



## MIC706P/R/S/T, MIC708R/S/T

### $\mu$ P Supervisory Circuit

## General Description

The MIC706 and MIC708 are inexpensive microprocessor supervisory circuits that monitor power supplies in 3.0V and 3.3V microprocessor-based systems. The circuit functions include a watchdog timer, microprocessor reset, power-failure warning, and a debounced manual reset input.

The MIC706 offers a watchdog timer function, while the MIC708 has an active-high reset output in addition to the active-low reset output.

The R, S, and T versions are similar in all respects except for supply voltage reset threshold levels. The threshold levels are 2.63, 2.93, and 3.08V, respectively. When the supply voltage drops below the reset threshold level, /RESET (and RESET for the MIC708) is asserted.

The MIC706P is identical to the MIC706R, except that the Reset output is asserted high.

Datasheets and support documentation are available on Micrel's web site at: [www.micrel.com](http://www.micrel.com).

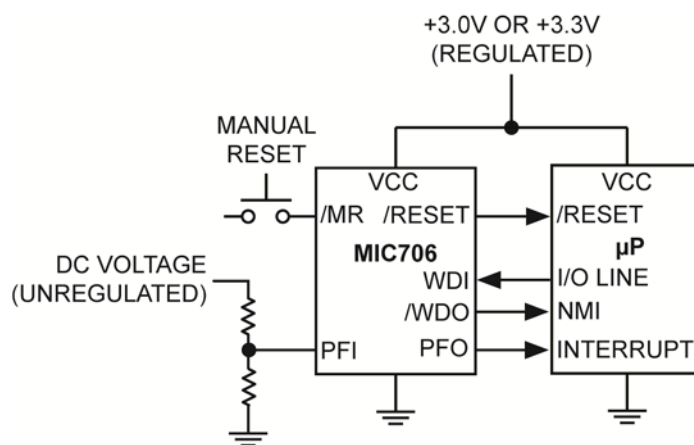
## Features

- Maximum supply current: 30 $\mu$ A
- Debounced manual reset input is TTL/CMOS compatible
- Reset pulse width: 200ms
- Watchdog timer: 1.6s (MIC706)
- Precision supply voltage monitor
- Easy power-fail warning or low-battery detect

## Applications

- Laptop and desktop computers
- Intelligent systems
- Critical microprocessor power monitoring
- Printers
- Controllers

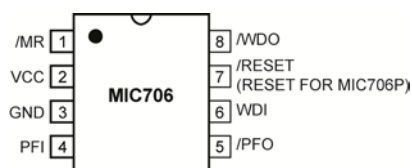
## Typical Application



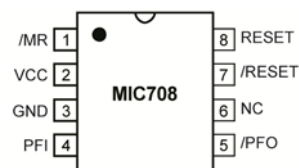
## Ordering Information

| Part Number | Threshold (V) | /RESET | RESET | WDI | Junction Temperature Range | Package    |
|-------------|---------------|--------|-------|-----|----------------------------|------------|
| MIC706PMY   | 2.63          |        | ✓     | ✓   | −40°C to +85°C             | 8-Pin SOIC |
| MIC706RMY   | 2.63          | ✓      |       | ✓   | −40°C to +85°C             | 8-Pin SOIC |
| MIC706SMY   | 2.93          | ✓      |       | ✓   | −40°C to +85°C             | 8-Pin SOIC |
| MIC706TMY   | 3.08          | ✓      |       | ✓   | −40°C to +85°C             | 8-Pin SOIC |
| MIC708RMY   | 2.63          | ✓      | ✓     |     | −40°C to +85°C             | 8-Pin SOIC |
| MIC708SMY   | 2.93          | ✓      | ✓     |     | −40°C to +85°C             | 8-Pin SOIC |
| MIC708TMY   | 3.08          | ✓      | ✓     |     | −40°C to +85°C             | 8-Pin SOIC |

