has VISOOUT fixed as 5V. Refer Table 1-1

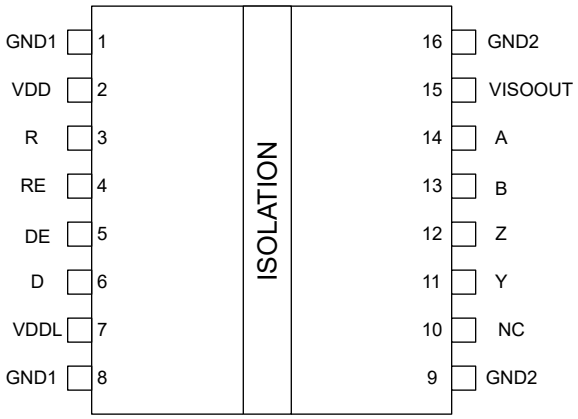


Figure 2-1. ISOW308x(P) Pin Configuration

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. Typical EVM Test Setup shows a typical test configuration for operating the ISOW3080DWEEVM using two power supplies.

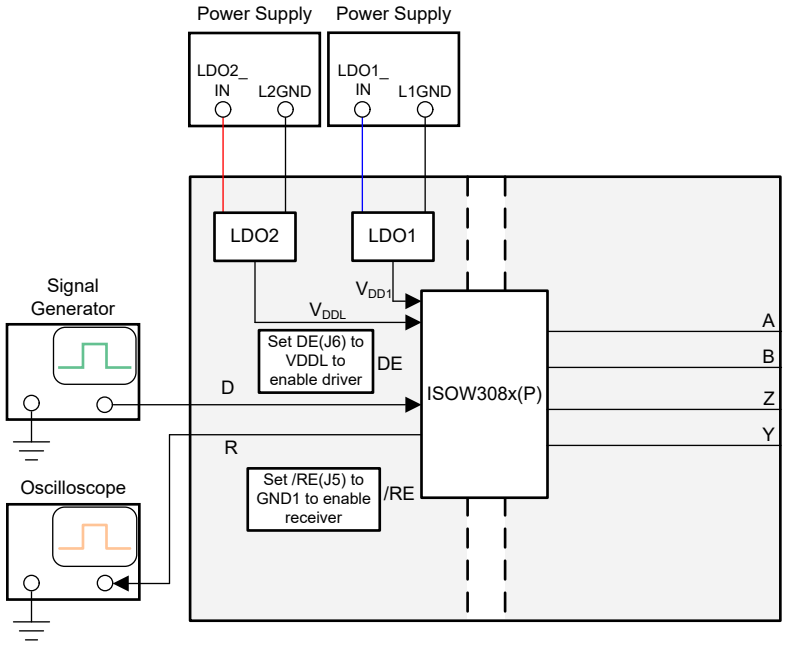


Figure 2-2. Typical EVM Test Setup

ISOW3080DWEEVM has many DNP resistors which can be populated or unpopulated along with 3-pin jumper options to setup the EVM to desired operating test conditions. Component Configurations 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 resistor 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 is between 9V and 12V
R5, R7, R9, R11, R13	Sets LDO U1 output voltage to 5V or 3.3V for VDD1. Populate only R5 and R9 with 0Ω resistors to set LDO U1 output voltage to 5V. Populate only R7, R11 and R13 with 0Ω resistors to set LDO U1 output voltage to 3.3V(Default Configuration).
R3, R16, R19	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 is between 9V and 12V.
R4, R6, R8, R10, R12, R14	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. Populate only R6, R12 and R14 with 0Ω resistors to set LDO U2 output voltage to 3.3V(Default Configuration). Populate only R8, R12 and R14 with 0Ω resistors to set LDO U2 output voltage to 2.5V.
R17	The resistor connects oscillator U3 output signal to U4 input D of ISOW3080, allowing EVM to be tested using a test signal without needing any external test signal input.
R20, R21	Populating R20 sets U3 output signal rate to 500Kbps(Default Configuration) and populating R21 sets the rate to 12Mbps.
R30, R31	These resistors allow shorting Y/Z and A/B on EVM to enable half-duplex configuration out of the full-duplex capable device.
L10, L11	Common-Mode Choke(CMC) on RS485 bus. If populating L10 then remove R26 and R27. If populating L11 then remove R28 and R29.
R26, R27, R28, R29	Populating R26 and R27 bypasses the CMC L10 on A/B Populating R28 and R29 bypasses the CMC L11 on Y/Z
