TEXAS INSTRUMENTS

TPS92612

ZHCSL42 – APRIL 2020

具有保护功能的 TPS92612 40V、150mA 单通道线性 LED 驱动器（恒流源）

1 特性

- 单通道高精度电流源：
  - 在 –40°C 至 +125°C 范围内电流精度为 ±4.6%
  - 可通过外部感应电阻器调节电流
  - 最大电流高达 150mA
- 宽输入电压范围：4.5V 至 40V
- 通过输入 PWM 占空比进行亮度控制
- 低压降电压（包含电流感应压降）
  - 最大压降：10mA 时为 150mV
  - 最大压降：70mA 时为 400mV
  - 最大压降：150mA 时为 700mV
- 低静态电流：典型值 200µA
- 保护：
  - LED 短路保护，具有自动恢复功能
  - 热关断
- 与外部电阻器实现热共享
- 工作结温范围：–40°C 至 +150°C

2 应用

- LED 驱动器、恒流源或限流器，可用于：
  - 洗衣机和烘干机
  - 冰箱和冷冻柜
  - 气体检测仪
  - 工厂自动化和控制
  - 楼宇自动化
  - 医疗

3 说明

随着 LED 光源的广泛应用，简单的 LED 驱动器越来越受欢迎。与分立式解决方案相比，低成本单片解决方案可降低系统级组件数量，并显著提高电流精度和可靠性。

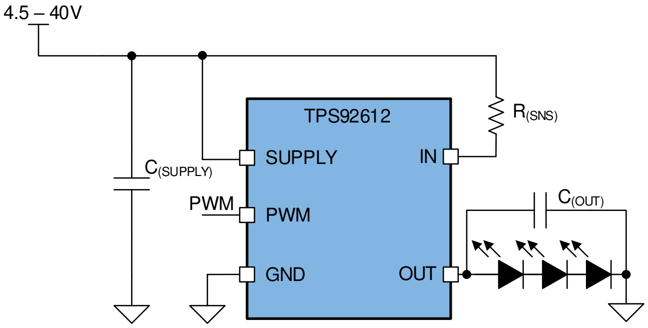
TPS92612 器件是一款单通道高侧线性 LED 驱动器，具有宽电源电压范围。这是一种简单而巧妙的解决方案，能够为单个 LED 灯串提供恒定电流。它支持通过长电缆连接非板载 LED。TPS92612 器件也可在其他应用中用作一般恒流源或限流器。

器件信息[1]

器件号	封装	封装尺寸（标称值）
TPS92612	SOT-23 (5)	2.9mm × 1.6mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。

典型应用图



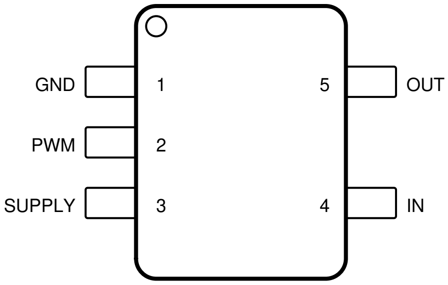
目录

4 修订历史记录

日期	修订版本	说明
2020 年 4 月	*	初始发行版。

5 Pin Configuration and Functions

TPS92612 DBV Package
5-Pin SOT-23
Top View



Not to scale

Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
	TPS92612		
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 ambient 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 ANSI/ESDA/JEDEC JS-001(1)	All pins	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	All pins	±500	
			Corner pins (3, 4, and 5)	±750	

(1) JEDEC document JEP155 states that 500-V HBM allows safemanufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safemanufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating ambient 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
Operating ambient temperature, T_A		–40		125	°C

6.4 Thermal Information

THERMAL METRIC		TPS92612	UNIT
		DBV (SOT23)	
		5 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	200.7	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	104.4	°C/W
$R_{\theta JB}$	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

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 = HIGH	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		1.16	1.2	1.24	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		0.66		24.5	Ω
$V_{(DROPOUT)}$	Voltage dropout from SUPPLY to OUT	$V_{(CS\_REG)}$ voltage included, current setting of 10 mA		120	150	mV
		$V_{(CS\_REG)}$ voltage included, current setting of 70 mA		250	400	
		$V_{(CS\_REG)}$ voltage included, current setting of 150 mA		430	700	
DIAGNOSTICS						
$V_{(SG\_th\_rising)}$	Channel output $V_{(OUT)}$ short-to-ground rising threshold		1.14	1.2	1.26	V
$V_{(SG\_th\_falling)}$	Channel output $V_{(OUT)}$ short-to-ground falling threshold		0.82	0.865	0.91	V
$I_{(Retry)}$	Channel output $V_{(OUT)}$ short-to-ground retry current		0.64	1.08	1.528	mA
THERMAL PROTECTION						
$T_{(TSD)}$	Thermal shutdown junction temperature threshold		157	172	187	°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 closed loop, t2 - t1 as shown in Figure 1	10	17	25	µs

Timing Requirements (continued)

		MIN	NOM	MAX	UNIT
$t_{(PWM\_delay\_falling)}$	PWM falling edge delay, 50% PWM voltage to 90% of output current open loop, t5 - t4 as shown in Figure 1	15	21	30	µs
$t_{(DEVICE\_STARTUP)}$	SUPPLY rising edge to 10% output current at 50-mA set current, t8 - t7 as shown in Figure 1		100	150	µs
$t_{(SG\_deg)}$	Output short-to-ground detection deglitch time	80	125	175	µs
$t_{(TSD\_deg)}$	Thermal over temperature deglitch timer		50		µs
$t_{(Recover\_deg)}$	Fault recovery deglitch timer	8.5	16	25	µs

