

Description

The Bay Linear B431 is a three terminal adjustable shunt regulator with thermal stability over Temperature range. Using two external resistors allows the output voltage to be adjusted from 2.5V to 36V. With a sharp turn on characteristics the B431 a superior replacement for zener diode applications.

The B431 shunt regulator has a tolerance of 0.5% which has proven to be sufficient to overcome all of the other errors in the system to virtually eliminate the need for trimming in the power supply manufacturers assembly line and contribute a significant cost savings.

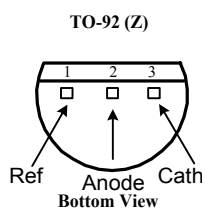
Features

- **Wide Operating Range ...1mA to100mA**
- **Tight Band Gap Tolerance 0.5%**
- **Low Temp. Coefficient.....30 ppm/°C**
- **Wide temp range of -40 to +105°C**
- **Available in TO92, SOT-89, SO-8**

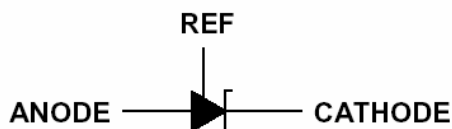
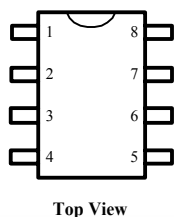
Applications

- **Switching Power Supplies**
- **Adjustable Power Supplies**
- **Linear Regulators**
- **Battery Powered Equipment**
- **Monitors, TV, VCR**
- **Instrumentation**

Package Information



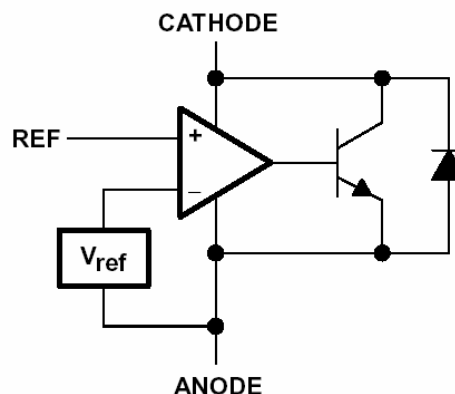
8-Pin Surface Mount (M)



Ordering Information

Package	Tolerance			
	0.5%	1%	1%	2%
TO-92	B431AZ	B431BZ	B431DBZ	B431CZ
SOT-89	B431AR	B431BR	B431DBR	B431CR
8SOIC	B431AM	B431BM	B431DBM	B431CM

The Electrical Grade & Type is specified on shipping Box Only



Absolute Max Ratings

Parameter	Symbol	Maximum	Units
Cathode Voltage	V_Z	37	V
Continuous Cathode Current	I_Z	150	mA
Reference Input Current	I_{REF}	10	mA
Power Dissipation at $T_A = 25^\circ\text{C}$ SOT-89 S0-8 TO-92	P_D	1000 750 775	mW
Thermal Resistance S0-8 TO-92 SOT-89	θ_{JA}	175 160 110	$^\circ\text{C/W}$
Operating Junction Temperature Range	T_J	-40 to +150	$^\circ\text{C}$
Operating Ambient Temperature	T_A	-40 to +105	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-65 to +150	$^\circ\text{C}$
Lead Temperature (Soldering) 10 seconds	T_{LEAD}	300	$^\circ\text{C}$
ESD Rating (Human Body Model)	T_{ESD}	2	kV

Recommended Operating Conditions

	Min	Max	Symbol
Cathode Voltage, V_Z	V_{REF}	36	V
Cathode Current, I_Z	0.1	100	mA

Electrical Characteristics

Unless specified: $T_A = 25^\circ\text{C}$. Values in bold apply over full operating ambient temperature.

