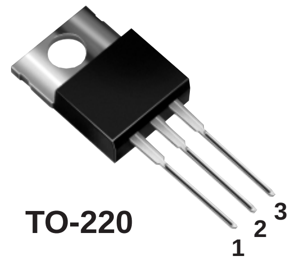
3-Terminal Adjustable Output Positive Voltage Regulators

Features

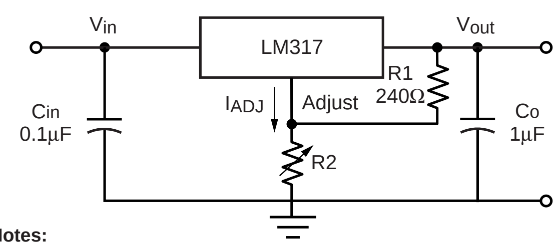
- Output current in excess of 1.5 ampere
- Output adjustable between 1.2V and 37V
- Internal thermal overload protection
- Internal short-circuit current limiting constant with temperature
- Output transistor safe-area compensation
- Floating operation for high voltage applications
- Eliminates stocking many fixed voltages



TO-220

1. Adjust
2. V_{out}
3. V_{in}
Heatsink is connected to pin 2

Standard Application



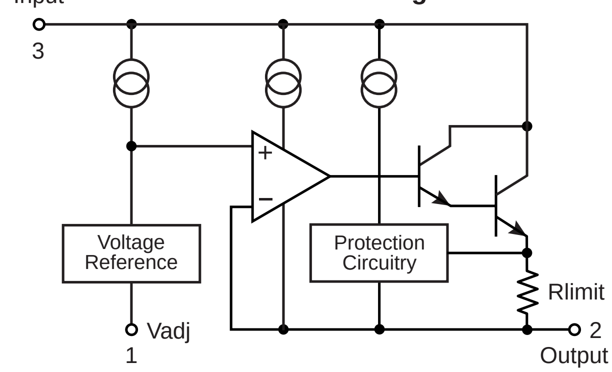
Notes:
Cin is required if regulator is located an appreciable distance from power supply filter.

Co is not needed for stability, however, it does improve transient response.

$V_{out} = 1.25V\ (1 + R_2/R_1) + I_{Adj}\ R2$

Since I_{Adj} is controlled to less than 100µA, the error associated with this term is negligible in most applications

Functional Block Diagram



Maximum Ratings

Ratings at 25°C ambient temperature unless otherwise specified.

Parameter	Symbol	Value	Unit
Input-Output Voltage Differential	V_i-V_o	40	Vdc
Junction-to-Case Thermal Resistance	$R_{\theta JC}$	3.0	°C
Power Dissipation, 25°C Case Temperature	P_D	15	W
Operating Junction Temperature Range	T_J	0 to +125	°C
Storage Junction Temperature Range	T_{stg}	–65 to +150	°C

