



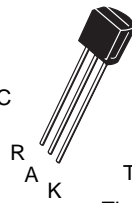
TL431I

Adjustable Precision Shunt Regulator (I Grade)

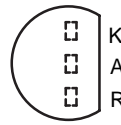
FEATURES

- Programmable Output Voltage to 40V
- Low Dynamic Output Impedance 0.2Ω
- Sink Current Capability of 0.1 mA to 100 mA
- Equivalent Full-Range Temperature Coefficient of 50 ppm/°C
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn on Respons
- Provided Pb-Free packages from the end of 2004
- * ESD tolerance (human body model) 2000V
- * Operating Temperature Range -60~+125 °C

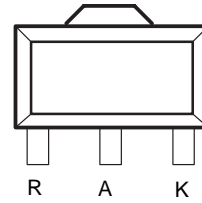
PIN CONNECTIONS



TO-92
TL431ICLP

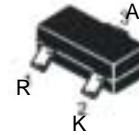
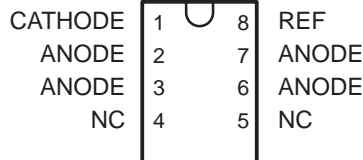


SOT-89
TL431ICPK



SOT-23
TL431ILT1

S08
TL431ACMX

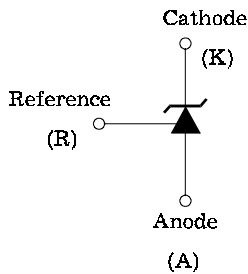


SOT-23
TL431ILT1

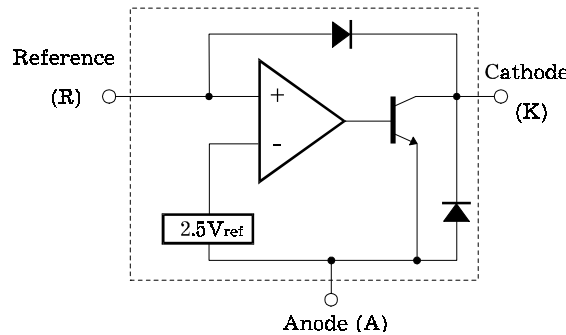
DESCRIPTION

The TL431I is a three-terminal adjustable regulator series with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{ref} (approximately 2.5 volts) and 40 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications. The TL431I is characterized for operation from -60°C to +125 °C.

SYMBOL



FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified)

Characteristic	Symbol	Value	Unit
Cathode Voltage	V_{KA}	42	V
Cathode Current Range (Continuous)	I_K	100 ~ 150	mA
Reference Input Current Range	I_{REF}	0.05 ~ 10	mA
Power Dissipation at 25°C: TO – 92 Package ($R_{\theta JA} = 178^{\circ}C/W$) SOT – 23 – 3 Package ($R_{\theta JA} = 625^{\circ}C/W$)	P_D	0.7 0.2	W
Junction Temperature Range	T_J	0 ~ 150	°C
Operating Temperature Range	T_g	-60 ~ +125	°C
Storage Temperature Range	T_{stg}	-65 ~ +150	°C

TL431I

Adjustable Precision Shunt Regulator (I Grade)

RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Cathode Voltage	V_{KA}		REF		40	V
Cathode Current	I_K		0.5		100	mA

ELECTRICAL CHARACTERISTICS

($T_a = 25^\circ\text{C}$, $V_{KA} = V_{REF}$, $I_K = 10\text{mA}$ unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Reference Input Voltage	V_{REF}		2.445	2.495	2.545	V
Deviation of Reference Input Voltage Over Full Temperature Range	$V_{REF(dev)}$	$T_{min} \leq T_a \leq T_{max}$ $V_{ka}=V_{ref}, I_k=10\text{mA}$		3	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$\Delta V_{KA} = 10\text{V} - V_{REF}$ $\Delta V_{KA} = 36\text{V} - 10\text{V}$		-1.4 -1.0	-2.7 -2.0	mV/V
Reference Input Current	I_{REF}	$R_1 = 10\text{K}\Omega, R_2 = \infty$		1.5	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$I_{REF(dev)}$	$R_1 = 10\text{K}\Omega, R_2 = \infty$		0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{K(min)}$			0.50	1	mA
Off-State Cathode Current	$I_{K(off)}$	$V_{KA} = 42\text{V}, V_{REF} = 0$		0.05	1.0	μA
Dynamic Impedance	Z_{KA}	$I_K = 10\text{mA to } 100\text{ mA}, f \leq 1.0\text{KHz}$		0.15	0.5	Ω

