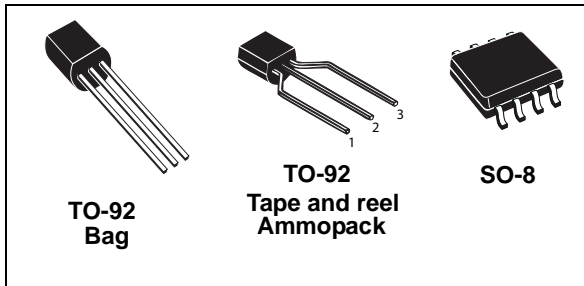


## Low current 1.2 to 37 V adjustable voltage regulators

Datasheet - production data



### Description

The LM217L/LM317L are monolithic integrated circuits in SO-8 and TO-92 packages intended for use as positive adjustable voltage regulators. They are designed to supply up to 100 mA of load current with an output voltage adjustable over a 1.2 to 37 V 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.

### Features

- Output voltage range: 1.2 to 37 V
- Output current in excess of 100 mA
- Output current up to 100 mA
- Line regulation typ. 0.01%
- Load regulation typ. 0.1%
- Thermal overload protection
- Short-circuit protection
- Output transition safe area compensation
- Floating operation for high voltage applications

Table 1. Device summary

Order codes			
SO-8 (tape and reel)	TO-92 (Bag)	TO-92 (Ampack)	TO-92 (tape and reel)
LM217LD13TR			LM217LZ-TR
LM217LD13TR	LM317LZ	LM317LZ-AP	LM317LZ-TR

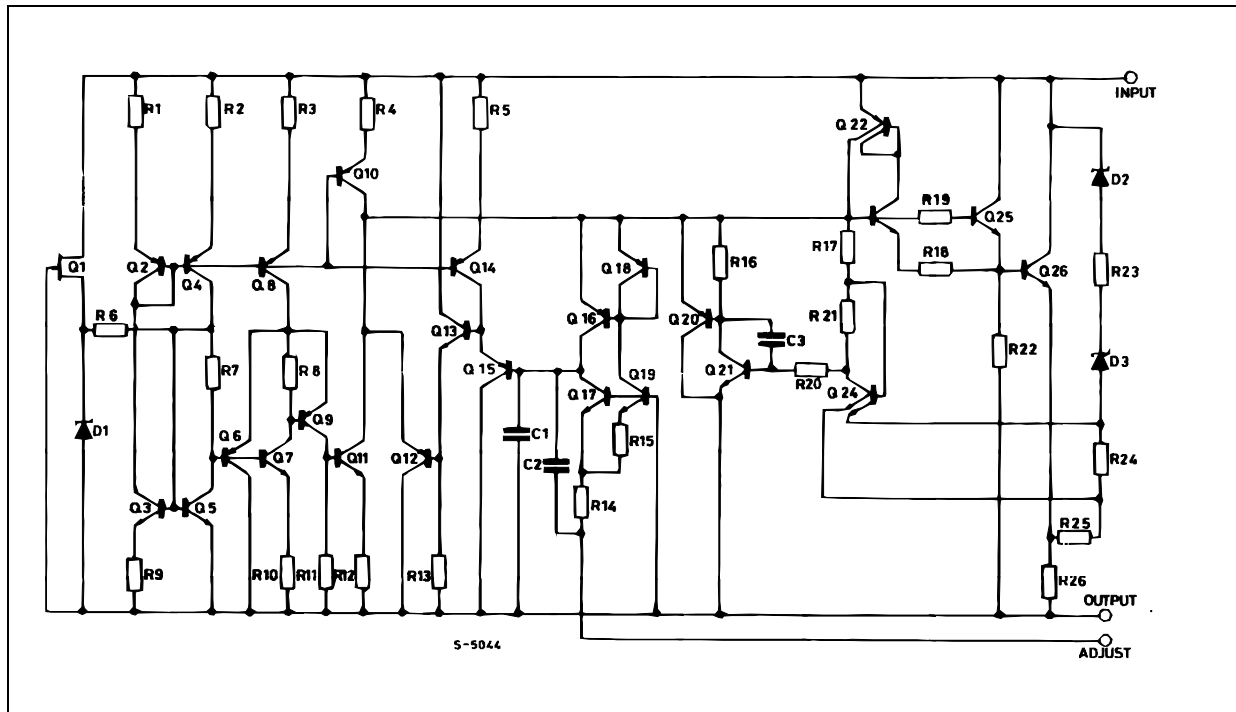
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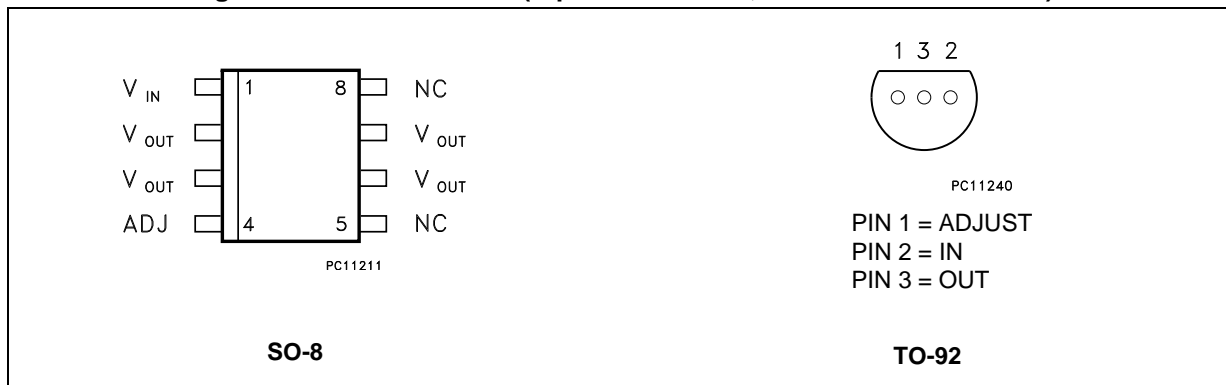
## 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connections (top view for SO-8, bottom view for TO-92)

