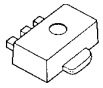
# ADJUSTABLE HIGH PRECISION SHUNT REGULATOR

## ■GENERAL DESCRIPTION

**NJM2373 / NJM2373A / NJM2376** is an adjustable high precision shunt regulator.

The output voltage can be adjusted to any value between reference voltage and 14V by two extend resistors.

## ■PACKAGE OUTLINE

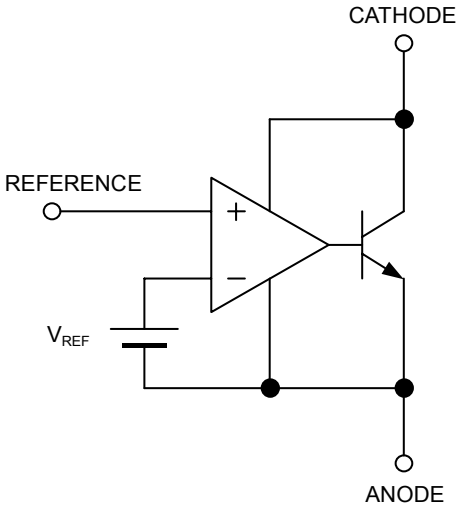


**NJM2373F/AF** **NJM2373AU**
**NJM2376F** **NJM2376U**

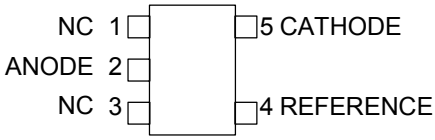
## ■FEATURES

- Operating Voltage $V_{REF}$ to 13V
- High Precision Voltage Reference NJM2373 1.25V±2%
  NJM2373A/76 1.25V±1%
- Minimum Input Current 80μA typ.
- Adjustable Output Voltage
- Bipolar Technology
- Package Outline SOT-89 (3pin), MTP5

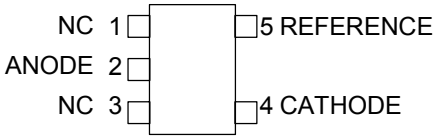
## ■BLOCK DIAGRAM



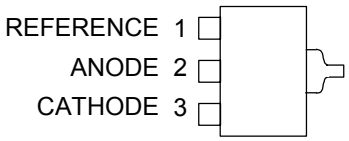

## ■PIN CONFIGURATION



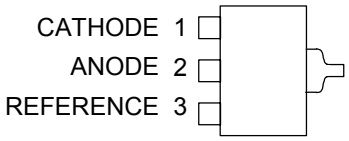

NJM2373F/73AF




NJM2376F




NJM2373AU




NJM2376U

■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| PARAMETER | SYMBOL | MAXIMUM RATINGS | UNIT |
|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | +14 | V |
| Continuous Cathode Current | $I_K$ | -30 ~ 50 | mA |
| Reference Input Current | $I_{REF}$ | -10 ~ 0.05 | mA |
| Power Dissipation | $P_D$ | (SOT-89) 350<br>(MTP5) 200 | mW |
| Operating Temperature Range | $T_{OPR}$ | -40 ~ +85 | °C |
| Storage Temperature Range | $T_{STG}$ | -40 ~ +150 | °C |

■RECOMMENDED OPERATING CONDITIONS (Ta=25°C)

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | $V_{REF}$ | – | 13 | V |
| Cathode Current | $I_K$ | 0.5 | – | 30 | mA |

