

# MAXIM

## MAX1232 Microprocessor Monitor

**MAX1232**

### General Description

The MAX1232 microprocessor ( $\mu$ P) supervisory circuit provides  $\mu$ P "housekeeping" and power-supply supervision functions while consuming only 1/10th the power of the DS1232. The MAX1232 enhances circuit reliability in  $\mu$ P systems by monitoring the power supply, monitoring software execution, and providing a debounced manual reset input. The MAX1232 is a plug-in upgrade of the Dallas DS1232.

A reset pulse of at least 250ms duration is supplied on power-up, power-down, and low-voltage brown-out conditions (5% or 10% supply tolerances can be selected digitally). Also featured is a debounced manual reset input that forces the reset outputs to their active states for a minimum of 250ms. A digitally-programmable watchdog timer monitors software execution and can be programmed for timeout settings of 150ms, 600ms, or 1.2sec. The MAX1232 requires no external components.

### Applications

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

### Features

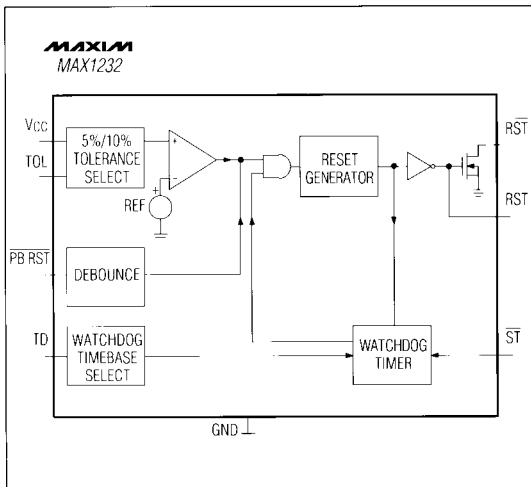
- ◆ Consumes 1/10th the Power of the DS1232
- ◆ Precision Voltage Monitor - Adjustable +4.5V or +4.75V
- ◆ Power OK/Reset Pulse Width - 250ms Min
- ◆ No External Components
- ◆ Adjustable Watchdog Timer - 150ms, 600ms, or 1.2sec
- ◆ Debounced Manual Reset Input for External Override
- ◆ Available in 8-pin DIP/Small Outline and 16-pin Wide Small Outline Packages

### Ordering Information

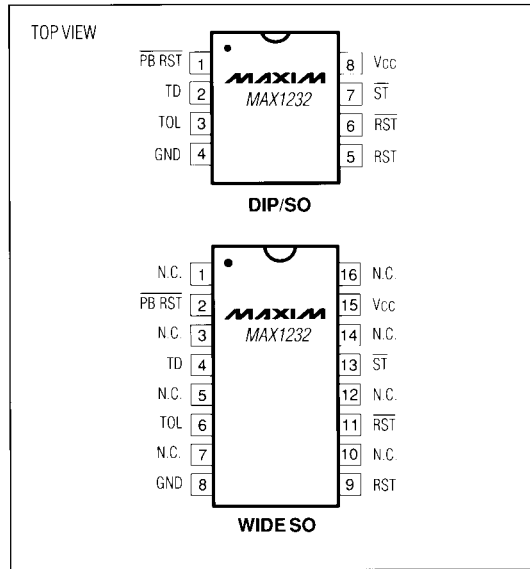
| PART       | TEMP. RANGE     | PIN-PACKAGE   |
|------------|-----------------|---------------|
| MAX1232CPA | 0°C to +70°C    | 8 Plastic DIP |
| MAX1232CSA | 0°C to +70°C    | 8 SO          |
| MAX1232CWE | 0°C to +70°C    | 16 Wide SO    |
| MAX1232C/D | 0°C to +70°C    | Dice*         |
| MAX1232EPA | -40°C to +85°C  | 8 Plastic DIP |
| MAX1232ESA | -40°C to +85°C  | 8 SO          |
| MAX1232EWE | -40°C to +85°C  | 16 Wide SO    |
| MAX1232MJA | -55°C to +125°C | 8 CERDIP      |

\* Contact factory for dice specifications.