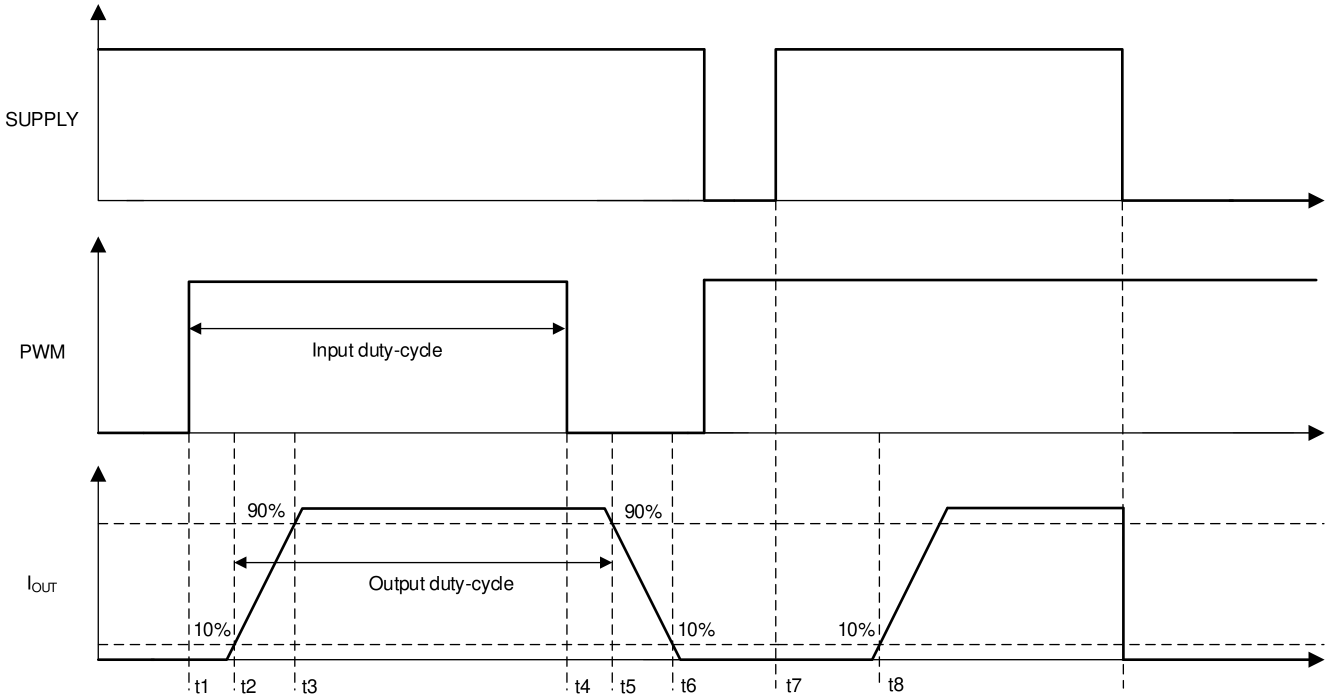
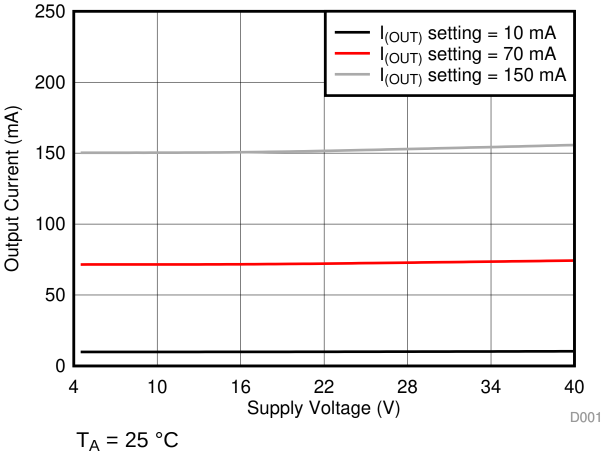


图 1. Output Timing Diagram

6.7 Typical Characteristics



T_A = 25 °C

图 2. Output Current vs Supply Voltage

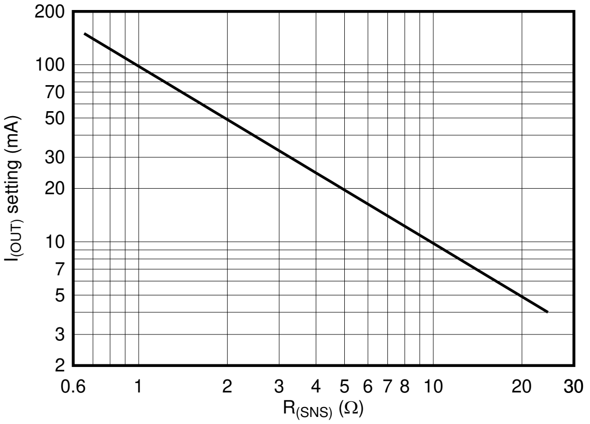
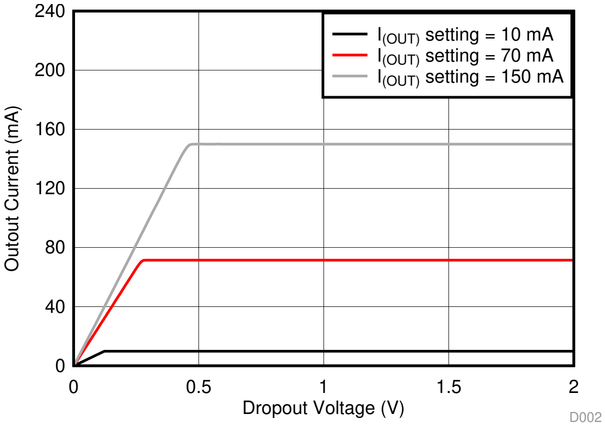


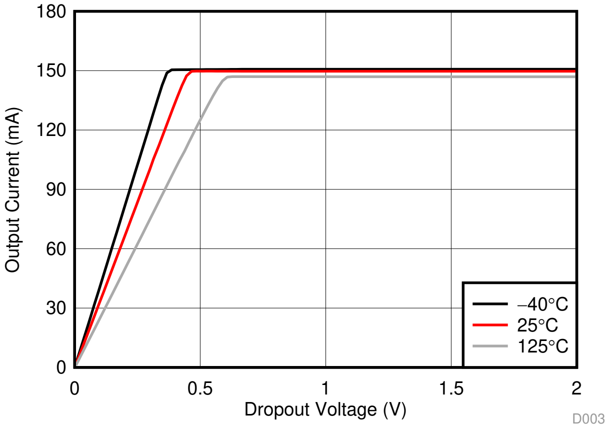
图 3. Output Current vs Current-Sense Resistor

Typical Characteristics (接下页)



