

# DATA SHEET

## **LP2985-XX**

Micropower 150 mA low noise,  
low dropout linear regulator

Product data

2001 Oct 03

File under Integrated Circuits, Standard Analog

# Micropower 150 mA low noise, low dropout linear regulator

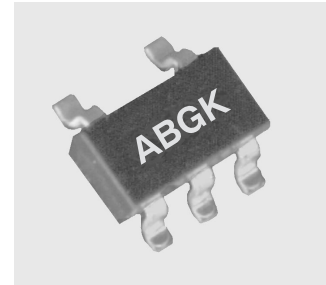
## LP2985-XX

### GENERAL DESCRIPTION

The LP2985-XX is a 150 mA, fixed output voltage regulator designed to provide very low dropout and low noise in battery powered and portable applications. The output voltage is preset to 1.8, 2.8, 3.0, 3.3, 3.6, or 5.0 V.

Designed with an optimized PNP process, the LP2985-XX achieves unequalled performance in all specifications critical to battery-powered designs such as low supply-current, low dropout voltage, low power consumption, small size, fast dynamic response to line and load, precision output, etc. This regulator consists of an internal voltage reference, an error amplifier, a driver with current limiter and a thermal shut-down mechanism.

The LP2985-XX is housed in a SOT23-5 5-lead package.



### FEATURES

- Very low consumption current: 85 mA typ. (when not loaded), 0.1 mA max. (when off)
- Very low dropout voltage: 100 mV typ. ( $I_{OUT} = 50$  mA)
- High precision output voltage:  $\pm 2\%$
- Output current capacity: 150 mA
- Low noise: 30 mV<sub>RMS</sub> @ 20 Hz to 80 kHz ( $C_n = 10$  nF)
- Good line regulation: 0.01%/V typ.
- Good load regulation: 30 mV typ. ( $I_{OUT} = 1$  to 150 mA)
- Low temperature drift co-efficient to  $V_{OUT}$ :  $\pm 100$  ppm/ $^{\circ}$ C
- Built-in current limit and thermal shut-down
- Wide operating temperature range:  $-30$  to  $+85$   $^{\circ}$ C
- Preset output voltages: 1.8, 2.8, 3.0, 3.3, 3.6, or 5.0 V

### APPLICATIONS

- Cellular phones, cordless phones, and 2-way radios
- Electronic notebooks, PDAs and palmtop computers
- Cameras, VCRs and camcorders
- PCMCIA cards
- Modems
- Battery-powered or hand-held instruments

