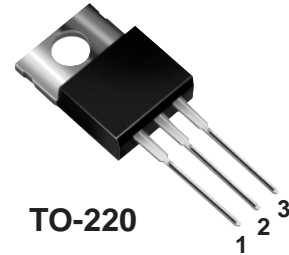


3-Terminal Adjustable Output Positive Voltage Regulators

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

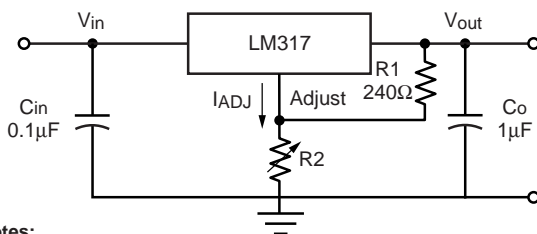


TO-220

1. Adjust
2. V_{out}
3. V_{in}

Heatsink is connected to pin 2

Standard Application



Notes:

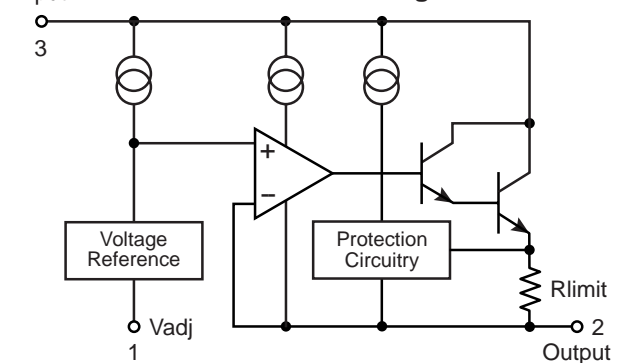
C_{in} is required if regulator is located an appreciable distance from power supply filter.

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

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

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⁾ $3.0V \leq V_i - V_o \leq 40V$	REG _{line}	$T_A = 25^\circ C$	–	0.01	0.04	%V _o /V
		$T_J = 0^\circ C$ thru $125^\circ C$	–	0.02	0.07	
Load Regulation (Fig. 2) ⁽³⁾ $T_J = 25^\circ C$, $10mA \leq I_o \leq 1.5A$	REG _{load}	$V_o \leq 5.0$	–	5	25	mV
		$V_o \geq 5.0$	–	0.1	0.5	%V _o
Load Regulation (Fig. 2) ⁽³⁾ $10mA \leq I_o \leq 1.5A$	REG _{load}	$V_o \leq 5.0$	–	20	70	mV
		$V_o \geq 5.0$	–	0.3	1.5	%V _o
Thermal Regulation	REG _{therm}	$T_J = 25^\circ C$, 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}	$10mA \leq I_L \leq 1.5A$ $2.5V \leq V_i - V_o \leq 40V$	–	0.2	5	μA
Reference Voltage (Fig. 3) ⁽⁴⁾	V _{ref}	$10mA \leq I_o \leq 1.5A$ $3V \leq V_i - V_o \leq 40V$	1.225	1.25	1.275	V
Temperature Stability (Fig. 3)	T _S	$T_{low} \leq T_J \leq T_{high}$	–	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}	$V_i - V_o \leq 15V$	1.5	2.2	–	A
		$V_i - V_o = 40V$, $T_J = 25^\circ C$	0.15	0.4	–	
RMS Noise, % of V _o	N	$T_J = 25^\circ C$, $10Hz \leq f \leq 10KHz$	—	0.003	–	%V _o
Ripple Rejection (Fig. 4)	RR	$V_o = 10V$, $f = 120Hz$ ⁽⁵⁾ $C_{Adj} = 10\mu F$	— 66	65 80	– –	dB
Long-Term Stability (after 1000 hr) Fig. 3	S	$T_J = 125^\circ C$ ⁽⁶⁾ , $T_J = 25^\circ C$ for Endpoint Measurements	–	0.3	1.0	%
Thermal Resistance Junction to Case	R _{θJC}	$T_{low} \leq T_J \leq T_{high}$	–	5.0	–	°C/W

