

## Microprocessor Voltage Monitor with Manual Reset

### Features

- Precision monitoring of +3V, +3.3V, and +5V power-supply voltages
- Fully specified over temperature
- Available in two output configurations
  - Push-pull  $\overline{\text{RESET}}$  output (SS8039L)
  - Push-pull RESET output (SS8039H)
- Manual reset input
- Power-on reset pulse width of 140ms min
- Supply current of 5 $\mu$ A
- Guaranteed reset valid to  $V_{CC} = +1V$
- Power supply transient immunity
- No external components
- 4-Pin SOT-143 package

### Applications

- Computers
- Controllers
- Intelligent instruments
- Critical  $\mu$ P and  $\mu$ C power monitoring
- Portable / battery-powered equipment
- Automotive

**Compatible with the popular "811" series**

### General Description

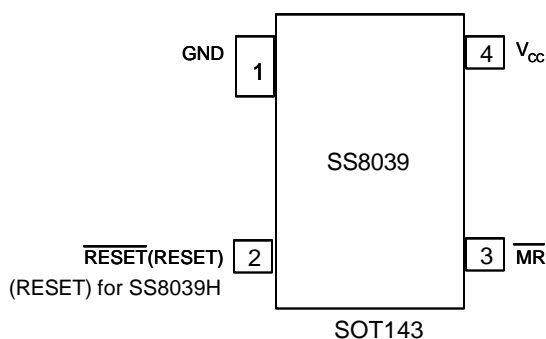
The SS8039 is a microprocessor ( $\mu$ P) supervisory circuit used to monitor the power supplies in  $\mu$ P and digital systems. It provides excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, +3.0V- powered circuits.

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

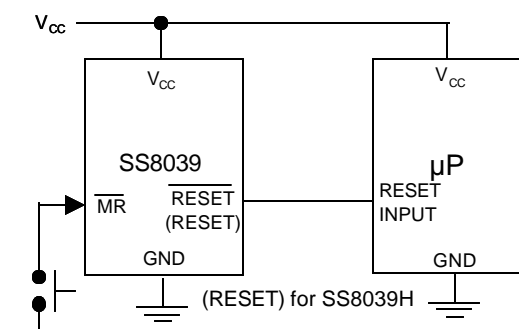
The SS8039 has a push-pull output stage. The SS8039L has an active-low  $\overline{\text{RESET}}$  output, while the SS8039H has an active-high RESET output. The reset comparator is designed to ignore fast transients on  $V_{CC}$ , and the outputs are guaranteed to be in the correct logic state for  $V_{CC}$  down to 1V.

Low supply current makes the SS8039 ideal for use in portable equipment, and it is available in a 4-pin SOT-143 package.

### Pin Configuration

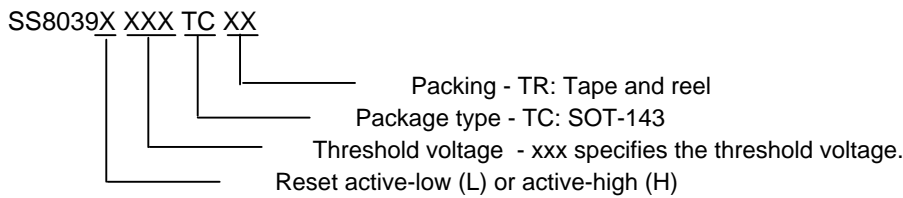


### Typical Application



## Ordering Information

Options are released to production as needed. Please check with Silicon Standard for availability.



Example: SS8039H263TCTR

SS8039 with push-pull active-high reset output at 2.63V in SOT-143 package supplied on tape and reel

## Absolute Maximum Ratings

Terminal voltages with respect to GND

$V_{CC}$ .....-0.3V to +6.0V  
 RESET,  $\overline{\text{RESET}}$  (push-pull).....-0.3V to ( $V_{CC}$  + 0.3V)  
 Input Current,  $V_{CC}$ .....20mA  
 Output Current, RESET,  $\overline{\text{RESET}}$  .....20mA

Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )  
 SOT-143 (derate 4mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ ).....320mW  
 Operating Temperature Range .....-40 $^\circ\text{C}$  to +105 $^\circ\text{C}$   
 Storage Temperature Range..... -65 $^\circ\text{C}$  to +150 $^\circ\text{C}$   
 Lead Temperature (soldering, 10s) .....+300 $^\circ\text{C}$

