Low Voltage Adjustable Precision Shunt Regulator
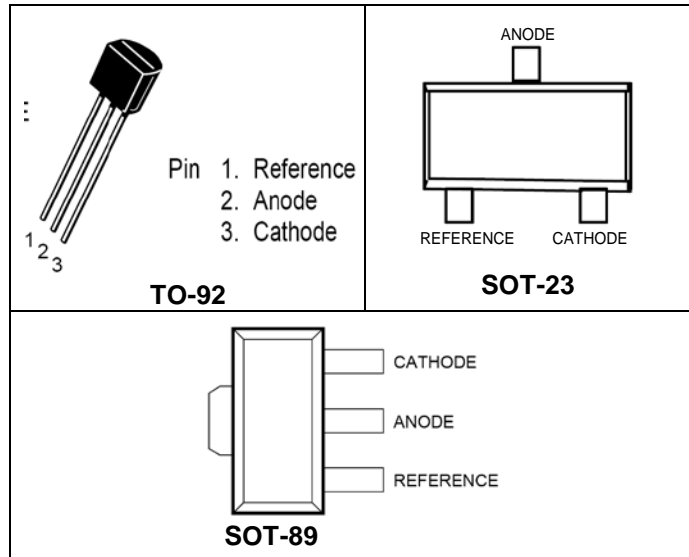
Features

- Precise Reference Voltage to 1.24V
- Guaranteed 2%, 1% , 0.5% Reference Voltage Tolerance
- Sink Current Capability, $80\mu A$ to$100mA$
- Quick Turn-on
- Adjustable Output Voltage, $V_o = V_{REF}$ to 15V
- 0.2Ω Typical Output Impedance
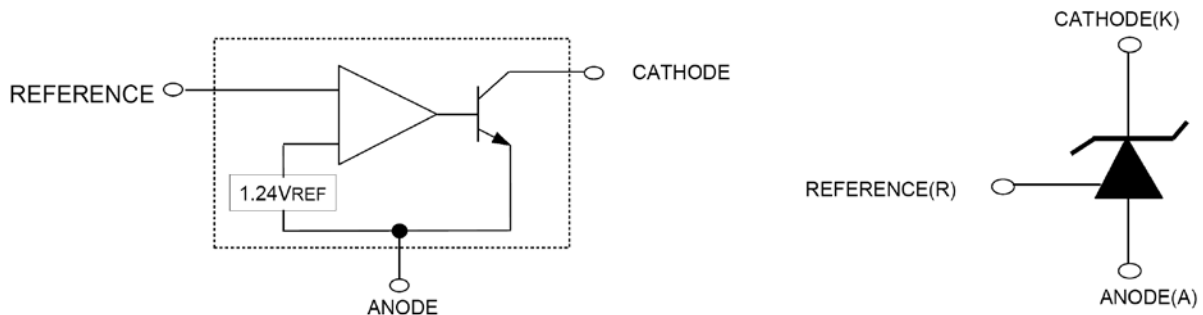- TO-92, SOT-23, SOT-89 packages.

Applications

- Linear Regulator
- Adjustable Supplies
- Switching Power Supplies
- Battery Charger
- Instrumentation
- Computer Disk Drives

PIN CONNECTIONS

Pin 1. Reference
2. Anode
3. Cathode

TO-92

SOT-23

SOT-89

Block Diagram

Absolute Maximum Ratings

Symbol	Parameter	Symbol	Rating	Unit
V_{KA}	Cathode voltage	V_{KA}	18	V
I_K	Continuous cathode current range	I_K	100	mA
I_{REF}	Reference current range	I_{REF}	3	mA
Tj	Operating Junction Temperature Range	Tj	- 40 to 150	°C

Pad #	Description
1	REF
2	ANODE
3	CATHODE

* Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device.
These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.
Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Electrical Characteristics   Ta= 25°C (unless otherwise noted)

