

TPS61391EVM-058 Evaluation Module

This user's guide describes the characteristics, operation, and use of the TPS61391EVM-058 evaluation module (EVM). The EVM contains the TPS61391 device, which is a step-up converter with the current mirror and sample and hold circuitry being integrated, which is designed for biasing and monitoring the avalanche photodiodes (APD) in the optical receivers. The user's guide includes EVM specifications, recommended test setup, test result, schematic diagram, bill of materials, and the board layout.

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1 Introduction

1.1 Performance Specification

Table 1 provides a summary of the TPS61391 EVM performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1. Performance Specification Summary

| Specification | Test Conditions | MIN | TYP | MAX | Unit |
|---------------|--|-----|-----|-----|------|
| V_{IN} | | 3.6 | | | V |
| V_{OUT} | $V_{IN} = 3.6\text{ V}$, $I_o \leq 3.5\text{ mA}$ | 35 | | | V |
| V_{PP+} | $V_{IN} = 3.6\text{ V}$, $I_{_VPP} \leq 2\text{ mA}$ | 70 | | | V |
| V_{PN-} | $V_{IN} = 3.6\text{ V}$, $I_{_VPN} \leq 3.5\text{ mA}$ | -35 | | | V |

1.2 Modification

The printed-circuit board (PCB) for this EVM is designed to accommodate some modifications by the user. The external component can be changed according to the user's application.

1.3 Input capacitor

A 100- μF tantalum capacitor (C1) is added as the input capacitor in the EVM. The ESR of the tantalum capacitor is 0.1 Ω which helps to damp the ringing of the input voltage when the EVM is powered by a power supply with a long cable. The capacitor is not required for proper operation and can be removed in a user's application.

1.4 Output Capacitor Selection

Two 0.1- μF ceramic capacitors (C3 and C4) are added as the output capacitors. These capacitors help ensure the low output ripple at heavy load.

1.5 APD Decoupling Capacitor Selection

The default APD decoupling capacitor is 220 pF (C10) on the EVM board. In the user's application, if there is already a decoupling capacitor on the optical module, then the decoupling capacitor C10 must be deleted from the EVM board. Too much decoupling capacitance results in poor optical detection sensitivity.

2 Setup

This section describes how to properly connect, set up, and use the TPS61391EVM.

2.1 *Input/Output Connector Descriptions*

Use the following connector descriptions to set up the EVM:

- J1-VIN: Positive input connection from the input supply for the EVM
- J2-GND: Return connection from the input supply for the EVM
- J3-VOOUT: Positive connection for the output voltage
- J4-GND: Return connection for the output voltage
- J5- VPP+: Positive charge pump output voltage connection
- J6-GND: Positive charge pump output voltage return connection
- J7- VPN-: Negative charge pump output voltage connection
- J8-GND: Negative charge pump output voltage return connection
- JP1-APD: Power supply for the APD pin
- JP2-Vo_ADJ: Adjust the output voltage
- JP3-EN: EN pin input jumper. Place a jumper across EN and pin 3 to turn on the IC, place a jumper across EN and pin 1 to turn off the IC

3 Schematic, Bill of Materials, and Board Layout

This section provides the TPS61391EVM schematic, bill of materials (BOM), and board layout.

3.1 Schematic

Figure 1 shows the EVM schematic.

