

**200 mA low quiescent current and low noise LDO**

Datasheet - production data

**Features**

- Input voltage from 2.5 to 13.2 V
- Very low-dropout voltage (100 mV typ. @ 100 mA load)
- Low quiescent current (typ. 40  $\mu$ A, 1  $\mu$ A in off mode)
- Low noise
- Output voltage tolerance:  $\pm 2.0\%$  @ 25  $^{\circ}$ C
- 200 mA guaranteed output current
- Wide range of output voltages available on request: fixed from 1.2 V to 12 V with 100 mV step and adjustable
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitor  $C_{OUT} = 1 \mu$ F
- Internal current and thermal limit
- Available in SOT23-5L, SOT323-5L and DFN6-1.2x1.3 packages
- Temperature range: -40  $^{\circ}$ C to 125  $^{\circ}$ C

**Applications**

- Battery-powered equipment
- TV
- Set-top box
- PC and laptop
- Industrial

**Description**

The LDK220 is a low drop voltage regulator, which provides a maximum output current of 200 mA from an input voltage in the range of 2.5 V to 13.2 V, with a typical dropout voltage of 100 mV.

A ceramic capacitor stabilizes it on the output.

The very low drop voltage, low quiescent current and low noise make it suitable for battery-powered applications.

The enable logic control function puts the LDK220 in shutdown mode allowing a total current consumption lower than 1  $\mu$ A.

The device also includes a short-circuit constant current limiting and thermal protection.

---

# Contents

1	Diagram .....	3
2	Pin configuration .....	4
3	Typical application .....	5
4	Maximum ratings .....	6
5	Electrical characteristics .....	7
6	Typical characteristics .....	9
7	Package mechanical data .....	14
8	Ordering information .....	21
9	Revision history .....	22

# 1 Diagram

Figure 1. Block diagram (fixed version)

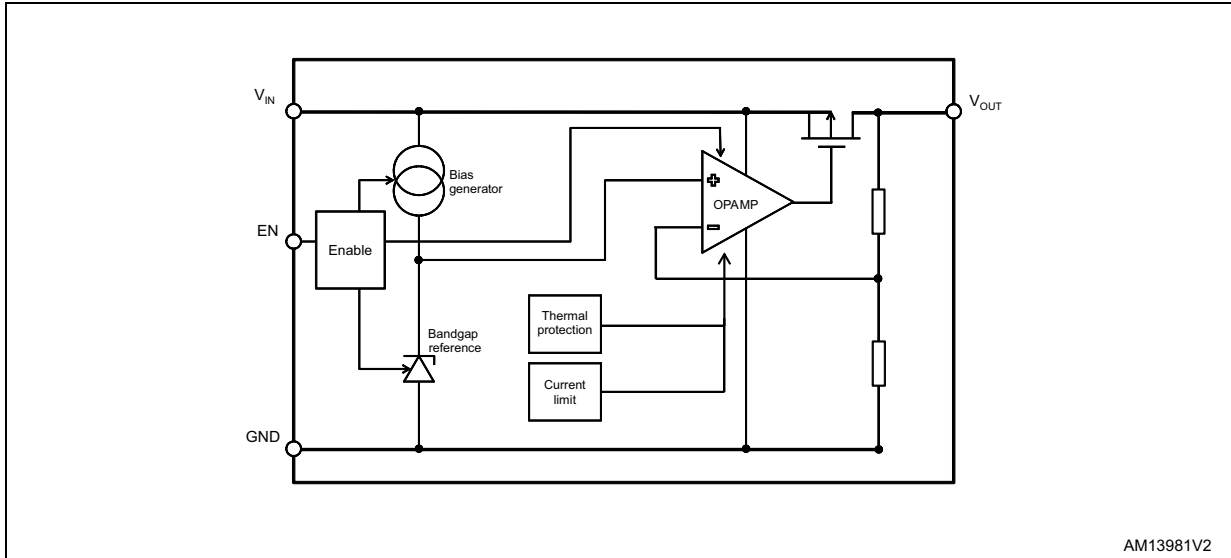
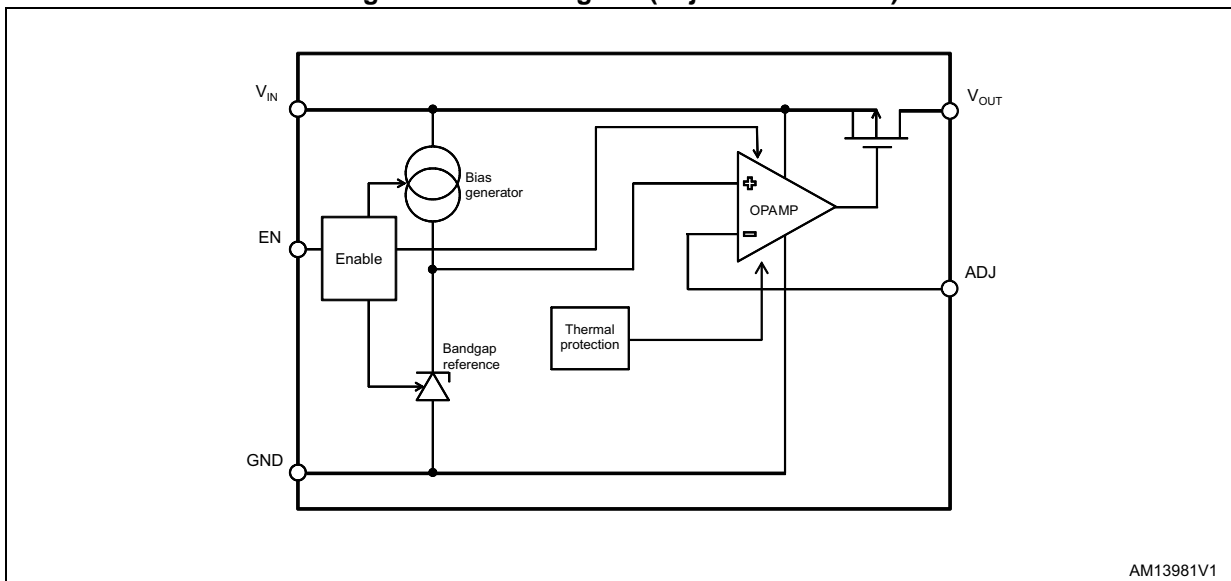
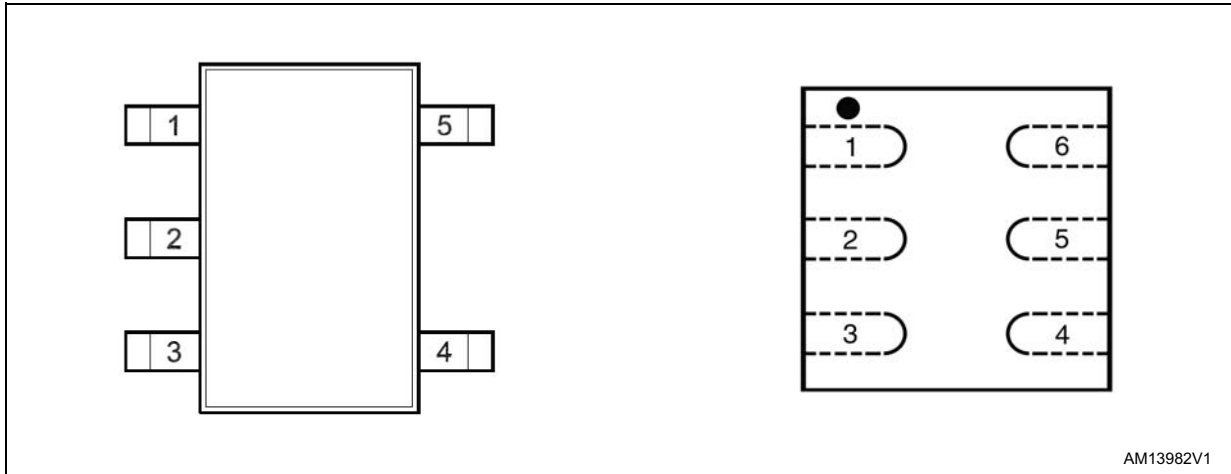


