

TPS92612-Q1 車載シングルチャネル・リニアLEDドライバ

1 特長

- 車載用途向けにAEC-Q100認定済み
 - デバイス温度グレード 1: $-40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ 、 T_A
- 機能安全に対応
 - 機能安全システムの設計に役立つ資料を利用可能
- PWM調光機能付きシングルチャネル定電流LEDドライバ
- 広い入力電圧範囲: $4.5\text{V} \sim 40\text{V}$
- 定出力電流、センス抵抗により調整可能
- 高精度の電流レギュレーション: 許容誤差 $\pm 4.6\%$
- 最大電流: 150mA
- 外付け抵抗との熱共有
- 低ドロップアウト電圧(電流検出での電圧降下を含む)
 - 最大ドロップアウト: 150mV (10mA 時)
 - 最大ドロップアウト: 400mV (70mA 時)
 - 最大ドロップアウト: 700mV (150mA 時)
- 低スタンバイ電流(デバイスごとに $250\mu\text{A}$ 未満)
- 保護機能
 - LED短絡保護と自動回復
 - 過熱保護
- 動作時の接合部温度範囲: $-40^{\circ}\text{C} \sim 150^{\circ}\text{C}$

2 アプリケーション

- 車載補助照明: ドーム型ライト、ドアハンドル、読書灯、その他のランプ
- 車載リアランプ、センター・ハイマウント・ストップ・ランプ、サイド・マーカ、死角検出インジケータ、充電インレット・インジケータ
- 汎用LEDドライバ・アプリケーション

3 概要

LEDが車載アプリケーションに広く使われているなか、シンプルなLEDドライバの人気が高まっています。ディスクリット・ソリューションに比べて、低コストのモノリシック・ソリューションではシステム・レベルの部品数を減らし、電流の精度や信頼性を大幅に高めることができます。

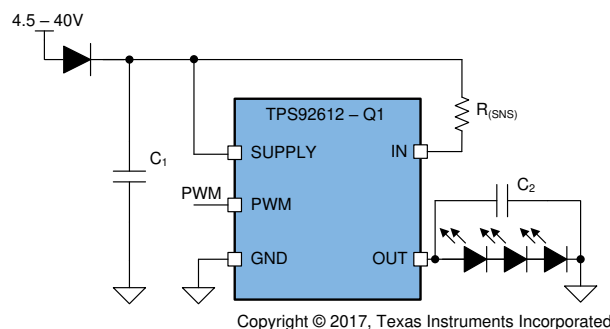
TPS92612-Q1デバイスは、自動車用バッテリーで動作する、シンプルなシングルチャネルのハイサイドLEDドライバです。単純かつ洗練されたソリューションで、単一のLEDストリングに一定の電流を供給できます。

製品情報⁽¹⁾

型番	パッケージ	本体サイズ(公称)
TPS92612-Q1	SOT-23 (5)	2.9mm×1.6mm

(1) 提供されているすべてのパッケージについては、巻末の注文情報を参照してください。

代表的なアプリケーションの図



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4 改訂履歴

Revision A (July 2018) から Revision B に変更

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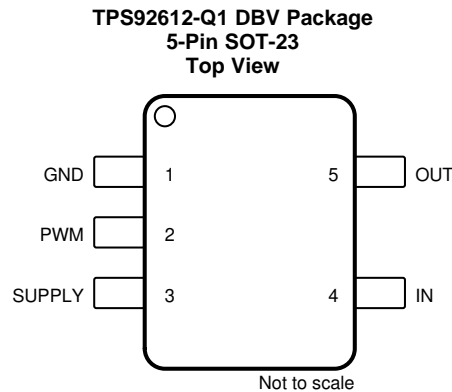
• 「 特長 」セクションに機能安全対応のリンクを追加.....	1
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2018年1月発行のものから更新

Page

• Changed "ambient temperature" to "junction temperature" in the condition statements of the <i>Absolute Maximum Ratings</i> and <i>Recommended Operating Conditions</i> tables.....	3
• Added ESD classification levels for HBM and CDM to the <i>ESD Ratings</i> table.....	3
• Changed rising and falling thresholds.....	4
• Added capacitors C ₁ and C ₂	11
• Added capacitors C ₁ and C ₂	12
• Added capacitors C ₁ and C ₂	15

5 Pin Configuration and Functions



Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO. TPS92612-Q1		
GND	1	—	Ground
IN	4	I	Current input
OUT	5	O	Constant-current output
PWM	2	I	PWM input
SUPPLY	3	I	Device supply voltage

6 Specifications

6.1 Absolute Maximum Ratings

over operating junction temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT
High-voltage input	IN, PWM, SUPPLY	−0.3	45	V
High-voltage output	OUT	−0.3	45	V
IN to OUT	$V_{(IN)} - V_{(OUT)}$	−0.3	45	V
SUPPLY to IN	$V_{(SUPPLY)} - V_{(IN)}$	−0.3	1	V
Operating junction temperature, T_J		−40	150	°C
Storage temperature, T_{stg}		−40	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per AEC Q100-002 ⁽¹⁾ HBM ESD Classification Level 2	±2000	V
		Charged-device model (CDM), per AEC Q100-011 CDM ESD Classification Level C3B [There isn't a C3B classification, unless there is a mistake in STDZ0171 on page 84.]	±500	
		Corner pins (3, 4, and 5)	±750	

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

6.3 Recommended Operating Conditions

over operating junction temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
SUPPLY	Device supply voltage	4.5		40	V
IN	Sense voltage	4.4		40	V
PWM	PWM inputs	0		40	V
OUT	Driver output	0		40	V
T _A	Operating ambient temperature	–40		125	°C

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		TPS92612-Q1	UNIT
		DBV (SOT23)	
		5 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	200.7	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	104.4	°C/W
R _{θJB}	Junction-to-board thermal resistance	45.6	°C/W
ψ _{JT}	Junction-to-top characterization parameter	17.5	°C/W
ψ _{JB}	Junction-to-board characterization parameter	45.2	°C/W

 (1) For more information about traditional and new thermal metrics, see [Semiconductor and IC Package Thermal Metrics](#).

