19-1933 Rev 1; 2/01

MAXIM

3-Pin, Low-Power µP Reset Circuits

General Description

The MAX6800/MAX6801/MAX6802 microprocessor (µP) supervisory circuits monitor the power supplies in 2.85V to 5.0V µP 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 $\overline{RESET}$ output, while the MAX6800 (push/pull) has an active-high 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 µP/µC 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 4.0µA 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 RESET, Push/Pull $\overline{RESET}$, Open-Drain $\overline{RESET}$**
- **Guaranteed RESET/$\overline{RESET}$ Valid to V_{CC} = 0.7V (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 SOT23-3
MAX6801UR_ _D_-T	-40°C to +125°C	3 SOT23-3
MAX6802UR_ _D_-T	-40°C to +125°C	3 SOT23-3

**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.*

3-Pin, Low-Power µP Reset Circuits

ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)
- V_{CC} .....-0.3V to +6V
- Push/Pull RESET, $\overline{RESET}$ .....-0.3V to (V_{CC} + 0.3V)
- Open-Drain $\overline{RESET}$ .....-0.3V to +6V

Input Current (V_{CC}) 20mA
Output Current (RESET, $\overline{RESET}$) 20mA

Continuous Power Dissipation (T_A = +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

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_{CC} = full range, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{CC} = +5.0V and T_A = +25°C, reset not asserted.) (Note 1)

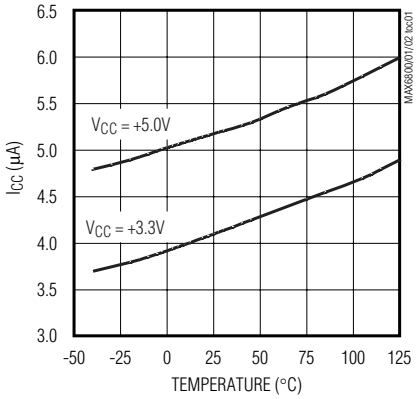
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage Range (Note 2)	V_{CC}	T_A = 0°C to +125°C	MAX6800/MAX6801	0.7		5.5	V
			MAX6802	1.0		5.5	
		T_A = -40°C to +125°C	MAX6800/MAX6801	0.78		5.5	
			MAX6802	1.2		5.5	
Supply Current	I_{CC}	No load	V_{CC} = +3.0V		4	10	µA
			V_{CC} = +5.0V		5	12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

Note 1: All parts are production tested at T_A = +25°C. Overtemperature limits are guaranteed by design and not production tested.
Note 2: I_{SOURCE} for the MAX6800 is I00nA. I_{SINK} for the MAX6801 is 100nA. I_{SINK} for the MAX6802 is 50µA.

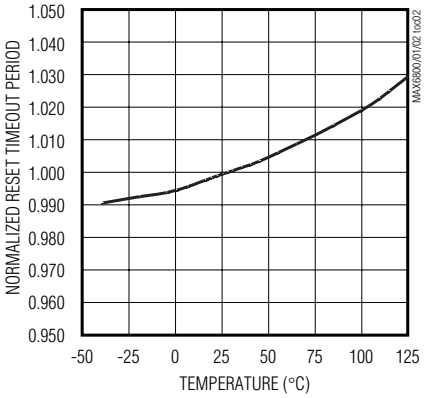
Typical Operating Characteristics

(Reset not asserted, T_A = +25°C, unless otherwise noted.)

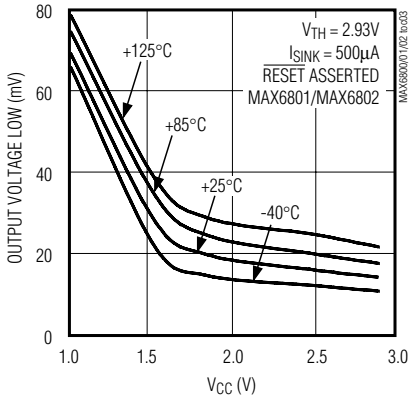
SUPPLY CURRENT vs. TEMPERATURE



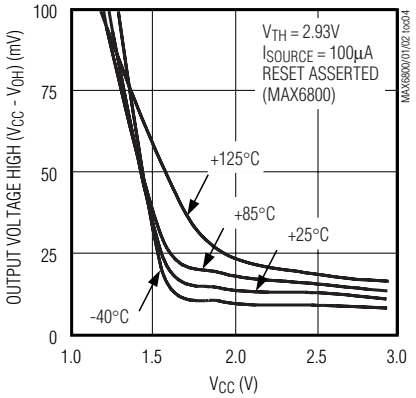
NORMALIZED RESET TIMEOUT PERIOD vs. TEMPERATURE



