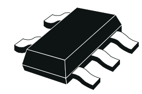
LD2985Axx
LD2985Bxx

Very low drop and low noise voltage regulator low ESR capacitors compatible, with inhibit function

Features

- Very low dropout voltage (280 mV at 150 mA and 7 mV at 1 mA load)
- Very low quiescent current (2 mA typ. at 150 mA load and 80 µA at no load)
- Output current up to 150 mA
- Logic controlled electronic shutdown
- Output voltage of 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5 V
- Internal current and thermal limit
- Available in ± 1.5 % tolerance (at 25 °C, A version)
- Low output noise voltage 30 mVrms
- Smallest package SOT23-5L
- Temperature range: - 40°C to 125 °C



SOT23-5L

Description

The LD2985A/Bxx is a 150 mA fixed output voltage regulator. The ultra low drop voltage and the low quiescent current make them particularly suitable for low noise, low power applications, and in battery powered systems. In sleep mode quiescent current is less than 1 µA when INHIBIT pin is pulled low. Shutdown logic control function is available on pin 3 (TTL compatible). 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.

An external capacitor, C_{BYP} = 10 nF, connected between bypass pin and GND reduce the noise to 30 µVrms.

Typical application are in cellular phone, palmtop laptop computer, personal digital assistant (PDA), personal stereo, camcorder and camera.

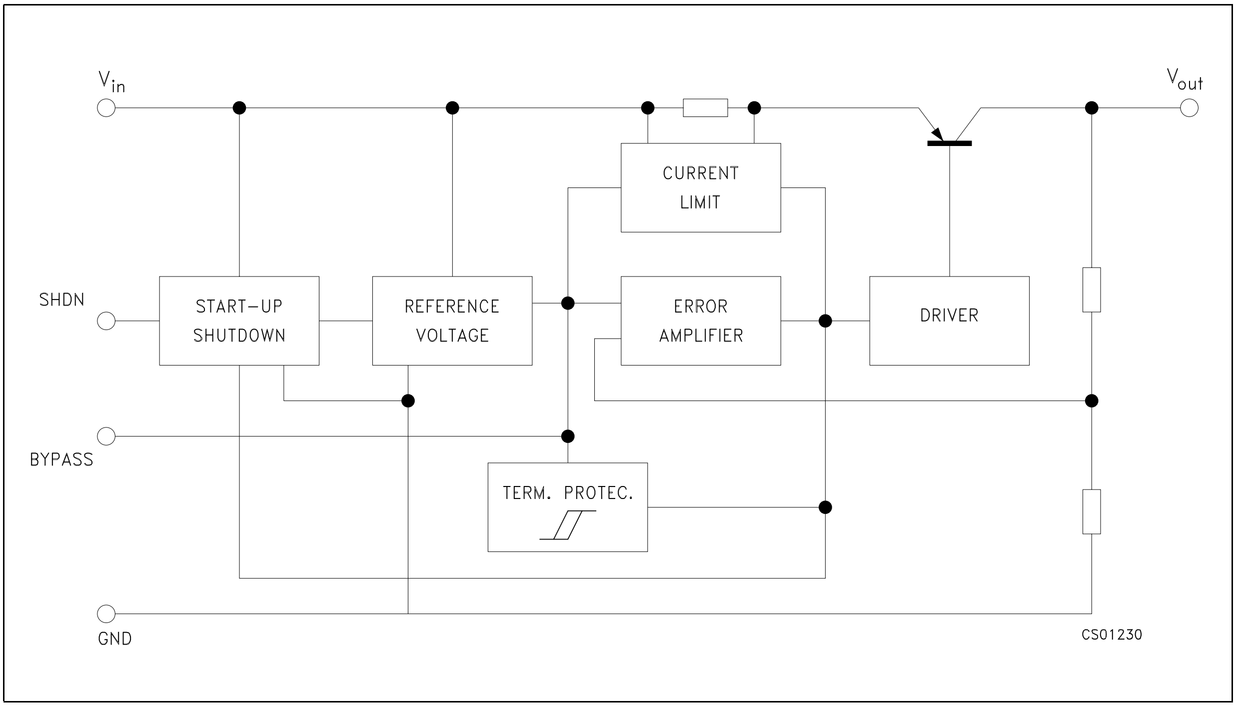
Table 1. Device summary

Part numbers		
A version	**B version**	**Output voltages**
LD2985AXX18	LD2985BXX18	1.8 V
LD2985AXX25	LD2985BXX25	2.5 V
LD2985AXX27	LD2985BXX27	2.7 V
LD2985AXX28	LD2985BXX28	2.8 V
LD2985AXX30	LD2985BXX30	3.0 V
LD2985AXX33	LD2985BXX33	3.3 V
LD2985AXX50	LD2985BXX50	5.0 V

Contents

1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

Figure 2. Pin connections (top view)

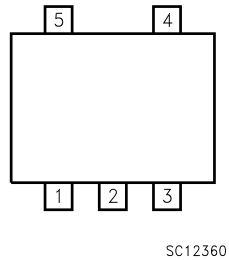


Table 2. Pin description

Pin n°	Symbol	Name and function
1	IN	Input port
2	GND	Ground pin
3	INHIBIT	Control switch ON/OFF. Inhibit is not internally pulled-up; it cannot be left floating. Disable the device when connected to GND or to a positive voltage less than 0.18V
4	Bypass	Bypass pin: capacitor to be connected to GND in order to improve the thermal noise performances
5	OUT	Output port

