

## ADJUSTABLE 3-TERMINAL POSITIVE VOLTAGE REGULATOR

### ■ GENERAL DESCRIPTION

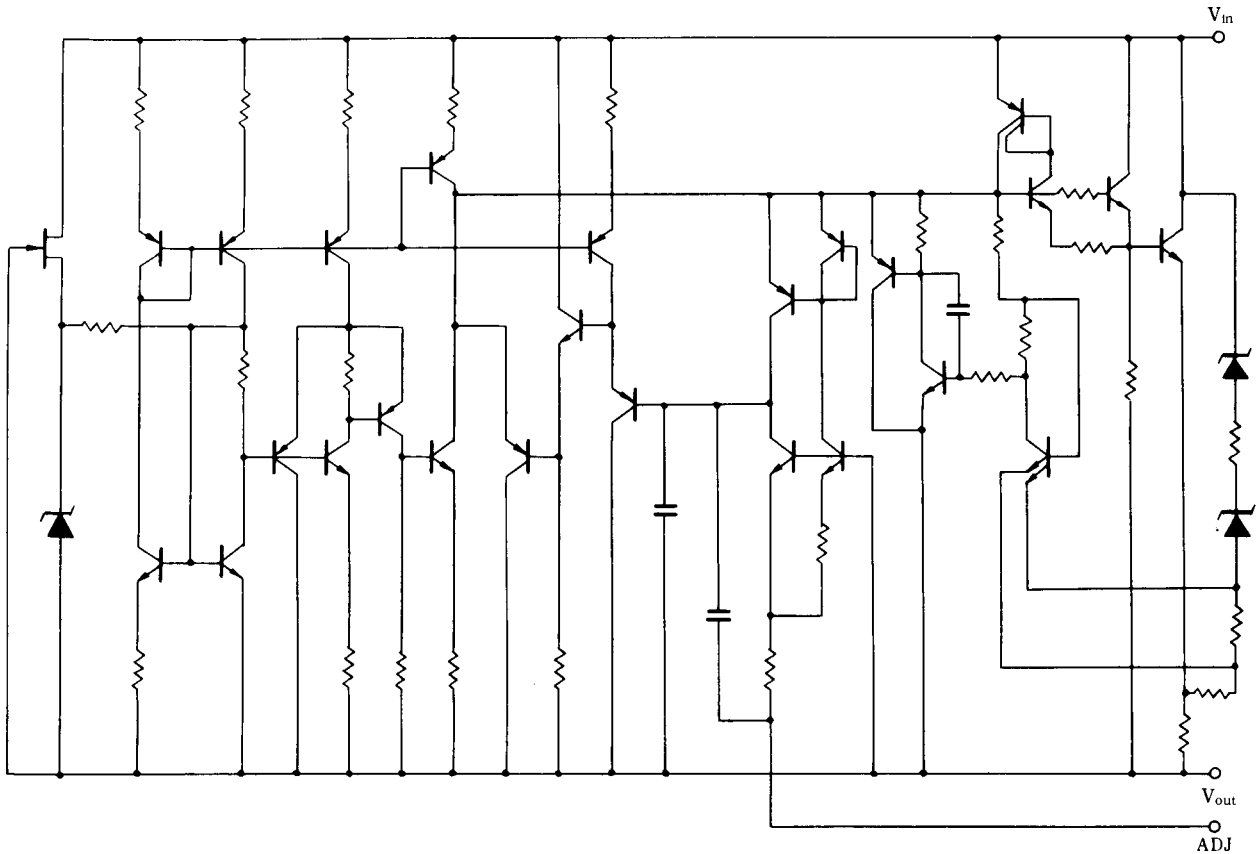
The NJM317 is adjustable 3-terminal positive voltage regulator IC. It is capable of adjustment from typical 1.25V to 37V output voltage range with two resistors. It is capable of supplying in excess of 1.5A with heat sink.

The NJM317 is suitable for the power supply of VCR, CD player and others.

