*EVM User's Guide: TMUX7348F TMUX7349F TMUX7309F TMUX7308F*

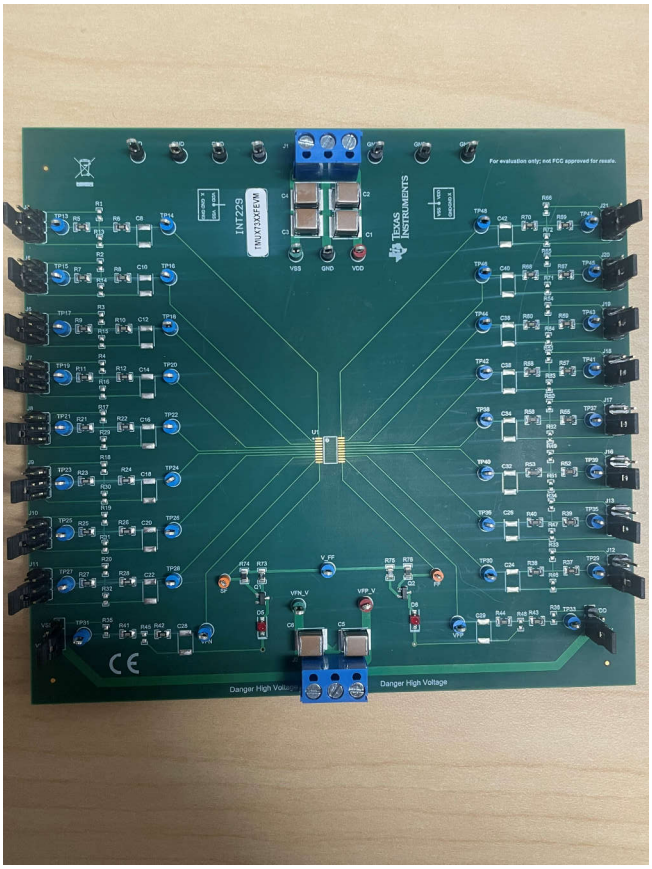
# *TMUX73XXF Evaluation Module*

## Description

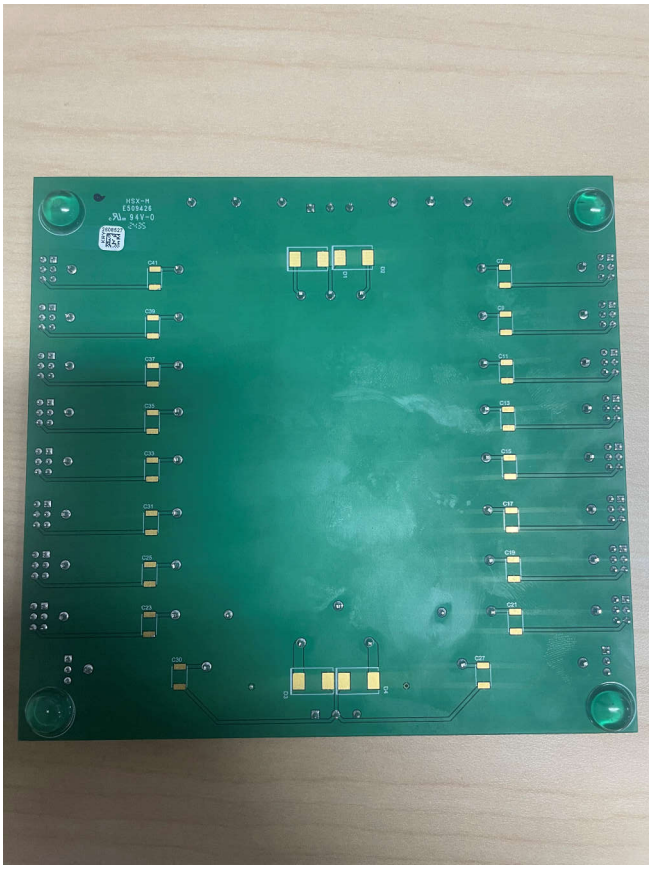
This user guide outlines the TMUX73XXF evaluation module (EVM) and its intended applications.
This board facilitates rapid prototyping and DC characterization of Texas Instruments' TMUX73XXF series of components in the TSSOP (PW) package. Additionally, it features onboard test points that provide the flexibility to test various signals.

## Features

- 2 power supply decoupling capacitors from VDD to GND (2 × 3.3 µF; 2× 1 µF)
- 2 power supply decoupling capacitors from VSS to GND (2 × 3.3 µF; 2× 1 µF)
- Protection diode pads are available near VDD and VSS input.
- 3.3µF supply decoupling capacitor to Ground on both VFP_V and VFN_V supplies
- Terminal block power supply connection
- DUT footprint compatible with 16-pin PW (TSSOP), and 20-pin PW (TSSOP)packages
- 16 length-matched signal inputs
- Terminal block OVP Triggering Threshold supply connection
- General and Specific Fault Indicator Flag LED circuits included on EVM
- Selectable connections to VDD, VSS, or GND for each signal input using a 2.54 mm shunt
- Footprints for pull-up and pull-down resistors for each signal input (on each of 16 signals and 2 OVP Trigger Thresholds)
- Footprints for series resistors for each signal input ( on each of 16 signals and 2 OVP Trigger Thresholds)
- Footprints for decoupling capacitors for each input ( footprint on each of 16 signals and 2 OVP Trigger Thresholds)
- 2 test points for each signal and OVP Trigger Thresholds
- Multiple GND test point connections around the board




**TMUX73XXF-EVM (Front Side)**



**TMUX73XXF-EVM (Back Side)**

# 1 Evaluation Module Overview

## 1.1 Introduction

This user guide describes the TMUX73XXF-EVM evaluation module (EVM) and its intended use. This board allows for the quick prototyping and characterization of TI's TMUX73XXF multiplexers.

