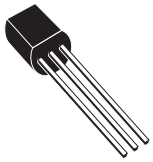
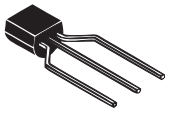
LM217L, LM317L

Low current 1.2 to 37 V adjustable voltage regulators

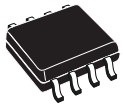
Datasheet - production data



TO-92
Bag



TO-92
Tape and reel
Ammopack



SO-8

Features

- Outuput voltage range: 1.2 to 37 V
- 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

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.

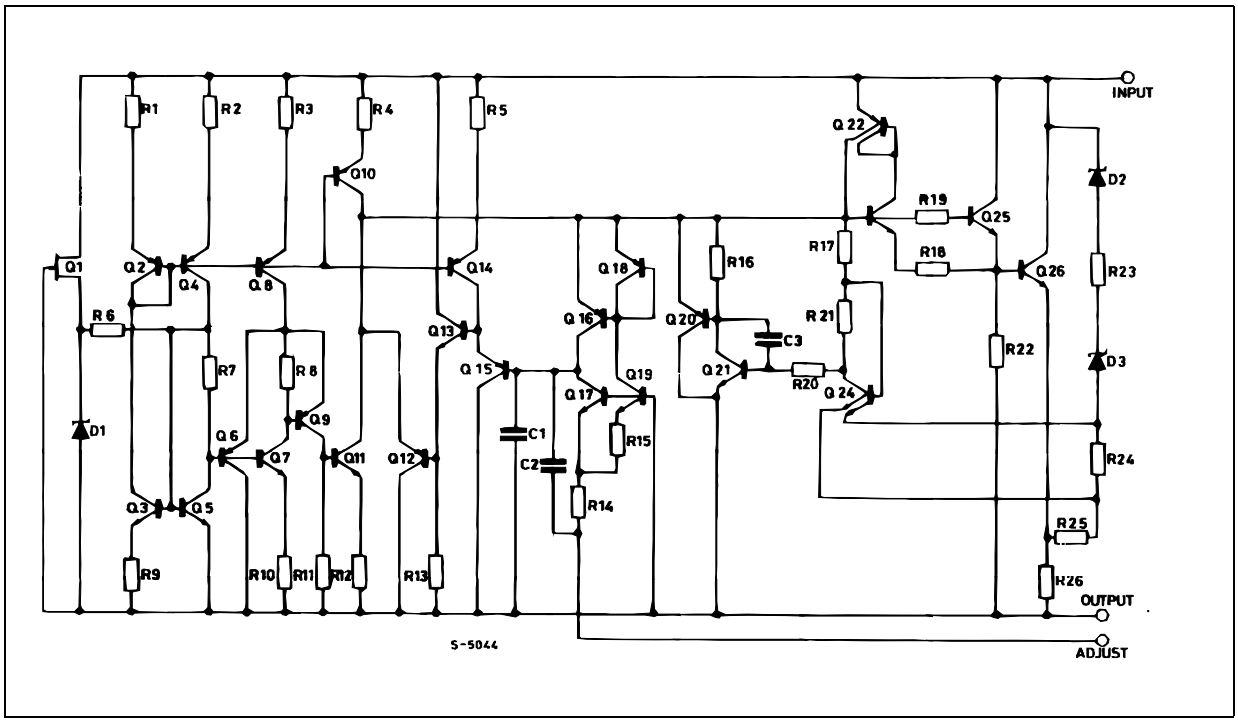
Table 1. Device summary

Order codes			
SO-8 (tape and reel)	**TO-92 (Bag)**	**TO-92 (Ammopack)**	**TO-92 (tape and reel)**
LM217LD13TR			LM217LZ-TR
LM317LD13TR	LM317LZ	LM317LZ-AP	LM317LZ-TR

