



SP431

High Voltage Adjustable Precision Shunt Regulators

DESCRIPTION

The SP431 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 V_{REF} (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 SP431 excellent replacements for low-voltage Zener diodes in many applications, including onboard regulation and adjustable power supplies.

APPLICATIONS

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

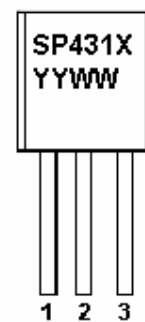
FEATURES

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

PIN CONFIGURATION (TO-92)



PART MARKING (TO-92)



X : Grade Code
Y : Year Code
W : Weak Code



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PIN DESCRIPTION

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

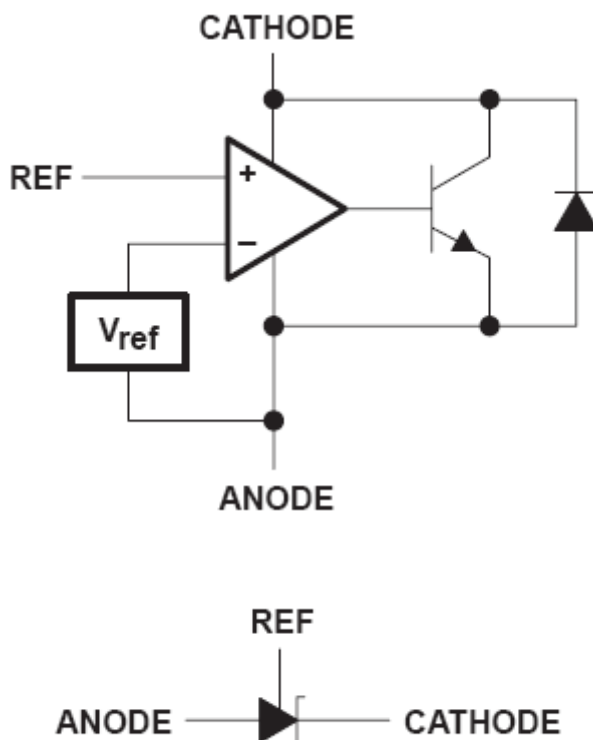
ORDERING INFORMATION

Part Number	Voltage Tolerance	Package	Part Marking
SP431AT92AG	1.0%	TO-92	SP431A
SP431BT92AG	0.5%	TO-92	SP431B

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

※ SP431AT92AG / SP431BT92AG : Tape Ammo ; Pb-Free

BLOCK DIAGRAM





SP431

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ABSOLUTE MAXIMUM RATINGS

(TA=25°C Unless otherwise specified)

Parameter	Symbol	Value	Unit
Cathode Voltage	VZ	37	V
Continuous Cathode Current	IZ	150	mA
Reference Current	IREF	10	mA
Operation Junction Temperature Range	TJ	-40 ~ +150	°C
Storage Temperature Range	TSTG	-65 ~ +150	°C
Lead Temperature Range (Soldering 10sec.)	TSOL	260	°C
Thermal Resistance	ΘJA	140	°C/W

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

(TA=25°C , Unless otherwise specified)

SP431XT92AG							
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Reference Voltage	VREF	VZ = VREF IZ = 10mA	SP431AT92AG	2.475	2.5	2.525	V
			SP431BT92AG	2.487	2.5	2.513	
VREF Temp Deviation	VDEV	TA=-40°C~+80°C VZ = VREF , IZ = 10mA		10	25	mV	
Ratio of change in VREF to change in Cathode voltage	$\Delta V_{REF} / \Delta V_Z$	IZ = 10mA $\Delta V_Z = 36V \sim V_{REF}$		-1.4	-2.7	mV / V	
Reference Input Current	IREF	R1=10KΩ , R2 = ∞ , IZ = 10mA		2	4	uA	
IREF Temp Deviation	IREF(DEV)	TA=-40°C~+80°C R1=10KΩ , R2 = ∞ , IZ = 10mA		0.8	2.5	uA	
Off state Cathode Current	IZ(OFF)	VREF = 0V VZ = 36V		0.1	0.5	uA	
Dynamic output impedance	RZ	f < 1KHZ , VZ = VREF IZ = 1mA ~ 100mA		0.25	0.5	Ω	
Minimum Operation Current	IZ(MIN)	VZ = VREF		0.4	0.7	mA	