Ordering Information

Grade	Accuracy	Marking	Min.	Typ.	Max.
AA	$\pm 0.5\%$ of Typ.	TL431AA	2.488V	2.495V	2.513V
A	$\pm 1\%$ of Typ.	TL431A	2.475V	2.495V	2.525V
B	$\pm 2\%$ of Typ.	TL431	2.445V	2.495V	2.545V

Notice: Please don't confuse the version of product (-A,-I,-B Suffix) with Grade of product (AA,A,B).

TEST CIRCUITS

Fig.1. Test Circuit for $V_{KA} = V_{REF}$

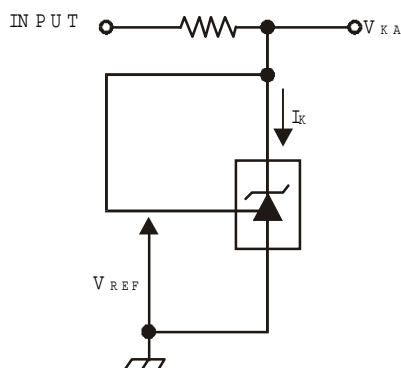


Fig.2. Test Circuit for $V_{KA} \geq V_{REF}$

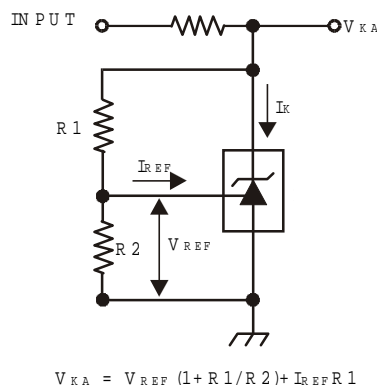
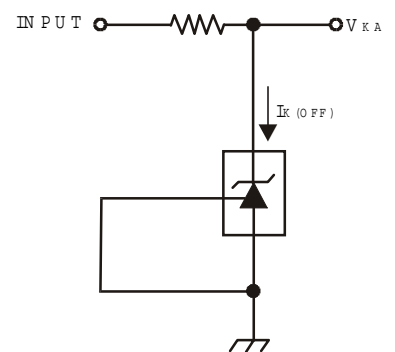
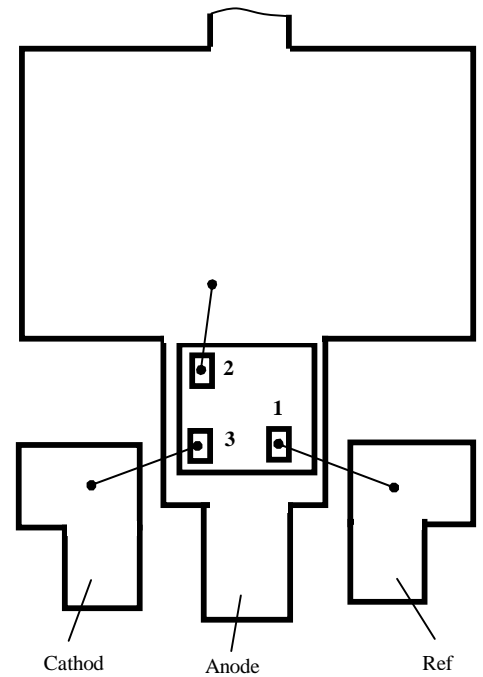


Fig.3. Test Circuit for I_{off}



BONDING DIAGRAM



Chip size: 0,62x 0,82
 Pad size : 80 x 80
 Unit : mm

PAD LOCATION

Pad No.	Pad Name	Description	X	Y
2	A	Anode	472	672
3	K	Cathode	68	672
1	R	Reference	94	244.5

PHYSICAL CHARACTERISTIC

Wafes dia	100 mm (4")
Wafes width	280 ±20µm
Scribe width	80 µm
Passivation	PSG
Backside metallization	Without metallization