### SIMPLIFIED DEVICE DIAGRAM

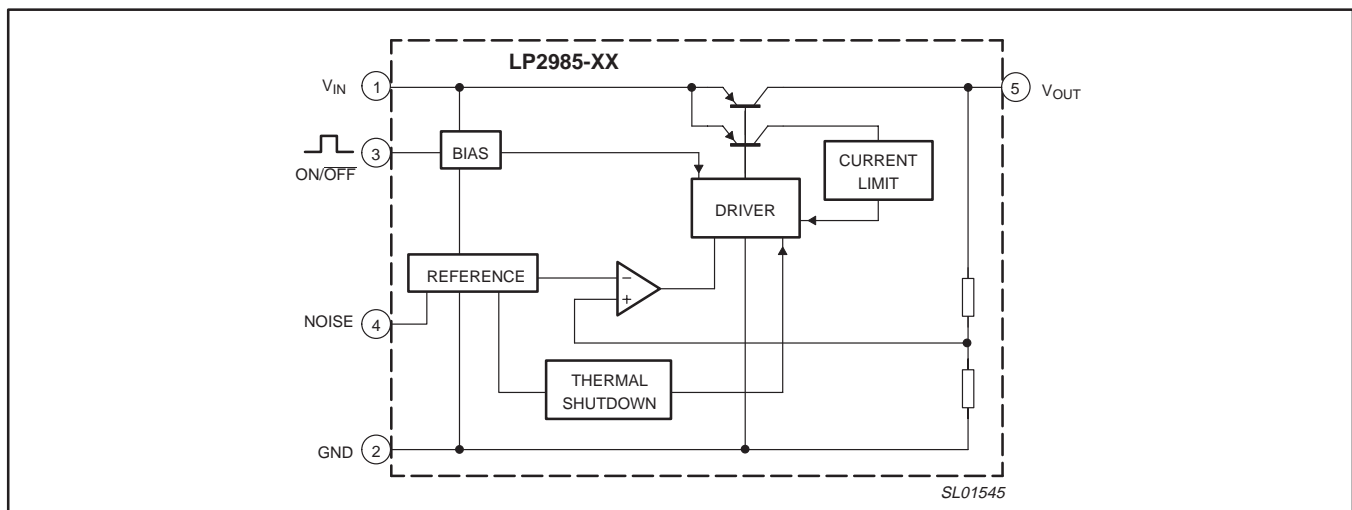


Figure 1. Simplified device diagram.

# Micropower 150 mA low noise, low dropout linear regulator

# LP2985-XX

## ORDERING INFORMATION

TYPE NUMBER	PACKAGE		TEMPERATURE RANGE
	NAME	DESCRIPTION	
LP2985-XXD	SOT23-5, SOT25, SO5	plastic small outline package; 5 leads (see dimensional drawing)	-30 to +85 °C

### NOTE:

The device has five voltage output options, indicated by the **XX** on the Type Number.

XX	VOLTAGE (Typical)
18	1.8 V
28	2.8 V
30	3.0 V
33	3.3 V
36	3.6 V
50	5.0 V

### Part number marking

Each device is marked with a four letter code. The first three letters designate the product. The fourth letter, represented by 'x', is a date tracking code.

Part number	Marking
LP2985-18D	A A B x
LP2985-28D	A A C x
LP2985-30D	A B G x
LP2985-33D	A B H x
LP2985-36D	A N B x
LP2985-50D	A B J x

## PIN CONFIGURATION

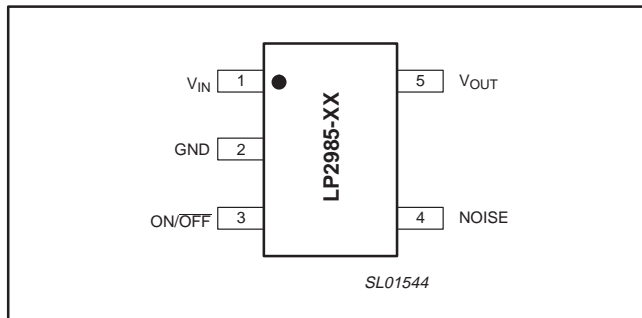


Figure 2. Pin configuration.

## PIN DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1	V <sub>IN</sub>	Voltage input.
2	GND	Device ground.
3	ON/OFF	ON/OFF control pin. Connect to V <sub>IN</sub> if not used.
4	NOISE	Noise decrease pin, for connecting external capacitor.
5	V <sub>OUT</sub>	Voltage output.

## MAXIMUM RATINGS

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V <sub>IN</sub>	Supply voltage	-0.3	+12.0	V
T <sub>oper</sub>	Operating temperature	-30	+85	°C
T <sub>stg</sub>	Storage temperature	-40	+150	°C
P <sub>D</sub>	Power dissipation	-	150	mW