6.5 Electrical Characteristics

 V_(SUPPLY) = 5 V to 40 V, T_J = –40°C to 150°C unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
BIAS						
V _(POR_rising)	Supply voltage POR rising threshold			3.2	4	V
V _(POR_falling)	Supply voltage POR falling threshold		2.2	3		V
I _(Quiescent)	Device standby current	PWM = LOW	0.1	0.2	0.25	mA
LOGIC INPUTS (PWM)						
V _{IL(PWM)}	Input logic-low voltage, PWM		1.045	1.1	1.155	V
V _{IH(PWM)}	Input logic-high voltage, PWM		1.14	1.2	1.26	V
CONSTANT-CURRENT DRIVER						
I _(OUT)	Device output-current range	100% duty cycle	4		150	mA
V _(CS_REG)	Sense-resistor regulation voltage	T _A = 25°C, V _(SUPPLY) = 4.5 V to 18 V	94	98	102	mV
		T _A = –40°C to 125°C, V _(SUPPLY) = 4.5 V to 18 V	93.5	98	102.5	
R _(CS_REG)	Sense-resistor value				24.5	Ω
V _(DROPOUT)	Voltage dropout from SUPPLY to OUT	V _(CS_REG) voltage included, current setting = 10 mA		120	150	mV
		V _(CS_REG) voltage included, current setting = 70 mA		250	400	
		V _(CS_REG) voltage included, current setting = 150 mA		430	700	
DIAGNOSTICS						
V _(SG_th_falling)	Channel output V _(OUT) short-to-ground falling threshold		1.14	1.2	1.26	V
V _(SG_th_rising)	Channel output V _(OUT) short-to-ground rising threshold		0.82	0.865	0.91	V
I _(Retry)	Channel output V _(OUT) short-to-ground retry current	V _(OUT) = 0 V	0.64	1.08	1.528	mA

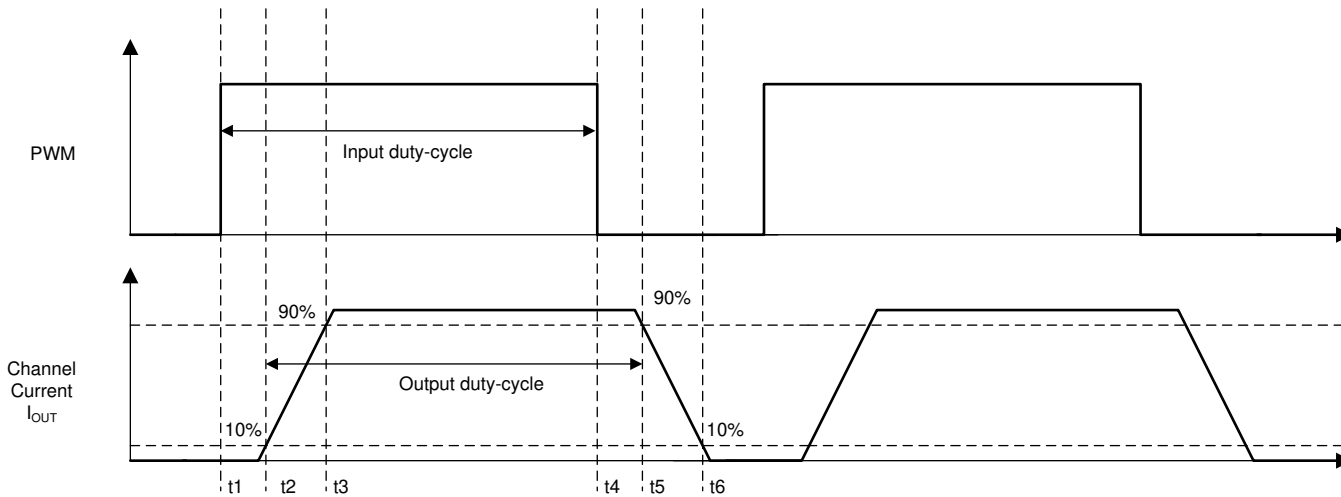
Electrical Characteristics (continued)

$V_{(SUPPLY)} = 5\text{ V to }40\text{ V}$, $T_J = -40^\circ\text{C to }150^\circ\text{C}$ unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
THERMAL PROTECTION						
$T_{(TSD)}$	Thermal shutdown junction temperature threshold			172		$^\circ\text{C}$
$T_{(TSD_HYS)}$	Thermal shutdown junction temperature hysteresis			15		$^\circ\text{C}$

