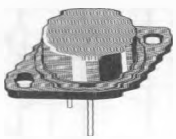
SGS-THOMSON
MICROELECTRONICS

LM117/217
LM317

1.2V TO 37V ADJUSTABLE 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

TO-220



TO-3

DESCRIPTION

The LM117/LM217/LM317 are monolithic integrated circuit in TO-220 and TO-3 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.

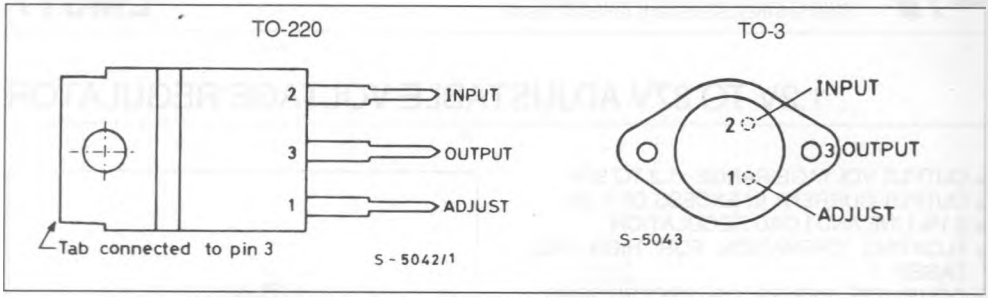
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{i-o}	Input-output Differential Voltage		40	V
I_O	Output Current		Internally Limited	
T_{op}	Operating Junction Temperature for :	LM117	– 55 to 150	°C
		LM217	– 25 to 150	°C
		LM317	0 to 125	°C
P_{tot}	Power Dissipation		Internally limited	
T_{stg}	Storage Temperature		– 65 to 150	°C

THERMAL DATA

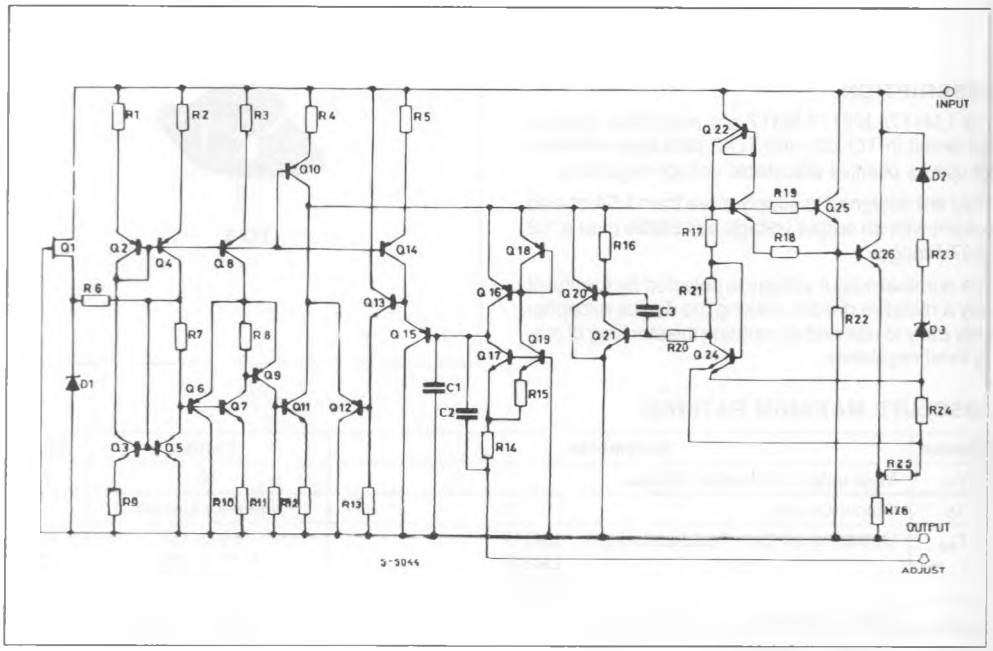
			TO-3	TO-220	
$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case	Max	4	4	°C/W
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	Max	35	50	°C/W

PIN CONNECTION

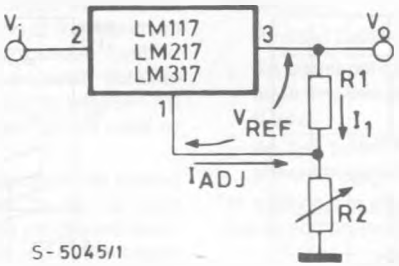


Type	TO-220	TO-3
LM117		LM117K
LM217	LM217T	LM217K
LM317	LM317T	LM317K

SCHEMATIC DIAGRAM



Basic adjustable regulator.



