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New Japan Radio Co.,Ltd.

www.njr.com

ADJUSTABLE 3-TERMINAL POSITIVE VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

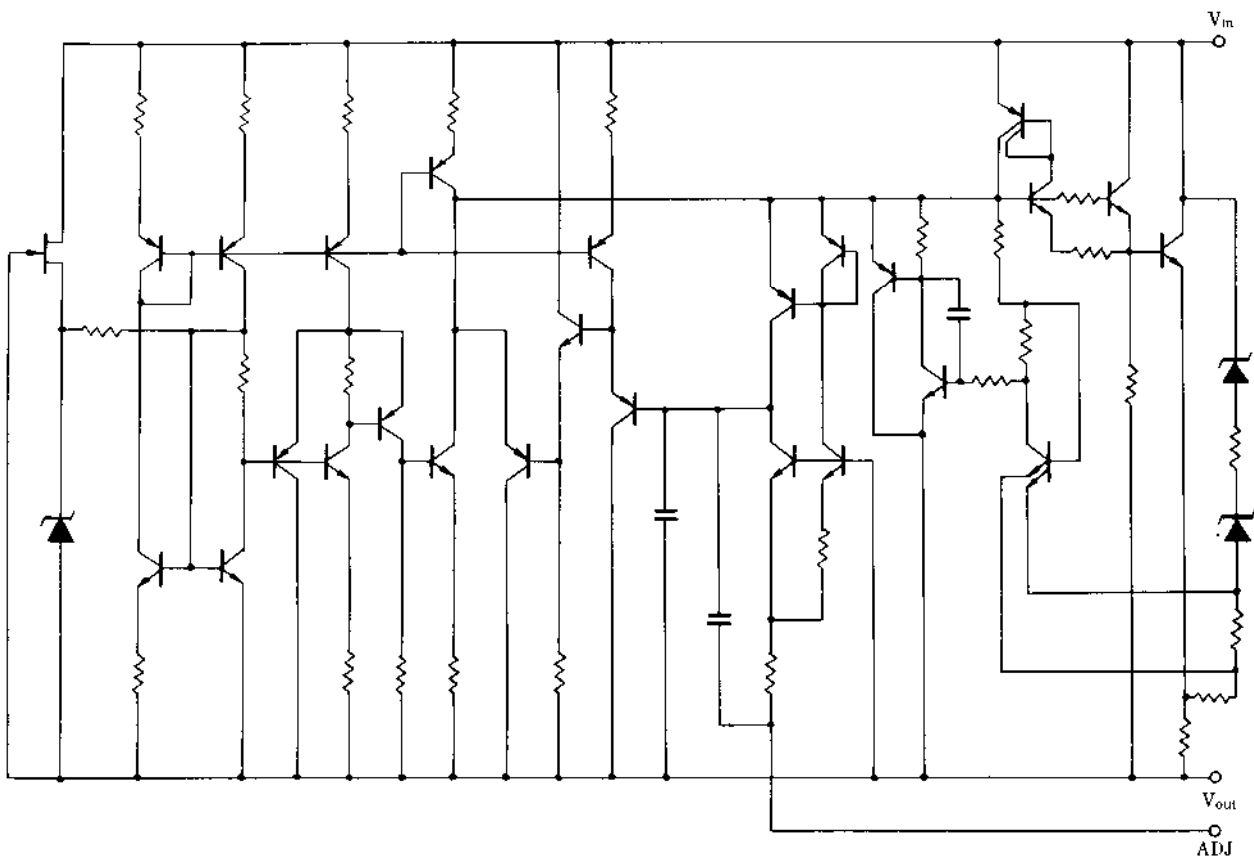
The NJM317 is adjustable 3-terminal positive voltage regulator IC. It is capable of adjustment from typical 1.25V to 37V output voltage range with two resistors. It is capable of supplying in excess of 1.5A with heat sink.

