

# LTC1232

## ABSOLUTE MAXIMUM RATINGS

(Note 1, 2 and 3)

Terminal Voltage

$V_{CC}$  ..... -0.3V to 7.0V

$\overline{ST}$  and  $\overline{RST}$  ..... -0.3V to 7.0V

All Other Inputs and Outputs ..... -0.3V to  $V_{CC} + 0.3V$

Power Dissipation ..... 500mW

Operating Temperature Range

LTC1232C ..... 0°C to 70°C

LTC1232I ..... -40°C to 85°C

Storage Temperature Range ..... -65°C to 150°C

Lead Temperature (Soldering, 10 sec) ..... 300°C

## PACKAGE/ORDER INFORMATION

|                                                                                                                                             |                          |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <p>TOP VIEW</p> <p>N8 PACKAGE<br/>8-LEAD PDIP<br/><math>T_{JMAX} = 100^{\circ}C</math>, <math>\theta_{JA} = 130^{\circ}C/W</math></p>       | ORDER<br>PART NUMBER     |
|                                                                                                                                             | LTC1232CN8               |
| <p>TOP VIEW</p> <p>S8 PACKAGE<br/>8-LEAD PLASTIC SO<br/><math>T_{JMAX} = 100^{\circ}C</math>, <math>\theta_{JA} = 180^{\circ}C/W</math></p> | ORDER<br>PART NUMBER     |
|                                                                                                                                             | LTC1232CS8<br>LTC1232IS8 |
|                                                                                                                                             | S8 PART MARKING          |
|                                                                                                                                             | 1232<br>1232I            |

Consult LTC Marketing for parts specified with wider operating temperature ranges.

## PRODUCT SELECTION GUIDE

|         | PINS | RESET | WATCHDOG<br>TIMER | BATTERY<br>BACKUP | POWER<br>FAIL<br>WARNING | RAM<br>WRITE<br>PROTECT | PUSH-BUTTON<br>RESET | CONDITIONAL<br>BATTERY<br>BACKUP |
|---------|------|-------|-------------------|-------------------|--------------------------|-------------------------|----------------------|----------------------------------|
| LTC1232 | 8    | X     | X                 |                   |                          |                         | X                    |                                  |
| LTC690  | 8    | X     | X                 | X                 | X                        |                         |                      |                                  |
| LTC691  | 16   | X     | X                 | X                 | X                        | X                       |                      |                                  |
| LTC694  | 8    | X     | X                 | X                 | X                        |                         |                      |                                  |
| LTC695  | 16   | X     | X                 | X                 | X                        | X                       |                      |                                  |
| LTC699  | 8    | X     | X                 |                   |                          |                         |                      |                                  |
| LTC1235 | 16   | X     | X                 | X                 | X                        | X                       | X                    | X                                |

**RECOMMENDED OPERATING CONDITIONS**

over the full operating temperature.  $V_{CC}$  = full operating range.

The ● denotes the specifications which apply

| SYMBOL   | PARAMETER                                                | CONDITIONS |   | MIN  | TYP | MAX          | UNITS |
|----------|----------------------------------------------------------|------------|---|------|-----|--------------|-------|
| $V_{CC}$ | Supply Voltage                                           |            | ● | 4.5  | 5   | 5.5          | V     |
| $V_{IH}$ | $\overline{ST}$ and $\overline{PB RST}$ Input High Level |            | ● | 2    |     | $V_{CC}+0.3$ | V     |
| $V_{IL}$ | $\overline{ST}$ and $\overline{PB RST}$ Input Low Level  |            | ● | -0.3 |     | 0.8          | V     |

**DC ELECTRICAL CHARACTERISTICS**

temperature.  $V_{CC}$  = full operating range.

