User's Guide

LM74500-Q1 Evaluation Module

ABSTRACT

This user's guide describes the evaluation module (EVM) for TI's reverse polarity protection controller, LM74500-Q1. This document provides configuration information and test setup details for evaluating LM74500-Q1 devices. An EVM schematic, board layout images, and bill of materials (BOM) are included.

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Trademarks

1 Introduction

Texas Instruments LM74500-Q1 evaluation module (LM74500Q1EVM) helps designers evaluate the operation and performance of the LM74500-Q1 reverse polarity protection controller. This evaluation module demonstrates how an N-channel power MOSFET can be used to realize input reverse voltage protection with low I_Q and low-leakage current flowing through the IC. In this design scheme, the LM74500-Q1 is combined with a MOSFET and used in series with a battery as a replacement of a traditional PFET based reverse-polarity protection circuitry as shown in Figure 2-1. For more information on the LM74500 functional and electrical characteristics, see *LM74500-Q1 reverse battery protection controller*.

2 Setup

This section describes the jumpers and connectors on the EVM, and how to properly connect, setup, and use the LM74500Q1EVM. Ensure the power supply is turned off while making connections on the board.

2.1 I/O Connector Description

VIN	J1: Power input connector to the positive rail of the input power supply
GND1	J3: Ground connection for the power supply
VOUT	J2: Power output connector to the positive side of the load
GND2	J4: Ground connection for the load
Test Points	VIN, VOUT, GND1, and GND2 are test points

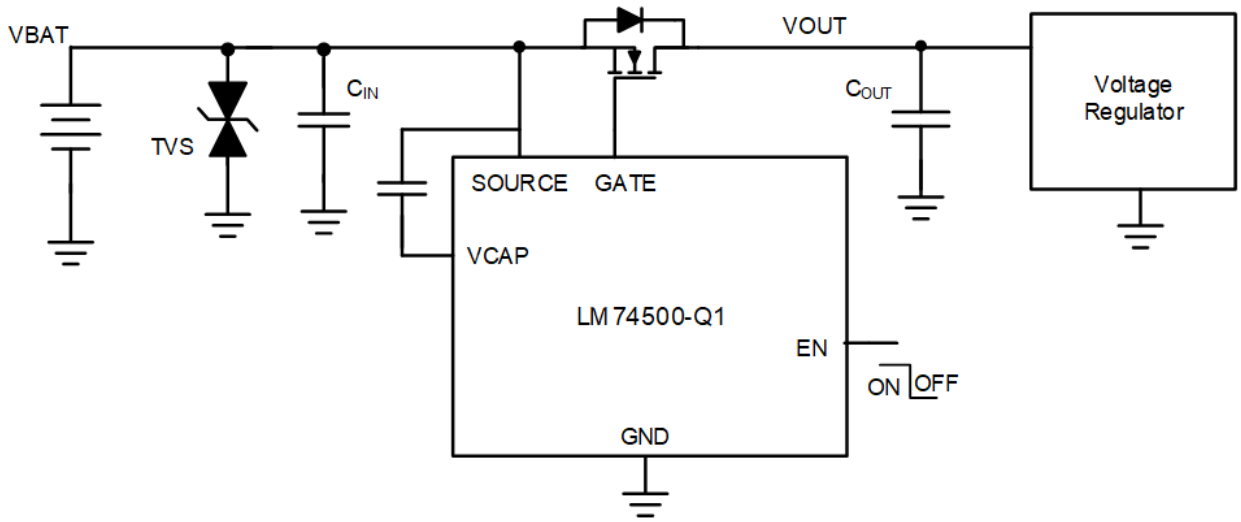

Figure 2-1. LM745000Q1EVM Typical Application Circuit

2.2 Board Setup

Before applying power to the LM74500Q1EVM, verify all external connections. Turn off external power supplies and connect them with the proper polarity to the VIN and GND1 connectors. An electronic or resistive load must be connected at the output VOUT and GND2 connectors. The tests outlined in this document are conducted with 3-A constant current as the load and 12 V at the input. Make sure that the external power-supply source for the input voltage is capable of providing enough current to the output load so that the output voltage can be obtained.