# Micropower 150 mA low noise, low dropout linear regulator

## LP2985-XX

### ELECTRICAL CHARACTERISTICS

$T_{amb} = 25\text{ °C}$ ,  $V_{IN} = V_{OUT(nom)} + 1\text{ V}$ ,  $V_{ON/OFF} = 2.0\text{ V}$ , unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{CC}$	No-load input current	$I_{OUT} = 0\text{ mA}$	–	85	130	$\mu\text{A}$
$I_{CC(OFF)}$	Standby input current	$V_{ON/OFF}$	–	0	0.1	$\mu\text{A}$
$V_{OUT}$	Output voltage		98	–	102	% $V_{nom}$
		LP2885-18	1.764	1.8	1.836	V
		LP2885-28	2.744	2.8	2.856	V
		LP2885-30	2.940	3.0	3.060	V
		LP2885-33	3.234	3.3	3.366	V
		LP2885-36	3.528	3.6	3.672	V
	LP2885-50	4.900	5.0	5.100	V	
$V_{IN-VOUT}$	Dropout voltage	$V_{IN} = V_{OUT(typ)} + 1\text{ to }10\text{ V}$	–	0.1	0.2	V
$\Delta V_{LNR}$	Line regulation	$V_{IN} = V_{OUT(typ)} + 1\text{ to }10\text{ V}$	–	10	20	mV
$\Delta V_{LDR}$	Load regulation	$I_{OUT} = 1\text{ to }150\text{ mA}$	–	30	90	mV
$\Delta V_{OUT}/\Delta T$	$V_{OUT}$ temperature coefficient	$-30\text{ °C} \leq T_j \leq +85\text{ °C}$	–	100	–	ppm/°C
RR1	Ripple rejection 1	$f = 120\text{ Hz}$ ; $V_{ripple} = 1\text{ V}$	50	70	–	dB
RR2	Ripple rejection 2	$f = 1\text{ kHz}$ ; $C_n = 0.01\text{ }\mu\text{F}$ ; $V_{ripple} = 1\text{ V}$	–	60	–	dB
$V_n$	Output noise voltage	$f_{BW} = 20\text{ Hz to }80\text{ kHz}$ ; $C_n = 0.01\text{ }\mu\text{F}$	–	30	–	$\mu\text{V}_{RMS}$
$I_{ON/OFF}$	ON/OFF pin input current	$V_{ON/OFF} = 5.0\text{ V}$	–	5	15	$\mu\text{A}$
$V_{OFF}$	ON/OFF low threshold voltage		–0.3	–	0.4	V
$V_{ON}$	ON/OFF high threshold voltage		1.6	–	$V_{IN} + 0.3$	V

# Micropower 150 mA low noise, low dropout linear regulator

LP2985-XX

## TECHNICAL DISCUSSION

As illustrated in Figure 3, the LP2985-XX consists of a band-gap voltage reference, an error amplifier, P-channel pass transistor, current limit circuit and an internal feedback voltage divider. The output voltage is fed back through an internal resistor voltage divider connected to the V<sub>OUT</sub> pin.

The reference is connected to the error amplifier's inverting input. The error amplifier compares the reference with the feedback voltage and amplifies the difference. If the feedback voltage is lower than the reference voltage, the pass transistor's gate is pulled lower, which allows more current to pass to the output and increase the

output voltage. If the feedback voltage is too high, the pass transistor gate is pulled up, allowing less current to pass to the output, resulting in a decrease in output voltage.

An external bypass capacitor connected to the NOISE pin reduces noise at the output.

Additional functional blocks include a current-limiter, thermal sensor and shut-down logic. The current-limiter monitors and controls the pass-transistor's gate voltage, limiting the output current to its specified maximum value. Thus it can withstand a short-circuited output for an indefinite amount of time without damaging the part.

