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

TO-92

SO-8

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

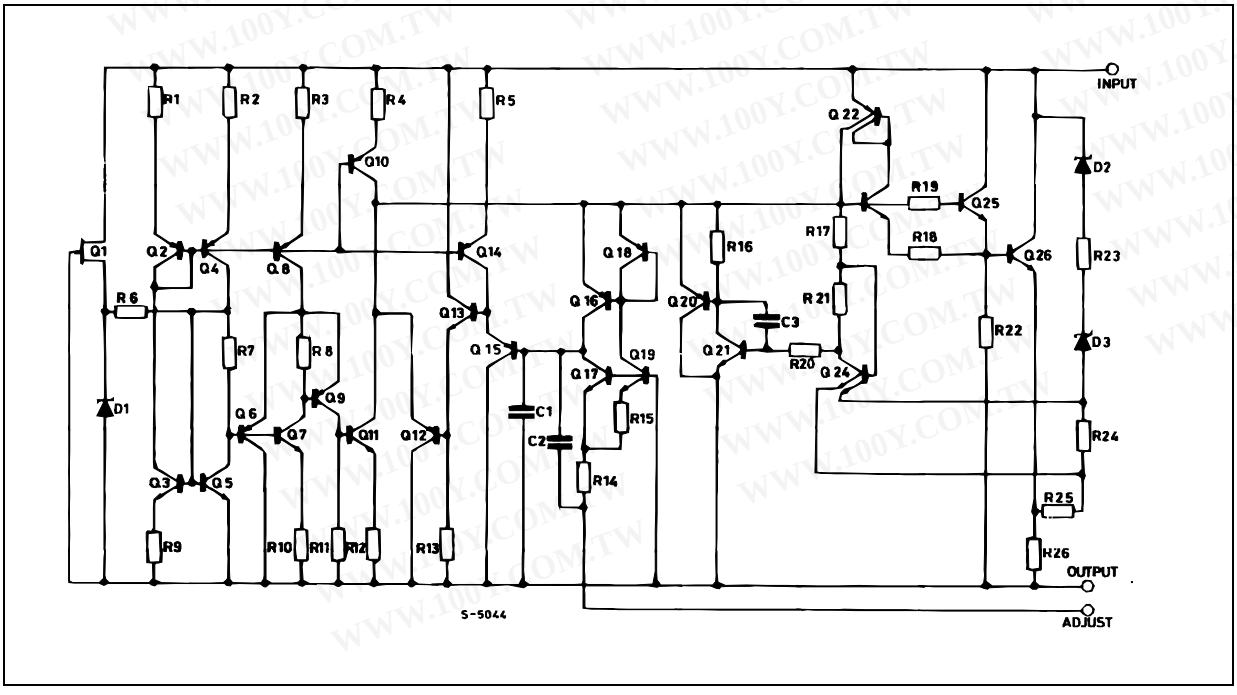
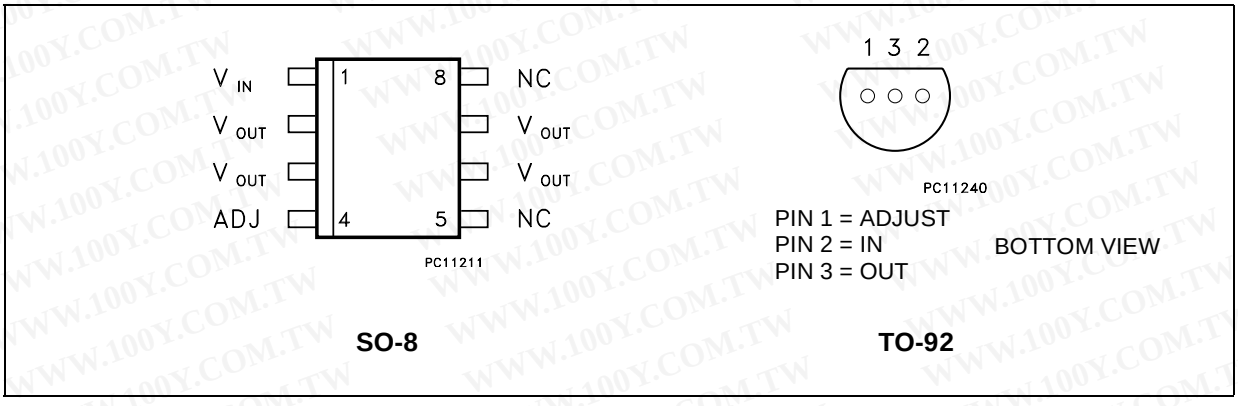


