

# QUICK START GUIDE FOR DC989B-B

## TINY NO $R_{SENSE}$ BOOST CONVERTER

LTC3872-1

### DESCRIPTION

Demonstration circuit 989B-B is a single-output boost converter, it features tiny, boost controller LTC3872-1. The input voltage is from 3.0V to 4.5V without output de-rating. The supply has one output: 5V/2A<sub>MAX</sub>. Minimum input voltage is 2.75V. When input voltage is lower than 3V, output current should be de-rated. The design employs the LTC3872-1, the small footprint NO  $R_{SENSE}$  boost regulator. The switching frequency is fixed at 550 kHz. With current mode control and OPTI-LOOP compensation, DC989B-B can be optimized to provide fast transient response. NO  $R_{SENSE}$  technique reduces both: size of the converter and power dissipation. However, care should be taken

to MOSFET selection, it's not only switching element, but also its  $R_{DS(ON)}$  represents the current sensing element for the control loop, see LTC3872-1 datasheet for details. LTC3872-1 allows design small size and high efficiency step-up DC/DC solutions.

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

TM-NO  $R_{SENSE}$  is trademark of Linear Technology Corporation

**Table 1. Performance Summary ( $T_A = 25^\circ\text{C}$ )**

| PARAMETER                           | CONDITION                                                                | VALUE               |
|-------------------------------------|--------------------------------------------------------------------------|---------------------|
| Minimum Input Voltage               | If the input voltage must be lower than 3V, degrade output load current. | 2.75V               |
| Maximum Input Voltage               |                                                                          | 4.5V                |
| Output Voltage $V_{OUT}$            |                                                                          | 5V +/- 2%           |
| Maximum Continuous output Current   | $V_{IN} = 3\text{V}$ to 4.5V                                             | 2A                  |
| Typical Operating Frequency         | Fixed                                                                    | 550kHz              |
| Typical Output Ripple ( $V_{OUT}$ ) | 20MHz BW, 2A load, $V_{IN} = 3\text{V}$ , frequency = 550kHz             | 30mV <sub>p-p</sub> |
| Efficiency                          | $V_{IN}=3\text{V}$ , $V_{OUT}=5\text{V}$ $I_{OUT}=2\text{A}$             | 90%                 |

### QUICK START PROCEDURE

Demonstration circuit 989B-B is easy to set up to evaluate the performance of the LTC3872-1. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place RUN in ON position for normal operation.

Connect the desired loads between 5V output terminal and the GND terminal on the board.

**NOTE:** The maximum load is 2A.

2. Connect the input power supply to the VIN and GND terminals on the right, center of the board.

**NOTE:** Do not increase  $V_{IN}$  over 5V.

3. Vary the input voltage from 3.0V to 4.5V and adjust the load current from 0 to 2A. Measure the output voltages.  $V_{OUT}$  should read between 5.0V  $\pm$  0.1V within specified maximum load current.
4. Measure the output ripple voltage at maximum output current level and minimum in-

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put voltage; it usually will measure less than 30mV.