### Block Diagram



### Pin Configuration



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## ABSOLUTE MAXIMUM RATINGS

Voltage on any pin (with respect to GND) ..... -1V to +7V      Storage Temperature Range ..... -65°C to +160°C  
 Operating Temperature Ranges:  
 MAX1232C\_ ..... 0°C to +70°C      Lead Temperature (Soldering, 10 sec.) ..... +300°C  
 MAX1232E\_ ..... -40°C to +85°C  
 MAX1232M\_ ..... -55°C to +125°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.*

## RECOMMENDED D.C. OPERATING CONDITIONS

(TA = TMIN to TMAX)

| PARAMETER  | SYMBOL | CONDITIONS | MIN  | TYP | MAX       | UNITS |
|--|--------|------------|------|-----|-----------|-------|
| Supply Voltage   | VCC    |            | 4.5  | 5.0 | 5.5       | V     |
| $\overline{ST}$ and $\overline{PB RST}$<br>Input High Level (Note 1) | VIH    |            | 2.0  |     | VCC + 0.3 | V     |
| $\overline{ST}$ and $\overline{PB RST}$<br>Input Low Level           | VIL    |            | -0.3 |     | +0.8      | V     |

## D.C. ELECTRICAL CHARACTERISTICS

(TA = TMIN to TMAX; VCC = +4.5V to +5.5V)

| PARAMETER                            | SYMBOL | CONDITIONS | MIN  | TYP  | MAX  | UNITS |
|--------------------------------------|--------|------------|------|------|------|-------|
| Input Leakage $\overline{ST}$ , TOL  | IIL    |            | -1.0 |      | +1.0 | μA    |
| Output Current RST                   | IOH    | VOH = 2.4V | -1.0 | -12  |      | mA    |
| Output Current RST, $\overline{RST}$ | IOL    | VOL = 0.4V | 2.0  | 10   |      | mA    |
| Operating Current (Note 2)           | Icc    |            |      | 50   | 200  | μA    |
| VCC 5% Trip Point (Note 3)           | VCCTP  | TOL = GND  | 4.50 | 4.62 | 4.74 | V     |
| VCC 10% Trip Point (Note 3)          | VCCTP  | TOL = VCC  | 4.25 | 4.37 | 4.49 | V     |

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## CAPACITANCE (Note 4)

(T<sub>A</sub> = +25°C)

| PARAMETER                   | SYMBOL           | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------|------------------|------------|-----|-----|-----|-------|
| Input Capacitance ST, TOL   | C <sub>IN</sub>  |            |     |     | 5   | pF    |
| Output Capacitance RST, RST | C <sub>OUT</sub> |            |     |     | 7   | pF    |

## A.C. ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>; V<sub>CC</sub> = +5V to ±10%)

| PARAMETER   | SYMBOL           | CONDITIONS                        | MIN  | TYP  | MAX  | UNITS |
|---|------------------|-----------------------------------|------|------|------|-------|
| PB RST (Note 5)   | t <sub>PB</sub>  | Figure 3                          | 20   |      |      | ms    |
| PB RST Delay  | t <sub>PBD</sub> | Figure 3                          | 1    | 4    | 20   | ms    |
| Reset Active Time                                       | t <sub>RST</sub> |                                   | 250  | 610  | 1000 | ms    |
| ST Pulse Width  | t <sub>ST</sub>  | Figure 4                          | 75   |      |      | ns    |
| ST Timeout Period                                       | t <sub>TD</sub>  | Figure 4<br>TD pin = 0V           | 62.5 | 150  | 250  | ms    |
|   |                  | TD pin = open                     | 250  | 600  | 1000 |       |
|   |                  | TD pin = V <sub>CC</sub>          | 500  | 1200 | 2000 |       |
| V <sub>CC</sub> Fall Time (Note 4)                      | t <sub>F</sub>   | Figure 5                          | 10   |      |      | μs    |
| V <sub>CC</sub> Rise Time (Note 4)                      | t <sub>R</sub>   | Figure 6                          | 0    |      |      | μs    |
| V <sub>CC</sub> Detect to RST High and RST Low          | t <sub>RPD</sub> | Figure 7, V <sub>CC</sub> falling |      |      | 100  | ns    |
| V <sub>CC</sub> Detect to RST Low and RST Open (Note 6) | t <sub>RPU</sub> | Figure 8, V <sub>CC</sub> rising  | 250  | 610  | 1000 | ms    |