Table 1: Absolute Maximum Ratings

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	°C
		for LM317L	0 to 125	
T_{stg}	Storage Temperature Range		-55 to 150	°C

Figure 2: Pin Connection (top view)



SO-8 **TO-92**

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

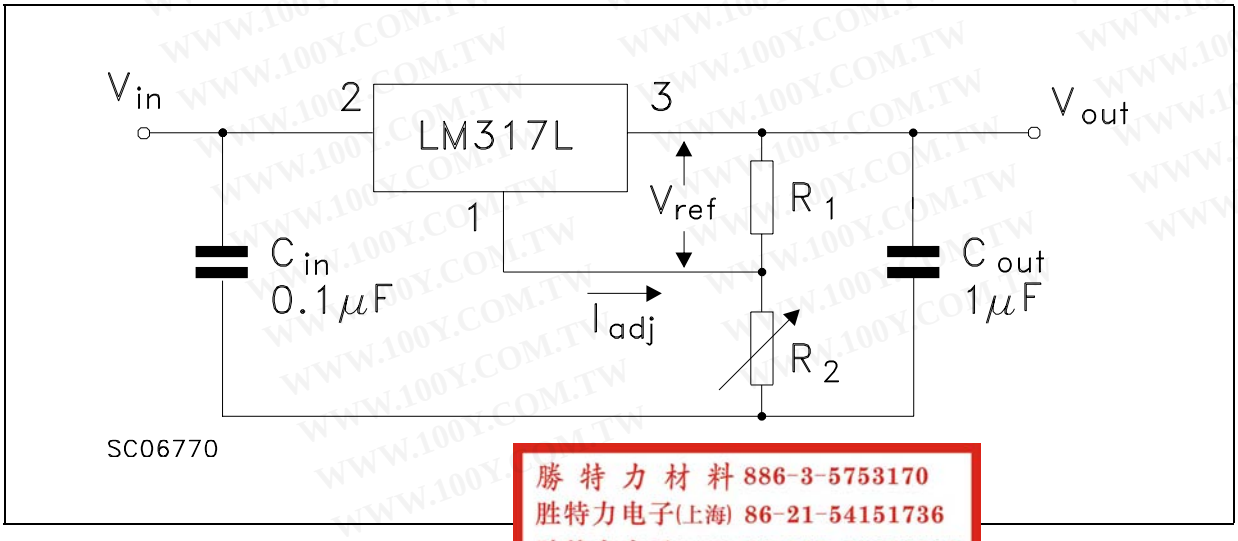


Table 3: Electrical Characteristics Of LM217L (refer to the test circuits, T_J = - 40 to 125°C, V_I - V_O = 5 V, I_O = 40 mA, unless otherwise specified).

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

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

Table 4: Electrical Characteristics Of LM317L (refer to the test circuits, T_J = 0 to 125°C, $V_I - V_O$ = 5 V, I_O = 40 mA, unless otherwise specified).

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

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

Figure 4: Current Limit

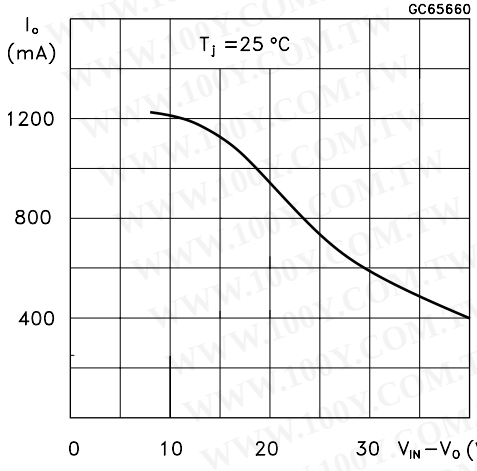
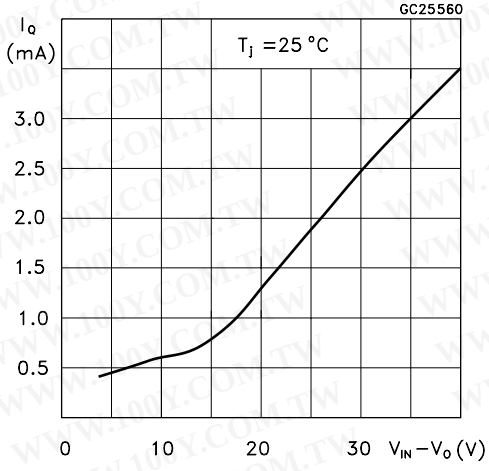


