

# RS431/ RS432 Precision Programmable Reference

## FEATURES

- Reference Voltage Tolerance at 25°C  
0.5% (A Grade)  
1% (B Grade)
- Programmable output voltage to 36 V
- Low dynamic output impedance 0.2 Ω
- Sink current capability of 0.5 mA to 100 mA
- 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 junction temperature from -40°C to 150°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 provided a very sharp turn-on characteristic, making these devices excellent replacement for Zener diodes in many applications.

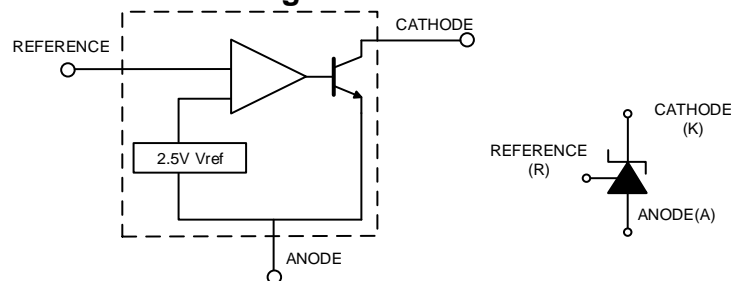
Both the RS431 and RS432 devices are offered in two grades, with initial tolerances (at 25°C) of 0.5% and 1%, for A and B grade.

### 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.

### Function Block Diagram

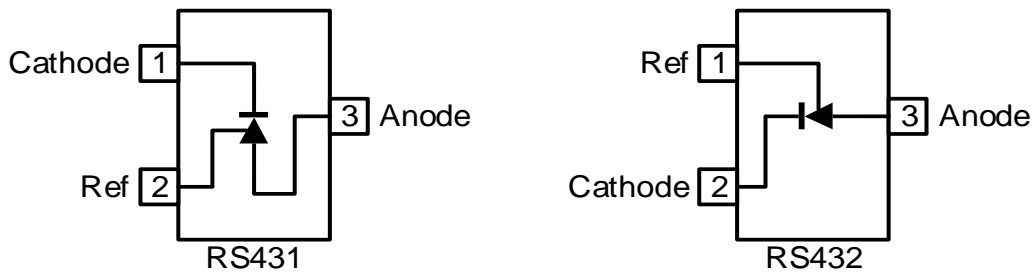


## Revision History

Note: Page numbers for previous revisions may differ from page numbers in the current version.

Version	Change Date	Change Item
A.1	2018/11/03	Initial version completed
A.2	2020/03/25	(1) Change part-number to ordering information table for production management. (2) Added Figure 8 Reference Voltage vs. Ambient Temperature
A.3	2021/10/28	(1) Update parameters in Electrical Characteristics on Page 5@A.2 Version (2) Update parameters in Typical Performance Characteristics on Page 7, 8@A.2 Version

## 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

**PACKAGE/ORDERING INFORMATION**

PRODUCT	ORDERING NUMBER	VOLTAGE TOLERANCE	PACKAGE LEAD	PACKAGE MARKING <sup>(1/2)</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

**NOTE:**

- (1) XX = Data Code
- (2) There may be additional marking, which relates to the lot trace code information (include data code and vendor code), the logo or the environmental category on the device.

## 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 <sub>KA</sub>	-0.3	37	V
Cathode Current Range (Continuous)	I <sub>KA</sub>	-100	+155	mA
Reference Input Current Range	I <sub>REF</sub>	-0.05	+10	mA
Operating junction temperature	T <sub>opr</sub>	-40	+150	°C
Power Dissipation	P <sub>D</sub>	370		mW
Storage temperature	T <sub>stg</sub>	-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 <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM)	±5000 V
		Charge device model (CDM)	±1500 V
		Machine model (MM)	±200 V

### Recommended Operating Conditions

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

Characteristics	Symbol	MIN	MAX	UNIT
Cathode Voltage	V <sub>KA</sub>	V <sub>REF</sub>	36	V
Cathode Current Range (Continuous)	I <sub>KA</sub>	0.5	100	mA
Operating Ambient Temperature Range	T <sub>A</sub>	-40	+125	°C

