# TLV702 300mA、低 $I_Q$、低ドロップアウト・レギュレータ

## 1 特長

- 超低ドロップアウト
  - $I_{OUT}$ = 50mA、$V_{OUT}$ = 2.8V で 37mV
  - $I_{OUT}$ = 100mA、$V_{OUT}$ = 2.8V で 75mV
  - $I_{OUT}$ = 300mA、$V_{OUT}$ = 2.8V で 220mV
- 精度 2%
- 低い$I_Q$: 35µA
- 1.2V～4.8Vの固定出力電圧の組み合わせが可能
- 高いPSRR: 1kHzにおいて68dB
- 実効容量0.1µFで安定(1)
- サーマル・シャットダウンおよび過電流保護機能
- パッケージ：5 ピン SOT-23 および 1.5mm × 1.5mm、6 ピン WSON

(1) 「*アプリケーション情報*」の「*入出力コンデンサの要件*」を参照。

## 2 アプリケーション

- ワイヤレス・ハンドセット
- スマートフォン
- ZigBee®ネットワーク
- *Bluetooth*®デバイス
- リチウムイオン電池で駆動する携帯機器
- 無線 LAN カードなどの PC アドオン・カード

## 3 概要

TLV702 シリーズの低ドロップアウト (LDO) リニア・レギュレータは、静止電流が小さく、ラインおよび負荷過渡性能が非常に優れています。これらの LDO は、低消費電力が求められる用途向けに設計されています。高精度のバンドギャップとエラー・アンプにより、全体で 2% の精度を実現しています。低出力ノイズ、非常に高い電源電圧変動除去比 (PSRR)、低いドロップアウト電圧を特長とする本シリーズのデバイスは、多種多様なバッテリ駆動式の携帯機器に最適です。デバイスのすべてのバージョンに、安全のためサーマル・シャットダウンと電流制限が組み込まれています。

さらに、これらのデバイスはわずか0.1µFの実効出力容量で安定します。この特長により、バイアス電圧が高く温度ディレーティングが大きい、コスト効率の高いコンデンサを使用できます。これらのデバイスは、出力負荷なしでも指定の精度へのレギュレーションを行います。

また TLV702P シリーズには、出力の高速放電を実行するアクティブ・プルダウン回路も内蔵されています。

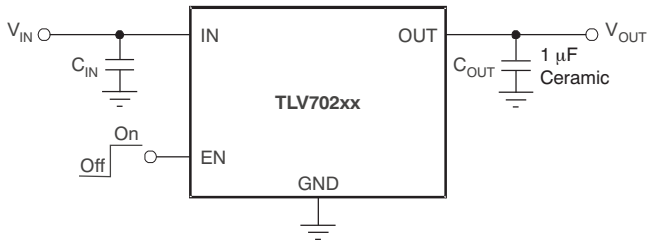
TLV702 シリーズの LDO リニア・レギュレータは、SOT23-5 および 1.5mm × 1.5mm WSON-6 パッケージで供給されます。

**製品情報(1)**

| 型番 | パッケージ | 本体サイズ（公称） |
|---|---|---|
| TLV702 | SOT-23 (5) | 2.90mm×1.60mm |
| | WSON (6) | 1.50mm×1.50mm |

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にある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回路**




英語版のTI製品についての情報を翻訳したこの資料は、製品の概要を確認する目的で便宜的に提供しているものです。該当する正式な英語版の最新情報は、www.ti.comで閲覧でき、その内容が常に優先されます。TIでは翻訳の正確性および妥当性につきましては一切保証いたしません。実際の設計などの前には、必ず最新版の英語版をご参照くださいますようお願いいたします。
English Data Sheet: SLVSAG6

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## 4 改訂履歴

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

**Revision C (March 2015)** から **Revision D** に変更 **Page**

- Changed OUT pin number from 5 to 3 for WSON package ... 3
- Added footnote to maximum EN voltage specification ... 4
- Added parameter names to *Recommended Operating Conditions* table ... 4

**Revision B (February 2011)** から **Revision C** に変更 **Page**

- 「*ESD 定格*」表、「*機能説明*」セクション、「*デバイスの機能モード*」、「*アプリケーションと実装*」セクション、「*電源に関する推奨事項*」セクション、「*レイアウト*」セクション、「*デバイスおよびドキュメントのサポート*」セクション、「*メカニカル、パッケージ、および注文情報*」セクション 追加 ... 1
- Changed Pin Configuration and Functions section; updated table format ... 3
- Deleted *Ordering Information* table ... 3
- Changed "free-air temperature" to "junction temperature" in *Absolute Maximum Ratings* condition statement ... 4
- Changed *Thermal Information* table; updated thermal resistance values for all packages ... 4
- Deleted *Dissipation Ratings* table ... 4
- Changed $V_{DO}$ dropout voltage test conditions; deleted $I_{OUT}$ = 50 mA and $I_{OUT}$ = 100 mA with $V_{OUT}$ = 2.8 V test parameters ... 5
- Deleted *EVM Dissipation Ratings* table ... 16

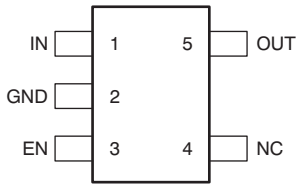
**Revision A (October 2010)** から **Revision B** に変更 **Page**

- SON-6 (DSE) パッケージと関連の記述をデータシートに追加 ... 1

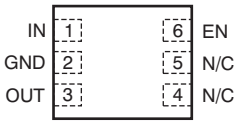

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# 5 Pin Configuration and Functions

**DBV Package**
**5-Pin SOT-23**
**Top View**




**DSE Package**
**6-Pin WSON**
**Top View**




**Pin Functions**

| PIN | | | I/O | DESCRIPTION |
|---|---|---|---|---|
| NAME | SOT-23 | WSON | | |
| IN | 1 | 1 | I | Input pin. A small, 1-μF ceramic capacitor is recommended from this pin to ground to assure stability and good transient performance. See *Input and Output Capacitor Requirements* in *Application Information* for more details. |
| GND | 2 | 2 | — | Ground pin |
| EN | 3 | 6 | I | Enable pin. Driving EN over 0.9 V turns on the regulator. Driving EN below 0.4 V puts the regulator into shutdown mode and reduces operating current to 1 μA, nominal. For TLV702P, output voltage is discharged through an internal 120-Ω resistor when device is shut down. |
| NC | 4 | 4, 5 | — | No connection. This pin can be tied to ground to improve thermal dissipation. |
| OUT | 5 | 3 | O | Regulated output voltage pin. A small, 1-μF ceramic capacitor is needed from this pin to ground to assure stability. See *Input and Output Capacitor Requirements* in *Application Information* for more details. |

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# 6 Specifications

## 6.1 Absolute Maximum Ratings

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

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Voltage(2) | IN | –0.3 | 6 | V |
| | EN | –0.3 | 6(3) | |
| | OUT | –0.3 | 6 | |
| Current (source) | OUT | Internally limited | | |
| Output short-circuit duration | | Indefinite | | |
| Total continuous power dissipation | | See *Thermal Information* | | |
| Temperature | Operating virtual junction, $T_J$ | –55 | 150 | °C |
| | Storage, $T_{stg}$ | –55 | 150 | |

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods my affect device reliability.
(2) All voltages are with respect to network ground terminal.
(3) The absolute maximum rating is $V_{IN}$ + 0.3 V or 6.0 V, whichever is smaller.

## 6.2 ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1) | ±2000 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2) | ±500 | |

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

## 6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted).

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{IN}$ | Input voltage | 2 | | 5.5 | V |
| $V_{OUT}$ | Output voltage | 1.2 | | 4.8 | V |
| $I_{OUT}$ | Output current | 0 | | 300 | mA |

## 6.4 Thermal Information

| THERMAL METRIC(1) | | TLV702 | | UNIT |
|---|---|---|---|---|
| | | DBV (SOT-23) | DSE (WSON) | |
| | | 5 PINS | 6 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 249.2 | 321.3 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 136.4 | 207.9 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 85.9 | 281.5 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 19.5 | 42.4 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 85.3 | 284.8 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | 142.3 | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.


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## 6.5 Electrical Characteristics

At $V_{IN}$ = $V_{OUT(nom)}$ + 0.5 V or 2 V (whichever is greater); $I_{OUT}$ = 10 mA, $V_{EN}$ = 0.9 V, $C_{OUT}$ = 1 µF, and $T_J$ = –40°C to +125°C, unless otherwise noted. Typical values are at $T_J$ = 25°C.

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input voltage range | | 2 | | 5.5 | V |
| $V_{OUT}$ | DC output accuracy | –40°C ≤ $T_J$ ≤ 125°C | –2% | 0.5% | 2% | |
| $\Delta V_{OUT(\Delta VIN)}$ | Line regulation | $V_{OUT(nom)}$ + 0.5 V ≤ $V_{IN}$ ≤ 5.5 V, $I_{OUT}$ = 10 mA | | 1 | 5 | mV |
| $\Delta V_{OUT(\Delta IOUT)}$ | Load regulation | 0 mA ≤ $I_{OUT}$ ≤ 300 mA | | 1 | 15 | mV |
| $V_{DO}$ | Dropout voltage(1) | $V_{IN}$ = 0.98 × $V_{OUT(nom)}$, $I_{OUT}$ = 300 mA | | 260 | 375 | mV |
| $I_{CL}$ | Output current limit | $V_{OUT}$ = 0.9 × $V_{OUT(nom)}$ | 320 | 500 | 860 | mA |
| $I_{GND}$ | Ground pin current | $I_{OUT}$ = 0 mA | | 35 | 55 | µA |
| | | $I_{OUT}$ = 300 mA, $V_{IN}$ = $V_{OUT}$ + 0.5 V | | 370 | | µA |
| $I_{SHDN}$ | Ground pin current (shutdown) | $V_{EN}$ ≤ 0.4 V, $V_{IN}$ = 2 V | | 400 | | nA |
| | | $V_{EN}$ ≤ 0.4 V, 2 V ≤ $V_{IN}$ ≤ 4.5 V, $T_J$ = –40°C to +85°C | | 1 | 2 | µA |
| PSRR | Power-supply rejection ratio | $V_{IN}$ = 2.3 V, $V_{OUT}$ = 1.8 V, $I_{OUT}$ = 10 mA, f = 1 kHz | | 68 | | dB |
| $V_n$ | Output noise voltage | BW = 100 Hz to 100 kHz, $V_{IN}$ = 2.3 V, $V_{OUT}$ = 1.8 V, $I_{OUT}$ = 10 mA | | 48 | | $\mu V_{RMS}$ |
| $t_{STR}$ | Start-up time(2) | $C_{OUT}$ = 1 µF, $I_{OUT}$ = 300 mA | | 100 | | µs |
| $V_{EN(high)}$ | Enable pin high (enabled) | | 0.9 | | $V_{IN}$ | V |
| $V_{EN(low)}$ | Enable pin low (disabled) | | 0 | | 0.4 | V |
| $I_{EN}$ | Enable pin current | $V_{IN}$ = $V_{EN}$ = 5.5 V | | 0.04 | | µA |
| UVLO | Undervoltage lockout | $V_{IN}$ rising | | 1.9 | | V |
| $R_{DISCHARGE}$ | Active pulldown resistance (TLV702P only) | $V_{EN}$ = 0 V | | 120 | | Ω |
| $T_{sd}$ | Thermal shutdown temperature | Shutdown, temperature increasing | | 165 | | °C |
| | | Reset, temperature decreasing | | 145 | | °C |
| $T_J$ | Operating junction temperature | | –40 | | 125 | °C |

