

LM317M

3-TERMINAL ADJUSTABLE REGULATOR

SLVS297C – APRIL 2000 – REVISED NOVEMBER 2001

- **Output Voltage Range Adjustable From 1.2 V to 37 V**
- **Output Current Greater Than 500 mA**
- **Internal Short-Circuit Current Limiting**
- **Thermal Overload Protection**
- **Output Safe-Area Compensation**

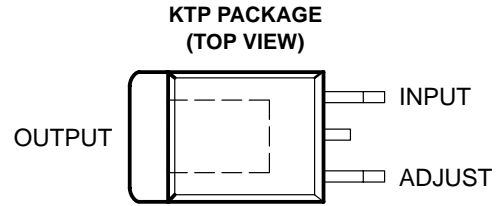
description

The LM317M is an adjustable 3-terminal positive-voltage regulator capable of supplying more than 500 mA over an output-voltage range of 1.2 V to 37 V. The LM317M 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 LM317M is packaged in the DPAK/TO-252-equivalent KTP package, which is easy to handle and use.

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

Normally, no capacitors are needed unless the device is more than 6 inches from the input filter capacitors, in which case an input bypass capacitor is needed. 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 3-terminal regulators.

The LM317M is characterized for operation over the virtual junction temperature range of 0°C to 125°C.



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



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 **TEXAS
INSTRUMENTS**

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absolute maximum ratings over operating 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)	28°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	28°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 impact reliability.
2. The package thermal impedance is calculated in accordance with JESD 51-5.

recommended operating conditions

	MIN	MAX	UNIT
$V_I - V_O$ Input-to-output voltage differential		37	V
I_O Output current		0.5	A
T_J Operating virtual junction temperature	0	125	°C

electrical characteristics over recommended operating virtual-junction temperature range, $V_I - V_O = 5$ V, $I_O = 0.1$ A (unless otherwise noted)

PARAMETER	TEST CONDITIONS [‡]	MIN	TYP	MAX	UNIT
Line regulation (see Note 3)	$V_I - V_O = 3$ V to 40 V	$T_J = 25^\circ\text{C}$		0.01	%V
		Full temperature range		0.02	
Load regulation	$I_O = 10$ mA to 500 mA	$T_J = 25^\circ\text{C}$		0.1	%V _O
		Full temperature range		0.3	
ADJUST terminal current			50	100	μA
ADJUST terminal current change	$V_I - V_O = 3$ V to 40 V, $I_O = 10$ mA to 500 mA		0.2	5	μA
Reference voltage	$V_I - V_O = 3$ V to 40 V, $I_O = 10$ mA to 500 mA	1.2	1.25	1.3	V
Output-voltage temperature stability			0.7%		
Minimum load current to maintain regulation			3.5	10	mA
Maximum output current	$V_I - V_O \leq 15$ V	500	900		mA
	$V_I - V_O = 40$ V, $P_D \leq P_{D(\max)}$, $T_J = 25^\circ\text{C}$	150	250		
Output noise voltage (% of V _O)	$f = 10$ Hz to 10 KHz, $T_J = 25^\circ\text{C}$		0.003%		
Ripple rejection (see Note 4)	$V_O = 10$ V, $f = 120$ Hz, $T_J = 25^\circ\text{C}$	$C_{ADJ} = 0$		65	dB
		$C_{ADJ} = 10$ μF		66	
Long-term stability	$T_J = 125^\circ\text{C}$		0.3	1	%/1k Hrs

[‡] Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

NOTES: 3. Input voltage regulation is expressed here as the percentage change in output voltage per 1-V change at the input.
4. C_{ADJ} is connected between the ADJUST terminal and ground.



