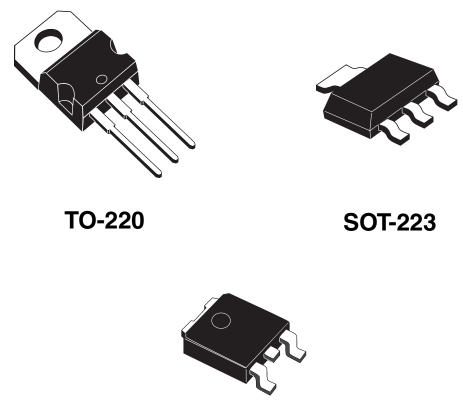
LD1117AXX12, LD1117AXX18, LD1117AXX33, LD1117AXX

Low drop fixed and adjustable positive voltage regulators

Datasheet — production data

Features

- Low dropout voltage:
  – 1.15 V typ. @ I_{OUT} = 1 A, 25 °C
- Very low quiescent current:
  – 5 mA typ. @ 25 °C
- Output current up to 1 A
- Fixed output voltage of:
  – 1.2 V, 1.8 V, 2.5 V, 3.3 V
- Adjustable version availability (V_{REF} = 1.25 V)
- Internal current and thermal limit
- Only 10 µF for stability
- Available in ± 2% (at 25 °C) and 4% in full temperature range
- High supply voltage rejection:
  – 80 dB typ. (at 25 °C)
- Temperature range: 0 °C to 125 °C



Description

The LD1117Axx is a low drop voltage regulator able to provide up to 1 A of output current, available also in adjustable versions (V_{REF} = 1.25 V). In fixed versions, the following output voltages are offered: 1.2 V, 1.8 V, 2.5 V and 3.3 V. The device is supplied in: SOT-223, DPAK and TO-220. Surface mounted packages optimize the thermal characteristics while offering a relevant space saving advantage. High efficiency is assured by an NPN pass transistor. Only a very common 10 µF minimum capacitor is needed for stability. Chip trimming allows the regulator to reach a very tight output voltage tolerance, within ± 2% at 25 °C.

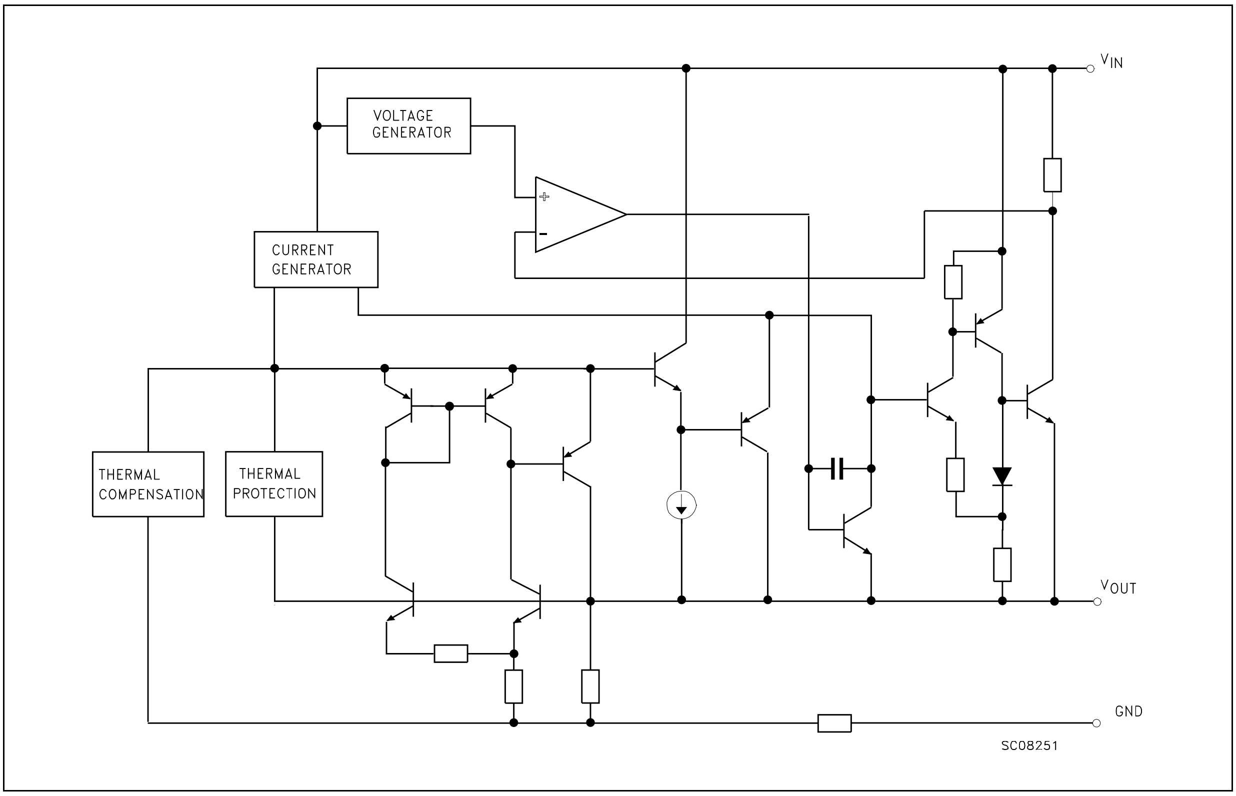
Table 1. Device summary

Order codes			Output voltage
SOT-223	DPAK	TO-220	
LD1117AS12TR	LD1117ADT12TR		1.2 V
LD1117AS18TR	LD1117ADT18TR		1.8 V
LD1117AS33TR	LD1117ADT33TR	LD1117AV33	3.3 V
LD1117ASTR	LD1117ADT-TR		Adjustable from 1.25 V

Contents

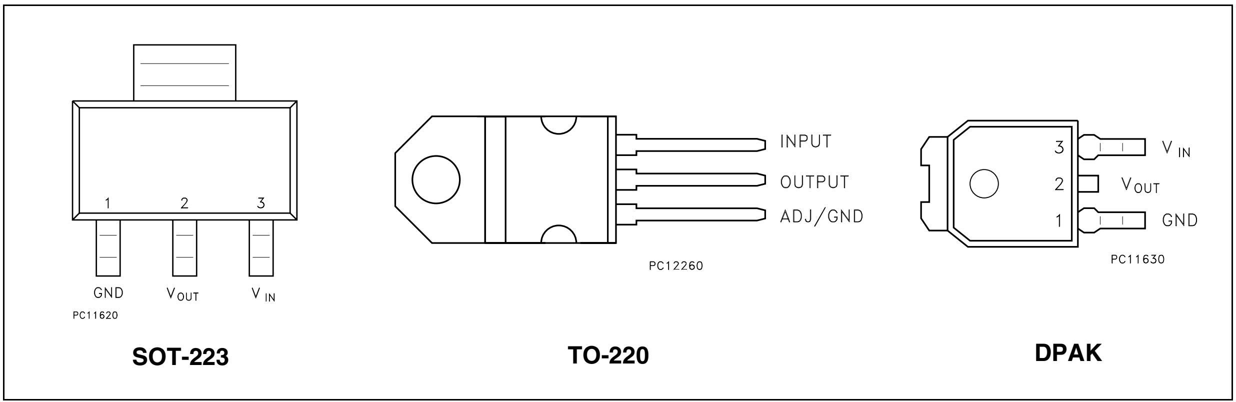
1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connections (top view)



Note: The TAB is connected to the V_{OUT}.

