

# 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: 4.5V~40V
- 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。ディスクリート・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。

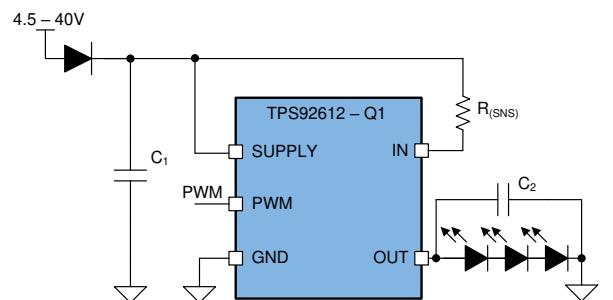
TPS92612-Q1デバイスは、自動車用バッテリで動作する、シンプルなシングルチャネルのハイサイドLEDドライバです。単純かつ洗練されたソリューションで、単一のLEDストリングに一定の電流を供給できます。

### 製品情報<sup>(1)</sup>

型番	パッケージ	本体サイズ(公称)
TPS92612-Q1	SOT-23 (5)	2.9mmx1.6mm

(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



## 目次

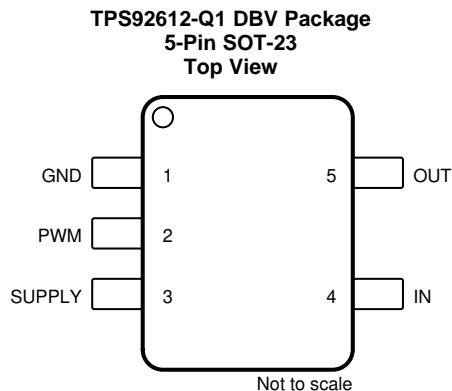
<b>1 特長</b>	1	7.4 Device Functional Modes	10
<b>2 アプリケーション</b>	1	<b>8 Application and Implementation</b>	11
<b>3 概要</b>	1	8.1 Application Information	11
<b>4 改訂履歴</b>	2	8.2 Typical Application	11
<b>5 Pin Configuration and Functions</b>	3	<b>9 Power Supply Recommendations</b>	14
<b>6 Specifications</b>	3	<b>10 Layout</b>	14
6.1 Absolute Maximum Ratings	3	10.1 Layout Guidelines	14
6.2 ESD Ratings	3	10.2 Layout Example	15
6.3 Recommended Operating Conditions	4	<b>11 デバイスおよびドキュメントのサポート</b>	16
6.4 Thermal Information	4	11.1 ドキュメントのサポート	16
6.5 Electrical Characteristics	4	11.2 ドキュメントの更新通知を受け取る方法	16
6.6 Timing Requirements	5	11.3 コミュニティ・リソース	16
6.7 Typical Characteristics	6	11.4 商標	16
<b>7 Detailed Description</b>	9	11.5 静電気放電に関する注意事項	16
7.1 Overview	9	11.6 Glossary	16
7.2 Functional Block Diagram	9	<b>12 メカニカル、パッケージ、および注文情報</b>	16
7.3 Feature Description	9		

## 4 改訂履歴

	Page
Revision A (July 2018) から Revision B に変更	1
• 「 <a href="#">特長</a> 」セクションに機能安全対応のリンクを追加	1

	Page
2018年1月発行のものから更新	1
• 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 <sub>1</sub> and C <sub>2</sub>	11
• Added capacitors C <sub>1</sub> and C <sub>2</sub>	12
• Added capacitors C <sub>1</sub> and C <sub>2</sub>	15

## 5 Pin Configuration and Functions



### Pin Functions

<b>PIN</b>		<b>I/O</b>	<b>DESCRIPTION</b>
<b>NAME</b>	<b>NO.</b>		
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)<sup>(1)</sup>

		<b>MIN</b>	<b>MAX</b>	<b>UNIT</b>
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

			<b>VALUE</b>	<b>UNIT</b>
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per AEC Q100-002 <sup>(1)</sup> HBM ESD Classification Level 2	All pins	$\pm 2000$
		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 STDZ017I on page 84.]	All pins	$\pm 500$
			Corner pins (3, 4, and 5)	$\pm 750$

(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 <sub>A</sub>	Operating ambient temperature	-40	125		°C

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		TPS92612-Q1	UNIT
		DBV (SOT23)	
		5 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	200.7	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	104.4	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	45.6	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	17.5	°C/W
Ψ <sub>JB</sub>	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<sub>(SUPPLY)</sub> = 5 V to 40 V, T<sub>J</sub> = -40°C to 150°C unless otherwise noted

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

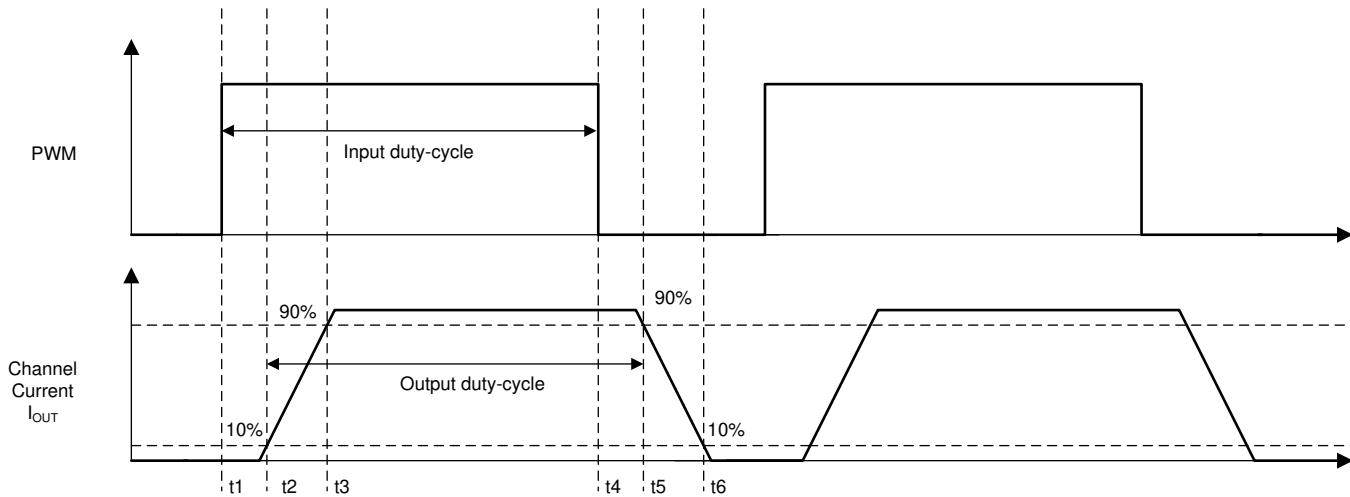
## Electrical Characteristics (continued)

