



# 5 V and 3.3 V Supply Monitor, Watchdog Timer, Manual Reset, with Active High & Low Resets



## FEATURES

- Selectable reset voltage tolerance
  - CAT1232LP for 5 V supply
  - CAT1832 for 3.3 V supply
- Selectable watchdog period: 150 ms, 600 ms or 1.2 s
- Two reset outputs
  - Active high, push-pull reset output
  - Active low, open-drain reset output (CAT1232LP)
  - Active low, push-pull reset output (CAT1832)
- Debounced manual push-button reset
- Compact SOIC and MSOP packages

For Ordering Information details, see page 11.

## APPLICATIONS

- Microprocessor Systems
- Portable Equipment
- Controllers
- Single Board Computers
- Instrumentations
- Telecommunications

## DESCRIPTION

The CAT1232LP and CAT1832 microprocessor supervisors can halt and restart a “hung-up” or “stalled” microprocessor, restart a microprocessor after a power failure, and debounce a manual/push-button microprocessor reset switch. The devices are drop in replacements for the Maxim/Dallas Semiconductor DS1232LP and DS1832 supervisors

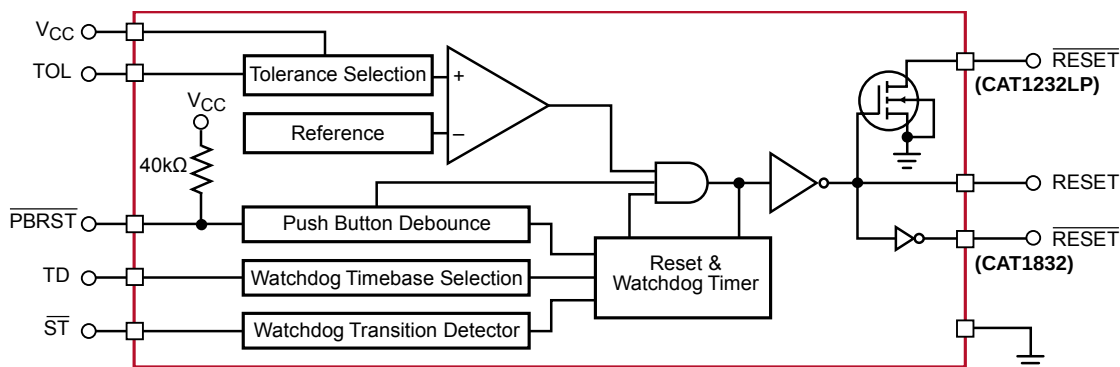
Precision reference and comparator circuits monitor the 5 V or 3.3 V system power supply voltage,  $V_{CC}$ . During power-up or when the power supply falls outside selectable tolerance limits, both the RESET and  $\overline{\text{RESET}}$  become active. After the power supply voltage rises above the RESET threshold voltage, the reset signals remain active for a minimum of 250ms, allowing the power supply and system processor to stabilize. The trip-point tolerance input, TOL, selects the trip level tolerance to be either 5% or 10% for the CAT1232LP 5 V supply and 10% or 20% for the CAT1832 3.3 V supply.

Each device has a push-pull, active HIGH reset output. The CAT1232LP also has an open drain, active LOW reset output while the CAT1832 also has a push-pull, active LOW reset output.

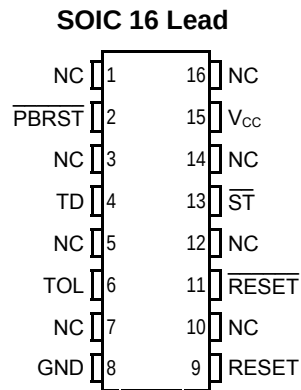
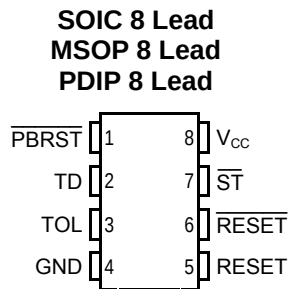
A debounced manual reset input activates the reset outputs and holds them active for a minimum period of 250 ms after being released.

Also included is a watchdog timer to reset a microprocessor that has stopped due to a software or hardware failure. Three watchdog time-out periods are selectable: 150 ms, 600 ms and 1.2 s. If the  $\overline{\text{ST}}$  input is not strobed low before the watchdog time out period expires, the reset signals become active for a minimum of 250 ms.

