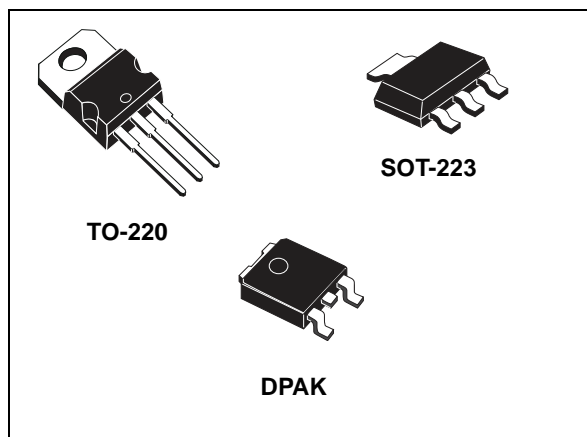


Low drop fixed and adjustable positive voltage regulators

Datasheet - production data



- 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

Description

The LD1117A 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, 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 μ 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.

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, 3.3 V
- Adjustable version availability ($V_{REF} = 1.25$ V)
- Internal current and thermal limit
- Only 10 μ F for stability

Table 1. Device summary

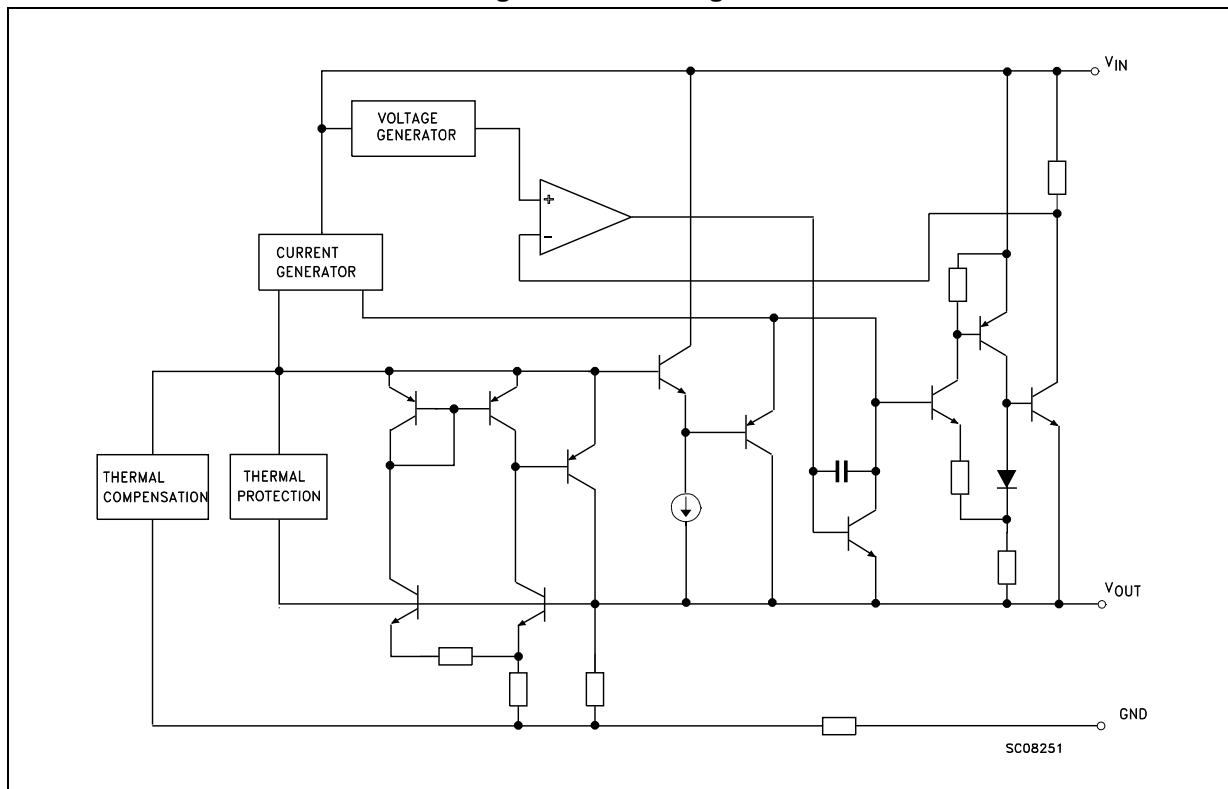
Order codes			Output voltage
SOT-223	DPAK	TO-220	
LD1117AS12TR	LD1117ADT12TR		1.2 V
LD1117AS18TR	LD1117ADT18TR		1.8 V
LD1117AS33TR	LD1117ADT33TR	LD1117AV33	3.3 V
LD1117ASTR	LD1117ADT-TR		Adjustable from 1.25 V

Contents

1	Diagram	3
2	Pin configuration	4
3	Maximum ratings	5
4	Schematic application	6
5	Electrical characteristics	7
6	Typical application	10
7	LD1117A adjustable: application note	12
8	Package mechanical data	13
9	Packaging mechanical data	19
10	Revision history	23

