

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 916

## LOW NOISE REGULATED CHARGE PUMP IN 2X2 DFN

### LTC3204B-5 and LTC3204B-3.3

## DESCRIPTION

Demonstration circuit 916 is a low noise regulated charge pump in 2X2 DFN. There are two assembly versions, DC916A-A and DC916A-B for featuring LTC3204B-5 and LTC3204B-3.3 respectively. The DC916A-A produces a regulated 5V output from a 2.7V to 5.5V input. The guaranteed output load current is **150mA** for  $V_{IN}$  between 3.1V and 5.5V, and 65mA for  $V_{IN}$  less than 3.1V. The DC916A-B produces a regulated 3.3V output from a 1.8V to 4.5V input. The guaranteed output current is 50mA from  $V_{IN}$  between 1.9V and 4.5V, and 40mA for  $V_{IN}$  less than 1.9V. The circuit requires only three tiny 0603 surface mount capacitors and consumes minimal board

space. No inductor and diode are needed. The circuit features constant frequency operation at any load. Built-in soft-start circuitry prevents excessive inrush current during start-up. Thermal shutdown and current-limit circuitry allow the parts to survive a continuous output short circuit from  $V_{OUT}$  to GND. These circuits are particularly useful in applications that require low  $V_{OUT}$  ripple and extremely small size.

**Design files for this circuit board are available. Call the LTC factory.**

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## PERFORMANCE SUMMARY

PARAMETER	CONDITION	MIN	TYP	MAX
Input Voltage Range	DC916A-A (LTC3204B-5)	2.7V		5.5V
	DC916A-B (LTC3204B-3.3)	1.8V		4.5V
Output Voltage $V_{OUT}$	DC916A-A (LTC3204B-5) 3.1V < $V_{IN}$ < 5.5V, $I_{OUT}$ < 150mA 2.7V < $V_{IN}$ < 5.5V, $I_{OUT}$ < 65mA	4.8V	5V	5.2V
	DC916A-B (LTC3204B-3.3) 1.9V < $V_{IN}$ < 4.5V, $I_{OUT}$ < 50mA 1.8V < $V_{IN}$ < 4.5V, $I_{OUT}$ < 40mA	3.168V	3.3V	3.432V
Output Ripple $V_{OUT}$	$V_{IN} = 3.6V$ , $I_{OUT} = 150mA$ (DC916A-A)		20mV <sub>P-P</sub>	50mV <sub>P-P</sub>
	$V_{IN} = 2.4V$ , $I_{OUT} = 50mA$ (DC916A-B)		10mV <sub>P-P</sub>	20mV <sub>P-P</sub>
Nominal Switching Frequency			1.2MHz	
Efficiency	$V_{IN} = 3.0V$ , $I_{OUT} = 100mA$ (DC916A-A)		81.2%	
	$V_{IN} = 1.8V$ , $I_{OUT} = 20mA$ (DC916A-B)		90.2%	

### QUICK START PROCEDURE

Demonstration circuit 916 is easy to set up to evaluate the performance of the LTC3204B-5 and LTC3204B-3.3. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

**NOTE:** When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the  $V_{IN}$  or  $V_{OUT}$  and GND terminals. See Figure 2 for proper scope probe technique.

- Place jumpers in the following positions:

**JP1**    ON

- With power off, connect the input power supply to  $V_{IN}$  and GND terminals.

- Connect the load between  $V_{OUT}$  and GND terminals.
- Turn on the power at the input.

**NOTE:** Make sure that the input voltage does not exceed 5.5V for DC916A-A or 4.5V for DC916A-B. To prevent input voltage overshoot when the circuit is connected to a live supply, an aluminum electrolytic capacitor can be added to bypass the  $V_{IN}$  at the input terminals. See Linear Technology Application Note 88 for a complete discussion.

- Check for the proper output voltages.  $V_{OUT} = 4.8V$  to  $5.2V$  for DC916A-A,  $V_{OUT} = 3.168V$  to  $3.432V$  for DC916A-B