The ● denotes the specifications which apply over the full operating

| SYMBOL               | PARAMETER                                        | CONDITIONS           |   | MIN  | TYP  | MAX  | UNITS   |
|----------------------|--------------------------------------------------|----------------------|---|------|------|------|---------|
| $I_{IL}$             | Input Leakage                                    | (Note 3)             | ● | -1   |      | 1    | $\mu A$ |
| $I_{OH}$             | Output Current at 2.4V                           | (Note 5)             | ● | -1   | -13  |      | mA      |
| $I_{OL}$             | Output Current at 0.4V                           | (Note 5)             | ● | 2    | 6    |      | mA      |
| $I_{CC}$             | Supply Current                                   | (Note 4)             | ● |      | 0.5  | 2    | mA      |
| $V_{CCTP}$           | $V_{CC}$ Trip Point                              | TOL = GND            | ● | 4.5  | 4.62 | 4.74 | V       |
| $V_{CCTP}$           | $V_{CC}$ Trip Point                              | TOL = $V_{CC}$       | ● | 4.25 | 4.37 | 4.49 | V       |
| $V_{HYS}$            | $V_{CC}$ Trip Point Hysteresis                   |                      |   |      | 40   |      | mV      |
| $V_{\overline{RST}}$ | $\overline{RST}$ Output Voltage at $V_{CC} = 1V$ | $I_{SINK} = 10\mu A$ |   |      | 4    | 200  | mV      |

**AC CHARACTERISTICS**

$V_{CC}$  = full operating range.

The ● denotes the specifications which apply over the full operating temperature.

| SYMBOL    | PARAMETER                                                                                      | CONDITIONS     |   | MIN | TYP  | MAX  | UNITS   |
|-----------|------------------------------------------------------------------------------------------------|----------------|---|-----|------|------|---------|
| $t_{PB}$  | $\overline{PB RST} = V_{IL}$                                                                   |                | ● | 40  |      |      | ms      |
| $t_{RST}$ | RESET Active Time                                                                              |                | ● | 250 | 610  | 1000 | ms      |
| $t_{ST}$  | $\overline{ST}$ Pulse Width                                                                    |                | ● | 20  |      |      | ns      |
| $t_{RPD}$ | $V_{CC}$ Detect to $\overline{RST}$ and $\overline{RST}$                                       |                | ● |     |      | 100  | ns      |
| $t_f$     | $V_{CC}$ Slew Rate 4.75V–4.25V                                                                 |                | ● | 300 |      |      | $\mu s$ |
| $t_{RPU}$ | $V_{CC}$ Detect to $\overline{RST}$ and $\overline{RST}$ (Reset Active Time)                   | $t_R = 5\mu s$ | ● | 250 | 610  | 1000 | ms      |
| $t_R$     | $V_{CC}$ Slew Rate 4.25V–4.75V                                                                 |                | ● | 0   |      |      | ns      |
| $t_{TD}$  | $\overline{ST}$ Pin Detect to $\overline{RST}$ and $\overline{RST}$ (Watchdog Time-Out Period) | TD = GND       | ● | 60  | 150  | 250  | ms      |
|           |                                                                                                | TD = Floating  | ● | 250 | 610  | 1000 | ms      |
|           |                                                                                                | TD = $V_{CC}$  | ● | 500 | 1200 | 2000 | ms      |
| $C_{IN}$  | Input Capacitance                                                                              |                |   |     | 5    |      | pF      |
| $C_{OUT}$ | Output Capacitance                                                                             |                |   |     | 5    |      | pF      |

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** All voltage values are with respect to GND.

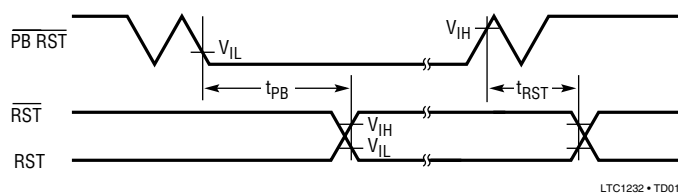
**Note 3:** The  $\overline{PB RST}$  pin is internally pulled up to  $V_{CC}$  with an internal impedance of 10k typical. The TD pin has internal bias current.

**Note 4:** Measured with outputs open.

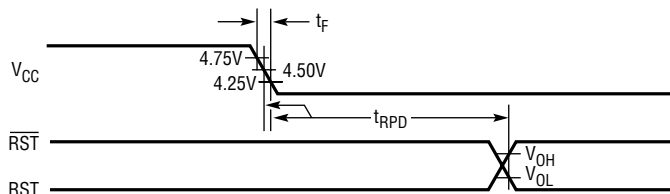
**Note 5:** The  $\overline{RST}$  pin is an open drain output.

