FEATURES

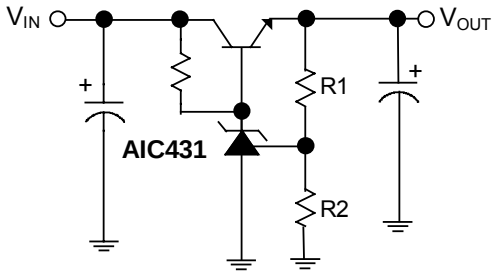
- Unconditionally Stable.
- Precision Reference Voltage.
  AIC431 :2.495V ±0.5%
  TL431A :2.495V ±1.0%
  TL431 :2.495V ±1.6%
- Sink Current Capability: 200mA.
- Minimum Cathode Current for Regulation: 250μA.
- Equivalent Full-Range Temperature Coefficient: 50 ppm/°C.
- Fast Turn-On Response.
- Low Dynamic Output Impedance: 0.08Ω.
- Adjustable Output Voltage.
- Low Output Noise.
- Space Saving SOT-89 and TO-92 packages.

DESCRIPTION

The AIC431/TL431A/TL431 are 3-terminal adjustable precision shunt regulators with guaranteed temperature stability over the applicable extended commercial temperature range. The output voltage may be set at any level greater than 2.495V (V_{REF}) up to 16V merely by selecting two external resistors that act as a voltage divider network. These devices have a typical output impedance of 0.08Ω. Active output circuitry provides a very sharp turn-on characteristics, making these devices excellent improved replacements for zener diodes in many applications.

The precise ±0.5% reference voltage tolerance of the AIC431 makes it possible in many applications to avoid the use of a variable resistor, consequently saving cost and eliminating drift and reliability problems associated with it.

TYPICAL APPLICATION CIRCUIT



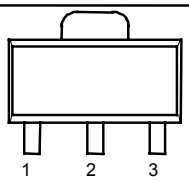
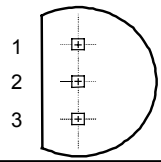
$V_{OUT}=(1+R1/R2)V_{REF}$

Precision Regulator

ORDERING INFORMATION

AIC431 XX
TL431A XX
TL431 XX

- PACKAGING TYPE
  X: SOT-89
  Z: TO-92
- TEMPERATURE RANGE
  C: 0°C~+70°C

ORDER NUMBER	PIN CONFIGURATION
AIC431CX TL431ACX TL431CX (SOT-89)	FRONT VIEW 1: VREF 2: ANODE 3: CATHODE 
AIC431CZ TL431ACZ TL431CZ (TO-92)	FRONT VIEW 1: VREF 2: ANODE 3: CATHODE 

■ ABSOLUTE MAXIMUM RATINGS

Cathode Voltage 16V

Continuous Cathode Current ..... -10mA ~ 250mA

Reference Input Current Range 10mA

Operating Temperature Range ..... -20°C ~ 85°C

Lead Temperature ..... 260°C

Storage Temperature ..... -65°C ~ 150°C

Power Dissipation **(Notes 1, 2)** SOT-89 Package 0. 80W

TO-92 Package 0.78W

Note 1: $T_{J,\,max}$ = 150°C.

Note 2: Ratings apply to ambient temperature at 25°C.

■ TEST CIRCUITS

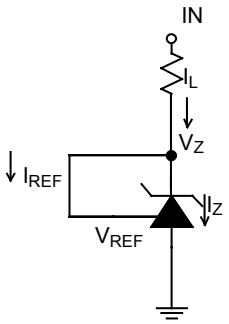
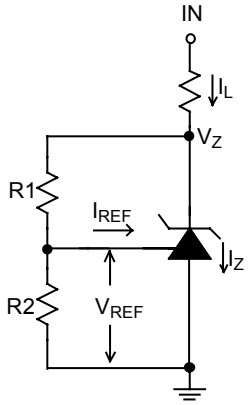