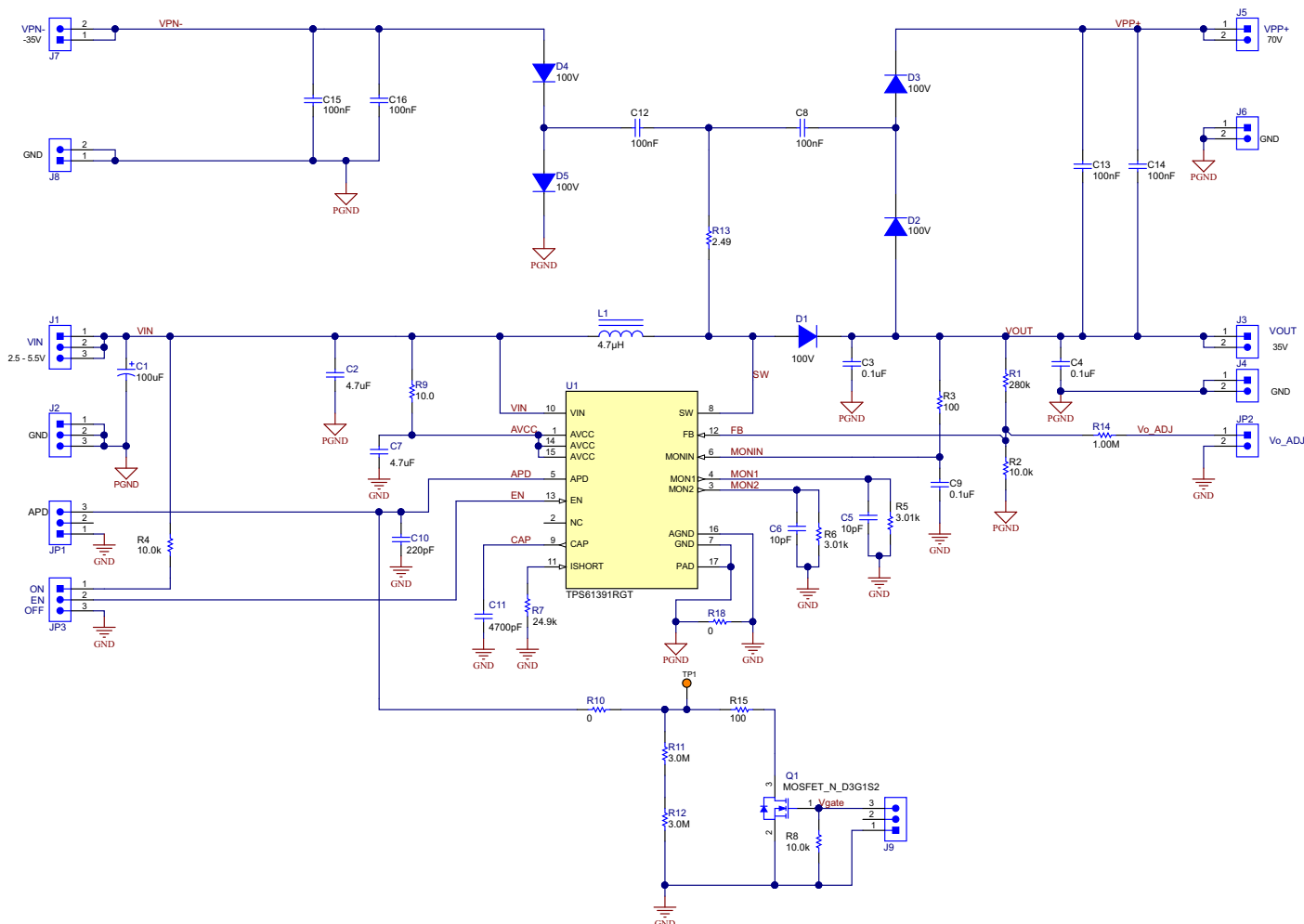


Figure 1. TPS61391EVM Schematic

3.2 Bill of Materials

Table 2 lists the EVM BOM.

