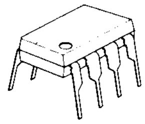
ADJUSTABLE PRECISION SHUNT REGULATOR

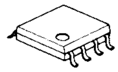
■ GENERAL DESCRIPTION

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.

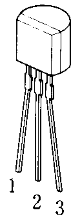
■ PACKAGE OUTLINE



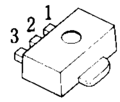
NJM431D



NJM431M



1. REF
2. ANODE
3. CATHODE

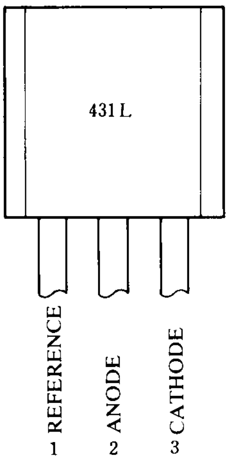


NJM431L(TO-92) **NJM431U**(SOT-89)

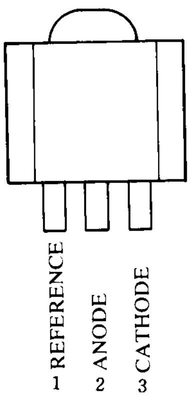
■ FEATURES

- Operating Voltage (V_{KA} = V_{REF} to 36V)
- Fast Tum-On Respability
- Cathode Current (1mA to 100mA)
- Low Dynamic Output Impedance (0.2Ωtyp.)
- Load Regulation typically (0.1%)
- Package Outline DIP8, DMP8. TO-92. SOT-89
- Bipolar Technology

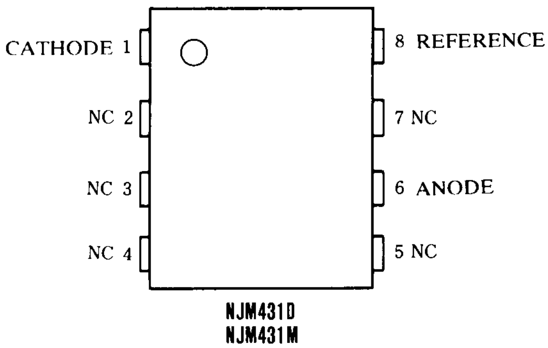
■ PIN CONFIGURATION



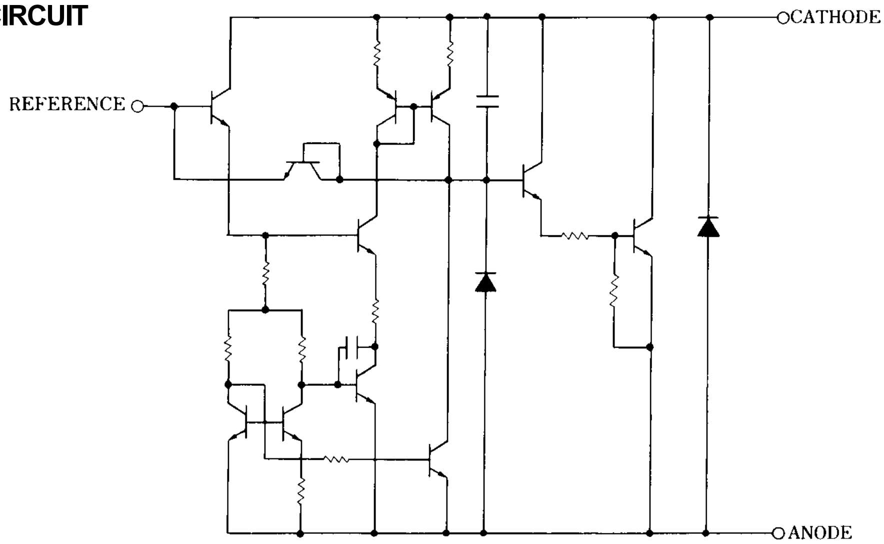
NJM431L



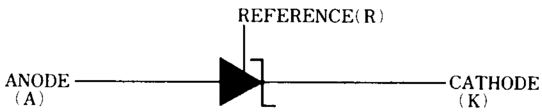
NJM431U



■ EQUIVALENT CIRCUIT



■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

(T_a=25°C)

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

(note) Unless specified, all voltage value 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 (T_a=25°C)

