# LDO_513

## IP Library: Power Supply Range 2.9V to 13V, Low Power, 50mA Low Dropout Voltage Regulator

**PRODUCT PREVIEW**

- CHARGE CONTROL REGULATOR
- VERY LOW DROPOUT VOLTAGE : 60mV
- LARGE INPUT VOLTAGE RANGE
- OUTPUT CURRENT : 50mA
- LOW QUIESCENT CURRENT : 280µA
- HIGH PSRR : 60dB
- NO CURRENT IN POWER DOWN MODE
- SHORT CIRCUIT PROTECTION

### TYPICAL APPLICATIONS

– Cellular and Cordless phones supplied by 1 cell Lithium-ion battery / 3 cells Ni-MH or Ni-Cd battery

– PDA (Personal Digital Assistant), Smart phone

– Portable equipment

– Supply for Charge control devices of cellular phone

### APPLICATION NOTE

An external capacitor ($C_{OUT}$ = 1µF) with an equivalent serial resistance (ESR) in the range 0.02 to 0.6Ω is used for regulator stability.

The regulator needs two separated power supplies, one ($V_{5V}$) for the digital parts and programming inputs (Stand-by and Power-down mode) which cannot exceed 5V and one (Vin) as the input voltage of the regulator.

**Figure 1 :** Block Diagram

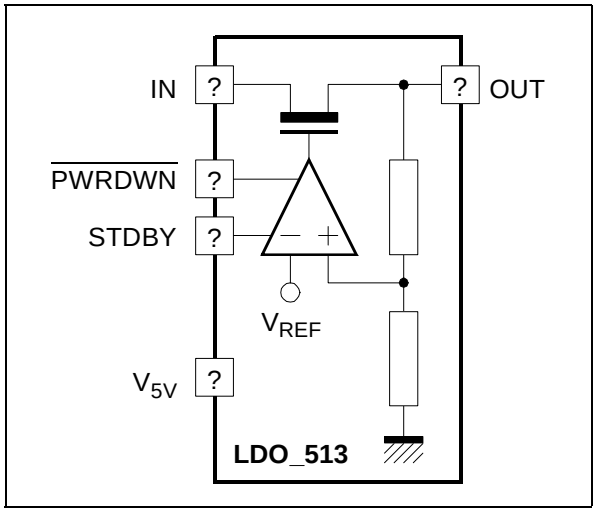
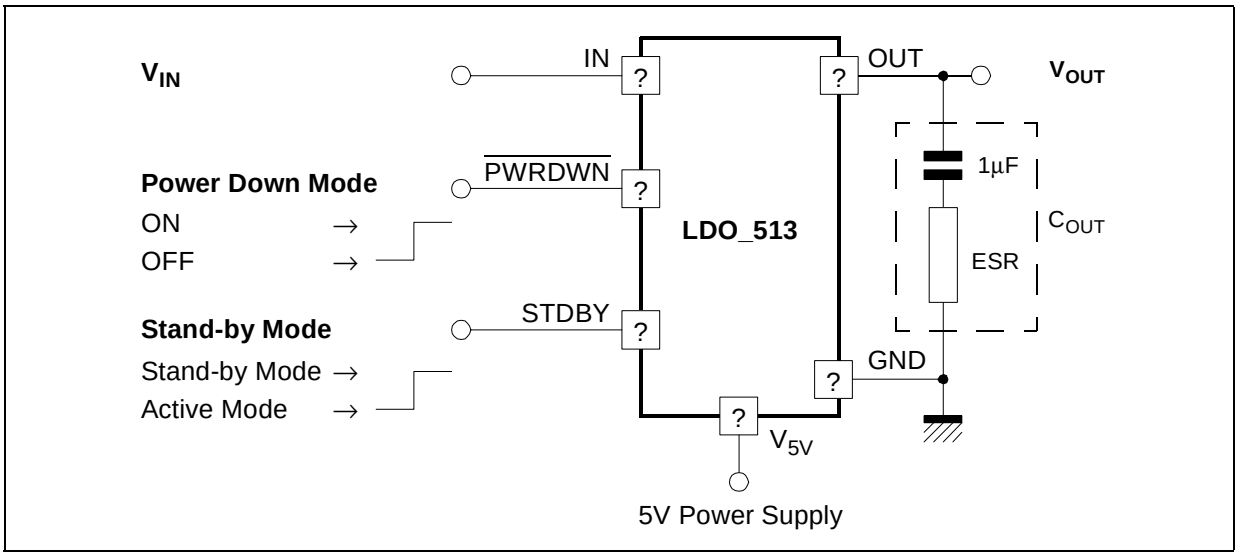



