

Adjustable Precision Shunt Regulator

IR9431/IR9431N

T-58-11-23

IR9431/IR9431N Adjustable Precision Shunt Regulator

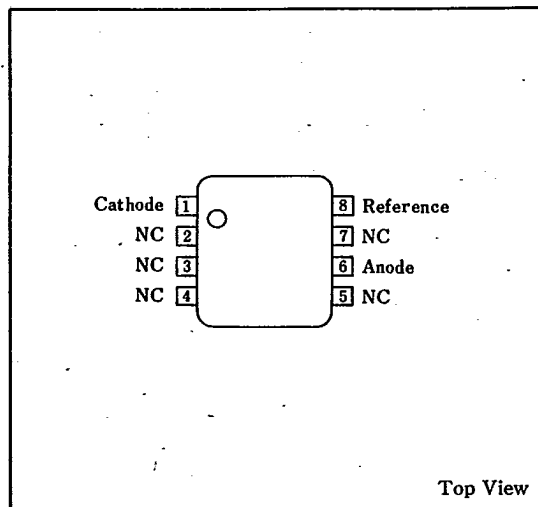
Description

The IR9431/IR9431N is a shunt regulator IC which adjusts output voltages from 2.5 to 36V through external resistors over the entire operating temperature range. It has a typical dynamic output impedances of 0.2Ω . Active output circuitry provides a very sharp turn-on characteristics making it excellent replacements for zener diodes in many applications.

Features

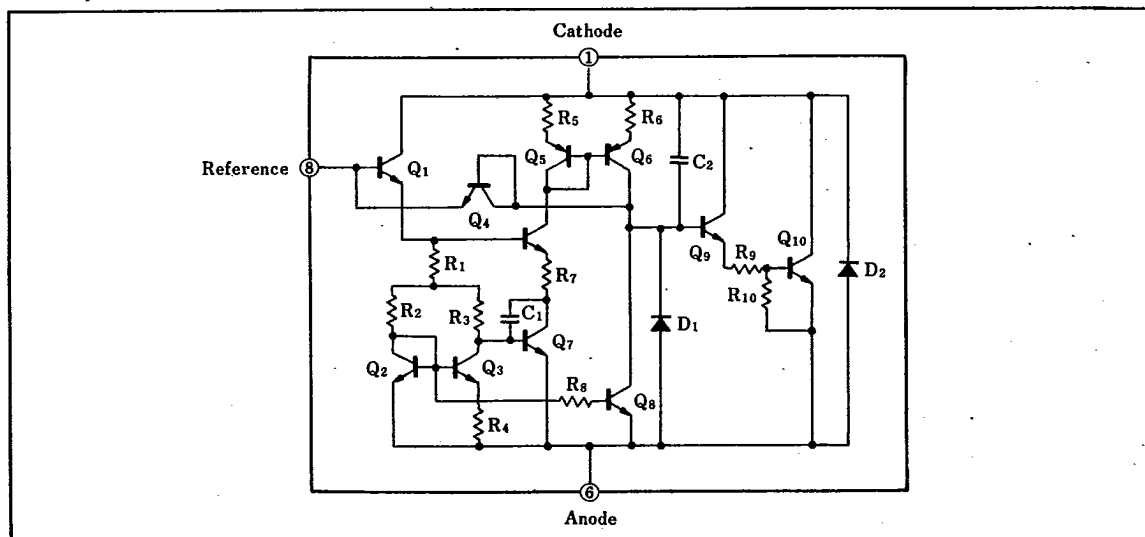
1. Temperature stability 50ppm/°C (TYP.)
2. Adjustable output voltage
3. Fast turn-on response
4. Low dynamic output impedance 0.2Ω (TYP.)
5. Low output noise voltage
6. 8-pin dual-in-line package (IR9431)
8-pin small-outline package (IR9431N)

Pin Connections



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Equivalent Circuit



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Adjustable Precision Shunt Regulator

IR9431/IR9431N

Absolute Maximum Ratings

Parameter	Symbol	Condition		Rating	Unit
Cathode voltage	V_K			37	V
Cathode current	I_K			-100~+150	mA
Reference input current	I_{REF}			+0.05~+10	mA
Power dissipation	P_D	$T_a \leq 25^{\circ}C$	IR9431	750	mW
			IR9431N	500	
P_D derating ratio	$\Delta P_D/^{\circ}C$	$T_a > 25^{\circ}C$	IR9431	6	mW/ $^{\circ}C$
			IR9431N	4	
Operating temperature	T_{opr}			-20~+100	$^{\circ}C$
Storage temperature	T_{stg}			-65~+150	$^{\circ}C$

Recommended Operating Conditions

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Cathode voltage	V_K		V_{REF}		36	V
Cathode current	I_K		1		100	mA

Electrical Characteristics

(Ta=25°C)

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Reference voltage	V_{REF}	$V_K = V_{REF}, I_K = 10\text{mA}$	2,458	2,495	2,532	mV
Temperature change of reference voltage	$V_{REF(dev)}$	$V_K = V_{REF}, I_K = 10\text{mA}$ $T_a = \text{full range}$		8	17	mV
Voltage fluctuation of reference voltage	$\frac{\Delta V_{REF}}{\Delta V_K}$	$I_K = 10\text{mA}$	$\Delta V_K = 10\text{V} - V_{REF}$	-1.4	-2.7	mV/V
			$\Delta V_K = 36\text{V} - 10\text{V}$	-1	-2	
Reference input current	I_{REF}	$I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$		2	4	μA
Temperature change of reference current	$I_{REF(dev)}$	$I_K = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$ $T_a = \text{full range}$		0.4	1.2	μA
Minimum cathode current	I_{MIN}	$V_K = V_{REF}$		0.4	1	mA
OFF-state cathode current	I_{OFF}	$V_K = 36\text{V}, V_{REF} = 0\text{V}$		0.1	1	μA
Dynamic impedance	$ Z_{KA} $	$V_K = V_{REF}, I_K = 1 \sim 10\text{mA}$ $f < 1\text{kHz}$		0.2	0.5	Ω

* Refer to the figure to the right.