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>THERMAL PROTECTION</b>					
$T_{(TSD)}$	Thermal shutdown junction temperature threshold			172	°C
$T_{(TSD\_HYS)}$	Thermal shutdown junction temperature hysteresis			15	°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 <a href="#">図 1</a>		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 <a href="#">図 1</a>		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



Copyright © 2017, Texas Instruments Incorporated

**図 1. Output Timing Diagram**

## 6.7 Typical Characteristics

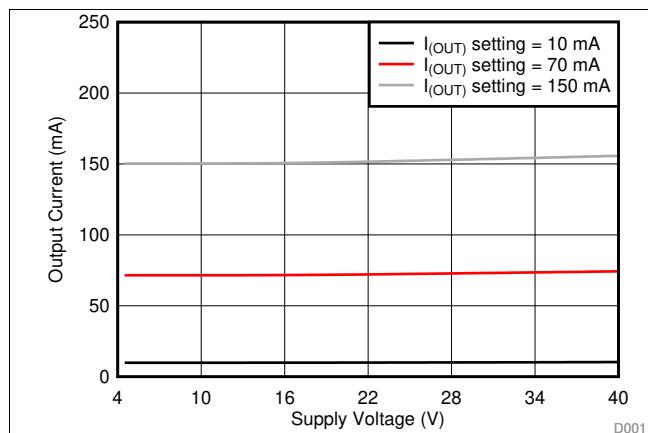


图 2. Output Current vs Supply Voltage

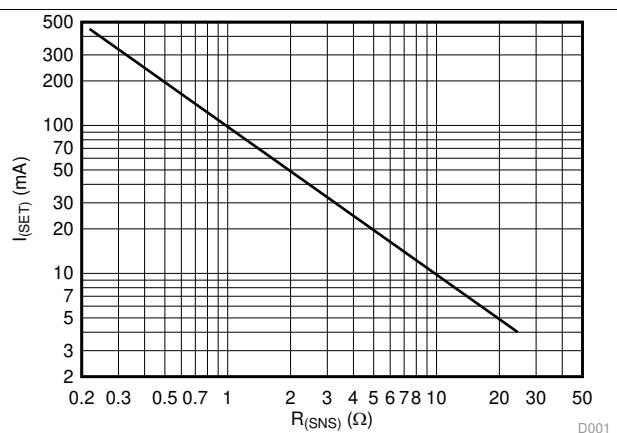


图 3. Output Current vs Current-Sense Resistor

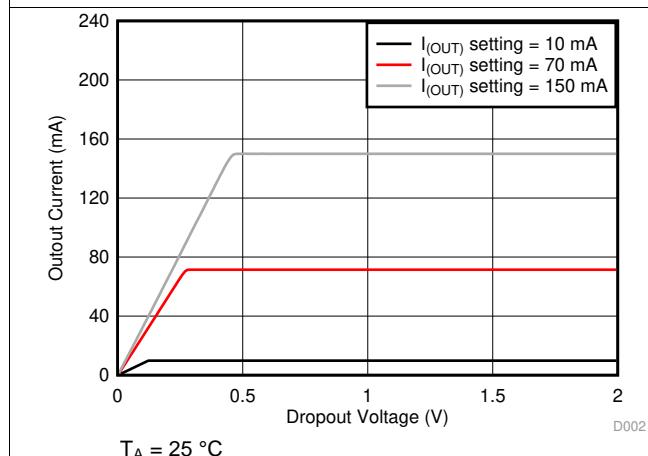


图 4. Output Current vs Dropout Voltage

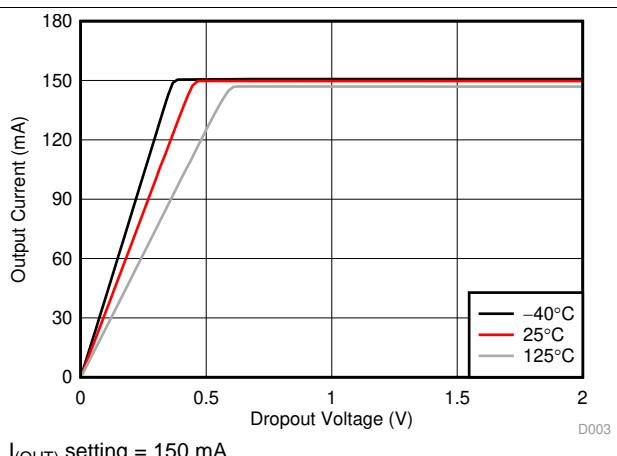


图 5. Output Current vs Temperature

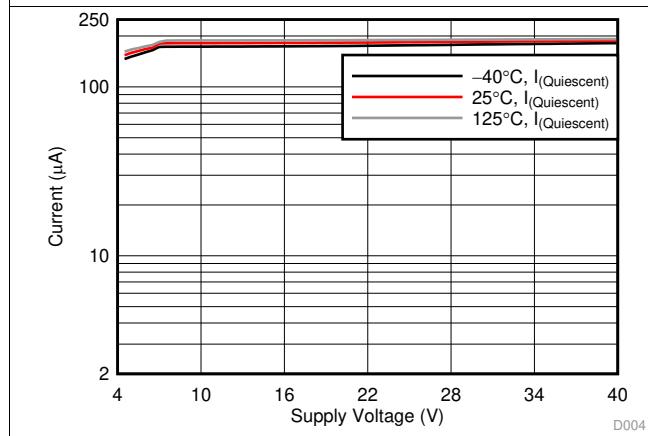


图 6. Quiescent Current vs Input Voltage

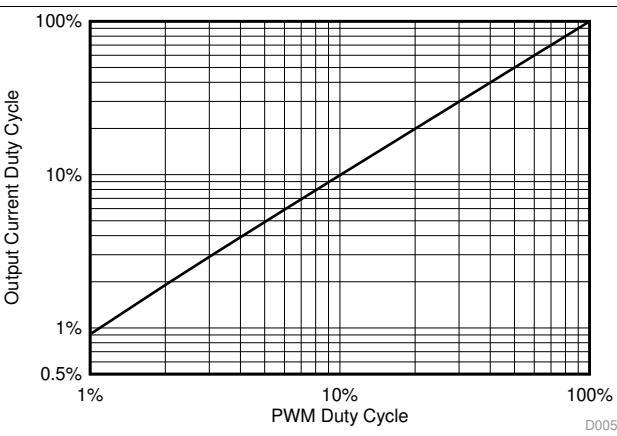
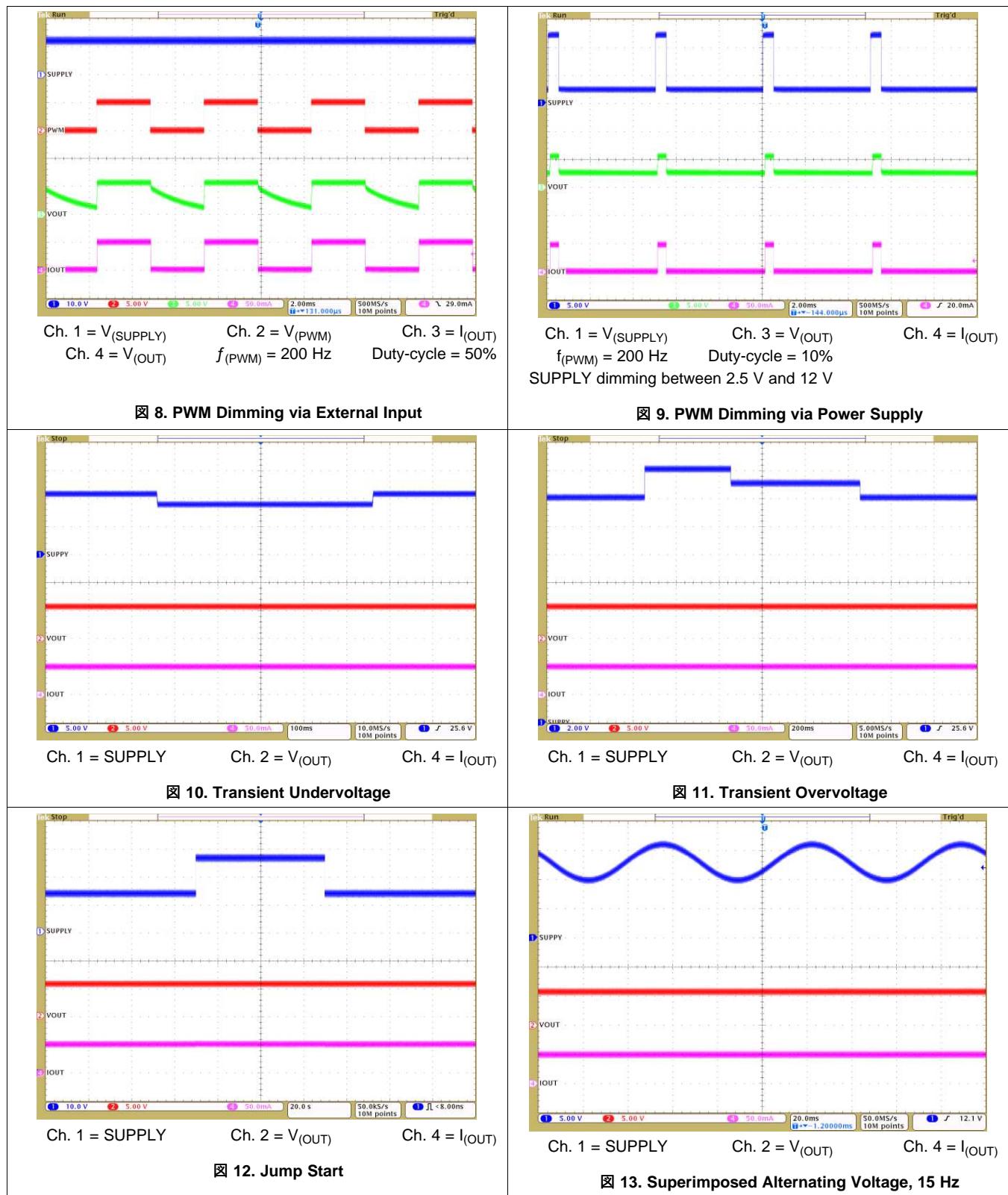