### ■ FEATURES

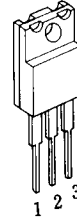
- Operating Voltage (+4.25V to +40V)
- Adjustable Output Down to 1.2V
- Guarantee'd 1.5A Output Current
- Line Regulation typically (0.01%/V)
- Load Regulation typically (0.1%)
- 80dB Ripple Rejection
- Package Outline TO-220F
- Bipolar Technology

### ■ EQUIVALENT CIRCUIT

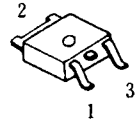


### ■ PACKAGE OUTLINE

(TO-220F)



(TO-252)



NJM317F

NJM317DL1

1. Adjustment
2. Output
3. Input

# NJM317

## ■ ABSOLUTE MAXIMUM RATINGS

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

PARAMETER	SYMBOL	RATINGS	UNIT
Input-Output Differential Voltage	$V_{IN} - V_O$	40 ( $T_C=25^\circ\text{C}$ )	V
Power Dissipation	$P_D$	TO-220F 16 ( $T_C \leq 70^\circ\text{C}$ ) TO-252 10 ( $T_C \leq 25^\circ\text{C}$ ) 1 ( $T_a \leq 25^\circ\text{C}$ )	W
Operating Temperature Range (Junction) (Ambient)	$T_{opr(j)}$ $T_{opr(a)}$	-40 to +150 -40 to +85	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-50 to +150	$^\circ\text{C}$

## ■ THERMAL CHARACTERISTICS

			TO-220F	TO-252		
Thermal Resistance	Junction-To-Ambient	$\theta_{ja}$	60	125	$^\circ\text{C/W}$	
	Junction-To-Case	$\theta_{jc}$	5	12.5		

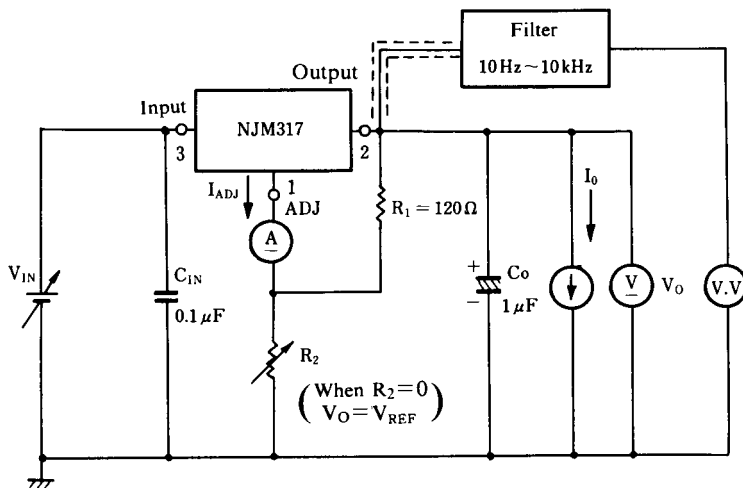
## ■ ELECTRICAL CHARACTERISTICS ( $V_{IN} - V_O = 5\text{V}$ , $I_O = 500\text{mA}$ , $C_{IN} = 0.1\mu\text{F}$ , $C_O = 1\mu\text{F}$ , $T_J = 25^\circ\text{C}$ )

Measurement is to be conducted in pulse testing.

