User's Guide
ISOW7741 Quad-Channel Digital Isolator With Integrated DC-DC Converter Evaluation Module

TEXAS INSTRUMENTS

ABSTRACT

This user's guide describes the ISOW7741 quad-channel digital isolator 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 any of the quad-channel device variants of ISOW77xx 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 a supply or digital input/output must be maintained within the 0-V to 5.5-V recommended operating range.

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1 Introduction

This user's guide describes EVM operation with respect to the ISOW7741 quad-channel digital isolator with integrated DC-DC converters. However, the EVM may be reconfigured for evaluation of any of quad-channel device variants of ISOW77xx family in a 20-pin WB SOIC package (DFM-20). This guide also describes the EVM BoM, EVM schematic, EVM PCB layout, and typical laboratory setup.

2 Overview

The ISOW7741 device is a galvanically-isolated quad- channel digital isolator with an integrated high-efficiency, low emissions power converter. The integrated DC-DC converter provides up to 500 mW 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 –40°C to +125°C. This device provides improved emissions performance, allowing for simplified board design and has provisions for ferrite beads to further attenuate emissions. The ISOW7741 has been designed with enhanced protection features in mind, including soft-start to limit inrush current, over-voltage and under-voltage lock out, fault detection on the EN_DC DC pin, overload and short-circuit protection, and thermal shutdown.

The ISOW7741 device provides high electromagnetic immunity while isolating CMOS or LVCMOS digital I/Os. The signal-isolation channel has a logic input and output buffer separated by a double capacitive silicon dioxide (SiO2) insulation barrier, whereas, power isolation uses on-chip transformers separated by thin film polymer as insulating material. The ISOW7741 can operate from a single supply voltage of 3 V to 5.5 V by connecting VIO and VDD together on PCB. If lower logic levels are required, these devices support 1.71 V to 5.5 V logic supply (VIO) that can be independent from the power converter supply (VDD) of 3 V to 5.5 V. VISOIN and VISOOUT needs to be connected on board with either a ferrite bead or fed through a LDO.

The EVM enables a user to evaluate ISOW7741 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 VIO and VDD pins of ISOW7741. 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 beteween 9V to 12V. The EVM also includes an on-board oscillator (LTC6908-1) that can be connected to the inputs of ISOW7741 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.

The EVM can be used to verify many of ISOW7741 datasheet parameters like input threshold voltages, current consumption and others. Some of the datasheet specifications require a different test setup configuration than the ISOW7741DFMEVM and hence, they cannot be verified from the EVM as is. The example parameters include maximum datarate, propagation delay and other timing specifications.

3 Pin Configuration of the ISOW7741 Quad-Channel Digital Isolator with Integrated DC-DC Converter

Figure 3-1 shows the ISOW7741 Quad-Channel Digital Isolator with Integrated DC-DC Converter pin configuration.

V_{IO}	1	20	V_{ISOIN}
INA	2	19	OUTA
INB	3	18	OUTB
INC	4	17	OUTC
OUTD	5	16	IND
GND1	6	15	GND2
EN_IO1	7	14	EN_IO2
EN_DCDC	8	13	VSEL
V_{DD}	9	12	V_{ISOOUT}
GND1	10	11	GND2
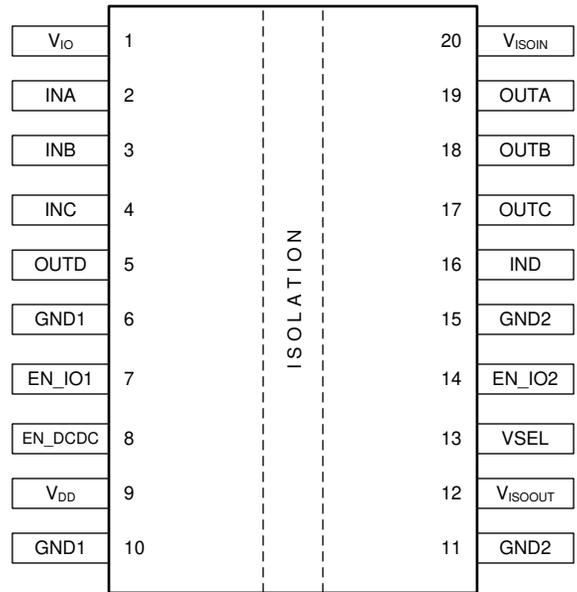
ISOLATION

