

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

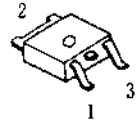
■ PACKAGE OUTLINE

(TO-220F)



NJM317F

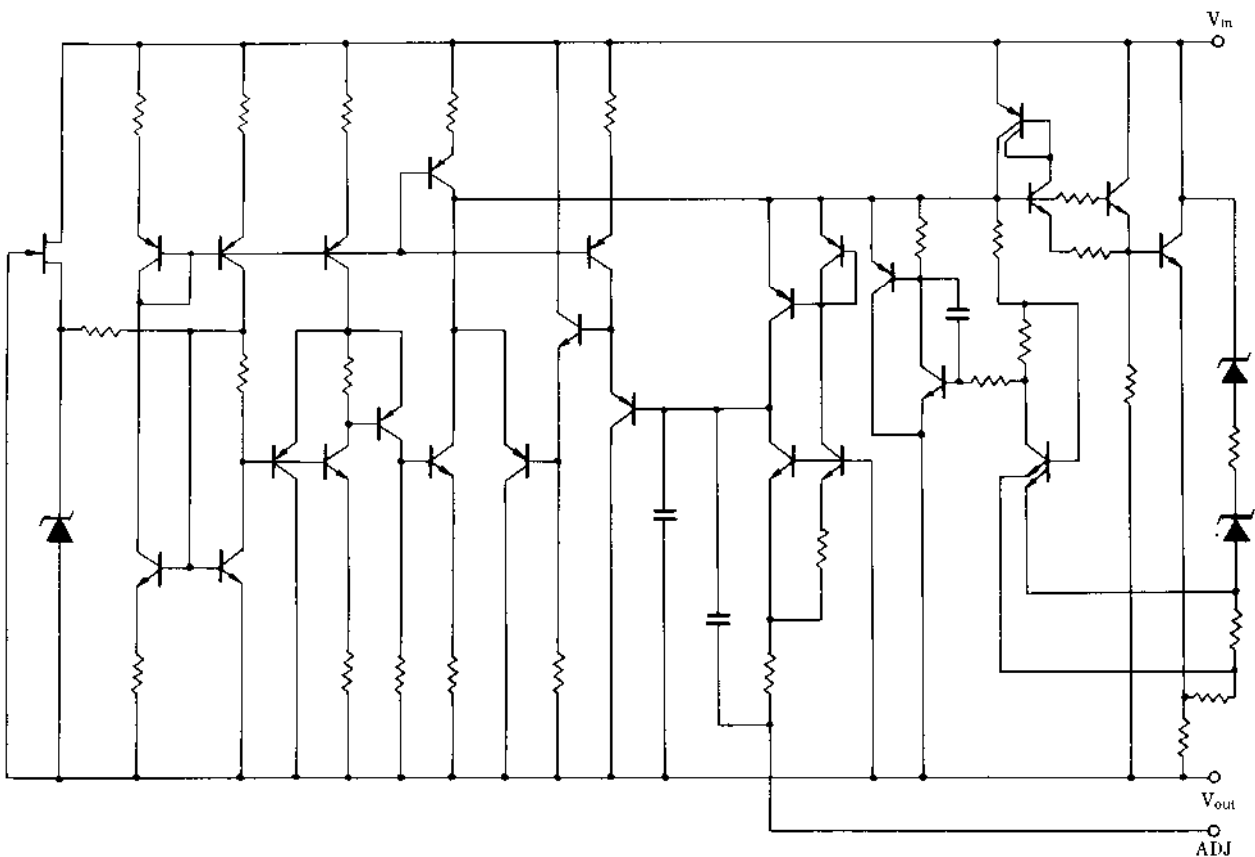
(TO-252)



NJM317DL1

1. Adjustment
2. Output
3. Input

■ EQUIVALENT CIRCUIT



■ 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	θ_{ja}	60	125	$^\circ\text{C/W}$	
	Junction-To-Case	θ_{jc}	5	12.5		