Figure 5: Minimum Operating Current



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} (100µA 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

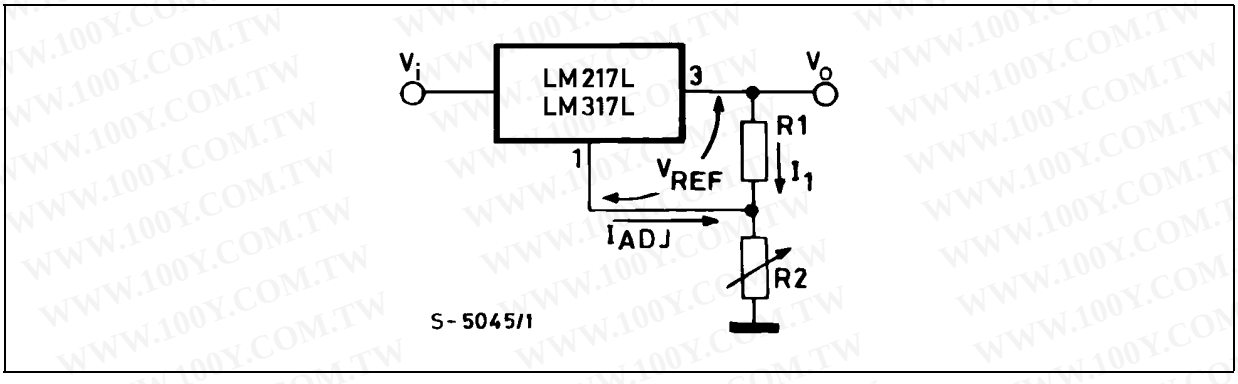


