RS421/ RS422 Precision Programmable Reference

FEATURES

- **Reference Voltage Tolerance at 25°C 0.5%**
- **Programmable output voltage to 36V**
- **Low dynamic output impedance 0.1Ω**
- **Sink current capability of 0.5mA 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 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 RS421 and RS422 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 1.18V) 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.

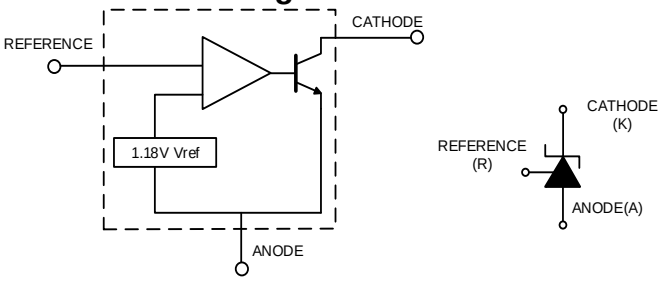
Both the RS421 and RS422 devices are offered in two grades, with initial tolerances (at 25°C) of 0.5%.

Device Information (1)

PART NUMBER	PACKAGE(PIN)	BODY SIZE (NOM)
RS421	SOT23(3)	1.30mm×2.92mm
RS422	SOT23(3)	1.30mm×2.92mm

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

Function Block Diagram

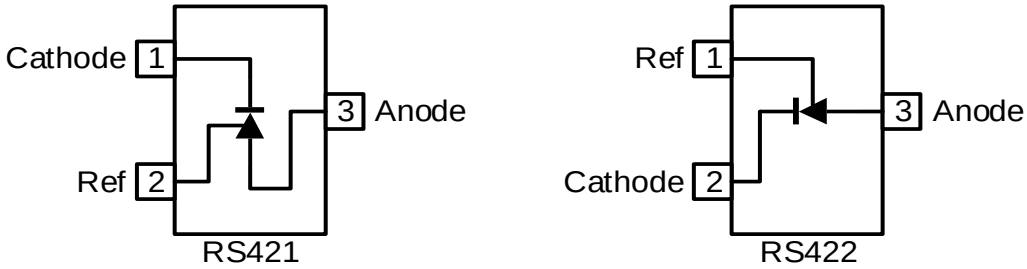


Revision History

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

VERSION	Change Date	Change Item
A.0	2021/11/18	Preview version completed
A.1	2021/11/29	Update parameters in Electrical Characteristics on Page 6@A.0 Version

Pin configuration and Functions (Top View)



Pin Description

NAME	PIN		DESCRIPTION
	RS421	RS422	
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
RS421	RS421AYSF3	0.5%	SOT23	421AXX	Tape and Reel,3000
RS422	RS422AYSF3	0.5%	SOT23	422AXX	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)	±4000	V
		Charge device model (CDM)	±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)		RS421/ RS422 SOT23 3 PINS	UNIT
$R_{\theta JA}$	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 Output Voltage	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA	0.5%	1.174	1.18	1.186	V
Deviation of reference Input Voltage Over temperature	ΔV_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA T_A= -40°C ~ +125°C		-	10	20	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	I_{KA}=10mA	ΔV_{KA}=10V~V_{REF}	-	-0.08	-0.2	mV/V
			ΔV_{KA}=36V~10V	-	-0.06	-0.2	
Reference Input Current	I_{REF}	I_{KA}=10mA, R1=10kΩ, R2=∞		-	0.4	1.2	uA
Deviation of Reference Input Current Over Full Temperature Range	ΔI_{REF}	I_{KA}=10mA, R1=10kΩ, R2=∞ T_A= -40°C ~ +125°C		-	0.3	1.2	uA
Minimum cathode current for regulation	I_{KA} (min)	$V_{KA}=V_{REF}$	T_A= 25°C	-	0.17	0.3	mA
Off-state Cathode Current	I_{KA} (OFF)	V_{KA}=36V, V_{REF}=0V	T_A= 25°C	-	5	10	uA
		V_{KA}=18V, V_{REF}=0V	T_A= 25°C		0.03	0.1	
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1mA to100mA f≤1.0KHz		-	0.1	0.4	Ω

