

## 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
- 14 $\mu\text{A}$  Supply Current
- Guaranteed Reset Valid to  $V_{\text{CC}} = 0.8\text{V}$
- Power Supply Transient Immunity
- 5 pin SOT-23-5 or TSOT-23-5 Packages
- 2% Threshold Accuracy

### Applications

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

### General Description

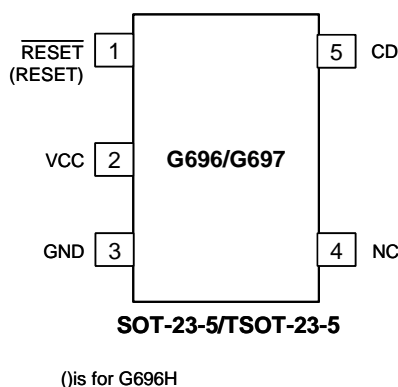
The G696/G697 are microprocessor ( $\mu\text{P}$ ) supervisory circuits used to monitor the power supplies in  $\mu\text{P}$  and digital systems. They provide excellent circuit reliability and low cost and adjustments when used with +5V, +3.3V, +3.0V- powered circuits.

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.

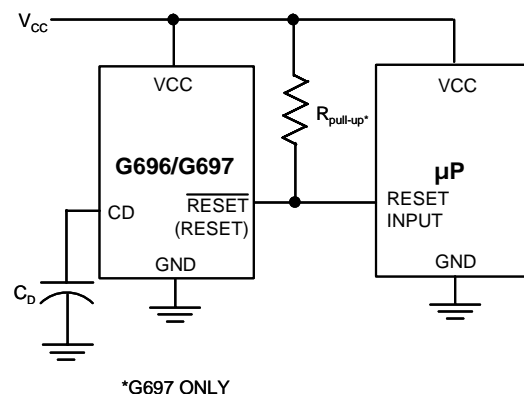
The G697L has an open-drain output stage, while the G696 have push-pull outputs. The G697L's open-drain  $\overline{\text{RESET}}$  output requires a pull-up resistor that can be connected to a voltage higher than  $V_{\text{CC}}$ . The G696L have an active-low  $\overline{\text{RESET}}$  output, while 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 or TSOT-23-5 packages.

### Pin Configuration



### Typical Application Circuit



**Ordering Information**

ORDER NUMBER	ORDER NUMBER (Pb free)	TEMP. RANGE	PACKAGE
G696HxxxT1U	G696HxxxT1Uf	-40°C ~ +105°C	SOT-23-5
G696LxxxT1U	G696LxxxT1Uf	-40°C ~ +105°C	SOT-23-5
G697LxxxT1U	G697LxxxT1Uf	-40°C ~ +105°C	SOT-23-5
G696HxxxTOU	G696HxxxTOUf	-40°C ~ +105°C	TSOT-23-5
G696LxxxTOU	G696LxxxTOUf	-40°C ~ +105°C	TSOT-23-5
G697LxxxTOU	G697LxxxTOUf	-40°C ~ +105°C	TSOT-23-5

Note: T1: SOT-23-5 TO: TSOT-23-5

U: Tape &amp; Reel

\* xxx specifies the threshold voltage.

e.g. 263 denotes the 2.64V threshold voltage.

