# 采用微型封装的 TMP303 易于使用型、低功耗、1°C、低电源温度范围监控器

## 1 特性

- 低功耗：5µA（最大值）
- SOT-563 封装：1.60 × 1.60 × 0.6mm
- 跳闸点精度：
  - –40°C 至 125°C 范围内为 ±0.2°C（典型值）
- 推挽式输出
- 可选迟滞：1/2/5/10°C
- 电源电压范围：1.4V 至 3.6V

## 2 应用

- 电池充电
- 电池过热保护
- 消费类电子产品
- 企业
- 电信

## 3 说明

TMP303 器件是温度范围监控器，可通过超小尺寸 (SOT-563)、低功耗（最大 5µA）和低电源电压性能（低至 1.4V）提供设计灵活性。

这些器件的运行无需附加组件；每个器件都可以独立于微处理器或微控制器运行。

有 7 个可用的跳闸点，请参阅*器件选项*。跳闸点可以在出厂前编程为任何所需的温度。对于需要不同值的要求，请联系您当地的 TI 代表。

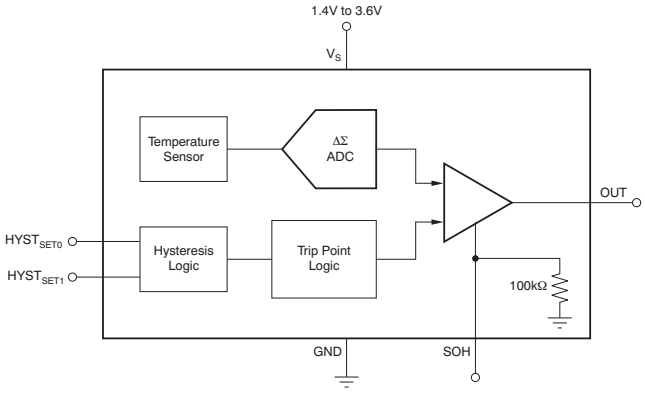
OUT 引脚是推挽式高电平有效输出。当测量的温度超出跳闸点范围且设置输出高电平 (SOH) 引脚处于低电平状态时，OUT 引脚处于高电平。SOH 引脚是一个带内部下拉电阻器的输入引脚。当 SOH 引脚被强制为高电平时，则无论测量的温度是多少，OUT 引脚都会变为高电平。

器件信息(1)

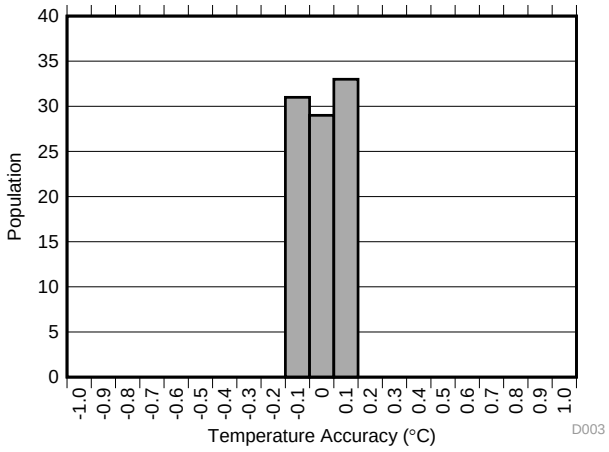
| 器件型号 | 封装 | 封装尺寸（标称值） |
|---|---|---|
| TMP303 | SOT-563 (6) | 1.60mm x 1.20mm |

(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。

**TMP303 功能方框图**




**-20°C 至 125°C 时的典型跳匣阈值精度**




本文档旨在为方便起见，提供有关 TI 产品中文版本的信息，以确认产品的概要。 有关适用的官方英文版本的最新信息，请访问 www.ti.com，其内容始终优先。 TI 不保证翻译的准确性和有效性。 在实际设计之前，请务必参考最新版本的英文版本。

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## 4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

**Changes from Revision H (October 2018) to Revision I** — **Page**

- Changed input pin voltage maximum value in the *Absolute Maximum Ratings* table from: ((V+) + 0.5) and ≤ 4 to: ($(V_S)$ + 0.3) and ≤ 4 ... 4
- Changed output pin voltage maximum value n the *Absolute Maximum Ratings* table from: ((V+) + 0.5) and ≤ 4 to: ($(V_S)$ + 0.3) and ≤ 4 ... 4

**Changes from Revision F (February 2016) to Revision G** — **Page**

- 已添加 在数据表中添加了 TMP303E、TMP303F 和 TMP303G 器件 ... 1
- 已更改 将器件选项的个数由 4 更改为 7 ... 1
- Changed Trip Point Accuracy in *Electrical Characteristics* from $T_A$ = -20 to 125°C to $T_A$ = 60 to 125°C ... 5

**Changes from Revision E (October 2015) to Revision F** — **Page**

- 已添加 为器件选项表添加了交叉参考 ... 1
- 已添加 添加了新的跳匣阈值精度图像 ... 1
- Added Trip Points covering range -20 to 125°C ... 5
- Added Trip Accuracy Error vs Temperature graph. ... 6

**Changes from Revision D (September 2015) to Revision E** — **Page**

- Changed I/O value of $HYST_{SET1}$ row in *Pin Functions* table ... 3

**Changes from Revision C (September 2015) to Revision D** — **Page**

- 将器件编号合并到通用 TMP303。 ... 1


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**Changes from Revision B (January 2011) to Revision C** **Page**

- 已添加 *添加了 ESD 额定值 表、特性 说明 部分、器件功能模式 部分、应用和实施 部分、电源建议 部分、布局 部分、器件和文档支持 部分以及机械、封装和可订购信息 部分* ..... 1

**Changes from Revision A (September 2009) to Revision B** **Page**

- 已添加 在数据表中添加了 TMP303B 器件 ..... 1

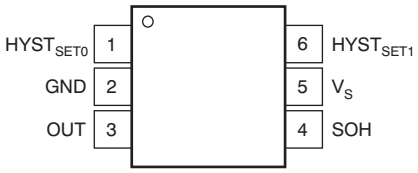
## 5 器件选项

| 器件 | 跳闸点 (°C) |
|---|---|
| TMP303A | $T_L$ = 0，$T_H$ = 60(1) |
| TMP303B | $T_L$ = 0，$T_H$ = 55(1) |
| TMP303C | $T_L$ = -20，$T_H$ = 60(1) |
| TMP303D | $T_L$ = -15，$T_H$ = 125(1) |
| TMP303E | $T_L$ = 0，$T_H$ = 70(1) |
| TMP303F | $T_L$ = 0，$T_H$ = 80(1) |
| TMP303G | $T_L$ = 0，$T_H$ = 90(1) |

(1) 请联系 TI 代表了解其他跳闸点。

## 6 Pin Configuration and Functions

**DRL Package**
**6-Pin SOT-563**
**Top View**




**Pin Functions**

| PIN | | I/O | DESCRIPTION |
|---|---|---|---|
| NAME | NO. | | |
| HYST$_{SET0}$ | 1 | Digital Input | This pin is used to set the amount of thermal hysteresis. |
| GND | 2 | Ground | Ground |
| OUT | 3 | Digital Output | Active high, push-pull output pin. Does not require a pullup resistor to $V_S$. |
| SOH | 4 | Digital Input | Set output high (SOH) pin. If the SOH pin is pulled high, the TMP303 forces the output high. If the SOH pin is grounded or left floating, this pin has no effect on the behavior of the TMP303. |
| $V_S$ | 5 | Power Supply | Power supply |
| HYST$_{SET1}$ | 6 | Digital Input | This pin is used to set the amount of thermal hysteresis. |

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# 7 Specifications

## 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Supply Voltage, $V_S$ – GND | | | 4 | V |
| Input Pins, Voltage | SOH, $HYST_{SET1}$, $HYST_{SET0}$ | –0.5 | (($V_S$) + 0.3) and ≤ 4 | V |
| Output Pin, Voltage | OUT | –0.5 | (($V_S$) + 0.3) and ≤ 4 | V |
| Output Pin, Current | OUT | –55 | 8 | mA |
| Operating Temperature | | | 130 | °C |
| Junction Temperature, $T_J$ max | | | 150 | °C |
| Storage Temperature, $T_{stg}$ | | –60 | 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.

## 7.2 ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1) | ±2000 | V |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101(2) | ±1000 | |
| | | Machine model (MM) | ±200 | |

(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.

