

# 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 (G696L)  
Push-Pull  $\text{RESET}$  Output (G696H)  
Open-Drain  $\overline{\text{RESET}}$  Output (G697L)
- Externally Programmable Time Delay Generator
- 6 $\mu\text{A}$  Supply Current
- Guaranteed Reset Valid to  $V_{\text{CC}} = 0.8\text{V}$
- Power Supply Transient Immunity
- 5 pin SOT23-5 Packages

## Applications

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

## General Description

The G696/G697 are microprocessor ( $\mu\text{P}$ ) supervisory circuits used to monitor the power supplies in  $\mu\text{P}$  and digital systems. They provide excellent circuit reliability and low cost 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  $V_{\text{CC}}$  supply voltage declines below a preset threshold, with hysteresis keeping it asserted for time delay determined by externally programmable time delay generator. after  $V_{\text{CC}}$  has risen above the reset threshold. Reset thresholds suitable for operation with a variety of supply voltages are available.

The G697L has an open-drain output stage, while the G696 have push-pull outputs. The G697L's open-drain  $\overline{\text{RESET}}$  output requires a pull-up resistor that can be connected to a voltage higher than  $V_{\text{CC}}$ . The G696L have an active-low  $\overline{\text{RESET}}$  output, while the G696H has an active-high  $\text{RESET}$  output. The reset comparator is designed to ignore fast transients on  $V_{\text{CC}}$ , and the outputs are guaranteed to be in the correct logic state for  $V_{\text{CC}}$  down to 0.8V.

Low supply current makes the G696/G697 ideal for use in portable equipment. The G696/G697 are available in 5-pin SOT23-5 packages.

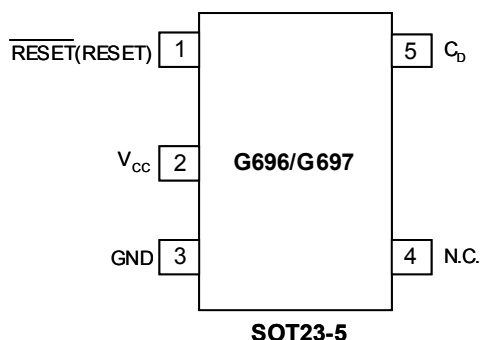
## Ordering Information

| PART          | TEMP. RANGE    | PIN-PACKAGE |
|---------------|----------------|-------------|
| G696H(L)xxxT1 | -40°C ~ +105°C | SOT23-5     |
| G697LxxxT1    | -40°C ~ +105°C | SOT23-5     |

\* xxx specifies the threshold voltage.

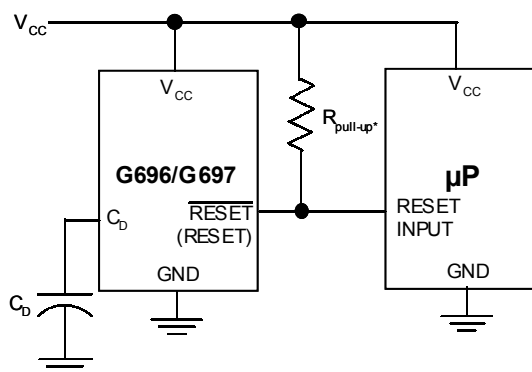
e.g. 263 denotes the 2.63V threshold voltage.

## Pin Configuration



( ) is for G696H

## Typical Operating Circuit



\*G697 ONLY

**Absolute Maximum Ratings**

Terminal Voltage (with respect to GND)

 $V_{CC}$ .....-0.3V to +6.0VDelay Capacitor Pin Voltage,  $V_{CD}$ .....-0.3 to ( $V_{CC} + 0.3V$ )RESET, RESET (push-pull).....-0.3V to ( $V_{CC} + 0.3V$ )

