ZHT431
Adjustable Precision Zener Shunt Regulator

Description

The ZHT431 is a three terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 100mA. The device offers extended operating temperature range working from -55 to +125°C. The output voltage may be set to any chosen voltage between 2.5 and 20 volts by selection of two external divider resistors.

The devices can be used as a replacement for zener diodes in many applications requiring an improvement in zener performance.

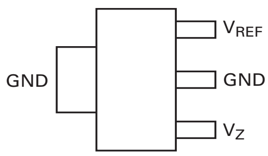
Features

- Surface mount SOT223 and SOT23 packages
- 0.5%, 1% and 2% tolerance
- Maximum temperature coefficient 67 ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- 50mA to 100mA current sink capability
- Low output noise
- Available in “Green” Molding Compound (No Br, Sb) denoted by -7
- Wide temperature range -55 to +125°C

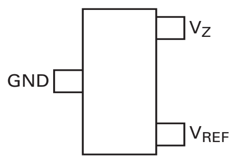
Applications

- Series and shunt regulator
- Voltage monitor
- Over voltage / under voltage protection
- Switch mode power supplies

Pinout Information



SOT223
Pinout - Top view

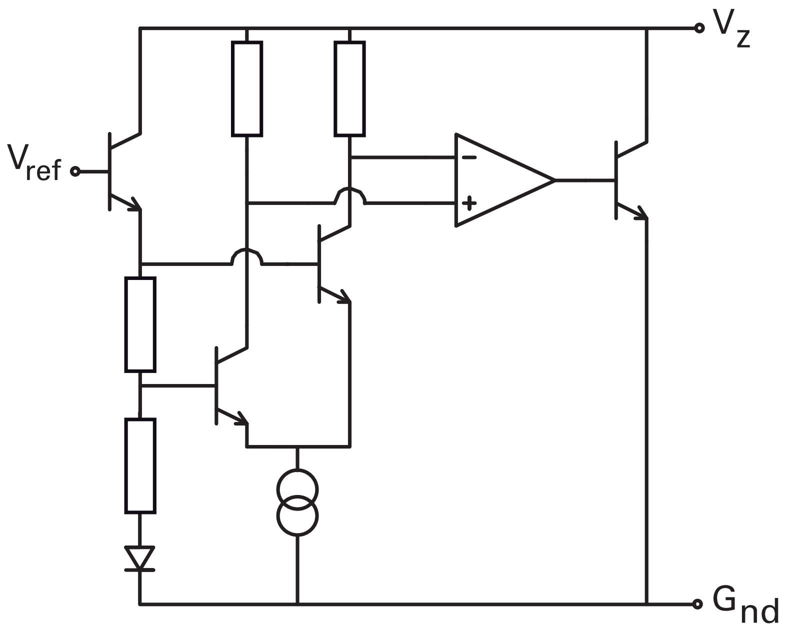


SOT23
Pinout - Top view

Ordering Information

Order Reference	Tolerance (%)	Package	Part mark	Status	Reel size (inches)	Quantity per reel	Tape width
ZHT431C01L	1	TO92	ZHT43101	Obsolete	Loose	4000	-
ZHT431C01STOB	1	TO92	ZHT43101	Obsolete	12.5	1500	-
ZHT431C01STZ	1	TO92	ZHT43101	Obsolete	Concertina	1500	-
ZHT431C02L	2	TO92	ZHT43102	Obsolete	Loose	4000	-
ZHT431C02STOB	2	TO92	ZHT43102	Obsolete	12.5	1500	-
ZHT431C02STZ	2	TO92	ZHT43102	Obsolete	Concertina	1500	-
ZHT431F01TA	1	SOT23	43C	Active	7	3000	8mm
ZHT431F01-7	1	SOT23	43C	Active	7	3000	8mm
ZHT431FMTA	0.5	SOT23	43P	Active	7	3000	8mm
ZHT431F02TA	2	SOT23	43D	Active	7	3000	8mm
ZHT431G01TA	1	SOT223	ZHT43101	Active	7	1000	12mm
ZHT431G02TA	2	SOT223	ZHT43102	Active	7	1000	12mm

Schematic Diagram



Absolute Maximum Rating

Cathode voltage (V_Z)	20V	**Power dissipation (T_{amb}=25°C)**	
Cathode current	150mA	(T_{jmax} = 150°C)	
Operating temperature	-55 to 125°C	SOT23	330mW
Storage temperature	-55 to 150°C	SOT223	2W

