



1.5°C Accurate Programmable Digital Temperature Sensors with SPI™ Interface

FEATURES

- **DIGITAL OUTPUT: SPI-Compatible Interface**
- **PROGRAMMABLE RESOLUTION:**
9- to 12-Bits + Sign
- **ACCURACY:**
±1.5°C from –25°C to +85°C (max)
±2.0°C from –40°C to +125°C (max)
- **LOW QUIESCENT CURRENT: 50µA**
- **WIDE SUPPLY RANGE: 2.7V to 5.5V**
- **TINY SOT23-6 AND SO-8 PACKAGES**
- **OPERATION TO 150°C**
- **PROGRAMMABLE HIGH/LOW SETPOINTS**

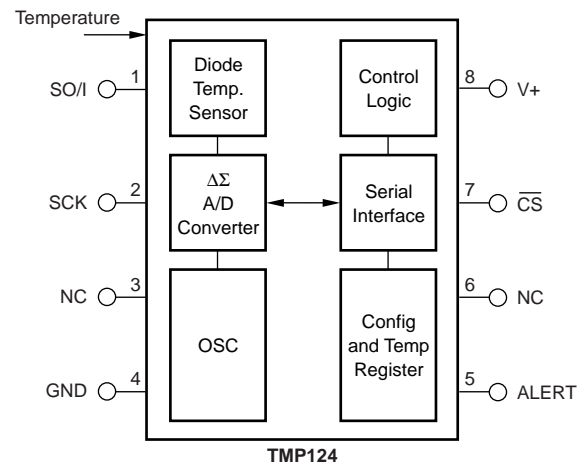
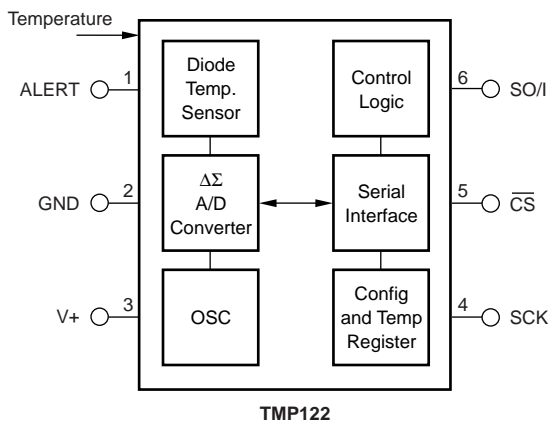
APPLICATIONS

- **POWER-SUPPLY TEMPERATURE MONITORING**
- **COMPUTER PERIPHERAL THERMAL PROTECTION**
- **NOTEBOOK COMPUTERS**
- **CELL PHONES**
- **BATTERY MANAGEMENT**
- **OFFICE MACHINES**
- **THERMOSTAT CONTROLS**
- **ENVIRONMENTAL MONITORING and HVAC**
- **ELECTROMECHANICAL DEVICE TEMPERATURE**

DESCRIPTION

The TMP122 and TMP124 are SPI-compatible temperature sensors available in SOT23-6 and SO-8 packages. Requiring only a pull-up resistor for complete function, the TMP122 and TMP124 temperature sensors are capable of measuring temperatures within 2°C of accuracy over a temperature range of –40°C to +125°C, with operation up to 150°C. Programmable resolution, programmable set points and shut down function provide versatility for any application. Low supply current and a supply range from 2.7V to 5.5V make the TMP122 and TMP124 excellent candidates for low-power applications.

The TMP122 and TMP124 are ideal for extended thermal measurement in a variety of communication, computer, consumer, environmental, industrial, and instrumentation applications.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

SPI is a registered trademark of Motorola. All other trademarks are the property of their respective owners.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

SUNSTAR 传感与控制 <http://www.sensor-ic.com/> TEL:0755-83376549 FAX:0755-83376182 E-MAIL:szss20@163.com

| | |
|---|-----------------|
| Power Supply, V+ | 7V |
| Input Voltage ⁽²⁾ | -0.3V to 7V |
| Input Current | 10mA |
| Operating Temperature Range | -55°C to +150°C |
| Storage Temperature Range | -60°C to +150°C |
| Junction Temperature (T _J Max) | +150°C |
| Lead Temperature (soldering) | +300°C |

NOTES: (1) Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods may affect device reliability. (2) Input voltage rating applies to all TMP122 and TMP124 input voltages.



ELECTROSTATIC DISCHARGE SENSITIVITY

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.

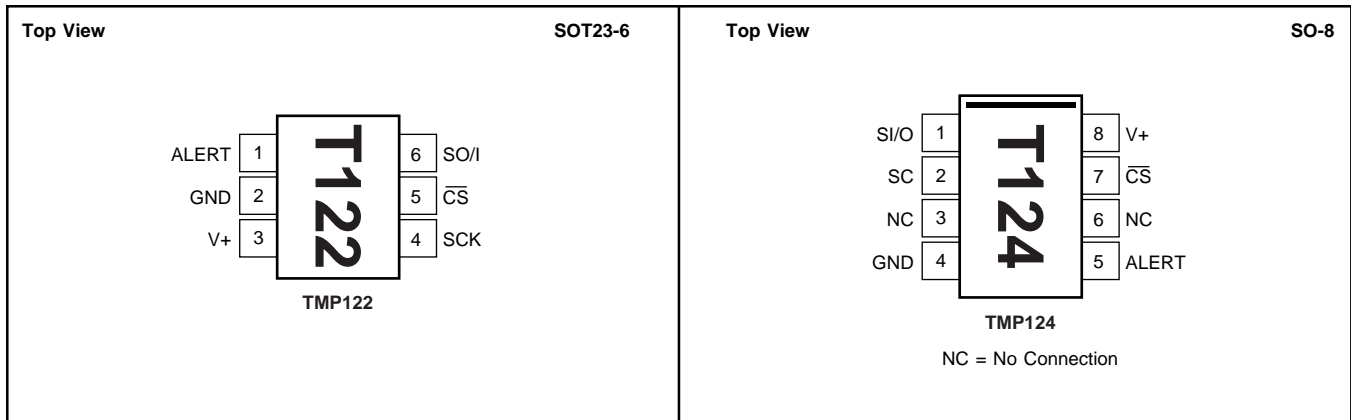
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION

| PRODUCT | PACKAGE-LEAD | PACKAGE DESIGNATOR ⁽¹⁾ | SPECIFIED TEMPERATURE RANGE | PACKAGE MARKING | ORDERING NUMBER | TRANSPORT MEDIA, QUANTITY |
|-------------|--------------|-----------------------------------|-----------------------------|-----------------|------------------------------|---|
| TMP122 " | SOT23-6 " | DBV " | -40°C to +125°C " | T122 " | TMP122AIDBVT TMP122AIDBVR | Tape and Reel, 250 Tape and Reel, 3000 |
| TMP124 " | SO-8 " | D " | -40°C to +125°C " | T124 " | TMP124AID TMP124AIDR | Rails, 100 Tape and Reel, 2500 |

NOTE: (1) For the most current specifications and package information, refer to our web site at www.ti.com.

