ALPHA
SEMICONDUCTOR
Excellence in Analog Power Products

AS433/AS433L

Ultra 2.5V Precision Adjustable Shunt Regulator
150mA/100mA

FEATURES
- Trimmed Bandgap up to 0.2%
- Wide Operating Current ..... 1mA to 150/100mA
- Extended Temperature Range.....-25°C to 105°C
- Low Temperature Coefficient .....30 ppm/°C
- Offered in SOIC, SOT-89, TO-92 and SOT-23 (AS433L)
- Improved Replacement in Performance for LT1431
- Low Cost Solution

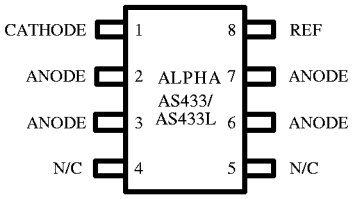
APPLICATIONS
- Notebook/ Personal Computer
- Precision Voltage Reference
- Battery Operating Equipment
- Adjustable Supplies
- Switching Power Supplies
- Error Amplifiers
- Single Supply Amplifier
- Monitors/ VCR/ TV

PRODUCT DESCRIPTION
The ALPHA Semiconductor AS433/AS433L are 3-terminal adjustable shunt voltage regulators providing a highly accurate 0.2% bandgap reference. It offers tight tolerance selection of 0.2%, 0.3% and 0.4%. The AS433/AS433L provides the highest available maximum operating current of 150mA and 100mA respectively. AS433/AS433L acts as an open-loop error amplifier with a 2.5V temperature compensation reference. The AS433/AS433L thermal stability, wide operating current (150mA/100mA) and temperature range (-25°C to 105°C) makes it suitable for a wide variety of applications that are looking for a low cost solution with high performance. AS433/AS433L tolerance of 0.2% is 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 manufacturing assembly line contributing to a significant Cost Savings.

The output voltage may be adjusted to any value between V_{REF} and 36V with two external resistors. The AS433/AS433L have an extended operating temperature range of -25°C to 105°C. The AS433/AS433L are available in TO-92, SO-8, SOT-89 and SOT-23 packages.

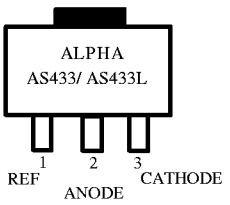
PIN CONFIGURATIONS

8-Pin Surface Mount (S)



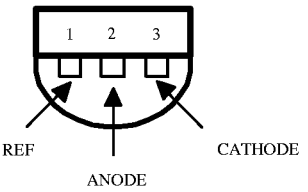
Top View

SOT-89 (M1)



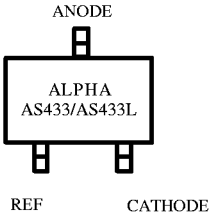
Front View

TO-92 (N)



Bottom View

SOT-23 (M)



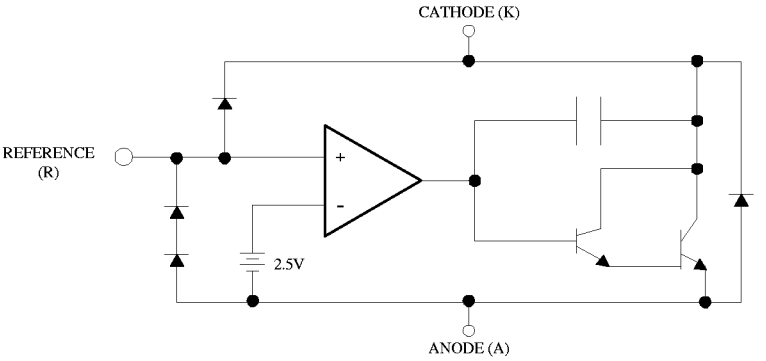
Top View

Alpha Semiconductor Inc. 1031 Serpentine Lane. Pleasanton, CA 94566 Tel: (925) 417-1391 Fax: (925) 417-1390
Rev. 8/24/99

ORDERING INFORMATION

Part Number	Temperature Range	Package Type
AS433XYN	-25°C to 105°C	TO-92
AS433XYM1	-25°C to 105°C	SOT-89
AS433XYS	-25°C to 105°C	SO-8
AS433LYM	-25°C to 105°C	SOT-23

X= Maximum Operating Current, (L= 100mA, "Blank" 150mA)
Y= Output Tolerance (A, C or Blank)



