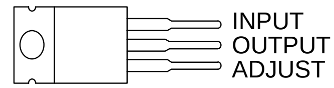
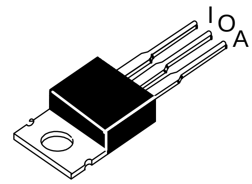
- **Output Voltage Range Adjustable From 1.2 V to 37 V**
- **Output Current Greater Than 1.5 A**
- **Internal Short-Circuit Current Limiting**
- **Thermal Overload Protection**
- **Output Safe-Area Compensation**
- **Package Options Include Plastic Small-Outline Transistor SOT-223 (DCY), Flange Mounted (KTE) and Heat-Sink Mounted (KC) Packages**

KC PACKAGE
(TOP VIEW)

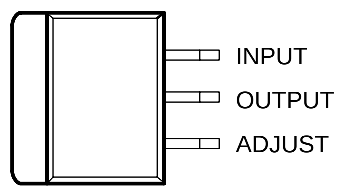


The OUTPUT terminal is in electrical contact with the mounting base.

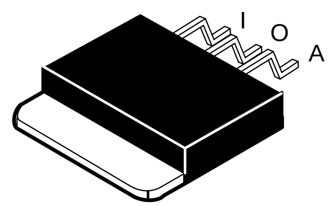
TO-220AB



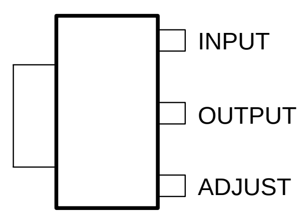
KTE PACKAGE
(TOP VIEW)



The OUTPUT terminal is in electrical contact with the mounting base.



DCY PACKAGE
(TOP VIEW)



description

The LM317 is an adjustable three-terminal positive-voltage regulator capable of supplying more than 1.5 A over an output-voltage range of 1.2 V to 37 V. It is exceptionally easy to use and requires only two external resistors to set the output voltage. Furthermore, both line and load regulation are better than standard fixed regulators. The LM317 is packaged in the KC (TO-220AB) and KTE packages, which are easy to handle and use.

In addition to having higher performance than fixed regulators, this device includes on-chip current limiting, thermal overload protection, and safe-operating-area protection. All overload protection remains fully functional, even if the ADJUST terminal is disconnected.

The LM317 is versatile in its applications, including uses in programmable output regulation and local on-card regulation. Or, by connecting a fixed resistor between the ADJUST and OUTPUT terminals, the LM317 can function as a precision current regulator. An optional output capacitor can be added to improve transient response. The ADJUST terminal can be bypassed to achieve very high ripple-rejection ratios, which are difficult to achieve with standard three-terminal regulators.

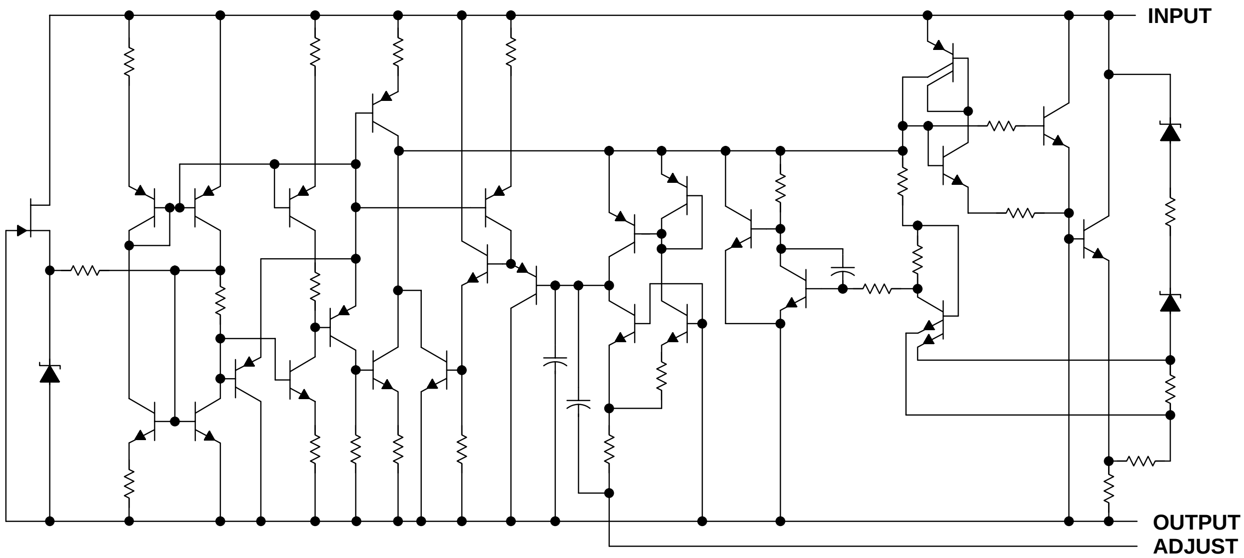
The LM317 is characterized for operation over the virtual junction temperature range of 0°C to 125°C.