Figure 3-1. ISOW7741 Quad-Channel Digital Isolator with Integrated DC-DC Converter Pin Configuration

4 EVM Setup and Operation

This section describes the typical setup and operation of the EVM for device evaluation. Figure 4-1 shows a typical test configuration for operating the ISOW7741DFMEVM using two power supplies.
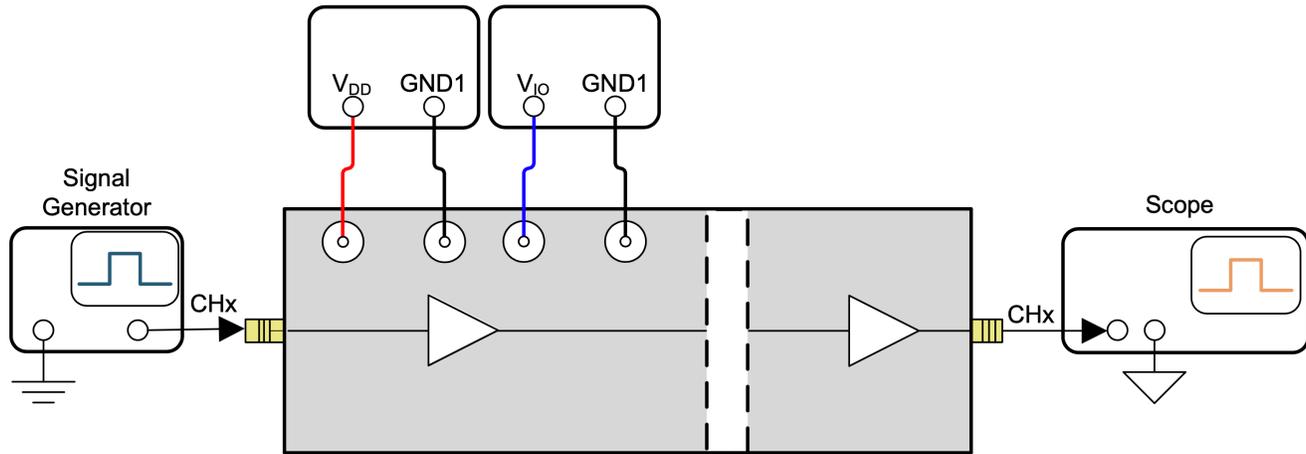

Figure 4-1. Typical EVM test setup

ISOW7741DFMEVM 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 various resistors.

