



## 4-Pin $\mu$ P Voltage Monitors with Manual Reset Input

### 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 (G692L)  
Push-Pull RESET Output (G692H)  
Open-Drain  $\overline{\text{RESET}}$  Output (G693L)
- 140ms min Power-On Reset Pulse Width
- 5 $\mu$ A Supply Current
- Guaranteed Reset Valid to  $V_{CC} = +1V$
- Power Supply Transient Immunity
- No External Components
- Manual Reset Input
- 4-Pin SOT143 Package

### Applications

- Computers
- Controllers
- Intelligent Instruments
- Critical  $\mu$ P and  $\mu$ C Power Monitoring
- Portable / Battery-Powered Equipment
- Automotive

### General Description

The G692/G693 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. The G692/G693 also provide a de-bounced manual reset input.

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 G693L has an open-drain output stage, while the G692 have push-pull outputs. The G693L's open-drain  $\overline{\text{RESET}}$  output requires a pull-up resistor that can be connected to a voltage higher than  $V_{CC}$ . The G692L have an active-low  $\overline{\text{RESET}}$  output, while the G692H 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 G692/G693 ideal for use in portable equipment. The G692/G693 are available in a 4-pin SOT143 packages.

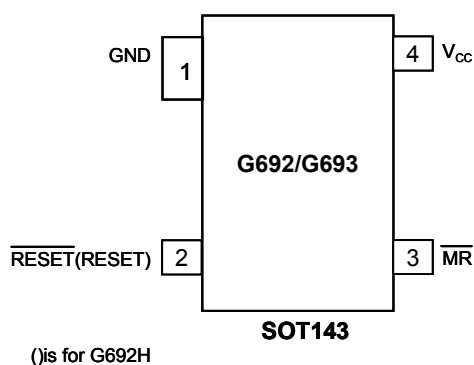
### Ordering Information

| PART          | TEMP. RANGE    | PIN-PACKAGE |
|---------------|----------------|-------------|
| G692H(L)xxxTC | -40°C ~ +105°C | SOT143      |
| G693LxxxTC    | -40°C ~ +105°C | SOT143      |

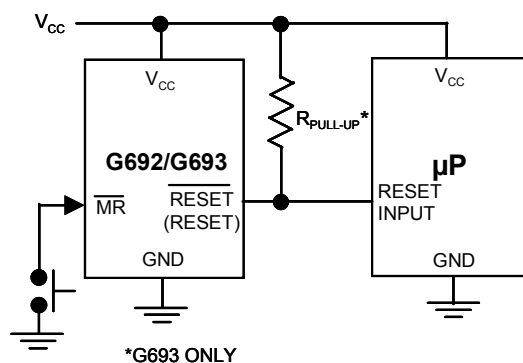
\* xxx specifies the threshold voltage.

e.g. 263 denotes the 2.63V threshold voltage.

### Pin Configuration



### Typical Operating Circuit



**Absolute Maximum Ratings**

Terminal Voltage (with respect to GND)

 $V_{CC}$ .....-0.3V to +6.0VRESET,  $\overline{\text{RESET}}$  (push-pull).....-0.3V to ( $V_{CC} + 0.3V$ ) $\overline{\text{RESET}}$  (open drain).....-0.3V to +6.0VInput Current,  $V_{CC}$  .....20mAOutput Current, RESET,  $\overline{\text{RESET}}$  .....20mAContinuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )SOT 143 (derate 4mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ ).....320mWOperating 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  |          | $T_A = 0^\circ\text{C} + 70^\circ\text{C}$    | 1.0   |      | 5.5   | V             |
|                 |          | $T_A = -40^\circ\text{C} + 105^\circ\text{C}$ | 1.2   |      | 5.5   |               |
| Supply Current  | $I_{CC}$ | $T_A = -40^\circ\text{C} + 105^\circ\text{C}$ |       |      |       | $\mu\text{A}$ |
|                 |          | $V_{CC} < 5.5V$ , G69_ _463/438/400_          |       | 5.5  | 9     |               |
|                 |          | $V_{CC} < 3.6V$ , G69_ _308/293/263_          |       | 5    | 8     |               |
| Reset Threshold | $V_{TH}$ | G69_ _463_ $T_A = +25^\circ\text{C}$          | 4.537 | 4.63 | 4.722 | V             |
|                 |          | G69_ _438_ $T_A = +25^\circ\text{C}$          | 4.292 | 4.38 | 4.467 |               |
|                 |          | G69_ _400_ $T_A = +25^\circ\text{C}$          | 3.92  | 4.00 | 4.08  |               |
|                 |          | G69_ _308_ $T_A = +25^\circ\text{C}$          | 3.018 | 3.08 | 3.141 |               |
|                 |          | G69_ _293_ $T_A = +25^\circ\text{C}$          | 2.871 | 2.93 | 2.988 |               |
|                 |          | G69_ _263_ $T_A = +25^\circ\text{C}$          | 2.577 | 2.63 | 2.682 |               |

