19-0136; Rev. 1; 6/94

MAXIM

Power-Supply Monitor with Reset

General Description

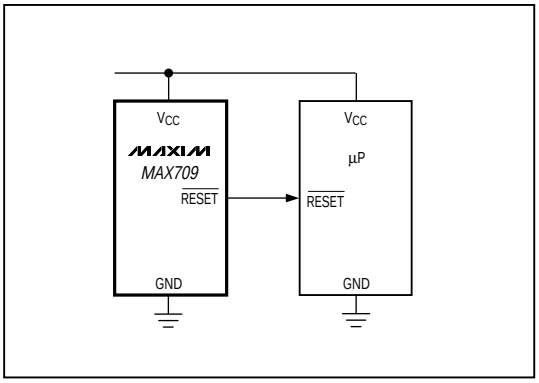
The MAX709 provides a system reset during power-up, power-down, and brownout conditions. When V_{CC} falls below the reset threshold, $\overline{RESET}$ goes low and holds the µP in reset for 140ms min after V_{CC} rises above the threshold.

The $\overline{RESET}$ output is guaranteed to be in the correct state with V_{CC} down to 1V. The MAX709 provides excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, or +3V powered systems. The MAX709 is available 8-pin DIP, µMAX, and SO packages.

Applications

Minimum Component Count,
Low-Cost Processor Systems

Typical Operating Circuit



Features

- **+5V, +3.3V, and +3V Versions**
- **No External Components**
- **Low Cost**
- **Precise Power-Down Reset Threshold**
- **140ms Min Power-On Reset Delay**
- **Immune to Short Negative V_{CC} Transients**
- **8-Pin DIP, µMAX, and SO Packages**
- **Low Supply Current: 35µA - MAX709R/S/T**
  65µA - MAX709L/M

Ordering Information

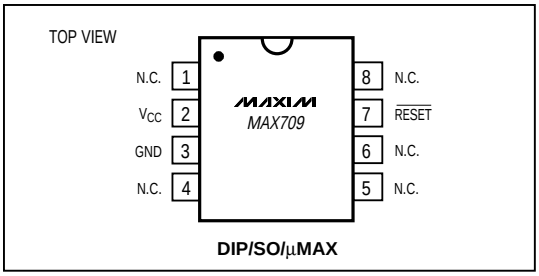
PART	TEMP. RANGE	PIN-PACKAGE
MAX709_CPA	0°C to +70°C	8 Plastic DIP
MAX709_CUA	0°C to +70°C	8 µMAX
MAX709_CSA	0°C to +70°C	8 SO
MAX709_C/D	0°C to +70°C	Dice
MAX709_EPA	-40°C to +85°C	8 Plastic DIP
MAX709_EUA	-40°C to +85°C	8 µMAX
MAX709_ESA	-40°C to +85°C	8 SO

** Dice are specified at T_A = +25°C, DC parameters only.*

Note: 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.

RESET THRESHOLD	
SUFFIX	**VOLTAGE (V)**
L	4.65
M	4.40
T	3.08
S	2.93
R	2.63

Pin Configuration



DIP/SO/µMAX

Call toll free 1-800-998-8800 for free samples or literature.

ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)
- V_{CC} ..... -0.3V to 6.0V
- $\overline{RESET}$ ..... -0.3V to (V_{CC} + 0.3V)

Input Current, V_{CC} 20mA
Output Current, $\overline{RESET}$ 20mA
Rate-of-Rise, V_{CC} 100V/µs
Continuous Power Dissipation (T_A = +70°C)
- Plastic DIP (derate 9.09mW/°C above +70°C) 727mW
- µMAX (derate 4.10mW/°C above +70°C) 330mW
- SO (derate 5.88mW/°C above +70°C) 471mW

Operating Temperature Ranges
- MAX709_C___ ..... 0°C to +70°C
- MAX709_E___ ..... -40°C to +85°C

Storage Temperature Range ..... -65°C to +160°C
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

