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 (G690L)**
  - **Push-Pull RESET Output (G690H)**
  - **Open-Drain $\overline{\text{RESET}}$ Output (G691L)**
- **140ms min Power-On Reset Pulse Width**
- **10µA Supply Current**
- **Guaranteed Reset Valid to V_{CC} = +1V**
- **Power Supply Transient Immunity**
- **No External Components**
- **3-Pin SOT89, SOT23 and SC70 Packages**

Applications

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

General Description

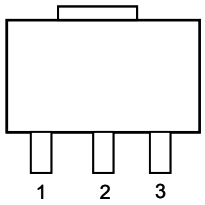
The G690/G691 are microprocessor (µP) supervisory circuits used to monitor the power supplies in µP and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, +3.0V- powered circuits.

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.

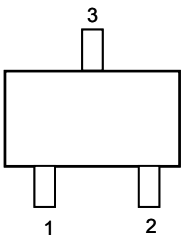
The G691L has an open-drain output stage, while the G690 have push-pull outputs. The G691L's open-drain $\overline{\text{RESET}}$ output requires a pull-up resistor that can be connected to a voltage higher than V_{CC}. The G690L have an active-low $\overline{\text{RESET}}$ output, while the G690H has 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 G690/G691 ideal for use in portable equipment. The G690/G691 are available in 3-pin SOT89 or SOT23 or SC70 packages.

Pin Configuration

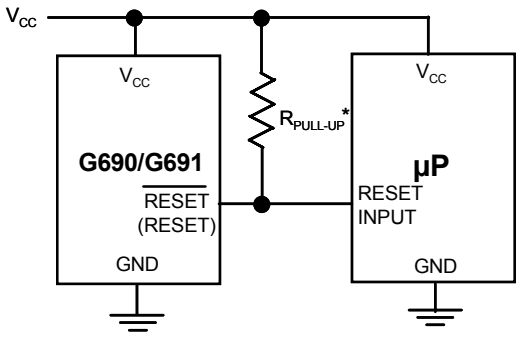


SOT 89



SOT23/SC70

Typical Application

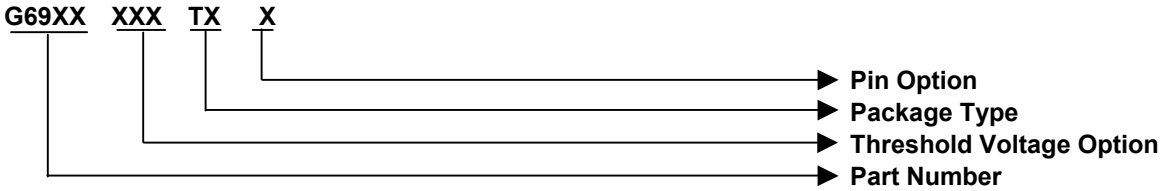


*G691 ONLY

Ordering Information

PART	TEMP. RANGE	OUTPUT TYPE
G690LxxxTxx	-40°C ~ +105°C	Push-Pull Active Low
G690HxxxTxx	-40°C ~ +105°C	Push-Pull Active High
G691LxxxTxx	-40°C ~ +105°C	Open-Drain

Order Number Identification



PART NUMBER

G690L : Push-Pull Active Low Output
G690H : Push-Pull Active High Output
G691L : Open-Drain Output

THRESHOLD VOLTAGE OPTION

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

PACKAGE TYPE

T2 : SOT 89
T7 : SOT 23
T9 : SC 70

PIN OPTION

	1	2	3
1 :	$\overline{RESET}$	GND	V_{CC}
2 :	$\overline{RESET}$	V_{CC}	GND
3 :	GND	$\overline{RESET}$	V_{CC}
4 :	GND	V_{CC}	$\overline{RESET}$
5 :	V_{CC}	GND	$\overline{RESET}$
6 :	V_{CC}	$\overline{RESET}$	GND