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNITS
Cathode-Anode Reverse Breakdown- (AS433L/ AS433)	V_{KA}	30/37	V
Anode-Cathode Forward Current	I_{AK}	1	A
Operating Cathode Current	I_{KA}	150/100	mA
Reference Input Current	I_{REF}	10	mA
Continuous Power Dissipation at 25° C	P_D		
TO-92		775	mW
8L SOIC		750	mW
SOT-89		1000	mW
SOT-23		300	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	- 65 to 150	°C
Lead Temperature (Soldering 10 sec.)	T_L	300	°C

Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

RECOMMENDED CONDITIONS

PARAMETER	SYMBOL	RATING	UNIT
Cathode Voltage	V_{KA}	V_{REF} to 20	V
Cathode Current	I_K	10	mA

TYPICAL THERMAL RESISTANCES

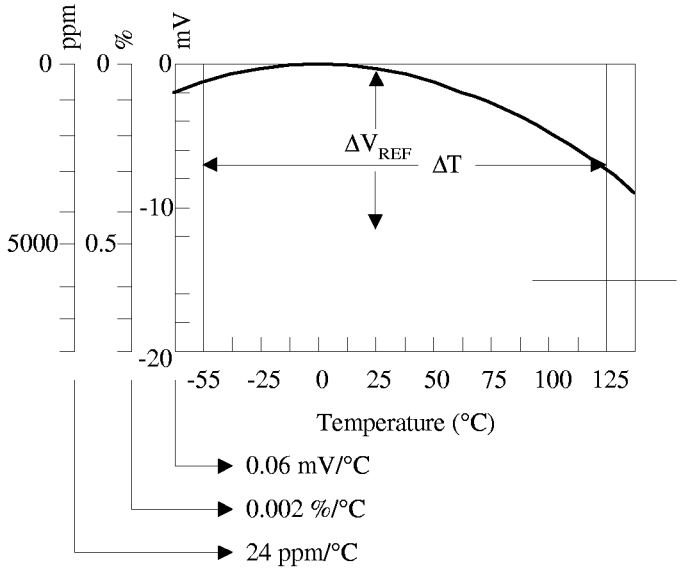
PACKAGE	0_{JA}	0_{JC}	TYPICAL DERATING
TO-92	160 °C/W	80 °C/W	6.3 mW/°C
SOIC	175 °C/W	45 °C/W	5.7 mW/°C
SOT-89	110 °C/W	8 °C/W	9.1 mW/°C
SOT-23	575 °C/W	150 °C/W	1.7 mW/°C

ELECTRICAL CHARACTERISTICS at 25°C I_K @ 10mA $V_K=V_{REF}$, unless otherwise specified.

Parameter	Test Conditions	Test Circuit	AS433A/AS433LA 0.2%			AS433/AS433L 0.3%			AS433C/AS433LC 0.4%			Unit
			Typ	Min	Max	Typ	Min	Max	Typ	Min	Max	
Reference Voltage (V_{REF})	T_A = 25°C	1	2.5	2.4950	2.5050	2.5	2.4925	2.5075	2.5	2.4900	2.5100	V
ΔV_{REF} with Temp.* (TC)		1		0.07	0.20		0.07	0.20		0.07	0.20	mV/°C
Ratio of Change in V_{REF} to Cathode Voltage	V_{REF} to 10V 10V to 36V	 2	-2.7 -2	-1.0 -0.4	 0.3	-2.7 -2	-1.0 -0.4	 0.3	-2.7 -2	-1.0 -0.4	 0.3	mV/V
Reference Input Current (I_{REF})		2		0.7	4		0.7	4		0.7	4	µA
I_{REF} Temp Deviation (ΔI_{REF})	Over Temp.	2		0.4	1.2		0.4	1.2		0.4	1.2	µA
Min I_K for Regulation $I_{K(MIN)}$		1		0.4	1		0.4	1		0.4	1	mA
Off State Leakage $I_{K(OFF)}$	V_{REF} = 0V, V_{KA} = 36V	 3		0.04	250		0.04	250		0.04	250	nA
Dynamic Output Impedance (Z_{KA})		1		0.15	0.5		0.15	0.5		0.15	0.5	Ω

TC = Test Circuit

Calculating Average Temperature Coefficient (TC)



