ALPHA
SEMICONDUCTOR
Excellence in Analog Power Products

AS431C

Precision Adjustable Shunt Regulator

FEATURES

- **Wide Operating Current..... 1mA to 150mA**
- **Extended Termperature Range..... 105°C**
- Low Temperature Coeffecient 30 ppm/°C
- **Offered in TO-92**
- **Improved** Replacement in Performance for TL431
- **Low Cost Solution**

APPLICATIONS

- Battery Operating Equipments
- Adjustable Supplies
- Switching Power Supplies
- Error Amplifiers
- Single Supply Amplifier
- Monitors / VCR / TV
- Personal Computers

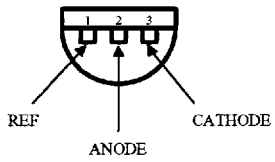
PRODUCT DESCRIPTION

The ALPHA Semiconductor AS431C is a 3-Terminal Adjustable Shunt Voltage Regulator providing a highly accurate bandgap reference. AS431C acts as an open-loop error amplifier with a 2.5V temperature compensation reference. The AS431C thermal stability, wide operating current (150mA) and temperature range (105°C) makes it suitable for all variety of applications that are looking for a low cost solution with high performance.

The output voltage may be adjusted to any value between V_{REF} and 36V with 2 external resistors. The AS431C is operating in full industrial temperature range of 0°C to 105°C. The AS431C is available in TO-92 and SOT-89 packages.

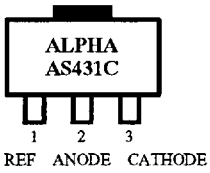
PIN CONFIGURATION

TO-92 (N)



Bottom View

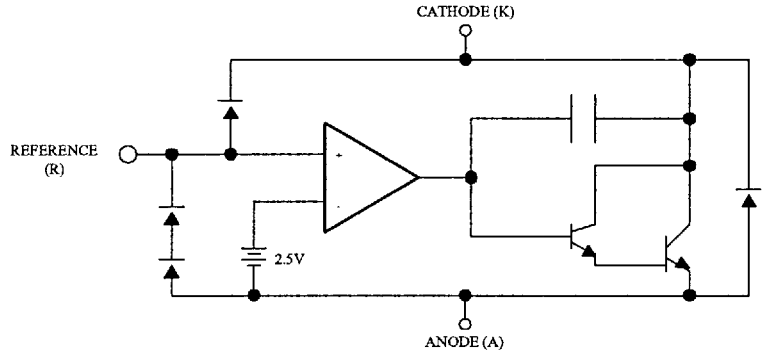
SOT-89 (M1)



Front View

ORDERING INFORMATION

Part Number	Temperature Range	Package Type
AS431CN	0°C to 105°C	TO-92
AS431CM1	0°C to 105°C	SOT-89



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Rev.11/16/98

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Units
Cathode-Anode Reverse Breakdown	V_{KA}	37	V
Anode-Cathode Forward Current	I_{AK}	1	A
Operating Cathode Current	I_{KA}	150	mA
Reference Input Current	I_{REF}	10	mA
Continuous Power Dissipation at 25°C	P_D		
TO-92		775	mW
8L SOIC		750	mW
SOT-89		1000	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	- 65 to +150	°C
Lead Temperature (Soldering 10 sec.)	T_L	30	°C

Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

RECOMMENDED CONDITIONS

Parameter	Symbol	Rating	Unit
Cathode Voltage	V_{KA}	V_{REF} to 20	V
Cathode Current	I_K	10	mA