Symbol	Parameter	Test Conditions	TL432			Unit
			Min	Typ	Max	
V_{RFF}	Reference voltage	$V_{KA}=V_{REF}$, I_K=10mA (Fig. 1) T_A =25°C 　　　　HT432C　　(2%) 　　　　HT432B　　(1%) 　　　　HT432A　(0.5%)	1.216 1.228 1.234	1.240 1.240 1.240	1.264 1.252 1.246	V
V_{DEV}	V_{REF} Temp Deviation	T_A=full range (see Note1) $V_{KA}=V_{REF}$, I_K=10mA (Fig. 1)		10	25	mV
$\Delta V_{REF}/\Delta V_{KA}$	Ratio of Change in V_{REF} to Change in Cathode Voltage	I_K=10mA, V_{KA}=15V to V_{REF} (Fig. 2)		-1	-2.7	mV / V
I_{REF}	Reference Input Current	I_K=10mA, R_1 =10kΩ R_2=∞ (Fig.2)		0.5	1.0	μA
$I_{REF(DEV)}$	I_{REF} Temp Deviation	T_K=full range (see Note 1), R_1 =10kΩ, R_2=∞, I_K=10mA (Fig. 2)		0.05	0.3	μA
Ik(off)	Off-state cathode current	V_{REF}=0 V,(Fig.3) V_k=15V		0.04	0.5	μA
Zka	Dynamic Output Impedance	$V_{ka}=V_{ref}$, I_k=1mA to 100mA F ≤1kHz (Fig. 1)		0.2	0.4	Ω
IK(MIN)	Minimum Operating Current	$V_{KA}=V_{REF}$(Fig. 1)		60	80	μA

Notes: 1. Full temperature range is -40°C to 105°C for HT432
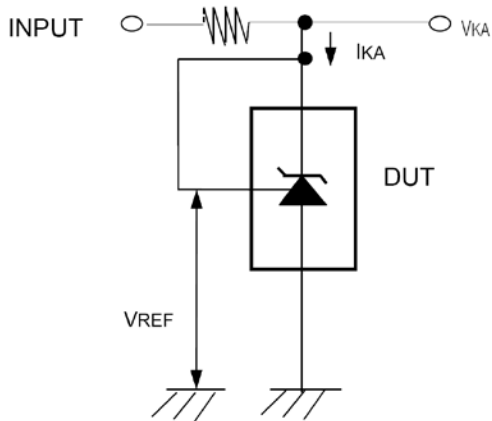
TEST CIRCUITS

Fig. 1 Test Circuit for $V_{KA}=V_{REF}$
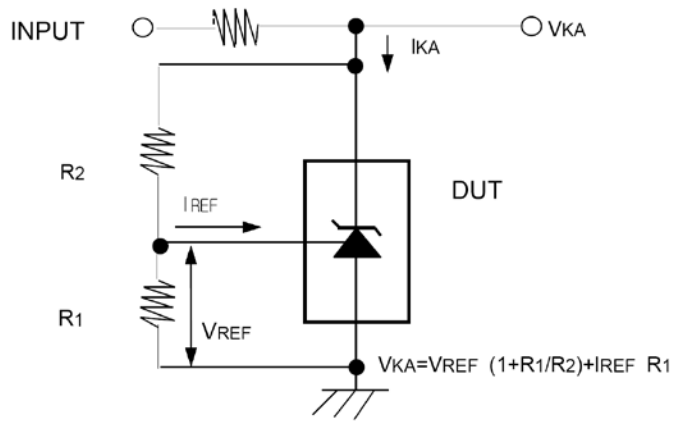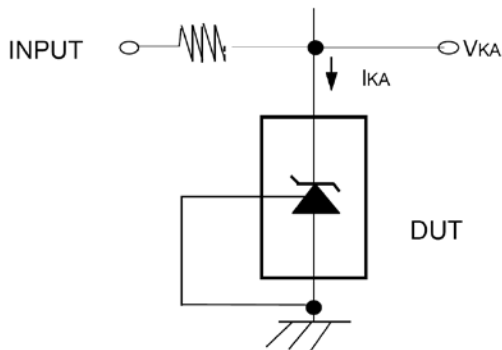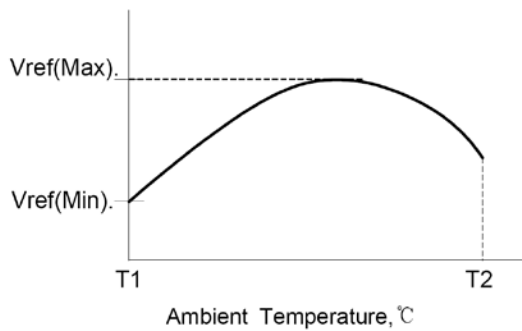
Fig. 2 Test Circuit for $V_{KA}\geq V_{REF}$

