

## LOW CURRENT 1.2 TO 37V ADJUSTABLE VOLTAGE REGULATOR

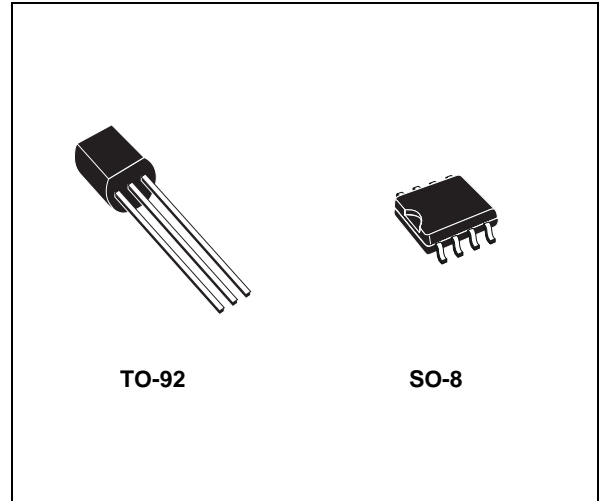
- OUTPUT VOLTAGE RANGE: 1.2 TO 37V
- OUTPUT CURRENT IN EXCESS OF 100 mA
- LINE REGULATION TYP. 0.01%
- LOAD REGULATION TYP. 0.1%
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSISTOR SAFE AREA COMPENSATION
- FLOATING OPERATION FOR HIGH VOLTAGE APPLICATIONS

### DESCRIPTION

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

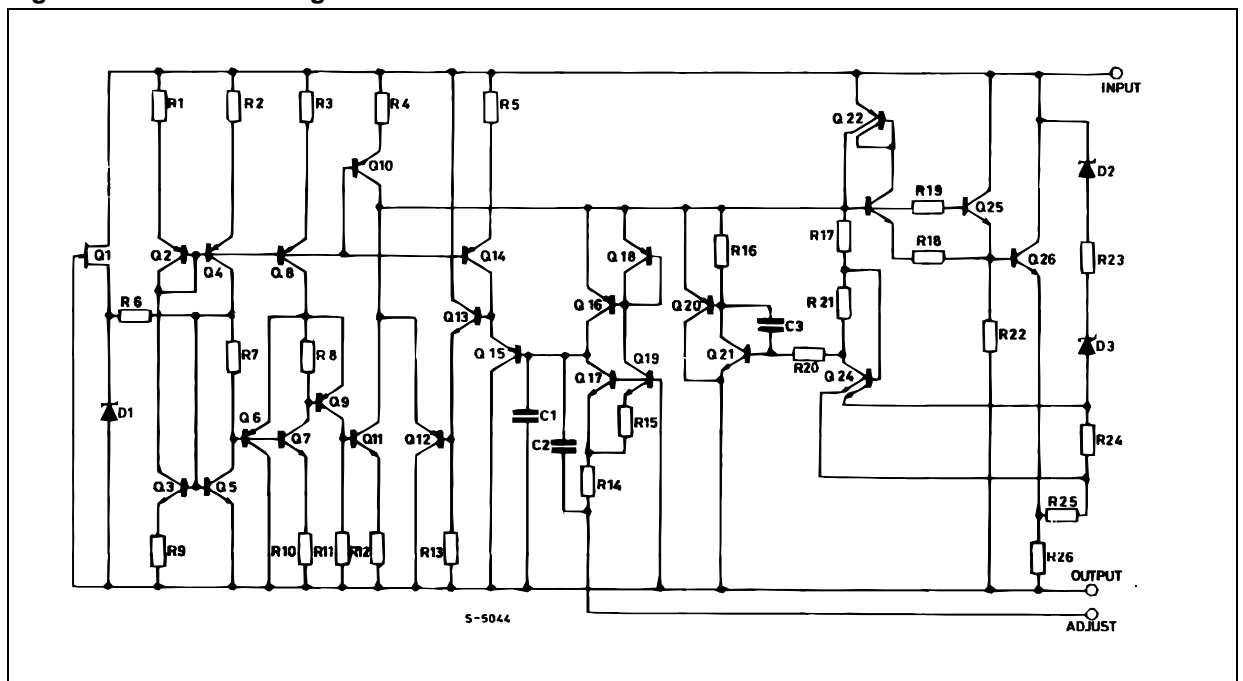
They are designed to supply until 100 mA of load current with an output voltage adjustable over a 1.2 to 37V range.

