

# NCP1232

## Microprocessor Monitor

The NCP1232 is a fully-integrated processor supervisor. It provides three important functions to safeguard processor functionality: precision power on/off reset control, watchdog timer and external reset override.

On power-up, the NCP1232 holds the processor in the reset state for a minimum of 250 msec after  $V_{CC}$  is within tolerance to ensure a stable system start-up.

Microprocessor functionality is monitored by the on-board watchdog circuit. The microprocessor must provide a periodic low-going signal on the  $\overline{ST}$  input. Should the processor fail to supply this signal within the selected time-out period (150 msec, 600 msec or 1200 msec), an out-of-control processor is indicated and the NCP1232 issues a processor reset as a result.

The outputs of the NCP1232 are immediately driven active when the PB input is brought low by an external push-button switch or other electronic signal. When connected to a push-button switch, the NCP1232 provides contact debounce.

The NCP1232 is packaged in a space-saving 8-pin plastic SOIC package and requires no external components.

### Features

- Precision Voltage Monitor  
(Adjustable +4.5 V or +4.75 V)
- Reset Pulse Width (250 msec Min)
- No External Components
- Adjustable Watchdog Timer  
(150 msec, 600 msec or 1.2 sec)
- Debounced Manual Reset Input for External Override

### Applications

- Computers
- Controllers
- Intelligent Instruments
- Automotive Systems
- Critical  $\mu$ P Power Monitoring



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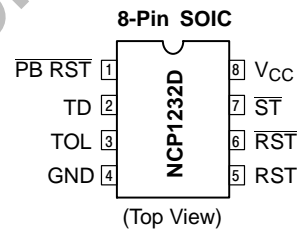
SO-8  
D SUFFIX  
CASE 751

### MARKING DIAGRAM



YY, Y = Year  
WW = Work Week  
X = Assembly ID Code  
Z = Subcontractor ID Code

### PIN CONNECTIONS



### ORDERING INFORMATION

| Device     | Package | Shipping         |
|------------|---------|------------------|
| NCP1232DR2 | SO-8    | 2500 Tape & Reel |



# NCP1232

## PIN DESCRIPTION

| Pin No.<br>(8-Pin SOIC) | Symbol   | Description  |
|-------------------------|----------|--|
| 1                       | PB RST   | Push-button Reset Input. A debounced active-low input that ignores pulses less than 1 msec in duration and is guaranteed to recognize inputs of 20 msec or greater.  |
| 2                       | TD       | Time Delay Set. The watchdog time-out select input ( $t_{TD} = 150$ msec for TD = 0 V, $t_{TD} = 600$ msec for TD = open, $t_{TD} = 1.2$ sec for TD = $V_{CC}$ .)  |
| 3                       | TOL      | Tolerance Input. Connect to GND for 5% tolerance or to $V_{CC}$ for 10% tolerance.   |
| 4                       | GND      | Ground.  |
| 5                       | RST      | Reset Output (Active High) - goes active:<br>1. If $V_{CC}$ falls below the selected reset voltage threshold<br>2. If $\overline{\text{PB RST}}$ is forced low<br>3. If ST is not strobed within the minimum time-out period<br>4. During power-up |
| 6                       | RST      | Reset Output (Active Low, Open Drain) - see RST.   |
| 7                       | ST       | Strobe Input. Input for watchdog timer.  |
| 8                       | $V_{CC}$ | The +5 V Power Supply Input.   |

ARCHIVE  
DEVICE NOT RECOMMENDED FOR NEW DESIGN

# NCP1232

**ABSOLUTE MAXIMUM RATINGS\*** Voltage on any pin (with respect to GND) -0.3 V to +5.8 V

| Rating                                      | Value       | Unit |
|---|-------------|------|
| Operating Temperature Range                 | -40 to +85  | °C   |
| Storage Temperature Range, T <sub>stg</sub> | -65 to +150 | °C   |
| Lead Temperature (Soldering, 10 sec)        | +300        | °C   |

\*Stresses beyond 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 beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**DC ELECTRICAL CHARACTERISTICS** (T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>; V<sub>CC</sub> = +4.5 V to 5.5 V, unless otherwise specified.)