3 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	DC input voltage	15	V
P_D	Power dissipation	12	W
T_{STG}	Storage temperature range	-40 to +150	°C
T_{OP}	Operating junction temperature range	0 to +125	°C

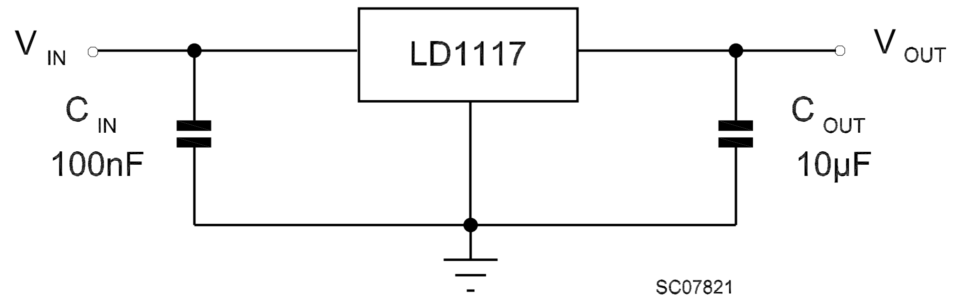
Note: *Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied. Beyond the above suggested max. power dissipation, a short-circuit may permanently damage the device.*

Table 3. Thermal data

Symbol	Parameter	SOT-223	DPAK	TO-220	Unit
R_{thJC}	Thermal resistance junction-case	15	8	5	°C/W
R_{thJA}	Thermal resistance junction-ambient	110	100	50	°C/W

4 Schematic application

Figure 3. Application circuit (for other fixed output voltages)



5 Electrical characteristics

Refer to the test circuits, T_J = 0 to 125 °C, C_O = 10 µF, C_I = 10 µF, R = 120 Ω between OUT-GND, unless otherwise specified.

Table 4. Electrical characteristics of LD1117A#12

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	V_I = 5.3 V, I_O = 10 mA, T_J = 25 °C	1.176	1.2	1.224	V
V_O	Output voltage	I_O = 0 to 1 A, V_I = 2.75 to 10 V	1.152	1.2	1.248	V
ΔV_O	Line regulation	V_I = 2.75 to 8 V, I_O = 0 mA		1	6	mV
ΔV_O	Load regulation	V_I = 2.75 V, I_O = 0 to 1 A		1	10	mV
ΔV_O	Temperature stability			0.5		%
ΔV_O	Long term stability	1000 hrs, T_J = 125 °C		0.3		%
V_I	Operating input voltage	I_O = 100 mA			10	V
I_d	Quiescent current	$V_I \leq 8$ V, I_O = 0 mA		5	10	mA
I_O	Output current	V_I - V_O = 5 V, T_J = 25 °C	1000	1200		mA
eN	Output noise voltage	B =10 Hz to 10 kHz, T_J = 25 °C		100		µV
SVR	Supply voltage rejection	I_O = 40 mA, f = 120 Hz V_I - V_O = 3 V, V_{ripple} = 1 V_{PP}	60	80		dB
V_D	Dropout voltage	I_O = 100 mA		1	1.10	V
		I_O = 500 mA		1.05	1.15	
		I_O = 1 A		1.15	1.30	
$\Delta V_{O(pwr)}$	Thermal regulation	T_a = 25 °C, 30 ms pulse		0.08	0.2	%/W

Refer to the test circuits, T_J = 0 to 125 °C, C_O = 10 µF, C_I = 10 µF, unless otherwise specified.

Table 5. Electrical characteristics of LD1117A#18

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	V_I = 3.8 V, I_O = 10 mA, T_J = 25 °C	1.764	1.8	1.836	V
V_O	Output voltage	I_O = 0 to 1 A, V_I = 3.3 to 8 V	1.728		1.872	V
ΔV_O	Line regulation	V_I = 3.3 to 8 V, I_O = 0 mA		1	6	mV
ΔV_O	Load regulation	V_I = 3.3 V, I_O = 0 to 1 A		1	10	mV
ΔV_O	Temperature stability			0.5		%
ΔV_O	Long term stability	1000 hrs, T_J = 125 °C		0.3		%
V_I	Operating input voltage	I_O = 100 mA			10	V
I_d	Quiescent current	$V_I \leq$ 8 V, I_O = 0 mA		5	10	mA
I_O	Output current	V_I - V_O = 5 V, T_J = 25 °C	1000			mA
eN	Output noise voltage	B =10 Hz to 10 kHz, T_J = 25 °C		100		µV
SVR	Supply voltage rejection	I_O = 40 mA, f = 120 Hz V_I - V_O = 3 V, V_{ripple} = 1 V_{PP}	60	80		dB
V_D	Dropout voltage	I_O = 100 mA		1	1.10	V
		I_O = 500 mA		1.05	1.15	
		I_O = 1 A		1.15	1.30	
$\Delta V_{O(pwr)}$	Thermal regulation	T_a = 25 °C, 30 ms pulse		0.08	0.2	%/W

Refer to the test circuits, T_J = 0 to 125 °C, C_O = 10 µF, C_I = 10 µF, unless otherwise specified.

Table 6. Electrical characteristics of LD1117A#33

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	V_I = 5.3 V, I_O = 10 mA, T_J = 25 °C	3.234	3.3	3.366	V
V_O	Output voltage	I_O = 0 to 1 A, V_I = 4.75 to 10 V	3.168		3.432	V
ΔV_O	Line regulation	V_I = 4.75 to 8 V, I_O = 0 mA		1	6	mV
ΔV_O	Load regulation	V_I = 4.75 V, I_O = 0 to 1 A		1	10	mV
ΔV_O	Temperature stability			0.5		%
ΔV_O	Long term stability	1000 hrs, T_J = 125 °C		0.3		%
V_I	Operating input voltage	I_O = 100 mA			10	V
I_d	Quiescent current	$V_I \leq$ 10 V, I_O = 0 mA		5	10	mA
I_O	Output current	V_I - V_O = 5 V, T_J = 25 °C	1000	1200		mA
eN	Output noise voltage	B =10 Hz to 10 kHz, T_J = 25 °C		100		µV
SVR	Supply voltage rejection	I_O = 40 mA, f = 120 Hz V_I - V_O = 3 V, V_{ripple} = 1 V_{PP}	60	75		dB
V_D	Dropout voltage	I_O = 100 mA		1	1.10	V
		I_O = 500 mA		1.05	1.15	
		I_O = 1 A		1.15	1.30	
$\Delta V_{O(pwr)}$	Thermal regulation	T_a = 25 °C, 30 ms pulse		0.08	0.2	%/W

Refer to the test circuits, T_J = 0 to 125 °C, C_O = 10 µF, C_I = 10 µF, unless otherwise specified.

Table 7. Electrical characteristics of LD1117A (Adjustable)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Reference voltage	V_I = 5.3 V, I_O = 10 mA, T_J = 25 °C	1.225	1.25	1.275	V
V_O	Reference voltage	I_O = 10 mA to 1 A, V_I = 2.75 to 10 V	1.2		1.3	V
ΔV_O	Line regulation	V_I = 2.75 to 8 V, I_O = 0 mA		1	6	mV
ΔV_O	Load regulation	V_I = 2.75 V, I_O = 0 to 1 A		1	10	mV
ΔV_O	Temperature stability			0.5		%
ΔV_O	Long term stability	1000 hrs, T_J = 125 °C		0.3		%
V_I	Operating input voltage	I_O = 100 mA			10	V
I_{adj}	Adjustment pin current	$V_{in} \leq$ 10 V		60	120	µA
ΔI_{adj}	Adjustment pin current change	V_{in} - V_O = 1.4 to 10 V, I_O = 10 mA to 1 A		1	5	µA
$I_{O(min)}$	Minimum load current	V_{in} = 10 V		2	5	mA
I_O	Output current	V_I - V_O = 5 V, T_J = 25 °C	1000	1200		mA
eN	Output noise voltage	B =10 Hz to 10 kHz, T_J = 25 °C		100		µV
SVR	Supply voltage rejection	I_O = 40 mA, f = 120 Hz V_I - V_O = 3 V, V_{ripple} = 1 V_{PP}	60	80		dB
V_D	Dropout voltage	I_O = 100 mA		1	1.10	V
		I_O = 500 mA		1.05	1.15	
		I_O = 1 A		1.15	1.30	
$\Delta V_{O(pwr)}$	Thermal regulation	T_a = 25 °C, 30 ms pulse		0.08	0.2	%/W