## 7.3 Recommended Operating Conditions

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

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| $V_S$ | Power Supply Voltage | 1.4 | | 3.6 | V |
| $T_A$ | Specified Temperature Range | –40 | | 125 | °C |

## 7.4 Thermal Information

| THERMAL METRIC(1) | | TMP303 DRL (SOT-563) 6 PINS | UNIT |
|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 210.3 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 105.0 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 87.5 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 6.1 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 87.0 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, SPRA953.


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## 7.5 Electrical Characteristics

At $T_A$ = –40°C to 125°C and $V_S$ = 1.4 V to 3.6 V, unless otherwise noted.(1)

| PARAMETER | | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **TEMPERATURE MEASUREMENT** | | | | | | |
| $T_L$, $T_H$ Trip Point Accuracy(2) | | $T_A$ = 55°C to 60°C, $V_S$ = 3.3 V | | ±0.2 | ±1 | °C |
| | | $T_A$ = -20 to 60°C, $V_S$ = 1.4 V to 3.6 V | | ±0.2 | ±1.5 | |
| | | $T_A$ = 60 to 125°C, $V_S$ = 1.4 V to 3.6 V | | ±0.2 | ±2.0 | |
| | | vs Supply | | ±0.1 | | °C/V |
| Hysteresis | | See *Bit Setting vs Hysteresis Window* | 1 | | 10 | °C |
| **HYSTERESIS SET INPUT** | | | | | | |
| Input Logic Levels | $V_{IH}$ | | 0.7 × $V_S$ | | 3.6 | V |
| | $V_{IL}$ | | –0.5 | | 0.3 × $V_S$ | |
| Input Current | $I_{IN}$ | 0 < $V_{IN}$ < 3.6 V | | | 1 | µA |
| **SOH INPUT** | | | | | | |
| Pulldown Resistor Value | | | 80 | 100 | 120 | kΩ |
| Input Logic Levels | $V_{IH}$ | | 0.7 × $V_S$ | | 3.6 | V |
| | $V_{IL}$ | | –0.5 | | 0.3 × $V_S$ | |
| Input Current | | $V_{IN}$ = 3.6 V | | 36 | | µA |
| **OUTPUT** | | | | | | |
| Output Logic Levels | $V_{OH}$ | $V_S$ > 2 V, $I_{OH}$ = 0.5 mA | $V_S$ – 0.4 | | $V_S$ | V |
| | | $V_S$ < 2 V, $I_{OH}$ = 0.5 mA | $V_S$ – 0.2 × ($V_S$) | | $V_S$ | |
| | $V_{OL}$ | $V_S$ > 2 V, $I_{OL}$ = 1 mA | 0 | | 0.4 | |
| | | $V_S$ < 2 V, $I_{OL}$ = 1 mA | 0 | | 0.2 × $V_S$ | |
| **POWER SUPPLY** | | | | | | |
| Specified Supply Voltage Range | $V_S$ | | 1.4 | | 3.6 | V |
| Power-up Start-up Time | | $V_S$ > 1.4 V | 20 | 28 | 35 | ms |
| Quiescent Current | $I_Q$ | $T_A$ = –55°C to 60°C | | 3.5 | 5 | µA |
| | | $T_A$ = –40°C to 125°C | | 4 | 8 | |
| **TEMPERATURE RANGE** | | | | | | |
| Specified Range | | | –40 | | 125 | °C |
| Operating Range | | | –55 | | 130 | °C |

(1) 100% of all units are production tested at $T_A$ = 25°C. Over temperature specifications are specified by design.
(2) $T_L$, $T_H$ are device-specific. For example, TMP303A $T_L$ = 0°C, $T_H$ = 60°C; TMP303B $T_L$ = 0°C, $T_H$ = 55°C; TMP303C $T_L$ = –20°C, $T_H$ = 60°C; TMP303D $T_L$ = –15°C, $T_H$ = 125°C; TMP303E $T_L$ = 0°C, $T_H$ = 70°C; TMP303F $T_L$ = 0°C, $T_H$ = 80°C; TMP303G $T_L$ = 0°C, $T_H$ = 90°C

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## 7.6 Typical Characteristics

At $V_S$ = 3.3 V and $T_A$ = 25°C, unless otherwise noted.

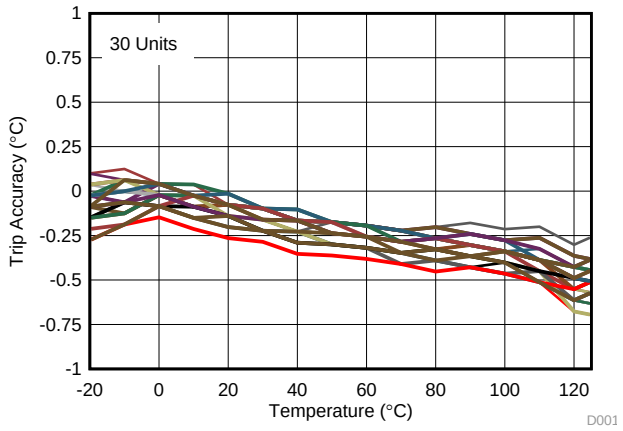



**Figure 1. Trip Accuracy Error vs Temperature**

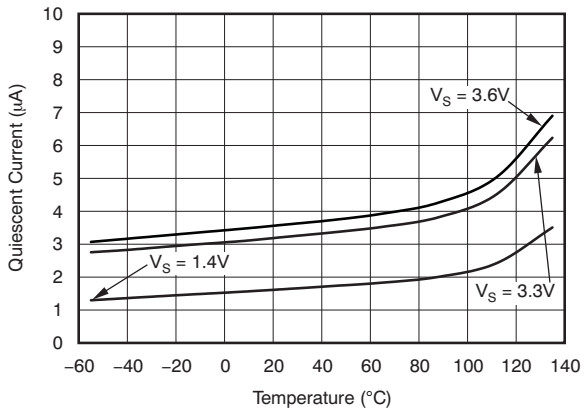



**Figure 2. Quiescent Current vs Temperature**

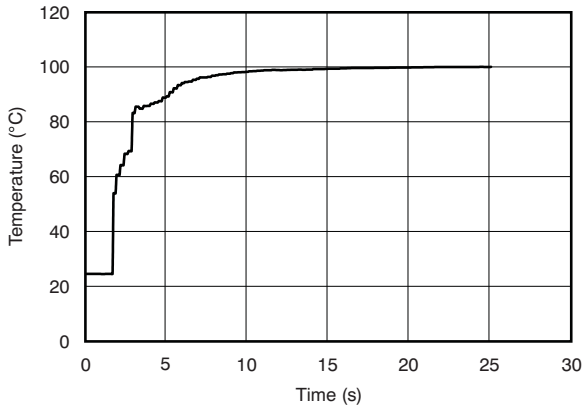



**Figure 3. Temperature Step Response in Perfluorinated Fluid at 100°C vs Time**

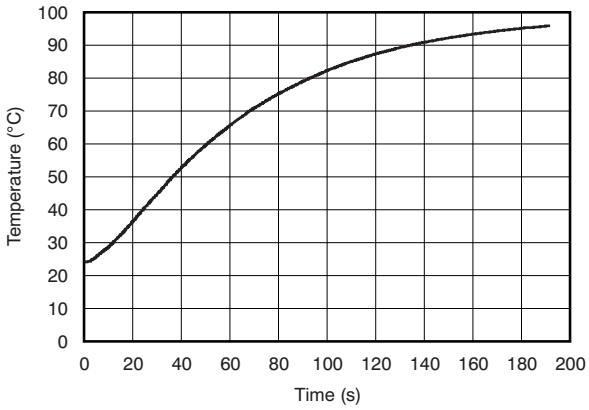



**Figure 4. Thermal Step Response in Air at 100°C vs Time**

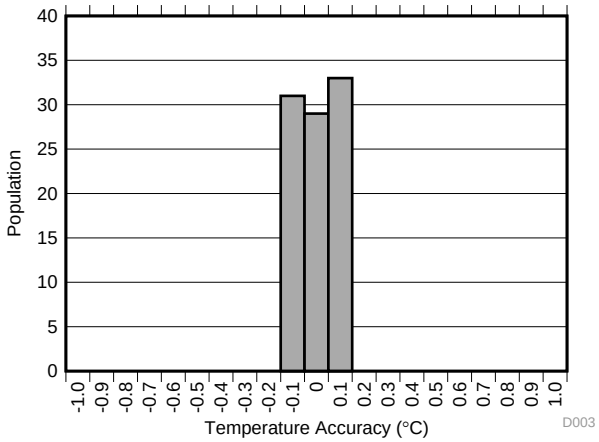



**Figure 5. Trip Threshold Accuracy at -20°C to 125°C**

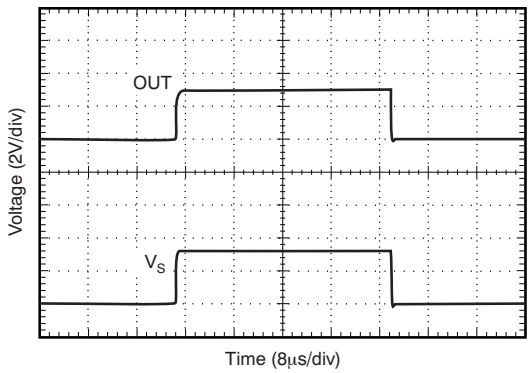



**Figure 6. Power-Up and Power-Down Transient Response**


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## Typical Characteristics (continued)

At $V_S$ = 3.3 V and $T_A$ = 25°C, unless otherwise noted.

