G696/G697

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 RESET Output (G696H)
  Open-Drain $\overline{\text{RESET}}$ Output (G697L)
- **Externally Programmable Time Delay Generator**
- **14µA Supply Current**
- **Guaranteed Reset Valid to V_{CC} = 0.8V**
- **Power Supply Transient Immunity**
- **5 pin SOT-23-5 or TSOT-23-5 Packages**
- **2% Threshold Accuracy**

Applications

- **Computers**
- **Controllers**
- **Intelligent Instruments**
- **Critical µP and µC Power Monitoring**
- **Portable / Battery-Powered Equipment**
- **Automotive**

General Description

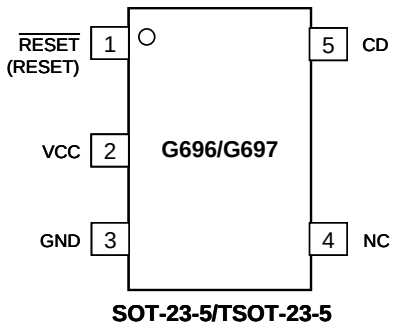
The G696/G697 are microprocessor (µP) supervisory circuits used to monitor the power supplies in µP and digital systems. They provide excellent circuit reliability and low cost and adjustments when used with +5V, +3.3V, +3.0V- powered circuits.

These circuits perform a single function: they assert a reset signal whenever the V_{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_{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_{CC}. The G696L have an active-low $\overline{\text{RESET}}$ output, while the G696H 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 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.

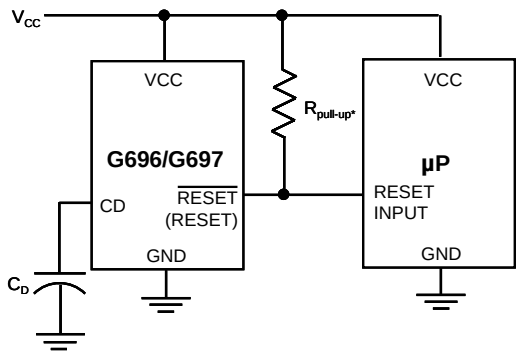
Pin Configuration



SOT-23-5/TSOT-23-5

()is for G696H

Typical Application Circuit



*G697 ONLY
ICC may increased at high T_A, Therefore, can not connect Resistors to VCC to prevent Icc abnormal behavior at high T_A.

Ordering Information

ORDER NUMBER (Pb free/Green)	TEMP. RANGE	PACKAGE
G696HxxxT1Uf	-40°C ~ +105°C	SOT-23-5
G696LxxxT1Uf	-40°C ~ +105°C	SOT-23-5
G697LxxxT1Uf	-40°C ~ +105°C	SOT-23-5
G696HxxxTOUf	-40°C ~ +105°C	TSOT-23-5
G696LxxxTOUf	-40°C ~ +105°C	TSOT-23-5
G697LxxxTOUf	-40°C ~ +105°C	TSOT-23-5

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

U: Tape & Reel

* xxx specifies the threshold voltage.

