



Microprocessor and Non-Volatile Memory Supervisory Circuits

MAX792/MAX820

General Description

The MAX792/MAX820 microprocessor (μ P) supervisory circuits provide the most functions for power-supply and watchdog monitoring in systems without battery backup. Built-in features include the following:

- 1) μ P reset: Assertion of RESET and $\overline{\text{RESET}}$ outputs during power-up, power-down, and brownout conditions. $\overline{\text{RESET}}$ is guaranteed valid for V_{CC} down to 1V.
- 2) Manual-reset input.
- 3) Two-stage power-fail warning: A separate low-line comparator compares V_{CC} to a preset threshold 120mV above the reset threshold; the low-line and reset thresholds can be programmed externally.
- 4) Watchdog fault output: Assertion of WDO if the watchdog input is not toggled within a preset timeout period.
- 5) Pulsed watchdog output: Advance warning of impending WDO assertion from watchdog timeout that causes hardware shutdown.
- 6) Write protection of CMOS RAM, EEPROM, or other memory devices.

The MAX792 and MAX820 are identical, except the MAX820 guarantees higher low-line and reset threshold accuracy ($\pm 2\%$).

Applications

- Computers
- Controllers
- Intelligent Instruments
- Critical μ P Power Monitoring

Features

- ◆ Manual-Reset Input
- ◆ 200ms Power OK/Reset Time Delay
- ◆ Independent Watchdog Timer—Preset or Adjustable
- ◆ On-Board Gating of Chip-Enable Signals
- ◆ Memory Write-Cycle Completion
- ◆ 10ns (max) Chip-Enable Gate Propagation Delay
- ◆ Voltage Monitor for Overvoltage Warning
- ◆ $\pm 2\%$ Reset and Low-Line Threshold Accuracy (MAX820, external programming mode)

Ordering Information

PART**	TEMP. RANGE	PIN-PACKAGE
MAX792_CPE	0°C to +70°C	16 Plastic DIP
MAX792_CSE	0°C to +70°C	16 Narrow SO
MAX792_C/D	0°C to +70°C	Dice*

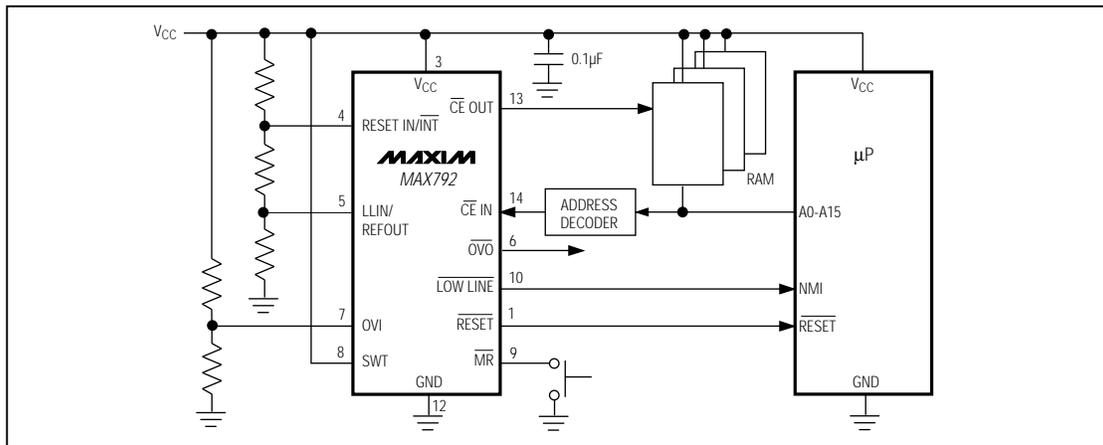
Ordering Information continued on last page.

* Dice are tested at $T_A = +25^\circ\text{C}$, DC parameters only.

**These parts offer 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.

SUFFIX	RESET THRESHOLD (V)
L	4.62
M	4.37
T	3.06
S	2.91
R	2.61

Typical Operating Circuit



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ABSOLUTE MAXIMUM RATINGS

Input Voltage (with respect to GND)	
V _{CC}	-0.3V to +6V
All Other Inputs	-0.3V to (V _{CC} + 0.3V)
Input Current	
GND	25mA
All Other Outputs	25mA
Continuous Power Dissipation (T _A = +70°C)	
Plastic DIP (derate 10.53mW/°C above +70°C)	842mW
Narrow SO (derate 9.52mW/°C above +70°C)	762mW
CERDIP (derate 10.00mW/°C above +70°C)	800mW

Operating Temperature Ranges:	
MAX792_C_/MAX820_C_	0°C to +70°C
MAX792_E_/MAX820_E_	-40°C to +85°C
MAX792_MJE_/MAX820_MJE_	-55°C to +125°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} = 2.55V to 5.5V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Voltage Range		2.55			V
Supply Current			70	150	μA
RESET COMPARATOR					
Reset Threshold Voltage— Internal Threshold Mode (V _{TH})	MAX792L, MAX820L	4.50	4.62	4.75	V
	MAX792M, MAX820M	4.25	4.37	4.50	
	MAX792R, MAX820R	2.55	2.61	2.70	
	MAX792S, MAX820S	2.85	2.91	3.00	
	MAX792T, MAX820T	3.00	3.06	3.15	
	MAX820L, T _A = +25°C, V _{CC} falling	4.55		4.70	
	MAX820M, T _A = +25°C, V _{CC} falling	4.30		4.45	
	MAX820R, T _A = +25°C, V _{CC} falling	2.55		2.66	
	MAX820S, T _A = +25°C, V _{CC} falling	2.85		2.96	
	MAX820T, T _A = +25°C, V _{CC} falling	3.00		3.11	
Reset Threshold Voltage External Threshold Mode (V _{TH})	MAX792, V _{CC} = 5V or V _{CC} = 3V	1.25	1.30	1.35	V
	MAX820, V _{CC} = 5V or V _{CC} = 3V	1.274	1.30	1.326	
RESET IN/INT Mode Threshold (Note 1)	Internal threshold mode			60	mV
RESET IN/INT Leakage Current			±0.01	±25	nA
Reset Threshold Hysteresis			0.016 x V _{TH}		V
Reset Comparator Delay	V _{CC} falling		70		μs
Reset Active Timeout Period	V _{CC} rising	140	200	280	ms
RESET Output Voltage	I _{SINK} = 50μA, V _{CC} = 1V, V _{CC} falling		0.01	0.3	V
	I _{SINK} = 1.6mA		0.1	0.4	
	I _{SOURCE} = 1mA		V _{CC} - 1		
	I _{SOURCE} = 100μA		V _{CC} - 0.5		
RESET Output Voltage	I _{SINK} = 1.6mA		0.1	0.4	V
	I _{SOURCE} = 1mA		V _{CC} - 1		
	I _{SOURCE} = 100μA		V _{CC} - 0.5		

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ELECTRICAL CHARACTERISTICS (continued)

