



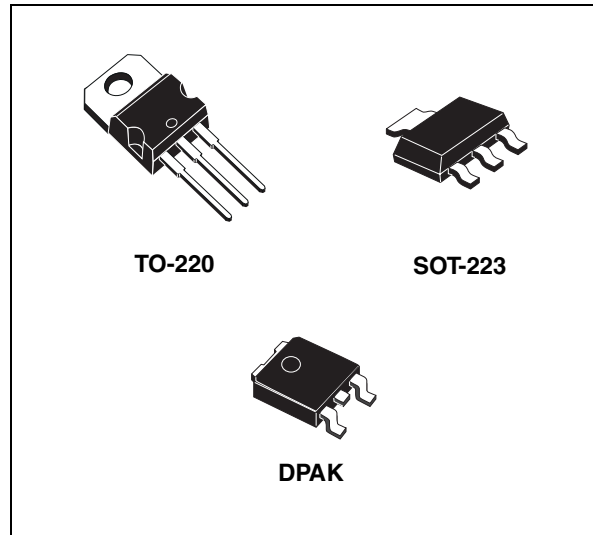
# LD1117AXX12, LD1117AXX18, LD1117AXX33, LD1117AXX

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  $\mu$ F for stability
- Available in  $\pm 2\%$  (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



common 10  $\mu$ F minimum capacitor is needed for stability. Chip trimming allows the regulator to reach a very tight output voltage tolerance, within  $\pm 2\%$  at 25 °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

**Table 1. Device summary**

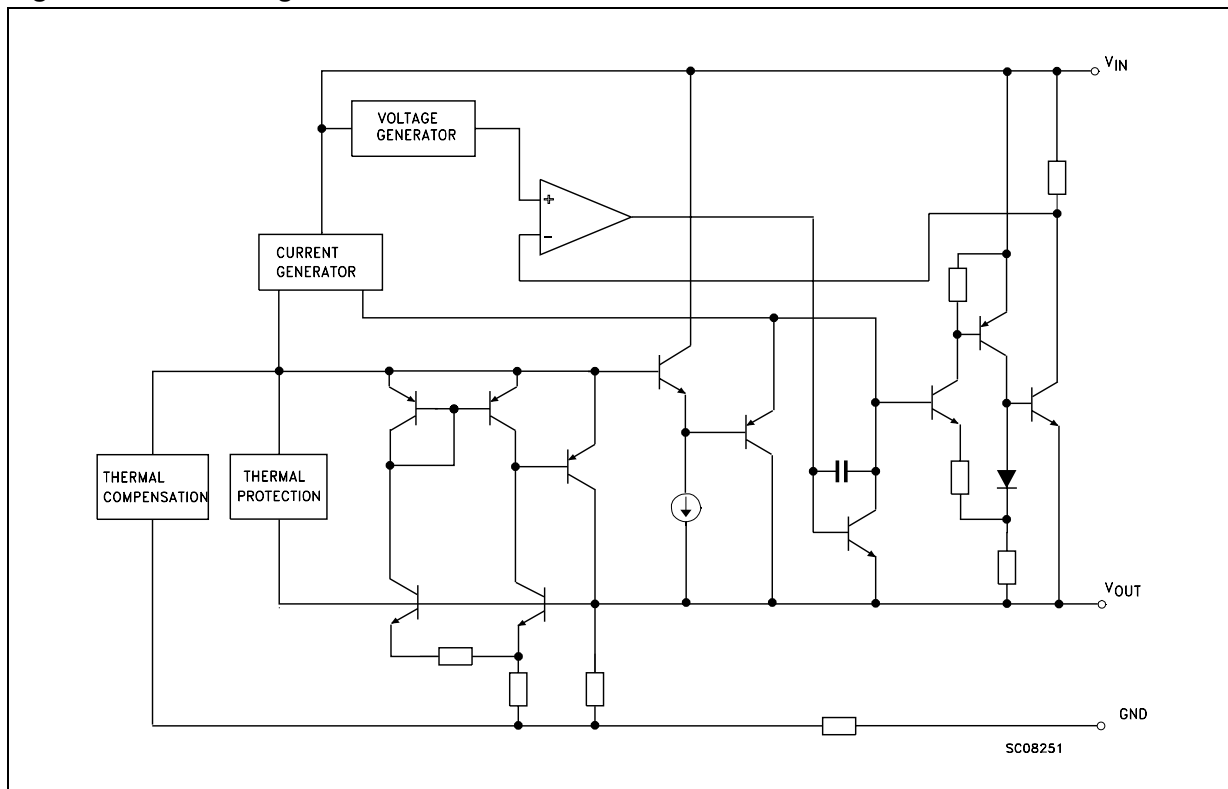
Order codes			Output voltage
SOT-223	DPAK	TO-220	
LD1117AS12TR	LD1117ADT12TR		1.2 V
LD1117AS18TR	LD1117ADT18TR		1.8 V
LD1117AS33TR	LD1117ADT33TR	LD1117AV33	3.3 V
LD1117ASTR	LD1117ADT-TR		Adjustable from 1.25 V

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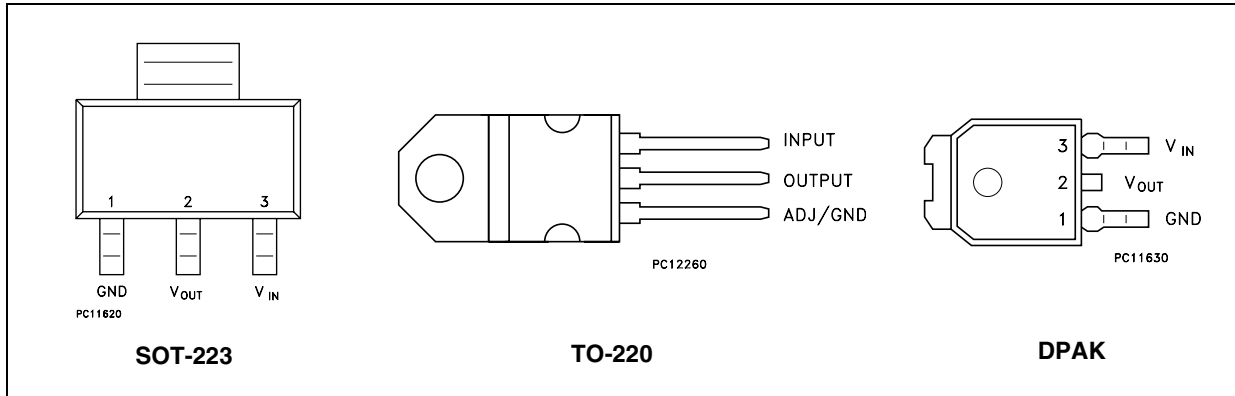
# 1 Diagram