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

TEST CIRCUITS

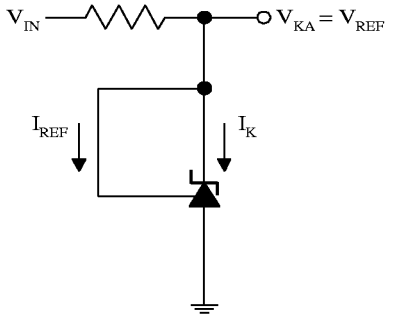


Figure 1a. Test Circuit 1

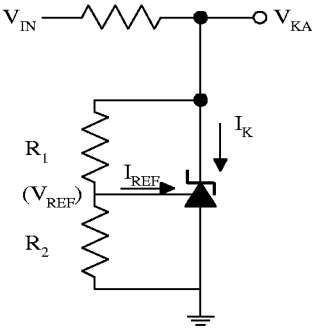


Figure 1b. Test Circuit 2

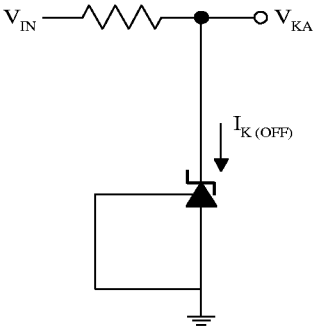


Figure 1c. Test Circuit 3

TYPICAL PERFORMANCE CURVES

Low Current Operating Characteristics

