

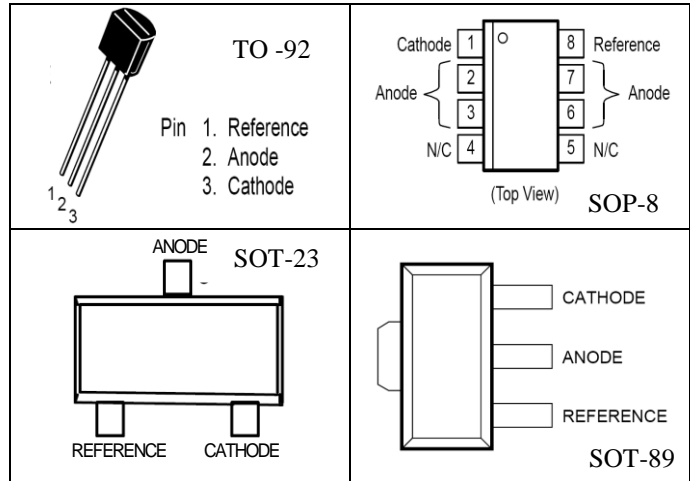
Programmable Precision Reference

TL431Z

FEATURES

- Programmable Output Voltage to 40V
- Low Dynamic Output Impedance 0.2Ω
- Sink Current Capability of 0.1 mA to 100 mA
- Equivalent Full-Range Temperature Coefficient of 50 ppm/°C
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn on Response
- TO-92, SOP- 8, SOT-23, SOT-89 packages

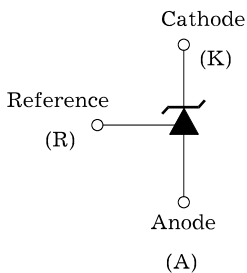
PIN CONNECTIONS



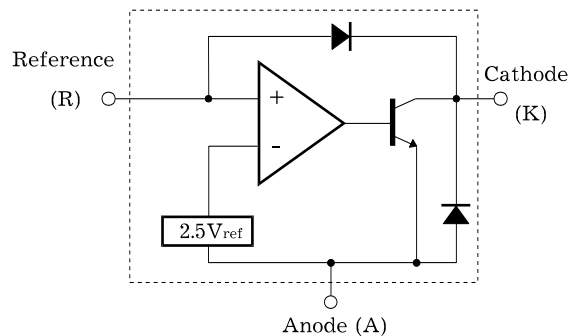
DESCRIPTION

The TL431Z 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 Vref (approximately 2.5 volts) and 40 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications. The TL431Z is characterized for operation from -25°C to +85°C.

SYMBOL



FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified)

Characteristic	Symbol	Value	Unit
Cathode Voltage	V _{KA}	44	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 _{θJA} = 178°C/W) SOT Package (R _{θJA} = 625°C/W)	P _D	0.7 0.2	W
Junction Temperature Range	T _J	-25 ~ 150	°C
Operating Temperature Range	T _g	-25 ~ 85	°C
Storage Temperature Range	T _{stg}	-65 ~ 150	°C

RECOMMENDED OPERATING CONDITIONS

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Cathode Voltage	V_{KA}		V_{REF}		40	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}	$V_{KA} = V_{REF}$, $I_K = 10\text{mA}$ TL431Z (2%) TL431Z-A (1%) TL431Z-C (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	$V_{REF(\text{dev})}$	$T_{\text{min}} \leq T_a \leq T_{\text{max}}$		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	μA
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	μA
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	μA
Dynamic Impedance	Z_{KA}	$I_K = 10\text{mA}$ to 100mA , $f \leq 1.0\text{KHz}$		0.22	0.5	Ω

