

## DESCRIPTION

ST432 is low-voltage three-terminal adjustable voltage references, with specified thermal stability over applicable industrial and commercial temperature ranges. Output voltage can be set to any value between VREF (1.24V) and 20V with two external resistors. These devices have a typical output impedance of 0.25Ω. Active output circuitry provides a very sharp turn-on characteristic, making the ST432 excellent replacements for low-voltage Zener diodes in many applications, including onboard regulation and adjustable power supplies.

## FEATURES

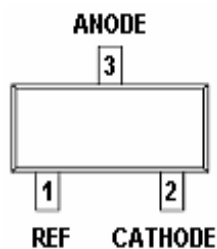
- Low-Voltage Operation down to 1.24 V
- Adjustable Output Voltage,  $V_{OUT} = V_{REF}$  to 20 V
- Low Operational Cathode Current 80uA
- 0.25Ω Typical Output Impedance

## APPLICATIONS

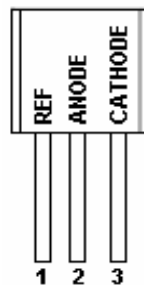
- Battery Power Equipment
- Linear Regulators
- Switch Power Supply
- Cellular Phone
- Digital Camera
- Computer Disk

## PIN CONFIGURATION

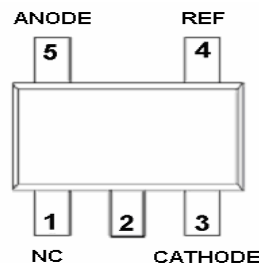
SOT-23



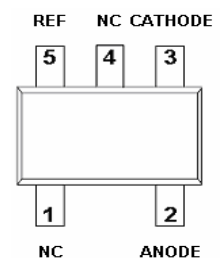
TO-92



SOT-23-5L

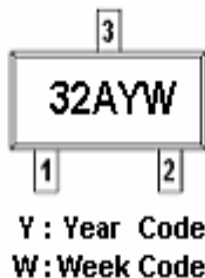


SOT-353 (SC-70)

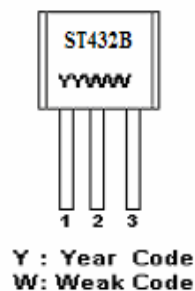


## PART MARKING

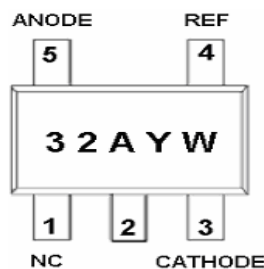
SOT-23



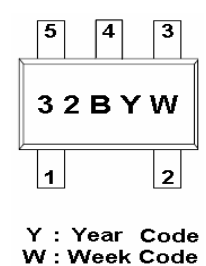
TO-92



SOT-23-5L



SOT-353 (SC-70)





**PIN DESCRIPTION**

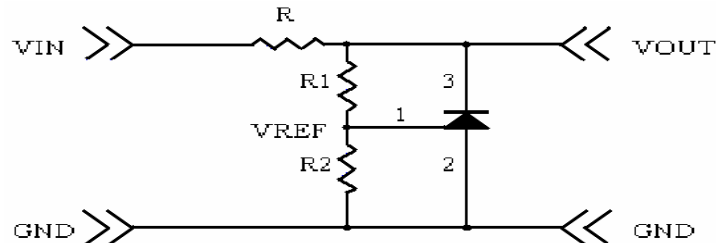
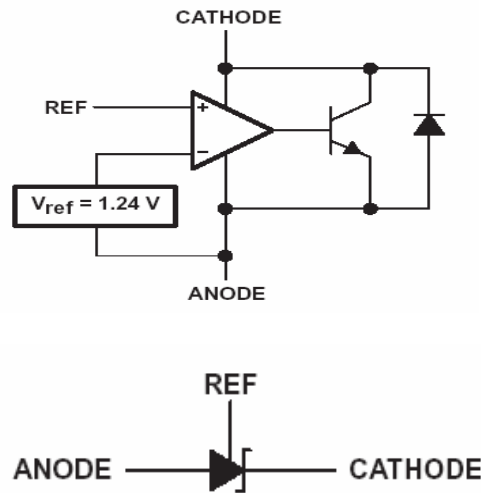
Pin	Symbol	Description
1	R	REF
2	C	CATHODE
3	A	ANODE

**ORDERING INFORMATION**

Part Number	Voltage Tolerance	Package	Part Marking
ST432AS23RG	0.5%	SOT-23	32AYW
ST432BS23RG	1.0%	SOT-23	32BYW
ST432AS25RG	0.5%	SOT-23-5L	32AYW
ST432BS25RG	1.0%	SOT-23-5L	32BYW
ST432BT92AG	1.0%	TO-92	SP432B
ST432AS35RG	0.5%	SOT-353	32AYW
ST432BS35RG	1.0%	SOT-353	32BYW