Contents

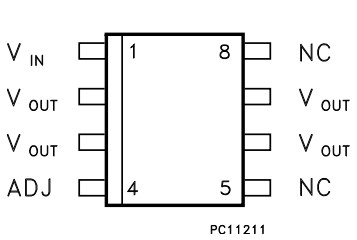
1 Diagram

Figure 1. Schematic diagram

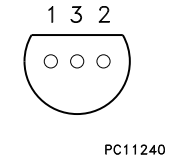


2 Pin configuration

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



SO-8



PIN 1 = ADJUST
PIN 2 = IN
PIN 3 = OUT

TO-92

3 Maximum ratings

Table 2. Absolute maximum ratings

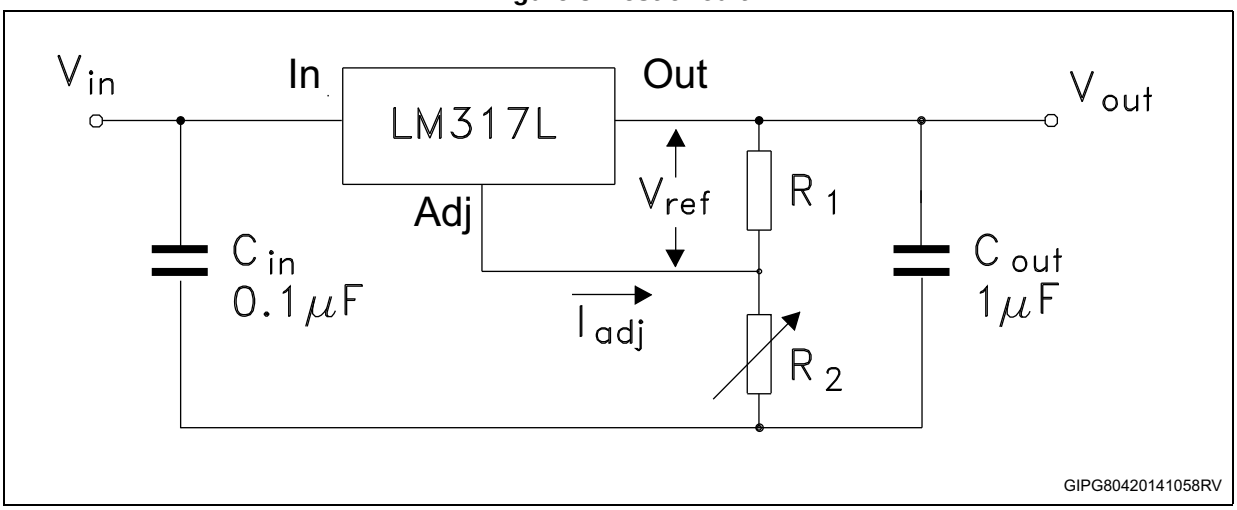
Symbol	Parameter		Value	Unit
V_I-V_O	Input-output differential voltage		40	V
P_D	Power dissipation		Internally limited	mW
T_{OP}	Operating junction temperature range	for LM217L	-40 to 125	°C
		for LM317L	0 to 125	
T_{STG}	Storage temperature range		-55 to 150	°C

Table 3. Thermal data

Symbol	Parameter	SO-8	TO-92	Unit
R_{thJC}	Thermal resistance junction-case (max)	20		°C/W
R_{thJA}	Thermal resistance junction-ambient (max)	55(1)(2)	200	

1. Considering 6 cm² of copper Board heat-sink.
2. Our SO-8 package used for voltage regulators is modified internally to have pins 2, 3, 6 and 7 electrically communed to the die attach flag. This particular frame decreases the total thermal resistance of the package and increases its ability to dissipate power when an appropriate area of copper on the printed circuit board is available for heat-sinking. The external dimensions are the same as for the standard SO-8.

