



# LM217L LM317L

## LOW CURRENT 1.2 TO 37V ADJUSTABLE VOLTAGE REGULATOR

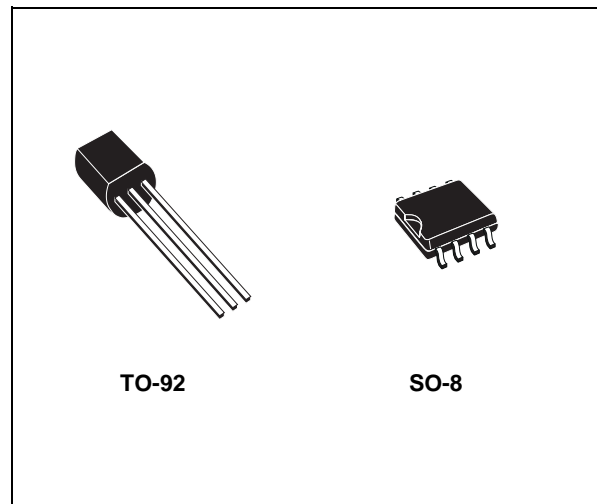
- OUTPUT VOLTAGE RANGE: 1.2 TO 37V
- OUTPUT CURRENT IN EXCESS OF 100 mA
- LINE REGULATION TYP. 0.01%
- LOAD REGULATION TYP. 0.1%
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSISTOR SAFE AREA COMPENSATION
- FLOATING OPERATION FOR HIGH VOLTAGE APPLICATIONS

### DESCRIPTION

The LM217L/LM317L are monolithic integrated circuit in SO-8 and TO-92 packages intended for use as positive adjustable voltage regulators.

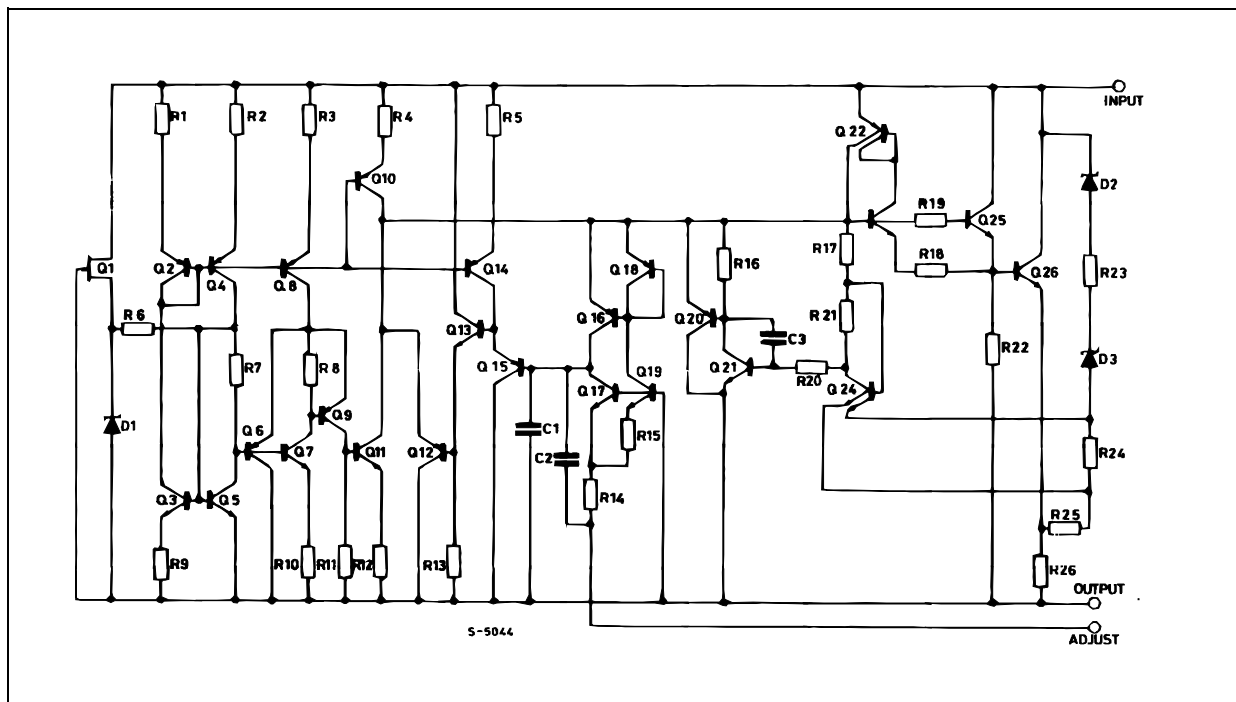
They are designed to supply until 100 mA of load current with an output voltage adjustable over a 1.2 to 37V range.