## FUNCTIONAL DIAGRAM



## PIN CONFIGURATION



## PIN DESCRIPTION

| Pin Number<br>8-Lead<br>Package | Pin Number<br>16-Lead<br>Package | Name                      | Function                                                                                                                                                                                                                                                                     |
|---------------------------------|----------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                               | 2                                | $\overline{\text{PBRST}}$ | Debounced manual pushbutton reset input                                                                                                                                                                                                                                      |
| 2                               | 4                                | TD                        | Watchdog typical time delay selection:<br>a) $t_{\text{TD}} = 150 \text{ ms}$ for TD = GND<br>b) $t_{\text{TD}} = 600 \text{ ms}$ for TD = Open<br>c) $t_{\text{TD}} = 1200 \text{ ms}$ for TD = $V_{\text{CC}}$                                                             |
| 3                               | 6                                | TOL                       | CAT1232LP TOL selects 5% (TOL = GND) or 10% (TOL = $V_{\text{CC}}$ ) trip point tolerance. CAT1832 TOL selects 10% (TOL = GND) or 20% (TOL = $V_{\text{CC}}$ ) trip point tolerance.                                                                                         |
| 4                               | 8                                | GND                       | Ground                                                                                                                                                                                                                                                                       |
| 5                               | 9                                | RESET                     | Active HIGH reset output. RESET is active<br>1. If $V_{\text{CC}}$ falls below the reset voltage trip point<br>2. If $\overline{\text{PBRST}}$ is low<br>3. If $\overline{\text{ST}}$ is not strobed low before the timeout period set by TD expires.<br>4. During power-up. |
| 6                               | 11                               | RESET                     | Active LOW reset output. (See RESET)                                                                                                                                                                                                                                         |
| 7                               | 13                               | $\overline{\text{ST}}$    | Strobe Input                                                                                                                                                                                                                                                                 |
| 8                               | 15                               | $V_{\text{CC}}$           | Power Supply                                                                                                                                                                                                                                                                 |
|                                 | 1, 3, 5, 7, 10,<br>12, 14, 16    | NC                        | No internal connection                                                                                                                                                                                                                                                       |

## ABSOLUTE MAXIMUM RATINGS (\*)

| Parameters                                                | Ratings                       | Units |
|-----------------------------------------------------------|-------------------------------|-------|
| Voltage on $V_{\text{CC}}$                                | -0.5 to 7.0                   | V     |
| Voltage on $\overline{\text{ST}}$ and TD                  | -0.5 to $V_{\text{CC}} + 0.5$ | V     |
| Voltage on $\overline{\text{PBRST}}$ ,<br>RESET and RESET | -0.5 to $V_{\text{CC}} + 0.5$ | V     |

| Parameters                       | Ratings     | Units |
|----------------------------------|-------------|-------|
| Maximum Junction Temperature     | 125         | °C    |
| Storage Temperature Range        | -65 to +150 | °C    |
| Lead Soldering Temperature (10s) | 300         | °C    |
| Operating Temperature Range      | -40 to +85  | °C    |

## Note:

\* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions outside of those listed in the operational sections of this specification is not implied. Exposure to any absolute maximum rating for extended periods may affect device performance and reliability.

**ELECTRICAL CHARACTERISTICS**

Unless otherwise stated, 1.0 V -  $V_{CC}$  - 5.5 V and over the operating temperature range of -40°C to +85°C.

All voltages are referenced to ground.

| Symbol     | Parameter                                               | Conditions                        | Min              | Typ              | Max              | Units      |
|------------|---------------------------------------------------------|-----------------------------------|------------------|------------------|------------------|------------|
| $V_{CC}$   | Supply Voltage                                          |                                   | 1.0              |                  | 5.5              | V          |
| $I_{CC1}$  | Supply Current                                          | $V_{CC} = 5.5$ V, CAT1232LP       |                  | 35               | 50               | $\mu$ A    |
|            |                                                         | $V_{CC} = 3.6$ V, CAT1832         |                  | 20               | 35               |            |
| $V_{IH}$   | ST and $\overline{PBRST}$ Input High Level              | (5)                               | 2                |                  | $V_{CC} + 0.3$ V | V          |
|            |                                                         | (6)                               | $V_{CC} - 0.4$ V |                  |                  |            |
| $V_{IL}$   | ST and $\overline{PBRST}$ Input Low Level               | $V_{CC} = 5.5$ V, CAT1232LP       | -0.3             |                  | 0.8              | V          |
|            |                                                         | $V_{CC} = 3.6$ V, CAT1832         |                  |                  | 0.5              |            |
| $V_{CCTP}$ | $V_{CC}$ Trip Point (TOL = GND)                         | CAT1232LP                         | 4.50             | 4.62             | 4.74             | V          |
| $V_{CCTP}$ | $V_{CC}$ Trip Point (TOL = $V_{CC}$ )                   | CAT1232LP                         | 4.25             | 4.37             | 4.49             | V          |
| $V_{CCTP}$ | $V_{CC}$ Trip Point (TOL = GND)                         | CAT1832                           | 2.80             | 2.88             | 2.97             | V          |
| $V_{CCTP}$ | $V_{CC}$ Trip Point (TOL = $V_{CC}$ )                   | CAT1832                           | 2.47             | 2.55             | 2.64             | V          |
| $t_{TD}$   | Watchdog Time-Out Period                                | TD = GND                          | 62.5             | 150              | 250              | ms         |
| $t_{TD}$   | Watchdog Time-Out Period                                | TD = $V_{CC}$                     | 500              | 1200             | 2000             | ms         |
| $t_{TD}$   | Watchdog Time-Out Period                                | TD floating                       | 250              | 600              | 1000             | ms         |
| $V_{OH}$   | Output Voltage                                          | $I = -500$ $\mu$ A <sup>(3)</sup> | $V_{CC} - 0.5$ V | $V_{CC} - 0.1$ V |                  | V          |
| $I_{OH}$   | Output Current                                          | Output = 2.4 V <sup>(2)</sup>     |                  | -350             |                  | $\mu$ A    |
| $I_{OL}$   | Output Current                                          | Output = 0.4 V                    | 10               |                  |                  | mA         |
| $I_{IL}$   | Input Leakage                                           | (1)                               | -1.0             |                  | 1.0              | $\mu$ A    |
| $R_{PU}$   | Internal Pull-Up Resistor                               | (1)                               | 32               | 40               | 55               | k $\Omega$ |
| $C_{IN}$   | Input Capacitance                                       |                                   |                  |                  | 5                | pF         |
| $C_{OUT}$  | Output Capacitance                                      |                                   |                  |                  | 7                | pF         |
| $t_{PB}$   | $\overline{PBRST}$ Manual Reset Minimum Low Time        | $\overline{PBRST} = V_{IL}$       | 20               |                  |                  | ms         |
| $t_{RST}$  | Reset Active Time                                       |                                   | 250              | 600              | 1000             | ms         |
| $t_{ST}$   | $\overline{ST}$ Pulse Width                             | (4)                               | 20               |                  |                  | ns         |
| $t_{RPD}$  | $V_{CC}$ Fail Detect to RESET or RESET                  |                                   |                  | 5                | 8                | $\mu$ s    |
| $t_F$      | $V_{CC}$ Slew Rate                                      |                                   | 20               |                  |                  | $\mu$ s    |
| $t_{PDLY}$ | $\overline{PBRST}$ Stable LOW to RESET and RESET Active |                                   |                  |                  | 20               | ms         |
| $t_{RPU}$  | $V_{CC}$ Detect to RESET or RESET Inactive              | $t_{RISE} = 5$ $\mu$ s            | 250              | 600              | 1000             | ms         |
| $t_R$      | $V_{CC}$ Slew Rate                                      | 4.25 V to 4.75 V                  | 0                |                  |                  | ns         |