(1) $V_{DO}$ is measured for devices with $V_{OUT(nom)}$ ≥ 2.35 V.
(2) Start-up time = time from EN assertion to 0.98 × $V_{OUT(nom)}$.

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## 6.6 Typical Characteristics

Over operating temperature range ($T_J$ = –40°C to +125°C), $V_{IN}$ = $V_{OUT(nom)}$ + 0.5 V or 2 V, whichever is greater; $I_{OUT}$ = 10 mA, $V_{EN}$ = $V_{IN}$, $C_{OUT}$ = 1 µF, unless otherwise noted. Typical values are at $T_J$ = 25°C.

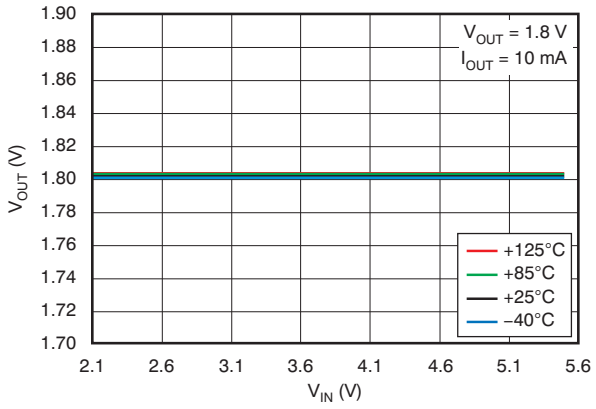



**Figure 1. Line Regulation**

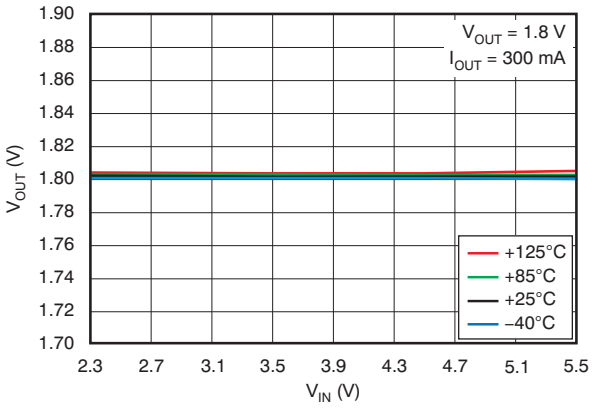



**Figure 2. Line Regulation**

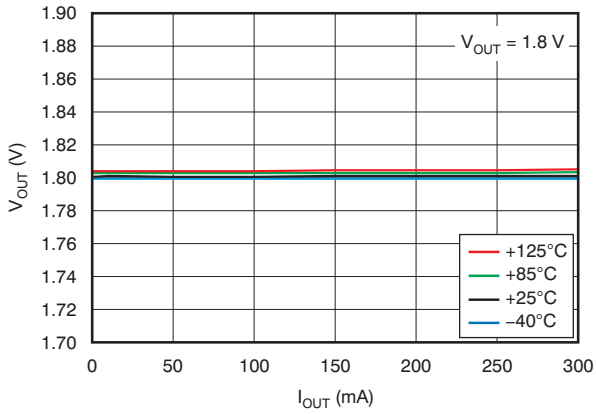



**Figure 3. Load Regulation**

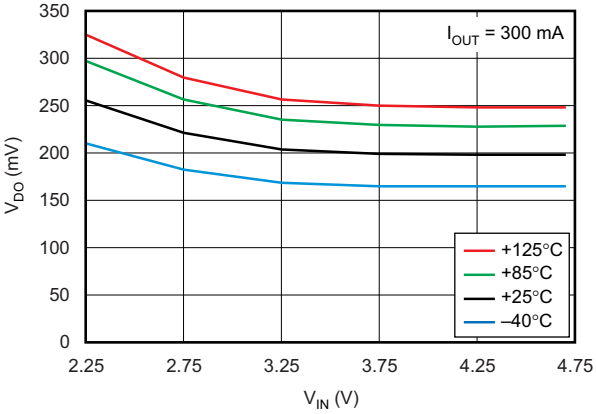



**Figure 4. Dropout Voltage vs Input Voltage**

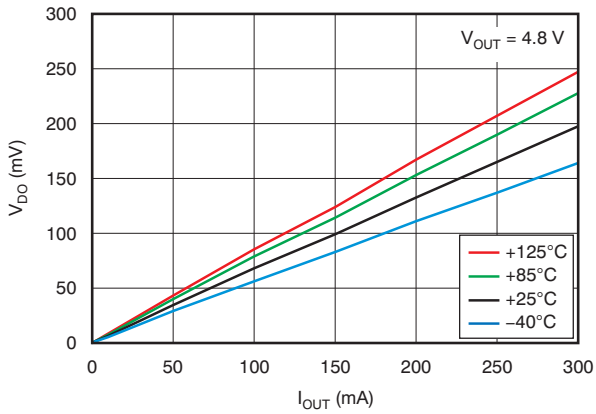



**Figure 5. Dropout Voltage vs Output Current**

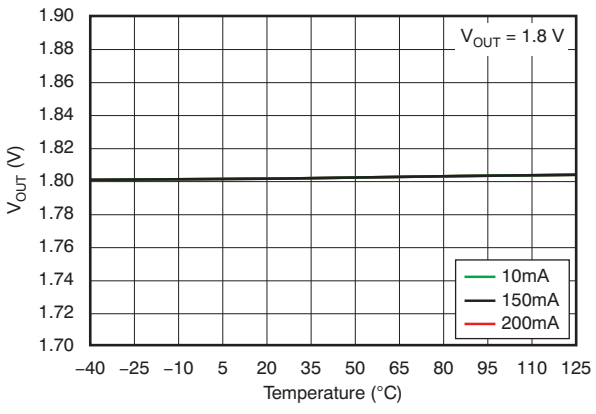



**Figure 6. Output Voltage vs Temperature**


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## Typical Characteristics (continued)

Over operating temperature range ($T_J$ = –40°C to +125°C), $V_{IN}$ = $V_{OUT(nom)}$ + 0.5 V or 2 V, whichever is greater; $I_{OUT}$ = 10 mA, $V_{EN}$ = $V_{IN}$, $C_{OUT}$ = 1 µF, unless otherwise noted. Typical values are at $T_J$ = 25°C.