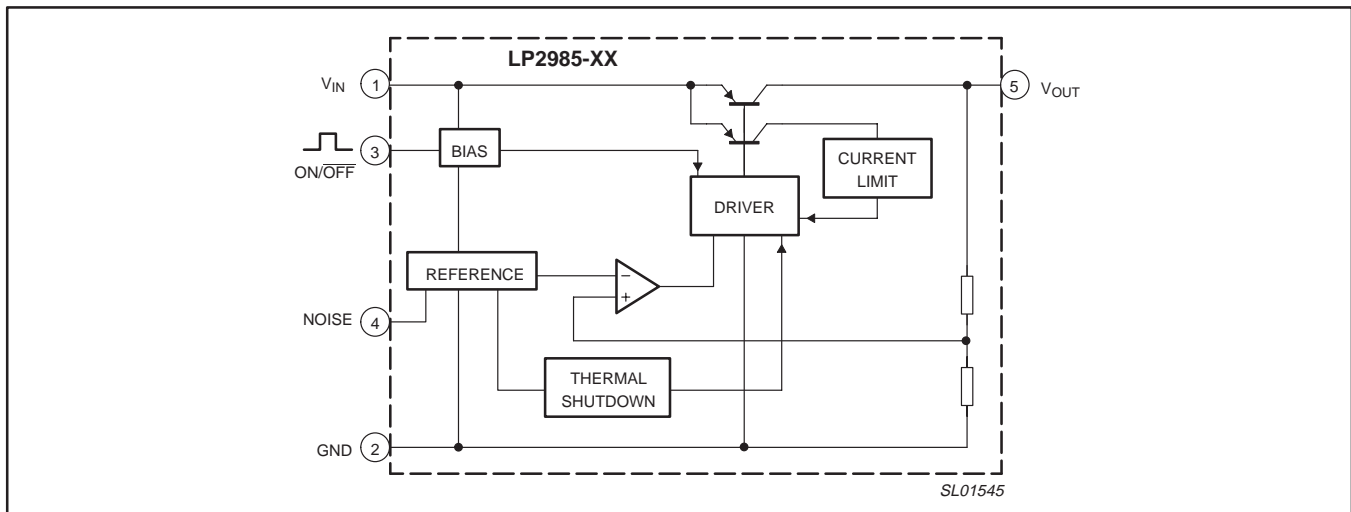


Figure 3. Block diagram.

# Micropower 150 mA low noise, low dropout linear regulator

LP2985-XX

## APPLICATION INFORMATION

The following points have to be kept in mind for good performance while using these devices:

### Input Capacitor

An input capacitor of greater than 1  $\mu\text{F}$  is required between the LP2985-XX input pin and the circuit ground (the amount of capacitance may be increased without limit). This capacitor must be located as close as possible to the  $V_{\text{IN}}$  or GND pin (not more than 1 cm away from the pin) and returned to a clean analog ground. Any good quality ceramic, tantalum, or film capacitor will work.

### Output Capacitor

Phase compensation is used for securing stable operation even if the load current varies. For this reason, an output capacitor with

good frequency characteristics is needed. Set it as close to the circuit as possible and make the wiring as short as possible. The value of the output capacitance must be at least 1  $\mu\text{F}$  and must have B-type temperature characteristics. Also it must have the ESR (Equivalent Series Resistance) value within the stable range shown in the ESR versus  $I_{\text{O}}$  plot.

### ON/OFF (Chip Enable) Pin

The ON/OFF pin must be actively terminated, not floating. If the function is not to be used, the pin should be tied to  $V_{\text{IN}}$ .

### Line Impedance of $V_{\text{IN}}$ and GND

The  $V_{\text{IN}}$  and GND lines should be sufficiently wide to minimize impedance. If the impedance of these lines is high, there is a chance to pick up noise or malfunction.