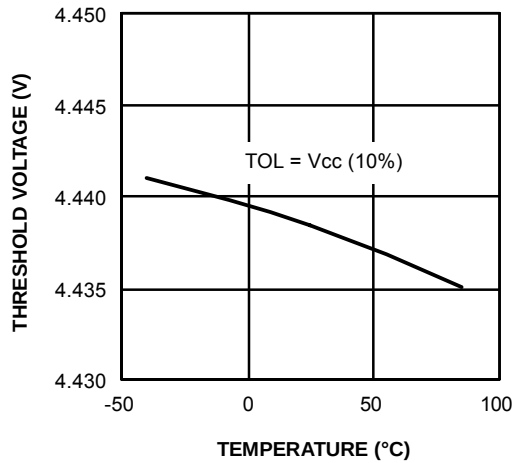
**Notes:**

- (1)  $\overline{PBRST}$  is internally pulled HIGH to  $V_{CC}$  through a nominal 40 k $\Omega$  resistor (RPU).
- (2) RESET is an open drain output on the CAT1232LP.
- (3) RESET remains within 0.5 V of  $V_{CC}$  on power-down until  $V_{CC}$  falls below 2 V. RESET remains within 0.5 V of ground on power-down until  $V_{CC}$  falls below 2.0 V.
- (4) Must not exceed the minimum watchdog time-out period ( $t_{TD}$ ). The watchdog circuit cannot be disabled. To avoid a reset,  $\overline{ST}$  must be strobed.
- (5) Measured with  $V_{CC} \geq 2.7$  V.
- (6) Measured with  $V_{CC} < 2.7$  V.

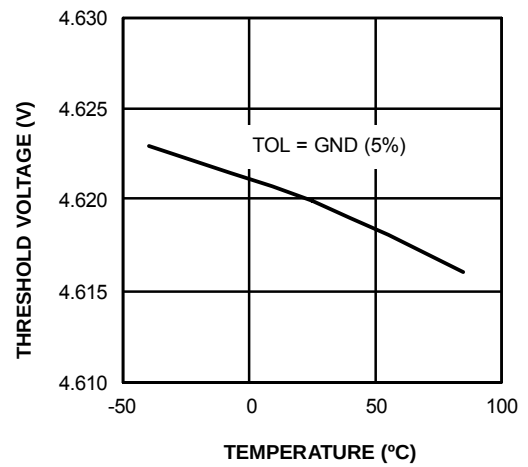
## TYPICAL CHARACTERISTICS

For the CAT1232LP,  $V_{CC} = 5\text{ V}$  and  $T_{AMB} = 25^\circ\text{C}$  unless otherwise stated.

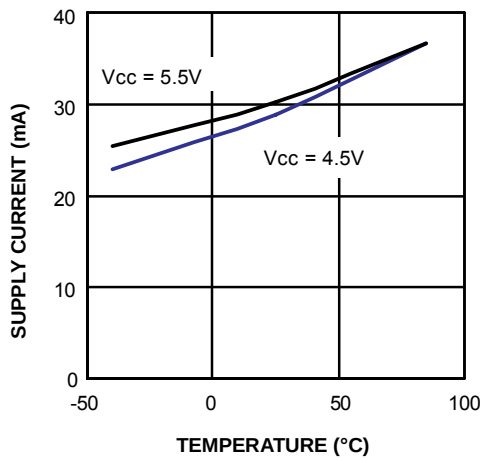
Threshold Voltage vs. Temperature (10% TOL)



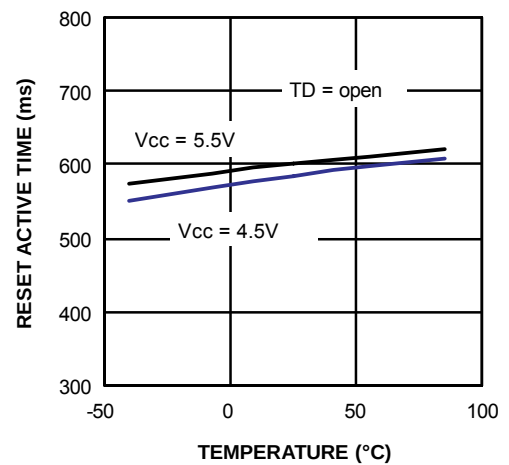
Threshold Voltage vs. Temperature (5% TOL)