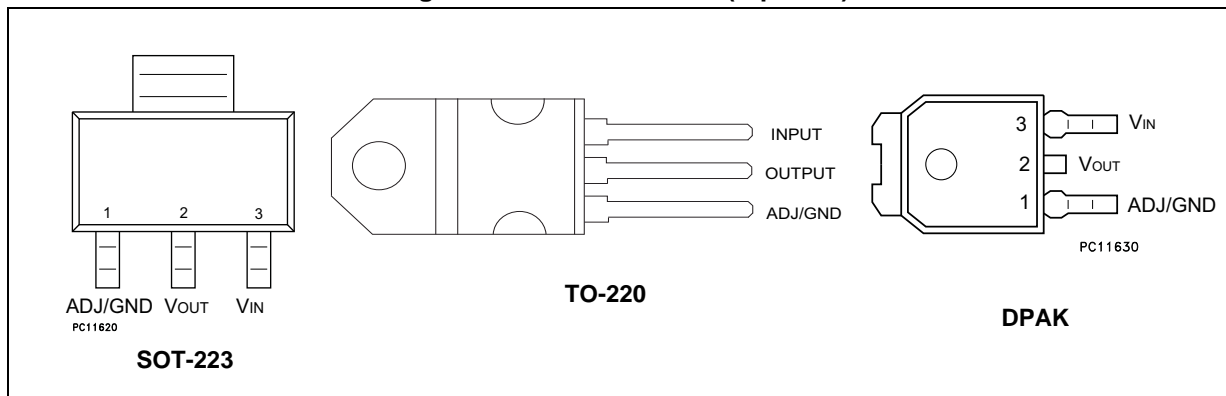
1 Diagram

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

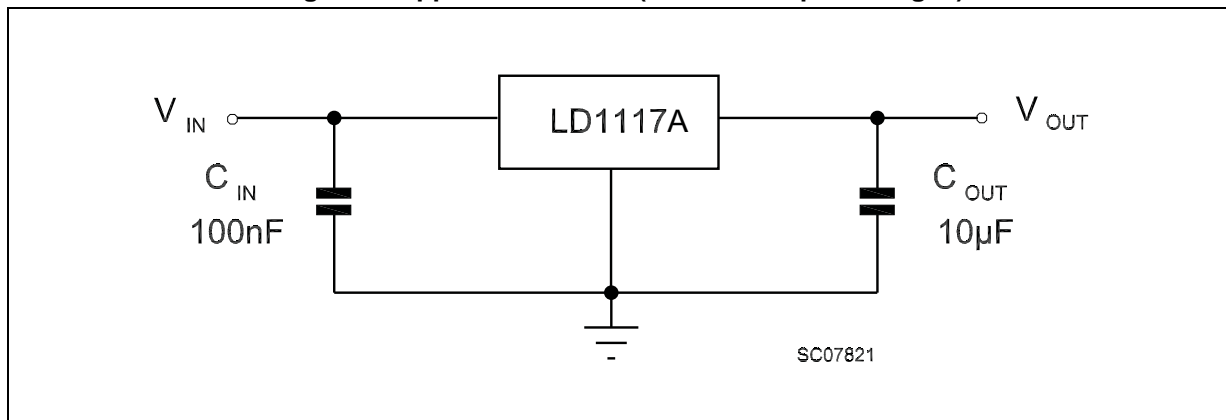
Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied. Beyond the above suggested max. power dissipation, a short-circuit may permanently damage the device.

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 fixed output voltages)



5 Electrical characteristics

Refer to the test circuits, $T_J = 0$ to 125 °C, $C_O = 10$ μ F, $C_I = 10$ μ F, $R = 120$ 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		μ V
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, $C_O = 10$ μ F, $C_I = 10$ μ 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
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

Table 5. Electrical characteristics of LD1117A#18 (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
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	
ΔV _{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 ≤ 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	
ΔV _{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 _{REF}	Reference voltage	V _I = 5.3 V, I _O = 10 mA, T _J = 25 °C	1.225	1.25	1.275	V
V _{REF}	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

Table 7. Electrical characteristics of LD1117A (adjustable) (continued)

