

# 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  $\mu$ sec of  $V_{CC}$  falling through the reset voltage threshold. Reset is maintained active for a minimum of 140 msec 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. The output of the MAX809 is guaranteed valid down to  $V_{CC} = 1.0$  V. Both devices are available in a SOT-23 package.

The MAX809/810 are optimized to reject fast transient glitches on the  $V_{CC}$  line. Low supply current of 1.0  $\mu$ A ( $V_{CC} = 3.2$  V) makes these devices suitable for battery powered applications.

### Features

- Precision  $V_{CC}$  Monitor for 2.5 V, 3.0 V, 3.3 V, and 5.0 V Supplies
- Precision Monitoring Voltages from 1.6 V to 4.9 V Available in 100 mV Steps
- 140 msec Guaranteed Minimum  $\overline{\text{RESET}}$  Output Duration
- $\overline{\text{RESET}}$  Output Guaranteed to  $V_{CC} = 1.0$  V
- Low Supply Current
- $V_{CC}$  Transient Immunity
- Small SOT-23 Package
- No External Components
- Wide Operating Temperature:  $-40^{\circ}\text{C}$  to  $105^{\circ}\text{C}$

### Typical Applications

- Computers
- Embedded Systems
- Battery Powered Equipment
- Critical  $\mu$ P Power Supply Monitoring

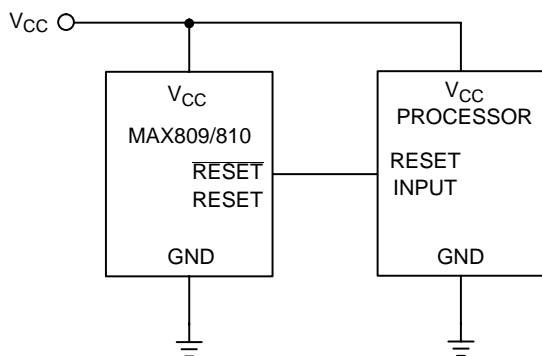


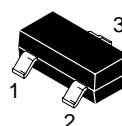
Figure 1. Typical Application Diagram



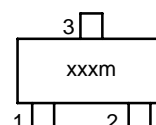
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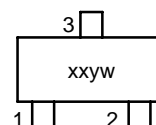
### MARKING DIAGRAMS



SOT-23  
(TO-236)  
CASE 318

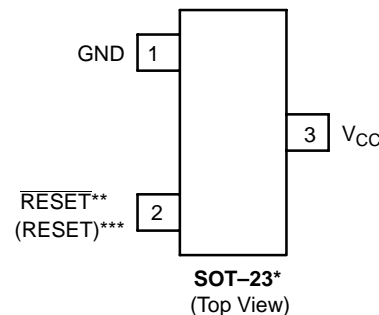


See specific device marking information on page 8.



xx, xxx = Specific Device Code  
m = Date Code  
y = Year  
w = Work Week

### PIN CONFIGURATION



NOTE: \* SOT-23 is equivalent to JEDEC (TO-236)  
\*\* RESET is for MAX809  
\*\*\* RESET is for MAX810

### ORDERING INFORMATION

Device	Package	Shipping
MAX809xTR	SOT-23	3000 Tape/Reel
MAX809SNxxxT1	SOT-23	3000 Tape/Reel
MAX810xTR	SOT-23	3000 Tape/Reel

NOTE: The "x" and "xxx" denotes a suffix for  $V_{CC}$  voltage threshold options – see page 8 for more details.

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 8 of this data sheet.

# MAX809 Series, MAX810 Series

## PIN DESCRIPTION

Pin No.	Symbol	Description
1	GND	Ground
2	RESET (MAX809)	RESET output remains low while $V_{CC}$ is below the reset voltage threshold, and for 240 msec (typ.) 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 240 msec (typ.) after $V_{CC}$ rises above reset threshold
3	$V_{CC}$	Supply Voltage (typ.)

