ZHT431
ADJUSTABLE PRECISION ZENER SHUNT REGULATOR

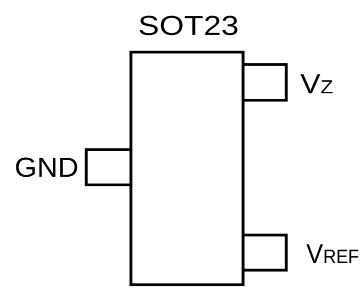
Description

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.

Pin Assignments



(Top View)

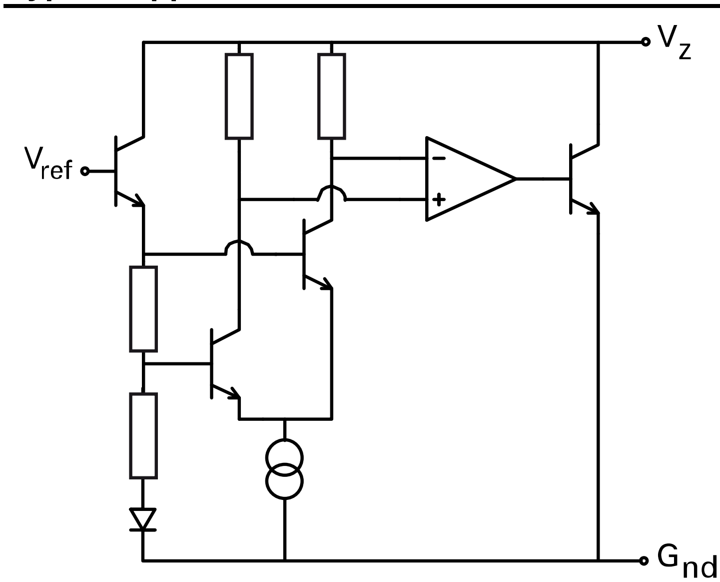
Features

- Surface mount SOT23 package
- 0.5%, 1% and 2% tolerance
- Maximum temperature coefficient 67ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- 50µA to 100mA current sink capability
- Low output noise
- Available in "Green" Molding Compound (**See page 7**)
- Wide temperature range -55 to +125°C

Applications

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

Typical Application Circuit



Absolute Maximum Ratings (Voltages to GND Unless Otherwise Stated)

Parameter	Rating	Unit
Cathode Voltage (V_Z)	20	V
Cathode Current	150	mA
Operating Temperature	-55 to 125	°C
Storage Temperature	-55 to 150	°C
Power Dissipation (T_{amb} = 25°C, T_{JMAX} = 150°C)	330	mW

Recommended Operating Conditions

Parameter	Min	Max	Units
Cathode Voltage V_{REF}	-	20	V
Cathode Current	0.05	100	mA

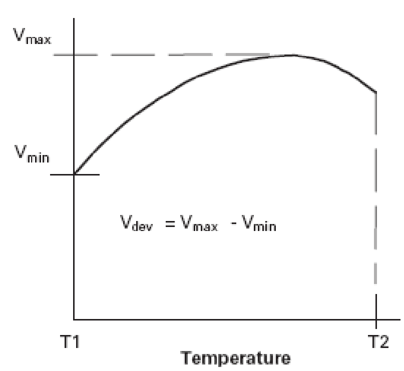
Electrical Characteristics (Test conditions unless otherwise specified: T_{amb} = 25°C)

Symbol	Parameter	Values			Units	Conditions
		Min.	Typ.	Max.		
V_{REF}	Reference Voltage 2% 1% 0.5%	2.45 2.475 2.4875	2.50 2.50 2.50	2.55 2.525 2.5125	V	I_L=10mA (Fig.1), 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.	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	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:

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



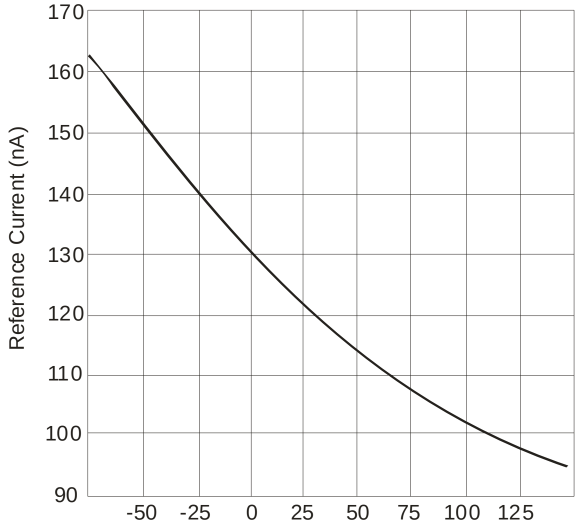
The dynamic output impedance, R_Z, is defined as:

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

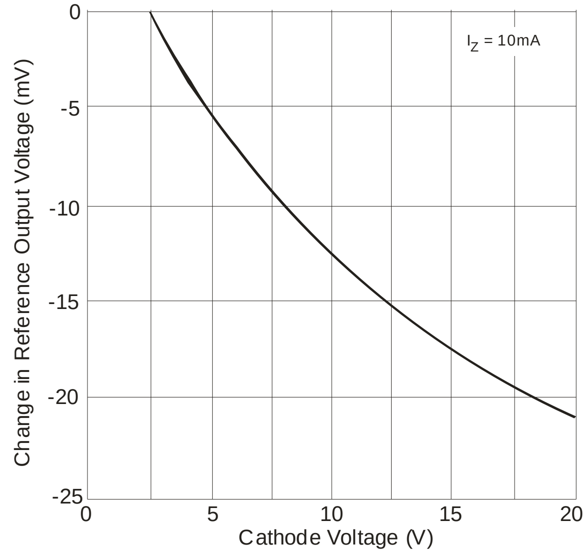
When the device is programmed with two external resistors, R1 and R2, (fig 2) , the dynamic output impedance of the overall circuit, R', is defined as:

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

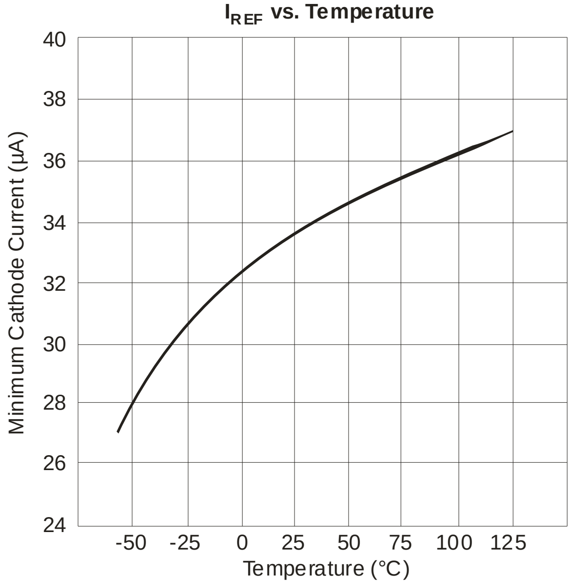
Typical Operating Conditions



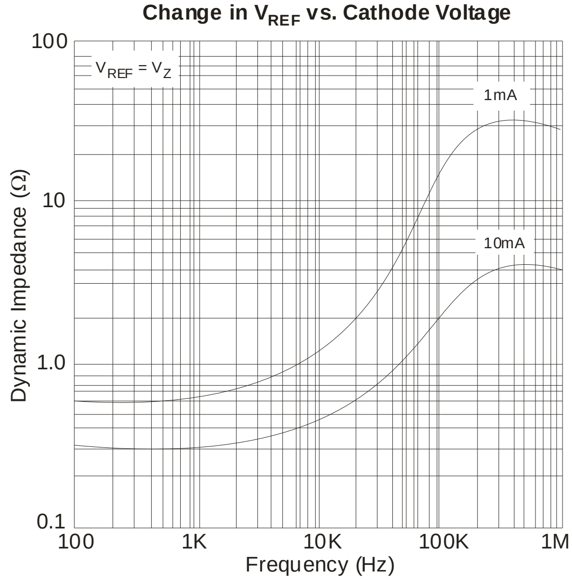
I_{REF} vs. Temperature



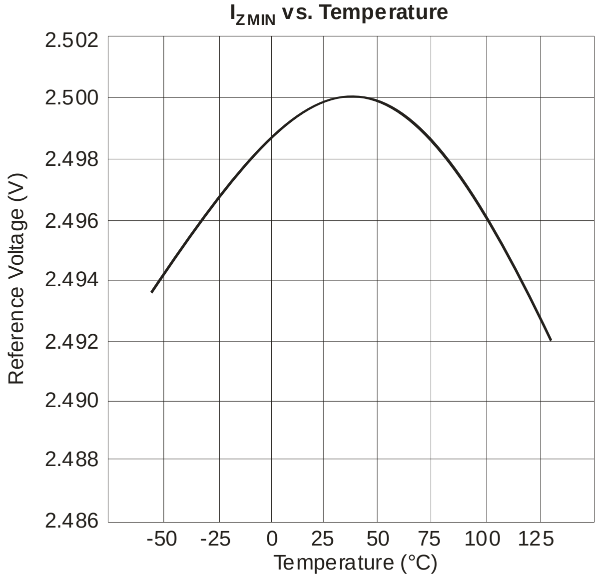
Change in V_{REF} vs. Cathode Voltage



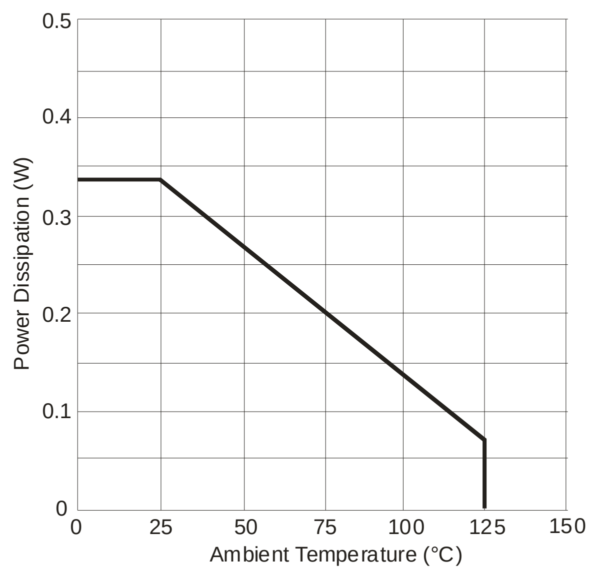
I_{ZMIN} vs. Temperature



Dynamic Impedance vs. Frequency

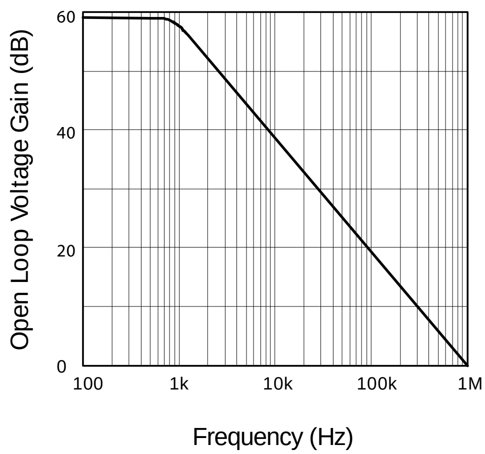


V_{REF} vs. Temperature

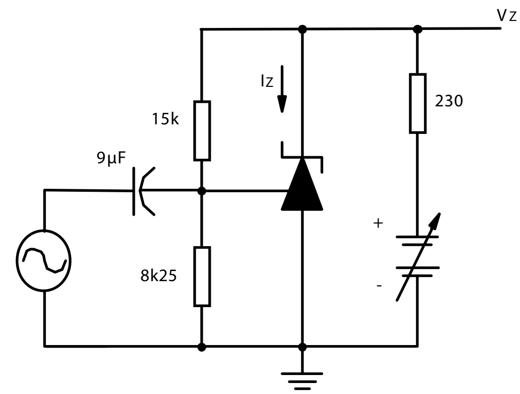


Power Dissipation Derating

Typical Operating Conditions (Cont.)