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

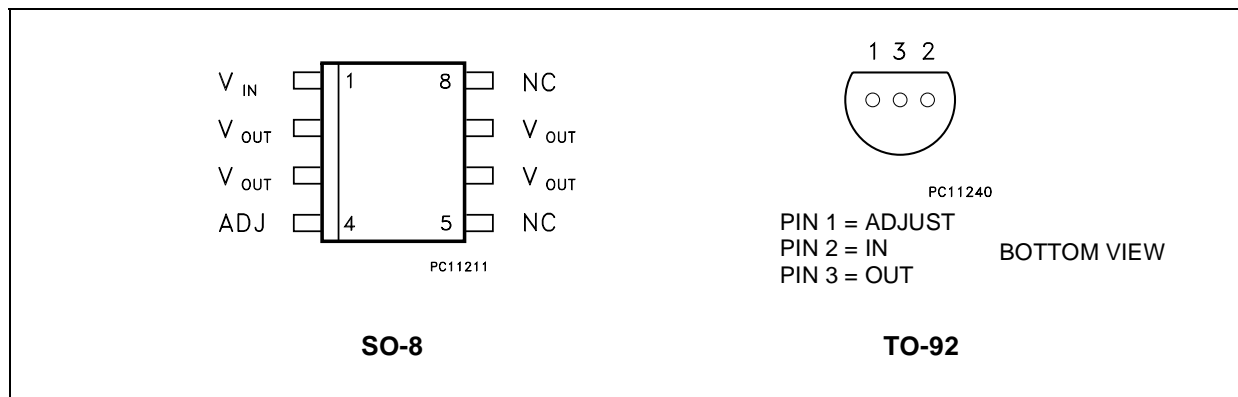


# LM217L/LM317L

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter <sup>2</sup>	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 LM217L	-40 to 125
		for LM317L	0 to 125
$T_{stg}$	Storage Temperature Range	-55 to 150	°C

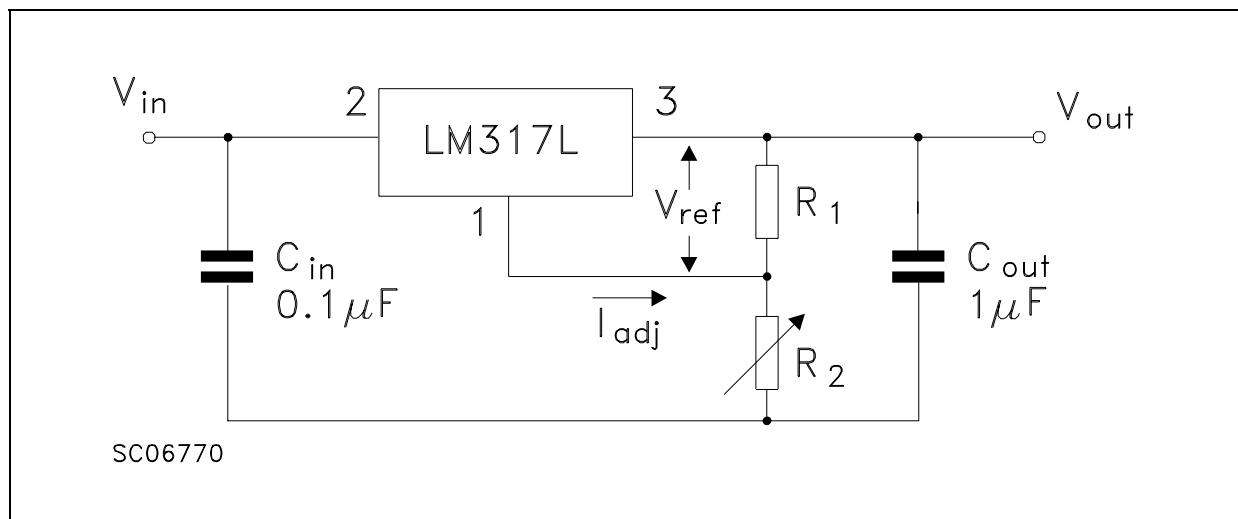
## CONNECTION DIAGRAM (top view)