Notes:

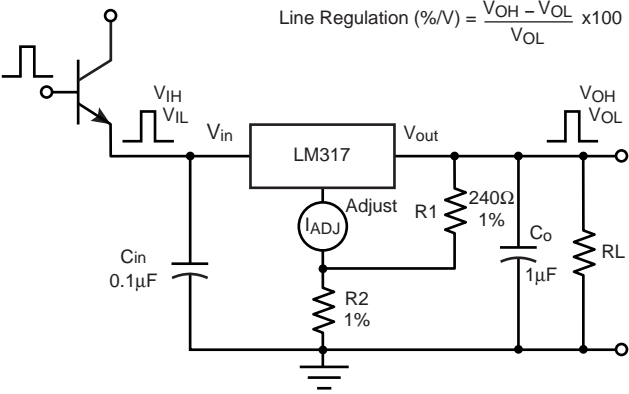
(1) $T_{low} = 0^\circ C$ $T_{high} = 125^\circ C$

(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.

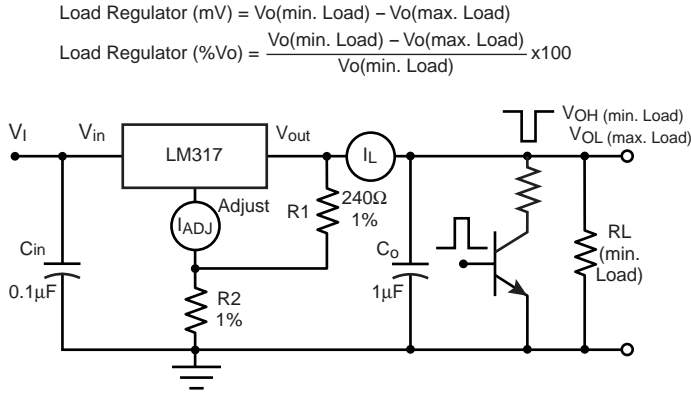
Fig. 1 – Line Regulation Test Circuit



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

Pulse Testing Required:
1% Duty Cycle is Suggested

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

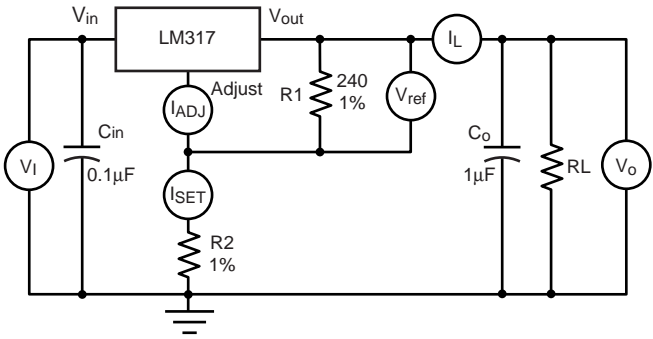


$$\text{Load Regulator (mV)} = V_{o(\text{min. Load})} - V_{o(\text{max. Load})}$$

$$\text{Load Regulator (\%V}_o) = \frac{V_{o(\text{min. Load})} - V_{o(\text{max. Load})}}{V_{o(\text{min. Load})}} \times 100$$

Pulse Testing Required:
1% Duty Cycle is Suggested

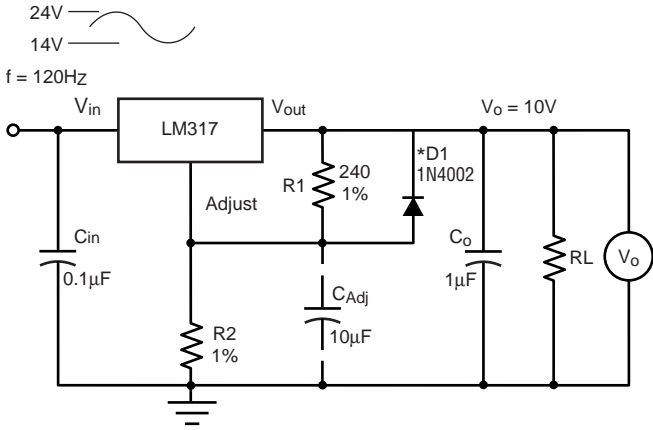
Fig. 3 – Standard Test Circuit



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 ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Fig. 5 – Load Regulation

