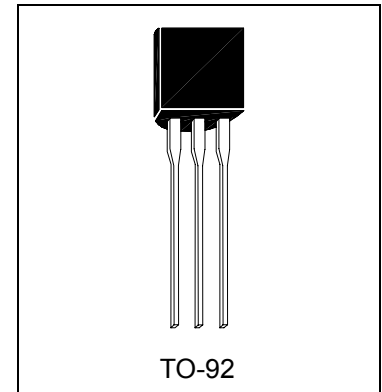


**Adjustable Precision Shunt Regulators**

# TL431XA3


**Description**

The TL431 series are three-terminal adjustable regulators with guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between  $V_{REF}$  (approximately 2.495 volts) and 36 volts with two external resistors. These devices have a typical dynamic output impedance of  $0.2\Omega$ . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

**Features**

- Programmable output voltage
- Temperature coefficient is 50ppm/°C typical
- Temperature compensated for operation over full temperature range
- Low output noise voltage
- Fast turn on response
- Pb-free package

**Classification**

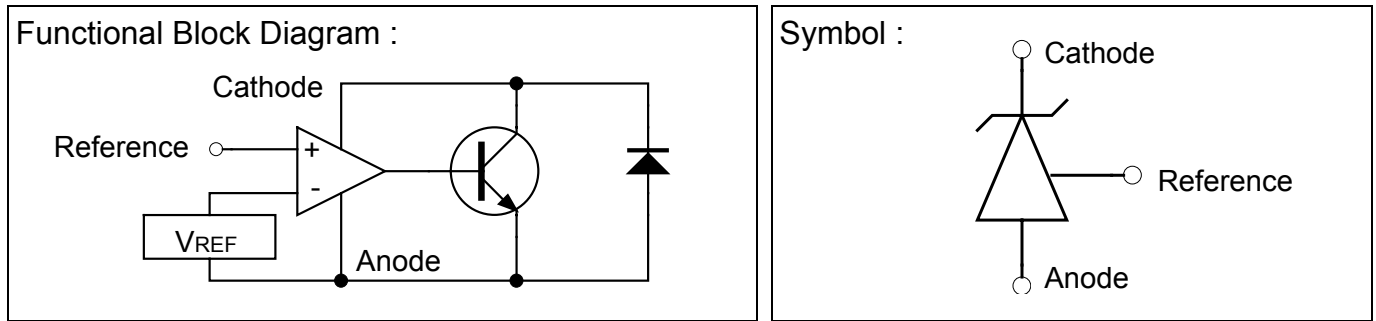
Rank	A	B	C
$V_{REF}$	$2.495\pm 0.5\%$	$2.495\pm 1\%$	$2.495\pm 2\%$

**Absolute Maximum Ratings**

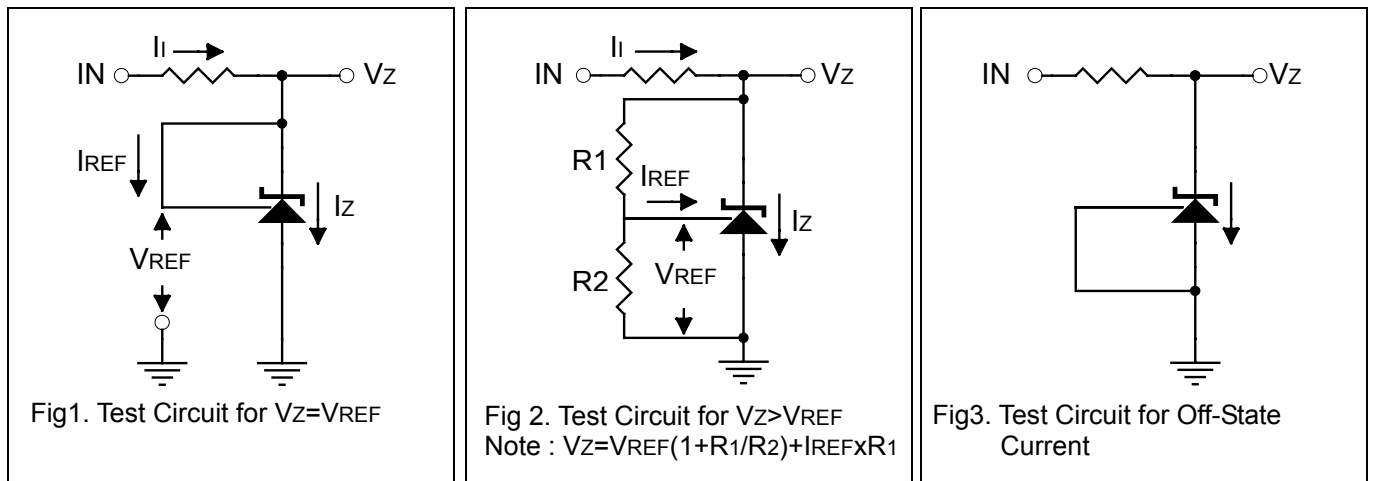
(Operating temperature range applies unless otherwise specified)

