MMBT431

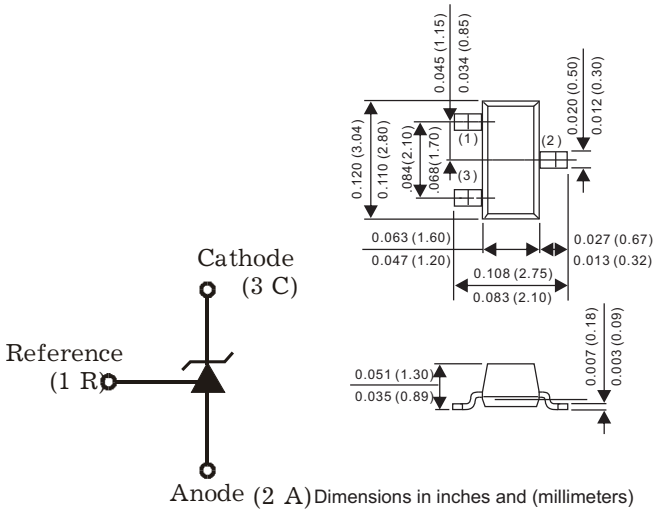
Programmable Shunt Regulator

SOT-23

FEATURES

- Programmable Output Voltage to 36V
- Low Dynamic Output Impedance 0.22Ω
- Sink Current Capability of 0.5 mA to 100 mA
- Equivalent Full-Range Temperature Coefficient of 50 ppm/
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn on Response
- Bare chip is available

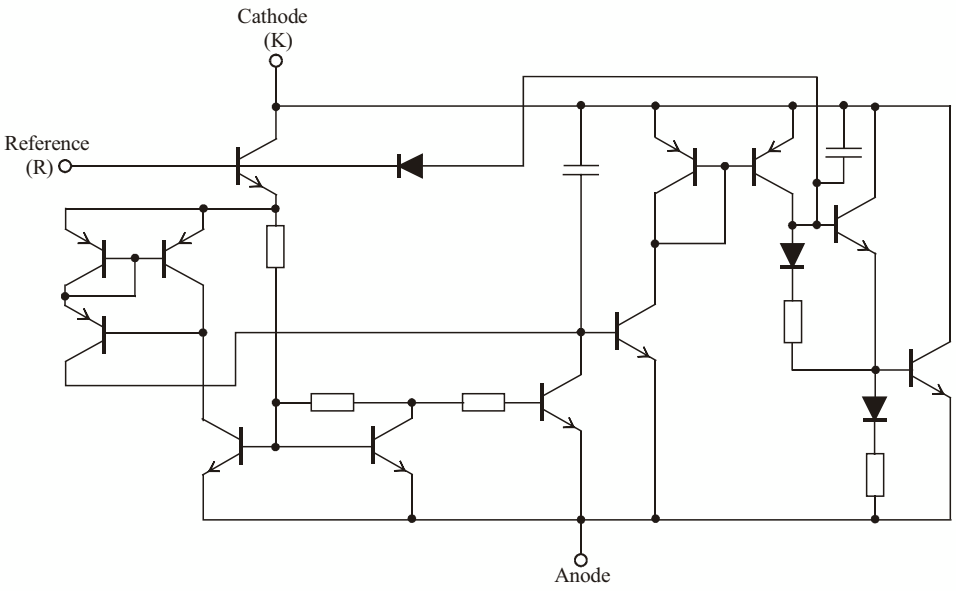
Marking:431



DESCRIPTION

The 431 isathree-terminaladjustableregulator series with a quaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between Vref (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.

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Cathode Voltage	V_{KA}	40	V
Cathode Current Range (Continuous)	I_K	-100 ~ +150	mA
Reference Input Current Range	I_{REF}	-0.05 ~ +10	mA
Maximum Junction Temperature	$T_{J, MAX}$	+150	°C
Storage Temperature Range	T_{stg}	-65 ~ +150	°C

ESD MAXIMUM RATINGS (T_a = 25°C, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Electrostatic Discharge Voltage	V_{ESD}	MIL-STD-883 (Human Body Model)			2.5	kV

RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Cathode Voltage	V_{KA}		V_{REF}		36	V
Cathode Current	I_K		0.5		100	mA

ELECTRICAL CHARACTERISTICS (Ta =25℃, V_{KA}=VREF, I_K = 10mA unless otherwise specified))