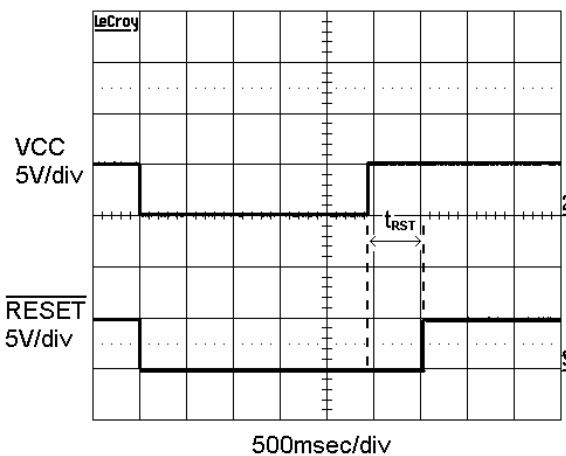
Supply Current vs. Temperature



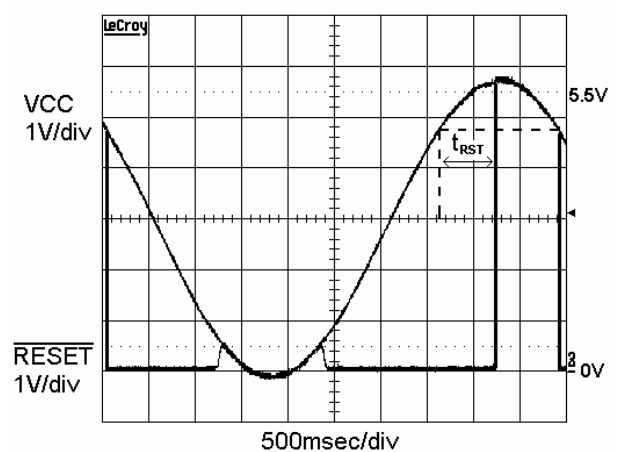
Reset Active Time vs. Temperature



Reset Active Time Waveform



Transient Response



## APPLICATION INFORMATION

### SUPPLY VOLTAGE MONITOR

#### Reset Signal Polarity and Output Stage Structure

$\overline{\text{RESET}}$  is an active LOW signal. It is developed with an open drain driver in the CAT1232LP. A pull-up resistor is required, typical values are 10 k $\Omega$  to 50 k $\Omega$ . The CAT1832 uses a CMOS push-pull output stage for the  $\overline{\text{RESET}}$ .

RESET is an active High signal developed by a CMOS push-pull output stage and is the logical opposite to  $\overline{\text{RESET}}$ .

#### Trip Point Tolerance Selection

The TOL input is used to select the  $V_{CC}$  trip point threshold. This selection is made connecting the TOL input to ground or  $V_{CC}$ . Connecting TOL to Ground makes the  $V_{CC}$  trip threshold 4.62 V for the CAT1232LP and 2.88 V for the CAT1832.

Connecting TOL to  $V_{CC}$  makes the  $V_{CC}$  trip threshold 4.37 V for the CAT1232LP and 2.55 V for the CAT1832.

After  $V_{CC}$  has risen above the trip point set by TOL,  $\overline{\text{RESET}}$  and  $\overline{\text{RESET}}$  remain active for a minimum time period of 250 ms.

On power-down, once  $V_{CC}$  falls below the reset threshold the  $\overline{\text{RESET}}$  outputs will remain active and are guaranteed valid down to a  $V_{CC}$  level of 1.0 V.

| Tolerance Select Voltage    | Trip Point Tolerance | Trip Point Voltage (V) |         |      |
|-----------------------------|----------------------|------------------------|---------|------|
|                             |                      | Min                    | Nominal | Max  |
| CAT1232LP<br>TOL = $V_{CC}$ | 10 %                 | 4.25                   | 4.37    | 4.49 |
| CAT1232LP<br>TOL = GND      | 5 %                  | 4.50                   | 4.62    | 4.74 |
| CAT1832<br>TOL = $V_{CC}$   | 20 %                 | 2.47                   | 2.55    | 2.64 |
| CAT1832<br>TOL = GND        | 10 %                 | 2.80                   | 2.88    | 2.97 |

#### Manual Reset Operation

Push-button input,  $\overline{\text{PBRST}}$ , allows the user to issue reset signals. The pushbutton input is debounced and is pulled high through an internal 40 k $\Omega$  resistor.

When  $\overline{\text{PBRST}}$  is held low for the minimum time of 20 ms, both resets become active and remain active for a minimum time period of 250 ms after  $\overline{\text{PBRST}}$  returns high.

No external pull-up resistor is required, since  $\overline{\text{PBRST}}$  is pulled high by an internal 40 k $\Omega$  resistor.

$\overline{\text{PBRST}}$  can be driven from a TTL or CMOS logic line or short-ed to ground with a mechanical switch.

