

# MAXIM

## 3-Pin, Low-Power $\mu$ P Reset Circuits

MAX6800/MAX6801/MAX6802

### General Description

The MAX6800/MAX6801/MAX6802 microprocessor ( $\mu$ P) supervisory circuits monitor the power supplies in 2.85V to 5.0V  $\mu$ P and digital systems. They increase circuit reliability and reduce cost by eliminating external components and adjustments.

These devices perform a single function—they assert a reset signal whenever the  $V_{CC}$  supply voltage declines below a preset threshold, keeping it asserted for a preset timeout period after  $V_{CC}$  has risen above the reset threshold. The only difference among the three devices is their output. The MAX6801 (push/pull) and MAX6802 (open-drain) have an active-low  $\overline{\text{RESET}}$  output, while the MAX6800 (push/pull) has an active-high  $\text{RESET}$  output. The MAX6800/MAX6801 are guaranteed to be in the correct state for  $V_{CC}$  down to 0.7V. The MAX6802 is guaranteed to be in the correct state for  $V_{CC}$  down to 1.0V.

The reset comparator in these ICs is designed to ignore fast transients on  $V_{CC}$ . Reset thresholds are factory-trimmable between 2.63V and 4.80V, in approximately 100mV increments. These devices are available with a 1ms (min), 20ms (min), or 100ms (min) reset pulse width. Ideal for space-critical applications, the MAX6800/MAX6801/MAX6802 come packaged in a 3-pin SOT23. For a lower threshold voltage version, see the MAX6332/MAX6333/MAX6334.

### Applications

Computers  
 Controllers  
 Intelligent Instruments  
 Critical  $\mu$ P/ $\mu$ C Power Monitoring  
 Portable/Battery-Powered Equipment  
 Automotive

**Typical Operating Circuit and Pin Configuration appear at end of data sheet.**

**Selector Guide appears at end of data sheet.**

### Features

- ◆ Ultra-Low 0.7V Operating Supply Voltage
- ◆ Low 4.0 $\mu$ A Supply Current
- ◆ Precision Monitoring of 2.85V to 5.0V Power-Supply Voltages
- ◆ Reset Thresholds Available from 2.63V to 4.80V, in Approximately 100mV Increments
- ◆ Fully Specified over Temperature
- ◆ Three Power-On Reset Timeout Periods Available (1ms min, 20ms min, 100ms min)
- ◆ Low Cost
- ◆ Three Available Output Structures: Push/Pull  $\overline{\text{RESET}}$ , Push/Pull  $\text{RESET}$ , Open-Drain  $\overline{\text{RESET}}$
- ◆ Guaranteed  $\overline{\text{RESET}}/\text{RESET}$  Valid to  $V_{CC} = 0.7\text{V}$  (MAX6800/MAX6801)
- ◆ Power-Supply Transient Immunity
- ◆ No External Components Required
- ◆ 3-Pin SOT23 Package
- ◆ Pin Compatible with MAX809/MAX810, MAX6326/MAX6327/MAX6328, and MAX6346/MAX6347/MAX6348

### Ordering Information

| PART               | TEMP RANGE      | PIN-PACKAGE |
|--------------------|-----------------|-------------|
| MAX6800UR_ _D_-T   | -40°C to +125°C | 3 SOT23     |
| MAX6800UR_ _D_/V-T | -40°C to +125°C | 3 SOT23     |
| MAX6801UR_ _D_-T   | -40°C to +125°C | 3 SOT23     |
| MAX6801UR_ _D_/V-T | -40°C to +125°C | 3 SOT23     |
| MAX6802UR_ _D_-T   | -40°C to +125°C | 3 SOT23     |
| MAX6802UR_ _D_/V-T | -40°C to +125°C | 3 SOT23     |

\*These devices are available in factory-set  $V_{CC}$  reset thresholds from 2.63V to 4.80V, in approximately 0.1V increments. Choose the desired reset threshold suffix from Table 1 and insert it in the blanks following "UR" in the part number. Factory-programmed reset timeout periods are also available. Insert the number corresponding to the desired nominal reset timeout period (1 = 1ms min, 2 = 20ms min, 3 = 100ms min) in the blank following "D" in the part number. There are 15 standard versions with a required order increment of 2500 pieces. Sample stock is generally held on the standard versions only (see Selector Guide). Contact the factory for availability of non-standard versions (required order increment is 10,000 pieces). All devices available in tape-and-reel only.