Week Code : A ~ Z ( 1 ~ 26 ) ; a ~ z ( 27 ~ 52 )

ST432XS23RG : X: Tolerance; R: Tape Reel; A: Tape Ammo; G: Pb - Free

**TYPICAL APPLICATION CIRCUIT**

**BLOCK DIAGRAM**

**ABSOLUTE MAXIMUM RATINGS** ( $T_A=25$  unless otherwise specified)

Parameter	Symbol	Value	Unit	
Cathode Voltage	$V_Z$	20	V	
Continuous Cathode Current	$I_Z$	100	mA	
Reference Current	$I_{REF}$	3	mA	
Operation Junction Temperature Range	$T_J$	-40 ~ +150		
Storage Temperature Range	$T_{STG}$	-65 ~ +150		
Lead Temperature Range (Soldering 10sec.)	$T_{SOL}$	260		
Thermal Resistance	$\Theta_{JA}$	TO-92	140	/W
		SOT-23	206	
		SOT-23-5L	206	
		SOT-353	252	

The IC has a protection circuit against static electricity. Do not apply high static electricity or high voltage that exceeds the performance of the protection circuit to the IC.

**ELECTRICAL CHARACTERISTICS** ( $T_A=25^\circ\text{C}$ , unless otherwise specified)

SP432AS23RG & SP432AS25RG & SP432AS35RG							
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Reference Voltage for 432A	$V_{REF}$	$V_Z = V_{REF}$ $I_Z = 10\text{mA}$	$T_A=25$	1.234	1.24	1.246	V
			$T_A=-40 \sim +80$	1.222		1.258	
Reference Voltage for 432B	$V_{REF}$	$V_Z = V_{REF}$ $I_Z = 10\text{mA}$	$T_A=25$	1.228	1.24	1.252	V
			$T_A=-40 \sim +80$	1.215		1.265	
$V_{REF}$ Temp Deviation	$V_{DEV}$	$T_A=-40 \sim +80$ $V_Z = V_{REF}, I_Z = 10\text{mA}$		10	25	mV	
Ratio of change in $V_{REF}$ to change in Cathode voltage	$\Delta V_{REF} / \Delta V_Z$	$I_Z = 10\text{mA}$ $\Delta V_Z = 16\text{V} \sim V_{REF}$		-1.0	-2.7	mV/V	
Reference Input Current	$I_{REF}$	$R_1=10\text{K}\Omega, R_2=\infty, I_Z=10\text{mA}$		0.15	0.5	$\mu\text{A}$	
$I_{REF}$ Temp Deviation	$I_{REF(DEV)}$	$T_A=-40 \sim +80$ $R_1=10\text{K}\Omega, R_2=\infty, I_Z=10\text{mA}$		0.1	0.4	$\mu\text{A}$	
Off state Cathode Current	$I_{Z(OFF)}$	$V_{REF} = 0\text{V}$	$V_Z = 6\text{V}$		0.5	1.0	$\mu\text{A}$
			$V_Z = 12\text{V}$				
Dynamic output impedance	$R_Z$	$f < 1\text{KHZ}, V_Z = V_{REF}$ $I_Z = 1\text{mA} \sim 100\text{mA}$		0.25	0.4	$\Omega$	
Minimum Operation Current	$I_{Z(MIN)}$	$V_Z = V_{REF}$		30	80	$\mu\text{A}$	

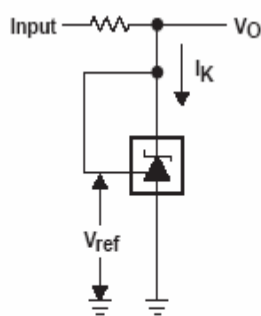
**APPLICATION CIRCUIT**


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

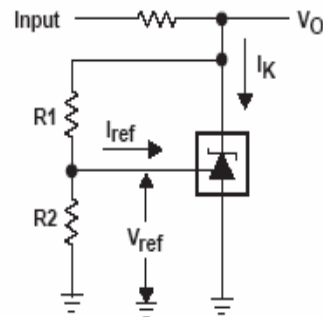


Figure 2. Test Circuit for  $V_{KA} > V_{ref}$ .  
 $V_O = V_{KA} = V_{ref} \times (1 + R_1/R_2) + I_{ref} \times R_1$