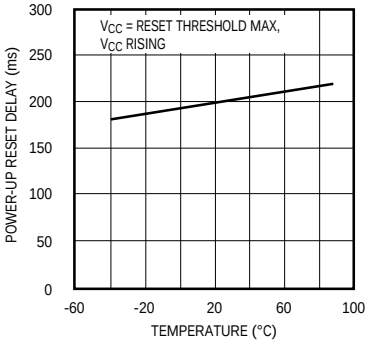
(V_{CC} = full range, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{CC} Range	MAX709_C		1.0		5.5	V
	MAX709_E		1.2		5.5	
Supply Current (Note 1)	MAX709R/S/T only	MAX709_C, V_{CC} < 3.6V		35	85	µA
		MAX709_E, V_{CC} < 3.6V		35	110	
	All versions	MAX709_C, V_{CC} < 5.5V		65	150	
		MAX709_E, V_{CC} < 5.5V		65	200	
$\overline{RESET}$ Threshold, V_{TH}	MAX709L		4.50	4.65	4.75	V
	MAX709M		4.25	4.40	4.50	
	MAX709T		3.00	3.08	3.15	
	MAX709S		2.85	2.93	3.00	
	MAX709R		2.55	2.63	2.70	
V_{CC} to $\overline{RESET}$ Delay	V_{CC} = reset threshold max to reset threshold min			20		µs
Reset Active Timeout Period	V_{CC} = reset threshold max, V_{CC} rising		140	280	560	ms
$\overline{RESET}$ Output Voltage	I_{SINK} = 1.2mA, V_{CC} = reset threshold min, MAX709R/S/T only				0.3	V
	I_{SINK} = 3.2mA, V_{CC} = reset threshold min, MAX709L/M only				0.4	
	I_{SINK} = 50µA, V_{CC} ≥ 1.0V, MAX709_C				0.3	
	I_{SINK} = 100µA, V_{CC} ≥ 1.2V, MAX709_E				0.4	
	I_{SOURCE} = 500µA, V_{CC} ≥ reset threshold max, MAX709R/S/T only		0.8 x V_{CC}			
	I_{SOURCE} = 800µA, V_{CC} ≥ reset threshold max, MAX709L/M only		V_{CC} - 1.5			

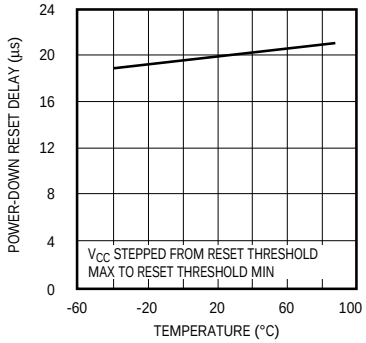
Note 1: Supply current is measured with V_{CC} = 3.6V for MAX709R/S/T, and V_{CC} = 5.5V for all versions.

Typical Operating Characteristics

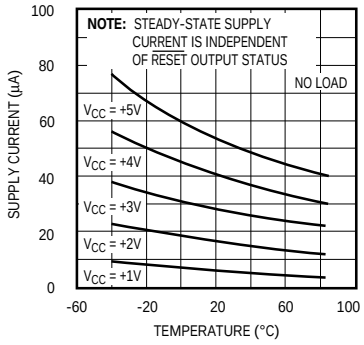
POWER-UP RESET DELAY vs. TEMPERATURE



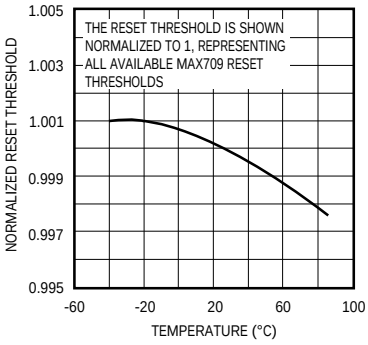
POWER-DOWN RESET DELAY vs. TEMPERATURE



SUPPLY CURRENT vs. TEMPERATURE



NORMALIZED RESET THRESHOLD vs. TEMPERATURE



Power-Supply Monitor with Reset

Pin Description

PIN	NAME	FUNCTION
1, 4, 5, 6, 8	N.C.	No Connect. There is no internal connection to this pin.
2	V_{CC}	+5V, +3.3V, or +3V Supply Voltage
3	GND	Ground
7	$\overline{RESET}$	Reset Output remains low while V_{CC} is below the reset threshold, and for 280ms after V_{CC} rises above the reset threshold.

