



LDS3985xx

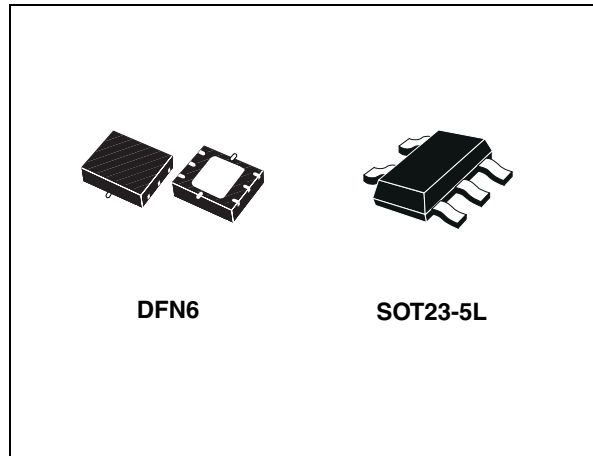
Ultra low drop-low noise BiCMOS 300 mA voltage regulator for use with very low ESR output capacitor

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 μ A typ. at no load, 200 μ A typ. at 300 mA load; max 1.5 μ 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 μ 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 μ V_{RMS} 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

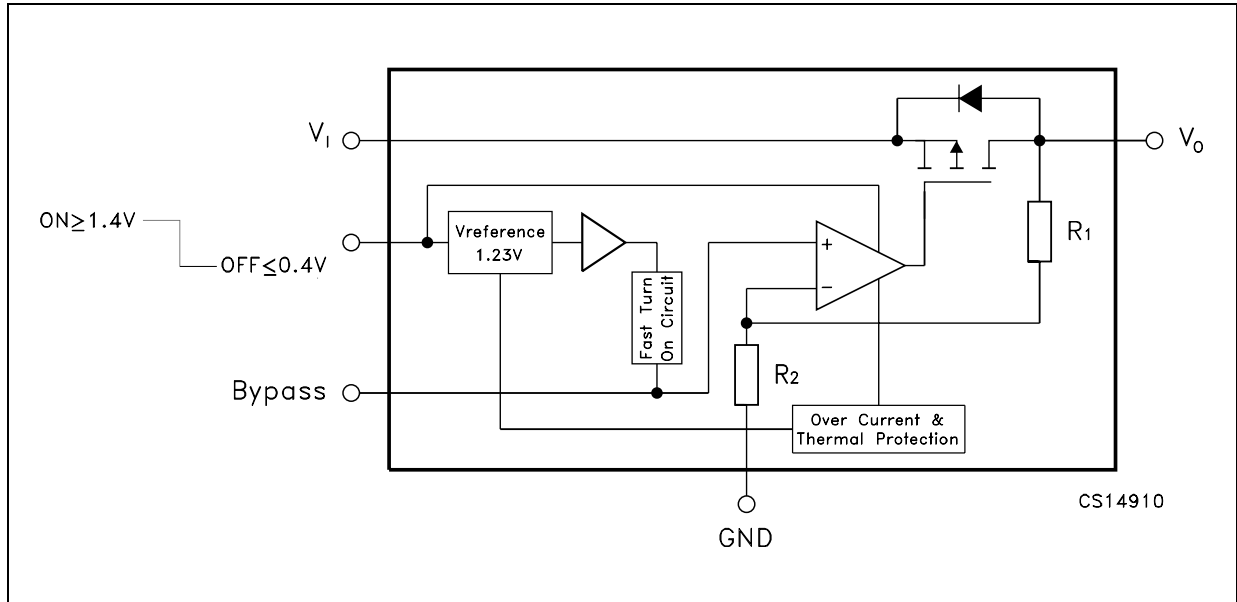
Part numbers	Output voltages
LDS3985XX15	1.5 V
LDS3985XX18	1.8 V
LDS3985XX25	2.5 V
LDS3985XX28	2.8 V
LDS3985XX30	3.0 V
LDS3985XX33	3.3 V
LDS3985XX50	5.0 V

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1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

