

Description

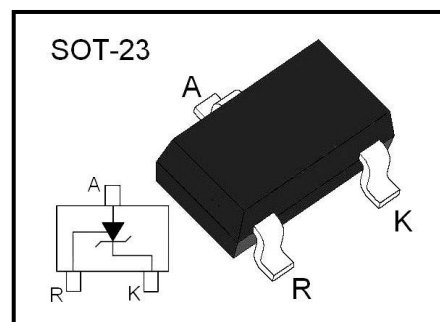
The TL431 is a programmable shunt voltage reference with guaranteed temperature stability over the entire temperature range of operation.

The output voltage may be set to any value between 2.5V and 36V with two external resistors.

The TL431 operates with a wide current range from 1 to 100mA with a typical dynamic impedance of 0.22Ω.

Features

- Adjustable Output Voltage: 2.5 to 36V
- Sink Current Capability: 1 to 100mA
- Typical Output Impedance: 0.22Ω
- 0.5% ,1% And 2% Voltage Precision



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Cathode to Anode Voltage	V_{KA}	37	V
Continuous Cathode Current Range	I_K	-100 to +150	mA
Reference Input Current Range	I_{ref}	-0.05 to +10	μA
Power Dissipation	P_D	300	mW
Storage Temperature Range	T_{STG}	-55 ~ + 150	°C

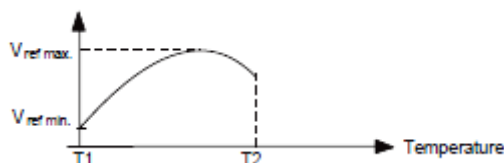
Electrical Characteristics $T_{amb} = 25^{\circ}\text{C}$ (unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reference Input Voltage	V_{REF}	$V_{KA} = V_{REF}, I_K = 10\text{mA}$ $T_A = 25^{\circ}\text{C}$	2.440	2.495	2.550	V
Reference Input Voltage Deviation Over-Temperature Range - note 1	$\frac{\Delta V_{REF}}{\Delta T}$	$V_{KA} = V_{REF}, I_K = 10\text{mA}$, $T_{MIN} \leq T_A \leq T_{MAX}$		4.5	17	mV
Ratio of Change in Reference Input Voltage to Change in Cathode to Anode Voltage - (figure 2)	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_K = 10\text{mA}$, $\Delta V_{KA} = 10\text{V to } V_{REF}$		-1.4	-2.7	mV/V
		$\Delta V_{KA} = 36\text{V to } 10\text{V}$		-1.5	-2.0	
Reference Input Current	I_{REF}	$I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$		1.8	4	μA
Reference Input Current Deviation Over Temperature Range	$\frac{\Delta I_{REF}}{\Delta T}$	$I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$ $T_A = \text{full range}$		0.4	1.2	μA
Minimum Cathode Current for Regulation	I_{MIN}	$V_{KA} = V_{REF}$		0.5	1.0	mA
Off-State Cathode Current	$I_{KA(off)}$	$V_{KA} = 36\text{V}, V_{REF} = 0$		0.05	1.0	μA
Dynamic Impedance - note 2	$ Z_{KA} $	$V_{KA} = V_{REF}, I_K = 1 \text{ to } 100\text{mA}$, $f \leq 1\text{kHz}$		0.20	0.5	Ω

Notes:

1) ΔV_{ref} is defined as the difference between the maximum and minimum values obtained over the full temperature range.

$\Delta V_{ref} = V_{ref \text{ max.}} - V_{ref \text{ min.}}$



2) The dynamic Impedance is defined as $|Z_{KA}| = \Delta V_{KA} / \Delta I_K$

Test Circuits

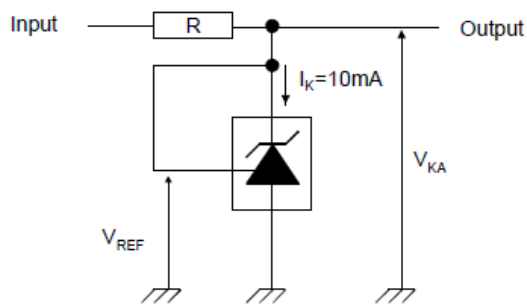
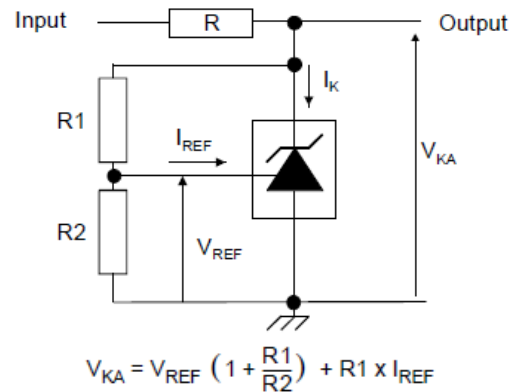
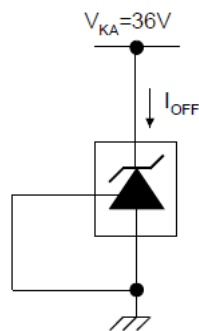
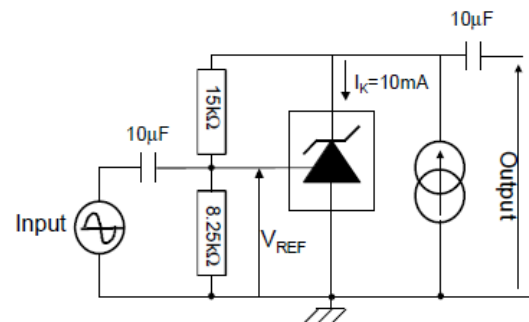
Figure 1 : Test Circuit for $V_{KA} = V_{REF}$ Figure 2 : Test Circuit for $V_{KA} > V_{REF}$ Figure 3 : Test Circuit for I_{OFF} 