ELECTRICAL CHARACTERISTICS (V_i-V_o = 5V, I_o = 500mA, unless otherwise specified)

Symbol	Parameter	Test Conditions		LM117/LM217			LM317			Unit
				Min.	Typ.	Max.	Min.	Typ.	Max.	
ΔV_o	Line Regulation	V_i-V_o = 3 to 40V	T_j = 25°C		0.01	0.02		0.01	0.04	%/V
					0.02	0.05		0.02	0.07	
ΔV_o	Load Regulation	$V_o \leq 5V$ I_o = 10mA to 1.5A	T_j = 25°C		5	15		5	25	mV
					20	50		20	70	
		$V_o \geq 5V$ I_o = 10mA to 1.5A	T_j = 25°C		0.1	0.3		0.1	0.5	%
					0.3	1		0.3	1.5	
I_{ADJ}	Adjustment Pin Current				50	100		50	100	µA
ΔI_{ADJ}	Adjustment Pin Current	V_i-V_o = 2.5 to 40V I_o = 10mA to 1.5A			0.2	5		0.2	5	µA
V_{REF}	Reference Voltage (between pin 3 and pin 1)	V_i-V_o = 3 to 40V I_o = 10mA to 1.5A		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 = 40V			3.5	5		3.5	10	mA
$I_{o\,max}$	Maximum Load Current	V_i-$V_o \leq 15V$		1.5	2.2		1.5	2.2		A
		V_i-V_o = 40V			0.4			0.4		
e_N	Output Noise (percentage of V_o)	T_j = 25°C, 10Hz to 10KHz			0.003			0.003		%
SVR	Supply Voltage Rejection (*)	T_j = 25°C f = 120Hz	C_{ADJ} = 0		65			65		dB
			C_{ADJ} = 10µF	66	80		66	80		

(*) CADJ is connected between pin 1 and ground

Note : 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.

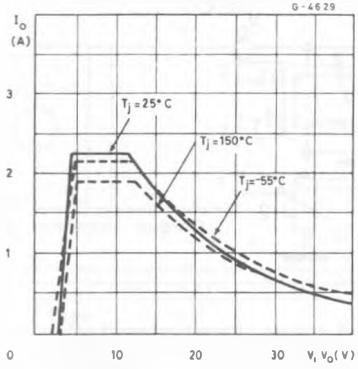


Figure 2 : Dropout Voltage vs. Junction Temperature.

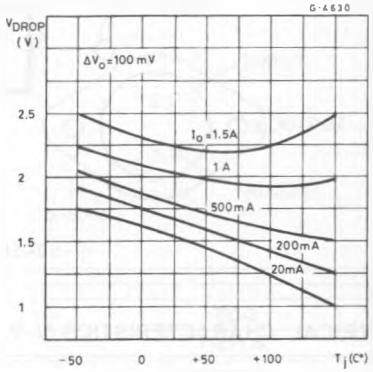


Figure 3 : Reference Voltage vs. Junction Temperature.

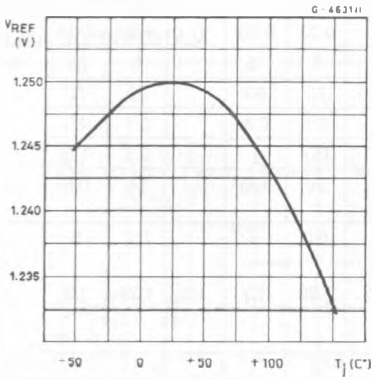
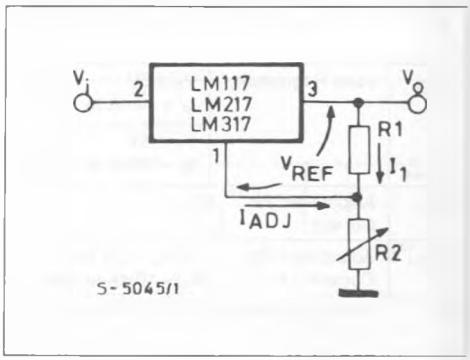


Figure 4 : Basic Adjustable Regulator.



APPLICATION INFORMATION

The LM117/LM217/LM317 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 V_O of :

$$V_O = V_{REF}\left(1 + \frac{R2}{R1}\right) + I_{ADJ}\,R2$$

The device was designed to minimize the term I_{ADJ} (100µA max) and to maintain it very constant with line and load changes. Usually, the error term I_{ADJ} 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/LM217/LM317 is a floating regulator and "sees" only the input-to-output differential 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.