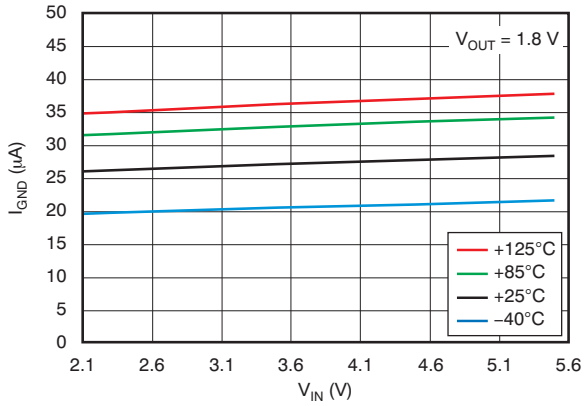



**Figure 7. Ground Pin Current vs Input Voltage**

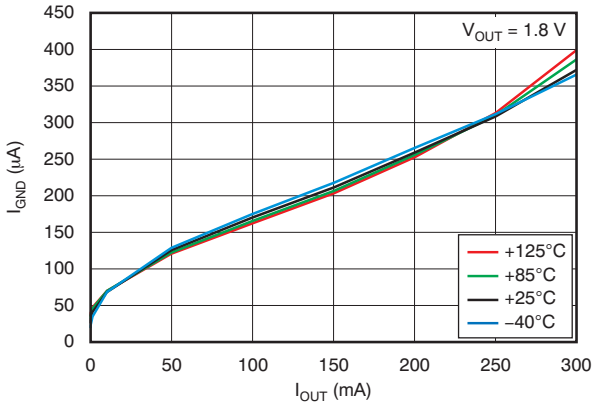



**Figure 8. Ground Pin Current vs Load**

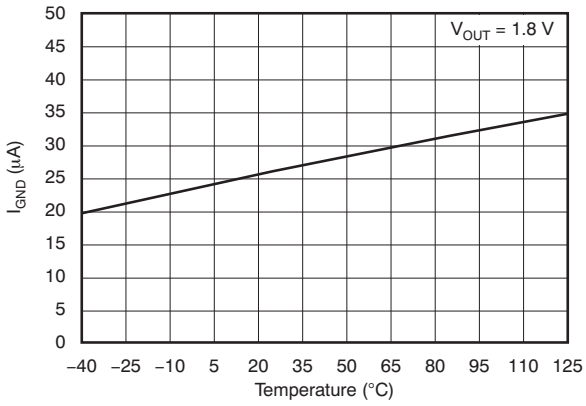



**Figure 9. Ground Pin Current vs Temperature**

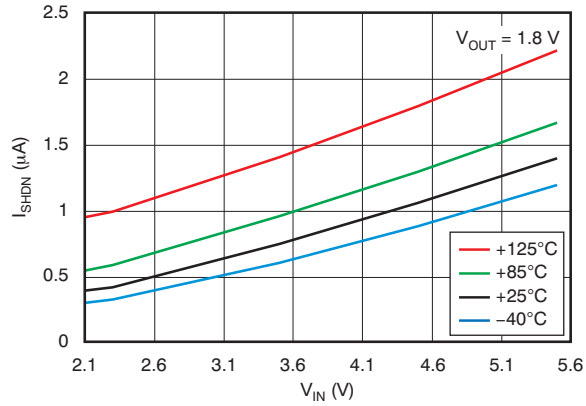



**Figure 10. Shutdown Current vs Input Voltage**

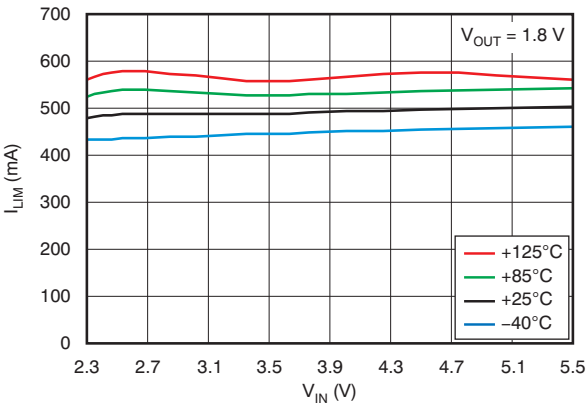



**Figure 11. Current Limit vs Input Voltage**

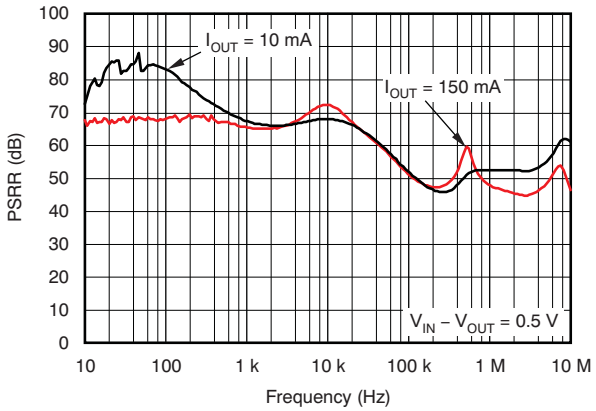



**Figure 12. Power-Supply Ripple Rejection vs Frequency**

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## Typical Characteristics (continued)

Over operating temperature range ($T_J$ = –40°C to +125°C), $V_{IN}$ = $V_{OUT(nom)}$ + 0.5 V or 2 V, whichever is greater; $I_{OUT}$ = 10 mA, $V_{EN}$ = $V_{IN}$, $C_{OUT}$ = 1 µF, unless otherwise noted. Typical values are at $T_J$ = 25°C.

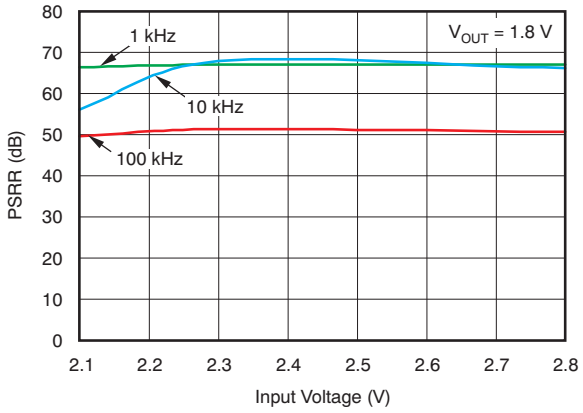



**Figure 13. Power-Supply Ripple Rejection vs Input Voltage**

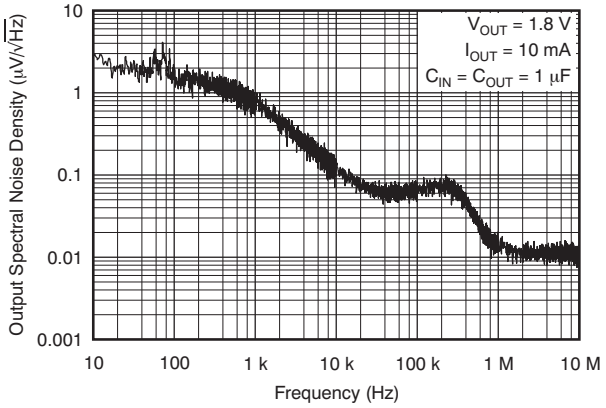



**Figure 14. Output Spectral Noise Density vs Frequency**

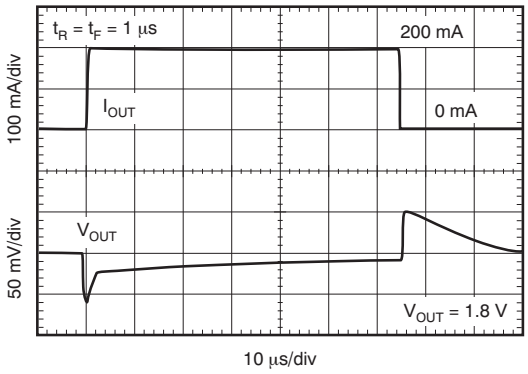



**Figure 15. Load Transient Response**

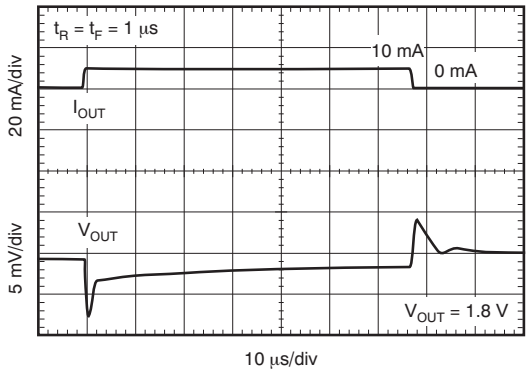



**Figure 16. Load Transient Response**

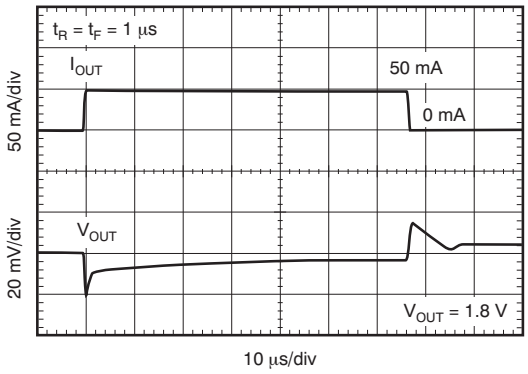



**Figure 17. Load Transient Response**

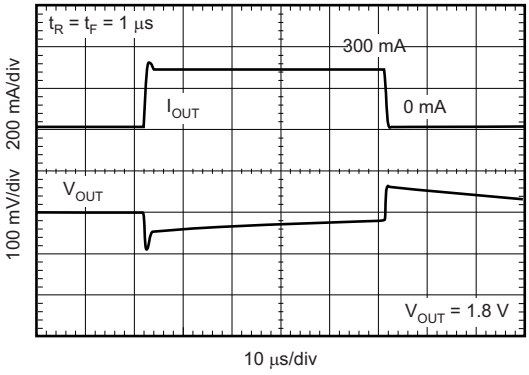



**Figure 18. Load Transient Response**


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## Typical Characteristics (continued)

Over operating temperature range ($T_J$ = –40°C to +125°C), $V_{IN}$ = $V_{OUT(nom)}$ + 0.5 V or 2 V, whichever is greater; $I_{OUT}$ = 10 mA, $V_{EN}$ = $V_{IN}$, $C_{OUT}$ = 1 µF, unless otherwise noted. Typical values are at $T_J$ = 25°C.