Recommended Operating Conditions

	Min.	**Max.**
Cathode voltage	V_{REF}	20V
Cathode current	50µA	100mA

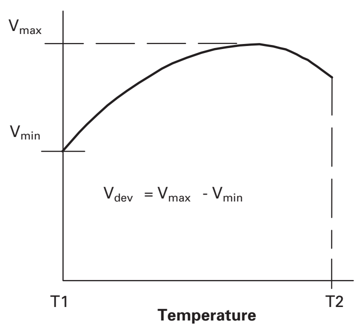
Electrical Characteristics Test Conditions (unless otherwise stated):T_{amb}=25°C

Symbol	Parameter	Value Min.	Value Typ.	Value Max.	Units	Conditions
V_{REF}	Reference voltage 2%	2.45	2.50	2.55	V	I_L=10mA (Fig.1), V_Z=V_{REF}
	1%	2.475	2.50	2.525	V	
	0.5%	2.4875	2.50	2.5125	V	
V_{DEV}	Deviation of reference input voltage over temperature		10	30	mV	I_L=10mA, V_Z=V_{REF} T_{amb}=full range (Fig1)
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of the change in reference voltage to the change in cathode voltage		-1.85	-2.7	mV/V	V_Z from V_{REF} to 10V I_Z=10mA (Fig.2)
			-1.0	-2.0	mv/V	V_Z from 10V to 20V I_Z=10mA (Fig.2)
I_{REF}	Reference input current		0.12	1.0	mA	R1=10k, R2=O/C, I_L=10mA (Fig.2)
DI_{REF}	Deviation of reference input current over temperature		0.04	0.2	mA	R1=10k, R2=O/C, I_L=10mA T_{amb}=full range (Fig.2)
I_{Zmin}	Minimum cathode current for regulation		35	50	mA	V_Z=V_{REF} (Fig.1)
I_{Zoff}	Off-state current			0.1	mA	V_Z=20V, V_{REF}=0V(Fig.3)
R_Z	Dynamic output impedance			0.75	V	V_Z=V_{REF} (Fig.1), f=0Hz, I_C=1mA to 100mA

Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range.

The average temperature coefficient of the reference input voltage, V_{REF} is defined as:

$$V_{REF}\left(\frac{ppm}{°C}\right) = \frac{V_{DEV}\, x\, 1000000}{V_{REF}\,(T1 - T2)}$$



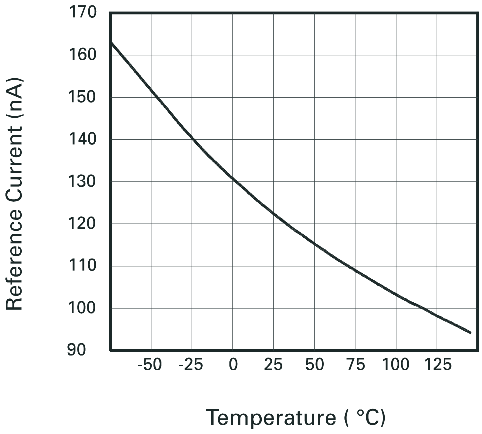
The dynamic output impedance, R_Z, is defined as:

$$R_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

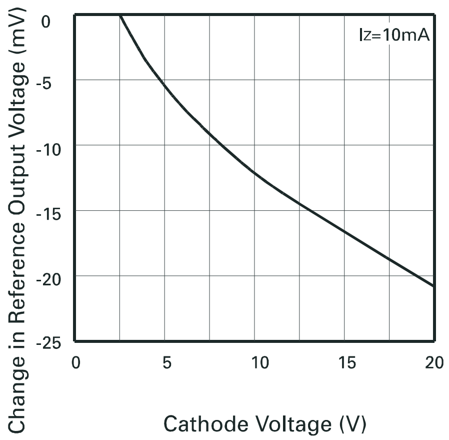
When the device is programmed with two externalresistors, R1 and R2, (fig 2) , the dynamic outputimpedance of the overall circuit, R', is defined as:

$$R' = R_Z\left(1 + \frac{R1}{R2}\right)$$

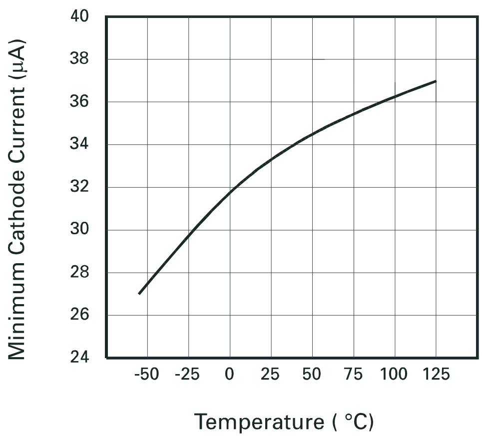
Typical Characteristics



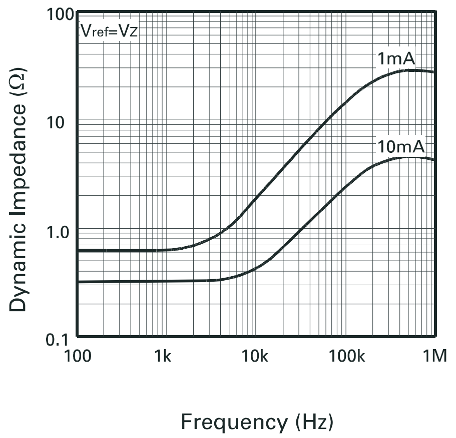
Iref vs. Temperature



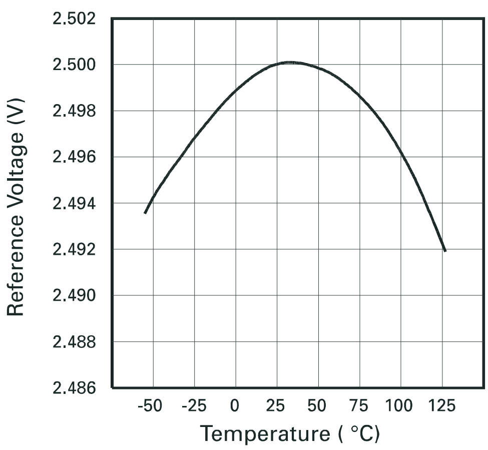
Change in Vref v Cathode Voltage



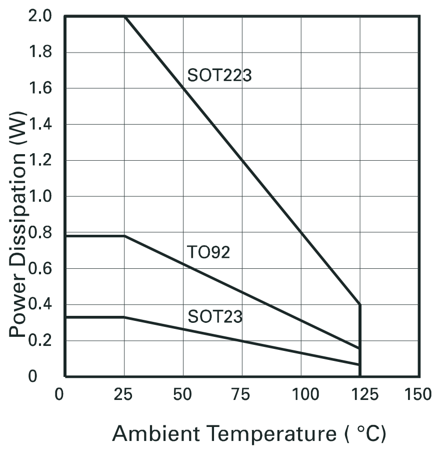
Izmin vs. Temperature



Dynamic Impedance v Frequency

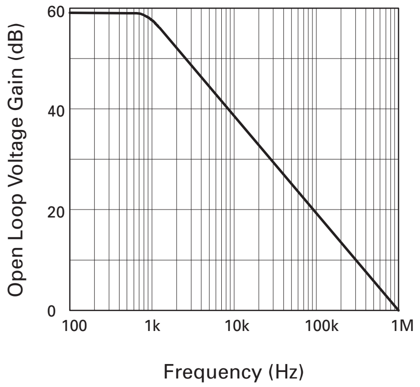


Vref vs. Temperature

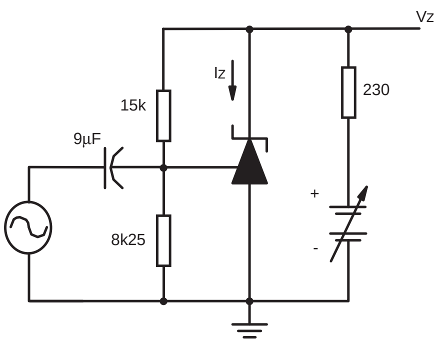


Power Dissipation Derating

Typical Characteristics

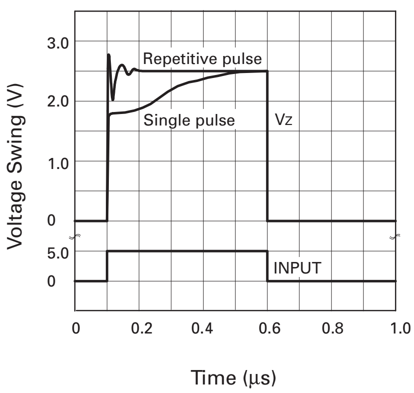


Gain v Frequency

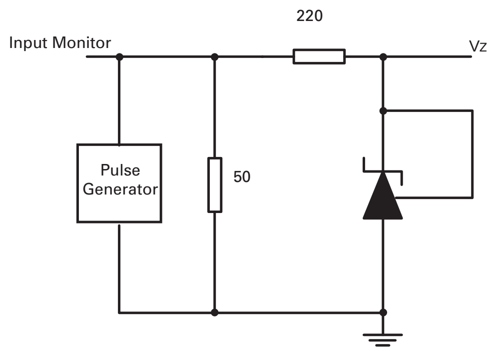


I_Z = 10mA, T_A = 25°C