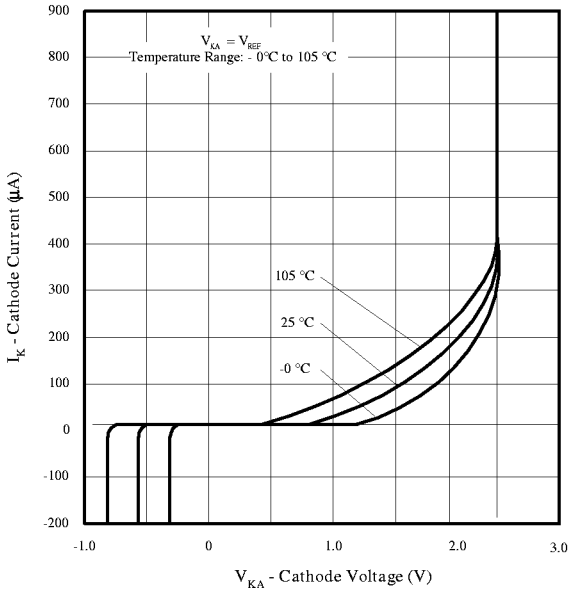


Figure 2

High Current Operating Characteristics

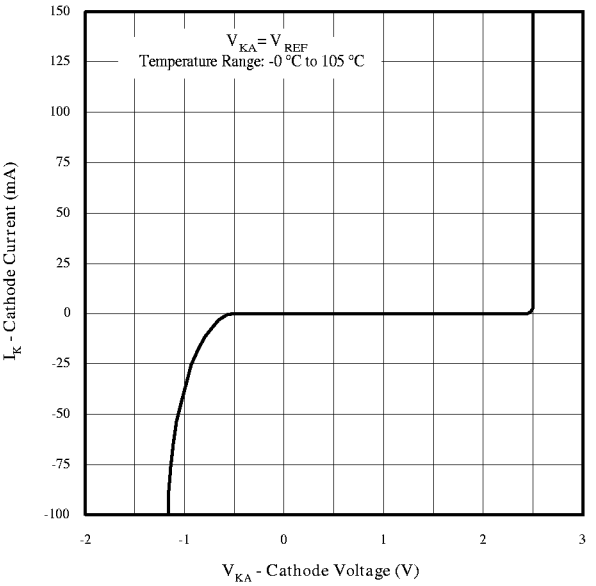


Figure 3

Off State Leakage

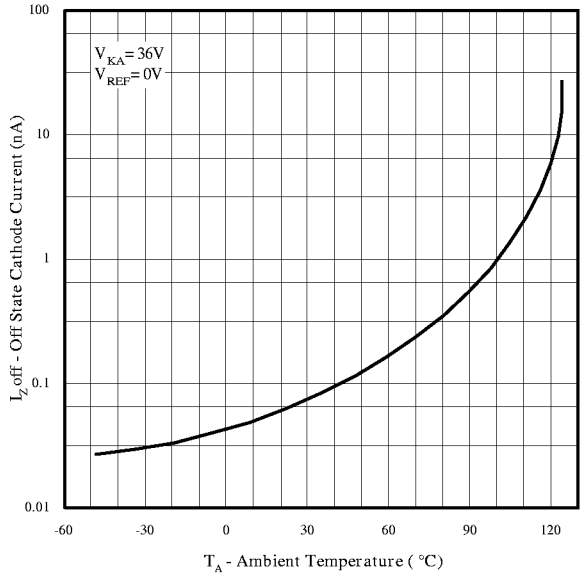


Figure 4

Reference Voltage vs. Ambient Temperature

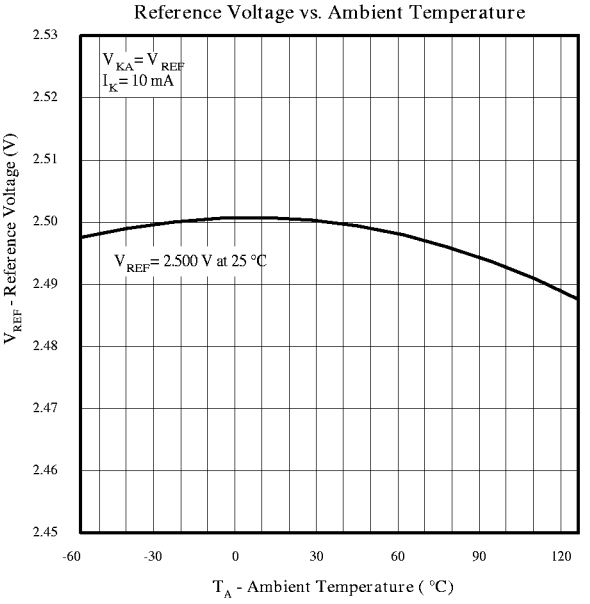


Figure 5

TYPICAL PERFORMANCE CURVES