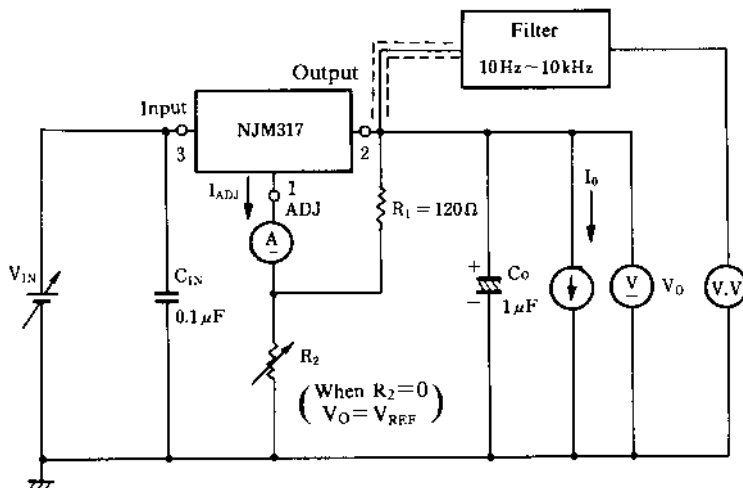
■ ELECTRICAL CHARACTERISTICS ($V_{IN} - V_O = 5\text{V}$, $I_O = 500\text{mA}$, $C_{IN} = 0.1\mu\text{F}$, $C_O = 1\mu\text{F}$, $T_J = 25^\circ\text{C}$)

Measurement is to be conducted in pulse testing.

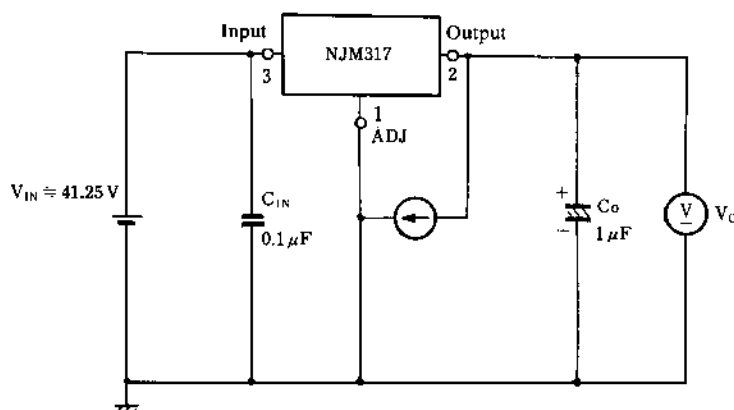
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage	V_{REF}	$3\text{V} \leq (V_{IN} - V_O) \leq 40\text{V}$, $I_O = 100\text{mA}$ $10\text{mA} \leq I_O \leq 1.5\text{A}$ (TO-220F) $10\text{mA} \leq I_O \leq 500\text{mA}$ (TO-252)	1.2	1.25	1.3	V
	$V_{REF} - V_{IN}$		1.2	1.25	1.3	
	$V_{REF} - I_O$		1.2	1.25	1.3	
			1.2	1.25	1.3	
Reference Voltage Thermal Change	ΔV_{REF-T}	$0 \leq T_J \leq 125^\circ\text{C}$	-	5	-	mV
Adjustment Pin Current	I_{ADJ}		-	50	100	μA
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	μA
	$\Delta I_{ADJ} - I_O$		-	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)