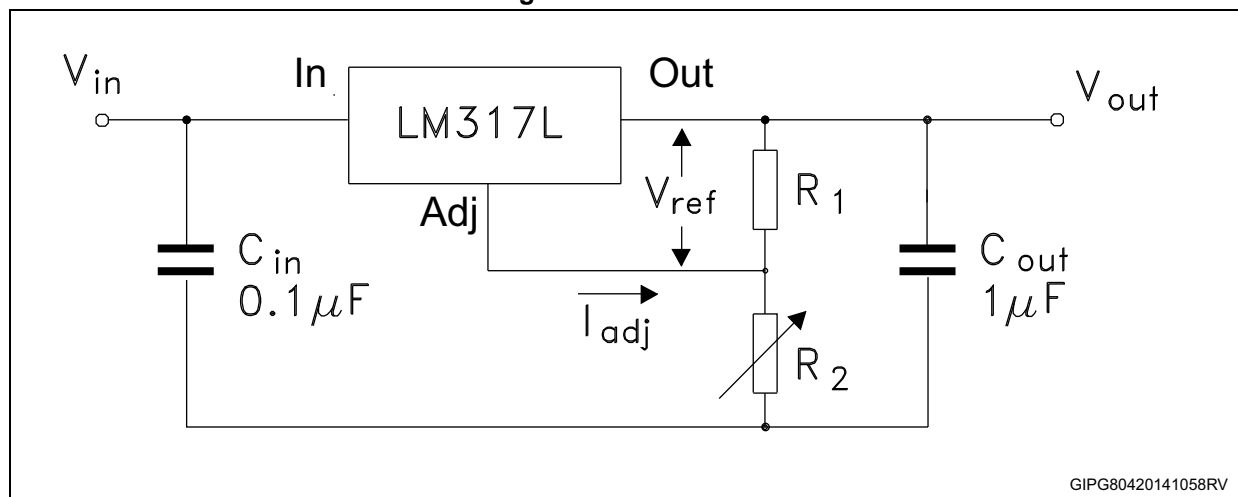


### 3 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_I-V_O$	Input-output differential voltage	40	V
$P_D$	Power dissipation	Internally limited	mW
$T_{OP}$	Operating junction temperature range	for LM217L	-40 to 125
		for LM317L	0 to 125
$T_{STG}$	Storage temperature range	-55 to 150	°C

Figure 3. Test circuit



## 4 Electrical characteristics

(Refer to the test circuits,  $T_J = -40$  to  $125^\circ\text{C}$ ,  $V_I - V_O = 5$  V,  $I_O = 40$  mA, unless otherwise specified)

**Table 3. Electrical characteristics of LM217L**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$DV_O$	Line regulation	$V_I - V_O = 3$ to $40$ V, $I_L = 20$ mA	$T_J = 25^\circ\text{C}$		0.01	0.02	%V
					0.02	0.05	
$DV_O$	Load regulation	$V_O \leq 5$ V, $I_O = 5$ to $100$ mA	$T_J = 25^\circ\text{C}$		5	15	mV
					20	50	
		$V_O \geq 5$ V, $I_O = 5$ to $100$ mA	$T_J = 25^\circ\text{C}$		0.1	0.3	%
					0.3	1	
$I_{ADJ}$	Adjustment pin current			50	100	$\mu\text{A}$	
$DI_{ADJ}$	Adjustment pin current	$V_I - V_O = 3$ to $40$ V, $I_O = 5$ to $100$ mA $P_d < 625$ mW		0.2	5	$\mu\text{A}$	
$V_{REF}$	Reference voltage	$V_I - V_O = 3$ to $40$ V, $I_O = 10$ to $500$ mA $P_d < 625$ mW	1.2	1.25	1.3	V	
$DV_O/V_O$	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, $T_J = 25^\circ\text{C}$		0.003		%	
SVR	Supply voltage rejection <sup>(1)</sup>	$T_J = 25^\circ\text{C}$ $f = 120$ Hz	$C_{ADJ} = 0$		65	dB	
			$C_{ADJ} = 10 \mu\text{F}$	66	80		

1.  $C_{ADJ}$  is connected between adjust pin and ground.

(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)

Table 4. Electrical characteristics of LM317L

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$DV_O$	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	
$DV_O$	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	$\mu\text{A}$	
$DI_{ADJ}$	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	
$DV_O/V_O$	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 <sup>(1)</sup>	$T_J = 25^\circ\text{C}$ $f = 120\text{ Hz}$	$C_{ADJ} = 0$		65		dB
			$C_{ADJ} = 10\ \mu\text{F}$	66	80		

1.  $C_{ADJ}$  is connected between adjust pin and ground.