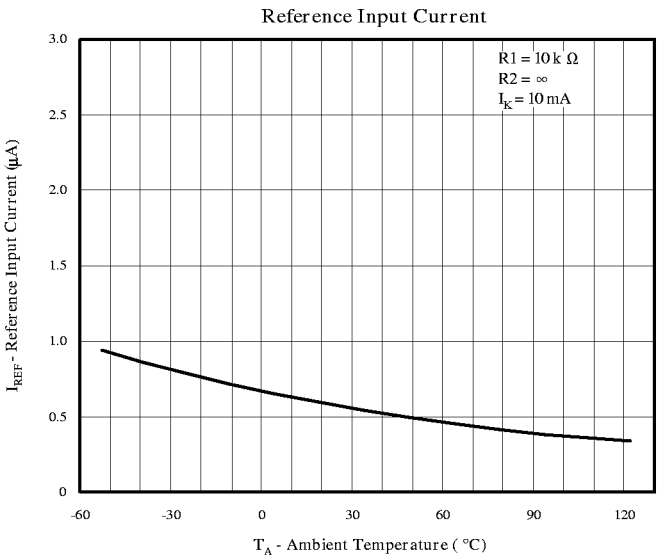


Figure 6

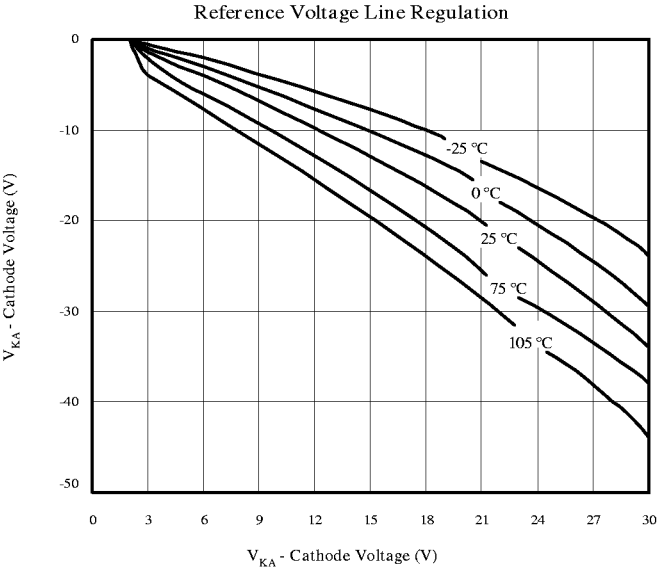


Figure 7

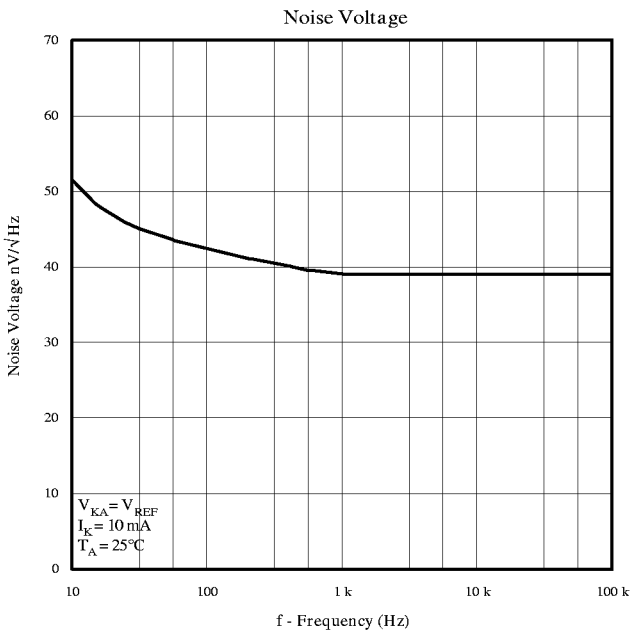


Figure 8

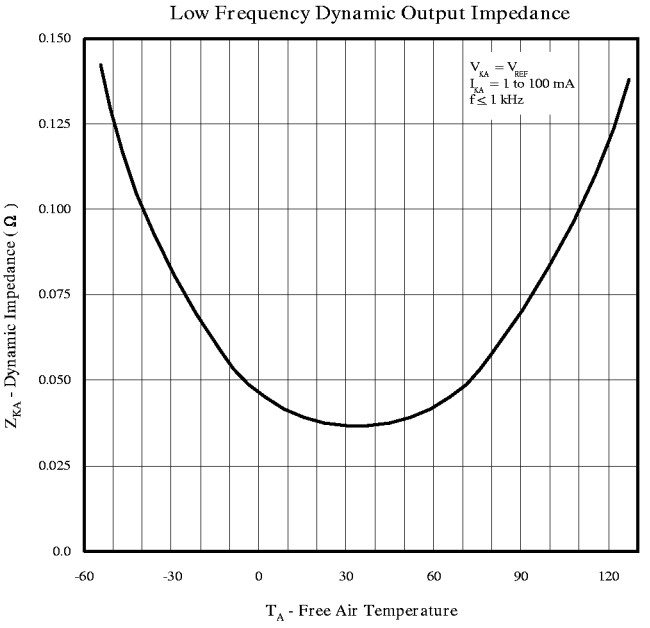


Figure 9

TYPICAL PERFORMANCE CURVES

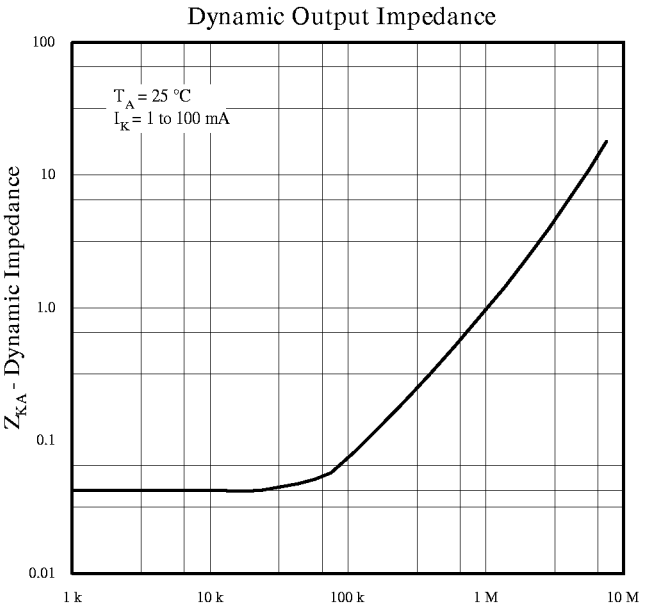
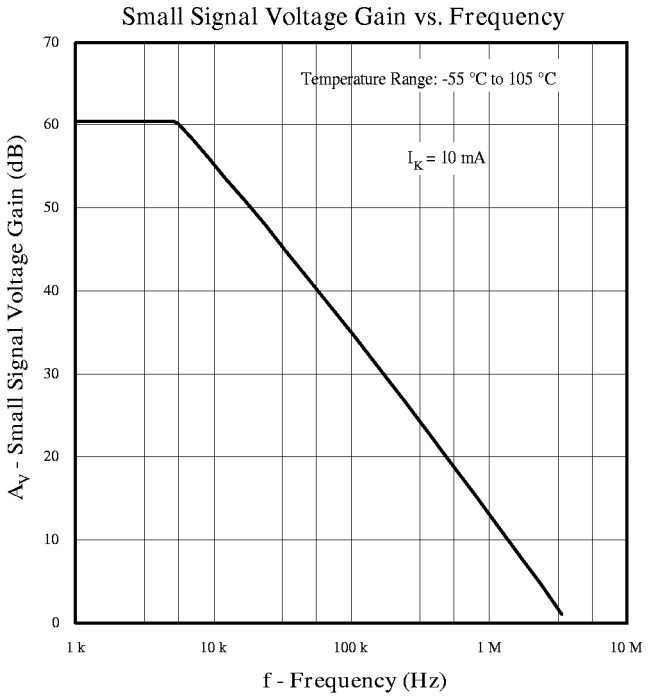