Figure 3. Test circuit



4 Electrical characteristics

(Refer to the test circuits, T_J = - 40 to 125°C, V_I - V_O = 5 V, I_O = 40 mA, unless otherwise specified)

Table 4. Electrical characteristics of LM217L

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V, I_O = 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, I_O = 5 to 100 mA P_d < 625 mW			0.2	5	µA
V_{REF}	Reference voltage	V_I - V_O = 3 to 40 V, I_O = 10 to 100 mA P_d < 625 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 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 (1)	T_J = 25°C f = 120 Hz	C_{ADJ} = 0		65		dB
			C_{ADJ} = 10 µF	66	80		

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

(Refer to the test circuits, T_J = 0 to 125°C, V_I - V_O = 5 V, I_O = 40 mA, unless otherwise specified)

Table 5. Electrical characteristics of LM317L

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V, I_O = 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, I_O = 5 to 100 mA P_d < 625 mW			0.2	5	µA
V_{REF}	Reference voltage	V_I - V_O = 3 to 40 V, I_O = 5 to 100 mA P_d < 625 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 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 (1)	T_J = 25°C f = 120 Hz	C_{ADJ} = 0		65		dB
			C_{ADJ} = 10 µF	66	80		

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

5 Typical performance

Figure 4. Current limit

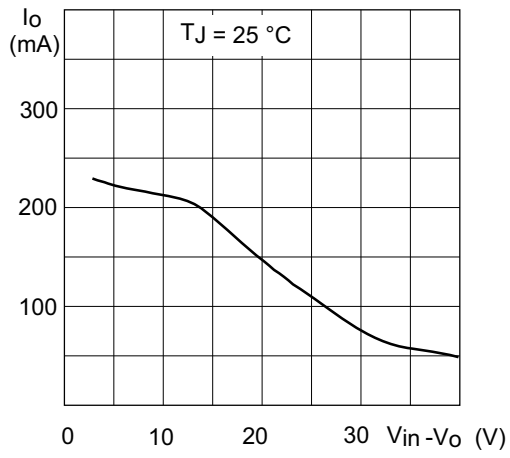
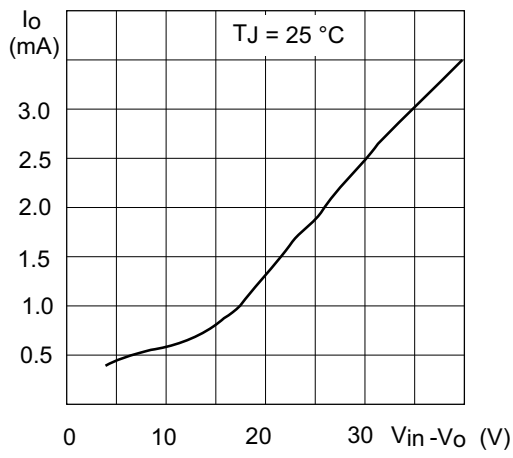


Figure 5. Minimum operating current



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 µA 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

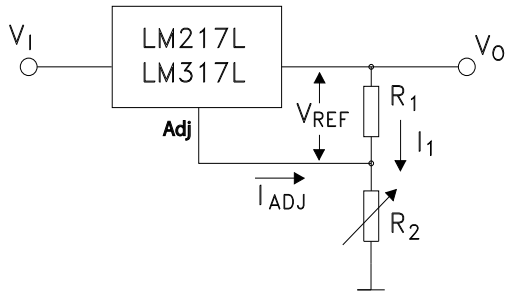


Figure 7. Voltage regulator with protection diodes

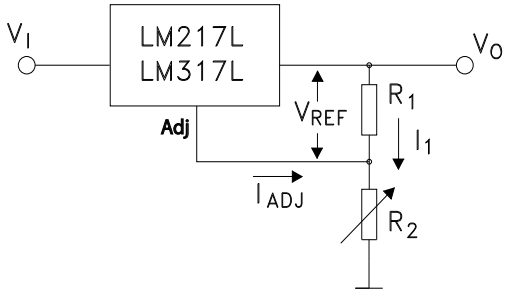


Figure 8. Slow turn-on 15 V regulator

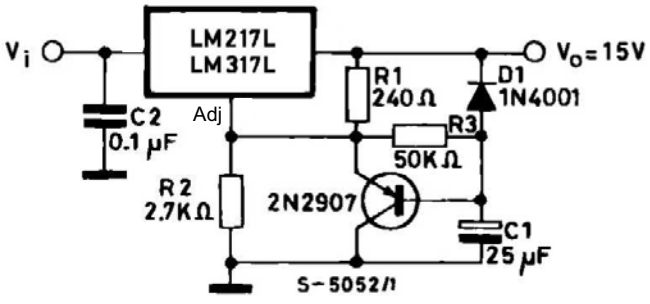
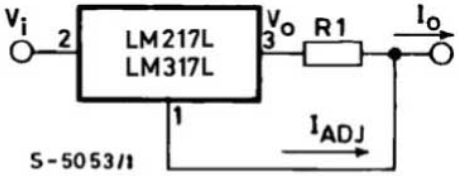


