Programmable Precision Shunt Regulator TJR431

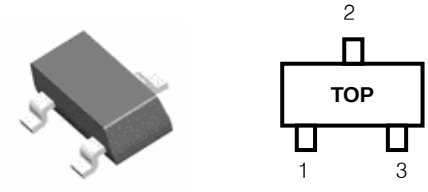
FEATURES

- Programmable Output Voltage to 28V
- Guaranteed 0.5% Reference Voltage Tolerance
- Cathode Current Range (Continuous) 100 mA
- Temperature Compensated For Operation Over Full Rate Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn-on Response
- Available in SOT-23-3L Package

APPLICATIONS

- Shunt Regulator
- Precision High-Current Series Regulator
- High-Current Shunt Regulator
- Crowbar Circuit
- PWM Converter With Reference
- Voltage Monitor
- Precision Current Limiter

SOT-23 PKG



Pin 1. CATHODE 2. ANODE 3. REFERENCE

ORDERING INFORMATION

Device	Package
TJR431xSF	SOT-23-3L
TJR431GxSF	SOT-23-3L

* Refer to the ordering information for the details.

DESCRIPTION

The TJR431 is a three-terminal adjustable shunt regulator with specified thermal stability over applicable temperature V_{REF} (2.495V) and 28V with two external resistors. This device has a typical dynamic output impedance of 0.25Ω. Active output circuitry provides a very sharp turn-on characteristic, making this device excellent replacement for Zener diodes in many applications. The TJR431 is characterized for operation from -40°C to +125°C.

ABSOLUTE MAXIMUM RATINGS

(Full operating ambient temperature range applies unless otherwise noted.)

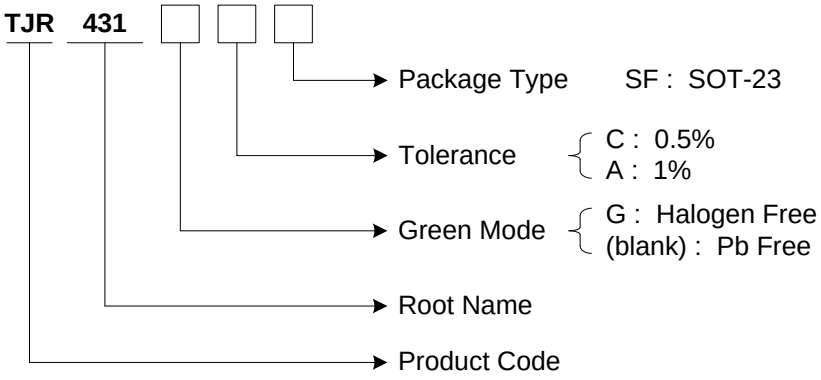
PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Cathode Voltage	V_{KA}	-	37	V
Cathode Current Range	I_{KA}	-100	150	mA
Reference Input Current Range	I_{REF}	-0.05	10	mA
Junction Temperature Range	T_J	-40	150	°C
Storage Temperature Range	T_{STG}	-65	150	°C

RECOMMENDED OPERATING CONDITIONS

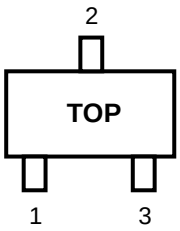
PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	28	V
Cathode Current	I_{KA}	1.0	100	mA
Operating Temperature Range	T_{OPR}	-40	125	°C

ORDERING INFORMATION

V_{REF}	Package	Tolerance	Order No.	Package Marking	Supplied As
2.495V	SOT-23	0.5%	TJR431CSF	-	Reel
			TJR431GCSF	-	
		1%	TJR431ASF	-	Reel
			TJR431GASF	-	



PIN CONFIGURATION

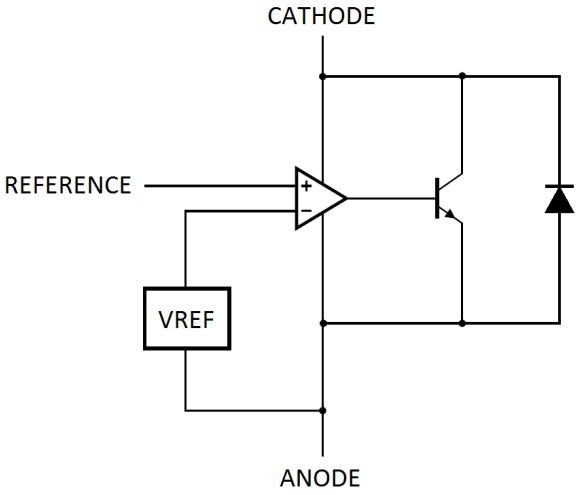


SOT-23 PKG

PIN DESCRIPTION

Pin No.	Pin Name	Pin Description
1	CATHODE	Input Supply Voltage
2	ANODE	Ground
3	REFERENCE	Reference Voltage