## Pin Configuration



**MIC706**  
8-Pin SOIC (M)  
(Top View)



**MIC708**  
8-Pin SOIC (M)  
(Top View)

## Pin Description

| Pin Number<br>MIC706 | Pin Number<br>MIC708 | Pin Name | Pin Name                                                                                                                                                                                                                                                                                                                          |
|----------------------|----------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                    | 1                    | /MR      | Manual reset input forces reset outputs to assert when pulled below 0.8V. An internal pull-up current of 250μA on this input forces it high when left floating. This input can also be driven from TTL or CMOS logic.                                                                                                             |
| 2                    | 2                    | VCC      | Primary supply input, +5V.                                                                                                                                                                                                                                                                                                        |
| 3                    | 3                    | GND      | IC ground pin, 0V reference.                                                                                                                                                                                                                                                                                                      |
| 4                    | 4                    | PFI      | Power-Fail Input: Internally-connected to the power-fail comparator which is referenced to 1.25V. The power-fail output (/PFO) remains high if PFI is above 1.25V. PFI should be connected to GND or V <sub>OUT</sub> if the power-fail comparator is not used.                                                                   |
| 5                    | 5                    | /PFO     | Power-Fail Output: The power-fail comparator is independent of all other function on this device.                                                                                                                                                                                                                                 |
| 6                    | N/A                  | WDI      | Watchdog Input. The WDI input monitors microprocessor activity; an internal watchdog timer resets itself with each transition on the watchdog input. If the WDI pin is held high or low for longer than the watchdog timeout period, /WDO is forced to active low. The watchdog function can be disabled by floating the WDI pin. |
| N/A                  | 6                    | N/C      | Not internally connected.                                                                                                                                                                                                                                                                                                         |

**Pin Description (Continued)**

| Pin Number<br>MIC706 | Pin Number<br>MIC708 | Pin Name | Pin Name                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------|----------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7                    | 7                    | /RESET   | /RESET is asserted if either V <sub>CC</sub> goes below the reset threshold voltage or by low signal on the manual reset input (/MR). /RESET remains asserted for one reset timeout period (200ms) after VCC exceeds the reset threshold voltage or after the manual reset pin transition from low to high. The watchdog timer will not assert /RESET unless /WDO is connected to /MR. |
| 8                    | N/A                  | /WDO     | Output for the watchdog timer. The watchdog timer resets itself with each transition to the watchdog input. If the WDI pin is held high or low for longer than the watchdog timeout period, /WDO is forced low. /WDO will also be forced low if VCC is below the reset threshold voltage and will remain low until VCC returns to a valid level.                                       |
| 7<br>(MIC706P)       | 8                    | RESET    | RESET is the compliment of /RESET and is asserted if either VCC goes below the reset threshold voltage or by a low signal on the manual reset input (/MR). RESET is suitable for microprocessor systems that use active high reset.                                                                                                                                                    |

**Absolute Maximum Ratings<sup>(1)</sup>**

## Terminal Voltage

 $V_{CC}$  ..... -0.3V to +6.0VAll Other Inputs ..... -0.3V to ( $V_{CC} + 0.3V$ )

## Input Current

 $V_{CC}$ , GND ..... 25mA

Output Current (All) ..... 20mA

Lead Temperature (soldering, 10s) ..... 300°C

Storage Temperature ( $T_S$ ) ..... -65°C to +150°C**Operating Ratings<sup>(2)</sup>**

Operating Temperature Range ..... -40°C to +85°C

Power Dissipation (SOP) ..... 400mW

Thermal Resistance

8-Pin SOIC ..... 150°C/W

**Electrical Characteristics<sup>(3)</sup>** $V_{CC} = 2.70V$  to  $5.5V$  for MIC70\_P/R;  $V_{CC} = 3.00V$  to  $5.5V$  for MIC70\_S;  $V_{CC} = 3.15V$  to  $5.5V$  for MIC70\_T. $T_A$  = Operating Temperature Range, **bold** values indicate  $-40^\circ C \leq T_A \leq +85^\circ C$ , unless noted.