Table 4-1. Resistor configurations

Resistor	Description
R1	It connects LDOs U1, U2 inputs together allowing only one power supply to be used instead of two power supplies.
R2, R5, R7, R10	Sets LDO U2 output voltage to 5V, 3.3V, 2.5V or 1.8V, respectively. Only one of the four resistors needs to be populated.
R6, R9	Sets LDO U1 output voltage to 5V or 3.3V, respectively. Only one of the two resistors needs to be populated.
R11, R3, R17	Populating R11 bypasses LDO U1 allowing VDD to be powered directly from external power supply. When R11 is populated, R3 and R17 need to be unpopulated to disconnect the LDO. When LDO is not bypassed, the recommended input voltage to LDO should be between 9V and 12V.
R15, R4, R18	Populating R15 bypasses LDO U2 allowing VIO to be powered directly from external power supply. When R15 is populated, R4 and R18 need to be unpopulated to disconnect the LDO. When LDO is not bypassed, the recommended input voltage to LDO should be between 9V and 12V.
R13, R14, R16	These resistors allow one input signal connection to multiple input channels.
R23	It connects oscillator U3 output signal to U4 inputs allowing EVM to be tested using a test signal without needing any external test signal input.
R24, R25	Populating only R24 sets U3 output signal frequency to 2.5 MHz (5 Mbps) and populating both R24 & R25 sets the frequency to 5 MHz (10 Mbps).
R26, R42	Populating R26 enabled DC-DC converter of ISOW7741 and populating R42 disables it. Only one of the two resistors needs to be populated.
R35, R37, R38	These resistors allow one output signal connection to multiple input channels.
R40, R41	Populating R40 sets VISOOUT to 5V and populating R41 sets it to 3.3V. Only one of the two resistors needs to be populated.
R33, R34, R36, R39	One or more of these resistors can be populated to facilate external load to VISOOUT.

5 EVM Schematics

The ISOW7741DFMEVM is designed to accommodate any of the ISOW774x quad-channel devices in a 20-pin WB SOIC package (DFM-20). To evaluate any of the ISOW774x quad-channel devices in a 20-pin WB SOIC package (DFM-20), replace ISOW7741 with the device of interest on the ISOW7741DFMEVM board. No other component requires any modification. Figure 5-1 shows the ISOW7741DFMEVM schematic.
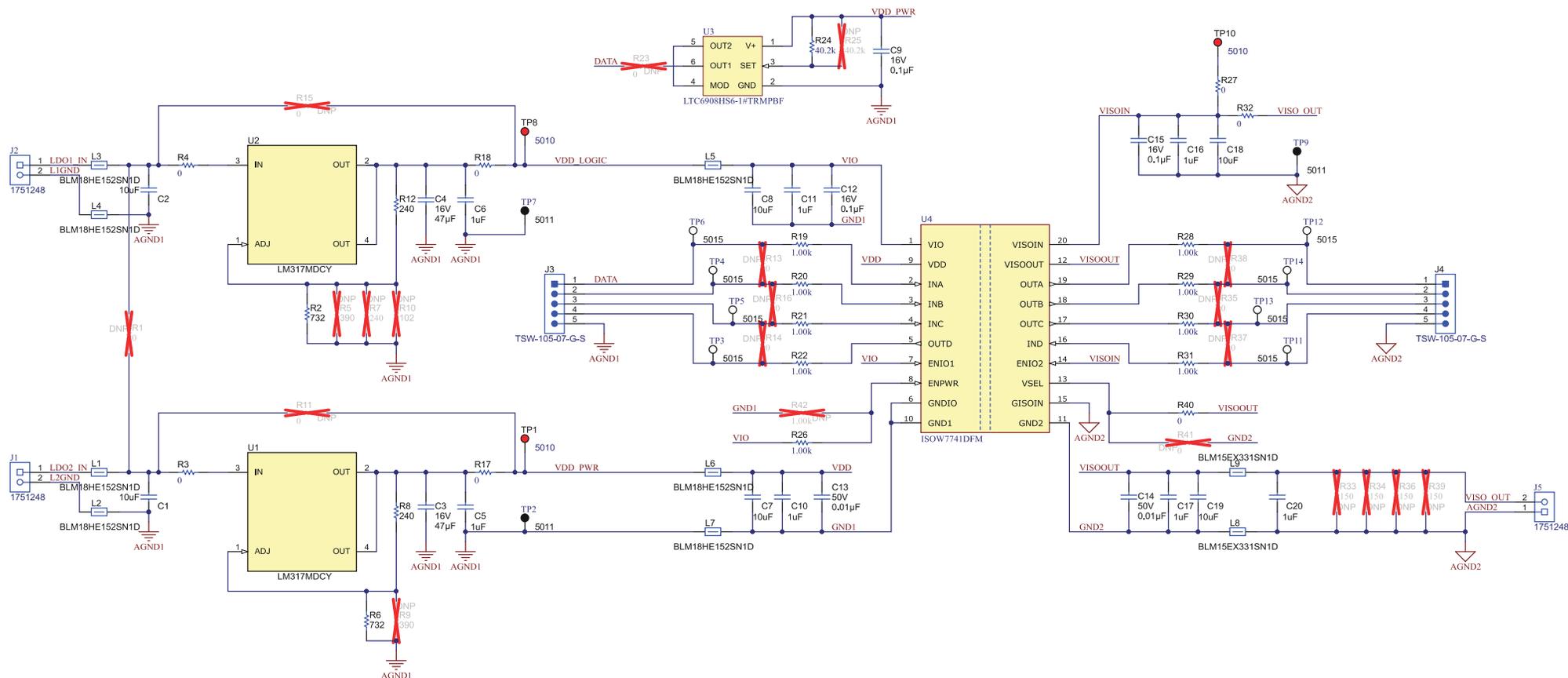

