

ADJUSTABLE PRECISION SHUNT REGULATOR

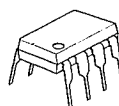
■ GENERAL DESCRIPTION

The NJM431 is a 3 terminal adjustable shunt regulator. The output voltage may be set to any value between V_{REF} (about 2.5V) and 36V by two resistors. Output circuitry shows a sharp turn-on characteristics. Applications include shunt regulators, series regulators for small power and isolation regulators with photo couplers.

■ FEATURES

- Operating Voltage ($V_{KA} = V_{REF} \sim 36V$)
- Fast Turn-On Respability
- Cathode Current (1mA $\sim$ 100mA)
- Low Dynamic Output Impedance (0.2Ω typ.)
- Package Outline DIP8, DMP8, TO-92, SOT-89
- Bipolar Technology

■ PACKAGE OUTLINE



NJM431D

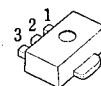


NJM431M



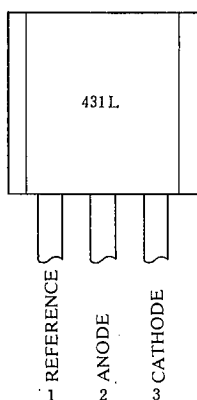
NJM431L (TO-92)

1. REF
2. ANODE
3. CATHODE

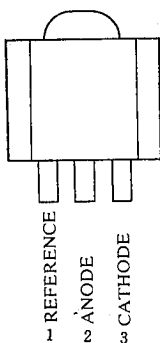


NJM431U (SOT-89)

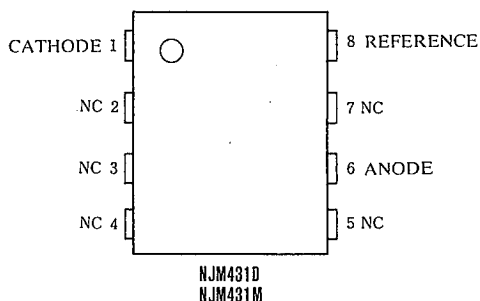
■ PIN CONFIGURATION



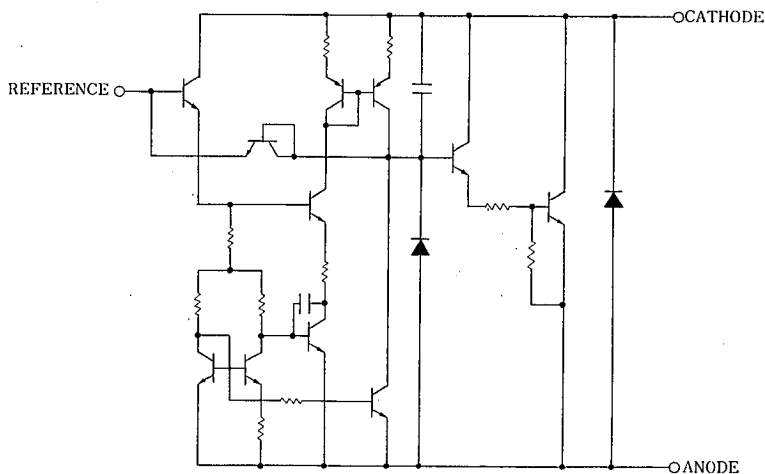
NJM431L



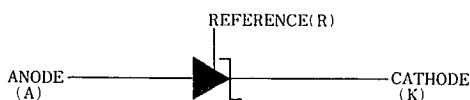
NJM431U

NJM431D
NJM431M

■ EQUIVALENT CIRCUIT



■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Cathode Voltage (note).	V_{KA}	37	V
Continuous Cathode Current	I_{KA}	-100 ~ 150	mA
Reference Input Current	I_{REF}	-0.05 ~ 10	mA
Power Dissipation	P_D	(DIP8) 700	mW
		(DMP8) 300	mW
		(TO92) 500	mW
		(SOT89) 350	mW
Operating Temperature	T_{opr}	-40 ~ +85	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

(note) Unless specified, all voltage values are with respect to the anode terminal.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	—	36	V
Cathode Current	I_K	I	—	100	mA

■ ELECTRICAL CHARACTERISTICS (Ta=25°C)