Devices are available in both leaded and lead-free packaging. Specify lead-free by replacing "-T" with "+T" when ordering. /V Denotes an automotive-qualified part.



# 3-Pin, Low-Power μP Reset Circuits

## ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)

|                                                          |                                   |
|----------------------------------------------------------|-----------------------------------|
| V <sub>CC</sub> .....                                    | -0.3V to +6V                      |
| Push/Pull RESET, $\overline{\text{RESET}}$ .....         | -0.3V to (V <sub>CC</sub> + 0.3V) |
| Open-Drain $\overline{\text{RESET}}$ .....               | -0.3V to +6V                      |
| Input Current (V <sub>CC</sub> ) .....                   | 20mA                              |
| Output Current (RESET, $\overline{\text{RESET}}$ ) ..... | 20mA                              |
| Continuous Power Dissipation (T <sub>A</sub> = +70°C)    |                                   |
| 3-Pin SOT23 (derate 4mW/°C above +70°C) .....            | 320mW                             |

|                                         |                 |
|-----------------------------------------|-----------------|
| Operating Temperature Range .....       | -40°C to +125°C |
| Junction Temperature .....              | +150°C          |
| Storage Temperature Range .....         | -65°C to +150°C |
| Lead Temperature (soldering, 10s) ..... | +300°C          |
| Soldering Temperature (reflow) .....    | +300°C          |
| Lead (Pb)-free packages .....           | +260°C          |
| Package containing lead (Pb) .....      | +240°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.

## ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = full range, T<sub>A</sub> = -40°C to +125°C, unless otherwise noted. Typical values are at V<sub>CC</sub> = +5.0V and T<sub>A</sub> = +25°C, reset not asserted.) (Note 1)