■ELECTRICAL CHARACTERISTICS ($I_K$=1mA, Ta=25°C)

| PARAMETER | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Reference Voltage | $V_{REF}$ | $V_{KA}=V_{REF}$<br>NJM2373A | (*1) | 1225 | 1250 | 1275 | mV |
| | | $V_{KA}=V_{REF}$<br>NJM2373A/ NJM2376 | (*1) | 1237 | 1250 | 1263 | |
| Reference Voltage Change vs. Cathode Voltage Change | $\Delta V_{REF}/\Delta V_{KA}$ | $\lvert V_{REF} \rvert \leq V_{KA} \leq 5V$ | (*2) | – | – | ±2.7 | mV/V |
| | | $5V \leq V_{KA} \leq 13V$ | (*2) | – | – | ±2.0 | mV/V |
| Reference Input Current | $I_{REF}$ | $V_{KA}=V_{REF}$<br>R1=10kΩ, R2=∞ | (*2) | – | 2.0 | 4.0 | μA |
| Minimum Input Current | $I_{MIN}$ | $V_{KA}=V_{REF}$, $\Delta V_{REF}$=±1% | (*1) | – | 80 | 500 | μA |
| Cathode Current (Off Cond.) | $I_{OFF}$ | $V_{KA}$=13V, $V_{REF}$=0V | (*3) | – | 0.01 | 1.0 | μA |
| Dynamic Impedance | $\lvert Z_{KA} \rvert$ | $V_{KA}=V_{REF}$, f≤1kHz<br>0.5mA ≤ $I_K$ ≤ 30mA | (*1) | – | 0.12 | – | Ω |

■TEMPERATURE CHARACTERISTICS ($I_K$=1mA, Ta= -40°C ~ 85°C)

| PARAMETER | SYMBOL | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Reference Voltage Change | $\Delta V_{REF}$ | $V_{KA}=V_{REF}$ | (*1) | – | ±10 | – | mV |
| Reference Input Current Change | $\Delta I_{REF}$ | $V_{KA}=V_{REF}$<br>R1=10kΩ, R2=∞ | (*2) | – | 0.5 | – | μA |

$\lvert V_{REF} \rvert$ ···Reference voltage includes error.

(*1): Test Circuit (Fig.1)

(*2): Test Circuit (Fig.2)

(*3): Test Circuit (Fig.3)

■TEST CIRCUIT

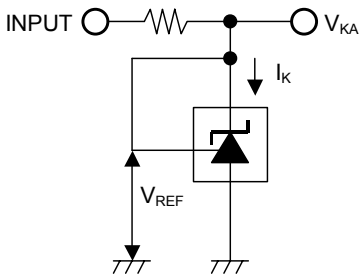



Fig.1 $V_{KA}=V_{REF}$ to test circuit

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

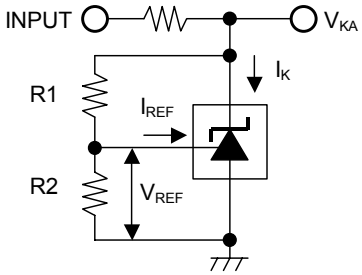



Fig.2 $V_{KA}>V_{REF}$ to test circuit

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

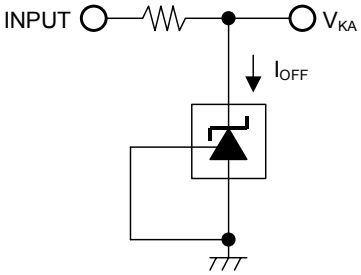



Fig.3 $I_{OFF}$ to test circuit

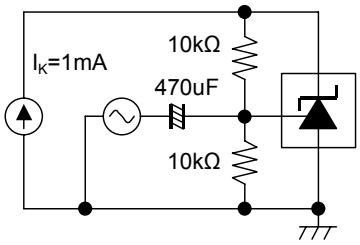
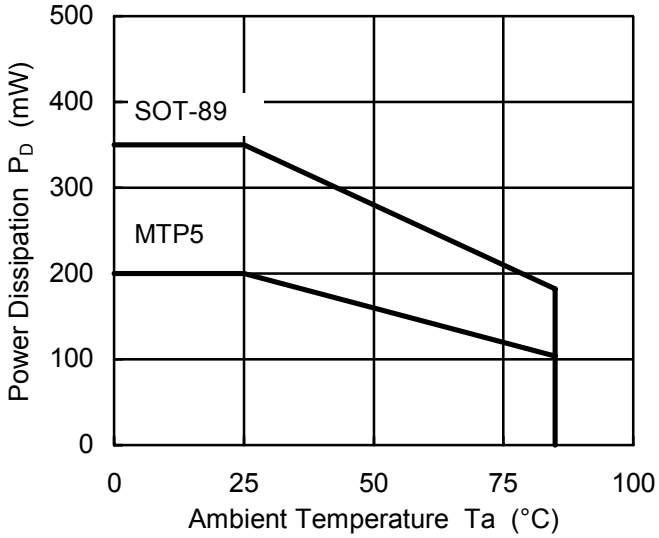