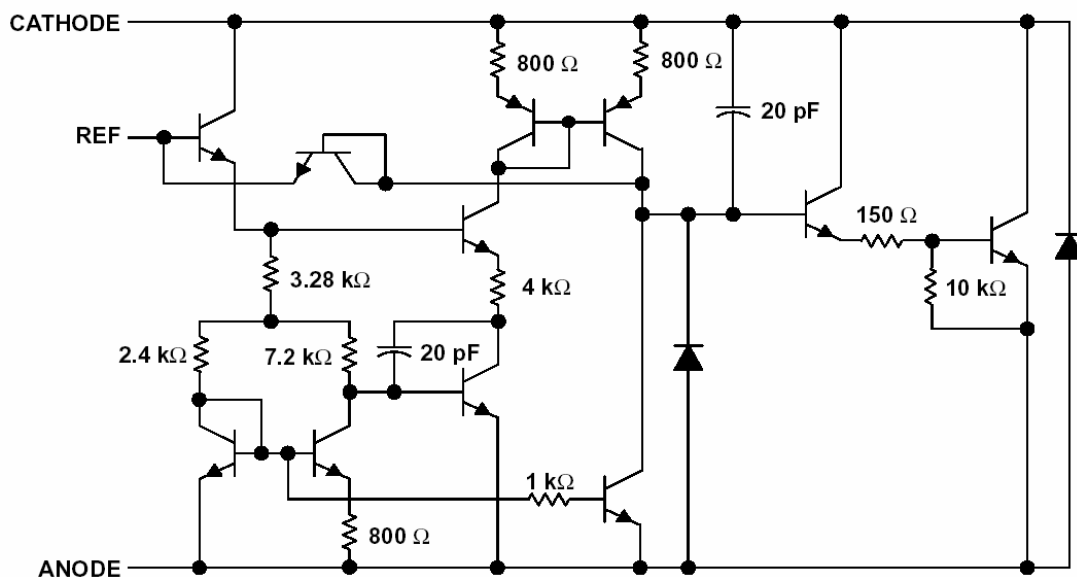
			B431 0.5%			
Parameter	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage	V_{REF}	$V_Z = V_{REF1}$ $I_Z = 10\text{mA}^{(1)}$	2.483	2.495	2.507	V
V_{REF} Temp Deviation	V_{DEV}	$V_Z = V_{REF1}$ $I_Z = 10\text{mA}^{(1)}$		4	17	mV
Ratio of Change in V_{REF} To Change in V_Z	$\frac{\Delta V_{REF}}{\Delta V_Z}$	$I_Z = 10\text{mA}, \Delta V_Z = 10\text{V to } V_{REF}$		-1.0	-2.7	mV/V
		$I_Z = 10\text{mA}, \Delta V_Z = 36\text{V to } 10\text{V}$		-0.4	-2.0	
Reference Input Current	I_{REF}	$R1 = 10\text{k}\Omega, R2 = \infty,$ $I_Z = 10\text{mA}^{(2)}$		0.7	4	μA
I_{REF} Temperature Deviation	$I_{REF(DEV)}$	$R1 = 10\text{k}\Omega, R2 = \infty,$ $I_Z = 10\text{mA}^{(2)}$		0.4	1.2	μA
Off-State Cathode Current	$I_{Z(OFF)}$	$V_{REF} = 0\text{V}, V_Z = 36\text{V}^{(3)}$		0.1	1	μA
Dynamic Output Impedance	r_Z	$F < 1\text{kHz}, V_Z = V_{REF}$ $I_Z = 1\text{mA to } 100\text{mA}^{(1)}$		0.20	0.50	Ω
Minimum Operating Current	$I_{Z(MIN)}$	$V_Z = V_{REF}^{(1)}$		0.4	1	mA

			B431 1%			
Parameter	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage	V_{REF}	$V_Z = V_{REF1} \ I_Z = 10mA^{(1)}$	2.470	2.495	2.520	V
V_{REF} Temp Deviation	V_{DEV}	$V_Z = V_{REF1} \ I_Z = 10mA^{(1)}$		4	17	mV
Ratio of Change in V_{REF} To Change in V_Z	$\frac{\Delta V_{REF}}{\Delta V_Z}$	$I_Z = 10mA, \Delta V_Z = 10V \text{ to } V_{Ref}$		-1.0	-2.7	mV/V
		$I_Z = 10mA, \Delta V_Z = 36V \text{ to } 10V$		-0.4	-2.0	
Reference Input Current	I_{REF}	$R1 = 10k\Omega, R2 = \infty, \ I_Z = 10mA^{(2)}$		0.7	4	μA
I_{REF} Temperature Deviation	$I_{REF(DEV)}$	$R1 = 10k\Omega, R2 = \infty, \ I_Z = 10mA^{(2)}$		0.4	1.2	μA
Off-State Cathode Current	$I_{Z(OFF)}$	$V_{REF} = 0V, V_Z = 36V^{(3)}$		0.1	1	μA
Dynamic Output Impedance	r_Z	$F < 1kHz, V_Z = V_{REF} \ I_Z = 1mA \text{ to } 100mA^{(1)}$		0.20	0.50	Ω
Minimum Operating Current	$I_{Z(MIN)}$	$V_Z = V_{REF}^{(1)}$		0.4	1	mA

