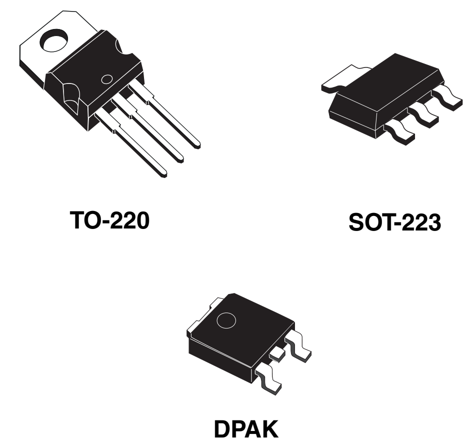
LD1117AXX12, LD1117AXX18, LD1117AXX33, LD1117AXX

Low drop fixed and adjustable positive voltage regulators

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.

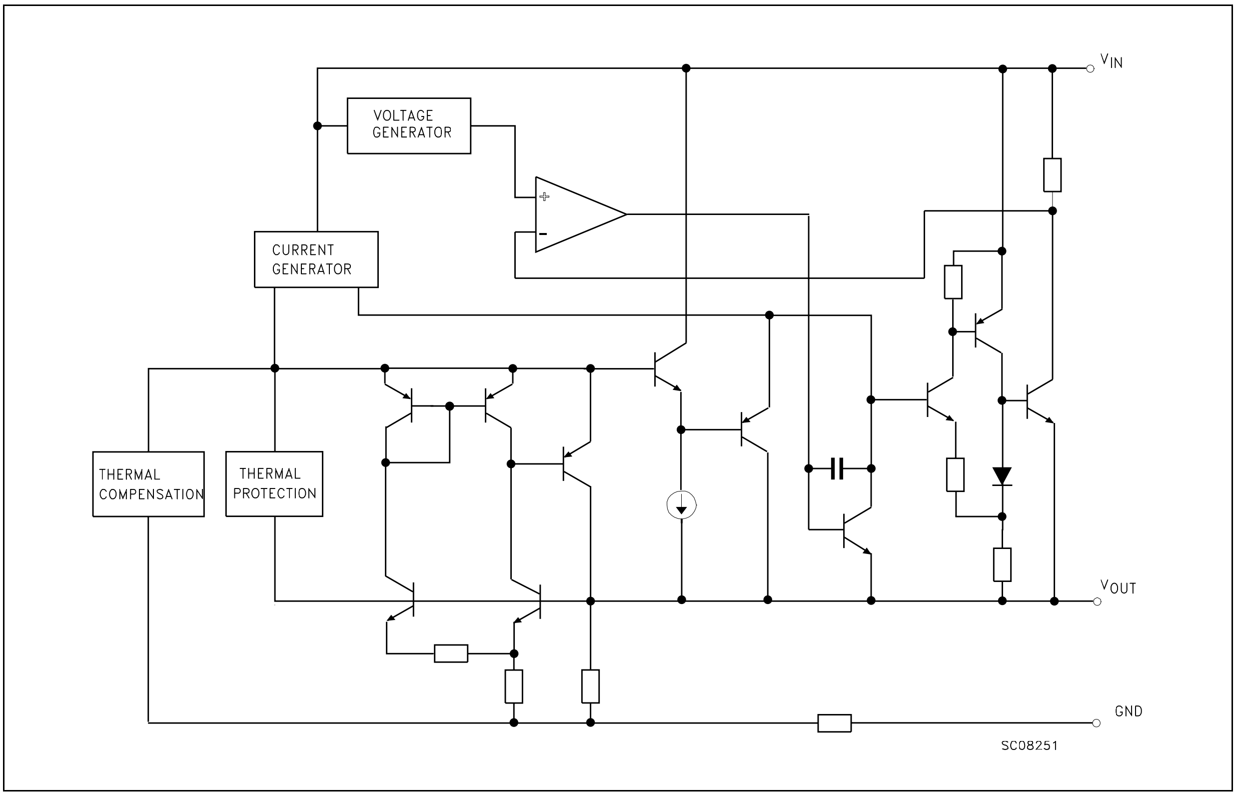
Table 1. Device summary

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

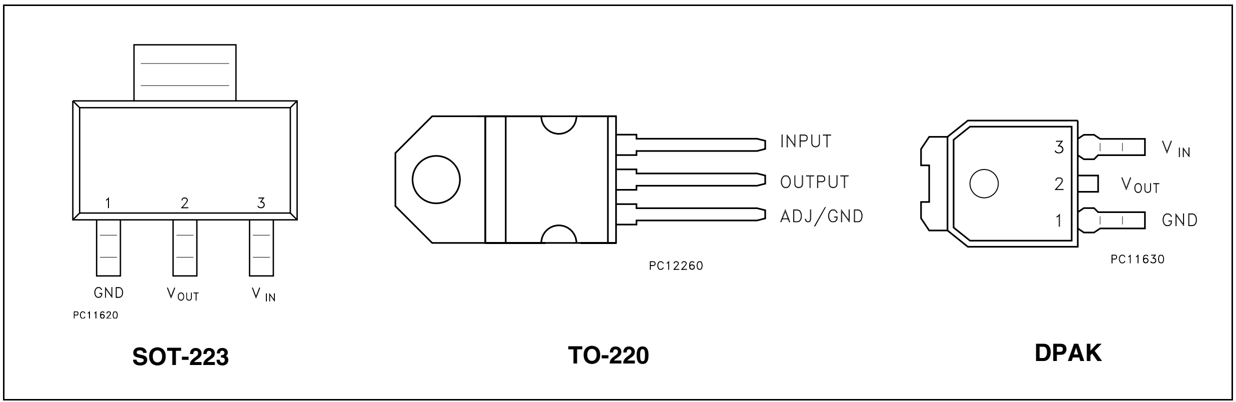
1 Diagram

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

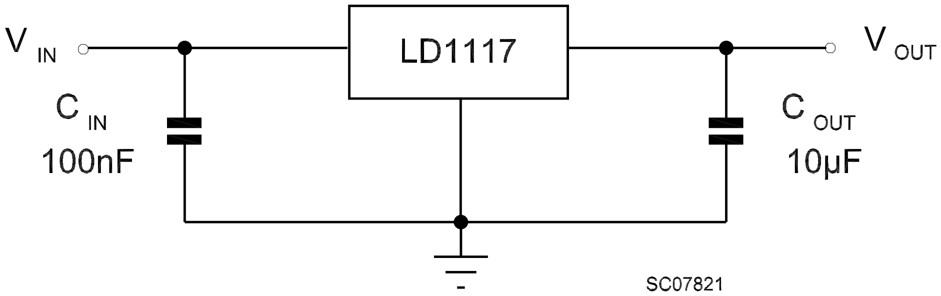
Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied. Beyond the above suggested max. power dissipation, a short-circuit may permanently damage the device.

