# LM57 电阻可编程温度开关和模拟温度传感器

## 1 特性

- 关于 AEC-Q100 1 级/0 级/0 级扩展标准（符合 AEC-Q100 标准并采用汽车级流程制造），请参见 LM57-Q1 数据表
- 可通过外部电阻在 −40°C 至 +150°C 温度范围内设置跳变温度，
  精度为 ±1.7°C 或 ±2.3°C
- 电阻容差不会引入误差
- 推挽和开漏开关输出
- 宽工作温度范围：−50°C 至 150°C
- 超线性模拟 $V_{TEMP}$ 温度传感器输出，−50°C 至 +150°C 温度范围内的精度为
  ±0.8°C 或 ±1.3°C
- 具有短路保护的模拟和数字输出
- 数字输出具有锁存功能
- TRIP-TEST 引脚支持系统内测试
- 低功耗特性最大程度减少自发热，使其低于 0.02°C

## 2 应用范围

- 工厂自动化
- 工业用
- 汽车用
- 井下设备
- 航空电子设备
- 电信基础设施

## 3 说明

LM57 器件是一款具有模拟温度传感器输出的精密双路输出温度开关，适用于宽温度范围的工业级应用。 跳变温度 ($T_{TRIP}$) 可从 –40°C 至 150°C 温度范围内的 256 种可能值中进行选择。$V_{TEMP}$ 是 AB 类模拟电压输出，该电压输出与温度成正比，负温度系数 (NTC) 可编程。 两个外部 1% 电阻设置 $T_{TRIP}$ 和 $V_{TEMP}$ 斜率。 数字和模拟输出具有保护功能，并且可监视系统过热事件。

内置的热滞后功能 ($T_{HYST}$) 可防止数字输出发生振荡。 $T_{OVER}$ 和 $\overline{T_{OVER}}$ 数字输出将在芯片温度超过 $T_{TRIP}$ 时置为有效，在芯片温度低于 $T_{TRIP}$ 与 $T_{HYST}$ 的差值时置为无效。

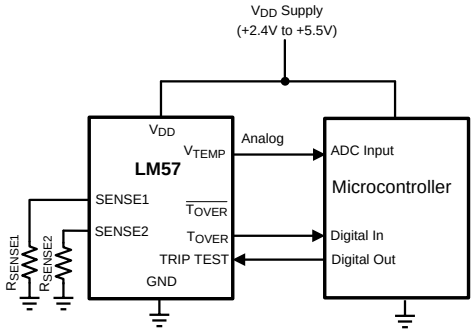
$T_{OVER}$ 为高电平有效，并且采用推挽结构。 $\overline{T_{OVER}}$ 为低电平有效，并且采用开漏结构。 将 $T_{OVER}$ 与 TRIP-TEST 相连，可在输出发生跳变后将其锁存。 将 TRIP-TEST 强制为低电平可将输出清零。 将 TRIP-TEST 驱动为高电平会将数字输出置为有效。 处理器可检查 $T_{OVER}$ 或 $\overline{T_{OVER}}$ 的状态，从而确认它们是否已切换至激活状态。 这样一来，便可以在系统装配后现场验证比较器和输出电路的功能。 当 TRIP-TEST 为高电平时，$V_{TEMP}$ 引脚为跳变基准电压。 系统随后可使用该电压计算 LM57

器件信息 (1) (2)

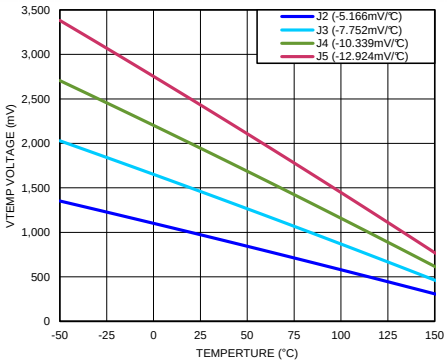
| 器件型号 | 封装 | 封装尺寸（标称值） |
|---|---|---|
| LM57BISD | WSON (8) | 2.50mm × 2.50mm |
| LM57FPW | TSSOP (8) | 3.00mm × 6.40mm |

(1) 要了解所有可用封装，请见数据表末尾的可订购产品附录。
(2) 关于器件比较，请参见 *Device Comparison Table* 。

**LM57 过热报警**




温度传递函数



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## 4 修订历史记录

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

**Changes from Revision D (February 2013) to Revision E** **Page**

- 已添加*引脚配置和功能*部分，*ESD 额定值*表，*特性描述*部分，*器件功能模式*，*应用和实施*部分，*电源相关建议*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
- 已在整篇数据表中添加 TSSOP 封装选项 ... 1

**Changes from Revision C (February 2010) to Revision D** **Page**

- 已更改 国家数据表的布局以符合 TI 格式 ... 1


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# 5 Device Comparison Table

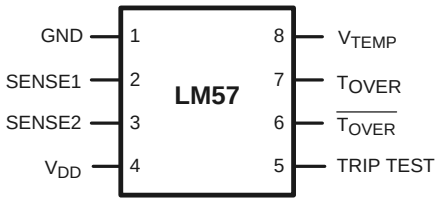
| ORDER NUMBER | PACKAGE | GRADE (TEMP RANGE) | $V_{TEMP}$ ACCURACY | TRIP POINT ACCURACY | HYSTERESIS |
|---|---|---|---|---|---|
| LM57BISD-5, LM57BISDX-5 | WSON/SD/NGR /DFN (8) | Commercial (-50°C to 150°C) | ±0.8°C | ±1.5°C | 5°C |
| LM57BISD-10, LM57BISDX-10 | WSON/SD/NGR /DFN (8) | Commercial (-50°C to 150°C) | ±0.8°C | ±1.5°C | 10°C |
| LM57CISD-5, LM57CISD-5 | WSON/SD/NGR /DFN (8) | Commercial (-50°C to 150°C) | ±1.3°C | ±2.3°C | 5°C |
| LM57CISD-10, LM57CISDX-10 | WSON/SD/NGR /DFN (8) | Commercial (-50°C to 150°C) | ±1.3°C | ±2.3°C | 10°C |
| LM57FPW, LM57FPWR | PW/TSSOP (8) | Commercial (-50°C to 150°C) | ±1.3°C | ±2.3°C | 5°C |
| LM57TPW, LM57TPWR | PW/TSSOP (8) | Commercial (-50°C to 150°C) | ±1.3°C | ±2.3°C | 10°C |
| LM57FSPWQ1, LM57FSPWRQ1 (1) | PW/TSSOP (8) | Automotive Grade 0 Extended (-50°C to 160°C) | ±1.3°C | ±2.3°C | 5°C |
| LM57TSPWQ1, LM57TSPWRQ1 (1) | PW/TSSOP (8) | Automotive Grade 0 Extended (-50°C to 160°C) | ±1.3°C | ±2.3°C | 10°C |
| LM57FEPWQ1, LM57FEPWRQ1 (1) | PW/TSSOP (8) | Automotive Grade 0 Standard (-50°C to 150°C) | ±1.3°C | ±2.3°C | 5°C |
| LM57TEPWQ1, LM57TEPWRQ1 (1) | PW/TSSOP (8) | Automotive Grade 0 Standard (-50°C to 150°C) | ±1.3°C | ±2.3°C | 10°C |
| LM57FQPWQ1, LM57FQPWRQ1 (1) | PW/TSSOP (8) | Automotive Grade 1 Standard (-50°C to 125°C) | ±1.3°C | ±2.3°C | 5°C |
| LM57TQPWQ1, LM57TQPWRQ1 (1) | PW/TSSOP (8) | Automotive Grade 1 Standard (-50°C to 125°C) | ±1.3°C | ±2.3°C | 10°C |

(1) For Automotive grade device complete datasheet see LM57-Q1.

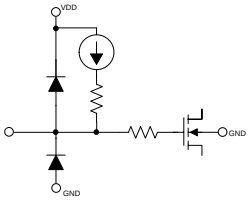
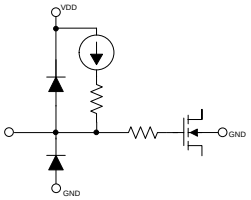
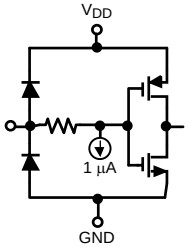
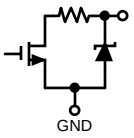
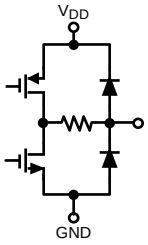
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# 6 Pin Configuration and Functions

**TSSOP/PW and WSON/SD/NGR/DFN Packages**
**8-Pin**
**Top View**

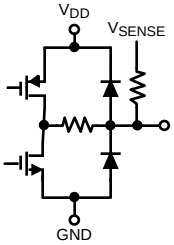



## Pin Functions

| PIN | | TYPE | EQUIVALENT CIRCUIT | DESCRIPTION |
|---|---|---|---|---|
| NAME | NO. | | | |
| GND | 1 | Ground | — | Power supply ground |
| SENSE1 | 2 | — |  | Trip-point resistor sense. One of two sense pins which selects the temperature at which $T_{OVER}$ and $\overline{T_{OVER}}$ will assert. |
| SENSE2 | 3 | — |  | Trip-point resistor sense. One of two sense pins which selects the temperature at which $T_{OVER}$ and $\overline{T_{OVER}}$ will assert. |
| $V_{DD}$ | 4 | Power | | Supply voltage |
| TRIP TEST | 5 | Digital Input |  | TRIP TEST pin. Active High input.<br>If TRIP TEST = 0 (default), then the $V_{TEMP}$ output has the analog temperature sensor output voltage.<br>If TRIP TEST = 1, then $T_{OVER}$ and $\overline{T_{OVER}}$ outputs are asserted and $V_{TEMP}$ = $V_{TRIP}$, the temperature trip voltage.<br>Tie this pin to ground if not used. |
| $\overline{T_{OVER}}$ | 6 | Digital Output |  | Overtemperature switch output<br>Active low, open-drain (see *LM57 $V_{TEMP}$ Voltage-to-Temperature Equations* regarding required pullup resistor.)<br>Asserted when the measured temperature exceeds the Trip Point Temperature or if TRIP TEST = 1<br>This pin may be left open if not used. |
| $T_{OVER}$ | 7 | Digital Output |  | Overtemperature switch output<br>Active high, push-pull<br>Asserted when the measured temperature exceeds the trip point temperature or if TRIP TEST = 1<br>This pin may be left open if not used. |


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**Pin Functions (continued)**

| PIN | | TYPE | EQUIVALENT CIRCUIT | DESCRIPTION |
|---|---|---|---|---|
| NAME | NO. | | | |
| $V_{TEMP}$ | 8 | Analog Output |  | $V_{TEMP}$ analog voltage output<br>If TRIP TEST = 0, then $V_{TEMP} = V_{TS}$, temperature sensor output voltage<br>If TRIP TEST = 1, then $V_{TEMP} = V_{TRIP}$, temperature trip voltage<br>This pin may be left open if not used. |
| Thermal Pad (WSON package only) | — | — | — | Connected to GND |

# 7 Specifications

## 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1) (2)

| | MIN | MAX | UNIT |
|---|---|---|---|
| Supply voltage | −0.3 | 6 | V |
| Voltage at $\overline{T_{OVER}}$ | −0.3 | 6 | V |
| Voltage at $T_{OVER}$ , $V_{TEMP}$, TRIP-TEST, SENSE1, and SENSE2 | −0.3 | ($V_{DD}$ + 0.3 V) | V |
| Current at any pin | | 5 | mA |
| Storage temperature | −65 | 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.
(2) Soldering process must comply with Reflow Temperature Profile specifications. Refer to www.ti.com/packaging.

## 7.2 ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| LM57BISD and LM57CISD in WSON package | | | | |
| $V_{(ESD)}$ | Electrostatic discharge (1) | Human body model (HBM) | ±5500 | V |
| | | Charged-device model (CDM) | ±1250 | |
| | | Machine Model (MM) | ±450 | |
| LM57FPW and LM57TPW in TSSOP package | | | | |
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 (2) | ±2000 | V |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101 (3) | ±750 | |

(1) The Human Body Model (HBM) is a 100-pF capacitor charged to the specified voltage then discharged through a 1.5-kΩ resistor into each pin. The Machine Model (MM) is a 200 pF capacitor charged to the specified voltage then discharged directly into each pin. The Charged Device Model (CDM) is a specified circuit characterizing an ESD event that occurs when a device acquires charge through some triboelectric (frictional) or electrostatic induction processes and then abruptly touches a grounded object or surface.
(2) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(3) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

## 7.3 Recommended Operating Conditions

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| Supply voltage | | 2.4 | | 5.5 | V |
| Free air temperature range ($T_{MIN} \le T_A \le T_{MAX}$) | | −50 | | 150 | °C |

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## 7.4 Thermal Information

| THERMAL METRIC (1) | | LM57 | | UNIT |
|---|---|---|---|---|
| | | NGR (WSON/SD) | PW (TSSOP) | |
| | | 8 PINS | 8 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 71.3 | 183 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 82.8 | 66 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 43.4 | 111 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 2.2 | 8 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 43.7 | 110 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | 11.9 | — | °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 - Accuracy Characteristics – Trip Point Accuracy

| PARAMETER | | TEST CONDITIONS | | LM57B | | | LM57C, LM57F or LM57T | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| Trip Point Accuracy (Includes 1% set-resistor tolerance) (1) | J2 | $T_A$ = −41°C to 52°C | $V_{DD}$ = 2.4 V to 5.5 V | | | ±1.5 | | | ±2.3 | °C |
| | J3 | $T_A$ = 52°C to 97°C | $V_{DD}$ = 2.4 V to 5.5 V | | | ±1.5 | | | ±2.3 | °C |
| | J4 | $T_A$ = 97°C to 119°C | $V_{DD}$ = 2.4 V to 5.5 V | | | ±1.5 | | | ±2.3 | °C |
| | J5 | $T_A$ = 119°C to free air temperature max | $V_{DD}$ = 2.4 V to 5.5 V | | | ±1.5 | | | ±2.3 | °C |

(1) Accuracy is defined as the error between the measured and reference output voltages, tabulated in the Conversion Table at the specified conditions of supply gain setting, voltage, and temperature (expressed in °C). Accuracy limits include line regulation within the specified conditions. Accuracy limits do not include load regulation; they assume no DC load.

