

## 300mA CMOS LDO Regulator

REV:00

### General Description

The LD6909 is a micropower linear regulator, featuring low-noise, low-dropout and high ripple rejection ratio. The precision of feedback reference voltage is within  $\pm 2\%$  and output current is up to 300mA. As well, the LD6909 can be stable with an output capacitor of  $1\mu\text{F}$  which reduces the board space and cost.

The LD6909 is available in a space saving SOT23-5 or SC70-6 package.

+Patent pending

### Features

- Shutdown current  $< 1\mu\text{A}$
- Ultra-Fast Response in Load Transient
- Thermal Shutdown and Current Limiting Protection
- $V_{\text{OUT}}$  Discharge Function
- Stable with  $1\mu\text{F}$  Output Capacitor
- Soft Start Operation
- Output Voltage: 1.8V to 3.3V (step 0.1V)

### Applications

- Battery-Powered Equipment
- Hand-Held Instruments

### Typical Application

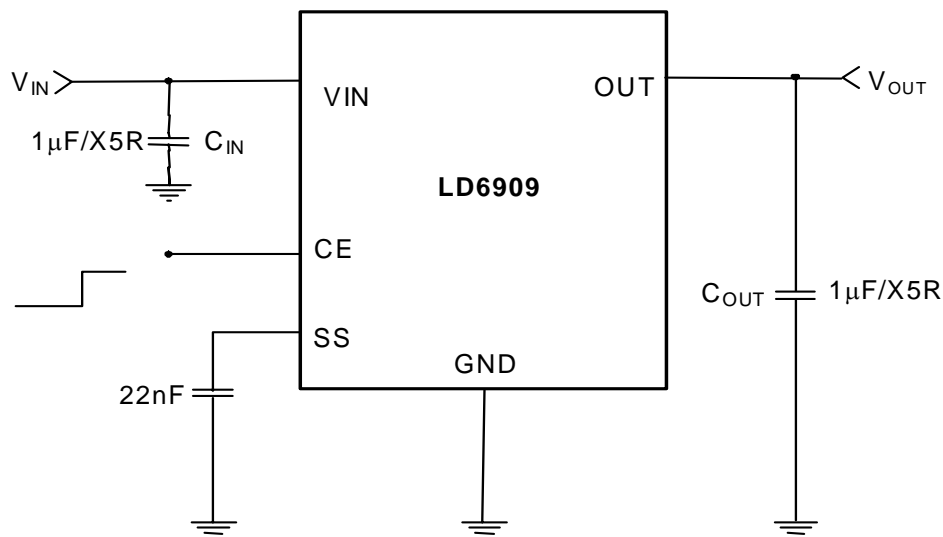
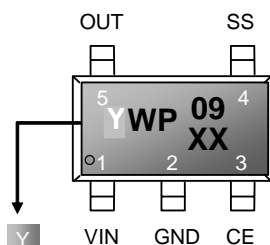


Fig.1 Typical Application Circuit

## Pin Configuration

SOT-23-5 (TOP VIEW)



The PB-free package is identified in embossed font

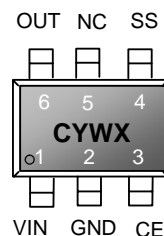
YY, Y: Year code (E: 2005, F: 2006.....)

WW, W: Week code

P: LD69..  
(Product family code)

XX: Output Voltage

SC-70-6 (TOP VIEW)



C: Product code: LD6909

Y: Year code (E: 2005, F: 2006.....)

W: Week code

X: Output Voltage (4~9:1.8V~2.3V, a~j:  
2.4V~3.3V)

## Ordering Information

Part number	Package	TOP MARK	Shipping
LD6909 PL-XX	SOT23-5 (PB FREE)	YWP/09XX	3000 /tape & reel
LD6909 GL-XX	SOT23-5 (Green Compound)	YWP/09XX	3000 /tape & reel
LD6909 PU-XX	SC70-6 (PB FREE)	CYWX	3000 /tape & reel
LD6909 GU-XX	SC70-6 (Green Compound)	CYWX	3000 /tape & reel

Note: Part number XX: Output voltage, ex: 18:1.8V, 33:3.3V... (step 0.1V)

The LD6909 is ROHS compliance.

