

## Adjustable Precision Shunt Regulator

### ◆ Description

The ET432 is a three-terminal adjustable shunt regulator series with a guaranteed thermal stability over applicable industrial temperature ranges and wide operating current (up to 100mA). The output voltage between 1.24 and 18 volts by selection of two external divider resistors.

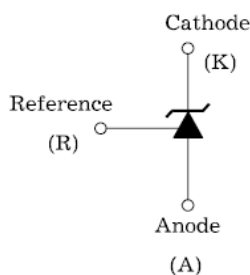
The ET432 have a typical output impedance of  $0.2 \Omega$ . Active output circuitry provides a very sharp turn-on characteristic, making the APL431L excellent replacements for zener diodes in many applications, including on-board regulation and adjustable power supplies.

### ◆ Features

- Precise Reference Voltage to 1.24V .
- $0.2 \Omega$  Typical Output Impedance.
- Sink Current Capability, 80uA to 100mA.
- Temperature Range -40 to 125°C.
- Adjustable Output Voltage Vref to 18V
- Quick Turn-on.
- SOT-23, TO-92, SOT-89, SOT-23-5 packages
- Reference Voltage Tolerance at 25°C
 

-0.5%	ET432A
-1%	ET432B
-1.5%	ET432C

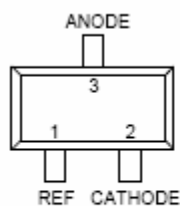
### ◆ Symbol



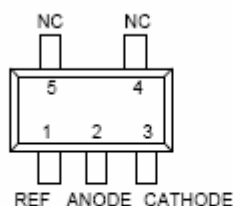
### ◆ Applications

- Precision Voltage Reference
- Linear Regulator
- Adjustable Power Supply
- Switching Power Supply
- Instrumentation
- Computer Disk Drivers

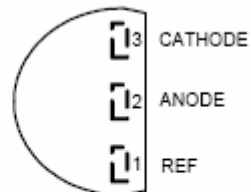
### ◆ Pin Description



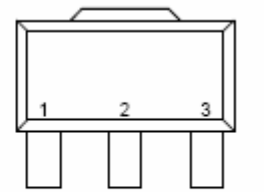
SOT-23-3 (Top View)



SOT-23-5 (Top View)



TO-92 (Top View)



SOT-89 (Top View)

**◆ Ordering Information**

Part Number	Accurate	Temperature	Package	Pin Assignment			Packing
				R	A	C	
ET432AAI	0.5%	-40°C~+125°C	SOT-23	1	3	2	Tape & Reel
ET432AEI			TO-92	1	2	3	Tape & Box
ET432ADI			SOT-89	1	2	3	Tape & Reel
ET432ABI			SOP-23-5	1	2	3	Tape & Reel
ET432BAI	1%		SOT-23	1	3	2	Tape & Reel
ET432BEI			TO-92	1	2	3	Tape & Box
ET432BDI			SOT-89	1	2	3	Tape & Reel
ET432BBI			SOP-23-5	1	2	3	Tape & Reel
ET432CAI	1.5%		SOT-23	1	3	2	Tape & Reel
ET432CEI			TO-92	1	2	3	Tape & Box
ET432CDI			SOT-89	1	2	3	Tape & Reel
ET432CBI			SOP-23-5	1	2	3	Tape & Reel

**◆ Absolute Maximum Ratings**

Symbol	Parameter	Value	Unit
$V_{KA}$	Cathode Voltage	18	V
$I_K$	Cathode Current Range(Continuous)	100	mA
$I_{REF}$	Reference Input Current Range	3	mA
$T_{oper.}$	Operating Temperature Range	-40~+125	°C
$T_J$	Junction Temperature Range	-40~+150	°C
$T_{stg}$	Storage Temperature Range	-65~+150	°C

**◆ Thermal Characteristics**

Symbol	Parameter	Package	Typical Value	Unit
$\theta_{JA}$	Thermal Resistance From Junction to Ambient in Free Air. (Measured with the component mounted on a high effective thermal conductivity test board in free air.)	SOT-23	416	°C/W
		TO-92	250	
		SOT-89	250	
		SOP-23-5	357	

