

# TPS22921/22/22B Load Switch EVM

## User's Guide



Literature Number: SLVU286  
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|          |                                                            |           |
|----------|------------------------------------------------------------|-----------|
| <b>1</b> | <b>TPS22921/22/22B Load Switch Evaluation Module (EVM)</b> | <b>5</b>  |
| 1.1      | Introduction                                               | 5         |
| <b>2</b> | <b>Schematics and Bill of Materials</b>                    | <b>7</b>  |
| 2.1      | EVM Options                                                | 7         |
| 2.2      | Schematic                                                  | 7         |
| 2.3      | Bill of Materials                                          | 8         |
| <b>3</b> | <b>Board Layout</b>                                        | <b>9</b>  |
| 3.1      | TPS22921/22/22B EVM Board                                  | 9         |
| 3.2      | Layout Considerations                                      | 11        |
| <b>4</b> | <b>EVM Setup</b>                                           | <b>13</b> |
| 4.1      | Recommended Test Equipment                                 | 13        |
| 4.2      | Calculating Voltage Drop and Load Current                  | 13        |
| <b>5</b> | <b>Related Documentation from Texas Instruments</b>        | <b>15</b> |
|          | <b>Important Notices</b>                                   | <b>16</b> |

## List of Figures

|     |                                                              |    |
|-----|--------------------------------------------------------------|----|
| 3-1 | TPS22921/22/22B EVM Component Placement .....                | 9  |
| 3-2 | TPS22921/22/22B EVM Top-Side Layout .....                    | 10 |
| 3-3 | TPS22921/22/22B EVM Bottom-Side Layout.....                  | 10 |
| 4-1 | EVM Setup For Calculating Voltage Drop and Load Current..... | 13 |

## List of Tables

|     |                                   |   |
|-----|-----------------------------------|---|
| 2-1 | TPS22921/22/22B EVM Options ..... | 7 |
| 2.4 | Bill of Materials .....           | 8 |

## ***TPS22921/22/22B Load Switch Evaluation Module (EVM)***

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This user's guide describes the TPS22921/22/22B evaluation module (EVM). This guide contains the EVM schematics, bill of materials, assembly drawings, and top and bottom board layouts.

### **1.1 Introduction**

The TPS22921/22/22B EVM is an evaluation module for the Texas Instruments family of low-input voltage, ultra-low  $r_{ON}$  load switches. This EVM operates over a 0.9 V to 3.6 V range and provides a continuous output current of up to  $\approx 110$  mA. Additional open resistor and capacitor footprints allow for the use of customer-selected input and output load values.

The TPS22921/22/22B EVM accepts a YFP-6 packaged load switch for any of three (3) possible devices: TPS22921, TPS22922, or TPS22922B. These switches have a low threshold enable input, internally controlled slew rate, and ultra-low quiescent/shutdown current. The TPS22922 and TPS22922B also incorporate a 120- $\Omega$  quick output discharge resistor internally.

[Table 2-1](#) summarizes the available EVM options.



