



NJM431

ADJUSTABLE PRECISION SHUNT REGULATOR

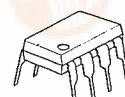
■ GENERAL DESCRIPTION

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 Responsability
- Cathode Current (1mA ~ 100mA)
- Low Dynamic Output Impedance (0.2Ω typ.)
- Package Outline DIP8, DMP8, TO-92, SOT-89
- Bipolar Technology

■ PACKAGE OUTLINE



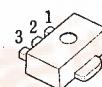
NJM431D



NJM431M

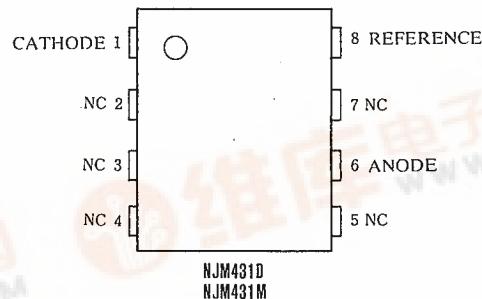
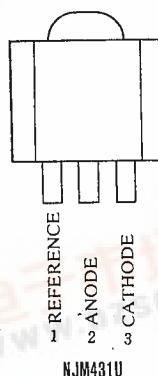
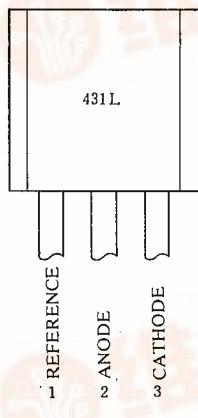


NJM431L (TO-92)

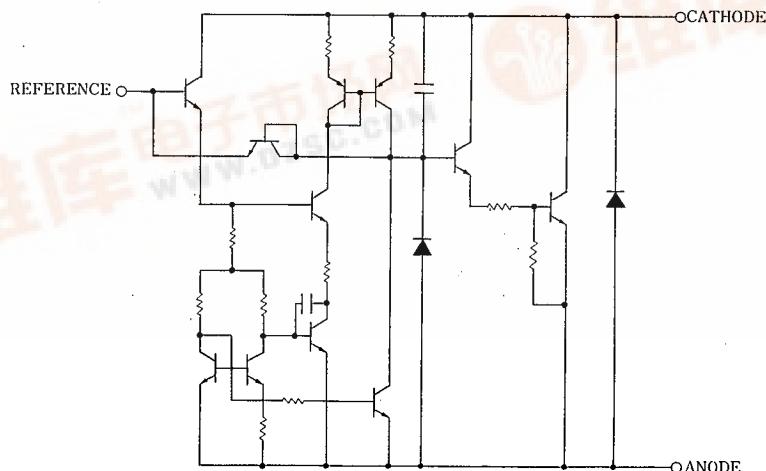


NJM431U (SOT-89)

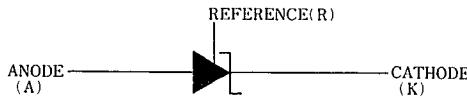
■ PIN CONFIGURATION



■ 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
		(DIP8) 700	mW
Power Dissipation	P _D	(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 =10mA (note 1)	2440	2495	2550	mV
Reference Voltage Change (Full Oper. Temp. Range)	V _{REF} (dev)	V _{KA} =V _{REF} , I _K =10mA (note 1) Ta=-20°C~+85°C	—	8	17	mV
Reference Voltage Change vs. Cathode Voltage Change	ΔV _{REF} ΔV _{KA}	I _K =10mA (note 2)	—	-1.4	-2.7	mV/V
Reference Input Current	I _{REF}	I _K =10mA, R ₁ =10kΩ, R ₂ =∞ (note 2)	—	2	4	μA
Reference Input Current Change (Full Oper. Temp. Range)	I _{REF} (dev)	I _K =10mA, R ₁ =10kΩ, R ₂ =∞ (note 2) Ta=-20°C~+85°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} =36V, V _{REF} =0 (note 3)	—	0.1	1.0	μA
Dynamic Impedance	Z _{KA}	V _{KA} =V _{REF} , I _K =1mA~100mA, f≤1kHz (note 1)	—	0.2	0.5	Ω