## 5 Typical performance

Figure 4. Current limit

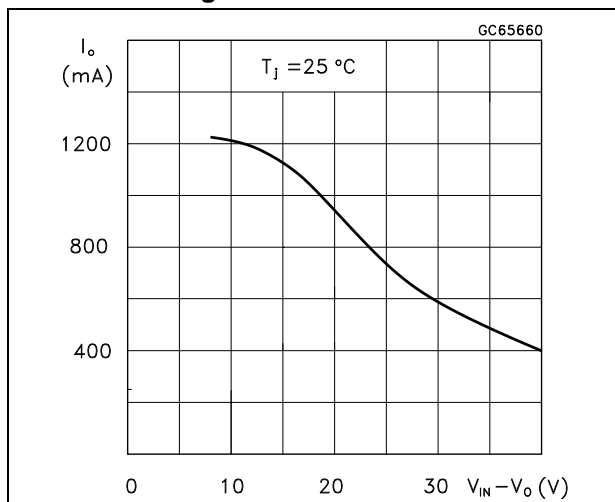
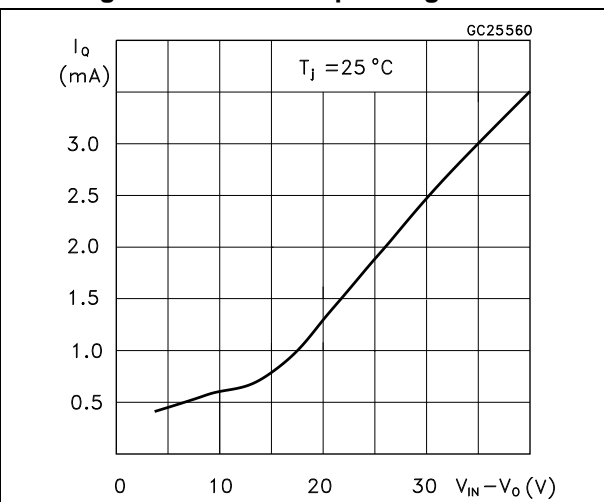


Figure 5. Minimum operating current





## 6 Application information

The LM317L provides an internal reference voltage of 1.25 V between the output and adjustments terminals. This is used to set a constant current flow across an external resistor divider (see [Figure 6.](#)), 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 regulator as the maximum input-to-output differential is not exceeded. Furthermore, programmable regulators 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 [Figure 6.](#)) 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.

