



# 300mA, Dual Channel Ultra-Fast CMOS LDO Regulator

## General Description

The LP2201 is a dual channel, low noise, and low dropout regulator sourcing up to 300mA at each channel. The range of output voltage is from 1.2V to 3.6V from operating from 2.5V to 5.5V input.

LP2201 offers 2% accuracy, extremely low dropout voltage (80mV @ 100mA), and extremely low ground current, only 25µA per LDO. The shutdown current is near zero current which is suitable for battery-power devices. Other features include current limiting, over temperature, output short circuit protection.

LP2201 is short circuit thermal folded back protected. LP2201 lowers its OTP trip point from 150°C to 125°C when output short circuit occurs (VOUT<0.4V) providing maximum safety to end users.

LP2201 can operate stably with very small ceramic output capacitors, reducing required board space and component cost. LP2201 is available in fixed output voltages in the SOT-23-6 package.

## Order Information

- LP2201 □ □ □ □ □ □
- F: Pb-Free
  - Package Type
  - B6: SOT23-6
  - Out1/Out2 Voltage Type
- 18/28: 1.8V/2.8V
  - 18/33: 1.8V/3.3V
  - 25/28: 2.5V/2.8V
  - 28/28: 2.8V/2.8V
  - 28/12: 2.8V/1.2V
  - 28/33: 2.8V/3.3V
  - 30/30: 3.0V/3.0V
  - 30/33: 3.0V/3.3V
  - 33/33: 3.3V/3.3V
  - 18/26: 1.8V/2.6V
  - 15/28: 1.5V/2.8V
  - 13/28: 1.3V/2.8V

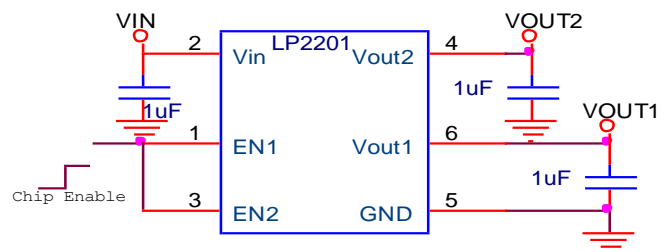
## Features

- ◆ Wide Operating Voltage Ranges : 2.5V to 5.5V
- ◆ Low-Noise for RF Application
- ◆ High PSRR 65dB at 1kHz
- ◆ No Noise Bypass Capacitor Required
- ◆ Fast Response in Line/Load Transient
- ◆ TTL-Logic-Controlled Shutdown Input
- ◆ Dual LDO Outputs (250mV/300mA)
- ◆ High Output Accuracy 2%
- ◆ Ultra-low Quiescent Current 27uA
- ◆ Thermal Shutdown Protection
- ◆ Tiny SOT-23-6 Package
- ◆ RoHS Compliant and 100% Lead (Pb)-Free

## Applications

- ◇ CDMA/GSM Cellular Handsets
- ◇ Smart mobile phone
- ◇ Battery-Powered Equipment
- ◇ DSC Sensor
- ◇ Wireless Card

