3-Pin Microprocessor Reset Circuits

❖ GENERAL DESCRIPTION

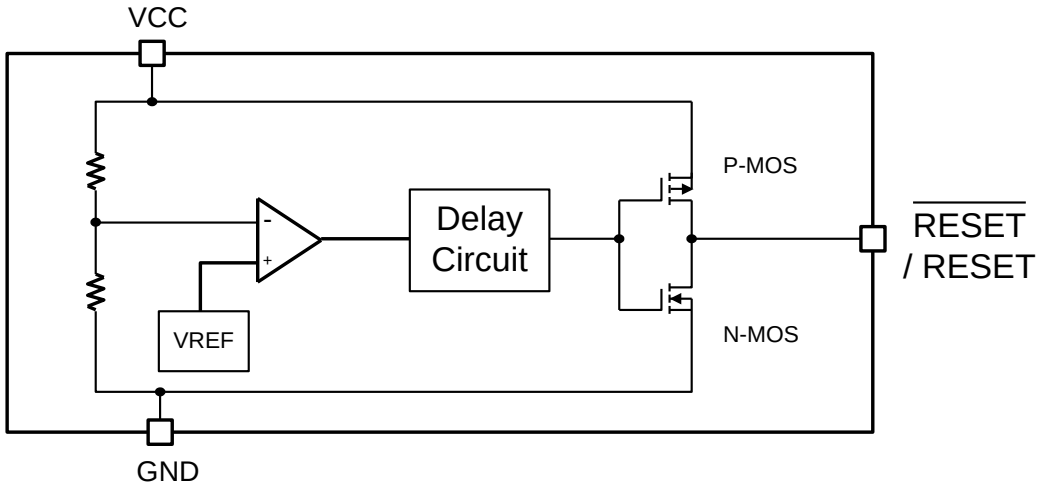
TheAX6901/2/3/4 is used for microprocessor (μP) supervisory circuits to monitor the power supplies in μP and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, +3.0V, +2.5V powered circuits.

These circuits perform a single function: they assert a reset signal whenever the VCC supply voltage declines below a preset threshold, keeping it asserted for at least 200ms after VCC has risen above the reset threshold. Reset thresholds suitable for operation with a variety of supply voltages are available. TheAX6901/2/3/4 has push pull outputs. TheAX6901/3 has an active low $\overline{\text{RESET}}$ output, while theAX6902/4 has an active high RESET output. The reset comparator is designed to ignore fast transients on VCC, and the outputs are guaranteed to be in the correct logic state for VCC down to 1.0V. Low supply current makes theAX6901/2/3/4 ideal for use in portable equipment. TheAX6901/2/3/4 is available in a 3-pin SOT23 package.

❖ FEATURES

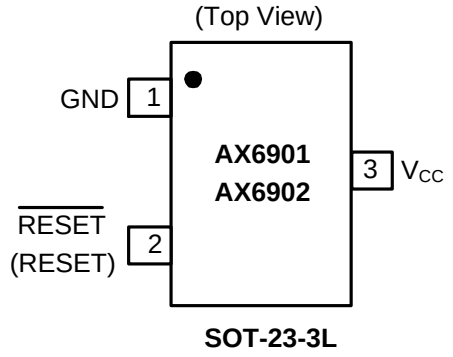
- Precision Monitoring of +2.5,+3V, +3.3V, and +5V Power-Supply Voltages
- Fully Specified Over Temperature
- Available in Three Output Configurations
- Push-Pull $\overline{\text{RESET}}$ Low Output(AX6901/3)
- Push-Pull RESET High Output(AX6902/4
- 200ms (Typ.)min Power-On Reset Pulse Width
- 25μA Supply Current
- Guaranteed Reset Valid to V_{CC} = +1.0V
- Power Supply Transient Immunity
- No External Components
- Available in the 3-Pin Pb-Free SOT-23 Package

