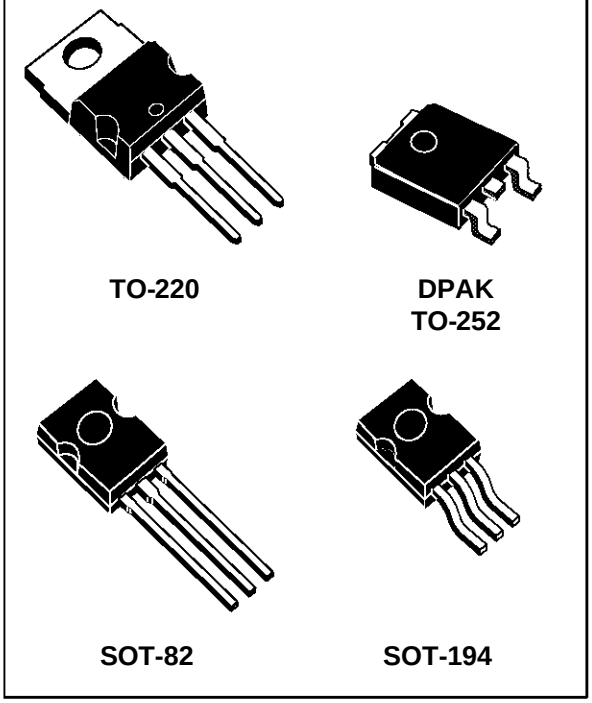
SGS-THOMSON MICROELECTRONICS

LM217M
LM317M

MEDIUM CURRENT 1.2 TO 37V ADJUSTABLE VOLTAGE REGULATOR

- OUTPUT VOLTAGE RANGE : 1.2 TO 37V
- OUTPUT CURRENT IN EXCESS OF 500 mA
- LINE REGULATION TYP. 0.01%
- LOAD REGULATION TYP. 0.1%
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSISTOR SAFE AREA COMPENSATION
- FLOATING OPERATION FOR HIGH VOLTAGE APPLICATIONS



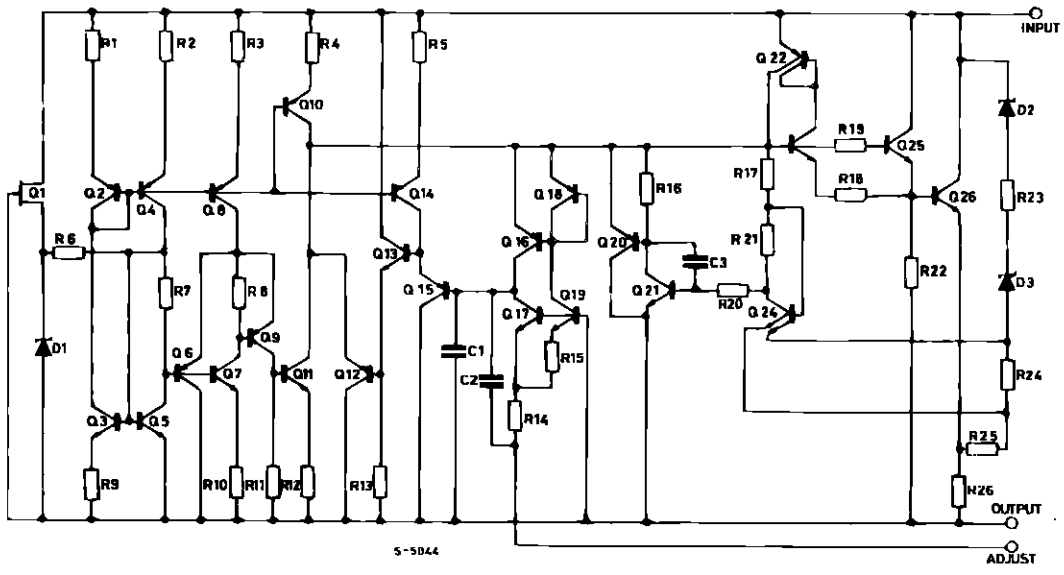
DESCRIPTION

The LM217M/LM317M are monolithic integrated circuits in TO-220, DPAK, SOT-82 and SOT-194 packages intended for use as positive adjustable voltage regulators.

They are designed to supply until 500 mA 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.