Fig. 1 Test Circuit for V_Z=V_{REF}



Note: V_Z=V_{REF}(1+R1/R2)+I_{REF}×R1

Fig. 2 Test circuit for V_Z>V_{REF}

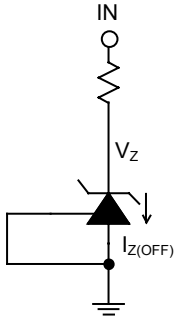


Fig. 3 Test circuit for off-state Current

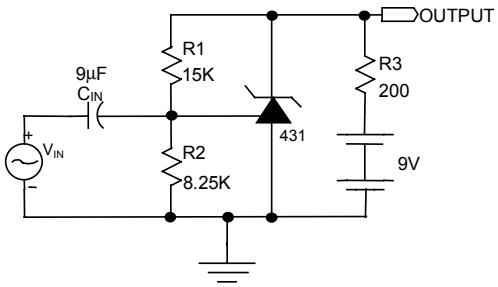


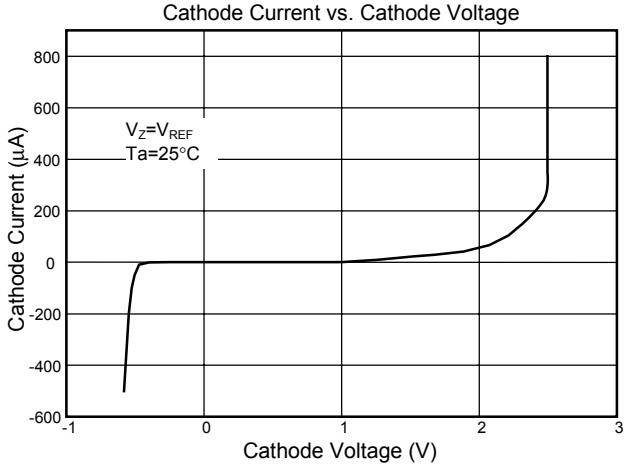
Fig. 4 Test Circuit for Frequency Response

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified.)

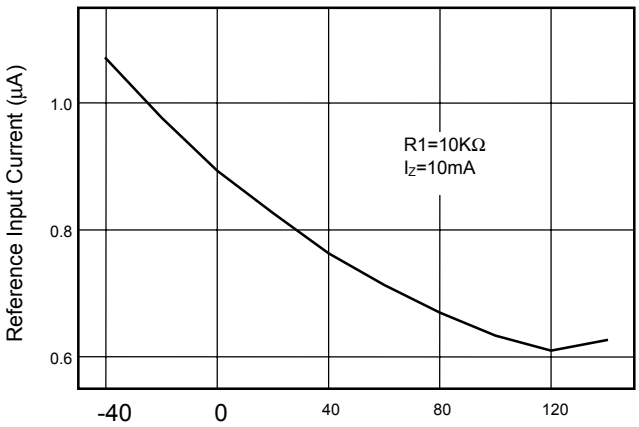
PARAMETER	TEST CONDITIONS		SYMBOL	MIN.	TYP.	MAX.	UNIT
Reference Voltage	$V_Z=V_{REF}$, I_L =10mA (Fig. 1)	AIC431	V_{REF}	2.482	2.495	2.508	V
		TL431A		2.470	2.495	2.520	V
		TL431		2.455	2.495	2.535	V
Deviation of Reference Input Voltage Over Temperature **(Note 3)**	$V_Z = V_{REF}$, I_L =10mA, Ta = 0°C~ +70°C (Fig. 1)		V_{DEV}		9.0	20	mV
Ratio of the Change in Reference Voltage to the Change in Cathode voltage	I_Z=10mA (Fig. 2)	$V_Z=V_{REF}$ ~ 10V	$\frac{\Delta V_{REF}}{\Delta V_Z}$		-0.5	-2.0	mV/V
		V_Z=10V ~ 25V			-0.35	-1.5	mV/V