**APPLICATION CIRCUIT**

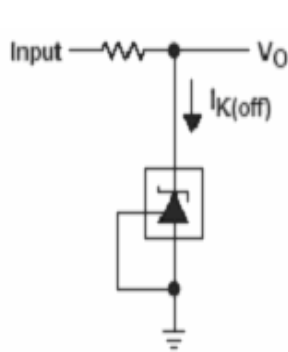


Figure 3. Test Circuit for  $I_{K(off)}$

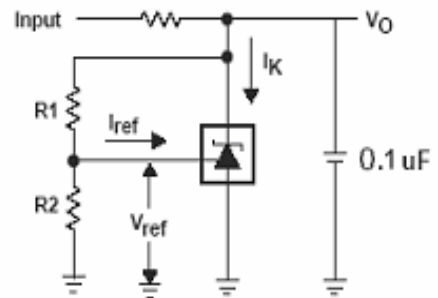


Figure 4. Test Circuit for  $V_{KA} > V_{ref}$ ,  
 $V_O = V_{KA} = V_{ref} \times (1 + R1/R2) + I_{ref} \times R1$

To improve the stability of output voltage, a 0.1uF capacitor is recommended between cathodes to anode

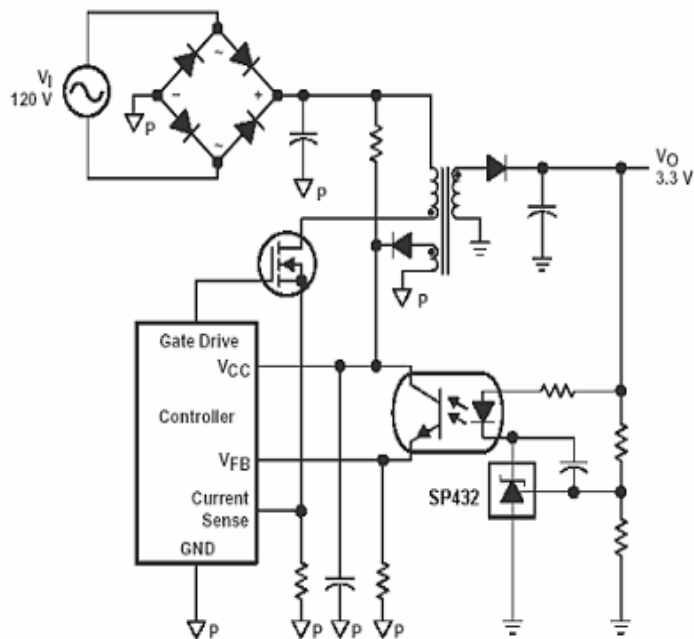
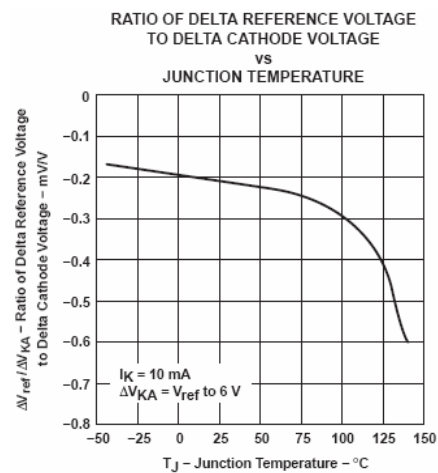
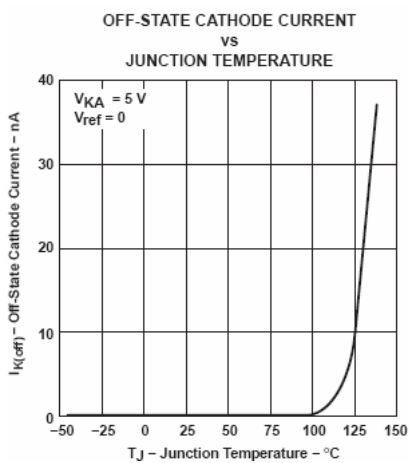
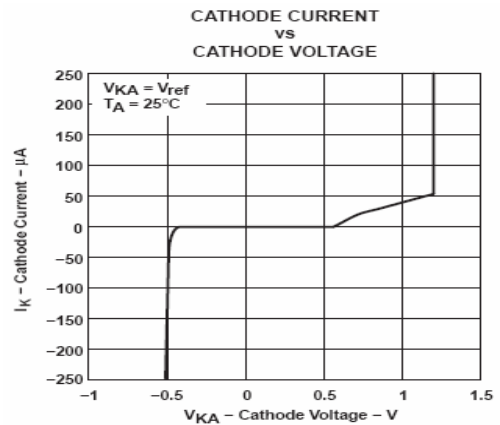
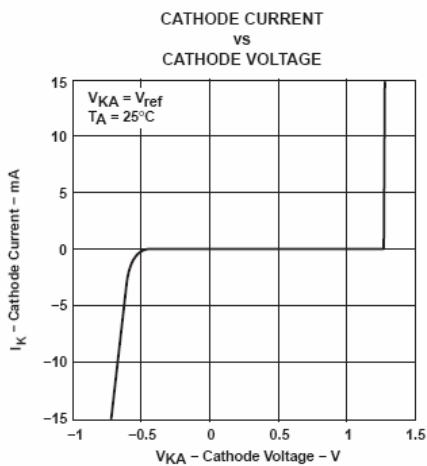
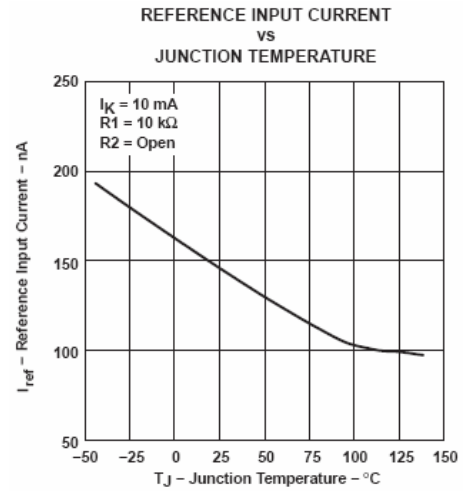
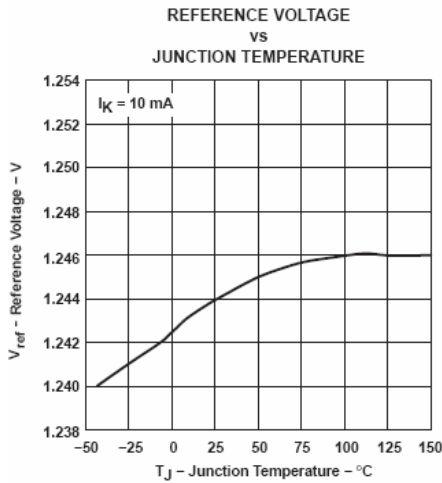
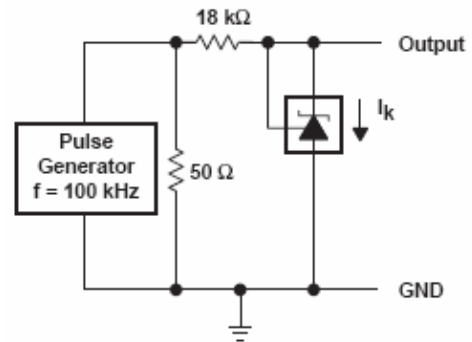
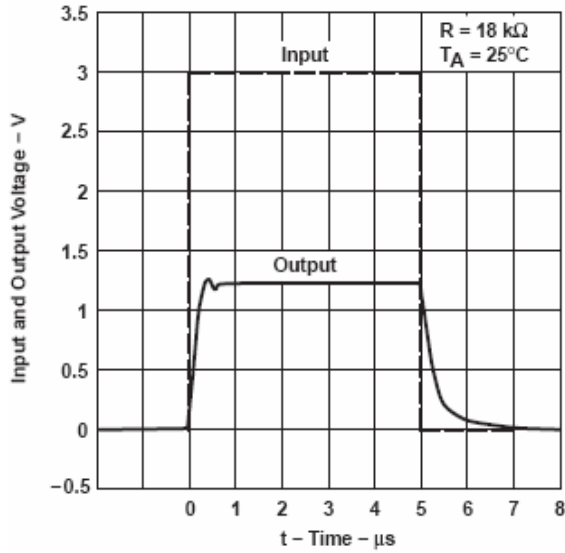


