MAX809 Series, MAX810 Series

Very Low Supply Current 3-Pin Microprocessor Reset Monitors

The MAX809 and MAX810 are cost−effective system supervisor circuits designed to monitor V_{CC} in digital systems and provide a reset signal to the host processor when necessary. No external components are required.

The reset output is driven active within 10 μsec of V_{CC} falling through the reset voltage threshold. Reset is maintained active for a timeout period which is trimmed by the factory after V_{CC} rises above the reset threshold. The MAX810 has an active−high RESET output while the MAX809 has an active−low $\overline{\text{RESET}}$ output. Both devices are available in SOT−23 and SC−70 packages.

The MAX809/810 are optimized to reject fast transient glitches on the V_{CC} line. Low supply current of 0.5 μA (V_{CC} = 3.2 V) makes these devices suitable for battery powered applications.

Features

- Precision V_{CC} Monitor for 1.5 V, 2.5 V, 3.0 V, 3.3 V, and 5.0 V Supplies
- Precision Monitoring Voltages from 1.2 V to 4.9 V Available in 100 mV Steps
- Four Guaranteed Minimum Power−On Reset Pulse Width Available (1 ms, 20 ms, 100 ms, and 140 ms)
- $\overline{\text{RESET}}$ Output Guaranteed to V_{CC} = 1.0 V.
- Low Supply Current
- Compatible with Hot Plug Applications
- V_{CC} Transient Immunity
- No External Components
- Wide Operating Temperature: −40°C to 105°C
- Pb−Free Packages are Available

Typical Applications

- Computers
- Embedded Systems
- Battery Powered Equipment
- Critical Microprocessor Power Supply Monitoring

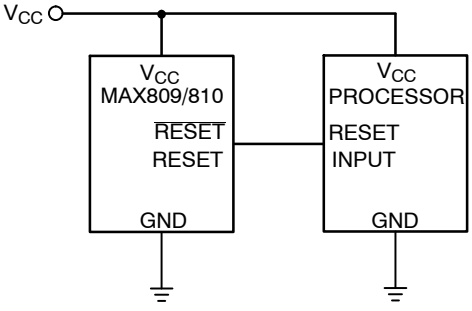

Figure 1. Typical Application Diagram

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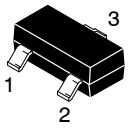
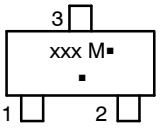
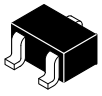
MARKING DIAGRAM

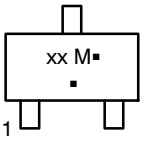


SOT−23 (TO−236) CASE 318



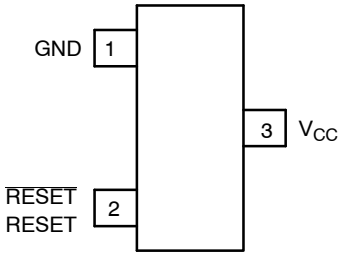


SC−70 (SOT−323) CASE 419



xxx = Specific Device Code
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

PIN CONFIGURATION



SOT−23/SC−70
(Top View)

NOTE: $\overline{\text{RESET}}$ is for MAX809
RESET is for MAX810

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 10 of this data sheet.

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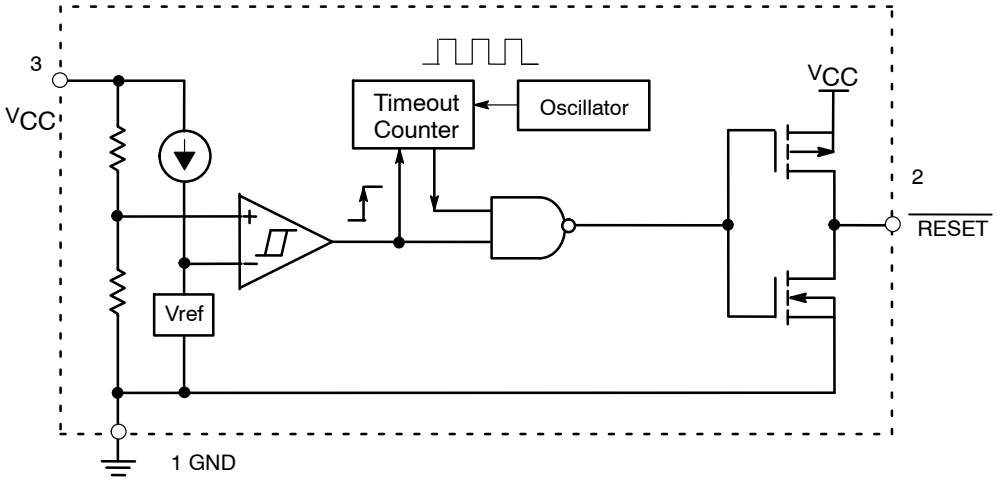


