



3-Pin Microprocessor Reset Circuits

General Description

The MAX803/MAX809/MAX810 are microprocessor (μP) supervisory circuits used to monitor the power supplies in μP and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, +3.0V, or +2.5V-powered circuits.

These circuits perform a single function: they assert a reset signal whenever the V_{CC} supply voltage declines below a preset threshold, keeping it asserted for at least 140ms after V_{CC} has risen above the reset threshold. Reset thresholds suitable for operation with a variety of supply voltages are available.

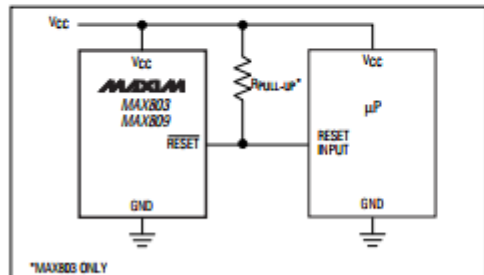
The MAX803 has an open-drain output stage, while the MAX809/MAX810 have push-pull outputs. The MAX803's open-drain RESET output requires a pull-up resistor that can be connected to a voltage higher than V_{CC} . The MAX803/MAX809 have an active-low RESET output, while the MAX810 has an active-high RESET output. The reset comparator is designed to ignore fast transients on V_{CC} , and the outputs are guaranteed to be in the correct logic state for V_{CC} down to 1V.

Low supply current makes the MAX803/MAX809/MAX810 ideal for use in portable equipment. The MAX803 is available in a 3-pin SC70 package, and the MAX809/MAX810 are available in 3-pin SC70 or SOT23 packages.

Applications

Computers
Controllers
Intelligent Instruments
Critical μP and μC Power Monitoring
Portable/Battery-Powered Equipment
Automotive

Typical Operating Circuit



Features

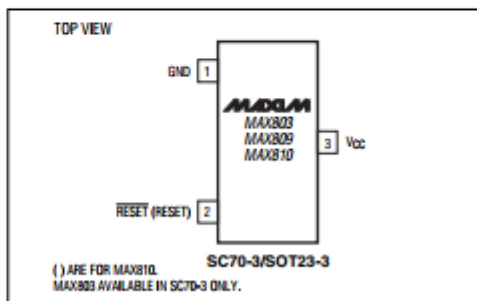
- ◆ Precision Monitoring of +2.5V, +3V, +3.3V, and +5V Power-Supply Voltages
- ◆ Fully Specified Over Temperature
- ◆ Available in Three Output Configurations
 - Open-Drain RESET Output (MAX803)
 - Push-Pull RESET Output (MAX809)
 - Push-Pull RESET Output (MAX810)
- ◆ 140ms min Power-On Reset Pulse Width
- ◆ 12 μA Supply Current
- ◆ Guaranteed Reset Valid to $V_{\text{CC}} = +1\text{V}$
- ◆ Power Supply Transient Immunity
- ◆ No External Components
- ◆ 3-Pin SC70 and SOT23 Packages

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX803_EXR-T	-40°C to +105°C	3 SC70-3
MAX803_EXR-T10	-40°C to +105°C	3 SC70-3
MAX809_EXR-T	-40°C to +105°C	3 SC70-3
MAX809_EXR-T10	-40°C to +105°C	3 SC70-3
MAX809_EUR-T	-40°C to +105°C	3 SOT23-3
MAX809_EUR-T10	-40°C to +105°C	3 SOT23-3
MAX810_EXR-T	-40°C to +105°C	3 SC70-3
MAX810_EXR-T10	-40°C to +105°C	3 SC70-3
MAX810_EUR-T	-40°C to +105°C	3 SOT23-3
MAX810_EUR-T10	-40°C to +105°C	3 SOT23-3

Note: These parts are offered in 2.5k or 10k reels, and must be ordered in 2.5k or 10k increments. Order MAX803_EXR-T for 2.5k reels and MAX803_EXR-T10 for 10k reels. Insert the desired suffix letter from the Selector Guide into the blank to complete the part number. All versions of these products may not be available at the time of announcement. Contact factory for availability.