Electrical Characteristics

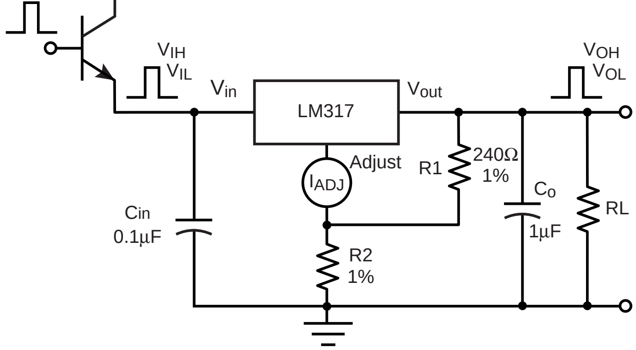
V_i -V_O = 5V, I_O = 0.5A, T_J = T_{low} to T_{high} (see Note 1), I_{max} and P_{max} per Note 2, unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Line Regulation (Fig. 1)(3) 3.0V ≤ V_I – V_O ≤ 40V	REG_{line}	T_A = 25°C	–	0.01	0.04	%V_O/V
		T_J = 0°C thru 125°C	–	0.02	0.07	
Load Regulation (Fig. 2)(3) T_J = 25°C, 10mA ≤ I_O ≤ 1.5A	REG_{load}	V_O ≤ 5.0	–	5	25	mV
		V_O ≥ 5.0	–	0.1	0.5	%V_O
Load Regulation (Fig. 2)(3) 10mA ≤ I_O ≤ 1.5A	REG_{load}	V_O ≤ 5.0	–	20	70	mV
		V_O ≥ 5.0	–	0.3	1.5	%V_O
Thermal Regulation	REG_{therm}	T_J = 25°C, 20ms Pulse	–	0.03	0.07	%V_O/W
Adjustment Pin Current (Fig. 3)	I_{Adj}		–	50	100	µA
Adjustment Pin Current Change	ΔI_{Adj}	10mA ≤ I_L ≤ 1.5A 2.5V ≤ V_I – V_O ≤ 40V	–	0.2	5	µA
Reference Voltage (Fig. 3)(4)	V_{ref}	10mA ≤ I_O ≤ 1.5A 3V ≤ V_I – V_O ≤ 40V	1.225	1.25	1.275	V
Temperature Stability (Fig. 3)	T_S	T_{low} ≤ T_J ≤ T_{high}	–	1	–	%V_O
Min. Load Current to Maintain Regulation (Fig. 3)	I_{Lmin}	V_I – V_O = 40V	–	3.5	10	mA
Maximum Output Current (Fig. 3)	I_{max}	V_I – V_O ≤ 15V	1.5	2.2	–	A
		V_I – V_O = 40V, T_J = 25°C	0.15	0.4	–	
RMS Noise, % of V_O	N	T_J = 25°C, 10HZ ≤ f ≤ 10KHZ	—	0.003	–	%V_O
Ripple Rejection (Fig. 4)	RR	V_O = 10V, f = 120HZ(5) C_{Adj} = 10µF	— 66	65 80	– –	dB
Long-Term Stability (after 1000 hr) Fig. 3	S	T_J = 125°C(6), T_J = 25°C for Endpoint Measurements	–	0.3	1.0	%
Thermal Resistance Junction to Case	$R_{\theta JC}$	T_{low} ≤ T_J ≤ T_{high}	–	5.0	–	°C/W

Notes:
(1) T_{low} = 0°C T_{high} = 125°C
(2) I_{max} = 1.5A P_{max} is internally limited
(3) Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.
(4) Selected devices with tightened tolerance reference voltage available.

Fig. 1 – Line Regulation Test Circuit

$$\text{Line Regulation (\%/V)} = \frac{V_{OH} - V_{OL}}{V_{OL}} \times 100$$

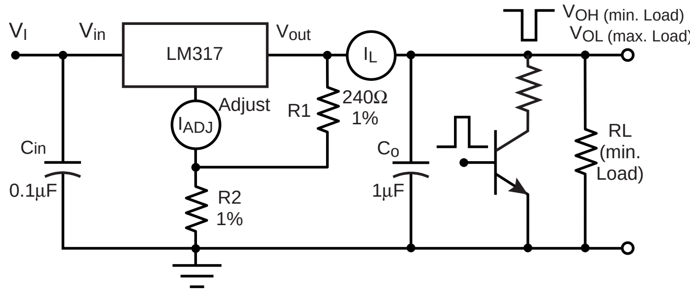


Pulse Testing Required:
1% Duty Cycle is Suggested

Fig. 2 – Load Regulation and ΔI_{adj}/Load Test Circuit

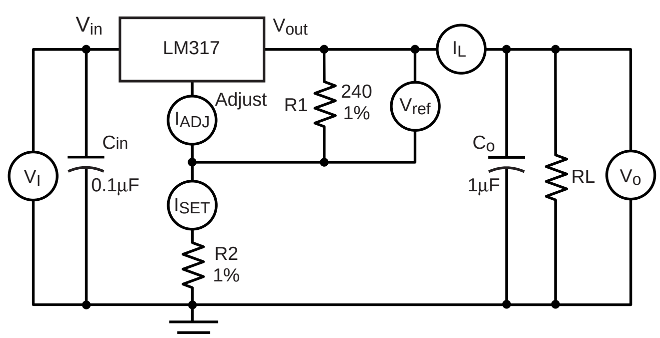
Load Regulator (mV) = Vo(min. Load) – Vo(max. Load)

$$\text{Load Regulator (\%Vo)} = \frac{\text{Vo(min. Load)} - \text{Vo(max. Load)}}{\text{Vo(min. Load)}} \times 100$$