R32, R34, R35, R37	Optional footprints for external fail safe biasing. ISOW3080 has internal failsafe biasing enabled, hence DNP.
R38, R39, R40, R41	Populate these for split termination configuration on A/B and Y/Z.
C32, C33	Populate these for split termination configuration on A/B and Y/Z.
D1, D2	Optional SOT-23 footprints for TVS Diode installation.
R42, R43	Optional resistors which can be populated to extract ILOAD from VISOOUT when RS485 is not in use. Do not populate when using RS485 functionality.
C18. C19, C20, C21	Optional capacitors for noise filtering on digital signal lines on Side1.
J3	Don't use jumper to connect any pins. This just acts as an additional probe point for probing output R of ISOW3080
J4	Connect this jumper between the middle pin and GND1 to tie the input D pin low. Connect this jumper between the middle pin and VDDL to tie the input D pin high.
J5	Connect this jumper between the middle pin and GND1 to tie the DE pin low. The driver input is disabled when the DE pin is low. Connect this jumper between the middle pin and VDDL to tie the DE pin high. The driver input is enabled when the DE pin is high.
J6	Connect this jumper between the middle pin and GND1 to tie the RE pin low. The receiver is enabled when the RE pin is low.. Connect this jumper between the middle pin and VDDL to tie the RE pin high. The receiver is disabled when the RE pin is high
J7	Jumper option to power ON or OFF the U3 oscillator.

3 Hardware Design Files

3.1 Schematics

The ISOW3080DWEEVM is designed to accommodate any of the ISOW308x(P) devices in a 16-pin WB SOIC package (DWE-16). To evaluate any of the ISOW308x(P) devices in a 16-pin WB SOIC package (DWE-16), replace ISOW3080 with the device of interest on the ISOW3080DWEEVM board. No other component requires any modification for ISOW308x devices. To evaluate any of the ISOW308xP devices, Pin2(VDD1) needs to be changed to 5V from the default setup of 3.3V by changing resistor options on U1. Figure 3-1 shows the ISOW3080DWEEVM schematic.