**◆ Electrical Characteristics**

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit	
$V_{REF}$	Reference input Voltage	$V_{KA}=V_{REF}$ , $I_K=10\text{mA}$	0.5%	1.234	1.240	1.246	V
			1%	1.228	1.240	1.252	
			1.5%	1.223	1.240	1.258	
$V_{REF(\text{dev})}$	Deviation of Reference Input Voltage Over Full Temperature Range	$T_{\min} \leq T_a \leq T_{\max}$	-	10	25	mV	
$\Delta V_{REF}/\Delta V_{KA}$	Ratio of change in $V_{REF}$ to Change in Cathode Voltage	$V_{KA}=V_{REF}$ to 18V	-	-1	-2.7	mV/V	
$I_{REF}$	Reference Input Current	$R_1=10\text{K}\Omega$ , $R_2=\infty$	-	0.25	0.5	$\mu\text{A}$	
$I_{REF(\text{dev})}$	Deviation of Reference Input Current Over Full Temperature Range	$R_1=10\text{K}\Omega$ , $R_2=\infty$	-	0.05	0.3	$\mu\text{A}$	
$I_{K(\text{min})}$	Minimum Cathode Current for Regulation	$V_{KA}=V_{REF}$	-	60	80	$\mu\text{A}$	
$I_{K(\text{off})}$	Off-State Cathode Current	$V_{KA}=18\text{V}$ , $V_{REF}=0$	-	0.04	0.5	$\mu\text{A}$	
$Z_{KA}$	Dynamic Impedance	$I_K=1\text{mA}$ to $100\text{mA}$ $f \leq 1.0\text{KHz}$	-	0.2	0.4	$\Omega$	

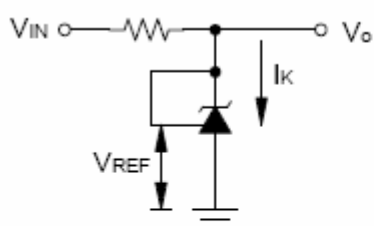
**◆ Test Circuit**


Figure 1. Test Circuit for  
 $V_{KA}=V_{REF}$ ,  $V_O=V_{KA}=V_{REF}$

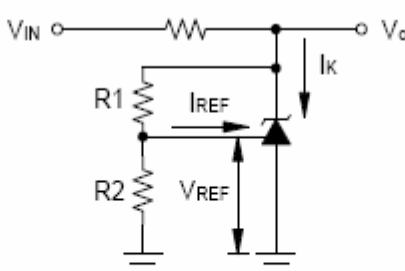


Figure 2. Test Circuit for  $V_{KA} > V_{REF}$ ,  
 $V_O = V_{KA} = V_{REF} \times (1 + R_1/R_2) + I_{REF} \times R_1$

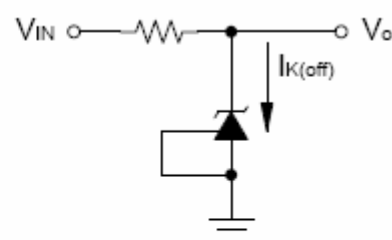
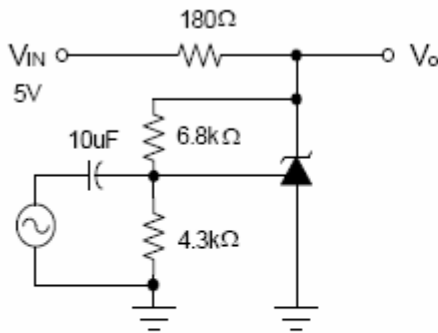
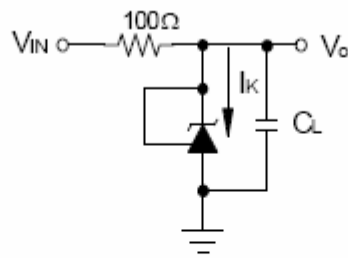
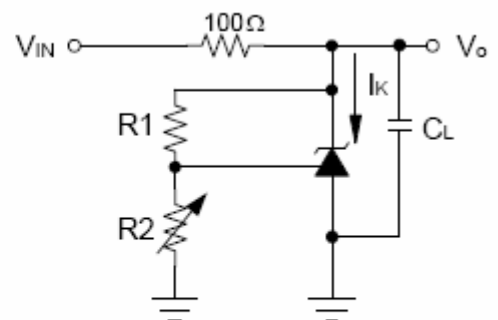
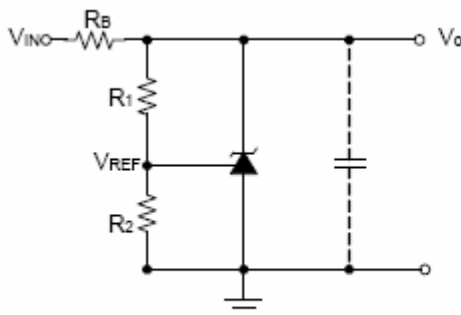