Table 2. TPS61391EVM Bill of Materials

| Designator | QTY | Value | Description | Package | Part Number | MFG |
|---|-----|-----------------|---|-----------------------------|----------------------|-----------------------------|
| C2, C7 | 1 | 4.7 μ F | CAP, CERM, 4.7 μ F, 10 V, \pm 10%, X5R, 0603 | 0603 | 0603ZD475KAT2A | AVX |
| C3, C4, C8, C9, C12, C13, C14, C15, C16 | 9 | 0.1 μ F | CAP, CERM, 0.1 μ F, 100 V, \pm 10%, X7R, 0603 | 0603 | GRM188R72A104KA35D | MuRata |
| C5, C6 | 2 | 10 pF | CAP, CERM, 10 pF, 50 V, \pm 5%, C0G/NP0, 0603 | 0603 | GCM1885C2A100JA16D | MuRata |
| C10 | 1 | 220 pF | CAP, CERM, 220 pF, 100 V, \pm 5%, C0G/NP0, 0603 | 0603 | GCM1885C2A221JA16D | MuRata |
| C11 | 1 | 4700 pF | CAP, CERM, 4700 pF, 100 V, \pm 10%, X7R, AEC-Q200 Grade 1, 0603 | 0603 | CGA3E2X7R2A472K080AA | TDK |
| D1, D2, D3, D4, D5 | 5 | 100 V | Diode, Switching, 100 V, 0.25 A, AEC-Q101, SOD-123 | SOD-123 | BAS16D-E3-08 | Vishay-Semiconductor |
| J1, J2, J9, JP1, JP3 | 5 | | Header, 100 mil, 3 \times 1, Tin, TH | Header, 3 PIN, 100 mil, Tin | PEC03SAAN | Sullins Connector Solutions |
| J3, J4, J5, J6, J7, J8, JP2 | 7 | | Header, 100 mil, 2 \times 1, Tin, TH | Header, 2 PIN, 100 mil, Tin | PEC02SAAN | Sullins Connector Solutions |
| L1 | 1 | 4.7 μ H | Inductor, Shielded, Metal Composite, 4.7 μ H, 1.2 A, 0.252 Ω , SMD | 2 \times 1.6 mm | DFE201612E-4R7M=P2 | MuRata |
| Q1 | 1 | 100 V | MOSFET, N-CH, 100 V, 0.17 A, SOT-23 | SOT-23 | BSS123 | Fairchild Semiconductor |
| R1 | 1 | 280 k Ω | RES, 280 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW0603280KFKEA | Vishay-Dale |
| R2, R4, R8 | 3 | 10.0 k Ω | RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW060310K0FKEA | Vishay-Dale |
| R3, R15 | 2 | 100 Ω | RES, 100, 0.5%, 0.1 W, 0603 | 0603 | RT0603DRE07100RL | Yageo America |
| R5, R6 | 2 | 3.01 k Ω | RES, 3.01 k, 0.5%, 0.1 W, 0603 | 0603 | RT0603DRE073K01L | Yageo America |
| R7 | 1 | 24.9 k Ω | RES, 24.9 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW060324K9FKEA | Vishay-Dale |
| R9 | 1 | 10.0 Ω | RES, 10.0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW060310R0FKEA | Vishay-Dale |
| R10, R18 | 2 | 0 | RES, 0, 5%, 0.125 W, 0603 | 0603 | MCT06030Z0000ZP500 | Vishay/Beyschlag |
| R11, R12 | 2 | 3.0 Meg | RES, 3.0 M, 5%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW06033M00JNEA | Vishay-Dale |
| R13 | 1 | 2.49 | RES, 2.49, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW06032R49FKEA | Vishay-Dale |
| R14 | 1 | 1.00 Meg | RES, 1.00 M, 1%, 0.1 W, AEC-Q200 Grade 0, 0603 | 0603 | CRCW06031M00FKEA | Vishay-Dale |
| SH-JP1 | 1 | 1 \times 2 | Shunt, 100 mil, Gold plated, Black | Shunt | SNT-100-BK-G | Samtec |
| TP1 | 1 | | Test Point, Miniature, Orange, TH | Orange Miniature Testpoint | 5003 | Keystone |
| U1 | 1 | | 85-V _{OUT} boost converter with current mirror and sample / hold, RGT0016C (VQFN-16) | RGT0016C | TPS61391RGT | Texas Instruments |
| C1 | 0 | 100 μ F | CAP, TA, 100 μ F, 16 V, \pm 10%, 0.1 ohm, SMD | 7343-43 | T495X107K016ATE100 | Kemet |

3.3 Board Layout

Figure 2 through Figure 5 illustrate the EVM board layouts.

