

1.2V TO 37V VOLTAGE REGULATOR

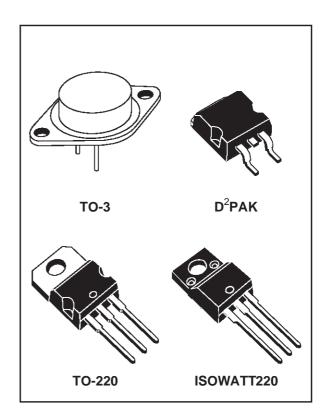
- OUTPUT VOLTAGE RANGE: 1.2 TO 37V
- OUTPUT CURRENT IN EXCESS OF 1.5A
- 0.1% LINE AND LOAD REGULATION
- FLOATING OPERATION FOR HIGH VOLTAGES
- COMPLETE SERIES OF PROTECTIONS: CURRENT LIMITING, THERMAL SHUTDOWN AND SOA CONTROL

DESCRIPTION

The LM117/LM217/LM317 are monolithic integrated circuit in TO-220, ISOWATT220, TO-3 and D²PAK packages intended for use as positive adjustable voltage regulators.

They are designed to supply more than 1.5A of load current with an output voltage adjustable over a 1.2 to 37V range.

The nominal output voltage is selected by means of only a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.



ABSOLUTE MAXIMUM RATING

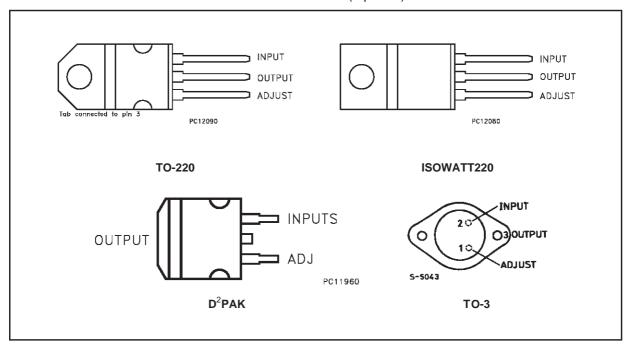
Symbol	Parameter	Value	Unit
V _{i-o}	Input-output Differential Voltage	40	V
Io	Output Current	Intenrally Limited	
Тор	Operating Junction Temperature for: LM117 LM217 LM317	-55 to 150 -25 to 150 0 to 125	ပို့ ပို့
P _{tot}	Power Dissipation	Internally Limited	
T _{stg}	Storage Temperature	- 65 to 150	°C

THERMAL DATA

Symbol	Parameter		TO-3	TO-220	ISOWATT220	D ² PAK	Unit
R _{thj-case}	Thermal Resistance Junction-case Thermal Resistance Junction-ambient	Max	4	3	4	3	°C/W
R _{thj-amb}		Max	35	50	60	62.5	°C/W

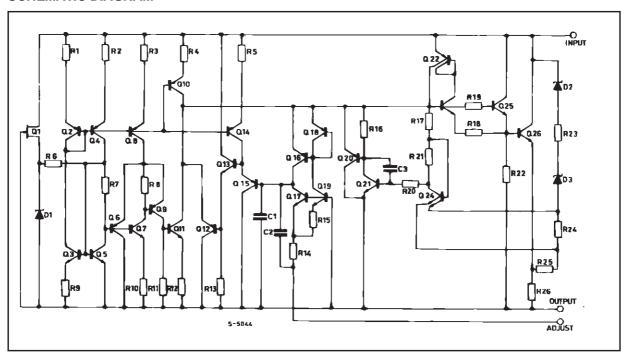
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CONNECTION DIAGRAM AND ORDERING NUMBERS (top view)

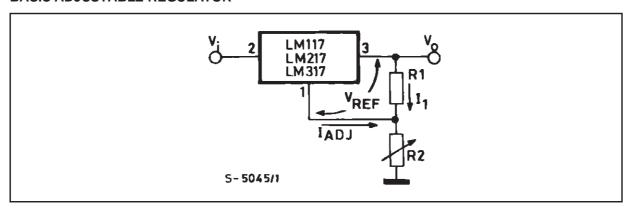


Туре	TO-3	TO-220	ISOWATT220	D ² PAK
LM117	LM117K			
LM217	LM217K	LM217T		LM217D2T
LM317	LM317K	LM317T	LM317P	LM317D2T

SCHEMATIC DIAGRAM



BASIC ADJUSTABLE REGULATOR



ELECTRICAL CHARACTERISTICS ($V_i - V_0 = 5 \text{ V}$, $I_0 = 500 \text{ mA}$, $I_{MAX} = 1.5 \text{A}$ and $P_{MAX} = 20 \text{W}$, unless otherwise specified)