6 Typical application

Figure 4. Negative supply

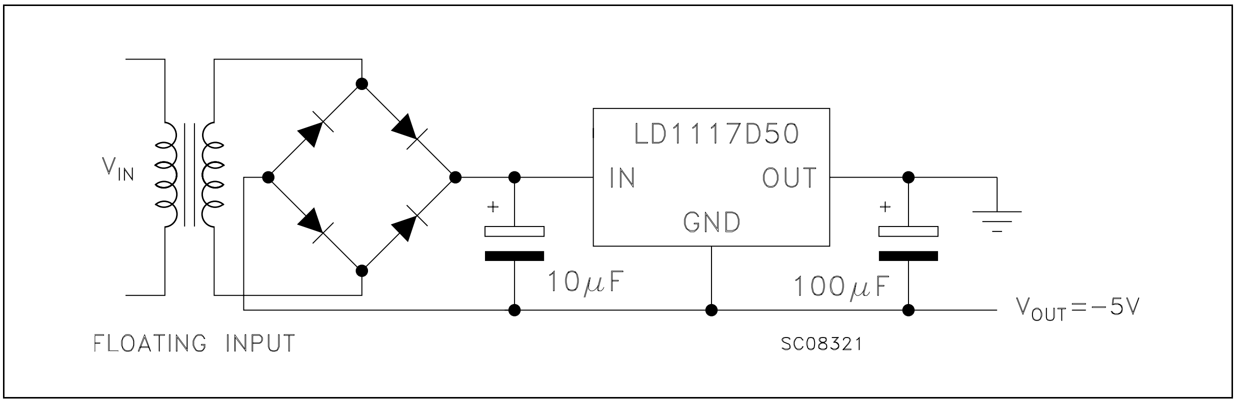


Figure 5. Active terminator for SCSI-2 bus

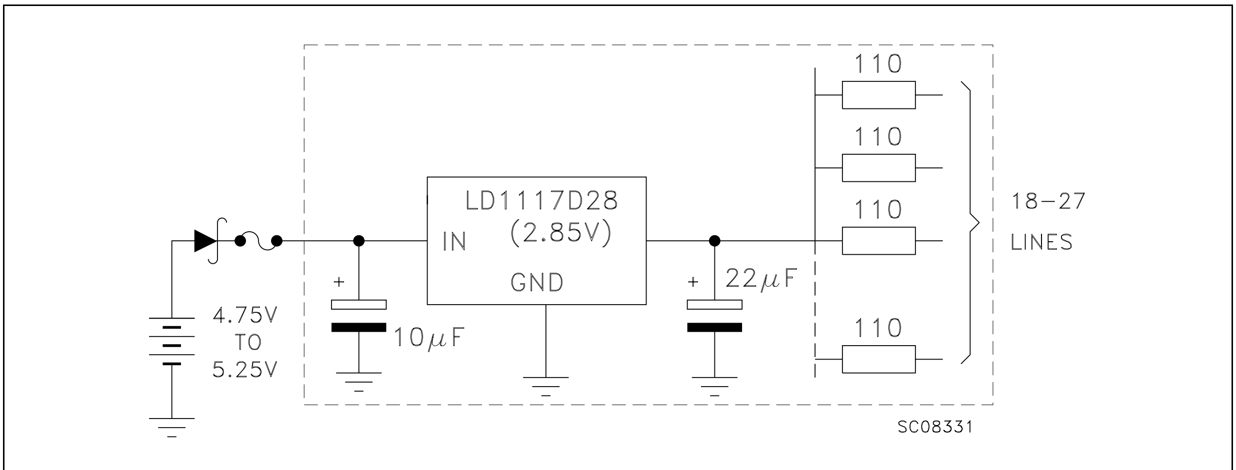


Figure 6. Circuit for increasing output voltage

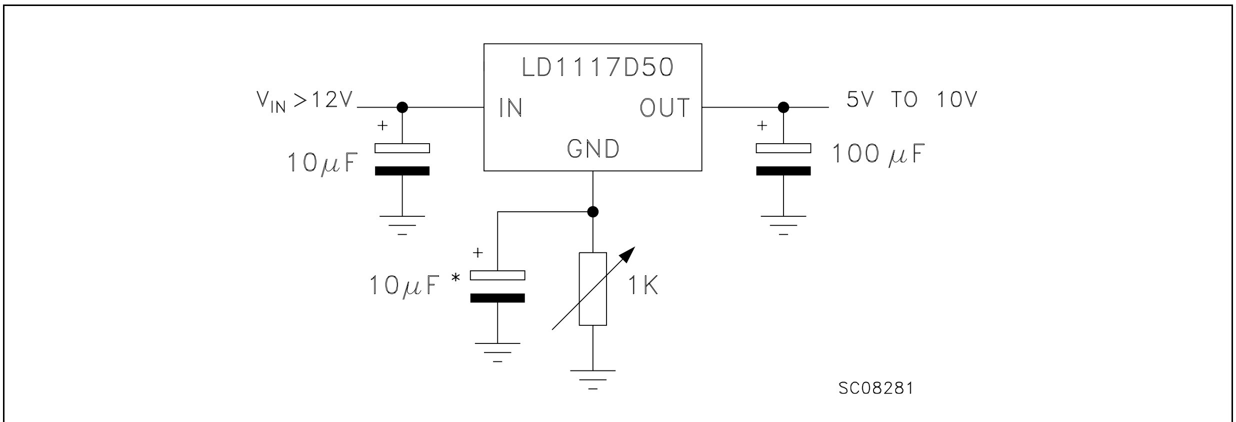


Figure 7. Voltage regulator with reference

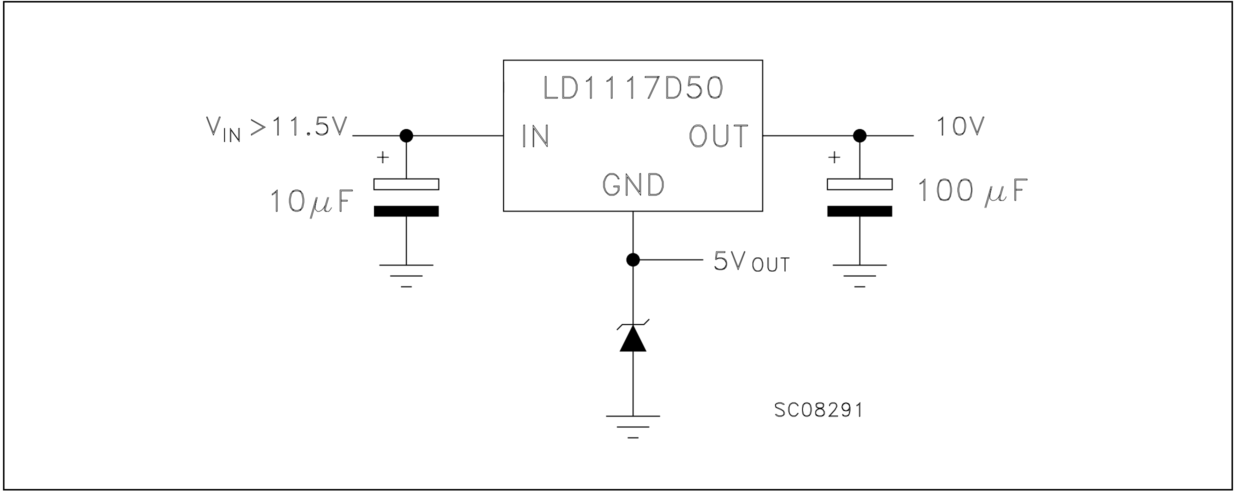


Figure 8. Battery backed-up regulated supply

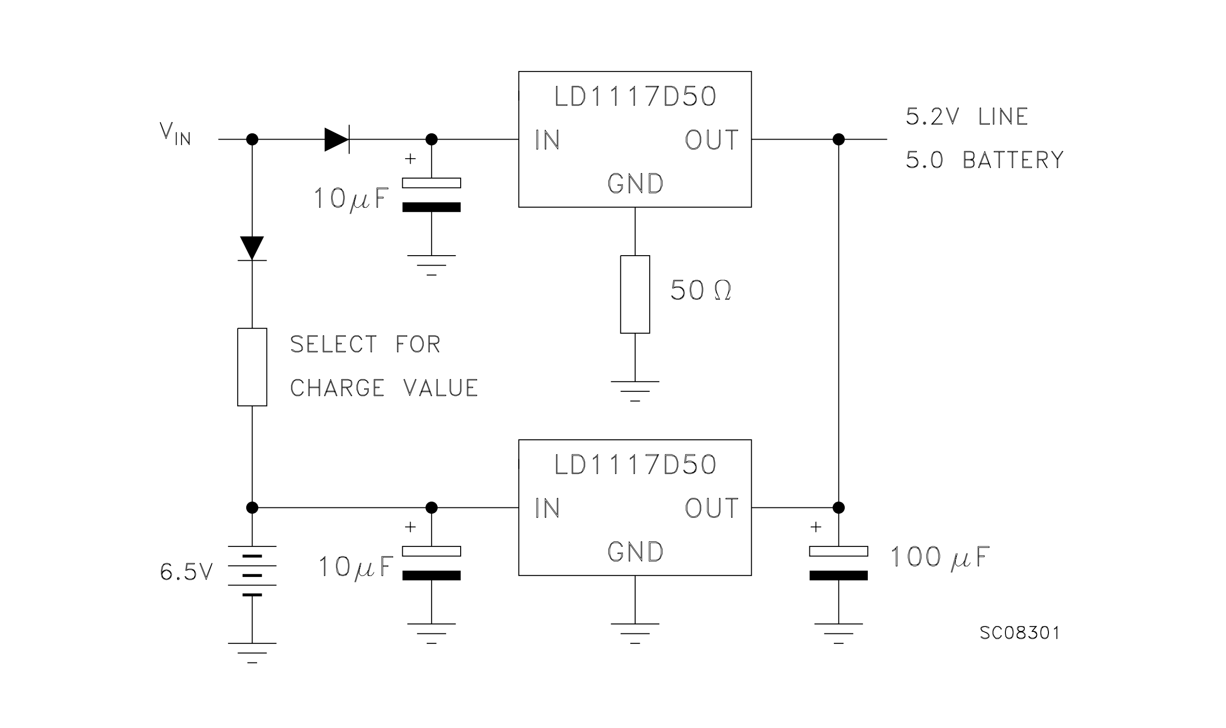
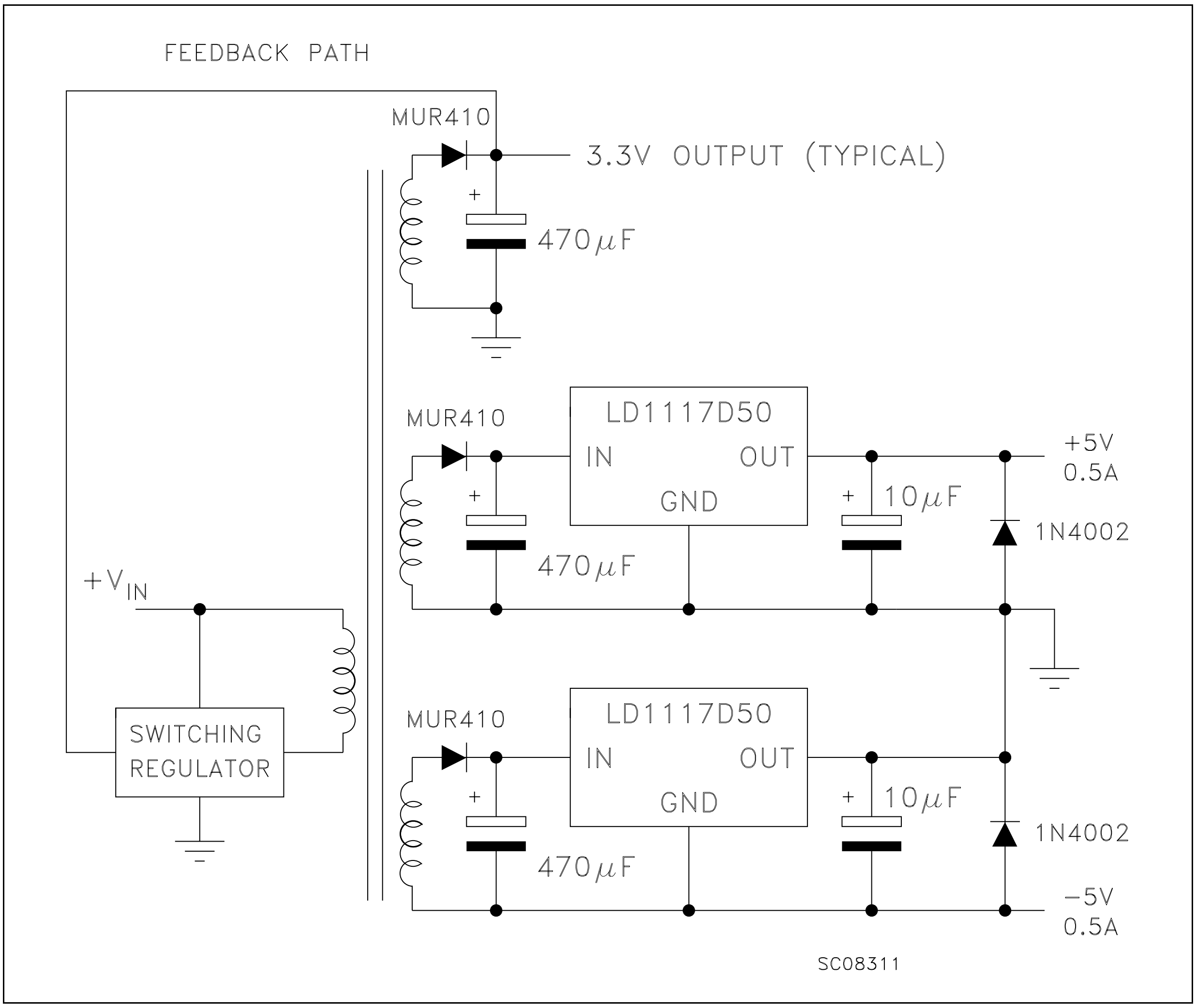


Figure 9. Post-regulated dual supply



7 LD1117A adjustable: application note

The LD1117A adjustable has a thermal stabilized 1.25 ± 0.012 V reference voltage between the OUT and ADJ pins. I_{ADJ} is 60 µA typ. (120 µA max.) and ΔI_{ADJ} is 1 µA typ. (5 µA max.).

R_1 is normally fixed to 120 Ω. From *Figure 7* the following is obtained:

$V_{OUT} = V_{REF} + R_2 (I_{ADJ} + I_{R1}) = V_{REF} + R_2 (I_{ADJ} + V_{REF} / R_1) = V_{REF} (1 + R_2 / R_1) + R_2 \times I_{ADJ}$.

