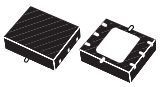
LDS3985xx

Ultra low drop-low noise BiCMOS 300 mA volt. reg. 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 (85µA typ. at no load, 200 µA typ. at 300 mA load; max 1.5 µA 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 µs [C_O = 2.2 µF, C_{BYP} = 33 nF and I_O = 1 mA]
- Logic-controlled electronic shutdown
- Internal current and thermal limit
- Output low noise voltage 30 μV_{RMS} over 10 Hz to 100 kHz
- S.V.R. of 55 dB at 1 kHz, 50 dB at 10 kHz
- Temperature range: -40°C to 125°C



DFN6

SOT23-5L

TSOT23-5L

Description

The LDS3985 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.

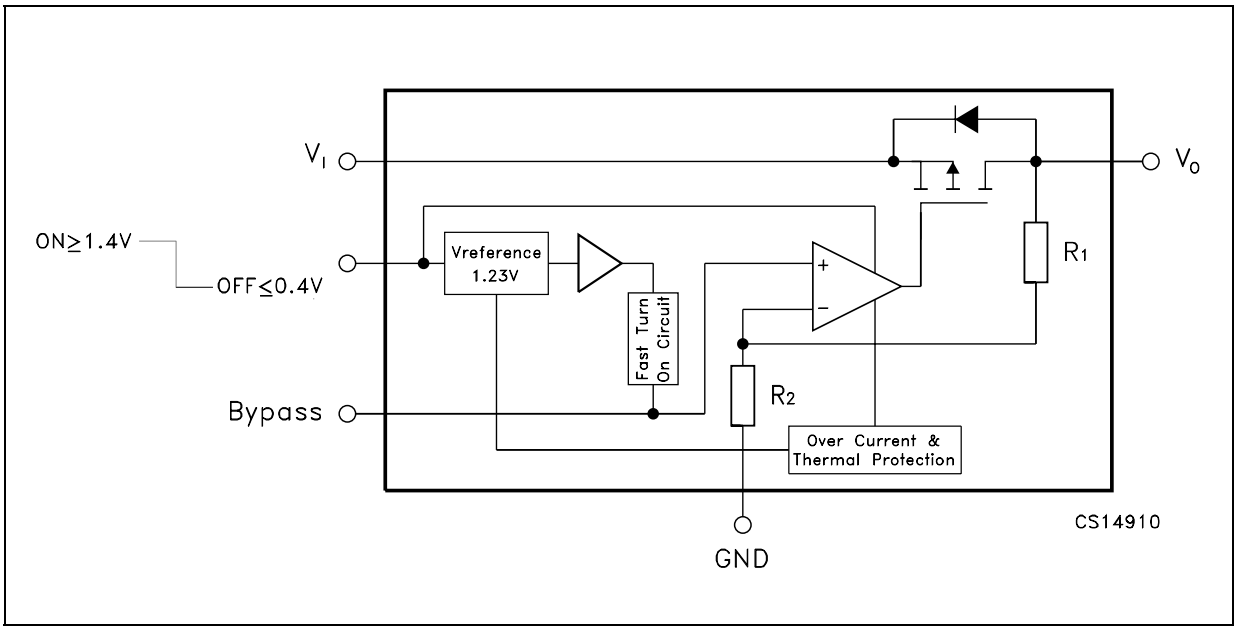
Table 1. Device summary

Part number	Output voltage
LDS3985xx15	1.5 V
LDS3985xx18	1.8 V
LDS3985xx25	2.5 V
LDS3985xx28	2.8 V
LDS3985xx30	3.0 V
LDS3985xx33	3.3 V

Contents

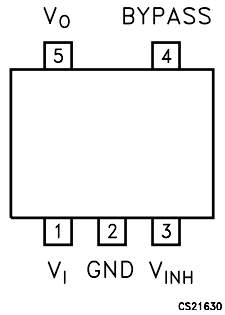
1 Diagram

Figure 1. Schematic diagram

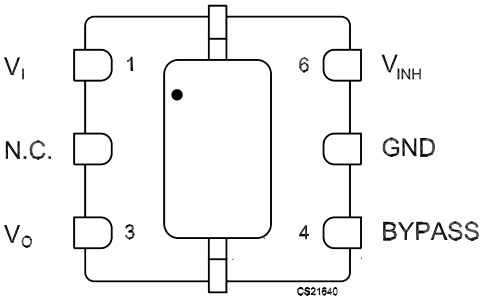


2 Pin configuration

Figure 2. Pin connections (top view for SOT and TSOT, top through view for DFN6)



