Features

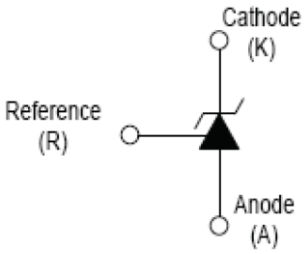
- Programmable Precise Output Voltage from 2.495V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 4.5mV Typical
- Low Equivalent Full-range Temperature Coefficient with 50PPM/℃ Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125℃

Description

The TL431 is a three-terminal adjustable shunt regulator with guaranteed thermal stability over a full operation range. It features sharp turn-on characteristics, low temperature coefficient and low output impedance, which make it ideal substitute for Zener diode in applications such as switching power supply, charger and other adjustable regulators.

Application

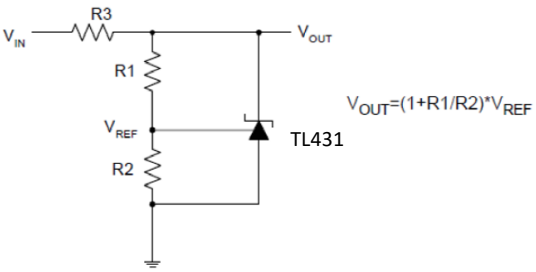
- Shunt Regulator
- High-Current Shunt Regulator
- Precision Current Limiter



