

# 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 provide a very sharp turn-on characteristic, making these devices excellent replacement for Zener diodes in many applications.

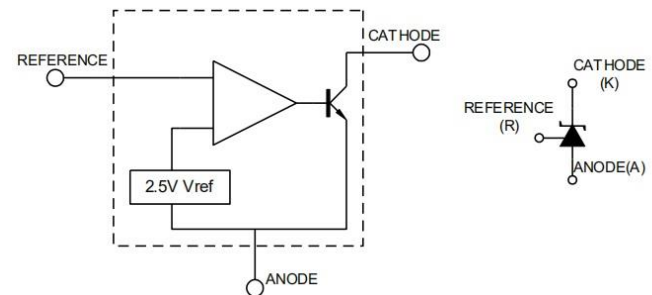
Both the RS431 and RS432 devices are offered in two grades, with initial tolerances (at 25°C) of 0.5% and 1%, for A and B grade.

## Device Information (1)

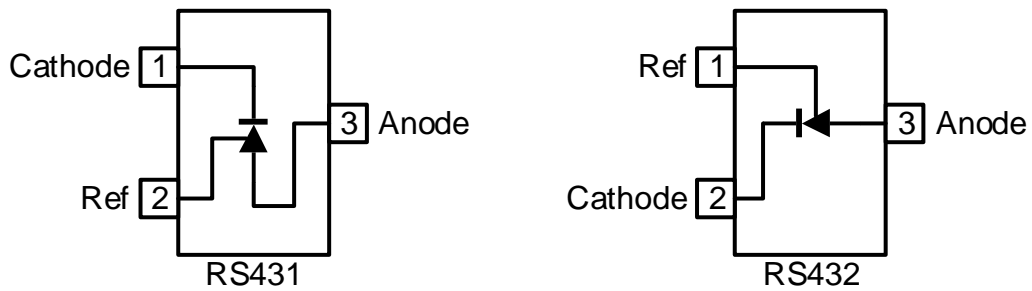
PART NUMBER	PACKAGE(PIN)	BODY SIZE (NOM)
RS431	SOT23(3)	1.30mmx2.92mm
RS432	SOT23(3)	1.30mmx2.92mm

(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 <sup>(1)</sup>	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) <sup>(1)(2)</sup>

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) <sup>(1)</sup>

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

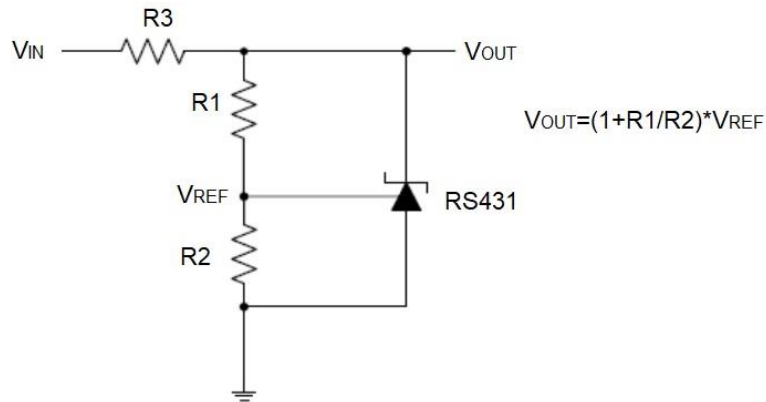
THERMAL METRIC (1)		RS431/RS432		UNIT
		SOT23		
		3 PINS		
$R_{\theta JA}$	Junction-to-ambient thermal resistance	185.6		°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	104.3		°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	54.5		°C/W
$\Psi_{JT}$	Junction-to-top characterization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

## Electrical Characteristics

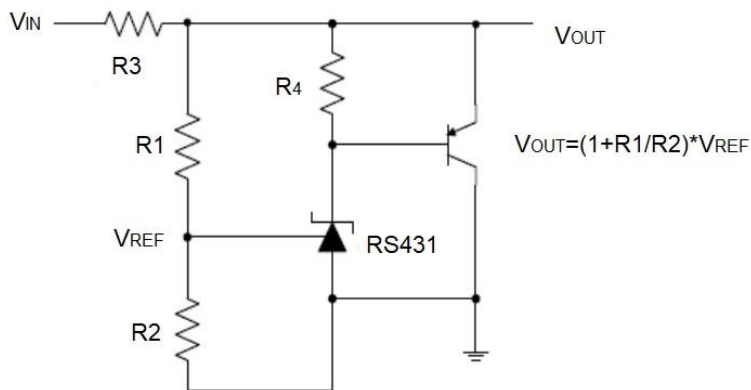
(Over recommended operating conditions, Full = -40°C to +105°C, typical values are at  $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