($V_{CC} = 2.55V$ to $5.5V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
LOW-LINE COMPARATOR					
Low-Line Threshold Voltage (Internal Threshold Mode)— V_{TH}	MAX792/MAX820L/M	50	120	200	mV
	MAX792/MAX820R/S/T	40	100	200	
Low-Line Threshold Voltage (External Programming Mode)	MAX792, $V_{CC} = 5V$ OR $V_{CC} = 3V$	1.25	1.30	1.35	V
	MAX820, $V_{CC} = 5V$ OR $V_{CC} = 3V$	1.274	1.30	1.326	
Low-Line Hysteresis (Internal Threshold Mode)			20		mV
LLIN/REFOUT Leakage Current External Programming Mode			± 0.01	± 25	nA
Low-Line Comparator Delay	V_{CC} falling		450		μs
LOWLINE Voltage	$I_{SINK} = 3.2mA$			0.4	V
	$I_{SOURCE} = 1\mu A$	$V_{CC} - 1$			
LOWLINE Short-Circuit Current	Output source current, $V_{CC} = 5.5V$		10	50	μA
WATCHDOG FUNCTION					
Watchdog Timeout Period	SWT connected to V_{CC} , $V_{CC} = 5V$	1.00	1.60	2.25	sec
	SWT connected to V_{CC} , $V_{CC} = 3V$	1.00	1.60	2.25	
	4.7nF capacitor connected from SWT to GND, $V_{CC} = 3V$		70		ms
	4.7nF capacitor connected from SWT to GND, $V_{CC} = 5V$		100		
Watchdog Input Pulse Width	$V_{IL} = 0V$, $V_{IH} = V_{CC}$	$V_{CC} = 3V$	100		ns
		$V_{CC} = 5V$	300		
WDO Output Voltage	$I_{SINK} = 50\mu A$, $V_{CC} = 1V$, V_{CC} falling		0.01	0.30	V
	$I_{SINK} = 1.6mA$		0.1	0.4	
	$I_{SOURCE} = 1mA$	$V_{CC} - 1$			
	$I_{SOURCE} = 100\mu A$	$V_{CC} - 0.5$			
WDPO to WDO Delay			70		ns
WDPO Duration		0.5	1.7	6.0	ms
WDPO Output Voltage	$I_{SINK} = 50\mu A$, $V_{CC} = 1V$, V_{CC} falling		0.01	0.3	V
	$I_{SINK} = 1.6mA$		0.1	0.4	
	$I_{SOURCE} = 1mA$	$V_{CC} - 1$			
	$I_{SOURCE} = 100\mu A$	$V_{CC} - 0.5$			
WDI Threshold Voltage	$V_{CC} = 4.25V$	V_{IH}	$0.75 \times V_{CC}$		V
		V_{IL}	0.8		
	$V_{CC} = 2.55V$	V_{IH}	$0.9 \times V_{CC}$		
		V_{IL}	0.2		
WDI Input Current				± 1	μA

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ELECTRICAL CHARACTERISTICS (continued)

($V_{CC} = 2.55V$ to $5.5V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
OVERVOLTAGE COMPARATOR						
OVI Input Threshold	$V_{CC} = 5V$ or $V_{CC} = 3V$		1.25	1.30	1.35	V
OVI Leakage Current				±0.01	±25	nA
OVO Output Voltage	$I_{SINK} = 3.2mA$					V
	$I_{SOURCE} = 1\mu A$		$V_{CC} - 1$			
OVO Short-Circuit Current	Output source current, $V_{CC} = 5.5V$			10	50	μA
OVI to OVO Delay	$V_{OD} = 100mV$, OVI rising					μs
	$V_{OD} = 100mV$, OVI falling		55			
CHIP-ENABLE GATING						
CE IN Threshold Voltage	$V_{CC} = 4.25V$	V_{IH}	$0.75 \times V_{CC}$			V
		V_{IL}			0.8	
	$V_{CC} = 2.55V$	V_{IH}	$0.75 \times V_{CC}$			
		V_{IL}			0.2	
CE IN Leakage Current	Disabled mode			±0.005	±1	μA
CE IN to CE OUT Resistance	Enabled mode	$V_{CC} = 5V$		75	150	Ω
		$V_{CC} = 3V$		150	300	
CE OUT Short-Circuit Current	Disabled mode, $\overline{CE}_{OUT} = 0V$	$V_{CC} = 5V$		0.5	2.5	mA
		$V_{CC} = 3V$		0.05	0.2	
Chip-Enable Propagation Delay (Note 2)	50Ω source impedance driver, $C_{LOAD} = 50pF$	$V_{CC} = 5V$		6	10	ns
		$V_{CC} = 3V$		8	13	
Chip-Enable Output Voltage High (Reset Active)	$I_{OUT} = -100\mu A$		$V_{CC} - 1$			V
	$I_{OUT} = 10\mu A$		$V_{CC} - 0.5$			
Reset Active to CE OUT High	V_{CC} falling					15
MANUAL RESET						
MR Minimum Pulse Width			25			μs
MR to RESET Propagation Delay			12			μs
MR Threshold Range			1.1	1.3	1.5	V
MR Pull-Up Current	MR = 0V	$V_{CC} = 4.25V$ to $V_{CC} = 5.5V$	5	23	80	μA
		$V_{CC} = 2.5V$	1			

Note 1: Pulling RESET IN/ \overline{INT} below 60mV selects internal threshold mode and connects the internal voltage divider to the reset and low-line comparators. External programming mode allows an external resistor divider to set the low-line and reset thresholds (see Figure 4).

