

### General Description

The AHK432 is a low voltage adjustable shunt reference with thermal stability guaranteed over the full industrial temperature range. This 3-terminal regulator has an output voltage range that extends from  $V_{REF}$  (1.24V) to 20V, giving designers outstanding flexibility in the development of power supplies and instrumentation. With a low operating current of 60 $\mu$ A, the AHK432 is well suited for battery-powered portable electronic applications. It also has a sharp turn-on characteristic and a dynamic resistance of only 50m $\Omega$  making it an excellent replacement for zener diodes in low tempco designs.

The AHK432 is available in the surface-mount 3 or 5 pin SOT-23, as well as the through hole TO-92. Three voltage tolerance options are offered in each package:  $\pm 0.5\%$ ,  $\pm 1\%$ , and  $\pm 2\%$ .

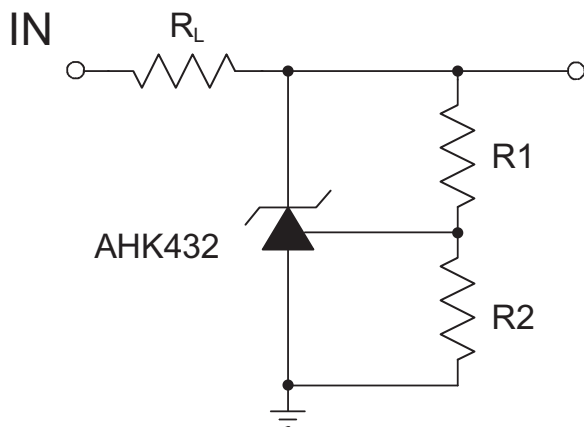
### Features

- Wide output voltage range (1.24 to 20V)
- Operating current from 60 $\mu$ A to 100mA
- Low dynamic output resistance of 50m $\Omega$
- $\pm 0.5\%$  trimmed voltage reference
- 10mV typ.  $V_{REF}$  deviation, from -40 to +105 $^{\circ}$ C
- Surface mount 3 or 5 pin SOT-23 or through-hole 3 pin TO-92 packages

### Applications

- Notebook computers
- Isolated feedback in switching power supplies
- Adjustable and programmable supplies
- Linear regulators (External Reference)
- Instrumentation
- Medical Electronics\*
- Global voltage reference for multiple power supplies

### Typical Application



Adjustable regulator:

$$OUT = V_{REF} \left( \frac{R1 + R2}{R2} \right)$$

### Absolute Maximum Ratings ( $T_A=25^\circ\text{C}$ unless otherwise noted)

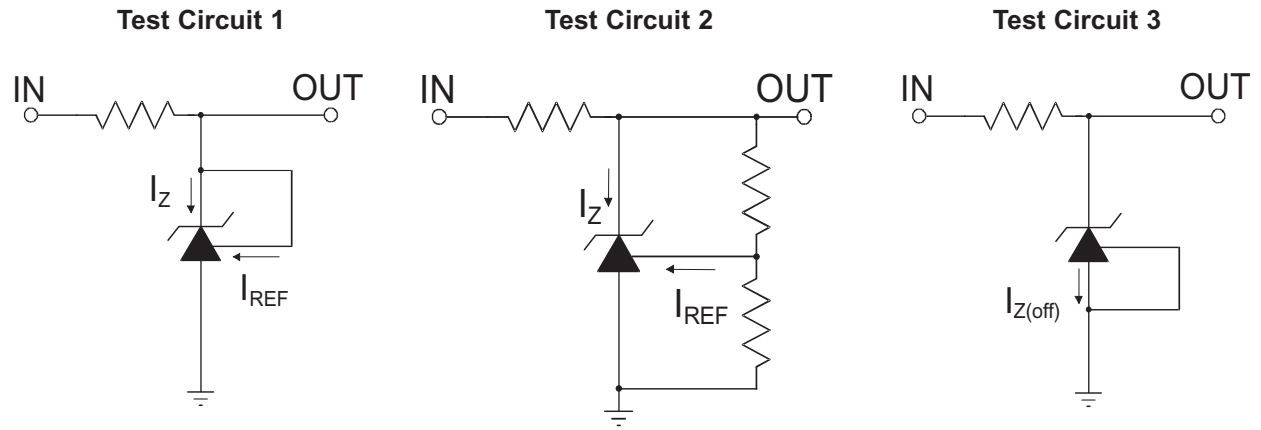
Symbol	Description	Value	Units
$V_Z$	Cathode Voltage	20	V
$I_Z$	Continuous Cathode Current	100	mA
$I_{REF}$	Reference Current	3	mA
$T_J$	Operating Junction Temperature Range	-40 to 150	$^\circ\text{C}$
$\Theta_{JA}$	Maximum Thermal Resistance	TO-92	160
		SOT-23-3, SOT-23-5	410
$P_D$	Maximum Power Dissipation	TO-92	780
		SOT-23-3, SOT-23-5	300
$T_{LEAD}$	Maximum Soldering Temperature (at Leads)	260	$^\circ\text{C}$

