

## Microprocessor Reset IC

### FEATURES

- Precision monitoring of +3V, +3.3V, and +5V power-supply voltages
- Fully specified over temperature
- Available in three output configurations
  - Push-pull  $\overline{\text{RESET}}$  output (SS8037L)
  - Push-pull RESET output (SS8037H)
  - Open-drain  $\overline{\text{RESET}}$  output (SS8038L)
- Power-on reset pulse width of 140ms min
- Supply current of 10 $\mu$ A
- Guaranteed reset valid to  $V_{CC} = +1V$
- Power supply transient immunity
- No external components
- SOT23-3 package

### APPLICATIONS

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

### DESCRIPTION

The SS8037/8 are microprocessor ( $\mu$ P) supervisory circuits used to monitor the power supplies in  $\mu$ P and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, +3.0V- powered circuits.

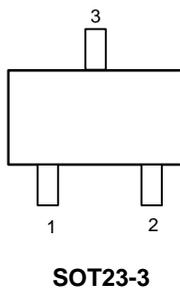
These circuits perform a single function: they assert a reset signal whenever the  $V_{CC}$  supply voltage declines below a preset threshold, keeping it asserted for at least 140ms after  $V_{CC}$  has risen above the reset threshold. Reset thresholds suitable for operation with a variety of supply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

The SS8038L has an open-drain output stage, while the SS8037H/L have push-pull outputs. The SS8038L's open-drain  $\overline{\text{RESET}}$  output requires a pull-up resistor that can be connected to a voltage higher than  $V_{CC}$ . The SS8037L has an active-low  $\overline{\text{RESET}}$  output, while the SS8037H 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.

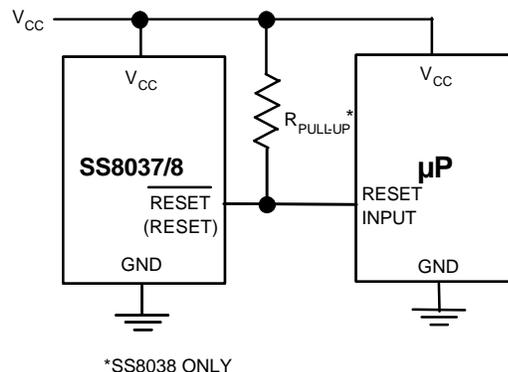
Low supply current makes the SS8037/8 ideal for use in portable equipment. They are available in a 3-pin SOT23-3 package.

 This device is supplied with Pb-free lead finish (second-level interconnect).

### PIN CONFIGURATION

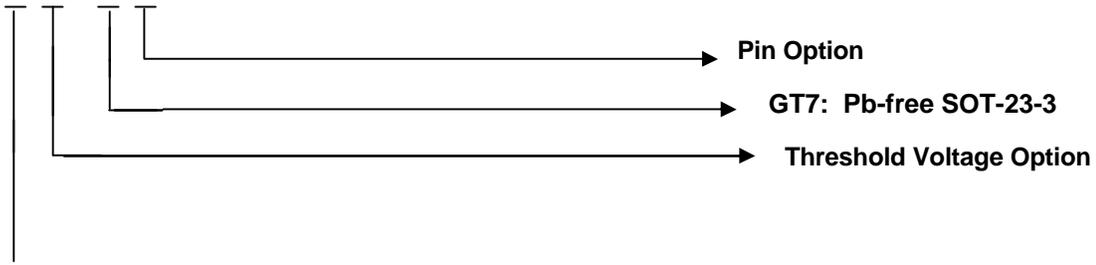


### TYPICAL APPLICATION



**ORDERING INFORMATION**

SS803xxxxGT7x


**PART NUMBER**

SS8037L : Push-Pull Active Low Output  
 SS8037H : Push-Pull Active High Output  
 SS8038L : Open-Drain Output

**THRESHOLD VOLTAGE OPTION**

\* xxx specifies the threshold voltage.  
 e.g. 263 denotes the 2.63V threshold voltage.