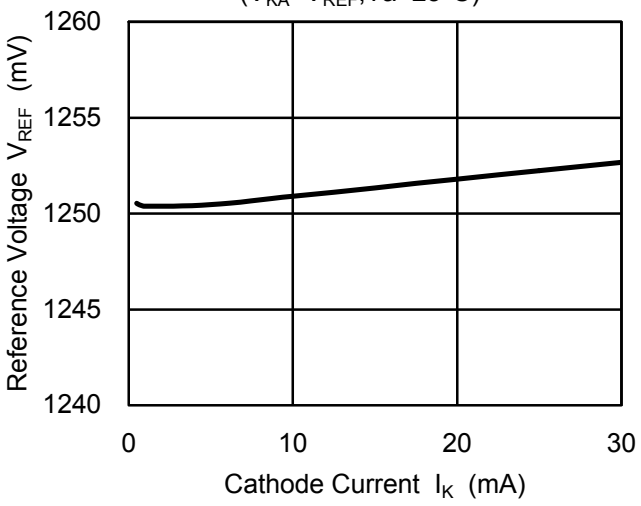

Fig.4 Gain and Phase to test circuit

■POWER DISSIPATION VS. AMBIENT TEMPERATURE

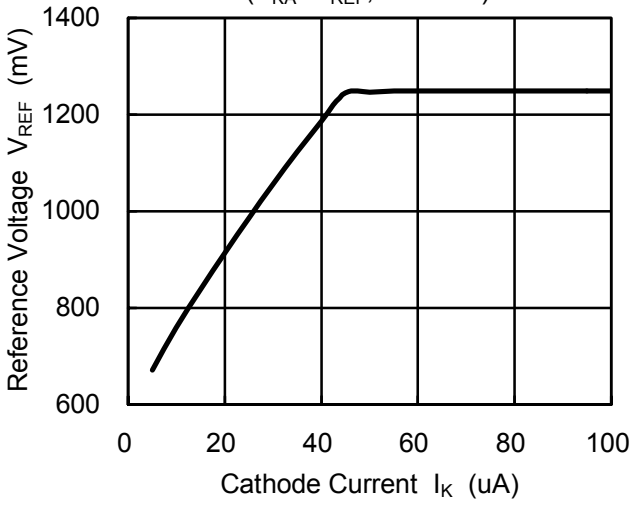


■TYPICAL CHARACTERISTICS

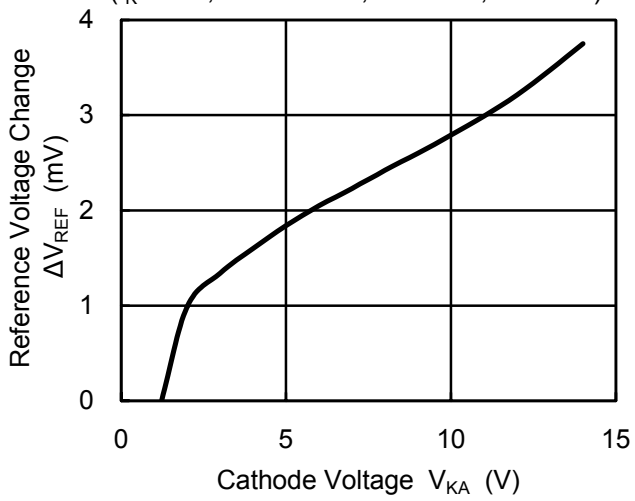
Reference Voltage vs. Cathode Current
($V_{KA}$=$V_{REF}$,Ta=25°C)