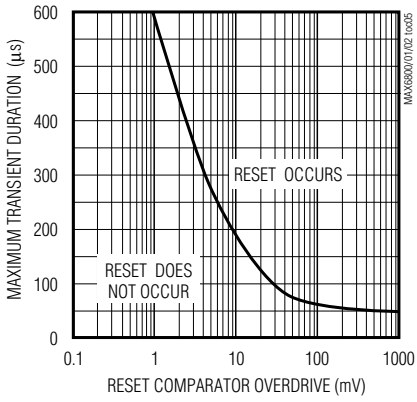
$\overline{RESET}$ (V_{OL}) vs. SUPPLY VOLTAGE



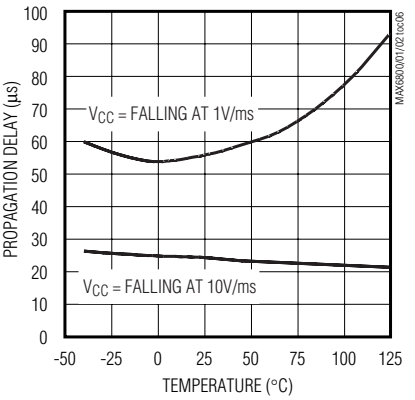
RESET (V_{OH}) vs. SUPPLY VOLTAGE



MAXIMUM TRANSIENT DURATION vs. RESET COMPARATOR OVERDRIVE



V_{CC} FALLING PROPAGATION DELAY vs. TEMPERATURE



Pin Description

PIN		NAME	FUNCTION
MAX6800	MAX6801/ MAX6802		
1	1	GND	Ground
—	2	$\overline{RESET}$	Active-Low Reset Output. $\overline{RESET}$ 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. $\overline{RESET}$ on the MAX6801 is push/pull. $\overline{RESET}$ 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

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Applications Information

Interfacing to µPs with Bidirectional Reset Pins

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

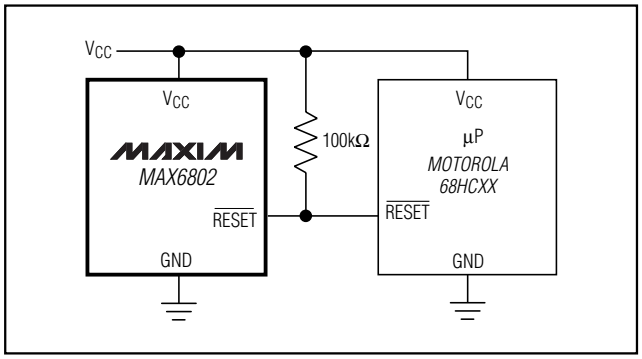


Figure 1. Interfacing to µPs with Bidirectional Reset Pins

Negative-Going VCC Transients

In addition to issuing a reset to the µP during power-up, power-down, and brownout conditions, these devices are relatively immune to short-duration, negative-going V_{CC} 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 V_{CC} transient may typically have without issuing a reset signal. As the amplitude of the transient increases, the maximum allowable pulse width decreases.

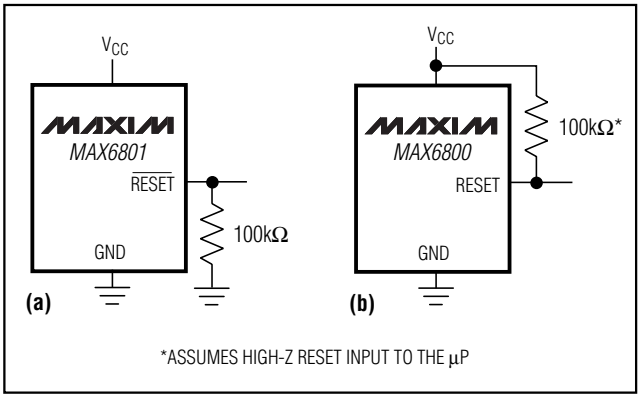
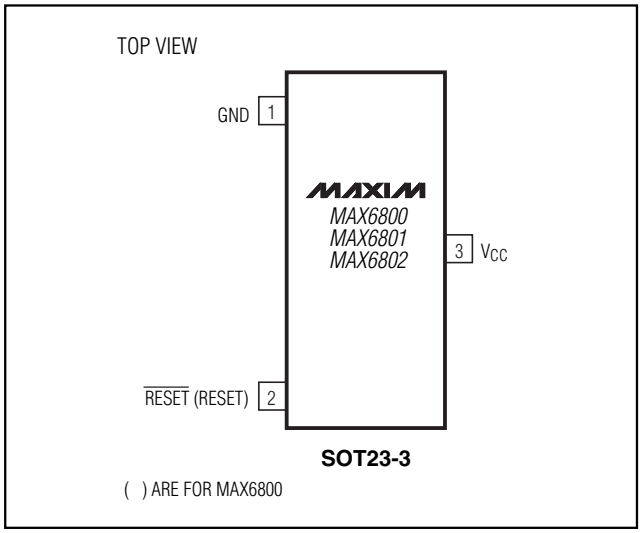
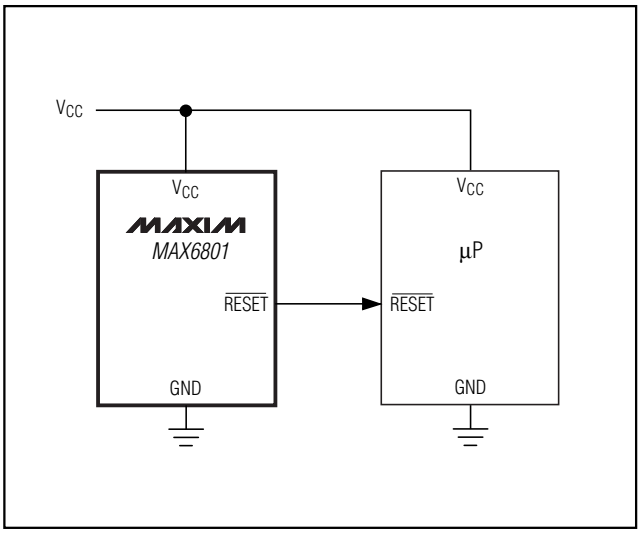