*RESET for G690H

Absolute Maximum Ratings

Terminal Voltage (with respect to GND)
V_{CC}.....-0.3V to +6.0V
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

Continuous Power Dissipation (T_A = +70°C)
3-Pin SOT89.....500mW
3-Pin SOT23 (derate 4mW/°C above +70°C)....320mW
3-Pin SC70 (derate 2.17mW/°C above +70°C)..174mW
Operating Temperature Range .....-40°C to +105°C
Storage Temperature Range.....-65°C to +150°C
Lead Temperature (soldering, 10s) .....+300°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 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°C +70°C		1.0		5.5	V
		T_A = -40°C +105°C		1.2		5.5	
Supply Current (SOT23)	I_{CC}	T_A = -40°C +105°C	V_{CC}<5.5V, G69_ _463/438/400_		22	30	µA
			V_{CC}<3.6V, G69_ _308/293/263_		10	23	
Reset Threshold	V_{TH}	G69_ _463_	T_A = +25°C	4.56	4.63	4.70	V
			T_A = -40°C to +85°C	4.50		4.75	
			T_A = +85°C to +105°C	4.40		4.86	
		G69_ _438_	T_A = +25°C	4.31	4.38	4.45	
			T_A = -40°C to +85°C	4.25		4.50	
			T_A = +85°C to +105°C	4.16		4.56	
		G69_ _400_	T_A = +25°C	3.93	4.00	4.06	
			T_A = -40°C to +85°C	3.89		4.10	
			T_A = +85°C to +105°C	3.80		4.20	
		G69_ _308_	T_A = +25°C	3.04	3.08	3.11	
			T_A = -40°C to +85°C	3.00		3.15	
			T_A = +85°C to +105°C	2.92		3.23	
		G69_ _293_	T_A = +25°C	2.89	2.93	2.96	
			T_A = -40°C to +85°C	2.85		3.00	
			T_A = +85°C to +105°C	2.78		3.08	
		G69_ _263_	T_A = +25°C	2.59	2.63	2.66	
			T_A = -40°C to +85°C	2.55		2.70	
			T_A = +85°C to +105°C	2.50		2.76	

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 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/°C
V_{CC} to Reset Delay (Note 2)		V_{CC} = V_{TH} to (V_{TH} – 100mV)		7		µs
Reset Active Timeout Period		V_{CC} = V_{TH} max, G69_ _ 463/438/400	280		640	ms
		V_{CC} = V_{TH} max, G69_ _308/293/263	140		550	
$\overline{\text{RESET}}$ Output Current Low (push-pull active low, and open-drain active-low, G690L and G691L)	I_{OL}	V_{CC} = 2.5V, $V_{\overline{\text{RESET}}}$ = 0.5V	8			mA
$\overline{\text{RESET}}$ Output Current High (push-pull active low, G690L)	I_{OH}	V_{CC} = 5V, $V_{\overline{\text{RESET}}}$ = 4.5V, G690L463/438/400	4.5			mA
		V_{CC} = 3.3V, $V_{\overline{\text{RESET}}}$ = 2.8V, G690L308/293	3			
		V_{CC} = 3V, $V_{\overline{\text{RESET}}}$ = 2.5V, G690L263	2			
RESET Output Current Low (push-pull active high, G690H)	I_{OL}	V_{CC} = 5V, V_{RESET} = 0.5V, G690H463/438/400	16			mA
		V_{CC} = 3.3V, V_{RESET} = 0.5V, G690H308/293	12			
		V_{CC} = 3V, V_{RESET} = 0.5V, G690H263	10			
RESET Output Current High (push-pull active high, G690H)	I_{OH}	V_{CC} = 2.5V, V_{RESET} = 2V	2			mA
$\overline{\text{RESET}}$ Open-Drain Output Leakage Current (G691L)		V_{CC} > V_{TH}, $\overline{\text{RESET}}$ deasserted			1	µA

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

Note 2: $\overline{\text{RESET}}$ output is for G690L/G691L; While RESET output is for G690H.