PIN CONFIGURATIONS



ELECTRICAL CHARACTERISTICS

SUNSTAR 传感器与执行器 <http://www.sensor-ic.com/> TEL: 0755-83376549 FAX: 0755-83376182 E-MAIL: szss20@163.com

At $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, and $V_+ = 2.7\text{V}$ to 5.5V , unless otherwise noted.

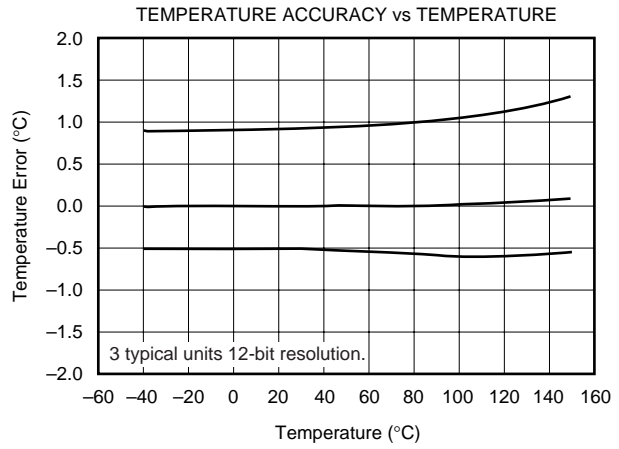
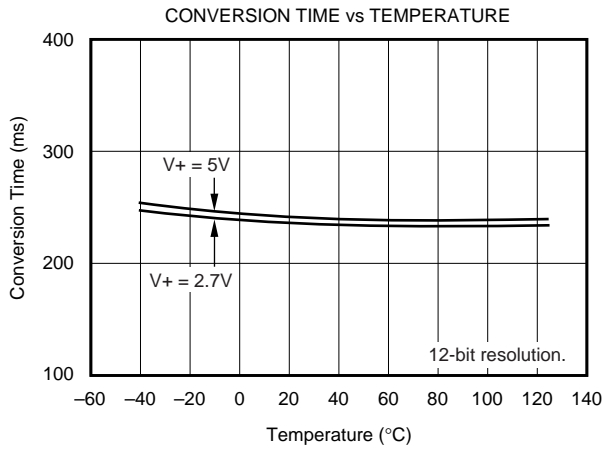
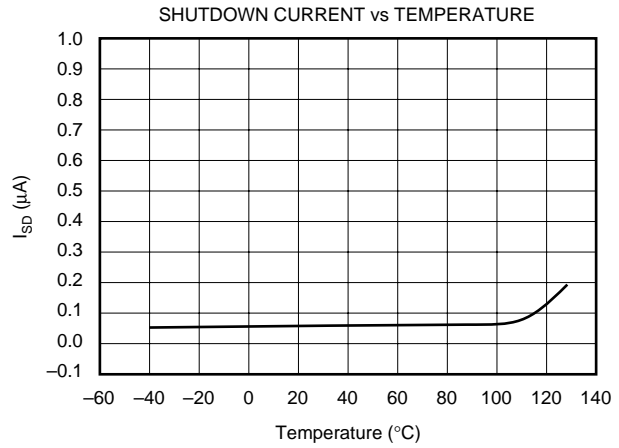
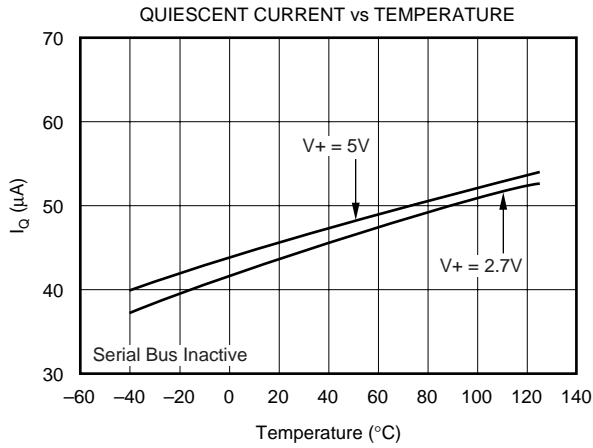
| PARAMETER | CONDITION | TMP122, TMP124 | | | UNITS |
|--|---|----------------|----------------|-----------|---------------------------|
| | | MIN | TYP | MAX | |
| TEMPERATURE INPUT | | | | | |
| Range | -25°C to $+85^\circ\text{C}$ | -40 | | +125 | $^\circ\text{C}$ |
| Accuracy (Temperature Error) | -40°C to $+125^\circ\text{C}$ | | ± 0.5 | ± 1.5 | $^\circ\text{C}$ |
| | -55°C to $+150^\circ\text{C}$ | | ± 1.0 | ± 2.0 | $^\circ\text{C}$ |
| vs Supply | | | ± 1.5 | | $^\circ\text{C}/\text{V}$ |
| Resolution ⁽¹⁾ | Selectable | -0.3 | 0.1 | +0.3 | $^\circ\text{C}$ |
| | | | ± 0.0625 | | $^\circ\text{C}$ |
| DIGITAL INPUT/OUTPUT | | | | | |
| Input Logic Levels: | | | | | |
| V_{IH} | | 0.7(V+) | | | V |
| V_{IL} | | | | 0.3(V+) | V |
| Input Current, SO/I, SCK, $\overline{\text{CS}}$ | $0\text{V} \leq V_{IN} \leq V_+$ | | | ± 1 | μA |
| Output Logic Levels: | | | | | |
| V_{OL} SO/I | $I_{SINK} = 3\text{mA}$ | | | 0.4 | V |
| V_{OH} SO/I | $I_{SOURCE} = 2\text{mA}$ | (V+)-0.4 | | | V |
| V_{OL} ALERT | $I_{SINK} = 4\text{mA}$ | | | 0.4 | V |
| Leakage Current ALERT | $0\text{V} \leq V_{IN} \leq 6\text{V}$ | | | ± 1 | μA |
| Input Capacitance, SO/I, SCK, $\overline{\text{CS}}$, ALERT | | | 2.5 | | pF |
| Resolution | Selectable | | 9 to 12 + Sign | | Bits |
| Conversion Time | | | | | |
| | 9-Bit + Sign | | 30 | 40 | ms |
| | 10-Bit + Sign | | 60 | 80 | ms |
| | 11-Bit + Sign | | 120 | 160 | ms |
| | 12-Bit + Sign | | 240 | 320 | ms |
| POWER SUPPLY | | | | | |
| Operating Range | | 2.7 | | 5.5 | V |
| Quiescent Current | I_Q Serial Bus Inactive | | 50 | 75 | μA |
| Shutdown Current | I_{SD} Serial Bus Inactive | | 0.1 | 1 | μA |
| TEMPERATURE RANGE | | | | | |
| Specified Range | | -40 | | +125 | $^\circ\text{C}$ |
| Operating Range | | -55 | | +150 | $^\circ\text{C}$ |
| Storage Range | | -60 | | +150 | $^\circ\text{C}$ |
| Thermal Resistance, θ_{JA} | SOT23-6 Surface-Mount | | 200 | | $^\circ\text{C}/\text{W}$ |
| | SO-8 Surface-Mount | | 150 | | $^\circ\text{C}/\text{W}$ |

NOTE: (1) Specified for 12-bit resolution.

