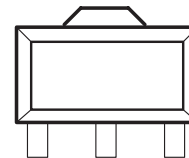


FEATURES

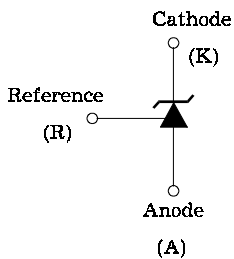
- Programmable Output Voltage to 36V
- Low Dynamic Output Impedance 0.2Ω
- Sink Current Capability of 0.1 mA to 100 mA
- Equivalent Full-Range Temperature Coefficient of 50 ppm/°C
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn on Response



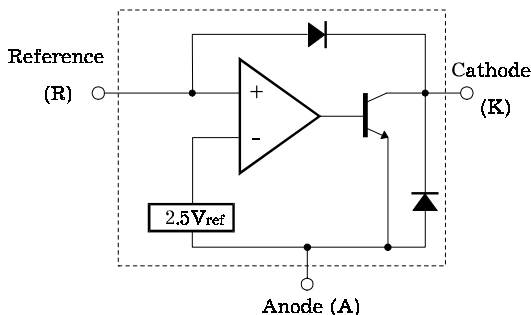
DESCRIPTION

The TL431A is a three-terminal adjustable regulator series with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{ref} (approximately 2.5 volts) and 36 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications. The TL431A is characterized for operation from -0°C to +70°C.

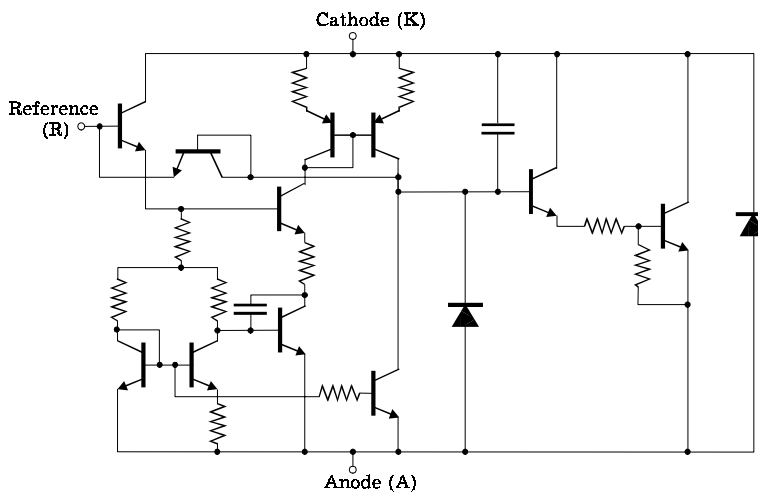
SYMBOL



FUNCTIONAL BLOCK DIAGRAM



SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified)

Characteristic	Symbol	Value	Unit
Cathode Voltage	V _{KA}	37	V
Cathode Current Range (Continuous)	I _K	-100 ~ +150	mA
Reference Input Current Range	I _{REF}	0.05 ~ +10	mA
Operating Temperature Range	T _A	0 ~ +70	°C
Storage Temperature Range	T _{stg}	-65 ~ +150	°C

RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Cathode Voltage	V _{KA}		V _{REF}		36	V
Cathode Current	I _K		1.0		100	mA

ELECTRICAL CHARACTERISTICS

(T_A = 25°C, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Reference Input Voltage	V _{REF}	V _{KA} = V _{REF} , I _K = 10mA	2.475	2.495	2.515	V
Deviation of Reference Input Voltage Over-Temperature (Note 1)	V _{REF(dev)}	V _{KA} = V _{REF} , I _K = 10mA T _{min} ≤ T _A ≤ T _{max}		3	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I _K = 10mA				mV/V
Reference Input Current	I _{REF}	I _K = 10mA, R ₁ = 10KΩ, R ₂ = ∞		1.8	4	μA
Deviation of Reference Input Current Over Full Temperature Range	I _{REF(dev)}	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}		0.5	1.0	mA
Off-State Cathode Current	I _{K(off)}	V _{KA} = 36V, V _{REF} = 0		0.26	1.0	μA
Dynamic Impedance (Note2)	Z _{KA}	V _{KA} = V _{REF} , I _K = 10mA to 100mA f ≤ 1.0KHz		0.22	0.4	Ω

Note: 1. The deviation parameters V_{REF(dev)} and I_{REF(dev)} are defined as the differences between the maximum and minimum values obtained over the rated temperature range.

$$V_{REF(dev)} = V_{REF(max)} - V_{REF(min)}$$

The equivalent full-range temperature coefficient of the reference input voltage, αV_{REF} is defined as:

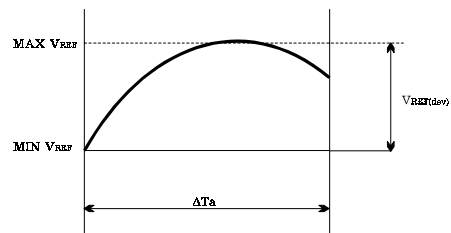
$$\alpha V_{REF} \left(\frac{ppm}{^{\circ}C} \right) = \frac{\left(\frac{V_{REF(dev)}}{V_{REF@^{\circ}C}} \right) \times 10^6}{\Delta T_A}$$

Where ΔT_A is the rated 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.