# 7 Application circuits

Figure 6. Basic adjustable regulator

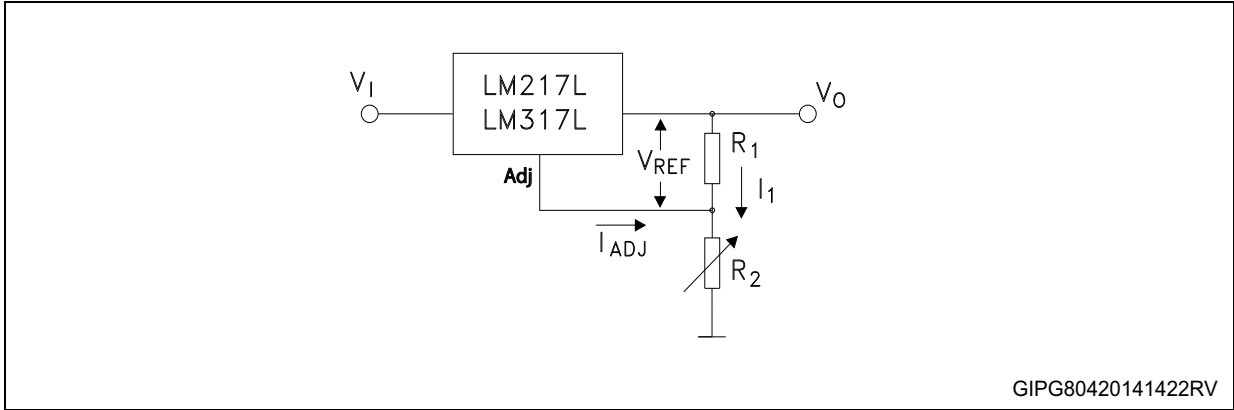


Figure 7. Voltage regulator with protection diodes

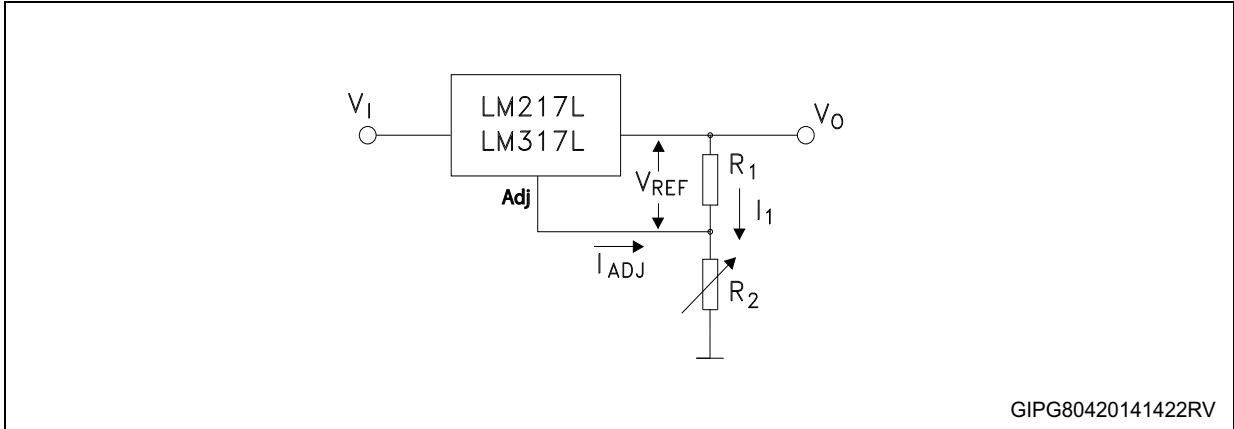


Figure 8. Slow turn-on 15 V regulator

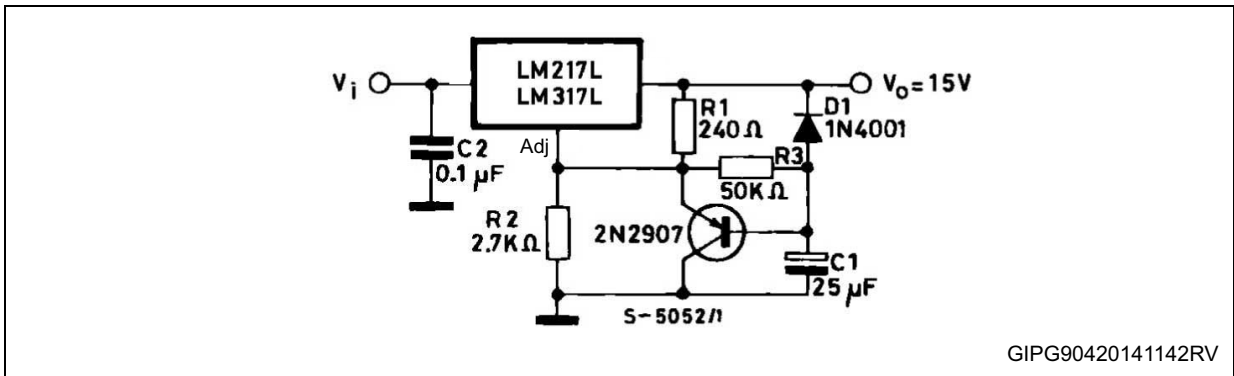


Figure 9. Current regulator

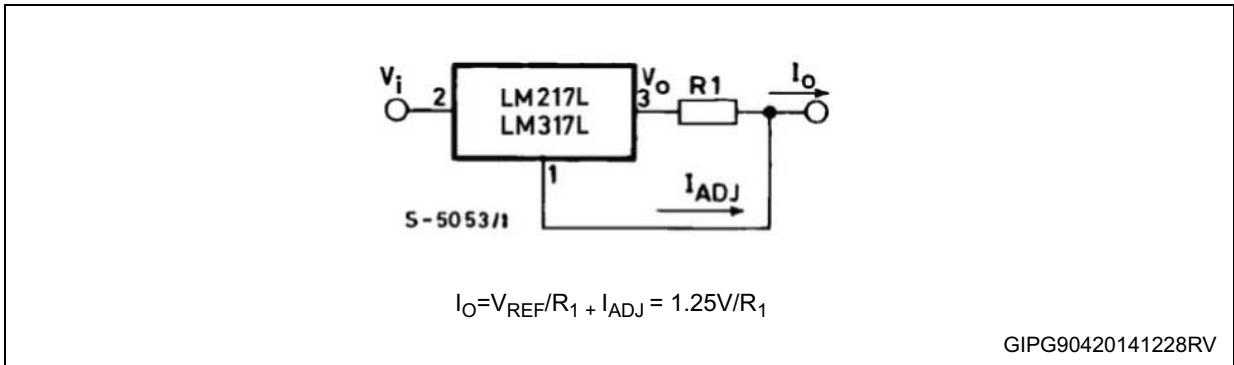


Figure 10. 5 V Electronic shut-down regulator

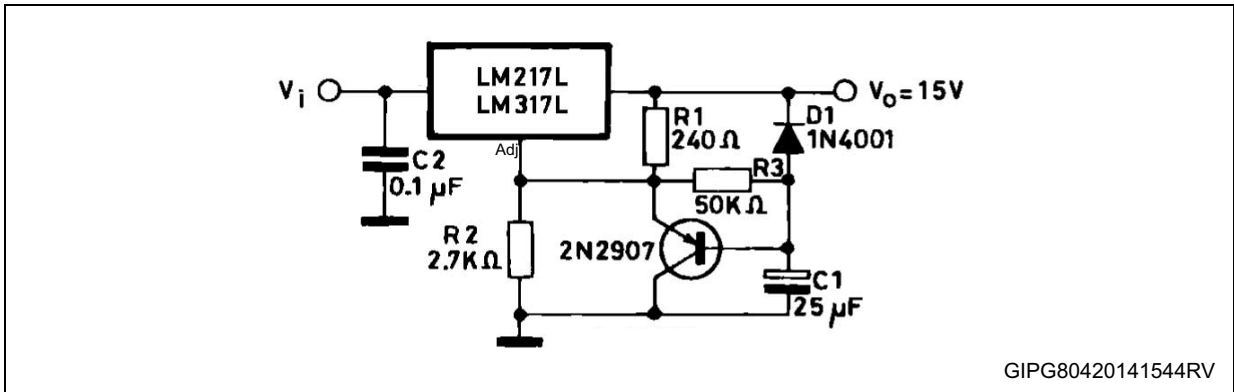