| PARAMETER                                                         | SYMBOL          | CONDITIONS                                                                 |                                                      | MIN                       | TYP             | MAX                       | UNITS |
|-------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------|------------------------------------------------------|---------------------------|-----------------|---------------------------|-------|
| Supply Voltage Range<br>(Note 2)                                  | V <sub>CC</sub> | T <sub>A</sub> = 0°C to +125°C                                             | MAX6800/MAX6801                                      | 0.7                       |                 | 5.5                       | V     |
|                                                                   |                 |                                                                            | MAX6802                                              | 1.0                       |                 | 5.5                       |       |
|                                                                   |                 | T <sub>A</sub> = -40°C to +125°C                                           | MAX6800/MAX6801                                      | 0.78                      |                 | 5.5                       |       |
|                                                                   |                 |                                                                            | MAX6802                                              | 1.2                       |                 | 5.5                       |       |
| Supply Current                                                    | I <sub>CC</sub> | No load                                                                    | V <sub>CC</sub> = +3.0V                              |                           | 4               | 10                        | μA    |
|                                                                   |                 |                                                                            | V <sub>CC</sub> = +5.0V                              |                           | 5               | 12                        |       |
| Reset Threshold                                                   | V <sub>TH</sub> | MAX680_UR_ _D_-T,<br>Table 1                                               | T <sub>A</sub> = +25°C                               | V <sub>TH</sub><br>- 1.8% | V <sub>TH</sub> | V <sub>TH</sub><br>+ 1.8% | V     |
|                                                                   |                 |                                                                            | T <sub>A</sub> = -40°C to +125°C                     | V <sub>TH</sub><br>- 3%   | V <sub>TH</sub> | V <sub>TH</sub><br>+ 3%   |       |
| V <sub>CC</sub> Falling Reset Delay                               |                 | V <sub>CC</sub> falling at 10V/ms                                          |                                                      |                           | 30              |                           | μs    |
| Reset Active Timeout Period                                       | t <sub>RP</sub> | MAX680_UR_ _D1-T                                                           |                                                      | 1                         | 1.5             | 2                         | ms    |
|                                                                   |                 | MAX680_UR_ _D2-T                                                           |                                                      | 20                        | 30              | 40                        |       |
|                                                                   |                 | MAX680_UR_ _D3-T                                                           |                                                      | 100                       | 150             | 200                       |       |
| $\overline{\text{RESET}}$ Output Low Voltage<br>(MAX6801/MAX6802) | V <sub>OL</sub> | Reset asserted                                                             | I <sub>SINK</sub> = 50μA, V <sub>CC</sub> ≥ 1.0V     |                           |                 | 0.4                       | V     |
|                                                                   |                 |                                                                            | I <sub>SINK</sub> = 1.2mA, V <sub>CC</sub> ≥ 2.5V    |                           |                 | 0.3                       |       |
|                                                                   |                 |                                                                            | I <sub>SINK</sub> = 1.2mA, V <sub>CC</sub> ≥ 4.25V   |                           |                 | 0.4                       |       |
| $\overline{\text{RESET}}$ Output High Voltage<br>(MAX6801)        | V <sub>OH</sub> | Reset not asserted                                                         | I <sub>SOURCE</sub> = 500μA, V <sub>CC</sub> ≥ 3.0V  | 0.8 × V <sub>CC</sub>     |                 |                           | V     |
|                                                                   |                 |                                                                            | I <sub>SOURCE</sub> = 800μA, V <sub>CC</sub> ≥ 5.0V  | 0.8 × V <sub>CC</sub>     |                 |                           |       |
| RESET Output Voltage<br>(MAX6800)                                 | V <sub>OH</sub> | Reset asserted                                                             | I <sub>SOURCE</sub> = 1μA, V <sub>CC</sub> ≥ 1.0V    | 0.8 × V <sub>CC</sub>     |                 |                           | V     |
|                                                                   |                 |                                                                            | I <sub>SOURCE</sub> = 200μA, V <sub>CC</sub> ≥ 1.8V  | 0.8 × V <sub>CC</sub>     |                 |                           |       |
|                                                                   |                 |                                                                            | I <sub>SOURCE</sub> = 800μA, V <sub>CC</sub> ≥ 4.25V | 0.8 × V <sub>CC</sub>     |                 |                           |       |
|                                                                   | V <sub>OL</sub> | Reset not asserted                                                         | I <sub>SINK</sub> = 1.2mA, V <sub>CC</sub> ≥ 3.0V    |                           |                 | 0.3                       |       |
|                                                                   |                 |                                                                            | I <sub>SINK</sub> = 3.2mA, V <sub>CC</sub> ≥ 5.0V    |                           |                 | 0.4                       |       |
| $\overline{\text{RESET}}$ Output Leakage Current<br>(MAX6802)     |                 | V <sub>CC</sub> > V <sub>TH</sub> , $\overline{\text{RESET}}$ not asserted |                                                      |                           |                 | 0.5                       | μA    |

