



## LDS3985xx

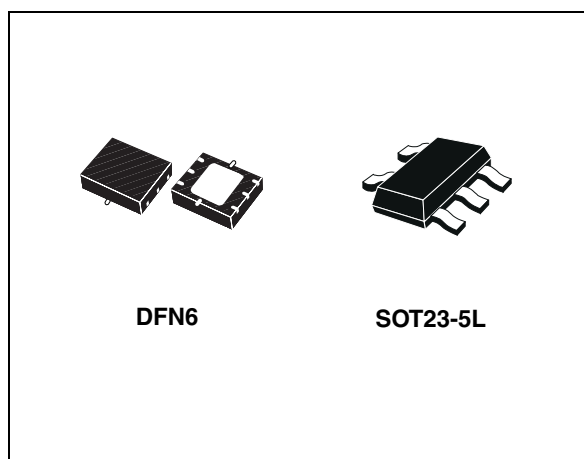
Ultra low drop-low noise BiCMOS 300 mA voltage regulator for use with very low ESR output capacitor

### Features

- Input voltage from 2.5 V to 6 V
- Stable with low ESR ceramic capacitors
- Ultra low dropout voltage (150 mV typ. at 300 mA load, 0.4 mV typ. at 1 mA load)
- Very low quiescent current (85  $\mu$ A typ. at no load, 200  $\mu$ A typ. at 300 mA load; max 1.5  $\mu$ A in off mode)
- Guaranteed output current up to 300 mA
- Wide range of output voltage:
  - from 1.25 V to 5.0 V
- Fast turn-on time: typ. 240  $\mu$ s
  - [ $C_O = 2.2 \mu$ F,  $C_{BYP} = 33$  nF and  $I_O = 1$  mA]
- Logic-controlled electronic shutdown
- Internal current and thermal limit
- Output low noise voltage 30  $\mu$ V<sub>RMS</sub> over 10 Hz to 100 kHz
- SVR of 55 dB at 1 kHz, 50 dB at 10 kHz
- Temperature range: - 40 °C to 125 °C

### Description

The LDS3985xx provides up to 300 mA, from 2.5 V to 6 V input voltage. It is stable with ceramic and high quality tantalum capacitor. The ultra low drop voltage, low quiescent current and low noise



makes it suitable for low power applications and in battery powered systems. Regulator ground current increases only slightly in dropout, further prolonging the battery life. Shutdown logic control function is available, this means that when the device is used as local regulator, it is possible to put a part of the board in standby, decreasing the total power consumption. Typical applications are in mobile phone and similar battery powered wireless systems, portable information appliances.

**Table 1. Device summary**

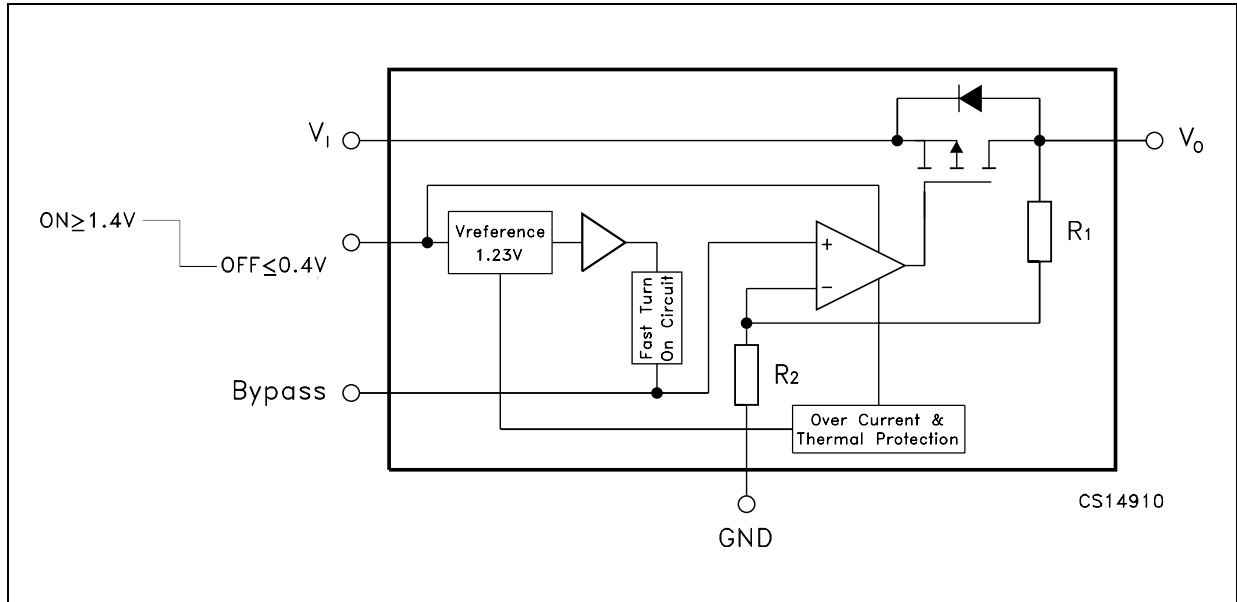
Part numbers	Output voltages
LDS3985XX15	1.5 V
LDS3985XX18	1.8 V
LDS3985XX25	2.5 V
LDS3985XX28	2.8 V
LDS3985XX30	3.0 V
LDS3985XX33	3.3 V
LDS3985XX50	5.0 V

# Contents

1	Diagram .....	3
2	Pin configuration .....	4
3	Typical application .....	5
4	Maximum ratings .....	6
5	Electrical characteristics .....	7
6	Typical performance characteristics .....	9
7	Package mechanical data .....	12
8	Order codes .....	18
9	Revision history .....	19

# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connections (top view for SOT23-5L, top through view for DFN6)