TYPICAL PERFORMANCE CHARACTERISTICS

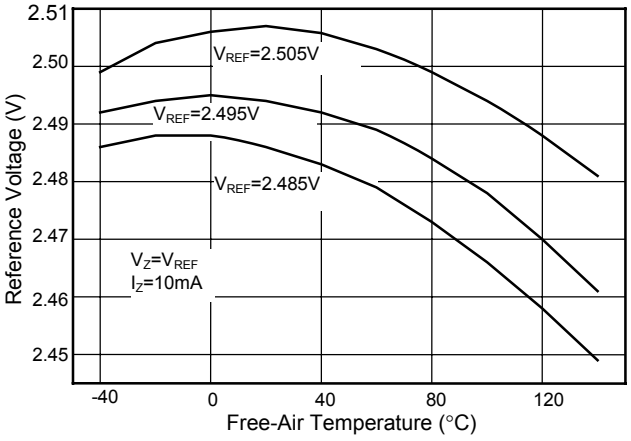
Cathode Current vs. Cathode Voltage



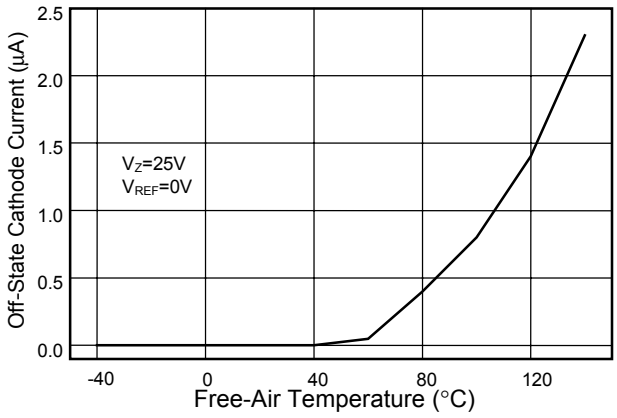
Reference Input Current vs. Free-Air Temperature



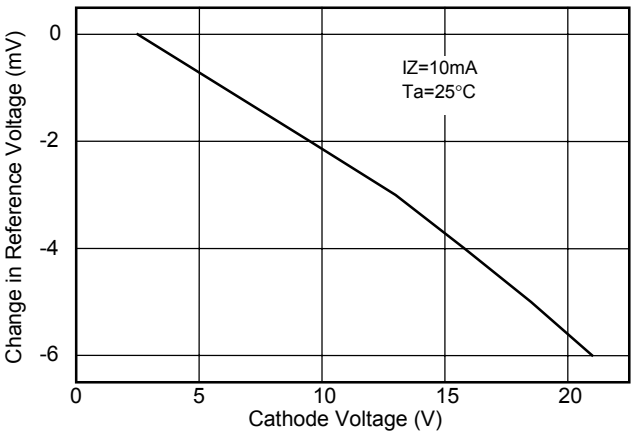
Reference Voltage vs. Temperature



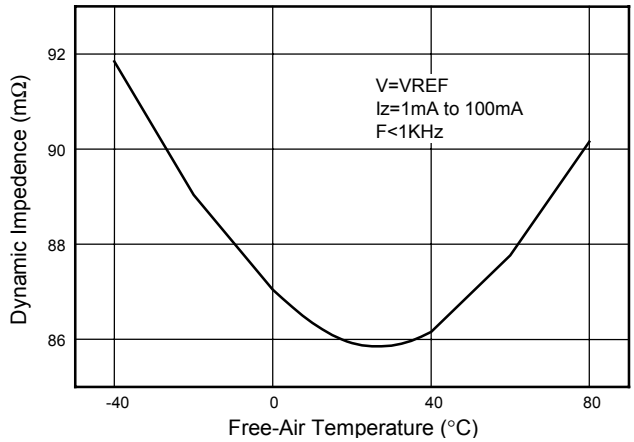
Off-State Cathode Current vs. Free-Air Temperature



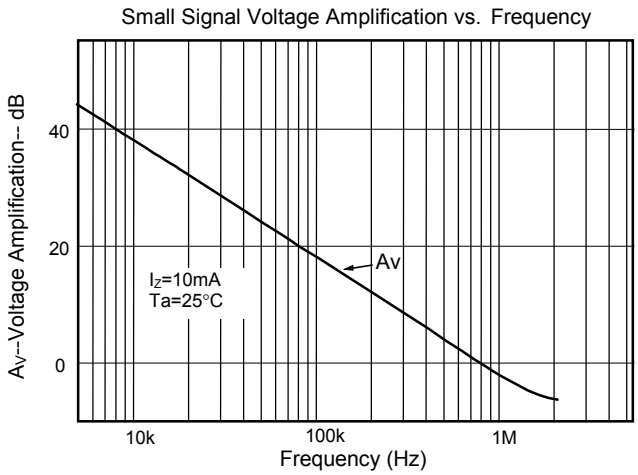
Change in Reference Voltage vs. Cathode Voltage

