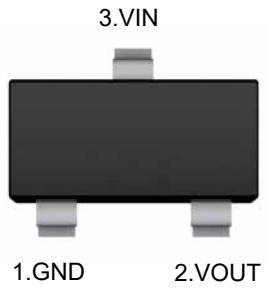
Description

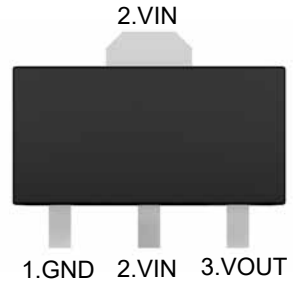
The LB9501 is a low-dropout (LDO) voltage regulators with enable function that operates from 2V to 7V. It provides up to 500mA of output current and offers low-power operation in miniaturized packaging.

The features of low quiescent current as low as 1μA and almost zero disable current is ideal for powering the battery equipment to a longer service life.The other features include current limit function, over temperature protection and output discharge function.

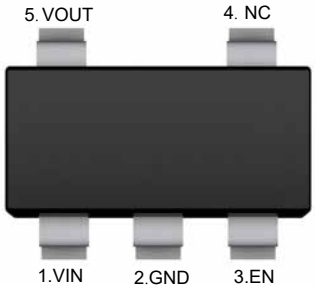
SOT-23-3



SOT-89



SOT-23-5



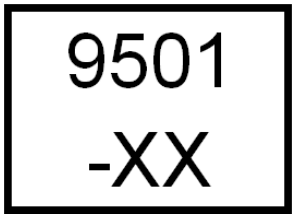
Features

- Ultra Fast Response in Line/Load Transient
- Maximum Output Current: 500mA
- Low Dropout : 230mV @ 200mA(3.3V)
- Wide Operating Voltage Ranges : 2V to 7V
- Over-Temperature Protection
- Current Limiting Protection
- Thermal Shutdown Protection

Applications

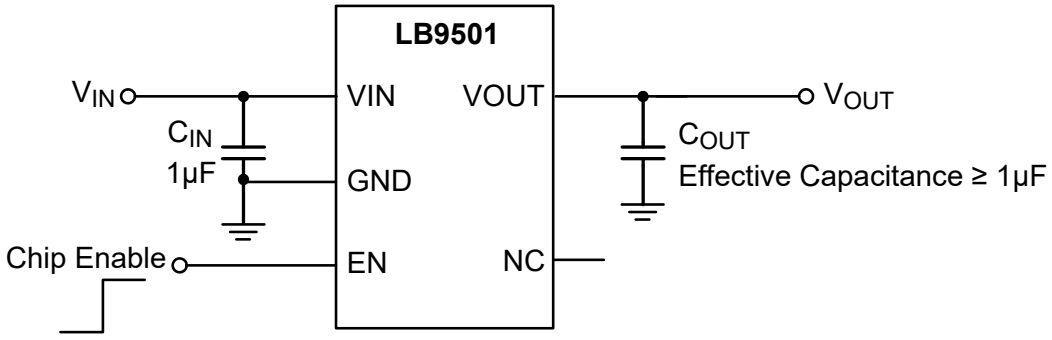
- Battery-Powered Equipment
- Ultra Low Power Microcontrollers
- Notebook Computers