SP431

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TESTING CIRCUIT

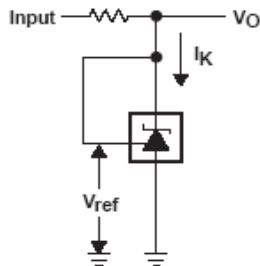


Figure 1. Test Circuit for $V_{KA} = V_{ref}$.
 $V_O = V_{KA} = V_{ref}$

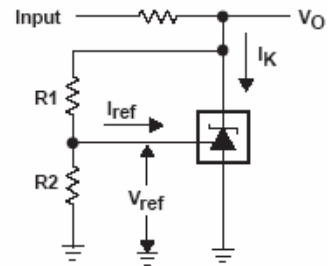


Figure 2. Test Circuit for $V_{KA} > V_{ref}$.
 $V_O = V_{KA} = V_{ref} \times (1 + R1/R2) + I_{ref} \times R1$

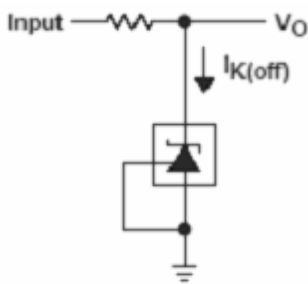


Figure 3. Test Circuit for $I_{K(off)}$

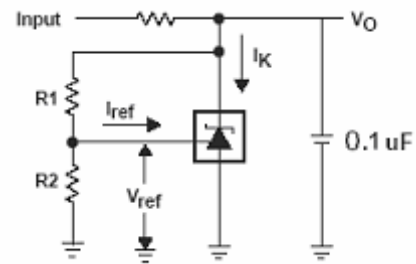


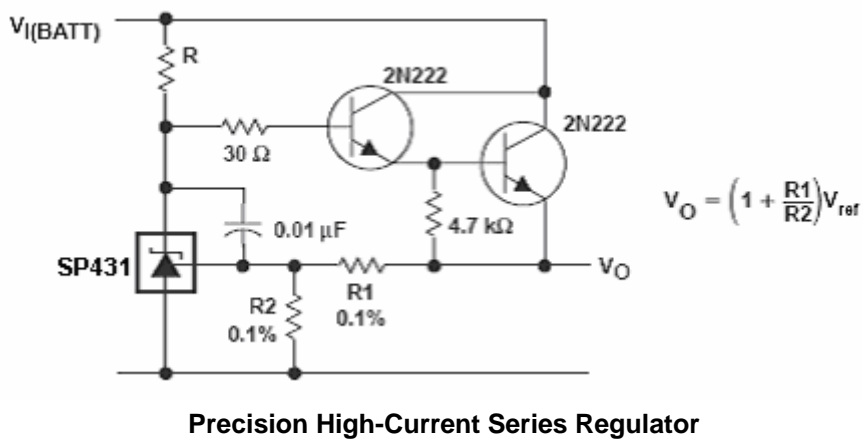
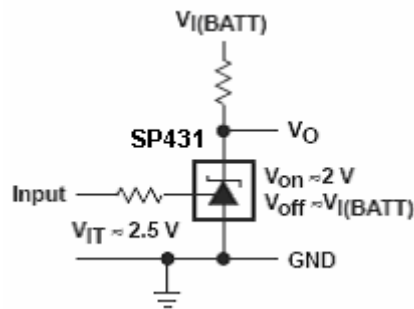
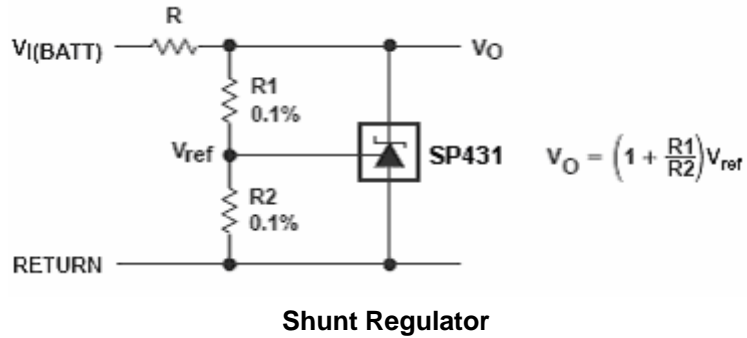
Figure 4. Test Circuit for $V_{KA} > V_{ref}$.
 $V_O = V_{KA} = V_{ref} \times (1 + R1/R2) + I_{ref} \times R1$



