



3-Pin Microprocessor Reset Circuits

■ Features

- Precision Monitoring of +2.5V, +3V, +3.3V, and +5V Power-Supply Voltages
- Fully Specified Over Temperature
- Available in Three Output Configurations
- Push-Pull $\overline{\text{RESET}}$ Low Output (AP1701/3)
- Push-Pull $\overline{\text{RESET}}$ High Output (AP1702/4)
- 200ms min Power-On Reset Pulse Width
- 20 μ A Supply Current (Typ.)
- Guaranteed Reset Valid to $V_{CC} = +1V$
- Power Supply Transient Immunity
- No External Components
- 3-pin SOT23, TSOT23, **Pb-Free** Package

■ Applications

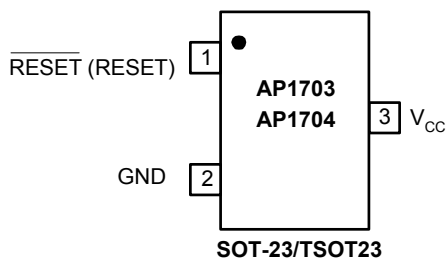
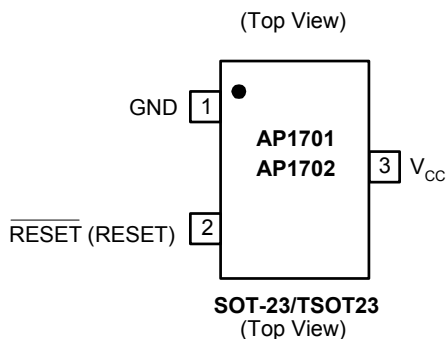
- Computers
- Controllers
- Intelligent Instruments
- Critical μ P and μ C Power Monitoring
- Portable/Battery Powered Equipment
- Automotive

■ General Description

The AP1701/2/3/4 are used for microprocessor (μ P) supervisory circuits to monitor the power supplies in μ 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.

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 240ms after V_{CC} has risen above the reset threshold. Reset thresholds suitable for operation with a variety of supply voltages are available. The AP1701/2/3/4 have push pull outputs. The AP1701/3 have an active low $\overline{\text{RESET}}$ output, while the AP1702/4 has an active high $\overline{\text{RESET}}$ 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 AP1701/2/3/4 ideal for use in portable equipment. The AP1701/2/3/4 is available in a 3-pin SOT23, TSOT23 package.

■ Pin Assignments



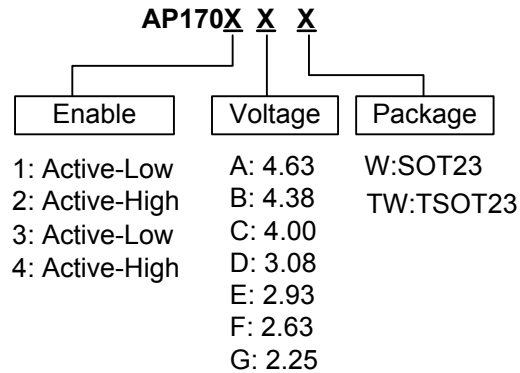
■ Pin Descriptions

Name	Description
GND	Ground
$\overline{\text{RESET}}$ (RESE)	Reset output pin L: for AP1701/3 H: for AP1702/4
V_{CC}	Operating voltage input



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■ Ordering Information



■ Absolute Maximum Ratings

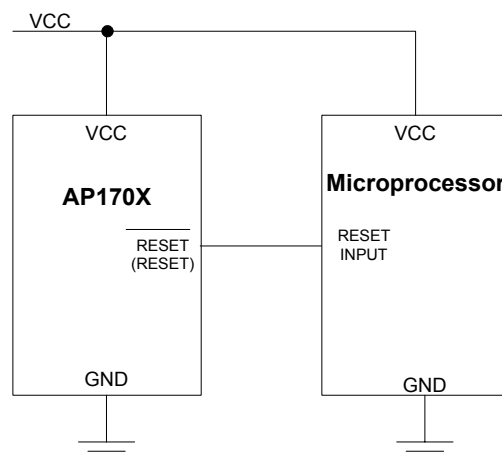
Symbol	Parameter	Rating	Unit
V_{CC}	Terminal Voltage (with respect to GND)	-0.3 to +6.0	V
V_{RESET}	RESET, \overline{RESET} (push-pull)	-0.3 to ($V_{CC} + 0.3$)	V
I_{CC}	Input Current, V_{CC}	20	mA
I_o	Output Current, RESET, \overline{RESET}	20	mA
P_D	Continuous Power Dissipation ($T_A = +70^\circ\text{C}$), de-rate 4mW/°C above +70°C	320	mW
T_{OP}	Operating Temperature Range	-40 to +105	°C
T_{ST}	Storage Temperature Range	-65 to +150	°C
T_{LEAD}	Lead Temperature (soldering, 10s)	+300	°C