Marking Code



XX:Output Voltage
e.g. 30:3.0V 33:3.3V

Typical Application Circuit



Ordering Information

LB9501- □□□□

Package Type
SC : SOT-23-3
SE : SOT-23-5
SQ : SOT-89

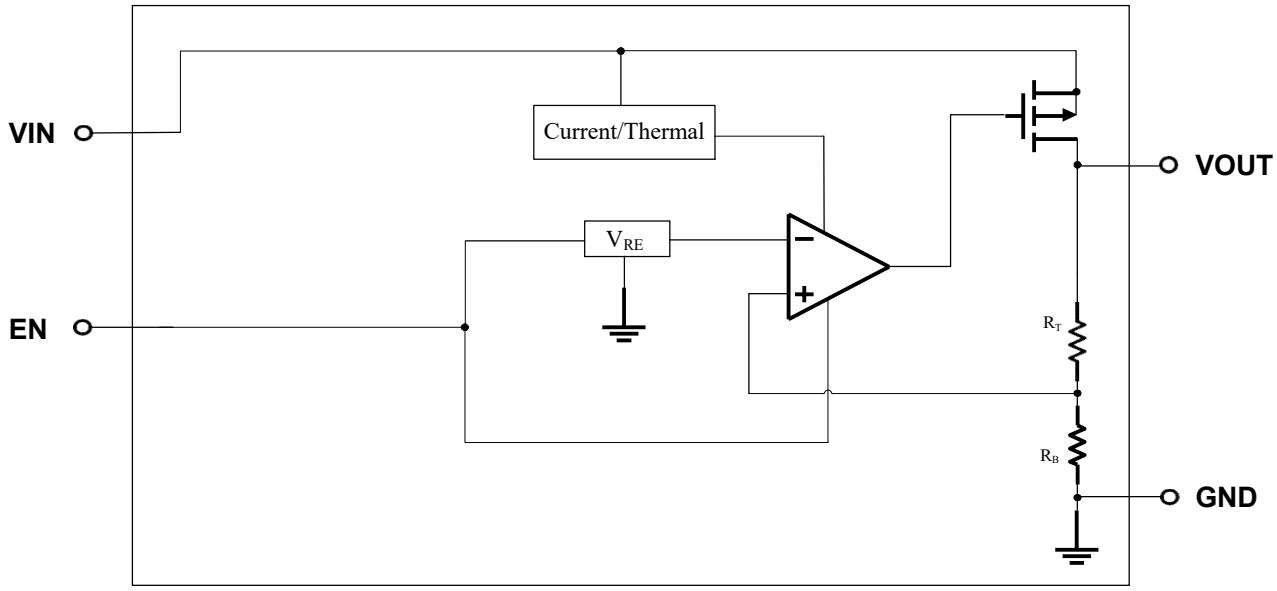
Output Voltage
12 : 1.2V 15 : 1.5V 18 : 1.8V
25 : 2.5V 28 : 2.8V 30 : 3.0V
33 : 3.3V 36 : 3.6V

Output current tap
M : 500mA

Functional Pin Description

Pin Name	Pin Function
EN	Chip Enable (Active High). Note that this pin is high impedance
NC	NO Connected
GND	Ground.
VOUT	Output Voltage.
VIN	Power Input Voltage.

Function Block Diagram



Absolute Maximum Ratings Note1

Ratings at 25℃ ambient temperature unless otherwise specified.

Parameter		Value	Unit
VIN,VEN to GND Voltage		-0.3~9	V
VOUT to VIN Voltage		-0.3~VIN+0.3	V
Power Dissipation	SOT-89	500	mW
	SOT-23-3	450	mW
	SOT-23-5	450	mW
Thermal Resistance,Junction-to-Ambient	SOT-89	200	℃/W
	SOT-23-3	220	℃/W
	SOT-23-5	220	℃/W
Operating Ambient Temperature		-25~85	℃
Maximum Junction Temperature		260	℃
Storage temperature range		-50~125	℃
ESD(HBM)		4	KV
ESD(MM)		200	V

Note 1. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

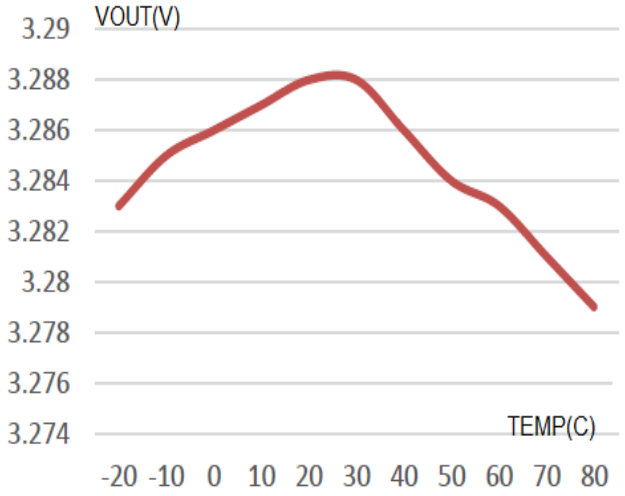
Electrical Characteristics

(V_{IN}=V_{OUT}+1, EN=V_{IN}, C_{IN}=C_{OUT}=1μF, T_A=25℃ , unless otherwise noted.)