TYPICAL THERMAL RESISTANCE

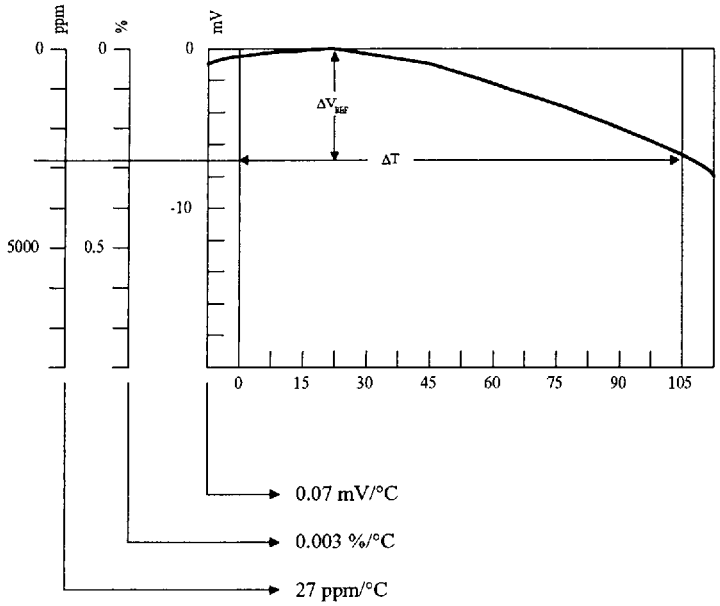
Package Type	θ_{JA}	θ_{JC}	Typical Derating
TO-92	160°C/W	80°C/W	6.3 mW/°C
SOT-89	110°C/W	8°C/W	9.1 mW/°C

ELECTRICAL CHARACTERISTICS at 25°C I_k @ 10mA $V_k=V_{ref}$, unless otherwise specified.

Parameter	Symbol	Test Conditions	AS431C			Unit
			Min	Typ	Max	
Reference Voltage	V_{REF}	T_A = 25°C TC = 1	2.445	2.495	2.545	V
Ratio of Change in V_{REF} to Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_K}$	V_{REF} to 10V 10V to 36V TC = 2	-2.7 -2	-1.0 -0.4	 0.3	mV/V
Reference Input Current	I_{REF}	TC = 2		0.7	4	µA
I_{REF} Temp Deviation	ΔI_{REF}	Over Temp. TC = 2		0.4	1.2	µA
Min I_K for Regulation	$I_{K(MIN)}$	TC = 1		0.4	1	mA
Off State Leakage	$I_{K(OFF)}$	V_{REF} = 0V, V_{KA} = 36V TC=3		0.04	1	µA
Dynamic Output Impedance	Z_{KA}	TC = 1		0.15	0.5	Ω

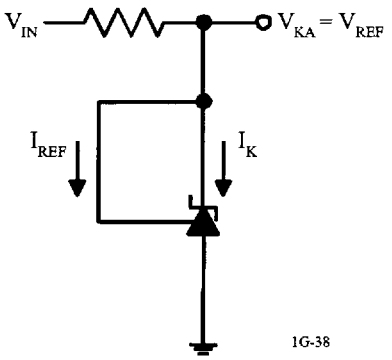
TC = Test Circuit

*CALCULATING AVERAGE TEMPERATURE COEFFICEINT (TC)

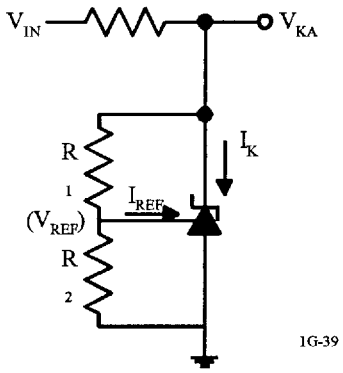


- TC in mV/°C $= \dfrac{\Delta V_{REF}(mV)}{\Delta T_A}$
- TC in mV/°C $= \dfrac{\left(\dfrac{\Delta V_{REF}}{\Delta V_{REF}\text{at } 25°C}\right) \times 100}{\Delta T_A}$
- TC in ppm/°C $= \dfrac{\left(\dfrac{\Delta V_{REF}}{\Delta V_{REF}\text{at } 25°C}\right) \times 10^6}{\Delta T_A}$

