Description
The TPS92621-Q1 Evaluation Module (EVM) user's guide describes the characteristics of the device and the operation of EVM. This user's guide includes a complete schematic diagram, printed-circuit board layout, and bill of materials (BOM).

Features
The EVM has the following features:
- LED short-to-GND, open-circuit detection and auto-recovery
- Open fault mask during low-dropout mode
- Thermal sharing with external resistors when supply voltage is high

Applications
This EVM is used in the following applications:
- Automotive exterior rear light: rear lamp, center high mounted stop lamp (CHMSL), side marker
- Automotive interior light: dome lamp, glove box lamp, reading lamp
- Automotive exterior small light: door handle, blind spot detection indicator, charging inlet
- General-purpose LED driver applications
1 Evaluation Module Overview

1.1 Introduction

The TPS92621Q1EVM helps designers evaluate the operation and performance of the TPS92621-Q1, a linear single-channel LED driver with full LED diagnostic for automotive lighting applications. For linear LED drivers used in automotive lighting end equipment, thermal is a big design challenge. TPS92621-Q1 can help designers to easily deal with the challenge, and TPS92621Q1EVM can help to validate those features.

1.2 Kit Contents

The TPS92621Q1EVM kit includes the following materials and is illustrated in Figure 1-1.

![Figure 1-1. TPS92621Q1EVM Kit](image)

1.3 Specification

The TPS92621Q1EVM is set up for a default output current of 250 mA. External shunt resistors on RES pin are leveraged to share output current and dissipate power out of the device. The device has an enable selection through EN pin, when the EN signal is low, the device is in sleep mode with ultra low quiescent current, which can help to save system-level current consumption in applications. By applying external voltage duty cycle signal on either SUPPLY or PWM pins, the device is able to operate in SUPPLY or PWM dimming modes. The device can be used to verify diagnostic and protective functions, the LED open detection can be disabled when the voltage applied on DIAGEN pin is less than the logic-low voltage threshold to avoid false open diagnostic during low-dropout operation.

1.4 Device Information

The TPS92621Q1EVM is based on the device of TPS92621-Q1, single-channel linear LED driver. This device has a unique thermal management design to reduce temperature rising on the device, and can be directly powered by automotive batteries with large voltage variation to output full current loads up to 300 mA. The device can also provide features, such as full diagnostics, wide voltage input, and PWM dimming.
2 Hardware

2.1 Test Setup

Table 2-1 shows the typical parameters for the TPS92621Q1EVM. The typical input voltage range is from 9 V to 20 V. The full-scale output current of the TPS92621Q1EVM is 250 mA. Users can adjust the output current by changing the sensing resistor (Rsns).

Table 2-1. TPS92621Q1EVM Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage (V)</td>
<td>typical: 9-20</td>
</tr>
<tr>
<td>Output current per channel (mA)</td>
<td>250 mA</td>
</tr>
<tr>
<td>LED per channel</td>
<td>3s1p LED string</td>
</tr>
<tr>
<td>Rsns (Ω)</td>
<td>0.6</td>
</tr>
<tr>
<td>Rres (Ω)</td>
<td>25</td>
</tr>
</tbody>
</table>

Follow these steps for the EVM test setup:

1. Set the voltage of the dc power supply to 12 V and set the current limit to 1 A.
2. Connect the positive and negative outputs of the power supply to connectors VBAT and GND respectively on the EVM board.
3. With the default jumper connections, the board must begin operating after the power supply is turned on. Modify the jumpers for other operating modes.
4. For short-to-battery detection, set the voltage of dc power to 10.5V and the current limit to 2.5A, avoid the risk of damaging LEDs under long-term failure condition.

2.2 Connector Map

The EVM has the following connectors. Table 2-2 shows their functions.

Table 2-2. Connector Map

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT</td>
<td>This connector is a power supply input.</td>
</tr>
<tr>
<td>GND</td>
<td>This connector is a device part ground.</td>
</tr>
<tr>
<td>VBAT+</td>
<td>SUPPLY. This connector shows the positive input supply voltage.</td>
</tr>
<tr>
<td>DIAGEN</td>
<td>DIAGEN. This connector shows the LED open diagnostic enable input.</td>
</tr>
<tr>
<td>FAULT</td>
<td>FAULT. This connector is the fault status output of the LED driver.</td>
</tr>
<tr>
<td>OUT</td>
<td>This connector shows the output voltage.</td>
</tr>
</tbody>
</table>

2.3 Jumper Map

The EVM provides some jumpers for designers to conveniently validate the device. Table 2-3 shows the jumper map.