The NJM317 is suitable for the power supply for general purpose.

■ FEATURES

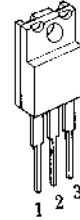
- Operating Voltage (+4.25V to +40V)
- Adjustable Output Down to 1.2V
- Guarantee'd 1.5A Output Current
- Line Regulation typically (0.01%/V)
- Load Regulation typically (0.1%)
- 80dB Ripple Rejection
- Package Outline TO-220F, TO-252
- Bipolar Technology

■ EQUIVALENT CIRCUIT



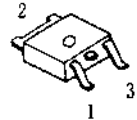
■ PACKAGE OUTLINE

(TO-220F)



NJM317F

(TO-252)



NJM317DL1

1. Adjustment
2. Output
3. Input

■ ABSOLUTE MAXIMUM RATINGS

(T_a=25°C)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|--|---|------|
| Input-Output Differential Voltage | V _{IN} - V _O | 40 (T _C =25°C) | V |
| Power Dissipation | P _D | TO-220F 16 (T _C ≤70°C) TO-252 10 (T _C ≤25°C) 1 (T _a ≤25°C) | W |
| Operating Temperature Range (Junction) (Ambient) | T _{opr (j)} T _{opr (a)} | -40 to +150 -40 to +85 | °C |
| Storage Temperature Range | T _{stg} | -50 to +150 | °C |

■ THERMAL CHARACTERISTICS

| | | | TO-220F | TO-252 | | |
|--------------------|---------------------|-----------------|---------|--------|------|--|
| Thermal Resistance | Junction-To-Ambient | θ _{ja} | 60 | 125 | °C/W | |
| | Junction-To-Case | θ _{jc} | 5 | 12.5 | | |

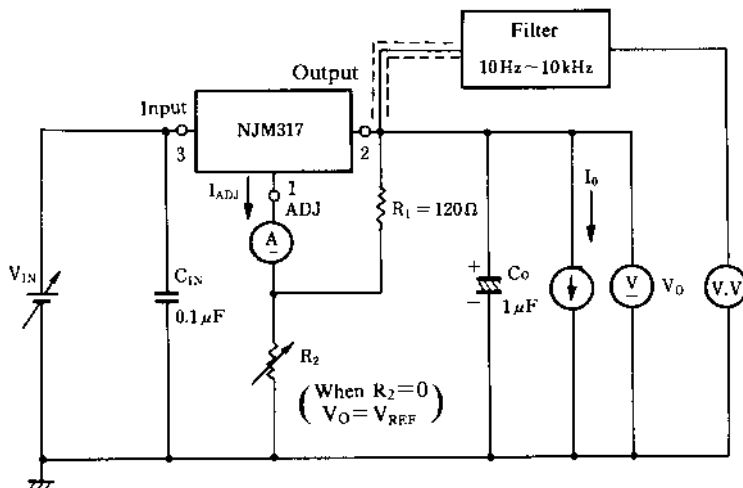
■ ELECTRICAL CHARACTERISTICS (V_{IN} - V_O = 5V, I_O = 500mA, C_{IN} = 0.1μF, C_O = 1μF, T_J = 25°C)

Measurement is to be conducted in pulse testing.