INPUT V_{KA}
I_{KA}
DUT
V_{REF}

INPUT V_{KA}
I_{KA}
R2
I_{REF}
DUT
R1
V_{REF}
$V_{KA}=V_{REF}\ (1+R_1/R_2)+I_{REF}\ R_1$

Fig. 3 Test Circuit for IKA(off)

INPUT V_{KA}
I_{KA}
DUT

Note1] The deviation parameter $\triangle V_{ref}$ is defined as the differences between the maximum and minimum values obtained over the full operating ambient temperature range that applies.

Vref(Max).

Vref(Min).

T1   T2

Ambient Temperature, ℃

$\triangle V_{ref} = Vref(Max.) - Vref(Min)$
Ta= T2-T1

The average temperature coefficient of the Reference input voltage, αVref. is defined as:

$$\alpha Vref. = \frac{ppm}{\text{℃}} = \frac{\left(\frac{\triangle Vref}{Vref\ @25\text{℃}}\right) \times 10^6}{\triangle Ta} = \frac{\triangle Vref \times 10^6}{\triangle Ta(\ Vref\ @25\text{℃})}$$
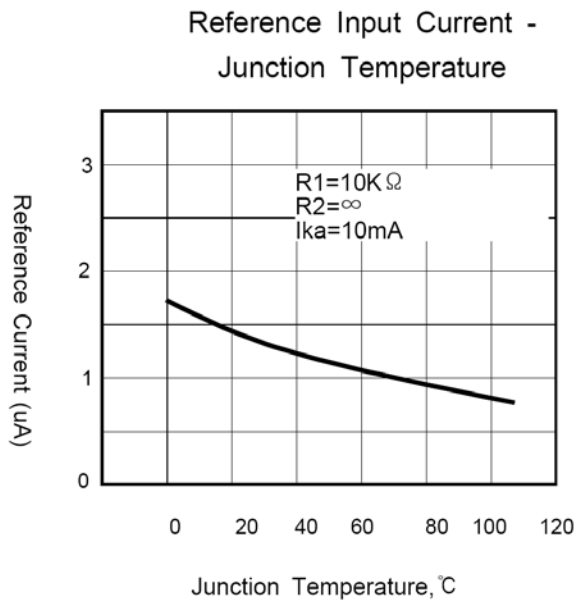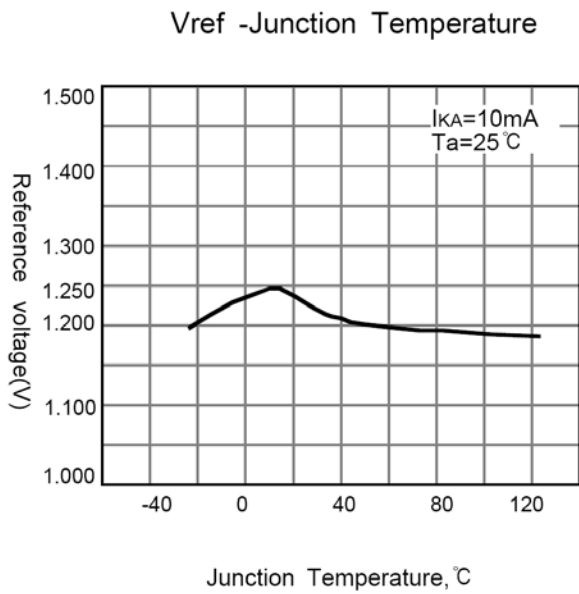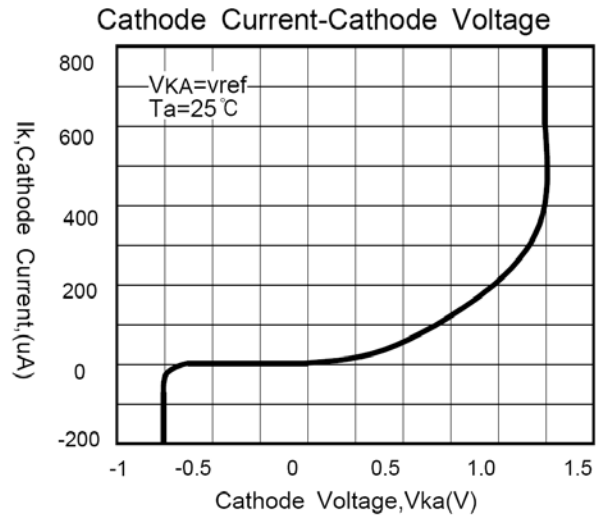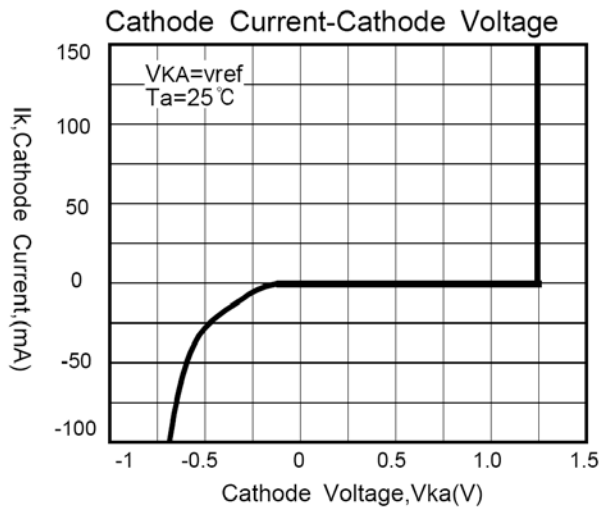
αVref. is can be positive or negative depending on whether Vref.Min. or Vref.Max. occurs at the lower ambient temperature.