			B431 2%			
Parameter	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage	V_{REF}	$V_Z = V_{REF1} \ I_Z = 10mA^{(1)}$	2.445	2.495	2.545	V
V_{REF} Temp Deviation	V_{DEV}	$V_Z = V_{REF1} \ I_Z = 10mA^{(1)}$		4	17	mV
Ratio of Change in V_{REF} To Change in V_Z	$\frac{\Delta V_{REF}}{\Delta V_Z}$	$I_Z = 10mA, \Delta V_Z = 10V \text{ to } V_{Ref}$		-1.0	-2.7	mV/V
		$I_Z = 10mA, \Delta V_Z = 36V \text{ to } 10V$		-0.4	-2.0	
Reference Input Current	I_{REF}	$R1 = 10k\Omega, R2 = \infty, \ I_Z = 10mA^{(2)}$		0.7	4	μA
I_{REF} Temperature Deviation	$I_{REF(DEV)}$	$R1 = 10k\Omega, R2 = \infty, \ I_Z = 10mA^{(2)}$		0.4	1.2	μA
Off-State Cathode Current	$I_{Z(OFF)}$	$V_{REF} = 0V, V_Z = 36V^{(3)}$		0.1	1	μA
Dynamic Output Impedance	r_Z	$F < 1kHz, V_Z = V_{REF} \ I_Z = 1mA \text{ to } 100mA^{(1)}$		0.20	0.50	Ω
Minimum Operating Current	$I_{Z(MIN)}$	$V_Z = V_{REF}^{(1)}$		0.4	1	mA

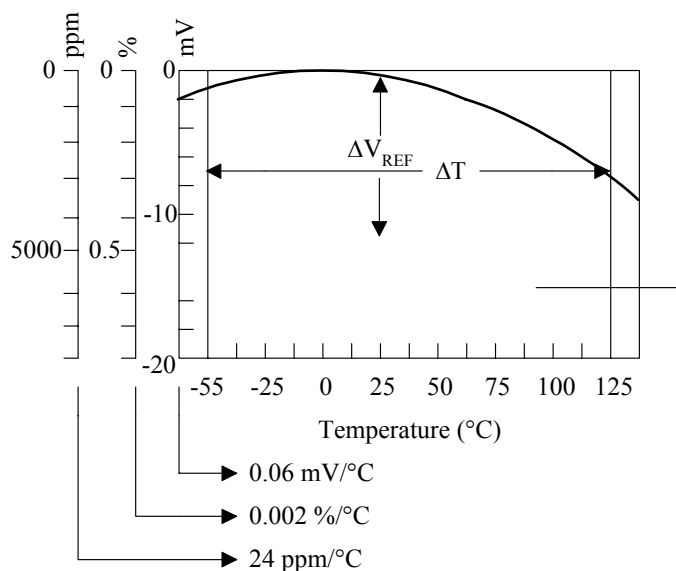
			B431D 1%			
Parameter	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage	V_{REF}	$V_Z = V_{REF1}$ $I_Z = 10\text{mA}^{(1)}$	2.470	2.495	2.520	V
V_{REF} Temp Deviation	V_{DEV}	$V_Z = V_{REF1}$ $I_Z = 10\text{mA}^{(1)}$		4	17	mV
Ratio of Change in V_{REF} To Change in V_Z	$\frac{\Delta V_{REF}}{\Delta V_Z}$	$I_Z = 10\text{mA}, \Delta V_Z = 10\text{V to } V_{Ref}$		-1.0	-2.7	mV/V
		$I_Z = 10\text{mA}, \Delta V_Z = 36\text{V to } 10\text{V}$		-0.4	-2.0	
Reference Input Current	I_{REF}	$R1 = 10\text{k}\Omega, R2 = \infty, I_Z = 10\text{mA}^{(2)}$		0.7	4	μA
I_{REF} Temperature Deviation	$I_{REF(DEV)}$	$R1 = 10\text{k}\Omega, R2 = \infty, I_Z = 10\text{mA}^{(2)}$		0.4	1.2	μA
Off-State Cathode Current	$I_{Z(OFF)}$	$V_{REF} = 0\text{V}, V_Z = 36\text{V}^{(3)}$		0.1	1	μA
Dynamic Output Impedance	r_Z	$F < 1\text{kHz}, V_Z = V_{REF}$ $I_Z = 1\text{mA to } 100\text{mA}^{(1)}$		0.20	0.50	Ω
Minimum Operating Current	$I_{Z(MIN)}$	$V_Z = V_{REF}^{(1)}$		0.4	1	mA

Note 1: B431D is rated at -40°C to $+85^\circ\text{C}$ and $50\text{ppm}/^\circ\text{C}$



† All component values are nominal.