❖ BLOCK DIAGRAM

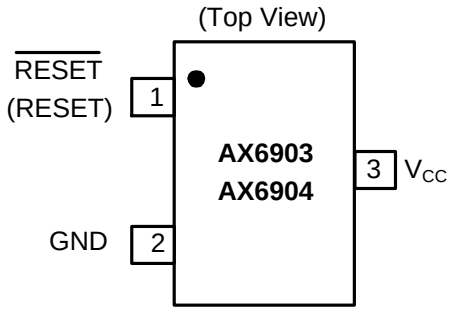


❖ PIN ASSIGNMENT

The package of AX6901/2/3/4 is SOT-23-3L; the pin assignment is given by:



SOT-23-3L



SOT-23-3L

Name	Description
GND	Ground
$\overline{\text{RESET}}$ (RESET)	Reset output pin L: forAX6901/3 H: forAX6902/4
V_{CC}	Operating voltage input

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking (SOT-23-3L)

AX690 X X X X

Enable	Voltage	Package	Packing
1: Active-Low 2: Active-High 3: Active-Low 4: Active-High	A: 4.63 B: 4.38 C: 4.00 D: 3.08 E: 2.93 F: 2.63 G: 2.25 H: 2.70 I : 4.25 J: 2.80	R:SOT23-3L	Blank : Bag A : Taping

L L Y W X
- X → ID Code: internal
- W → WW : 01~26(A~Z)
27~52(a~z)
- Y → Year : A = 2010
1 = 2011
- L L → Identification code

Appendix

Part Number	Package	Identification Code	Part Number	Package	Identification Code
AX6901A	SOT-23-3L	CA	AX6903A	SOT-23-3L	CO
AX6901B	SOT-23-3L	CB	AX6903B	SOT-23-3L	CP
AX6901C	SOT-23-3L	CC	AX6903C	SOT-23-3L	CQ
AX6901D	SOT-23-3L	CD	AX6903D	SOT-23-3L	CR
AX6901E	SOT-23-3L	CE	AX6903E	SOT-23-3L	CS
AX6901F	SOT-23-3L	CF	AX6903F	SOT-23-3L	CT
AX6901G	SOT-23-3L	CG	AX6903G	SOT-23-3L	CU
AX6901H	SOT-23-3L	Ca	AX6903H	SOT-23-3L	Cf
AX6901I	SOT-23-3L	Cb	AX6903I	SOT-23-3L	Cg
AX6901J	SOT-23-3L	Ci	AX6903J	SOT-23-3L	Cj
AX6902A	SOT-23-3L	CH	AX6904A	SOT-23-3L	C1
AX6902B	SOT-23-3L	CI	AX6904B	SOT-23-3L	C2
AX6902C	SOT-23-3L	CJ	AX6904C	SOT-23-3L	C3
AX6902D	SOT-23-3L	CK	AX6904D	SOT-23-3L	C4
AX6902E	SOT-23-3L	CL	AX6904E	SOT-23-3L	C5
AX6902F	SOT-23-3L	CM	AX6904F	SOT-23-3L	C6
AX6902G	SOT-23-3L	CN	AX6904G	SOT-23-3L	C7
AX6902H	SOT-23-3L	Cd	AX6904H	SOT-23-3L	Ch
AX6902I	SOT-23-3L	Ce	AX6904I	SOT-23-3L	Cm
AX6902J	SOT-23-3L	Ck	AX6904J	SOT-23-3L	Cn

❖ ABSOLUTE MAXIMUM RATUNGS (at T_A=25°C)

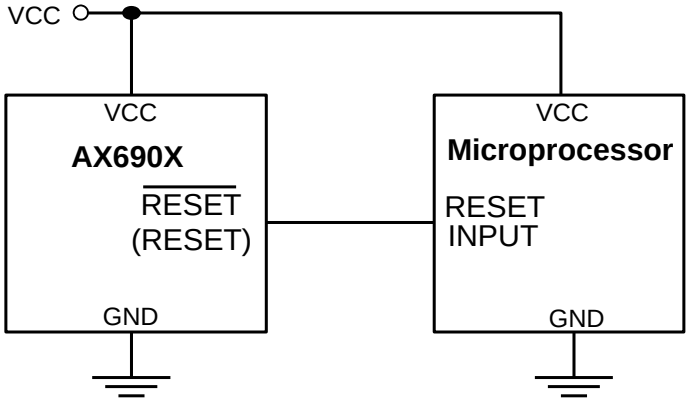
Characteristics	Symbol	Rating	Unit
VCC Pin Voltage	V_{CC}	GND - 0.3 to GND + 6.5	V
RESET, $\overline{\text{RESET}}$ (push-pull) Pin Voltage	V_{RESET}	GND - 0.3 to V_{CC} + 0.3	V
Input Current, V_{CC}	I_{CC}	20	mA
Output Current, RESET, $\overline{\text{RESET}}$	I_O	5	mA
Power Dissipation	PD	$(T_J-T_A) / \theta_{JA}$	mW
Storage Temperature Range	T_{ST}	-60 to +150	°C
Operating Temperature Range	T_{OP}	-40 to +85	°C
Junction Temperature	T_J	-40 to +150	°C
Thermal Resistance from Junction to case	θ_{JC}	110	°C/W
Thermal Resistance from Junction to ambient	θ_{JA}	250	°C/W

