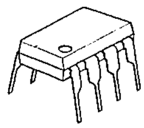
ADJUSTABLE PRECISION SHUNT REGULATOR

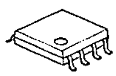
■ GENERAL DESCRIPTION

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.

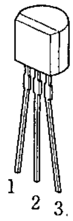
■ PACKAGE OUTLINE



NJM431D

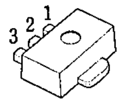


NJM431M



1.REF
2.ANODE
3.CATHODE

NJM431L (TO-92)

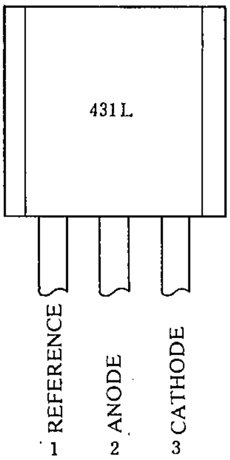


NJM431U (SOT-89)

■ FEATURES

- Operating Voltage ($V_{KA}=V_{REF}\sim36V$)
- Fast Turn-On Respability
- Cathode Current (1mA～100mA)
- Low Dynamic Output Impedance (0.2Ω typ.)
- Package Outline DIP8, DMP8. TO-92. SOT-89
- Bipolar Technology

■ PIN CONFIGURATION



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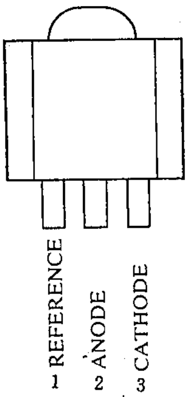

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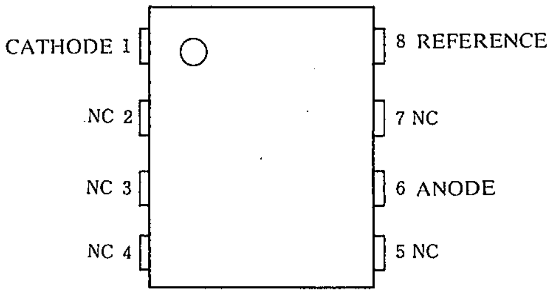
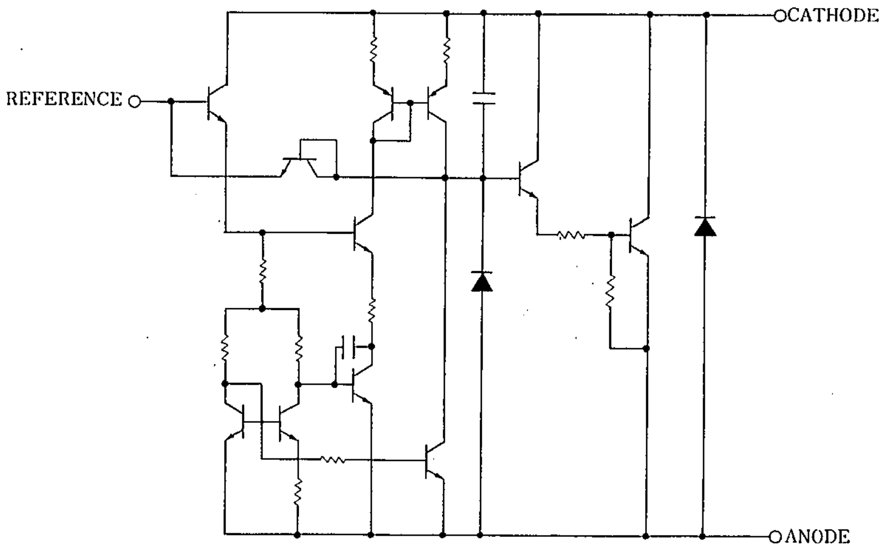
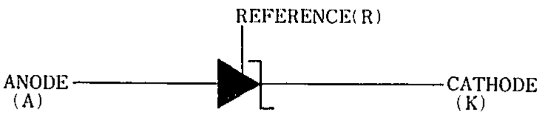


NJM431D
NJM431M

■ EQUIVALENT CIRCUIT



■ BLOCK DIAGEAM



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

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 (DMP8) 300 (TO92) 500 (SOT89) 350	mW mW mW mW
Operating Temperature	T_{opr}	−40～+85	℃
Storage Temperature	T_{stg}	−40～+125	℃

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

■ RECOMMENDED OPERATING CONDITIONS

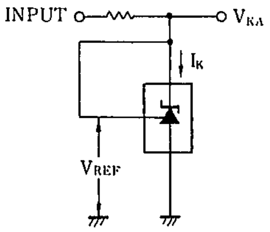
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	—	36	V
Cathode Current	I_K	1	—	100	mA

■ ELECTRICAL CHARACTERISTICS (Ta=25℃)