6.6 Timing Requirements

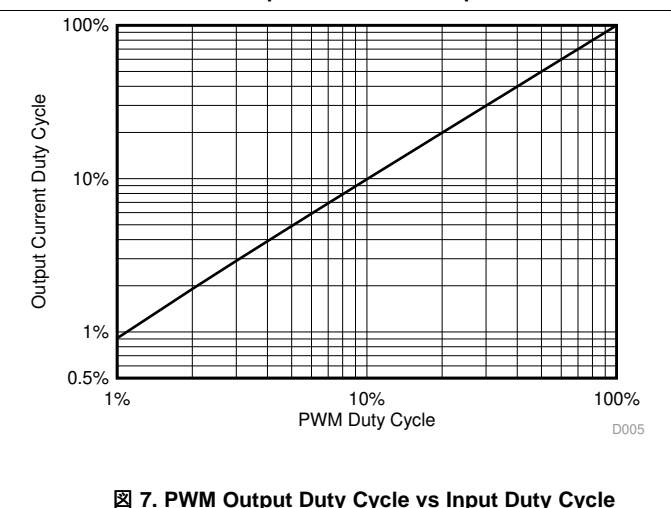
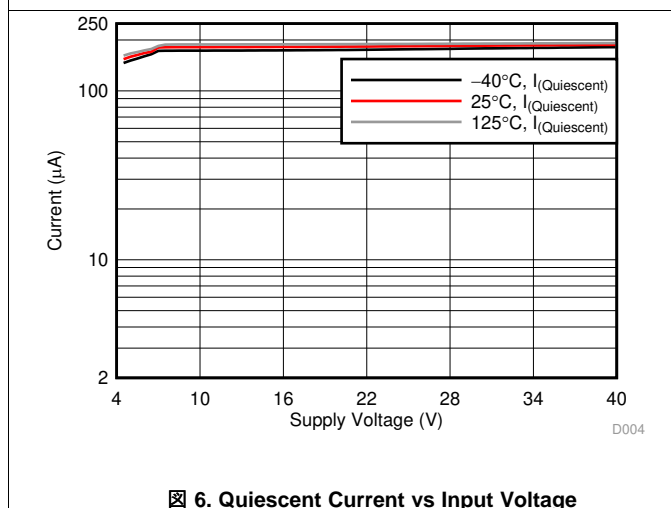
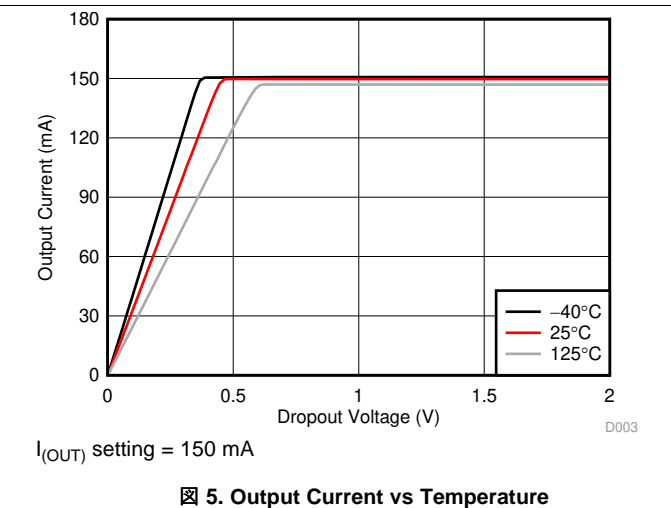
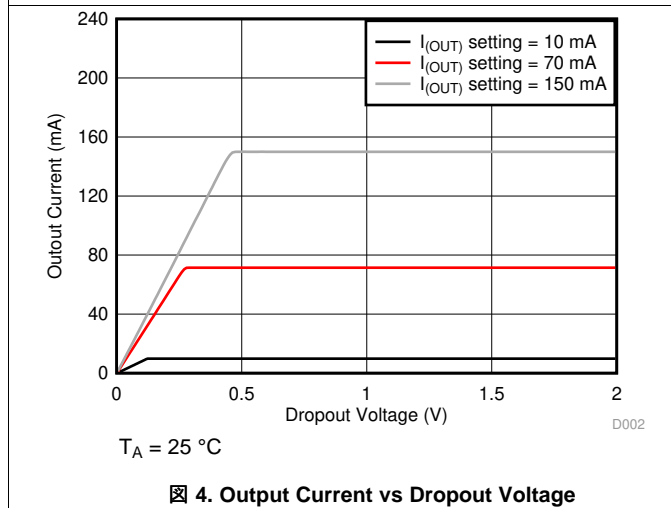
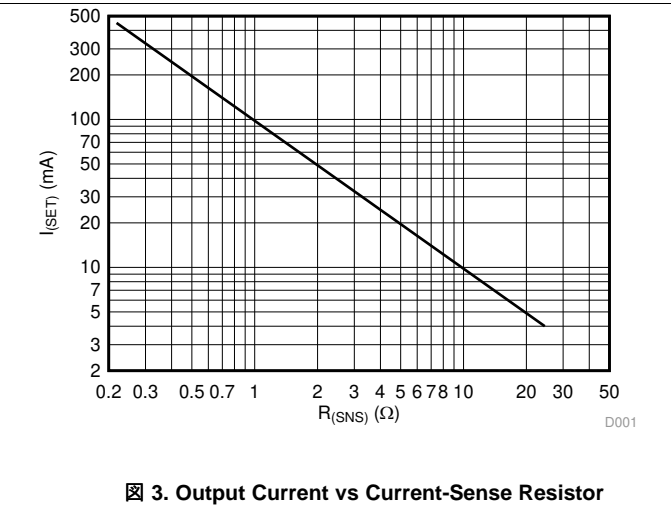
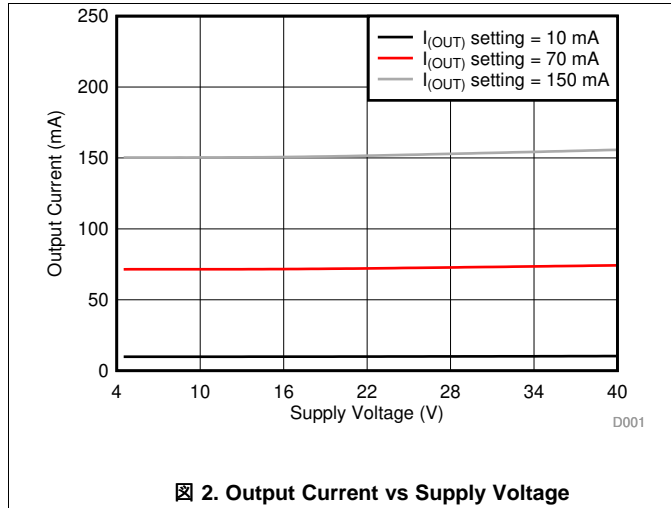
		MIN	NOM	MAX	UNIT
$t_{(PWM_delay_rising)}$	PWM rising edge delay, 50% PWM voltage to 10% of output current, $t_2 - t_1$ as shown in Fig 1		17		μs
$t_{(PWM_delay_falling)}$	PWM falling edge delay, 50% PWM voltage to 90% of output current, $t_5 - t_4$ as shown in Fig 1		21		μs
$t_{(TSD_deg)}$	Thermal overtemperature deglitch time		60		μs
$t_{(SG_deg)}$	Channel-output short-to-ground detection deglitch time	80	125	175	μs
$t_{(Recover_deg)}$	Recovery deglitch time		16		μs