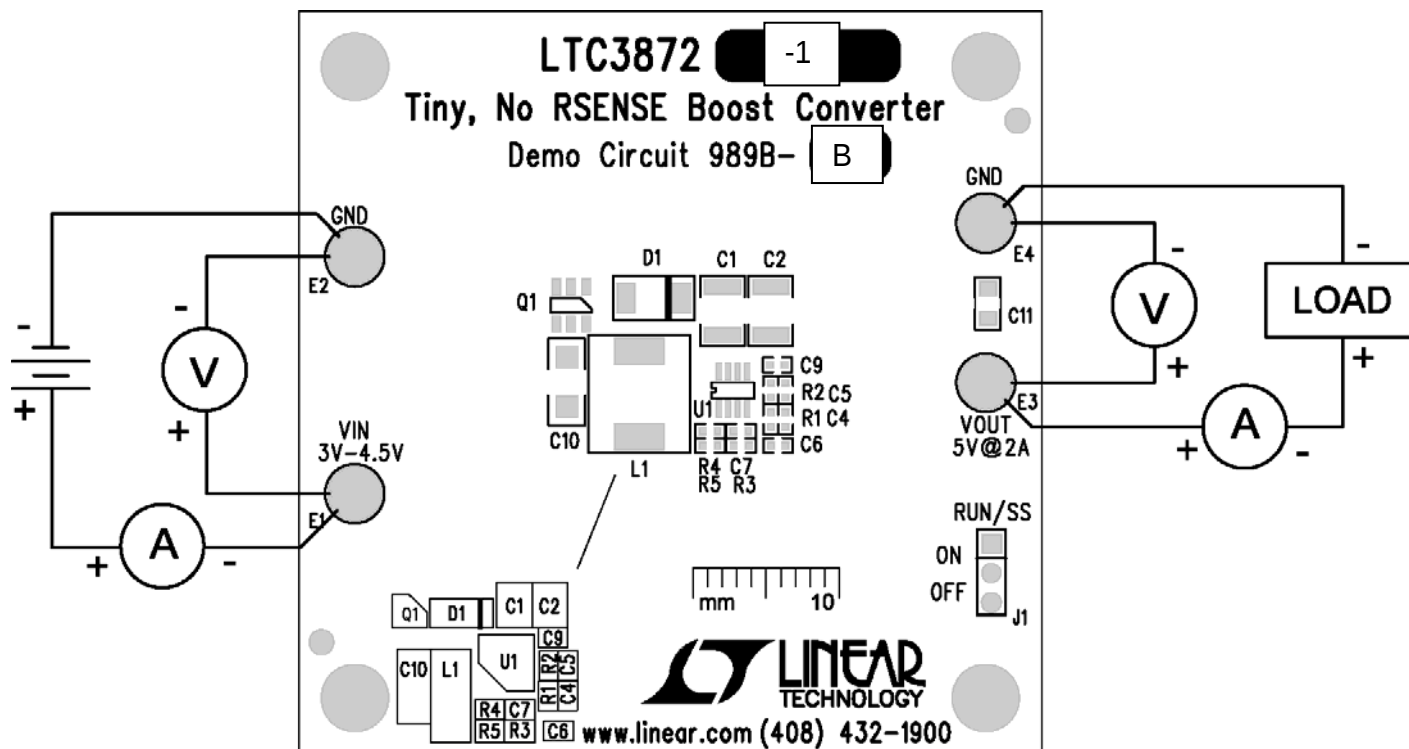


Figure 1. Proper Measurement Equipment Setup

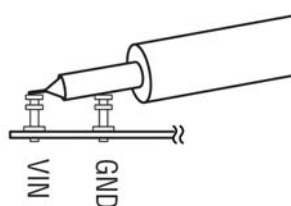


Figure 2. Scope Probe Placements for Measuring Input or Output Ripple.

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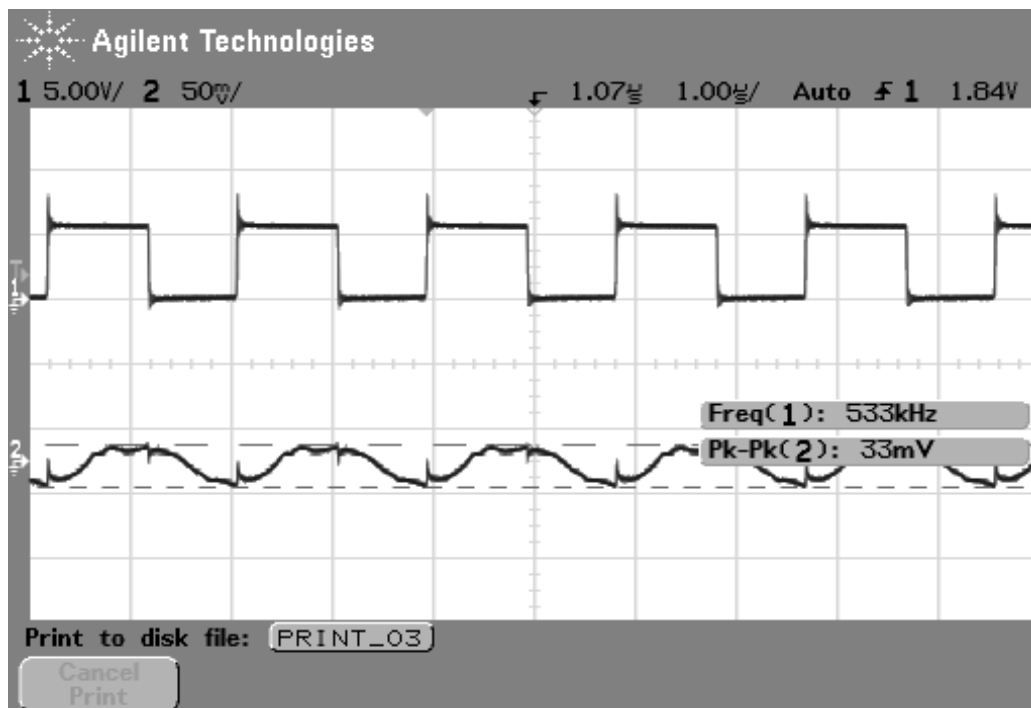