Figure 1. Timing Diagram: Power Up

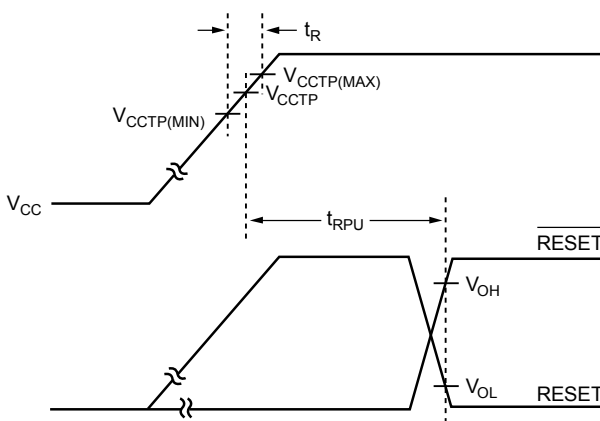
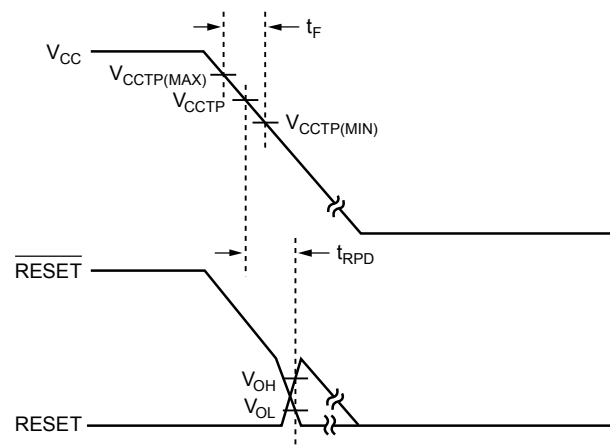


Figure 2. Timing Diagram: Power Down



## WATCHDOG TIMER AND $\overline{ST}$ INPUT

A watchdog timer stops and restarts a microprocessor that has stopped proper operation or become “hung”. The watchdog performs this function by monitoring the  $\overline{ST}$  input. After the reset outputs go inactive the  $\overline{ST}$  input must be strobed with a high-to-low signal transition prior to the minimum watchdog timeout period. However if the  $\overline{ST}$  input is not strobed with a high-to-low signal transition prior to a watchdog timeout the reset outputs will become active for TRST resetting and restarting the microprocessor. Once the resets return to the inactive state the watchdog timer restarts the process.

The TD input allows the user to select from three predetermined watchdog timeout periods. Always use the minimum timeout period to determine the required frequency of  $\overline{ST}$  high-to-low transitions and the maximum to determine the time prior to the reset outputs becoming active.  $\overline{ST}$  pulse widths must be 20 ns or greater.

The watchdog timer cannot be disabled. It must be strobed with a high-to-low signal transition to avoid a watchdog timeout and subsequent reset.

| TD Voltage Level | Watchdog Time-out Period (ms) |         |      |
|------------------|-------------------------------|---------|------|
|                  | Min                           | Nominal | Max  |
| GND              | 62.5                          | 150     | 250  |
| Floating         | 250                           | 600     | 1000 |
| V <sub>CC</sub>  | 500                           | 1200    | 2000 |