Figure 5. Flyback with isolation using SP432 as voltage reference and error amplifier

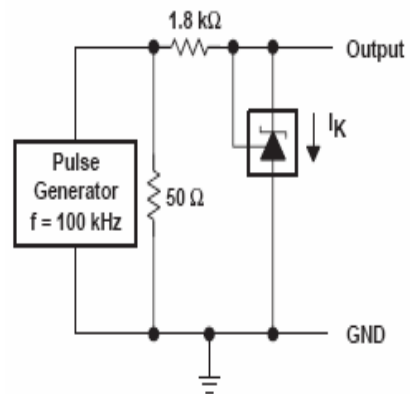
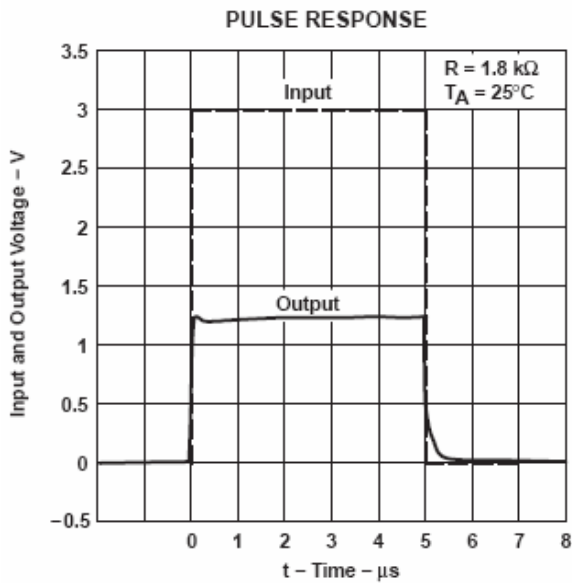
**PERFORMANCE CHARACTERISTICS**