## 1.2 Kit Contents

The EVM kit includes the following:

1. TMUX73XXF-EVM board

## 1.3 Specification

The TMUX73XXF-EVM features two test points for each I/O and OVP Trigger Threshold, resulting in thirty-four test points available for testing the TMUX73XXF line of devices. Seven extra ground test points are included to facilitate easier board testing.

# 2 Hardware

## 2.1 Power Requirements

The TMUX73XXF-EVM requires a power supply connected either through the J1 terminal or directly to the red VDD test point. This setup establishes a passive signal pathway between the Sx and Dx pins based on the selected logic. When testing TMUX734XF devices, the Fault Indicator Flag LED circuits can be activated by applying a voltage to the V_FF pin. Additionally, the Over Voltage Protection (OVP) Trigger Thresholds can be powered using either the J2 terminal or the VFP_V and VFN_V pins.

## 2.2 Setup

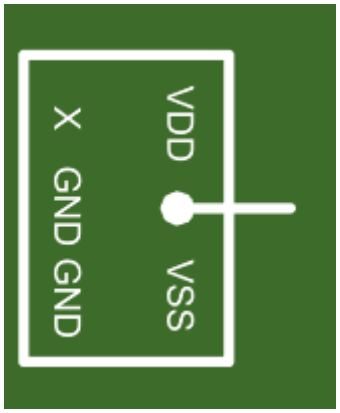
1. All 16 generic signal pathway headers contain six pins. Figure 2-1 and Figure 2-2 show the generalized pinout of the headers for the left and right sides of the board respectively. Note that the orientation is based on J1 being on the top of the board.
2. 


**Figure 2-1. Left Side Jumper (J4-J11) Configuration or Pinout**

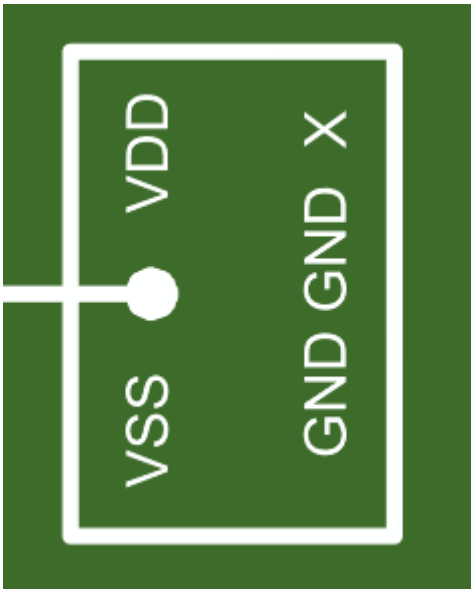



**Figure 2-2. Right Side Jumper (J12,13,J16-J21) Configuration or Pinout**

## 2.3 Jumper Information

For the left side header, pin 1 is at the top left corner pin (denoted as an X). The right side header has pin 1 (denoted as an X), which is at the top right corner. Table 2-1 shows the jumper configurations. Note: U1 refers to the signal pathway that connects to the U1 TMUX73XXF footprint.

**Table 2-1. Jumper Pinout Map**

| Jumper ID | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 |
|---|---|---|---|---|---|---|
| J4 | Floating | VDD | GND | U1 Pin 1 | GND | VSS |
| J5 | Floating | VDD | GND | U1 Pin 2 | GND | VSS |
| J6 | Floating | VDD | GND | U1 Pin 3 | GND | VSS |
| J7 | Floating | VDD | GND | U1 Pin 4 | GND | VSS |
| J8 | Floating | VDD | GND | U1 Pin 5 | GND | VSS |
| J9 | Floating | VDD | GND | U1 Pin 6 | GND | VSS |
| J10 | Floating | VDD | GND | U1 Pin 7 | GND | VSS |
| J11 | Floating | VDD | GND | U1 Pin 8 | GND | VSS |
| J12 | Floating | VDD | GND | U1 Pin 13 | GND | VSS |
| J13 | Floating | VDD | GND | U1 Pin 14 | GND | VSS |
| J14 | VSS | U1 Pin 9 | VFN_V | N/A | N/A | N/A |
| J15 | VDD | U1 Pin 12 | VFP_V | N/A | N/A | N/A |
| J16 | Floating | VDD | GND | U1 Pin 15 | GND | VSS |
| J17 | Floating | VDD | GND | U1 Pin 16 | GND | VSS |
| J18 | Floating | VDD | GND | U1 Pin 17 | GND | VSS |
| J19 | Floating | VDD | GND | U1 Pin 18 | GND | VSS |
| J20 | Floating | VDD | GND | U1 Pin 19 | GND | VSS |
| J21 | Floating | VDD | GND | U1 Pin 20 | GND | VSS |

Check the device-specific data sheet for the pin-out. For power (VDD or VSS) and ground (GND), lines connect shunts on the appropriate jumpers to short the U1 pin to the respective VDD, VSS, or GND line. For testing where control pins do not change state (such as the select or enable pin always being at a logic ‘1’ for the duration of testing), shunts can be connected on the appropriate jumpers to short the U1 control pins to VDD or GND. For the remaining I/O pins (VDD, VSS, and GND), signals can be applied using shunts in the same manner as before or the shunt can be removed and an external signal can be applied to the U1 pin of the jumper or the respective test point.

In cases where the tests require pull-up or pull-down resistors versus directly attaching the source to the respective U1 pin, all 16 generic pathways contain 0603 resistor pads to add these components. Table 2-2 shows the IDs.