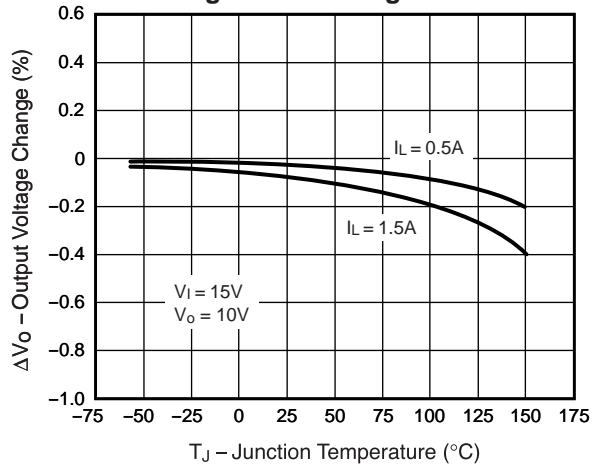


Fig. 6 – Current Limit

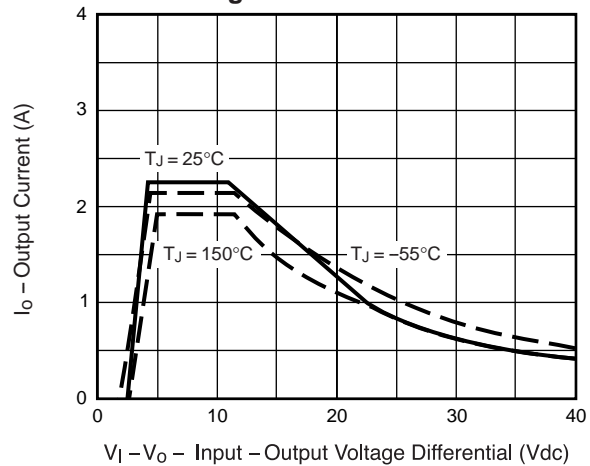


Fig. 7 – Adjustment Pin Current

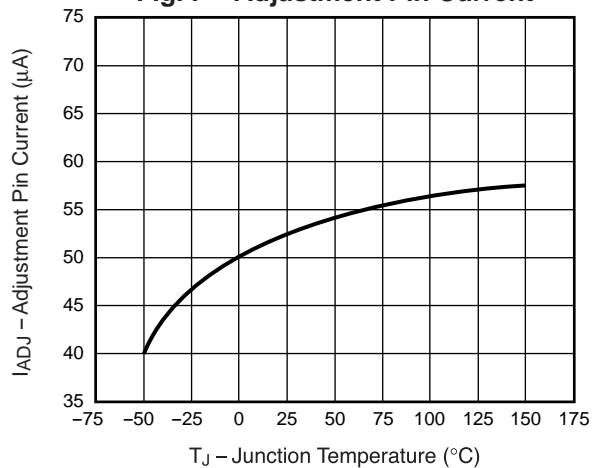


Fig. 8 – Dropout Voltage

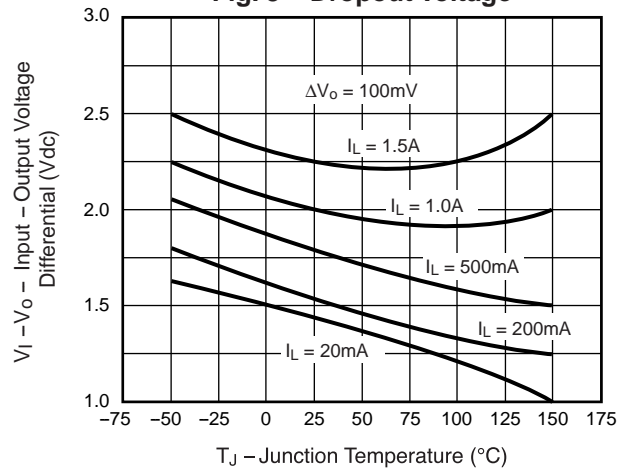


Fig. 9 – Temperature Stability