Figure 2. Block diagram (adjustable version)



## 2 Pin configuration

Figure 3. Pin connection (top view)



AM13982V1

Table 1. Pin description (SOT23-5L, SOT323-5L)

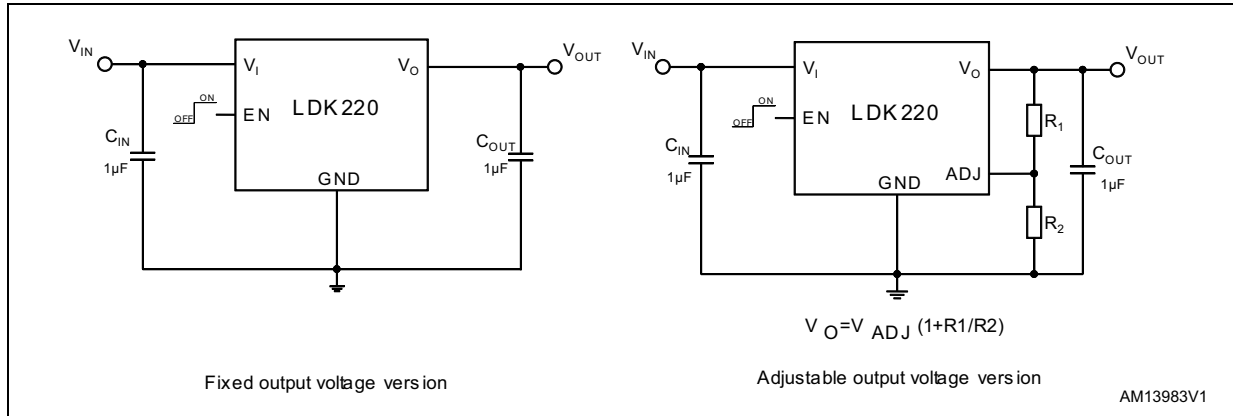
Pin	Symbol	Function
1	IN	Input voltage of the LDO
2	GND	Common ground
3	EN	Enable pin logic input: low = shutdown, high = active
4	ADJ/NC	Adjustable pin on ADJ version, not connected on fixed version
5	OUT	Output voltage of the LDO

Table 2. Pin description (DFN6)

Pin n°	Symbol	Function
1	OUT	Output voltage of the LDO
2	N/C	Not connected
3	ADJ/NC	Adjustable pin on ADJ version, not connected in fixed version
4	EN	Enable pin logic input: low = shutdown, high = active
5	GND	Common ground
6	IN	Input voltage of the LDO

### 3 Typical application

Figure 4. Typical application circuits



## 4 Maximum ratings

**Table 3. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{IN}$	DC input voltage	- 0.3 to 14	V
$V_{OUT}$	DC output voltage	- 0.3 to $V_I + 0.3$	V
$V_{EN}$	Enable input voltage	- 0.3 to $V_I + 0.3$	V
$V_{ADJ}$	ADJ pin voltage	- 0.3 to 2	V
$I_{OUT}$	Output current	Internally limited	mA
$P_D^{(1)}$	Power dissipation	500	mW
$T_{STG}$	Storage temperature range	- 65 to 150	°C
$T_{OP}$	Operating junction temperature range	- 40 to 125	°C

1. Maximum power dissipation has to be calculated taking into account the package thermal performance.

*Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. All values are referred to GND.*

**Table 4. Thermal data**

Symbol	Parameter	SOT23-5L	SOT323-5L	DFN-6	Unit
$R_{thJA}$	Thermal resistance junction-ambient	160	246	237	°C/W
$R_{thJC}$	Thermal resistance junction-case	68	134	104	°C/W

## 5 Electrical characteristics

$T_J = 25\text{ °C}$ ,  $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = V_{IN}$ , unless otherwise specified.

**Table 5. LDK220 electrical characteristics for fixed output version**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Operating input voltage		2.5		13.2	V
$V_{OUT}$	$V_{OUT}$ accuracy	$I_{OUT} = 1\text{ mA}$ , $T_J = 25\text{ °C}$	-2.0		2.0	%
		$I_{OUT} = 1\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$	-3.0		3.0	%
$\Delta V_{OUT}$	Static line regulation	$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 13.2\text{ V}$ , $I_{OUT} = 1\text{ mA}$		0.001	0.05	%/V
$\Delta V_{OUT}$	Static load regulation	$I_{OUT} = 1\text{ mA}$ to 200 mA		0.001	0.003	%/mA
$V_{DROP}$	Dropout voltage <sup>(1)</sup>	$I_{OUT} = 100\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$		100		mV
		$I_{OUT} = 200\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$ $40\text{ °C} < T_J < 125\text{ °C}$		200	350	
$e_N$	Output noise voltage	10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$		20		$\mu\text{V}_{RMS}/\text{V}$
SVR	Supply voltage rejection	$V_{IN} = V_{OUTNOM} + 0.5\text{ V} + /-V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ frequency = 120 Hz to 1 kHz $I_{OUT} = 10\text{ mA}$		55		dB
		$V_{IN} = V_{OUTNOM} + 0.5\text{ V} + /-V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ frequency = 10 kHz $I_{OUT} = 10\text{ mA}$		50		
$I_Q$	Quiescent current	$V_{IN} = V_{OUT} + 1\text{ V}$ $I_{OUT} = 0\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		40	60	$\mu\text{A}$
		$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 13.2\text{ V}$ <sup>(2)</sup> $I_{OUT} = 200\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		55	100	
		$V_{IN}$ input current in off mode: $V_{EN} = \text{GND}$ , $T_J = 25\text{ °C}$		0.1	1	
$I_{SC}$	Short-circuit current <sup>(2)</sup>	$R_L = 0$		400		mA
$V_{EN}$	Enable input logic low	$V_{IN} = 2.5\text{ V}$ to 13.2 V, $-40\text{ °C} < T_J < 125\text{ °C}$			0.4	V
	Enable input logic high	$V_{IN} = 2.5\text{ V}$ to 13.2 V, $-40\text{ °C} < T_J < 125\text{ °C}$	1.2			
$I_{EN}$	Enable pin input current	$V_{EN} = V_{IN}$		0.1	100	nA
$T_{SHDN}$	Thermal shutdown			160		$\text{°C}$
	Hysteresis			20		
$C_{OUT}$	Output capacitor	Capacitance (see <a href="#">Section 6: Typical characteristics</a> )	1		22	$\mu\text{F}$

1. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value.
2. The maximum current has to be limited according to the maximum power dissipation.

$T_J = 25\text{ °C}$ ,  $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = V_{IN}$ , unless otherwise specified.