TYPICAL CHARACTERISTICS

SUNSTAR自动化控制 <http://www.sensor-ic.com/> TEL:0755-83376549 FAX:0755-83376182 E-MAIL:szss20@163.com

At $T_A = +25^\circ\text{C}$, and $V_+ = 5.0\text{V}$, unless otherwise noted.



The TMP122 and TMP124 digital temperature sensors are optimal for thermal management and thermal protection applications. The TMP122/TMP124 are SPI interface-compatible and specified for a temperature range of -40°C to $+125^{\circ}\text{C}$.

The TMP122/TMP124 require minimal external components for operation, needing only a pull-up resistor on the ALERT pin and a bypass capacitor on the supply. Bypass capacitors of $0.1\mu\text{F}$ is recommended. Figure 1 shows typical connections for the TMP122 and TMP124.

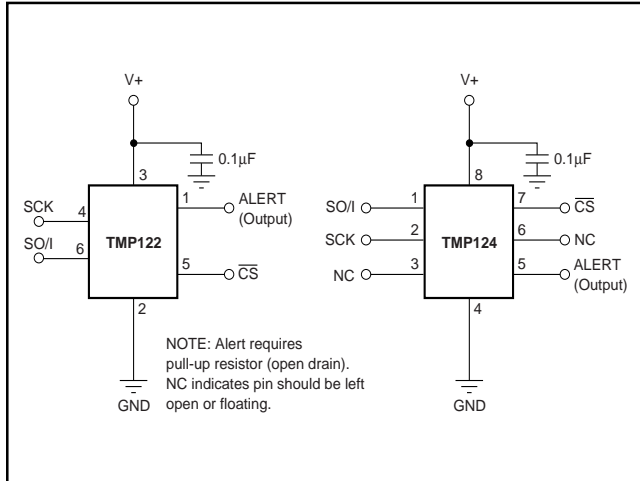


FIGURE 1. Typical Connections of the TMP122 and TMP124.

To maintain accuracy in applications requiring air or surface temperature measurement, care should be taken to isolate the package and leads from ambient air temperature.

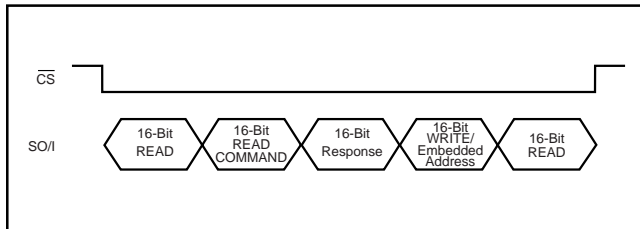


FIGURE 2. Multiple Command Sequence.

The TMP122/TMP124 converts continuously. If $\overline{\text{CS}}$ is brought low during a conversion the conversion process continues, but the last completed conversion is available at the output register. Communication with the TMP122/TMP124 is initiated by pulling $\overline{\text{CS}}$ low. The first 16 clocks of data transfer will return temperature data from the temperature sensors. The 16-bit data word is clocked out sign bit first, followed by the MSB. Any portion of the 16-bit word may be read before raising $\overline{\text{CS}}$. If the user wishes to continue with $\overline{\text{CS}}$ low, the following 16 clocks transfer in a READ or WRITE command. READ and WRITE commands are described in Tables I and II.

The READ command contains an embedded address in bits D4 and D3 to identify which register to read. Bits D4 and D3 are internally registered and will hold their value following a READ command until a entire 16-bit read is completed by the user. The completion of the 16-bit READ acknowledges that the READ command has been completed. If the user issues a READ command and then raises $\overline{\text{CS}}$ with less than 16 subsequent clocks, the data from that register will be available at the next fall of $\overline{\text{CS}}$. The registered READ address will remain in effect until a full 16 clocks have been received. After the completion of a 16-bit READ from the part, the READ address is reset to return data from the Temperature Register. A WRITE command to a register will not change the READ address registered. For further discussion on the READ address register, see the *Read Address Register* section.

Multiple commands may be strung together as illustrated in Figure 2. The TMP122/TMP124 accepts commands alternating with 16-bit response data. On lowering $\overline{\text{CS}}$, the part always responds with a READ from the address location indicated by the READ address register. If the next command is a READ command then data is returned from the address specified by the READ command with the 16th clock resetting the READ address register to the default temperature register. The TMP122/TMP124 then expect a 16-bit command. If the command is a WRITE command, then the 16 clocks following the command will again return temperature data.

Figures 3, 4, 5, and 6 detail the communication sequences.

| Read Command | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------------------------|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
| Temperature | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Configuration Register | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Low Temp Threshold | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| High Temp Threshold | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |

TABLE I. Read Command.

| Write Command | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------------------------|-----|-----|-----|-----|-----|-----|----|----|----|----|-----|-----|-----|----|----|----|
| Configuration Register | 0 | 0 | 0 | 0 | D1 | D0 | R1 | R0 | F1 | F0 | POL | TM1 | TM0 | 0 | 1 | 0 |
| Low Temp Threshold | T12 | T11 | T10 | T9 | T8 | T7 | T6 | T5 | T4 | T3 | T2 | T1 | T0 | 1 | 0 | 0 |
| High Temp Threshold | T12 | T11 | T10 | T9 | T8 | T7 | T6 | T5 | T4 | T3 | T2 | T1 | T0 | 1 | 1 | 0 |
| Shutdown Command | x | x | x | x | x | x | x | x | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

TABLE II. Write Command.