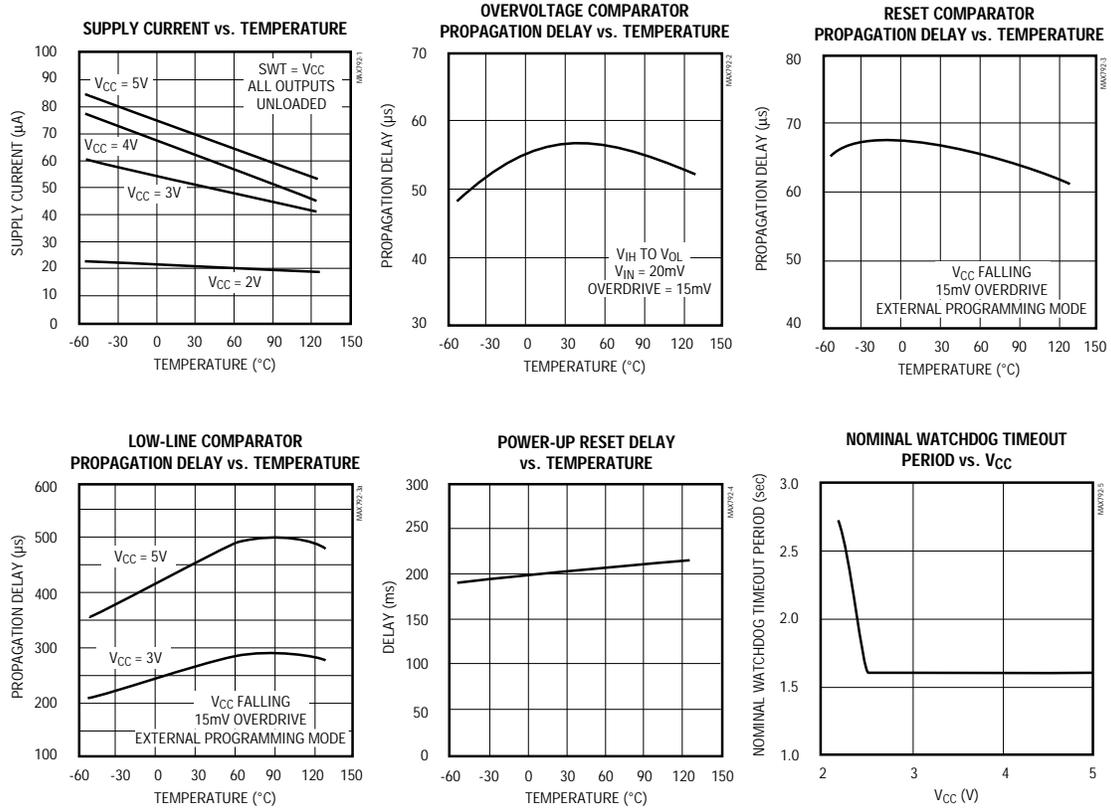
Note 2: The Chip-Enable Propagation delay is measured from the 50% point at \overline{CE} IN to the 50% point at \overline{CE} OUT.

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Typical Operating Characteristics

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

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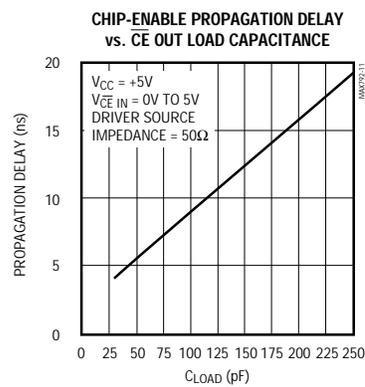
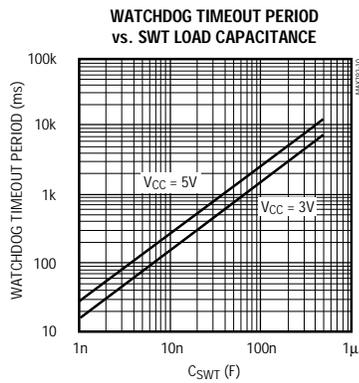
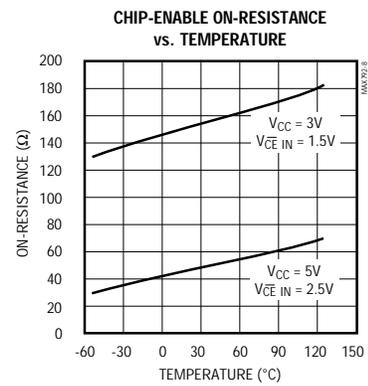
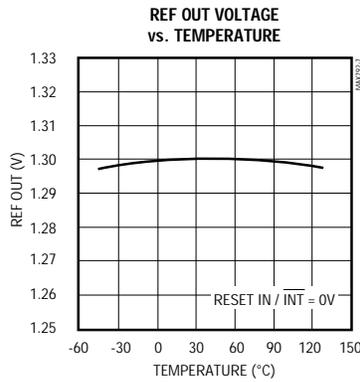
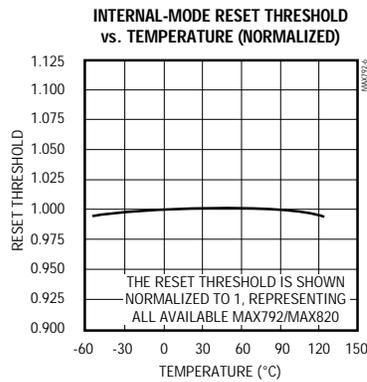


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MAX792/MAX820

Typical Operating Characteristics (continued)

(T_A = +25°C, unless otherwise noted.)



Microprocessor and Non-Volatile Memory Supervisory Circuits

Pin Description

MAX792/MAX820

PIN	NAME	FUNCTION
1	RESET	Active-Low Reset Output goes low whenever V_{CC} falls below the reset threshold in internal threshold programming mode, or RESET IN falls below 1.30V in external threshold programming mode. RESET remains low for 200ms typ after the threshold is exceeded on power-up.
2	RESET	Reset is the inverse of RESET.
3	V_{CC}	Input Supply Voltage
4	RESET IN/INT	Reset-Input/Internal-Mode Select. Connect this input to GND to select internal threshold mode. Select external programming mode by pulling this input 600mV or higher through an external voltage divider.
5	LLIN/REF OUT	Low-Line Input/Reference Output connects directly to the low-line comparator in external programming mode (RESET IN/INT \geq 600mV). Connects directly to the internal 1.30V reference in internal threshold mode (RESET IN/INT \leq 60mV).
6	OVO	Overvoltage Comparator Output goes low when OVI is greater than 1.30V. This is an uncommitted comparator and has no effect on any other internal circuitry.
7	OVI	Inverting Input to the Overvoltage Comparator. When OVI is greater than 1.30V, OVO goes low. Connect OVI to GND or V_{CC} when not used.
8	SWT	Set Watchdog-Timeout Input. Connect this input to V_{CC} to select the default 1.6sec watchdog timeout period. Connect a capacitor between this input and GND to select another watchdog-timeout period. Watchdog timeout period = k x (capacitor value in nF)mV, where k = 27 for V_{CC} = 5V and k = 16.2 for V_{CC} = 3V. If the watchdog function is unused, connect SWT to V_{CC} .
9	MR	Manual-Reset Input. This input can be tied to an external momentary pushbutton switch, or to a logic gate output. Internally pulled up to V_{CC} .
10	LOW LINE	Low-Line Output. LOW LINE goes low 120mV above the reset threshold in internal threshold mode, or when LLIN/REFOUT goes below 1.30V in external programming mode.
11	WDI	Watchdog Input. If WDI remains either high or low for longer than the watchdog timeout period, WDPO pulses low and WDO goes low. WDO remains low until the next transition at WDI. Connect to GND or V_{CC} if unused.
12	GND	Ground
13	CE OUT	Chip-Enable Output. CE OUT goes low only when CE IN is low and reset is not asserted. If CE IN is low when reset is asserted, CE OUT will stay low for 15 μ s or until CE IN goes high, whichever occurs first.
14	CE IN	Chip-Enable Input—the input to the chip-enable transmission gate. Connect to GND or V_{CC} if not used.
15	WDO	Watchdog Output. WDO goes low if WDI remains either high or low longer than the watchdog timeout period. WDO returns high on the next transition at WDI.
16	WDPO	Watchdog-Pulse Output. Upon the absence of a transition at WDI, WDPO will pulse low for a minimum of 500 μ s. WDPO precedes WDO by typically 70ns.