When all connections to the LM74500Q1EVM are verified, apply power to VIN. Figure 2-2 captures EVM board setup.

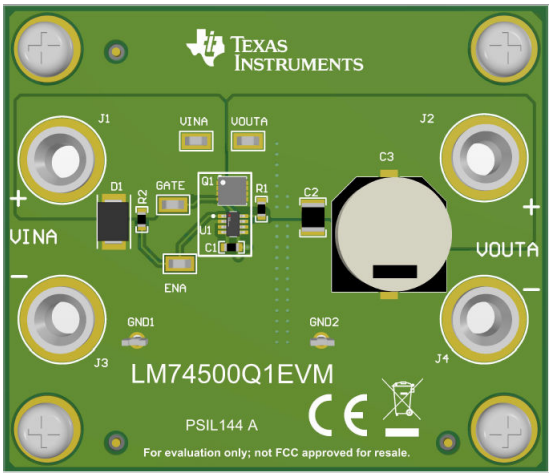

Figure 2-2. LM74500Q1EVM

2.3 Schematic

Figure 2-3 illustrates the EVM schematic.

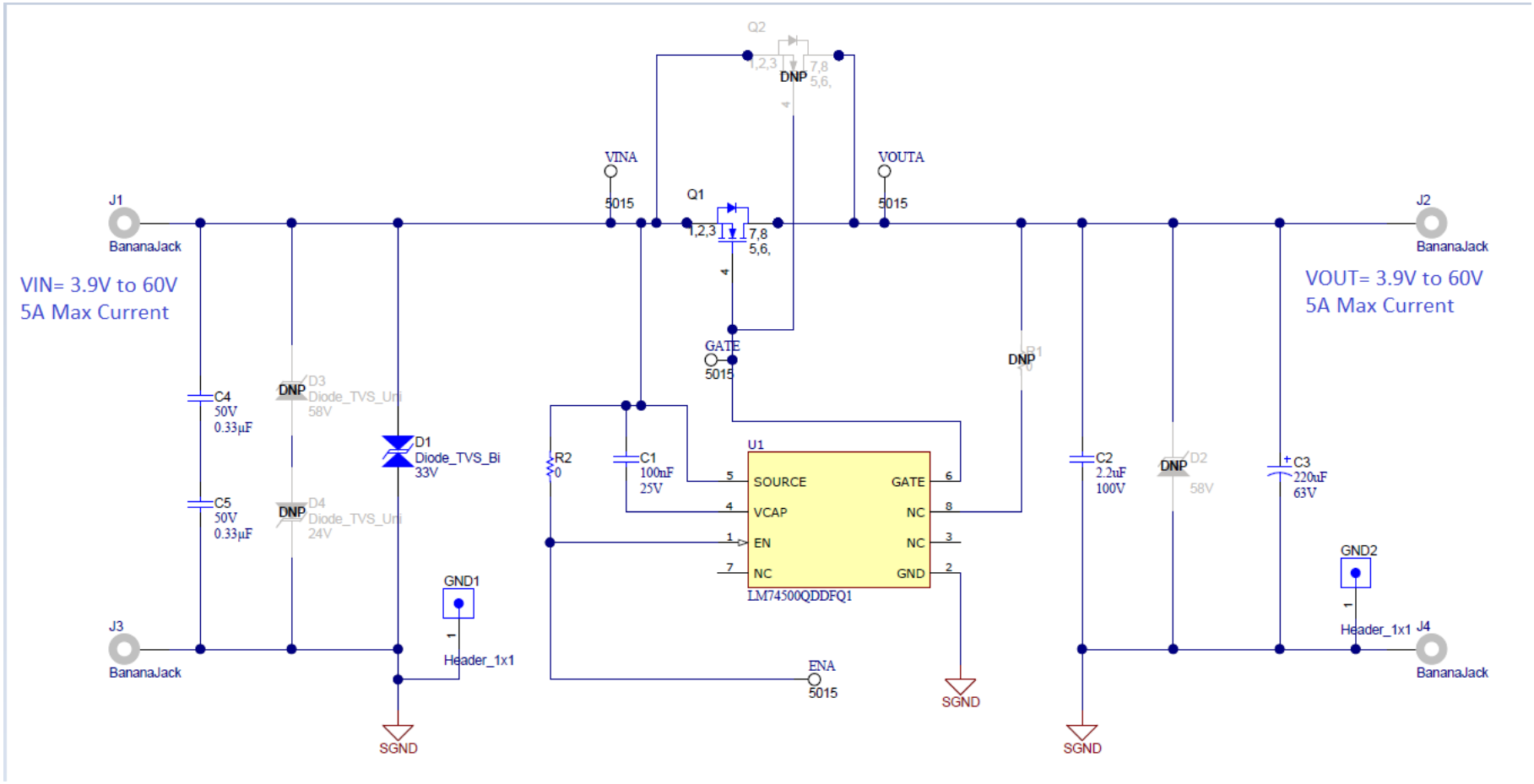

Figure 2-3. LM74500Q1EVM Schematic

3 Operation

3.1 LM74500Q1EVM Performance Capture

A startup pulse from 0 V to 12 V is applied at the input of the LM74500Q1EVM. Figure 3-1 shows the input voltage (CH1) rises from 0 V to 12 V and the gate voltage (CH3) comes up