SemTron Microtech Corporation

TL431

Adjustable Precision Shunt Regulatror

■DESCRIPTION

The TL431 is high-voltage three-terminal adjustable voltage references, with specified thermal stability over applicable industrial and commercial temperature ranges. Output voltage can be set to any value between V_{REF} (2.5V) and 40V with two external resistors. These devices have a typical output impedance of 0.2Ω. Active output circuitry provides a very sharp turn-on characteristic making the TL431 excellent replacements for low-voltage zener diodes in many applications, including onboard regulation and adjustable power supplies.

■FEATURE

- Voltage Reference Accuracy of 1%,0.5%
- Sink Current Capability from 1mA to 100mA
- Adjustable Output Voltage from V_{REF} to 40V
- Low Output Noise
- Typical Output Dynamic Impedance Less Than 0.25Ω
- Available in SOT23 and TO-92 package
- Full RoHS compliance

■APPLICATIONS

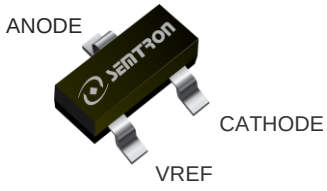
- Battery Power Equipment
- Linear Regulators
- Switch Power Supply
- Cellular Phone
- Digital Cameras
- Computer Disk Drivers
- Instrumentation

■PART NUMBER INFORMATION

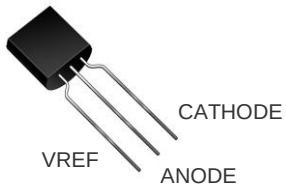
TL	431	X	X	-	XX	G
a	b	c	d		e	f

a : Product type name.
b : Product serial number.
c : Accuracy Code. A: 0.5%, B: 1%
d : Package code S: SOT-23, T: TO-92
e : Handling code TR: Tape&Reel, TB: Tape&Box
f : Green produce code G: *RoHS Compliant*

■PIN CONFIGURATION



SOT-23
Top View



TO-92
Top View

■ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Maximum	Unit
Cathode Voltage		V_{KA}	40	V
Continuous Cathode Current Range		I_{KA}	-100~150	mA
Power Dissipation	SOT-23	P_D	280	mW
	TO-92		750	
Reference Current Range		I_{REF}	0.05~10	mA
Operating Junction Temperature Range		T_J	0~150	°C
Storage Temperature Range		T_{STG}	-65~+150	°C

Note: The power dissipation values are based on the condition that temperature Tj and ambient temperature T_A difference is 100°C
Stresses beyond those listed under “absolute maximum rating” may cause permanent damage to the device.
These are stress rating only, and function operation of the device at these or any other conditions beyond those indicated under
“ “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

■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	Min	Typ	Max	Unit
Cathode Voltage	V_{KA}	V_{REF}	-	40	V
Cathode Current	I_K	0.5	-	100	mA

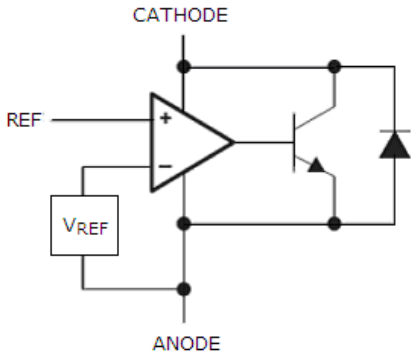
■ELECTRICAL CHARACTERISTICS (T_A=25°C, V_{KA}=V_{REF} , I_K=10mA unless otherwise specified)

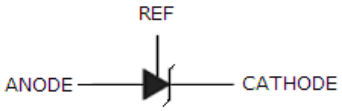
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage	V_{REF}	TL431A	2.483	2.495	2.507	V
		TL431B	2.470	2.495	2.520	
V_{REF} Temp Deviation	V_{DEV}	T_A=-40°C~+80°C V_{KA}=V_{REF}	-	5	17	mV
Ratio Of Change In R_{EF} To Change In Cathode Voltage	△V_{REF}/△V_{KA}	I_K=10mA, △V_{KA}=36V~10V	-0.4	0	2.0	mV/V
Reference Input Current	I_{REF}	R_1=10kΩ R_2=∞	-	1.8	4	μA
I_{REF} Temp Deviation	$I_{REF(DEV)}$	T_A=-40°C~+80°C R_1=10KΩ , R_2=∞	-	0.4	1.2	μA
Off-State Cathode Current	$I_{K(OFF)}$	V_{REF}=0V , V_{KA}=36V	-	0.05	0.9	μA
Minimum Operating Current	$I_{K(MIN)}$	V_{KA}=V_{REF}	-	0.26	0.5	mA
Dynamic Output Impedance	Z_{KA}	f≦1kHz , V_{KA}=V_{REF} I_K=1~100mA	-	0.25	0.5	Ω