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

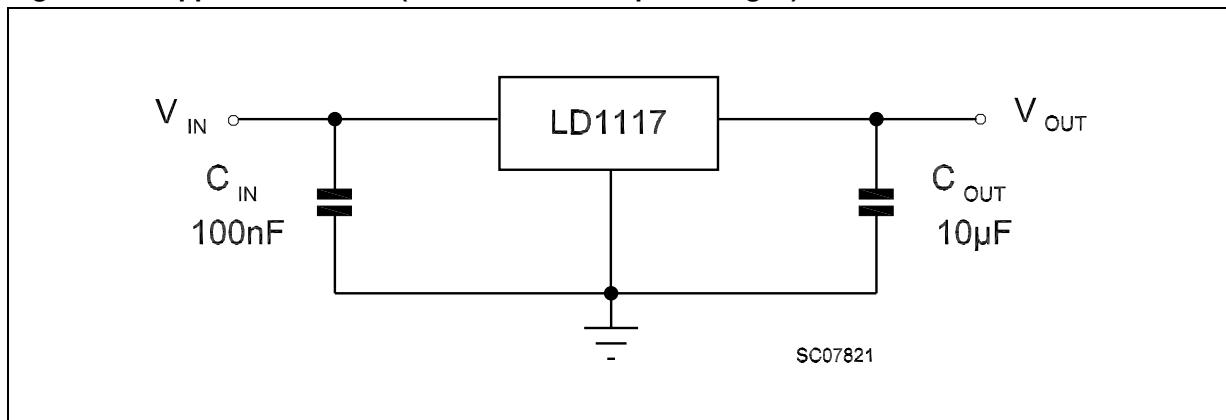
*Note:* Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied. Beyond the above suggested max. power dissipation, a short-circuit may permanently damage the device.

**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,  $C_O = 10$   $\mu$ F,  $C_I = 10$   $\mu$ F,  $R = 120$   $\Omega$  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
$\Delta V_O$	Line regulation	$V_I = 2.75$ to $8$ V, $I_O = 0$ mA		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 2.75$ V, $I_O = 0$ to $1$ A		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	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		$\mu$ V
SVR	Supply voltage rejection	$I_O = 40$ mA, $f = 120$ Hz $V_I - V_O = 3$ V, $V_{ripple} = 1$ V <sub>PP</sub>	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,  $C_O = 10$   $\mu$ F,  $C_I = 10$   $\mu$ F, 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
$\Delta V_O$	Line regulation	$V_I = 3.3$ to $8$ V, $I_O = 0$ mA		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 3.3$ V, $I_O = 0$ to $1$ A		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	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		$\mu$ V
SVR	Supply voltage rejection	$I_O = 40$ mA, $f = 120$ Hz $V_I - V_O = 3$ V, $V_{\text{ripple}} = 1$ V <sub>PP</sub>	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	
$\Delta V_{O(\text{pwr})}$	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,  $C_O = 10$   $\mu$ F,  $C_I = 10$   $\mu$ F, 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
$\Delta V_O$	Line regulation	$V_I = 4.75$ to $8$ V, $I_O = 0$ mA		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 4.75$ V, $I_O = 0$ to $1$ A		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	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		$\mu$ V
SVR	Supply voltage rejection	$I_O = 40$ mA, $f = 120$ Hz $V_I - V_O = 3$ V, $V_{\text{ripple}} = 1$ V <sub>PP</sub>	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	
$\Delta V_{O(\text{pwr})}$	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,  $C_O = 10$   $\mu$ F,  $C_I = 10$   $\mu$ F, 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
$\Delta V_O$	Line regulation	$V_I = 2.75$ to 8 V, $I_O = 0$ mA		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 2.75$ V, $I_O = 0$ to 1 A		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	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	$\mu$ A
$\Delta I_{adj}$	Adjustment pin current change	$V_{in} - V_O = 1.4$ to 10 V, $I_O = 10$ mA to 1 A		1	5	$\mu$ A
$I_{O(min)}$	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		$\mu$ V
SVR	Supply voltage rejection	$I_O = 40$ mA, $f = 120$ Hz $V_I - V_O = 3$ V, $V_{ripple} = 1$ V <sub>PP</sub>	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