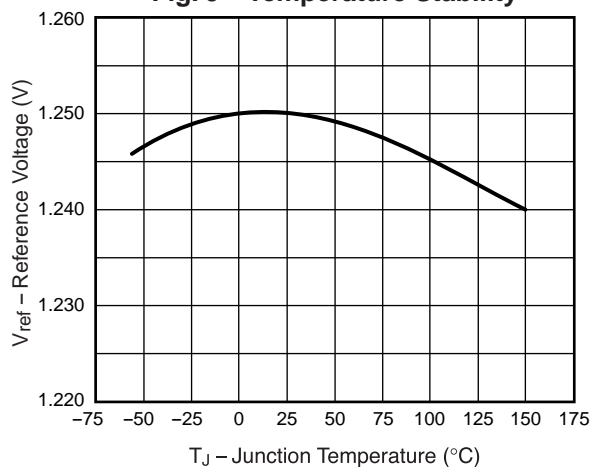
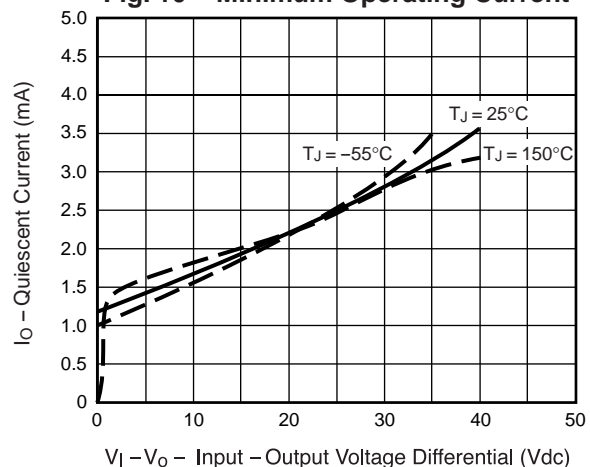


Fig. 10 – Minimum Operating Current



Ratings and Characteristic Curves ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Fig. 11 – Ripple Rejection vs. Output Voltage