Table 3. Thermal data

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

3 Maximum ratings

Table 4. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	DC input voltage	16	V
V_{INH}	INHIBIT input voltage	16	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

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

4 Electrical characteristics

Table 5. Electrical characteristics for LD2985A (T_J = 25 °C, $V_I = V_O$ + 1 V, I_O = 50 mA, V_{SHDN} = 2 V, $C_I = C_O$ = 1 µF, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{OP}	Operating input voltage		2.5		16	V
V_O	Output voltage	V_I = 2.5V	1.478	1.5	1.522	V
		I_O = 1 to 150mA	1.462		1.538	
		I_O = 1 to 150mA, T_J= -40 to 125°C	1.447		1.553	
V_O	Output voltage	V_I = 2.8V	1.773	1.8	1.827	V
		I_O = 1 to 150mA	1.755		1.845	
		I_O = 1 to 150mA, T_J= -40 to 125°C	1.737		1.863	
V_O	Output voltage	V_I = 3.5V	1.463	2.5	2.537	V
		I_O = 1 to 50mA	2.4375		2.5625	
		I_O = 1 to 50mA, T_J= -40 to 125°C	2.4125		2.5875	
V_O	Output voltage	V_I = 3.7V	2.660	2.7	2.740	V
		I_O = 1 to 150mA	2.6325		2.7675	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.6055		2.7945	
V_O	Output voltage	V_I = 3.8V	2.758	2.8	2.842	V
		I_O = 1 to 150mA	2.730		2.870	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.702		2.898	
V_O	Output voltage	V_I = 3.85V	2.808	2.85	2.892	V
		I_O = 1 to 150mA	2.778		2.921	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.750		2.950	
V_O	Output voltage	V_I = 4.0V	2.955	3.0	3.045	V
		I_O = 1 to 150mA	2.925		3.075	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.895		3.105	
V_O	Output voltage	V_I = 4.1V	3.054	3.1	3.146	V
		I_O = 1 to 150mA	3.022		3.1775	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.9915		3.2085	
V_O	Output voltage	V_I = 4.2V	3.152	3.2	3.248	V
		I_O = 1 to 150mA	3.120		3.280	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.088		3.312	
V_O	Output voltage	V_I = 4.3V	3.251	3.3	3.349	V
		I_O = 1 to 150mA	3.2175		3.3825	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.1845		3.4155	
V_O	Output voltage	V_I = 4.5V	3.448	3.5	3.552	V
		I_O = 1 to 150mA	3.412		3.587	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.377		3.622	
V_O	Output voltage	V_I = 4.6V	3.546	3.6	3.654	V
		I_O = 1 to 150mA	3.510		3.690	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.474		3.726	

Table 5. Electrical characteristics for LD2985A (continued) (T_J = 25 °C, $V_I = V_O + 1$ V, I_O = 50 mA, V_{SHDN} = 2 V, $C_I = C_O$ = 1 µF, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	V_I = 4.8V	3.743	3.8	3.857	V
		I_O = 1 to 150mA	3.705		3.895	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.667		3.933	
V_O	Output voltage	V_I = 5.0V	3.94	4	4.06	V
		I_O = 1 to 150mA	3.9		4.1	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.86		4.14	
V_O	Output voltage	V_I = 5.7V	4.63	4.7	4.77	V
		I_O = 1 to 150mA	4.582		4.817	
		I_O = 1 to 150mA, T_J= -40 to 125°C	4.5355		4.8645	
V_O	Output voltage	V_I = 6.0V	4.925	5	5.075	V
		I_O = 1 to 150mA	4.875		5.125	
		I_O = 1 to 150 mA, T_J= -40 to 125°C	4.825		5.175	
I_{SC}	Short circuit current	R_L = 0		400		mA
$\Delta V_O/\Delta V_I$	Line regulation	$V_I = V_O$ + 1V to 16V, I_O = 1 mA		0.003	0.014	%/V_I
		$V_I = V_O$ + 1V to 16V, I_O = 1 mA, T_J= -40 to 125°C			0.032	
V_{DROP}	Dropout voltage	I_O = 0		1	3	mV
		I_O = 0, T_J= -40 to 125°C			5	
		I_O = 1mA		7	10	
		I_O = 1mA, T_J= -40 to 125°C			15	
		I_O = 10mA		40	60	
		I_O = 10mA, T_J= -40 to 125°C			90	
		I_O = 50mA		120	150	
		I_O = 50mA, T_J= -40 to 125°C			225	
		I_O = 150mA		280	350	
		I_O = 150mA, T_J= -40 to 125°C			575	
I_Q	Quiescent current ON MODE	I_O = 0		80	100	µA
		I_O = 0, T_J= -40 to 125°C			150	
		I_O = 1mA		100	150	
		I_O = 1mA, T_J= -40 to 125°C			200	
		I_O = 10mA		200	300	
		I_O = 10mA, T_J= -40 to 125°C			400	
		I_O = 50mA		600	900	
		I_O = 50mA, T_J= -40 to 125°C			1200	
		I_O = 150mA		2000	3000	
		I_O = 150mA, T_J= -40 to 125°C			4000	
	OFF MODE	V_{INH}<0.18V		0		
		V_{INH}<0.18V, T_J= -40 to 125°C			2	
SVR	Supply voltage rejection	C_{BYP} = 0.01µF, C_O = 10µF, f = 1kHz		45		dB
V_{IL}	Control input logic low	T_J= -40 to 125°C			0.15	V