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

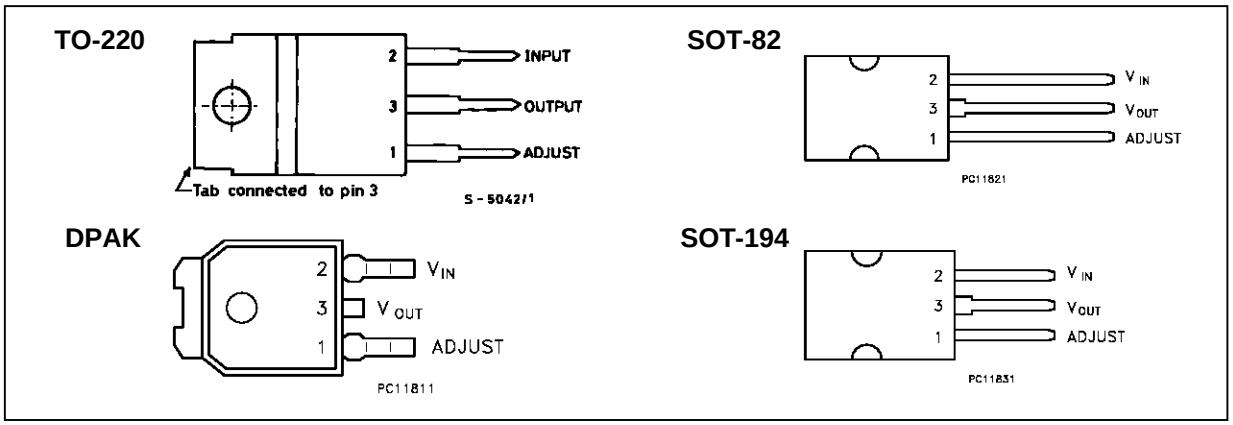
Symbol	Parameter	Value	Unit
V_i - V_o	Input-Output Differential Voltage	40	V
P_d	Power Dissipation	Internally Limited	
T_{opr}	Operating Junction Temperature Range (*) for **LM217M** for **LM317M**	-40 to 125 0 to 125	^oC ^oC
T_{stg}	Storage Temperature Range	-55 to 150	^oC

(*) Re-Boot is not guaranteed for $T_j \geq 85\ ^oC$

THERMAL DATA

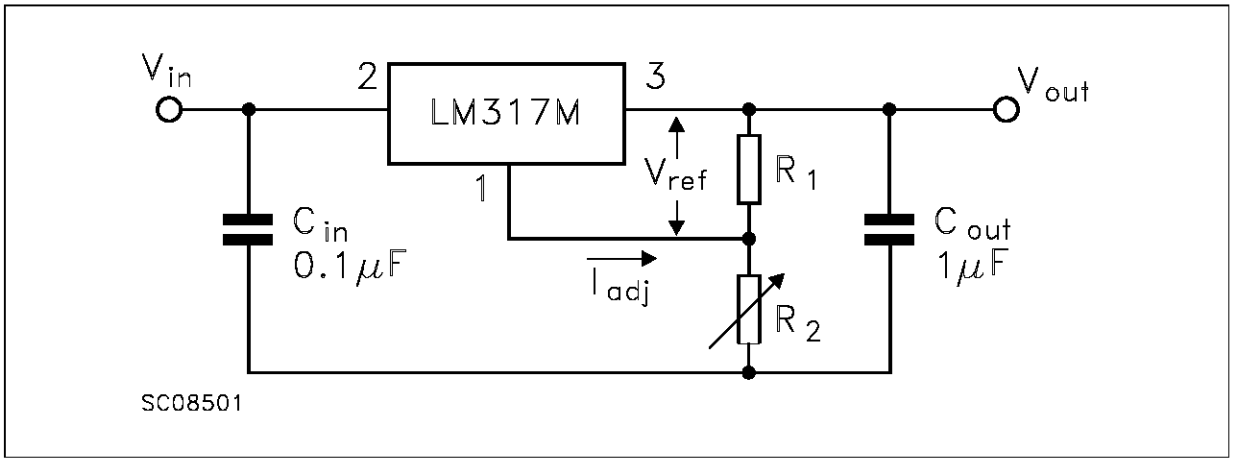
Symbol	Parameter	SOT-82 SOT-194 DPAK	TO-220	Unit
$R_{thj\text{-}case}$	Thermal Resistance Junction-case Max	8	3	$^oC/W$
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient Max	100	50	$^oC/W$