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

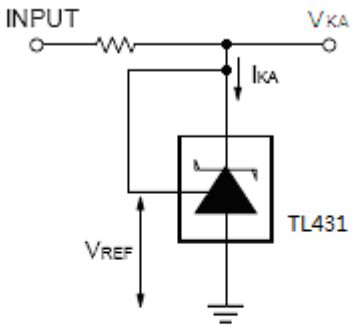
$V_{REF(DEV)} = V_{REF(MAX)} - V_{REF(MIN)}$

■FUNCTION BLOCK DIAGRAM

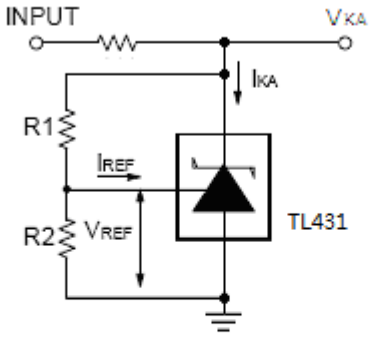




■TEST APPLICATIONS

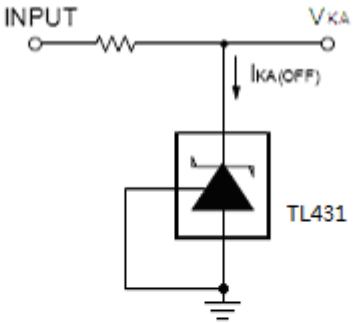


Firgure1. Test Circuit $V_{KA}=V_{REF}$

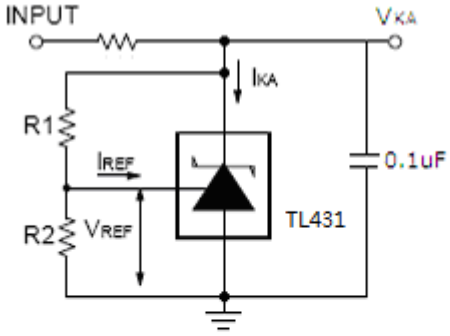


Firgure2. Test Circuit $V_{KA}>V_{REF}$

$V_{KA}=V_{REF}X(1+R1/R2)I_{REF}XR1$



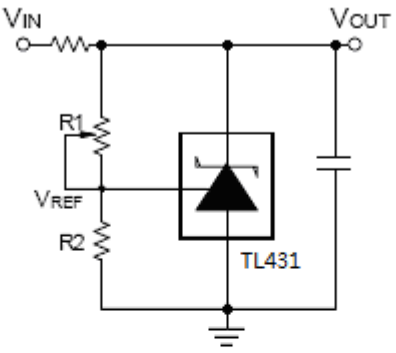
Firguie3. Test Circuit $I_{K(OFF)}$



Firgure4. Test Circuit $V_{KA}>V_{REF}$

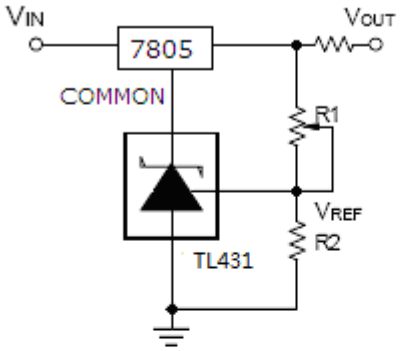
$V_{KA}=V_{REF}X(1+R1/R2)I_{REF}XR1$

