

## DESCRIPTION

The TL431 are three-terminal adjustable shunt regulators with specified thermal stability. The output voltage may be set to any value between  $V_{ref}$  and 36V with two external resistors. Active output circuitry provides a very sharp turnon characteristic, making these devices excellent replacements for zener diodes in many applications.

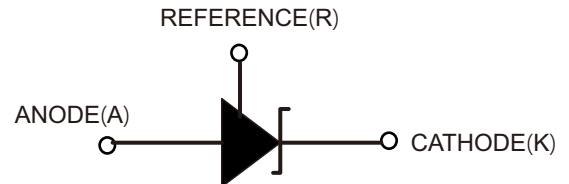
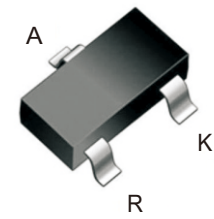
## Features

- The output voltage can be adjusted 2.5V to 36V
- The TL431 precision reference is offered in two voltage tolerance: 0.4% and 0.8%.
- Fast turn-on response
- Sink current capability 1mA to 100mA
- Low output noise
- Industrial temperature range

## Application

- Shunt regulator
- High-current shunt regulator
- Precision current limiter

SOT-23



## Absolute Maximum Ratings (Note 1)

Symbol	Parameter		Rating	Unit
$V_{KA}$	Cathode Voltage		40	V
$I_{KA}$	Cathode Current Range (Continuous)		-100 to 150	mA
$I_{REF}$	Reference Input Current Range		10	mA
$P_D$	Power Dissipation		Z, R Package: 770	mW
			N Package: 370	
$\theta_{JA}$	Thermal Resistance (Junction to Ambient)	SOT-23	380	$^{\circ}\text{C}/\text{W}$
$T_J$	Junction Temperature		+150	$^{\circ}\text{C}$
$T_{STG}$	Storage Temperature Range		-65 to +150	$^{\circ}\text{C}$
ESD	ESD (Human Body Model)		2000	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
$V_{KA}$	Cathode Voltage	$V_{REF}$	36	V
$I_{KA}$	Cathode Current	1.0	100	mA
$T_A$	Operating Ambient Temperature Range	-40	+125	°C

## Electrical Characteristics (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{REF}$	Reference Voltage	JTL431A 0.4%	$V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$	2.490	2.500	2.510	V
		JTL431B 0.8%		2.480	2.500	2.520	
$\Delta V_{REF}$	Deviation of Reference Voltage Over Full Temperature Range	$V_{KA} = V_{REF}$ $I_{KA} = 10\text{mA}$	0 to +70°C	—	4.5	8	mV
			-40 to +85°C	—	4.5	10	
			-40 to +125°C	—	4.5	16	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in Reference Voltage to the Change in Cathode Voltage	$I_{KA} = 10\text{mA}$	$\Delta V_{KA} = 10\text{V to } V_{REF}$	—	-1.0	-2.7	mV/V
			$\Delta V_{KA} = 36\text{V to } 10\text{V}$	—	-0.5	-2.0	
$I_{REF}$	Reference Current	$I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty$	—	0.7	4	$\mu\text{A}$	
$\Delta I_{REF}$	Deviation of Reference Current Over Full Temperature Range	$I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty, T_A = -40 \text{ to } +125^\circ\text{C}$	—	0.4	1.2	$\mu\text{A}$	
$I_{KA}(\text{Min})$	Minimum Cathode Current for Regulation	$V_{KA} = V_{REF}$	—	0.4	1.0	mA	
$I_{KA}(\text{Off})$	Off-state Cathode Current	$V_{KA} = 36\text{V}, V_{REF} = 0$	—	0.05	1.0	$\mu\text{A}$	
$Z_{KA}$	Dynamic Impedance	$V_{KA} = V_{REF}, I_{KA} = 1 \text{ to } 100\text{mA}, f \leq 1.0\text{kHz}$	—	0.15	0.5	$\Omega$	
$\theta_{JC}$	Thermal Resistance	SOT23	—	135.48	—	°C/W	