**NOTE:** If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

- Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

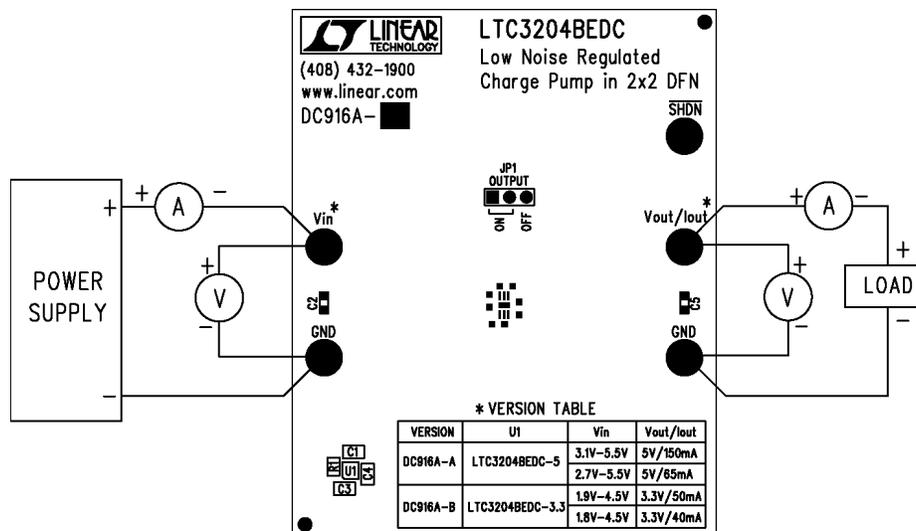


Figure 1. Proper Measurement Equipment Setup

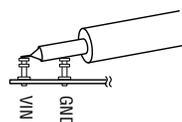


Figure 2. Measuring Input or Output Ripple

## OPERATING PRINCIPLES

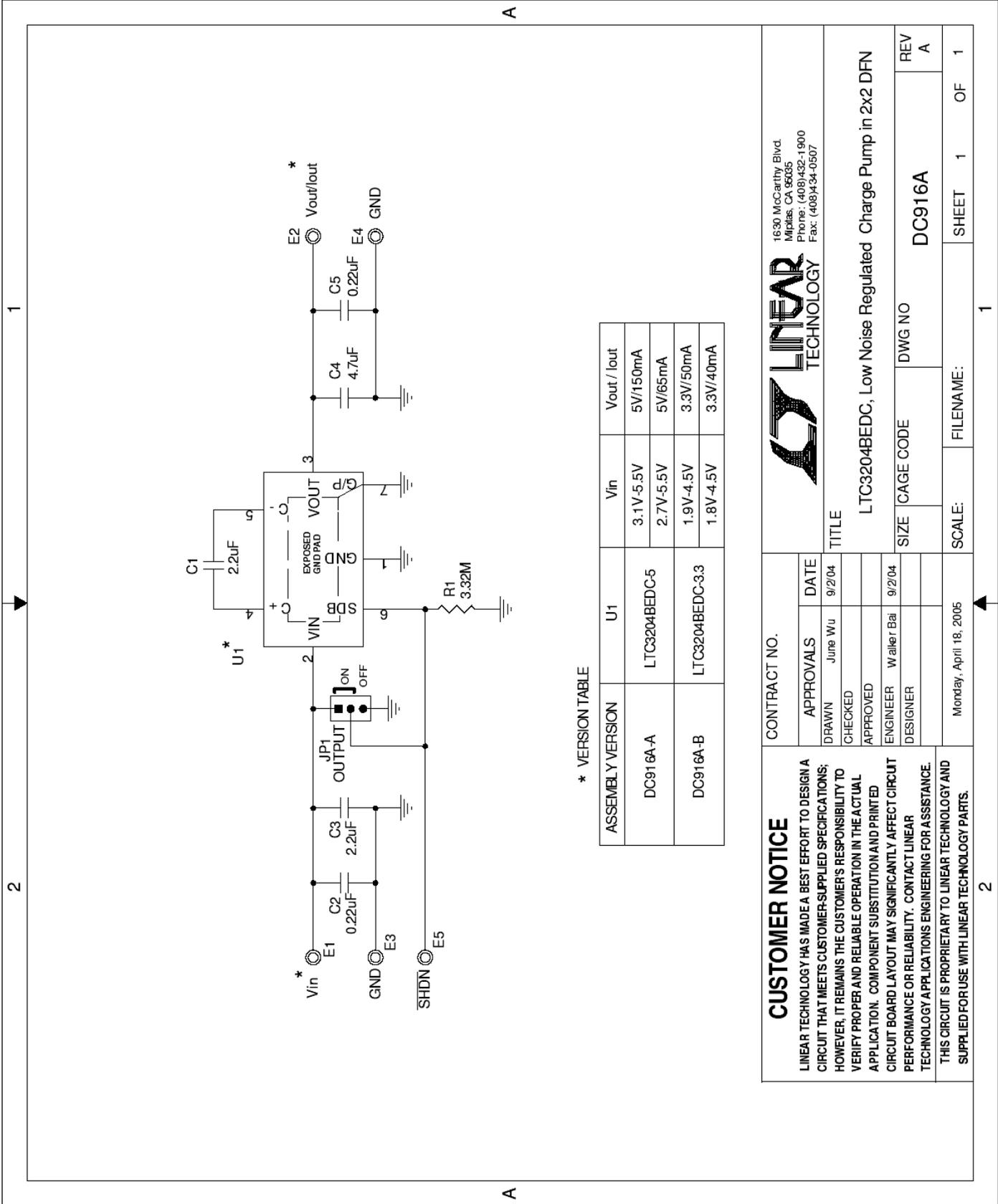
The LTC3204B-5/LTC3204B-3.3 use switched capacitor charge pump to boost  $V_{IN}$  to a regulated voltage. Regulation is achieved by sensing the output voltage through an internal resistor divider and by modulating the charge pump output current based on the error signal. A 2-phase non-overlapping clock activates the charge pump switches. The flying capacitor is charged from  $V_{IN}$  on the first phase of the clock. On

the second phase of the clock, it is stacked in series with  $V_{IN}$  and connected to  $V_{OUT}$ . This sequence of charging and discharging the flying capacitor continues at a free running frequency of 1.2MHz.

The LTC3204B datasheet gives complete description of the part, operation and application information. The datasheet must be read in conjunction with this quick start guide for demo circuit 916.

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## LOW NOISE REGULATED CHARGE PUMP IN 2X2 DFN



\* VERSION TABLE

ASSEMBLY VERSION	U1	Vin	Vout / Iout
DC916A-A	LTC3204BEDC-5	3.1V-5.5V	5V/150mA
		2.7V-5.5V	5V/65mA
		1.9V-4.5V	3.3V/50mA
DC916A-B	LTC3204BEDC-3.3	1.8V-4.5V	3.3V/40mA

### CUSTOMER NOTICE

LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE. THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

### CONTRACT NO.

APPROVALS	DATE
DRAWN June Wu	9/2/04
CHECKED	
APPROVED	
ENGINEER Walter Bai	9/2/04
DESIGNER	
Monday, April 18, 2005	

### TITLE

LTC3204BEDC, Low Noise Regulated Charge Pump in 2x2 DFN



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SIZE	CAGE CODE	DWG NO	REV
		DC916A	A
SCALE:	FILENAME:	SHEET	OF
		1	1

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