During the evaluation of TMUX734X devices, it is recommended to use the shunts on J14 and J15 to connect the multiplexer’s VFP and VFN pins to the desired VFP/VFN threshold voltage. The VFP_V and VFN_V threshold supplies can be either powered through the J2 terminal block or connected directly to the VFP_V and VFN_V test points. Additionally, the fault flag voltage (VFF_V) can be connected and powered through the V_FF blue test point.

**Table 2-2. Pull-Up or Pull-Down Resistor Configuration Map**

| 0603 Sized Resistor Pad ID | Jumper ID | Function |
|---|---|---|
| R1 | J4 | Pull up |
| R13 | J4 | Pull down |
| R2 | J5 | Pull up |
| R14 | J5 | Pull down |
| R3 | J6 | Pull up |
| R15 | J6 | Pull down |
| R4 | J7 | Pull up |
| R16 | J7 | Pull down |
| R17 | J8 | Pull up |
| R29 | J8 | Pull down |
| R18 | J9 | Pull up |
| R30 | J9 | Pull down |
| R19 | J10 | Pull up |
| R31 | J10 | Pull down |
| R20 | J11 | Pull up |
| R32 | J11 | Pull down |
| R33 | J12 | Pull up |
| R46 | J12 | Pull down |
| R34 | J13 | Pull up |
| R47 | J13 | Pull down |
| R35 | J14 | Pull Up |
| R45 | J14 | Pull down |
| R36 | J15 | Pull Up |
| R48 | J15 | Pull down |
| R49 | J16 | Pull Up |
| R61 | J16 | Pull down |
| R50 | J17 | Pull Up |
| R62 | J17 | Pull down |
| R51 | J18 | Pull Up |
| R63 | J18 | Pull down |
| R54 | J19 | Pull Up |
| R64 | J19 | Pull down |
| R65 | J20 | Pull Up |
| R71 | J20 | Pull down |
| R66 | J21 | Pull Up |
| R72 | J21 | Pull down |

Now loads can be attached to the board. If a pull-down pad was unused, then this pad can now be used as a pad for a resistive load. There are also pads for capacitive loads for each of the 16 generic signal paths and 2 OVP Trigger Thresholds that can also be utilized. Table 2-3 shows the corresponding pad and jumper IDs.

**Note**

The 1812-sized capacitor pads are on the bottom side of the EVM.

**Table 2-3. RC Load Configuration Map**

| Jumper ID | 0603 Sized Resistor Pad ID | 1206 Sized Capacitor Pad ID | 1812 Sized Capacitor Pad ID |
|---|---|---|---|
| J4 | R13 | C8 | C7 |
| J5 | R14 | C10 | C9 |
| J6 | R15 | C12 | C11 |
| J7 | R16 | C14 | C13 |
| J8 | R29 | C16 | C15 |
| J9 | R30 | C18 | C17 |
| J10 | R31 | C20 | C19 |
| J11 | R32 | C22 | C21 |
| J12 | R46 | C24 | C23 |
| J13 | R47 | C26 | C25 |
| J14 | R45 | C28 | C27 |
| J15 | R48 | C29 | C30 |
| J16 | R61 | C32 | C31 |
| J17 | R62 | C34 | C33 |
| J18 | R63 | C36 | C35 |
| J19 | R64 | C38 | C37 |
| J20 | R71 | C40 | C39 |
| J21 | R72 | C42 | C41 |

Now that the loading is complete for the board, additional supply decoupling capacitance to ground can be added for the VDD or VSS lines. Table 2-4 shows the power supply decoupling capacitance for each VDD or VSS line. If the default capacitance is enough, then move on to step 8.

**Table 2-4. Capacitors**

| Capacitor Pad ID | Pad Size (LxW) | Associated Power Signal |
|---|---|---|
| C1 | 6mm × 5mm | VDD |
| C2 | 6mm × 5mm | VDD |
| C3 | 6mm × 5mm | VSS |
| C4 | 6mm × 5mm | VSS |

Finally, attach the supply signals (VDD, GND, or VSS) to the appropriate pins of the terminal block labeled J1. Power is now ready to be applied to the board. For test points, please see the next section.

## 2.4 Test Points

There are multiple test points (48) on the board that can be used to either measure the associated trace or apply external signals for testing purposes. Table 2-5 shows the test points for the sixteen generic U1 connections and 2 OVP Trigger Thresholds. There are two test points per pin of the IC, which are colored blue.

**Table 2-5. Test Points for Jumpers Map**

| Jumper ID | Test Point ID | Test Point ID | U1 Pin |
|---|---|---|---|
| J4 | TP13 | TP14 | 1 |
| J5 | TP15 | TP16 | 2 |
| J6 | TP17 | TP18 | 3 |
| J7 | TP19 | TP20 | 4 |
| J8 | TP21 | TP22 | 5 |
| J9 | TP23 | TP24 | 6 |
| J10 | TP25 | TP26 | 7 |
| J11 | TP27 | TP28 | 8 |
| J12 | TP29 | TP30 | 13 |
| J13 | TP35 | TP36 | 14 |
| J14 | TP31 | VFN | 9 |
| J15 | TP33 | VFP | 12 |
| J16 | TP39 | TP40 | 15 |
| J17 | TP37 | TP38 | 16 |
| J18 | TP41 | TP42 | 17 |
| J19 | TP43 | TP44 | 18 |
| J20 | TP45 | TP46 | 19 |
| J21 | TP47 | TP48 | 20 |

Test points also connect to VSS, VDD, and GND planes. In addition, there are test points for the fault flag indicator led circuits and OVP Trigger Thresholds.