FIGURE 1. TEST CIRCUIT FOR  $V_{KA} = V_{REF}$

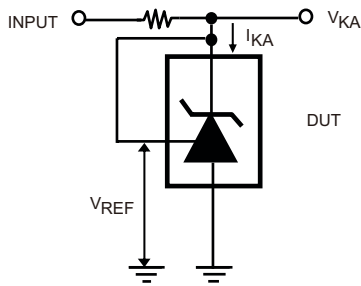


FIGURE 2. TEST CIRCUIT FOR  $V_{KA} \geq V_{REF}$

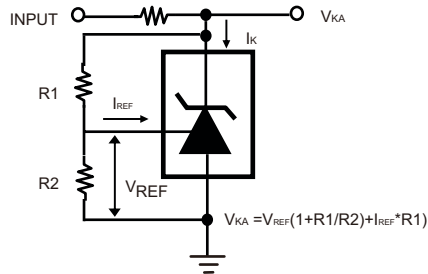


FIGURE 3. TEST CIRCUIT FOR  $I_{KA}$  (OFF)

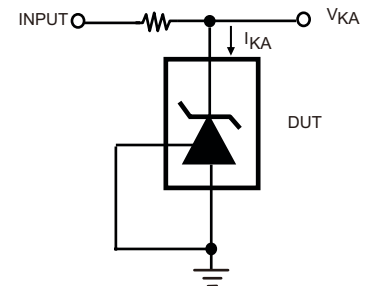


FIGURE 4. TEST CIRCUIT FOR PULSE RESPONSE

