Lead-free Green

Description

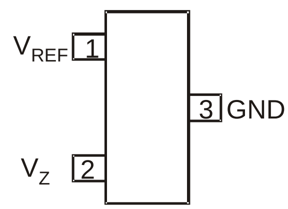
The ZR431L is a three terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 25mA. The output voltage may be set to any chosen voltage between 1.24 and 10 volts by selection of two external divider resistors.

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

The ZR431L is particularly used in the feedback control loop of switch mode power supplies. In this application the device 1.24 volt reference enables the generation of low voltage supplies, typically 3.3 volts or 3 volts.

Pin Assignments

(Top View)



SOT23

Features

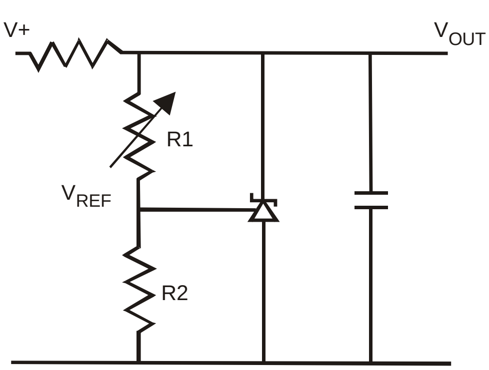
- 2.5% and 1% Tolerance
- Max. Temperature Coefficient 50ppm/°C
- Temperature Compensated for Operation over The Full Temperature Range
- Programmable Output Voltage
- 100µA to 100mA Current Sink Capability
- Surface Mount SOT23 Package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- Shunt Regulator
- Series Regulator
- Voltage Monitor
- Over Voltage/ Under Voltage Protection
- Switch Mode Power Supplies

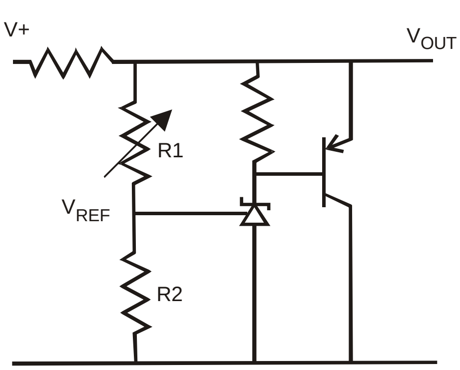
Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit



$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

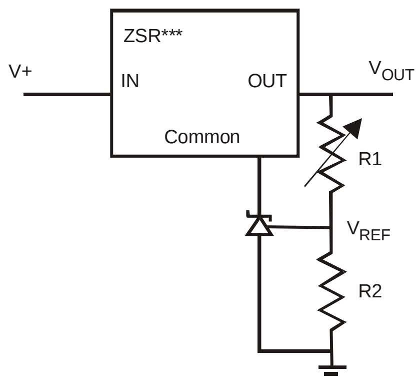
SHUNT REGULATOR



$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

HIGHER CURRENT SHUNT REGULATOR

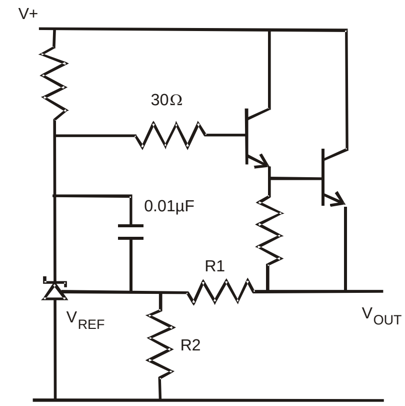
Typical Applications Circuit (cont.)



$V_{OUT(MIN)} = V_{REF} + V_{REG}$

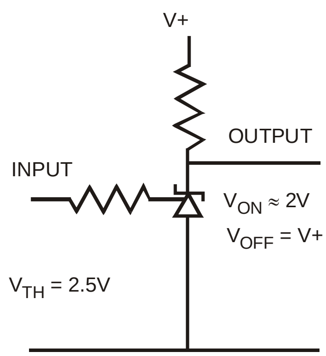
$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