## Typical Application Circuit



## Marking Information

Device	Marking	Package	Shipping
LP2201-02		SOT23-6	3K/REEL



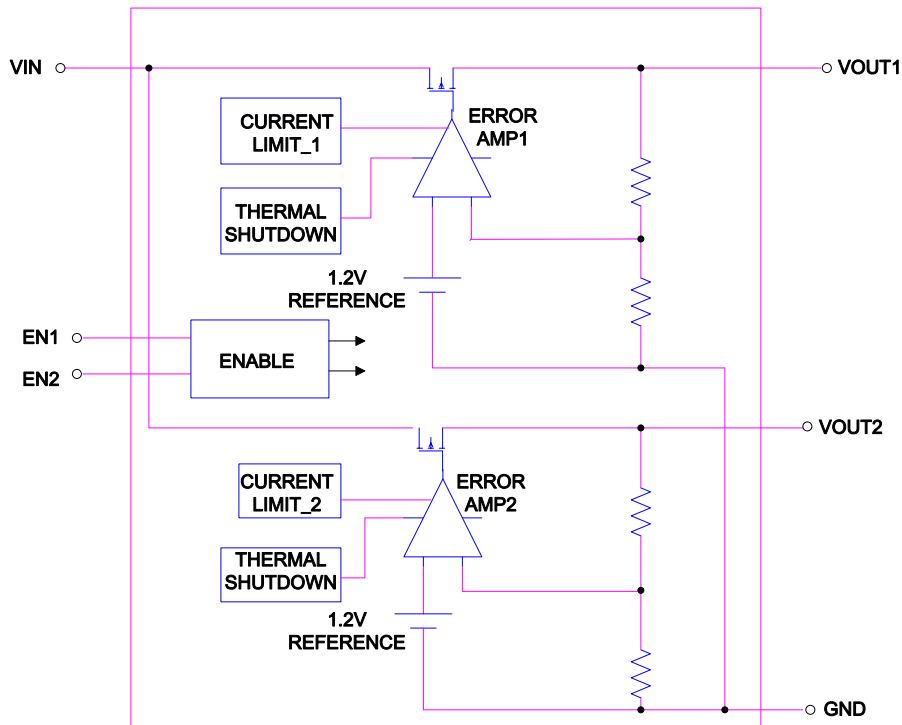
### Functional Pin Description

Package Type	Pin Configurations
SOT23-6	<p>TOP VIEW</p> <p>SOT23-6</p>

### Pin Description

Pin	Name	Description
1	EN1	Chip Enable1 (Active High)
2	VIN	Supply Input
3	EN2	Chip Enable2 (Active High)
4	VOUT2	Channel 2 Output Voltage
5	GND	Common Ground
6	VOUT1	Channel 1 Output Voltage

### Function Diagram





## Absolute Maximum Ratings

- ◇ Supply Input Voltage ----- 6V  
Power Dissipation, PD @ TA = 25°C
- ◇ SOT23-6 ----- 450mW  
Package Thermal Resistance
- ◇ SOT23-6,  $\theta_{JA}$  ----- 250°C/W
- ◇ Lead Temperature (Soldering, 10 sec.) ----- 260°C
- ◇ Storage Temperature Range ----- -65°C to 150°C
- ESD Susceptibility
- ◇ HBM (Human Body Mode) ----- 2kV
- ◇ MM(Machine-Mode) ----- 200V
- Recommended Operating Conditions
- ◇ Operation Junction Temperature Range ----- -40°C to 125°C
- ◇ Operation Ambient Temperature Range ----- -40°C to 85°C