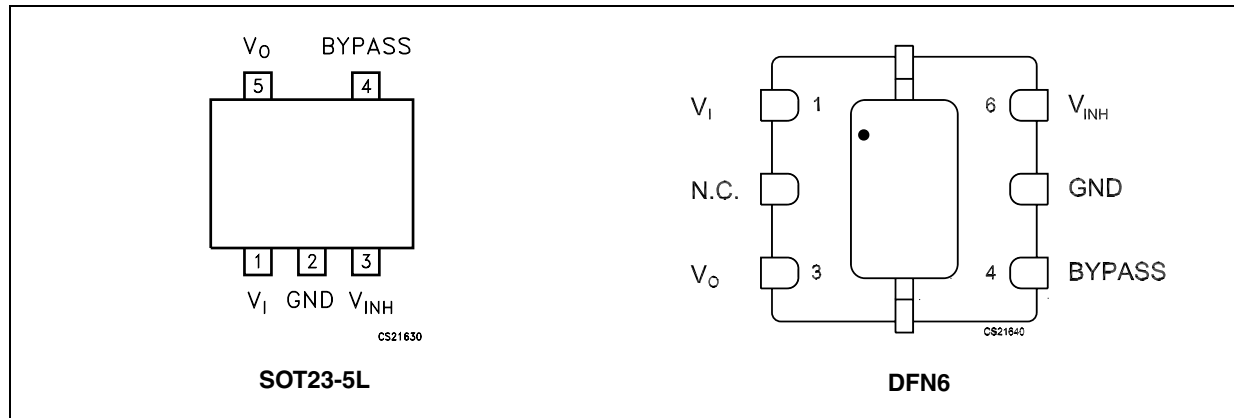
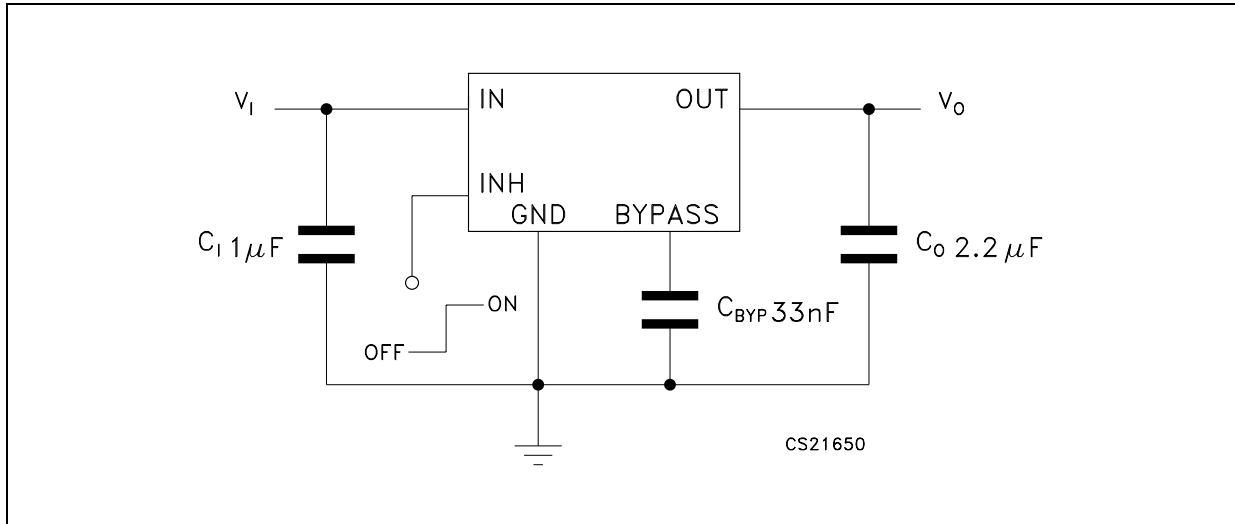


Table 2. Pin description

Pin n° for SOT23-5L	Pin n° for DFN6	Symbol	Name and function
1	1	$V_I$	Input voltage of the LDO
2	5	GND	Common ground
3	6	$V_{INH}$	Inhibit input voltage: on mode when $V_{INH} \geq 1.2$ V, off mode when $V_{INH} \leq 0.4$ V (Do not leave floating, not internally pulled down/up)
4	4	BYPASS	Bypass pin: connect an external capacitor (usually 10 nF) to minimize noise voltage
5	3	$V_O$	Output voltage of the LDO
-	2	N.C.	Not connect

### 3 Typical application

Figure 3. Typical application circuit



## 4 Maximum ratings

**Table 3. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_I$	DC input voltage	-0.3 to 6 <sup>(1)</sup>	V
$V_O$	DC output voltage	-0.3 to $V_I+0.3$	V
$V_{INH}$	INHIBIT input voltage	-0.3 to $V_I+0.3$	V
$I_O$	Output current	Internally limited	
$P_D$	Power dissipation	Internally limited	
$T_{STG}$	Storage temperature range	-65 to 150	°C
$T_{OP}$	Operating junction temperature range	-40 to 125	°C

1. The input pin is able to withstand non repetitive spike of 6.5 V for 200 ms.

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

**Table 4. Thermal data**

Symbol	Parameter	SOT23-5L	DFN6	Unit
$R_{thJC}$	Thermal resistance junction-case	81	10	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	255	55	°C/W

## 5 Electrical characteristics

$T_J = 25\text{ }^\circ\text{C}$ ,  $V_I = V_{O(NOM)} + 0.5\text{ V}$ ,  $C_I = 1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$ ,  $C_{BYP} = 33\text{ nF}$ ,  $I_O = 1\text{ mA}$ ,  
 $V_{INH} = 1.4\text{ V}$ , unless otherwise specified.

**Table 5. Electrical characteristics for LDS3985xx**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_I$	Operating input voltage		2.5		6	V
$V_O$	Output voltage < 2.5 V	$I_O = 1\text{ mA}$	-50		50	mV
		$T_J = -40\text{ to }125\text{ }^\circ\text{C}$	-75		75	
$V_O$	Output voltage $\geq 2.5\text{ V}$	$I_O = 1\text{ mA}$	-2		2	% of $V_{O(NOM)}$
		$T_J = -40\text{ to }125\text{ }^\circ\text{C}$	-3		3	
$\Delta V_O$	Line regulation <sup>(1)</sup>	$V_I = V_{O(NOM)} + 0.5\text{ to }6\text{ V}$ , $T_J = -40\text{ to }125\text{ }^\circ\text{C}$	-0.1		0.1	%V
		$V_O = 4.7\text{ to }5\text{ V}$	-0.19		0.19	
$\Delta V_O$	Load regulation	$I_O = 1\text{ mA to }300\text{ mA}$ , $V_O \leq 2.5\text{ V}$ $T_J = -40\text{ to }125\text{ }^\circ\text{C}$		0.005	0.01	%/mA
$\Delta V_O$	Load regulation	$I_O = 1\text{ mA to }300\text{ mA}$ , $V_O \geq 2.5\text{ V}$ $T_J = -40\text{ to }125\text{ }^\circ\text{C}$		0.0008	0.004	%/mA
$\Delta V_O$	Output AC line regulation <sup>(2)</sup>	$V_I = V_{O(NOM)} + 1\text{ V}$ , $I_O = 300\text{ mA}$ , $t_R = t_F = 30\text{ }\mu\text{s}$		5		mV <sub>PP</sub>
$I_Q$	Quiescent current ON MODE: $V_{INH} = 1.24\text{ V}$	$I_O = 0$		85		$\mu\text{A}$
		$I_O = 0$ , $T_J = -40\text{ to }125\text{ }^\circ\text{C}$			150	
		$I_O = 0\text{ to }300\text{ mA}$		200		
		$I_O = 0\text{ to }300\text{ mA}$ , $T_J = -40\text{ to }125\text{ }^\circ\text{C}$			300	
	OFF MODE: $V_{INH} = 0.4\text{ V}$			0.003		
		$T_J = -40\text{ to }125\text{ }^\circ\text{C}$			1.5	
$V_{DROP}$	Dropout voltage <sup>(3)</sup>	$I_O = 1\text{ mA}$		0.4		mV
		$I_O = 1\text{ mA}$ , $T_J = -40\text{ to }125\text{ }^\circ\text{C}$			2	
		$I_O = 150\text{ mA}$		60		
		$I_O = 150\text{ mA}$ , $T_J = -40\text{ to }125\text{ }^\circ\text{C}$			100	
		$I_O = 300\text{ mA}$		150		
		$I_O = 300\text{ mA}$ , $T_J = -40\text{ to }125\text{ }^\circ\text{C}$			250	
$I_{SC}$	Short circuit current	$R_L = 0$		600		mA
SVR	Supply voltage rejection	$V_I = V_{O(NOM)} + 0.25\text{ V} \pm$ $V_{RIPPLE} = 0.1\text{ V}$ , $I_O = 50\text{ mA}$ For $V_{O(NOM)} < 2.5\text{ V}$ , $V_I = 2.55\text{ V}$	$f = 1\text{ kHz}$		55	dB
			$f = 10\text{ kHz}$		50	
$I_{O(PK)}$	Peak output current	$V_O \geq V_{O(NOM)} - 5\%$	300	550		mA