**PIN OPTION**

	<b>1</b>	<b>2</b>	<b>3</b>
1:	$\overline{\text{RESET}}$	GND	V <sub>CC</sub>
2:	$\overline{\text{RESET}}$	V <sub>CC</sub>	GND
3:	GND	$\overline{\text{RESET}}$	V <sub>CC</sub>
4:	GND	V <sub>CC</sub>	$\overline{\text{RESET}}$
5:	V <sub>CC</sub>	GND	$\overline{\text{RESET}}$
6:	V <sub>CC</sub>	$\overline{\text{RESET}}$	GND

\*RESET for SS8037H

**SELECTION GUIDE AND MARKING INFORMATION**

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK
SS8038L463GT71	4.63	Open-Drain	689Fx
SS8038L438GT71	4.38	Open-Drain	689Ex
SS8038L400GT71	4.00	Open-Drain	689Dx
SS8038L308GT71	3.08	Open-Drain	689Cx
SS8038L293GT71	2.93	Open-Drain	689Bx
SS8038L263GT71	2.63	Open-Drain	689Ax
SS8037H463GT71	4.63	Push-Pull $\overline{\text{RESET}}$	688Lx
SS8037H438GT71	4.38	Push-Pull $\overline{\text{RESET}}$	688Kx
SS8037H400GT71	4.00	Push-Pull $\overline{\text{RESET}}$	688Jx
SS8037H308GT71	3.08	Push-Pull $\overline{\text{RESET}}$	688Ix
SS8037H293GT71	2.93	Push-Pull $\overline{\text{RESET}}$	688Hx
SS8037H263GT71	2.63	Push-Pull $\overline{\text{RESET}}$	688Gx
SS8037L463GT71	4.63	Push-Pull $\overline{\text{RESET}}$	688Fx
SS8037L438GT71	4.38	Push-Pull $\overline{\text{RESET}}$	688Ex
SS8037L400GT71	4.00	Push-Pull $\overline{\text{RESET}}$	688Dx
SS8037L308GT71	3.08	Push-Pull $\overline{\text{RESET}}$	688Cx
SS8037L293GT71	2.93	Push-Pull $\overline{\text{RESET}}$	688Bx
SS8037L263GT71	2.63	Push-Pull $\overline{\text{RESET}}$	688Ax

**Note: T71: SOT23 pin-out option 1**

Not all product options are released for mass production, please contact Silicon Standard for availability.

**SELECTION GUIDE AND MARKING INFORMATION (cont.)**

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK
SS8038L463GT72	4.63	Open-Drain	687Fx
SS8038L438GT72	4.38	Open-Drain	687Ex
SS8038L400GT72	4.00	Open-Drain	687Dx
SS8038L308GT72	3.08	Open-Drain	687Cx
SS8038L293GT72	2.93	Open-Drain	687Bx
SS8038L263GT72	2.63	Open-Drain	687Ax
SS8037H463GT72	4.63	Push-Pull RESET	686Lx
SS8037H438GT72	4.38	Push-Pull RESET	686Kx
SS8037H400GT72	4.00	Push-Pull RESET	686Jx
SS8037H308GT72	3.08	Push-Pull RESET	686Ix
SS8037H293GT72	2.93	Push-Pull RESET	686Hx
SS8037H263GT72	2.63	Push-Pull RESET	686Gx
SS8037L463GT72	4.63	Push-Pull RESET	686Fx
SS8037L438GT72	4.38	Push-Pull RESET	686Ex
SS8037L400GT72	4.00	Push-Pull RESET	686Dx
SS8037L308GT72	3.08	Push-Pull RESET	686Cx
SS8037L293GT72	2.93	Push-Pull RESET	686Bx
SS8037L263GT72	2.63	Push-Pull RESET	686Ax

**Note: T72: SOT23 pin-out option 2**

Not all product options are released for mass production, please contact Silicon Standard for availability.

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	
SS8038L463GT73	4.63	Open-Drain	691Fx
SS8038L438GT73	4.38	Open-Drain	691Ex
SS8038L400GT73	4.00	Open-Drain	691Dx
SS8038L308GT73	3.08	Open-Drain	691Cx
SS8038L293GT73	2.93	Open-Drain	691Bx
SS8038L263GT73	2.63	Open-Drain	691Ax
SS8037H463GT73	4.63	Push-Pull RESET	690Lx
SS8037H438GT73	4.38	Push-Pull RESET	690Kx
SS8037H400GT73	4.00	Push-Pull RESET	690Jx
SS8037H308GT73	3.08	Push-Pull RESET	690Ix
SS8037H293GT73	2.93	Push-Pull RESET	690Hx
SS8037H263GT73	2.63	Push-Pull RESET	690Gx
SS8037L463GT73	4.63	Push-Pull RESET	690Fx
SS8037L438GT73	4.38	Push-Pull RESET	690Ex
SS8037L400GT73	4.00	Push-Pull RESET	690Dx
SS8037L308GT73	3.08	Push-Pull RESET	690Cx
SS8037L293GT73	2.93	Push-Pull RESET	690Bx
SS8037L263GT73	2.63	Push-Pull RESET	690Ax

**Note: T73: SOT23 pin-out option 3**

Not all product options are released for mass production, please contact Silicon Standard for availability.