Figure 3. Test Circuit for  $I_{K(\text{off})}$

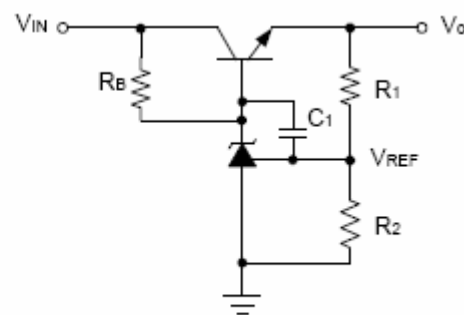
**◆ Test Circuit (Continued)**


Gain &amp; Phase Test Circuit


 Stability Test Circuit for  $V_{KA} = V_{REF}$ 

 Stability Test Circuit for  $V_{KA} > V_{REF}$   
 $V_O = V_{KA} = V_{REF} \times (1 + R_1/R_2) + I_{REF} \times R_1$   
 Use the MLCC for CL

**◆ Typical Application Circuits**


Precision Voltage Reference



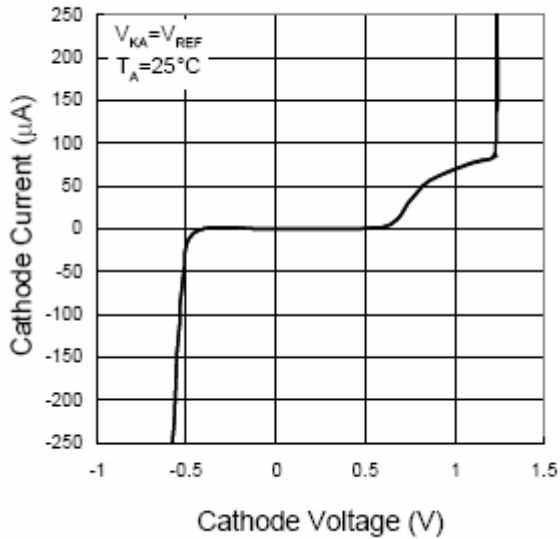
Precision High-Current Series Regulator

Notes for Typical Application Circuits:

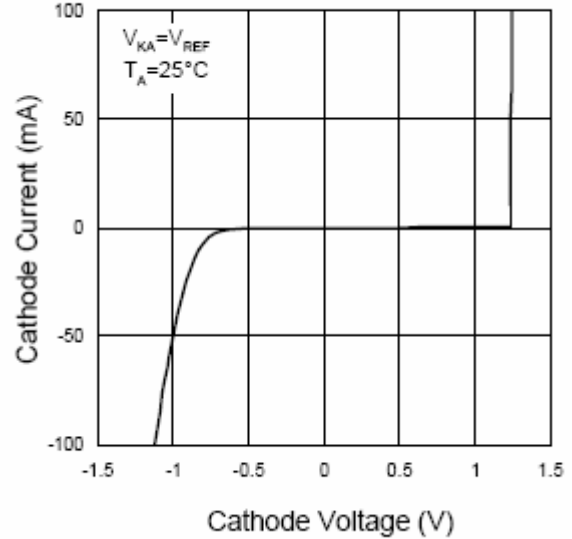
1. For the series regulator applications, add a compensation capacitor  $C_1$  between CATHODE and REF is strongly recommended to improve the stability of output voltage.
2. Set  $V_o$  according to the following equation:  $V_o = V_{REF}(1 + R_1/R_2) + I_{REF} \times R_1$ .
3. Choose the Value for  $R_B$  as below:
  - (1). The maximum limit for  $R_B$  should be such that the cathode current ( $I_K$ ) is greater than the minimum operating current (80μA) at  $V_{IN(MIN)}$ .
  - (2). The minimum limit for  $R_B$  should be such that the cathode current ( $I_K$ ) does not exceed 100mA under all load conditions, and the instantaneous turn-on value for  $I_K$  does not exceed 120mA.