Table 5. Electrical characteristics for LD2985A (continued) (T_J = 25 °C, $V_I = V_O$ + 1 V, I_O = 50 mA, V_{SHDN} = 2 V, $C_I = C_O$ = 1 µF, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IH}	Control input logic high	T_J= -40 to 125°C	2			V
I_{INH}	Control input current	V_{INH} = 5V, T_J= -40 to 125°C		5	15	µA
		V_{INH} = 0V, T_J= -40 to 125°C		0	-1	
e_N	Output noise voltage	B = 300 Hz to 50 kHz, C_{BYP} = 0.01µF, C_O = 10µF		30		µV

Table 6. Electrical characteristics for LD2985B (T_J = 25 °C, $V_I = V_O$ + 1 V, I_O = 50 mA, V_{SHDN} = 2 V, $C_I = C_O$ = 1 µF, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{OP}	Operating input voltage		2.5		16	V
V_O	Output voltage	V_I = 2.5V	1.463	1.5	1.537	V
		I_O = 1 to 150mA	1.455		1.545	
		I_O = 1 to 150mA, T_J= -40 to 125°C	1.440		1.560	
V_O	Output voltage	V_I = 2.8V	1.755	1.8	1.845	V
		I_O = 1 to 150mA	1.746		1.854	
		I_O = 1 to 150mA, T_J= -40 to 125°C	1.728		1.872	
V_O	Output voltage	V_I = 3.5V	2.437	2.5	2.562	V
		I_O = 1 to 150mA	2.425		2.575	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.4		2.6	
V_O	Output voltage	V_I = 3.5V	2.633	2.7	2.767	V
		I_O = 1 to 150mA	2.619		2.781	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.592		2.808	
V_O	Output voltage	V_I = 3.8V	2.73	2.8	2.87	V
		I_O = 1 to 150mA	2.716		2.884	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.688		2.912	
V_O	Output voltage	V_I = 3.85V	2.779	2.85	2.921	V
		I_O = 1 to 150mA	2.764		2.935	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.736		2.964	
V_O	Output voltage	V_I = 4.0V	2.925	3.0	3.075	V
		I_O = 1 to 150mA	2.91		3.09	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.88		3.12	
V_O	Output voltage	V_I = 4.1V	3.023	3.1	3.177	V
		I_O = 1 to 150mA	3.007		3.193	
		I_O = 1 to 150mA, T_J= -40 to 125°C	2.976		3.224	
V_O	Output voltage	V_I = 4.2V	3.120	3.2	3.28	V
		I_O = 1 to 150mA	3.104		3.296	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.072		3.328	
V_O	Output voltage	V_I = 4.3V	3.218	3.3	3.382	V
		I_O = 1 to 150mA	3.201		3.399	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.168		3.432	

Table 6. Electrical characteristics for LD2985B (continued) (T_J = 25 °C, $V_I = V_O$ + 1 V, I_O = 50 mA, V_{SHDN} = 2 V, $C_I = C_O$ = 1 µF, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	V_I = 4.5V	3.413	3.5	3.587	V
		I_O = 1 to 150mA	3.395		3.605	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.360		3.640	
V_O	Output voltage	V_I = 4.6V	3.51	3.6	3.69	V
		I_O = 1 to 150mA	3.492		3.708	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.456		3.744	
V_O	Output voltage	V_I = 4.8V	3.705	3.8	3.895	V
		I_O = 1 to 150mA	3.686		3.914	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.648		3.952	
V_O	Output voltage	V_I = 5.0V	3.900	4	4.100	V
		I_O = 1 to 150mA	3.88		4.12	
		I_O = 1 to 150mA, T_J= -40 to 125°C	3.84		4.16	
V_O	Output voltage	V_I = 5.7V	4.583	4.7	4.817	V
		I_O = 1 to 150mA	4.559		4.841	
		I_O = 1 to 150mA, T_J= -40 to 125°C	4.512		4.888	
V_O	Output voltage	V_I = 6.0V	4.875	5	5.125	V
		I_O = 1 to 150mA	4.85		5.15	
		I_O = 1 to 150 mA, T_J= -40 to 125°C	4.8		5.2	
I_{SC}	Short circuit current	R_L = 0		400		mA
$\Delta V_O/\Delta V_I$	Line regulation	$V_I = V_O$ + 1V to 16V, I_O = 1 mA		0.003	0.014	%/V_I
		$V_I = V_O$ + 1V to 16V, I_O = 1 mA, T_J= -40 to 125°C			0.032	
V_{DROP}	Dropout voltage	I_O = 0		1	3	mV
		I_O = 0, T_J= -40 to 125°C			5	
		I_O = 1mA		7	10	
		I_O = 1mA, T_J= -40 to 125°C			15	
		I_O = 10mA		40	60	
		I_O = 10mA, T_J= -40 to 125°C			90	
		I_O = 50mA		120	150	
		I_O = 50mA, T_J= -40 to 125°C			225	
		I_O = 150mA		280	350	
		I_O = 150mA, T_J= -40 to 125°C			575	