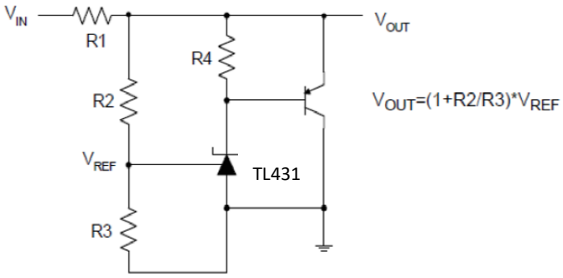
Equivalent Circuit

Pb-Free RoHS Halogen-Free

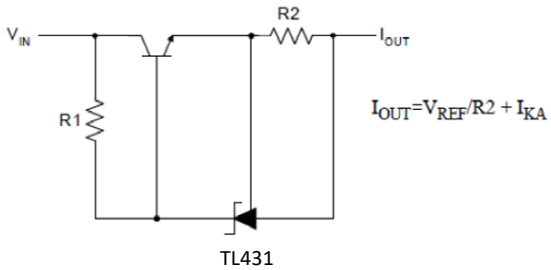
Typical Applications Circuit



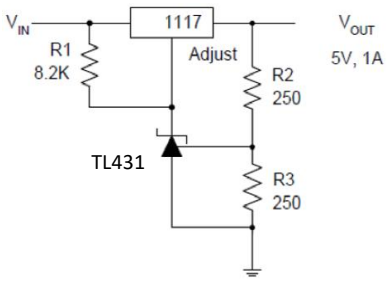
Shunt Regulator



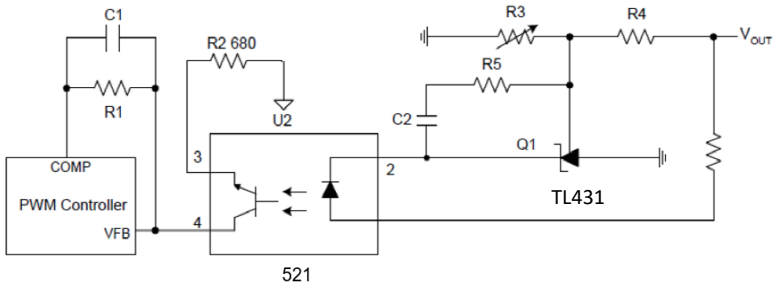
High Current Shunt Regulator



Current Source or Current Limit

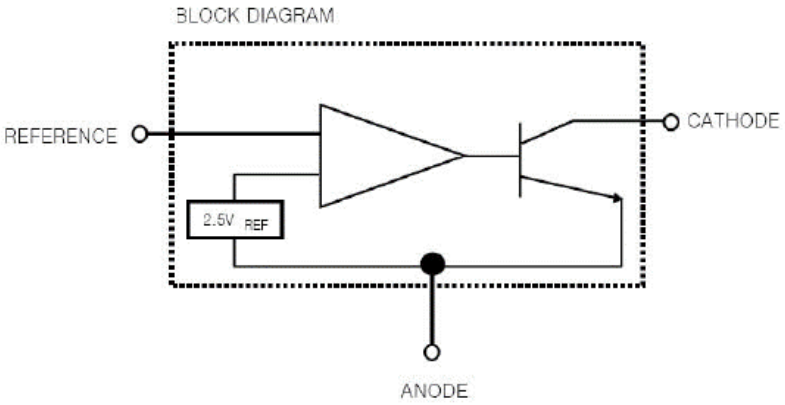


Precision 5V 1A Regulator



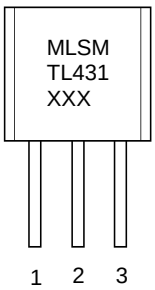
PWM Converter with Reference

Functional Block Diagram

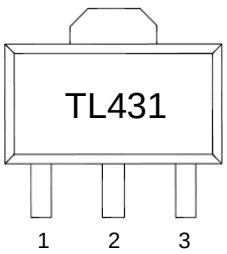


Packages And Pin Assignment

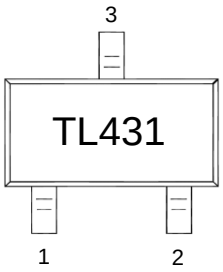
TO-92



SOT-89



SOT-23



Pin No.			Pin Name	Pin Description
SOT-23	SOT-89	TO-92		
1	1	1	R	Reference pin
3	2	2	A	Anode pin
2	3	3	K	Cathode pin

Absolute Maximum Ratings（Note）

Symbol	Parameter	Value			Unit
		SOT-23	SOT-89	TO-92	
V_{KA}	Cathode Voltage	36			V
I_{KA}	Cathode Current Range (Continuous)	-100~+150			mA
I_{REF}	Reference Input Current Range	0.05~+10			mA
P_D	Power Dissipation	300	500	770	mW
$R_{\Theta JA}$	Thermal Resistance from Junction to Ambient	380	165	165	℃/W
T_J	Operating JunctionTemperature	-40~+125			℃
T_{STG}	Storage Temperature Range	-65~150			℃
ESD	ESD (Human Body Model)	2000			V

Note：Stresses greater than 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 under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

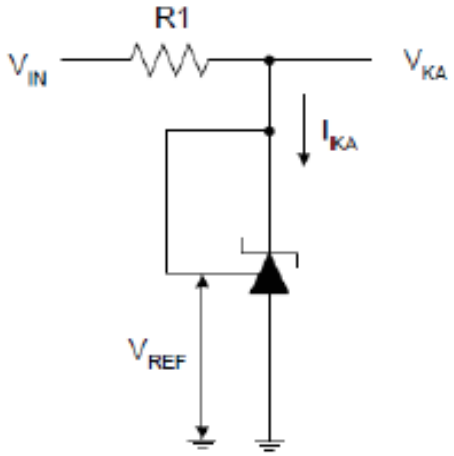
Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Cathode Current	1.0	100	mA
T_A	Operating JunctionTemperature Range	-40	125	℃

