# 150 mA C-MOS L.D.O. Regulator LM1185SF

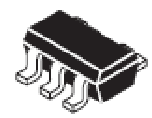
## FEATURES

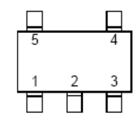
- Extremely Low Supply Current(50μA,Typ.)
- Very Low Dropout Voltage
- 150mA Output Current
- High Output Voltage Accuracy +/- 1.4 %
- Standard or Custom Output Voltages
- Over Currentand Over Temperature Protection
- Small input/output differential : 0.165V at 150mA
- Moisture Sensitivity Level 3

## APPLICATIONS

- Battery Operated Systems
- Portable Computers
- Portable Cameras and Video Recorders
- Medical Instruments
- Instrumentation
- Cellular/GSM/PHS Phones
- Linear Post-Regulators for SMPS
- Pagers

SOT−23−5L(SOT−25)






1.Vin 2.Gnd 3.$\overline{\text{SHDN}}$ 4.Bypass 5.Vout

ORDERING INFORMATION

| Device | Marking | Package |
|---|---|---|
| LM1185 SF5 | HAXX | SOT−23−5L |

(Note : "XX" is Output Voltage for SOT-25 Pkg,
1.5V=HA15, 1.8V=HA18….3.3V=HA33)

## DESCRIPTION

The LM1185 series is a low−dropout linear regulators.
There are devices designed specifically for battery−operated Systems. Ground current is very small (2μA − Typ), that significantly extending battery life.
Low power consumption and high accuracy is achieved through CMOS and programmable fuse technologies. Output voltage: 1.5V to 6.0V.
The LM1185 consists of a high−precision voltage reference, an error correction circuit, and a current limited output driver. With good transient responses, output remains stable even during load changes.
The SHDN input enables the output to be turned off, resulting in reduced power consumption. Also, the LM1185 having high ripple rejection ratios, the series can be used with power supply noise. A 470pF capacitor from the Bypass input to ground reduces noise present on the internal reference, which in turn significantly reduces output noise.
If output noise is not a concern, this input may be left unconnected. Larger capacitor values Cbp be used, but results in a longer time period to rated output voltage when power is initially applied. The LM1185 incorporates both over−temperature and over−current protection. SOT23−5 (300mW) and SOT−89−5 (500mW) packages are available.

## ABSOLUTE MAXIMUM RATING (Note 1)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Supply Voltage | | Vin | +6.5 | V |
| Output Current | | Iout | 150 | mA |
| Output Voltage | | Vout | Vss-0.3 to Vin+0.3 | V |
| Total Power Dissipation | SOT23-5LD | Pd | 300 | mW |
| | SOT89-5LD | | 500 | |
| Operating Ambient Temperature | | Topr | -40 ~ +85 | °C |
| Lead Temperature (soldering, 5 sec) | | | 260 | °C |
| Storage Temperature | | Tstg | -40 ~ +125 | °C |

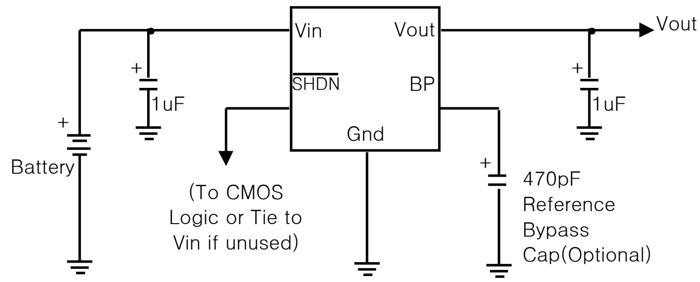
## ELECTRICAL CHARACTERISTICS

(at Ta = 25℃, VIN = Vout+0.5V, unless otherwise noted)