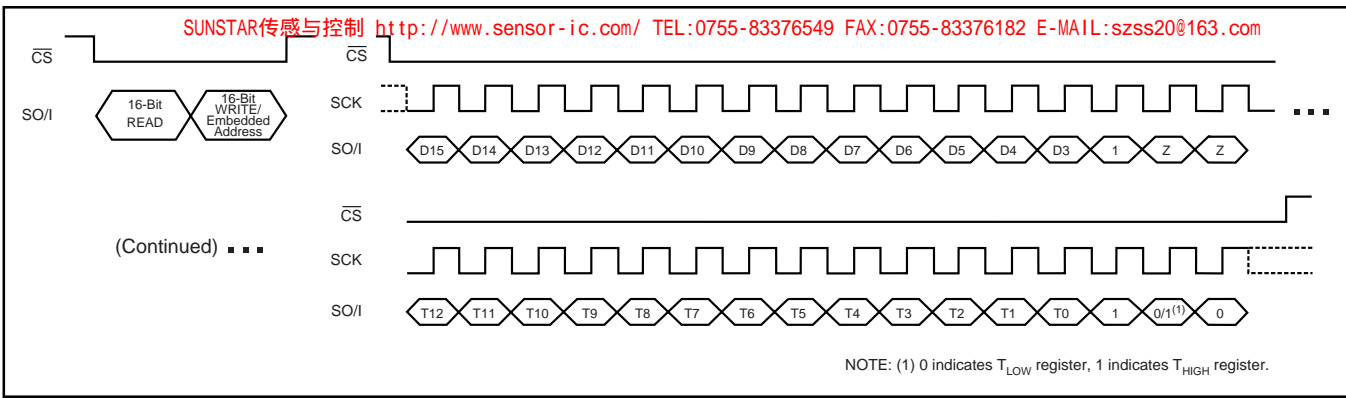


FIGURE 3. READ followed by WRITE COMMAND to T_{LOW}/T_{HIGH} Register.

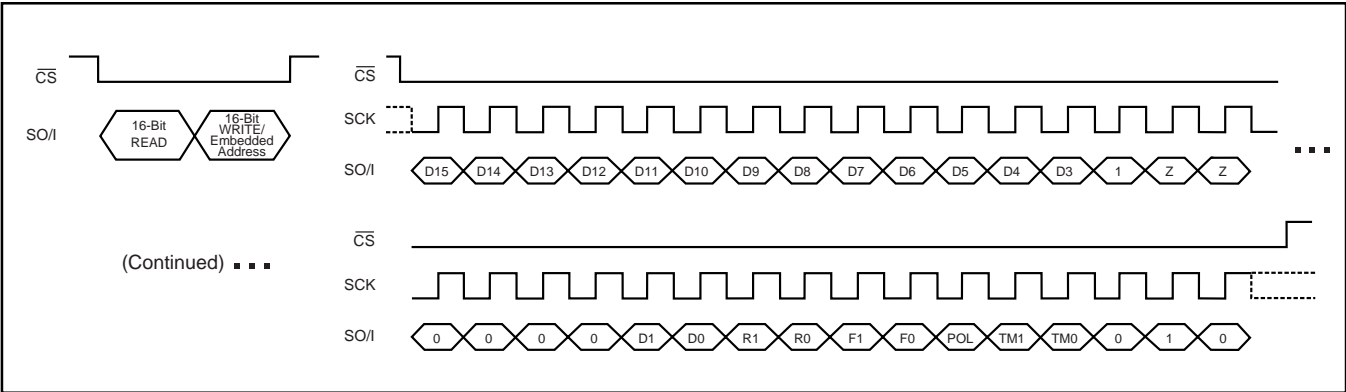


FIGURE 4. READ followed by WRITE COMMAND to Configuration Register.

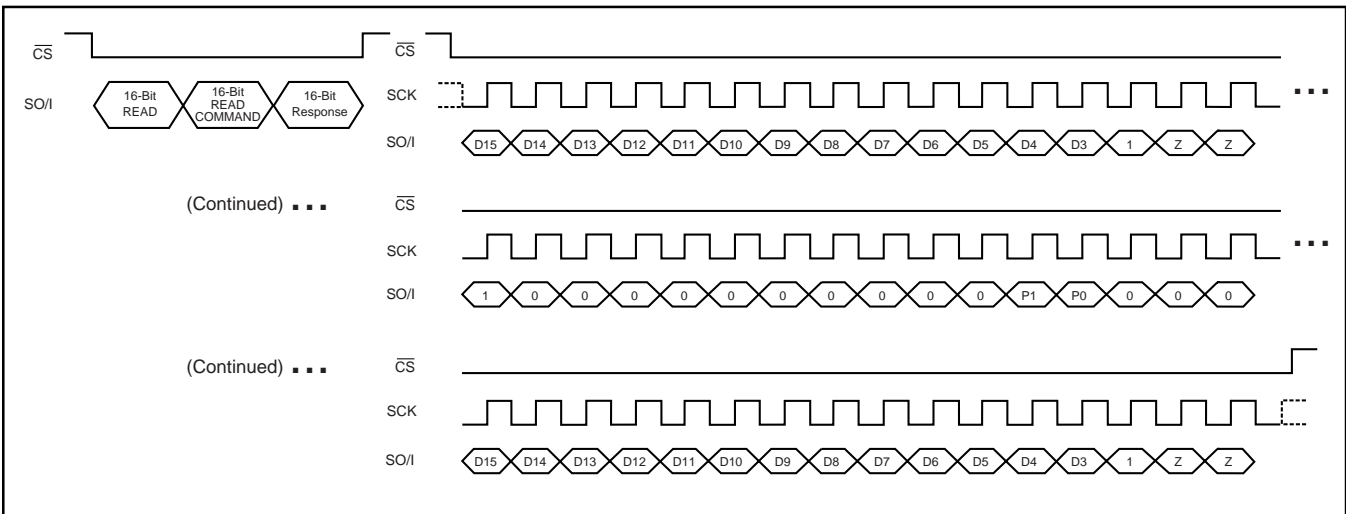


FIGURE 5. READ followed by READ COMMAND and Response.

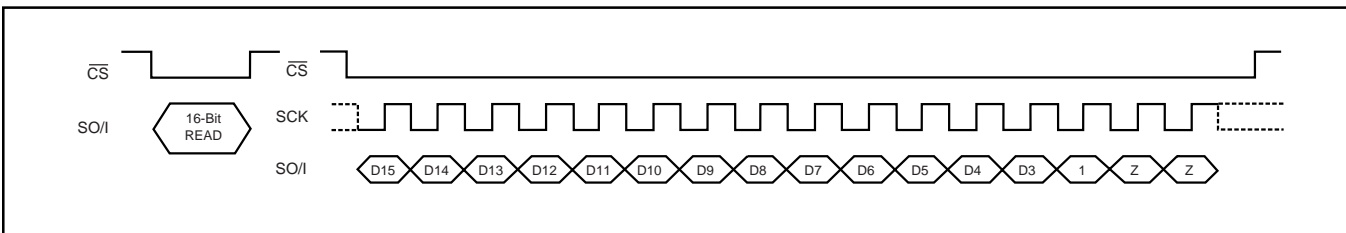


FIGURE 6. Data READ.

READ ADDRESS REGISTER

Figure 7 shows the internal register structure of the TMP122/TMP124. Table III describes the addresses of the registers available. The READ address register uses the two bits to identify which of the data registers should respond to a read command. Following a complete 16-bit read, the READ address register is reset to the default power-up state of P1/P0 equal 0/0.