Figure 3. Typical Switch Node and Output Ripple Waveform

$V_{IN}=3.0V$ ,  $V_{OUT}=5V$ ,  $I_{OUT}=2A$

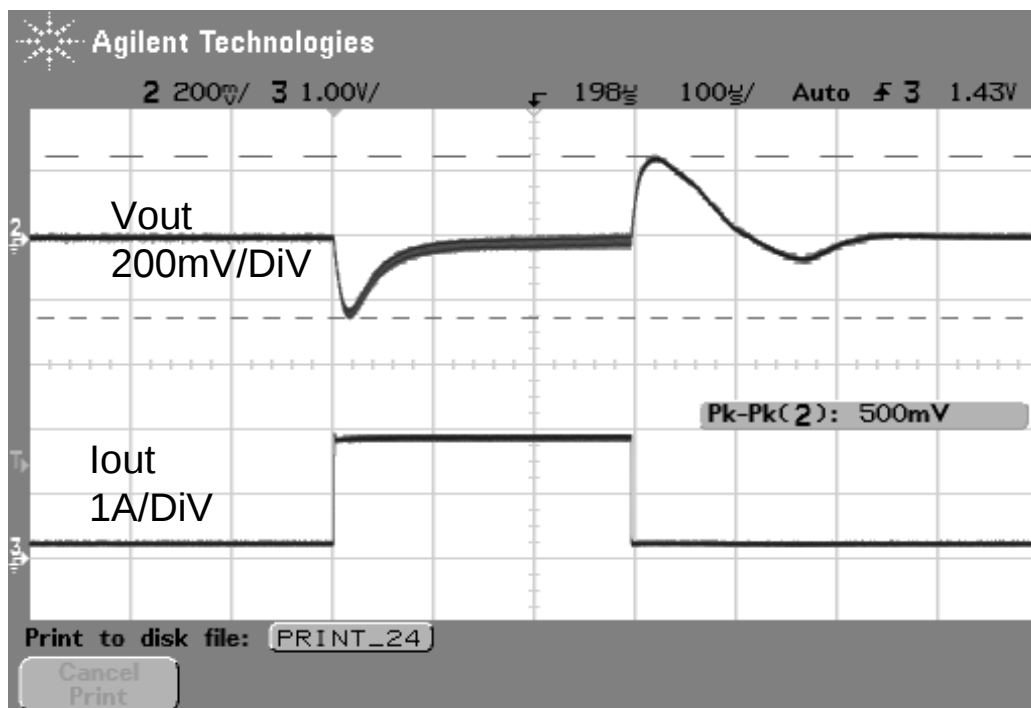
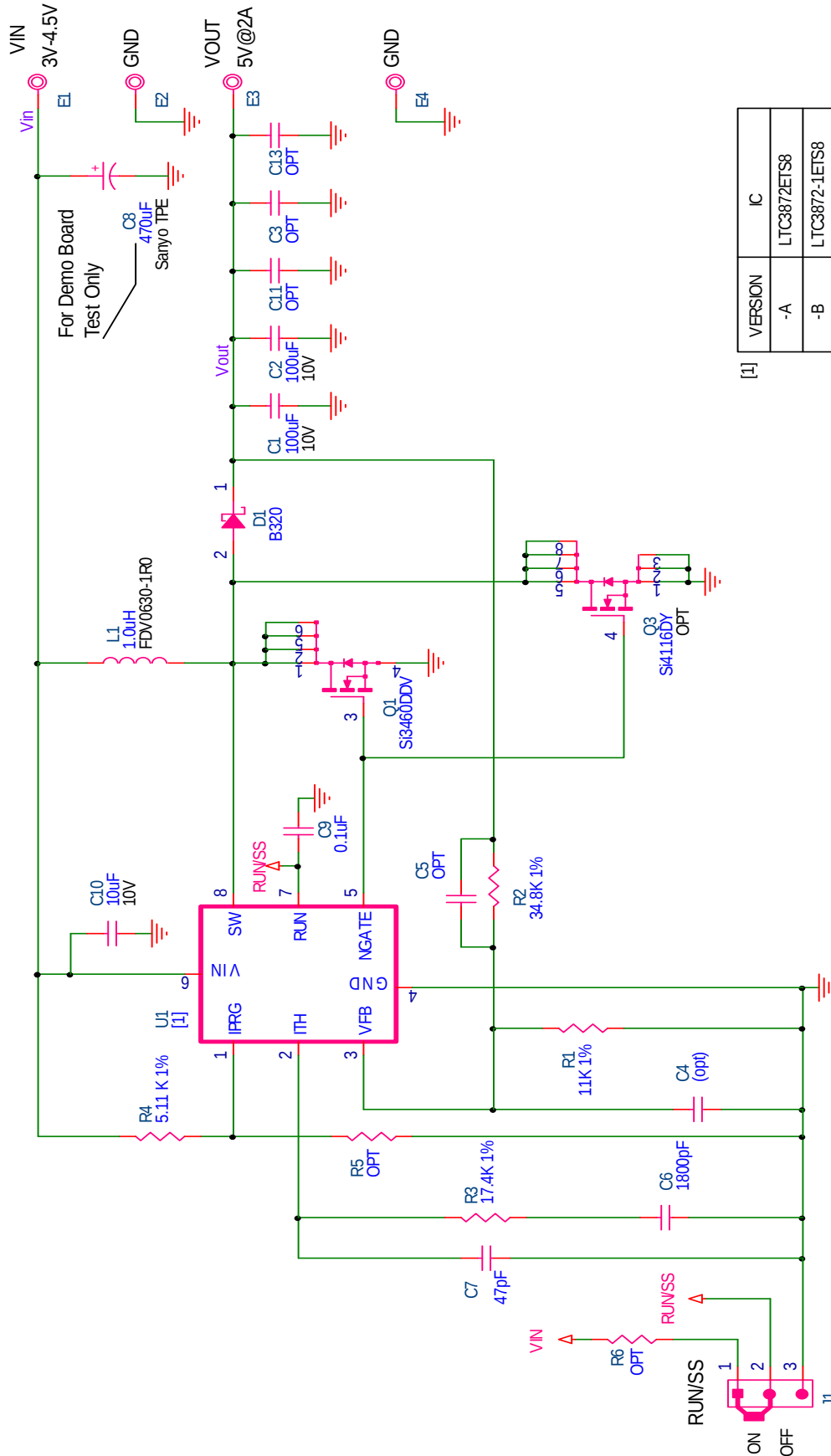