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

Selector Guide

ORDER NUMBER (Pb free/Green)	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK
G697L463T1Uf	4.60	Open-Drain $\overline{\text{RESET}}$	697Gx
G697L438T1Uf	4.32	Open-Drain $\overline{\text{RESET}}$	697Fx
G697L400T1Uf	3.96	Open-Drain $\overline{\text{RESET}}$	697Ex
G697L330T1Uf	3.30	Open-Drain $\overline{\text{RESET}}$	697Dx
G697L308T1Uf	3.10	Open-Drain $\overline{\text{RESET}}$	697Cx
G697L293T1Uf	2.91	Open-Drain $\overline{\text{RESET}}$	697Bx
G697L263T1Uf	2.64	Open-Drain $\overline{\text{RESET}}$	697Ax
G697L250T1Uf	2.50	Open-Drain $\overline{\text{RESET}}$	697Hx
G696H463T1Uf	4.60	Push-Pull RESET	696Lx
G696H438T1Uf	4.32	Push-Pull RESET	696Kx
G696H400T1Uf	3.96	Push-Pull RESET	696Jx
G696H330T1Uf	3.30	Push-Pull RESET	696Nx
G696H308T1Uf	3.10	Push-Pull RESET	696Ix
G696H293T1Uf	2.91	Push-Pull RESET	696Hx
G696H263T1Uf	2.64	Push-Pull RESET	696Gx
G696H250T1Uf	2.50	Push-Pull RESET	696Qx
G696L463T1Uf	4.60	Push-Pull $\overline{\text{RESET}}$	696Fx
G696L438T1Uf	4.32	Push-Pull $\overline{\text{RESET}}$	696Ex
G696L400T1Uf	3.96	Push-Pull $\overline{\text{RESET}}$	696Dx
G696L330T1Uf	3.30	Push-Pull $\overline{\text{RESET}}$	696Mx
G696L308T1Uf	3.10	Push-Pull $\overline{\text{RESET}}$	696Cx
G696L293T1Uf	2.91	Push-Pull $\overline{\text{RESET}}$	696Bx
G696L263T1Uf	2.64	Push-Pull $\overline{\text{RESET}}$	696Ax
G696L250T1Uf	2.50	Push-Pull $\overline{\text{RESET}}$	696Px

T1: SOT-23-5

Selector Guide

ORDER NUMBER (Pb free/Green)	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK
G697L463TOUf	4.60	Open-Drain $\overline{\text{RESET}}$	697Gx
G697L438TOUf	4.32	Open-Drain $\overline{\text{RESET}}$	697Fx
G697L400TOUf	3.96	Open-Drain $\overline{\text{RESET}}$	697Ex
G697L330TOUf	3.30	Open-Drain $\overline{\text{RESET}}$	697Dx
G697L308TOUf	3.10	Open-Drain $\overline{\text{RESET}}$	697Cx
G697L293TOUf	2.91	Open-Drain $\overline{\text{RESET}}$	697Bx
G697L263TOUf	2.64	Open-Drain $\overline{\text{RESET}}$	697Ax
G697L250TOUf	2.50	Open-Drain $\overline{\text{RESET}}$	697Hx
G696H463TOUf	4.60	Push-Pull RESET	696Lx
G696H438TOUf	4.32	Push-Pull RESET	696Kx
G696H400TOUf	3.96	Push-Pull RESET	696Jx
G696H330TOUf	3.30	Push-Pull RESET	696Nx
G696H308TOUf	3.10	Push-Pull RESET	696Ix
G696H293TOUf	2.91	Push-Pull RESET	696Hx
G696H263TOUf	2.64	Push-Pull RESET	696Gx
G696H250TOUf	2.50	Push-Pull RESET	696Qx
G696L463TOUf	4.60	Push-Pull $\overline{\text{RESET}}$	696Fx
G696L438TOUf	4.32	Push-Pull $\overline{\text{RESET}}$	696Ex
G696L400TOUf	3.96	Push-Pull $\overline{\text{RESET}}$	696Dx
G696L330TOUf	3.30	Push-Pull $\overline{\text{RESET}}$	696Mx
G696L308TOUf	3.10	Push-Pull $\overline{\text{RESET}}$	696Cx
G696L293TOUf	2.91	Push-Pull $\overline{\text{RESET}}$	696Bx
G696L263TOUf	2.64	Push-Pull $\overline{\text{RESET}}$	696Ax
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 +6.0V
Delay 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 +6.0V
Input Current, V_{CC} 20mA
Output Current, RESET, $\overline{RESET}$ 20mA
Junction Temperature (T_J) . . . . . 150°C
Thermal Resistance Junction to Ambient, (θ_{JA})
SOT-23-5/TSOT-23-5 . . . . . .420°C/W

Continuous Power Dissipation (T_A = +25°C)
SOT-23-5/TSOT-23-5 . . . . . 297mW
Thermal Resistance Junction to Case, (θ_{JC})
SOT-23-5 . . . . . 180°C/W
Operating Temperature Range. . . . . -40°C to +105°C
Storage Temperature Range . . . . . -65°C to +150°C
Reflow Temperature (soldering, 10sec) . . . . . 260°C
ESD Rating (Human Body Model) 2kV

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 = 25°C, unless otherwise noted. Typical values are at 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)