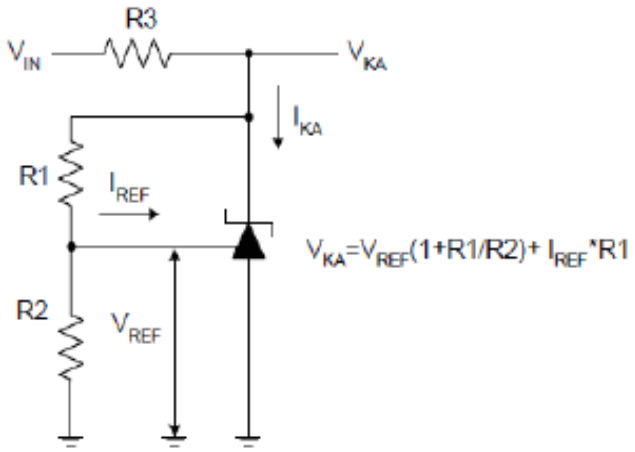
Electrical Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_{REF}	Reference Input Voltage	$V_{KA}=V_{REF}$, I_{KA}=10mA	0.50%	2.483	2.495	2.507	V
			1.00%	2.470	2.495	2.520	V
ΔV_{REF}	Deviation of Reference Voltage Over Full Temperature Range	$V_{KA}=V_{REF}$, I_{KA} =10mA	$T_{MIN}\leqslant TA\leqslant T_{MAX}$	-	3.00	17.0	mV
$\Delta V_{REF}/\Delta V_{KA}$	Ratio of change in reference Input voltage to the change in cathode voltage	I_{KA}=10mA	ΔV_{KA}=10V~V_{REF}	-	-0.4	-2.7	mV/V
			ΔV_{KA}=36V~10V	-	-0.40	-2.0	mV/V
I_{REF}	Reference Input Current	I_{KA}= 10mA,R1=10KΩ, R2=∞		-	1.50	4.0	uA
ΔI_{REF}	Deviation of reference input currentover full temperature range	I_{KA}= 10mA,R1=10KΩ R2=∞, T_A = -40 to +125°C		-	0.40	1.2	uA
I_{KA} (Min)	Minimum Cathode Current for Regulation	V_{KA} = V_{REF}		-	0.25	1.0	mA
I_{KA} (Off)	Off-state Cathode Current	V_{KA} = 36V, V_{REF} = 0		-	0.05	0.9	uA
Z_{KA}	Dynamic Impedance	V_{KA} = V_{REF}, I_{KA} = 1 to 100mA, f ≤ 1.0kHz		-	0.27	0.5	Ω
θ_{JC}	Thermal Resistance	SOT-23		-	135.48	-	℃/W
		TO-92		-	81.63	-	℃/W
		SOT-89		-	29.80	-	℃/W

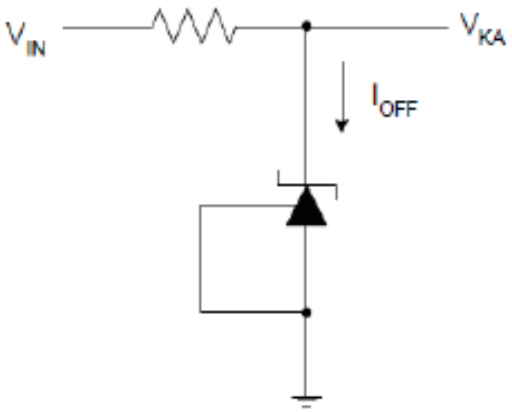
Electrical Characteristics(Cont.)