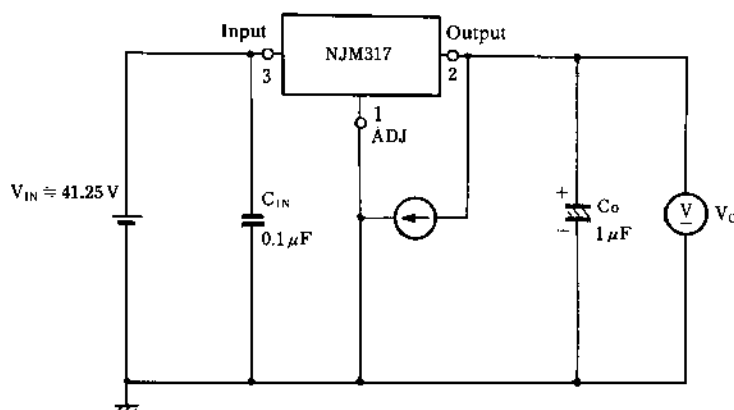
| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|----------------------------------|-------------------------------------|--|------|-------|------|------------------|
| Reference Voltage | V _{REF} | 3V ≤ (V _{IN} - V _O) ≤ 40V, I _O = 100mA 10mA ≤ I _O ≤ 1.5A (TO-220F) 10mA ≤ I _O ≤ 500mA (TO-252) | 1.2 | 1.25 | 1.3 | V |
| | V _{REF} - V _{IN} | | 1.2 | 1.25 | 1.3 | |
| | V _{REF} - I _O | | 1.2 | 1.25 | 1.3 | |
| | | | 1.2 | 1.25 | 1.3 | |
| Reference Voltage Thermal Change | ΔV _{REF-T} | 0 ≤ T _J ≤ 125°C | - | 5 | - | mV |
| Adjustment Pin Current | I _{ADJ} | | - | 50 | 100 | μA |
| Adjustment Pin Current Change | ΔI _{ADJ} - V _{IN} | 3V ≤ (V _{IN} - V _O) ≤ 40V, I _O = 100mA 10mA ≤ I _O ≤ 1.5A (TO-220F) 10mA ≤ I _O ≤ 500mA (TO-252) | - | 0.2 | 5 | μA |
| | ΔI _{ADJ} - I _O | | - | 0.2 | 5 | |
| | | | - | 0.2 | 5 | |
| Line Regulation | ΔV _O - V _{IN} | 3V ≤ (V _{IN} - V _O) ≤ 40V, I _O = 100mA | - | 0.01 | 0.04 | %/V |
| Load Regulation | ΔV _O - I _O | 10mA ≤ I _O ≤ 1.5A (TO-220F) 10mA ≤ I _O ≤ 500mA (TO-252) V _O ≤ 5V V _O > 5V | - | 5 | 25 | mV % |
| | | | - | 0.1 | 0.5 | |
| | | | | | | |
| Minimum Load Current | I _{O(MIN)} | (V _{IN} - V _O) = 40V | - | 3.5 | 10 | mA |
| Peak Output Current | I _{O(PEAK)} | 5V ≤ (V _{IN} - V _O) ≤ 15V (V _{IN} - V _O) = 40V | 1.5 | 2.2 | - | A |
| | | | 0.15 | 0.4 | - | |
| RMS Output Noise Voltage | V _{NO} | 10Hz ≤ f ≤ 10kHz (RMS) | - | 0.001 | - | %/V _O |
| Ripple Rejection Ratio | RR | V _O = 10V, f = 120Hz, ΔV _{IN} = 1V _{rms} C _{ADJ} = 0 C _{ADJ} = 10μF | - | 65 | - | dB |
| | | | 66 | 80 | - | |
| | | | | | | |

■ TEST CIRCUIT

- 1) (Reference Voltage Thermal Change), (Adjustment Pin Current Change), (Line Regulation), (Load Regulation), (Peak Output Current), (RMS Output Noise Current)