SOT23-5L/TSOT23-5L



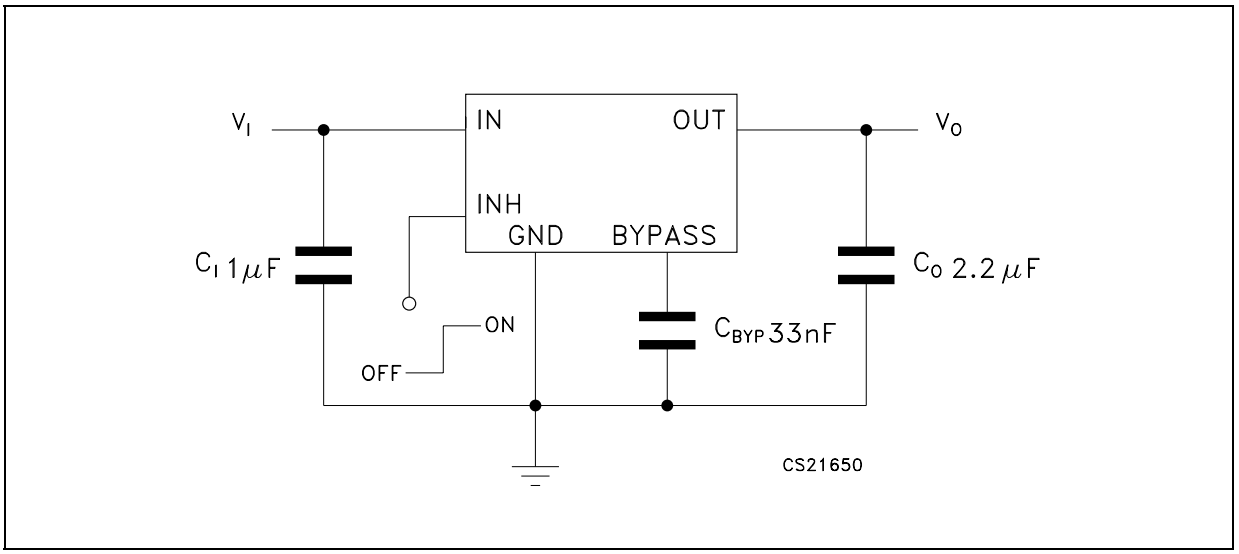
DFN6

Table 2. Pin description

Pin N° for SOT23-5L/ TSOT23-5L	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 $V_{INH} \geq 1.2V$, OFF MODE when $V_{INH} \leq 0.4V$ (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 (1)	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/ TSOT23	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

Table 5. Electrical characteristics for LDS3985 (T_J = 25°C, V_I = $V_{O(NOM)}$ +0.5 V, C_I = 1 µF, C_O = 2.2 µF, C_{BYP} = 33 nF, I_O = 1 mA, V_{INH} = 1.4 V, unless otherwise specified)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_I	Operating input voltage			2.5		6	V
V_O	Output voltage < 2.5V	I_O = 1 mA		-50		50	mV
		T_J= -40 to 125°C		-75		75	
V_O	Output voltage ≥ 2.5V	I_O = 1 mA		-2		2	% of $V_{O(NOM)}$
		T_J= -40 to 125°C		-3		3	
ΔV_O	Line regulation (*Note: 1*)	V_I = $V_{O(NOM)}$ + 0.5 to 6 V, T_J= -40 to 125°C		-0.1		0.1	%/V
		V_O = 4.7 to 5 V		-0.19		0.19	
ΔV_O	Load regulation	I_O = 1 mA to 300 mA, V_O ≤2.5V T_J = -40 to 125°C			0.005	0.01	%/mA
ΔV_O	Load regulation	I_O = 1 mA to 300 mA, V_O ≥ 2.5 V T_J= -40 to 125°C			0.0008	0.004	%/mA
ΔV_O	Output AC line regulation (*Note 2*)	V_I = $V_{O(NOM)}$ + 1 V, I_O = 300 mA, t_R= t_F = 30 µs			5		mV_{PP}
I_Q	Quiescent current ON MODE: V_{INH} = 1.24V	I_O = 0			85		µA
		I_O = 0, T_J= -40 to 125°C				150	
		I_O = 0 to 300 mA			200		
		I_O = 0 to 300 mA, T_J= -40 to 125°C				300	
	OFF MODE: V_{INH} = 0.4V				0.003		
		T_J= -40 to 125°C				1.5	
V_{DROP}	Dropout voltage (*Note 3*)	I_O = 1 mA			0.4		mV
		I_O = 1 mA, T_J= -40 to 125°C				2	
		I_O = 150 mA			60		
		I_O = 150 mA, T_J= -40 to 125°C				100	
		I_O = 300 mA			150		
		I_O = 300 mA, T_J= -40 to 125°C				250	
I_{SC}	Short circuit current	R_L = 0			600		mA
SVR	Supply voltage rejection	V_I = $V_{O(NOM)}$+0.25 V ± V_{RIPPLE} = 0.1 V, I_O = 50 mA For $V_{O(NOM)}$ < 2.5 V, V_I = 2.55 V	f = 1 kHz		55		dB
			f = 10 kHz		50		
$I_{O(PK)}$	Peak output current	V_O ≥ $V_{O(NOM)}$ - 5%		300	550		mA
V_{INH}	Inhibit input logic Low	V_I = 2.5 V to 6 V, T_J= -40 to 125°C				0.4	V
	Inhibit input logic High			1.4			
I_{INH}	Inhibit input current	V_{INH} = 0.4 V, V_I = 6 V			±1		nA

Table 5. Electrical characteristics for LDS3985 (T_J = 25°C, V_I = $V_{O(NOM)}$ +0.5 V, C_I = 1 µF, C_O = 2.2 µF, C_{BYP} = 33 nF, I_O = 1 mA, V_{INH} = 1.4 V, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
eN	Output noise voltage	B_W = 10 Hz to 100 KHz, C_O = 2.2 µF		30		μV_{RMS}
t_{ON}	Turn On Time (*Note 4*)	C_{BYP} = 33 nF		240		µs
T_{SHDN}	Thermal shutdown	*Note 5*		160		°C
C_O	Output capacitor	Capacitance	2.2		22	µF
		ESR	5		5000	mΩ

Note: 1 For $V_{O(NOM)}$ < 2V, V_I = 2.5 V

2 For $V_{O(NOM)}$ =1.25 V, V_I = 2.5 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°C

6 Typical performance characteristics

(T_J = 25°C, $V_I = V_{O(NOM)}$ +0.5V, C_I = 1µF, C_O = 2.2µF, C_{BYP} = 33nF, I_O = 1mA, V_{INH} = 1.4V, unless otherwise specified)