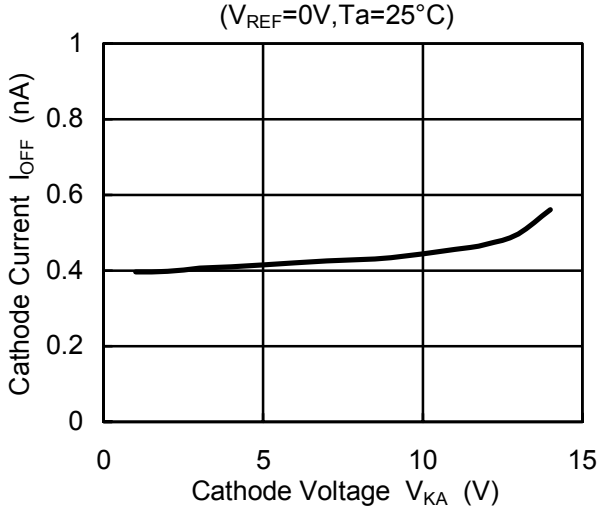

Reference Voltage vs. Cathode Current
($V_{KA}$=$V_{REF}$,Ta=25°C)



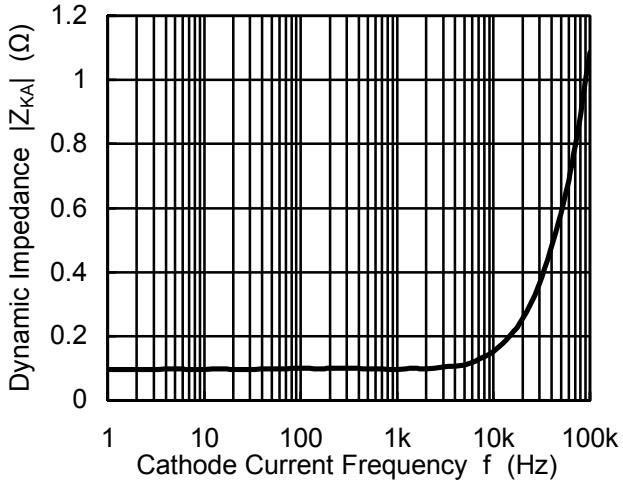

Reference Voltage Change vs. Cathode Voltage
($I_K$=1mA,R1=Variable,R2=10kΩ,Ta=25°C)



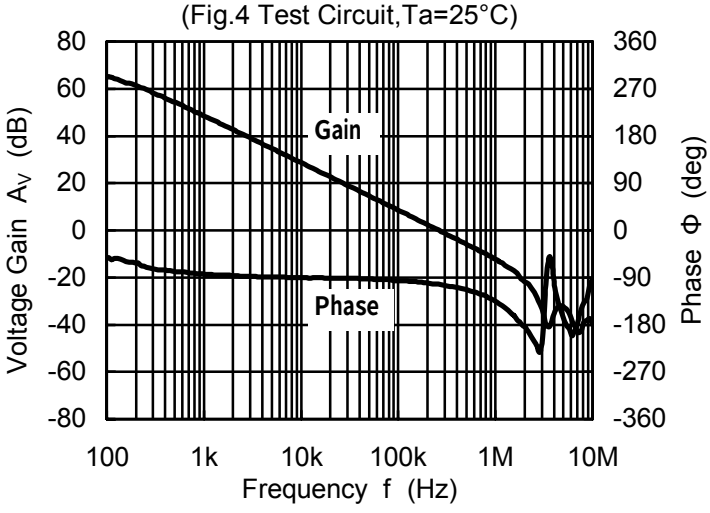

Cathode Current (Off Cond.) vs. Cathode Voltage
($V_{REF}$=0V,Ta=25°C)




Dynamic Impedance
($I_K$=0.5~30mA,$V_{KA}$=$V_{REF}$,Ta=25°C)