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

6 Typical application

Figure 4. Negative supply

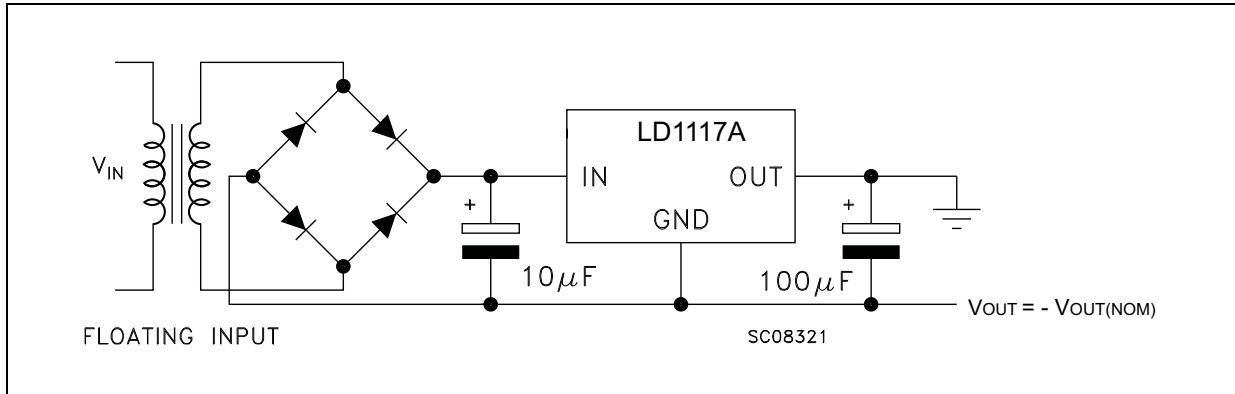


Figure 5. Circuit for increasing output voltage

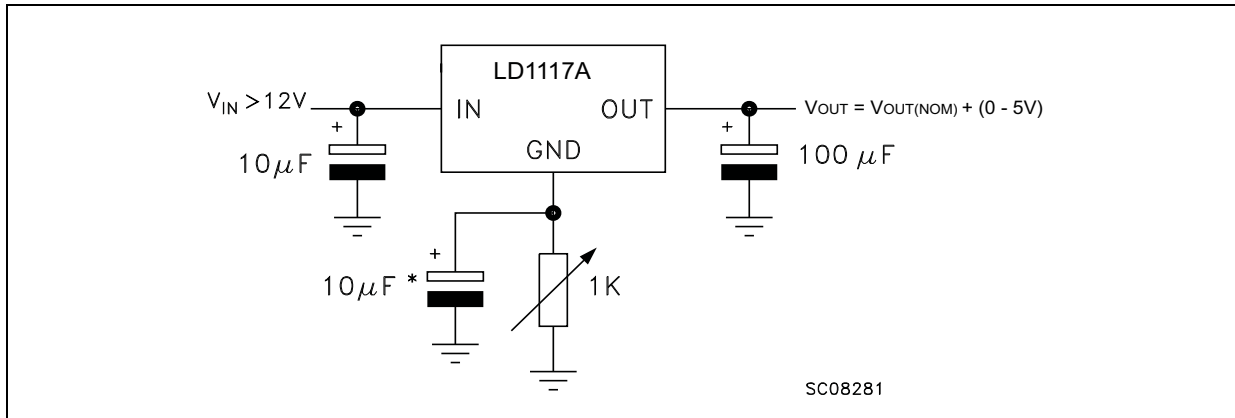


Figure 6. Voltage regulator with reference

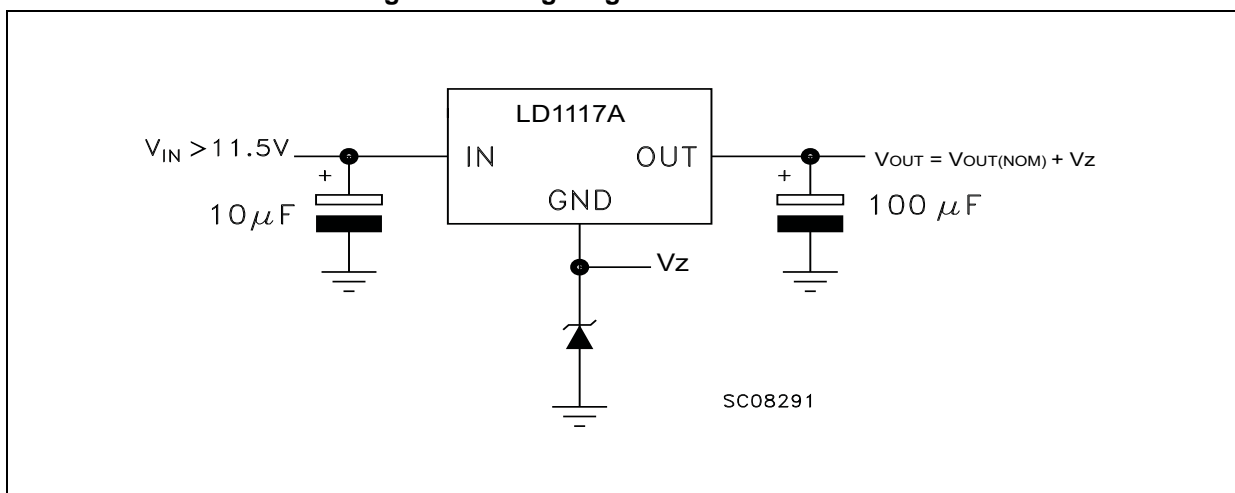
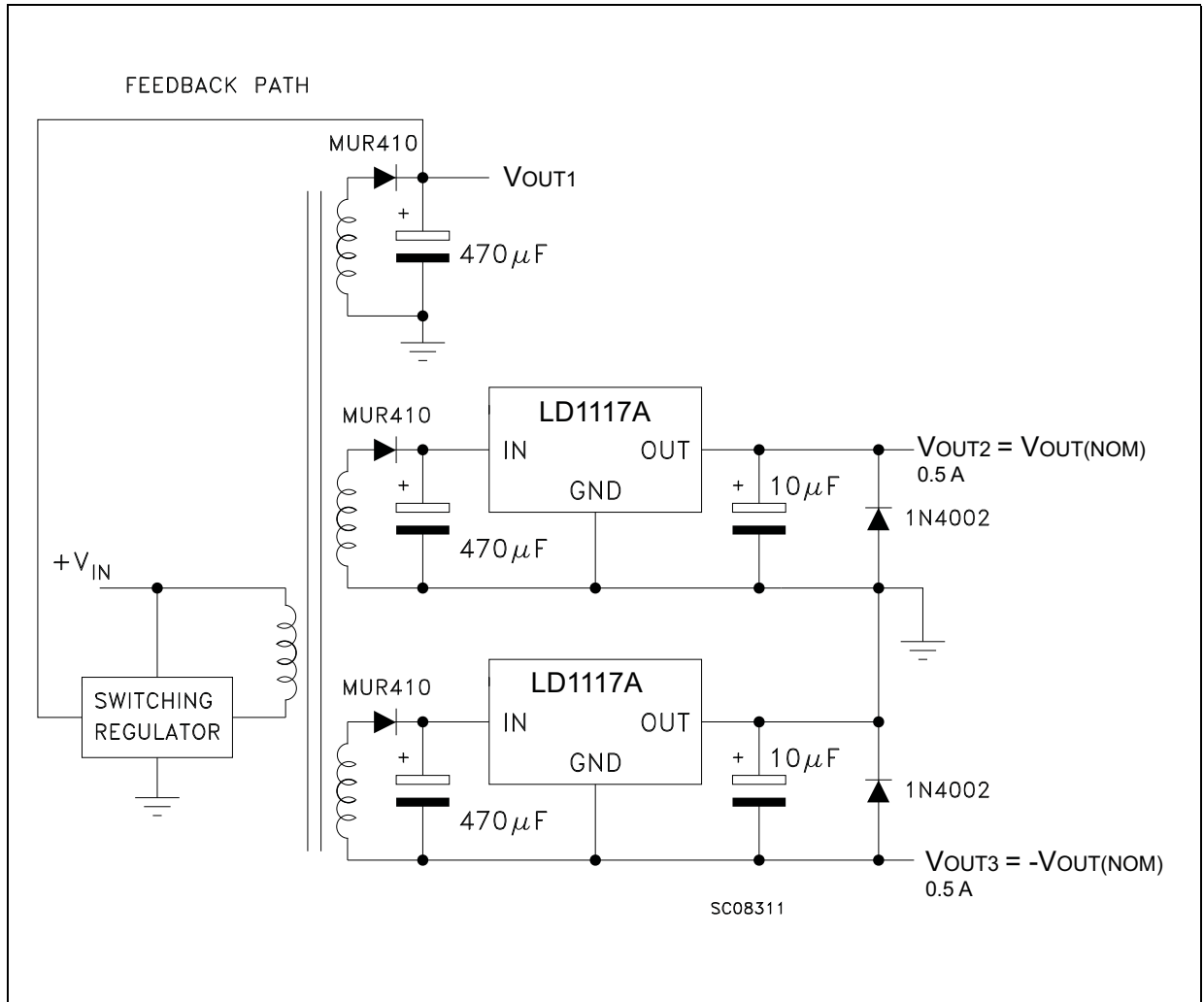


Figure 7. Post-regulated dual supply



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 μ A typ. (120 μ A max.) and ΔI_{ADJ} is 1 μ A typ. (5 μ A max.).