Figure 4. Output voltage vs temperature

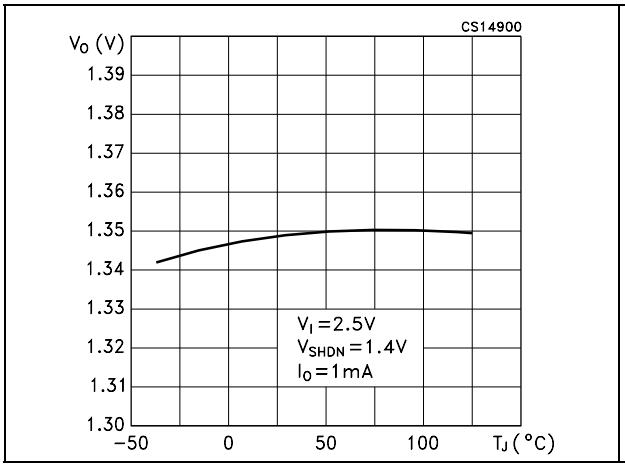


Figure 5. Output voltage vs temperature

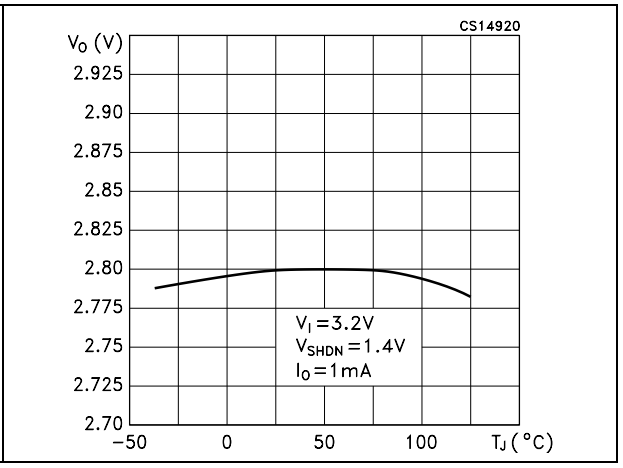


Figure 6. Output voltage vs temperature

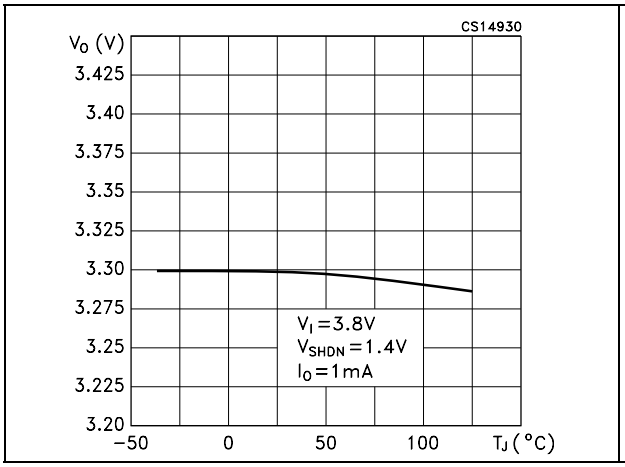


Figure 7. Shutdown voltage vs temperature

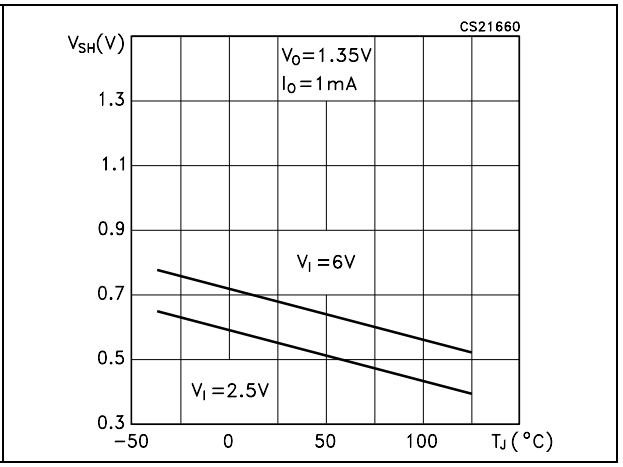


Figure 8. Shutdown voltage vs temperature

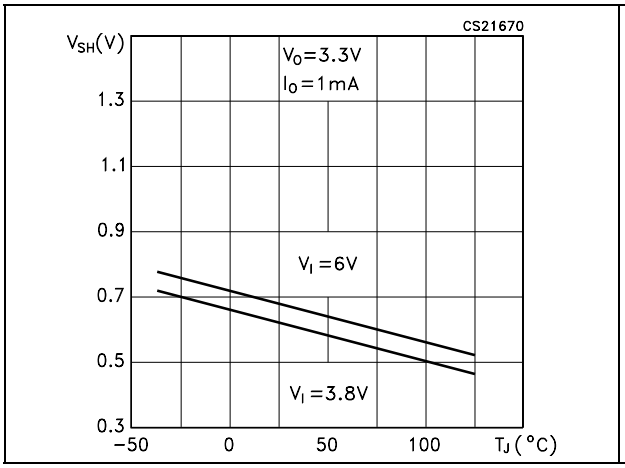


Figure 9. Line regulation vs temperature