## TIMING DIAGRAMS

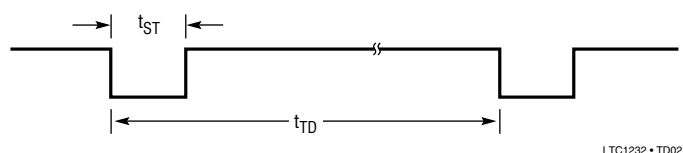
Push-Button Reset



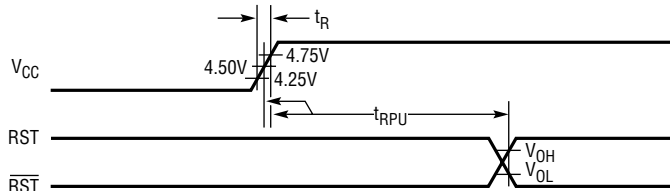
Power Down



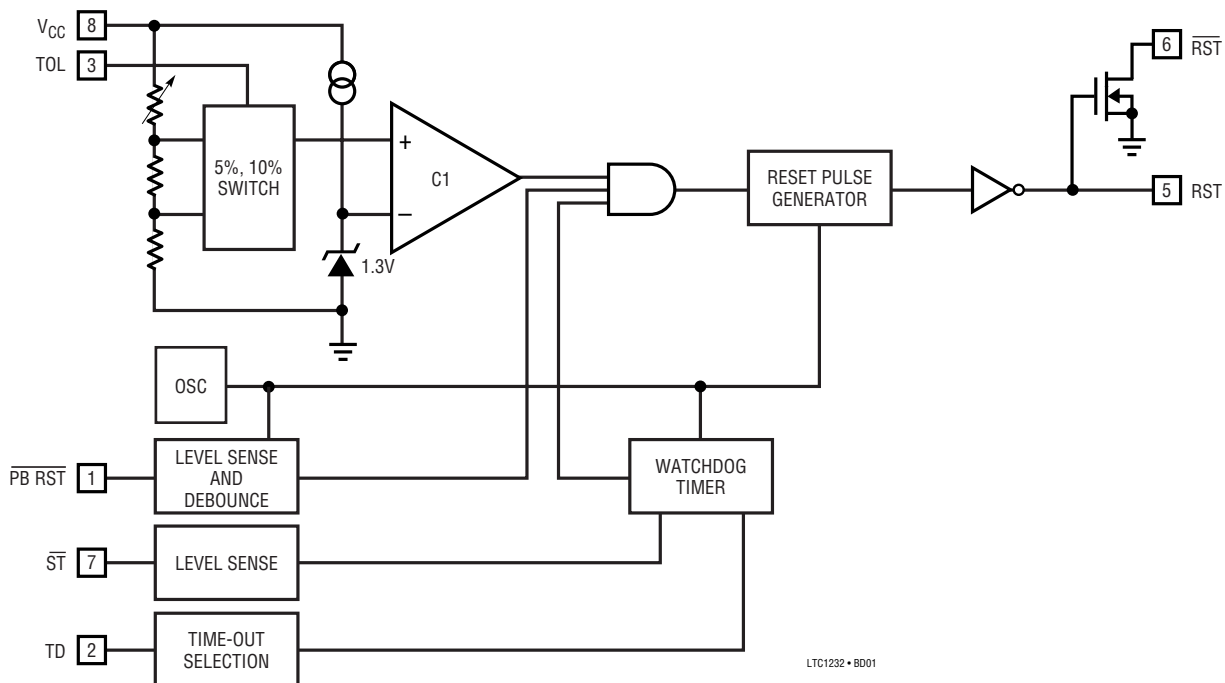
Strobe Input



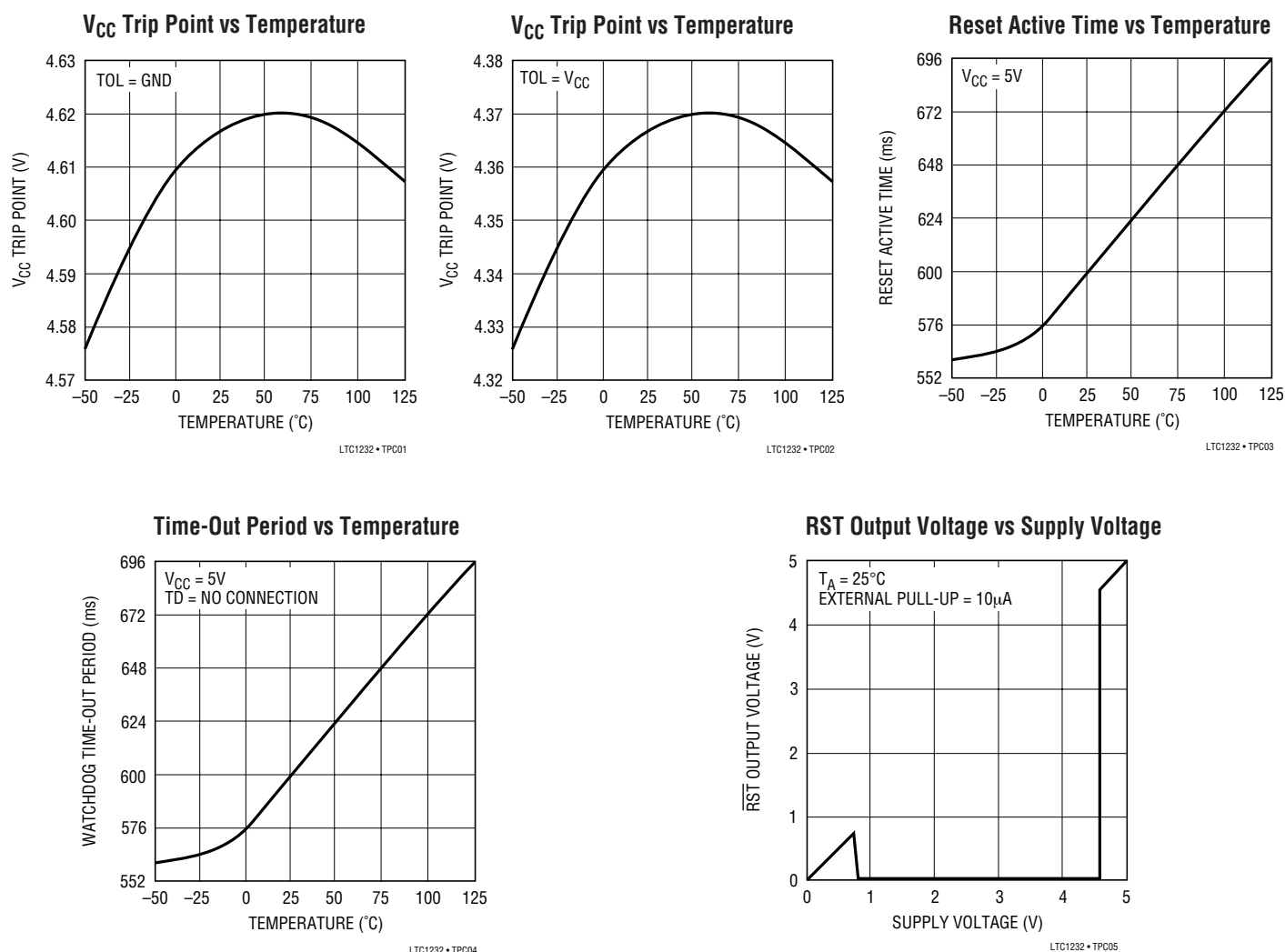
Power Up



## BLOCK DIAGRAM



## TYPICAL PERFORMANCE CHARACTERISTICS



## PIN FUNCTIONS

**V<sub>CC</sub>:** 5V Supply Input. The V<sub>CC</sub> pin should be bypassed with a 0.1µF capacitor.

**GND:** Ground Pin.

**PB RST:** Logic Input to be Directly Connected to a Push-Button. The PB RST input requires an active low signal which is debounced and timed for a minimum of 40ms. When this condition is satisfied, the reset pulse generator forces the reset outputs to active states. The reset outputs remain in active states for a minimum of 250ms after PB RST is released from logic low level.