SP431

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APPLICATION CIRCUIT

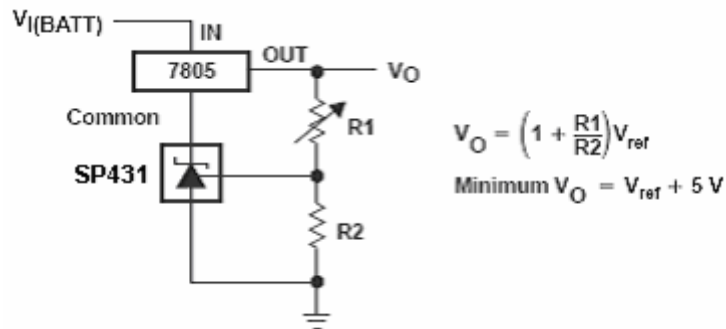




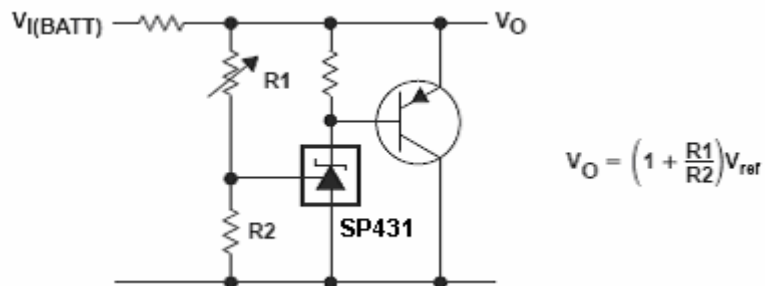
SP431

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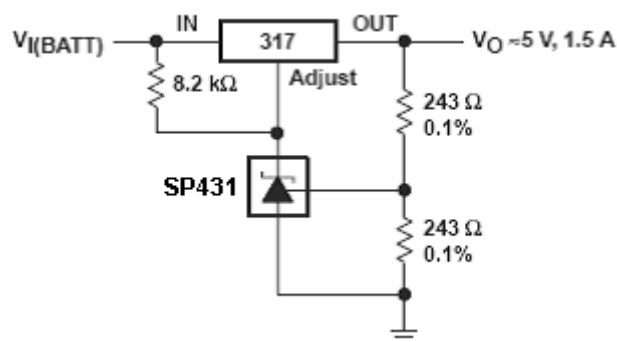
APPLICATION CIRCUIT