## Electrical Characteristics

( $V_{CC}$  = full range,  $T_A = -40^\circ\text{C}$  to  $+105^\circ\text{C}$ , unless otherwise noted. Typical values are at  $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$  for 463/438/400 versions,  $V_{CC} = 3.3\text{V}$  for 308/293 versions, and  $V_{CC} = 3\text{V}$  for 263 version.) (Note 1)

PARAMETER	SYMBOL	CONDITION		MIN	TYP	MAX	UNITS
$V_{CC}$ Range		$T_A = 0^\circ\text{C} +70^\circ\text{C}$		1.0		5.5	V
		$T_A = -40^\circ\text{C} +105^\circ\text{C}$		1.2		5.5	
Supply Current	$I_{CC}$	$T_A = -40^\circ\text{C} +105^\circ\text{C}$	$V_{CC} < 5.5\text{V}$ , SS8039x463/438/400		5.5	9	$\mu\text{A}$
			$V_{CC} < 3.6\text{V}$ , SS8039x308/293/263		5	8	
Reset Threshold	$V_{TH}$	SS8039x463	$T_A = +25^\circ\text{C}$	4.537	4.63	4.722	V
		SS8039x438	$T_A = +25^\circ\text{C}$	4.292	4.38	4.467	
		SS8039x400	$T_A = +25^\circ\text{C}$	3.92	4.00	4.08	
		SS8039x308	$T_A = +25^\circ\text{C}$	3.018	3.08	3.141	
		SS8039x293	$T_A = +25^\circ\text{C}$	2.871	2.93	2.988	
		SS8039x263	$T_A = +25^\circ\text{C}$	2.577	2.63	2.682	

**Electrical Characteristics (Continued)**

( $V_{CC}$  = full range,  $T_A$  = -40°C to +105°C, unless otherwise noted. Typical values are at  $T_A$  = +25°C,  $V_{CC}$  = 5V for 463/438/400 versions,  $V_{CC}$  = 3.3V for 308/293 versions, and  $V_{CC}$  = 3V for 263 version.) (Note 1)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS
Reset Threshold Tempco				70		ppm/°C
$V_{CC}$ to Reset Delay (Note 2)		$V_{CC} = V_{TH}$ to $(V_{TH} - 100\text{mV})$		15		
Reset Active Timeout Period		$V_{CC} = V_{TH}$ max, SS8039x463/438/400	250	510	720	ms
		$V_{CC} = V_{TH}$ max, SS8039x308/293/263	140	310	520	
$\overline{\text{MR}}$ Minimum Pulse Width	$t_{MR}$			10		μs
$\overline{\text{MR}}$ Glitch Immunity (Note 3)				100		ns
$\overline{\text{MR}}$ to Reset Propagation Delay (Note 2)	$t_{MD}$			0.5		μs
$\overline{\text{MR}}$ Input Threshold	$V_{IH}$	$V_{CC} > V_{TH(\text{max})}$	$0.6 \times V_{CC}$		$0.25 \times V_{CC}$	V
	$V_{IL}$					
$\overline{\text{MR}}$ Pull-up Resistance			10	20	30	KΩ
RESET Output Current Low (push-pull active low, SS8039L)	$I_{OL}$	$V_{CC} = 2.5\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$	8			mA
RESET Output Current High (push-pull active low, SS8039L)	$I_{OH}$	$V_{CC} = 5\text{V}$ , $V_{\overline{\text{RESET}}} = 4.5\text{V}$ , SS8039L463/438/400	4.5			mA
		$V_{CC} = 3.3\text{V}$ , $V_{\overline{\text{RESET}}} = 2.8\text{V}$ , SS8039L308/293	3			
		$V_{CC} = 3\text{V}$ , $V_{\overline{\text{RESET}}} = 2.5\text{V}$ , SS8039L263	2			
RESET Output Current Low (push-pull active high, SS8039H)	$I_{OL}$	$V_{CC} = 5\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$ , SS8039H463/438/400	16			mA
		$V_{CC} = 3.3\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$ , SS8039H308/293	12			
		$V_{CC} = 3\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$ , SS8039H263	10			
RESET Output Current High (push-pull active high, SS8039H)	$I_{OH}$	$V_{CC} = 2.5\text{V}$ , $V_{\overline{\text{RESET}}} = 2\text{V}$	2			mA

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

Note 2: RESET output is for SS8039L; RESET output is for SS8039H.

Note 3: "Glitches" of 100ns or less typically will not generate a reset pulse.