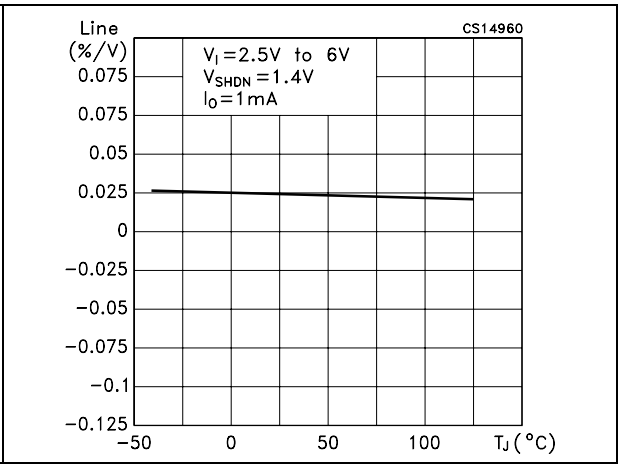


Figure 10. Line regulation vs temperature

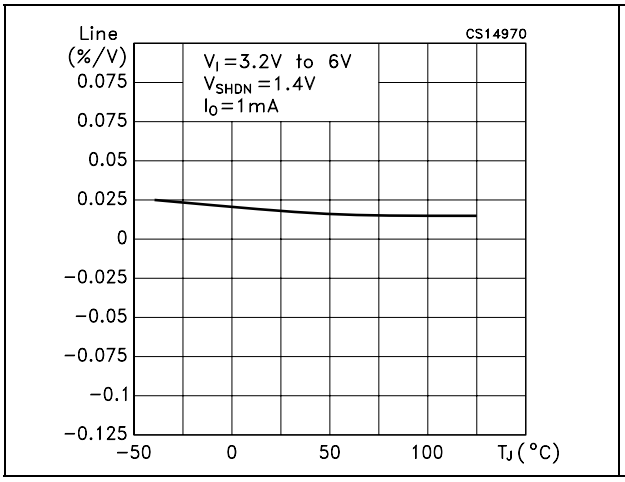


Figure 11. Line regulation vs temperature

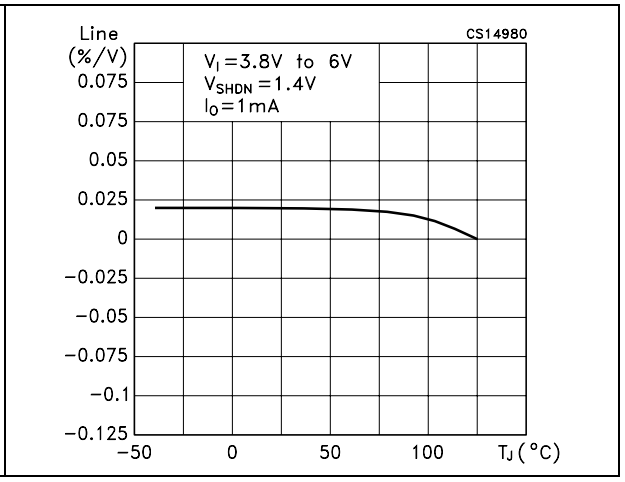


Figure 12. Quiescent current vs temperature

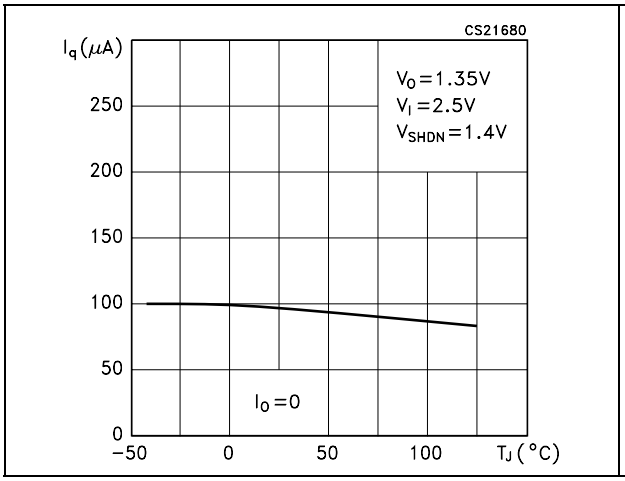


Figure 13. Quiescent current vs temperature

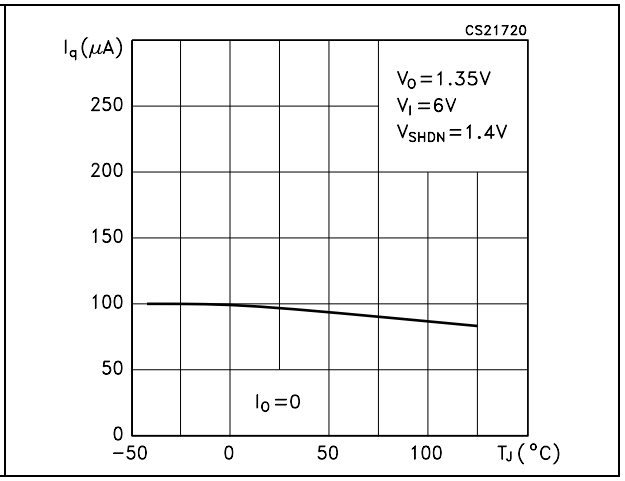


Figure 14. Quiescent current vs temperature

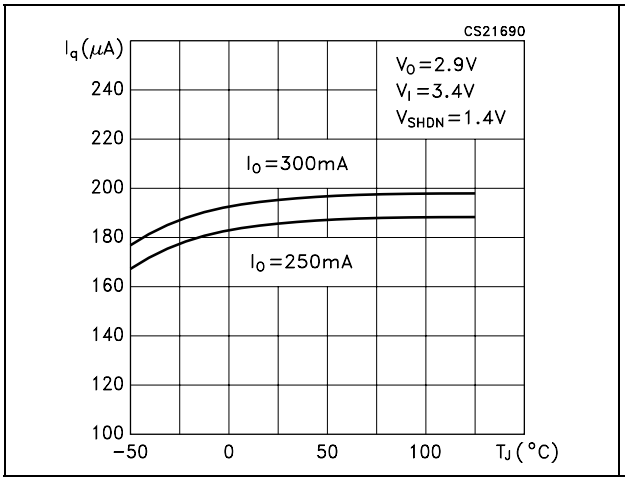


