

RS431/RS432 Precision Programmable Reference

Features

- Reference Voltage Tolerance at 25°C
0.5% (A Grade)
1% (B Grade)
- Programmable output voltage to 36V
- Low dynamic output impedance 0.2Ω
- Sink current capability of 0.5 to 100mA
- Equivalent full-range temperature coefficient of 50ppm/°C typical
- Temperature compensated for operation over full rated operating temperature range
- Low output noise voltage
- Fast turn on response
- Operation from -40°C to 105°C
- Lead-Free Packages: SOT23

Applications

- Adjustable voltage and current referencing
- Power supply
- Zener replacement
- Voltage monitoring
- Comparator with integrated reference
- As precision voltage reference

Description

The RS431 and RS432 device are three-terminal adjustable shunt regulators, with a guaranteed thermal stability over applicable temperature ranges. The output voltage can be set to any value between V_{REF} (approximately 2.5V) and 36V with two external resistors. These devices have provides a very sharp turn-on characteristic, making these devices excellent replacement for Zener diodes in many applications.

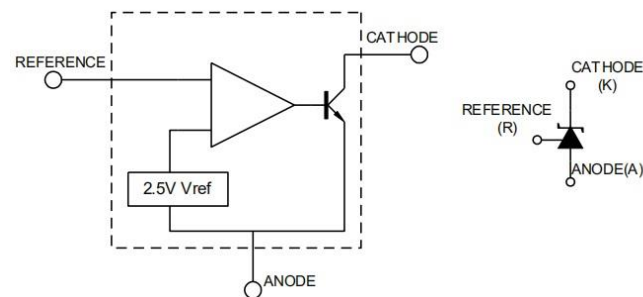
Both the RS431 and RS432 devices are offered in two grades, with initial tolerances (at 25°C) of 0.5% and 1%, for A and B grade.

Device Information (1)

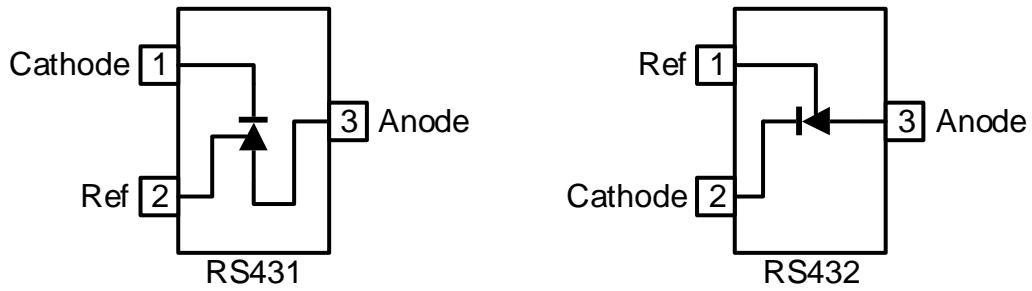
PART NUMBER	PACKAGE(PIN)	BODY SIZE (NOM)
RS431	SOT23(3)	1.30mmx2.92mm
RS432	SOT23(3)	1.30mmx2.92mm

(1) For more detail information packages, see the order sheet.

Block Diagram



Pin configuration and Functions (Top View)



Pin Description

NAME	PIN		DESCRIPTION
	RS431	RS432	
Cathode	1	2	Shunt Current/Voltage input
Ref	2	1	Threshold relative to common anode
Anode	3	3	Common pin, normally connected to ground



Ordering information

PRODUCT	ORDERING NUMBER	Voltage Tolerance	PACKAGE LEAD	PACKAGE MARKING ⁽¹⁾	PACKAGE OPTION
RS431	RS431AYSF3	0.5%	SOT23	431AXX	Tape and Reel,3000
	RS431BYSF3	1%	SOT23	431BXX	Tape and Reel,3000
RS432	RS432AYSF3	0.5%	SOT23	432AXX	Tape and Reel,3000
	RS432BYSF3	1%	SOT23	432BXX	Tape and Reel,3000

(1) XX indicate data code



Specifications

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) ⁽¹⁾⁽²⁾

Characteristics	Symbol	MIN	MAX	UNIT
Cathode Voltage	V_{KA}	-0.3	37	V
Cathode Current Range (Continuous)	I_{KA}	-100	+155	mA
Reference Input Current Range	I_{REF}	-0.05	+10	mA
Operating temperature	T_{opr}	-40	+105	°C
Power Dissipation	P_D	370		mW
Storage temperature	T_{stg}	-55	150	°C

- (1) Stresses beyond 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-rated conditions for extended periods may affect device reliability.
- (2) All voltages are with respect to the GND pin.