Pin Configuration



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ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)

V_{CC}	-0.3V to +6.0V
RESET, $\overline{\text{RESET}}$ (push-pull)	-0.3V to ($V_{\text{CC}} + 0.3\text{V}$)
RESET (open drain)	-0.3V to +6.0V
Input Current, V_{CC}	20mA
Output Current, RESET, $\overline{\text{RESET}}$	20mA
Rate of Rise, V_{CC}	100V/ μs

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

($V_{\text{CC}} =$ full range, $T_{\text{A}} = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$, unless otherwise noted. Typical values are at $T_{\text{A}} = +25^{\circ}\text{C}$, $V_{\text{CC}} = 5\text{V}$ for L/M/J versions, $V_{\text{CC}} = 3.3\text{V}$ for T/S versions, $V_{\text{CC}} = 3\text{V}$ for R version, and $V_{\text{CC}} = 2.5\text{V}$ for Z version.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
V_{CC} Range		$T_{\text{A}} = 0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$	1.0		5.5	V	
		$T_{\text{A}} = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	1.2		5.5		
Supply Current (SOT23)	I_{CC}	$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	$V_{\text{CC}} < 5.5\text{V}$, MAXB_ <u>J</u> /L/M $V_{\text{CC}} < 3.6\text{V}$, MAXB_ <u>R</u> /S/T	24	60	μA	
		$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	$V_{\text{CC}} < 5.5\text{V}$, MAXB_ <u>L</u> /M $V_{\text{CC}} < 3.6\text{V}$, MAXB_ <u>R</u> /S/T	17	50		
					100		
					100		
Supply Current (SC70)	I_{CC}	$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	$V_{\text{CC}} < 5.5\text{V}$, MAXB_ <u>L</u> /M $V_{\text{CC}} < 3.6\text{V}$, MAXB_ <u>R</u> /S/T/Z	16	35	μA	
		$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	$V_{\text{CC}} < 5.5\text{V}$, MAXB_ <u>L</u> /M $V_{\text{CC}} < 3.6\text{V}$, MAXB_ <u>R</u> /S/T/Z	12	30		
					75		
					75		
Reset Threshold	V_{TH}	MAXB_ <u>L</u>	$T_{\text{A}} = +25^{\circ}\text{C}$	4.56	4.63	4.70	V
			$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	4.50		4.75	
			$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	4.40		4.86	
		MAXB_ <u>M</u>	$T_{\text{A}} = +25^{\circ}\text{C}$	4.31	4.38	4.45	
			$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	4.25		4.50	
			$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	4.16		4.56	
		MAX809J (SOT only)	$T_{\text{A}} = +25^{\circ}\text{C}$	3.93	4.00	4.06	
			$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	3.89		4.10	
			$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	3.80		4.20	
		MAXB_ <u>T</u>	$T_{\text{A}} = +25^{\circ}\text{C}$	3.04	3.08	3.11	
			$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	3.00		3.15	
			$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	2.92		3.23	
MAXB_ <u>S</u>	$T_{\text{A}} = +25^{\circ}\text{C}$	2.89	2.93	2.96			
	$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	2.85		3.00			
	$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	2.78		3.08			
MAXB_ <u>R</u>	$T_{\text{A}} = +25^{\circ}\text{C}$	2.59	2.63	2.66			
	$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	2.55		2.70			
	$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	2.50		2.76			
MAXB_ <u>Z</u> (SC70 only)	$T_{\text{A}} = +25^{\circ}\text{C}$	2.28	2.32	2.35			
	$T_{\text{A}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	2.25		2.38			
	$T_{\text{A}} = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	2.21		2.45			

MAX803L/M/R/S/T/Z, MAX809J/L/M/R/S/T/Z, MAX810L/M/R/S/T/Z

3-Pin Microprocessor Reset Circuits

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = full range, T_A = -40°C to +105°C, unless otherwise noted. Typical values are at T_A = +25°C, V_{CC} = 5V for L/M/J versions, V_{CC} = 3.3V for T/S versions, V_{CC} = 3V for R version, and V_{CC} = 2.5V for Z version.) (Note 1)