## ABSOLUTE MAXIMUM RATINGS\* (Note 1)

Rating	Symbol	Value	Unit
Supply Voltage ( $V_{CC}$ to GND)	$V_{CC}$	6.0	V
RESET		-0.3 to ( $V_{CC} + 0.3$ )	V
Input Current, $V_{CC}$		20	mA
Output Current, RESET		20	mA
dV/dt ( $V_{CC}$ )		100	V/ $\mu$ sec
Thermal Resistance, Junction to Air	$R_{\theta JA}$	491	$^{\circ}$ C/W
Operating Temperature Range (Data given for MAX809 threshold levels: 1.60 V, 2.32 V, 2.93 V, 4.63 V and 4.90 V)	$T_A$	-40 to +105	$^{\circ}$ C
Operating Temperature Range (Data given for MAX809 threshold levels: 2.63 V, 3.08 V, 4.00 V and 4.38 V; MAX810 threshold levels: 2.63 V, 2.93 V, 3.08 V, 4.38 V and 4.63 V)	$T_A$	-40 to +85	$^{\circ}$ C
Storage Temperature Range	$T_{stg}$	-65 to +150	$^{\circ}$ C
Lead Temperature (Soldering, 10 Seconds)	$T_{sol}$	+260	$^{\circ}$ C
Latch-up performance:	$I_{Latch-up}$	200 200	mA
	Positive	200	
	Negative	200	

\*Maximum Ratings are those values beyond which damage to the device may occur.

- This device series contains ESD protection and exceeds the following tests:  
Human Body Model 2000 V per MIL-STD-883, Method 3015.  
Machine Model Method 350 V.
- The maximum package power dissipation limit must not be exceeded.

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

## ELECTRICAL CHARACTERISTICS $T_A = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$ unless otherwise noted. Typical values are at $T_A = +25^{\circ}\text{C}$ . (Note 3)

The following data is given for MAX809 threshold levels: 1.60 V, 2.32 V, 2.93 V, 4.63 V and 4.90 V.

Characteristic	Symbol	Min	Typ	Max	Unit
$V_{CC}$ Range $T_A = 0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ $T_A = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$		1.0 1.2	- -	5.5 5.5	V
Supply Current $V_{CC} = 3.3$ V $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ $T_A = 85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$ $V_{CC} = 5.5$ V $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ $T_A = 85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	$I_{CC}$	- - - -	0.5 - 0.8 -	1.2 2.0 1.8 2.5	$\mu$ A

- Production testing done at  $T_A = 25^{\circ}\text{C}$ , over temperature limits guaranteed by design.

## MAX809 Series, MAX810 Series

**ELECTRICAL CHARACTERISTICS (continued)**  $T_A = -40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$  unless otherwise noted. Typical values are at  $T_A = +25^{\circ}\text{C}$ .  
 (Note 4) The following data is given for MAX809 threshold levels: 1.60 V, 2.32 V, 2.93 V, 4.63 V and 4.90 V.