Selector Guide

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK		
			SOT 89	SOT 23	SC70
G691L463Tx1	4.63	Open-Drain	689Fx	689Fx	689Fx
G691L438Tx1	4.38	Open-Drain	689Ex	689Ex	689Ex
G691L400Tx1	4.00	Open-Drain	689Dx	689Dx	689Dx
G691L308Tx1	3.08	Open-Drain	689Cx	689Cx	689Cx
G691L293Tx1	2.93	Open-Drain	689Bx	689Bx	689Bx
G691L263Tx1	2.63	Open-Drain	689Ax	689Ax	689Ax
G690H463Tx1	4.63	Push-Pull RESET	688Lx	688Lx	688Lx
G690H438Tx1	4.38	Push-Pull RESET	688Kx	688Kx	688Kx
G690H400Tx1	4.00	Push-Pull RESET	688Jx	688Jx	688Jx
G690H308Tx1	3.08	Push-Pull RESET	688Ix	688Ix	688Ix
G690H293Tx1	2.93	Push-Pull RESET	688Hx	688Hx	688Hx
G690H263Tx1	2.63	Push-Pull RESET	688Gx	688Gx	688Gx
G690L463Tx1	4.63	Push-Pull	688Fx	688Fx	688Fx
G690L438Tx1	4.38	Push-Pull	688Ex	688Ex	688Ex
G690L400Tx1	4.00	Push-Pull	688Dx	688Dx	688Dx
G690L308Tx1	3.08	Push-Pull	688Cx	688Cx	688Cx
G690L293Tx1	2.93	Push-Pull	688Bx	688Bx	688Bx
G690L263Tx1	2.63	Push-Pull	688Ax	688Ax	688Ax

Note: T2: SOT89; T7: SOT23; T9: SC70

Selector Guide

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK		
			SOT 89	SOT 23	SC70
G691L463Tx2	4.63	Open-Drain	687Fx	687Fx	687Fx
G691L438Tx2	4.38	Open-Drain	687Ex	687Ex	687Ex
G691L400Tx2	4.00	Open-Drain	687Dx	687Dx	687Dx
G691L308Tx2	3.08	Open-Drain	687Cx	687Cx	687Cx
G691L293Tx2	2.93	Open-Drain	687Bx	687Bx	687Bx
G691L263Tx2	2.63	Open-Drain	687Ax	687Ax	687Ax
G690H463Tx2	4.63	Push-Pull RESET	686Lx	686Lx	686Lx
G690H438Tx2	4.38	Push-Pull RESET	686Kx	686Kx	686Kx
G690H400Tx2	4.00	Push-Pull RESET	686Jx	686Jx	686Jx
G690H308Tx2	3.08	Push-Pull RESET	686Ix	686Ix	686Ix
G690H293Tx2	2.93	Push-Pull RESET	686Hx	686Hx	686Hx
G690H263Tx2	2.63	Push-Pull RESET	686Gx	686Gx	686Gx
G690L463Tx2	4.63	Push-Pull	686Fx	686Fx	686Fx
G690L438Tx2	4.38	Push-Pull	686Ex	686Ex	686Ex
G690L400Tx2	4.00	Push-Pull	686Dx	686Dx	686Dx
G690L308Tx2	3.08	Push-Pull	686Cx	686Cx	686Cx
G690L293Tx2	2.93	Push-Pull	686Bx	686Bx	686Bx
G690L263Tx2	2.63	Push-Pull	686Ax	686Ax	686Ax

