ZETEX SEMICONDUCTORS

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.

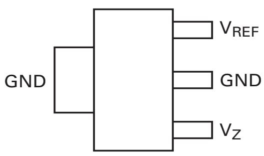
Features

- Surface mount SOT223 and SOT23 packages
- 2% and 1% tolerance
- Maximum temperature coefficient 67 ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- 50µA to 100mA current sink capability
- Low output noise
- Wide temperature range -55 to +125°C

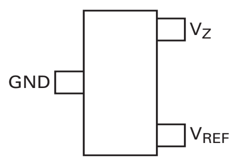
Applications

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

Pinout information



SOT223
Pinout - Top view

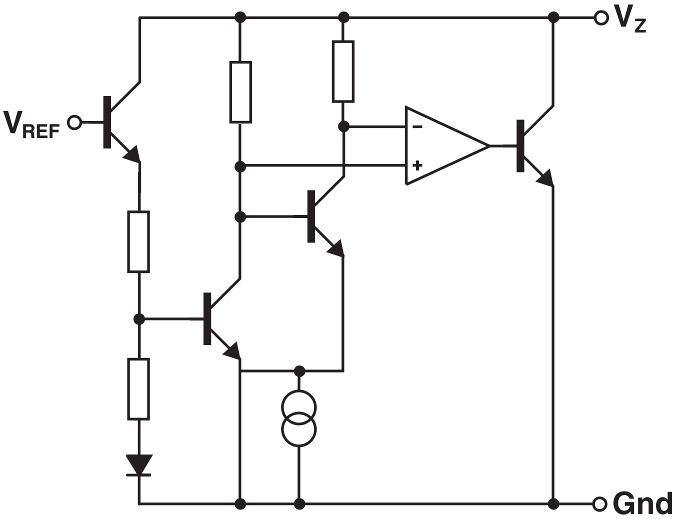


SOT23
Pinout - Top view

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	Released	7	3000	8mm
ZHT431F02TA	2	SOT23	43D	Released	7	3000	8mm
ZHT431G01TA	1	SOT223	ZHT43101	Released	7	1000	12mm
ZHT431G02TA	2	SOT223	ZHT43102	Released	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	TO92	780mW
		SOT223	2W

Recommended operating conditions

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

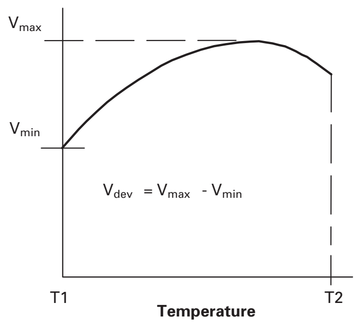
Electrical characteristics test conditions (unless otherwise stated):T_{amb}=25°C

Symbol	Parameter	Value			Units	Conditions
		Min.	Typ.	Max.		
V_{REF}	Reference voltage 2%	2.45	2.50	2.55	V	I_L=10mA (Fig.1),
	1%	2.475	2.50	2.525	V	V_Z=V_{REF}
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	μA	R1=10k, R2=O/C, I_L=10mA (Fig.2)
ΔI_{REF}	Deviation of reference input current over temperature		0.04	0.2	μA	R1=10k, R2=O/C, I_L=10mA T_{amb}=full range (Fig.2)
I_{Zmin}	Minimum cathode current for regulation		35	50	μA	V_Z=V_{REF} (Fig.1)
I_{Zoff}	Off-state current			0.1	μA	V_Z=20V, V_{REF}=0V(Fig.3)
R_Z	Dynamic output impedance			0.75	Ω	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:

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



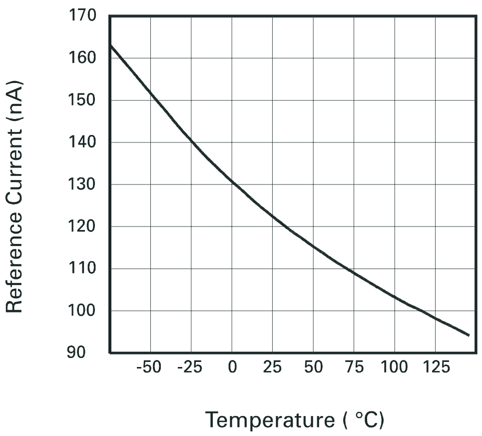
The dynamic output impedance, R_Z, is defined as:

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

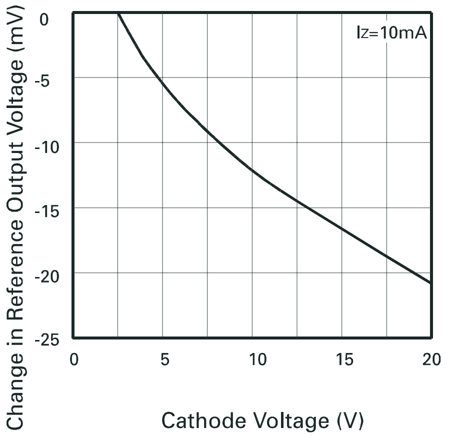
When the device is programmed with two externalresistors, R1 and R2, (fig 2) , the dynamic outputimpedance of the overall circuit, R', is defined as:

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

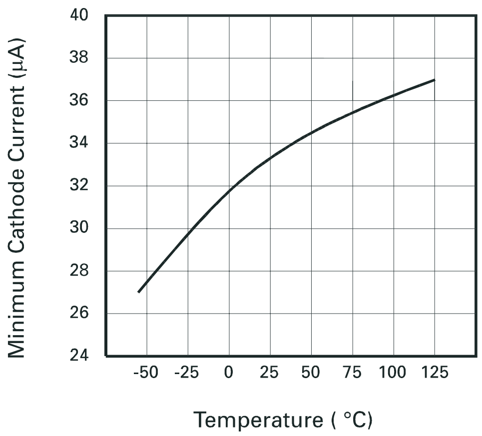
Typical characteristics



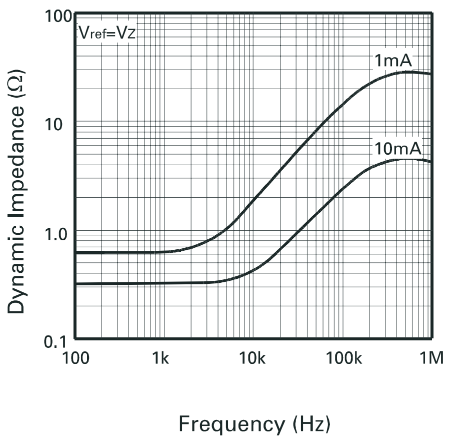
Iref vs. Temperature



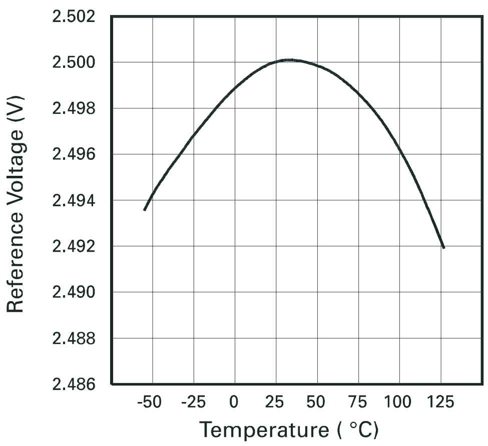
Change in Vref v Cathode Voltage



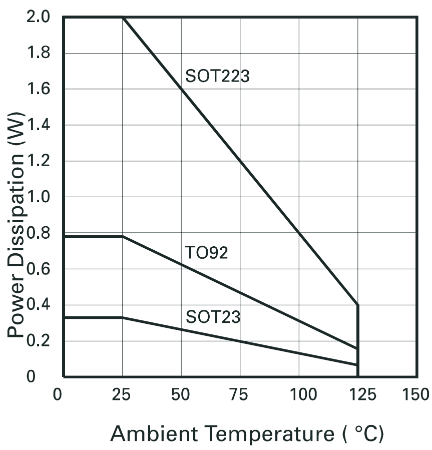
Izmin vs. Temperature



Dynamic Impedance v Frequency

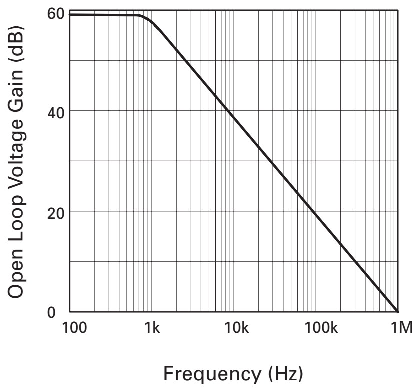


Vref vs. Temperature

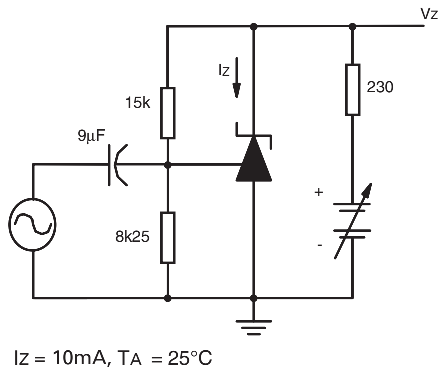