Test Circuit 4 for $V_{KA} = V_{REF}$



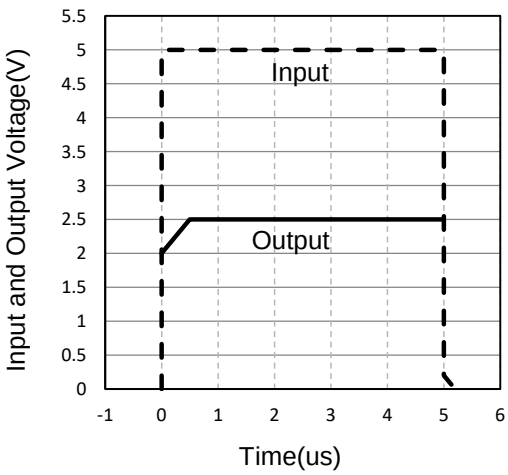
Test Circuit 5 for $V_{KA} > V_{REF}$

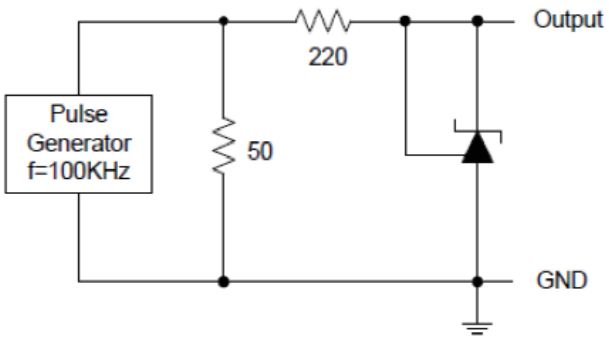


Test Circuit 6 for I_{OFF}

Performance Characteristics(Cont.)

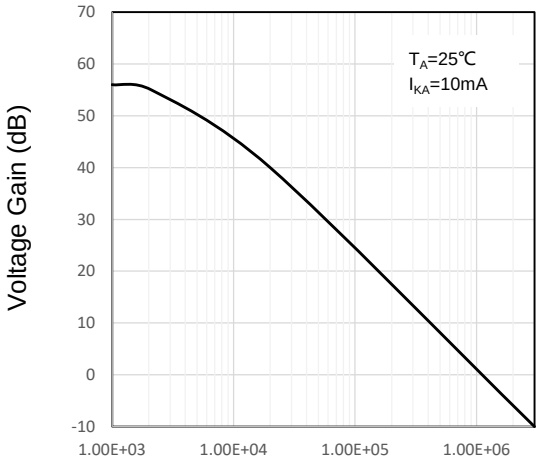
Pulse Response of Input and Output Voltage



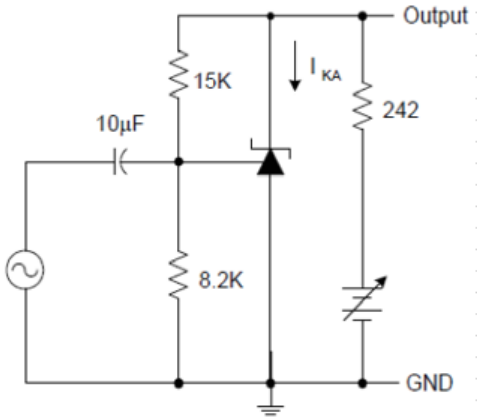


Performance Characteristics(Cont.)

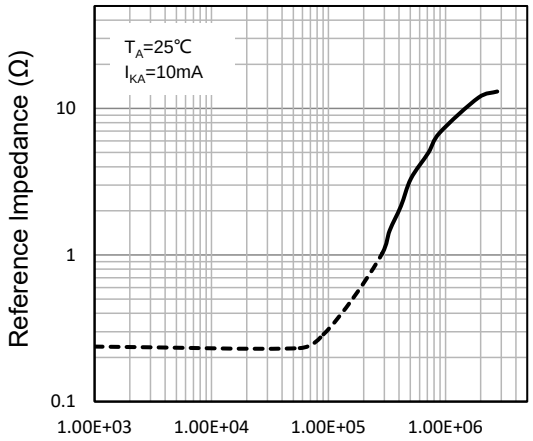
Small Signal Voltage Gain vs. Frequency



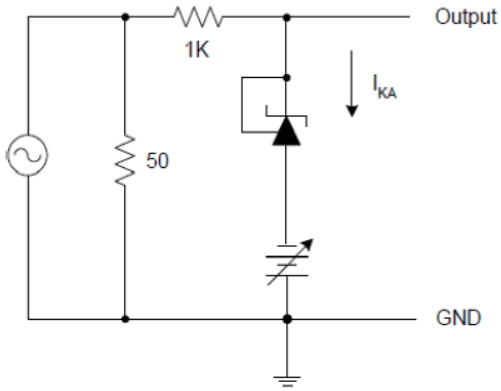
Small Signal Frequency (Hz)