Note: T2: SOT89; T7: SOT23; T9: SC70

Selector Guide

PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK		
			SOT 89	SOT 23	SC70
G691L463Tx3	4.63	Open-Drain	691Fx	691Fx	691Fx
G691L438Tx3	4.38	Open-Drain	691Ex	691Ex	691Ex
G691L400Tx3	4.00	Open-Drain	691Dx	691Dx	691Dx
G691L308Tx3	3.08	Open-Drain	691Cx	691Cx	691Cx
G691L293Tx3	2.93	Open-Drain	691Bx	691Bx	691Bx
G691L263Tx3	2.63	Open-Drain	691Ax	691Ax	691Ax
G690H463Tx3	4.63	Push-Pull RESET	690Lx	690Lx	690Lx
G690H438Tx3	4.38	Push-Pull RESET	690Kx	690Kx	690Kx
G690H400Tx3	4.00	Push-Pull RESET	690Jx	690Jx	690Jx
G690H308Tx3	3.08	Push-Pull RESET	690Ix	690Ix	690Ix
G690H293Tx3	2.93	Push-Pull RESET	690Hx	690Hx	690Hx
G690H263Tx3	2.63	Push-Pull RESET	690Gx	690Gx	690Gx
G690L463Tx3	4.63	Push-Pull	690Fx	690Fx	690Fx
G690L438Tx3	4.38	Push-Pull	690Ex	690Ex	690Ex
G690L400Tx3	4.00	Push-Pull	690Dx	690Dx	690Dx
G690L308Tx3	3.08	Push-Pull	690Cx	690Cx	690Cx
G690L293Tx3	2.93	Push-Pull	690Bx	690Bx	690Bx
G690L263Tx3	2.63	Push-Pull	690Ax	690Ax	690Ax

Note: T2: SOT89; T7: SOT23; T9: SC70

Selector Guide

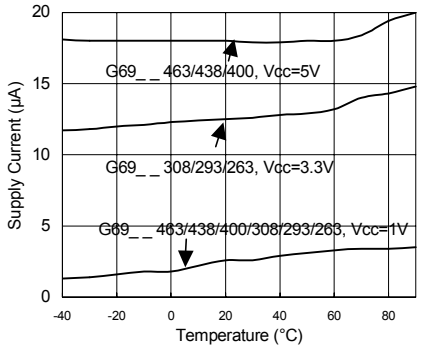
PART/SUFFIX	RESET THRESHOLD (V)	OUTPUT TYPE	TOP MARK		
			SOT 89	SOT 23	SC70
G691L463Tx6	4.63	Open-Drain	685Fx	685Fx	685Fx
G691L438Tx6	4.38	Open-Drain	685Ex	685Ex	685Ex
G691L400Tx6	4.00	Open-Drain	685Dx	685Dx	685Dx
G691L308Tx6	3.08	Open-Drain	685Cx	685Cx	685Cx
G691L293Tx6	2.93	Open-Drain	685Bx	685Bx	685Bx
G691L263Tx6	2.63	Open-Drain	685Ax	685Ax	685Ax
G690H463Tx6	4.63	Push-Pull RESET	684Lx	684Lx	684Lx
G690H438Tx6	4.38	Push-Pull RESET	684Kx	684Kx	684Kx
G690H400Tx6	4.00	Push-Pull RESET	684Jx	684Jx	684Jx
G690H308Tx6	3.08	Push-Pull RESET	684Ix	684Ix	684Ix
G690H293Tx6	2.93	Push-Pull RESET	684Hx	684Hx	684Hx
G690H263Tx6	2.63	Push-Pull RESET	684Gx	684Gx	684Gx
G690L463Tx6	4.63	Push-Pull	684Fx	684Fx	684Fx
G690L438Tx6	4.38	Push-Pull	684Ex	684Ex	684Ex
G690L400Tx6	4.00	Push-Pull	684Dx	684Dx	684Dx
G690L308Tx6	3.08	Push-Pull	684Cx	684Cx	684Cx
G690L293Tx6	2.93	Push-Pull	684Bx	684Bx	684Bx
G690L263Tx6	2.63	Push-Pull	684Ax	684Ax	684Ax