Note: θ_{JA} is measured with the PCB copper area of approximately 1 in^2(Multi-layer). That need connect to V_{SS} pin.

❖ ELECTRICAL CHARACTERISTICS T_A=25 °C (unless otherwise noted)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Operating V_{CC} Range	V_{Range}		1.0	-	6	V
Supply Current	I_{CC}	V_{CC} = V_{TH}+1.0V	-	25	35	μA
Reset Threshold T_A=25°C	V_{TH}	AX6901/2/3/4A	4.54	4.63	4.71	V
		AX6901/2/3/4B	4.29	4.38	4.46	
		AX6901/2/3/4I	4.16	4.25	4.33	
		AX6901/2/3/4C	3.92	4.00	4.08	
		AX6901/2/3/4D	3.02	3.08	3.15	
		AX6901/2/3/4E	2.87	2.93	3.00	
		AX6901/2/3/4H	2.64	2.70	2.75	
		AX6901/2/3/4F	2.57	2.63	2.69	
		AX6901/2/3/4G	2.20	2.25	2.30	
Reset Threshold Tempco	V_{THT}	T_A = 0°C to +85°C	-	50	-	ppm/°C
Set-up Time	T_S	V_{CC} = 0 to (V_{TH} – 100mV)	1	-	-	μs
V_{CC} to Reset Delay	T_{RD}	V_{CC}=V_{TH} to (V_{TH}-100mV)	-	20	-	μs
Reset Active Timeout Period	T_{DELAY}	T_A = 0°C to +85°C	160	200	260	ms
$\overline{RESET}$ Output Voltage (AX6901/3)	V_{OL}	1.8V<V_{CC} < $V_{TH(min)}$, I_{SINK} = 1.2mA	-	-	0.3	V
		1.2V < V_{CC} < 1.8V, I_{SINK} = 50uA				
	V_{OH}	V_{CC} > $V_{TH\ (max)}$, I_{SOURCE} = 500uA,	0.8V_{CC}	-	-	V
RESET Output Voltage (AX6902/4)	V_{OL}	V_{CC} > $V_{TH\ (max)}$, I_{SINK} = 1.2mA,	-	-	0.3	V
	V_{OH}	1.8V < V_{CC} < $V_{TH\ (min)}$, I_{SOURCE} = 500uA	0.8 V_{CC}	-	-	V
		1.2V < V_{CC} < 1.8V, I_{SOURCE} = 150uA				
Hysteresis at V_{CC}	V_{Hys}	Input voltage	-	40	-	mV

❖ APPLICATION CIRCUIT



❖ FUNCTION DESCRIPTIONS

A microprocessor's (µP's) reset input starts the µP in a known state. The AX6901/2/3/4 asserts 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 200ms after VCC has risen above the reset threshold. The AX6901/2/3/4 has a push-pull output stage.

❖ APPLICATION INFORMATION

Negative-Going VCC Transients

In addition to issuing a reset to the µP during power-up, power-down, and brownout conditions, the AX6901/2/3/4 is relatively immune to short-duration negative-going VCC transients (glitches).

The AX6901/2/3/4 does 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 50mV below the reset threshold A 0.1µF 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 > 1.0V. 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.