## ORDERING CODES

TYPE	SO-8	TO-92
LM217L	LM217LD	LM217LZ
LM317L	LM317LD	LM317LZ

## TEST CIRCUIT



**ELECTRICAL CHARACTERISTICS OF LM217L** (refer to the test circuits,  $T_J = -40$  to  $125^\circ\text{C}$ ,  $V_I - V_O = 5\text{ V}$ ,  $I_O = 40\text{ mA}$ , unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$\Delta V_O$	Line Regulation	$V_I - V_O = 3$ to $40\text{ V}$ $I_L < 20\text{ mA}$		$T_J = 25^\circ\text{C}$	0.01	0.02	%V
					0.02	0.05	
$\Delta V_O$	Load Regulation	$V_O \leq 5\text{ V}$ $I_O = 5$ to $100\text{ mA}$		$T_J = 25^\circ\text{C}$	5	15	mV
					20	50	
		$V_O \geq 5\text{ V}$ $I_O = 5$ to $100\text{ mA}$		$T_J = 25^\circ\text{C}$	0.1	0.3	%
					0.3	1	
$I_{ADJ}$	Adjustment Pin Current			50	100	$\mu\text{A}$	
$\Delta I_{ADJ}$	Adjustment Pin Current	$V_I - V_O = 3$ to $40\text{ V}$ $I_O = 5$ to $100\text{ mA}$ $P_d < 625\text{ mW}$		0.2	5	$\mu\text{A}$	
$V_{REF}$	Reference Voltage	$V_I - V_O = 3$ to $40\text{ V}$ $I_O = 10$ to $500\text{ mA}$ $P_d < 625\text{ mW}$	1.2	1.25	1.3	V	
$\Delta V_O/V_O$	Output Voltage Temperature Stability			0.7		%	
$I_{O(min)}$	Minimum Load Current	$V_I - V_O = 40\text{ V}$		3.5	5	mA	
$I_{O(max)}$	Maximum Output Current	$V_I - V_O = 3$ to $13\text{ V}$	100	200		mA	
		$V_I - V_O = 40\text{ V}$		50			
eN	Output Noise Voltage	$B = 10\text{ Hz}$ to $10\text{ KHz}$ $T_J = 25^\circ\text{C}$		0.003		%	
SVR	Supply Voltage Rejection (*)	$T_J = 25^\circ\text{C}$ $f = 120\text{ Hz}$	$C_{ADJ} = 0$	65		dB	
			$C_{ADJ} = 10\ \mu\text{F}$	66	80		

(\*)  $C_{ADJ}$  is connected between Adjust pin and Ground.

**ELECTRICAL CHARACTERISTICS OF LM317L** (refer to the test circuits,  $T_J = 0$  to  $125^\circ\text{C}$ ,  $V_I - V_O = 5\text{ V}$ ,  $I_O = 40\text{ mA}$ , unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$\Delta V_O$	Line Regulation	$V_I - V_O = 3$ to $40\text{ V}$ $I_L < 20\text{ mA}$		$T_J = 25^\circ\text{C}$	0.01	0.04	%V
					0.02	0.07	
$\Delta V_O$	Load Regulation	$V_O \leq 5\text{ V}$ $I_O = 5$ to $100\text{ mA}$		$T_J = 25^\circ\text{C}$	5	25	mV
					20	70	
		$V_O \geq 5\text{ V}$ $I_O = 5$ to $100\text{ mA}$		$T_J = 25^\circ\text{C}$	0.1	0.5	%
					0.3	1.5	
$I_{ADJ}$	Adjustment Pin Current			50	100	$\mu\text{A}$	
$\Delta I_{ADJ}$	Adjustment Pin Current	$V_I - V_O = 3$ to $40\text{ V}$ $I_O = 5$ to $100\text{ mA}$ $P_d < 625\text{ mW}$		0.2	5	$\mu\text{A}$	
$V_{REF}$	Reference Voltage	$V_I - V_O = 3$ to $40\text{ V}$ $I_O = 5$ to $100\text{ mA}$ $P_d < 625\text{ mW}$	1.2	1.25	1.3	V	
$\Delta V_O/V_O$	Output Voltage Temperature Stability			0.7		%	
$I_{O(min)}$	Minimum Load Current	$V_I - V_O = 40\text{ V}$		3.5	5	mA	
$I_{O(max)}$	Maximum Output Current	$V_I - V_O = 3$ to $13\text{ V}$	100	200		mA	
		$V_I - V_O = 40\text{ V}$		50			
eN	Output Noise Voltage	$B = 10\text{ Hz}$ to $10\text{ KHz}$ $T_J = 25^\circ\text{C}$		0.003		%	
SVR	Supply Voltage Rejection (*)	$T_J = 25^\circ\text{C}$ $f = 120\text{ Hz}$	$C_{ADJ} = 0$	65		dB	
			$C_{ADJ} = 10\ \mu\text{F}$	66	80		

(\*)  $C_{ADJ}$  is connected between Adjust pin and Ground.