Note: Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one Absolute Maximum rating should be applied at any one time.

### Electrical Characteristics ( $T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Description	Conditions	AHK432 0.5%			AHK432 1.0%			AHK432 2.0%			Units	
			min	typ	max	min	typ	Max	min	typ	max		
$V_{REF}$	Reference Voltage	$V_Z=V_{REF}$ $I_Z=10\text{mA}$ (test circuit 1)	$T_A=25^\circ\text{C}$	1.234	1.240	1.246	1.228	1.240	1.252	1.215	1.240	1.265	V
			$T_A=-40$ to $+105^\circ\text{C}$	1.222		1.258	1.215		1.265	1.200		1.280	
$V_{DEV}$	$V_{REF}$ Temp Deviation	$T_A=-40$ to $+105^\circ\text{C}$ , $V_Z=V_{REF}$ , $I_Z=10\text{mA}$ (test circuit 1)		10	25		10	25		10	25	mV	
$\Delta V_{REF}/\Delta V_Z$	Ratio of Change in $V_{REF}$ to Change in Cathode Voltage	$I_Z=10\text{mA}$ , $\Delta V_Z=16\text{V}$ to $V_{REF}$ (test circuit 2)		-1.0	-2.7		-1.0	-2.7		-1.0	-2.7	mV/V	
$I_{REF}$	Reference Input Current	$R1=10\text{k}\Omega$ , $R2=\infty$ , $I_Z=10\text{mA}$ (test circuit 2)		0.15	0.5		0.15	0.5		0.15	0.5	$\mu\text{A}$	
$I_{REF(DEV)}$	$I_{REF}$ Temp Deviation	$T_A=-40$ to $+105^\circ\text{C}$ $R1=10\text{k}\Omega$ , $R2=\infty$ , $I_Z=10\text{mA}$ (test circuit 2)		0.1	0.4		0.1	0.4		0.1	0.4	$\mu\text{A}$	
$I_{Z(OFF)}$	Off State Cathode Current	$V_{REF}=0\text{V}$ (test circuit 3)	$V_Z=6\text{V}$	0.04	0.1		0.04	0.1		0.04	0.1	$\mu\text{A}$	
			$V_Z=16\text{V}$	0.04	0.5		0.04	0.5		0.04	0.5		
$R_Z$	Dynamic Output Impedance	$f<1\text{kHz}$ , $V_Z=V_{REF}$ , $I_Z=100\text{mA}$ to $100\text{mA}$ (test circuit 1)		0.05	0.2		0.05	0.2		0.05	0.2	$\Omega$	
$I_{Z(MIN)}$	Minimum Operating Current	$V_Z=V_{REF}$ (test circuit 1)		60	80		60	80		60	80	$\mu\text{A}$	