ESD Ratings

		VALUE	UNIT	
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM)	2000	V
		Charge device model (MM)	200	V

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

Characteristics	Symbol	MIN	MAX	UNIT
Cathode Voltage	V_{KA}	V_{REF}	36	V
Cathode Current Range (Continuous)	I_{KA}	0.5	100	mA
Operating Ambient Temperature Range	T_A	-40	+105	°C

Thermal Information

THERMAL METRIC (1)		RS431/RS432		UNIT
		SOT23		
		3 PINS		
$R_{\theta JA}$	Junction-to-ambient thermal resistance	185.6		°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	104.3		°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	54.5		°C/W
Ψ_{JT}	Junction-to-top characterization parameter	31.0		°C/W
Ψ_{JB}	Junction-to-board characterization parameter	54.5		°C/W
$R_{JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A		°C/W

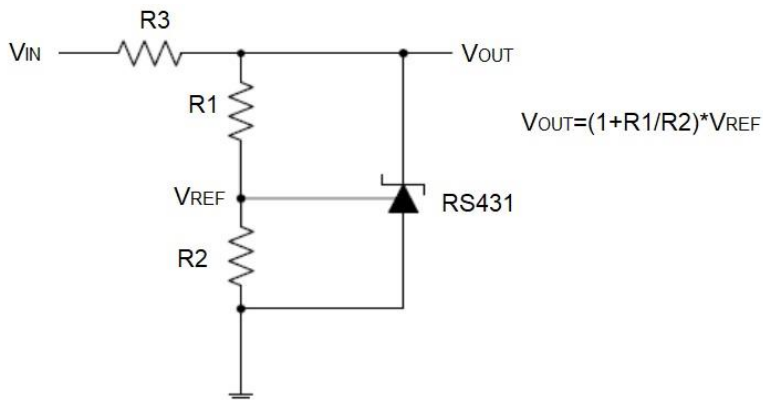


Electrical Characteristics

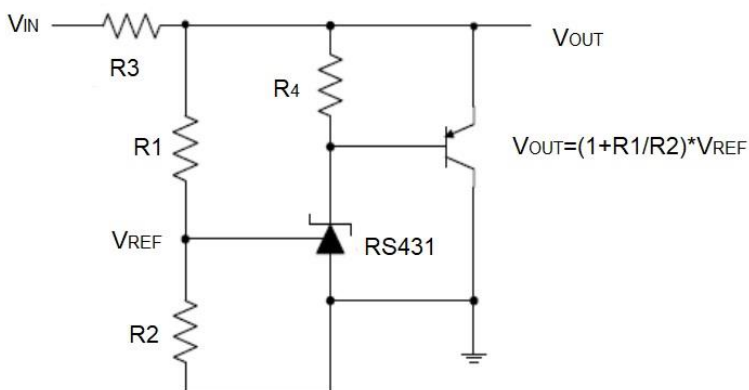
(Over recommended operating conditions, Full = -40°C to +105°C, typical values are at $T_A = +25^\circ\text{C}$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}, I_{KA}=10\text{mA}$	0.5%	2.488	2.50	2.512	V
			1%	2.475	2.50	2.525	V
Deviation of reference Input Voltage Over temperature	ΔV_{REF}	$V_{KA}=V_{REF}, I_{KA}=10\text{mA}$ $T_{min} \leq T_A \leq T_{max}$	-	4.5	25	mV	
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_{KA}=10\text{mA}$	$\Delta V_{KA}=10\text{V} \sim V_{REF}$	-	-1.0	-2.7	mV/V
			$\Delta V_{KA}=36\text{V} \sim 10\text{V}$	-	-0.5	-2.0	
Reference Input Current	I_{REF}	$I_{KA}=10\text{mA}, R_1=10\text{k}\Omega, R_2=\infty$	-	1.5	4	μA	
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T_A$	$I_{KA}=10\text{mA}, R_1=10\text{k}\Omega, R_2=\infty$ $T_A=\text{full Temperature}$	-	0.2	0.4	μA	
Minimum cathode current for regulation	$I_{KA}(\text{min})$	$V_{KA}=V_{REF}$	-	0.3	0.5	mA	
Off-state cathode Current	$I_{KA}(\text{OFF})$	$V_{KA}=36\text{V}, V_{REF}=0\text{V}$	-	0.05	0.5	μA	
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}, I_{KA}=1 \text{ to } 100\text{mA}$ $f \leq 1.0\text{KHz}$	-	0.15	0.5	Ω	