AVAILABLE OPTIONS

T_J	PACKAGED DEVICES		
	HEAT-SINK (DCY)†	HEAT-SINK MOUNTED, TO-220 (KC)	PLASTIC FLANGE MOUNTED, POWER FLEX (KTE)‡
0°C to 125°C	LM317DCY	LM317KC	LM317KTER

† The DCY package also is available taped and reeled, e.g., LM317DCYR.
‡ The KTE package has the same footprint as TO-263 and can be mounted on a TO-263 land pattern. The KTE package is only available taped and reeled.

schematic diagram



absolute maximum ratings over virtual junction temperature range (unless otherwise noted)§

Input-to-output differential voltage, $V_I – V_O$ . . . . 40 V
Package thermal impedance, θ_{JA} (see Notes 1 and 2): DCY package . . . . 49°C/W
(see Notes 1 and 3): KC package . . . . 25°C/W
(see Notes 1 and 2): KTE package . . . . 23°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . 260°C
Storage temperature range, T_{stg} . . . . –65°C to 150°C

§ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) – T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
2. The package thermal impedance is calculated in accordance with JESD 51-5.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	MAX	UNIT
$V_I – V_O$	Input-to-output voltage differential	3	37	V
I_O	Output current		1.5	A
T_J	Operating virtual junction temperature	0	125	°C

electrical characteristics over recommended ranges of operating virtual junction temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS†			MIN	TYP	MAX	UNIT
Input voltage (line) regulation‡	$V_I - V_O$ = 3 V to 40 V		T_J = 25°C		0.01	0.04	%/V
			T_J = 0°C to 125°C		0.02	0.07	
Output voltage (load) regulation	I_O = 10 mA to 1500 mA	C_{ADJ} = 10 μF§, T_J = 25°C	$V_O \le 5$ V			25	mV
			$V_O \ge 5$ V		0.1	0.5	$\%V_O$
		T_J = 0°C to 125°C	$V_O \le 5$ V		20	70	mV
			$V_O \ge 5$ V		0.3	1.5	$\%V_O$
Thermal regulation	20-ms pulse,	T_J = 25°C			0.03	0.07	$\%V_O$/W
ADJUST terminal current					50	100	μA
Change in ADJUST terminal current	$V_I - V_O$ = 2.5 V to 40 V, $P_D \le 20$ W, I_O = 10 mA to 1500 mA				0.2	5	μA
Reference voltage (V_{ref}) (OUTPUT to ADJUST)	$V_I - V_O$ = 3 V to 40 V, $P_D \le 20$ W, I_O = 10 mA to 1500 mA			1.2	1.25	1.3	V
Output-voltage temperature stability	T_J = 0°C to 125°C				0.7		$\%V_O$
Minimum load current to maintain regulation	$V_I - V_O$ = 40 V				3.5	10	mA
Peak output current	$V_I - V_O \le 15$ V,	$P_D < P_{MAX}$ (see Note 1)		1.5	2.2		A
	$V_I - V_O \le 40$ V, $P_D < P_{MAX}$ (see Note 1), T_J = 25°C			0.15	0.4		
Output noise voltage (RMS)	f = 10 Hz to 10 kHz,	T_J = 25°C			0.003		$\%V_O$
Ripple rejection	V_O = 10 V,	f = 120 Hz	C_{ADJ} = 0 μF§		57		dB
			C_{ADJ} = 10 μF§	62	64		
Long-term stability	T_J = 25°C				0.3	1	%/1k Hrs