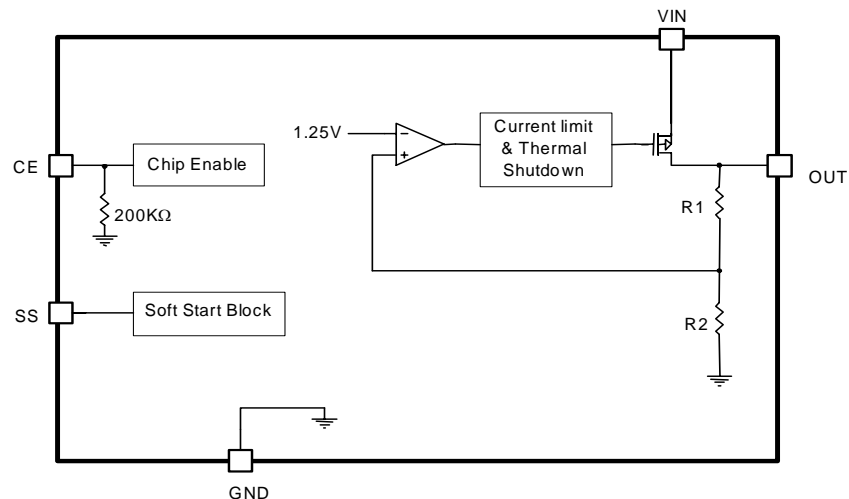
## Pin Descriptions

SOT-23-5

PIN	NAME	FUNCTION
1	VIN	Input Voltage
2	GND	IC GND
3	CE	Chip Enable, High=Enable, Low=Disable
4	SS	This pin combines noise reduction and soft start function. Connect a capacitor to GND to adjust soft start time. $C_{ss} > 1nF$ is recommended.
5	OUT	Regulator output

**SOT-70-6**

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1	VIN	Input Voltage
2	GND	IC GND
3	CE	Chip Enable, High=Enable, Low=Disable
4	SS	This pin combines noise reduction and soft start function. Connect a capacitor to GND to adjust soft start time. $C_{ss} > 1nF$ is recommended.
5	NC	No connection
6	OUT	Regulator output

**Block Diagram**

**Absolute Maximum Ratings**

VIN, VOUT Pin.....	-0.3V~6V
SS, CE Pin.....	-0.3V~(VIN+0.3)V
Power dissipation SOT23-5@Ta=25°C.....	400mW
Power dissipation SC70-6@Ta=25°C.....	300mW
Operating Temperature Range.....	-30°C to 85°C
Package Thermal Resistance SOT23-5.....	250°C/W
Package Thermal Resistance SC70-6.....	333°C/W
Storage Temperature Range.....	-55°C to 125°C
Lead temperature (Soldering, 10sec).....	260°C
ESD Level (Human Body Model).....	2KV
ESD Level (Machine Model).....	200V

**Caution:**

Stresses beyond the ratings specified in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

**Electrical Characteristics**

( $T_A = +25^\circ\text{C}$  unless otherwise stated,  $V_{IN}=V_{OUT}+1\text{V}$ ,  $C_{IN}=C_{OUT}=1\mu\text{F}$ ,  $C_{SS}=22\text{nF}$ )