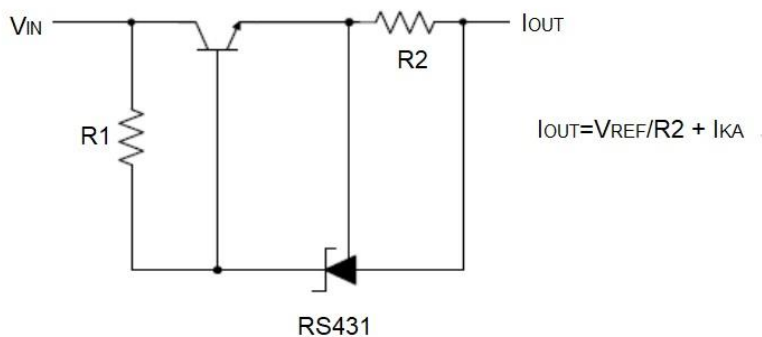
Typical Applications Circuit



Shunt Regulator



High Current Shunt Regulator



Current Source or Current Limit

Typical Performance Characteristics

Fig 1 Cathode Current Vs Cathode Voltage

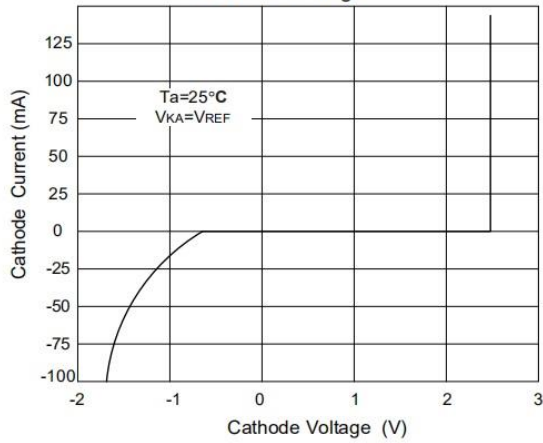


Fig 2 Cathode Current Vs Cathode Voltage

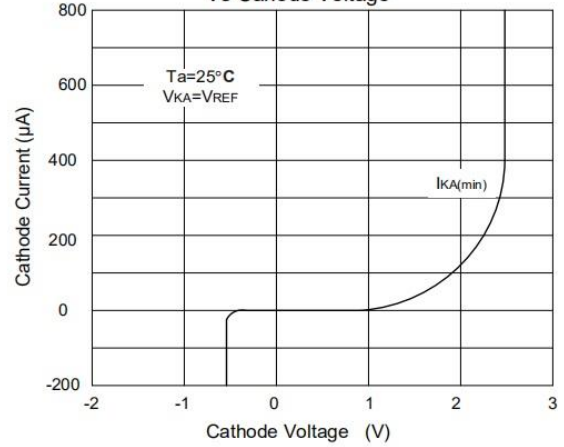


Fig 3 Change in Reference Input Voltage Vs Cathode voltage

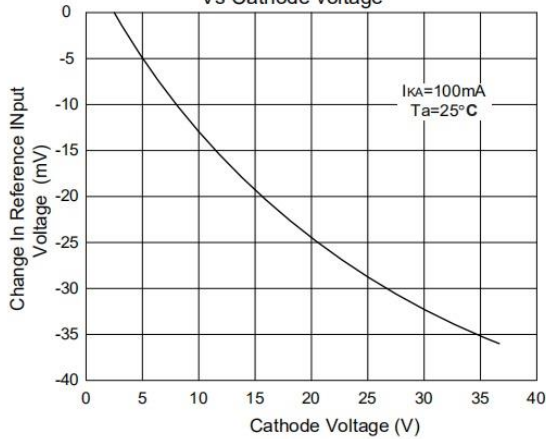


Fig 4 Pulse Response

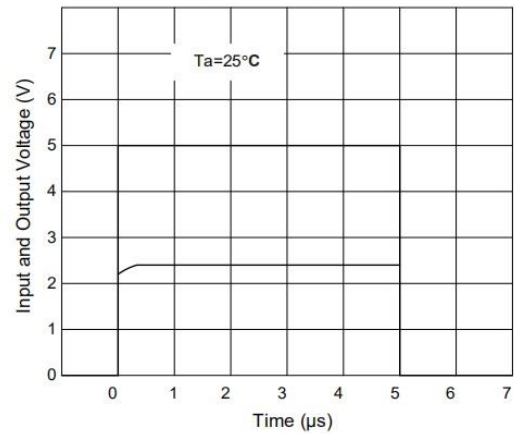


Fig 5 Dynamic Impedance Vs Frequency

