EVM User's Guide: TPS92621Q1EVM

TPS92621-Q1 Evaluation Module

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

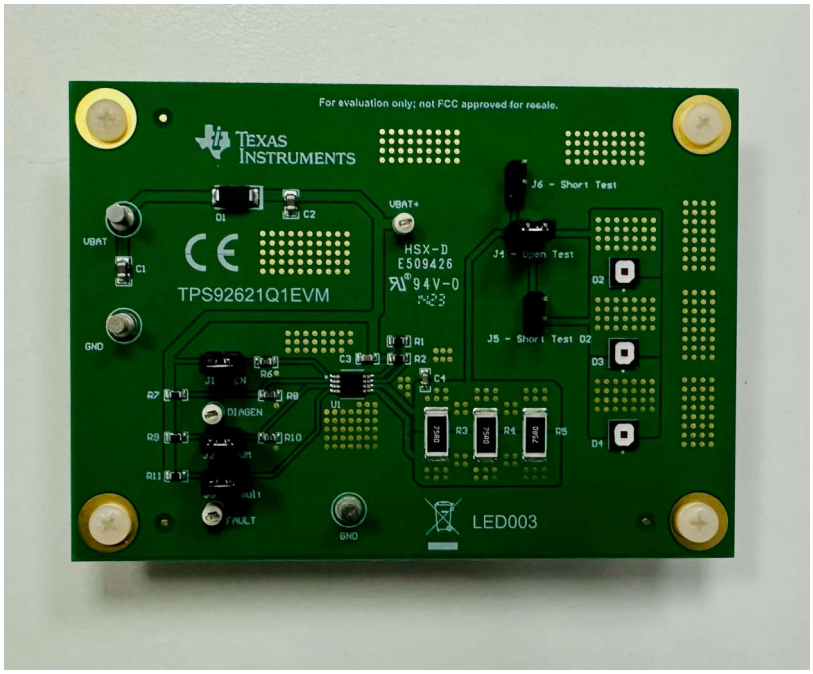
The EVM has the following features:

- 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



TPS92621Q1EVM Board

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.

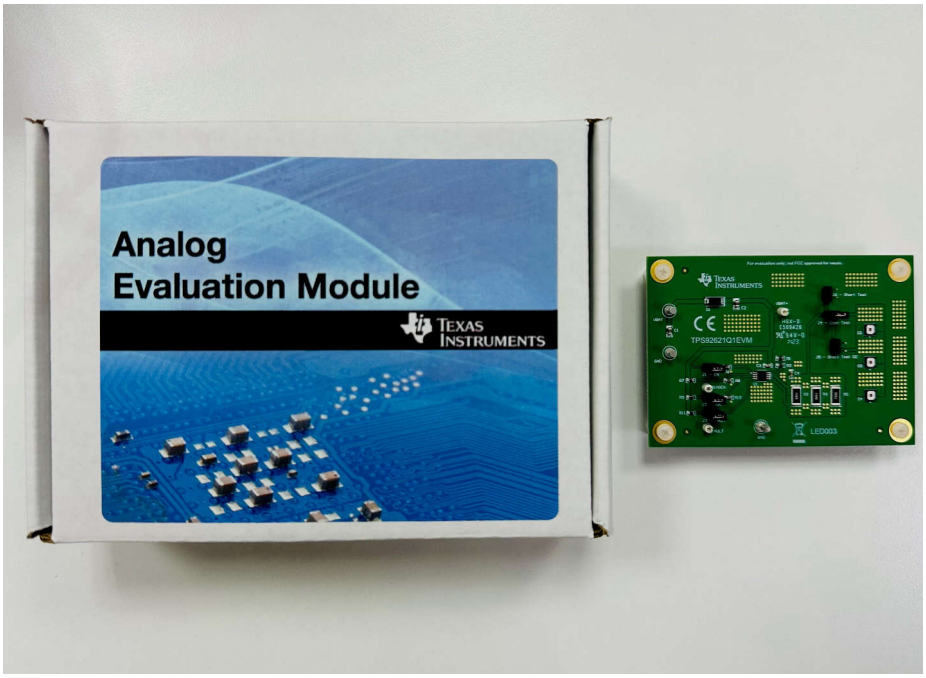


Figure 1-1. TPS92621Q1EVM Kit

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

Parameters	Value
Input voltage (V)	typical: 9-20
Output current per channel (mA)	250 mA
LED per channel	3s1p LED string
Rsns (Ω)	0.6
Rres (Ω)	25

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

Connector	Description
VBAT	This connector is a power supply input.
GND	This connector is a device part ground.
VBAT+	SUPPLY. This connector shows the positive input supply voltage.
DIAGEN	DIAGEN. This connector shows the LED open diagnostic enable input.
FAULT	FAULT. This connector is the fault status output of the LED driver.
OUT	This connector shows the output voltage.