RESET (open drain).....-0.3V to +6.0V

Input Current,  $V_{CC}$  .....20mA

Output Current, RESET, RESET .....20mA

Continuous Power Dissipation ( $T_A = +70^{\circ}C$ )5-Pin SOT23-5 (derate 2.17mW/ $^{\circ}C$  above  $+70^{\circ}C$ ).174mWOperating Temperature Range .....-40 $^{\circ}C$  to  $+105^{\circ}C$ Storage Temperature Range.....-65 $^{\circ}C$  to  $+150^{\circ}C$ Lead Temperature (soldering, 10s).....+300 $^{\circ}C$ 

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,  $T_A = -40^{\circ}C$  to  $+105^{\circ}C$ , unless otherwise noted. Typical values are at  $T_A = +25^{\circ}C$ ,  $V_{CC} = 5V$  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                    |           | $T_A = 0^{\circ}C$ $+70^{\circ}C$       | 0.8   |      | 5.5   | V                |
|                                   |           | $T_A = -40^{\circ}C$ $+105^{\circ}C$    | 1     |      | 5.5   |                  |
| Supply Current (SOT23-5)          | $I_{CC}$  | $V_{CC} < 5.5V$ , G69_ 463/438/400/330_ |       | 6    | 10    | $\mu A$          |
|                                   |           | $V_{CC} < 3.6V$ , G69_ 308/293/263_     |       | 5    | 8.5   |                  |
| Reset Threshold                   | $V_{TH}$  | G69_ 463_                               | 4.537 | 4.63 | 4.722 | V                |
|                                   |           | G69_ 438_                               | 4.293 | 4.38 | 4.467 |                  |
|                                   |           | G69_ 400_                               | 3.92  | 4    | 4.08  |                  |
|                                   |           | G69_ 330_                               | 3.234 | 3.30 | 3.366 |                  |
|                                   |           | G69_ 308_                               | 3.019 | 3.08 | 3.141 |                  |
|                                   |           | G69_ 293_                               | 2.872 | 2.93 | 2.988 |                  |
|                                   |           | G69_ 263_                               | 2.578 | 2.63 | 2.682 |                  |
| Reset Threshold Hysteresis        | $V_{HYS}$ | G69_ 463_                               | 139   | 231  | 324   | mV               |
|                                   |           | G69_ 438_                               | 132   | 219  | 306   |                  |
|                                   |           | G69_ 400_                               | 120   | 200  | 280   |                  |
|                                   |           | G69_ 330_                               | 99    | 165  | 231   |                  |
|                                   |           | G69_ 308_                               | 93    | 154  | 215   |                  |
|                                   |           | G69_ 293_                               | 88    | 146  | 205   |                  |
|                                   |           | G69_ 263_                               | 79    | 131  | 184   |                  |
| Reset Threshold Tempco            |           |                                         |       | 70   |       | ppm/ $^{\circ}C$ |
| $C_D$ Delay Pin Threshold Voltage | $V_{TDC}$ | $V_{CC} = 5V$ G69_ 463/438/400/330_     | 3     | 3.3  | 3.9   | V                |
|                                   |           | $V_{CC} = 3.3V$ G69_ 308/293            | 1.9   | 2.3  | 2.7   |                  |
|                                   |           | $V_{CC} = 3.0V$ G69_ 263_               | 1.8   | 2.2  | 2.6   |                  |
| Delay Capacitor Pin Sink Current  | $I_{CD}$  | $V_{CC} = 1.5V$ , $V_{CD} = 0.5V$       | 3     | 5    |       | mA               |
| Delay Pull up Resistance          | $R_D$     |                                         | 1     | 1.5  | 2.3   | M $\Omega$       |