**TOL:** Input to Select 5% or 10% Variation on V<sub>CC</sub>. When TOL is connected to GND, the reset pulse generator forces the reset outputs to active states as V<sub>CC</sub> falls below 4.75V (4.62V typical). When TOL is connected to V<sub>CC</sub>, the reset pulse generator forces the reset outputs to active states as V<sub>CC</sub> falls below 4.5V (4.37V typical).

**TD:** Time-Out Delay. TD is a three-level input to select three different time-out periods. The time-out period is set by the TD input to be 150ms with TD connected to GND, 600ms with TD left floating, and 1.2 seconds with TD connected to V<sub>CC</sub>.

## PIN FUNCTIONS

**RST:** Open Drain Logic Output for  $\mu$ P Reset Control. The LTC1232 provides three ways to generate  $\mu$ P reset. First, when  $V_{CC}$  falls below  $V_{CC}$  trip point (4.75V with TOL = GND and 4.5V with TOL =  $V_{CC}$ ),  $\overline{RST}$  goes active low. After  $V_{CC}$  returns to 5V, the reset pulse generator forces  $\overline{RST}$  to remain active low for a minimum of 250ms. Second, when the watchdog timer is not serviced prior to a selected time-out period, the reset pulse generator also forces  $\overline{RST}$  to active low for a minimum of 250ms and repeats for every time-out period. Third and the last, when the  $\overline{PB RST}$  pin stays active low for a minimum of 40ms,  $\overline{RST}$  becomes active low. The  $\overline{RST}$  output will remain

active low for a minimum of 250ms from the moment the push-button reset input is released from logic low level.

**RST:**  $\overline{RST}$  is an Active High Logic Output. It is the inverse of  $\overline{RST}$ .

**ST:** Logic Input to Reset the Watchdog Timer. Driving  $\overline{ST}$  either high or low longer than the time-out period set by the TD input, forces the reset outputs to active states for a minimum of 250ms. The timer resets itself and begins to time-out again with each high to low transition on the  $\overline{ST}$  input (see Figure 2).

## APPLICATIONS INFORMATION

### Power Monitoring

The LTC1232 uses a bandgap voltage reference and a precision voltage comparator, C1, to monitor the 5V supply input on  $V_{CC}$  (see Block Diagram). When  $V_{CC}$  falls below the  $V_{CC}$  trip point (4.62V typical with TOL = GND and 4.37V typical with TOL  $V_{CC}$ ), the reset outputs are forced to active states. The  $V_{CC}$  trip point accounts for a 5% or 10% variation on  $V_{CC}$ , so the reset outputs become active when  $V_{CC}$  falls below the  $V_{CC}$  trip point. On power-up, the reset signals are held in active states for a minimum of 250ms after the  $V_{CC}$  trip point is reached to allow the power supply and microprocessor to stabilize. On power-down, the  $\overline{RST}$  signal remains active low even with  $V_{CC}$  as low as 1V. This capability helps hold the microprocessor in stable shutdown condition. Figure 1 shows the timing diagram of the  $\overline{RST}$  signal.

The precision voltage comparator, C1, typically has 40mV of hysteresis which ensures that glitches at  $V_{CC}$  pin do not activate the reset outputs. Response time is typically 10 $\mu$ s. To help prevent mitriggering due to transient loads,  $V_{CC}$  pin should be bypassed with a 0.1 $\mu$ F capacitor with the leads trimmed as short as possible.

### Push-Button Reset

The LTC1232 provides a logic input pin,  $\overline{PB RST}$ , for direct connection to a push-button. This push-button reset input requires an active low signal. Internally, this input signal is debounced and timed for a minimum of 40ms. When this