**PERFORMANCE CHARACTERISTICS**  
**PULSE RESPONSE**



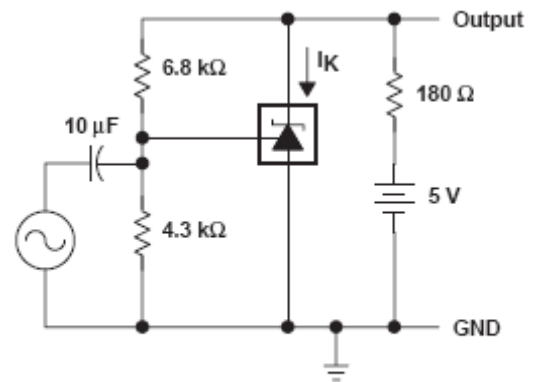
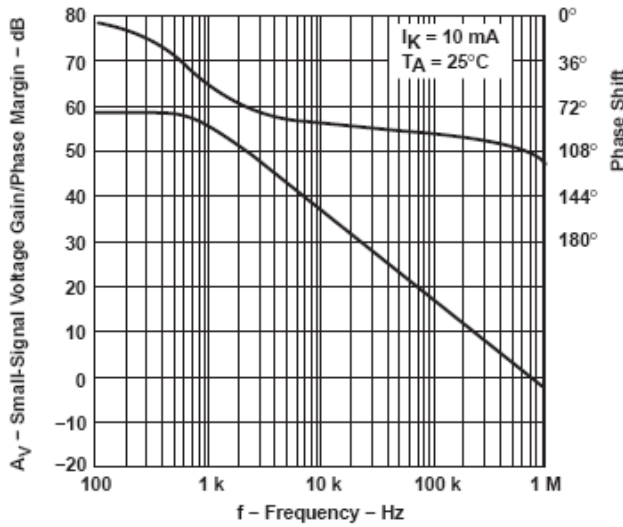
TEST CIRCUIT FOR PULSE RESPONSE



TEST CIRCUIT FOR PULSE RESPONSE

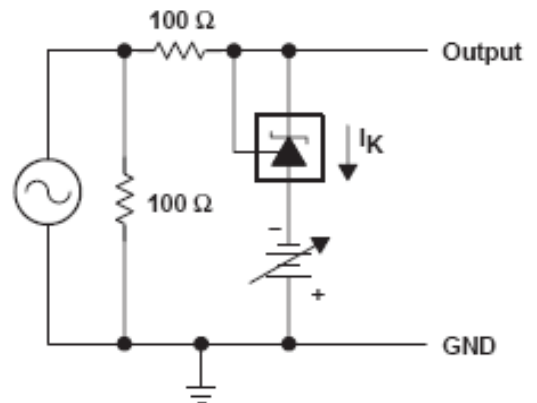
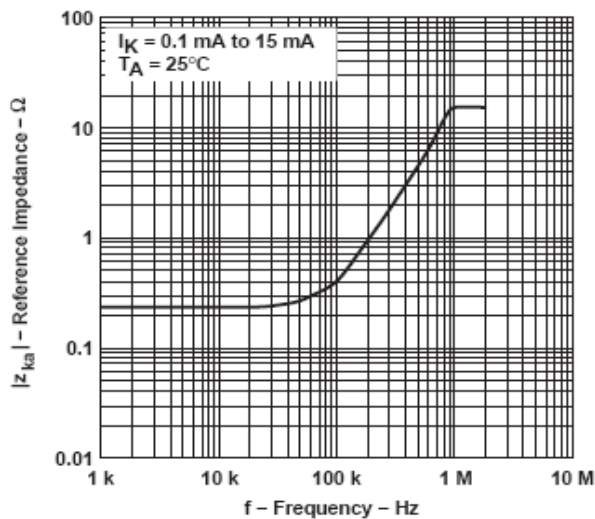
**PERFORMANCE CHARACTERISTICS**