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

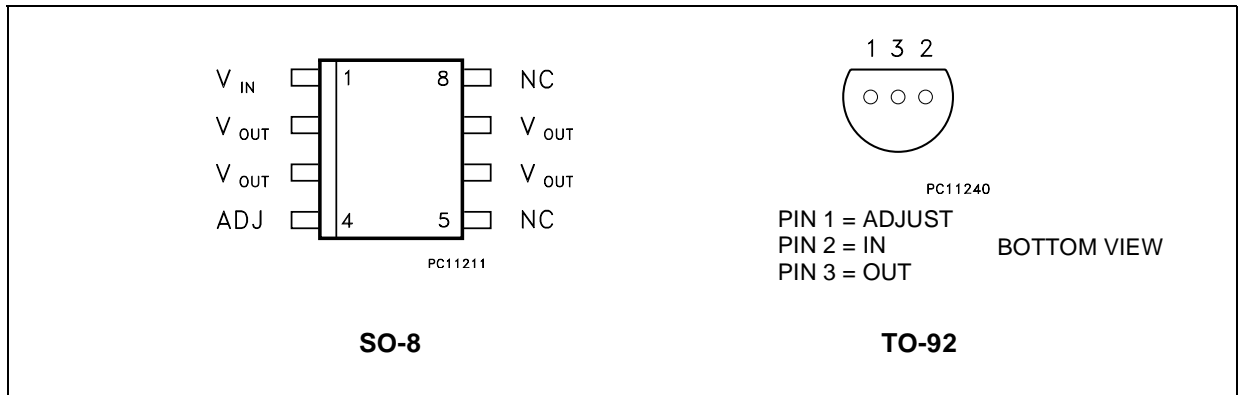
**Figure 1: Schematic Diagram**



**Table 1: 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 LM217L	-40 to 125
		for LM317L	0 to 125
$T_{stg}$	Storage Temperature Range	-55 to 150	°C

**Figure 2: Pin Connection (top view)**



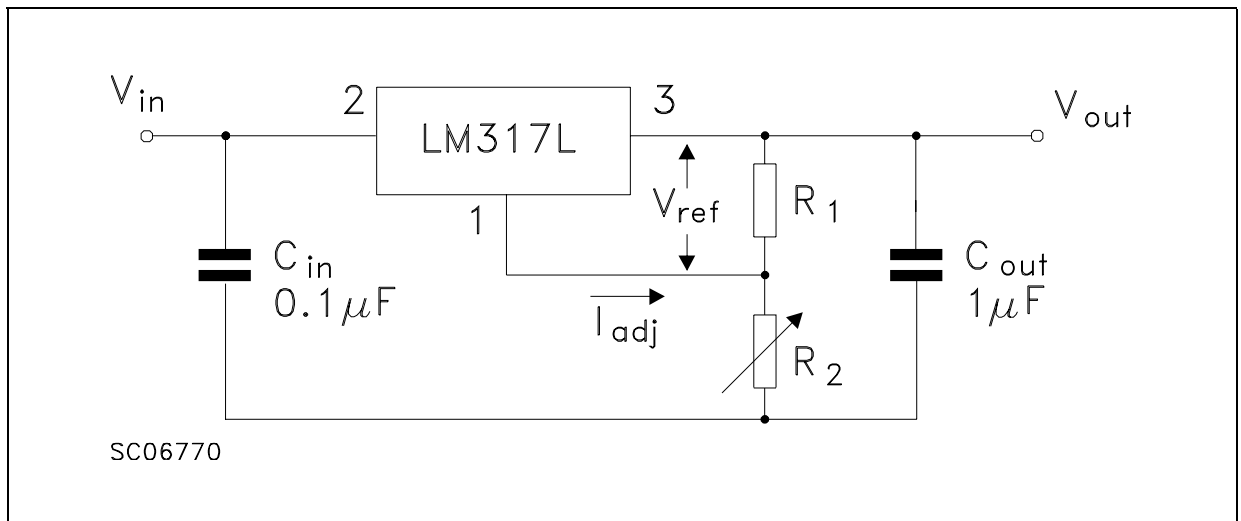
**Table 2: Order Codes**

TYPE	SO-8 (TUBE) (*)	TO-92 (BAG) (#)
LM217L	LM217LD	LM217LZ
LM317L	LM317LD	LM317LZ

(\*) Available in Tape & Reel with the suffix "-TR".

(#) Available in Tape & Reel with the suffix "-TR" and in Ammopak with the suffix "-AP". Please note that in these cases pins are shaped according to Tape & Reel specifications.