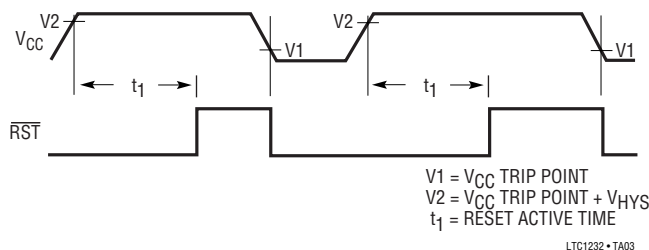


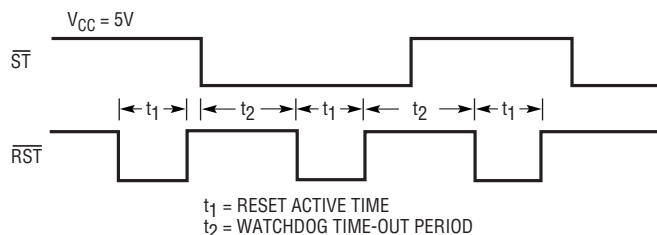
Figure 1. Reset Active Time

## APPLICATIONS INFORMATION

condition is satisfied, the reset pulse generator forces the reset outputs to active states. The reset signals will remain active for a minimum of 250ms from the moment the push-button reset input is released from logic low level (see Timing Diagram).

### Watchdog Timer

The LTC1232 provides a watchdog timer function to monitor the activity of the microprocessor. If the microprocessor does not stimulate the strobe input,  $\overline{ST}$ , within a selected time-out period, the reset outputs are forced to active states for a minimum of 250ms. The time-out period is selected by the Time-Out Delay input, TD, to be 150ms with TD connected to GND, 600ms with TD left floating, and 1.2 seconds with TD connected to  $V_{CC}$ . The 1.2 second time-out period is adequate for many systems to serve the watchdog timer immediately after a reset. Figure 2 shows the timing diagram of watchdog time-out period and reset active time. The watchdog time-out period is restarted as



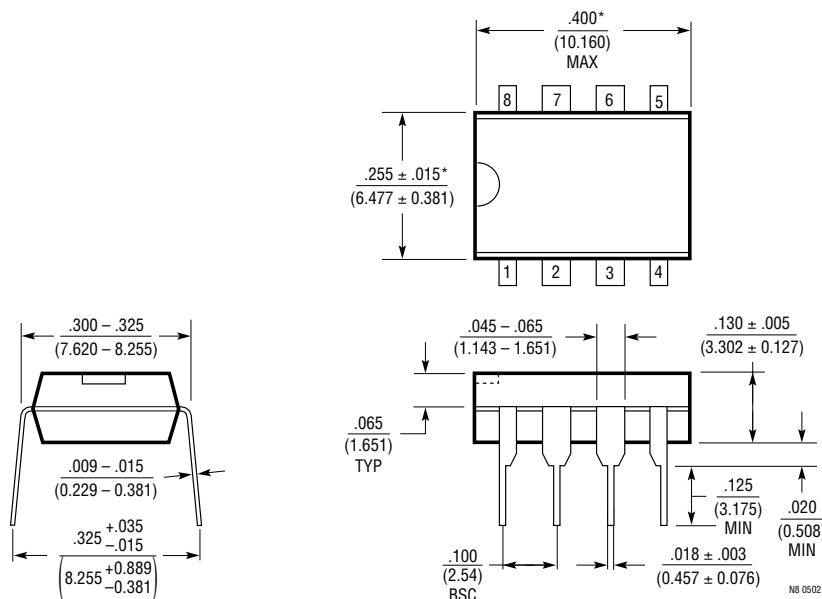
LTC1232 • TA04

**Figure 2. Watchdog Time-Out Period and Reset Active Time**

soon as the reset outputs are inactive. When a high-to-low transition occurs at the  $\overline{ST}$  pin prior to time-out, the watchdog time is reset and begins to time-out again. To ensure the watchdog time does not time-out, a high-to-low transition on the  $\overline{ST}$  pin must occur at or less than the minimum time-out period. If the input to the  $\overline{ST}$  pin remains either high or low, reset pulses will be issued for every time-out period selected by the TD pin. The watchdog timer is disabled when  $V_{CC}$  falls below the  $V_{CC}$  trip point.