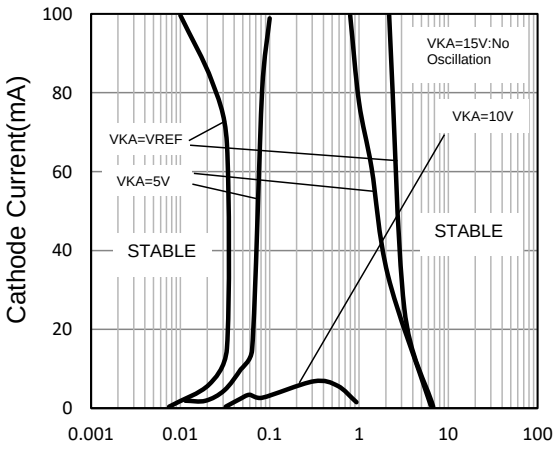
Reference Impedance vs. Frequency



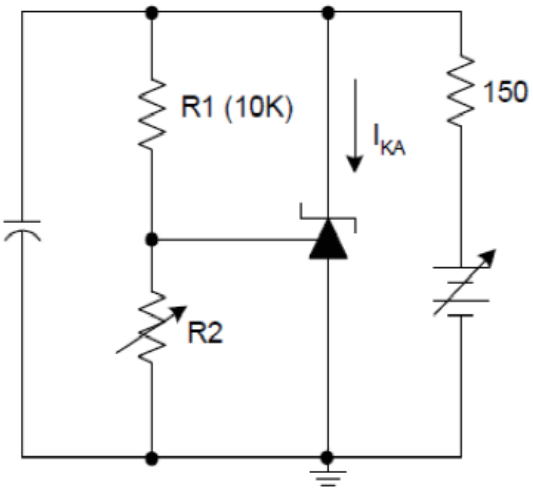
Frequency (Hz)



Stability Boundary Conditions vs. Load Capacitance

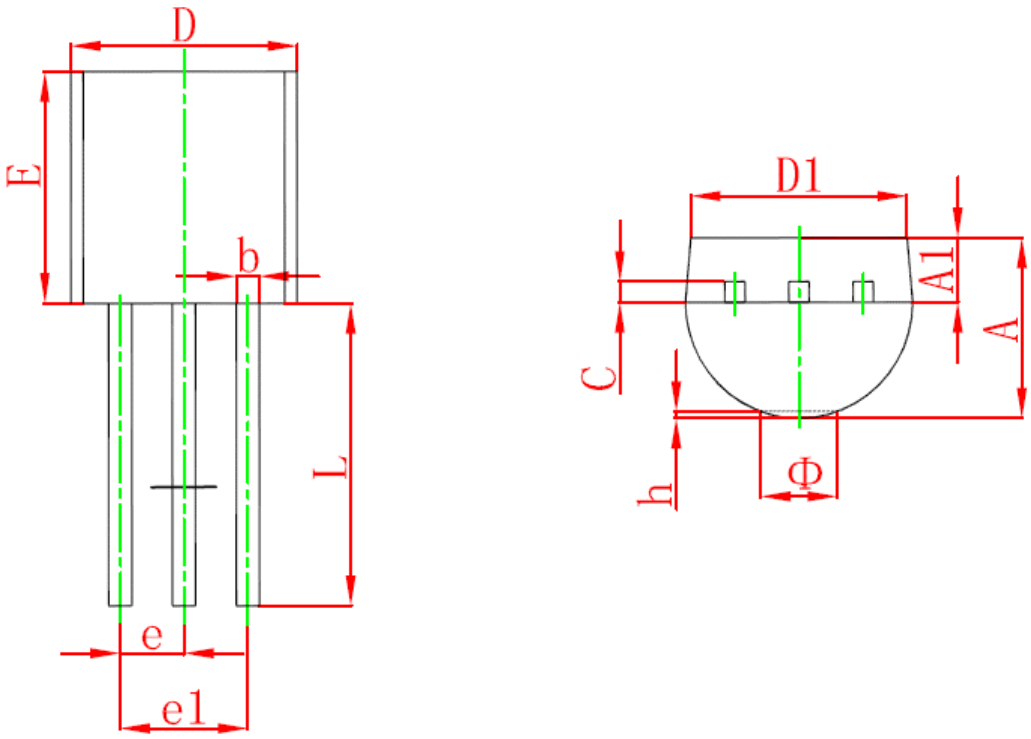


Load Cabacitance(uF)