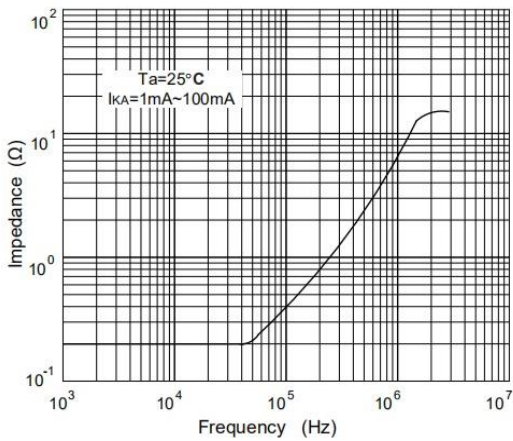


Fig 6 Small Signal Voltage Amplification Vs Frequency

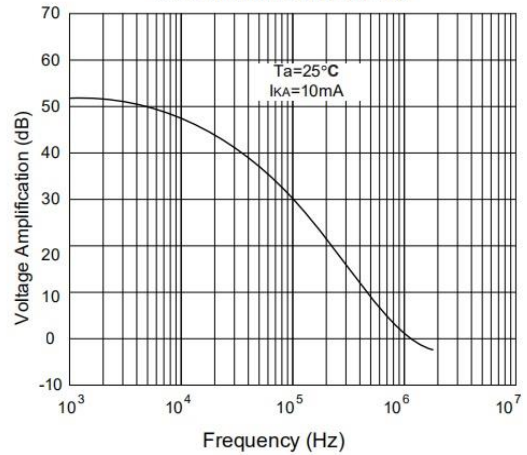
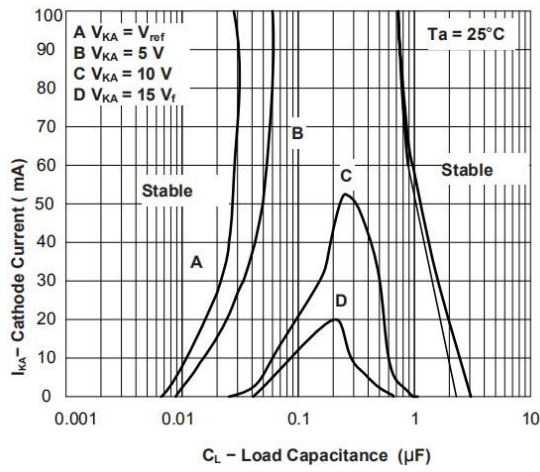
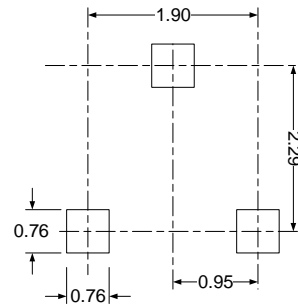
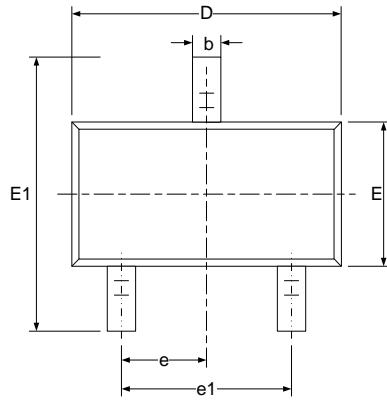


Fig 7 Cathode Current Vs Load Capacitance

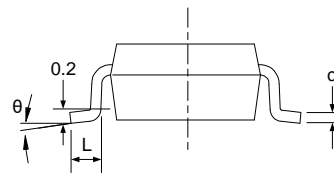
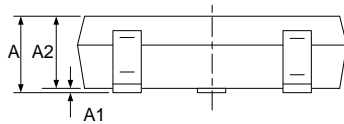


Marking Information

SOT23



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
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(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°