■TYPICAL APPLICATIONS



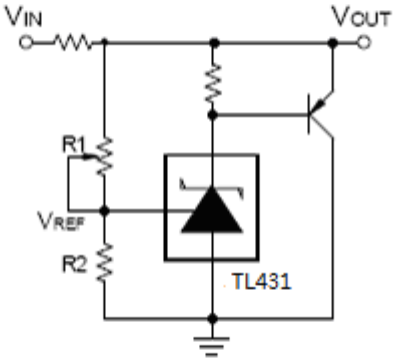
VOUT=(1+R1/R2)*VREF

Shutdown Regulator



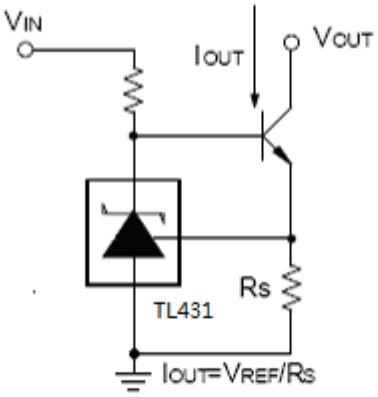
VOUT=(1+R1/R2)*VREF

Output Control of Three-Terminal Fixed Regulator

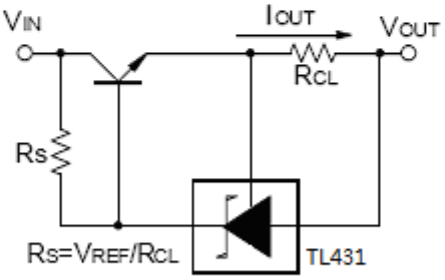


VOUT=(1+R1/R2)*VREF

Higher Current Shunt Regulator



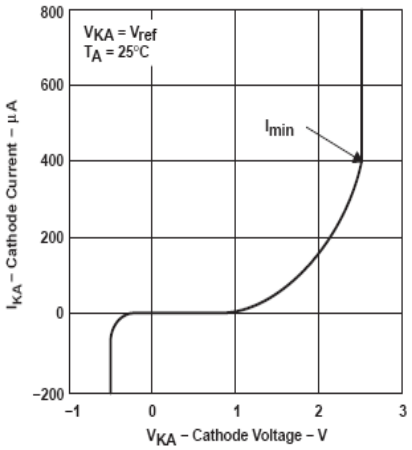
Constant Current Sink



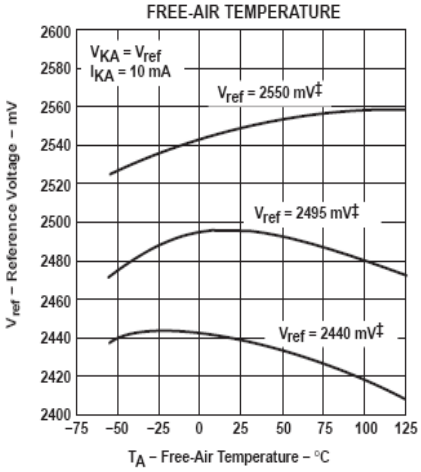
Current Limiting or Current Source

TYPICAL CHARACTERISTICS

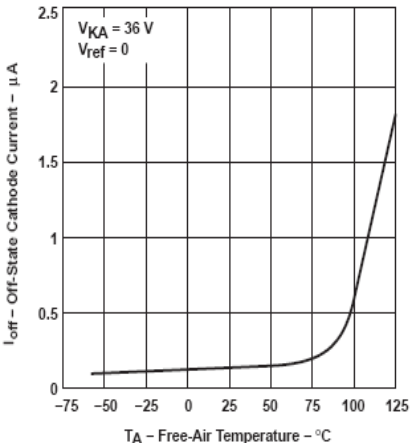
CATHODE CURRENT vs CATHODE VOLTAGE



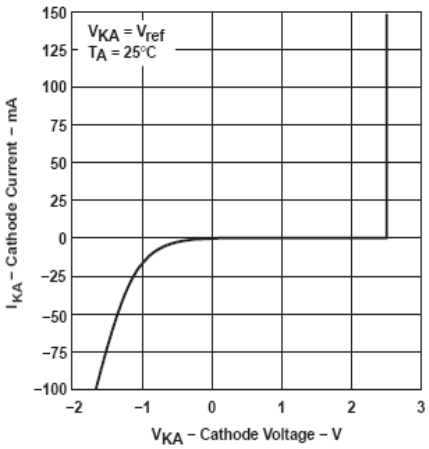
REFERENCE VOLTAGE vs FREE-AIR TEMPERATURE