## PACKAGE DESCRIPTION

**N8 Package**  
**8-Lead PDIP (Narrow .300 Inch)**  
 (Reference LTC DWG # 05-08-1510)



NOTE:

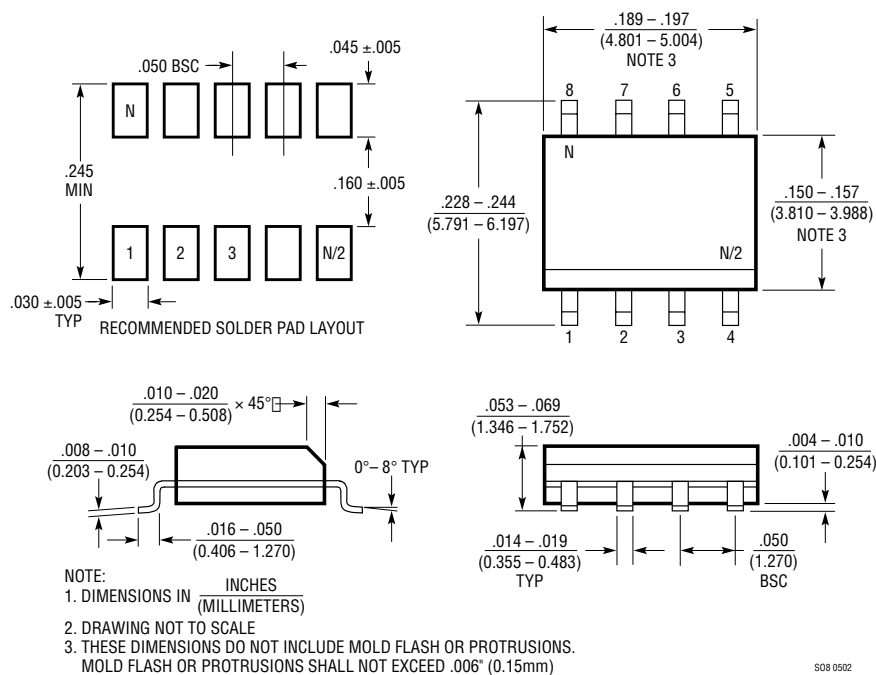
1. DIMENSIONS ARE INCHES  
 MILLIMETERS

\*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
 MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

sn1232 1232fas

## PACKAGE DESCRIPTION

**S8 Package**  
**8-Lead Plastic Small Outline (Narrow .150 Inch)**  
 (Reference LTC DWG # 05-08-1610)



S08 0502

## RELATED PARTS

| PART NUMBER             | DESCRIPTION                                                       | COMMENTS                                          |
|-------------------------|-------------------------------------------------------------------|---------------------------------------------------|
| LTC690                  | 5V Supply Monitor, Watchdog Timer and Battery Backup              | 4.65V Threshold                                   |
| LTC694-3.3              | 3.3V Supply Monitor, Watchdog Timer and Battery Backup            | 2.9V Threshold                                    |
| LTC699                  | 5V Supply Monitor and Watchdog Timer                              | 4.65V Threshold                                   |
| LTC1326                 | Micropower Precision Triple Supply Monitor for 5V, 3.3V and ADJ   | 4.725V, 3.118V, 1V Thresholds (±0.75%)            |
| LTC1326-2.5             | Micropower Precision Triple Supply Monitor for 2.5V, 3.3V and ADJ | 2.363V, 3.118V, 1V Thresholds (±0.75%)            |
| LTC1536                 | Precision Triple Supply Monitor for PCI Applications              | Meets PCI t <sub>FAIL</sub> Timing Specifications |
| LTC1726-2.5             | Micropower Triple Supply Monitor for 2.5V, 3.3V and ADJ           | Adjustable RESET and Watchdog Time-Outs           |
| LTC1726-5               | Micropower Triple Supply Monitor for 5V, 3.3V and ADJ             | Adjustable RESET and Watchdog Time-Outs           |
| LTC1727-2.5/LTC1727-5   | Micropower Triple Supply Monitor with Open-Drain Reset            | Individual Monitor Outputs in MSOP                |
| LTC1728-1.8/LTC1728-3.3 | Micropower Triple Supply Monitor with Open-Drain Reset            | 5-Lead SOT-23 Package                             |
| LTC1728-2.5/LTC1728-5   | Micropower Triple Supply Monitor with Open-Drain Reset            | 5-Lead SOT-23 Package                             |
| LTC1985-1.8             | Micropower Triple Supply Monitor with Push-Pull Reset Output      | 5-Lead SOT-23 Package                             |