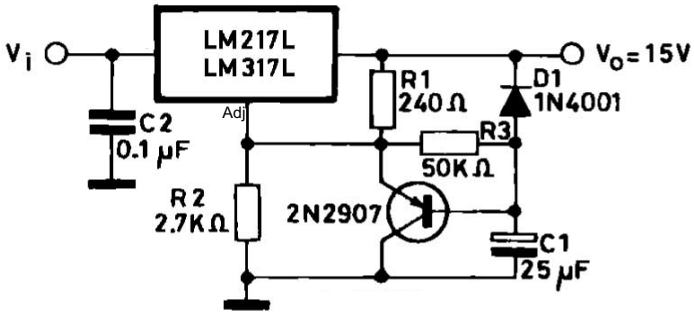
Figure 9. Current regulator



$I_O=V_{REF}/R_1 + I_{ADJ} = 1.25V/R_1$

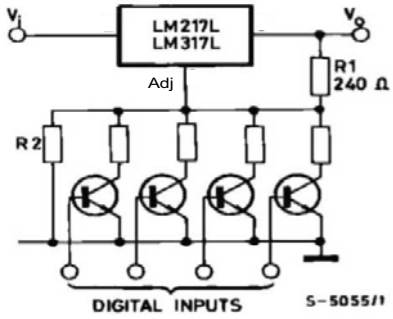
GIPG90420141228RV

Figure 10. 5 V Electronic shut-down regulator



GIPG80420141544RV

Figure 11. Digitally selected outputs



(R_2 = sets maximum V_O)