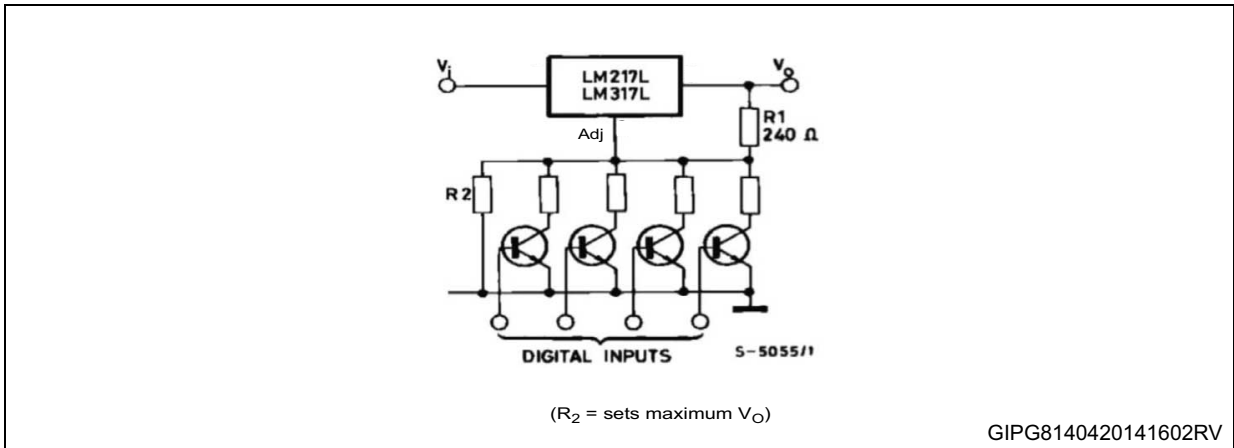


Figure 11. Digitally selected outputs



## 8 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Figure 12. SO-8 drawing

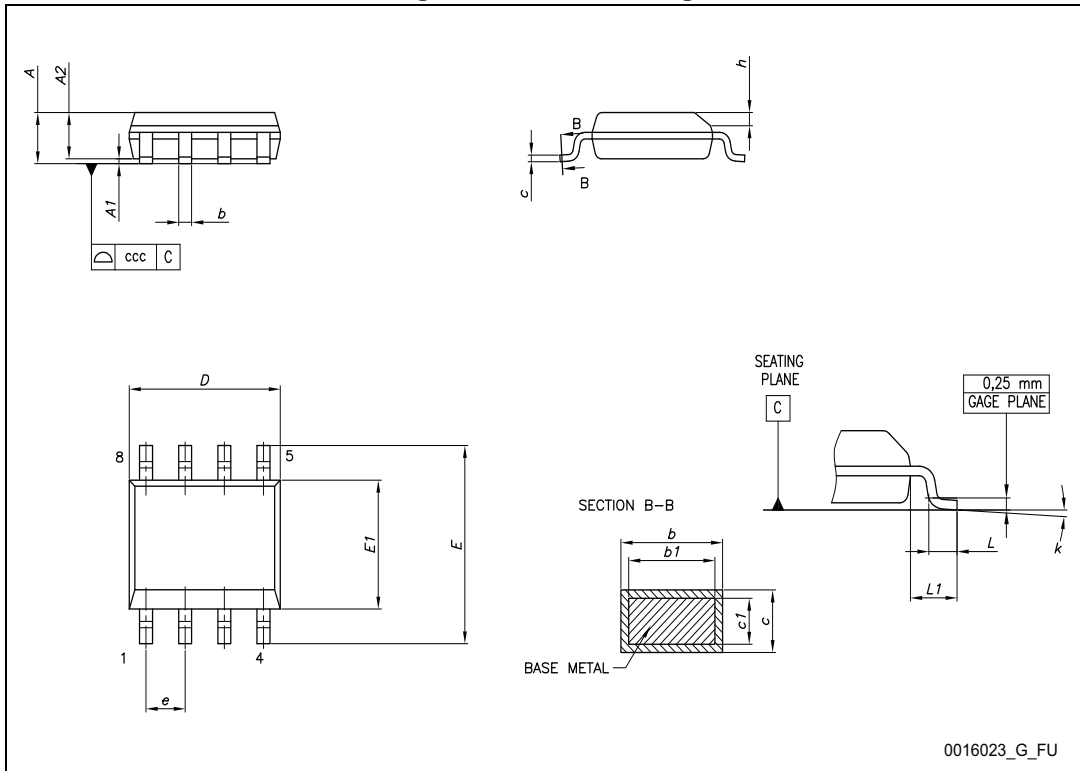


Table 5. SO-8 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.31		0.51
b1	0.28		0.48
c	0.10		0.25
c1	0.10		0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27	
h	0.25		0.50
L	0.40		1.27
L1		1.04	
L2		0.25	
k	0°		8°
ccc			0.10