◆ **Typical Characteristics**

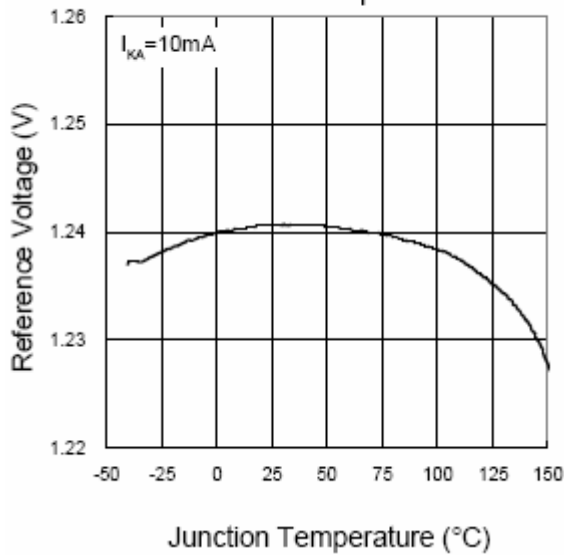
Cathode Current vs. Cathode Voltage



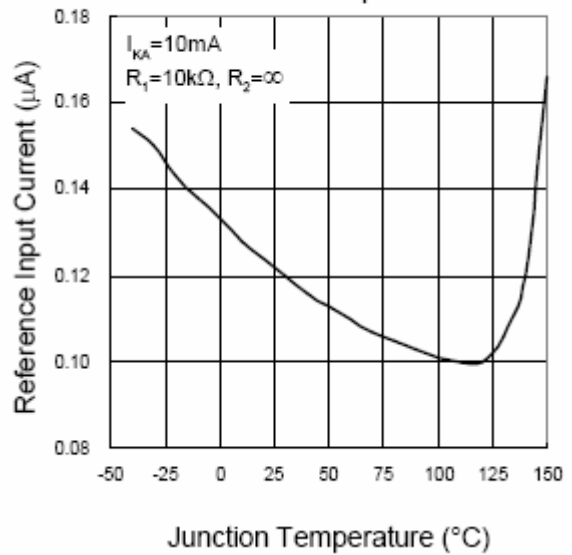
Cathode Current vs. Cathode Voltage