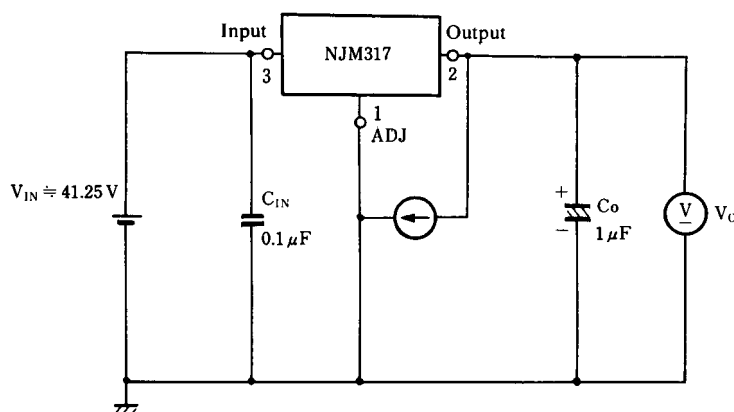
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage	$V_{REF}$	$3\text{V} \leq (V_{IN} - V_O) \leq 40\text{V}$ , $I_O = 100\text{mA}$ $10\text{mA} \leq I_O \leq 1.5\text{A}$ (TO-220F) $10\text{mA} \leq I_O \leq 500\text{mA}$ (TO-252)	1.2	1.25	1.3	V
	$V_{REF-V_{IN}}$		1.2	1.25	1.3	
	$V_{REF-I_O}$		1.2	1.25	1.3	
			1.2	1.25	1.3	
Reference Voltage Thermal Change	$\Delta V_{REF-T}$	$0 \leq T_J \leq 125^\circ\text{C}$	-	5	-	mV
Adjustment Pin Current	$I_{ADJ}$		-	50	100	$\mu\text{A}$
Adjustment Pin Current Change	$\Delta I_{ADJ} - V_{IN}$	$3\text{V} \leq (V_{IN} - V_O) \leq 40\text{V}$ , $I_O = 100\text{mA}$ $10\text{mA} \leq I_O \leq 1.5\text{A}$ (TO-220F) $10\text{mA} \leq I_O \leq 500\text{mA}$ (TO-252)	-	0.2	5	$\mu\text{A}$
	$\Delta I_{ADJ} - I_O$		-	0.2	5	
			-	0.2	5	
Line Regulation	$\Delta V_O - V_{IN}$	$3\text{V} \leq (V_{IN} - V_O) \leq 40\text{V}$ , $I_O = 100\text{mA}$	-	0.01	0.04	$\%/V$
Load Regulation	$\Delta V_O - I_O$	$10\text{mA} \leq I_O \leq 1.5\text{A}$ (TO-220F) $10\text{mA} \leq I_O \leq 500\text{mA}$ (TO-252) $V_O \leq 5\text{V}$ $V_O > 5\text{V}$	-	5	25	mV %
			-	0.1	0.5	
Minimum Load Current	$I_{O(MIN)}$	$(V_{IN} - V_O) = 40\text{V}$	-	3.5	10	mA
Peak Output Current	$I_{O(PEAK)}$	$5\text{V} \leq (V_{IN} - V_O) \leq 15\text{V}$ $(V_{IN} - V_O) = 40\text{V}$	1.5	2.2	-	A
			0.15	0.4	-	
RMS Output Noise Voltage	$V_{NO}$	$10\text{Hz} \leq f \leq 10\text{kHz}$ (RMS)	-	0.001	-	$\%/V_O$
Ripple Rejection Ratio	RR	$V_O = 10\text{V}$ , $f = 120\text{Hz}$ , $\Delta V_{IN} = 1\text{V}_{rms}$ $C_{ADJ} = 0$ $C_{ADJ} = 10\mu\text{F}$	-	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)

