

### **General Description**

The MAX811/MAX812 are low-power microprocessor (µP) supervisory circuits used to monitor power supplies in µP and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with 5Vpowered or 3V-powered circuits. The MAX811/MAX812 also provide a debounced manual reset input.

These devices perform a single function: They assert a reset signal whenever the VCC supply voltage falls below a preset threshold, keeping it asserted for at least 140ms after VCC has risen above the reset threshold. The only difference between the two devices is that the MAX811 has an active-low RESET output (which is guaranteed to be in the correct state for VCC down to 1V), while the MAX812 has an active-high RESET output. The reset comparator is designed to ignore fast transients on VCC. Reset thresholds are available for operation with a variety of supply voltages.

Low supply current makes the MAX811/MAX812 ideal for use in portable equipment. The devices come in a 4-pin SOT143 package.

### **Applications**

Computers

Controllers

Intelligent Instruments

Critical µP and µC Power Monitoring

Portable/Battery-Powered Equipment

## **Features**

- ♦ Precision Monitoring of 3V, 3.3V, and 5V **Power-Supply Voltages**
- ♦ 6µA Supply Current
- ♦ 140ms Min Power-On Reset Pulse Width; RESET Output (MAX811), RESET Output (MAX812)
- **♦** Guaranteed Over Temperature
- ♦ Guaranteed RESET Valid to V<sub>CC</sub> = 1V (MAX811)
- **♦ Power-Supply Transient Immunity**
- ♦ No External Components
- ♦ 4-Pin SOT143 Package

### **Ordering Information**

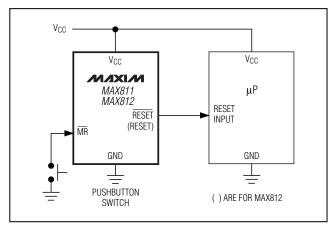
PART*	TEMP RANGE	PIN-PACKAGE
MAX811_EUS-T	-40°C to +85°C	4 SOT143
MAX812_EUS-T	-40°C to +85°C	4 SOT143

\*This part offers a choice of five different reset threshold voltages. Select the letter corresponding to the desired nominal reset threshold voltage, and insert it into the blank to complete the part number.

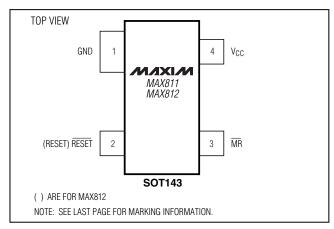
Devices are available in both leaded and lead-free packaging. Specify lead-free by replacing "-T" with "+T" when ordering.

RESET THRESHOLD				
SUFFIX	VOLTAGE (V)			
L	4.63			
М	4.38			
Т	3.08			
S	2.93			
R	2.63			

### **Typical Operating Circuit**



## **Pin Configuration**



MIXIM

Maxim Integrated Products 1

#### **ABSOLUTE MAXIMUM RATINGS**

Terminal Voltage (with respect to GND)		Continuous Power Dissipation ( $T_A = +70^{\circ}C$ )
Vcc	0.3V to 6.0V	SOT143 (derate 4mW/°C above +70°C)320mW
All Other Inputs	0.3V to $(V_{CC} + 0.3V)$	Operating Temperature Range40°C to +85°C
Input Current, V <sub>CC</sub> , MR	20mA	Storage Temperature Range65°C to +160°C
Output Current, RESET or RESET	20mA	Lead Temperature (soldering, 10sec)+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**

 $(V_{CC} = 5V \text{ for L/M versions, } V_{CC} = 3.3V \text{ for T/S versions, } V_{CC} = 3V \text{ for R version, } T_{A} = -40^{\circ}\text{C} \text{ to } +85^{\circ}\text{C}, \text{ unless otherwise noted.}$  Typical values are at  $T_{A} = +25^{\circ}\text{C.}$ ) (Note 1)