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

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

3 Hardware Design Files

3.1 Schematics

Figure 3-1 shows the TPS92621Q1EVM schematic.

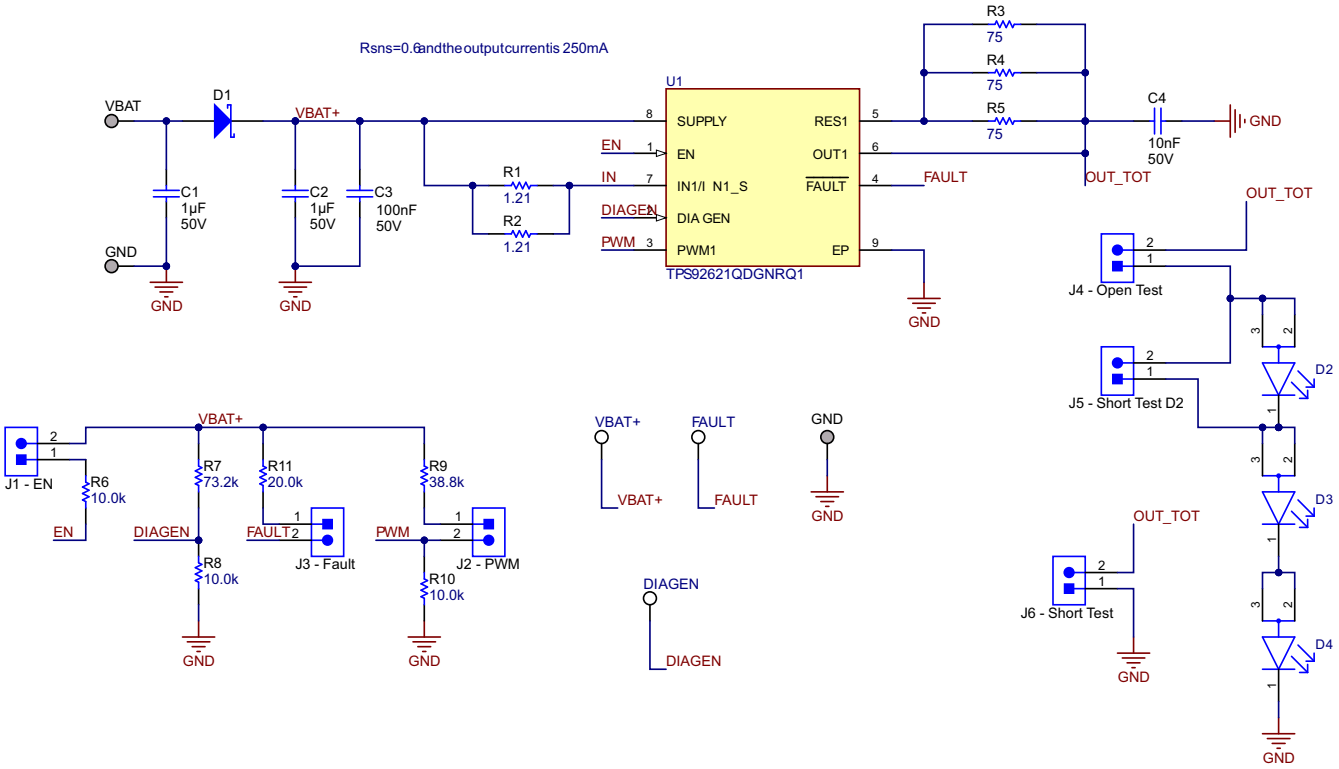


Figure 3-1. Schematic

3.2 PCB Layout

Figure 3-2 illustrates the EVM board layout.