**Electrical Characteristics (Continued)**

( $V_{CC}$  = 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                                                                      |          |                                                                                       |                     | 70  |                      | ppm/ $^{\circ}\text{C}$ |
| $V_{CC}$ 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, G69__ 463/438/400                                              | 250                 | 510 | 720                  | ms                      |
|                                                                                             |          | $V_{CC} = V_{TH}$ max, G69__ 308/293/263                                              | 140                 | 310 | 520                  |                         |
| MR Minima Pulse Width                                                                       | $t_{MR}$ |                                                                                       |                     | 10  |                      | $\mu\text{s}$           |
| MR Glitch Immunity (Note 3)                                                                 |          |                                                                                       |                     | 100 |                      | ns                      |
| MR to Reset Propagation Delay (Note 2)                                                      | $t_{MD}$ |                                                                                       |                     | 0.5 |                      | $\mu\text{s}$           |
| MR Input Threshold                                                                          | $V_{IH}$ | $V_{CC} > V_{TH(\text{max})}$                                                         | $0.6 \times V_{CC}$ |     |                      | V                       |
|                                                                                             | $V_{IL}$ |                                                                                       |                     |     | $0.25 \times V_{CC}$ |                         |
| MR Pull-up Resistance                                                                       |          |                                                                                       | 10                  | 20  | 30                   | $\text{K}\Omega$        |
| RESET Output Current Low (push-pull active low, and open-drain active-low, G692L and G693L) | $I_{OL}$ | $V_{CC} = 2.5\text{V}$ , $V_{\overline{\text{RESET}}} = 0.5\text{V}$                  | 8                   |     |                      | mA                      |
| RESET Output Current High (push-pull active low, G692L)                                     | $I_{OH}$ | $V_{CC} = 5\text{V}$ , $V_{\overline{\text{RESET}}} = 4.5\text{V}$ , G692L463/438/400 | 4.5                 |     |                      | mA                      |
|                                                                                             |          | $V_{CC} = 3.3\text{V}$ , $V_{\overline{\text{RESET}}} = 2.8\text{V}$ , G692L308/293   | 3                   |     |                      |                         |
|                                                                                             |          | $V_{CC} = 3\text{V}$ , $V_{\overline{\text{RESET}}} = 2.5\text{V}$ , G692L263         | 2                   |     |                      |                         |
| RESET Output Current Low (push-pull active high, G692H)                                     | $I_{OL}$ | $V_{CC} = 5\text{V}$ , $V_{\text{RESET}} = 0.5\text{V}$ , G692H463/438/400            | 16                  |     |                      | mA                      |
|                                                                                             |          | $V_{CC} = 3.3\text{V}$ , $V_{\text{RESET}} = 0.5\text{V}$ , G692H308/293              | 12                  |     |                      |                         |
|                                                                                             |          | $V_{CC} = 3\text{V}$ , $V_{\text{RESET}} = 0.5\text{V}$ , G692H263                    | 10                  |     |                      |                         |
| RESET Output Current High (push-pull active high, G692H)                                    | $I_{OH}$ | $V_{CC} = 2.5\text{V}$ , $V_{\text{RESET}} = 2\text{V}$                               | 2                   |     |                      | mA                      |
| RESET Open-Drain Output Leakage Current (G693L)                                             |          | $V_{CC} > V_{TH}$ , $\overline{\text{RESET}}$ deasserted                              |                     |     | 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 G692L/G693L; While RESET output is for G692H.