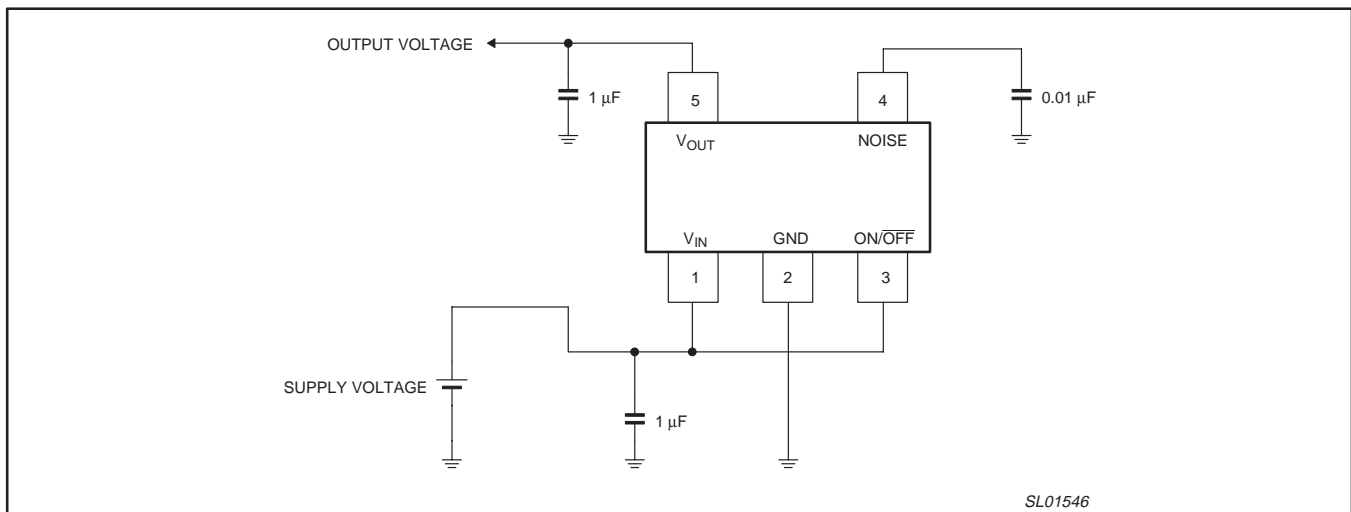


Figure 4. Typical application circuit, device always ON.

## TEST CIRCUITS

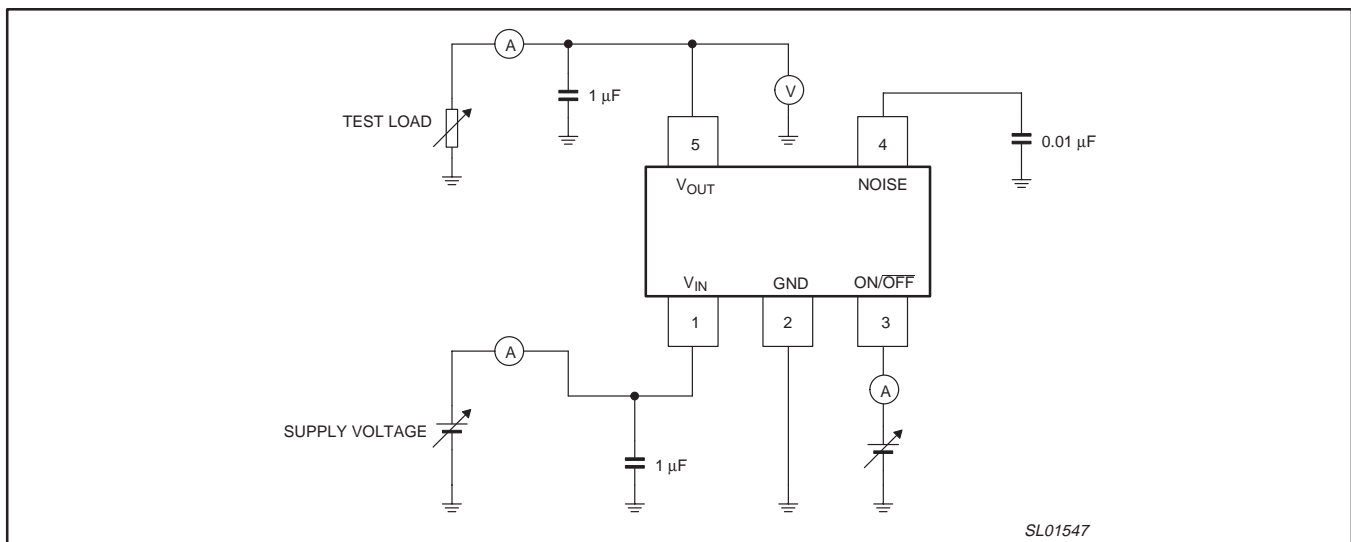


Figure 5. Test circuit.

