ZR431
Adjustable precision shunt regulator

Description

The ZR431 is a three terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 100mA. 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.

The ZR431 is available with halogen free SOT23 packaging which is denoted by the '-7 suffix'

Features

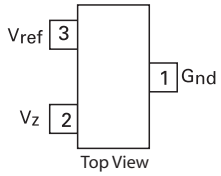
- 50μA to 100mA current sink capability
- Max. temperature coefficient 55 ppm/°C
- 2%, 1 % and 0.5% tolerance
- Surface mount SOT223 and SOT23 packages
- Low output noise
- Programmable output voltage

Applications

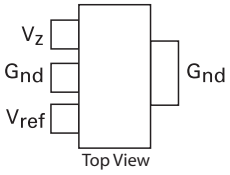
- Shunt regulator
- Series regulator
- Voltage monitor
- Over voltage / under voltage protection
- Switch mode power supplies

Connection Diagrams

SOT23 Package Suffix -F



SOT223 Package Suffix -G



Ordering information

Part No	Tol (%)	Package	Mark	Reel Size (inches)	Tape Width (mm)	Quantity per reel
ZR431F005-7 (*)	0.5	SOT23	43R	7	8	3000
ZR431F005TA	0.5	SOT23	43R	7	8	3000
ZR431F01-7(*)	1	SOT23	43B	7	8	3000
ZR431F01TA	1	SOT23	43B	7	8	3000
ZR431F-7(*)	2	SOT23	ZR43101	7	8	3000
ZR431FTA	2	SOT23	43A	7	8	3000
ZR431GTA	2	SOT223	ZR431	7	12	1000

NOTES:
(*) -7 denotes "green" product
(**) For obsolete variants, see table on page 8

Absolute maximum rating

Cathode voltage (V_z)	20V
Cathode current	150mA
Operating temperature	-40 to 85°C
Storage temperature	-55 to 125°C

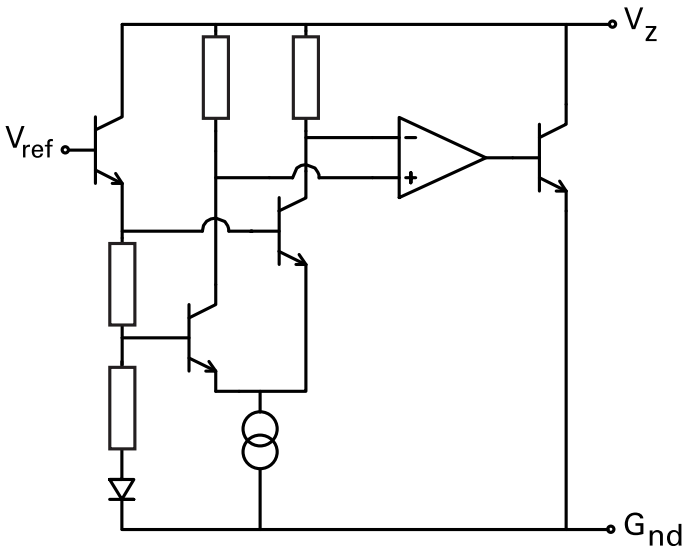
Power Dissipation

Package	P_{DIS} **T_{amb} =25°C** T_{jmax}=150°C
SOT23	330mW
SOT223	2W

Recommended operating conditions

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

Schematic diagram



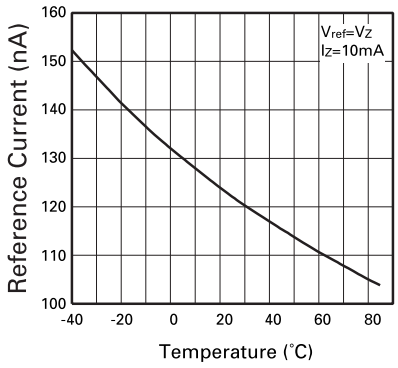
Electrical characteristics test conditions(unless otherwise stated) Tamb=25ºC