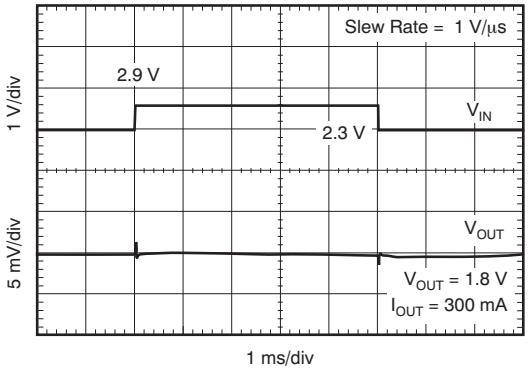



**Figure 19. Line Transient Response**

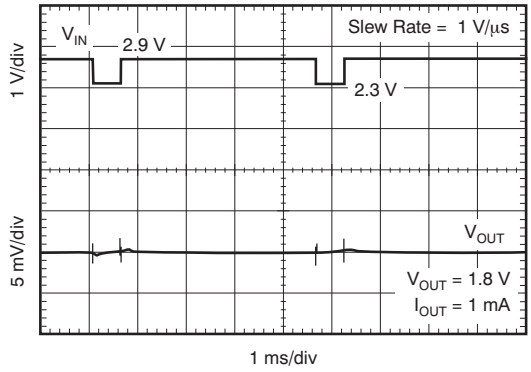



**Figure 20. Line Transient Response**

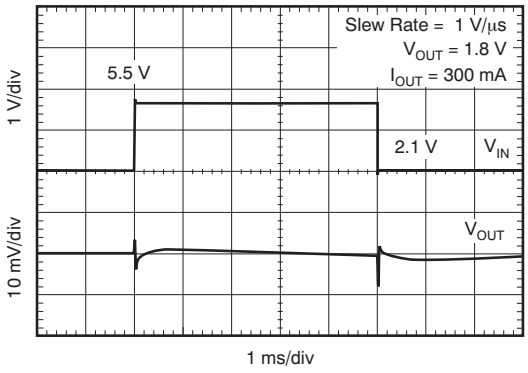



**Figure 21. Line Transient Response**

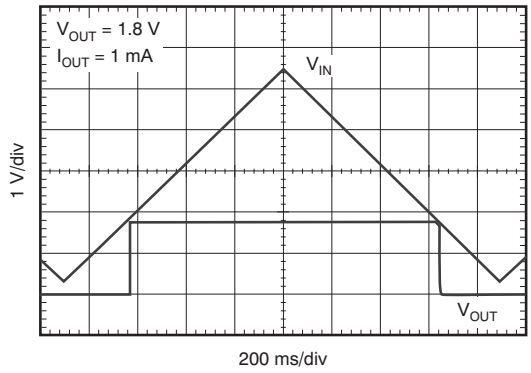



**Figure 22. $V_{IN}$ Ramp Up, Ramp Down Response**

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# 7 Detailed Description

## 7.1 Overview

The TLV702 series of low-dropout (LDO) linear regulators are low quiescent current devices with excellent line and load transient performance. These LDOs are designed for power-sensitive applications. A precision bandgap and error amplifier provides overall 2% accuracy. Low output noise, very high power-supply rejection ratio (PSRR), and low dropout voltage make this series of devices ideal for most battery-operated handheld equipment. All device versions have integrated thermal shutdown, current limit, and undervoltage lockout (UVLO).

## 7.2 Functional Block Diagrams

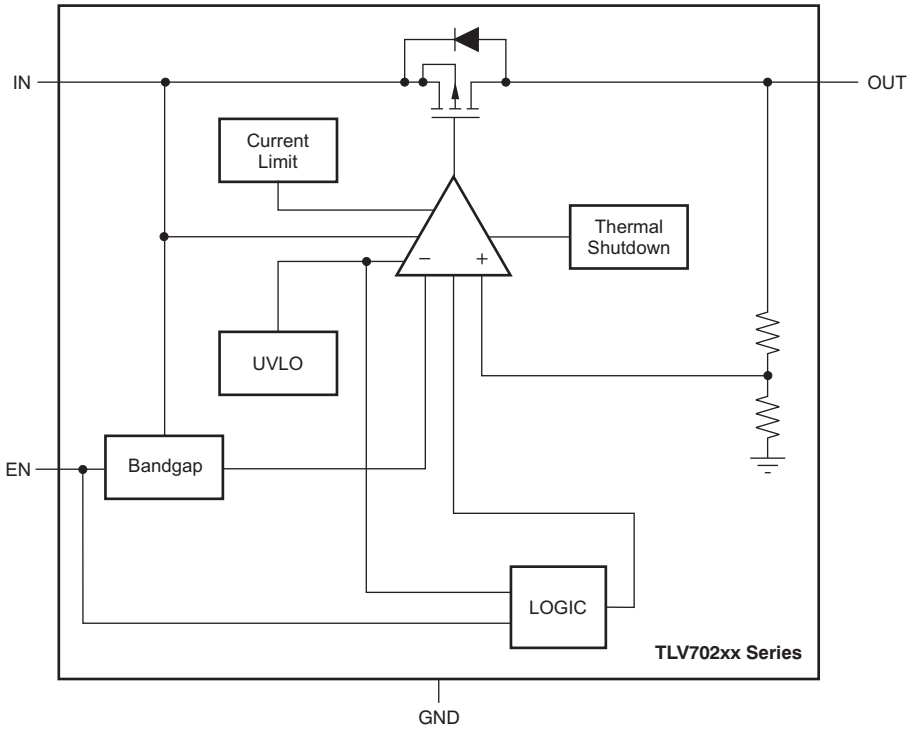



**Figure 23. TLV702 Block Diagram**


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## Functional Block Diagrams (continued)

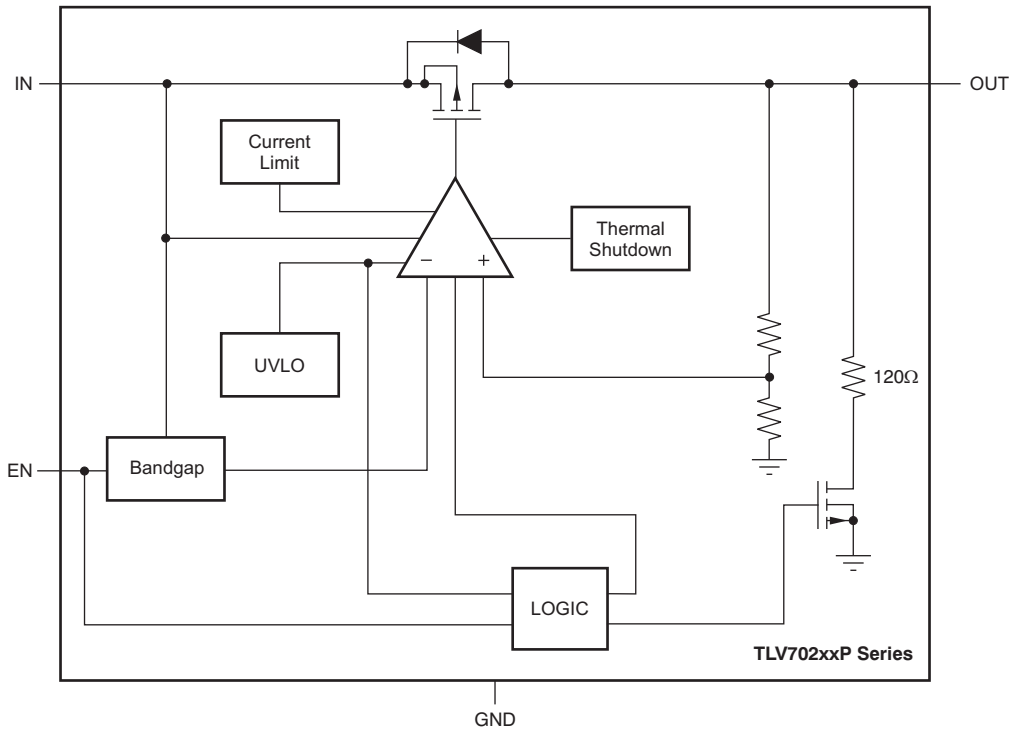



**Figure 24. TLV702P Block Diagram**

## 7.3 Feature Description

### 7.3.1 Internal Current Limit

The TLV702 internal current limit helps to protect the regulator during fault conditions. During current limit, the output sources a fixed amount of current that is largely independent of the output voltage. In such a case, the output voltage is not regulated, and is $V_{OUT} = I_{CL} \times R_{LOAD}$. The PMOS pass transistor dissipates $(V_{IN} – V_{OUT}) \times I_{CL}$ until thermal shutdown is triggered and the device turns off. As the device cools, it is turned on by the internal thermal shutdown circuit. If the fault condition continues, the device cycles between current limit and thermal shutdown. See *Thermal Consideration* for more details.

The PMOS pass element in the TLV702 has a built-in body diode that conducts current when the voltage at OUT exceeds the voltage at IN. This current is not limited, so if extended reverse voltage operation is anticipated, external limiting to 5% of the rated output current is recommended.

### 7.3.2 Shutdown

The enable pin (EN) is active high. The device is enabled when voltage at EN pin goes above 0.9 V. The device is turned off when the EN pin is held at less than 0.4 V. When shutdown capability is not required, EN can be connected to the IN pin.

The TLV702P version has internal active pulldown circuitry that discharges the output with a time constant of:

$$\tau = \frac{(120 \bullet R_L)}{(120 + R_L)} \bullet C_{OUT} \quad (1)$$

where:

- $R_L$ = Load resistance
- $C_{OUT}$ = Output capacitor

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## Feature Description (continued)

### 7.3.3 Dropout Voltage

The TLV702 uses a PMOS pass transistor to achieve low dropout. When ($V_{IN}$ – $V_{OUT}$) is less than the dropout voltage ($V_{DO}$), the PMOS pass device is in the linear (triode) region of operation and the input-to-output resistance is the $R_{DS(on)}$ of the PMOS pass element. $V_{DO}$ scales approximately with output current because the PMOS device behaves as a resistor in dropout.

As with any linear regulator, PSRR and transient response are degraded as ($V_{IN}$ – $V_{OUT}$) approaches dropout. This effect is shown in Figure 13.

### 7.3.4 Undervoltage Lockout

The TLV702 uses a UVLO circuit to keep the output shut off until internal circuitry is operating properly.

## 7.4 Device Functional Modes

### 7.4.1 Normal Operation

The device regulates to the nominal output voltage under the following conditions:

- The input voltage is greater than the nominal output voltage added to the dropout voltage.
- The output current is less than the current limit.
- The input voltage is greater than the UVLO voltage.

### 7.4.2 Dropout Operation

If the input voltage is lower than the nominal output voltage plus the specified dropout voltage, but all other conditions are met for normal operation, the device operates in dropout mode. In this condition, the output voltage is the same as the input voltage minus the dropout voltage. The transient performance of the device is significantly degraded because the pass device is in a triode state and no longer regulates the output voltage of the LDO. Line or load transients in dropout may result in large output voltage deviations.

Table 1 lists the conditions that lead to the different modes of operation.

**Table 1. Device Functional Mode Comparison**

| OPERATING MODE | PARAMETER | |
|---|---|---|
| | $V_{IN}$ | $I_{OUT}$ |
| Normal mode | $V_{IN} > V_{OUT\ (nom)} + V_{DO}$ | $I_{OUT} < I_{CL}$ |
| Dropout mode | $V_{IN} < V_{OUT\ (nom)} + V_{DO}$ | $I_{OUT} < I_{CL}$ |
| Current limit | $V_{IN} >$ UVLO | $I_{OUT} > I_{CL}$ |


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# 8 Application and Implementation

**NOTE**

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 TLV702 belongs to a new family of next-generation value LDO regulators. These devices consume low quiescent current and deliver excellent line and load transient performance. These characteristics, combined with low noise and very good PSRR with little ($V_{IN}$ – $V_{OUT}$) headroom, make this family of devices ideal for portable RF applications. This family of regulators offers current limit and thermal protection, and is specified from –40°C to +125°C.