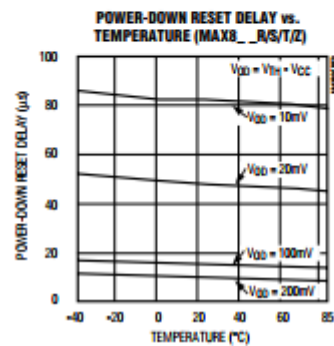
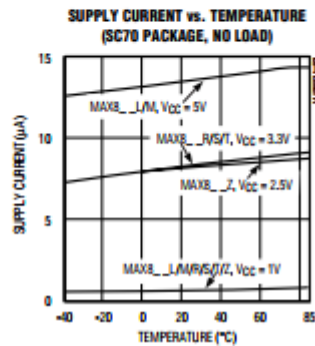
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Reset Threshold Tempco				30		ppm/°C
V_{CC} to Reset Delay (Note 2)		$V_{CC} = V_{TH}$ to ($V_{TH} - 100mV$)		20		μs
Reset Active Timeout Period (SOT23)		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	140	240	560	ms
		$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$	100		840	
Reset Active Timeout Period (SC70)		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	140	240	460	ms
		$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$	100		840	
RESET Output Voltage Low (push-pull active low and open-drain active-low, MAX803 and MAX809)	V_{OL}	$V_{CC} = V_{TH}$ min, $I_{SINK} = 1.2mA$, MAX803R/S/T/Z, MAX809R/S/T/Z			0.3	V
		$V_{CC} = V_{TH}$ min, $I_{SINK} = 3.2mA$, MAX803L/M, MAX809J/L/M			0.4	
		$V_{CC} > 1.0V$, $I_{SINK} = 50\mu A$			0.3	
RESET Output Voltage High (push-pull active low, MAX809)	V_{OH}	$V_{CC} > V_{TH}$ max, $I_{SOURCE} = 500\mu A$, MAX809R/S/T/Z	0.8		V_{CC}	V
		$V_{CC} > V_{TH}$ max, $I_{SOURCE} = 800\mu A$, MAX809J/L/M			$V_{CC} - 1.5$	
RESET Output Voltage Low (push-pull active high, MAX810)	V_{OL}	$V_{CC} = V_{TH}$ max, $I_{SINK} = 1.2mA$, MAX810R/S/T/Z			0.3	V
		$V_{CC} = V_{TH}$ max, $I_{SINK} = 3.2mA$, MAX810L/M			0.4	
RESET Output Voltage High (push-pull active high, MAX810)	V_{OH}	$1.8V < V_{CC} < V_{TH}$ min, $I_{SOURCE} = 150\mu A$	0.8		V_{CC}	V
RESET Open-Drain Output Leakage Current (MAX803)		$V_{CC} > V_{TH}$, RESET deasserted			1	μA

Note 1: Production testing done at T_A = +25°C; limits over temperature guaranteed by design only.

Note 2: RESET output for MAX803/MAX809; RESETE output for MAX810.

Typical Operating Characteristics

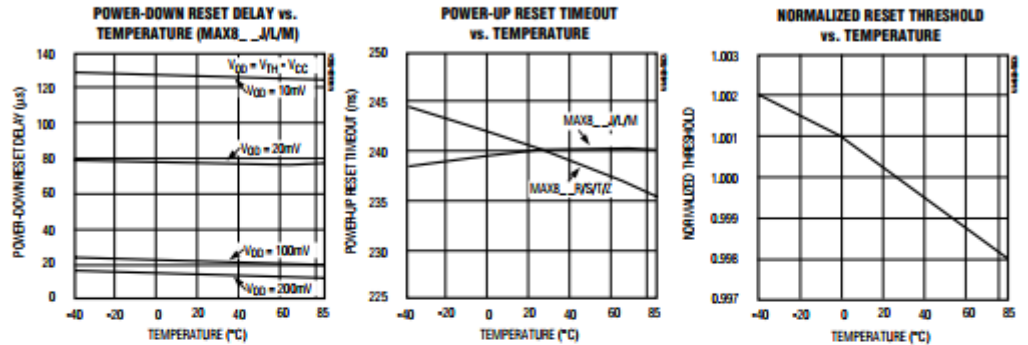
(V_{CC} = full range, T_A = -40°C to +105°C, unless otherwise noted. Typical values are at T_A = +25°C, V_{CC} = +5V for L/M/J versions, V_{CC} = +3.3V for T/S versions, V_{CC} = +3V for R version, and V_{CC} = +2.5V for Z version.)