图 7. PWM Output Duty Cycle vs Input Duty Cycle

## Typical Characteristics (continued)



## Typical Characteristics (continued)

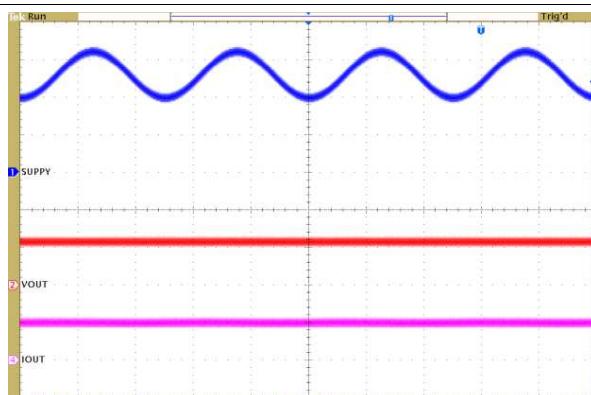


図 14. Superimposed Alternating Voltage, 1kHz

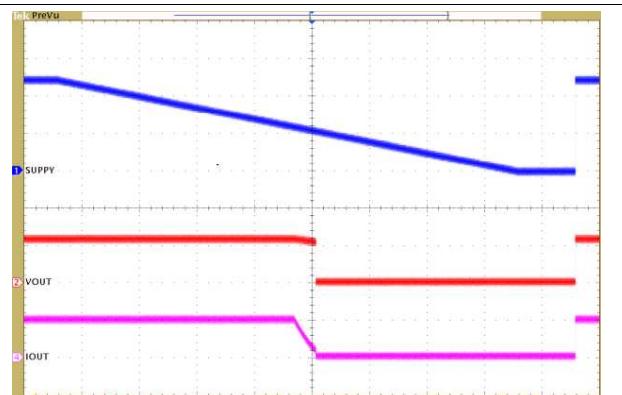


図 15. Slow Decrease, Quick Increase of Supply Voltage

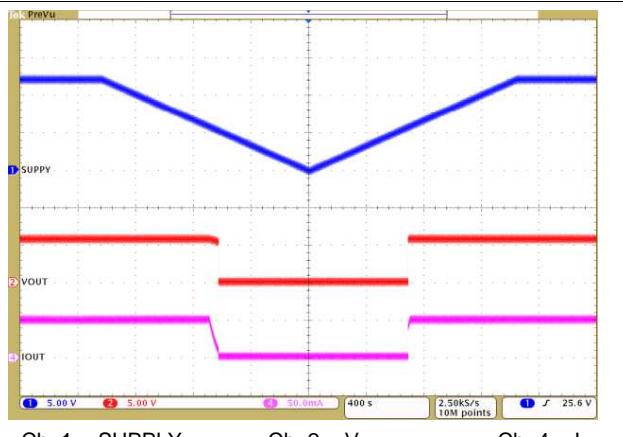


図 16. Slow Decrease and Slow Increase of Supply Voltage

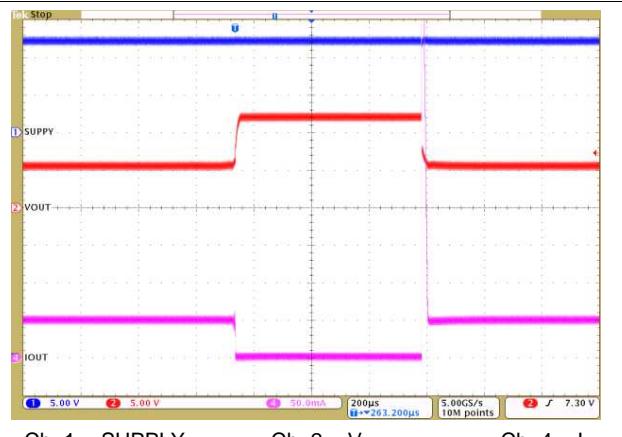


図 17. LED Open-Circuit and Recovery

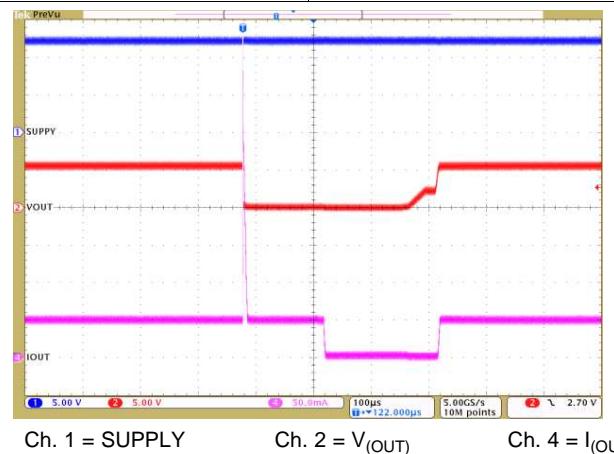


図 18. LED Short-Circuit Protection and Recovery

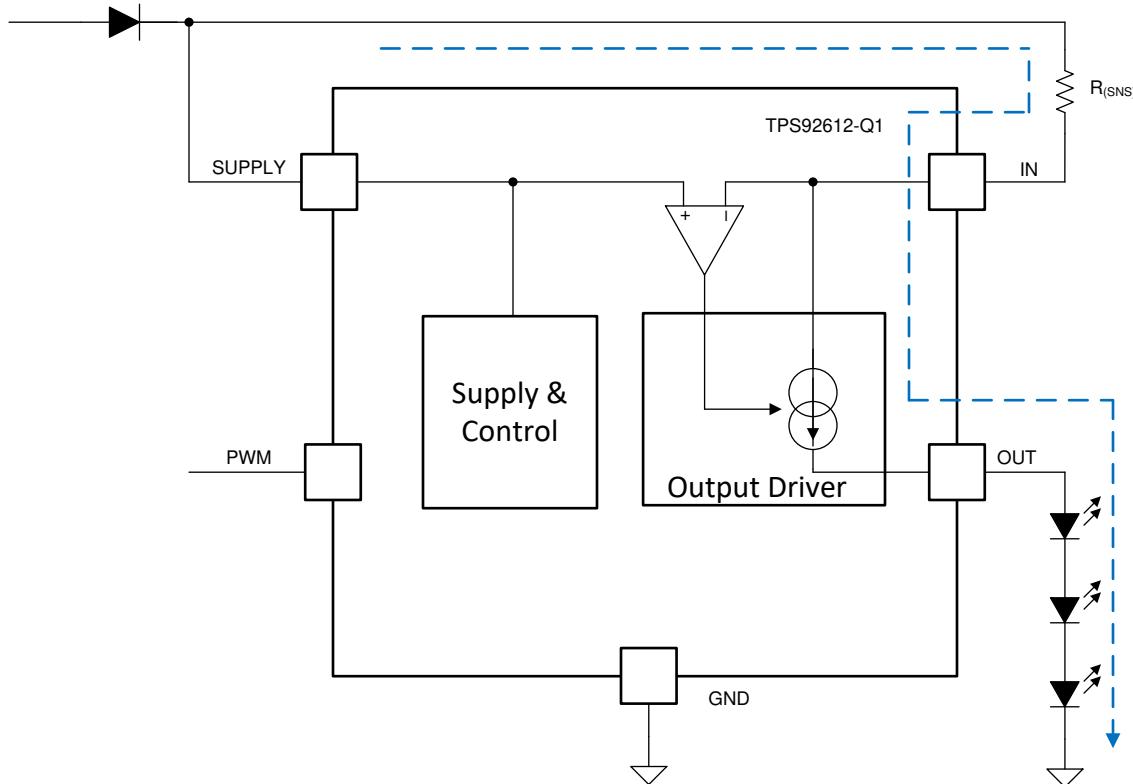
## 7 Detailed Description

### 7.1 Overview

The TPS92612-Q1 device is 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



Copyright ©2017, Texas Instruments Incorporated

### 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

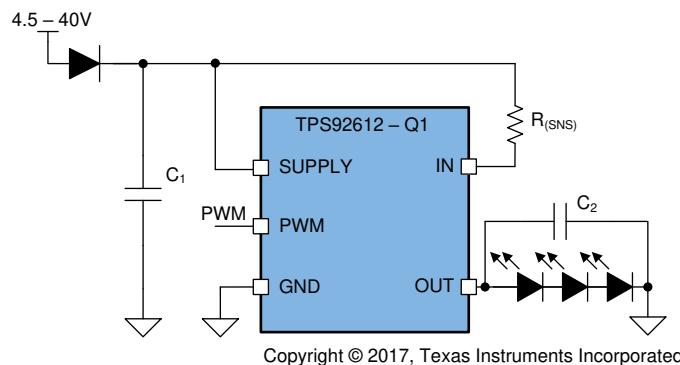
In automotive lighting applications, thermal performance is always a design challenge for linear LED drivers.

To increase current-driving capability, the TPS92612-Q1 device supports heat sharing using an external parallel resistor as shown in [図 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.