### Thermal Information

THERMAL METRIC (1)		RS431/ RS432		UNIT
		SOT23		
		3 PINS		
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	185.6		°C/W
R <sub>θJC (top)</sub>	Junction-to-case (top) thermal resistance	104.3		°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	54.5		°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	31.0		°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	54.5		°C/W
R <sub>θJC (bot)</sub>	Junction-to-case (bottom) thermal resistance	N/A		°C/W

## Electrical Characteristics

(Over recommended operating conditions, Full= -40°C to +125°C, typical values are at T<sub>A</sub>= +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT	
Reference Input Voltage	V <sub>REF</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =10mA	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 <sub>REF</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =10mA T <sub>A</sub> = -40°C ~ +125°C	-	20	60	mV	
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	ΔV <sub>REF</sub> /ΔV <sub>KA</sub>	I <sub>KA</sub> =10mA	ΔV <sub>KA</sub> =10V~V <sub>REF</sub>	-	-1.2	-2.0	mV/V
			ΔV <sub>KA</sub> =36V~10V	-	-1.5	-2.0	
Reference Input Current	I <sub>REF</sub>	I <sub>KA</sub> =10mA, R1=10kΩ, R2=∞	-	1.7	4.0	uA	
Deviation of Reference Input Current Over Full Temperature Range	ΔI <sub>REF</sub>	I <sub>KA</sub> =10mA, R1=10kΩ, R2=∞ T <sub>A</sub> = -40°C ~ +125°C	-	2	5	uA	
Minimum cathode current for regulation	I <sub>KA</sub> (min)	V <sub>KA</sub> =V <sub>REF</sub>	-	0.3	0.5	mA	
Off-state Cathode Current	I <sub>KA</sub> (OFF)	V <sub>KA</sub> =36V, V <sub>REF</sub> =0V	-	0.05	0.5	uA	
Dynamic Impedance	Z <sub>KA</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =1mA to100mA f≤1.0KHz	-	0.2	0.5	Ω	