Microprocessor and Non-Volatile Memory Supervisory Circuits

Detailed Description

Manual-Reset Input

Many μP -based products require manual-reset capability, allowing the operator to initiate a reset. The manual/external-reset input ($\overline{\text{MR}}$) can connect directly to a switch without an external pull-up resistor or debouncing network. $\overline{\text{MR}}$ internally connects to a 1.30V comparator, and has a high-impedance pull-up to V_{CC} , as shown in Figure 1. The propagation delay from asserting $\overline{\text{MR}}$ to reset asserted is typically 12 μs . Pulsing $\overline{\text{MR}}$ low for a minimum of 25 μs asserts the reset function (see *Reset Function* section). The reset output remains active as long as $\overline{\text{MR}}$ is held low, and the reset timeout period begins after $\overline{\text{MR}}$ returns high (Figure 2). To provide extra noise immunity in high-noise environments, pull $\overline{\text{MR}}$ up to V_{CC} with a 100k Ω resistor.

Use $\overline{\text{MR}}$ as either a digital logic input or as a second low-line comparator. Normal TTL/CMOS levels can be wire-OR connected via pull-down diodes (Figure 3), and open-drain/collector outputs can be wire-ORed directly.

Monitoring the Regulated Supply

The MAX792/MAX820 offer two modes for monitoring the regulated supply and providing reset and non-maskable interrupt (NMI) signals to the μP : internal threshold mode uses the factory preset low-line and reset thresholds, and external programming mode allows the low-line and reset thresholds to be programmed externally using a resistor voltage divider (Figure 4).

Internal Threshold Mode

Connecting the reset-input/internal-mode select pin (RESET IN/INT) to ground selects internal threshold mode (Figure 4a). In this mode, the low-line and reset thresholds are factory preset by an internal voltage divider (Figure 1) to the threshold voltages specified in the *Electrical Characteristics* (Reset Threshold Voltage and Low-Line Threshold Voltage). Connect the low-line output ($\overline{\text{LOWLINE}}$) to the μP NMI pin, and connect the active-high reset output (RESET) or active-low reset output ($\overline{\text{RESET}}$) to the μP reset input pin.

Additionally, the low-line input/reference-output pin (LLIN/REFOUT) connects to the internal 1.30V reference in internal threshold mode. Buffer LLIN/REFOUT with a high-impedance buffer to use it with external circuitry. In this mode, when V_{CC} is falling, $\overline{\text{LOWLINE}}$ is guaranteed to be asserted prior to reset assertion.

External Programming Mode

Connecting RESET IN/INT to a voltage above 600mV selects external programming mode. In this mode, the low-line and reset comparators disconnect from the internal voltage divider and connect to LLIN/REFOUT and RESET IN/INT, respectively (Figure 1). This mode allows flexibility in determining where in the operating voltage range the NMI and reset are generated. Set the low-line and reset thresholds with an external resistor divider, as in Figure 4b or Figure 4c. RESET typically remains valid for V_{CC} down to 2.5V; $\overline{\text{RESET}}$ is guaranteed to be valid with V_{CC} down to 1V.

Calculate the values for the resistor voltage divider in Figure 4b using the following equations:

- 1) $R3 = (1.30 \times V_{\text{CC MAX}}) / (V_{\text{LOW LINE}} \times I_{\text{MAX}})$
- 2) $R2 = [(1.30 \times V_{\text{CC MAX}}) / (V_{\text{RESET}} \times I_{\text{MAX}})] - R3$
- 3) $R1 = (V_{\text{CC MAX}} / I_{\text{MAX}}) - (R2 + R3)$.

First choose the desired maximum current through the voltage divider (I_{MAX}) when V_{CC} is at its highest ($V_{\text{CC MAX}}$). There are two things to consider here. First, I_{MAX} contributes to the overall supply current for the circuit, so you would generally make it as small as possible. Second, I_{MAX} cannot be too small or leakage currents will adversely affect the programmed threshold voltages; 5 μA is often appropriate. Determine R3 after you have chosen I_{MAX} . Use the value for R3 to determine R2, then use both R2 and R3 to determine R1.

For example, to program a 4.75V low-line threshold and a 4.4V reset threshold, first choose I_{MAX} to be 5 μA when $V_{\text{CC}} = 5.5\text{V}$ and substitute into equation 1.

$$R3 = (1.30 \times 5.5) / (4.75 \times 5\text{E-}6) = 301.05\text{k}\Omega.$$

301k Ω is the nearest standard 0.1% value. Substitute into equation 2:

$$R2 = [(1.30 \times 5.5) / (4.4 \times 5\text{E-}6)] - 301\text{k}\Omega = 23.95\text{k}\Omega.$$

The nearest 0.1% resistor value is 23.7k Ω . Finally, substitute into equation 3:

$$R1 = (5.5/5\text{E-}6) - (23.7\text{k}\Omega + 301\text{k}\Omega) = 775\text{k}\Omega.$$

The nearest 0.1% value resistor is 787k Ω . Determine the actual low-line threshold by rearranging equation 1 and plugging in the standard resistor values. The actual low-line threshold is 4.75V and the actual reset threshold is 4.40V. An additional resistor allows the MAX792/MAX820 to monitor the unregulated supply and provide an NMI before the regulated supply begins to fall (Figure 4c).

Both of these thresholds will vary from circuit to circuit with resistor tolerance, reference variation, and comparator offset variation. The initial thresholds for each circuit will also vary with temperature due to reference and offset drift. For highest accuracy, use the MAX820.

