



### General Description

The AF431N is high-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 (2.5V) and 36V 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 AF431N excellent replacements for low-voltage Zener diodes in many applications, including onboard regulation and adjustable power supplies.

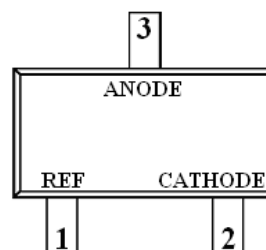
### Features

- ◆ Low Output Noise
- ◆ Adjustable Output Voltage,  $V_O = V_{ref}$  to 36 V
- ◆ Low Operational Cathode Current
- ◆ 0.2Ω Typical Output Impedance

### Application

- Battery Power Equipment
- Linear Regulators
- Switch Power Supply
- Cellular Phone
- Digital Cameras
- Computer Disk Drivers
- Instrumentation

### Pin Define SOT-23

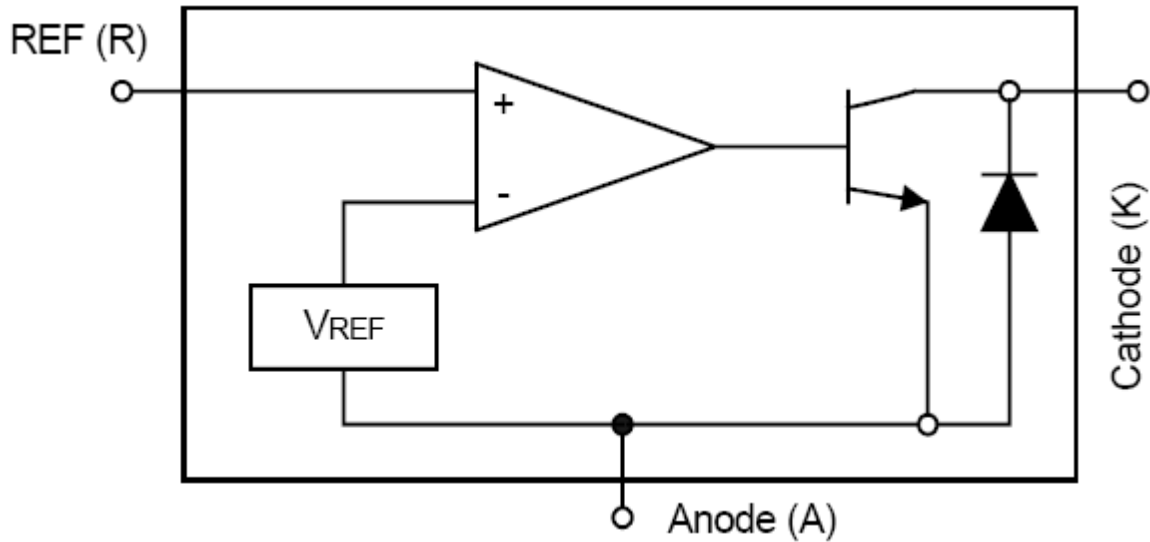


### Marking Information SOT-23





**Block Diagram**



**Pin Description ( SOT-23 )**

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

**Ordering Information**

Part Number	Voltage Tolerance	Package	Part Marking	Unit	Quantity
AF431NS23RG	0.4%	SOT-23	3NYW	Tape & Reel	3000 EA
AF431NAS23RG	0.5%	SOT-23	3NAYW	Tape & Reel	3000 EA

- ※ Week Code : A ~ Z ( 1 ~ 26 ) ; a ~ z ( 27 ~ 52 )
- ※ AF431NS23RG : 7" Tape Reel ; Pb- Free ; Halogen- Free
- ※ AF431NAS23RG : 7" Tape Reel ; Pb- Free ; Halogen- Free



**Absolute Maximum Ratings**

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

Parameter	Symbol	Value	Unit
Cathode Voltage	$V_Z$	36	V
Continuous Cathode Current	$I_Z$	250	mA
Reference Current	$I_{REF}$	10	mA
Operation Junction Temperature Range	$T_J$	-40 ~ +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 ~ +150	$^\circ\text{C}$
Lead Temperature Range(Soldering 10sec.)	$T_{SOL}$	260	$^\circ\text{C}$
Thermal Resistance	$\Theta_{JA}$	SOT-23	206
		TO-92	140

