LR8802

Low Dropout
250mA Linear Regulator

DESCRIPTION

The LR8802 is a low-noise, low-dropout linear regulator. It operates from 2.7V to 6.5V input voltage, and regulates the output voltage with 2% accuracy at 2.5V, 2.85V, 3.3V, or from 1.25V to 5V.

The LR8802 can supply up to 250mA of load current. The LR8802 features thermal overload protection. It is available in a 5-pin TSOT23-5 package.

FIXED VOLTAGE PART NUMBERS

Part Number	Output Voltage
LR8802DJ –2.5	2.5V
LR8802DJ –2.85	2.85V
LR8802DJ –3.3	3.3V

EVALUATION BOARD REFERENCE

Board Number	Output*	Dimensions
LR8802DJ-00A	2.85V	2.0”X x 2.0”Y x 0.4”Z

* Default output voltage adjustable from 1.25V to 5.0V using an external resistor divider.

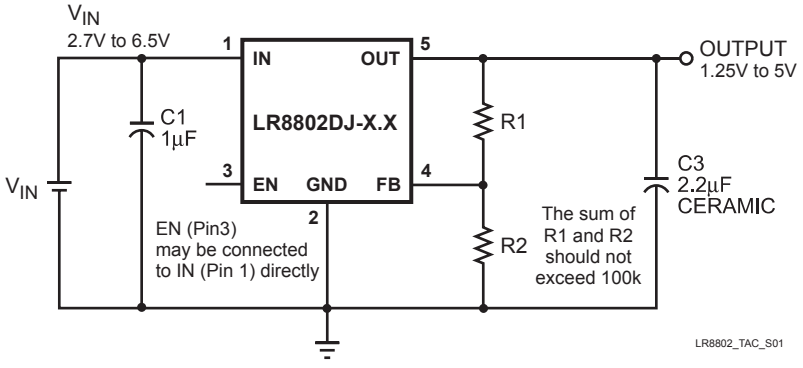
FEATURES

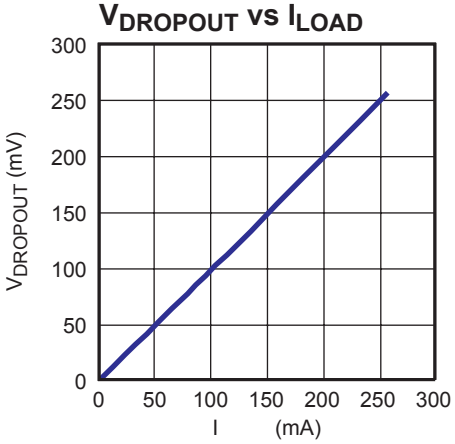
- Low 250mV Dropout at 250mA Output
- 2% Accurate Output Voltage
- Fixed Output Voltage Options of 2.5V, 2.85V or 3.3V
- Adjustable Output Voltage Option from 1.25V to 5V using an External Resistor Divider
- Up to 6.5V Input Voltage
- High PSRR
  - o 70dB at 1KHz
  - o 30dB at 1MHz
- Better Than 0.001%/mA Load Regulation
- Stable With Low-ESR Output Capacitor
- Low 125µA Ground Current
- Internal Thermal Protection

APPLICATIONS

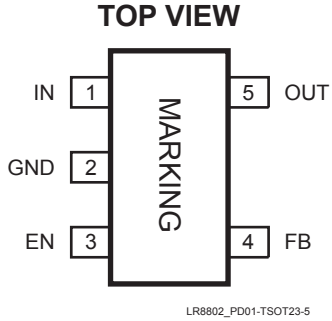
- 802.11 PC Cards
- Mobile Handset PLL Power
- Audio Codec Power

TYPICAL APPLICATION





PACKAGE REFERENCE



Part Number**	Package	Temperature
LR8802DJ–2.5	TSOT23-5	–40°C to +85°C
LR8802DJ–2.85		
LR8802DJ–3.3		

ABSOLUTE MAXIMUM RATINGS (1)