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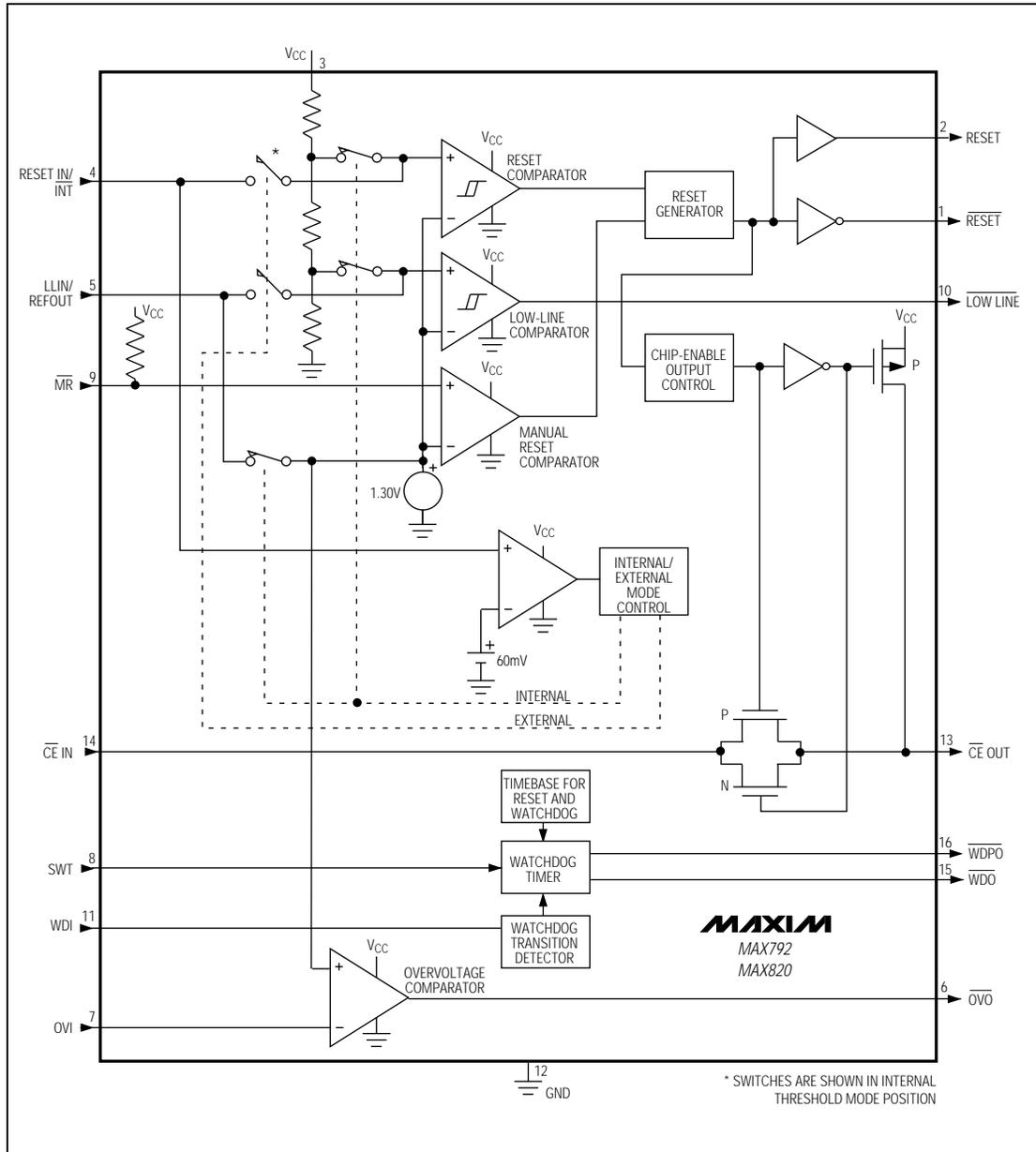


Figure 1. Block Diagram

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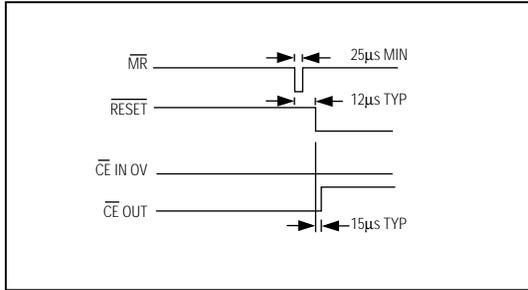


Figure 2. Manual-Reset Timing Diagram

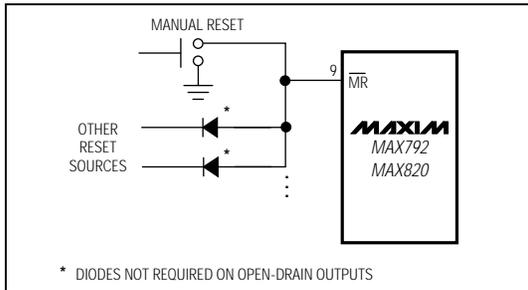


Figure 3. Diode "OR" connections allow multiple reset sources to connect to MR.

Low-Line Output

In internal threshold mode, the low-line comparator monitors V_{CC} with a threshold voltage typically 120mV above the reset threshold, and with 15mV of hysteresis. For normal operation (V_{CC} above the reset threshold), **LOWLINE** is pulled to V_{CC} . Use **LOWLINE** to provide an NMI to the μP , as described in the previous section, when V_{CC} begins to fall (Figure 4).

Reset Function

The MAX792/MAX820 provide both **RESET** and **RESET** outputs. The **RESET** and **RESET** outputs ensure that the μP powers up in a known state, and prevent code-execution errors during power-up, power-down, or brownout conditions.

The reset function will be asserted during the following conditions:

- 1) V_{CC} less than the programmed reset threshold.
- 2) **MR** less than 1.30V typ.
- 3) Reset remains asserted for 200ms typ after V_{CC} rises above the reset threshold or after **MR** has exceeded 1.30V typ.

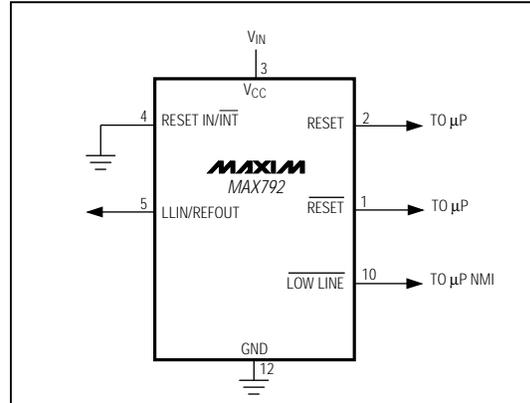


Figure 4a. Connection for Internal Threshold Mode

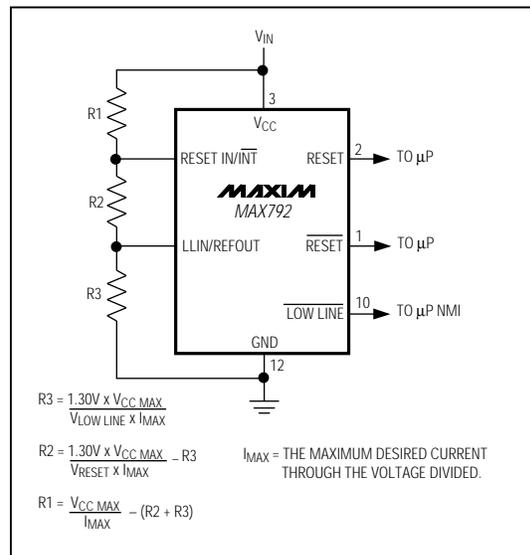


Figure 4b. Connection for External Threshold Programming Mode

When reset is asserted, all the internal counters are reset, the watchdog output (**WDO**) and watchdog-pulse output (**WDPO**) are set high, and the set watchdog-timeout input (**SWT**) is set to ($V_{CC} - 0.6V$) if it is not already connected to V_{CC} (for internal timeouts). The chip-enable transmission gate is also disabled while reset is asserted; the chip-enable input (**CE IN**) becomes high impedance and the chip-enable output (**CE OUT**) is pulled up to V_{CC} .