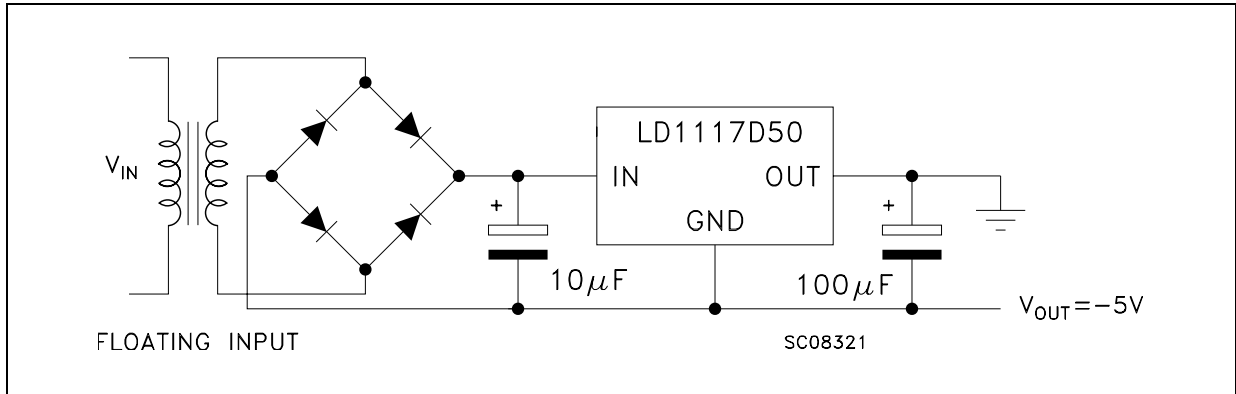


Figure 5. Active terminator for SCSI-2 bus

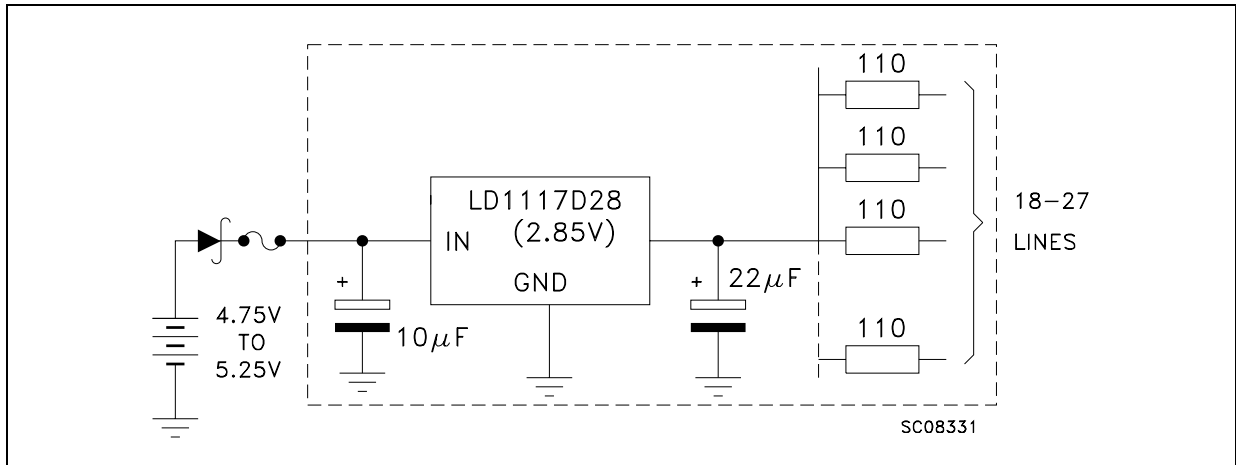


Figure 6. Circuit for increasing output voltage

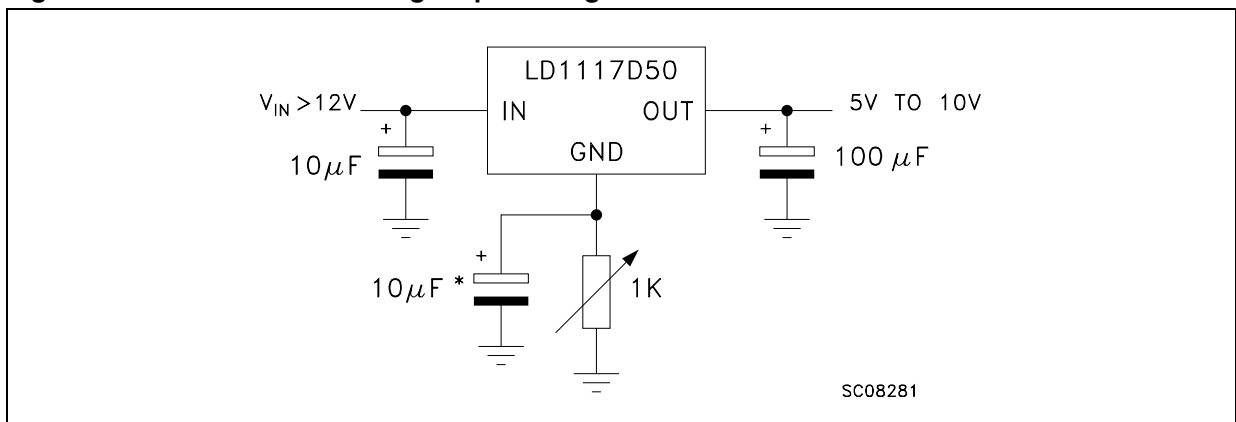