**図 19. Typical Application Diagram**

#### 8.2.1.1 Design Requirements

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

#### 8.2.1.2 Detailed Design Procedure

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

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

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

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

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

TI recommends to add capacitors  $C_1$  and  $C_2$  at SUPPLY and OUT. TI recommends  $C_1$  of 1  $\mu$ 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

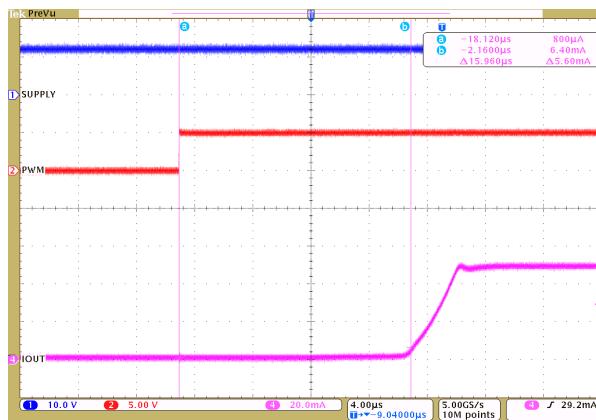
Ch. 1 =  $V_{(OUT)}$ Ch. 2 =  $V_{(PWM)}$ Ch. 4 =  $I_{(OUT)}$ 

图 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.

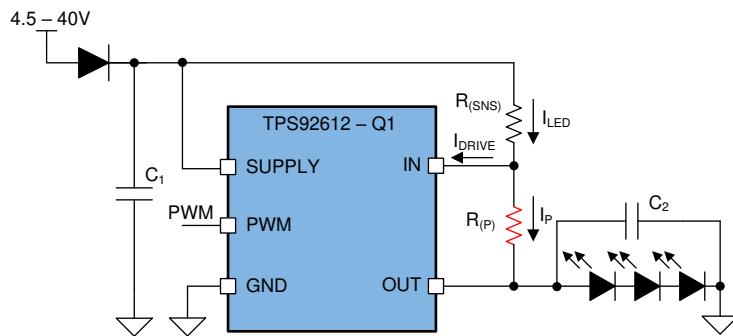


图 21. Heat Sharing With a Parallel Resistor

#### 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  $\mu\text{F}$  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.

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

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.

