

# LTC1517 Micropower Regulated Charge Pump DC/DC Converter

## DESCRIPTION

Demonstration Circuit 174A is a micropower step-up DC/DC converter that produces a regulated output from a 2V to 5V input. Two fixed output voltages are available: 3.3V and 5V. The LTC<sup>®</sup>1517-X can supply up to 20mA of output current. The circuit requires only small surface

mount components and thus consumes minimal board space. This power supply circuit is particularly useful in battery-powered systems that require extremely low quiescent current and extremely small size.

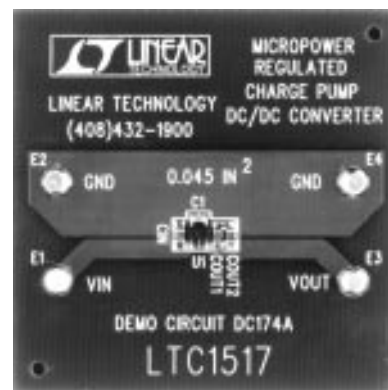
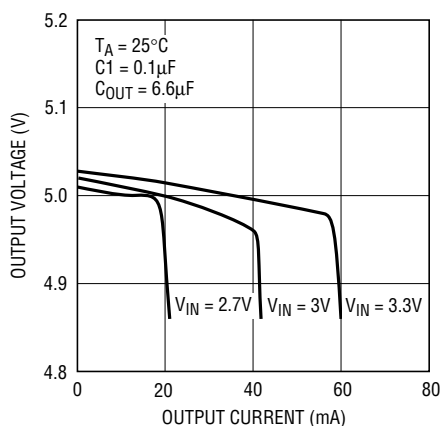
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## PERFORMANCE SUMMARY Operating Temperature Range 0°C to 70°C.

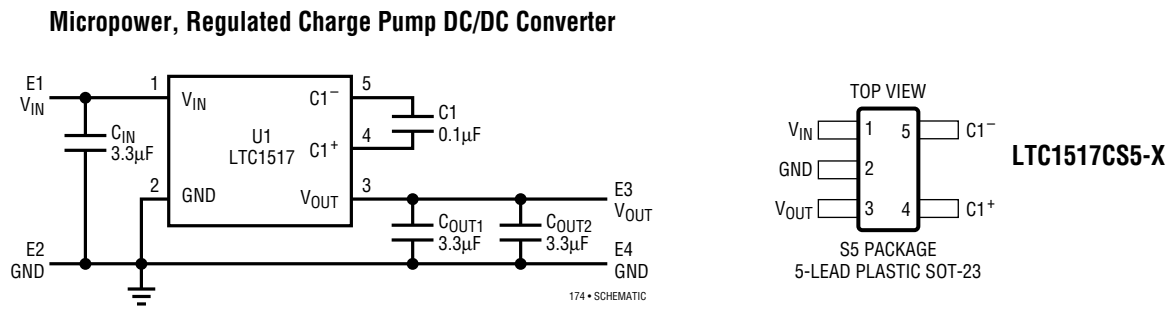
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$V_{IN}$ Operating Voltage	LTC1517-3.3	2.0		4.4	V
	LTC1517-5	2.7		5	V
$V_{OUT}$ (LTC1517-3.3)	$2V \leq V_{IN} \leq 4.4V, I_{OUT} \leq 8mA$	3.17	3.3	3.43	V
	$2.5V \leq V_{IN} \leq 4.4V, I_{OUT} \leq 15mA$	3.17	3.3	3.43	V
$V_{OUT}$ (LTC1517-5)	$2.7V \leq V_{IN} \leq 5V, I_{OUT} \leq 10mA$	4.8	5.0	5.2	V
	$3V \leq V_{IN} \leq 5V, I_{OUT} \leq 20mA$	4.8	5.0	5.2	V
$I_{CC}$	$I_{OUT} = 0$		6	15	$\mu A$
$V_{OUT}$ Ripple (LTC1517-3.3)	$V_{IN} = 2.5V, I_{OUT} = 15mA$		50		mV
$V_{OUT}$ Ripple (LTC1517-5)	$V_{IN} = 3V, I_{OUT} = 20mA$		75		mV
Efficiency	$V_{IN} = 3V, V_{OUT} = 5V, I_{OUT} = 20mA$		81		%