**Electrical Characteristics**

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Reference Voltage	$V_{REF}$	$V_Z = V_{REF}$ $I_Z = 10\text{mA}$ (Fig.1)	AF431NS23RG	2.49	2.5	2.51	2.512
			AF431NAS23RG	2.487	2.5	2.512	
Deviation of Reference Input Voltage over full temperature range	$V_{REF(DVE)}$	$V_{KA} = V_{REF}$ , $I_{KA} = 10\text{mA}$ , $T_A = -20\sim 85^\circ\text{C}$ (Fig.1)		6	20	mV	
Ratio of change in $V_{REF}$ to change in Cathode voltage	$\Delta V_{REF} / \Delta V_{KA}$	$I_{KA} = 10\text{mA}$ (Fig.2)	$V_{KA} = 10\text{V} \sim V_{REF}$	-2.0	-1.2		mV / V
			$V_{KA} = 36\text{V} \sim 10\text{V}$	-2.0	-1.0		
Reference Input Current	$I_{REF}$	$R_1=10\text{K}\Omega, R_2 = \infty$ $I_{KA}= 10\text{mA}$ (Fig.2)		1.5	3.5	$\mu\text{A}$	
$I_{REF}$ Temp Deviation	$I_{REF(DEV)}$	$R_1=10\text{K}\Omega, R_2 = \infty$ $I_{KA}= 10\text{mA}$ $T_A = -20\sim 85^\circ\text{C}$ (Fig.2)		0.4	1.2	$\mu\text{A}$	
Off state Cathode Current	$I_{KA(OFF)}$	$V_{KA} = 36\text{V}$ , $V_{REF} = 0\text{V}$ (Fig.3)		0.1	1	$\mu\text{A}$	
Dynamic output impedance	$I_{Z_{KAL}}$	$f < 1\text{KHZ}$ , $V_Z = V_{REF}$ $I_Z = 1\text{mA} \sim 100\text{mA}$ (Fig.1)		0.2	0.5	$\Omega$	
Minimum Cathode Current	$I_{Z(MIN)}$	$V_Z = V_{REF}$ (Fig.1)		0.2	0.5	mA	

**Testing Circuit**

Fig1:  $V_{KA}=V_{REF}$

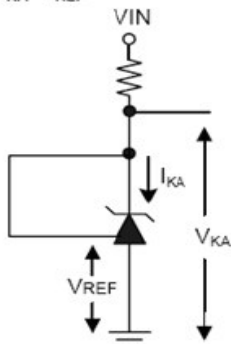


Fig2:  $V_{KA}>V_{REF}$

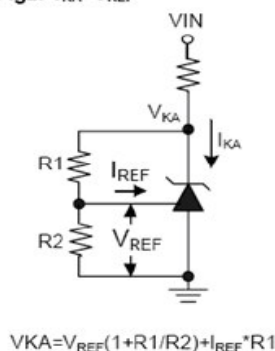
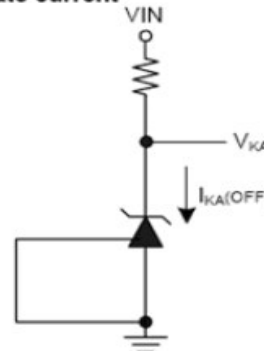
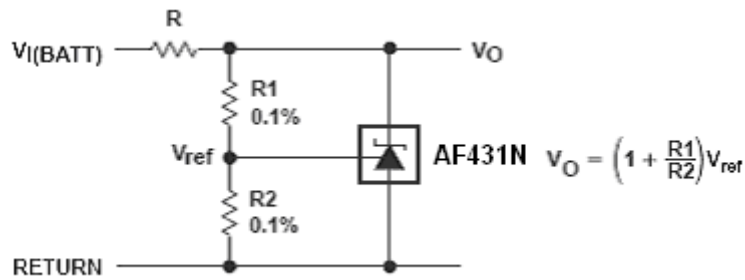