**Selector Guide**

ORDER NUMBER	ORDER NUMBER (Pb free)	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK
G697L463T1U	G697L463T1Uf	4.60	Open-Drain $\overline{\text{RESET}}$	697Gx
G697L438T1U	G697L438T1Uf	4.32	Open-Drain $\overline{\text{RESET}}$	697Fx
G697L400T1U	G697L400T1Uf	3.96	Open-Drain $\overline{\text{RESET}}$	697Ex
G697L330T1U	G697L330T1Uf	3.30	Open-Drain $\overline{\text{RESET}}$	697Dx
G697L308T1U	G697L308T1Uf	3.10	Open-Drain $\overline{\text{RESET}}$	697Cx
G697L293T1U	G697L293T1Uf	2.91	Open-Drain $\overline{\text{RESET}}$	697Bx
G697L263T1U	G697L263T1Uf	2.64	Open-Drain $\overline{\text{RESET}}$	697Ax
G697L250T1U	G697L250T1Uf	2.50	Open-Drain $\overline{\text{RESET}}$	697Hx
G696H463T1U	G696H463T1Uf	4.60	Push-Pull RESET	696Lx
G696H438T1U	G696H438T1Uf	4.32	Push-Pull RESET	696Kx
G696H400T1U	G696H400T1Uf	3.96	Push-Pull RESET	696Jx
G696H330T1U	G696H330T1Uf	3.30	Push-Pull RESET	696Nx
G696H308T1U	G696H308T1Uf	3.10	Push-Pull RESET	696Ix
G696H293T1U	G696H293T1Uf	2.91	Push-Pull RESET	696Hx
G696H263T1U	G696H263T1Uf	2.64	Push-Pull RESET	696Gx
G696H250T1U	G696H250T1Uf	2.50	Push-Pull RESET	696Qx
G696L463T1U	G696L463T1Uf	4.60	Push-Pull $\overline{\text{RESET}}$	696Fx
G696L438T1U	G696L438T1Uf	4.32	Push-Pull $\overline{\text{RESET}}$	696Ex
G696L400T1U	G696L400T1Uf	3.96	Push-Pull $\overline{\text{RESET}}$	696Dx
G696L330T1U	G696L330T1Uf	3.30	Push-Pull $\overline{\text{RESET}}$	696Mx
G696L308T1U	G696L308T1Uf	3.10	Push-Pull $\overline{\text{RESET}}$	696Cx
G696L293T1U	G696L293T1Uf	2.91	Push-Pull $\overline{\text{RESET}}$	696Bx
G696L263T1U	G696L263T1Uf	2.64	Push-Pull $\overline{\text{RESET}}$	696Ax
G696L250T1U	G696L250T1Uf	2.50	Push-Pull $\overline{\text{RESET}}$	696Px

T1: SOT-23-5

**Selector Guide**

ORDER NUMBER	ORDER NUMBER (Pb free)	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK
G697L463TOU	G697L463TOUf	4.60	Open-Drain $\overline{\text{RESET}}$	697Gx
G697L438TOU	G697L438TOUf	4.32	Open-Drain $\overline{\text{RESET}}$	697Fx
G697L400TOU	G697L400TOUf	3.96	Open-Drain $\overline{\text{RESET}}$	697Ex
G697L330TOU	G697L330TOUf	3.30	Open-Drain $\overline{\text{RESET}}$	697Dx
G697L308TOU	G697L308TOUf	3.10	Open-Drain $\overline{\text{RESET}}$	697Cx
G697L293TOU	G697L293TOUf	2.91	Open-Drain $\overline{\text{RESET}}$	697Bx
G697L263TOU	G697L263TOUf	2.64	Open-Drain $\overline{\text{RESET}}$	697Ax
G697L250TOU	G697L250TOUf	2.50	Open-Drain $\overline{\text{RESET}}$	697Hx
G696H463TOU	G696H463TOUf	4.60	Push-Pull $\overline{\text{RESET}}$	696Lx
G696H438TOU	G696H438TOUf	4.32	Push-Pull $\overline{\text{RESET}}$	696Kx
G696H400TOU	G696H400TOUf	3.96	Push-Pull $\overline{\text{RESET}}$	696Jx
G696H330TOU	G696H330TOUf	3.30	Push-Pull $\overline{\text{RESET}}$	696Nx
G696H308TOU	G696H308TOUf	3.10	Push-Pull $\overline{\text{RESET}}$	696Ix
G696H293TOU	G696H293TOUf	2.91	Push-Pull $\overline{\text{RESET}}$	696Hx
G696H263TOU	G696H263TOUf	2.64	Push-Pull $\overline{\text{RESET}}$	696Gx
G696H250TOU	G696H250TOUf	2.50	Push-Pull $\overline{\text{RESET}}$	696Qx
G696L463TOU	G696L463TOUf	4.60	Push-Pull $\overline{\text{RESET}}$	696Fx
G696L438TOU	G696L438TOUf	4.32	Push-Pull $\overline{\text{RESET}}$	696Ex
G696L400TOU	G696L400TOUf	3.96	Push-Pull $\overline{\text{RESET}}$	696Dx
G696L330TOU	G696L330TOUf	3.30	Push-Pull $\overline{\text{RESET}}$	696Mx
G696L308TOU	G696L308TOUf	3.10	Push-Pull $\overline{\text{RESET}}$	696Cx
G696L293TOU	G696L293TOUf	2.91	Push-Pull $\overline{\text{RESET}}$	696Bx
G696L263TOU	G696L263TOUf	2.64	Push-Pull $\overline{\text{RESET}}$	696Ax
G696L250TOU	G696L250TOUf	2.50	Push-Pull $\overline{\text{RESET}}$	696Px