Characteristic	Symbol	Min	Typ	Max	Unit
Reset Threshold (Note 5)	$V_{TH}$				V
MAX809SN490					
$T_A = +25^{\circ}\text{C}$		4.83	4.9	4.97	
$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		4.78	–	5.02	
$T_A = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$		4.66	–	5.14	
MAX809LTR					
$T_A = +25^{\circ}\text{C}$		4.56	4.63	4.70	
$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		4.50	–	4.75	
$T_A = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$		4.40	–	4.86	
MAX809STR					
$T_A = +25^{\circ}\text{C}$		2.89	2.93	2.96	
$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		2.85	–	3.00	
$T_A = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$		2.78	–	3.08	
MAX809SN232					
$T_A = +25^{\circ}\text{C}$		2.28	2.32	2.35	
$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		2.25	–	2.38	
$T_A = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$		2.21	–	2.45	
MAX809SN160					
$T_A = +25^{\circ}\text{C}$		1.58	1.6	1.62	
$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		1.56	–	1.64	
$T_A = +85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$		1.52	–	1.68	
Reset Temperature Coefficient		–	30	–	ppm/ $^{\circ}\text{C}$
$V_{CC}$ to Reset Delay $V_{CC} = V_{TH}$ to $(V_{TH} - 100\text{ mV})$		–	10	–	$\mu\text{sec}$
Reset Active Timeout Period		140	240	460	msec
RESET Output Voltage Low $V_{CC} = V_{TH} - 0.2\text{ V}$ $1.6\text{ V} \leq V_{TH} \leq 2.0\text{ V}$ , $I_{SINK} = 0.5\text{ mA}$ $2.1\text{ V} \leq V_{TH} \leq 4.0\text{ V}$ , $I_{SINK} = 1.2\text{ mA}$ $4.1\text{ V} \leq V_{TH} \leq 4.9\text{ V}$ , $I_{SINK} = 3.2\text{ mA}$	$V_{OL}$	–	–	0.3	V
RESET Output Voltage High $V_{CC} = V_{TH} + 0.2\text{ V}$ $1.6\text{ V} \leq V_{TH} \leq 2.4\text{ V}$ , $I_{SOURCE} = 200\text{ }\mu\text{A}$ $2.5\text{ V} \leq V_{TH} \leq 4.9\text{ V}$ , $I_{SOURCE} = 500\text{ }\mu\text{A}$	$V_{OH}$	$0.8 V_{CC}$	–	–	V

4. Production testing done at  $T_A = 25^{\circ}\text{C}$ , over temperature limits guaranteed by design.
5. Contact your ON Semiconductor sales representative for other threshold voltage options.

## MAX809 Series, MAX810 Series

**ELECTRICAL CHARACTERISTICS** ( $V_{CC}$  = Full Range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  unless otherwise noted. Typical values are at  $T_A$  =  $+25^{\circ}\text{C}$ ,  $V_{CC}$  = 5.0 V for L/M/J, 3.3 V for T/S, 3.0 V for R) (Note 6) The following data is given for MAX809 threshold levels: 2.63 V, 3.08 V, 4.00 V and 4.38 V; MAX810 threshold levels: 2.63 V, 2.93 V, 3.08 V, 4.38 V and 4.63 V.