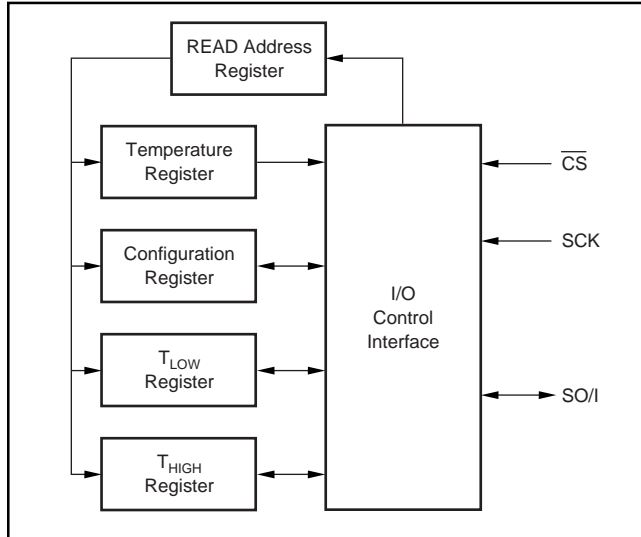


FIGURE 7. Internal Register Structure of the TMP122 and TMP124.

| P1 | P0 | REGISTER |
|----|----|---|
| 0 | 0 | Temperature Register (READ Only) |
| 0 | 1 | Configuration Register (READ/WRITE) |
| 1 | 0 | T _{LOW} Register (READ/WRITE) |
| 1 | 1 | T _{HIGH} Register (READ/WRITE) |

TABLE III. Pointer Addresses of the TMP122 and TMP124 Registers.

TEMPERATURE REGISTER

The Temperature Register of the TMP122/TMP124 is a 16-bit, signed read-only register that stores the output of the most recent conversion. The TMP122/TMP124 are specified for the temperature range of -40°C to $+125^{\circ}\text{C}$ with operation from -55°C to $+150^{\circ}\text{C}$. Up to 16 bits can be read to obtain data and are described in Table IV. The first 13 bits are used to indicate temperature where bit D2 is 1, and D1, D0 are in a high impedance state. Data format for temperature is summarized in Table V. Following power-up or reset, the Temperature Register will read 0°C until the first conversion is complete.

| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 |
|-----|-----|-----|-----|-----|-----|----|----|
| T12 | T11 | T10 | T9 | T8 | T7 | T6 | T5 |

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----|----|----|----|----|----|----|----|
| T4 | T3 | T2 | T1 | T0 | 1 | Z | Z |

TABLE IV. Temperature Register.

| TEMPERATURE ($^{\circ}\text{C}$) | DIGITAL OUTPUT ⁽¹⁾ (BINARY) | HEX |
|------------------------------------|--|------|
| 150 | 0100 1011 0000 0111 | 4B07 |
| 125 | 0011 1110 1000 0111 | 3E87 |
| 25 | 0000 1100 1000 0111 | 0C87 |
| 0.0625 | 0000 0000 0000 1111 | 000F |
| 0 | 0000 0000 0000 0111 | 0007 |
| -0.0625 | 1111 1111 1111 1111 | FFFF |
| -25 | 1111 0011 1000 0111 | F387 |
| -55 | 1110 0100 1000 0111 | E487 |

NOTE: (1) The last 2 bits are high impedance and are shown as 11 in the table.

TABLE V. Temperature Data Format.

The user can obtain 9, 10, 11, or 12 bits of resolution by addressing the Configuration Register and setting the resolution bits accordingly. For 9-, 10-, or 11-bit resolution, the most significant bits in the Temperature Register are used with the unused LSBs set to zero.

CONFIGURATION REGISTER

The Configuration Register is a 16-bit read/write register used to store bits that control the operational modes of the temperature sensor. Read/write operations are performed MSB first. The format of the Configuration Register for the TMP122/TMP124 is shown in Table VI, followed by a breakdown of the register bits. The power-up/reset value of the Configuration Register bits R1/R0 equal 1/1, all other bits equal zero.

| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 |
|-----|-----|-----|-----|-----|-----|----|----|
| 0 | 0 | 0 | 0 | D1 | D0 | R1 | R0 |

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----|----|-----|-----|-----|----|----|----|
| F1 | F0 | POL | TM1 | TM0 | 0 | 1 | 0 |

TABLE VI. Configuration Register.

SHUTDOWN MODE (SD)

The Shutdown Mode of the TMP122/TMP124 can be used to shut down all device circuitry except the serial interface. Shutdown mode occurs when the last 8 bits of the WRITE command are equal to 1, and will occur once the current conversion is completed, reducing current consumption to less than $1\mu\text{A}$. To take the part out of shutdown, send any command or pattern after the 16-bit read with the last 8 bits not equal to one. Power on default is in active mode.

THERMOSTAT MODE (TM1/TM0)

SUNSTAR传感与控制 <http://www.sensor-ic.com/> TEL:0755-83376549 FAX:0755-83376182 E-MAIL:szss20@163.com

The Thermostat Mode bits of the TMP122/TMP124 indicate to the device whether to operate in Comparator Mode, Interrupt Mode or Interrupt Comparator Mode. For more information on Comparator and Interrupt Mode, see text HIGH and LOW limit registers. The bit assignments for thermostat mode are described in Table VII. Power on default is comparator mode.

| TM1 | TM0 | MODE OF OPERATION |
|-----|-----|---------------------------|
| 0 | 0 | Comparator Mode |
| 0 | 1 | Interrupt Mode |
| 1 | 0 | Interrupt Comparator Mode |
| 1 | 1 | — |

TABLE VII. Mode Settings of the TMP122.

POLARITY (POL)

The Polarity Bit of the TMP122/TMP124 adjusts the polarity of the ALERT pin output. By default, POL = 0 and the ALERT pin will be active LOW, as shown in Figure 8. For POL = 1 the ALERT Pin will be active HIGH, and the state of the ALERT Pin is inverted.

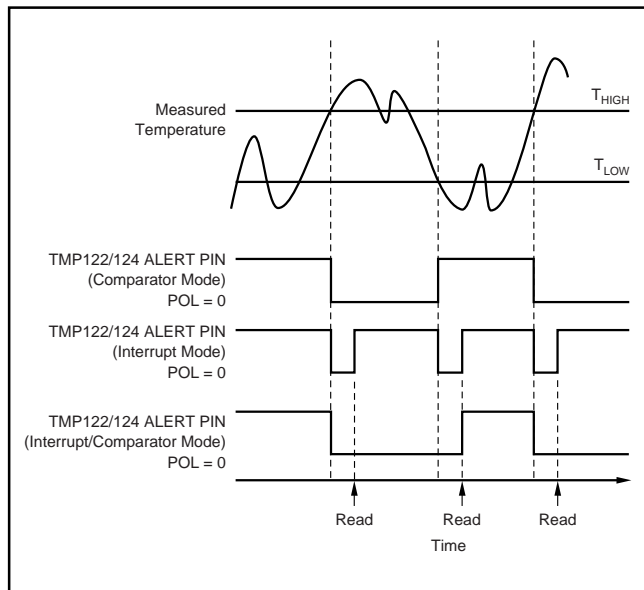


FIGURE 8. ALERT Output Transfer Function Diagrams.