Calculating Average Temperature Coefficient (TC)



- TC in mV/°C = $\frac{\Delta V_{REF} \text{ (mV)}}{\Delta T_A}$
- TC in %/°C = $\frac{\left(\frac{\Delta V_{REF}}{V_{REF} \text{ at } 25^\circ\text{C}} \right)}{\Delta T_A} \times 100$
- TC in ppm/°C = $\frac{\left(\frac{\Delta V_{REF}}{V_{REF} \text{ at } 25^\circ\text{C}} \right)}{\Delta T_A} \times 10^6$

Test Circuit

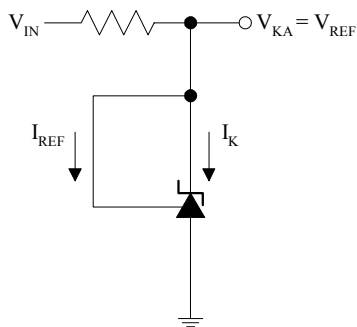


Figure 1a. Test Circuit 1

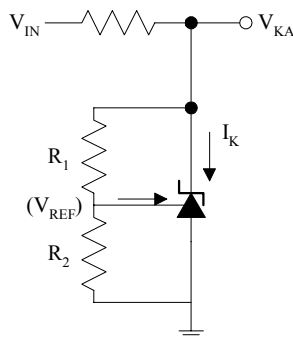


Figure 1b. Test Circuit 2