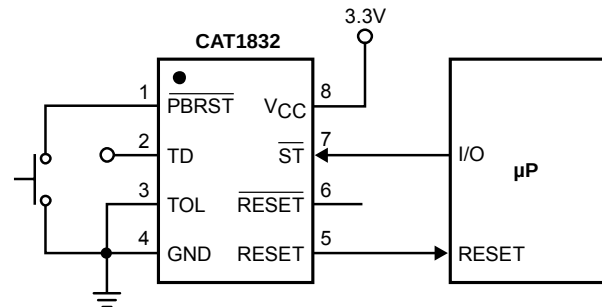


Figure 4. CAT1832 Application Circuit: Pushbutton Reset

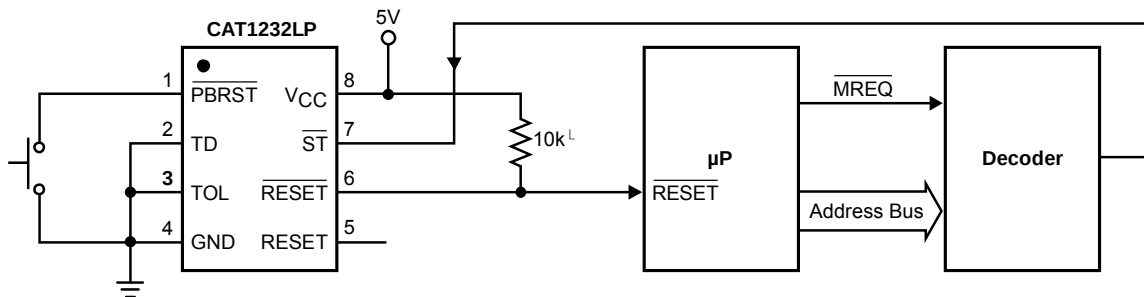


Figure 5. CAT1232LP Application Circuit: Watchdog Timer

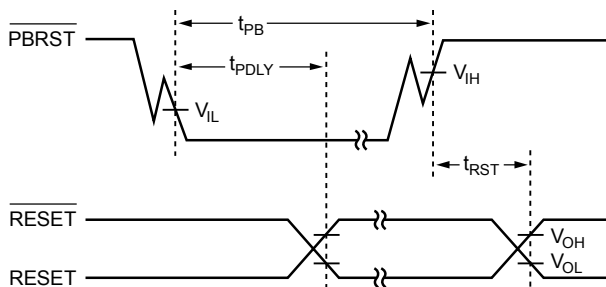


Figure 6. Timing Diagram: Pushbutton Reset

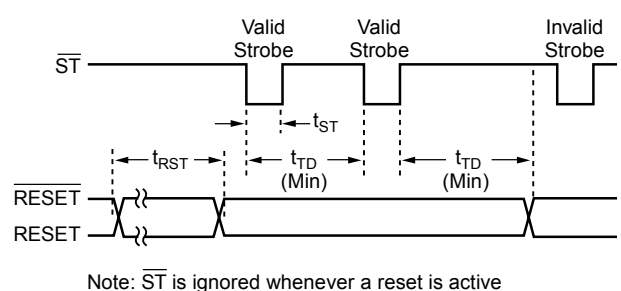
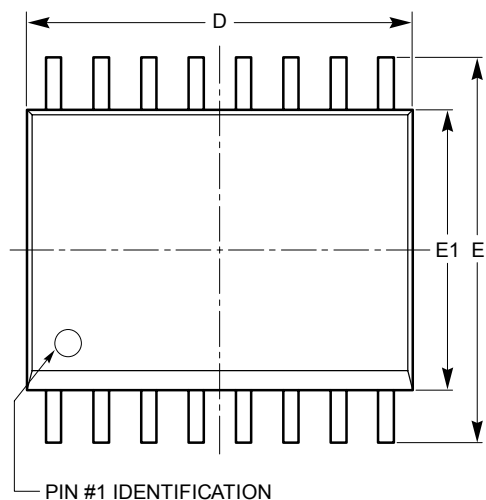


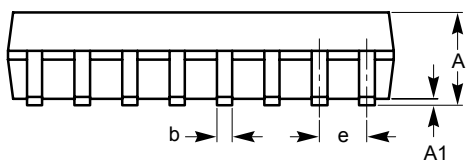
Figure 7. Timing Diagram: Strobe Input

## PACKAGE OUTLINE DRAWINGS

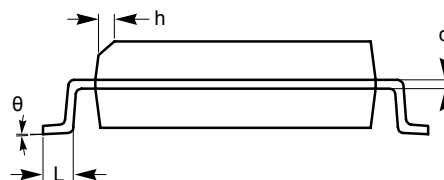
SOIC 16-Lead 300 mils (W)<sup>(1)(2)</sup>

TOP VIEW

| SYMBOL   | MIN      | NOM   | MAX   |
|----------|----------|-------|-------|
| A        | 2.36     | 2.49  | 2.64  |
| A1       | 0.10     |       | 0.30  |
| b        | 0.33     | 0.41  | 0.51  |
| c        | 0.18     | 0.23  | 0.28  |
| D        | 10.08    | 10.31 | 10.49 |
| E        | 10.01    | 10.31 | 10.64 |
| E1       | 7.39     | 7.49  | 7.59  |
| e        | 1.27 BSC |       |       |
| h        | 0.25     |       | 0.75  |
| L        | 0.38     | 0.81  | 1.27  |
| $\theta$ | 0°       |       | 8°    |



SIDE VIEW

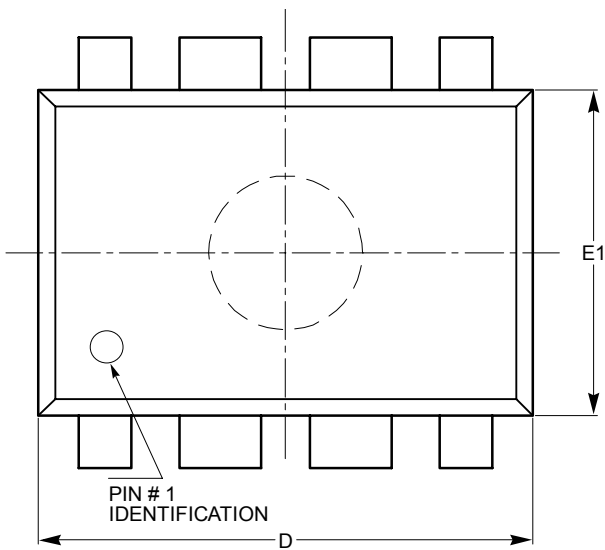


END VIEW

**Notes:**

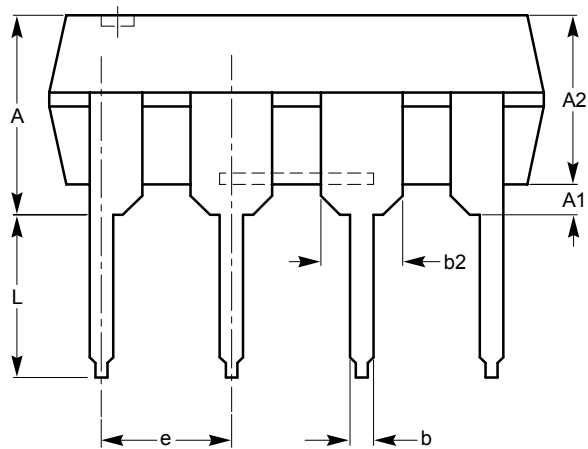
- (1) All dimensions are in millimeters.  
 (2) Complies with JEDEC MS-013.