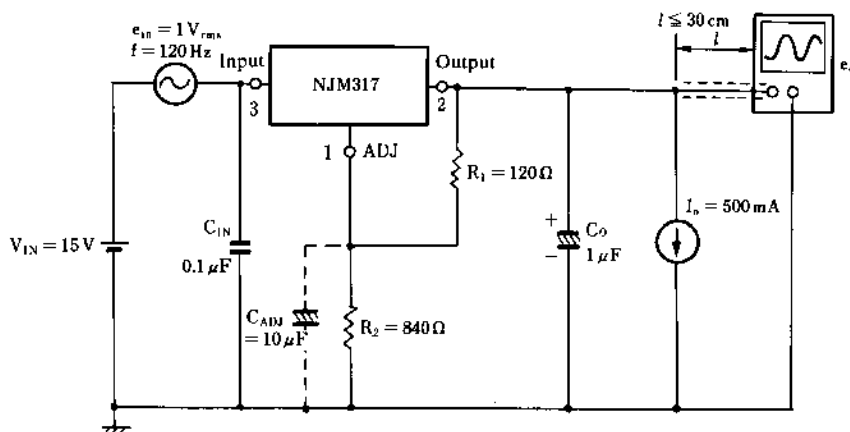


- 2) Minimum Load Current



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

- 3) Ripple Rejection

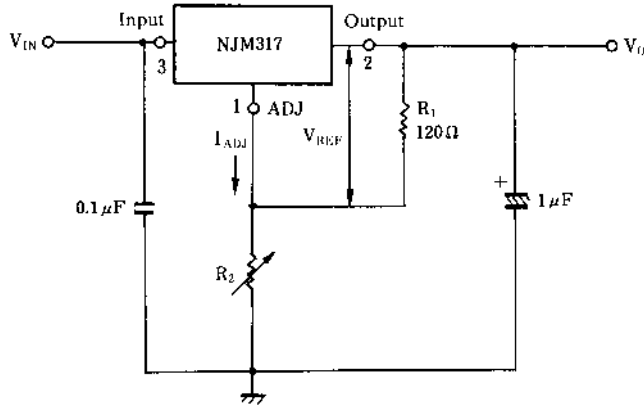


$$\text{Ripple Rejection} = 20 \log_{10} \left(\frac{e_{\text{IN}}}{e_o} \right) \text{ [dB]}$$

NJM317

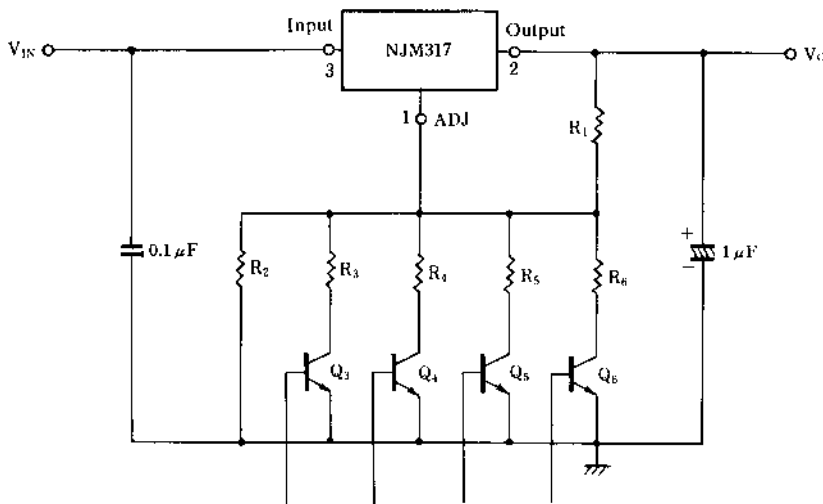
■ TYPICAL APPLICATIONS

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



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,

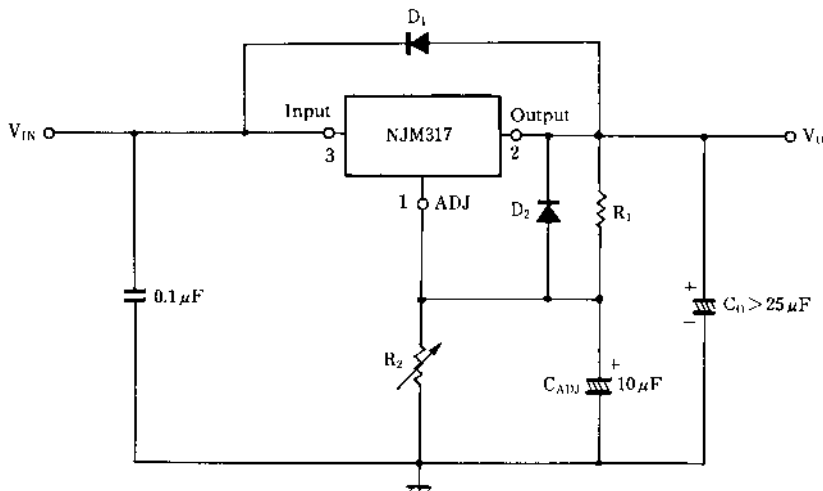
$$V_O \approx V_{REF} \times \left(1 + \frac{R_2}{R_1}\right)$$

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.