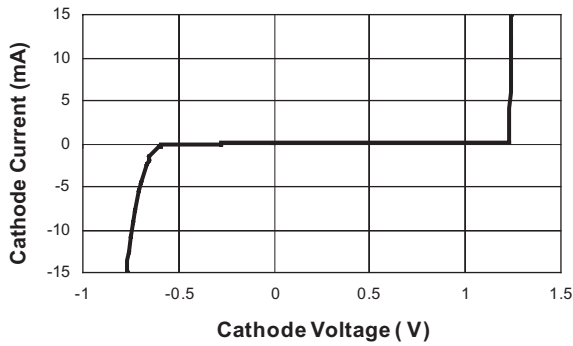
### Test Circuits



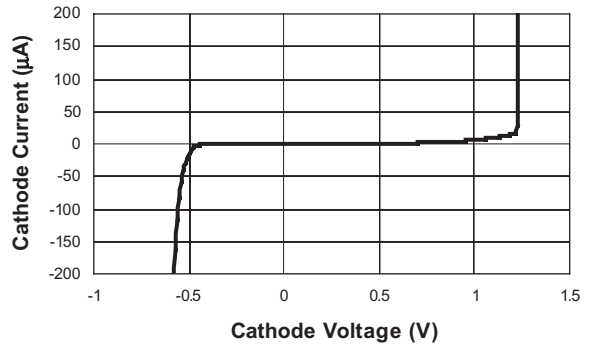
### Typical Characteristics

(Unless otherwise noted,  $T_A = 25^\circ\text{C}$ ,  $I_Z = 10\text{mA}$ )

