60mA High Voltage Linear Regulator

REV:01

General Description

The LD6903 is a high voltage, micropower linear regulator, which features wide input voltage, low-noise, low-dropout and low-quiescent current. The precision of feedback reference voltage is within ±1.5% and output current is up to 60mA.

The LD6903 is available in a space saving SOT23-6 or SC70-6 package.

+Patent pending

Features

- ±1.5% feedback reference
- Shutdown current <1μA
- High input voltage: up to 19V
- Thermal shutdown and current limit protection
- Vout discharge function
- Soft start operation

Applications

- Microcontroller Power
- Hand-Held Instruments

Typical Application

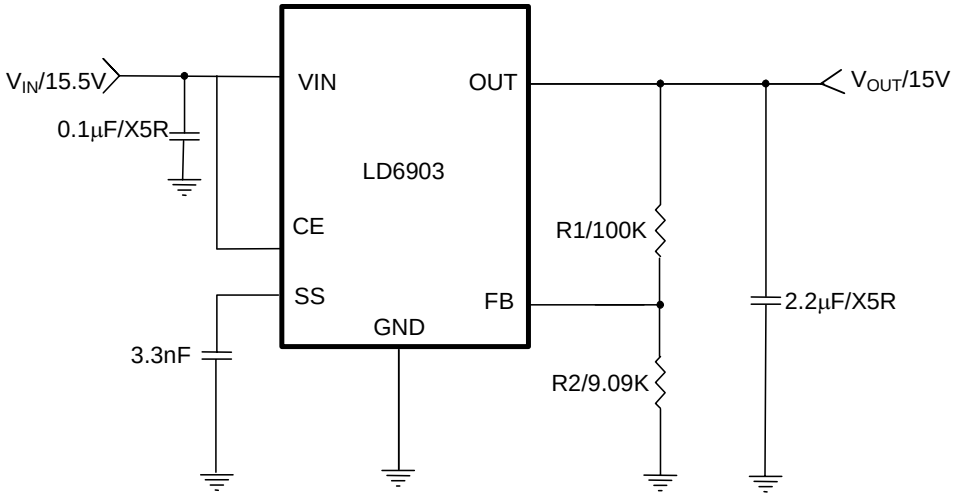
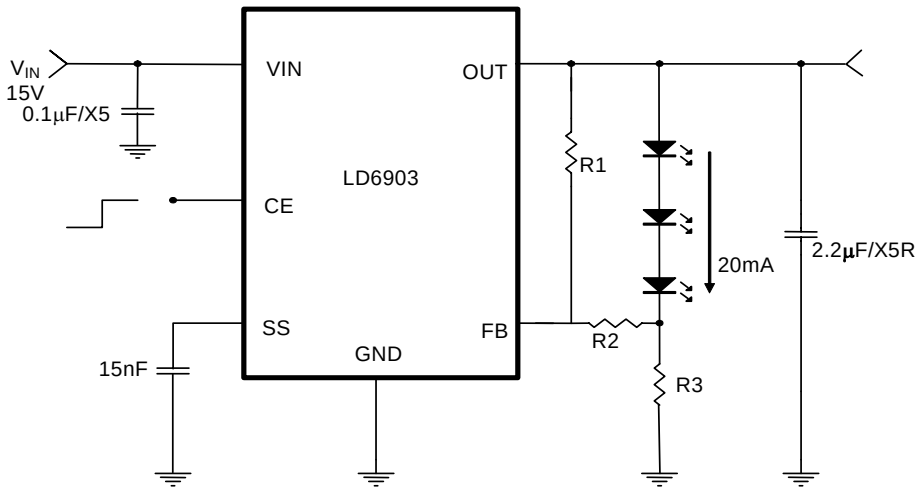