Characteristics	Symbol	Value	Unit
Cathode Voltage	$V_{KA}$	37	V
Cathode Current Range (Continuous)	$I_K$	-100~+150	mA
Reference Input Current Range	$I_{REF}$	0.05~+10	mA
Power Dissipation	$P_D$	770	mW
Operating Temperature Range	$T_{opr}$	0~+70	°C
Storage Temperature Range	$T_{stg}$	-65~+150	°C

**Functional Block Diagram & Symbol**



**Test Circuits**

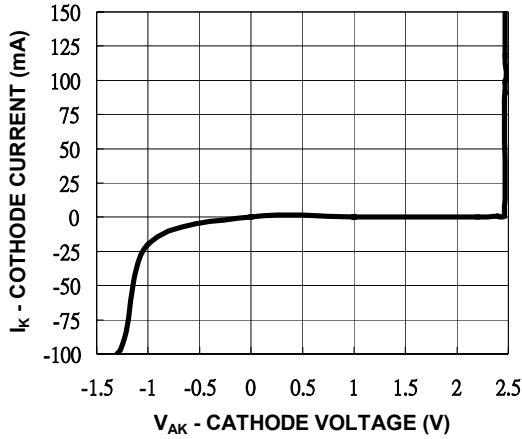


**Electrical Characteristics ( Ta=25°C unless otherwise specified )**

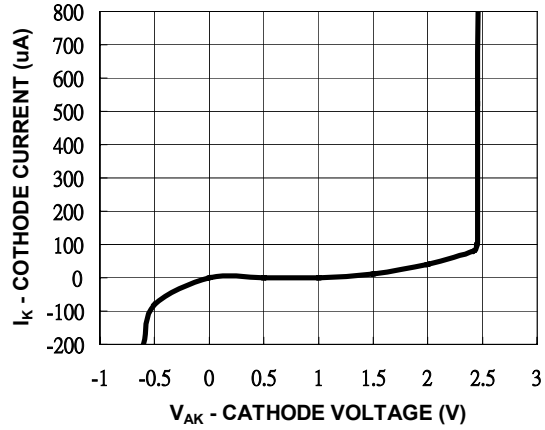
Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage TL431A TL431B TL431C	$V_{REF}$	$V_{KA}=V_{REF}, I_K=10mA$	2.445	2.495	2.545	V
			2.470	2.495	2.520	
			2.480	2.495	2.510	
Deviation of Reference Input Voltage Over-Temperature	$V_{REF(dev)}$	$V_{KA}=V_{REF}, I_K=10mA$ $T_{min} \leq T_a \leq T_{max}$	-	4	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF} / \Delta V_{KA}$	$I_K=10mA,$ $\Delta V_{KA}=10V-V_{REF}$	-	-1.4	-2.7	mV
		$I_K=10mA,$ $\Delta V_{KA}=36V-10V$	-	-1.0	-2.0	V
Reference Input Current	$I_{REF}$	$I_K=10mA, R_1=10k\Omega,$ $R_2=\infty$	-	2	4	$\mu A$
Deviation of Reference Input Current Over Full Temperature Range	$I_{REF(dev)}$	$I_K=10mA, R_1=10k\Omega,$ $R_2=\infty, T_a=Full\ Range$	-	0.4	1.2	$\mu A$
Minimum Cathode Current for Regulation	$I_{K(min)}$	$V_{KA}=V_{REF}$	-	0.4	1.0	mA
Off-State Cathode Current	$I_{K(off)}$	$V_{KA}=36V, V_{REF}=0$	-	0.1	1.0	$\mu A$
Dynamic impedance	$Z_{KA}$	$V_{KA}=V_{REF}, f \leq 1.0KHz$ $I_K=1\ to\ 100mA$	-	0.2	0.5	$\Omega$