| Parameter                            | Condition                                            | Min.                | Typ. | Max. | Units   |
|--------------------------------------|------------------------------------------------------|---------------------|------|------|---------|
| Operating Voltage Range              |                                                      | 1.4                 |      | 5.5  | V       |
| Supply Current                       |                                                      |                     |      | 30   | $\mu A$ |
| Reset Voltage Threshold              | MIC70_P/R                                            | 2.55                | 2.63 | 2.70 | V       |
|                                      | MIC70_S                                              | 2.85                | 2.93 | 3.00 |         |
|                                      | MIC70_T                                              | 3.00                | 3.08 | 3.15 |         |
| Reset Threshold Hysteresis           |                                                      |                     | 20   |      | mV      |
| Reset Pulse Width ( $t_{RS}$ )       |                                                      | 140                 | 200  | 280  | ms      |
| /RESET Output Voltage (MIC70_R/S/T)  | $I_{SOURCE} = 200\mu A$                              | $0.8 \times V_{CC}$ |      |      | V       |
|                                      | $I_{SINK} = 1.2mA$                                   |                     |      | 0.3  |         |
|                                      | $I_{SINK} = 50\mu A$ , $V_{CC} = 1.4V$               |                     |      | 0.3  |         |
| RESET Output Voltage (MIC706P)       | $I_{SOURCE} = 200\mu A$                              | $0.8 \times V_{CC}$ |      |      | V       |
|                                      | $I_{SINK} = 1.2mA$                                   |                     |      | 0.3  |         |
| RESET Output Voltage (MIC708R/S/T)   | $I_{SOURCE} = 200\mu A$                              | $0.8 \times V_{CC}$ |      |      | V       |
|                                      | $I_{SINK} = 500\mu A$                                |                     |      | 0.3  |         |
| Watchdog Timeout Period ( $t_{WD}$ ) |                                                      | 1.0                 | 1.6  | 2.25 | s       |
| WDI Minimum Input Pulse ( $t_{WP}$ ) | $V_{IL} = 0.4V$ , $V_{IH} = 80\%$ of $V_{CC}$        | 100                 |      |      | ns      |
|                                      | $V_{IL} = 0.4V$ , $V_{IH} = 80\%$ of $V_{CC} > 4.5V$ | 50                  |      |      |         |
| WDI Threshold Voltage                | $V_{IH}$                                             | $0.7 \times V_{CC}$ |      |      | V       |
|                                      | $V_{IL}$                                             |                     |      | 0.6  |         |
| WDI Input Current                    | WDI = 0V or $V_{CC}$                                 | -1                  |      | 1    | $\mu A$ |
| WDO Output Voltage                   | $I_{SOURCE} = 200\mu A$                              | $0.8 \times V_{CC}$ |      |      | V       |
|                                      | $I_{SINK} = 500\mu A$                                |                     |      | 0.3  |         |
| /MR Pull-Up Current                  | /MR = 0V                                             | 20                  | 250  | 600  | $\mu A$ |

**Notes:**

1. Exceeding the absolute maximum ratings may damage the device.
2. The device is not guaranteed to function outside its operating ratings.
3. Specification for packaged product only.

## Electrical Characteristics<sup>(3)</sup> (Continued)

$V_{CC}$  = 2.70V to 5.5V for MIC70\_P/R;  $V_{CC}$  = 3.00V to 5.5V for MIC70\_S;  $V_{CC}$  = 3.15V to 5.5V for MIC70\_T.

$T_A$  = Operating Temperature Range, **bold** values indicate  $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ , unless noted.

| Parameter                              | Condition                     | Min.                | Typ. | Max. | Units |
|----------------------------------------|-------------------------------|---------------------|------|------|-------|
| /MR Pulse Width ( $t_{MR}$ )           | $V_{CC} > 4.5\text{V}$        | 500                 |      |      | ns    |
|                                        |                               | 150                 |      |      |       |
| /MR Input Threshold                    | $V_{IL}$                      |                     |      | 0.6  | V     |
|                                        | $V_{IH}$                      | $0.7 \times V_{CC}$ |      |      |       |
| /MR-to-Reset Output Delay ( $t_{MD}$ ) |                               |                     |      | 750  | ns    |
| PFI Input Threshold                    |                               | 1.2                 | 1.25 | 1.3  | V     |
| PFI Input Current                      |                               | -25                 | 0.01 | +25  | nA    |
| /PFO Output Voltage                    | $I_{SINK} = 1.2\text{mA}$     |                     |      | 0.3  | V     |
|                                        | $I_{SOURCE} = 200\mu\text{A}$ | $0.8 \times V_{CC}$ |      |      |       |