Fig.1 High voltage linear regulator application

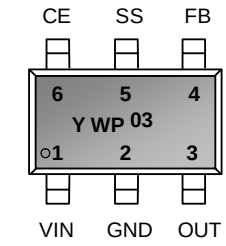


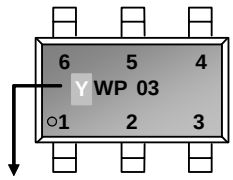
	2 WLED	3 WLED
R1	62K	62K
R2	3.24K	2K
R3	47.5Ω	47.5Ω

Fig.2 WLED driver application

Pin Configuration

SOT-26 (TOP VIEW)

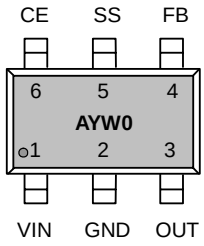




Y The PB freed package is identified in embossed font

YY, Y : Year code (D: 2004, E: 2005…..)
WW, W: Week code
P : LD69.
(Product family code)
: Production code

SC70-6 (TOP VIEW)



A : Product Code (A: LD6903)
Y : Year code (E: 2005, F: 2006…)
W : Week code
0 : Voltage code (0: adjustable)

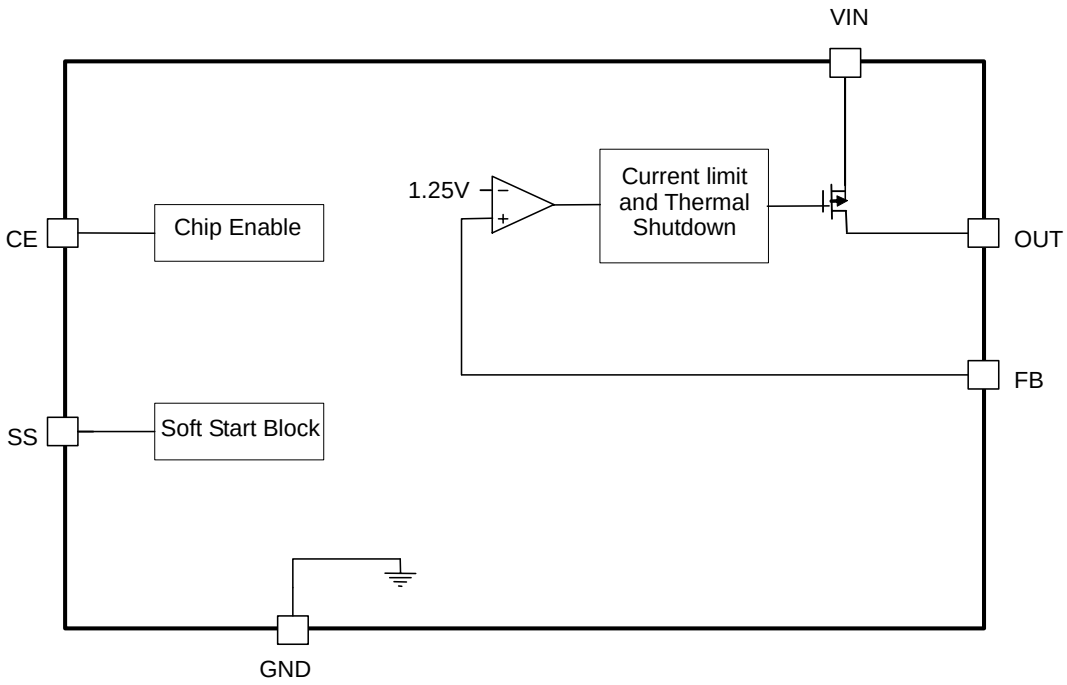
Ordering Information

Part number	Package	TOP MARK	Shipping
LD6903 PL	SOT-26 (PB FREE)	YWP/03	3000 /tape & reel
LD6903 GL	SOT-26 (Green Compound)	YWP/03	3000 /tape & reel
LD6903 PU	SC70-6 (PB FREE)	AYW0	3000 /tape & reel
LD6903 GU	SC70-6 (Green Compound)	AYW0	3000 /tape & reel

Pin Descriptions

PIN	NAME	FUNCTION
1	VIN	Input Voltage
2	GND	IC GND
3	OUT	Regulator Output
4	FB	Output Feedback
5	SS	This pin combines noise bypass and soft start function. Connect a capacitor to GND to adjust soft start time.
6	CE	Chip Enable, High=Enable, Low=Disable, Note that this pin is high impedance. There should be a pull low resistor connected to GND, when this pin is floating.