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_{REF}	Reference voltage	I_L=10mA (fig1), V_z=V_{ref}	2%	2.45	2.5	2.55	V
			1%	2.475	2.5	2.525	
			0.5% (*)	2.487	2.5	2.513	
V_{dev}	Deviation of reference input voltage over temperature	I_L=10mA (fig1), V_z=V_{ref} Ta=full range (Fig1)			8.0	17.0	mV
$\frac{\Delta V_{ref}}{\Delta V_z}$	Ratio of change in reference voltage to the change in cathode voltage	V_z from V_{REF} to 10V, I_Z= 10mA (Fig 2)			-1.85	-2.7	mV/V
		VZ from 10V to 20V I_Z=10mA (Fig2)			-1.0	-2.0	
I_{REF}	Reference input current	I_L= 10mA, R_1 = 10kΩ., R_2 = OC			0.12	1.0	µA
$I_{REF(dev)}$	I_{REF} deviation of reference input current over temp	I_L = 10mA, R_1 = 10kΩ, R_2 = OC	Ta = full temp range (fig2)				µA
					0.04	0.2	
I_{ZMIN}	Minimum cathode current for regulation	V_Z = V_{ref}	T_A = -40 to 125°C		35	50	µA
$I_{z(OFF)}$	Off-state current	V_{KA} = 20V, V_{REF} =0V (Fig 3)				0.1	µA
R_Z	Dynamic output impedance	V_Z = V_{ref}, f = 0Hz,				0.75	Ω

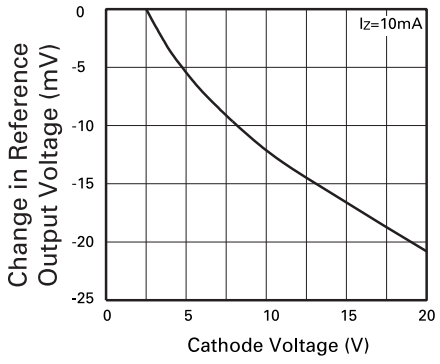
NOTES:
(*) SOT23 Only

For definitions of reference voltage temperature coefficient and dynamic output impedance see notes following DC test circuits