OUTPUT CONTROL OF A THREE TERMINAL FIXED REGULATOR

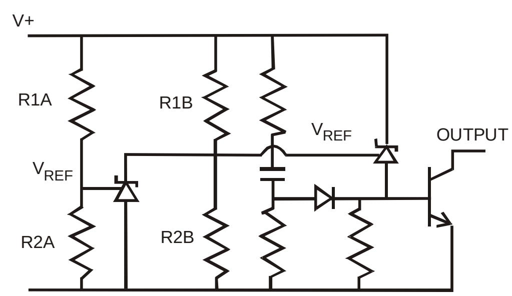


$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

SERIES REGULATOR



SINGLE SUPPLY COMPARATOR WITH TEMPERATURE COMPENSATED THRESHOLD

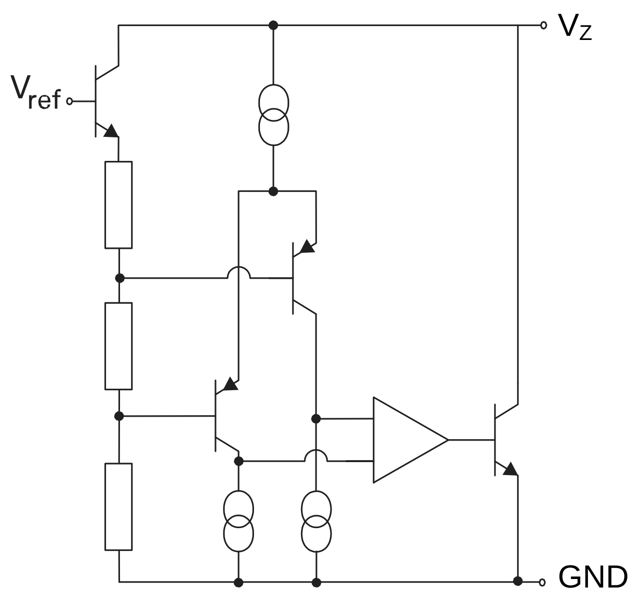


$$\text{Low limit} + \left(1 + \frac{R1B}{R2B}\right) V_{REF}$$

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

OVER VOLTAGE/UNDER VOLTAGE PROTECTION CIRCUIT

Functional Block Diagram



Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.) (Note 4)

Symbol	Parameter		Rating	Unit
V_Z	Cathode Voltage		10	V
I_Z	Cathode Current		50	mA
T_J	Junction Temperature		-40 to +125	°C
T_{STG}	Storage Temperature		-55 to +105	°C
θ_{JA}	Thermal Resistance	SOT23	380	°C/W

Note 4: Stresses beyond 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 conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_Z	Cathode Voltage	V_{REF}	10	V
I_Z	Cathode Current	0.1	25	mA
T_A	Operating Temperature	-40	+85	°C

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter		Test Conditions	Min	Typ.	Max	Unit
V_{REF}	Reference Voltage	2.5%	I_L = 10mA (Figure 1), $V_Z = V_{REF}$	1.209	1.24	1.271	V
		1%		1.228	1.24	1.252	
V_{DEV}	Deviation of Reference Input Voltage Over Temperature		I_L = 10mA, $V_Z = V_{REF}$ T_A = Full range (Figure 1)	–	4	8	mV
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of The Change in Reference Voltage to The Change in Cathode Voltage		V_Z from V_{REF} to 10V I_Z = 10mA (Figure 2)	–	0.5	2	mV/V
I_{REF}	Reference Input Current		R1 = 10k, R2 = O/C, I_L = 10mA (Figure 2)	0.02	0.11	0.4	µA
ΔI_{REF}	Deviation of Reference Input Current over Temperature		R1 = 10k, R2 = O/C, I_L = 10mA T_A = Full range (Figure 2)	–	0.02	0.2	µA
$I_{Z(MIN)}$	Minimum Cathode Current for Regulation		$V_Z = V_{REF}$ (Figure 1)	–	30	100	µA
$I_{Z(OFF)}$	Off-state Current		V_Z = 10V, V_{REF} = 0V (Figure 3)	–	10	30	µA
R_Z	Dynamic Output Impedance		$V_Z = V_{REF}$ (Figure 1), f = 0Hz	–	0.25	2	Ω

For definitions of reference voltage temperature coefficient and dynamic output impedance see NOTES following DC TEST CIRCUITS.