Figure 7. Voltage regulator with reference

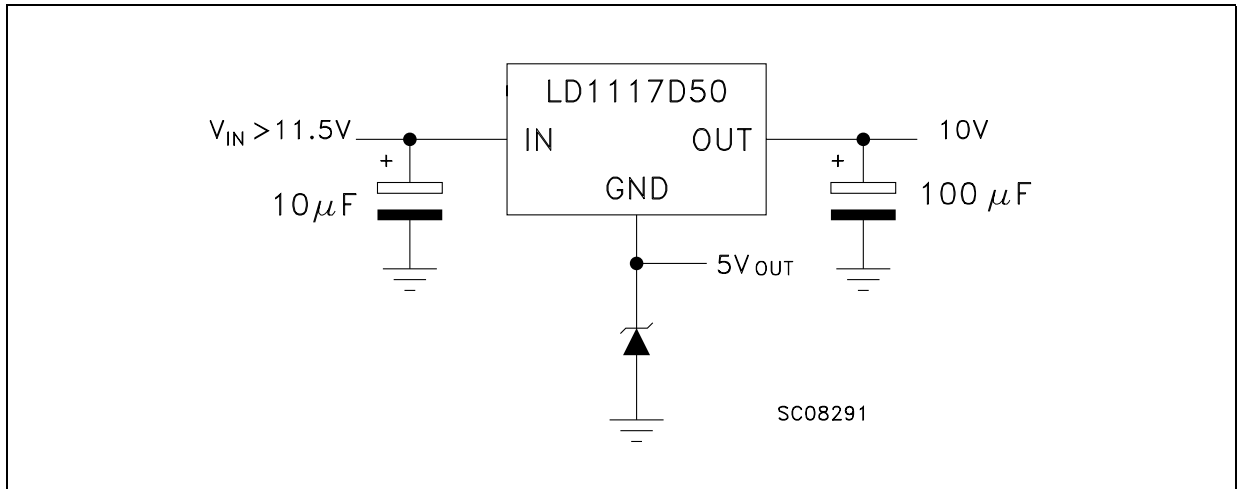


Figure 8. Battery backed-up regulated supply

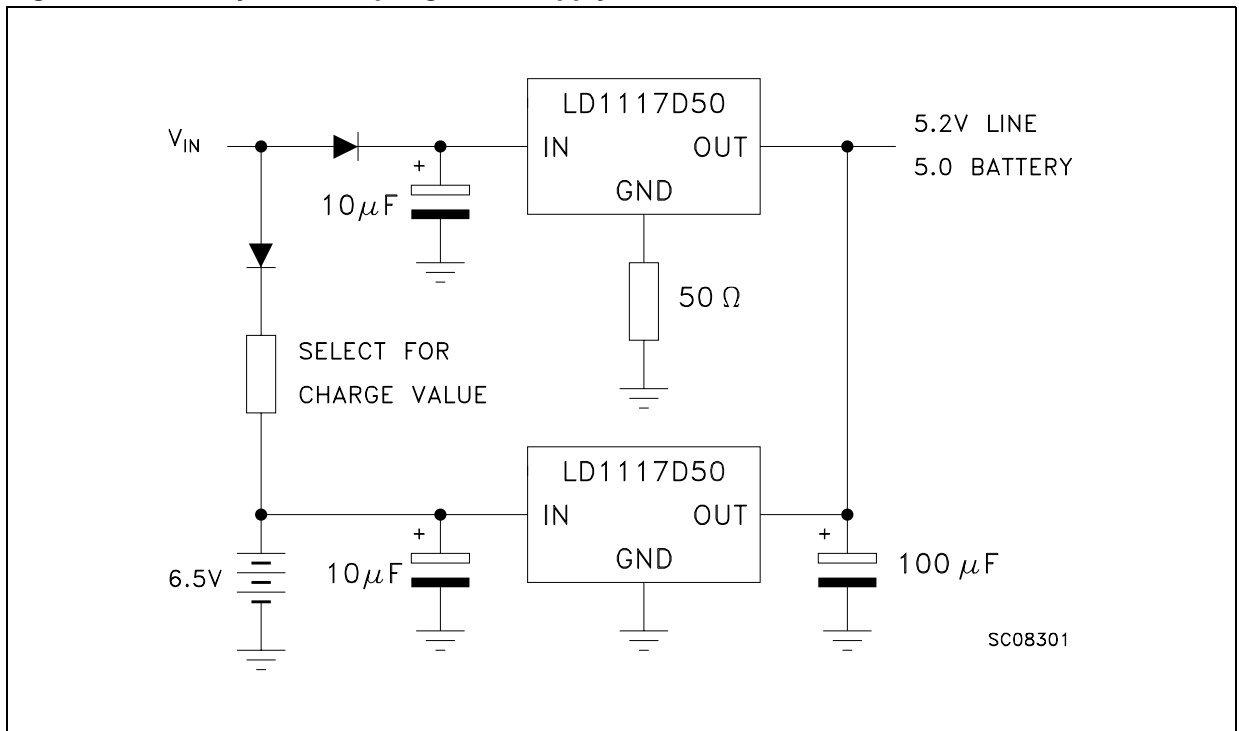
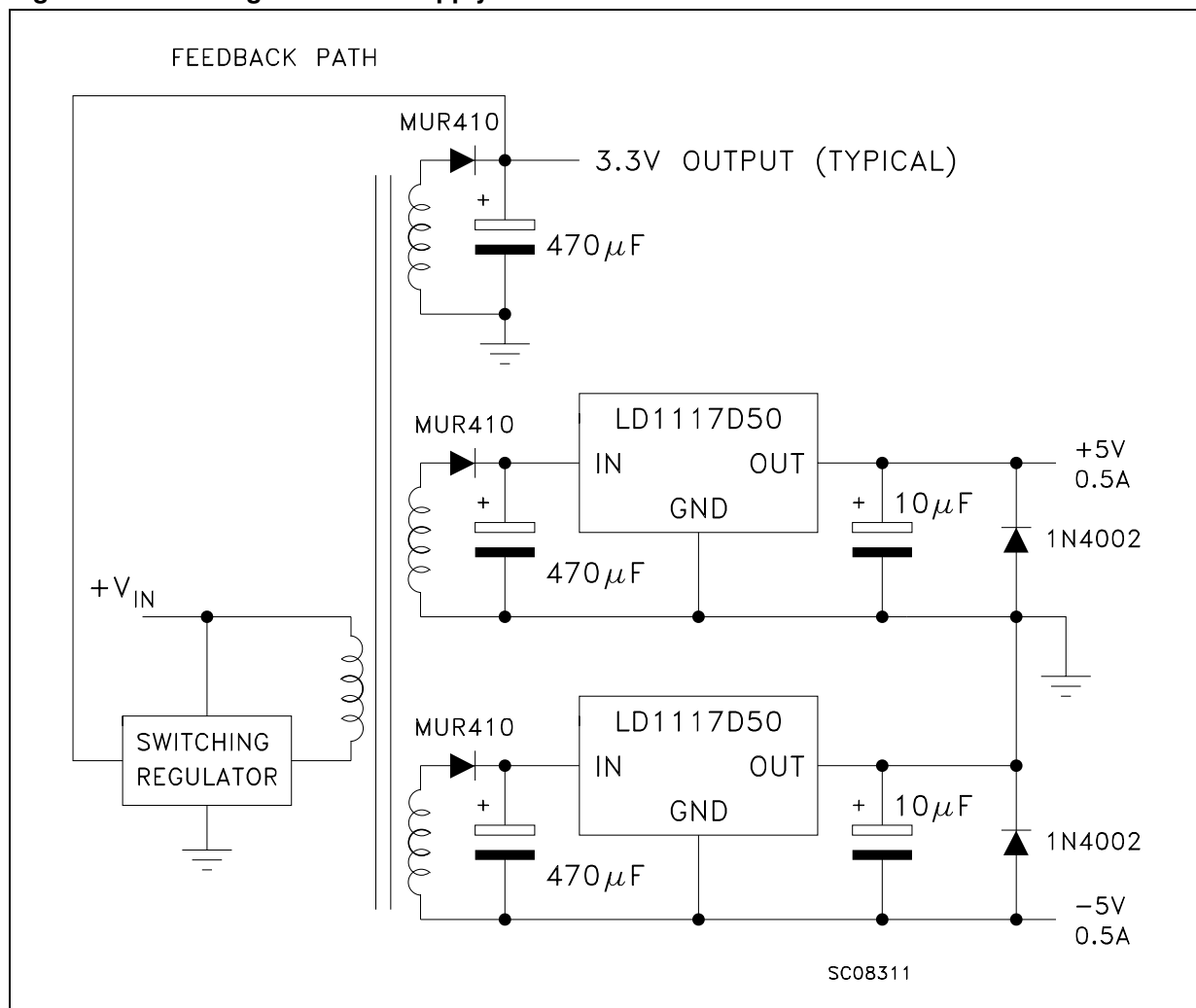