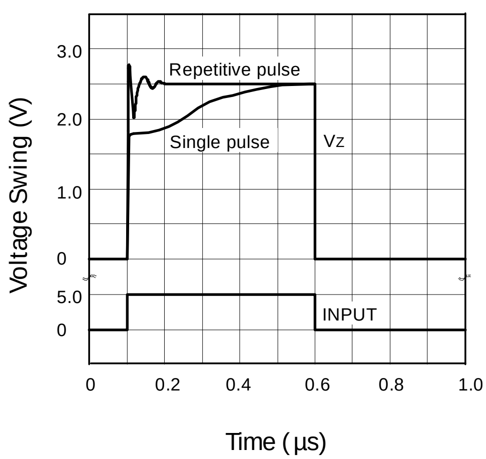


Gain v Frequency

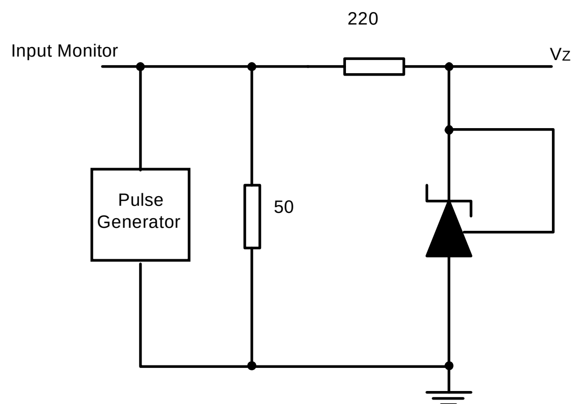


I_Z = 10mA, T_A = 25°C

Test Circuit for Open Loop Voltage Gain

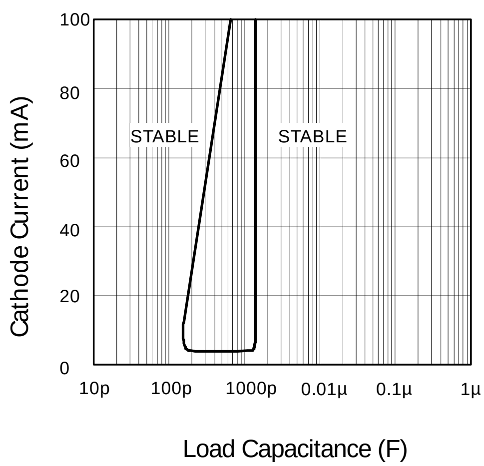


Pulse Response

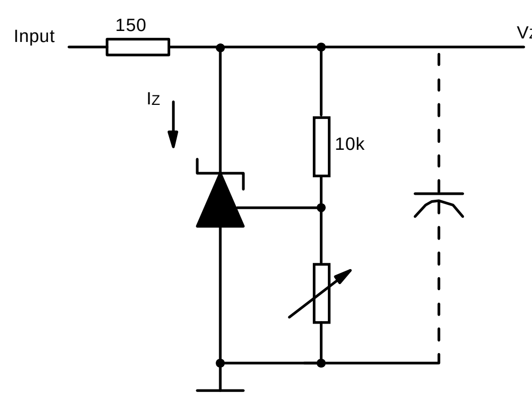


T_A = 25°C

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

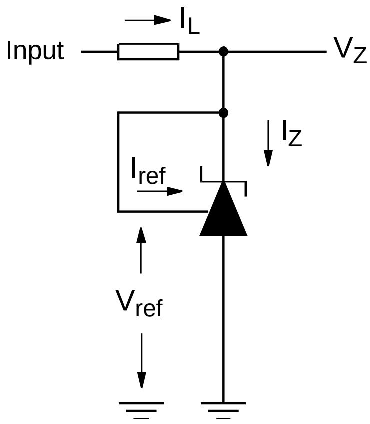


Fig 1 - Test circuit for $V_Z = V_{ref}$

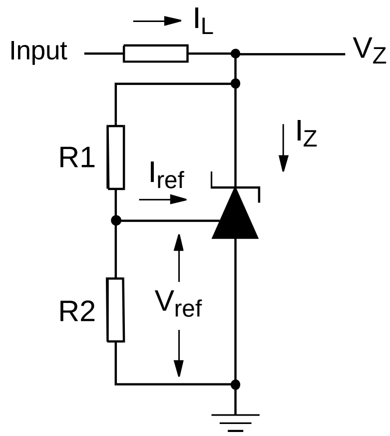


Fig 2 - Test circuit for $V_Z > V_{ref}$

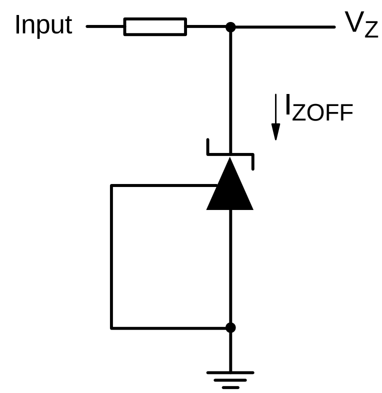