Figure 15. Supply voltage rejection vs frequency

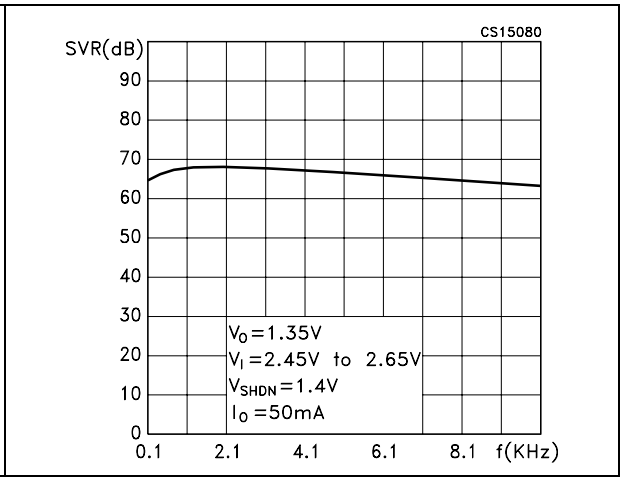


Figure 16. Dropout voltage vs temperature

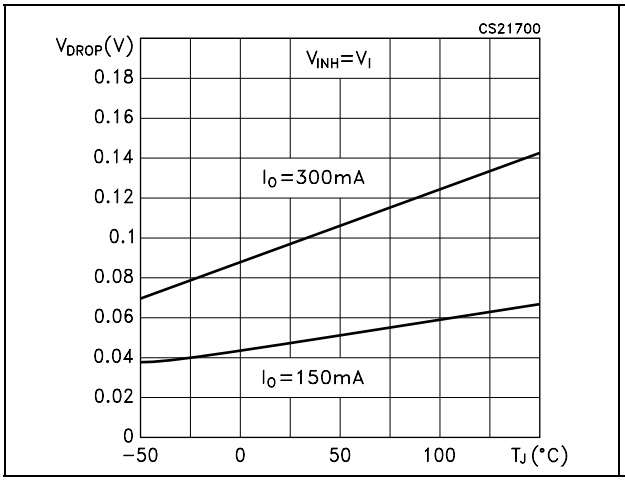


Figure 17. Dropout voltage vs output current

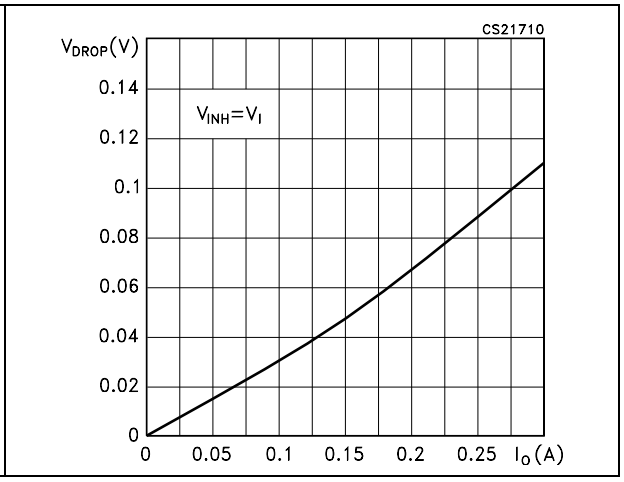
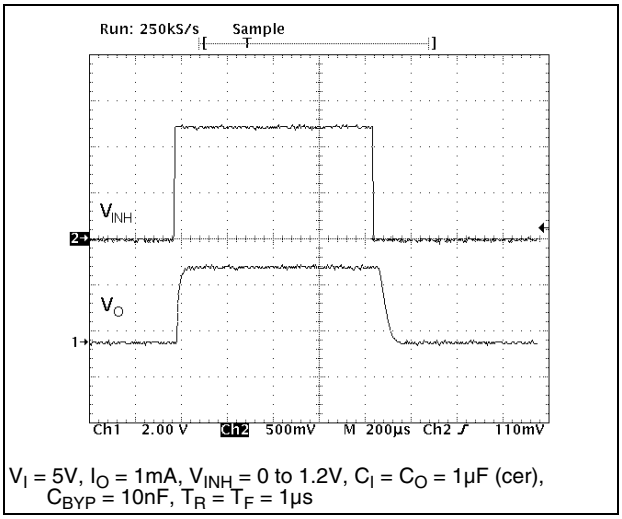


Figure 18. Inhibit transient



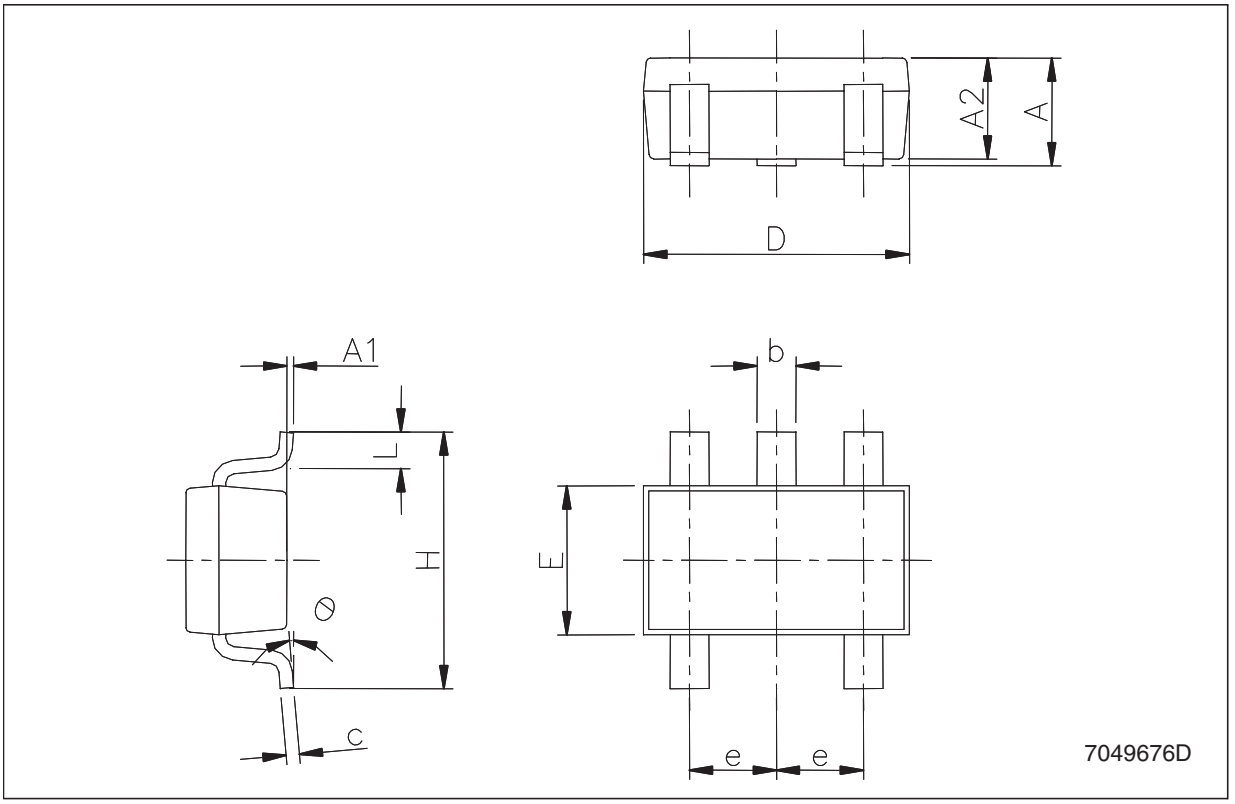
V_I = 5V, I_O = 1mA, V_{INH} = 0 to 1.2V, C_I = C_O = 1µF (cer), C_{BYP} = 10nF, T_R = T_F = 1µs