FAULT QUEUE (F1/F0)

A fault condition occurs when the measured temperature exceeds the limits set in the T_{HIGH} and T_{LOW} registers. The Fault Queue is provided to prevent a false alert due to environmental noise and requires consecutive fault measurements to trigger the alert function of the TMP122/TMP124. Table VIII defines the number of consecutive faults required to trigger a consecutive alert condition. Power-on default for F1/F0 is 0/0.

| F1 | F0 | CONSECUTIVE FAULTS |
|----|----|--------------------|
| 0 | 0 | 1 |
| 0 | 1 | 2 |
| 1 | 0 | 4 |
| 1 | 1 | 6 |

TABLE VIII. Fault Settings of the TMP122 and TMP124.

HIGH AND LOW LIMIT REGISTERS

In Comparator Mode (TM1/TM0 = 0/0), the ALERT Pin of the TMP122/TMP124 becomes active when the temperature equals or exceeds the value in T_{HIGH} and generates a consecutive number of faults according to fault bits F1 and F0. The ALERT pin will remain active until the temperature falls below the indicated T_{LOW} value for the same number of faults.

In Interrupt Mode (TM1/TM0 = 0/1) the ALERT pin becomes active when the temperature equals or exceeds T_{HIGH} for a consecutive number of fault conditions. The ALERT pin remains active until a read operation of any register occurs. The ALERT pin will also be cleared if the device is placed in Shutdown Mode. Once the ALERT pin is cleared, it will only become active again by the temperature falling below T_{LOW} . When the temperature falls below T_{LOW} , the ALERT pin becomes active and remains active until cleared by a read operation of any register. Once the ALERT pin is cleared, the above cycle will repeat with the ALERT pin becoming active when the temperature equals or exceeds T_{HIGH} .

In Interrupt/Comparator Mode (TM1/TM0 = 1/0), the ALERT Pin of the TMP122/TMP124 becomes active when the temperature equals or exceeds the value in T_{HIGH} and generates a consecutive number of faults according to fault bits F1 and F0. The ALERT pin will remain active until the temperature falls below the indicated T_{LOW} value for the same number of faults and a communication with the device has occurred after that point.

Operational modes are represented in Figure 8. Tables IX and X describe the format for the T_{HIGH} and T_{LOW} registers. Power-up reset values for T_{HIGH} and T_{LOW} are: $T_{HIGH} = 80^{\circ}\text{C}$ and $T_{LOW} = 75^{\circ}\text{C}$. The format of the data for T_{HIGH} and T_{LOW} is the same as for the Temperature Register.

All 13 bits for the Temperature, T_{HIGH} , and T_{LOW} registers are used in the comparisons for the ALERT function for all converter resolutions. The three LSBs in T_{HIGH} and T_{LOW} can affect the ALERT output even if the converter is configured for 9-bit resolution.

| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 |
|-----|-----|-----|-----|-----|-----|----|----|
| H12 | H11 | H10 | H9 | H8 | H7 | H6 | H5 |

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----|----|----|----|----|----|----|----|
| H4 | H3 | H2 | H1 | H0 | 1 | 1 | 0 |

TABLE IX. T_{HIGH} Register.

| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 |
|-----|-----|-----|-----|-----|-----|----|----|
| L12 | L11 | L10 | L9 | L8 | L7 | L6 | L5 |

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----|----|----|----|----|----|----|----|
| L4 | L3 | L2 | L1 | L0 | 1 | 0 | 0 |

TABLE X. T_{LOW} Register.

CONVERTER RESOLUTION (R1/R0)

The Converter Resolution Bits control the resolution of the internal Analog-to-Digital (A/D) converter. This allows the user to maximize efficiency by programming for higher resolution or faster conversion time. Table XI identifies the Resolution Bits and the relationship between resolution and conversion time. The TMP122/TMP124 have a default resolution of 12 bits.

| R1 | R0 | RESOLUTION | CONVERSION TIME (typical) |
|----|----|------------------------------|---------------------------|
| 0 | 0 | 9 Bits (0.5°C) plus sign | 30ms |
| 0 | 1 | 10 Bits (0.25°C) plus sign | 60ms |
| 1 | 0 | 11 Bits (0.125°C) plus sign | 120ms |
| 1 | 1 | 12 Bits (0.0625°C) plus sign | 240ms |

TABLE XI. Resolution of the TMP122 and TMP124.

DELAY TIME

The Delay Bits control the amount of time delay between each conversion. This feature allows the user to maximize power savings by eliminating unnecessary conversions, and minimizing current consumption. During active conversion the TMP122/TMP124 typically requires 50μA of current for approximately 0.25s conversion time, and approximately 20μA for idle times between conversions. Delay settings are identified in Table XII as conversion time and period, and are shown in Figure 9. Default power up is D1/D0 equal 0/0. Conversion time and conversion periods scale with resolution. Conversion period denotes time between conversion starts.

| D1 | D0 | CONVERSION TIME | CONVERSION PERIOD |
|----|----|-----------------|-------------------|
| 0 | 0 | 0.25s | 0.25s |
| 0 | 1 | 0.25s | 0.5s |
| 1 | 0 | 0.25s | 1s |
| 1 | 1 | 0.25s | 8s |

TABLE XII. Conversion Delay for 12-Bit Resolution.

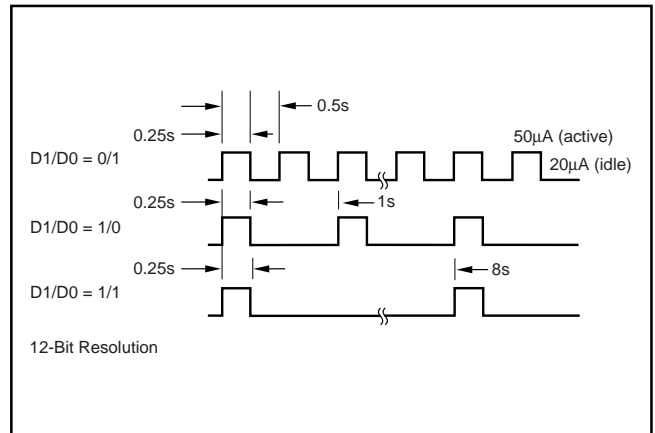


FIGURE 9. Conversion Time and Period Description.