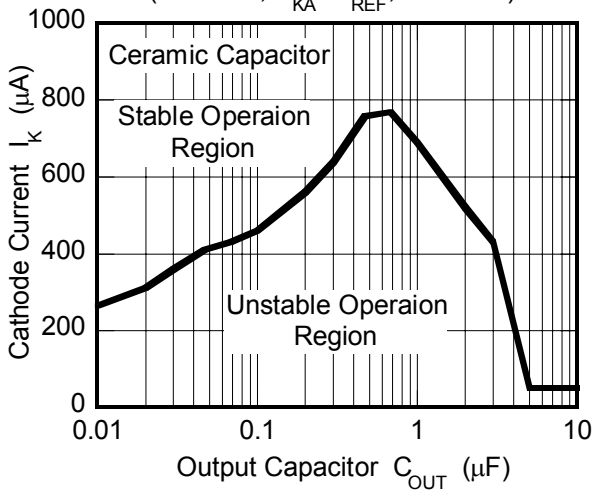

Voltage Gain · Phase vs. Frequency
(Fig.4 Test Circuit,Ta=25°C)



■TYPICAL CHARACTERISTICS

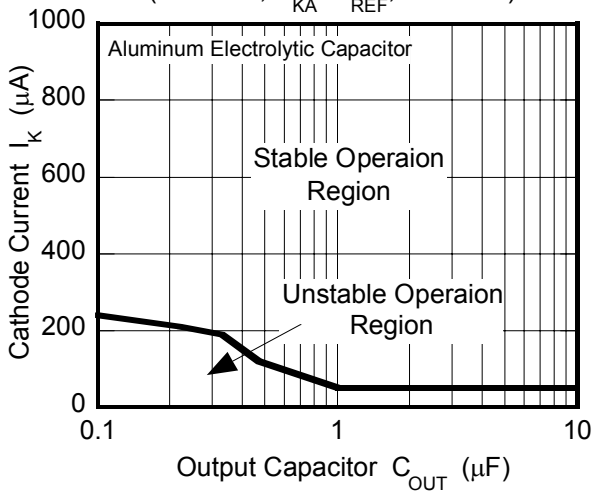
Safety Operating Boundary Condition

(Rin=1kΩ, $V_{KA}$=$V_{REF}$, Ta=25°C)



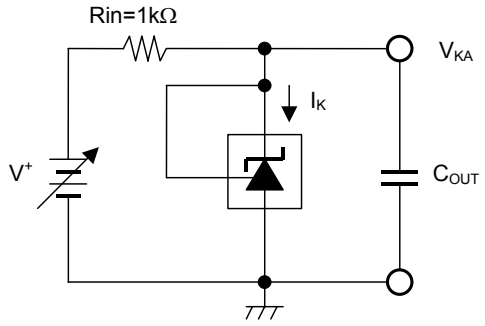

Safety Operating Boundary Condition

(Rin=1kΩ, $V_{KA}$=$V_{REF}$, Ta=25°C)




Safety Operating Boundary Condition

Test Circuit

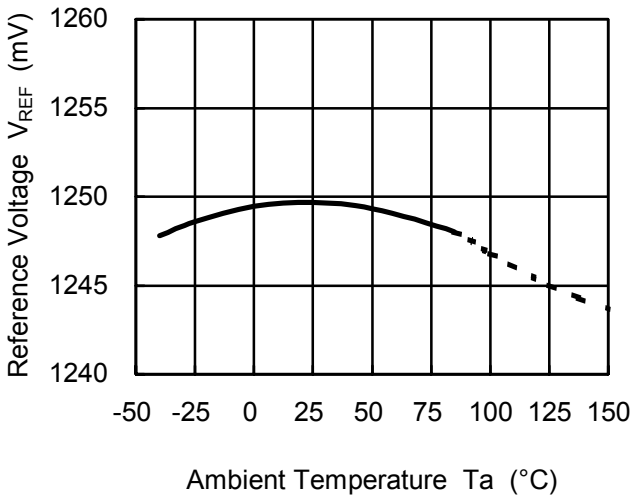



Note) Oscillation might occur while operating within the range of safety curve.