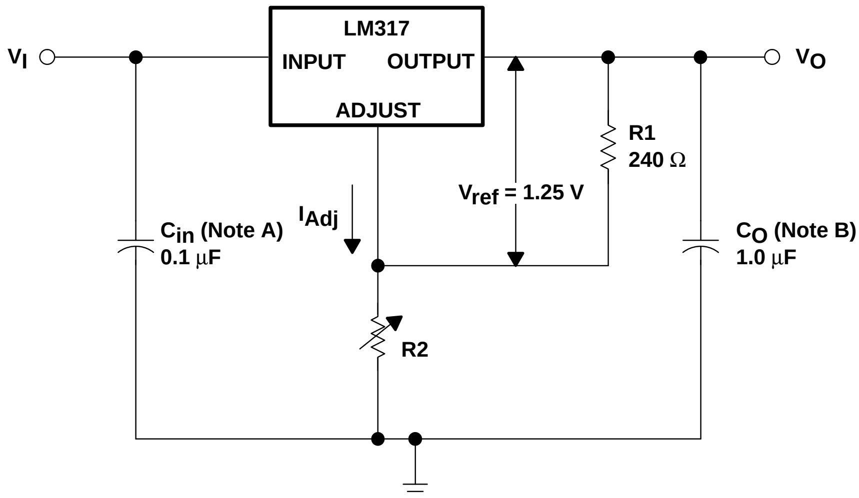
† Unless otherwise noted, the following test conditions apply: $|V_I - V_O|$ = 5 V and I_{OMAX} = 1.5 A, T_J = 0°C to 125°C. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

‡ Input regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

§ C_{ADJ} is connected between the ADJUST terminal and GND.

NOTE 4: Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.

APPLICATION INFORMATION



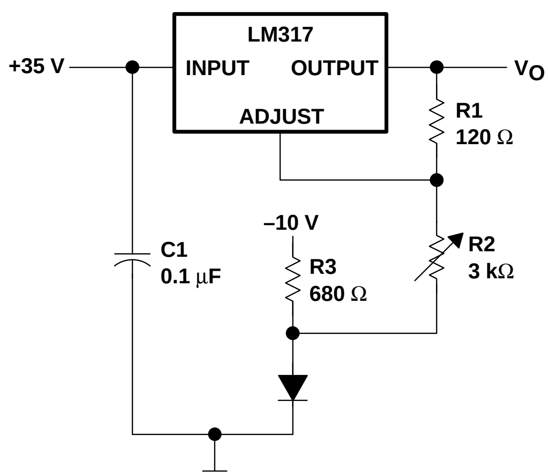
NOTES: A. C_{in} is not required if the regulator is close enough to the power-supply filter.
B. C_O improves transient response, but is not needed for stability.

V_{out} is calculated as:

$$V_{out} = V_{ref}\left(1 + \frac{R2}{R1}\right) + (I_{Adj} \times R2)$$

Since I_{Adj} is typically 50 µA, it is negligible in most applications.

Figure 1. Adjustable Voltage Regulator



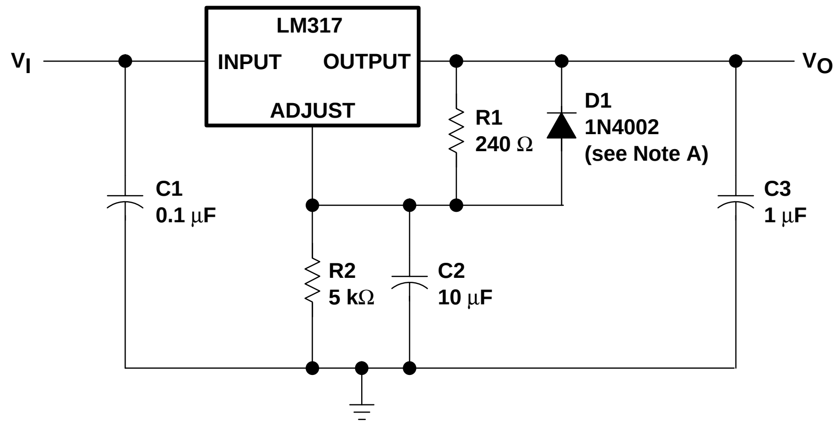
V_{out} is calculated as:

$$V_{out} = V_{ref}\left(1 + \frac{R2 + R3}{R1}\right) + I_{Adj}(R2 + R3) - 10\ V$$

Since I_{Adj} is typically 50 µA, it is negligible in most applications.

Figure 2. 0-V to 30-V Regulator Circuit

APPLICATION INFORMATION



NOTE A: D1 discharges C2 if the output is shorted to ground.