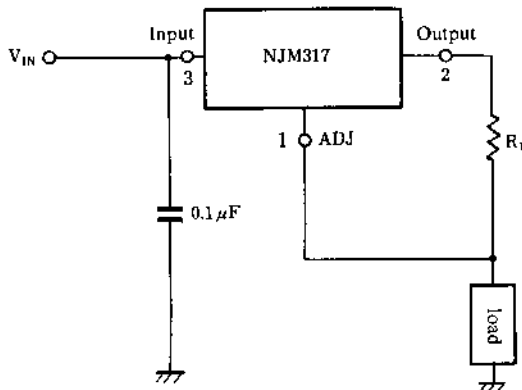
3) Regulator with Protection Diodes



D_1 protects about C_O

D_2 protects about C_{ADJ}

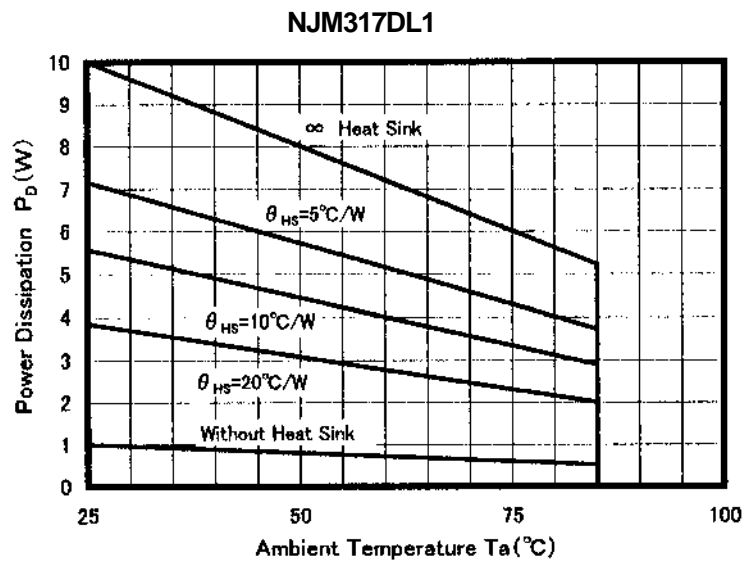
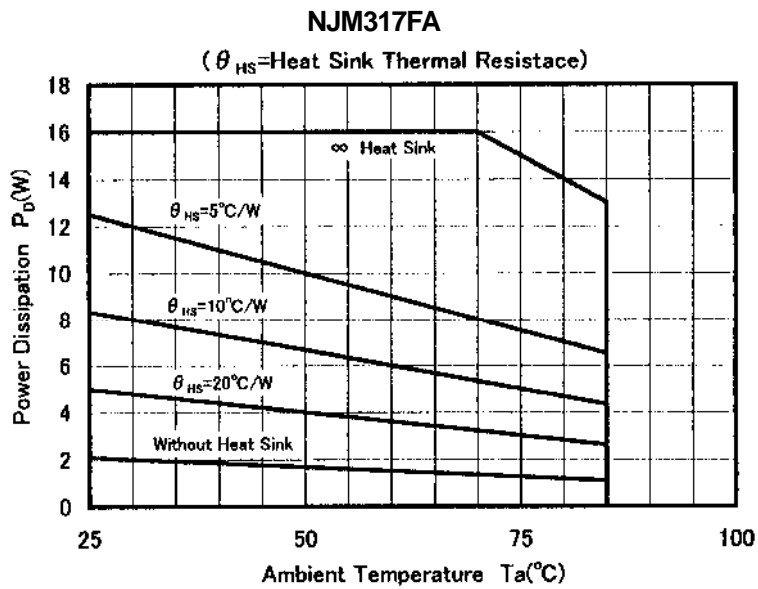
4) Constant Current Regulator