Figure 2. MAX809 Series Complementary Active−Low Output

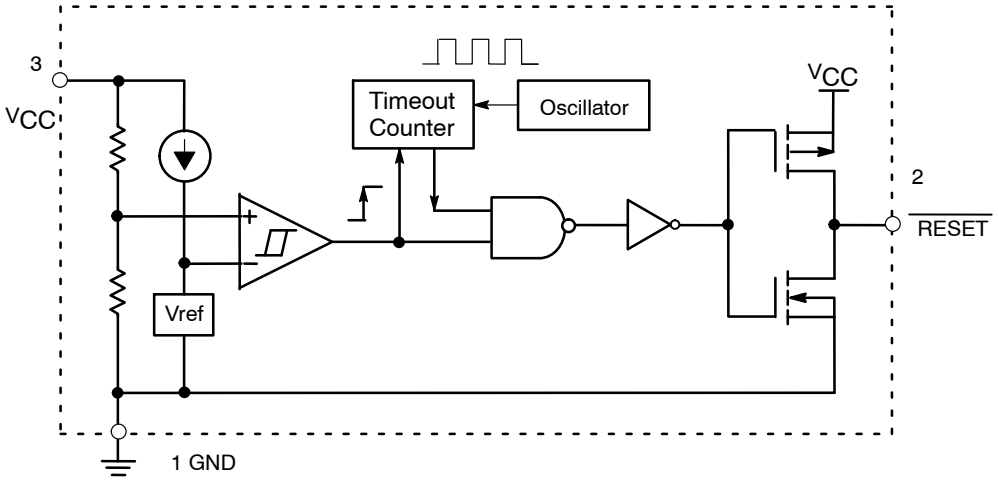


Figure 3. MAX810 Series Complementary Active−High Output

PIN DESCRIPTION

Pin No.	Symbol	Description
1	GND	Ground
2	$\overline{\text{RESET}}$ (MAX809)	$\overline{\text{RESET}}$ output remains low while V_{CC} is below the reset voltage threshold, and for a reset timeout period after V_{CC} rises above reset threshold
2	RESET (MAX810)	RESET output remains high while V_{CC} is below the reset voltage threshold, and for a reset timeout period after V_{CC} rises above reset threshold
3	V_{CC}	Supply Voltage (Typ)

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage (V_{CC} to GND)	V_{CC}	−0.3 to 6.0	V
RESET Output Voltage (CMOS)		−0.3 to (V_{CC} + 0.3)	V
Input Current, V_{CC}		20	mA
Output Current, $\overline{\text{RESET}}$		20	mA
dV/dt (V_{CC})		100	V/μsec
Thermal Resistance, Junction−to−Air (Note 1) SOT−23 SC−70	$R_{\theta JA}$	301 314	°C/W
Operating Junction Temperature Range	T_J	−40 to +105	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C
Lead Temperature (Soldering, 10 Seconds)	T_{sol}	+260	°C
ESD Protection Human Body Model (HBM): Following Specification JESD22−A114 Machine Model (MM): Following Specification JESD22−A115		 2000 200	V
Latchup Current Maximum Rating: Following Specification JESD78 Class II Positive Negative	$I_{Latchup}$	 200 200	mA

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. This based on a 35x35x1.6mm FR4 PCB with 10mm^2 of 1 oz copper traces under natural convention conditions and a single component characterization.
2. The maximum package power dissipation limit must not be exceeded.

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}} \quad \text{with } T_{J(max)} = 150°C$$

ELECTRICAL CHARACTERISTICS T_A = −40°C to +105°C unless otherwise noted. Typical values are at T_A = +25°C. (Note 3)

Characteristic	Symbol	Min	Typ	Max	Unit
V_{CC} Range					V
T_A = 0°C to +70°C		1.0	–	5.5	
T_A = −40°C to +105°C		1.2	–	5.5	
Supply Current	I_{CC}				μA
V_{CC} = 3.3 V					
T_A = −40°C to +85°C		–	0.5	1.2	
T_A = 85°C to +105°C		–	–	2.0	
V_{CC} = 5.5 V					
T_A = −40°C to +85°C		–	0.8	1.8	
T_A = 85°C to +105°C		–	–	2.5	
Reset Threshold (V_{in} Decreasing) (Note 4)	V_{TH}				V
MAX809SN490					
T_A = +25°C		4.83	4.9	4.97	
T_A = −40°C to +85°C		4.78	–	5.02	
T_A = +85°C to +105°C		4.66	–	5.14	
MAX8xxLTR, MAX8xxSQ463					
T_A = +25°C		4.56	4.63	4.70	
T_A = −40°C to +85°C		4.50	–	4.75	
T_A = +85°C to +105°C		4.40	–	4.86	
MAX809HTR					
T_A = +25°C		4.48	4.55	4.62	
T_A = −40°C to +85°C		4.43		4.67	
T_A = +85°C to +105°C		4.32		4.78	
MAX8xxMTR, MAX8xxSQ438					
T_A = +25°C		4.31	4.38	4.45	
T_A = −40°C to +85°C		4.27		4.49	
T_A = +85°C to +105°C		4.16		4.60	
MAX809JTR, MAX8xxSQ400					
T_A = +25°C		3.94	4.00	4.06	
T_A = −40°C to +85°C		3.90	–	4.10	
T_A = +85°C to +105°C		3.80	–	4.20	
MAX8xxTTR, MAX809SQ308					
T_A = +25°C		3.04	3.08	3.11	
T_A = −40°C to +85°C		3.00	–	3.16	
T_A = +85°C to +105°C		2.92	–	3.24	
MAX8xxSTR, MAX8xxSQ293					
T_A = +25°C		2.89	2.93	2.96	
T_A = −40°C to +85°C		2.85	–	3.00	
T_A = +85°C to +105°C		2.78	–	3.08	
MAX8xxRTR, MAX8xxSQ263					
T_A = +25°C		2.59	2.63	2.66	
T_A = −40°C to +85°C		2.56	–	2.70	
T_A = +85°C to +105°C		2.49	–	2.77	
MAX809SN232, MAX809SQ232					
T_A = +25°C		2.28	2.32	2.35	
T_A = −40°C to +85°C		2.25	–	2.38	
T_A = +85°C to +105°C		2.21	–	2.45	
MAX809SN160					
T_A = +25°C		1.58	1.60	1.62	
T_A = −40°C to +85°C		1.56	–	1.64	
T_A = +85°C to +105°C		1.52	–	1.68	
MAX809SN120, MAX8xxSQ120					
T_A = +25°C		1.18	1.20	1.22	
T_A = −40°C to +85°C		1.17	–	1.23	
T_A = +85°C to +105°C		1.14	–	1.26	

3. Production testing done at T_A = 25°C, over temperature limits guaranteed by design.
4. Contact your ON Semiconductor sales representative for other threshold voltage options.