Note: T2: SOT89; T7: SOT23; T9: SC70

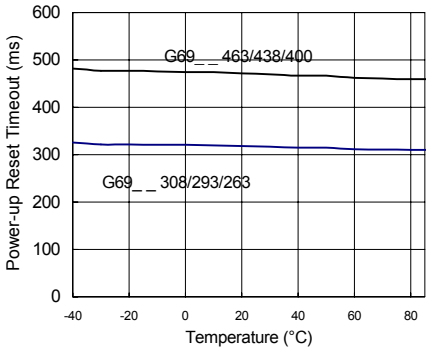
Typical Operating Characteristics

(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 versions, V_{CC}= 3.3V for 308/293 versions, and V_{CC} = 3V for 263 version.)

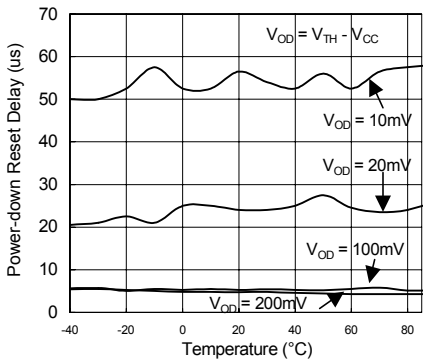
Supply Current vs.Temperature (No Load)



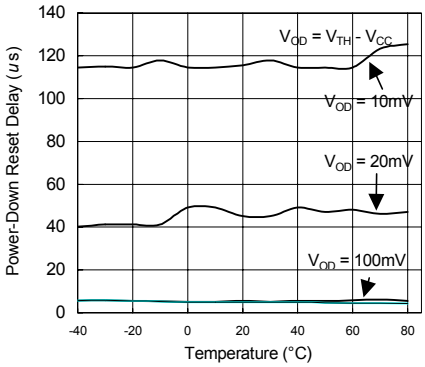
Power-up Reset Timeout vs. Temperature



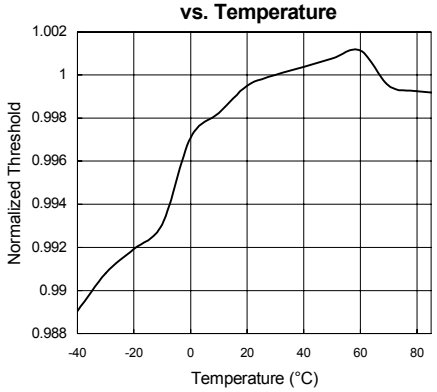
Power-down Reset Delay vs. Temperature (G69_ _308/293/263)



Power-down Reset Delay vs. Temperature (G69_ _463/438/400)



Normalized Reset Threshold vs. Temperature



Pin Description

PIN	NAME	FUNCTION
1	GND	Ground
2	(G691L/G690L)	$\overline{\text{RESET}}$ 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 (G690H)	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)

Detailed Description

A microprocessor's (µP's) reset input starts the µP in a known state. The G691L/G690L/G690H 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 G691L uses an open-drain output, and the G690L/G690H have a push-pull output stage. Connect a pull-up resistor on the G691L's $\overline{\text{RESET}}$ output to any supply between 0 and 5.5V.

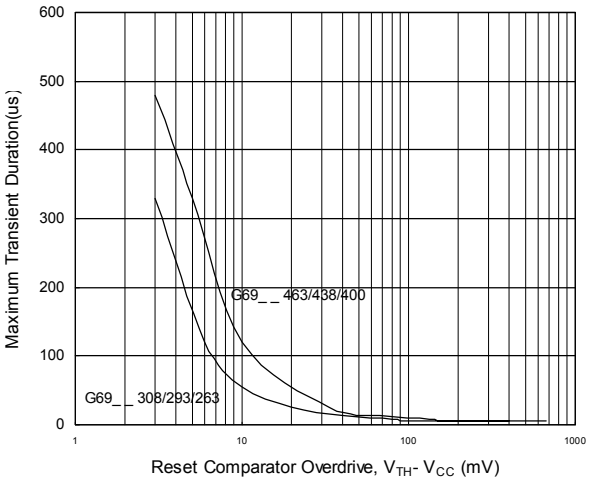


Figure 1. Maximum Transient Duration Without Causing a Reset Pulse vs. Reset Comparator Overdrive