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			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

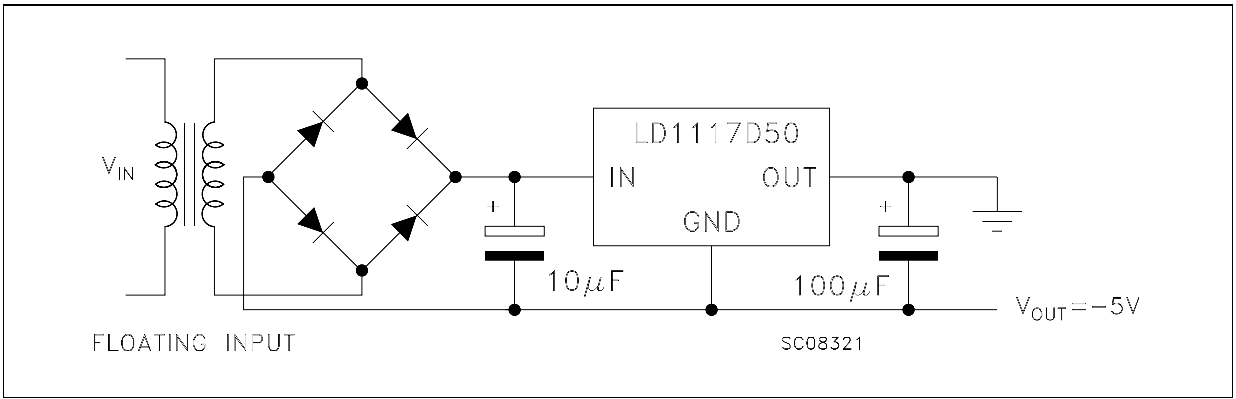


Figure 5. Active terminator for SCSI-2 bus

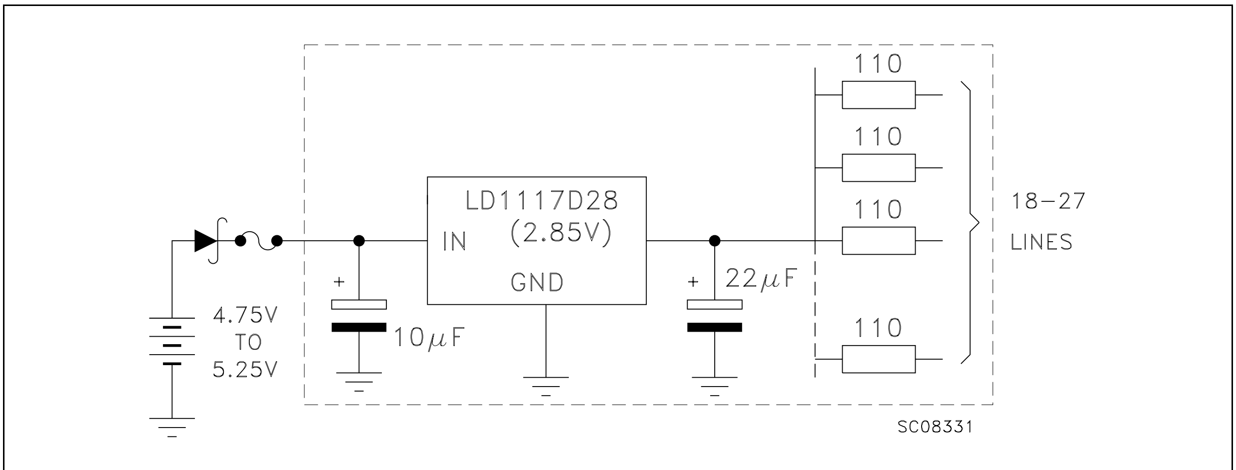


Figure 6. Circuit for increasing output voltage

