

RA0431

Low-Voltage Adjustable Precision Shunt Regulator

Features

- Low voltage operation to 1.24V
- 1% reference voltage tolerance
- Output voltage adjustable from Vref to 12V
- Low 80µA operational cathode current
- 0.25Ω typical output impedance
- · SOT23-5 package

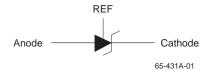
Applications

• Voltage reference for discrete power circuits

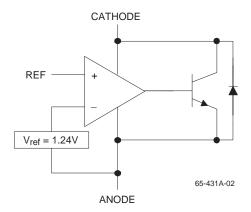
Description

The RA0431 is a low-voltage 3-terminal adjustable precision voltage reference regulator. It has an excellent thermal stability over the standard commercial temperature range. The output voltage can be set to any value between Vref (1.24V) and 12V using two external resistors. The RA0431 operates from a lower voltage (1.24V) than the traditional shunt regulator references which operate from 2.5V. When used with an optocoupler, the RA0431 will be an ideal voltage reference in an isolated feedback circuit for use in switched-mode power supplies and modular DC-DC converters. The RA0431 has a low output impedance of active output circuitry offering a very sharp turn-on characteristic. The RA0431 will be an excellent replacement for low-voltage zener diodes in many applications such as on-board regulation and adjustable power supplies.

Symbol



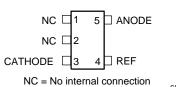
Block Diagram



RA0431A PRODUCT SPECIFICATION

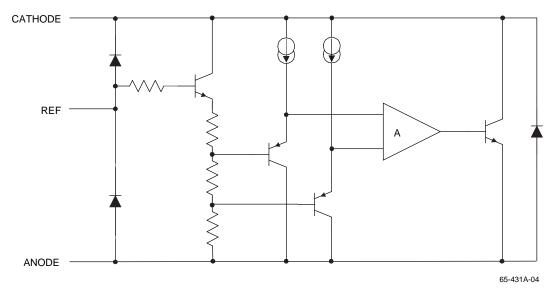
Pin Assignments

SOT-23 PACKAGE (TOP VIEW)



65-431A-03

Equivalent Schematic



Absolute Maximum Ratings

Ratings are over full operating free-air temperature range unless otherwise noted.

Cathode voltage, VKA	13.2V
Continuous cathode current IK	-20mA to 20mA
Reference current, I _{ref}	-0.05mA to 3mA
Power dissipation	See Dissipation Rating Table
Storage temperature range	-65° to 150°C

Notes:

Recommended Operating Conditions

Parameter	Min.	Max.	Units
Cathode voltage, VKA	VREF	12	V
Cathode current, IK	0.1	15	mA
Operating temperature range in free-air, TA	0	70	°C

^{1.} Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

Dissipation Rating Table

Package	Power Rating	Derating Factor	Power Rating
	TA ≤ 25°C	T _A ≥ 25°C	TA = 70°C
SOT23-5	150mW	1.2mW/°C	96mW

Electrical Specifications

T_A = 25°C (unless otherwise noted), at free-air

Symbol	Parameters	Conditions	Min.	Тур.	Max.	Units
Vref	Reference Voltage	VKA = Vref, TA = 25°C	1.228	1.24	1.252	V
		I _K = 10mA, T _A = 0 to 70°C	1.221		1.259	
Vref (dev)	V _{ref} deviation over full temperature range (see note 2)	VKA = V _{ref} , I _K = 10mA, See note 2 and Figure 1.		4	12	mV
ΔV _{ref} ΔVKA	Ratio of V _{ref} change in cathode voltage change	$I_K = 10$ mA, $\Delta V_{KA} = V_{ref}$ to 6V. See figure 2.		-1.5	-2.7	mV
Iref	Reference terminal current	I _K = 10mA, R1 = 10KΩ, R2 = ∞ See figure 2.		0.15	0.5	μА
Iref(dev)	I _{ref} deviation over full temperature range (see note 2)	I _K = 10mA, R1 = 10KΩ, R2 = ∞ See note 1 & figure 2.		0.05	0.3	μА
lK(min)	Minimum cathode current for regulation	VKA = Vref See figure 1.		55	80	μА
loff	Off-state cathode current	VKA = 6V, V _{ref} = 0 See figure 3.		0.001	0.1	μΑ
ZKA	Dynamic impedance (see note 3)	$V_{KA} = V_{ref}, f \le 1KHz$ $I_{K} = 0.1mA \text{ to } 15mA,$ See figure 1.		0.25	0.4	Ω

Notes:

- 1. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.
- 2. Full temperature range is 0°C to 70°C.
- 3. The deviation parameters V_{ref(dev)} and I_{ref(dev)} are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage, ∞V_{ref}, is defined as:

$$\left| \infty V_{ref} \right| \left< ppm/^{\circ}C \right> \ = \ \frac{\left\{ V_{ref(dev)} \middle/ V_{ref} \middle< T_{A} = 25^{\circ}C \right> \right\} \times 10^{6}}{\Delta T_{A}}$$

where ΔT_A is the rated operating free-air temperature range of the device.