**SMALL-SIGNAL VOLTAGE GAIN/PHASE MARGIN  
VS  
FREQUENCY**



**TEST CIRCUIT FOR VOLTAGE GAIN  
AND PHASE MARGIN**

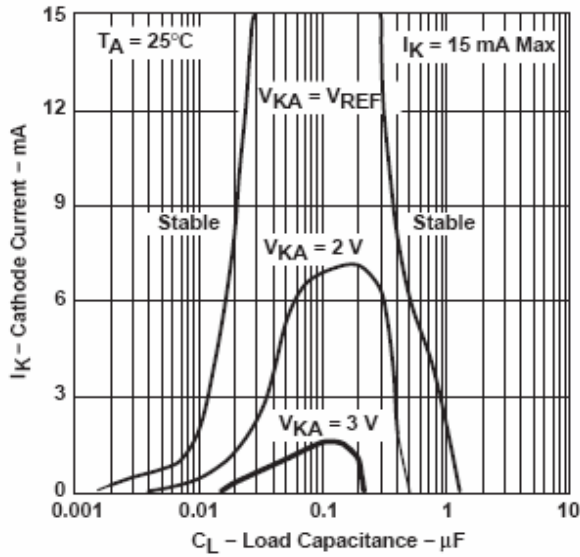
**REFERENCE IMPEDANCE  
VS  
FREQUENCY**





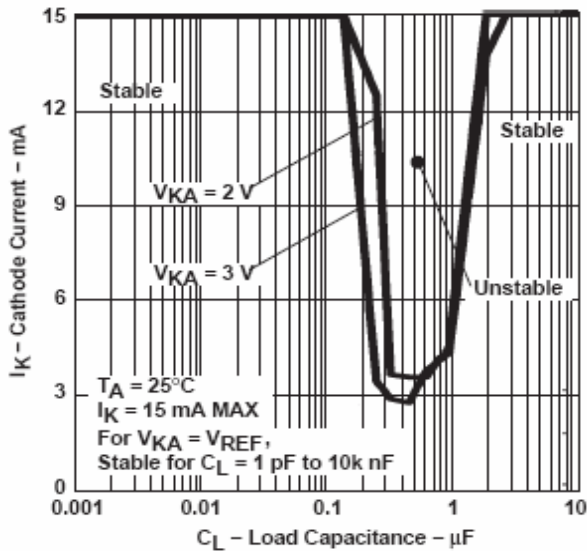
**PERFORMANCE CHARACTERISTICS**

**STABILITY BOUNDARY CONDITION**

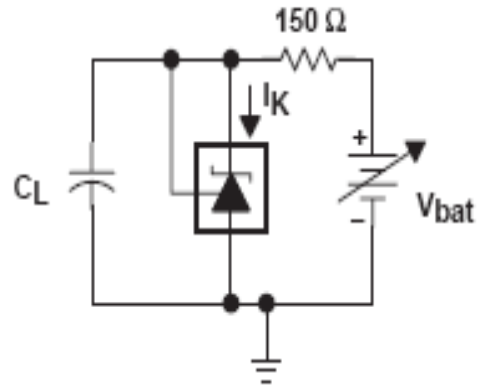


(For 1.0%)