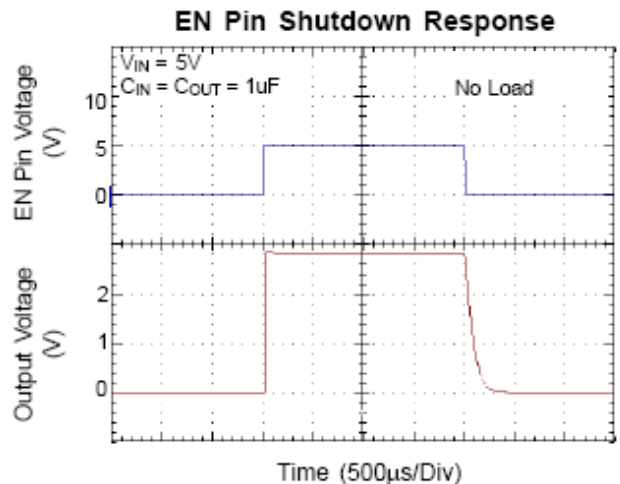
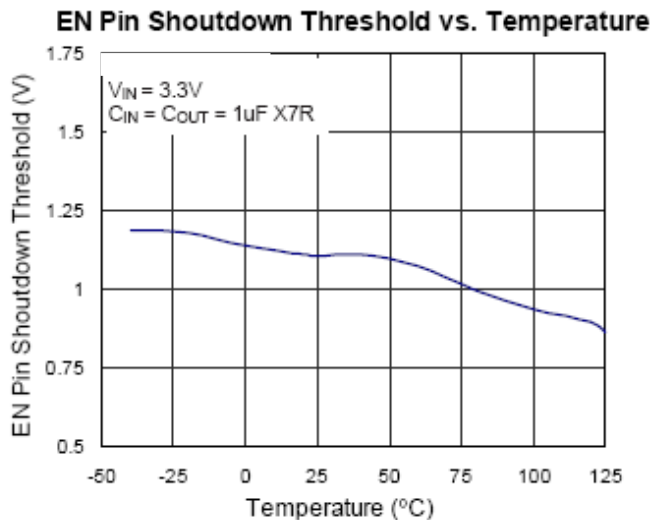
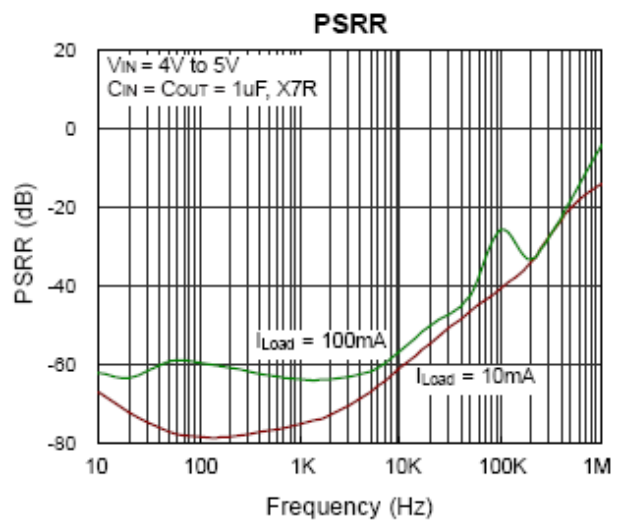
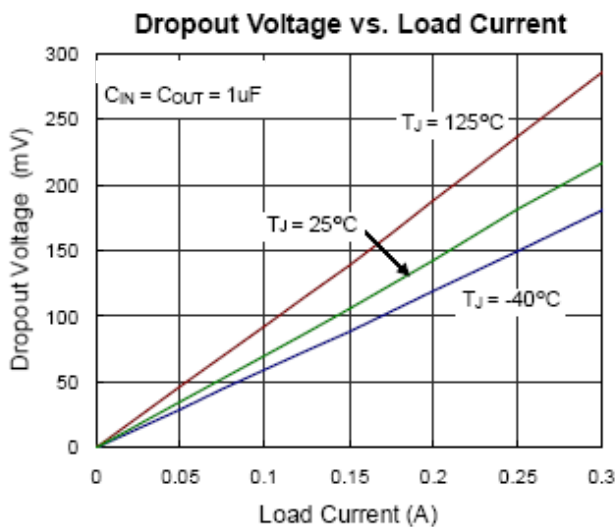
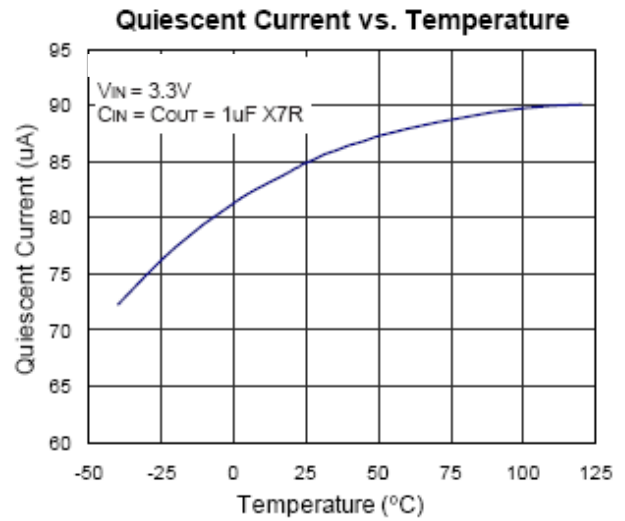
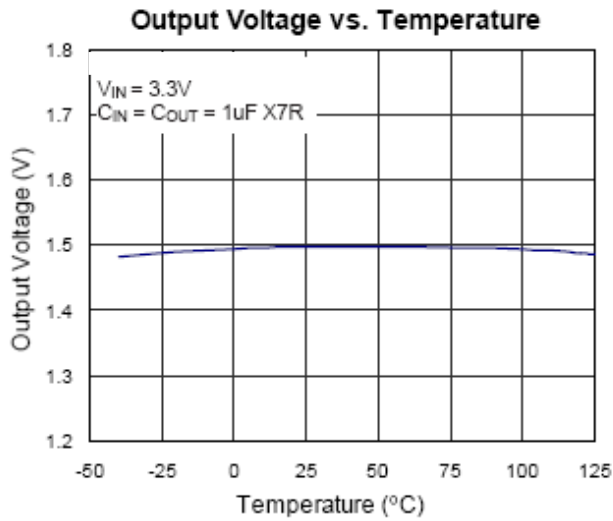
## Electrical Characteristics