PARAMETER	SYMBOL	CONI	DITIONS	MIN	TYP	MAX	UNITS
On another Weller on December	Vcc	$T_A = 0$ °C to +70°C		1.0		5.5	1/
Operating Voltage Range		$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$		1.2			V
Supply Current	Icc	MAX81_L/M, VCC = 5.5V, IOUT = 0			6	15	
		MAX81_R/S/T, V <sub>CC</sub> = 3.6V, I <sub>OUT</sub> = 0			2.7	10	μΑ
		MAX81_L	T <sub>A</sub> = +25°C	4.54	4.63	4.72	
			$T_A = -40$ °C to $+85$ °C	4.50		4.75	
		MAX81_M	T <sub>A</sub> = +25°C	4.30	4.38	4.46	
		IVIAXO1_IVI	$T_A = -40$ °C to $+85$ °C	4.25		4.50	
Reset Threshold	V <sub>TH</sub>	MAX81 T	T <sub>A</sub> = +25°C	3.03	3.08	3.14	V
neset mreshold	VIH	IVIAA01_1	$T_A = -40$ °C to $+85$ °C	3.00		3.15	V
		MAYO1 C	T <sub>A</sub> = +25°C	2.88	2.93	2.98	
		MAX81_S	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	2.85		3.00	-
		MAX81_R	T <sub>A</sub> = +25°C	2.58	2.63	2.68	
			$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	2.55		2.70	
Reset Threshold Tempco			1		30		ppm/°C
V <sub>CC</sub> to Reset Delay (Note 2)		$V_{OD} = 125$ mV, MAX8	1_L/M		40		110
VCC to neset Delay (Note 2)		$V_{OD} = 125$ mV, MAX8	1_R/S/T		20		μs
Reset Active Timeout Period	trp	VCC = VTH(MAX)		140		560	ms
MR Minimum Pulse Width	tmr			10			μs
MR Glitch Immunity (Note 3)					100		ns
MR to Reset Propagation Delay (Note 2)	t <sub>MD</sub>				0.5		μs
	VIH	VCC > VTH(MAX), MAX81_L/M		2.3			
MR Input Threshold	VIL					0.8	
	VIH	\/\/	/01 D/0/T	0.7 x V <sub>CC</sub>			V
	VIL	VCC > VTH(MAX), MAX81_R/S/T			0.2	25 x Vcc	1
MR Pull-Up Resistance				10	20	30	kΩ
RESET Output Voltage (MAX812)	Voh	ISOURCE = 150µA, 1.8V < VCC < VTH(MIN)  MAX812R/S/T only, ISINK = 1.2mA,  VCC = VTH(MAX)		0.8 x V <sub>CC</sub>			
	.,					0.3	V
	VoL	MAX812L/M only, ISIN VCC = VTH(MAX)	NK = 3.2mA,			0.4	

#### **ELECTRICAL CHARACTERISTICS (continued)**

 $(V_{CC} = 5V \text{ for L/M versions, } V_{CC} = 3.3V \text{ for T/S versions, } V_{CC} = 3V \text{ for R version, } T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C, \text{ unless otherwise noted.}$  Typical values are at  $T_{A} = +25^{\circ}C.$ ) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RESET Output Voltage (MAX811)		MAX811R/S/T only, I <sub>SINK</sub> = 1.2mA, VCC = VTH(MIN)			0.3	
	VoL	MAX811L/M only, ISINK = 3.2mA, VCC = VTH(MIN)	0.4			
		ISINK = 50µA, VCC > 1.0V			0.3	V
	Voh	MAX811R/S/T only, ISOURCE = 500μA, VCC > VTH(MAX)	0.8 x V <sub>CC</sub>			
	VOH	MAX811L/M only, ISOURCE = 800μA, VCC > VTH(MAX)	V <sub>CC</sub> - 1.5			

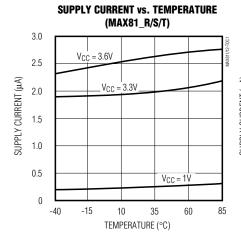
**Note 1:** Production testing done at  $T_A = +25^{\circ}C$ , over temperature limits guaranteed by design using six sigma design limits.

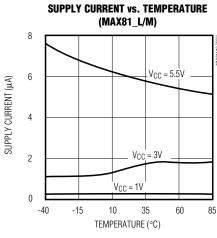
Note 2: RESET output for MAX811, RESET output for MAX812.

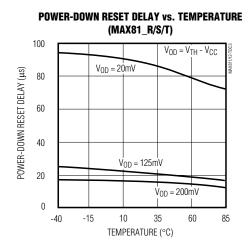
Note 3: "Glitches" of 100ns or less typically will not generate a reset pulse.