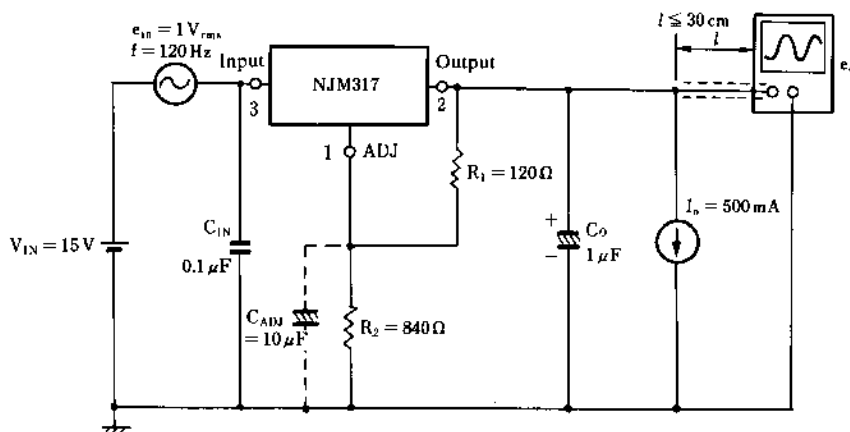


- 2) Minimum Load Current



$I_{O\text{MIN}}$: Minimum I_o for
 $V_o = V_{\text{REF}}$ (Typical 1.25V)
 $(V_{\text{IN}} = 40 + V_{\text{REF}})$

- 3) Ripple Rejection

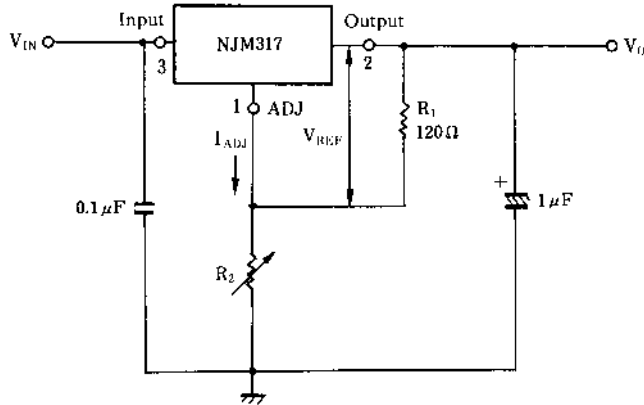


$$\text{Ripple Rejection} = 20 \log_{10} \left(\frac{e_{\text{IN}}}{e_o} \right) \text{ [dB]}$$

NJM317

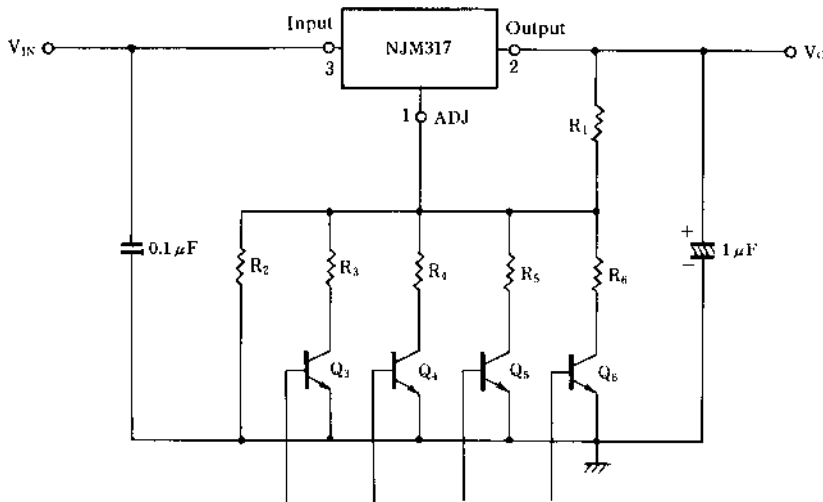
■ TYPICAL APPLICATIONS

1) $V_O = 1.25V$ to $37V$ Adjustable Voltage Regulator



$$V_O = V_{REF} \times \left(1 + \frac{R_2}{R_1}\right) + R_2 \times I_{ADJ}$$

2) Selected Output Voltage



Selective Signal Inputs

The transistors Q_3 are switched by selective signal inputs and the output voltage V_O is controlled by the transistor on or off.