**Table 6. LDK220 electrical characteristics for adjustable version**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Operating input voltage		2.5		13.2	V
$V_{ADJ}$	$V_{ADJ}$ accuracy	$I_{OUT} = 1\text{ mA}$ , $T_J = 25\text{ °C}$	-2%	1.19	+2%	mV
		$I_{OUT} = 1\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$	-3.0	1.185	3.0	%
$\Delta V_{OUT}$	Static line regulation	$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 13.2\text{ V}$ , $I_{OUT} = 1\text{ mA}$		0.001	0.05	%/V
$\Delta V_{OUT}$	Static load regulation	$I_{OUT} = 1\text{ mA}$ to 200 mA		0.0002	0.003	%/mA
$V_{DROP}$	Dropout voltage <sup>(1)</sup>	$I_{OUT} = 100\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$		100		mV
		$I_{OUT} = 200\text{ mA}$ , $V_{OUT} = 3.3\text{ V}$ $40\text{ °C} < T_J < 125\text{ °C}$ ,		200	350	
$e_N$	Output noise voltage	10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$		100		$\mu\text{V}_{RMS}/\sqrt{\text{V}}$
$I_{ADJ}$	Adjust pin current				1	$\mu\text{A}$
SVR	Supply voltage rejection	$V_{IN} = V_{OUTNOM} + 0.5\text{ V} + /-V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ frequency=120 Hz to 1 kHz $I_{OUT} = 10\text{ mA}$		60		dB
		$V_{IN} = V_{OUTNOM} + 0.5\text{ V} + /-V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ frequency=10 kHz $I_{OUT} = 10\text{ mA}$		45		
$I_Q$	Quiescent current	$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 13.2\text{ V}$ $I_{OUT} = 0\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		40	60	$\mu\text{A}$
		$V_{OUT} + 1\text{ V} \leq V_{IN} \leq 13.2\text{ V}^{(2)}$ $I_{OUT} = 200\text{ mA}$ , $-40\text{ °C} < T_J < 125\text{ °C}$		55	100	
		$V_{IN}$ input current in off mode: $V_{EN} = \text{GND}$ , $T_J = 25\text{ °C}$		0.1	1	
$I_{SC}$	Short-circuit current <sup>(2)</sup>	$R_L = 0$		400		mA
$V_{EN}$	Enable input logic low	$V_{IN} = 2.5\text{ V}$ to 13.2 V, $-40\text{ °C} < T_J < 125\text{ °C}$			0.4	V
	Enable input logic high	$V_{IN} = 2.5\text{ V}$ to 13.2 V, $-40\text{ °C} < T_J < 125\text{ °C}$	1.2			
$I_{EN}$	Enable pin input current	$V_{EN} = V_{IN}$		0.1	100	nA
$T_{SHDN}$	Thermal shutdown			160		$\text{°C}$
	Hysteresis			20		
$C_{OUT}$	Output capacitor	Capacitance (see <a href="#">Section 6: Typical characteristics</a> )	1		22	$\mu\text{F}$

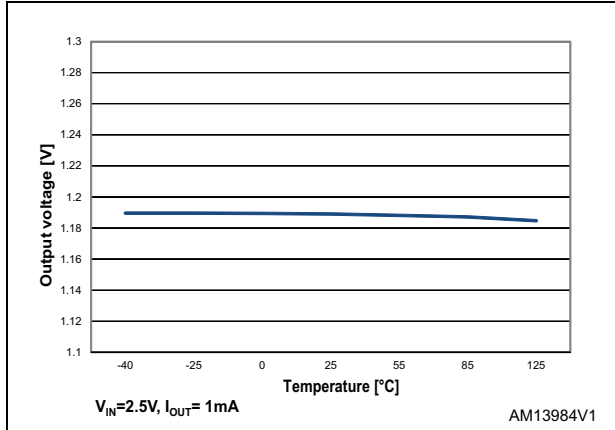
- Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value.
- The maximum current has to be limited according to the maximum power dissipation.



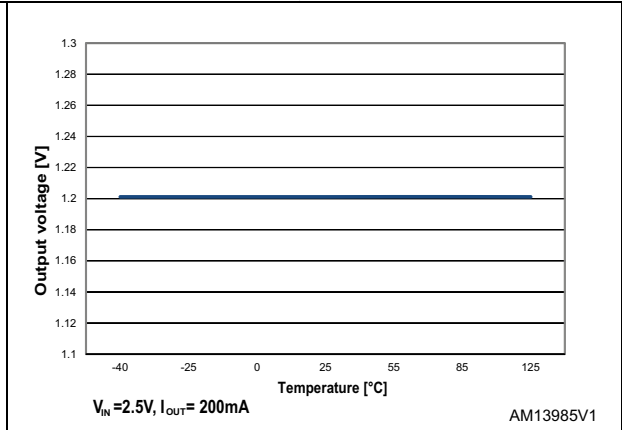
## 6 Typical characteristics

( $C_{IN} = C_{OUT} = 1 \mu F$ ,  $V_{EN}$  to  $V_{IN}$ )

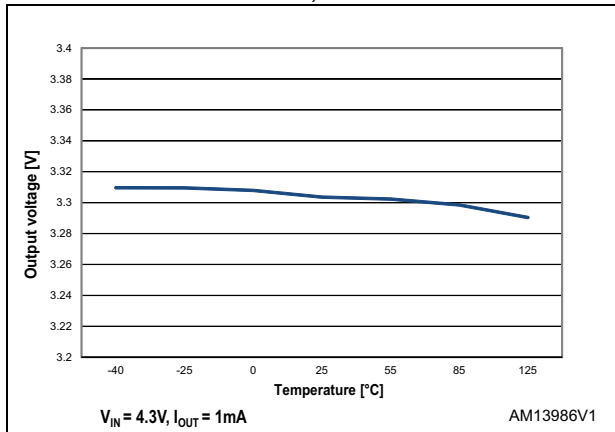
**Figure 5. Output voltage vs. temperature**  
( $V_{OUT}=V_{ADJ}$ ,  $I_{OUT}=1 \text{ mA}$ )



**Figure 6. Output voltage vs. temperature**  
( $V_{OUT}=V_{ADJ}$ ,  $I_{OUT}=200 \text{ mA}$ )



**Figure 7. Output voltage vs. temperature**  
( $V_{OUT}=3.3 \text{ V}$ ,  $I_{OUT}=1 \text{ mA}$ )



**Figure 8. Output voltage vs. temperature**  
( $V_{OUT}=3.3 \text{ V}$ ,  $I_{OUT}=200 \text{ mA}$ )

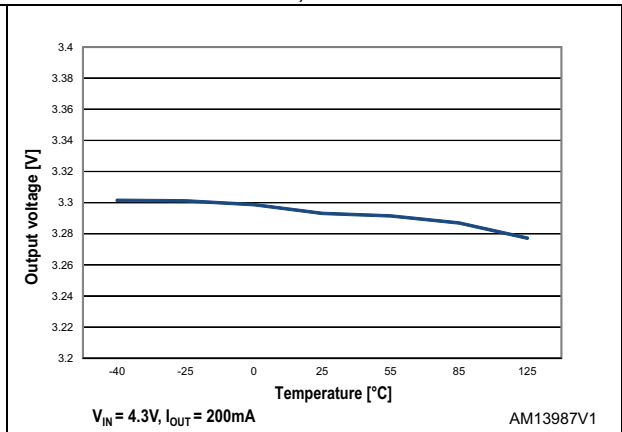


Figure 9. Short-circuit current vs. temperature

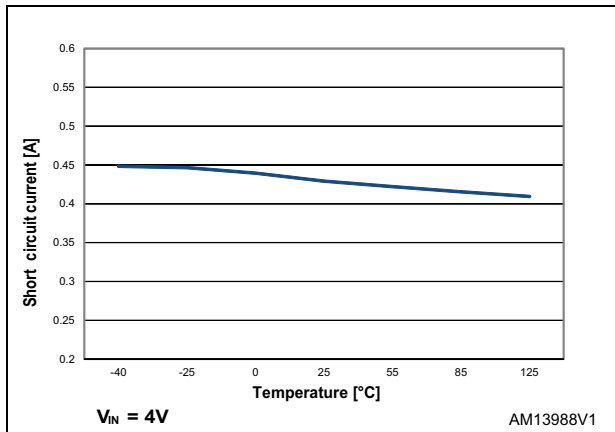


Figure 10. Line regulation vs. temperature ( $V_{OUT}=3.3V$ )