ELECTRICAL CHARACTERISTICS (continued) T_A = −40°C to +105°C unless otherwise noted. Typical values are at T_A = +25°C. (Note 5)

Characteristic	Symbol	Min	Typ	Max	Unit
Detector Voltage Threshold Temperature Coefficient		–	30	–	ppm/°C
V_{CC} to Reset Delay V_{CC} = V_{TH} to (V_{TH} − 100 mV)		–	10	–	μsec
Reset Active TimeOut Period (Note 6) MAX8xxSN(Q)293D1 MAX8xxSN(Q)293D2 MAX8xxSN(Q)293D3 MAX8xxSN(Q)293	t_{RP}	 1.0 20 100 140	 – – – –	 3.3 66 330 460	msec
$\overline{RESET}$ Output Voltage Low (No Load) (MAX809) V_{CC} = V_{TH} − 0.2 V 1.6 V ≤ V_{TH} ≤ 2.0 V, I_{SINK} = 0.5 mA 2.1 V ≤ V_{TH} ≤ 4.0 V, I_{SINK} = 1.2 mA 4.1 V ≤ V_{TH} ≤ 4.9 V, I_{SINK} = 3.2 mA	V_{OL}	–	–	0.3	V
$\overline{RESET}$ Output Voltage High (No Load) (MAX809) V_{CC} = V_{TH} + 0.2 V 1.6 V ≤ V_{TH} ≤ 2.4 V, I_{SOURCE} = 200 μA 2.5 V ≤ V_{TH} ≤ 4.9 V, I_{SOURCE} = 500 μA	V_{OH}	0.8 V_{CC}	–	–	V
RESET Output Voltage High (No Load) (MAX810) V_{CC} = V_{TH} − 0.2 V 1.6 V ≤ V_{TH} ≤ 2.4 V, I_{SOURCE} = 200 μA 2.5 V ≤ V_{TH} ≤ 4.9 V, I_{SOURCE} = 500 μA	V_{OH}	0.8 V_{CC}	–	–	V
RESET Output Voltage Low (No Load) (MAX810) V_{CC} = V_{TH} + 0.2 V 1.6 V ≤ V_{TH} ≤ 2.0 V, I_{SINK} = 0.5 mA 2.1 V ≤ V_{TH} ≤ 4.0 V, I_{SINK} = 1.2 mA 4.1 V ≤ V_{TH} ≤ 4.9 V, I_{SINK} = 3.2 mA	V_{OL}	–	–	0.3	V

5. Production testing done at T_A = 25°C, over temperature limits guaranteed by design.
6. Contact your ON Semiconductor sales representative for timeout options availability for other threshold voltage options.