Table 6. Electrical characteristics for LD2985B (continued) (T_J = 25 °C, $V_I = V_O$ + 1 V, I_O = 50 mA, V_{SHDN} = 2 V, $C_I = C_O$ = 1 µF, unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_Q	Quiescent current ON MODE	I_O = 0		80	100	µA
		I_O = 0, T_J= -40 to 125°C			150	
		I_O = 1mA		100	150	
		I_O = 1mA, T_J= -40 to 125°C			200	
		I_O = 10mA		200	300	
		I_O = 10mA, T_J= -40 to 125°C			400	
		I_O = 50mA		600	900	
		I_O = 50mA, T_J= -40 to 125°C			1200	
		I_O = 150mA		2000	3000	
		I_O = 150mA, T_J= -40 to 125°C			4000	
	OFF MODE	V_{INH}<0.18V		0		
		V_{INH}<0.18V, T_J= -40 to 125°C			2	
SVR	Supply voltage rejection	C_{BYP} = 0.01µF, C_O = 10µF, f = 1kHz		45		dB
V_{IL}	Inhibit input logic low	T_J= -40 to 125°C			0.15	V
V_{IH}	Inhibit input logic high	T_J= -40 to 125°C	2			V
I_{INH}	Inhibit input current	V_{INH} = 0V, T_J= -40 to 125°C		5	15	µA
		V_{INH} = 5V, T_J= -40 to 125°C		0	-1	
e_N	Output noise voltage	B = 300 Hz to 50 kHz, C_{BYP} = 0.01µF, C_O = 10µF		30		µV

5 Typical characteristics

(T_J = 25 °C, $V_I = V_{O(NOM)}$ +1 V, C_I = 1 µF(X7R), C_O = 2.2 µF(X7R), V_{INH} = 2 V, unless otherwise specified).