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

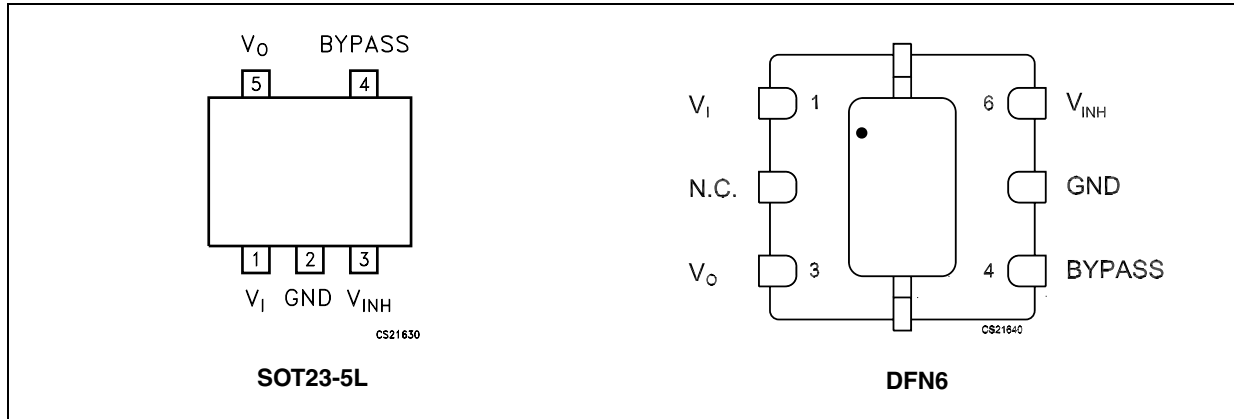
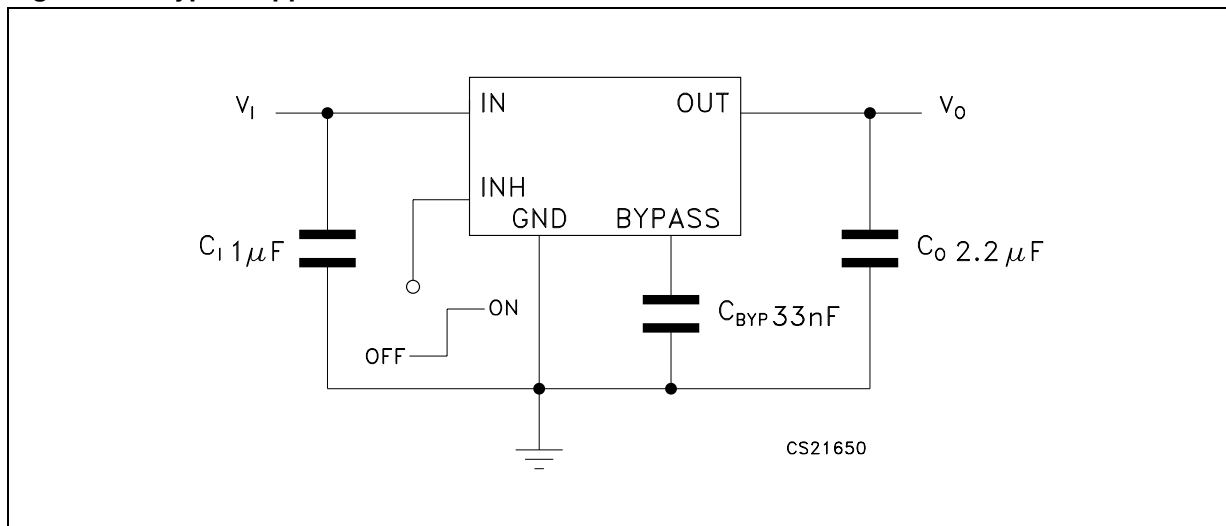


Table 2. Pin description

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 ⁽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	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	
ΔV_O	Line regulation ⁽¹⁾	$V_I = V_{O(NOM)} + 0.5\text{ to }6\text{ V}$, $T_J = -40\text{ to }125\text{ }^\circ\text{C}$	-0.1		0.1	%V
		$V_O = 4.7\text{ to }5\text{ V}$	-0.19		0.19	
ΔV_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
ΔV_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
ΔV_O	Output AC line regulation ⁽²⁾	$V_I = V_{O(NOM)} + 1\text{ V}$, $I_O = 300\text{ mA}$, $t_R = t_F = 30\text{ }\mu\text{s}$		5		mV _{PP}
I_Q	Quiescent current ON MODE: $V_{INH} = 1.24\text{ V}$	$I_O = 0$		85		μA
		$I_O = 0$, $T_J = -40\text{ to }125\text{ }^\circ\text{C}$			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 ⁽³⁾	$I_O = 1\text{ mA}$		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

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	$V_{INH} = 0.4\text{ V}, V_I = 6\text{ V}$		± 1		nA
eN	Output noise voltage	$B_W = 10\text{ Hz to }100\text{ kHz}, C_O = 2.2\text{ }\mu\text{F}$		30		μV_{RMS}
t_{ON}	Turn On time ⁽⁴⁾	$C_{BYP} = 33\text{ nF}$		240		μs
T_{SHDN}	Thermal shutdown	⁽⁵⁾		160		$^\circ\text{C}$
C_O	Output capacitor	Capacitance	2.2		22	μF
		ESR	5		5000	m Ω

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. ($V_I = 3.2\text{ V}$)**

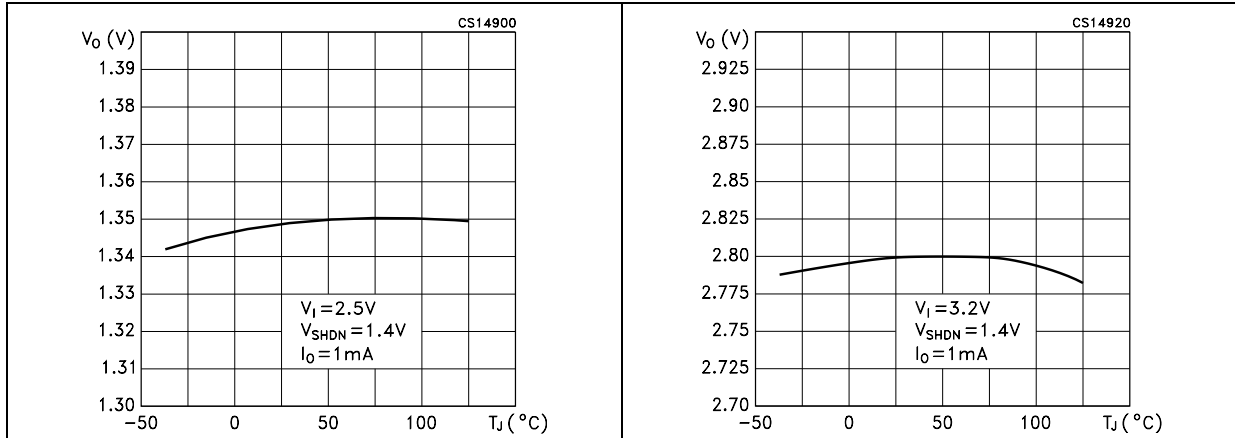


Figure 6. Output voltage vs. temp. ($V_I = 3.8\text{ V}$) **Figure 7. Shutdown voltage vs. temperature ($V_O = 1.35\text{ V}$)**