**Figure 3: Test Circuit**



**Table 3: 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 $40\text{ V}$ $P_d < 625\text{ mW}$	$I_O = 5$ to $100\text{ mA}$		0.2	5	$\mu\text{A}$
$V_{REF}$	Reference Voltage	$V_I - V_O = 3$ to $40\text{ V}$ $P_d < 625\text{ mW}$	$I_O = 10$ to $500\text{ mA}$	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		

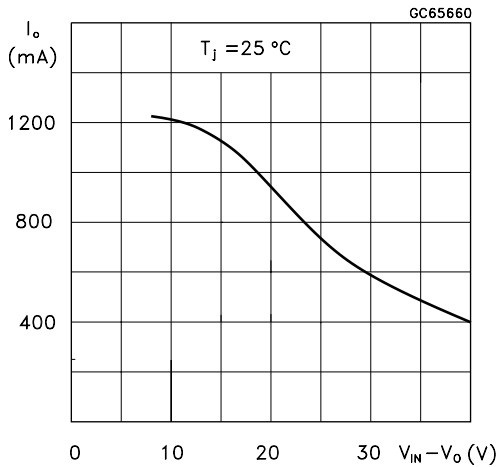
(\*)  $C_{ADJ}$  is connected between Adjust pin and Ground.

**Table 4: 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).

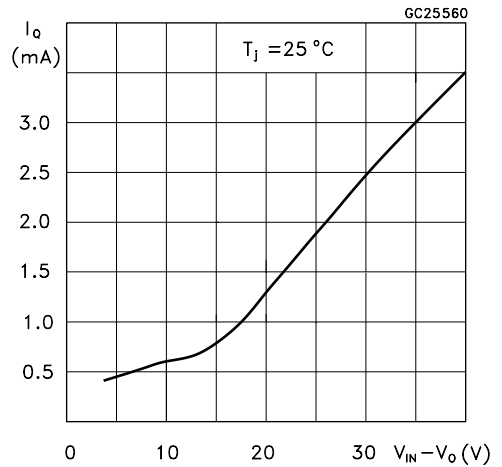
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
$\Delta V_O$	Line Regulation	$V_I - V_O = 3$ to $40\text{ V}$ $I_L < 20\text{ mA}$	$T_J = 25^\circ\text{C}$		0.01	0.04	%V
					0.02	0.07	
$\Delta V_O$	Load Regulation	$V_O \leq 5\text{ V}$ $I_O = 5$ to $100\text{ mA}$	$T_J = 25^\circ\text{C}$		5	25	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 $40\text{ V}$ $P_d < 625\text{ mW}$	$I_O = 5$ to $100\text{ mA}$		0.2	5	$\mu\text{A}$
$V_{REF}$	Reference Voltage	$V_I - V_O = 3$ to $40\text{ V}$ $P_d < 625\text{ mW}$	$I_O = 5$ to $100\text{ mA}$	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 4: Current Limit**