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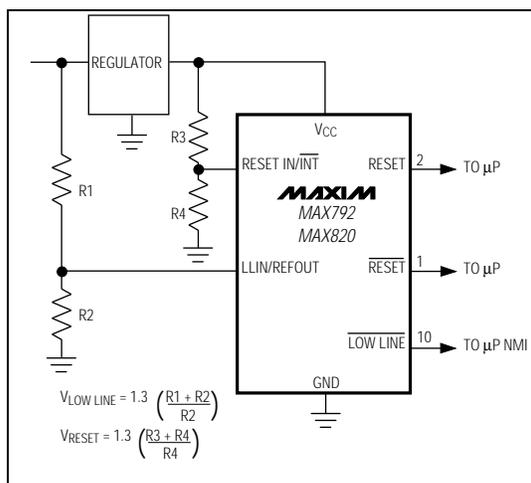


Figure 4c. Alternative connection for external programming mode

Reset Outputs (\overline{RESET} and \overline{RESET})

The \overline{RESET} output is active low and typically sinks 1.6mA at 0.1V. When deasserted, \overline{RESET} sources 1.6mA at typically $V_{CC} - 1.5V$. The \overline{RESET} output is the inverse of \overline{RESET} . \overline{RESET} is guaranteed to be valid down to $V_{CC} = 1V$, and an external 10kΩ pull-down resistor on \overline{RESET} ensures that it will be valid with V_{CC} down to GND (Figure 5). As V_{CC} goes below 1V, the gate drive to the \overline{RESET} output switch reduces accordingly, increasing the $r_{DS(ON)}$ and the saturation voltage. The 10kΩ pull-down resistor ensures that the parallel combination of switch plus resistor will be around 10kΩ and the saturation voltage will be below 0.4V while sinking 40μA. When using an external pull-down resistor of 10kΩ, the high state for the \overline{RESET} output with $V_{CC} = 4.75V$ is typically 4.60V.

Overvoltage Comparator

The overvoltage comparator is an uncommitted comparator that has no effect on the operation of other chip functions. Use this input to provide overvoltage indication by connecting a voltage divider from the input supply, as in Figure 6.

Connect OVI to ground if the overvoltage function is not used. \overline{OVO} goes low when OVI goes above 1.30V. With OVI below 1.30V, \overline{OVO} is actively pulled to V_{CC} and can source 1μA.

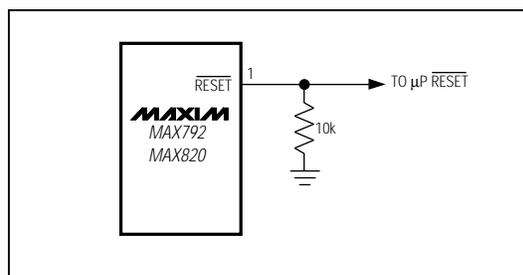


Figure 5. Adding an external pull-down resistor ensures \overline{RESET} is valid with V_{CC} down to GND.

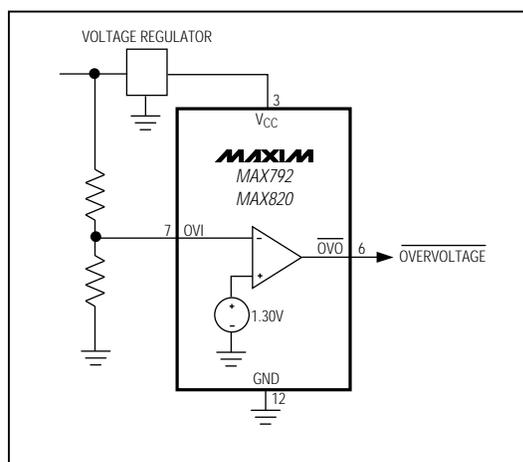


Figure 6. Detecting an Overvoltage Condition

Watchdog Function

The watchdog monitors μP activity via the watchdog input (WDI). If the μP becomes inactive, \overline{WDO} and \overline{WDPO} are asserted. To use the watchdog function, connect WDI to a μP bus line or I/O line. If WDI remains high or low for longer than the watchdog time-out period (1.6sec nominal), \overline{WDPO} and \overline{WDO} are asserted, indicating a software fault condition (see *Watchdog-Pulse Output* and *Watchdog Output* sections).

Watchdog Input

If the watchdog function is unused, connect WDI to V_{CC} or GND. A change of state (high-to-low, low-to-high, or a minimum 100ns pulse) at WDI during the watchdog period resets the watchdog timer. The watchdog timer

Microprocessor and Non-Volatile Memory Supervisory Circuits

MAX792/MAX820

Chip-Enable Signal Gating

The MAX792/MAX820 provide internal gating of chip-enable (CE) signals, which prevents erroneous data from corrupting CMOS RAM in the event of an under-voltage condition. The MAX792/MAX820 use a series transmission gate from $\overline{\text{CE}} \text{ IN}$ to $\overline{\text{CE}} \text{ OUT}$ (Figure 1).

During normal operation (reset not asserted), the CE transmission gate is enabled and passes all CE transitions. When reset is asserted, this path becomes disabled, preventing erroneous data from corrupting the CMOS RAM. The 10ns max CE propagation delay from $\overline{\text{CE}} \text{ IN}$ to $\overline{\text{CE}} \text{ OUT}$ enables the MAX792/MAX820 to be used with most μPs . If $\overline{\text{CE}} \text{ IN}$ is low when reset asserts, $\overline{\text{CE}} \text{ OUT}$ remains low for a short period to permit completion of the current write cycle.

Chip-Enable Input

The CE transmission gate is disabled and $\overline{\text{CE}} \text{ IN}$ is high impedance (disabled mode) while reset is asserted.

During a power-down sequence when V_{CC} passes the reset threshold, the CE transmission gate disables and $\overline{\text{CE}} \text{ IN}$ immediately becomes high impedance if the voltage at $\overline{\text{CE}} \text{ IN}$ is high. If $\overline{\text{CE}} \text{ IN}$ is low when reset is asserted, the CE transmission gate will disable at the moment $\overline{\text{CE}} \text{ IN}$ goes high or 15 μs after reset is asserted, whichever occurs first (Figure 9). This permits the current write cycle to complete during power-down.

During a power-up sequence, the CE transmission gate remains disabled and $\overline{\text{CE}} \text{ IN}$ remains high impedance regardless of $\overline{\text{CE}} \text{ IN}$ activity, until reset is deasserted following the reset timeout period.

While disabled, $\overline{\text{CE}} \text{ IN}$ is high impedance. When the CE transmission gate is enabled, the impedance of $\overline{\text{CE}} \text{ IN}$ will appear as a 75 Ω ($V_{\text{CC}} = 5\text{V}$) resistor in series with the load at $\overline{\text{CE}} \text{ OUT}$.

The propagation delay through the CE transmission gate depends on V_{CC} , the source impedance of the drive connected to $\overline{\text{CE}} \text{ IN}$, and the loading on $\overline{\text{CE}} \text{ OUT}$ (see the Chip-Enable Propagation Delay vs. $\overline{\text{CE}} \text{ OUT}$ Load Capacitance graph in the *Typical Operating Characteristics*). The CE propagation delay is production tested from the 50% point on $\overline{\text{CE}} \text{ IN}$ to the 50% point on $\overline{\text{CE}} \text{ OUT}$ using a 50 Ω driver and 50pF of load capacitance (Figure 10). For minimum propagation delay, minimize the capacitive load at $\overline{\text{CE}} \text{ OUT}$, and use a low output impedance driver.