## 8.2 Typical Application

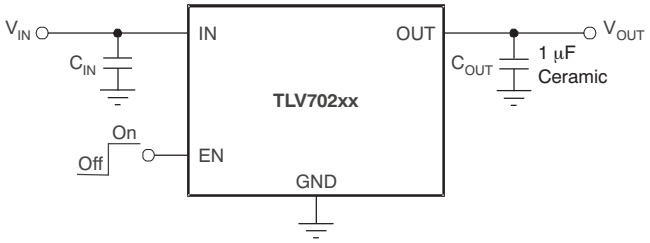



**Figure 25. Typical Application Circuit**

### 8.2.1 Design Requirements

Table 2 lists the design parameters.

**Table 2. Design Parameters**

| PARAMETER | DESIGN REQUIREMENT |
|---|---|
| Input voltage | 2.5 V to 3.3 V |
| Output voltage | 1.8 V |
| Output current | 100 mA |

### 8.2.2 Detailed Design Procedure

#### *8.2.2.1 Input and Output Capacitor Requirements*

1-µF X5R- and X7R-type ceramic capacitors are recommended because these capacitors have minimal variation in value and equivalent series resistance (ESR) overtemperature.

However, the TLV702 is designed to be stable with an *effective capacitance* of 0.1 µF or larger at the output. Thus, the device is stable with capacitors of other dielectric types as well, as long as the effective capacitance under operating bias voltage and temperature is greater than 0.1 µF. This effective capacitance refers to the capacitance that the LDO sees under operating bias voltage and temperature conditions; that is, the capacitance after taking both bias voltage and temperature derating into consideration. In addition to allowing the use of lower-cost dielectrics, this capability of being stable with 0.1-µF effective capacitance also enables the use of smaller footprint capacitors that have higher derating in size- and space-constrained applications.

Using a 0.1-µF rated capacitor at the output of the LDO does not ensure stability because the effective capacitance under the specified operating conditions must not be less than 0.1 µF. Maximum ESR should be less than 200 mΩ.

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Although an input capacitor is not required for stability, it is good analog design practice to connect a 0.1-μF to 1-μF, low ESR capacitor across the IN pin and GND pin of the regulator. This capacitor counteracts reactive input sources and improves transient response, noise rejection, and ripple rejection. A higher-value capacitor may be necessary if large, fast rise-time load transients are anticipated, or if the device is not located close to the power source. If source impedance is more than 2 Ω, a 0.1-μF input capacitor may be necessary to ensure stability.

#### *8.2.2.2 Transient Response*

As with any regulator, increasing the size of the output capacitor reduces overshoot and undershoot magnitude but increases the duration of the transient response.

### 8.2.3 Application Curves

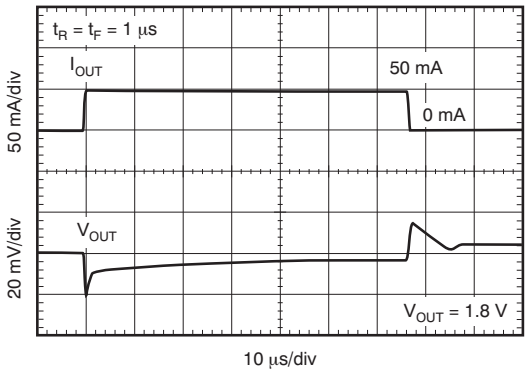



**Figure 26. Load Transient Response**

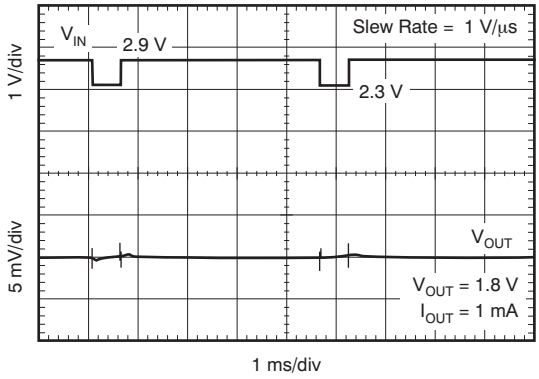



**Figure 27. Line Transient Response**


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# 9 Power Supply Recommendations

Connect a low output impedance power supply directly to the INPUT pin of the TLV702. Inductive impedances between the input supply and the INPUT pin can create significant voltage excursions at the INPUT pin during start-up or load transient events.

## 9.1 Power Dissipation

The ability to remove heat from the die is different for each package type, presenting different considerations in the printed-circuit-board (PCB) layout. The PCB area around the device that is free of other components moves the heat from the device to the ambient air.

Refer to *Thermal Information* for thermal performance on the TLV702 evaluation module (EVM). The EVM is a two-layer board with two ounces of copper per side.

Power dissipation depends on input voltage and load conditions. Power dissipation ($P_D$) is equal to the product of the output current and the voltage drop across the output pass element, as shown in Equation 2.

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} \quad (2)$$

# 10 Layout

## 10.1 Layout Guidelines

Input and output capacitors should be placed as close to the device pins as possible. To improve AC performance such as PSRR, output noise, and transient response, TI recommends designing the board with separate ground planes for $V_{IN}$ and $V_{OUT}$, with the ground plane connected only at the GND pin of the device. In addition, the ground connection for the output capacitor should be connected directly to the GND pin of the device. High ESR capacitors may degrade PSRR performance.

### 10.1.1 Thermal Consideration

Thermal protection disables the output when the junction temperature rises to approximately 165°C, allowing the device to cool. When the junction temperature cools to approximately 145°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits the dissipation of the regulator, protecting it from damage as a result of overheating.

Any tendency to activate the thermal protection circuit indicates excessive power dissipation or an inadequate heatsink. For reliable operation, junction temperature should be limited to 125°C maximum.

To estimate the margin of safety in a complete design (including heatsink), increase the ambient temperature until the thermal protection is triggered; use worst-case loads and signal conditions.

The internal protection circuitry of the TLV702 has been designed to protect against overload conditions. It was not intended to replace proper heatsinking. Continuously running the TLV702 into thermal shutdown degrades device reliability.

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## Layout Guidelines (continued)

### 10.1.2 Package Mounting

Solder pad footprint recommendations for the TLV702 are available from the TI website at www.ti.com. The recommended land pattern for the DBV and DSE packages are shown in Figure 28 and Figure 29, respectively.

## 10.2 Layout Examples

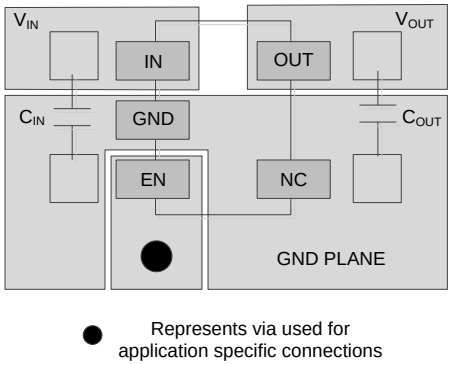



**Figure 28. Layout Example for the DBV Package**

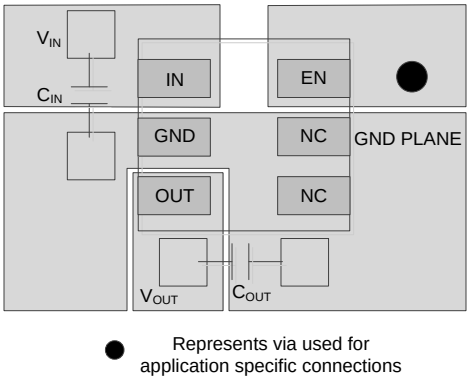



**Figure 29. Layout Example for the DSE Package**


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# 11 デバイスおよびドキュメントのサポート

## 11.1 デバイス・サポート

### 11.1.1 開発サポート

#### *11.1.1.1 SPICEモデル*

SPICEを使用した回路パフォーマンスのコンピュータによるシミュレーションは、アナログ回路やシステムのパフォーマンスを分析するため多くの場合に有用です。TLV702用のSPICEモデルは、製品フォルダの「ツールとソフトウェア」から入手できます。

### 11.1.2 デバイスの項目表記

**表 3. 製品情報(1)**

| 製品名 | $V_{OUT}$ (2) |
|---|---|
| TLV702**xx** ***yyyz*** | **XX**は公称出力電圧です(例: 28 =2.8V)。<br>**YYY**はパッケージ指定子です。<br>**Z**はテープ・アンド・リール数量です(R = 3,000、T = 250)。 |

(1) 最新のパッケージおよび注文情報については、このドキュメントの最後にあるパッケージ・オプションの付録を参照するか、www.ti.comのデバイス製品フォルダをご覧ください。
(2) 出力電圧は、1.2Vから4.8Vまで、50mV刻みで利用できます。詳細と在庫については、工場にお問い合わせください。

## 11.2 ドキュメントのサポート

### 11.2.1 関連資料

関連資料については、以下を参照してください。

テキサス・インスツルメンツ、*『Using the TLV700xxEVM-503』ユーザー・ガイド* (英語)

## 11.3 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。

## 11.4 コミュニティ・リソース

The following links connect to TI community resources. Linked contents are 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.

**TI E2E™ Online Community** ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

## 11.5 商標

E2E is a trademark of Texas Instruments.
*Bluetooth* is a registered trademark of Bluetooth SIG.
ZigBee is a registered trademark of the ZigBee Alliance.
All other trademarks are the property of their respective owners.