R_1 is normally fixed to 120 Ω . From [Figure 6](#) 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 k Ω , 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 μ F electrolytic capacitor placed in parallel to the R_2 resistor (see [Figure 8](#)).

Figure 8. Adjustable output voltage application

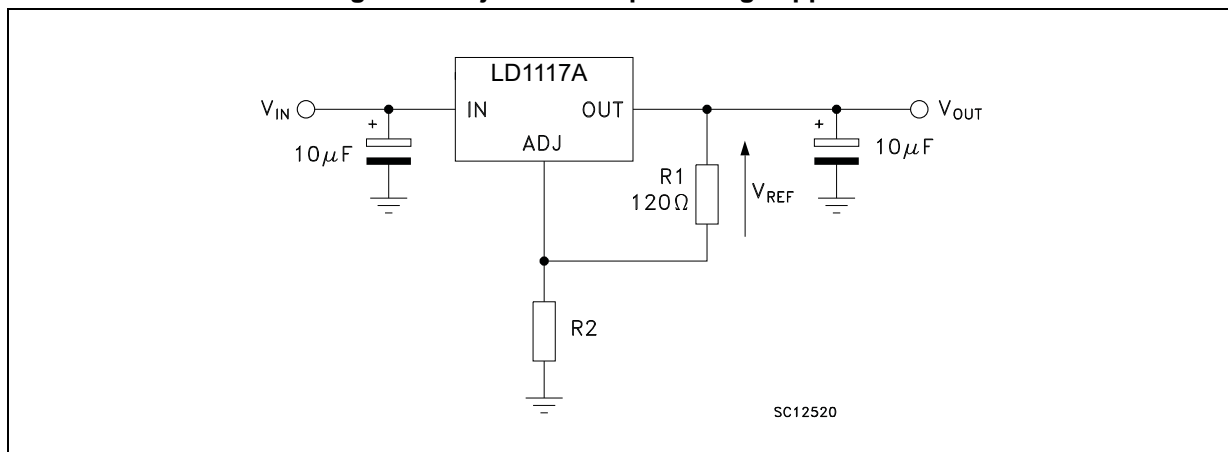
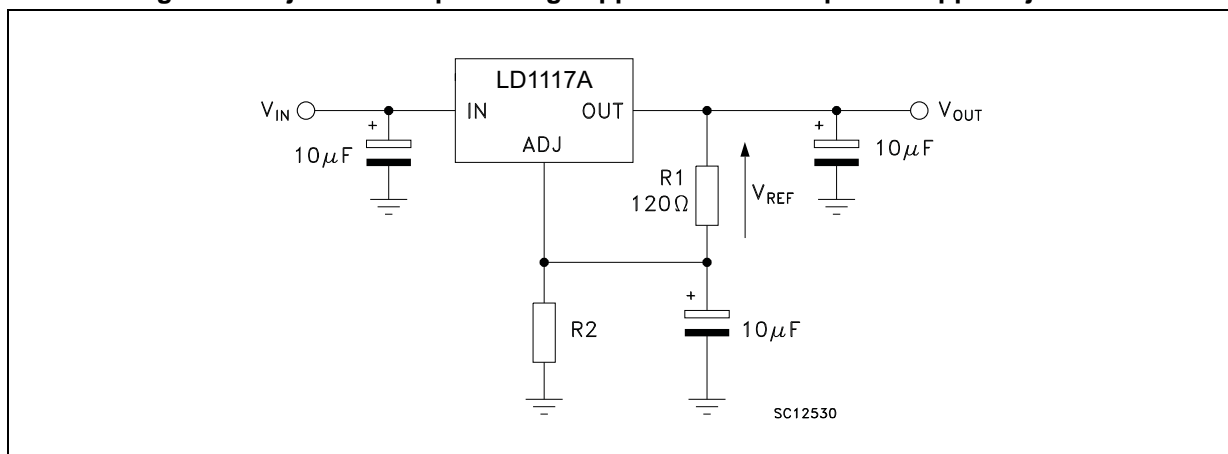