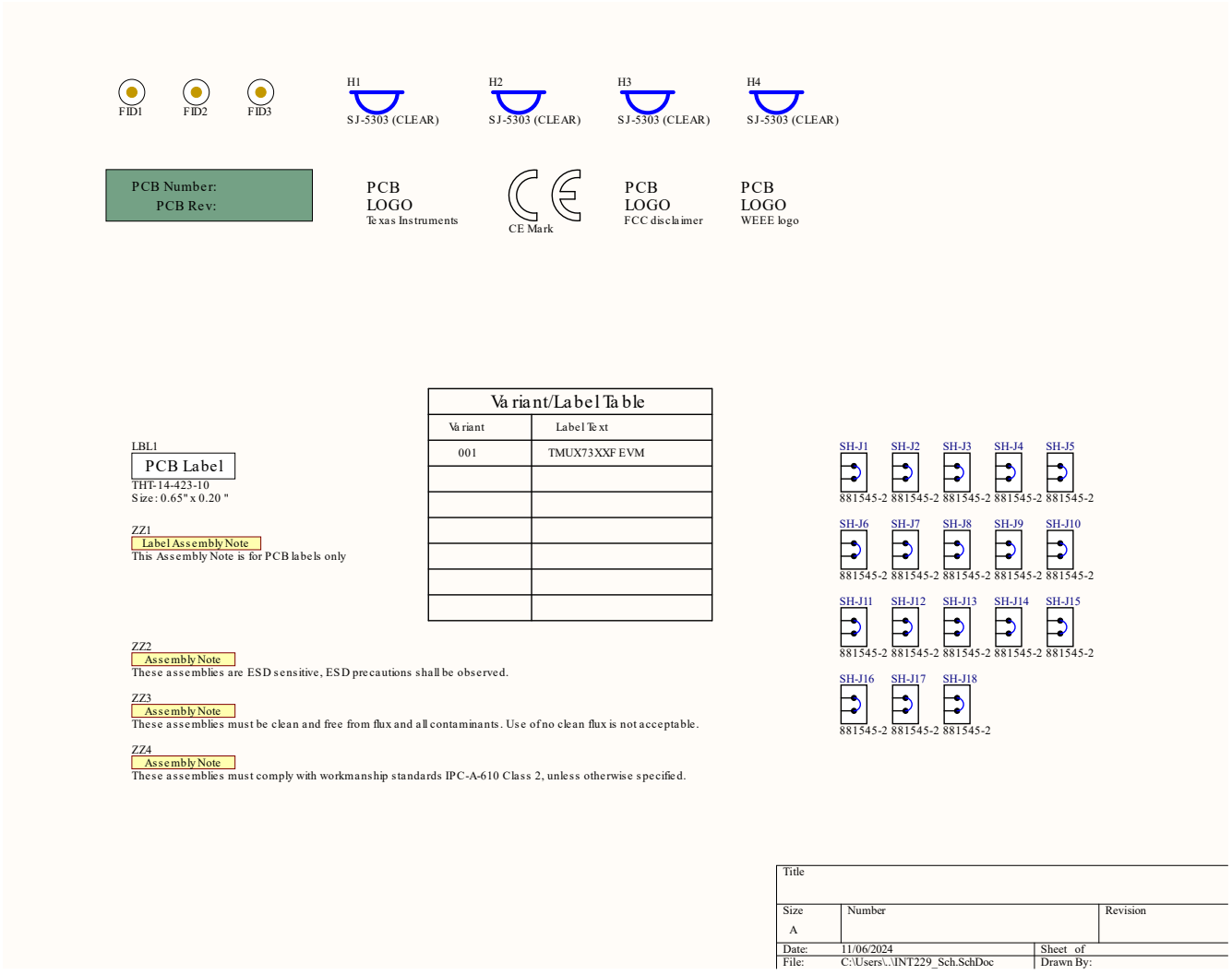
Table 2-6 shows these test points.

