

## Adjustable Precision Shunt Regulator

CL431

**■ Description**

The CL431 is a 3-terminal adjustable shunt regulator with guaranteed temperature stability over the entire temperature range of operation. The output voltage may be set at any level greater than 2.5V (VREF) up to 18V merely by selecting two external resistors that act as a voltage divided network.

Due to the sharp turn-on characteristics this device is an excellent replacement for many zener diode applications

**■ Features**

- Average temperature coefficient 50 ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- Fast turn-on response
- Low output noise

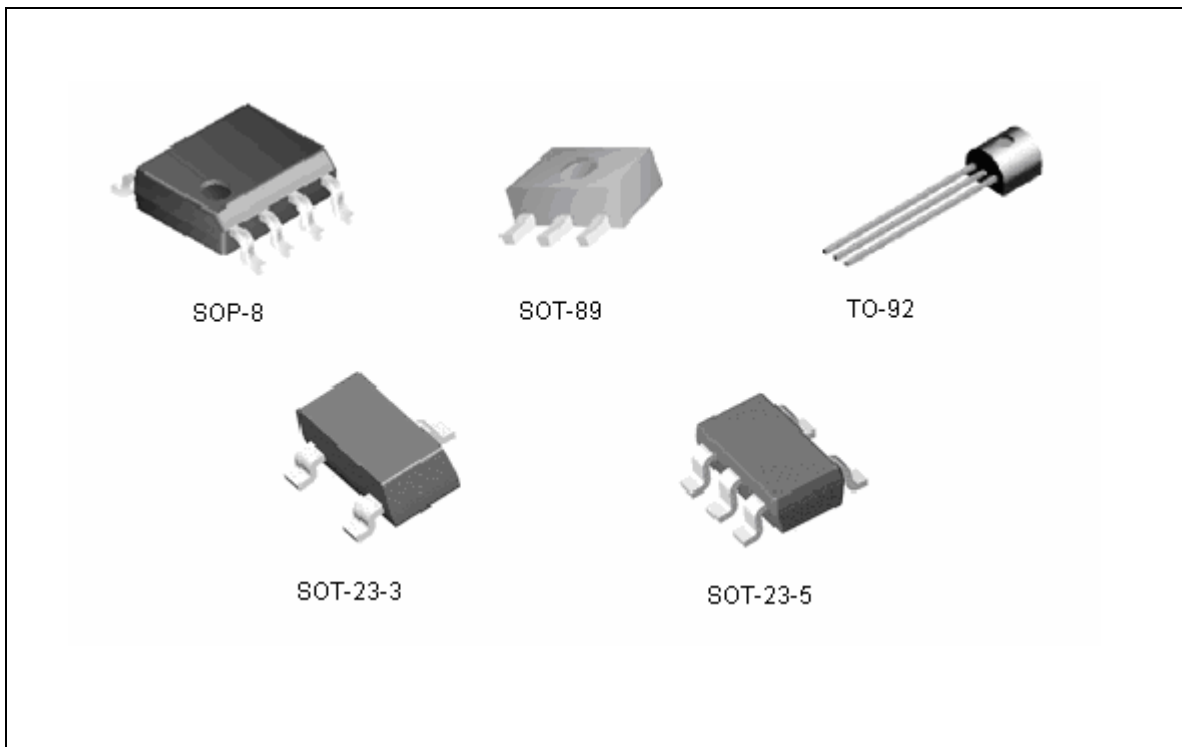
**■ Package**

Figure 1. Package Types of CL431

■ Pin Configuration

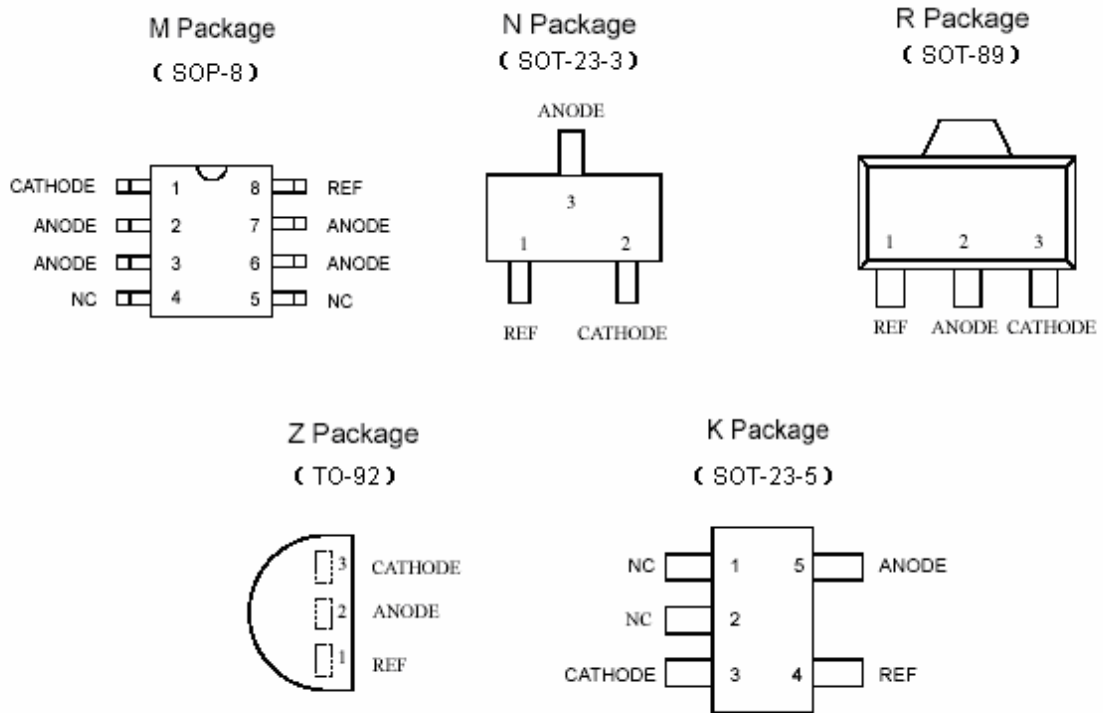


Figure 2. Pin Configuration of CL431 (Top View)

■ Functional Block Diagram

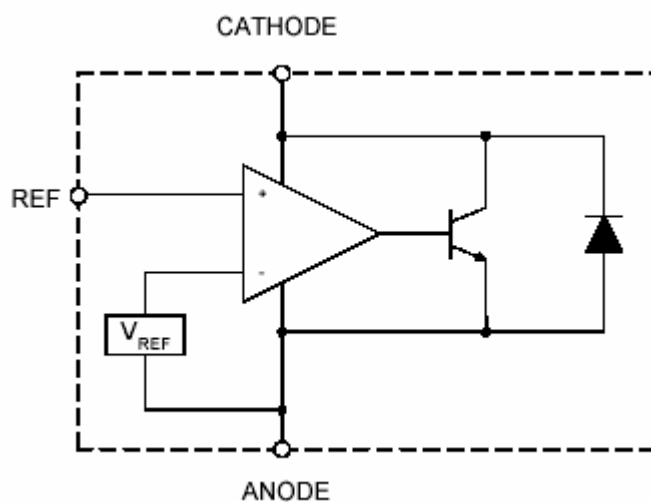
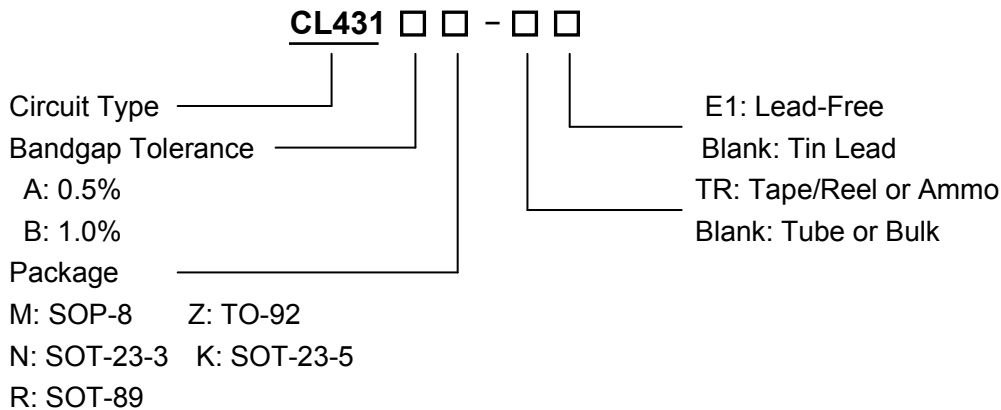


Figure 3. Functional Block Diagram of CL431

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**Ordering Information**

**Absolute Maximum Ratings**

Parameter	Symbol	Value	Unit
Cathode Voltage	VKA	18	V
Cathode Current Range (Continuous)	IKA	-100 to 150	mA
Reference Input Current Range	IREF	10	mA
Power Dissipation	PD	M,Z,R Package: 750	mW
		N,K Package: 350	
Junction Temperature	TJ	150	°C
Storage Temperature Range	TSTG	-40 to +150	°C
Package Thermal Impedance	JA	M Package: 150	°C/W
		Z Package: 150	°C/W

Stresses greater than those listed under “ABSOLUTE MAXIMUM RATINGS” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

**Recommended Operating Conditions**

Parameter	Symbol	Min	Max	Unit
Cathode Voltage	VKA	VREF	16	V
Cathode Current	IKA	1.0	100	mA
Operating Ambient Temperature	TA	-40	+125	°C

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**■ Electrical Characteristics for CL431**

Operating Conditions: TA=25°C unless otherwise specified.