Figure 9. Adjustable output voltage application with improved ripple rejection



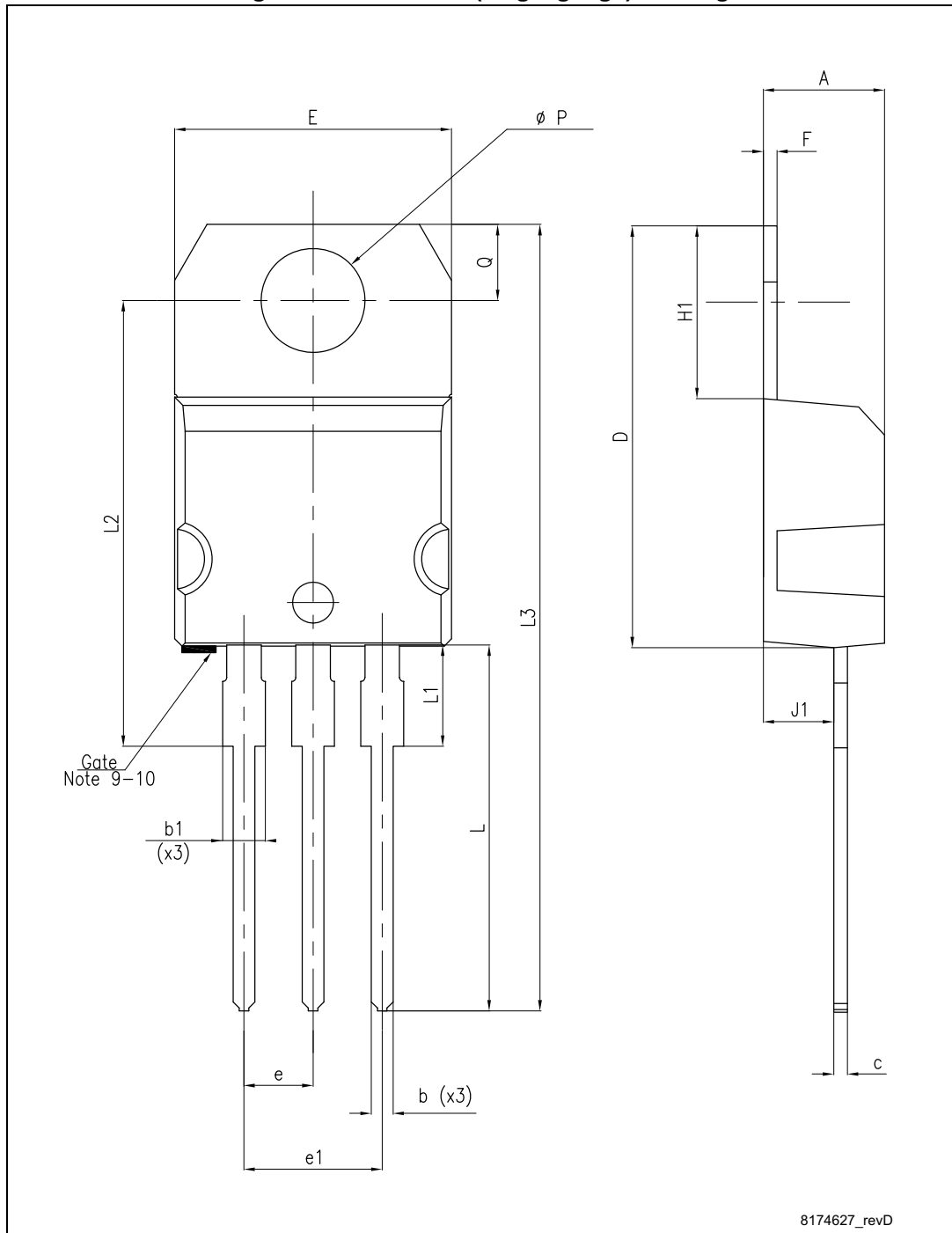
8 Package mechanical data

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 SG (single gauge) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	0.51		0.60
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 10. TO-220 SG (single gauge) drawing

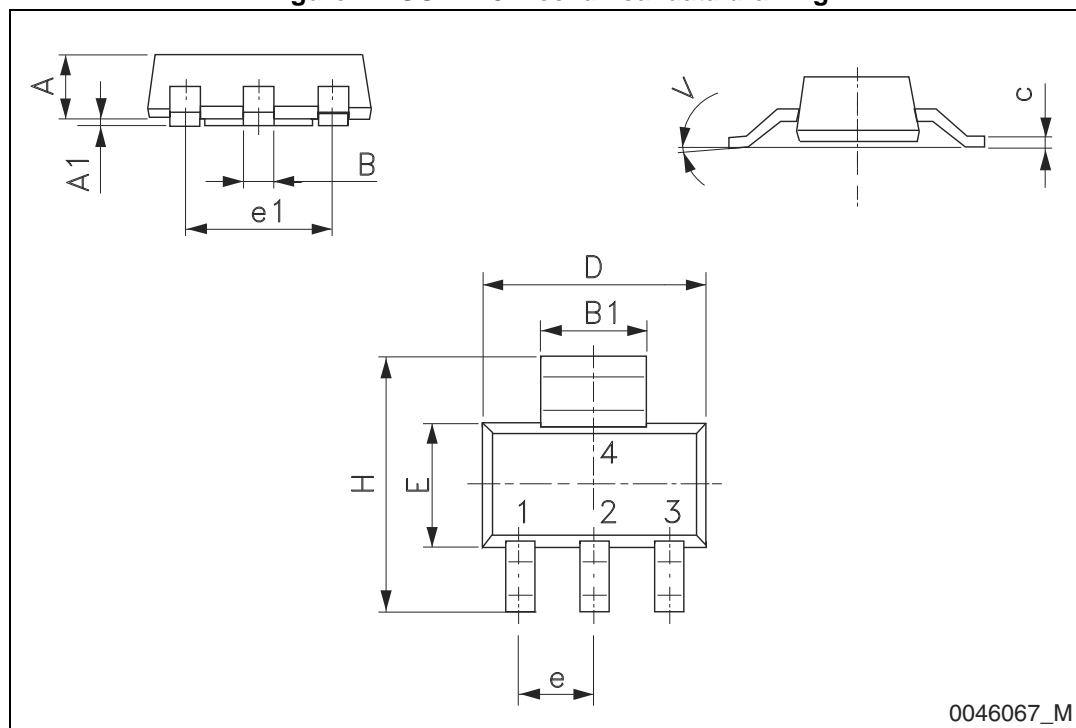


8174627_revD

Table 9. SOT-223 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.80
A1	0.02		0.1
B	0.60	0.70	0.85
B1	2.90	3.00	3.15
c	0.24	0.26	0.35
D	6.30	6.50	6.70
e		2.30	
e1		4.60	
E	3.30	3.50	3.70
H	6.70	7.00	7.30
V			10°

Figure 11. SOT-223 mechanical data drawing



0046067_M

Table 10. DPAK (TO-252) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 12. DPAK (TO-252) drawing