## TYPICAL PERFORMANCE CHARACTERISTICS AND BOARD PHOTO

Typical 5V Output Voltage vs Output Current



PACKAGE AND SCHEMATIC DIAGRAMS



PARTS LIST

REFERENCE DESIGNATOR	QUANTITY	PART NUMBER	DESCRIPTION	VENDOR	TELEPHONE
C1	1	0603YC104KAT1A	0.1µF 16V 10% Chip Capacitor X7R	AVX	(803) 946-0362
CIN, COUT1, COUT2	3	0805ZG335ZT1A	3.3µF 10V 80% -20% Chip Capacitor Y5V	AVX	(803) 946-0362
E1, E2, E3, E4	4	2502-2	Turret Terminal	MILL-MAX	(516) 922-6000
U1	1	LTC1517-3.3	3.3V Charge Pump IC	LTC	(408) 432-1900
U1	1	LTC1517-5	5V Charge Pump IC	LTC	(408) 432-1900

OPERATION

The LTC1517 series of ICs uses a switched capacitor charge pump to boost  $V_{IN}$  to a  $\pm 4\%$  regulated output (refer to Figure 1). Each part achieves regulation by sensing the output voltage through an internal resistor divider and enabling the charge pump when the divided output droops below the comparator's lower trip point (set by  $V_{REF}$ ). When the charge pump is enabled, a 2-phase, nonoverlapping clock controls the internal charge pump switches. Flying capacitor C1 is charged to  $V_{IN}$  on phase one of the clock. On phase two of the clock, C1 is stacked in series with  $V_{IN}$  and connected to  $V_{OUT}$  through an internal switch. This sequence of charging and discharging the flying capacitor occurs at a free-running frequency

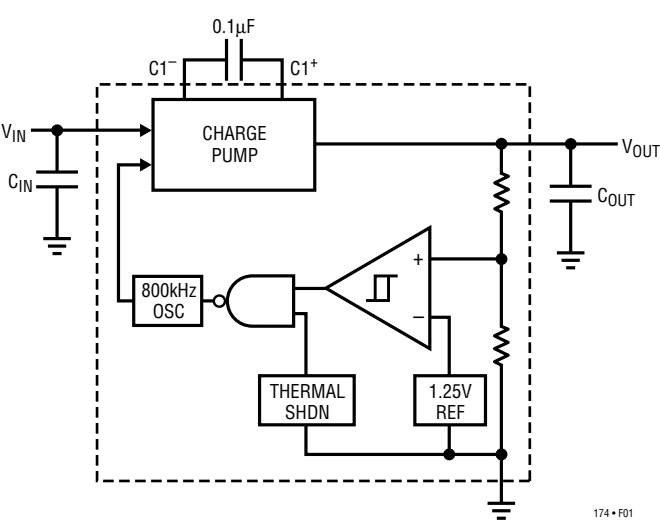


Figure 1. LTC1517-X Block Diagram

## OPERATION

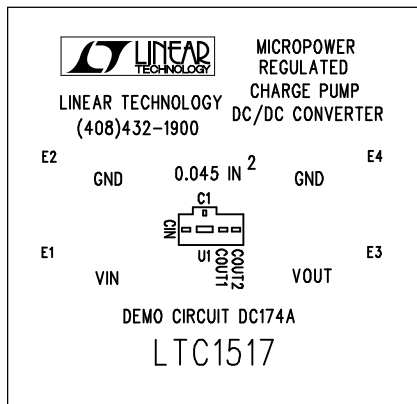
of 800kHz (typ) and continues until the divided output voltage reaches the upper trip point of the comparator. Once the output is back in regulation, the charge pump is disabled. This method of bursting the charge pump on and off enables the LTC1517-X to achieve high efficiency at extremely low output loads.