| Characteristic                              | Symbol             | Test Conditions         | Min  | Typ  | Max                   | Unit |
|---|--------------------|-------------------------|------|------|-----------------------|------|
| Supply Voltage                              | V <sub>CC</sub>    | -                       | 4.5  | 5.0  | 5.5                   | V    |
| $\overline{ST}$ and PB RST Input High Level | V <sub>IH</sub>    | Note 1                  | 2.0  | -    | V <sub>CC</sub> + 0.3 | V    |
| $\overline{ST}$ and PB RST Input Low Level  | V <sub>IL</sub>    | -                       | -0.3 | -    | +0.8                  | V    |
| Input Leakage $\overline{ST}$ , TOL         | I <sub>L</sub>     | -                       | -1.0 | -    | +1.0                  | μA   |
| Output Current RST                          | I <sub>OH</sub>    | V <sub>OH</sub> = 2.4 V | -1.0 | -12  | -                     | mA   |
| Current RST, $\overline{RST}$               | I <sub>OL</sub>    | V <sub>OL</sub> = 0.4 V | 2.0  | 10   | -                     | mA   |
| Operating Current                           | I <sub>CC</sub>    | Note 2                  | -    | 50   | 200                   | μA   |
| V <sub>CC</sub> 5% Trip Point (Note 3)      | V <sub>CC</sub> TP | TOL = GND               | 4.50 | 4.62 | 4.74                  | V    |
| V <sub>CC</sub> 10% Trip Point (Note 3)     | V <sub>CC</sub> TP | TOL = V <sub>CC</sub>   | 4.25 | 4.37 | 4.49                  | V    |

**CAPACITANCE (Note 4)** (T<sub>A</sub> = +25°C)

| Characteristic                           | Symbol           | Test Conditions | Min | Typ | Max | Unit |
|--|------------------|-----------------|-----|-----|-----|------|
| Input Capacitance $\overline{ST}$ , TOL  | C <sub>IN</sub>  | -               | -   | -   | 5.0 | pF   |
| Output Capacitance RST, $\overline{RST}$ | C <sub>OUT</sub> | -               | -   | -   | 7.0 | pF   |

**AC ELECTRICAL CHARACTERISTICS** (T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>; V<sub>CC</sub> = +5.0 V to ±10%, unless otherwise specified.)

| Characteristic  | Symbol           | Test Conditions   | Min                | Typ                | Max                 | Unit |
|---|------------------|---|--------------------|--------------------|---------------------|------|
| PB RST (Note 5)   | t <sub>PB</sub>  | Figure 3  | 20                 | -                  | -                   | msec |
| PB RST Delay  | t <sub>PBD</sub> | Figure 3  | 1.0                | 4.0                | 20                  | msec |
| Reset Active Time   | t <sub>RST</sub> | -   | 250                | 610                | 1000                | msec |
| $\overline{ST}$ Pulse Width   | t <sub>ST</sub>  | Figure 4  | 20                 | -                  | -                   | nsec |
| $\overline{ST}$ Time-out Period                                       | t <sub>TD</sub>  | Figure 4<br>TD Pin = 0 V<br>TD Pin = Open<br>TD Pin = V <sub>CC</sub> | 62.5<br>250<br>500 | 150<br>600<br>1200 | 250<br>1000<br>2000 | msec |
| V <sub>CC</sub> Fall Time (Note 4)                                    | t <sub>F</sub>   | Figure 5  | 10                 | -                  | -                   | μsec |
| V <sub>CC</sub> Rise Time (Note 4)                                    | t <sub>R</sub>   | Figure 6  | 0                  | -                  | -                   | μsec |
| V <sub>CC</sub> Detect to RST High and $\overline{RST}$ Low           | t <sub>RPD</sub> | Figure 7, V <sub>CC</sub> Falling                                     | -                  | -                  | 100                 | nsec |
| V <sub>CC</sub> Detect to RST High and $\overline{RST}$ Open (Note 6) | t <sub>RPU</sub> | Figure 8, V <sub>CC</sub> Rising                                      | 250                | 610                | 1000                | msec |

1. PB RST is internally pulled up to V<sub>CC</sub> with an internal impedance of typically 40 kΩ.
2. Measured with outputs open.
3. All voltages references to GND.
4. Guaranteed by design.
5. PB RST must be held low for a minimum of 20 msec to guarantee a reset.
6. t<sub>R</sub> = 5 μsec.