TYPICAL APPLICATIONS CIRCUIT

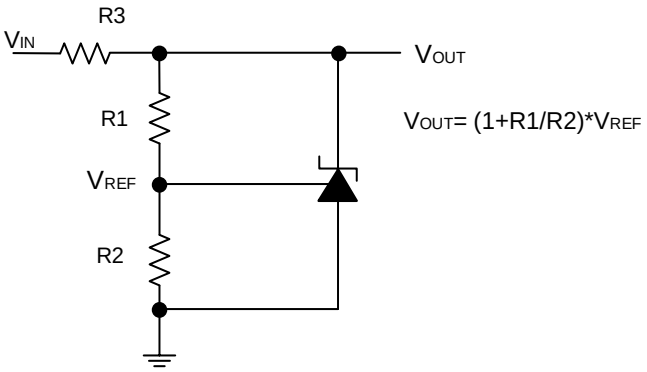


Figure 1. Shunt Regulator

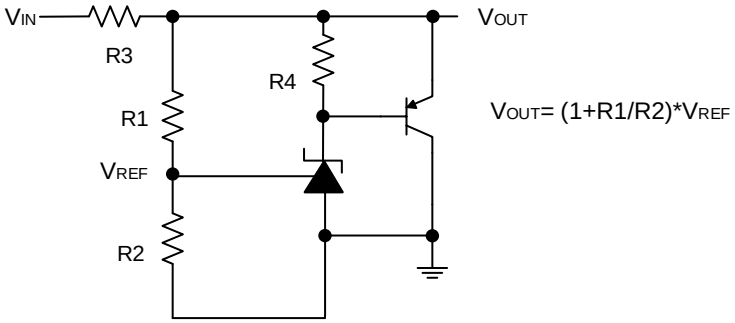


Figure 2. High Current Shunt Regulator

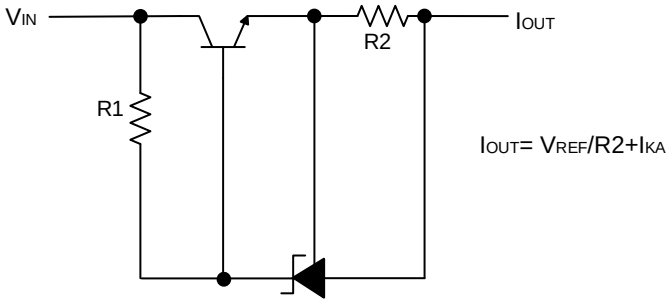


Figure 3. Current Source or Current Limit

TYPICAL PERFORMANCE CHARACTERISTICS

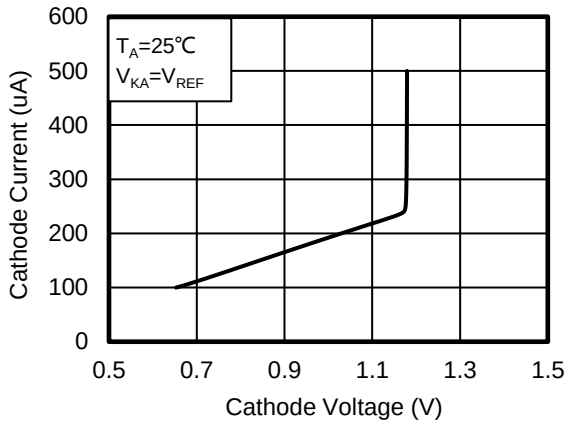


Figure 4. Cathode Current vs Cathode Voltage

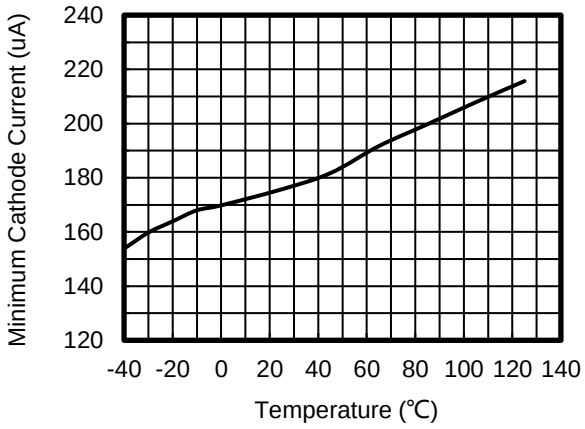