## TYPICAL APPLICATIONS CIRCUIT

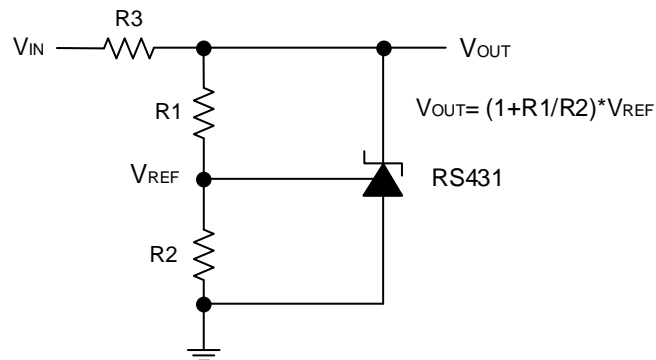


Figure 1. Shunt Regulator

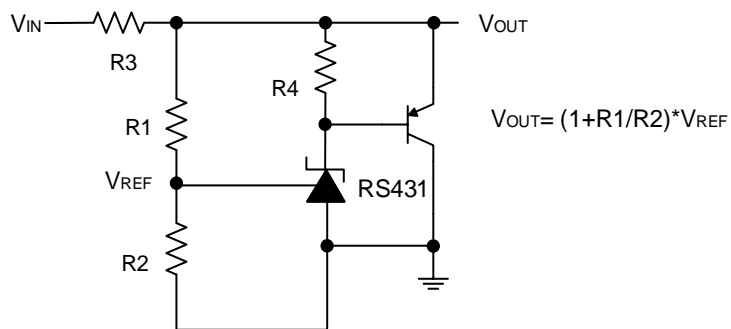


Figure 2. High Current Shunt Regulator

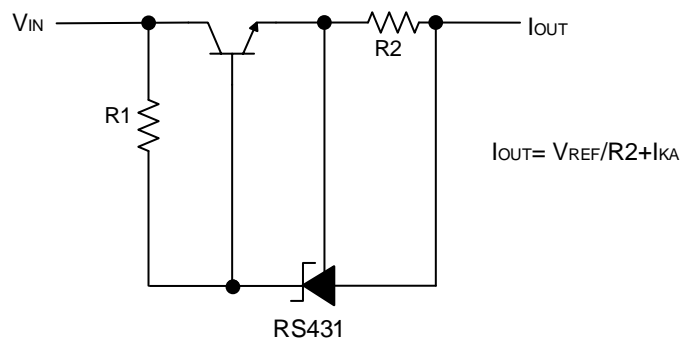
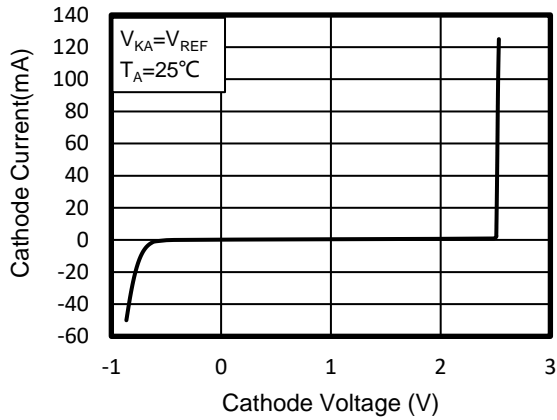
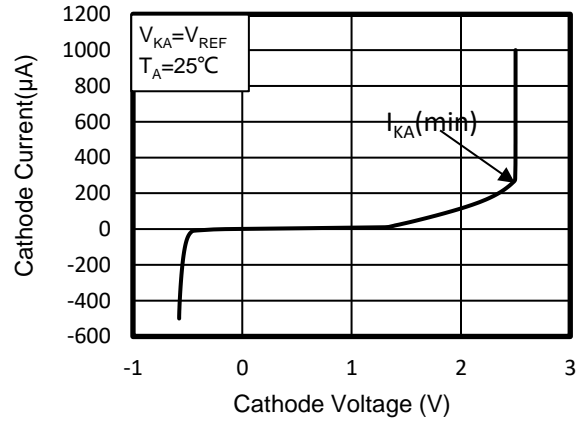


Figure 3. Current Source or Current Limit

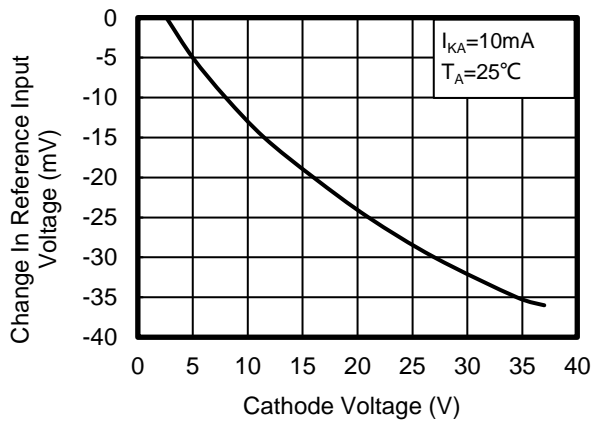
**TYPICAL PERFORMANCE CHARACTERISTICS**



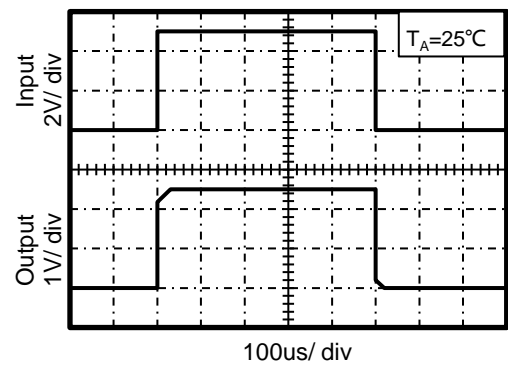
**Figure 4. Cathode Current vs Cathode Voltage**