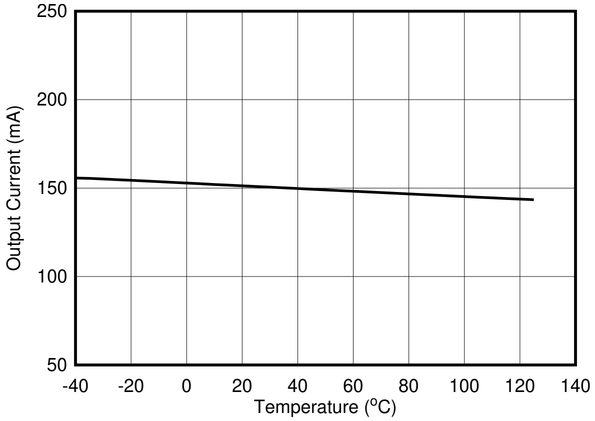
T_A = 25 °C

图 4. Output Current vs Dropout Voltage



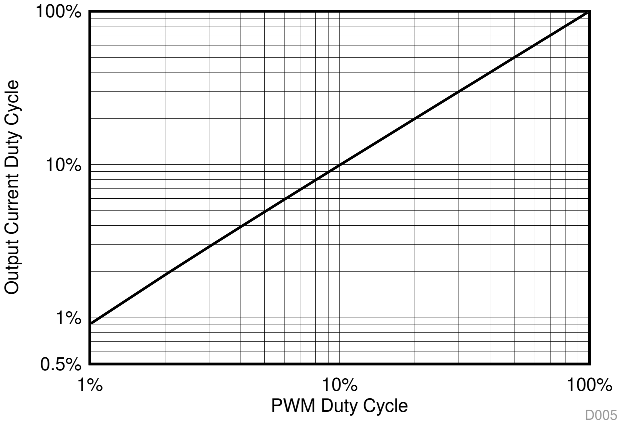
$I_{(OUT)}$ setting = 150 mA

图 5. Output Current vs Dropout Voltage



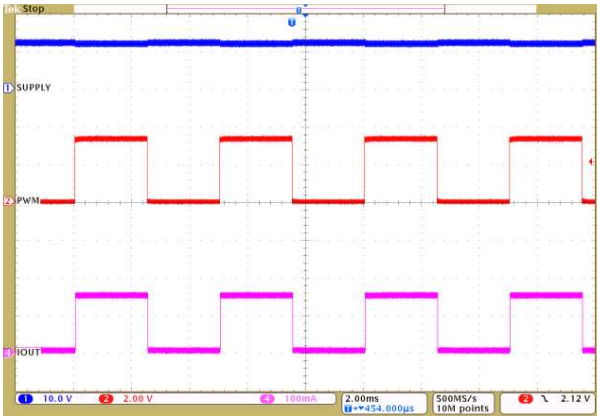
$I_{(OUT)}$ setting = 150 mA $V_{(SUPPLY)}$-$V_{(OUT)}$ = 2 V

图 6. Output Current vs Temperature



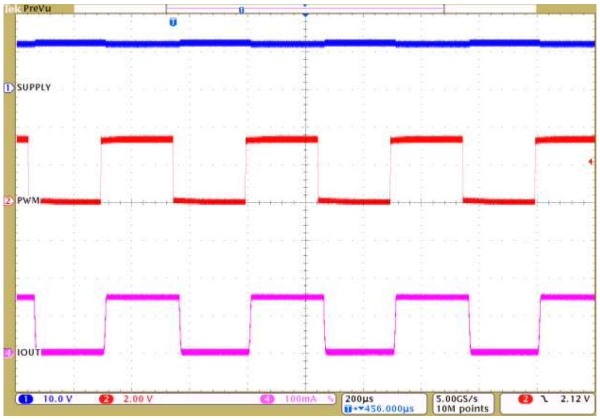
$f_{(PWM)}$ = 200 Hz

图 7. PWM Output Duty Cycle vs Input Duty Cycle



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

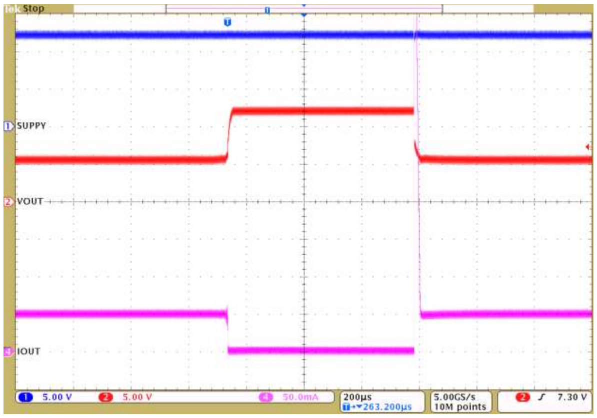
图 8. PWM Dimming at 200 Hz



Ch. 1 = SUPPLY Ch. 2 = $V_{(PWM)}$ Ch. 4 = $I_{(OUT)}$
$f_{(PWM)}$ = 2 kHz Duty-cycle = 50%

图 9. PWM Dimming at 2 kHz

Typical Characteristics (接下页)



