

ADJUSTABLE PRECISION ZENER SHUNT REGULATOR

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ZR431

急出货

DEVICE 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.

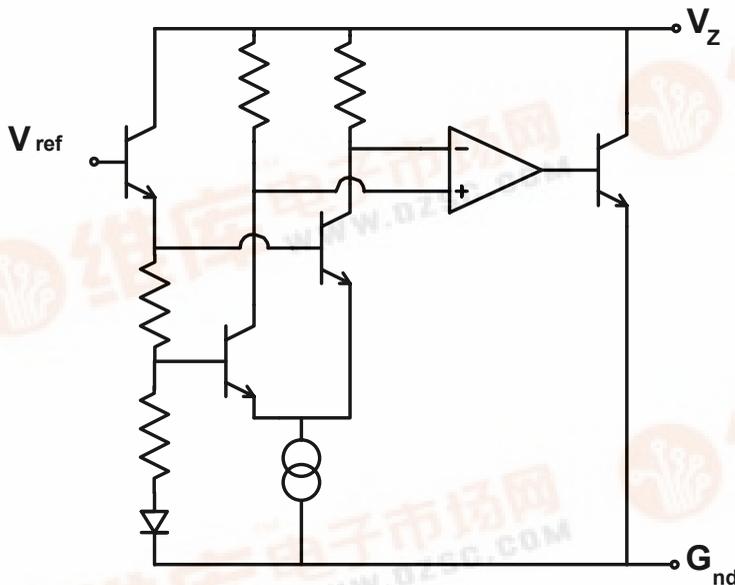
FEATURES

- Surface mount SO8, SOT223 and SOT23 packages
- TO92 package
- 2%, 1 % and 0.5% tolerance
- Max. temperature coefficient 55 ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- 50µA to 100mA current sink capability
- Low output noise

APPLICATIONS

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

SCHEMATIC DIAGRAM



ZR431

ABSOLUTE MAXIMUM RATING

| | | | |
|-----------------------------------|--------------|---|-------|
| Cathode Voltage (V _Z) | 20V | Power Dissipation (T_{amb}=25°C, T_{jmax}=150°C) | |
| Cathode Current | 150mA | SOT23 | 330mW |
| Operating Temperature | -40 to 85°C | TO92 | 780mW |
| Storage Temperature | -55 to 125°C | SOT223 | 2W |
| | | SO8 | 780mW |

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

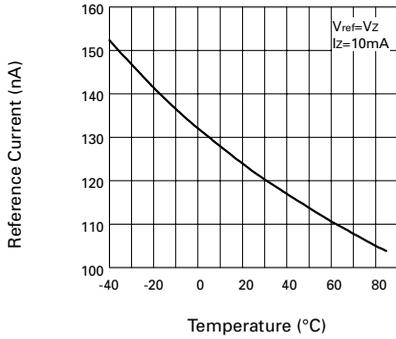
| PARAMETER | SYMBOL | VALUE | | | UNITS | CONDITIONS |
|---|-------------------------------------|-------|-------|-------|-------|---|
| | | MIN | TYP | MAX | | |
| Reference Voltage | V _{ref} | 2.45 | 2.50 | 2.55 | V | I _L =10mA (Fig1), V _Z =V _{ref} |
| | | 2.475 | 2.50 | 2.525 | | |
| | | 2.489 | 2.50 | 2.513 | | |
| Deviation of Reference Input Voltage over Temperature | V _{dev} | | 8.0 | 17 | mV | I _L =10mA, V _Z =V _{ref} T _a =full range (Fig1) |
| Ratio of the change in Reference Voltage to the Change in Cathode Voltage | $\frac{\Delta V_{ref}}{\Delta V_Z}$ | | -1.85 | -2.7 | mV/V | V _Z from V _{ref} to 10V I _Z =10mA (Fig2) |
| | | | -1.0 | -2.0 | mV/V | V _Z from 10V to 20V I _Z =10mA (Fig2) |
| Reference Input Current | I _{ref} | | 0.12 | 1.0 | μA | R1=10k, R2=O/C, I _L =10mA (Fig2) |
| Deviation of Reference Input Current over Temperature | ΔI _{ref} | | 0.04 | 0.2 | μA | R1=10k, R2=O/C, I _L =10mA T _a =full range (Fig2) |
| Minimum Cathode Current for Regulation | I _{Zmin} | | 35 | 50 | μA | V _Z =V _{ref} (Fig1) |
| Off-state Current | I _{Zoff} | | | 0.1 | μA | V _Z =20V, V _{ref} =0V (Fig3) |
| Dynamic Output Impedance | R _Z | | | 0.75 | Ω | V _Z =V _{ref} (Fig1), f=0Hz |