## 7.6 Electrical Characteristics - Accuracy Characteristics – $V_{TEMP}$ Analog Temperature Sensor Output Accuracy

These limits do not include DC load regulation. These stated accuracy limits are with reference to the values in Table 1.

| PARAMETER | | TEST CONDITIONS | | LM57B | | | LM57C, LM57F or LM57T | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{TEMP}$ Accuracy (These stated accuracy limits are with reference to the values in Table 1, LM57 $V_{TEMP}$ Temperature-to-Voltage.) (1) | J2 | $T_A$ = −50°C to free air temperature max | $V_{DD}$ = 2.4 V to 5.5 V | | | ±0.95 | | | ±1.3 | °C |
| | J3 | $T_A$ = −50°C to free air temperature max | $V_{DD}$ = 2.4 V to 5.5 V | | | ±0.8 | | | ±1.3 | °C |
| | J4 | $T_A$ = 20°C to 50°C | $V_{DD}$ = 2.4 V to 5.5 V | | | ±0.7 | | | ±1.3 | °C |
| | | $T_A$ = 0°C to free air temperature max | $V_{DD}$ = 2.7 V to 5.5 V | | | ±0.7 | | | ±1.3 | |
| | | $T_A$ = −50°C to 0°C | $V_{DD}$ = 3.1 V to 5.5 V | | | ±0.8 | | | ±1.3 | |
| | J5 | $T_A$ = 60°C to free air temperature max | $V_{DD}$ = 2.4 V to 5.5 V | | | ±0.7 | | | ±1.3 | °C |
| | | $T_A$ = 20°C to 50°C | $V_{DD}$ = 2.9 V to 5.5 V | | | ±0.7 | | | ±1.3 | |
| | | $T_A$ = 0°C to free air temperature max | $V_{DD}$ = 3.2 V to 5.5 V | | | ±0.7 | | | ±1.3 | |
| | | $T_A$ = −50°C to 0°C | $V_{DD}$ = 4 V to 5.5 V | | | ±0.8 | | | ±1.3 | |

(1) Accuracy is defined as the error between the measured and reference output voltages, tabulated in the Conversion Table at the specified conditions of supply gain setting, voltage, and temperature (expressed in °C). Accuracy limits include line regulation within the specified conditions. Accuracy limits do not include load regulation; they assume no DC load.

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## 7.7 Electrical Characteristics

Unless otherwise noted, these specifications apply for $V_{DD}$ = 2.4 to 5.5 V. Limits apply over free air temperature range.

| PARAMETER | | TEST CONDITIONS | MIN (1) | TYP (2) | MAX (1) | UNIT |
|---|---|---|---|---|---|---|
| **TEMPERATURE SENSOR** | | | | | | |
| | $V_{TEMP}$ sensor gain | J2: −50°C to 52°C | | −5.166 | | mV/°C |
| | | J3: 52°C to 97°C | | −7.752 | | |
| | | J4: 97°C to 119°C | | −10.339 | | |
| | | J5: 119°C to 150°C | | −12.924 | | |
| | Line regulation DC: supply-to-$V_{TEMP}$ (3) | $V_{DD}$ = 2.4 V to 5.5 V<br>Temp = 90°C | | 0.18 | | mV |
| | | | | 58 | | µV/V |
| | | | | −84 | | dB |
| | Load regulation: $V_{TEMP}$ output (4) | Source ≤ 240 µA, ($V_{DD}$ – $V_{TEMP}$) ≥ 200 mV; $T_A$ = −50°C to 150°C | | | −1 | mV |
| | | Sink ≤ 300 µA, $V_{TEMP}$ ≥ 360 mV; $T_A$ = −50°C to 150°C | | | 1 | |
| | | Source or sink = 100 µA; $T_A$ = −50°C to 150°C | | 1 | | Ω |
| | Maximum Load capacitance: $V_{TEMP}$ output | No output series resistor required; (See *$V_{TEMP}$ Capacitive Loads*) | | | 1100 | pF |
| $I_S$ | Supply current: quiescent (5) | | | 24 | 28 | µA |
| **TRIP-TEST INPUT** | | | | | | |
| $V_{IH}$ | Logic 1 threshold voltage | | $V_{DD}$ – 0.5 | | | V |
| $V_{IL}$ | Logic 0 threshold voltage | | | | 0.5 | V |
| $I_{IH}$ | Logic 1 input current | | | 1.4 | 3 | µA |
| $I_{IL}$ | Logic 0 input leakage current (6) | $T_A$ = −50°C to 150°C | | 0.001 | 1 | µA |
| **$T_{OVER}$ (PUSH-PULL, ACTIVE-HIGH) OUTPUT** | | | | | | |
| $V_{OH}$ | Logic 1 push-pull output voltage | Source ≤ 600 µA | $V_{DD}$ – 0.2 | | | V |
| | | Source ≤ 1.2 mA | $V_{DD}$ – 0.45 | | | |
| $V_{OL}$ | Logic 0 output voltage | Sink ≤ 600 µA | | | 0.2 | V |
| | | Sink ≤ 1.2 mA | | | 0.45 | |
| **$\overline{T}_{OVER}$ (OPEN-DRAIN, ACTIVE-LOW) OUTPUT** | | | | | | |
| $V_{OL}$ | Logic 0 output voltage | Sink ≤ 600 µA | | | 0.2 | V |
| | | Sink ≤1.2 mA | | | 0.45 | |
| $I_{OH}$ | Logic 1 output leakage current (6) | Temperature = 30°C; | | 0.001 | 1 | µA |

(1) Limits are specified to TI's average outgoing quality level (AOQL).
(2) Typicals are at $T_J$ = $T_A$ = 25°C and represent most likely parametric norm.
(3) Line regulation (DC) is calculated by subtracting the output voltage at the highest supply voltage from the output voltage at the lowest supply voltage. The typical DC line regulation specification does not include the output voltage shift discussed in *$V_{TEMP}$ Voltage Shift*.
(4) Source currents are flowing out of the LM57. Sink currents are flowing into the LM57. Load Regulation is calculated by measuring $V_{TEMP}$ at 0 µA and subtracting the value with the conditions specified.
(5) Supply current refers to the quiescent current of the LM57 only and does not include any load current
(6) This current is leakage current only and is therefore highest at high temperatures. Prototype test indicate that the leakage is well below 1 µA over the full temperature range. This 1 µA specification reflects the limitations of measuring leakage at room temperature. For this reason only, the leakage current is not specified at a lower value.


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## Electrical Characteristics (continued)

Unless otherwise noted, these specifications apply for $V_{DD}$ = 2.4 to 5.5 V. Limits apply over free air temperature range.

| PARAMETER | | TEST CONDITIONS | MIN (1) | TYP (2) | MAX (1) | UNIT |
|---|---|---|---|---|---|---|
| **HYSTERESIS** | | | | | | |
| $T_{HYST}$ | Hysteresis temperature | 5°C hysteresis option (for all LM57F or LM57-5) | 4.7 | 5 | 5.4 | °C |
| | | 10°C hysteresis option (for all LM57T or LM57-10) | 9.6 | 10 | 10.6 | °C |

## 7.8 Switching Characteristics

Unless otherwise noted, these specifications apply for $V_{DD}$ = 2.4 to 5.5 V over the free air temperature range.

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $t_{EN}$ | Maximum time from power on to digital output enabled | | | 1.5 | 2.9 | ms |
| $t_{VTEMP}$ | Maximum time from power on to analog temperature ($V_{TEMP}$) valid | | | 1.5 | 2.9 | ms |

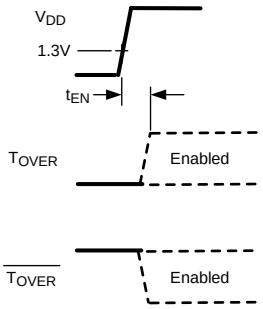



**Figure 1. Definition of $t_{EN}$**

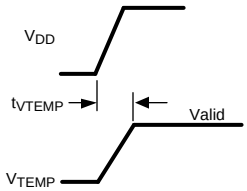



**Figure 2. Definition of $t_{VTEMP}$**

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## 7.9 Typical Characteristics

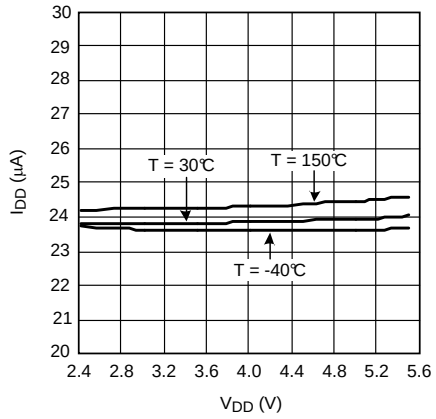



**Figure 3. Supply Current vs Supply Voltage**

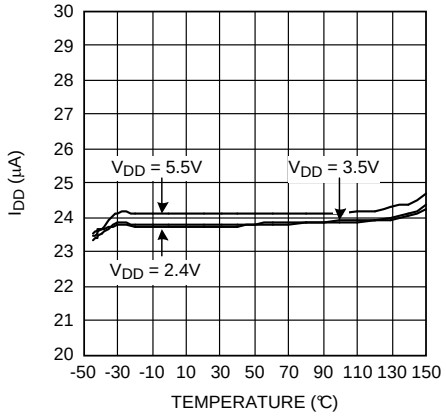



**Figure 4. Supply Current vs Temperature**

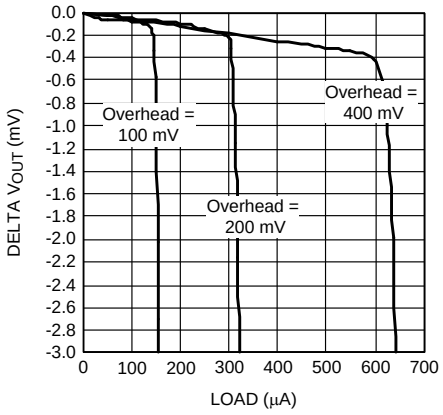



**Figure 5. Load Regulation: Change In $V_{TEMP}$ vs Source Current Overhead Is Vdd-Vtemp**

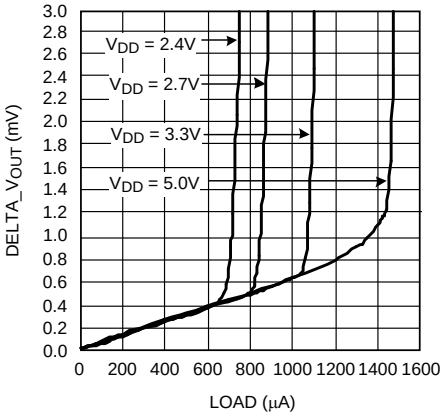



**Figure 6. Load Regulation: Change In $V_{TEMP}$ vs Sink Current**

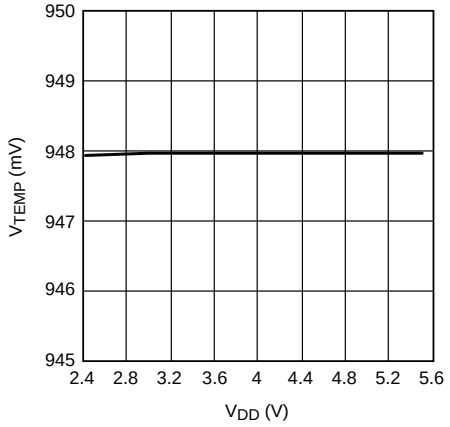



**Figure 7. Line Regulation: $V_{TEMP}$ vs Supply Voltage**

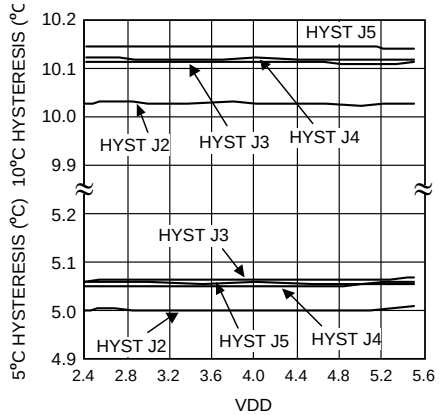



**Figure 8. Line Regulation: Hysteresis vs Supply Voltage 30°C**


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## Typical Characteristics (continued)

