

ADJUSTABLE PRECISION SHUNT REGULATORS

Description

The AS431 is a three-terminal adjustable shunt regulator with guaranteed thermal stability over a full operation range. It features sharp turn-on characteristics, low temperature coefficient and low output impedance, which make it ideal substitute for Zener diode in applications such as switching power supply, charger and other adjustable regulators.

The output voltage of AS431 can be set to any value between VREF (2.5V) and the corresponding maximum cathode voltage (36V).

The AS431 precision reference is offered in two voltage tolerance: 0.5% and 1.0%.

This IC is available in 4 packages: TO-92 (bulk or ammo packing), SOT-23, SOT-23-5 and SOT-89.

Features

- Programmable Precise Output Voltage from 2.5V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 4.5mV Typical
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Packages: SOT-23, SOT-23-5, TO-92, SOT-89
 - Totally Lead-Free; RoHS Compliant (Notes 1 & 2)
- Lead-Free Packages, Available in "Green" Molding Compound: SOT-23, SOT-23-5, TO-92, SOT-89
 - Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
 - Halogen and Antimony Free. "Green" Device (Note 3)

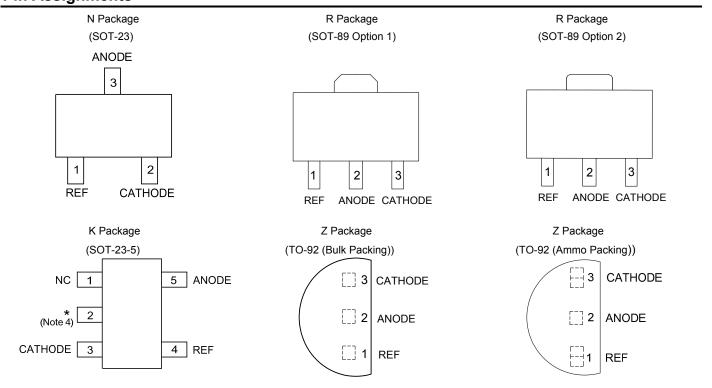
Applications

- Charger
- Voltage Adapter
- Switching Power Supply
- Graphic Card
- Precision Voltage Reference

Notes:

- 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
- See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
- 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

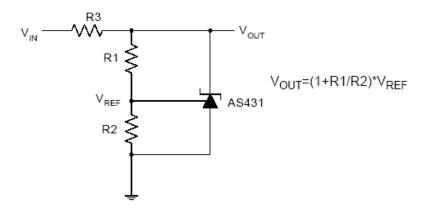
Pin Assignments



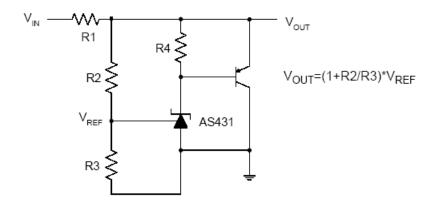
Note: 4. * Pin 2 is attached to substrate and must be connected to ANODE or open.



Typical Applications Circuit



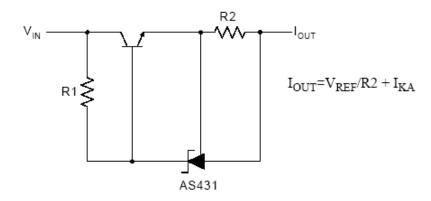
Shunt Regulator



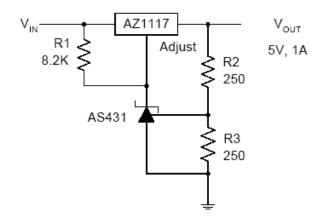
High Current Shunt Regulator



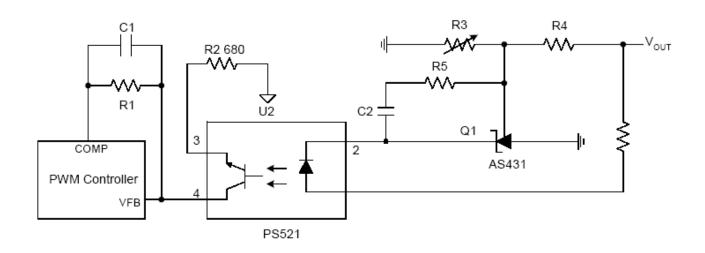
Typical Applications Circuit (Cont.)