Block Diagram



Absolute Maximum Ratings

VIN Pin	-0.3V~21V
OUT Pin	-0.9V~21V
SS, CE, FB Pin	-0.3V~(VIN+0.3)V
Power dissipation @Ta=25°C	300mW
Operating Temperature Range	-30°C to 85°C
Operating Junction Temperature	125°C
Storage Temperature Range	-55°C to 125°C
Package Thermal Resistance SOT23-6	250°C/W
Package Thermal Resistance SC70-6	333°C/W
Lead temperature (SC70-6, 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°C unless otherwise stated, V_{IN}=15V, CE=V_{IN}, I_{LOAD}=5μA, C_{IN}=0.1μF, C_{OUT}=2.2μF)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT POWER					
Input Voltage		5	-	19	V
Nominal Supply Current	CE=V_{IN}	-	60	90	μA
Shutdown Supply Current	CE=GND	-	-	1	μA
REFERENCE VOLTAGE					
Feedback Reference	FB=OUT V_{IN}=6V to 18V, I_{LOAD} =1mA		1.25		V
Reference Voltage Tolerance		-1.5		+1.5	%
Feedback Input Current	V_{FB}=1.3V		10		nA
Soft Start					
Soft Start Current		-	1.5	-	μA
OUTPUT					
Output Current Limit		60	80	-	mA
Output Reverse Leakage Current	V_{IN}=unconnected, OUT set to 5V	-	30	-	μA
Dropout Voltage	I_{LOAD} =30mA	-	0.2	0.3	V
Ripple Rejection	F=120Hz, ein=1Vrms, Iout=10mA	-	65		dB
	F=10KHz, ein=1Vrms, Iout=10mA	-	55		dB
Discharge Current	CE=High to Low	-	30		mA
CE					
CE Input Current	CE=0 or 15V	-1	-	1	μA
CE Input Level	Enable	2.4	-	-	V
	Disable	-	-	0.6	V
THERMAL PROTECTION					
Thermal Protection	V_{OUT} short to GND		145		°C
Hysteresis			30		°C