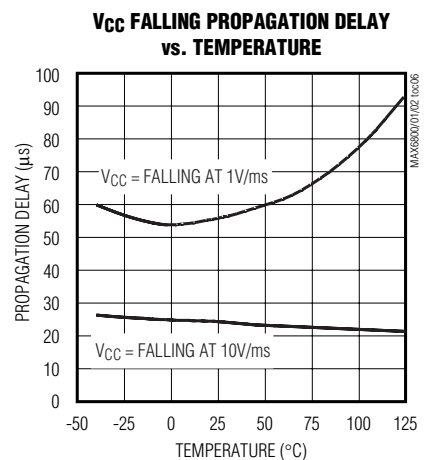
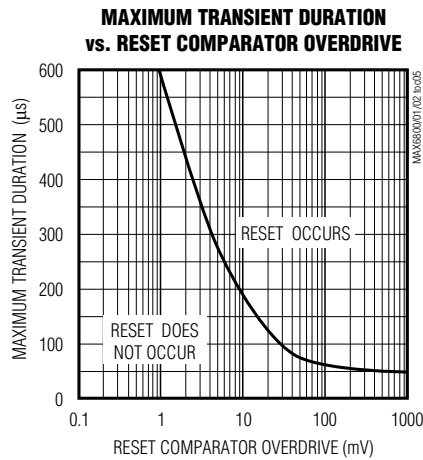
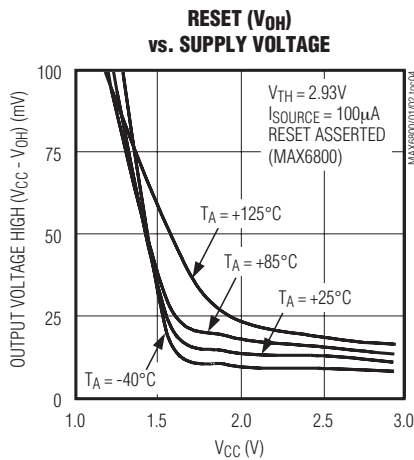
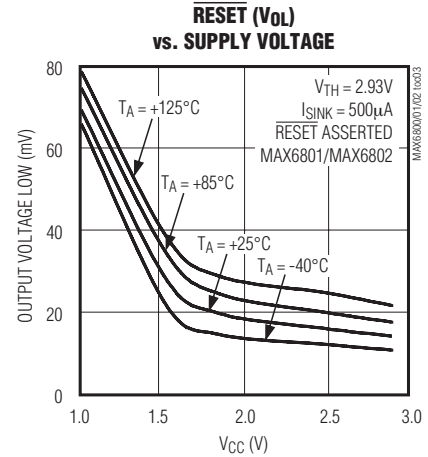
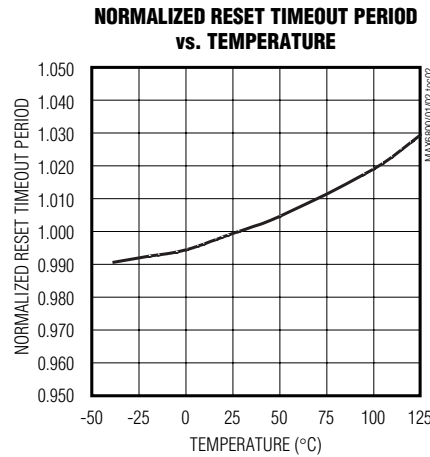
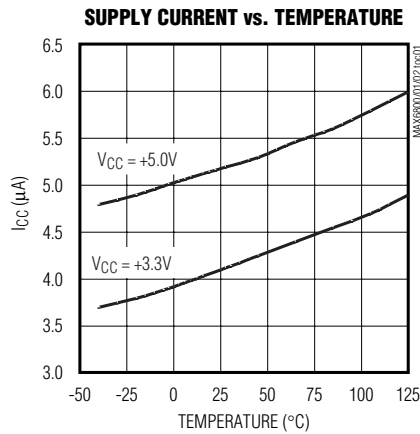
**Note 1:** All parts are production tested at T<sub>A</sub> = +25°C. Overtemperature limits are guaranteed by design and not production tested.

**Note 2:** I<sub>SOURCE</sub> for the MAX6800 is 100nA. I<sub>SINK</sub> for the MAX6801 is 100nA. I<sub>SINK</sub> for the MAX6802 is 50μA.

# 3-Pin, Low-Power $\mu$ P Reset Circuits

## Typical Operating Characteristics

(Reset not asserted,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



## Pin Description

| PIN     |                     | NAME     | FUNCTION                                                                                                                                                                                                                                                                   |
|---------|---------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MAX6800 | MAX6801/<br>MAX6802 |          |                                                                                                                                                                                                                                                                            |
| 1       | 1                   | GND      | Ground                                                                                                                                                                                                                                                                     |
| —       | 2                   | RESET    | Active-Low Reset Output. RESET is asserted while $V_{CC}$ is below the reset threshold and remains asserted for a reset timeout period ( $t_{RP}$ ) after $V_{CC}$ rises above the reset threshold. RESET on the MAX6801 is push/pull. RESET on the MAX6802 is open-drain. |
| 2       | —                   | RESET    | Active-High Reset Output. RESET is asserted while $V_{CC}$ is below the reset threshold and remains asserted for a reset timeout period ( $t_{RP}$ ) after $V_{CC}$ rises above the reset threshold. RESET on the MAX6800 is push/pull.                                    |
| 3       | 3                   | $V_{CC}$ | Supply Voltage Input                                                                                                                                                                                                                                                       |

# 3-Pin, Low-Power $\mu$ P Reset Circuits

## Applications Information

### Interfacing to $\mu$ Ps with Bidirectional Reset Pins

Since the  $\overline{\text{RESET}}$  output on the MAX6802 is open-drain, this device interfaces easily with  $\mu$ Ps that have bidirectional reset pins, such as the Motorola 68HC11. Connecting the  $\mu$ P supervisor's  $\overline{\text{RESET}}$  output directly to the microcontroller's ( $\mu$ C's)  $\overline{\text{RESET}}$  pin with a single pullup resistor allows either device to assert reset (Figure 1).