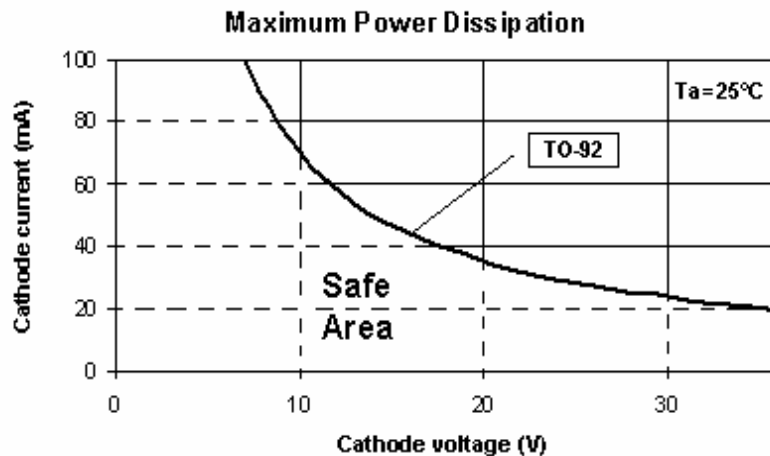


Fig. 1 Maximum Power Dissipation

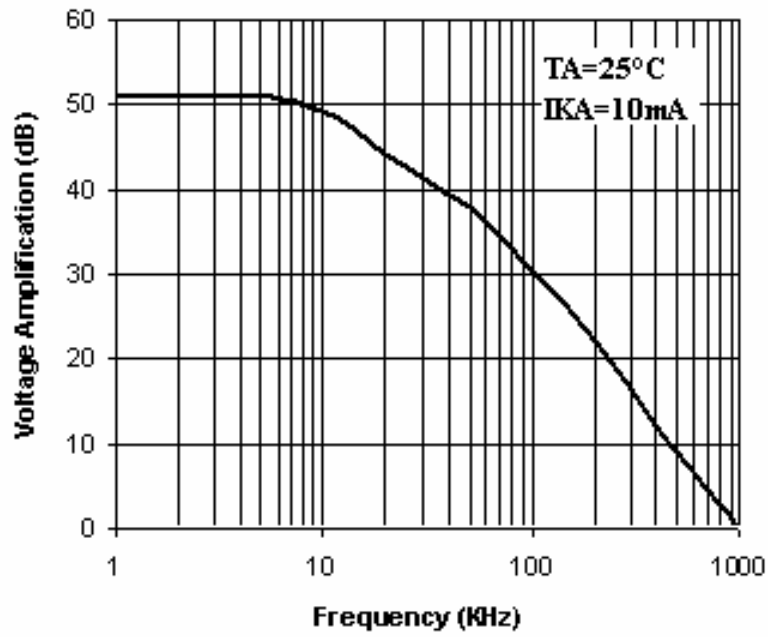


Fig. 2 Small Signal Voltage Amplification vs. Frequency

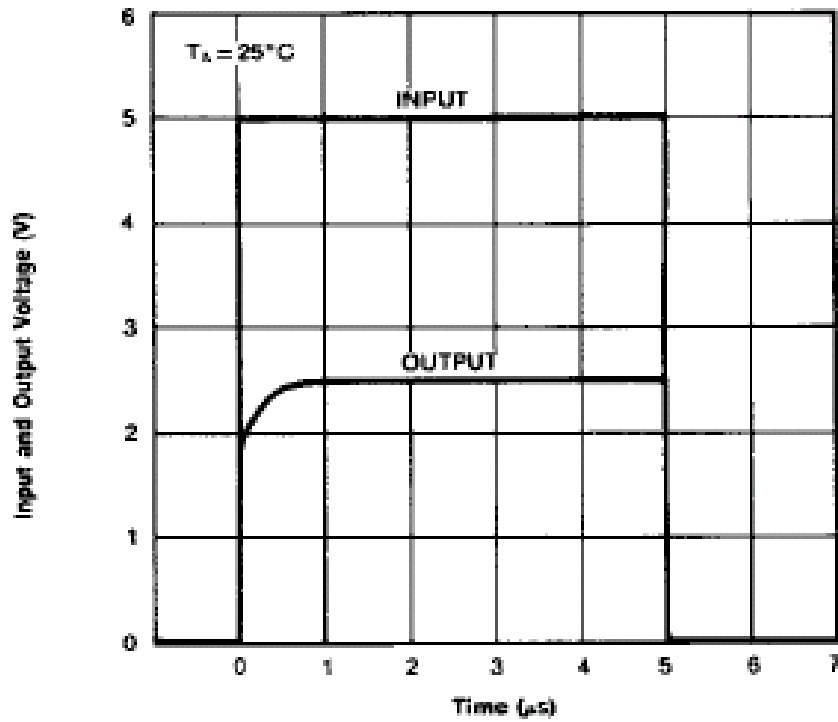
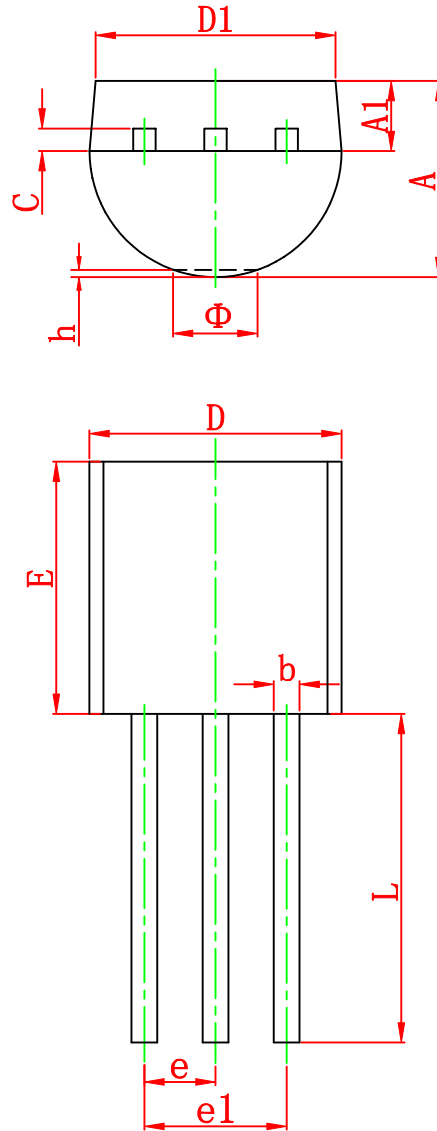


