

### General Description

The MIC1232 is a multifunction circuit which monitors microprocessor activity, external reset and power supplies in microprocessor based systems. The circuit functions include a watchdog timer, power supply monitor, microprocessor reset, and manual pushbutton reset input.

The power supply line is monitored with a comparator and an internal voltage reference. /RST is forced low when an out-of-tolerance condition exists and remains asserted for at least 250ms after  $V_{CC}$  rises above the threshold voltage (4.5V or 4.75V). The /RST pin will remain logic low with  $V_{CC}$  as low as 1.4V.

The Watchdog input (/ST) monitors μP activity and will assert /RST if no μP activity has occurred within the watchdog timeout period. The watchdog timeout period is selectable with nominal period of 150, 600, 1200 milliseconds.

### Features

- Power OK/Reset time delay, 250ms min.
- Watchdog timer, 150ms, 600ms, or 1.2s typical
- Precision supply voltage monitor, select between 5% or 10% of supply voltage
- Available in 8-pin surface mount (SO)
- Debounced External reset input
- Low supply current, <math>18\mu A</math> typical

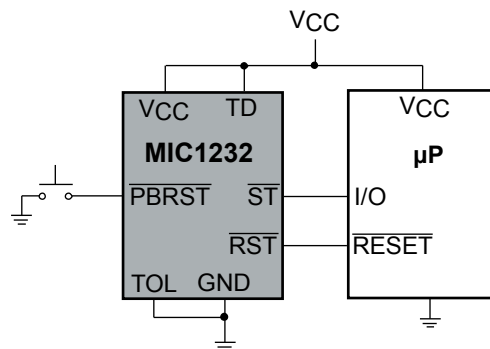
### Applications

- Automotive systems
- Intelligent systems
- Critical microprocessor power monitoring
- Battery powered computers
- Controllers

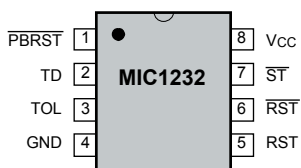
### Ordering Information

Part Number		Temperature Range	Package
Standard	Pb-Free		
MIC1232N	MIC1232NY	-40°C to +85°C	8-Pin PDIP
MIC1232M	MIC1232MY	-40°C to +85°C	8-Pin SOIC

### Typical Application



## Pin Configuration



**8-Pin PDIP Package**

**8-Pin SOIC Package**

## Pin Description

Pin Number	Pin Name	Pin Function
1	/PBRST	Pushbutton Reset Input: This input is debounced and can be driven with external logic signals or by means of a mechanical pushbutton to actively force a reset. All pulses less than 1ms in duration on the /PBRST pin are ignored, whereas, any pulse with a duration of 20ms or greater is guaranteed to cause a reset.
2	TD	Time Delay input: This input selects the timebase used by the watchdog timer. When TD = 0V, the watchdog timeout period is set to a normal value of 150ms, when TD = open, the watchdog timeout period is set to a nominal value of 600ms and when TD = V <sub>CC</sub> , the watchdog period is 1.2s nominally.
3	TOL	Tolerance Select Input: Selects whether 5% or 10% of V <sub>CC</sub> is used as the reset threshold voltage. When TOL = 0V, the 5% tolerance level is selected and when TOL = V <sub>CC</sub> , a 10% tolerance level is selected.
4	GND	IC ground pin, 0V reference
5	RST	RST is asserted high if either V <sub>CC</sub> goes below the reset threshold, the watchdog times out or /PBRST is pulled low for a minimum of 20ms. RST remains asserted for one reset timeout period after V <sub>CC</sub> exceeds the reset threshold or after the watch times out or after /PBRST goes high.
6	/RST	/RST is asserted low if either V <sub>CC</sub> goes below the reset threshold, the watchdog times out or /PBRST is pulled low for a minimum of 20ms. /RST remains asserted for one reset timeout period after V <sub>CC</sub> exceeds the reset threshold or after the watch times out or after /PBRST goes high. Open-drain output
7	/ST	Input to watchdog timer. If /ST does not see a transition from high to low within the watchdog timeout period, RST and /RST will be asserted.
8	VCC	Primary supply input, +5V