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

图 10. LED Open-Circuit and Recovery

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

图 11. LED Short-Circuit Protection and Recovery

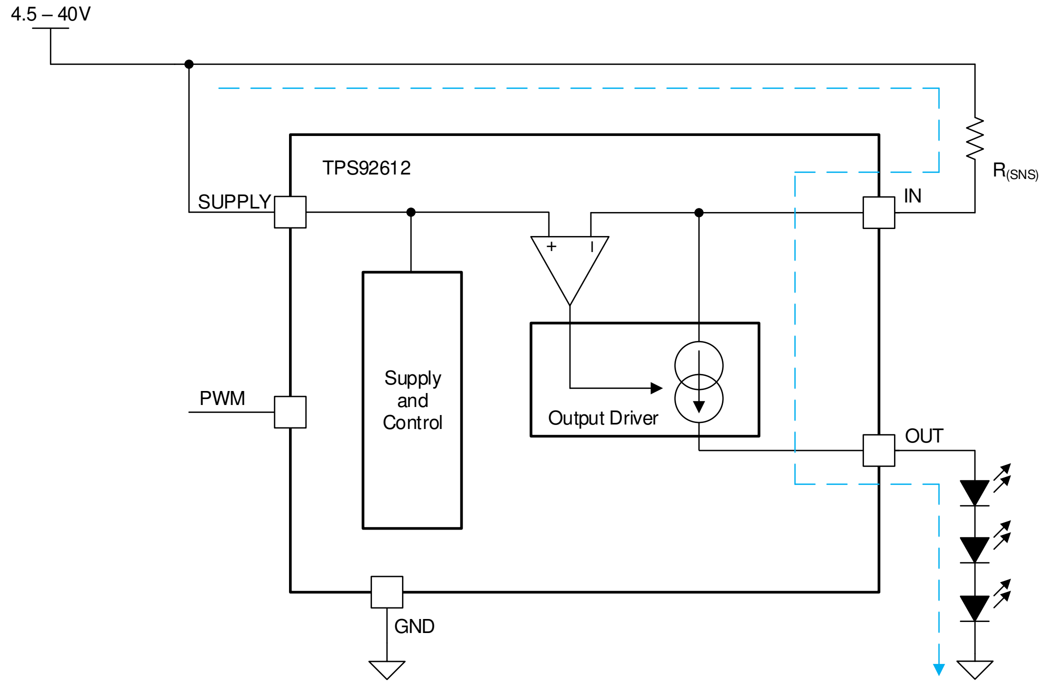
7 Detailed Description

7.1 Overview

The TPS92612 device is a single-channel linear LED driver providing a simple current source with protection.

The output current at OUT pin can be set by an external $R_{(SNS)}$ resistor. Current flows from the supply through the $R_{(SNS)}$ resistor into the integrated current regulation circuit and to the output through OUT pin. Brightness can be controlled by PWM pin.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Device Bias

7.3.1.1 Power-On Reset (POR)

The TPS92612 device has an internal power-on-reset (POR) function. When power is applied to the SUPPLY pin, 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 device is a high-side constant-current driver. The device controls the output current through regulating the voltage drop on an external high-side current-sense resistor, $R_{(SNS)}$. An integrated error amplifier drives an internal power transistor to maintain the voltage drop on the current-sense resistor $R_{(SNS)}$ to $V_{(CS\_REG)}$ and therefore regulates the current output to target value. When the output current is in regulation, the current value can be calculated by using 公式 1.

$$I_{(OUT)} = \frac{V_{(CS\_REG)}}{R_{(SNS)}}$$

where

- $V_{(CS\_REG)}$ = 98 mV (typical) (1)

Feature Description (接下页)

When the SUPPLY-to-OUT voltage difference is below the required dropout voltage, $V_{(DROPOUT)}$, at a given output current, the TPS92612 is not able to deliver enough current output as set by the value of $R_{(SNS)}$, and the voltage across the current-sense resistor $R_{(SNS)}$ is less than $V_{(CS\_REG)}$.

7.3.3 PWM Control

The pulse width modulation (PWM) input of the TPS92612 functions as enable for the output current. When the voltage applied on the PWM pin is higher than $V_{IH(PWM)}$, the output current is enabled. When the voltage applied on PWM pin is lower than $V_{IL(PWM)}$, the output current is disabled. Besides output current enable and disable function, the PWM input of TPS92612 also supports adjustment of the average current for LED brightness control. TI recommends a 200 Hz – 2 kHz PWM signal for brightness control, which is out of visible frequency range of human eyes.

7.3.4 Protection

7.3.4.1 Short-to-GND Protection

The TPS92612 device has OUT short-to-GND protection. The device monitors the $V_{(OUT)}$ voltage when the output current is enabled and compares it with the internal reference voltage to detect a short-to-GND failure. If $V_{(OUT)}$ falls below $V_{(SG\_th\_falling)}$ 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 $V_{(SG\_th\_rising)}$, the timer is reset.

Once the device has detected a short-to-GND fault, the device turns off the output channel and retries automatically by sourcing a small current $I_{(retry)}$ from IN to OUT to pull up the loads continuously, regardless of the state of the PWM input. Once auto retry detects output voltage rising above $V_{(SG\_th\_rising)}$, the device clears the short-to-GND fault and resumes normal operation.

7.3.4.2 Over Temperature Protection

The TPS92612 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 recovers to normal operation.

7.4 Device Functional Modes

7.4.1 Undervoltage Lockout, $V_{(SUPPLY)} < V_{(POR\_rising)}$

When the TPS92612 device is in undervoltage lockout mode, the device disables all functions until the supply rises above the $V_{(POR\_rising)}$ threshold.

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

The device regulates output current in normal state. 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

The TPS92612 device is a constant-current regulator which can be used as a LED driver, general constant-current source or current limiter in industrial applications.

Thermal performance is one of the design challenges for linear devices. To increase current-driving capability, the device supports heat sharing using an external parallel resistor, as shown in 图 15. This technique provides the low-cost solution of using external resistors to minimize thermal accumulation on the device itself, and still keeps high accuracy of the total current output.

8.2 Typical Application

8.2.1 Single LED Driver

The TPS92612 offers a cost-effective and easy-to-use solution for LED driver applications. PWM input can be adopted for LED brightness adjust and LED ON/OFF control. The device also supports off-board LED connection with long cables.

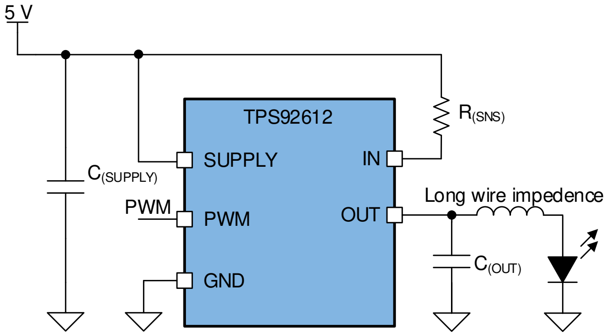


图 12. Typical Application Diagram

8.2.1.1 Design Requirements

The input voltage is 5 V ± 5%. LED maximum forward voltage V_{F_MAX} = 2.5 V, minimum forward voltage V_{F_MIN} = 1.9 V, current $I_{(LED)}$ = 150 mA. LED is connected to device OUT pin through a 1-m long wire.

8.2.1.2 Detailed Design Procedure

STEP 1: Determine the current setting resistor, $R_{(SNS)}$ value by using 公式 2.

$$R_{(SNS)} = \frac{V_{(CS\_REG)}}{I_{(LED)}} = 0.653\Omega$$

where

- $V_{(CS\_REG)}$ = 98 mV (typical)
- $I_{(LED)}$ = 150 mA (2)

STEP 2: Power consumption analysis for the worst application conditions.