Current Source or Current Limit



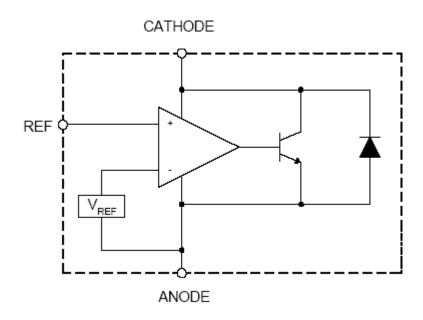
Precision 5V 1A Regulator



PWM Converter with Reference



Functional Block Diagram



Absolute Maximum Ratings (Note 5)

Symbol	Parameter	Rating	Unit	
V_{KA}	Cathode Voltage	40	V	
I _{KA}	Cathode Current Range (Continuous)	-100 to 150	mA	
I _{REF}	Reference Input Current Range	10		mA
	B B: : #	Z, R Package	R Package 770	
P_{D}	Power Dissipation	N, K Package	370	mW
TJ	Junction Temperature	+150		°C
T_{STG}	Storage Temperature Range	-65 to +150		°C
ESD	ESD (Human Body Model)	2000	V	

Note 5: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V _{KA}	Cathode Voltage	V _{REF}	36	V
I _{KA}	Cathode Current	1.0	100	mA
T _A	Operating Ambient Temperature Range	-40	+125	°C





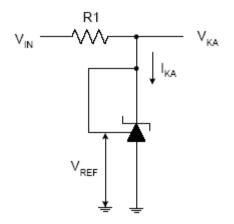
AS431

Electrical Characteristics (Operating Conditions: T_A = +25°C, unless otherwise specified.)

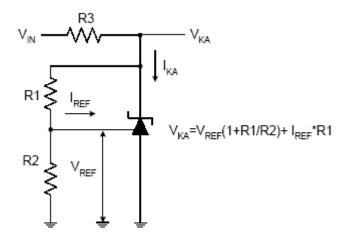
Symbol	Parameter		Test Circuit	C	Conditions	Min	Тур	Max	Unit	
V	0.5%		4	\/ = \/ l	V _{KA} = V _{REF} , I _{KA} = 10mA		2.500	2.512	v	
V _{REF}	Reference Voltage	1.0%	4	VKA - VREF, IKA	A - TOTILA	2.475	2.500	2.525	V	
				., .,	0 to +70°C	_	4.5	8		
ΔV_{REF}	Deviation of Referen Over Full Temperatu	J	4	$V_{KA} = V_{REF},$ $I_{KA} = 10mA$	-40 to +85°C	_	4.5	10	mV	
	Over 1 dir Temperata	re range		IKA – TOTTIA	-40 to +125°C	_	4.5	16		
ΔV_{REF}	Ratio of Change in R				ΔV_{KA} = 10V to V_{REF}	_	-1.0	-2.7		
ΔV_{KA}	Voltage to the Change in Cathode Voltage		5	I _{KA} = 10mA	ΔV_{KA} = 36V to 10V	_	-0.5	-2.0	mV/V	
I _{REF}	Reference Current		5	I _{KA} = 10mA, R1 = 10KΩ, R2 = ∞		_	0.7	4	μA	
ΔI_{REF}	Deviation of Reference Current Over Full Temperature Range		5	I_{KA} = 10mA, R1 = 10KΩ, R2 = ∞, T_A = -40 to +125°C		_	0.4	1.2	μA	
I _{KA} (Min)	Minimum Cathode Current for Regulation		4	V _{KA} = V _{REF}		_	0.4	1.0	mA	
I _{KA} (Off)	Off-state Cathode Current		6	V _{KA} = 36V, V _{RI}	_{EF} = 0	_	0.05	1.0	μA	
Z _{KA}	Dynamic Impedance	Dynamic Impedance		$V_{KA} = V_{REF}$, $I_{KA} = 1$ to 100mA, $f \le 1.0$ KHz		ı	0.15	0.5	Ω	
	Thermal Resistance		-	SOT-23 SOT-23-5 TO-92 SOT-89		_	135.9	_		
θ _{JC}						_	135.9	_	°C/W	
						_	81.9	_		
						_	29.8	-		



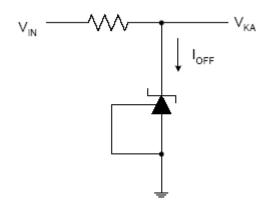
Electrical Characteristics (Cont.)