Characteristic	Symbol	Min	Typ	Max	Unit
$V_{CC}$ Range $T_A$ = $0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ $T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		1.0 1.2	– –	5.5 5.5	V
Supply Current MAX8xxM/MAX809J/MAX810L: $V_{CC}$ < 5.5 V MAX8xxR/T/MAX810S: $V_{CC}$ < 3.6 V	$I_{CC}$	– –	24 17	60 50	$\mu\text{A}$
Reset Threshold (Note 6) MAX810L: $T_A$ = $25^{\circ}\text{C}$ $T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ MAX8xxM: $T_A$ = $25^{\circ}\text{C}$ $T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ MAX809J: $T_A$ = $25^{\circ}\text{C}$ $T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ MAX8xxT: $T_A$ = $25^{\circ}\text{C}$ $T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ MAX810S: $T_A$ = $25^{\circ}\text{C}$ $T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ MAX8xxR: $T_A$ = $25^{\circ}\text{C}$ $T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	$V_{TH}$	4.56 4.50 4.31 4.25 3.93 3.89 3.04 3.00 2.89 2.85 2.59 2.55	4.63 – 4.38 – 4.00 – 3.08 – 2.93 – 2.63 –	4.70 4.75 4.45 4.50 4.06 4.10 3.11 3.15 2.96 3.00 2.66 2.70	V
Reset Threshold Temperature Coefficient		–	30	–	ppm/ $^{\circ}\text{C}$
$V_{CC}$ to Reset Delay $V_{CC} = V_{TH}$ to $(V_{TH} - 100 \text{ mV})$		–	20	–	$\mu\text{sec}$
Reset Active Timeout Period		140	240	560	msec
RESET Output Voltage Low (MAX809) MAX809R/T: $V_{CC} = V_{TH}$ min, $I_{SINK} = 1.2 \text{ mA}$ MAX809M/J: $V_{CC} = V_{TH}$ min, $I_{SINK} = 3.2 \text{ mA}$ $V_{CC} > 1.0 \text{ V}$ , $I_{SINK} = 50 \mu\text{A}$	$V_{OL}$	– – –	– – –	0.3 0.4 0.3	V
RESET Output Voltage High (MAX809) MAX809R/T: $V_{CC} > V_{TH}$ max, $I_{SOURCE} = 500 \mu\text{A}$ MAX809M/J: $V_{CC} > V_{TH}$ max, $I_{SOURCE} = 800 \mu\text{A}$	$V_{OH}$	0.8 $V_{CC}$ $V_{CC} - 1.5$	– –	– –	V
RESET Output Voltage Low (MAX810) MAX810R/S/T: $V_{CC} = V_{TH}$ max, $I_{SINK} = 1.2 \text{ mA}$ MAX810L/M: $V_{CC} = V_{TH}$ max, $I_{SINK} = 3.2 \text{ mA}$	$V_{OL}$	– –	– –	0.3 0.4	V
RESET Output Voltage High (MAX810) $1.8 < V_{CC} < V_{TH}$ min, $I_{SOURCE} = 150 \mu\text{A}$	$V_{OH}$	0.8 $V_{CC}$	–	–	V

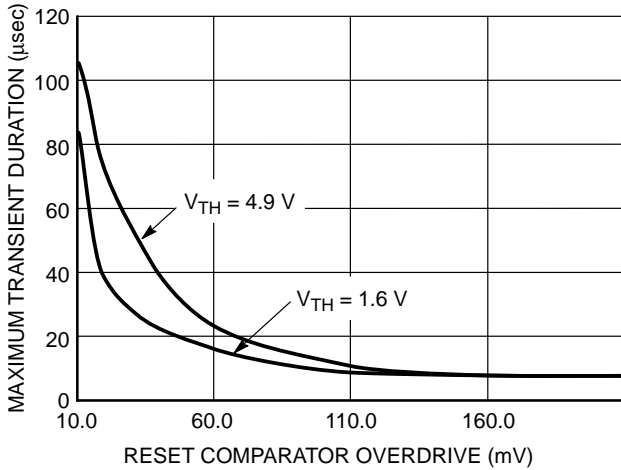
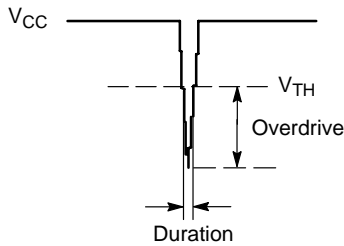
6. Production testing done at  $T_A = 25^{\circ}\text{C}$ , over temperature limits guaranteed by design.

# MAX809 Series, MAX810 Series

## APPLICATIONS INFORMATION

### V<sub>CC</sub> Transient Rejection

The MAX809 provides accurate V<sub>CC</sub> 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 2 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 μs or less will not cause a reset pulse. Transient immunity can be improved by adding a capacitor in close proximity to the V<sub>CC</sub> pin of the MAX809.

