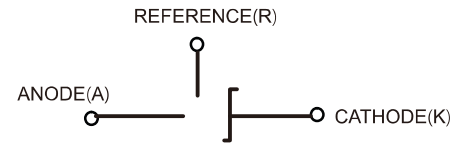


Description

◆The TL431/TL431S 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 turn-on characteristic, making these devices excellent replacements for zener diodes in many applications.

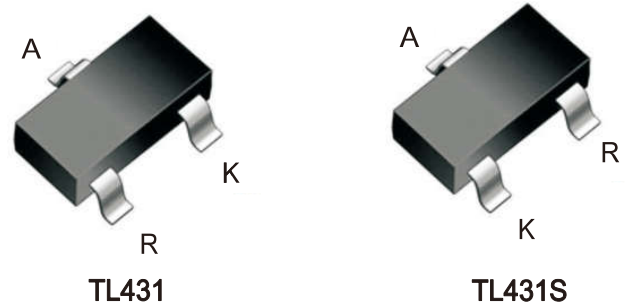


Features

- ◆The output voltage can be adjusted 2.5V to 36V
- ◆The TL431/TL431S precision reference is offered in two voltage tolerance: 0.4% and 0.8%.
- ◆Fast turn-on response
- ◆Sink current capability 1mA to 100mA
- ◆ Industrial temperature range
- ◆Low output noise

Application

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



SOT-23

Marking Code	
TL431A	431A
TL431B	431B
TL431SA	431SA
TL431SB	431SB

Absolute Maximum Ratings (Note 1)

Parameter	Symbols	Rating	Units
Cathode Voltage	V_{KA}	40	V
Cathode Current Range (Continuous)	I_{KA}	-100 ~ +150	mA
Reference Input Current Range	I_{REF}	10	mA
Power Dissipation	P_D	Z, R Package: 770	mW
		N Package: 370	
Thermal Resistance (Junction to Ambient)	θ_{JA}	380	°C/W
Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
ESD (Human Body Model)	ESD	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

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

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

Parameter		Conditions	Symbol	Min	Typ	Max	Unit				
Reference Voltage	0.4%	TL431A	$V_{KA} = V_{REF}$ $I_{KA} = 10\text{mA}$	V_{REF}	2.49	2.50	2.51	V			
		TL431SA									
	0.8%	TL431B							2.48	2.50	2.52
		TL431SB									
Deviation of Reference Voltage Over Full Temperature Range		$V_{KA} = V_{REF}$ $I_{KA} = 10\text{mA}$	ΔV_{REF}	-	4.5	8	mV				
				-40 to +85°C	-	4.5		10			
				-40 to +125°C	-	4.5		16			
Ratio of Change in Reference Voltage to the Change in Cathode Voltage		$I_{KA} = 10\text{mA}$	ΔV_{REF} ΔV_{KA}	-	-1.0	-2.7	mV/V				
				$\Delta V_{KA} = 36\text{V to }10\text{V}$	-	-0.5		-2.0			
Reference Current		$I_{KA} = 10\text{mA}$, $R_1 = 10\text{k}\Omega$, $R_2 = \infty$	I_{REF}	-	0.7	4	μA				
Deviation of Reference Current Over Full Temperature Range		$I_{KA} = 10\text{mA}$, $R_1 = 10\text{k}\Omega$, $R_2 = \infty$, $T_A = -40$ to $+125^{\circ}\text{C}$	ΔI_{REF}	-	0.4	1.2	μA				
Minimum Cathode Current for Regulation		$V_{KA} = V_{REF}$	I_{KA} (Min)	-	0.4	1.0	mA				
Off-state Cathode Current		$V_{KA} = 36\text{V}$, $V_{REF} = 0$	I_{KA} (Off)	-	0.05	1.0	μA				
Dynamic Impedance		$V_{KA} = V_{REF}$, $I_{KA} = 1$ to 100mA , $f \leq 1.0\text{kHz}$	Z_{KA}	-	0.15	0.5	Ω				
Thermal Resistance		SOT-23	θ_{JC}	-	135.48	-	°C/W				

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

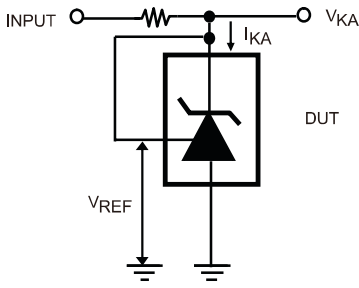


FIGURE 2. TEST CIRCUIT FOR $V_{KA} > V_{REF}$

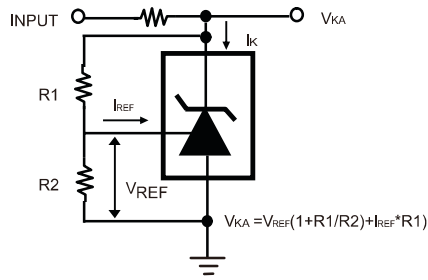


FIGURE 3. TEST CIRCUIT FOR I_{KA} (OFF)