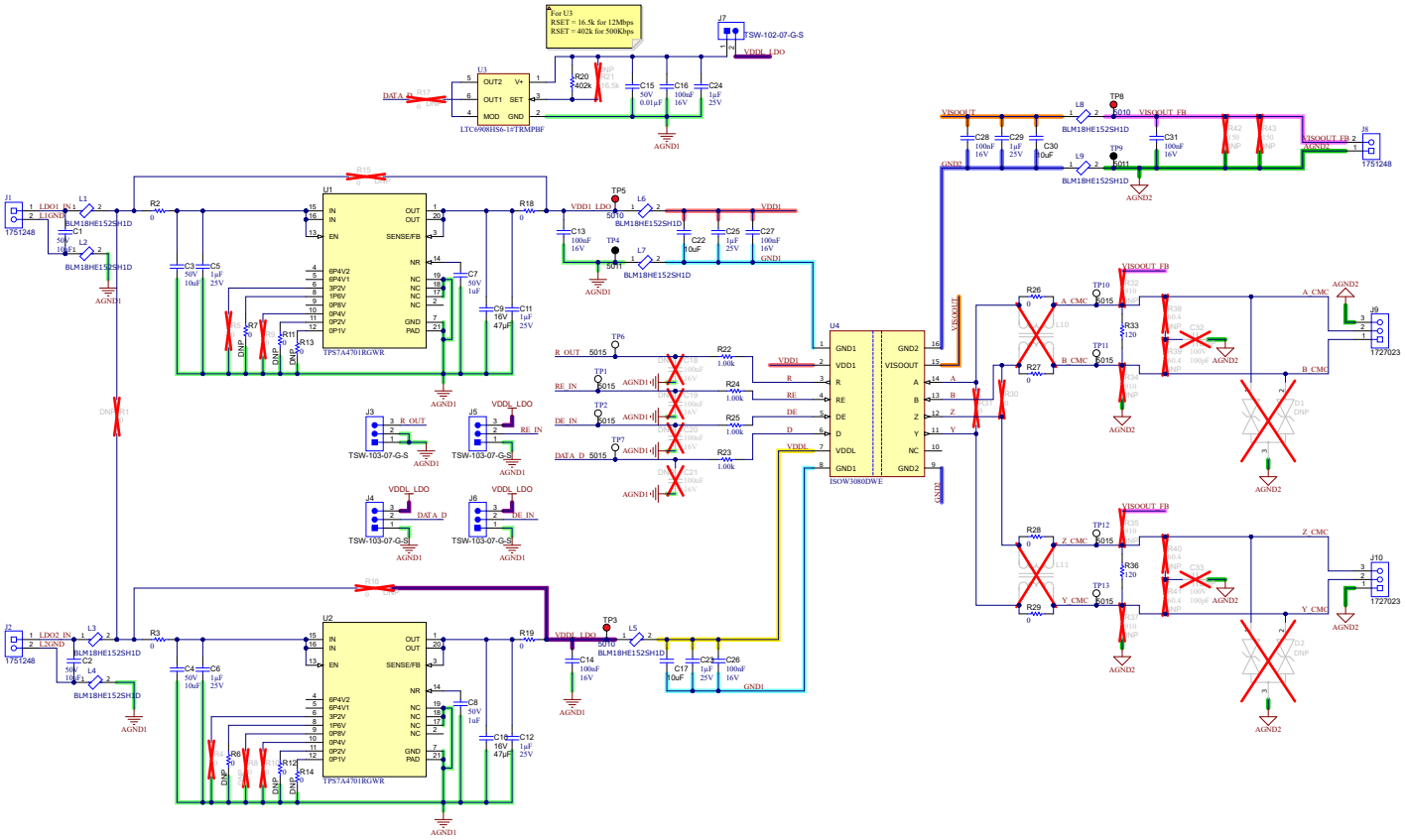


Figure 3-1. ISOW3080DWEEVM Schematic

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. Figure 3-4 and Figure 3-5 shows a 3D diagram of the PCB indicating how a finished board looks like.