**Power Monitor**

The NCP1232 detects out-of-tolerance power supply conditions and warns a processor-based system of an impending power failure. When  $V_{CC}$  is detected as below the preset level defined by  $TOL$ , the  $V_{CC}$  comparator outputs the signals  $RST$  and  $\overline{RST}$ . If  $TOL$  is connected to ground, the  $RST$  and  $\overline{RST}$  signals become active as  $V_{CC}$  falls below 4.75 volts. If  $TOL$  is connected to  $V_{CC}$ , the  $RST$  and  $\overline{RST}$  become active as  $V_{CC}$  falls below 4.5 volts. Because the processing is stopped at the last possible moment of valid  $V_{CC}$ , the  $RST$  and  $\overline{RST}$  are excellent control signals for a  $\mu P$ . The reset outputs will remain in their active states until  $V_{CC}$  has been continuously in-tolerance for a minimum of 250 msec allowing the power supply and  $\mu P$  to stabilize before  $\overline{RST}$  is released.

**Push-button Reset Input**

The debounced manual reset input ( $\overline{PB RST}$ ) manually forces the reset outputs into their active states. Once  $\overline{PB RST}$  has been low for a time,  $t_{PBD}$ , the push-button delay time, the reset outputs go active. The reset outputs remain in their active states for a minimum of 250 msec after  $\overline{PB RST}$  rises above  $V_{IH}$  (Figure 3).

A mechanical push-button or active logic signal can drive the  $\overline{PB RST}$  input. The debounced input ignores input pulses less than 1 msec and is guaranteed to recognize pulses of 20 msec or greater. No external pull-up resistor is required because the  $\overline{PB RST}$  input has an internal pull-up to  $V_{CC}$  of approximately 100  $\mu A$ .

**Watchdog Timer**

When the  $\overline{ST}$  input is not stimulated for a preset time period, the watchdog timer function forces  $RST$  and  $\overline{RST}$  signals to the active state. The preset time period is determined by the  $\overline{TD}$  inputs to be 150 msec with  $\overline{TD}$  connected to ground, 600 msec with  $\overline{TD}$  open, or 1200 msec with  $\overline{TD}$  connected to  $V_{CC}$ , typical. The watchdog timer starts timing out from the set time period as soon as  $RST$  and  $\overline{RST}$  are inactive. If a high-to-low transition occurs on the  $\overline{ST}$  input pin prior to time-out, the watchdog timer is reset and begins to time-out again. If the watchdog timer is allowed to time-out, then the  $RST$  and  $\overline{RST}$  signals are driven to the active state for 250 msec minimum (Figure 2).

The software routine that strobes  $\overline{ST}$  is critical. The code must be in a section of software that is executed regularly so the time between toggles is less than the watchdog time-out period. One common technique controls the  $\mu P$  I/O line from two sections of the program. The software might set the I/O

line high while operating in the foreground mode and set it low while in the background or interrupt mode. If both modes do not execute correctly, the watchdog timer issues reset pulses.

**Supply Monitor Noise Sensitivity**

The NCP1232 is optimized for fast response to negative-going changes in  $V_{DD}$ . Systems with an inordinate amount of electrical noise on  $V_{DD}$  (such as systems using relays), may require a 0.01  $\mu F$  or 0.1  $\mu F$  bypass capacitor to reduce detection sensitivity. This capacitor should be installed as close to the NCP1232 as possible to keep the capacitor lead length short.