Timing Diagrams

The TMP122/TMP124 are SPI compatible. Figures 10 to 12 describe the various timing parameters of the TMP122/TMP124 with timing definitions in Table XIII.

| PARAMETER | MIN | MAX | UNITS |
|--|-----|-----|-------|
| SCK Period | 100 | | ns |
| Data In to Rising Edge SCK Setup Time | 20 | | ns |
| SCK Falling Edge to Output Data Delay | | 30 | ns |
| SCK Rising Edge to Input Data Hold Time | 20 | | ns |
| \overline{CS} to Rising Edge SCK Set-Up Time | 40 | | ns |
| \overline{CS} to Output Data Delay | | 30 | ns |
| \overline{CS} Rising Edge to Output High Impedance | | 30 | ns |

TABLE XIII. Timing Description.

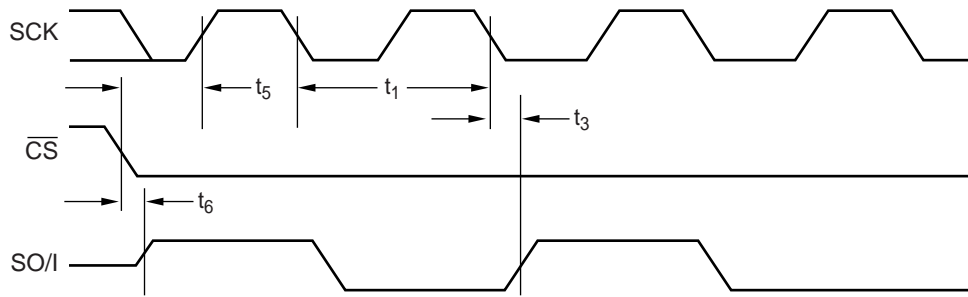


FIGURE 10. Output Data Timing Diagram.

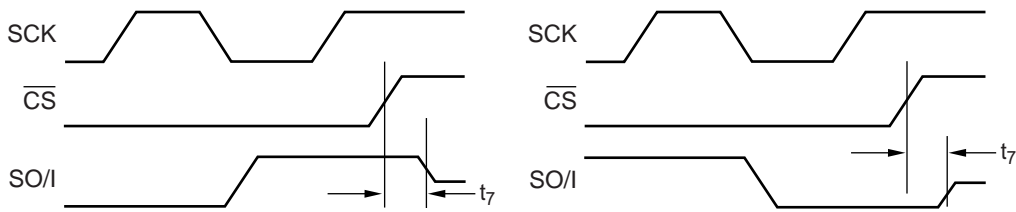


FIGURE 11. High Impedance Output Timing Diagram.

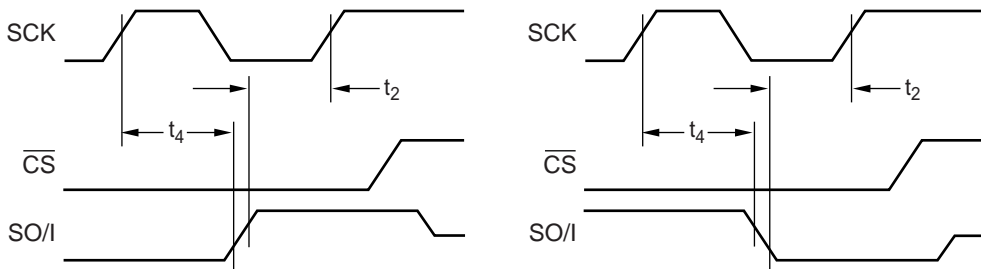


FIGURE 12. Input Data Timing Diagram.

PACKAGING INFORMATION

| ORDERABLE DEVICE | STATUS(1) | PACKAGE TYPE | PACKAGE DRAWING | PINS | PACKAGE QTY |
|------------------|-----------|--------------|-----------------|------|-------------|
| TMP122AIDBVR | ACTIVE | SOP | DBV | 6 | 3000 |
| TMP122AIDBVT | ACTIVE | SOP | DBV | 6 | 250 |
| TMP124AID | ACTIVE | SOIC | D | 8 | 100 |
| TMP124AIDR | ACTIVE | SOIC | D | 8 | 2500 |

(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.

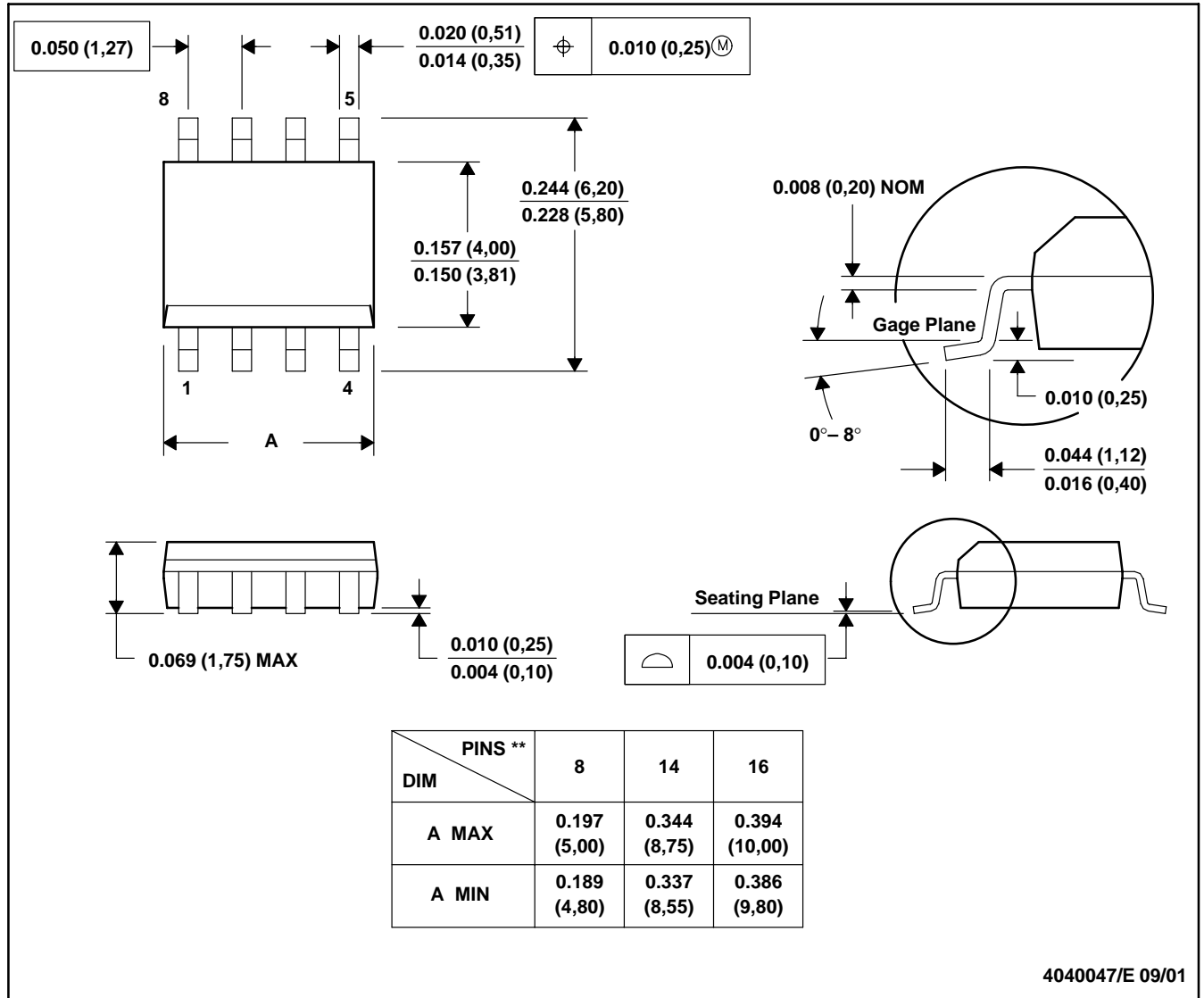
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