IN Supply Voltage ..... –0.3V to +7.0V
FB Voltage ..... –0.3V to V_{OUT} + 0.3V
All Other Pins ..... –0.3V to +6V
Junction Temperature ..... 150°C
Lead Temperature ..... 260°C
Storage Temperature ..... –65°C to +150°C

Recommended Operating Conditions (2)

Input Voltage ..... 2.7V to 6.5V
Output Voltage ..... 1.25V to 5V
Load Current ..... 250mA Maximum
Operating Temperature ..... –40°C to +85°C

Thermal Resistance (3)

	θ_{JA}	θ_{JC}	
TSOT23-5	220	110	°C/W

Notes:
1) Exceeding these ratings may damage the device.
2) The device is not guaranteed to function outside of its operating conditions.
3) Measured on approximately 1" square of 1 oz copper.

ELECTRICAL CHARACTERISTICS

V_{IN} = 5V, T_A = +25°C, unless otherwise noted.

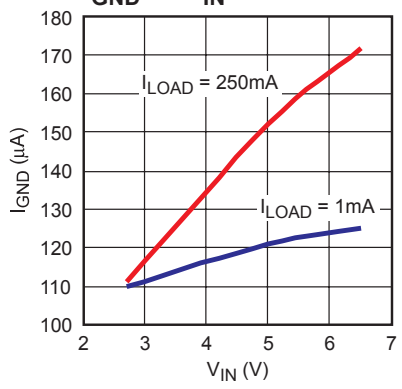
Parameter	Symbol	Condition	Min	Typ (4)	Max	Units
Operating Voltage		I_{OUT} = 1mA	2.7		6.5	V
Output Voltage Accuracy		I_{OUT} = 1mA, V_{OUT} = 1.25V to 5V	-2.0	±1.0	2.0	%
Ground Pin Current		I_{OUT} = 1mA–250mA		125	155	µA
Shutdown Current		V_{EN} = 0V, V_{IN} = 5V		0.1	1	µA
FB Regulation Voltage			1.197	1.222	1.246	V
		–40°C ≤ T_A ≤ +85°C	1.194	1.222	1.249	
Dropout Voltage (5)		I_{OUT} = 250mA, V_{OUT} = 3V			230	mV
		I_{OUT} = 250mA, V_{OUT} = 4V			190	
Line Regulation		I_{OUT} = 1mA, V_{IN} = (V_{OUT} + 0.5V) to 6.5V (6)		0.005	0.08	%/V
Load Regulation		I_{OUT} = 1mA to 250mA, V_{IN} = V_{OUT} + 0.5V (6)		0.001	0.02	%/mA
PSRR		V_{IN} > V_{OUT} +0.5V, C_{OUT} = 2.2µF, V_{IN}(AC) = 100mV, f = 1kHz		70		dB
		V_{IN} > V_{OUT} + 0.5V, C_{OUT} = 2.2µF, V_{IN}(AC) = 100mV, f = 1MHz		30		dB
Output Voltage Noise		f = 1kHz, C_{FB} > 0.1µF, I_{OUT} = 1mA		300		nV/√Hz
EN Input High Voltage					1.5	V
EN Input Low Voltage			0.4			V
EN Input Bias Current		V_{EN} = 0V, 5V		0.01	1	µA
Thermal Protection				155		°C
Thermal Protection Hysteresis				30		°C

Notes:
4) Parameter is guaranteed by design, not production tested.
5) Dropout Voltage is defined as the input to output differential when the output voltage drops 1% below its normal value.
6) V_{IN} = 2.7V for V_{OUT} = 1.25V to 2.2V

TYPICAL PERFORMANCE CHARACTERISTICS

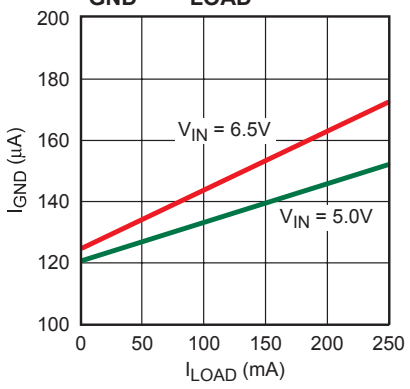
V_{IN} = 4.5V, V_{OUT} = 2.85V, C1 = 1μF, C2 = 0.1μF, C3 = 2.2μF, T_A = +25°C unless otherwise noted.