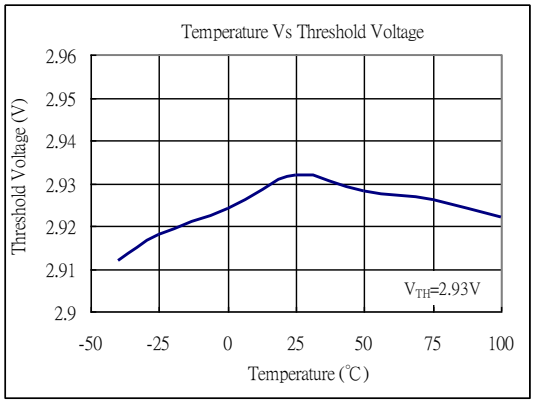
When VCC falls below 1.0V, theAX6901/3 RESET output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to $\overline{\text{RESET}}$ can drift to undetermined voltages.

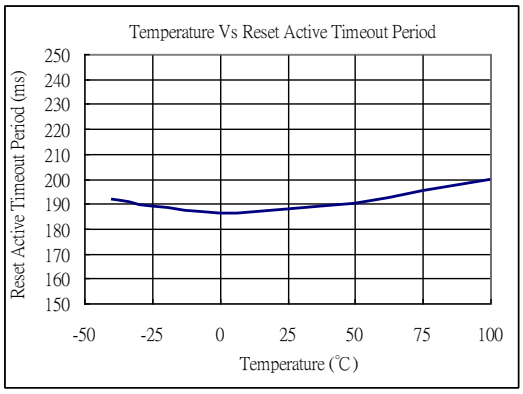
This presents no problem in most applications since most µP and other circuitry is inoperative with VCC below 1.0V. However, in applications where $\overline{\text{RESET}}$ must be valid down to 0V, adding a pull down resistor to $\overline{\text{RESET}}$ causes any stray leakage currents to flow to 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 theAX6902/4 if RESET is required to remain valid for VCC < 1.0V.

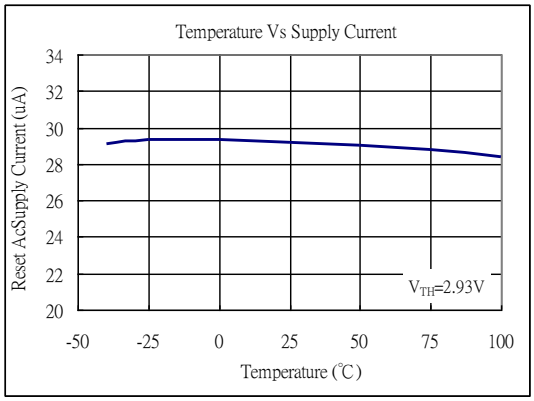
Benefits of Highly Accurate Reset Threshold

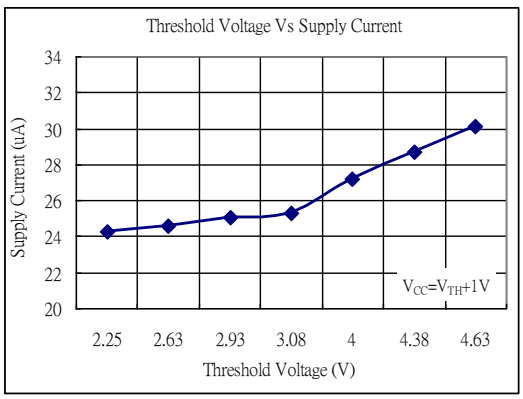
Most µP supervisor ICs has reset threshold voltages between 5% and 10% below the value of nominal sup-ply voltages. This ensures a reset will not occur within 5% of the nominal supply, but will occur when the supply is 10% below nominal. When using ICs rated at only the nominal supply ±5%, this leaves a zone of uncertainty where the supply is between 5% and 10% low, and where the reset may or may not be asserted.