GIPG8140420141602RV

8 Package information

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

8.1 TO-92 Bag package information

Figure 12. TO-92 Bag package outline

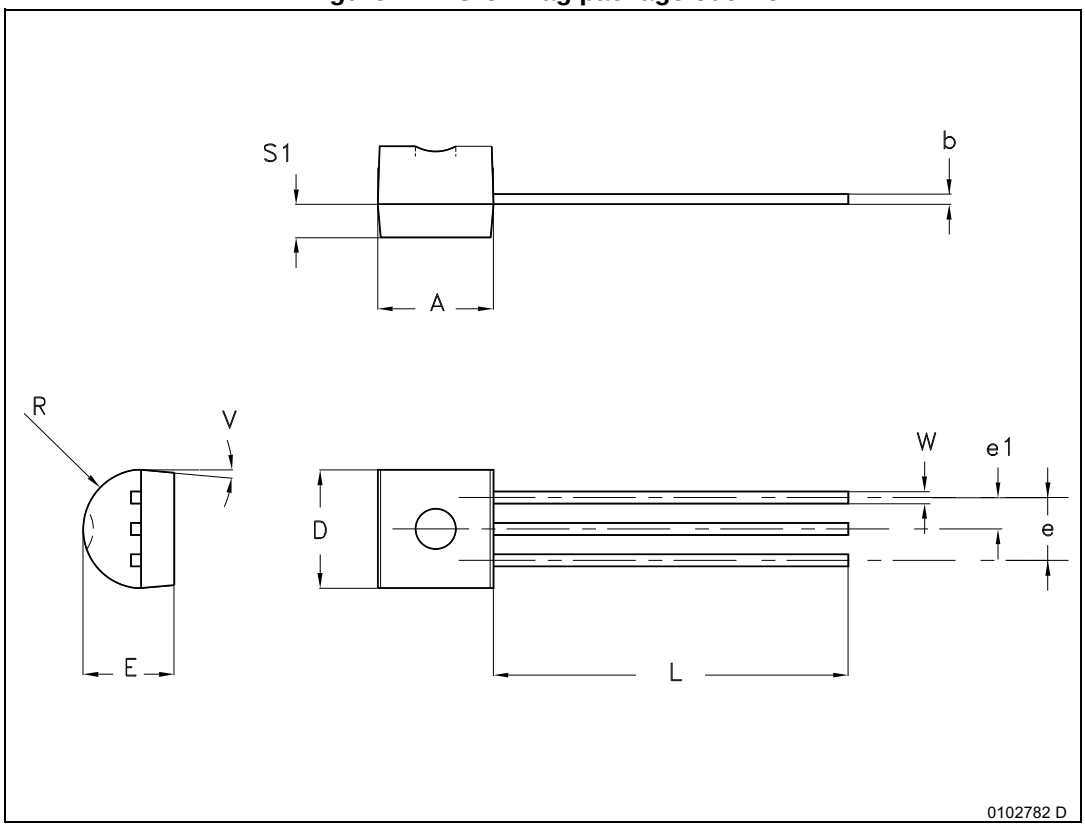


Table 6. TO-92 Bag mechanical data

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°	

8.2 TO-92 Ammopack package information