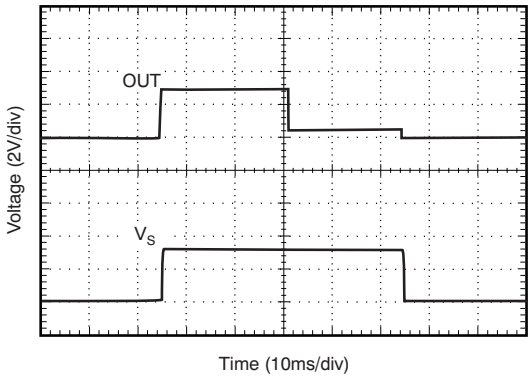



**Figure 7. Power-Up, Trip, and Power-Down Response**

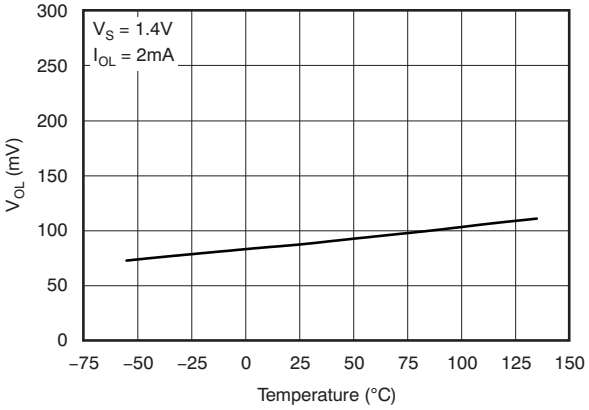



**Figure 8. Output Logic Level Low vs Temperature**

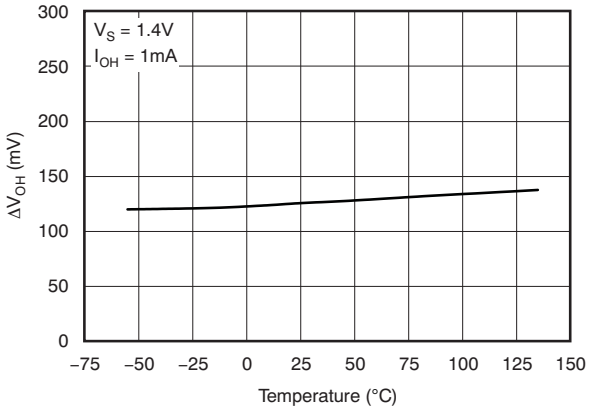



**Figure 9. Output Logic Level High vs Temperature**

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# 8 Detailed Description

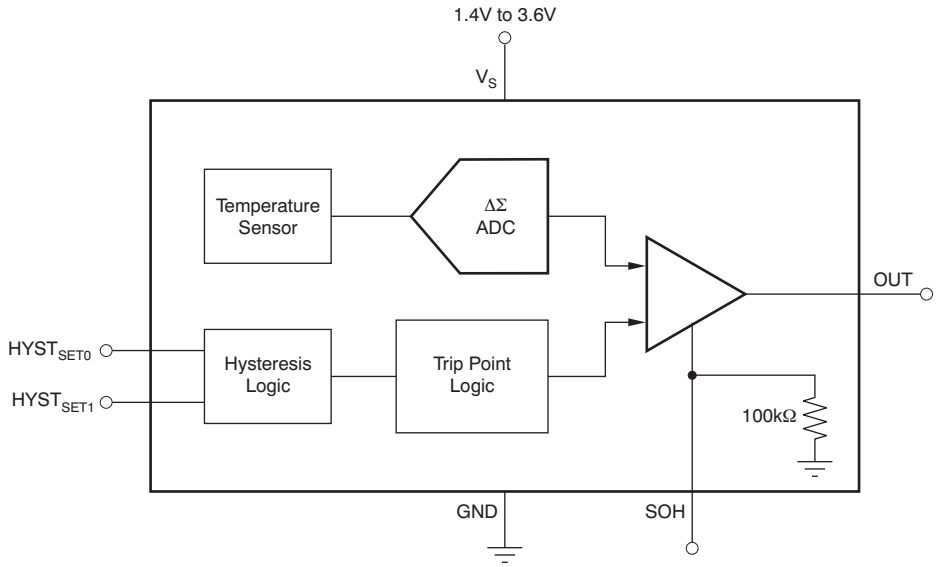
## 8.1 Overview

The TMP303 devices are temperature switches used in battery-powered applications that require accurate monitoring of a very specific temperature range from 0°C to 60°C (TMP303A), 0°C to 55°C (TMP303B), –20°C to 60°C (TMP303C), –15°C to 125°C (TMP303D), 0°C to 70°C (TMP303E), 0°C to 80°C (TMP303F) or 0°C to 90°C (TMP303G). This functionality is accomplished through the preset trip window and two hysteresis bits, $HYST_{SET0}$ and $HYST_{SET1}$. The preset trip window temperature thresholds are configured at the factory; for other trip points, contact a TI representative. Table 1 summarizes the bit setting versus hysteresis temperature window.

**Table 1. Bit Setting vs Hysteresis Window**

| $HYST_{SET1}$ | $HYST_{SET0}$ | HYSTERESIS |
|---|---|---|
| GND | GND | 1°C |
| GND | $V_S$ | 2°C |
| $V_S$ | GND | 5°C |
| $V_S$ | $V_S$ | 10°C |

## 8.2 Functional Block Diagram





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## 8.3 Feature Description

### 8.3.1 $HYST_{SET0}$, $HYST_{SET1}$ and SOH Functionality

The TMP303A temperature trip window resides within the range of 0°C to 60°C, the TMP303B within 0°C to 55°C, the TMP303C within –20°C to 60°C, the TMP303D within –15°C to 125°C, the TMP303E within 0°C to 70°C, the TMP303F within 0°C to 80°C, and the TMP303G within 0°C to 90°C. When any of these trip thresholds is crossed, the output (OUT) changes state from low to high. OUT does not return to its original low state until the temperature crosses the hysteresis threshold and returns within the range of the temperature trip window.

As an example, if the TMP303A is configured with a 10°C hysteresis window (that is, $HYST_{SET0}$ = $HYST_{SET1}$ = $V_S$), the output does not return to its low state until the temperature either crosses ($T_L$ + *hysteresis*) = 10°C or ($T_H$ – *hysteresis*) = 50°C. The Set Output High (SOH) pin is intended to add test functionality to verify the connectivity of the output (OUT) pin to the system controller or other temperature response system. The SOH pin is internally pulled down to ground with a 100-kΩ resistor. If the SOH pin is grounded or left floating, it has no effect on the behavior of the TMP303A. If the SOH pin is pulled high, the TMP303A immediately forces the output high, regardless of temperature.

**NOTE**

This response occurs even if the temperature falls within the 0°C to 60°C temperature window.

Figure 10 shows this design in graphical form.