Output Control of a Three-Terminal Fixed Regulator



High-Current Shunt Regulator



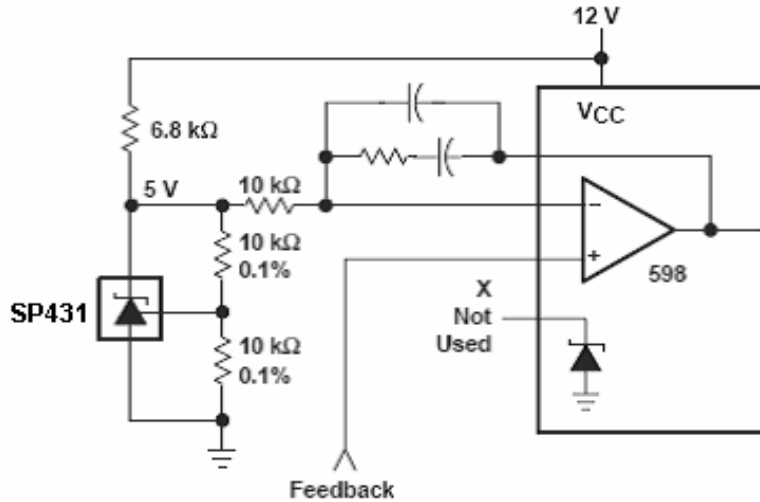
Precision 5-V 1.5-A Regulator



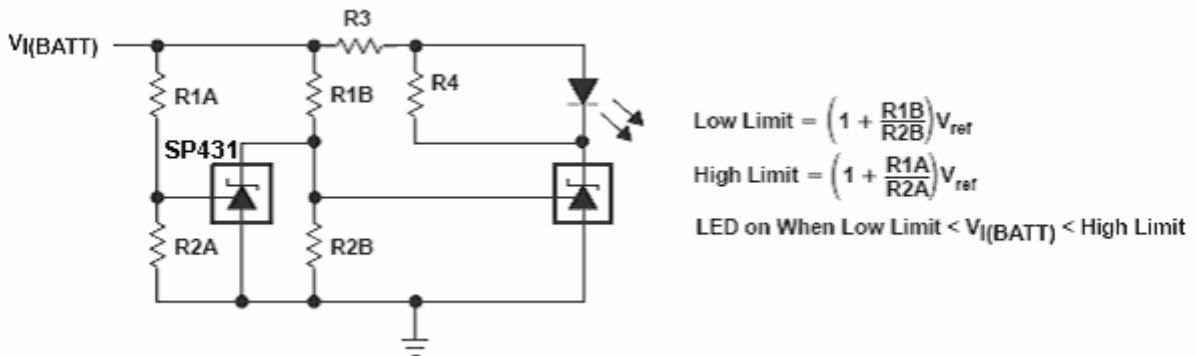
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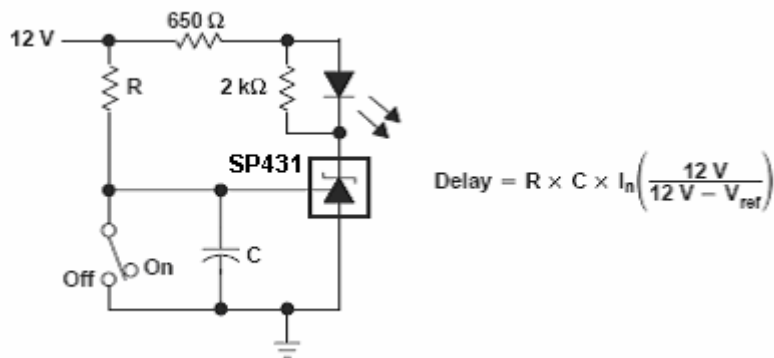
APPLICATION CIRCUIT



PWM Converter With Reference



Voltage Monitor



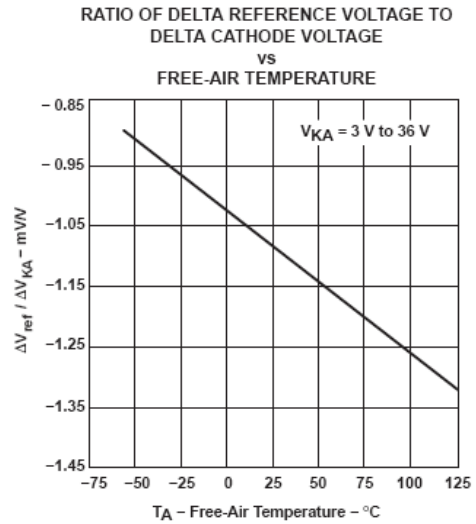
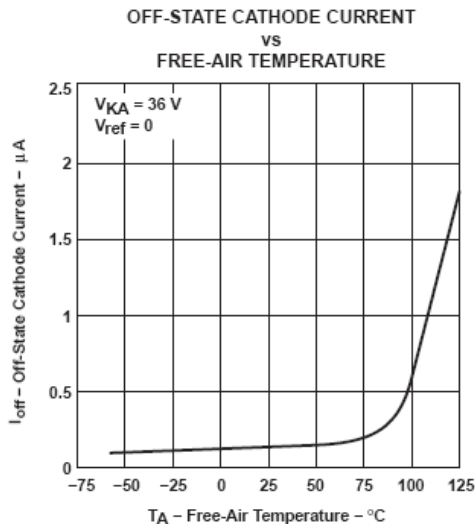
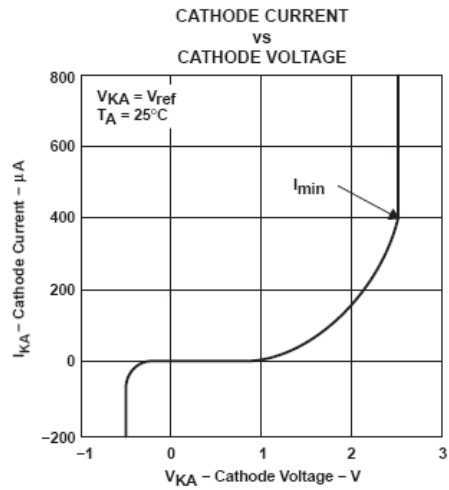
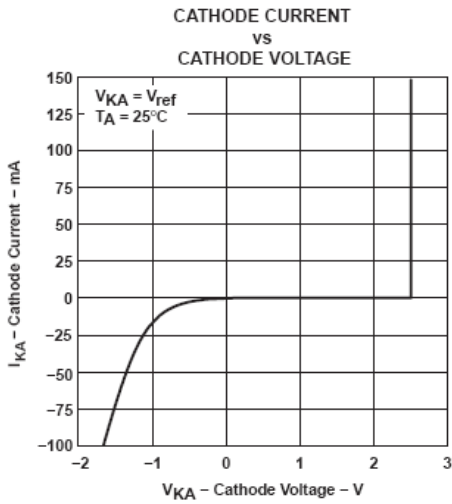
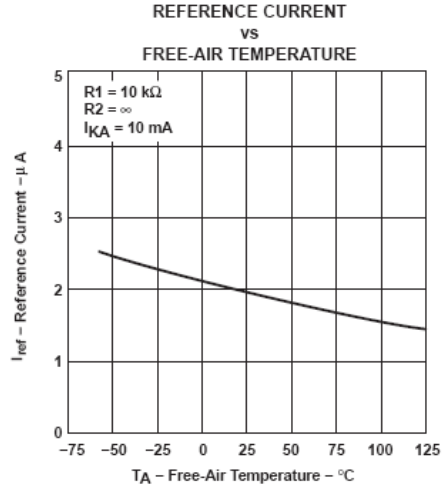
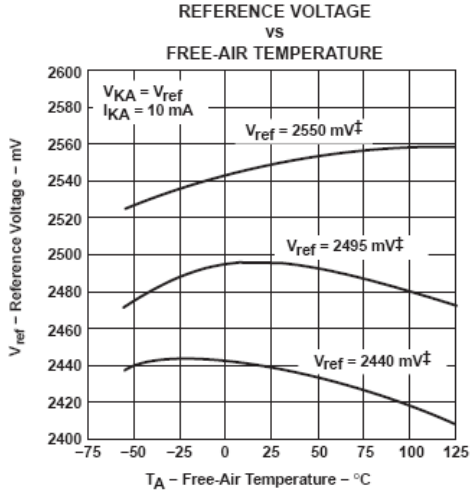
Delay Timer