Applications Information

Negative-Going V_{CC} Transients

In addition to issuing a reset to the microprocessor (µP) during power-up, power-down, and brownout conditions, the MAX709 is relatively immune to short duration negative-going V_{CC} transients (glitches).

Figure 1 shows typical transient duration vs. reset comparator overdrive, for which the MAX709 does not generate a reset pulse. The graph was generated using a negative-going pulse applied to V_{CC}, starting 1.5V above the actual reset threshold and ending below it by the magnitude indicated (reset comparator overdrive). The graph indicates the typical maximum pulse width that a negative-going V_{CC} 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, for the MAX709L/MAX709M, a V_{CC} transient that goes 100mV below the reset threshold and lasts 40µs or less will not cause a reset pulse to be issued.

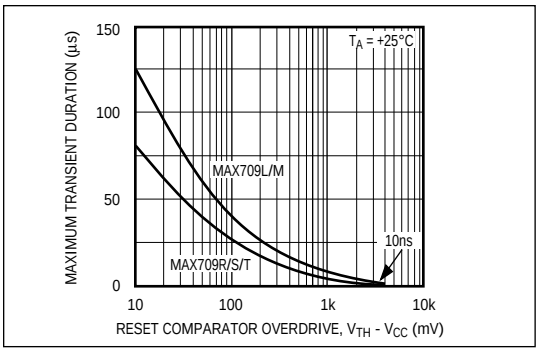


Figure 1. Maximum Transient Duration without Causing a Reset Pulse vs. Reset Comparator Overdrive

A 0.1µF bypass capacitor mounted as close as possible to pin 2 (V_{CC}) provides additional transient immunity.

Ensuring a Valid $\overline{RESET}$ Output Down to V_{CC} = 0V

When V_{CC} falls below 1V, the MAX709 $\overline{RESET}$ output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to the $\overline{RESET}$ output can drift to undermined voltages. This presents no problem in most applications, since most µP and other circuitry is inoperative with V_{CC} below 1V. However, in applications where the $\overline{RESET}$ output must be valid down to 0V, adding a pull-down resistor to the $\overline{RESET}$ pin will cause any stray leakage currents to flow to ground, holding $\overline{RESET}$ low (see Figure 2). The resistance value of R1 is not critical. It should be about 100kΩ, which is large enough not to load $\overline{RESET}$ and small enough to pull $\overline{RESET}$ to ground.

