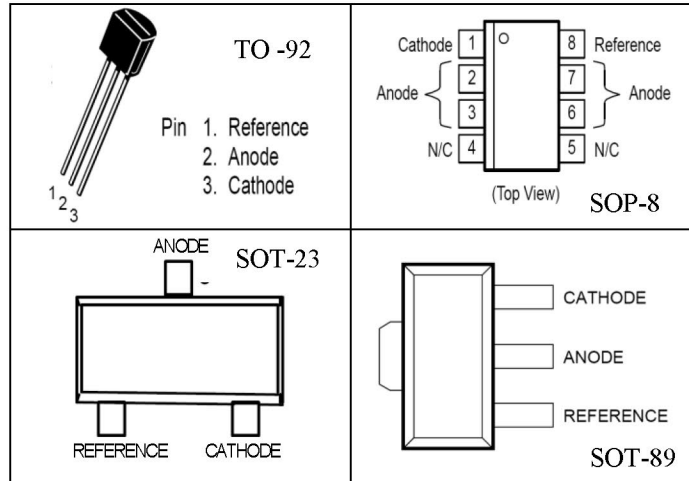


# Programmable Precision Reference

## FEATURES

- Programmable Output Voltage to 36V
- Low Dynamic Output Impedance  $0.2\Omega$
- Sink Current Capability of 0.1 mA to 100 mA
- Equivalent Full-Range Temperature Coefficient of  $50 \text{ ppm}/^\circ\text{C}$
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn on Response
- TO-92, SOIC- 8, SOT-23, SOT-89 packages

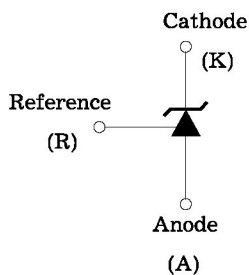
## PIN CONNECTIONS



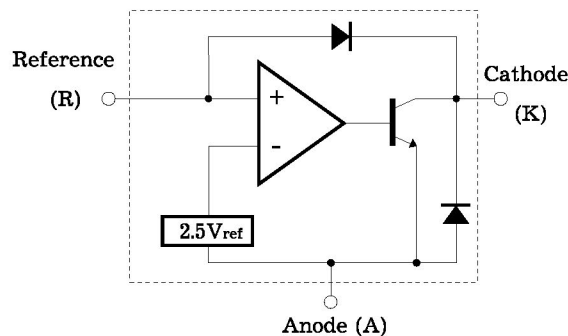
## DESCRIPTION

The TK431 is a three-terminal adjustable regulator series with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between  $V_{ref}$  (approximately 2.5 volts) and 40 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.

## SYMBOL



## FUNCTIONAL BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified)

Characteristic	Symbol	Value	Unit
Cathode Voltage	$V_{KA}$	40	V
Cathode Current Range (Continuous)	$I_K$	-100 ~ 150	mA
Reference Input Current Range	$I_{REF}$	0.05 ~ 10	mA
Power Dissipation at 25°C: SOP, TO – 92 Package ( $R_{\theta JA} = 178^\circ\text{C}/\text{W}$ ) SOT Package ( $R_{\theta JA} = 625^\circ\text{C}/\text{W}$ )	$P_D$	0.7 0.2	W
Junction Temperature Range	$T_J$	-25 ~ 150	$^\circ\text{C}$
Operating Temperature Range	$T_g$	C: -0 ~ 70 I: -40 ~ 85	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 ~ 150	$^\circ\text{C}$

**RECOMMENDED OPERATING CONDITIONS**

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Cathode Voltage	$V_{KA}$		$V_{REF}$		36	V
Cathode Current	$I_K$		0.5		100	mA

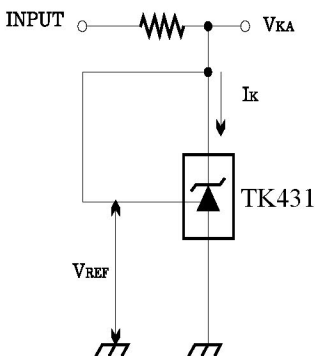
**ELECTRICAL CHARACTERISTICS**

( $T_a = 25^\circ\text{C}$ ,  $V_{KA} = V_{REF}$ ,  $I_K = 10\text{mA}$  unless otherwise specified)