Note2] The dynamic impedance Z_{ka} is defined as:

$$|Z_{ka}| = \frac{\triangle VKA}{\triangle IK}$$
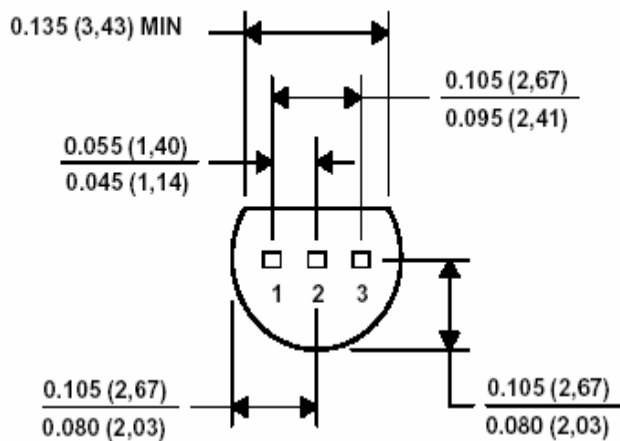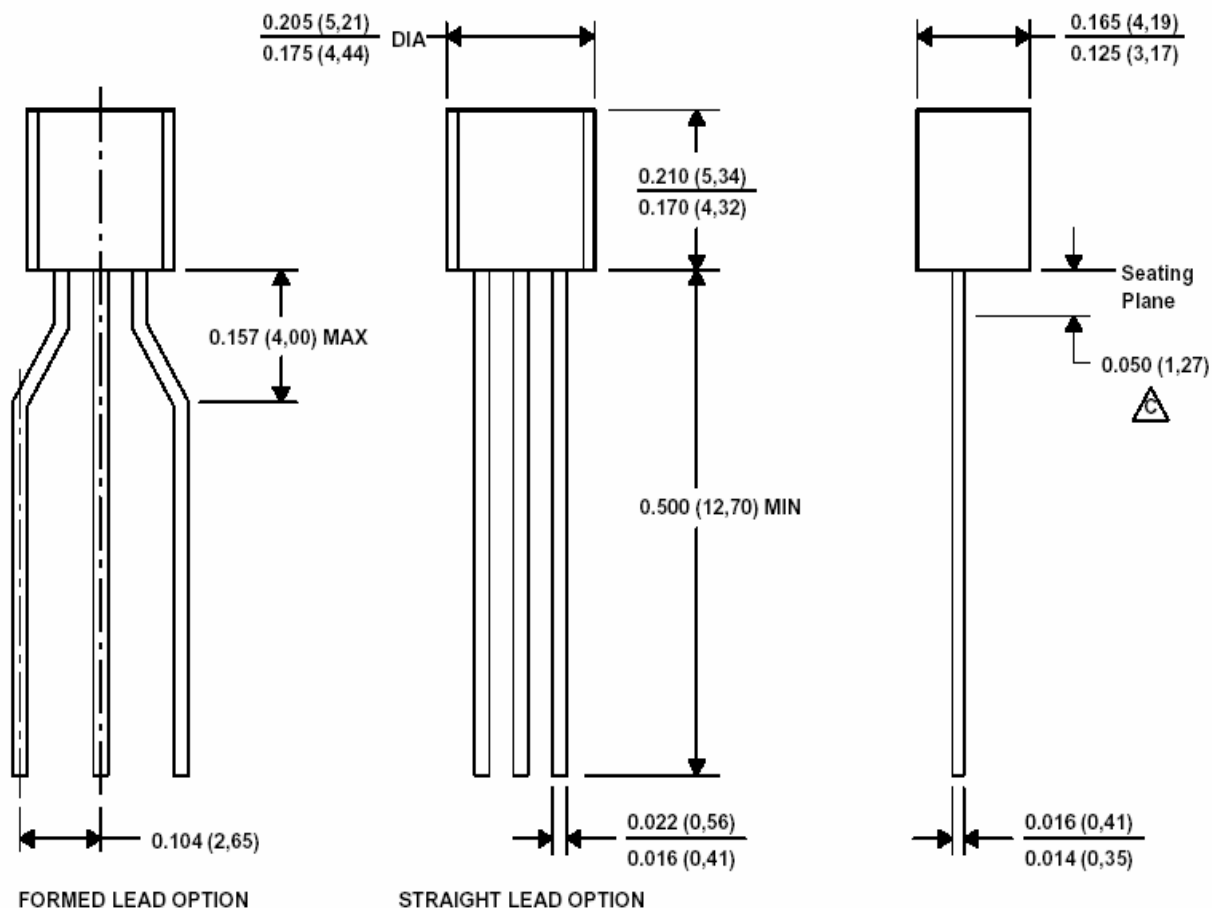
When the device is programmed with two external resistors, R1 an R2,(Refer to Fig.2) the total dynamic impedance of the circuit is defined as :

$$|Z_{ka}'| = |Z_{ka}| \left(1 + \frac{R1}{R2}\right)$$

TYPICAL PERFORMANCE CHARACTERISTICS

Cathode Current-Cathode Voltage

Cathode Current-Cathode Voltage

Vref -Junction Temperature

Reference Input Current - Junction Temperature

Package Dimensions

TO-92

0.205 (5,21) / 0.175 (4,44) DIA

0.165 (4,19) / 0.125 (3,17)

0.210 (5,34) / 0.170 (4,32)

0.157 (4,00) MAX

Seating Plane

0.050 (1,27)

Ⓒ

0.500 (12,70) MIN

0.104 (2,65)

0.022 (0,56) / 0.016 (0,41)

0.016 (0,41) / 0.014 (0,35)

FORMED LEAD OPTION

STRAIGHT LEAD OPTION

0.135 (3,43) MIN

0.105 (2,67) / 0.095 (2,41)

0.055 (1,40) / 0.045 (1,14)

1 2 3

0.105 (2,67) / 0.080 (2,03)

0.105 (2,67) / 0.080 (2,03)

SOT-23-3L PACKAGE OUTLINE DIMENSIONS

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

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