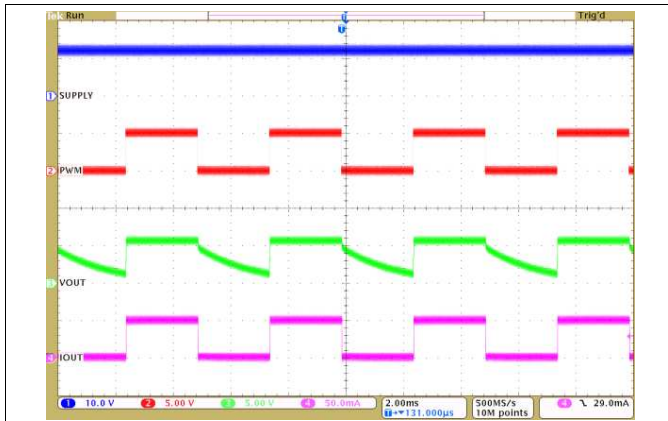
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Fig 1. Output Timing Diagram

6.7 Typical Characteristics

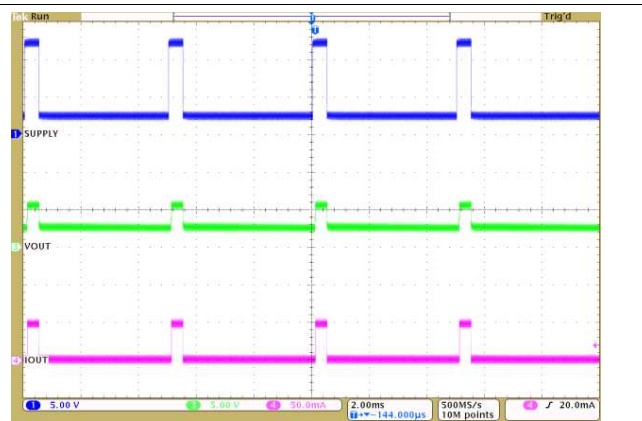


Typical Characteristics (continued)



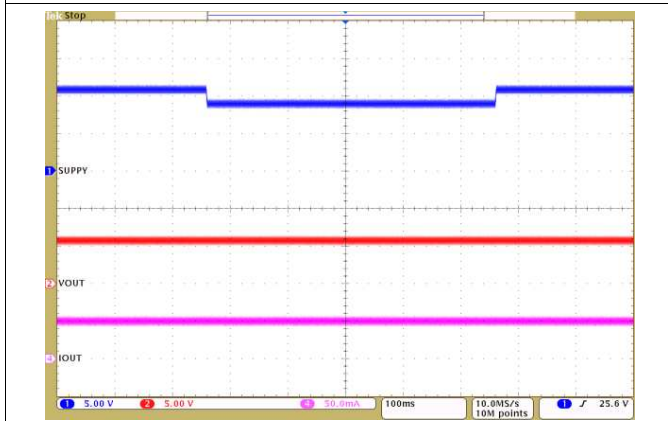
Ch. 1 = $V_{(SUPPLY)}$ Ch. 2 = $V_{(PWM)}$ Ch. 3 = $I_{(OUT)}$
 Ch. 4 = $V_{(OUT)}$ $f_{(PWM)} = 200\text{ Hz}$ Duty-cycle = 50%

8. PWM Dimming via External Input



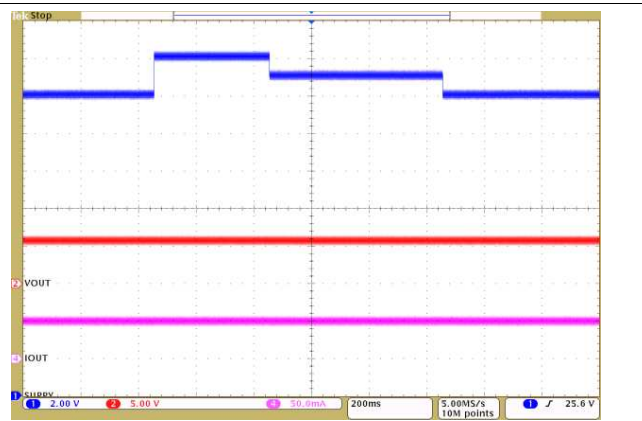
Ch. 1 = $V_{(SUPPLY)}$ Ch. 3 = $V_{(OUT)}$ Ch. 4 = $I_{(OUT)}$
 $f_{(PWM)} = 200\text{ Hz}$ Duty-cycle = 10%
 SUPPLY dimming between 2.5 V and 12 V

9. PWM Dimming via Power Supply



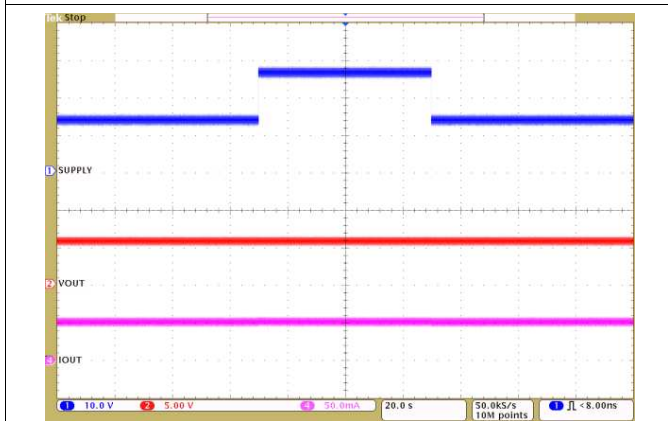
Ch. 1 = SUPPLY Ch. 2 = $V_{(OUT)}$ Ch. 4 = $I_{(OUT)}$

10. Transient Undervoltage



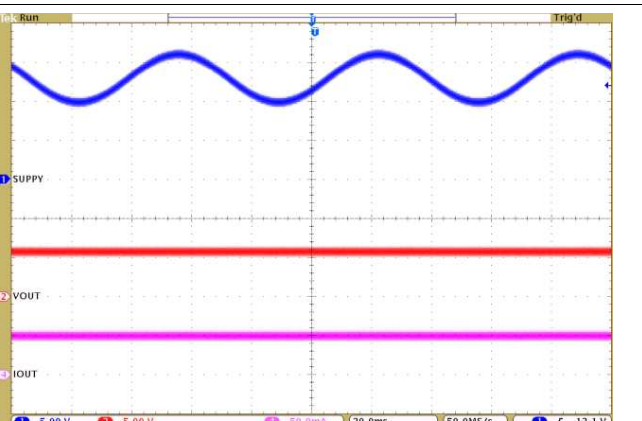
Ch. 1 = SUPPLY Ch. 2 = $V_{(OUT)}$ Ch. 4 = $I_{(OUT)}$

