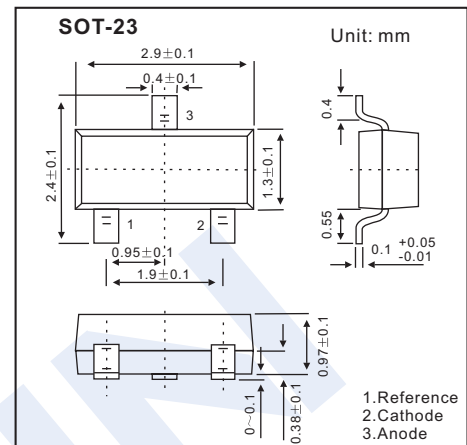


## Adjustable Accurate Reference Source

## TL431

## ■ Features

- The output voltage can be adjusted to 36V
- Low dynamic output impedance, its typical value is  $0.2\ \Omega$
- Trapping current capability is 1 to 100mA
- The typical value of the equivalent temperature factor in the whole temperature scope is  $50\ \text{ppm}/^\circ\text{C}$
- The effective temperature compensation in the working range of full temperature
- Low output noise voltage
- Fast on-state response



## ■ Absolute Maximum Ratings (Operating temperature range applies unless otherwise specified)

Parameter	Symbol	Rating	Unit
Cathode Voltage	$V_{KA}$	37	V
Cathode Current Range (Continuous)	$I_{KA}$	-100 ~ +150	mA
Reference Input Current Range	$I_{REF}$	0.05 ~ +10	mA
Power Dissipation	$P_D$	350	mW
Operating Temperature	$T_{OPR}$	-40 ~ 125	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 ~ +150	$^\circ\text{C}$

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

Parameter	Symbol	Testconditions	Min	Typ	Max	Unit
Reference Input Voltage	$V_{REF}$	$V_{KA} = V_{REF}$ , $I_{KA} = 10\text{mA}$	2.45	2.5	2.55	V
Deviation of Reference Input Voltage Over Temperature (*)	$\Delta V_{REF}/\Delta T$	$V_{KA} = V_{REF}$ , $I_{KA} = 10\text{mA}$ $T_{min} \leq T_a \leq T_{max}$		4.5	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	$I_{KA} = 10\text{mA}$ , $\Delta V_{KA} = 10\text{V} \sim V_{REF}$ $I_{KA} = 10\text{mA}$ , $\Delta V_{KA} = 36\text{V} \sim 10\text{V}$		-1.0	-2.7	mV/V
Reference Input Current	$I_{REF}$	$I_{KA} = 10\text{mA}$ , $R_1 = 10\text{K}\ \Omega$ , $R_2 = \infty$		1.5	4	$\mu\text{A}$
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	$I_{KA} = 10\text{mA}$ , $R_1 = 10\text{K}\ \Omega$ , $R_2 = \infty$ $T_a = \text{Full Temperature}$		0.4	1.2	$\mu\text{A}$
Minimum Cathode Current for Regulation	$I_{KA(min)}$	$V_{KA} = V_{REF}$		0.45	1.0	mA
Off-state Cathode Current	$I_{KA(OFF)}$	$V_{KA} = 36\text{V}$ , $V_{REF} = 0$		0.05	1.0	$\mu\text{A}$
Dynamic Impedance	$Z_{KA}$	$V_{KA} = V_{REF}$ , $I_{KA} = 1\text{ to }100\text{mA}$ , $f \leq 1.0\text{KHz}$		0.15	0.5	$\Omega$

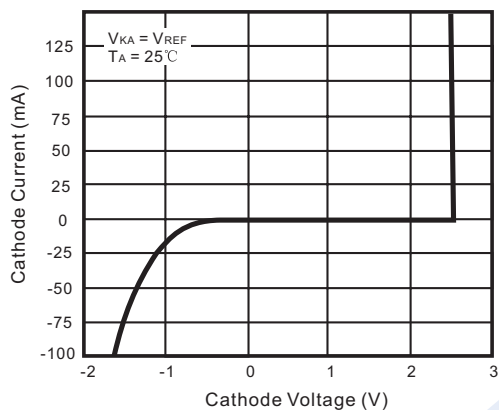
\*  $T_{MIN} = -40^\circ\text{C}$ ,  $T_{MAX} = +125^\circ\text{C}$

