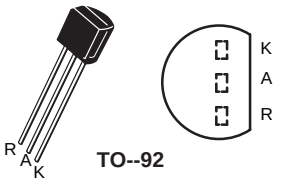
TL431
Precision adjustable shunt regulator

Device Description

The TL431 is a three-terminal adjustable shunt regulator offering excellent temperature stability. This. device has a typical dynamic output impedance of 0.2Ω. The device can be used as a replacement for zener diodes in many applications.



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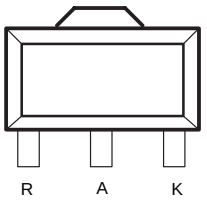

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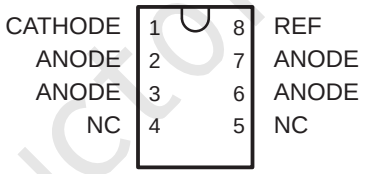
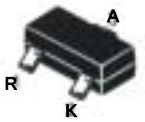
FEATURES

- The output voltage can be adjusted to 36V
- Low dynamic output impedance, its typical value is 0.2Ω
- Trapping current capability is 1 to 100mA
- Low output noise voltage
- Fast on -state response
- The effective temperature compensation in the working range of full temperature
- The typical value of the equivalent temperature factor in the whole temperature scope is 50 ppm/℃

SOP-8



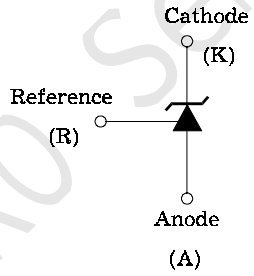
SOT-23



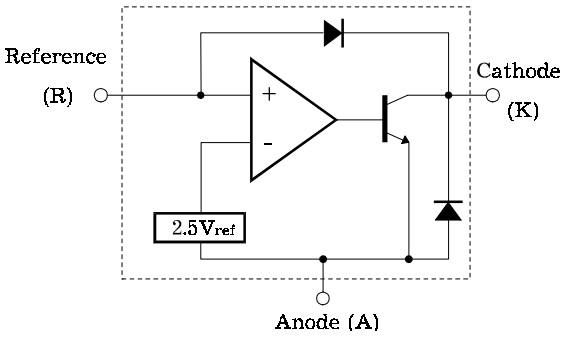
Applications

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

SYMBOL



FUNCTIONAL BLOCK DIAGRAM



Limiting Values (Absolute Maximum Rating)

Parameter	Symbol	Value	Unit
Cathode Voltage	V_{KA}	37	V
Cathode Current Range (Continuous)	I_{KA}	-100~+150	mA
Reference Input Current Range	Iref	0.05~+10	mA
Power Dissipation	P_D	300	mW
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	417	℃/W
Operating Junction Temperature	T_j	150	℃
Operating Ambient Temperature Range	T_{opr}	-25~+85	℃
Storage temperature Range	Tstg	-65~+150	℃

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Electrical Characteristics (T_A=25℃ unless otherwise noted)

Parameter	Symbol	Test conditions		Min	Typ	Max	Unit
Reference input voltage (Fig.1)	V_{ref}	$V_{KA}=V_{REF}$, I_{KA}=10mA		2.475	2.5	2.525	V
Deviation of reference input voltage over temperature (note) (Fig.1)	$\triangle V_{ref}/\triangle T$	$V_{KA}=V_{REF}$, I_{KA}=10mA $T_{MIN}\leq T_a\leq T_{MAX}$			4.5	17	mV
Ratio of change in reference input voltage to the change in cathode voltage (Fig.2)	$\triangle V_{ref}/\triangle V_{KA}$	I_{KA}=10mA	$\triangle V_{KA}$ =10V~V_{REF}		-1.0	-2.7	mV/V
			$\triangle V_{KA}$ =36V~ 10V		-0.5	-2.0	mV/V
Reference input current (Fig.2)	I_{ref}	I_{KA}= 10mA,R_1=10kΩ R_2=∞			1.5	4	μA
Deviation Of reference input current over full temperature range (Fig.2)	$\triangle I_{ref}/\triangle T$	I_{KA}=10mA, R_1=10kΩ R_2=∞ T_A=-25 to 85℃			0.4	1.2	μA
Minimum cathode current for regulation (Fig.1)	$I_{KA(min)}$	$V_{KA}=V_{REF}$			0.45	1.0	mA
Off-state cathode Current (Fig.3)	$I_{KA(OFF)}$	V_{KA}=36V,V_{REF}=0			0.05	1.0	μA
Dynamic impedance	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to 100mA f≤1.0kHz			0.15	0.5	Ω