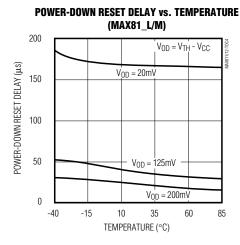
\_\_\_\_\_Typical Operating Characteristics

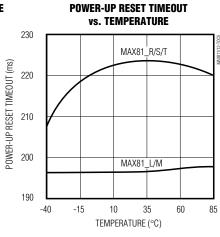
 $(T_A = +25^{\circ}C, \text{ unless otherwise noted.})$ 

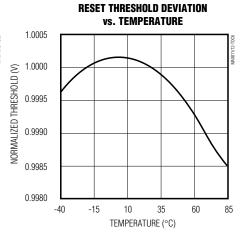












**Pin Description** 

Р	IN	NAME	FUNCTION
MAX811	MAX812	NAME	FUNCTION
1	1	GND	Ground
2	_	RESET	Active-Low Reset Output. RESET remains low while VCC is below the reset threshold or while MR is held low. RESET remains low for the Reset Active Timeout Period (tRP) after the reset conditions are terminated.
_	2	RESET	Active-High Reset Output. RESET remains high while V <sub>CC</sub> is below the reset threshold or while $\overline{\text{MR}}$ is held low. RESET remains high for Reset Active Timeout Period (t <sub>RP</sub> ) after the reset conditions are terminated.
3	3	MR	Manual Reset Input. A logic low on $\overline{\text{MR}}$ asserts reset. Reset remains asserted as long as $\overline{\text{MR}}$ is low and for 180ms after $\overline{\text{MR}}$ returns high. This active-low input has an internal $20\text{k}\Omega$ pull-up resistor. It can be driven from a TTL or CMOS-logic line, or shorted to ground with a switch. Leave open if unused.
4	4	Vcc	+5V, +3.3V, or +3V Supply Voltage

### \_Detailed Description

#### **Reset Output**

A microprocessor's ( $\mu P$ 's) reset input starts the  $\mu P$  in a known state. These  $\mu P$  supervisory circuits assert reset to prevent code execution errors during power-up, power-down, or brownout conditions.

RESET is guaranteed to be a logic low for V<sub>CC</sub> > 1V. Once V<sub>CC</sub> exceeds the reset threshold, an internal timer keeps RESET low for the reset timeout period; after this interval, RESET goes high.

If a brownout condition occurs (VCC dips below the reset threshold),  $\overline{\text{RESET}}$  goes low. Any time VCC goes below the reset threshold, the internal timer resets to zero, and  $\overline{\text{RESET}}$  goes low. The internal timer starts after VCC returns above the reset threshold, and  $\overline{\text{RESET}}$  remains low for the reset timeout period.

The manual reset input  $(\overline{MR})$  can also initiate a reset. See the *Manual Reset Input* section.

The MAX812 has an active-high RESET output that is the inverse of the MAX811's RESET output.

#### Manual Reset Input

Many µP-based products require manual reset capability, allowing the operator, a test technician, or external logic circuitry to initiate a reset. A logic low on  $\overline{\text{MR}}$  asserts reset. Reset remains asserted while  $\overline{\text{MR}}$  is low, and for the Reset Active Timeout Period (tRP) after  $\overline{\text{MR}}$  returns high. This input has an internal  $20\text{k}\Omega$  pull-up resistor, so it can be left open if it is not used.  $\overline{\text{MR}}$  can be driven with TTL or CMOS-logic levels, or with opendrain/collector outputs. Connect a normally open momentary switch from  $\overline{\text{MR}}$  to GND to create a manual-reset function; external debounce circuitry is not required. If  $\overline{\text{MR}}$  is driven from long cables or if the device is used in a noisy environment, connecting a 0.1µF capacitor from  $\overline{\text{MR}}$  to ground provides additional noise immunity.

#### **Reset Threshold Accuracy**

The MAX811/MAX812 are ideal for systems using a 5V  $\pm$ 5% or 3V  $\pm$ 5% power supply with ICs specified for 5V  $\pm$ 10% or 3V  $\pm$ 10%, respectively. They are designed to meet worst-case specifications over temperature. The reset is guaranteed to assert after the power supply falls out of regulation, but before power drops below the minimum specified operating voltage range for the system ICs. The thresholds are pre-trimmed and exhibit tight distribution, reducing the range over which an undesirable reset may occur.

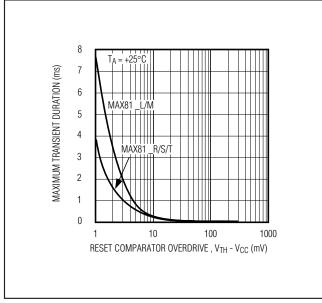


Figure 1. Maximum Transient Duration without Causing a Reset Pulse vs. Comparator Overdrive

# Applications Information Negative-Going Vcc Transients

In addition to issuing a reset to the  $\mu P$  during power-up, power-down, and brownout conditions, the MAX811/ MAX812 are relatively immune to short duration negative-going VCC transients (glitches).

