300mA, Micropower, VLDO Linear Regulator

UM185XX *SOT23-5*

General Description

The UM185XX series are VLDO (very low dropout) linear regulators designed for low power portable applications. Typical output noise is only 75μV$_{RMS}$ and maximum dropout is just 90mV at the load current of 150mA.The internal P-channel MOSFET pass transistor requires no base current, allowing the device to draw only 100μA during normal operation at the maximum load current of 300mA.

Other features include high output voltage accuracy, excellent transient response, under voltage lockout, stability with ultralow ESR ceramic capacitors as small as 1μF, reverse-battery and reverse-current protection, short-circuit and thermal overload protection and output current limiting.

The UM185XX series are available in a low profile SOT23-5 package.

Applications

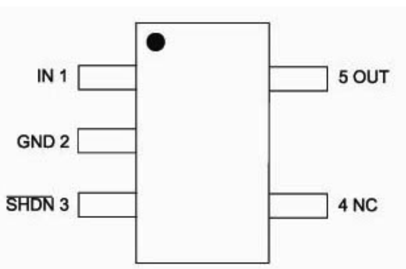
- Bluetooth/802.11 Cards
- PDAs and Notebook Computers
- Portable Instruments and Battery-Powered Systems
- Cellular Phones

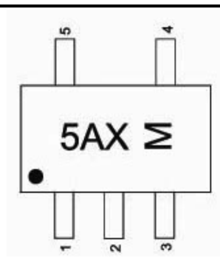
Features

- Very Low Dropout: 90mV(max) at 150mA
- Maximum Input Voltage: 6.0V
- Low Noise:75μV$_{RMS}$ (10Hz to 100kHz)
- ±1%Voltage Accuracy at 150mA
- Fast Transient Response
- Under Voltage Lockout
- Fixed Output Voltage: 3.3V/3.0V/2.8V/2.7V/2.5V/1.8V/1.5V
- Output Current Limit
- Reverse-Battery and Reverse-Current Protection
- No Protection Diodes Needed
- Stable with 1μF Output Capacitor
- Short-Circuit and Thermal Overload Protection
- Low Profile SOT23-5 Package

Pin Configurations

Top View





UM185XX
M: Monthly Code
SOT23-5

Ordering Information

Part Number	Output Voltage	Packaging Type	Marking Code	Shipping Qty
UM18533	3.3V	SOT23-5	5AU	3000pcs/7Inch Tape & Reel
UM18530	3.0V		5AR	
UM18528	2.8V		5AQ	
UM18527	2.7V		5AP	
UM18525	2.5V		5AN	
UM18518	1.8V		5AK	
UM18515	1.5V		5AJ	

Pin Description

Pin Number	Symbol	Function
1	IN	Power Supply
2	GND	Ground
3	$\overline{SHDN}$	Shutdown Input, Active Low
4	NC	Not Connected
5	OUT	Voltage Regulated Output

Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Value	Unit
V_{IN}	Supply Voltage on IN Pin	-7.5 to +7.5	V
$V_{\overline{SHDN}}$	Voltage on $\overline{SHDN}$ Pin	-0.3 to +7.5	V
V_{OUT}	Voltage on OUT Pin	-0.3 to +7.5	V
	Output Short-Circuit Duration	Indefinite	
T_J	Operating Junction Temperature (Notes 2, 3)	-40 to +125	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
T_L	Lead Temperature for Soldering 10 seconds	+300	°C

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: The UM185XX is tested and specified under pulse load conditions such that $T_J \approx T_A$. The device is guaranteed to meet performance specifications from 0℃ to 70℃. Specifications over the –40℃ to 125℃ operating junction temperature range are assured by design, characterization and correlation with statistical process controls.