**Figure 2 :** Typical Application Circuit



## ELECTRICAL CHARACTERISTICS

2.9V < $V_{IN}$ < 13V, -30°C < $T_A$ < +85°C, $C_{OUT}$ = 1µF ±20%, 20mΩ < ESR < 0.6Ω, $I_{LOAD}$ = 50mA.

Typical case: $V_{IN}$ = 4V, T = 25°C, $C_{OUT}$ = 1µF.

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input Voltage Range (Note 1) | $V_{IN}$ | | 2.9 | | 13 | V |
| Output Voltage | Vout | | 1.8 | | 5 | V |
| Output Voltage Accuracy | | | | 3 | | % |
| Output current | $I_{OUT}$ | | | | 50 | mA |
| Dropout Voltage | $\Delta V_{DO}$ | $\Delta V_{OUT}$ = 50mV, $I_{LOAD}$ = 50mA | | | 70 | mV |
| | | (Note 2) | 200 | | | |
| Quiescent current | $I_Q$ | $I_{LOAD}$ = 100µA | | 40 | | µA |
| | | $I_{LOAD}$ = 10mA | | 100 | | |
| | | $I_{LOAD}$ = 50mA | | 270 | 340 | |
| Power down mode quiescent current | $I_{QPDM}$ | Power down active | | 100 | | nA |
| Power Supply Rejection Ratio | PSRR | DC | 45 | 60 | | dB |
| | | f = 10KHz | 40 | 60 | | |
| Line Regulation | $L_{IR}$ | $I_{LOAD}$ = 50mA, $V_{IN}$ = 3V to 13V | | | 3 | mV |
| Load Regulation | $L_{DR}$ | $I_{LOAD}$ = 100µA - 50mA | | | 40 | mV |
| Line Transient | $L_{IRT}$ | $\Delta V_{IN}$ = 300mV $t_{RISE}$ = $t_{FALL}$ = 10µs | | | 3 | mV |
| Load Transient | $L_{DTR}$ | $I_{LOAD}$=100µA - 50mA in 10µs | | | 6 | mV |
| Output Noise Voltage | en | 100Hz | | 1.2 | | $\frac{\mu V}{\sqrt{Hz}}$ |
| | | 1KHz | | 400 | | $\frac{nV}{\sqrt{Hz}}$ |
| | | 10KHz | | 150 | | |
| | | 100KHz | | 70 | | |
| | $en_{RMS}$ | BW : 100Hz to 100KHz | | 35 | | $\mu V_{RMS}$ |
| Output decoupling Capacitor | $C_{OUT}$ | | | 1 | | µF |
| Settling time | | From power down to active mode | | | 120 | µs |
| Short Circuit Current Limit | $I_{SHORT}$ | | | 100 | 220 | mA |

Notes: 1. Above characteristics are given for 2.9V minimum input operating range voltage, but regulator is operational with 2.7V minimum input voltage.

2. All parameters are guaranteed with 200mV min Dropout voltage.

## ELECTRICAL CHARACTERISTICS : STAND-BY MODE

$3V < V_{IN} < 5.5V$, $-30°C < T_A < +85°C$, $V_{REF} = 2.8V$, $C_{OUT} = 4.7\mu F \pm 20\%$, $20m\Omega < ESR < 0.6\Omega$.
$I_{LOAD} = 500\mu A$.

Typical case : $V_{IN} = 4V$, Ambient temperature, $I_{LOAD} = 500\mu A$.

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output current in stand-by mode | $I_{OUTSTDBY}$ | | | | 500 | µA |
| Quiescent Current in stand-by mode | $I_{STDBY}$ | $I_{LOAD} = 500\mu A$ | | 20 | 40 | µA |
| Power Supply Rejection Ratio in stand-by mode | $PSRR_{STY}$ | f = 10KHz | | 70 | | dB |

## TYPICAL CHARACTERISTICS

**Figure 3 :** PSRR vs Frequency for Various Voltage Drop ($I_{LOAD}$ = 50mA)