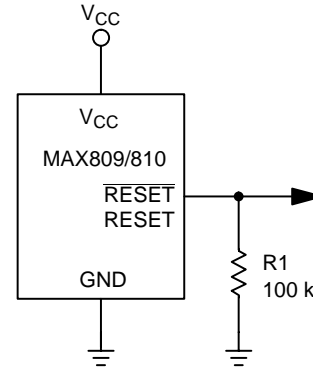


**Figure 2. Maximum Transient Duration vs. Overdrive for Glitch Rejection at 25°C**

### RESET Signal Integrity During Power-Down

The MAX809  $\overline{\text{RESET}}$  output is valid to V<sub>CC</sub> = 1.0 V. Below this voltage the output becomes an “open circuit” and does not sink current. This means CMOS logic inputs to the μP 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

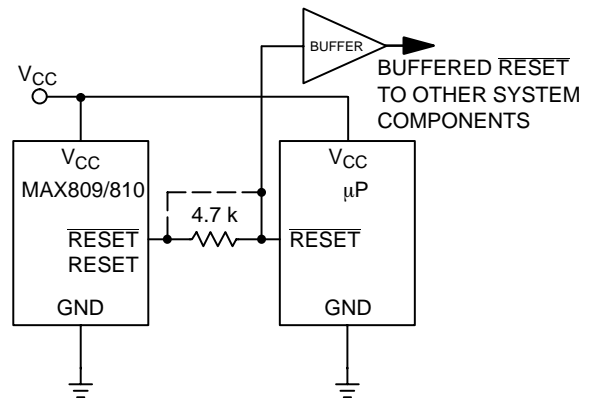
valid to V<sub>CC</sub> = 0 V, a pull-down resistor must be connected from  $\overline{\text{RESET}}$  to ground to discharge stray capacitances and hold the output low (Figure 3). This resistor value, though not critical, should be chosen such that it does not appreciably load  $\overline{\text{RESET}}$  under normal operation (100 kΩ will be suitable for most applications).



**Figure 3. Ensuring RESET Valid to V<sub>CC</sub> = 0 V**

### Processors With Bidirectional I/O Pins

Some μP's (such as Motorola 68HC11) have bi-directional 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 4). 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 μP, the buffer should be connected as shown with the solid line.



**Figure 4. Interfacing to Bidirectional Reset I/O**

# MAX809 Series, MAX810 Series

## TYPICAL CHARACTERISTICS

The following data is given for MAX809 threshold levels: 1.60 V, 2.32 V, 2.93 V, 4.63 V and 4.90 V.