# TL431

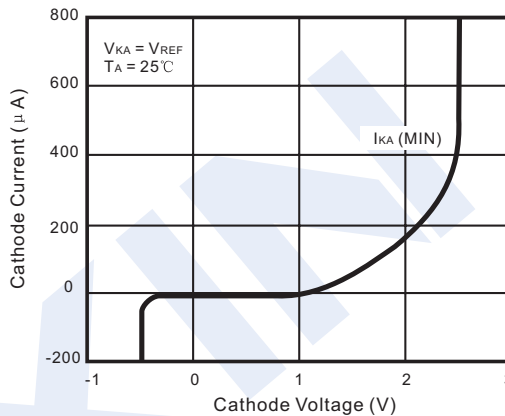
## Classification Of VREF

Rank	0.5%	1%	2%
Range	2.487 ~ 2.512	2.475 ~ 2.525	2.450 ~ 2.550

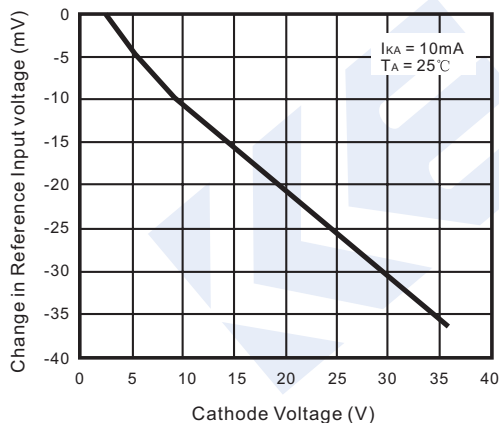
## Typical Characteristics



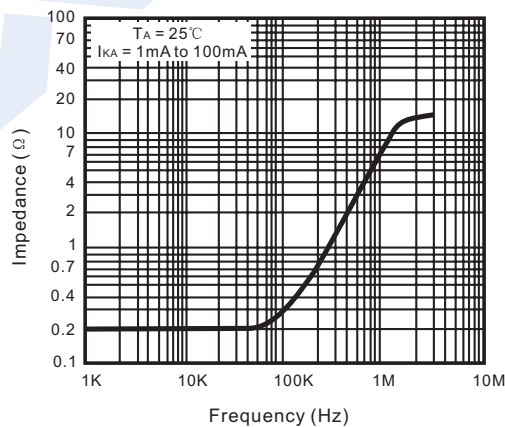
Cathode Current vs. Cathode Voltage



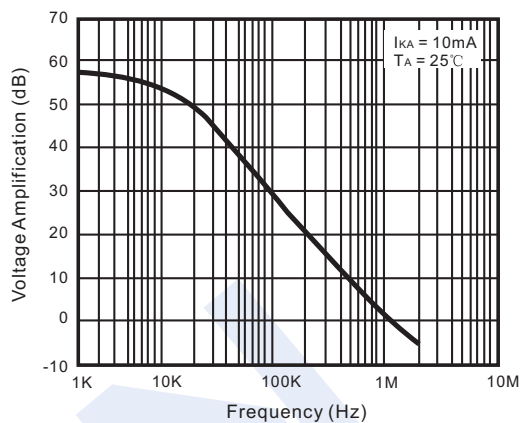
Cathode Current vs. Cathode Voltage



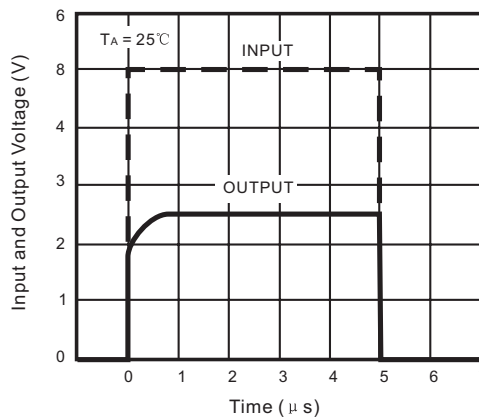
Change in Reference Input Voltage vs. Cathode Voltage



Dynamic Impedance Frequency



Small Signal Voltage Amplification vs. Frequency



Pulse Response