

IR9431/IR9431N

Adjustable Precision Shunt Regulator

www.DataSheet4U.com

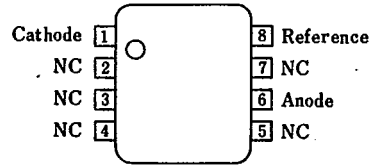
■ Description

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

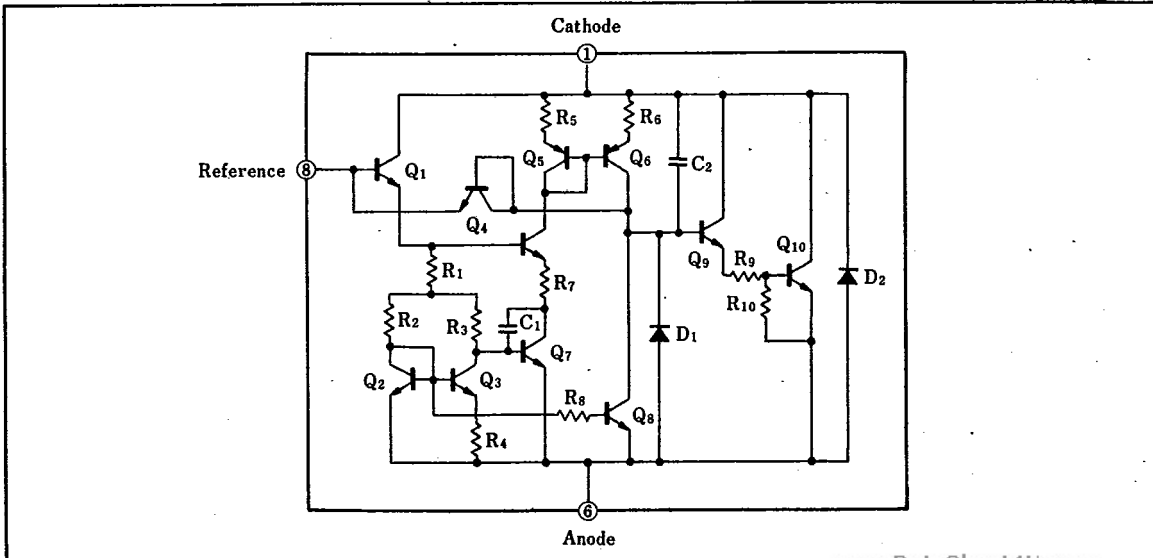
1. Temperature stability 50ppm/°C (TYP.)
2. Adjustable output voltage
3. Fast turn-on response
4. Low dynamic output impedance 0.2Ω (TYP.)
5. Low output noise voltage
6. 8-pin dual-in-line package (IR9431)
8-pin small-outline package (IR9431N)

■ Pin Connections



Top View

■ Equivalent Circuit



www.DataSheet4U.com

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 | $T_a \leq 25^\circ\text{C}$ | IR9431 | 750 | mW |
| | | | IR9431N | 500 | |
| P_D derating ratio | $\Delta P_D / ^\circ\text{C}$ | $T_a > 25^\circ\text{C}$ | IR9431 | 6 | mW/ $^\circ\text{C}$ |
| | | | IR9431N | 4 | |
| Operating temperature | T_{opr} | | -20 ~ +100 | $^\circ\text{C}$ | |
| Storage temperature | T_{stg} | | -65 ~ +150 | $^\circ\text{C}$ | |

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 | $\frac{\Delta V_{RE}}{\Delta V_K}$ | $I_K = 10\text{mA}$ | $\Delta V_K = 10\text{V} - V_{REF}$ | -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.

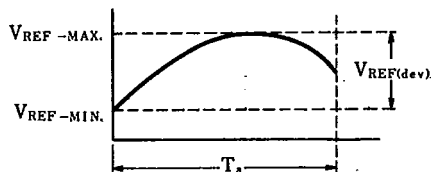
$$|\alpha V_{REF}| = \frac{V_{REF(dev)} @ 25^\circ\text{C}}{\Delta T_a} \cdot 10^6 \quad (\text{ppm}/^\circ\text{C})$$

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

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

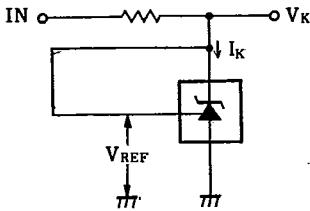
dynamic impedance is defined by the following equation.

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

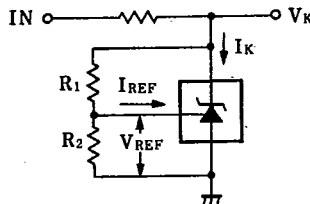


Test Circuit

(1) $V_K = V_{REF}$



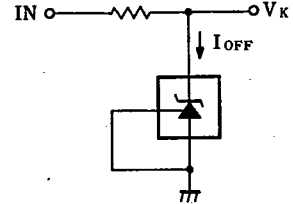
(2) $V_K > V_{REF}$



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

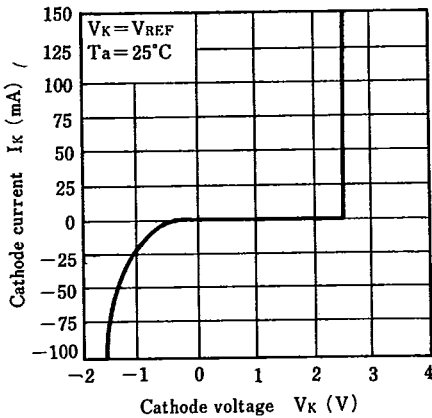
$$|Z| = \frac{\Delta V}{\Delta I} \approx |Z_K| \left(1 + \frac{R_1}{R_2}\right)$$

(3) I_{OFF}

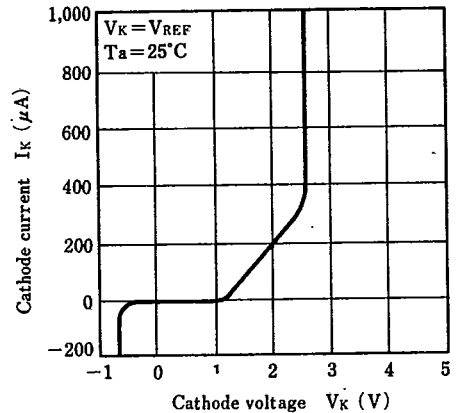


Electrical Characteristic Curves

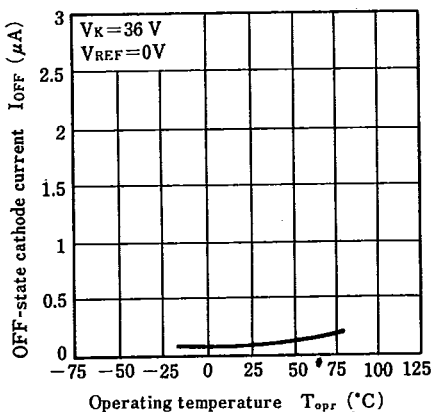
Cathode current — Cathode voltage Characteristics



Cathode current — Cathode voltage Characteristics



OFF-state cathode current — Operating temperature Characteristics



Noise voltage — Frequency Characteristics