Figure 7: Voltage Regulator with Protection Diodes

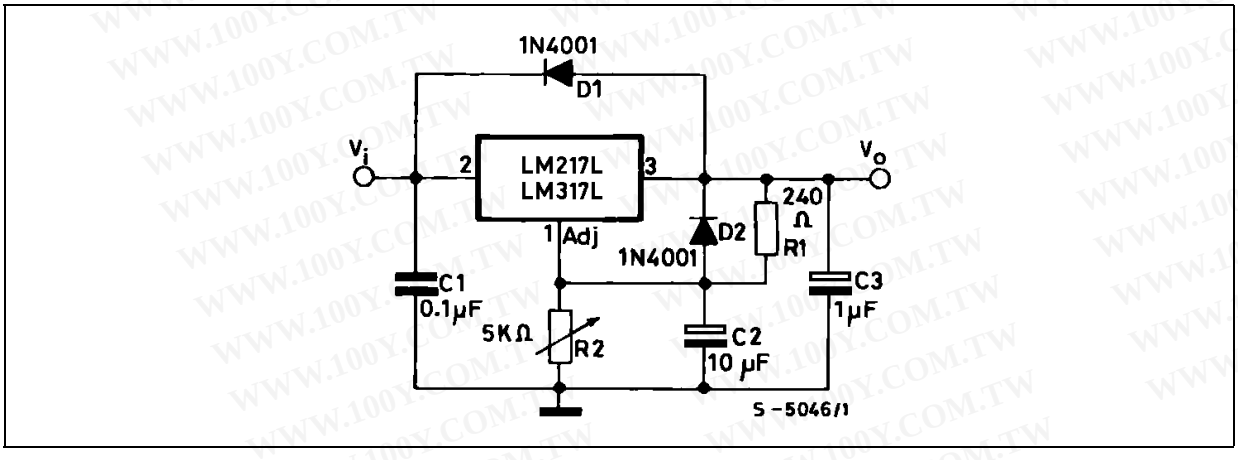


Figure 8: Slow Turn-on 15V Regulator

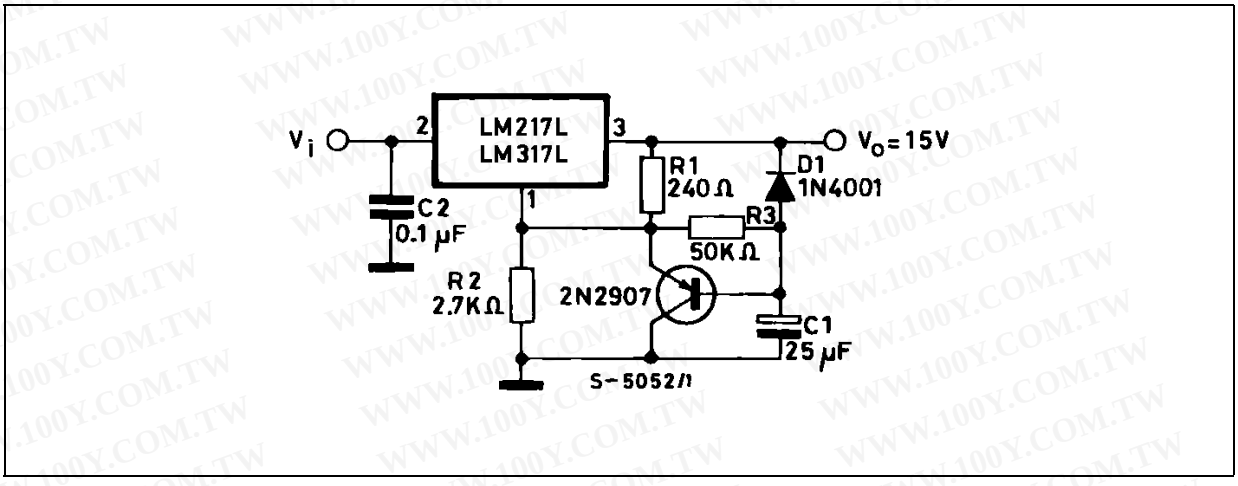
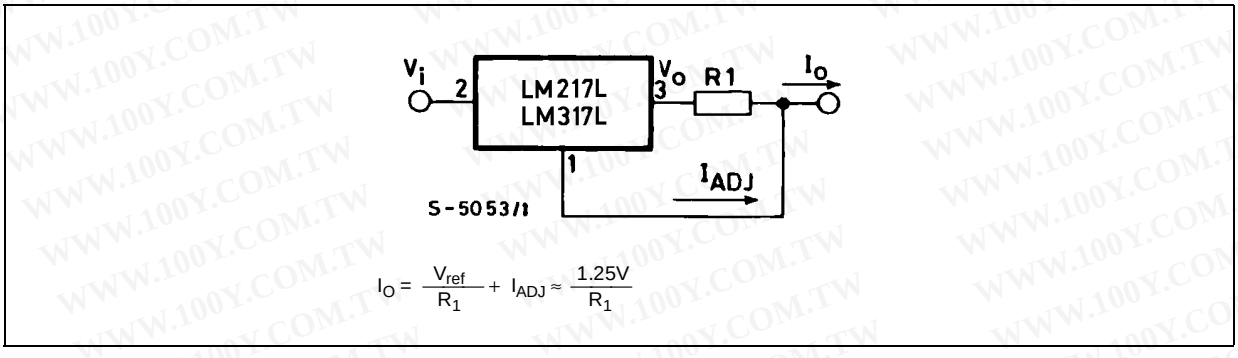