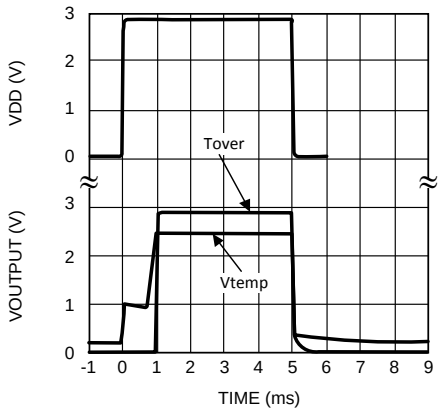



**Figure 9. Start-Up Response**

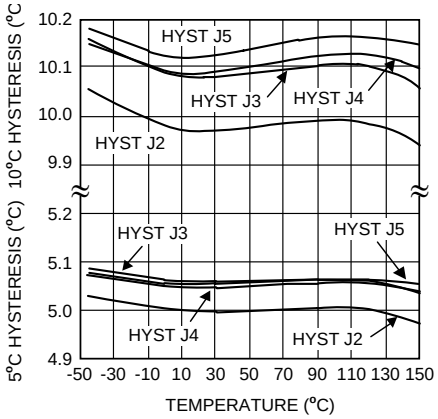



**Figure 10. Hysteresis vs Temperature**

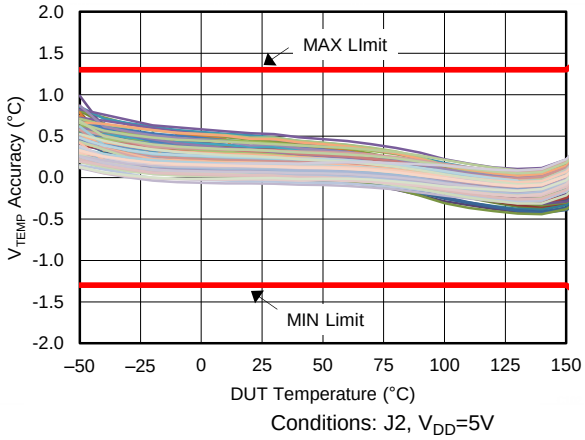



**Figure 11. J2 Accuracy Specification Over Temperature**

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# 8 Detailed Description

## 8.1 Overview

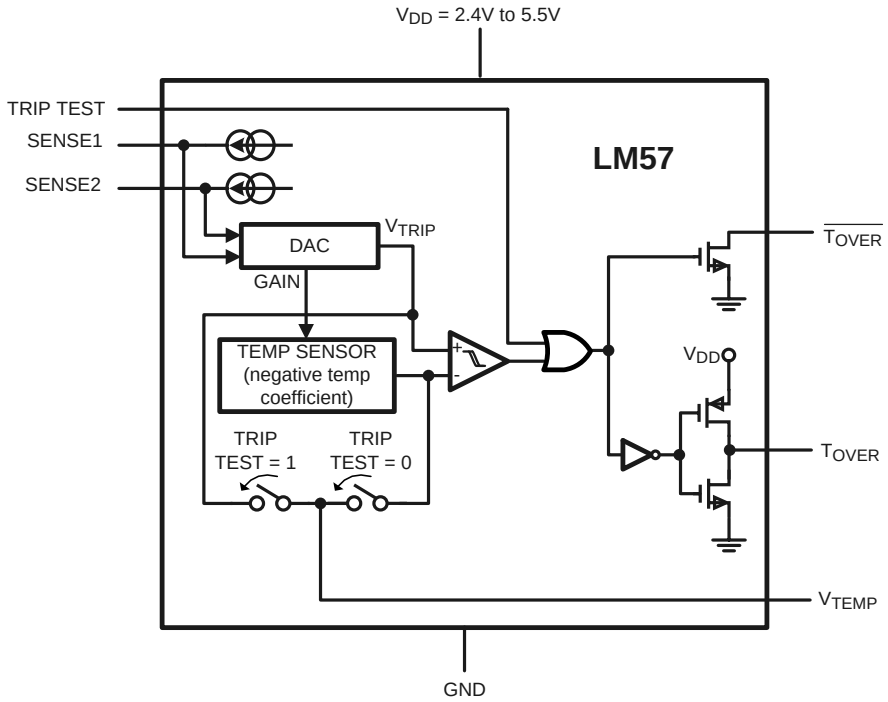
The LM57 is a precision, dual-output, temperature switch with analog temperature sensor output. The trip temperature ($T_{TRIP}$) is selected from 256 possible values by using two external 1% resistors. The $V_{TEMP}$ class AB analog output provides a voltage that is proportional to temperature. The LM57 includes an internal reference DAC, analog temperature sensor and analog comparator. The reference DAC is connected to one of the comparator inputs. The reference DAC output voltage ($V_{TRIP}$) is controlled by the value of resistance applied to the SENSE pins. The resistance value sets one of 16 "logic" levels at the SENSE pins. These "logic" levels are then decoded and applied to the DAC input, thus the actual resistance tolerance does not directly affect the threshold level accuracy. The result of the reference DAC voltage and the temperature sensor output comparison is provided on two output pins $\overline{T_{OVER}}$ and $T_{OVER}$.

The $V_{TEMP}$ output has a programmable gain. The output gain has 4 possible settings as described in Figure 12. The gain setting is dependent on the trip point selected by resistance applied to the SENSE pins.

Built-in temperature hysteresis ($T_{HYST}$) prevents the digital outputs from oscillating. The $T_{OVER}$ and $\overline{T_{OVER}}$ will activate when the die temperature exceeds $T_{TRIP}$ and will release when the temperature falls below a temperature equal to $T_{TRIP}$ minus $T_{HYST}$. $T_{OVER}$ is active-high with a push-pull structure. $\overline{T_{OVER}}$ , is active-low with an open-drain structure. There are two different hysteresis options available that are factory preset. The preset hysteresis can be selected by purchasing the proper order number as described in *Device Comparison Table* .

Driving the TRIP-TEST high will activate the digital outputs. A processor can check the logic level of the $T_{OVER}$ or $\overline{T_{OVER}}$ , confirming that they changed to their active state. This allows for system production testing verification that the comparator and output circuitry are functional after system assembly. When the TRIP-TEST pin is high, the trip-level reference voltage appears at the $V_{TEMP}$ pin. Tying $T_{OVER}$ to TRIP-TEST will latch the output after it trips. It can be cleared by forcing TRIP-TEST low or powering off the LM57.

## 8.2 Functional Block Diagram





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## 8.3 Feature Description

### 8.3.1 LM57 $V_{TEMP}$ Temperature-to-Voltage Transfer Function

The value of the $R_{SENSE}$ resistors select a trip point and a corresponding $V_{TEMP}$ gain (J2, J3, J4, or J5).The trip point range associated with a given gain is shown in bold green in Table 1. The $V_{TEMP}$ gain is selected by the $R_{SENSE}$ resistors. $V_{TEMP}$ is valid over the entire temperature range. The $V_{TEMP}$ gain is selected by the $R_{SENSE}$ resistors. $V_{TEMP}$ is valid over the entire temperature range.

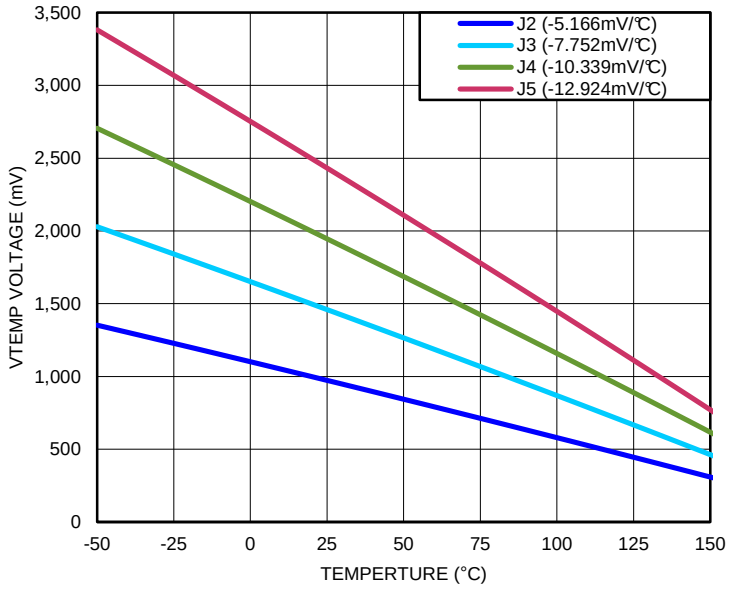



**Figure 12. Temperature Transfer Characteristics**

**Table 1. LM57 $V_{TEMP}$ Temperature to Voltage (1)**

| Temperature (°C) | $V_{TEMP}$ VOLTAGE (mV) | | | |
|---|---|---|---|---|
| | J2 (-5.166 mV/°C) | J3 (–7.752 mV/°C) | J4 (–10.339 mV/°C) | J5 (–12.924 mV/°C) |
| –50 | 1352.56 | 2028.80 | 2705.20 | 3381.40 |
| –49 | 1347.60 | 2021.35 | 2695.26 | 3368.98 |
| –48 | 1342.64 | 2013.90 | 2685.32 | 3356.55 |
| –47 | 1337.67 | 2006.44 | 2675.38 | 3344.12 |
| –46 | 1332.70 | 1998.98 | 2665.43 | 3331.68 |
| –45 | 1327.73 | 1991.52 | 2655.47 | 3319.23 |
| –44 | 1322.76 | 1984.05 | 2645.51 | 3306.78 |
| –43 | 1317.78 | 1976.58 | 2635.54 | 3294.32 |
| –42 | 1312.81 | 1969.11 | 2625.57 | 3281.85 |
| –41 | **1307.82** | 1961.63 | 2615.60 | 3269.38 |
| –40 | **1302.84** | 1954.15 | 2605.62 | 3256.90 |
| –39 | **1297.86** | 1946.66 | 2595.63 | 3244.41 |
| –38 | **1292.87** | 1939.17 | 2585.64 | 3231.92 |
| –37 | **1287.88** | 1931.68 | 2575.64 | 3219.42 |
| –36 | **1282.88** | 1924.18 | 2565.64 | 3206.92 |
| –35 | **1277.89** | 1916.68 | 2555.63 | 3194.41 |
| –34 | **1272.89** | 1909.17 | 2545.62 | 3181.89 |

(1) The $R_{SENSE}$ resistors select a trip point and a corresponding $V_{TEMP}$ gain (J2, J3, J4, or J5). The trip point range associated with a given gain is shown in bold green on this table. $V_{TEMP}$ is valid over the entire temperature range.

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## Feature Description (continued)

**Table 1. LM57 $V_{TEMP}$ Temperature to Voltage (1) (continued)**

| Temperature (°C) | $V_{TEMP}$ VOLTAGE (mV) | | | |
|---|---|---|---|---|
| | J2 (-5.166 mV/°C) | J3 (–7.752 mV/°C) | J4 (–10.339 mV/°C) | J5 (–12.924 mV/°C) |
| –33 | **1267.88** | 1901.66 | 2535.60 | 3169.37 |
| –32 | **1262.88** | 1894.15 | 2525.58 | 3156.84 |
| –31 | **1257.87** | 1886.63 | 2515.56 | 3144.30 |
| –30 | **1252.86** | 1879.11 | 2505.52 | 3131.76 |
| –29 | **1247.85** | 1871.59 | 2495.49 | 3119.21 |
| –28 | **1242.84** | 1864.06 | 2485.44 | 3106.66 |
| –27 | **1237.82** | 1856.53 | 2475.40 | 3094.10 |
| –26 | **1232.80** | 1848.99 | 2465.34 | 3081.53 |
| –25 | **1227.78** | 1841.45 | 2455.29 | 3068.96 |
| –24 | **1222.75** | 1833.91 | 2445.23 | 3056.38 |
| –23 | **1217.73** | 1826.36 | 2435.16 | 3043.79 |
| –22 | **1212.70** | 1818.81 | 2425.09 | 3031.20 |
| –21 | **1207.67** | 1811.26 | 2415.01 | 3018.60 |
| –20 | **1202.63** | 1803.70 | 2404.93 | 3006.00 |
| –19 | **1197.59** | 1796.13 | 2394.84 | 2993.38 |
| –18 | **1192.55** | 1788.57 | 2384.74 | 2980.77 |
| –17 | **1187.51** | 1781.00 | 2374.65 | 2968.14 |
| –16 | **1182.46** | 1773.42 | 2364.54 | 2955.51 |
| –15 | **1177.42** | 1765.85 | 2354.44 | 2942.87 |
| –14 | **1172.37** | 1758.26 | 2344.32 | 2930.23 |
| –13 | **1167.31** | 1750.68 | 2334.20 | 2917.58 |
| –12 | **1162.26** | 1743.09 | 2324.08 | 2904.93 |
| –11 | **1157.20** | 1735.50 | 2313.95 | 2892.26 |
| –10 | **1152.14** | 1727.90 | 2303.82 | 2879.60 |
| –9 | **1147.07** | 1720.30 | 2293.68 | 2866.92 |
| –8 | **1142.01** | 1712.69 | 2283.54 | 2854.24 |
| –7 | **1136.94** | 1705.09 | 2273.39 | 2841.55 |
| –6 | **1131.87** | 1697.47 | 2263.24 | 2828.86 |
| –5 | **1126.79** | 1689.86 | 2253.08 | 2816.16 |
| –4 | **1121.72** | 1682.24 | 2242.91 | 2803.45 |
| –3 | **1116.64** | 1674.61 | 2232.74 | 2790.74 |
| –2 | **1111.56** | 1666.99 | 2222.57 | 2778.02 |
| –1 | **1106.47** | 1659.35 | 2212.39 | 2765.30 |
| 0 | **1101.39** | 1651.72 | 2202.21 | 2752.57 |
| 1 | **1096.30** | 1644.08 | 2192.02 | 2739.83 |
| 2 | **1091.20** | 1636.44 | 2181.82 | 2727.08 |
| 3 | **1086.11** | 1628.79 | 2171.62 | 2714.33 |
| 4 | **1081.01** | 1621.14 | 2161.42 | 2701.58 |
| 5 | **1075.91** | 1613.48 | 2151.21 | 2688.82 |
| 6 | **1070.81** | 1605.83 | 2141.00 | 2676.05 |
| 7 | **1065.71** | 1598.16 | 2130.78 | 2663.27 |
| 8 | **1060.60** | 1590.50 | 2120.55 | 2650.49 |
| 9 | **1055.49** | 1582.83 | 2110.32 | 2637.70 |
| 10 | **1050.38** | 1575.15 | 2100.09 | 2624.91 |
| 11 | **1045.26** | 1567.48 | 2089.85 | 2612.10 |