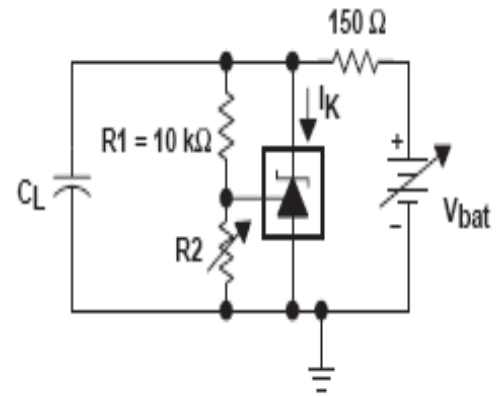
**STABILITY BOUNDARY CONDITION†**



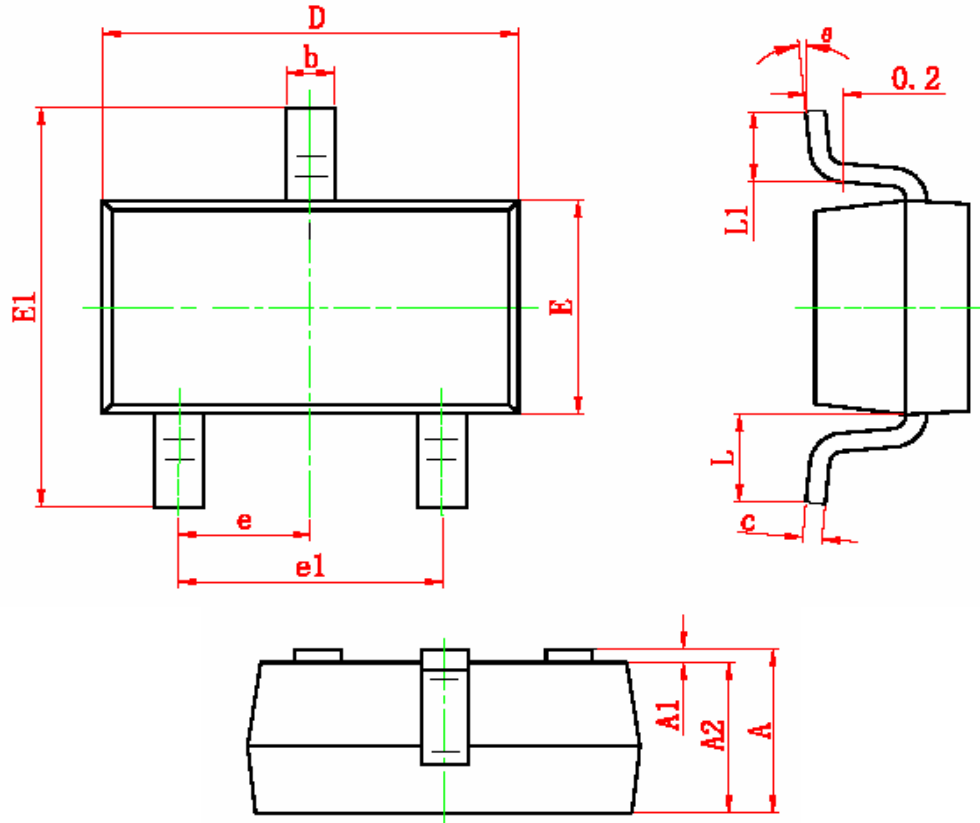
(For 0.5%)