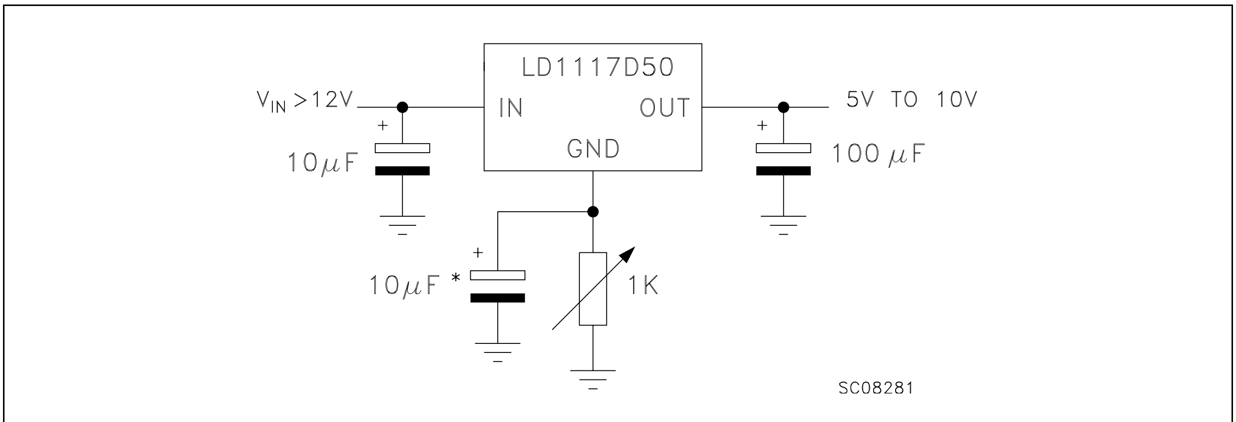


Figure 7. Voltage regulator with reference

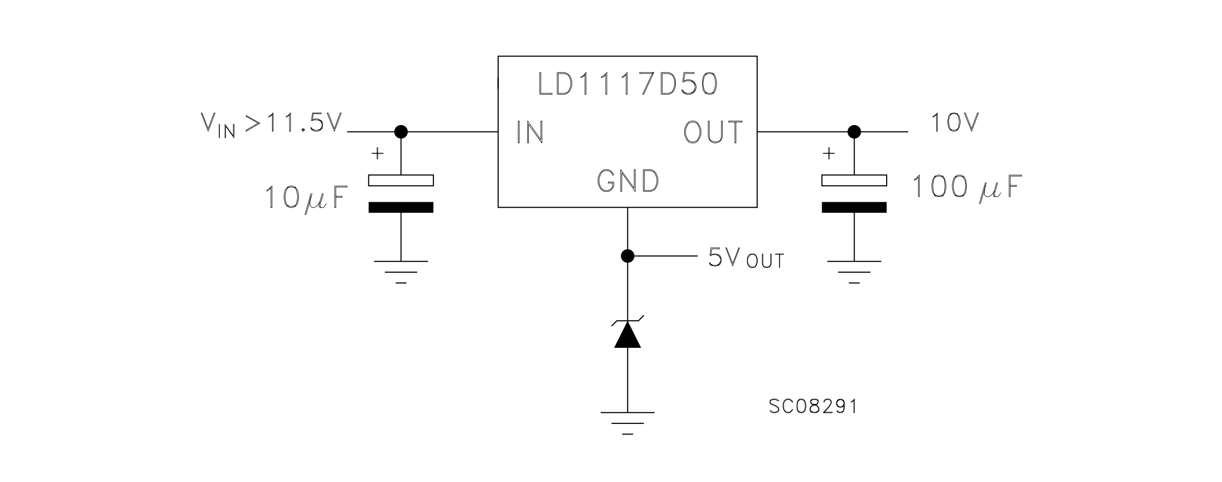


Figure 8. Battery backed-up regulated supply

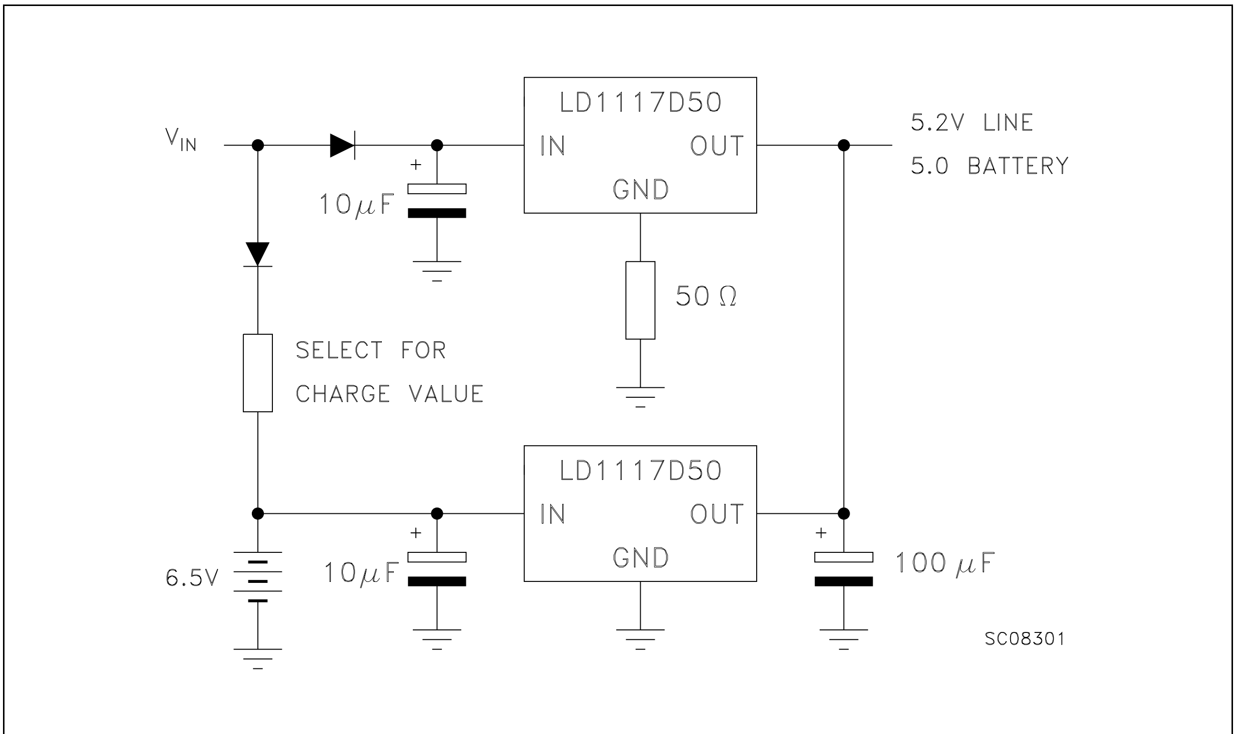
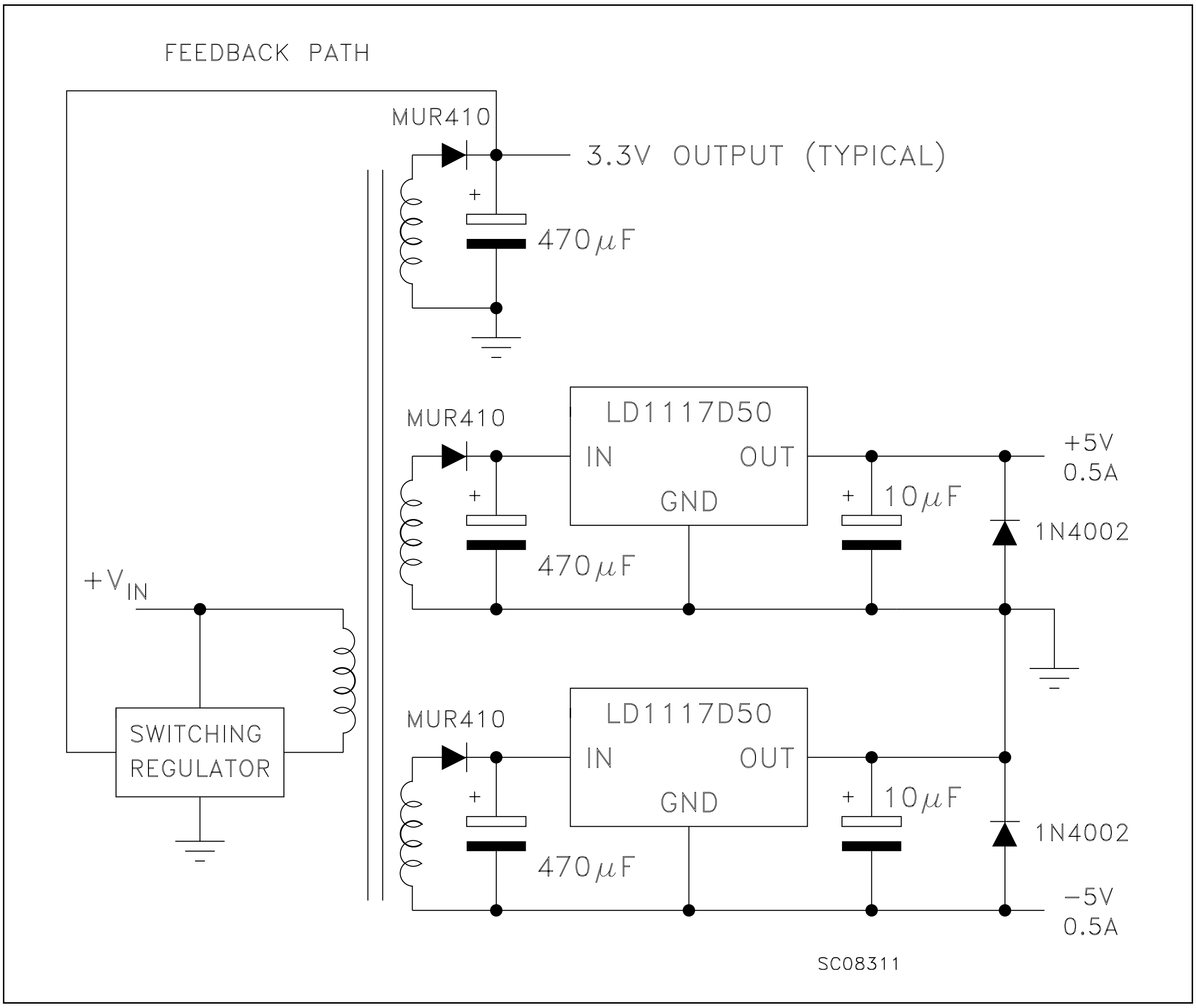