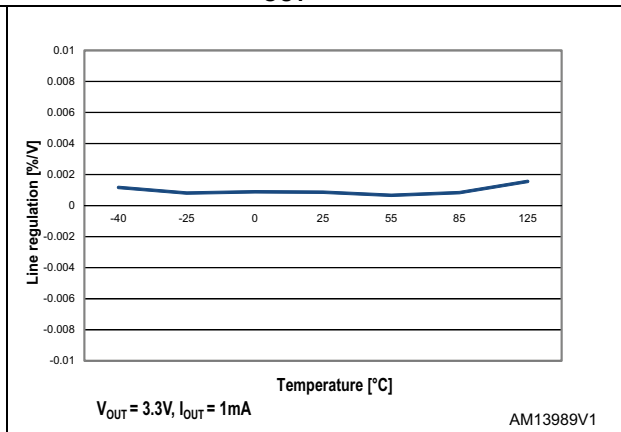


Figure 11. Line regulation vs. temperature ( $V_{OUT}=V_{ADJ}$ )

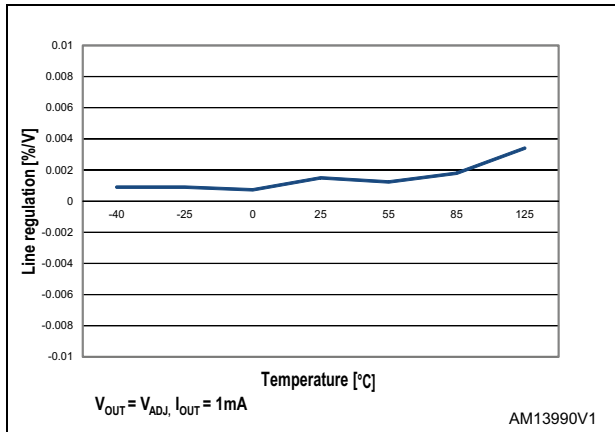


Figure 12. Load regulation vs. temperature ( $V_{OUT}=3.3V$ )

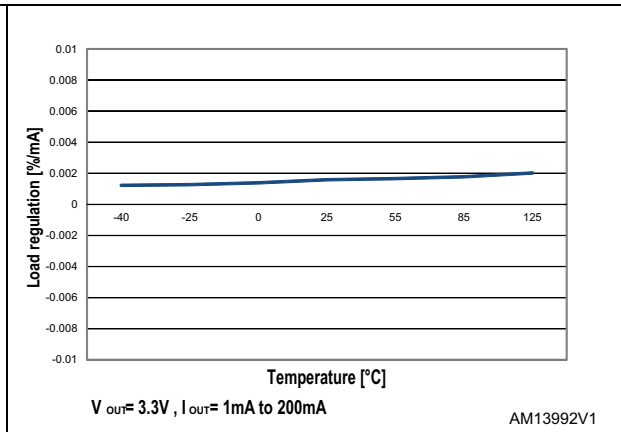


Figure 13. Load regulation vs. temperature ( $V_{OUT}=V_{ADJ}$ )

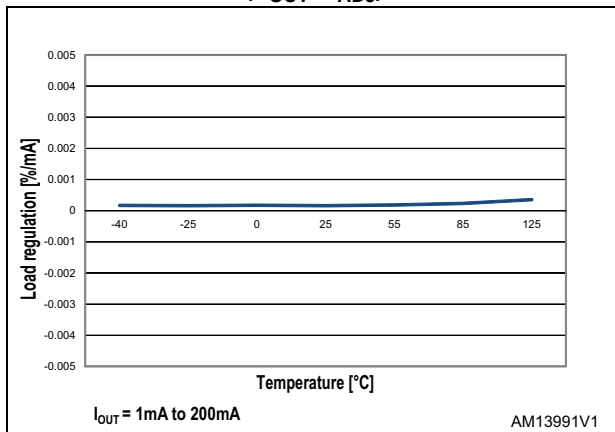


Figure 14. Enable thresholds vs. temperature

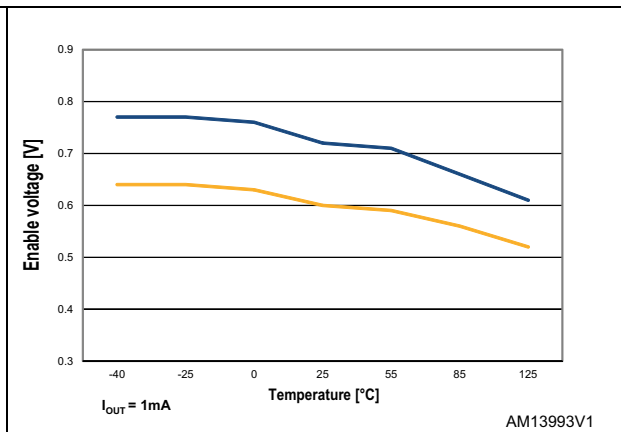


Figure 15. Dropout voltage vs. temperature

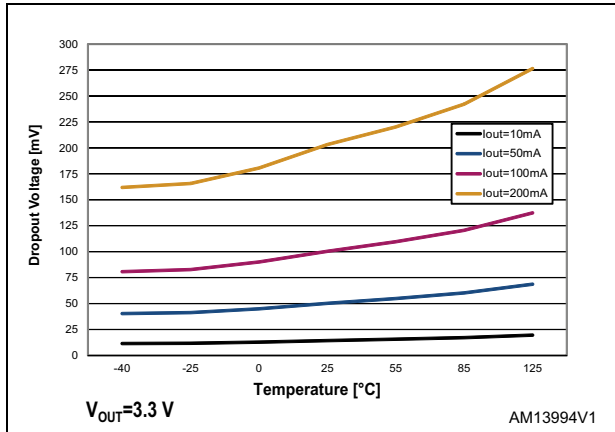


Figure 16. Quiescent current vs. temperature ( $I_{OUT}=0\text{ mA}$ )

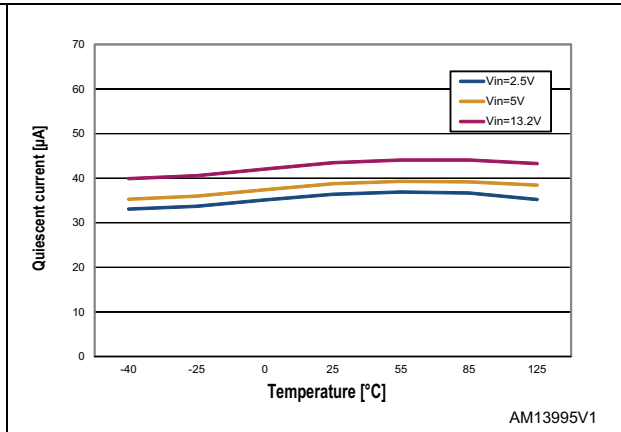


Figure 17. Quiescent current vs. temperature ( $I_{OUT}=200\text{ mA}$ )

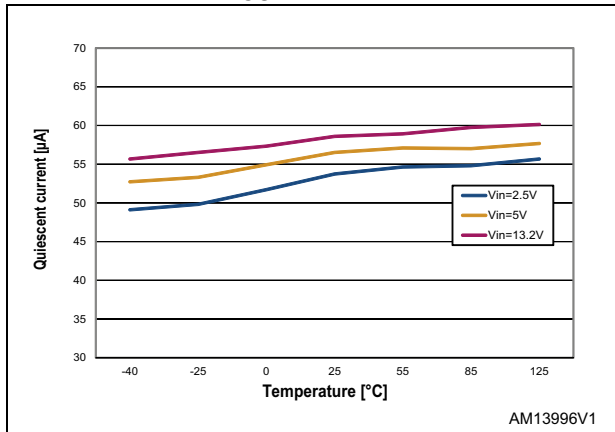


Figure 18. Off-state current vs. temperature

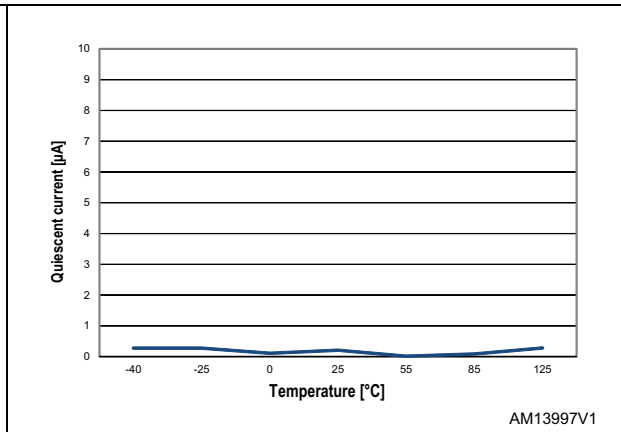


Figure 19. SVR vs. frequency ( $V_{OUT}=3.3\text{ V}$ )