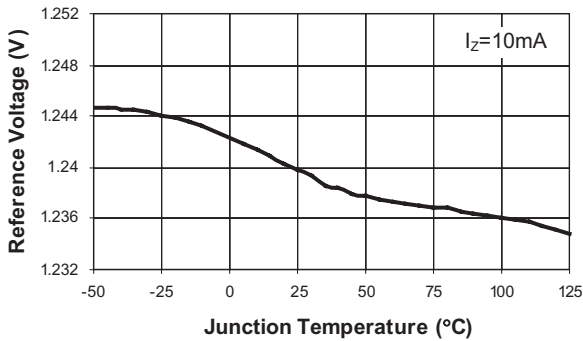
Cathode Current vs. Cathode Voltage



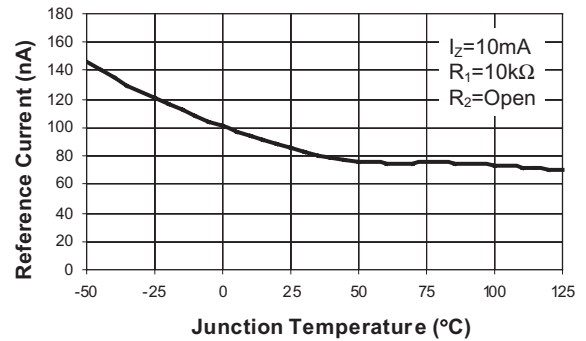
Cathode Current vs. Cathode Voltage



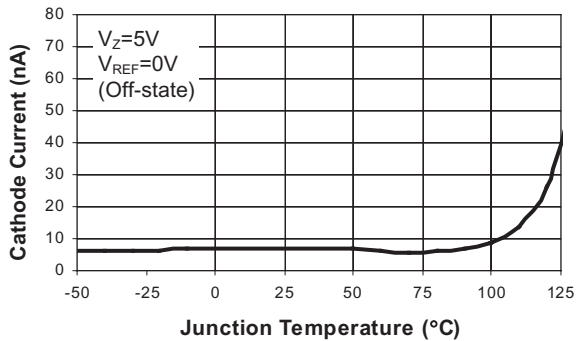
Reference Voltage vs. Temperature



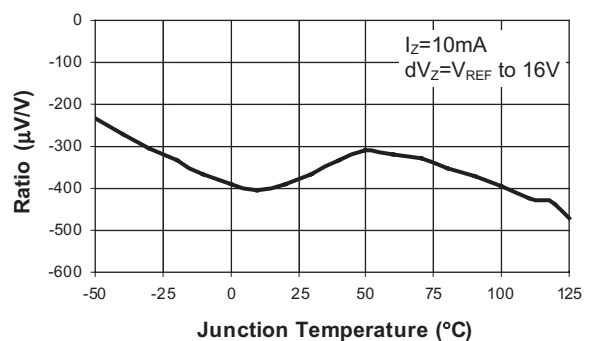
Reference Current vs. Temperature



Cathode Current vs. Temperature

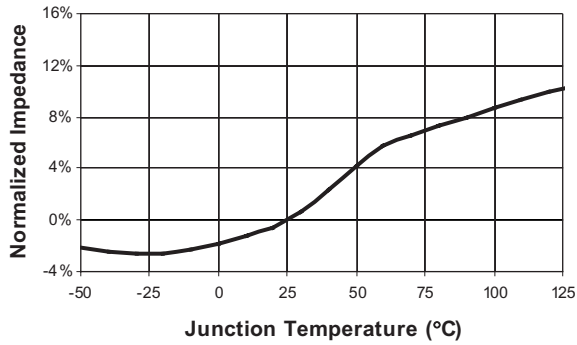


Ratio of  $\Delta V_{\text{REF}} / \Delta V_Z$  vs. Temperature

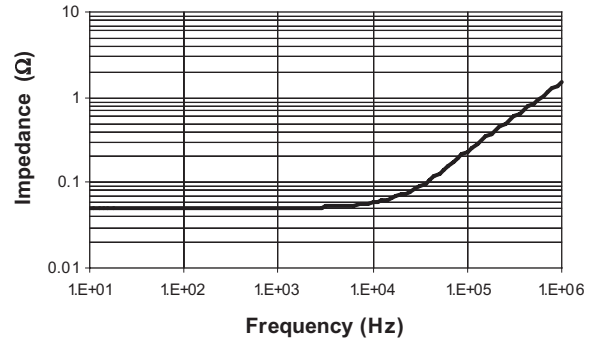


(Unless otherwise noted,  $T_A = 25^\circ\text{C}$ ,  $I_Z = 10\text{mA}$ )

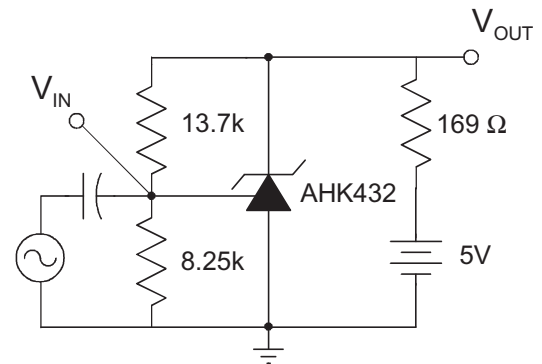
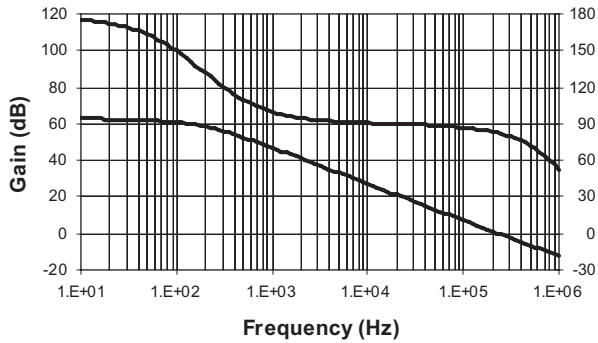
**Cathode Impedance vs. Temperature**



**Impedance vs. Frequency**

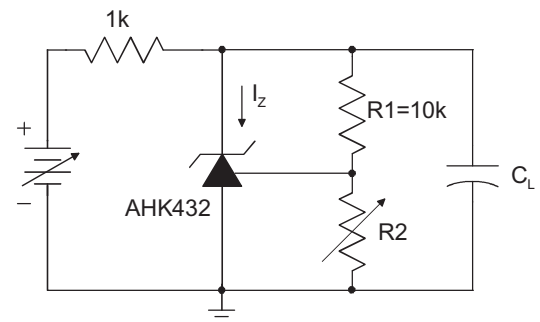
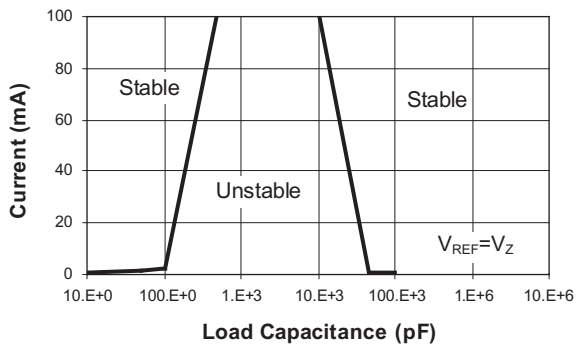


