# LM26LV and LM26LV-Q1 1.6-V, WSON-6 Factory Preset Temperature Switch and Temperature Sensor

## 1 Features

- Low 1.6-V Operation
- Low Quiescent Current
- Latching Function: Device Can Latch the Over Temperature Condition
- Push-Pull and Open-Drain Temperature Switch Outputs
- Wide Trip Point Range of 0°C to 150°C
- Very Linear Analog $V_{TEMP}$ Temperature Sensor Output
- $V_{TEMP}$ Output Short-Circuit Protected
- Accurate Over –50°C to 150°C Temperature Range
- Excellent Power Supply Noise Rejection
- LM26LVQISD-130 and LM26LVQISD-135 are AEC-Q100 Qualified and are Manufactured on an Automotive Grade Flow:
  - Device Temperature Grade 0: –40°C to 150°C Ambient Operating Temperature Range
  - Device HBM ESD Classification Level 3 A
  - Device CDM ESD Classification Level C6
  - Device MM ESD Classification Level M3

## 2 Applications

- Cell Phones and Wireless Transceivers
- Digital Cameras
- Battery Management Systems
- Automotive Applications
- Disk Drives
- Games and Appliances

## 3 Description

The LM26LV and LM26LV-Q1 are low-voltage, precision, dual-output, low-power temperature switches and temperature sensors. The temperature trip point ($T_{TRIP}$) can be preset at the factory to any temperature in the range of 0°C to 150°C in 1°C increments. Built-in temperature hysteresis ($T_{HYST}$) keeps the output stable in an environment of temperature instability.

In normal operation the LM26LV or LM26LV-Q1 temperature switch outputs assert when the die temperature exceeds $T_{TRIP}$. The temperature switch outputs will reset when the temperature falls below a temperature equal to ($T_{TRIP}$ – $T_{HYST}$). The OVERTEMP digital output, is active-high with a push-pull structure, while the $\overline{\text{OVERTEMP}}$ digital output, is active-low with an open-drain structure.

The analog output, $V_{TEMP}$, delivers an analog output voltage with Negative Temperature Coefficient (NTC).

Driving the TRIP_TEST input high causes the digital outputs to be asserted for in-situ verification and causes the threshold voltage to appear at the VTEMP output pin, which could be used to verify the temperature trip point.

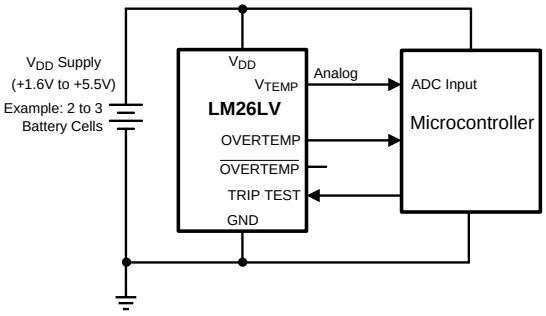
The LM26LV's and LM26LV-Q1's low minimum supply voltage makes them ideal for 1.8-V system designs. The wide operating range, low supply current, and excellent accuracy provide a temperature switch solution for a wide range of commercial and industrial applications.

**Device Information**[1]

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| LM26LV, LM26LV-Q1 | WSON (6) | 2.20 mm × 2.50 mm |

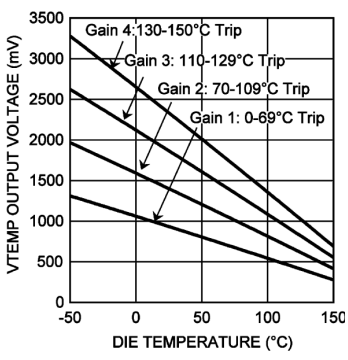
(1) For all available packages, see the orderable addendum at the end of the data sheet.

**Redundant Protection and Monitoring**




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**Typical Transfer Characteristic**




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## 4 Revision History

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

**Changes from Revision F (February 2013) to Revision G** **Page**

- Added *Device Information* table, *Pin Configuration and Functions* section, *Specifications* section, *ESD Ratings* table, *Thermal Information* table, *Switching Characteristics* table, *Detailed Description* section, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section ... 1
- Updated values in the *Thermal Information* table to align with JEDEC standards ... 5

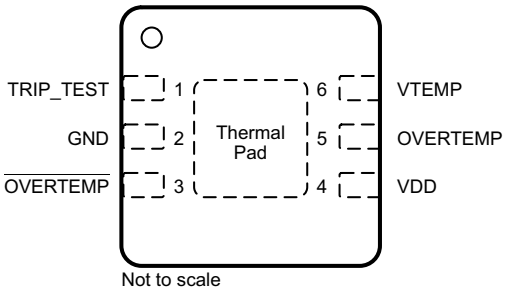
**Changes from Revision E (February 2013) to Revision F** **Page**

- Changed layout of National Semiconductor Data Sheet to TI format ... 1


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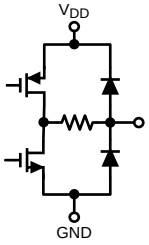
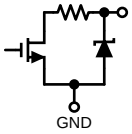
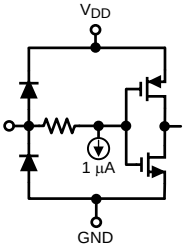
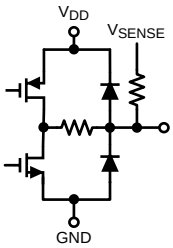
# 5 Pin Configuration and Functions

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




Not to scale

**Pin Functions**

| PIN | | TYPE | DESCRIPTION | EQUIVALENT CIRCUIT |
|---|---|---|---|---|
| NAME | NO. | | | |
| GND | 2 | GND | Power supply ground | — |
| OVERTEMP | 5 | O | Overtemperature switch output. Active high, push-pull.<br>Asserted when the measured temperature exceeds the trip point temperature or if TRIP_TEST = 1. This pin may be left open if not used. |  |
| $\overline{\text{OVERTEMP}}$ | 3 | O | Overtemperature switch output. Active low, open-drain (See *Determining the Pullup Resistor Value*).<br>Asserted when the measured temperature exceeds the trip point temperature or if TRIP_TEST = 1. This pin may be left open if not used. |  |
| TRIP_TEST | 1 | I | TRIP_TEST pin. Active high input.<br>If TRIP_TEST = 0 (Default) then: $V_{TEMP} = V_{TS}$, temperature sensor output voltage.<br>If TRIP_TEST = 1 then: OVERTEMP and $\overline{\text{OVERTEMP}}$ outputs are asserted and $V_{TEMP} = V_{TRIP}$, temperature trip voltage.<br>This pin may be left open if not used. |  |
| VDD | 4 | PWR | Positive supply voltage | — |
| VTEMP | 6 | O | $V_{TEMP}$ 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. |  |

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**Pin Functions (continued)**

| PIN | | TYPE | DESCRIPTION | EQUIVALENT CIRCUIT |
|---|---|---|---|---|
| NAME | NO. | | | |
| Thermal Pad | — | — | The best thermal conductivity between the device and the PCB is achieved by soldering the DAP of the package to the thermal pad on the PCB. The thermal pad can be a floating node. However, for improved noise immunity the thermal pad must be connected to the circuit GND node, preferably directly to pin 2 (GND) of the device. | — |

# 6 Specifications

## 6.1 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 $\overline{\text{OVERTEMP}}$ pin | –0.3 | 6 | V |
| Voltage at $\overline{\text{OVERTEMP}}$ and VTEMP pins | –0.3 | $V_{DD}$ + 0.5 | V |
| TRIP_TEST input voltage | –0.3 | $V_{DD}$ + 0.5 | V |
| Output current, any output pin | –7 | 7 | mA |
| Input current at any pin(3) | | 5 | mA |
| Maximum junction temperature, $T_{J(MAX)}$ | | 155 | °C |
| Storage temperature, $T_{stg}$ | –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) For soldering specifications, see *Absolute Maximum Ratings for Soldering*.
(3) When the input voltage ($V_I$) at any pin exceeds power supplies ($V_I$ < GND or $V_I$ > $V_{DD}$), the current at that pin must be limited to 5 mA.

## 6.2 ESD Ratings: LM26LV

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1) | ±4500 | V |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101(2) | ±1000 | |
| | | Machine model (MM)(3) | ±300 | |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible with the necessary precautions.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.
(3) The machine model (MM) is a 200-pF capacitor charged to the specified voltage then discharged directly into each pin.

## 6.3 ESD Ratings: LM26LV-Q1

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), per AEC Q100-002(1) | ±4500 | V |
| | | Charged-device model (CDM), per AEC Q100-011 | ±1000 | |
| | | Machine model (MM) | ±300 | |

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

## 6.4 Recommended Operating Conditions

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

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{DD}$ | Supply voltage | 1.6 | | 5.5 | V |
| | Supply current | | 8 | | µA |
| $T_A$ | Specified ambient temperature | –50 | | 150 | °C |


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## 6.5 Thermal Information

| THERMAL METRIC[1] | | LM26LV and LM26LV-Q1 NGF (WSON) 6 PINS | UNIT |
|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 100.7 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 121.7 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 70 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 7.1 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 70.3 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | 15.9 | °C/W |

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

## 6.6 Electrical Characteristics

Typical values apply for $T_A = T_J = 25°C$; minimum and maximum limits apply for $T_A = T_J = –50°C$ to 150°C, $V_{DD}$ = 1.6 V to 5.5 V (unless otherwise noted).[1][2]

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **GENERAL SPECIFICATIONS** | | | | | | |
| $I_S$ | Quiescent power supply current | | | 8 | 16 | µA |
| | Hysteresis | | 4.5 | 5 | 5.5 | °C |
| **OVERTEMP DIGITAL OUTPUT—ACTIVE HIGH, PUSH-PULL** | | | | | | |
| $V_{OH}$ | Logic *High* output voltage | $V_{DD} \geq 1.6$ V, Source ≤ 340 µA | $V_{DD} – 0.2$ | | | V |
| | | $V_{DD} \geq 2$ V, Source ≤ 498 µA | $V_{DD} – 0.2$ | | | |
| | | $V_{DD} \geq 3.3$ V, Source ≤ 780 µA | $V_{DD} – 0.2$ | | | |
| | | $V_{DD} \geq 1.6$ V, Source ≤ 600 µA | $V_{DD} – 0.45$ | | | |
| | | $V_{DD} \geq 2$ V, Source ≤ 980 µA | $V_{DD} – 0.45$ | | | |
| | | $V_{DD} \geq 3.3$ V, Source ≤ 1.6 mA | $V_{DD} – 0.45$ | | | |
| **BOTH OVERTEMP AND $\overline{\text{OVERTEMP}}$ DIGITAL OUTPUTS** | | | | | | |
| $V_{OL}$ | Logic *Low* output voltage | $V_{DD} \geq 1.6$ V, Source ≤ 385 µA | | | 0.2 | V |
| | | $V_{DD} \geq 2$ V, Source ≤ 500 µA | | | 0.2 | |
| | | $V_{DD} \geq 3.3$ V, Source ≤ 730 µA | | | 0.2 | |
| | | $V_{DD} \geq 1.6$ V, Source ≤ 690 µA | | | 0.45 | |
| | | $V_{DD} \geq 2$ V, Source ≤ 1.05 mA | | | 0.45 | |
| | | $V_{DD} \geq 3.3$ V, Source ≤ 1.62 mA | | | 0.45 | |
| **$\overline{\text{OVERTEMP}}$ DIGITAL OUTPUT—ACTIVE LOW, OPEN DRAIN** | | | | | | |
| $I_{OH}$ | Logic *High* output leakage current[3] | $T_A = 30°C$ | | 0.001 | 1 | µA |
| | | $T_A = 150°C$ | | 0.025 | 1 | |

(1) Limits are specified to TI's AOQL (Average Outgoing Quality Level).
(2) Typical values apply for $T_J = T_A = 25°C$ and represent most likely parametric norm.
(3) The 1-µA limit is based on a testing limitation and does not reflect the actual performance of the part. Expect to see a doubling of the current for every 15°C increase in temperature. For example, the 1-nA typical current at 25°C would increase to 16 nA at 85°C.