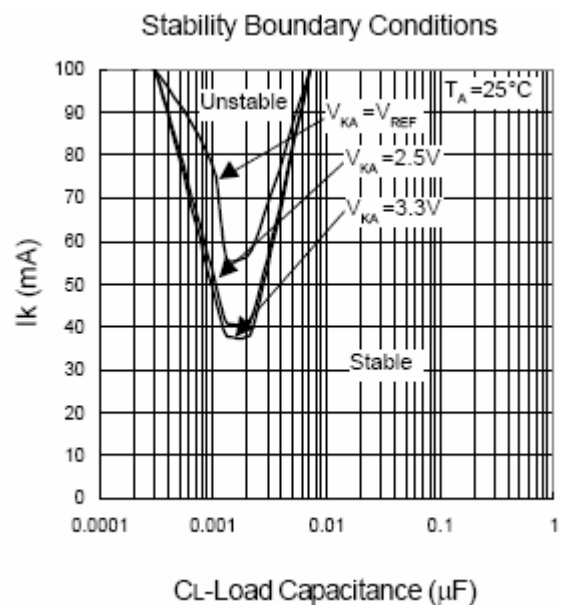
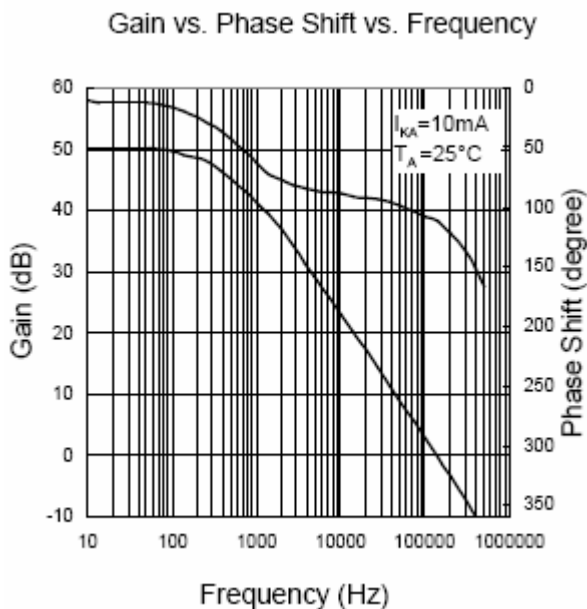
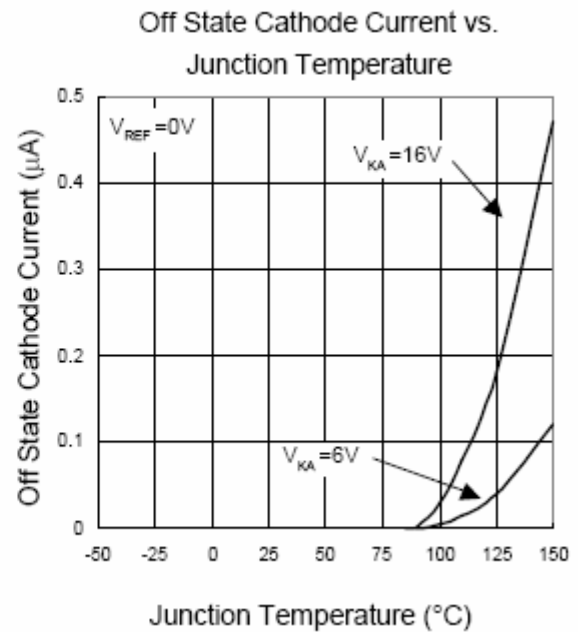
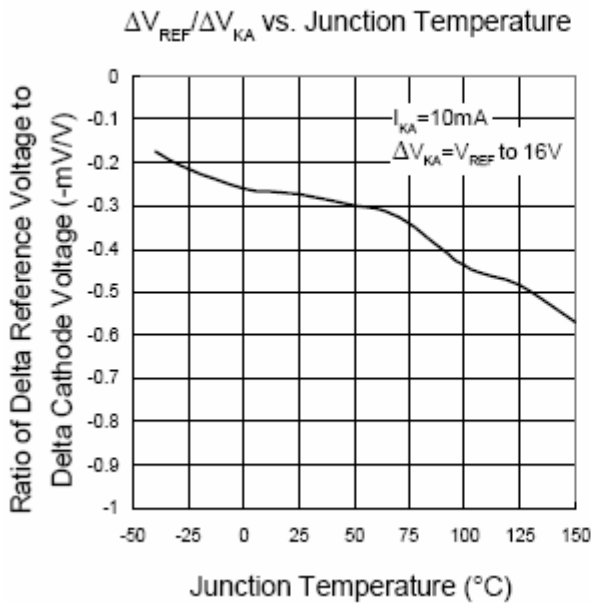
Reference Voltage vs. Junction Temperature