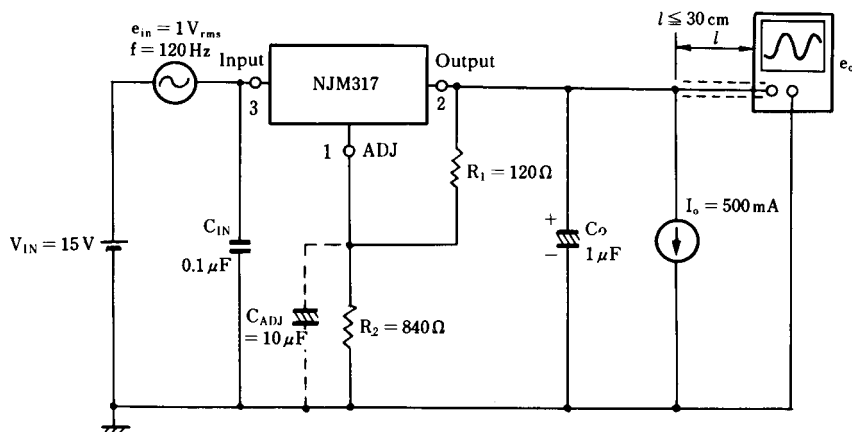


- 2) Minimum Load Current



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

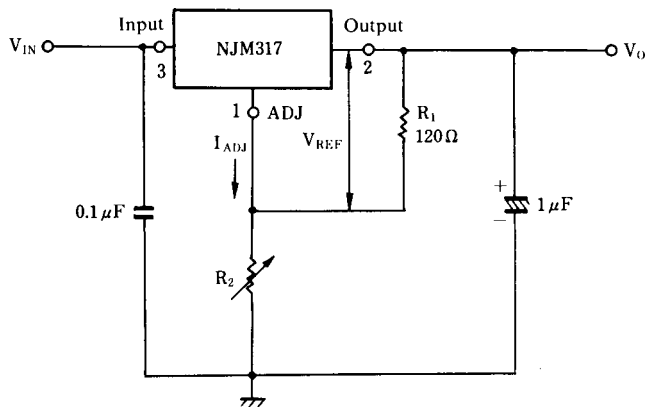
- 3) Ripple Rejection



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

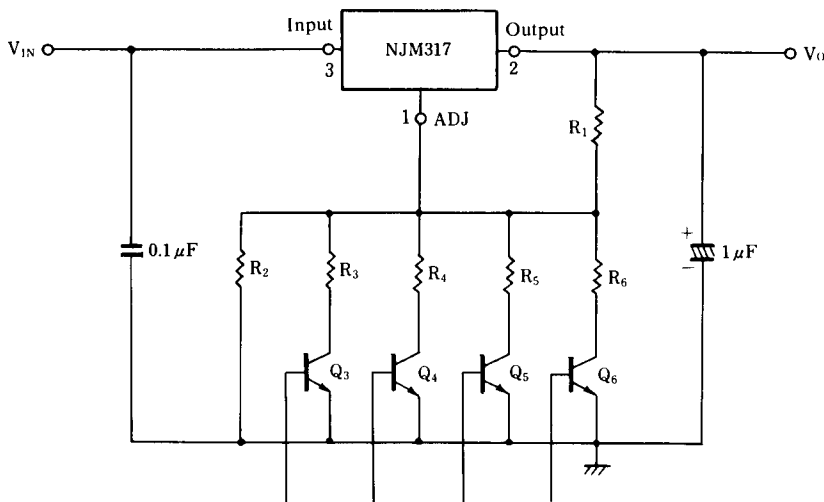
## ■ TYPICAL APPLICATIONS

### 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,

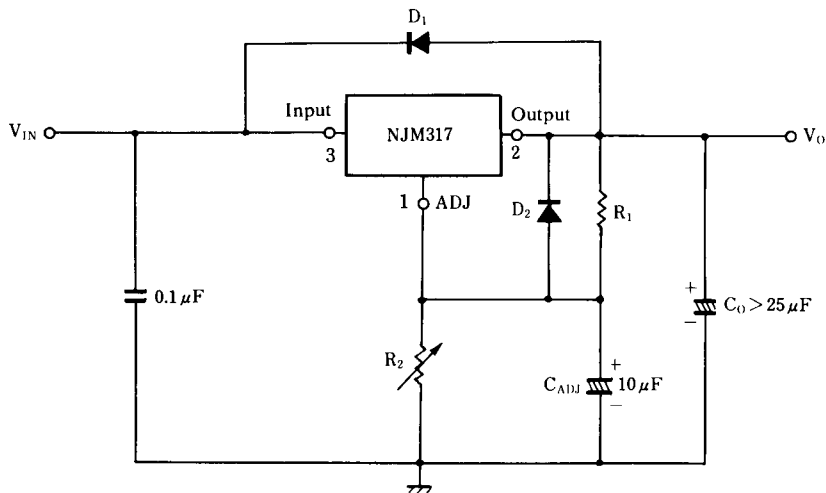
$$V_O \approx V_{REF} \times \left(1 + \frac{R_2}{R_1}\right)$$

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.