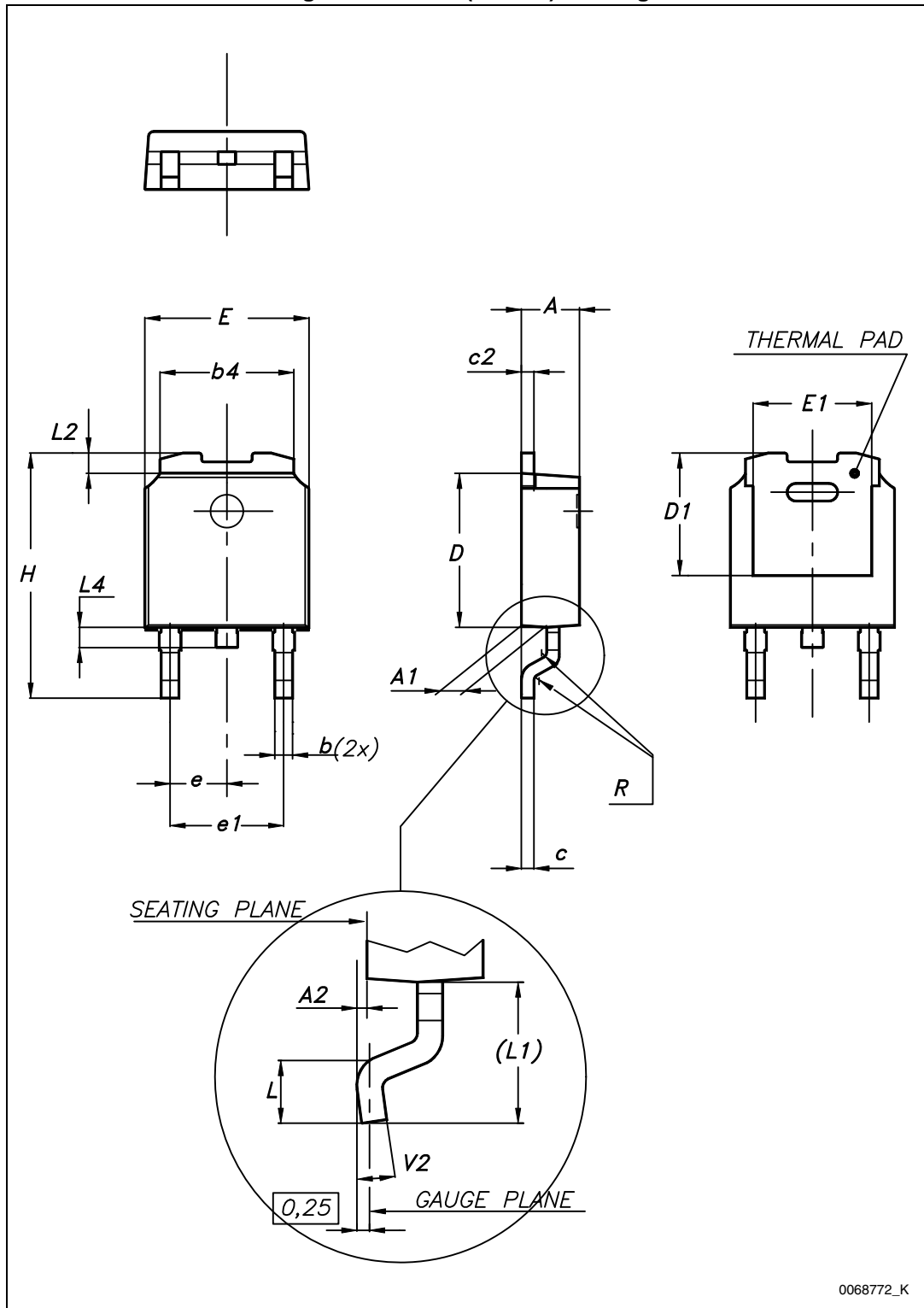
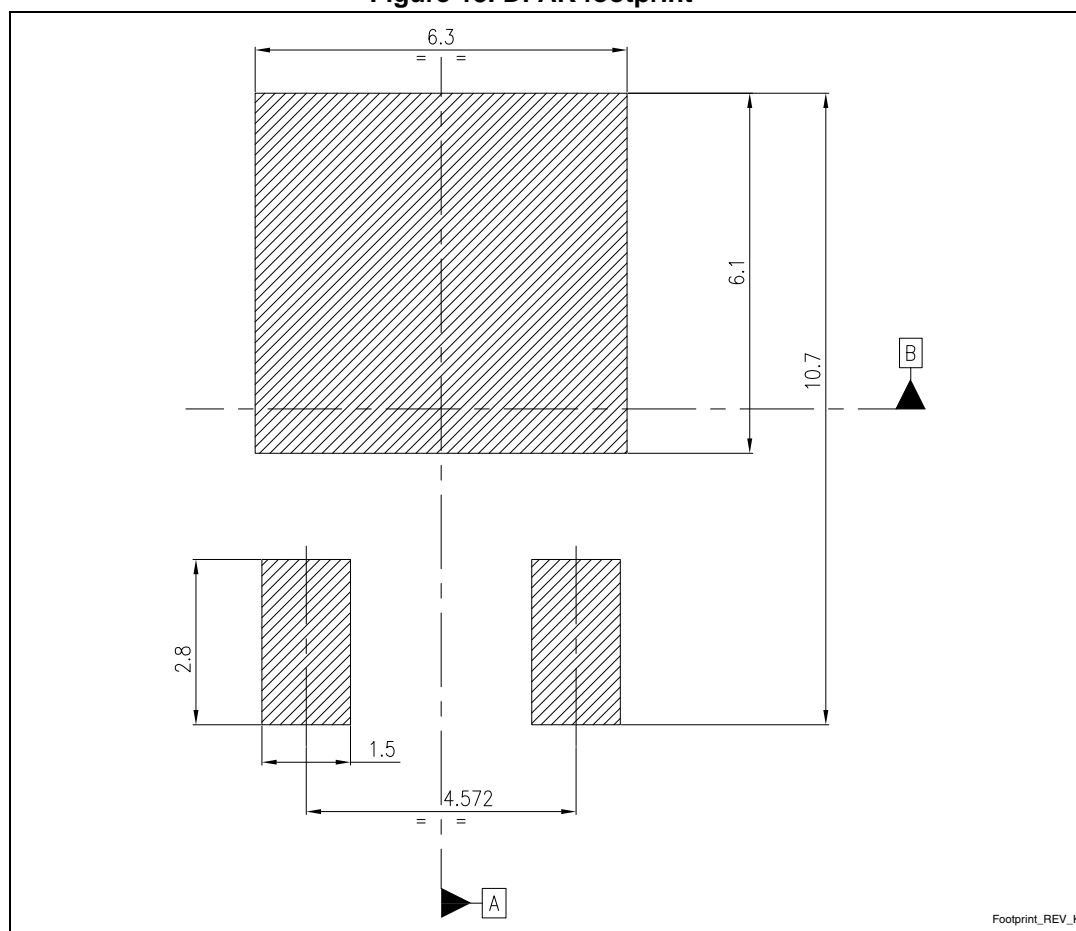