## Electrical characteristics

## LDS3985xx

Table 5. Electrical characteristics for LDS3985xx (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{INH}$	Inhibit input logic Low	$V_I = 2.5\text{ V to }6\text{ V}, T_J = -40\text{ to }125\text{ }^\circ\text{C}$			0.4	V
	Inhibit input logic High		1.4			
$I_{INH}$	Inhibit input current	$V_{INH} = 0.4\text{ V}, V_I = 6\text{ V}$		$\pm 1$		nA
eN	Output noise voltage	$B_W = 10\text{ Hz to }100\text{ kHz}, C_O = 2.2\text{ }\mu\text{F}$		30		$\mu\text{V}_{RMS}$
$t_{ON}$	Turn On time <sup>(4)</sup>	$C_{BYP} = 33\text{ nF}$		240		$\mu\text{s}$
$T_{SHDN}$	Thermal shutdown	<sup>(5)</sup>		160		$^\circ\text{C}$
$C_O$	Output capacitor	Capacitance	2.2		22	$\mu\text{F}$
		ESR	5		5000	m $\Omega$

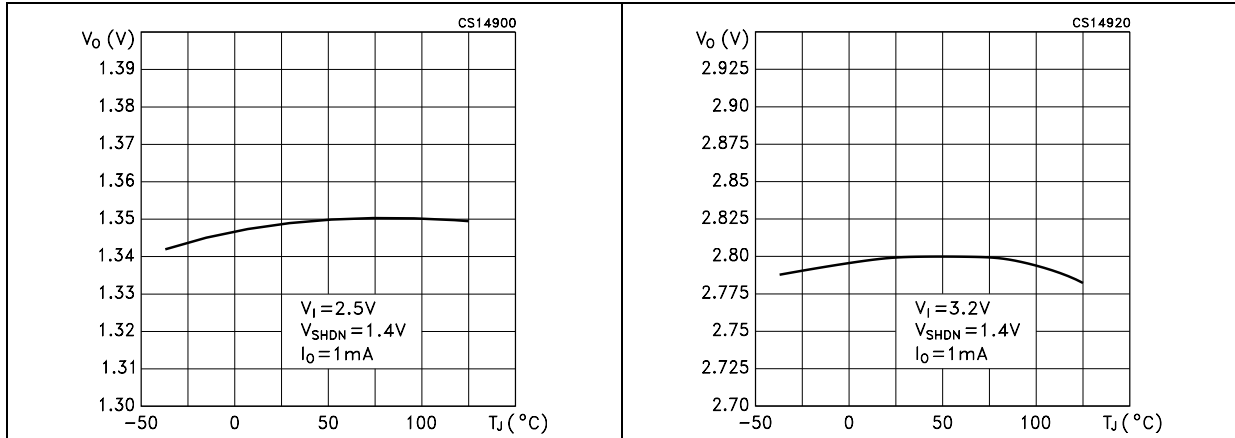
1. For  $V_{O(NOM)} < 2\text{ V}, V_I = 2.5\text{ V}$
2. For  $V_{O(NOM)} = 1.25\text{ V}, V_I = 2.5\text{ V}$
3. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification does not apply for input voltages below 2.5 V
4. Turn-on time is time measured between the enable input just exceeding  $V_{INH}$  high value and the output voltage just reaching 95 % of its nominal value
5. Typical thermal protection hysteresis is 20  $^\circ\text{C}$



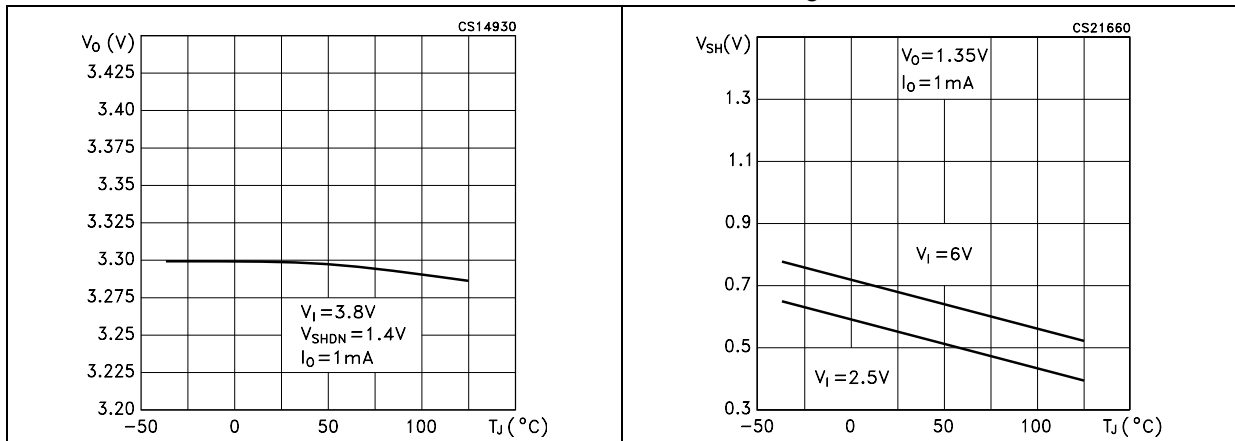
## 6 Typical performance characteristics

$T_J = 25\text{ }^\circ\text{C}$ ,  $V_I = V_{O(NOM)} + 0.5\text{ V}$ ,  $C_I = 1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$ ,  $C_{BYP} = 33\text{ nF}$ ,  $I_O = 1\text{ mA}$ ,  $V_{INH} = 1.4\text{ V}$ , unless otherwise specified.