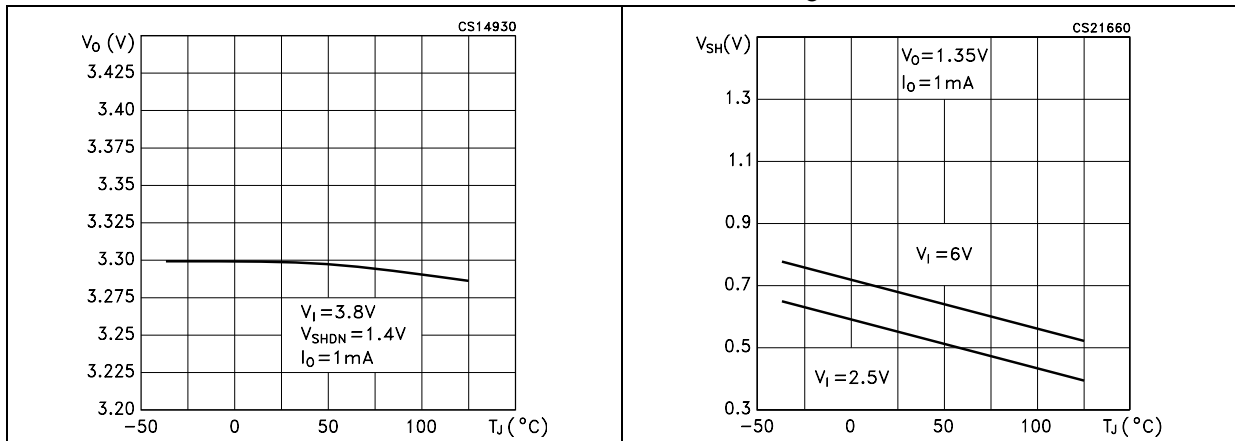


Figure 8. Shutdown voltage vs. temperature ($V_O = 3.3\text{ V}$) **Figure 9. Line regulation vs. temperature ($V_I = 2.5\text{ V to }6\text{ V}$)**

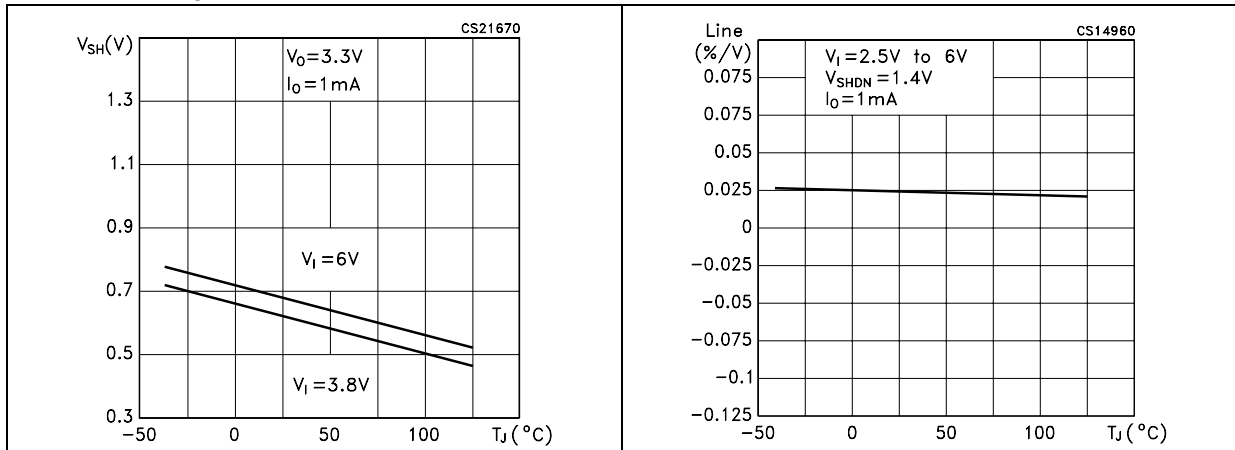


Figure 10. Line regulation vs. temperature
($V_I = 3.2\text{ V to }6\text{ V}$)

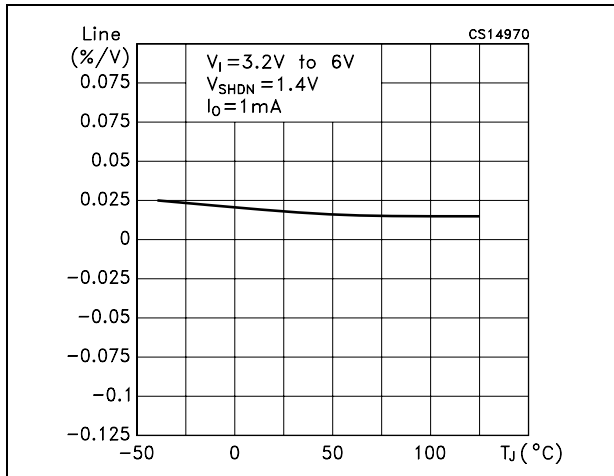


Figure 11. Line regulation vs. temperature
($V_I = 3.8\text{ V to }6\text{ V}$)