Note: T_{MIN}=-25℃ ,T_{MAX}=+85℃

CLASSIFICATION of V_{ref}

Rank	**0.5%**	**1%**
Range	2.487-2.513	2.475-2.525

Figure 1. Test Circuit for V_{KA} = V_{ref}

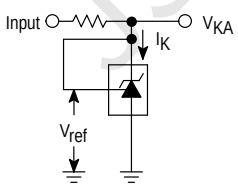


Figure 2. Test Circuit for V_{KA} > V_{ref}

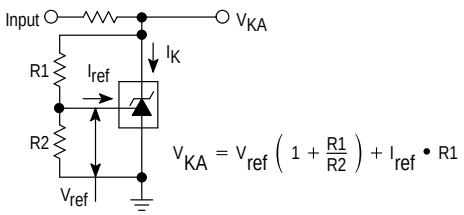
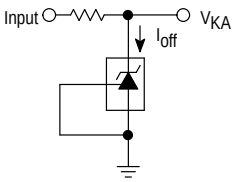


Figure 3. Test Circuit for I_{off}



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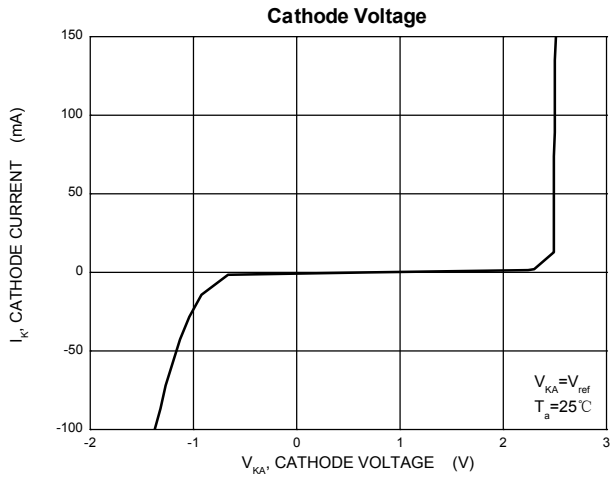
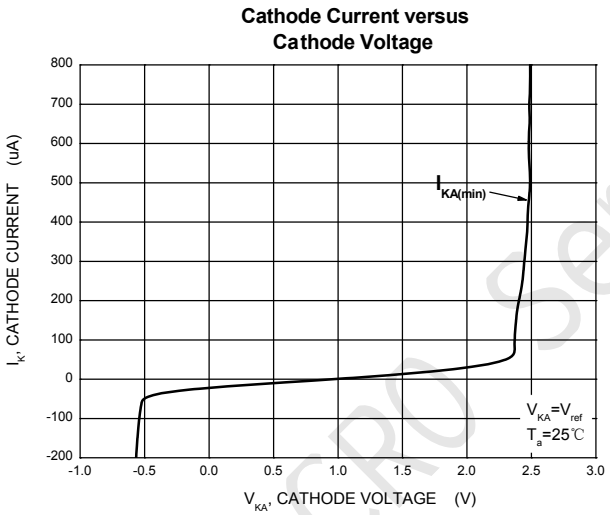
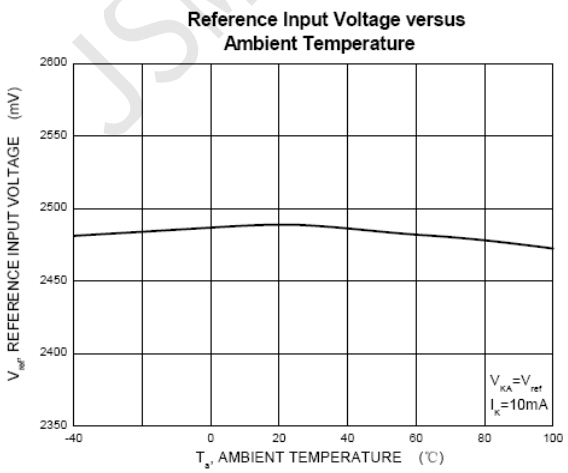
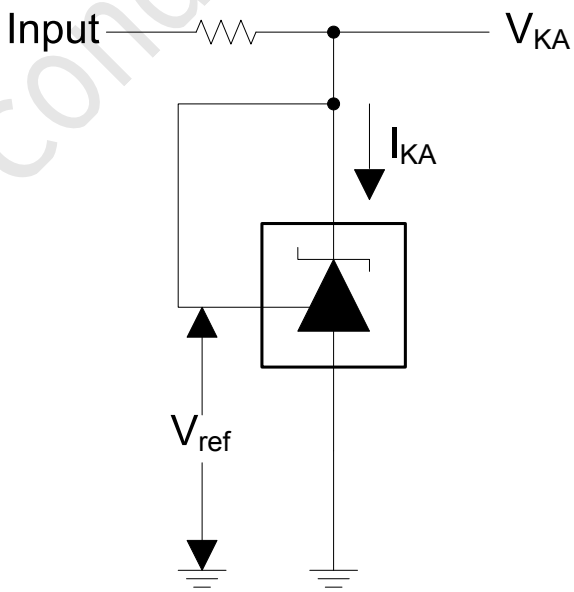
Typical Characteristics