TYPICAL OPERATING CHARACTERISTICS

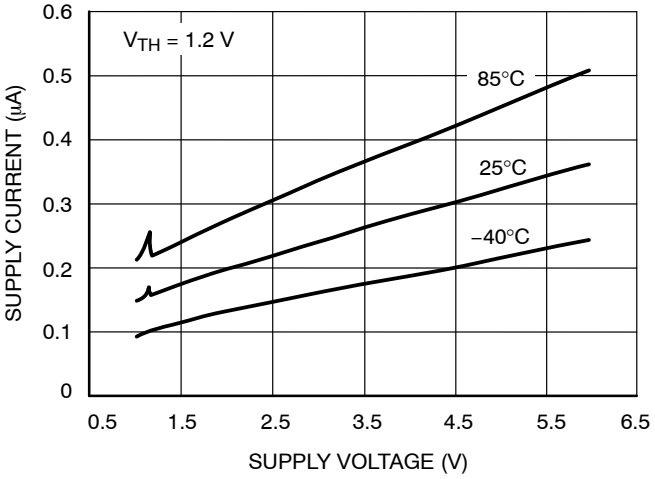


Figure 4. Supply Current vs. Supply Voltage

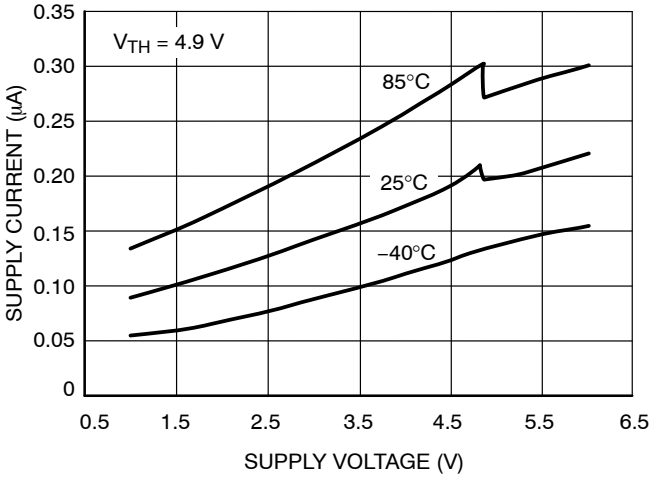


Figure 5. Supply Current vs. Supply Voltage

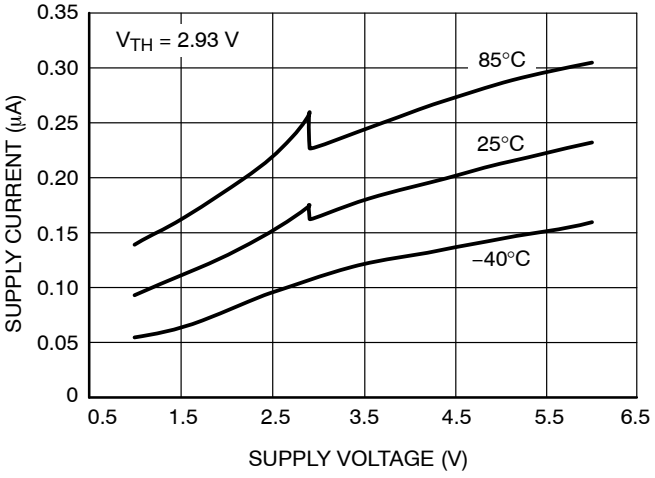


Figure 6. Supply Current vs. Supply Voltage

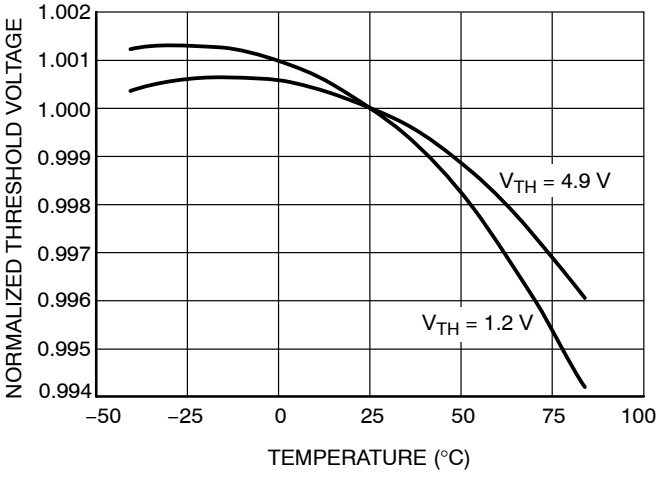


Figure 7. Normalized Reset Threshold Voltage vs. Temperature

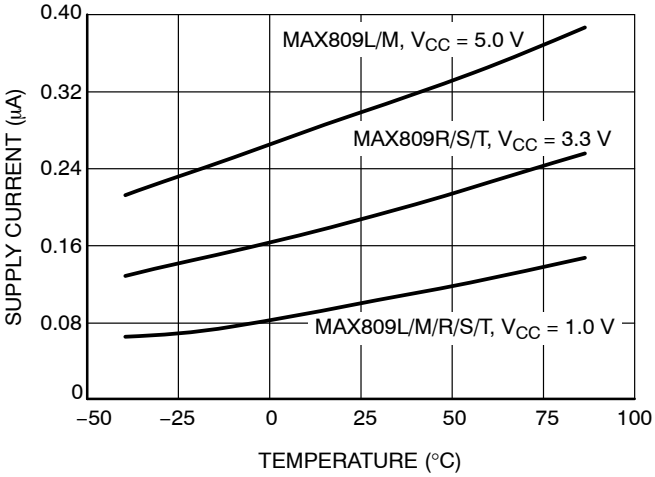


Figure 8. Supply Current vs. Temperature (No Load, MAX809)

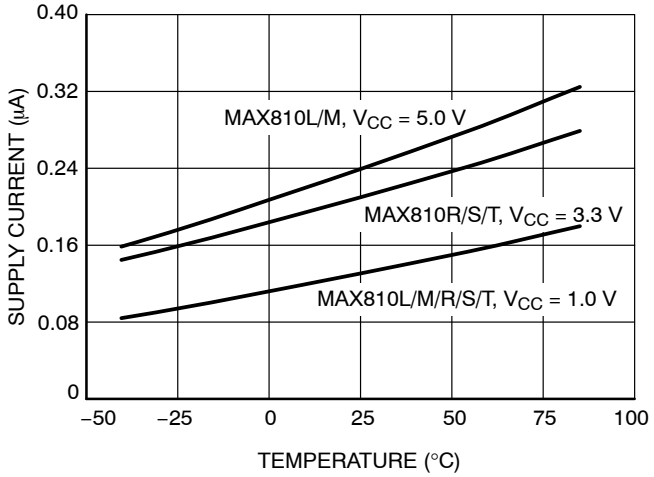


Figure 9. Supply Current vs. Temperature (No Load, MAX810)