Figure 9: Current Regulator



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

Figure 10: 5V Electronic Shut-down Regulator

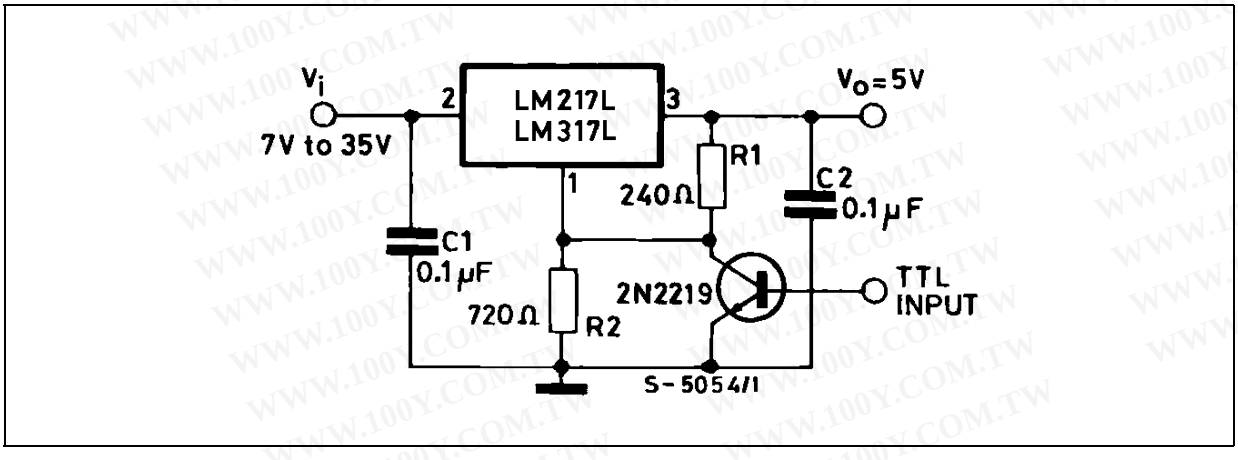
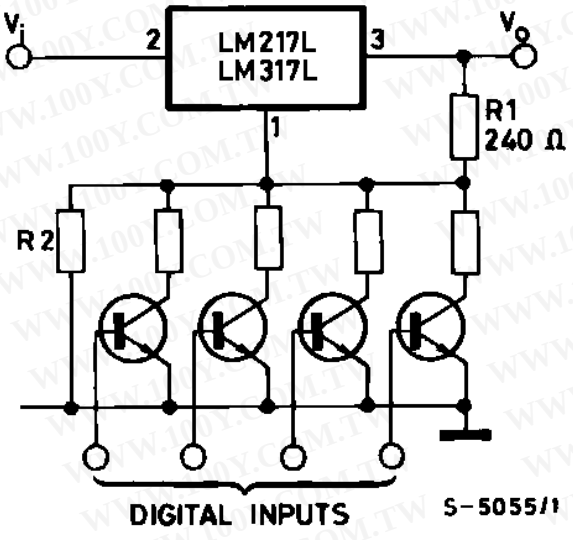


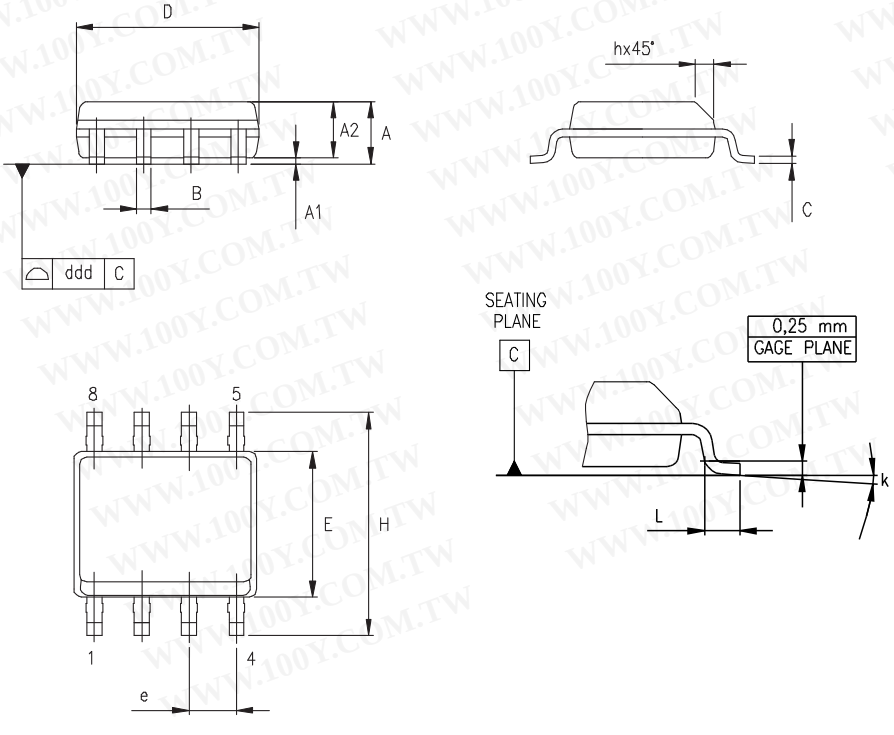
Figure 11: Digitally Selected Outputs



(R_2 = sets maximum V_O)