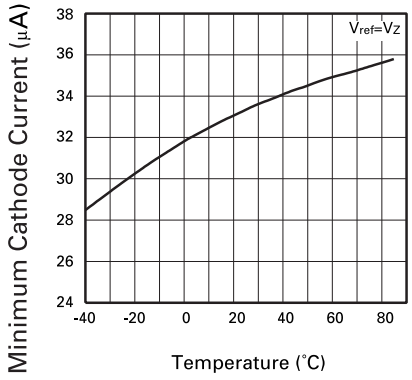
Typical characteristics



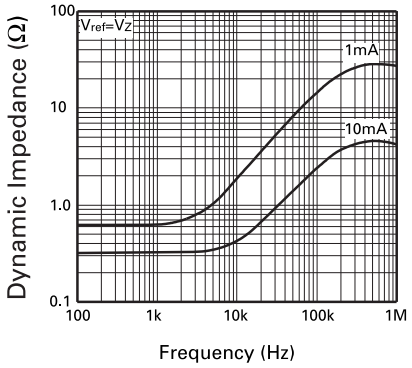
Reference Current v Temperature



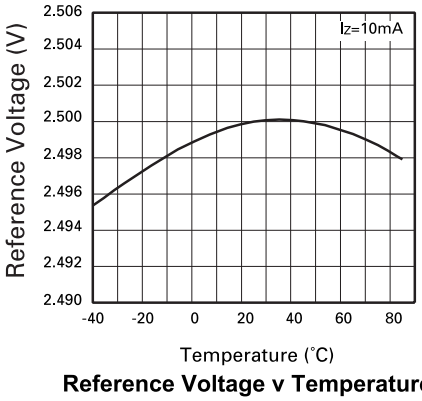
Change in Vref v Cathode Voltage



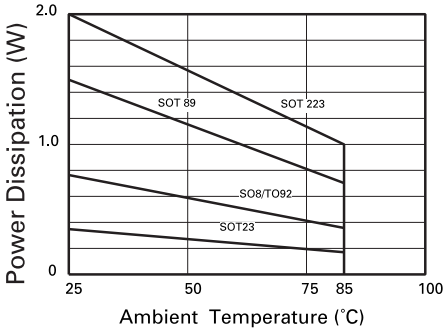
Cathode Current v Temperature



Dynamic Impedance v Frequency

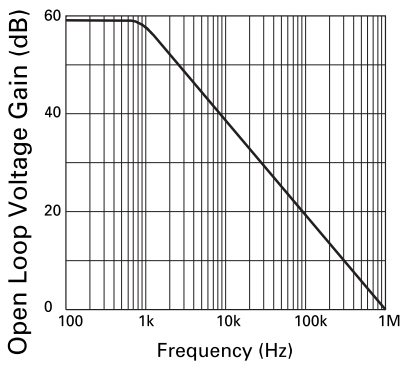


Reference Voltage v Temperature

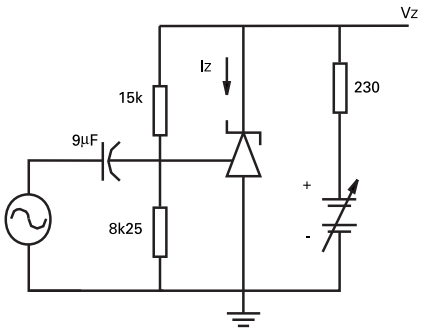


Power Dissipation Derating

Typical characteristics

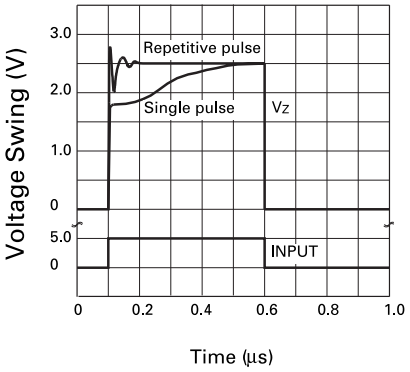


Gain v Frequency

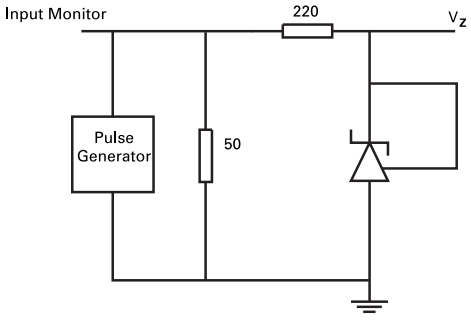


I_Z = 10mA, T_A = 25°C

Test Circuit for Open Loop Voltage Gain

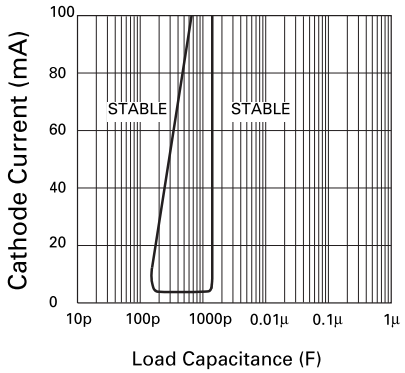


Pulse Response

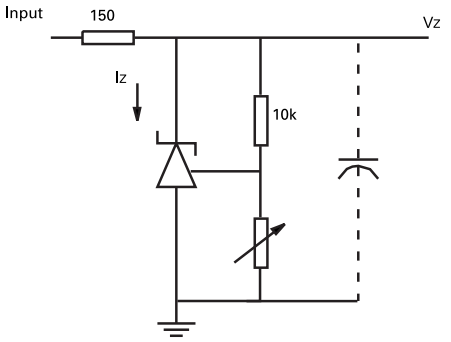


T_A = 25°C

Test Circuit for Pulse Response



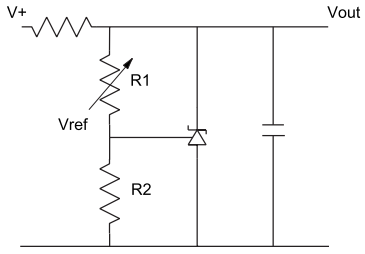
Stability Boundary Conditions



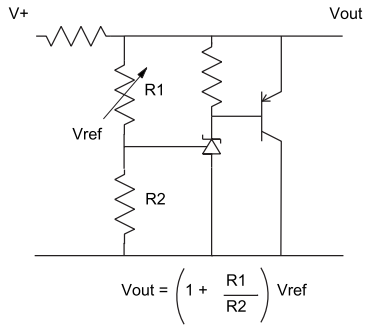
$V_{ref} < V_Z < 20$, I_Z = 10mA, T_A = 25°C