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■ Electrical Characteristics (T_A=25°C)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{CC}	V _{CC} Range	T _A = 0°C to +70°C	1.0		5.5	V
I _{CC}	Supply Current	V _{TH} +1.0V		20	30	μA
V _{TH}	Reset Threshold T _A =25°C	AP1701/2/3/4A	4.54	4.63	4.72	V
		AP1701/2/3/4B	4.29	4.38	4.47	
		AP1701/2/3/4C	3.92	4.00	4.08	
		AP1701/2/3/4D	3.02	3.08	3.14	
		AP1701/2/3/4E	2.87	2.93	2.99	
		AP1701/2/3/4F	2.57	2.63	2.68	
		AP1701/2/3/4G	2.20	2.25	2.30	
	Reset Threshold Tempco			30		ppm/°C
T _S	Set-up Time	V _{CC} = 0 to (V _{TH} - 100mV)	100			μs
T _{DELAY}	Reset Active Timeout Period	T _A = 0°C to +70°C	100	240	600	ms
V _{OL}	RESET Output Voltage Low	V _{CC} = V _{TH} min, I _{SINK} = 1.2mA, AP1701/3			0.3	V
		V _{CC} = V _{TH} min, I _{SINK} = 3.2mA			0.4	
		V _{CC} > 1.0V, I _{SINK} = 50uA			0.3	
V _{OH}	RESET Output Voltage-High	V _{CC} > V _{TH} max, I _{SOURCE} = 500uA, AP1701/3	0.8V _{CC}			V
		V _{CC} > V _{TH} max, I _{SOURCE} = 800uA	V _{CC} -1.5			
V _{OL}	RESET Output Voltage-Low	V _{CC} = V _{TH} max, I _{SINK} = 1.2mA, AP1702/4			0.3	V
		V _{CC} = V _{TH} max, I _{SINK} = 3.2mA			0.4	
V _{OH}	RESET Output Voltage-High	1.8V < V _{CC} < V _{TH} min, I _{SOURCE} = 150uA, AP1702/4	0.8 V _{CC}			V

■ Application Circuit





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■ Function Description

A microprocessor's (μP 's) reset input starts the μP in a known state. The AP1701/2/3/4 assert reset to prevent code-execution errors during power-up, power-down, or brownout conditions. They assert a reset signal whenever the VCC supply voltage declines below a preset threshold, keeping it asserted for at least 240ms after VCC has risen above the reset threshold. The AP1701/2/3/4 have a push-pull output stage.

Applications Information

Negative-Going VCC Transients

In addition to issuing a reset to the μP during power-up, power-down, and brownout conditions, the AP1701/2/3/4 are relatively immune to short-duration negative-going VCC transients (glitches).

The AP1701/2/3/4 do not generate a reset pulse. The graph was generated using a negative going pulse applied to VCC, 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 VCC 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, a VCC transient that goes 100mV below the reset threshold and lasts 100 μs or less will not cause a reset pulse. A 0.1 μF bypass capacitor mounted as close as possible to the VCC pin provides additional transient immunity.

Ensuring a Valid Reset Output

Down to VCC = 0

$\overline{\text{RESET}}$ is guaranteed to be a logic low for VCC > 1V. Once VCC exceeds the reset threshold, an internal timer keeps $\overline{\text{RESET}}$ low for the reset timeout period; after this interval, $\overline{\text{RESET}}$ goes high. If a brownout condition occurs (VCC dips below the reset threshold), $\overline{\text{RESET}}$ goes low. Any time VCC goes below the reset threshold, the internal timer resets to zero, and $\overline{\text{RESET}}$ goes low. The internal timer starts after VCC returns above the reset threshold, and $\overline{\text{RESET}}$ remains low for the reset timeout period.