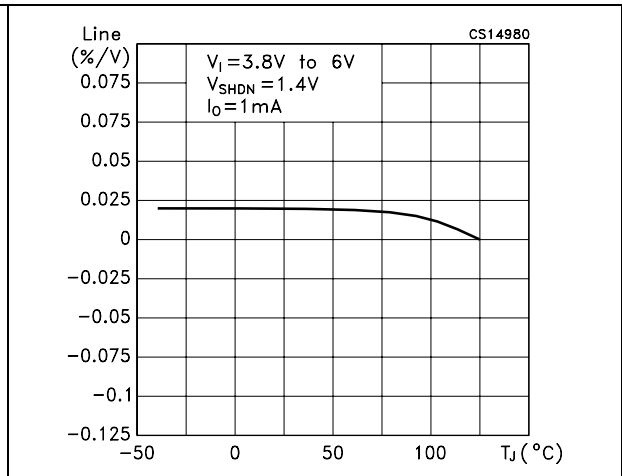


Figure 12. Quiescent current vs. temperature
($V_I = 2.5\text{ V}$)

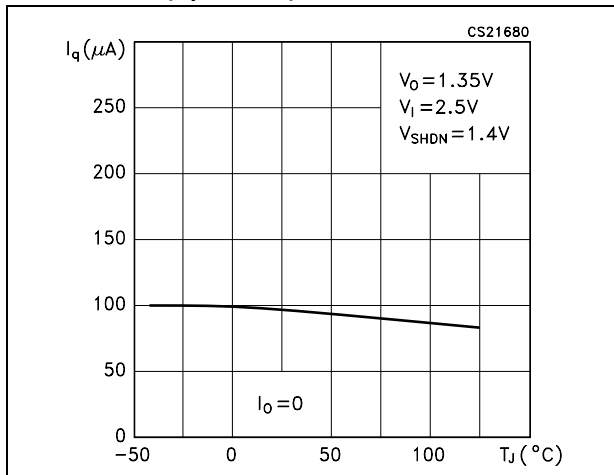


Figure 13. Quiescent current vs. temperature
($V_I = 6\text{ V}$)

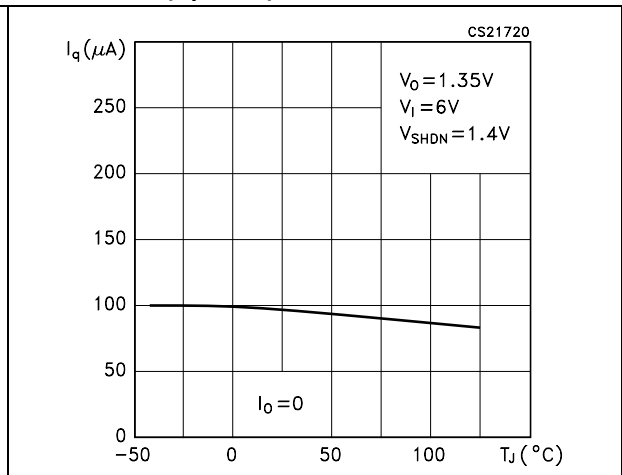


Figure 14. Quiescent current vs. temperature
($V_I = 3.4\text{ V}$)