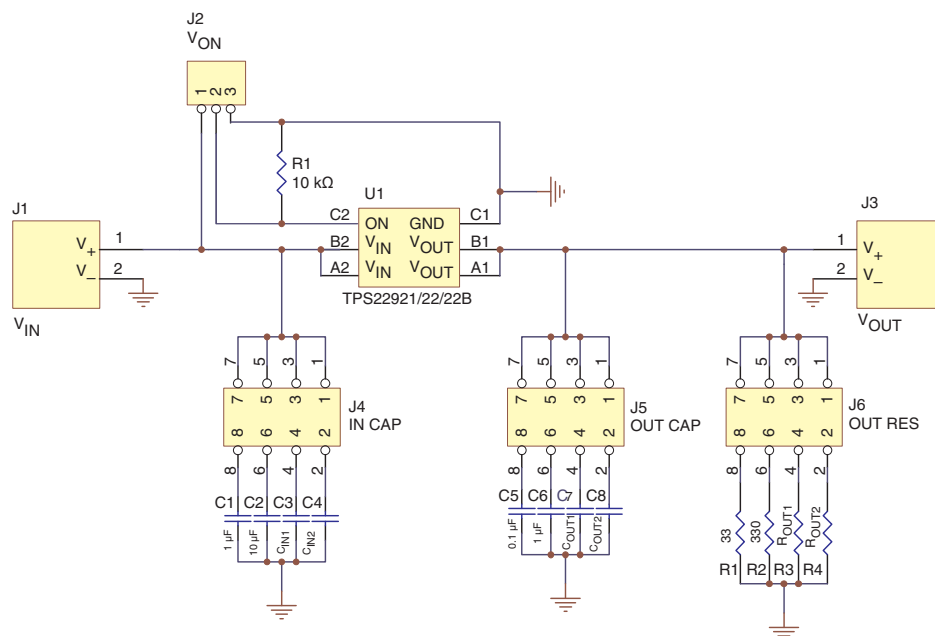
## Schematics and Bill of Materials

### 2.1 EVM Options

Table 2-1. TPS22921/22/22B EVM Options

| EVM       | DEVICE    | SLEW RATE   | QUICK<br>OUTPUT DISCHARGE | MAX<br>OUTPUT CURRENT | ENABLE      |
|-----------|-----------|-------------|---------------------------|-----------------------|-------------|
| HPA393-01 | TPS22921  | 30 $\mu$ s  | No                        | 2 A                   | Active high |
| HPA393-02 | TPS22922  | 30 $\mu$ s  | Yes                       | 2 A                   | Active high |
| HPA393-03 | TPS22922B | 200 $\mu$ s | Yes                       | 2 A                   | Active high |

### 2.2 Schematic



## 2.3 Bill of Materials

**Table 2.4. Bill of Materials**

| QTY |     |     | REFDES         | VALUE         | DESCRIPTION                                                  | SIZE                  | PART NUMBER        | MFR                         |
|-----|-----|-----|----------------|---------------|--------------------------------------------------------------|-----------------------|--------------------|-----------------------------|
| -01 | -02 | -03 |                |               |                                                              |                       |                    |                             |
| 1   | 1   | 1   | –              | –             | Two-layer, 2420 × 2320 mil, PCB                              | 2420 × 2320 mil       | HPA393             | Any                         |
| 2   | 2   | 2   | C1, C6         | 1 $\mu$ F     | Capacitor, ceramic, 25 V, X5R                                | 805                   | GRM216R61E105KA12D | STD                         |
| 1   | 1   | 1   | C2             | 10 $\mu$ F    | Capacitor, ceramic, 16 V, X5R                                | 805                   | GRM21BR61C106KE15L | STD                         |
| 1   | 1   | 1   | C5             | 0.1 $\mu$ F   | Capacitor, ceramic, 25 V, X7R                                | 805                   | GRM21BR71E104KA01L | STD                         |
| 0   | 0   | 0   | C3, C4, C7, C8 | –             | Capacitor, ceramic, 16 V, X5R                                | 805                   | –                  | STD                         |
| 1   | 1   | 1   | J2             | –             | Header, 3 × 1 pin, 100 mil spacing                           | 0.100 × 0.100 in      | PEC36SAAN          | Sullins Connector Solutions |
| 3   | 3   | 3   | J4, J5, J6     | –             | Header, 4 × 2 pin, 100 mil spacing                           | 0.100 × 0.100 in      | PEC36DAAN          | Sullins Connector Solutions |
| 2   | 2   | 2   | J1, J3         | –             | Terminal block, 6A, 125 V, 3.5-mm pitch                      | 7 × 6.5 mm            | ED555/2DS          | OnShore Technology          |
| 1   | 1   | 1   | R1             | 10 k $\Omega$ | Resistor, chip, 1/8 W, 5%                                    | 805                   | ERJ-6GEYJ103V      | STD                         |
| 1   | 1   | 1   | R2             | 33 $\Omega$   | Resistor, chip, 1/8 W, 5%                                    | 805                   | ERJ-6GEYJ330V      | STD                         |
| 1   | 1   | 1   | R3             | 330 $\Omega$  | Resistor, chip, 1/8 W, 5%                                    | 805                   | ERJ-6GEYJ331V      | STD                         |
| 0   | 0   | 0   | R4, R5         | –             | Resistor, chip, 1/8 W, 5%                                    | 805                   | –                  | STD                         |
| 1   | 0   | 0   | U1             | TPS22921      | IC, ultra-small, low-input voltage, low $r_{ON}$ load switch | YFP/0.4-mm pitch WCSP | TPS22921YFPR       | TI                          |
| 0   | 1   | 0   | U1             | TPS22922      | IC, ultra-small, low-input voltage, low $r_{ON}$ load switch | YFP/0.4-mm pitch WCSP | TPS22922YFPR       | TI                          |
| 0   | 0   | 1   | U1             | TPS22922B     | IC, ultra-small, low-input voltage, low $r_{ON}$ load switch | YFP/0.4-mm pitch WCSP | TPS22922BYFPR      | TI                          |
| 3   | 3   | 3   | –              | –             | Conn. jumper, shorting, gold, flash                          | 0.100 × 0.256 in      | SPC02SYAN          | Sullins Connector Solutions |
| 4   | 4   | 4   | –              | –             | Bumpon, hemisphere, .44 × .20, clear                         | 11.1 mm × 5.1 mm      | SJ-5303            | 3M                          |