**Figure 5: 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 6: Basic Adjustable Regulator

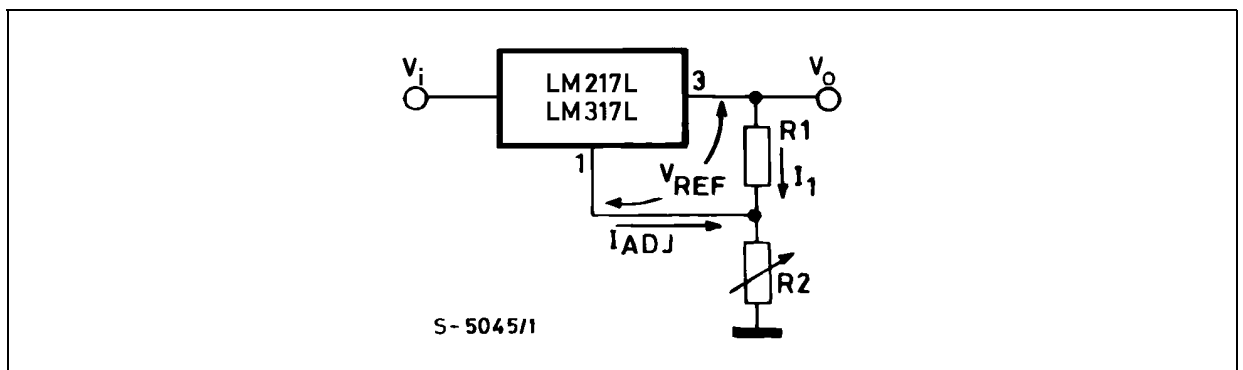


Figure 7: Voltage Regulator with Protection Diodes