**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 463/438/400/330 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 Output Current Low (push-pull active low, and open-drain active-low, G696L and G697L) | $I_{OL}$ | $V_{CC} = 2.5V, V_{\overline{RESET}} = 0.5V$                     | 8   |     |     | mA      |
| RESET Output Current High (push-pull active low, G696L)                                     | $I_{OH}$ | $V_{CC} = 5V, V_{\overline{RESET}} = 4.5V, G696L463/438/400/330$ | 4.5 |     |     | mA      |
|                                                                                             |          | $V_{CC} = 3.3V, V_{\overline{RESET}} = 2.8V, G696L308/293$       | 3   |     |     |         |
|                                                                                             |          | $V_{CC} = 3V, V_{\overline{RESET}} = 2.5V, G696L263$             | 2   |     |     |         |
| RESET Output Current Low (push-pull active high, G696H)                                     | $I_{OL}$ | $V_{CC} = 5V, V_{RESET} = 0.5V, G696H463/438/400/330$            | 16  |     |     | mA      |
|                                                                                             |          | $V_{CC} = 3.3V, V_{RESET} = 0.5V, G696H308/293$                  | 12  |     |     |         |
|                                                                                             |          | $V_{CC} = 3V, V_{RESET} = 0.5V, G696H263$                        | 10  |     |     |         |
| RESET Output Current High (push-pull active high, G696H)                                    | $I_{OH}$ | $V_{CC} = 2.5V, V_{RESET} = 2V$                                  | 2   |     |     | mA      |
| RESET Open-Drain Output Leakage Current (G697L)                                             |          | $V_{CC} > V_{TH}, \overline{RESET}$ deasserted                   |     |     | 1   | $\mu A$ |

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

**Selector Guide**

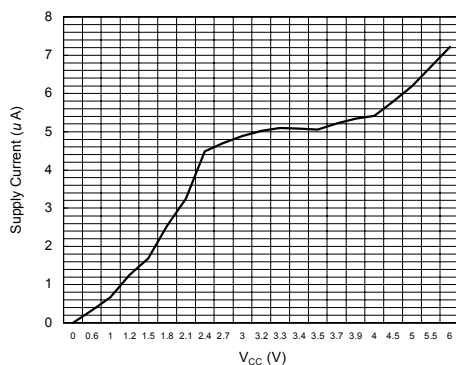
| PART/SUFFIX | RESET THRESHOLD (V) | OUTPUT TYPE                   | TOP MARK |
|-------------|---------------------|-------------------------------|----------|
| G697L463T_  | 4.63                | Open-Drain $\overline{RESET}$ | 697Gx    |
| G697L438T_  | 4.38                | Open-Drain $\overline{RESET}$ | 697Fx    |
| G697L400T_  | 4.00                | Open-Drain $\overline{RESET}$ | 697Ex    |
| G697L330T_  | 3.30                | Open-Drain $\overline{RESET}$ | 697Dx    |
| G697L308T_  | 3.08                | Open-Drain $\overline{RESET}$ | 697Cx    |
| G697L293T_  | 2.93                | Open-Drain $\overline{RESET}$ | 697Bx    |
| G697L263T_  | 2.63                | Open-Drain $\overline{RESET}$ | 697Ax    |
| G696H463T_  | 4.63                | Push-Pull $\overline{RESET}$  | 696Lx    |
| G696H438T_  | 4.38                | Push-Pull $\overline{RESET}$  | 696Kx    |
| G696H400T_  | 4.00                | Push-Pull $\overline{RESET}$  | 696Jx    |
| G696H330T_  | 3.30                | Push-Pull $\overline{RESET}$  | 696Nx    |
| G696H308T_  | 3.08                | Push-Pull $\overline{RESET}$  | 696Ix    |
| G696H293T_  | 2.93                | Push-Pull $\overline{RESET}$  | 696Hx    |
| G696H263T_  | 2.63                | Push-Pull $\overline{RESET}$  | 696Gx    |
| G696L463T_  | 4.63                | Push-Pull $\overline{RESET}$  | 696Fx    |
| G696L438T_  | 4.38                | Push-Pull $\overline{RESET}$  | 696Ex    |
| G696L400T_  | 4.00                | Push-Pull $\overline{RESET}$  | 696Dx    |
| G696L330T_  | 3.30                | Push-Pull $\overline{RESET}$  | 696Mx    |
| G696L308T_  | 3.08                | Push-Pull $\overline{RESET}$  | 696Cx    |
| G696L293T_  | 2.93                | Push-Pull $\overline{RESET}$  | 696Bx    |
| G696L263T_  | 2.63                | Push-Pull $\overline{RESET}$  | 696Ax    |