Package Outline Dimensions

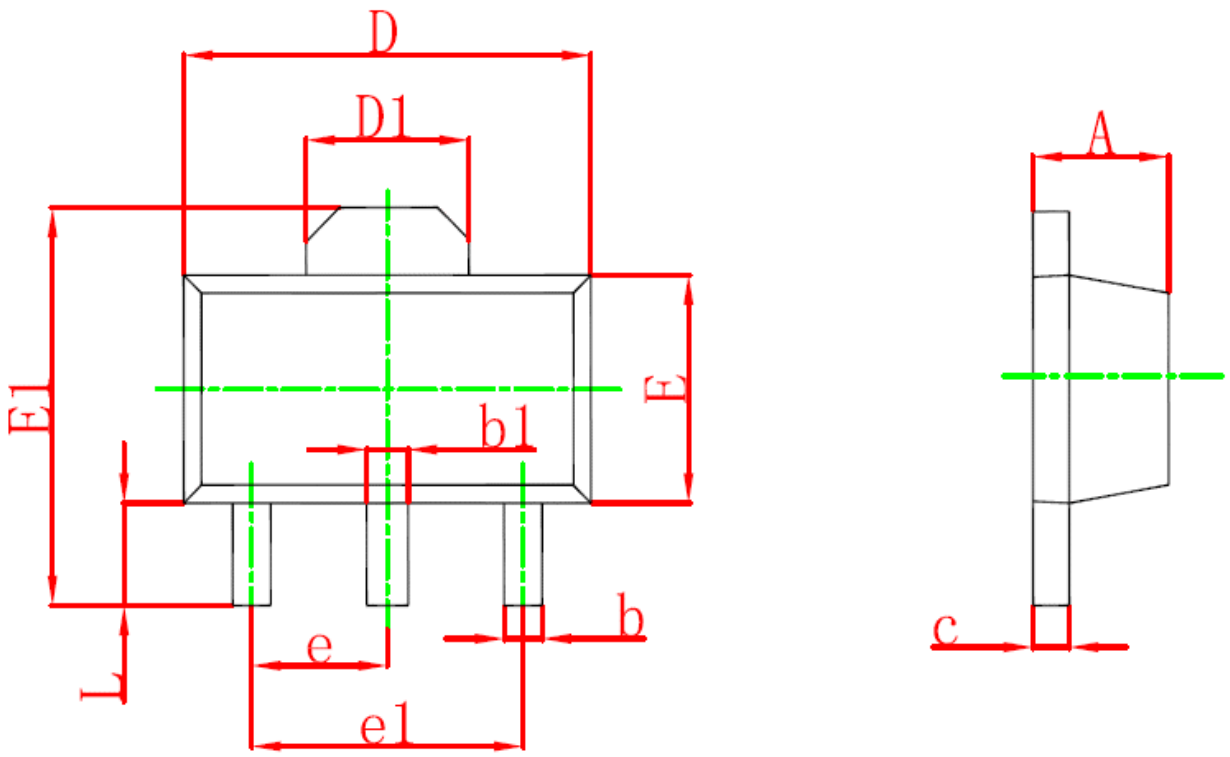
TO-92



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	3.480	3.560	0.137	0.140
A1	1.100	1.400	0.043	0.055
b	0.390	0.500	0.015	0.020
c	0.360	0.400	0.014	0.016
D	4.400	4.800	0.173	0.189
D1	3.430		0.135	
E	4.500	4.700	0.177	0.185
e	1.250TYP		0.049TYP	
e1	2.440	2.640	0.096	0.104
L	13.000	15.000	0.512	0.590
Φ		1.600		0.063
h	0.000	0.380	0.000	0.015