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## Feature Description (continued)

**Table 1. LM57 $V_{TEMP}$ Temperature to Voltage (1) (continued)**

| Temperature (°C) | $V_{TEMP}$ VOLTAGE (mV) | | | |
|---|---|---|---|---|
| | J2 (-5.166 mV/°C) | J3 (–7.752 mV/°C) | J4 (–10.339 mV/°C) | J5 (–12.924 mV/°C) |
| 12 | **1040.14** | 1559.80 | 2079.60 | 2599.30 |
| 13 | **1035.02** | 1552.11 | 2069.35 | 2586.48 |
| 14 | **1029.90** | 1544.42 | 2059.10 | 2573.66 |
| 15 | **1024.77** | 1536.73 | 2048.84 | 2560.84 |
| 16 | **1019.65** | 1529.03 | 2038.57 | 2548.01 |
| 17 | **1014.51** | 1521.33 | 2028.30 | 2535.17 |
| 18 | **1009.38** | 1513.63 | 2018.03 | 2522.32 |
| 19 | **1004.25** | 1505.92 | 2007.75 | 2509.47 |
| 20 | **999.11** | 1498.21 | 1997.46 | 2496.61 |
| 21 | **993.97** | 1490.49 | 1987.17 | 2483.75 |
| 22 | **988.82** | 1482.77 | 1976.88 | 2470.88 |
| 23 | **983.68** | 1475.05 | 1966.58 | 2458.00 |
| 24 | **978.53** | 1467.32 | 1956.27 | 2445.12 |
| 25 | **973.38** | 1459.59 | 1945.96 | 2432.23 |
| 26 | **968.22** | 1451.86 | 1935.64 | 2419.34 |
| 27 | **963.07** | 1444.12 | 1925.32 | 2406.43 |
| 28 | **957.91** | 1436.38 | 1915.00 | 2393.53 |
| 29 | **952.74** | 1428.63 | 1904.67 | 2380.61 |
| 30 | **947.58** | 1420.88 | 1894.33 | 2367.69 |
| 31 | **942.41** | 1413.13 | 1883.99 | 2354.76 |
| 32 | **937.24** | 1405.37 | 1873.64 | 2341.83 |
| 33 | **932.07** | 1397.61 | 1863.29 | 2328.89 |
| 34 | **926.90** | 1389.84 | 1852.94 | 2315.94 |
| 35 | **921.72** | 1382.07 | 1842.57 | 2302.99 |
| 36 | **916.54** | 1374.30 | 1832.21 | 2290.03 |
| 37 | **911.36** | 1366.52 | 1821.84 | 2277.07 |
| 38 | **906.17** | 1358.74 | 1811.46 | 2264.10 |
| 39 | **900.98** | 1350.96 | 1801.08 | 2251.12 |
| 40 | **895.79** | 1343.17 | 1790.69 | 2238.14 |
| 41 | **890.60** | 1335.38 | 1780.30 | 2225.15 |
| 42 | **885.41** | 1327.58 | 1769.90 | 2212.15 |
| 43 | **880.21** | 1319.78 | 1759.50 | 2199.15 |
| 44 | **875.01** | 1311.98 | 1749.09 | 2186.14 |
| 45 | **869.81** | 1304.17 | 1738.68 | 2173.12 |
| 46 | **864.60** | 1296.36 | 1728.26 | 2160.10 |
| 47 | **859.39** | 1288.54 | 1717.84 | 2147.07 |
| 48 | **854.18** | 1280.72 | 1707.41 | 2134.04 |
| 49 | **848.97** | 1272.90 | 1696.98 | 2121.00 |
| 50 | **843.75** | 1265.07 | 1686.54 | 2107.95 |
| 51 | **838.53** | 1257.24 | 1676.10 | 2094.90 |
| 52 | **833.31** | 1249.41 | 1665.65 | 2081.84 |
| 53 | 828.09 | **1241.57** | 1655.20 | 2068.77 |
| 54 | 822.86 | **1233.73** | 1644.74 | 2055.70 |
| 55 | 817.63 | **1225.88** | 1634.28 | 2042.62 |
| 56 | 812.40 | **1218.03** | 1623.81 | 2029.54 |

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## Feature Description (continued)

**Table 1. LM57 $V_{TEMP}$ Temperature to Voltage (1) (continued)**

| Temperature (°C) | $V_{TEMP}$ VOLTAGE (mV) | | | |
|---|---|---|---|---|
| | J2 (-5.166 mV/°C) | J3 (–7.752 mV/°C) | J4 (–10.339 mV/°C) | J5 (–12.924 mV/°C) |
| 57 | 807.17 | **1210.18** | 1613.34 | 2016.44 |
| 58 | 801.93 | **1202.32** | 1602.86 | 2003.35 |
| 59 | 796.69 | **1194.46** | 1592.38 | 1990.24 |
| 60 | 791.45 | **1186.60** | 1581.89 | 1977.13 |
| 61 | 786.20 | **1178.73** | 1571.40 | 1964.02 |
| 62 | 780.96 | **1170.86** | 1560.90 | 1950.89 |
| 63 | 775.71 | **1162.98** | 1550.40 | 1937.76 |
| 64 | 770.46 | **1155.10** | 1539.89 | 1924.63 |
| 65 | 765.20 | **1147.22** | 1529.37 | 1911.49 |
| 66 | 759.94 | **1139.33** | 1518.86 | 1898.34 |
| 67 | 754.68 | **1131.44** | 1508.33 | 1885.19 |
| 68 | 749.42 | **1123.54** | 1497.80 | 1872.02 |
| 69 | 744.16 | **1115.64** | 1487.27 | 1858.86 |
| 70 | 738.89 | **1107.74** | 1476.73 | 1845.68 |
| 71 | 733.62 | **1099.83** | 1466.19 | 1832.50 |
| 72 | 728.35 | **1091.92** | 1455.64 | 1819.32 |
| 73 | 723.07 | **1084.01** | 1445.08 | 1806.13 |
| 74 | 717.79 | **1076.09** | 1434.53 | 1792.93 |
| 75 | 712.51 | **1068.17** | 1423.96 | 1779.72 |
| 76 | 707.23 | **1060.24** | 1413.39 | 1766.51 |
| 77 | 701.94 | **1052.31** | 1402.82 | 1753.30 |
| 78 | 696.65 | **1044.38** | 1392.24 | 1740.07 |
| 79 | 691.36 | **1036.44** | 1381.65 | 1726.84 |
| 80 | 686.07 | **1028.50** | 1371.07 | 1713.61 |
| 81 | 680.77 | **1020.55** | 1360.47 | 1700.36 |
| 82 | 675.48 | **1012.60** | 1349.87 | 1687.11 |
| 83 | 670.17 | **1004.65** | 1339.27 | 1673.86 |
| 84 | 664.87 | **996.69** | 1328.66 | 1660.60 |
| 85 | 659.56 | **988.73** | 1318.04 | 1647.33 |
| 86 | 654.25 | **980.77** | 1307.42 | 1634.05 |
| 87 | 648.94 | **972.80** | 1296.80 | 1620.77 |
| 88 | 643.63 | **964.83** | 1286.17 | 1607.49 |
| 89 | 638.31 | **956.85** | 1275.53 | 1594.19 |
| 90 | 632.99 | **948.87** | 1264.89 | 1580.89 |
| 91 | 627.67 | **940.89** | 1254.25 | 1567.59 |
| 92 | 622.35 | **932.90** | 1243.60 | 1554.28 |
| 93 | 617.02 | **924.91** | 1232.94 | 1540.96 |
| 94 | 611.69 | **916.92** | 1222.28 | 1527.63 |
| 95 | 606.36 | **908.92** | 1211.61 | 1514.30 |
| 96 | 601.02 | **900.91** | 1200.94 | 1500.97 |
| 97 | 595.69 | 892.91 | **1190.27** | 1487.62 |
| 98 | 590.34 | 884.90 | **1179.59** | 1474.27 |
| 99 | 585.00 | 876.88 | **1168.90** | 1460.92 |
| 100 | 579.66 | 868.87 | **1158.21** | 1447.55 |
| 101 | 574.31 | 860.84 | **1147.52** | 1434.18 |


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## Feature Description (continued)

**Table 1. LM57 $V_{TEMP}$ Temperature to Voltage (1) (continued)**

| Temperature (°C) | $V_{TEMP}$ VOLTAGE (mV) | | | |
|---|---|---|---|---|
| | J2 (-5.166 mV/°C) | J3 (–7.752 mV/°C) | J4 (–10.339 mV/°C) | J5 (–12.924 mV/°C) |
| 102 | 568.96 | 852.82 | **1136.81** | 1420.81 |
| 103 | 563.61 | 844.79 | **1126.11** | 1407.43 |
| 104 | 558.25 | 836.76 | **1115.40** | 1394.04 |
| 105 | 552.89 | 828.72 | **1104.68** | 1380.65 |
| 106 | 547.53 | 820.68 | **1093.96** | 1367.24 |
| 107 | 542.17 | 812.63 | **1083.23** | 1353.84 |
| 108 | 536.80 | 804.59 | **1072.50** | 1340.42 |
| 109 | 531.43 | 796.53 | **1061.77** | 1327.01 |
| 110 | 526.06 | 788.48 | **1051.02** | 1313.58 |
| 111 | 520.69 | 780.42 | **1040.28** | 1300.15 |
| 112 | 515.31 | 772.35 | **1029.53** | 1286.71 |
| 113 | 509.93 | 764.29 | **1018.77** | 1273.26 |
| 114 | 504.55 | 756.21 | **1008.01** | 1259.81 |
| 115 | 499.17 | 748.14 | **997.24** | 1246.36 |
| 116 | 493.78 | 740.06 | **986.47** | 1232.89 |
| 117 | 488.39 | 731.98 | **975.69** | 1219.42 |
| 118 | 483.00 | 723.89 | **964.91** | 1205.95 |
| 119 | 477.61 | 715.80 | **954.12** | 1192.46 |
| 120 | 472.21 | 707.70 | 943.33 | **1178.98** |
| 121 | 466.81 | 699.61 | 932.53 | **1165.48** |
| 122 | 461.41 | 691.50 | 921.73 | **1151.98** |
| 123 | 456.00 | 683.40 | 910.92 | **1138.47** |
| 124 | 450.60 | 675.29 | 900.11 | **1124.96** |
| 125 | 445.19 | 667.18 | 889.29 | **1111.44** |
| 126 | 439.78 | 659.06 | 878.47 | **1097.91** |
| 127 | 434.36 | 650.94 | 867.64 | **1084.38** |
| 128 | 428.94 | 642.81 | 856.81 | **1070.84** |
| 129 | 423.52 | 634.68 | 845.97 | **1057.29** |
| 130 | 418.10 | 626.55 | 835.13 | **1043.74** |
| 131 | 412.67 | 618.41 | 824.28 | **1030.18** |
| 132 | 407.25 | 610.27 | 813.43 | **1016.62** |
| 133 | 401.82 | 602.13 | 802.57 | **1003.05** |
| 134 | 396.38 | 593.98 | 791.71 | **989.47** |
| 135 | 390.95 | 585.83 | 780.84 | **975.89** |
| 136 | 385.51 | 577.67 | 769.97 | **962.30** |
| 137 | 380.07 | 569.51 | 759.09 | **948.70** |
| 138 | 374.63 | 561.35 | 748.20 | **935.10** |
| 139 | 369.18 | 553.18 | 737.32 | **921.49** |
| 140 | 363.73 | 545.01 | 726.42 | **907.87** |
| 141 | 358.28 | 536.84 | 715.52 | **894.25** |
| 142 | 352.83 | 528.66 | 704.62 | **880.62** |
| 143 | 347.37 | 520.48 | 693.71 | **866.99** |
| 144 | 341.91 | 512.29 | 682.80 | **853.35** |
| 145 | 336.45 | 504.10 | 671.88 | **839.70** |
| 146 | 330.99 | 495.91 | 660.95 | **826.05** |

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## Feature Description (continued)

**Table 1. LM57 $V_{TEMP}$ Temperature to Voltage (1) (continued)**

| Temperature (°C) | $V_{TEMP}$ VOLTAGE (mV) | | | |
|---|---|---|---|---|
| | J2 (-5.166 mV/°C) | J3 (–7.752 mV/°C) | J4 (–10.339 mV/°C) | J5 (–12.924 mV/°C) |
| 147 | 325.52 | 487.71 | 650.03 | **812.39** |
| 148 | 320.05 | 479.51 | 639.09 | **798.73** |
| 149 | 314.58 | 471.30 | 628.15 | **785.05** |
| 150 | 309.10 | 463.09 | 617.21 | **771.38** |


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#### 8.3.1.1 LM57 $V_{TEMP}$ Voltage-to-Temperature Equations

$$V_{TEMP} = a\,(T-30)^2 + b\,(T-30) + c$$

where

- $V_{TEMP}$ is in mV and T is in °C

(1)

$$T = \frac{-b - \sqrt{b^2 - 4a(c - V_{TEMP})}}{2a} + 30°C$$

where

- T is in °C and $V_{TEMP}$ is in mV

(2)

**Table 2. LM57 $V_{TEMP}$ Voltage-to-Temperature Equations Coefficients**

| Trip-Point Region | LM57 Trip Point Range | a | b | c |
|---|---|---|---|---|
| J2 | −41°C to 52°C | – 0.00129 | − 5.166 | 947.6 |
| J3 | 52°C to 97°C | – 0.00191 | − 7.752 | 1420.9 |
| J4 | 97°C to 119°C | – 0.00253 | − 10.339 | 1894.3 |
| J5 | 119°C to 150°C | – 0.00316 | − 12.924 | 2367.7 |

### 8.3.2 $R_{SENSE}$

The LM57 uses the voltage at the two SENSE pins to set the trip point for the temperature switch. It is possible to drive the two SENSE pins with a voltage equal to the value generated by the resistor and the internal current-source and have the same switch point. Thus one can use an external DAC to drive each SENSE pin, allowing for the temperature trip point to be set dynamically by the system processor. Table 3 shows the $R_{SENSE}$ value and its corresponding generated SENSE pin voltage (the center value).