Test Circuit for $V_{KA}=V_{ref}$

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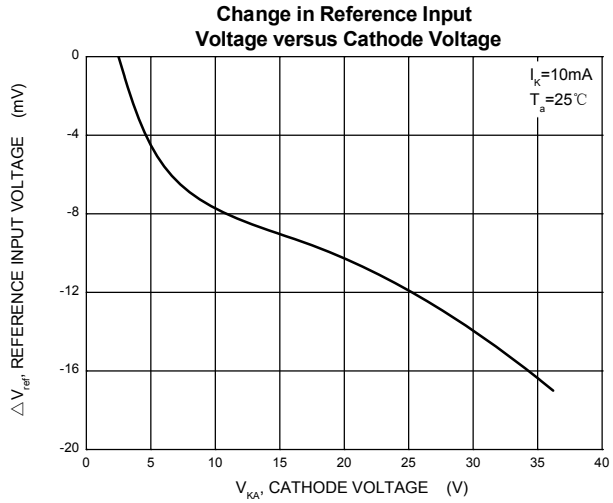
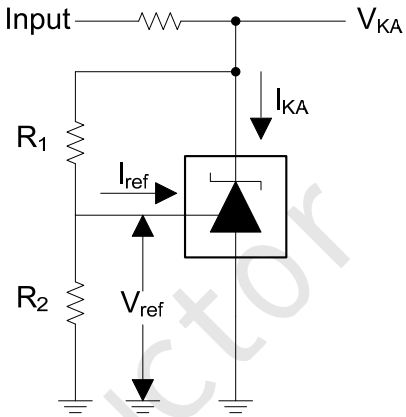
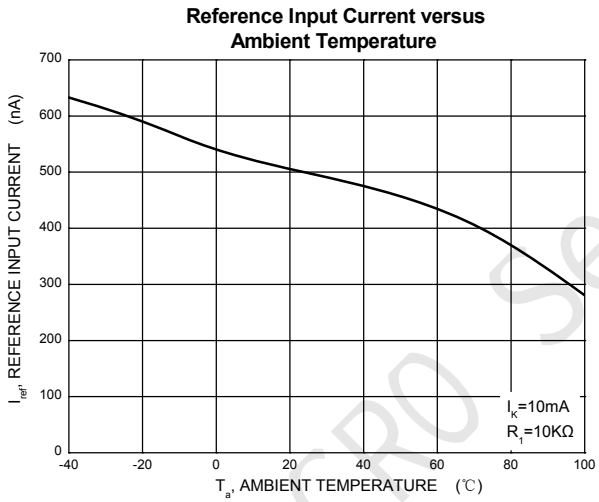
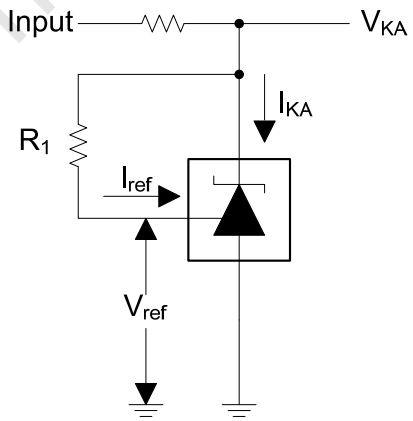
Typical Characteristics