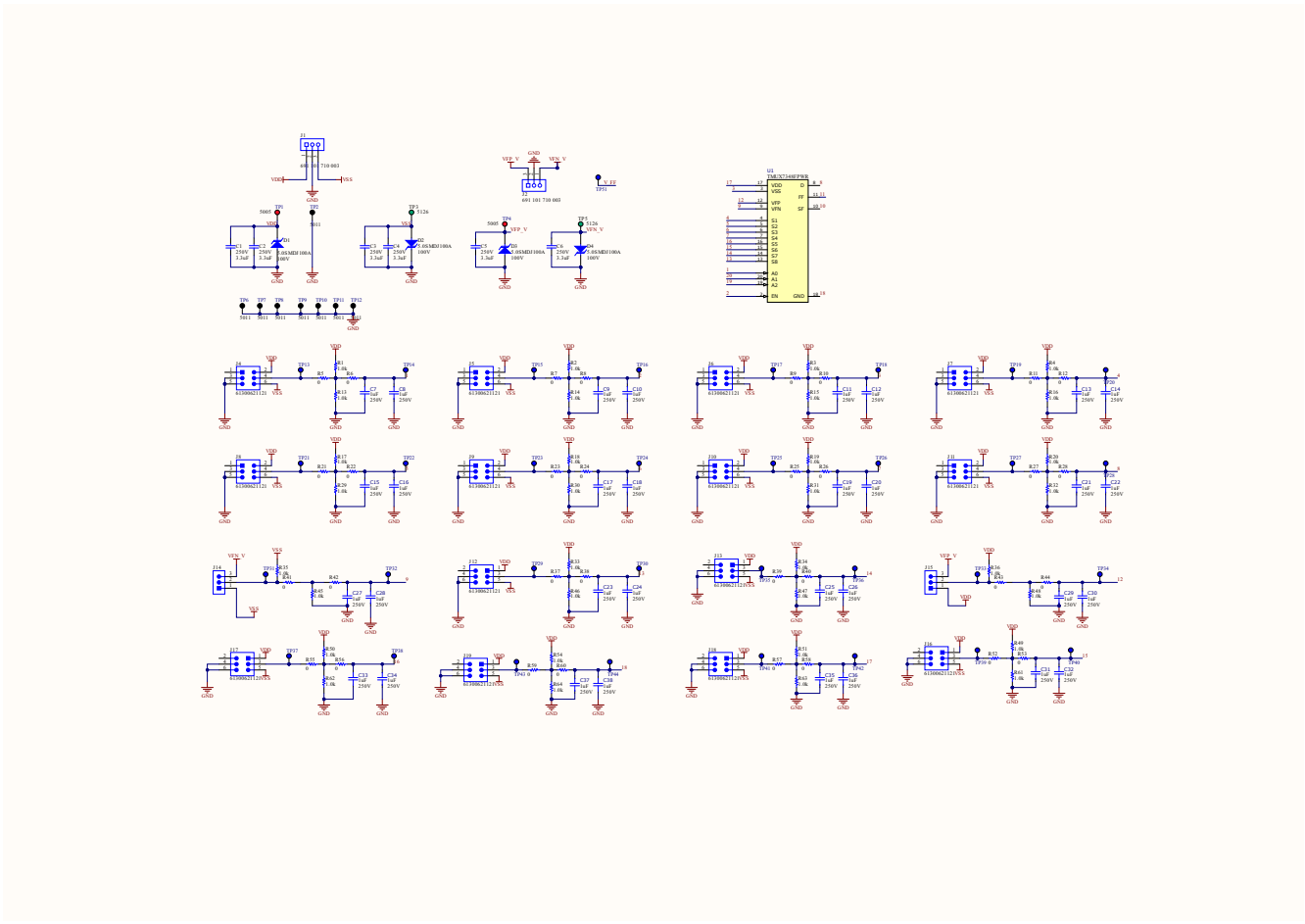
**Table 2-6. Test Points**

| Test Point ID | Color | Signal |
|---|---|---|
| VDD | Red | VDD |
| GND | Black | GND |
| VSS | Green | VSS |
| VFP_V | Red | VFP Threshold Supply |
| VFN_V | Green | VFN Threshold Supply |