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

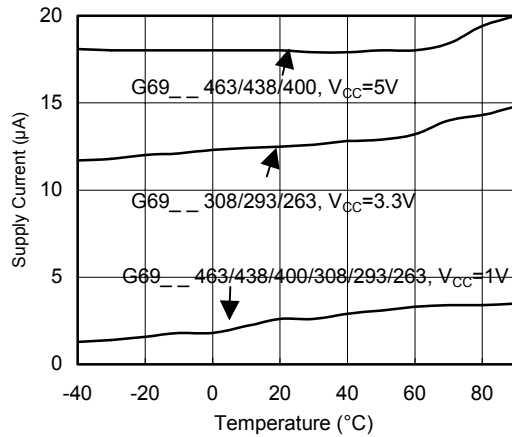
**Selector Guide**

| PART/SUFFIX | RESET THRESHOLD (V) | OUTPUT TYPE                          | TOP MARK |
|-------------|---------------------|--------------------------------------|----------|
| G693L463T_  | 4.63                | Open-Drain $\overline{\text{RESET}}$ | 693Fx    |
| G693L438T_  | 4.38                | Open-Drain $\overline{\text{RESET}}$ | 693Ex    |
| G693L400T_  | 4.00                | Open-Drain $\overline{\text{RESET}}$ | 693Dx    |
| G693L308T_  | 3.08                | Open-Drain $\overline{\text{RESET}}$ | 693Cx    |
| G693L293T_  | 2.93                | Open-Drain $\overline{\text{RESET}}$ | 693Bx    |
| G693L263T_  | 2.63                | Open-Drain $\overline{\text{RESET}}$ | 693Ax    |
| G692H463T_  | 4.63                | Push-Pull RESET                      | 692Lx    |
| G692H438T_  | 4.38                | Push-Pull RESET                      | 692Kx    |
| G692H400T_  | 4.00                | Push-Pull RESET                      | 692Jx    |
| G692H308T_  | 3.08                | Push-Pull RESET                      | 692Ix    |
| G692H293T_  | 2.93                | Push-Pull RESET                      | 692Hx    |
| G692H263T_  | 2.63                | Push-Pull RESET                      | 692Gx    |
| G692L463T_  | 4.63                | Push-Pull $\overline{\text{RESET}}$  | 692Fx    |
| G692L438T_  | 4.38                | Push-Pull $\overline{\text{RESET}}$  | 692Ex    |
| G692L400T_  | 4.00                | Push-Pull $\overline{\text{RESET}}$  | 692Dx    |
| G692L308T_  | 3.08                | Push-Pull $\overline{\text{RESET}}$  | 692Cx    |
| G692L293T_  | 2.93                | Push-Pull $\overline{\text{RESET}}$  | 692Bx    |
| G692L263T_  | 2.63                | Push-Pull $\overline{\text{RESET}}$  | 692Ax    |

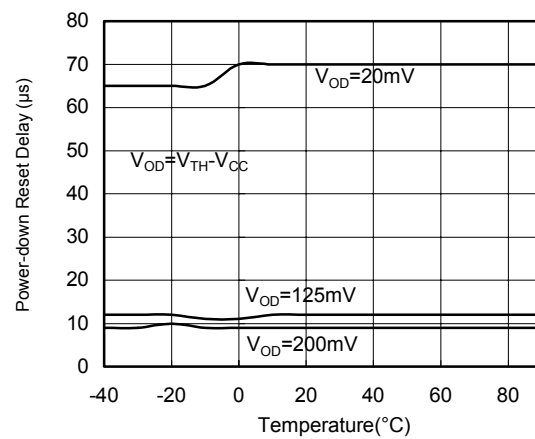
**Typical Operating Characteristics**

( $V_{CC}$  = 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.)

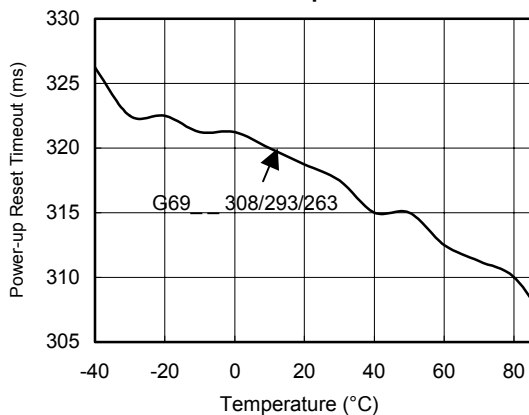
**Supply Current vs. Temperature  
(No Load)**