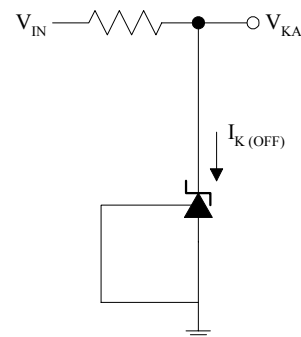


Figure 1c. Test Circuit 3

TYPICAL PERFORMANCE CURVES

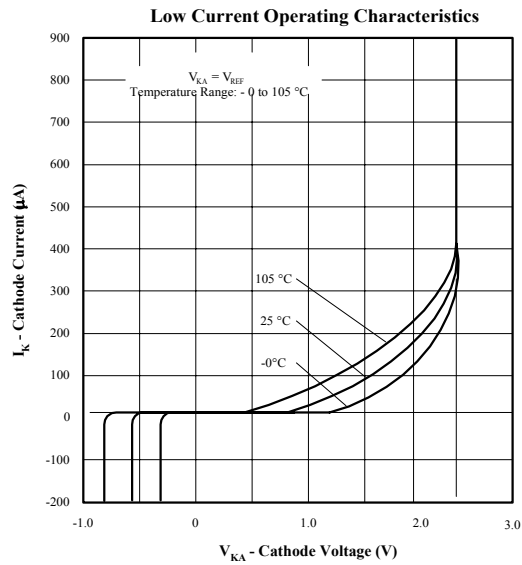


Figure 2

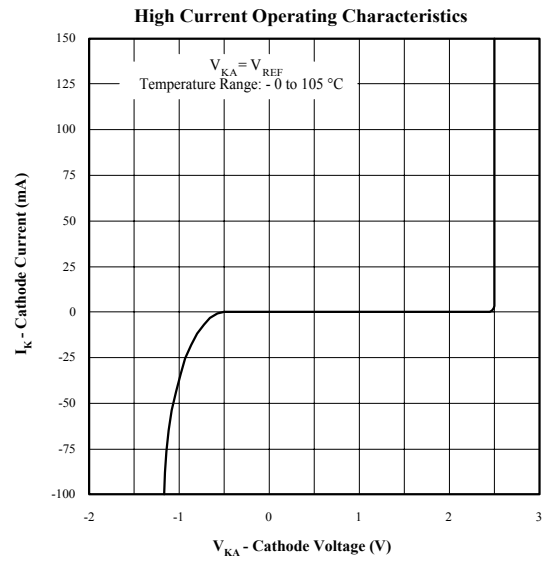


Figure 3

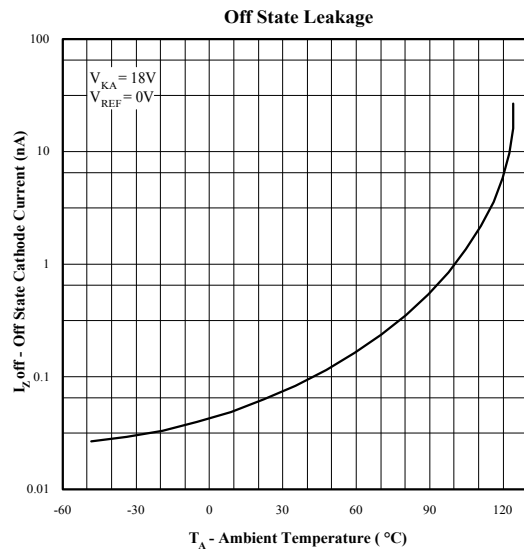


Figure 4

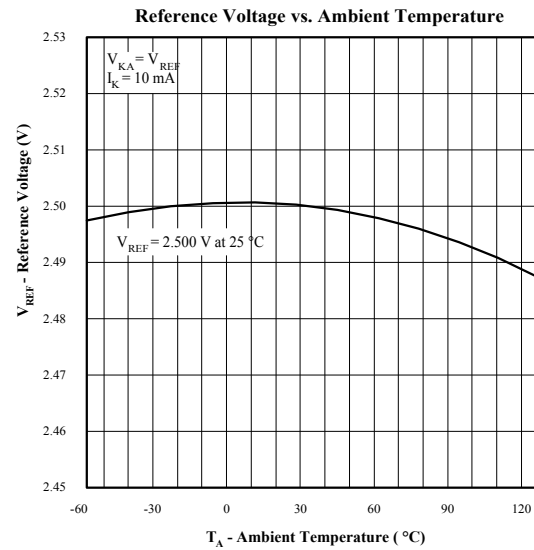


Figure 5

TYPICAL PERFORMANCE CURVES

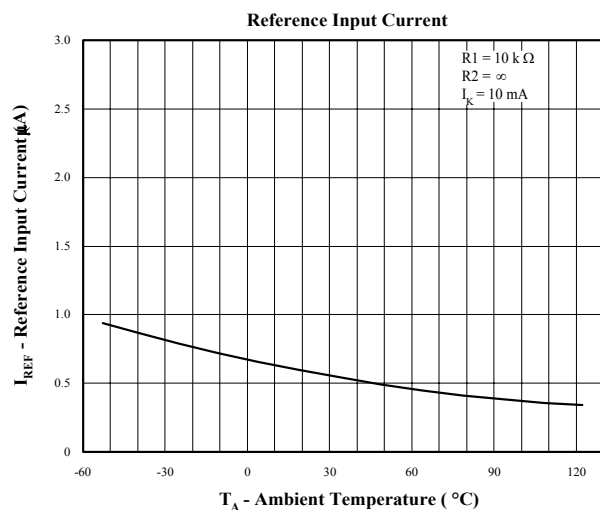


Figure 6

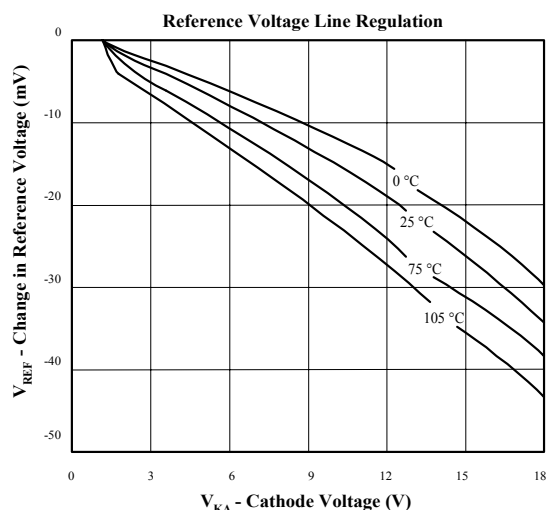


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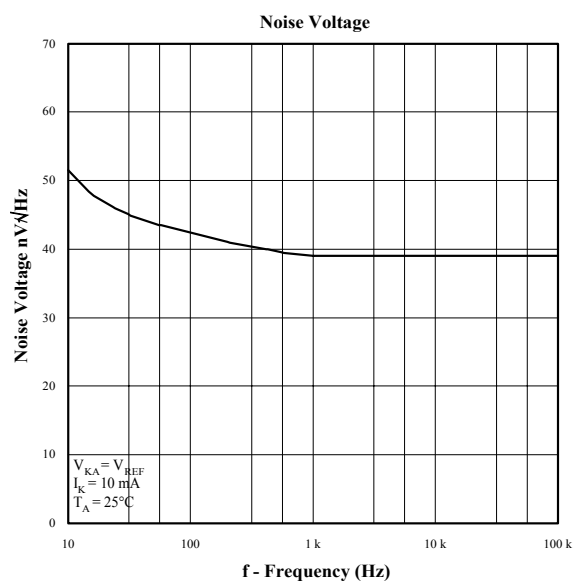