11. Transient Overvoltage



Ch. 1 = SUPPLY Ch. 2 = $V_{(OUT)}$ Ch. 4 = $I_{(OUT)}$

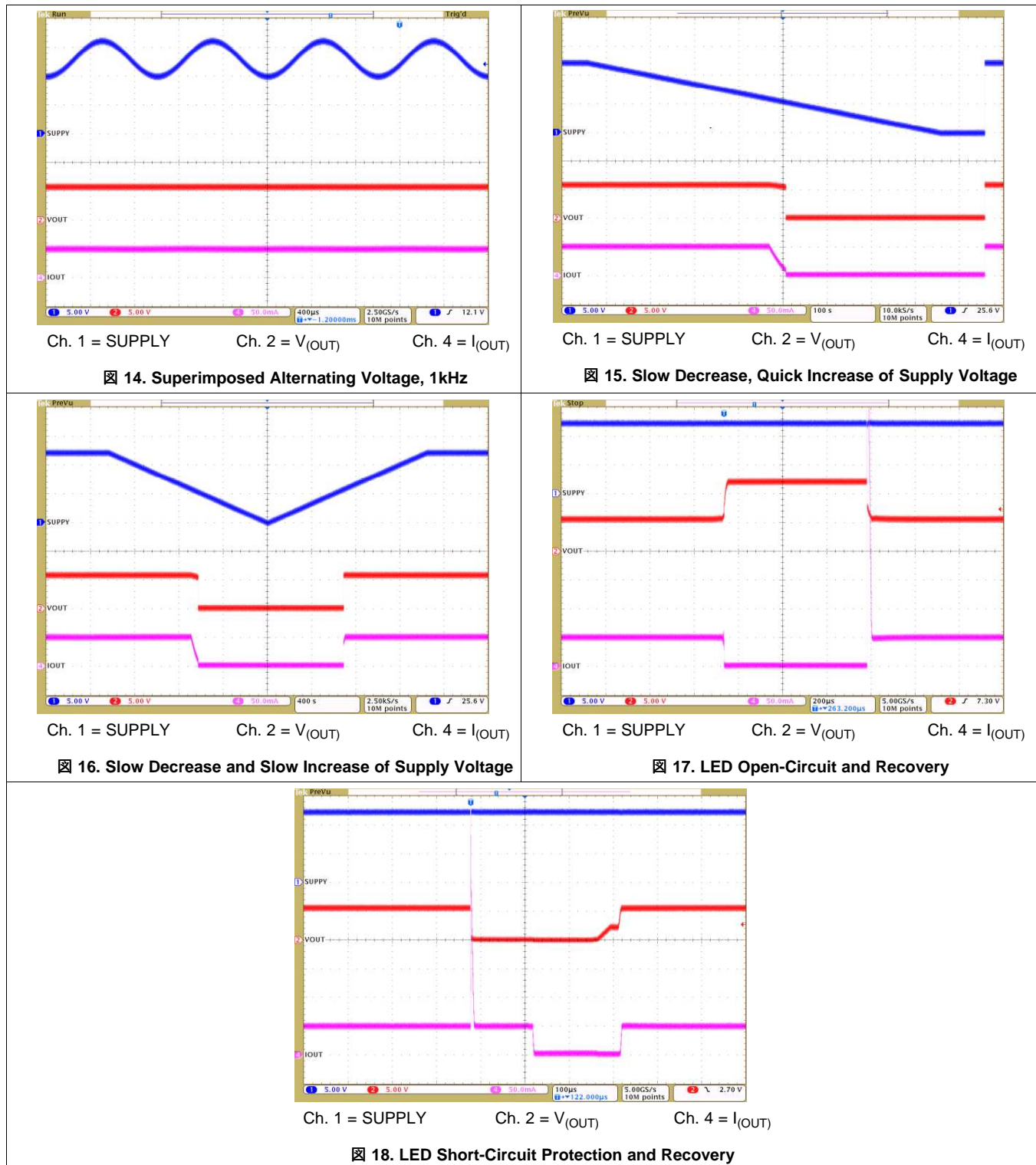
12. Jump Start



Ch. 1 = SUPPLY Ch. 2 = $V_{(OUT)}$ Ch. 4 = $I_{(OUT)}$

13. Superimposed Alternating Voltage, 15 Hz

Typical Characteristics (continued)