TO: TSOT-23-5

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

Operating Temperature Range. . . . . -40°C to +105°C

Storage Temperature Range . . . . . -65°C to +150°C

Reflow Temperature (soldering, 10sec) . . . . . 260°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**

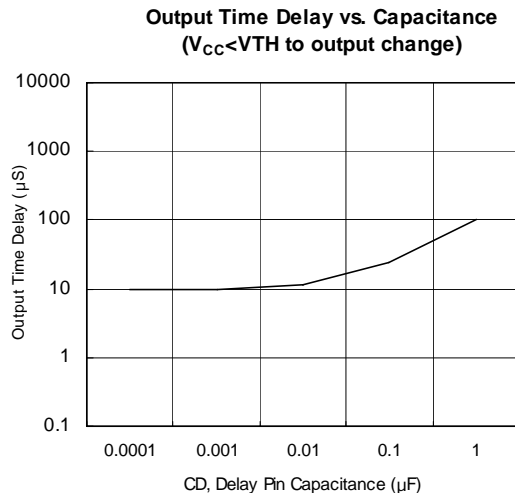
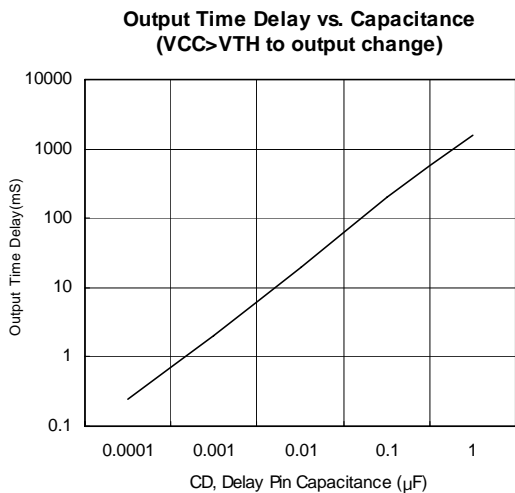
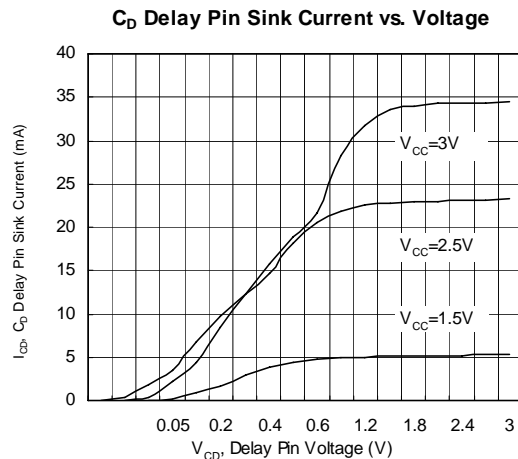
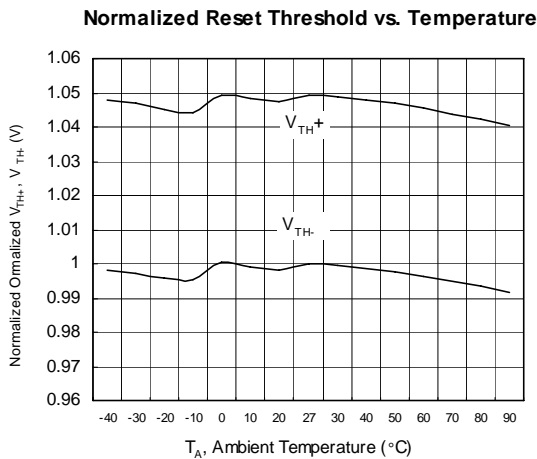
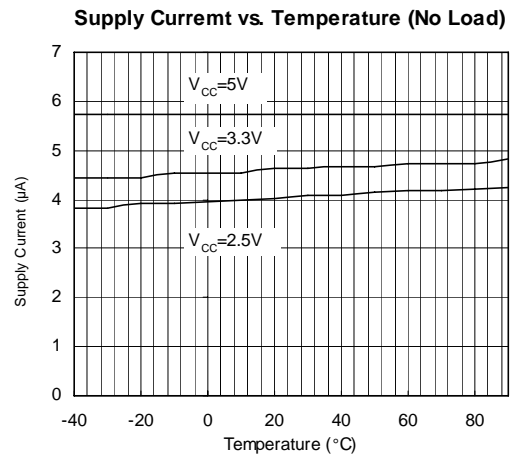
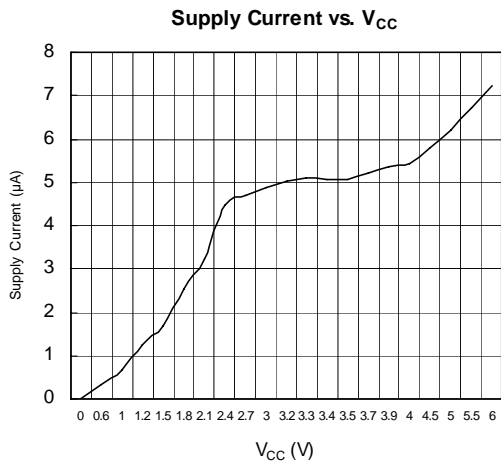
( $V_{CC}$  = full range,  $T_A$  = -40°C to +105°C, unless otherwise noted. Typical values are at  $T_A$  = +25°C,  $V_{CC}$  = 5V for 463/438/400/330 versions,  $V_{CC}$  = 3.3V for 308/293 versions, and  $V_{CC}$  = 3V for 263/250 version.) (Note 1)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
V <sub>CC</sub> Range		T <sub>A</sub> = 0°C +70°C	0.8	---	5.5	V
		T <sub>A</sub> = -40°C +105°C	1	---	5.5	
Supply Current (SOT-23-5)	I <sub>CC</sub>	V <sub>CC</sub> < 5.5V, G69_ 463/438/400/330_	---	16.5	25	μA
		V <sub>CC</sub> < 3.6V, G69_ 308/293/263/250_	---	13.9	22	
Reset Threshold	V <sub>TH</sub>	G69_ 463_	4.50	4.6	4.69	V
		G69_ 438_	4.23	4.32	4.40	
		G69_ 400_	3.88	3.96	4.04	
		G69_ 330_	3.25	3.3	3.37	
		G69_ 308_	3.04	3.10	3.16	
		G69_ 293_	2.86	2.91	2.96	
		G69_ 263_	2.59	2.64	2.69	
Reset Threshold Hysteresis	V <sub>HYS</sub>		3.6	5.3	7	%