Test Circuit 4 for $V_{KA} = V_{REF}$



Test Circuit 5 for $V_{KA} > V_{REF}$

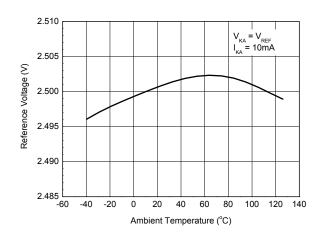


Test Circuit 6 for I_{OFF}

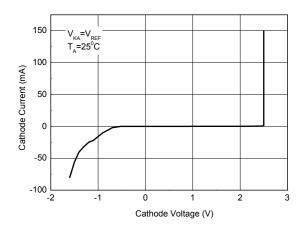


Performance Characteristics

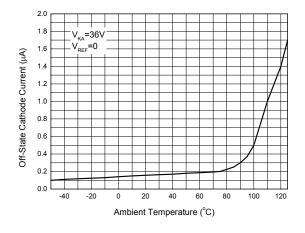
Reference Voltage vs. Ambient Temperature



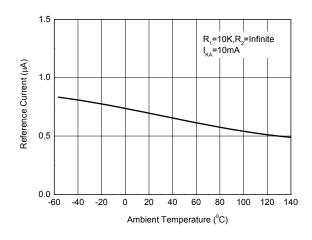
Cathode Current vs. Cathode Voltage



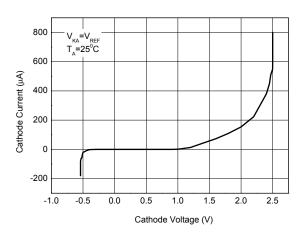
Off-State Cathode Current vs. Ambient Temperature



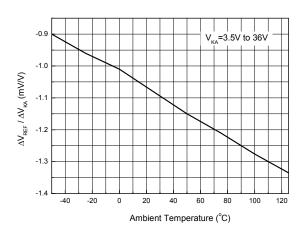
Reference Current vs. Ambient Temperature



Cathode Current vs. Cathode Voltage



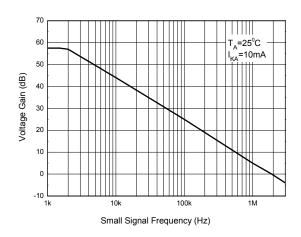
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage

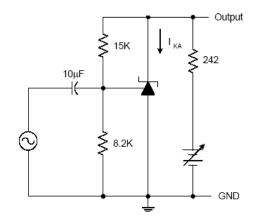




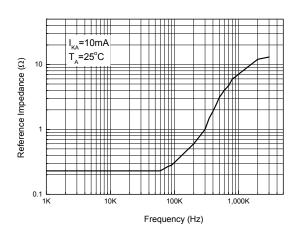
Performance Characteristics (Cont.)

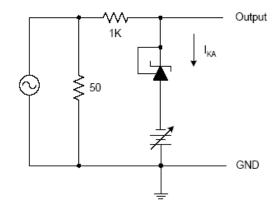
Small Signal Voltage Gain vs. Frequency



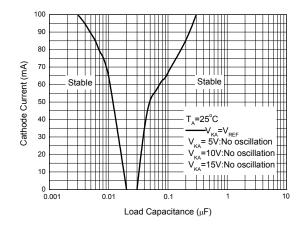


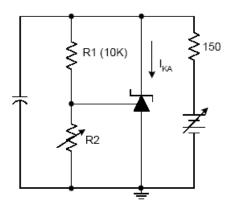
Reference Impedance vs. Frequency





Stability Boundary Conditions vs. Load Capacitance

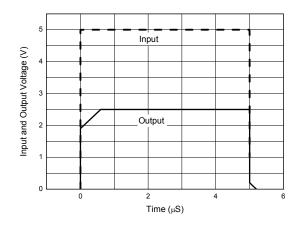


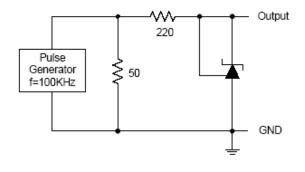




Performance Characteristics (Cont.)