Typical Application (接下页)

Normally the thermal analysis is necessary for linear LED-driver applications to ensure that the operation junction temperature of TPS92612 is well managed. The total power consumption on the TPS92612 itself is one important factor determining operation junction temperature, and it can be calculated by using 公式 3. Based on the worst-case analysis for maximum power consumption on device, consider either optimizing PCB layout for better power dissipation as *Layout* describes or adding an extra heat-sharing resistor as described in *Single-Channel LED Driver With Heat Sharing*.

$$P_{(DEV)} = \left(V_{(SUPPLY)} - V_{(CS\_REG)} - V_{(OUT)}\right) \times I_{(LED)} + V_{(SUPPLY)} \times I_{(Quiescent)}$$

$$P_{(DEV\_MAX)} = (5.25 - 0.098 - 1.9) \times 0.15 + 5.25 \times 0.00025 = 0.489W$$

where

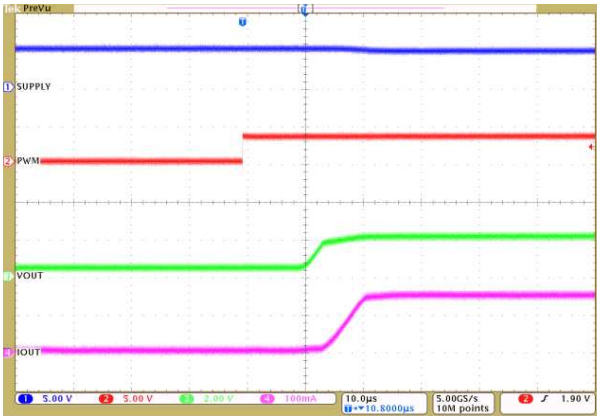
- $V_{(CS\_REG)}$ = 98 mV (typical)
- $I_{(Quiescent)}$ = 250 µA (maximum) (3)

In this application, the calculated result for maximum power consumption on the TPS92612 is 0.489 W at $V_{(SUPPLY)}$ = 5.25 V and $I_{(LED)}$ = 150 mA conditions.

TI recommends to add capacitors $C_{(SUPPLY)}$ at SUPPLY and $C_{(OUT)}$ at OUT. TI recommends one 1-µF capacitor plus one 100-nF decoupling ceramic capacitor close to the SUPPLY pin for $C_{(SUPPLY)}$ and a 10-nF ceramic capacitor close to the OUT pin for $C_{(OUT)}$. The larger capacitor for $C_{(SUPPLY)}$ or $C_{(OUT)}$ is helpful for EMI and ESD immunity; however, large $C_{(OUT)}$ takes a longer time to charge up the capacitor and may affect PWM dimming performance.

8.2.1.3 *Application Curve*

A 1-µH inductor is connected between OUT and the LED to simulate the 1-m long cable.



Ch. 1 = $V_{(SUPPLY)}$ Ch. 2 = $V_{(PWM)}$
Ch. 3 = $V_{(OUT)}$ Ch. 4 = $I_{(OUT)}$

图 13. Output Current With PWM Input

Ch. 1 = $V_{(SUPPLY)}$ Ch. 2 = $V_{(PWM)}$
Ch. 3 = $V_{(OUT)}$ Ch. 4 = $I_{(OUT)}$

图 14. 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 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 current $I_{(DRIVE)}$ and parallel resistor current $I_{(P)}$ combine to the total current.

Typical Application (接下页)

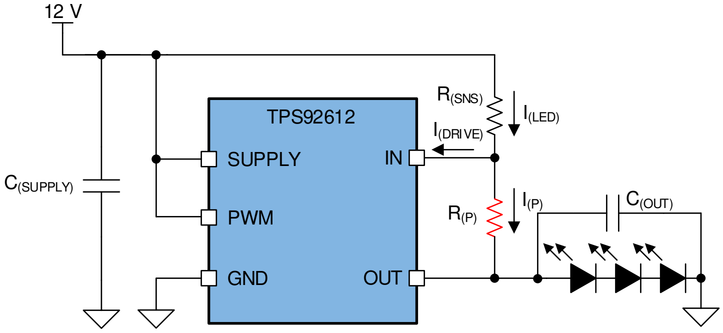


图 15. Heat Sharing With a Parallel Resistor

8.2.2.1 Design Requirements

The input voltage range is 12 V ± 10%, LED maximum forward voltage V_{F_MAX} = 2.5 V, minimum forward voltage V_{F_MIN} = 1.9 V, current $I_{(LED)}$ = 150 mA.

8.2.2.2 Detailed Design Procedure

In linear LED driver applications, the input and output voltage variation generates the most of the thermal concerns. The resistor current $I_{(P)}$, as indicated by Ohm's law, depends on the voltage across the external resistors. The TPS92612 controls the driver current $I_{(DRIVE)}$ to attain the desired total current. If $I_{(P)}$ increases, the TPS92612 device decreases $I_{(DRIVE)}$ to compensate, and vice versa. The parallel-resistor takes highest current and generates maximum heat at maximum supply voltage and minimum LED-string forward voltage.

The parallel resistor value must be carefully calculated to ensure that 1) thermal dissipation for both the TPS92612 device and the resistor is within their thermal dissipation limits, and 2) device current at high voltage drop condition is above the minimal output-current requirement.

STEP 1: Determine the current setting resistor, $R_{(SNS)}$ value by using 公式 4.

$$R_{(SNS)} = \frac{V_{(CS\_REG)}}{I_{(LED)}} = 0.653\Omega$$

where

- $V_{(CS\_REG)}$ = 98 mV (typical)
- $I_{(LED)}$ = 150 mA (4)

The calculated result for $R_{(SNS)}$ is 0.653 Ω.

STEP 2: Calculate the parallel resistor, $R_{(P)}$ value by using 公式 5.

The parallel resistor $R_{(P)}$ is recommended to consume 50% of the total current at maximum supply voltage and minimum LED-string forward voltage.

$$R_{(P)} = \frac{V_{(SUPPLY)} - V_{(CS\_REG)} - V_{(OUT)}}{0.5 \times I_{(LED)}} = \frac{13.2 - 0.098 - 3 \times 1.9}{0.5 \times 0.15} \approx 100\Omega$$

where

- $V_{(CS\_REG)}$ = 98 mV (typical)
- $I_{(LED)}$ = 150 mA (5)

The calculated result for $R_{(P)}$ is about 100 Ω at $V_{(SUPPLY)}$ = 13.2 V.