Typical Performance Characteristics

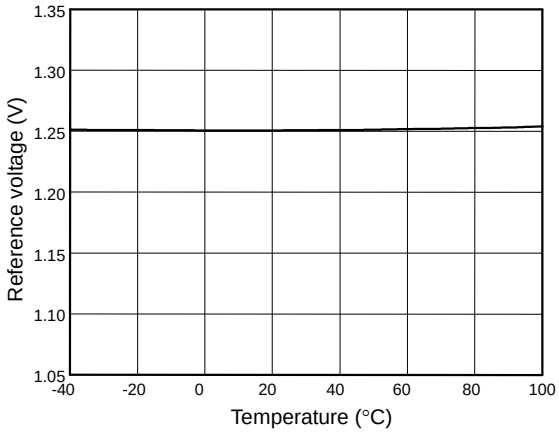


Fig. 3 Reference voltage vs. Temperature

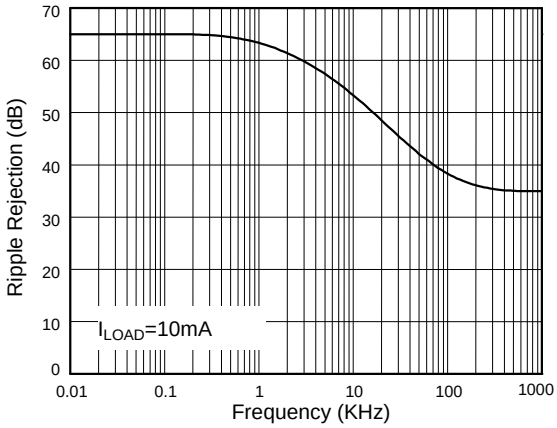


Fig. 4 Ripple Rejection vs. Frequency

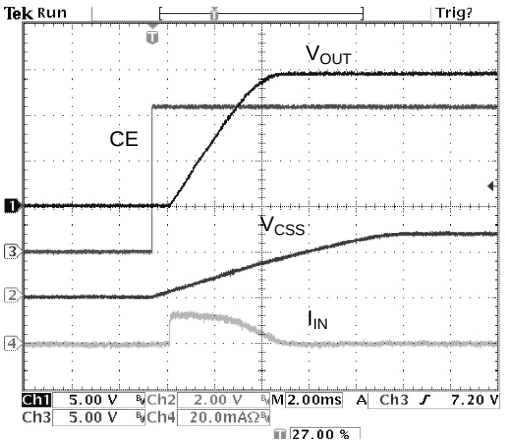


Fig. 5 Start up waveform Css=3.3nF

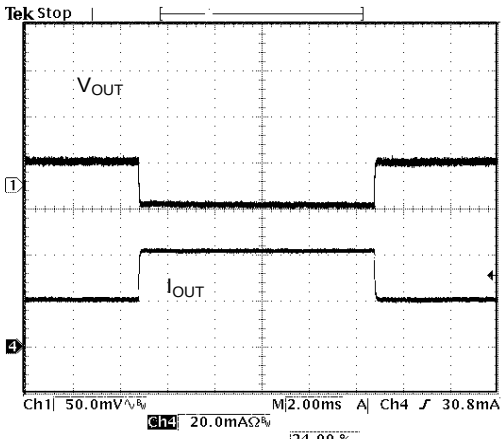


Fig. 6 Load Transient Response

Application Information

Capacitor Selection

The input capacitor is needed between the input and GND to stabilize V_{IN}. The input capacitor should be at least 0.1μF to have a beneficial effect. Higher values will improve line transient response.

The LD6903 requires an output capacitor to stabilize the internal control loop. For stable operations, the output capacitor should be at least 2.2μF and its ESR must be less than 1Ω. Those higher output capacitor values can improve load transient response, stability and PSRR. The output capacitor should be located no more than 5mm of the distance from the OUT pin.

X5R or X7R type capacitors are recommended for input and output capacitors.

Current Limit

Output current is limited to 80mA (typical). When current limit engages, the output voltage scales back linearly until the overcurrent condition ends. Take care not to exceed the power dispassion ratings of the package.

Thermal Consideration

When the junction temperature exceeds T_J=145°C, the thermal sensor will turn off the pass transistor and cool down the device. The thermal sensor turns the pass transistor on after the IC's junction temperature cools by 30°C (typical). For continuous operation, do not exceed absolute maximum operation junction temperature Tj=125°C. The maximum power dispassion depends on the thermal resistance of IC package, PCB layout, airflow and temperature difference between junction to ambient.

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

θ_{JA}: Package Thermal Resistance

Ex: the maximum power dispassion at Ta=25°C can be calculated by following formula.

P_{DMAX}=(125°C-25°C)/250=400mW (SOT23-6 package)

P_{DMAX}=(125°C-25°C)/333=300mW (SC70-6 package)

Negative Voltage at OUT pin

The negative voltage at OUT pin should be smaller than -0.9V while using LD6903. Please refer to Fig.7, while the output is set to a high voltage value (typically > 10V) and short to GND with a very high dV/dt slew rate, then it will induce a negative voltage lower than -0.9V at OUT pin and maybe damage the device. To avoid this phenomenon, it is recommended to place a 1Ω resistor between OUT pin and the output capacitor. (Shown as Fig.8)