Figure 10



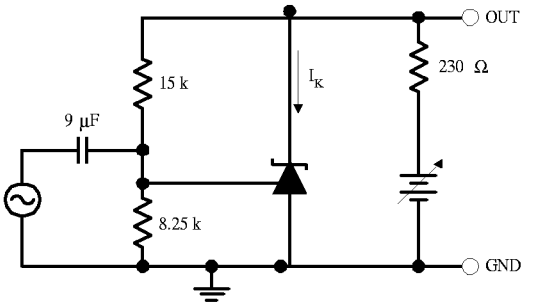
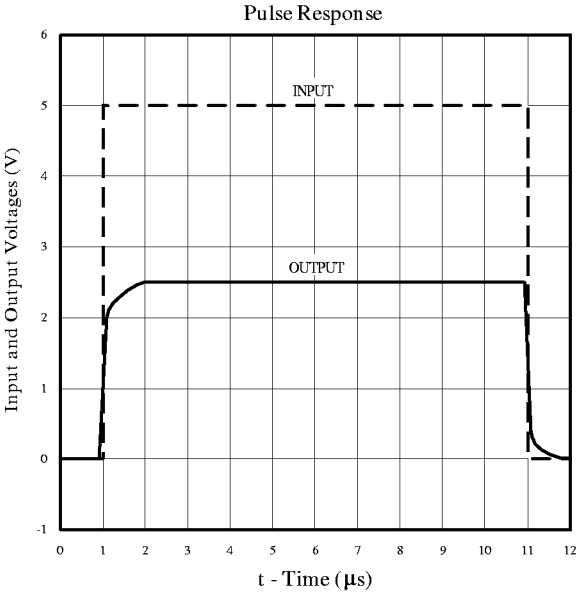


Figure 11

TYPICAL PERFORMANCE CURVES



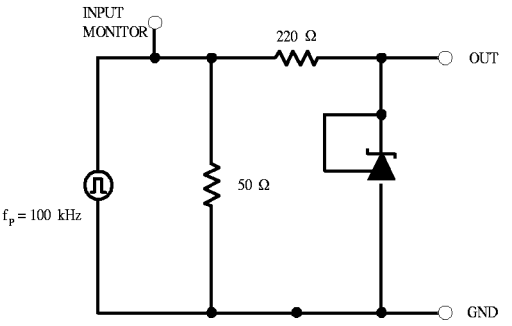
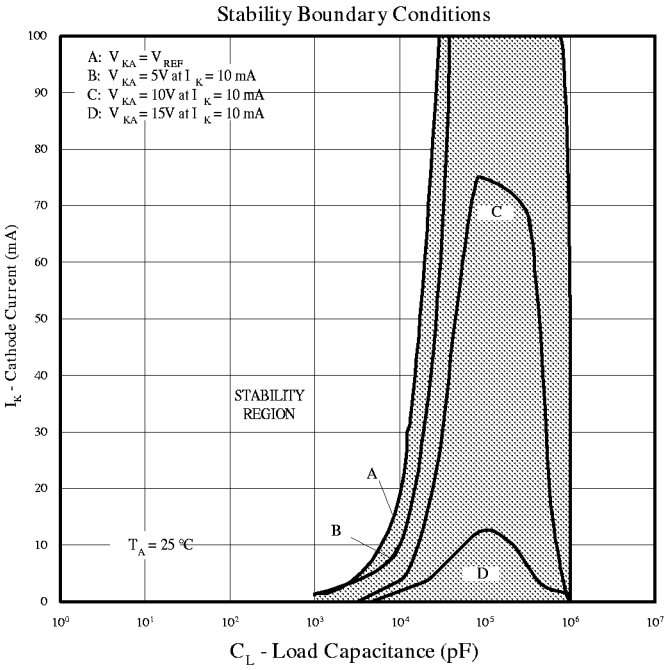