Figure 9. Post-regulated dual supply



## 7 LD1117A adjustable: application note

The LD1117A adjustable has a thermal stabilized  $1.25 \pm 0.012$  V reference voltage between the OUT and ADJ pins.  $I_{ADJ}$  is  $60 \mu\text{A}$  typ. ( $120 \mu\text{A}$  max.) and  $\Delta I_{ADJ}$  is  $1 \mu\text{A}$  typ. ( $5 \mu\text{A}$  max.).

$R_1$  is normally fixed to  $120 \Omega$ . From [Figure 7](#) the following is obtained:

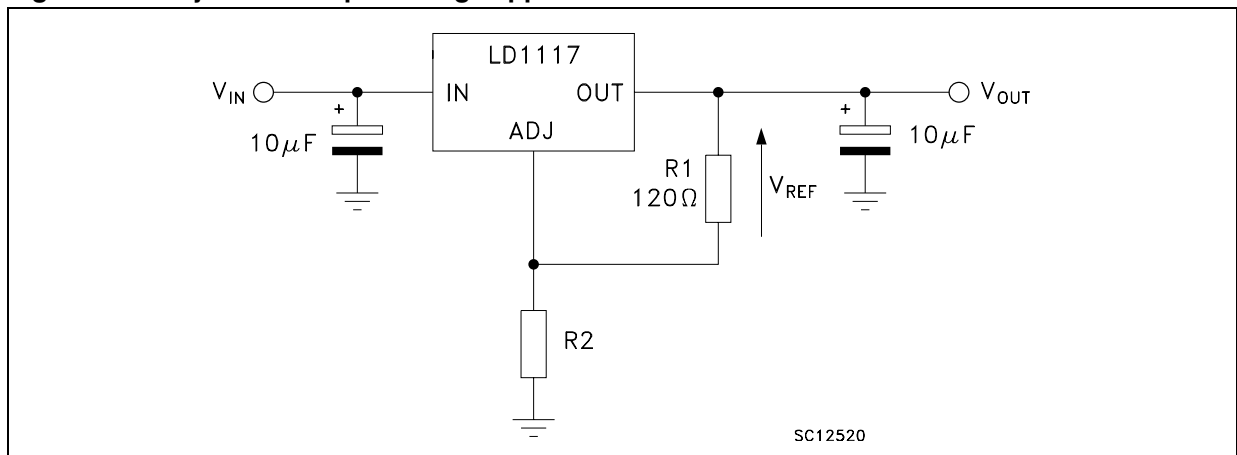
$$V_{OUT} = V_{REF} + R_2 (I_{ADJ} + I_{R1}) = V_{REF} + R_2 (I_{ADJ} + V_{REF} / R_1) = V_{REF} (1 + R_2 / R_1) + R_2 \times I_{ADJ}$$

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

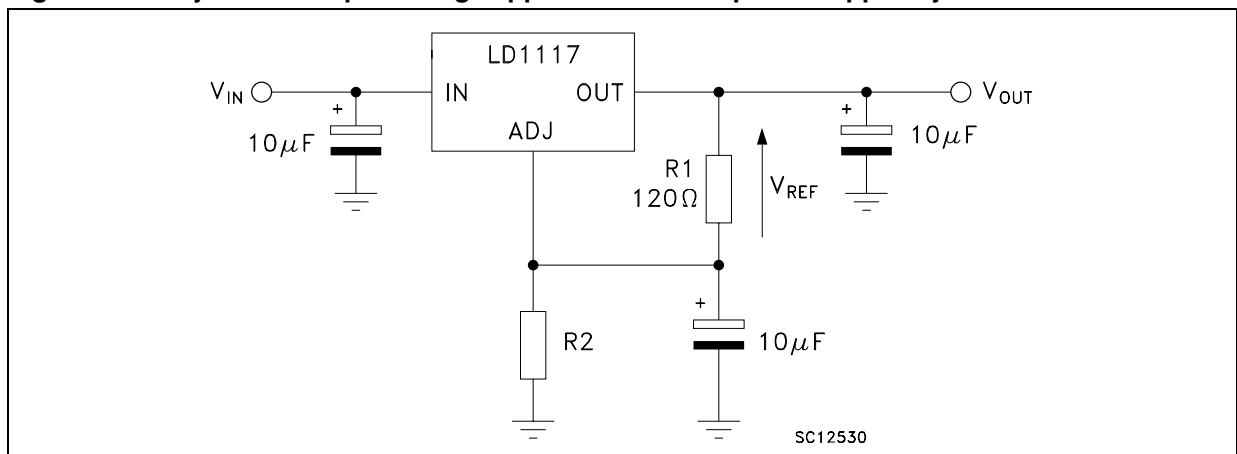
$$V_{OUT} = V_{REF} (1 + R_2 / R_1).$$

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  $10 \mu\text{F}$  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