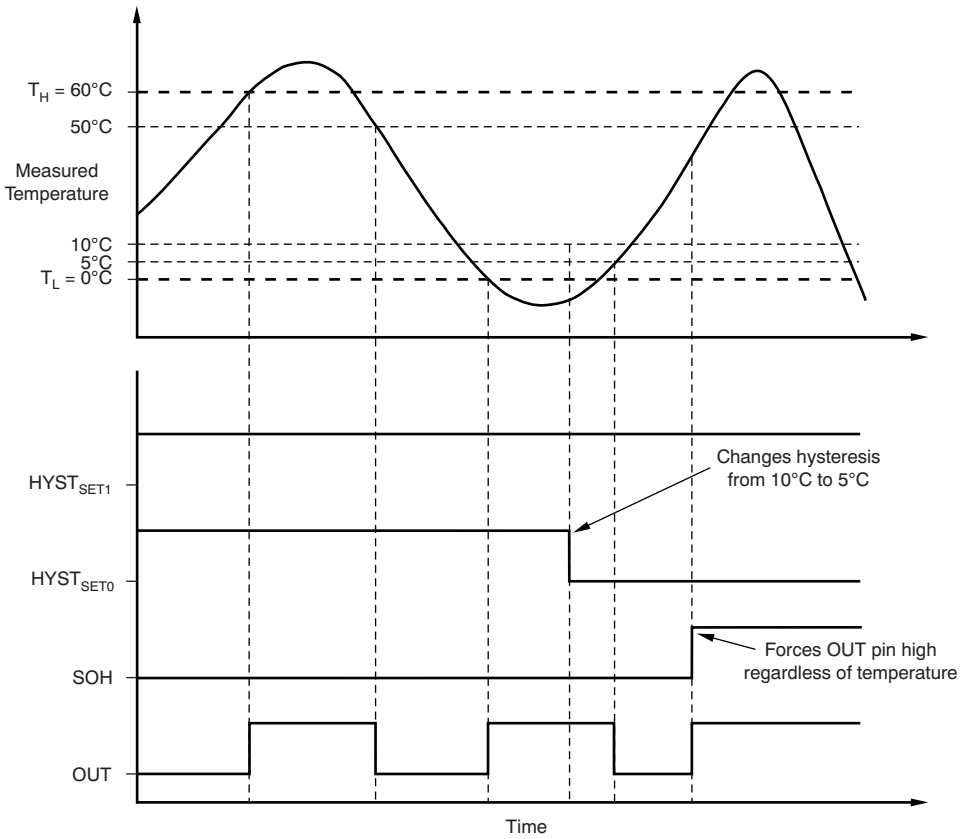



**Figure 10. TMP303A Output Transfer Curves With Hysteresis Change from 10°C to 5°C and SOH Functionality**

## Feature Description (continued)

### 8.3.2 TMP303 Power Up and Timing

At device power up, the TMP303 exerts OUT = high, and typically requires 26 ms to return to a low state only if the temperature falls within the hysteresis window set by $HYST_{SET0}$ and $HYST_{SET1}$.

The tolerance of the thermal response time is largely a result of the differences in conversion time, which varies from 20 ms to 35 ms; likewise, this conversion does not take place after a power cycle until the supply voltage has reached a level of at least 1.4 V. This sequence is illustrated in Figure 11.

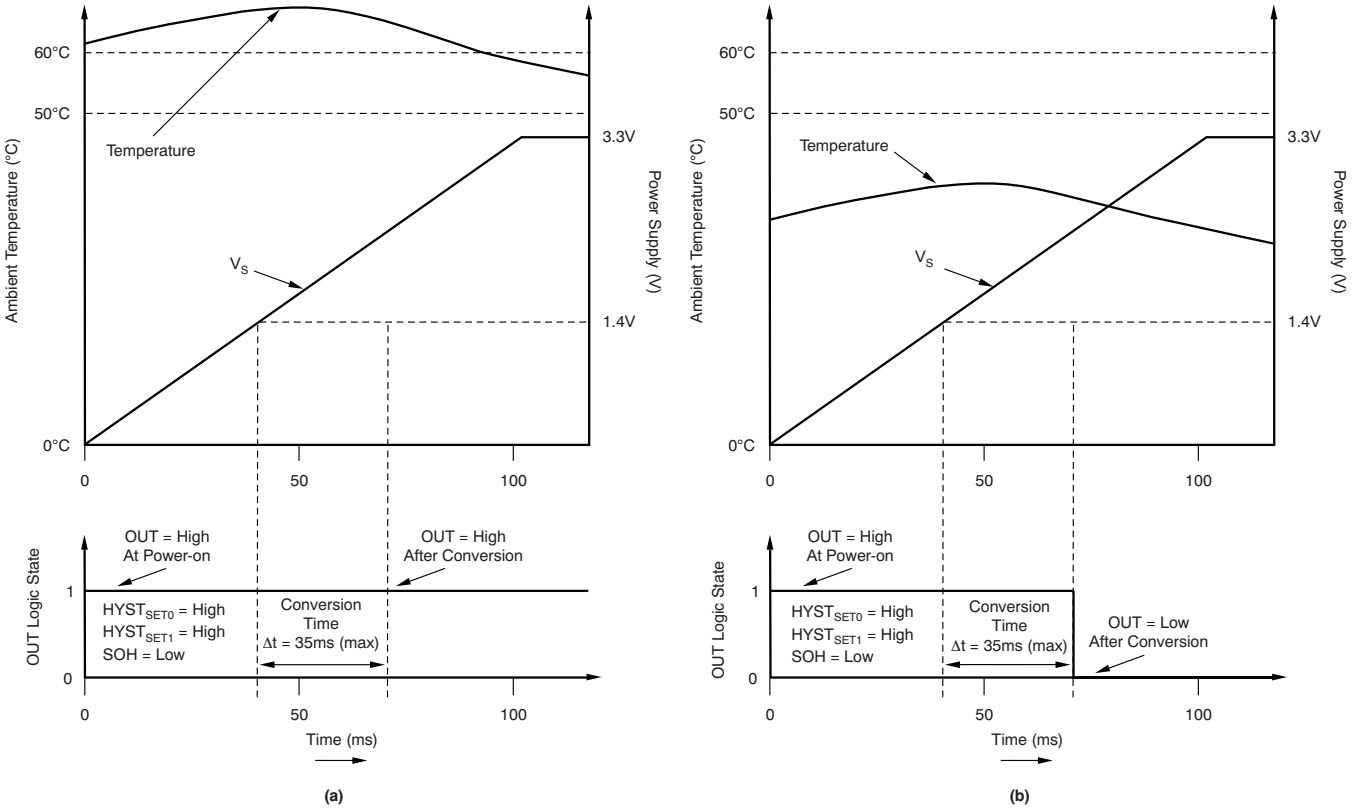



**Figure 11. TMP303A Start-Up Delay vs Output Voltage ($HYST_{SET0}$ = $HYST_{SET1}$ = $V_S$)**

After the TMP303 powers up, all successive thermal response results for the device are achieved in a time frame of 0.985 s to 1 s. This period is the minimum time frame required for the push-pull output (OUT) to change its state from high to low (or conversely) when the device is active.


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## Feature Description (continued)

A maximum low output voltage is defined as a voltage level equivalent to (0.2 × $V_S$); likewise, a minimum high-output voltage is defined as (0.8 × $V_S$). The timing associated with start-up time and conversion is shown in Figure 12.