## Timing Diagram

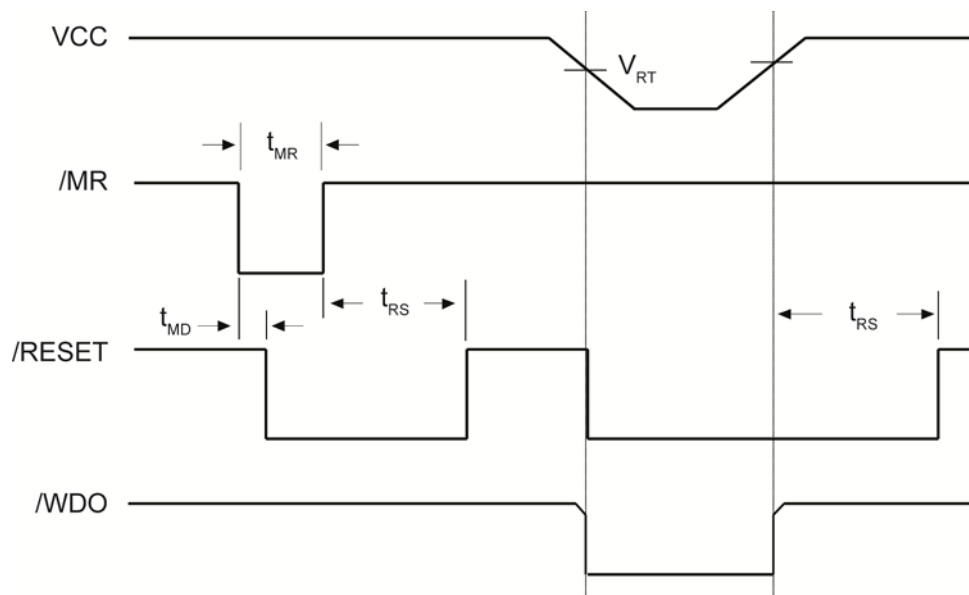
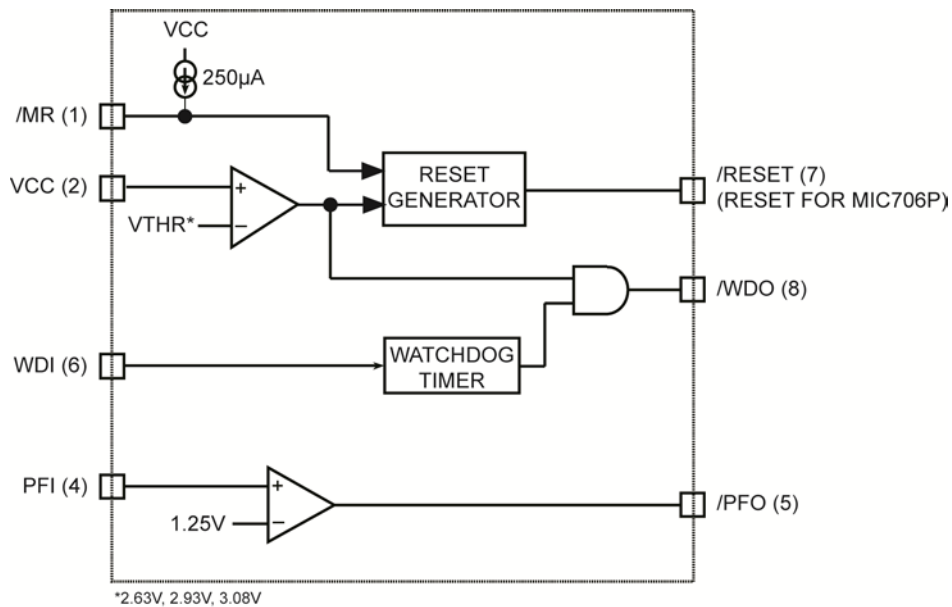
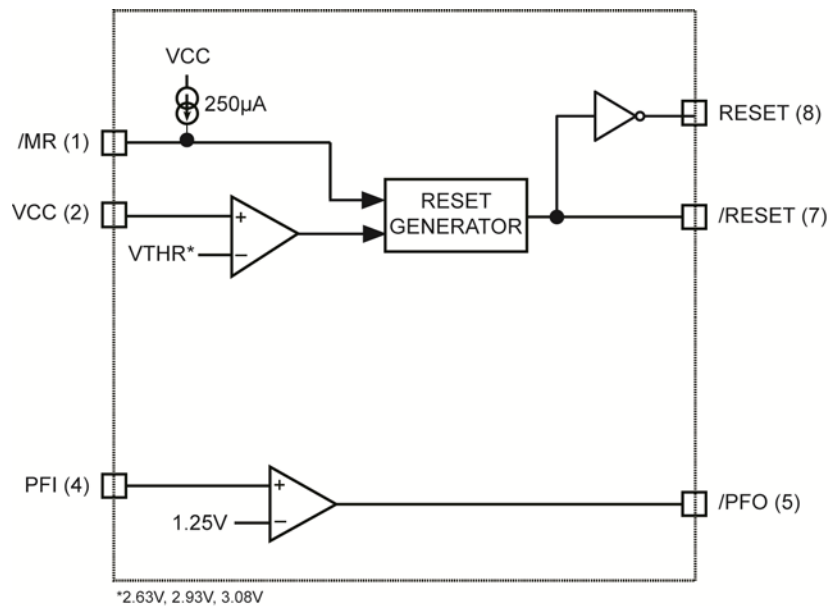