Note 3: This IC includes overtemperature protection that is intended to protect the device during momentary overload conditions. Junction temperature will exceed 125℃ when overtemperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

Electrical Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_{IN}	Input Voltage Range			V_{OUT}+ V_{DROP}		6.0	V
V_{UVLO}	Input Under Voltage Lockout	V_{IN} falling		2.2		2.4	V
I_Q	Operating Quiescent Current	I_{OUT}=0mA			90		μA
		I_{OUT}=300mA			100		
$I_{\overline{SHDN}}$	Shutdown Leakage Current					1	μA
	ESD Rating	Human Body Mode		2			KV
I_{OUT}	Output Current			300			mA
	Output Voltage Accuracy	1mA≤I_{OUT}≤150mA, T_A=+25℃		-1		+1	%
		1mA≤I_{OUT}≤150mA, T_A=-40℃ to +85℃		-2		+2	
		1mA≤I_{OUT}≤300mA, T_A=-40℃ to +85℃		-2.5		+2.5	
ΔV_{DO}	Dropout Voltage	I_{OUT}=150mA				90	mV
I_{LIMT}	Output Current Limit	V_{IN}≥2.5V		450			mA
	Input Reverse Leakage Current (OUT to IN Leakage Current)	V_{IN}=4V, V_{OUT}=5.5V chip active			0.01	1.5	μA
t	Startup Time Response	R_L=68Ω, C_{OUT}=1μF			40		μs
V_{IL}	$\overline{SHDN}$ Input Low Voltage					0.3×V_{IN}	V
V_{IH}	$\overline{SHDN}$ Input High Voltage			0.7×V_{IN}			V
	$\overline{SHDN}$ Input Current	$\overline{SHDN}$=V_{IN} or GND		-1	0.1	+1	μA
T_{SHDN}	Thermal-Shutdown Temperature				160		℃
ΔT_{SHDN}	Thermal-Shutdown Hysteresis				20		℃
	Line Regulation	V_{OUT}+1V≤V_{IN}≤V_{OUT}+2V I_{OUT}=10mA			0.09		%/V
	Load Regulation	V_{IN}=V_{OUT}+1V 1mA≤I_{OUT}≤150mA			0.2		%
	Output Voltage Noise	10Hz to 100KHz C_{IN}=0.1μF, I_{OUT}=10mA			75		μV_{RMS}
PSRR	Power Supply Ripple Rejection	V_{IN}=V_{OUT}+1V I_{OUT}=100mA	F=100Hz	70			dB
			F=1KHz	65			
			F=10KHz	50			
			F=100KHz	40			

Pin Function

IN (Pin 1): Power for UM185XX and Load. Power is supplied to the devices through the IN pin. The IN pin should be locally bypassed to ground if the UM185XX series are more than a few inches away from another source of bulk capacitance. In general, the output impedance of a battery rises with frequency, so it is usually advisable to include an input bypass capacitor in battery-powered circuits. A capacitor in the range of 0.1μF to 1μF is usually sufficient. The UM185XX series are designed to withstand reverse voltages on the IN pin with respect to both ground and the output pin. In the case of a reversed input, which can happen if a battery is plugged in backwards, the UM185XX will act as if there is a large resistor in series with its input with only a small amount of current flow.

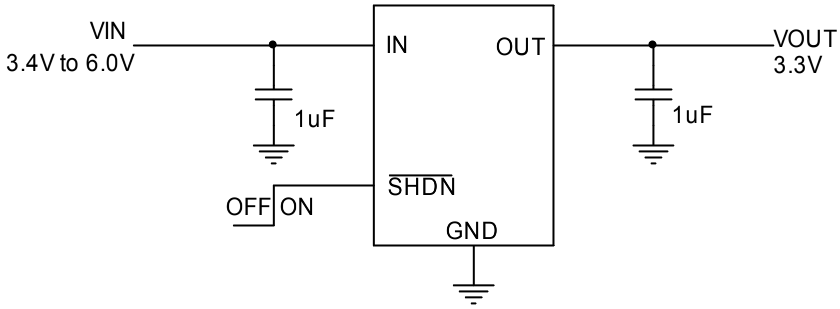
GND (Pin 2): Ground and Heat Sink. Solder to a ground plane or large pad to maximize heat dissipation.