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## Electrical Characteristics (continued)

Typical values apply for $T_A = T_J = 25°C$; minimum and maximum limits apply for $T_A = T_J = –50°C$ to 150°C, $V_{DD}$ = 1.6 V to 5.5 V (unless otherwise noted).(1)(2)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **$V_{TEMP}$ ANALOG TEMPERATURE SENSOR OUTPUT** | | | | | | | |
| | VTEMP sensor gain | Gain 1 (trip point = 0°C to 69°C) | | | –5.1 | | mV/°C |
| | | Gain 2 (trip point = 70°C to 109°C) | | | –7.7 | | |
| | | Gain 3 (trip point = 110°C to 129°C) | | | –10.3 | | |
| | | Gain 4 (trip point = 130°C to 150°C) | | | –12.8 | | |
| | VTEMP load regulation(4) | 1.6 V ≤ $V_{DD}$ < 1.8 V | Source ≤ 90 µA, $V_{DD} – V_{TEMP}$ ≥ 200 mV | –1 | –0.1 | | mV |
| | | | Sink ≤ 100 µA, $V_{TEMP}$ ≥ 260 mV | | 0.1 | 1 | |
| | | $V_{DD}$ ≥ 1.8 V | Source ≤ 120 µA, $V_{DD} – V_{TEMP}$ ≥ 200 mV | –1 | –0.1 | | |
| | | | Sink ≤ 200 µA, $V_{TEMP}$ ≥ 260 mV | | 0.1 | 1 | |
| | | Source or sink = 100 µA | | | 1 | | Ω |
| | Supply to VTEMP DC line regulation(5) | $V_{DD}$ = 1.6 V to 5.5 V | | | 0.29 | | mV |
| | | | | | 74 | | µV/V |
| | | | | | –82 | | dB |
| $C_L$ | VTEMP output load capacitance | Without series resistor. See *Capacitive Loads*. | | | 1100 | | pF |
| **TRIP_TEST DIGITAL INPUT** | | | | | | | |
| $V_{IH}$ | Logic *High* threshold voltage | | | $V_{DD}$ – 0.5 | | | V |
| $V_{IL}$ | Logic *Low* threshold voltage | | | | | 0.5 | |
| $I_{IH}$ | Logic *High* input current | | | | 1.5 | 2.5 | µA |
| $I_{IL}$ | Logic *Low* input current(3) | | | | 0.001 | 1 | µA |

(4) Source currents are flowing out of the LM26LV or LM26LV-Q1. Sink currents are flowing into the LM26LV or LM26LV-Q1.
(5) 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 *Voltage Shift*.

## 6.7 Switching Characteristics

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

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $t_{EN}$ | Time from power ON to digital output enabled(1) | | | 1.1 | 2.3 | ms |
| $t_{VTEMP}$ | Time from power ON to analog temperature valid(1) | $C_L$ = 0 pF to 1100 pF | | 1 | 2.9 | ms |

(1) Figure 1 and Figure 2 show the definitions of $t_{EN}$ and $t_{VTEMP}$.


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## 6.8 Accuracy Characteristics

See (1)

| PARAMETER | TEST CONDITIONS | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| **TRIP POINT ACCURACY** | | | | | |
| Trip point accuracy(2) | $T_A$ = 0°C to 150°C, $V_{DD}$ = 5 V | | –2.2 | 2.2 | °C |
| **$V_{TEMP}$ ANALOG TEMPERATURE SENSOR OUTPUT ACCURACY(3)** | | | | | |
| $V_{TEMP}$ temperature accuracy(2) | Gain 1<br>trip point = 0°C to 69°C | $T_A$ = 20°C to 40°C, $V_{DD}$ = 1.6 V to 5.5 V | –1.8 | 1.8 | °C |
| | | $T_A$ = 0°C to 70°C, $V_{DD}$ = 1.6 V to 5.5 V | –2 | 2 | |
| | | $T_A$ = 0°C to 90°C, $V_{DD}$ = 1.6 V to 5.5 V | –2.1 | 2.1 | |
| | | $T_A$ = 0°C to 120°C, $V_{DD}$ = 1.6 V to 5.5 V | –2.2 | 2.2 | |
| | | $T_A$ = 0°C to 150°C, $V_{DD}$ = 1.6 V to 5.5 V | –2.3 | 2.3 | |
| | | $T_A$ = –50°C to 0°C, $V_{DD}$ = 1.7 V to 5.5 V | –1.7 | 1.7 | |
| | Gain 2<br>trip point = 70°C to 109°C | $T_A$ = 20°C to 40°C, $V_{DD}$ = 1.8 V to 5.5 V | –1.8 | 1.8 | |
| | | $T_A$ = 0°C to 70°C, $V_{DD}$ = 1.9 V to 5.5 V | –2 | 2 | |
| | | $T_A$ = 0°C to 90°C, $V_{DD}$ = 1.9 V to 5.5 V | –2.1 | 2.1 | |
| | | $T_A$ = 0°C to 120°C, $V_{DD}$ = 1.9 V to 5.5 V | –2.2 | 2.2 | |
| | | $T_A$ = 0°C to 150°C, $V_{DD}$ = 1.9 V to 5.5 V | –2.3 | 2.3 | |
| | | $T_A$ = –50°C to 0°C, $V_{DD}$ = 2.3 V to 5.5 V | –1.7 | 1.7 | |
| | Gain 3<br>trip point = 110°C to 129°C | $T_A$ = 20°C to 40°C, $V_{DD}$ = 2.3 V to 5.5 V | –1.8 | 1.8 | |
| | | $T_A$ = 0°C to 70°C, $V_{DD}$ = 2.5 V to 5.5 V | –2 | 2 | |
| | | $T_A$ = 0°C to 90°C, $V_{DD}$ = 2.5 V to 5.5 V | –2.1 | 2.1 | |
| | | $T_A$ = 0°C to 120°C, $V_{DD}$ = 2.5 V to 5.5 V | –2.2 | 2.2 | |
| | | $T_A$ = 0°C to 150°C, $V_{DD}$ = 2.5 V to 5.5 V | –2.3 | 2.3 | |
| | | $T_A$ = –50°C to 0°C, $V_{DD}$ = 3 V to 5.5 V | –1.7 | 1.7 | |
| | Gain 4<br>trip point = 130°C to 150°C | $T_A$ = 20°C to 40°C, $V_{DD}$ = 2.7 V to 5.5 V | –1.8 | 1.8 | |
| | | $T_A$ = 0°C to 70°C, $V_{DD}$ = 3 V to 5.5 V | –2 | 2 | |
| | | $T_A$ = 0°C to 90°C, $V_{DD}$ = 3 V to 5.5 V | –2.1 | 2.1 | |
| | | $T_A$ = 0°C to 120°C, $V_{DD}$ = 3 V to 5.5 V | –2.2 | 2.2 | |
| | | $T_A$ = 0°C to 150°C, $V_{DD}$ = 3 V to 5.5 V | –2.3 | 2.3 | |
| | | $T_A$ = –50°C to 0°C, $V_{DD}$ = 3.6 V to 5.5 V | –1.7 | 1.7 | |

(1) Limits are specified to TI's AOQL (Average Outgoing Quality Level).
(2) Accuracy is defined as the error between the measured and reference output voltages, tabulated in Table 1 at the specified conditions of supply gain setting, voltage, and temperature (°C). Accuracy limits include line regulation within the specified conditions. Accuracy limits do not include load regulation; they assume no DC load.
(3) Changes in output due to self heating can be computed by multiplying the internal dissipation by the temperature thermal resistance.

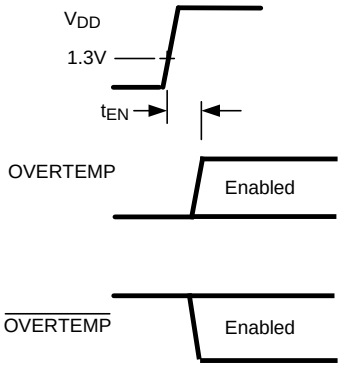



**Figure 1. Definition of $t_{EN}$**

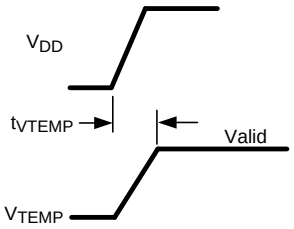



**Figure 2. Definition of $t_{VTEMP}$**


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## 6.9 Typical Characteristics

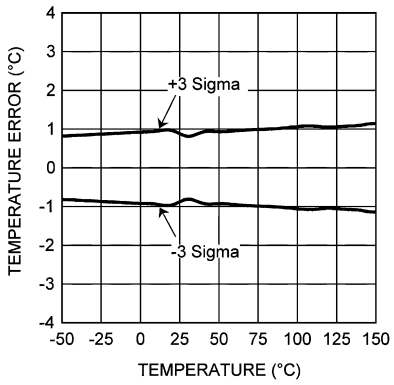



**Figure 3. VTEMP Output Temperature Error vs Temperature**

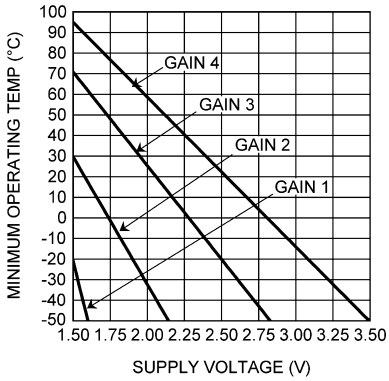



**Figure 4. Minimum Operating Temperature vs Supply Voltage**

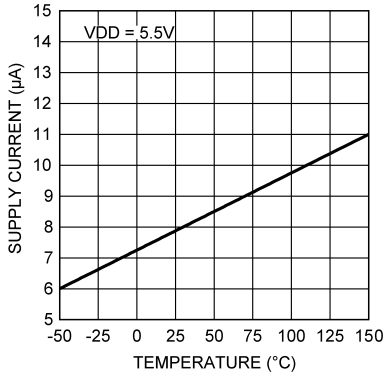



**Figure 5. Supply Current vs Temperature**

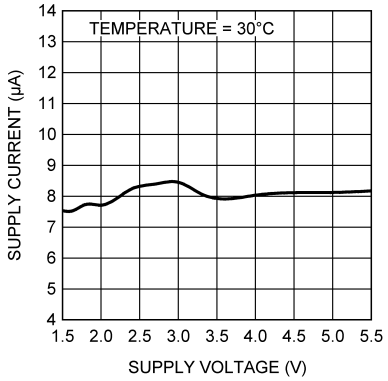
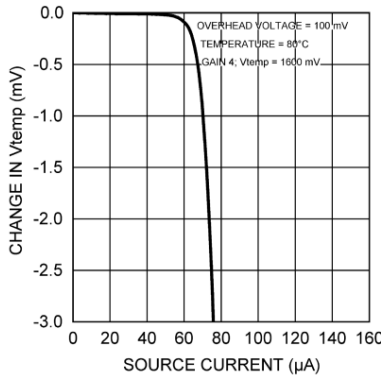
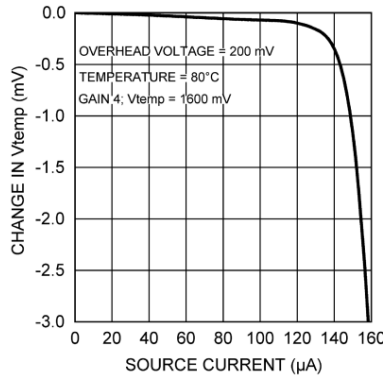