Table 2-3. Jumper Map

<table>
<thead>
<tr>
<th>Function</th>
<th>Designator</th>
<th>Attached Function</th>
<th>With Shunt</th>
<th>Without Shunt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device enable</td>
<td>J1</td>
<td>EN</td>
<td>The device is enabled (EN connected to SUPPLY via a resistor)</td>
<td>The device is disabled (EN floating)</td>
</tr>
<tr>
<td>PWM dimming input</td>
<td>J2</td>
<td>PWM</td>
<td>Enable PWM (PWM connected to SUPPLY via a resistor)</td>
<td>Disable PWM or use external control signal</td>
</tr>
<tr>
<td>Fault option</td>
<td>J3</td>
<td>FAULT</td>
<td>One fails, others off</td>
<td>Use external control signal</td>
</tr>
<tr>
<td>Open detect</td>
<td>J4</td>
<td>LED open</td>
<td>LED string connect to out</td>
<td>LED string open</td>
</tr>
<tr>
<td>Short detect</td>
<td>J5</td>
<td>Single LED short</td>
<td>Short single LED in LED string</td>
<td>3 LED series in LED string</td>
</tr>
<tr>
<td></td>
<td>J6</td>
<td>LED string short</td>
<td>Short all LEDs in LED string</td>
<td>3 LED series in LED string</td>
</tr>
</tbody>
</table>
3 Hardware Design Files
3.1 Schematics

Figure 3-1 shows the TPS92621Q1EVM schematic.

Figure 3-1. Schematic
3.2 PCB Layout

Figure 3-2 illustrates the EVM board layout.
### 3.3 Bill of Materials (BOM)

Table 3-1 lists the TPS92629Q1EVM BOM.

<table>
<thead>
<tr>
<th>Designator</th>
<th>Qty</th>
<th>Description</th>
<th>Part Number</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C2</td>
<td>2</td>
<td>CAP, CERM, 1 µF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603</td>
<td>08055C105K4Z2A</td>
<td>AVX</td>
</tr>
<tr>
<td>C3</td>
<td>1</td>
<td>CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 0, 0603</td>
<td>06035C104K4Z4A</td>
<td>AVX</td>
</tr>
<tr>
<td>C4</td>
<td>1</td>
<td>CAP, CERM, 0.01 µF, 50 V, +/- 10%, X7R, 0603</td>
<td>C1608X7R1H103K080AA</td>
<td>TDK</td>
</tr>
<tr>
<td>D1</td>
<td>1</td>
<td>DIODE, SCHOTTKY, 60 V, 3 A, DO214AC</td>
<td>SK36A-LTPMSCT-ND</td>
<td>Micro Commercial Co</td>
</tr>
<tr>
<td>D2, D3, D4</td>
<td>3</td>
<td>LED Uni-Color Red 71lm 632nm Chip LED 3-Pin SMD T/R</td>
<td>LR H9PP-HZJZ-1-1-350-R18-Z</td>
<td>Osram Opto</td>
</tr>
<tr>
<td>R1, R2</td>
<td>2</td>
<td>RES, 1.21, 1%, 0.1 W, AEC-Q200 Grade 0, 0603</td>
<td>CRCW06031R21FKEA</td>
<td>Vishay-Dale</td>
</tr>
<tr>
<td>R3, R4, R5</td>
<td>3</td>
<td>RES, 75, 5%, 1 W, AEC-Q200 Grade 0, 2512</td>
<td>CRCW25125R0JNEG</td>
<td>Vishay-Dale</td>
</tr>
<tr>
<td>R6, R8, R10</td>
<td>3</td>
<td>RES, 10.0 k, 1%, 0.1 W, 0603</td>
<td>RCG060310K0FKEA</td>
<td>Vishay Draloric</td>
</tr>
<tr>
<td>R7</td>
<td>1</td>
<td>RES, 73.2 k, 1%, 0.1 W, 0603</td>
<td>RC0603FR-073K2L</td>
<td>Yageo</td>
</tr>
<tr>
<td>R9</td>
<td>1</td>
<td>RES, 38.8 k, 0.1%, 0.1 W, 0603</td>
<td>RT0603R0738K8L</td>
<td>Yageo America</td>
</tr>
<tr>
<td>R11</td>
<td>1</td>
<td>RES, 20.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603</td>
<td>CRCW060320K0FKEA</td>
<td>Vishay-Dale</td>
</tr>
<tr>
<td>SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6</td>
<td>6</td>
<td>Shunt, 100mil, Flash Gold, Black</td>
<td>SPC02SYAN</td>
<td>Sullins Connector Solutions</td>
</tr>
<tr>
<td>J1 - EN, J2 - PWM, J3 - Fault, J4 - Open Test, J5 - Short Test D2, J6 - Short Test</td>
<td>6</td>
<td>Header, 2.54mm, 2x1, Tin, TH</td>
<td>TSW-102-23-T-S</td>
<td>Samtec</td>
</tr>
<tr>
<td>U1</td>
<td>1</td>
<td>Single-Channel, Automotive High Side LED Driver With Thermal Sharing Control</td>
<td>TPS92621QDGNRQ1</td>
<td>Texas Instruments</td>
</tr>
</tbody>
</table>

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This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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FCC Interference Statement for Class A EVM devices
NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

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3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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