Figure 1. Timing Diagram for Reset

## Block Diagram



**MIC706 Block Diagram**



**MIC708 Block Diagram**

## Application Information

An additional comparator which is independent of the other functions on the MIC706P and MIC708 is provided for early warning of power failure. An external voltage divider can be used to compare unregulated DC to an internal 1.25V reference. The voltage divider ratio on the input of the power-fail comparator (PFI) can be chosen so as to trip the power-fail comparator a few milliseconds before  $V_{CC}$  falls below the maximum reset threshold voltage. The output of the power-fail comparator (/PFO) can be used to interrupt the microprocessor when used in this mode and execute shutdown procedures prior to power loss. Hysteresis can be added to this comparator with external resistors, as is commonly done with any comparator.

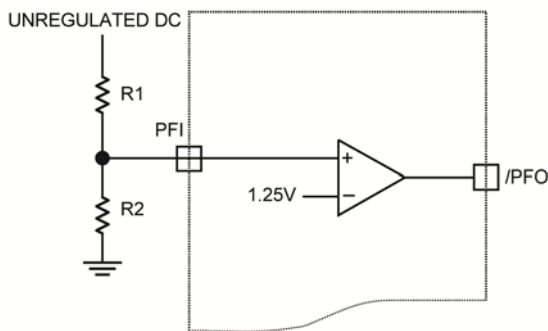


Figure 2. Power-Fail Comparator

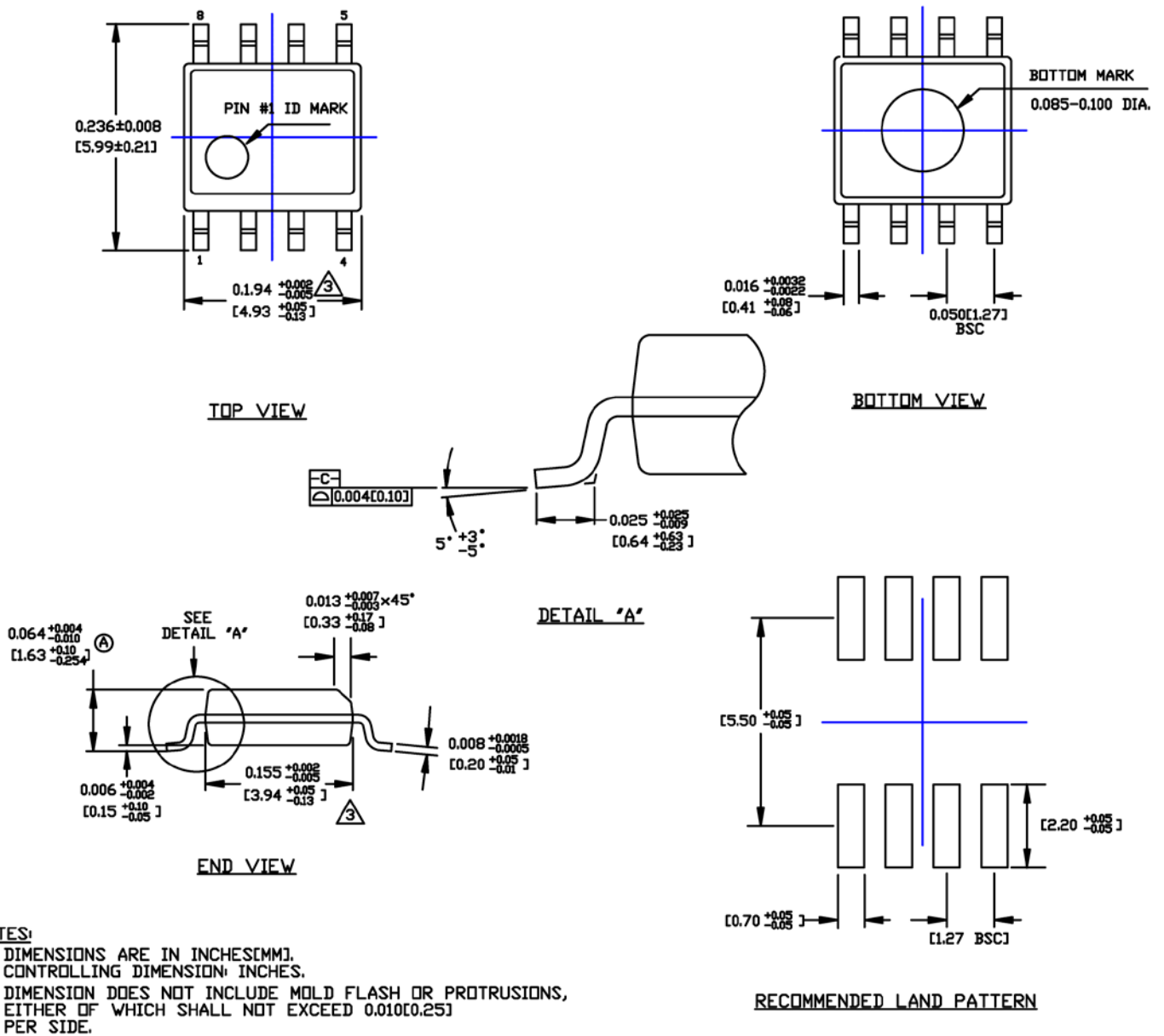
## Watchdog Timer

The microprocessor can be monitored by connecting the WDI pin (watchdog input) to a bus line or an I/O line. If a transition doesn't occur on the WDI pin within the watchdog timeout period, then /WDO will go low. A minimum pulse of 100ns or any transition low-to-high or high-to-low on the WDI pin will reset the watchdog timer. The output of the watchdog timer (/WDO) will remain high if WDI sees a valid transition within the watchdog period. If  $V_{CC}$  falls below the reset threshold voltage, then /WDO goes low immediately regardless of WDI. /WDO can be connected to /MR to generate a reset pulse upon watchdog timeout.

## Microprocessor Reset

The /RESET pin is asserted whenever  $V_{CC}$  falls below the reset threshold voltage or when /MR goes low. The reset pin remains asserted for a period of 200ms after  $V_{CC}$  has risen above the reset threshold voltage and /MR goes high. The reset function ensures the microprocessor is properly reset and powers up into a known condition after a power failure. /RESET will remain valid with  $V_{CC}$  as low as 1.4V.

## Package Information and Recommended Landing Pattern<sup>(4)</sup>



### 8-Pin SOIC (M)

#### Note:

4. Package information is correct as of the publication date. For updates and most current information, go to [www.micrel.com](http://www.micrel.com).

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