PIN CONNECTION AND ORDERING NUMBERS



Type	TO-220	DPAK	SOT-82	SOT-194
LM217M	LM217MT	LM217MDT	LM217MX	LM217MS
LM317M	LM317MT	LM317MDT	LM317MX	LM317MS

TEST CIRCUIT



ELECTRICAL CHARACTERISTICS FOR LM217M (Refer to the test circuits, $-40 \le T_j \le 125\ ^oC$
$V_i - V_o = 5\ V$, $I_o = 100\ mA$, $P_d \le 7.5W$, unless otherwise specified)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
ΔV_o	Line Regulation	$V_i - V_o = 3$ to 40 V	$T_j = 25\ ^oC$		0.01	0.02	%/V
					0.02	0.05	%/V
ΔV_o	Load Regulation	$V_o \le 5V$ $I_o = 10$ mA to 500 mA	$T_j = 25\ ^oC$		5	15	mV
					20	50	mV
		$V_o \ge 5V$ $I_o = 10$ mA to 500 mA	$T_j = 25\ ^oC$		0.1	0.3	%/V_o
					0.3	1	%/V_o
I_{ADJ}	Adjustment Pin Current				50	100	µA
ΔI_{ADJ}	Adjustment Pin Current	$V_i - V_o = 3$ to 40 V $I_o = 10$ mA to 500 mA			0.2	5	µA
V_{REF}	Reference Voltage	$V_i - V_o = 3$ to 40 V $I_o = 10$ mA to 500 mA		1.2	1.25	1.3	V
$\frac{\Delta V_o}{V_o}$	Output Voltage Temperature Stability				0.7		%
$I_{o(min)}$	Minimum Load Current	$V_i - V_o = 40$ V			3.5	5	mA
$I_{o(max)}$	Maximum Output Current	$V_i - V_o \le 15V$ $V_i - V_o = 40V$, $P_d < P_{dMAX}$, $T_j = 25^oC$		500	1000 200		mA
e_N	Output Noise Voltage (percentance of V_O)	B = 10Hz to 10KHz $T_j = 25\ ^oC$			0.003		%
SVR	Supply Voltage Rejection (*)	$T_j = 25\ ^oC$ f = 120 Hz	$C_{ADJ}=0$		65		dB
			$C_{ADJ}=10\mu F$	66	80		dB

(*) CADJ is connected between Adjust pin and Ground.

ELECTRICAL CHARACTERISTICS FOR LM317M (Refer to the test circuits, $0 \le T_j \le 125\ ^oC$
$V_i - V_o = 5\ V$, $I_o = 100\ mA$, $P_d \le 7.5W$, unless otherwise specified)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
ΔV_o	Line Regulation	$V_i - V_o = 3$ to 40 V	$T_j = 25\ ^oC$		0.01	0.04	%/V
					0.02	0.07	%/V
ΔV_o	Load Regulation	$V_o \le 5V$ $I_o = 10$ mA to 500 mA	$T_j = 25\ ^oC$		5	25	mV
					20	70	mV
		$V_o \ge 5V$ $I_o = 10$ mA to 500 mA	$T_j = 25\ ^oC$		0.1	0.5	%/V_o
					0.3	1.5	%/V_o
I_{ADJ}	Adjustment Pin Current				50	100	µA
ΔI_{ADJ}	Adjustment Pin Current	$V_i - V_o = 3$ to 40 V $I_o = 10$ mA to 500 mA			0.2	5	µA
V_{REF}	Reference Voltage	$V_i - V_o = 3$ to 40 V $I_o = 10$ mA to 500 mA		1.2	1.25	1.3	V
$\frac{\Delta V_o}{V_o}$	Output Voltage Temperature Stability				0.7		%
$I_{o(min)}$	Minimum Load Current	$V_i - V_o = 40$ V			3.5	10	mA
$I_{o(max)}$	Maximum Output Current	$V_i - V_o \le 15V$ $V_i - V_o = 40V$, $P_d < P_{dMAX}$, $T_j = 25^oC$		500	1000 200		mA
e_N	Output Noise Voltage (percentance of V_O)	B = 10Hz to 10KHz $T_j = 25\ ^oC$			0.003		%
SVR	Supply Voltage Rejection (*)	$T_j = 25\ ^oC$ f = 120 Hz	$C_{ADJ}=0$		65		dB
			$C_{ADJ}=10\mu F$	66	80		dB

(*) CADJ is connected between Adjust pin and Ground.