PDIP 8-Lead 300mils (L)<sup>(1)(2)</sup>

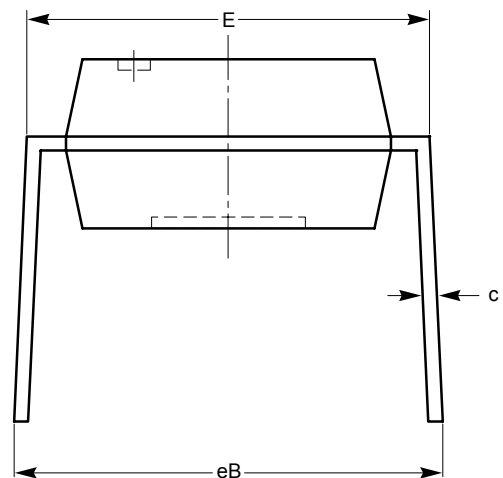


TOP VIEW

| SYMBOL | MIN      | NOM  | MAX   |
|--------|----------|------|-------|
| A      |          |      | 5.33  |
| A1     | 0.38     |      |       |
| A2     | 2.92     | 3.30 | 4.95  |
| b      | 0.36     | 0.46 | 0.56  |
| b2     | 1.14     | 1.52 | 1.78  |
| c      | 0.20     | 0.25 | 0.36  |
| D      | 9.02     | 9.27 | 10.16 |
| E      | 7.62     | 7.87 | 8.25  |
| e      | 2.54 BSC |      |       |
| E1     | 6.10     | 6.35 | 7.11  |
| eB     | 7.87     |      | 10.92 |
| L      | 2.92     | 3.30 | 3.80  |



SIDE VIEW

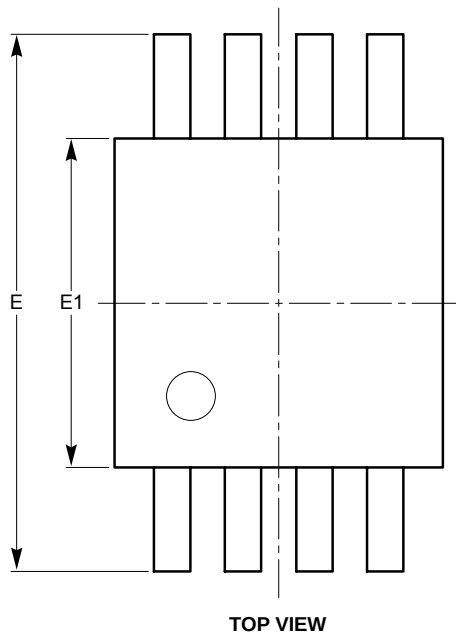


END VIEW

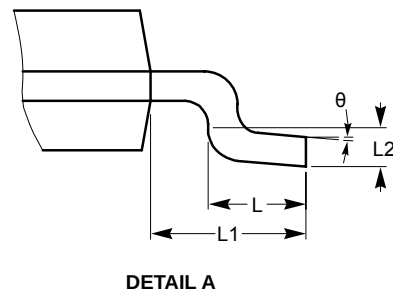
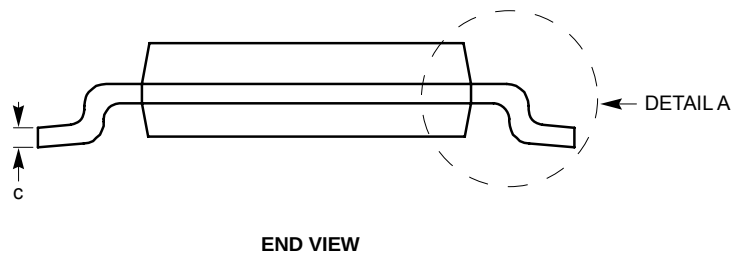
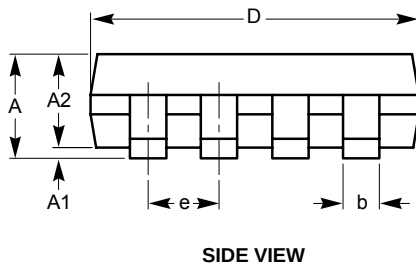
Notes:

- (1) All dimensions are in millimeters.
- (2) Complies with JEDEC MS-001.



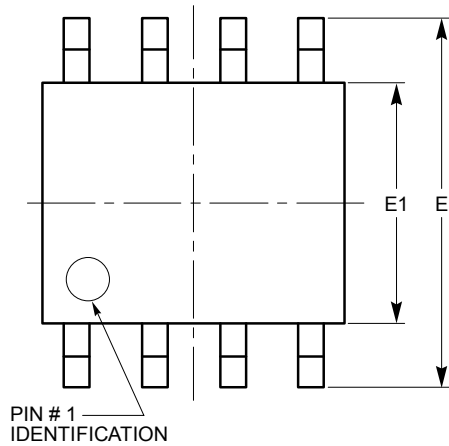
**MSOP 8-Lead (Z)** <sup>(1)(2)</sup>

| SYMBOL   | MIN      | NOM  | MAX  |
|----------|----------|------|------|
| A        |          |      | 1.10 |
| A1       | 0.05     | 0.10 | 0.15 |
| A2       | 0.75     | 0.85 | 0.95 |
| b        | 0.22     |      | 0.38 |
| c        | 0.13     |      | 0.23 |
| D        | 2.90     | 3.00 | 3.10 |
| E        | 4.80     | 4.90 | 5.00 |
| E1       | 2.90     | 3.00 | 3.10 |
| e        | 0.65 BSC |      |      |
| L        | 0.40     | 0.60 | 0.80 |
| L1       | 0.95 REF |      |      |
| L2       | 0.25 BSC |      |      |
| $\theta$ | 0°       |      | 6°   |

**Notes:**

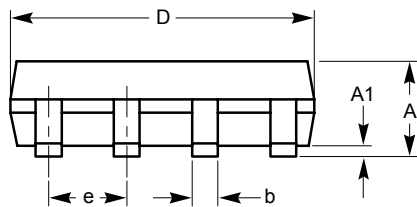
- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-187.