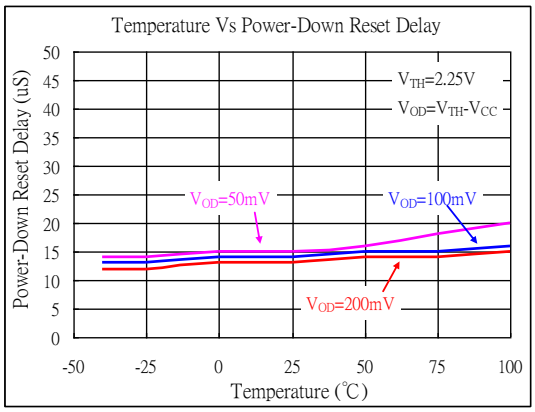
❖ TYPICAL CHARACTERISTICS

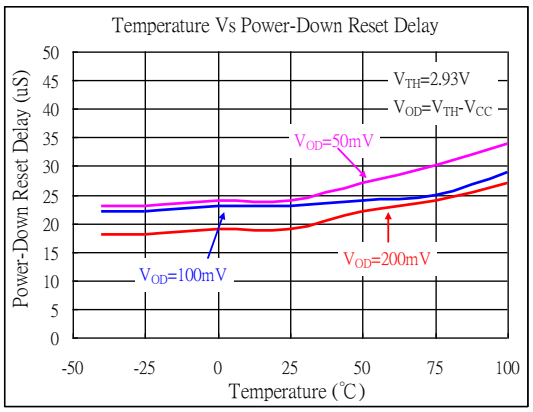


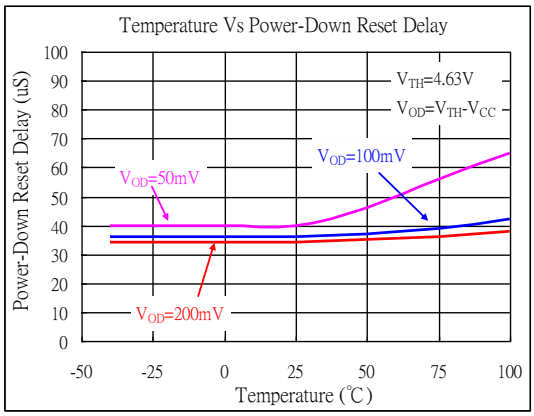




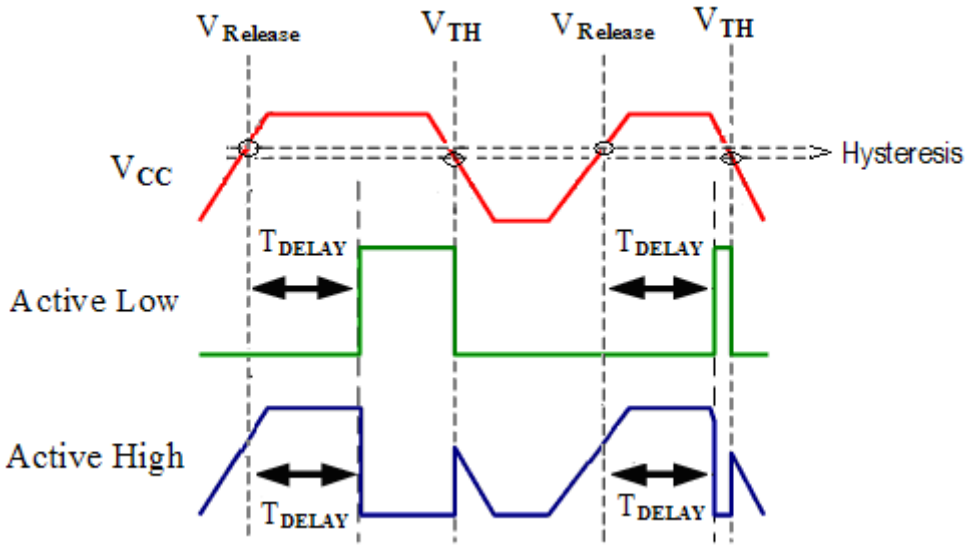


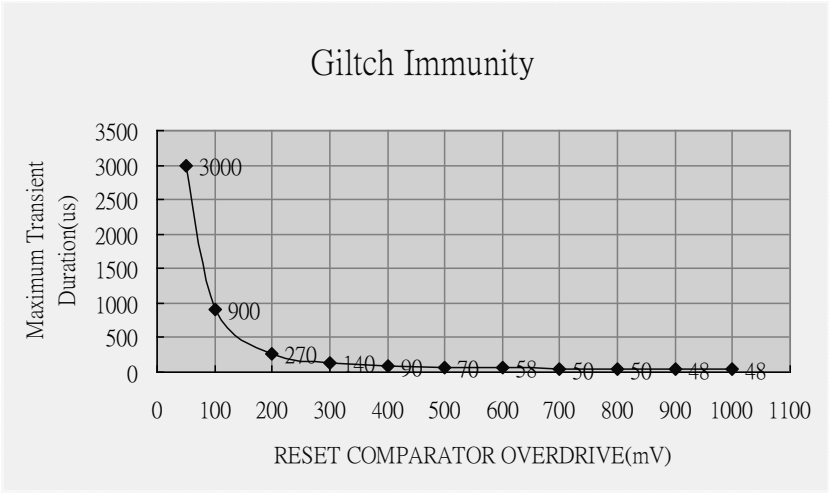






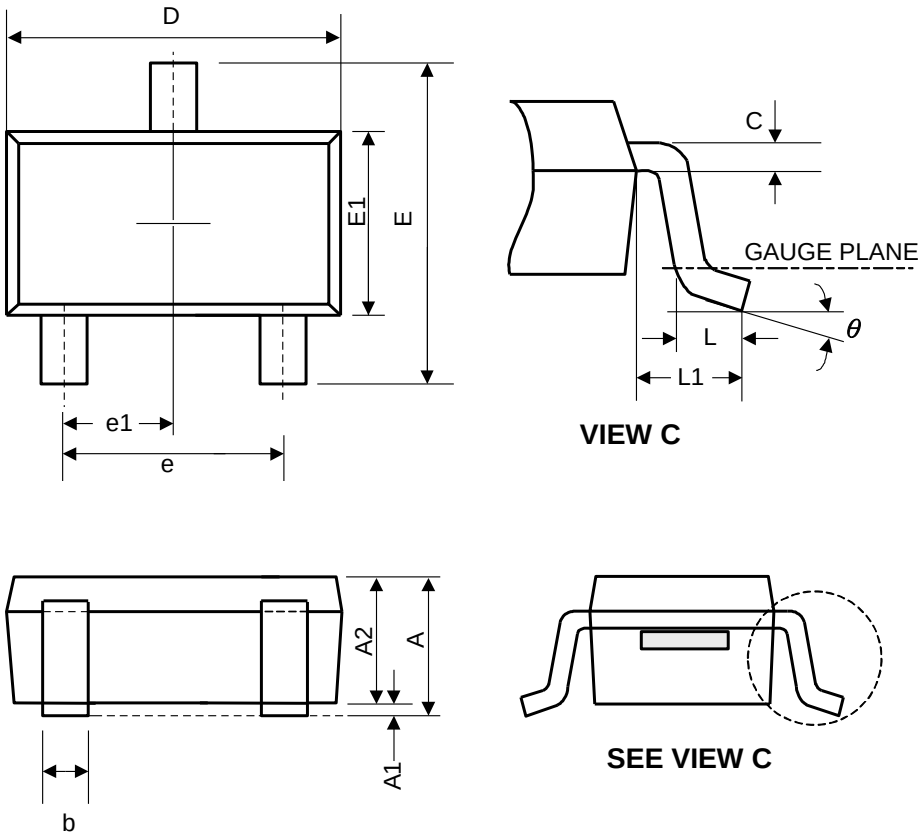
❖ TIMING DIAGRAM





❖ PACKAGE OUTLINES

SOT-23-3L



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.05	-	1.45	0.041	-	0.057
A1	0.05	-	0.15	0.002	-	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
b	0.30	-	0.50	0.012	-	0.020
C	0.08	-	0.20	0.003	-	0.008
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	1.40	1.60	1.80	0.055	0.063	0.071
L	0.30	-	0.60	0.012	-	0.024
L1	0.50	0.60	0.70	0.020	0.024	0.028
e	1.80	1.90	2.00	0.071	0.075	0.079
e1	0.85	1.00	1.15	0.033	0.039	0.045
θ	0°	5°	10°	0°	5°	10°