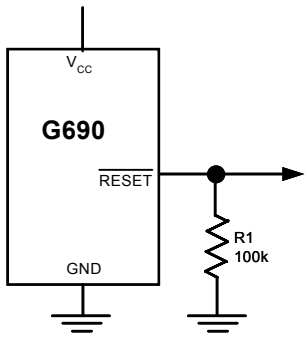


Figure2. $\overline{\text{RESET}}$ Valid to V_{CC} = Ground Circuit

Applications Information

Negative-Going V_{CC} Transients

In addition to issuing a reset to the µP during power-up, power-down, and brownout conditions, the G691L/G690H/G690L 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 G691L/G690H/G690L 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 7µs or less will not cause a reset pulse. A 0.1µF 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 G690 $\overline{\text{RESET}}$ 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 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). 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 VCC is also recommended for the G691L if $\overline{\text{RESET}}$ is required to remain valid for V_{CC} < 1V.

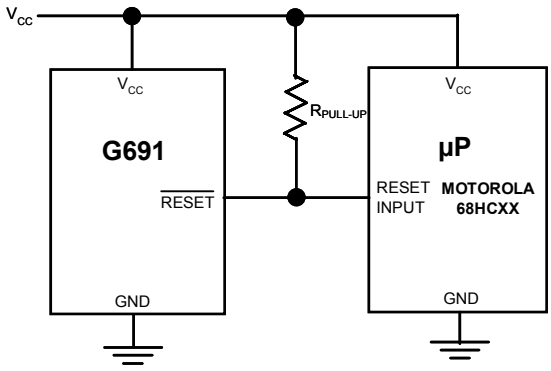


Figure 3. Interfacing to µPs with Bidirectional Reset I/O

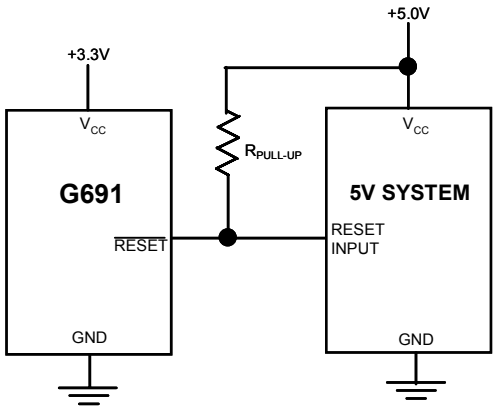


Figure 4. G691L Open-Drain $\overline{\text{RESET}}$ Output Allows Use with Multiple Supplies

Interfacing to µPs with Bidirectional Reset Pins

Since the $\overline{\text{RESET}}$ output on the G691L 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 3).

G691L Open-Drain $\overline{\text{RESET}}$ Output Allows Use with Multiple Supplies

Generally, the pull-up connected to the G691L 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 G691L'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.