Figure 12



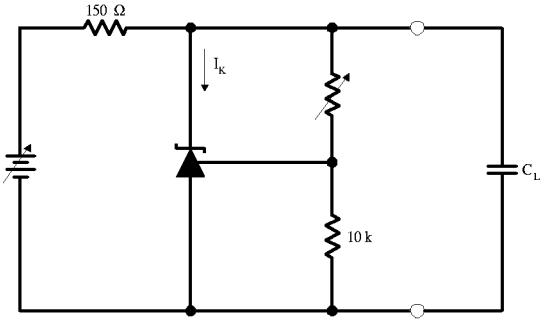
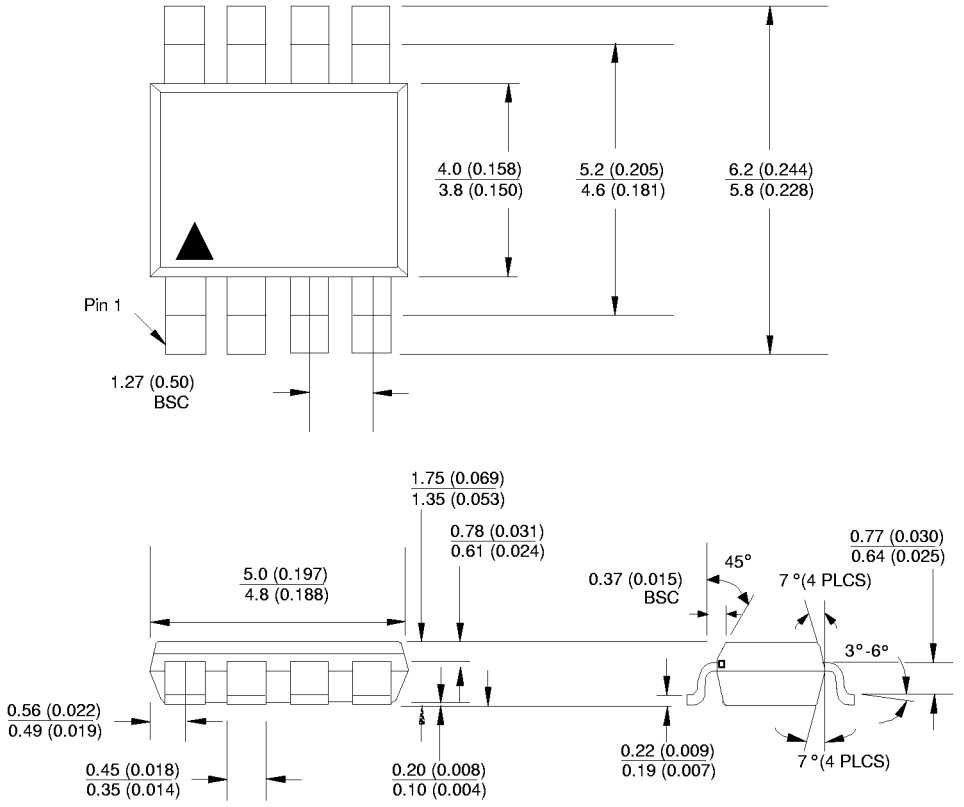
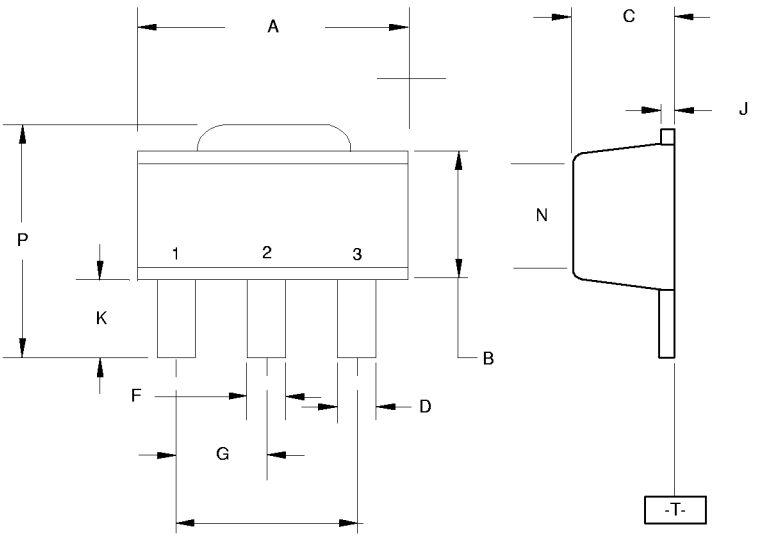