Parameter	Test Circuit	Symbol	Conditions	CL431			Unit	
				Min	Typ	Max		
Reference Voltage	4	VREF	VKA=VREF IKA=10mA	A	2.488	2.500	2.512	V
				B1	2.475		2.488	V
				B2	2.512		2.525	V
Deviation of Reference Voltage Over Temperature	4	$\Delta V_{REF}$	0 to 70°C		5	12	mV	
			-40 to +85°C		5	15		
Ratio of Change in Reference Voltage to the Change in Cathode Voltage	5	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	IKA=10mA $\Delta V_{KA}=10V$ to VREF		-1.2	-2.7	mV/V	
			IKA=10mA $\Delta V_{KA}=16V$ to 10V		-0.8	-2.2		
Reference Current	5	IREF	IKA=10mA R1=10K $\Omega$ , R2= $\infty$		0.8	4	$\mu A$	
Deviation of Reference Current Over Full Temperature Range	5	IREF	IKA=10mA R1=10K $\Omega$ , R2= $\infty$ TA=-40 to +85°C		0.4	1.2	$\mu A$	
Minimum Cathode Current for Regulation	4	IKA(min)	VKA=VREF		0.4	1.0	mA	
Off-State Cathode Current	6	IKA(off)	VKA=16V, VREF=0		0.1	1.0	$\mu A$	
Dynamic Impedance	4	ZKA	VKA=VREF IKA=1 to 100mA F $\leq$ 1.0KHz		0.2	0.5	ohm	