Figure 3. Adjustable Regulator Circuit With Improved Ripple Rejection

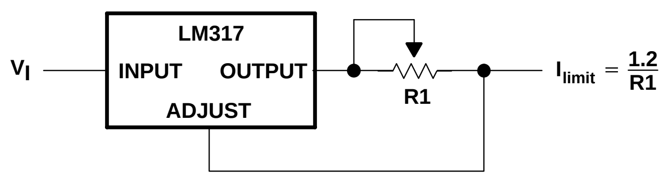


Figure 4. Precision Current-Limiter Circuit

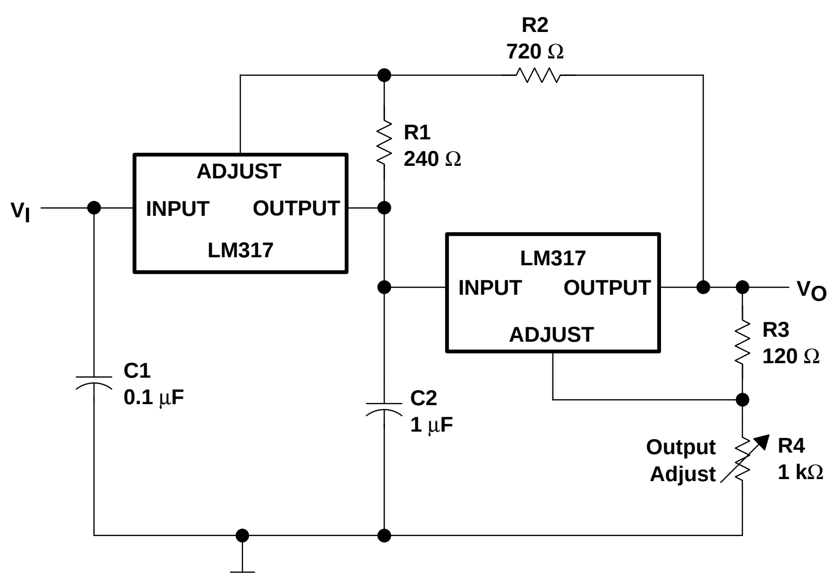


Figure 5. Tracking Preregulator Circuit

APPLICATION INFORMATION

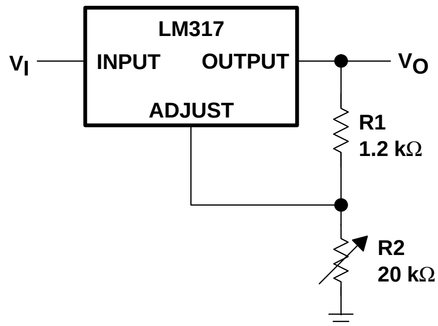
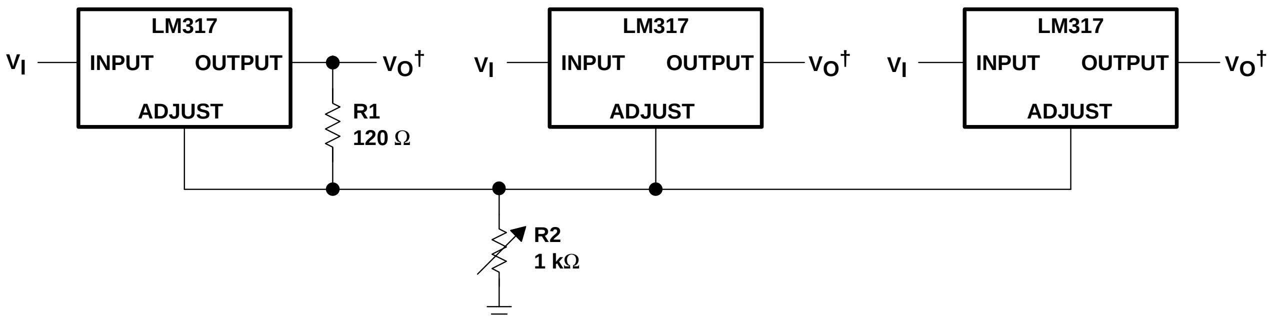
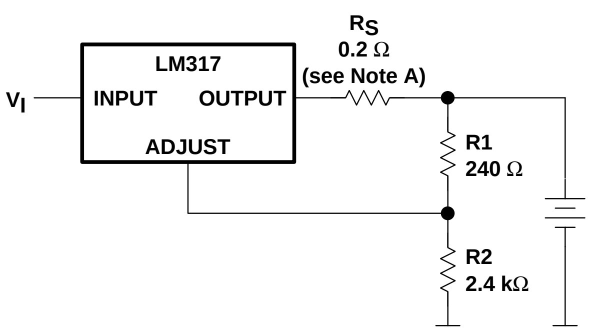


Figure 6. 1.2-V to 20-V Regulator Circuit With Minimum Program Current



† Minimum load current from each output is 10 mA. All output voltages are within 200 mV of each other.