(1) 0.5% SOT23 only.

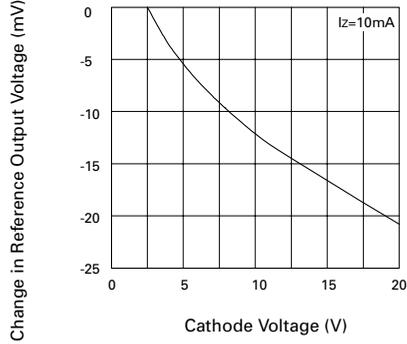
For definitions of reference voltage temperature coefficient and dynamic output impedance see NOTES following DC TEST CIRCUITS

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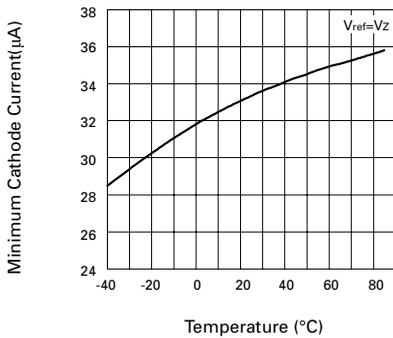
TYPICAL CHARACTERISTICS



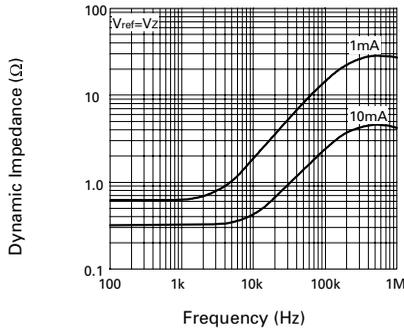
Reference Current v Temperature



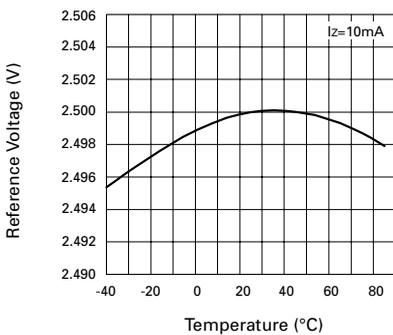
Change in Vref v Cathode Voltage



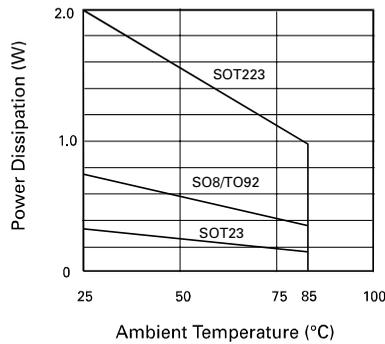
Cathode Current v Temperature



Dynamic Impedance v Frequency



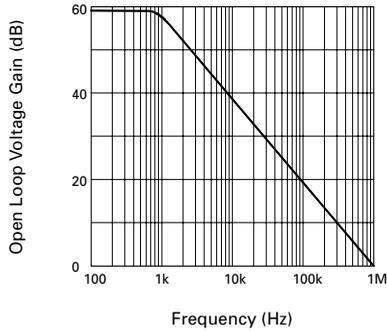
Reference Voltage v Temperature



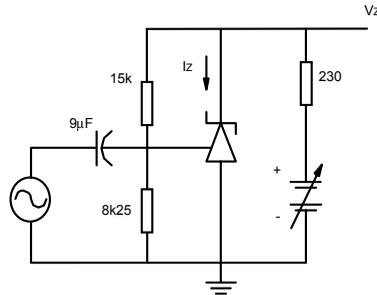
Power Dissipation Derating

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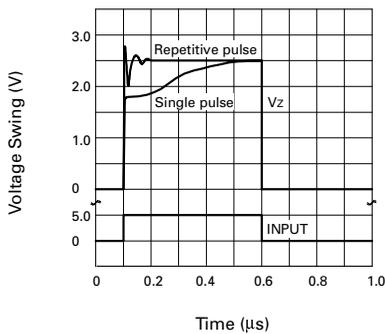
TYPICAL CHARACTERISTICS