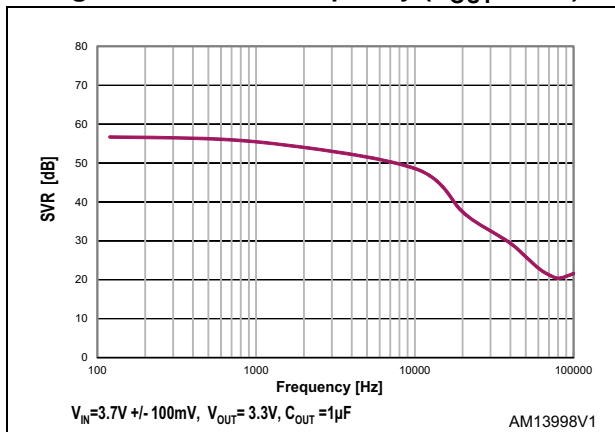


Figure 20. SVR vs. frequency ( $V_{OUT}=V_{ADJ}$ )

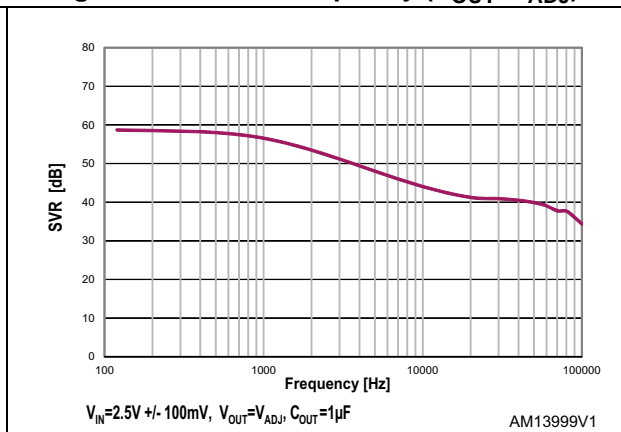


Figure 21. Output noise spectral density

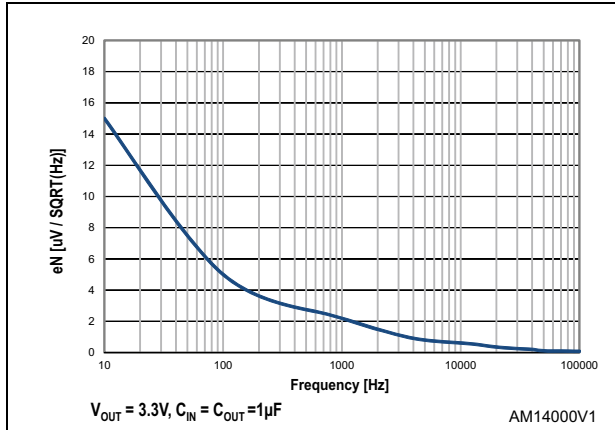


Figure 22. Stability vs. ( $C_{OUT}$ , ESR)

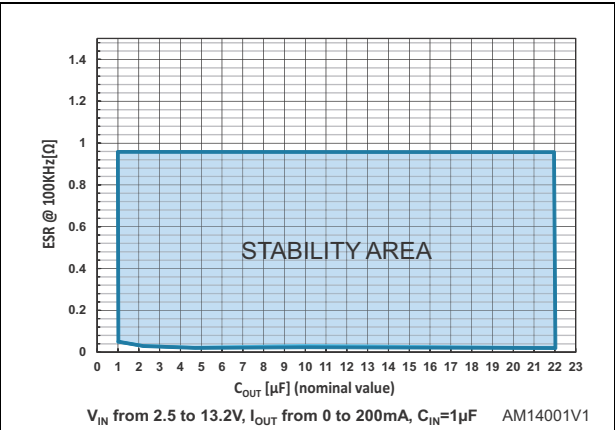


Figure 23. Startup with enable ( $V_{OUT} = 3.3 V$ )

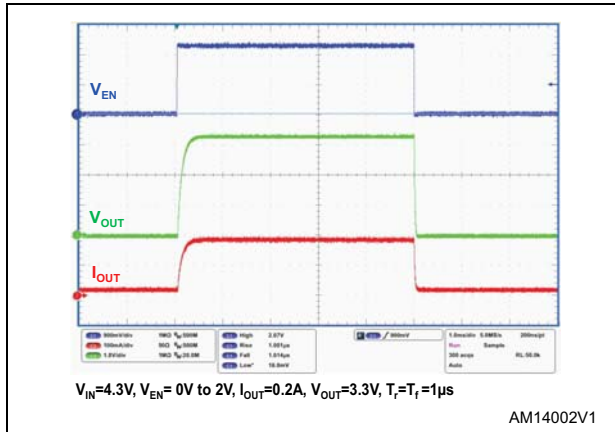


Figure 24. Startup with enable ( $V_{OUT} = V_{ADJ}$ )

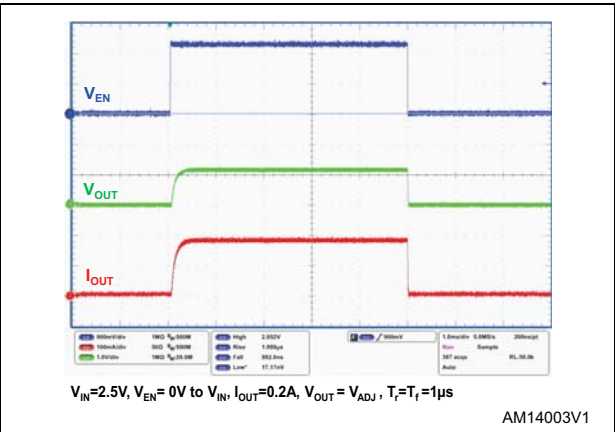


Figure 25. Turn-on time ( $V_{OUT} = 3.3 V$ )

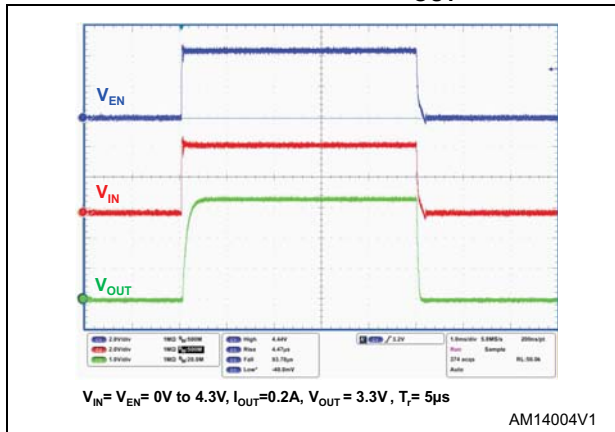


Figure 26. Turn-on time ( $V_{OUT} = V_{ADJ}$ )

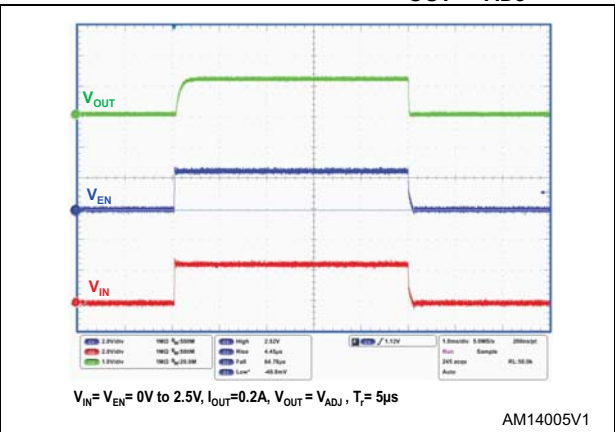


Figure 27. Line transient ( $V_{OUT}=3.3\text{ V}$ )