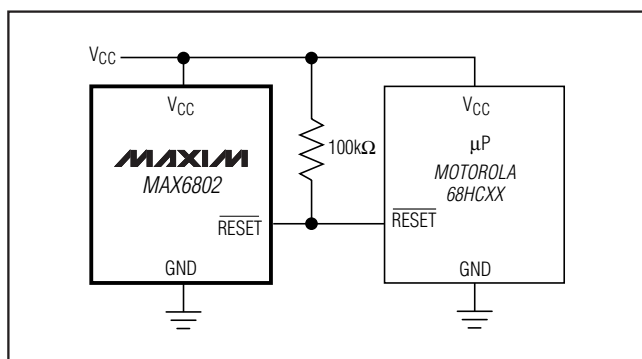


Figure 1. Interfacing to  $\mu$ Ps with Bidirectional Reset Pins

### Negative-Going VCC Transients

In addition to issuing a reset to the  $\mu$ P during power-up, power-down, and brownout conditions, these devices are relatively immune to short-duration, negative-going VCC transients (glitches). The *Typical Operating Characteristics* show the Maximum Transient Duration vs. Reset Comparator Overdrive graph. The graph shows the maximum pulse width that a negative-going VCC transient may typically have without issuing a reset signal. As the amplitude of the transient increases, the maximum allowable pulse width decreases.

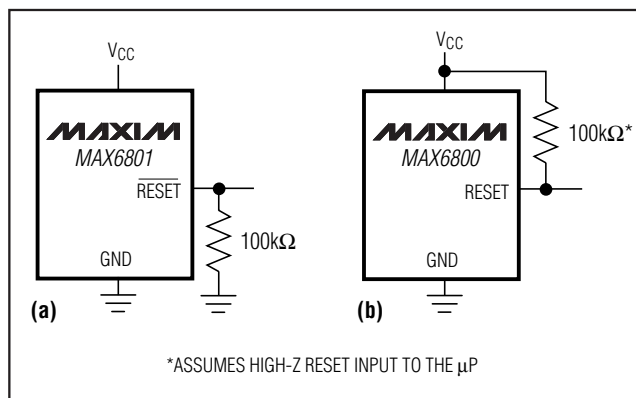
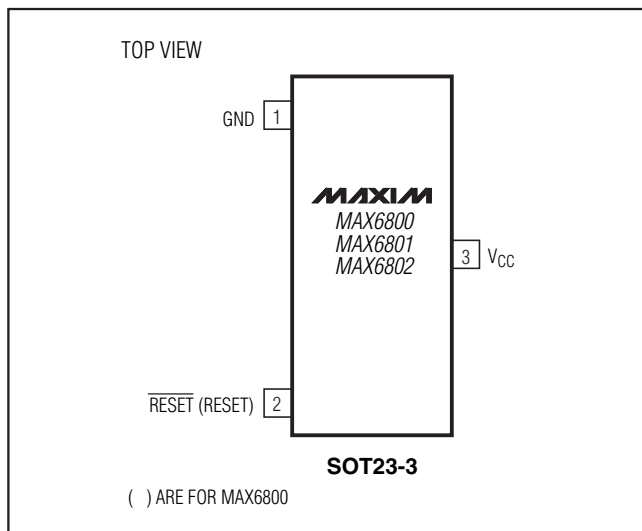
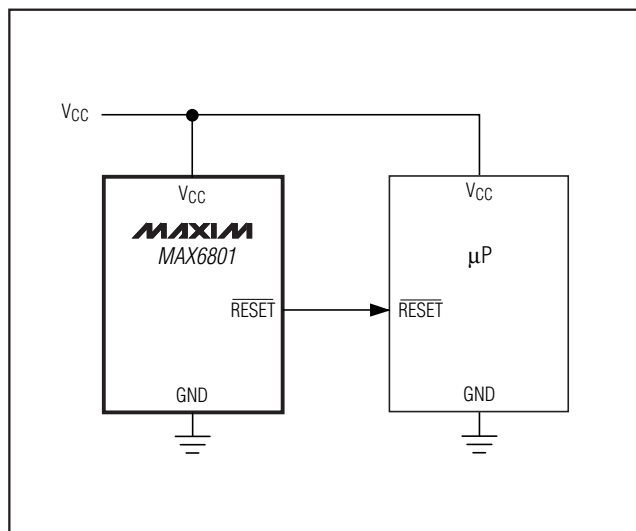