Pulse Testing Required:
1% Duty Cycle is Suggested

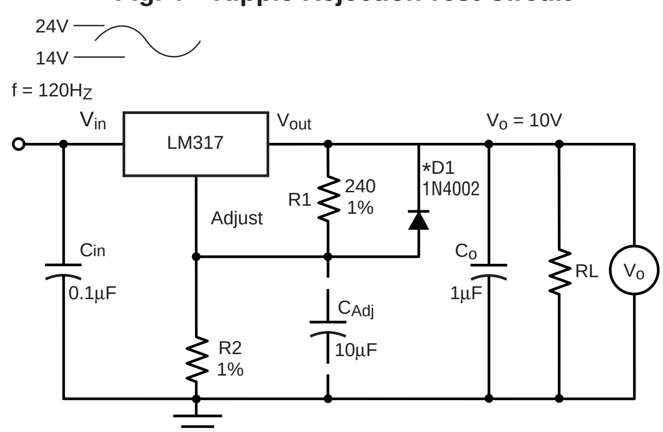
Fig. 3 – Standard Test Circuit



Pulse Testing Required:
1% Duty Cycle is Suggested

To Calculate R2:
$V_O = I_{SET}\,R2 + 1.250V$
Assume $I_{SET} = 5.25mA$

Fig. 4 – Ripple Rejection Test Circuit



*D1 Discharges C_{ADJ} if
Output is Shorted to Ground

Ratings and Characteristic Curves (TA = 25°C unless otherwise noted)