Figure 3. Output voltage vs temperature

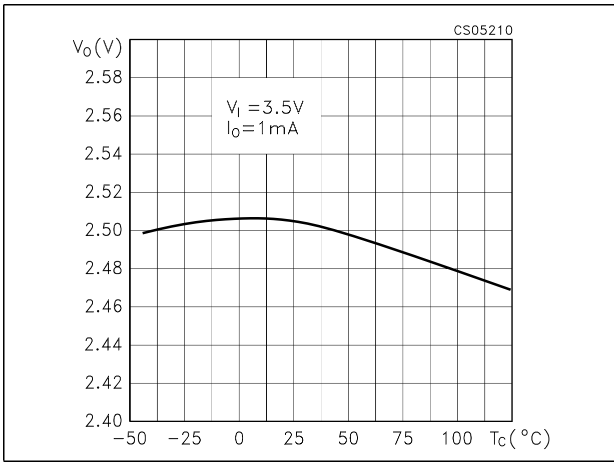


Figure 4. Dropout voltage vs temperature

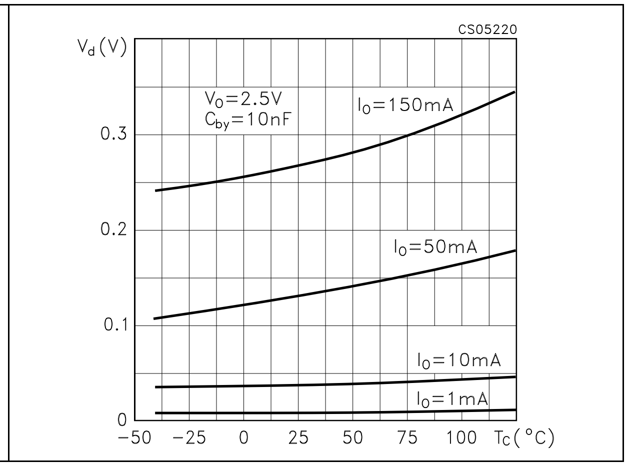


Figure 5. Dropout voltage vs output current

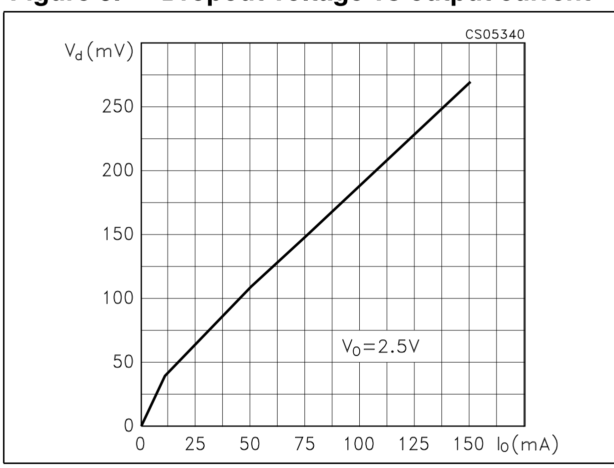


Figure 6. Quiescent current vs load current

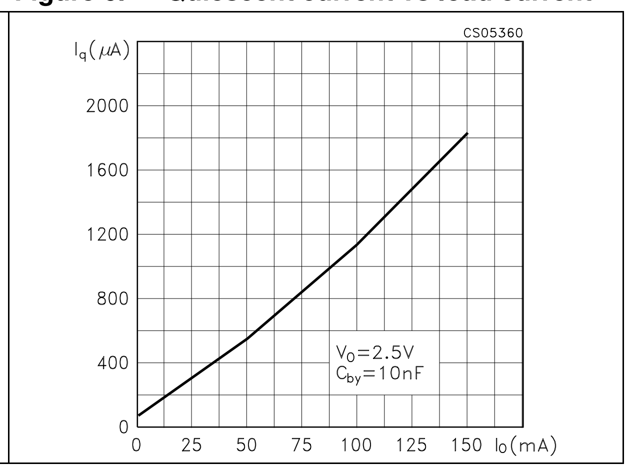


Figure 7. Quiescent current vs temperature

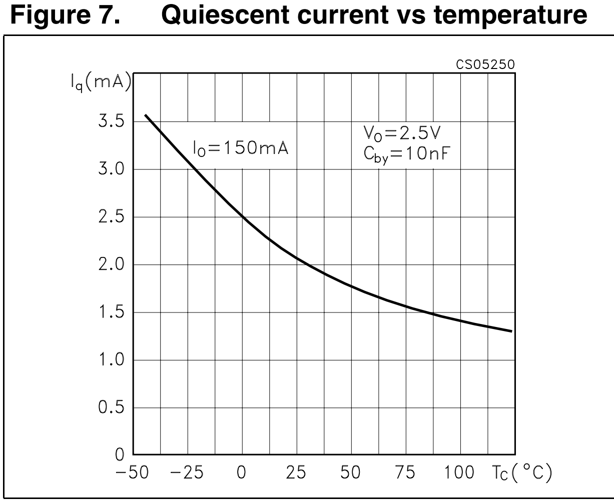


Figure 8. Supply voltage rejection vs temp.