D (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
 D. Falls within JEDEC MS-012



IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| Products | | Applications | |
|------------------|--|---------------------|--|
| Amplifiers | amplifier.ti.com | Audio | www.ti.com/audio |
| Data Converters | dataconverter.ti.com | Automotive | www.ti.com/automotive |
| DSP | dsp.ti.com | Broadband | www.ti.com/broadband |
| Interface | interface.ti.com | Digital Control | www.ti.com/digitalcontrol |
| Logic | logic.ti.com | Military | www.ti.com/military |
| Power Mgmt | power.ti.com | Optical Networking | www.ti.com/opticalnetwork |
| Microcontrollers | microcontroller.ti.com | Security | www.ti.com/security |
| | | Telephony | www.ti.com/telephony |
| | | Video & Imaging | www.ti.com/video |
| | | Wireless | www.ti.com/wireless |

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2003, Texas Instruments Incorporated

SUNSTAR商斯达实业集团是集研发、生产、工程、销售、代理经销、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有 10 多年历史的专业电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一，是一家专业代理和分销世界各大品牌 IC 芯片和电子元器件的连锁经营综合性国际公司。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商，已在全国范围内建成强大统一的供货和代理分销网络。我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM 电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA 软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。专业以现代信息产业（计算机、通讯及传感器）三大支柱之一的传感器为主营业务，专业经营各类传感器的代理、销售生产、网络信息、科技图书资料及配套产品设计、工程开发。我们的专业网站——中国传感器科技信息网（全球传感器数据库）www.SENSOR-IC.COM 服务于全球高科技生产商及贸易商，为企业科技产品开发提供技术交流平台。欢迎各厂商互通有无、交换信息、交换链接、发布寻求代理信息。欢迎国外高科技传感器、变送器、执行器、自动控制产品厂商介绍产品到中国，共同开拓市场。本网站是关于各种传感器-变送器-仪器仪表及工业自动化大型专业网站，深入到工业控制、系统工程计 测量、自动化、安防报警、消费电子等众多领域，把最新的传感器-变送器-仪器仪表买卖信息，最新技术供求，最新采购商，行业动态，发展方向，最新的技术应用和市场资讯及时的传递给广大科技开发、科学研究、产品设计人员。本网站已成功为石油、化工、电力、医药、生物、航空、航天、国防、能源、冶金、电子、工业、农业、交通、汽车、矿山、煤炭、纺织、信息、通信、IT、安防、环保、印刷、科研、气象、仪器仪表等领域从事科学研究、产品设计、开发、生产制造的科技人员、管理人员、和采购人员提供满意服务。我们公司专业生产、代理、经销、销售各种传感器、变送器、敏感元器件、开关、执行器、仪器仪表、自动化控制系统：专门从事设计、生产、销售各种传感器、变送器、各种测控仪表、热工仪表、现场控制器、计算机控制系统、数据采集系统、各类环境监控系统、专用控制系统应用软件以及嵌入式系统开发及应用等工作。如热敏电阻、压敏电阻、温度传感器、温度变送器、湿度传感器、湿度变送器、气体传感器、气体变送器、压力传感器、压力变送、称重传感器、物（液）位传感器、物（液）位变送器、流量传感器、流量变送器、电流（压）传感器、溶氧传感器、霍尔传感器、图像传感器、超声波传感器、位移传感器、速度传感器、加速度传感器、扭距传感器、红外传感器、紫外传感器、火焰传感器、激光传感器、振动传感器、轴角传感器、光电传感器、接近传感器、干簧管传感器、继电器传感器、微型电泵、磁敏（阻）传感器、压力开关、接近开关、光电开关、色标传感器、光纤传感器、齿轮测速传感器、时间继电器、计数器、计米器、温控仪、固态继电器、调压模块、电磁铁、电压表、电流表等特殊传感器。同时承接传感器应用电路、产品设计和自动化工程项目。

更多产品请看本公司产品专用销售网站：

商斯达中国传感器科技信息网：<http://www.sensor-ic.com/>

商斯达工控安防网：<http://www.pc-ps.net/>

商斯达电子元器件网：<http://www.sunstare.com/>

商斯达微波光电产品网：[HTTP://www.rfoe.net/](http://www.rfoe.net/)

商斯达消费电子产品网：<http://www.icasic.com/>

商斯达军工产品网：<http://www.junpinic.com/>

商斯达实业科技产品网：<http://www.sunstars.cn/> 传感器销售热线：

地址：深圳市福田区福华路福庆街鸿图大厦 1602 室

电话：0755-83607652 83376489 83376549 83370250 83370251 82500323

传真：0755-83376182 (0) 13902971329 MSN: SUNS888@hotmail.com

邮编：518033 E-mail: szss20@163.com QQ: 195847376

深圳赛格展销部：深圳华强北路赛格电子市场 2583 号 电话：0755-83665529 25059422

技术支持：0755-83394033 13501568376

欢迎索取免费详细资料、设计指南和光盘；产品凡多，未能尽录，欢迎来电查询。

北京分公司：北京海淀区知春路 132 号中发电子大厦 3097 号

TEL: 010-81159046 82615020 13501189838 FAX: 010-62543996

上海分公司：上海市北京东路 668 号上海赛格电子市场 D125 号

TEL: 021-28311762 56703037 13701955389 FAX: 021-56703037

西安分公司：西安高新开发区 20 所(中国电子科技集团导航技术研究所)

西安劳动南路 88 号电子商城二楼 D23 号

TEL: 029-81022619 13072977981 FAX:029-88789382