Figure 5-1. ISOW7741DFMEVM Schematic

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 looks like.
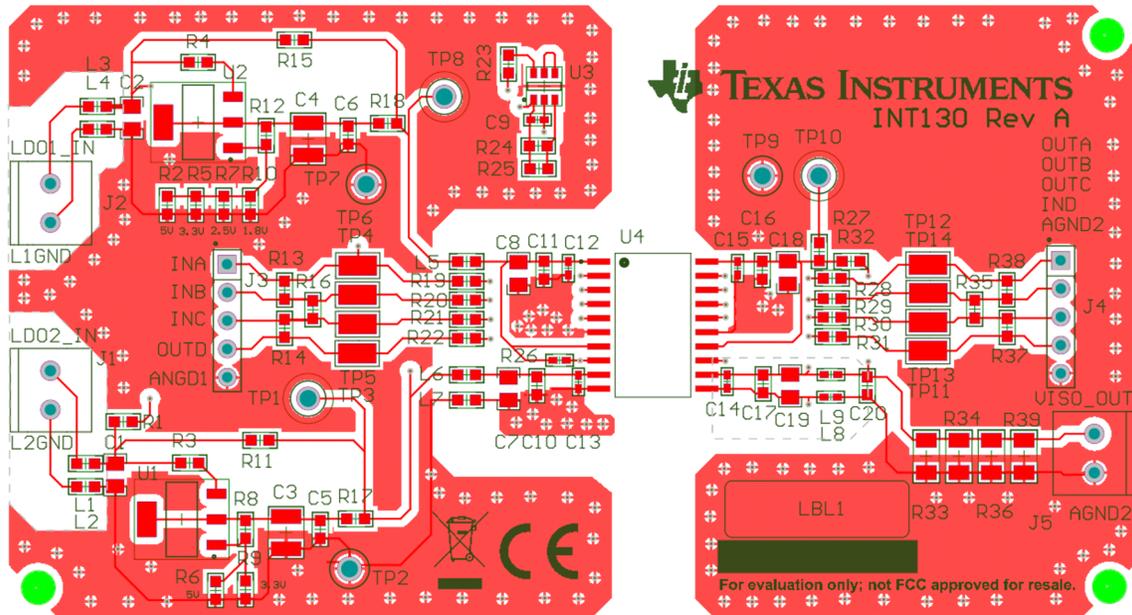
Figure 6-1. ISOW7741DFMEVM PCB layout - top layer