3-Pin Microprocessor Reset Circuits

Typical Operating Characteristics (continued)

(V_{CC} = full range, T_A = -40°C to +105°C, unless otherwise noted. Typical values are at T_A = +25°C, V_{CC} = +5V for L/M/J versions, V_{CC} = +3.3V for T/S versions, V_{CC} = +3V for R version, and V_{CC} = +2.5V for Z version.)



Selector Guide

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK	
			SOT	SC70
MAX803L	4.63	Open-Drain RESET	—	AAZ
MAX803M	4.38	Open-Drain RESET	—	ABA
MAX803T	3.08	Open-Drain RESET	—	ABB
MAX803S	2.93	Open-Drain RESET	—	ABC
MAX803R	2.63	Open-Drain RESET	—	ABD
MAX803Z	2.32	Open-Drain RESET	—	ABE
MAX809L	4.63	Push-Pull RESET	AAAA	AAN
MAX809M	4.38	Push-Pull RESET	ABAA	AAO
MAX809J	4.00	Push-Pull RESET	CWAA	—
MAX809T	3.08	Push-Pull RESET	ACAA	AAP
MAX809S	2.93	Push-Pull RESET	ADAA	AAQ
MAX809R	2.63	Push-Pull RESET	AFAA	AAR
MAX809Z	2.32	Push-Pull RESET	—	AAS
MAX810L	4.63	Push-Pull RESET	AGAA	AAT
MAX810M	4.38	Push-Pull RESET	AHAA	AAU
MAX810T	3.08	Push-Pull RESET	AJAA	AAV
MAX810S	2.93	Push-Pull RESET	AKAA	AAX
MAX810R	2.63	Push-Pull RESET	ALAA	AAW
MAX810Z	2.32	Push-Pull RESET	—	AAZ

3-Pin Microprocessor Reset Circuits

Pin Description

PIN	NAME	FUNCTION
1	GND	Ground
2	RESET (MAX803/MAX809)	RESET Output remains low while V _{CC} is below the reset threshold, and for at least 140ms after V _{CC} rises above the reset threshold.
	RESET (MAX810)	RESET Output remains high while V _{CC} is below the reset threshold, and for at least 140ms after V _{CC} rises above the reset threshold.
3	V _{CC}	Supply Voltage (+5V, +3.3V, +3.0V, or +2.5V)

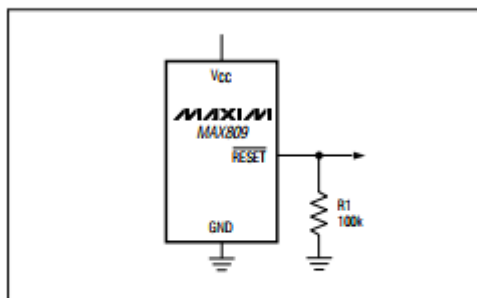


Figure 2. RESET Valid to V_{CC} = Ground Circuit

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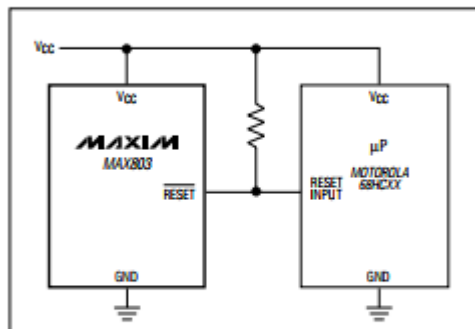


Figure 3. Interfacing to μ Ps with Bidirectional Reset I/O

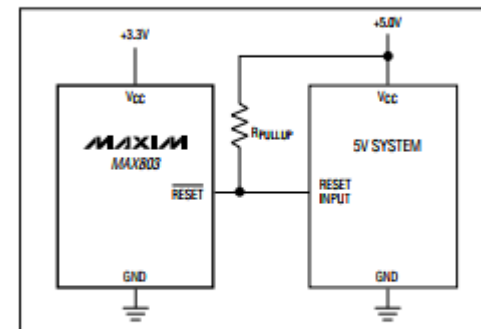


Figure 4. MAX803 Open-Drain RESET Output Allows Use with Multiple Supplies

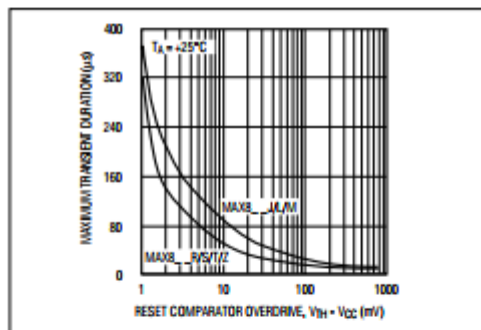


Figure 1. Maximum Transient Duration Without Causing a Reset Pulse vs. Reset Comparator Overdrive