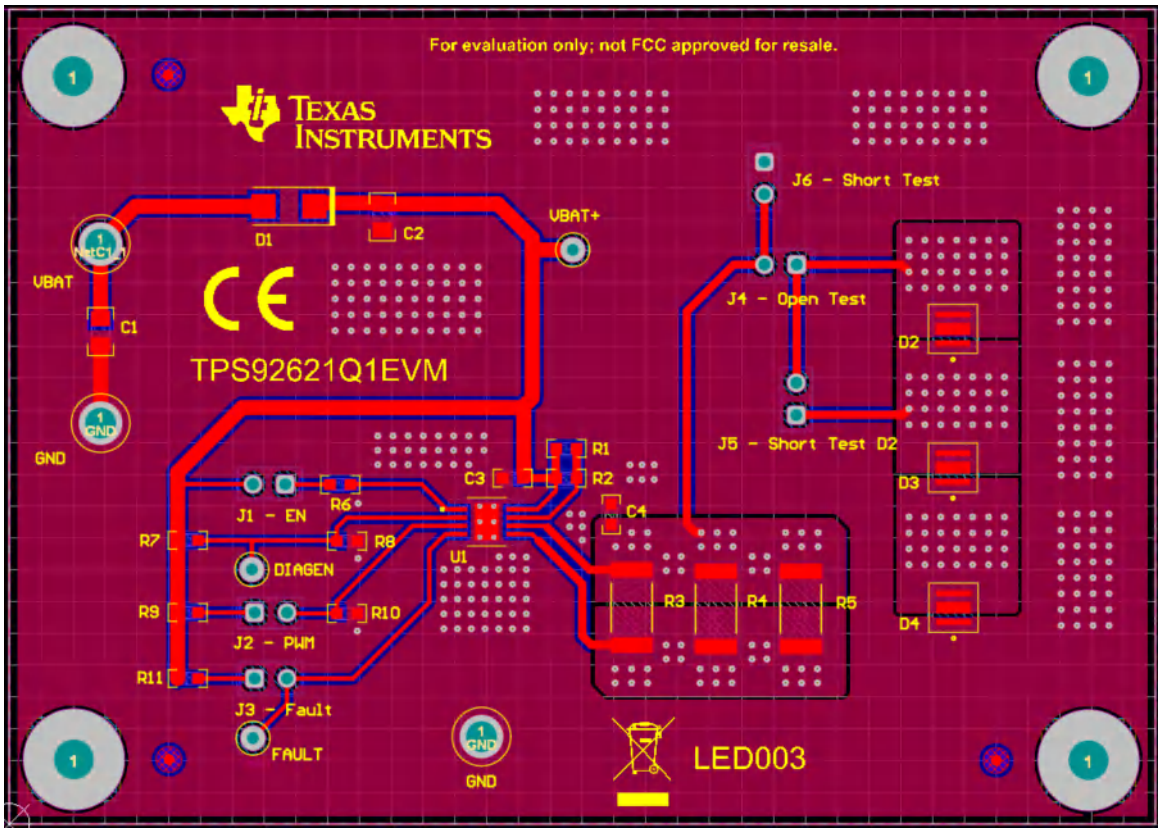


Figure 3-2. Layout

3.3 Bill of Materials (BOM)

Table 3-1 lists the TPS92629Q1EVM BOM.

Table 3-1. Bill of Materials

Designator	Qty	Description	Part Number	Manufacturer
C1, C2	2	CAP, CERM, 1 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	08055C105K4Z2A	AVX
C3	1	CAP, CERM, 0.1 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 0, 0603	06035C104K4Z4A	AVX
C4	1	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0603	C1608X7R1H103K080AA	TDK
D1	1	DIODE, SCHOTTKY, 60 V, 3 A, DO214AC	SK36A-LTPMSCT-ND	Micro Commercial Co
D2, D3, D4	3	LED Uni-Color Red 71lm 632nm Chip LED 3-Pin SMD T/R	LR H9PP-HZJZ-1-1-350-R18-Z	Osram Opto
R1, R2	2	RES, 1.21, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW06031R21FKEA	Vishay-Dale
R3, R4, R5	3	RES, 75, 5%, 1 W, AEC-Q200 Grade 0, 2512	CRCW251275R0JNEG	Vishay-Dale
R6, R8, R10	3	RES, 10.0 k, 1%, 0.1 W, 0603	RCG060310K0FKEA	Vishay Draloric
R7	1	RES, 73.2 k, 1%, 0.1 W, 0603	RC0603FR-0773K2L	Yageo
R9	1	RES, 38.8 k, 0.1%, 0.1 W, 0603	RT0603BRD0738K8L	Yageo America
R11	1	RES, 20.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW060320K0FKEA	Vishay-Dale
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6	6	Shunt, 100mil, Flash Gold, Black	SPC02SYAN	Sullins Connector Solutions
J1 - EN, J2 - PWM, J3 - Fault, J4 - Open Test, J5 - Short Test D2, J6 - Short Test	6	Header, 2.54mm, 2x1, Tin, TH	TSW-102-23-T-S	Samtec
U1	1	Single-Channel, Automotive High Side LED Driver With Thermal Sharing Control	TPS92621QDGNRQ1	Texas Instruments

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CAUTION

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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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This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

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