$$R_1 \leq 125\Omega$$

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

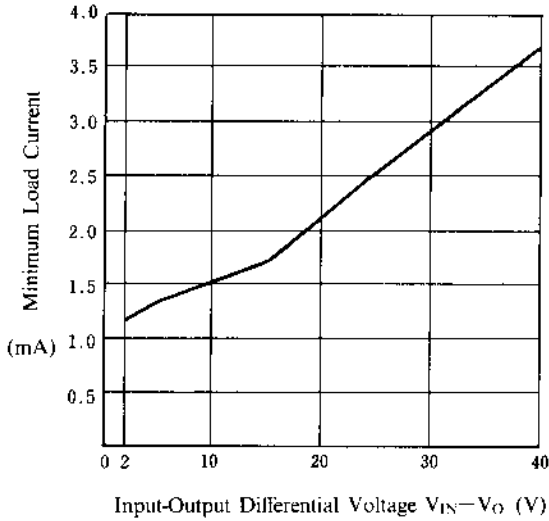
$$I_O = \frac{V_{REF}}{R_1}$$



■ TYPICAL CHARACTERISTICS

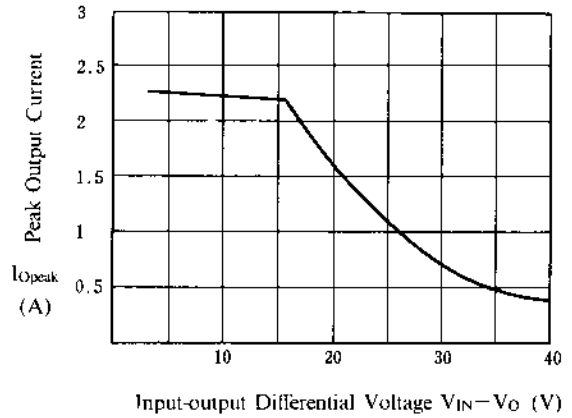
Minimum Load Current

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



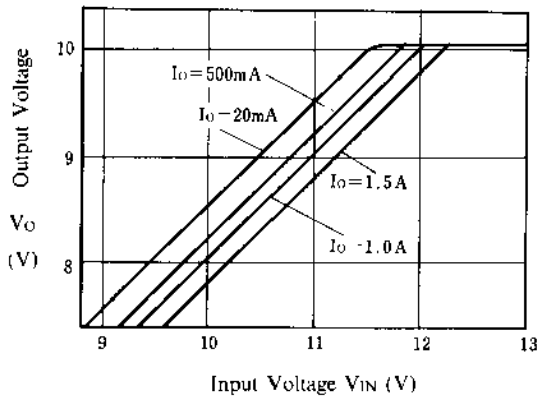
Peak Output Current vs. Input-Output Differential Voltage

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



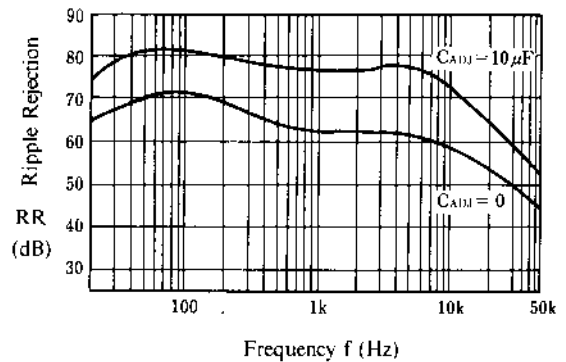
Output Voltage vs. Input Voltage.