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

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

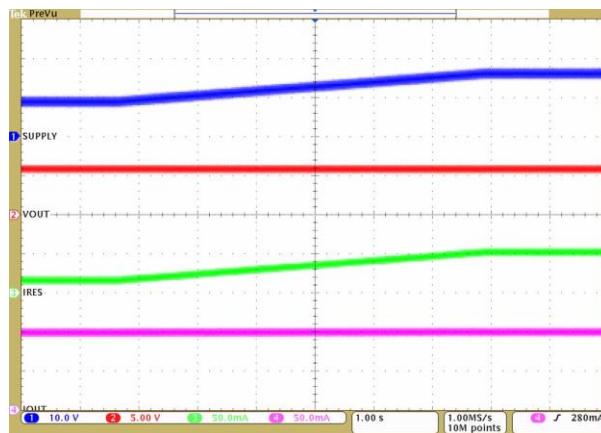
$$\begin{aligned} P_{(\text{DEV\_MAX})} &= \left( V_{(\text{SUPPLY})} - V_{(\text{CS\_REG})} - V_{(\text{OUT})} \right) \times \left( I_{(\text{LED})} - \frac{V_{(\text{SUPPLY})} - V_{(\text{CS\_REG})} - V_{(\text{OUT})}}{R_{(P)}} \right) + V_{(\text{SUPPLY})} \times I_{(\text{Quiescent})} \\ &= (16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

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

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

## Typical Application (continued)

### 8.2.2.3 Application Curve



$$\text{Ch. 1} = V_{(\text{SUPPLY})} \quad \text{Ch. 2} = V_{(\text{OUT})} \quad \text{Ch. 3} = I_{(\text{P})}$$

$$\text{Ch. 4} = I_{(\text{LED})}$$

Supply voltage increases from 9 V to 16 V

**図 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

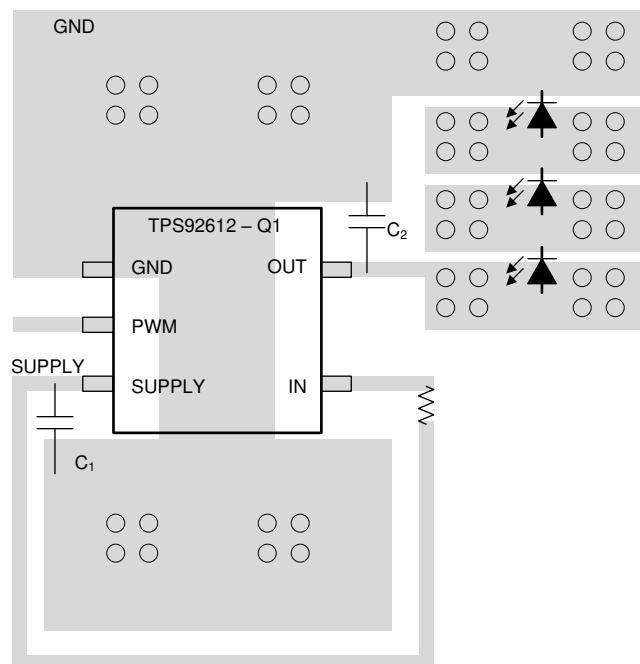


図 23. TPS92612-Q1 Example Layout Diagram

## 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

ドキュメントの更新についての通知を受け取るには、ti.comのデバイス製品フォルダを開いてください。右上の「アラートを受け取る」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

#### 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.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

#### 11.4 商標

E2E is a trademark of Texas Instruments.

All other trademarks are the property of their respective owners.

#### 11.5 静電気放電に関する注意事項



すべての集積回路は、適切なESD保護方法を用いて、取扱いと保存を行うようにして下さい。

静電気放電はわずかな性能の低下から完全なデバイスの故障に至るまで、様々な損傷を与えます。高精度の集積回路は、損傷に対して敏感であり、極めてわずかなパラメータの変化により、デバイスに規定された仕様に適合しなくなる場合があります。

#### 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ます、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
TPS92612QDBVRQ1.B	Active	Production	SOT-23 (DBV)   5	3000   LARGE T&R	-	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1J6F

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

<sup>(2)</sup> **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.

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

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

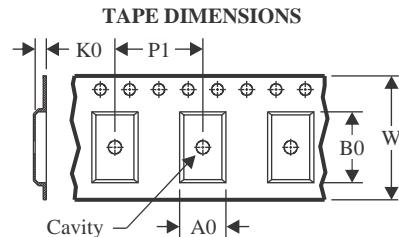
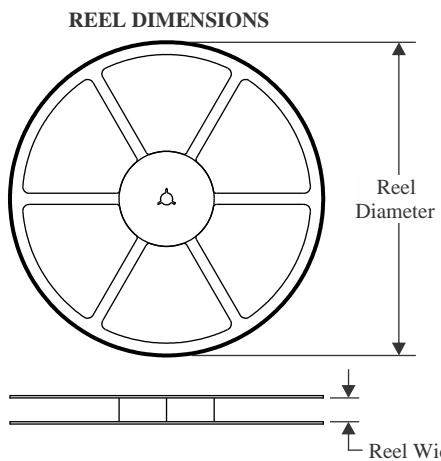
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF TPS92612-Q1 :**

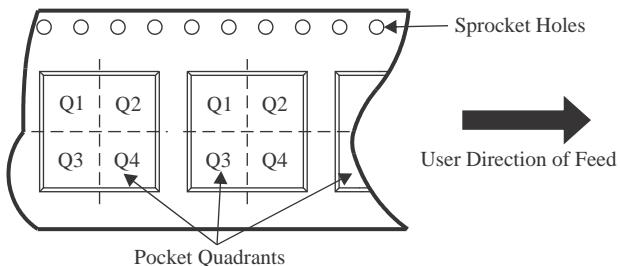
- Catalog : [TPS92612](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