**Table 3. $R_{SENSE}$ Values (kΩ) vs SENSE Pin Voltage (mV)**

| $R_{SENSE}$ (kΩ) | SENSE Pin Voltage (mV) |
|---|---|
| | Center Value |
| 976 | 1875 |
| 825 | 1585 |
| 698 | 1341 |
| 590 | 1134 |
| 499 | 959 |
| 412 | 792 |
| 340 | 653 |
| 280 | 538 |
| 226 | 434 |
| 178 | 342 |
| 140 | 269 |
| 105 | 202 |
| 75 | 146 |
| 46.4 | 87 |
| 22.6 | 43 |
| 0.01 | 0 |

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### 8.3.3 Resistor Selection

**Table 4. Trip Point (°C) vs Sense Resistor ($R_{SENSE}$) Values (Ω)**

| | | $R_{SENSE2}$ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | J2 (1) | | | | J3 (1) | | | J4 (1) | | J5 (1) | | | |
| | | 976 kΩ | 825 kΩ | 698 kΩ | 590 kΩ | 499 kΩ | 412 kΩ | 340 kΩ | 280 kΩ | 226 kΩ | 178 kΩ | 140 kΩ | 105 kΩ | 75 kΩ |
| $R_{SENSE1}$ | 976 kΩ | –40.68 | –16.26 | 7.33 | 30.38 | 52.73 | 67.77 | 82.74 | 97.47 | 108.61 | 119.62 | 128.46 | 137.28 | 146.08 |
| | 825 kΩ | –39.13 | –14.76 | 8.79 | 31.81 | 53.68 | 68.71 | 83.67 | 98.17 | 109.30 | 120.18 | 129.01 | 137.83 | 146.62 |
| | 698 kΩ | –37.57 | –13.27 | 10.24 | 33.24 | 54.62 | 69.65 | 84.60 | 98.86 | 110.00 | 120.73 | 129.56 | 138.38 | 147.16 |
| | 590 kΩ | –36.03 | –11.78 | 11.70 | 34.67 | 55.56 | 70.59 | 85.53 | 99.56 | 110.70 | 121.28 | 130.12 | 138.93 | 147.71 |
| | 499 kΩ | –34.49 | –10.29 | 13.15 | 36.10 | 56.50 | 71.52 | 86.46 | 100.25 | 111.39 | 121.84 | 130.67 | 139.49 | 148.25 |
| | 412 kΩ | –32.95 | –8.81 | 14.60 | 37.53 | 57.44 | 72.46 | 87.40 | 100.95 | 112.09 | 122.39 | 131.22 | 140.04 | 148.80 |
| | 340 kΩ | –31.41 | –7.32 | 16.05 | 38.95 | 58.39 | 73.40 | 88.33 | 101.64 | 112.79 | 122.94 | 131.77 | 140.59 | 149.34 |
| | 280 kΩ | –29.88 | –5.83 | 17.49 | 40.38 | 59.33 | 74.33 | 89.26 | 102.34 | 113.48 | 123.50 | 132.32 | 141.14 | 149.88 |
| | 226 kΩ | –28.34 | –4.35 | 18.93 | 41.81 | 60.27 | 75.27 | 90.19 | 103.03 | 114.18 | 124.05 | 132.87 | 141.69 | 150.43 |
| | 178 kΩ | –26.83 | –2.88 | 20.36 | 43.23 | 61.21 | 76.20 | 91.12 | 103.73 | 114.87 | 124.60 | 133.43 | 142.24 | |
| | 140 kΩ | –25.32 | –1.42 | 21.79 | 44.65 | 62.15 | 77.14 | 92.05 | 104.42 | 115.57 | 125.15 | 133.98 | 142.79 | |
| | 105 kΩ | –23.80 | 0.04 | 23.22 | 46.07 | 63.08 | 78.07 | 92.99 | 105.11 | 116.26 | 125.71 | 134.53 | 143.34 | |
| | 75 kΩ | –22.29 | 1.50 | 24.65 | 47.50 | 64.02 | 79.01 | 93.92 | 105.81 | 116.95 | 126.26 | 135.08 | 143.89 | |
| | 46.4 kΩ | –20.77 | 2.96 | 26.08 | 48.92 | 64.96 | 79.94 | 94.84 | 106.50 | 117.65 | 126.81 | 135.63 | 144.44 | |
| | 22.6 kΩ | –19.26 | 4.42 | 27.51 | 50.33 | 65.90 | 80.87 | 95.77 | 107.19 | 118.34 | 127.36 | 136.18 | 144.99 | |
| | 0.01 kΩ | –17.75 | 5.88 | 28.94 | 51.75 | 66.84 | 81.81 | 96.70 | 107.89 | 119.04 | 127.91 | 136.73 | 145.54 | |

(1) There are four gains corresponding to each of the four Temperature Trip Point Ranges:
J2 (-5.166 mV/°C) is the temperature sensor output gain used for Temperature Trip Points −40.68°C to 51.8°C.
J3 (-7.752 mV/°C) is for Trip Points 52°C to 97°C.
J4 (-10.339 mV/°C) for 97°C to 119°C.
J5 (-12.924 mV/°C) for 119°C to 150°C.


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**Table 5. $V_{TEMP}$ (mV) at the Trip Point vs Sense Resistor ($R_{SENSE}$) Value (Ω)**

| | | $R_{SENSE2}$ | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | J2 (1) | | | | J3 (1) | | | J4 (1) | | J5 (1) | | | |
| | | 976 kΩ | 825 kΩ | 698 kΩ | 590 kΩ | 499 kΩ | 412 kΩ | 340 kΩ | 280 kΩ | 226 kΩ | 178 kΩ | 140 kΩ | 105 kΩ | 75 kΩ |
| $R_{SENSE1}$ | 976 kΩ | 1306.23 | 1183.77 | 1064.00 | 945.63 | 1243.67 | 1125.34 | 1006.75 | 1185.27 | 1066.00 | 1184.05 | 1064.59 | 944.83 | 824.96 |
| | 825 kΩ | 1298.50 | 1176.23 | 1056.56 | 938.23 | 1236.27 | 1117.93 | 999.34 | 1177.83 | 1058.52 | 1176.57 | 1057.10 | 937.33 | 817.53 |
| | 698 kΩ | 1290.72 | 1168.70 | 1049.13 | 930.83 | 1228.88 | 1110.52 | 991.92 | 1170.40 | 1051.03 | 1169.10 | 1049.62 | 929.83 | 810.09 |
| | 590 kΩ | 1283.03 | 1161.16 | 1041.69 | 923.43 | 1221.48 | 1103.10 | 984.51 | 1162.96 | 1043.55 | 1161.63 | 1042.13 | 922.33 | 802.66 |
| | 499 kΩ | 1275.33 | 1153.62 | 1034.26 | 916.02 | 1214.09 | 1095.69 | 977.09 | 1155.52 | 1036.07 | 1154.16 | 1034.65 | 914.83 | 795.22 |
| | 412 kΩ | 1267.64 | 1146.09 | 1026.82 | 908.62 | 1206.69 | 1088.28 | 969.66 | 1148.09 | 1028.59 | 1146.68 | 1027.16 | 907.33 | 787.78 |
| | 340 kΩ | 1259.94 | 1138.55 | 1019.38 | 901.22 | 1199.30 | 1080.87 | 962.22 | 1140.65 | 1021.10 | 1139.21 | 1019.67 | 899.83 | 780.35 |
| | 280 kΩ | 1252.25 | 1131.02 | 1011.99 | 893.82 | 1191.90 | 1073.45 | 954.78 | 1133.22 | 1013.62 | 1131.74 | 1012.19 | 892.33 | 772.91 |
| | 226 kΩ | 1244.55 | 1123.48 | 1004.62 | 886.42 | 1184.50 | 1066.04 | 947.35 | 1125.78 | 1006.14 | 1124.27 | 1004.70 | 884.83 | 765.48 |
| | 178 kΩ | 1236.99 | 1116.05 | 997.26 | 879.02 | 1177.11 | 1058.63 | 939.91 | 1118.35 | 998.66 | 1116.79 | 997.22 | 877.33 | |
| | 140 kΩ | 1229.38 | 1108.61 | 989.89 | 871.61 | 1169.71 | 1051.22 | 932.48 | 1110.91 | 991.17 | 1109.32 | 989.73 | 869.82 | |
| | 105 kΩ | 1221.76 | 1101.18 | 982.53 | 864.21 | 1162.32 | 1043.80 | 925.04 | 1103.48 | 983.69 | 1101.85 | 982.25 | 862.32 | |
| | 75 kΩ | 1214.15 | 1093.74 | 975.16 | 856.81 | 1154.92 | 1036.39 | 917.61 | 1096.04 | 976.21 | 1094.38 | 974.76 | 854.82 | |
| | 46.4 kΩ | 1206.53 | 1086.30 | 967.80 | 849.41 | 1147.53 | 1028.98 | 910.17 | 1088.60 | 968.73 | 1086.90 | 967.28 | 847.32 | |
| | 22.6 kΩ | 1198.92 | 1078.87 | 960.43 | 842.01 | 1140.13 | 1021.57 | 902.74 | 1081.17 | 961.24 | 1079.43 | 959.79 | 839.82 | |
| | 0.01 kΩ | 1191.30 | 1071.43 | 953.07 | 834.62 | 1132.74 | 1014.15 | 895.30 | 1073.73 | 953.76 | 1072.04 | 952.31 | 832.32 | |

(1) There are four gains corresponding to each of the four Temperature Trip Point Ranges:
J2 (-5.166 mV/°C) is the temperature sensor output gain used for Temperature Trip Points −40.68°C to 51.8°C.
J3 (-7.752 mV/°C) is for Trip Points 52°C to 97°C.
J4 (-10.339 mV/°C) for 97°C to 119°C.
J5 (-12.924 mV/°C) for 119°C to 150°C.

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### 8.3.4 $T_{OVER}$ and $\overline{T_{OVER}}$ Digital Outputs

The $T_{OVER}$ active high, push-pull output and the $\overline{T_{OVER}}$ Active Low, Open-Drain Output both assert at the same time whenever the Die Temperature reaches the Trip Point. They also assert simultaneously whenever the TRIP TEST pin is set high. Both outputs de-assert when the die temperature goes below the (Temperature Trip Point) - (Hysteresis). These two types of digital outputs enable the user the flexibility to choose the type of output that is most suitable for his design.

Either the $T_{OVER}$ or the $\overline{T_{OVER}}$ Digital Output pins can be left open if not used.

The $\overline{T_{OVER}}$ Active Low, Open-Drain Digital Output, if used, requires a pullup resistor between this pin and $V_{DD}$.

#### *8.3.4.1 $T_{OVER}$ and $\overline{T_{OVER}}$ Noise Immunity*

The LM57 has some noise immunity to a premature trigger due to noise on the power supply. With the die temperature at 1°C below the trip point, there are no premature triggers for a square wave injected into the power supply with a magnitude of 100 $mV_{PP}$ over a frequency range of 100 Hz to 2 MHz. Above the frequency a premature trigger may occur.

With the die temperature at 2°C below the trip point, and a magnitude of 200 $mV_{PP}$, there are no premature triggers from 100 Hz to 300 kHz. Above that frequency a premature trigger may occur.

Therefore if the supply line is noisy, it is recommended that a local supply decoupling capacitor be used to reduce that noise.

### 8.3.5 Trip Test Digital Input

The TRIP TEST pin provides a means to test the digital outputs by causing them to assert, regardless of temperature.

In addition, when the TRIP TEST pin is pulled high the $V_{TEMP}$ pin will be at the $V_{TRIP}$ voltage.

### 8.3.6 $V_{TEMP}$ Analog Temperature Sensor Output

The $V_{TEMP}$ push-pull output provides the ability to sink and source significant current. This is beneficial when, for example, driving dynamic loads like an input stage on an analog-to-digital converter (ADC). In these applications the source current is required to quickly charge the input capacitor of the ADC. See the *Typical Application* section for more discussion of this topic. The LM57 is ideal for this and other applications which require strong source or sink current.