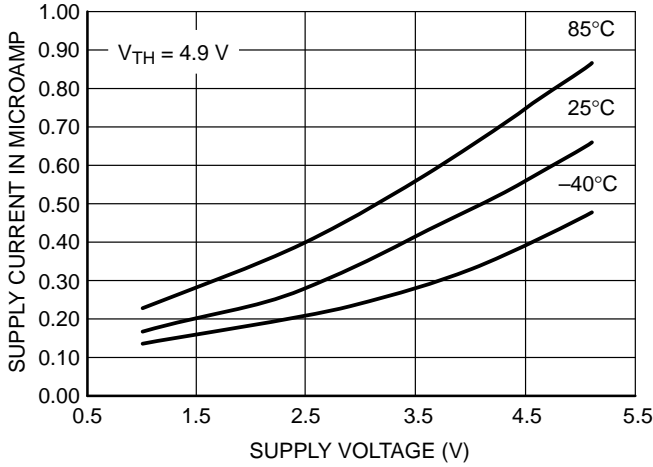


Figure 5. Supply Current vs. Supply Voltage

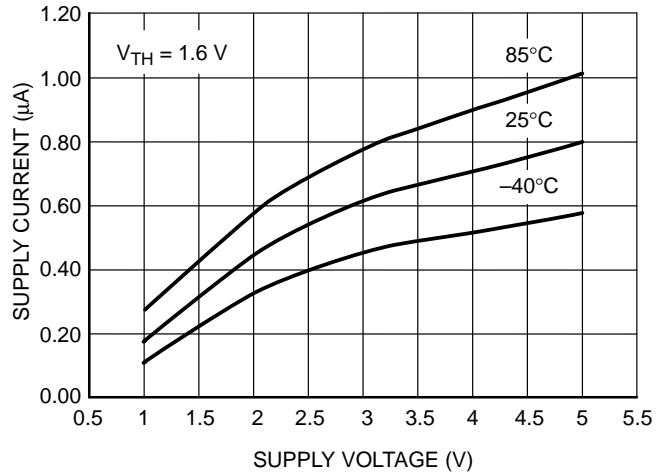


Figure 6. Supply Current vs. Supply Voltage

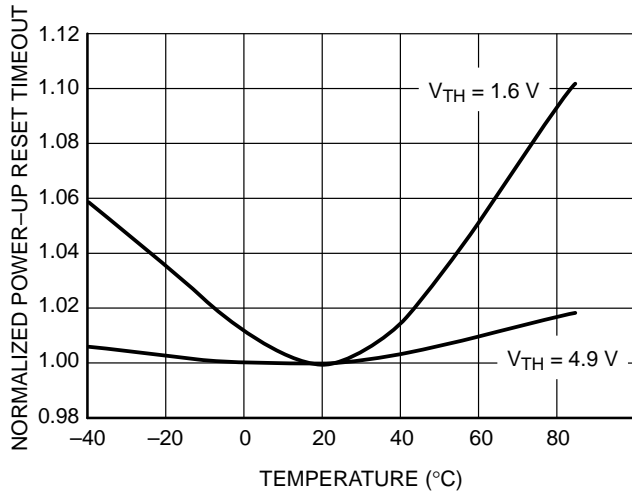


Figure 7. Normalized Power-Up Reset vs. Temperature

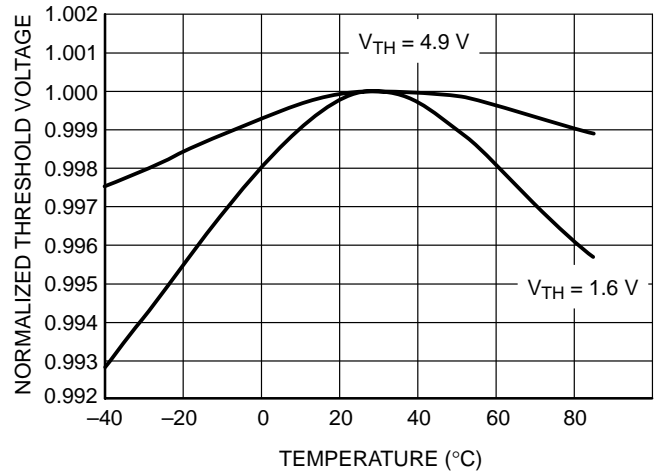
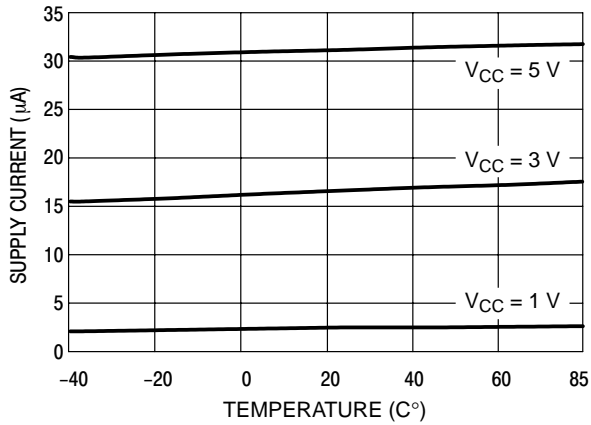