TYPICAL CHARACTERISTICS

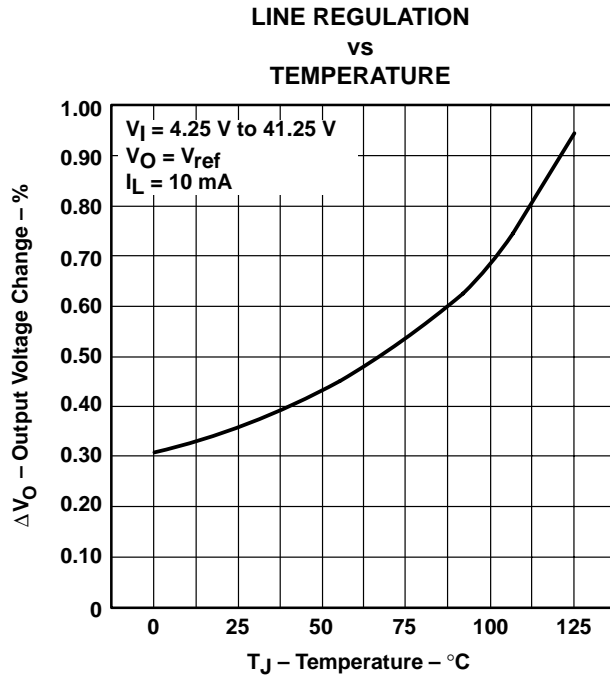


Figure 1

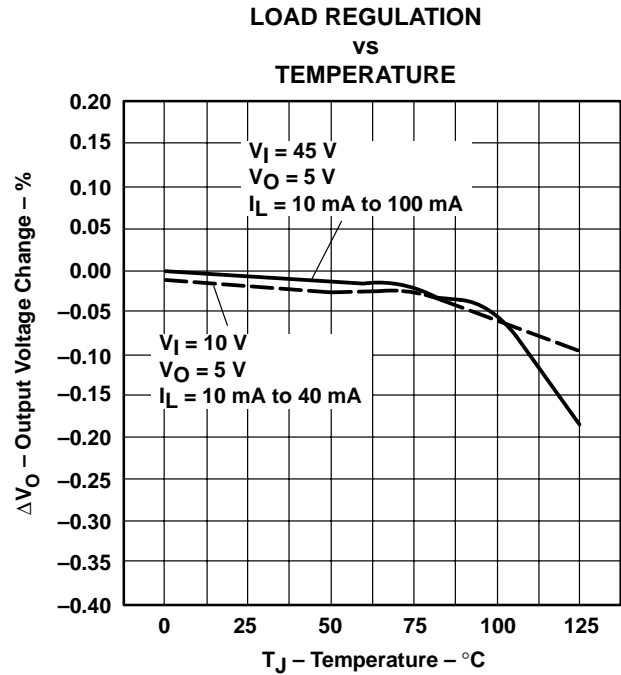


Figure 2

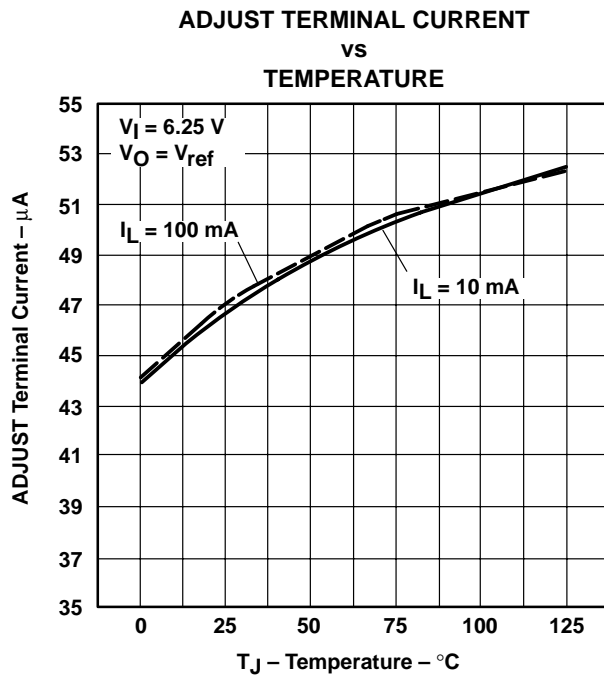


Figure 3

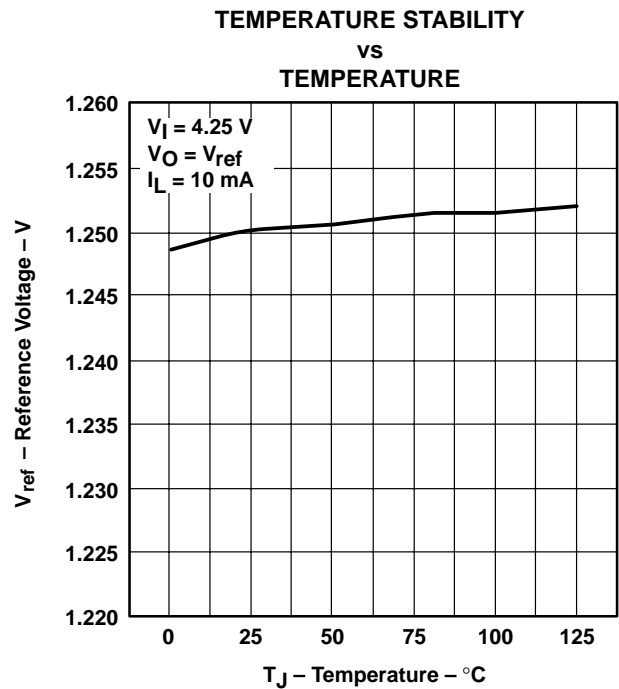


Figure 4