**Figure 6. Supply Current vs Supply Voltage**




100-mV overhead $T_A$ = 80°C Sourcing current

**Figure 7. Load Regulation** (1)



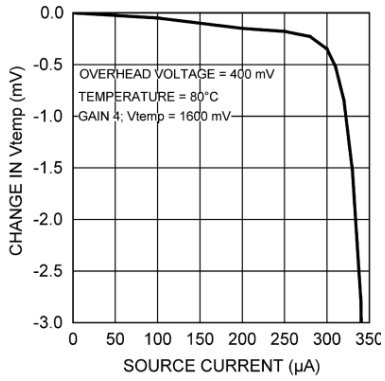

200-mV overhead $T_A$ = 80°C Sourcing Current

**Figure 8. Load Regulation(1)**

(1) The curves shown represent typical performance under worst-case conditions. Performance improves with larger $V_{TEMP}$, larger $V_{DD}$, and lower temperatures.

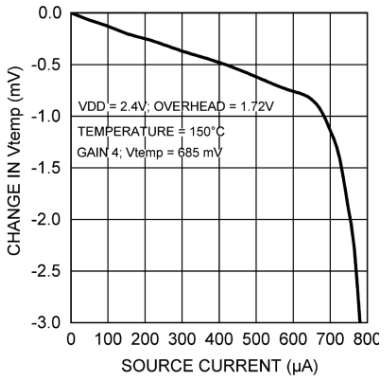
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## Typical Characteristics (continued)



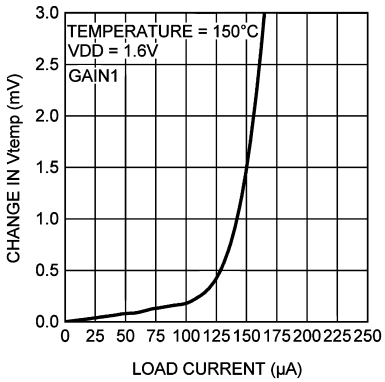

400-mV overhead $T_A$ = 80°C Sourcing current

**Figure 9. Load Regulation(1)**



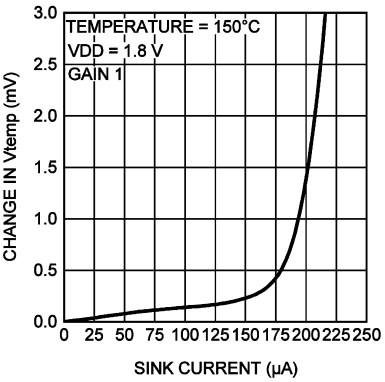

1.72-V overhead $T_A$ = 150°C $V_{DD}$ = 2.4 V Sourcing current

**Figure 10. Load Regulation(1)**



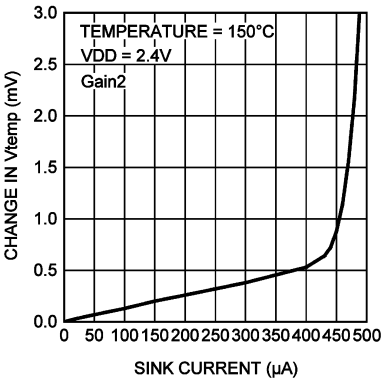

$V_{DD}$ = 1.6 V Sinking Current

**Figure 11. Load Regulation(1)**




$V_{DD}$ = 1.8 V Sinking Current

**Figure 12. Load Regulation(1)**




$V_{DD}$ = 2.4 V Sinking Current

**Figure 13. Load Regulation(1)**

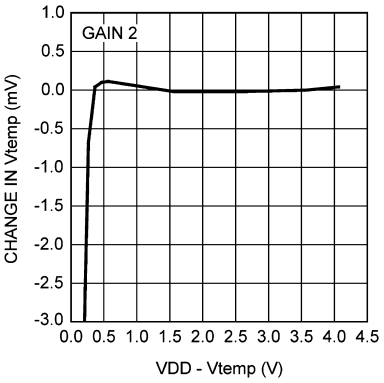



**Figure 14. Change in $V_{TEMP}$ vs Overhead Voltage**

(1) The curves shown represent typical performance under worst-case conditions. Performance improves with larger $V_{TEMP}$, larger $V_{DD}$, and lower temperatures.


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## Typical Characteristics (continued)

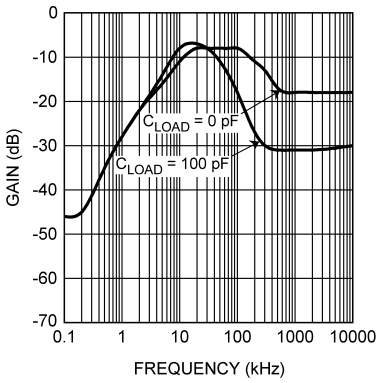
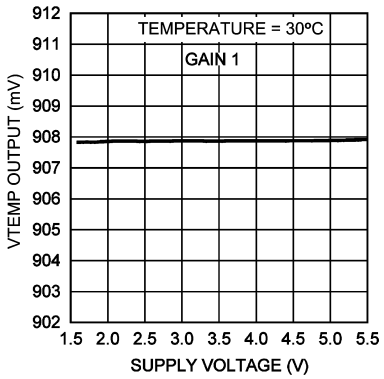
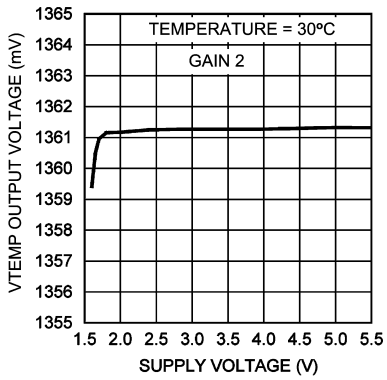



**Figure 15. $V_{TEMP}$ Supply-Noise Rejection vs Frequency**



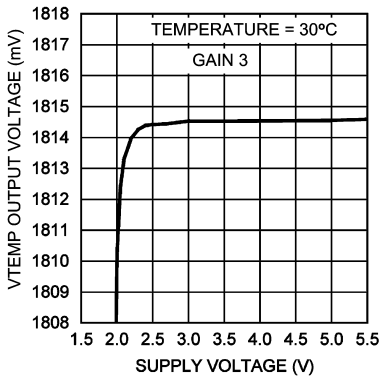

Gain 1 (Trip Points = 0°C tp 69°C)

**Figure 16. Line Regulation $V_{TEMP}$ vs Supply Voltage**



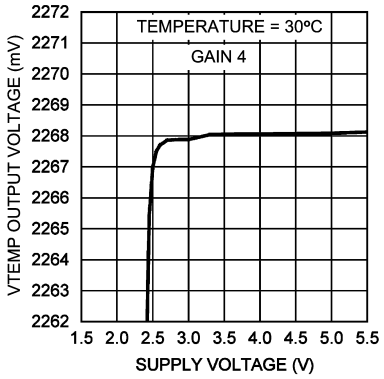

Gain 2 (Trip Points = 70°C to 109°C)

**Figure 17. Line Regulation $V_{TEMP}$ vs Supply Voltage**




Gain 3 (Trip Points = 110°C to 129°C)

**Figure 18. Line Regulation $V_{TEMP}$ vs Supply Voltage**




Gain 4 (Trip Points = 130°C to 150°C)

**Figure 19. Line Regulation $V_{TEMP}$ vs Supply Voltage**

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# 7 Detailed Description

## 7.1 Overview

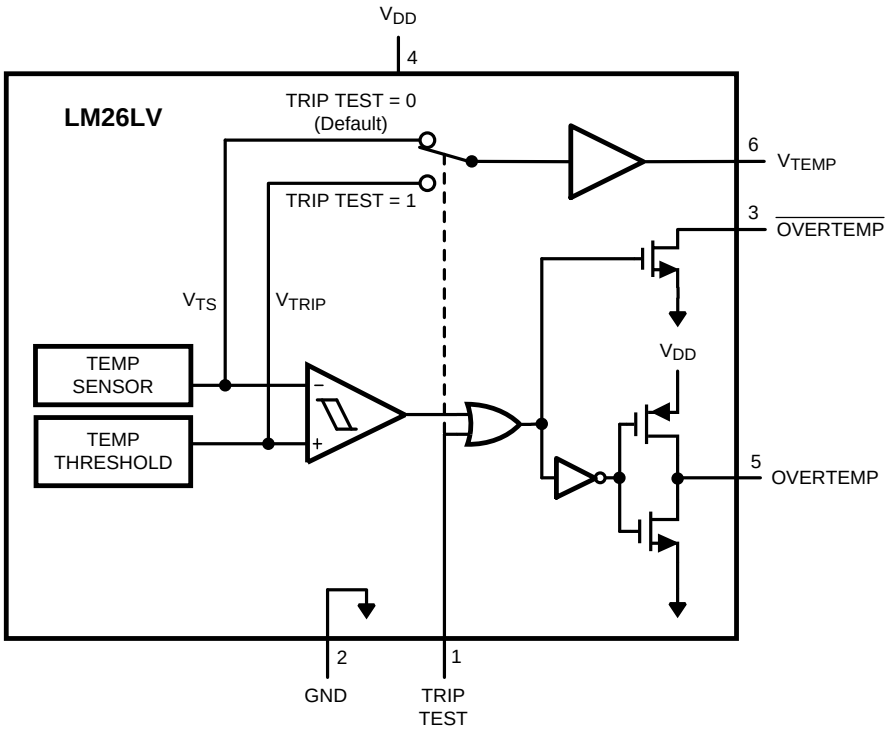
The LM26LV and LM26LV-Q1 are precision, dual-output, temperature switches with analog temperature sensor output. The trip temperature ($T_{TRIP}$) is factory selected by the order number. The $V_{TEMP}$ class AB analog output provides a voltage that is proportional to temperature. The LM26LV and LM26LV-Q1 include an internal reference DAC (TEMP THRESHOLD), 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 preprogrammed by TI. The result of the reference DAC voltage and the temperature sensor output comparison is provided on two output pins $\overline{\text{OVERTEMP}}$ and OVERTEMP.