Test Circuit for Open Loop Voltage Gain

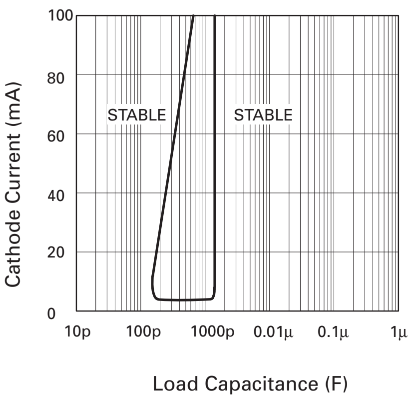


Pulse Response

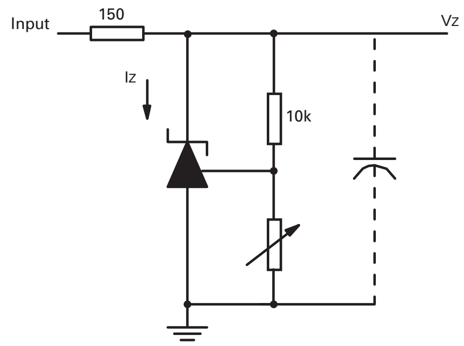


T_A = 25°C

Test Circuit for Pulse Response



Stability Boundary Conditions



$V_{ref} < V_Z < 20$, I_Z = 10mA, T_A = 25°C

Test Circuit for Stability Boundary Conditions

DC Test Circuits

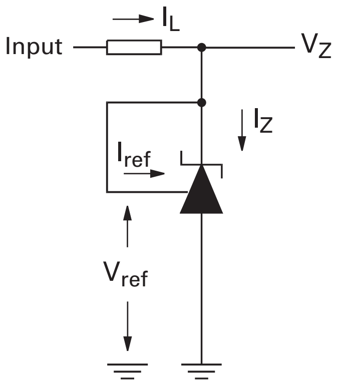


Fig 1 - Test circuit for $V_Z = V_{ref}$

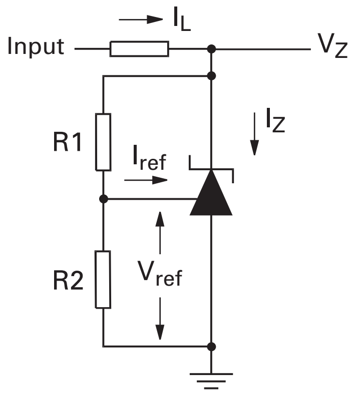


Fig 2 - Test circuit for $V_Z > V_{ref}$

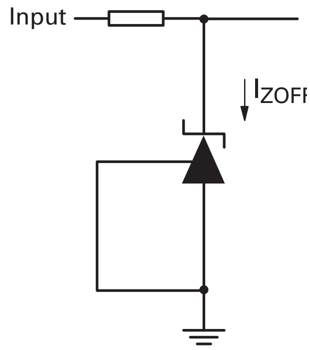
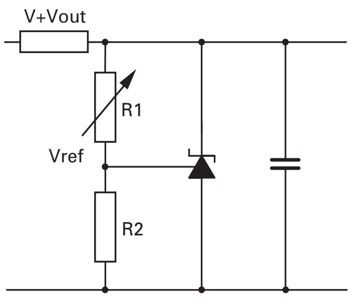


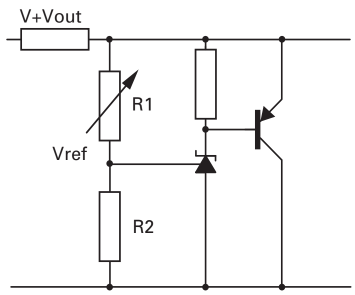
Fig 3 - Test circuit for for Of state current†