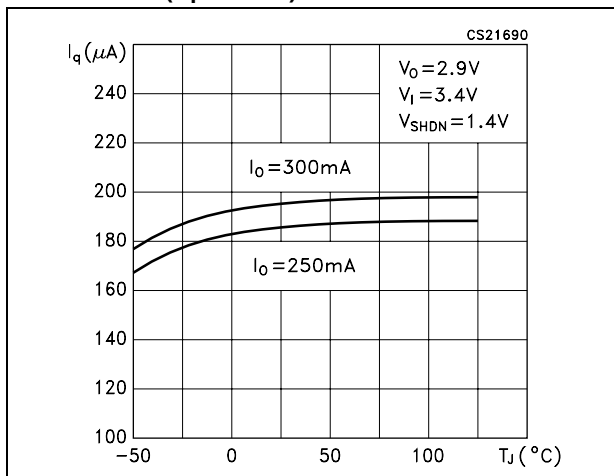


Figure 15. Supply voltage rejection vs. frequency

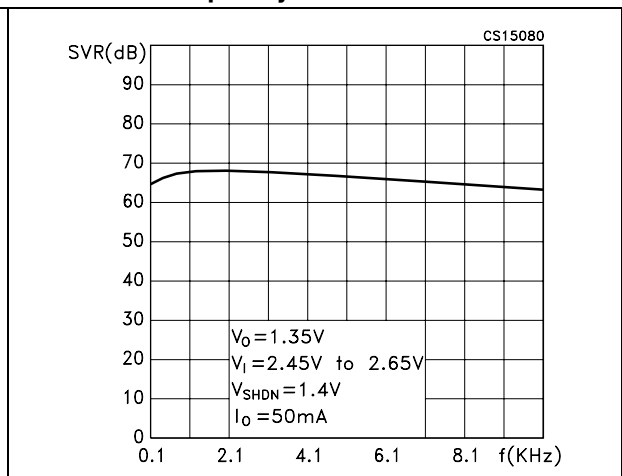


Figure 16. Dropout voltage vs. temperature

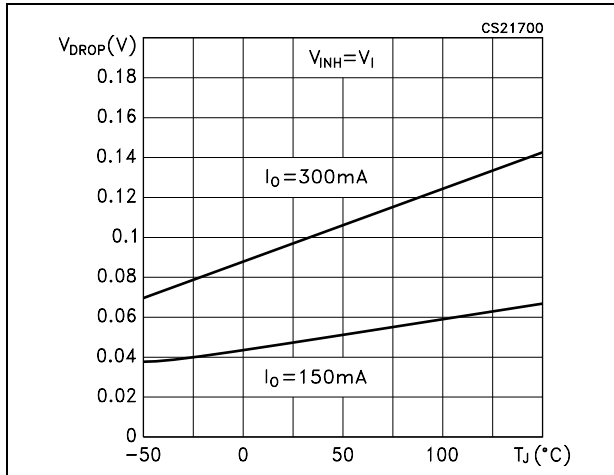


Figure 17. Dropout voltage vs. output current

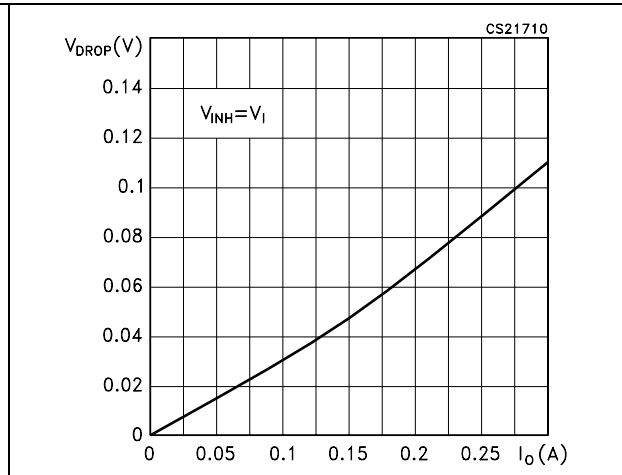
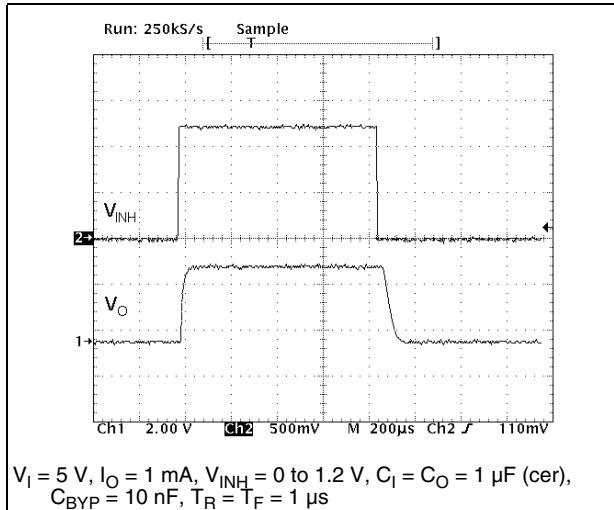