The $V_{TEMP}$ output has a programmable gain. The output gain has 4 possible settings as described in Table 1. The gain setting is dependent on the temperature trip point selected.

Built-in temperature hysteresis ($T_{HYST}$) prevents the digital outputs from oscillating. The OVERTEMP and $\overline{\text{OVERTEMP}}$ activates when the die temperature exceeds $T_{TRIP}$ and releases when the temperature falls below a temperature equal to $T_{TRIP}$ minus $T_{HYST}$. OVERTEMP is active-high with a push-pull structure. $\overline{\text{OVERTEMP}}$, is active-low with an open-drain structure. The comparator hysteresis is fixed at 5°C.

Driving the TRIP-TEST high activates the digital outputs. A processor can check the logic level of the OVERTEMP or $\overline{\text{OVERTEMP}}$, 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 OVERTEMP to TRIP-TEST latches the output after it trips. It can be cleared by forcing TRIP-TEST low or powering off the LM26LV or LM26LV-Q1.

## 7.2 Functional Block Diagram




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## 7.3 Feature Description

### 7.3.1 LM26LV and LM26LV-Q1 $V_{TEMP}$ vs Die Temperature Conversion Table

The LM26LV and LM26LV-Q1 have one out of four possible factory-set gains, Gain 1 through Gain 4, depending on the range of the Temperature Trip Point. The $V_{TEMP}$ temperature sensor voltage, in millivolts, at each discrete die temperature over the complete operating temperature range, and for each of the four Temperature Trip Point ranges, is shown in Table 1. This table is the reference from which the LM26LV and LM26LV-Q1 accuracy specifications (listed in *Accuracy Characteristics*) are determined. This table can be used, for example, in a host processor look-up table. See *The Second-Order Equation (Parabolic)* for the parabolic equation used in the Conversion Table.

**Table 1. $V_{TEMP}$ Temperature Sensor Output Voltage vs Die Temperature Conversion Table**

| DIE TEMPERATURE (°C) | ANALOG OUTPUT VOLTAGE, $V_{TEMP}$ (mV)(1) | | | |
|---|---|---|---|---|
| | GAIN 1 | GAIN 2 | GAIN 3 | GAIN 4 |
| –50 | 1312 | 1967 | 2623 | 3278 |
| –49 | 1307 | 1960 | 2613 | 3266 |
| –48 | 1302 | 1952 | 2603 | 3253 |
| –47 | 1297 | 1945 | 2593 | 3241 |
| –46 | 1292 | 1937 | 2583 | 3229 |
| –45 | 1287 | 1930 | 2573 | 3216 |
| –44 | 1282 | 1922 | 2563 | 3204 |
| –43 | 1277 | 1915 | 2553 | 3191 |
| –42 | 1272 | 1908 | 2543 | 3179 |
| –41 | 1267 | 1900 | 2533 | 3166 |
| –40 | 1262 | 1893 | 2523 | 3154 |
| –39 | 1257 | 1885 | 2513 | 3141 |
| –38 | 1252 | 1878 | 2503 | 3129 |
| –37 | 1247 | 1870 | 2493 | 3116 |
| –36 | 1242 | 1863 | 2483 | 3104 |
| –35 | 1237 | 1855 | 2473 | 3091 |
| –34 | 1232 | 1848 | 2463 | 3079 |
| –33 | 1227 | 1840 | 2453 | 3066 |
| –32 | 1222 | 1833 | 2443 | 3054 |
| –31 | 1217 | 1825 | 2433 | 3041 |
| –30 | 1212 | 1818 | 2423 | 3029 |
| –29 | 1207 | 1810 | 2413 | 3016 |
| –28 | 1202 | 1803 | 2403 | 3004 |
| –27 | 1197 | 1795 | 2393 | 2991 |
| –26 | 1192 | 1788 | 2383 | 2979 |
| –25 | 1187 | 1780 | 2373 | 2966 |
| –24 | 1182 | 1773 | 2363 | 2954 |
| –23 | 1177 | 1765 | 2353 | 2941 |
| –22 | 1172 | 1757 | 2343 | 2929 |
| –21 | 1167 | 1750 | 2333 | 2916 |
| –20 | 1162 | 1742 | 2323 | 2903 |
| –19 | 1157 | 1735 | 2313 | 2891 |
| –18 | 1152 | 1727 | 2303 | 2878 |
| –17 | 1147 | 1720 | 2293 | 2866 |
| –16 | 1142 | 1712 | 2283 | 2853 |
| –15 | 1137 | 1705 | 2272 | 2841 |
| –14 | 1132 | 1697 | 2262 | 2828 |
| –13 | 1127 | 1690 | 2252 | 2815 |
| –12 | 1122 | 1682 | 2242 | 2803 |

(1) $V_{DD}$ = 5 V. Values are **bold** for each gain's respective trip point range.

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## Feature Description (continued)

### Table 1. $V_{TEMP}$ Temperature Sensor Output Voltage vs Die Temperature Conversion Table (continued)

| DIE TEMPERATURE (°C) | ANALOG OUTPUT VOLTAGE, $V_{TEMP}$ (mV)(1) | | | |
|---|---|---|---|---|
| | GAIN 1 | GAIN 2 | GAIN 3 | GAIN 4 |
| –11 | 1116 | 1674 | 2232 | 2790 |
| –10 | 1111 | 1667 | 2222 | 2777 |
| –9 | 1106 | 1659 | 2212 | 2765 |
| –8 | 1101 | 1652 | 2202 | 2752 |
| –7 | 1096 | 1644 | 2192 | 2740 |
| –6 | 1091 | 1637 | 2182 | 2727 |
| –5 | 1086 | 1629 | 2171 | 2714 |
| –4 | 1081 | 1621 | 2161 | 2702 |
| –3 | 1076 | 1614 | 2151 | 2689 |
| –2 | 1071 | 1606 | 2141 | 2676 |
| –1 | 1066 | 1599 | 2131 | 2664 |
| 0 | **1061** | 1591 | 2121 | 2651 |
| 1 | **1056** | 1583 | 2111 | 2638 |
| 2 | **1051** | 1576 | 2101 | 2626 |
| 3 | **1046** | 1568 | 2090 | 2613 |
| 4 | **1041** | 1561 | 2080 | 2600 |
| 5 | **1035** | 1553 | 2070 | 2587 |
| 6 | **1030** | 1545 | 2060 | 2575 |
| 7 | **1025** | 1538 | 2050 | 2562 |
| 8 | **1020** | 1530 | 2040 | 2549 |
| 9 | **1015** | 1522 | 2029 | 2537 |
| 10 | **1010** | 1515 | 2019 | 2524 |
| 11 | **1005** | 1507 | 2009 | 2511 |
| 12 | **1000** | 1499 | 1999 | 2498 |
| 13 | **995** | 1492 | 1989 | 2486 |
| 14 | **990** | 1484 | 1978 | 2473 |
| 15 | **985** | 1477 | 1968 | 2460 |
| 16 | **980** | 1469 | 1958 | 2447 |
| 17 | **974** | 1461 | 1948 | 2435 |
| 18 | **969** | 1454 | 1938 | 2422 |
| 19 | **964** | 1446 | 1927 | 2409 |
| 20 | **959** | 1438 | 1917 | 2396 |
| 21 | **954** | 1431 | 1907 | 2383 |
| 22 | **949** | 1423 | 1897 | 2371 |
| 23 | **944** | 1415 | 1886 | 2358 |
| 24 | **939** | 1407 | 1876 | 2345 |
| 25 | **934** | 1400 | 1866 | 2332 |
| 26 | **928** | 1392 | 1856 | 2319 |
| 27 | **923** | 1384 | 1845 | 2307 |
| 28 | **918** | 1377 | 1835 | 2294 |
| 29 | **913** | 1369 | 1825 | 2281 |
| 30 | **908** | 1361 | 1815 | 2268 |
| 31 | **903** | 1354 | 1804 | 2255 |
| 32 | **898** | 1346 | 1794 | 2242 |
| 33 | **892** | 1338 | 1784 | 2230 |
| 34 | **887** | 1331 | 1774 | 2217 |
| 35 | **882** | 1323 | 1763 | 2204 |
| 36 | **877** | 1315 | 1753 | 2191 |
| 37 | **872** | 1307 | 1743 | 2178 |


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## Feature Description (continued)

### Table 1. $V_{TEMP}$ Temperature Sensor Output Voltage vs Die Temperature Conversion Table (continued)

| DIE TEMPERATURE (°C) | ANALOG OUTPUT VOLTAGE, $V_{TEMP}$ (mV)(1) | | | |
|---|---|---|---|---|
| | GAIN 1 | GAIN 2 | GAIN 3 | GAIN 4 |
| 38 | **867** | 1300 | 1732 | 2165 |
| 39 | **862** | 1292 | 1722 | 2152 |
| 40 | **856** | 1284 | 1712 | 2139 |
| 41 | **851** | 1276 | 1701 | 2127 |
| 42 | **846** | 1269 | 1691 | 2114 |
| 43 | **841** | 1261 | 1681 | 2101 |
| 44 | **836** | 1253 | 1670 | 2088 |
| 45 | **831** | 1245 | 1660 | 2075 |
| 46 | **825** | 1238 | 1650 | 2062 |
| 47 | **820** | 1230 | 1639 | 2049 |
| 48 | **815** | 1222 | 1629 | 2036 |
| 49 | **810** | 1214 | 1619 | 2023 |
| 50 | **805** | 1207 | 1608 | 2010 |
| 51 | **800** | 1199 | 1598 | 1997 |
| 52 | **794** | 1191 | 1588 | 1984 |
| 53 | **789** | 1183 | 1577 | 1971 |
| 54 | **784** | 1176 | 1567 | 1958 |
| 55 | **779** | 1168 | 1557 | 1946 |
| 56 | **774** | 1160 | 1546 | 1933 |
| 57 | **769** | 1152 | 1536 | 1920 |
| 58 | **763** | 1144 | 1525 | 1907 |
| 59 | **758** | 1137 | 1515 | 1894 |
| 60 | **753** | 1129 | 1505 | 1881 |
| 61 | **748** | 1121 | 1494 | 1868 |
| 62 | **743** | 1113 | 1484 | 1855 |
| 63 | **737** | 1105 | 1473 | 1842 |
| 64 | **732** | 1098 | 1463 | 1829 |
| 65 | **727** | 1090 | 1453 | 1816 |
| 66 | **722** | 1082 | 1442 | 1803 |
| 67 | **717** | 1074 | 1432 | 1790 |
| 68 | **711** | 1066 | 1421 | 1776 |
| 69 | **706** | 1059 | 1411 | 1763 |
| 70 | 701 | **1051** | 1400 | 1750 |
| 71 | 696 | **1043** | 1390 | 1737 |
| 72 | 690 | **1035** | 1380 | 1724 |
| 73 | 685 | **1027** | 1369 | 1711 |
| 74 | 680 | **1019** | 1359 | 1698 |
| 75 | 675 | **1012** | 1348 | 1685 |
| 76 | 670 | **1004** | 1338 | 1672 |
| 77 | 664 | **996** | 1327 | 1659 |
| 78 | 659 | **988** | 1317 | 1646 |
| 79 | 654 | **980** | 1306 | 1633 |
| 80 | 649 | **972** | 1296 | 1620 |
| 81 | 643 | **964** | 1285 | 1607 |
| 82 | 638 | **957** | 1275 | 1593 |
| 83 | 633 | **949** | 1264 | 1580 |
| 84 | 628 | **941** | 1254 | 1567 |
| 85 | 622 | **933** | 1243 | 1554 |
| 86 | 617 | **925** | 1233 | 1541 |