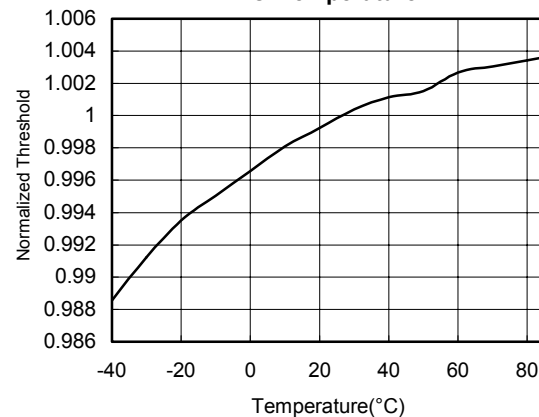
**Power-down Reset Delay vs. Temperature  
(G69\_308/293/263)**



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



**Normalized Reset Threshold  
vs. Temperature**



## Pin Description

| PIN | NAME                   | FUNCTION                                                                                                                                                                                                                                                                                                                                                             |
|-----|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | GND                    | Ground                                                                                                                                                                                                                                                                                                                                                               |
| 2   | RESET<br>(G693L/G692L) | 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<br>(G692H)       | 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   | $\overline{MR}$        | Manual Reset Input. A logic low on $\overline{MR}$ asserts reset. Reset remains asserted as long as $\overline{MR}$ is low and for at least 140ms after $\overline{MR}$ 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 ( $\mu P$ 's) reset input starts the  $\mu P$  in a known state. The G693L/G692L/G692H 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 G693L uses an open-drain output, and the G692L/G692H have a push-pull output stage. Connect a pull-up resistor on the G693L's RESET output to any supply between 0 and 5.5V.

The manual reset input ( $\overline{MR}$ ) can also initiate a reset. See the Manual Reset Input Section.

### Manual Reset Input

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

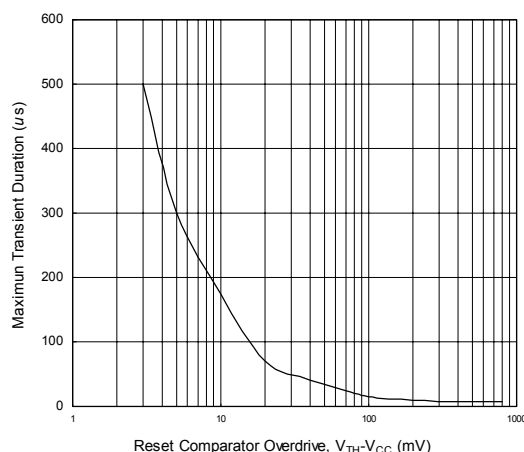


Figure 1. Maximum Transient Duration Without Causing a Reset Pulse vs. Reset Comparator Overdrive

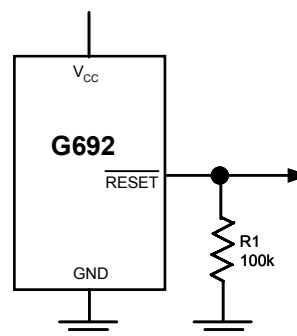


Figure 2.  $\overline{RESET}$  Valid to  $V_{CC}$  = Ground Circuit

## Applications Information

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

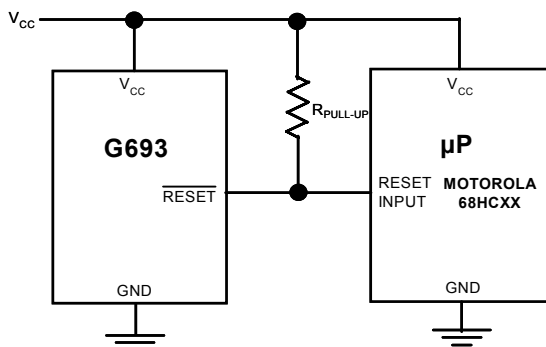
In addition to issuing a reset to the  $\mu P$  during power-up, power-down, and brownout conditions, the G693L/G692H/G692L are relatively immune to short-duration negative-going  $V_{CC}$  transients (glitches).

Figure 1 shows typical transient duration vs. reset comparator overdrive, for which the G693L/G692H/G692L 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 G69\_463 and G69\_438, a  $V_{CC}$  transient that goes 100mV below the reset threshold and lasts 15 $\mu s$  or less will not 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.