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	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_K=10mA$ (note 2)	$\Delta V_{KA}=10V-V_{REF}$	—	−1.4	−2.7	mV/V
			$\Delta V_{KA}=36V-10V$	—	−1	−2	mV/V
Reference Input Current	I_{REF}	$I_K=10mA$, $R_1=10k\Omega$, $R_2=\infty$ (note 2)		—	2	4	μA
Reference Input Current Change (Full Oper. Temp. Range)	I_{REF} (dev)	$I_K=10mA$, $R_1=10k\Omega$, $R_2=\infty$ (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	$\lvert Z_{KA}\rvert$	$V_{KA}=V_{REF}$, $I_K=1mA～100mA$, $f\leqq 1kHz$ (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)

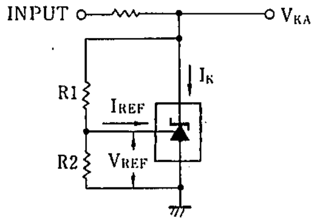
■ TEST CIRCUITS



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

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

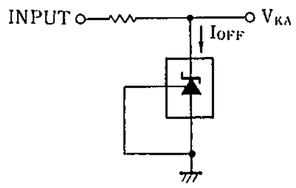
(Fig. 1)



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

$V_O=V_{KA}=V_{REF}\cdot\left(1+\frac{R1}{R2}\right)+I_{REF}\cdot R1$

(Fig. 2)

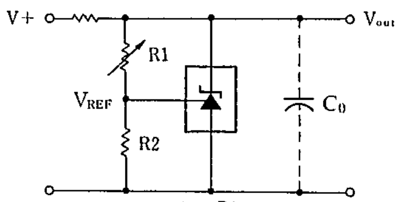


3. I_{OFF}

(Fig. 3)

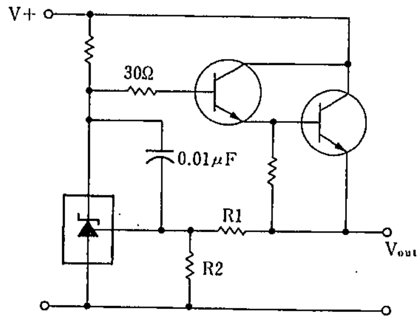
■ TYPICAL APPLICATION

(1) Shunt Regulator



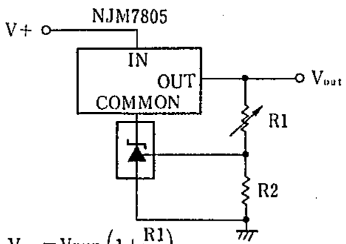
$V_{out}=\left(1+\frac{R1}{R2}\right)V_{REF}$

(2) Series Regulator



$V_{out}=\left(1+\frac{R1}{R2}\right)V_{REF}$

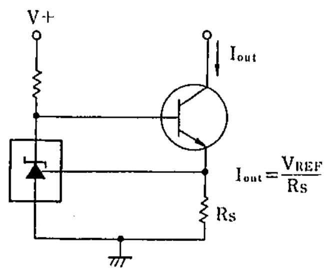
(3) Output Control of a Three-Terminal fixed Regulator



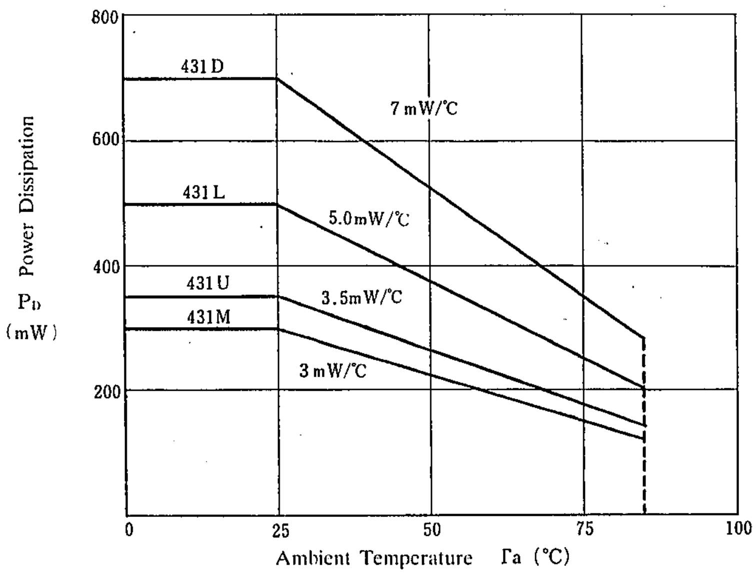
$V_{out}=V_{REF}\left(1+\frac{R1}{R2}\right)$

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

(4) Constant Current Source



■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



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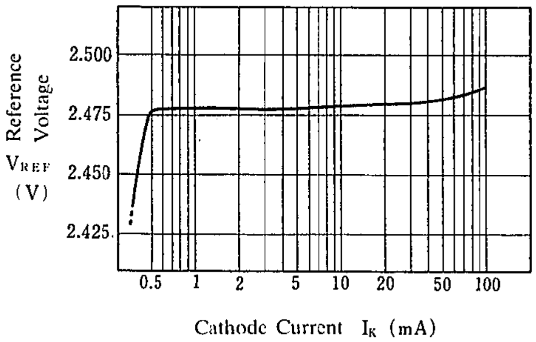
■ TYPICAL CHARACTERISTICS