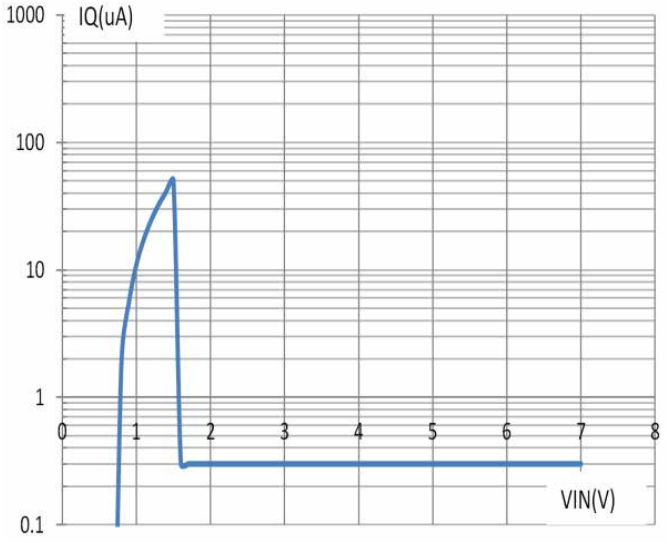
Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Voltage		V_{IN}		2		7	V
Output Voltage Accuracy		ΔV_{OUT}	I_{OUT}=1mA	-1.5		+1.5	%
Quiescent Current		I_Q	V_{IN}>V_{OUT},EN=V_{IN} I_{OUT}=0mA		1	3	μA
Dropout Voltage Note1 I_{OUT}=200mA		V_{DROP}	1.2V≤VOUT<1.5V		1.1	1.2	V
			1.5V≤VOUT<1.8V		1	1.1	
			1.8V≤VOUT<2.5V		0.4	0.5	
			2.5V≤VOUT<2.8V		0.26	0.4	
			2.8V≤VOUT<3.3V		0.26	0.35	
			3.3V≤VOUT		0.23	0.3	
Dropout Voltage Note1 I_{OUT}=300mA		V_{DROP}	1.2V≤VOUT<1.5V		1.2	1.3	V
			1.5V≤VOUT<1.8V		1.1	1.2	
			1.8V≤VOUT<2.5V		0.6	0.7	
			2.5V≤VOUT<2.8V		0.4	0.5	
			2.8V≤VOUT<3.3V		0.36	0.48	
			3.3V≤VOUT		0.35	0.45	
Line Regulation		ΔV_{LINE}	V_{IN}=V_{OUT}+1 to 5.5V I_{OUT}=1mA			0.17	%/V
Load Regulation		ΔV_{LOAD}	1mA<I_{OUT}<300mA			2	%/A
Short circuit/start carrying current		I_{SHORT}	RL=1Ω		90		mA
EN Leakage Current		I_{EN}	V_{EN} = 5.5V			0.1	μA
Current Limit		I_{LIM}	VIN=5V		550		mA
EN Input Threshold	Logic Low	V_{IL}	V_{IN}=5V, Shutdown			0.4	V
	Logic High	V_{IH}	V_{IN}=5V, Start up	1.2			V
Output Noise Voltage		e_{NO}	10Hz to100KHz, C_{OUT}=1uF		100		μV_{RMS}
Power Supply Rejection Ratio	f=1KHz	PSRR	I_{OUT}=100mA		-70		dB
	f=10KHz				-65		
Thermal Shutdown Temperature		T_{SD}	Shutdown, Temp increasing		160		℃
Thermal Shutdown Hysteresis		T_{SDHY}			20		℃

Note 1. The dropout voltage is defined as V_{IN} – V_{OUT}, when V_{OUT} is 98% of the normal value of V_{OUT}.