## ABSOLUTE MAXIMUM RATINGS

All terminal voltages with respect to GND

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

Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )  
 3-Pin SOT23 (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) ..... $+300^\circ\text{C}$

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,  $T_A = -40^\circ\text{C}$  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.) (Note 1)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS		
$V_{CC}$ Range		$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$	1.0		5.5	V		
		$T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$	1.2		5.5			
Supply Current (SOT-23)	$I_{CC}$	$T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$	$V_{CC} < 5.5V$ , 803xx463/438/400x		22	30	$\mu\text{A}$	
			$V_{CC} < 3.6V$ , 803xx308/293/263x		10	23		
Reset Threshold	$V_{TH}$	SS803xx463x	$T_A = +25^\circ\text{C}$	4.56	4.63	4.70	V	
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	4.50		4.75		
			$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$	4.40		4.86		
			$T_A = +25^\circ\text{C}$	4.31	4.38	4.45		
				$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	4.25			4.50
					$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$	4.16		
			SS803xx438x	$T_A = +25^\circ\text{C}$	3.93	4.00		4.06
				$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	3.89			4.10
				$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$	3.80			4.20
		SS803xx400x	$T_A = +25^\circ\text{C}$	3.04	3.08	3.11		
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	3.00		3.15		
			$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$	2.92		3.23		
		SS803xx308x	$T_A = +25^\circ\text{C}$	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		
		SS803xx293x	$T_A = +25^\circ\text{C}$	2.59	2.63	2.66		
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	2.55		2.70		
			$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$	2.50		2.76		
SS803xx263x	$T_A = +25^\circ\text{C}$							
	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$							
	$T_A = +85^\circ\text{C}$ to $+105^\circ\text{C}$							

**ELECTRICAL CHARACTERISTICS (Cont.)**

( $V_{CC}$  = 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.) (Note 1)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS
Reset Threshold Tempco				40		ppm/ $^{\circ}\text{C}$
$V_{CC}$ to Reset Delay (Note 2)		$V_{CC} = V_{TH}$ to $(V_{TH} - 100\text{mV})$		7		$\mu\text{s}$
Reset Active Timeout Period		$V_{CC} = V_{TH}$ max, SS803xx463/438/400	280		640	ms
		$V_{CC} = V_{TH}$ max, SS803xx308/293/263	140		550	
RESET Output Current Low (push-pull active low, and open-drain active-low, SS8037L and SS8038L)	$I_{OL}$	$V_{CC} = 2.5\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$	8			mA
RESET Output Current High (push-pull active low, SS8037L)	$I_{OH}$	$V_{CC} = 5\text{V}$ , $V_{\overline{\text{RESET}}} = 4.5\text{V}$ , SS8037L463/438/400	4.5			mA
		$V_{CC} = 3.3\text{V}$ , $V_{\overline{\text{RESET}}} = 2.8\text{V}$ , SS8037L308/293	3			
		$V_{CC} = 3\text{V}$ , $V_{\overline{\text{RESET}}} = 2.5\text{V}$ , SS8037L263	2			
RESET Output Current Low (push-pull active high, SS8037H)	$I_{OL}$	$V_{CC} = 5\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$ , SS8037H463/438/400	16			mA
		$V_{CC} = 3.3\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$ , SS8037H308/293	12			
		$V_{CC} = 3\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$ , SS8037H263	10			
RESET Output Current High (push-pull active high, SS8037H)	$I_{OH}$	$V_{CC} = 2.5\text{V}$ , $V_{\overline{\text{RESET}}} = 2\text{V}$	2			mA
RESET Open-Drain Output Leakage Current (SS8038L)		$V_{CC} > V_{TH}$ , $\overline{\text{RESET}}$ de-asserted			1	$\mu\text{A}$

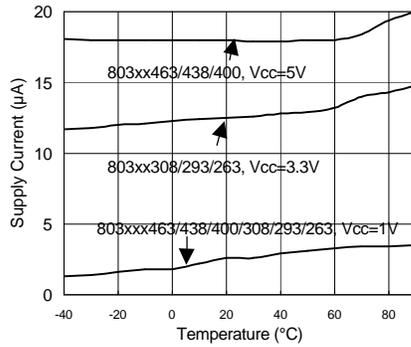
Note 1: Production testing done at  $T_A$  =  $+25^{\circ}\text{C}$ ; limits over temperature guaranteed by design.