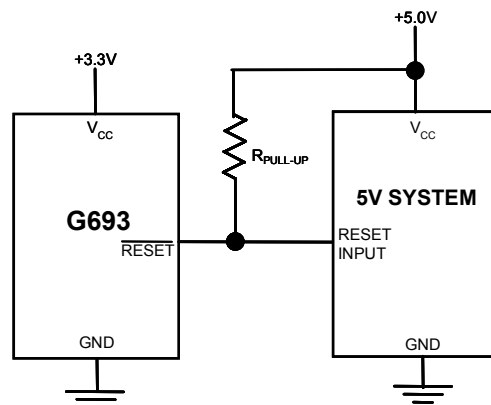
### Ensuring a Valid Reset Output Down to $V_{CC} = 0$

When  $V_{CC}$  falls below 1V, the G692  $\overline{RESET}$  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.

A 100k $\Omega$  pull-up resistor to  $V_{CC}$  is also recommended for the G693L if  $\overline{RESET}$  is required to remain valid for  $V_{CC} < 1V$ .



**Figure 3. Interfacing to  $\mu P$ s with Bidirectional Reset I/O**



**Figure 4. G693L Open-Drain  $\overline{RESET}$  Output Allows Use with Multiple Supplies**

### Interfacing to $\mu P$ s with Bidirectional Reset Pins

Since the  $\overline{RESET}$  output on the G693L is open drain, this device interfaces easily with  $\mu P$ s that have bidirectional reset pins, such as the Motorola 68HC11. Connecting the  $\mu P$  supervisor's  $\overline{RESET}$  output directly to the microcontroller's ( $\mu C$ 's)  $\overline{RESET}$  pin with a single pull-up resistor allows either device to assert reset (Figure 3).

### G693L Open-Drain $\overline{RESET}$ Output Allows Use with Multiple Supplies

Generally, the pull-up connected to the G693L 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 G693L's  $V_{CC}$  decreases below 1V, so does the IC's ability to sink current at  $\overline{RESET}$ . Also, with any pull-up,  $\overline{RESET}$  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.

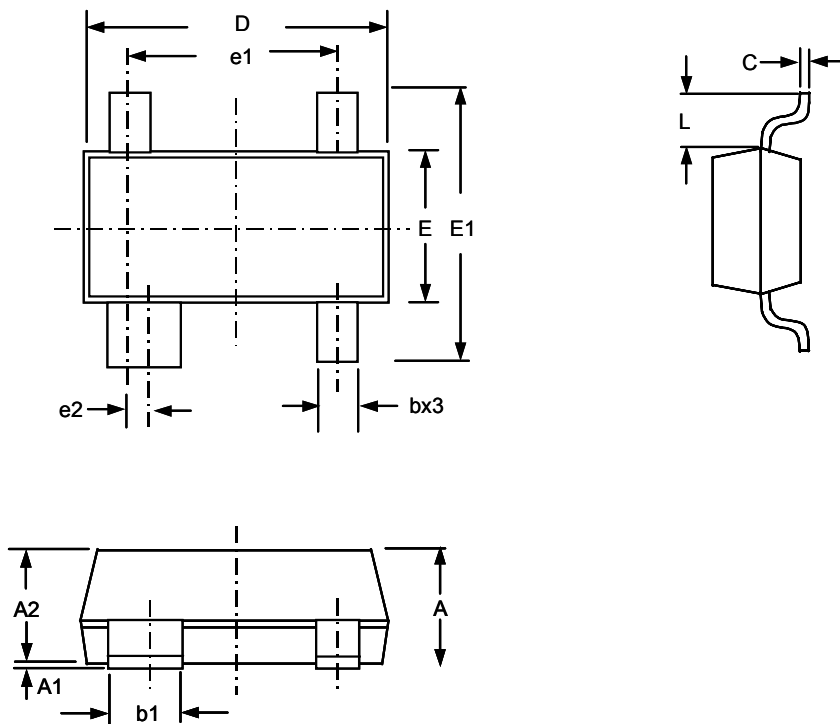
### Benefits of Highly Accurate Reset Threshold

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 G69\_463/G69\_308 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.

## Package Information



**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.          |       |

## Package Orientation