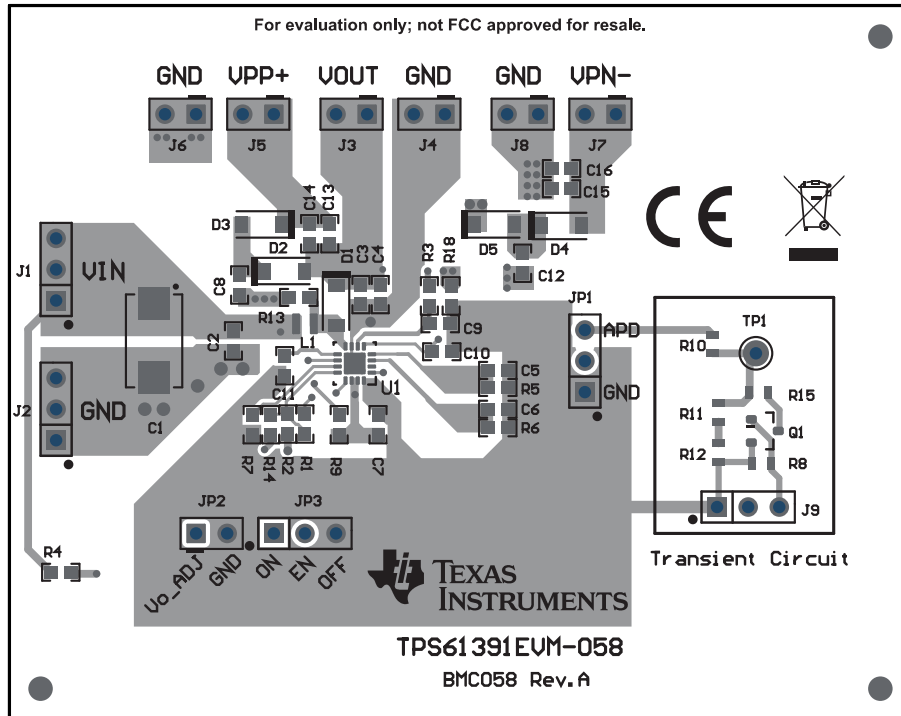


Figure 2. TPS61391EVM Top-Side Layout

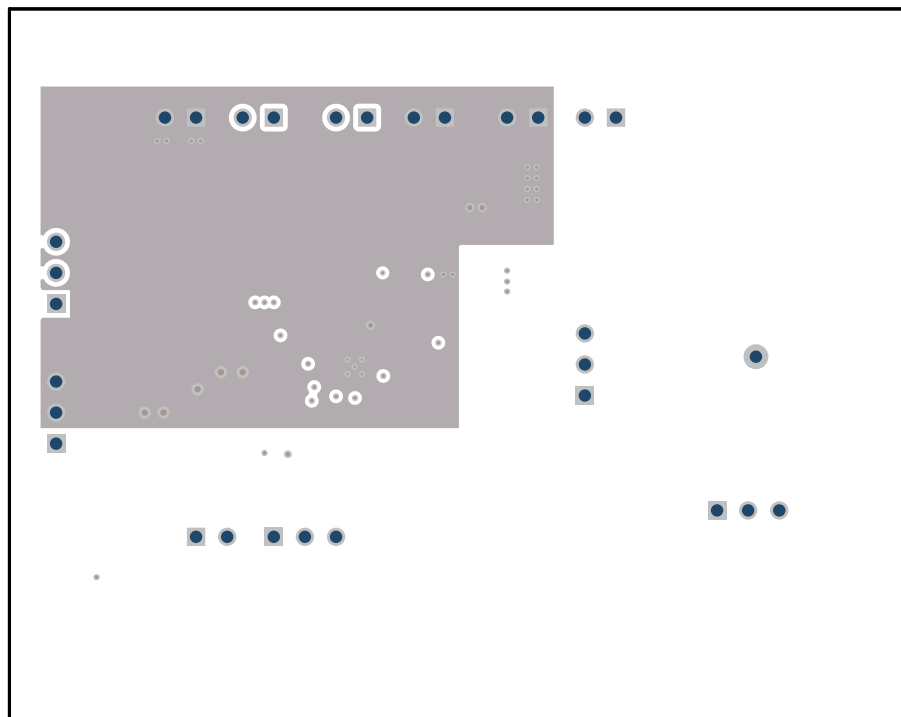


Figure 3. TPS61391EVM Inner Layer 1

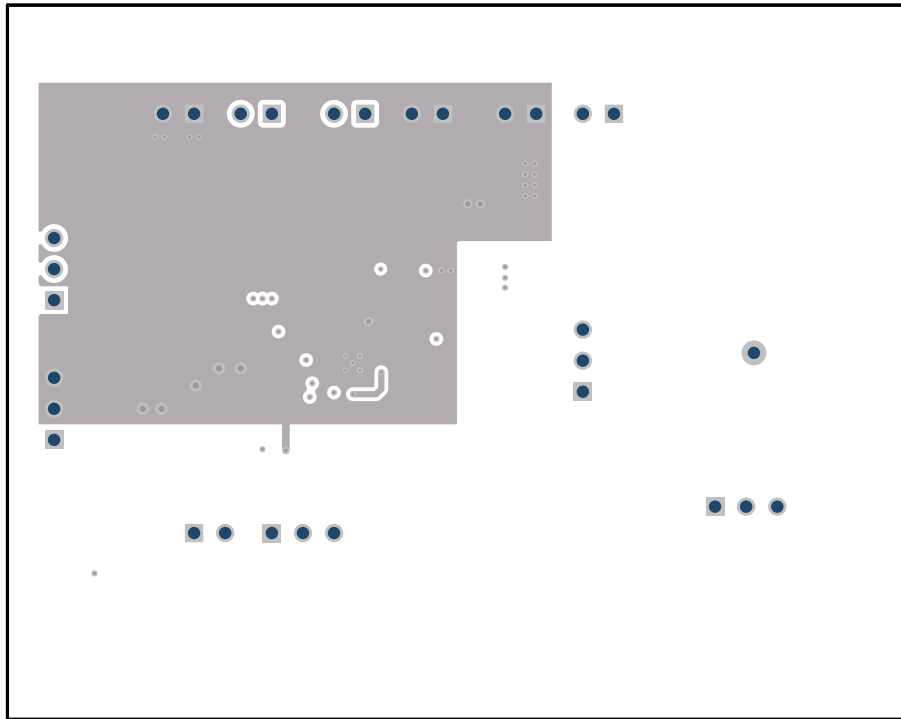