Characteristic	Symbol	Test Condition		Min	Typ	Max	Unit
Refernce Input Voltage	V_{REF}	V_{KA}=VREF, IK=10mA 0.5%		2.483	2.495	2.507	V
		V_{KA}=VREF, IK=10mA 1.0%		2.470	2.495	2.520	V
Deviation of Reference Input Voltage Over-Temperature (Note 1)	VREF(dev)	VKA=VREF, IK=10mA 0℃≤Ta≤70℃			5	17	mV
Ratio of Change in Reference Input Voltage to the Change in Catheode Voltage	$\frac{\triangle V_{REF}}{\triangle V_{KA}}$	IK=10mA	△VKA=10V-VREF		1.4	2.7	mV/V
			△VKA=36V-10V		1.0	2.0	
Reference Input Current	IREF	IK=10mA, R1=10KΩ, R2=∞			0.3	4	μA
Deviation of Reference Input Current Over Full Temperature Range	IREF(dev)	IK=10mA, R1=10KΩ, R3=∞ Ta=Full Range			0.15	1.2	μA
Minimum Cathode Current for Regulation	IK(min)	VKA=VREF			0.07	0.5	mA
Off-State Cathode Current	IK(off)	VKA=36V, VREF=0			0.05	0.9	μA
Dynamic Impedance (Note 2.)	ZKA	VKA=VREF, IK=1mA to 100mA f≤1KHz			0.22	0.5	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:

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

where ΔTa 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.

Note 2. The dynamic impedance is defined as:

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

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

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

TEST CIRCUITS

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

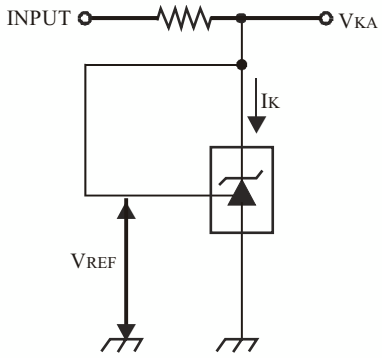


Fig.2. Test Circuit for $V_{KA} \geq V_{REF}$

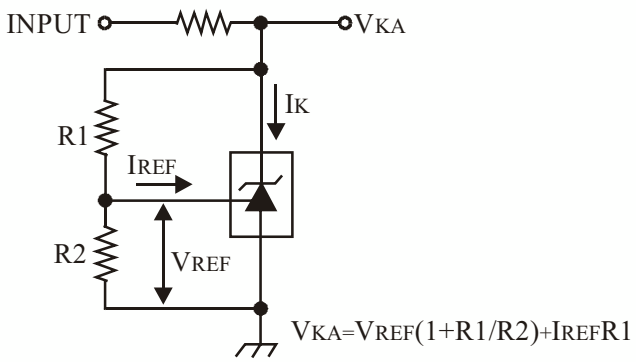
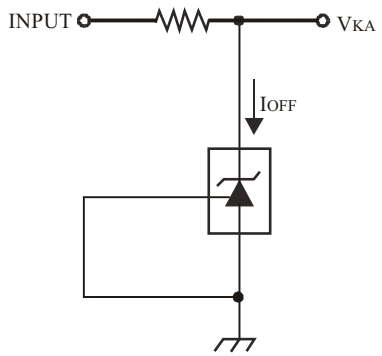
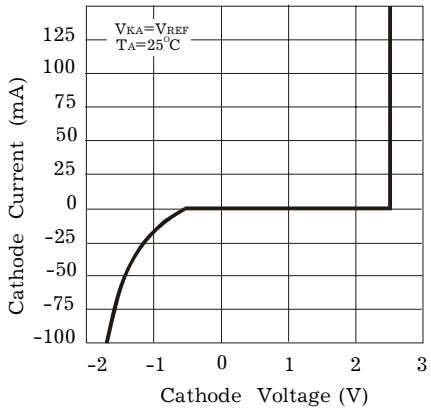