Figure 2. Ensuring Reset Valid Down to V_{CC} = 0

Pin Configuration



Typical Operating Circuit



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

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 $\overline{RESET}$ pin can drift to indeterminate voltages. This does not present a problem in most cases, since most µPs and circuitry do not operate when V_{CC} drops below 1V. For the MAX6801 application, where $\overline{RESET}$ must be valid down to 0, adding a pulldown resistor between $\overline{RESET}$ and GND removes stray leakage currents, holding $\overline{RESET}$ low (Figure 2a). The pulldown resistor value is not critical; 100kΩ is large enough not to load $\overline{RESET}$ and small enough to pull it low. For the MAX6800 application, where RESET must be valid to V_{CC} = 0, a 100kΩ 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, $\overline{RESET}$ 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 $\overline{RESET}$ pin is required to be valid down to V_{CC} = 0.

Table 1. Factory-Trimmed Reset Thresholds

RESET THRESHOLD SUFFIX	T_A = +25°C			T_A = -40°C to +125°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	4.830	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_{TH} (V)	MIN RESET TIMEOUT (ms)	SOT 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

TRANSISTOR COUNT: 505

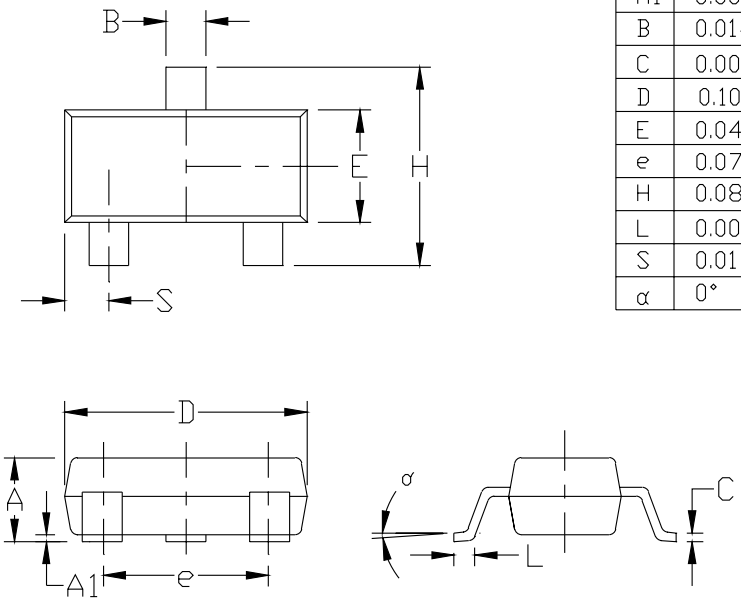
PROCESS: BiCMOS

Package Information

SOTPO3LEPS

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. CONTROLLING DIMENSION: MILLIMETER

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.031	0.047	0.787	1.194
A1	0.001	0.005	0.025	0.127
B	0.014	0.022	0.356	0.559
C	0.0034	0.006	0.086	0.152
D	0.105	0.120	2.667	3.048
E	0.047	0.055	1.194	1.397
e	0.070	0.080	1.778	2.032
H	0.082	0.098	2.083	2.489
L	0.004	0.012	0.102	0.305
S	0.017	0.022	0.432	0.559
α	0°	8°	0°	8°



MAXIM
PROPRIETARY INFORMATION
TITLE: PACKAGE OUTLINE,SOT-23, 3L
APPROVAL | DOCUMENT CONTROL NO. 21-0051 | REV C | 1/1