Figure 1 : Current Limit

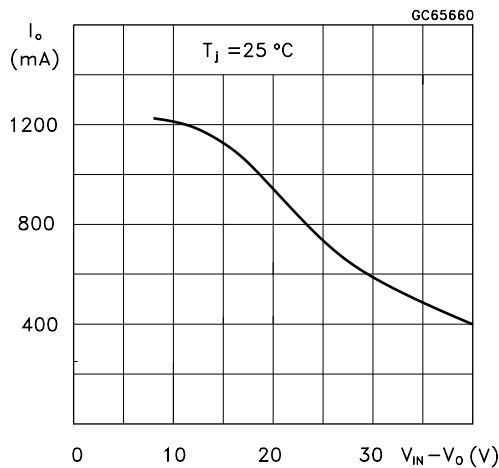
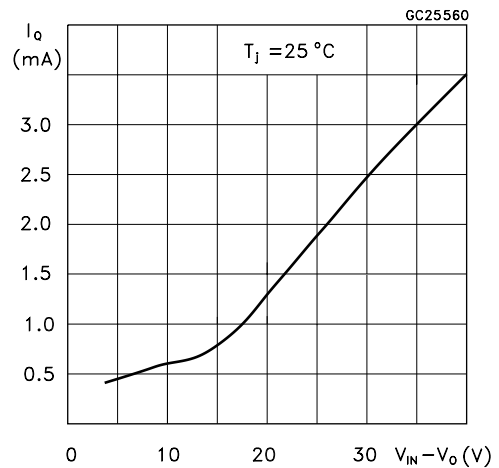


Figure 2 : Minimum Operating Current



**APPLICATION INFORMATION**

The LM317L 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:

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

The device was designed to minimize the term  $I_{ADJ}$  (100 $\mu$ A max) and to maintain it very constant with line and load changes. Usually, the error term  $I_{ADJ} \times R_2$  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 LM317L 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 optimize the load regulation, the current set resistor  $R_1$  (see fig. 4) should be tied as close as possible to the regulator, while the ground terminal of  $R_2$  should be near the ground of the load to provide remote ground sensing.