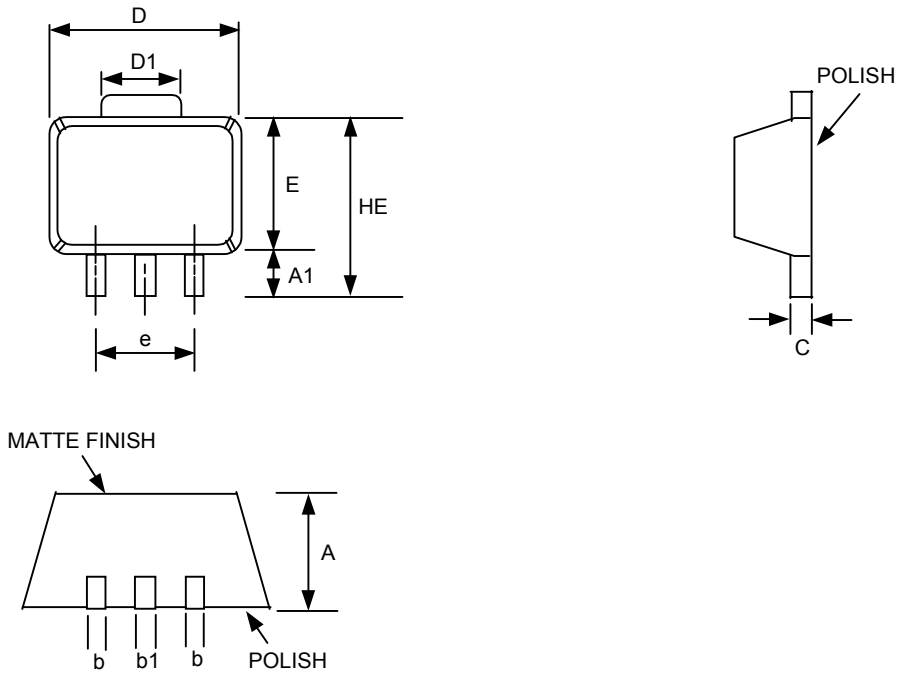
Benefits of Highly Accurate Reset Threshold

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.

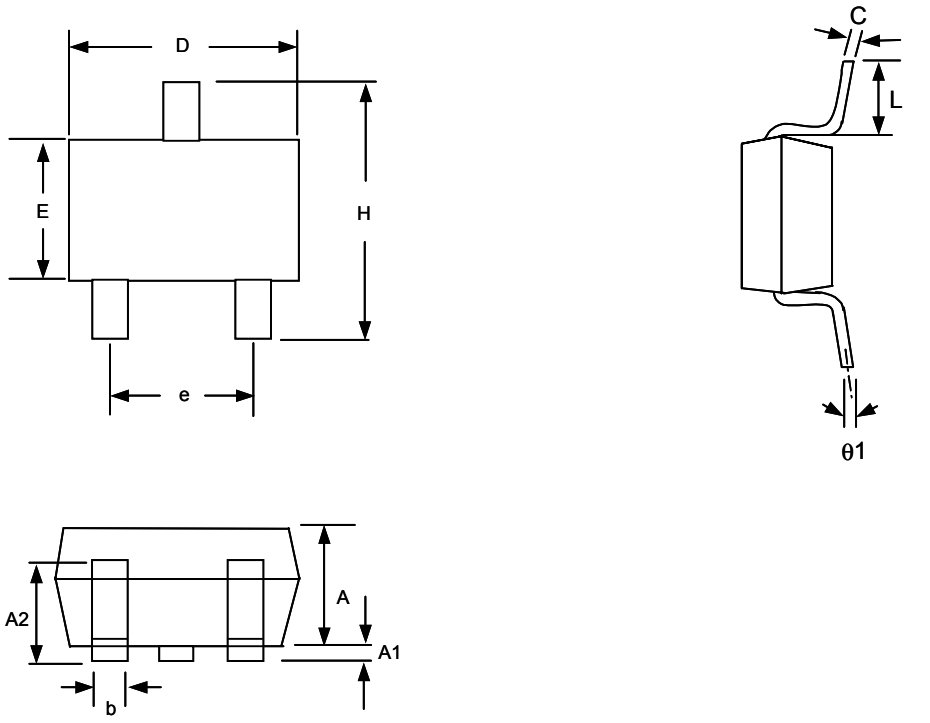
The G69_ _463/G69_ _308 use highly accurate circuitry to ensure that reset is asserted close to the 5% limit, and long before the supply has declined to 10% below nominal.