Figure 7. Adjusting Multiple On-Card Regulators With a Single Control



NOTE A: R_S controls the output impedance of the charger.

$$Z_{OUT} = R_S\left(1 + \frac{R2}{R1}\right)$$

The use of R_S allows for low charging rates with a fully charged battery.

Figure 8. Battery-Charger Circuit

APPLICATION INFORMATION

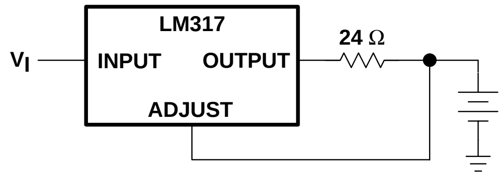


Figure 9. 50-mA Constant-Current Battery-Charger Circuit

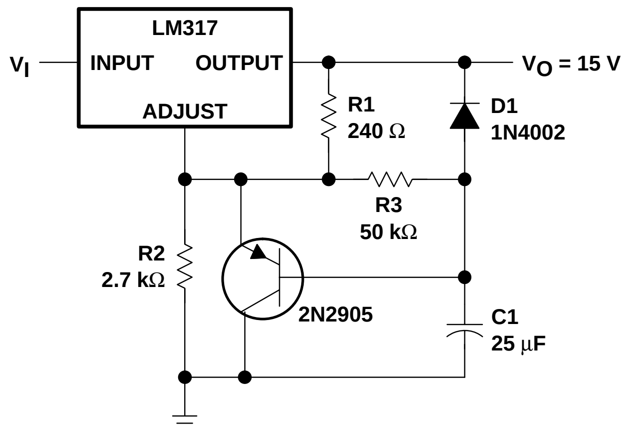


Figure 10. Slow Turn-On 15-V Regulator Circuit

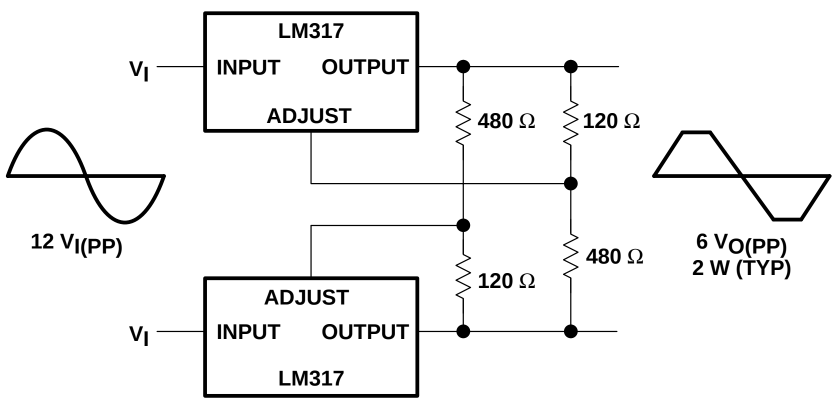
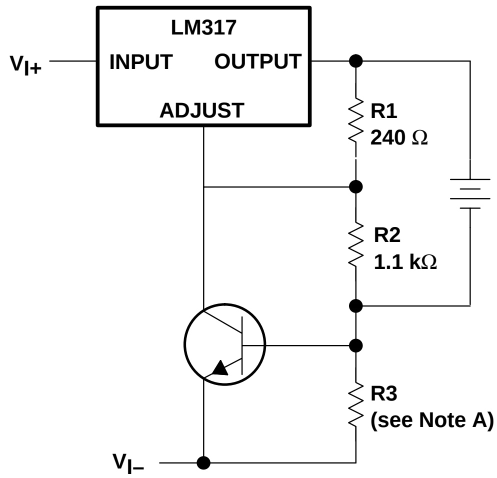


Figure 11. AC Voltage-Regulator Circuit

APPLICATION INFORMATION



NOTE A: R3 sets the peak current (0.6 A for a 1-Ω resistor).