Figure 13. DPAK footprint (a)



a. All dimensions are in millimeters

9 Packaging mechanical data

Table 11. SOT-223 tape and reel mechanical data

Tape				Reel		
Dim.	mm			Dim.	mm	
	Min.	Typ.	Max.		Min.	Max.
A0	6.75	6.85	6.95	A		180
B0	7.30	7.40	7.50	N	60	
K0	1.80	1.90	2.00	W1		12.4
F	5.40	5.50	5.60	W2		18.4
E	1.65	1.75	1.85	W3	11.9	15.4
W	11.7	12	12.3			
P2	1.90	2	2.10	Base quantity pcs		1000
P0	3.90	4	4.10	Bulk quantity pcs		1000
P1	7.90	8	8.10			
T	0.25	0.30	0.35			
Df	1.50	1.55	1.60			
D1f	1.50	1.60	1.70			

Figure 14. Tape for SOT-223 (dimensions are in mm)

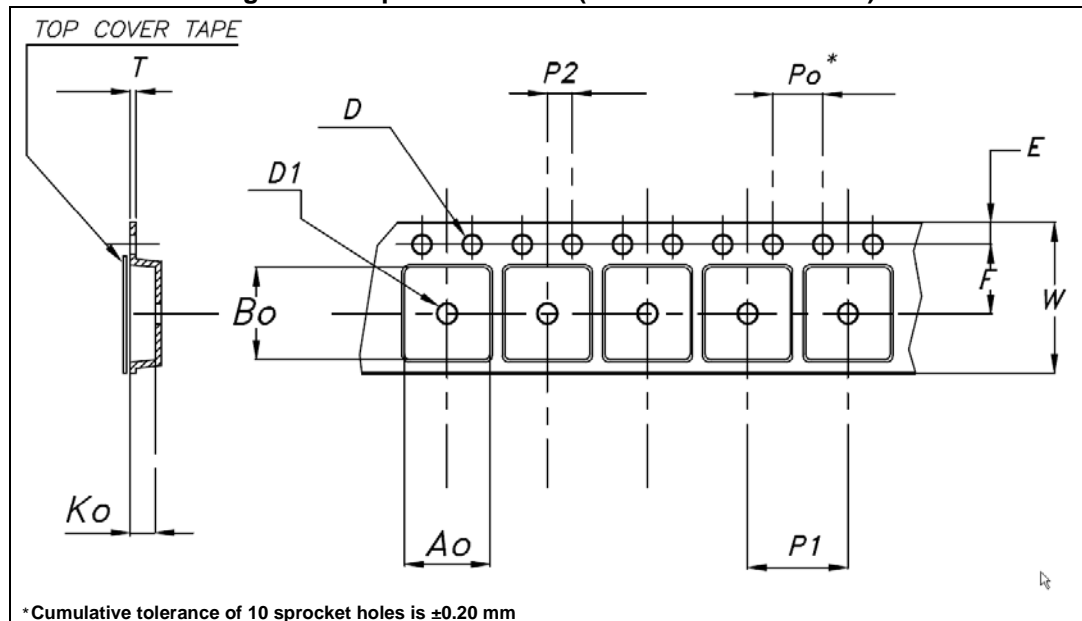


Figure 15. Reel for SOT-223 (dimensions are in mm)

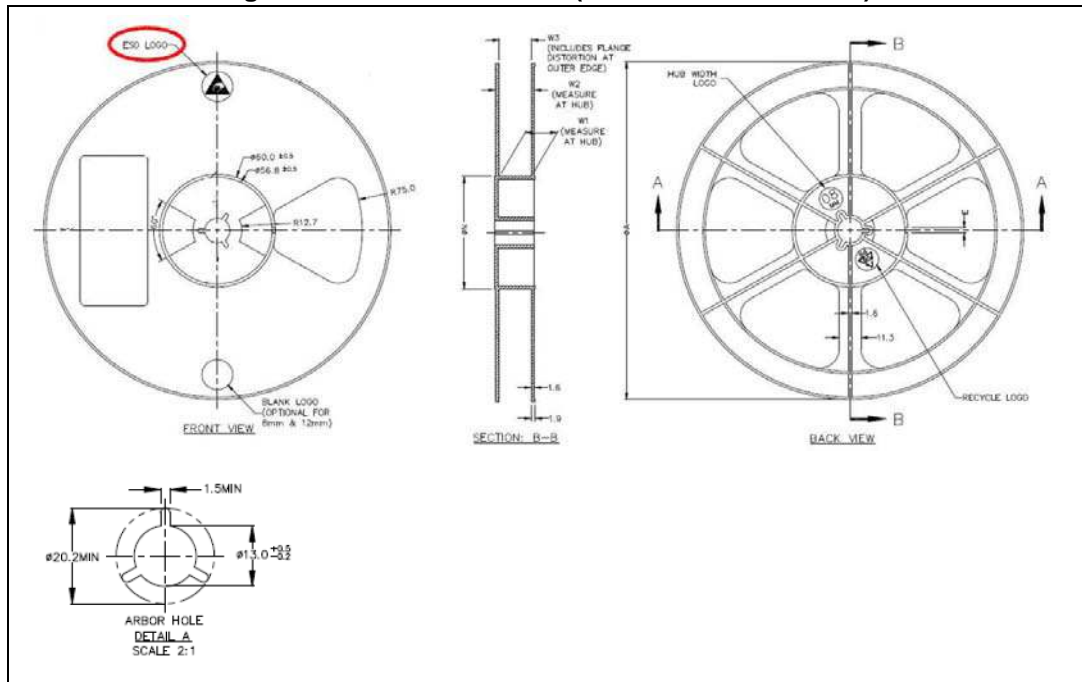


Table 12. DPAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 16. Tape for DPAK