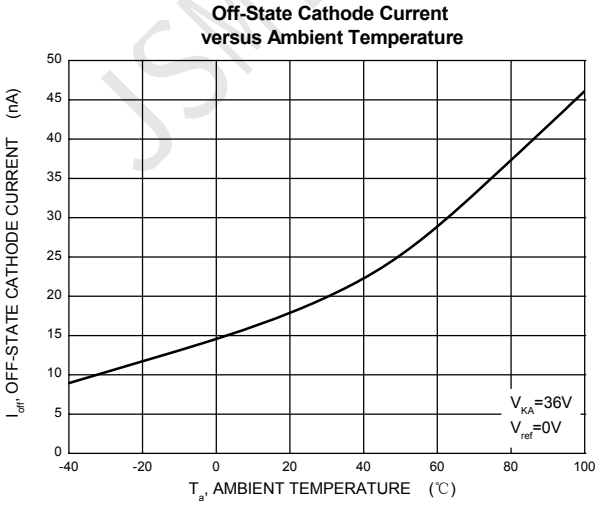


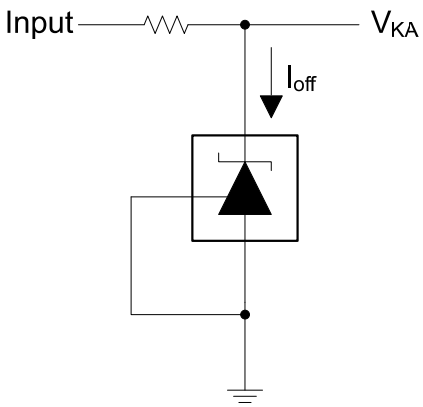
Test Circuit for $V_{KA}=V_{ref}(1+R1/R2)+R1*I_{ref}$





Test Circuit for I_{ref}





Test Circuit for I_{off}

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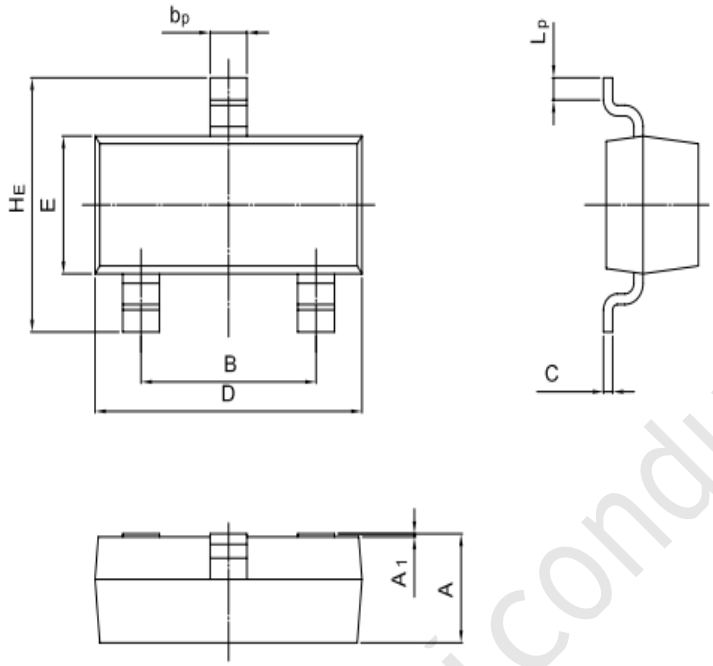
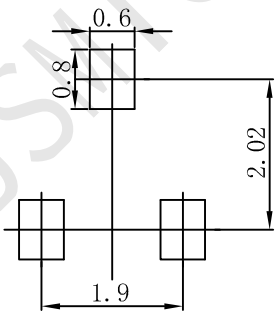
SOT-23 Package Outline Dimensions



UNIT	A	B	bp	C	D	E	HE	A1	Lp
mm	1.40 0.95	2.04 1.78	0.50 0.35	0.19 0.08	3.10 2.70	1.65 1.20	3.00 2.20	0.100 0.013	0.50 0.20

SOT-23 Suggested Pad Layout



Note:
1.Controlling dimension:in millimeters.
2.General tolerance:± 0.05mm.
3.The pad layout is for reference purposes only.