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TYPICAL CHARACTERISTICS

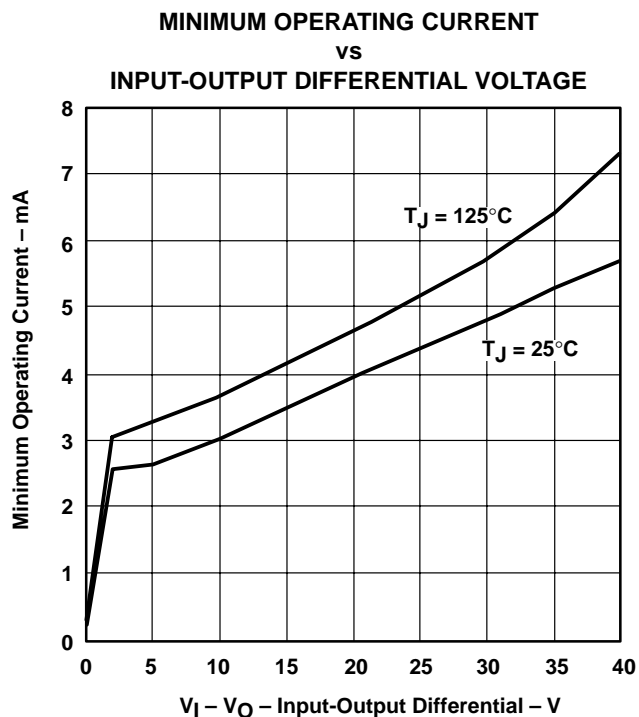


Figure 5

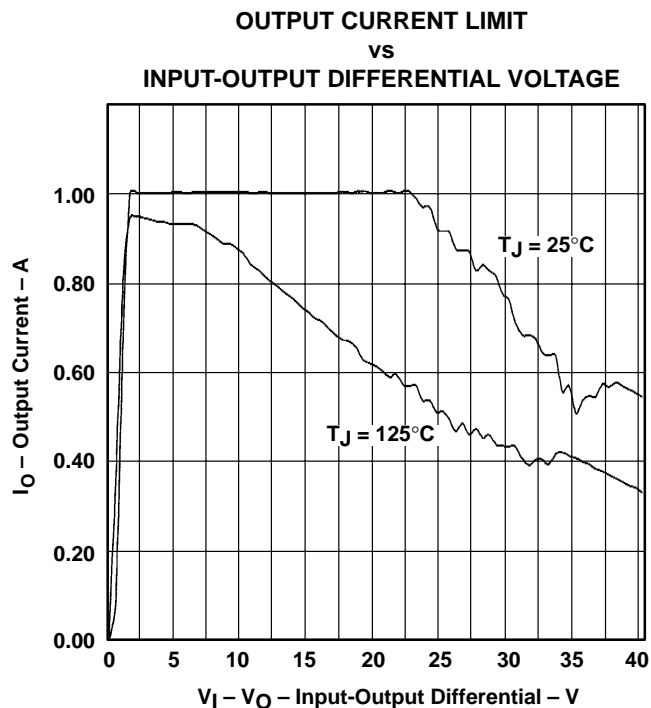


Figure 6

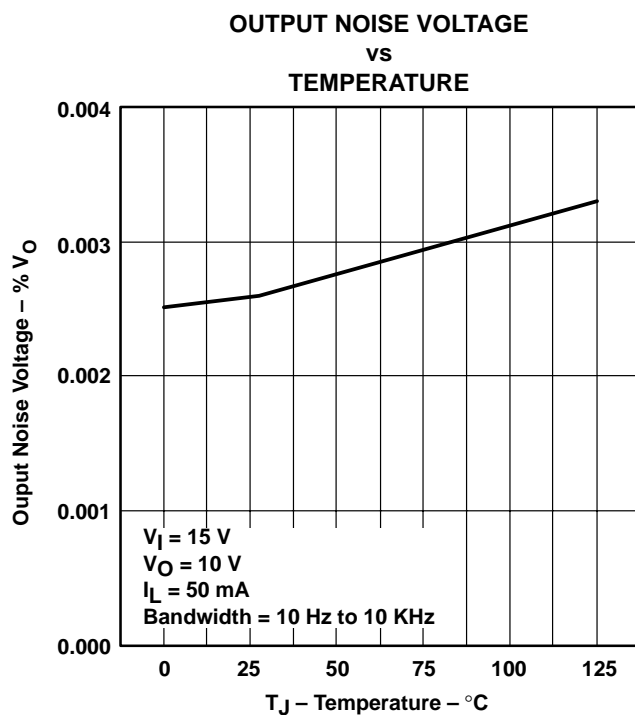


Figure 7