Figure 18. Inhibit transient

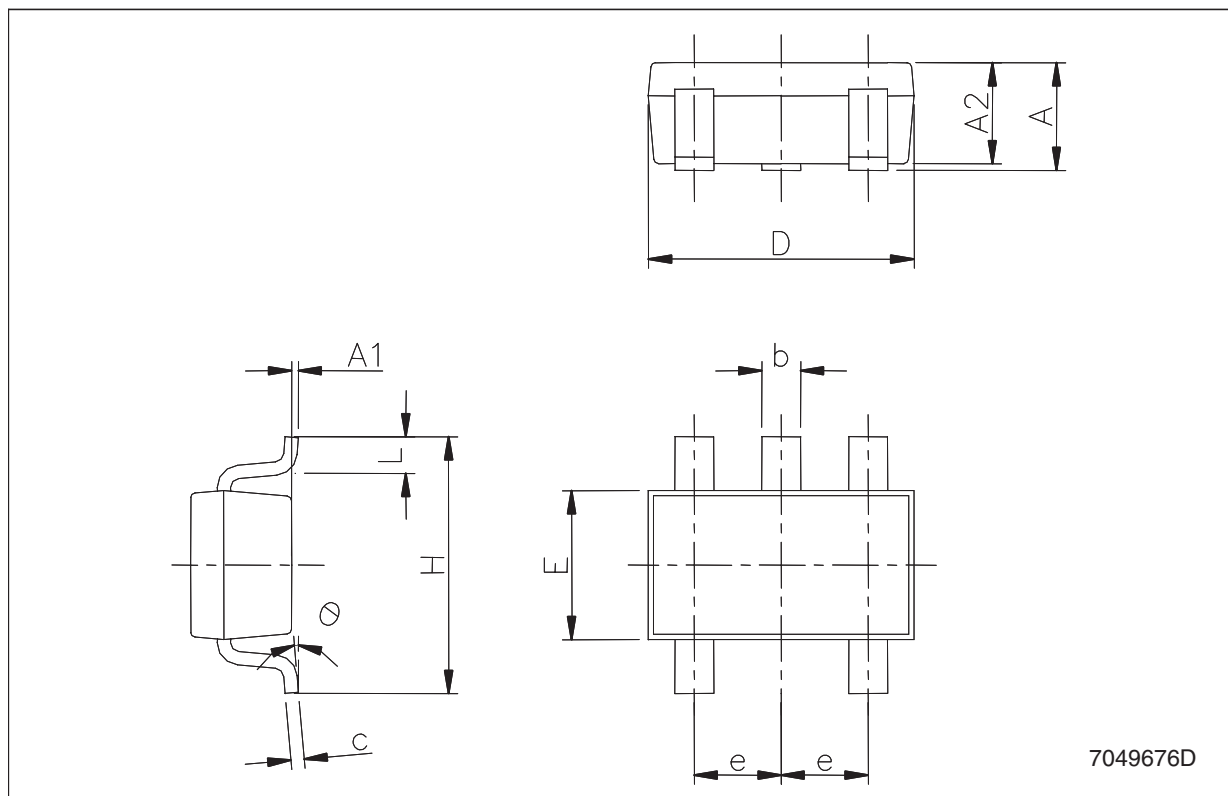


7 Package mechanical data

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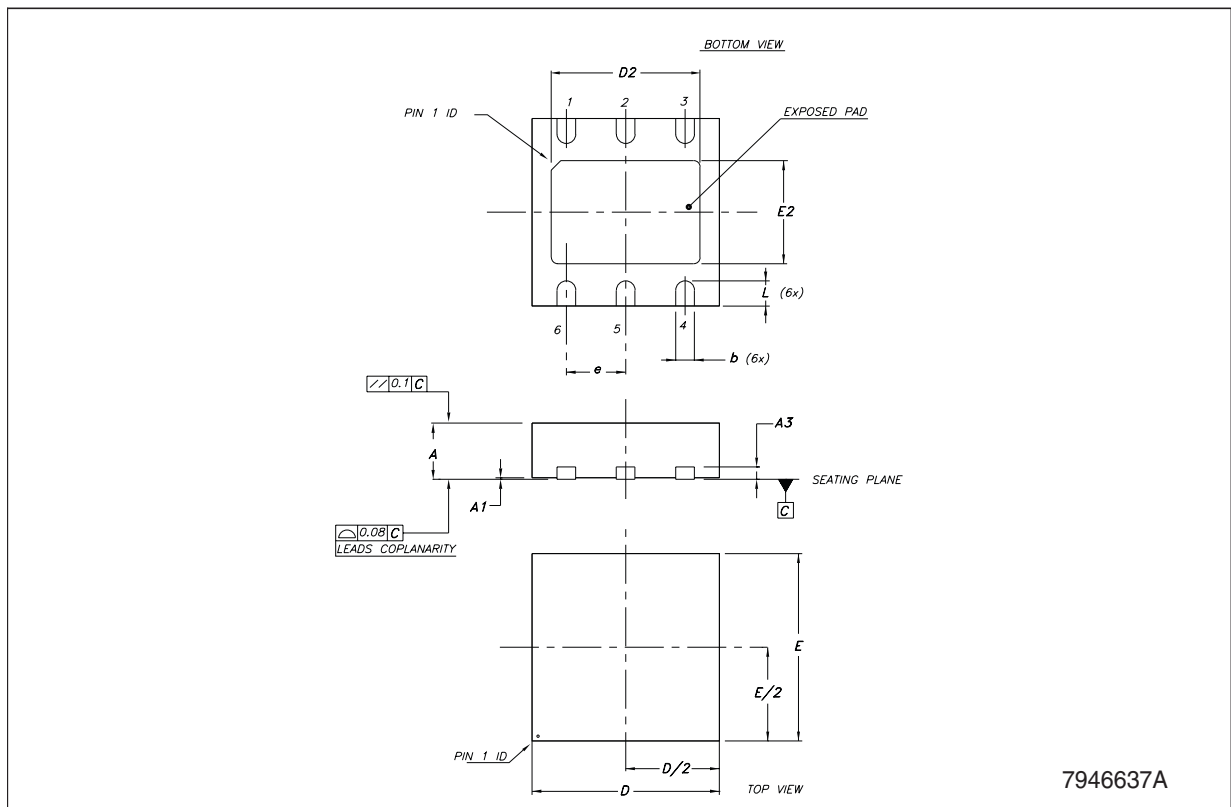
SOT23-5L mechanical data