Figure 1 : Current Limit

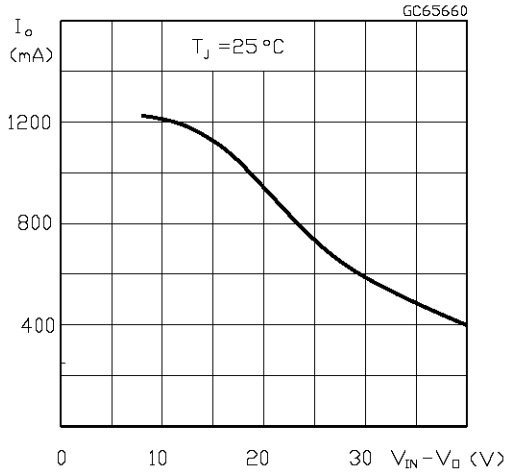


Figure 2 : Minimum Operating Current

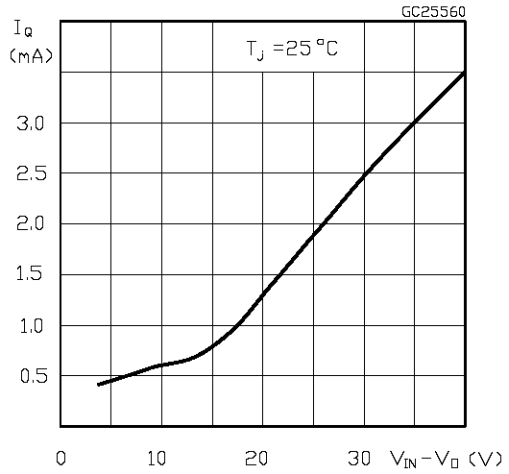


Figure 3 : Basic Adjustable Regulator.

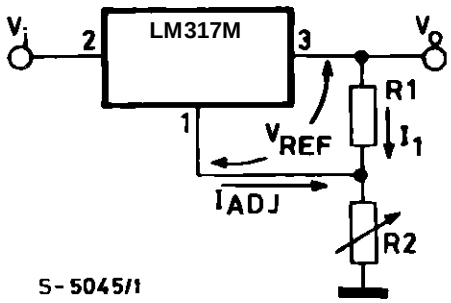
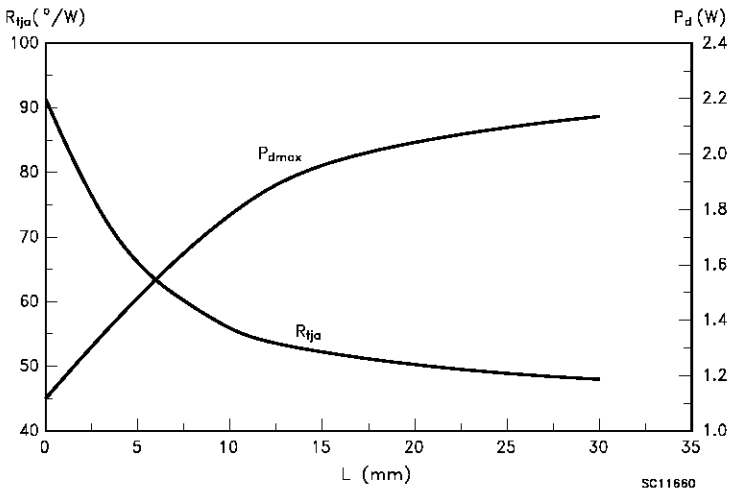


Figure 4 : Thermal Resistance & Maximum Power Dissipation vs P.C.B. Copper Lenght for DPAK



Pdmax calculated for T_a = 50 °C

APPLICATION INFORMATION

The LM317M 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. 3), giving an output voltage V_O of:

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

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 IADJ·R2 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 LM317M 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. 3) 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.

EXTERNAL CAPACITORS (Fig.5)

Normally no capacitors are needed unless the device is situated far from the input filter capacitors; in which case an input bypass is needed.