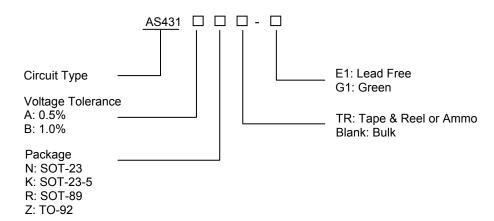
Pulse Response of Input and Output Voltage







Ordering Information

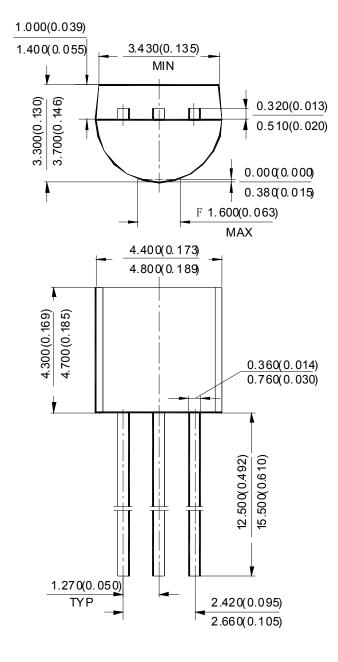


	Dankana	Temperature		Part N	umber	Marking ID		Packing
	Package	Range	Tolerance	Lead Free	Green	Lead Free	Green	Туре
Lead-Free	0.07.00	40.4 . 40500	0.5%	AS431ANTR-E1	AS431ANTR-G1	EB5	GB5	Tape & Reel
Pb Lead-free Green	SOT-23	-40 to +125°C	1.0%	AS431BNTR-E1	AS431BNTR-G1	EB6	GB6	Tape & Reel
Lead-Free	SOT-23-5	3-5 -40 to +125°C	0.5%	AS431AKTR-E1	AS431AKTR-G1	E6H	G6H	Tape & Reel
Lead-Free Lead-free Green			1.0%	AS431BKTR-E1	AS431BKTR-G1	E6I	G6I	Tape & Reel
	TO-92	TO-92 -40 to +125°C	0.5%	AS431AZ-E1	AS431AZ-G1	AS431AZ-E1	AS431AZ-G1	Bulk
Pb			0.5%	AS431AZTR-E1	AS431AZTR-G1	AS431AZ-E1	AS431AZ-G1	Ammo
Lead-Free			1.0%	AS431BZ-E1	AS431BZ-G1	AS431BZ-E1	AS431BZ-G1	Bulk
Lead-free Green			1.0%	AS431BZTR-E1	AS431BZTR-G1	AS431BZ-E1	AS431BZ-G1	Ammo
Lead-Free	SOT-89	OT-89 -40 to +125°C	0.5%	AS431ARTR-E1	AS431ARTR-G1	E43G	G43G	Tape & Reel
			1.0%	AS431BRTR-E1	AS431BRTR-G1	E43H	G43H	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

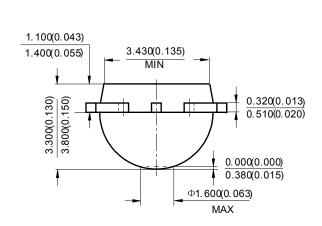


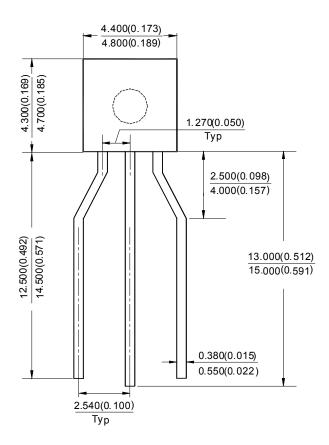
TO-92 (Bulk Packing)





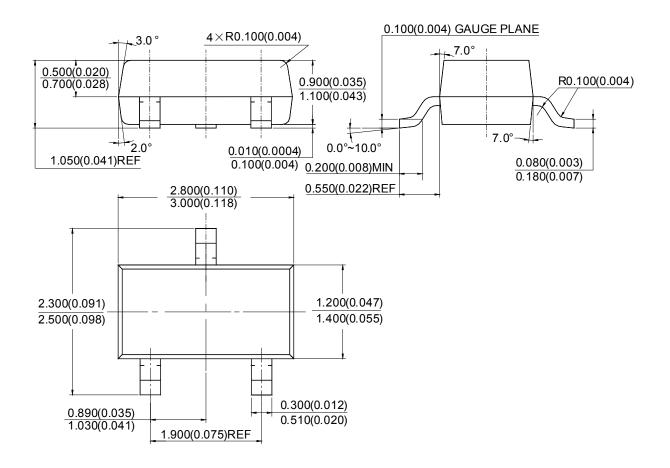
TO-92 (Ammo Packing)