Symbol	Parameter	Test Condit	ions	LM	117/LM	217	LM317			Unit
				Min.	Тур.	Max.	Min.	Тур.	Max.	
ΔVo	Line Regulation	$V_i - V_o = 3 \text{ to } 40 \text{ V}$	T _j = 25 °C		0.01	0.02		0.01	0.04	%/V
					0.02	0.05		0.02	0.07	%/V
ΔV_o	Load Regulation	$V_o \le 5V$	$T_j = 25$ °C		5	15		5	25	mV
		$I_0 = 10 \text{ mA to } I_{MAX}$			20	50		20	70	mV
		$V_o \ge 5V$	$T_j = 25$ °C		0.1	0.3		0.1	0.5	%
		$I_0 = 10 \text{ mA to } I_{MAX}$			0.3	1		0.3	1.5	%
I_{ADJ}	Adjustment Pin Current				50	100		50	100	μΑ
ΔI_{ADJ}	Adjustment Pin Current	$V_i - V_o = 2.5 \text{ to } 40 \text{ V}$ $I_o = 10 \text{ mA to } I_{MAX}$			0.2	5		0.2	5	μΑ
V_{REF}	Reference Voltage (between pin 3 and pin 1)	V_i - V_o = 2.5 to 40 V I_o = 10 mA to I_{MAX} $P_D \le P_{MAX}$		1.2	1.25	1.3	1.2	1.25	1.3	V
$\frac{\Delta V_o}{V_o}$	Output Voltage Temperature Stability				1			1		%
I _{o(min)}	Minimum Load Current	$V_i - V_o = 40 \text{ V}$			3.5	5		3.5	10	mΑ
I _{o(max)}	Maximum Load Current	$V_i - V_o \le 15 \text{ V}$ $P_D < P_{MAX}$		1.5	2.2		1.5	2.2		А
		$V_i - V_o = 40 \text{ V}$ $P_D < P_{MAX}$ $T_j = 25 ^{\circ}\text{C}$			0.4			0.4		А
e _N	Output Noise Voltage (percentance of V _O)	B = 10Hz to 10KHz $T_j = 25$ °C			0.003			0.003		%
SVR	Supply Voltage	T _j = 25 °C	C _{ADJ} =0		65			65		dB
	Rejection (*)	f = 120 Hz	C _{ADJ} =10μF	66	80		66	80		dB

^(*) CADJ is connected between pin 1 and ground.

Note:

(1) Unless otherwise specified the above specs, apply over the following conditions: LM 117 T_j = -55 to 150°C;

LM 217 T_j = -25 to 150°C; LM 317 T_j = 0 to 125°C.

Figure 1 : Output Current vs. Input-output Differential Voltage.

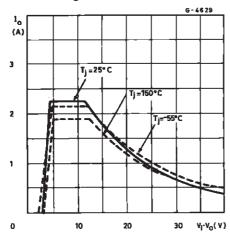
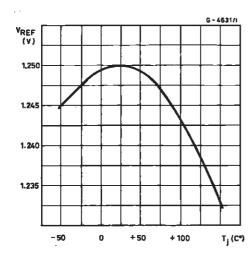


Figure 3: Reference Voltage vs. Junction



APPLICATION INFORMATION

The LM117/217/317 provides an internal reference voltage of 1.25V between the output and adjustments terminals. This is used to set a constant current flow across an external resistor divider (see fig. 4), giving an output voltage Vo of:

$$V_0 = V_{REF} (1 + \frac{R_2}{R_1}) + I_{ADJ} R_2$$

The device was designed to minimize the term I_{ADJ} (100 μ A max) and to maintain it very constant with line and load changes. Usually, the error term $I_{ADJ} \cdot R_2$ can be neglected. To obtain the previous requirement, all the regulator quiescent current is returned to the output terminal, imposing a minimum load current condition. If the load is insufficient, the output voltage will rise.

Since the LM117/217317 is a floating regulator and "sees" only the input-to-output differential

Figure 2: Dropout Voltage vs. Junction Temperature.

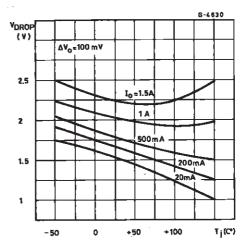
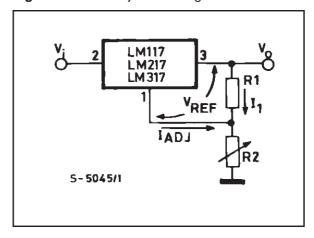


Figure 4: Basic Adjustable Regulator.



voltage, supplies of very high voltage with respect to ground can be regulated as long as the maximum input-to-output differential is not exceeded. Furthermore, programmable regulator are easily obtainable and, by connecting a fixed resistor between the adjustment and output, the device can be used as a precision current regulator.