7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

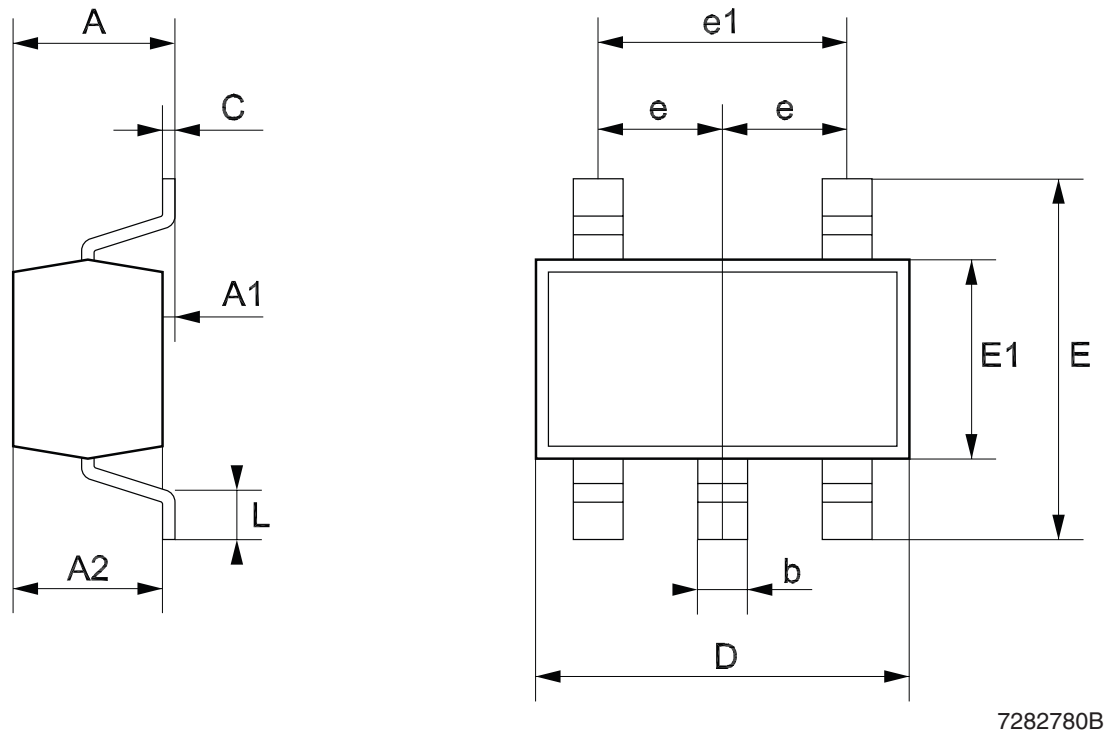
SOT23-5L mechanical data

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



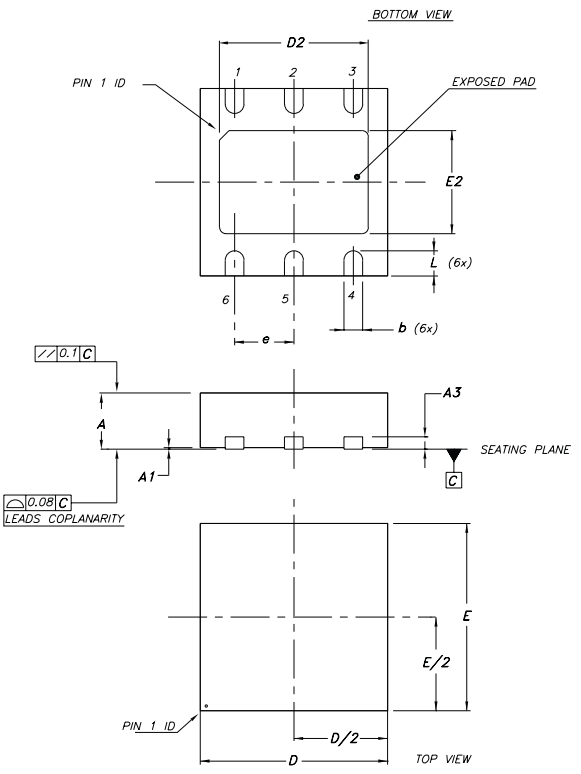
TSOT23-5L mechanical data

Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.1			43.3
A1	0		0.1			3.9
A2	0.7		1.0	27.6		39.4
b	0.3		0.5	11.8		19.7
C	0.08		0.2	3.1		7.9
D		2.9			114.2	
E		2.8			110.2	
E1		1.6			63.0	
e		0.95			37.4	
e1		1.9			74.8	
L	0.3		0.6	11.8		23.6