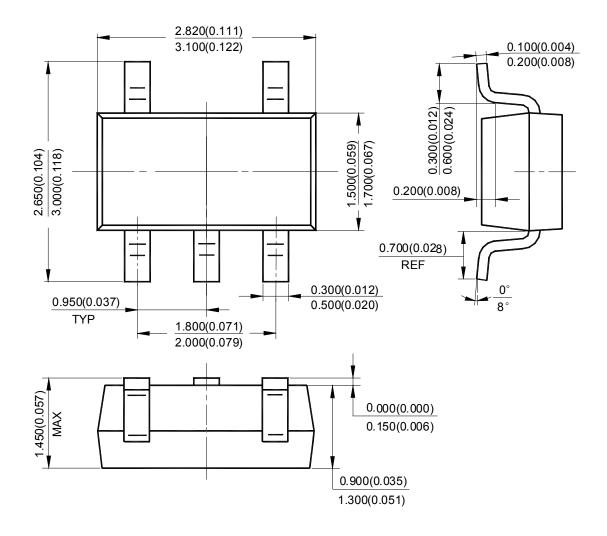


SOT-23



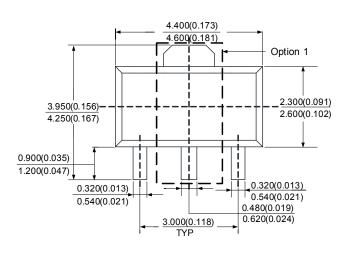


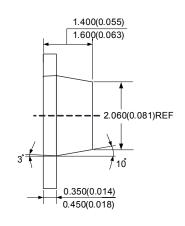
SOT-23-5

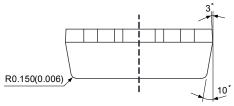


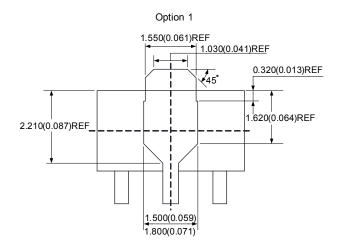


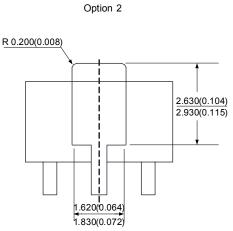
SOT-89







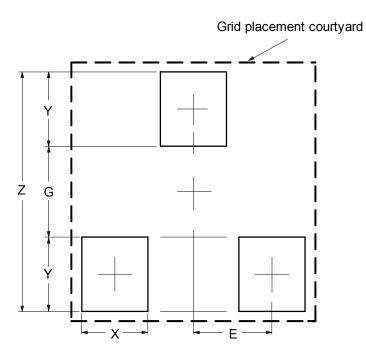






Suggested Pad Layout

SOT-23

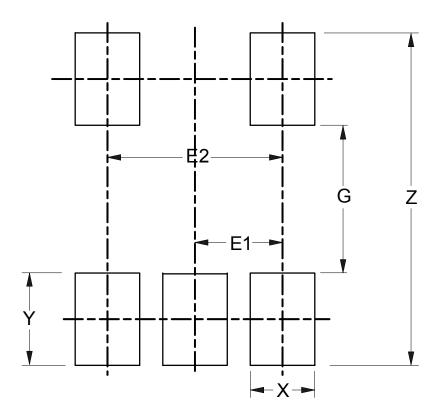


	Dimensions	Z	G	X	Υ	E
		(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)
	Value	2.900/0.114	1.100/0.043	0.800/0.031	0.900/0.035	0.950/0.037



Suggested Pad Layout (Cont.)

SOT-23-5

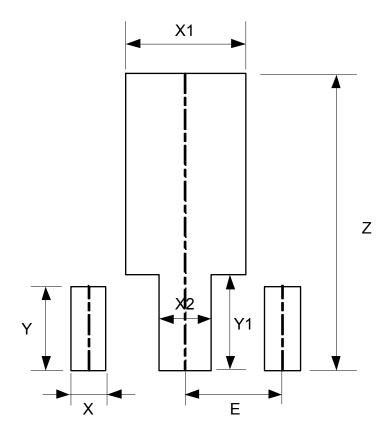


Dimensions	Z	G	Х	Y	E1	E2
	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)	(mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075



Suggested Pad Layout (Cont.)

SOT-89



Dimensions	Z	Х	X1	X2	Y	Y1	Е
	(mm)/(inch)						
Value	4.600/0.181	0.550/0.022	1.850/0.073	0.800/0.031	1.300/0.051	1.475/0.058	1.500/0.059





AS431

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