

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.

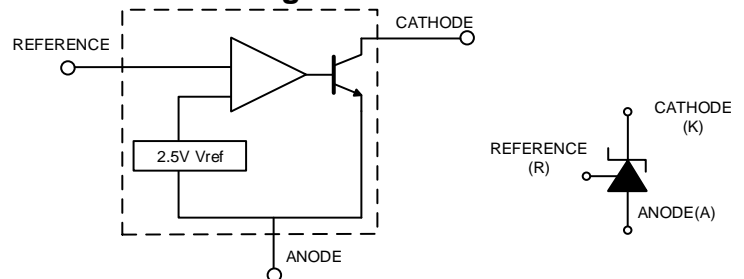
Both the RS431 and RS432 devices are offered in two grades, with initial tolerances (at 25°C) of 0.5% and 1%, for A and B grade.

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

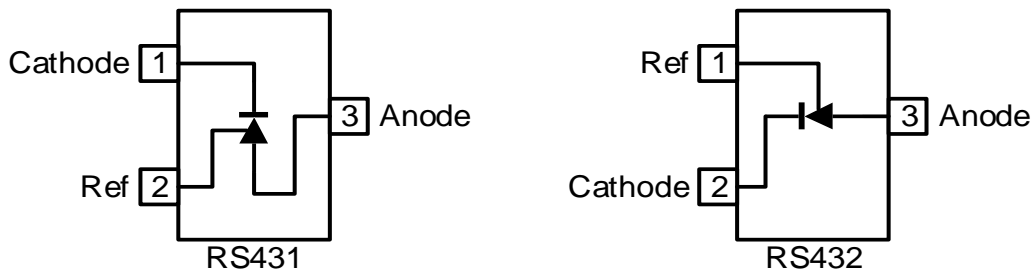


Revision History

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 ^(1/2)	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) ⁽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 junction temperature	T_{opr}	-40	+150	°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)	±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_{KA}	V_{REF}	36	V
Cathode Current Range (Continuous)	I_{KA}	0.5	100	mA
Operating Ambient Temperature Range	T_A	-40	+125	°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
$R_{\theta JC (bot)}$	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_A= +25°C, unless otherwise noted.)