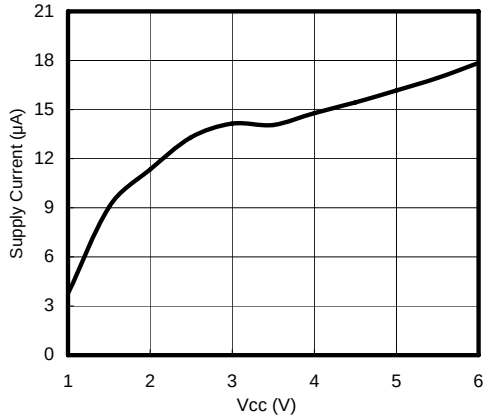
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
V_{CC} Range		T_A = 0°C +70°C	0.8	---	5.5	V
		T_A = -40°C +105°C	1	---	5.5	
Supply Current (SOT-23-5)	I_{CC}	V_{CC}<5.5V, G69_ _463/438/400/330_	---	16.5	25	µA
		V_{CC}<3.6V, G69_ _308/293/263/250_	---	13.9	22	
Reset Threshold	V_{TH-}	G69_ _463_	4.50	4.6	4.69	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	
		G69_ _250_	2.45	2.5	2.55	
Reset Threshold Hysterisis	V_{HYS}		3.6	5.3	7	%
Reset Threshold Tempco			---	70	---	ppm/°C
C_D Delay Pin Threshold Voltage	V_{TDC}		1.2	1.25	1.29	V
Delay Capacitor Pin Sink Current	I_{CD}	V_{CC} = 1.5V, V_{CD} = 0.5V	1.5	5	---	mA
Delay Capacitor Pin Source Current		V_{CC} > V_{TH-} + V_{HYS}	0.6	0.88	1.2	µA
$\overline{RESET}$ Output Current Low (push-pull active low, and open-drain active-low, G696L and G697L)	I_{OL}	V_{CC} = 2.3V, $V_{\overline{RESET}}$ = 0.5V	5	---	---	mA
$\overline{RESET}$ 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, 696L308/293	3	---	---	---
		V_{CC} = 3V, $V_{\overline{RESET}}$ = 2.5V, G696L263/250	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, G696H263/250	10	---	---	---
RESET Output Current High (push-pull active high, G696H)	I_{OH}	V_{CC} = 2.3V, V_{RESET} = 1.8V	2	---	---	mA
$\overline{RESET}$ Open-Drain Output Leakage Current (G697L)		V_{CC} > V_{TH}, $\overline{RESET}$ deasserted	---	---	1	µA

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

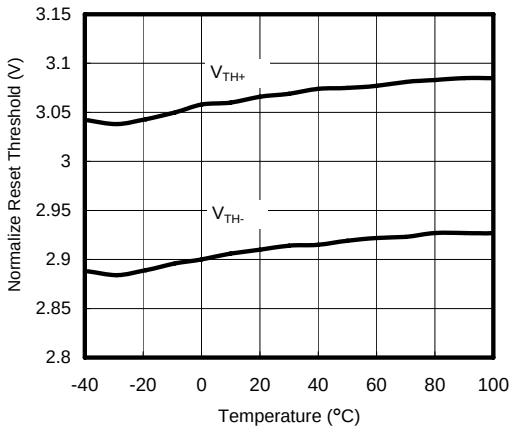
Typical Performance Characteristics

(V_{CC}= full range，T_A= -40°C~ +100°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 versions.