**Note 1:** PB RST is internally pulled up to V<sub>CC</sub> with an internal impedance of typically 40kΩ.

**Note 2:** Measured with outputs open.

**Note 3:** All voltages referenced to GND.

**Note 4:** Guaranteed by design.

**Note 5:** PB RST must be held low for a minimum of 20ms to guarantee a reset.

**Note 6:** t<sub>R</sub> = 5μs.

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## Pin Description

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

## Detailed Description

### Power Monitor

A voltage detector monitors VCC and holds the reset outputs (RST and  $\overline{\text{RST}}$ ) in their active states whenever VCC is below the selected 5% or 10% tolerance (4.62V or 4.37V typically). To select the 5% level, connect TOL to ground. To select the 10% level, connect TOL to VCC. The reset outputs will remain in their active states until VCC has been continuously in-tolerance for a minimum of 250ms (the reset active time) to allow the power supply and  $\mu\text{P}$  to stabilize.

The RST output both sinks and sources current, while the  $\overline{\text{RST}}$  output, an open-drain MOSFET, sinks current only and must be pulled high.

### Pushbutton Reset Input

The MAX1232's debounced manual reset input (PB RST) manually forces the reset outputs into their active states. The reset outputs go active after PB RST has been held low for a time  $t_{\text{PBD}}$ , the pushbutton reset delay time. The reset outputs remain in their active states for a minimum of 250ms after PB RST rises above  $V_{\text{IH}}$  (Figure 3).

A mechanical pushbutton or an active logic signal can drive the PB RST input. The debounced input ignores input pulses less than 1ms and is guaranteed to recognize pulses of 20ms or greater. The PB RST input has an internal pull-up to VCC of about 100 $\mu\text{A}$ ; therefore, an external pull-up resistor is not necessary.

### Watchdog Timer

The  $\mu\text{P}$  drives the  $\overline{\text{ST}}$  input with an Input/Output (I/O) line. The  $\mu\text{P}$  must toggle the  $\overline{\text{ST}}$  input within a set period (as determined by TD) to verify proper software execution. If a hardware or software failure keeps  $\overline{\text{ST}}$  from toggling within the minimum timeout period –  $\overline{\text{ST}}$  is activated only by falling edges (a high-to-low transition) – the MAX1232 reset outputs are forced to their active states for 250ms (Figure 2). This typically initiates the  $\mu\text{P}$ 's power-up routine. If the interruption continues, new reset pulses are generated each timeout period until  $\overline{\text{ST}}$  is strobed. The timeout period is determined by the TD input connection. This timeout period is typically 150ms with TD connected to GND, 600ms with TD floating, or 1200ms with TD connected to VCC.

The software routine that strobes  $\overline{\text{ST}}$  is critical. The code must be in a section of software that executes frequently enough so the time between toggles is less than the watchdog timeout period. One common technique controls the  $\mu\text{P}$  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.