 ∞V_{ref} can be positive or negative depending on whether minimum V_{ref} or maximum V_{ref} , respectively, occurs at the lower temperature.

4. The dynamic impedance is defined as: $|Z_{KA}| = \Delta V_{KA}/\Delta I_{K}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:

$$\left|Z_{KA}\right| = \frac{\Delta V}{\Delta I} \approx \left|Z_{KA}\right| \times \left(1 + \frac{R_1}{R_2}\right)$$

RA0431A PRODUCT SPECIFICATION

Parameter Measurement Information

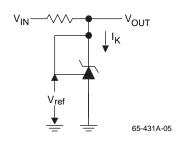


Figure 1. Test Circuit for VKA = VREF, VOUT = VKA = VREF

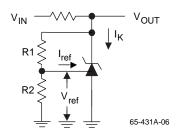


Figure 2. Test Circuit for VKA > VREF, VOUT = VKA = VREF x (1+R1/R2) + IREF x R1

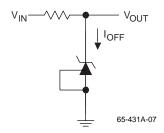


Figure 3. Test Circuit for IOFF

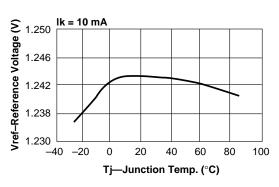


Figure 4. Reference Voltage vs. Junction Temp.

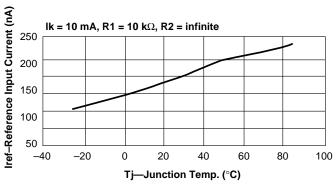


Figure 5. Reference Input Current vs. Junction Temp.

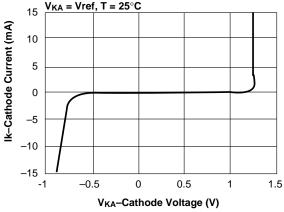


Figure 6. Cathode Current vs. Cathode Voltage

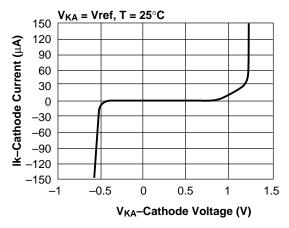


Figure 7. Cathode Current vs. Cathode Voltage

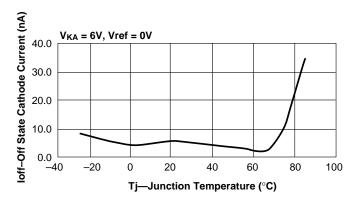


Figure 8. Off-State Cathode Current vs. Junction Temperature

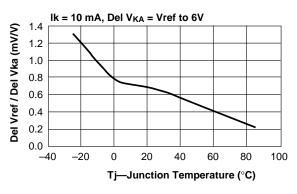


Figure 9. Ratio of Delta Reference Voltage to Delta Cathode Voltage vs. Junction Temperature

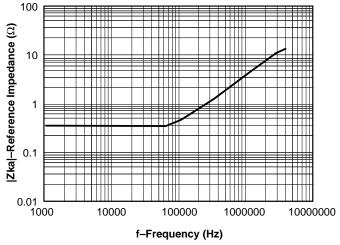


Figure 10. Reference Impedance vs. Frequency

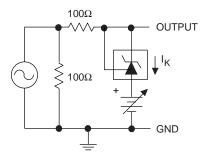


Figure 11. Test Circuit for Reference Impedance

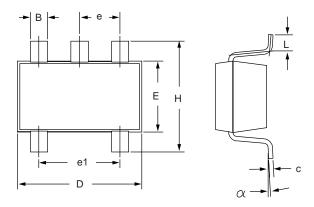
Mechanical Dimensions (continued)

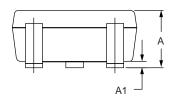
SOT23-5 Package

Cumbal	Inches		Millimeters		Notes
Symbol	Min.	Max.	Min.	Max.	Notes
Α	.170	.195	.90	1.45	
A1	.014	.020	.00	.15	
В	.008	.020	.20	.50	
С	.003	.010	.08	.25	
D	.106	.122	2.70	3.10	
Е	.059	.071	1.50	1.80	
е	.037	BSC	.95	BSC	
e1	.075 BSC		1.90	BSC	
Н	.087	.126	2.20	3.20	
L	.004	.024	.10	.60	
α	0°	10°	0°	10°	

Notes:

- 1. Package outline exclusive of mold flash & metal burr.
- 2. Package outline exclusive of solder plating.
- 3. EIAJ Ref Number SC-74A.





Notes:

RA0431A PRODUCT SPECIFICATION

Ordering Information

Product Number	Package
RA0431M	SOT23-5

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