■ Test Circuits

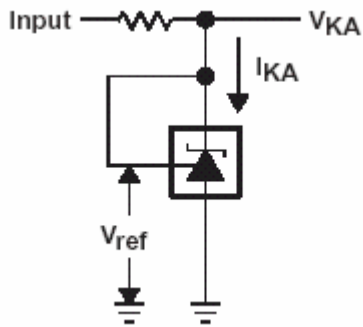


Figure 4. Test Circuit 4 for  $V_{KA}=V_{REF}$

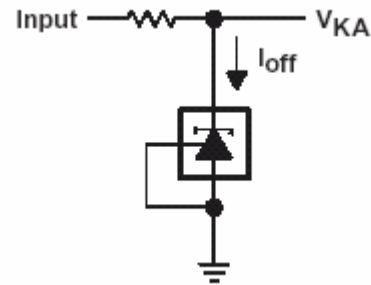


Figure 5. Test Circuit 5 for  $I_{OFF}$

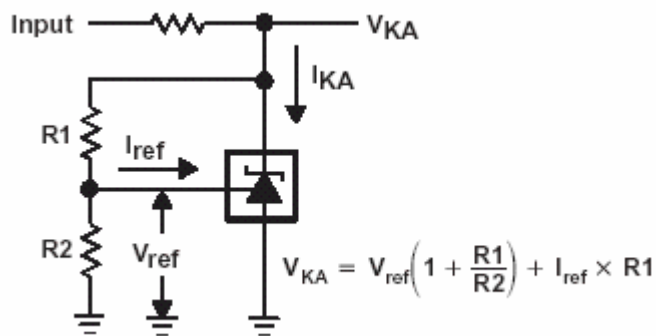


Figure 6. Test Circuit 6 for  $V_{KA} > V_{REF}$

■ Typical Performance Characteristics

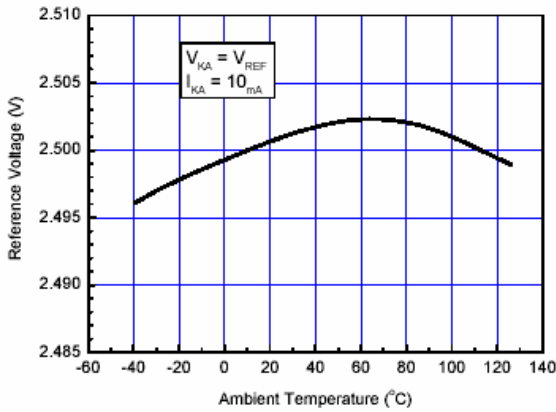


Figure 7. VREF vs. Ambient Temperature

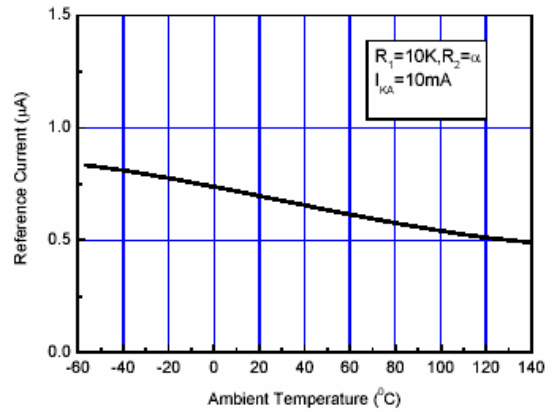


Figure 8. IREF vs. Ambient Temperature

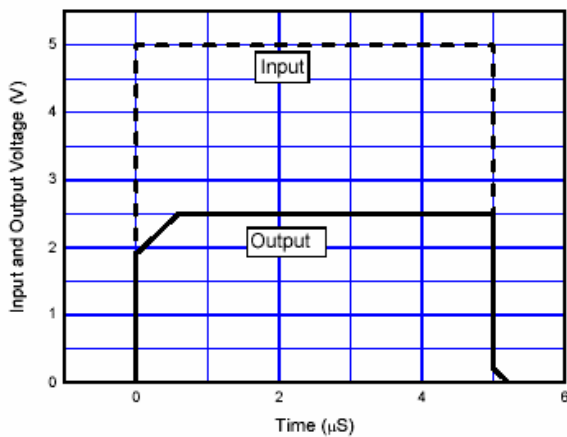
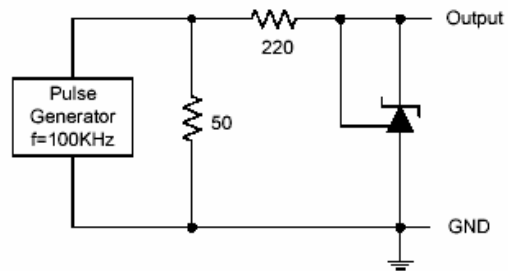


Figure 9. Pulse Response of Input and Output Voltage



■ Typical Applications

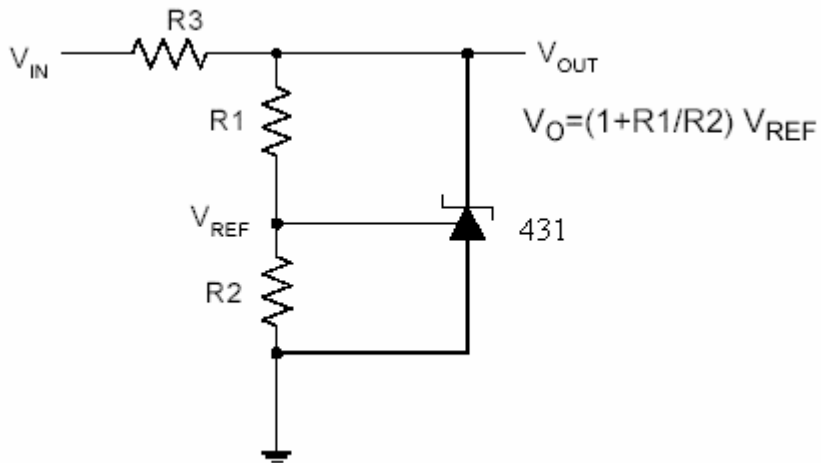
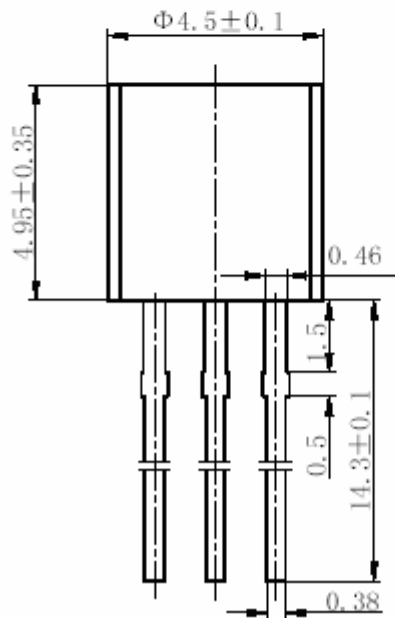
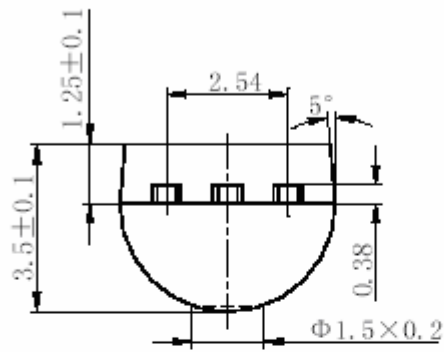


Figure 9. Shunt Regulator

■ Mechanical Dimensions

TO-92

Unit: mm





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