Figure 8

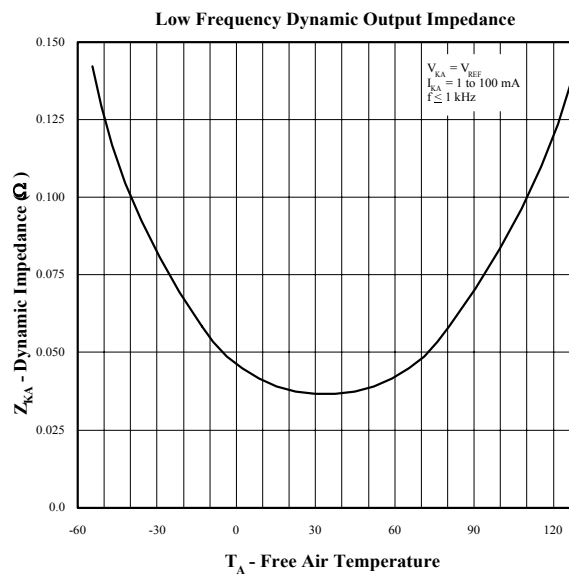


Figure 9

TYPICAL PERFORMANCE CURVES

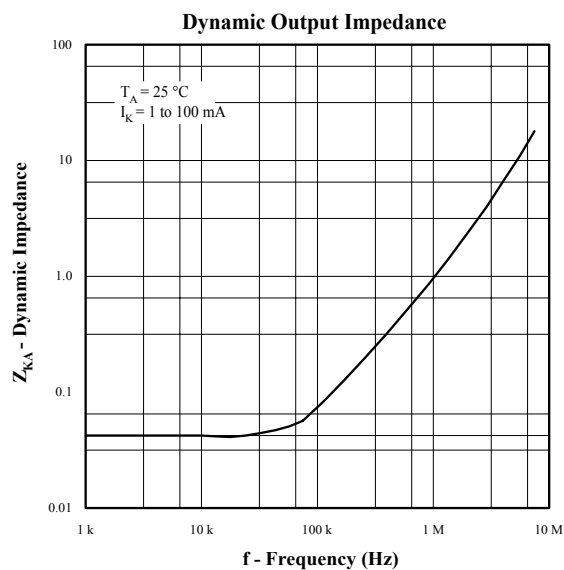


Figure 10

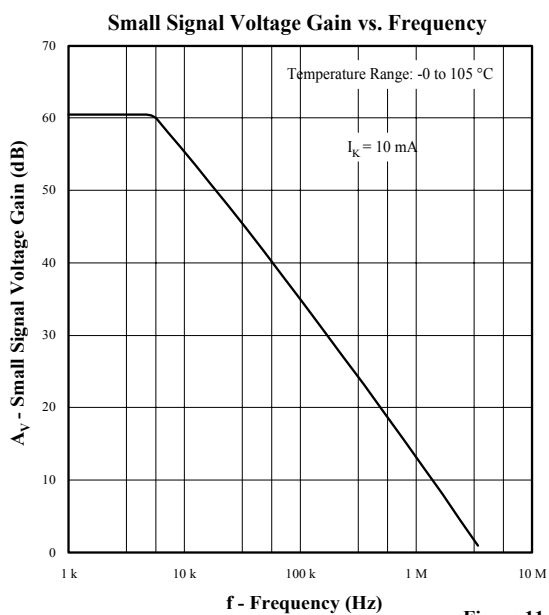
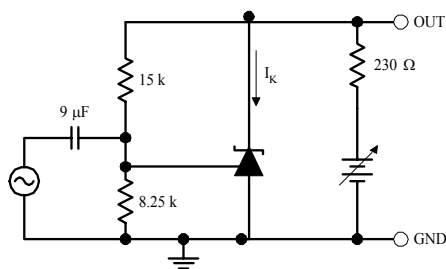