# Micropower 150 mA low noise, low dropout linear regulator

LP2985-XX

## PACKING METHOD

The LP2985-XX is packed in reels, as shown in Figure 6.

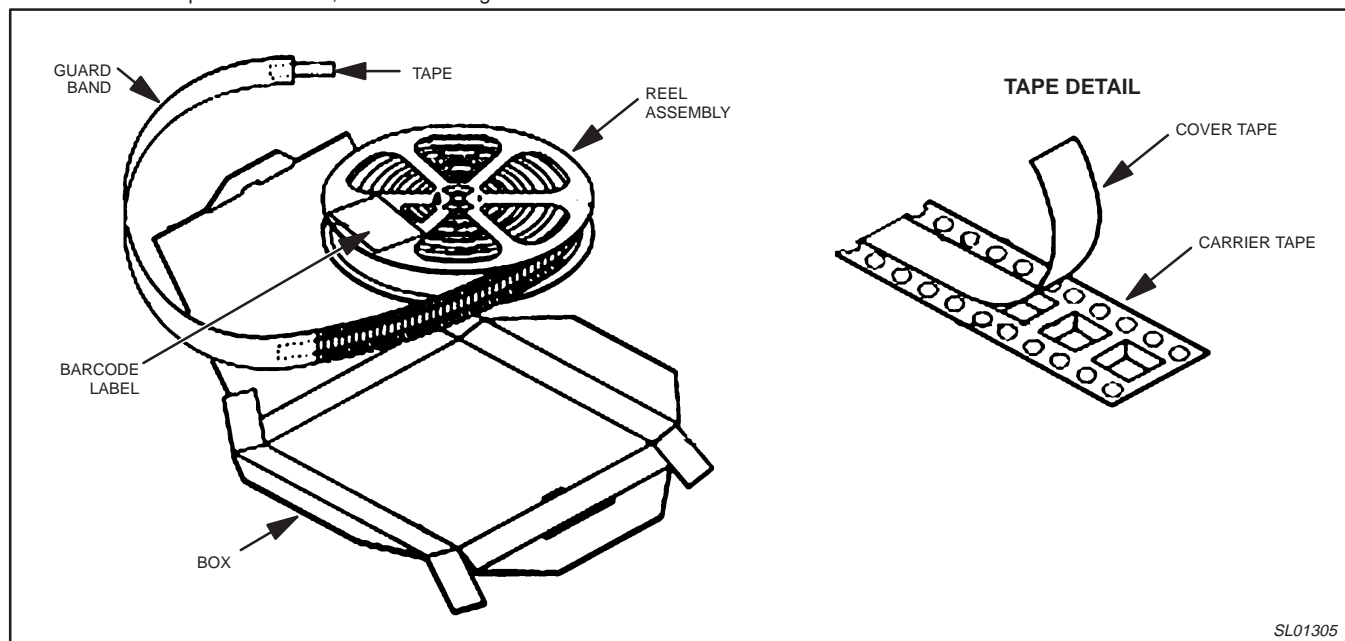
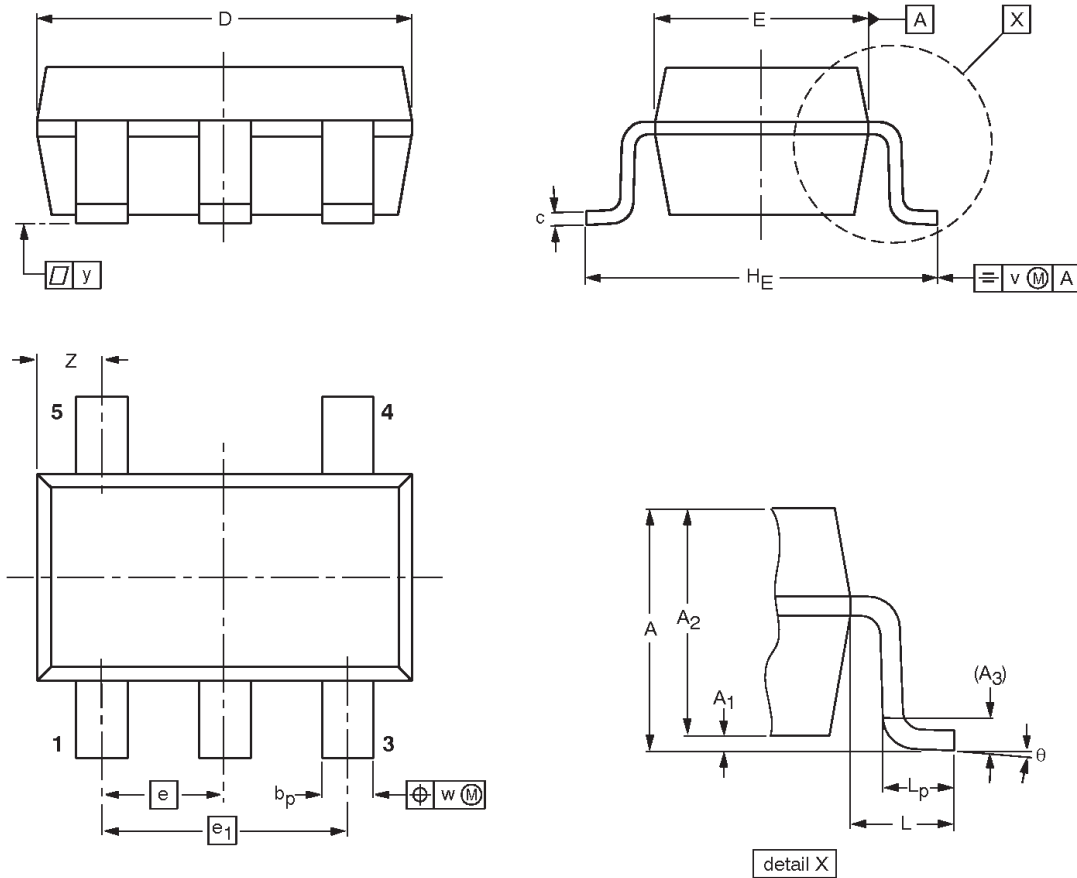