(Example)

When all transistor is off,

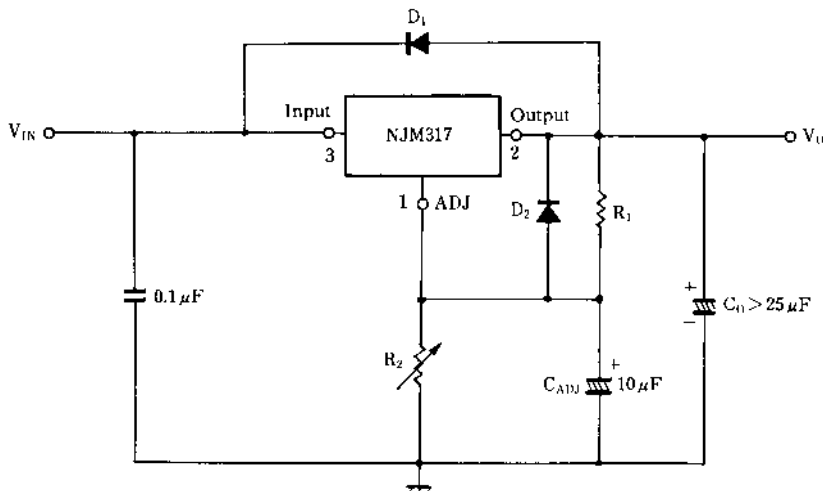
$$V_O \approx V_{REF} \times \left(1 + \frac{R_2}{R_1}\right)$$

When the transistor Q_3 is on, and others are off.

$$V_O \approx V_{REF} \times \left\{1 + \frac{R_2 \times R_3}{(R_2 + R_3) \times R_1}\right\}$$

* I_{ADJ} ignore.

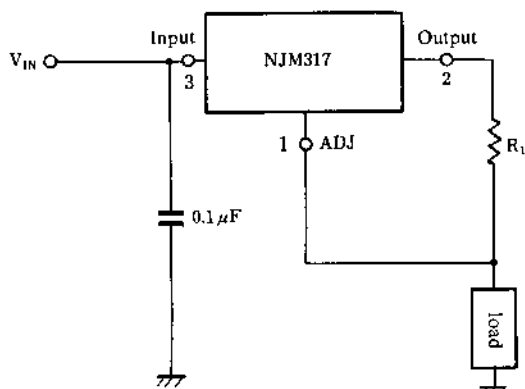
3) Regulator with Protection Diodes



D_1 protects about C_O

D_2 protects about C_{ADJ}

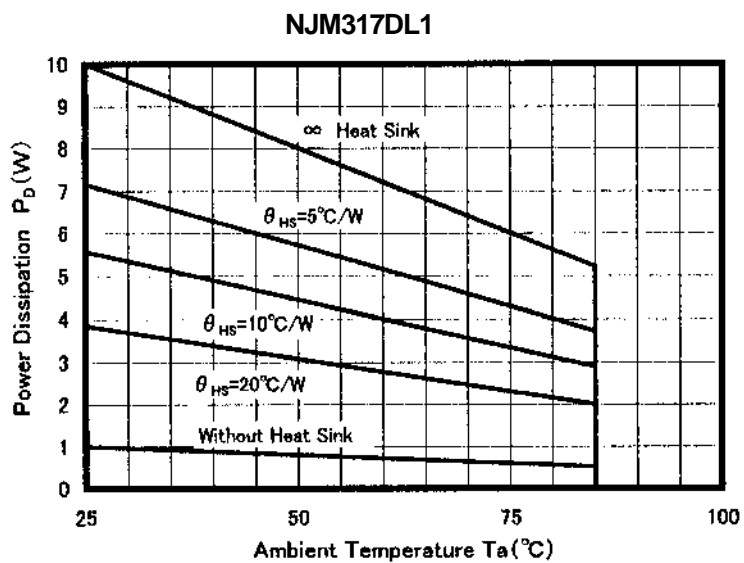
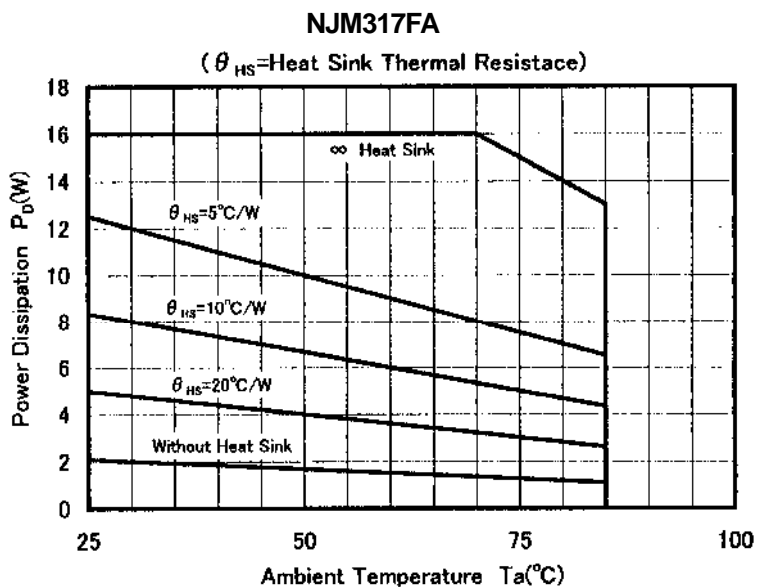
4) Constant Current Regulator