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>INPUT POWER</b>					
Input Voltage		2.8	-	5.5	V
Quiescent Current	$V_{IN}>1.2\text{V}$ , $I_{OUT}=0\text{mA}$	-	100	145	$\mu\text{A}$
Shutdown Supply Current	CE=GND	-		1	$\mu\text{A}$
<b>Dropt Voltage</b>					
Dropt Voltage	$I_{OUT}=200\text{mA}$ , $V_{out}>2.8\text{V}$		170	200	mV
	$I_{OUT}=300\text{mA}$ , $V_{out}>2.8\text{V}$		220	300	mV
<b>Soft Start</b>					
Soft Start Current		-	7.5	-	$\mu\text{A}$
<b>OUTPUT</b>					
Output Current Limit	$R_{LOAD}=1\Omega$	330	420	-	mA
Output Voltage Accuracy	$I_{OUT}=1\text{mA}$	-2		+2	%
Load Regulation	$1\text{mA}<I_{OUT}<300\text{mA}$	-		0.6	%
Ripple Rejection	$F=120\text{Hz}$ , $e_{in}=1\text{Vrms}$ , $I_{OUT}=10\text{mA}$	-	65	-	dB
	$F=10\text{KHz}$ , $e_{in}=1\text{Vrms}$ , $I_{OUT}=10\text{mA}$	-	55	-	dB
Discharge Current	CE=High to Low	-	30		mA
<b>CE</b>					
Impedance to GND			200		$\text{K}\Omega$
CE Input Level	Enable	1.5	-	-	V
	Disable	-	-	0.6	V
<b>THERMAL PROTECTION</b>					
Thermal Shutdown	$V_{OUT}$ short to GND		145		$^\circ\text{C}$
Hysteresis			30		$^\circ\text{C}$