Figure 5. Minimum Cathode Current vs Ambient Temperature

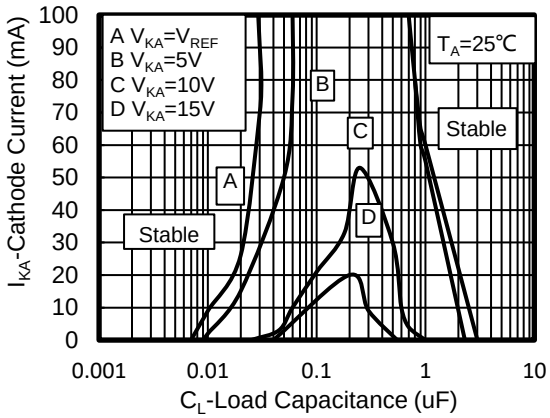


Figure 6. Cathode Current vs Load Capacitance

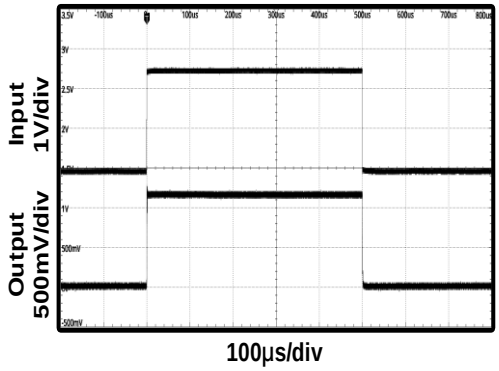


Figure 7. Pulse Response

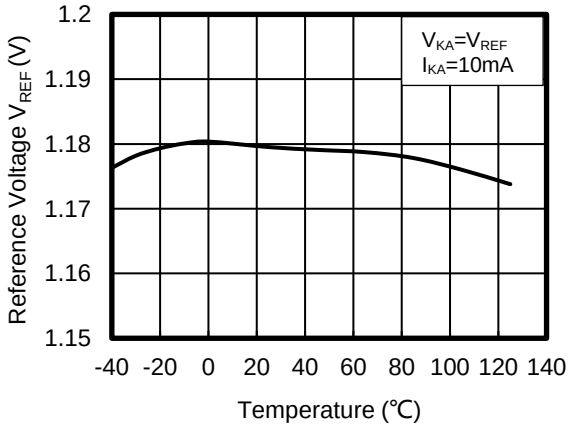


Figure 8. Reference Voltage vs Ambient Temperature

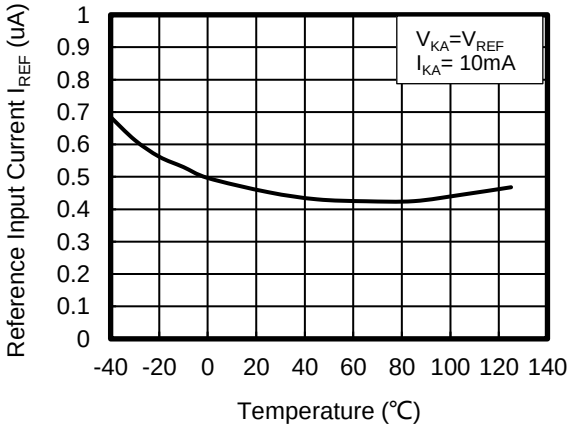


Figure 9. Reference Input Current vs Ambient Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