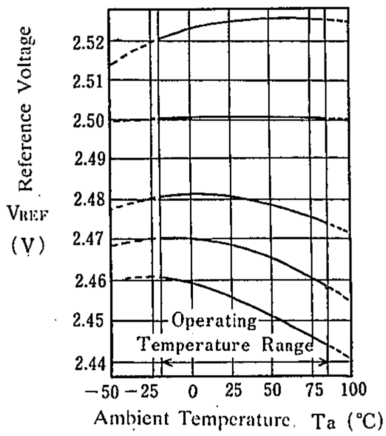
Reference Voltage

($V_{KA}=V_{REF}$, $Ta=25°C$)



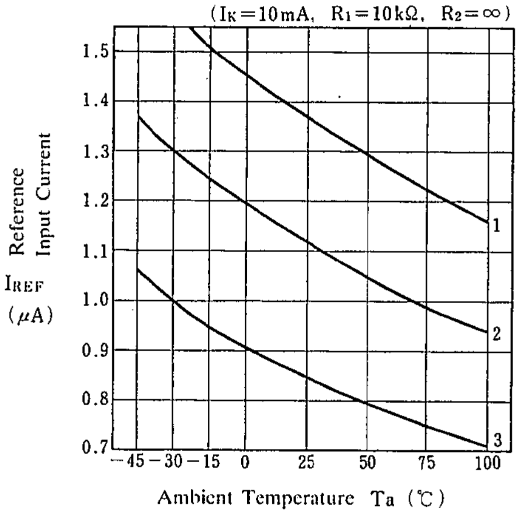
Reference Voltage

($V_{KA}=V_{REF}$, $I_K=10mA$)



Reference Input Current

($I_K=10mA$, $R_1=10k\Omega$, $R_2=\infty$)

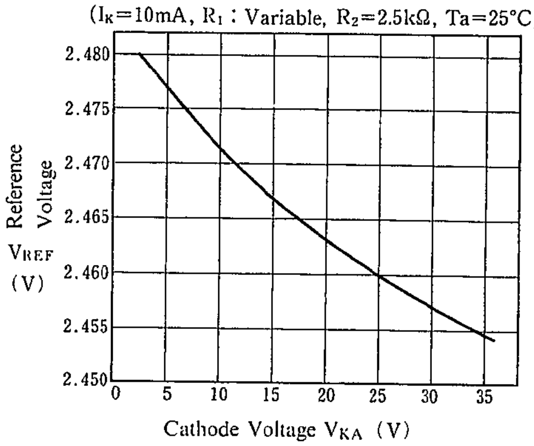


V_{REF}(dev)	(Ta=−20~25°C)	(Ta=25~85°C)	(Ta=25°C)
No. 1	+5 mV	+1 mV	2525mV
No. 2	0 mV	0 mV	2501mV
No. 3	0 mV	−6 mV	2481mV
No. 4	−2 mV	−9 mV	2468mV
No. 5	−5 mV	−12mV	2456mV

I_{REF}(dev)
No.1 −0.38μA
No.2 −0.27μA
No.3 −0.21μA

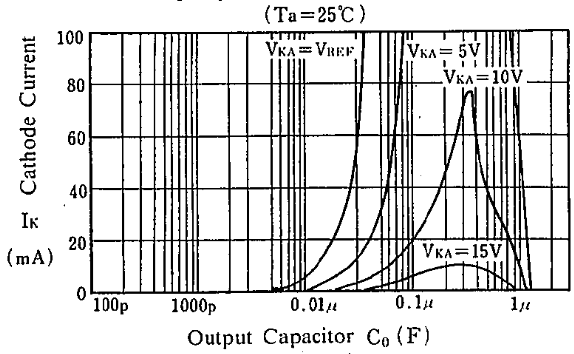
Reference Voltage

($I_K=10mA$, R_1 : Variable, $R_2=2.5k\Omega$, $Ta=25°C$)



Sefety Operating Boundary Condition

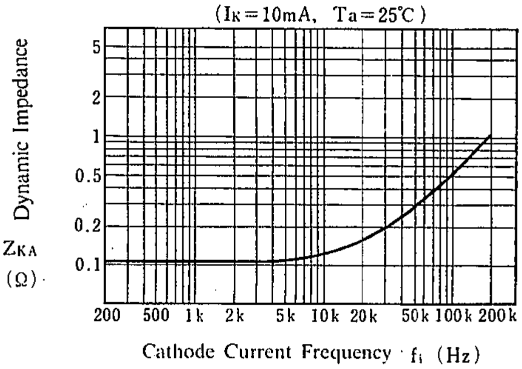
($Ta=25°C$)



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

Dynamic Impedance

($I_K=10mA$, $Ta=25°C$)



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MEMO