## 11.6 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。

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### 11.7 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。この情報は、そのデバイスについて利用可能な最新のデータです。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。


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## 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) |
|---|---|---|---|---|---|---|---|---|---|
| TLV70212DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVRG4.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70212DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVN |
| TLV70213DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | 12UW |
| TLV70213DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 12UW |
| TLV70213DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 12UW |
| TLV70213DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | 12UW |
| TLV70213DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 12UW |
| TLV70213DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 12UW |
| TLV70215DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SIR |
| TLV70215DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SIR |
| TLV70215DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SIR |
| TLV70215DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SIR |
| TLV70215DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SIR |
| TLV70215DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SIR |
| TLV70215PDBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SLG |
| TLV70215PDBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SLG |
| TLV70215PDBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SLG |
| TLV70215PDBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SLG |
| TLV70218DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70218DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70218DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70218DBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| TLV70218DBVRG4.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70218DBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70218DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70218DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70218DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUW |
| TLV70220PDBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXL |
| TLV70220PDBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXL |
| TLV70220PDBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXL |
| TLV70220PDBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXL |
| TLV70220PDBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXL |
| TLV70220PDBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXL |
| TLV70225DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DBVRG4.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVF |
| TLV70225DSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SY |
| TLV70225DSER.A | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SY |
| TLV70225DSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SY |
| TLV70225DSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SY |
| TLV70225DSET.A | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SY |
| TLV70225DSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SY |
| TLV70228DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUX |
| TLV70228DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUX |
| TLV70228DBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUX |
| TLV70228DBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUX |
| TLV70228DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUX |
| TLV70228DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUX |

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| TLV70228DSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VY |
| TLV70228DSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VY |
| TLV70228DSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VY |
| TLV70228DSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VY |
| TLV70228PDBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVA |
| TLV70228PDBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVA |
| TLV70228PDBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVA |
| TLV70228PDBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVA |
| TLV70228PDBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | QVA |
| TLV70228PDBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QVA |
| TLV70229DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SJW |
| TLV70229DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SJW |
| TLV70229DBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SJW |
| TLV70229DBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SJW |
| TLV70229DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SJW |
| TLV70229DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SJW |
| TLV70229DSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SZ |
| TLV70229DSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SZ |
| TLV70229DSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SZ |
| TLV70229DSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | SZ |
| TLV70230DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | QUY |
| TLV70230DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUY |
| TLV70230DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUY |
| TLV70230DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUY |
| TLV70230DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUY |
| TLV70230DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUY |
| TLV70231DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUZ |
| TLV70231DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUZ |
| TLV70231DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUZ |
| TLV70231DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUZ |
| TLV70231DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUZ |

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| TLV70231DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QUZ |
| TLV70233DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVRG4.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QVD |
| TLV70233DSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | WK |
| TLV70233DSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | WK |
| TLV70233DSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | WK |
| TLV70233DSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | WK |
| TLV70233PDBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SLH |
| TLV70233PDBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SLH |
| TLV70233PDBVRG4 | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SLH |
| TLV70233PDBVRG4.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SLH |
| TLV70233PDBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SLH |
| TLV70233PDBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SLH |
| TLV70235DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SDT |
| TLV70235DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SDT |
| TLV70235DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SDT |
| TLV70235DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SDT |
| TLV70235DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SDT |
| TLV70235DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SDT |
| TLV70236DSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VZ |
| TLV70236DSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VZ |
| TLV70236DSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VZ |
| TLV70236DSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | VZ |
| TLV70237DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | QXR |

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| TLV70237DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QXR |
| TLV70237DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QXR |
| TLV70237DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXR |
| TLV70237DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXR |
| TLV70237DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QXR |
| TLV70237DSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | D8 |
| TLV70237DSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | D8 |
| TLV70237DSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | D8 |
| TLV70237DSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | D8 |
| TLV70242PDSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | B9 |
| TLV70242PDSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | B9 |
| TLV70242PDSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | B9 |
| TLV70242PDSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | B9 |
| TLV70243DSER | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | 5Q |
| TLV70243DSER.B | Active | Production | WSON (DSE) \| 6 | 3000 \| LARGE T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | 5Q |
| TLV70243DSET | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | 5Q |
| TLV70243DSET.B | Active | Production | WSON (DSE) \| 6 | 250 \| SMALL T&R | Yes | NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | 5Q |
| TLV70245DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVTG4 | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVTG4.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV70245DBVTG4.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SCK |
| TLV702475DBVR | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | QWJ |
| TLV702475DBVR.A | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QWJ |
| TLV702475DBVR.B | Active | Production | SOT-23 (DBV) \| 5 | 3000 \| LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QWJ |
| TLV702475DBVT | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -40 to 125 | QWJ |
| TLV702475DBVT.A | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QWJ |

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| TLV702475DBVT.B | Active | Production | SOT-23 (DBV) \| 5 | 250 \| SMALL T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | QWJ |

(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 TLV702 :**

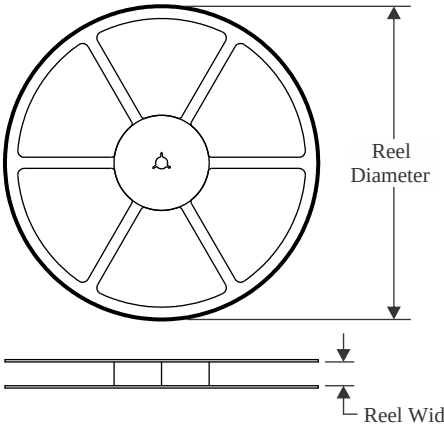
- Automotive : TLV702-Q1

NOTE: Qualified Version Definitions:

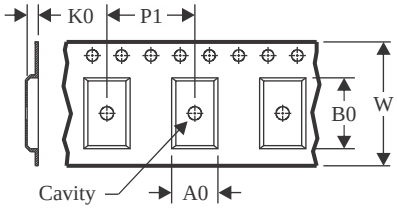
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