SP431

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PERFORMANCE CHARACTERISTICS

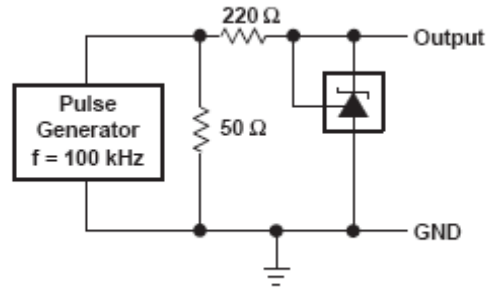
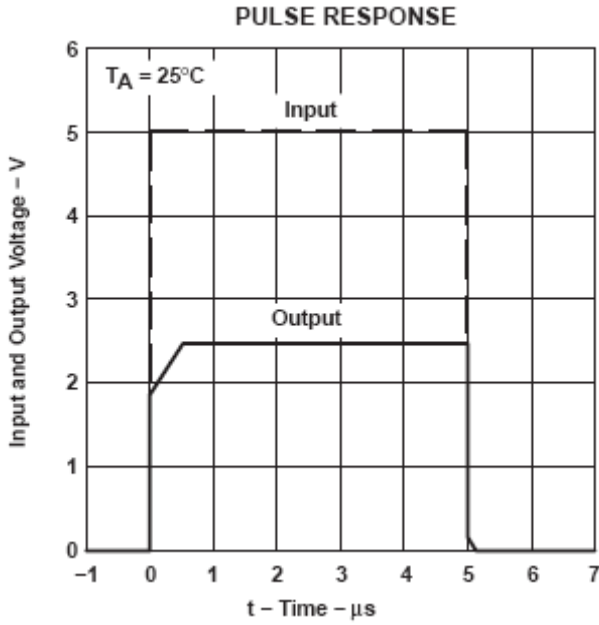