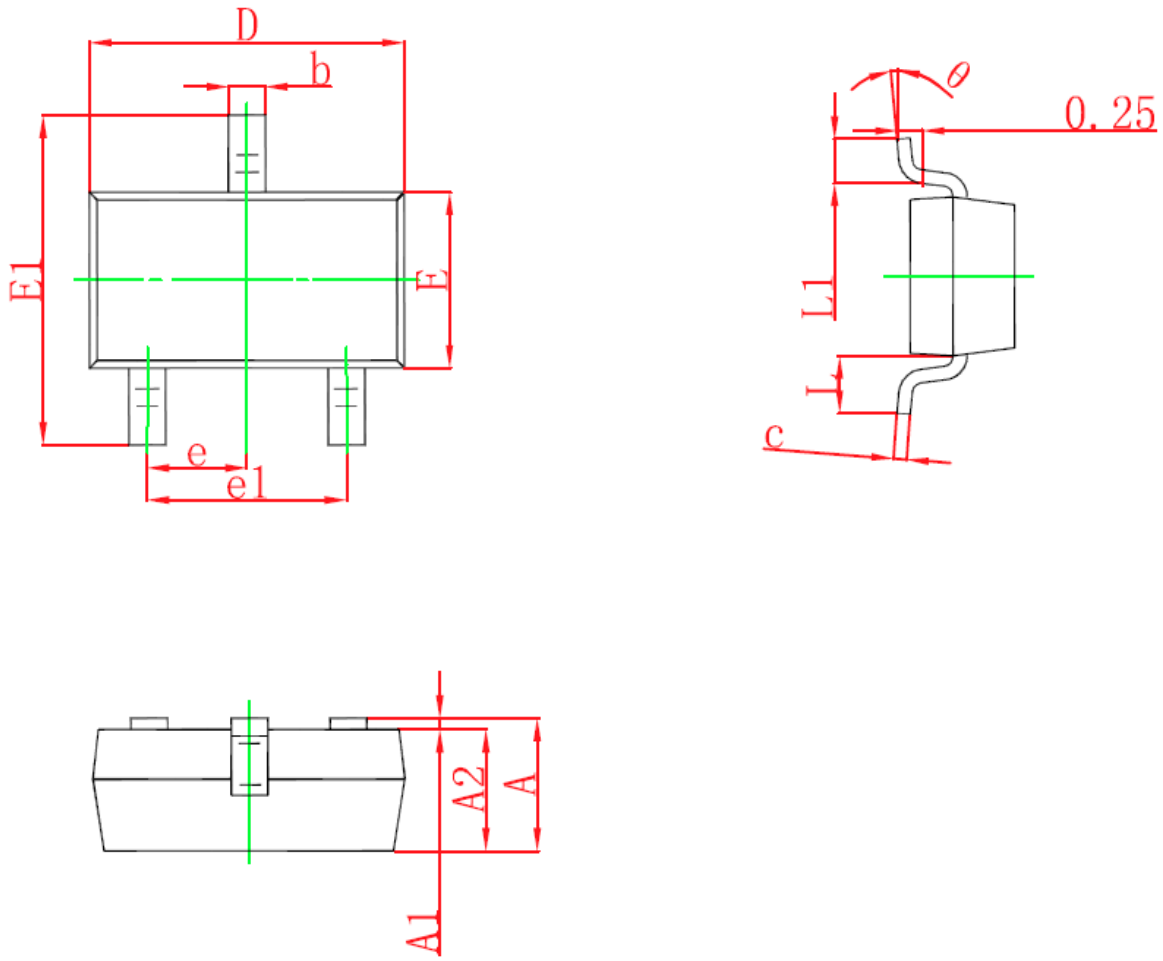
Package Outline Dimensions

SOT-89



Symbol	Dimensions in Millimeters(mm)		Dimensions in Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
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		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

SOT-23



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E1	2.250	2.550	0.088	0.100
E	1.200	1.400	0.047	0.055
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°