Reset Threshold Tempco			---	70	---	ppm/°C
C <sub>D</sub> Delay Pin Threshold Voltage	V <sub>TDC</sub>		0.87	1.25	1.29	V
Delay Capacitor Pin Sink Current	I <sub>CD</sub>	V <sub>CC</sub> = 1.5V, V <sub>CD</sub> = 0.5V	3	5	---	mA
Delay Capacitor Pin Source Current		V <sub>CC</sub> > V <sub>TH</sub> + V <sub>HYS</sub>	0.5	0.88	1.2	μA
RESET Output Current Low (push-pull active low, and open-drain active-low, G696L and G697L)	I <sub>OL</sub>	V <sub>CC</sub> = 2.5V, V <sub>RESET</sub> = 0.5V	8	---	---	mA
RESET Output Current High (push-pull active low, G696L)	I <sub>OH</sub>	V <sub>CC</sub> = 5V, V <sub>RESET</sub> = 4.5V, G696L463/438/400/330	4.5	---	---	mA
		V <sub>CC</sub> = 3.3V, V <sub>RESET</sub> = 2.8V, G696L308/293	3	---	---	---
		V <sub>CC</sub> = 3V, V <sub>RESET</sub> = 2.5V, G696L263/250	2	---	---	---
RESET Output Current Low (push-pull active high, G696H)	I <sub>OL</sub>	V <sub>CC</sub> = 5V, V <sub>RESET</sub> = 0.5V, G696H463/438/400/330	16	---	---	mA
		V <sub>CC</sub> = 3.3V, V <sub>RESET</sub> = 0.5V, G696H308/293	12	---	---	---
		V <sub>CC</sub> = 3V, V <sub>RESET</sub> = 0.5V, G696H263/250	10	---	---	---
RESET Output Current High (push-pull active high, G696H)	I <sub>OH</sub>	V <sub>CC</sub> = 2.5V, V <sub>RESET</sub> = 2V	2	---	---	mA
RESET Open-Drain Output Leakage Current (G697L)		V <sub>CC</sub> > V <sub>TH</sub> , $\overline{RESET}$ deasserted	---	---	1	μA