Test Circuit for Stability Boundary Conditions

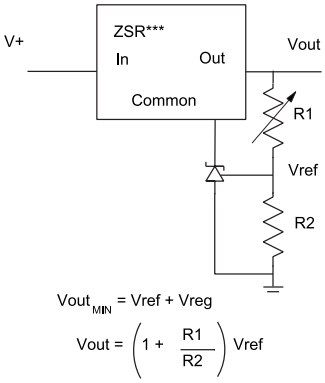
Application circuits



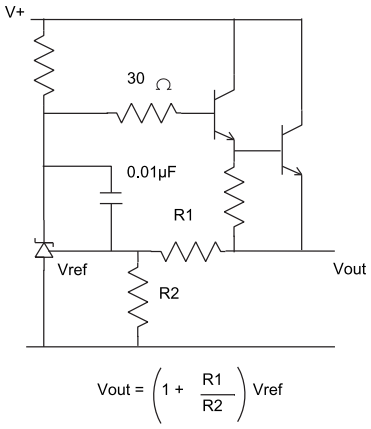
SHUNT REGULATOR



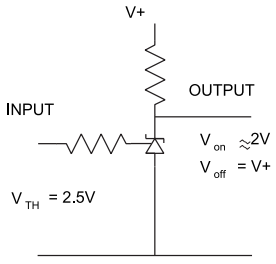
HIGHER CURRENT SHUNT REGULATOR



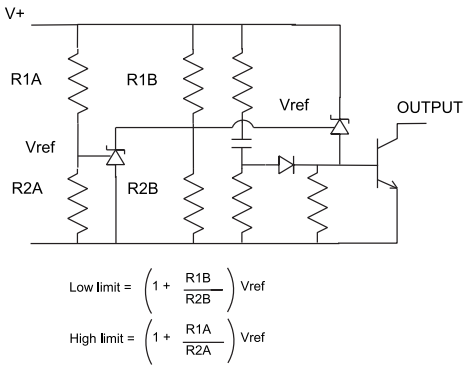
OUTPUT CONTROL OF A THREE TERMINAL FIXED REGULATOR



SERIES REGULATOR



SINGLE SUPPLY COMPARATOR WITH TEMPERATURE COMPENSATED THRESHOLD



OVER VOLTAGE / UNDER VOLTAGE PROTECTION CIRCUIT

DC test circuits

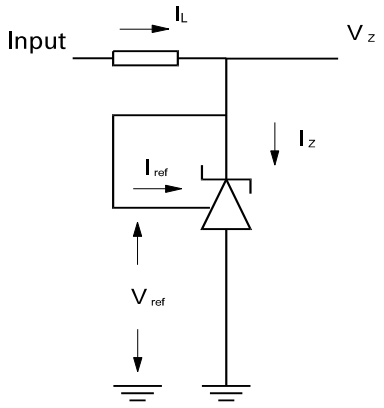


Fig 1. Test Circuit for $V_Z=V_{ref}$

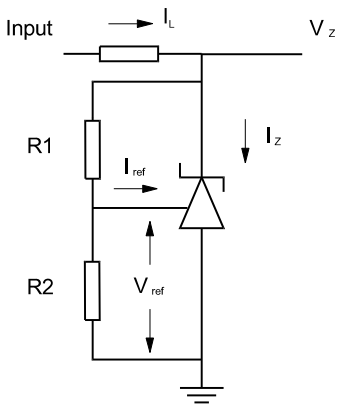


Fig 2. Test circuit for $V_Z>V_{ref}$

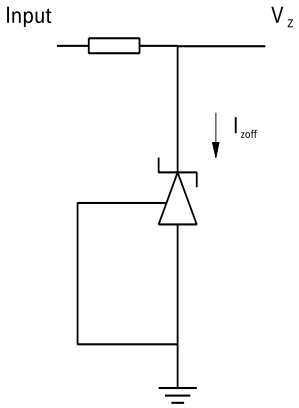


Fig 3. Test circuit for off state

Notes

Deviation of reference input voltage, Vdev, 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:

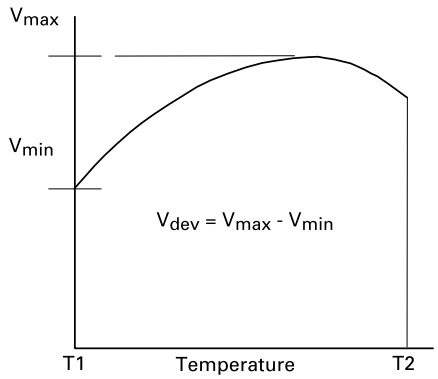
$$V_{ref}\,(ppm\ /^{o}C) = \frac{V_{dev} \bullet 1000000}{V_{ref}\,(T1 - T2)}$$