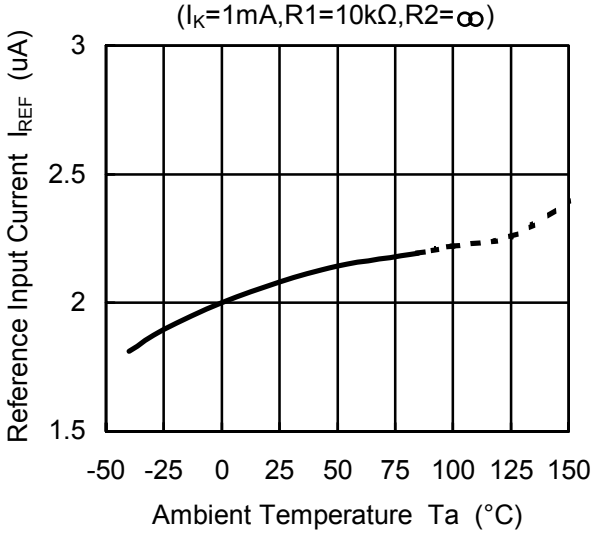
So that, it is necessary to make ample margins by taking considerations of fluctuation of the device.

■TYPICAL CHARACTERISTICS

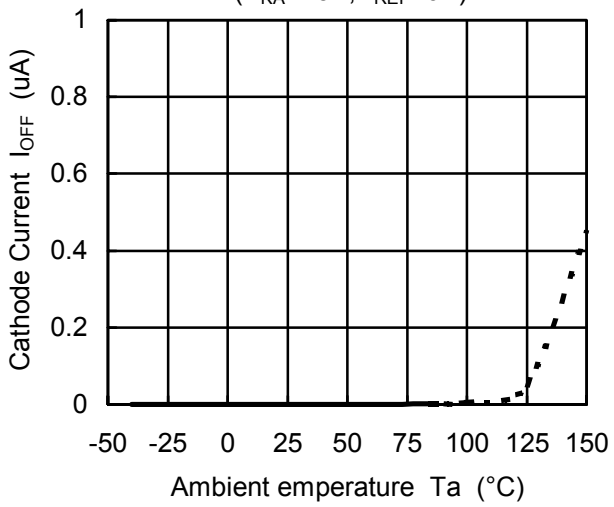
Reference Voltage vs. Temperature
($I_K$=1mA,$V_{KA}$=$V_{REF}$)



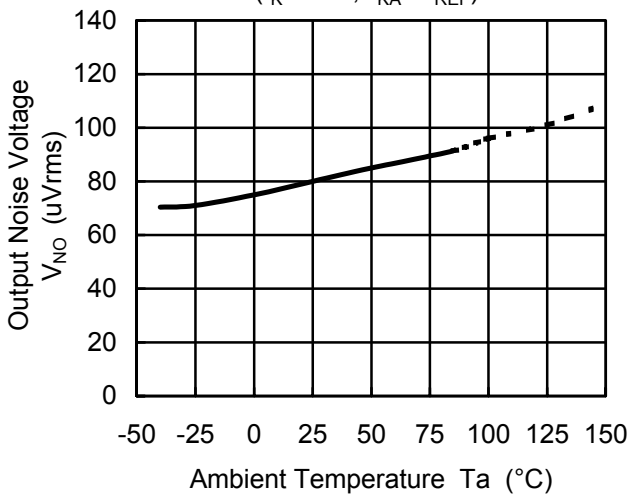

Reference Input Current vs. Temperature
($I_K$=1mA,R1=10kΩ,R2=∞)




Cathode Current (Off Cond.) vs. Temperature
($V_{KA}$=13V,$V_{REF}$=0V)




Output Noise Voltage vs. Temperature
($I_K$=1mA,$V_{KA}$=$V_{REF}$)



# MEMO

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