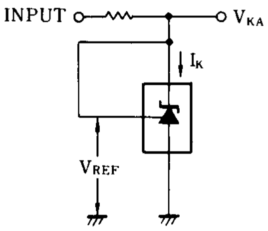
PARAMETER	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Reference Voltage	V_{REF}	V_{KA} = V_{REF}, I_K = 10mA (note 1)		2440	2495	2550	mV
Reference Voltage Change (Full Oper. Temp. Range)	V_{REF} (dev)	V_{KA} = V_{REF}, I_K = 10mA (note 1) Ta = -20ºC to +85 ºC		-	8	17	mV
Reference Voltage Change vs. Cathode Voltage Change	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I_K= 10mA (note 2)	ΔV_{KA}= 10V - V_{REF}	-	-1.4	-2.7	mV/V
			ΔV_{KA}= 36V - 10V	-	-1	-2	mV/V
Reference Input Current	I_{REF}	I_K= 10mA, R1 = 10kΩ, R2 = ∞ (note 2)		-	2	4	μA
Reference Input Current Change (Full Oper. Temp. Range)	I_{REF} (dev)	I_K= 10mA, R1 = 10kΩ, R2 = ∞ (note 2) Ta = -20ºC to +85 ºC		-	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 to 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)

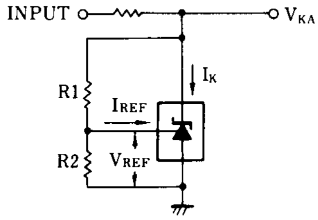
■ **TEST CIRCUITS**



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

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

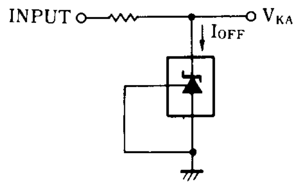
(Fig. 1)



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

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

(Fig. 2)

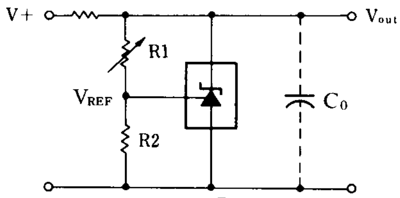


3. I_{OFF}

(Fig. 3)

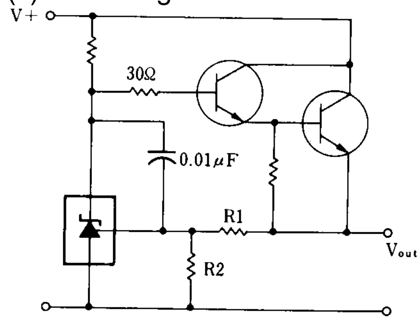
■ **TYPICAL APPLICATION**

(1) Shunt Regulator



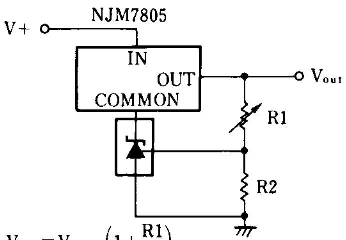
$V_{out} = \left(1 + \frac{R1}{R2}\right) V_{REF}$

(2) Series Regulator



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

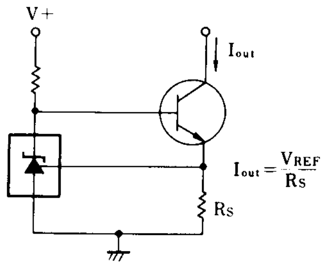
(3) Output Control of a Three-Terminal fixed Regulator



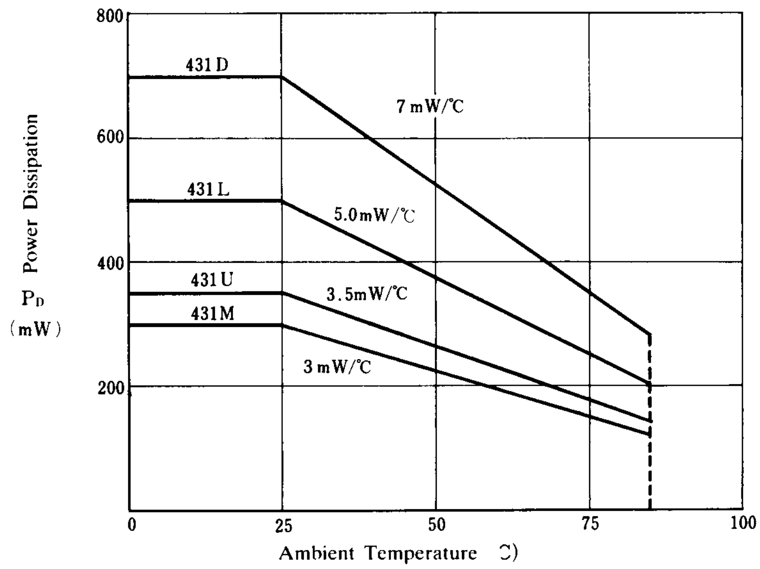
$V_{out} = V_{REF} \left(1 + \frac{R1}{R2}\right)$