Figure 9. Post-regulated dual supply



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

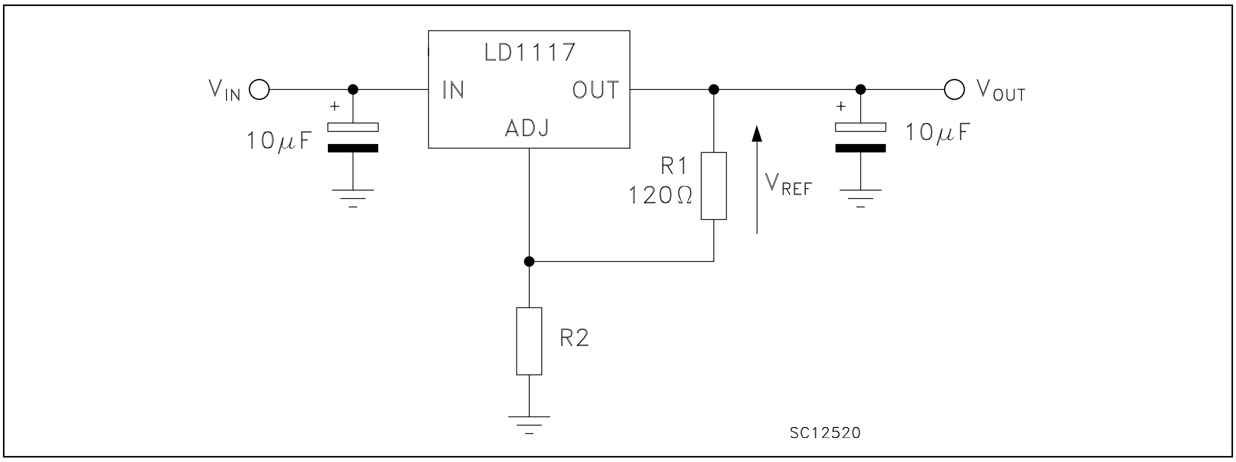
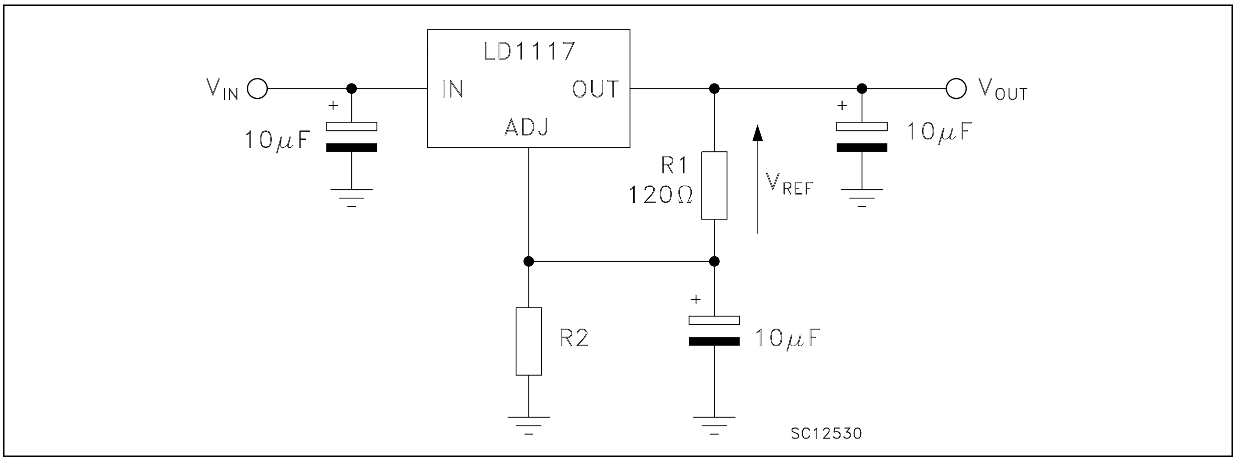