**Absolute Maximum Ratings (Note 1)**

Terminal Voltage	
$V_{CC}$ .....	-0.3V to +6.0V
All other inputs.....	-0.3V to ( $V_{CC} + 0.3V$ )
Input Current	
$V_{CC}$ .....	250mA
GND, all other inputs .....	25mA
Lead Temperature (soldering, 10 sec.).....	300°C
Storage Temperature.....	-65°C to 150°C
ESD Rating, <b>Note 3</b>	

**Operating Ratings (Note 2)**

Operating Temperature Range	
MIC1232M/N .....	-40°C to 85°C

**Electrical Characteristics**

$V_{CC} = 4.5V$  to  $5.5V$ ;  $T_A =$  Operating Temperature Range, **bold** values indicate  $-40^\circ C \leq T_A \leq +85^\circ C$ ; unless noted

Parameter	Condition	Min	Typ	Max	Units
Supply Voltage Range	$V_{CC}$	4.5		5.5	V
Supply Current	$I_{CC}$ , <b>(Note 4)</b>		18	40	$\mu A$
/ST and /PBRST Input Levels	$V_{IH}$ , <b>(Note 5)</b>	2.0		$V_{CC}+0.3$	V
	$V_{IL}$	-0.3		0.8	V
Input Leakage	$I_{IL}$			$\pm 1$	$\mu A$
Output Source Current, RST	$V_{OH} = 2.4V$	1.0	10		mA
Output Sink Current, /RST, RST	$V_{OL} = 0.4V$	2.0	10		mA
$V_{CC}$ 5% Trip Point (Reset Threshold Voltage)	TOL = GND	4.5	4.62	4.74	V
$V_{CC}$ 10% Trip Point (Reset Threshold Voltage)	TOL = $V_{CC}$	4.25	4.37	4.49	V
Input Capacitance, /ST, TOL	$C_{IN}$ , <b>(Note 6)</b>			5	pF
Output Capacitance, /RST, RST	$C_{OUT}$ , <b>(Note 6)</b>			7	pF

**AC Electrical Characteristics**

$V_{CC} = 4.5V$  to  $5.5V$ ;  $T_A =$  Operating Temperature Range, **bold** values indicate  $-40^\circ C \leq T_A \leq +85^\circ C$ ; unless noted

/PBRST Min. Pulse Width, $t_{PB}$	/PBRST = $V_{IL}$ <b>(Note 7)</b>	20			ms
/PBRST Delay, $t_{PBD}$		1	4	20	ms
Reset Active Time, $t_{RST}$		250	610	1000	ms
/ST Pulse Width, $t_{ST}$		20			ms
/ST Timeout Period, $t_{TD}$	TD = 0V	62.5	150	250	ms
	TD = Open	250	600	1000	ms
	TD = $V_{CC}$	500	1200	2000	ms
$V_{CC}$ Fall Time, $t_F$		10			$\mu s$
$V_{CC}$ Rise Time, $t_R$		0			ns
$V_{CC}$ Detect to /RST Low and RST High, $t_{RPD}$	$V_{CC}$ Falling <b>(Note 8)</b>		50	150	$\mu s$
$V_{CC}$ Detect to /RST Low and RST Low, $t_{RPD}$	$V_{CC}$ Falling <b>(Note 9)</b>	250	610	1000	$\mu s$