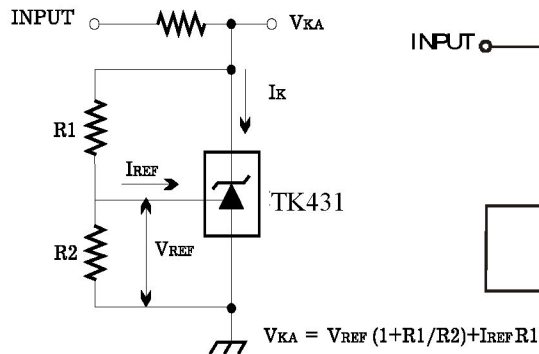
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Reference Input Voltage	$V_{REF}$	$V_{KA} = V_{REF}$ , $I_K = 10\text{mA}$ TK431C (2%) TK431B (1%) TK431A (0.5%)	2.440 2.470 2.482	2.495 2.495 2.495	2.550 2.520 2.508	V
Deviation of Reference Input Voltage Over Full Temperature Range	$V_{REF(\text{dev})}$	$T_{\min} \leq T_a \leq T_{\max}$		3	17	MV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$\Delta V_{KA} = 10\text{V} - V_{REF}$ $\Delta V_{KA} = 36\text{V} - 10\text{V}$		-1.4 -1.0	-2.7 -2.0	mV/V
Reference Input Current	$I_{REF}$	$R_1 = 10\text{K}\Omega$ , $R_2 = \infty$		1.8	4	$\mu\text{A}$
Deviation of Reference Input Current Over Full Temperature Range	$I_{REF(\text{dev})}$	$R_1 = 10\text{K}\Omega$ , $R_2 = \infty$		0.4	1.2	$\mu\text{A}$
Minimum Cathode Current for Regulation	$I_{K(\text{min})}$			0.25	0.5	mA
Off-State Cathode Current	$I_{K(\text{off})}$	$V_{KA} = 40\text{V}$ , $V_{REF} = 0$		0.26	0.9	$\mu\text{A}$
Dynamic Impedance	$Z_{KA}$	$I_K = 10\text{mA}$ to $100\text{mA}$ , $f \leq 1.0\text{KHz}$		0.22	0.5	$\Omega$

**TEST CIRCUITS**

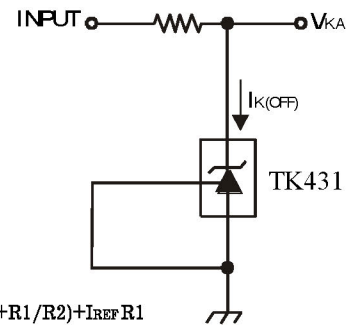
**Fig.1. Test Circuit for  $V_{KA} = V_{REF}$**   
 $I_{\text{off}}$



**Fig.2. Test Circuit for  $V_{KA} \geq V_{REF}$**



**Fig.3. Test Circuit for**

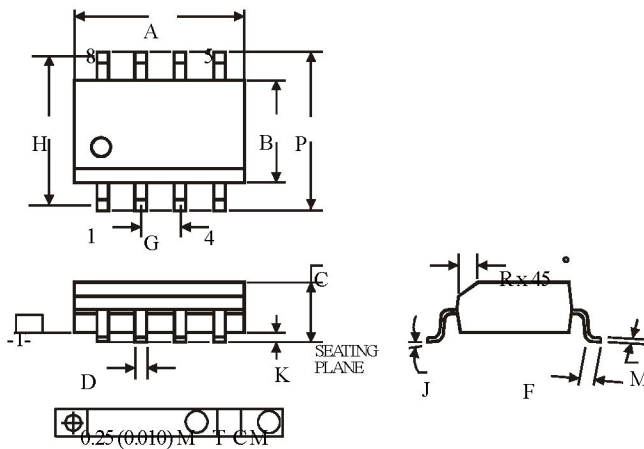
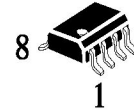