Figure 13. TO-92 Ammopack package outline

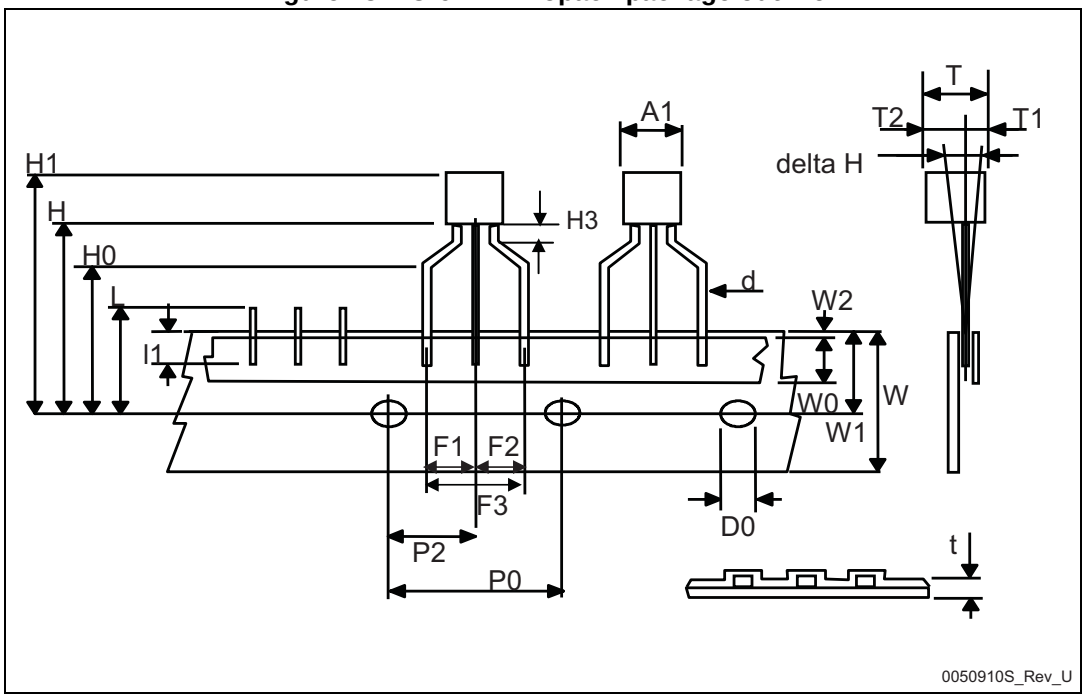


Table 7. TO-92 Ammopack mechanical data

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

8.3 TO-92 packing information

Figure 14. TO-92 tape and reel outline

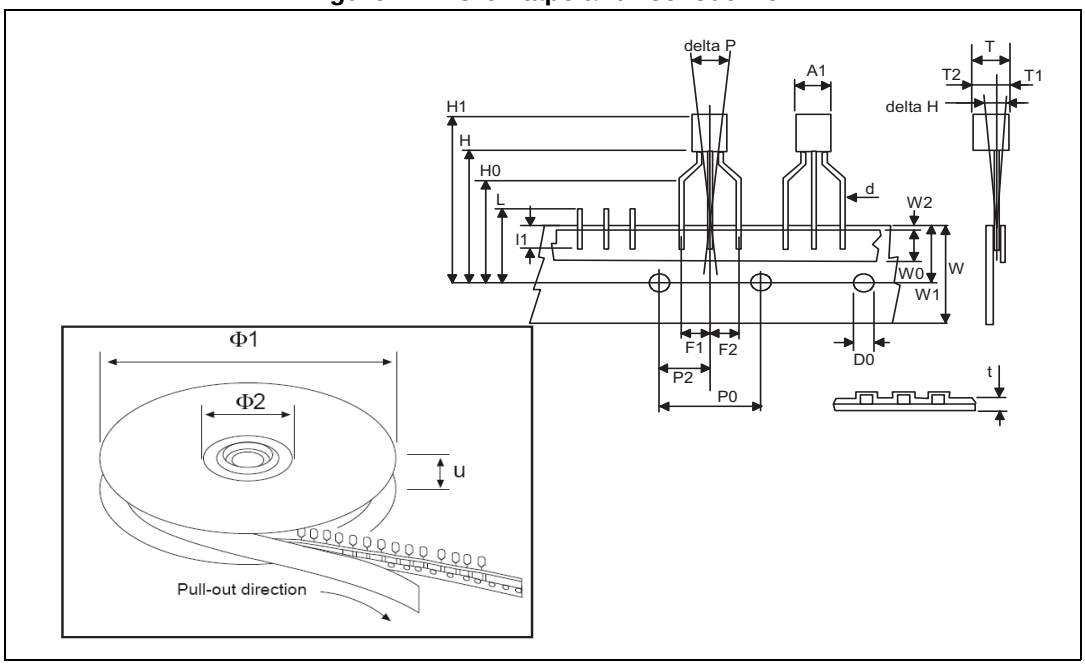


Table 8. TO-92 tape and reel mechanical data