Figure 8. Normalized Reset Threshold Voltage vs. Temperature

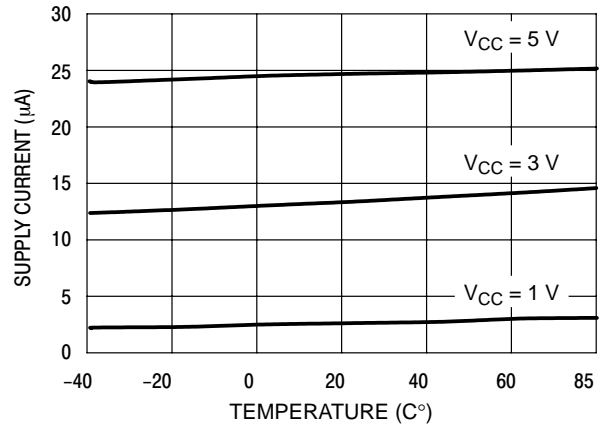
# MAX809 Series, MAX810 Series

## TYPICAL CHARACTERISTICS

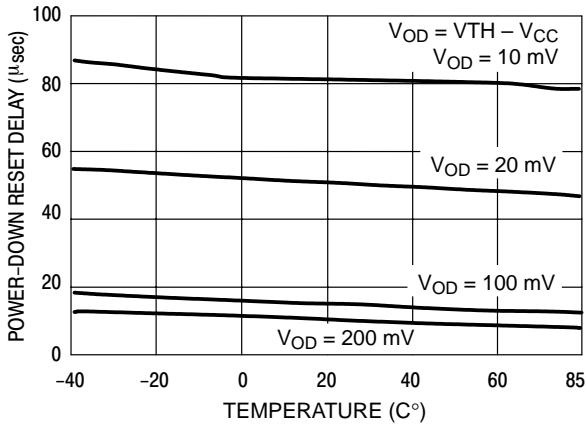
The following data is given for MAX809 threshold levels: 2.63 V, 3.08 V, 4.00 V and 4.38 V;  
 MAX810 threshold levels: 2.63 V, 2.93 V, 3.08 V, 4.38 V and 4.63 V.



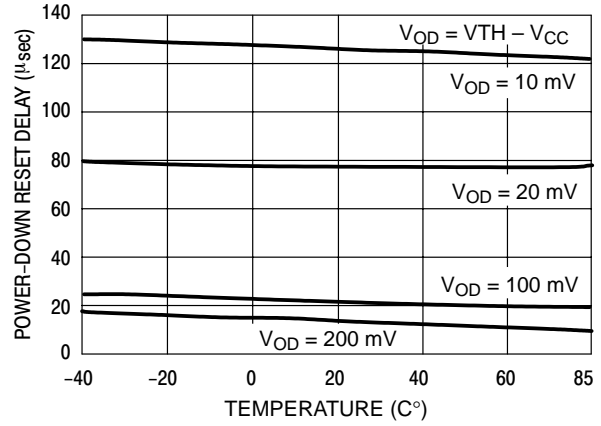
**Figure 9. Supply Current vs. Temperature (No Load, MAX8xxR/T, MAX810S)**



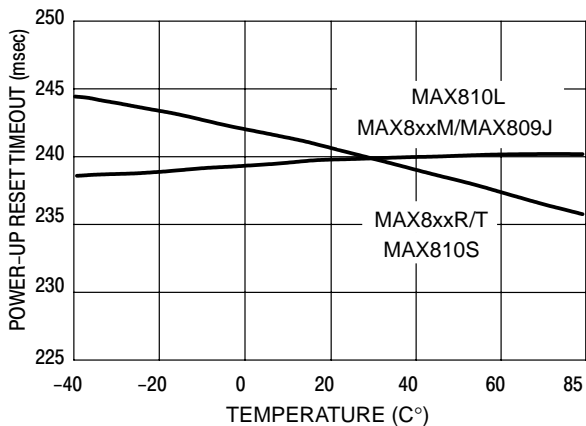
**Figure 10. Supply Current vs. Temperature (No Load, MAX8xxM/MAX809J, MAX810L)**