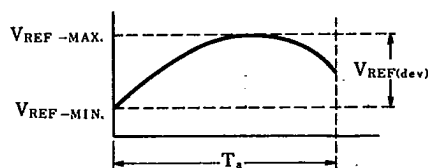
$$|\alpha V_{REF}| = \frac{V_{REF(dev)}}{V_{REF @ 25^\circ\text{C}}} \cdot 10^6 \quad (\text{ppm}/^\circ\text{C})$$

If the temperature coefficient of reference voltage
 $V_{REF(dev)} = 8\text{mV}$ (equation),

$$|\alpha V_{REF}| = \frac{8\text{mV}}{2,495\text{mV}} \cdot 10^6 = 46 \quad (\text{ppm}/^\circ\text{C})$$

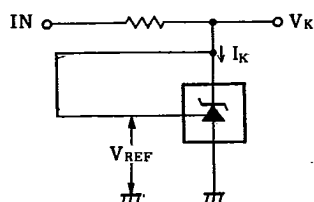
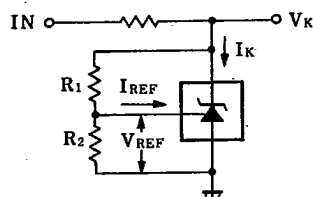
dynamic impedance is defined by the following
equation.

$$|Z_{KA}| = \frac{\Delta V_K}{\Delta I_K}$$



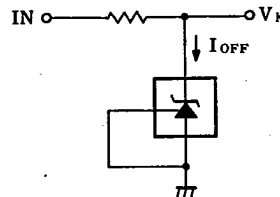
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Test Circuit

(1) $V_K = V_{REF}$ (2) $V_K > V_{REF}$ 

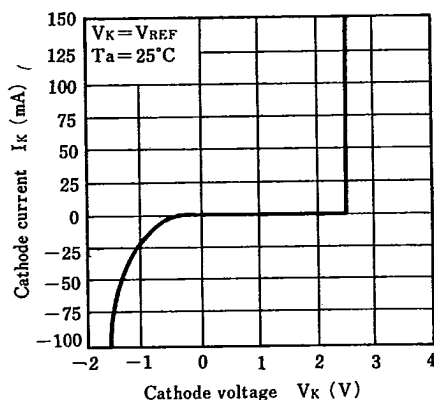
$$V_K = V_{REF} \left(1 + \frac{R_1}{R_2}\right) + I_{REF} \cdot R_1$$

$$|Z| = \frac{4V}{4I} \approx |Z_K| \left(1 + \frac{R_1}{R_2}\right)$$

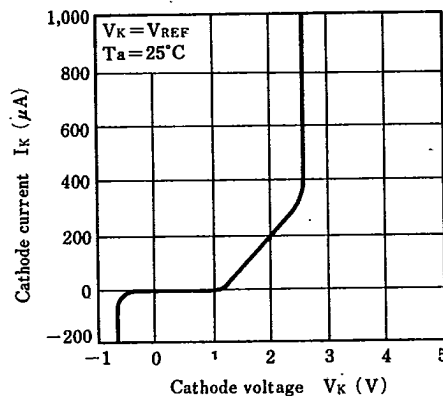
(3) I_{OFF} 

Electrical Characteristic Curves

Cathode current — Cathode voltage Characteristics

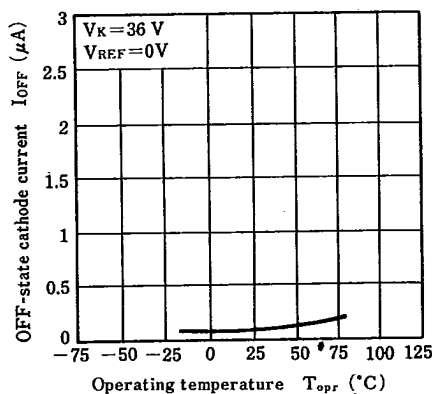


Cathode current — Cathode voltage Characteristics

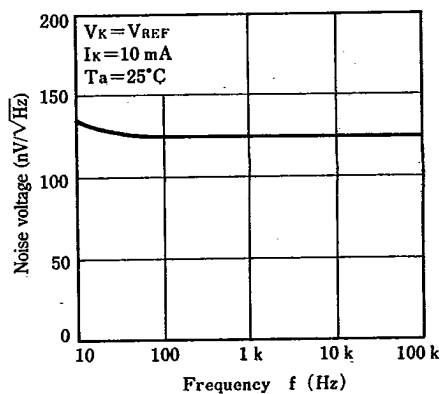


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OFF-state cathode current — Operating temperature Characteristics



Noise voltage — Frequency Characteristics



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