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



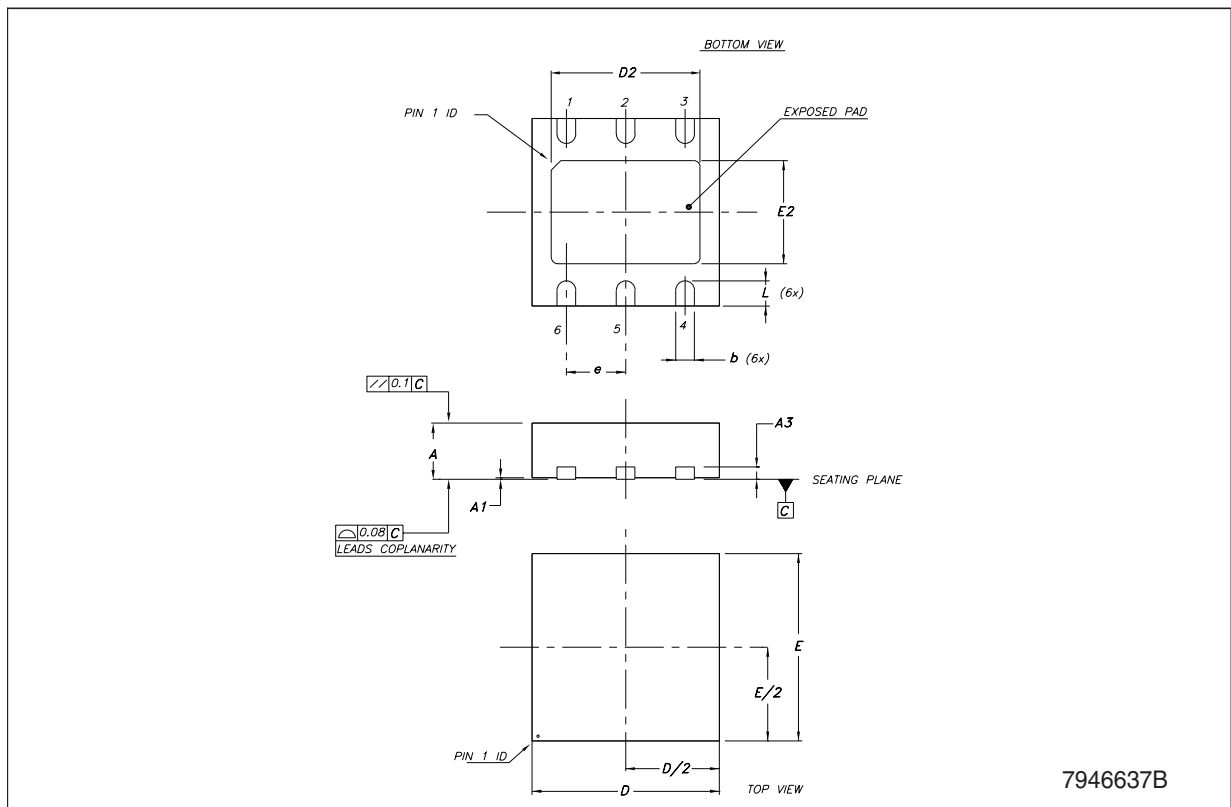
DFN6 (3x3 mm) mechanical data

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



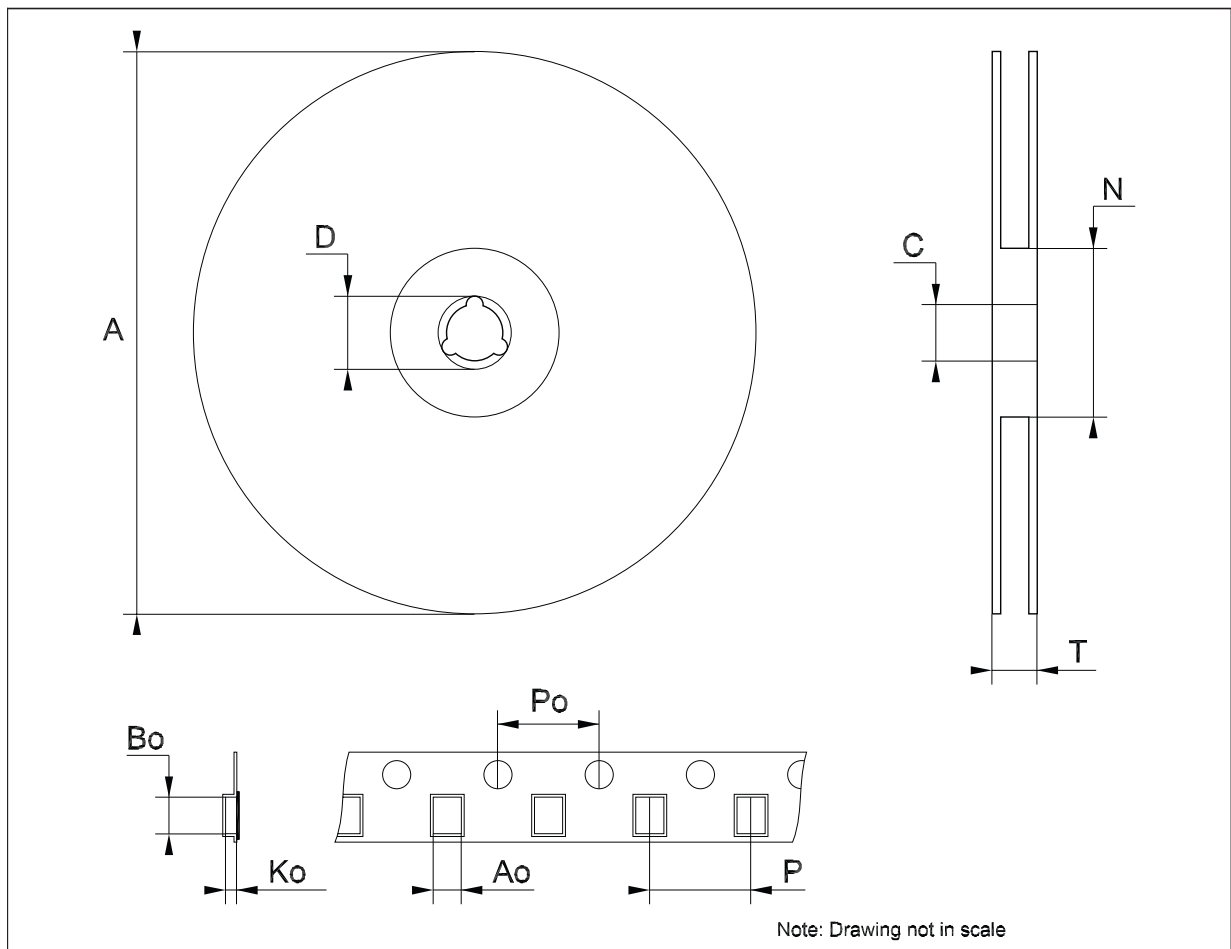
DFN6D (3x3 mm) mechanical data

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



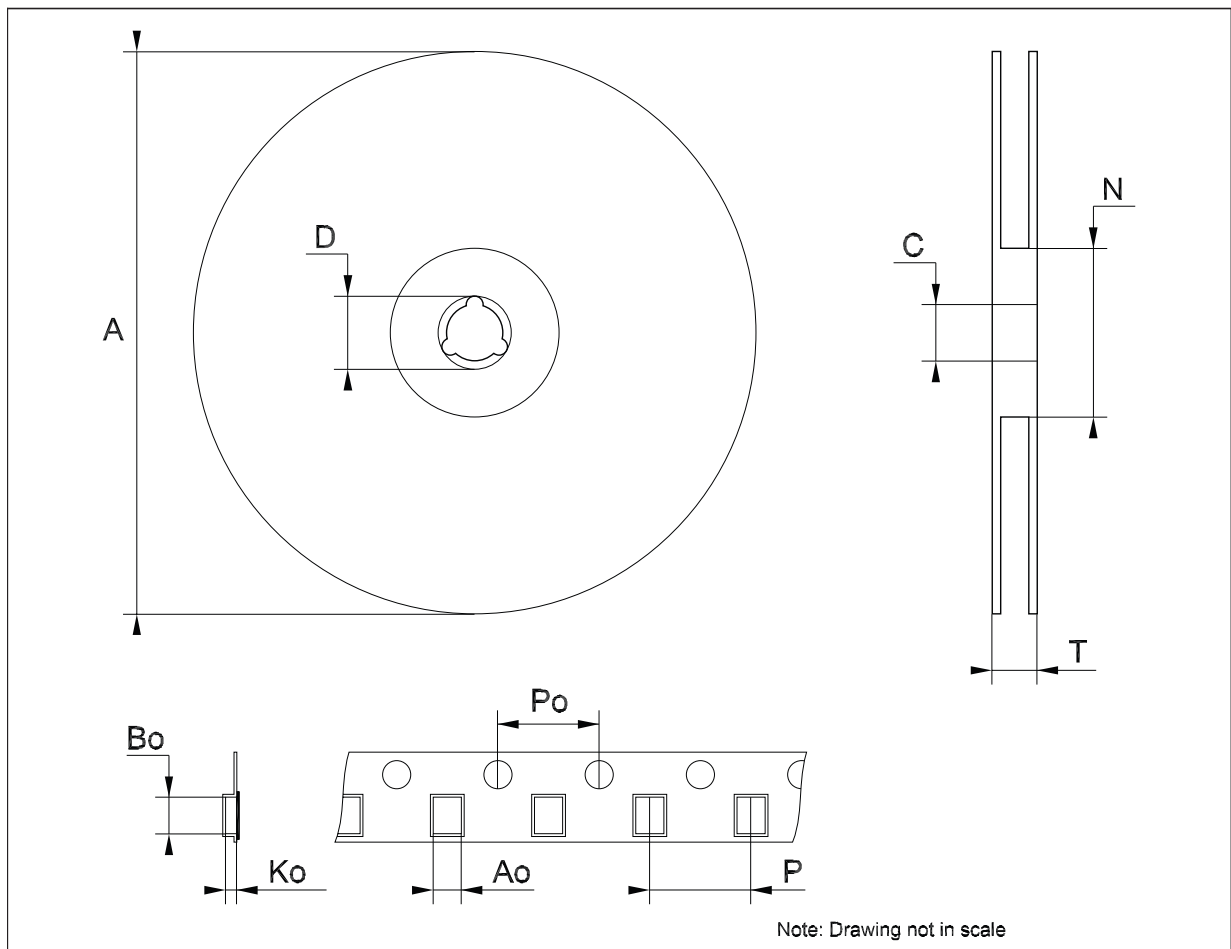
Tape & reel SOT23-xL mechanical data

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 <td 0.161	



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	



8 Order codes

Table 6. Order codes

Packages			Output voltage
SOT23-5L	DFN6	DFN6D	
LDS3985M125R ⁽¹⁾	LDS3985PM12R ⁽¹⁾		1.25 V
LDS3985M135R ⁽¹⁾	LDS3985PM13R ⁽¹⁾		1.35 V
LDS3985M15R	LDS3985PM15R ⁽¹⁾	LDS3985PU15R	1.5 V
LDS3985M18R	LDS3985PM18R ⁽¹⁾		1.8 V
LDS3985M20R ⁽¹⁾	LDS3985PM20R ⁽¹⁾		2.0 V