Figure 12. Current-Limited 6-V Charger Circuit

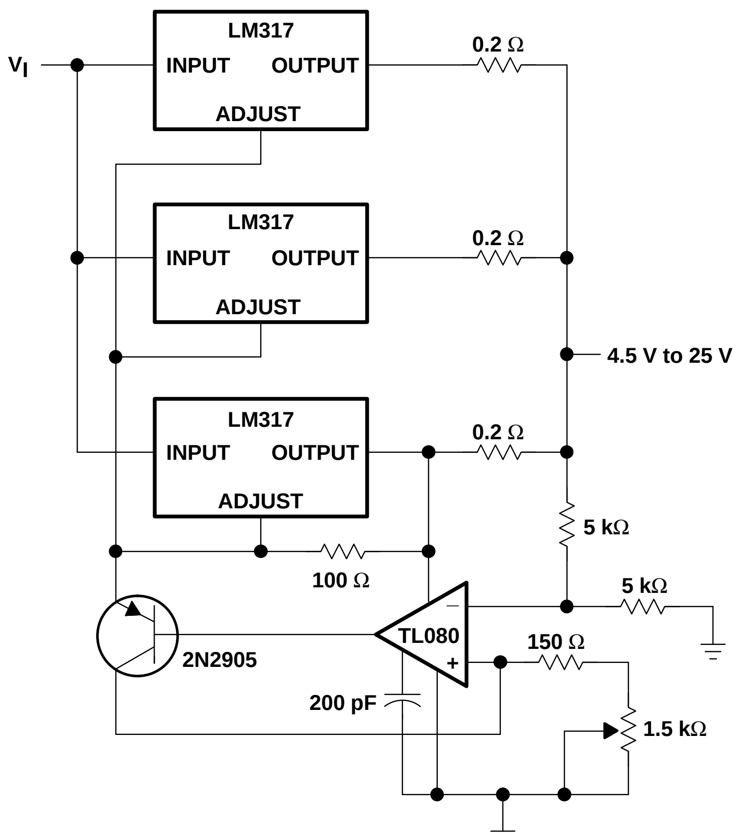
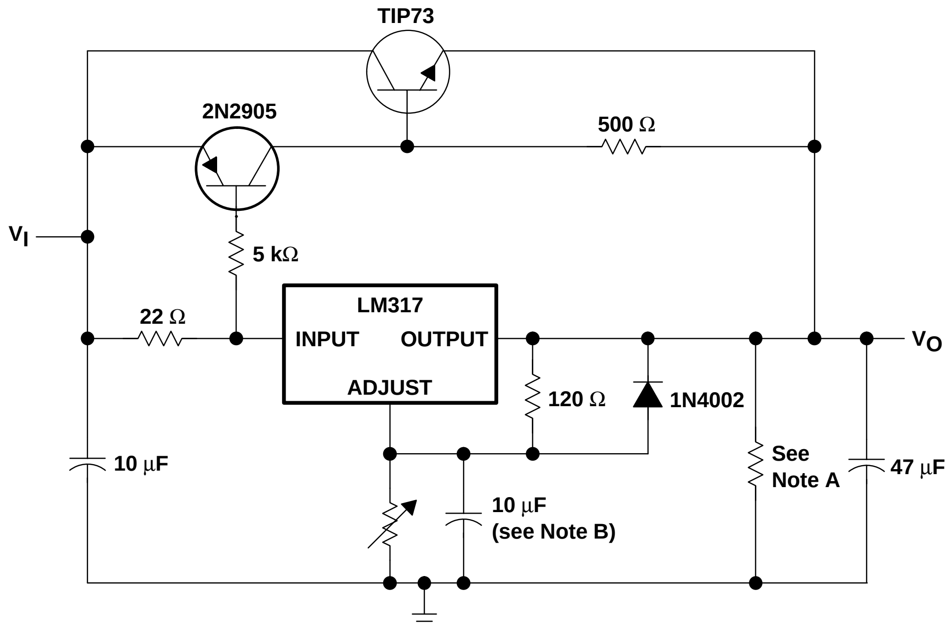


Figure 13. Adjustable 4-A Regulator Circuit

APPLICATION INFORMATION



NOTES: A. The minimum load current is 30 mA.
B. This optional capacitor improves ripple rejection.

Figure 14. High-Current Adjustable Regulator Circuit

IMPORTANT NOTICE

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