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## Feature Description (continued)

### Table 1. $V_{TEMP}$ Temperature Sensor Output Voltage vs Die Temperature Conversion Table (continued)

| DIE TEMPERATURE (°C) | ANALOG OUTPUT VOLTAGE, $V_{TEMP}$ (mV)(1) | | | |
|---|---|---|---|---|
| | GAIN 1 | GAIN 2 | GAIN 3 | GAIN 4 |
| 87 | 612 | **917** | 1222 | 1528 |
| 88 | 607 | **909** | 1212 | 1515 |
| 89 | 601 | **901** | 1201 | 1501 |
| 90 | 596 | **894** | 1191 | 1488 |
| 91 | 591 | **886** | 1180 | 1475 |
| 92 | 586 | **878** | 1170 | 1462 |
| 93 | 580 | **870** | 1159 | 1449 |
| 94 | 575 | **862** | 1149 | 1436 |
| 95 | 570 | **854** | 1138 | 1422 |
| 96 | 564 | **846** | 1128 | 1409 |
| 97 | 559 | **838** | 1117 | 1396 |
| 98 | 554 | **830** | 1106 | 1383 |
| 99 | 549 | **822** | 1096 | 1370 |
| 100 | 543 | **814** | 1085 | 1357 |
| 101 | 538 | **807** | 1075 | 1343 |
| 102 | 533 | **799** | 1064 | 1330 |
| 103 | 527 | **791** | 1054 | 1317 |
| 104 | 522 | **783** | 1043 | 1304 |
| 105 | 517 | **775** | 1032 | 1290 |
| 106 | 512 | **767** | 1022 | 1277 |
| 107 | 506 | **759** | 1011 | 1264 |
| 108 | 501 | **751** | 1001 | 1251 |
| 109 | 496 | **743** | 990 | 1237 |
| 110 | 490 | 735 | **979** | 1224 |
| 111 | 485 | 727 | **969** | 1211 |
| 112 | 480 | 719 | **958** | 1198 |
| 113 | 474 | 711 | **948** | 1184 |
| 114 | 469 | 703 | **937** | 1171 |
| 115 | 464 | 695 | **926** | 1158 |
| 116 | 459 | 687 | **916** | 1145 |
| 117 | 453 | 679 | **905** | 1131 |
| 118 | 448 | 671 | **894** | 1118 |
| 119 | 443 | 663 | **884** | 1105 |
| 120 | 437 | 655 | **873** | 1091 |
| 121 | 432 | 647 | **862** | 1078 |
| 122 | 427 | 639 | **852** | 1065 |
| 123 | 421 | 631 | **841** | 1051 |
| 124 | 416 | 623 | **831** | 1038 |
| 125 | 411 | 615 | **820** | 1025 |
| 126 | 405 | 607 | **809** | 1011 |
| 127 | 400 | 599 | **798** | 998 |
| 128 | 395 | 591 | **788** | 985 |
| 129 | 389 | 583 | **777** | 971 |
| 130 | 384 | 575 | 766 | **958** |
| 131 | 379 | 567 | 756 | **945** |
| 132 | 373 | 559 | 745 | **931** |
| 133 | 368 | 551 | 734 | **918** |
| 134 | 362 | 543 | 724 | **904** |
| 135 | 357 | 535 | 713 | **891** |


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## Feature Description (continued)

**Table 1. $V_{TEMP}$ Temperature Sensor Output Voltage vs Die Temperature Conversion Table (continued)**

| DIE TEMPERATURE (°C) | ANALOG OUTPUT VOLTAGE, $V_{TEMP}$ (mV)(1) | | | |
|---|---|---|---|---|
| | GAIN 1 | GAIN 2 | GAIN 3 | GAIN 4 |
| 136 | 352 | 527 | 702 | **878** |
| 137 | 346 | 519 | 691 | **864** |
| 138 | 341 | 511 | 681 | **851** |
| 139 | 336 | 503 | 670 | **837** |
| 140 | 330 | 495 | 659 | **824** |
| 141 | 325 | 487 | 649 | **811** |
| 142 | 320 | 479 | 638 | **797** |
| 143 | 314 | 471 | 627 | **784** |
| 144 | 309 | 463 | 616 | **770** |
| 145 | 303 | 455 | 606 | **757** |
| 146 | 298 | 447 | 595 | **743** |
| 147 | 293 | 438 | 584 | **730** |
| 148 | 287 | 430 | 573 | **716** |
| 149 | 282 | 422 | 562 | **703** |
| 150 | 277 | 414 | 552 | **690** |

### 7.3.2 $V_{TEMP}$ vs Die Temperature Approximations

The LM26LV's and LM26LV-Q1's $V_{TEMP}$ analog temperature output is very linear. Table 1 and the equation in *The Second-Order Equation (Parabolic)* represent the most accurate typical performance of the $V_{TEMP}$ voltage output versus temperature.

#### *7.3.2.1 The Second-Order Equation (Parabolic)*

The data from Table 1, or Equation 1, when plotted, has an umbrella-shaped parabolic curve. $V_{TEMP}$ is in mV.

$$\begin{aligned}
&\text{GAIN1}: V_{TEMP} = 907.9 - 5.132 \times (T_{DIE} - 30°C) - 1.08^{-3} \times (T_{DIE} - 30°C)\\
&\text{GAIN2}: V_{TEMP} = 1361.4 - 7.701 \times (T_{DIE} - 30°C) - 1.6^{-3} \times (T_{DIE} - 30°C)\\
&\text{GAIN3}: V_{TEMP} = 1814.6 - 10.27 \times (T_{DIE} - 30°C) - 2.12^{-3} \times (T_{DIE} - 30°C)\\
&\text{GAIN4}: V_{TEMP} = 2268.1 - 12.838 \times (T_{DIE} - 30°C) - 2.64^{-3} \times (T_{DIE} - 30°C)
\end{aligned} \quad (1)$$

#### *7.3.2.2 The First-Order Approximation (Linear)*

For a quicker approximation, although less accurate than the second-order, over the full operating temperature range the linear formula below can be used. Using Equation 2, with the constant and slope in the following set of equations, the best-fit $V_{TEMP}$ versus die temperature performance can be calculated with an approximation error less than 18 mV. $V_{TEMP}$ is in mV.

$$\begin{aligned}
&\text{GAIN1}: V_{TEMP} = 1060 - 5.18 \times T_{DIE}\\
&\text{GAIN2}: V_{TEMP} = 1590 - 7.77 \times T_{DIE}\\
&\text{GAIN3}: V_{TEMP} = 2119 - 10.36 \times T_{DIE}\\
&\text{GAIN4}: V_{TEMP} = 2649 - 12.94 \times T_{DIE}
\end{aligned} \quad (2)$$

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#### 7.3.2.3 First-Order Approximation (Linear) Over Small Temperature Range

For a linear approximation, a line can easily be calculated over the desired temperature range from Table 1 using the two-point equation:

$$V - V_1 = \left(\frac{V_2 - V_1}{T_2 - T_1}\right) \times (T - T_1)$$

where

- V is in mV
- T is in °C
- $T_1$ and $V_1$ are the coordinates of the lowest temperature
- $T_2$ and $V_2$ are the coordinates of the highest temperature (3)

For example, to determine the equation of a line with GAIN4, with a temperature from 20°C to 50°C, proceed using Equation 4, Equation 5, and Equation 6:

$$V - 2396\ mV = \left(\frac{2010\ mV - 2396\ mV}{50°C - 20°C}\right) \times (T - 20°C) \quad (4)$$

$$V - 2396\ mV = -12.8\ mV/°C \times (T - 20°C) \quad (5)$$

$$V = -12.8\ mV/°C \times (T - 20°C) + 2396\ mV \quad (6)$$

Using this method of linear approximation, the transfer function can be approximated for one or more temperature ranges of interest.

### 7.3.3 OVERTEMP and $\overline{\text{OVERTEMP}}$ Digital Outputs

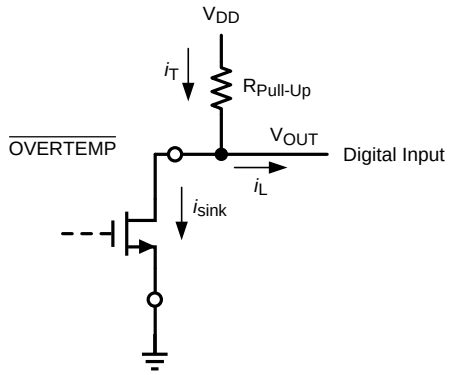
The OVERTEMP active high, push-pull output and the $\overline{\text{OVERTEMP}}$ active low, open-drain output both assert at the same time whenever the die temperature reaches the factory preset temperature trip point. They also assert simultaneously whenever the TRIP_TEST pin is set high. Both outputs deassert 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 OVERTEMP or the $\overline{\text{OVERTEMP}}$ digital output pins can be left open if not used.

#### 7.3.3.1 $\overline{\text{OVERTEMP}}$ Open-Drain Digital Output

The $\overline{\text{OVERTEMP}}$ active low, open-drain digital output, if used, requires a pullup resistor between this pin and $V_{DD}$. The following section shows how to determine the pullup resistor value.

##### 7.3.3.1.1 Determining the Pullup Resistor Value





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The pullup resistor value is calculated at the condition of maximum total current, $I_T$, through the resistor. The total current is:

$$I_T = I_L + I_{SINK} \quad (7)$$

where

- $I_T$ is the maximum total current through the pullup resistor at $V_{OL}$.
- $I_L$ is the load current, which is very low for typical digital inputs.

The pullup resistor maximum value can be found by using Equation 8.

$$R_{PULLUP} = \frac{V_{DD(MAX)} - V_{OL}}{I_T} \quad (8)$$

where

- $V_{DD(MAX)}$ is the maximum power supply voltage to be used in the customer's system.
- $V_{OUT}$ is the Voltage at the $\overline{\text{OVERTEMP}}$ pin. Use $V_{OL}$ for calculating the pullup resistor.

#### *7.3.3.1.1.1 Example Calculation*

Suppose, for this example, a $V_{DD}$ of 3.3 V ± 0.3 V, a CMOS digital input as a load, a $V_{OL}$ of 0.2 V.