Figure 3 : Basic Adjustable Regulator

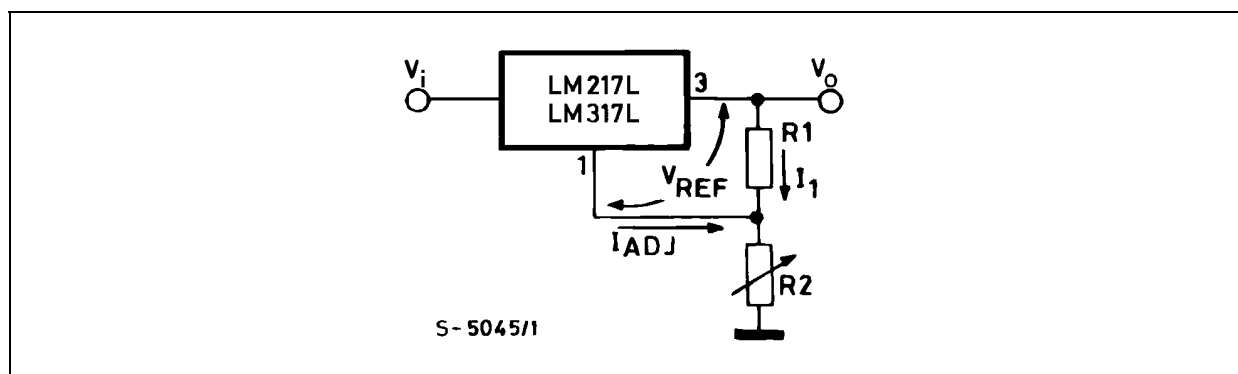


Figure 4 : Voltage Regulator with Protection Diodes

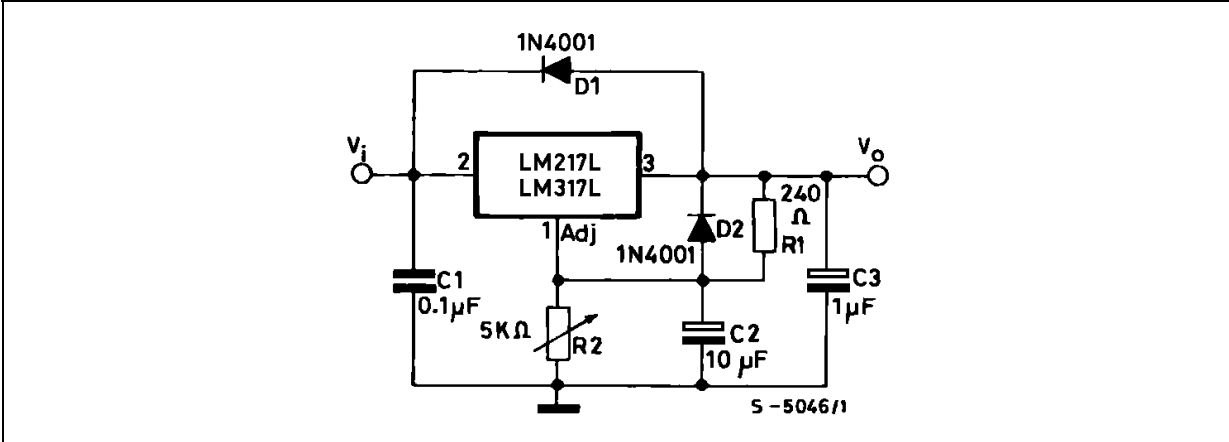


Figure 5 : Slow Turn-on 15V Regulator

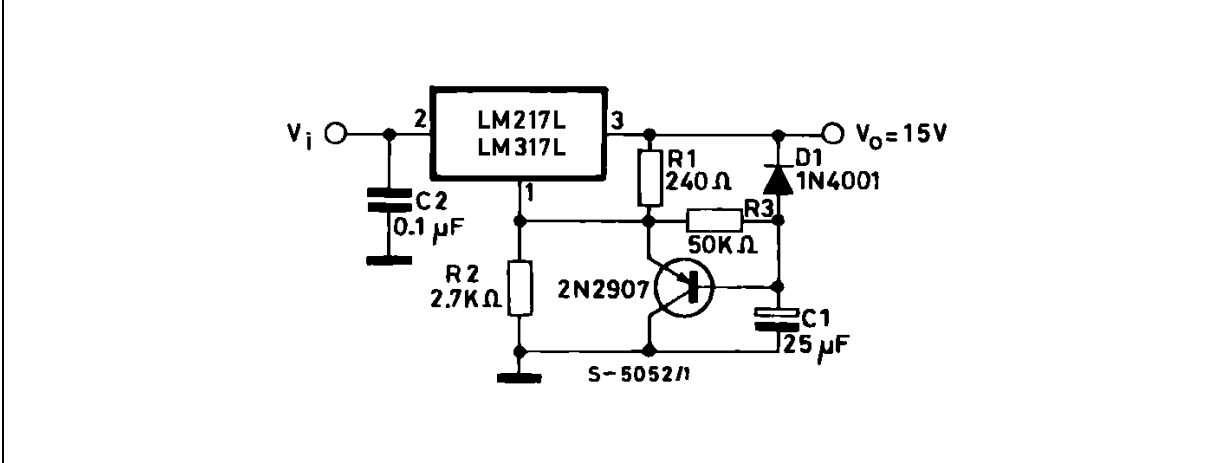