#### *8.3.6.1 $V_{TEMP}$ Noise Considerations*

A load capacitor on $V_{TEMP}$ can help to filter noise.

For noisy environments, TI recommends a 100 nF supply decoupling capacitor placed closed across $V_{DD}$ and GND pins of LM57.


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### 8.3.6.2 $V_{TEMP}$ Capacitive Loads

The $V_{TEMP}$ Output handles capacitive loading well. In an extremely noisy environment, or when driving a switched sampling input on an ADC, it may be necessary to add some filtering to minimize noise coupling. Without any precautions, the $V_{TEMP}$ can drive a capacitive load less than or equal to 1100 pF as shown in Figure 13. For capacitive loads greater than 1100 pF, a series resistor is required on the output, as shown in Figure 14, to maintain stable conditions.

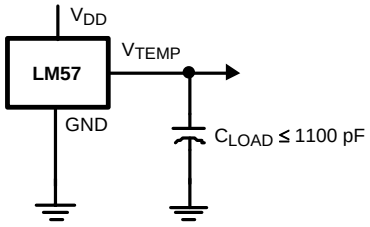



**Figure 13. LM57 With No Isolation Resistor Required**

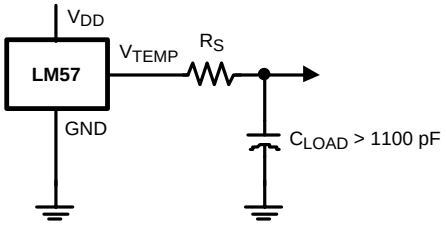



**Figure 14. LM57 With Series Resistor for Capacitive Loading Greater than 1100 pF**

**Table 6. $C_{LOAD}$ and $R_S$ Values of Figure 14**

| $C_{LOAD}$ | Minimum $R_S$ |
|---|---|
| 1.1 to 99 nF | 3 kΩ |
| 100 to 999 nF | 1.5 kΩ |
| 1 µF | 750 Ω |

### 8.3.6.3 $V_{TEMP}$ Voltage Shift

The LM57 is very linear over temperature and supply voltage range. Due to the intrinsic behavior of an NMOS/PMOS rail-to-rail buffer, a slight shift in the output can occur when the supply voltage is ramped over the operating range of the device. The location of the shift is determined by the relative levels of $V_{DD}$ and $V_{TEMP}$. The shift typically occurs when $V_{DD} - V_{TEMP} = 1$ V.

This slight shift (a few millivolts) takes place over a wide change (approximately 200 mV) in $V_{DD}$ or $V_{TEMP}$. Since the shift takes place over a wide temperature change of 5°C to 20°C, $V_{TEMP}$ is always monotonic. The accuracy specifications in the table already includes this possible shift.

## 8.4 Device Functional Modes

The LM57 has several modes of operation as detailed in the following drawings.

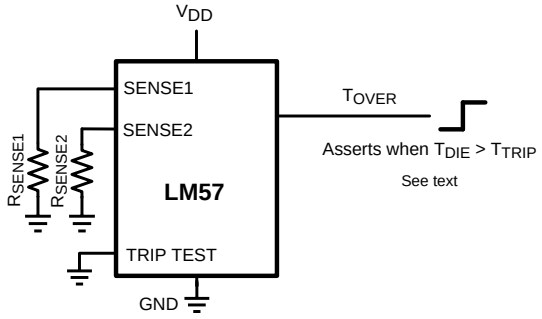



**Figure 15. Temperature Switch Using Push-Pull Output**

## Device Functional Modes (continued)

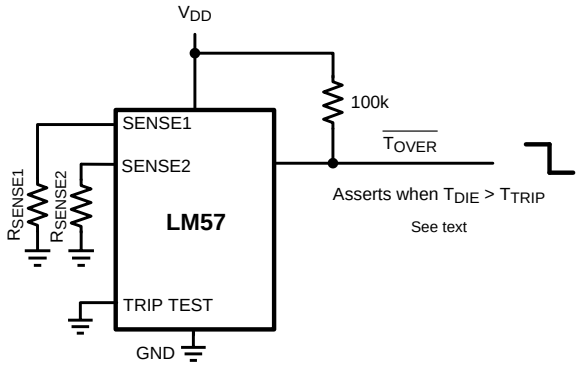



**Figure 16. Temperature Switch Using Open-Drain Output**

As shown in Figure 17 the LM57 has a TRIP Test input simplifying in situ board conductivity testing. Forcing TRIP TEST pin "HIGH" will drive the $\overline{T_{OVER}}$ pin "LOW" and the $T_{OVER}$ pin "HIGH".

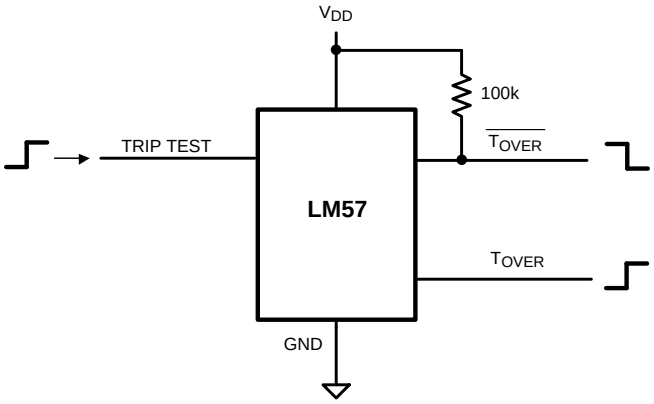



**Figure 17. Trip Test Digital Output Test Circuit**

In the circuit shown in Figure 18 when $T_{OVER}$ goes active high, it drives trip test high. Trip test high causes $T_{OVER}$ to stay high. It is therefore latched. To release the latch, power down, then power up. The LM57 always comes up in a released condition.

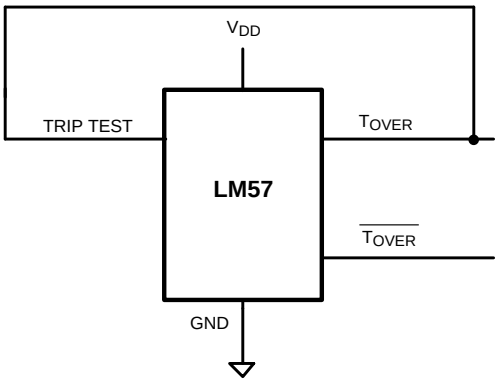



**Figure 18. Simple Latch Circuit**


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## Device Functional Modes (continued)

The TRIP TEST pin, normally used to check the operation of the $T_{OVER}$ and $\overline{T_{OVER}}$ pins, may be used to latch the outputs whenever the temperature exceeds the programmed limit and causes the digital outputs to assert. As shown in Figure 19, when $T_{OVER}$ goes high, the TRIP TEST input is also pulled high and causes $T_{OVER}$ output to latch high and the $\overline{T_{OVER}}$ output to latch low. Momentarily switching the TRIP TEST input low will reset the LM57 to normal operation. The resistor limits the current out of the $T_{OVER}$ output pin.

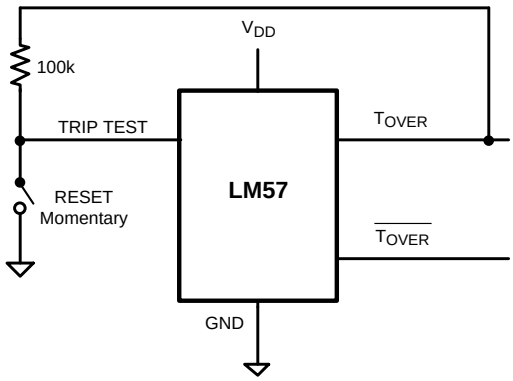



**Figure 19. Latch Circuit Using $T_{OVER}$ Output**

# 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 LM57 has several outputs allowing for varying system implementations.

### 9.1.1 ADC Input Considerations

The LM57 has an analog temperature sensor output ($V_{TEMP}$) that can be directly connected to an ADC (Analog to Digital Converter) input. Most CMOS ADCs found in microcontrollers and ASICs have a sampled data comparator input structure. When the ADC charges the sampling cap, it requires instantaneous charge from the output of the analog source such as the LM57 temperature sensor and many op amps. This requirement is easily accommodated by the addition of a capacitor ($C_{FILTER}$). The size of $C_{FILTER}$ depends on the size of the sampling capacitor and the sampling frequency. Because not all ADCs have identical input stages, the charge requirements will vary. The general ADC application shown in Figure 20 is an example only.

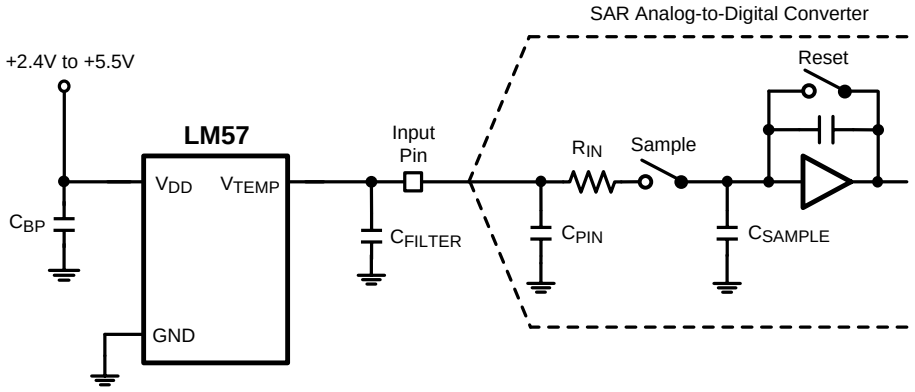



**Figure 20. Suggested Connection to a Sampling Analog-to-Digital Converter Input Stage**

## 9.2 Typical Application

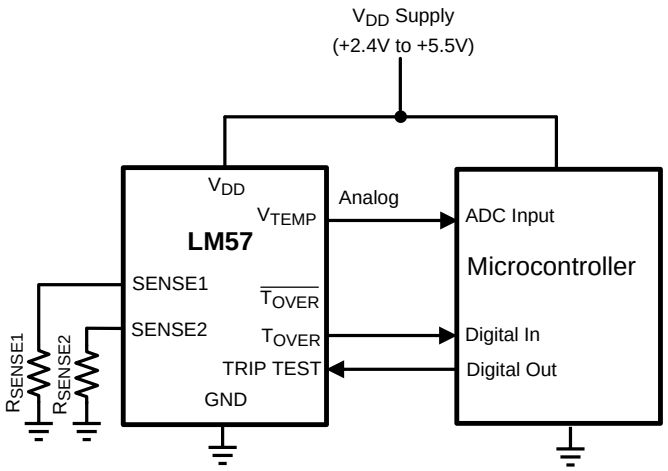



**Figure 21. Typical Application Schematic with Microcontroller TRIP TEST Control**


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## Typical Application (continued)

### 9.2.1 Design Requirements

By simply selecting the value of two resistors the trip point of the LM57 can easily be programmed as described in the following section. If standard 1% values are used the actual trip point threshold is not degraded and stands as described in the Electrical Characteristics section ( ).

### 9.2.2 Detailed Design Procedure

#### *9.2.2.1 Selection of $R_{SENSE}$ Resistors*

To set the trip point:

1. Locate the desired trip temperature in Table 4.
2. Identify the corresponding $R_{SENSE2}$ value by following the column up to the resistor value.
3. Identify the corresponding $R_{SENSE1}$ value by following the row leftwards to the resistor value.
4. Use only the EIA E96 standard resistor values from the list.
5. Use only a resistor with 1% tolerance and a temperature coefficient of 100 ppm (or better). These restrictions are necessary to stay at the selected setting, and not to slip into an adjacent setting.
6. This is consistent with using resistors from the thick film chip resistors CRCW0402 family. These are available with very small dimensions of L = 1 mm, W = 0.5 mm, H = 0.35 mm.
7. Note that the resistor tolerance does not diminish the accuracy of the trip point. As can be seen in the block diagram these inputs drive the logic inputs of a DAC thus their tolerance does affect the trip point accuracy unless the DAC setting slips into an adjacent level. See patent number 6924758.

### 9.2.3 Application Curves

The typical performance of the LM57 temperature sensor output can be seen in Figure 22. Figure 23 shows the output behavior of the LM57 $T_{OVER}$ output.

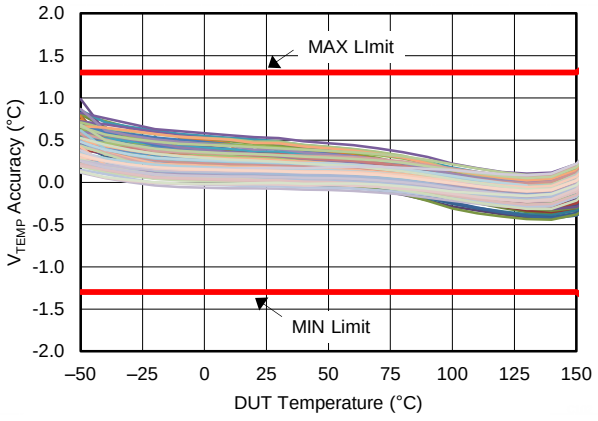



**Figure 22. J2 $V_{TEMP}$ Accuracy Characteristics**

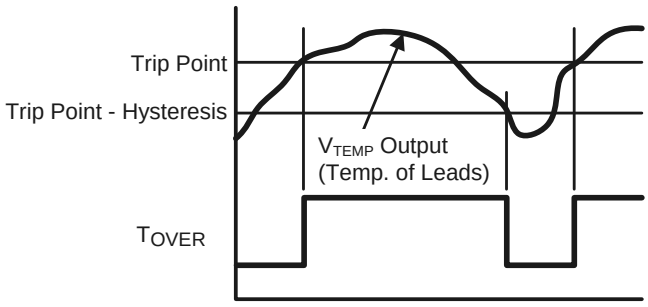



**Figure 23. Output Transfer Characteristic**

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## Typical Application (continued)

### 9.2.4 Grounding of the TRIP TEST Pin

The circuit in Figure 24 shows the TRIP TEST pin grounded. This allows the LM57 to function autonomously without microcontroller intervention. In all other respects this circuit functions similarly to the circuit shown in Figure 21.