- For $V_{OL}$ of 0.2 V the electrical specification for $\overline{\text{OVERTEMP}}$ shows a maximum $I_{SINK}$ of 385 µA.
- Let $I_L$ = 1 µA, then $I_T$ is about 386 µA maximum. If 35 µA is selected as the current limit then $I_T$ for the calculation becomes 35 µA.
- $V_{DD(MAX)}$ is 3.3 V + 0.3 V = 3.6 V, then calculate the pullup resistor as $R_{PULLUP}$ = (3.6 – 0.2) / 35 µA = 97 kΩ.
- Based on this calculated value, select the closest resistor value in the tolerance family used.

In this example, if 5% resistor values are used, then the next closest value is 100 kΩ.

### 7.3.4 TRIP_TEST Digital Input

The TRIP_TEST pin simply provides a means to test the OVERTEMP and $\overline{\text{OVERTEMP}}$ digital outputs electronically by causing them to assert, at any operating temperature, as a result of forcing the TRIP_TEST pin high.

When the TRIP_TEST pin is pulled high the $V_{TEMP}$ pin is at the $V_{TRIP}$ voltage.

If not used, the TRIP_TEST pin may either be left open or grounded.

### 7.3.5 $V_{TEMP}$ 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 *Application and Implementation* for more discussion of this topic. The LM26LV and LM26LV-Q1 are ideal for applications which require strong source or sink current.

#### *7.3.5.1 Noise Considerations*

The LM26LV's and LM26LV-Q1's supply-noise rejection (the ratio of the AC signal on $V_{TEMP}$ to the AC signal on $V_{DD}$) was measured during bench tests. The device's typical attenuation is shown in *Typical Characteristics*. A load capacitor on the output can help to filter noise.

For operation in very noisy environments, some bypass capacitance must be present on the supply within approximately 2 inches of the LM26LV or LM26LV-Q1.

#### *7.3.5.2 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 20. For capacitive loads greater than 1100 pF, a series resistor is required on the output, as shown in Figure 21, to maintain stable conditions.

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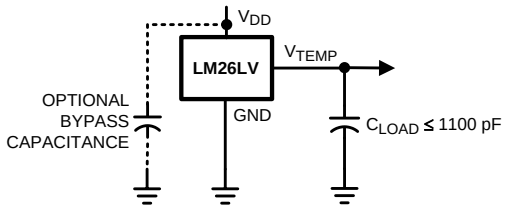



**Figure 20. LM26LV or LM26LV-Q1 No Decoupling Required for Capacitive Loads Less Than 1100 pF.**

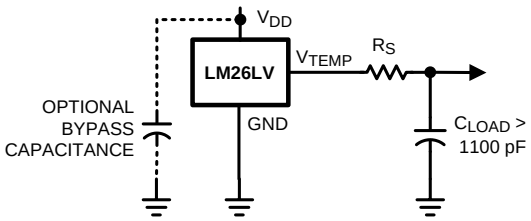



**Figure 21. LM26LV or LM26LV-Q1 With Series Resistor for Capacitive Loading Greater Than 1100 pF**

**Table 2. Minimum Series Resistence for Capacitive Loads**

| $C_{LOAD}$ | MINIMUM $R_S$ |
|---|---|
| 1.1 nF to 99 nF | 3 kΩ |
| 100 nF to 999 nF | 1.5 kΩ |
| 1 µF | 800 Ω |

#### *7.3.5.3 Voltage Shift*

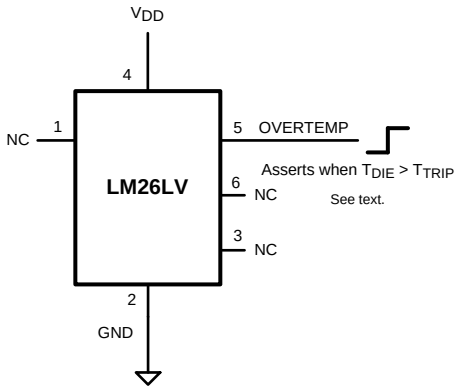
The LM26LV and LM26LV-Q1 are very linear over temperature and supply voltage range. Due to the intrinsic behavior of an NMOS/PMOS rail-to-rail buffer, a slight shift in the output can occur when the supply voltage is ramped over the operating range of the device. The location of the shift is determined 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 $V_{TEMP}$. Because the shift takes place over a wide temperature change of 5°C to 20°C, $V_{TEMP}$ is always monotonic. The accuracy specifications *Accuracy Characteristics* already includes this possible shift.


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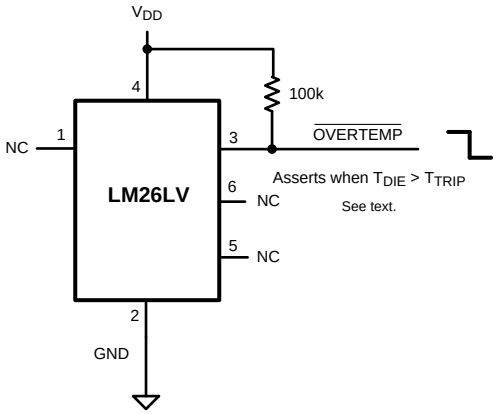
## 7.4 Device Functional Modes

The LM26LV and LM26LV-Q1 have several modes of operation as detailed in the following drawings.



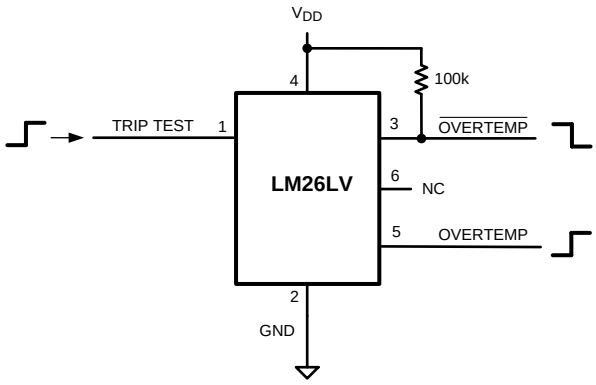

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**Figure 22. Temperature Switch Using Push-Pull Output**




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**Figure 23. Temperature Switch Using Open-Drain Output**

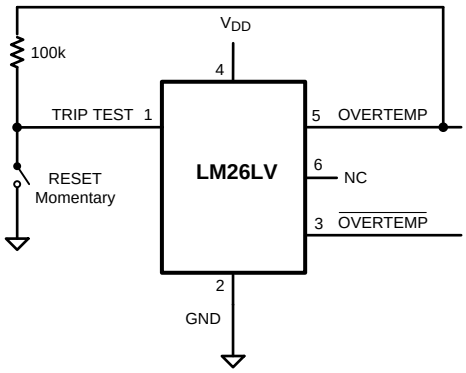



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**Figure 24. TRIP_TEST Digital Output Test Circuit**

The TRIP_TEST pin, normally used to check the operation of the OVERTEMP and $\overline{\text{OVERTEMP}}$ 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 25, when OVERTEMP goes high the TRIP_TEST input is also pulled high and causes OVERTEMP output to latch high and the $\overline{\text{OVERTEMP}}$ output to latch low. The latch can be released by either momentarily pulling the TRIP_TEST pin low (GND), or by toggling the power supply to the device. The resistor limits the current out of the $\overline{\text{OVERTEMP}}$ output pin.

## Device Functional Modes (continued)




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**Figure 25. Latch Circuit Using OVERTEMP Output**

Alternately, the circuit in Figure 25 the 100 kΩ can be replaced with a short and the momentary reset switch may be removed. In this configuration, when OVERTEMP goes active high, it drives TRIP_TEST high. THRIP TEST high causes OVERTEMP to stay high. It is therefore latched. To release the latch, power down, then power up the LM26LV or LM26LV-Q1. The LM26LV and LM26LV-Q1 always come up in a released condition.


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# 8 Application and Implementation

**NOTE**

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

## 8.1 Application Information

### 8.1.1 ADC Input Considerations

The LM26LV and LM26LV-Q1 have 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 LM26LV or LM26LV-Q1 temperature sensor. 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 vary. This general ADC application is shown as an example only.

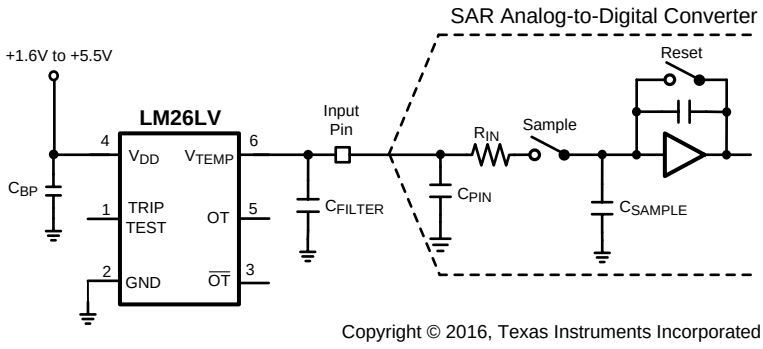



**Figure 26. Suggested Connection to a Sampling Analog-to-Digital Converter Input Stage**

## 8.2 Typical Application

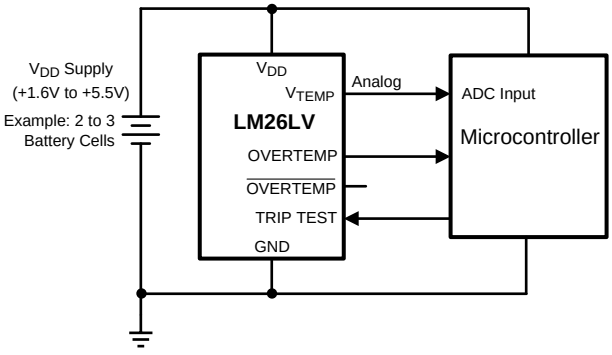



**Figure 27. Typical Application Schematic**

## Typical Application (continued)

### 8.2.1 Design Requirements

For this design example, use the parameters listed in Table 3 as the input parameters.

**Table 3. Design Parameters**

| PARAMETER | EXAMPLE VALUE |
|---|---|
| Temperature | 0°C to 150°C (LM26LV), –40°C to 85°C for microcontroller |
| Accuracy | ±2.3°C (Gain1, $T_A$ = 0°C to 150°C) |
| $V_{DD}$ | 3.3 V |
| $I_{DD}$ | 8 µA |

### 8.2.2 Detailed Design Procedure

The LM26LV and LM26LV-Q1 come with a factory preset trip point. See *Mechanical, Packaging, and Orderable Information* for available trip point options. Figure 27 shows the device's OVERTEMP output driving a microcontroller interrupt input to indicate an overtemperature event. In addition to the OVERTEMP output, a OVERTEMP output is available for use depending on the interrupt polarity of the microcontroller's interrupt pin. A VTEMP analog output is available to drive the microcontroller ADC input allowing the microcontroller to determine the sensing temperature of the LM26LV or LM26LV-Q1. The TRIP_TEST input is connected to a microcontroller output pin allowing the microcontroller to run on the fly electrical conductivity testing. For normal operation TRIP_TEST must be driven low by the microcontroller output. If no testing is required, the TRIP_TEST pin may be continuously grounded.