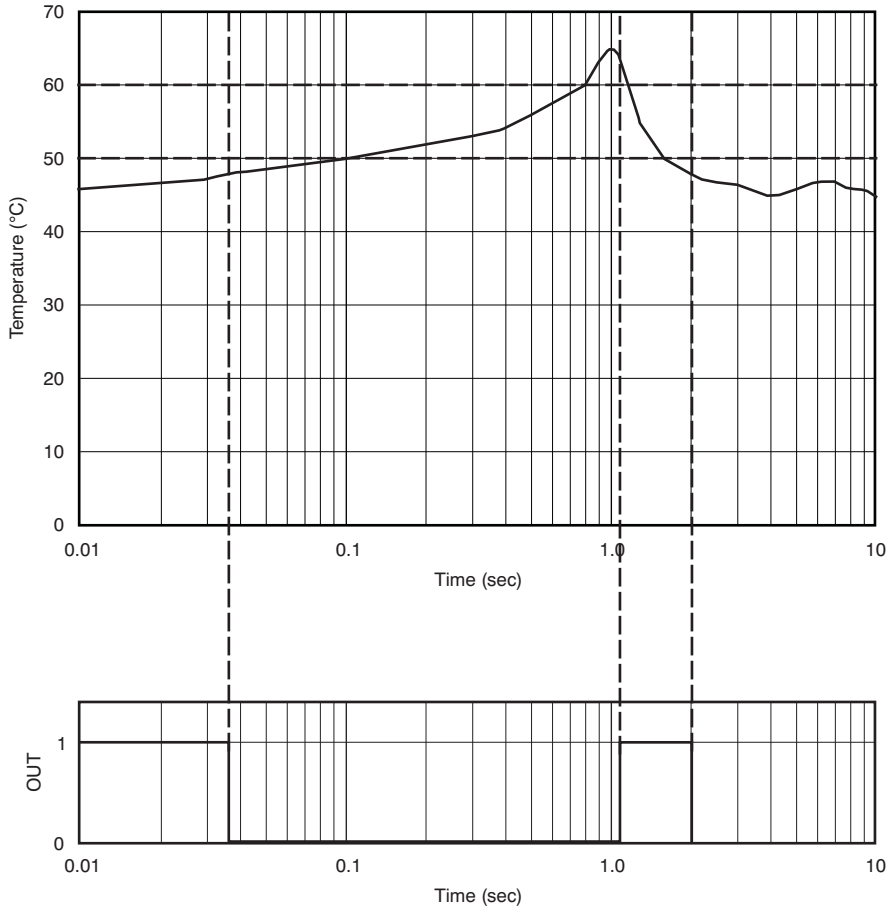



**Figure 12. TMP303A Start-Up and Conversion Timing ($HYST_{SET0}$ = $HYST_{SET1}$ = $V_S$)**

## 8.4 Device Functional Modes

The TMP303 family of devices has a single functional mode. Normal operation for the TMP303 family of devices occurs when the power-supply voltage applied between the $V_S$ pin and GND is within the specified operating range of 1.4 to 3.6 V.The temperature threshold is configured at the factory and the hysteresis is selected by connecting the $HYST_{SET0}$ and $HYST_{SET1}$ pins to either the GND or Vs pins (see Table 1).

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# 9 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.

## 9.1 Application Information

The TMP303 family of devices is simple to configure. The TMP303 contains an active high, push-pull output stage and does not require a pullup resistor to $V_S$ for proper operation. The only external component that the device requires is a bypass capacitor. TI strongly recommends using a 0.1-µF capacitor, placed as close as possible to the supply pin.

## 9.2 Typical Applications

### 9.2.1 TMP303 Typical Configuration

Figure 13 shows the typical circuit configuration for the TMP303 family of devices. These devices have preprogrammed trip-points. Select the TMP303 device that meets the application temperature trip requirement.

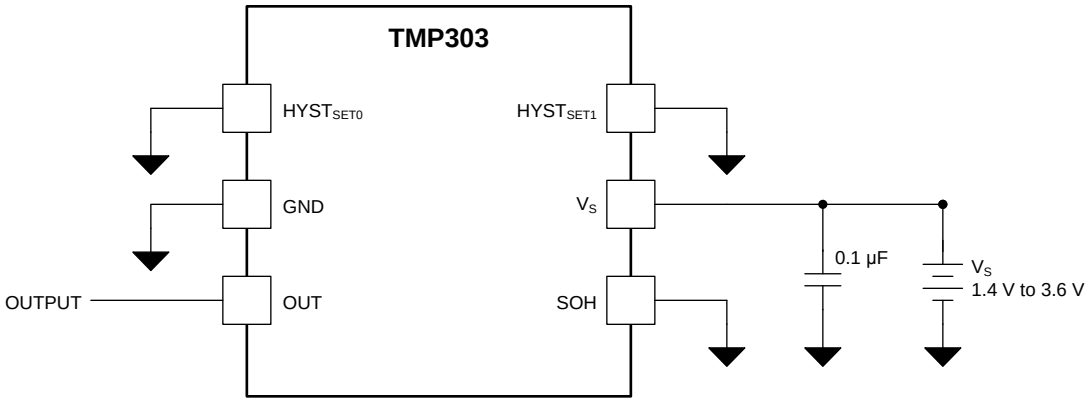



**Figure 13. TMP303 Typical Application Configuration Schematic**

#### *9.2.1.1 Design Requirements*

The TMP303 is a temperature switch commonly used to signal a microprocessor in the event of an over or under temperature condition. The temperature that the TMP303 issues a output is determined by the device preset trip window. The TMP303 issues an output when the temperature threshold is exceeded. To avoid the TMP303 signaling the microprocessor as soon as the temperature drops below the temperature threshold the TMP303 has a built-in hysteresis. The amount of hysteresis is determined by the hysteresis pins, $HYST_{SET0}$ and $HYST_{SET1}$ . These pins are digital inputs and must be tied either high or low, according to Table 1.

#### *9.2.1.2 Detailed Design Procedure*

Select the appropriate TMP303 device that matches the application requirements; see the *器件选项* table for different trip point ranges. Connect the $HYST_{SET0}$ and $HYST_{SET1}$ pins according to the application requirements; see Table 1. In Figure 13 the TMP303 device is configured with a 1°C hysteresis window (that is, $HYST_{SET0}$ = $HYST_{SET1}$ = GND). Place a 0.1-µF bypass capacitor close to the TMP303 device to reduce the noise coupled from the power supply.


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## Typical Applications (continued)

### 9.2.1.3 Application Curves

Figure 14 and Figure 15 show the TMP303A power-on response with the ambient temperature ($T_A$) less than 60°C and greater than 60°C respectively. TMP303B, TMP303C, TMP303D, TMP303E, TMP303F, and TMP303G devices behave similarly with regards to power-on response with $T_A$ below or above the trip point.

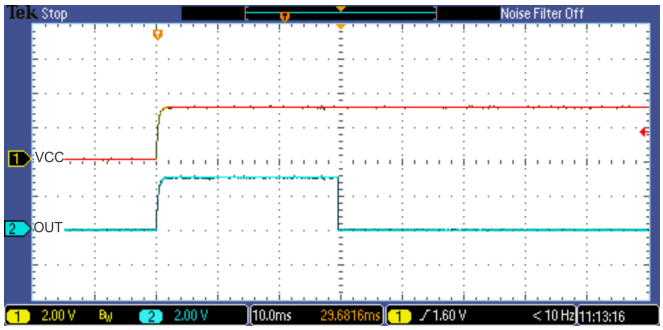



**Figure 14. TMP303A Power-On Response, $T_A$ Less Than 60°C**

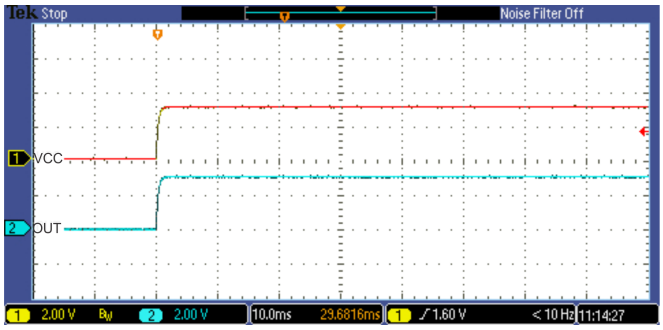



**Figure 15. TMP303A Power-On Response, $T_A$ Greater Than 60°C**

### 9.2.2 TMP303 With Switches

Figure 16 shows the most generic implementation of the TMP303 family of devices. Switches are shown connecting the $HYST_{SET0}$ and $HYST_{SET1}$ pins to either $V_S$ or GND. The use of switches is not a requirement; the switches are shown only to illustrate the various pin connection combinations. In practice, connecting the $HYST_{SET0}$ and $HYST_{SET1}$ pins to ground or directly to the $V_S$ pin is sufficient and minimizes board space and cost. If additional flexibility is desired, connections from the $HYST_{SET0}$ and $HYST_{SET1}$ pins can be made through 0-Ω resistors, which can be either populated or not, depending upon the desired connection.