I_{GND} vs V_{IN}



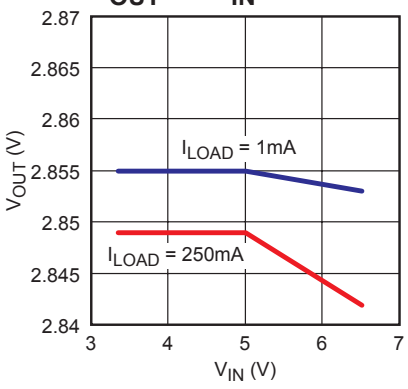
LR8802-TPC01

I_{GND} vs I_{LOAD}



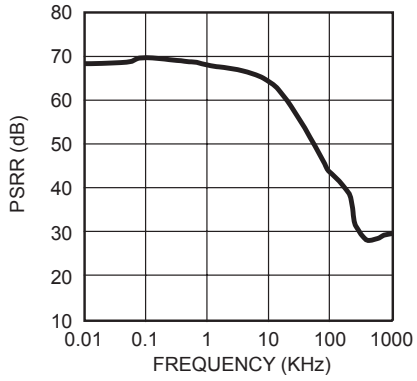
LR8802-TPC02

V_{OUT} vs. V_{IN}



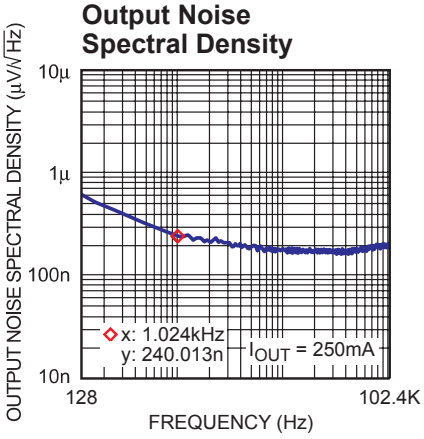
LR8802-TPC03

PSRR vs Frequency



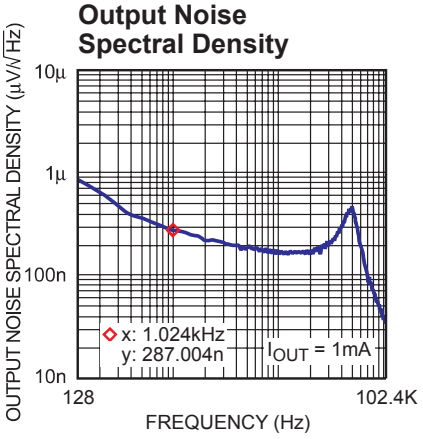
LR8802-TPC04

Output Noise Spectral Density



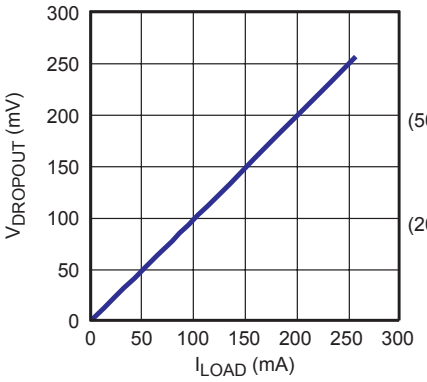
LR8802-TPC05

Output Noise Spectral Density



LR8802-TPC06

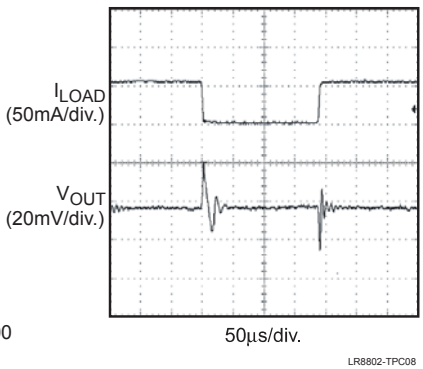
$V_{DROPOUT}$ vs I_{LOAD}



LR8802_TPC07

Load-Transient Response

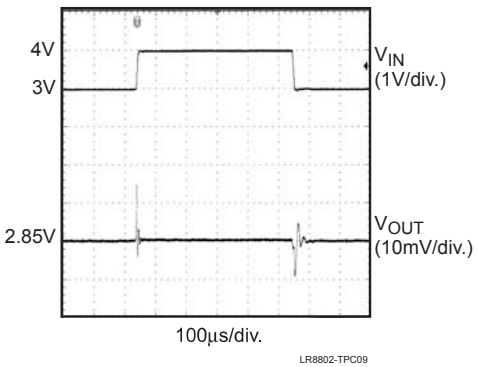
(Circuit in Figure 4)



LR8802-TPC08

Line-Transient Response

(Circuit in Figure 4)



LR8802-TPC09

PIN FUNCTIONS

Pin #	Name	Description
1	IN	Power Source Input. IN supplies the internal power to the LR8802 and is the source of the pass transistor. Bypass IN to GND with a 1μF or greater capacitor.
2	GND	Ground.
3	EN	Enable Input. Drive EN high to turn on the LR8802, drive EN low to turn it off. For automatic startup, connect EN to IN.
4	FB	Feedback Input. Connect a resistive voltage divider from OUT to FB to set the output voltage. OUT feedback threshold is 1.222V.
5	OUT	Regulator Output. OUT is the output of the linear regulator. Bypass OUT to GND with a 1μF or greater capacitor.

OPERATION

The LR8802 is a low-current, low-noise, high-PSRR, low-dropout, linear regulator. It is intended for use in devices that require very low noise power supplies and high-PSRR such as PLL VCO supplies for mobile handsets and 802.11 PC Cards, as well as audio codecs and microphones. The LR8802 uses a PMOS pass element and features internal thermal shutdown. As shown in Figures 1 and 2, optional feed-forward capacitor C_{BYP} may be added between FB and OUT pins for an improved transient response.