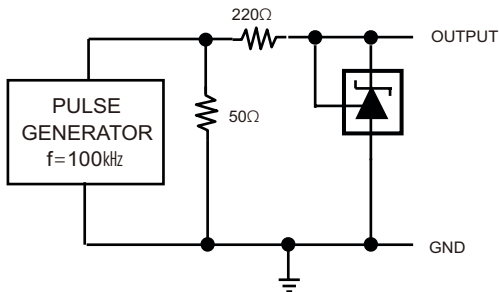
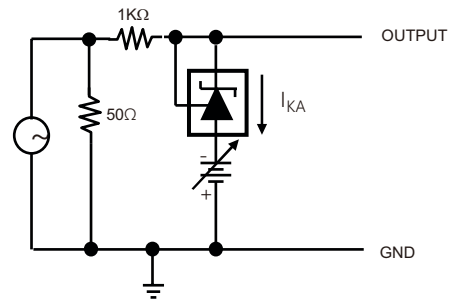
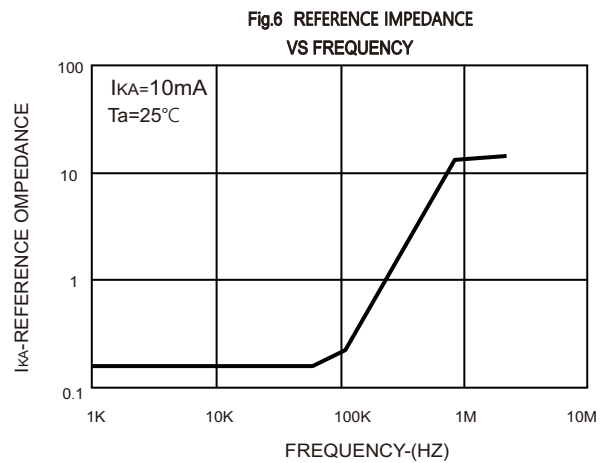
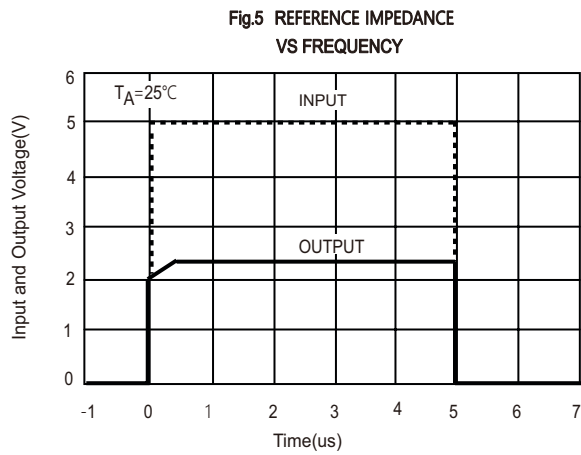
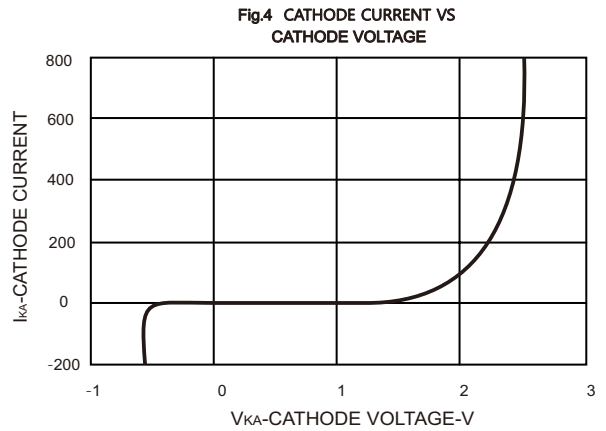
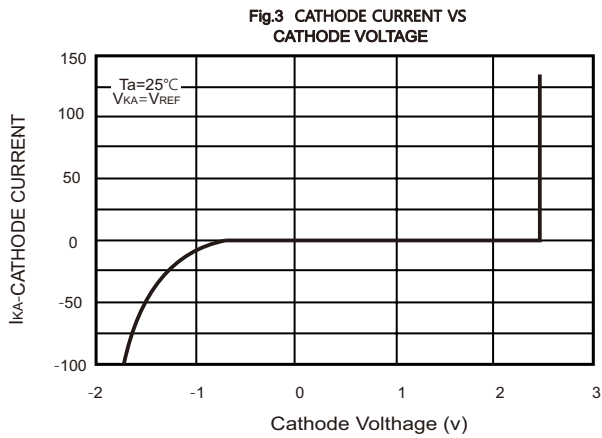
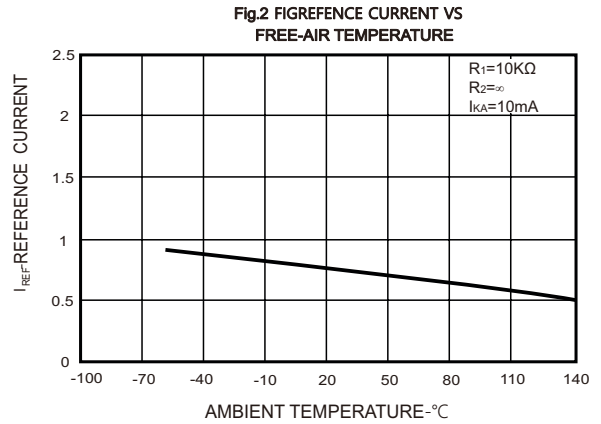
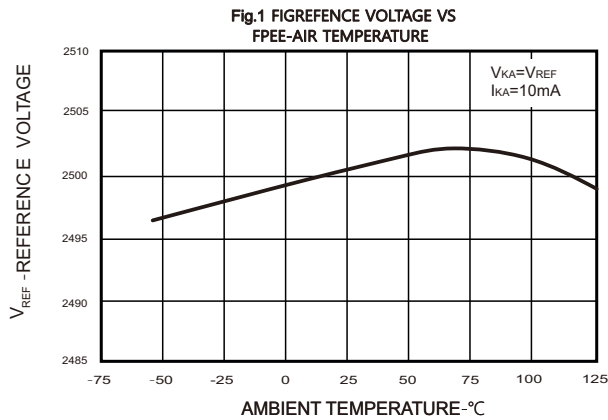