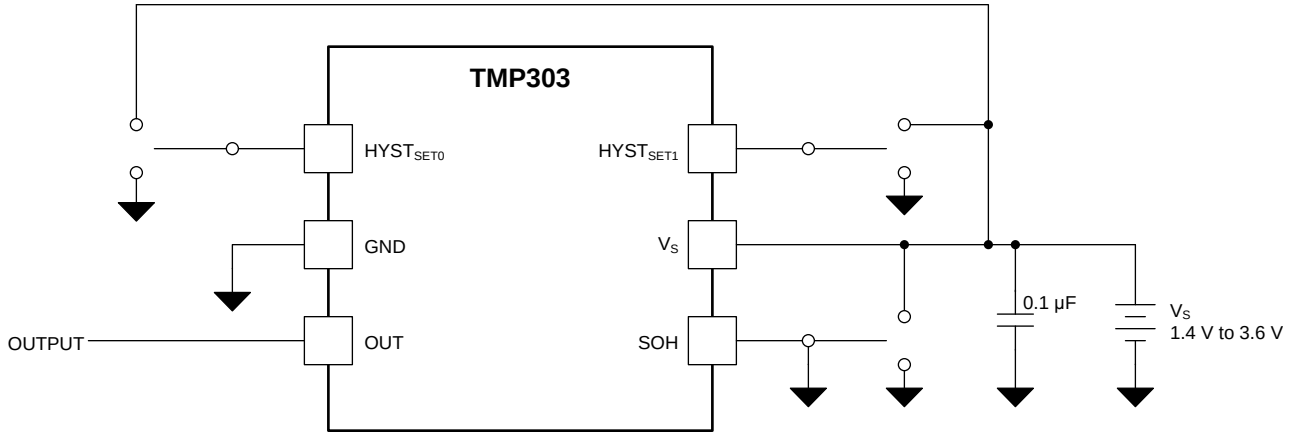



**Figure 16. TMP303 With Switches**

## Typical Applications (continued)

### 9.2.3 Simple Fan Controller

The circuit in Figure 17 senses system temperature and turns a cooling fan on when the sensor's temperature exceeds a preselected value. The TMP303 device can be used directly to control the fan. The OUT pin is active high, and it can be used directly to drive the DC fan. When temperature is within the temperature limits of the system, the fan turns off, and when the temperature exceeds the trip-point, the fan turns on. In this example, the TMP303A device is used and is configured with a 1°C hysteresis window ($HYST_{SET0}$ = $HYST_{SET1}$ = GND). The TMP303A high trip-point is 60°C. When this trip-point temperature is exceeded, the output (OUT) changes state from low to high. The output does not return to its low state until the temperature decreases below ($T_H$ – *hysteresis*) = 59°C.

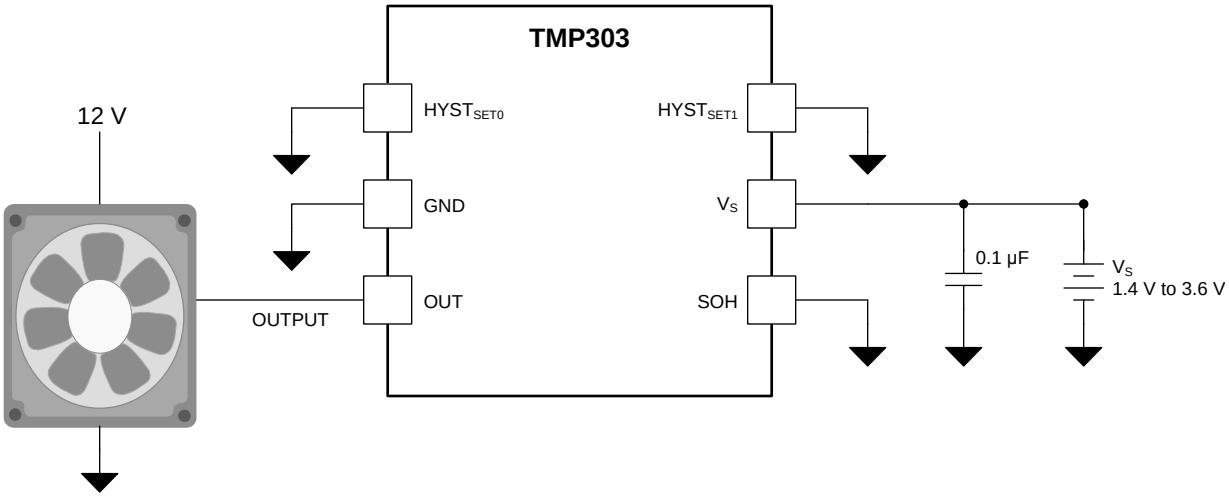



**Figure 17. Simple Fan Controller**


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## Typical Applications (continued)

### 9.2.4 Wireless Fixed Temperature Heat Detector

Heat detectors are needed in building automation. Conventional heat detectors need cables to supply power and send the information back to a central system. Adding cables can be very costly and technically challenging in old buildings, this leads to wireless battery operated heat detectors as preferred solutions. Running on battery requires designing a very low power system for long haul. TMP303 can be used to design a low power heat detector due to its very low quiescent current (5 µA maximum). The TMP303 device does not require any additional components and can be interfaced with the MCU using only one GPIO. As an example, a wireless transceiver with internal MCU can be used to monitor the TMP303 and communicate with a central system or turn on an alarm in case of temperatures exceeding the trip-point. Figure 18 shows typical connections.

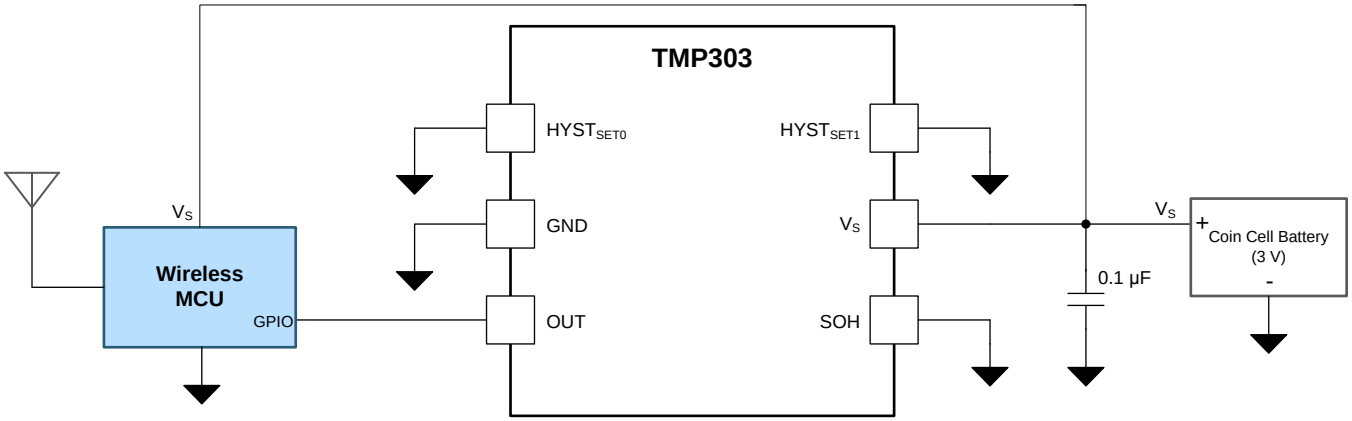



**Figure 18. Wireless Fixed Temperature Heat Detector**

# 10 Power Supply Recommendations

The TMP303 family of devices is designed to operate from a single power supply within the range of 1.4 V to 3.6 V. No specific power supply sequencing with respect to any of the input or output pins is required.

# 11 Layout

## 11.1 Layout Guidelines

Mount the TMP303 to a PCB as shown in Figure 19. For this example the $HYST_{SET0}$ and $HYST_{SET1}$ pins are connected directly to ground. Connecting these pins to ground configures the device for 1°C hysteresis. The SOH pin is grounded in this layout. Leaving this pin floating has no effect on the behavior of the TMP303.

- Bypass the $V_S$ pin to ground with a low-ESR ceramic bypass capacitor. The typical recommended bypass capacitance is a 0.1-µF ceramic capacitor with a X5R or X7R dielectric. The optimum placement is closest to the $V_S$ and GND pins of the device. Take care in minimizing the loop area formed by the bypass-capacitor connection, the $V_S$ pin, and the GND pin of the IC. Additional bypass capacitance can be added to compensate for noisy or high-impedance power supplies.
- The OUT pin is a push-pull, active-high output and does not require a pullup resistor to $V_S$.