Package Information



SOT- 89 (T2) Package

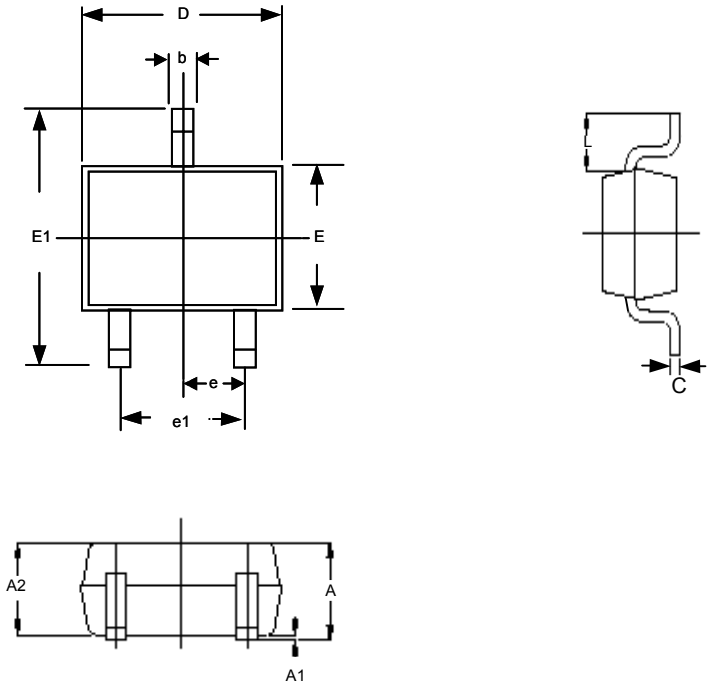
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	1.50	1.60	0.055	0.059	0.063
A1	0.80	1.04	-----	0.031	0.041	-----
b	0.36	0.42	0.48	0.014	0.016	0.048
b1	0.41	0.47	0.53	0.016	0.018	0.020
C	038	0.40	0.43	0.014	0.015	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.40	1.60	1.75	0.055	0.062	0.069
HE	-----	-----	4.25	-----	-----	0.167
E	2.40	2.50	2.60	0.094	0.098	0.102
e	2.90	3.00	3.10	0.114	0.118	0.122



SOT 23 (T7) Package

Note:
1.Package body sizes exclude mold flash protrusions or gate burrs
2.Tolerance ±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	------	-----
θ 1	1°	5°	9°

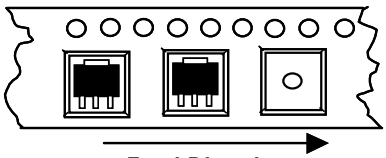


SC70 (T9) Package

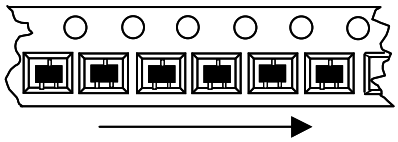
Note:
1. All dimensions are in millimeters
2. Dimensions are inclusive of plating of plating
3. Dimensions are exclusive of mold flash & metal burr
4. All specifications comply to EIAJ SC70
5. Coplanarity 4 Mils. Max.

SYMBOL	DIMENSION IN MILIMETERS		DIMENSION IN INCHS	
	MIN.	MAX.	MIN.	MAX.
A	0.90	1.20	0.035	0.047
A1	0.05	0.15	0.002	0.006
A2	0.85	1.05	0.033	0.041
b	0.20	0.40	0.008	0.016
C	0.10	0.15	0.004	0.006
D	1.90	2.10	0.075	0.083
E	1.15	1.35	0.045	0.053
E1	2.00	2.20	0.0787	0.0866
e	0.65 BSC.		0.0256 BSC.	
e1	1.30 BSC.		0.0512 BSC.	
L	0.425 REF.		0.0167 REF.	

Package Orientation



Feed Direction
SOT 89 Package Orientation



Feed Direction
SOT23, SC70 Package Orientation