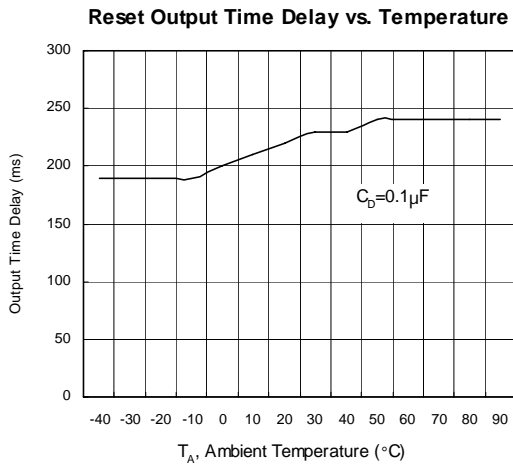
Note 1: Production testing done at T<sub>A</sub> = +25°C; limits over temperature guaranteed by design.

**Typical Operating Characteristics**

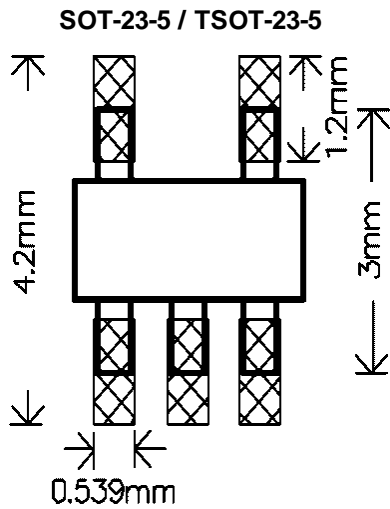
( $V_{CC}$  = full range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , unless otherwise noted. Typical values are at  $T_A$  =  $+25^{\circ}\text{C}$ ,  $V_{CC}$  = 5V for 463/438/400/330 versions,  $V_{CC}$  = 3.3V for 308/293 versions, and  $V_{CC}$  = 3V for 263/250 version.)