Figure 6. Tape and reel packing method

Micropower 150 mA low noise,  
low dropout linear regulator

LP2985-XX

SOT23-5: plastic small outline package; 5 leads; body width 1.5 mm



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	H <sub>E</sub>	L	L <sub>p</sub>		y	θ
mm	1.35	0.05 0.15	1.2 1.0	0.025	0.55 0.41	0.22 0.08	3.00 2.70	1.70 1.50	0.95	1.90	3.00 2.60	0.60	0.55 0.35		0.1	8° 0°

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			
	IEC	JEDEC	EIAJ	
		MO-178		



---

Micropower 150 mA low noise,  
low dropout linear regulator

---

LP2985-XX

**NOTES**

# Micropower 150 mA low noise, low dropout linear regulator

# LP2985-XX

## Data sheet status

Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup>	Definitions
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A.

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

## Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information** — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## Disclaimers

**Life support** — These products are not designed for use in life support appliances, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes** — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

## Contact information

For additional information please visit  
<http://www.semiconductors.philips.com>. Fax: +31 40 27 24825

© Koninklijke Philips Electronics N.V. 2001  
 All rights reserved. Printed in U.S.A.

Date of release: 10-01

For sales offices addresses send e-mail to:  
[sales.addresses@www.semiconductors.philips.com](mailto:sales.addresses@www.semiconductors.philips.com)

Document order number:

9397 750 08962

*Let's make things better.*

**Philips  
Semiconductors**



**PHILIPS**