Note 2:  $\overline{\text{RESET}}$  output is for SS8037L/38L; RESET output is for SS8037H.

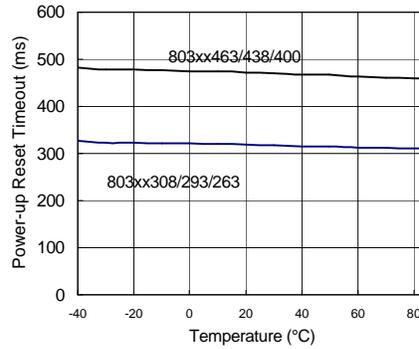
## TYPICAL PERFORMANCE CHARACTERISTICS

( $V_{CC}$  = 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.)

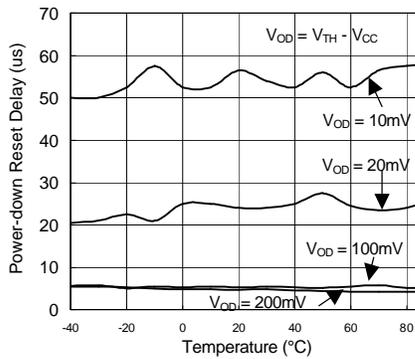
**Supply Current vs. Temperature  
(No Load)**



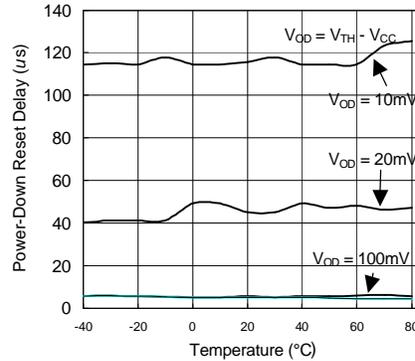
**Power-up Reset Timeout  
vs. Temperature**



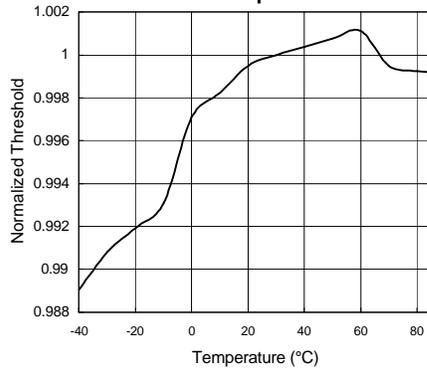
**Power-down Reset Delay vs.  
Temperature (803xx308/293/263)**



**Power-down Reset Delay vs.  
Temperature (803xx463/438/400)**



**Normalized Reset Threshold  
vs. Temperature**

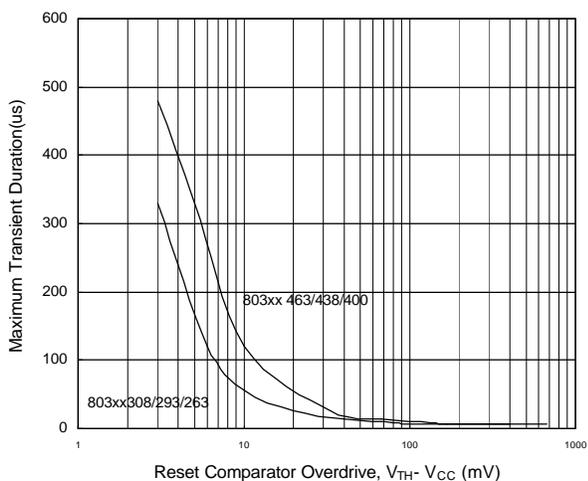


## PIN DESCRIPTION

PIN	NAME	FUNCTION
1	GND	Ground
2	(SS8037L/38L)	$\overline{\text{RESET}}$ 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 (SS8037H)	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	$V_{CC}$	Supply Voltage (+5V, +3.3V, +3.0V)