Fig. 5 – Load Regulation

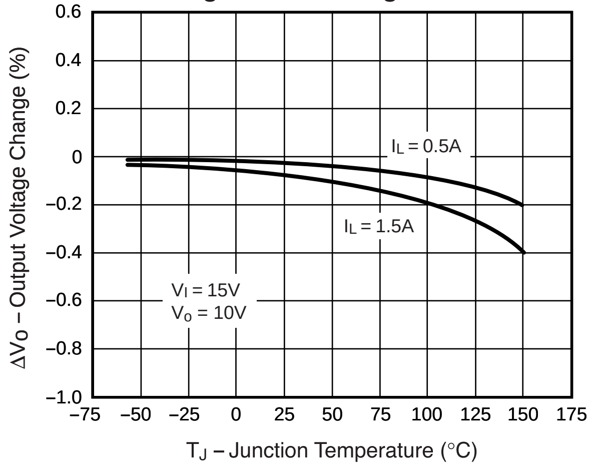


Fig. 6 – Current Limit

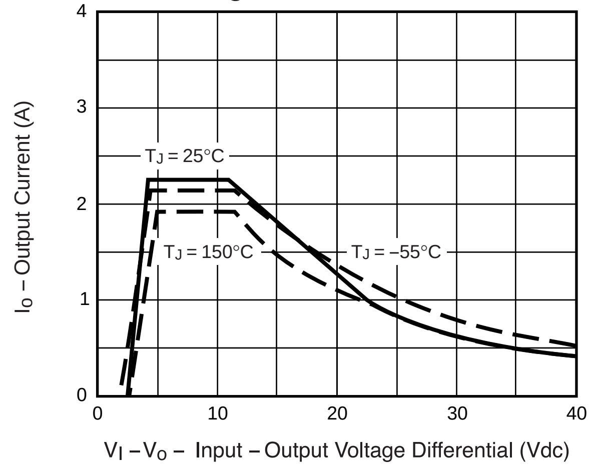


Fig. 7 – Adjustment Pin Current

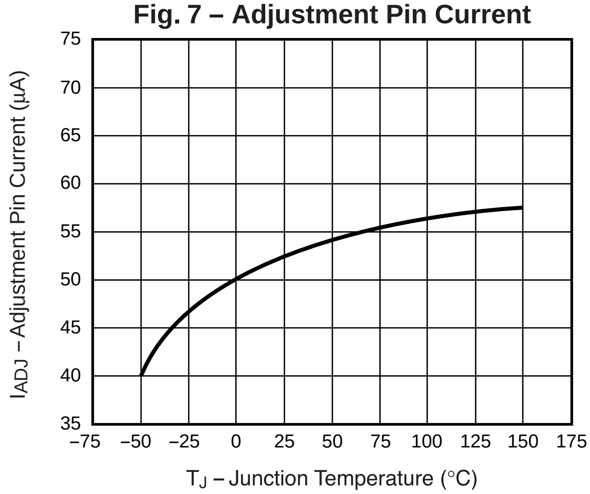


Fig. 8 – Dropout Voltage

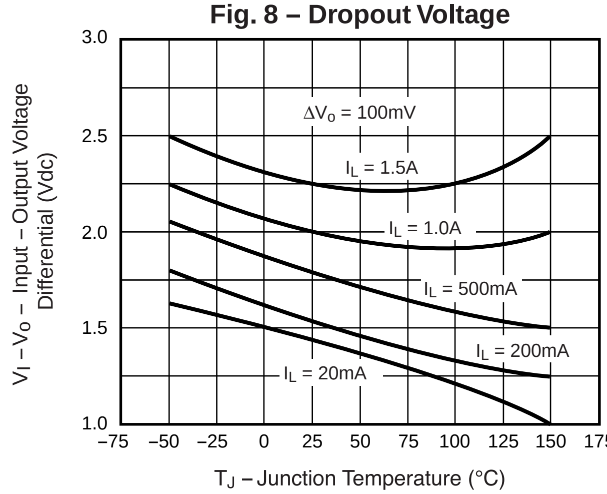


Fig. 9 – Temperature Stability

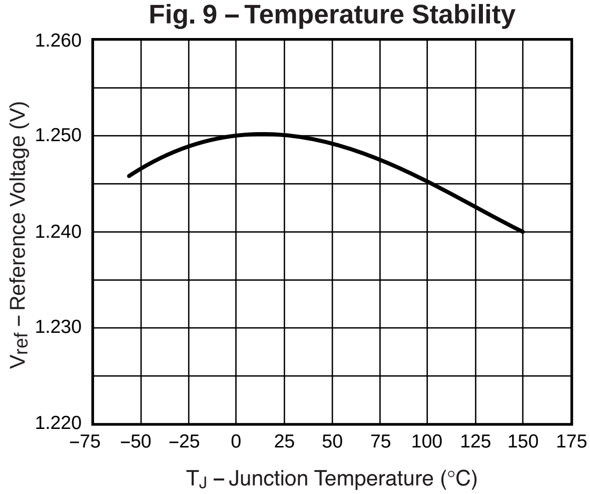
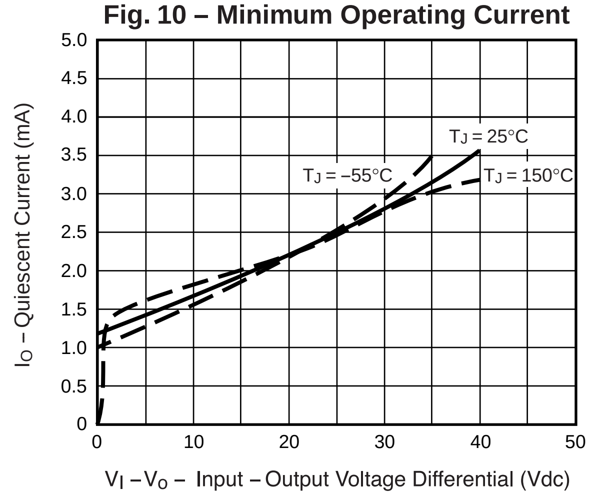


Fig. 10 – Minimum Operating Current



Ratings and Characteristic Curves (TA = 25°C unless otherwise noted)