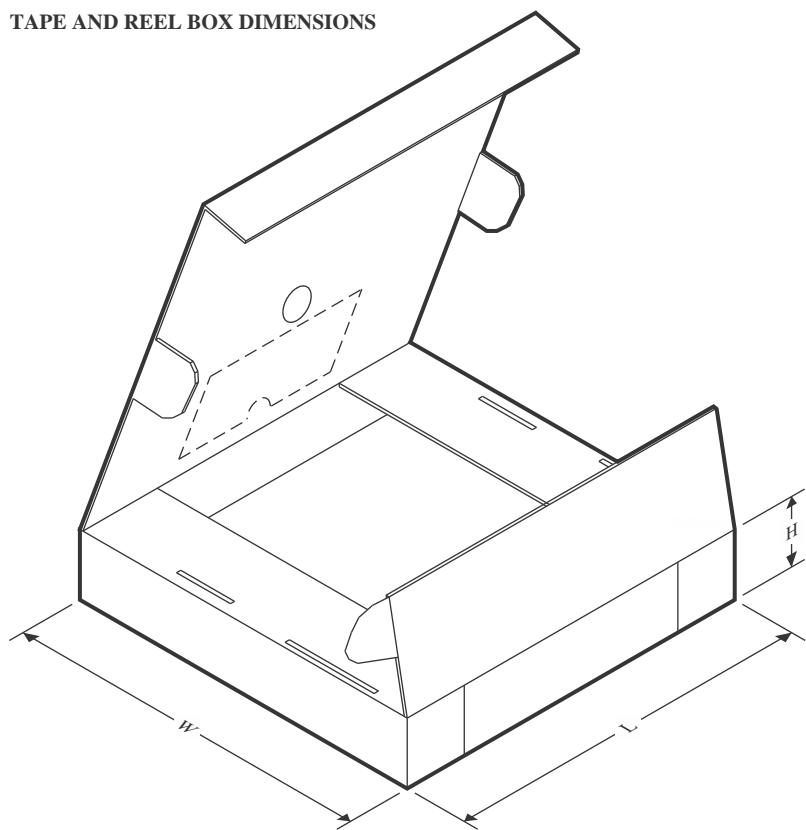
**TAPE AND REEL INFORMATION**

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**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