Figure 11



TYPICAL PERFORMANCE CURVES

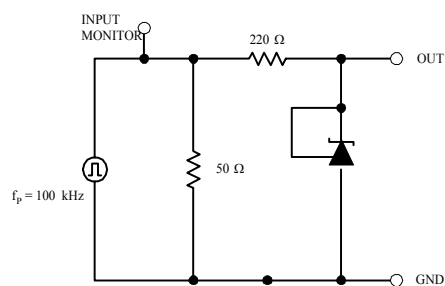
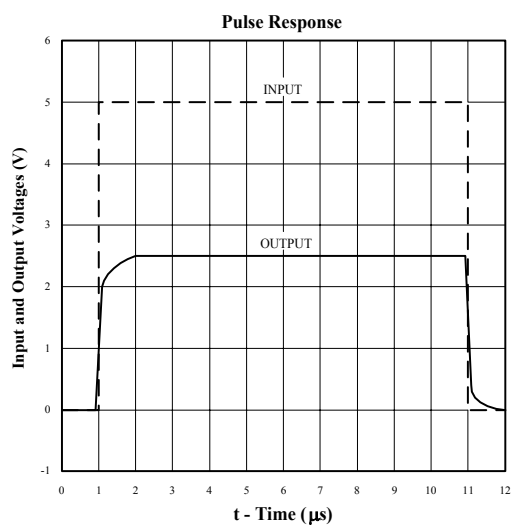


Figure 12

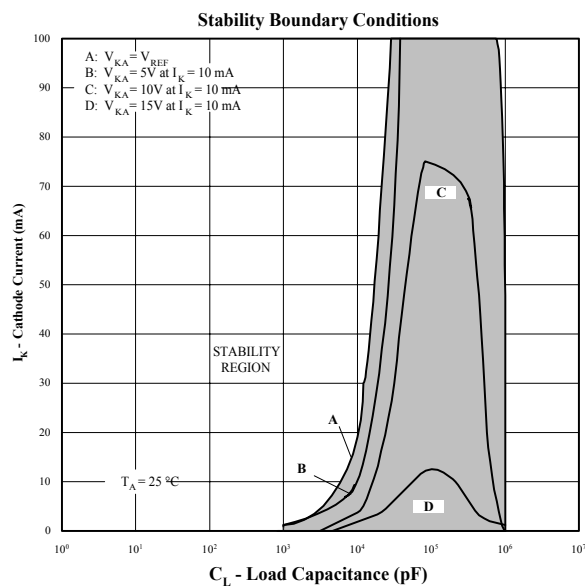
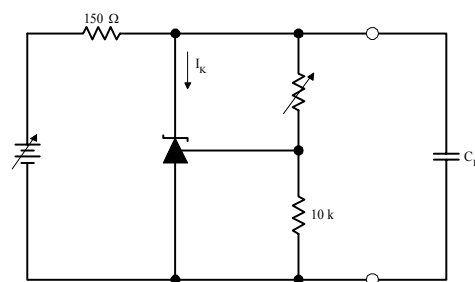
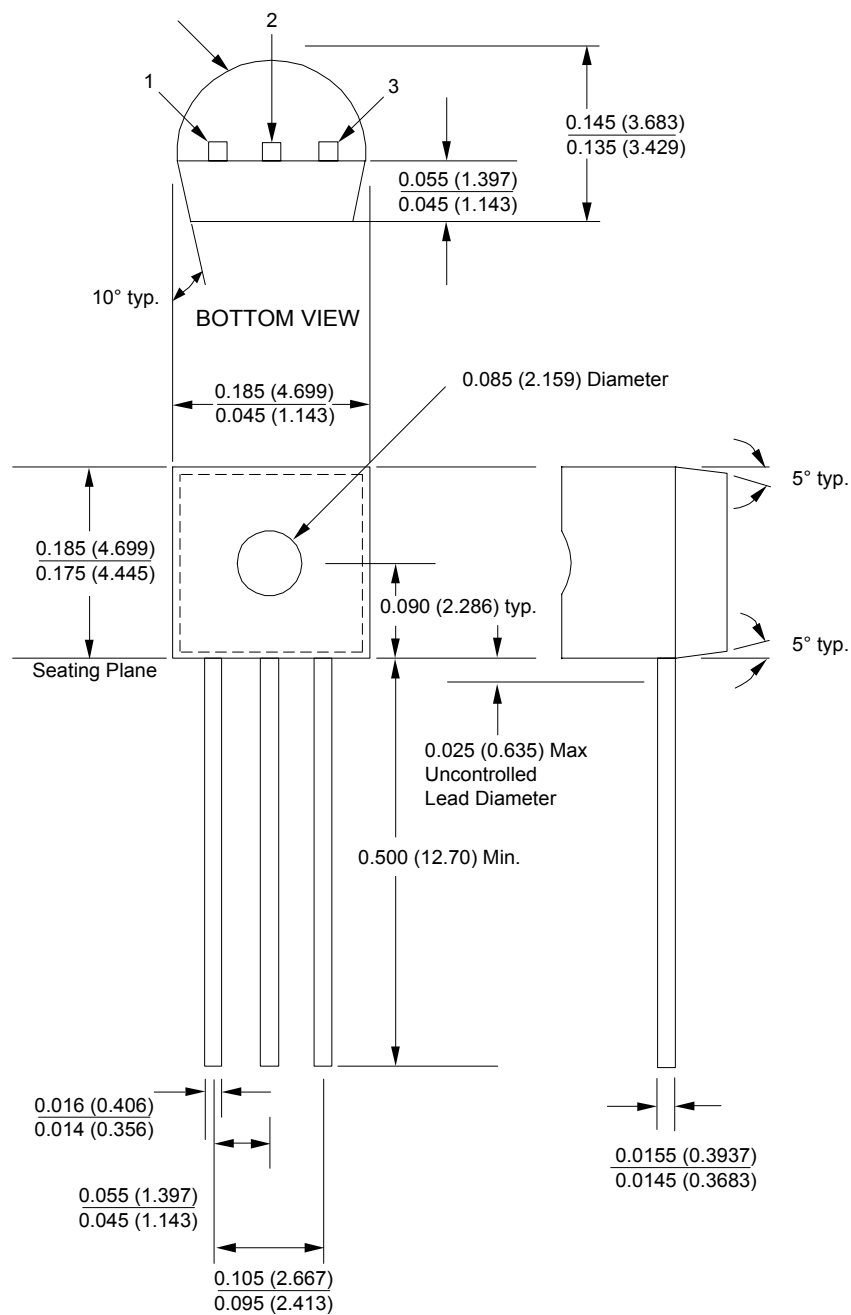