TEST CIRCUITS

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

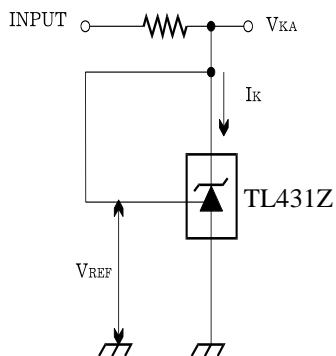


Fig.2. Test Circuit for $V_{KA} \geq V_{REF}$

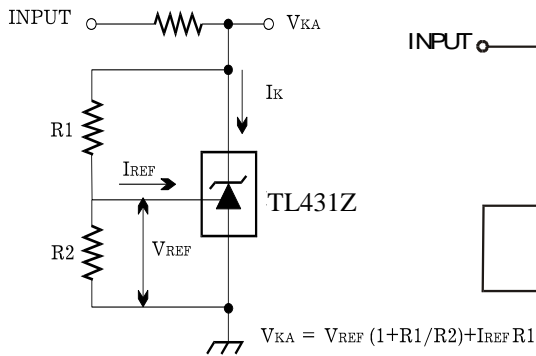
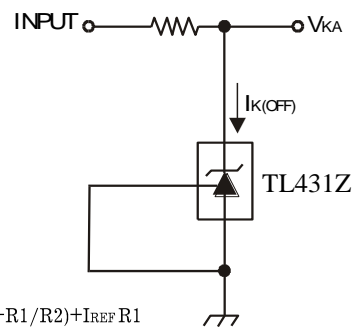


Fig.3. Test Circuit for $I_{K(\text{OFF})}$

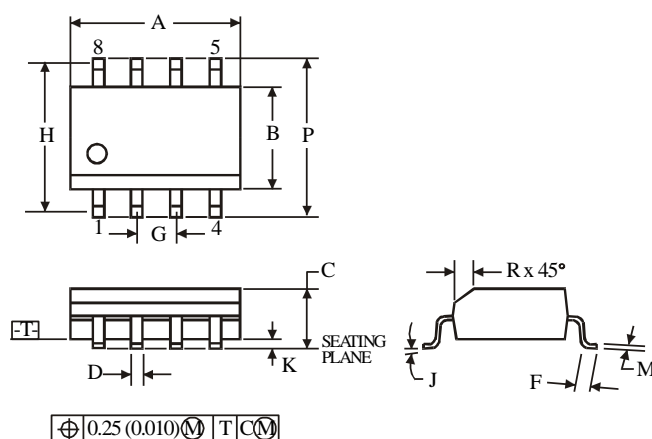
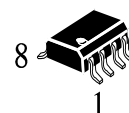


Ordering Information

Product Number	Reference Input Voltage	Package
TL431ZCLF TL431ZCLS	0.5%	TO-92
TL431ZCD		8-SOP
TL431ZCS		SOT-23
TL431ZCP		SOT-89
TL431ZALF TL431ZALS	1%	TO-92
TL431ZAD		8-SOP
TL431ZAS		SOT-23
TL431ZAP		SOT-89
TL431ZLF TL431ZLS	2%	TO-92
TL431ZD		8-SOP
TL431ZS		SOT-23
TL431ZP		SOT-89

Package Dimensions

D SUFFIX SOIC
(MS - 012AA)