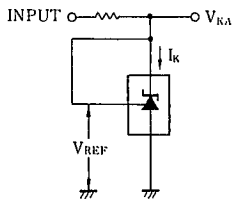
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage	V_{REF}	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$ (note 1)	2440	2495	2550	mV
Reference Voltage Change (Full Oper. Temp. Range)	V_{REF} (dev)	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$ (note 1). $T_a=-20^\circ\text{C}\sim+85^\circ\text{C}$	—	8	17	mV
Reference Voltage Change vs. Cathode Voltage Change	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_K=10\text{mA}$ (note 2) $\frac{\Delta V_{KA}=10\text{V}-V_{REF}}{\Delta V_{KA}=36\text{V}-10\text{V}}$	—	-1.4 -1	-2.7 -2	mV/V mV/V
Reference Input Current	I_{REF}	$I_K=10\text{mA}$, $R_1=10\text{k}\Omega$, $R_2=\infty$ (note 2)	—	2	4	μA
Reference Input Current Change (Full Oper. Temp. Range)	I_{REF} (dev)	$I_K=10\text{mA}$, $R_1=10\text{k}\Omega$, $R_2=\infty$ (note 2). $T_a=-20^\circ\text{C}\sim+85^\circ\text{C}$	—	0.4	1.2	μA
Minimum Input Current	I_{MIN}	$V_{KA}=V_{REF}$ (note 1)	—	0.4	1.0	mA
Cathode Current (Off Cond.)	I_{OFF}	$V_{KA}=36\text{V}$, $V_{REF}=0$ (note 3)	—	0.1	1.0	μA
Dynamic Impedance	$ Z_{KA} $	$V_{KA}=V_{REF}$, $I_K=1\text{mA}\sim100\text{mA}$, $f\leq 1\text{kHz}$ (note 1)	—	0.2	0.5	Ω

(note 1) TEST CIRCUIT (Fig. 1)

(note 2) TEST CIRCUIT (Fig. 2)

(note 3) TEST CIRCUIT (Fig. 3)

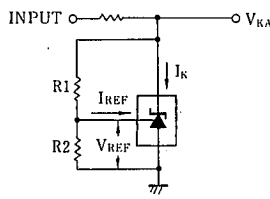
■ TEST CIRCUITS



1. $V_{KA} = V_{REF}$

$$V_O = V_{KA} = V_{REF}$$

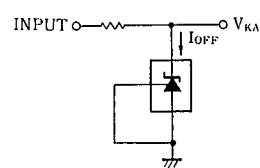
(Fig. 1)



2. $V_{KA} > V_{REF}$

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

(Fig. 2)

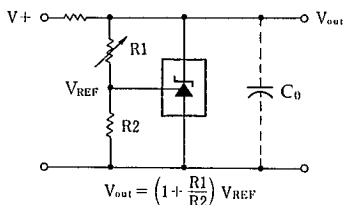


3. I_{OFF}

(Fig. 3)

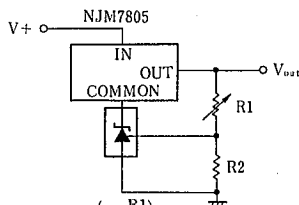
■ TYPICAL APPLICATION

(1) Shunt Regulator



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

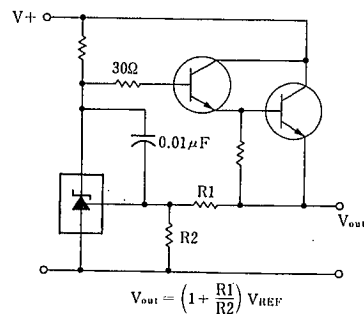
(3) Output Control of a Three-Terminal fixed Regulator



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

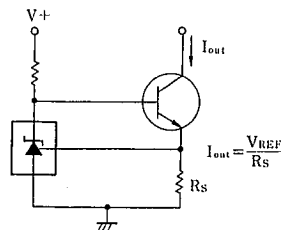
$$\text{Min } V_{out} = V_{REF} + 5V$$

(2) Series Regulator



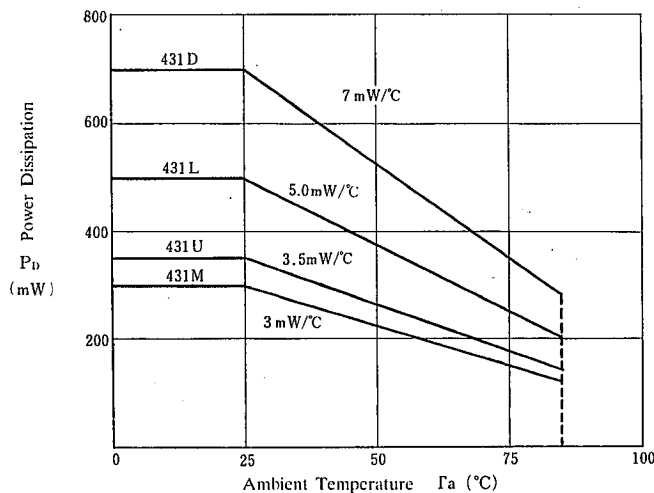
$$V_{out} = \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