Figure 13. SO-8 recommended footprint

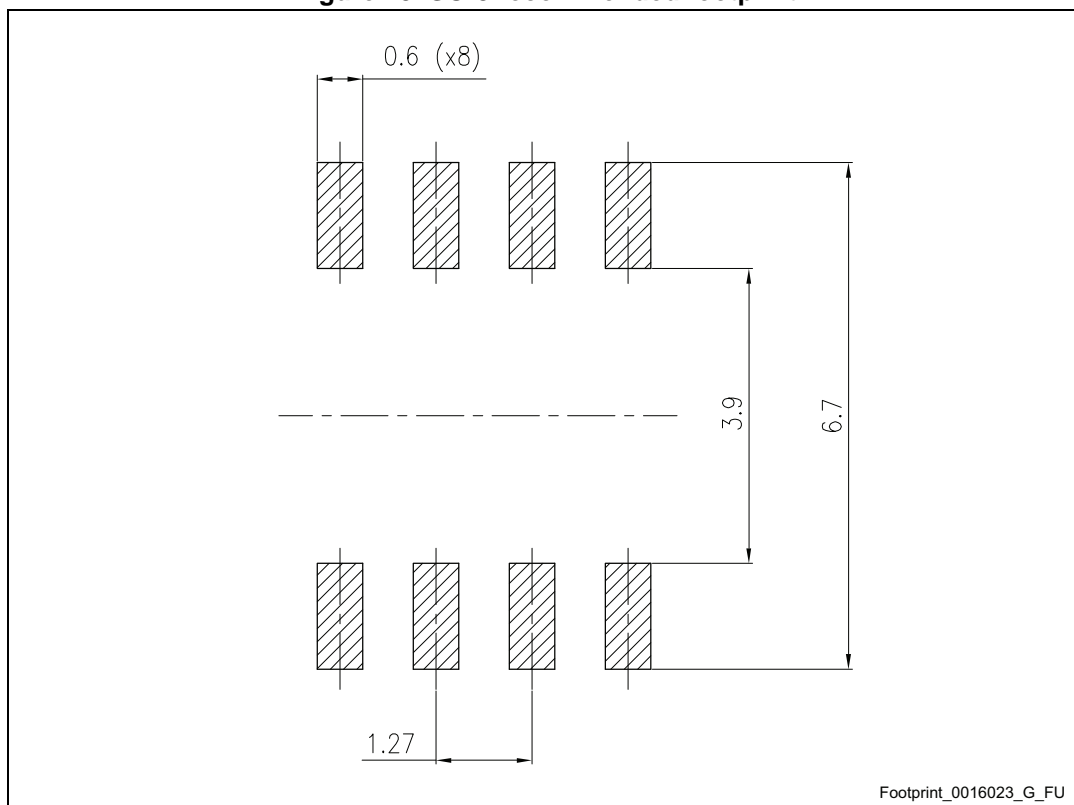
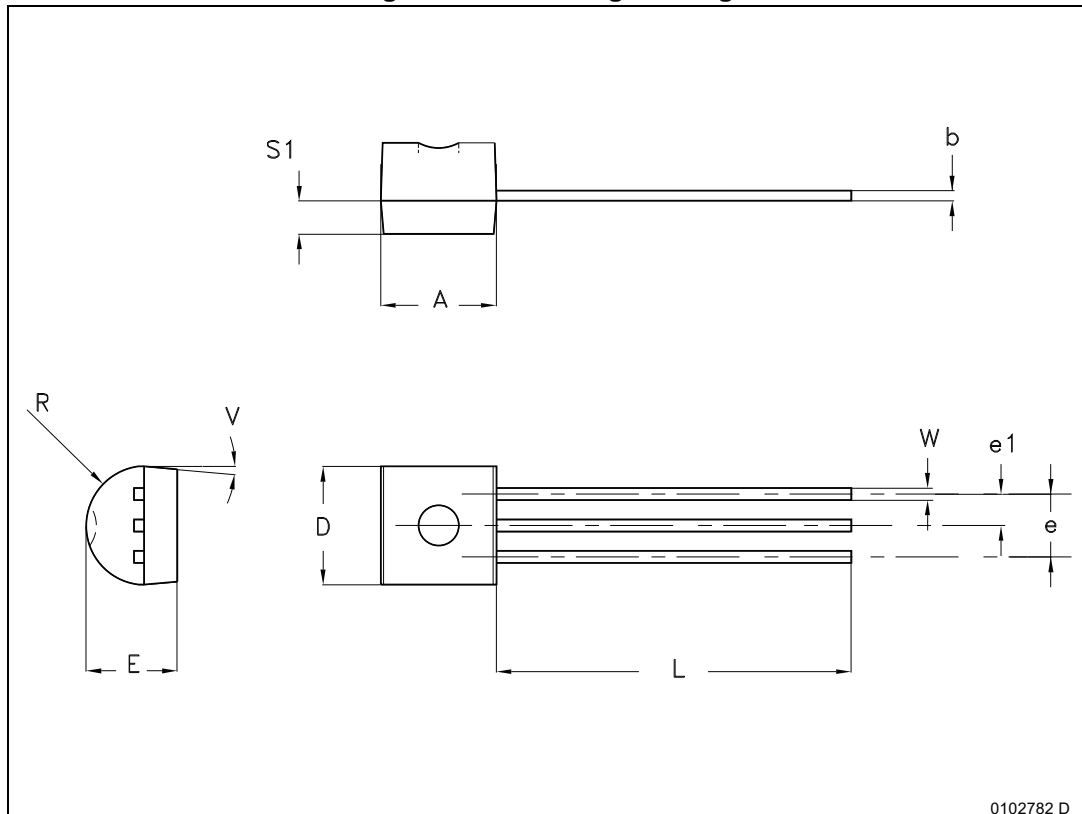