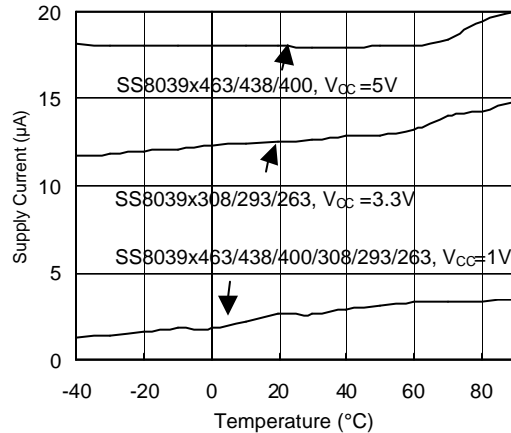
**Selection Guide and Part Marking**

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK
SS8039H463TC	4.63	Push-Pull RESET	692Lx
SS8039H438TC	4.38	Push-Pull RESET	692Kx
SS8039H400TC	4.00	Push-Pull RESET	692Jx
SS8039H308TC	3.08	Push-Pull RESET	692Ix
SS8039H293TC	2.93	Push-Pull RESET	692Hx
SS8039H263TC	2.63	Push-Pull RESET	692Gx
SS8039L463TC	4.63	Push-Pull $\overline{\text{RESET}}$	692Fx
SS8039L438TC	4.38	Push-Pull $\overline{\text{RESET}}$	692Ex
SS8039L400TC	4.00	Push-Pull $\overline{\text{RESET}}$	692Dx
SS8039L308TC	3.08	Push-Pull $\overline{\text{RESET}}$	692Cx
SS8039L293TC	2.93	Push-Pull $\overline{\text{RESET}}$	692Bx
SS8039L263TC	2.63	Push-Pull $\overline{\text{RESET}}$	692Ax

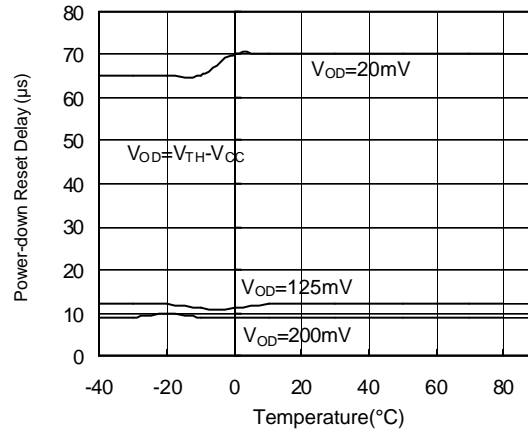
### Typical Operating Characteristics

( $V_{CC}$  = full range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , unless otherwise noted. Typical values are at  $T_A$  =  $+25^{\circ}\text{C}$ ,  $V_{CC}$  = 5V for 463/438/400 versions,  $V_{CC}$  = 3.3V for 308/293 versions, and  $V_{CC}$  = 3V for 263 version.)

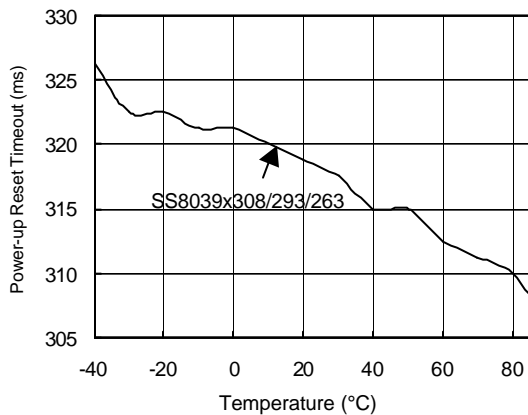
**Supply Current vs. Temperature  
(No Load)**



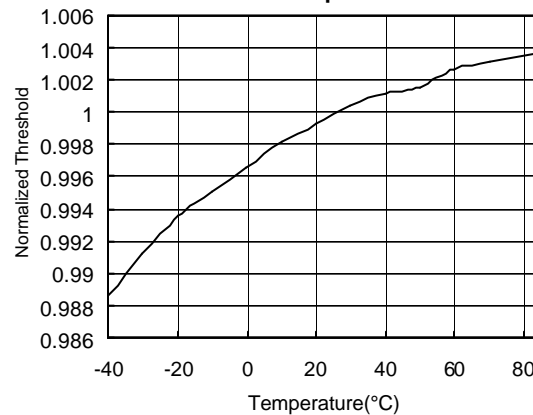
**Power-down Reset Delay vs. Temperature  
(SS8039x308/293/263)**