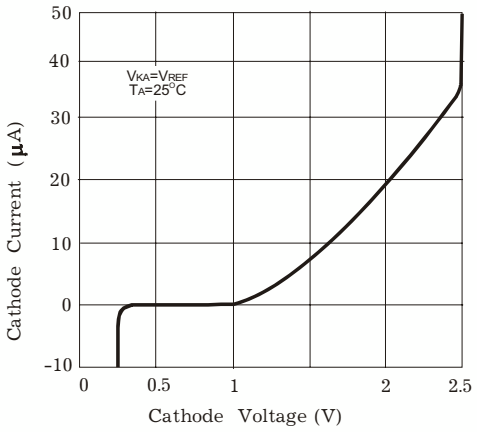
Fig.3. Test Circuit for I_{off}

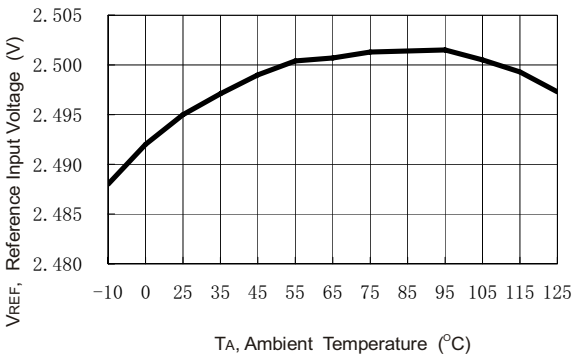


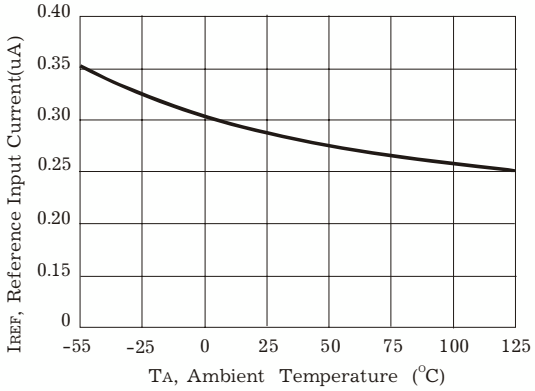
Typical Characteristics

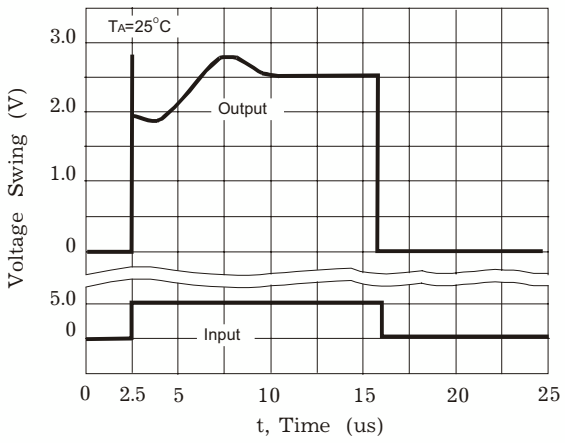


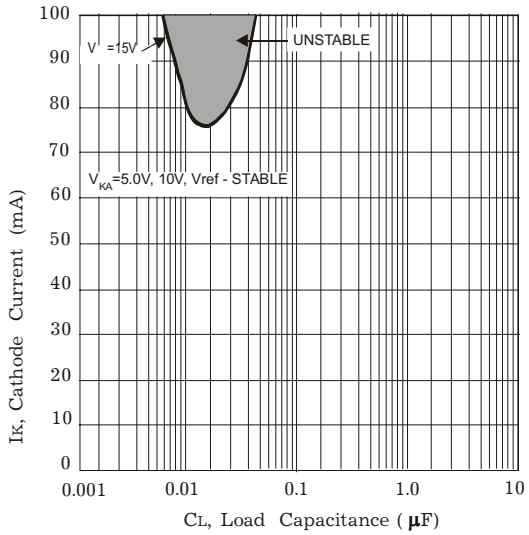
VKA=VREF, IKA=10mA





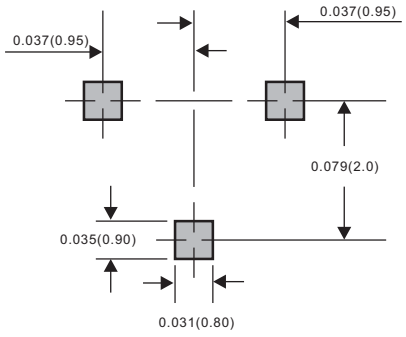






Suggested solder pad layout

SOT-23



Dimensions in inches and (millimeters)