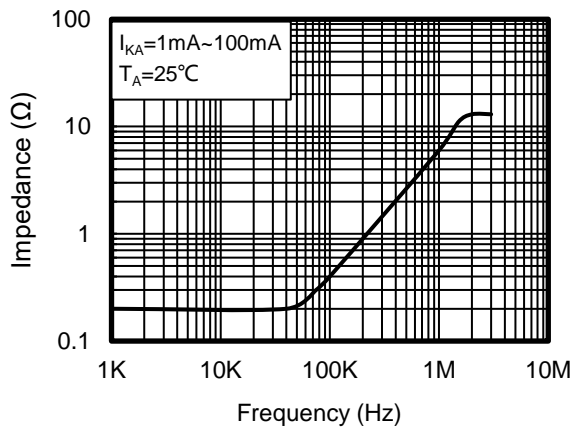
**Figure 5. Cathode Current vs Cathode Voltage**



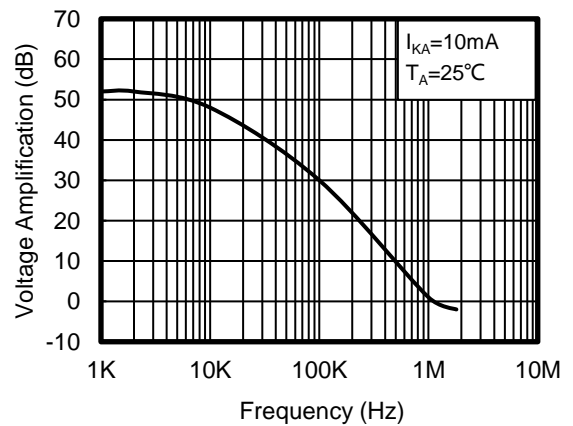
**Figure 6. Change in Reference Input Voltage vs Cathode voltage**



**Figure 7. Pulse Response**



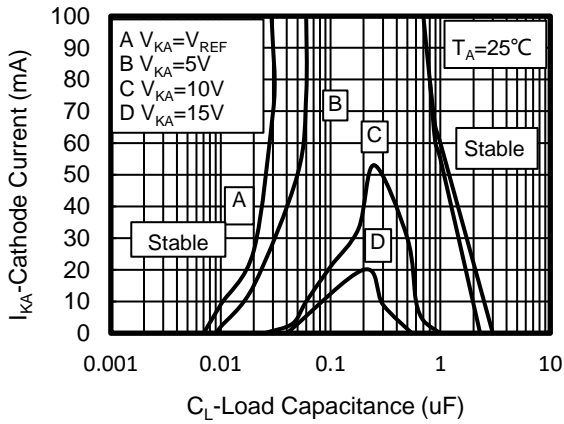
**Figure 8. Dynamic Impedance vs Frequency**



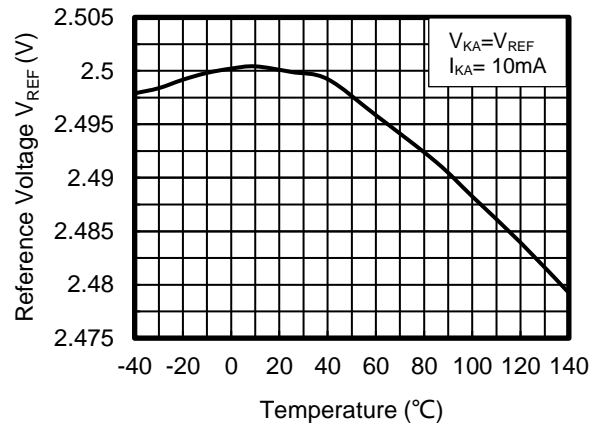
**Figure 9. Small Signal Voltage Amplification vs Frequency**



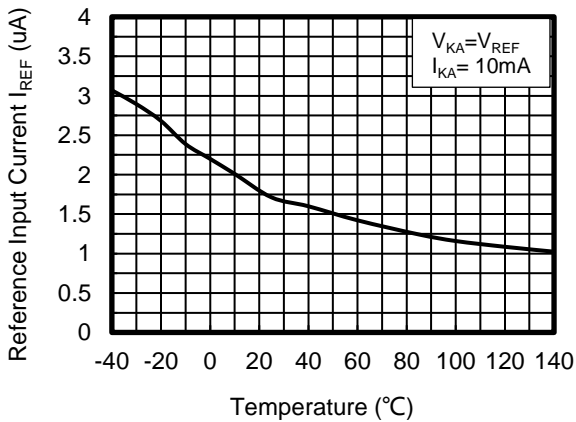
**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**