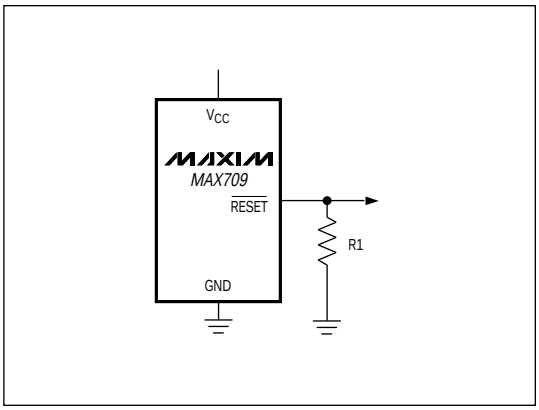


Figure 2. $\overline{RESET}$ Valid to V_{CC} = Ground Circuit

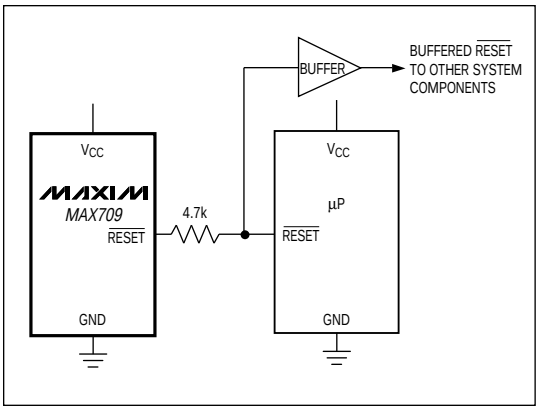


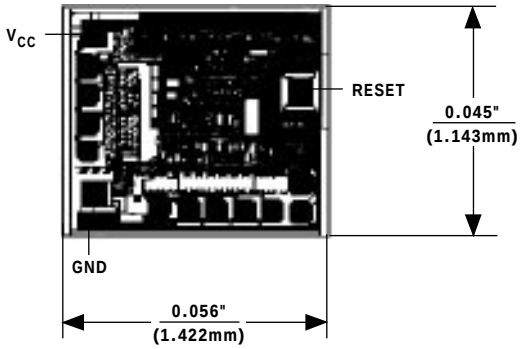
Figure 3. Interfacing to µPs with Bidirectional Reset I/O

Interfacing to µPs with Bidirectional Reset Pins

Microprocessors with bidirectional reset pins (such as the Motorola 68HC11 series) can contend with the MAX709 reset output. If, for example the MAX709 $\overline{RESET}$ output is asserted high and the µP wants to pull it low, indeterminate logic levels may result. To correct this, connect a 4.7kΩ resistor between the MAX709 $\overline{RESET}$ output and the µP reset I/O (see Figure 3). Buffer the MAX709 $\overline{RESET}$ output to other system components.

Part Number	Nominal Reset Threshold (V)	Minimum Reset Pulse Width (ms)	Nominal Watchdog Timeout Period (sec)	Backup-Battery Switch	$\overline{CE}$ - Write Protect	Power-Fail Comparator	Manual-Reset Input	Watchdog Output	Low-Line Output	Active-High Reset	Battery-On Output
MAX690A/692A	4.65/4.40	140	1.6	✔		✔					
MAX691A/693A	4.65/4.40	140/adj.	1.6/adj.	✔	✔/10ns	✔		✔	✔	✔	✔
MAX696	Adj.	35/adj.	1.6/adj.	✔		✔		✔	✔	✔	✔
MAX697	Adj.	35/adj.	1.6/adj.		✔	✔		✔	✔	✔	
MAX700	4.65/adj.	200	-				✔			✔	
MAX703/704	4.65/4.40	140	-	✔		✔	✔				
MAX705/706	4.65/4.40	140	1.6			✔	✔	✔			
MAX706P	2.63	140	1.6			✔	✔	✔		✔	
MAX706R/S/T	2.63/2.93/3.08	140	1.6			✔	✔	✔			
MAX707/708	4.65/4.40	140	-			✔	✔			✔	
MAX708R/S/T	2.63/2.93/3.08	140	-			✔	✔			✔	
MAX709L/M/R/S/T	4.65/4.40/2.63/2.93/3.08	140	-								
MAX791	4.65	140	1	✔	✔/10ns	✔	✔	✔	✔	✔	✔
MAX792L/M/R/S/T	4.65/4.40/2.63/2.93/3.08	140	1		✔/10ns	✔	✔	✔	✔	✔	
MAX800L/M	4.60/4.40	140	1.6/adj.	✔	✔/10ns	✔/±2%		✔	✔	✔	✔
MAX802L/M	4.60/4.40	140	1.6	✔		✔/±2%					
MAX805L	4.65	140	1.6	✔		✔				✔	
MAX813L	4.65	140	1.6			✔	✔	✔		✔	
MAX820L/M/R/S/T	4.65/4.40/2.63/2.93/3.08	140	1		✔/10ns	✔/±2%	✔	✔	✔	✔	
MAX1232	4.37/4.62	250	0.15/0.60/1.2				✔				
MAX1259	-	-	-	✔		✔					