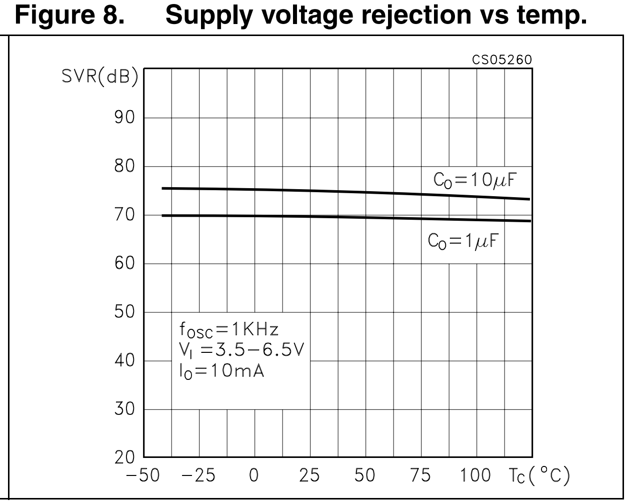


Figure 9. Supply voltage rejection vs output current

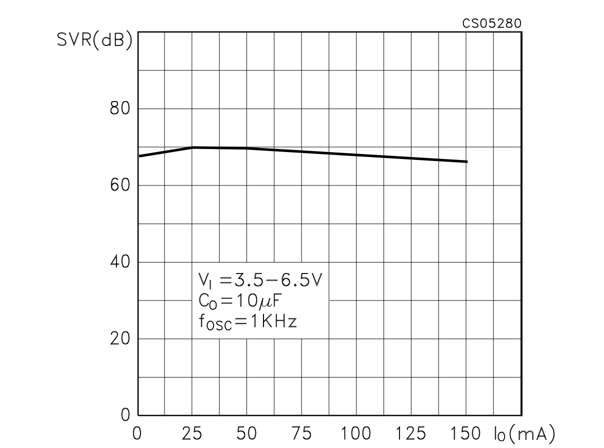


Figure 10. Supply voltage rejection vs output current

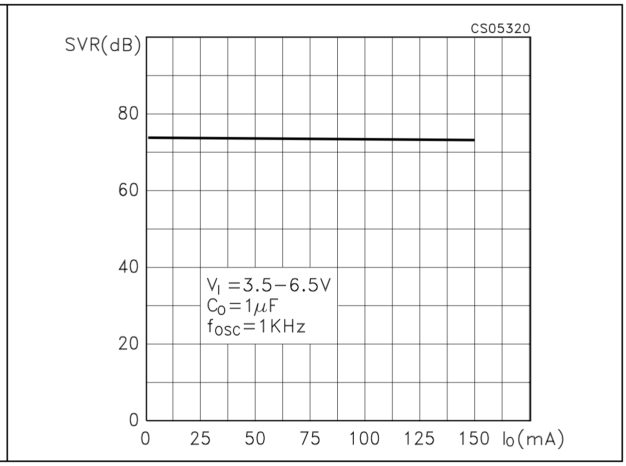


Figure 11. Supply voltage rejection vs frequency

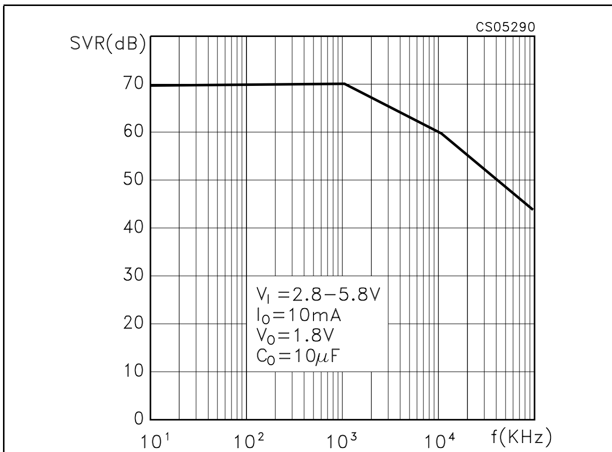


Figure 12. Supply voltage rejection vs frequency

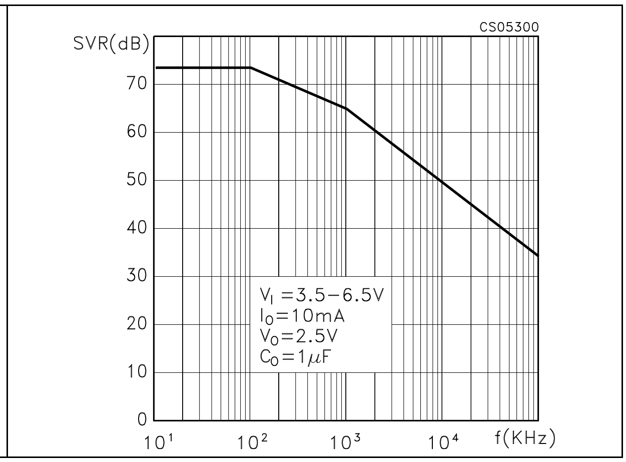
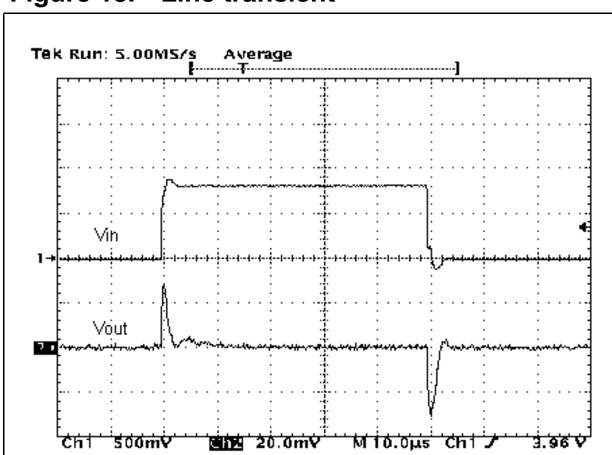
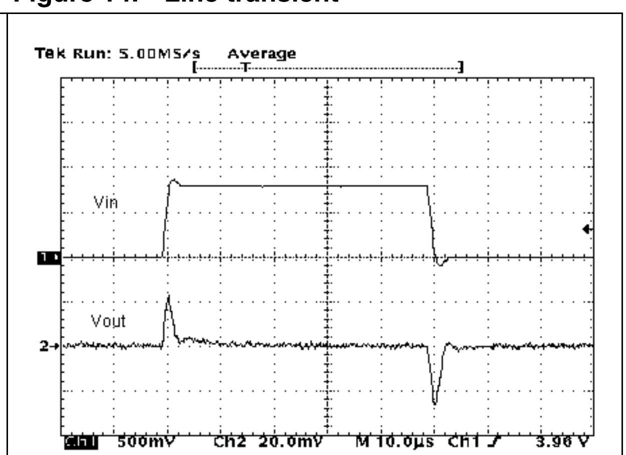


Figure 13. Line transient



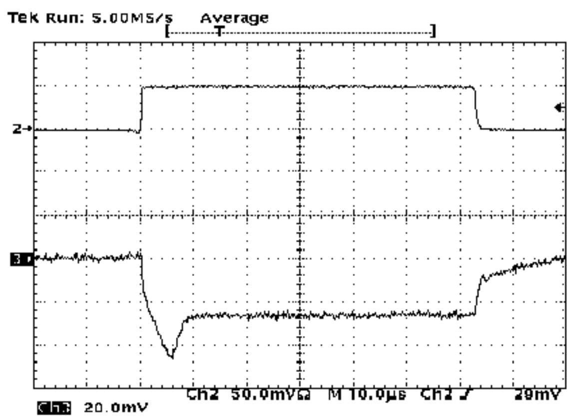
V_O = 2.5V, I_O = 50mA, no C_I, C_O = 4.7µF, t_r=t_f=2ns

Figure 14. Line transient



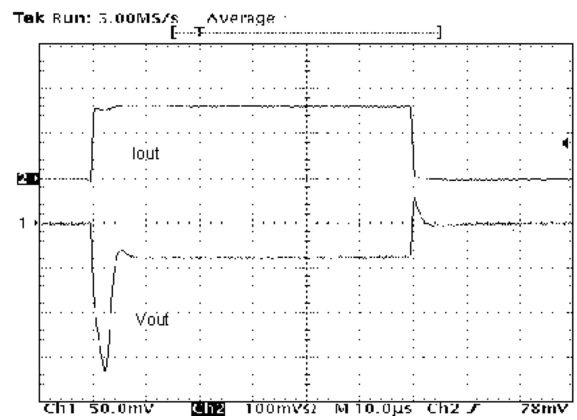
V_O = 2.5V, I_O = 50mA, no C_I, C_O = 4.7µF, t_r=t_f=1µs

Figure 15. Load transient



V_O = 2.5V, I_O = 0 to 50mA, no C_I, C_O = 10µF, t_r=t_f=2ns

Figure 16. Load transient



V_O = 2.5V, I_O = 0 to 50mA, no C_I, C_O = 4.7µF, t_r=t_f=2ns

6 Application notes

6.1 External capacitors

Like any low-dropout regulator, the LD2985 requires external capacitors for regulator stability. This capacitor must be selected to meet the requirements of minimum capacitance and equivalent series resistance. We suggest to solder input and output capacitors as close as possible to the relative pins.