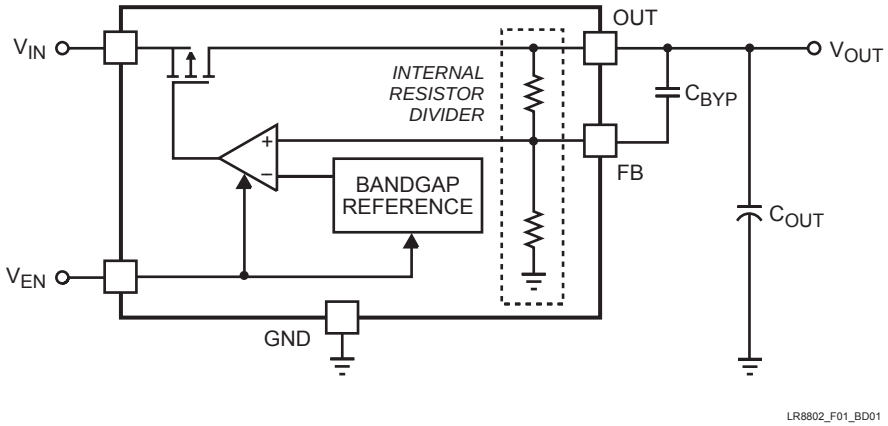


Figure 1—Ultra-Low-Noise Fixed Output Regulator

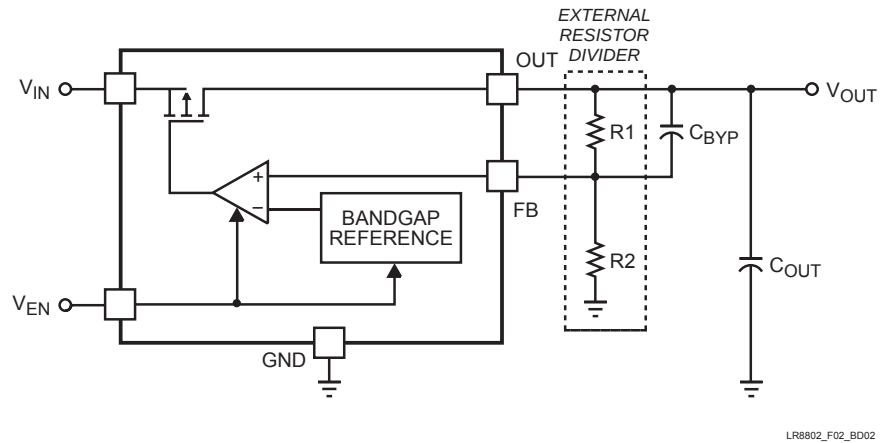


Figure 2—Ultra-Low-Noise Adjustable Regulator: $V_{OUT} = V_{FB}(1+(R1/R2))$

APPLICATION INFORMATION

SETTING THE OUTPUT VOLTAGE

The fixed output voltage of the LR8802DJ is set to 2.5V, 2.85V or 3.3V, depending on the internal resistor divider (Figure 1). You can also adjust the output voltage by using an external resistor divider (R1 and R2 in Figure 2). However, the sum of R1 and R2 should not exceed 100kΩ to minimize the impact of the internal resistor divider. For accurate output-voltage setting, it is suggested to use 10kΩ (±1%) for the low-side resistor R2 of the voltage divider, the high side resistor R1 can be determined by the equation:

$$R1 = R2 \times \left(\frac{V_{OUT} - V_{FB}}{V_{FB}} \right)$$

Where V_{FB} is the OUT feedback threshold voltage equal to 1.222V.

Example: For 2.5V Output

$$R1 = \frac{2.5V - 1.222V}{\left(\frac{1.222V}{10k\Omega} \right)} = 10.41k\Omega$$

You can select a standard 10.5k (±1%) resistor for R1.

The following table lists the selected R1 values for some typical output voltages:

Table 1—Adjustable Output Voltage R1 Values

V_{OUT} (V)	R1 (Ω)
1.25	232
1.5	2.26k
1.8	4.75k
2	6.34k
2.5	10.5k
2.8	13k
3	14.7k
3.3	16.9k
4	22.6k
5	30.9k

In Figures 3 and 4, C2 is added for an improved transient response.

TYPICAL APPLICATION CIRCUIT

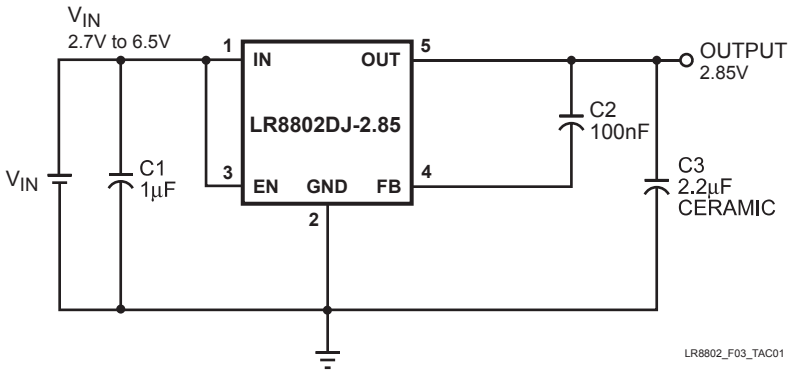


Figure 3—Typical Application Circuit (Fixed)