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

8.4 SO-8 package information

Figure 15. SO-8 package outline

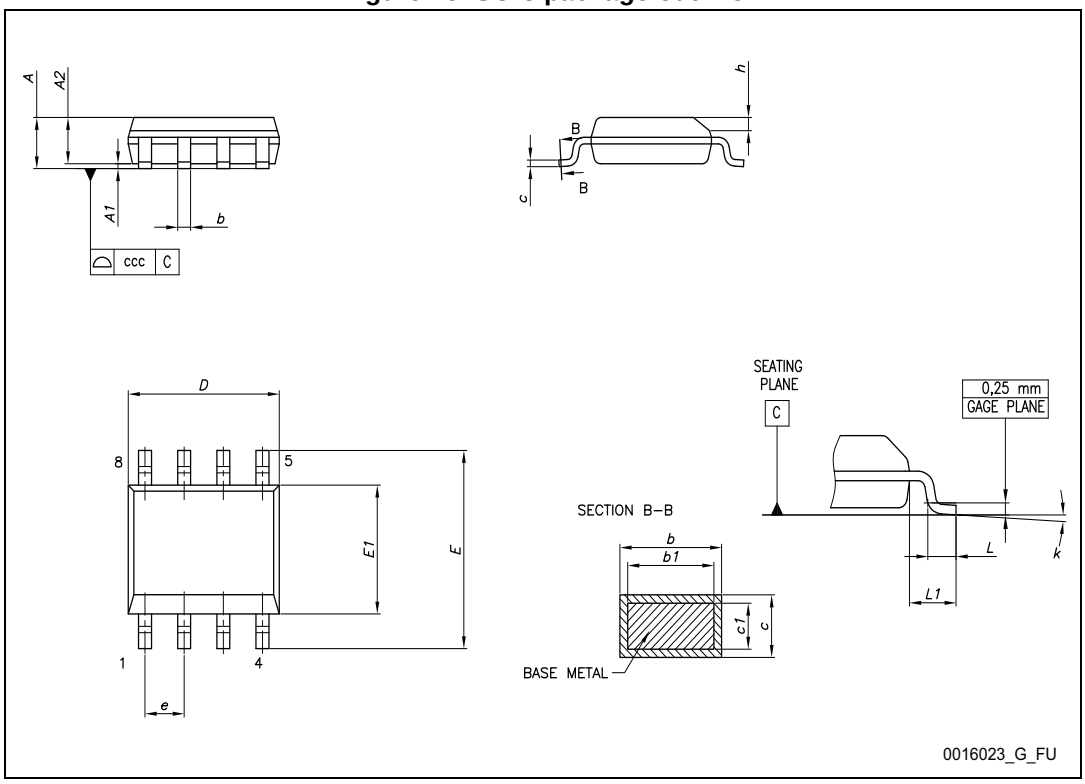
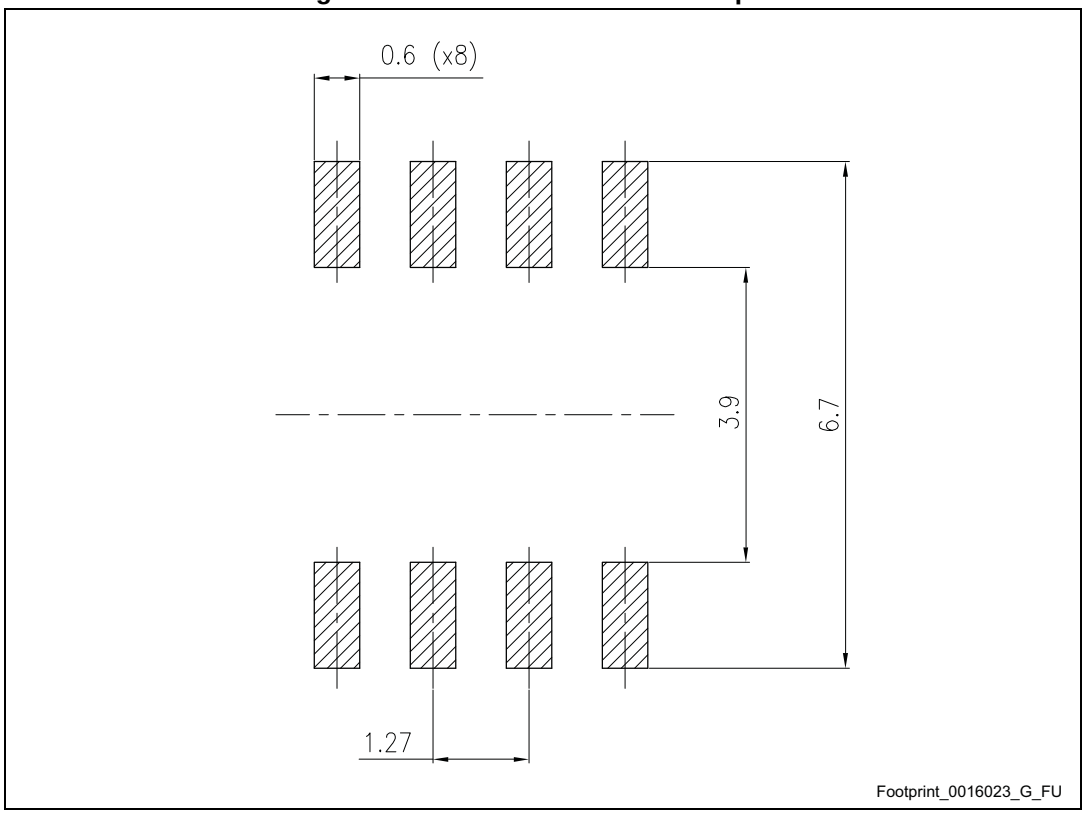


Table 9. SO-8 mechanical data

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 16. SO-8 recommended footprint