TYPICAL OPERATING CHARACTERISTICS

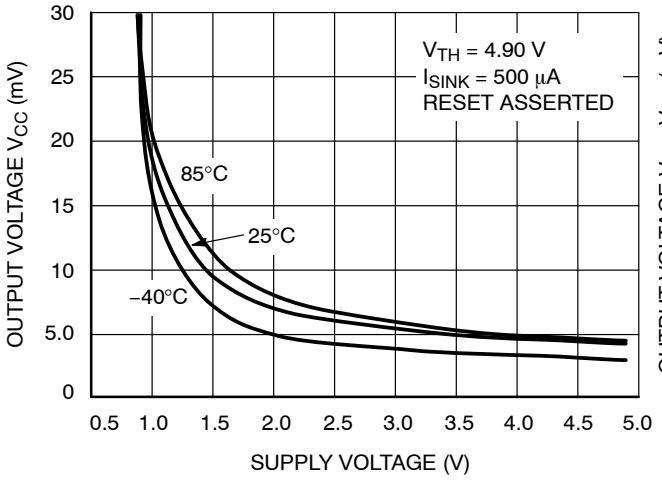


Figure 10. Output Voltage Low vs. Supply Voltage

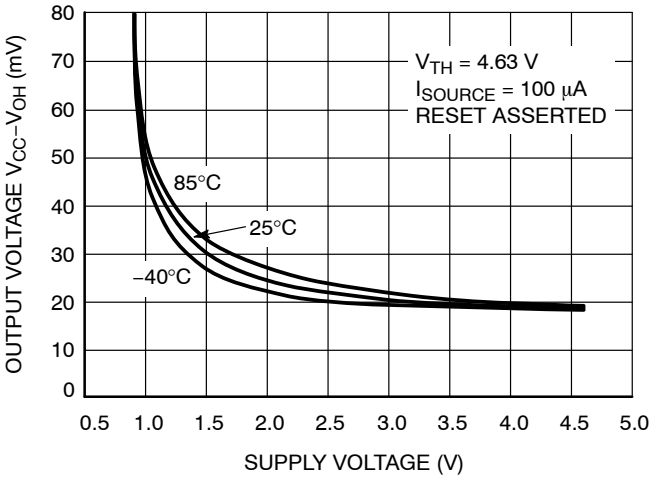


Figure 11. Output Voltage High vs. Supply Voltage

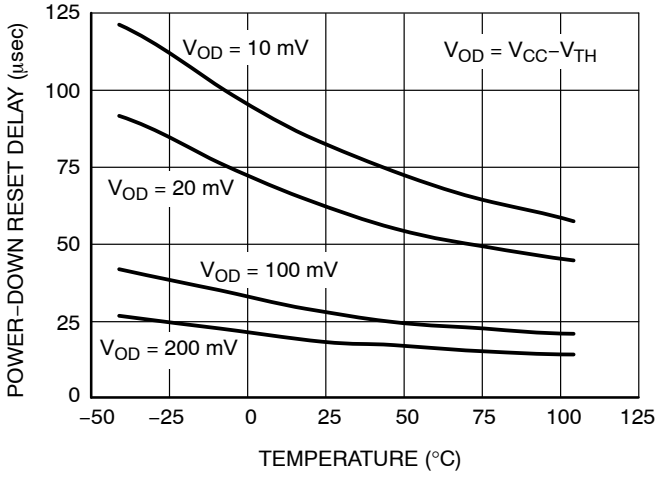


Figure 12. Power−Down Reset Delay vs. Temperature and Overdrive (V_{TH} = 1.2 V)

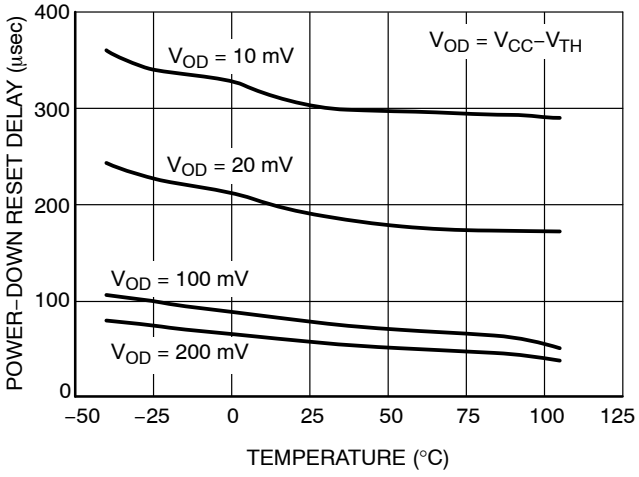


Figure 13. Power−Down Reset Delay vs. Temperature and Overdrive (V_{TH} = 4.9 V)

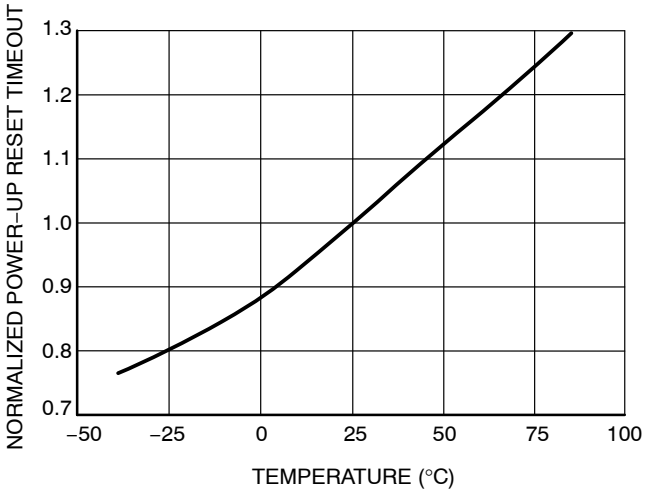


Figure 14. Normalized Power−Up Reset vs. Temperature

Detail Operation Description

The MAX809/810 series microprocessor reset supervisory circuits are designed to monitor the power supplies in digital systems and provide a reset signal to the processor without any external components. Figure 2 shows the timing diagram and a typical application below. Initially consider that input voltage V_{CC} is at a nominal level greater than the voltage detector upper threshold (V_{TH}). And the $\overline{\text{RESET}}$ (RESET) output voltage (Pin 2) will be in the high state for MAX809, or in the low state for MAX 810 devices. If there is an input power interruption and V_{CC} becomes significantly deficient, it will fall below the lower detector threshold (V_{TH-}). This event causes the RESET output to be in the low state for the MAX809, or in the high state for the NCP810 devices. After completion of the power interruption, V_{CC} will rise to its nominal level and become greater than the V_{TH}. This sequence activates the internal oscillator circuitry and digital counter to count. After the count of the timeout period, the reset output will revert back to the original state.

