



# LDO\_512

## IP Library: Ultra Low Noise, High PSRR, Low Power, 30mA Very Low Dropout Voltage Regulators

PRODUCT PREVIEW

- RF REGULATOR
- VERY LOW DROPOUT VOLTAGE : 30mV
- ULTRA LOW OUTPUT VOLTAGE NOISE
- HIGH PSRR : 70dB
- LOW STAND-BY CURRENT : 20 $\mu$ A
- LOW QUIESCENT CURRENT : 150 $\mu$ A FULL LOAD
- NO CURRENT IN POWER DOWN MODE
- SHORT CIRCUIT PROTECTION
- SMALL DECOUPLING CERAMIC CAPACITOR
- BIPOLAR INPUT STAGE

### 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 RF devices for cellular phone

### APPLICATION NOTE

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

Figure 1 : Block Diagram

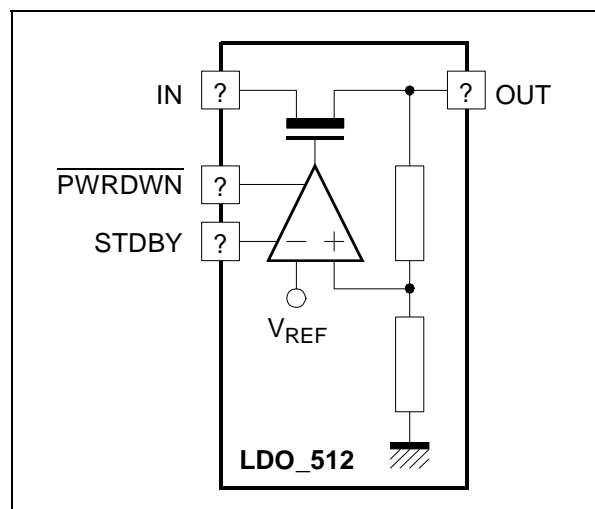
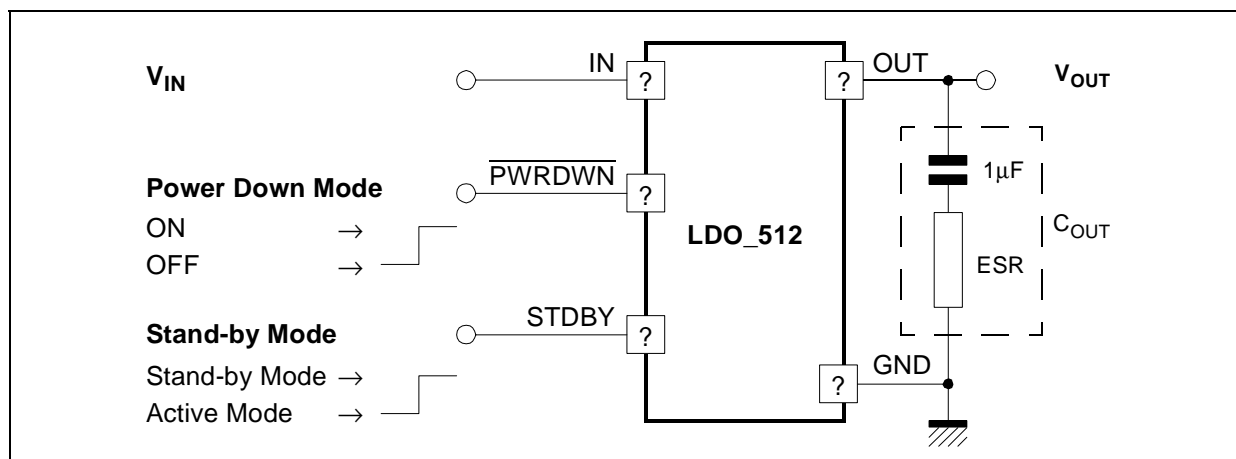


Figure 2 : Typical Application Circuit



**ELECTRICAL CHARACTERISTICS**

$3V < V_{IN} < 5.5V$ ,  $-30^{\circ}C < T_A < +85^{\circ}C$ ,  $V_{REF} = 2.8V$ ,  $0.8\mu F < C_{OUT} < 1.2\mu F$ ,  $20m\Omega < ESR < 0.6\Omega$ ,  
 $100\mu A < I_{LOAD} < 30mA$ .

Typical case :  $V_{IN} = 4V$ ,  $T = 25^{\circ}C$ ,  $I_{OUT} = 15mA$ .