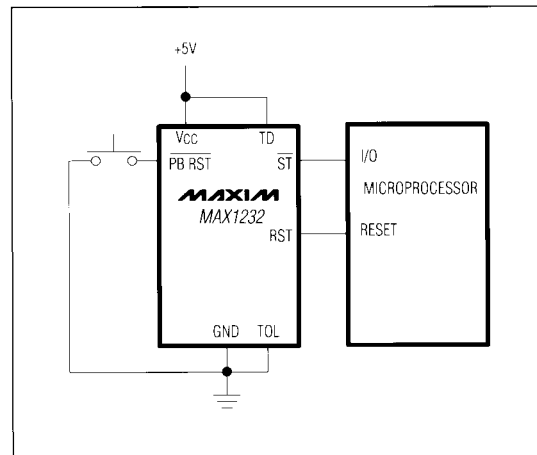


Figure 1. Pushbutton Reset

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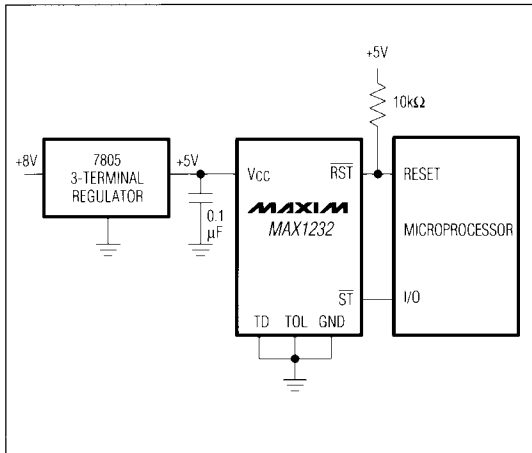


Figure 2. Watchdog Timer

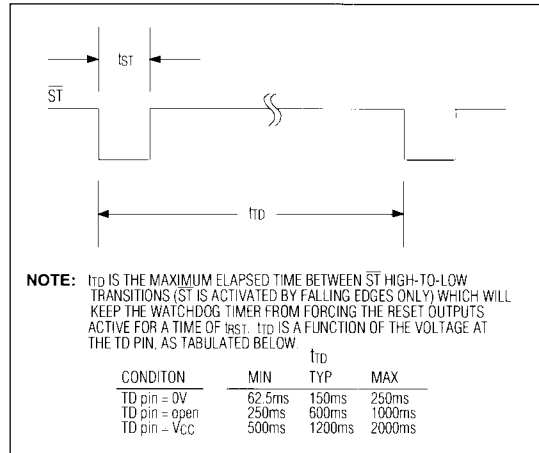


Figure 4. Watchdog Strobe Input

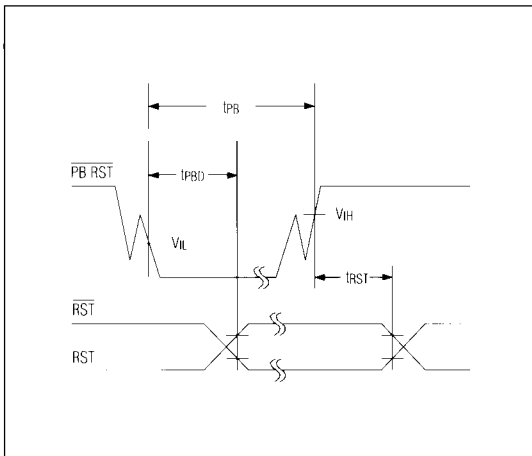


Figure 3. Pushbutton Reset. The debounced PB RST input ignores input pulses less than 1ms and is guaranteed to recognize pulses of 20ms or greater.