DC Test Circuits

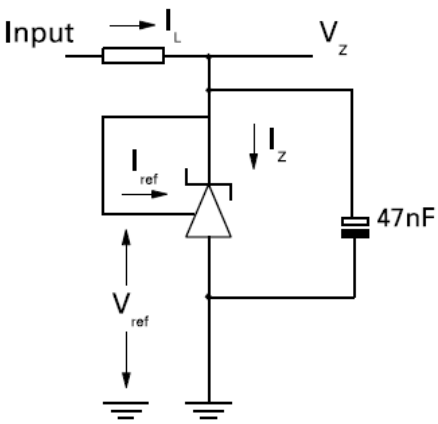


Figure 1. Test Circuit for $V_Z = V_{REF}$

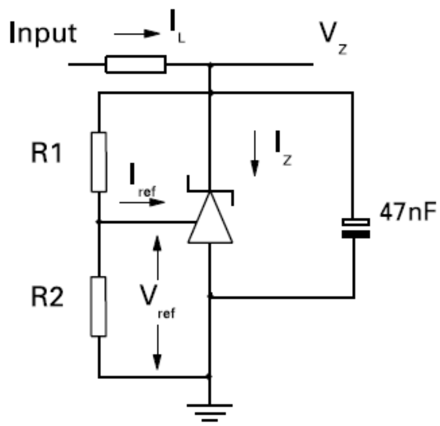


Figure 2. Test Circuit for $V_Z > V_{REF}$

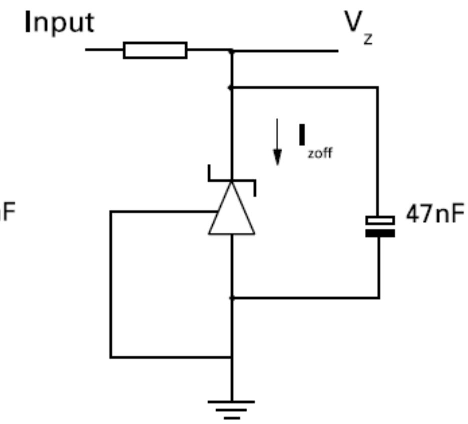
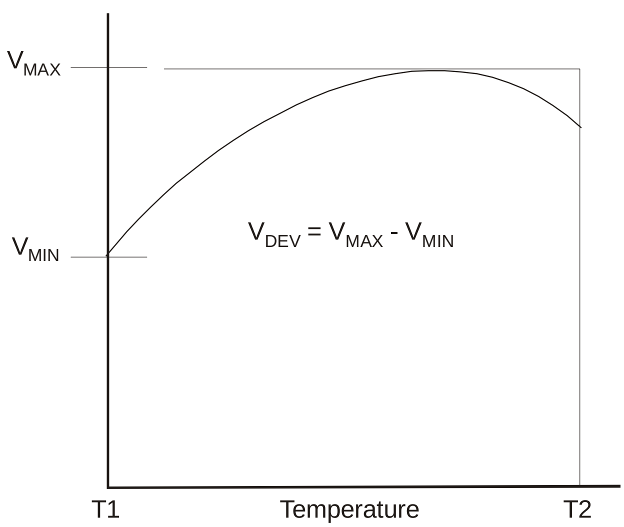


Figure 3. Test Circuit for Off State Current

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:



$$V_{ref}(ppm/^{o}C) = \frac{V_{dev} \times 1000000}{V_{ref}(T1 - T2)}$$

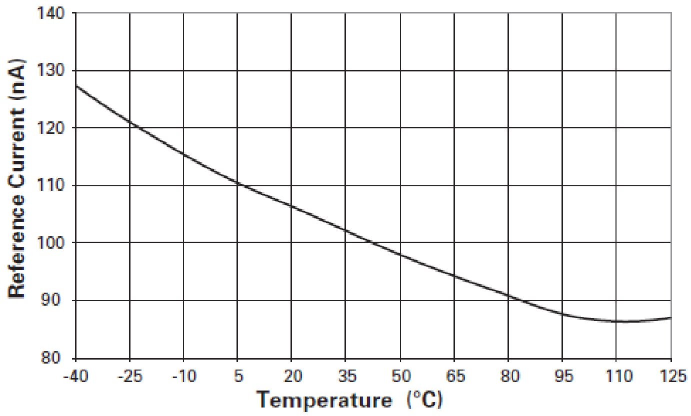
The dynamic output impedance, R_Z is defined as:

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

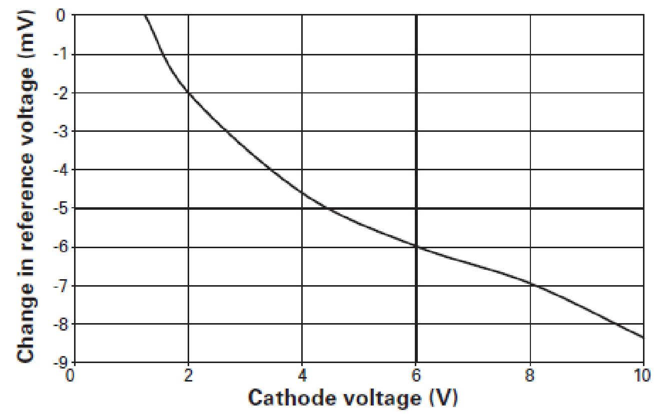
When the device is programmed with two external resistors, R1 and R2 (Figure 2), the dynamic output impedance of the overall circuit, R', is defined as:

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

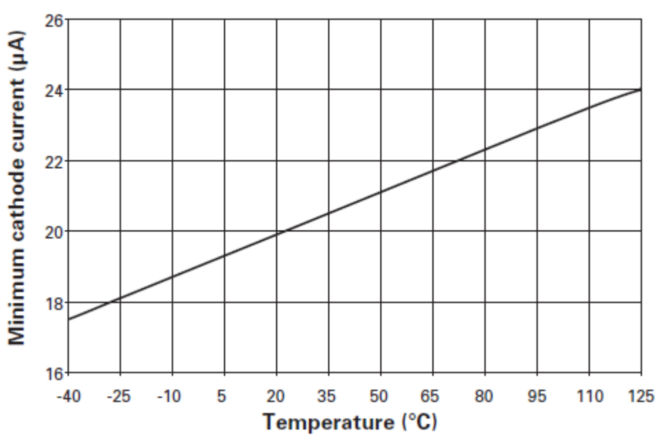
Performance Characteristics



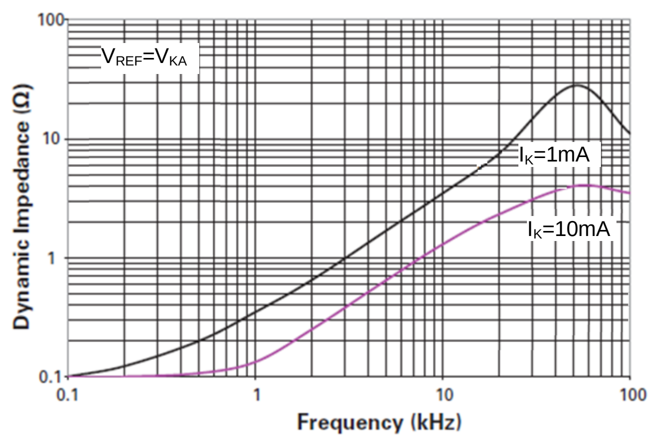
Reference Current v Temperature



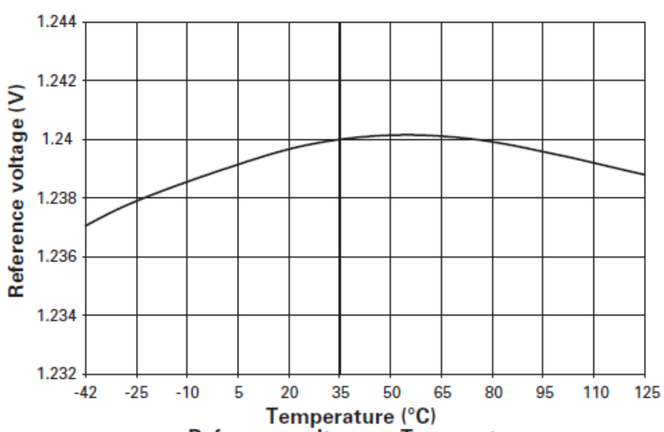
Change in reference voltage vs Cathode voltage