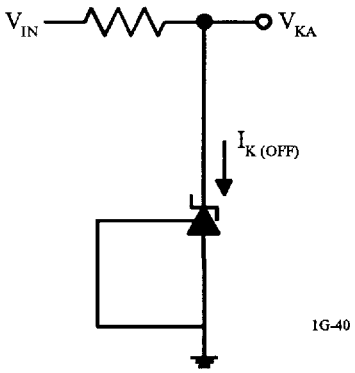
TEST CIRCUITS



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



TEST CIRCUIT
For $V_{KA} > V_{REF}$



TEST CIRCUIT
For I_{ROFF}

TYPICAL PERFORMANCE CURVES

Low Current Operating Characteristics

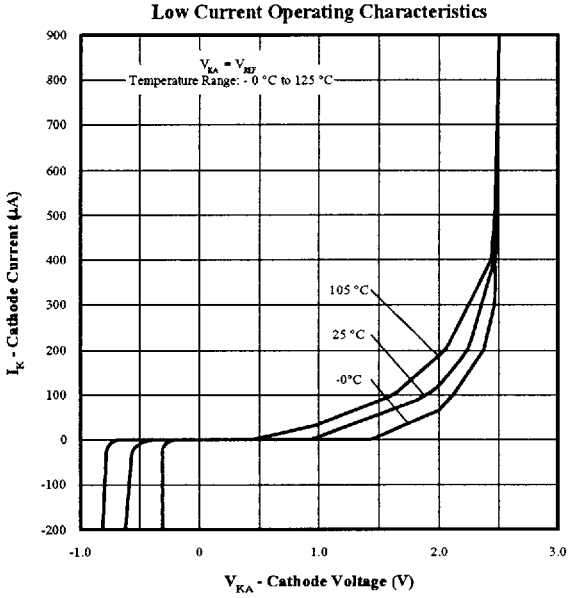


Figure 2