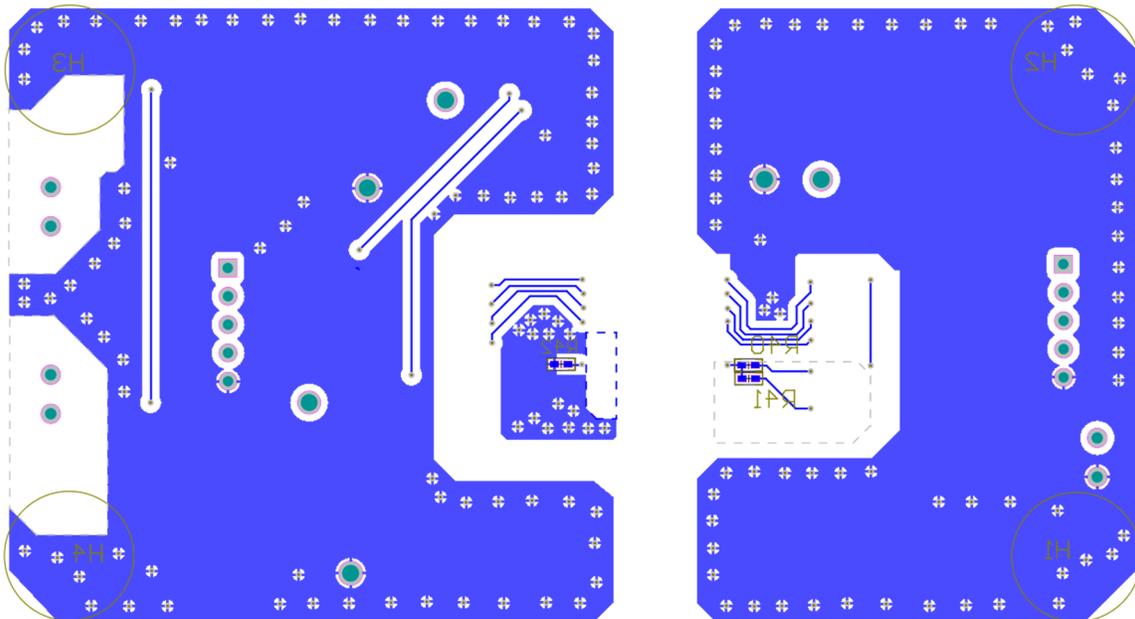
Figure 6-2. ISOW7741DFMEVM PCB layout - bottom layer
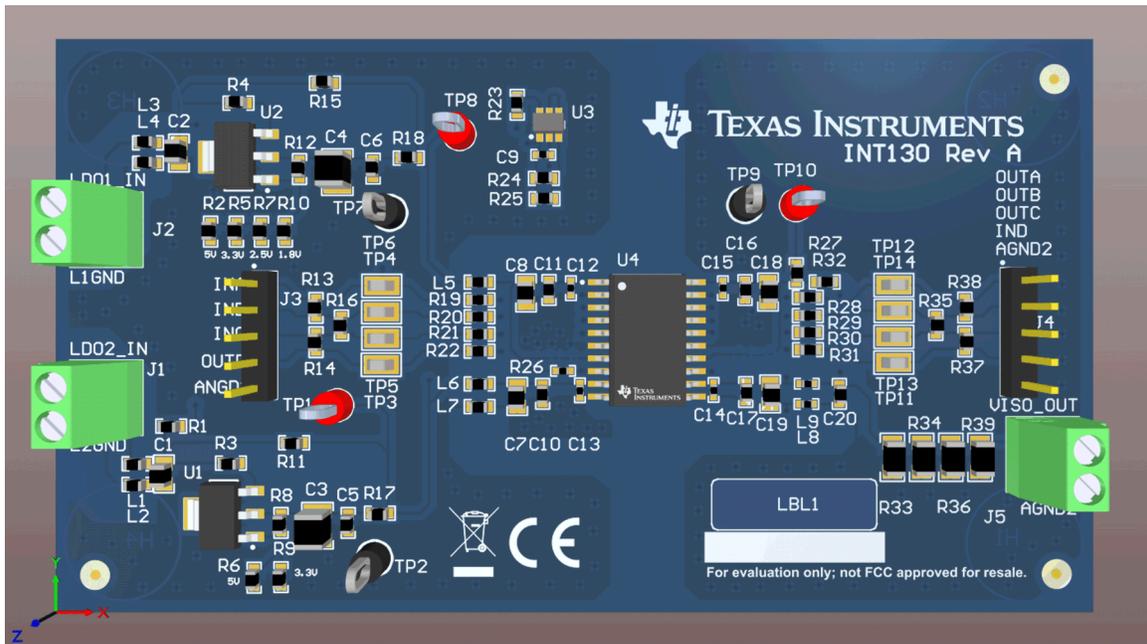
Figure 6-3. ISOW7741DFMEVM PCB 3D daigram