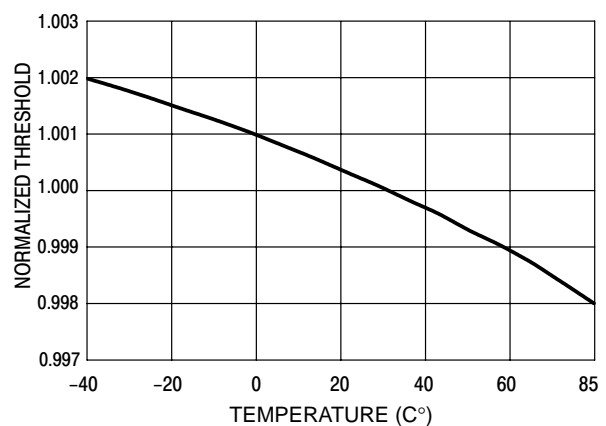
**Figure 11. Power-Down Reset Delay vs. Temperature and Overdrive (MAX8xxR/T, MAX810S)**



**Figure 12. Power-Down Reset Delay vs. Temperature and Overdrive (MAX8xxM/MAX809J, MAX810L)**



**Figure 13. Power-Up Reset Timeout vs. Temperature**

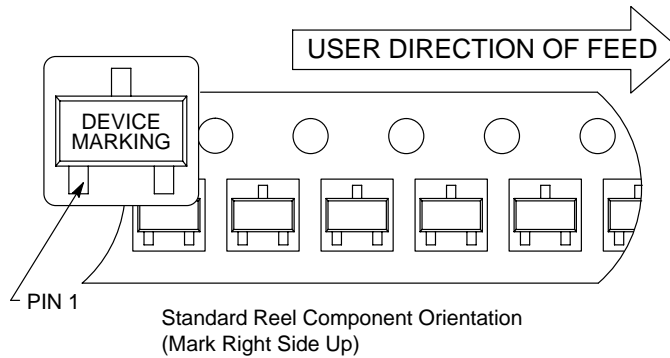


**Figure 14. Normalized Reset Threshold vs. Temperature**

# MAX809 Series, MAX810 Series

## TAPING FORM

### Component Taping Orientation for 3L SOT-23 (JEDEC-236) Devices



Tape & Reel Specifications Table

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOT-23	8 mm	4 mm	3000	7 inches

### MARKING AND THRESHOLD INFORMATION

ON Semiconductor Part #	$V_{TH}^*$	Description	Marking
MAX809SN160T1	1.60	Push-Pull $\overline{RESET}$	SAAm
MAX809SN232T1	2.32		SQPm
MAX809STR	2.93		SPTm
MAX809LTR	4.63		SPWm
MAX809SN490T1	4.90		SBHm
MAX809MTR	4.38		J2yw
MAX809TTR	3.08		J3yw
MAX809RTR	2.63		J5yw
MAX809JTR	4.00		J6yw
MAX810MTR	4.38		Push-Pull $\overline{RESET}$
MAX810TTR	3.08	K3yw	
MAX810RTR	2.63	K5yw	
MAX810LTR	4.63	K1yw	
MAX810STR	2.93	K4yw	

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

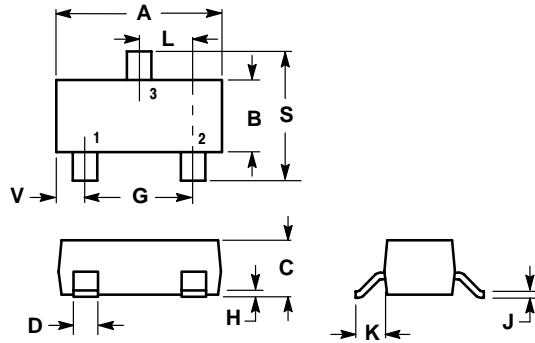
m = Date Code  
y = Year  
w = Work Week



# MAX809 Series, MAX810 Series

## PACKAGE DIMENSIONS

**SOT-23**  
 PLASTIC PACKAGE (TO-236)  
 CASE 318-08  
 ISSUE AH



**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. 318-03 AND -07 OBSOLETE, NEW STANDARD 318-08.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

**Notes**

**Notes**

## MAX809 Series, MAX810 Series

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