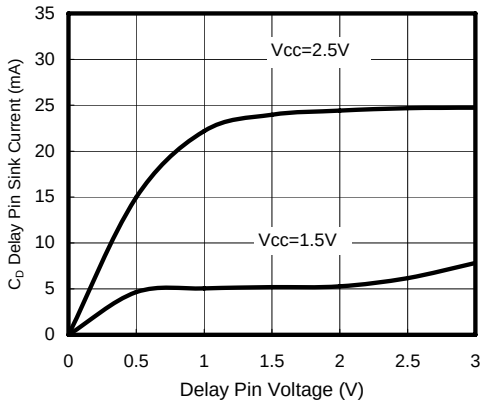
Supply Current vs. Vcc



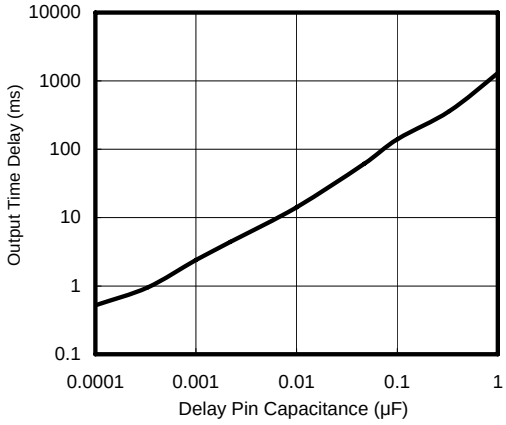
Normalize Reset Threshold vs. Temperature



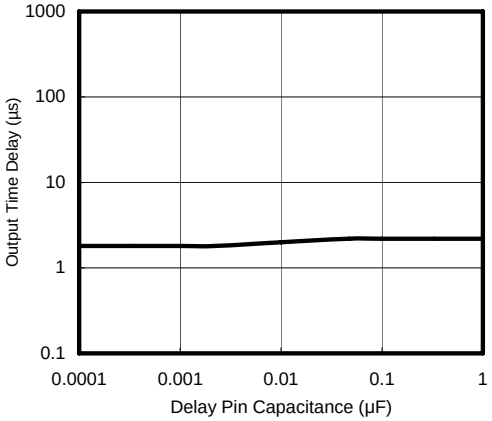
C_D Delay Pin Sink Current vs. Voltage



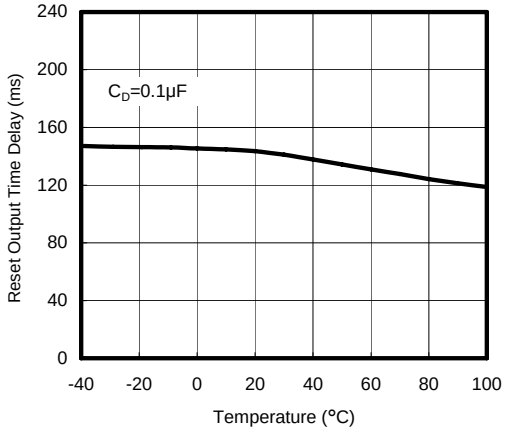
Output Time Delay vs. Capacitance (Vcc>V_{TH} to Output Change)



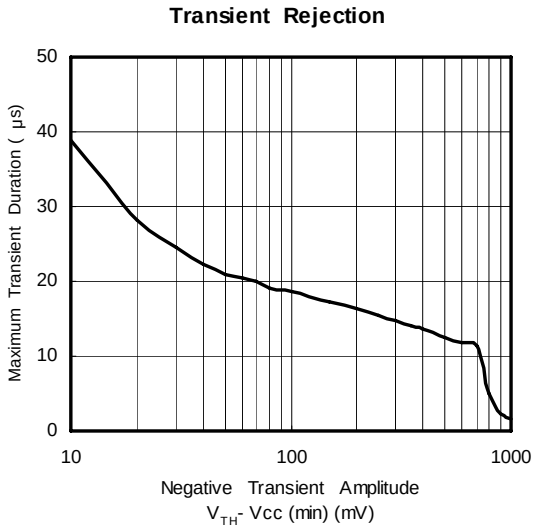
Output Time Delay vs. Capacitance (Vcc<V_{TH}-1V) to Output Change)



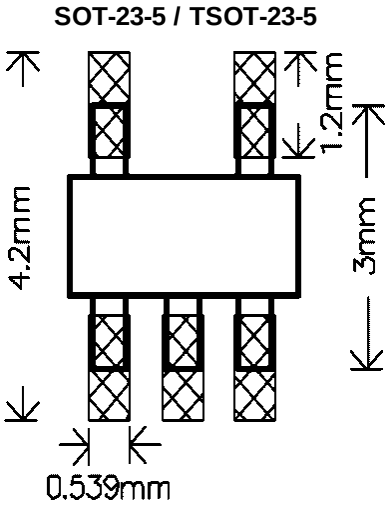
Reset Output Time Delay vs. Temperature



Typical Performance Characteristics (continued)