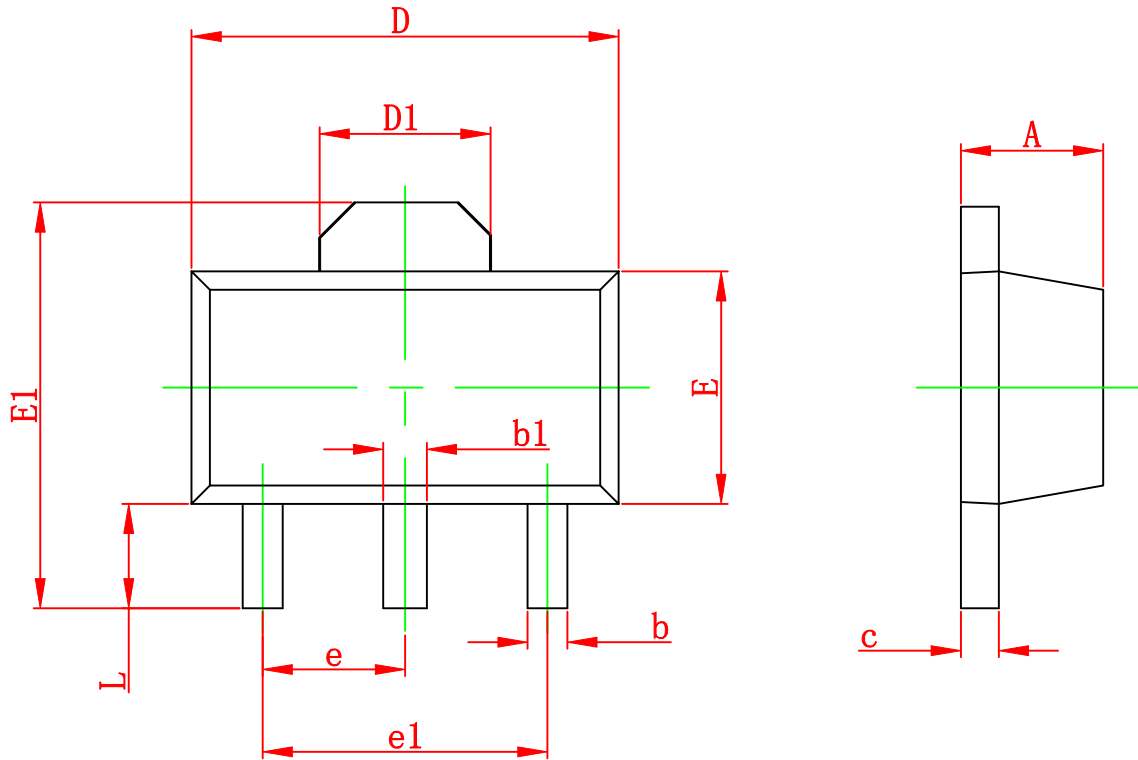
Fig. 3 Pulse Response

TO-92 PACKAGE OUTLINE DIMENSIONS