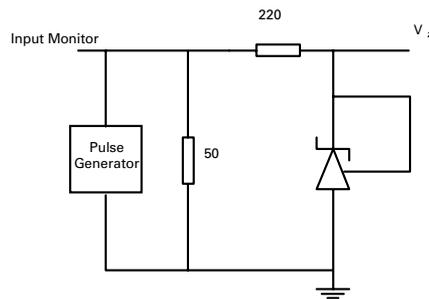
Gain v Frequency



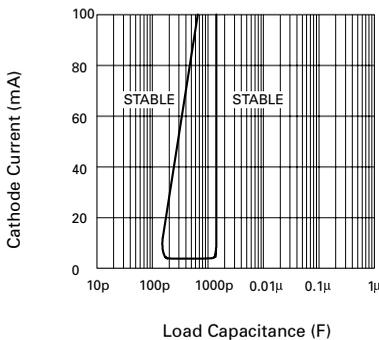
Test Circuit for Open Loop Voltage Gain



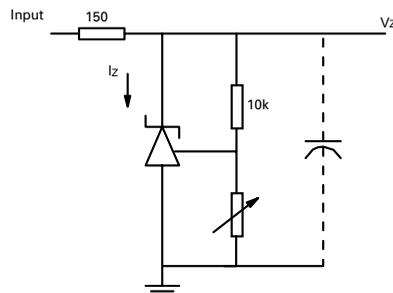
Pulse Response



Test Circuit for Pulse Response



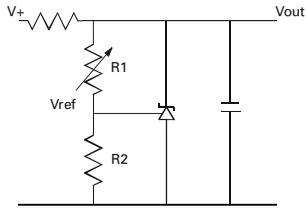
Stability Boundary Conditions



Test Circuit for Stability Boundary Conditions

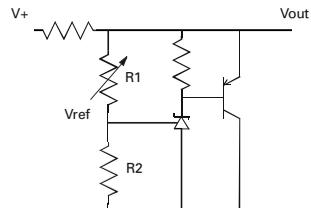
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APPLICATION CIRCUITS



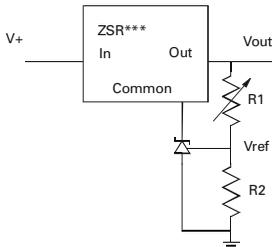
$$V_{out} = \left(1 + \frac{R1}{R2} \right) V_{ref}$$

SHUNT REGULATOR



$$V_{out} = \left(1 + \frac{R1}{R2} \right) V_{ref}$$

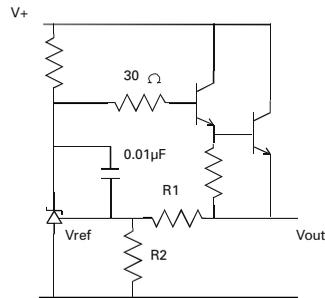
HIGHER CURRENT SHUNT REGULATOR



$$V_{out_MIN} = V_{ref} + V_{reg}$$

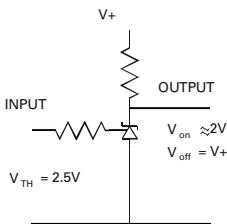
$$V_{out} = \left(1 + \frac{R1}{R2} \right) V_{ref}$$