Fig3: Off state current

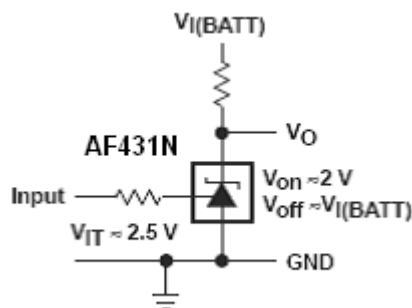




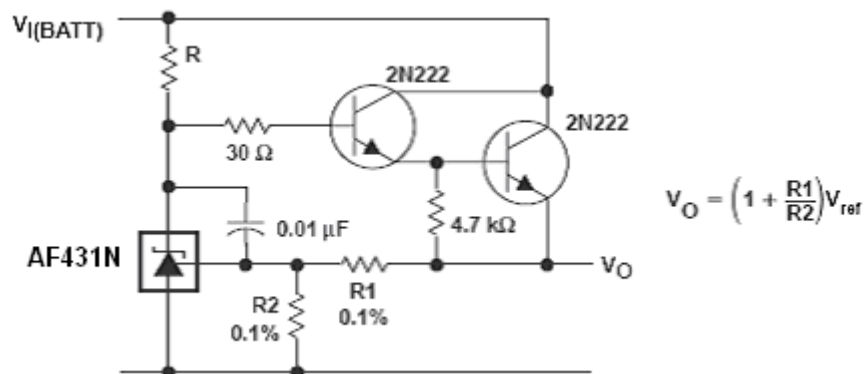
Application Circuit



Shunt Regulator



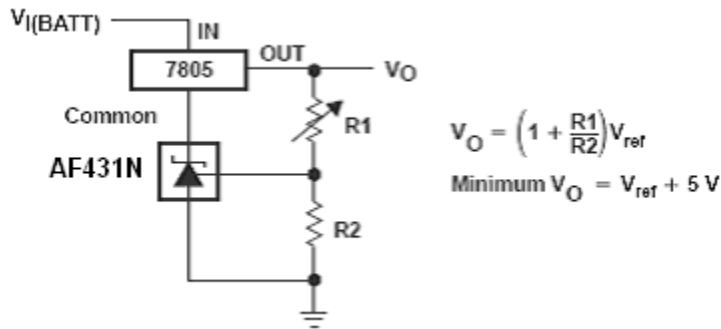
Single-Supply Comparator With Temperature-Compensated Threshold