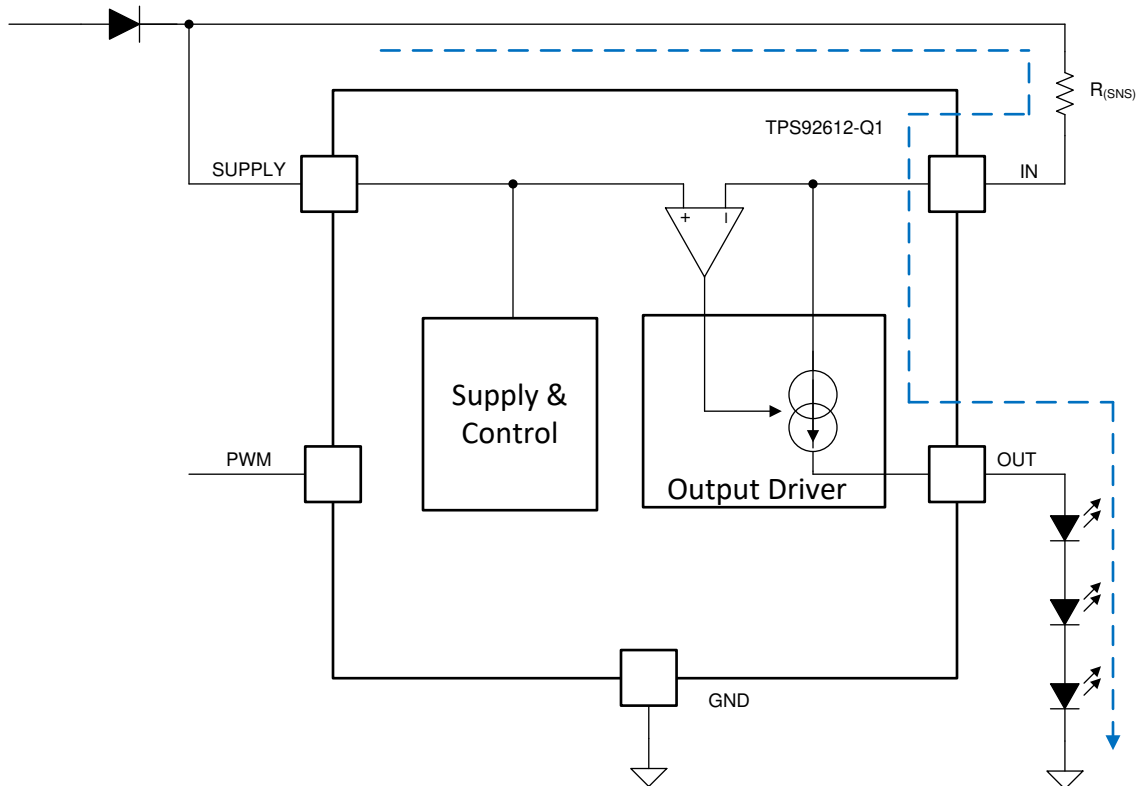
7 Detailed Description

7.1 Overview

The TPS92612-Q1 device is the one of a family of single-channel linear LED drivers. The device provides a simple current source with protection for automotive LED applications.

The output current can be set by an external $R_{(SNS)}$ resistor. Current flows from the supply through the $R_{(SNS)}$ resistor into the internal current source and to the LEDs.

7.2 Functional Block Diagram



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7.3 Feature Description

7.3.1 Device Bias

7.3.1.1 Power-On Reset (POR)

The TPS92612-Q1 device has an internal power-on-reset (POR) function. When power is applied to SUPPLY, the internal POR holds the device in the reset condition until $V_{(SUPPLY)}$ reaches $V_{(POR_rising)}$.

7.3.2 Constant-Current Driver

The TPS92612-Q1 device has a high-side constant-current integrated driver. The device senses channel current with an external high-side current-sense resistor, $R_{(SNS)}$. A current regulation loop drives an internal transistor and regulates the current-sense voltage at the current-sense resistor to $V_{(CS_REG)}$. When the output driver is in regulation, the output current can be set by the current-sense resistor using the following equation.

$$I_{(OUT)} = \frac{V_{(CS_REG)}}{R_{(SNS)}} \quad (1)$$

Feature Description (continued)

7.3.3 PWM Dimming

The TPS92612-Q1 device supports PWM dimming via PWM input dimming and supply dimming.

The PWM input functions as an enable for the output current.

Supply dimming applies PWM dimming on the power input. For an accurate PWM threshold, TI recommends using a resistor divider on the PWM input stage to set the PWM threshold higher than $V_{(POR_rising)}$.

7.3.4 Protection

7.3.4.1 Short-to-GND Protection

The TPS92612-Q1 device has LED short-to-GND protection. Short-to-GND detection monitors the output voltage when the channel is in the ON state. Once a short-to-GND LED failure is detected, the device turns off the output channel and retries automatically, ignoring the PWM input. If the retry mechanism detects removal of the LED short-to-GND fault, the device resumes normal operation.

The device monitors the $V_{(OUT)}$ voltage and compares it with the internal reference voltage to detect a short-to-GND failure. If $V_{(OUT)}$ falls below $V_{(SG_th_rising)}$ longer than the deglitch time of $t_{(SG_deg)}$, the device asserts the short-to-GND fault. During the deglitching time period, if $V_{(OUT)}$ rises above $V_{(SG_th_falling)}$, the timer is reset.

Once the device has detected a short-to-GND fault, the device turns off the output channel and retries automatically with a small current. When retrying, the device sources a small current $I_{(retry)}$ from IN to OUT to pull up the LED loads continuously. Once auto retry detects output voltage rising above $V_{(SG_th_falling)}$, the device clears the short-to-GND fault and resumes normal operation.

7.3.4.2 Overtemperature Protection

The TPS92612-Q1 device monitors device junction temperature. When the junction temperature reaches thermal shutdown threshold $T_{(TSD)}$, the output shuts down. Once the junction temperature falls below $T_{(TSD)} - T_{(TSD_HYS)}$, the device resumes normal operation.

7.4 Device Functional Modes

7.4.1 Undervoltage Lockout, $V_{(SUPPLY)} < V_{(POR_rising)}$

When the device is in undervoltage lockout mode, the TPS92612-Q1 device disables all functions until the supply rises above the POR-rising threshold.

7.4.2 Normal Operation, $V_{(SUPPLY)} \geq 4.5\text{ V}$

The device drives an LED string in normal operation. With enough voltage drop across SUPPLY and OUT, the device is able to drive the output in constant-current mode.

8 Application and Implementation

注

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

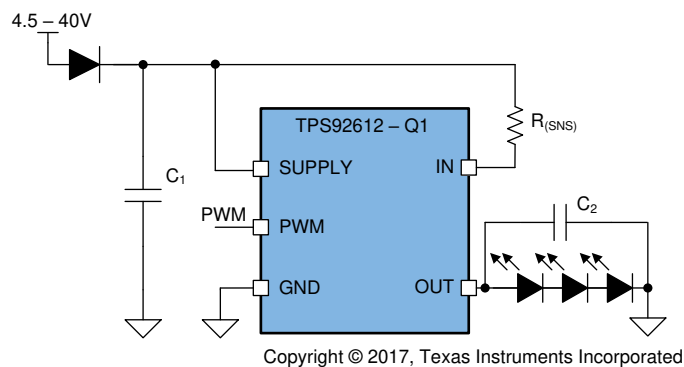
In automotive lighting applications, thermal performance is always a design challenge for linear LED drivers.

To increase current-driving capability, the TPS92612-Q1 device supports heat sharing using an external parallel resistor as shown in [Figure 21](#). This technique provides the low-cost solution of using external resistors to dissipate heat due to high input voltage, and still keeps high accuracy of the total current output.