**Ordering Information**

Part Number	Package	Packing	Temperature (TA)	Package Qty	V <sub>REF</sub>
TK431ACD	SOIC-8	Reel	0°C ~ 70°C	2500	0.5%
TK431ACLP	TO-92-3	Tube	0°C ~ 70°C	1000	0.5%
TK431ACPK	SOT-89-3	Reel	0°C ~ 70°C	3000	0.5%
TK431ACDB	SOT-23-3	Reel	0°C ~ 70°C	3000	0.5%
TK431AID	SOIC-8	Reel	-40°C ~ 85°C	2500	0.5%
TK431AILP	TO-92-3	Tube	-40°C ~ 85°C	1000	0.5%
TK431AIPK	SOT-89-3	Reel	-40°C ~ 85°C	3000	0.5%
TK431AIDB	SOT-23-3	Reel	-40°C ~ 85°C	3000	0.5%
TK431BCD	SOIC-8	Reel	0°C ~ 70°C	2500	1%
TK431BCLP	TO-92-3	Tube	0°C ~ 70°C	1000	1%
TK431BCPK	SOT-89-3	Reel	0°C ~ 70°C	3000	1%
TK431BCDB	SOT-23-3	Reel	0°C ~ 70°C	3000	1%
TK431BID	SOIC-8	Reel	-40°C ~ 85°C	2500	1%
TK431BILP	TO-92-3	Tube	-40°C ~ 85°C	1000	1%
TK431BIPK	SOT-89-3	Reel	-40°C ~ 85°C	3000	1%
TK431BIDB	SOT-23-3	Reel	-40°C ~ 85°C	3000	1%
TK431CD	SOIC-8	Reel	0°C ~ 70°C	2500	2%
TK431CLP	TO-92-3	Tube	0°C ~ 70°C	1000	2%
TK431CPK	SOT-89-3	Reel	0°C ~ 70°C	3000	2%
TK431CDB	SOT-23-3	Reel	0°C ~ 70°C	3000	2%

## Package Dimensions

### SOIC-8 PACKAGE OUTLINE DIMENSIONS

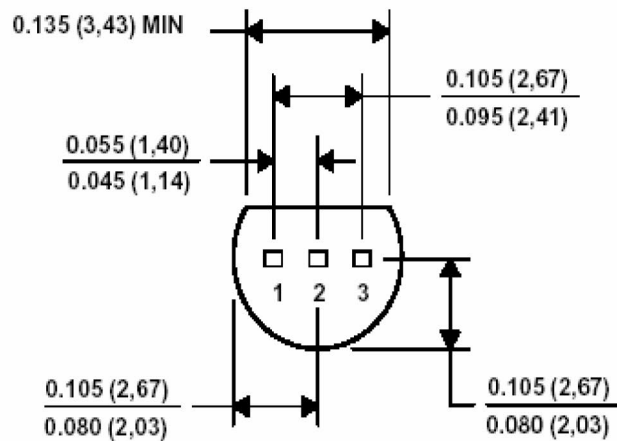
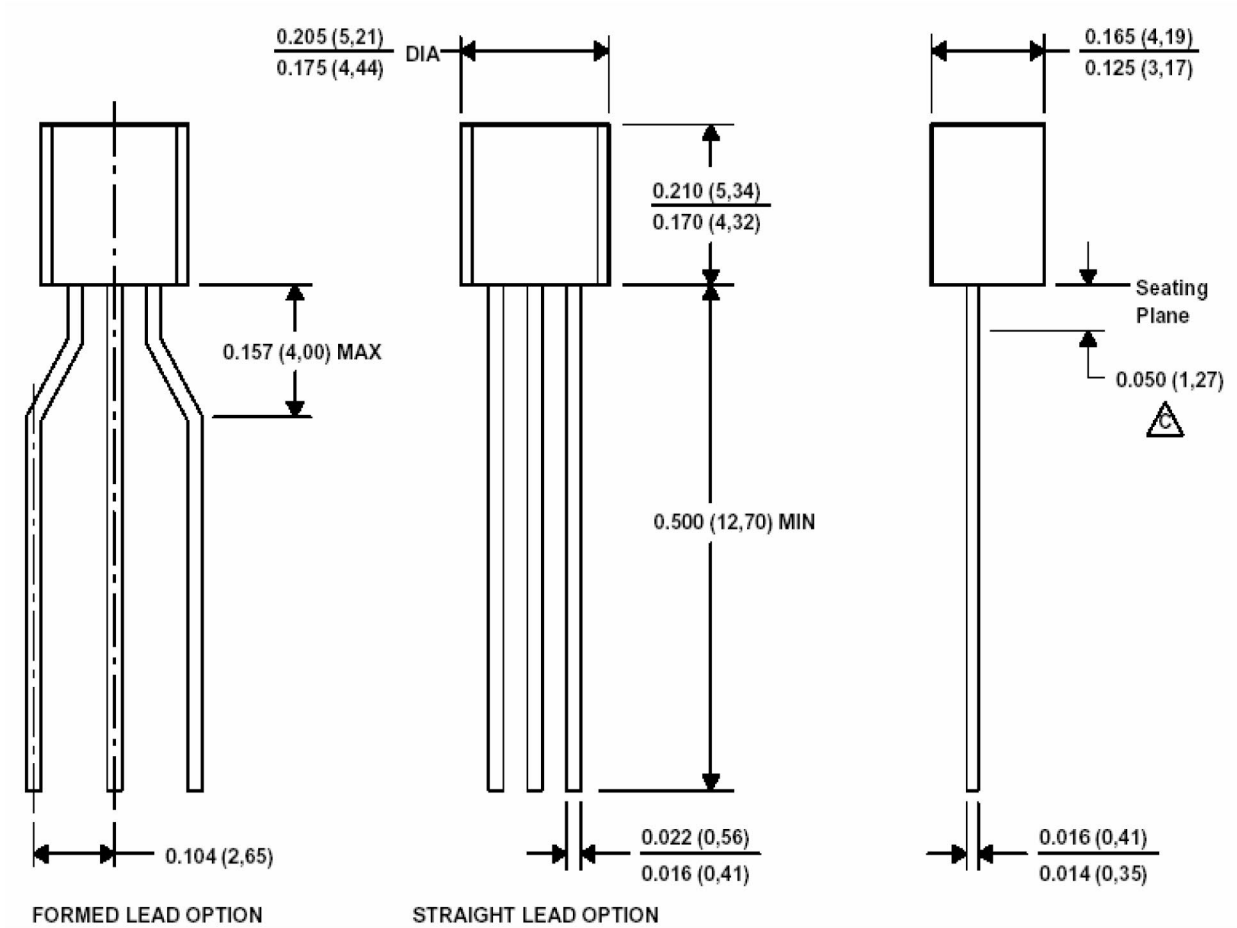