The dynamic output impedance, R_z, is defined as:

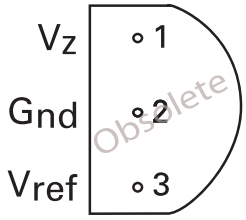
$$R_z = \frac{\Delta V_z}{\Delta I_z}$$

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:

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



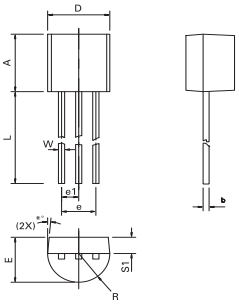
TO92 Information



Ordering information

Part No	Tol (%)	Package	Mark	Status	Reel Size (inches)	Quantity per reel
ZR431C01L	1	T092	ZR43101	Obsolete	Box	4000
ZR431C01SROB	1	T092	ZR43101	Obsolete	7	1500
ZR431C01STZ	1	T092	ZR43101	Obsolete	Concertina	1500
ZR431CL	2	T092	ZR431	Obsolete	Box	4000
ZR431CSTOB	2	T092	ZR431	Obsolete	7	1500
ZR431CSTZ	2	T092	ZR431	Obsolete	Concertina	1500
ZR431G01TA	1	SOT223	ZR43101	7	12	1000

T092 Package Information

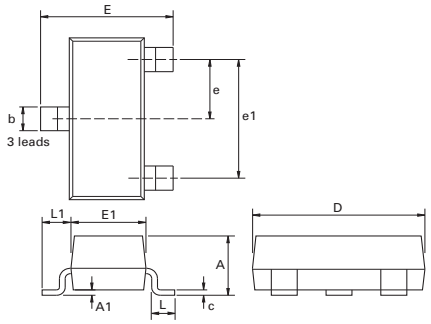


T092 Dimension table

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

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

Package information -SOT23

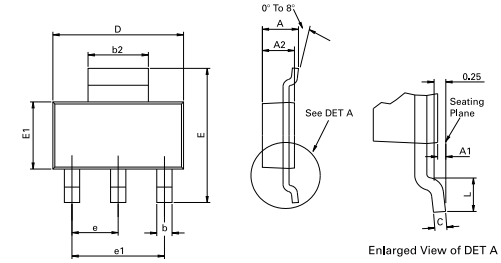


Dimension Table - SOT23

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 Information SOT223



Conforms to JEDEC TO-261 AA Issue B

Dimension table - SOT223

Dim.	Millimeters		Inches		Dim.	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	-	1.8	-	0.071	e	2.30 BSC		0.0905 BSC	
A1	0.02	0.1	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

Definitions

Product change

Diodes Incorporated reserves the right to alter, without notice, specifications, design, price or conditions of supply of any product or service. Customers are solely responsible for obtaining the latest relevant information before placing orders.

Applications disclaimer

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   1. are intended to implant into the body

or

   2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labelling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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Quality of product

Diodes Zetex Semiconductors Limited is an ISO 9001 and TS16949 certified semiconductor manufacturer.

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ESD (Electrostatic discharge)

Semiconductor devices are susceptible to damage by ESD. Suitable precautions should be taken when handling and transporting devices. The possible damage to devices depends on the circumstances of the handling and transporting, and the nature of the device. The extent of damage can vary from immediate functional or parametric malfunction to degradation of function or performance in use over time. Devices suspected of being affected should be replaced.

Green compliance

Diodes Zetex Semiconductors is committed to environmental excellence in all aspects of its operations which includes meeting or exceeding regulatory requirements with respect to the use of hazardous substances. Numerous successful programs have been implemented to reduce the use of hazardous substances and/or emissions.

All Diodes Zetex components are compliant with the RoHS directive, and through this it is supporting its customers in their compliance with WEEE and ELV directives.

Product status key:

"Preview"	Future device intended for production at some point. Samples may be available
"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

Datasheet status key:

"Draft version"	This term denotes a very early datasheet version and contains highly provisional information, which may change in any manner without notice.
"Provisional version"	This term denotes a pre-release datasheet. It provides a clear indication of anticipated performance. However, changes to the test conditions and specifications may occur, at any time and without notice.
"Issue"	This term denotes an issued datasheet containing finalized specifications. However, changes to specifications may occur, at any time and without notice.

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