Power Dissipation Derating

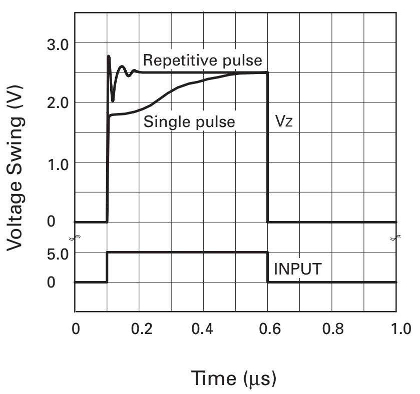
Typical characteristics



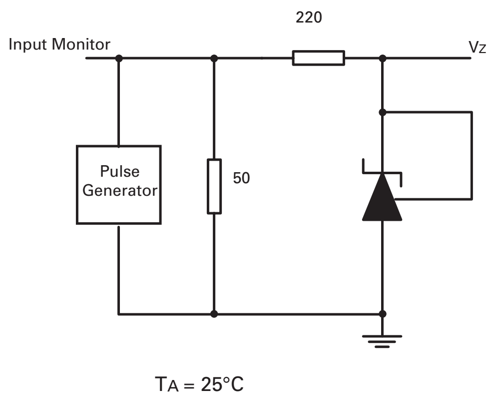
Gain v Frequency



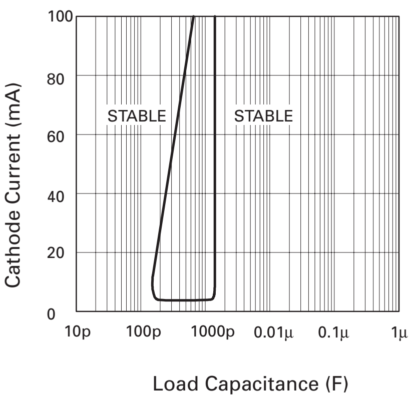
Test Circuit for Open Loop Voltage Gain



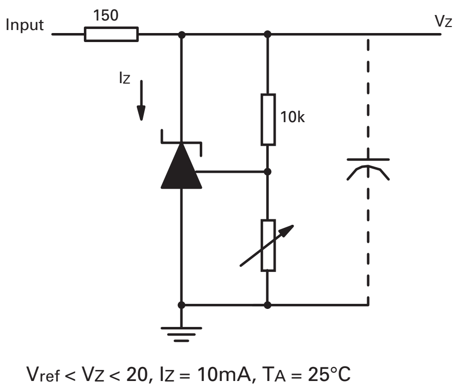
Pulse Response



Test Circuit for Pulse Response



Stability Boundary Conditions



Test Circuit for Stability Boundary Conditions

DC test circuits

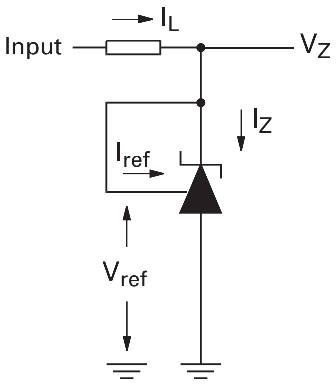


Fig 1 - Test circuit for $V_Z = V_{ref}$

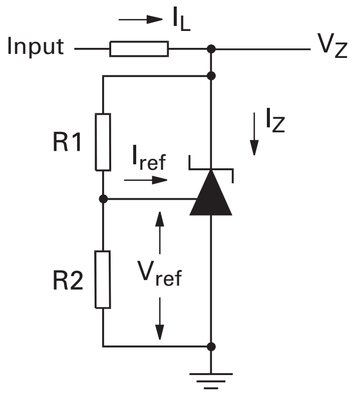


Fig 2 - Test circuit for $V_Z > V_{ref}$

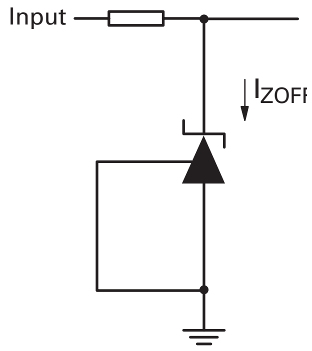
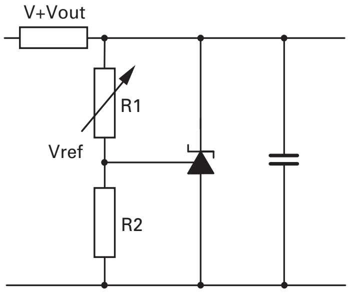