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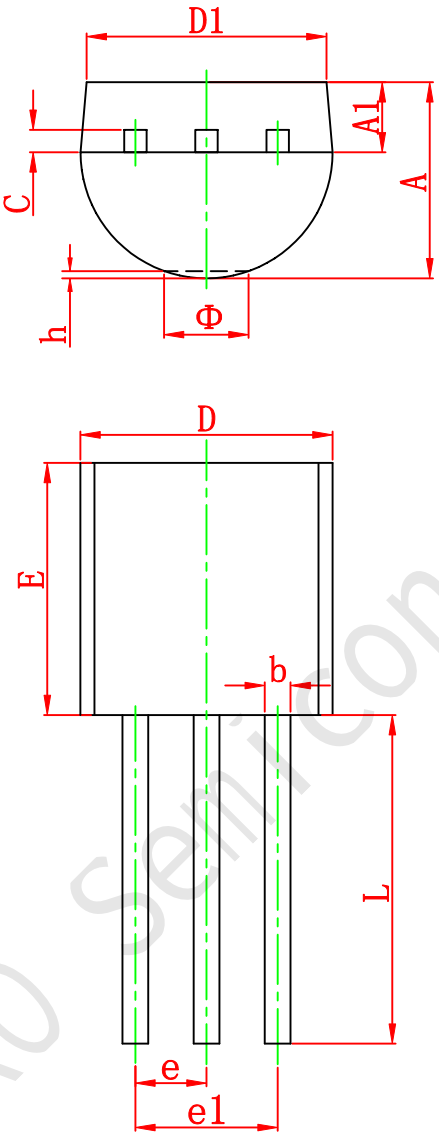
TO-92 Package Outline Dimensions



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

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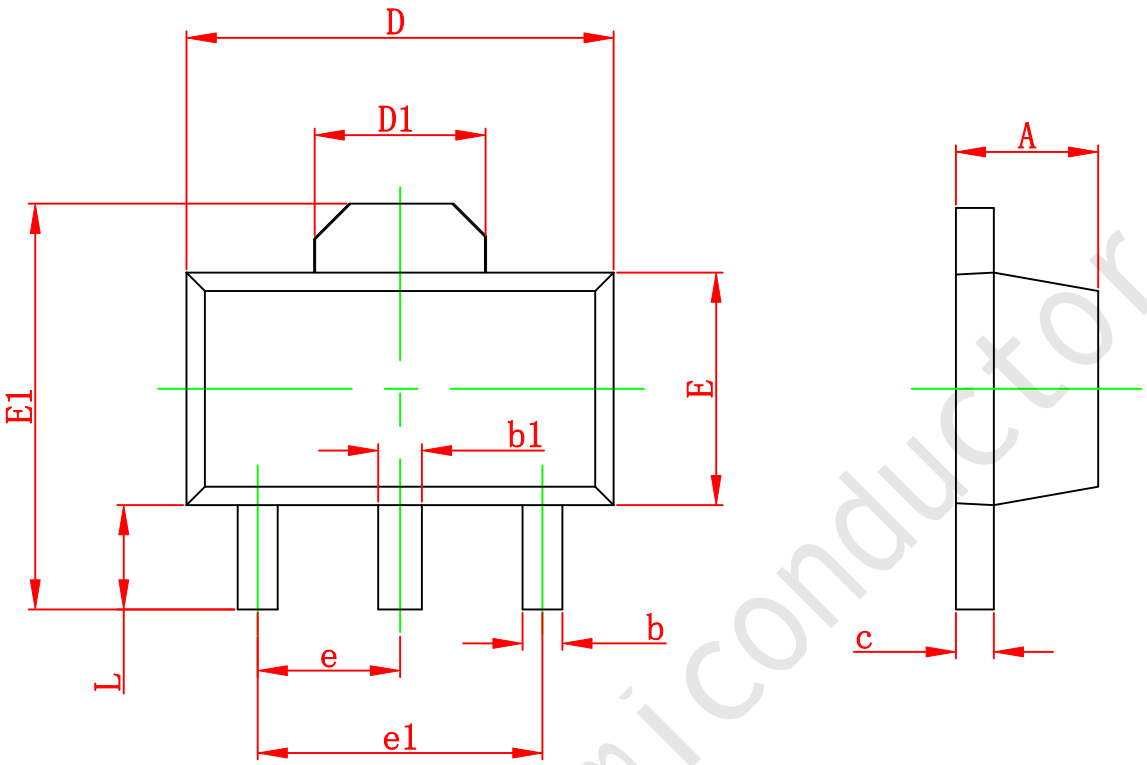
SOT-89 Package Outline Dimensions