Figure 11. Adjustable output voltage application with improved ripple rejection



8 Package mechanical data

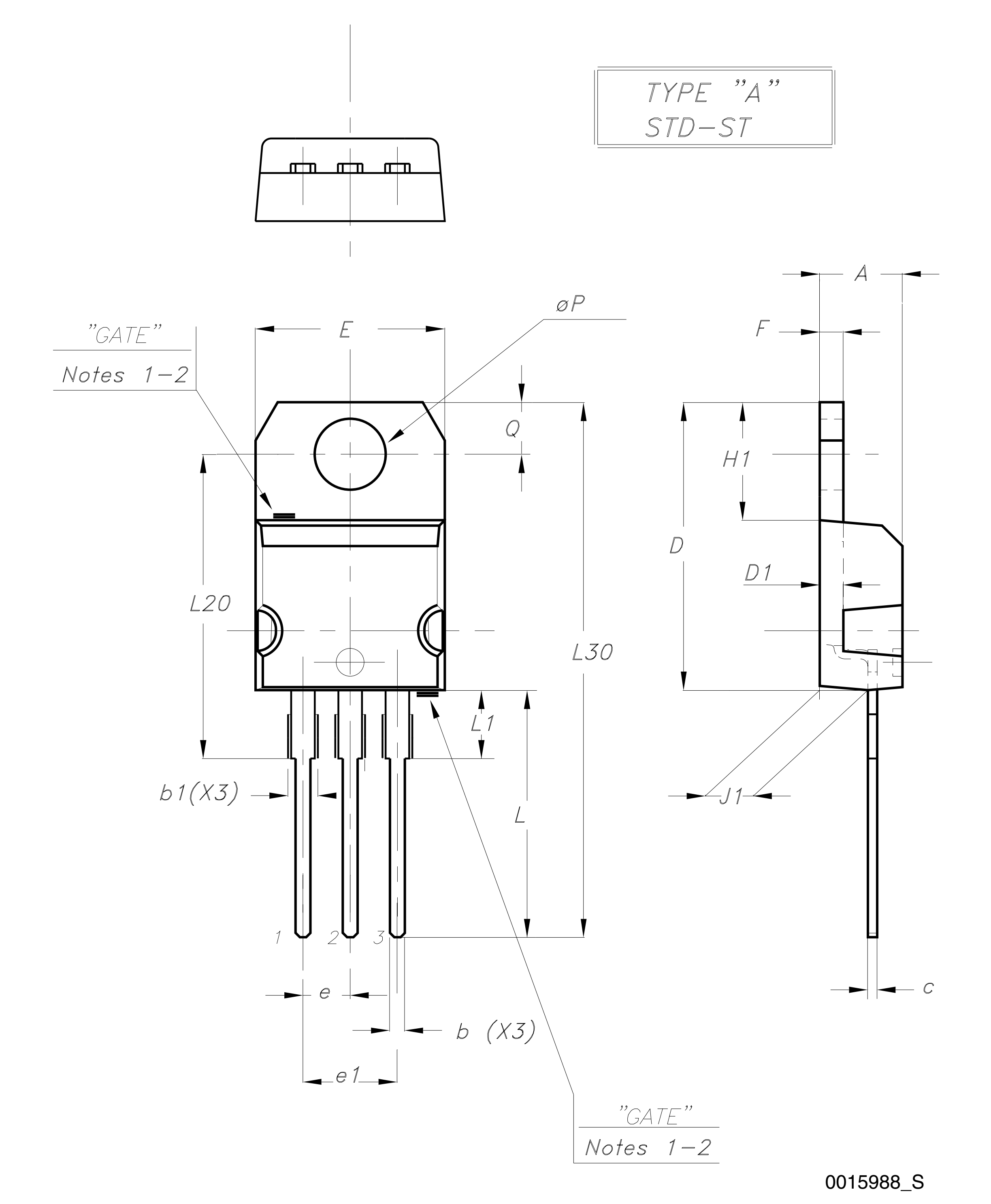
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK is an ST trademark.

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)