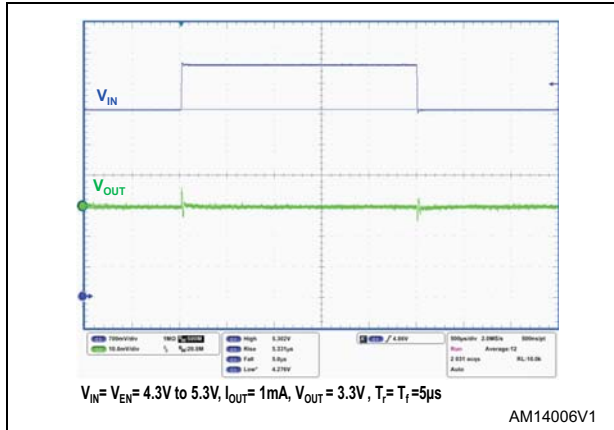


Figure 28. Line transient ( $V_{OUT}=V_{ADJ}$ )

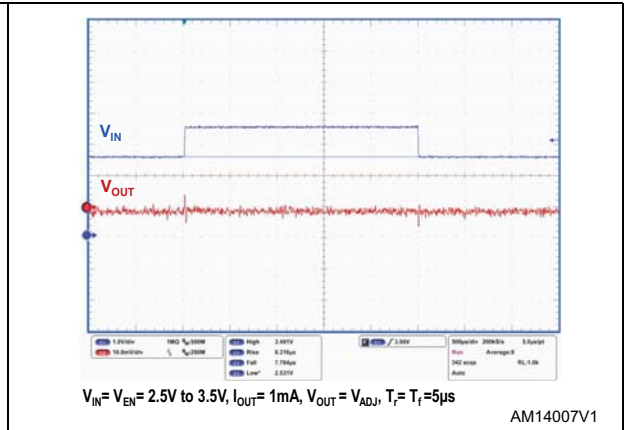


Figure 29. Load transient ( $V_{OUT}=3.3\text{ V}$ )

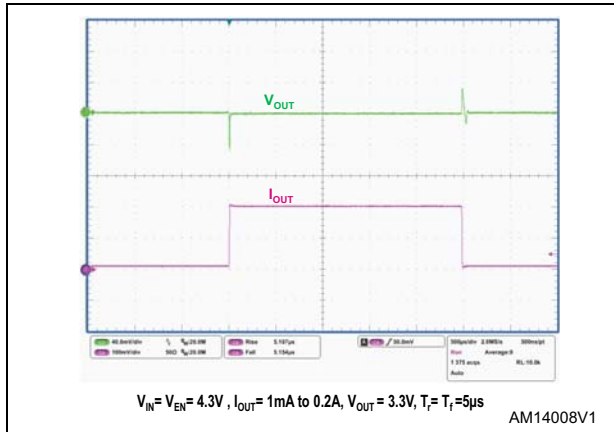
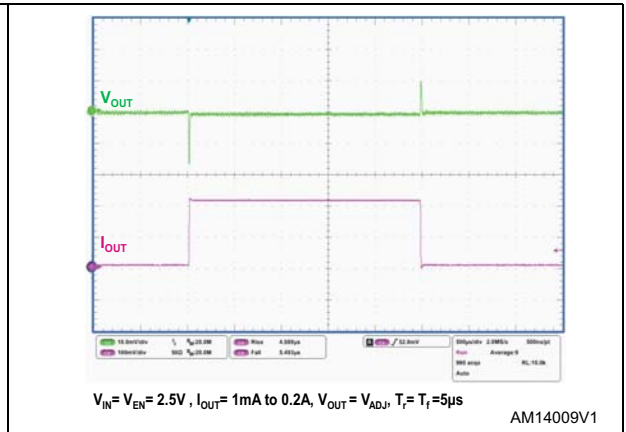


Figure 30. Load transient ( $V_{OUT}=V_{ADJ}$ )



## 7 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.

Figure 31. SOT23-5L drawings

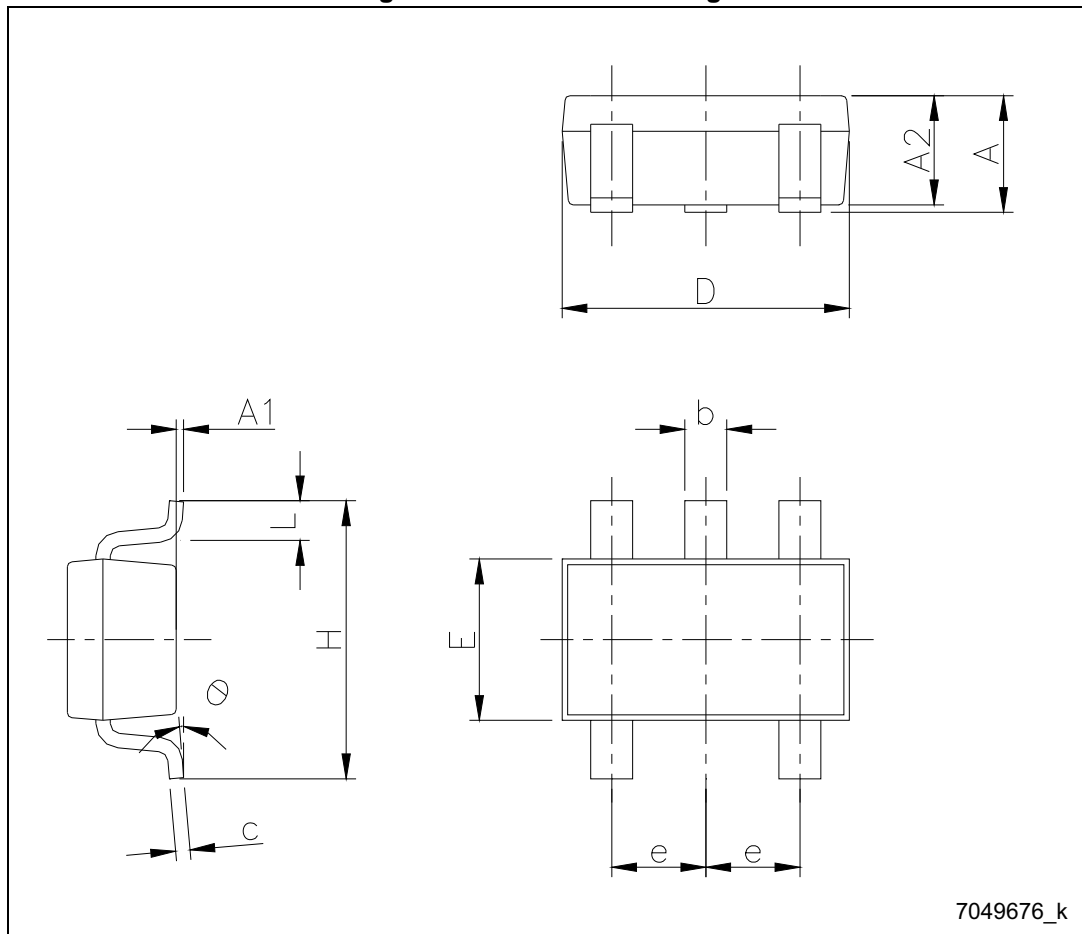


Table 7. SOT23-5L mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.90		1.45
A1	0		0.15
A2	0.90		1.30
b	0.30		0.50
c	2.09		0.20
D		2.95	
E		1.60	
e		0.95	
H		2.80	
L	0.30		0.60
$\theta$	0		8