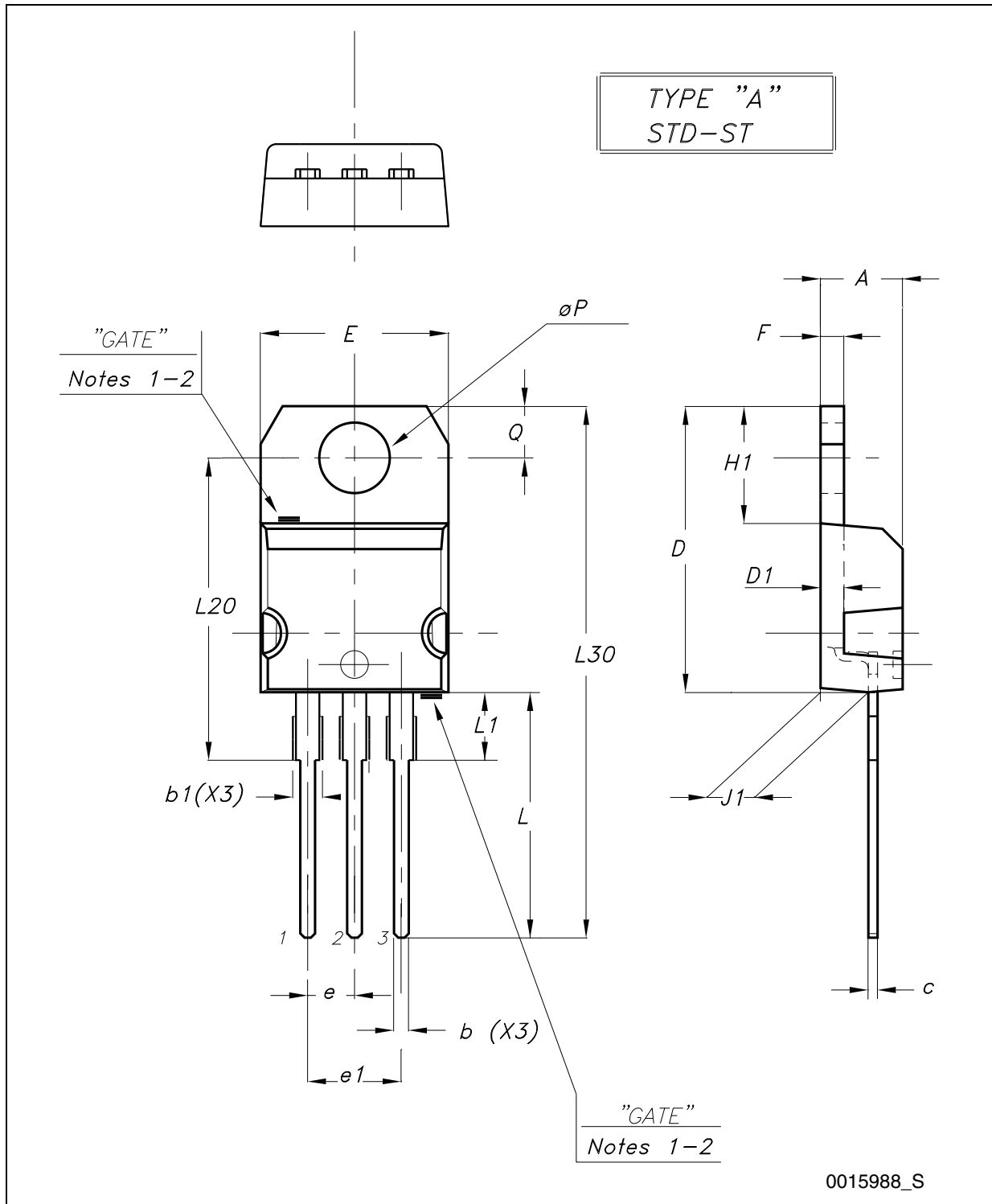
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