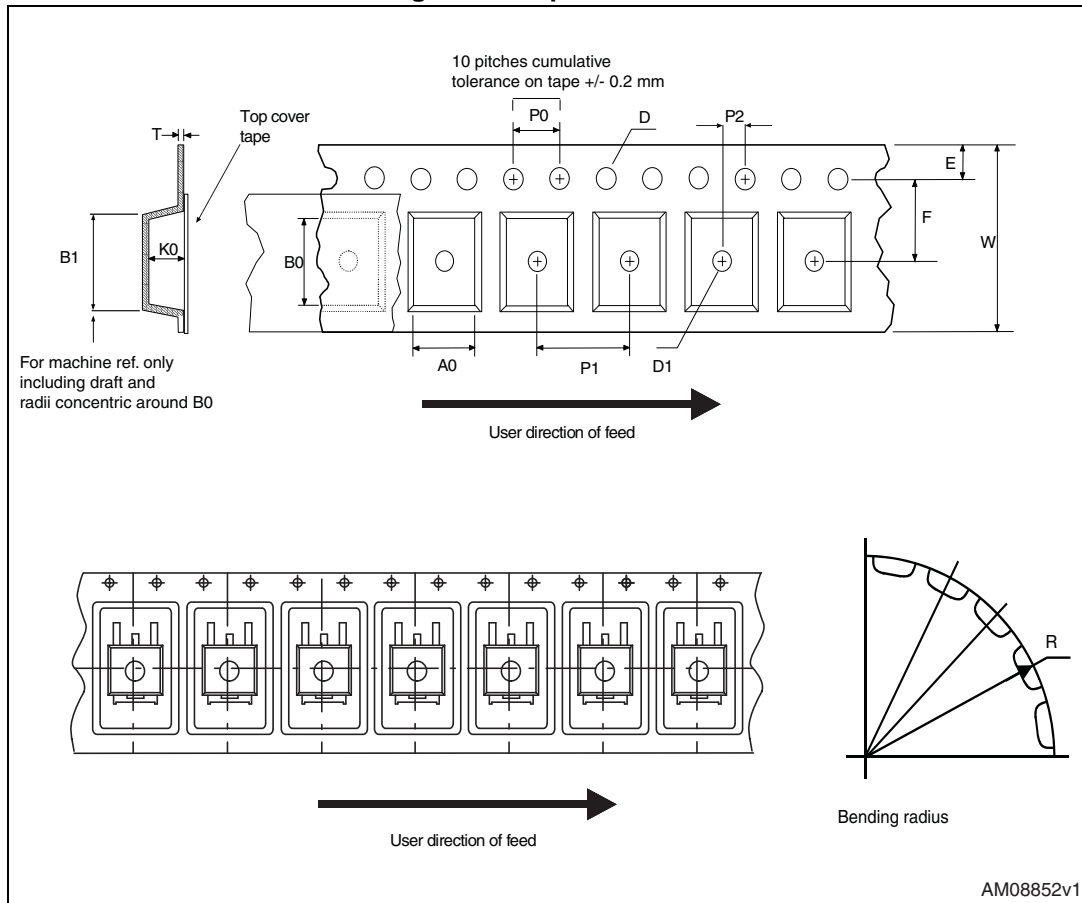
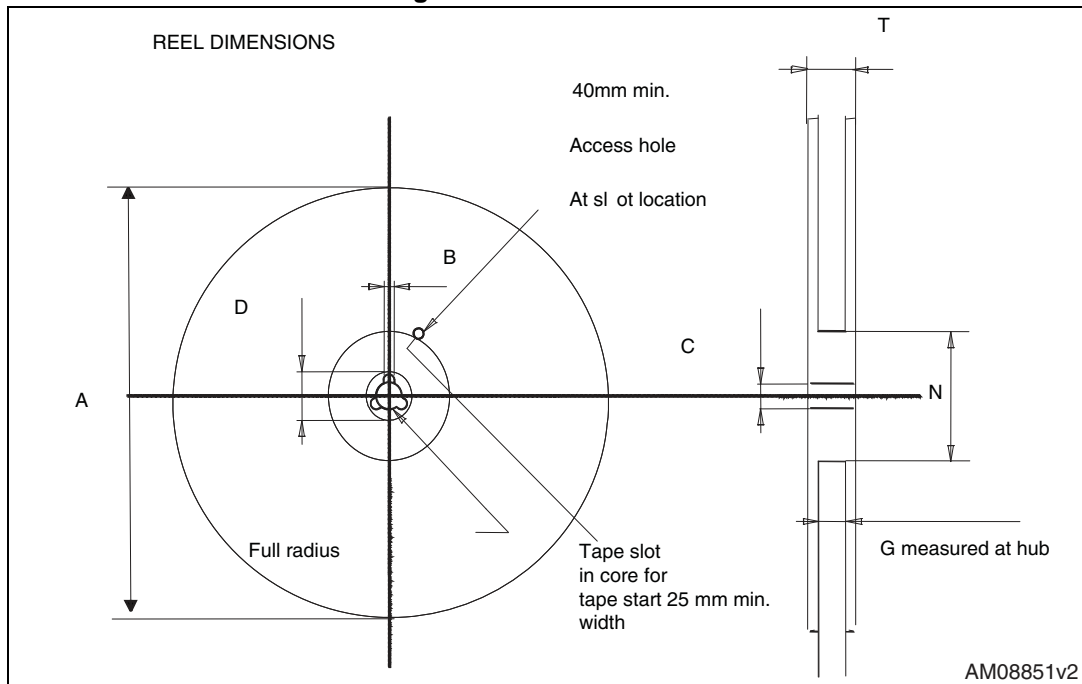


Figure 17. Reel for DPAK



10 Revision history

Table 13. 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 ² PAK/A.
05-Jul-2005	14	The DPAK mechanical data updated.
10-Feb-2006	15	Add new package - D ² PAK/A (B type).
20-Dec-2006	16	Change value V_{IN} on Table 2 .
19-Jan-2007	17	D ² PAK/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 14 on page 18 , Figure 15 on page 20 , Figure 16 and Figure 17 on page 21 .
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 8 .
19-Oct-2012	25	Added: R_{thJA} value for DPAK and SOT-223 Table 3 on page 5 .
24-Jul-2013	26	Part numbers LD1117AXX12, LD1117AXX18, LD1117AXX33, LD1117AXX changed to LD1117A. Modified Chapter 6: Typical application . Changed V_O symbol in to V_{REF} in Table 7: Electrical characteristics of LD1117A (adjustable) . Updated Chapter 8: Package mechanical data . Added Chapter 9: Packaging mechanical data . Minor text changes.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2013 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com