Figure 32. SOT23-5L recommended footprint (dimensions in mm)

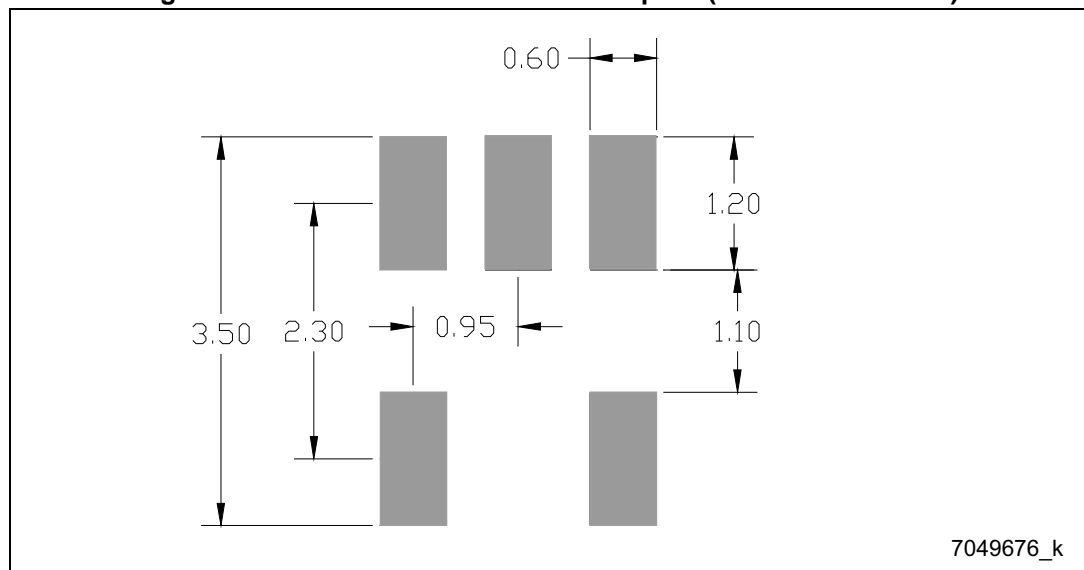


Figure 33. SOT323-5L drawings

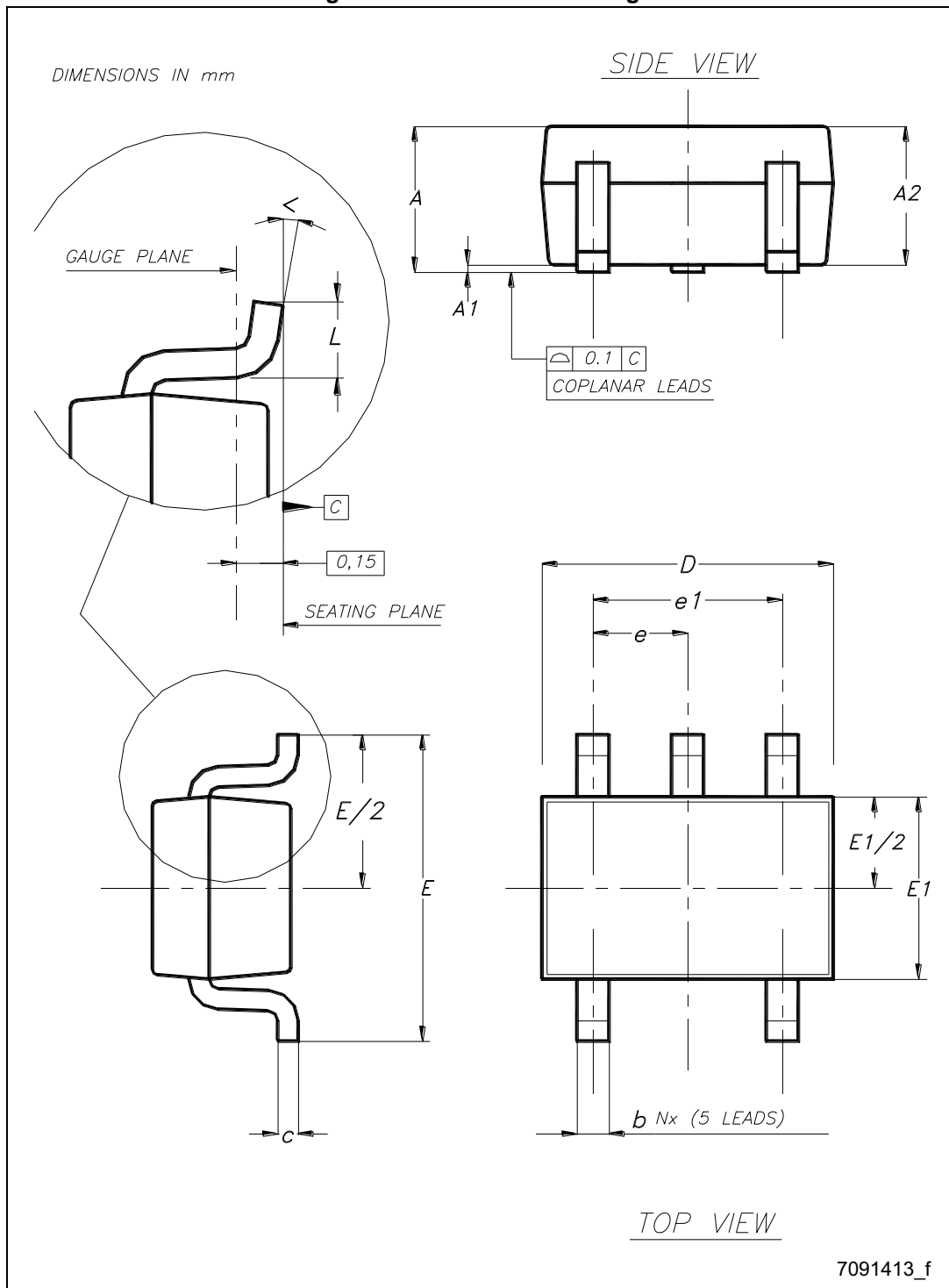
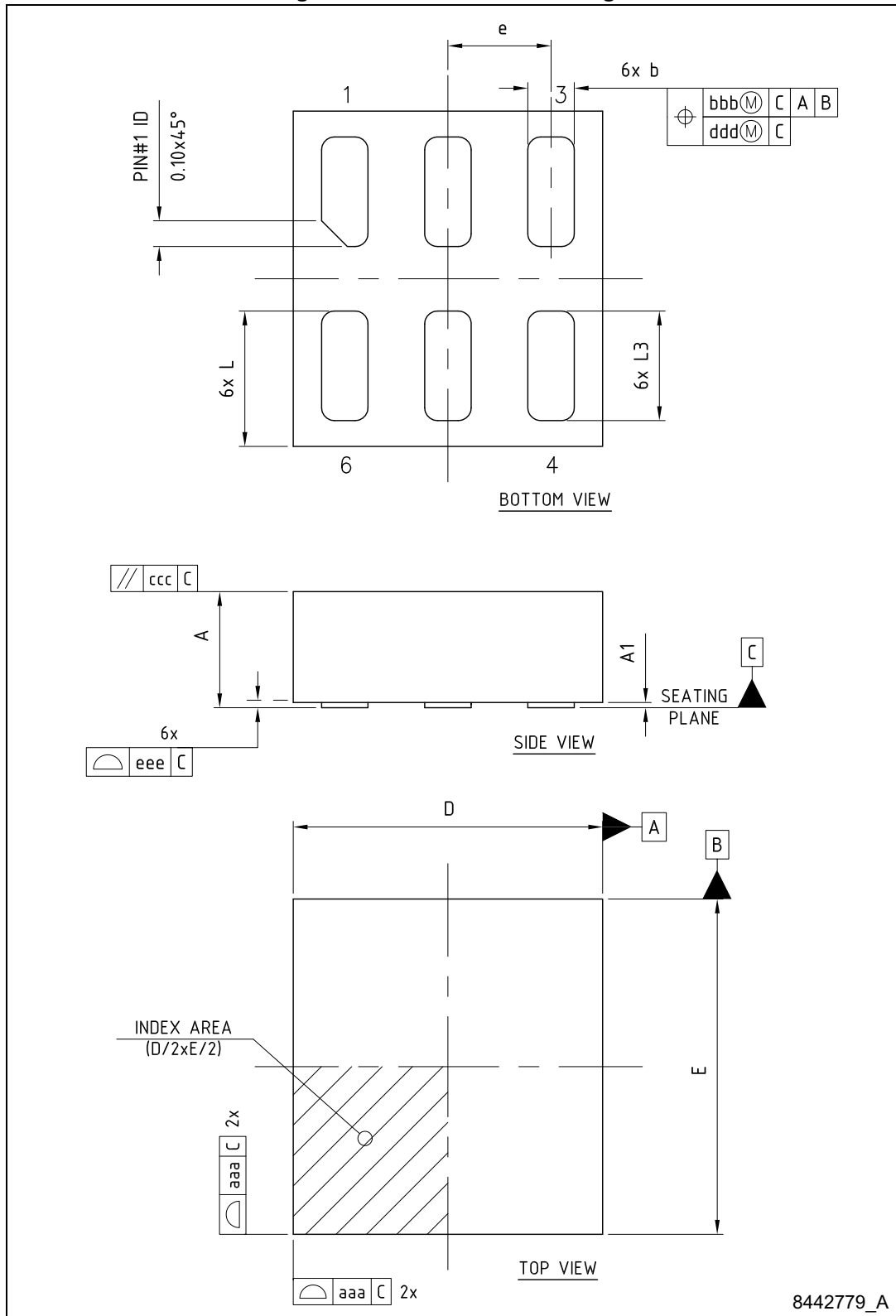




