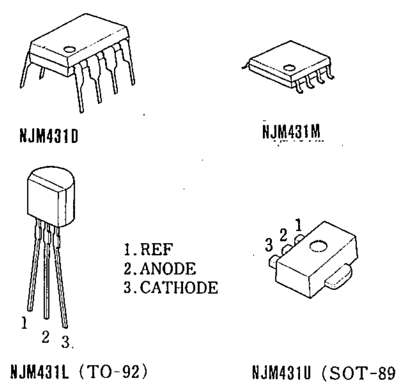
ADJUSTABLE PRECISION SHUNT REGULATOR

■ 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.

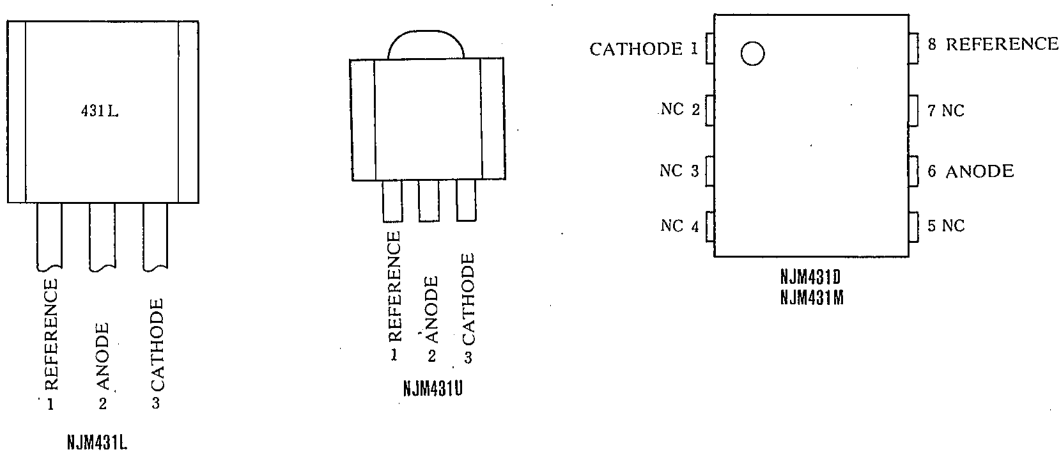
■ PACKAGE OUTLINE



■ FEATURES

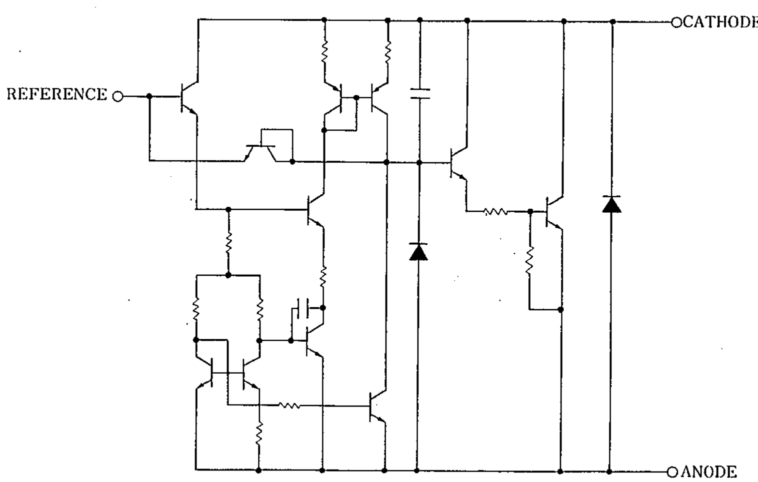
- Operating Voltage ($V_{KA}=V_{REF}\sim 36V$)
- Fast Turn-On Respability
- Cathode Current (1mA ~ 100mA)
- Low Dynamic Output Impedance (0.2Ω typ.)
- Package Outline DIP8, DMP8, TO-92, SOT-89
- Bipolar Technology