This section contains three views of the TPS22921/22/22B EVM evaluation board as well as some layout considerations.

**Texas Instruments Inc.**  
**TPS22921/22/22B EVM**

HPA393 REV. A

**J1 VIN**  
 + ☐ 1.0V to 3.6V -

**J2 ON OFF**  
☐ ☐ ☐

**R1**  
☐ 10k

**J3 VOUT**  
☐ +  
 -

**J4 IN CAP**  
☐ ☐ ☐ ☐  
 C1C2C3C4  
☐ ☐ ☐ ☐  
☐ ☐ ☐ ☐  
 1uF 10uF 1n1 1n2

**J5 OUT CAP**  
☐ ☐ ☐ ☐  
 C5C6C7C8  
☐ ☐ ☐ ☐  
☐ ☐ ☐ ☐  
 0.1uF 1uF Cout1 Cout2

**J6 OUT RES**  
☐ ☐ ☐ ☐  
 R2R3R4R5  
☐ ☐ ☐ ☐  
☐ ☐ ☐ ☐  
 33 330 Rout1 Rout2

**Figure 3-1. TPS22921/22/22B EVM Component Placement**

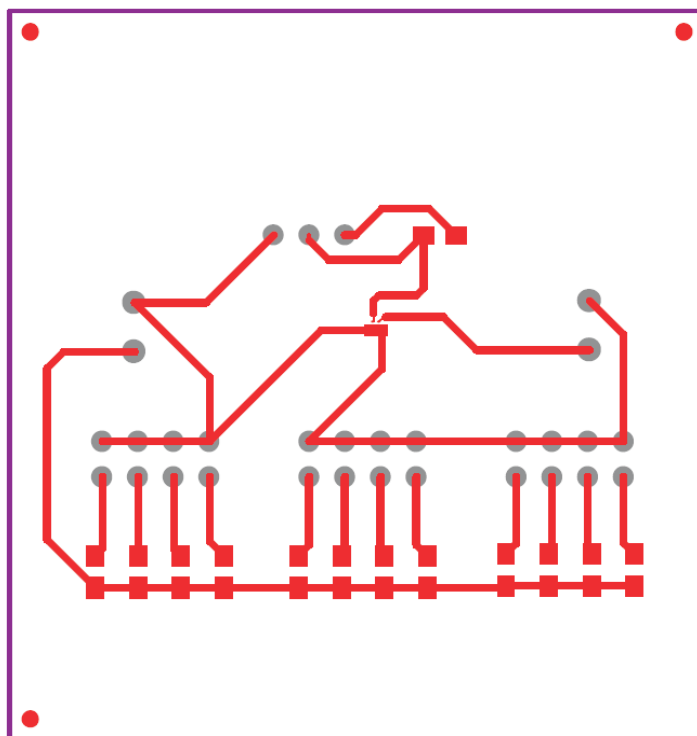


Figure 3-2. TPS22921/22/22B EVM Top-Side Layout

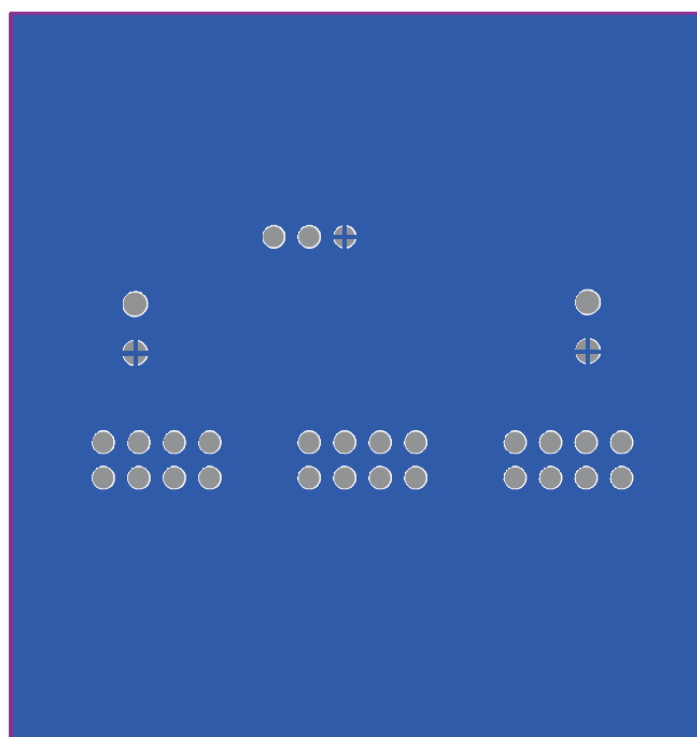


Figure 3-3. TPS22921/22/22B EVM Bottom-Side Layout

## 3.2 Layout Considerations

The  $V_{IN}$  and  $V_{OUT}$  pins of U1 can carry significant current; so, traces to these pins should be of suitable length and width to minimize voltage drop to the load. Locate the  $C_{IN}$  and  $C_{OUT}$  bypass capacitors close to the  $V_{IN}$  and  $V_{OUT}$  pins of U1.



## EVM Setup

### 4.1 Recommended Test Equipment

The following test equipment is recommended:

- Two-channel storage oscilloscope