| V_FF | Blue | Fault Flag Indicator Led Circuits Supply |
| SF | Orange | Specific Fault Flag |
| FF | Orange | General Fault Flag |

# 3 Hardware Design Files

## 3.1 Schematics





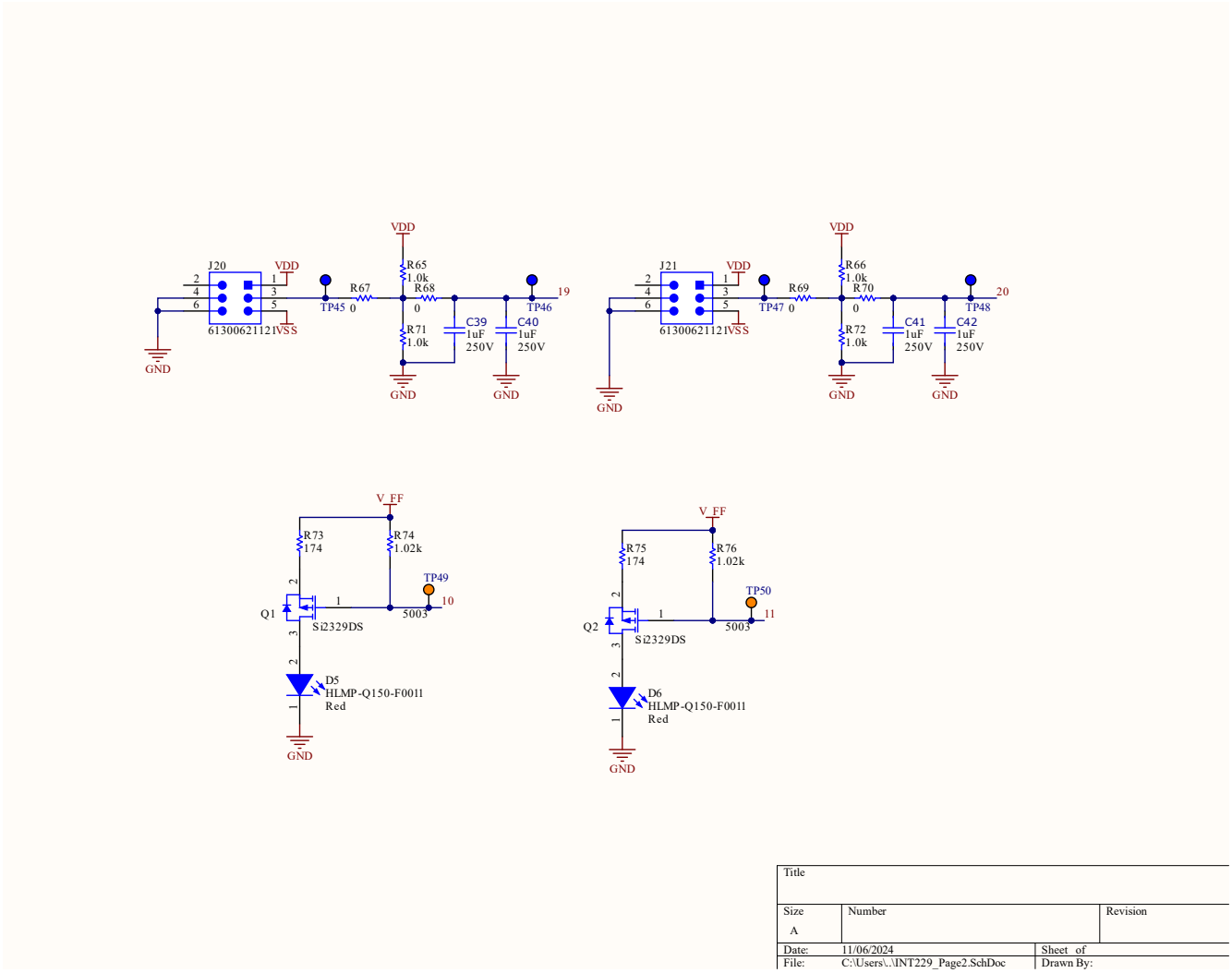
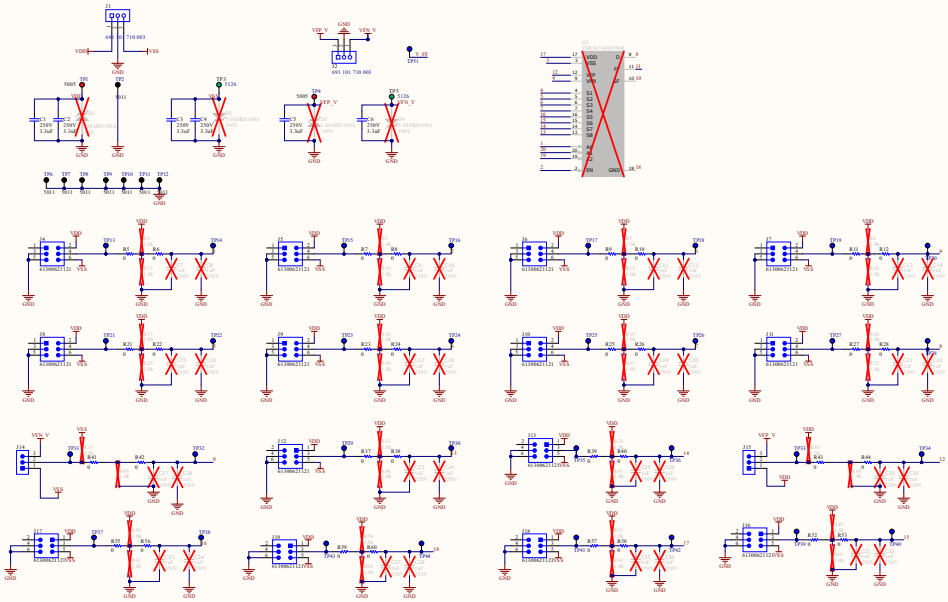



