NJM431

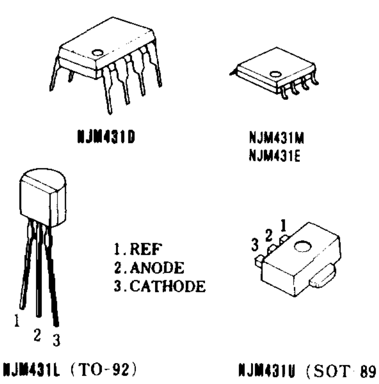
The NJM431 is a three-terminal adjustable shunt regulator. The output voltage may be set to any value between V_{REF} (about 2.5V) and 36V by two resistors. Output circuitry shows a sharp turn-on characteristics. Applications include shunt regulators, series regulators for small power and isolation regulators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

■ Absolute Maximum Ratings (Ta=25°C)

Cathode Voltage (note 1)	V_{KA}	37V
Continuous Cathode Current	I_{KA}	−100mA~150mA
Reference Input Current	I_{REF}	−50μA~10mA
Power Dissipation	P_D (L-Type)	500mW
	(D-Type)	700mW
	(M-Type)	300mW
	(U-Type)	350mW
Operating Temperature Range	T_{opr}	−20°C~+85°C
Storage Temperature Range	T_{stg}	−40°C~+125°C

(note 1) Unless specified, all voltage values are with respect to the anode terminal.

■ Package Outline



■ Recommended Operating Conditions

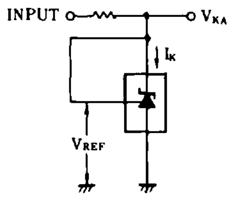
Parameter	Symbol	Min.	Typ.	Max.	Unit
Cathode Voltage	V_{KA}	V_{REF}	—	36	V
Cathode Current	I_K	1	—	100	mA

■ Electrical Characteristics (Ta=25°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	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_K=10mA$ (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≦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)

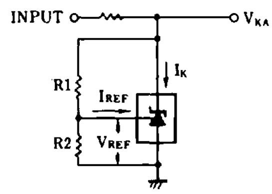
■ Test Circuits



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

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

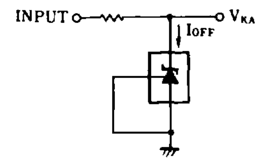
(Fig. 1)



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

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

(Fig. 2)

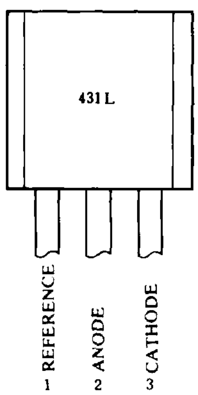


3 . I_{OFF}

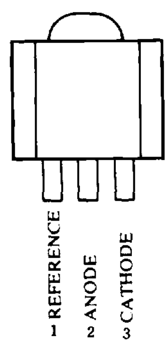
(Fig. 3)

■ Connection Diagram

L-Type

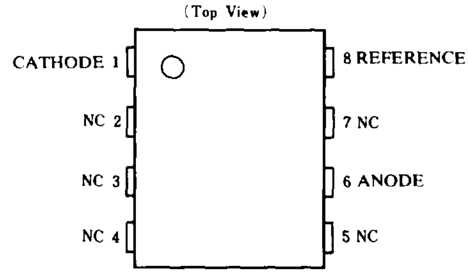


U-Type

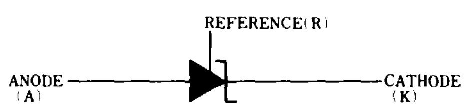


D,M-Type

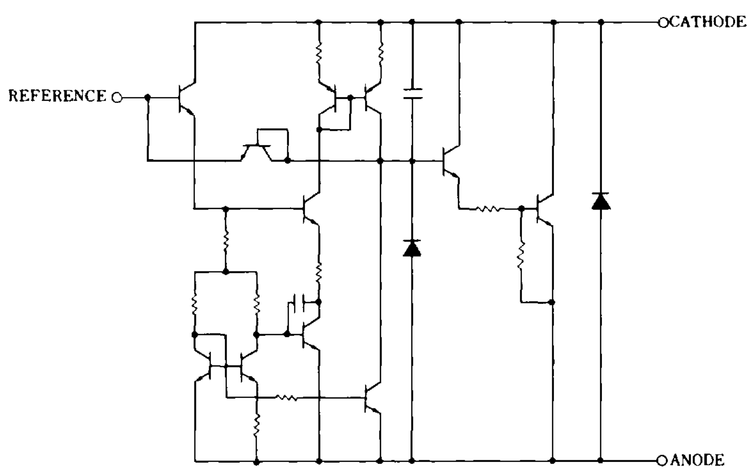
(Top View)