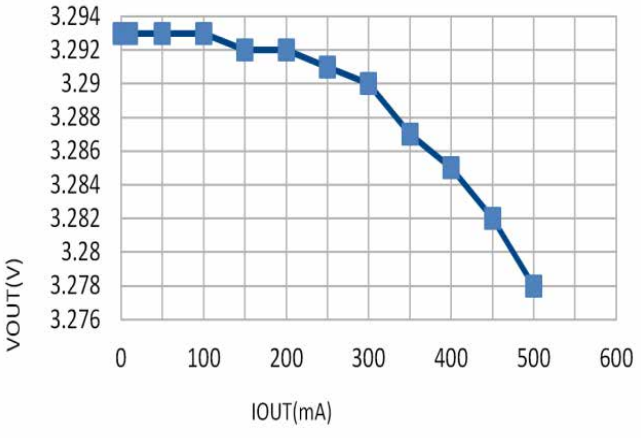
Typical Characteristic Curves



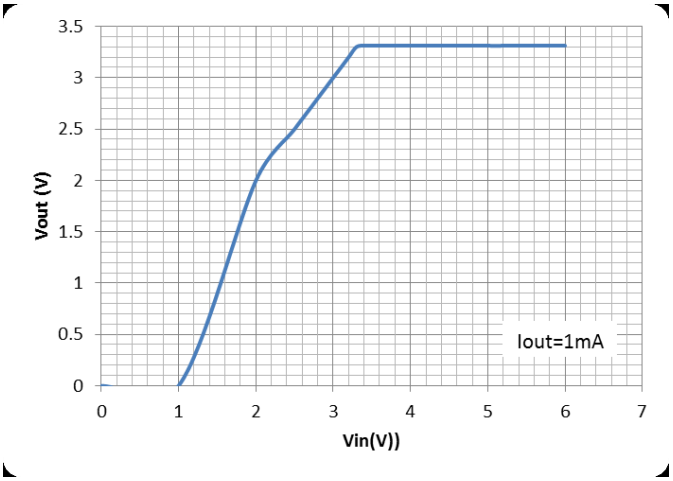
VOUT vs TEMP



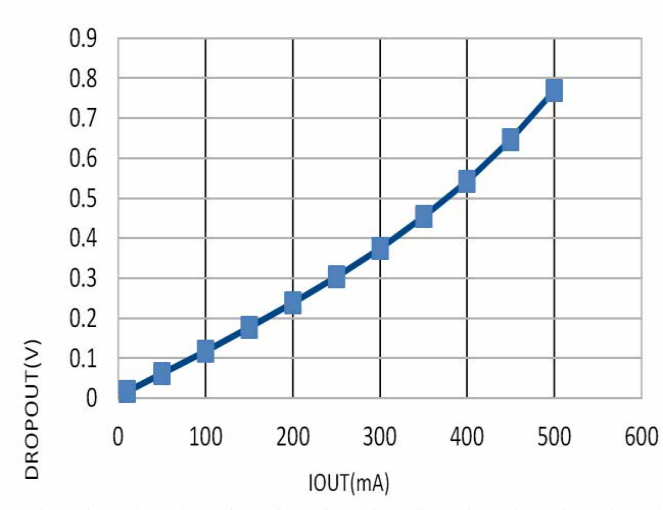
IQ vs VIN



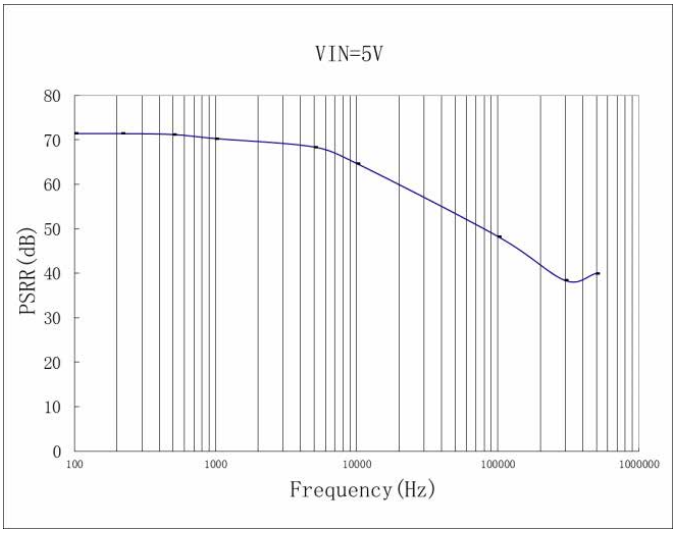
Load Regulation



Line Regulation



Dropout Voltage vs Load Current



PSRR

Applications Information

Input Capacitor

A 1μF ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended minimum output capacitance is 1μF, ceramic capacitor is recommended, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to VOUT and GND pins.