(4) Constant Current Source

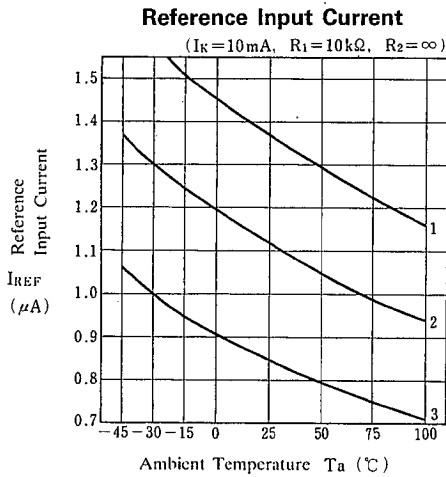
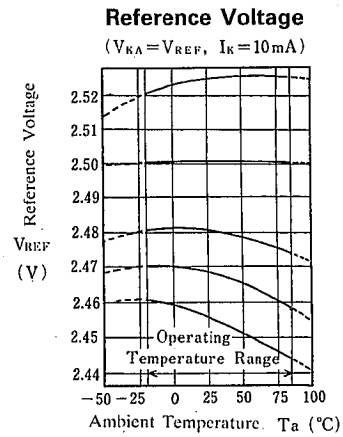
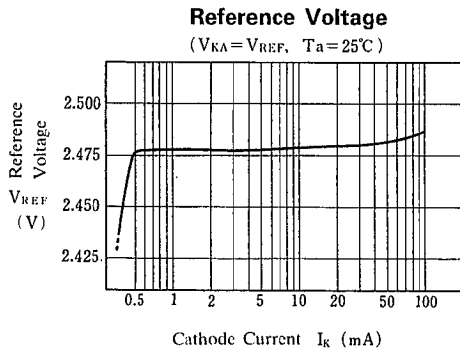


$$I_{out} = \frac{V_{REF}}{R_S}$$

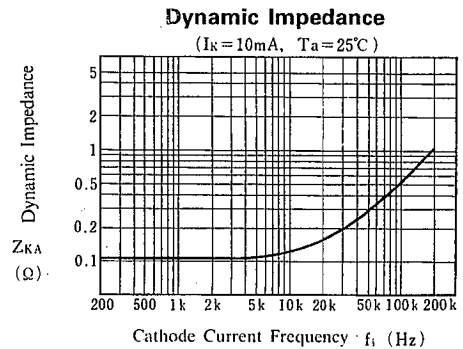
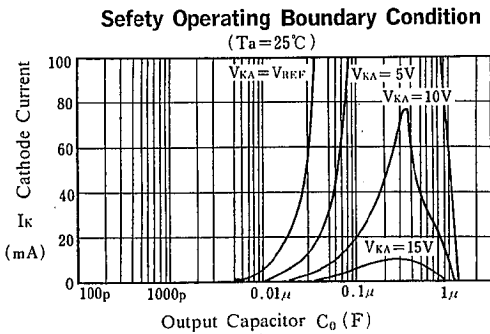
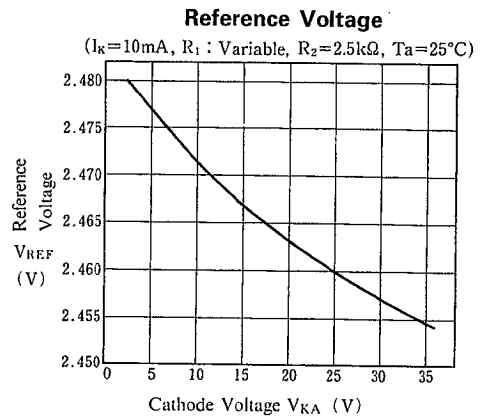
■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



■ TYPICAL CHARACTERISTICS



$V_{REF}(\text{dev})$	($T_a=-20\sim 25^\circ\text{C}$)	($T_a=25\sim 85^\circ\text{C}$)	($T_a=25^\circ\text{C}$)
No. 1	+ 5 mV	+ 1 mV	2525mV
No. 2	0 mV	0 mV	2501mV
No. 3	0 mV	- 6 mV	2481mV
No. 4	- 2 mV	- 9 mV	2468mV
No. 5	- 5 mV	-12mV	2456mV



Note) Oscillation might occur while operating within the range of safety curve. So that, it is necessary to make ample margins by taking considerations of fluctuation of the device.

MEMO

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