Figure 6 : Current Regulator

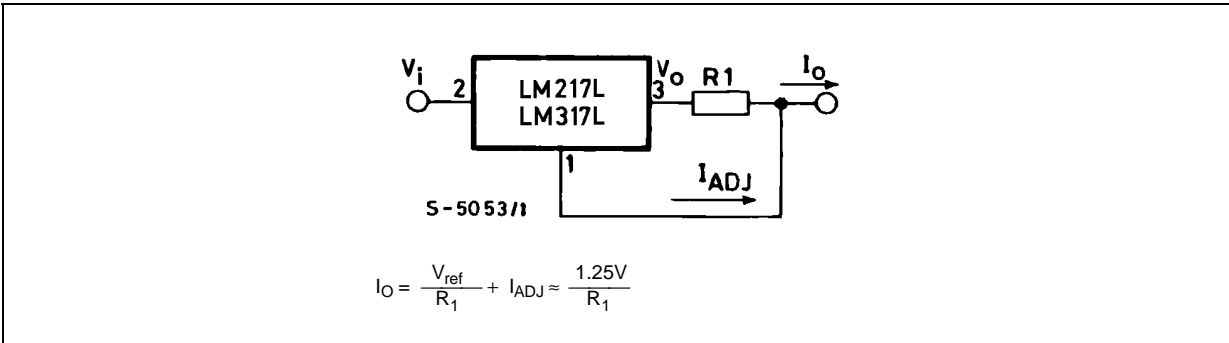


Figure 7 : 5V Electronic Shut-down Regulator

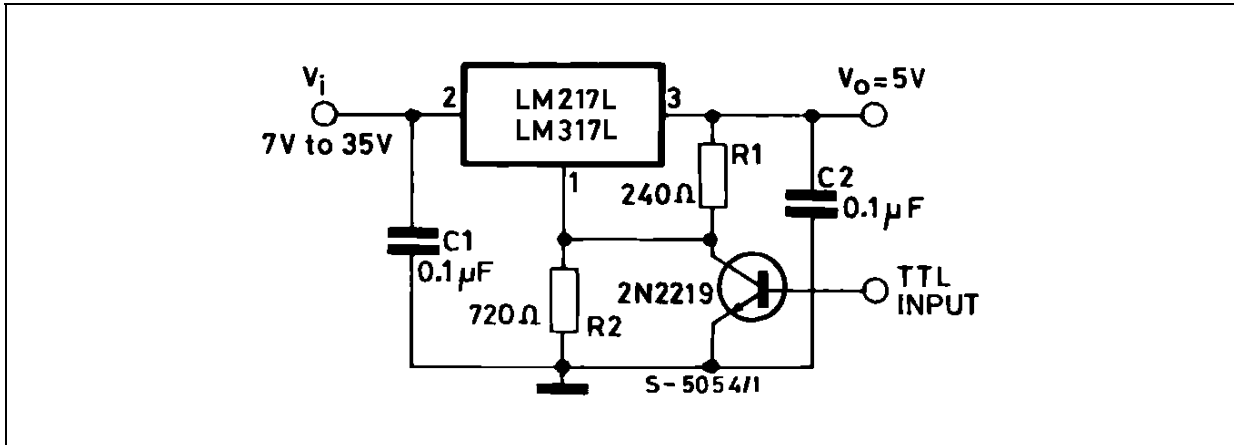
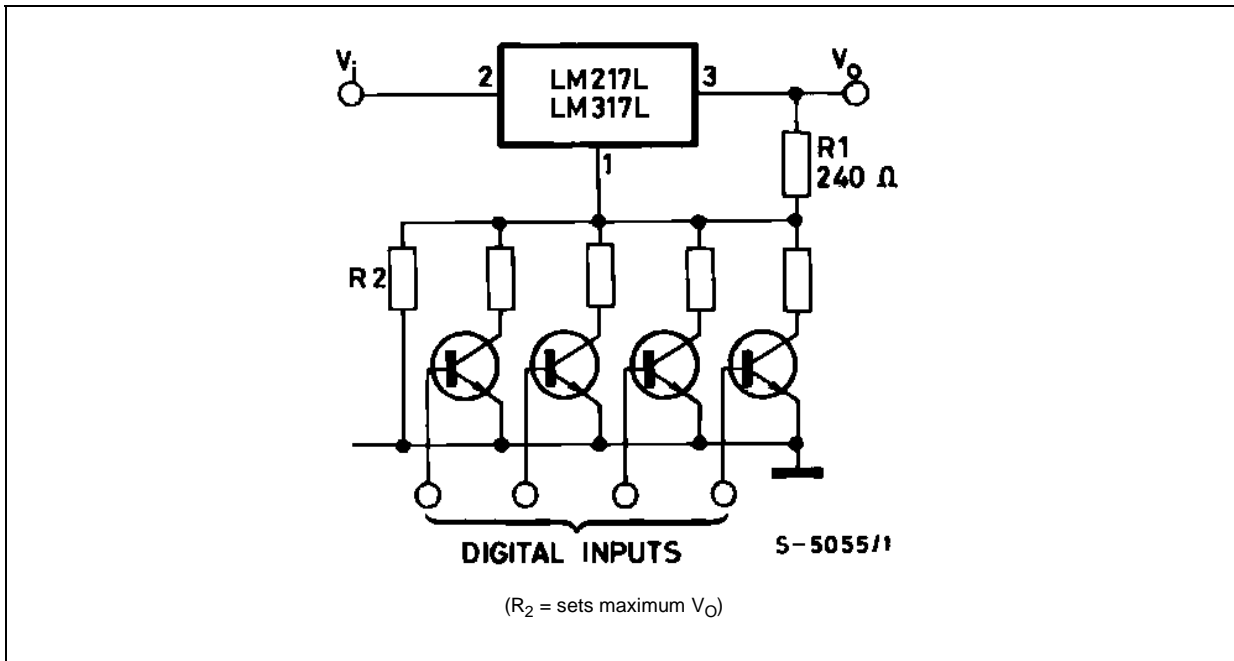
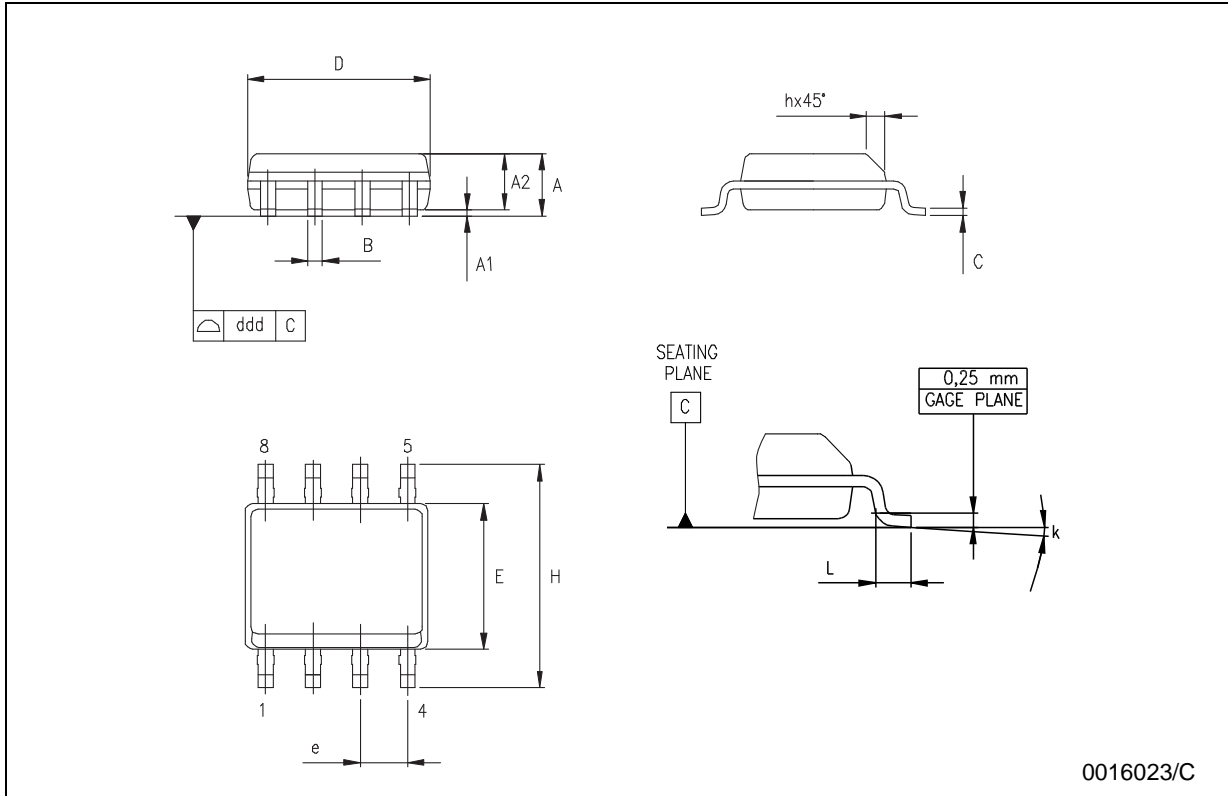