In normal applications the R_2 value is in the range of a few kΩ, so the $R_2 \times I_{ADJ}$ product can not be considered in the V_{OUT} calculation; the above expression then becomes:

$V_{OUT} = V_{REF} (1 + R_2 / R_1)$.

In order to have a better load regulation it is important to realize a good Kelvin connection of R_1 and R_2 resistors. In particular, the R_1 connection must be realized very close to the OUT and ADJ pins, while the R_2 ground connection must be placed as near as possible to the negative load pin. Ripple rejection can be improved by introducing a 10 µF electrolytic capacitor placed in parallel to the R_2 resistor (see *Figure 10*).

Figure 10. Adjustable output voltage application

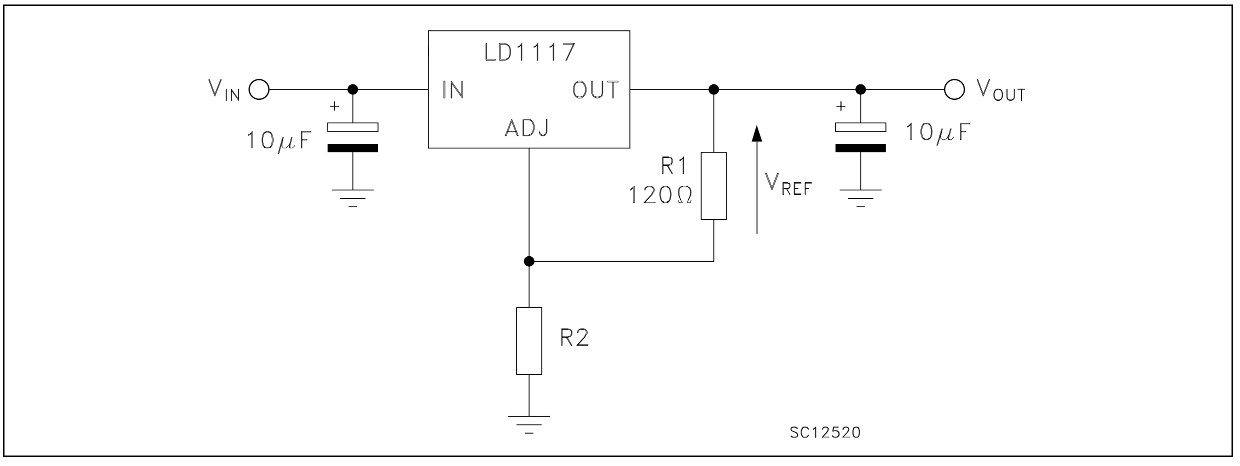
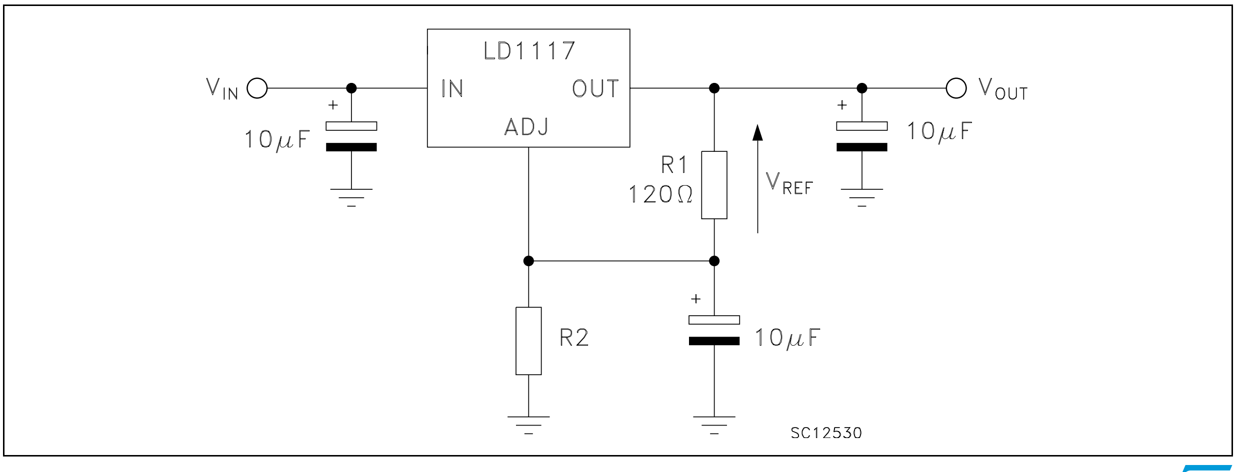


Figure 11. Adjustable output voltage application with improved ripple rejection



8 Package mechanical data

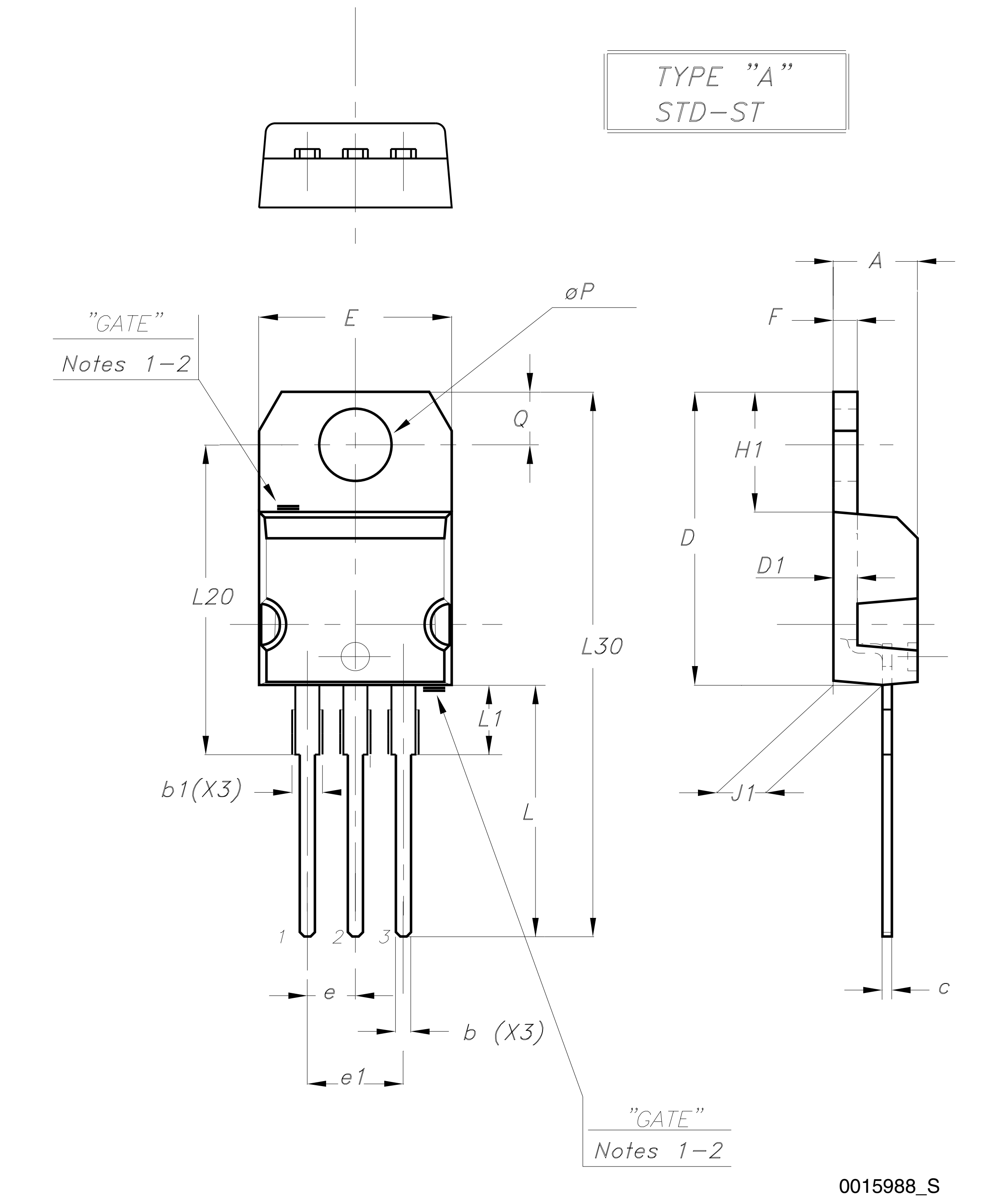
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK is an ST trademark.