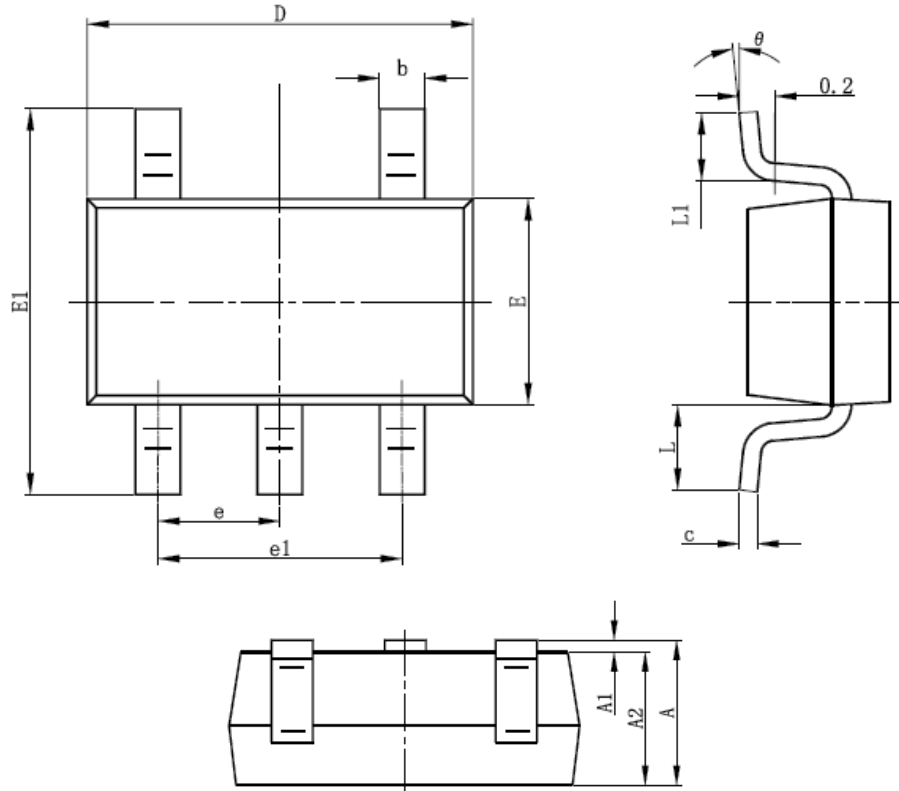
TEST CIRCUIT FOR  $V_{KA} = V_{REF}$



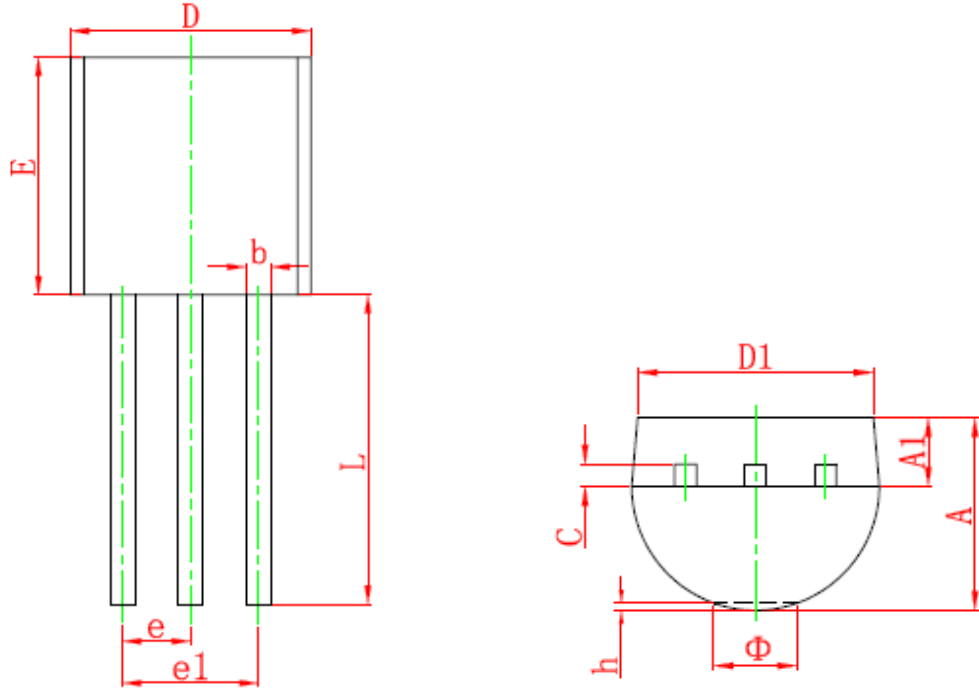
TEST CIRCUIT FOR  $V_{KA} = 2 \text{ V, } 3 \text{ V}$

**SOT-23 PACKAGE OUTLINE**


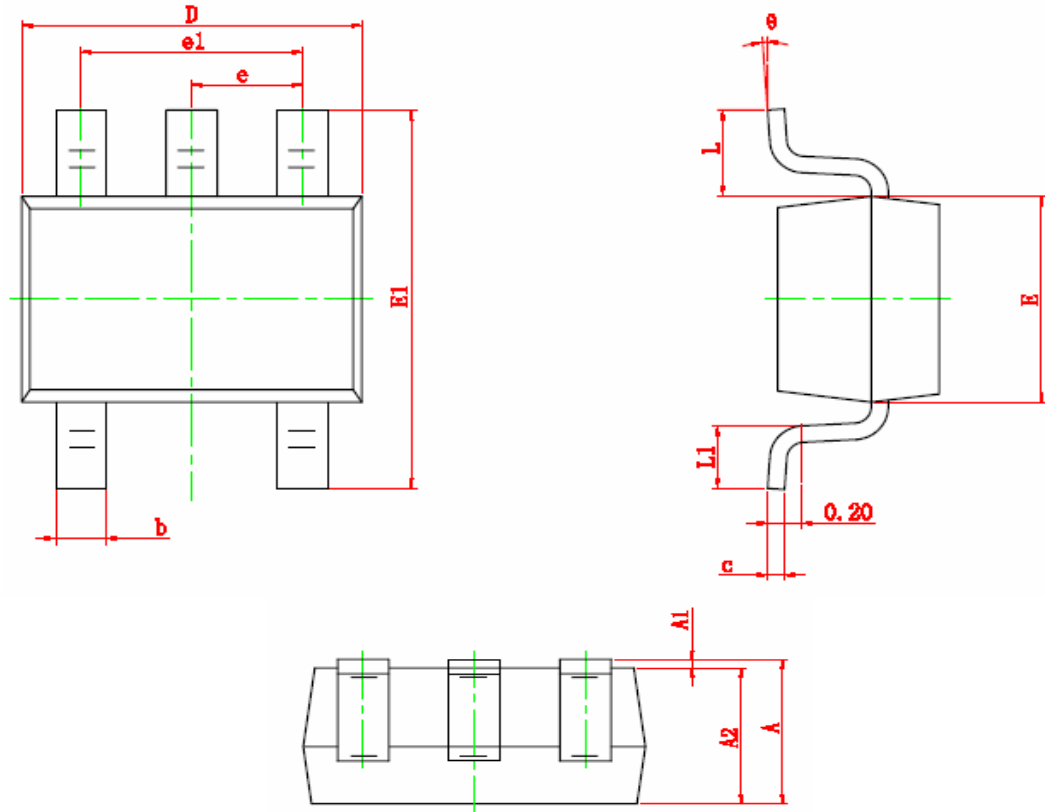
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.200	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.100	0.035	0.039
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
$\theta$	0°	8°	0°	6°

**SOT-23-5L PACKAGE OUTLINE**


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
$\theta$	0°	8°	0°	8°

**TO-92 PACKAGE OUTLINE**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
Φ		1.600		0.063
h	0.000	0.380	0.000	0.015

**SOT-353 PACKAGE OUTLINE**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°