IR9431/IR9431N Adjustable Precision Shunt Regulator

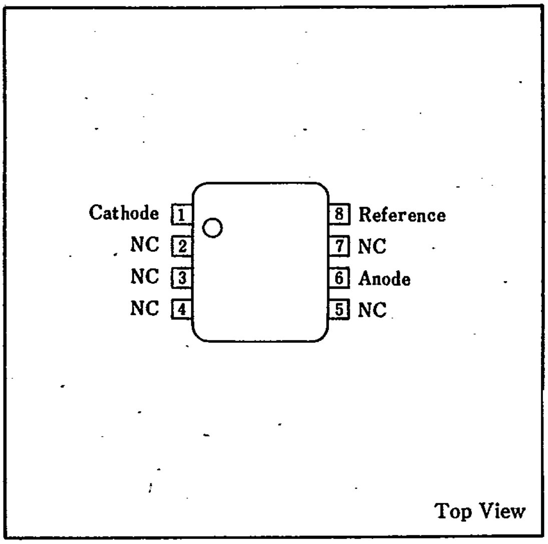
Description

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 replacemens for zener diodes in many applications.

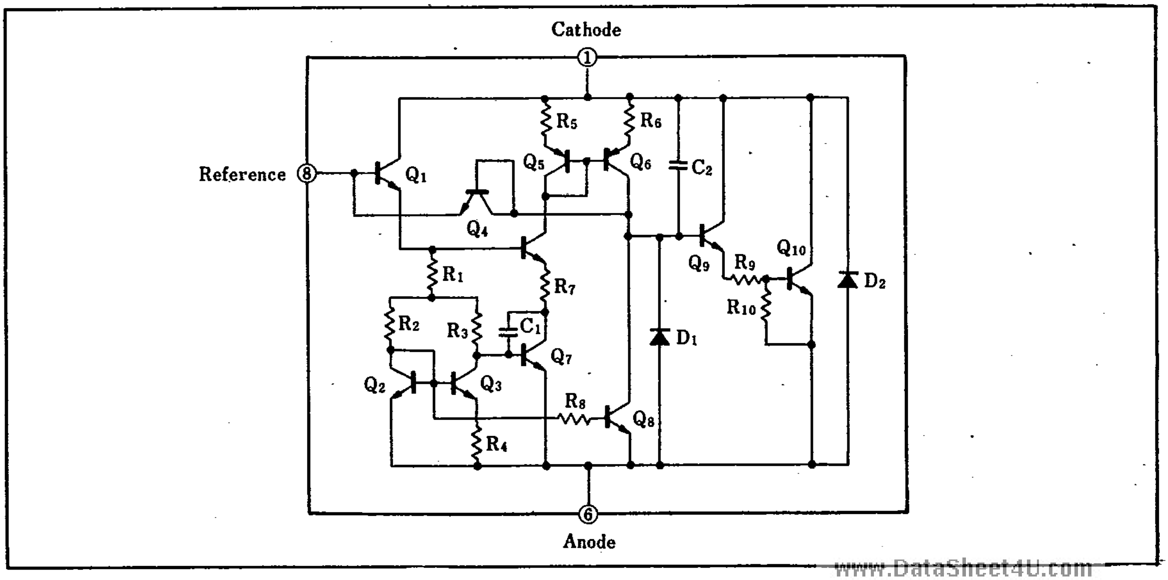
Features

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

Pin Connections



Equivalent Circuit



■ 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	Ta≦25℃	IR9431	750	mW
			IR9431N	500	
P_D derating ratio	ΔP_D/℃	Ta>25℃	IR9431	6	mW/℃
			IR9431N	4	
Operating temperature	T_{opr}			−20～+100	℃
Storage temperature	T_{stg}			−65～+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

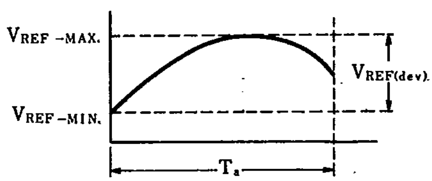
■ Electrical Characteristics

(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	$\frac{\Delta V_{RE}}{\Delta V_K}$	I_K=10mA	$\Delta V_K=10V-V_{REF}$		−1.4	−2.7	mV/V
			ΔV_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=1～10mA f<1kHz			0.2	0.5	Ω

* Refer to the figure to the right.