SO-8 MECHANICAL DATA

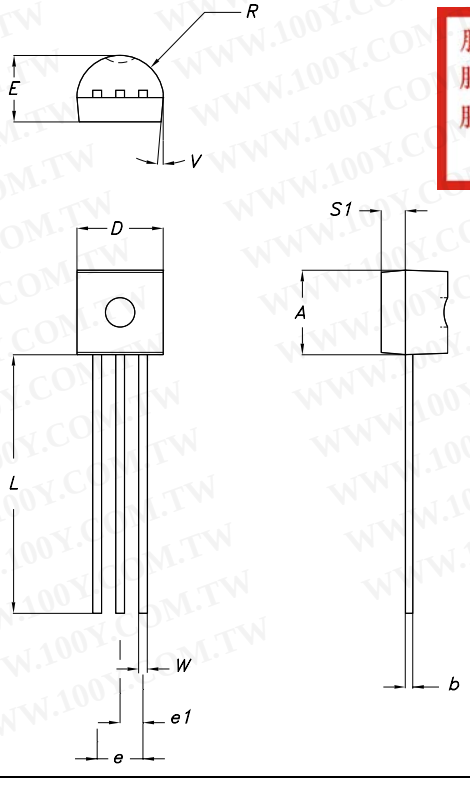
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L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



0016023/C

TO-92 MECHANICAL DATA

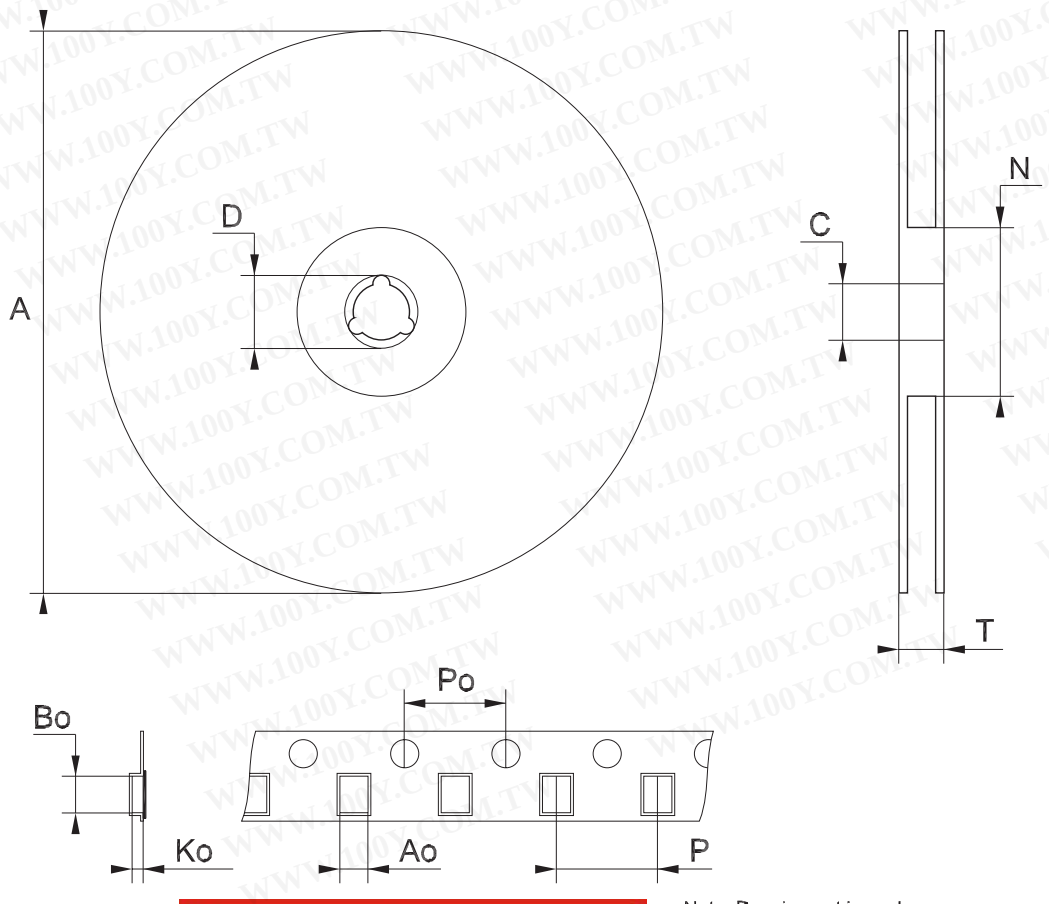
DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	170.1		194.9
b	0.36		0.51	14.2		20.1
D	4.45		4.95	175.2		194.9
E	3.30		3.94	129.9		155.1
e	2.41		2.67	94.9		105.1
e1	1.14		1.40	44.9		55.1
L	12.7		15.49	500.0		609.8
R	2.16		2.41	85.0		94.9
S1	0.92		1.52	36.2		59.8
W	0.41		0.56	16.1		22.0
α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