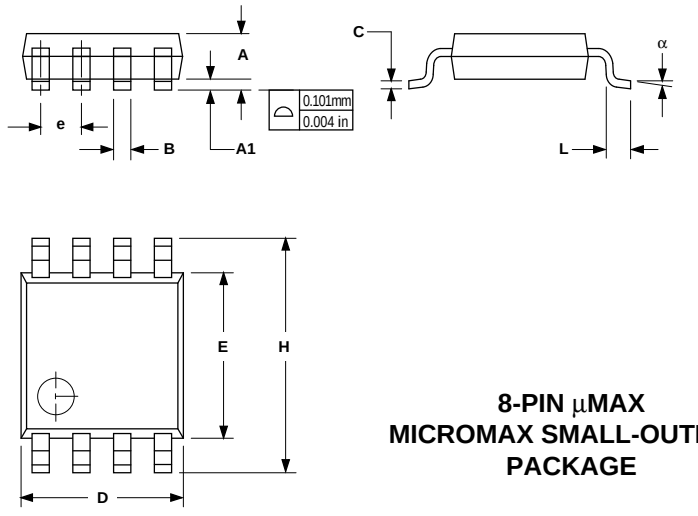
Chip Topography



TRANSISTOR COUNT: 380

SUBSTRATE CONNECTED TO V_{CC}

Package Information

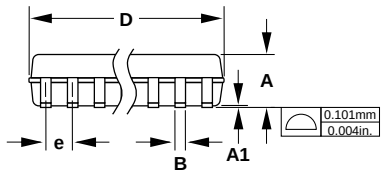


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.036	0.044	0.91	1.11
A1	0.004	0.008	0.10	0.20
B	0.010	0.014	0.25	0.36
C	0.005	0.007	0.13	0.18
D	0.116	0.120	2.95	3.05
E	0.116	0.120	2.95	3.05
e	0.0256		0.65	
H	0.188	0.198	4.78	5.03
L	0.016	0.026	0.41	0.66
α	0°	6°	0°	6°

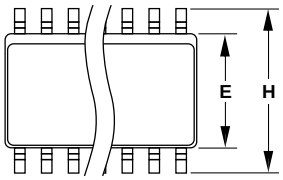
21-0036D

8-PIN μMAX
MICROMAX SMALL-OUTLINE
PACKAGE

Package Information (continued)



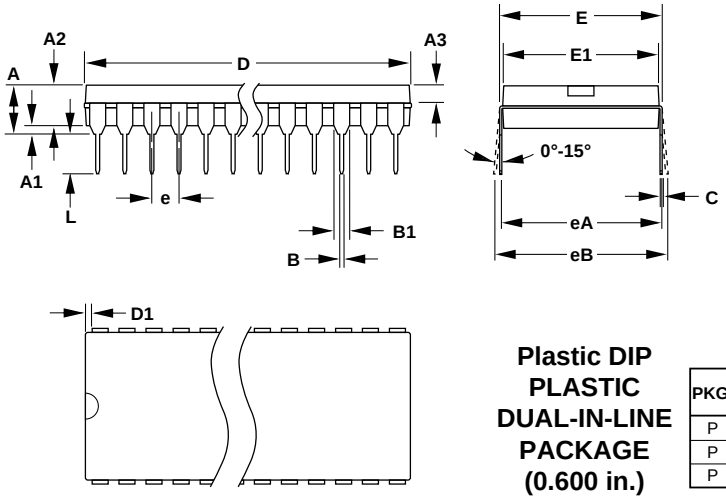
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
E	0.150	0.157	3.80	4.00
e	0.050		1.27	
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27



Narrow SO SMALL-OUTLINE PACKAGE (0.150 in.)

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	8	0.189	0.197	4.80	5.00
D	14	0.337	0.344	8.55	8.75
D	16	0.386	0.394	9.80	10.00

21-0041A



Plastic DIP PLASTIC DUAL-IN-LINE PACKAGE (0.600 in.)

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	–	0.200	–	5.08
A1	0.015	–	0.38	–
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.016	0.020	0.41	0.51
B1	0.045	0.065	1.14	1.65
C	0.008	0.012	0.20	0.30
D1	0.050	0.090	1.27	2.29
E	0.600	0.625	15.24	15.88
E1	0.525	0.575	13.34	14.61
e	0.100	–	2.54	–
eA	0.600	–	15.24	–
eB	–	0.700	–	17.78
L	0.120	0.150	3.05	3.81

PKG.	DIM	PINS	INCHES		MILLIMETERS	
			MIN	MAX	MIN	MAX
P	D	24	1.230	1.270	31.24	32.26
P	D	28	1.430	1.470	36.32	37.34
P	D	40	2.025	2.075	51.44	52.71

21-0044A

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