SOIC 8-Lead 150mils (V) <sup>(1)(2)</sup>

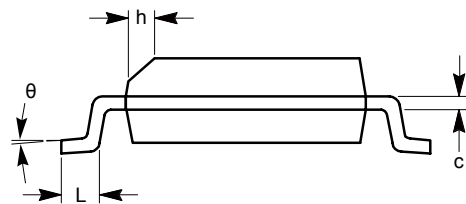


TOP VIEW

| SYMBOL   | MIN      | NOM | MAX  |
|----------|----------|-----|------|
| A        | 1.35     |     | 1.75 |
| A1       | 0.10     |     | 0.25 |
| b        | 0.33     |     | 0.51 |
| c        | 0.19     |     | 0.25 |
| D        | 4.80     |     | 5.00 |
| E        | 5.80     |     | 6.20 |
| E1       | 3.80     |     | 4.00 |
| e        | 1.27 BSC |     |      |
| h        | 0.25     |     | 0.50 |
| L        | 0.40     |     | 1.27 |
| $\theta$ | 0°       |     | 8°   |



SIDE VIEW

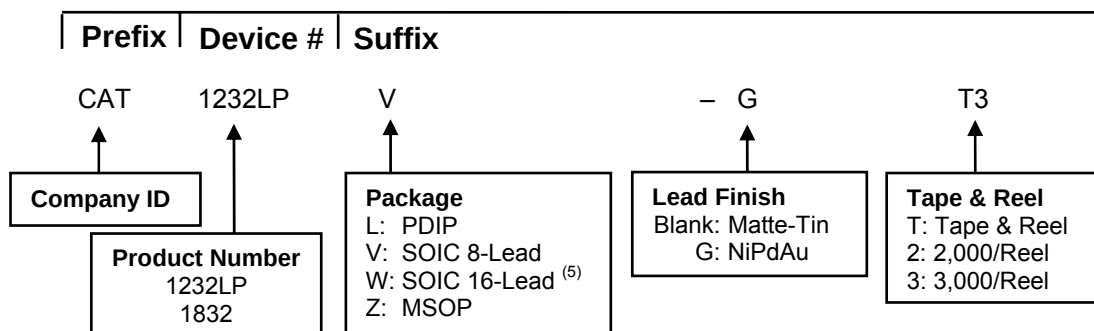


END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MS-012.

## EXAMPLE OF ORDERING INFORMATION



| ORDERING PART NUMBER | Package       | Parts per Tube | Parts Per Reel | Reel Size (inch) |
|----------------------|---------------|----------------|----------------|------------------|
| CAT1232LPL-G         | 8-lead, PDIP  | 50             | —              | —                |
| CAT1232LPV-GT3       | 8-lead, SOIC  | —              | 3,000          | 13               |
| CAT1232LPZ-GT3       | 8-lead, MSOP  | —              | 3,000          | 13               |
| CAT1232LPW-T2        | 16-lead, SOIC | —              | 2,000          | 13               |
| CAT1832L-G           | 8-lead, PDIP  | 50             | —              | —                |
| CAT1832V-GT3         | 8-lead, SOIC  | —              | 3,000          | 13               |
| CAT1832Z-GT3         | 8-lead, MSOP  | —              | 3,000          | 13               |

**Notes:**

- (1) All packages are RoHS-compliant (Lead-free, Halogen-free).
- (2) The standard lead finish is NiPdAu.
- (3) The device used in the above example is a CAT1232LPV-GT3 (SOIC 8-Lead, NiPdAu, Tape & Reel).
- (4) For additional package and temperature options, please contact your nearest ON Semiconductor Sales office.
- (5) The SOIC 16-Lead package is only available in Matte-Tin finish.

## REVISION HISTORY

| Date      | Rev. | Description                                                                                                             |
|-----------|------|-------------------------------------------------------------------------------------------------------------------------|
| 13-Jun-05 | 00   | Initial Issue                                                                                                           |
| 26-Jul-05 | 0A   | Update Electrical Characteristics<br>Add Typical Characteristics                                                        |
| 37-Mar-06 | 0B   | Update Document Title<br>Update Ordering Information                                                                    |
| 27-Nov-06 | 0C   | Add Ordering Information detail to page 1<br>Update Sample of Ordering Information                                      |
| 13-Nov-07 | D    | Update Package Outline Drawings<br>Update Example of Ordering Information<br>Change document number from 25088, Rev. OC |
| 06-Nov-08 | E    | Change logo and fine print to ON Semiconductor                                                                          |
| 09-Mar-09 | F    | Update Example of Ordering Information                                                                                  |

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