**Gain and Phase vs. Frequency**



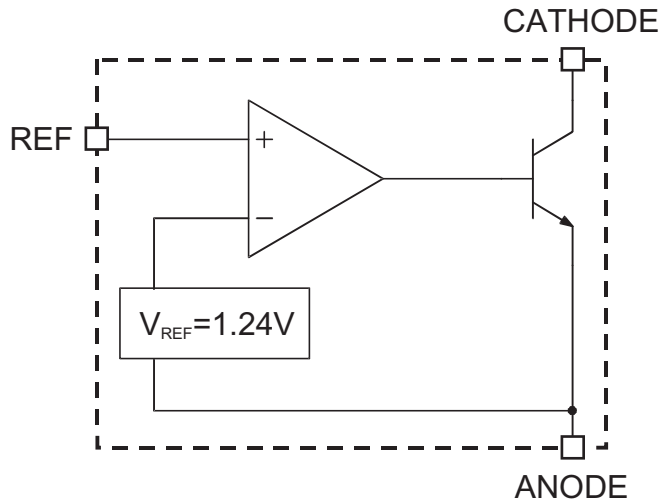
**Test Circuit for Voltage Gain and Phase**

**Stability Boundary**

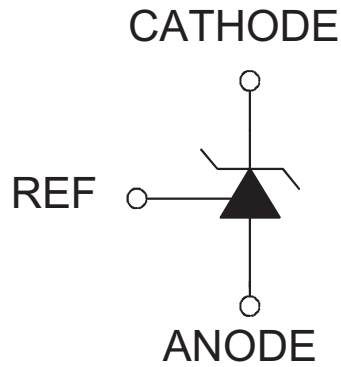


**Test Circuit for Stability**

### Functional Block Diagram



### Symbol Diagram



### Ordering Information

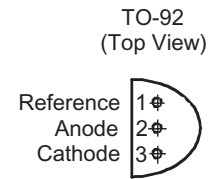
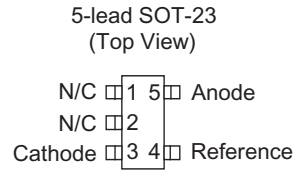
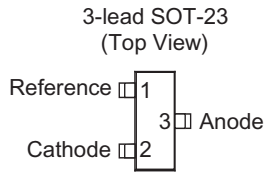
Package	Bulk or Tape and Reel	Tolerance		
		0.5%	1.0%	2.0%
SOT-23-3	Bulk	N/A	N/A	N/A
SOT-23-5		N/A	N/A	N/A
TO-92		AHK432ILY-.5-B1	AHK432ILY-1-B1	AHK432ILY-2-B1
SOT-23-3	Tape and Reel	AHK432IGY-.5-T1	AHK432IGY-1-T1	AHK432IGY-2-T1
SOT-23-5		AHK432IGV-.5-T1	AHK432IGV-1-T1	AHK432IGV-2-T1
TO-92	Ammo	AHK432ILY-.5-A1	AHK432ILY-1-A1	AHK432ILY-2-A1

**\* LIFE SUPPORT POLICY**

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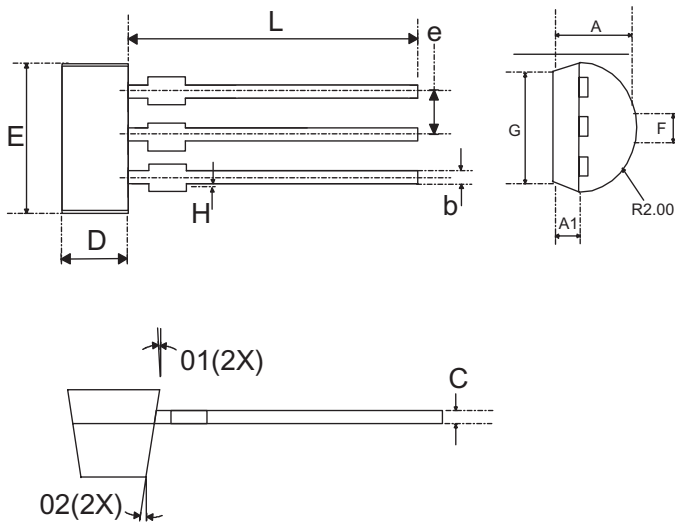
1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