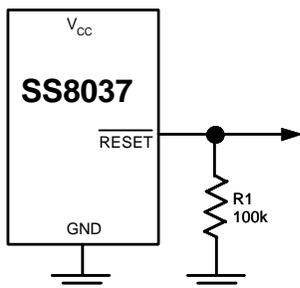
## APPLICATIONS INFORMATION

A microprocessor's ( $\mu\text{P}$ 's) reset input starts the  $\mu\text{P}$  in a known state. The SS8037L/H and 8038L 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 SS8038L uses an open-drain output, and the SS8037L/37H have push-pull output stages. Connect a pull-up resistor on the SS8038L's  $\overline{\text{RESET}}$  output to any supply between 0 and 5.5V.



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

**Fig 2.  $\overline{\text{RESET}}$  Valid to  $V_{CC} = \text{Ground}$  Circuit**



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

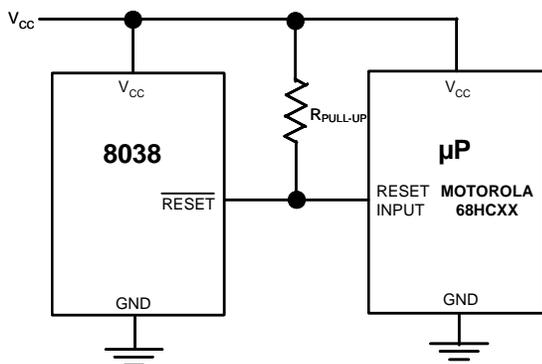
In addition to issuing a reset to the  $\mu\text{P}$  during power-up, power-down, and brownout conditions, the SS8037L/H/8038L are relatively immune to short-duration negative-going  $V_{CC}$  transients (glitches).

Figure 1 shows typical transient duration vs. reset comparator overdrive, for which the SS8037L/H/8038L 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. Typically, for the SS803xx 463 and SS803xx438, a  $V_{CC}$  transient that goes 100mV below the reset threshold and lasts 7 $\mu\text{s}$  or less will not cause a reset pulse. A 0.1 $\mu\text{F}$  bypass capacitor mounted as close as possible to the  $V_{CC}$  pin provides additional transient immunity.

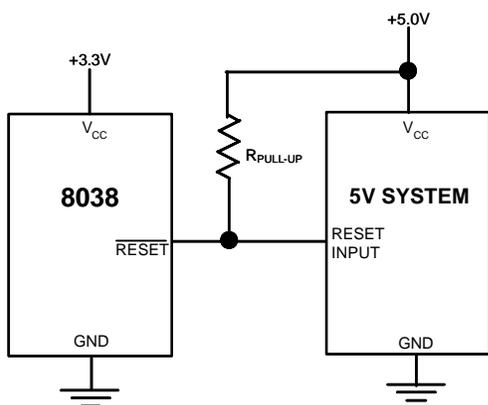
### Ensuring a Valid Reset Output Down to $V_{CC} = 0$

When  $V_{CC}$  falls below 1V, the SS8037  $\overline{\text{RESET}}$  output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to  $\overline{\text{RESET}}$  can drift to undetermined voltages. This presents no problem in most applications since most  $\mu\text{P}$  and other circuitry is inoperative with  $V_{CC}$  below 1V. However, in applications where  $\overline{\text{RESET}}$  must be valid down to 0V, adding a pull-down resistor to  $\overline{\text{RESET}}$  causes any stray leakage currents to flow to ground, holding  $\overline{\text{RESET}}$  low (Figure 2).  $R_1$ 's value is not critical; 100k $\Omega$  is large enough not to load  $\overline{\text{RESET}}$  and small enough to pull  $\overline{\text{RESET}}$  to ground.

A 100k $\Omega$  pull-up resistor to  $V_{CC}$  is also recommended for the SS8038L if  $\overline{\text{RESET}}$  is required to remain valid for  $V_{CC} < 1\text{V}$ .