$\overline{\text{SHDN}}$ **(Pin 3):** Shutdown, Active Low. This pin is used to put the UM185XX into shutdown. The $\overline{\text{SHDN}}$ pin cannot be left floating and must be tied to the input pin if not used.

NC (Pin 4): Not Connected.

OUT (Pin 5): Voltage Regulated Output. The OUT pin supplies power to the load. A minimum output capacitor of 1μF is required to ensure stability. Larger output capacitors may be required for applications with large transient loads to limit peak voltage transients. See the Applications Information section for more information on output capacitance.

Typical Application Circuit



Applications Information

The UM185XX series are 300mA very low dropout regulators with micropower quiescent current and shutdown. The maximum dropout is only 90mV at the load current of 150mA. Output voltage noise is as low as 75μV_{RMS} over a 10Hz to 100kHz bandwidth.

In addition to the low quiescent current, the UM185XX regulators incorporate several protection features which make them ideal for use in battery-powered systems. The devices are protected against both reverse input voltages and reverse voltages from output to input (reverse current protection). The devices also include current limit and thermal overload protection, and will survive an output short circuit indefinitely. The fast transient response over comes the traditional tradeoff between dropout voltage, quiescent current and load transient response inherent in most regulators by using a proprietary new architecture

Output Capacitance and Transient Response

The UM185XX regulators are designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability, most notably with small capacitors. A minimum output capacitor of 1μF with an ESR of 0.3Ω or less is recommended to ensure stability. The UM185XX series are micropower devices and output transient response will be a function of output capacitance. Larger values of output capacitance decrease the peak deviations and provide improved transient response for larger load current changes. The shaded region of Figure 1 defines the region over which the UM185XX regulators are stable. The maximum ESR allowed is 0.3Ω. High ESR tantalum and electrolytic capacitors may be used, but a low ESR ceramic capacitor must be in parallel at the output. There is no minimum ESR requirement.

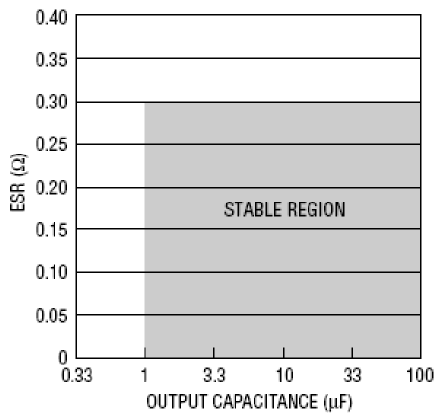


Figure 1

Extra consideration must be given to the use of ceramic capacitors. Ceramic capacitors are manufactured with a variety of dielectrics, each with different behavior across temperature and applied voltage. The most common dielectrics used are Z5U, Y5V, X5R and X7R. The Z5U and Y5V dielectrics are good for providing high capacitances in a small package, but exhibit strong voltage and temperature coefficients as shown in Figures 2 and 3. When used with a 5V regulator, a 10μF Y5V capacitor can exhibit an effective value as low as 1μF to 2μF over the operating temperature range. The X5R and X7R dielectrics result in more stable characteristics and are more suitable for use as the output capacitor. The X7R type has better stability across temperature, while the X5R is less expensive and is available in higher values.