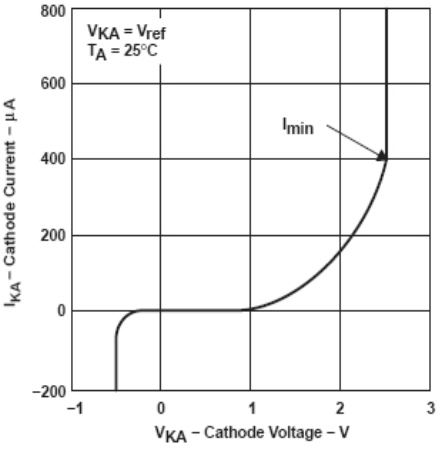
OFF-STATE CATHODE CURRENT vs FREE-AIR TEMPERATURE



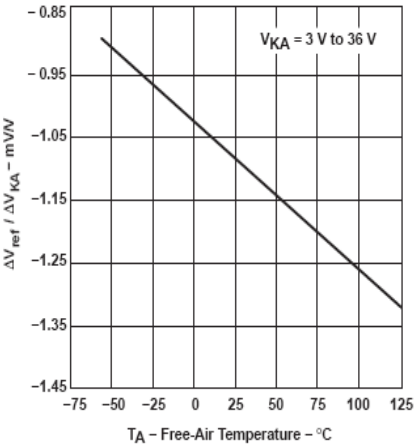
CATHODE CURRENT vs CATHODE VOLTAGE



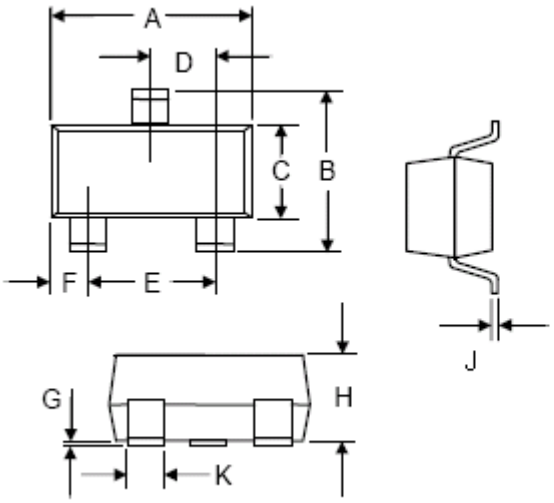
CATHODE CURRENT vs CATHODE VOLTAGE



RATIO OF DELTA REFERENCE VOLTAGE TO DELTA CATHODE VOLTAGE vs FREE-AIR TEMPERATURE

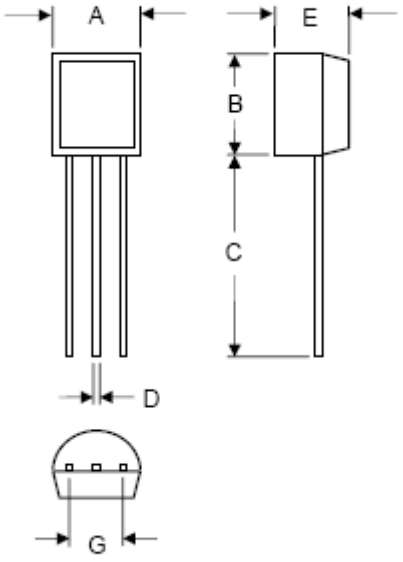


■SOT-23 PACKAGE DIMENSIONS



Dimensions				
Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	0.110	0.120	2.80	3.04
B	0.83	0.098	2.10	2.64
C	0.47	0.055	1.20	1.40
D	0.35	0.041	0.89	1.03
E	0.70	0.081	1.78	2.05
F	0.18	0.024	0.45	0.60
G	0.001	0.0039	0.013	0.100
H	0.035	0.044	0.89	1.12
J	0.003	0.007	0.085	0.18
K	0.015	0.02	0.37	0.51

■TO-92 PACKAGE DIMENSIONS



Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	.175	.185	4.45	4.70
B	.175	.185	4.45	4.70
C	.500	-----	12.70	-----
D	.016	.020	0.41	0.63
E	.135	.145	3.43	3.68
G	.095	.105	2.42	2.67