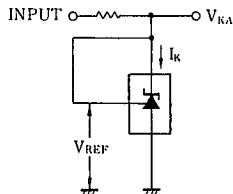
(note 1) TEST CIRCUIT (Fig. 1)

(note 2) TEST CIRCUIT (Fig. 2)

(note 3) TEST CIRCUIT (Fig. 3)

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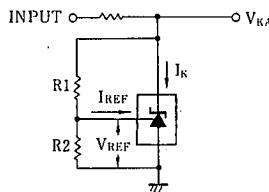
■ TEST CIRCUITS



1 . V_{KA} = V_{REF}

$$V_0 = V_{KA} = V_{REF}$$

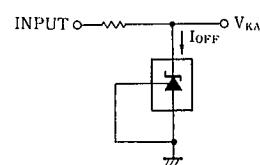
(Fig. 1)



2 . V_{KA} > V_{REF}

$$V_0 = V_{KA} = V_{REF} \cdot \left(1 + \frac{R_1}{R_2}\right) + I_{REF} \cdot R_1$$

(Fig. 2)

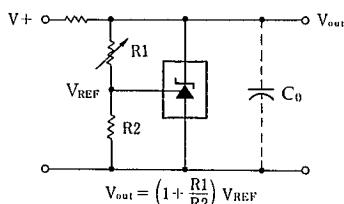


3 . I_{OFF}

(Fig. 3)

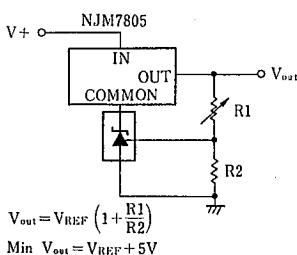
■ TYPICAL APPLICATION

(1) Shunt Regulator



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

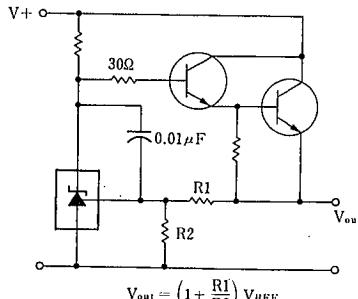
(3) Output Control of a Three-Terminal fixed Regulator



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

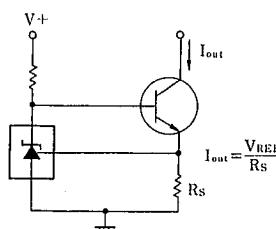
Min V_{out} = V_{REF} + 5V

(2) Series Regulator



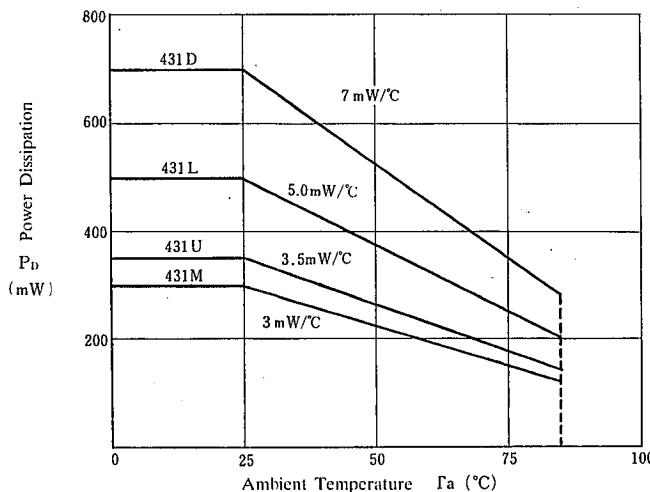
$$V_{out} = \left(1 + \frac{R_1}{R_2}\right) V_{REF}$$

(4) Constant Current Source



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

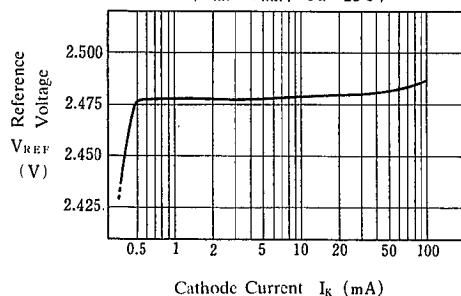
■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