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

TYPICAL APPLICATIONS CIRCUIT

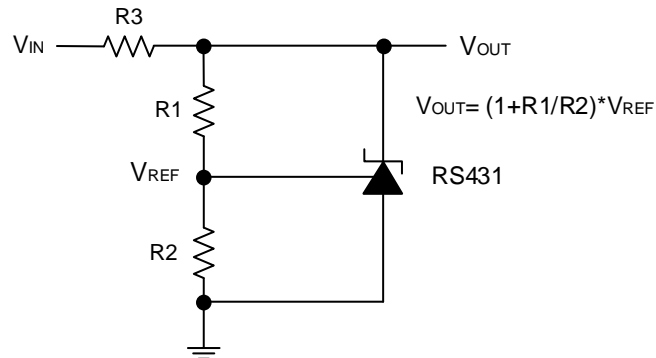


Figure 1. Shunt Regulator

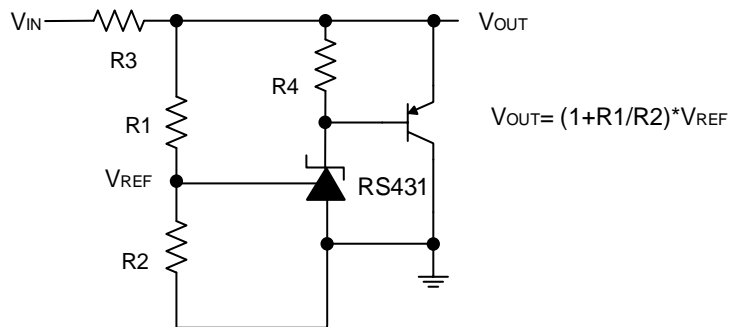


Figure 2. High Current Shunt Regulator

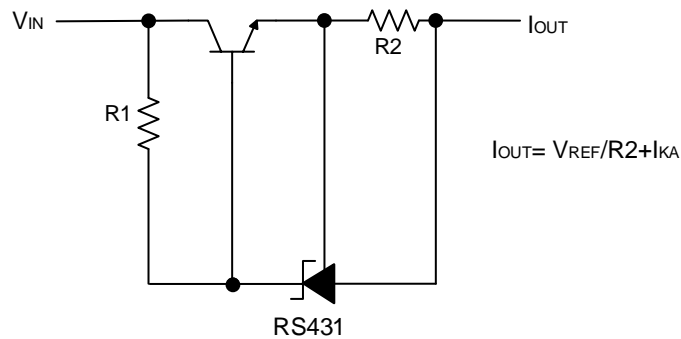


Figure 3. Current Source or Current Limit

TYPICAL PERFORMANCE CHARACTERISTICS

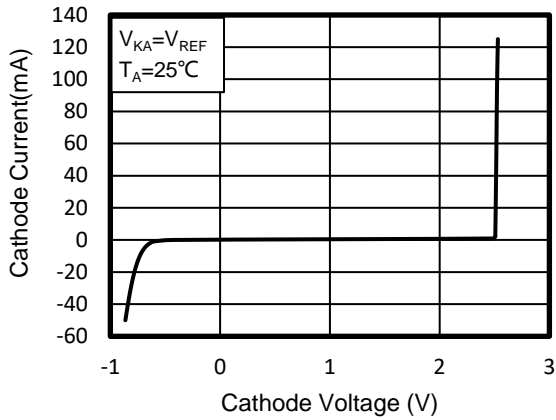


Figure 4. Cathode Current vs Cathode Voltage

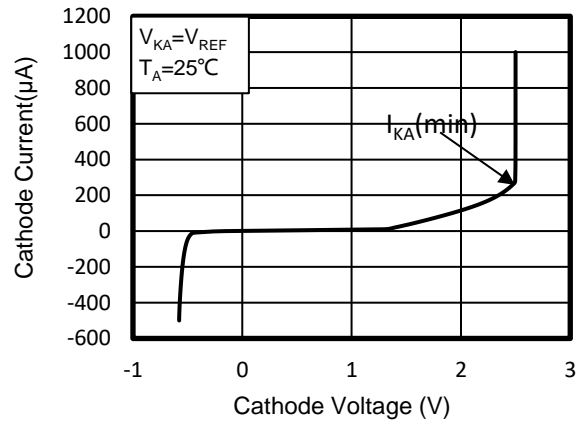


Figure 5. Cathode Current vs Cathode Voltage