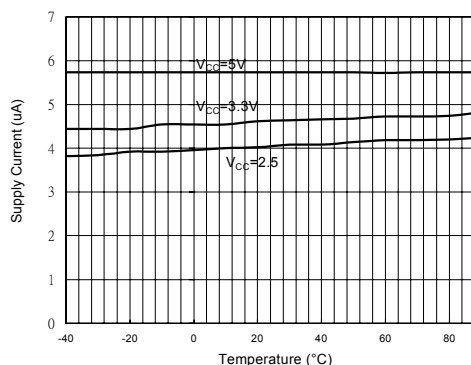
## Typical Operating Characteristics

( $V_{CC}$  = full range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , unless otherwise noted. Typical values are at  $T_A = +25^{\circ}\text{C}$ ,  $V_{CC} = 5\text{V}$  for 463/438/400/330 versions,  $V_{CC} = 3.3\text{V}$  for 308/293 versions, and  $V_{CC} = 3\text{V}$  for 263 version.)

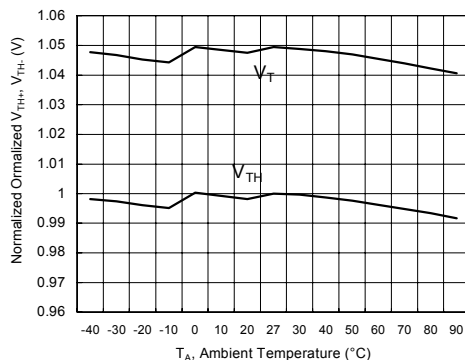
Supply Current vs.  $V_{CC}$



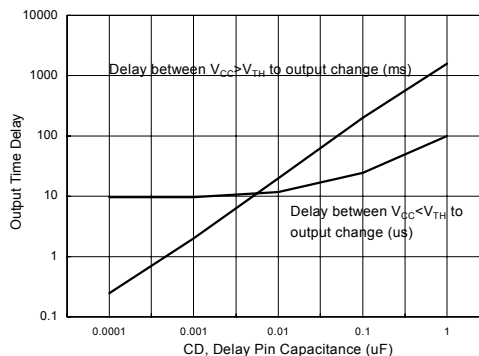
Supply Current vs. Temperature (No Load)



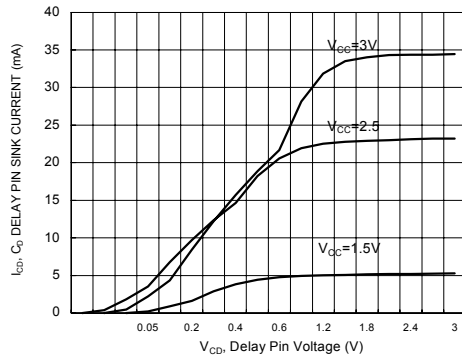
Normalized Reset Threshold vs. Temperature