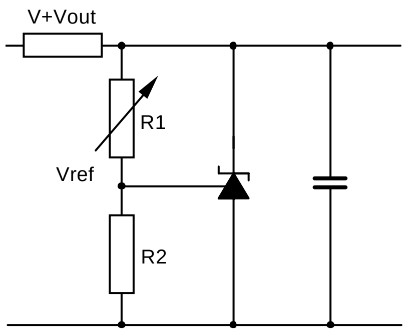


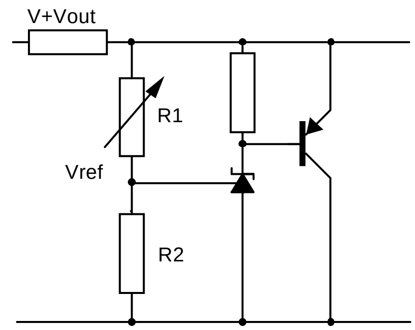
Fig 3 - Test circuit for Off state current†

Application Circuits



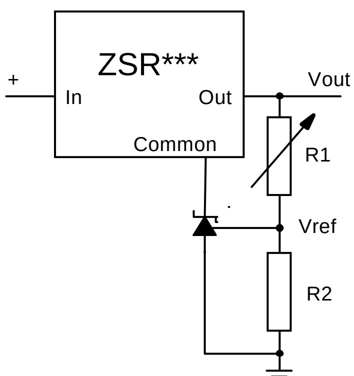
$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Shunt regulator



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

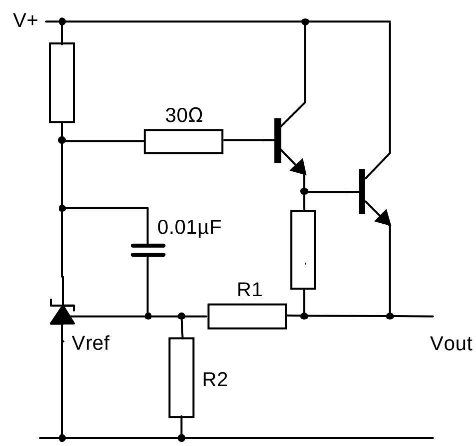
Higher current shunt regulator



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

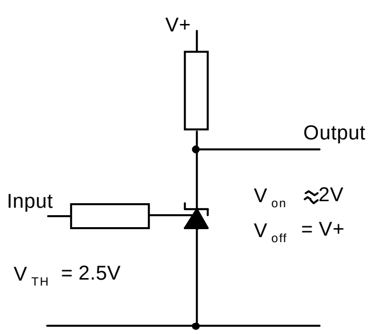
$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

