

Three Terminal Regulator

Features

- Programmable Output Voltage to 36V
- Voltage Reference Tolerance: $\pm 0.2\%$ (Typ.)@ 25°C (TL431D)
- Sink Current Capability of 1.0 mA to 100 mA
- Low Dynamic Output Impedance, 0.27 Ω Typical
- Wide Operating Range of -20 to 85°C
- Pb-Free, Halogen-Free/BFR-Free, Compliant with RoHS
- Low Output Noise Voltage

Applications

- Adjustable Voltage and Current References
- Voltage monitoring
- Replacement of Zener Diode
- Comparator with Integrated Reference

General Description

The TL431 is three-terminal adjustable regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{REF} (approximately 2.495V) and 36V with two external resistors. These devices have provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

Reference News

MARKING:

TL431:431

TL431A:431

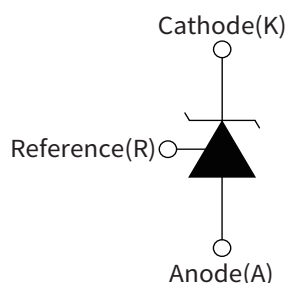
TL431B:431

TL431C:431

TL431D:431

TL431E:431

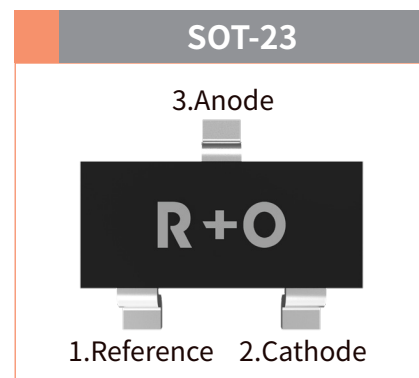
Schematic Diagram



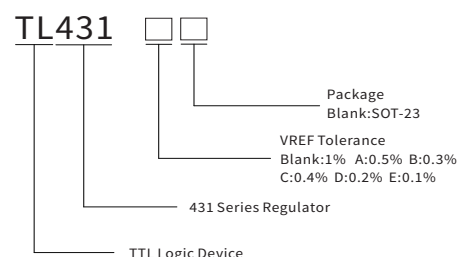
Ordering Information

Order Number	Package	Package Code	Unit Weight(g)	Reel(pcs)	Box(pcs)	Carton(pcs)	Delivery Mode	MSL
TL431 Series	SOT-23	R1	0.008	3000	30000	180000	7"	3

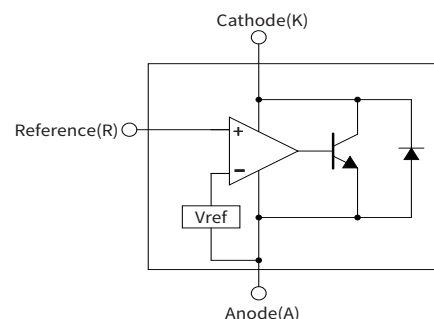
Output Voltage
36V(Max.)
Reference Voltage
Tolerance(Min.)
0.1%