A 0.1µF disc or 1µF tantalium input bypass capacitor (C_I) is recommended to reduce the sensitivity to input line impedance.

The adjustment terminal may be bypassed to ground to improve ripple rejection. This capacitor (C_{adj}) prevents ripple from being amplified as the output voltage is increased. A 10µF capacitor should improve ripple rejection about 80dB at 120Hz an a 10V application.

Although the LM317M is stable with no output capacitance like any feedback circuit, certain values of external capacitance can cause excessive ringing. An output capacitance (C_O) in the form of a 1µF tantalium or 25µF aluminium electrolytic capacitor on the output swamps this effect and insures stability.

PROTECTION DIODES (Fig.5)

When external capacitors are used with any IC regulator it is sometimes necessary to add protection diodes to prevent the capacitors from discharging through low current points into the regulator.

Figure 5 show the LM317M with the recommended protection diodes for output voltages in excess of 25V or high capacitance values (C_3 > 25µF, C_2 > 10µF). Diode D1 prevents C_3 from discharging through the IC during an input short-circuit. The combination of diodes D1 and D2 prevents C_2 from discarging through the regulator during an input or output short-circuit.

START-UP BLOCK

It's not guaranteed the Re-Boot of the device when the junction temperature is over 85 ^oC.

Figure 5 : Voltage Regulator with Protection Diodes.

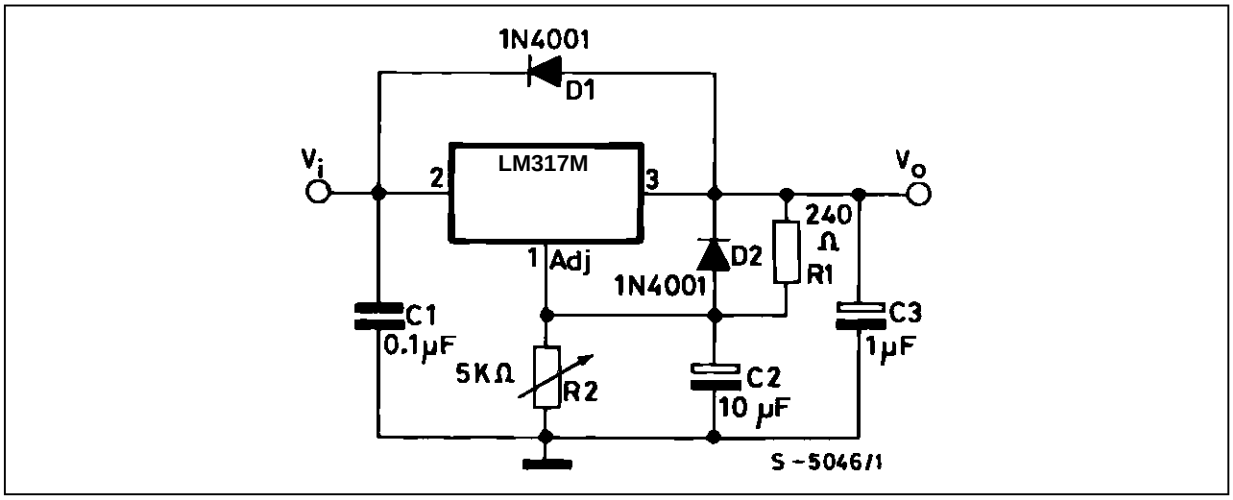


Figure 6 : Slow Turn-on 15V Regulator.

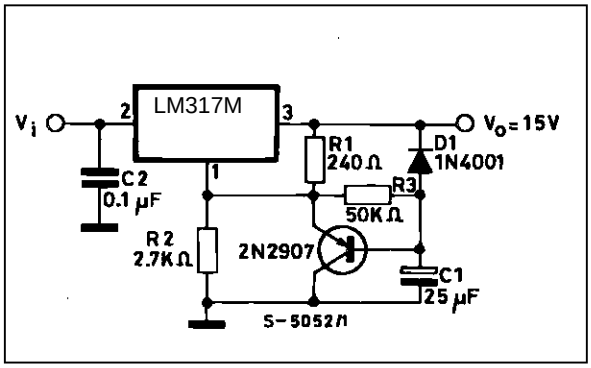
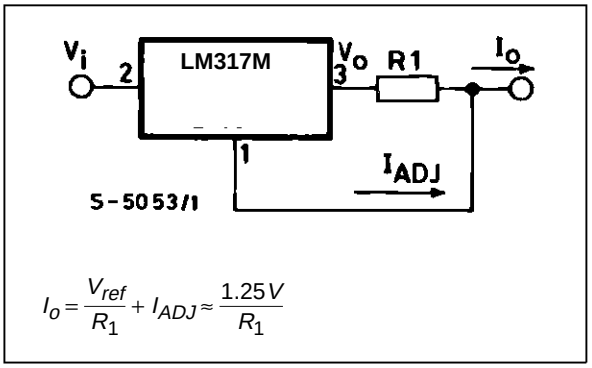