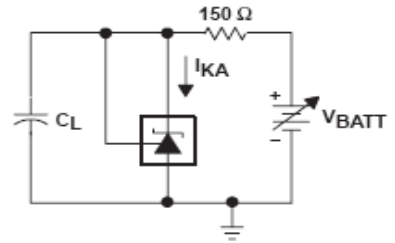
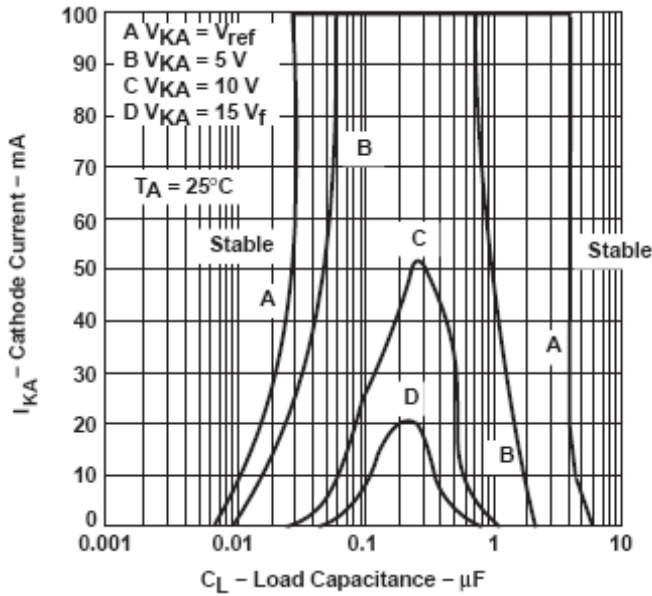
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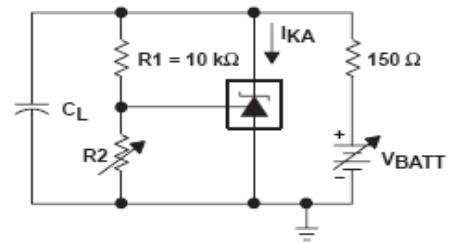
PERFORMANCE CHARACTERISTICS



TEST CIRCUIT FOR PULSE RESPONSE



TEST CIRCUIT FOR CURVE A



TEST CIRCUIT FOR CURVES B, C, AND D

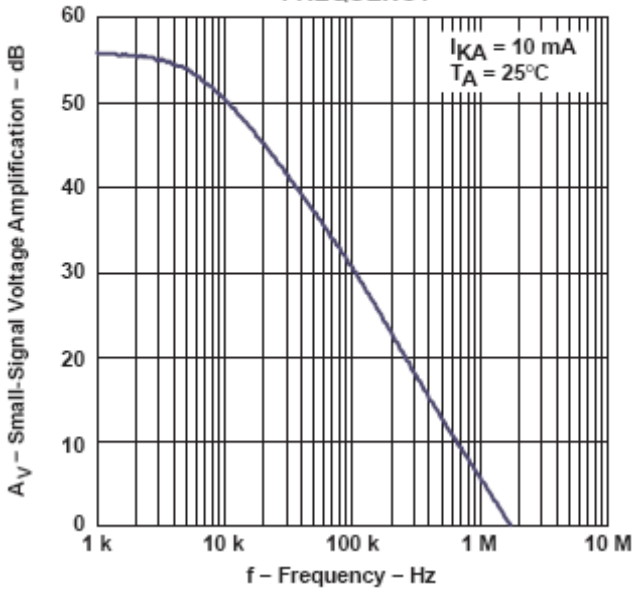


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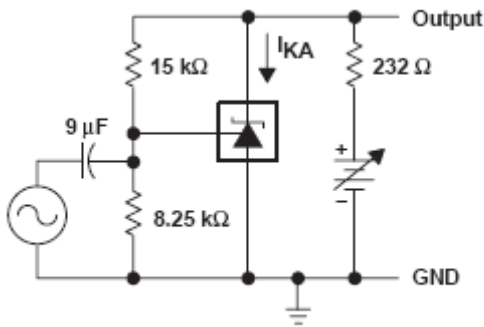
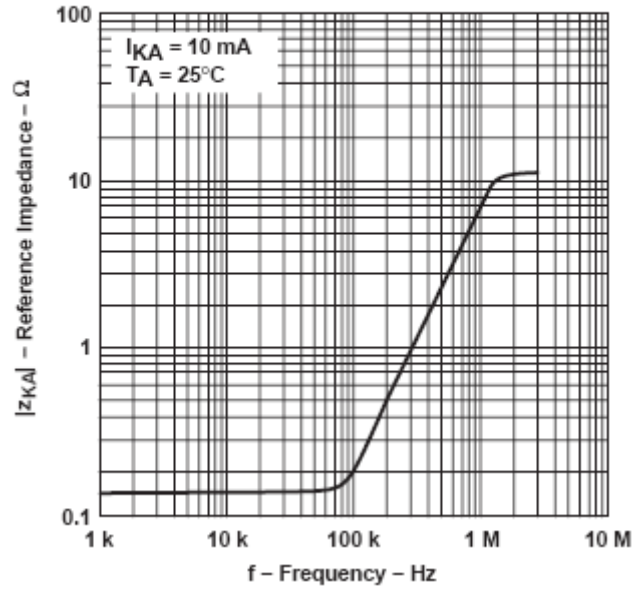
High Voltage Adjustable Precision Shunt Regulators