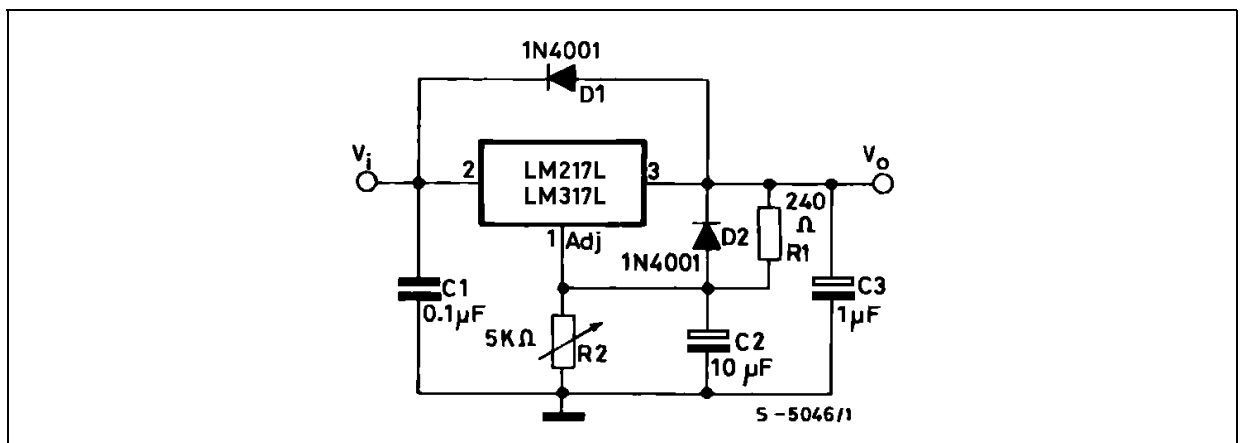


Figure 8: Slow Turn-on 15V Regulator

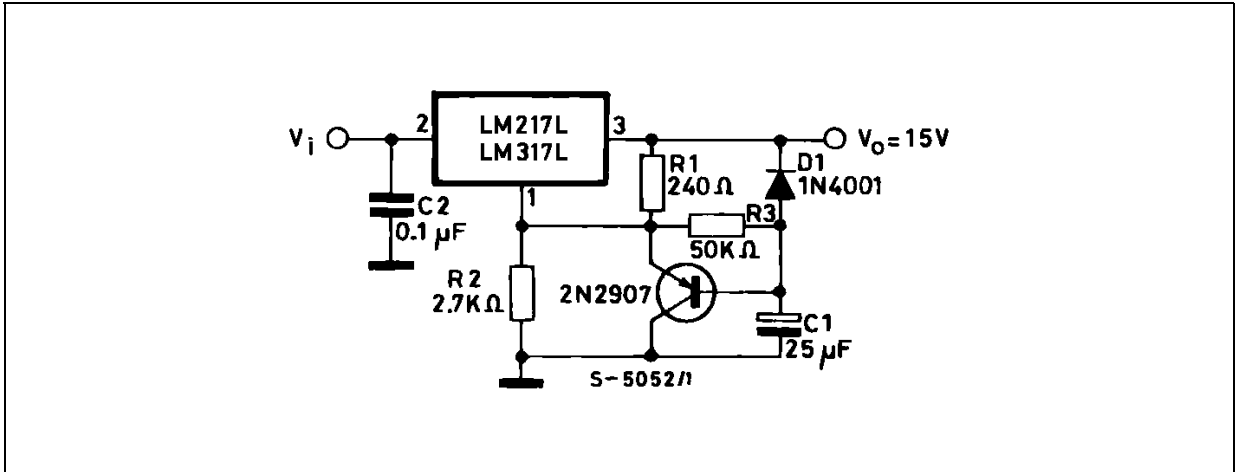


Figure 9: Current Regulator

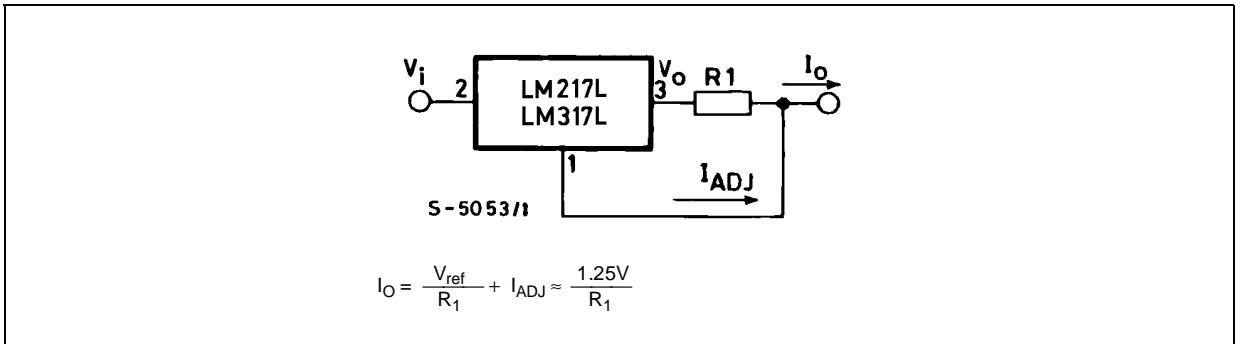