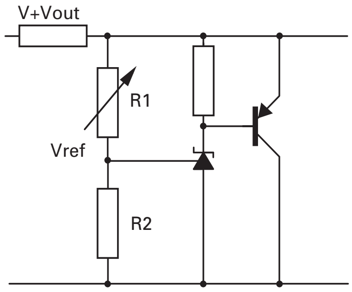
Fig 3 - Test circuit for for Of state current†

Application circuits



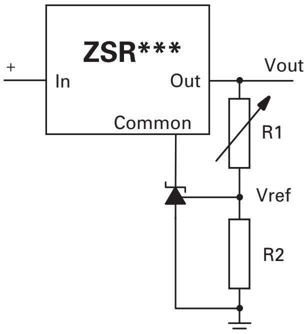
$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Shunt regulator



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

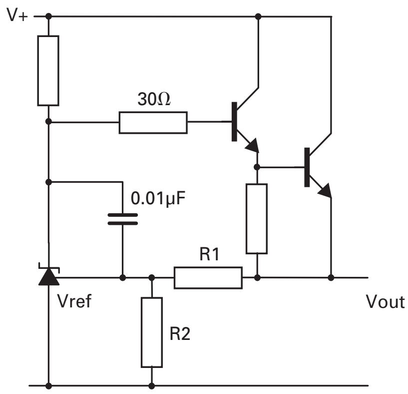
Higher current shunt regulator



$$Vout_{MIN} = Vref + Vreg$$

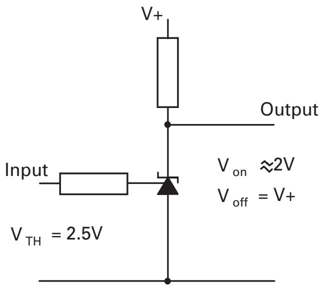
$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Output control of a three terminal fixed regulator