8.2 Typical Application

8.2.1 Single-Channel LED Driver

The TPS92612-Q1 device can be a good fit for many automotive lighting applications.



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Figure 19. Typical Application Diagram

8.2.1.1 Design Requirements

Input voltage range is 9 V to 16 V, LED maximum forward voltage $V_{fmax} = 2.5$ V, minimum forward voltage $V_{fmin} = 1.9$ V, current $I_{(LED)} = 50$ mA.

8.2.1.2 Detailed Design Procedure

Current setting by the sense resistor is as described in [Equation 1](#).

$$R_{(SNS)} = \frac{V_{(CS_REG)}}{I_{(LED)}} = 1.96\Omega \quad (2)$$

LED-string maximum forward voltage = 3×2.5 V = 7.5 V.

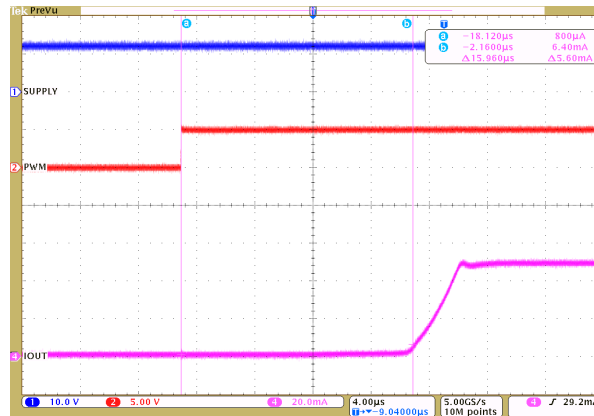
Total device power consumption at worst case is with 16-V input and LEDs at minimal forward voltage.

$$\begin{aligned} P_{(Max)} &= (V_{(SUPPLY)} - V_{(CS_REG)} - V_{(OUT)}) \times I_{(LED)} + V_{(SUPPLY)} \times I_{(Quiescent)} \\ &= (16 - 3 \times 1.9 - 0.098) \times 0.05 + 16 \times 0.00025 = 0.5141 \text{ W} \end{aligned} \quad (3)$$

TI recommends to add capacitors C_1 and C_2 at SUPPLY and OUT. TI recommends C_1 of 1 μ F and 100 nF close to the SUPPLY pin, and C_2 of 10 nF close to the OUT pin. A larger capacitor for C_1 or C_2 is helpful for EMC and ESD; however, it takes a longer time to charge up the capacitor and could affect PWM dimming performance.

Typical Application (continued)

8.2.1.3 Application Curve

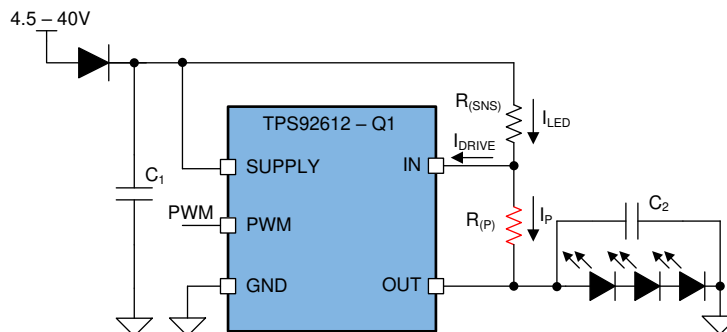


Ch. 1 = $V_{(OUT)}$ Ch. 2 = $V_{(PWM)}$ Ch. 4 = $I_{(OUT)}$

⊗ 20. Output Current With PWM Input

8.2.2 Single-Channel LED Driver With Heat Sharing

Using parallel resistors, thermal performance can be improved by balancing current between the TPS92612-Q1 device and the external resistors as follows. As the current-sense resistor controls the total LED string current, the LED string current $I_{(LED)}$ is set by $V_{(CS_REG)} / R_{(SNS)}$, while the TPS92612-Q1 current $I_{(DRIVE)}$ and parallel resistor current $I_{(P)}$ combine to the total current.



⊗ 21. Heat Sharing With a Parallel Resistor

8.2.2.1 Design Requirements

The input voltage range is 9 V to 16 V, LED maximum forward voltage $V_{fmax} = 2.5$ V, minimum forward voltage $V_{fmin} = 1.9$ V, current $I_{(LED)} = 100$ mA.

8.2.2.2 Detailed Design Procedure

In linear LED driver applications, the input voltage variation contributes to most of the thermal concerns. The resistor current, as indicated by Ohm's law, depends on the voltage across the external resistors. The TPS92612-Q1 device controls the driver current $I_{(DRIVE)}$ to attain the desired total current. If $I_{(P)}$ increases, the TPS92612-Q1 device decreases $I_{(DRIVE)}$ to compensate, and vice versa.

While in low-dropout mode, the voltage across the $R_{(P)}$ resistor may be close to zero, so that almost no current can flow through the external resistor $R_{(P)}$.

Typical Application (continued)

When the input voltage is high, parallel-resistor current $I_{(P)}$ is proportional to the voltage across the parallel resistor, $R_{(P)}$. The parallel resistor, $R_{(P)}$, takes the majority of the total string current, generating maximum heat. The device must prevent current from draining out to ensure current regulation capability.

In this case, the parallel resistor value must be carefully calculated to ensure that 1) enough output current is achieved in low-dropout mode, 2) thermal dissipation for both the TPS92612-Q1 device and the resistor is within their thermal dissipation limits, and 3) device current in the high-voltage mode is above the minimal output-current requirement.

TI recommends to add capacitors C_1 and C_2 at SUPPLY and OUT. TI recommends C_1 of 1 μ F and 100 nF close to the SUPPLY pin, and C_2 of 10 nF close to the OUT pin. A larger capacitor for C_1 or C_2 is helpful for EMC and ESD; however, it takes a longer time to charge up the capacitor and could affect PWM dimming performance.

Current setting by the sense resistor is as described in 式 1.

$$R_{(SNS)} = \frac{V_{(CS_REG)}}{I_{(LED)}} = 0.98\Omega \quad (4)$$

LED-string maximum forward voltage = $3 \times 2.5 \text{ V} = 7.5 \text{ V}$.