High Current Operating Characteristics

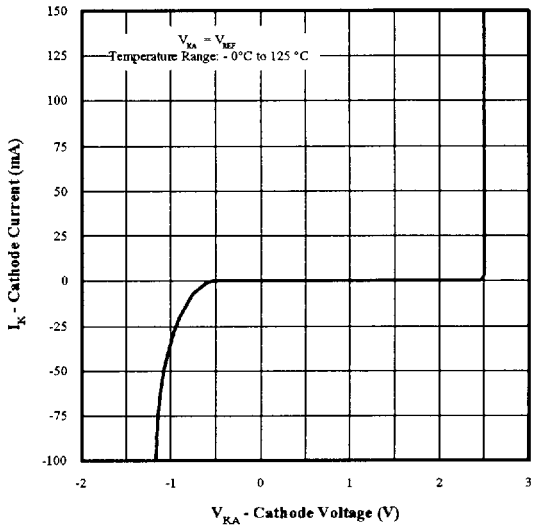


Figure 3

Off State Leakage

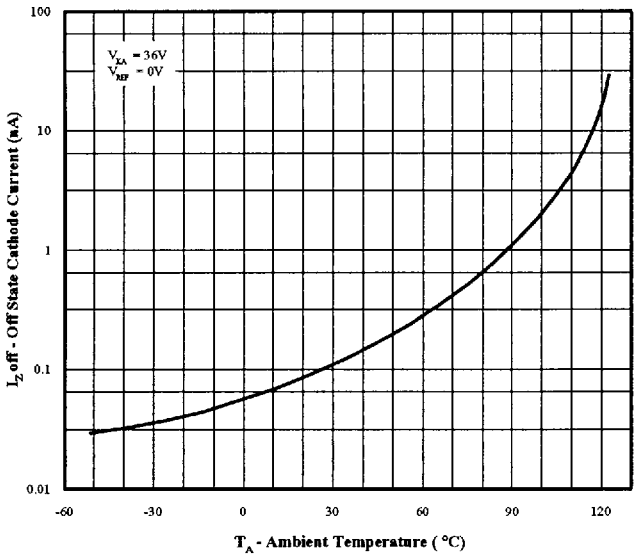


Figure 4

Reference Voltage vs. Ambient Temperature

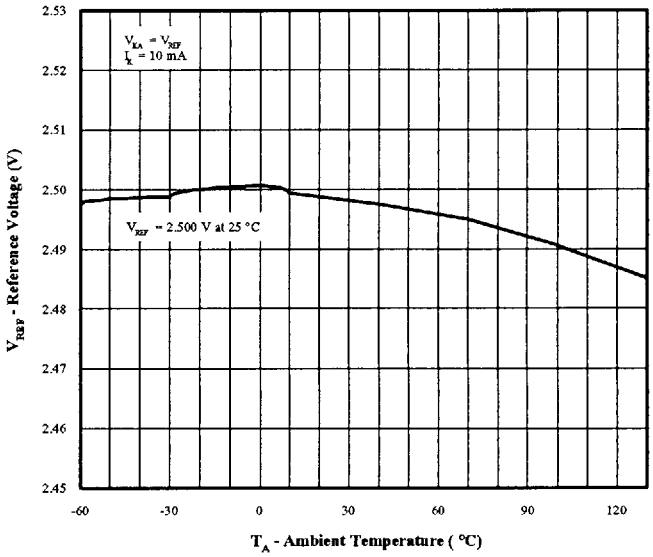


Figure 5

TYPICAL PERFORMANCE CURVES