Figure 8 : Digitally Selected Outputs



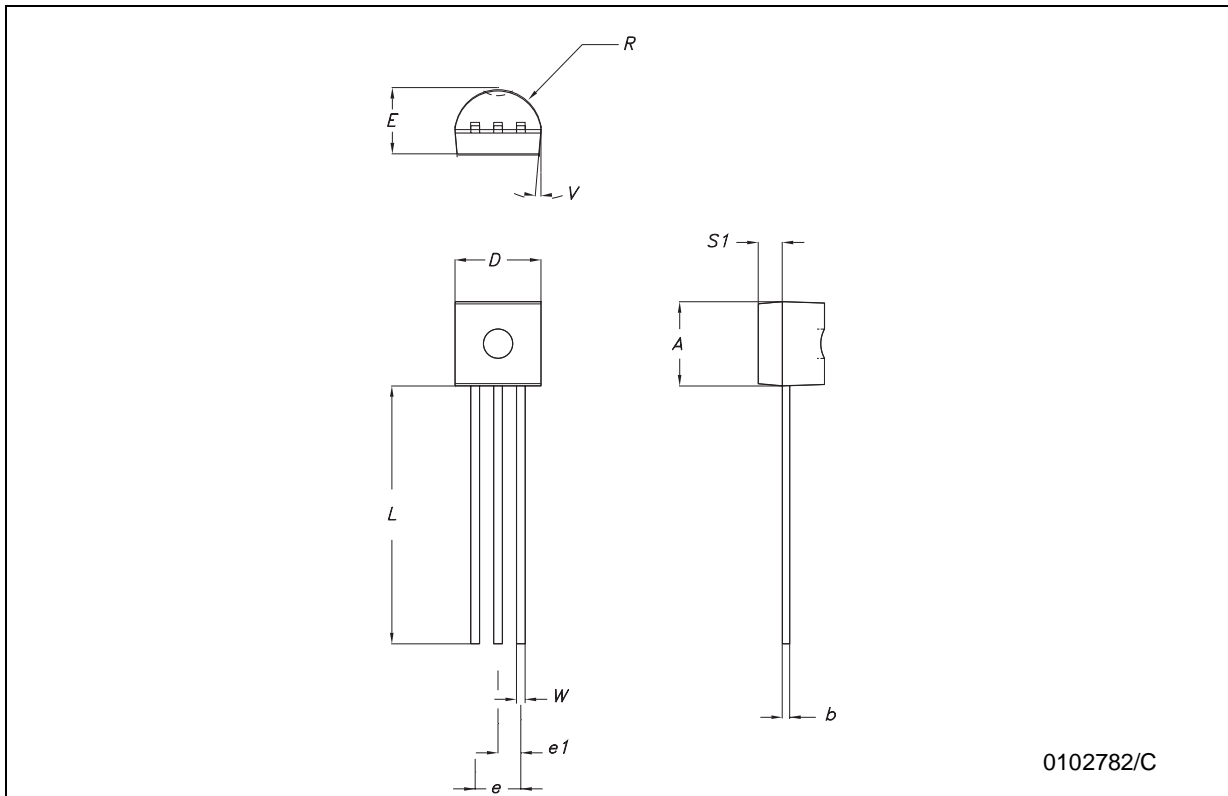
**SO-8 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