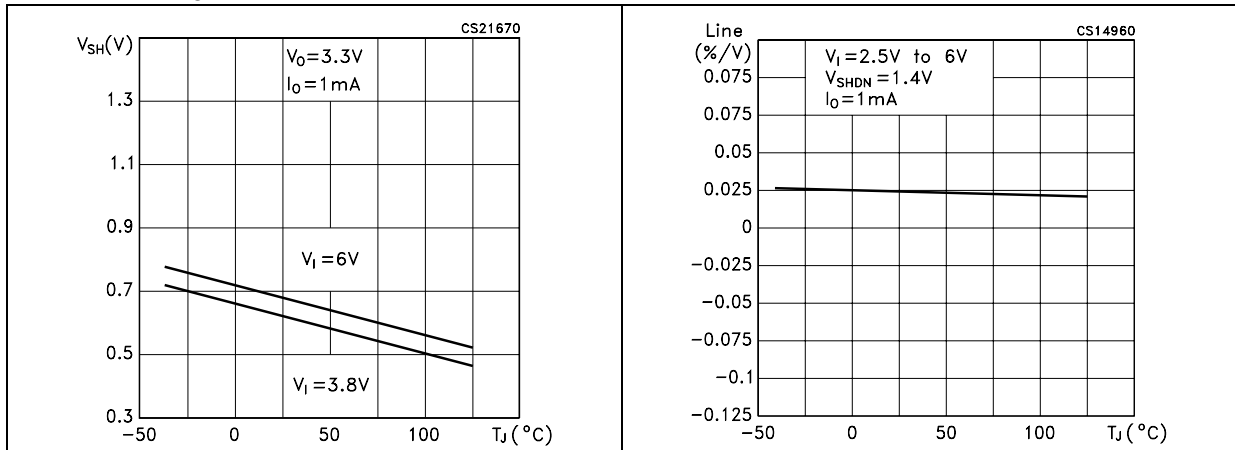
**Figure 4. Output voltage vs. temp. ( $V_I = 2.5\text{ V}$ )** **Figure 5. Output voltage vs. temp. ( $V_I = 3.2\text{ V}$ )**



**Figure 6. Output voltage vs. temp. ( $V_I = 3.8\text{ V}$ )** **Figure 7. Shutdown voltage vs. temperature ( $V_O = 1.35\text{ V}$ )**



**Figure 8. Shutdown voltage vs. temperature ( $V_O = 3.3\text{ V}$ )** **Figure 9. Line regulation vs. temperature ( $V_I = 2.5\text{ V to }6\text{ V}$ )**



Typical performance characteristics

LDS3985xx

Figure 10. Line regulation vs. temperature  
( $V_I = 3.2\text{ V to }6\text{ V}$ )

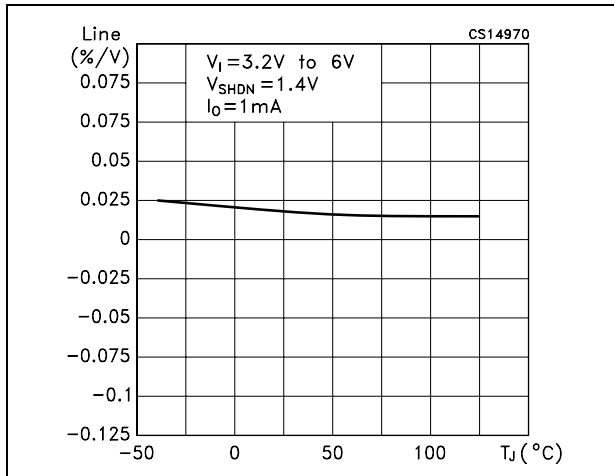


Figure 11. Line regulation vs. temperature  
( $V_I = 3.8\text{ V to }6\text{ V}$ )

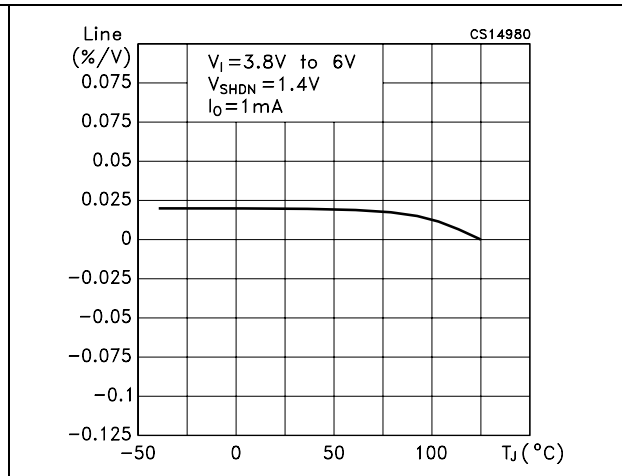


Figure 12. Quiescent current vs. temperature  
( $V_I = 2.5\text{ V}$ )

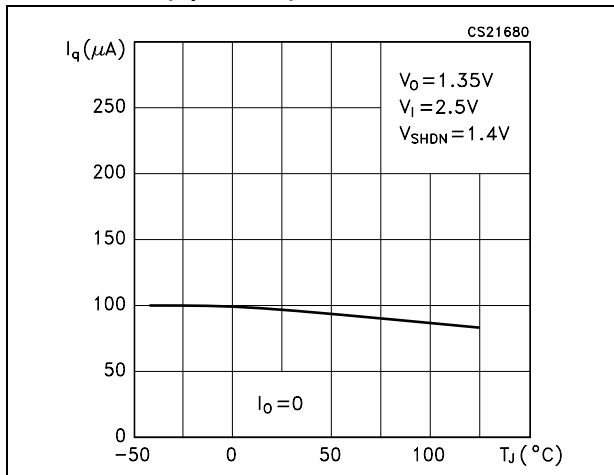


Figure 13. Quiescent current vs. temperature  
( $V_I = 6\text{ V}$ )

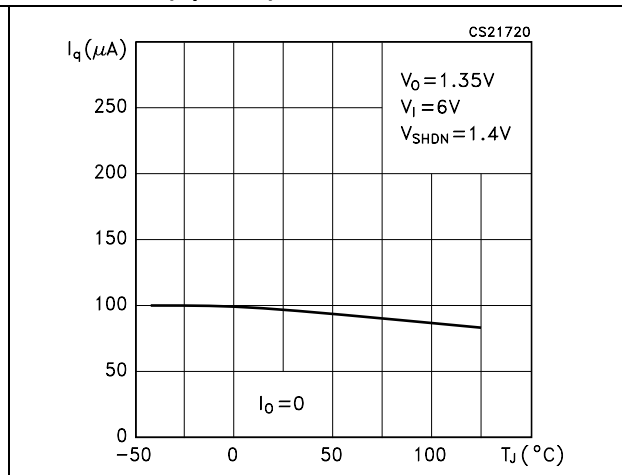


Figure 14. Quiescent current vs. temperature  
( $V_I = 3.4\text{ V}$ )