Application Circuits



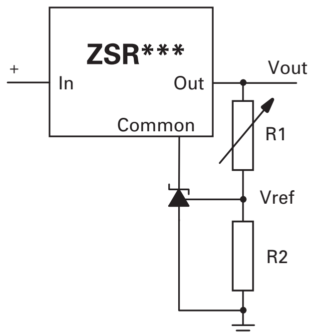
$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Shunt regulator



$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

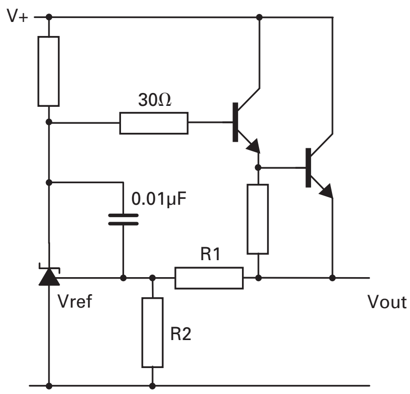
Higher current shunt regulator



$Vout_{MIN} = Vref + Vreg$

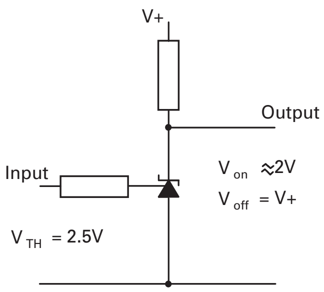
$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Output control of a three terminal fixed regulator