## 11.2 Layout Example

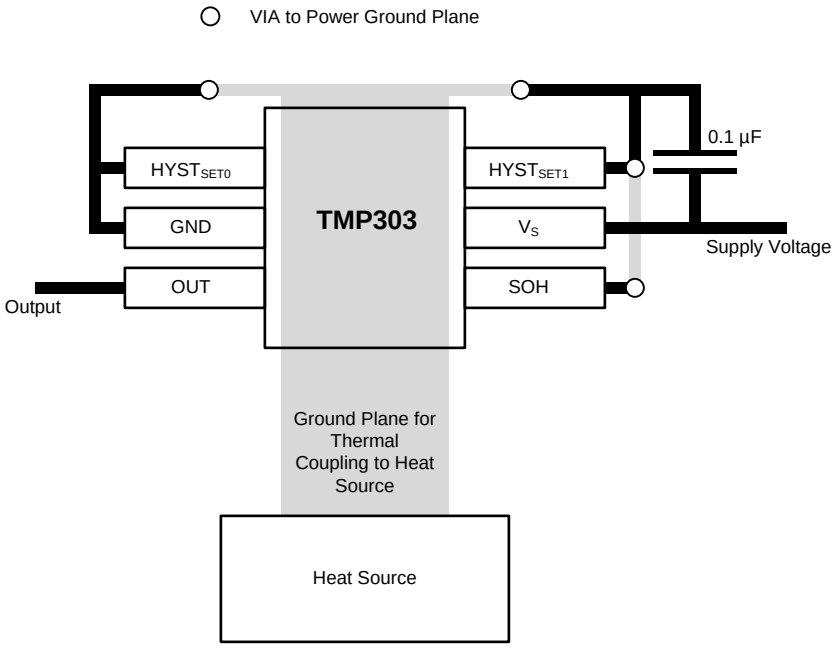



**Figure 19. PCB Layout Example**


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# 12 器件和文档支持

## 12.1 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。

## 12.2 社区资源

**下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 《使用条款》。**

**TI E2E™ 在线社区** ***TI 的工程师对工程师 (E2E) 社区。*** **此社区的创建目的在于促进工程师之间的协作。在 e2e.ti.com 中，您可以咨询问题、分享知识、拓展思路并与同行工程师一道帮助解决问题。**

**设计支持** ***TI 参考设计支持*** **可帮助您快速查找有帮助的 E2E 论坛、设计支持工具以及技术支持的联系信息。**

## 12.3 商标

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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。

## 12.5 术语表

SLYZ022 — *TI 术语表*。

这份术语表列出并解释术语、缩写和定义。

# 13 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。

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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) |
|---|---|---|---|---|---|---|---|---|---|
| TMP303ADRLR | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU \| NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | OCO |
| TMP303ADRLR.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | OCO |
| TMP303ADRLR.B | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | OCO |
| TMP303ADRLT | Obsolete | Production | SOT-5X3 (DRL) \| 6 | - | - | Call TI | Call TI | -40 to 125 | OCO |
| TMP303BDRLR | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU \| NIPDAUAG | Level-1-260C-UNLIM | -40 to 125 | QWM |
| TMP303BDRLR.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QWM |
| TMP303BDRLR.B | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | QWM |
| TMP303BDRLT | Obsolete | Production | SOT-5X3 (DRL) \| 6 | - | - | Call TI | Call TI | -40 to 125 | QWM |
| TMP303CDRLR | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 11U |
| TMP303CDRLR.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 11U |
| TMP303CDRLT | Obsolete | Production | SOT-5X3 (DRL) \| 6 | - | - | Call TI | Call TI | -40 to 125 | 11U |
| TMP303DDRLR | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (11U, 12Z) |
| TMP303DDRLR.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (11U, 12Z) |
| TMP303DDRLRG4 | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 11U |
| TMP303DDRLRG4.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 11U |
| TMP303DDRLT | Obsolete | Production | SOT-5X3 (DRL) \| 6 | - | - | Call TI | Call TI | -40 to 125 | 12Z |
| TMP303EDRLR | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 17Z |
| TMP303EDRLR.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 17Z |
| TMP303EDRLR.B | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 17Z |
| TMP303EDRLT | Obsolete | Production | SOT-5X3 (DRL) \| 6 | - | - | Call TI | Call TI | -40 to 125 | 17Z |
| TMP303FDRLR | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 18A |
| TMP303FDRLR.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 18A |
| TMP303FDRLR.B | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 18A |
| TMP303FDRLT | Obsolete | Production | SOT-5X3 (DRL) \| 6 | - | - | Call TI | Call TI | -40 to 125 | 18A |
| TMP303GDRLR | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 18B |
| TMP303GDRLR.A | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 18B |
| TMP303GDRLR.B | Active | Production | SOT-5X3 (DRL) \| 6 | 4000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 18B |
| TMP303GDRLT | Obsolete | Production | SOT-5X3 (DRL) \| 6 | - | - | Call TI | Call TI | -40 to 125 | 18B |

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

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

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

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

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

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

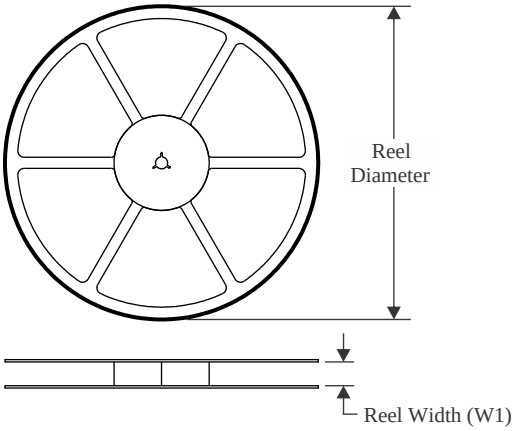
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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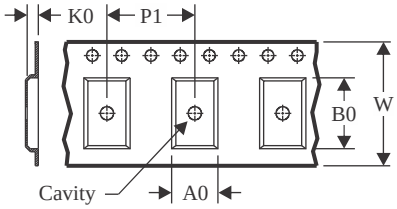
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## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

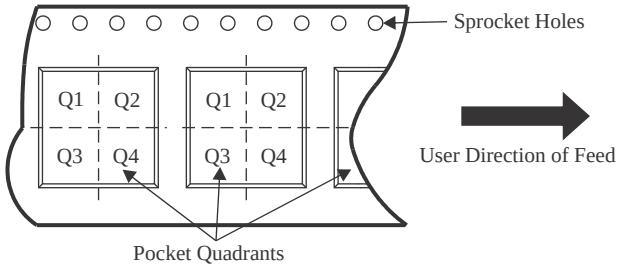



**TAPE DIMENSIONS**




| | |
|---|---|
| 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 |

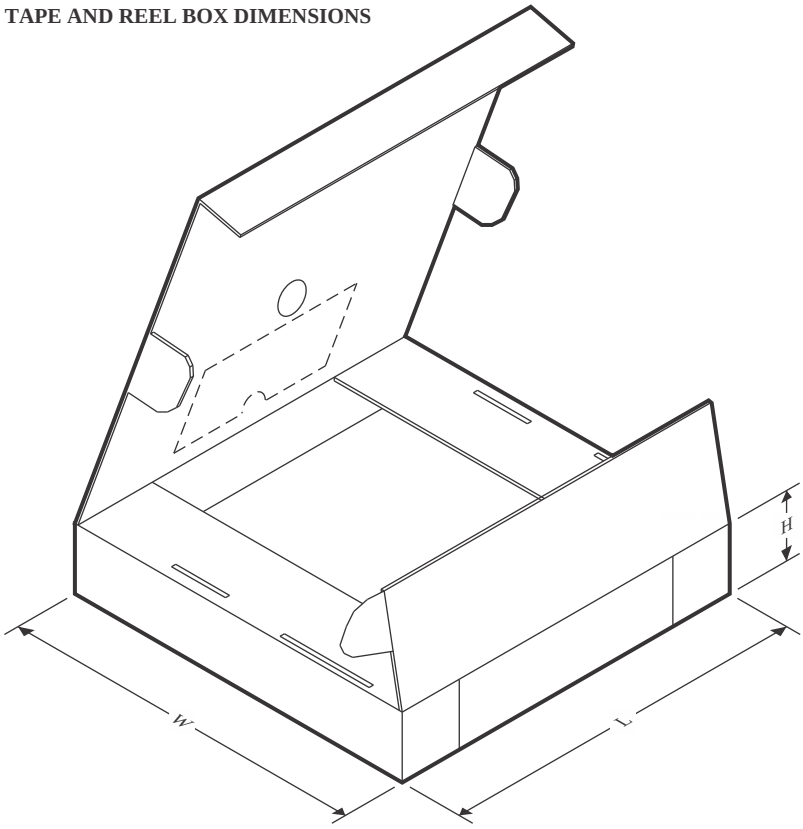
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TMP303ADRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TMP303ADRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 1.98 | 1.78 | 0.69 | 4.0 | 8.0 | Q3 |
| TMP303BDRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 1.98 | 1.78 | 0.69 | 4.0 | 8.0 | Q3 |
| TMP303BDRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TMP303CDRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TMP303DDRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TMP303DDRLRG4 | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TMP303EDRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TMP303FDRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TMP303GDRLR | SOT-5X3 | DRL | 6 | 4000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 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) |
|---|---|---|---|---|---|---|---|
| TMP303ADRLR | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |
| TMP303ADRLR | SOT-5X3 | DRL | 6 | 4000 | 202.0 | 201.0 | 28.0 |
| TMP303BDRLR | SOT-5X3 | DRL | 6 | 4000 | 202.0 | 201.0 | 28.0 |
| TMP303BDRLR | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |
| TMP303CDRLR | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |
| TMP303DDRLR | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |
| TMP303DDRLRG4 | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |
| TMP303EDRLR | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |
| TMP303FDRLR | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |
| TMP303GDRLR | SOT-5X3 | DRL | 6 | 4000 | 210.0 | 185.0 | 35.0 |