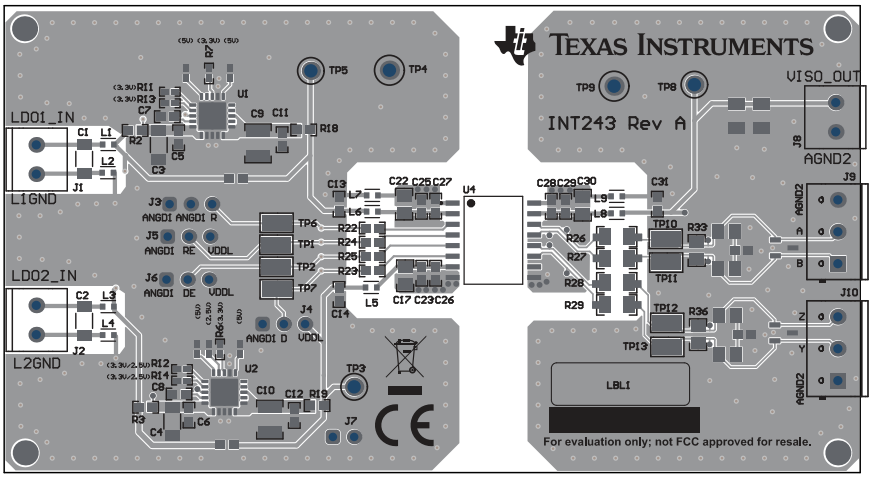


Figure 3-2. ISOW3080DWEEVM PCB Layout - Top

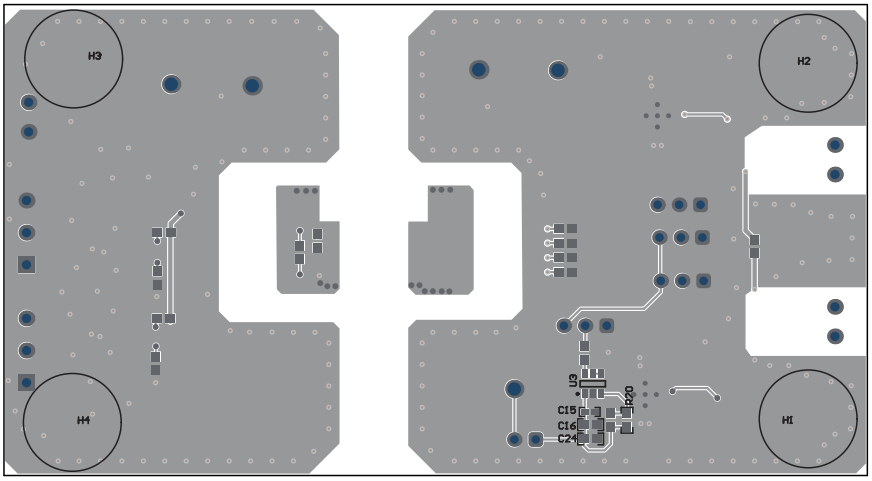


Figure 3-3. ISOW3080DWEEVM PCB Layout - Bottom

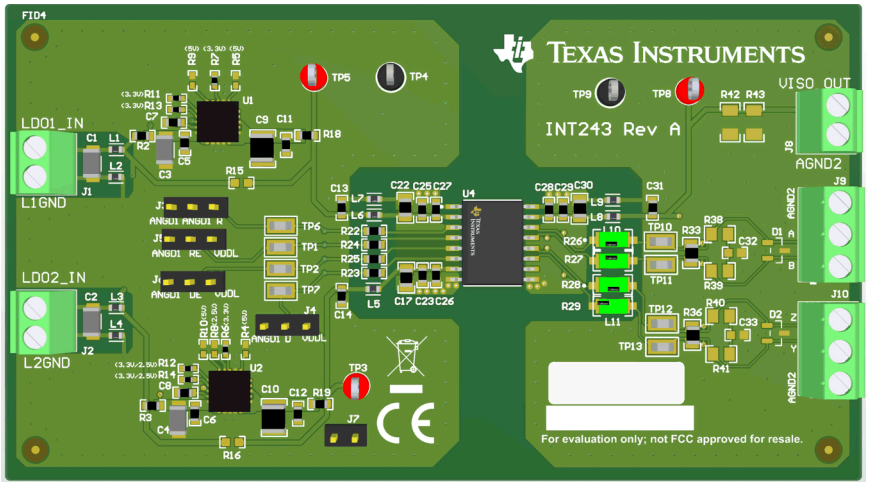


Figure 3-4. ISOW3080DWEEVM PCB 3D View - Top

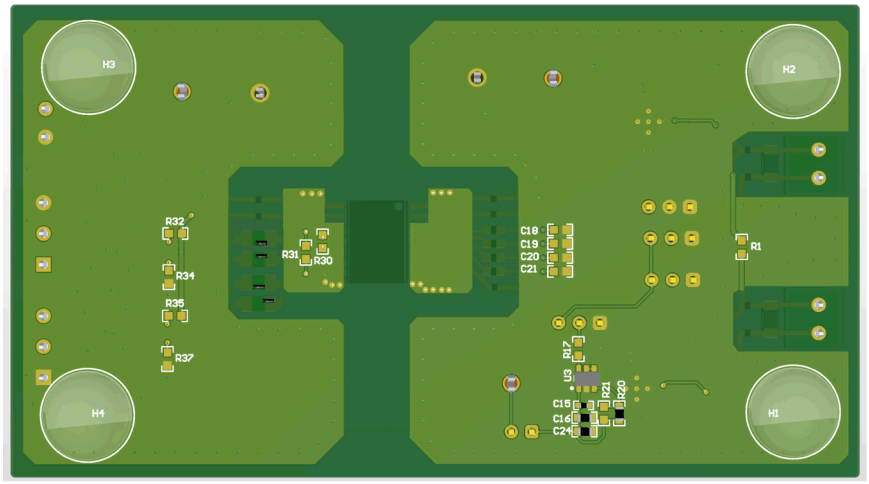


Figure 3-5. ISOW3080DWEEVM PCB 3D View - Bottom

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	PartNumber
1	C1, C2, C3, C4	CAP, CERM, 10uF, 50V, +/- 10%, X5R, 1206	TDK	C3216X5R1H106K160AB
2	C5, C6, C11, C12, C23, 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, C14, C16, C26, C27, C28, C31	CAP, CERM, 0.1uF, 16V, +/- 10%, X7R, 0603	Samsung Electro-Mechanics	CL10B104KO8NNNC
6	C15	CAP, CERM, 0.01 µF, 50V,+/- 10%, X7R, 0402	Walsin	0402B103K500CT
7	C17, C22, 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, J8	Conn Term Block, 2POS, 3.5mm, TH	Phoenix Contact	1751248
10	J3, J4, J5, J6	Header, 100mil, 3x1, Gold, TH	Samtec	TSW-103-07G-S
11	J7	Header, 100mil, 2x1, Gold, TH	Samtec	TSW-102-07G-S
12	J9, J10	Terminal Block Receptacle, 3x1, 3.81mm, R/A, TH	Phoenix Contact	1727023
13	L1, L2, L3, L4, L5, L6, L7, L8, L9	Chip Ferrite Bead, 0603, 1500Ω @ 100MHz, 0.5Ω, 25%, 500mA	Murata	BLM18HE152SH1D
14	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10
15	R2, R3, R18, R19	RES, 0, 5%, 0.1W, 0603	Yageo	RC0603JR-070RL
16	R6, R7, R11, R12, R13, R14	RES, 0, 5%, 0.063W, 0402	Vishay-Dale	CRCW04020000Z0ED
17	R20	RES, 402k, 1%, 0.1W, 0603	Yageo	RC0603FR-07402KL
18	R22, R23, R24, R25	RES, 1.00k, 1%, 0.1W, 0603	Yageo	RC0603FR-071KL
19	R26, R27, R28, R29	RES, 0, 5%, 0.25W, 1206	Vishay-Dale	CRCW12060000Z0EA