Figure 4. TPS61391EVM Inner Layer 2

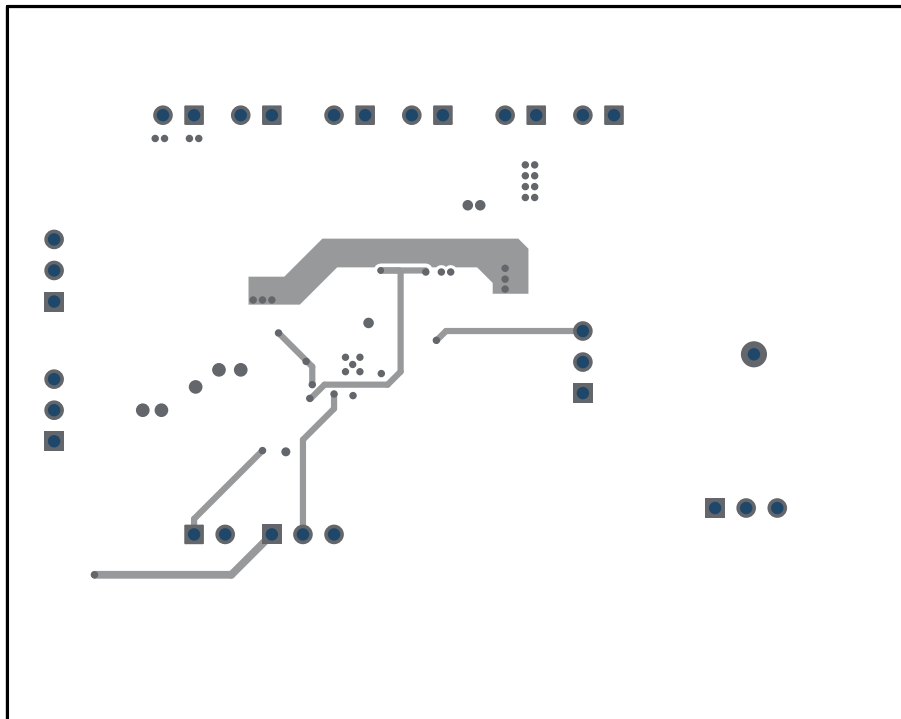


Figure 5. TPS61391EVM Bottom-Side Layout

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