**Power-up Reset Timeout  
vs. Temperature**



**Normalized Reset Threshold  
vs. Temperature**



## Pin Description

PIN	NAME	FUNCTION
1	GND	Ground
2	$\overline{\text{RESET}}$ (SS8039L)	$\overline{\text{RESET}}$ Output remains low while $V_{CC}$ is below the reset threshold, and for at least 140ms after $V_{CC}$ rises above the reset threshold.
	RESET (SS8039H)	RESET Output remains high while $V_{CC}$ is below the reset threshold, and for at least 140ms after $V_{CC}$ rises above the reset threshold.
3	$\overline{\text{MR}}$	Manual Reset Input. A logic low on $\overline{\text{MR}}$ asserts reset. Reset remains asserted as long as $\overline{\text{MR}}$ is low and for at least 140ms after $\overline{\text{MR}}$ returns high, This active-low input has an internal 20k $\Omega$ pull-up resistor. It can be driven from a TTL or CMOS-logic line, or shorted to ground with a switch. Leave open if unused.
4	$V_{CC}$	Supply Voltage (+5V, +3.3V, +3.0V)

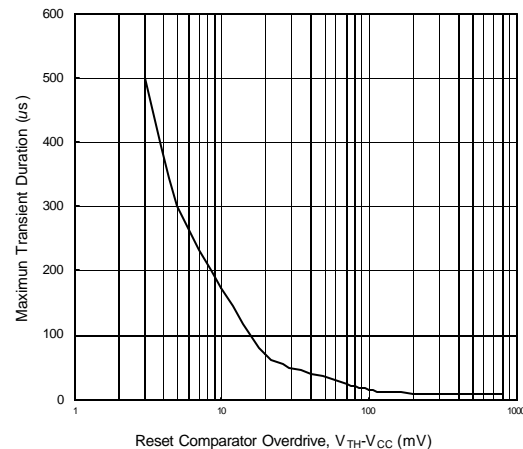
## Detailed Description

A microprocessor's ( $\mu\text{P}$ 's) reset input starts the  $\mu\text{P}$  in a known state. The SS8039L and SS8039H assert reset to prevent code-execution errors during power-up, power-down, or brownout conditions. They assert a reset signal whenever the  $V_{CC}$  supply voltage declines below a preset threshold, keeping it asserted for at least 140ms after  $V_{CC}$  has risen above the reset threshold.

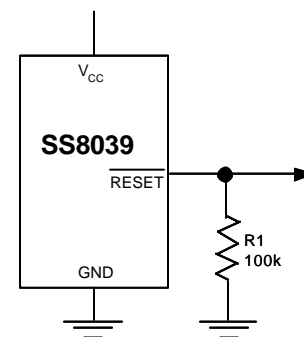
The SS8039L/SS8039H have a push-pull output stage. The manual reset input (MR) can also initiate a reset. See the Manual Reset Input Section.

### Manual Reset Input

Many  $\mu\text{P}$ -based products require manual reset capability allowing the operator, a test technician, or external logic circuitry to initiate a reset. A logic low on  $\overline{\text{MR}}$  asserts reset. Reset remains asserted while  $\overline{\text{MR}}$  is low, and for the Reset Active Timeout Period ( $t_{RP}$ ) after  $\overline{\text{MR}}$  returns high. This input has an internal 20k $\Omega$  pull-up resistor, so it can be left open if it is not used.  $\overline{\text{MR}}$  can be driven with TTL or CMOS-logic levels, or with open-drain / collector outputs. Connect a normally open momentary switch from  $\overline{\text{MR}}$  to GND to create a manual-reset function; external debounce circuitry is not required. If  $\overline{\text{MR}}$  is driven from long cables or if the device is used in a noisy environment, connecting a 0.1 $\mu\text{F}$  capacitor from  $\overline{\text{MR}}$  to ground provides additional noise immunity.



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



**Figure2.  $\overline{\text{RESET}}$  Valid to  $V_{CC} = \text{Ground}$  Circuit**

## Applications Information

### Negative-Going $V_{CC}$ Transients

In addition to issuing a reset to the  $\mu P$  during power-up, power-down, and brownout conditions, the SS8039H and SS8039L are relatively immune to short-duration negative-going  $V_{CC}$  transients (glitches).