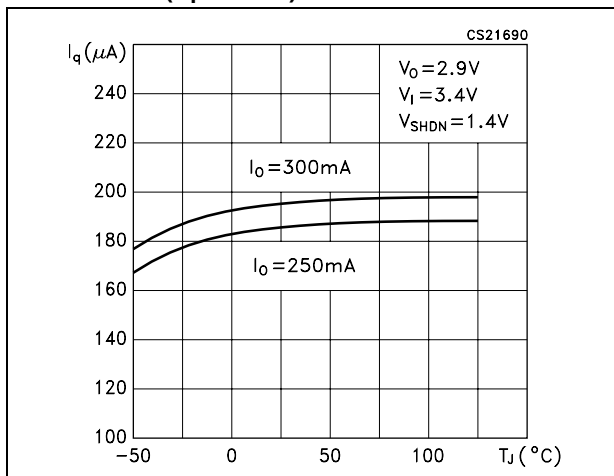


Figure 15. Supply voltage rejection vs. frequency

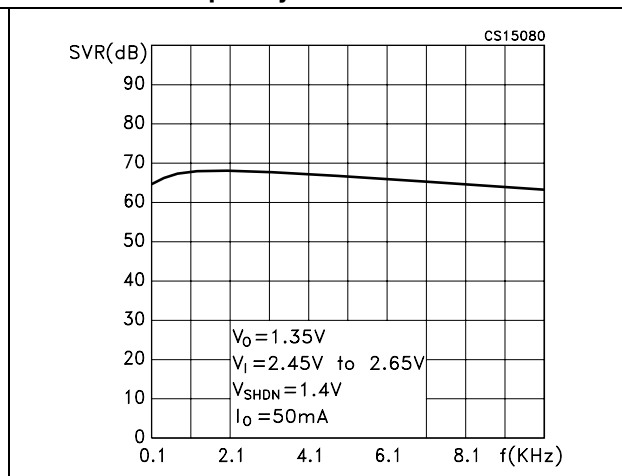


Figure 16. Dropout voltage vs. temperature

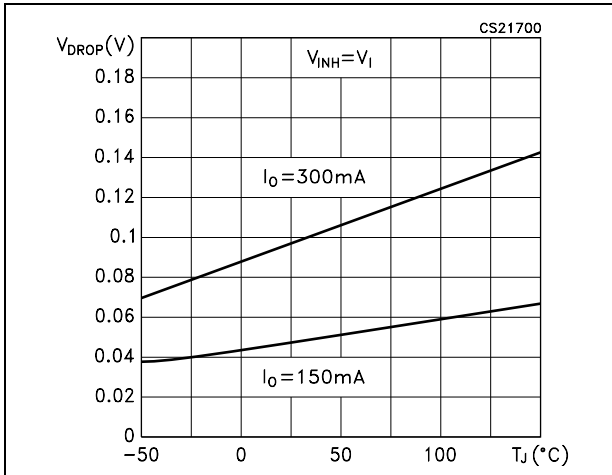


Figure 17. Dropout voltage vs. output current

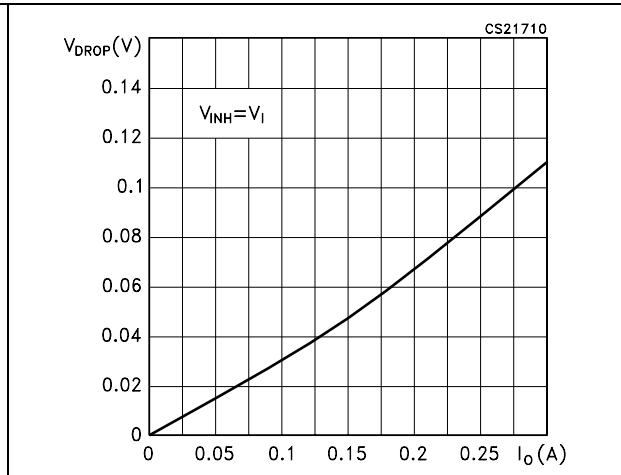
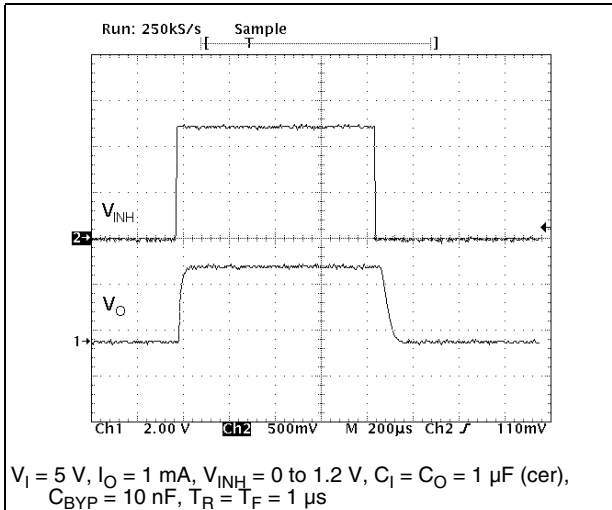