**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.

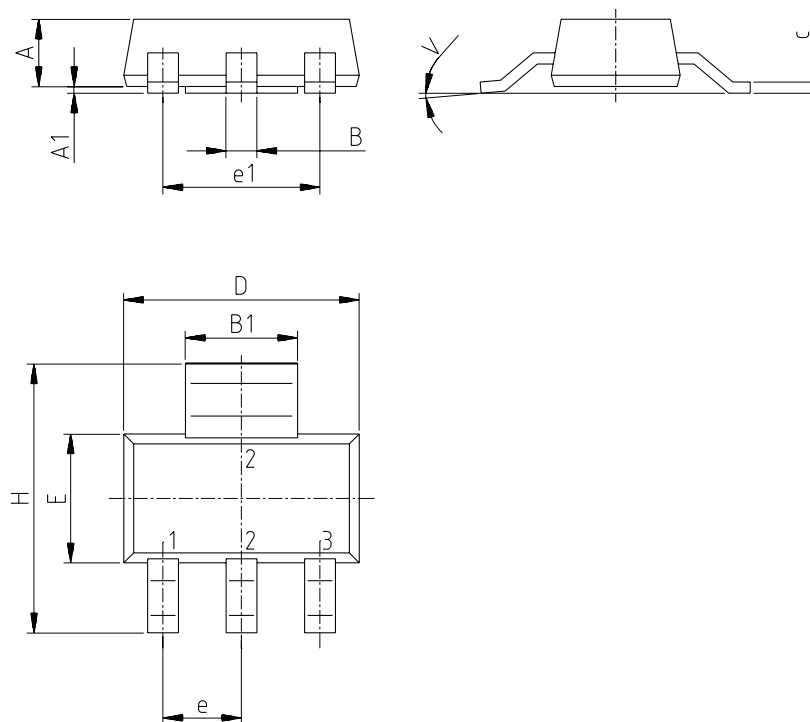






## SOT-223 mechanical data

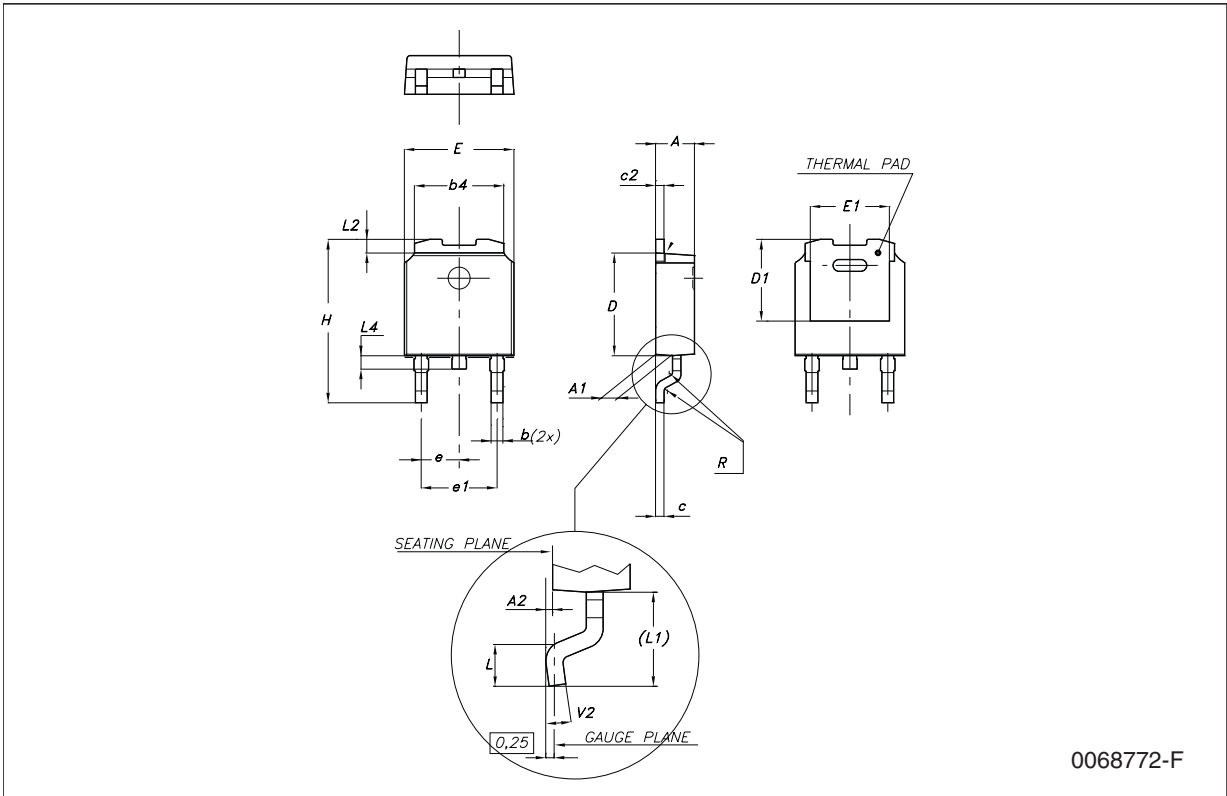
Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.8			70.9
A1	0.02		0.1	0.8		3.9
B	0.6	0.7	0.85	23.6	27.6	33.5
B1	2.9	3	3.15	114.2	118.1	124.0
c	0.24	0.26	0.35	9.4	10.2	13.8
D	6.3	6.5	6.7	248.0	255.9	263.8
e		2.3			90.6	
e1		4.6			181.1	
E	3.3	3.5	3.7	129.9	137.8	145.7
H	6.7	7	7.3	263.8	275.7	287.5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