**TO-92 MECHANICA DATA**

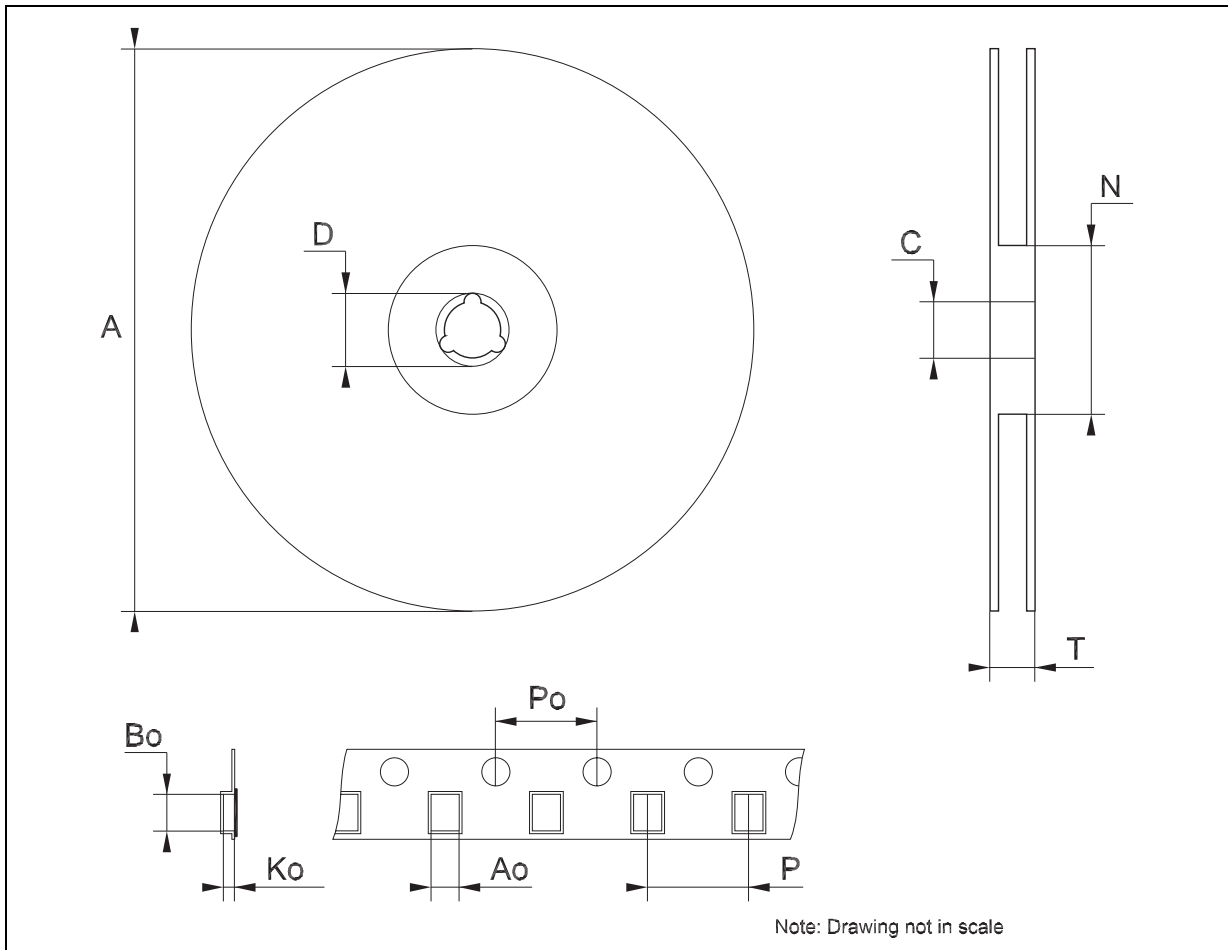
DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	170.1		194.9
b	0.36		0.51	14.2		20.1
D	4.45		4.95	175.2		194.9
E	3.30		3.94	129.9		155.1
e	2.41		2.67	94.9		105.1
e1	1.14		1.40	44.9		55.1
L	12.7		15.49	500.0		609.8
R	2.16		2.41	85.0		94.9
S1	0.92		1.52	36.2		59.8
W	0.41		0.56	16.1		22.0





**Tape & Reel SO-8 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	8.1		8.5	0.319		0.335
Bo	5.5		5.9	0.216		0.232
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



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