Minimum Footprint PCB Layout Section



Timing Diagram

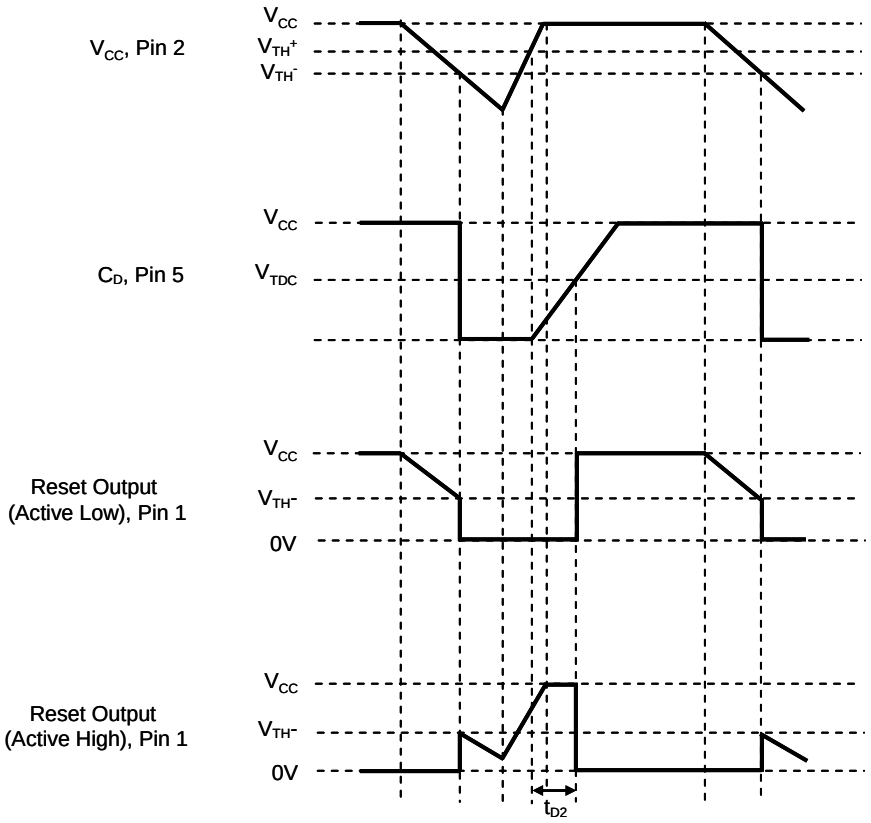


Figure 1

Functional Diagram

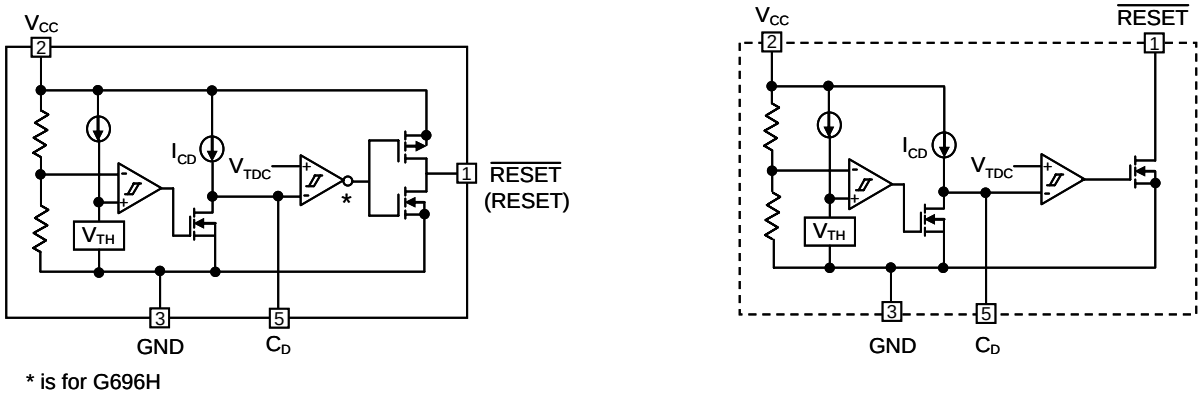


Figure 2

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 (µP's) reset input starts the µP 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 hysterisis to prevent erratic reset operation. The formula of time delay is T (ms) ≅ 1685 C_D (µF). Fig1 and Fig2 show a Timing Diagram and a Functional Block.