BLOCK DIAGRAM



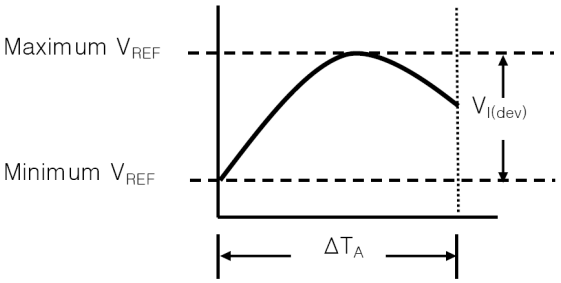
ELECTRICAL CHARACTERISTICS

(T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}$, I_K=10mA	TJR431C	2.483	2.495	2.507	V
			TJR431A	2.470	2.495	2.520	
Deviation of Reference Input Voltage (Note 1)	$\Delta V_{REF}/\Delta T$	$V_{KA}=V_{REF}$, I_K=10mA T_A=Full Range			35	50	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	I_K=10mA	ΔV_{KA}=10V to V_{REF}		-1.0	-2.7	mV/V
			ΔV_{KA}=28V to 10V		-0.4	-2.0	
Reference Input Current	I_{REF}	I_{KA}=10mA, R_1=10kΩ, R_2=∞			0.5	1.2	µA
Deviation of Reference Input Current (Note 1)	$\Delta I_{REF}/\Delta T$	I_K=10mA, R_1=10kΩ, R_2=∞ T_A=Full Range			0.4	1.2	µA
Minimum Cathode Current for Regulation	$I_{K(MIN)}$	$V_{KA}=V_{REF}$			0.4	1.0	mA
Off-State Cathode Current	$I_{K(OFF)}$	V_{KA}=28V, V_{REF}=0			0.1	1.0	µA
Dynamic Impedance (Note 2)	Z_{KA}	$V_{KA}=V_{REF}$, I_K=1mA~100mA f ≤ 1kHz			0.25	0.50	Ω

(Note 1) The deviation parameters $\Delta V_{REF}/\Delta T_A$ and $\Delta I_{REF}/\Delta T_A$ are defined as the differences between the maximum and minimum values obtained over the recommended temperature range. The average full-range temperature coefficient of the reference voltage, αV_{REF}, is defined as:

$$|\alpha V_{REF}|\ (ppm/°C)=\frac{\left(\frac{V_{I(dev)}}{V_{REF}\ at\ 25°C}\right)\times 10^6}{\Delta T_A}$$



Where:

ΔT_A is the recommended operating free-air temperature range of the device.

αV_{REF} can be positive or negative, depending on whether minimum V_{REF} or maximum V_{REF}, respectively, occurs at the lower temperature.

Example : Maximum V_{REF}=2496mV at 30°C, maximum V_{REF}=2492mV at 0°C, V_{REF}=2495mV at 25°C, ΔT_A=70°C for TJR431C.

$$|\alpha V_{REF}| =\frac{\left(\frac{4mv}{2495mV}\right)\times 10^6}{70°C} \approx 23ppm/°C$$

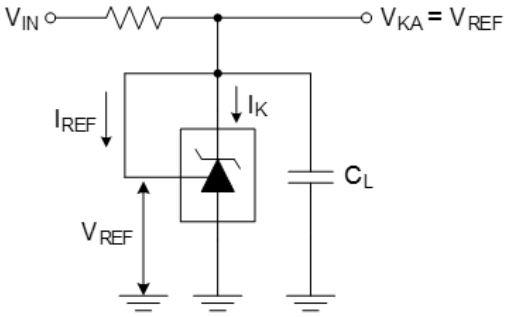
Because minimum V_{REF} occurs at the lower temperature, the coefficient is positive.

(Note 2) The dynamic impedance is defined as: $|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$

When the device is operating with two external resistors, the total dynamic impedance of the circuit is given by:

$$|Z'| = \frac{\Delta V}{\Delta I} \approx |Z_{KA}|(1+R1/R2)$$

TEST CIRCUITS



< Fig 1. Test circuit for $V_{KA} = V_{REF}$ >

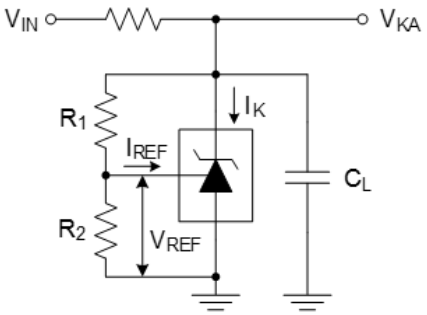
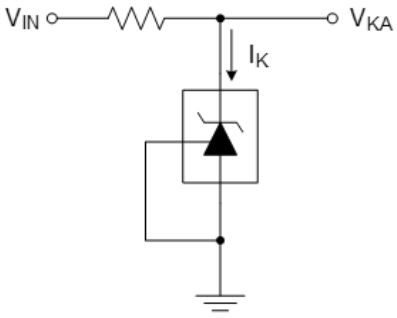


Fig 2. Test circuit for $V_{KA} \geq V_{REF}$ >



< Fig 3. Test circuit for $I_{KA(OFF)}$ >

REVISION NOTICE

The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.