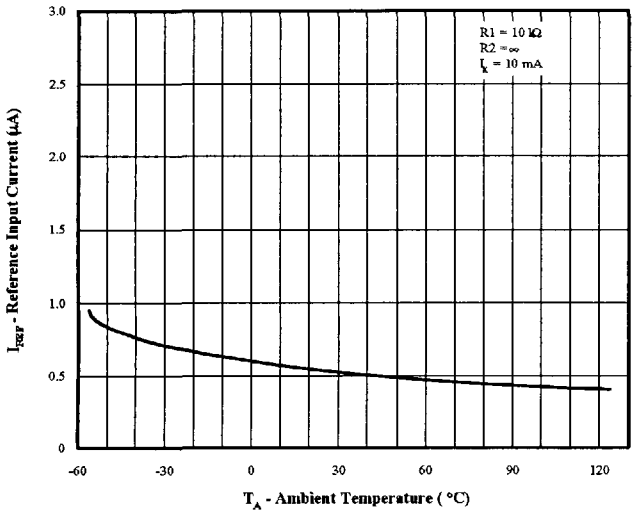


Figure 6

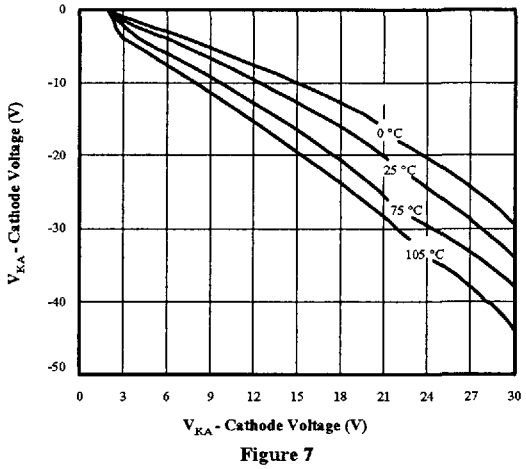


Figure 7

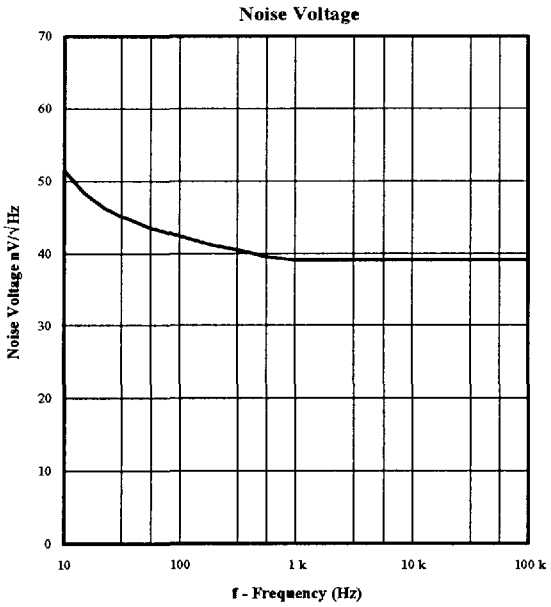


Figure 8

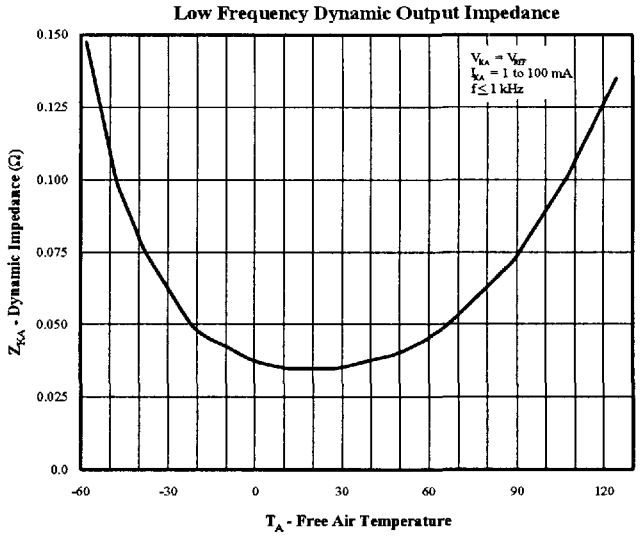


Figure 9

TYPICAL PERFORMANCE CURVES

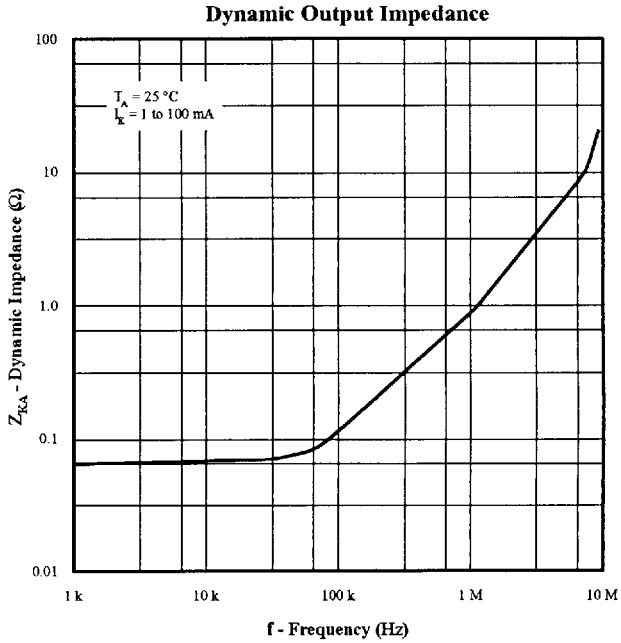
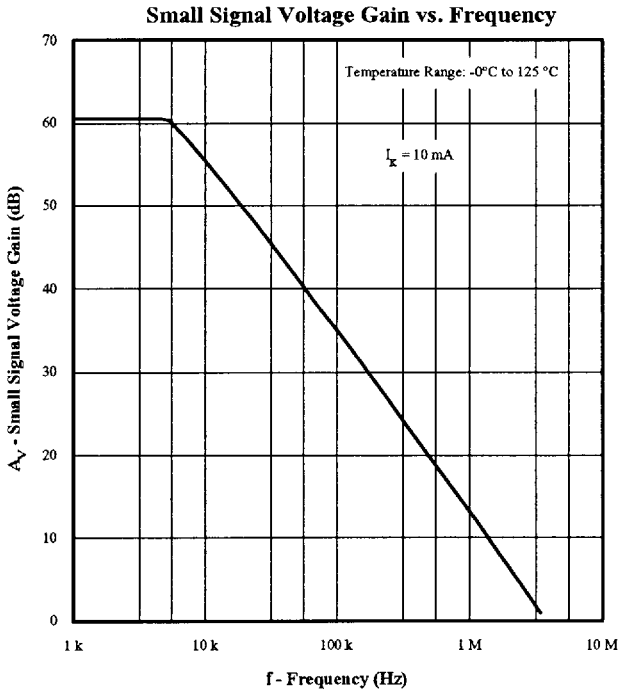