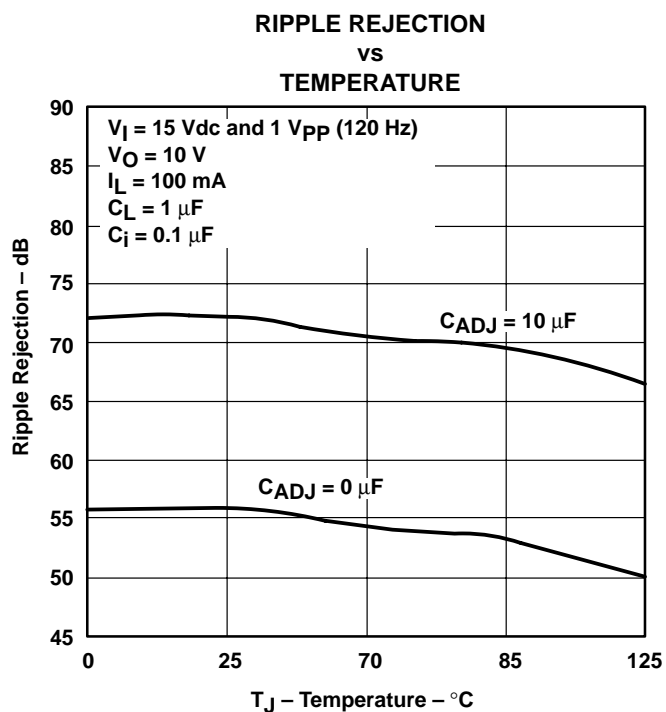


Figure 8

TYPICAL CHARACTERISTICS

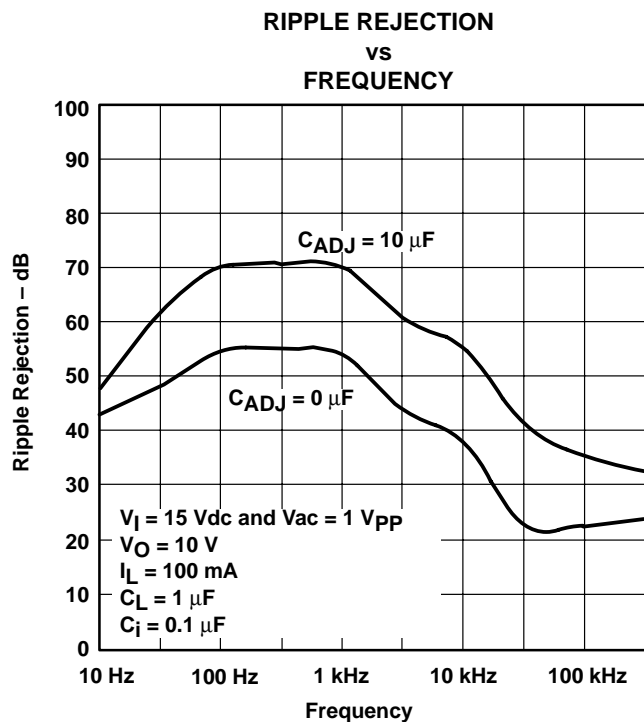


Figure 9

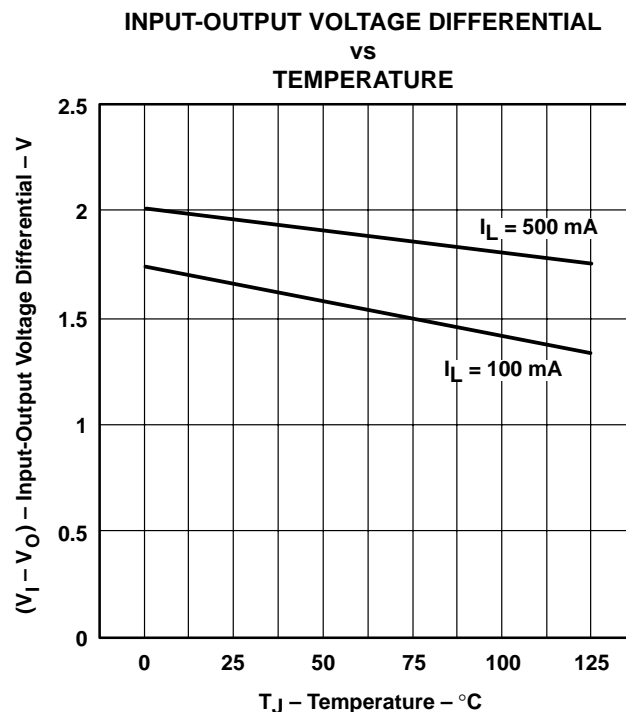


Figure 10

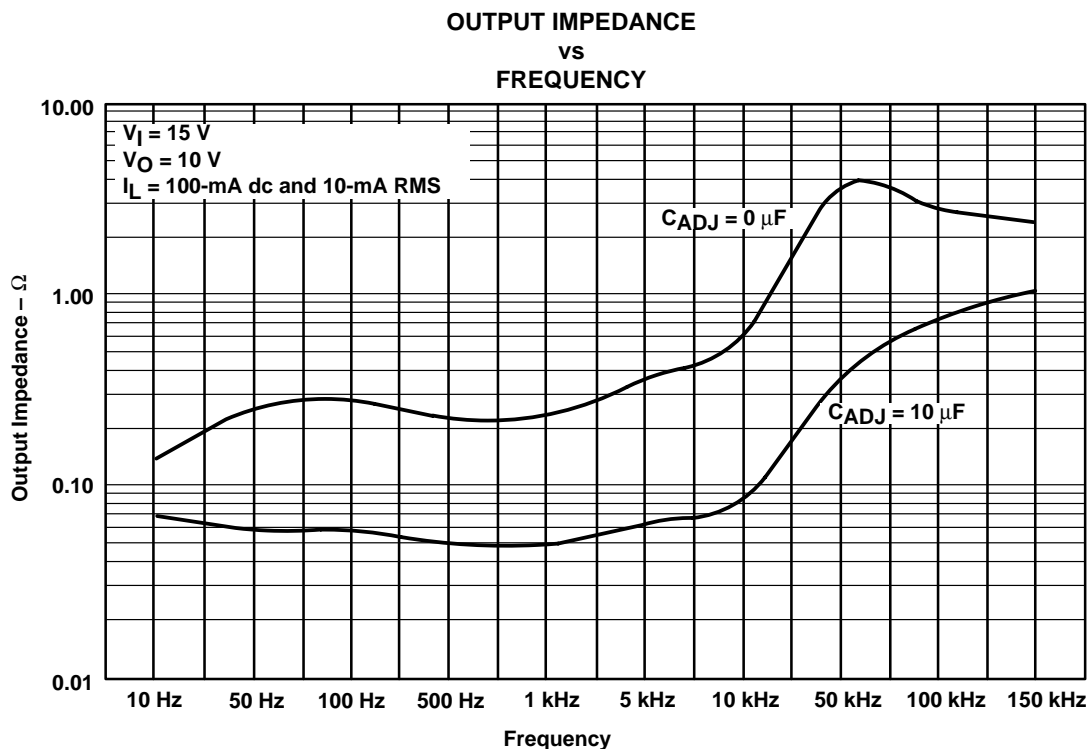


Figure 11