**Note 1.** Exceeding the absolute maximum rating may damage the device.

**Note 2.** The device is not guaranteed to function outside its operating rating.

**Note 3.** Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5k in series with 100pF.

**Note 4.**  $I_{CC}$  is measured with outputs open and inputs within 0.5V of supply rails

**Note 5.** /PBRST has an internal pull-up resistor to  $V_{CC}$  (typ. 40k $\Omega$ )

**Note 6.** Guaranteed by design

**Note 7.** /PBRST must be held low for a minimum of 20ms to guarantee a reset

**Note 8.**  $V_{CC}$  falling at 1.66mV/ $\mu s$

**Note 9.** /RST has an open drain output

# Timing Diagrams

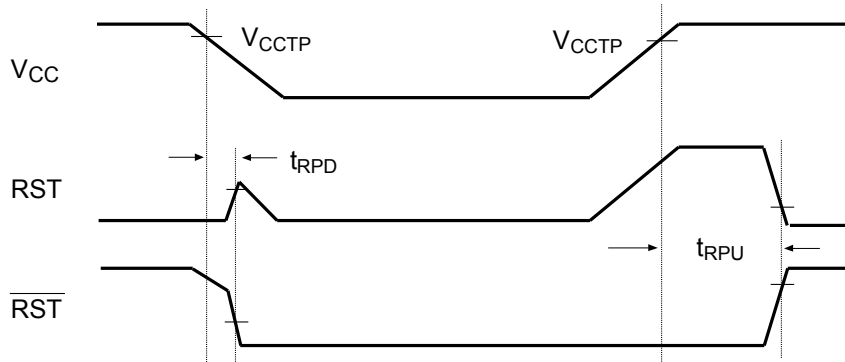


Figure 1. Power-Up/Power-Down Sequence

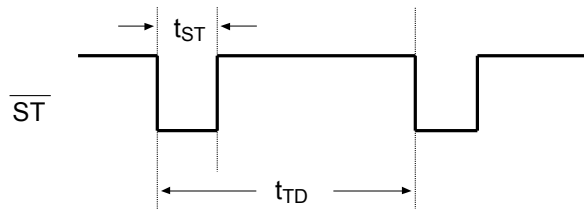


Figure 2. Watchdog Input

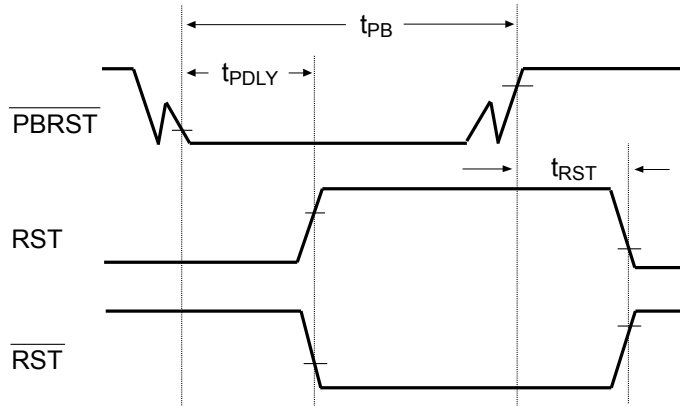


Figure 3. Pushbutton Reset

## Applications Information

### Power Monitor

The  $\overline{\text{RST}}$  and RST pins are asserted whenever  $V_{\text{CC}}$  falls below the reset threshold voltage as determined by the TOL pin. A 5% tolerance level (4.62V reset threshold voltage) can be selected by connecting the TOL pin to ground and a 10% tolerance can be selected by connecting the TOL pin to  $V_{\text{CC}}$ . The reset pins will remain asserted for a period of 250ms after  $V_{\text{CC}}$  has risen above the reset threshold voltage. The reset function ensures the microprocessor is properly reset and powers up into a known condition after a power failure.  $\overline{\text{RST}}$  will remain valid with  $V_{\text{CC}}$  as low as 1.4V.