**Figure 10. Cathode Current vs Load Capacitance**



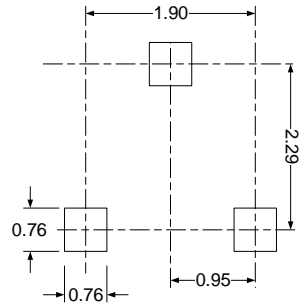
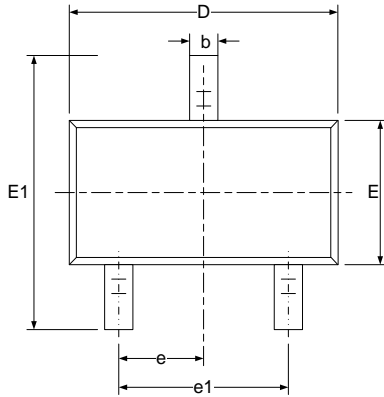
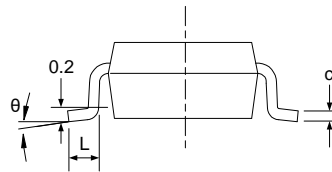
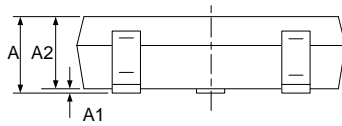
**Figure 11. Reference Voltage vs Ambient Temperature**



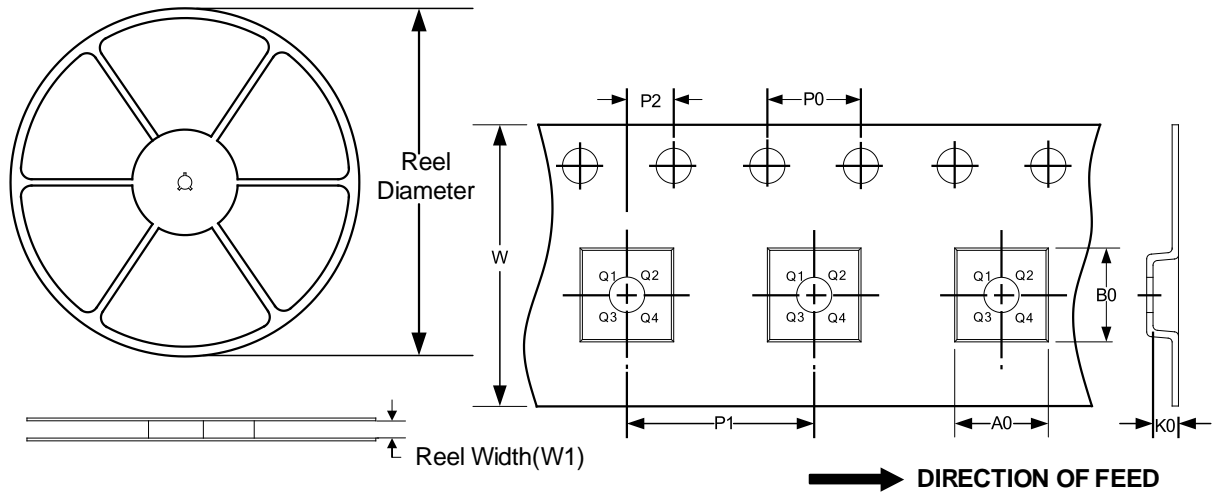
**Figure 12. Reference Input Current vs Ambient Temperature**

# PACKAGE OUTLINE DIMENSIONS

## 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°

**TAPE AND REEL INFORMATION**  
**REEL DIMENSIONS**
**TAPE DIMENSION**


NOTE: The picture is only for reference. Please make the object as the standard.

**KEY PARAMETER LIST OF TAPE AND REEL**

Package Type	Reel Diameter	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT23	7"	9.5	3.15	2.77	1.22	4.0	4.0	2.0	8.0	Q3