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	$\Delta V_{REF}$	$V_{KA}=V_{REF}, I_{KA}=10\text{mA}$ $T_{min} \leq T_A \leq T_{max}$	-	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	$\mu\text{A}$	
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	$\mu\text{A}$	
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	$\mu\text{A}$	
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	$\Omega$	

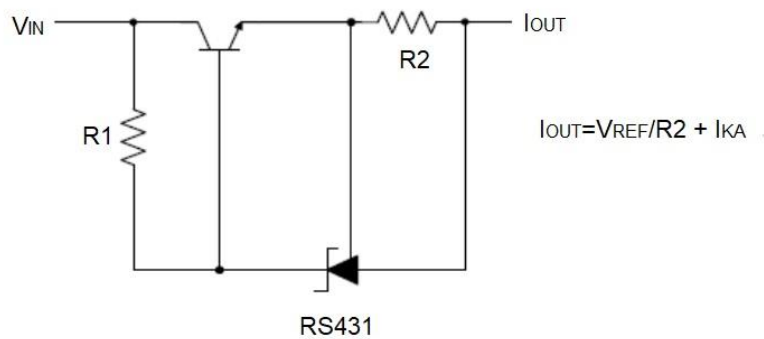
### Typical Applications Circuit



**Shunt Regulator**



**High Current Shunt Regulator**



**Current Source or Current Limit**

Typical Performance Characteristics

Fig 1 Cathode Current Vs Cathode Voltage

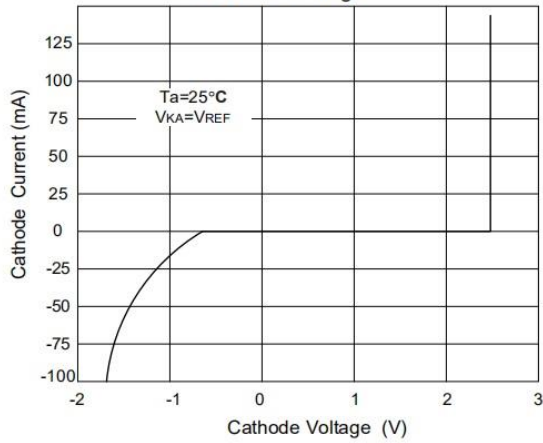


Fig 2 Cathode Current Vs Cathode Voltage