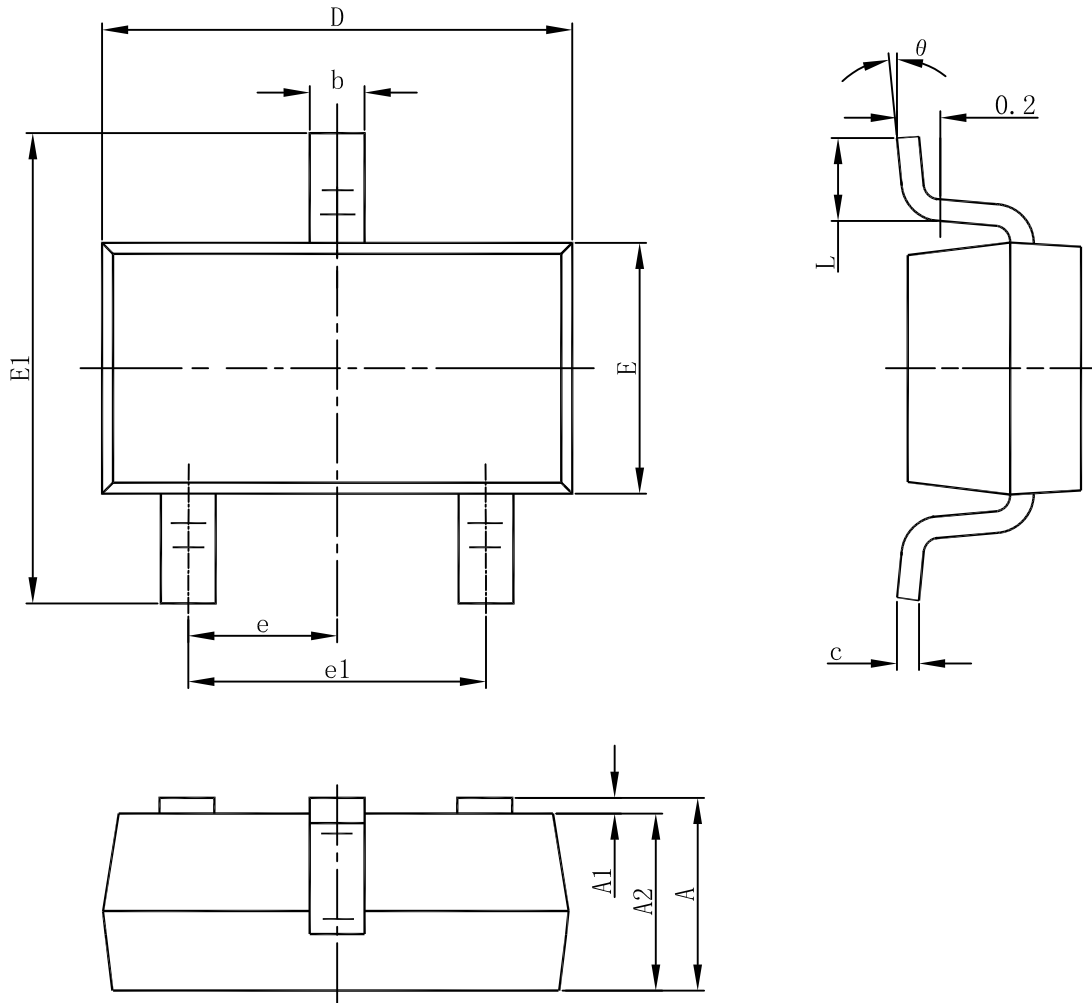
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
Φ		1.600		0.063
h	0.000	0.380	0.000	0.015