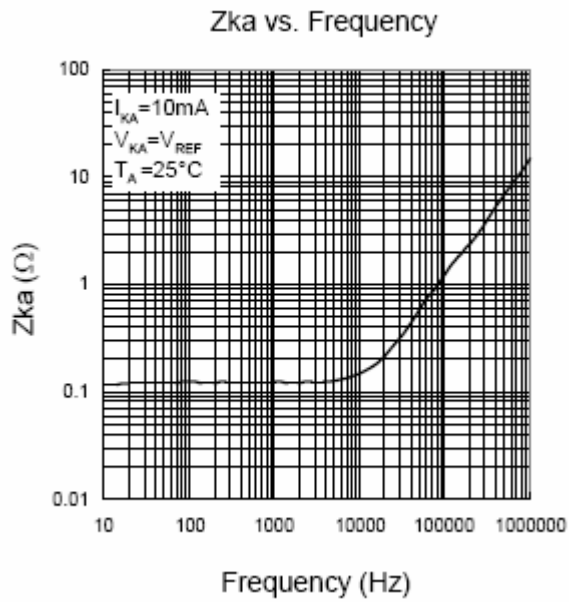
Reference Input Current vs. Junction Temperature



◆ **Typical Characteristics (Continued)**

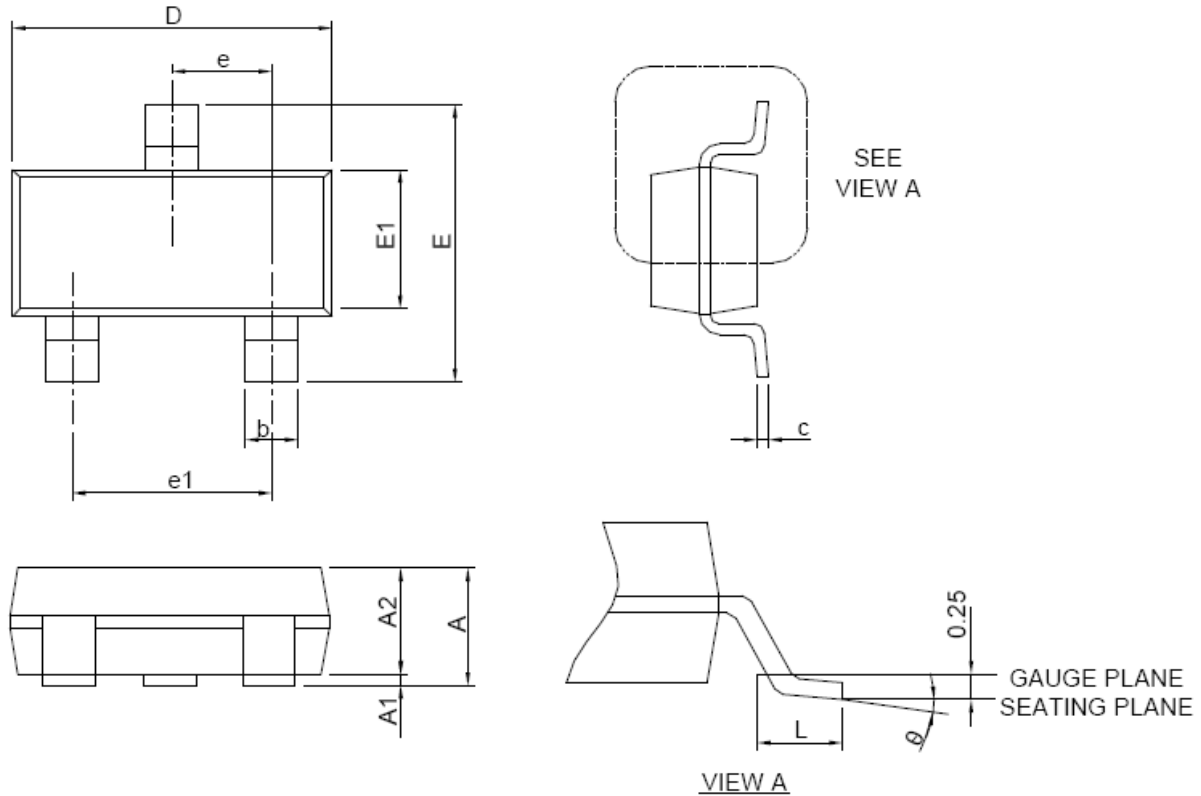


◆ Typical Characteristics (Continued)