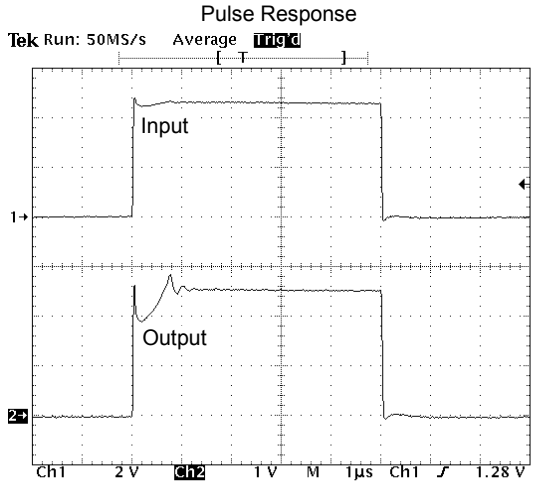


Dynamic Impedance vs. Free-Air Temperature

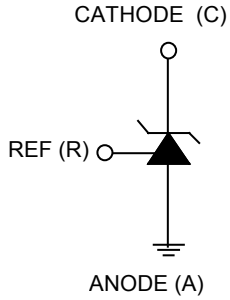


TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

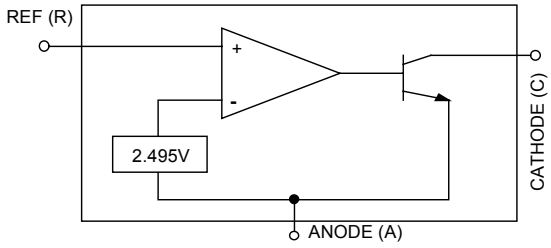




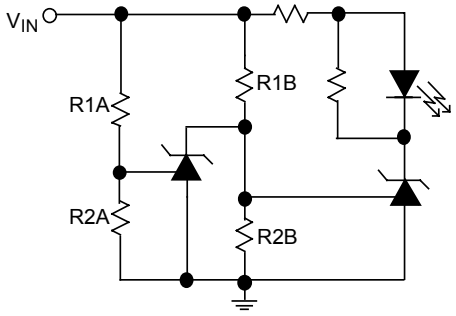
SYMBOL



BLOCK DIAGRAM



APPLICATION EXAMPLES

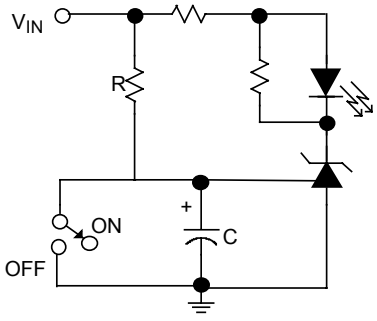


LED on when Low Limit<V_{IN}< High Limit

Low Limit ≅ V_{REF} (1+R1B/R2B)

High Limit ≅ V_{REF} (1+R1A/R2A)

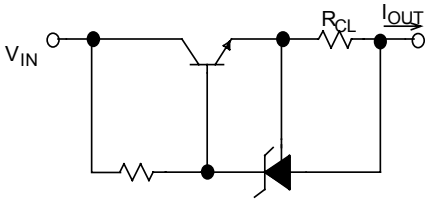
Fig. 4 Voltage Monitor



Delay=R × C × $n\left(\frac{V_{IN}}{V_{IN}-V_{REF}}\right)$

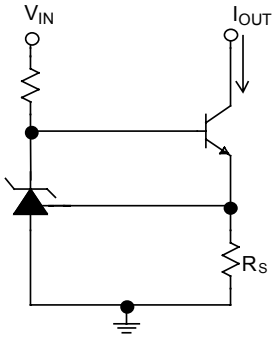
Fig. 5 Delay Timer

■ APPLICATION EXAMPLES (CONTINUED)