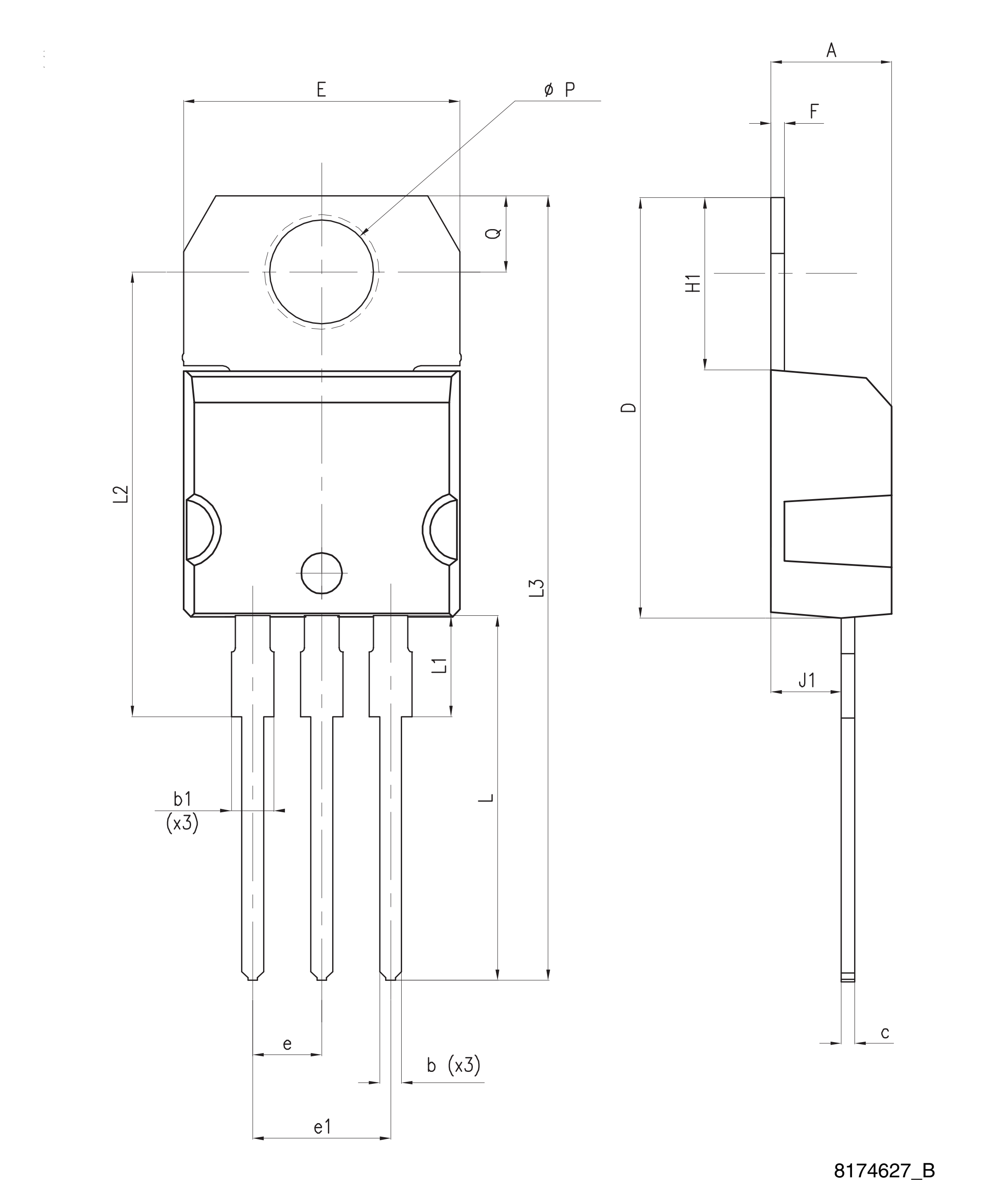


Figure 14. Drawing dimension tube for TO-220 Dual Gauge (mm.)