Figure 13

PACKAGE DRAWING
8-PIN SOIC (S)



PACKAGE DRAWING
SOT-89 (M1)



STYLE 1
PIN 1. BASE
2. COLLECTOR
3. EMITTER

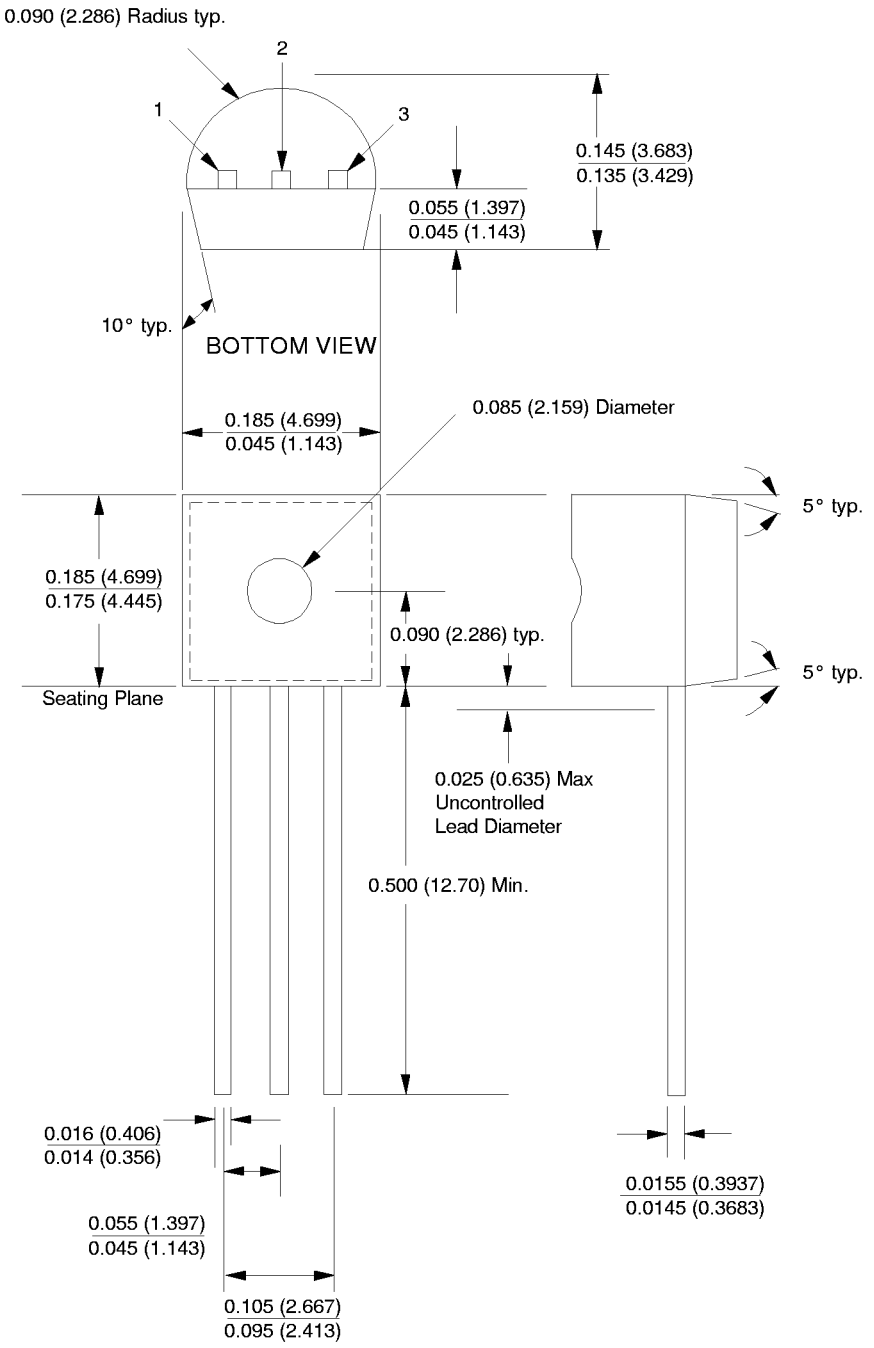
STYLE 3
PIN 1. GATE
2. ANODE
3. CATHODE

STYLE 2
PIN 1. ANODE
2. CATHODE
3. NO CONNECTION

STYLE 4
PIN 1. DRAIN
2. GATE
3. SOURCE

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

PACKAGE DRAWING
TO-92 (N)



PACKAGE DRAWING
SOT-23-3L (M)