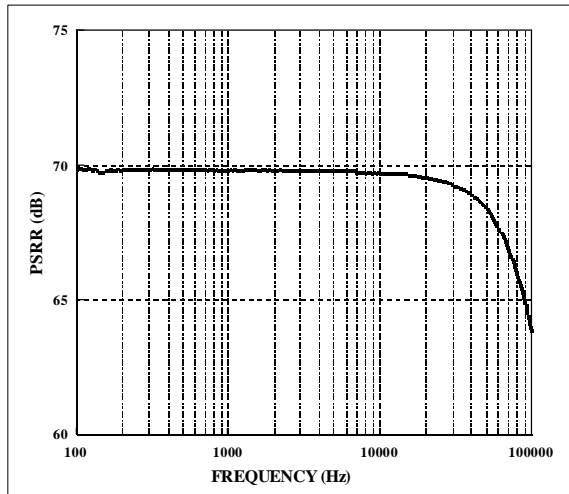
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input Voltage Range (Note 1)	$V_{IN}$		3		5.5	V
Output Voltage	$V_{OUT}$			2.8		V
Output current	$I_{OUT}$				30	mA
PMOS Output Resistance	$R_{ON}$				0.4	$\Omega$
Input Current	$I_{IN}$			200	600	nA
Dropout Voltage	$\Delta V_{DO}$	$I_{LOAD} = 30mA$ , $\Delta V_{OUT} = 50mV$			30	mV
		(Note 2)	170			
Quiescent current	$I_Q$	$I_{LOAD} = 100\mu A$		100	150	$\mu A$
		$I_{LOAD} = 30mA$		150	280	
Stand-by current	$I_{STDBY}$	$I_{LOAD} = 100\mu A$		20	30	$\mu A$
Power down mode quiescent current	$I_{PDN}$	Power down active		0.1		$\mu A$
Power Supply Rejection Ratio	PSRR	$f < 100KHz$	55	70		dB
Power Supply Rejection Ratio in stand-by mode	PSRR <sub>STY</sub>	$f < 100kHz$	60	65		dB
Load Regulation	$L_{DR}$			10	12	mV
Line Regulation	$L_{IR}$	$I_{LOAD} = 30mA$ , $V_{IN} = 3V$ to $5.1V$ , $V_{OUT} = 2.8V$		0.5	1	mV
Line Transient	$L_{IRT}$	$V_{OUT} = 2.8V$ , $I_{OUT} = 30mA$ , $\Delta V_{IN} = 300mV$ $t_{RISE} = t_{FALL} = 10\mu s$		0.5	1.5	mV
Load Transient	$L_{DTR}$	$V_{OUT} = 2.8V$ , $t_{RISE} = t_{FALL} = 10\mu s$ $100\mu A < I_{LOAD} < 30mA$			3	mV
		Recovery time		10	20	
Output Voltage Noise	en	$100Hz < f \leq 1KHz$		30	70	$\frac{nV}{\sqrt{Hz}}$
		$1KHz < f \leq 100KHz$		20	35	
		$f > 100KHz$		20	30	
Output Decoupling Capacitor	$C_{OUT}$			1		$\mu F$
Settling Time (from power down to active mode)		$V_{OUT} = 2.8V$ , $C_{OUT} = 1\mu F$		20	50	$\mu s$
Short Circuit Current Limit	$I_{SHORT}$				200	mA

Notes: 1. Above characteristics are given for 3V minimum input operating range voltage, but regulator is operational with 2.7V minimum input voltage.

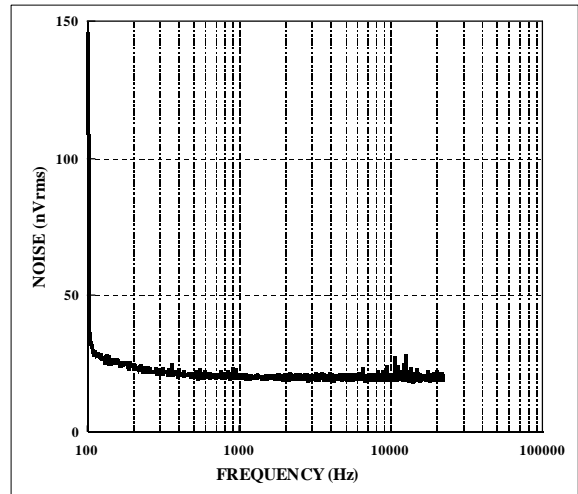
2. All parameters are guaranteed with 170mV Dropout voltage.