- Current probe
- Voltage probe
- 3.6 V at 2-A power supply
- Volt-ohm meter

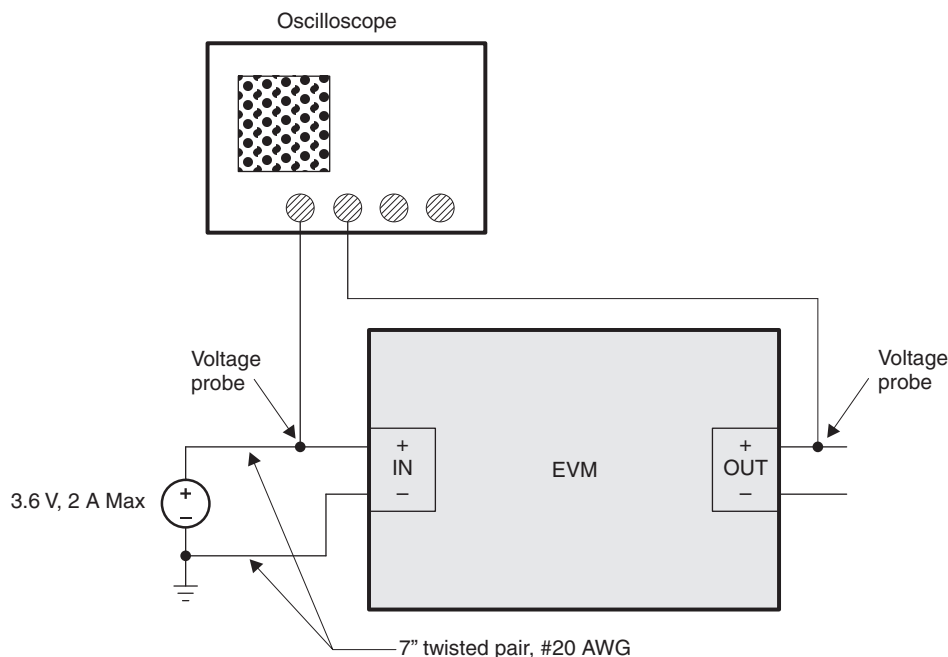
### 4.2 Calculating Voltage Drop and Load Current

The user should read the applicable data sheet before using the EVM.

Figure 4-1 shows the EVM test setup for measuring input and output voltage. The load switch is enabled into a passive on-board load for this measurement. After measuring the voltages at both  $V_{IN}$  and  $V_{OUT}$ , the voltage drop across the switch as well as the load current can be calculated from the following equations:

$$V_{DROP} = V_{IN} - V_{OUT}$$

$$I_{LOAD} = V_{OUT} / R_{LOAD}$$



**Figure 4-1. EVM Setup For Calculating Voltage Drop and Load Current**



## ***Related Documentation from Texas Instruments***

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- *TPS22921, TPS22922, TPS22922B, Low-Input Voltage, Ultra-Low  $r_{ON}$  Load Switches data sheet (SLVS749)*

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### EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 1.0 V to 3.6 V and the output voltage range of 1.0 V to 3.6 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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