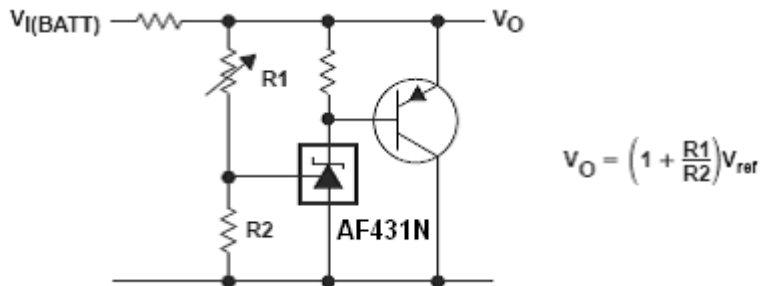
Precision High-Current Series Regulator



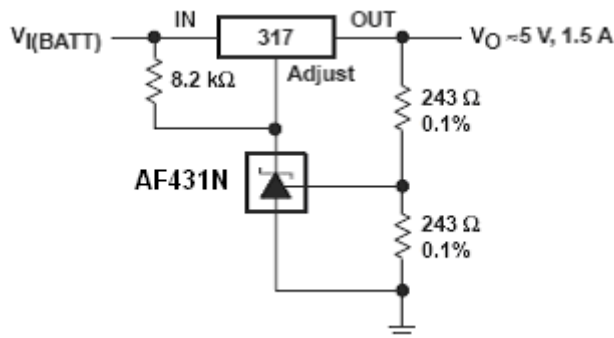
**Application Circuit**



**Output Control of a Three-Terminal Fixed Regulator**



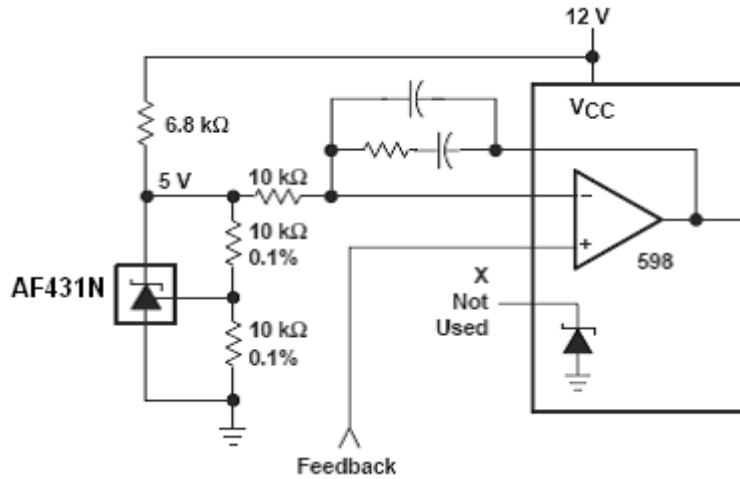
**High-Current Shunt Regulator**



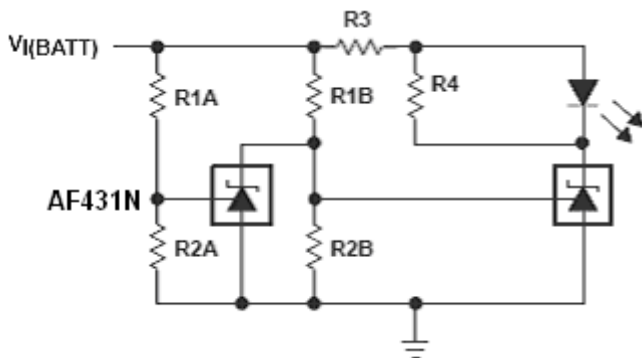
**Precision 5-V 1.5-A Regulator**



**Application Circuit**



**PWM Converter With Reference**

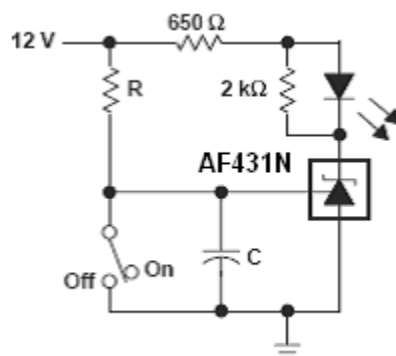


$$\text{Low Limit} = \left(1 + \frac{R1B}{R2B}\right) V_{ref}$$