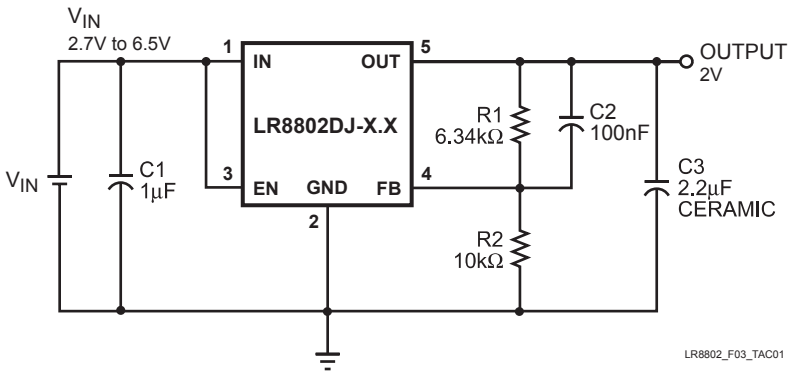
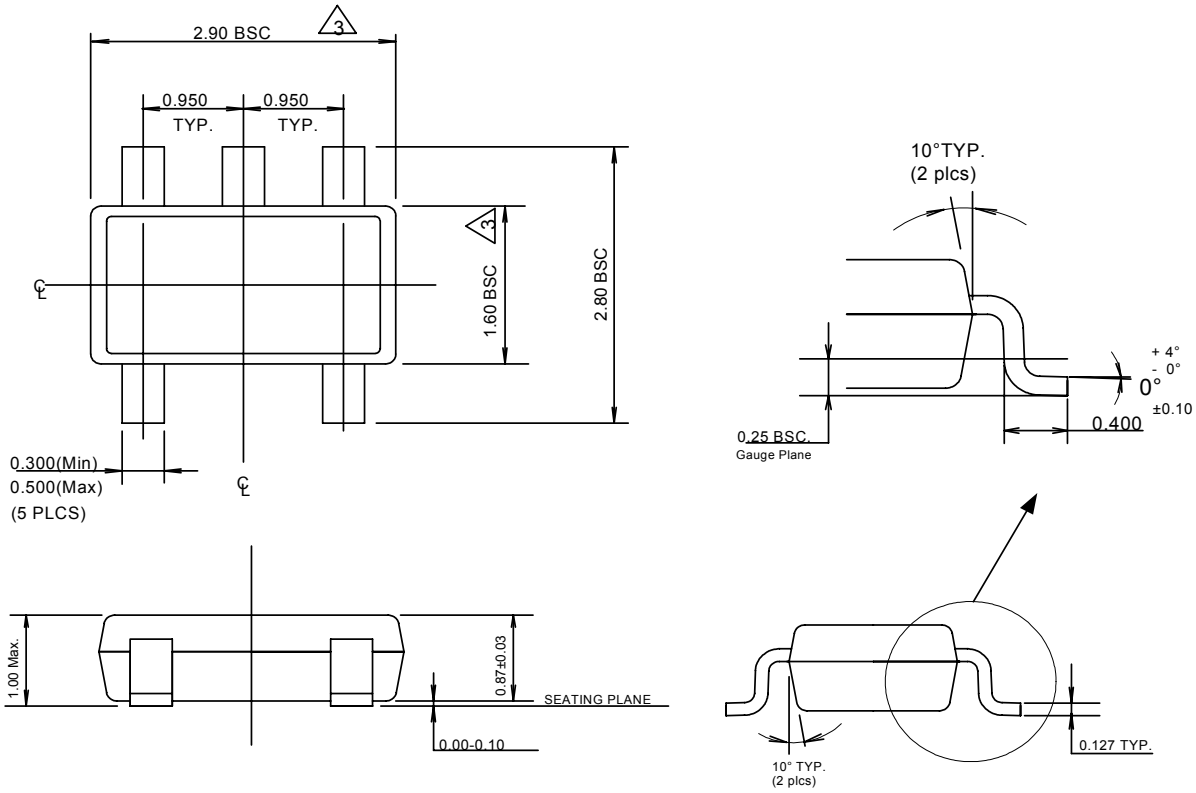


Figure 4—Typical Application Circuit (Adjustable)

PACKAGE INFORMATION

TSOT23-5



Dimensions are in millimeters