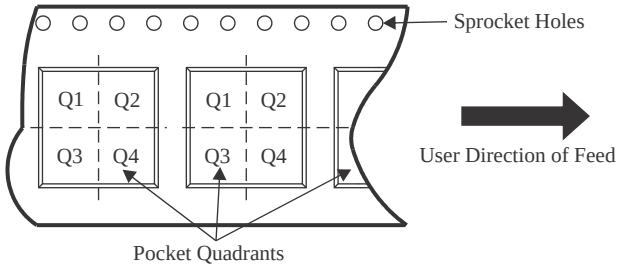



**TAPE DIMENSIONS**




| | |
|---|---|
| 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**



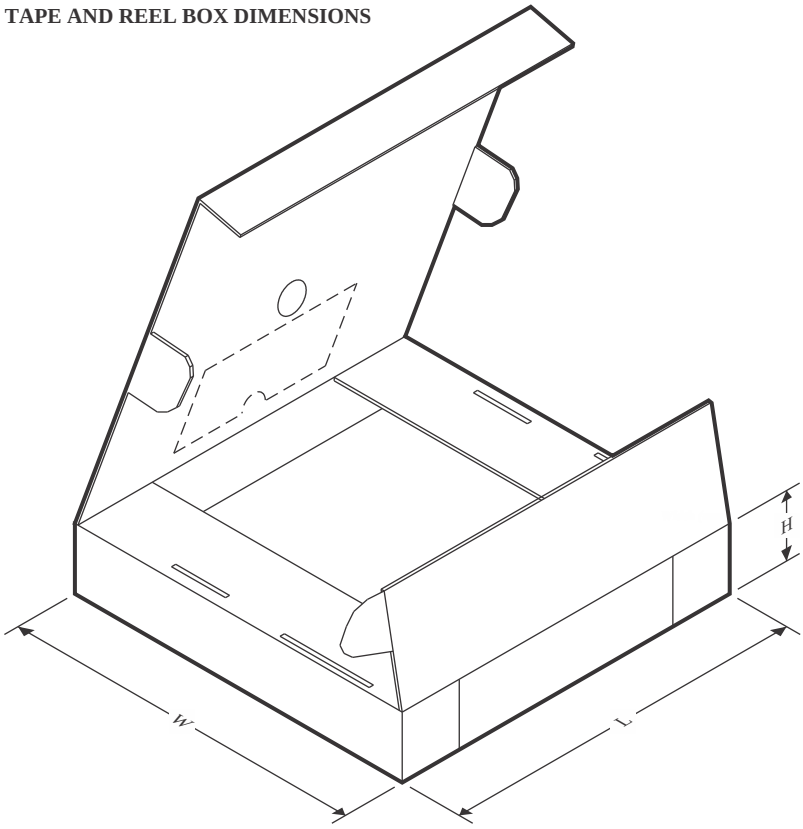

*All dimensions are nominal

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TLV70212DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70212DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70212DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70212DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70213DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70213DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70215DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70215DBVT | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70215DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70215PDBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70215PDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70215PDBVT | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.3 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TLV70218DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70218DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70218DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70218DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70220PDBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70220PDBVRG4 | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70220PDBVT | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70225DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70225DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70225DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70225DSER | WSON | DSE | 6 | 3000 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70225DSET | WSON | DSE | 6 | 250 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70228DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70228DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70228DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70228DSER | WSON | DSE | 6 | 3000 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70228DSET | WSON | DSE | 6 | 250 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70228PDBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70228PDBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70228PDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70228PDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70229DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70229DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70229DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70229DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70229DSER | WSON | DSE | 6 | 3000 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70229DSET | WSON | DSE | 6 | 250 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70230DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70230DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70231DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70231DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70233DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70233DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70233DBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70233DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70233DSER | WSON | DSE | 6 | 3000 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70233DSET | WSON | DSE | 6 | 250 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70233PDBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70233PDBVRG4 | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70233PDBVT | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70233PDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TLV70235DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70235DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70236DSER | WSON | DSE | 6 | 3000 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70236DSET | WSON | DSE | 6 | 250 | 179.0 | 8.4 | 1.8 | 1.8 | 1.0 | 4.0 | 8.0 | Q2 |
| TLV70237DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70237DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70237DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70237DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70237DSER | WSON | DSE | 6 | 3000 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70237DSET | WSON | DSE | 6 | 250 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70242PDSER | WSON | DSE | 6 | 3000 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70242PDSET | WSON | DSE | 6 | 250 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70243DSER | WSON | DSE | 6 | 3000 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70243DSET | WSON | DSE | 6 | 250 | 180.0 | 8.4 | 1.83 | 1.83 | 0.89 | 4.0 | 8.0 | Q2 |
| TLV70245DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70245DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV70245DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70245DBVT | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.3 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV70245DBVTG4 | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.3 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV702475DBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV702475DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TLV702475DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TLV702475DBVT | SOT-23 | DBV | 5 | 250 | 178.0 | 8.4 | 3.23 | 3.17 | 1.37 | 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) |
|---|---|---|---|---|---|---|---|
| TLV70212DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TLV70212DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70212DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70212DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70213DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70213DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70215DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70215DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TLV70215DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70215PDBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV70215PDBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70215PDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TLV70218DBVR | SOT-23 | DBV | 5 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70218DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70218DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TLV70218DBVT | SOT-23 | DBV | 5 | 250 | 183.0 | 183.0 | 20.0 |
| TLV70218DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70220PDBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TLV70220PDBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TLV70220PDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TLV70225DBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV70225DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70225DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70225DSER | WSON | DSE | 6 | 3000 | 200.0 | 183.0 | 25.0 |
| TLV70225DSET | WSON | DSE | 6 | 250 | 200.0 | 183.0 | 25.0 |
| TLV70228DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70228DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70228DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70228DSER | WSON | DSE | 6 | 3000 | 200.0 | 183.0 | 25.0 |
| TLV70228DSET | WSON | DSE | 6 | 250 | 200.0 | 183.0 | 25.0 |
| TLV70228PDBVR | SOT-23 | DBV | 5 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70228PDBVRG4 | SOT-23 | DBV | 5 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70228PDBVT | SOT-23 | DBV | 5 | 250 | 183.0 | 183.0 | 20.0 |
| TLV70228PDBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70229DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TLV70229DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70229DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70229DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70229DSER | WSON | DSE | 6 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70229DSET | WSON | DSE | 6 | 250 | 183.0 | 183.0 | 20.0 |
| TLV70230DBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV70230DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70231DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70231DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70233DBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV70233DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70233DBVRG4 | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70233DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70233DSER | WSON | DSE | 6 | 3000 | 200.0 | 183.0 | 25.0 |
| TLV70233DSET | WSON | DSE | 6 | 250 | 200.0 | 183.0 | 25.0 |
| TLV70233PDBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV70233PDBVRG4 | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TLV70233PDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TLV70233PDBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70235DBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV70235DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70236DSER | WSON | DSE | 6 | 3000 | 200.0 | 183.0 | 25.0 |
| TLV70236DSET | WSON | DSE | 6 | 250 | 203.0 | 203.0 | 35.0 |

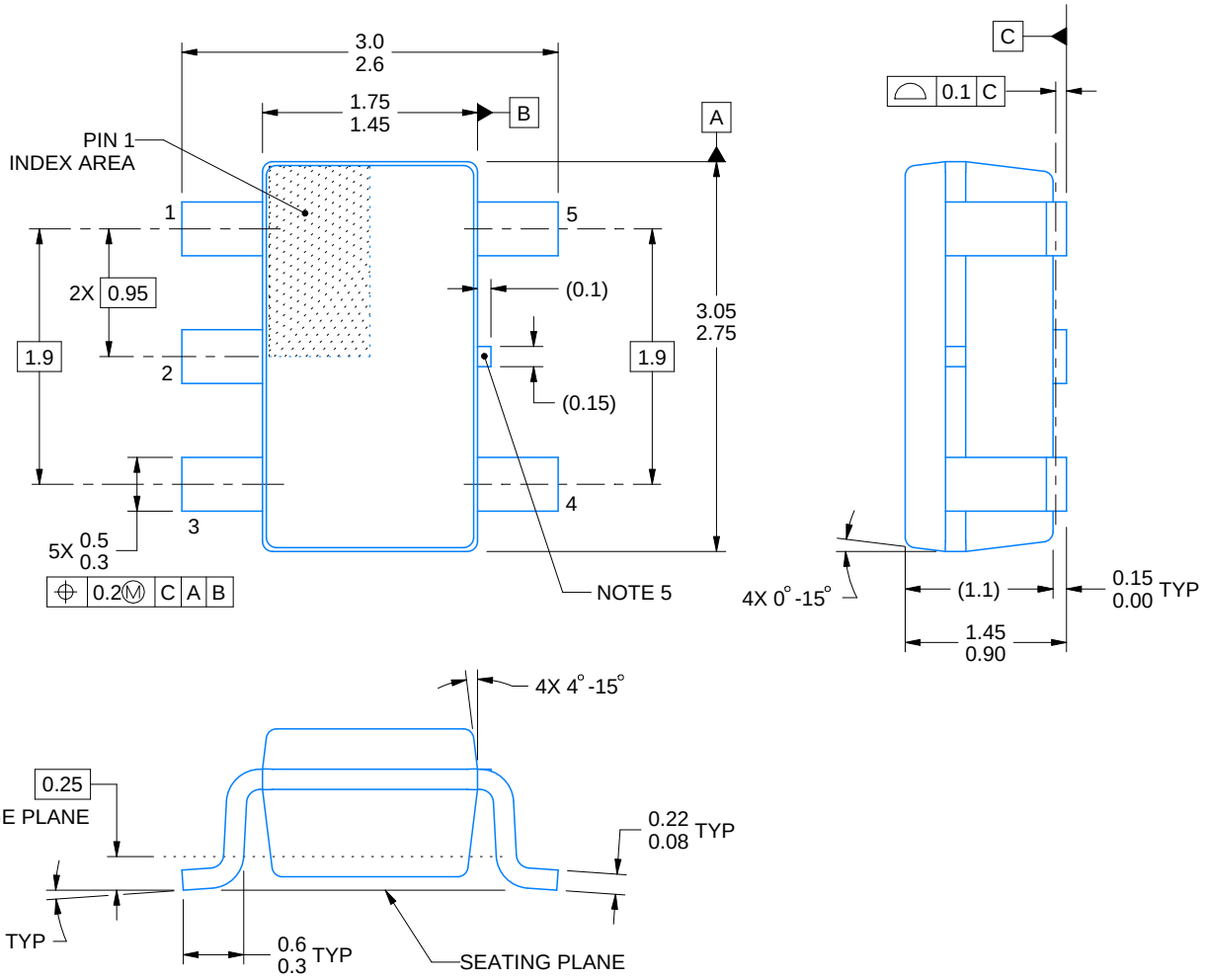
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TLV70237DBVR | SOT-23 | DBV | 5 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV70237DBVR | SOT-23 | DBV | 5 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70237DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TLV70237DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70237DSER | WSON | DSE | 6 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70237DSET | WSON | DSE | 6 | 250 | 183.0 | 183.0 | 20.0 |
| TLV70242PDSER | WSON | DSE | 6 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70242PDSET | WSON | DSE | 6 | 250 | 183.0 | 183.0 | 20.0 |
| TLV70243DSER | WSON | DSE | 6 | 3000 | 183.0 | 183.0 | 20.0 |
| TLV70243DSET | WSON | DSE | 6 | 250 | 183.0 | 183.0 | 20.0 |
| TLV70245DBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV70245DBVT | SOT-23 | DBV | 5 | 250 | 183.0 | 183.0 | 20.0 |
| TLV70245DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV70245DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TLV70245DBVTG4 | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TLV702475DBVR | SOT-23 | DBV | 5 | 3000 | 208.0 | 191.0 | 35.0 |
| TLV702475DBVT | SOT-23 | DBV | 5 | 250 | 183.0 | 183.0 | 20.0 |
| TLV702475DBVT | SOT-23 | DBV | 5 | 250 | 210.0 | 185.0 | 35.0 |
| TLV702475DBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |

# PACKAGE OUTLINE

## DBV0005A

## SOT-23 - 1.45 mm max height

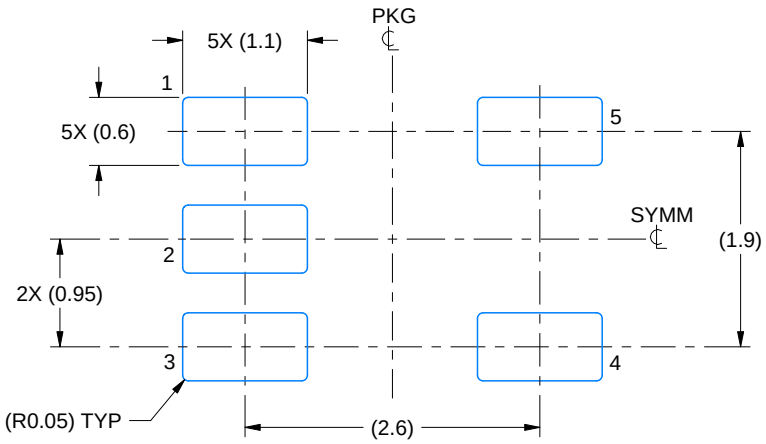
SMALL OUTLINE TRANSISTOR



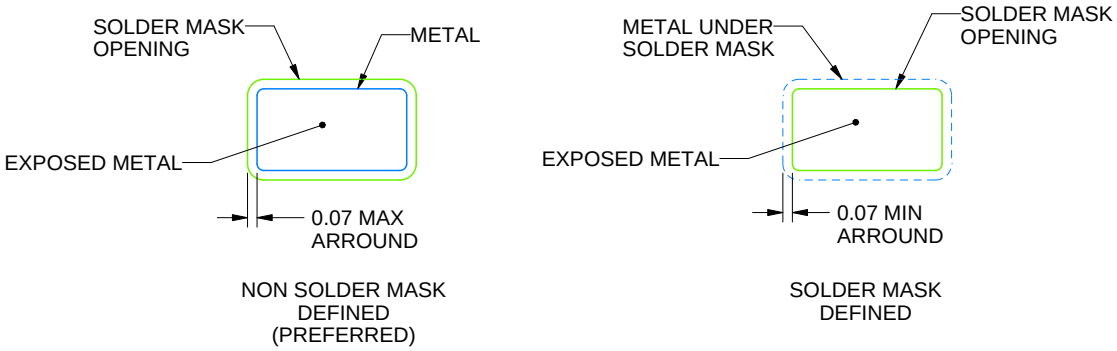

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NOTES:

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. 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

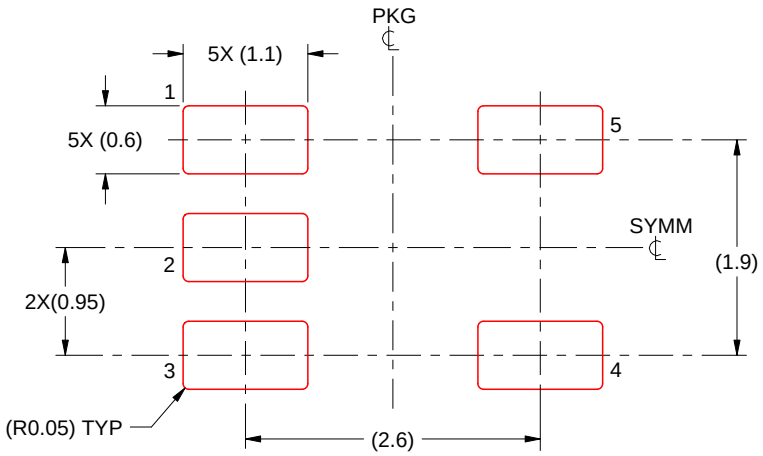



SOLDER MASK DETAILS

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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.