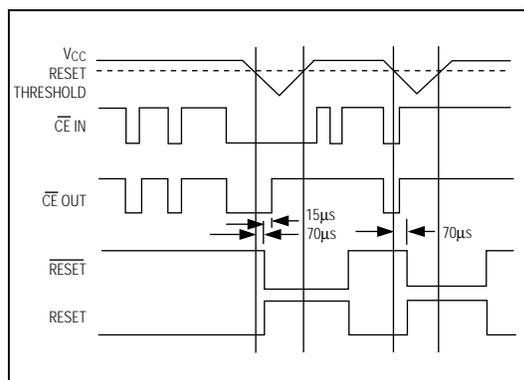


Figure 9. Reset and Chip-Enable Timing

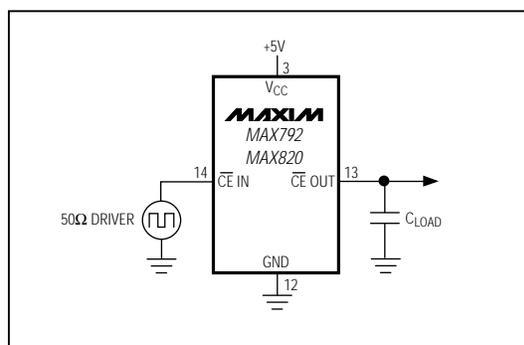


Figure 10. CE Propagation Delay Test Circuit

Chip-Enable Output

When the CE transmission gate is enabled, the impedance of $\overline{\text{CE}} \text{ OUT}$ is equivalent to 75 Ω in series with the source driving $\overline{\text{CE}} \text{ IN}$. In the disabled mode, the 75 Ω transmission gate is off and an active pull-up connects from $\overline{\text{CE}} \text{ OUT}$ to V_{CC} . This source turns off when the transmission gate is enabled.

Applications Information

Connect a 0.1 μF ceramic capacitor from V_{CC} to GND, as close to the device pins as possible. This reduces the probability of resets due to high-frequency power-supply transients. In a high-noise environment, additional bypass capacitance from V_{CC} to ground may be required. If long leads connect to the chip inputs, ensure that these lines are free from ringing, etc., which would forward bias the chip's protection diodes.

Microprocessor and Non-Volatile Memory Supervisory Circuits

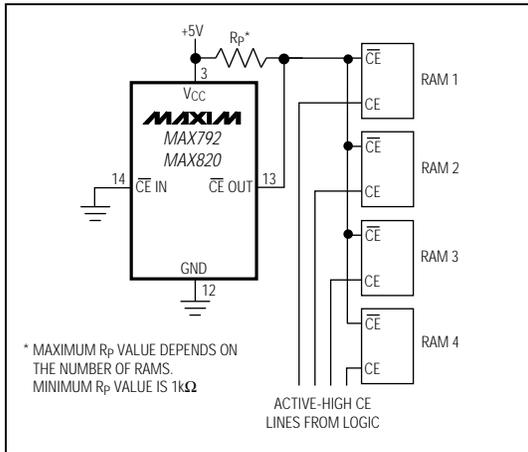


Figure 11. Alternate CE Gating

Alternative Chip-Enable Gating

Using memory devices with both CE and $\overline{\text{CE}}$ inputs allows the MAX792/MAX820 CE propagation delay to be bypassed. To do this, connect $\overline{\text{CE}}$ IN to ground, pull up CE OUT to V_{CC} , and connect CE OUT to the CE input of each memory device (Figure 11). The CE input of each memory device then connects directly to the chip-select logic, which does not have to be gated by the MAX792/MAX820.

Interfacing to μPs with Bidirectional Reset Inputs

μPs with bidirectional reset pins, such as the Motorola 68HC11 series, can contend with the MAX792/MAX820 RESET output. If, for example, the MAX792/MAX820 RESET output is asserted high and the μP wants to pull it low, indeterminate logic levels may result. To avoid this, connect a 4.7k Ω resistor between the MAX792/MAX820 RESET output and the μP reset I/O, as in Figure 12. Buffer the MAX792/MAX820 RESET output to other system components.

Negative-Going V_{CC} Transients

While issuing resets to the μP during power-up, power-down, and brownout conditions, these supervisors are relatively immune to short-duration negative-going V_{CC} transients (glitches). It is usually undesirable to reset the μP when V_{CC} experiences only small glitches.

Figure 13 shows maximum transient duration vs. reset-comparator overdrive, for which reset pulses are **not** generated. The graph was produced using negative-

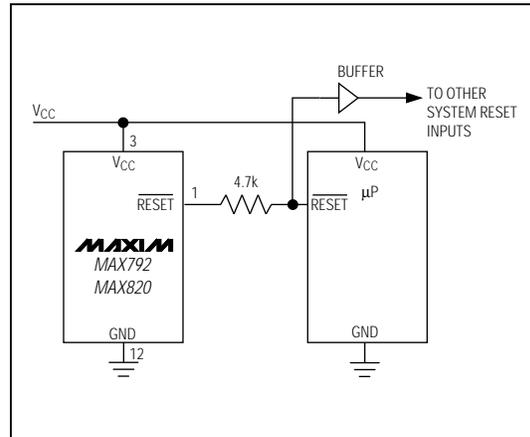


Figure 12. Interfacing to μPs with Bidirectional RESET Pins

going V_{CC} pulses, starting at 5V and ending below the reset threshold by the magnitude indicated (reset-comparator overdrive). The graph shows the maximum pulse width a negative-going V_{CC} transient may typically have without causing a reset pulse to be issued. As the amplitude of the transient increases (i.e., goes farther below the reset threshold), the maximum allowable pulse width decreases. Typically, a V_{CC} transient that goes 100mV below the reset threshold and lasts for 30 μs or less will not cause a reset pulse to be issued.

A 100nF bypass capacitor mounted close to the V_{CC} pin provides additional transient immunity.