**Typical Performance Characteristics**

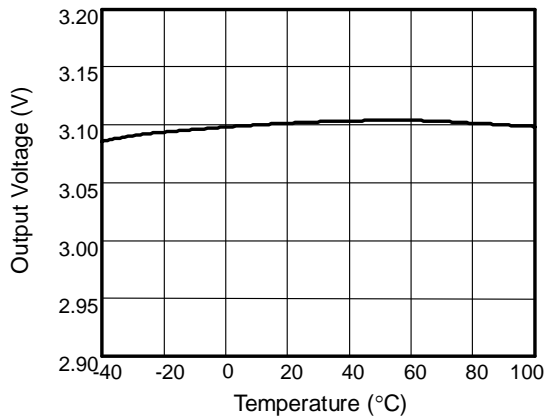


Fig. 2 Output Voltage vs. Temperature

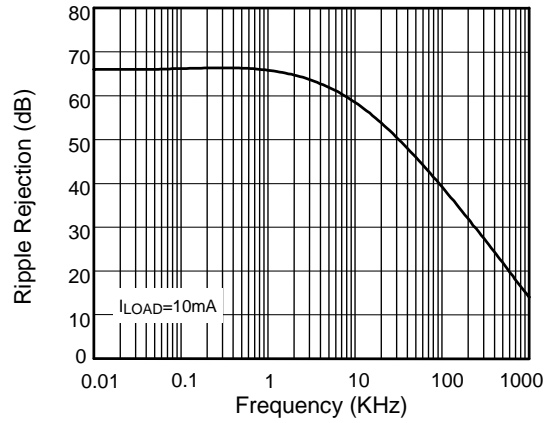


Fig. 3 Ripple Rejection vs. Frequency

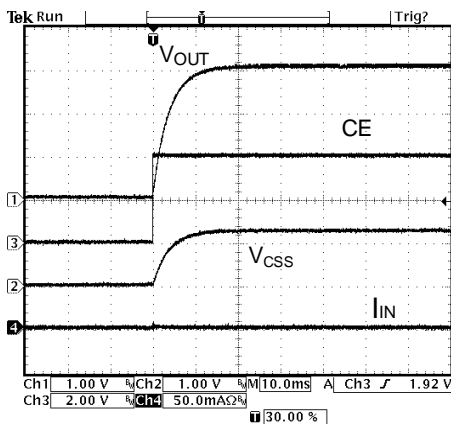


Fig. 4 Start Up Waveform  $C_{SS}=22nF$

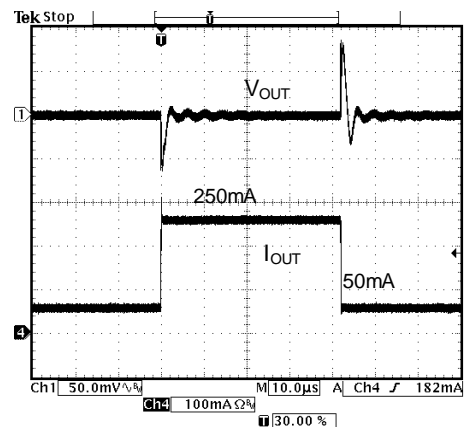


Fig. 5 Load Transient Response

## Application Information

### Operation Overview

An input capacitor is necessary to place between the input and GND to stabilize  $V_{IN}$ . The input capacitor should be at least  $1\mu\text{F}$  to obtain beneficial effect. Besides, the input capacitor should be located in the distance within 5mm from the VIN pin.

For stable operation, the output capacitor should be at least  $1\mu\text{F}$  with  $\text{ESR} > 25\text{m}\Omega$ . The figure 1 shows the curves of the allowable ESR range as a function of load current for  $C_{OUT}=1\mu\text{F}$ .

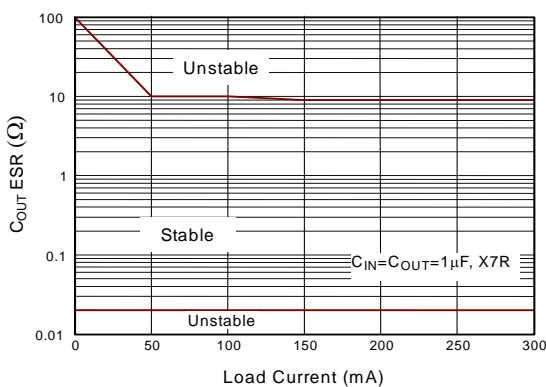


Fig. 1 Region of Stable  $C_{OUT}$  ESR vs. Load Current

Output capacitor of larger capacitance can reduce noise and improve load transient response, stability and PSRR. The output capacitor should be located in the distance within 5mm from the OUT pin.

X5R or X7R types of capacitors are recommended for the input and output capacitors.

### Current Limit

Output current is limited to 420mA (typical). When current limit engages, the output voltage scales back linearly until the overcurrent condition ends. Take care not to exceed the power dissipation ratings of the package.

### Thermal Consideration

When the junction temperature exceeds  $T_j=145^\circ\text{C}$ , the thermal sensor will turn off the pass transistor and allowing the IC to cool. The thermal sensor turns the pass transistor on after the IC's junction temperature cools by  $30^\circ\text{C}$  (typical) For continuous operation, do not exceed absolute maximum operation junction temperature at  $125^\circ\text{C}$ . The maximum power dissipation can be decided according to following equation.

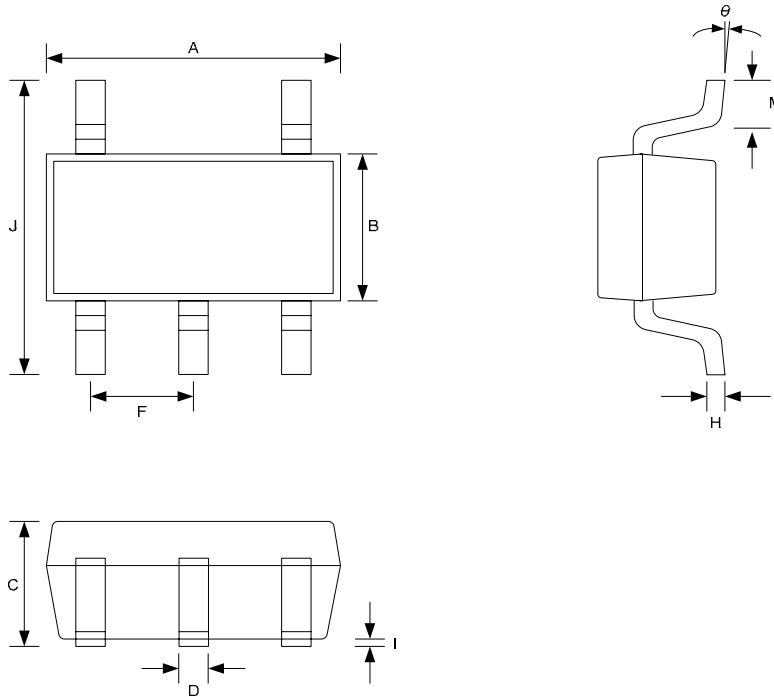
$$P_{D(\text{MAX})} = \frac{(T_{J(\text{MAX})} - T_A)}{\theta_{JA}}$$