**Figure 3-1. Main Schematic – TMUX73XXF-EVM All Components Shown**



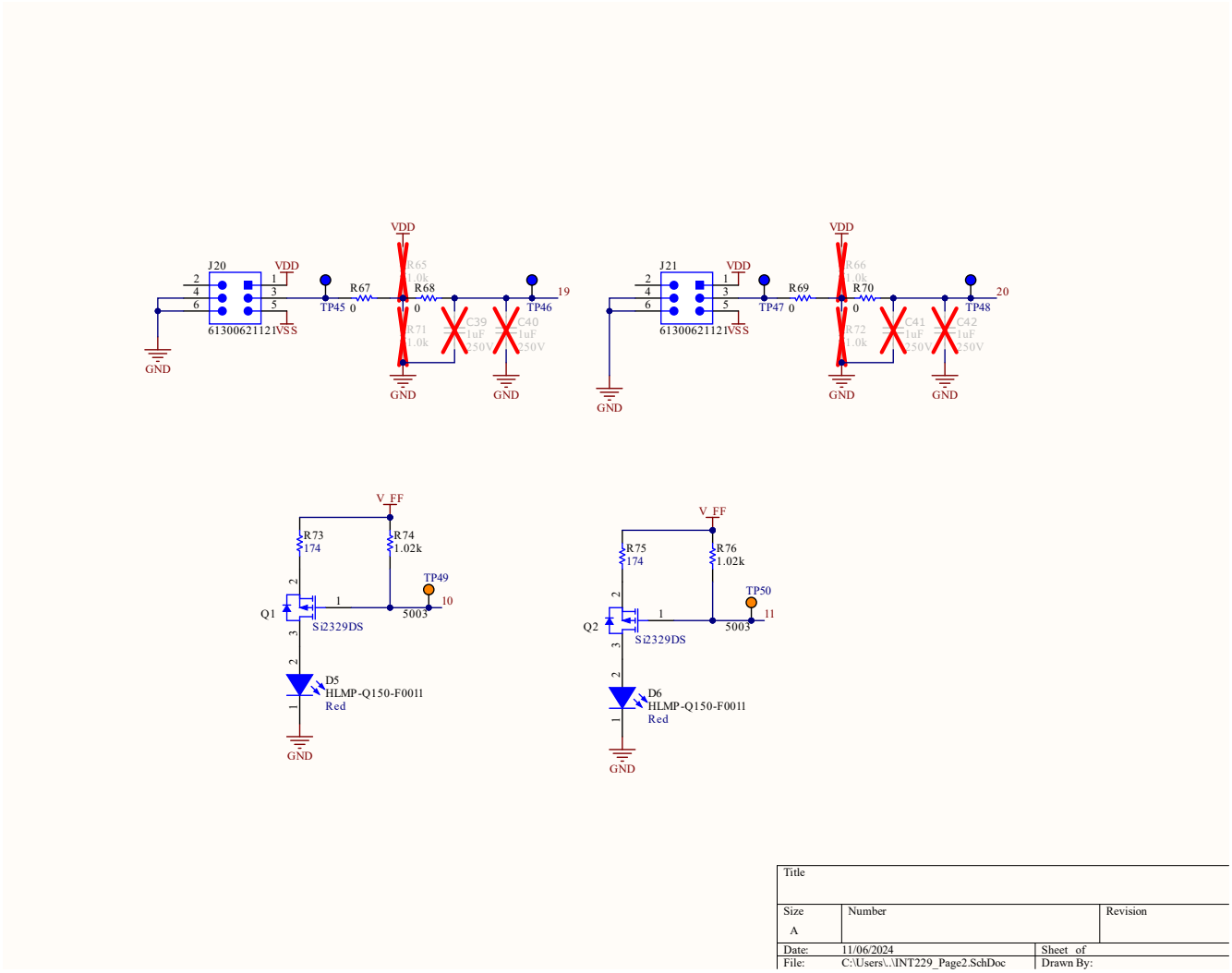



**Figure 3-2. Main Schematic – TMUX73XXF-EVM Default**

## 3.2 PCB Layouts

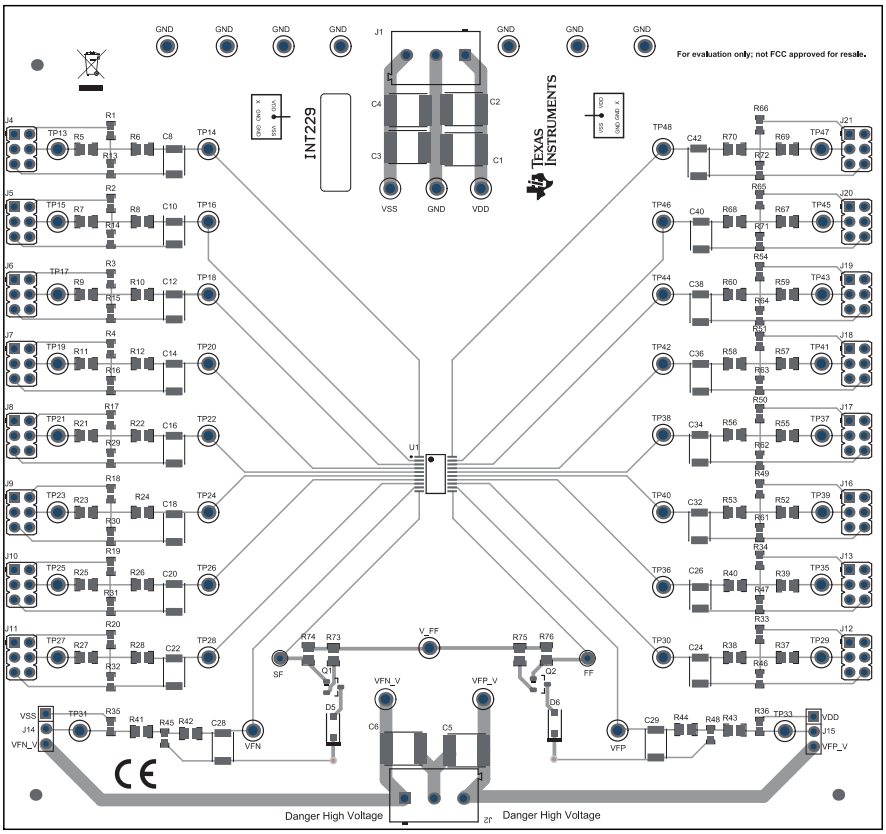



**Figure 3-3. TMUX73XXF-EVM Top Layer Layout**

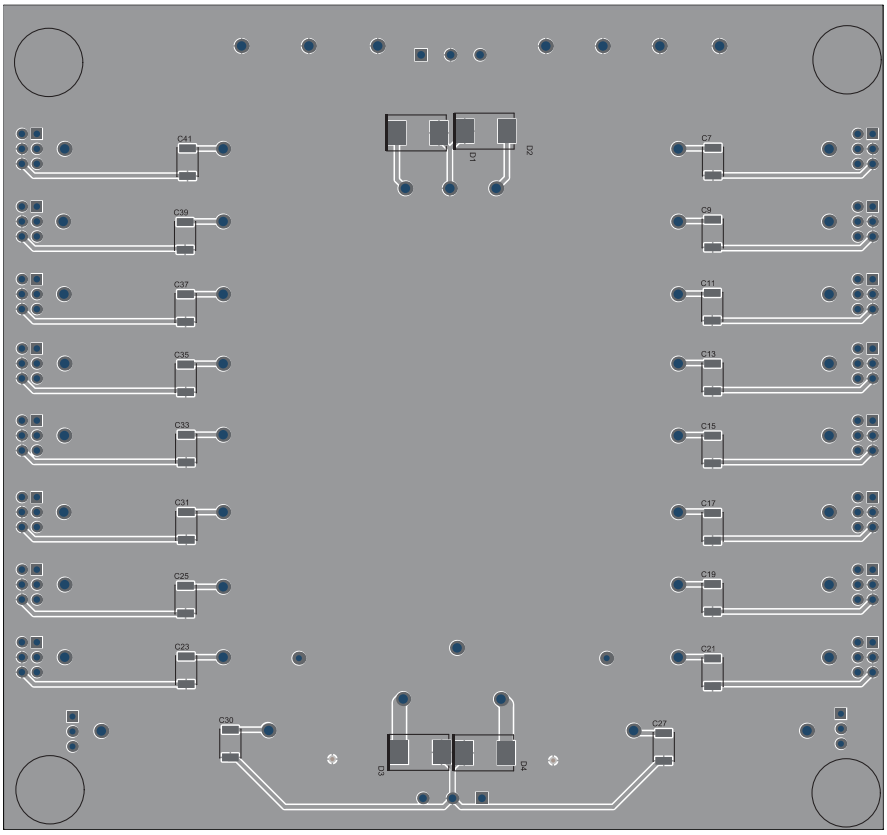



**Figure 3-4. TMUX73XXF-EVM Bottom Layer Layout**

## 3.3 Bill of Materials (BOM)

**Table 3-1. Bill of Materials**

| Description | Designator | PartNumber | Quantity | Manufacturer | PackageReference | Value |
|---|---|---|---|---|---|---|
| Printed Circuit Board | | | 1 | Any | | |
| CAP, CERM, 3.3 uF, 250 V, +/- 20%, X7T, AEC-Q200 Grade 1, 6x5x5mm | C1, C2, C3, C4, C5, C6 | CKG57NX7T2E335M500JH | 6 | TDK | 6x5x5mm | 3.3uF |
| LED, Red, SMD | D5, D6 | HLMP-Q150-F0011 | 2 | Avago | 2.08x2.21mm | Red |
| Fiducial mark. There is nothing to buy or mount. | FID1, FID2, FID3 | N/A | 3 | N/A | N/A | |
| Bumpon, Hemisphere, 0.44 X 0.20, Clear | H1, H2, H3, H4 | SJ-5303 (CLEAR) | 4 | 3M | Transparent Bumpon | |
| Terminal Block, 5 mm, 3x1, Tin, TH | J1, J2 | 691 101 710 003 | 2 | Wurth Elektronik | Terminal Block, 5 mm, 3x1, TH | |
| Header, 2.54mm, 3x2, Gold, TH | J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J16, J17, J18, J19, J20, J21 | 61300621121 | 16 | Wurth Elektronik | Header, 2.54mm, 3x2, TH | |
| Header, 100mil, 3x1, Gold, TH | J14, J15 | PBC03SAAN | 2 | Sullins Connector Solutions | PBC03SAAN | |
| Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll | LBL1 | THT-14-423-10 | 1 | Brady | PCB Label 0.650 x 0.200 inch | |
| MOSFET, P-CH, -8 V, -5.3 A, SOT-23 | Q1, Q2 | Si2329DS | 2 | Vishay-Semiconductor | SOT-23 | -8V |

**Table 3-1. Bill of Materials (continued)**

| Description | Designator | PartNumber | Quantity | Manufacturer | PackageReference | Value |
|---|---|---|---|---|---|---|
| RES, 0, 0%, W, AEC-Q200 Grade 0, 0805 | R5, R6, R7, R8, R9, R10, R11, R12, R21, R22, R23, R24, R25, R26, R27, R28, R37, R38, R39, R40, R41, R42, R43, R44, R52, R53, R55, R56, R57, R58, R59, R60, R67, R68, R69, R70 | PMR10EZPJ000 | 36 | Rohm | 0805 | 0 |
| RES, 174, 0.1%, 0.125 W, 0805 | R73, R75 | RT0805BRD07174RL | 2 | Yageo America | 0805 | 174 |
| RES, 1.02 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | R74, R76 | CRCW08051K02FKEA | 2 | Vishay-Dale | 0805 | 1.02k |