$$R_1 \leq 125\Omega$$

$$10\text{mA} \leq I_o \leq 1.5\text{A}$$

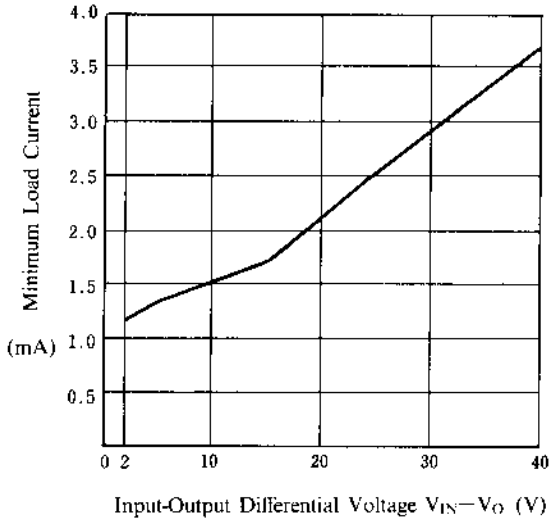
$$I_o = \frac{V_{REF}}{R_1}$$



■ TYPICAL CHARACTERISTICS

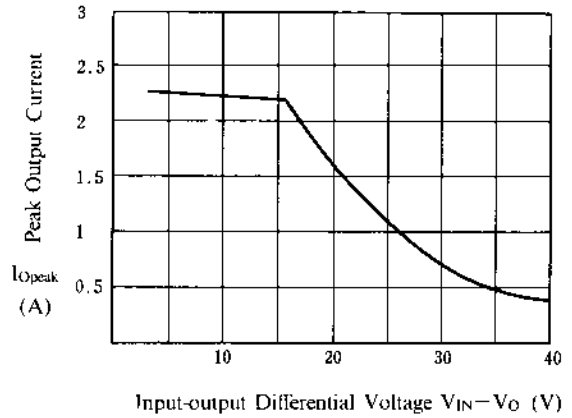
Minimum Load Current

($T_a = 25^\circ\text{C}$, $V_{OUT} = 1.25(V_{REF})$)