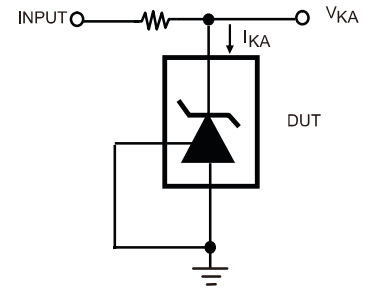


FIGURE 4. TEST CIRCUIT FOR PULSE RESPONSE

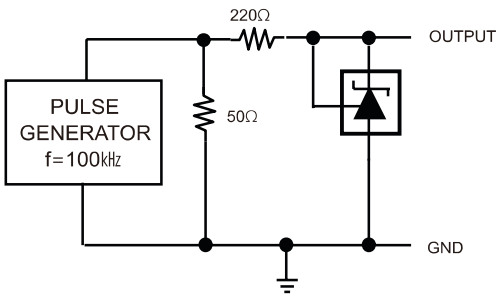
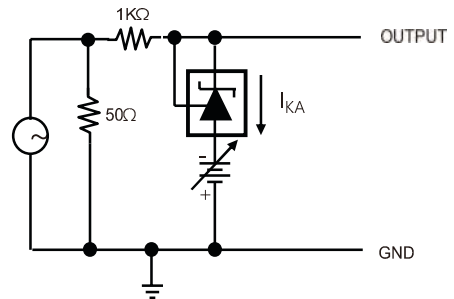
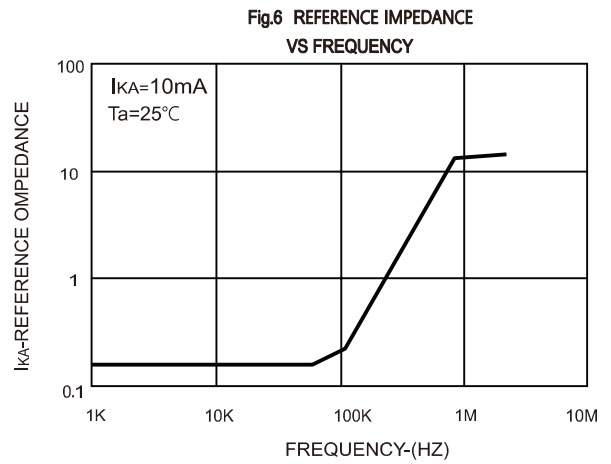
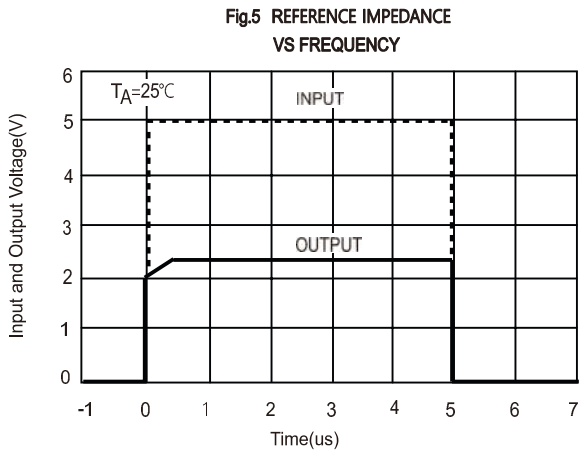
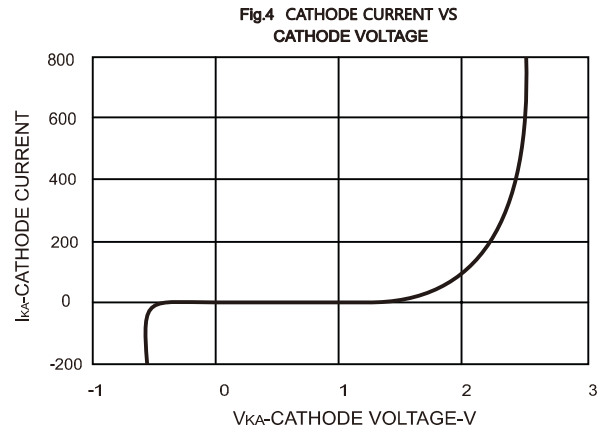
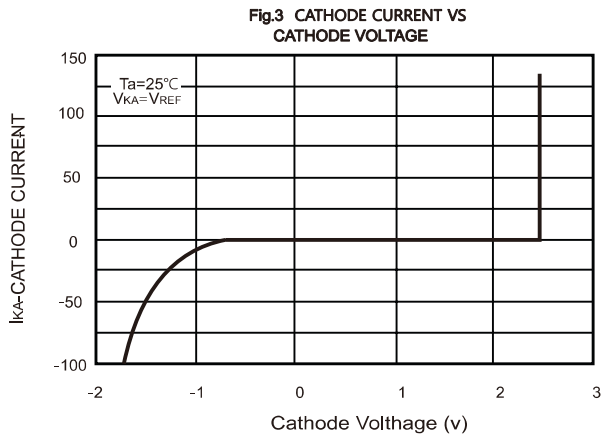
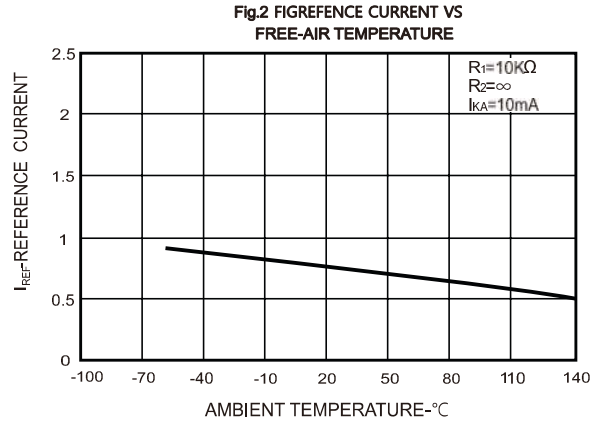
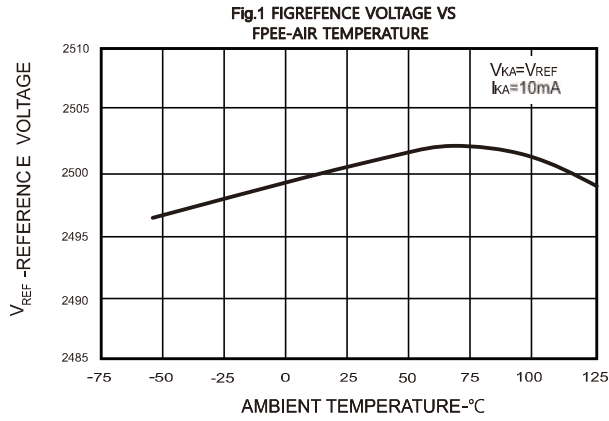