STEP 3: Power consumption analysis for the worst application conditions.

The total device power consumption can be calculated by 公式 6.

Typical Application (接下页)

$$P_{(DEV)} = \left(V_{(SUPPLY)} - V_{(CS\_REG)} - V_{(OUT)}\right) \times \left(I_{(LED)} - \frac{V_{(SUPPLY)} - V_{(CS\_REG)} - V_{(OUT)}}{R_{(P)}}\right) + V_{(SUPPLY)} \times I_{(Quiescent)}$$

$$P_{(DEV\_MAX)} = (13.2 - 0.098 - 3 \times 1.9) \times \left(0.15 - \frac{13.2 - 0.098 - 3 \times 1.9}{100}\right) + 13.2 \times 0.00025 = 0.566\text{W}$$

where

- $V_{(CS\_REG)}$ = 98 mV (typical)
- $I_{(Quiescent)}$ = 250 µA (maximum) (6)

The calculated maximum power consumption on the TPS92612 device is 0.566 W at $V_{(SUPPLY)}$ = 13.2 V, $V_{(OUT)}$ = 3 × 1.9 V = 5.7 V and $I_{(LED)}$ = 150 mA.

The power consumption on resistor $R_{(P)}$ can be calculated through 公式 7.

$$P_{(RP)} = \frac{\left(V_{(SUPPLY)} - V_{(CS\_REG)} - V_{(OUT)}\right)^2}{R_{(P)}}$$

$$P_{(RP\_MAX)} = \frac{(13.2 - 0.098 - 3 \times 1.9)^2}{100} = 0.548\text{W}$$

where

- $V_{(CS\_REG)}$ = 98 mV (typical) (7)

The calculated maximum power consumption on the 100 Ω, $R_{(P)}$ parallel resistor is 0.548 W at $V_{(SUPPLY)}$ = 13.2 V and $V_{(OUT)}$ = 3 × 1.9 V = 5.7 V.

TI recommends adding capacitors $C_{(SUPPLY)}$ at SUPPLY and $C_{(OUT)}$ at OUT. One 1-µF capacitor plus one 100-nF decoupling ceramic capacitor close to the SUPPLY pin is recommended for $C_{(SUPPLY)}$, and a 10-nF ceramic capacitor close to the OUT pin is recommended for $C_{(OUT)}$. The larger capacitor for $C_{(SUPPLY)}$ or $C_{(OUT)}$ is helpful for EMI and ESD immunity, however large $C_{(OUT)}$ takes a longer time to charge up the capacitor and could affect PWM dimming performance.

Note that the parallel resistor path cannot be shut down by PWM or fault protection. If PWM control is required, TI recommends an application circuit as shown in 图 16. A NPN bipolar transistor with a base current-limiting resistor, R_1, can modulate the output current together with the device PWM function. The resistor value of R_1 needs to be calculated based on the applied PWM voltage and β value of selected NPN transistor.

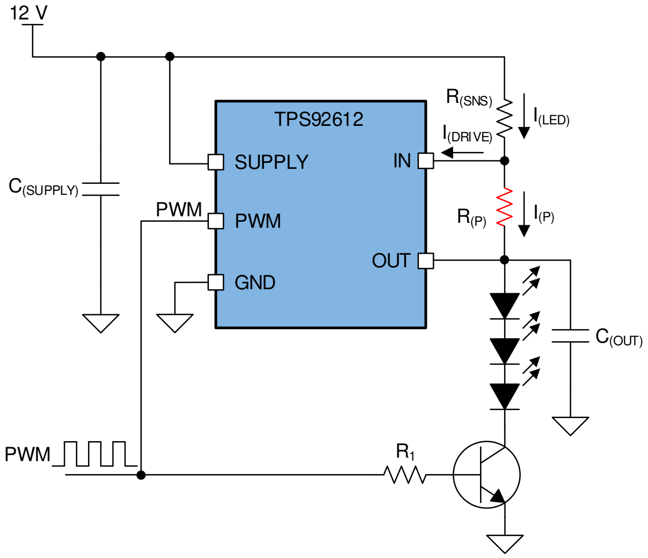
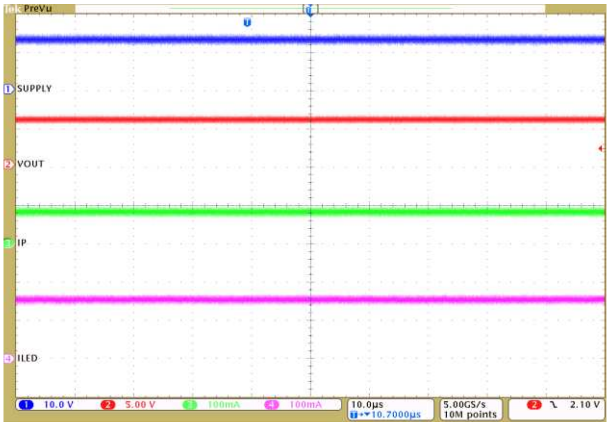


图 16. PWM Control With Heat Sharing Resistor

Typical Application (接下页)

8.2.2.3 Application Curve



Ch. 1 = $V_{(SUPPLY)}$ Ch. 2 = $V_{(OUT)}$ Ch. 3 = $I_{(P)}$ Ch. 4 = $I_{(LED)}$

图 17. Constant Output Current With Heat Sharing Resistor

9 Power Supply Recommendations

The TPS92612 is designed to operate from a power system within the range specified in the *Recommended Operating Conditions*. The SUPPLY input must be protected from reverse voltage and overvoltage over 40 V. The impedance of the input supply rail must be low enough that the input current transient does not cause drop below LED string required forward voltage. If the input supply is connected with long wires, additional bulk capacitance may be required in addition to normal input capacitor.