Table 8. TO-220 mechanical data

Dim.	Type STD - ST Dual Gauge			Type STD - ST Single Gauge		
	mm.			mm.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	4.40		4.60
b	0.61		0.88	0.61		0.88
b1	1.14		1.70	1.14		1.70
c	0.48		0.70	0.48		0.70
D	15.25		15.75	15.25		15.75
D1		1.27				
E	10.00		10.40	10.00		10.40
e	2.40		2.70	2.40		2.70
e1	4.95		5.15	4.95		5.15
F	1.23		1.32	0.51		0.60
H1	6.20		6.60	6.20		6.60
J1	2.40		2.72	2.40		2.72
L	13.00		14.00	13.00		14.00
L1	3.50		3.93	3.50		3.93
L20		16.40			16.40	
L30		28.90			28.90	
∅P	3.75		3.85	3.75		3.85
Q	2.65		2.95	2.65		2.95

Despite some difference in tolerances, the packages are compatible.

Figure 12. Drawing dimension TO-220 (type STD-ST Dual Gauge)



Note: 1 *Maximum resin gate protrusion: 0.5 mm.*

2 *An accepted resin gate protrusion can be found in each of the two positions shown on the drawing, or in their symmetrical position with respect to the vertical axis.*

Figure 13. Drawing dimension TO-220 (type STD-ST Single Gauge)

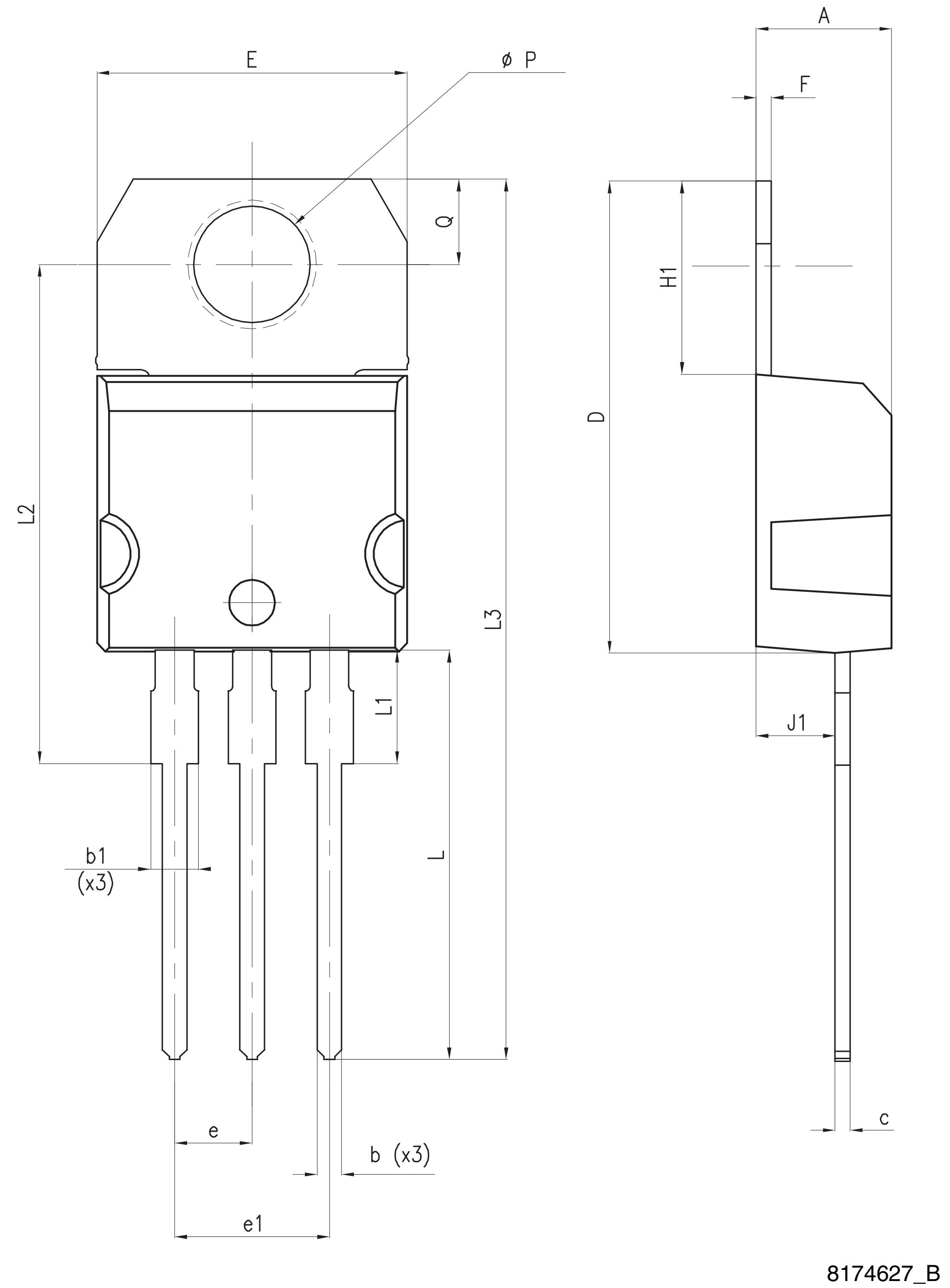


Figure 14. Drawing dimension tube for TO-220 Dual Gauge (mm.)