20	R33, R36	RES, 120, 1%, 0.4W, 0805	Rohm	ESR10EZPF1200
21	TP1, TP2, TP6, TP7, TP10, TP11, TP12, TP13	Test Point, Miniature, SMT	Keystone	5015
22	TP3, TP5, TP8	Test Point, Red, Through Hole, RoHS, Bulk	Keystone	5010
23	TP4, TP9	Test Point, Multipurpose, Black, TH	Keystone	5011
24	U1, U2	36V, 1A, 4.17µVRMS, RF Low-Dropout (LDO) Voltage Regulator, RGW0020A (VQFN-20)	Texas Instruments	TPS7A4701RGWR
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
26	U4	ISOW3080DWE	Texas Instruments	ISOW3080DWE
27	C18, C19, C20, C21	CAP, CERM, 0.1uF, 16V, +/- 10%, X7R, 0603	Samsung Electro-Mechanics	CL10B104KO8NNNC
28	C32, C33	CAP, CERM, 100pF, 100V, +/- 5%, C0G/NP0, 0603	MuRata	GRM1885C2A101JA01D
29	D1, D2	Two-channel bidirectional 12V ESD protection diode 3-SOT-23 -40 to 125	Texas Instruments	Any 2-channel SOT-23 package TVS of choice

Table 3-1. Bill of Materials (continued)

Item	Designator	Description	Manufacturer	PartNumber
31	L10, L11	100µH @ 100kHz 2 Line Common Mode Choke Surface Mount 5.8 kOhms @ 10MHz 150mA DCR 2Ohm	TDK	ACT45B-101-2P-TL003
32	R1, R15, R16, R17, R30, R31	RES, 0, 5%, 0.1W, 0603	Yageo	RC0603JR-070RL
33	R4, R5, R8, R9, R10	RES, 0, 5%, 0.063W, 0402	Vishay-Dale	CRCW04020000Z0ED
34	R21	RES, 16.5k, 1%, 0.1W, 0603	Yageo	RC0603FR-0716K5L
35	R32, R34, R35, R37	RES, 910, 1%, 0.1W, 0603	Yageo	RC0603FR-07910RL
36	R38, R39, R40, R41	RES, 60.4, 1%, 0.125W, AEC-Q200 Grade 0, 0805	Vishay-Dale	CRCW080560R4FKEA
37	R42, R43	RES, 0, 5%, 0.25W, 1206	Yageo America	RC1206JR-070RL

4 Additional Information

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