$$\text{High Limit} = \left(1 + \frac{R1A}{R2A}\right) V_{ref}$$

LED on When Low Limit < V<sub>I</sub>(BATT) < High Limit

**Voltage Monitor**

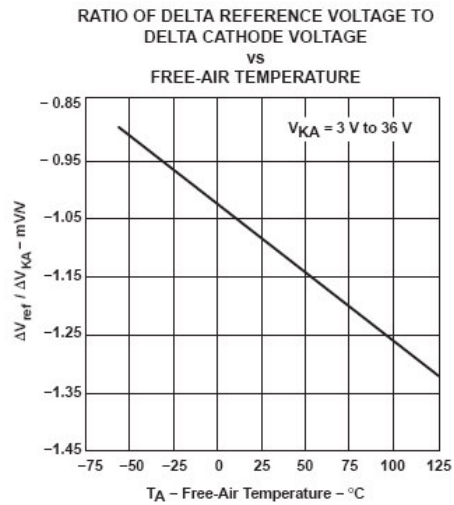
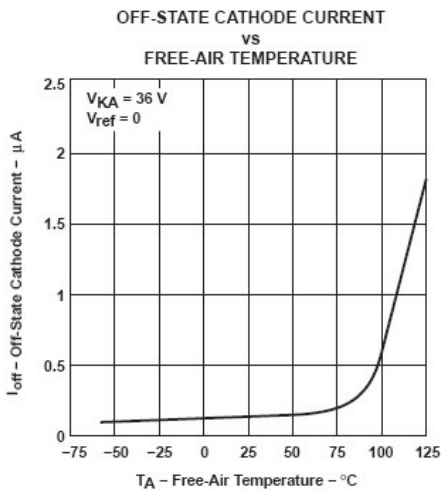
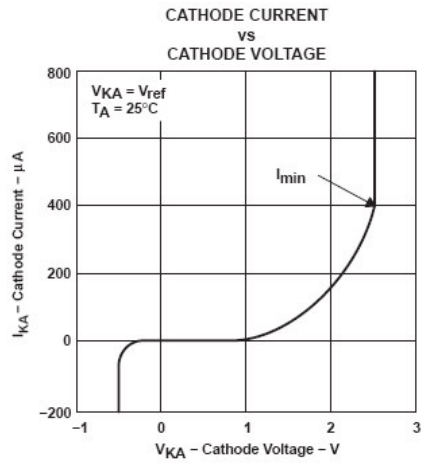
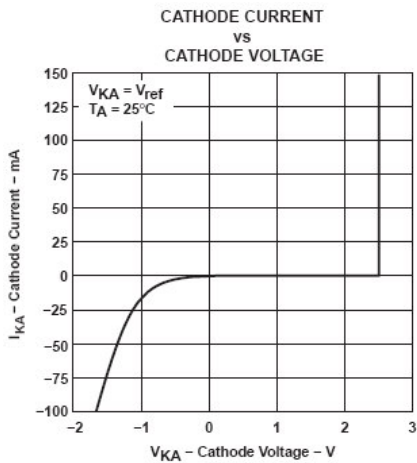
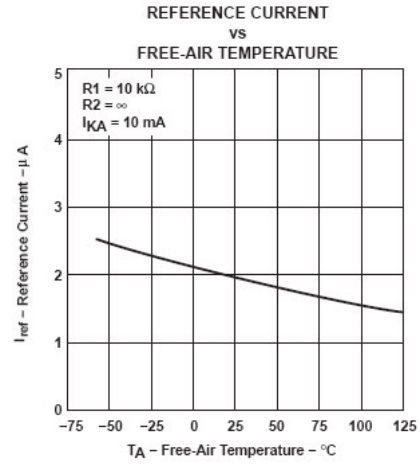
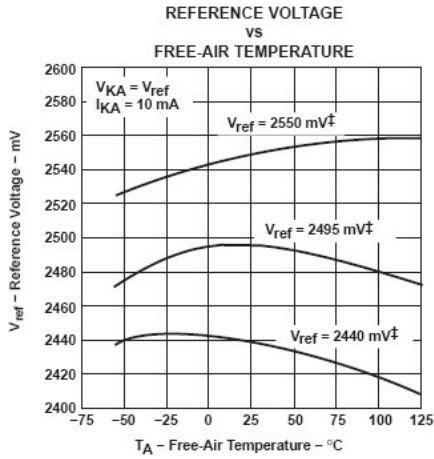


$$\text{Delay} = R \times C \times I_n \left( \frac{12V}{12V - V_{ref}} \right)$$

**Delay Timer**

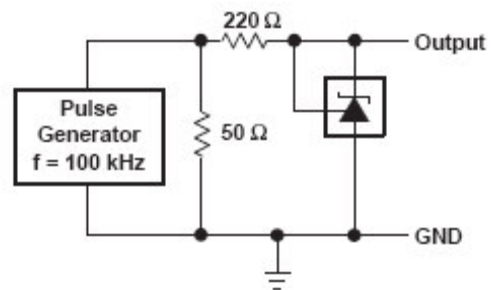
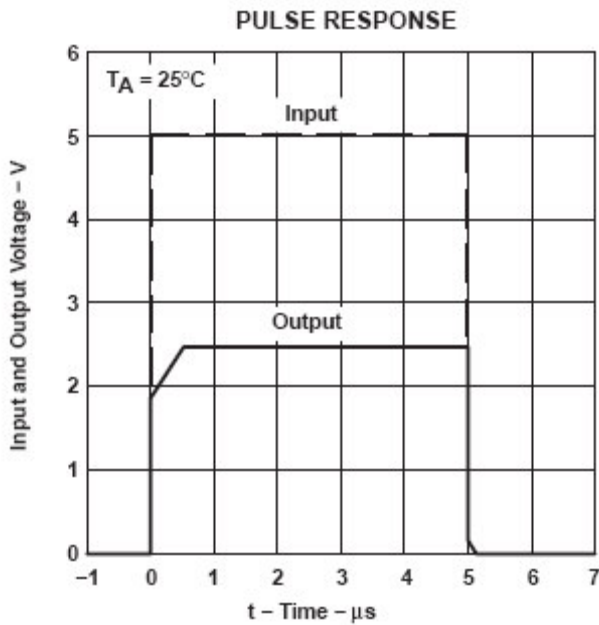