after input voltage crosses device PoR threshold . The gate of external N-FET is fully enhanced and FET is turned on. Output voltage (CH2) rises smoothly from 0 V to 12 V.

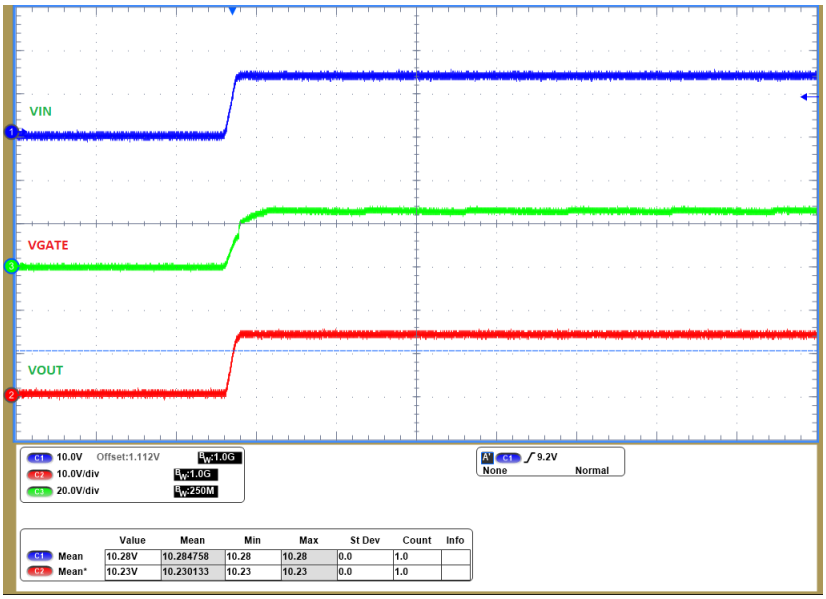

Figure 3-1. LM74500Q1EVM Startup

A –12 V source is connected to the VIN input of the LM74500Q1EVM. Figure 3-2 shows that the output voltage remains at a constant 0 V in this situation. This test simulates the event of connecting a 12-V battery in the reverse direction; therefore, protecting the load from negative input voltages.