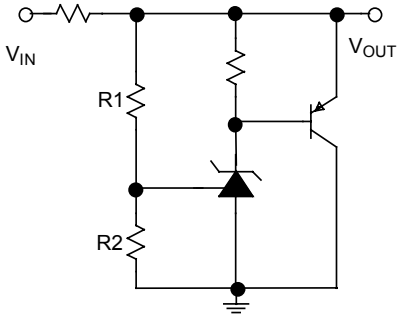
$I_{OUT}=V_{REF}/ R_{CL}$

Fig. 6 Current Limiter or Current Source



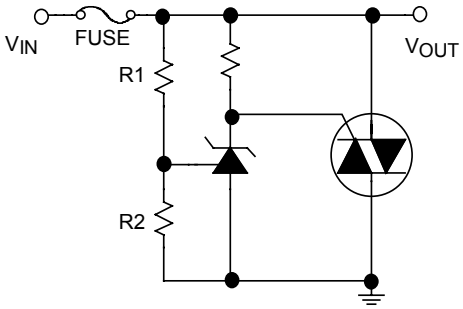
$I_{OUT}=V_{REF}/R_S$

Fig. 7 Constant-Current Sink



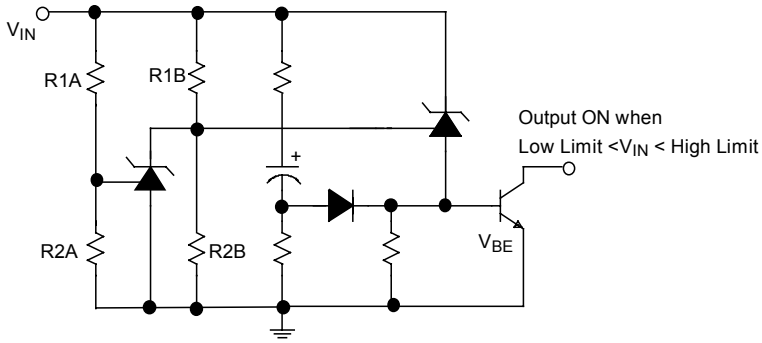
$V_{OUT} \cong (1+R1/R2) \times V_{REF}$

Fig 8. Higher-Current Shunt Regulator



$V_{LIMIT} \cong (1+R1/R2) \times V_{REF}$

Fig 9. Crow Bar

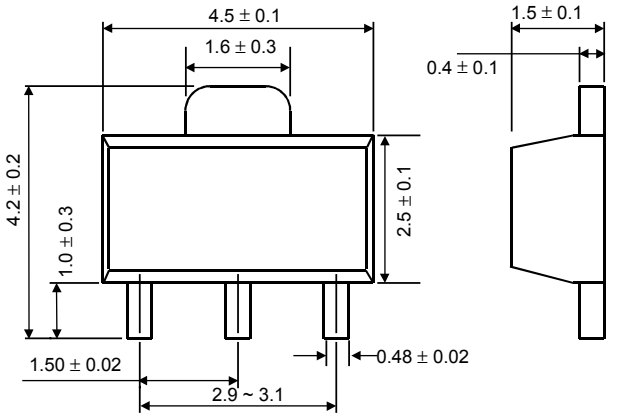


Low Limit $\cong V_{REF}$ (1+ R1B/ R2B)+ V_{BE}
High Limit $\cong V_{REF}$ (1+ R1A/ R2A)

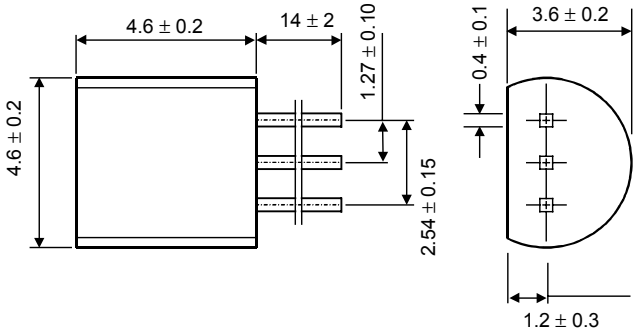
Fig 10. Over-Voltage/Under-Voltage Protection Circuit

PHYSICAL DIMENSIONS

- **SOT-89**



- **TO-92**



UNIT: mm

SOT-89 **MARKING**

Part No.	Marking
AIC431	AC01
TL431	AC02
TL431A	AC03

BONDING DIAGRAM