FIGURE 5. TEST CIRCUIT REFERENCE IMPEDANCE

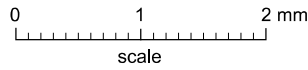
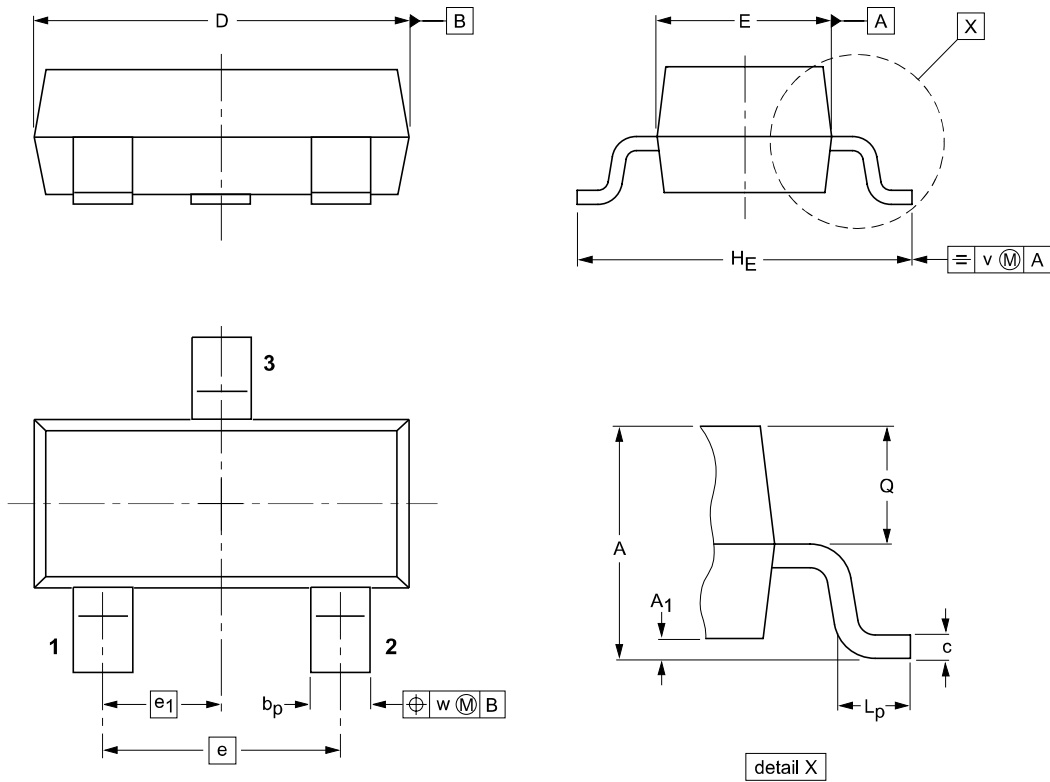


Typical Characteristics



Package Outline

SOT-23



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max.	b _p	c	D	E	e	e ₁	H _E	L _p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

Summary of Packing Options

Package	Packing Description	Packing Quantity	Industry Standard
SOT-23	Tape/Reel, 7" reel	3000	EIA-481-1