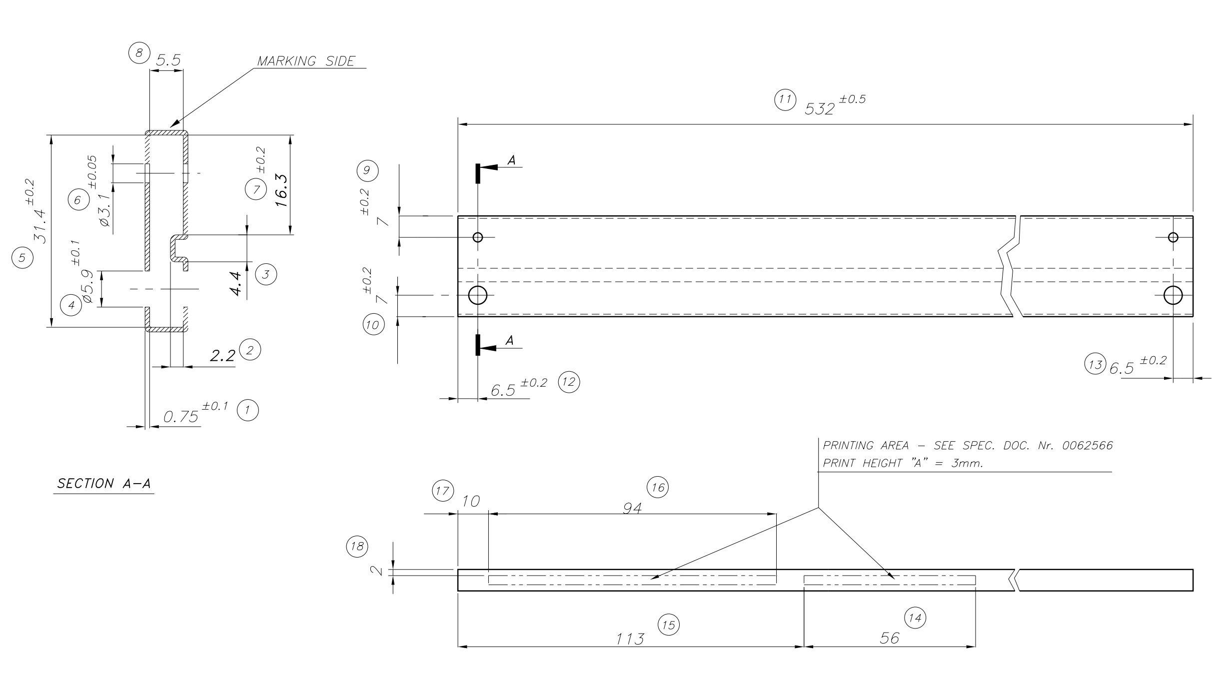
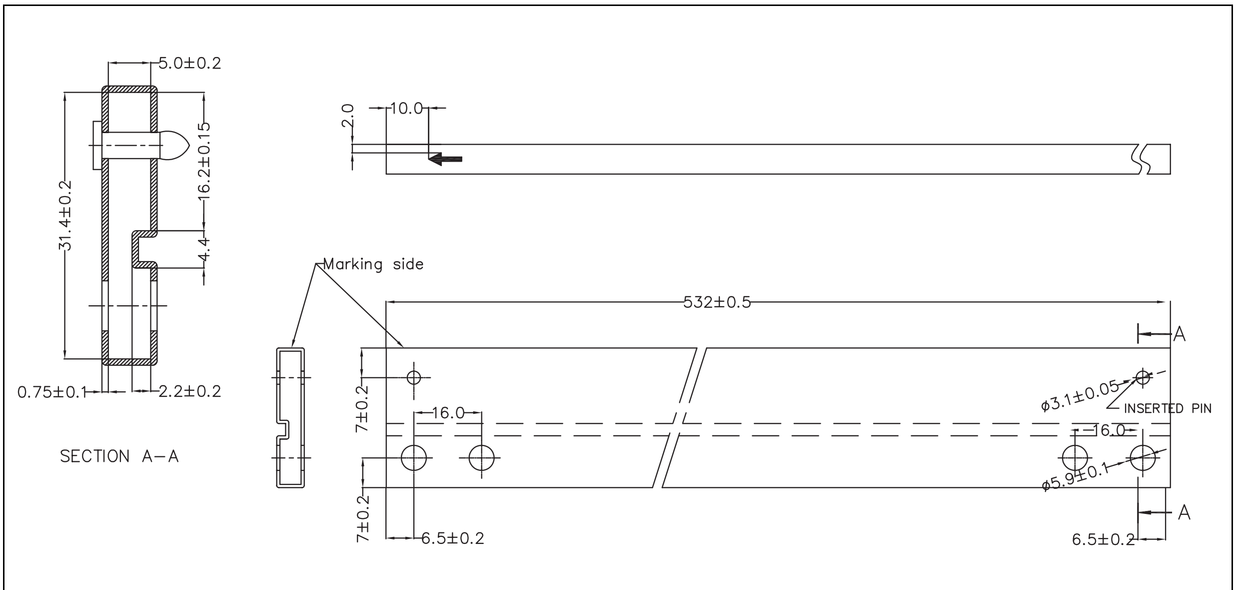
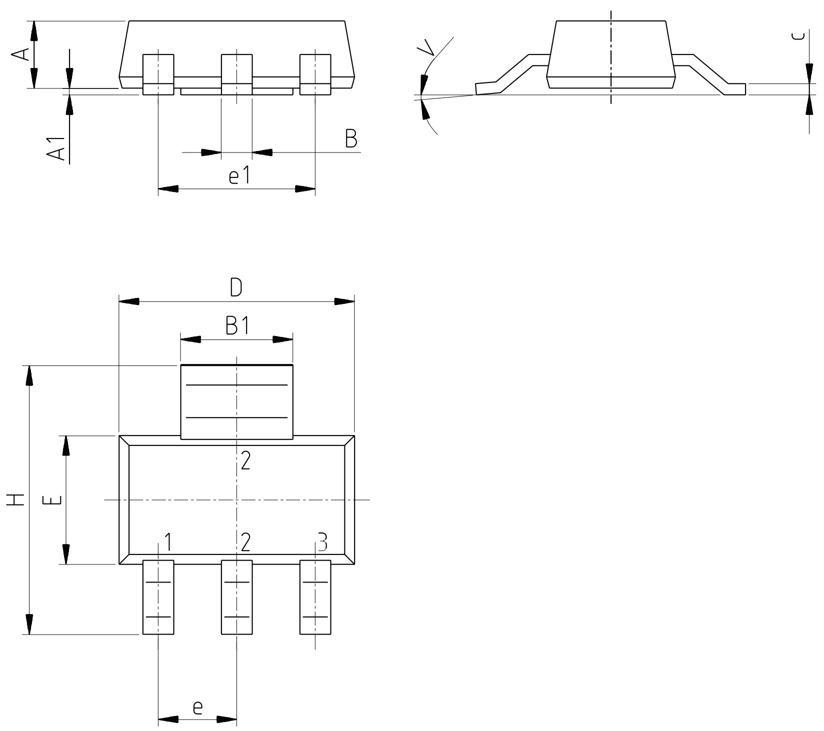


Figure 15. Drawing dimension tube for TO-220 Single Gauge (mm.)



SOT-223 mechanical data

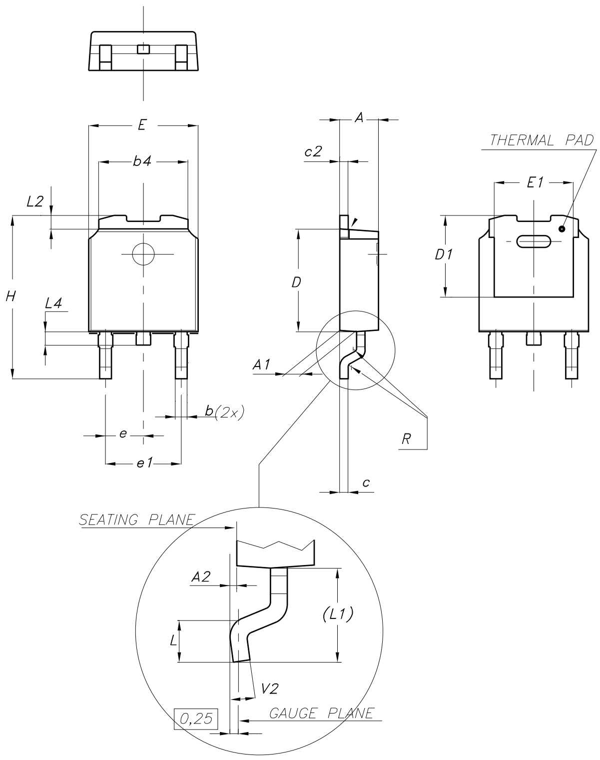
Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.8			70.9
A1	0.02		0.1	0.8		3.9
B	0.6	0.7	0.85	23.6	27.6	33.5
B1	2.9	3	3.15	114.2	118.1	124.0
c	0.24	0.26	0.35	9.4	10.2	13.8
D	6.3	6.5	6.7	248.0	255.9	263.8
e		2.3			90.6	
e1		4.6			181.1	
E	3.3	3.5	3.7	129.9	137.8	145.7
H	6.7	7	7.3	263.8	275.7	287.5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