**TYPICAL CHARACTERISTICS**

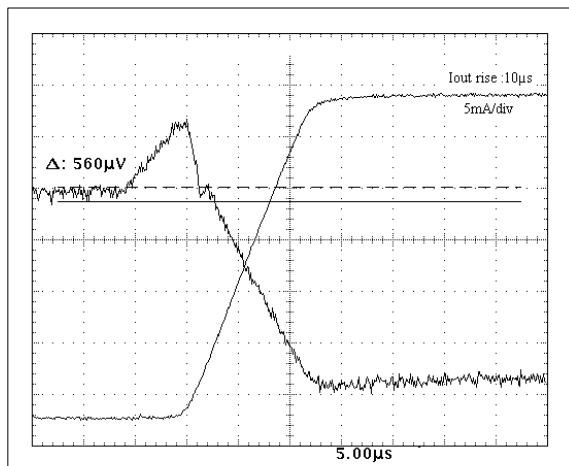
**Figure 3 : PSRR vs Frequency**  
(Iload max - Vin min)



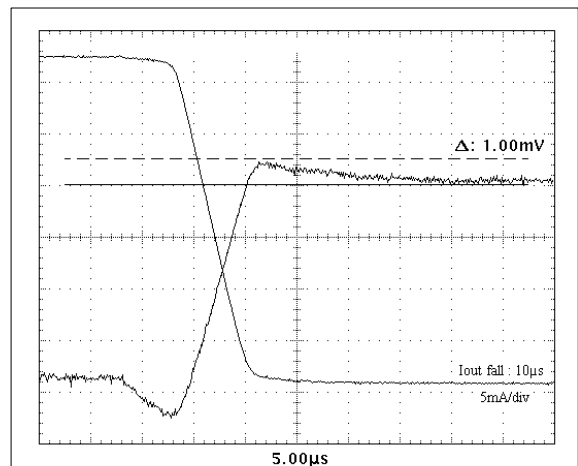
**Figure 4 : Noise vs Frequency**  
(Iload max - Vin min)



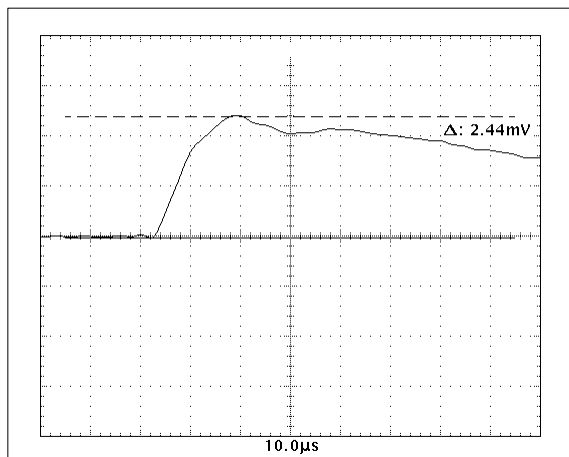
**Figure 5 : Load Transient (rising edge)**



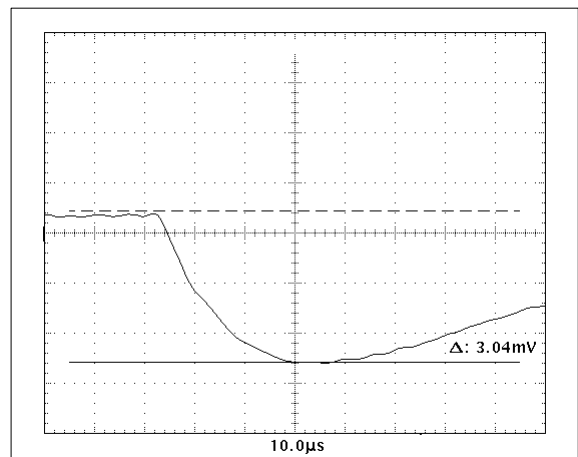
**Figure 6 : Load Transient (falling edge)**



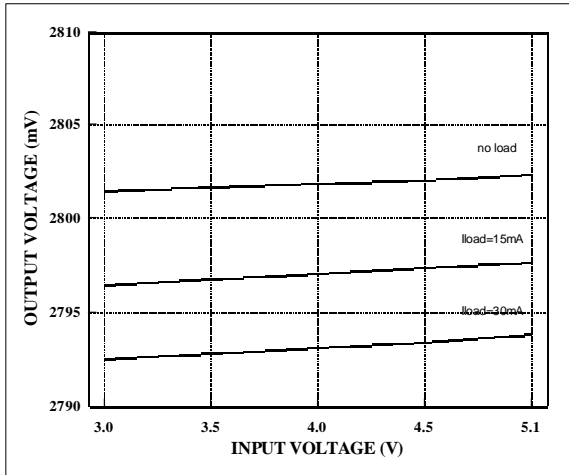
**Figure 7 : Load Transient in Std-by mode**  
(rising edge)