$\theta_{JA}$ : Package Thermal Resistance

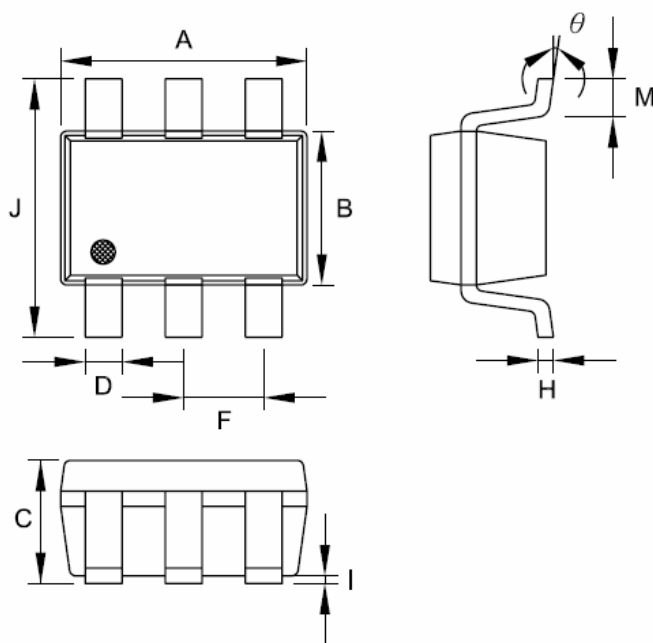
The maximum power dissipation at  $T_a=25^\circ\text{C}$  can be obtained by above formula.

$$P_{D(\text{MAX})} = (125^\circ\text{C} - 25^\circ\text{C}) / 250 = 400\text{mW} \text{ (SOT23-5 package)}$$

$$P_{D(\text{MAX})} = (125^\circ\text{C} - 25^\circ\text{C}) / 333 = 300\text{mW} \text{ (SC70-6 package)}$$

**Package Information**
**SOT23-5**


Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	2.692	3.099	0.106	0.122
B	1.397	1.803	0.055	0.071
C	-----	1.450	-----	0.058
D	0.300	0.550	0.012	0.022
F	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
I	0.050	0.150	0.002	0.006
J	2.600	3.000	0.102	0.118
M	0.300	0.600	0.012	0.024
$\theta$	0°	10°	0°	10°

**SC70-6**


Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.80	2.20	0.071	0.087
B	1.15	1.35	0.045	0.053
C	0.80	1.10	0.031	0.043
D	0.15	0.40	0.006	0.016
F	0.65 TYP.		0.026 TYP.	
H	0.08	0.25	0.003	0.010
I	0.00	0.10	0.000	0.004
J	1.80	2.40	0.071	0.094
M	0.10	0.46	0.004	0.018
$\theta$	0°	12°	0°	12°

**Important Notice**

Leadtrend Technology Corp. reserves the right to make changes or corrections to its products at any time without notice. Customers should verify the datasheets are current and complete before placing order.



**Revision History**

Rev.	Date	Change Notice
00	4/4/06	Original Specification.
01	5/1/06	Outline dimension of SC-70-6 package