Fig. 11 – Ripple Rejection vs. Output Voltage

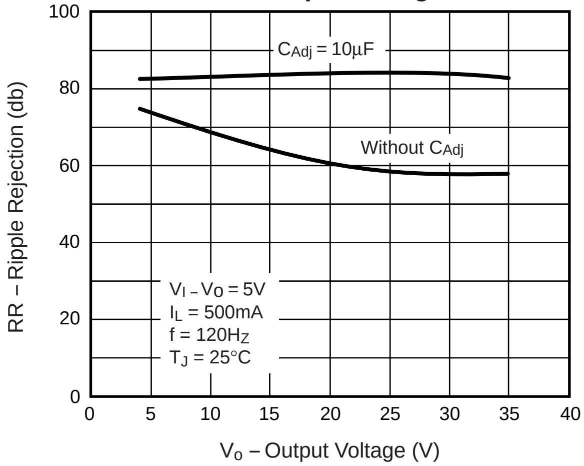


Fig. 12 – Ripple Rejection vs. Output Current

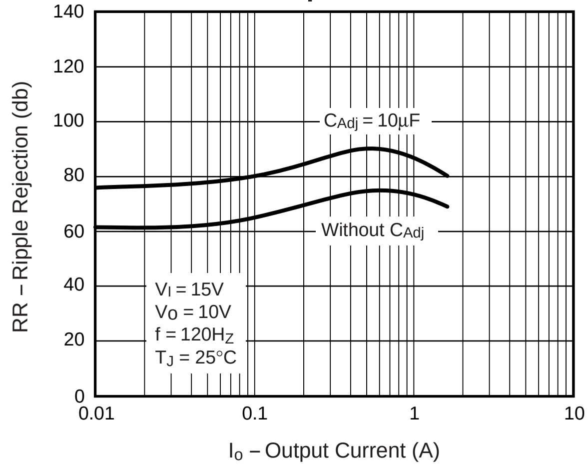


Fig. 13 – Ripple Rejection vs. Frequency

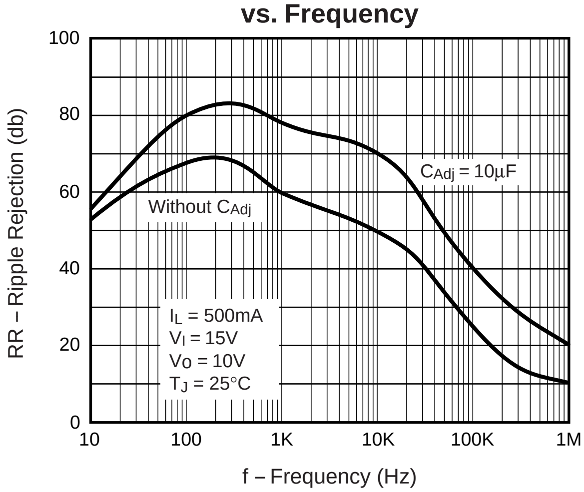


Fig. 14 – Output Impedance

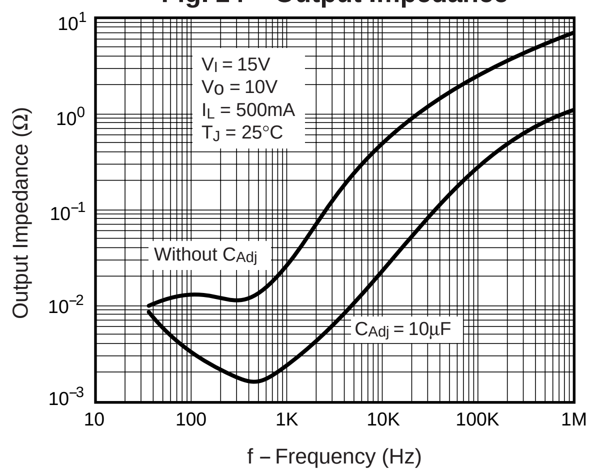


Fig. 15 – Line Transient Response

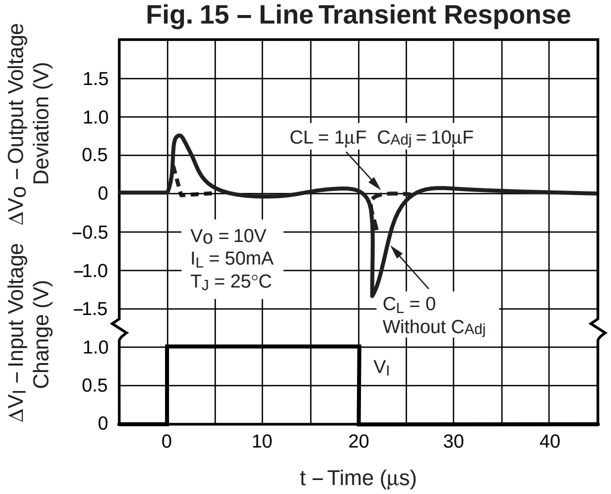
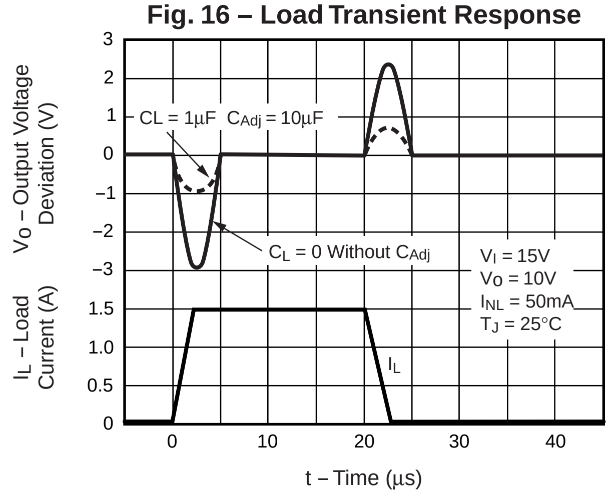


Fig. 16 – Load Transient Response



TO-220 Case Outline