DFN6 (3x3 mm) mechanical data

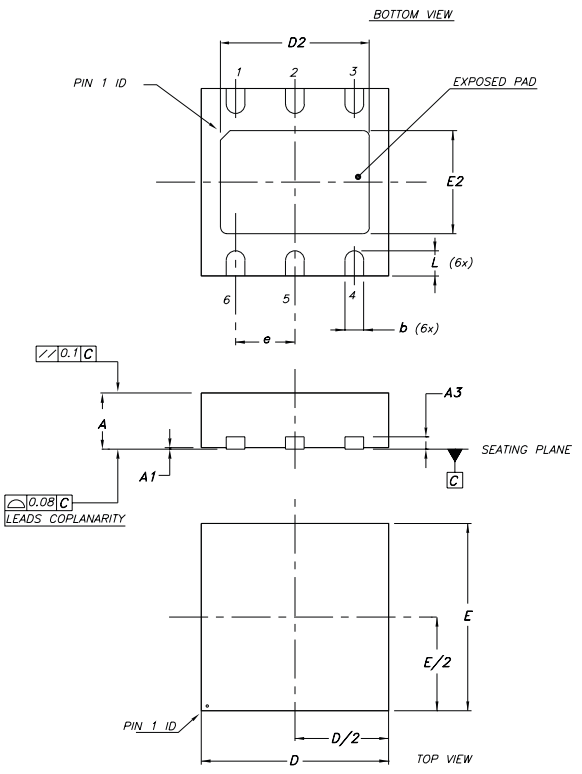
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80	0.90	1.00	0.031	0.035	0.039
A1	0	0.02	0.05	0	0.001	0.002
A3		0.20			0.008	
b	0.23	0.30	0.38	0.009	0.012	0.015
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	2.23	2.38	2.48	0.088	0.094	0.098
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.50	1.65	1.75	0.059	0.065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



7946637A

DFN6D (3x3 mm) mechanical data

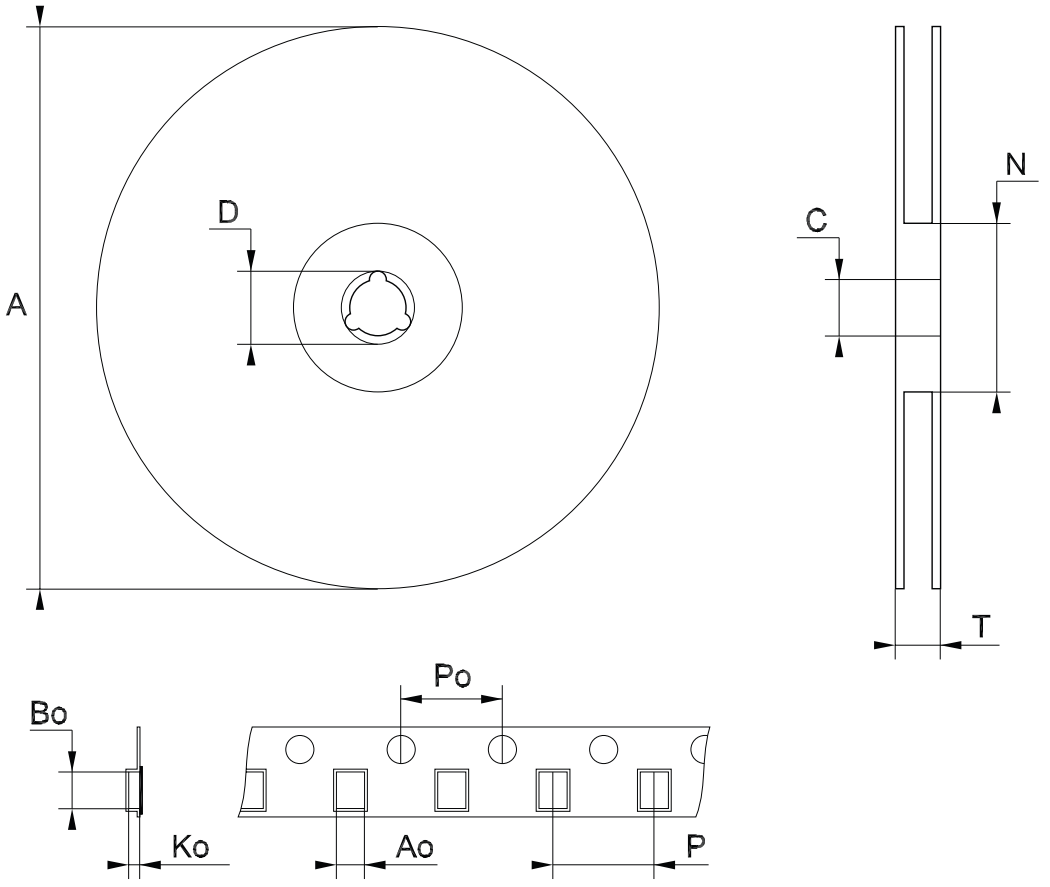
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80		1.00	0.031		0.039
A1	0	0.02	0.05	0	0.001	0.002
A3		0.20			0.008	
b	0.23		0.45	0.009		0.018
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	2.23		2.50	0.088		0.098
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.50		1.75	0.059		0.069
e		0.95			0.037	
L	0.30	0.40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