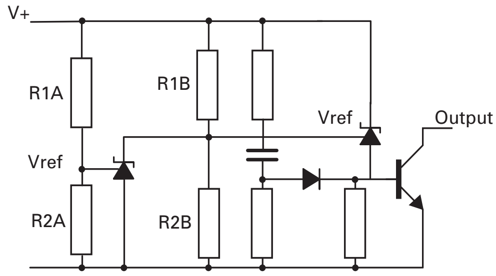


$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Series regulator



Single supply comparator with temperature compensated threshold

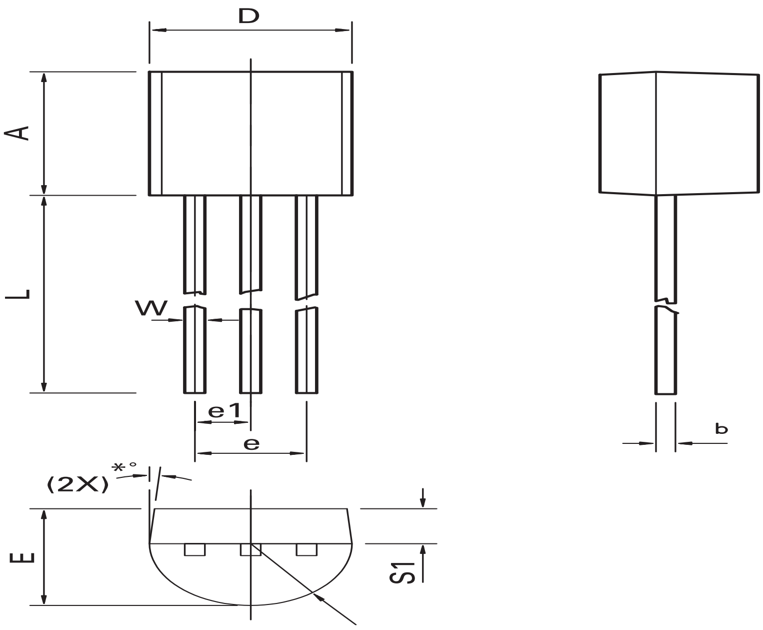


$$\text{Low limit} = \left(1 + \frac{R1B}{R2B}\right) Vref$$

$$\text{High limit} = \left(1 + \frac{R1A}{R2A}\right) Vref$$

Over voltage / under voltage protection circuit

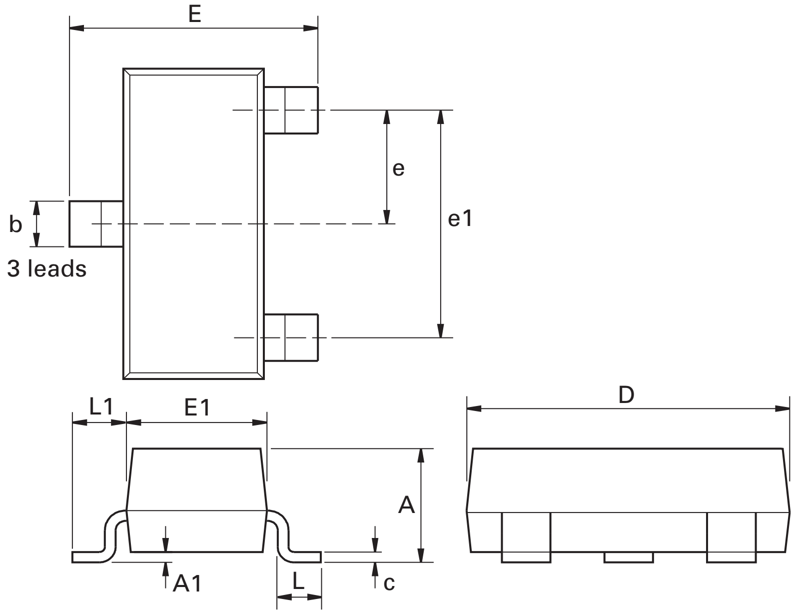
Package Outline - TO92



DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.32	4.95	0.170	0.195
b	0.36	0.51	0.014	0.020
E	3.30	3.94	0.130	0.155
e	2.41	2.67	0.095	0.105
e1	1.14	1.40	0.045	0.055
L	12.70	15.49	0.500	0.610
R	2.16	2.41	0.085	0.095
S1	1.14	1.52	0.045	0.060
W	0.41	0.56	0.016	0.022
D	4.45	4.95	0.175	0.195
*°	4°	6°	4°	6°

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

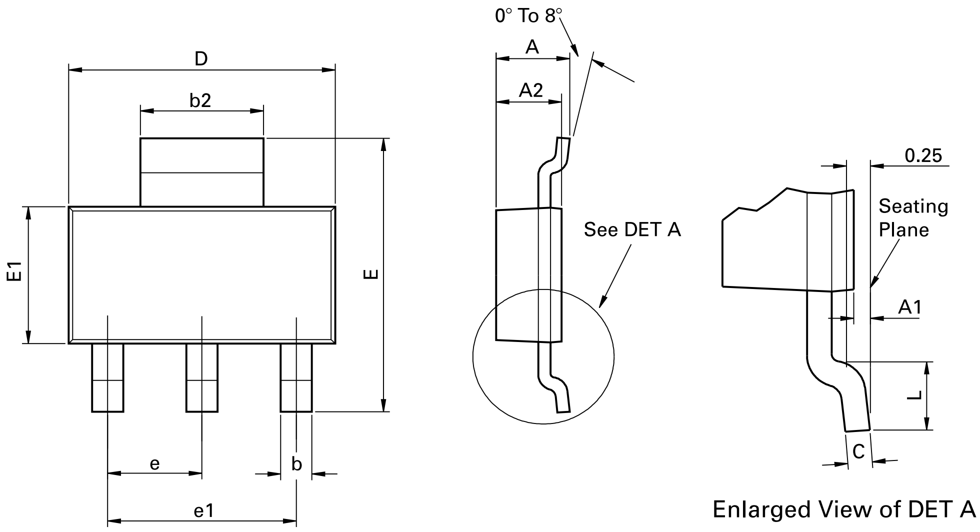
Package outline - SOT23



Dim.	Millimeters		Inches		Dim.	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	-	1.12	-	0.044	e1	1.90 NOM		0.075 NOM	
A1	0.01	0.10	0.0004	0.004	E	2.10	2.64	0.083	0.104
b	0.30	0.50	0.012	0.020	E1	1.20	1.40	0.047	0.055
c	0.085	0.20	0.003	0.008	L	0.25	0.60	0.0098	0.0236
D	2.80	3.04	0.110	0.120	L1	0.45	0.62	0.018	0.024
e	0.95	NOM	0.037	NOM	-	-	-	-	-

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

Package outline - SOT223



Enlarged View of DET A

Conforms to JEDEC TO-261 AA Issue B

Dim.	Millimeters		Inches		Dim.	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	-	1.80	-	0.071	D	6.30	6.70	0.248	0.264
A1	0.02	0.10	0.0008	0.004	e	2.30 BSC		0.0905 BSC	
A2	1.55	1.65	0.0610	0.0649	e1	4.60 BSC		0.181 BSC	
b	0.66	0.84	0.026	0.033	E	6.70	7.30	0.264	0.287
b2	2.90	3.10	0.114	0.122	E1	3.30	3.70	0.130	0.146
C	0.23	0.33	0.009	0.013	L	0.90	-	0.355	-

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

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