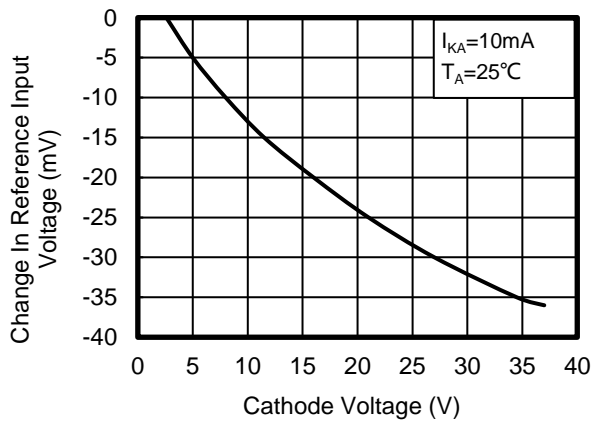


Figure 6. Change in Reference Input Voltage vs Cathode Voltage

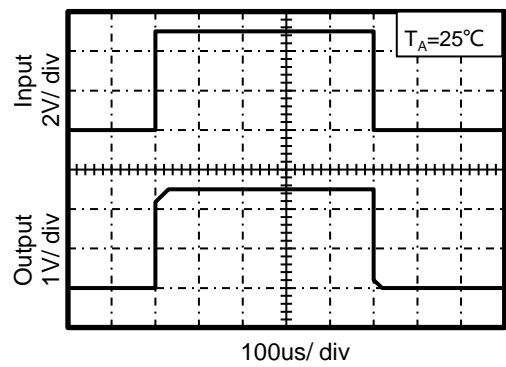


Figure 7. Pulse Response

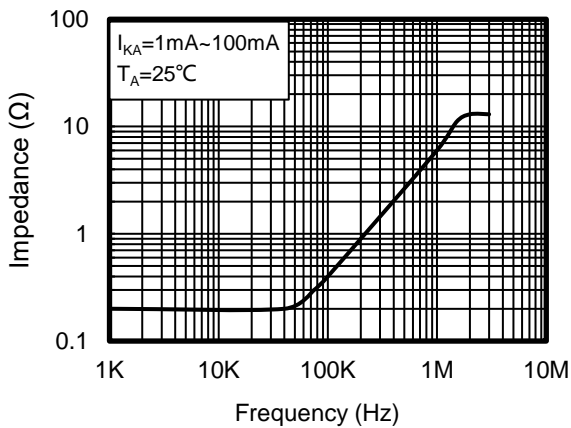


Figure 8. Dynamic Impedance vs Frequency

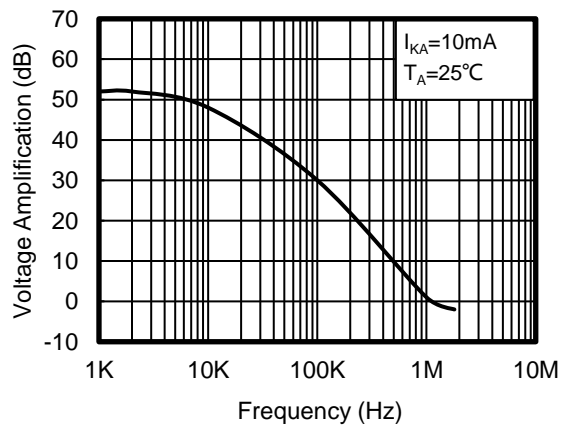


Figure 9. Small Signal Voltage Amplification vs Frequency

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

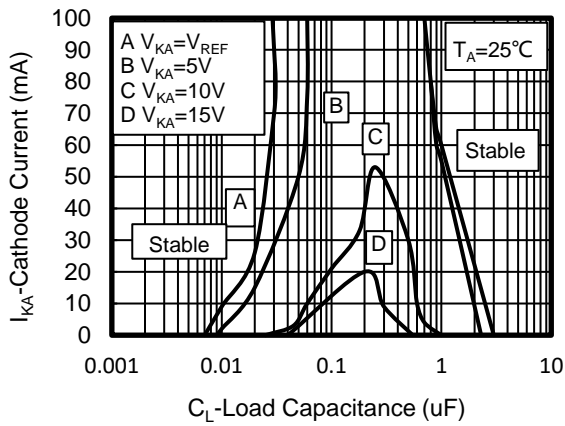


Figure 10. Cathode Current vs Load Capacitance