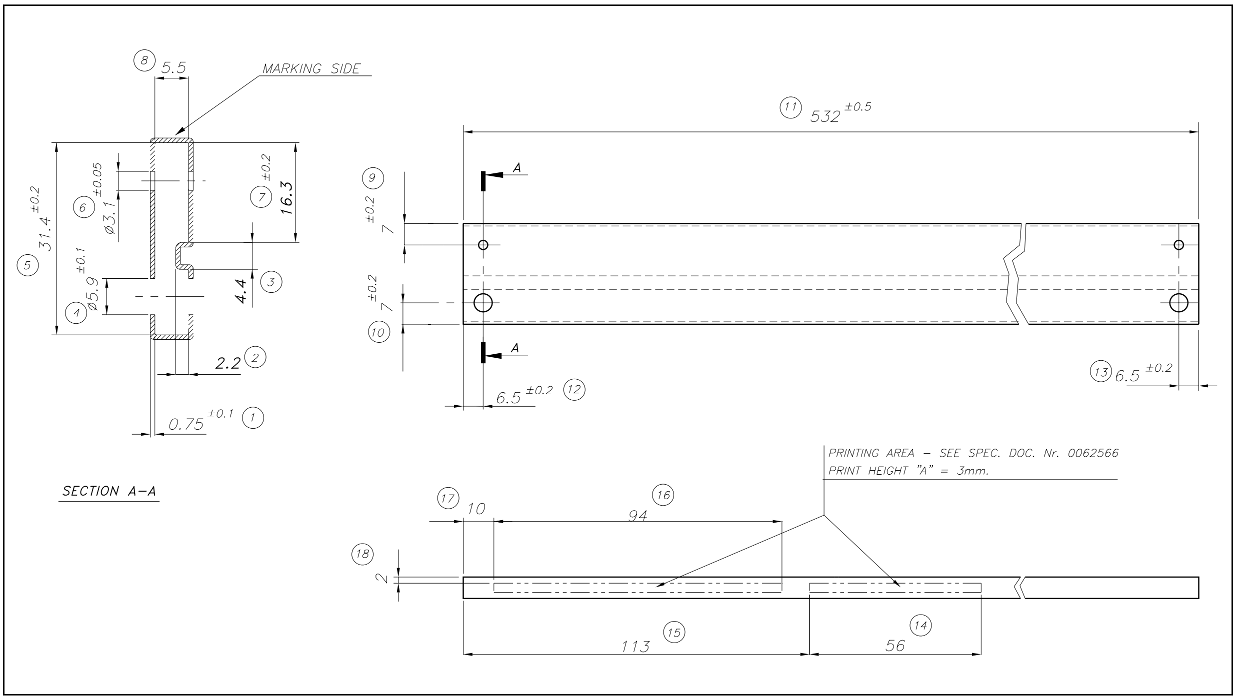
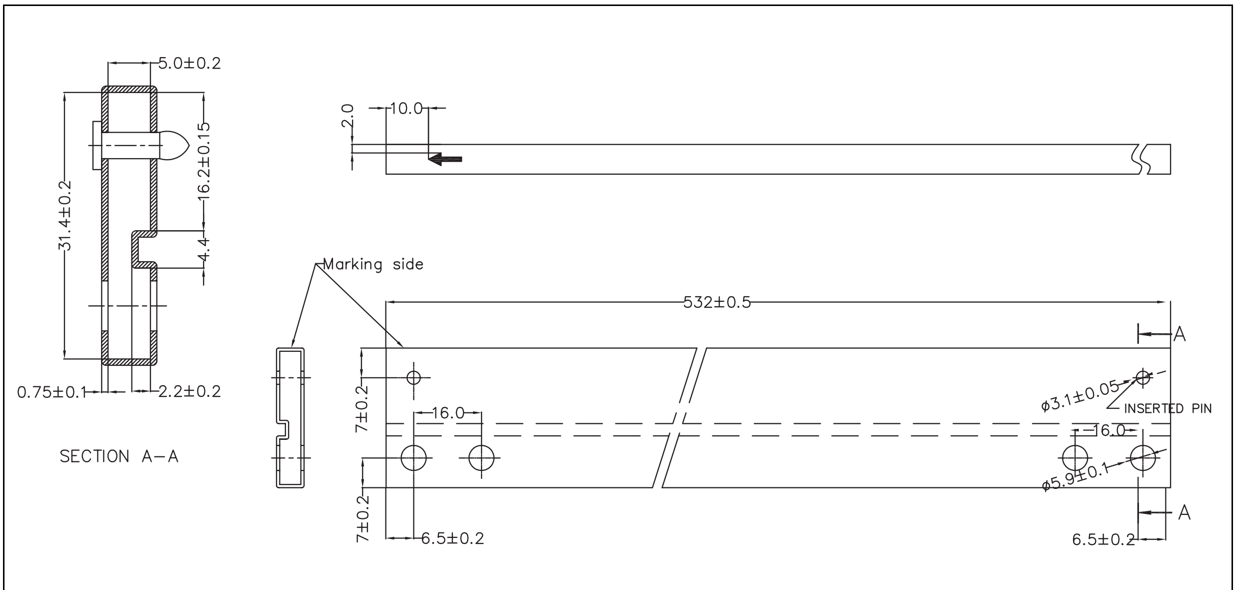
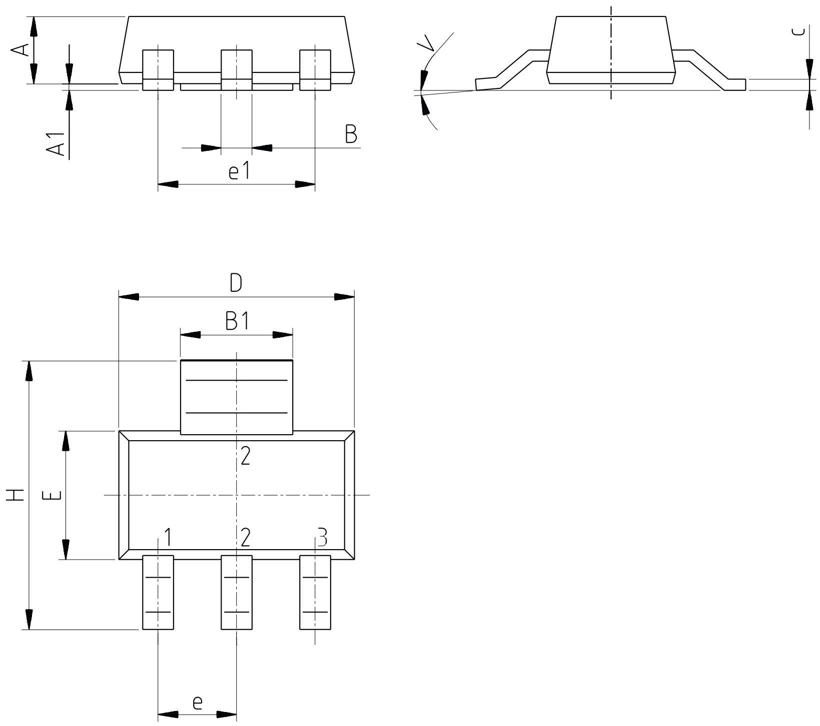


Figure 15. Drawing dimension tube for TO-220 Single Gauge (mm.)



SOT-223 mechanical data

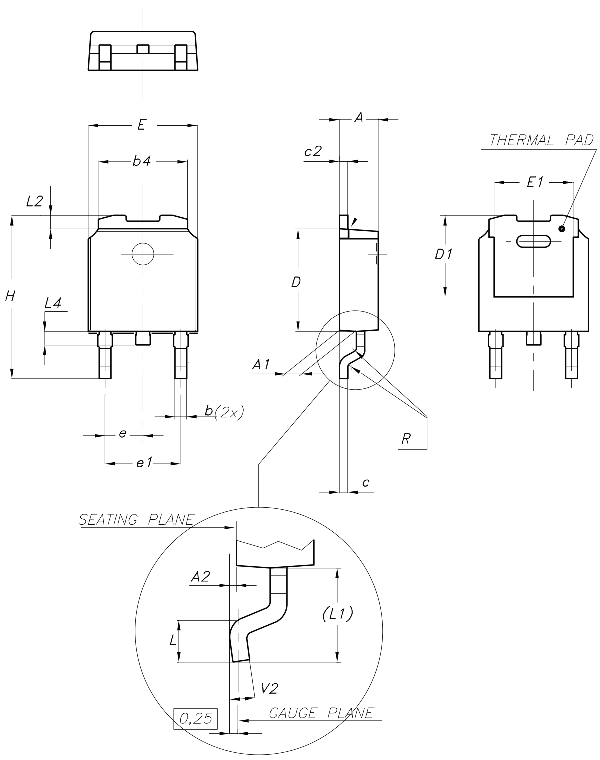
Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.8			70.9
A1	0.02		0.1	0.8		3.9
B	0.6	0.7	0.85	23.6	27.6	33.5
B1	2.9	3	3.15	114.2	118.1	124.0
c	0.24	0.26	0.35	9.4	10.2	13.8
D	6.3	6.5	6.7	248.0	255.9	263.8
e		2.3			90.6	
e1		4.6			181.1	
E	3.3	3.5	3.7	129.9	137.8	145.7
H	6.7	7	7.3	263.8	275.7	287.5
V			10°			10°