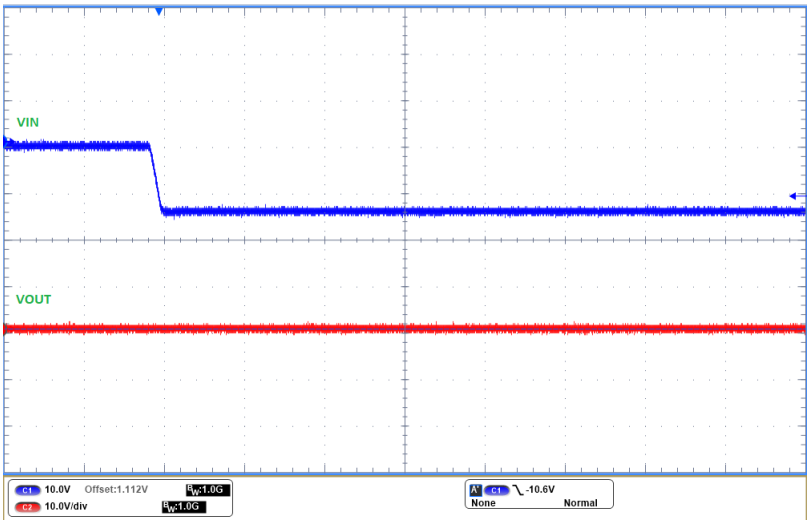

Figure 3-2. Startup Reverse Polarity (–12 V)

4 EVM Board Assembly Drawings and Layout Guidelines

4.1 PCB Drawings

Figure 4-1 through Figure 4-4 show component placement and layout of this EVM.