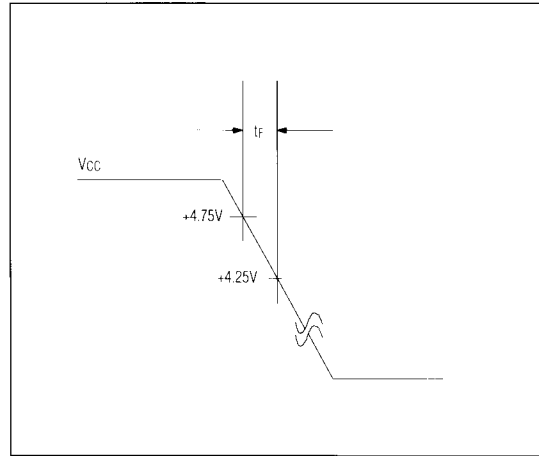


Figure 5. Power-Down Slew Rate

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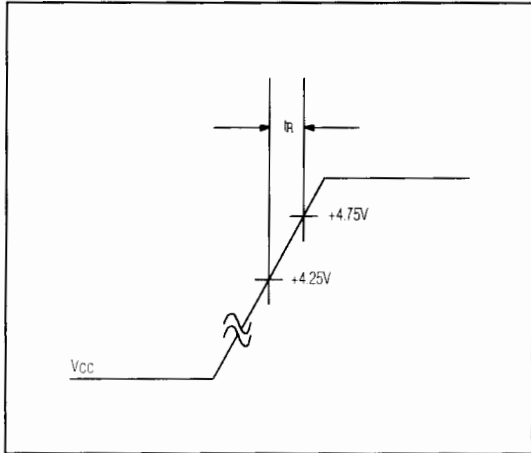


Figure 6. Power-Up Slew Rate

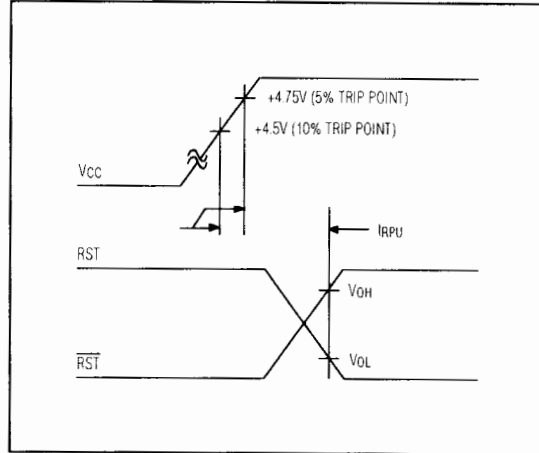


Figure 8. VCC Detect Reset Output Delay (Power-Up)

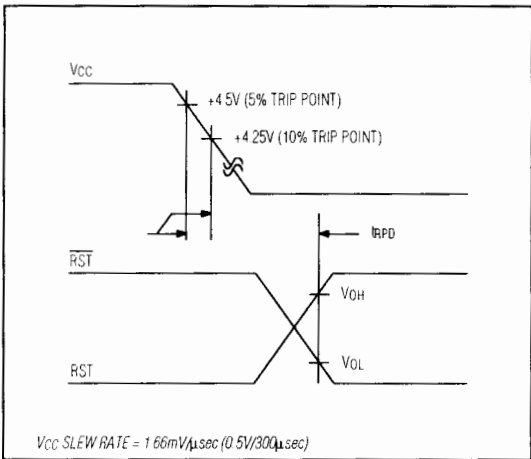
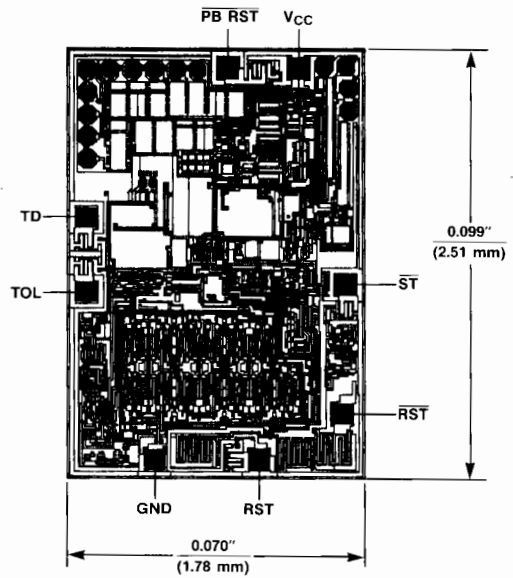


Figure 7. VCC Detect Reset Output Delay (Power-Down)

## Chip Topography



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