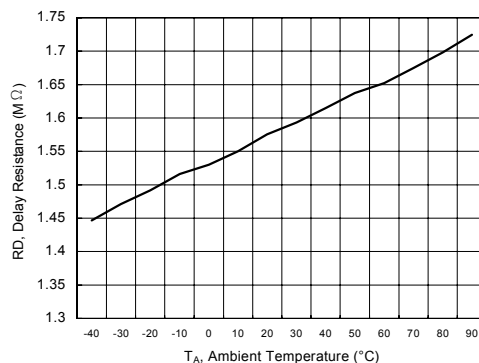
Output Time Delay vs. Capacitance



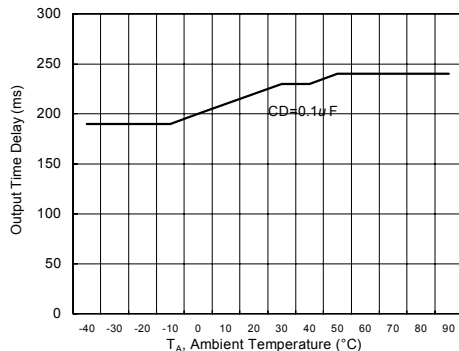
$C_D$  Delay Pin Sink Current vs. Voltage



Delay Resistance vs. Temperature



Reset Output Time Delay vs. Temperature



## Timing Diagram

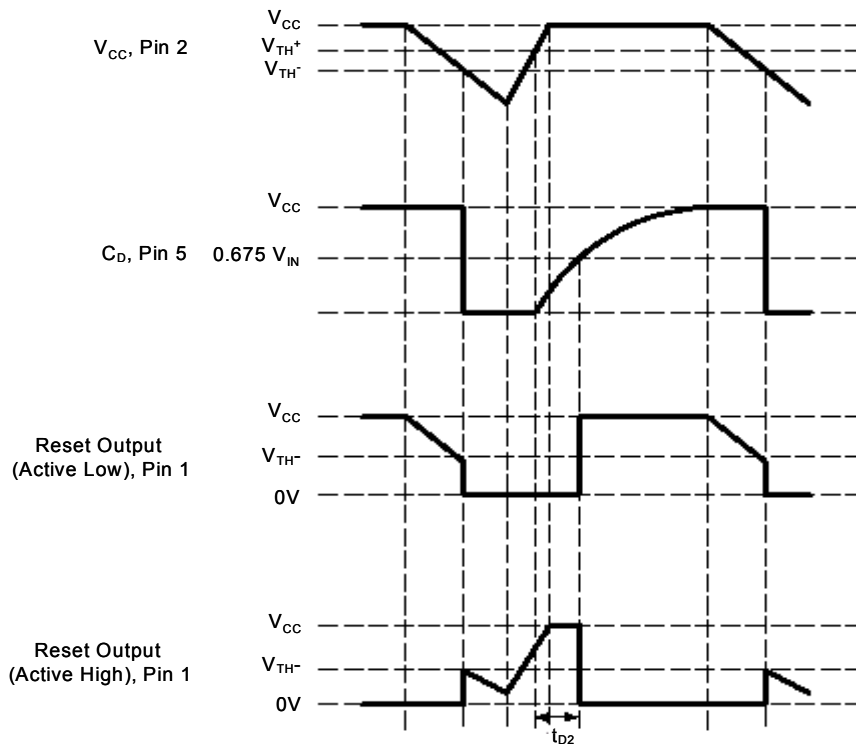


Figure 1

## Functional Diagram

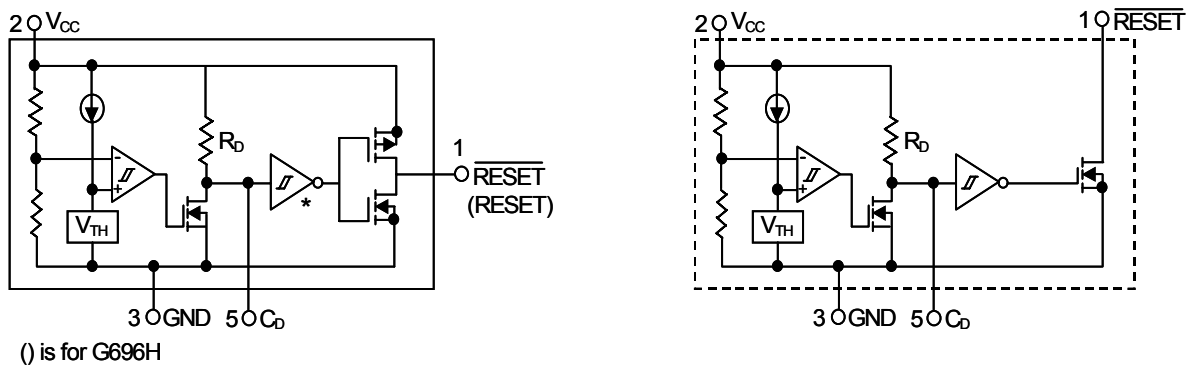


Figure 2

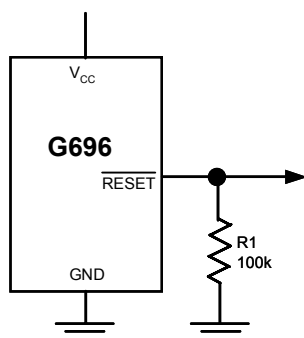
## Pin Description

| PIN | NAME                                    | FUNCTION                                                                                                                                               |
|-----|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | $\overline{\text{RESET}}$ (G696L/G697L) | RESET Output remains low while $V_{CC}$ is below the reset threshold, and for delay time set by $C_D$ after $V_{CC}$ rises above the reset threshold.  |
|     | RESET (G696H)                           | RESET Output remains high while $V_{CC}$ is below the reset threshold, and for delay time set by $C_D$ after $V_{CC}$ rises above the reset threshold. |
| 2   | $V_{CC}$                                | Supply Voltage (+5V, +3.3V, +3.0V)                                                                                                                     |
| 3   | GND                                     | Ground                                                                                                                                                 |