7946637B

Tape & reel SOT23-xL mechanical data

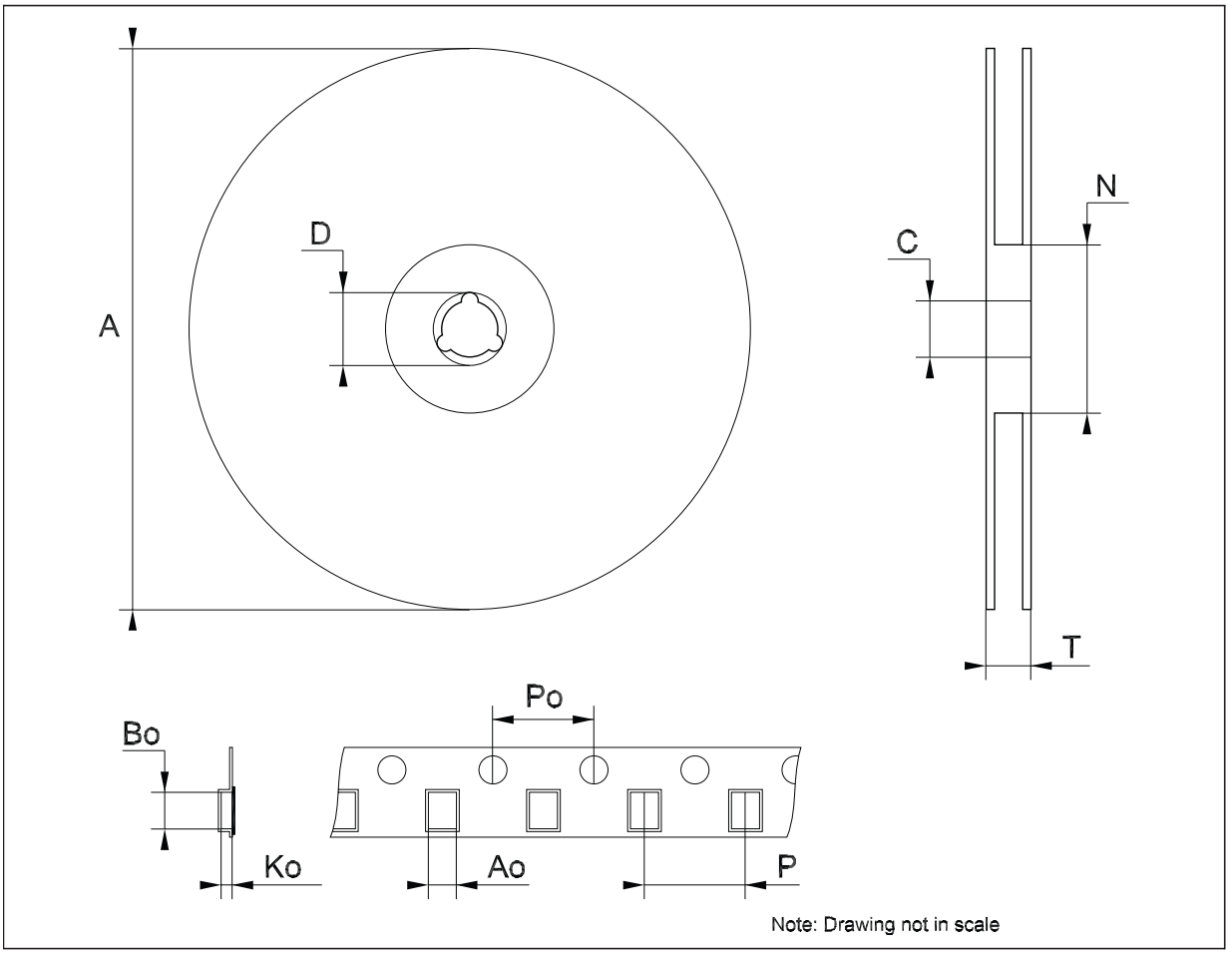
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.086
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	3.13	3.23	3.33	0.123	0.127	0.131
Bo	3.07	3.17	3.27	0.120	0.124	0.128
Ko	1.27	1.37	1.47	0.050	0.054	0.0.58
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	3.9	4.0	4.1	0.153	0.157	0.161



Note: Drawing not in scale

Tape & 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	



Note: Drawing not in scale

8 Order codes

Table 6. Order codes

Part numbers				
Packages				Output voltage
SOT23-5L	TSOT23	DFN6	DFN6D	
LDS3985M125R (1)		LDS3985PM12R (1)		1.25 V
LDS3985M135R (1)		LDS3985PM13R (1)		1.35 V
LDS3985M15R (1)		LDS3985PM15R (1)	LDS3985PU15R	1.5 V
LDS3985M18R		LDS3985PM18R		1.8 V
	LDS3985G19R (1)			1.9 V
LDS3985M20R (1)		LDS3985PM20R (1)		2.0 V
LDS3985M21R (1)		LDS3985PM21R (1)		2.1 V
LDS3985M22R (1)		LDS3985PM22R (1)		2.2 V
LDS3985M25R		LDS3985PM25R		2.5 V
LDS3985M26R (1)		LDS3985PM26R (1)		2.6 V
LDS3985M27R (1)		LDS3985PM27R (1)		2.7 V
LDS3985M28R		LDS3985PM28R		2.8 V
LDS3985M285R (1)		LDS3985PM285R (1)		2.85 V
LDS3985M29R (1)		LDS3985PM29R (1)		2.9 V
LDS3985M30R (1)		LDS3985PM30R (1)		3.0 V
		LDS3985PM31R (1)		3.1 V
LDS3985M32R (1)		LDS3985PM32R (1)		3.2 V
LDS3985M33R		LDS3985PM33R		3.3 V
LDS3985M47R (1)		LDS3985PM47R (1)		4.7 V
LDS3985M48R (1)		LDS3985PM48R (1)		4.8 V
LDS3985M49R (1)		LDS3985PM49R (1)		4.9 V
LDS3985M50R (1)		LDS3985PM50R (1)		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	Add new package TSOT23-5L and the document has been reformatted.
16-May-2007	3	Add new mechanical data DFN6D and order codes has been updated.
06-Sep-2007	4	Add *Table 1.* in cover page.

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