Figure 14. TO-92 Bag drawing



0102782 D

Table 6 TO-92 Bag mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

# 9 Packaging information

Figure 15. SO-8 tape and reel drawing

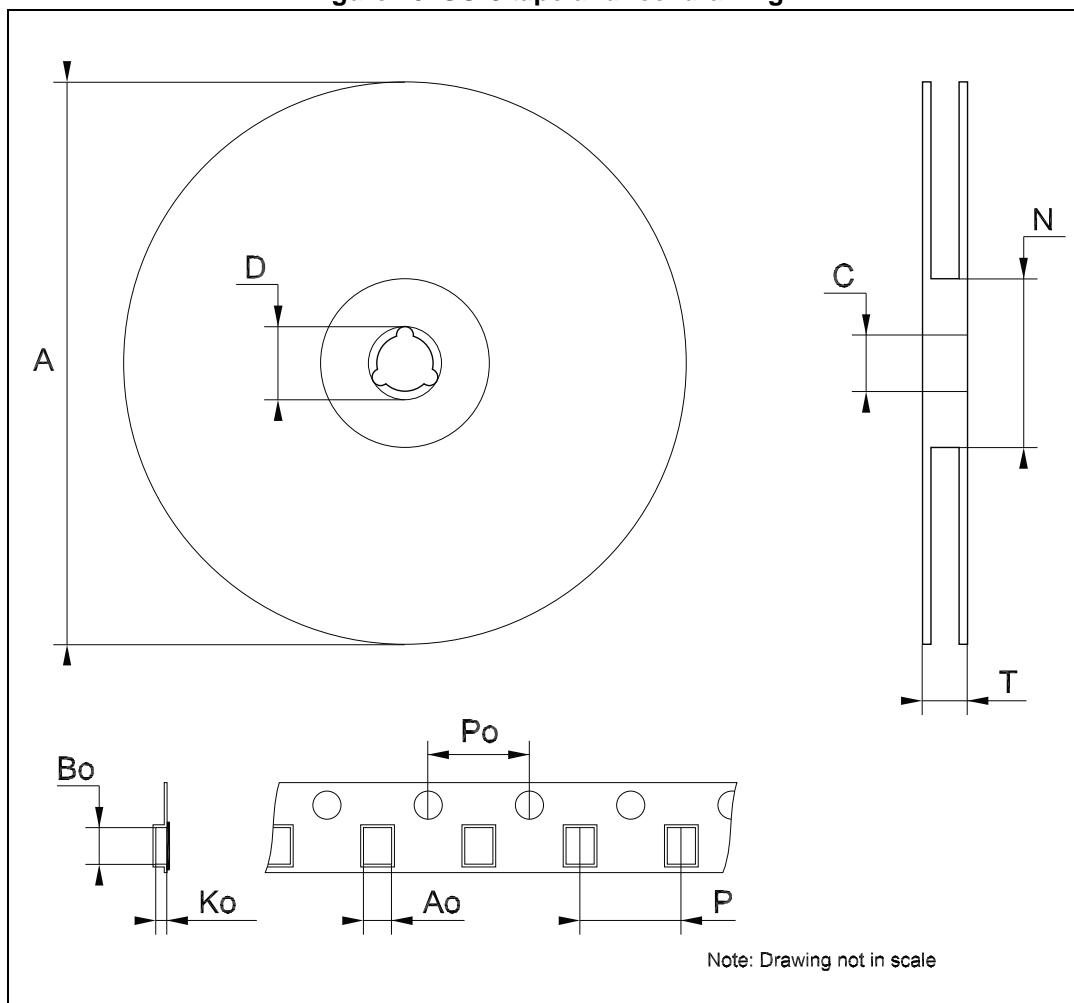




Table 7 SO-8 tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			330
C	12.8		13.2
D	20.2		
N	60		
T			22.4
Ao	8.1		8.5
Bo	5.5		5.9
Ko	2.1		2.3
Po	3.9		4.1
P	7.9		8.1