Figure 18. Inhibit transient

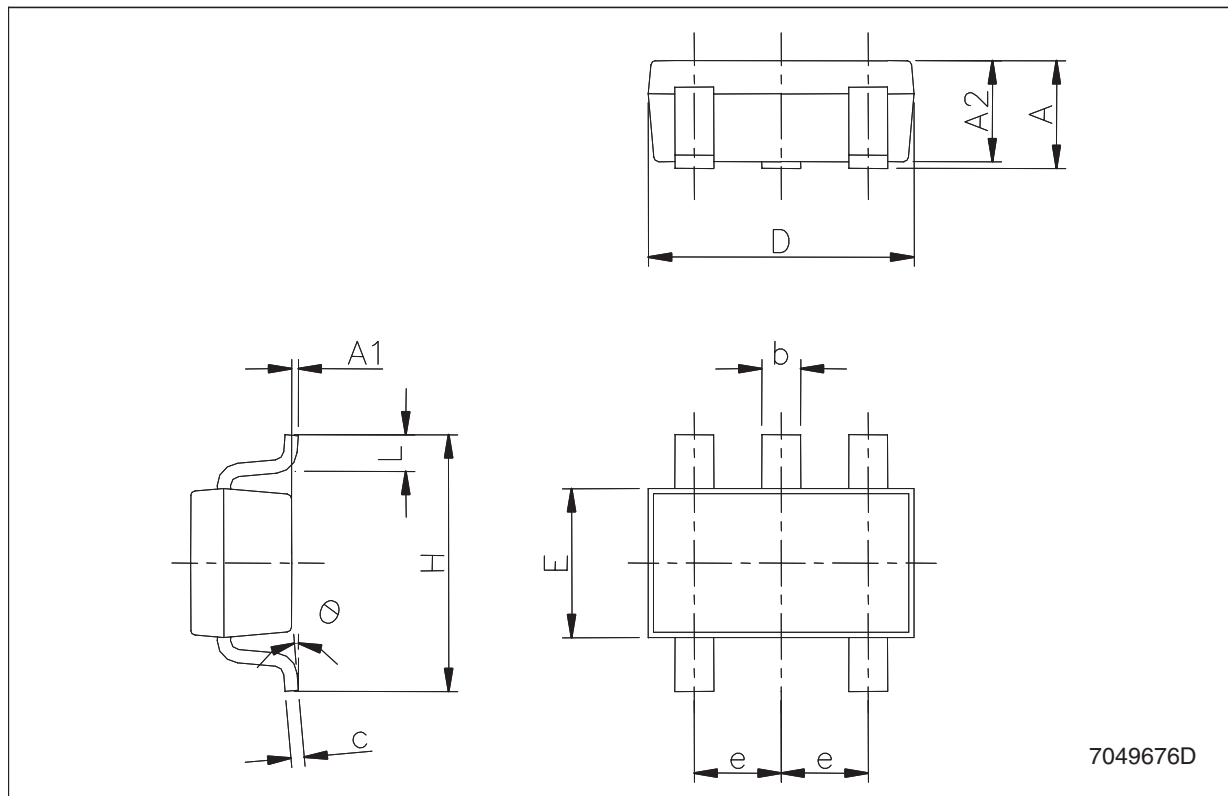


## 7 Package mechanical data

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

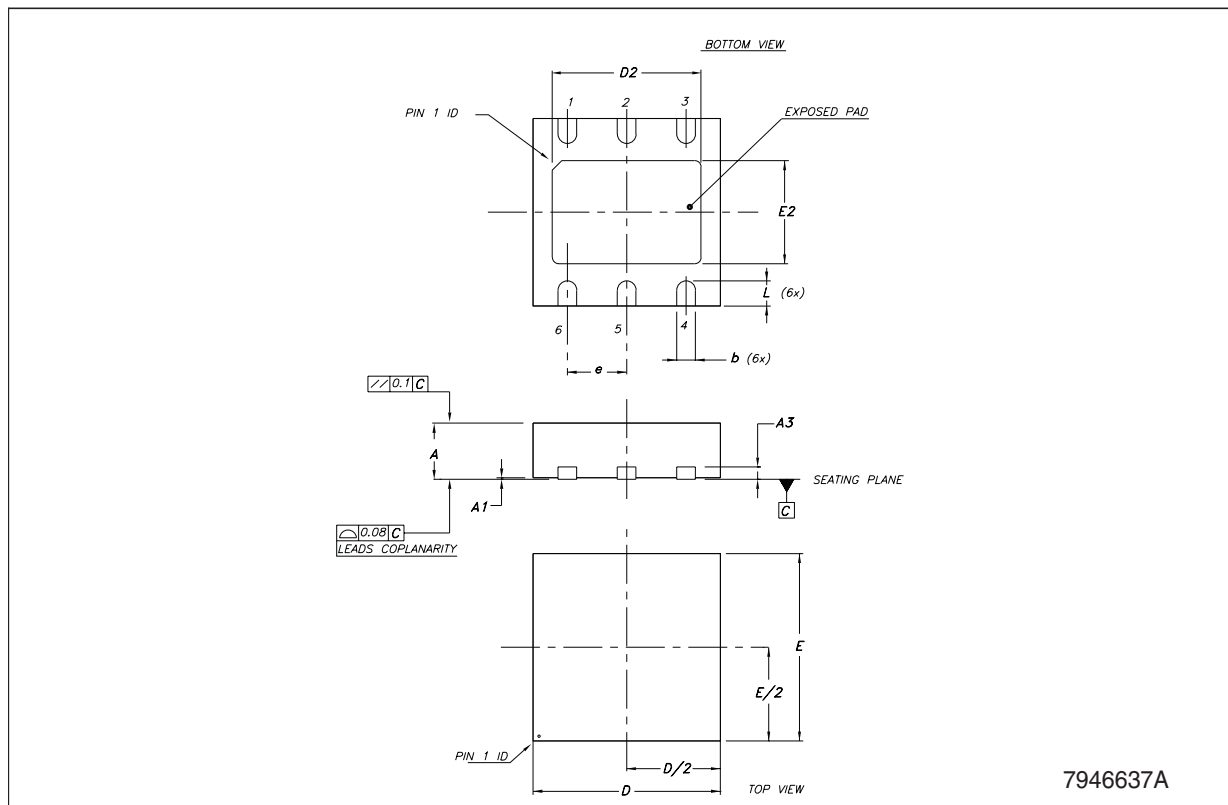
## SOT23-5L mechanical data

Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.45	35.4		57.1
A1	0.00		0.10	0.0		3.9
A2	0.90		1.30	35.4		51.2
b	0.35		0.50	13.7		19.7
C	0.09		0.20	3.5		7.8
D	2.80		3.00	110.2		118.1
E	1.50		1.75	59.0		68.8
e		0.95			37.4	
H	2.60		3.00	102.3		118.1
L	0.10		0.60	3.9		23.6