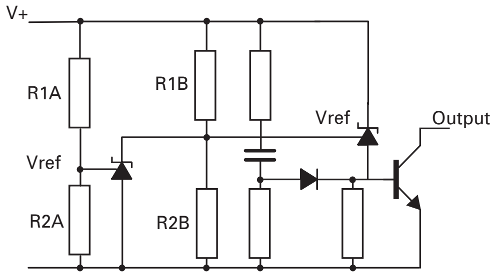


$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Series regulator



Single supply comparator with temperature compensated threshold

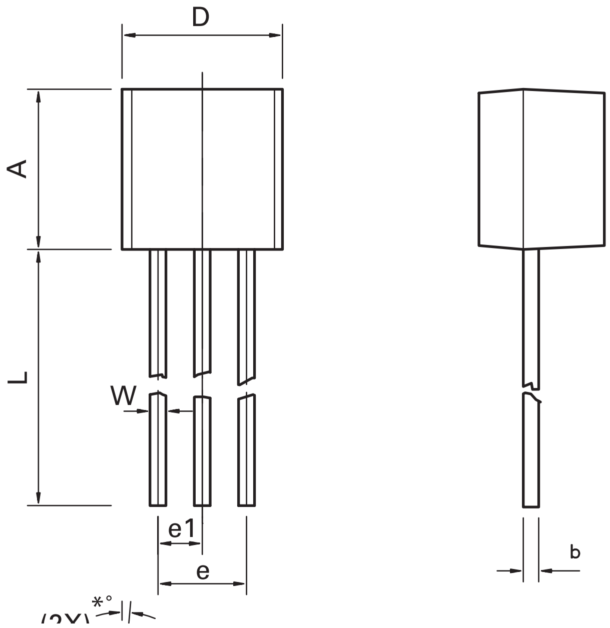


$$\text{Low limit} = \left(1 + \frac{R1B}{R2B}\right) Vref$$

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

Over voltage / under voltage protection circuit

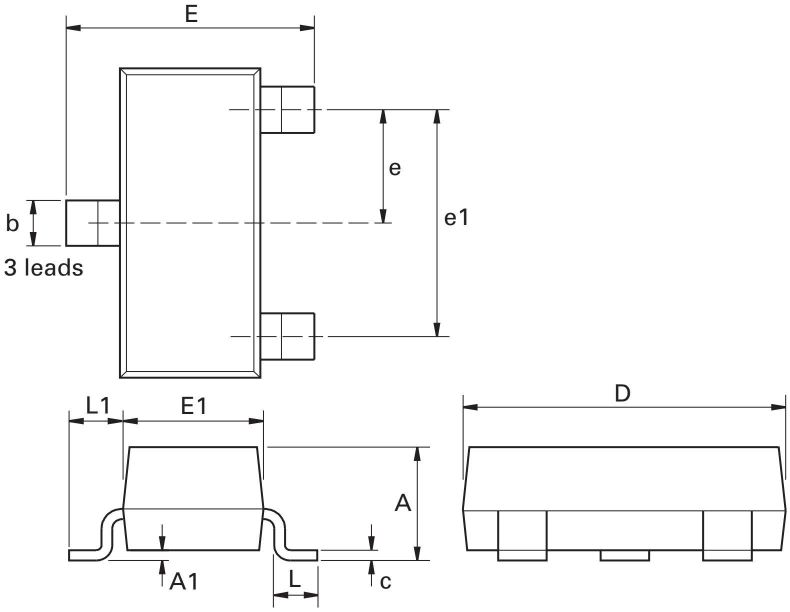
Package outline - TO92



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

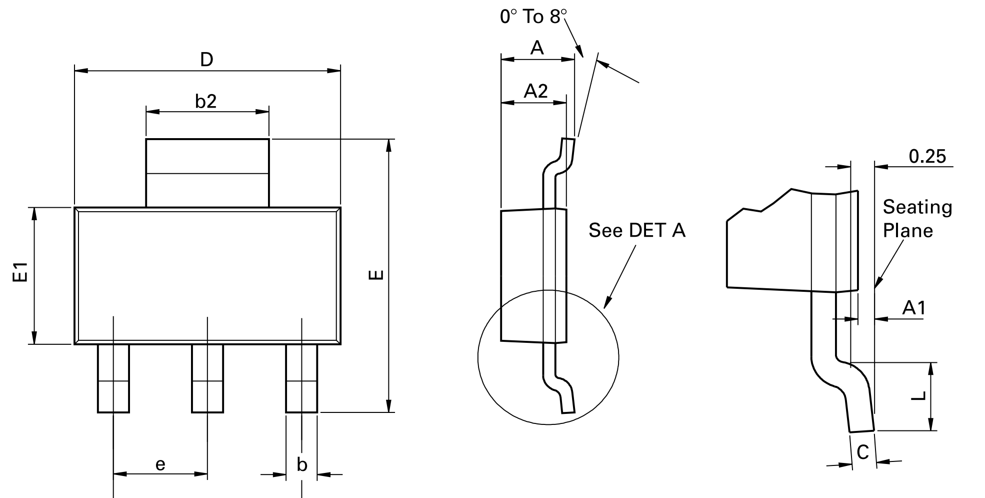
Package outline - SOT23



Dim.	Millimeters		Inches		Dim.	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Max.	Max.
A	2.67	3.05	0.105	0.120	H	0.33	0.51	0.013	0.020
B	1.20	1.40	0.047	0.055	K	0.01	0.10	0.0004	0.004
C	-	1.10	-	0.043	L	2.10	2.50	0.083	0.0985
D	0.37	0.53	0.015	0.021	M	0.45	0.64	0.018	0.025
F	0.085	0.15	0.0034	0.0059	N	0.95 NOM		0.0375 NOM	
G	1.90 NOM		0.075 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	e	2.30 BSC		0.0905 BSC	
A1	0.02	0.10	0.0008	0.004	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	-
D	6.30	6.70	0.248	0.264	-	-	-	-	-

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

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or

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"Active"	Product status recommended for new designs
"Last time buy (LTB)"	Device will be discontinued and last time buy period and delivery is in effect
"Not recommended for new designs"	Device is still in production to support existing designs and production
"Obsolete"	Production has been discontinued

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Zetex sales offices

Europe	Americas	Asia Pacific	Corporate Headquarters
Zetex GmbH Kustermann-park Balanstraße 59 D-81541 München Germany Telefon: (49) 89 45 49 49 0 Fax: (49) 89 45 49 49 49 europe.sales@zetex.com	Zetex Inc 700 Veterans Memorial Highway Hauppauge, NY 11788 USA Telephone: (1) 631 360 2222 Fax: (1) 631 360 8222 usa.sales@zetex.com	Zetex (Asia Ltd) 3701-04 Metroplaza Tower 1 Hing Fong Road, Kwai Fong Hong Kong Telephone: (852) 26100 611 Fax: (852) 24250 494 asia.sales@zetex.com	Zetex Semiconductors plc Zetex Technology Park, Chadderton Oldham, OL9 9LL United Kingdom Telephone: (44) 161 622 4444 Fax: (44) 161 622 4446 hq@zetex.com