0046067/H

DPAK mechanical data

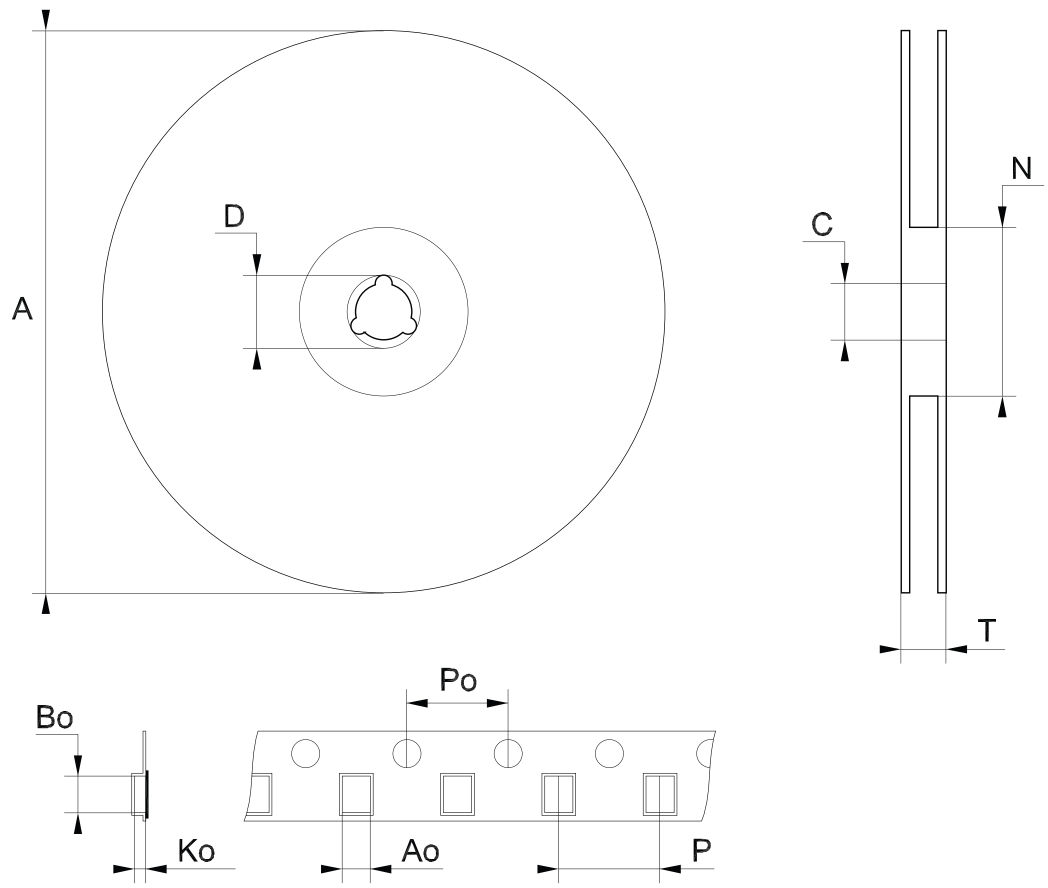
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
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°



0068772-F

Tape & reel SOT223 mechanical data

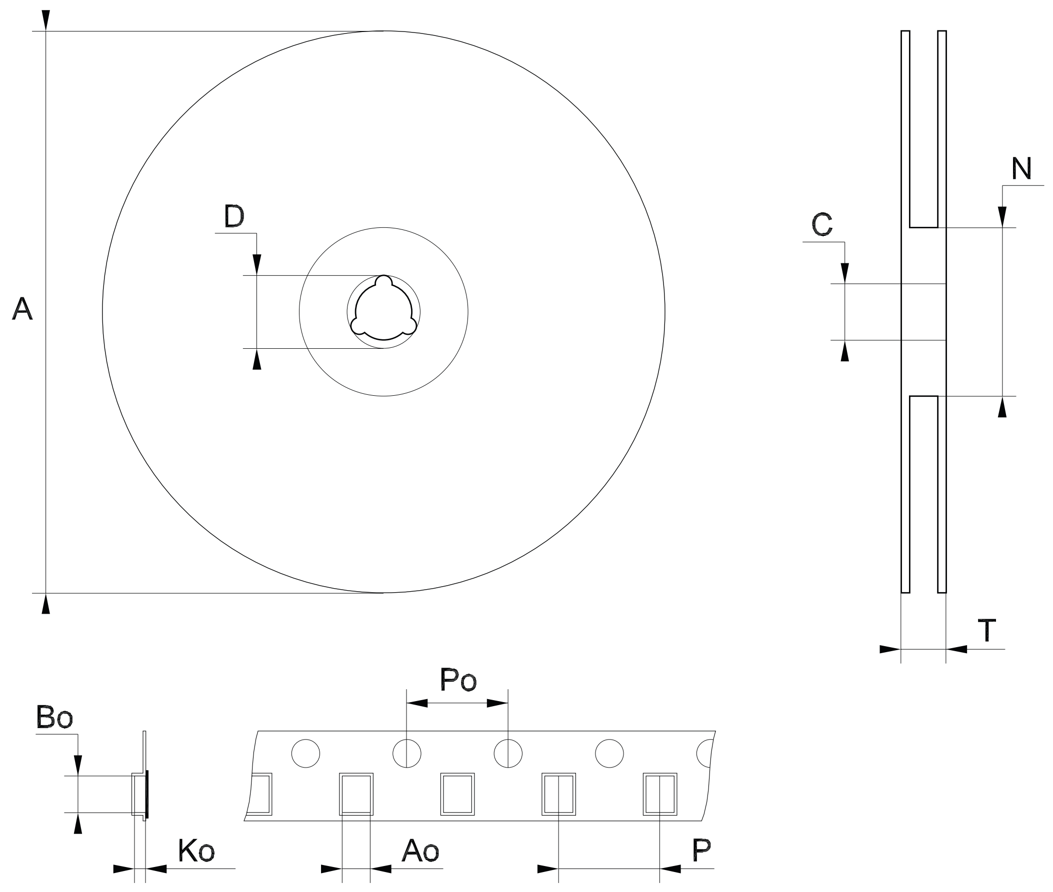
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	6.73	6.83	6.93	0.265	0.269	0.273
Bo	7.32	7.42	7.52	0.288	0.292	0.296
Ko	1.78		2	0.070		0.078
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315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



Note: Drawing not in scale

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*.