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**DPAK mechanical data**

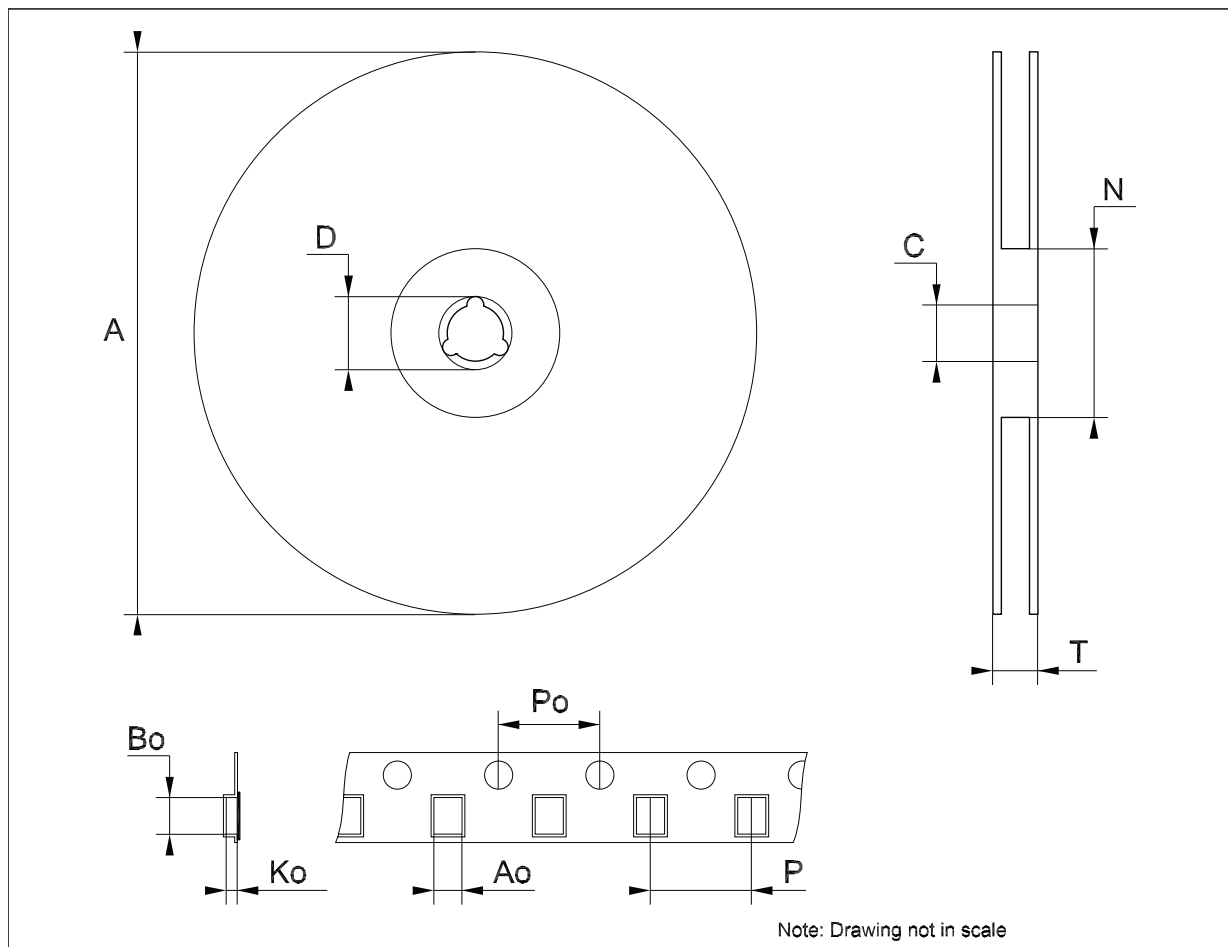
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
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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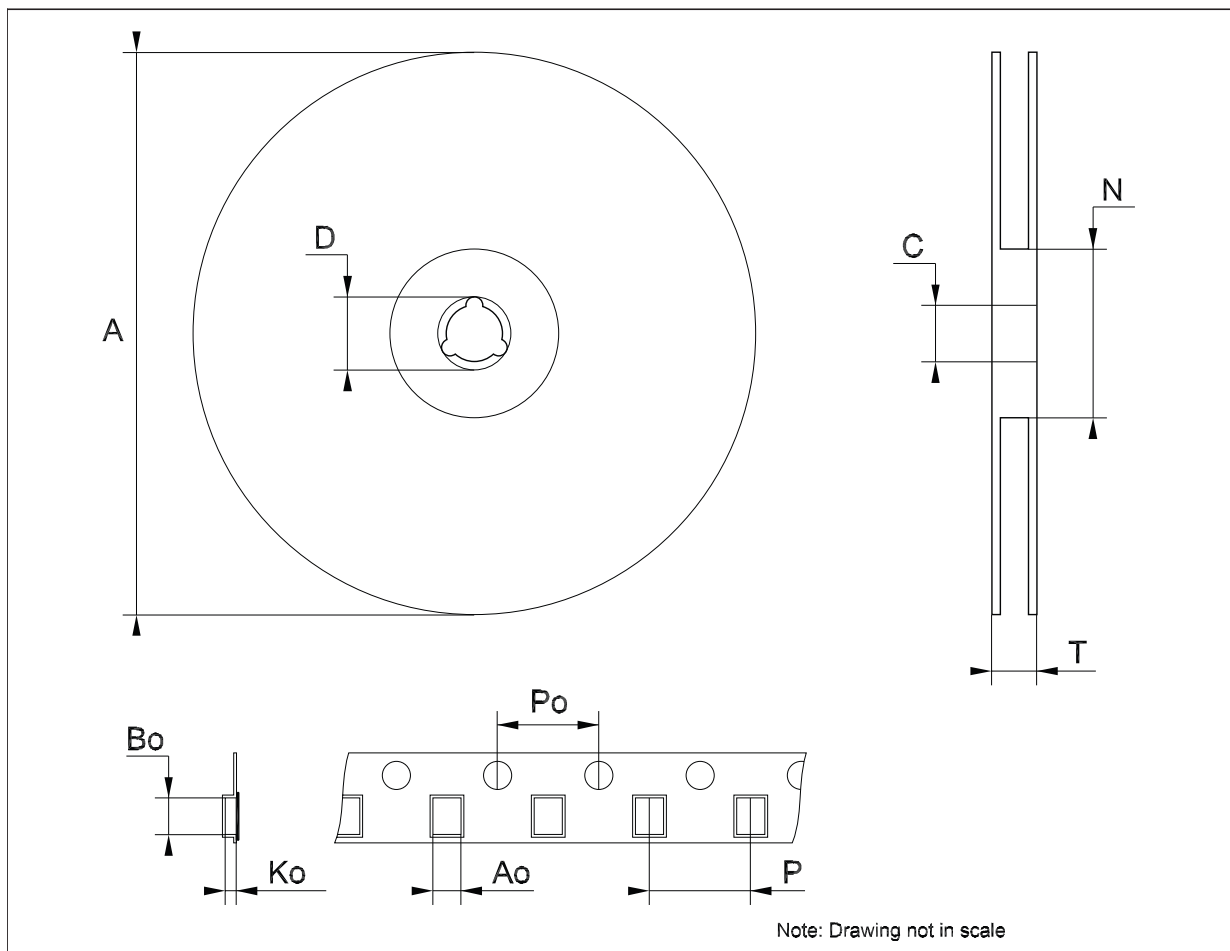
## Tape &amp; reel SOT223 mechanical data

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



**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	0.276
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 <sup>2</sup> PAK/A.
05-Jul-2005	14	The DPAK mechanical data updated.
10-Feb-2006	15	Add new package - D <sup>2</sup> PAK/A (B type).
20-Dec-2006	16	Change value $V_{IN}$ on <a href="#">Table 2</a> .
19-Jan-2007	17	D <sup>2</sup> PAK/A mechanical data updated and add footprint data.
28-May-2007	18	Add $I_{ADJ}$ and $\Delta I_{ADJ}$ values on <a href="#">Table 7</a> .
07-Jun-2007	19	Add $I_{O(min)}$ value on <a href="#">Table 7</a> .
15-Apr-2008	20	Modified: Table 10.
28-Jul-2009	21	Modified: Table 10.
05-Jul-2010	22	Added: <a href="#">Table 8 on page 15</a> , <a href="#">Figure 12 on page 16</a> , <a href="#">Figure 13 on page 17</a> , <a href="#">Figure 14</a> and <a href="#">Figure 15 on page 18</a> .
16-Nov-2010	23	Modified: <a href="#">Table 1 on page 1</a> , $R_{thJC}$ value for TO-220 <a href="#">Table 3 on page 5</a> .
16-Dec-2011	24	Modified: $V_O$ parameter output voltage ==> Reference voltage <a href="#">Table 7 on page 10</a> .
19-Oct-2012	25	Added: $R_{thJA}$ value for DPAK and SOT-223 <a href="#">Table 3 on page 5</a> .

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