Figure 13

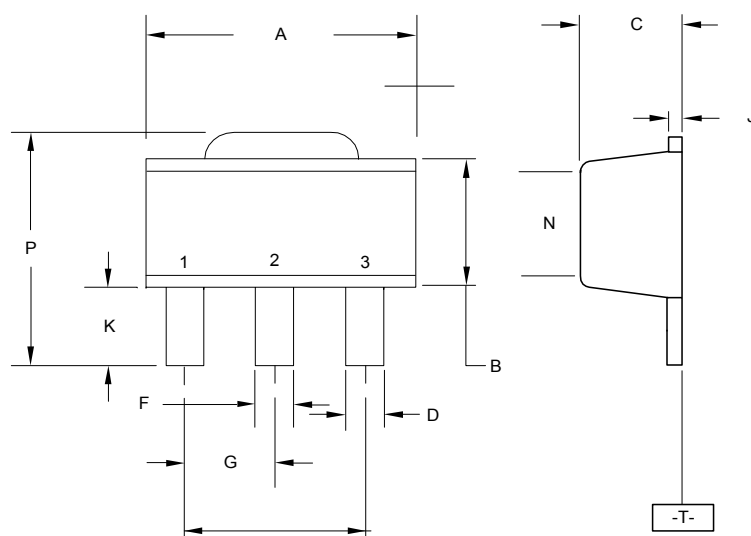


TO-92

0.090 (2.286) Radius typ.



SOT-89



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.174	0.181
B	2.29	2.60	0.091	0.102
C	140	160	0.056	0.062
D	0.36	0.48	0.015	0.018
E	1.62	1.80	0.064	0.070
F	0.44	0.53	0.018	0.020
G	150 BSC		0.059 BSC	
J	0.35	0.44	0.014	0.017
K	0.80	1.04	0.032	0.040
L	300 BSC		0.118 BSC	
N	2.04	2.28	0.081	0.089
P	3.94	4.25	0.156	0.167

Advance Information- These data sheets contain descriptions of products that are in development. The specifications are based on the engineering calculations, computer simulations and/or initial prototype evaluation.

Preliminary Information- These data sheets contain minimum and maximum specifications that are based on the initial device characterizations. These limits are subject to change upon the completion of the full characterization over the specified temperature and supply voltage ranges.

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