SOT-89-3L PACKAGE OUTLINE DIMENSIONS



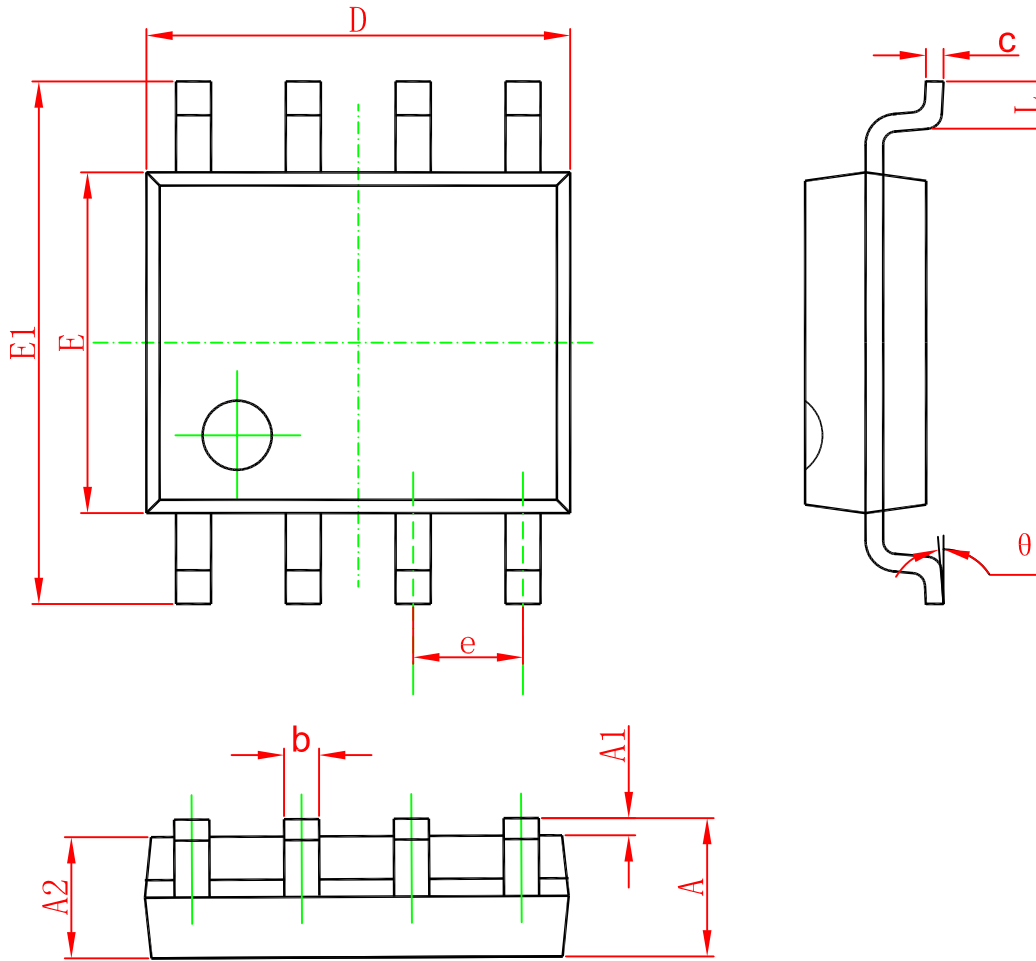
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060TYP	
e1	3.000 TYP		0.118TYP	
L	0.900	1.200	0.035	0.047

SOT-23-3L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
theta	0°	8°	0°	8°