Figure 7 : Current Regulator.



$$I_o = \frac{V_{ref}}{R_1} + I_{ADJ} \approx \frac{1.25V}{R_1}$$

Figure 8 : 5V Electronic Shut-down Regulator.

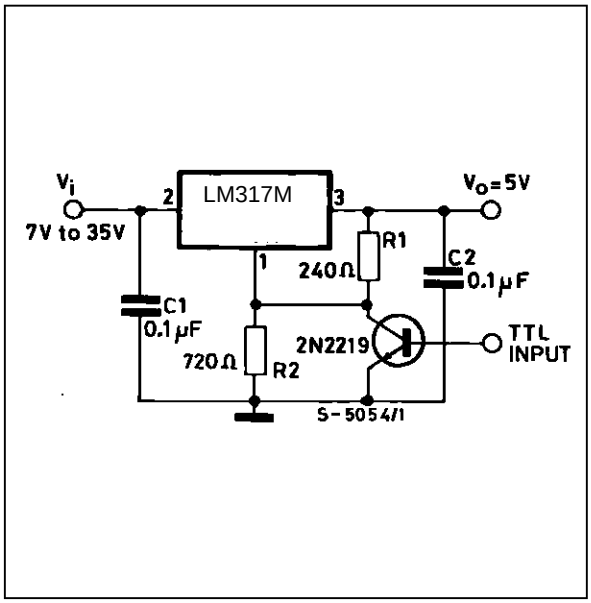
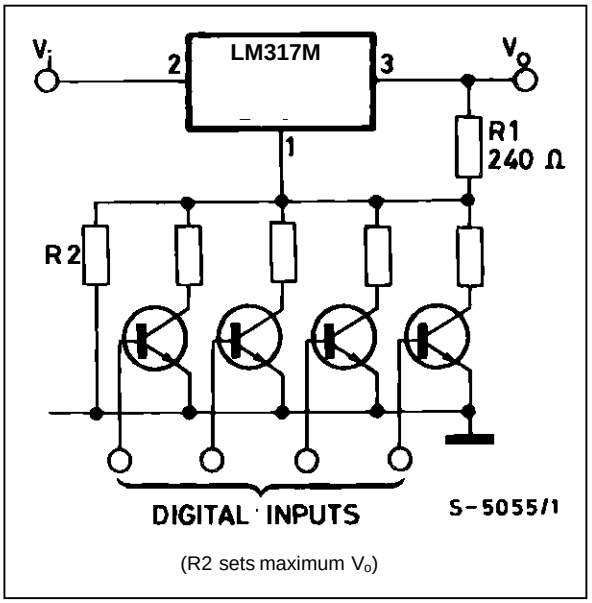