In order to optimise the load regulation, the current set resistor R1 (see fig. 4) should be tied as close as possible to the regulator, while the ground terminal of R2 should be near the ground of the load to provide remote ground sensing.

Performance may be improved with added capacitance as follow:

An input bypass capacitor of 0.1μF

An adjustment terminal to ground 10µF capacitor

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to improve the ripple rejection of about 15 dB ($C_{\mbox{\scriptsize ADJ}}$).

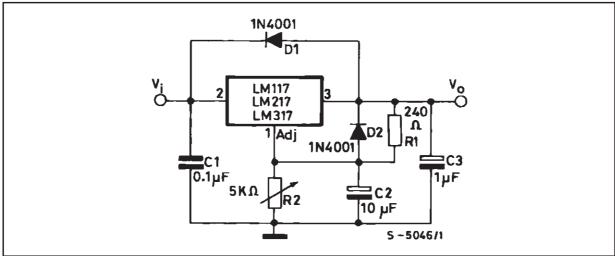
An $1\mu F$ tantalium (or $25\mu F$ Aluminium electrolitic) capacitor on the output to improve transient response.

In additional to external capacitors, it is good

practice to add protection diodes, as shown in fig.5.

D1 protect the device against input short circuit, while D2 protect against output short circuit for capacitance discharging.

Figure 5: Voltage Regulator with Protection Diodes.



D1 protect the device against input short circuit, while D2 protects against output short circuit for capacitors discharging

Figure 6: Slow Turn-on 15V Regulator.

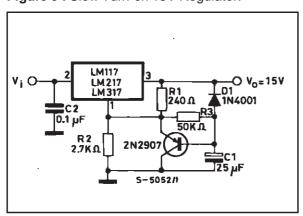


Figure 7: Current Regulator.

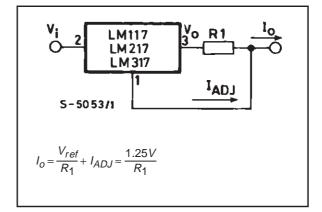


Figure 8:5V Electronic Shut-down Regulator

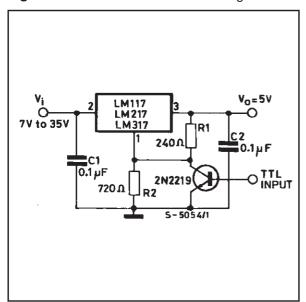


Figure 10: Battery Charger (12V)

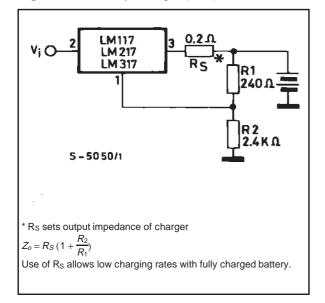


Figure 9: Digitally Selected Outputs

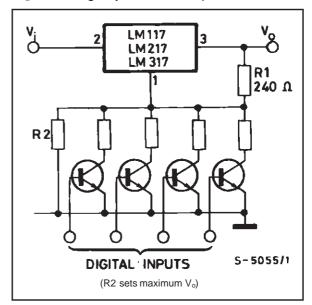
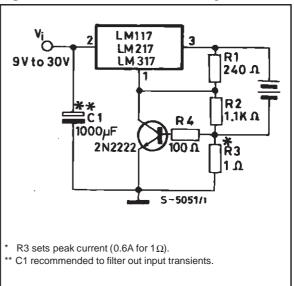