| Parameter | Symbol | Condition | Limit Min | Limit Typ | Limit Max | Units |
|---|---|---|---|---|---|---|
| Output Voltage Accuracy | Vout | Io=1mA | -1.5% | 1 | 1.5% | V |
| | | Io=0.1~150 mA | | 1.5% | | |
| Line Reguration | ΔVout/ΔVin | Io=1mA, (Vout+0.1V)<Vin<6.5V | | 0.15 | 0.35 | %/V |
| Load Reguration(Note.1) | ΔVout/ΔIo | Vin=6V, 1mA<Io<120 mA, Cout=1uF | | 0.01 | 0.05 | %/mA |
| Maximum Output Current | Io | Vin=5V, Vout >0.96VRATING | 150 | | | mA |
| Current Limit | ICL | | 160 | 500 | | mA |
| Ground Current | IGND | Io=0~300 mA | | 2 | 5 | µA |
| Dropout Voltage for Vout>2.5 | Vdrop | Io=150 mA | | 165 | 250 | mV |
| for 2.0V<Vout<2.5V | | | | 220 | 350 | |
| for Vout<2.0V | | | | 330 | 500 | |
| Shutdown Exit Delay | | CBP=0µF Cout=1µF Io=100mA | | 450 | 800 | µs |
| Shutdown Input Bias Current | | $V_{SHDN}$=Vin | | 200 | 400 | nA |
| Shutdown Supply Current | | $V_{SHDN}$=Gnd | | 600 | 1100 | µA |
| Shutdown Input Threshold Low | | Vin=2.5 to 5.5V | | | 0.4 | V |
| Shutdown Input Threshold High | | Vin=2.5 to 5.5V | 2 | | | V |

Note : Load Regulation is measured using pulse techniques with duty cycle < 5%

### Typical Application Circuit




## Detail Description

### 1. Output Capacitor

1uF(min) capacitor from VOUT to GND is required.
The output capacitor could have an effective series resistance greater than 0.1 Ω and less than .0Ω.
1uF capacitor should be connected from VIN to GND if there is more than 10 inche sofwire between the regulator and the AC filter capacitor ,or if a battery is used as the power source. Aluminum electrolytic or tantalum capacitor types can be used. (Since many aluminum electrolytic capacitors freeze at approximately -30°C, solid tantalums are recommended for applications operating below -25°C.)
When operating from sources other than batteries,supply-noise rejection and transient response can be improved by increasing the value of the input and output capacitors and employing passive filtering techniques.

### 2. Bypass Input

470pF capacitor connected from the Bypass input to ground reduces noise present on the internal reference, which in turn significantly reduces output noise. If output noise is not concern, this input maybe left unconnected. Larger capacitor values maybe used, but results in a longer time period to rated output voltage when power is initially applied.

### 3. THERMAL CONSIDERATIONS

### 3.1 Thermal Shutdown

Integrated thermal protection circuitry shuts the regulator off when die temperature exceeds150°C.
The regulator remains off until the die temperature drops to approxi mately 140°C.

### 3.2 Power Dissipation

The amount of power the regulator dissipate is primarily a function of input and output voltage, and output current. The following equation is used to calculate worst case actual power dissipation:

EQUATION 3-1:

$$P_D \approx (V_{INMAX} - V_{OUTMIN})I_{LOADMAX}$$

Where:

$P_D$ = Worst case actual power dissipation
$V_{INMAX}$ = Maximum voltage on $V_{IN}$
$V_{OUTMIN}$ = Minimum regulator output voltage
$I_{LOADMAX}$ = Maximum output (load) current

The maximum allowable power dissipation (Equation 3-2) is a function of the maximum ambient temperature($T_{AMAX}$), the maximum allowable die temperature($T_{JMAX}$) and the thermal resistance from junction-to-air($\theta_{JA}$).

EQUATION 3-2:

$$P_{DMAX} = \frac{(T_{JMAX} - T_{AMAX})}{\theta_{JA}}$$

Where all terms are previously defined.

Equation 3-1 can be used in conjunction with Equation 4-2 to ensure regulator thermal operation is within limits.Forexample:

Given:

$V_{INMAX}$ = 3.0V +10%
$V_{OUTMIN}$ = 2.7V – 2.5%
$I_{LOADMAX}$ = 40mA
$T_{JMAX}$ = 125°C
$T_{AMAX}$ = 55°C

Find: 1. Actual power dissipation
2. Maximum allowable dissipation

Actual power dissipation:

$$P_D \approx (V_{INMAX} - V_{OUTMIN})I_{LOADMAX}$$
$$= [(3.0 \times 1.1) - (2.7 \times .975)]40 \times 10^{-3}$$
$$= 26.7\text{mW}$$

Maximum allowable power dissipation:

$$P_{DMAX} = \frac{(T_{JMAX} - T_{AMAX})}{\theta_{JA}}$$
$$= \frac{(125 - 55)}{220}$$
$$= 318\text{mW}$$

**3.3 Layout Considerations :**

The primary path of heat conduction out of the package is via the package leads. Therefore,layouts having a ground plane,wide traces at the pads,and wide power supply bus lines combine to lower $\theta_{JA}$ and therefore increase the maximum allow able power dissipation limit.