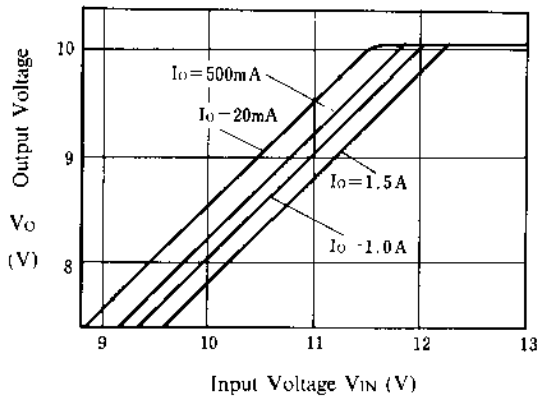
Peak Output Current vs. Input-Output Differential Voltage

($T_a = 25^\circ\text{C}$)



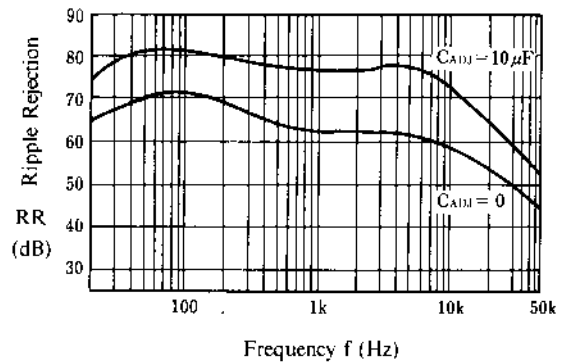
Output Voltage vs. Input Voltage.

($T_a = 25^\circ\text{C}$)



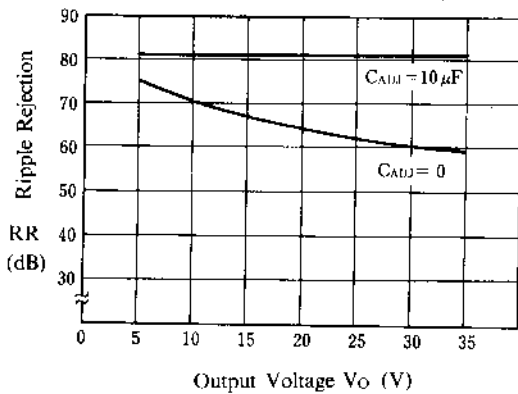
Ripple Rejection vs. Frequency

($V_{IN} = 15\text{V}$, $V_O = 10\text{V}$, $e_{in} = 1\text{Vrms}$, $I_O = 500\text{mA}$, $T_a = 25^\circ\text{C}$)



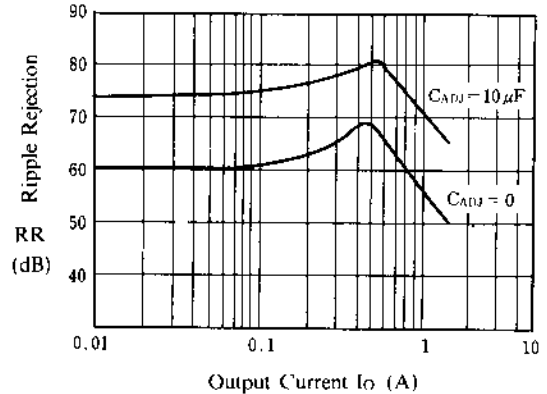
Ripple Rejection vs. Output Voltage

($V_{IN} - V_O = 5\text{V}$, $e_{in} = 1\text{Vrms}$, $f = 120\text{Hz}$, $I_O = 500\text{mA}$, $T_a = 25^\circ\text{C}$)