■ PIN CONFIGURATION

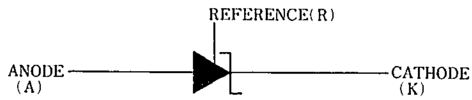


6

■ 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	mW
		(DMP8) 300	mW
		(TO92) 500	mW
		(SOT89) 350	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

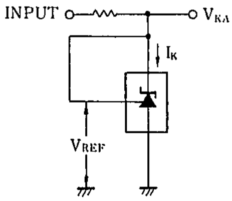
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	—	36	V
Cathode Current	I_K	1	—	100	mA

■ 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	$\Delta V_{REF}/\Delta V_{KA}$	$I_K=10mA$ (note 2), $\Delta V_{KA}=10V-V_{REF}$	—	−1.4	−2.7	mV/V
		$I_K=10mA$ (note 2), $\Delta V_{KA}=36V-10V$	—	−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	$\|Z_{KA}\|$	$V_{KA}=V_{REF}$, $I_K=1mA$～$100mA$, $f\leqq 1kHz$ (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)

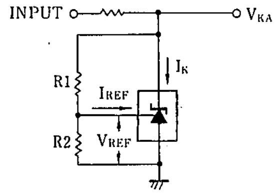
■ TEST CIRCUITS



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

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

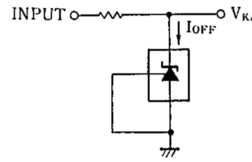
(Fig. 1)



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

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

(Fig. 2)

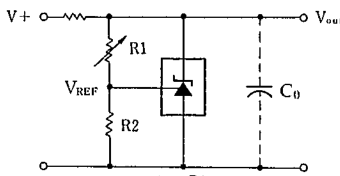


3. I_{OFF}

(Fig. 3)

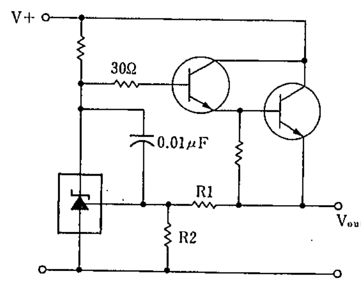
■ TYPICAL APPLICATION

(1) Shunt Regulator



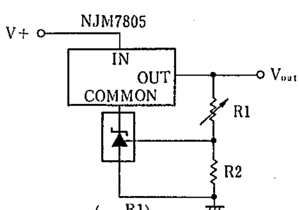
$V_{out}=\left(1+\frac{R1}{R2}\right)V_{REF}$

(2) Series Regulator



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

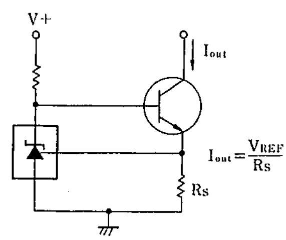
(3) Output Control of a Three-Terminal fixed Regulator



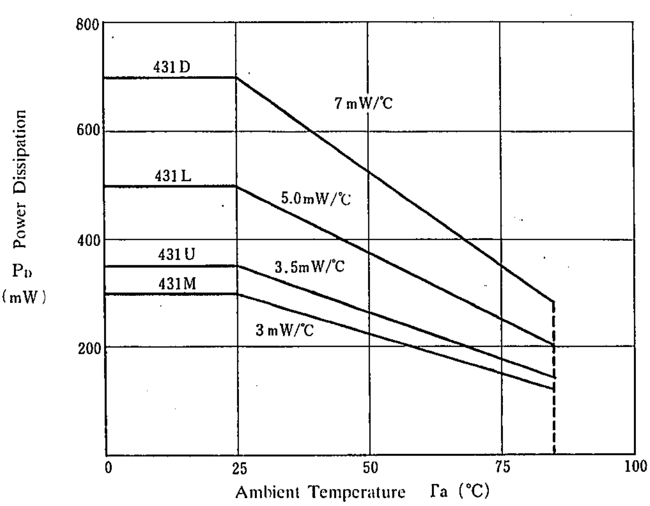
$V_{out}=V_{REF}\left(1+\frac{R1}{R2}\right)$