Figure 1 shows typical transient durations, vs. the reset comparator overdrive, for which both the SS8039H and SS8039L do not generate a reset pulse. The graph was generated using a negative-going pulse applied to  $V_{CC}$ , starting 0.5V above the actual reset threshold and ending below it by the magnitude indicated (reset comparator overdrive). The graph indicates the maximum pulse width a negative-going  $V_{CC}$  transient can have without causing a reset pulse. As the magnitude of the transient increases (goes farther below the reset threshold), the maximum allowable pulse width decreases. For the SS8039x463 and SS8039x438, a  $V_{CC}$  transient that goes 100mV below the reset threshold and lasts 15 $\mu s$  or less will not typically cause a reset pulse. A 0.1 $\mu F$  bypass capacitor mounted as close as possible to the  $V_{CC}$  pin provides additional transient immunity.

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

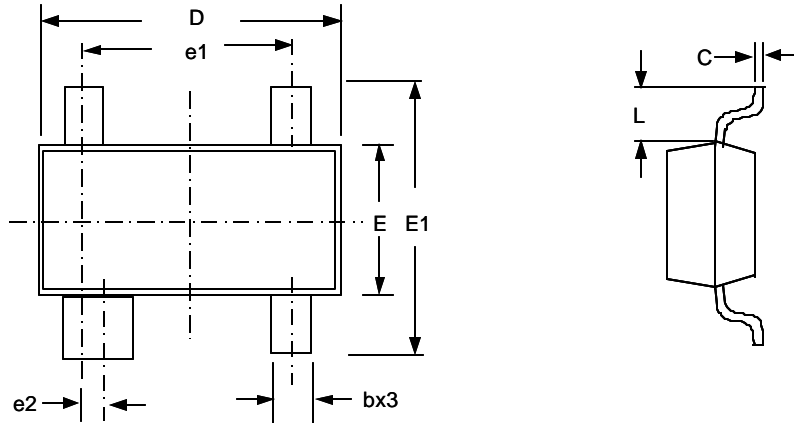
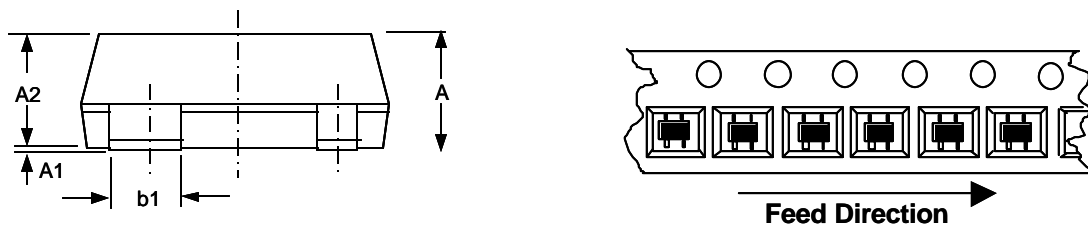
When  $V_{CC}$  falls below 1V, the SS8039  $\overline{RESET}$  output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to  $\overline{RESET}$  can drift to undetermined voltages. This presents no problem in most applications since most  $\mu P$  and other circuitry is inoperative with  $V_{CC}$  below 1V. However, in applications where  $\overline{RESET}$  must be valid down to 0V, adding a pull-down resistor to  $\overline{RESET}$  causes any stray leakage currents to flow to ground, holding  $\overline{RESET}$  low (Figure 2). R1's value is not critical; 100k $\Omega$  is large enough not to load  $\overline{RESET}$  and small enough to pull  $\overline{RESET}$  to ground.

### Benefits of Highly Accurate Reset Threshold

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

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

The SS8039x uses highly accurate circuitry to ensure that reset is asserted close to the 5% limit, and long before the supply has declined to 10% below nominal.

**Physical Dimensions**

**Package Orientation**

**SOT 143 Package**

SYMBOL	DIMENSION IN MILLIMETERS		DIMENSION IN INCHS	
	MIN.	MAX.	MIN.	MAX.
A	0.95	1.20	0.037	0.047
A1	0.05	0.10	0.002	0.004
A2	0.90	1.10	0.035	0.043
b	0.37	0.46	0.145	0.018
b1	0.76	0.89	0.030	0.035
C	0.10	0.18	0.004	0.007
D	2.80	3.04	0.110	0.120
E	1.20	1.40	0.047	0.055
E1	2.30	2.50	0.091	0.098
e1	1.92 BSC.		0.75 BSC.	
e2	0.20 BSC.		0.078 BSC.	
L	0.69 REF.		0.27 REF.	

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