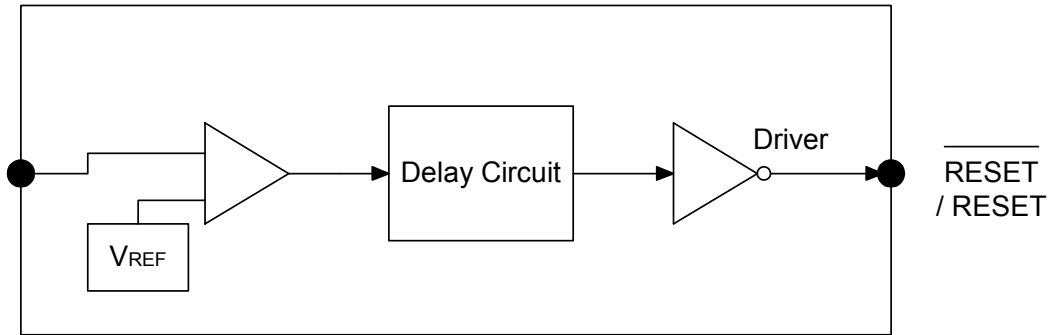
When VCC falls below 1V, the AP1701/3 $\overline{\text{RESET}}$ output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to $\overline{\text{RESET}}$ can drift to undetermined voltages.

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. R1's value is not critical; 100k is large enough not to load $\overline{\text{RESET}}$ and small enough to pull $\overline{\text{RESET}}$ to ground. For the AP1702/4 if $\overline{\text{RESET}}$ is required to remain valid for VCC < 1V.

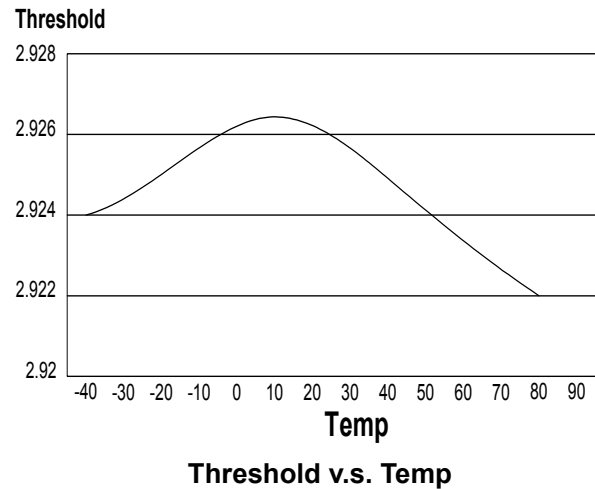
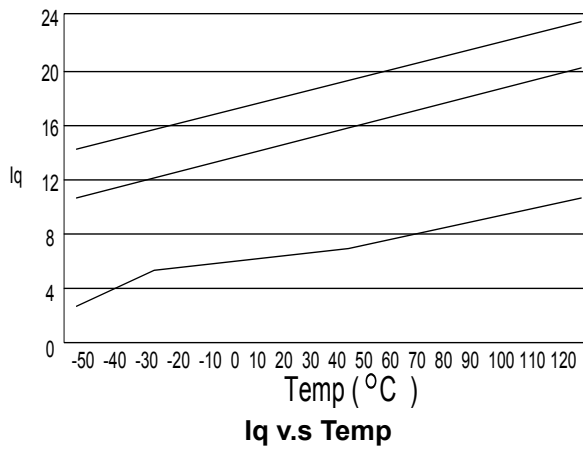
Benefits of Highly Accurate Reset Threshold

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 $\pm 5\%$, 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.