### Pin Configuration



### Package Information

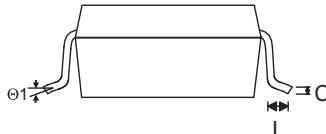
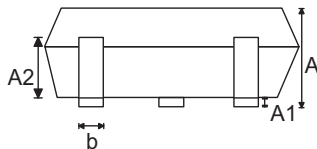
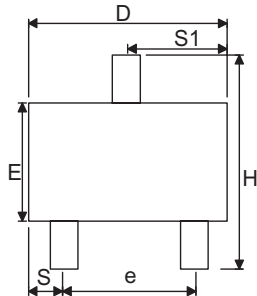
TO-92 M



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	2.40	2.60	0.094	0.102
A1	0.70	0.90	0.028	0.036
b	0.35	0.55	0.014	0.022
C	0.00	0.00	0.000	0.000
D	2.80	3.20	0.110	0.126
E	3.80	4.20	0.149	0.165
e	0.00	0.00	0.000	0.000
F	1.91	2.31	0.075	0.091
G	3.35	3.75	0.132	0.148
H	0.00	0.15	0.000	0.006
L	13.80	14.20	0.543	0.559
θ1	2°		2°	
θ2	5°		5°	

Note: PACKAGE OUTLINE EXCLUSIVE OF ANY MOLD FLASHES AND BURR DIMENSION

### SOT-23-3

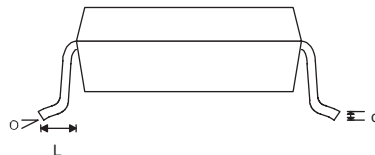
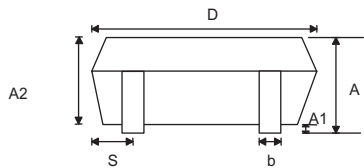
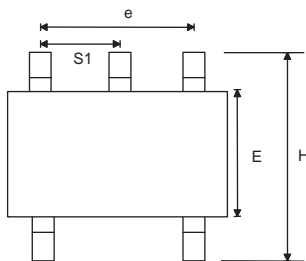


Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	.887	1.02	0.034	.040
A1	.013	0.10	0.0005	.004
A2	-	-	-	-
b	0.37	0.51	0.015	0.020
C	0.085	0.180	0.003	0.007
D	2.80	3.04	0.110	0.120
E	1.20	1.40	0.047	0.055
e	1.78	2.05	0.070	0.080
H	2.10	2.64	0.083	0.104
L	-	0.69	-	0.027
S	0.45	0.60	0.018	0.024
S1	0.89	1.03	0.035	0.040
$\theta$	0°	8°	0°	8°

Note:

1. PACKAGE BODY SIZE EXCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.
2. TOLERANCE  $\pm 0.1000$  mm (4mi) UNLESS OTHERWISE SPECIFIED
3. COPLANARITY: 0.1000
4. DIMENSION L IS MEASURED IN GAGE PLANE

### SOT-23-5



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	0.95	1.45	0.037	0.057
A1	0.05	0.15	0.002	0.006
A2	0.90	1.30	0.035	0.051
b	0.35	0.50	0.014	0.019
c	0.08	0.20	0.003	0.078
D	2.84	3.00	0.112	0.112
E	1.50	1.70	0.059	0.067
e	1.90		0.0748	
H	2.60	3.00	0.102	0.118
L	0.35	0.55	.0137	.0216
S	0.47	0.55	0.019	.0216
S1	.95		0.037	
$\theta$	0°	10°	0°	10°