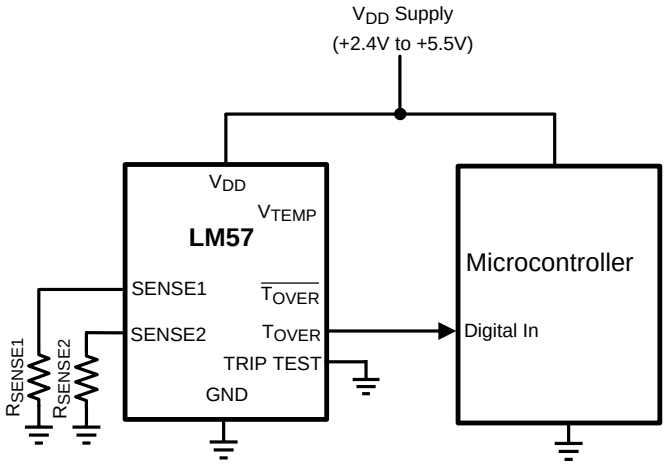



**Figure 24. Typical Application Schematic without Microcontroller TRIP TEST Control**

## 10 Power Supply Recommendations

Power supply bypass capacitors are optional and may be required if the supply line is noisy. TI recommends that a local supply decoupling capacitor be used to reduce noise. For noisy environments, TI recommends a 100-nF supply decoupling capacitor placed closed across $V_{DD}$ and GND pins of LM57.

## 11 Layout

### 11.1 Layout Guidelines

The LM57 can be applied easily in the same way as other integrated-circuit temperature sensors. It can be glued or cemented to a surface. The temperatures of the lands and traces to the other leads of the LM57 will also affect the temperature reading.

Alternatively, the LM57 can be mounted inside a sealed-end metal tube, and can then be dipped into a bath or screwed into a threaded hole in a tank. As with any IC, the LM57 and accompanying wiring and circuits must be kept insulated and dry, to avoid leakage and corrosion. This is especially true if the circuit may operate at cold temperatures where condensation can occur. If moisture creates a short circuit from the $V_{TEMP}$ output to ground or $V_{DD}$, the $V_{TEMP}$ output from the LM57 will not be correct. Printed-circuit coatings are often used to ensure that moisture cannot corrode the leads or circuit traces.


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## 11.2 Layout Example

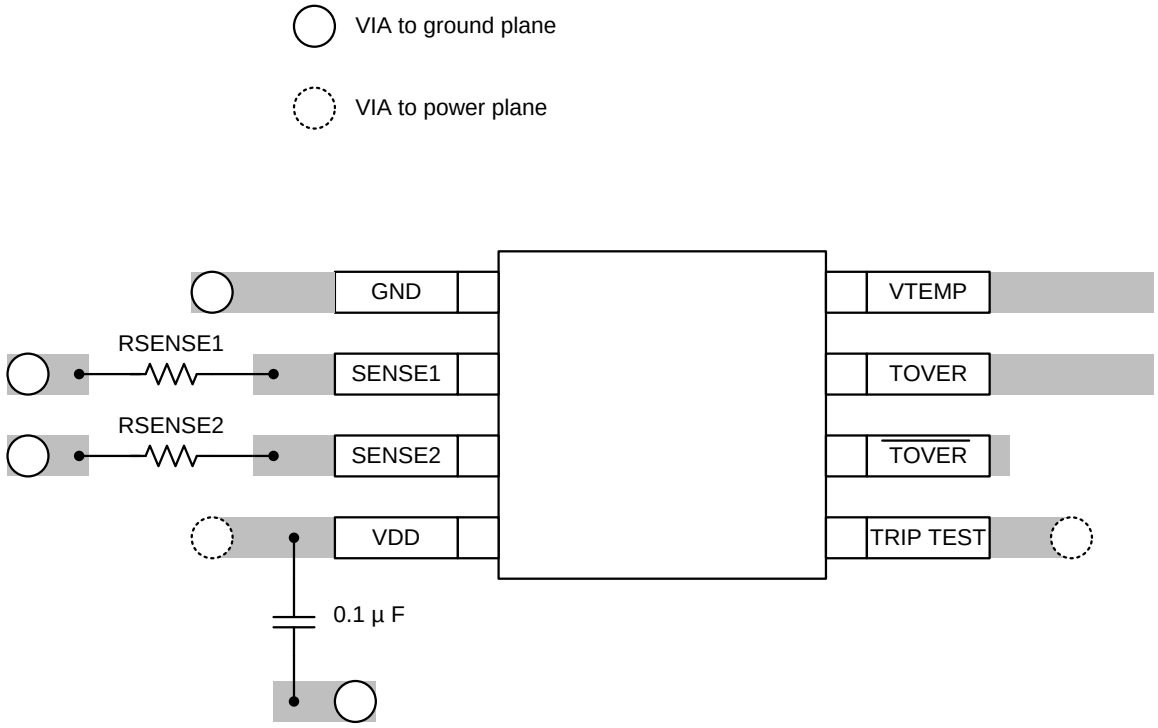
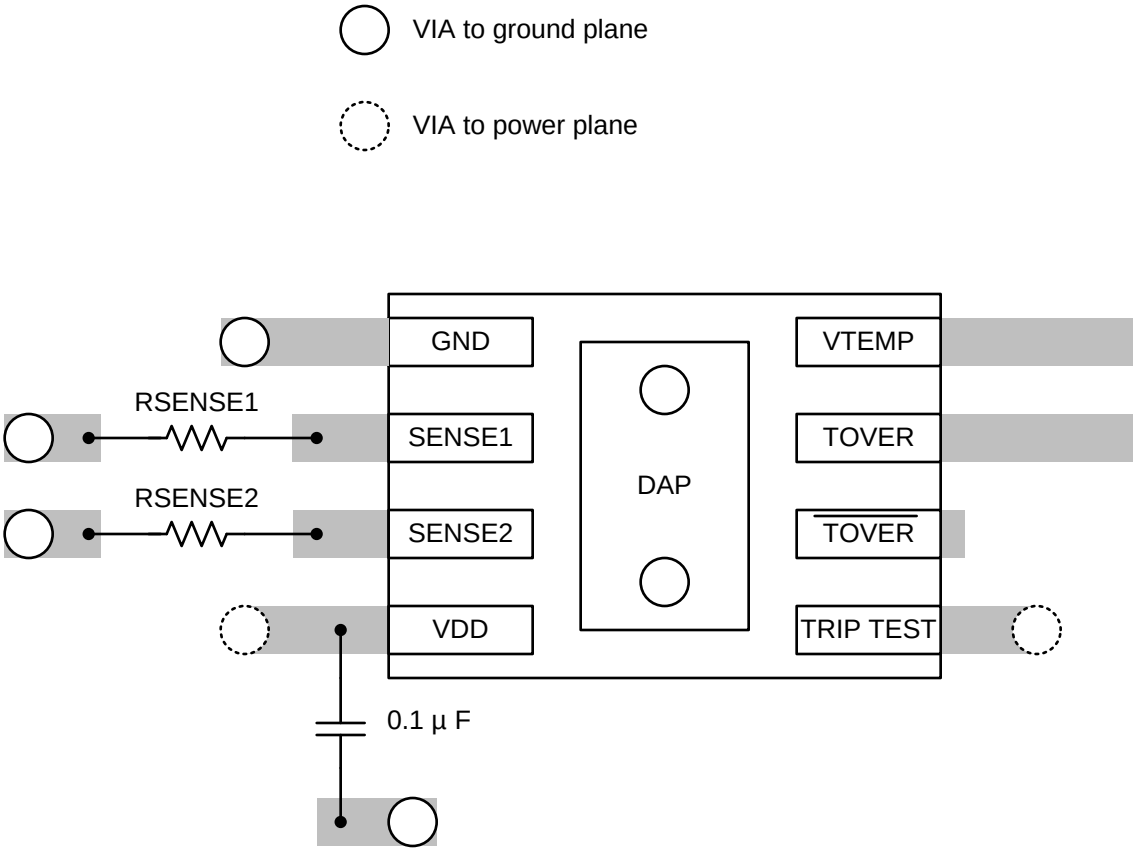



**Figure 25. PW (TSSOP) Package Layout Example**

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## Layout Example (continued)




The best thermal conductivity to the junction of the LM57 is through the DAP. Make sure it is connected to the surface whose temperature that is being measured.

**Figure 26. SD (WSON) Package Layout Example**

## 11.3 Temperature Considerations

The junction temperature of the LM57 is the actual temperature being measured. The thermal resistance junction-to-ambient ($R_{\theta JA}$) is the parameter (from *Thermal Information* ) used to calculate the rise of a device junction temperature due to its power dissipation. Equation 3 is used to calculate the rise in the die temperature of the LM57.

$$T_J = T_A + R_{\theta JA} \left[ (V_{DD} I_Q) + (V_{DD} - V_{TEMP}) \, I_L \right] \quad (3)$$

where

- $T_A$ is the ambient temperature.
- $I_Q$ is the quiescent current.
- $I_L$ is the load current on $V_{TEMP}$.
- $R_{\theta JA}$ can be found in *Thermal Information*

For example using an LM57 in the PW (TSSOP) package, in an application where $T_A$ = 30°C, $V_{DD}$ = 5.5 V, $I_{DD}$ = 28 µA, J5 gain, $V_{TEMP}$ = 2368 mV, and $I_L$ = 0 µA, the total temperature rise would be [183°C/W × 5.5 V × 28 µA] = 0.028°C. To minimize self-heating, the load current on $V_{TEMP}$ should be minimized.


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# 12 器件和文档支持

## 12.1 文档支持

### 12.1.1 相关文档

相关文档如下：

- LM57-Q1 汽车级数据表。
- 《回流温度曲线》规范，www.ti.com/packaging。
- 应用报告《IC 封装热指标》，SPRA953

## 12.2 社区资源

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## 12.5 Glossary

SLYZ022 — *TI Glossary*.

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

# 13 机械、封装和可订购信息

以下页中包括机械、封装和可订购信息。 这些信息是针对指定器件可提供的最新数据。 这些数据会在无通知且不对本文档进行修订的情况下发生改变。 欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

## PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| LM57BISD-10/NOPB | Obsolete | Production | WSON (NGR) \| 8 | - | - | Call TI | Call TI | -50 to 150 | 57B9 |
| LM57BISD-5/NOPB | Obsolete | Production | WSON (NGR) \| 8 | - | - | Call TI | Call TI | -50 to 150 | 57B5 |
| LM57BISDX-10/NOPB | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | -50 to 150 | 57B9 |
| LM57BISDX-10/NOPB.A | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | See LM57BISDX-10/ NOPB | 57B9 |
| LM57BISDX-5/NOPB | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | -50 to 150 | 57B5 |
| LM57BISDX-5/NOPB.A | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | See LM57BISDX-5/ NOPB | 57B5 |
| LM57CISD-10/NOPB | Obsolete | Production | WSON (NGR) \| 8 | - | - | Call TI | Call TI | -50 to 150 | 57C9 |
| LM57CISD-5/NOPB | Obsolete | Production | WSON (NGR) \| 8 | - | - | Call TI | Call TI | -50 to 150 | 57C5 |
| LM57CISDX-10/NOPB | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | -50 to 150 | 57C9 |
| LM57CISDX-10/NOPB.A | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | See LM57CISDX-10/ NOPB | 57C9 |
| LM57CISDX-5/NOPB | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | -50 to 150 | 57C5 |
| LM57CISDX-5/NOPB.A | Active | Production | WSON (NGR) \| 8 | 4500 \| LARGE T&R | Yes | SN | Level-3-260C-168 HR | See LM57CISDX-5/ NOPB | 57C5 |
| LM57FPW | Obsolete | Production | TSSOP (PW) \| 8 | - | - | Call TI | Call TI | -50 to 150 | LM57F |
| LM57FPWR | Active | Production | TSSOP (PW) \| 8 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -50 to 150 | LM57F |
| LM57FPWR.A | Active | Production | TSSOP (PW) \| 8 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | See LM57FPWR | LM57F |
| LM57TPWR | Active | Production | TSSOP (PW) \| 8 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | -50 to 150 | LM57T |
| LM57TPWR.A | Active | Production | TSSOP (PW) \| 8 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-2-260C-1 YEAR | See LM57TPWR | LM57T |

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

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

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

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

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

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

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

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**OTHER QUALIFIED VERSIONS OF LM57 :**

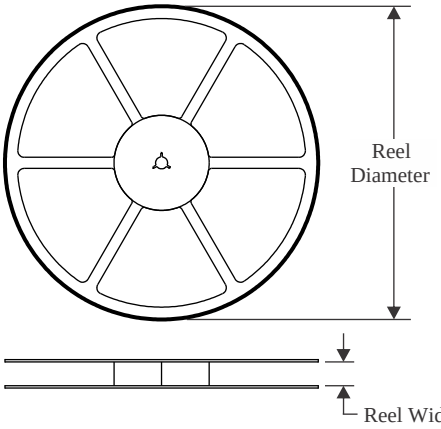
- Automotive : LM57-Q1

NOTE: Qualified Version Definitions:

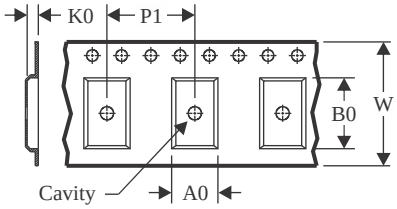
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

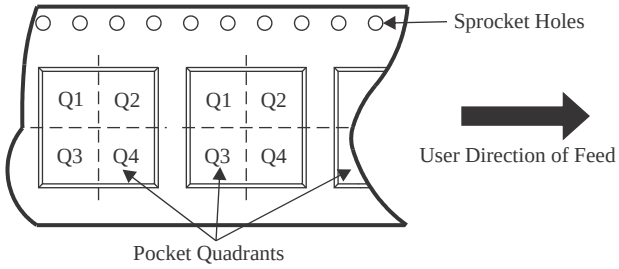



**TAPE DIMENSIONS**




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

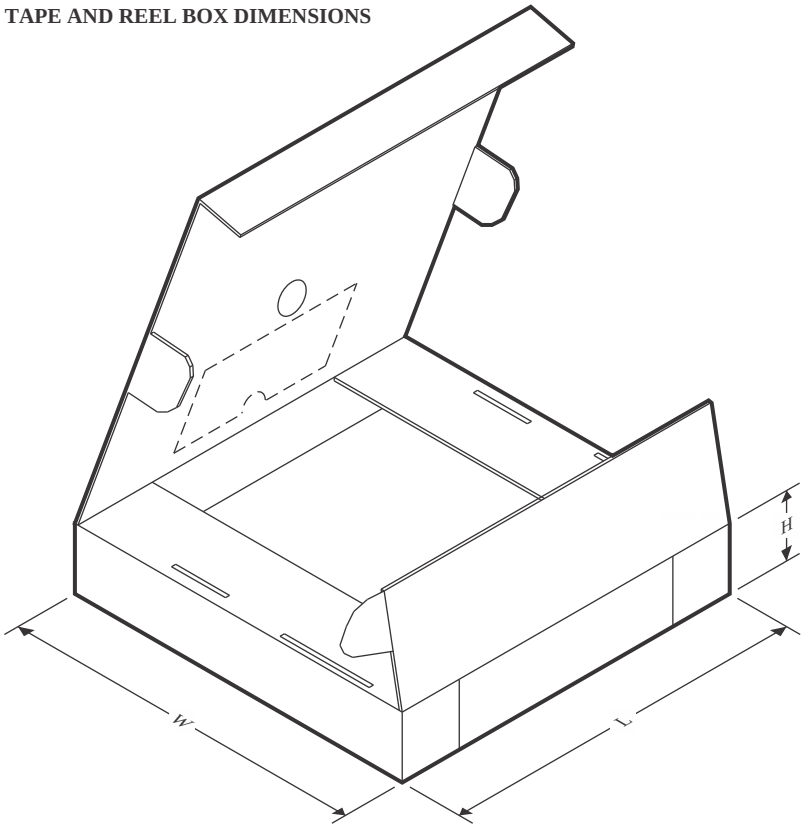
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LM57BISDX-10/NOPB | WSON | NGR | 8 | 4500 | 330.0 | 12.4 | 2.8 | 2.8 | 1.0 | 8.0 | 12.0 | Q1 |
| LM57BISDX-5/NOPB | WSON | NGR | 8 | 4500 | 330.0 | 12.4 | 2.8 | 2.8 | 1.0 | 8.0 | 12.0 | Q1 |
| LM57CISDX-10/NOPB | WSON | NGR | 8 | 4500 | 330.0 | 12.4 | 2.8 | 2.8 | 1.0 | 8.0 | 12.0 | Q1 |
| LM57CISDX-5/NOPB | WSON | NGR | 8 | 4500 | 330.0 | 12.4 | 2.8 | 2.8 | 1.0 | 8.0 | 12.0 | Q1 |
| LM57FPWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| LM57TPWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| LM57BISDX-10/NOPB | WSON | NGR | 8 | 4500 | 356.0 | 356.0 | 36.0 |
| LM57BISDX-5/NOPB | WSON | NGR | 8 | 4500 | 356.0 | 356.0 | 36.0 |
| LM57CISDX-10/NOPB | WSON | NGR | 8 | 4500 | 356.0 | 356.0 | 36.0 |
| LM57CISDX-5/NOPB | WSON | NGR | 8 | 4500 | 356.0 | 356.0 | 36.0 |
| LM57FPWR | TSSOP | PW | 8 | 2000 | 353.0 | 353.0 | 32.0 |
| LM57TPWR | TSSOP | PW | 8 | 2000 | 353.0 | 353.0 | 32.0 |

# GENERIC PACKAGE VIEW

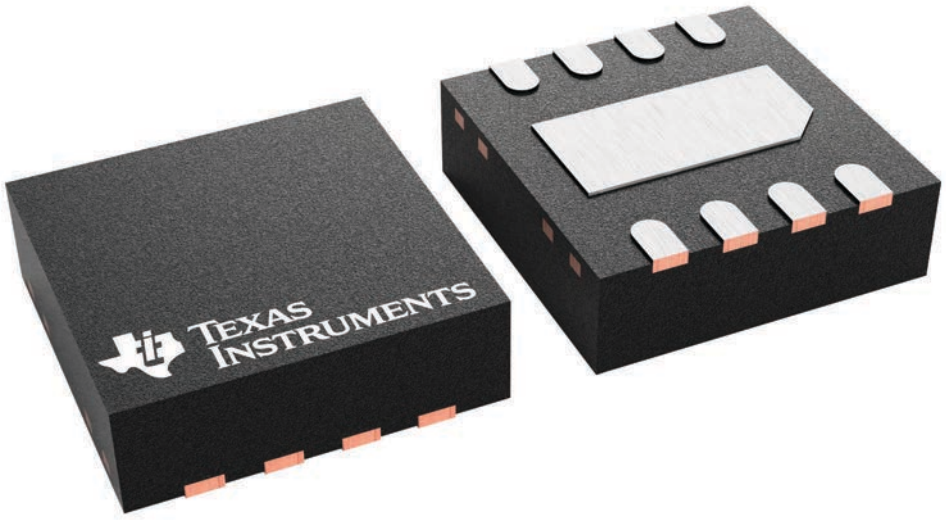
## NGR 8

## WSON - 0.8 mm max height

**2.5 x 2.5, 0.5 mm pitch**

PLASTIC SMALL OUTLINE - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



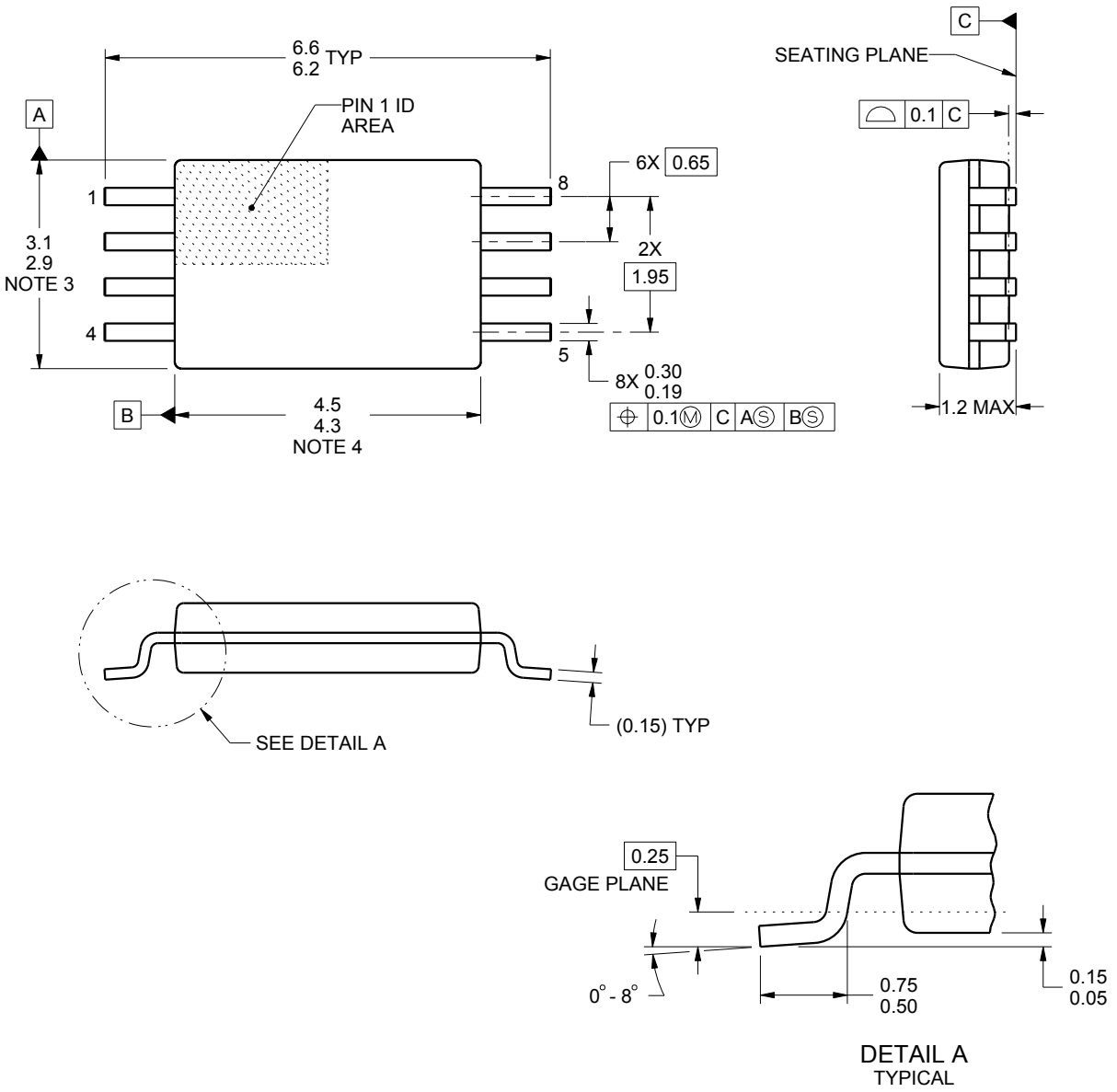

4227146/A

# PACKAGE OUTLINE

## PW0008A

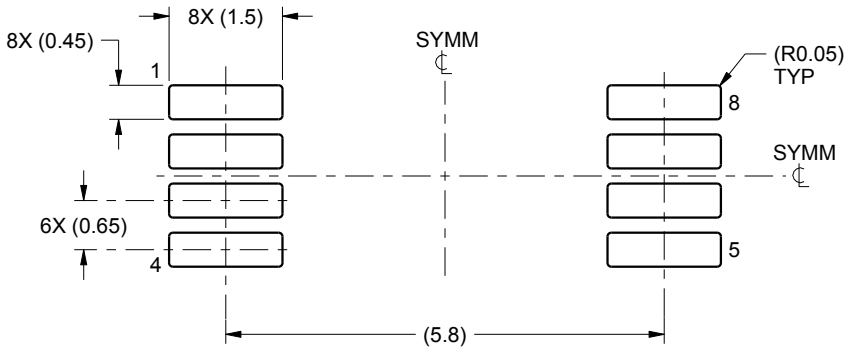
## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

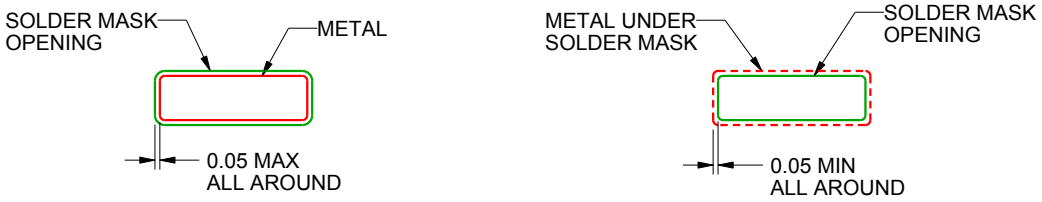



NOTES:

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. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153, variation AA.




LAND PATTERN EXAMPLE
SCALE:10X

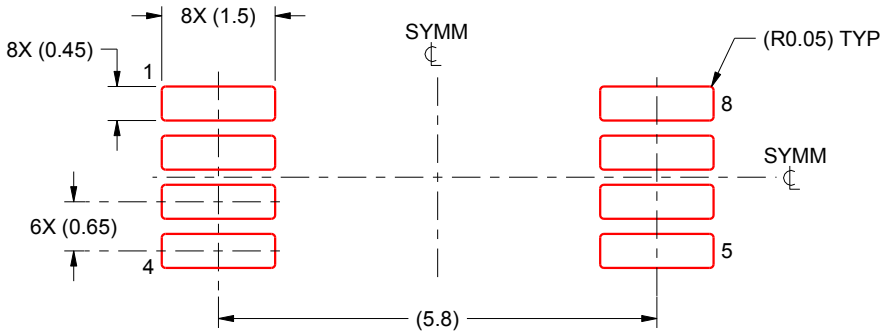



SOLDER MASK DETAILS
NOT TO SCALE

4221848/A 02/2015

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:10X

4221848/A 02/2015

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