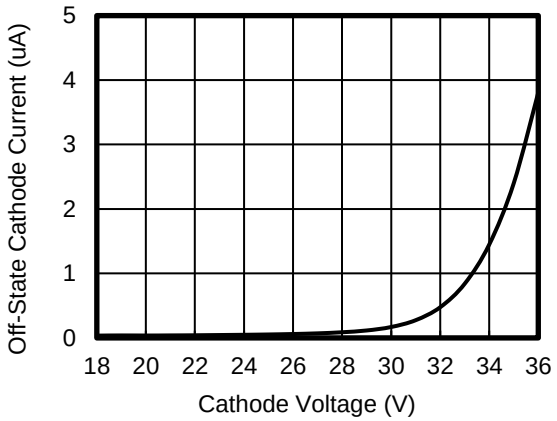
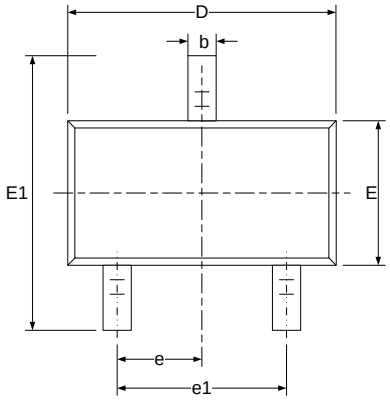
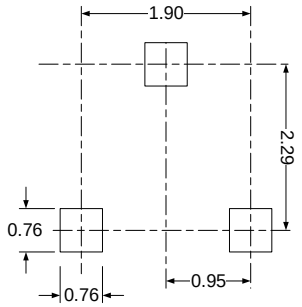


Figure 10. Cathode Voltage vs Off-State Cathode Current

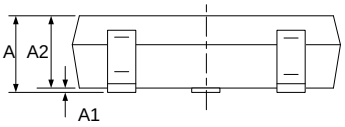
PACKAGE OUTLINE DIMENSIONS

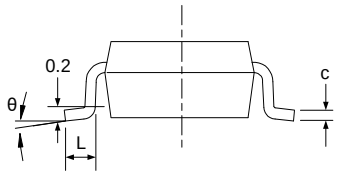
SOT23





RECOMMENDED LAND PATTERN (Unit: mm)



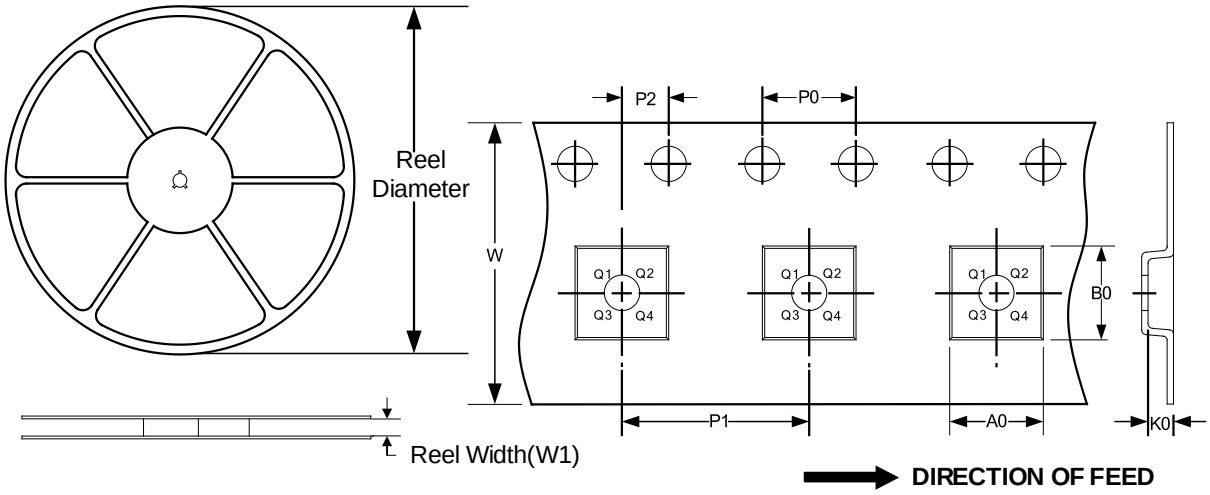


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 (BSC)		0.037 (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