Figure 4. Load Step Response

$V_{IN} = 3.3V$ ,  $V_{OUT} = 5V$  & 1.6A Load Step

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| Item                                             | Qty | Ref- Des         | Part Description                       | Manufacturer's Part Number       |
|--------------------------------------------------|-----|------------------|----------------------------------------|----------------------------------|
| <b>REQUIRED CIRCUIT COMPONENTS:</b>              |     |                  |                                        |                                  |
| 1                                                | 2   | C1,C2            | CAP 1210 100uF 20% 10V X5R             | TAIYO YUDEN LMK325ABJ107MM-T     |
| 2                                                | 1   | C6               | CAP 0402 1800pF 5% 50V X7R             | AVX 04025C182JAT                 |
| 3                                                | 1   | C7               | CAP 0402 47pF 5% 25V NPO               | AVX 0603YC104KAT                 |
| 4                                                | 1   | C8               | CAP 7343 470uF 20% 6.3V POSCAP         | SANYO 6TPE470M                   |
| 5                                                | 1   | C9               | CAP 0402 0.1uF 10% 16V X5R             | TDK C1005X5R1C104K               |
| 6                                                | 1   | C10              | CAP 1206 10uF 10% 10V X5R              | TAIYO YUDEN LMK316BJ106KD-T      |
| 7                                                | 1   | D1               | DIODE B320A-13                         | DIODES INC. B320A-13             |
| 8                                                | 1   | L1               | IND 1.0uH                              | TOYO FDV0630-1R0M-P3             |
| 9                                                | 1   | Q1               | XSTR MOSFET N-CHANNEL 20V              | VISHAY SI3460DDV                 |
| 10                                               | 1   | R1               | RES 0402 11k OHMS 1% 1/16W             | VISHAY CRCW040211K0FKED          |
| 11                                               | 1   | R2               | RES 0402 34.8k OHMS 1% 1/16W           | VISHAY CRCW040234K8FKED          |
| 12                                               | 1   | R3               | RES 0402 17.4k OHMS 1% 1/10W           | VISHAY CRCW040217K4FKED          |
| 13                                               | 1   | R4               | RES 0402 5.11k OHMS 1% 1/16W           | VISHAY CRCW04025K11FKED          |
| 14                                               | 1   | U1               | IC CURRENT MODE BOOST DC/DC CONTROLLER | LINEAR TECH. LTC3872-1ETS8#TRPBF |
| <b>ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:</b> |     |                  |                                        |                                  |
| 1                                                |     | C3,C4,C5,C11,C13 |                                        | OPT                              |
| 2                                                |     | Q3               |                                        | VISHAY Si4116DY OPTION           |
| 3                                                |     | R5,R6            |                                        | OPT                              |
| <b>HARDWARE</b>                                  |     |                  |                                        |                                  |
| 1                                                | 4   | E1,E2,E3,E4      | TURRET                                 | MILL MAX 2501-2-00-80-00-00-07-0 |
| 2                                                | 1   | J1               | HEADER 3PIN 2mm                        | SULLINS NRPN031PAEN-RC           |
| 3                                                | 1   | JP1              | SHUNT                                  | SAMTEC 2SN-BK-G                  |