Figure 2. Ensuring Reset Valid Down to  $V_{CC} = 0V$

## Pin Configuration



## Typical Operating Circuit



## 3-Pin, Low-Power $\mu$ P Reset Circuits

### Ensuring a Valid Reset Output Down to $V_{CC} = 0V$

When  $V_{CC}$  falls below 1V and approaches the minimum operating voltage of 0.7V, push/pull-structured reset sinking (or sourcing) capabilities decrease drastically. High-impedance CMOS-logic inputs connected to the RESET pin can drift to indeterminate voltages. This does not present a problem in most cases, since most  $\mu$ Ps and circuitry do not operate when  $V_{CC}$  drops below 1V. For the MAX6801 application, where  $\overline{\text{RESET}}$  must be valid down to 0V, adding a pulldown resistor between  $\overline{\text{RESET}}$  and GND removes stray leakage currents, holding  $\overline{\text{RESET}}$  low (Figure 2a). The pulldown resistor value is not critical; 100k $\Omega$  is large enough not

to load  $\overline{\text{RESET}}$  and small enough to pull it low. For the MAX6800 application, where RESET must be valid to  $V_{CC} = 0V$ , a 100k $\Omega$  pullup resistor between RESET and  $V_{CC}$  will hold RESET high when  $V_{CC}$  falls below 0.7V (Figure 2b).

Since the MAX6802 has an open-drain, active-low output, it typically uses a pullup resistor. With this device,  $\overline{\text{RESET}}$  will most likely not maintain an active condition, but will drift to a non-active level due to the pullup resistor and the reduced sinking capability of the open-drain device. Therefore, this device is not recommended for applications where the  $\overline{\text{RESET}}$  pin is required to be valid down to  $V_{CC} = 0V$ .

**Table 1. Factory-Trimmed Reset Thresholds**

| RESET<br>THRESHOLD<br>SUFFIX | $T_A = +25^\circ\text{C}$ |                  |       | $T_A = -40^\circ\text{C to } +125^\circ\text{C}$ |       |
|------------------------------|---------------------------|------------------|-------|--------------------------------------------------|-------|
|                              | MIN                       | TYP ( $V_{TH}$ ) | MAX   | MIN                                              | MAX   |
| 48                           | 4.714                     | 4.80             | 4.886 | 4.656                                            | 4.944 |
| 47                           | 4.615                     | 4.70             | 4.785 | 4.559                                            | 4.841 |
| 46                           | 4.547                     | 4.63             | 4.713 | 4.491                                            | 4.769 |
| 45                           | 4.419                     | 4.50             | 4.581 | 4.365                                            | 4.635 |
| 44                           | 4.301                     | 4.38             | 4.459 | 4.249                                            | 4.511 |
| 43                           | 4.223                     | 4.30             | 4.377 | 4.171                                            | 4.429 |
| 42                           | 4.124                     | 4.20             | 4.276 | 4.074                                            | 4.326 |
| 41                           | 4.026                     | 4.10             | 4.174 | 3.977                                            | 4.223 |
| 40                           | 3.928                     | 4.00             | 4.072 | 3.880                                            | 4.120 |
| 39                           | 3.830                     | 3.90             | 3.970 | 3.783                                            | 4.017 |
| 38                           | 3.732                     | 3.80             | 3.868 | 3.686                                            | 3.914 |
| 37                           | 3.633                     | 3.70             | 3.767 | 3.589                                            | 3.811 |
| 36                           | 3.535                     | 3.60             | 3.665 | 3.492                                            | 3.708 |
| 35                           | 3.437                     | 3.50             | 3.563 | 3.395                                            | 3.605 |
| 34                           | 3.339                     | 3.40             | 3.461 | 3.298                                            | 3.502 |
| 33                           | 3.241                     | 3.30             | 3.359 | 3.201                                            | 3.399 |
| 32                           | 3.142                     | 3.20             | 3.258 | 3.104                                            | 3.296 |
| 31                           | 3.025                     | 3.08             | 3.135 | 2.988                                            | 3.172 |
| 30                           | 2.946                     | 3.00             | 3.054 | 2.910                                            | 3.090 |
| 29                           | 2.877                     | 2.93             | 2.983 | 2.842                                            | 3.018 |
| 28                           | 2.750                     | 2.80             | 2.850 | 2.716                                            | 2.884 |
| 27                           | 2.651                     | 2.70             | 2.749 | 2.619                                            | 2.781 |
| 26                           | 2.583                     | 2.63             | 2.677 | 2.551                                            | 2.709 |