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

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NOTES: (continued)

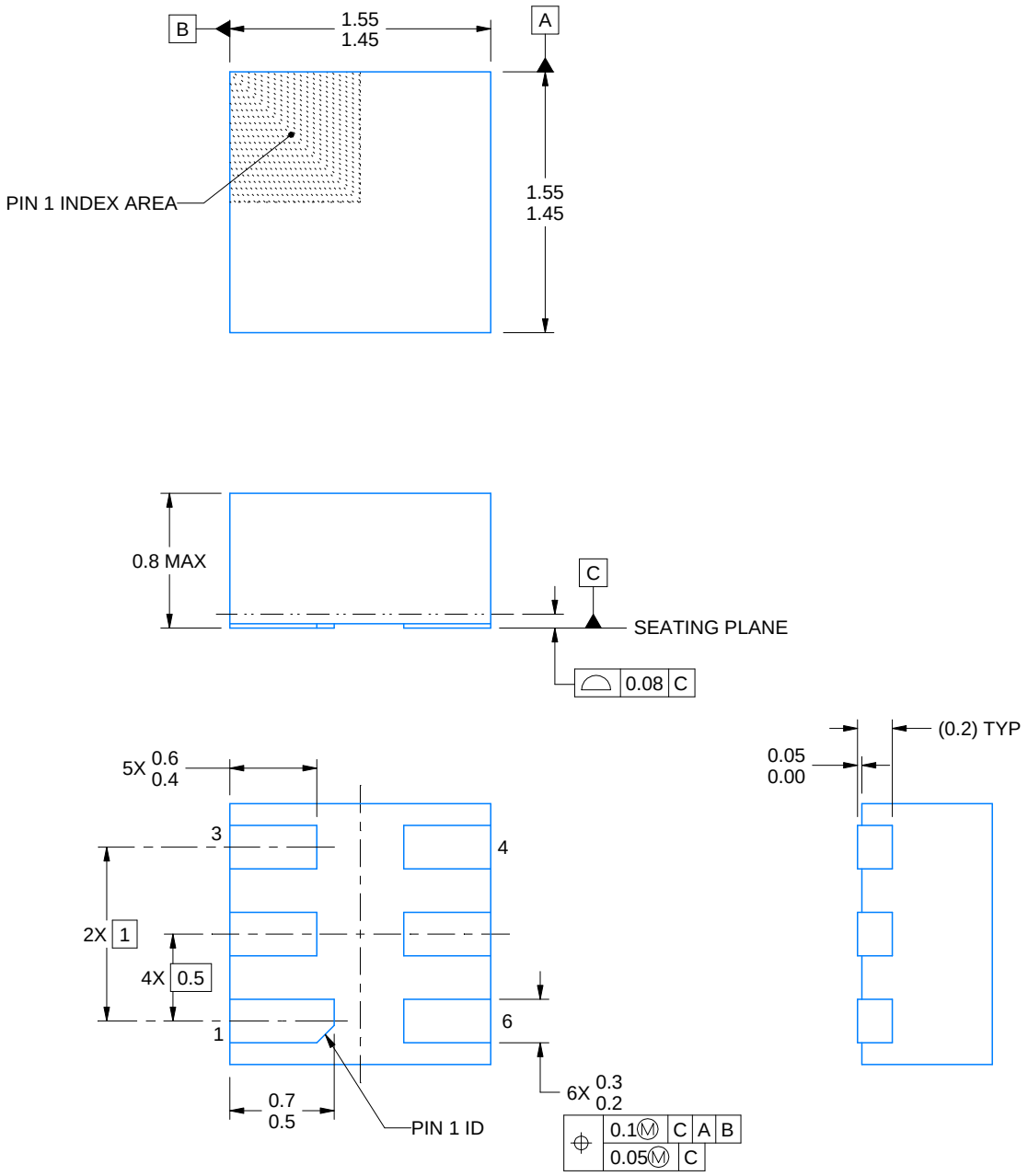
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# DSE0006A

# PACKAGE OUTLINE

## WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD




4220552/B 01/2024

NOTES:

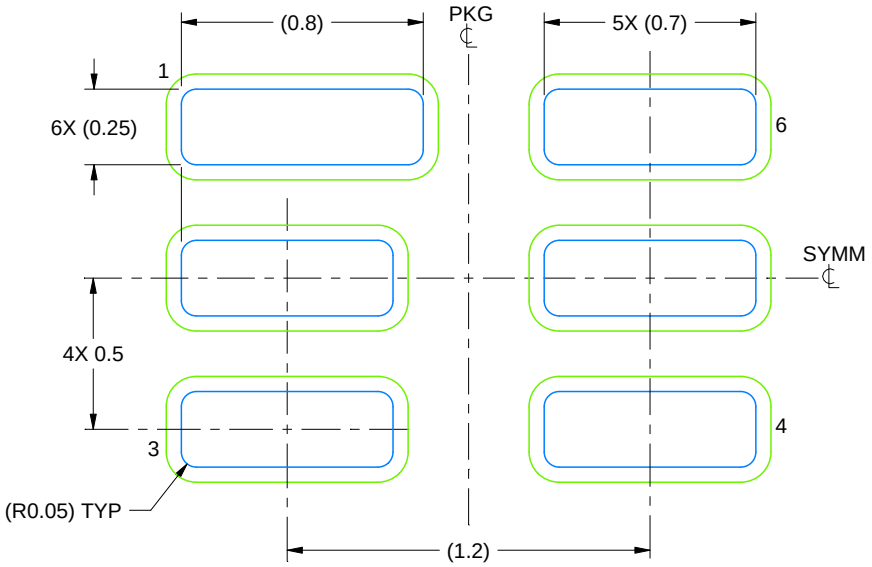
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

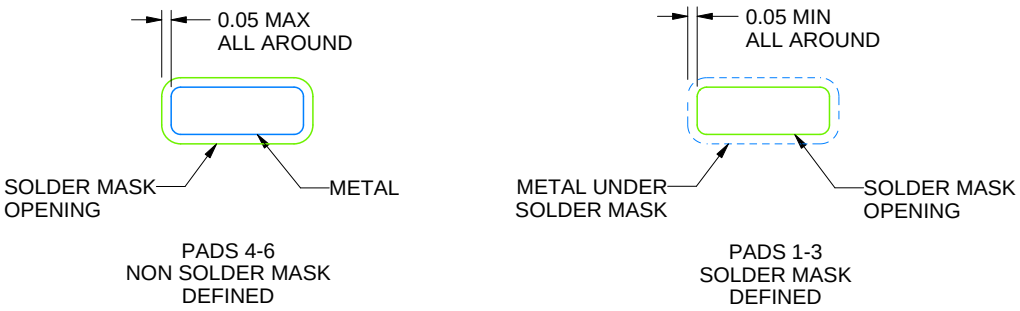
## DSE0006A

## WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD




LAND PATTERN EXAMPLE
SCALE:40X




SOLDER MASK DETAILS

4220552/B 01/2024

NOTES: (continued)

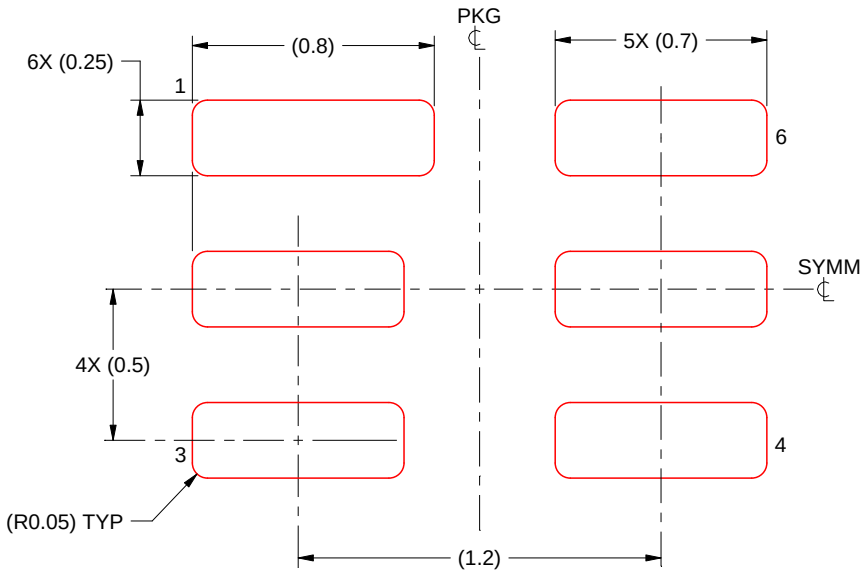
3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

# EXAMPLE STENCIL DESIGN

## DSE0006A

## WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:40X

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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