Figure 1 shows typical transient durations vs. reset comparator overdrive, for which the MAX811/MAX812 do not generate a reset pulse. This graph was generated using a negative-going pulse applied to VCC, starting above the actual reset threshold and ending below it by the magnitude indicated (reset comparator overdrive). The graph indicates the typical maximum pulse width a negative-going VCC transient may have without causing a reset pulse to be issued. As the magnitude of the transient increases (goes farther below the reset threshold), the maximum allowable pulse width decreases. Typically, a VCC transient that goes 125mV below the reset threshold and lasts 40µs or less (MAX81\_L/M) or 20µs or less (MAX81\_T/S/R) will not cause a reset pulse to be issued. A 0.1µF capacitor mounted as close as possible to VCC provides additional transient immunity.

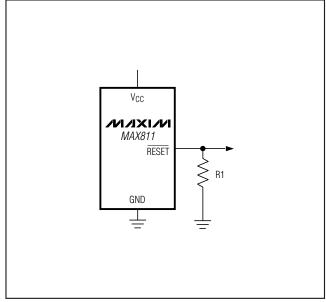


Figure 2. RESET Valid to VCC = Ground Circuit

#### Ensuring a Valid $\overline{RESET}$ Output Down to VCC = 0V

When VCC falls below 1V, the MAX811  $\overline{RESET}$  output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS-logic inputs connected to the RESET output can drift to undetermined voltages. This presents no problem in most applications, since most  $\mu P$  and other circuitry is inoperative with VCC below 1V. However, in applications where the RESET output must be valid down to 0V, adding a pull-down resistor to the RESET pin will cause any stray leakage currents to flow to ground, holding RESET low (Figure 2). R1's value is not critical;  $100k\Omega$  is large enough not to load RESET and small enough to pull RESET to ground.

A 100k $\Omega$  pull-up resistor to VCC is also recommended for the MAX812 if RESET is required to remain valid for VCC < 1V.

# Interfacing to µPs with Bidirectional Reset Pins

μPs with bidirectional reset pins (such as the Motorola 68HC11 series) can contend with the MAX811/MAX812 reset outputs. If, for example, the MAX811  $\overline{\text{RESET}}$  output is asserted high and the μP wants to pull it low, indeterminate logic levels may result. To correct such cases, connect a 4.7k $\Omega$  resistor between the MAX811  $\overline{\text{RESET}}$  (or MAX812 RESET) output and the μP reset I/O (Figure 3). Buffer the reset output to other system components.

**Chip Information** 

TRANSISTOR COUNT: 341

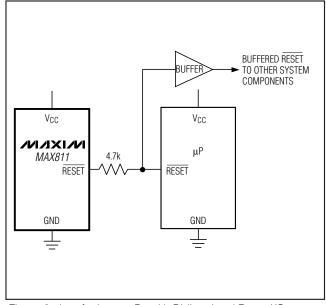
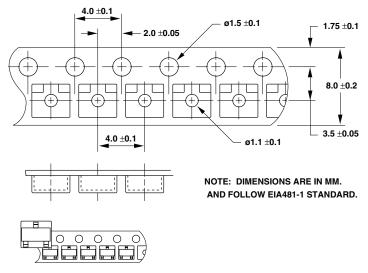


Figure 3. Interfacing to µPs with Bidirectional Reset I/O

### Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to <a href="https://www.maxim-ic.com/packages">www.maxim-ic.com/packages</a>.)

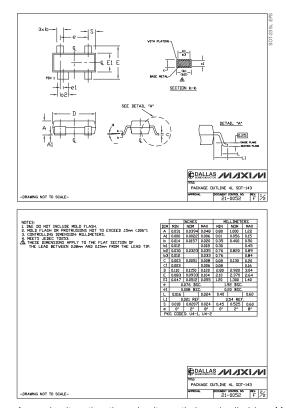


MARKING
INFORMATION†

LOT SPECIFIC
CODE

AMAA OR KABB = MAX811L
ANAA OR KABC = MAX811M
APAA OR KABC = MAX811T
AQAA OR KABC = MAX811R
ASAA OR KABF = MAX812L
ATAA OR KABH = MAX812M
AVAA OR KABH = MAX812T
AWAA OR KABJ = MAX812T
AWAA OR KABJ = MAX812T
AWAA OR KABJ = MAX812S
AXAA OR KABK = MAX812R

† ICs MAY ALSO BE MARKED WITH FULL PART NAME: 811L, 811M\_...



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