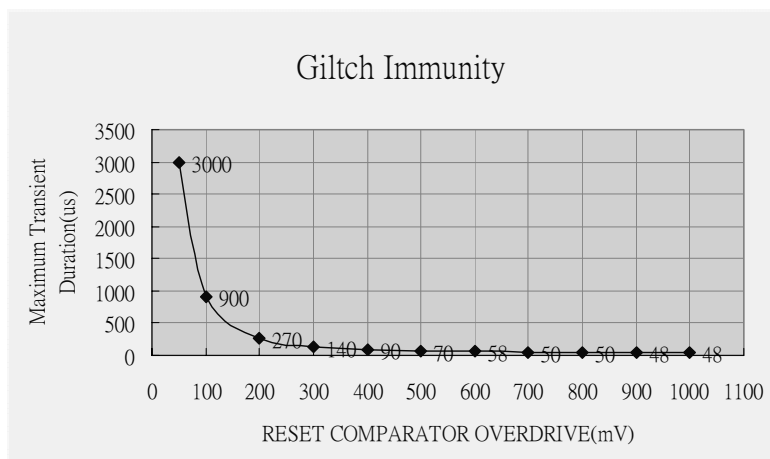
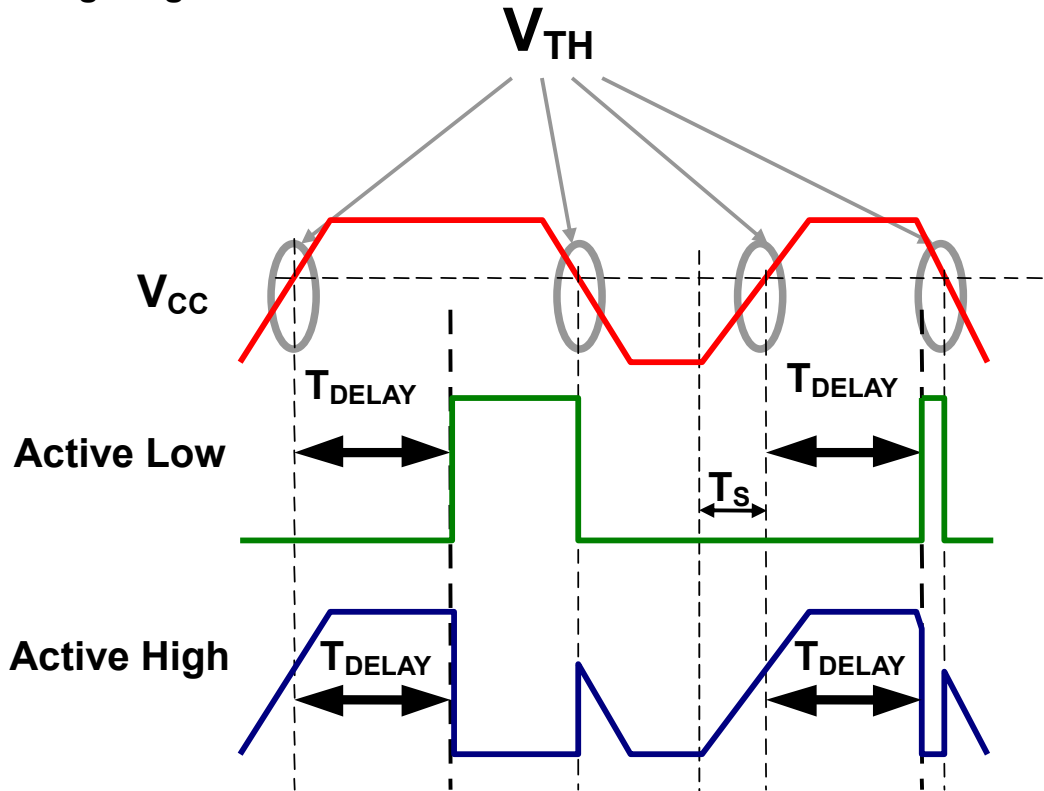
■ Function Block