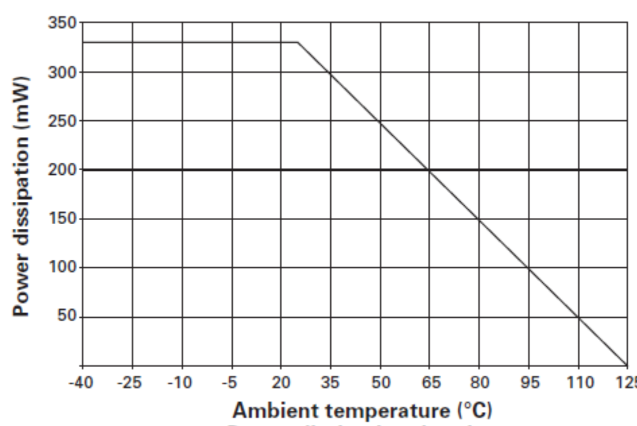
Minimum cathode current vs temperature



Dynamic impedance vs frequency

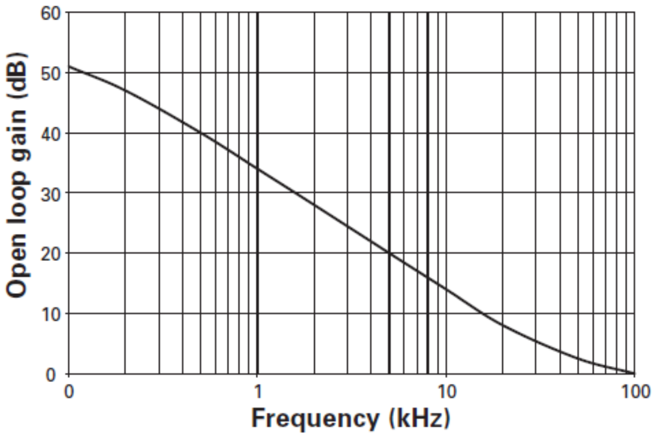


Reference voltage vs Temperature

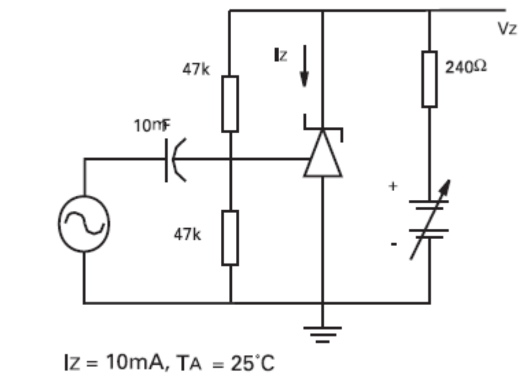


Power dissipation derating

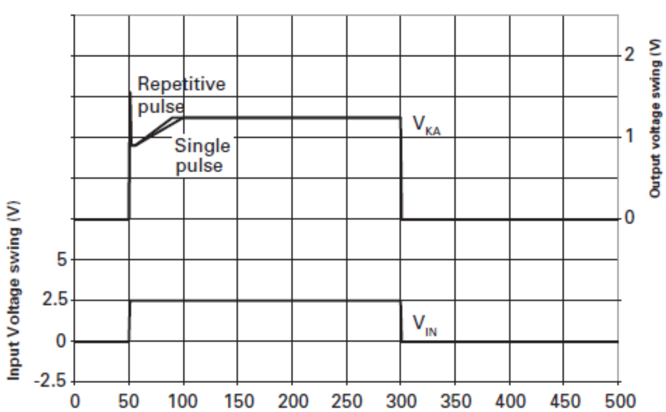
Performance Characteristics (cont.)