8.5 SO-8 packing information

Figure 17. SO-8 tape and reel outline

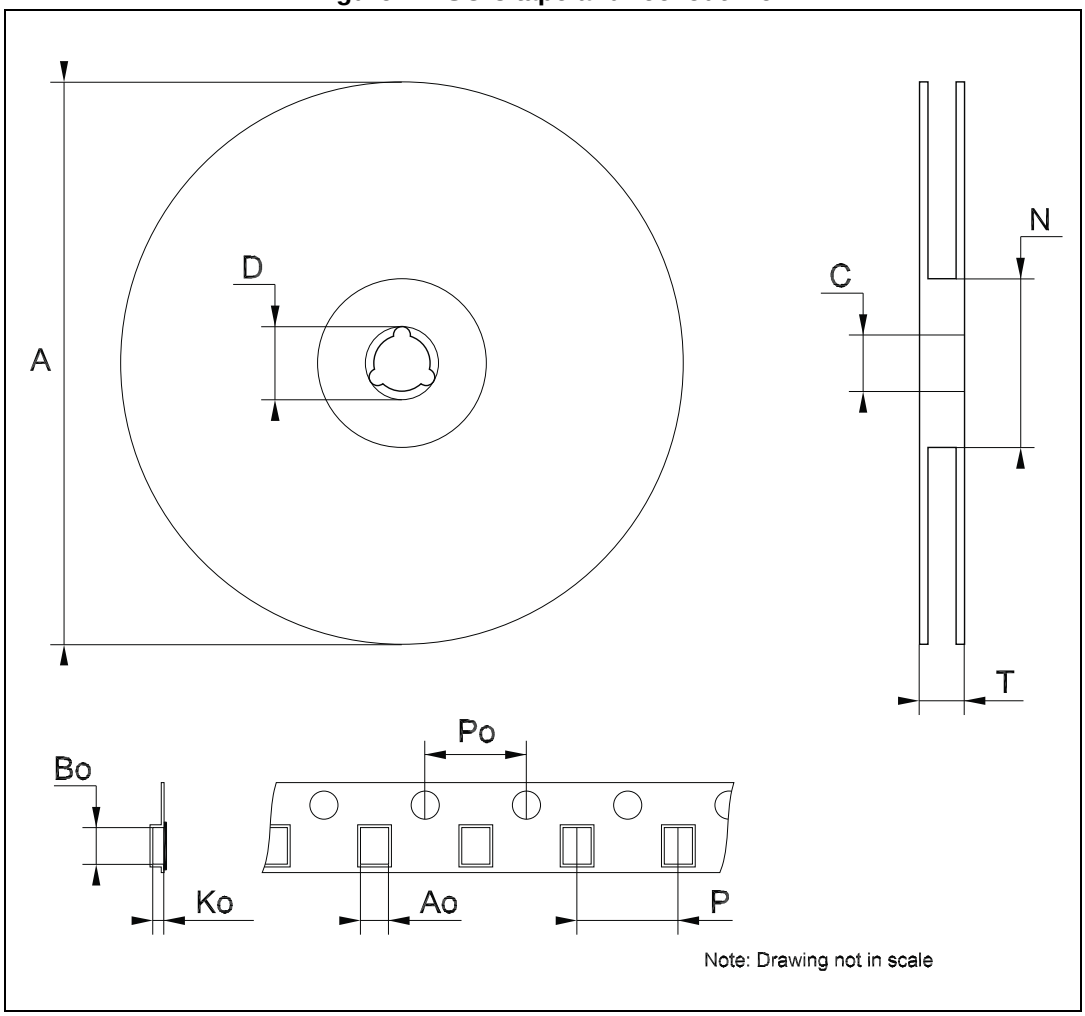


Table 10. SO-8 tape and reel mechanical data

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

9 Revision history

Table 11. 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 *Section 6: Application information* and *Section 8: Package information*. Added *Section 8.5: SO-8 packing information*. Minor text changes.
19-May-2015	6	Updated the features in cover page, *Table 4: Electrical characteristics of LM217L*, *Table 5: Electrical characteristics of LM317L* and *Figure 4: Current limit*. Added *Table 3: Thermal data*. Minor text changes.
17-Sep-2015	7	Updated *Table 1: Device summary*. Minor text changes.