OUTPUT CONTROL OF A THREE TERMINAL FIXED REGULATOR

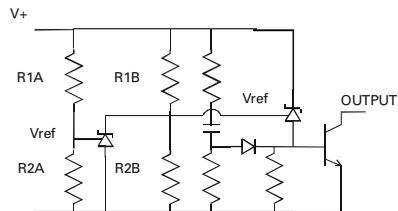


$$V_{out} = \left(1 + \frac{R1}{R2} \right) V_{ref}$$

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

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DC TEST CIRCUITS

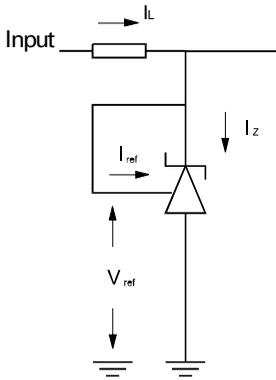


Fig 1 – Test Circuit for $V_z = V_{ref}$

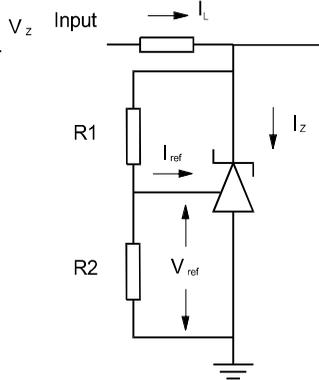


Fig 2 – Test Circuit for $V_z > V_{ref}$

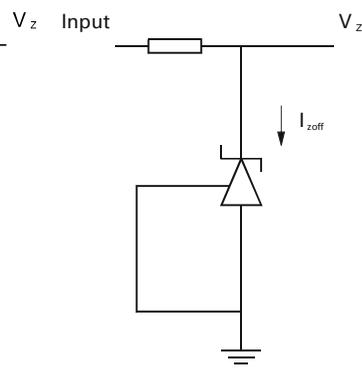
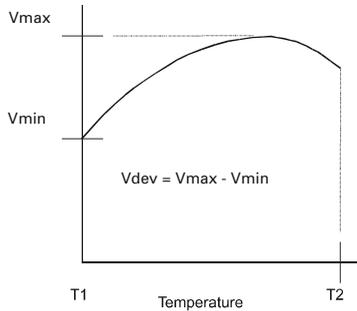


Fig 3 – Test Circuit for Off State current

NOTES

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:



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

The dynamic output impedance, R_z , is defined as:

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

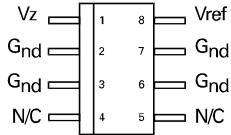
When the device is programmed with two external resistors, R_1 and R_2 , (fig 2), the dynamic output impedance of the overall circuit, R' , is defined as:

$$R' = R_z \left(1 + \frac{R_1}{R_2} \right)$$

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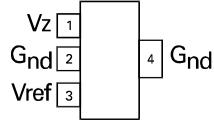
CONNECTION DIAGRAMS

SO8 Package Suffix - N8



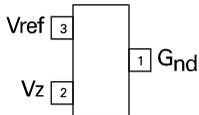
Top View

SOT223 Package Suffix - G



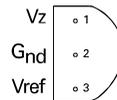
Top View -
Pin 4 floating or connected to pin 2

SOT23 Package Suffix - F



Top View

TO92 Package Suffix - C



Bottom View

ORDERING INFORMATION

| Part Number | Package | Tol. % | Part Mark |
|-------------|---------|--------|-----------|
| ZR431C01 | TO92 | 1.0 | ZR43101 |
| ZR431C | TO92 | 2.0 | ZR431 |
| ZR431G01 | SOT223 | 1.0 | ZR43101 |
| ZR431G | SOT223 | 2.0 | ZR431 |
| ZR431F005 | SOT23 | 0.5 | 43R |
| ZR431F01 | SOT23 | 1.0 | 43B |
| ZR431F | SOT23 | 2.0 | 43A |
| ZR431N801 | SO8 | 1.0 | ZR43101 |
| ZR431N8 | SO8 | 2.0 | ZR431 |