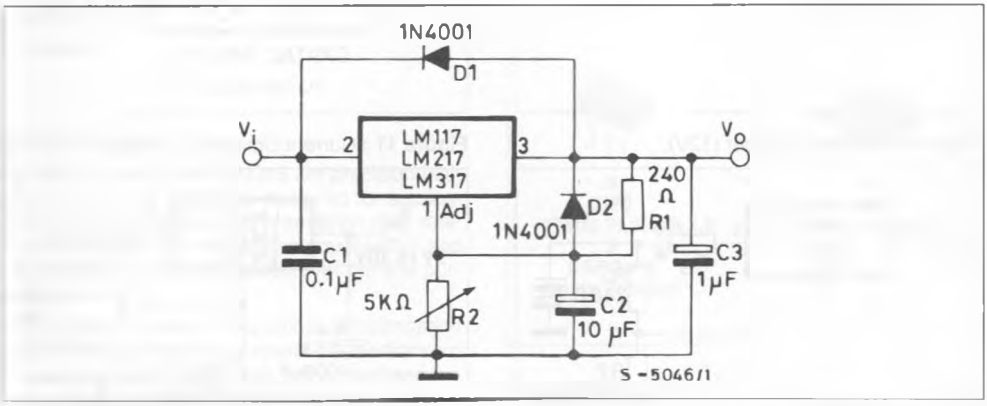
In order to optimise the load regulation, the current set resistor R1 (see fig. 4) should be tied as close as possible to the regulator, while the ground terminal of R2 should be near the ground of the load to provide remote ground sensing.

No external capacitors are required, but performance may be improved with added capacitance as follows :

- An input bypass capacitor of 0.1µF
- An adjustment terminal to ground 10µF capacitor to improve the ripple rejection of about 15dB (C_{ADJ})
- An 1µF tantalum 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.

Figure 5 : Voltage Regulator with Protection Diodes.



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

Figure 6 : Slow Turn-on 15V Regulator.

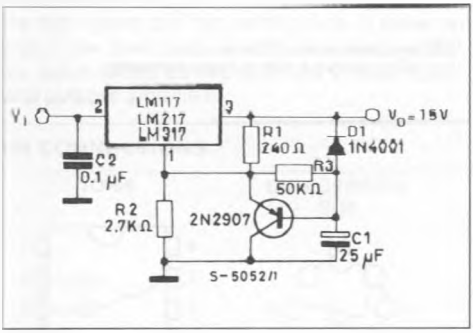


Figure 7 : Current Regulator.

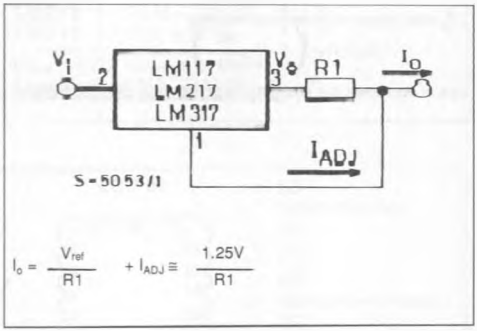


Figure 8 : 5V Electronic Shut-down Regulator.

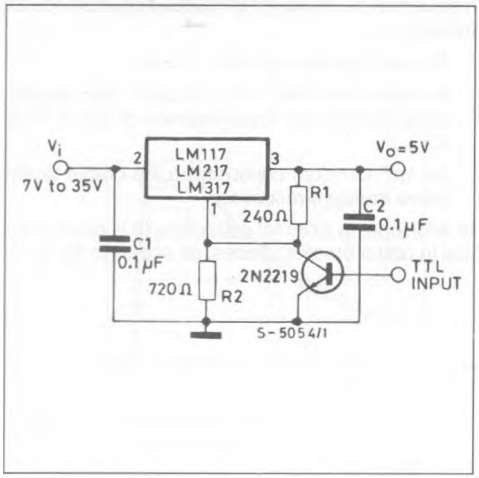


Figure 9 : Digitally Selected Outputs.

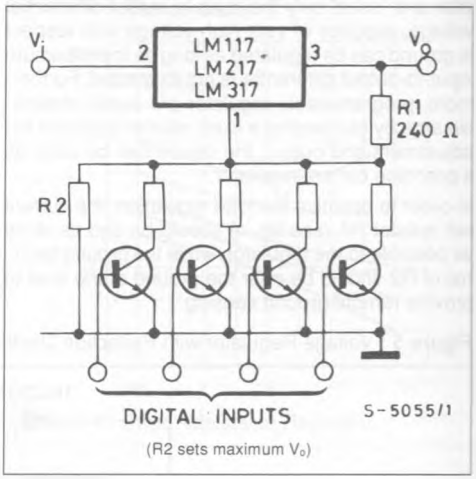


Figure 10 : Battery Charger (12V).

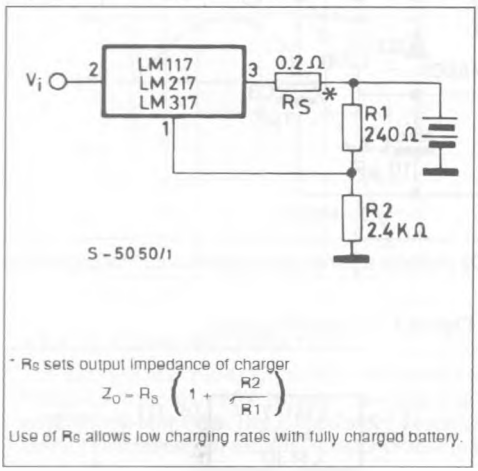


Figure 11 : Current Limited 6V Charger.