**Characteristic Curves**

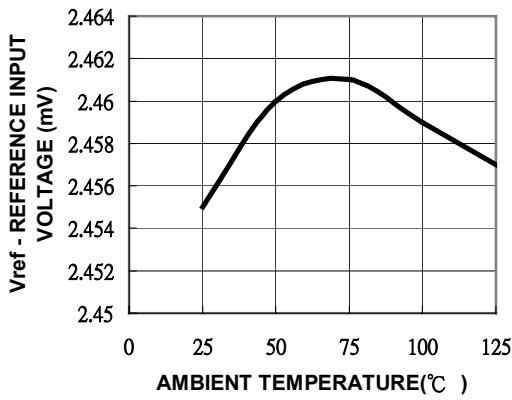
**CATHODE CURRENT vs CATHODE VOLTAGE**



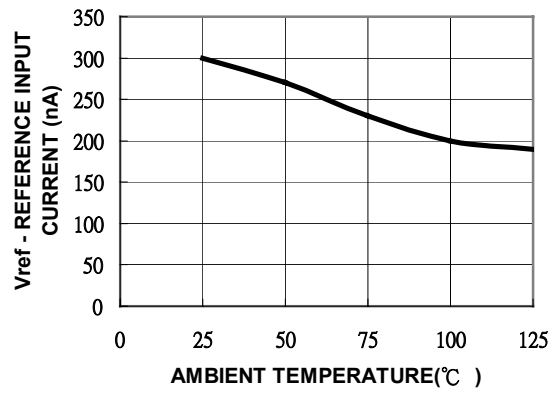
**CATHODE CURRENT vs CATHODE VOLTAGE**



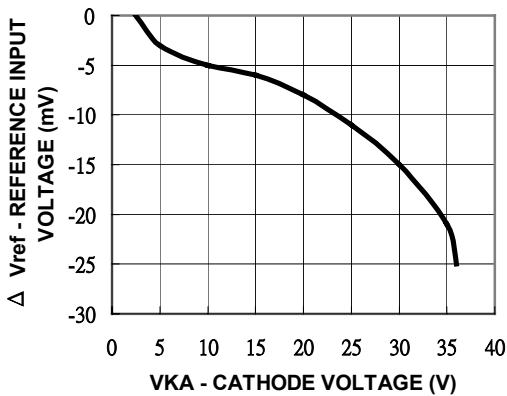
**REFERENCE INPUT VOLTAGE vs AMBIENT TEMPERATURE**



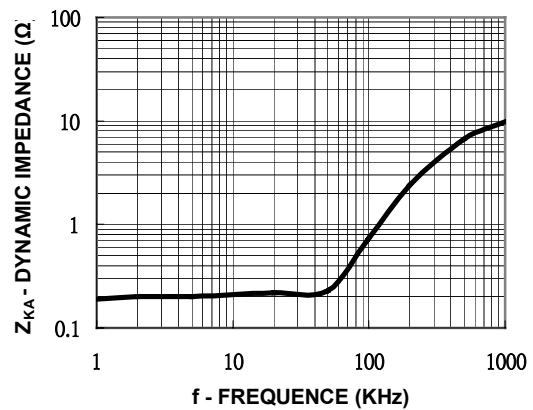
**REFERENCE INPUT CURRENT vs AMBIENT TEMPERATURE**