Table 8. SOT323-5L mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.10
A1	0		0.10
A2	0.80	0.90	1
b	0.15		0.30
c	0.10		0.22
D	1.80	2	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e		0.65	
e1		1.30	
L	0.26	0.36	0.46
<	0°		8°

Figure 34. DFN6-1.2x1.3 drawings

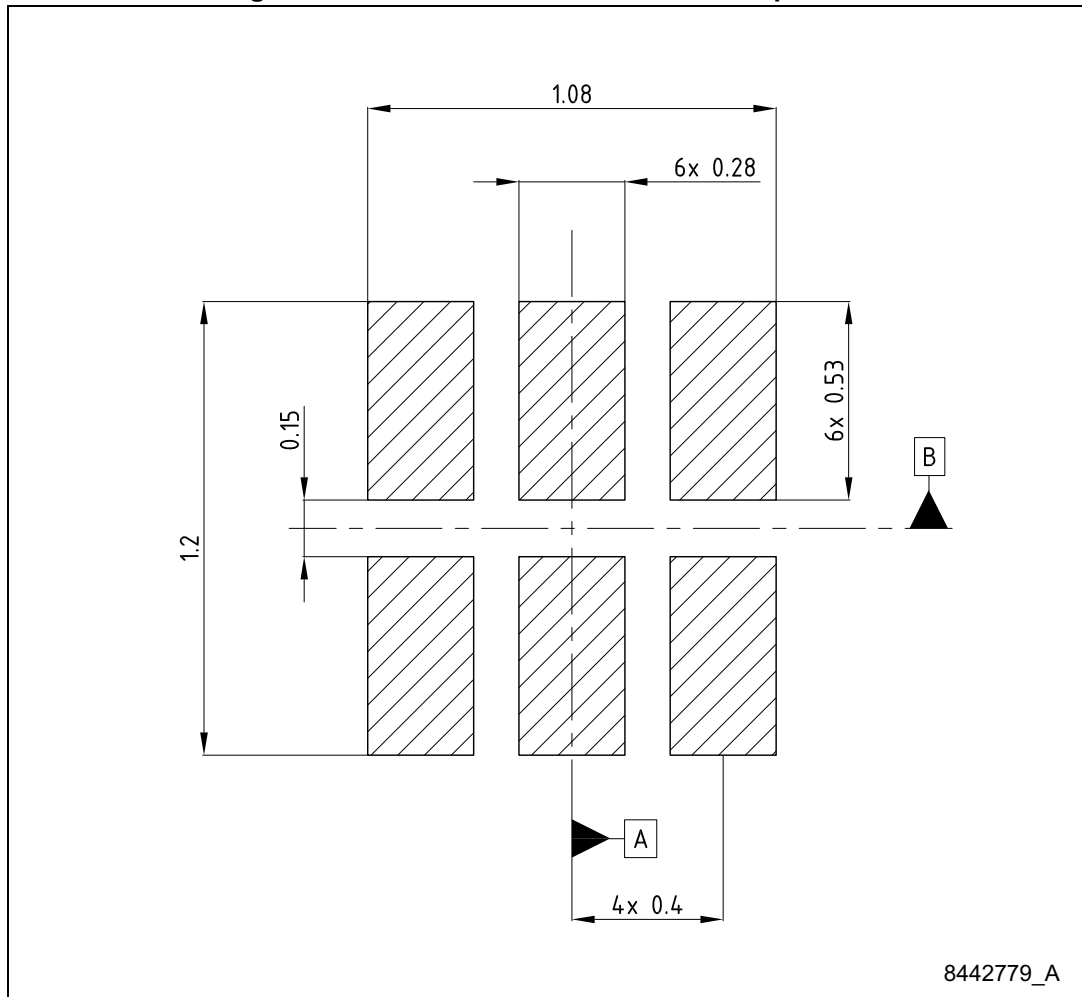


8442779\_A

Table 9. DFN6-1.2x1.3 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.41	0.45	0.50
A1	0.00	0.02	0.05
D	-	1.20	-
E	-	1.30	-
e	-	0.40	-
b	0.15	0.18	0.25
L	0.475	0.525	0.575
L3	0.375	0.425	0.475
aaa	-	0.05	-
bbb	-	0.10	-
ccc	-	0.05	-
ddd	-	0.05	-
eee	-	0.05	-

Figure 35. DFN6-1.2x1.3 recommended footprint (a)



a. Dimensions are in mm.

## 8 Ordering information

Table 10. Order codes

SOT323-5L	SOT23-5L	DFN6	Output voltage (V)
LDK220C12R	LDK220M12R	LDK220PU12R	1.2
LDK220C13R	LDK220M13R	LDK220PU13R	1.3
LDK220C15R	LDK220M15R	LDK220PU15R	1.5
LDK220C18R	LDK220M18R	LDK220PU18R	1.8
LDK220C25R	LDK220M25R	LDK220PU25R	2.5
LDK220C27R	LDK220M27R	LDK220PU27R	2.7
LDK220C28R	LDK220M28R	LDK220PU28R	2.8
LDK220C30R	LDK220M30R	LDK220PU30R	3
LDK220C31R	LDK220M31R	LDK220PU31R	3.1
LDK220C32R	LDK220M32R	LDK220PU32R	3.2
LDK220C33R	LDK220M33R	LDK220PU33R	3.3
LDK220C36R	LDK220M36R	LDK220PU36R	3.6
LDK220C40R	LDK220M40R	LDK220PU40R	4
LDK220C42R	LDK220M42R	LDK220PU42R	4.2
LDK220C50R	LDK220M50R	LDK220PU50R	5
LDK220C60R	LDK220M60R	LDK220PU60R	6
LDK220C85R	LDK220M85R	LDK220PU85R	8.5
LDK220C90R	LDK220M90R	LDK220PU90R	9
LDK220C-R	LDK220M-R	LDK220PU-R	adj

## 9 Revision history

Table 11. Document revision history

Date	Revision	Changes
19-Mar-2014	1	Initial release.

**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 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.

© 2014 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](http://www.st.com)