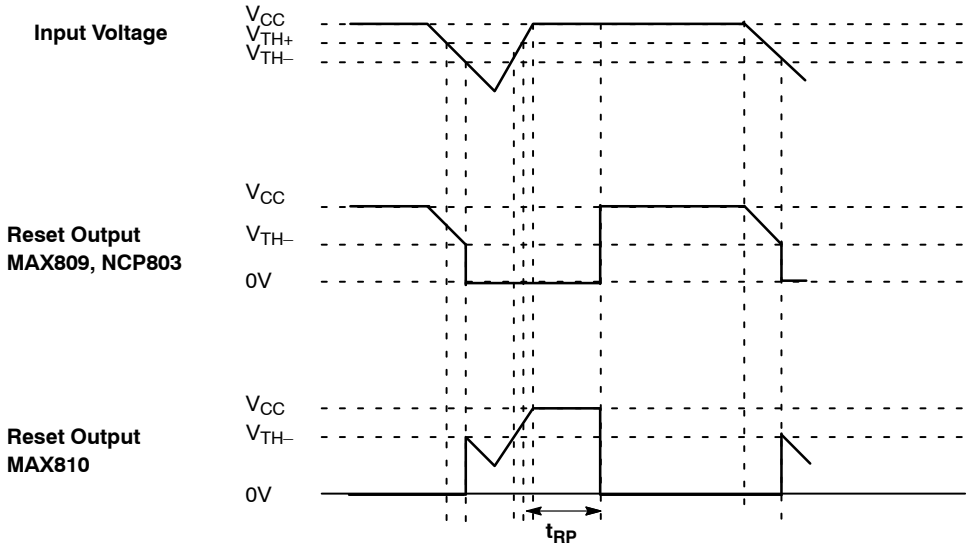
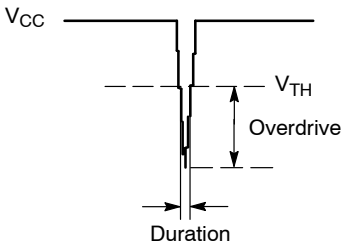


Figure 15. Timing Waveforms

APPLICATIONS INFORMATION

V_{CC} Transient Rejection

The MAX809 provides accurate V_{CC} monitoring and reset timing during power−up, power−down, and brownout/sag conditions, and rejects negative−going transients (glitches) on the power supply line. Figure 16 shows the maximum transient duration vs. maximum negative excursion (overdrive) for glitch rejection. Any combination of duration and overdrive which lies **under** the curve will **not** generate a reset signal. Combinations above the curve are detected as a brownout or power−down. Typically, transient that goes 100 mV below the reset threshold and lasts 5.0 μs or less will not cause a reset pulse. Transient immunity can be improved by adding a capacitor in close proximity to the V_{CC} pin of the MAX809.



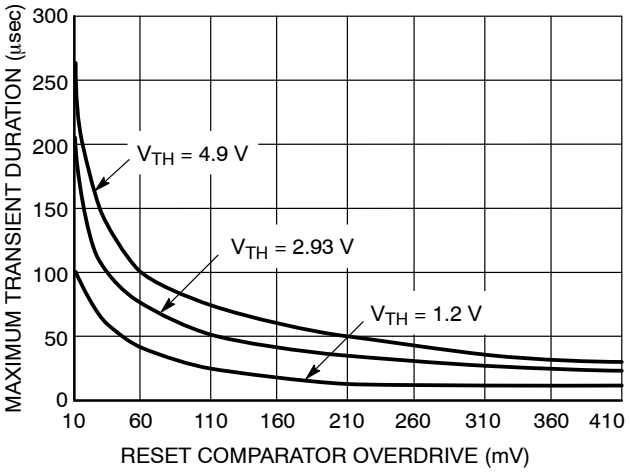


Figure 16. Maximum Transient Duration vs. Overdrive for Glitch Rejection at 25°C

$\overline{\text{RESET}}$ Signal Integrity During Power−Down

The MAX809 $\overline{\text{RESET}}$ output is valid to V_{CC} = 1.0 V. Below this voltage the output becomes an “open circuit” and does not sink current. This means CMOS logic inputs to the Microprocessor will be floating at an undetermined voltage. Most digital systems are completely shutdown well above this voltage. However, in situations where $\overline{\text{RESET}}$ must be maintained valid to V_{CC} = 0 V, a pull−down resistor must be connected from $\overline{\text{RESET}}$ to ground to discharge stray capacitances and hold the output low (Figure 17). This resistor value, though not critical, should be chosen such that it does not appreciably load $\overline{\text{RESET}}$ under normal operation (100 kΩ will be suitable for most applications).

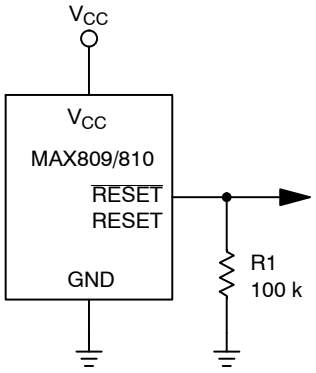


Figure 17. Ensuring RESET Valid to V_{CC} = 0 V

Processors With Bidirectional I/O Pins

Some Microprocessor’s have bidirectional reset pins. Depending on the current drive capability of the processor pin, an indeterminate logic level may result if there is a logic conflict. This can be avoided by adding a 4.7 kΩ resistor in series with the output of the MAX809 (Figure 18). If there are other components in the system which require a reset signal, they should be buffered so as not to load the reset line. If the other components are required to follow the reset I/O of the Microprocessor, the buffer should be connected as shown with the solid line.