Figure 10: 5V Electronic Shut-down Regulator

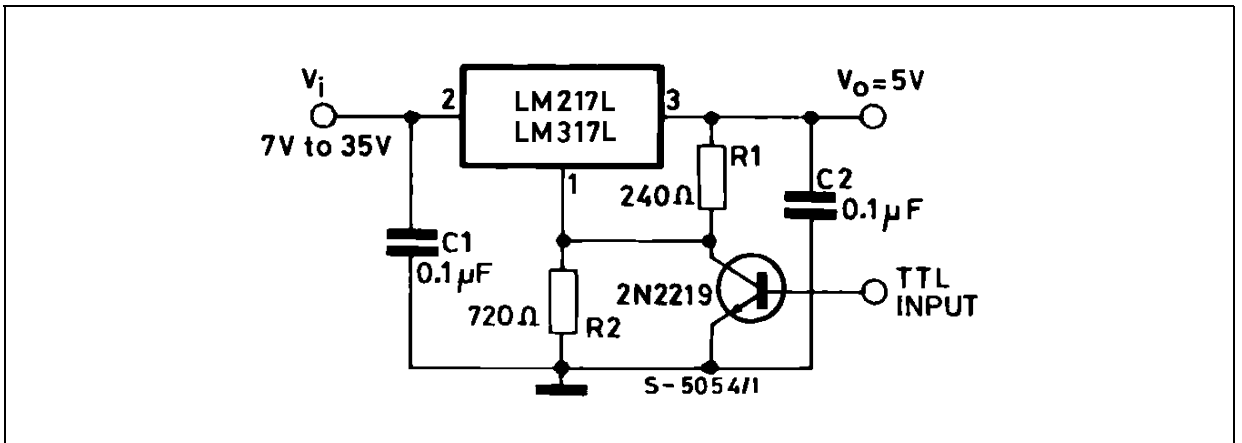
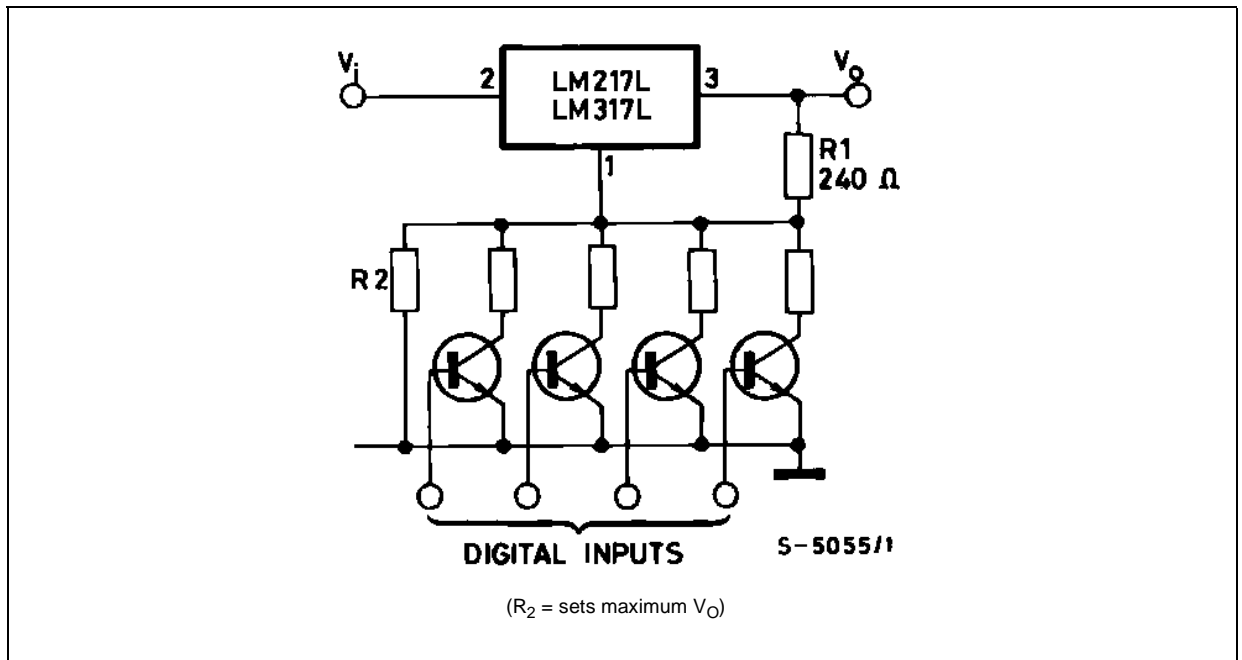
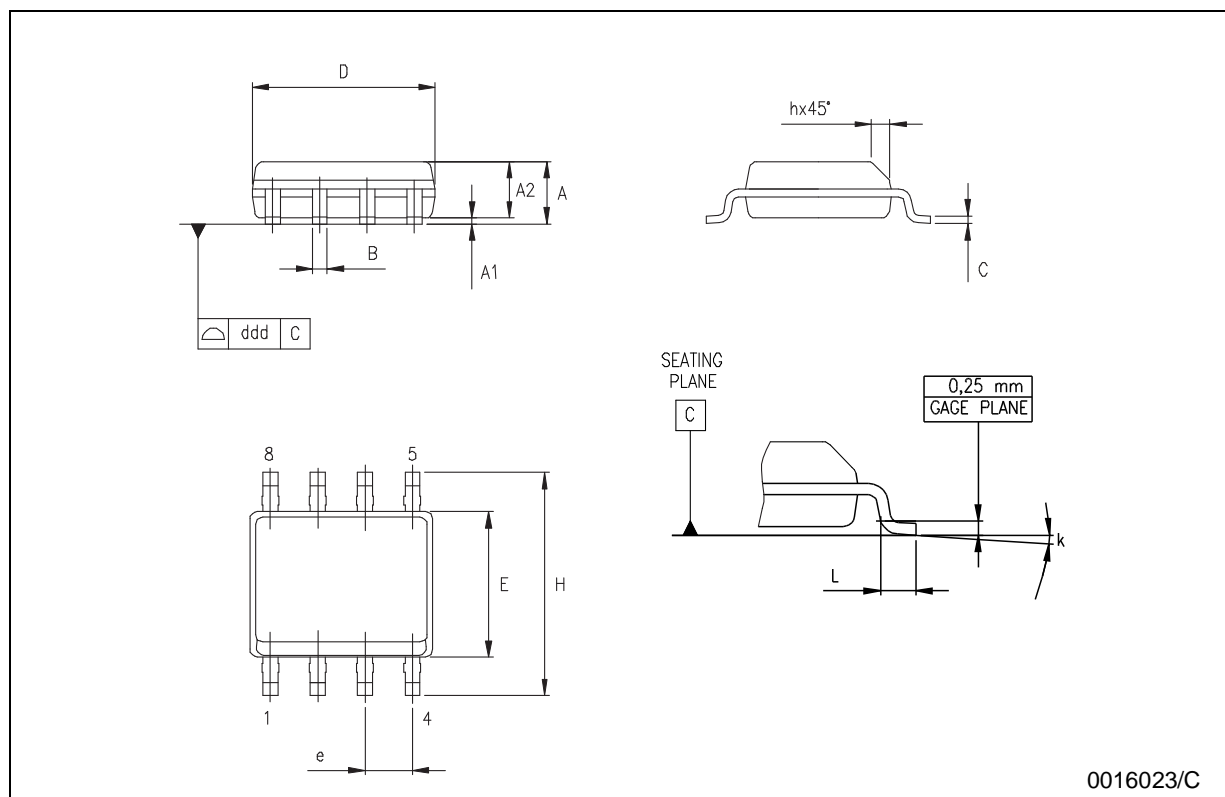