Parallel resistor $R_{(P)}$ is recommended to consume 1/2 of the total current at maximum supply voltage.

$$R_{(P)} = \frac{V_{(SUPPLY)} - V_{(CS_REG)} - V_{(OUT)}}{0.5 \times I_{(LED)}} = \frac{16 - 0.098 - 3 \times 1.9}{0.5 \times 0.1} \approx 200\Omega \quad (5)$$

Total device power consumption is maximum with 16-V input and LEDs at minimal forward voltage.

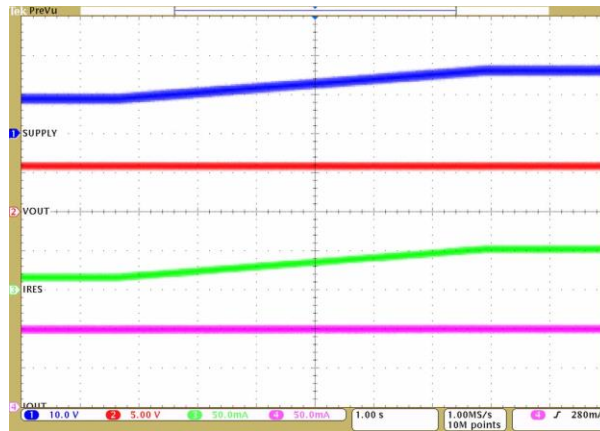
$$\begin{aligned} P_{(DEV_MAX)} &= \left(V_{(SUPPLY)} - V_{(CS_REG)} - V_{(OUT)} \right) \times \left(I_{(LED)} - \frac{V_{(SUPPLY)} - V_{(CS_REG)} - V_{(OUT)}}{R_{(P)}} \right) + V_{(SUPPLY)} \times I_{(Quiescent)} \\ &= (16 - 0.098 - 3 \times 1.9) \times \left(0.1 - \frac{16 - 0.098 - 3 \times 1.9}{200} \right) + 16 \times 0.00025 = 0.504\text{W} \end{aligned} \quad (6)$$

Resistor $R_{(P)}$ maximum power consumption is at 16-V input.

$$P_{(RP_MAX)} = \frac{\left(V_{(SUPPLY)} - V_{(CS_REG)} - V_{(OUT)} \right)^2}{R_{(P)}} = \frac{(16 - 0.098 - 3 \times 1.9)^2}{200} = 0.52\text{W} \quad (7)$$

Typical Application (continued)

8.2.2.3 Application Curve



Ch. 1 = V_{SUPPLY} Ch. 2 = V_{OUT} Ch. 3 = I_{P}

Ch. 4 = I_{LED}

Supply voltage increases from 9 V to 16 V

☒ 22. Constant Output Current With Increasing Supply Voltage

9 Power Supply Recommendations

The TPS92612-Q1 device is qualified for automotive applications. The normal power supply connection is therefore to an automobile electrical system that provides a voltage within the range specified in the [Recommended Operating Conditions](#).

10 Layout

10.1 Layout Guidelines

Thermal dissipation is the primary consideration for TPS92612-Q1 layout. TI recommends good thermal dissipation area beneath the device for better thermal performance.

10.2 Layout Example

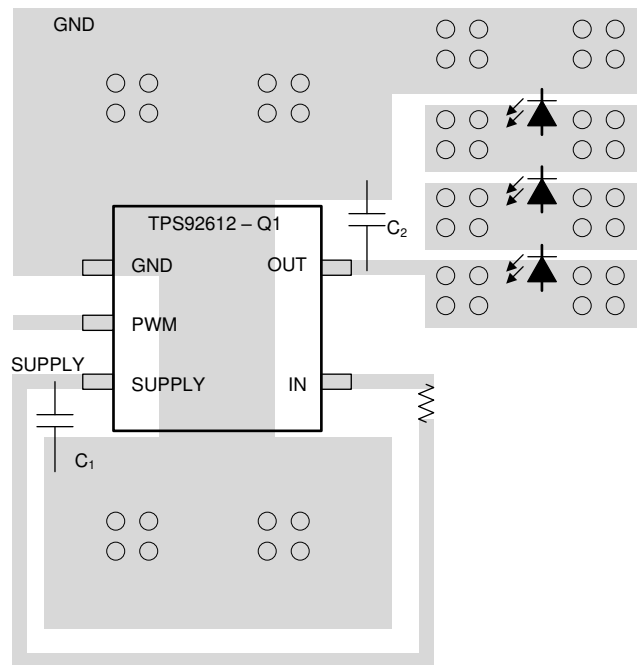


图 23. TPS92612-Q1 Example Layout Diagram

11 デバイスおよびドキュメントのサポート

11.1 ドキュメントのサポート

11.1.1 関連資料

関連資料については、以下を参照してください。

- 『[TPS92610-Q1 車載シングルチャネル・リニアLEDドライバ](#)』
- 『[TPS92611-Q1 車載シングルチャネル・リニアLEDドライバ](#)』
- 『[TPS92610-Q1 EVMユーザー・ガイド](#)』
- 『[車外照明アプリケーションにおけるTPS92630-Q1の最大出力電流の計算方法](#)』
- 『[センター・ハイマウント・ストップ・ランプ\(CHMSL\)用の車載リニアLEDドライバのリファレンス・デザイン](#)』
- 『[センター・ハイマウント・ストップ・ランプ\(CHMSL\)用の車載リニアLEDドライバのリファレンス・デザイン](#)』

11.2 ドキュメントの更新通知を受け取る方法

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11.3 コミュニティ・リソース

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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11.6 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

12 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。これらの情報は、指定のデバイスに対して提供されている最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS92612QDBVRQ1	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1J6F
TPS92612QDBVRQ1.A	Active	Production	SOT-23 (DBV) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1J6F

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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OTHER QUALIFIED VERSIONS OF TPS92612-Q1 :

- Catalog : [TPS92612](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS92612QDBVRQ1	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS92612QDBVRQ1	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS92612QDBVRQ1	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS92612QDBVRQ1	SOT-23	DBV	5	3000	210.0	185.0	35.0

DBV0005A



PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.

EXAMPLE BOARD LAYOUT

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

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NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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