Figure 10



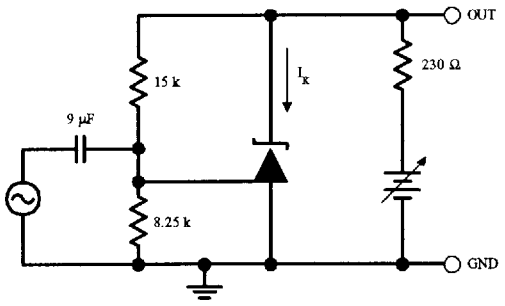
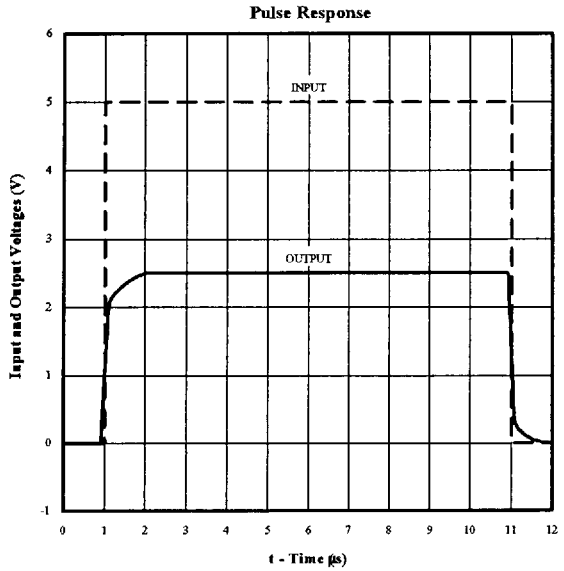


Figure 11

TYPICAL PERFORMANCE CURVES



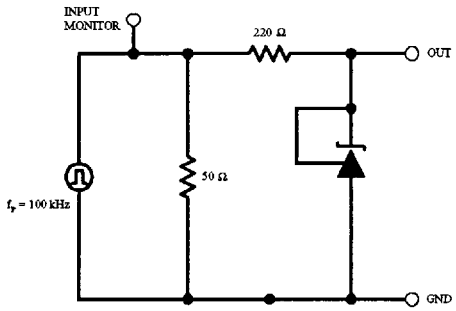
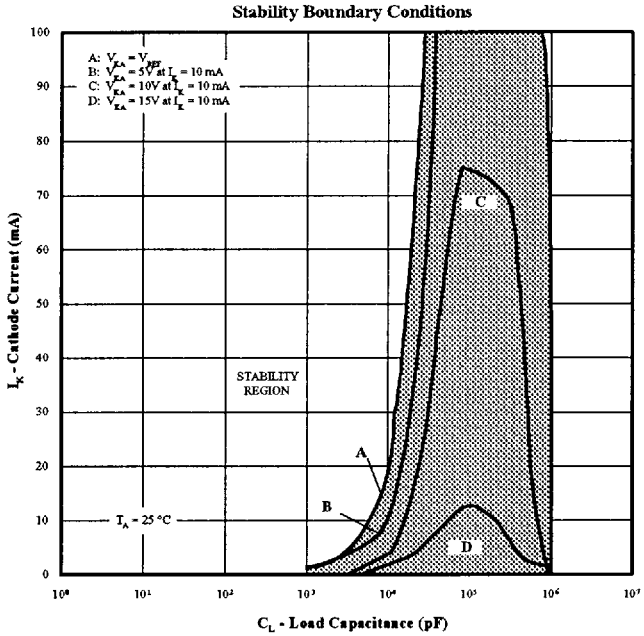


Figure 12



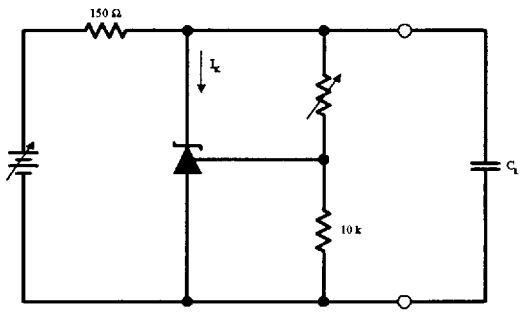


Figure 13