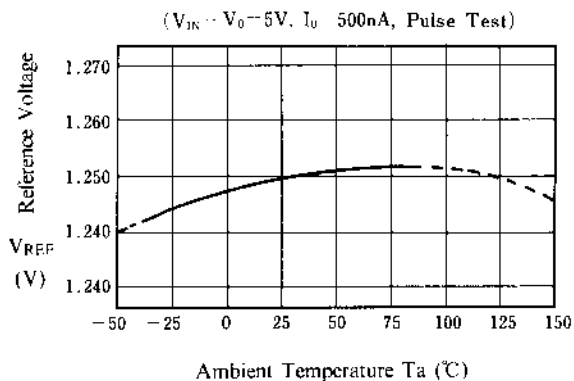
Ripple Rejection vs. Output Current

($V_{IN} = 15\text{V}$, $V_O = 10\text{V}$, $f = 120\text{Hz}$, $e_{in} = 1\text{Vrms}$, $T_a = 25^\circ\text{C}$)

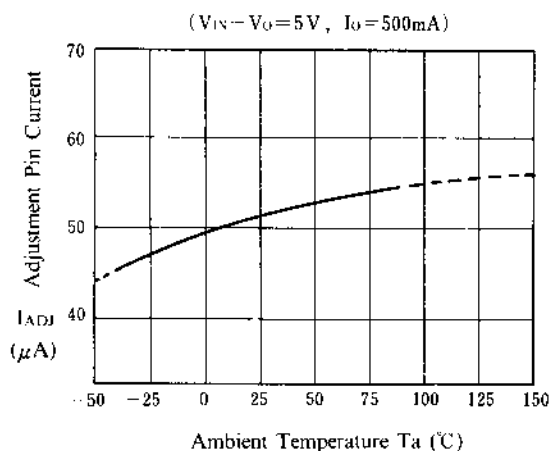


■ TYPICAL CHARACTERISTICS

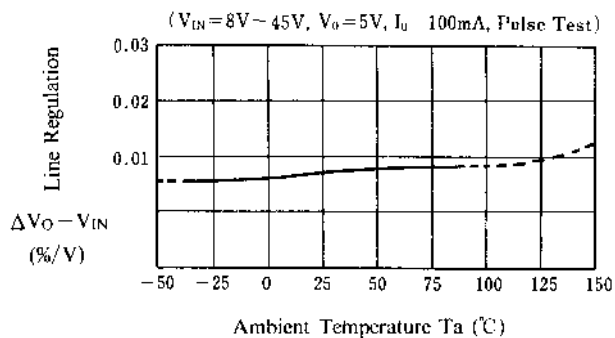
Reference Voltage vs. Temperature



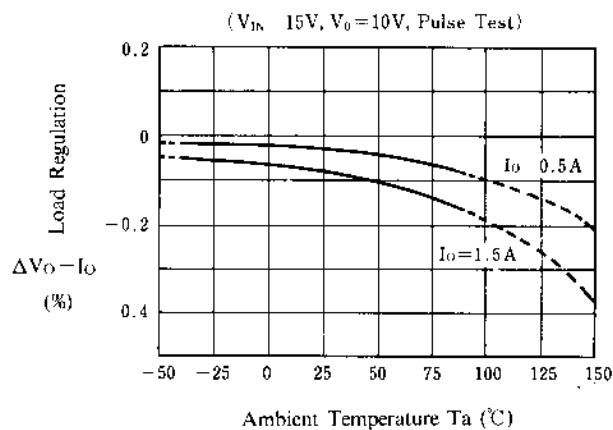
Adjustment Pin Current vs. Temperature



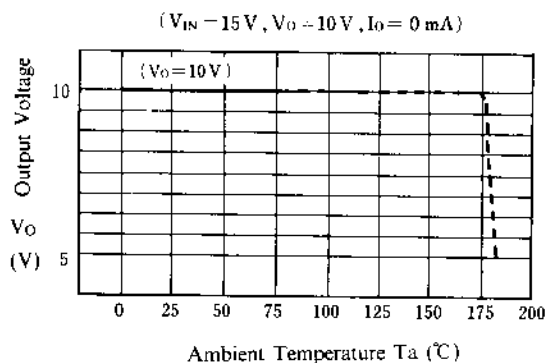
Line Regulation vs. Temperature



Load Regulation vs. Temperature





Thermal Shutdown



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