### Watchdog Timer

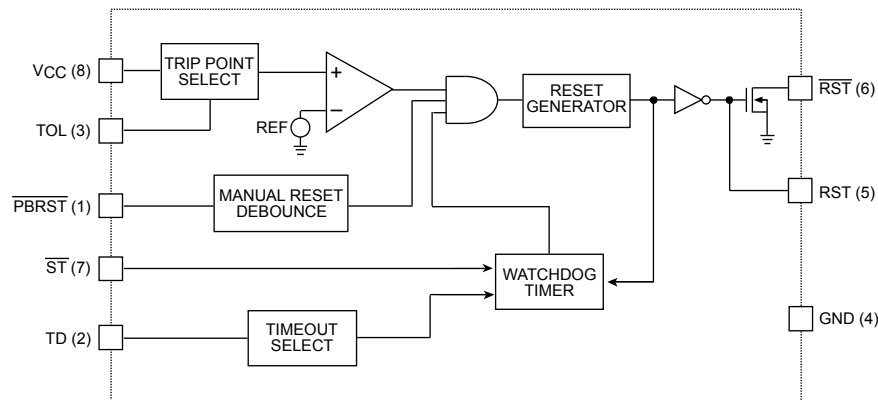
The microprocessor can be mounted by connecting the  $\overline{\text{ST}}$  pin (watchdog input) to a bus line or I/O line. If a high-to-low does not occur on the  $\overline{\text{ST}}$  pin within the watchdog timeout

period (determined by the TD pin, see Table 1.), the  $\overline{\text{RST}}$  and the RST will remain asserted for 250ms when this occurs. A minimum pulse of 75ns or any transition high-to-low on the  $\overline{\text{ST}}$  pin will reset the watchdog timer. The watchdog timer will be reset if  $\overline{\text{ST}}$  sees a valid transition within the watchdog timeout period.

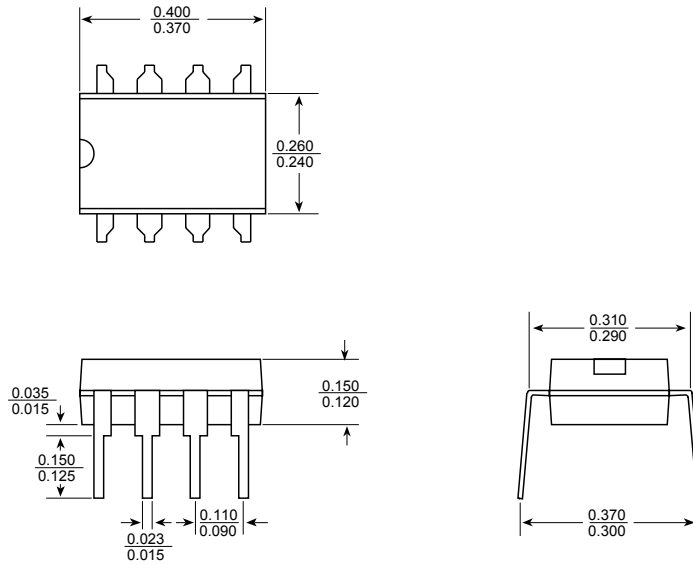
### Pushbutton Reset Input

The  $\overline{\text{PBRST}}$  input can be driven with a manual pushbutton switch or with external logic signals. The input is internally debounced and requires an active low signal to force the reset outputs into their active states. The  $\overline{\text{PBRST}}$  input will recognize any pulse that is 20ms in duration or greater and will ignore all pulses that are less than 1ms in duration.

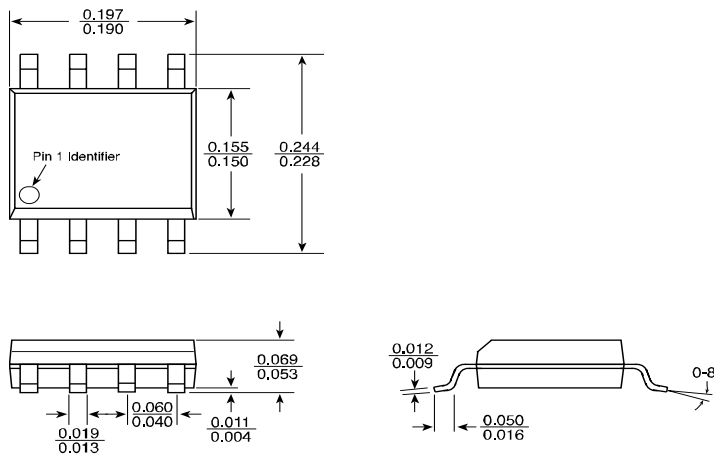
## Block Diagram



## Package Information



**8-Pin PDIP (N)**



**8-Pin SOIC (M)**

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