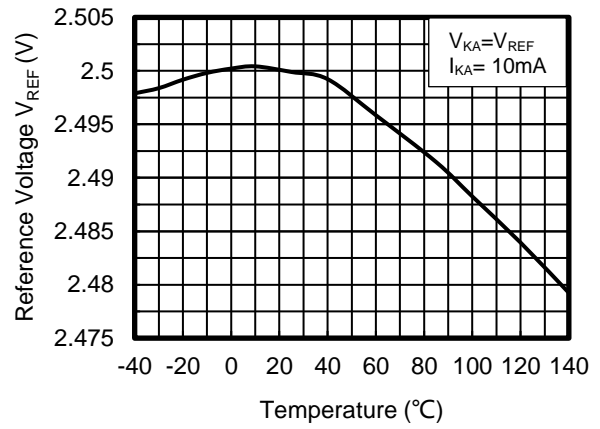


Figure 11. Reference Voltage vs Ambient Temperature

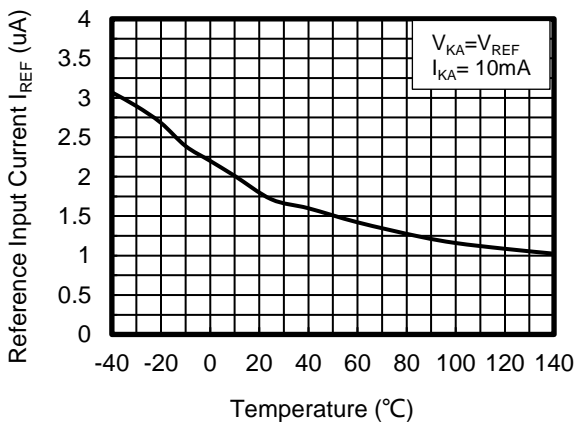
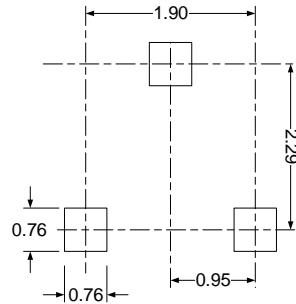
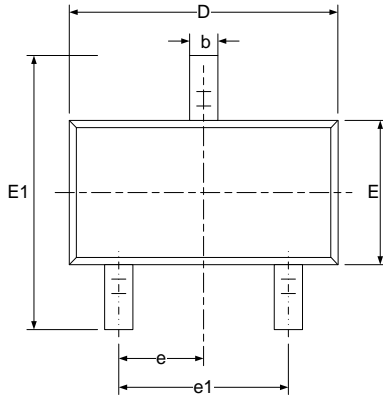


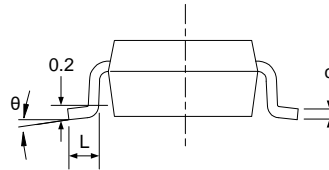
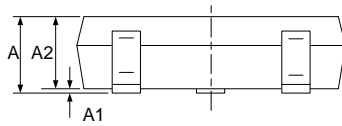
Figure 12. Reference Input Current vs Ambient Temperature

PACKAGE OUTLINE DIMENSIONS

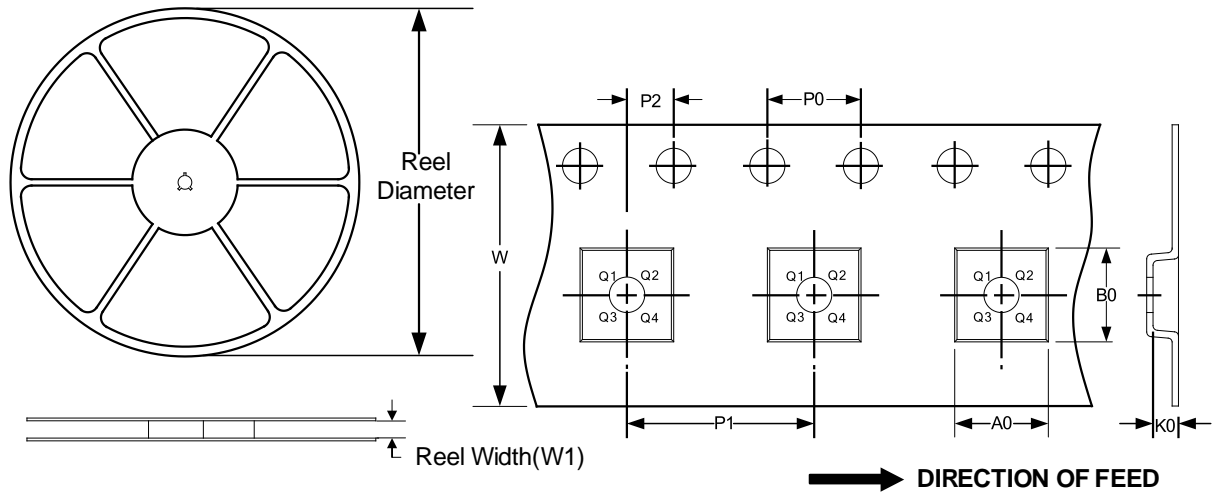
SOT23



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
θ	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