**Figure 3. Interfacing to  $\mu$ Ps with bidirectional reset I/O**



**Figure 4. SS8038L open-drain  $\overline{\text{RESET}}$  output allows use with multiple supplies**

### Interfacing to $\mu$ Ps with Bidirectional Reset Pins

Since the  $\overline{\text{RESET}}$  output on the SS8038L is open drain, this device interfaces easily with  $\mu$ Ps that have bidirectional reset pins, such as the Motorola 68HC11. Connecting the  $\mu$ P supervisor's  $\overline{\text{RESET}}$  output directly to the microcontroller's ( $\mu$ C's)  $\overline{\text{RESET}}$  pin with a single pull-up resistor allows either device to assert reset (Figure 3).

### 8038L Open-Drain $\overline{\text{RESET}}$ Output Allows Use with Multiple Supplies

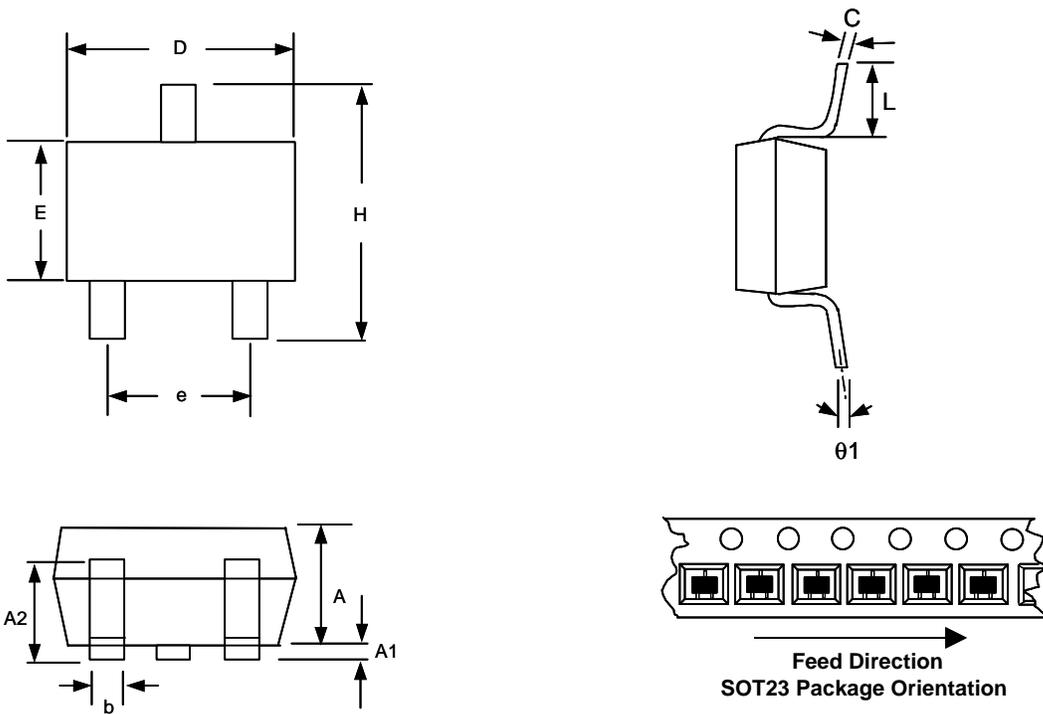
Generally, the pull-up connected to the SS8038L will connect to the supply voltage that is being monitored at the IC's  $V_{CC}$  pin. However, some systems may use the open-drain output to level-shift from the monitored supply to reset circuitry powered by some other supply (Figure 4). Note that as the SS8038L's  $V_{CC}$  decreases below 1V, so does the IC's ability to sink current at  $\overline{\text{RESET}}$ . Also, with any pull-up,  $\overline{\text{RESET}}$  will be pulled high as  $V_{CC}$  decays toward 0. The voltage where this occurs depends on the pull-up resistor value and the voltage to which it is connected.

### 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 SS803xx463/803xx308 use 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**

**SOT 23 (T7) Package**
**Note:**

- 1.Package body sizes exclude mold flash protrusions or gate burrs
- 2.Tolerance  $\pm 0.1000$  mm (4mil) unless otherwise specified
- 3.Coplanarity: 0.1000mm
- 4.Dimension L is measured in gage plane

SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.00	1.10	1.30
A1	0.00	-----	0.10
A2	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E	1.40	1.60	1.80
e	-----	1.90(TYP)	-----
H	2.60	2.80	3.00
L	0.37	-----	-----
$\Theta 1$	1°	5°	9°

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