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



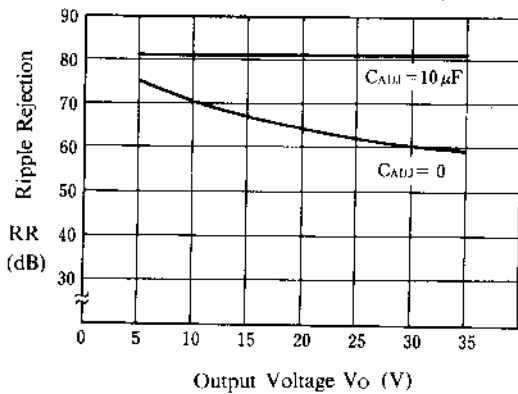
Ripple Rejection vs. Frequency

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



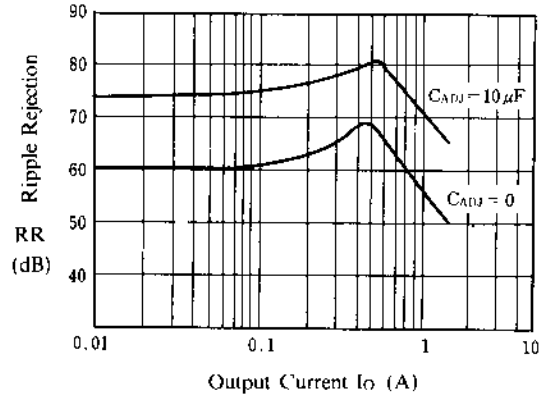
Ripple Rejection vs. Output Voltage

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



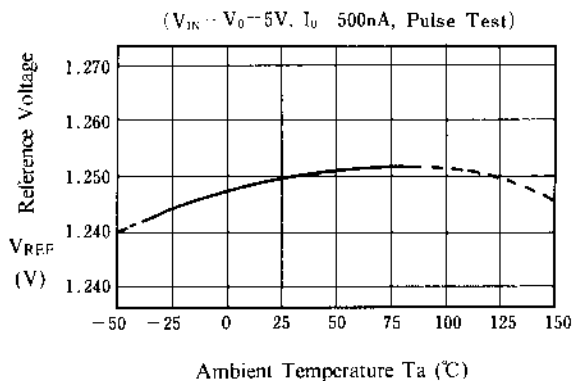
Ripple Rejection vs. Output Current

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

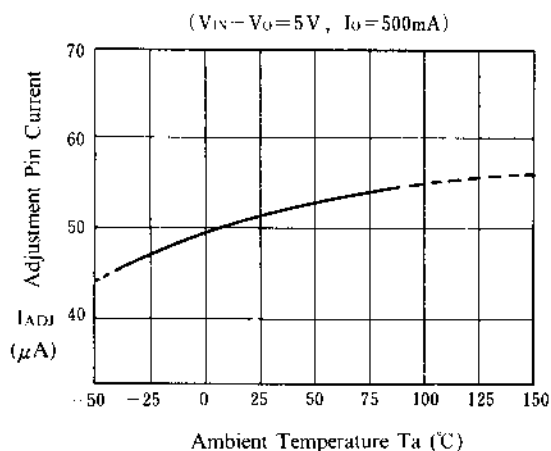


■ TYPICAL CHARACTERISTICS

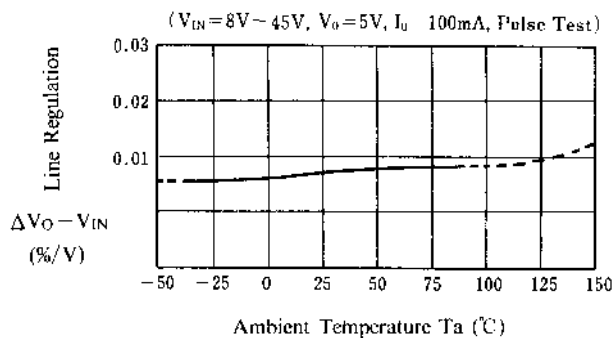
Reference Voltage vs. Temperature



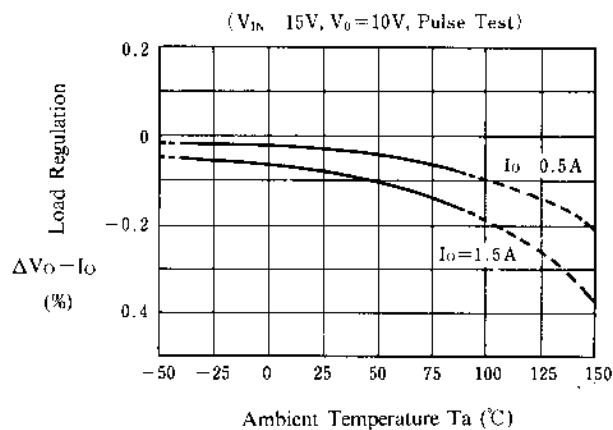
Adjustment Pin Current vs. Temperature



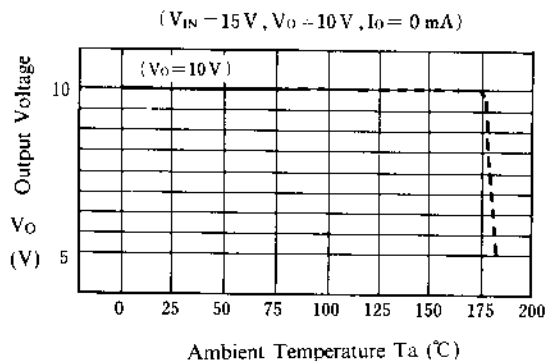
Line Regulation vs. Temperature



Load Regulation vs. Temperature



Thermal Shutdown



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