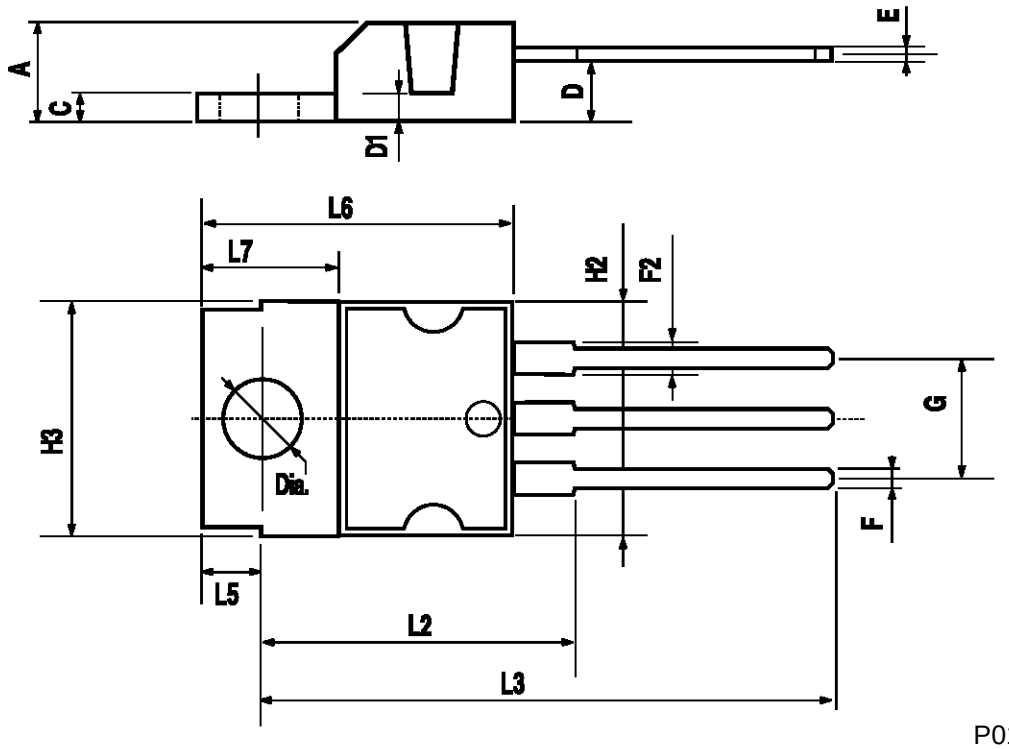
Figure 9 : Digitally Selected Outputs.



(R2 sets maximum V_o)

TO-220 MECHANICAL DATA

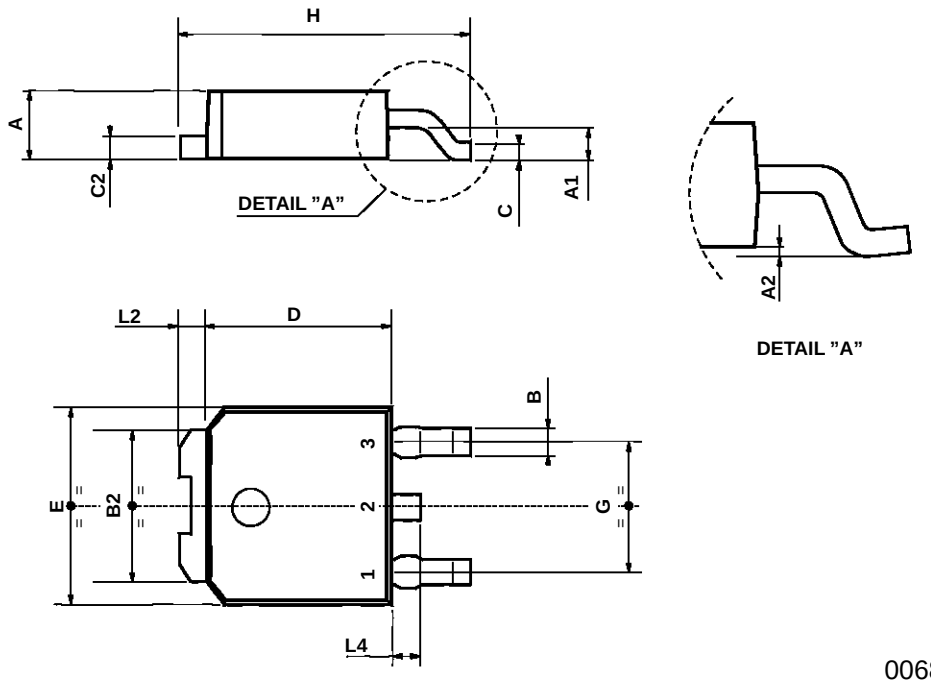
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.61		0.94	0.024		0.037
F2	1.15		1.4	0.045		0.055
G	4.95	5.08	5.21	0.195	0.200	0.205
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L2		16.2			0.638	
L3	26.3	26.7	27.1	1.035	1.051	1.067
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
Dia.	3.65		3.85	0.144		0.152