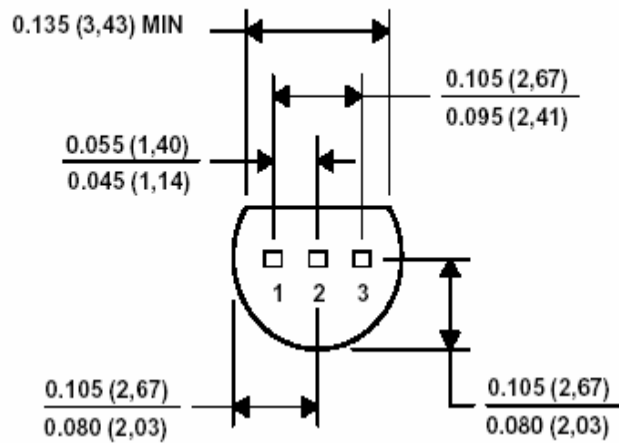
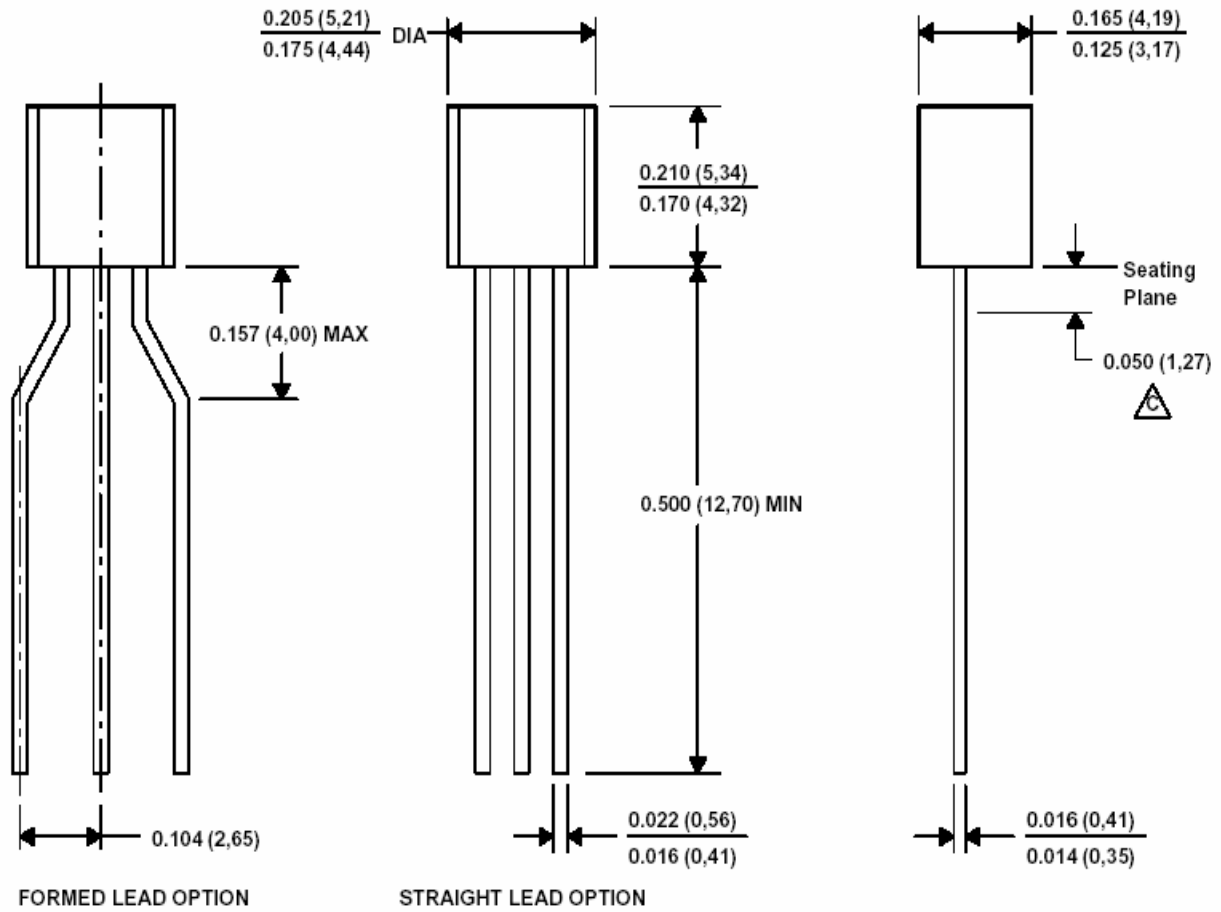


Symbol	Dimension, mm	
	MIN	MAX
A	4.80	5.00
B	3.80	4.00
C	1.35	1.75
D	0.33	0.51
F	0.40	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.10	0.25
M	0.19	0.25
P	5.80	6.20
R	0.25	0.50