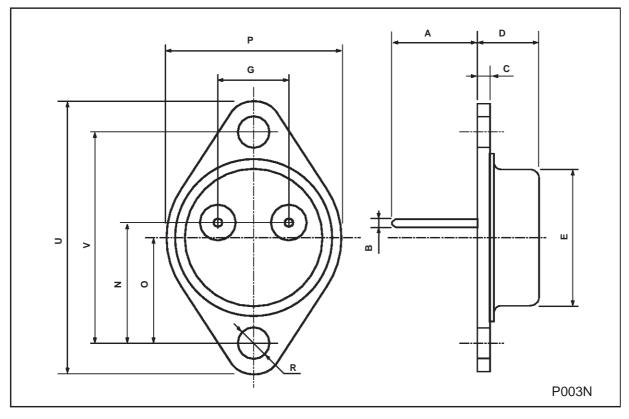
Figure 11 : Current Limited 6V Charger



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TO-3 (R) MECHANICAL DATA

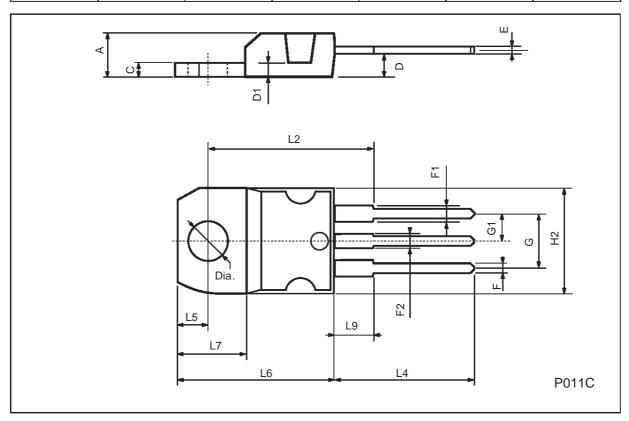
DIM.		mm		inch			
2	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
А		11.7			0.460		
В	0.96		1.10	0.037		0.043	
С			1.70			0.066	
D			8.7			0.342	
E			20.0			0.787	
G		10.9			0.429		
N		16.9			0.665		
Р			26.2			1.031	
R	3.88		4.09	0.152		0.161	
U			39.50			1.555	
V		30.10			1.185		



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TO-220 MECHANICAL DATA

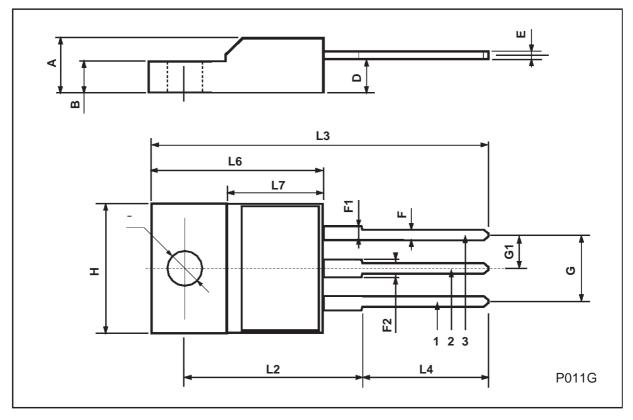
DIM.		mm			inch	
Dilvi.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
Α	4.40		4.60	0.173		0.181
С	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



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ISOWATT220 MECHANICAL DATA

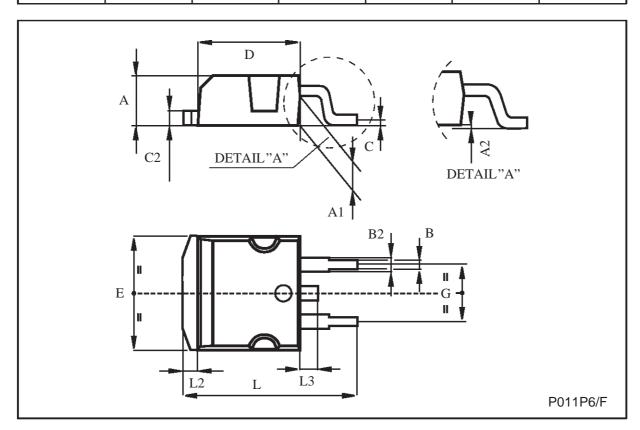
DIM.		mm		inch			
DIIVI.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
А	4.4		4.6	0.173		0.181	
В	2.5		2.7	0.098		0.106	
D	2.5		2.75	0.098		0.108	
Е	0.4		0.7	0.015		0.027	
F	0.75		1	0.030		0.039	
F1	1.15		1.7	0.045		0.067	
F2	1.15		1.7	0.045		0.067	
G	4.95		5.2	0.195		0.204	
G1	2.4		2.7	0.094		0.106	
Н	10		10.4	0.393		0.409	
L2		16			0.630		
L3	28.6		30.6	1.126		1.204	
L4	9.8		10.6	0.385		0.417	
L6	15.9		16.4	0.626		0.645	
L7	9		9.3	0.354		0.366	
Ø	3		3.2	0.118		0.126	



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TO-263 (D²PAK) MECHANICAL DATA

DIM.		mm		inch			
Diiii.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
А	4.4		4.6	0.173		0.181	
A1	2.49		2.69	0.098		0.106	
В	0.7		0.93	0.027		0.036	
B2	1.14		1.7	0.044		0.067	
С	0.45		0.6	0.017		0.023	
C2	1.23		1.36	0.048		0.053	
D	8.95		9.35	0.352		0.368	
E	10		10.4	0.393		0.409	
G	4.88		5.28	0.192		0.208	
L	15		15.85	0.590		0.624	
L2	1.27		1.4	0.050		0.055	
L3	1.4		1.75	0.055		0.068	



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