**CATHODE VOLTAGE vs REFERENCE INPUT VOLTAGE**

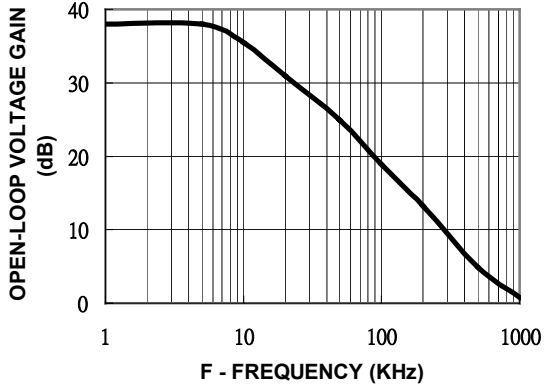


**DYNAMIC IMPEDANCE vs FREQUENCY**

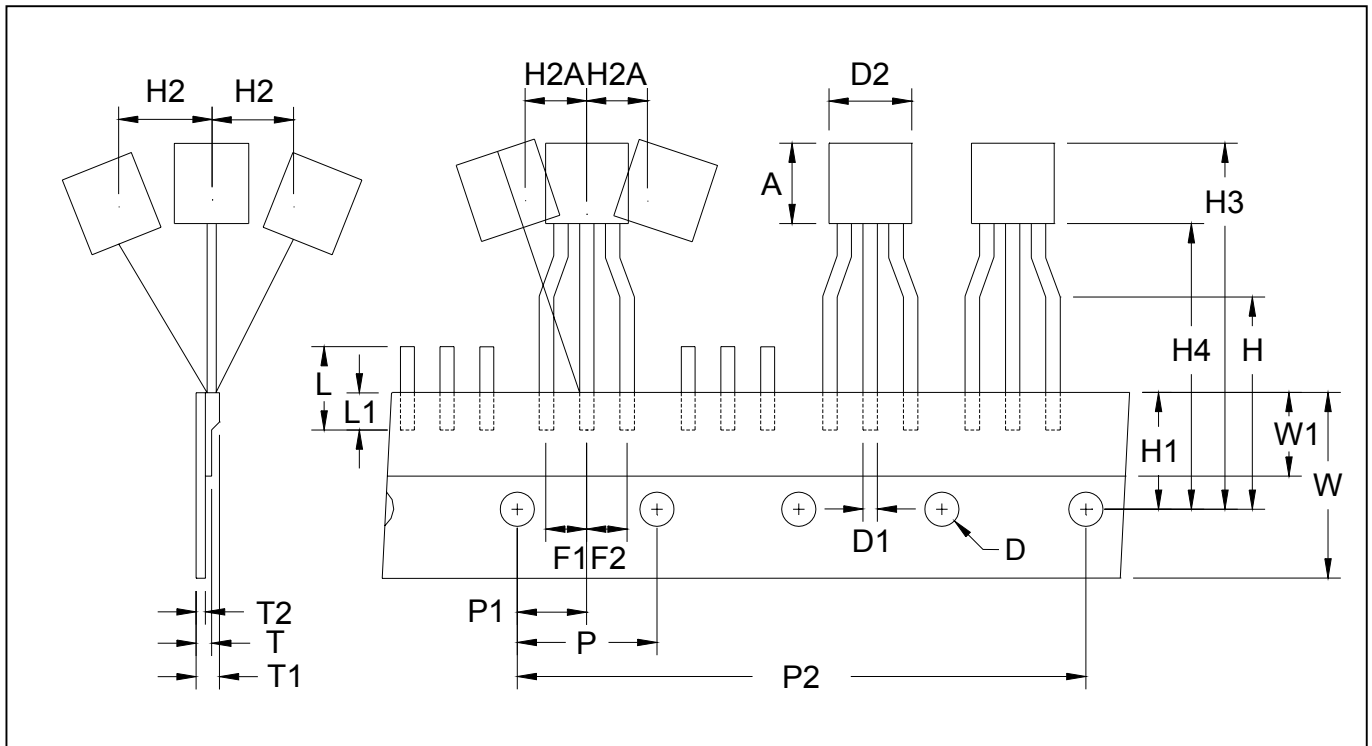




**OPEN-LOOP VOLTAGE GAIN  
vs FREQUENCY**

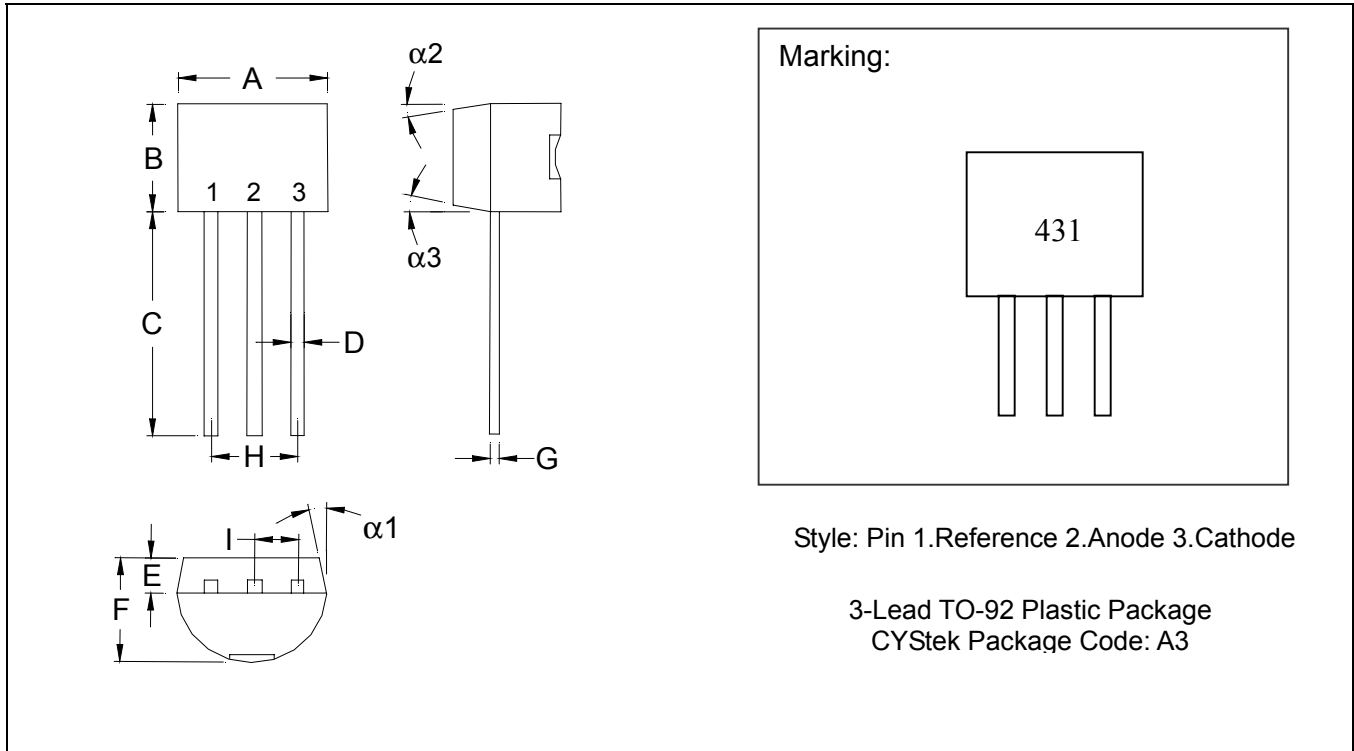


**TO-92 Taping Outline**



DIM	Item	Millimeters	
		Min.	Max.
A	Component body height	4.33	4.83
D	Tape Feed Diameter	3.80	4.20
D1	Lead Diameter	0.36	0.53
D2	Component Body Diameter	4.33	4.83
F1,F2	Component Lead Pitch	2.40	2.90
F1,F2	F1-F2	-	±0.3
H	Height Of Seating Plane	15.50	16.50
H1	Feed Hole Location	8.50	9.50
H2	Front To Rear Deflection	-	1
H2A	Deflection Left Or Right	-	1
H3	Component Height	-	27
H4	Feed Hole To Bottom Of Component	-	21
L	Lead Length After Component Removal	-	11
L1	Lead Wire Enclosure	2.50	-
P	Feed Hole Pitch	12.50	12.90
P1	Center Of Seating Plane Location	5.95	6.75
P2	4 Feed Hole Pitch	50.30	51.30
T	Over All Tape Thickness	-	0.55
T1	Total Taped Package Thickness	-	1.42
T2	Carrier Tape Thickness	0.36	0.68
W	Tape Width	17.50	19.00
W1	Adhesive Tape Width	5.00	7.00
-	20 pcs Pitch	253	255

**TO-92 Dimension**



\*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1704	0.1902	4.33	4.83	G	0.0142	0.0220	0.36	0.56
B	0.1704	0.1902	4.33	4.83	H	-	*0.1000	-	*2.54
C	0.5000	-	12.70	-	I	-	*0.0500	-	*1.27
D	0.0142	0.0220	0.36	0.56	$\alpha 1$	-	*5°	-	*5°
E	-	*0.0500	-	*1.27	$\alpha 2$	-	*2°	-	*2°
F	0.1323	0.1480	3.36	3.76	$\alpha 3$	-	*2°	-	*2°

Notes: 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: 42 Alloy ; solder plating
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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