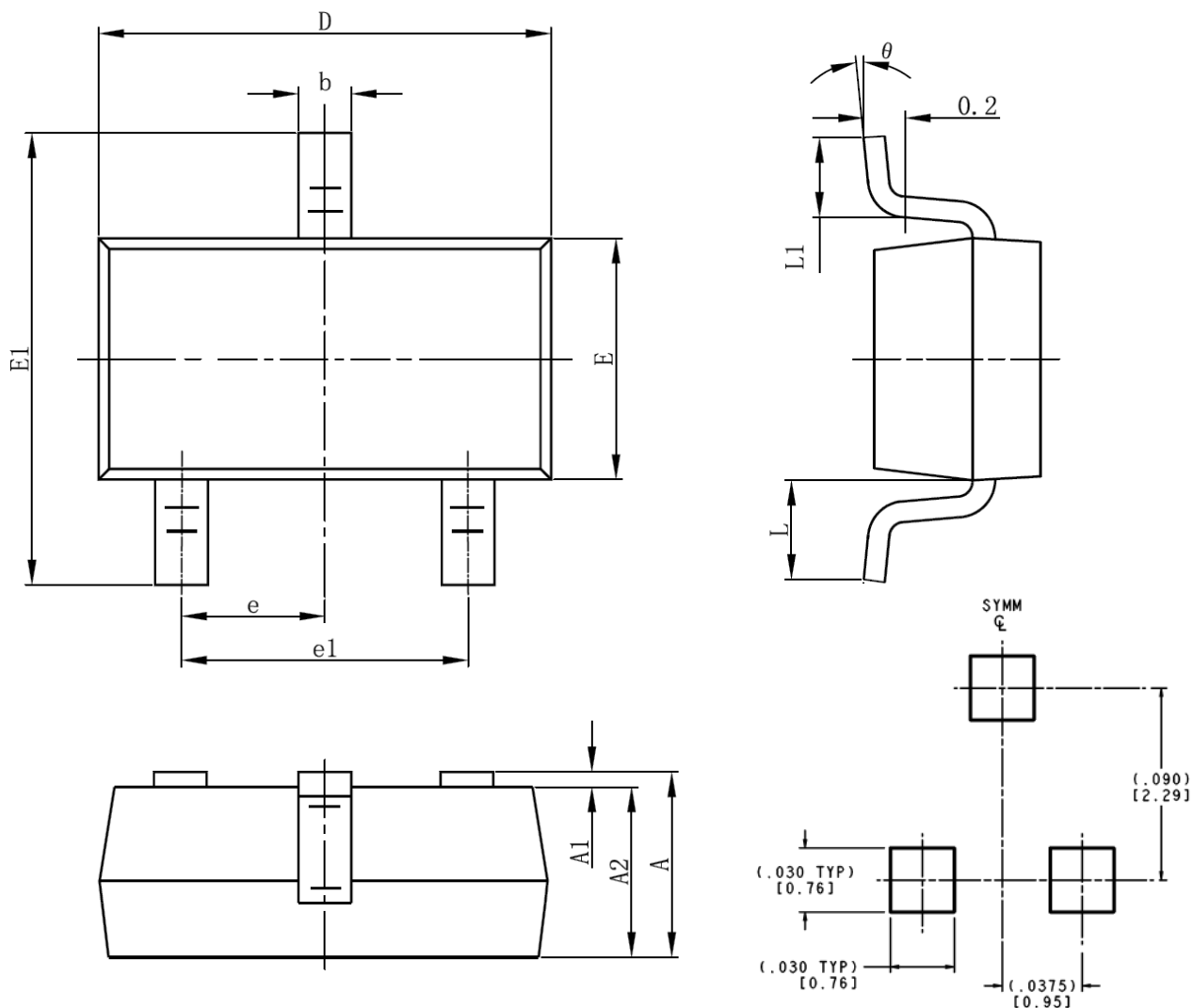
NOTES:

- Dimensions A and B do not include mold flash or protrusion.
- 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



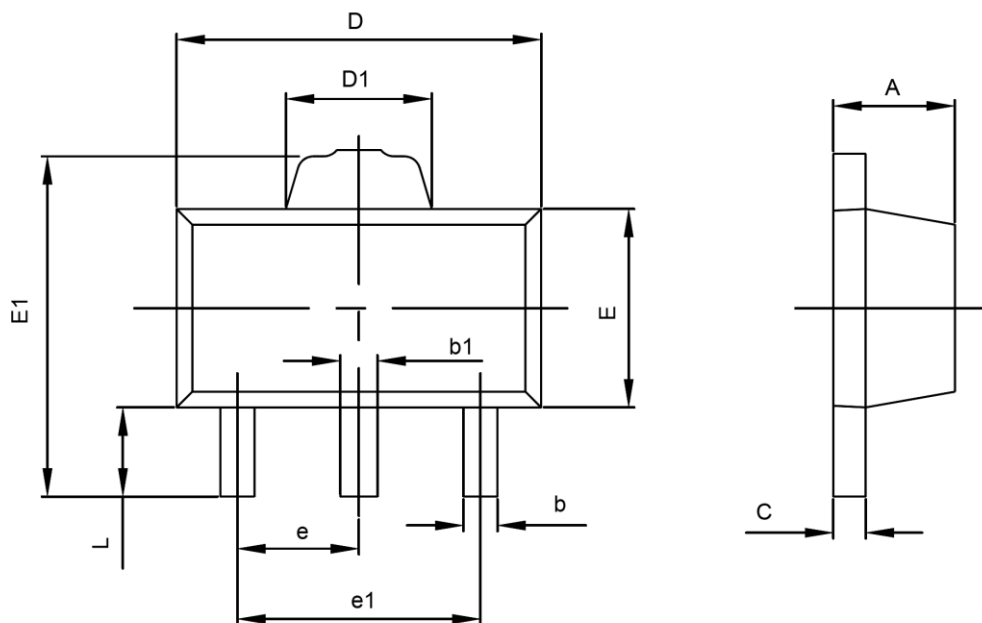
SOT-23-3L PACKAGE OUTLINE DIMENSIONS



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
θ	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