### 8.2.3 Application Curves

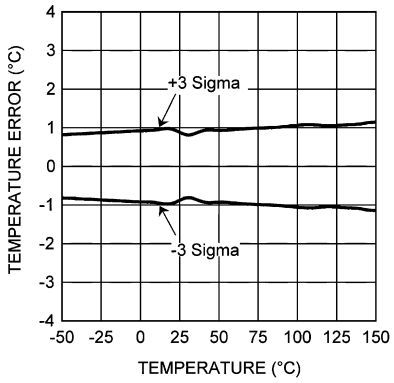



**Figure 28. $V_{TEMP}$ Analog Output Temperature Error**

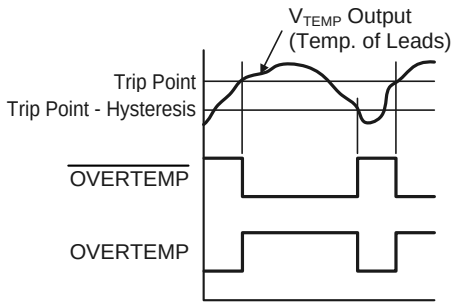



**Figure 29. Switch Output Function**


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# 9 Power Supply Recommendations

Bypass capacitors are optional, and maybe required if the supply line is extremely noisy at high frequencies. 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 the $V_{DD}$ and GND pins of the LM26LV or LM26LV-Q1.

## 9.1 Power Supply Noise Immunity

The LM26LV and LM26LV-Q1 are virtually immune from false triggers on the OVERTEMP and $\overline{\text{OVERTEMP}}$ digital outputs due to noise on the power supply. Test have been conducted showing that, with the die temperature within 0.5°C of the temperature trip point, and the severe test of a 3 V***pp square wave "***noise" signal injected on the $V_{DD}$ line, with $V_{DD}$ from 2 V to 5 V, there were no false triggers.

# 10 Layout

## 10.1 Layout Guidelines

### 10.1.1 Mounting and Temperature Conductivity

The LM26LV or LM26LV-Q1 can be applied easily in the same way as other integrated-circuit temperature sensors. The devices can be glued or cemented to a surface.

The best thermal conductivity between the device and the PCB is achieved by soldering the DAP of the package to the thermal pad on the PCB. The temperatures of the lands and traces to the other leads of the LM26LV and LM26LV-Q1 also affect the temperature reading.

Alternatively, the LM26LV or LM26LV-Q1 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 LM26LV or LM26LV-Q1 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 LM26LV or LM26LV-Q1 is not correct. Printed-circuit coatings are often used to ensure that moisture cannot corrode the leads or circuit traces.

The thermal resistance junction-to-ambient ($R_{\theta JA}$) is the parameter used to calculate the rise of a device junction temperature due to its power dissipation. The equation used to calculate the rise in the LM26LV's and LM26LV-Q1's die temperature is

$$T_J = T_A + R_{\theta JA} \times \left( (V_{DD} \times I_Q) + (V_{DD} - V_{TEMP}) \times I_L \right) \quad (9)$$

where

- $T_A$ is the ambient temperature
- $I_Q$ is the quiescent current
- $I_L$ is the load current on the output
- $V_O$ is the output voltage

For example, in an application where $T_A$ = 30°C, $V_{DD}$ = 5 V, $I_{DD}$ = 9 µA, Gain 4, $V_{TEMP}$ = 2231 mV, and $I_L$ = 2 µA, the junction temperature would be 30.021°C, showing a self-heating error of only 0.021°C. Because the LM26LV's and LM26LV-Q1's junction temperature is the actual temperature being measured, minimize the load current that the $V_{TEMP}$ output is required to drive. If $\overline{\text{OVERTEMP}}$ is used with a 100-k pullup resistor, and is asserted (low), then for this example the additional contribution is (152°C/W) × (5 V)$^2$ / 100 kΩ = 0.038°C for a total self-heating error of 0.059°C. *Thermal Information* shows the thermal resistance of the LM26LV and LM26LV-Q1.

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## 10.2 Layout Example

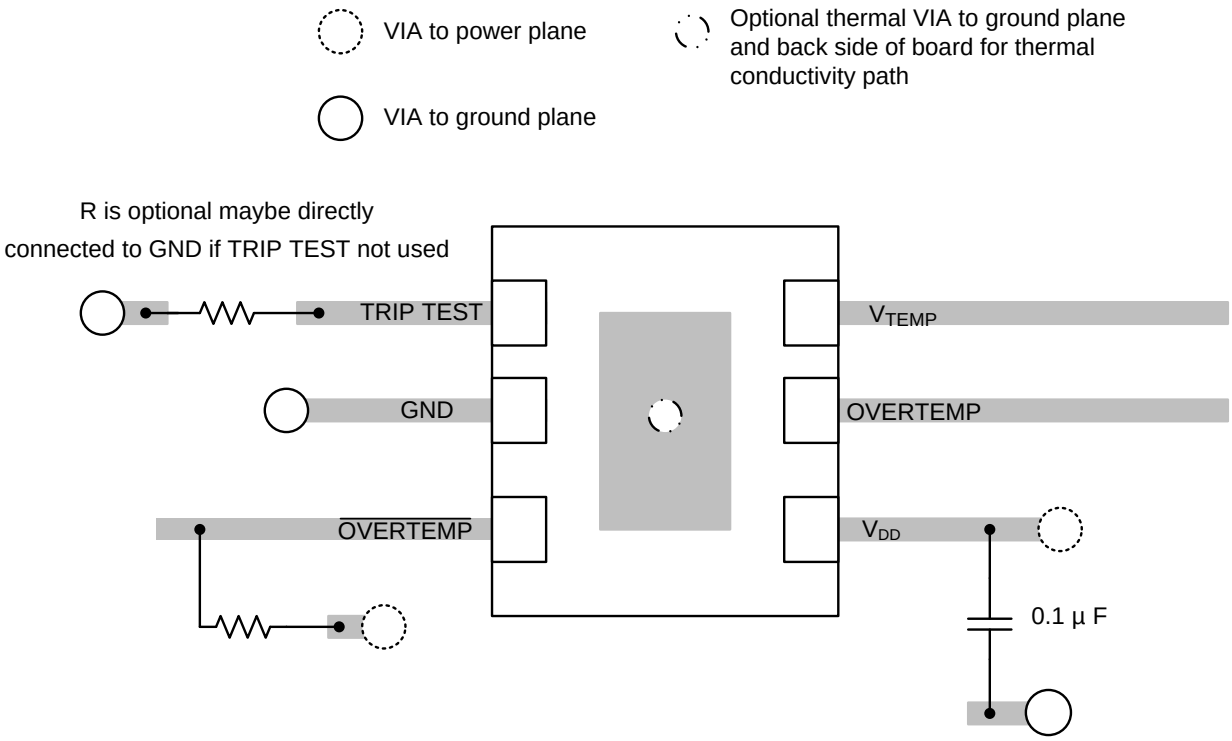



**Figure 30. Typical Layout Example**

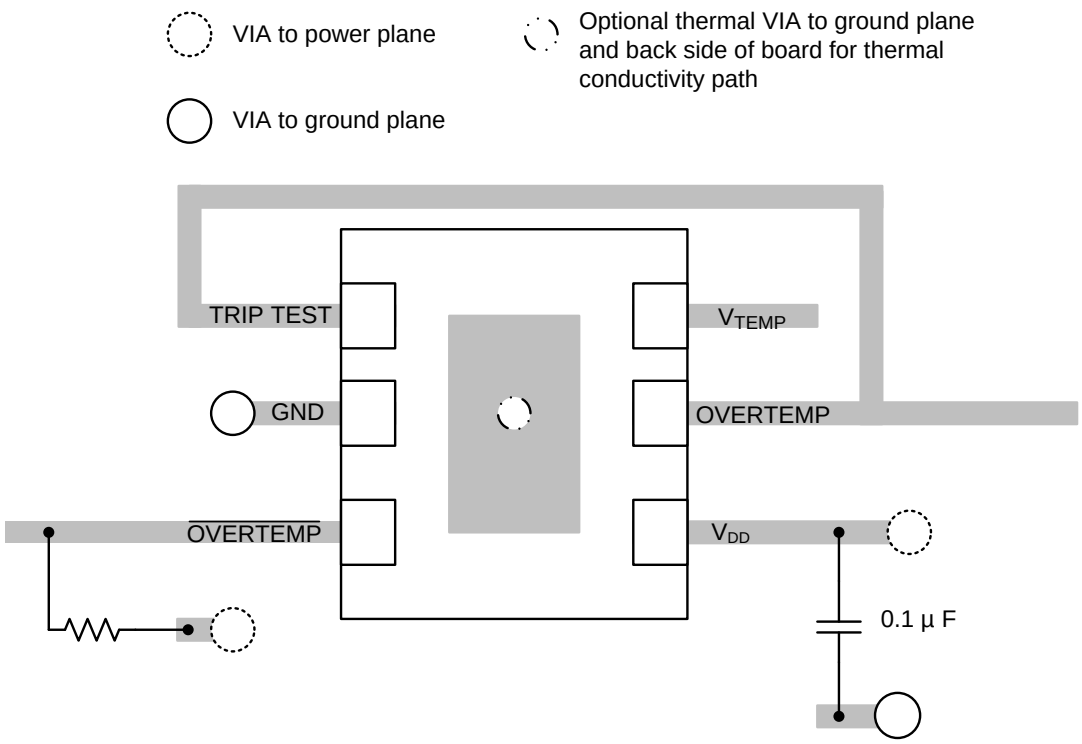



**Figure 31. Latching Layout Example**


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# 11 Device and Documentation Support

## 11.1 Documentation Support

### 11.1.1 Related Documentation

For related documentation see the following:

*Absolute Maximum Ratings for Soldering* (SNOA549)

## 11.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 4. Related Links**

| PARTS | PRODUCT FOLDER | SAMPLE & BUY | TECHNICAL DOCUMENTS | TOOLS & SOFTWARE | SUPPORT & COMMUNITY |
|---|---|---|---|---|---|
| LM26LV | Click here | Click here | Click here | Click here | Click here |
| LM26LV-Q1 | Click here | Click here | Click here | Click here | Click here |

## 11.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

## 11.4 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

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

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

## 11.5 Trademarks

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

## 11.6 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 11.7 Glossary

SLYZ022 — *TI Glossary*.