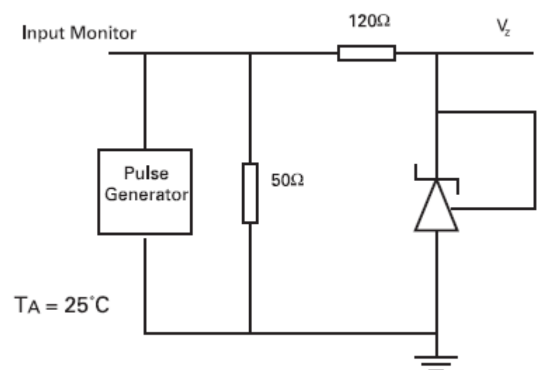
Open loop gain vs frequency



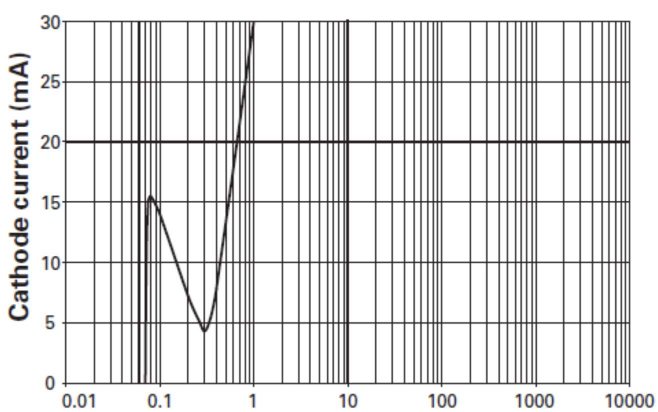
Test Circuit for Open Loop Voltage Gain



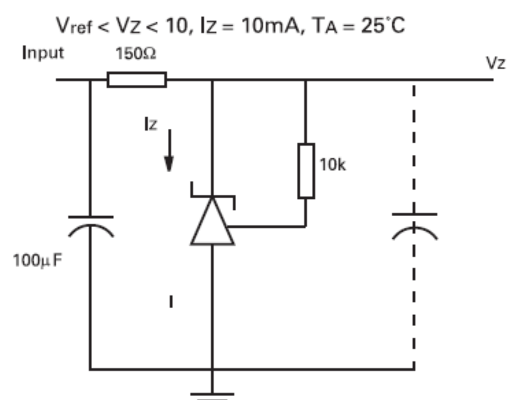
Pulse response



Test Circuit for Pulse Response

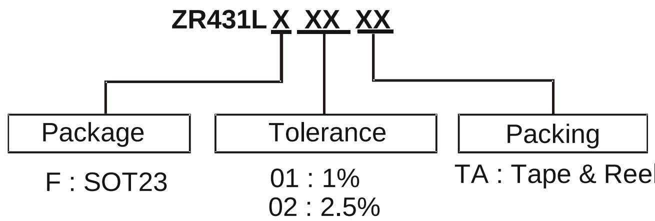


Stability boundary conditions



Test Circuit for Stability Boundary Conditions

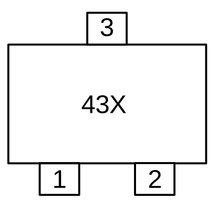
Ordering Information



Part Number	Tolerance	Package Code	Part Mark	Packaging	7" Tape and Reel	
					Quantity	Part Number Suffix
ZR431LF01TA	1%	F	43M	SOT23	3000/Tape & Reel	TA
ZR431LF02TA	2.5%	F	43L	SOT23	3000/Tape & Reel	TA

Marking Information

(Top View)

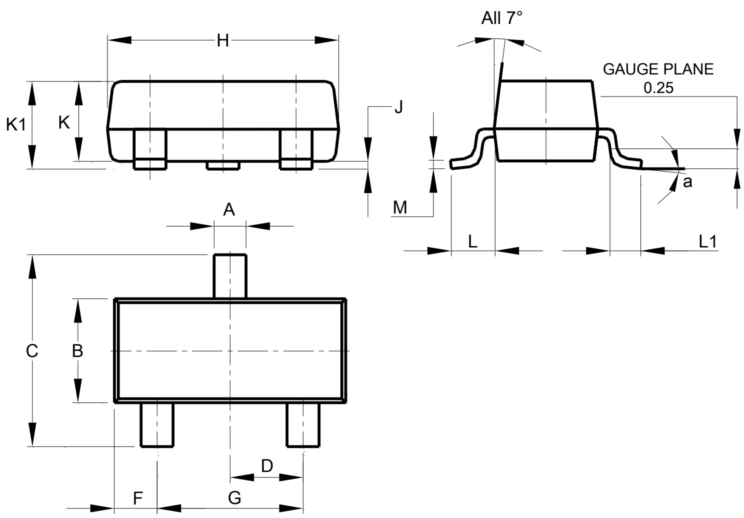


43: Identification Code
X: Voltage Tolerance
M : 1%
L : 2.5%

Package Outline Dimensions

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

(1) Package Type: SOT23



SOT23			
Dim	**Min**	**Max**	**Typ**
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	8°		
All Dimensions in mm			

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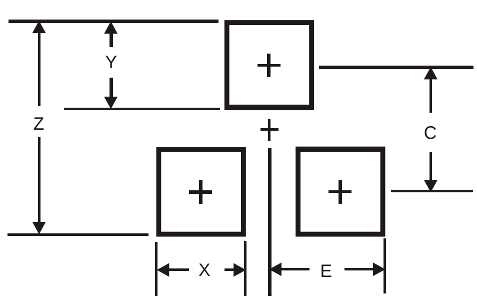
Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

(1) Package Type: SOT23



Dimensions	Value (in mm)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

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