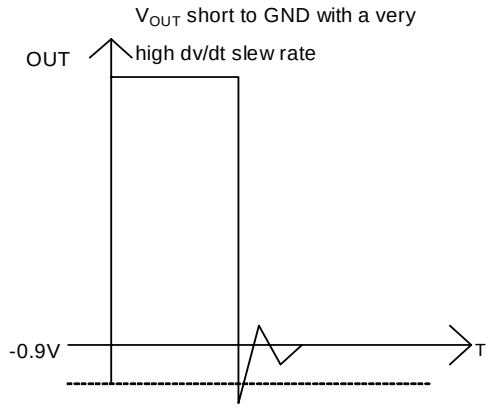


Fig.7 V_{OUT} short to GND with a very high dV/dt slew rate

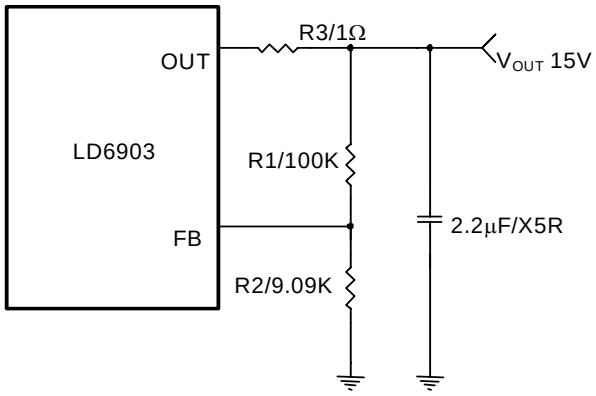
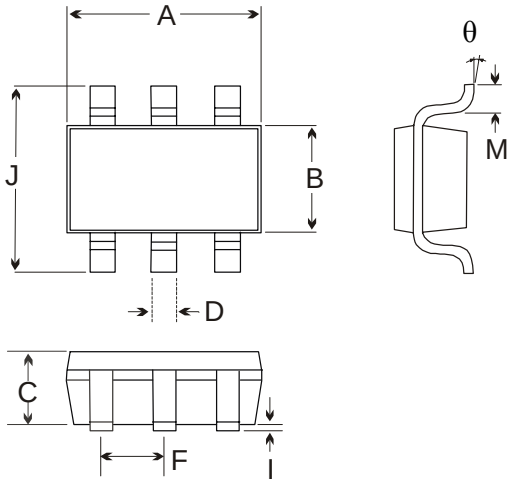


Fig.8 A resistor of 1Ω is placed between OUT pin and output capacitor

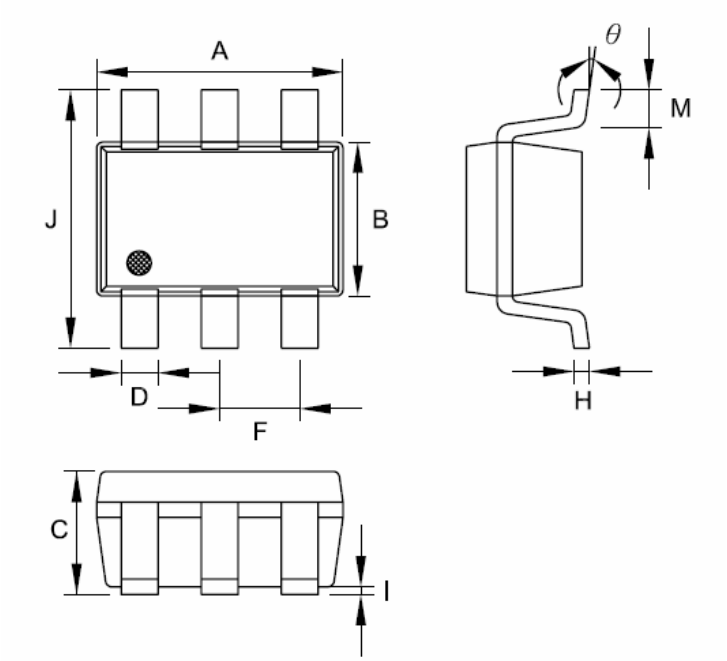
Package Information

SOT-26



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
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
θ	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
θ	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
01	6/6/06	Outline dimension of SOT-26 package