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

# 12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LM26LVCISD-050/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 050 | Samples |
| LM26LVCISD-060/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 060 | Samples |
| LM26LVCISD-065/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 065 | Samples |
| LM26LVCISD-070/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 070 | Samples |
| LM26LVCISD-075/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 075 | Samples |
| LM26LVCISD-080/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 080 | Samples |
| LM26LVCISD-085/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 085 | Samples |
| LM26LVCISD-090/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 090 | Samples |
| LM26LVCISD-095/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 095 | Samples |
| LM26LVCISD-100/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 100 | Samples |
| LM26LVCISD-105/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 105 | Samples |
| LM26LVCISD-110/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 110 | Samples |
| LM26LVCISD-115/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 115 | Samples |
| LM26LVCISD-120/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 120 | Samples |
| LM26LVCISD-125/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 125 | Samples |
| LM26LVCISD-135/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 135 | Samples |
| LM26LVCISD-140/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 140 | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LM26LVCISD-145/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 145 | Samples |
| LM26LVCISD-150/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 150 | Samples |
| LM26LVCISDX-060/NOPB | ACTIVE | WSON | NGF | 6 | 4500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 060 | Samples |
| LM26LVCISDX-120/NOPB | ACTIVE | WSON | NGF | 6 | 4500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | 120 | Samples |
| LM26LVQISD-130/NOPB | ACTIVE | WSON | NGF | 6 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | Q30 | Samples |
| LM26LVQISDX-130/NOPB | ACTIVE | WSON | NGF | 6 | 4500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | Q30 | Samples |
| LM26LVQISDX-135/NOPB | ACTIVE | WSON | NGF | 6 | 4500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 150 | Q35 | Samples |

(1) The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.
**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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**OTHER QUALIFIED VERSIONS OF LM26LV, LM26LV-Q1 :**

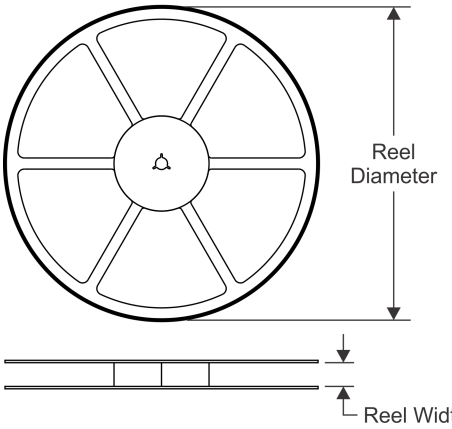
- Catalog: LM26LV
- Automotive: LM26LV-Q1

NOTE: Qualified Version Definitions:

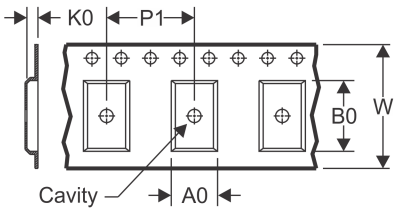
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

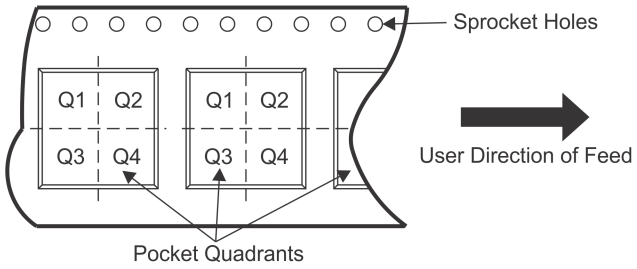



**TAPE DIMENSIONS**




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

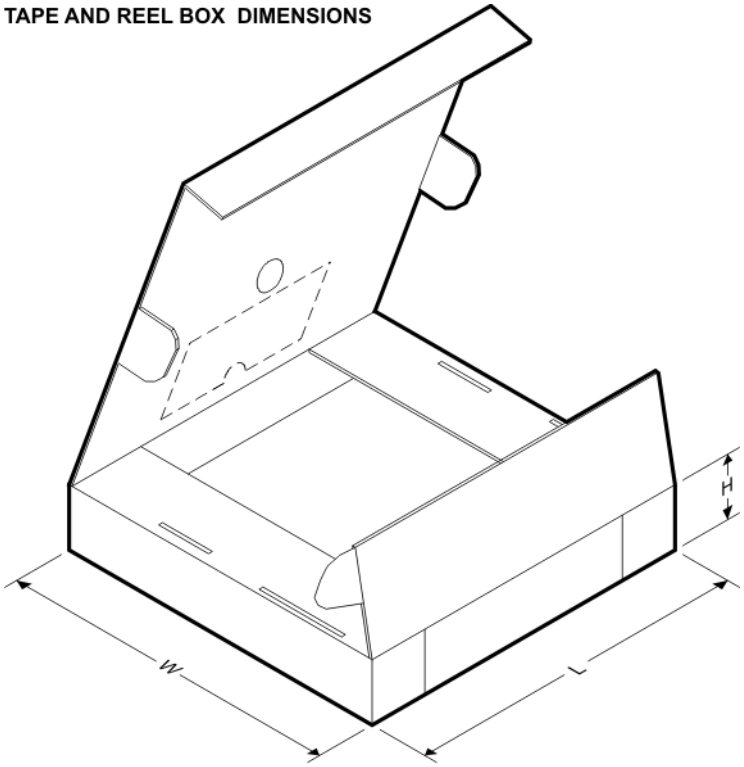



*All dimensions are nominal

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LM26LVCISD-050/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-060/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-065/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-070/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-075/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-080/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-085/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-090/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-095/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-100/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-105/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-110/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-115/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-120/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-125/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-135/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-140/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISD-145/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LM26LVCISD-150/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISDX-060/NOPB | WSON | NGF | 6 | 4500 | 330.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVCISDX-120/NOPB | WSON | NGF | 6 | 4500 | 330.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVQISD-130/NOPB | WSON | NGF | 6 | 1000 | 178.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVQISDX-130/NOPB | WSON | NGF | 6 | 4500 | 330.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |
| LM26LVQISDX-135/NOPB | WSON | NGF | 6 | 4500 | 330.0 | 12.4 | 2.8 | 2.5 | 1.0 | 8.0 | 12.0 | Q1 |

**TAPE AND REEL BOX DIMENSIONS**

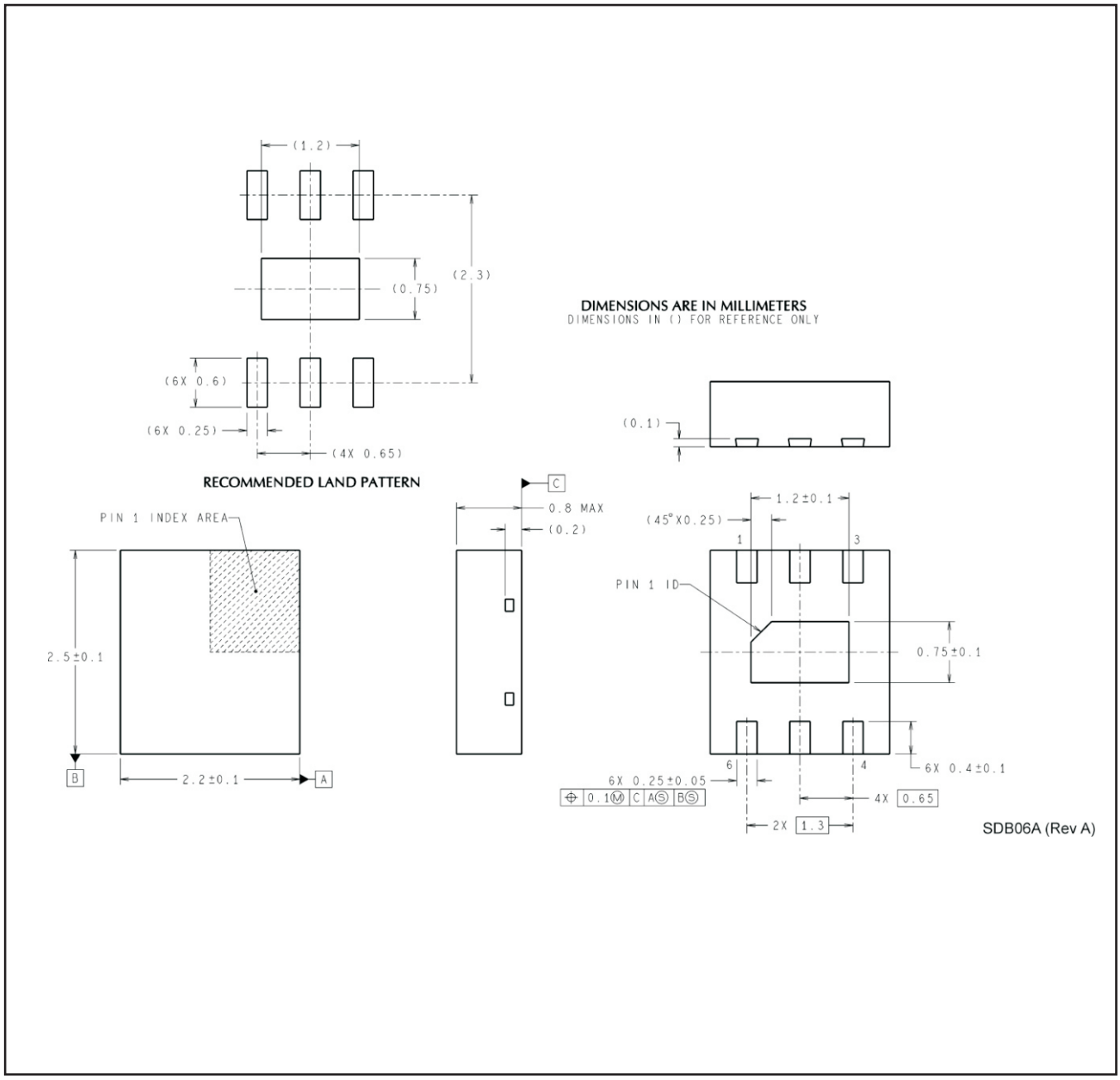



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| LM26LVCISD-050/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-060/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-065/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-070/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-075/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-080/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-085/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-090/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-095/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| LM26LVCISD-100/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-105/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-110/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-115/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-120/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-125/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-135/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-140/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-145/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISD-150/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVCISDX-060/NOPB | WSON | NGF | 6 | 4500 | 367.0 | 367.0 | 35.0 |
| LM26LVCISDX-120/NOPB | WSON | NGF | 6 | 4500 | 367.0 | 367.0 | 35.0 |
| LM26LVQISD-130/NOPB | WSON | NGF | 6 | 1000 | 210.0 | 185.0 | 35.0 |
| LM26LVQISDX-130/NOPB | WSON | NGF | 6 | 4500 | 367.0 | 367.0 | 35.0 |
| LM26LVQISDX-135/NOPB | WSON | NGF | 6 | 4500 | 367.0 | 367.0 | 35.0 |

# NGF0006A


(1.2)
(2.3)
(0.75)
(6X 0.6)
(6X 0.25)
(4X 0.65)
RECOMMENDED LAND PATTERN
DIMENSIONS ARE IN MILLIMETERS
DIMENSIONS IN ( ) FOR REFERENCE ONLY
(0.1)
PIN 1 INDEX AREA
2.5±0.1
2.2±0.1
B
A
C
0.8 MAX
(0.2)
1.2±0.1
(45°X0.25)
1
3
PIN 1 ID
0.75±0.1
6
4
6X 0.4±0.1
6X 0.25±0.05
0.10 M C A S B S
4X 0.65
2X 1.3
SDB06A (Rev A)

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