Enable Function

The LB9501 has an EN pin to turn on or turn off the regulator, When the EN pin is in logic high, the regulator will be turned on. The shutdown current is almost 0μA typical. The EN pin may be directly tied to VIN to keep the part on.The Enable input is CMOS logic and cannot be left floating.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula :

$P_{D(MAX)} = (T_{J(MAX)} - T_A) / R_{\theta JA}$

Where $T_{J(MAX)}$ is the maximum operation junction temperature 125°C, T_A is the ambient temperature and the $R_{\theta JA}$ is the junction to ambient thermal resistance.

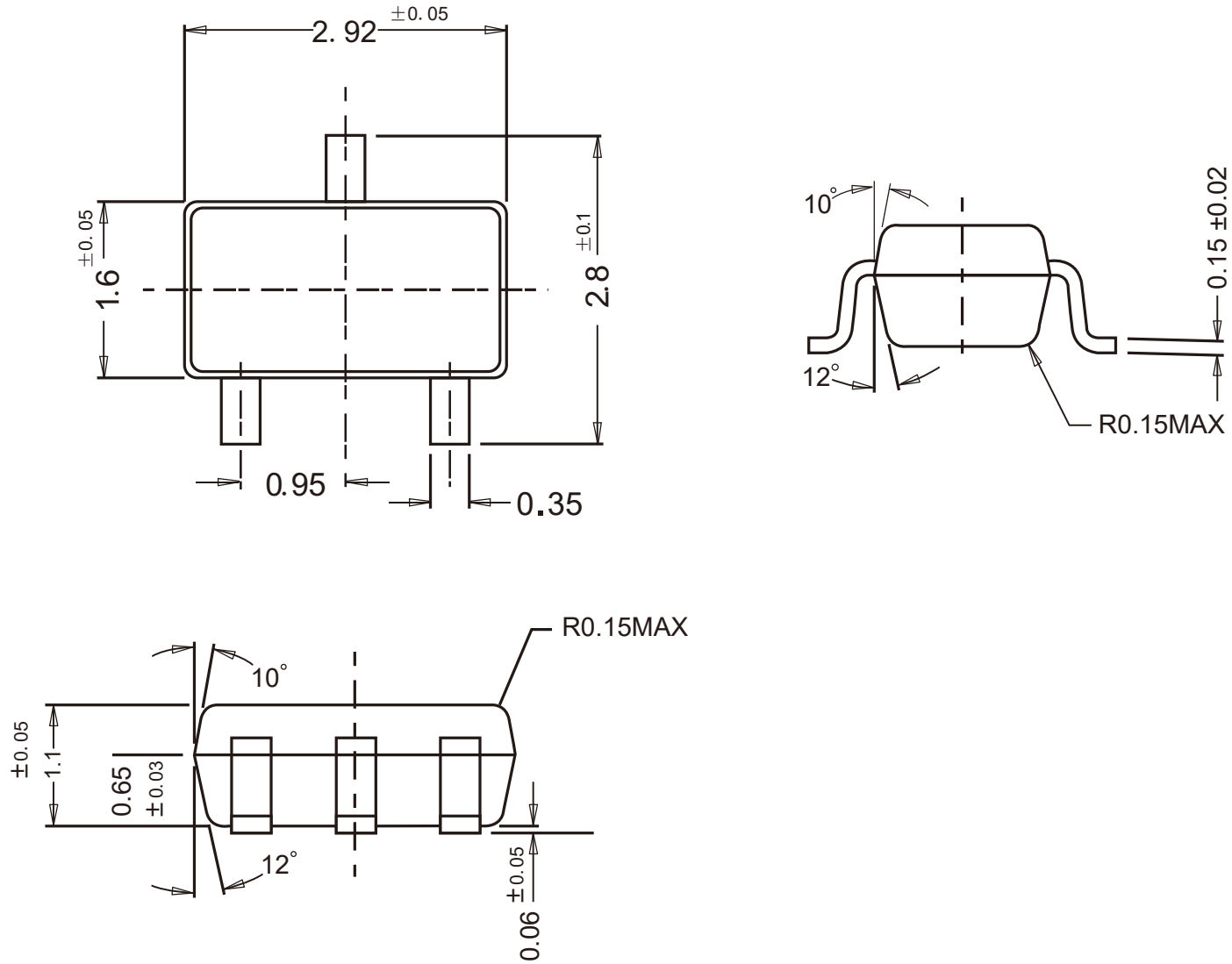
The power dissipation definition in device is:

$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$

Layout Consideration

By placing input and output capacitors on the same side of the PCB as the LDO, and placing them as close as is practical to the package can achieve the best performance. The ground connections for input and output capacitors must be back to the LB9501 ground pin using as wide and as short of a copper trace as is practical.Connections using long trace lengths, narrow trace widths, and connections through via must be avoided. These add parasitic inductances and resistance that results in worse performance especially during transient conditions.

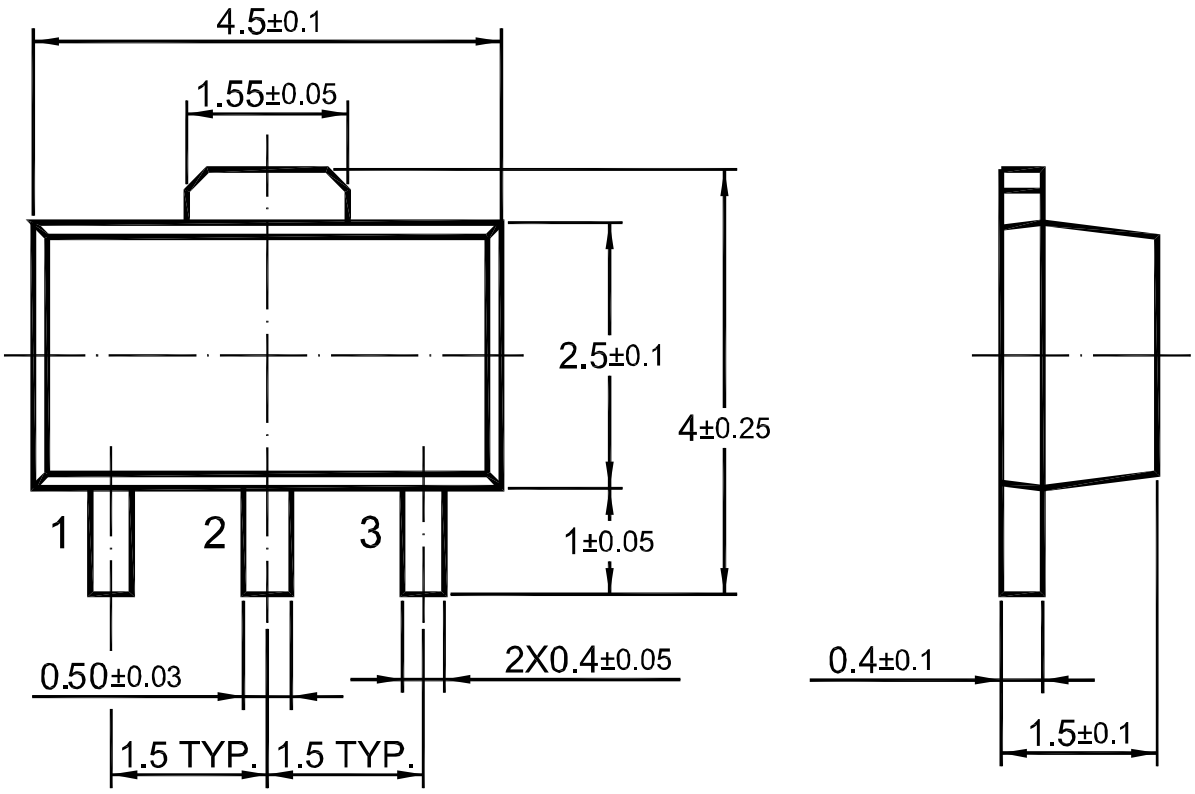
Package Outline
SOT-23-3
Dimensions in mm



Ordering Information

Device	Package	Shipping
LB9501	SOT-23-3	3,000/ Tape & Reel (7 inches)