## 3-Pin, Low-Power μP Reset Circuits

### Selector Guide (Standard Versions\*)

| PART            | OUTPUT STAGE                         | NOMINAL V <sub>TH</sub> (V) | MIN RESET<br>TIMEOUT (ms) | SOT<br>TOP MARK |
|-----------------|--------------------------------------|-----------------------------|---------------------------|-----------------|
| MAX6800UR26D3-T | Push/Pull RESET                      | 2.63                        | 100                       | FZIE            |
| MAX6800UR29D3-T | Push/Pull RESET                      | 2.93                        | 100                       | FZIF            |
| MAX6800UR31D3-T | Push/Pull RESET                      | 3.08                        | 100                       | FZIG            |
| MAX6800UR44D3-T | Push/Pull RESET                      | 4.38                        | 100                       | FZIH            |
| MAX6800UR46D3-T | Push/Pull RESET                      | 4.63                        | 100                       | FZII            |
| MAX6801UR26D3-T | Push/Pull $\overline{\text{RESET}}$  | 2.63                        | 100                       | FZIK            |
| MAX6801UR29D3-T | Push/Pull $\overline{\text{RESET}}$  | 2.93                        | 100                       | FZIM            |
| MAX6801UR31D3-T | Push/Pull $\overline{\text{RESET}}$  | 3.08                        | 100                       | FZIN            |
| MAX6801UR44D3-T | Push/Pull $\overline{\text{RESET}}$  | 4.38                        | 100                       | FZIO            |
| MAX6801UR46D3-T | Push/Pull $\overline{\text{RESET}}$  | 4.63                        | 100                       | FZIP            |
| MAX6802UR26D3-T | Open-Drain $\overline{\text{RESET}}$ | 2.63                        | 100                       | FZIQ            |
| MAX6802UR29D3-T | Open-Drain $\overline{\text{RESET}}$ | 2.93                        | 100                       | FZIR            |
| MAX6802UR31D3-T | Open-Drain $\overline{\text{RESET}}$ | 3.08                        | 100                       | FZIS            |
| MAX6802UR44D3-T | Open-Drain $\overline{\text{RESET}}$ | 4.38                        | 100                       | FZIT            |
| MAX6802UR46D3-T | Open-Drain $\overline{\text{RESET}}$ | 4.63                        | 100                       | FZIU            |

\*Sample stock is generally held on all standard versions.

### Chip Information

PROCESS: BiCMOS

### Package Information

For the latest package outline information and land patterns (footprints), go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages). Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

| PACKAGE<br>TYPE | PACKAGE<br>CODE | OUTLINE<br>NO.          | LAND<br>PATTERN NO.     |
|-----------------|-----------------|-------------------------|-------------------------|
| 3 SOT23         | U3-1            | <a href="#">21-0051</a> | <a href="#">90-0179</a> |

# 3-Pin, Low-Power μP Reset Circuits

## Revision History

| REVISION<br>NUMBER | REVISION<br>DATE | DESCRIPTION                                                                  | PAGES<br>CHANGED |
|--------------------|------------------|------------------------------------------------------------------------------|------------------|
| 3                  | 10/11            | Added automotive-qualified part information to <i>Ordering Information</i> . | 1                |
| 4                  | 3/12             | Updated <i>Factory-Trimmed Reset Thresholds</i> table.                       | 5                |

MAX6800/MAX6801/MAX6802

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time. The parametric values (min and max limits) shown in the Electrical Characteristics table are guaranteed. Other parametric values quoted in this data sheet are provided for guidance.

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