0046067/H

DPAK mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



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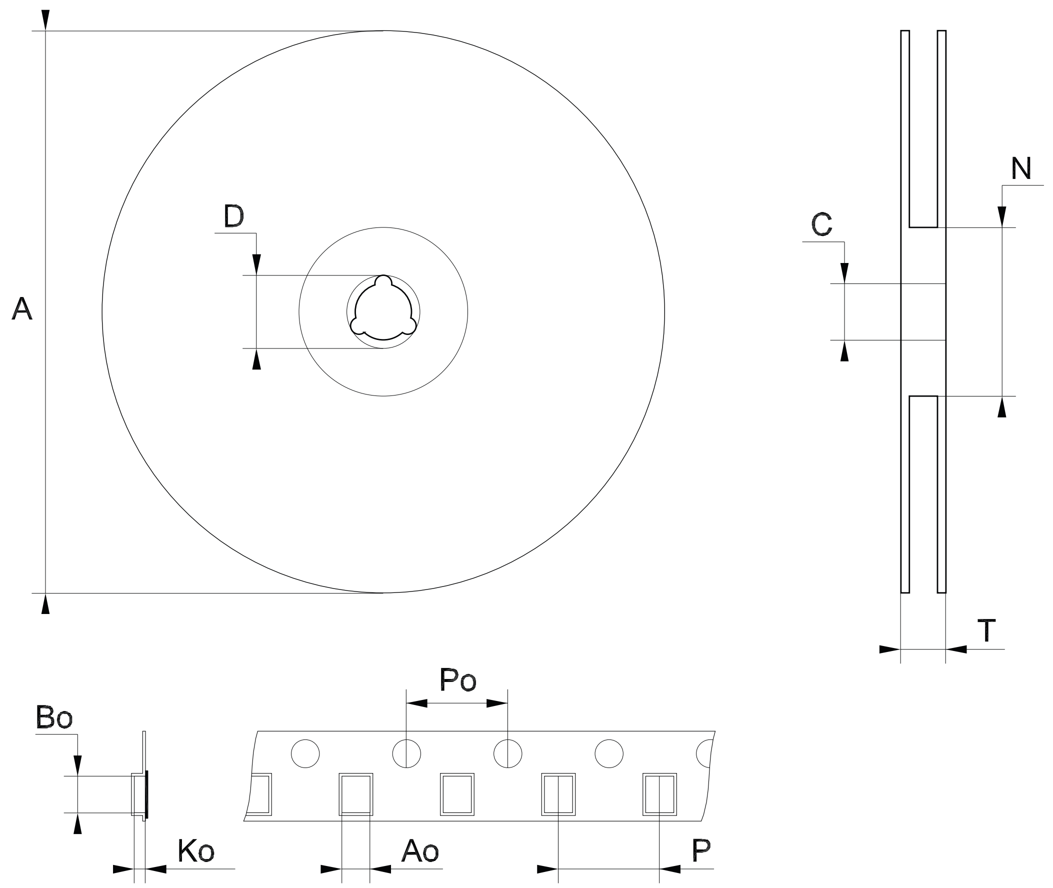
Tape & reel SOT223 mechanical data

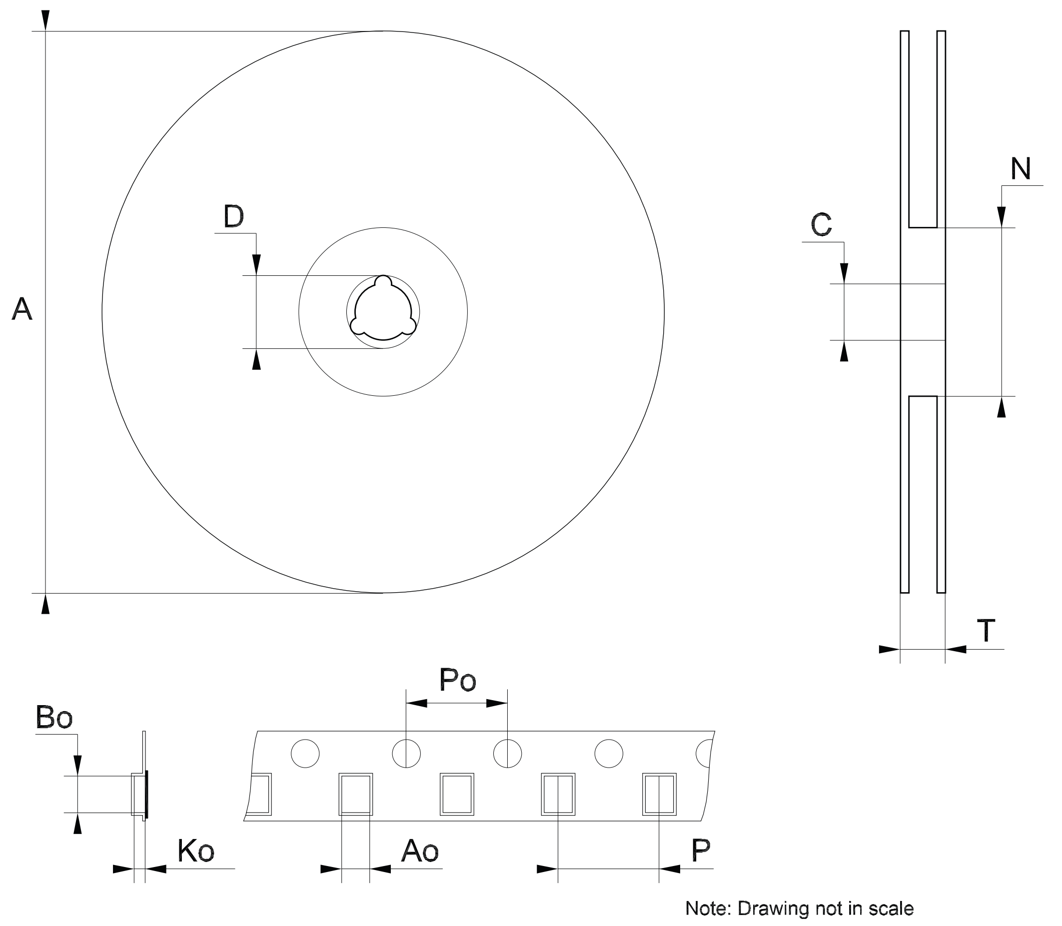
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	6.73	6.83	6.93	0.265	0.269	0.273
Bo	7.32	7.42	7.52	0.288	0.292	0.296
Ko	1.78		2	0.070		0.078
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315	0.319



Note: Drawing not in scale

Tape & reel DPAK-PPAK mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.80	6.90	7.00	0.268	0.272	0.2.76
Bo	10.40	10.50	10.60	0.409	0.413	0.417
Ko	2.55	2.65	2.75	0.100	0.104	0.105
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315	0.319



9 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Sep-2004	11	Add new part number.
12-Oct-2004	12	Mistake V_O max. - Table 4.
21-Apr-2005	13	Add new package - D^2PAK/A.
05-Jul-2005	14	The DPAK mechanical data updated.
10-Feb-2006	15	Add new package - D^2PAK/A (B type).
20-Dec-2006	16	Change value V_{IN} on *Table 2*.
19-Jan-2007	17	D^2PAK/A mechanical data updated and add footprint data.
28-May-2007	18	Add I_{ADJ} and ΔI_{ADJ} values on *Table 7*.
07-Jun-2007	19	Add $I_{O(min)}$ value on *Table 7*.
15-Apr-2008	20	Modified: Table 10.
28-Jul-2009	21	Modified: Table 10.
05-Jul-2010	22	Added: *Table 8 on page 15*, *Figure 12 on page 16*, *Figure 13 on page 17*, *Figure 14* and *Figure 15 on page 18*.
16-Nov-2010	23	Modified: *Table 1 on page 1*, R_{thJC} value for TO-220 *Table 3 on page 5*.
16-Dec-2011	24	Modified: V_O parameter output voltage ==> Reference voltage *Table 7 on page 10*.
19-Oct-2012	25	Added: R_{thJA} value for DPAK and SOT-223 *Table 3 on page 5*.