Figure 11: Digitally Selected Outputs



## 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	$8^{\circ}$ (max.)					
ddd			0.1			0.04

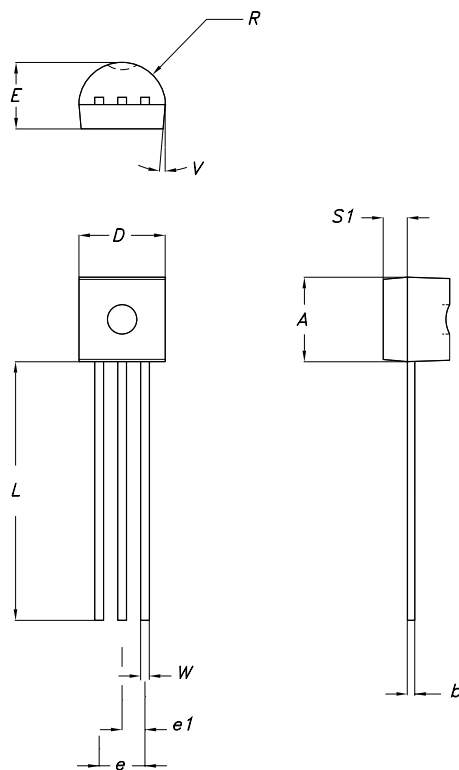


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## TO-92 MECHANICAL DATA

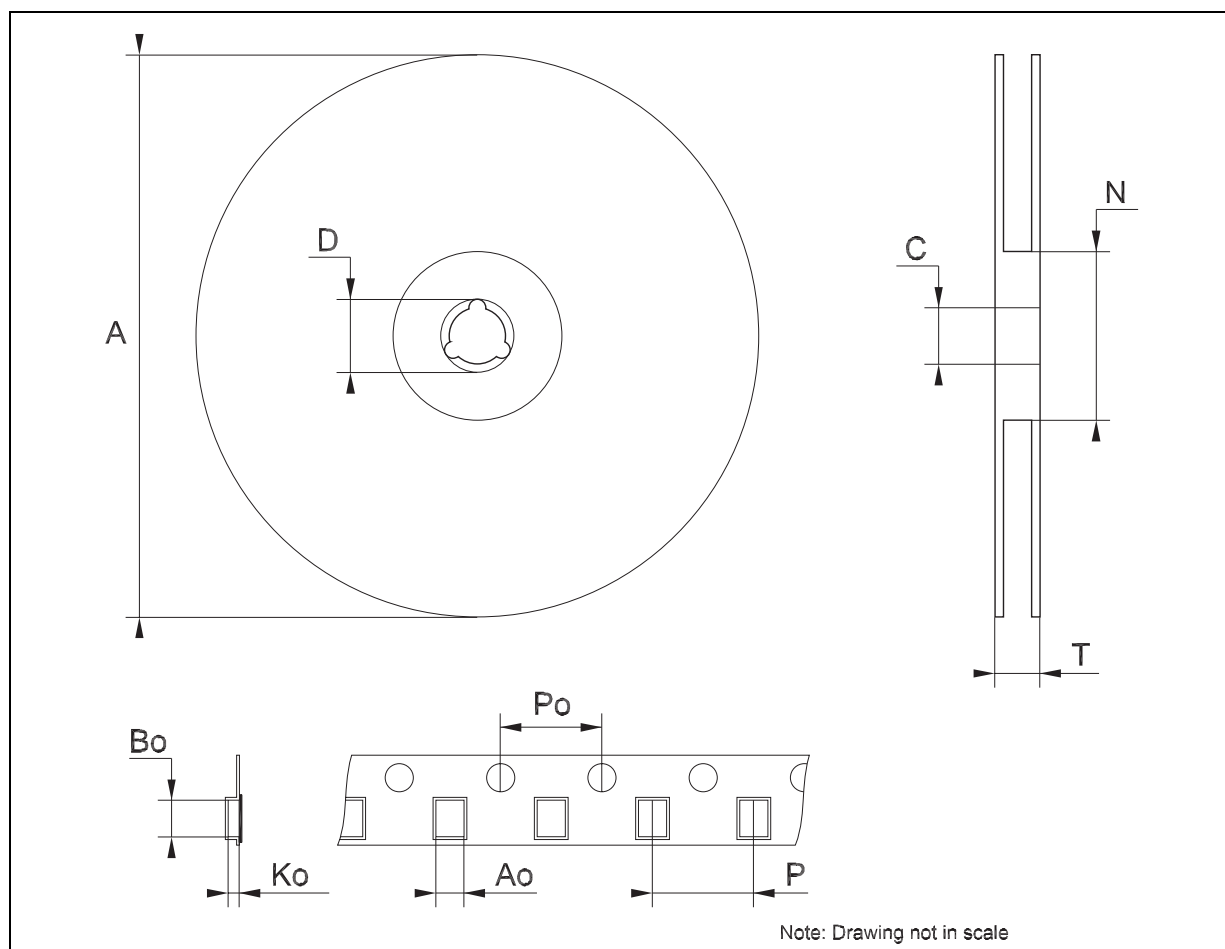
DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	170.1		194.9
b	0.36		0.51	14.2		20.1
D	4.45		4.95	175.2		194.9
E	3.30		3.94	129.9		155.1
e	2.41		2.67	94.9		105.1
e1	1.14		1.40	44.9		55.1
L	12.7		15.49	500.0		609.8
R	2.16		2.41	85.0		94.9
S1	0.92		1.52	36.2		59.8
W	0.41		0.56	16.1		22.0
$\alpha$		5°			5°	