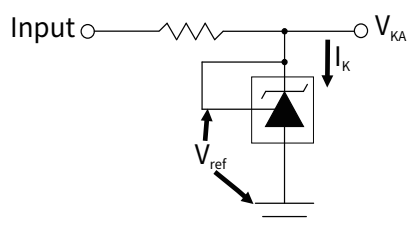
Part Numbering



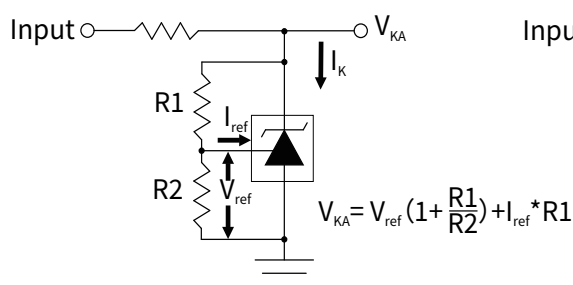
Functional Block Diagram



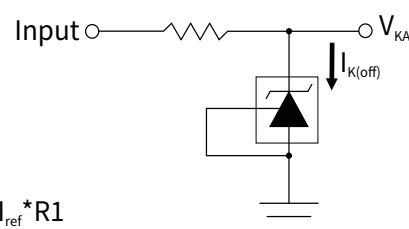
Typical Application Circuit



Test Circuit
for $V_{KA} = V_{ref}$



Test Circuit
for $V_{KA} > V_{ref}$



Test Circuit
for $I_{K(off)}$

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

Parameter	Symbol	Value	Unit
Cathode to Anode Voltage	V_{KA}	40	V
Cathode Current Range	I_K	-100 to +150	mA
Reference Input Current Range	I_{REF}	-0.05 to +10	mA
Power Dissipation	P_D	200	mW
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	625	$^\circ\text{C}/\text{W}$
Solder Temperature	T_d	260/10	$^\circ\text{C}/\text{S}$
Operating Ambient Temperature	T_{op}	-20 to +85	$^\circ\text{C}$
Junction and Storage Temperature	T_j, T_{stg}	-40 to +125	$^\circ\text{C}$

Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

Electrical Characteristics ($V_{KA} = V_{REF}$, $I_{KA} = 10\text{mA}$, $T_A = 25^\circ\text{C}$ Unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Reference Input Voltage	0.1%	$V_{KA}=V_{REF}$ $I_{KA}=10\text{mA}$	2.493	2.495	2.492	V
			2.490	2.495	2.500	
			2.488	2.495	2.502	
			2.485	2.495	2.505	
			2.483	2.495	2.507	
			2.470	2.495	2.520	
Deviation Of reference Input Voltage Over temperature	$\Delta V_{REF} / \Delta T$	$V_{KA}=V_{REF}, I_{KA}=10\text{mA}$ -20~+85 $^\circ\text{C}$	—	3	17	mV
Ratio Of Change In Reference Input Voltage Change In Cathode Voltage	$\Delta V_{REF} / \Delta V_{KA}$	$I_{KA}=10\text{mA}$, $\Delta V_{KA}=10\text{V} \sim V_{REF}$	-0.4	0	2.7	mV/V
		$\Delta V_{KA}=36\text{V} \sim 10\text{V}$	-0.4	0	2.0	
Reference Input Current	I_{REF}	$I_{KA}=10\text{mA}$ $R1=10\text{k}\Omega, R2=\infty$	—	1.8	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF} / \Delta T$	$I_{KA}=10\text{mA}$, $R1=10\text{k}\Omega, R2=\infty$ $T_A=-20 \sim +85^\circ\text{C}$	—	0.4	1.2	μA
Minimum Cathode Current For Regulation	$I_{KA}(\text{MIN})$	$V_{KA}=V_{REF}$	—	0.25	0.5	mA
Off-state Cathode Current	$I_{KA}(\text{OFF})$	$V_{KA}=40\text{V}, V_{REF}=0\text{V}$	—	0.17	1.0	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}, I_{KA}=1 \sim 100\text{mA}$ $f \leq 1\text{kHz}$	—	0.27	0.5	Ω

● Ratings And Characteristics Curves ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