P011D

TO-252 (DPAK) MECHANICAL DATA

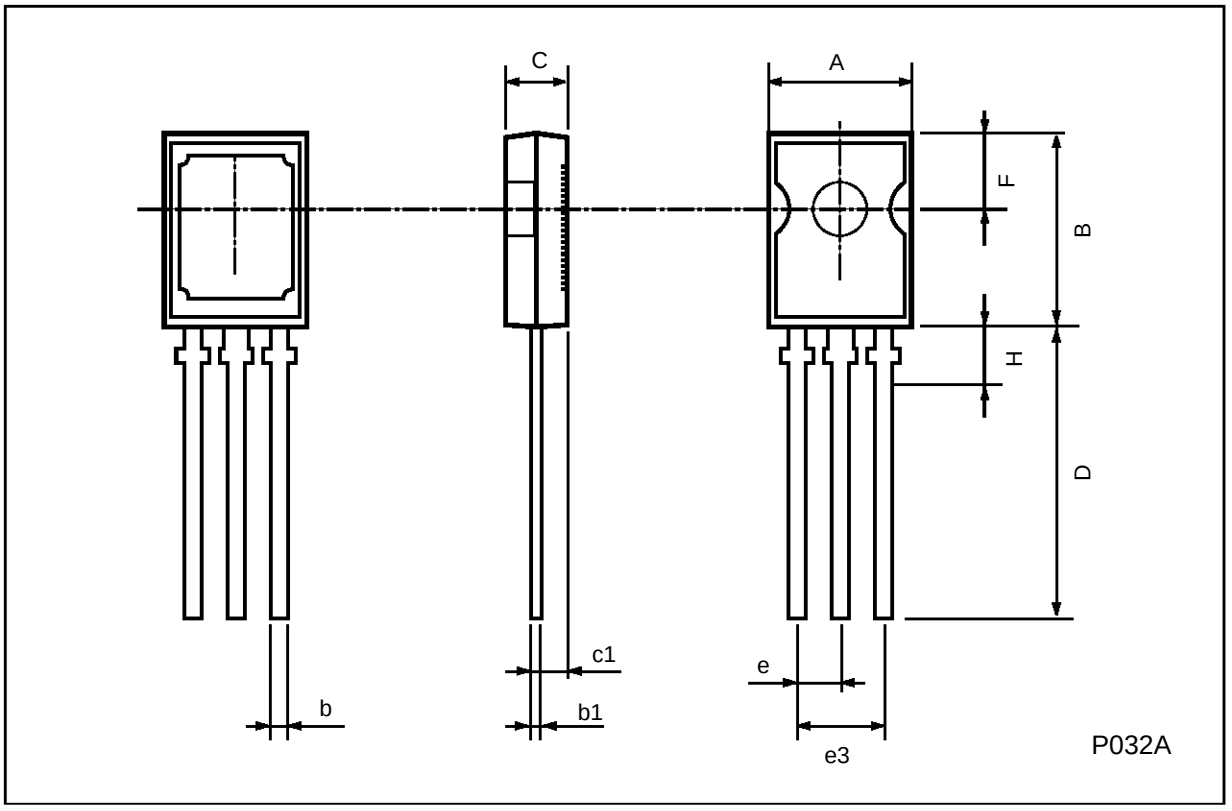
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
B2	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L2		0.8			0.031	
L4	0.6		1	0.023		0.039



0068772-B

SOT-82 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	7.4		7.8	0.291		0.307
B	10.5		11.3	0.413		0.445
b	0.7		0.9	0.028		0.035
b1	0.49		0.75	0.019		0.030
C	2.4		2.7	0.04		0.106
c1		1.2			0.047	
D		15.7			0.618	
e		2.2			0.087	
e3		4.4			0.173	
F		3.8			0.150	
H			2.54		0.100	



SOT-194 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	7.4		7.8	0.291		0.307
B	10.5		11.3	0.413		0.445
b	0.7		0.9	0.028		0.035
b1	0.49		0.75	0.019		0.030
C	2.4		2.7	0.094		0.106
c1		1.2			0.047	
c2		1.3			0.051	
D		6			0.236	
e		2.2			0.087	
e3		4.4			0.173	
F		3.8			0.150	
H			2.54			0.100
P	45 (typ.)					
S		4			0.157	
S1		2			0.079	
T		0.1			0.004