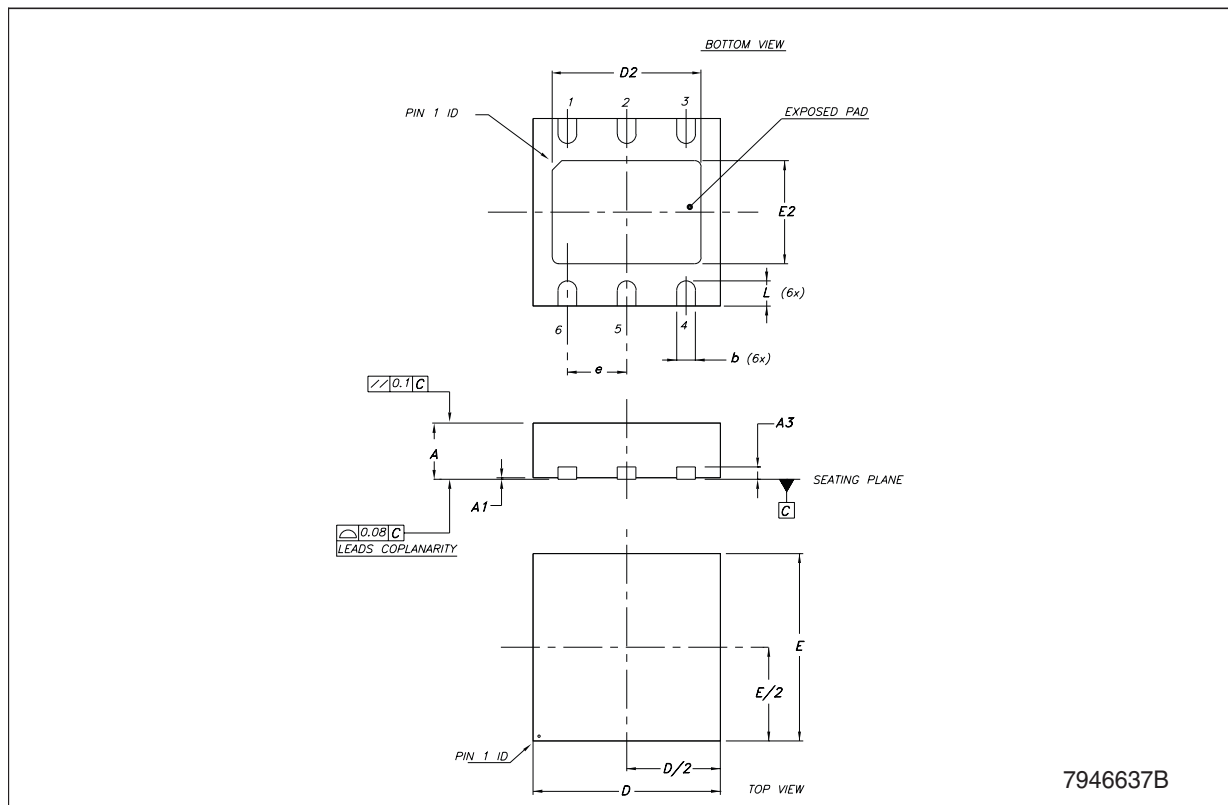
## DFN6 (3x3 mm) mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80	0.90	1.00	0.031	0.035	0.039
A1	0	0.02	0.05	0	0.001	0.002
A3		0.20			0.008	
b	0.23	0.30	0.38	0.009	0.012	0.015
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	2.23	2.38	2.48	0.088	0.094	0.098
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.50	1.65	1.75	0.059	0.065	0.069
e		0.95			0.037	
L	0.30	0.40	0.50	0.012	0.016	0.020



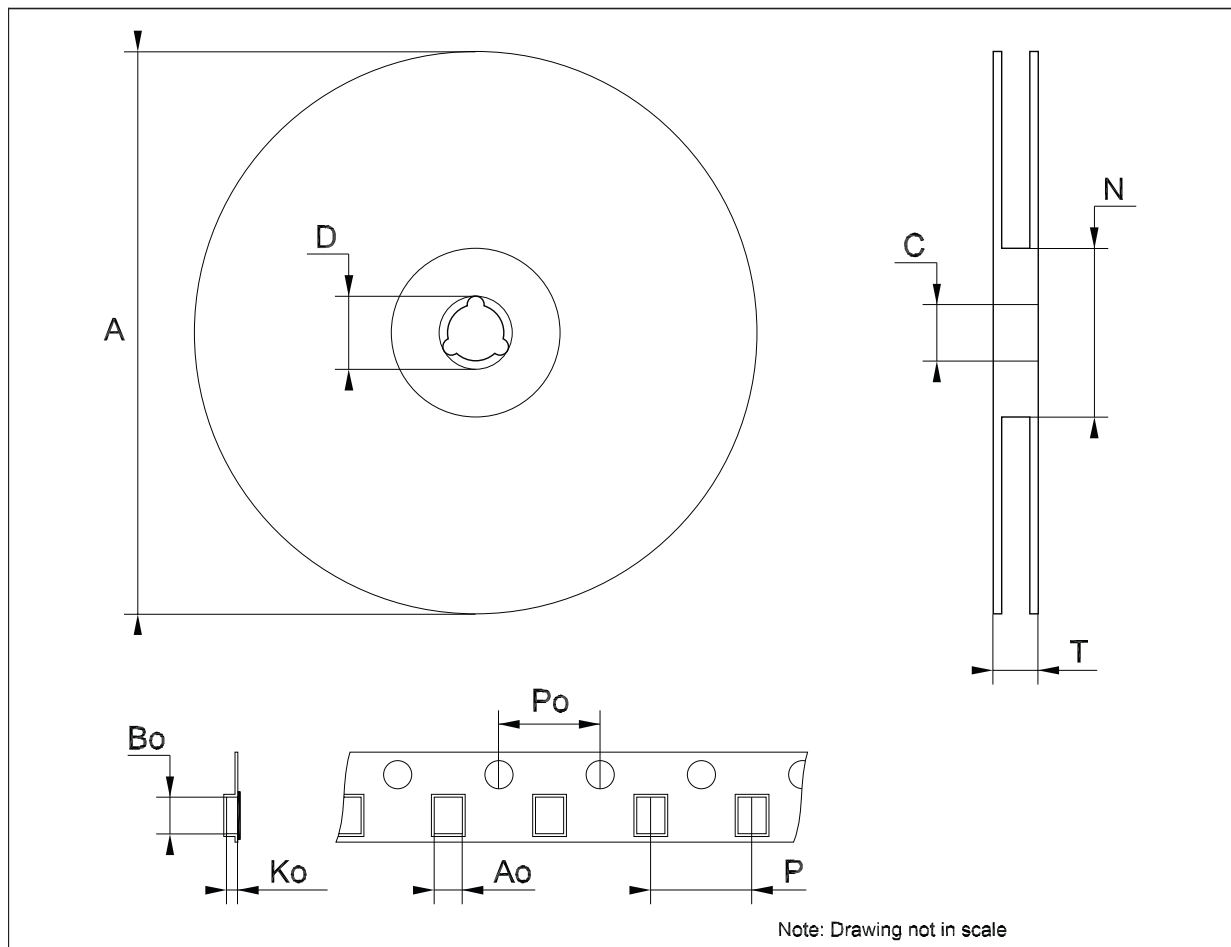
## DFN6D (3x3 mm) mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80		1.00	0.031		0.039
A1	0	0.02	0.05	0	0.001	0.002
A3		0.20			0.008	
b	0.23		0.45	0.009		0.018
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	2.23		2.50	0.088		0.098
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.50		1.75	0.059		0.069
e		0.95			0.037	
L	0.30	0.40	0.50	0.012	0.016	0.020