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TYPICAL CHARACTERISTICS

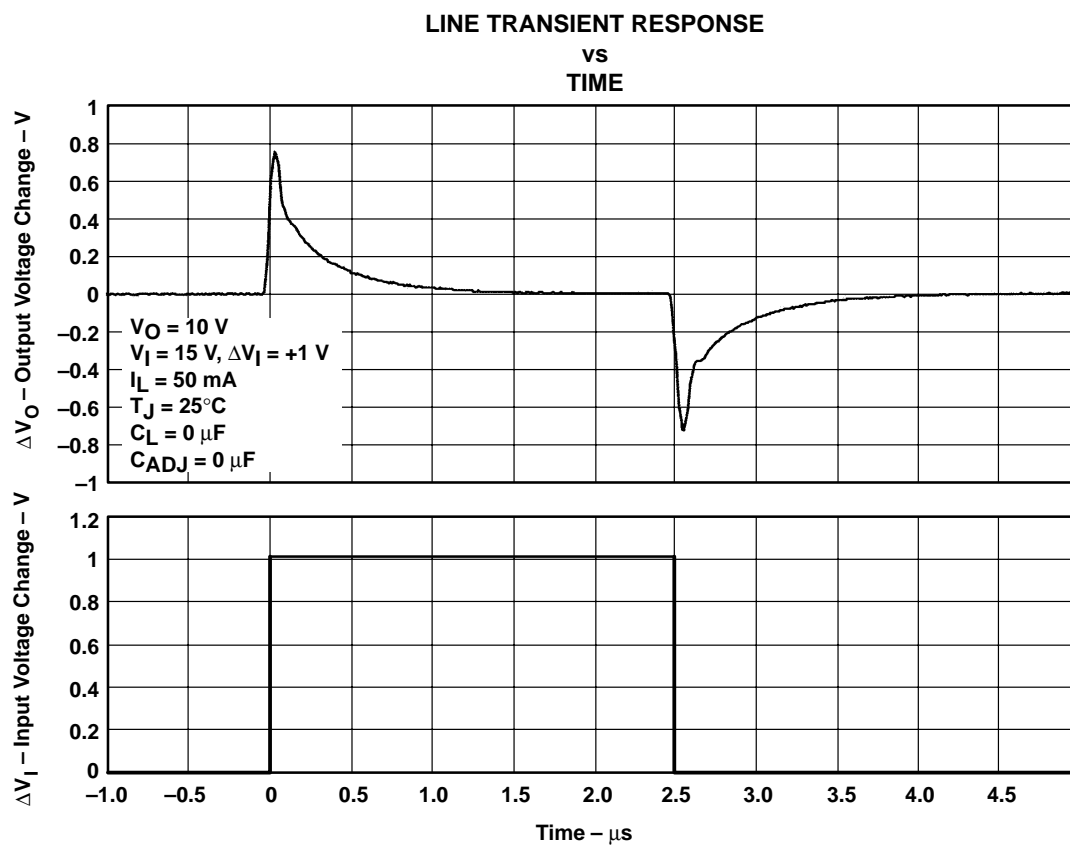


Figure 12

TYPICAL CHARACTERISTICS

LOAD TRANSIENT RESPONSE

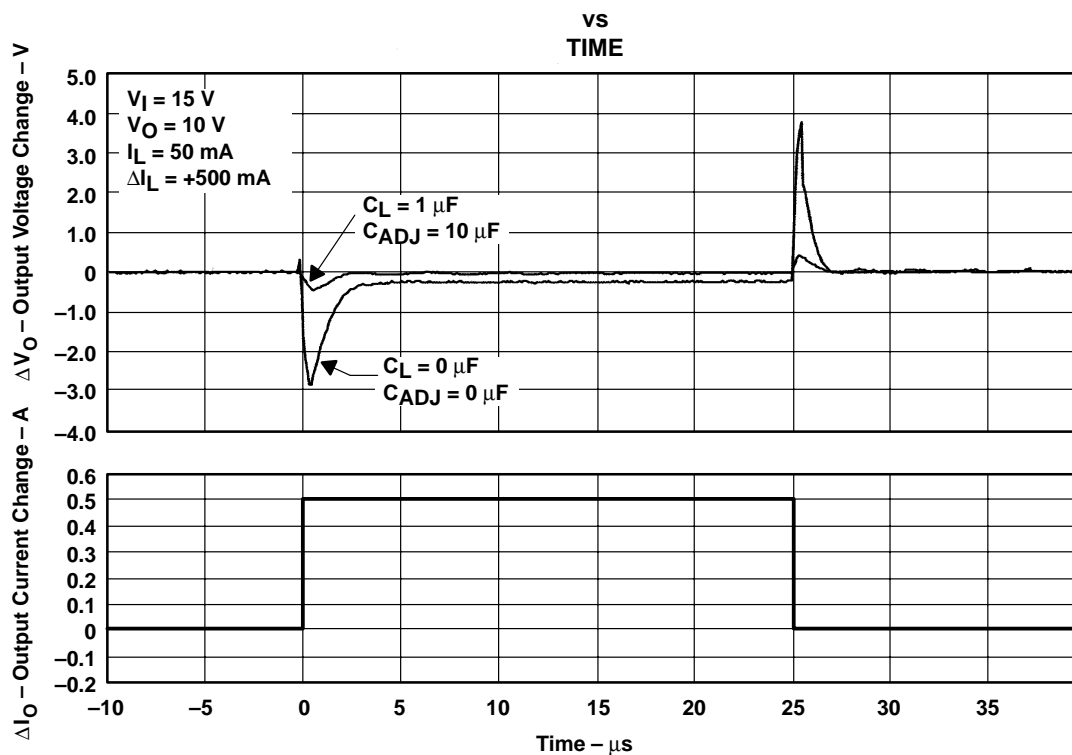


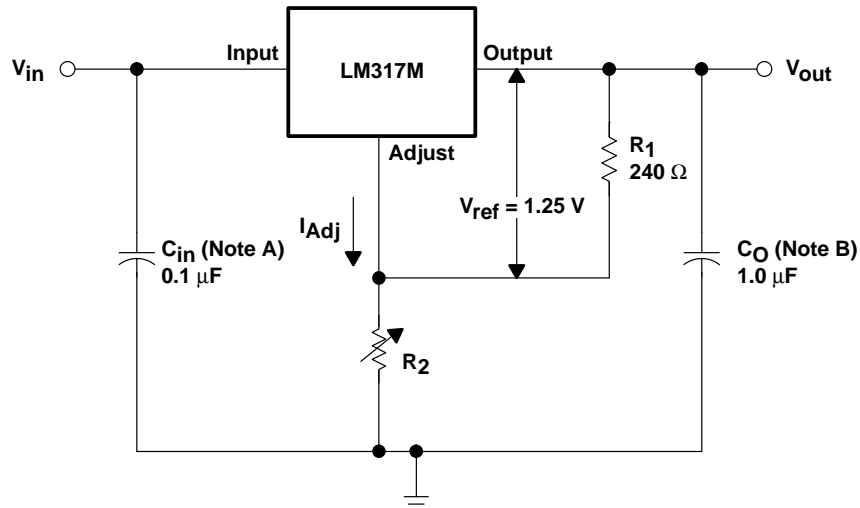
Figure 13

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APPLICATION INFORMATION



NOTES: A. C_{in} is not required unless the LM317M is more than 6 inches from the input filter capacitors.

B. C_O improves transient response, but is not needed for stability.

V_{out} is calculated as shown:

$$V_{out} = V_{ref} \left(1 + \frac{R_2}{R_1} \right) + (I_{Adj} \times R_2)$$

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

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