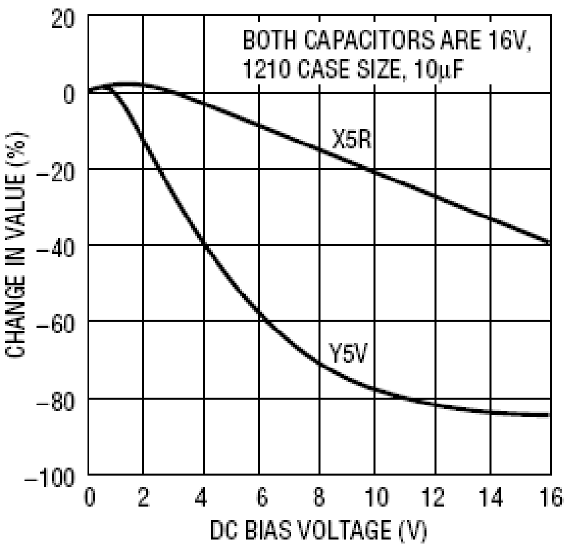


Figure 2

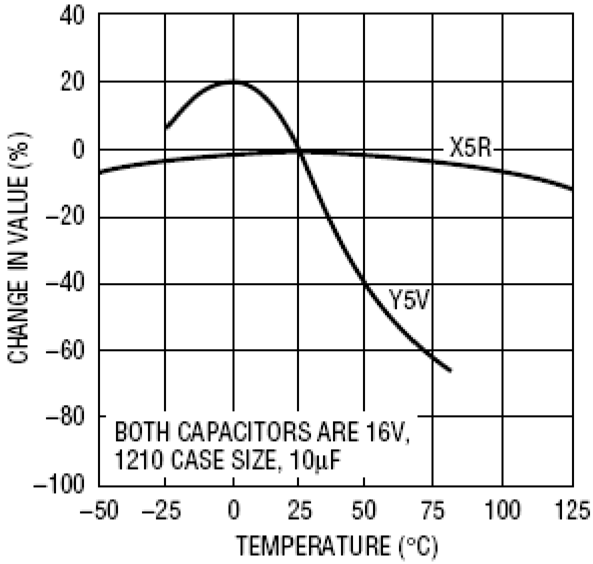


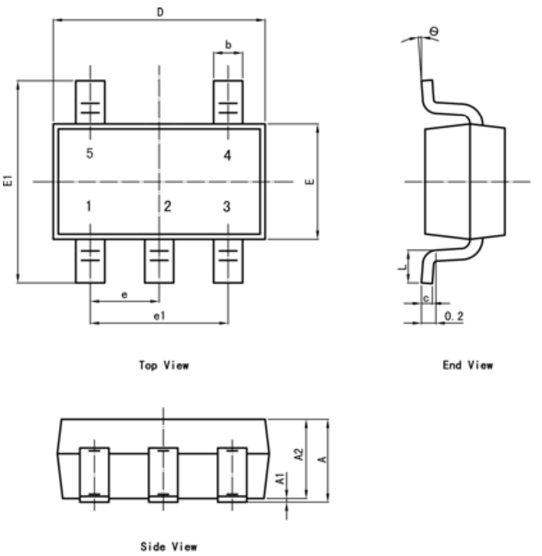
Figure 3

Additionally, some ceramic capacitors have a piezoelectric response. A piezoelectric device generates voltage across its terminals due to mechanical stress, similar to the way a piezoelectric accelerometer or microphone works. For a ceramic capacitor the stress can be induced by vibrations in the system or thermal transients. The resulting voltages produced can cause appreciable amounts of noise, especially when a ceramic capacitor is used for noise bypassing.

Package Information

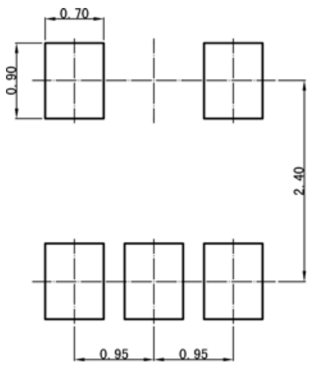
UM185XX: SOT23-5

Outline Drawing



Symbol	DIMENSIONS			
	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950REF		0.037REF	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

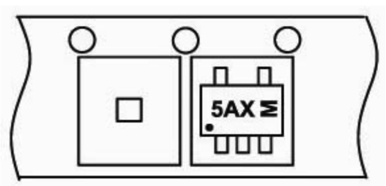
Land Pattern



NOTES:

1. Compound dimension: 2.92×1.60 ;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



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