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

(4) Constant Current Source

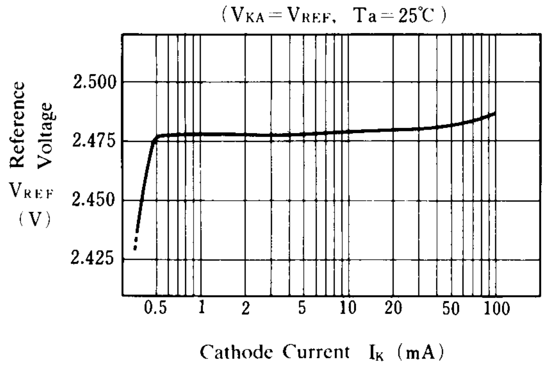


■ **POWER DISSIPATION VS. AMBIENT TEMPERATURE**

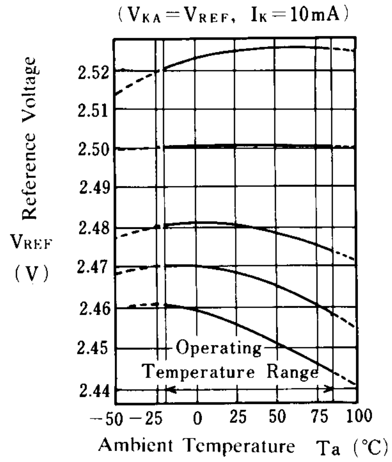


■TYPICAL CHARACTERISTICS

Reference Voltage

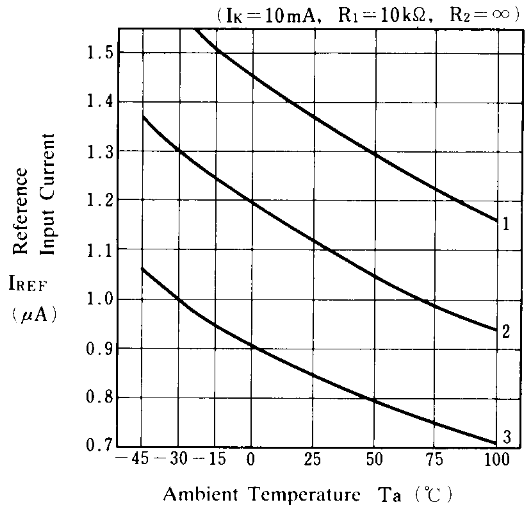


Reference Voltage



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

Reference Input Current



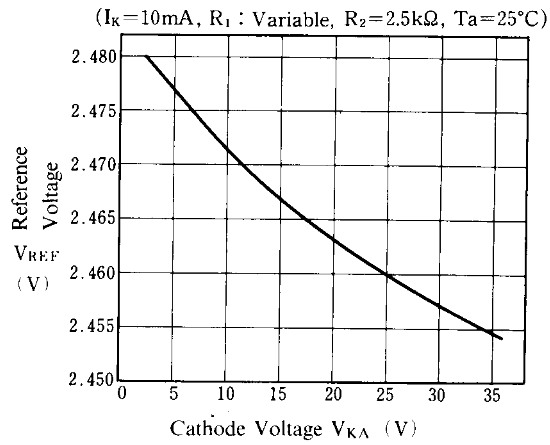
I_{REF}(dev)

No.1 -0.38μA

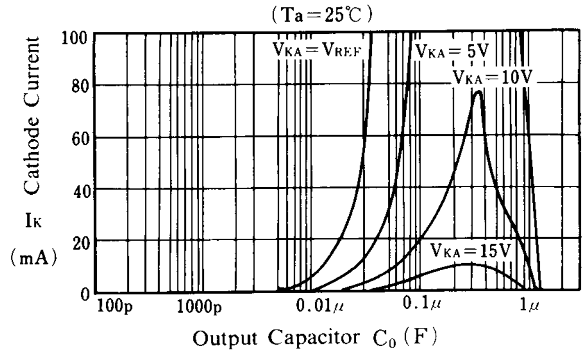
No.2 -0.27μA

No.3 -0.21μA

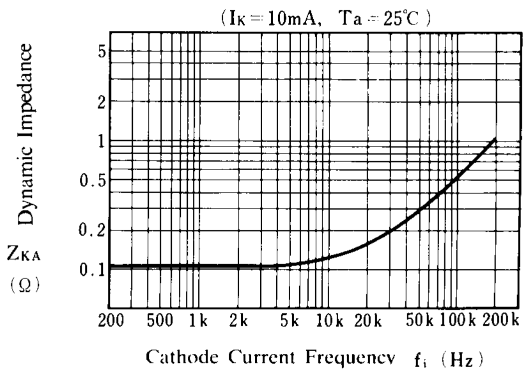
Reference Voltage



Safety Operating Boundary Condition



Dynaminc Impedance



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 fluctuation of the device.