**◆ Package Information**

SOT-23

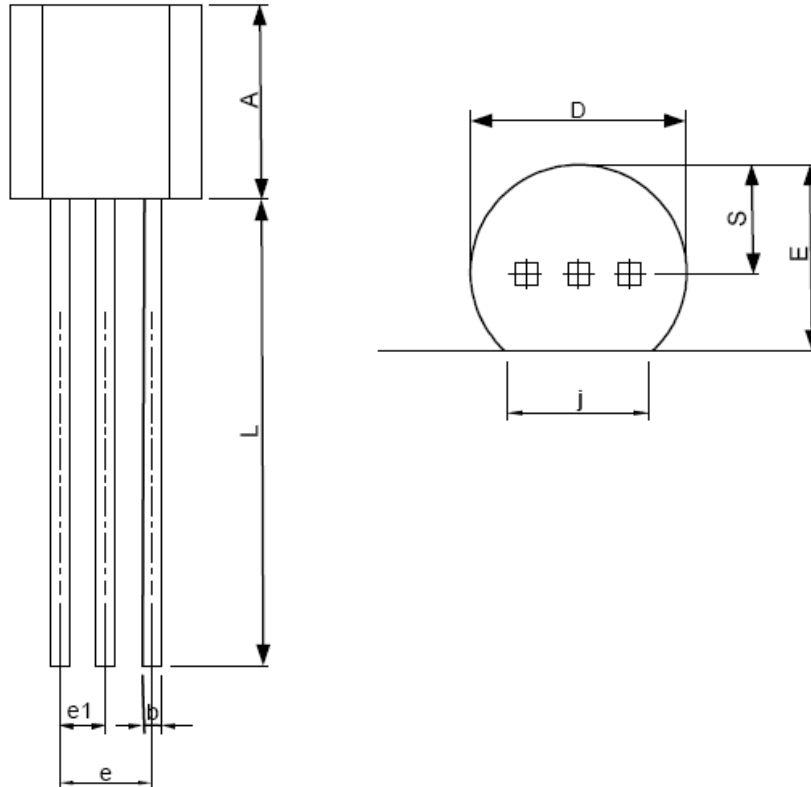


SYMBOL	SOT-23			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.15		0.045
A1	0.00	0.10	0.000	0.004
A2	0.90	1.05	0.035	0.041
b	0.30	0.50	0.012	0.020
c	0.08	0.15	0.003	0.006
D	2.70	3.00	0.110	0.118
E	2.25	2.55	0.089	0.100
E1	1.20	1.40	0.047	0.055
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30	0.60	0.012	0.024
$\theta$	0°	8°	0°	8°