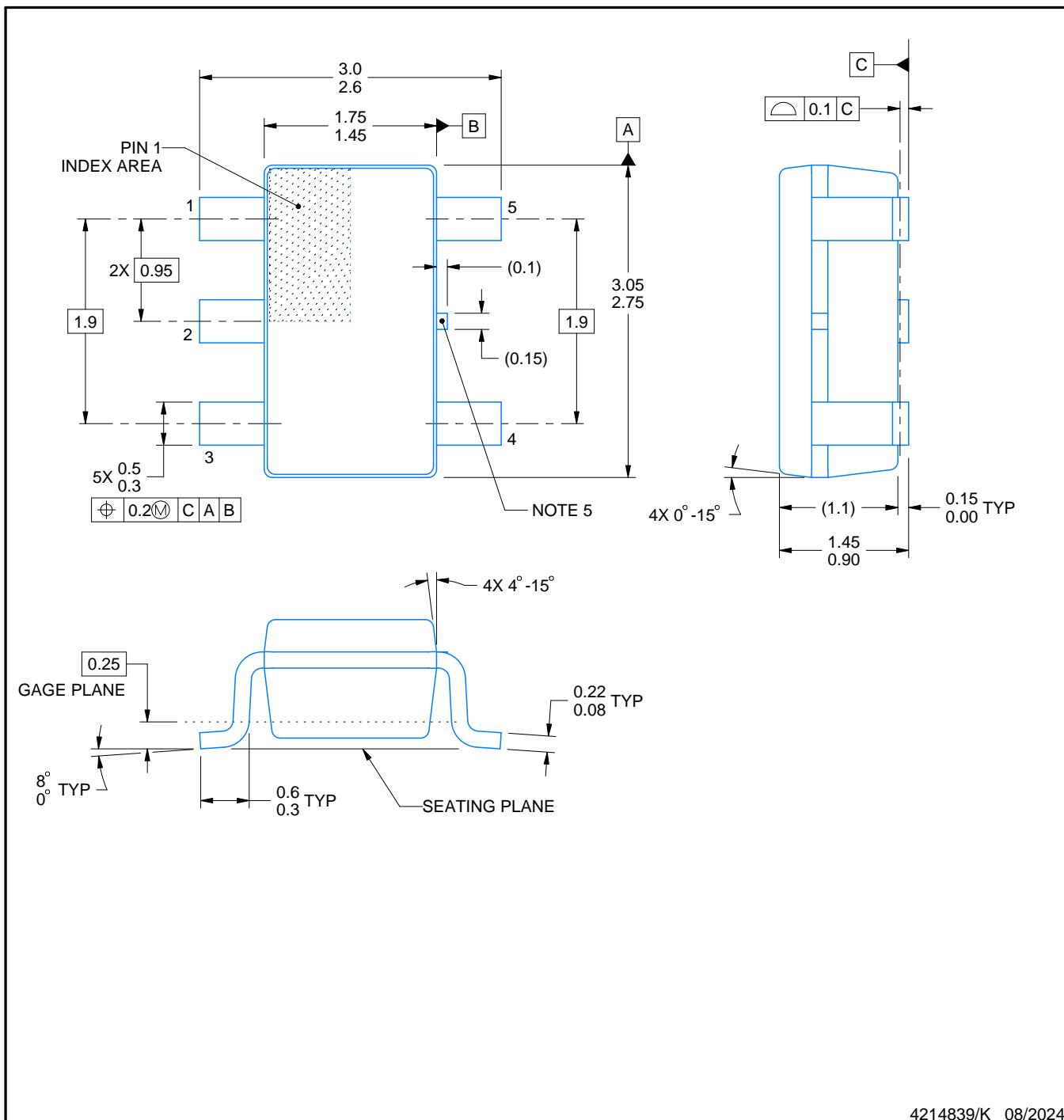
# PACKAGE OUTLINE

**DBV0005A**



**SOT-23 - 1.45 mm max height**

SMALL OUTLINE TRANSISTOR



4214839/K 08/2024

## NOTES:

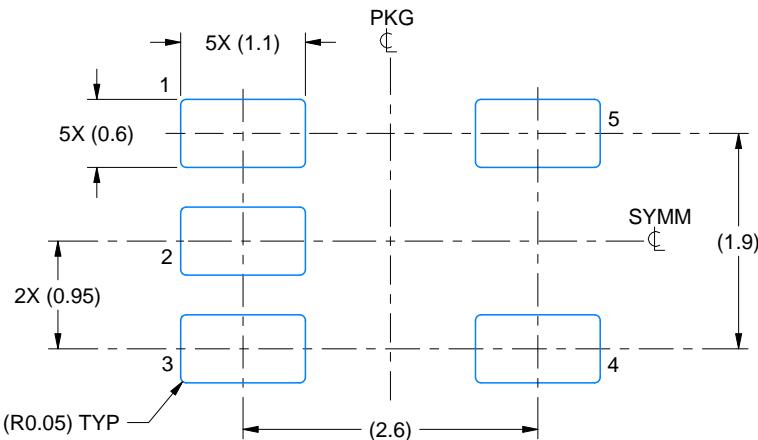
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold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

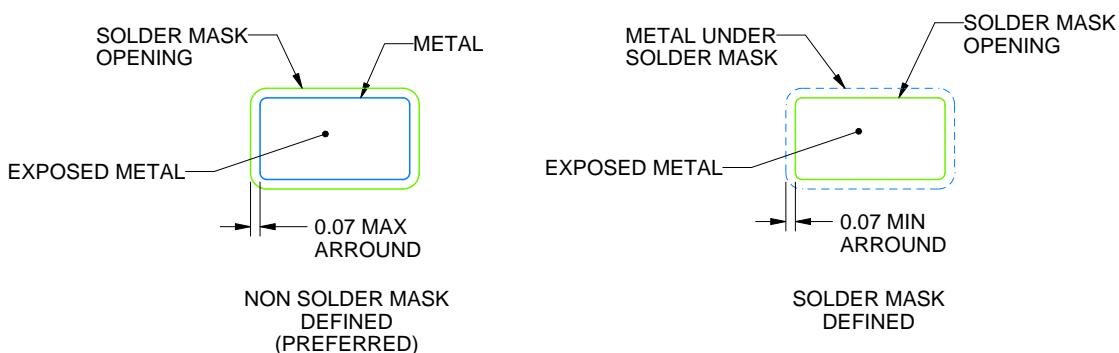
DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214839/K 08/2024

NOTES: (continued)

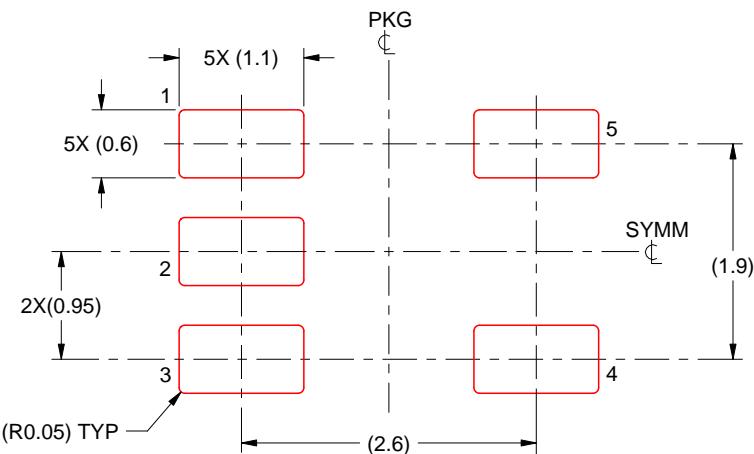
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# 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

4214839/K 08/2024

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.

## 重要なお知らせと免責事項

テキサス・インスツルメンツは、技術データと信頼性データ(データシートを含みます)、設計リソース(リファレンス デザインを含みます)、アプリケーションや設計に関する各種アドバイス、Web ツール、安全性情報、その他のリソースを、欠陥が存在する可能性のある「現状のまま」提供しており、商品性および特定目的に対する適合性の默示保証、第三者の知的財産権の非侵害保証を含むいかなる保証も、明示的または默示的にかかわらず拒否します。

これらのリソースは、テキサス・インスツルメンツ製品を使用する設計の経験を積んだ開発者への提供を意図したものです。(1)お客様のアプリケーションに適したテキサス・インスツルメンツ製品の選定、(2)お客様のアプリケーションの設計、検証、試験、(3)お客様のアプリケーションに該当する各種規格や、その他のあらゆる安全性、セキュリティ、規制、または他の要件への確実な適合に関する責任を、お客様のみが単独で負うものとします。

上記の各種リソースは、予告なく変更される可能性があります。これらのリソースは、リソースで説明されているテキサス・インスツルメンツ製品を使用するアプリケーションの開発の目的でのみ、テキサス・インスツルメンツはその使用をお客様に許諾します。これらのリソースに関して、他の目的で複製することや掲載することは禁止されています。テキサス・インスツルメンツや第三者の知的財産権のライセンスが付与されている訳ではありません。お客様は、これらのリソースを自身で使用した結果発生するあらゆる申し立て、損害、費用、損失、責任について、テキサス・インスツルメンツおよびその代理人を完全に補償するものとし、テキサス・インスツルメンツは一切の責任を拒否します。

テキサス・インスツルメンツの製品は、[テキサス・インスツルメンツの販売条件](#)、または [ti.com](http://ti.com) やかかるテキサス・インスツルメンツ製品の関連資料などのいずれかを通じて提供する適用可能な条項の下で提供されています。テキサス・インスツルメンツがこれらのリソースを提供することは、適用されるテキサス・インスツルメンツの保証または他の保証の放棄の拡大や変更を意味するものではありません。

お客様がいかなる追加条項または代替条項を提案した場合でも、テキサス・インスツルメンツはそれらに異議を唱え、拒否します。

郵送先住所 : Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2025, Texas Instruments Incorporated