| 4   | N.C.                                    | No Connection.                                                                                                                                         |
| 5   | $C_D$                                   | External Programmable time delay is set by the capacitor connect to $C_D$ pin.                                                                         |

## Detailed Description

A microprocessor's ( $\mu P$ 's) reset input starts the  $\mu P$  in a known state. The G697L/G696L/G696H 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 ( $V_{TH-}$ ), keeping it asserted for time delay set by capacitor connected to  $C_D$  pin, after  $V_{CC}$  has risen above the high reset threshold  $V_{TH+}$  ( $V_{TH+} + V_{HYS}$ ). The G697L uses an open-drain output, and the G696L/G696H have a push-pull output stage. Connect a pull-up resistor on the G697L's  $\overline{\text{RESET}}$  output to any supply between 0 and 5.5V.

The time delay is set by external capacitor  $C_D$ , and internal pull up resistor  $R_D$ . When the voltage at  $C_D$  pin exceeds the buffer threshold, typically  $0.675 V_{CC}$ , the  $\overline{\text{RESET}}$  output high (RESET output low). The voltage detector and buffer have built-in hysteresis to prevent erratic reset operation. The formula of time delay is  $T \text{ (ms)} \approx 1685 C_D \text{ (}\mu\text{F)}$ . Fig1 and Fig2 show a timing diagram and a Functional Block.



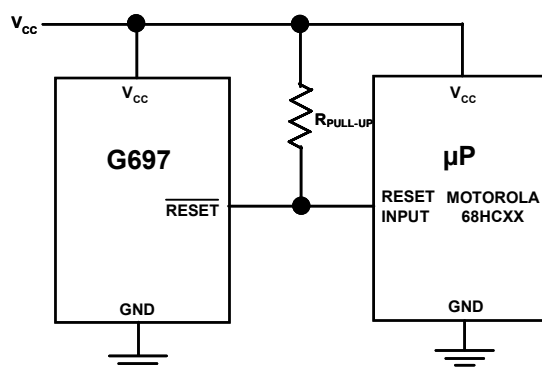
**Figure3.  $\overline{\text{RESET}}$  Valid to  $V_{CC} = \text{Ground}$  Circuit**