7 Bill of Materials

lists the bill of materials (BOM) for this EVM.

Table 7-1. Bill of Materials

Item	Designator	Description	Manufacturer	PartNumber
1	C1, C2, C7, C8, C18, C19	CAP, CERM, 10 uF, 35 V, +/- 10%, X5R, 0805	MuRata	GRM21BR6YA106KE43L
2	C3, C4	CAP, CERM, 47 µF, 16 V,+/- 10%, X5R, 1210	Samsung Electro-Mechanics	CL32A476KOJNNNE
3	C5, C6, C10, C11, C16, C17, C20	CAP, CERM, 1 uF, 50 V, +/- 10%, X5R, 0603	Samsung Electro-Mechanics	CL10A105KA8NNNC
4	C9, C12, C15	CAP, CERM, 0.1 µF, 16 V,+/- 10%, X7R, 0402	Walsin	CL05B104KO5NNNC
5	C13, C14	CAP, CERM, 0.01 µF, 50 V,+/- 10%, X7R, 0402	Walsin	0402B103K500CT
6	H1, H2, H3, H4	Bumpon, Hemisphere, 0.44 X 0.20, Clear	3M	SJ-5303 (CLEAR)
7	J1, J2, J5	Conn Term Block, 2POS, 3.5mm, TH	Phoenix Contact	1751248
8	J3, J4	Header, 100mil, 5x1, Gold, TH	Samtec	TSW-105-07-G-S
9	L1, L2, L3, L4, L5, L6, L7	Ferrite Bead, 1500 ohm @ 100 MHz, 0.5 A, 0603	MuRata	BLM18HE152SN1D
10	L8, L9	Ferrite Bead, 330 ohm @ 100 MHz, 1.1 A, 0402	MuRata	BLM15EX331SN1D
11	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10
12	R2, R6	RES, 732, 1%, 0.1 W, 0603	Yageo	RC0603FR-07732RL
13	R3, R4, R17, R18, R27, R32	RES, 0, 5%, 0.1 W, 0603	Yageo	RC0603JR-070RL
14	R8, R12	RES, 240, 1%, 0.1 W, 0603	Yageo	RC0603FR-07240RL
15	R19, R20, R21, R22, R28, R29, R30, R31	RES, 1.00 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-071KL
16	R24	RES, 40.2 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-0740K2L
17	R26	RES, 1.00 k, 1%, 0.0625 W, 0402	Yageo America	RC0402FR-071KL
18	R40	RES, 0, 5%, 0.063 W, 0402	Yageo America	RC0402JR-070RL
19	TP1, TP8, TP10	Test Point, Red, Through Hole, RoHS, Bulk	Keystone	5010
20	TP2, TP7, TP9	Test Point, Multipurpose, Black, TH	Keystone	5011
21	TP3, TP4, TP5, TP6, TP11, TP12, TP13, TP14	Test Point, Miniature, SMT	Keystone	5015
22	U1, U2	3/4 Pin 500mA Adjustable Positive Voltage Regulator, DCY0004A (SOT-223-4)	Texas Instruments	LM317MDCY
23	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
24	U4	ISOW7741DFM	Texas Instruments	ISOW7741DFM

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