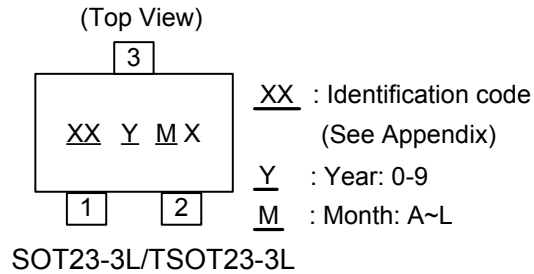
■ Performance Characteristics



■ Timing Diagram



■ Marking Information

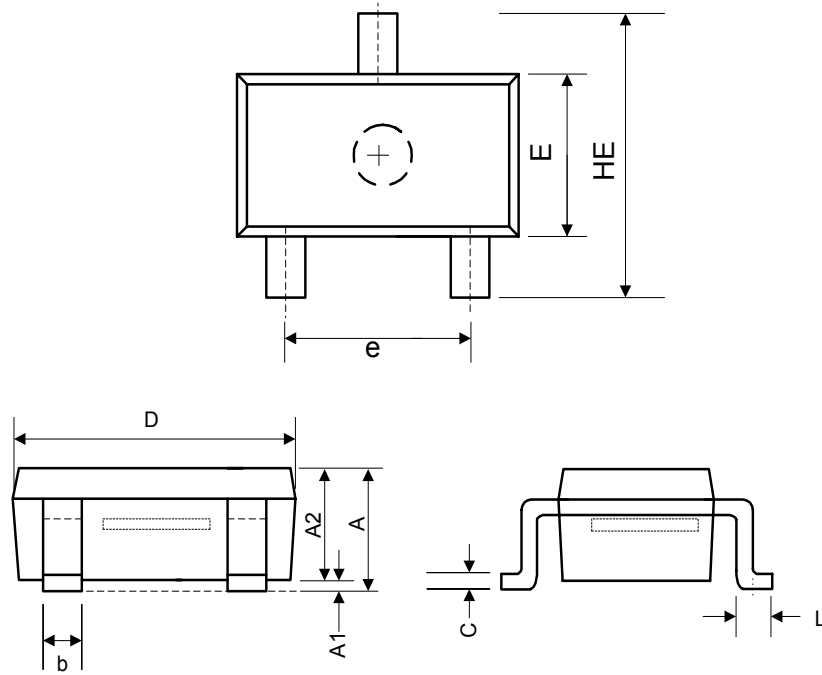


Appendix

Part Number	Identification Code	Part Number	Identification Code
AP1701A	EA	AP1703A	EG
AP1701B	EB	AP1703B	EH
AP1701C	EC	AP1703C	EI
AP1701D	ED	AP1703D	EJ
AP1701E	EE	AP1703E	EK
AP1701F	EF	AP1703F	EL
AP1701G	W1	AP1703G	W3
AP1702A	E0	AP1704A	E7
AP1702B	E2	AP1704B	E8
AP1702C	E3	AP1704C	E9
AP1702D	E4	AP1704D	EM
AP1702E	E5	AP1704E	EN
AP1702F	E6	AP1704F	EP
AP1702G	W2	AP1704G	W4

■ Package Information

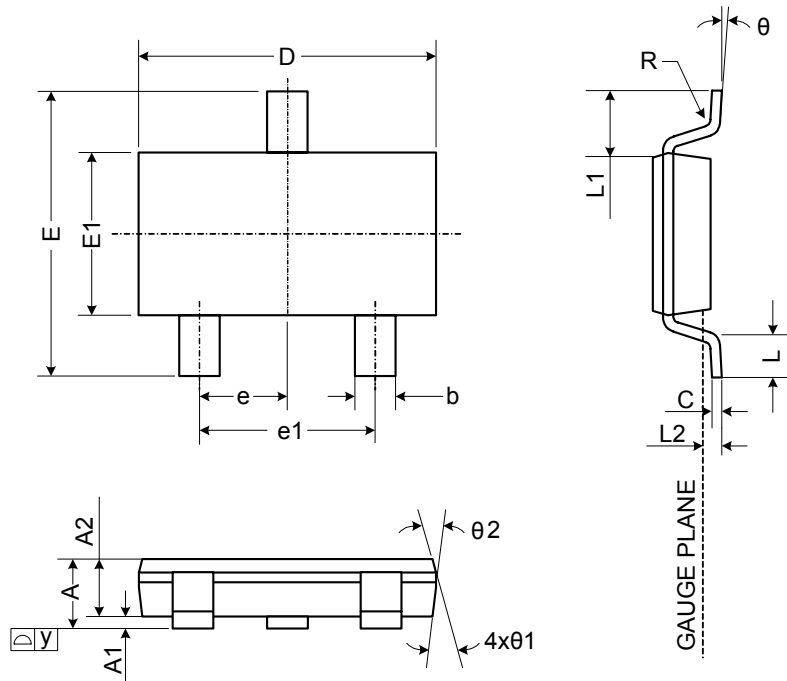
(1) Package Type: SOT23-3L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.00	1.20	1.40	0.039	0.047	0.055
A1	0.00	-	0.10	0.000	-	0.004
A2	1.00	1.15	1.30	0.039	0.045	0.051
b	0.35	-	0.50	0.014	-	0.020
C	0.10	0.175	0.25	0.004	0.007	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	1.70	2.00	2.30	0.067	0.079	0.091
HE	2.40	2.70	3.00	0.094	0.106	0.118
L	0.30	-	0.55	0.012	-	0.022

■ Package Information (Continued)

(2) Package Type: TSOT23-3L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.75	-	0.90	0.030	-	0.035
A1	0.00	-	0.10	0.000	-	0.004
A2	0.70	0.75	0.80	0.028	0.030	0.031
b	0.35	-	0.51	0.014	-	0.020
C	0.10	-	0.25	0.004	-	0.010
D	2.80	2.90	3.00	0.110	0.114	0.118
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
e	0.95 BSC.			0.037		
e1	1.90 BSC.			0.075		
L	0.37	-	-	0.015	-	-
L1	0.60 REF.			0.024		
L2	0.25 BSC.			0.010		
y	-	-	0.10	-	-	0.004
R	0.10	-	-	0.004	-	-
theta	0°	-	8°	0°	-	8°
theta1	7° NOM.			7° NOM.		
theta2	5° NOM.			5° NOM.		