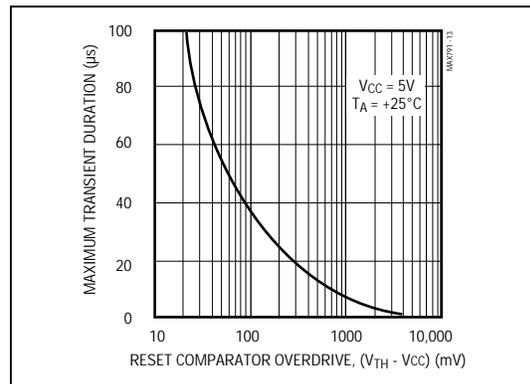


Figure 13. Maximum Transient Duration without Causing a Reset Pulse vs. Reset-Comparator Overdrive

Microprocessor and Non-Volatile Memory Supervisory Circuits

MAX792/MAX820

Ordering Information (continued)

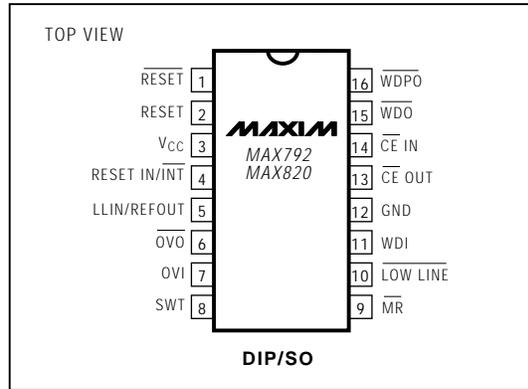
PART**	TEMP. RANGE	PIN-PACKAGE
MAX792_EPE	-40°C to +85°C	16 Plastic DIP
MAX792_ESE	-40°C to +85°C	16 Narrow SO
MAX792_EJE	-40°C to +85°C	16 CERDIP
MAX792_MJE	-55°C to +125°C	16 CERDIP
MAX820_CPE	-0°C to +70°C	16 Plastic DIP
MAX820_CSE	-0°C to +70°C	16 Narrow SO
MAX820_EPE	-40°C to +85°C	16 Plastic DIP
MAX820_ESE	-40°C to +85°C	16 Narrow SO
MAX820_EJE	-40°C to +85°C	16 CERDIP
MAX820_MJE	-55°C to +125°C	16 CERDIP

* Dice are tested at $T_A = +25^\circ\text{C}$.

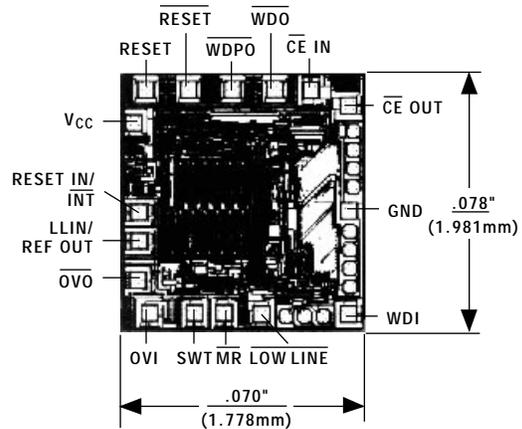
**These parts offer a choice of five different reset threshold voltages. Select the letter corresponding to the desired nominal reset threshold voltage and insert it into the blank to complete the part number.

SUFFIX	RESET THRESHOLD (V)
L	4.62
M	4.37
T	3.06
S	2.91
R	2.61

Pin Configuration



Chip Topography

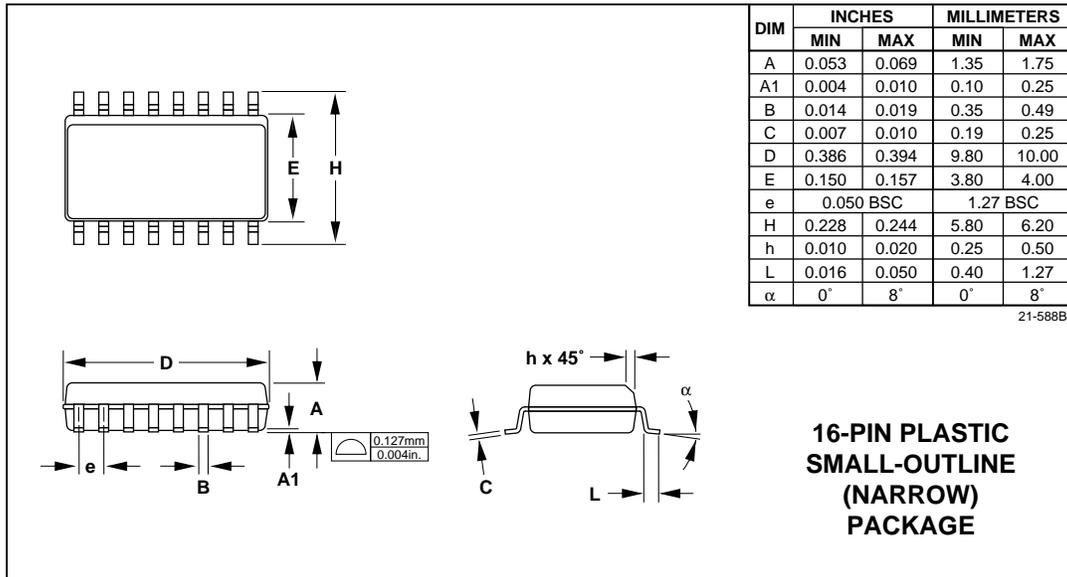
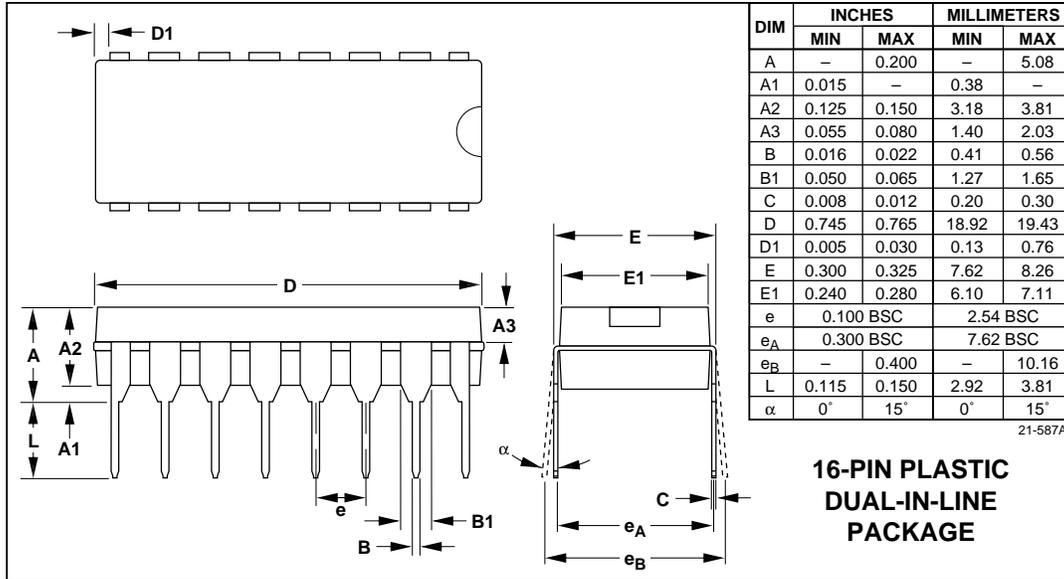


TRANSISTOR COUNT: 950;
SUBSTRATE CONNECTED TO V_{CC} .

Microprocessor and Non-Volatile Memory Supervisory Circuits

MAX792/MAX820

Package Information



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