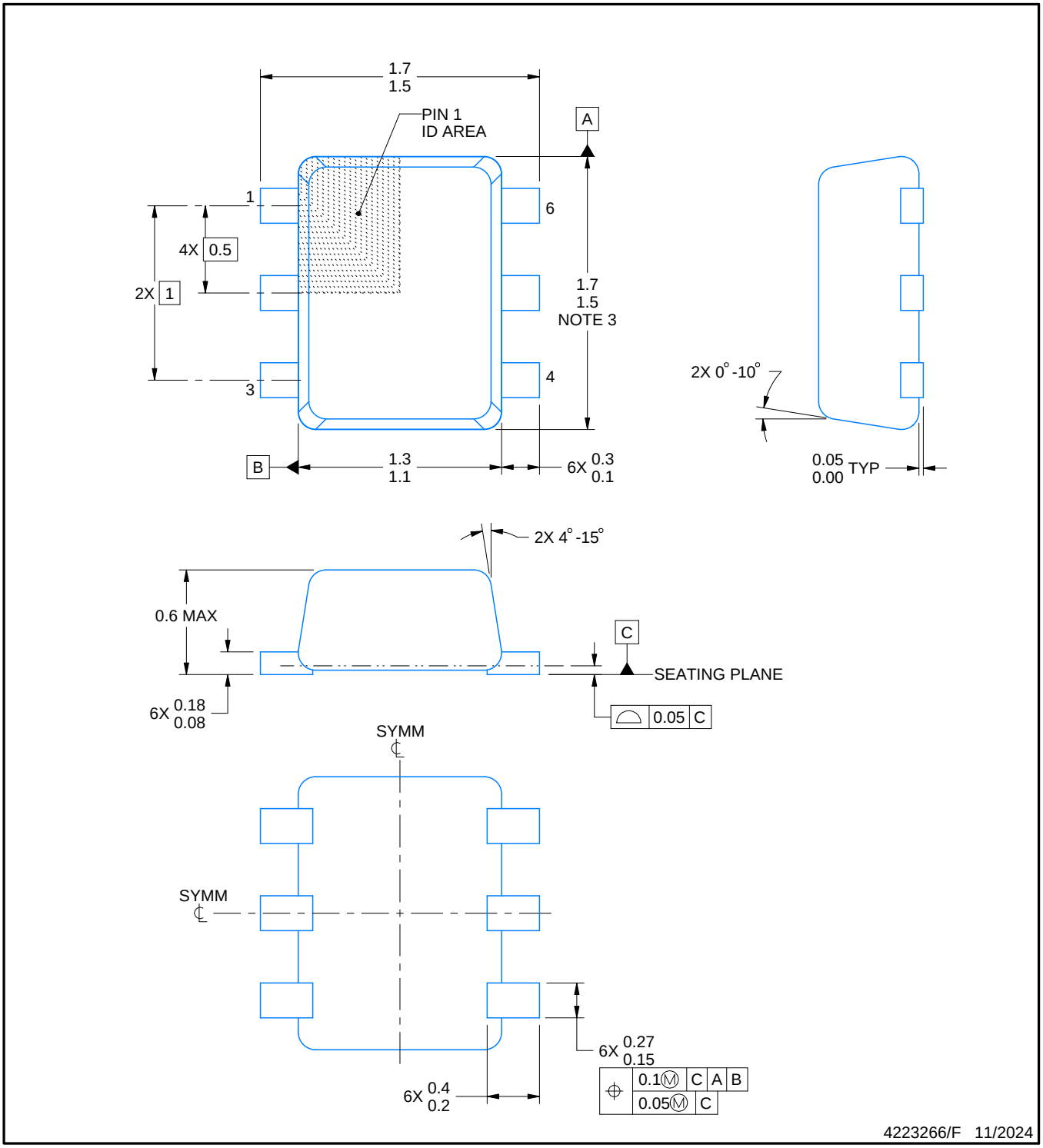


# PACKAGE OUTLINE

## DRL0006A

## SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE




NOTES:

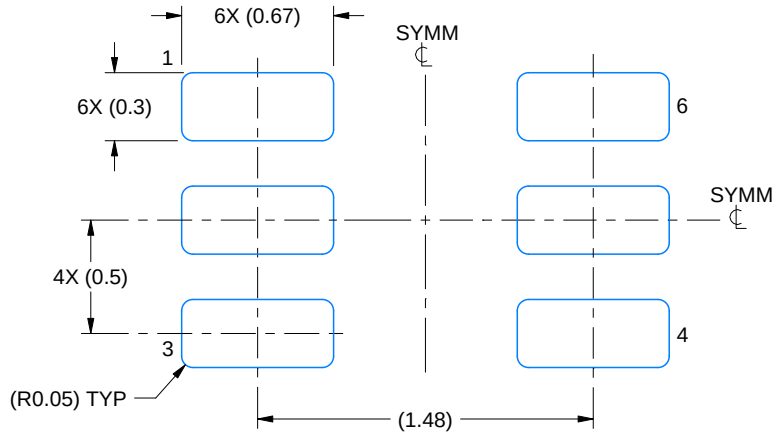
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-293 Variation UAAD

# EXAMPLE BOARD LAYOUT

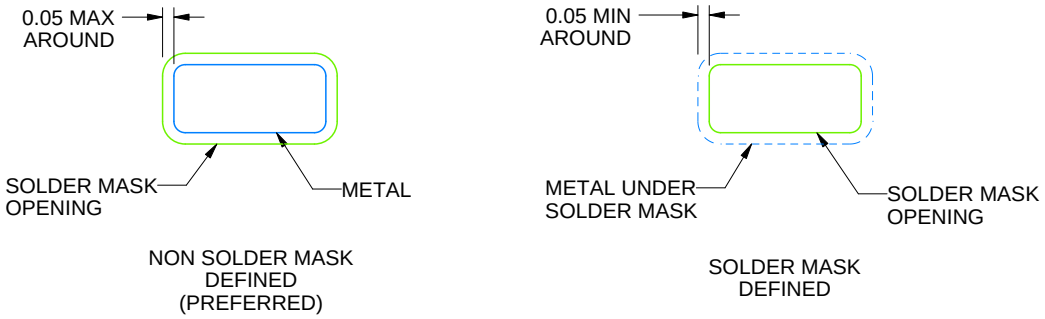
## DRL0006A

## SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE




LAND PATTERN EXAMPLE
SCALE:30X




SOLDERMASK DETAILS

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NOTES: (continued)

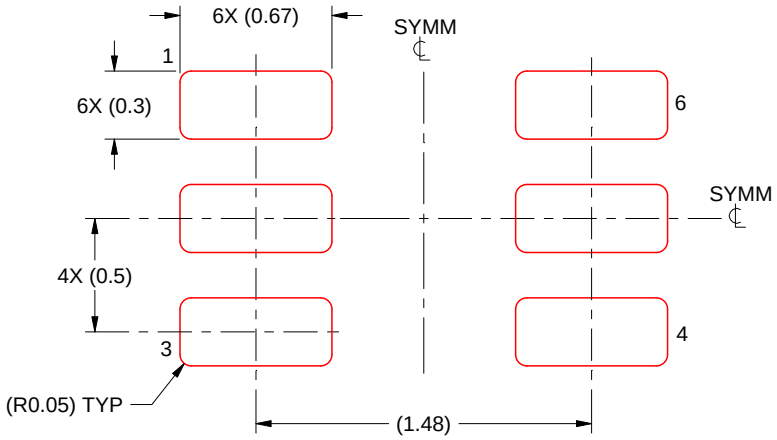
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
7. Land pattern design aligns to IPC-610, Bottom Termination Component (BTC) solder joint inspection criteria.

# EXAMPLE STENCIL DESIGN

## DRL0006A

## SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE




SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:30X

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NOTES: (continued)

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

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最后更新日期：2025 年 10 月