10 Layout

10.1 Layout Guidelines

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

10.2 Layout Example

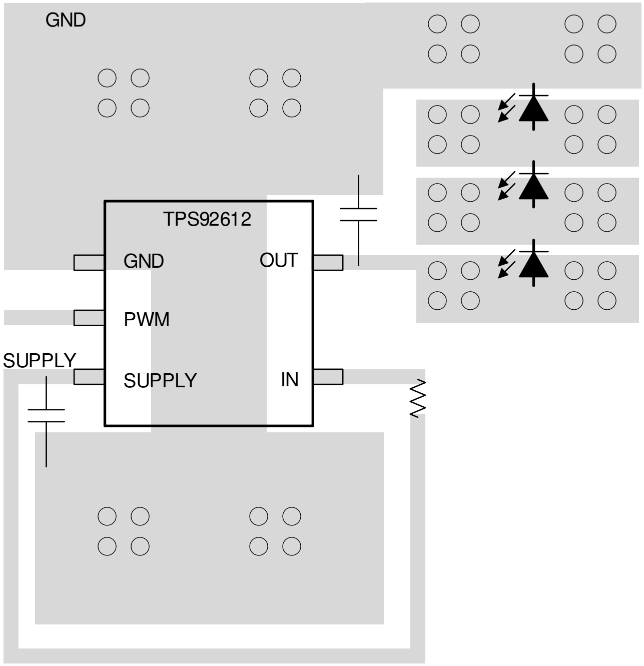


图 18. TPS92612 Example Layout Diagram

11 器件和文档支持

11.1 接收文档更新通知

要接收文档更新通知，请导航至 ti.com.cn 上的器件产品文件夹。单击右上角的*通知我*进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

11.2 支持资源

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.

11.3 商标

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

11.4 静电放电警告

ESD 可能会损坏该集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理措施和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。 精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

11.5 Glossary

SLYZ022 — *TI Glossary*.

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

12 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

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)
TPS92612DBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	22SF
TPS92612DBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	22SF

(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.

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 :

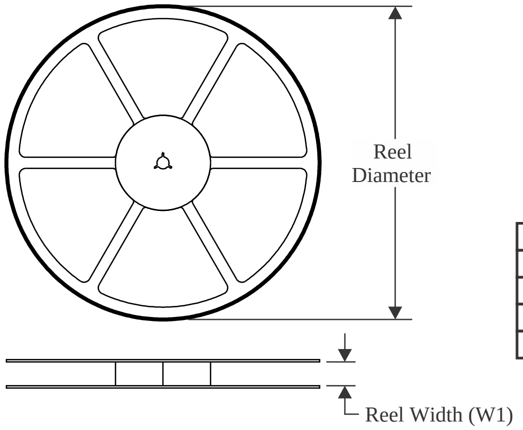
- Automotive : TPS92612-Q1

NOTE: Qualified Version Definitions:

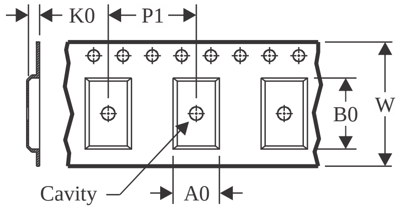
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

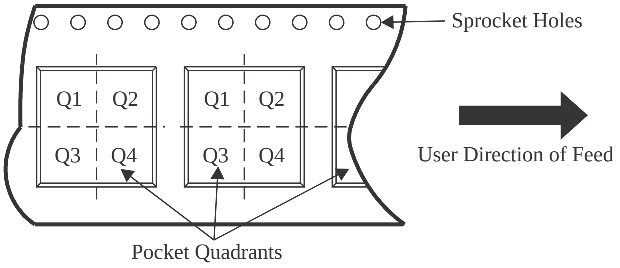


TAPE DIMENSIONS



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

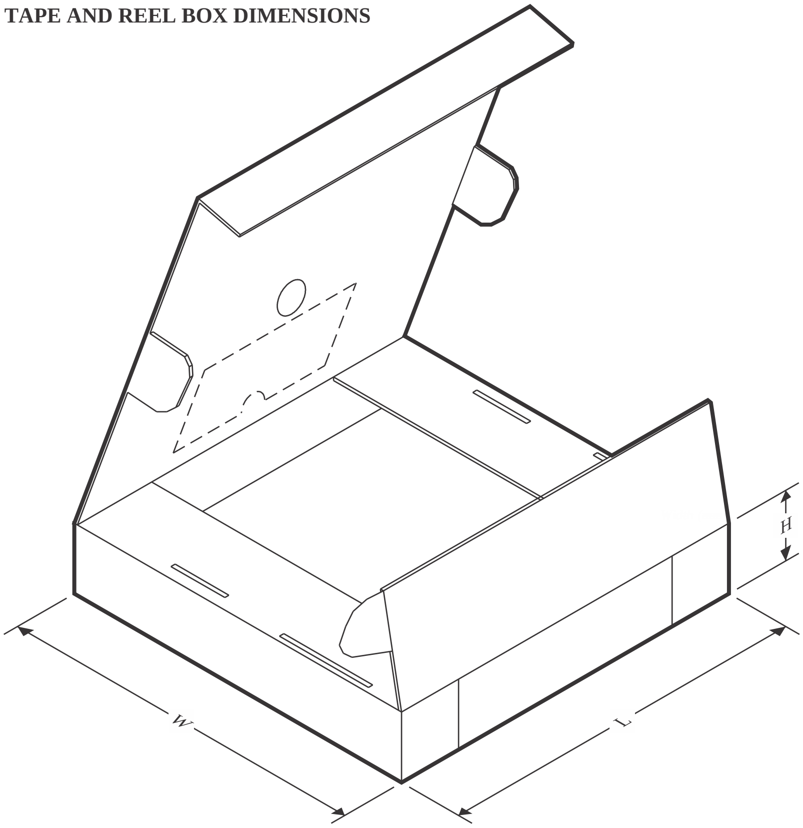
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPS92612DBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS92612DBVR	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