Output control of a
three terminal fixed regulator

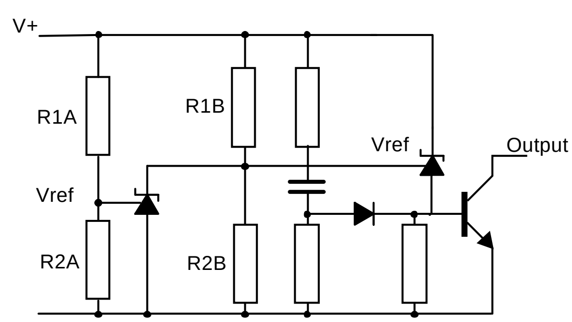


$$Vout = \left(1 + \frac{R1}{R2}\right) Vref$$

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

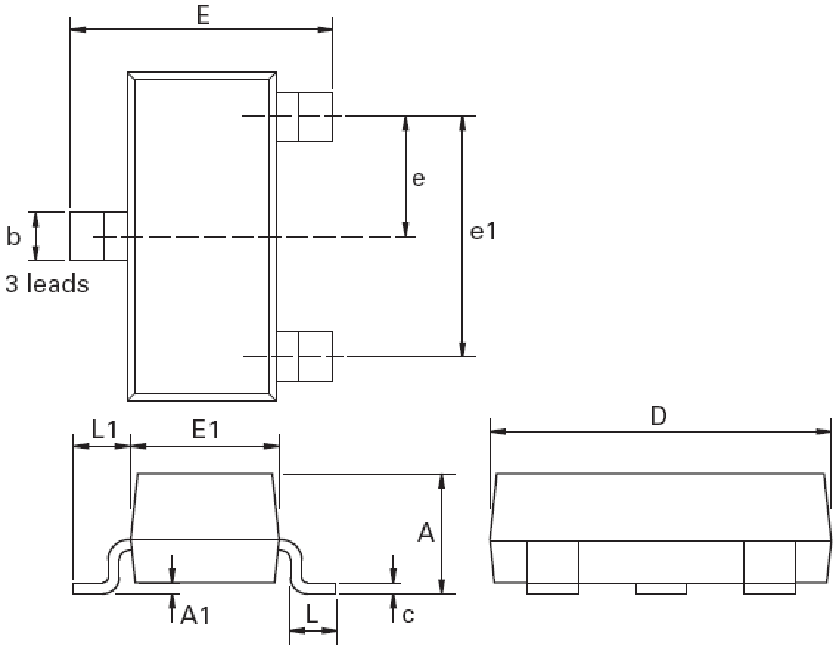
Ordering Information

Ordering Reference	Tolerance (%)	Package	Part Mark	Status	Reel Size (inches)	Quantity per reel	Tape Width
ZHT431F01TA [1]	1	SOT23	43C	Active	7	3000	8mm
ZHT431F01-7 [2]	1	SOT23	43C	Active	7	3000	8mm
ZHT431FMTA [1]	0.5	SOT23	43P	Active	7	3000	8mm
ZHT431F02TA [1]	2	SOT23	43D	Active	7	3000	8mm

Notes: 1. A ‘Green’ molding compound is used from date code 1010. For further details, refer to http://www.diodes.com/quality/lead_free.html
2. All date codes of the ‘-7’ option use ‘Green’ molding compound.

Package Outline Dimensions

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

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