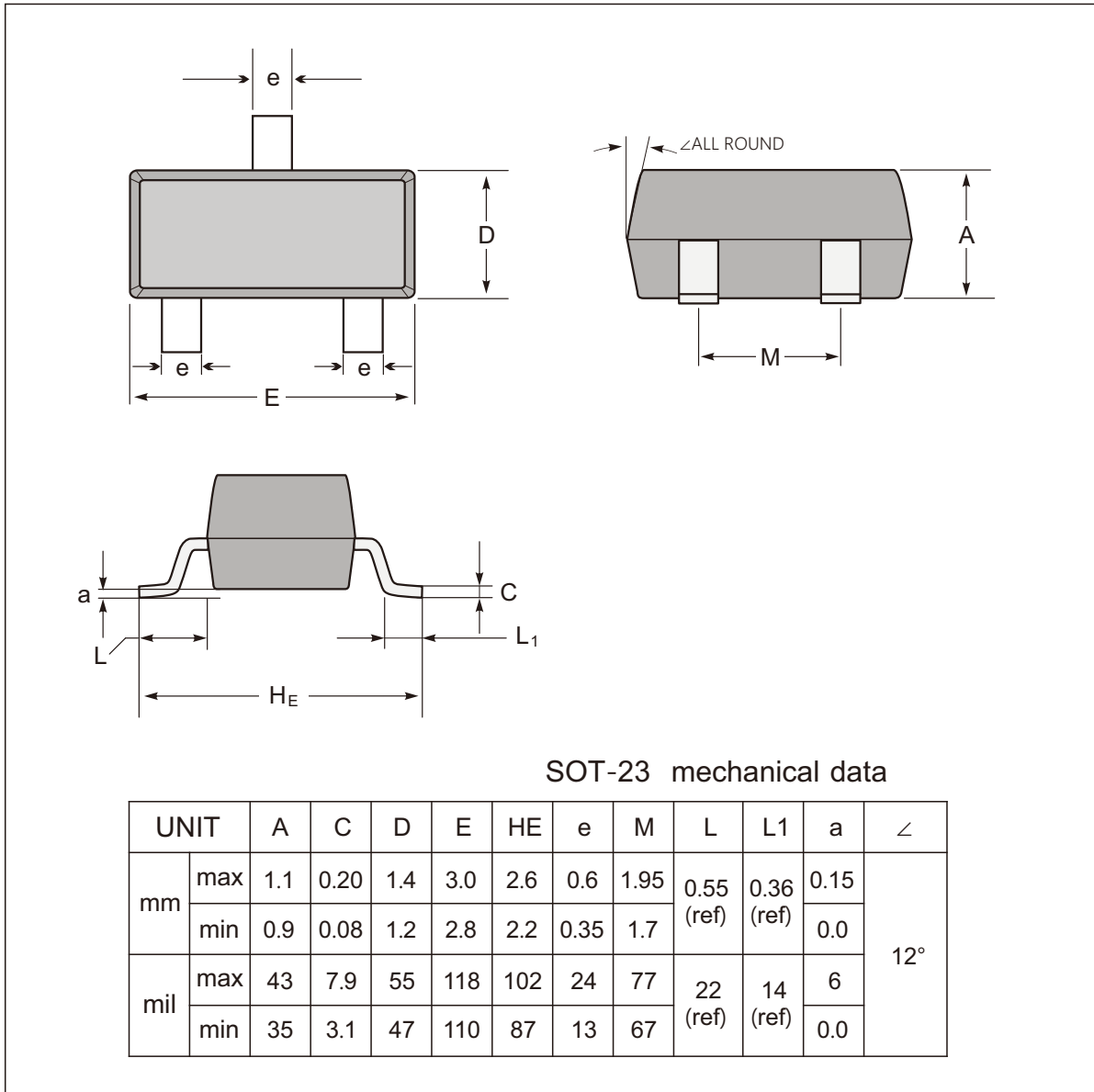
FIGURE 5. TEST CIRCUIT REFERENCE IMPEDANCE



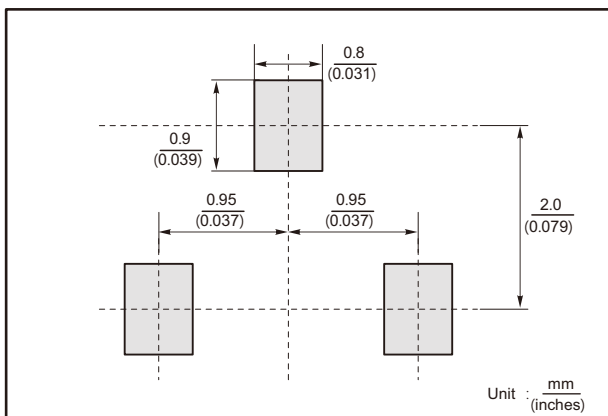
## Typical Characteristics



## SOT-23 Package Outline Dimensions



### The recommended mounting pad size



### Marking

Type number	Marking code
TL431	431