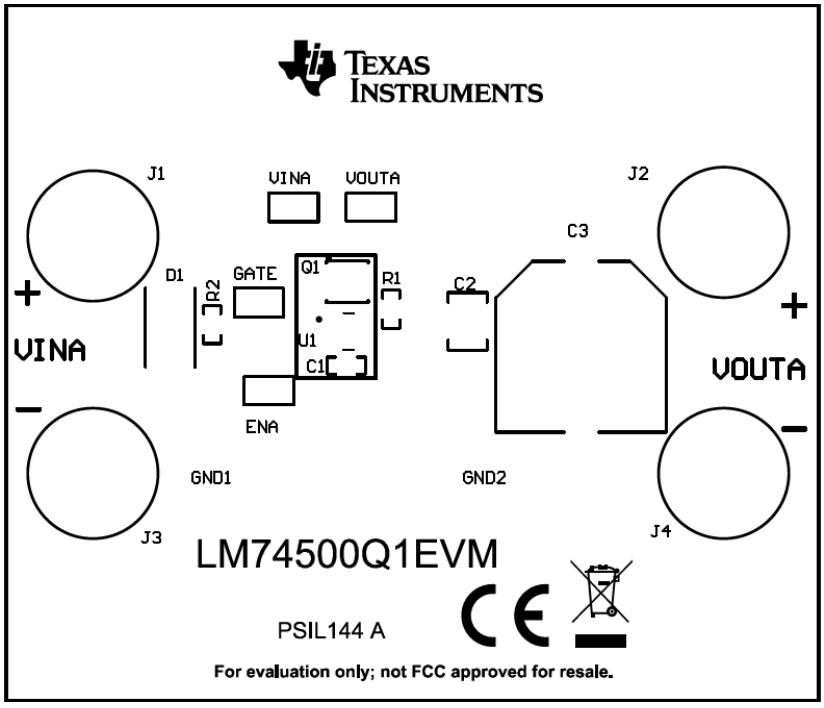

Figure 4-1. LM74500Q1EVM Top Side Placement

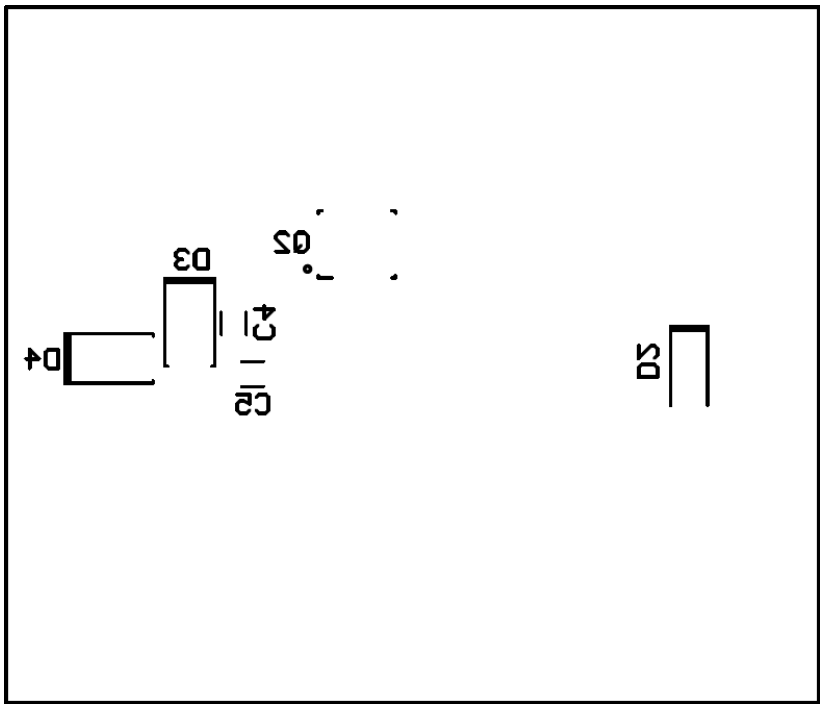

Figure 4-2. LM74500Q1EVM Bottom Side Placement

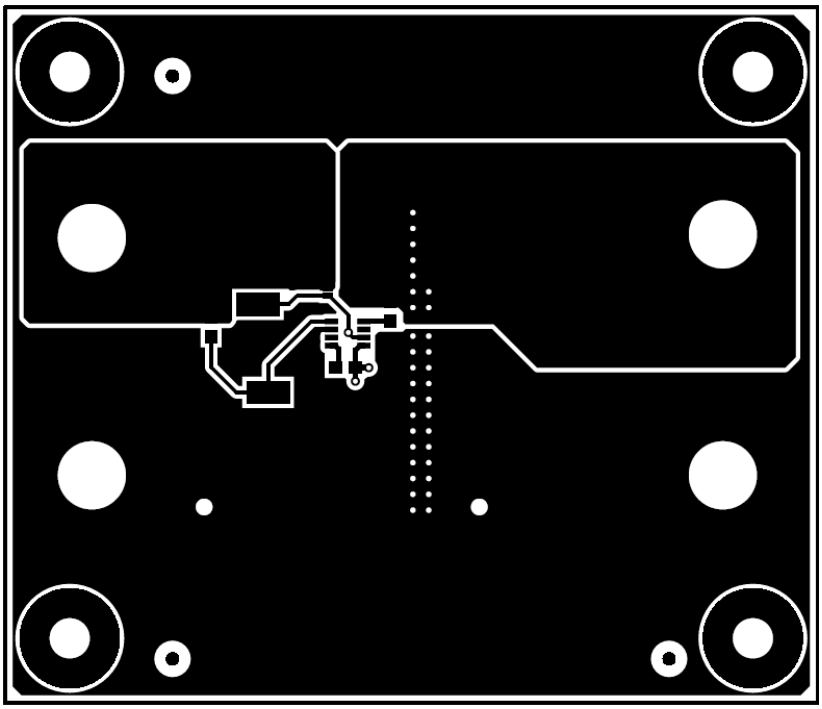

Figure 4-3. LM74500Q1EVM Top Layer Routing

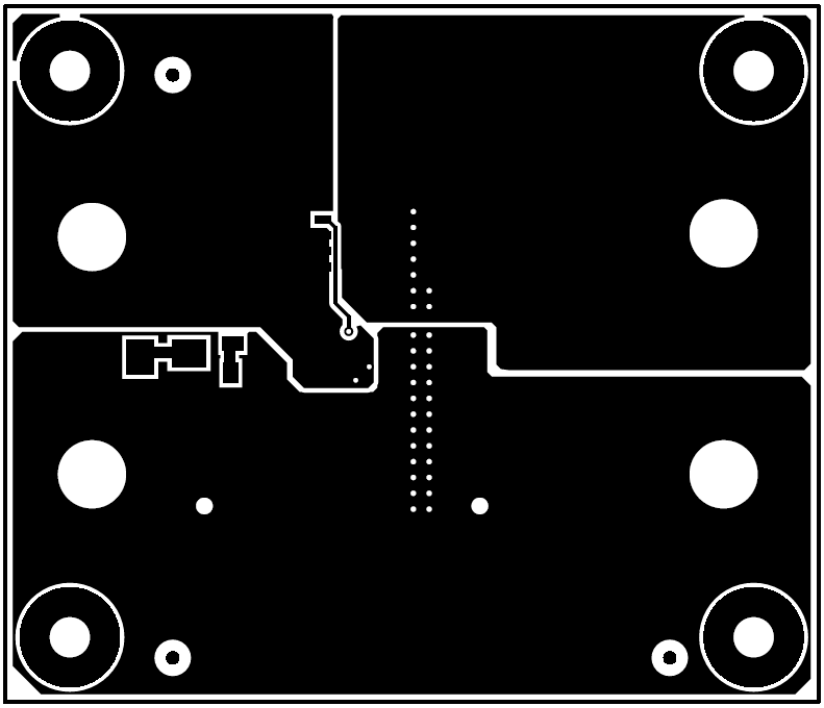

Figure 4-4. LM74500Q1EVM Bottom Layer Routing

4.2 Bill of Materials

Section 4.2 lists the LM74500Q1EVM BOM.

Table 4-1. Bill of Materials

Fitted	Description	Designator	Part Number	QTY	Manufacturer	Package Reference	Value
Fitted	CAP, CERM, 1 µF, 25 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	C1	CGA3E1X7R1E105K080AD	1	TDK	0603	1 uF
Fitted	CAP, CERM, 2.2 uF, 100 V, +/- 10%, X7R, 1210	C2	C1210C225K1RACTU	1	Kemet	1210	2.2 uF
Fitted	CAP, AL, 220 µF, 63 V, +/- 20%, 0.16 ohm, AEC-Q200 Grade 2, SMD	C3	EEV-FK1J221Q	1	Panasonic	SMT Radial H13	220 uF
Fitted	CAP, CERM, 0.33 µF, 50 V,+/- 10%, X8R, AEC-Q200 Grade 0, 1206	C4, C5	CGA5L2X8R1H334K160AA	2	TDK	1206	0.33 uF
Fitted	Diode, TVS, Bi, 33 V, SMB	D1	SMBJ33CA-13-F	1	Diodes Inc.	SMB	33 V
Fitted	Test Point, Miniature, SMT	EN, GATE, VIN, VOUT	5015	4	Keystone	Testpoint_Keystone_Miniature	