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



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

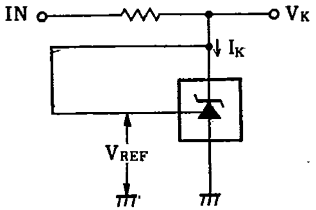
$$|\alpha V_{REF}| = \frac{\frac{8mV}{2,495mV}10^6}{70℃} = 46 \quad (ppm/℃)$$

dynamic impedance is defined by the following equation.

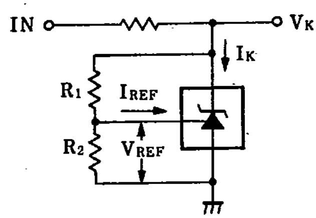
$$|Z_{KA}| = \frac{\Delta V_K}{\Delta I_K}$$

Test Circuit

(1) $V_K = V_{REF}$



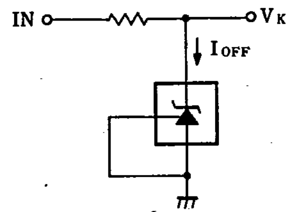
(2) $V_K > V_{REF}$



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

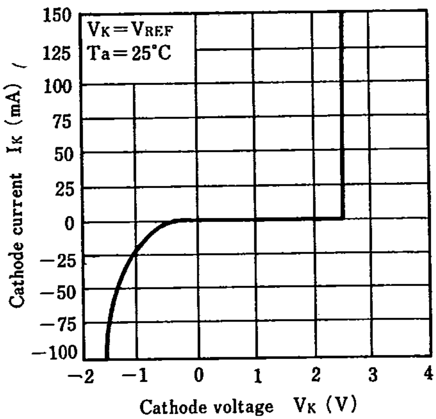
$$|Z| = \frac{\Delta V}{\Delta I} \fallingdotseq |Z_K|\left(1+\frac{R_1}{R_2}\right)$$

(3) I_{OFF}

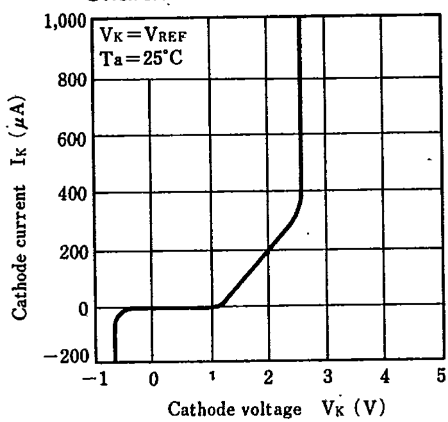


Electrical Characteristic Curves

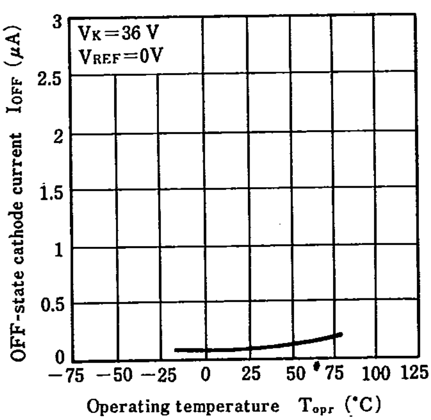
Cathode current — Cathode voltage Characteristics



Cathode current — Cathode voltage Characteristics



OFF-state cathode current — Operating temperature Characteristics



Noise voltage — Frequency Characteristics