2. The dynamic impedance is defined as:

$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_K}$$



TL431A

Adjustable Precision Shunt Regulator

When the device is operated with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:

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

TEST CIRCUITS

Fig.1. Test Circuit for $V_{KA} = V_{REF}$

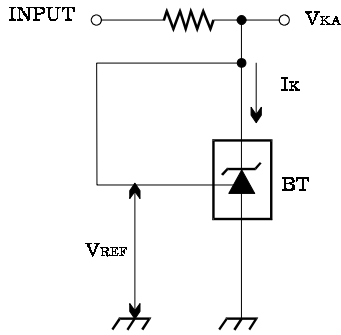


Fig.2. Test Circuit for $V_{KA} \geq V_{REF}$

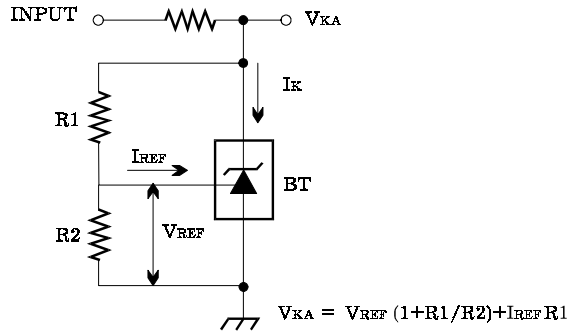
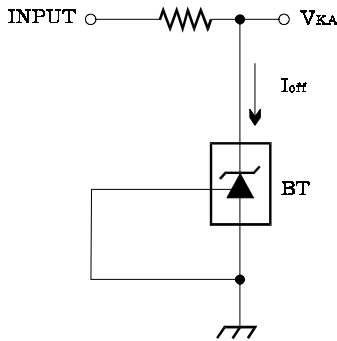
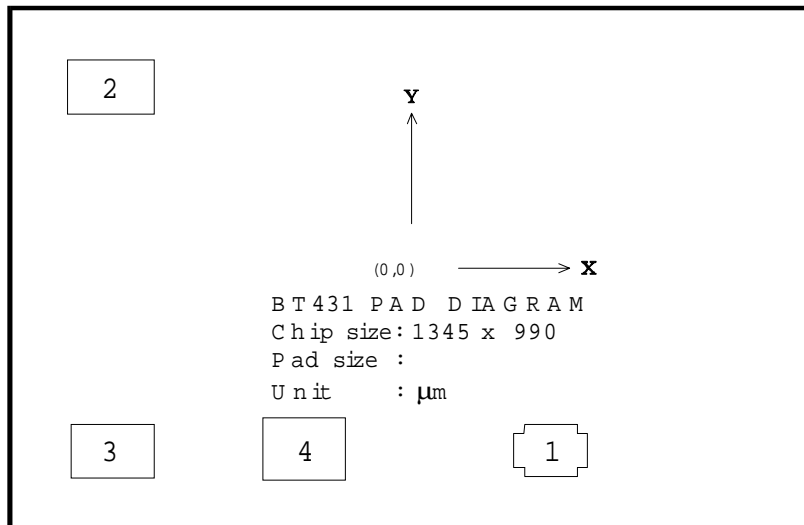


Fig.3. Test Circuit for I_{off}



PAD LAYOUT



PAD LOCATION

Unit: μm

Pad No.	Pad Name	Description	X	Y
1	R	Reference	235	400
2	K	Cathode	-505	343.5
3	K	Cathode	-497.5	-346
4	A	Anode	-177.5	-341.5

Physical Characteristics		
Wafes	4»	4» Wafes $460 \pm 40 \mu\text{m}$
Size	$1.35 \times 0.99 \text{ mm}$	
Scribe width	$90 \mu\text{m}$	
Wafe's Backside	Ti - Ni - Ag: Ti - $0.1 \pm 0.02 \mu\text{m}$ Ni - $0.5 \pm 0.1 \mu\text{m}$ Ag - $0.6 \pm 0.1 \mu\text{m}$	
Passivation	PSG	