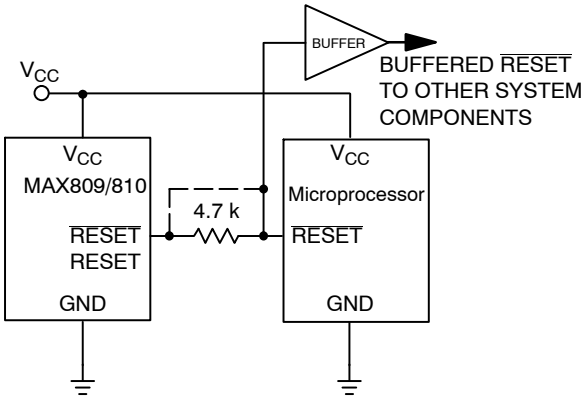


Figure 18. Interfacing to Bidirectional Reset I/O

ORDERING, MARKING AND THRESHOLD INFORMATION

Part Number	V_{TH}* (V)	Timeout* (ms)	Description	Marking	Package	Shipping†
MAX809SN160T1	1.60	140−460	Push−Pull $\overline{\text{RESET}}$	SAA	SOT23−3	3000 / Tape & Reel
MAX809SN160T1G	1.60	140−460		SAA	SOT23−3 (Pb−Free)	
MAX809SN232T1	2.32	140−460		SQP	SOT23−3	
MAX809SN232T1G	2.32	140−460		SQP	SOT23−3 (Pb−Free)	
MAX809RTR	2.63	140−460		SPS	SOT23−3	
MAX809RTRG	2.63	140−460		SPS	SOT23−3 (Pb−Free)	
NCV809RTRG	2.63	140−460		RPA	SOT23−3 (Pb−Free)	
MAX809STR	2.93	140−460		SPT	SOT23−3	
MAX809STRG	2.93	140−460		SPT	SOT23−3 (Pb−Free)	
NCV809STRG	2.93	140−460		SUC	SOT23−3 (Pb−Free)	
MAX809TTR	3.08	140−460		SPU	SOT23−3	
MAX809TTRG	3.08	140−460		SPU	SOT23−3 (Pb−Free)	
MAX809JTR	4.00	140−460		SPR	SOT23−3	
MAX809JTRG	4.00	140−460		SPR	SOT23−3 (Pb−Free)	
MAX809MTR	4.38	140−460		SPV	SOT23−3	
MAX809MTRG	4.38	140−460		SPV	SOT23−3 (Pb−Free)	
NCV809MTRG	4.38	140−460		TAT	SOT23−3 (Pb−Free)	
MAX809HTR	4.55	140−460		SBD	SOT23−3	
MAX809HTRG	4.55	140−460		SBD	SOT23−3 (Pb−Free)	
MAX809LTR	4.63	140−460		SPW	SOT23−3	
MAX809LTRG	4.63	140−460		SPW	SOT23−3 (Pb−Free)	
NCV809LTRG	4.63	140−460		STA	SOT23−3 (Pb−Free)	
MAX809SN490T1	4.90	140−460		SBH	SOT23−3	
MAX809SN490T1G	4.90	140−460		SBH	SOT23−3 (Pb−Free)	
MAX809SN120T1G	1.20	140−460		SSO	SOT23−3 (Pb−Free)	
MAX809SN293D1T1G	2.93	1−3.3		SSP	SOT23−3 (Pb−Free)	
MAX809SN293D2T1G	2.93	20−66		SSQ	SOT23−3 (Pb−Free)	
NCV809SN293D2T1G	2.93	20−66		ACE	SOT23−3 (Pb−Free)	
MAX809SN293D3T1G	2.93	100−330		SSR	SOT23−3 (Pb−Free)	
MAX809SQ120T1G	1.20	140−460		ZD	SC70−3 (Pb−Free)	
MAX809SQ232T1G	2.32	140−460		ZE	SC70−3 (Pb−Free)	
MAX809SQ263T1G	2.63	140−460		ZF	SC70−3 (Pb−Free)	
MAX809SQ293T1G	2.93	140−460		ZG	SC70−3 (Pb−Free)	
MAX809SQ308T1G	3.08	140−460		ZH	SC70−3 (Pb−Free)	
MAX809SQ400T1G	4.00	140−460		SZ	SC70−3 (Pb−Free)	
MAX809SQ438T1G	4.38	140−460		ZI	SC70−3 (Pb−Free)	
MAX809SQ463T1G	4.63	140−460		ZJ	SC70−3 (Pb−Free)	