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

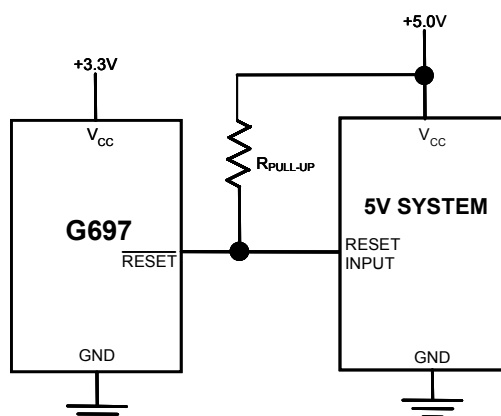
When  $V_{CC}$  falls below 0.8V, the G696  $\overline{\text{RESET}}$  output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to  $\overline{\text{RESET}}$  can drift to undetermined voltages. This presents no problem in most applications since most  $\mu P$  and other circuitry is inoperative with  $V_{CC}$  below 0.8V. 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 4). R1'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 G697L if  $\overline{\text{RESET}}$  is required to remain valid for  $V_{CC} < 0.8V$ .



**Figure 4. Interfacing to  $\mu P$ s with Bidirectional Reset I/O**



**Figure 5. G697L 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 G697L 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 5).

## G697L Open-Drain $\overline{\text{RESET}}$ Output Allows Use with Multiple Supplies

Generally, the pull-up connected to the G697L 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 6). Note that as the G697L'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.

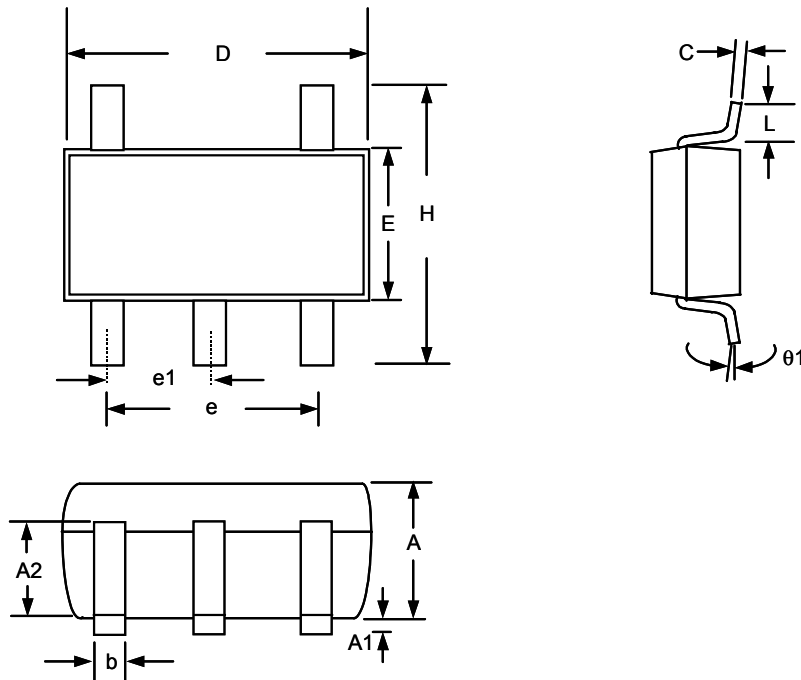
## Benefits of Highly Accurate Reset Threshold

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 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

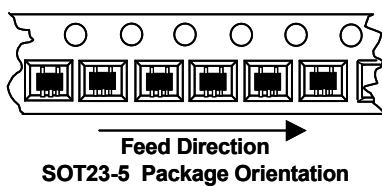


### Note:

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) | ---- |
| e1         | ----                      | 0.95      | ---- |
| H          | 2.60                      | 2.80      | 3.00 |
| L          | 0.37                      | ----      | ---- |
| $\theta 1$ | 1°                        | 5°        | 9°   |

## Taping Specification



GMT Inc. does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and GMT Inc. reserves the right at any time without notice to change said circuitry and specifications.