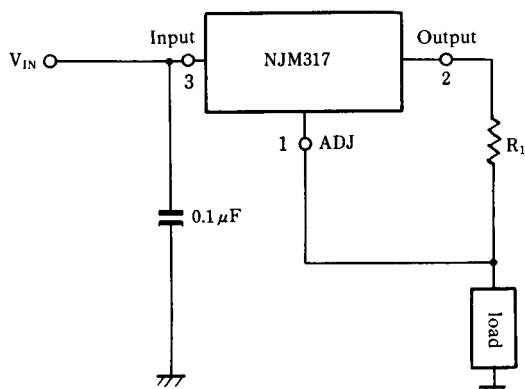
### 3) Regulator with Protection Diodes



$D_1$  protects about  $C_O$

$D_2$  protects about  $C_{ADJ}$

## 4) Constant Current Regulator



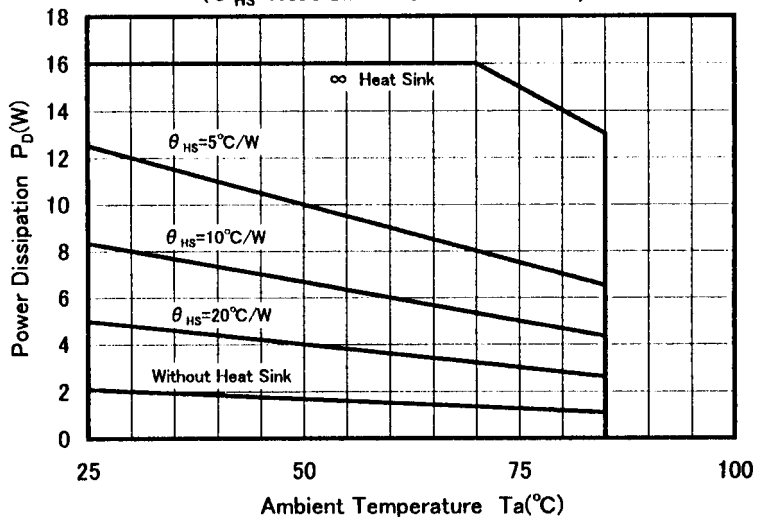
$$R_1 \leq 125\Omega$$

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

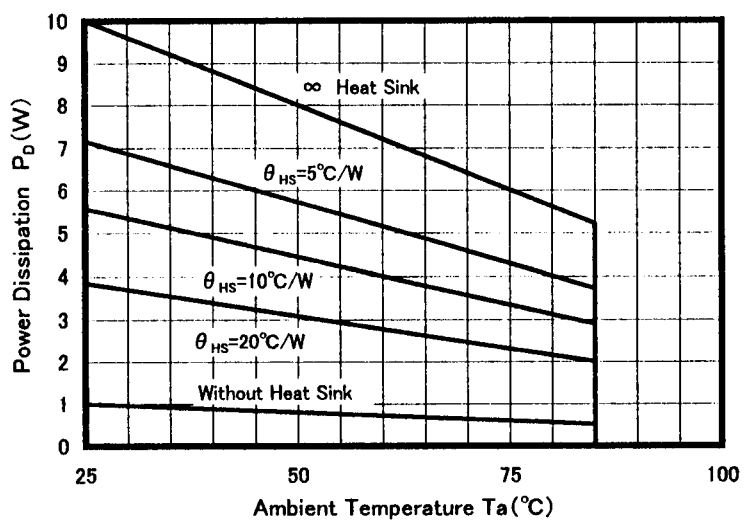
$$I_o = \frac{V_{REF}}{R_1}$$

### NJM317FA

( $\theta_{HS}$ =Heat Sink Thermal Resistance)