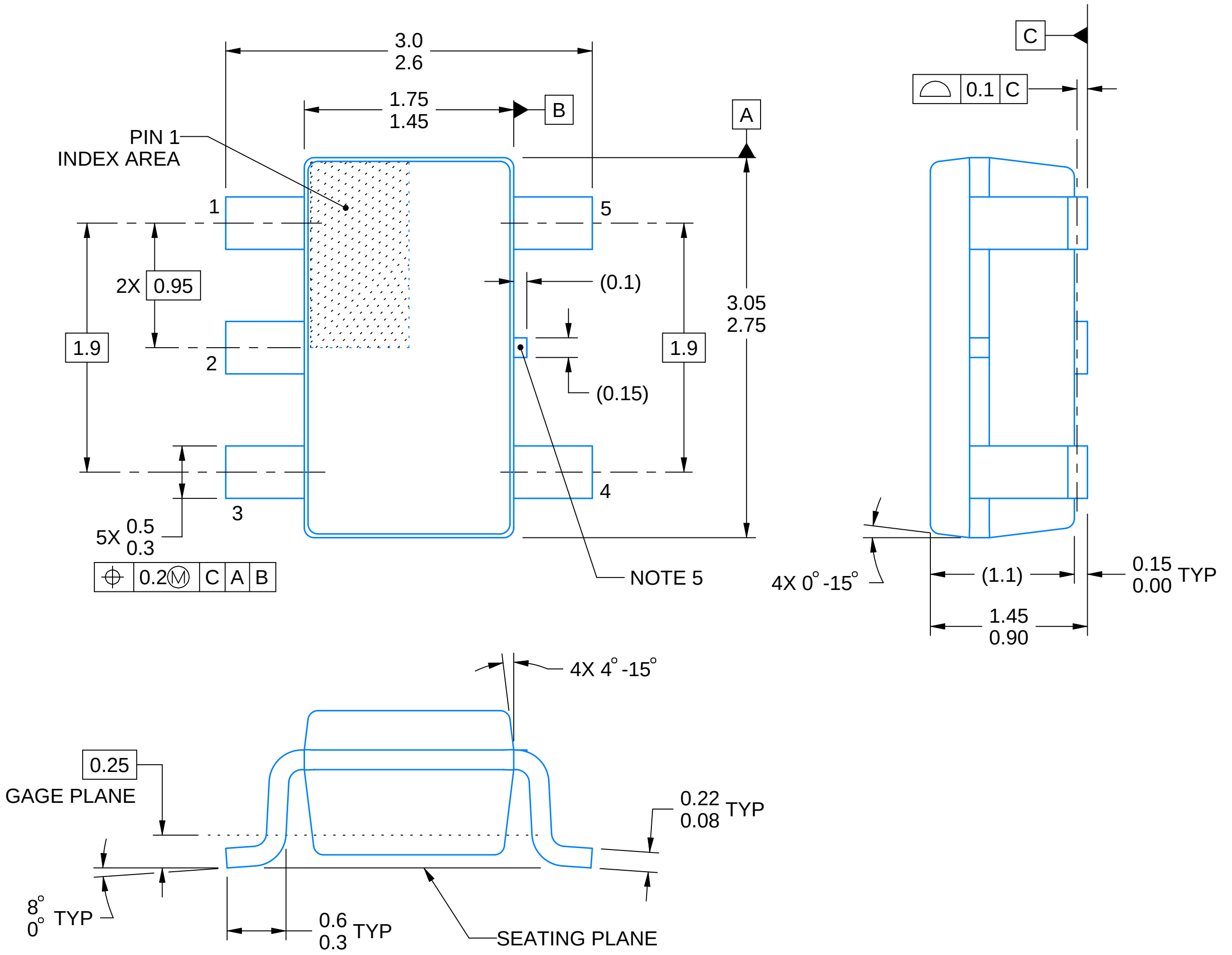
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS92612DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS92612DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0

PACKAGE OUTLINE

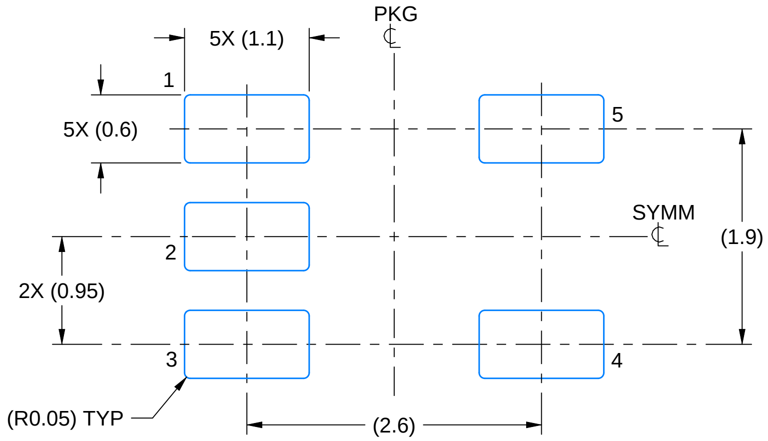
SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR

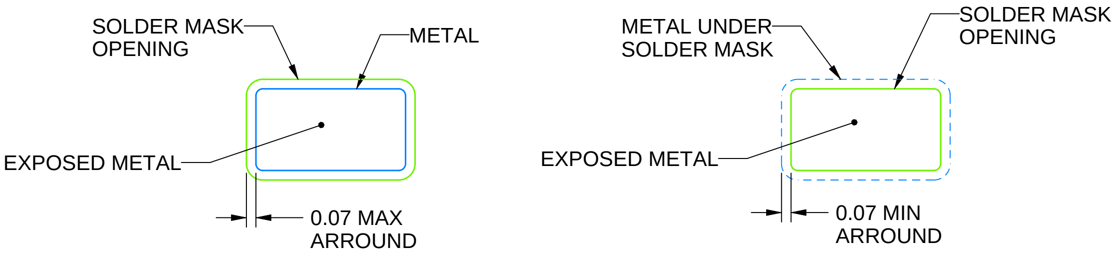


NOTES:

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. Refernce 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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



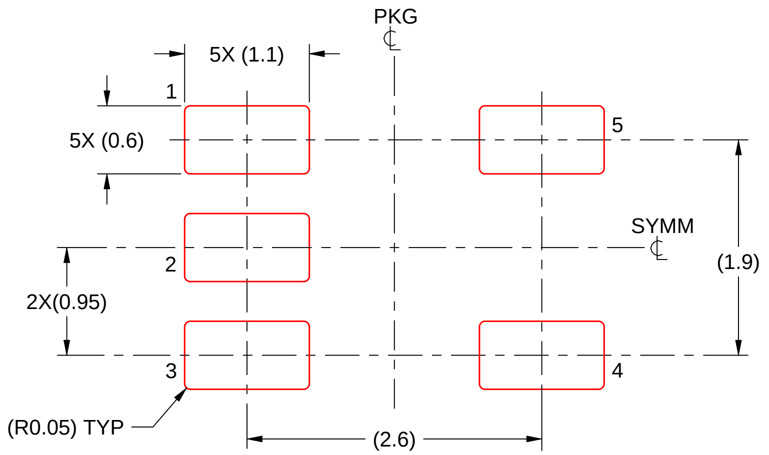
NON SOLDER MASK
DEFINED
(PREFERRED)

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

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.



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.

重要通知和免责声明