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 $0.2\,\Omega$. Active output circuitry provides a very sharp turn-on characteristics making it excellent replacemens for zener diodes in many applications.
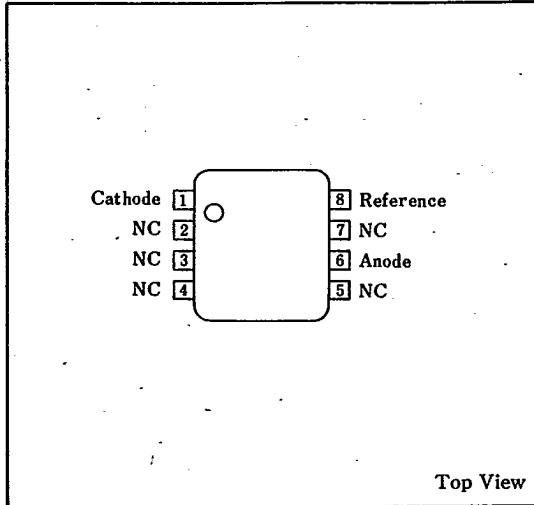
■ Features

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

■ Pin Connections

Cathode	1		8	Reference
NC	2		7	NC
NC	3		6	Anode
NC	4		5	NC

Top View

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■ Equivalent Circuit
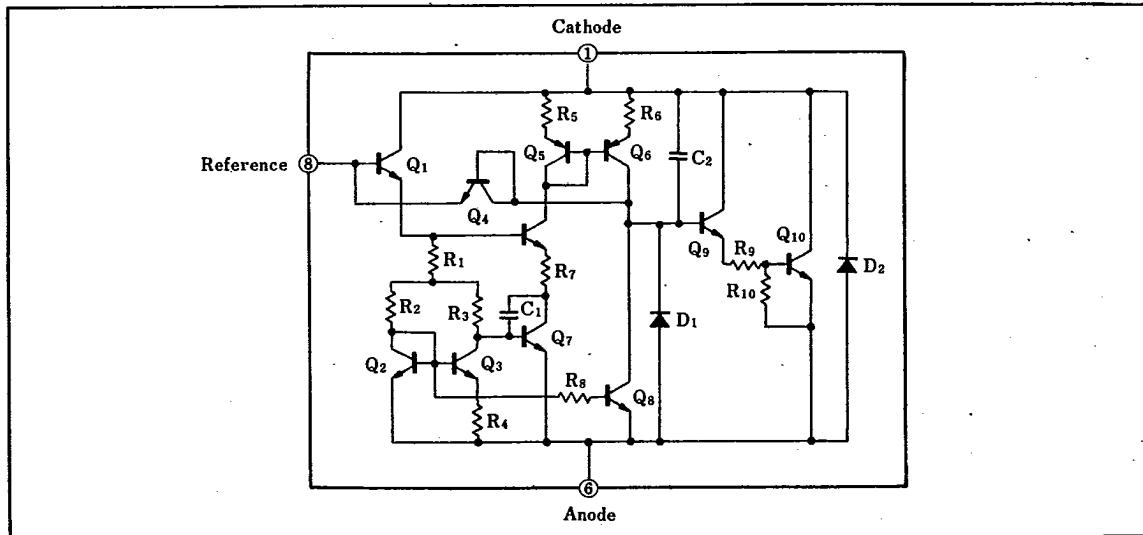
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Adjustable Precision Shunt Regulator   IR9431/IR9431N

■ Absolute Maximum Ratings

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

■ 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℃)

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

* Refer to the figure to the right.

$$|\alpha V_{REF}| = \frac{\dfrac{V_{REF(dev)}}{V_{REF@25℃}} 10^6}{\Delta Ta} \quad (ppm/℃)$$

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

$$|\alpha V_{REF}| = \frac{\dfrac{8mV}{2,495mV} 10^6}{70℃} = 46 \quad (ppm/℃)$$

dynamic impedance is defined by the following equation.

$$|Z_{KA}| = \frac{\Delta V_K}{\Delta I_K}$$
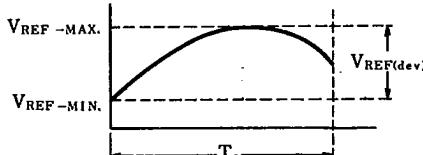
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Adjustable Precision Shunt Regulator   *T-58-11-23*   IR9431/IR9431N

■ Test Circuit

(1) $V_K = V_{REF}$
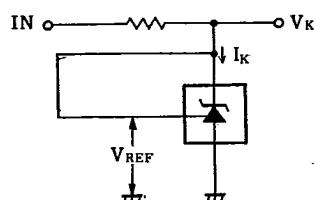
(2) $V_K > V_{REF}$
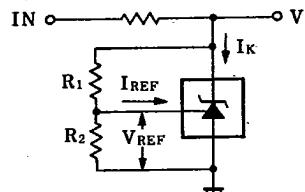
(3) I_{OFF}
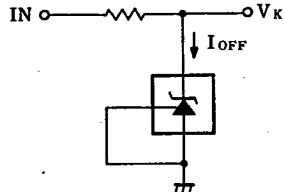
$$V_K = V_{REF}(1 + \frac{R_1}{R_2}) + I_{REF} \cdot R_1$$

$$|Z| = \frac{\Delta V}{\Delta I} \doteqdot |Z_K|(1 + \frac{R_1}{R_2})$$

## ■ Electrical Characteristic Curves

Cathode current — Cathode voltage Characteristics
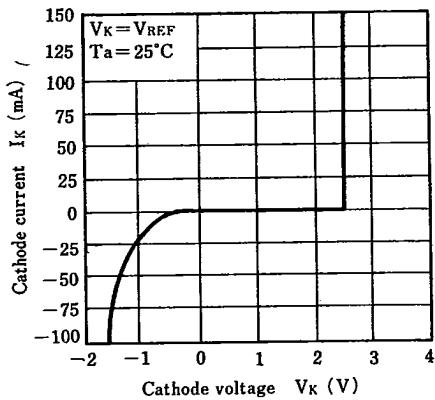
Cathode current — Cathode voltage Characteristics
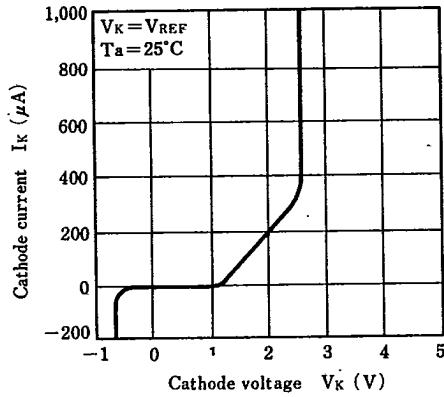
OFF-state cathode current — Operating temperature Characteristics
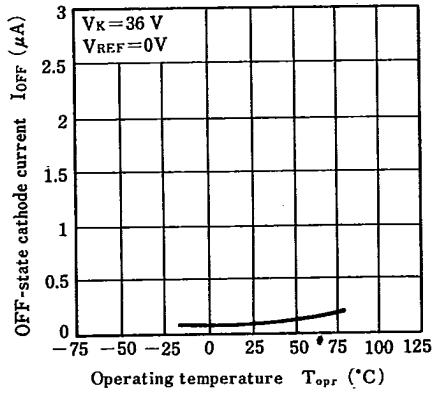
Noise voltage — Frequency Characteristics