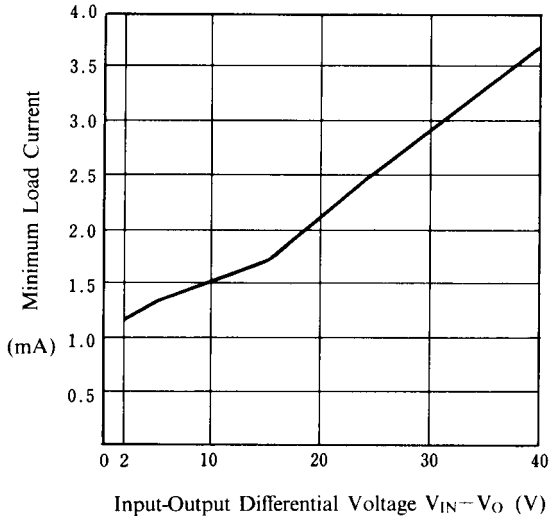
### NJM317DL1



## ■ TYPICAL CHARACTERISTICS

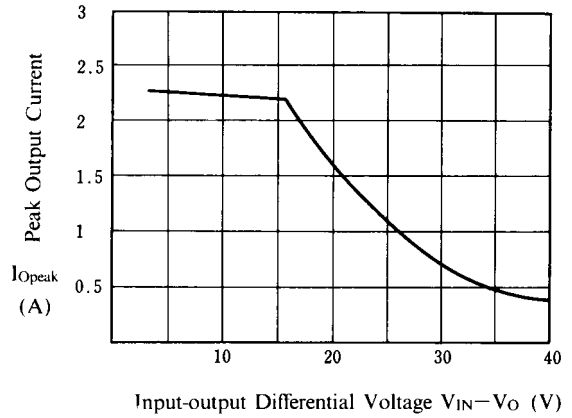
### Minimum Load Current

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



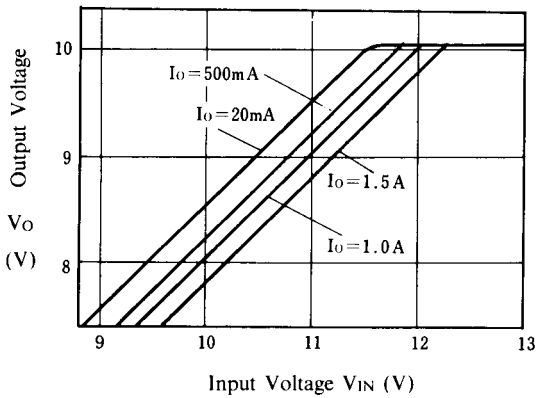
### Peak Output Current vs. Input-Output Differential Voltage