■ TYPICAL CHARACTERISTICS

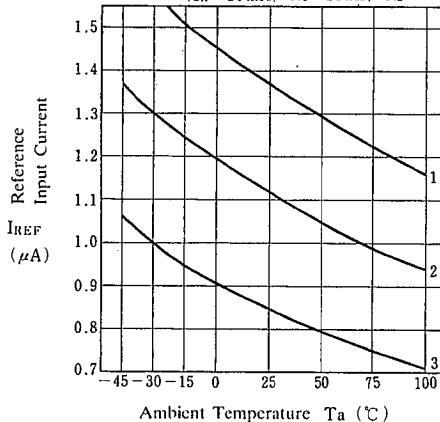
Reference Voltage

($V_{KA} = V_{REF}$, $T_a = 25^\circ C$)



Reference Input Current

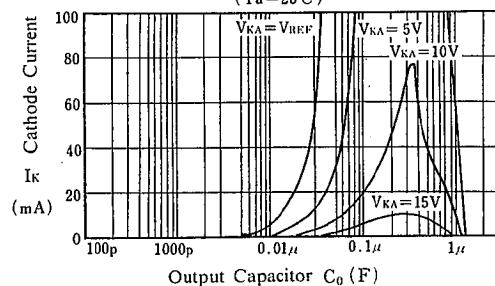
($I_k = 10\text{mA}$, $R_1 = 10\text{k}\Omega$, $R_2 = \infty$)



$I_{REF}(\text{dev})$
No.1 -0.38μA
No.2 -0.27μA
No.3 -0.21μA

Safety Operating Boundary Condition

($T_a = 25^\circ C$)

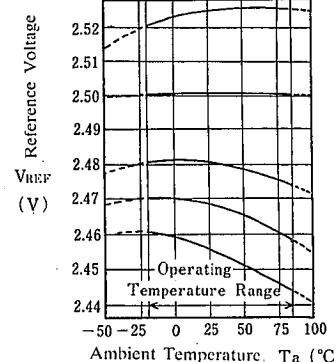


Note) Oscillation might occur while operating within the range of safety curve.

So that, it is necessary to make ample margins by taking considerations of fluctuation of the device.

Reference Voltage

($V_{KA} = V_{REF}$, $I_k = 10\text{mA}$)

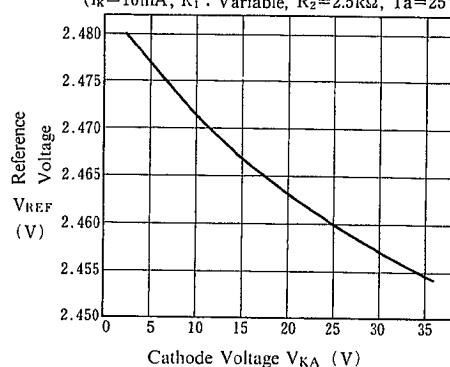


$V_{REF}(\text{dev})$ ($T_a = -20 \sim 25^\circ C$) ($T_a = 25 \sim 85^\circ C$) ($T_a = 25^\circ C$)

	($T_a = -20 \sim 25^\circ C$)	($T_a = 25 \sim 85^\circ C$)	($T_a = 25^\circ C$)
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

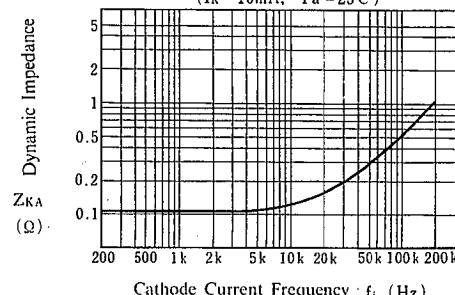
Reference Voltage

($I_k = 10\text{mA}$, R_1 : Variable, $R_2 = 2.5\text{k}\Omega$, $T_a = 25^\circ C$)



Dynamic Impedance

($I_k = 10\text{mA}$, $T_a = 25^\circ C$)



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MEMO

[CAUTION]
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