6.2 Input capacitor

An input capacitor whose value is 1 µF is required with the LD2985 (amount of capacitance can be increased without limit). This capacitor must be located a distance of not more than 0.5" from the input pin of the device and returned to a clean analog ground. Any good quality ceramic, tantalum or film capacitors can be used for this capacitor.

6.3 Output capacitor

The LD2985 is designed specifically to work with ceramic output capacitors. It may also be possible to use Tantalum capacitors, but these are not as attractive for reasons of size and cost. By the way, the output capacitor must meet both the requirement for minimum amount of capacitance and ESR (equivalent series resistance) value. Due to the different loop gain, the stability improves for higher output versions and so the suggested minimum output capacitor value, if low ESR ceramic type is used, is 1 µF for output voltages equal or major than 3.8 V, 2.2 µF for V_O going from 1.8 to 3.3 V, and 3.3 µF for the other versions. However, if an output capacitor lower than the suggested one is used, it's possible to make stable the regulator adding a resistor in series to the capacitor.

6.4 Important

The output capacitor must maintain its ESR in the stable region over the full operating temperature to assure stability. Also, capacitor tolerance and variation with temperature must be considered to assure the minimum amount of capacitance is provided at all times. This capacitor should be located not more than 0.5" from the output pin of the device and returned to a clean analog ground.

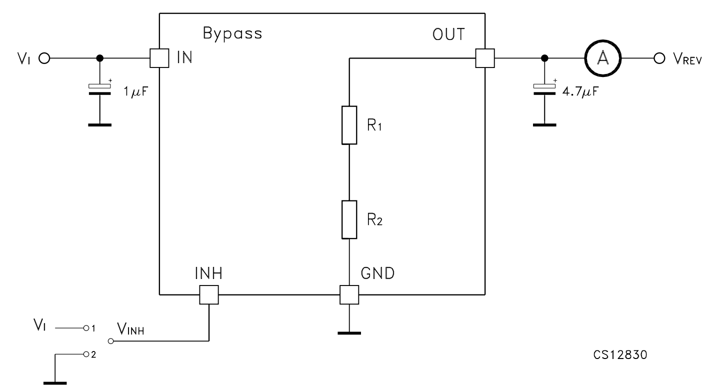
6.5 Inhibit input operation

The inhibit pin can be used to turn OFF the regulator when pulled low, so drastically reducing the current consumption down to less than 1 µA. When the inhibit feature is not used, this pin must be tied to V_I to keep the regulator output ON at all times. To assure proper operation, the signal source used to drive the inhibit pin must be able to swing above and below the specified thresholds listed in the electrical characteristics section under V_{IH} V_{IL}. Any slew rate can be used to drive the inhibit.

6.6 Reverse current

The power transistor used in the LD2985 has not an inherent diode connected between the regulator input and output. If the output is forced above the input, no current will flow from the output to the input across the series pass transistor. When a V_{REV} voltage is applied on the output, the reverse current measured flows to the GND across the two feedback resistors. This current typical value is 160 µA. R_1 and R_2 resistors are implanted type; typical values are, respectively, 42.6 kΩ and 51.150 kΩ.

Figure 17. Reverse current test circuit

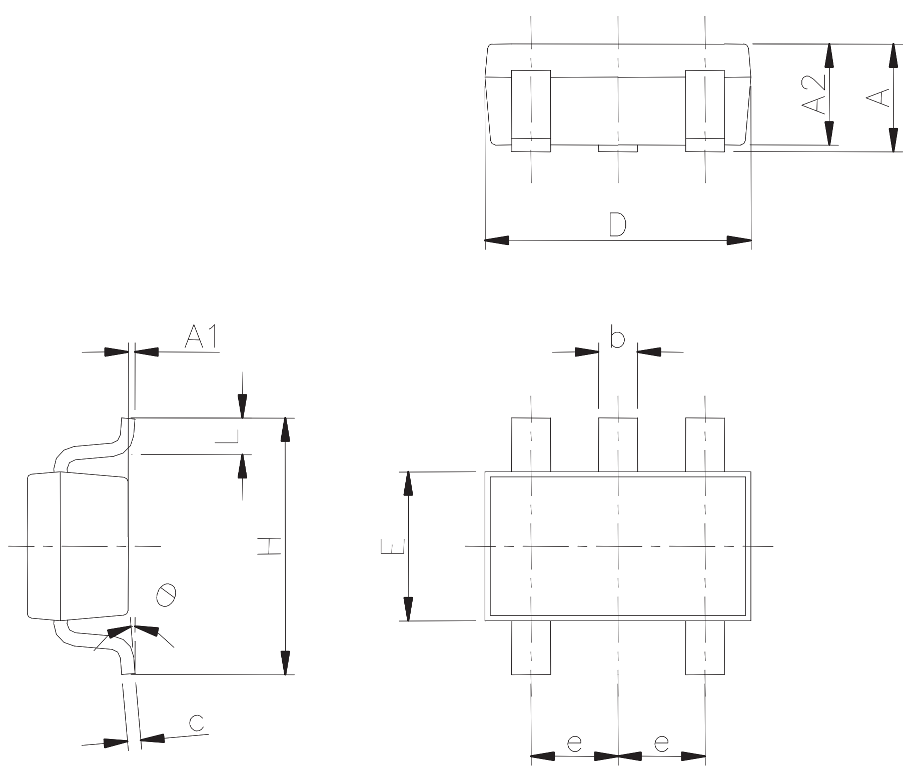


7 Package mechanical data

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. ECOPACK® is an ST trademark.