Figure 4 : Test Circuit for Phase Margin and Voltage Gain

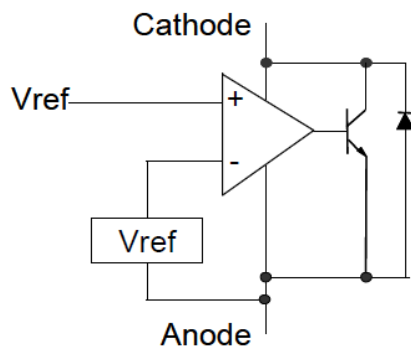


Figure 5 : Block diagram of TL431

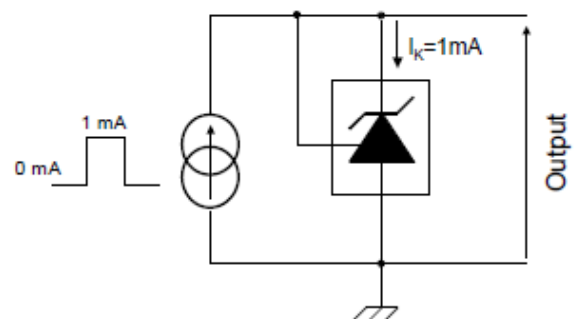


Figure 6 : Test Circuit for Response time

Typical Characteristics

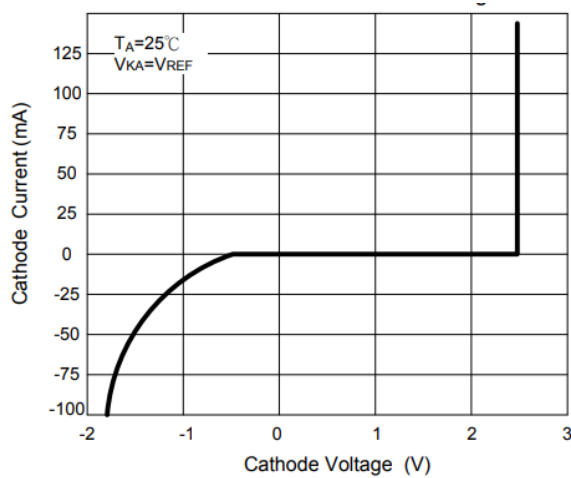


Figure 7. Cathode Current vs. Cathode Voltage

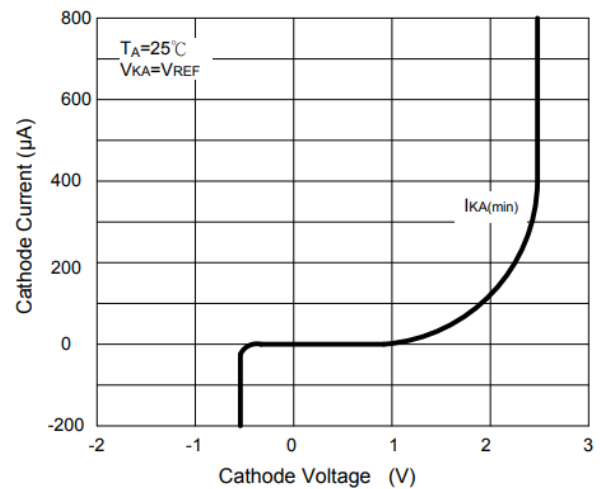


Figure 8. Cathode Current vs. Cathode Voltage

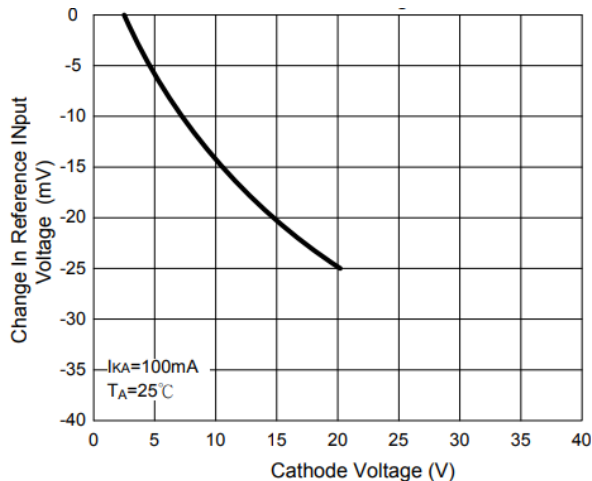


Figure 9. Change In Reference Input Voltage vs. Cathode Voltage

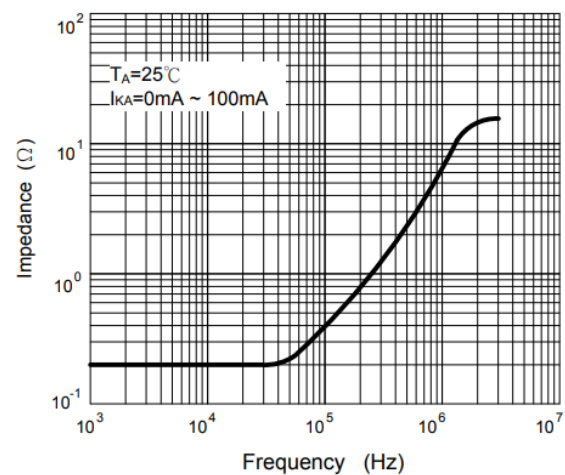