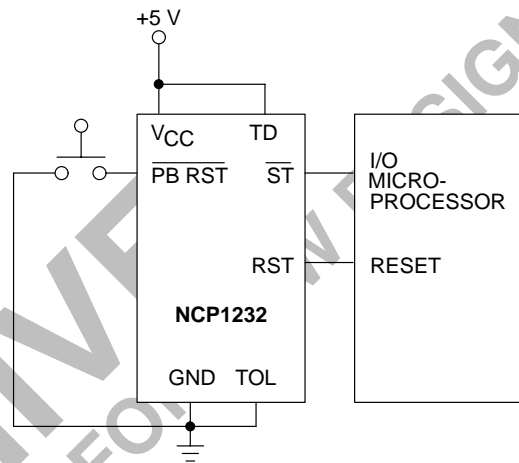


Figure 1. Push-button Reset

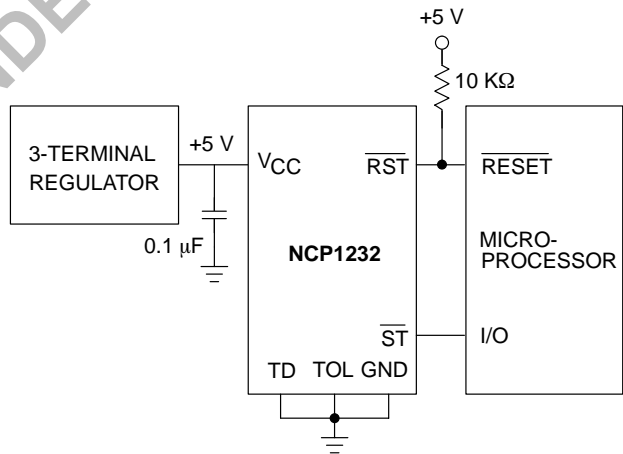
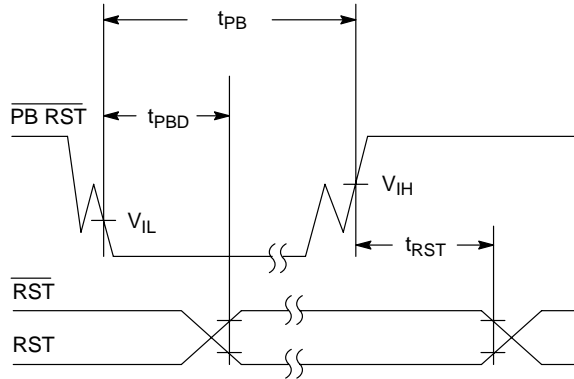
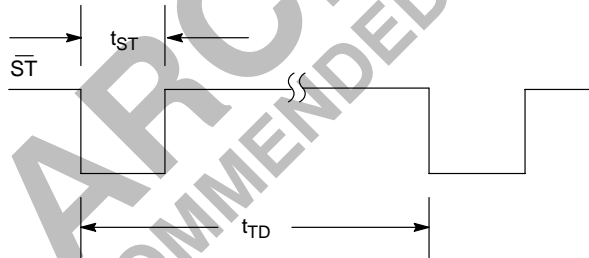


Figure 2. Watchdog Timer



**Figure 3. Push-button Reset.** The debounced  $\overline{\text{PB RST}}$  input ignores input pulses less than 1 msec and is guaranteed to recognized pulses of 20 msec or greater

**PUSH-BUTTON RESET**



**Figure 4. Strobe Input**

NOTE:  $t_{TD}$  is the maximum elapsed time between  $\overline{\text{ST}}$  high-to-low transitions ( $\overline{\text{ST}}$  is activated by falling edges only) which will keep the watchdog timer from forcing the reset outputs active for a time of  $t_{RST}$ .  $t_{TD}$  is a function of the voltage at the TD pin, as tabulated below.

| CONDITION                  | MIN       | $t_{TD}$<br>TYP | MAX       |
|----------------------------|-----------|-----------------|-----------|
| TD PIN = 0 V 62.5 msec     | 150 msec  | 250 msec        |           |
| TD PIN = OPEN              | 250 msec  | 600 msec        | 1000 msec |
| TD PIN = $V_{CC}$ 500 msec | 1200 msec | 2000 msec       |           |