Figure 16. TO-92 tape and reel drawing

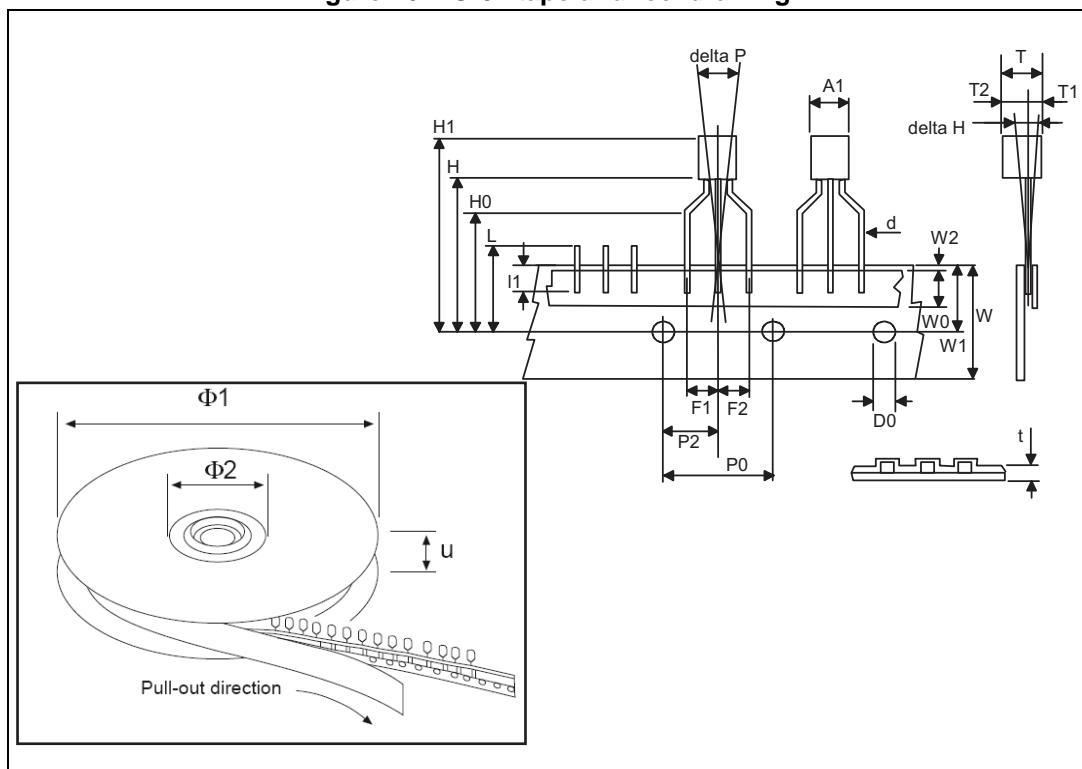
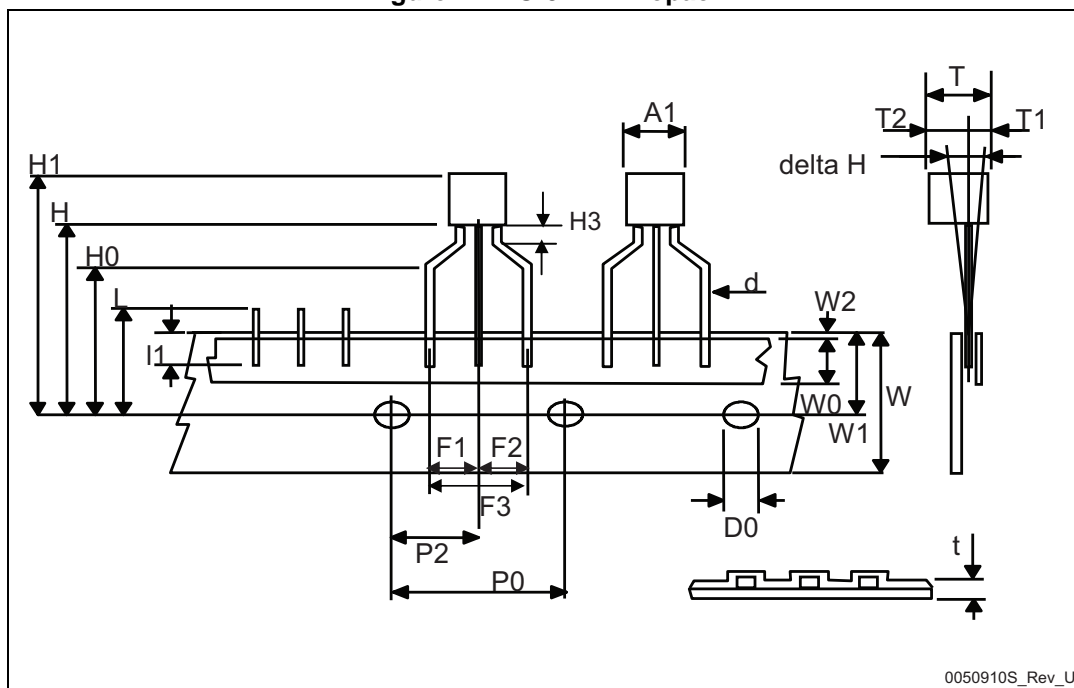


Table 8. TO-92 tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A1			4.80
T			3.80
T1			1.60
T2			2.30
d	0.45	0.47	0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1, F2	2.40	2.50	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.5	6.00	6.5
W1	8.50	9.00	9.25
W2			0.50
H		18.50	21
H3	0.5	1	2
H0	15.50	16.00	18.8
H1		25.0	27.0
D0	3.80	4.00	4.20
t			0.90
L			11.00
l1	3.00		
delta P	-1.00		1.00
Ø1	352	355	358
Ø2	28	30	32
u	44	47	50

Figure 17. TO-92 Ammopack



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Table 9. TO-92 Ammopack mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A1			4.80
T			3.80
T1			1.60
T2			2.30
d	0.45	0.47	0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1, F2	2.40	2.50	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.5	6.00	6.5
W1	8.50	9.00	9.25
W2			0.50
H		18.50	21
H3	0.5	1	2
H0	15.50	16.00	18.8
H1		25.0	27.0
D0	3.80	4.00	4.20
t			0.90
L			11.00
l1	3.00		
delta P	-1.00		1.00

## 10 Revision history

**Table 10. Revision history**

Date	Revision	Changes
16-Mar-2005	2	Add Tape & reel for TO-92.
23-Dec-2005	3	Mistake on ordering table in header.
18-May-2007	4	Order codes has been updated and the document has been reformatted.
20-May-2014	5	Added TO-92 Ammopack package. Updated <a href="#">Section 6: Application information</a> and <a href="#">Section 8: Package mechanical data</a> . Added <a href="#">Section 9: Packaging information</a> . Minor text changes.

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