## Tape &amp; reel SOT23-xL mechanical data

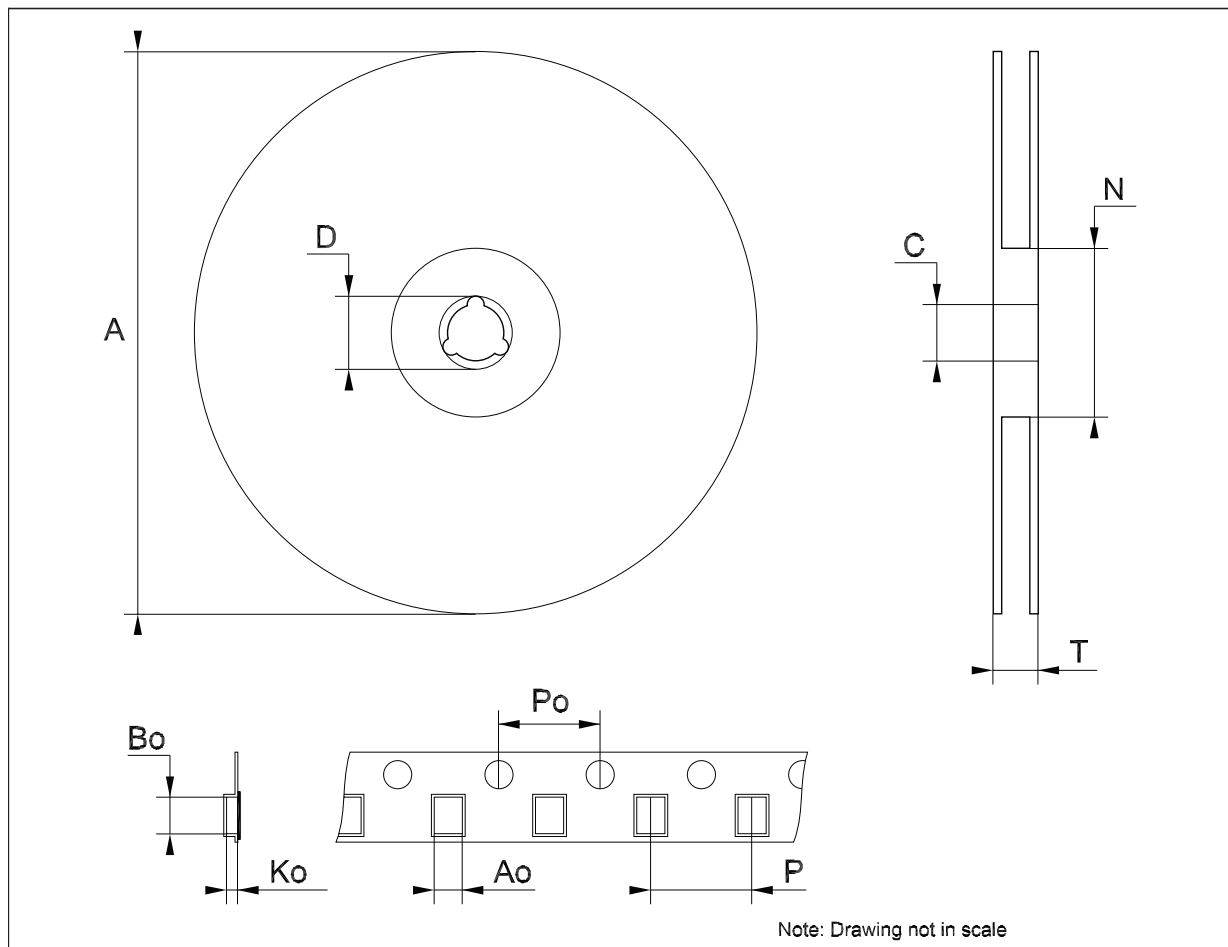
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.086
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	3.13	3.23	3.33	0.123	0.127	0.131
Bo	3.07	3.17	3.27	0.120	0.124	0.128
Ko	1.27	1.37	1.47	0.050	0.054	0.058
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	3.9	4.0	4.1	0.153	0.157	0.161





## Tape &amp; reel QFNxx/DFNxx (3x3) mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.087
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao		3.3			0.130	
Bo		3.3			0.130	
Ko		1.1			0.043	
Po		4			0.157	
P		8			0.315	



## 8 Order codes

Table 6. Order codes

Packages			Output voltage
SOT23-5L	DFN6	DFN6D	
LDS3985M125R <sup>(1)</sup>	LDS3985PM12R <sup>(1)</sup>		1.25 V
LDS3985M135R <sup>(1)</sup>	LDS3985PM13R <sup>(1)</sup>		1.35 V
LDS3985M15R	LDS3985PM15R <sup>(1)</sup>	LDS3985PU15R	1.5 V
LDS3985M18R	LDS3985PM18R <sup>(1)</sup>		1.8 V
LDS3985M20R <sup>(1)</sup>	LDS3985PM20R <sup>(1)</sup>		2.0 V
LDS3985M21R <sup>(1)</sup>	LDS3985PM21R <sup>(1)</sup>		2.1 V
LDS3985M22R <sup>(1)</sup>	LDS3985PM22R <sup>(1)</sup>		2.2 V
LDS3985M25R	LDS3985PM25R <sup>(1)</sup>		2.5 V
LDS3985M26R <sup>(1)</sup>	LDS3985PM26R <sup>(1)</sup>		2.6 V
LDS3985M27R <sup>(1)</sup>	LDS3985PM27R <sup>(1)</sup>		2.7 V
LDS3985M28R		LDS3985PU28R	2.8 V
LDS3985M285R <sup>(1)</sup>	LDS3985PM285R <sup>(1)</sup>		2.85 V
LDS3985M29R <sup>(1)</sup>	LDS3985PM29R <sup>(1)</sup>		2.9 V
LDS3985M30R	LDS3985PM30R <sup>(1)</sup>		3.0 V
LDS3985M33R		LDS3985PU33R	3.3 V
LDS3985M47R <sup>(1)</sup>	LDS3985PM47R <sup>(1)</sup>		4.7 V
LDS3985M48R <sup>(1)</sup>	LDS3985PM48R <sup>(1)</sup>		4.8 V
LDS3985M49R <sup>(1)</sup>	LDS3985PM49R <sup>(1)</sup>		4.9 V
LDS3985M50R	LDS3985PM50R <sup>(1)</sup>		5.0 V

1. Available on request.

## 9 Revision history

**Table 7. Document revision history**

Date	Revision	Changes
02-Dec-2004	1	First release.
10-Apr-2007	2	Added: new package TSOT23-5L.
16-May-2007	3	Added: new mechanical data DFN6D and order codes updated.
06-Sep-2007	4	Added: <a href="#">Table 1</a> in cover page.
11-Jun-2008	5	Modified: <a href="#">Table 6 on page 18</a> .
11-Jul-2009	6	Modified: <a href="#">Table 6 on page 18</a> .
29-Jul-2010	7	Modified: <a href="#">Table 1 on page 1</a> and <a href="#">Table 6 on page 18</a> .

**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.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

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.

© 2010 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)