LDS3985M21R ⁽¹⁾	LDS3985PM21R ⁽¹⁾		2.1 V
LDS3985M22R ⁽¹⁾	LDS3985PM22R ⁽¹⁾		2.2 V
LDS3985M25R	LDS3985PM25R ⁽¹⁾		2.5 V
LDS3985M26R ⁽¹⁾	LDS3985PM26R ⁽¹⁾		2.6 V
LDS3985M27R ⁽¹⁾	LDS3985PM27R ⁽¹⁾		2.7 V
LDS3985M28R		LDS3985PU28R	2.8 V
LDS3985M285R ⁽¹⁾	LDS3985PM285R ⁽¹⁾		2.85 V
LDS3985M29R ⁽¹⁾	LDS3985PM29R ⁽¹⁾		2.9 V
LDS3985M30R	LDS3985PM30R ⁽¹⁾		3.0 V
LDS3985M33R		LDS3985PU33R	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	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	Added: new package TSOT23-5L.
16-May-2007	3	Added: new mechanical data DFN6D and order codes updated.
06-Sep-2007	4	Added: Table 1 in cover page.
11-Jun-2008	5	Modified: Table 6 on page 18 .
11-Jul-2009	6	Modified: Table 6 on page 18 .
29-Jul-2010	7	Modified: Table 1 on page 1 and Table 6 on page 18 .

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