Typical Performance Characteristics

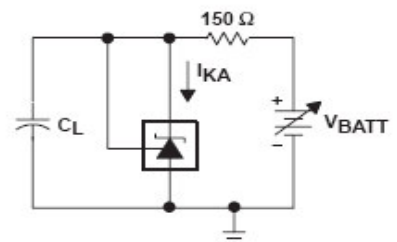
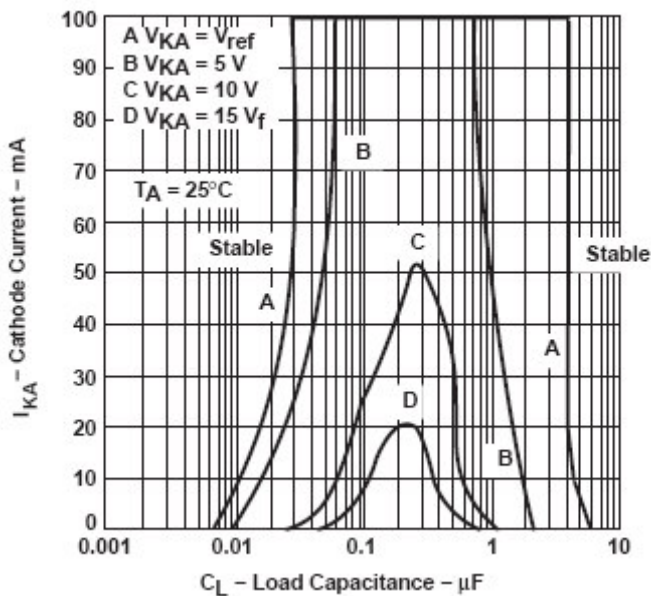




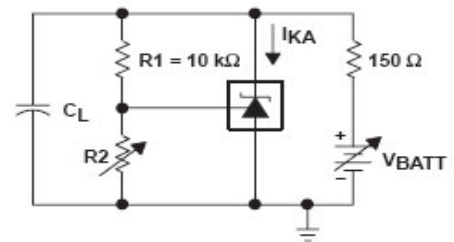
**Typical Performance Characteristics**



**TEST CIRCUIT FOR PULSE RESPONSE**



**TEST CIRCUIT FOR CURVE A**

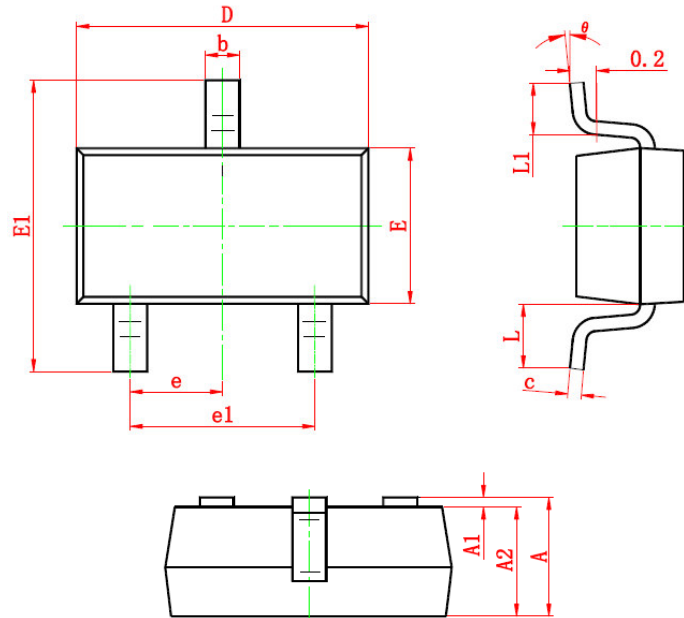


**TEST CIRCUIT FOR CURVES B, C, AND D**





**Package Information ( SOT-23 )**



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
θ	0°	8°	0°	6°

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