0102782/D

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



Note: Drawing not in scale

Tape & 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	

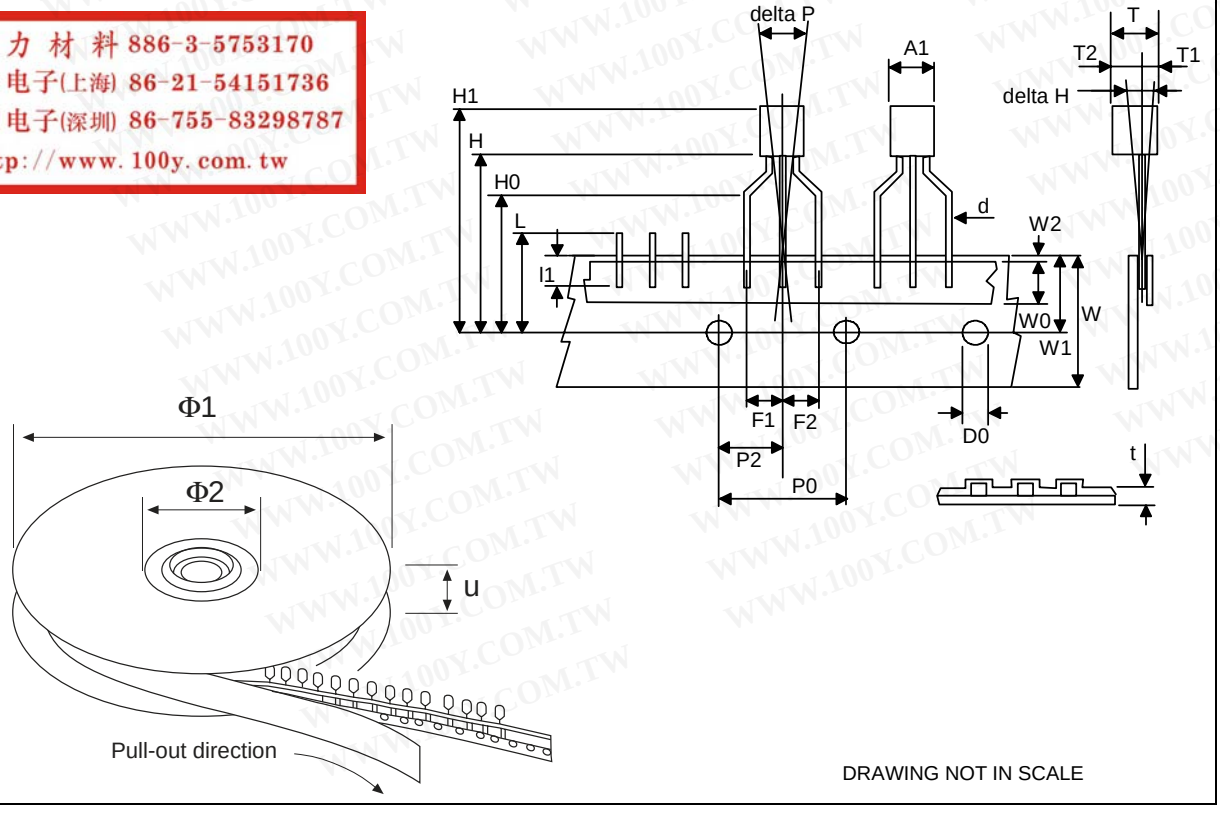


Table 5: Revision History

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