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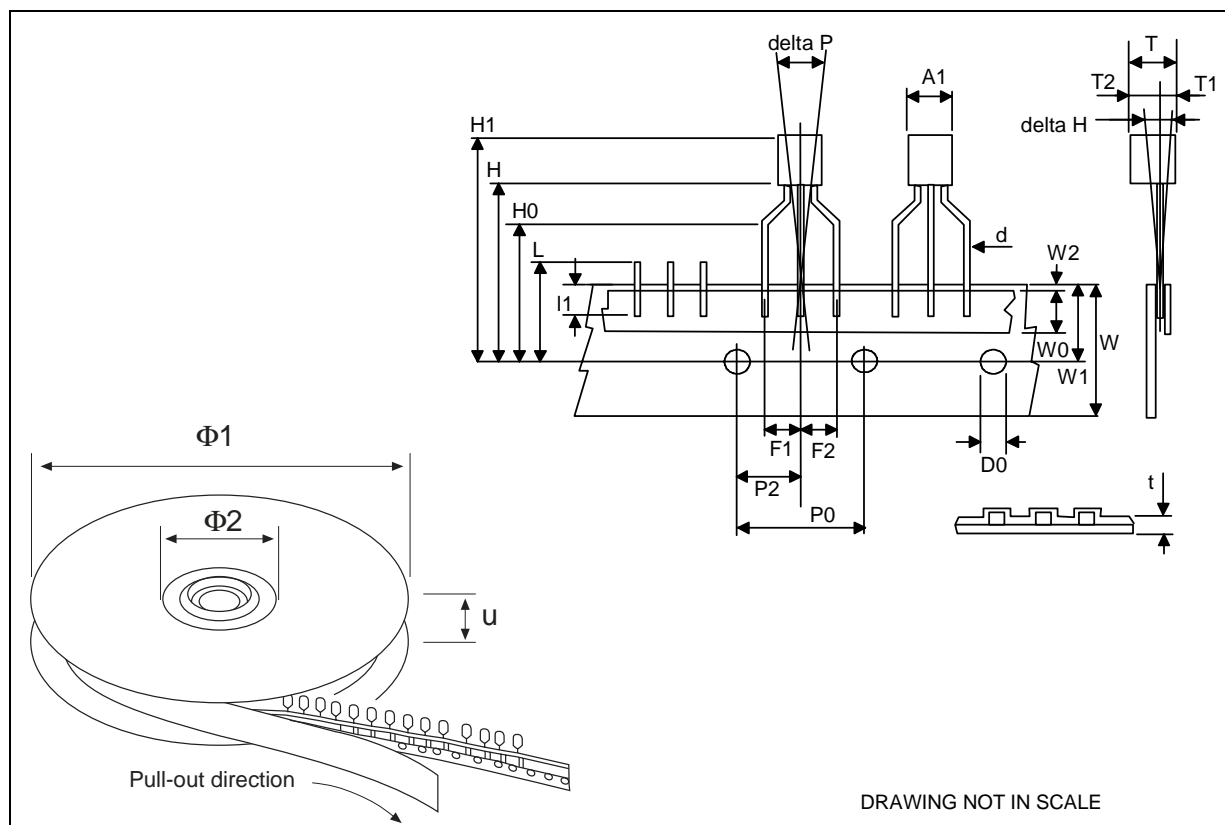
## Tape &amp; Reel SO-8 MECHANICAL DATA

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



## Tape &amp; Reel for TO-92 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A1		4.80			0.189	
T		3.80			0.150	
T1		1.60			0.063	
T2		2.30			0.091	
d		0.48			0.019	
P0	12.5		12.9	0.492		0.508
P2	5.65		7.05	0.222		0.278
F1, F2	2.44	2.54	2.94	0.096	0.100	0.116
delta H		±2			0.079	
W	17.5	18.00	19.0	0.689	0.709	0.748
W0	5.7		6.3	0.224		0.248
W1	8.5		9.25	0.335		0.364
W2		0.50			0.20	
H		18.50	18.70		0.728	0.726
H0	15.50		16.50	0.610		0.650
H1		25.00			0.984	
D0	3.8		4.2	0.150		0.165
t		0.90			0.035	
L1		3			0.118	
delta P		±1			0.039	
u		50			1.968	
Φ1		360			14.173	
Φ2		30			1.181	



**Table 5: Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
16-Mar-2005	2	Add Tape & Reel for TO-92.
23-Dec-2005	3	Mistake on Ordering Table in Header.

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