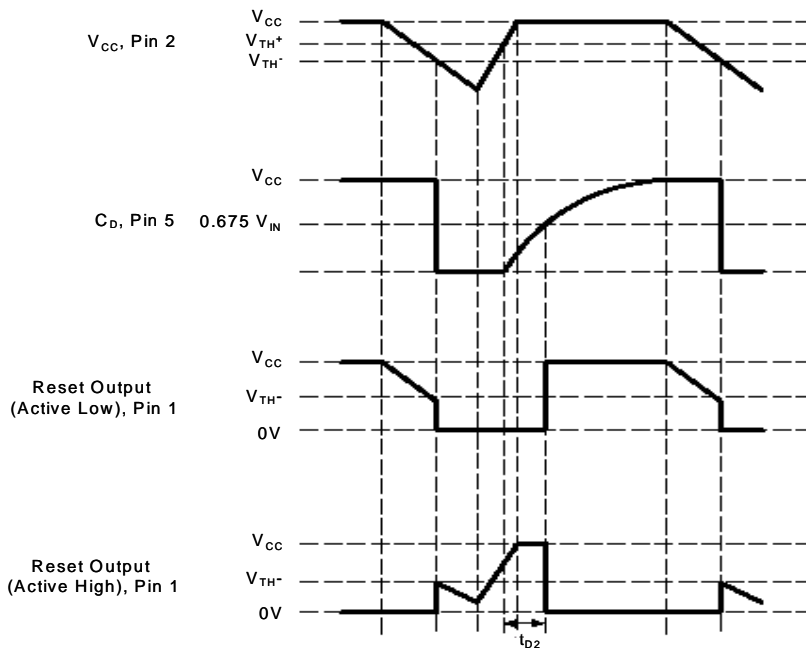
Typical Operating Characteristics (continued)



**Recommended Minimum Footprint**

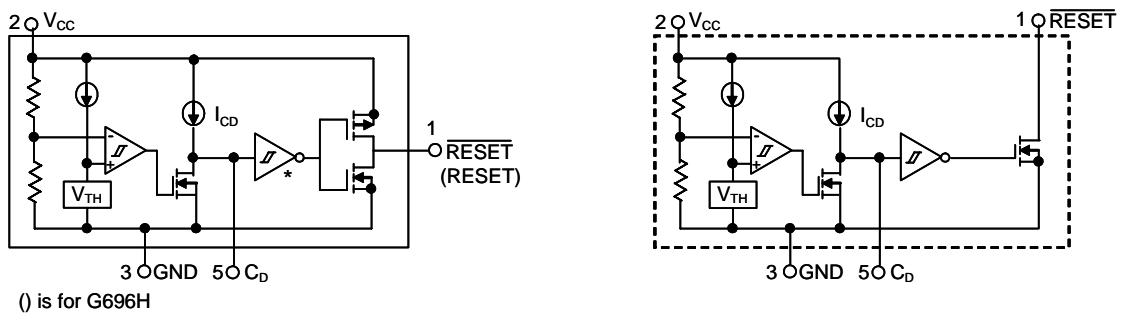


**Timing Diagram**



**Figure 1**

**Functional Diagram**



( ) is for G696H

**Figure 2**

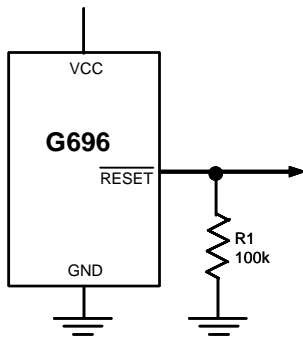
**Pin Description**

PIN	NAME	FUNCTION
1	$\overline{\text{RESET}}$ (G696L/G697L)	$\overline{\text{RESET}}$ 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	VCC	Supply Voltage (+5V, +3.3V, +3.0V)
3	GND	Ground
4	NC	No Connection.
5	CD	External Programmable time delay is set by the capacitor connect to $C_D$ pin.

**Detailed Description**

A microprocessor's ( $\mu\text{P}$ 's) reset input starts the  $\mu\text{P}$  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 current  $I_{CD}$ . When the voltage at  $C_D$  pin exceeds the buffer threshold, typically 1.25V, 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  $T$  (ms)  $\approx 1685 C_D$  ( $\mu\text{F}$ ). Fig1 and Fig2 show a timing diagram and a Functional Block.