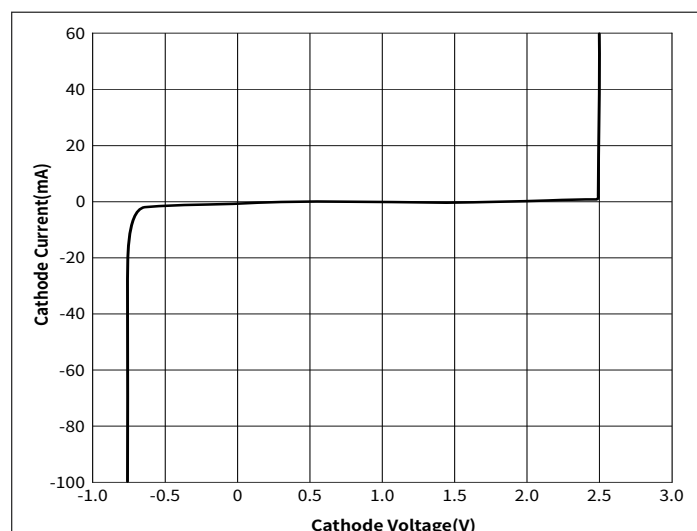


Fig.1 Cathode Current vs. Cathode Voltage

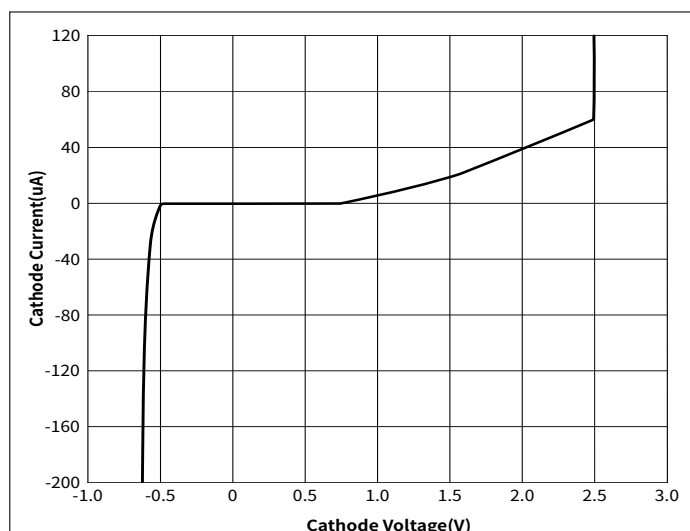


Fig.2 Cathode Current vs. Cathode Voltage

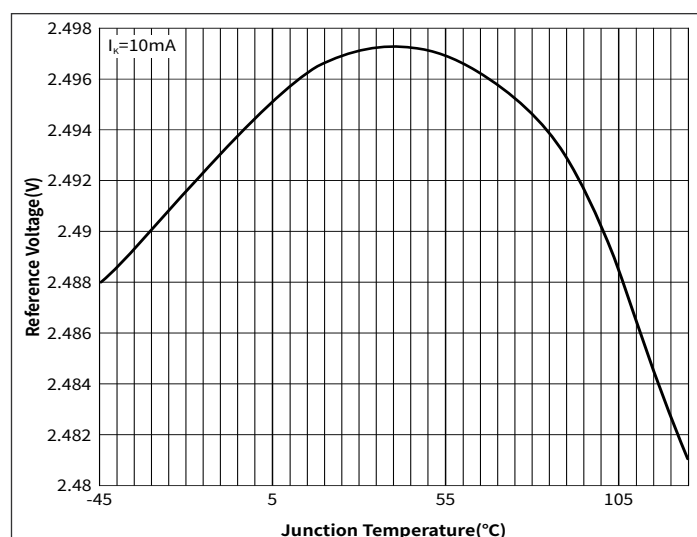


Fig.3 Reference Voltage vs. Junction Temperature

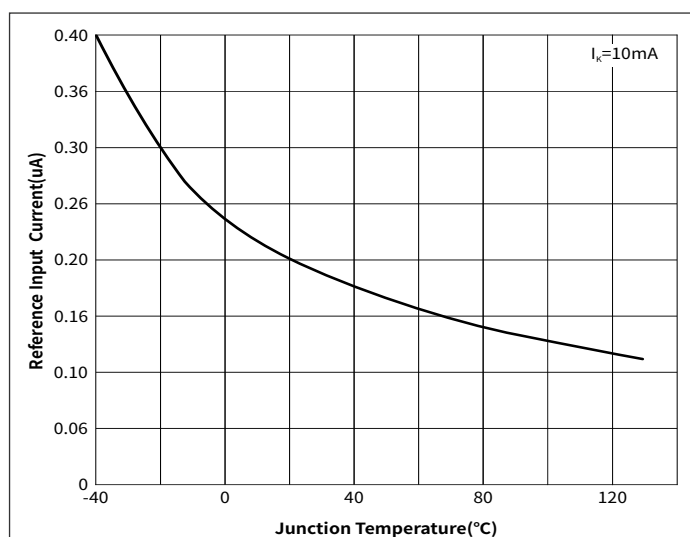


Fig.4 Reference Input Current vs. Junction Temperature

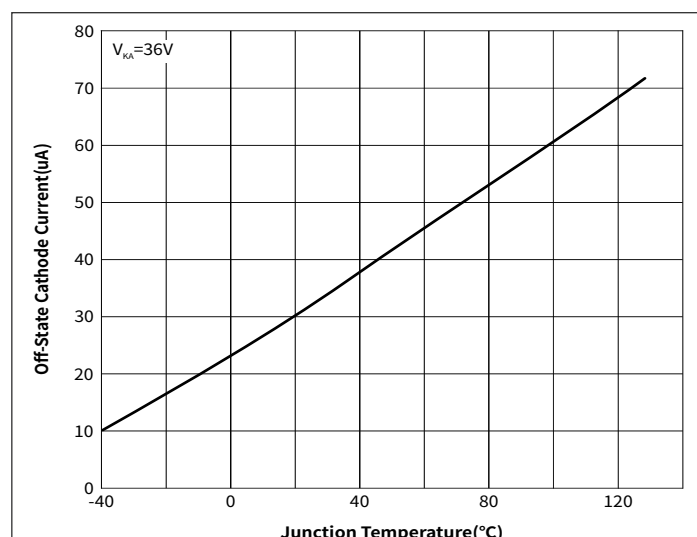


Fig.5 Off-State Cathode Current vs. Junction Temperature

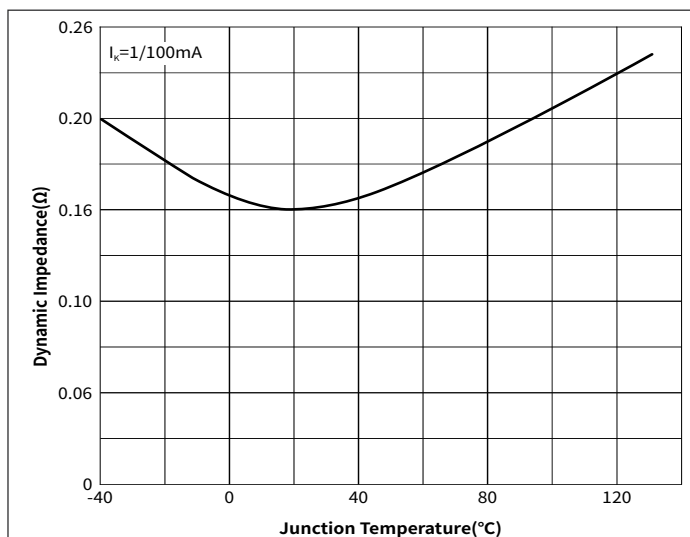


Fig.6 Dynamic Impedance vs. Junction Temperature

● Package Outline Dimensions (SOT-23)

Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.15	0.035	0.045
A1	-	0.10	-	0.004
A2	0.90	1.05	0.035	0.041
b	0.30	0.50	0.012	0.020
c	0.10	0.20	0.004	0.008
D	2.80	3.00	0.110	0.118
E	1.20	1.40	0.047	0.055
E1	2.25	2.55	0.089	0.100
e	0.950TYP		0.037TYP	
e1	1.80	2.00	0.071	0.079
L	0.550REF		0.022REF	
L1	0.30	0.50	0.012	0.020
θ	-	8°	-	8°

● Suggested Pad Layout

Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
J	0.80	-	0.031	-
K	-	0.90	-	0.035
M	2.00	-	0.078	-
N	-	1.90	-	0.074