Figure 10. Dynamic Impedance Frequency

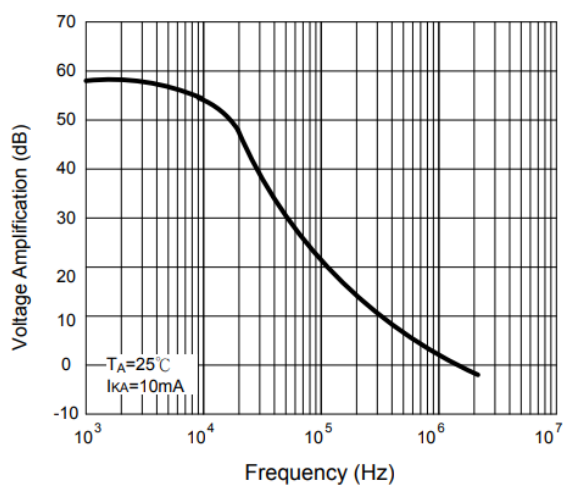


Figure 11. Small Signal Voltage Amplification vs. Frequency

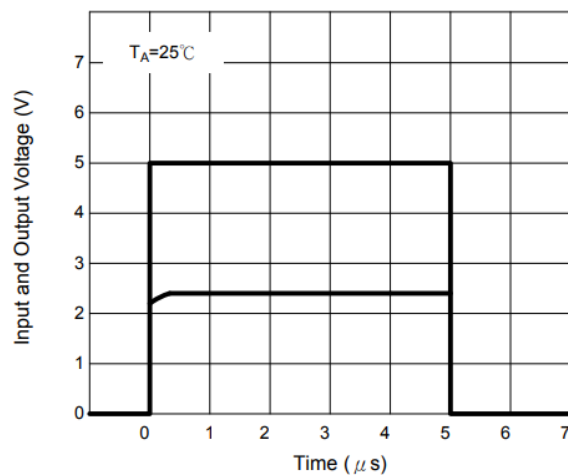
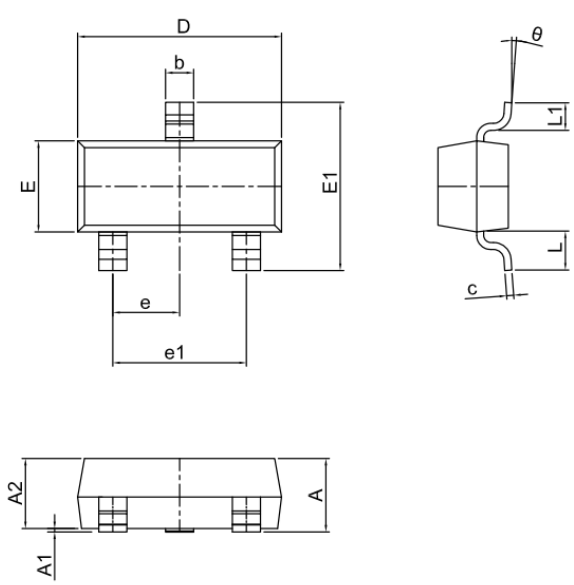


Figure 12. Pulse Response

Package Dimensions

 Dim	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.15	0.035	0.045
A1	0.00	0.10	0.000	0.004
A2	0.90	1.05	0.035	0.041
b	0.30	0.50	0.012	0.020
c	0.08	0.15	0.003	0.006
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	0.90	1.00	0.035	0.039
e1	1.80	2.00	0.071	0.079
L	0.50	0.60	0.020	0.024
L1	0.30	0.50	0.012	0.020