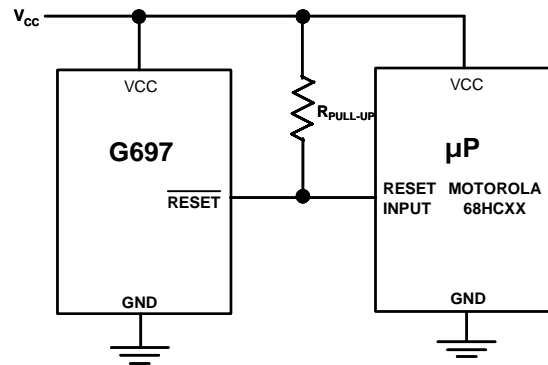
**Figure3.  $\overline{\text{RESET}}$  Valid to  $V_{CC} = \text{Ground}$  Circuit**

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

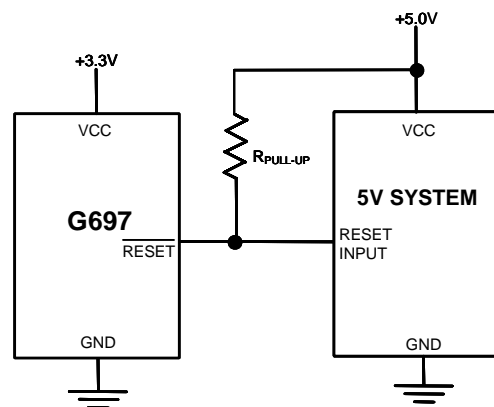
When  $V_{CC}$  falls below 0.8V, the G696  $\overline{\text{RESET}}$  output no longer sinks current-it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to  $\overline{\text{RESET}}$  can drift to undetermined voltages. This presents no problem in most applications since most  $\mu\text{P}$  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).  $R_1$ '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 G697L if  $\overline{\text{RESET}}$  is required to remain valid for  $V_{CC} < 0.8\text{V}$ .



**Figure 4. Interfacing to  $\mu\text{P}$ 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  $V_{\text{CC}}$  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  $V_{\text{CC}}$  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  $V_{\text{CC}}$  decays toward 0. The voltage where this occurs depends on the pull-up resistor value and the voltage to which it is connected.

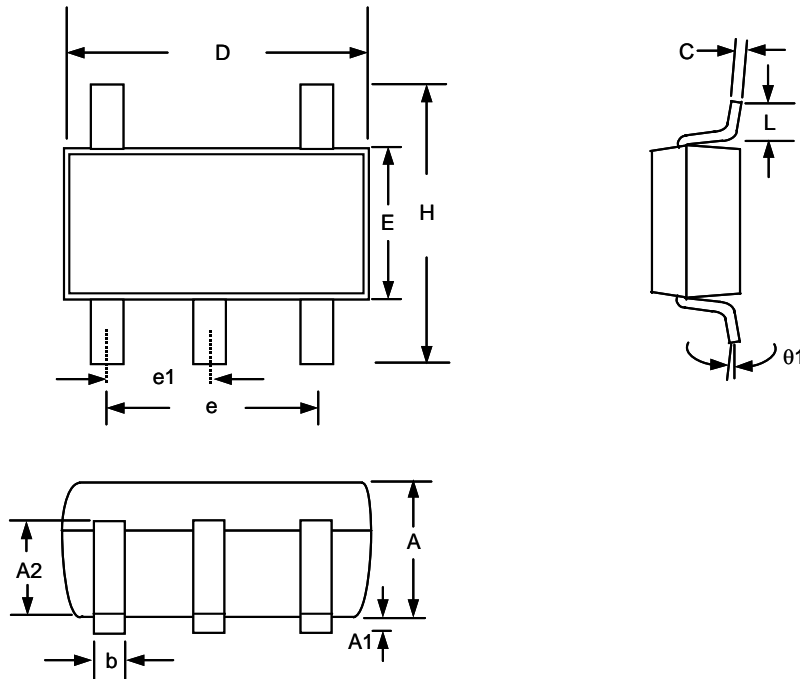
**Benefits of Highly Accurate Reset Threshold**