ORDERING, MARKING AND THRESHOLD INFORMATION

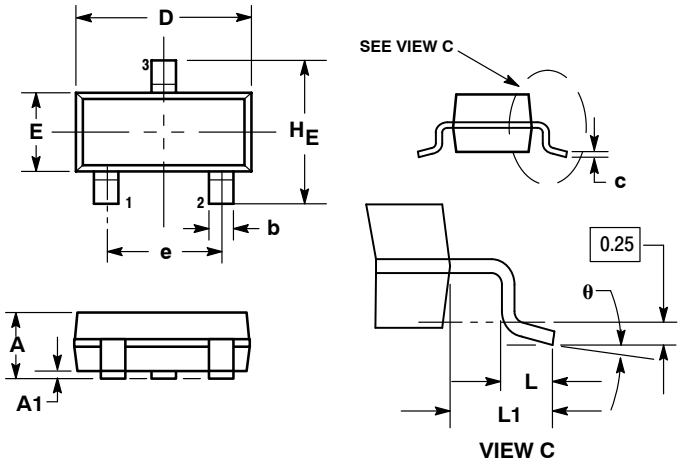
Part Number	V_{TH}* (V)	Timeout* (ms)	Description	Marking	Package	Shipping†
MAX809SQ293D1T1G	2.93	1–3.3	Push–Pull $\overline{\text{RESET}}$	ZK	SC70–3 (Pb–Free)	3000 / Tape & Reel
MAX809SQ293D2T1G	2.93	20–66		ZL	SC70–3 (Pb–Free)	
MAX809SQ293D3T1G	2.93	100–330		ZM	SC70–3 (Pb–Free)	
MAX810RTR	2.63	140–460		SPX	SOT23–3	
MAX810RTRG	2.63	140–460		SPX	SOT23–3 (Pb–Free)	
MAX810STR	2.93	140–460		SPY	SOT23–3	
MAX810STRG	2.93	140–460		SPY	SOT23–3 (Pb–Free)	
MAX810TTR	3.08	140–460		SPZ	SOT23–3	
MAX810TTRG	3.08	140–460		SPZ	SOT23–3 (Pb–Free)	
MAX810MTR	4.38	140–460		SQA	SOT23–3	
MAX810MTRG	4.38	140–460		SQA	SOT23–3 (Pb–Free)	
MAX810LTR	4.63	140–460		SQB	SOT23–3	
MAX810LTRG	4.63	140–460		SQB	SOT23–3 (Pb–Free)	
MAX810SN120T1G	1.20	140–460		SSS	SOT23–3 (Pb–Free)	
MAX810SN293D1T1G	2.93	1–3.3		SST	SOT23–3 (Pb–Free)	
MAX810SN293D2T1G	2.93	20–66		SSU	SOT23–3 (Pb–Free)	
MAX810SN293D3T1G	2.93	100–330		SSZ	SOT23–3 (Pb–Free)	
MAX810SQ120T1G	1.20	140–460		ZN	SC70–3 (Pb–Free)	
MAX810SQ263T1G	2.63	140–460		ZO	SC70–3 (Pb–Free)	
MAX810SQ270T1G	2.70	20–66		ZB	SC70–3 (Pb–Free)	
MAX810SQ293T1G	2.93	140–460		ZP	SC70–3 (Pb–Free)	
MAX810SQ400T1G	4.00	20–66		ZC	SC70–3 (Pb–Free)	
MAX810SQ438T1G	4.38	140–460		ZQ	SC70–3 (Pb–Free)	
MAX810SQ463T1G	4.63	140–460		ZR	SC70–3 (Pb–Free)	
MAX810SQ293D1T1G	2.93	1–3.3		ZS	SC70–3 (Pb–Free)	
MAX810SQ293D2T1G	2.93	20–66		ZT	SC70–3 (Pb–Free)	
MAX810SQ293D3T1G	2.93	100–330		ZU	SC70–3 (Pb–Free)	

†For information on tape and reel specifications,including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*Contact your ON Semiconductor sales representative for other threshold voltage options.

PACKAGE DIMENSIONS

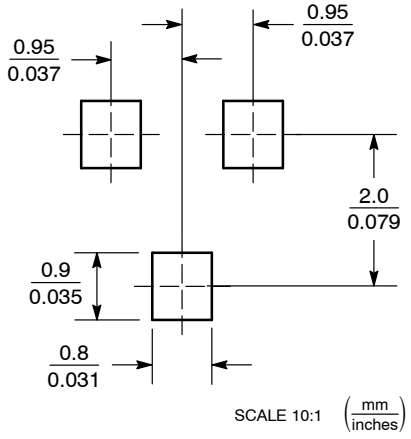
SOT−23 (TO236)
CASE 318−08
ISSUE AN



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318−01 THRU −07 AND −09 OBSOLETE, NEW STANDARD 318−08.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
H_E	2.10	2.40	2.64	0.083	0.094	0.104

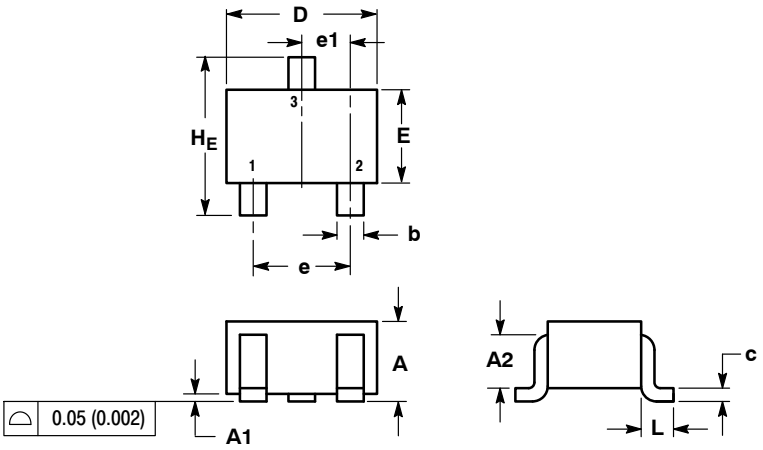
SOLDERING FOOTPRINT*



*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

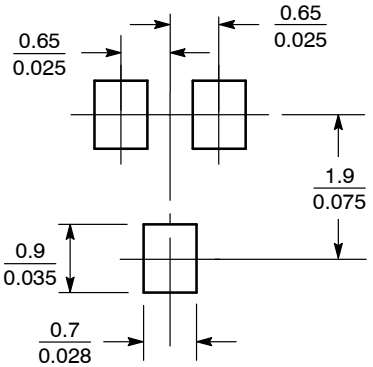
SC−70 (SOT−323)
CASE 419−04
ISSUE M



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.90	1.00	0.032	0.035	0.040
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2		0.7 REF			0.028 REF	
b	0.30	0.35	0.40	0.012	0.014	0.016
c	0.10	0.18	0.25	0.004	0.007	0.010
D	1.80	2.10	2.20	0.071	0.083	0.087
E	1.15	1.24	1.35	0.045	0.049	0.053
e	1.20	1.30	1.40	0.047	0.051	0.055
e1		0.65 BSC			0.026 BSC	
L		0.425 REF			0.017 REF	
H_E	2.00	2.10	2.40	0.079	0.083	0.095

SOLDERING FOOTPRINT*



*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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