SOT23-5L mechanical data

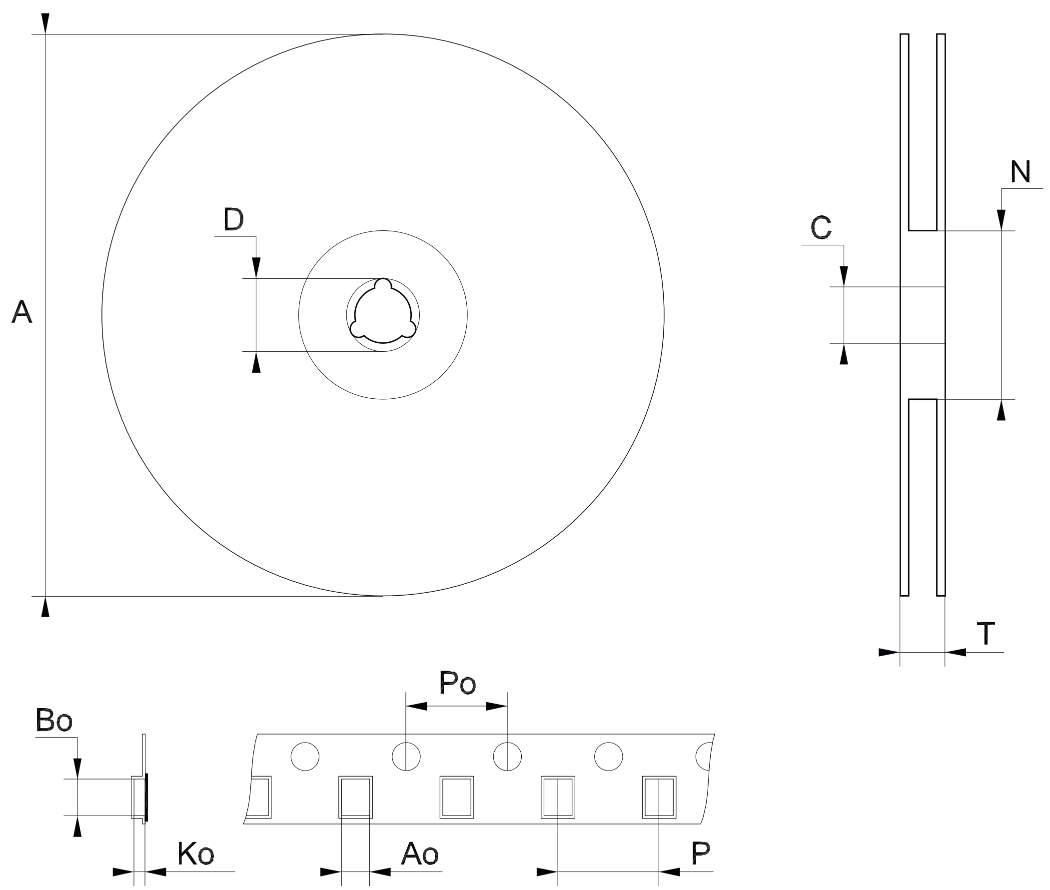
Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.45	35.4		57.1
A1	0.00		0.10	0.0		3.9
A2	0.90		1.30	35.4		51.2
b	0.35		0.50	13.7		19.7
C	0.09		0.20	3.5		7.8
D	2.80		3.00	110.2		118.1
E	1.50		1.75	59.0		68.8
e		0.95			37.4	
H	2.60		3.00	102.3		118.1
L	0.10		0.60	3.9		23.6



7049676D

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

8 Order codes

Table 7. Order codes

A version	B version	Output voltages
LD2985AM18R	LD2985BM18R	1.8 V
LD2985AM25R	LD2985BM25R	2.5 V
	LD2985BM27R	2.7 V
LD2985AM28R	LD2985BM28R	2.8 V
LD2985AM30R	LD2985BM30R	3.0 V
LD2985AM33R	LD2985BM33R	3.3 V
LD2985AM50R	LD2985BM50R	5.0 V

9 Revision history

Table 8. Document revision history

Date	Revision	Changes
22-Aug-2005	4	Add new value V_O ==> 2.7 V on tables 5 and 6.
02-Sep-2005	5	Mistake V_O min. ==> 2.7 V on table 5.
25-Jul-2006	6	Order codes updated.
13-Feb-2008	7	Added: *Table 1 on page 1*.
04-Mar-2008	8	Modified: *Table 5 on page 6* and *Table 6 on page 8*.
10-Jul-2008	9	Modified: *Table 1 on page 1* and *Table 7 on page 19*.
27-Aug-2008	10	Modified*: Features on page 1*.
27-Jan-2009	11	Modified*: Features on page 1*.