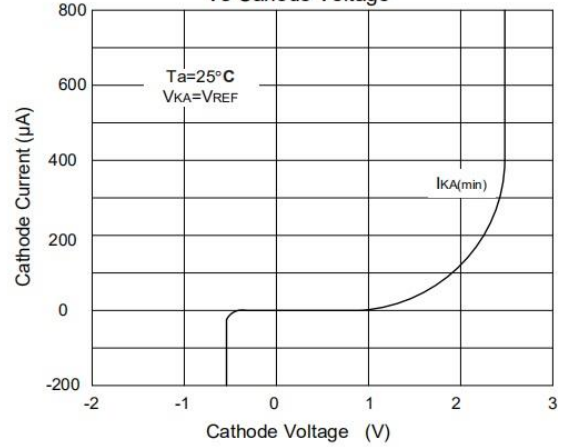


Fig 3 Change in Reference Input Voltage Vs Cathode voltage

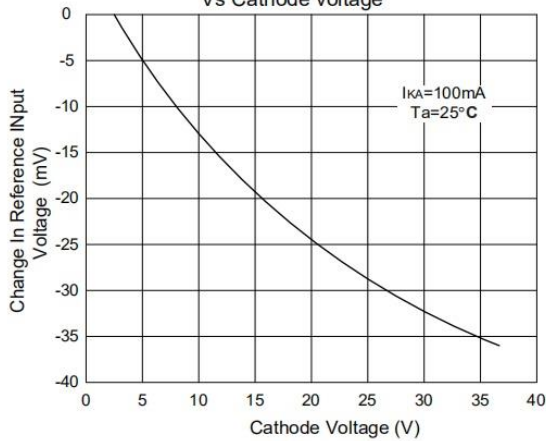


Fig 4 Pulse Response

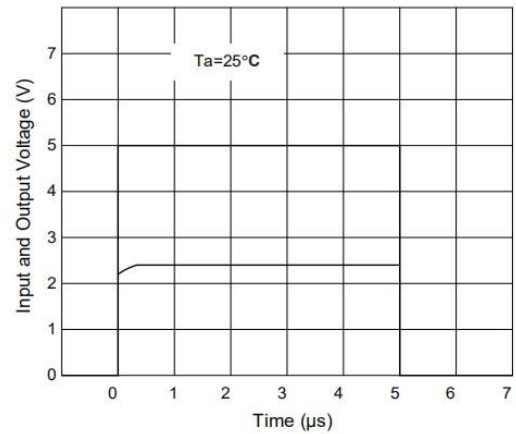


Fig 5 Dynamic Impedance Vs Frequency

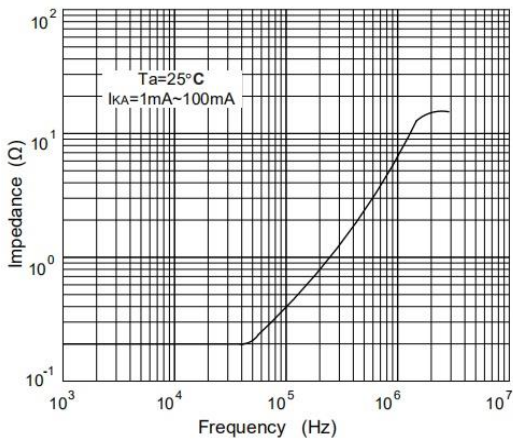


Fig 6 Small Signal Voltage Amplification Vs Frequency

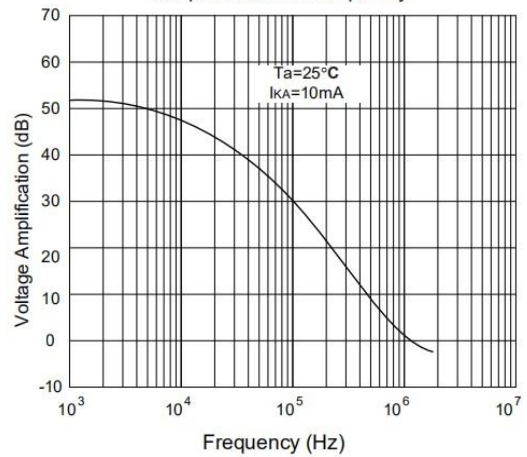
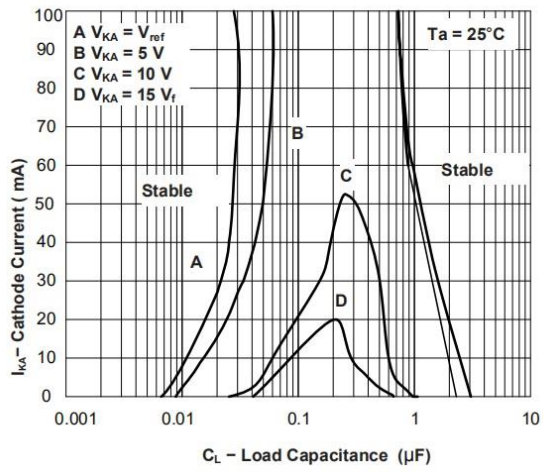


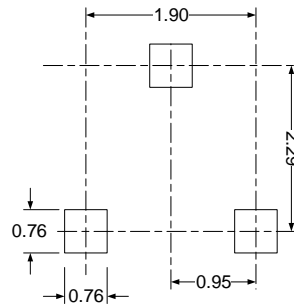
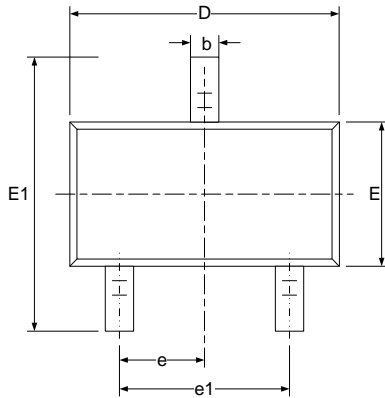
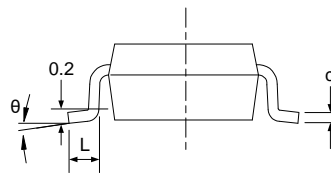
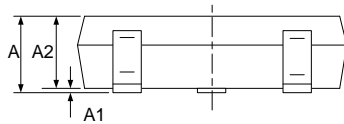
Fig 7 Cathode Current Vs Load Capacitance





# 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
$\theta$	0°	8°	0°	8°