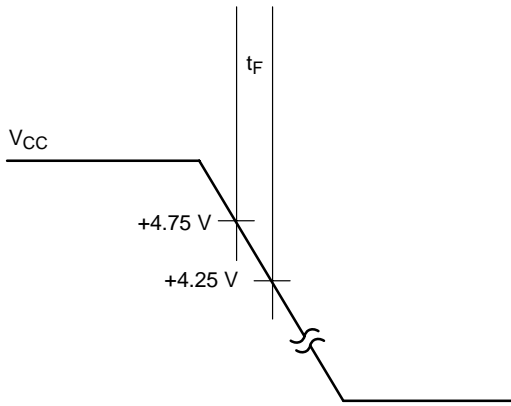


Figure 5. Power-Down Slew Rate

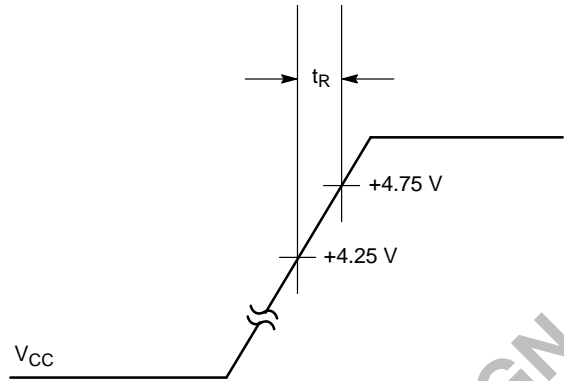


Figure 6. Power-Up Slew Rate

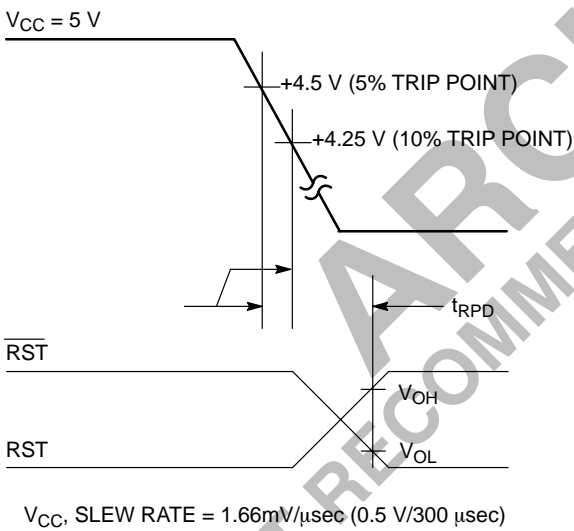


Figure 7.  $V_{CC}$  Detect Reset Output Delay (Power-Down)

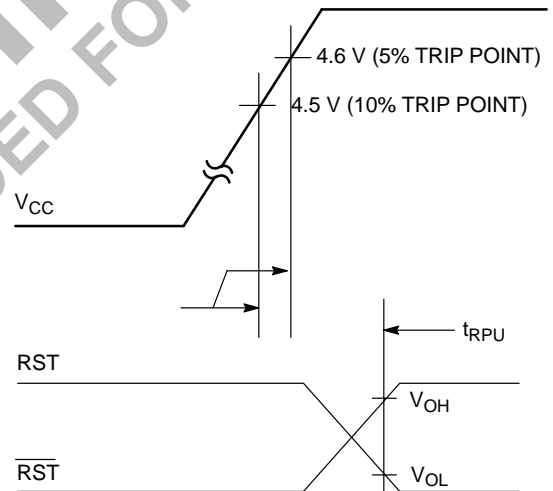
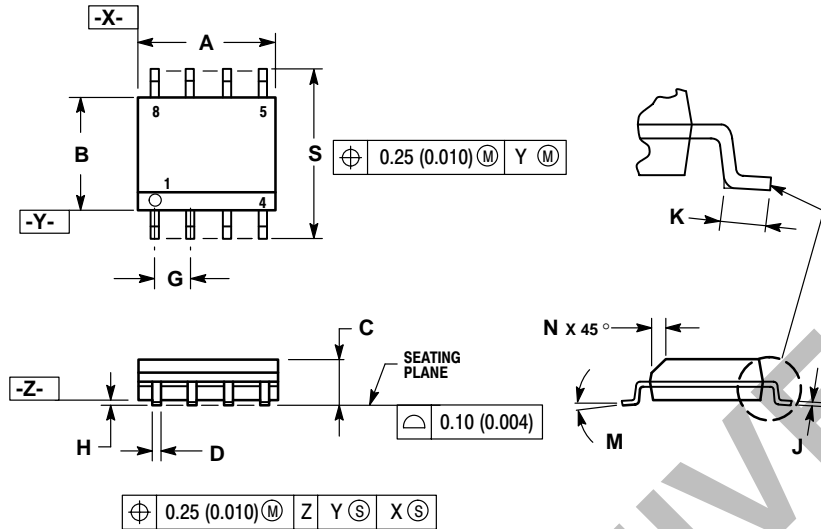


Figure 8.  $V_{CC}$  Detect Reset Output Delay (Power-Up)

# NCP1232

## PACKAGE DIMENSIONS

**SO-8**  
**D SUFFIX**  
 CASE 751-07  
 ISSUE AA



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

| MILLIMETERS |          | INCHES |           |       |
|-------------|----------|--------|-----------|-------|
| DIM         | MIN      | MAX    | MIN       | MAX   |
| A           | 4.80     | 5.00   | 0.189     | 0.197 |
| B           | 3.80     | 4.00   | 0.150     | 0.157 |
| C           | 1.35     | 1.75   | 0.053     | 0.069 |
| D           | 0.33     | 0.51   | 0.013     | 0.020 |
| G           | 1.27 BSC |        | 0.050 BSC |       |
| H           | 0.10     | 0.25   | 0.004     | 0.010 |
| J           | 0.19     | 0.25   | 0.007     | 0.010 |
| K           | 0.40     | 1.27   | 0.016     | 0.050 |
| M           | 0°       | 8°     | 0°        | 8°    |
| N           | 0.25     | 0.50   | 0.010     | 0.020 |
| S           | 5.80     | 6.20   | 0.228     | 0.244 |

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