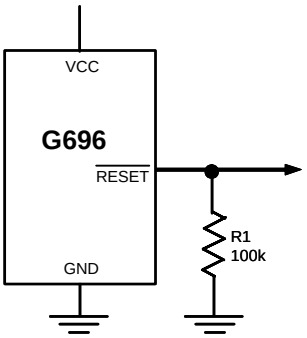


Figure3. $\overline{\text{RESET}}$ Valid to V_{CC} = Ground Circuit

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 µP and other circuitry is inoperative with VCC 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 3). R1's value is not critical; 100kΩ is large enough not to load $\overline{\text{RESET}}$ and small enough to pull $\overline{\text{RESET}}$ to ground.

A 100kΩ 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.

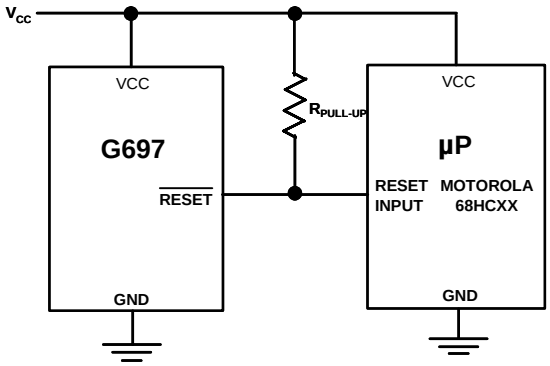


Figure 4. Interfacing to µPs with Bidirectional Reset I/O

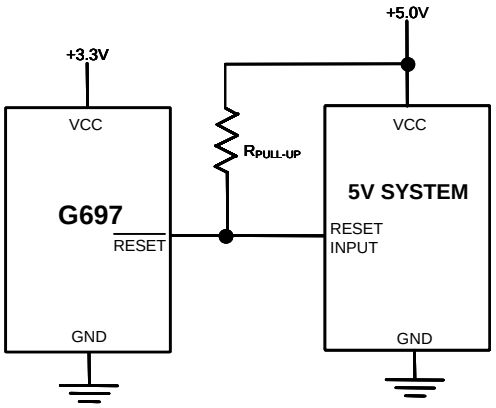


Figure 5. G697L Open-Drain $\overline{\text{RESET}}$ Output Allows Use with Multiple Supplies

Interfacing to µPs with Bidirectional Reset Pins

Since the $\overline{\text{RESET}}$ output on the G697L is open drain, this device interfaces easily with µPs that have bidirectional reset pins, such as the Motorola 68HC11. Connecting the µP supervisor's $\overline{\text{RESET}}$ output directly to the microcontroller's (µC's) $\overline{\text{RESET}}$ pin with a single pull-up resistor allows either device to assert reset (Figure 4).

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 5). 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 VCC decays toward 0. The voltage where this occurs depends on the pull-up resistor value and the voltage to which it is connected.