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



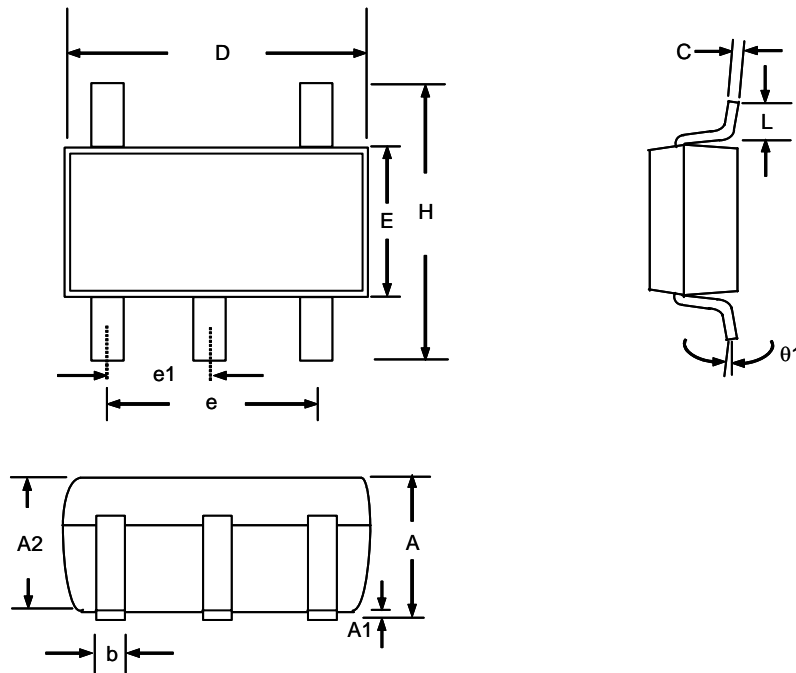
**SOT-23-5 (T1) Package**

**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

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.00	1.10	1.30	0.039	0.043	0.051
A1	0.00	-----	0.10	0.000	-----	0.004
A2	0.70	0.80	0.90	0.028	0.031	0.035
b	0.35	0.40	0.50	0.014	0.016	0.020
C	0.10	0.15	0.25	0.004	0.006	0.010
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.40	1.60	1.80	0.055	0.063	0.071
e	-----	1.90(TYP)	-----	-----	0.075(TYP)	-----
e1	-----	0.95	-----	-----	0.037	-----
H	2.60	2.80	3.00	0.102	0.110	0.118
L	0.37	-----	-----	0.015	-----	-----
$\theta 1$	1°	5°	9°	1°	5°	9°

5.



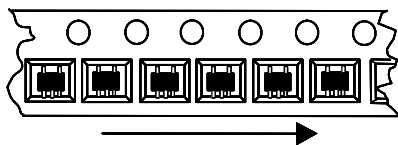
**TSOT-23-5 (TO) Package**

**Note:**

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

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	----	----	1.00	----	----	0.039
A1	0.00	----	0.10	0.000	----	0.004
A2	----	----	0.90	----	----	0.035
b	0.35	0.40	0.50	0.014	0.016	0.020
C	0.10	0.15	0.25	0.004	0.006	0.010
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.40	1.60	1.80	0.055	0.063	0.071
e	----	1.90(TYP)	----	----	0.075(TYP)	----
e1	----	0.95	----	----	0.037	----
H	2.60	2.80	3.00	0.102	0.110	0.118
L	0.37	-----	----	0.015	----	----
$\theta 1$	1°	5°	9°	1°	5°	9°

**Taping Specification**



**TSOT-23-5 · SOT-23-5 Package Orientation**

PACKAGE	Q'TY/REEL
SOT-23-5	3,000 ea
TSOT-23-5	3,000 ea

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