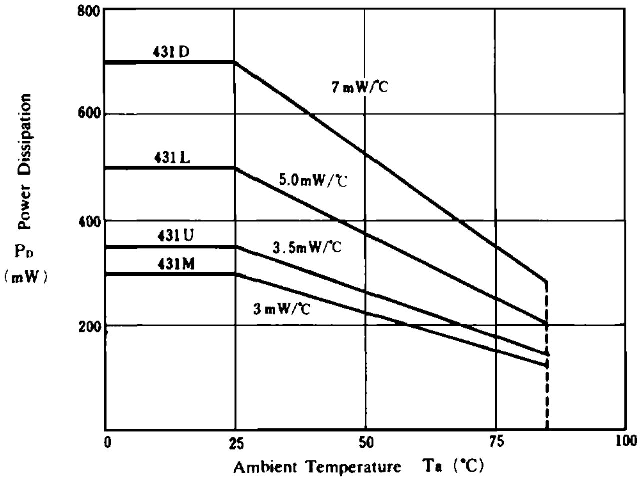
■ Block Diagram



■ Equivalent Circuit



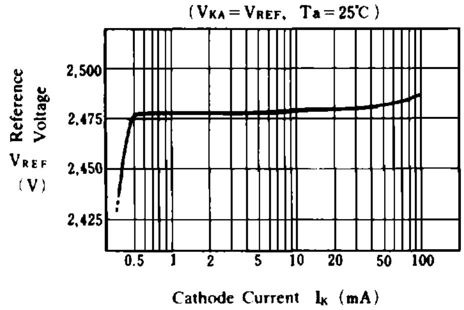
■ Power Dissipation vs. Ambient Temperature



■ Typical Characteristics

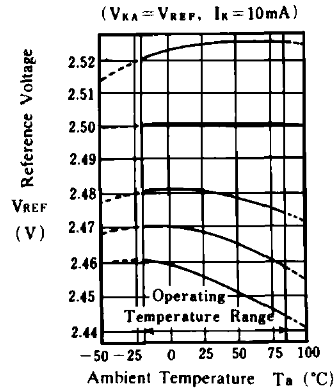
Reference Voltage

($V_{KA}=V_{REF}$, $Ta=25$℃)



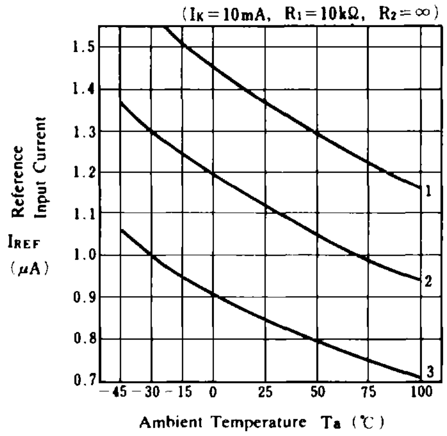
Reference Voltage

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



Reference Input Current

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

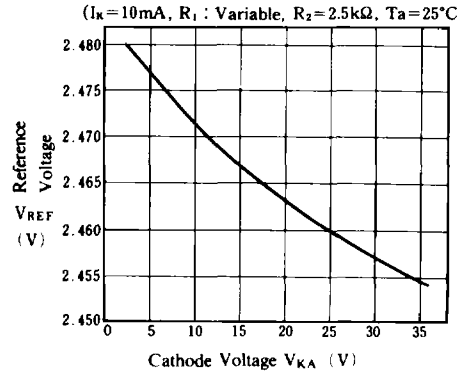


I_{REF}(dev)	
No.1	−0.38μA
No.2	−0.27μA
No.3	−0.21μA

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

Reference Voltage

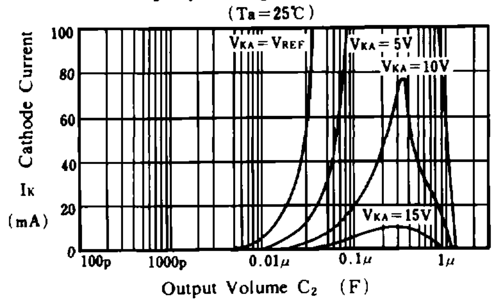
($I_K=10$mA, R_1 : Variable, $R_2=2.5$kΩ, $Ta=25$°C)



■ Typical Characteristics

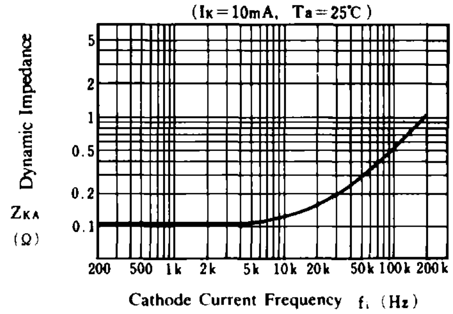
Sefety Operating Boundary Condition

(Ta=25℃)



Dynamic Impedance

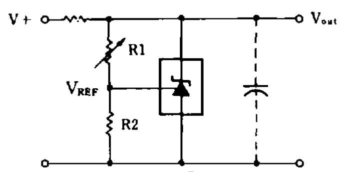
(Ik=10mA, Ta=25℃)



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.

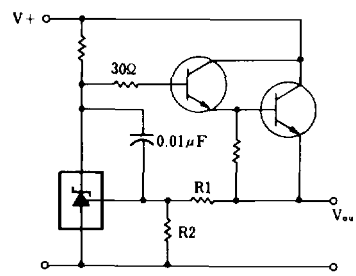
■ Typical Application

(1) Shunt Regulator



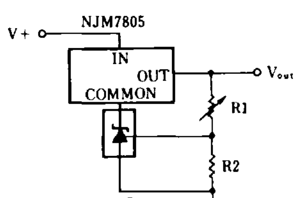
$V_{out} = \left(1+\frac{R1}{R2}\right) V_{REF}$

(2) Series Regulator



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

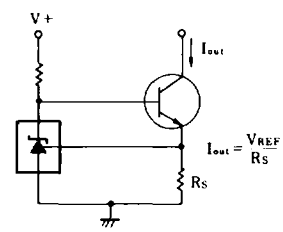
(3) Output Control of a Three-Terminal fixed Regulator



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

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

(4) Current Limiter



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