Detailed Description

A microprocessor's (μ P's) reset input starts the μ P in a known state. The MAX803/MAX809/MAX810 assert reset to prevent code-execution errors during power-up, power-down, or brownout conditions. They assert a reset signal whenever the V_{CC} supply voltage declines below a preset threshold, keeping it asserted for at least 140ms after V_{CC} has risen above the reset threshold. The MAX803 uses an open-drain output, and the MAX809/MAX810 have a push-pull output stage. Connect a pull-up resistor on the MAX803's RESET output to any supply between 0 and 6V.

Applications Information

Negative-Going V_{CC} Transients

In addition to issuing a reset to the μ P during power-up, power-down, and brownout conditions, the MAX803/MAX809/MAX810 are relatively immune to short-duration negative-going V_{CC} transients (glitches).

Figure 1 shows typical transient duration vs. reset comparator overdrive, for which the MAX803/MAX809/MAX810 do not generate a reset pulse. The graph was generated using a negative-going pulse applied to V_{CC}, starting 0.5V above the actual reset threshold and ending below it by the magnitude indicated (reset comparator overdrive). The graph indicates the maximum pulse width a negative-going V_{CC} transient can have without causing a reset pulse. As the magnitude of the transient increases (goes farther below the reset threshold), the maximum allowable pulse width decreases. Typically, for the MAX8_L and MAX8_M, a V_{CC} transient that goes 100mV below the reset threshold and lasts 20 μ s or less will not cause a reset pulse. A 0.1 μ F bypass capacitor mounted as close as possible to the V_{CC} pin provides additional transient immunity.

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

When V_{CC} falls below 1V, the MAX809 RESET output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to RESET can drift to undetermined voltages. This presents no problem in most applications since most μ P and other circuitry is inoperative with V_{CC} below 1V. However, in applications where RESET must be valid down to 0V, adding a pull-down resistor to RESET causes any stray leakage currents to flow to

ground, holding RESET low (Figure 2). R1's value is not critical; 100k Ω is large enough not to load RESET and small enough to pull RESET to ground.

A 100k Ω pull-up resistor to V_{CC} is also recommended for the MAX810 if RESET is required to remain valid for V_{CC} < 1V.

Interfacing to μ Ps with Bidirectional Reset Pins

Since the RESET output on the MAX803 is open drain, this device interfaces easily with μ Ps that have bidirectional reset pins, such as the Motorola 68HC11. Connecting the μ P supervisor's RESET output directly to the microcontroller's (μ C's) RESET pin with a single pull-up resistor allows either device to assert reset (Figure 3).

MAX803 Open-Drain RESET Output Allows Use with Multiple Supplies

Generally, the pull-up connected to the MAX803 will connect to the supply voltage that is being monitored at the IC's V_{CC} pin. However, some systems may use the open-drain output to level-shift from the monitored supply to reset circuitry powered by some other supply (Figure 4). Note that as the MAX803's V_{CC} decreases below 1V, so does the IC's ability to sink current at RESET. Also, with any pull-up, RESET will be pulled high as V_{CC} decays toward 0. The voltage where this occurs depends on the pull-up resistor value and the voltage to which it is connected.

Benefits of Highly Accurate Reset Threshold

Most μ P supervisor ICs have reset threshold voltages between 5% and 10% below the value of nominal supply voltages. This ensures a reset will not occur within 5% of the nominal supply, but will occur when the supply is 10% below nominal.

When using ICs rated at only the nominal supply \pm 5%, this leaves a zone of uncertainty where the supply is between 5% and 10% low, and where the reset may or may not be asserted.

The MAX8_L/T/Z use highly accurate circuitry to ensure that reset is asserted close to the 5% limit, and long before the supply has declined to 10% below nominal.

Chip Information

TRANSISTOR COUNT: 275 (SOT23)
380 (SC70)