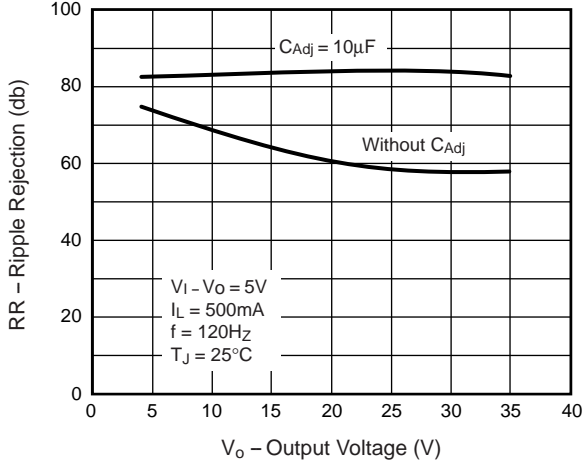


Fig. 12 – Ripple Rejection vs. Output Current

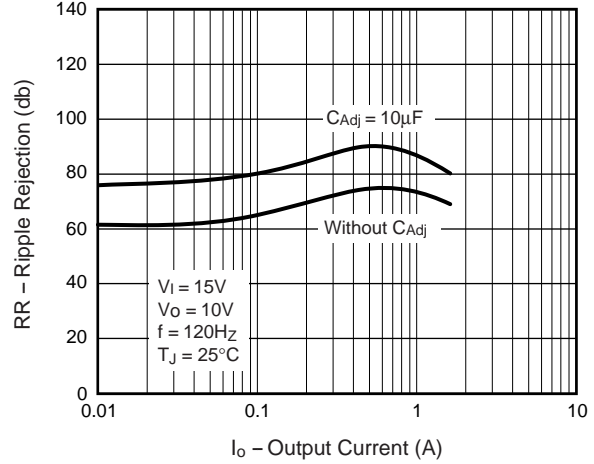


Fig. 13 – Ripple Rejection vs. Frequency

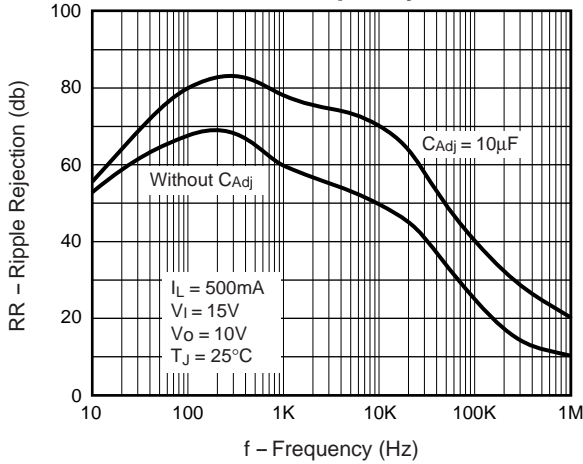


Fig. 14 – Output Impedance

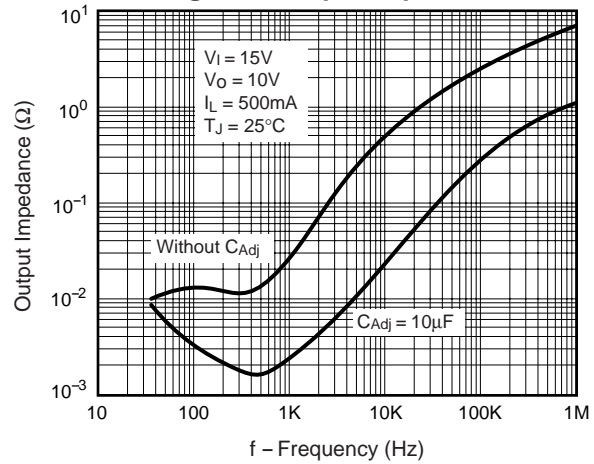


Fig. 15 – Line Transient Response

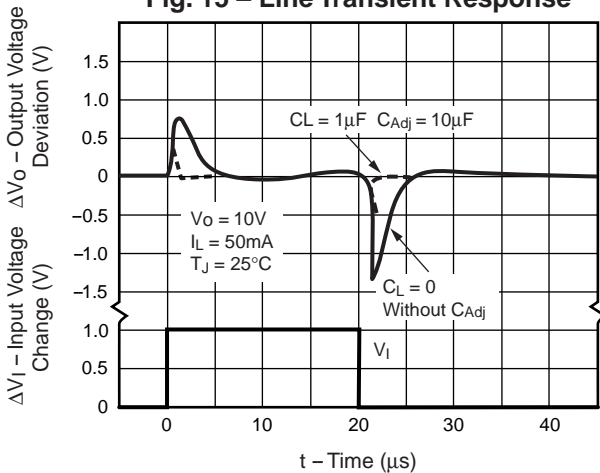
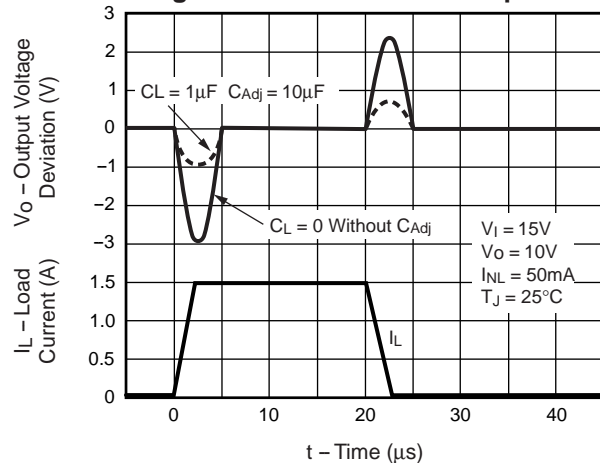


Fig. 16 – Load Transient Response



TO-220 Case Outline