(VIN = VOUT + 1V, CIN = COUT = 1μF, TA = 25° C, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage Accuracy		$\Delta V_{OUT}$	IOUT = 1mA	-2	--	+2	%
Maximum output Current		I <sub>max</sub>	Continuous	300			mA
Current Limit		I <sub>LIM</sub>	R <sub>LOAD</sub> = 1Ω	360	400	700	mA
Quiescent Current		I <sub>Q</sub>	V <sub>EN</sub> ≥ 1.2V, I <sub>OUT</sub> = 0mA		75	110	μA
Dropout Voltage		V <sub>DROP</sub>	I <sub>OUT</sub> = 30mA, V <sub>OUT</sub> > 2.8V		30	45	mV
			I <sub>OUT</sub> = 150mA, V <sub>OUT</sub> > 2.8V		80	150	mV
Line Regulation		$\Delta V_{LINE}$	V <sub>IN</sub> = (V <sub>OUT</sub> + 1V) to 5.5V, I <sub>OUT</sub> = 1mA			0.3	%
Load Regulation		$\Delta V_{LOAD}$	1mA < I <sub>OUT</sub> < 300mA			0.6	%
Standby Current		I <sub>STBY</sub>	V <sub>EN</sub> = GND, Shutdown		0.1	1	μA
EN Input Bias Current		I <sub>I<sub>BSD</sub></sub>	V <sub>EN</sub> = GND or V <sub>IN</sub>		0.1	1	uA
EN Threshold	Logic-Low Voltage	V <sub>IL</sub>	V <sub>IN</sub> = 3V to 5.5V, Shutdown			0.4	V
	Logic-High Voltage	V <sub>IH</sub>	V <sub>IN</sub> = 3V to 5.5V, Start-Up	1.2			V
Output Noise Voltage			10Hz to 100kHz, I <sub>OUT</sub> = 200mA C <sub>OUT</sub> = 1μF		100		uVRM S
Power Supply	f = 100Hz	PSRR	C <sub>OUT</sub> = 1μF, I <sub>OUT</sub> = 10mA		-75		dB
Rejection Rate	f = 10kHz				-65		dB
Thermal Shutdown Temperature		TSD			150		°C



### Typical Operating Characteristics





## Applications Information

Like any low-dropout regulator, the external capacitors used with the LP2201 must be carefully selected for regulator stability and performance. Using a capacitor whose value is  $> 1\mu\text{F}$  on the LP2201 input and the amount of capacitance can be increased without limitation. The input capacitor must be located in a distance of no more than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response. The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The LP2201 is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least  $1\mu\text{F}$  with ESR is  $> 25\text{m}\Omega$  on the LP2201 output ensures stability. The LP2201 still works well with output capacitor of other types due to the wide stable ESR range. Output capacitor which is of larger capacitance can reduce noise and improve the speed of load transient response, stability, and PSRR. The output capacitor should be located no more than 0.5 inch from the VOUT pin of the LP2201 and returned to a clean analog ground.

### Start-up Function Enable Function

The LP2201 features an LDO regulator enable/disable function. To ensure the LDO regulator will switch on, the EN turn on control level must be greater than 1.2 volts. The LDO regulator will go into the shutdown mode when the voltage on the EN pin falls below 0.4 volts. For protecting the system, the LP2201 have a quick-discharge function. If the enable function is not needed in a specific application, it may be tied to VIN to keep the LDO regulator in a continuously on state.

### Thermal Considerations

Thermal protection limits power dissipation in LP2201. When the operation junction temperature exceeds  $150^\circ\text{C}$ , the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turn on again after the junction temperature cools by  $25^\circ\text{C}$ . For continuous operation, do not exceed absolute maximum operation junction temperature  $125^\circ\text{C}$ .

The power dissipation definition in device is :

$$PD = (VIN - VOUT) \times IO_{UT} + VIN \times IQ$$

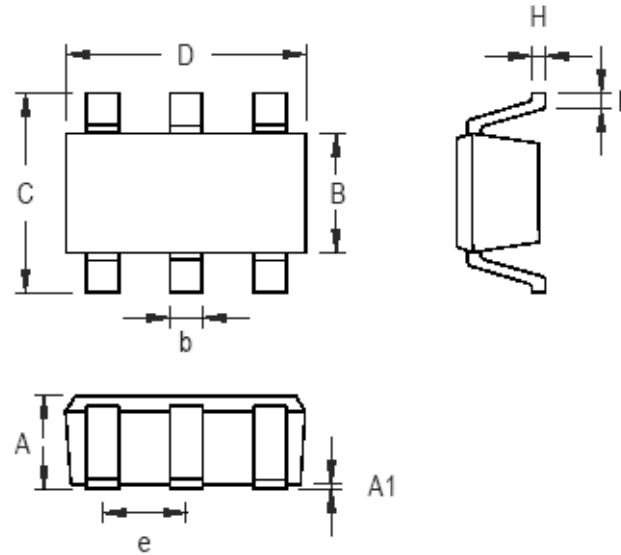
The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient.

The maximum power dissipation can be calculated by following formula :

$$PD(\text{MAX}) = (T_{J(\text{MAX})} - T_A) / \theta_{JA}$$



Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.031	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-6 Surface Mount Package