| Shunt, 100mil, Gold plated, Black | SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10, SH-J11, SH-J12, SH-J13, SH-J14, SH-J15, SH-J16, SH-J17, SH-J18 | 881545-2 | 18 | TE Connectivity | Shunt 2 pos. 100 mil | |
| Test Point, Compact, Red, TH | TP1, TP4 | 5005 | 2 | Keystone | Red Compact Testpoint | |

**Table 3-1. Bill of Materials (continued)**

| Description | Designator | PartNumber | Quantity | Manufacturer | PackageReference | Value |
|---|---|---|---|---|---|---|
| Test Point, Multipurpose, Black, TH | TP2, TP6, TP7, TP8, TP9, TP10, TP11, TP12 | 5011 | 8 | Keystone | Black Multipurpose Testpoint | |
| Test Point, Multipurpose, Green, TH | TP3, TP5 | 5126 | 2 | Keystone | Green Multipurpose Testpoint | |
| Test Point, Compact, Blue, TH | TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33, TP34, TP35, TP36, TP37, TP38, TP39, TP40, TP41, TP42, TP43, TP44, TP45, TP46, TP47, TP48, TP51 | 5122 | 37 | Keystone | Blue Compact Testpoint | |
| Test Point, Miniature, Orange, TH | TP49, TP50 | 5003 | 2 | Keystone | Orange Miniature Testpoint | |

**Table 3-1. Bill of Materials (continued)**

| Description | Designator | PartNumber | Quantity | Manufacturer | PackageReference | Value |
|---|---|---|---|---|---|---|
| Multilayer Ceramic Capacitors 1uF ±10% 250V X7T SMD 1812 | C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42 | C4532X7T2E105K250KA | 0 | TDK | 1812 | 1µF |
| Diode, TVS, Uni, 100 V, 162 Vc, SMC | D1, D2, D3, D4 | 5.0SMDJ100A | 0 | Littelfuse | SMC | 100V |
| RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603 | R1, R2, R3, R4, R13, R14, R15, R16, R17, R18, R19, R20, R29, R30, R31, R32, R33, R34, R35, R36, R45, R46, R47, R48, R49, R50, R51, R54, R61, R62, R63, R64, R65, R66, R71, R72 | CRCW06031K00JNEA | 0 | Vishay-Dale | 0603 | 1.0k |

**Table 3-1. Bill of Materials (continued)**

| Description | Designator | PartNumber | Quantity | Manufacturer | PackageReference | Value |
|---|---|---|---|---|---|---|
| +60 V or -60 V Tolerant, Fault-protected, Latch-up Immune, Single-Ended 8:1 Multiplexers with Adjustable Fault Threshold | U1 | TMUX7348FPWR | 0 | Texas Instruments | TSSOP20 | |

# 4 Additional Information

## 4.1 Trademarks

All trademarks are the property of their respective owners.

# IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265