**◆ Package Information**

TO-92

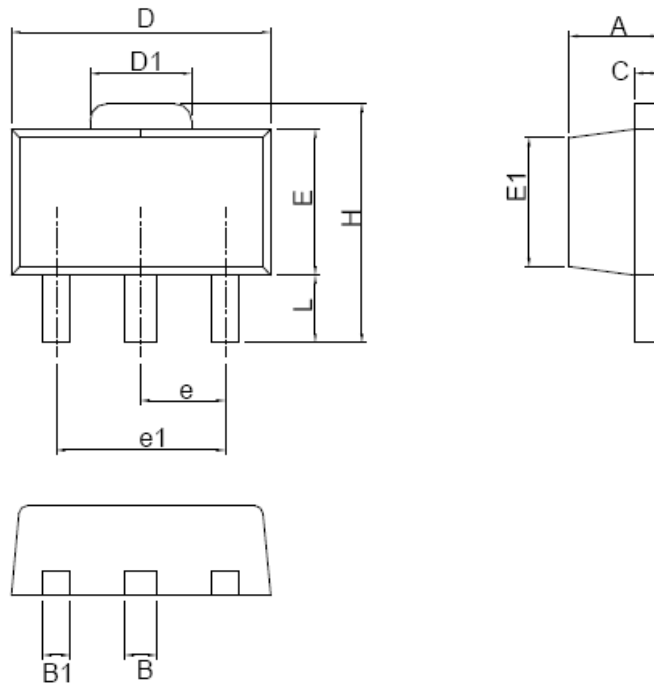


SYMBOL	TO-92			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.32	5.33	0.170	0.210
b	0.41	0.53	0.016	0.021
D	4.45	5.20	0.175	0.205
E	3.18	4.19	0.125	0.165
e	2.42	2.66	0.095	0.105
e1	1.15	1.39	0.045	0.055
j	3.43	4.00	0.135	0.157
L	12.70	15.00	0.500	0.591
S	2.03	2.66	0.080	0.105

Note : Follow JEDEC TO-92.

**◆ Package Information**

SOT-89

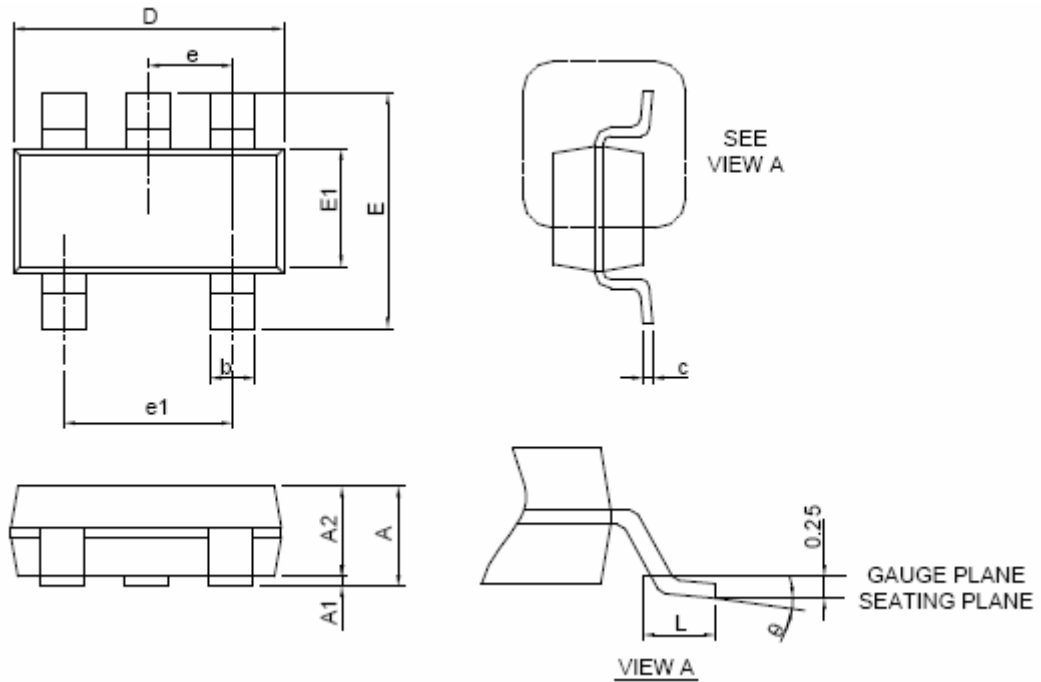


SYMBOL	SOT-89			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	1.40	1.60	0.055	0.063
B	0.44	0.56	0.017	0.022
B1	0.36	0.48	0.014	0.019
C	0.35	0.44	0.014	0.017
D	4.40	4.60	0.173	0.181
D1	1.62	1.83	0.064	0.072
E	2.29	2.60	0.090	0.102
E1	2.13	2.29	0.084	0.090
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
H	3.94	4.25	0.155	0.167
L	0.89	1.20	0.035	0.047

Note : Follow JEDEC TO-243 AA.

**◆ Package Information**

SOT-23-5



SYMBOL	SOT-23-5			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.45		0.057
A1	0.00	0.15	0.000	0.006
A2	0.90	1.30	0.035	0.051
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.70	3.10	0.016	0.122
E	2.60	3.00	0.102	0.118
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30	0.60	0.012	0.024
$\theta$	0°	8°	0°	8°

Note : Follow JEDEC TO-178 AA.