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

(4) Constant Current Source



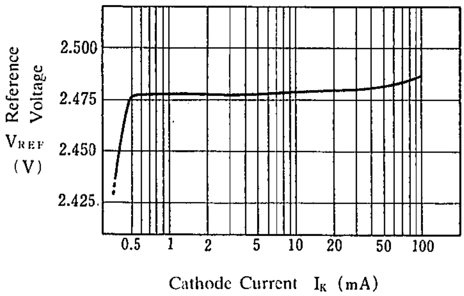
■ POWER DISSIPATION VS. AMBIENT TEMPERATURE



■ TYPICAL CHARACTERISTICS

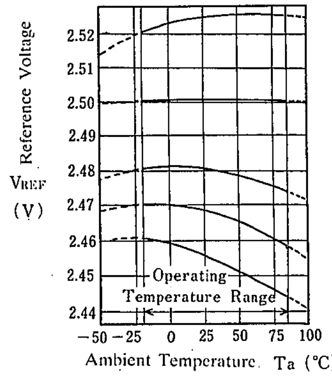
Reference Voltage

($V_{KA}=V_{REF}$, Ta=25℃)



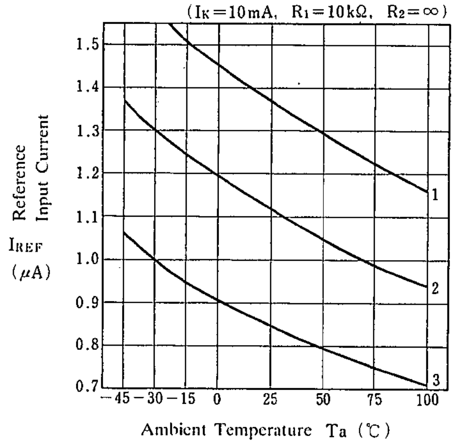
Reference Voltage

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



Reference Input Current

(I_K=10mA, R_1=10kΩ, R_2=∞)

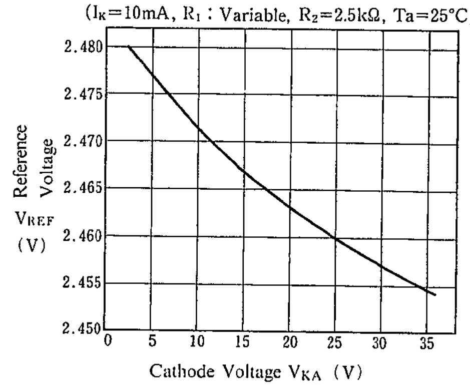


I_{REF}(dev)
No.1 −0.38μA
No.2 −0.27μA
No.3 −0.21μA

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

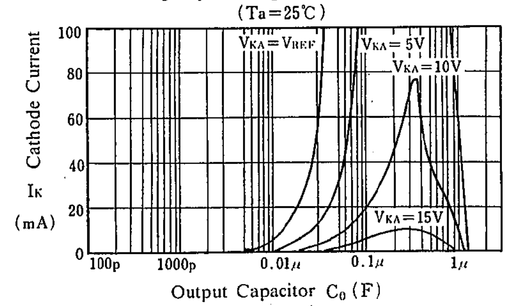
Reference Voltage

(I_K=10mA, R_1 : Variable, R_2=2.5kΩ, Ta=25°C)



Sefety Operating Boundary Condition

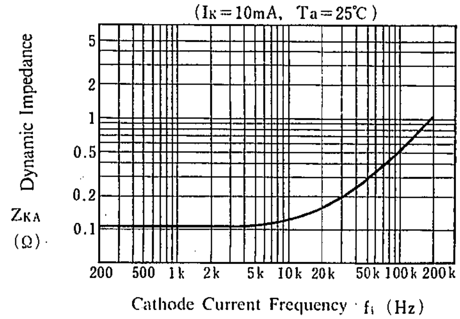
(Ta=25℃)



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℃)



MEMO