Fitted	TEST POINT SLOTTED .118", TH	GND1, GND2	1040	2	Keystone	Test point, TH Slot Test point	
Fitted	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	H1, H2, H3, H4	NY PMS 440 0025 PH	4	B&F Fastener Supply	Screw	
Fitted	Standoff, Hex, 0.5"L #4-40 Nylon	H5, H6, H7, H8	1902C	4	Keystone	Standoff	
Fitted	Standard Banana Jack, Uninsulated, 8.9mm	J1, J2, J3, J4	575-8	4	Keystone	Keystone575-8	
Fitted	MOSFET, N-CH, 60 V, 15 A, AEC-Q101, 8-PowerVDFN	Q1	DMT6007LFG-13	1	Diodes Inc.	8-PowerVDFN	60 V
Fitted	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	R1	CRCW06030000Z0EA	1	Vishay-Dale	0603	0
Fitted	IC, Ideal Didoe	U1	LM74500QDDFRQ1	1	Texas Instruments	SOT23-6	
Not Fitted	Diode, TVS, Uni, 58 V, SMA	D2	SMAJ58A	0	Diodes Inc.	SMA	58 V
Not Fitted	Diode, TVS, Uni, 58 V, 93.6 Vc, SMB	D3	SMBJ58A-13-F	0	Diodes Inc.	SMB	58 V
Not Fitted	Diode, TVS, Uni, 24 V, 38.9 Vc, SMB	D4	SMBJ24A-13-F	0	Diodes Inc.	SMB	24 V
Not Fitted	Fiducial mark. There is nothing to buy or mount.	FID1, FID2, FID3, FID4, FID5, FID6	N/A	0	N/A	N/A	
Not Fitted	MOSFET, N-CH, 60 V, 17.9 A, AEC-Q101, 8-PowerTDFN	Q2	DMT6005LPS-13	0	Diodes Inc.	8-PowerTDFN	60 V

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