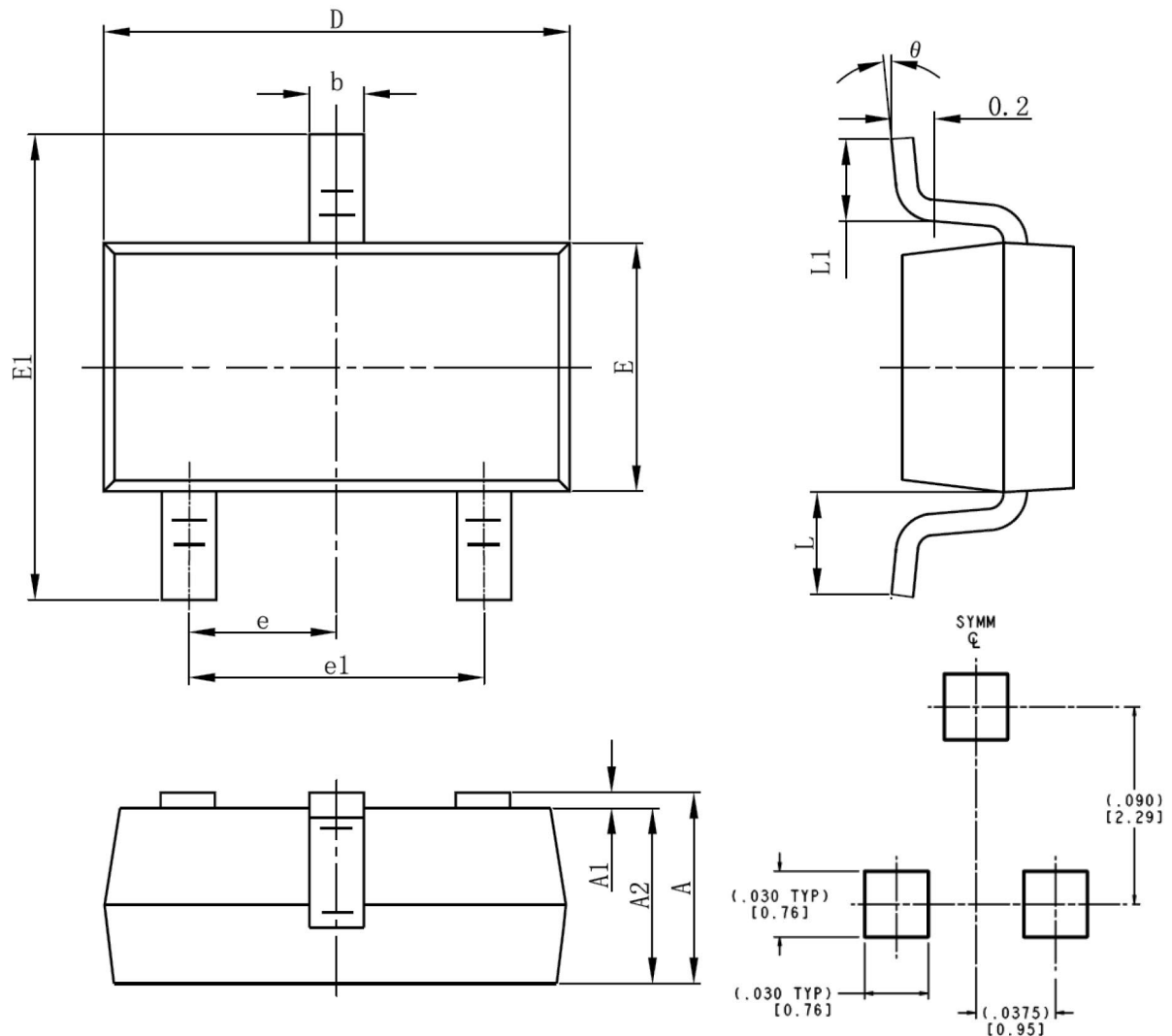
Symbol	Dimension, mm	
	MIN	MAX
<b>A</b>	4.80	5.00
<b>B</b>	3.80	4.00
<b>C</b>	1.35	1.75
<b>D</b>	0.33	0.51
<b>F</b>	0.40	1.27
<b>G</b>	1.27	
<b>H</b>	5.72	
<b>J</b>	0°	8°
<b>K</b>	0.10	0.25
<b>M</b>	0.19	0.25
<b>P</b>	5.80	6.20
<b>R</b>	0.25	0.50

#### NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.

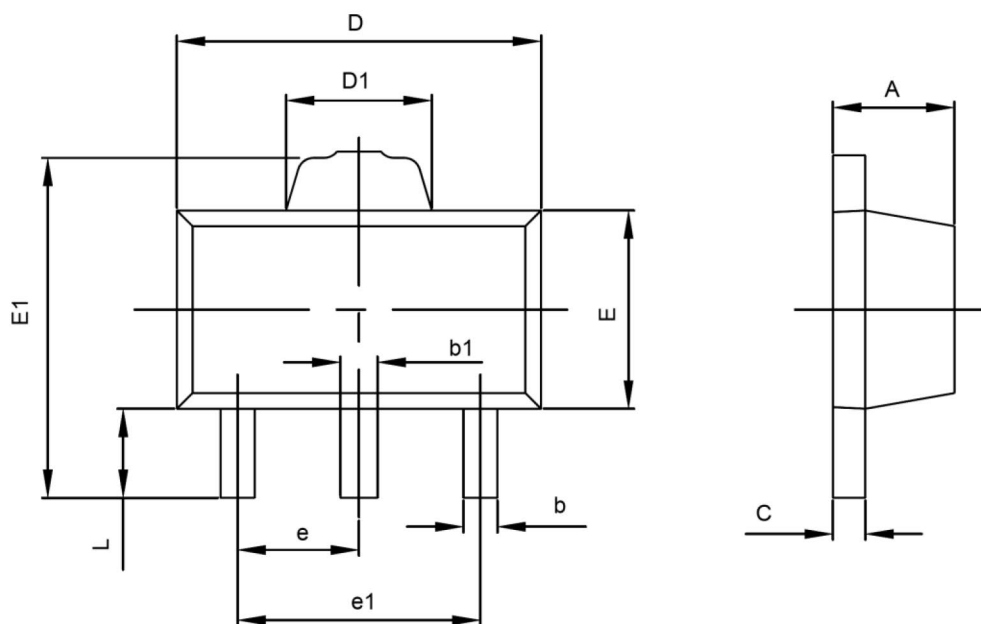
## TO-92 PACKAGE OUTLINE DIMENSIONS



**SOT-23-3L PACKAGE OUTLINE DIMENSIONS**


LAND PATTERN RECOMMENDATION

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

**SOT-89-3L PACKAGE OUTLINE DIMENSIONS**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043