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

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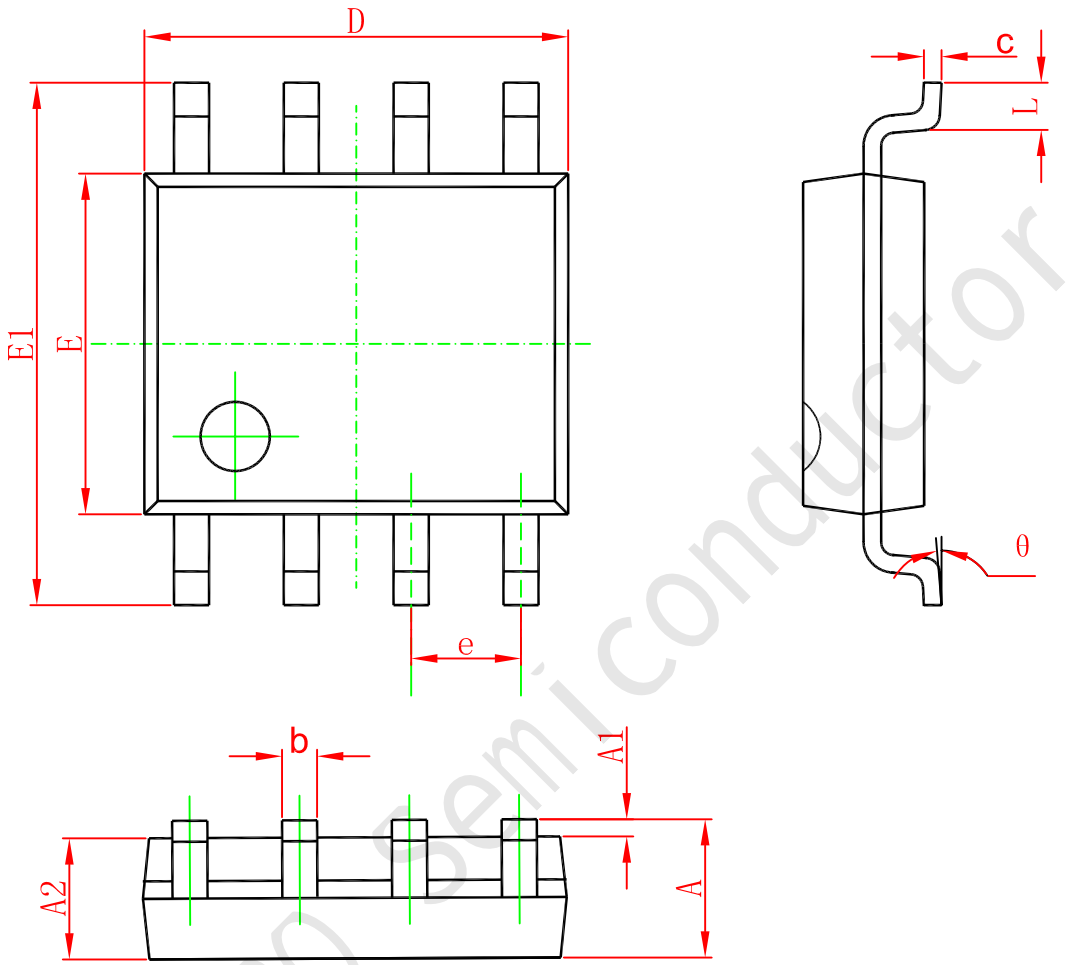
SOP-8 Package Outline Dimensions



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
θ	0°	8°	0°	8°

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