### Capacitor Selection

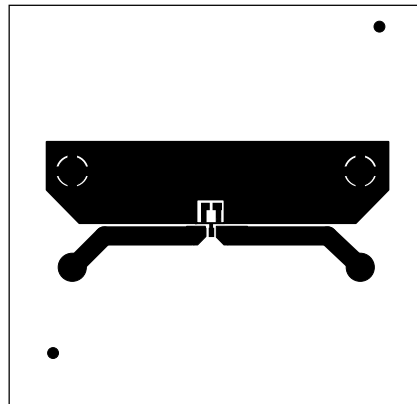
The capacitors used with the LTC1517 series will affect the circuit's performance. For proper operation, the LTC1517

series requires low ESR input and output capacitors placed as close as possible to the device. Using capacitors with  $ESR \geq 0.05\Omega$  will result in reduced efficiency and higher output voltage ripple. The capacitors used in this demo board were chosen based on performance and size. The flying capacitor C1 is a 0.1 $\mu$ F ceramic. C<sub>IN</sub> is a 3.3 $\mu$ F ceramic and C<sub>OUT</sub> consists of two 3.3 $\mu$ F ceramics in parallel. Ceramic capacitors provide the lowest ESR and smallest size, but tend to be more expensive than tantalum capacitors of the same value. Larger values for C<sub>OUT</sub> (10 $\mu$ F to 22 $\mu$ F) will further reduce output ripple.

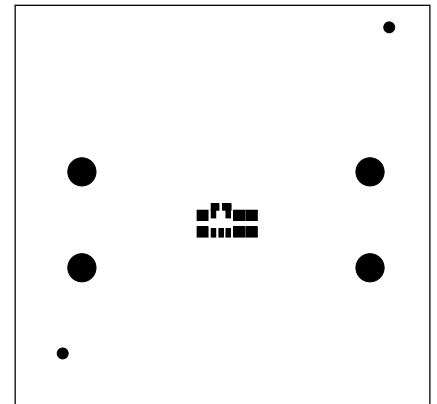
## PC LAYOUT AND FILM



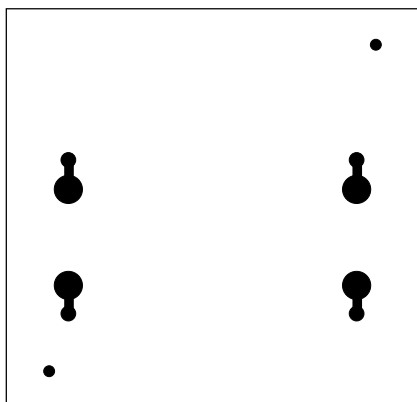
Component Side Silkscreen



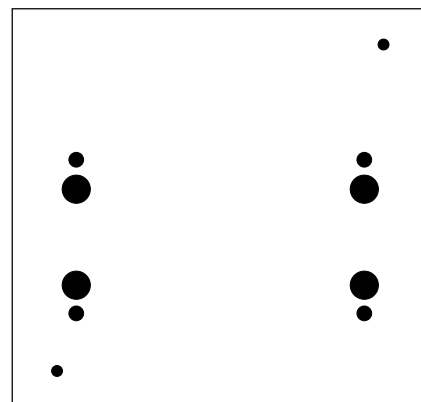
Component Side



Component Side Mask

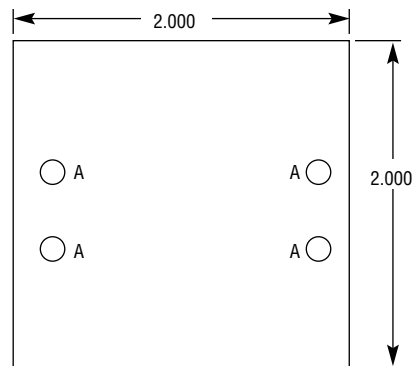


Solder Side



Solder Side Mask

PC FAB DRAWING



- NOTES:
- 1. MATERIAL IS FR4, 0.062" THICK WITH 2 OZ COPPER
  - 2. PCB WILL BE TWO LAYER WITH PLATED THROUGH HOLES
  - 3. PLATED THROUGH HOLE - WALL THICKNESS MIN 0.0014" (1 OZ)
  - 4. USE SOLDER MASK OVER BARE COPPER PROCESS
  - 5. SOLDER MASK BOTH SIDES WITH LPI GREEN USING FILM PROVIDED
  - 6. SILKSCREEN COMPONENT SIDE USING FILM PROVIDED USE WHITE NONCONDUCTIVE INK
  - 7. ALL DIMENSIONS ARE IN INCHES  $\pm 0.005$
  - 8. ALL PANELS IN ORDER MUST BE THE SAME DIMENSIONS  $\pm 0.030"$
  - 9. ALL HOLE SIZES AFTER PLATING 0.003/-0

SYMBOL	DIAMETER	NUMBER OF HOLES
A	0.094	4

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