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



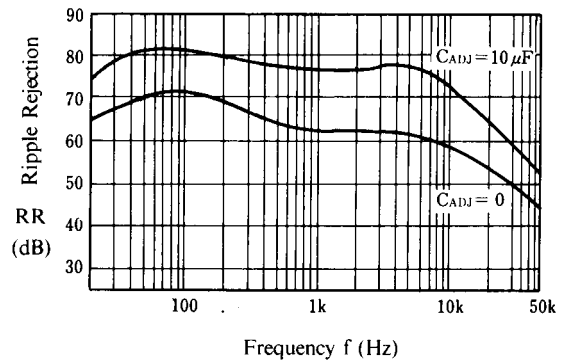
### Output Voltage vs. Input Voltage

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



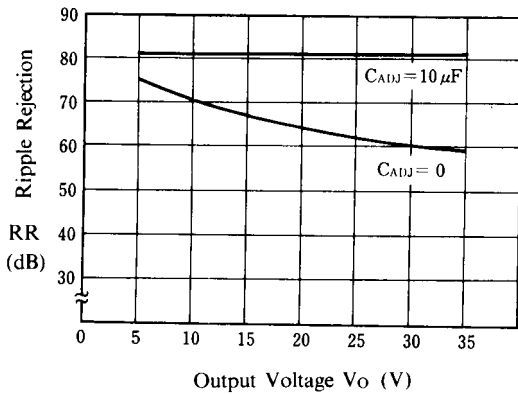
### Ripple Rejection vs. Frequency

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



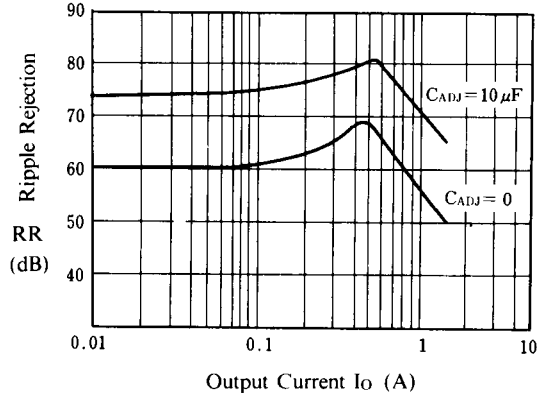
### Ripple Rejection vs. Output Voltage

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



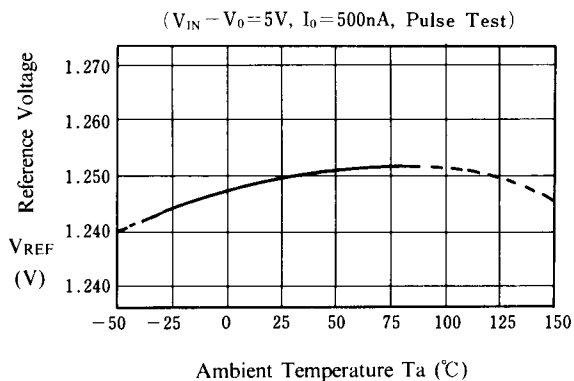
### Ripple Rejection vs. Output Current

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

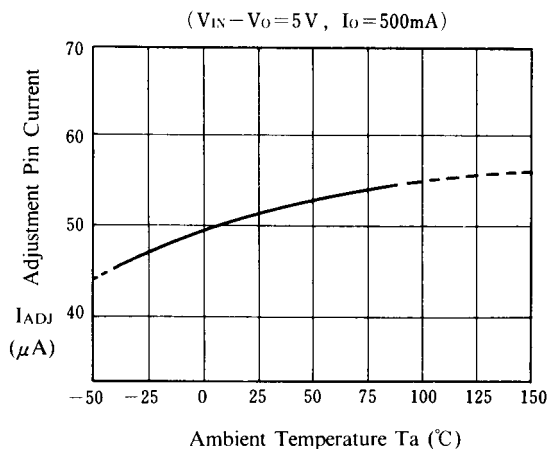


## ■ TYPICAL CHARACTERISTICS

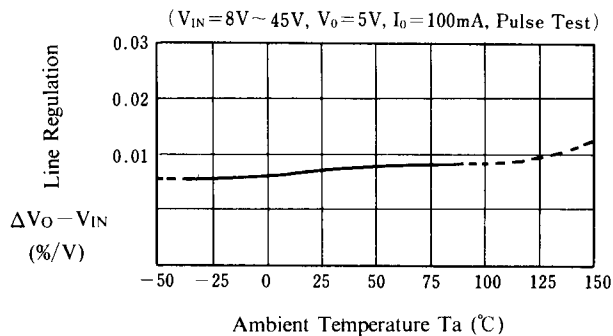
### Reference Voltage vs. Temperature



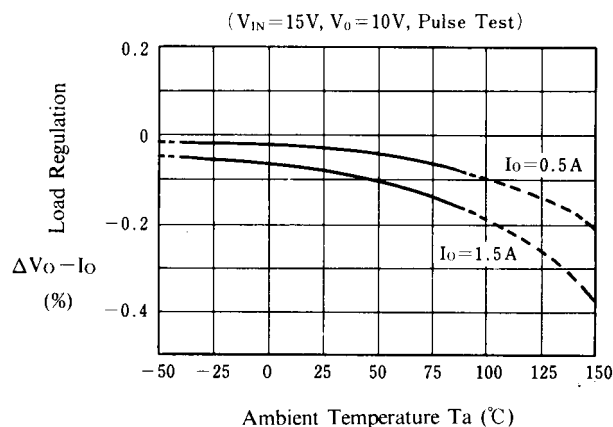
### Adjustment Pin Current vs. Temperature



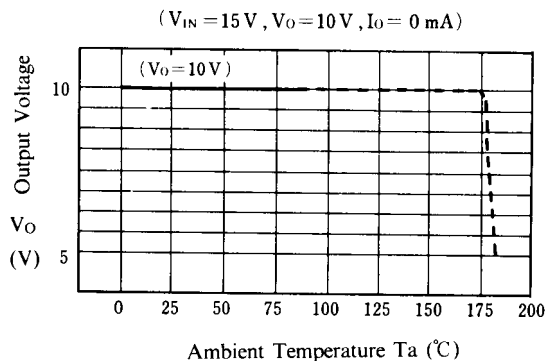
### Line Regulation vs. Temperature



### Load Regulation vs. Temperature



### Thermal Shutdown



**[CAUTION]**

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