PERFORMANCE CHARACTERISTICS

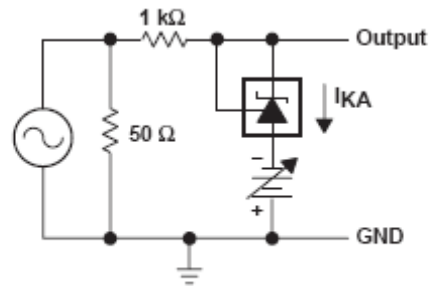
SMALL-SIGNAL VOLTAGE AMPLIFICATION
VS
FREQUENCY



REFERENCE IMPEDANCE
VS
FREQUENCY



TEST CIRCUIT FOR VOLTAGE AMPLIFICATION



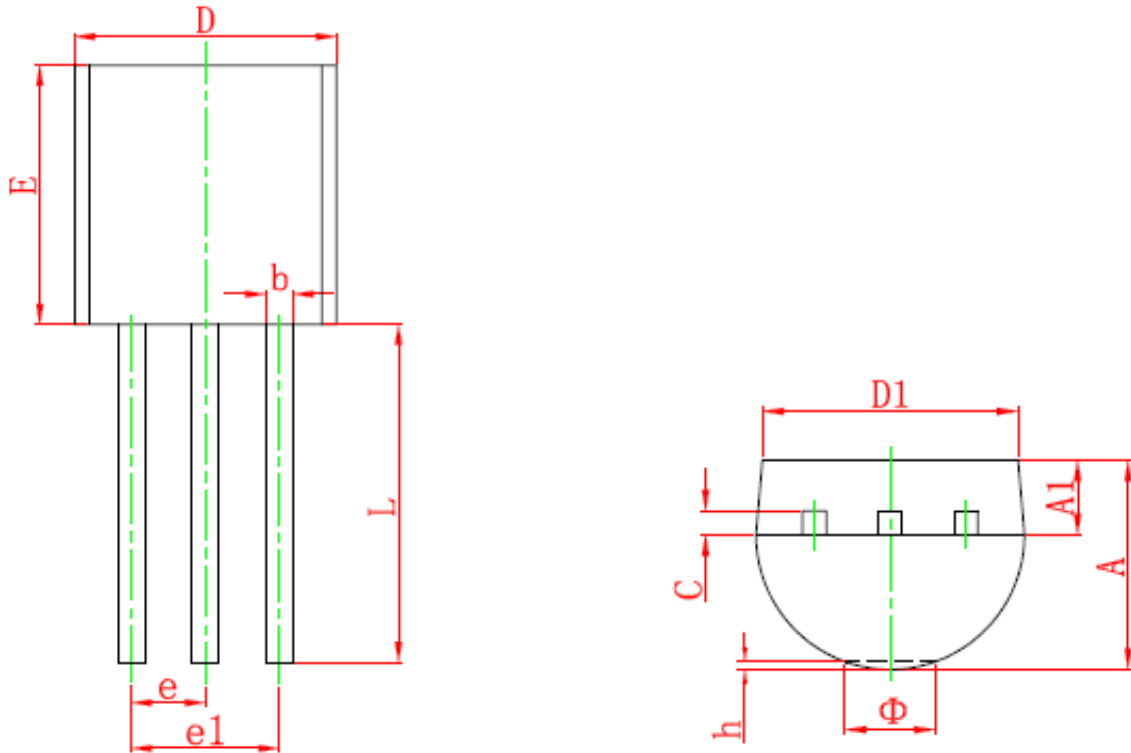
TEST CIRCUIT FOR REFERENCE IMPEDANCE



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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