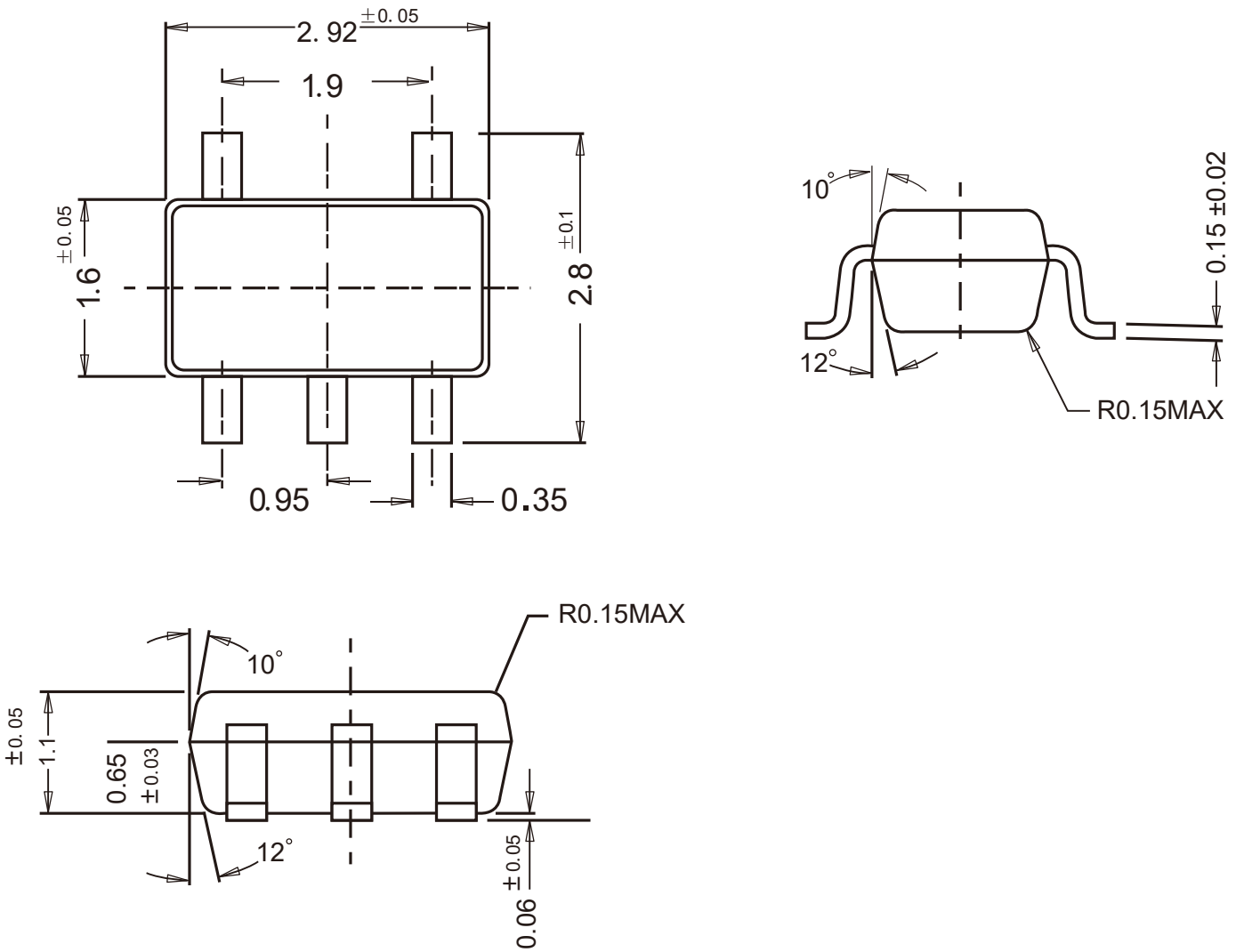
Package Outline
SOT-89
Dimensions in mm



Ordering Information

Device	Package	Shipping
LB9501	SOT-89	1,000PCS/Reel&Tape(7inch)

Package Outline
SOT-23-5
Dimensions in mm



Ordering Information

Device	Package	Shipping
LB9501	SOT-23-5	3,000/ Tape & Reel (7 inches)