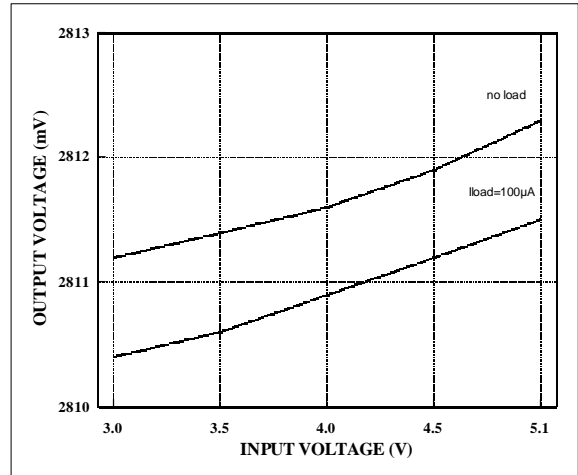
**Figure 8 : Load Transient in Std-by mode**  
(falling edge)



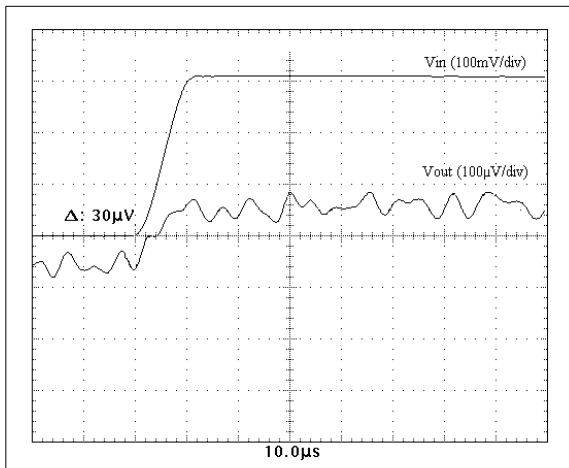
**Figure 9 : Output Voltage vs Input Voltage (Line Regulation)**



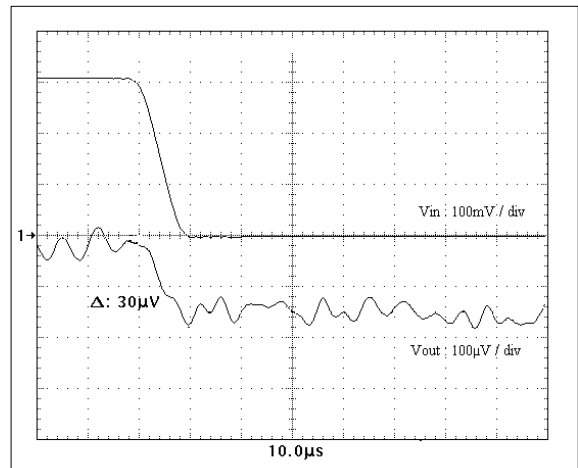
**Figure 10 : Output Voltage vs Input Voltage (Line Regulation - Stand-by mode)**



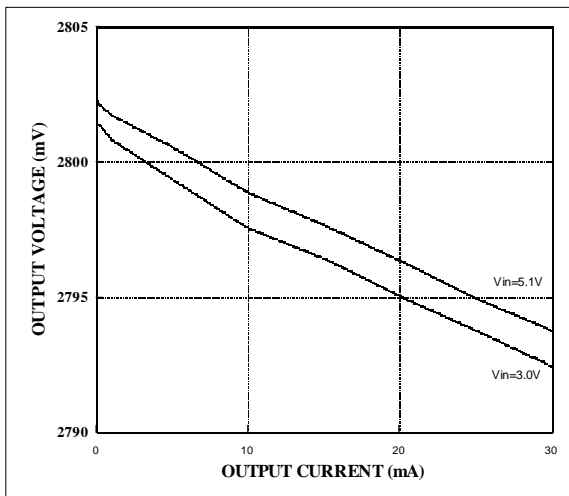
**Figure 11 : Line Transient (rising edge ; Vin min ; Iload max)**



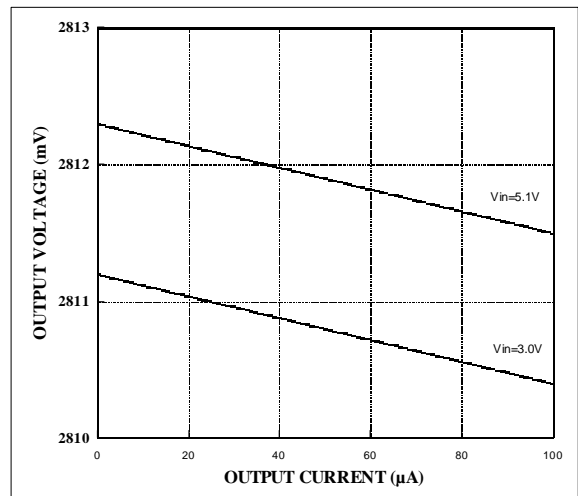
**Figure 12 : Line Transient (falling edge ; Vin min ; Iload max)**



**Figure 13 : Output Voltage vs Output Current (Load Regulation)**



**Figure 14 : Output Voltage vs Output Current (Load Regulation - Stand-by mode)**



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