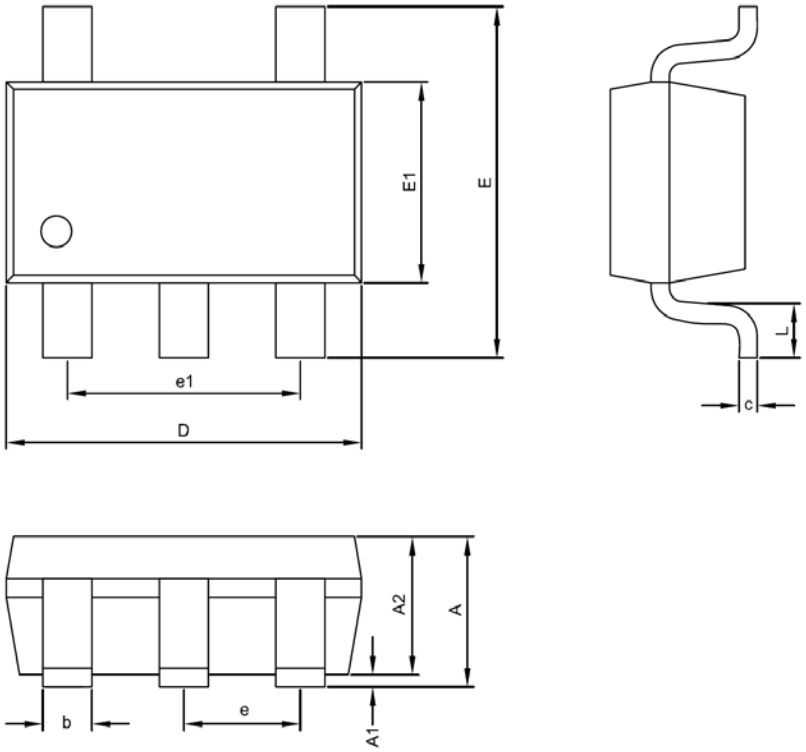
Benefits of Highly Accurate Reset Threshold

Most µP 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 ±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.

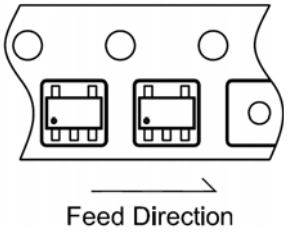
Package Information



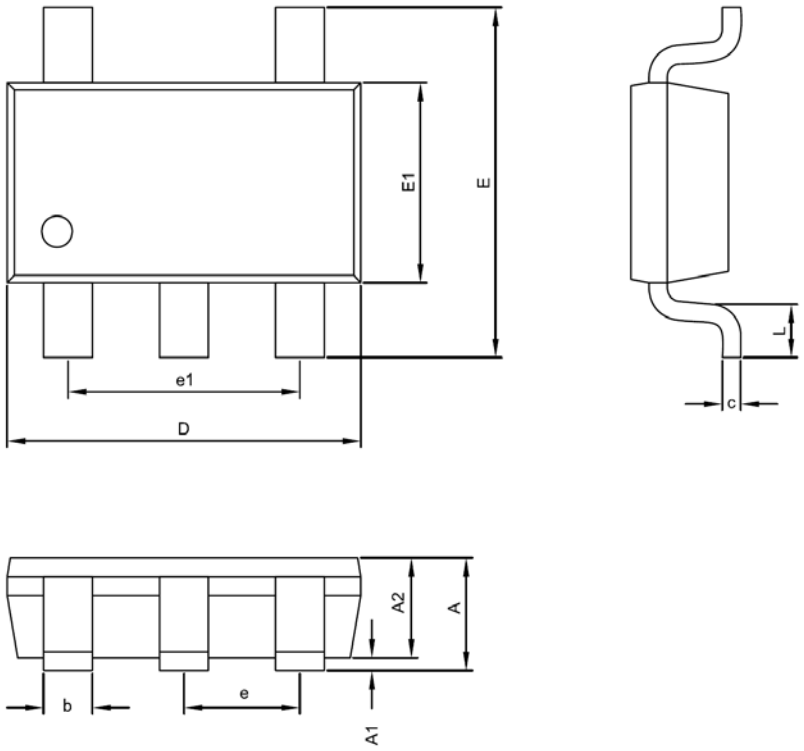
SOT-23-5 (T1) Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.00	1.10	1.45	0.039	0.043	0.057
A1	0.00	---	0.15	0.000	---	0.006
A2	1.00	1.10	1.30	0.039	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



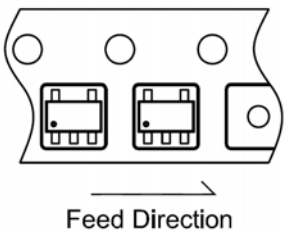
PACKAGE	Q'TY/REEL
SOT-23-5	3,000 ea



TSOT-23-5 (TO) Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	- - -	- - -	1.00	- - -	- - -	0.039
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2	0.70	0.80	0.90	0.028	0.031	0.035
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



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