

LTC3452EUF  
SYNCHRONOUS BUCK-BOOST  
MAIN/CAMERA WHITE LED DRIVER

## DESCRIPTION

**WARNING!****Do not look directly at operating LED.**

This circuit produces light that can damage eyes.

Demonstration circuit 928 is a SYNCHRONOUS BUCK-BOOST MAIN/CAMERA WHITE LED DRIVER featuring the LTC3452EUF.

The circuit drives two banks of LEDs: one 250mA flash device, and a bank of 5 LEDs at 20mA each for backlighting. The backlight LED currents are typically matched within 2%. The input voltage range of 2.7V to 5.5V is suitable for a single Lithium-Ion battery or three AAA batteries in series. Some of the many features include: Lithium-Ion battery input voltage range, flash LED output, separate, dimmable backlight outputs, internal synchronous power switches, minimal and low-profile external components, and simple design; therefore the LTC3452 is the top solution for highly efficient, space-constrained, cellular telephone camera flash solutions.

The flash output (LED<sub>H</sub>) is activated by depressing The 'FLASH' momentary switch, or connecting the 'ENH' terminal to 'V<sub>IN</sub>' with a jumper wire.

**WARNING-** The LED<sub>H</sub> LED can be permanently damaged if the flash mode is engaged for more than a few seconds.

The backlight outputs (LED<sub>L1-5</sub>) are activated by depressing The 'DISPLAY' momentary switch, or connecting the 'ENL' terminal to 'V<sub>IN</sub>' with a jumper wire. The backlight intensity can be modulated by applying a 10kHz pwm signal to the 'ENL' terminal, as indicated in the table.

Figure 2 shows efficiency at 200mA flash output with various 4.7uH inductors.

The LTC3452 datasheet gives a complete description of the part along with operation and applications information. The datasheet must be read in conjunction with this Quick Start Guide for demonstration circuit 928. In addition, the Nichia NSCW100 datasheet ([www.nichia.com](http://www.nichia.com)) and the AOT2015 datasheet ([www.aot.com](http://www.aot.com)) must be read to understand thermal and LED current constraints for varying flash current pulse-widths and intensity. The LTC3452 is offered in a small low profile QFN package. Proper board layout is essential for maximum thermal performance. See the datasheet section 'Layout Considerations'.

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

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## PERFORMANCE SUMMARY Specifications are at TA = 25°C

| SYMBOL                            | PARAMETER  | CONDITIONS   | MIN | TYP  | MAX | UNITS             |
|-----------------------------------|--|--|-----|------|-----|-------------------|
| V <sub>IN</sub>                   | Input Supply Range   |  | 2.7 |      | 5.5 | V                 |
| V <sub>OUT</sub>                  | Output Voltage Range   |  |     |      | 4.4 | V                 |
| I <sub>OUT</sub>                  | Output Current – LED <sub>H</sub>                            | V <sub>IN</sub> = 2.7V to 5.5V                             |     | 250  |     | mA                |
| I <sub>OUT</sub>                  | Output Current – LED <sub>L1</sub> through LED <sub>L5</sub> | V <sub>IN</sub> = 2.7V to 5.5V                             |     | 20   |     | mA each           |
| V <sub>OUT P-P</sub>              | Output Ripple  | V <sub>IN</sub> = 4.2V, I <sub>OUT</sub> = 20mA (20MHz BW) |     | 10   |     | mV <sub>P-P</sub> |
| I <sub>REG</sub>                  | Output Regulation  | Line, V <sub>IN</sub> = 2.7V to 5.5V                       |     | ±1.0 |     | %                 |
| F <sub>SW</sub>                   | Switching Frequency  |  |     | 1.0  |     | MHz               |
| P <sub>OUT</sub> /P <sub>IN</sub> | Efficiency   | V <sub>IN</sub> = 4.2V, I <sub>OUT</sub> = 200mA           |     | 85   |     | %                 |

## QUICK START PROCEDURE

Demonstration circuit 928 is easy to set up to evaluate the performance of the LTC3452EUF. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

**NOTE.** When measuring output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip directly across the output capacitor. See Figure 2 for proper scope probe technique.

1. Preset a dc source capable of 5.5V at 1A to 4V.
2. With power off, connect the input power supply to 'VIN' and 'GND' of the circuit.
3. Turn on the power at the input. The input voltage may be varied between 2.7V and 5.5VDC .

**NOTE.** Make sure that the input voltage does not exceed 5.5V.

4. Press 'DISPLAY' to observe a constant 20mA x 5 LED backlight for displays.
5. Press 'FLASH' to observe a 250mA camera flash.

**WARNING-** The LEDH LED can be permanently damaged if the flash mode is engaged for more than a few seconds.

6. Alternatively, the backlight and flash modes can be enabled by connecting 'ENL' (backlight), or 'ENH' (flash) to 'VIN'.
7. The backlight intensity can be modulated by applying a 10kHz, 2V pwm signal to the 'ENL' terminal. Output current will vary with duty cycle, as indicated in the table on the board.

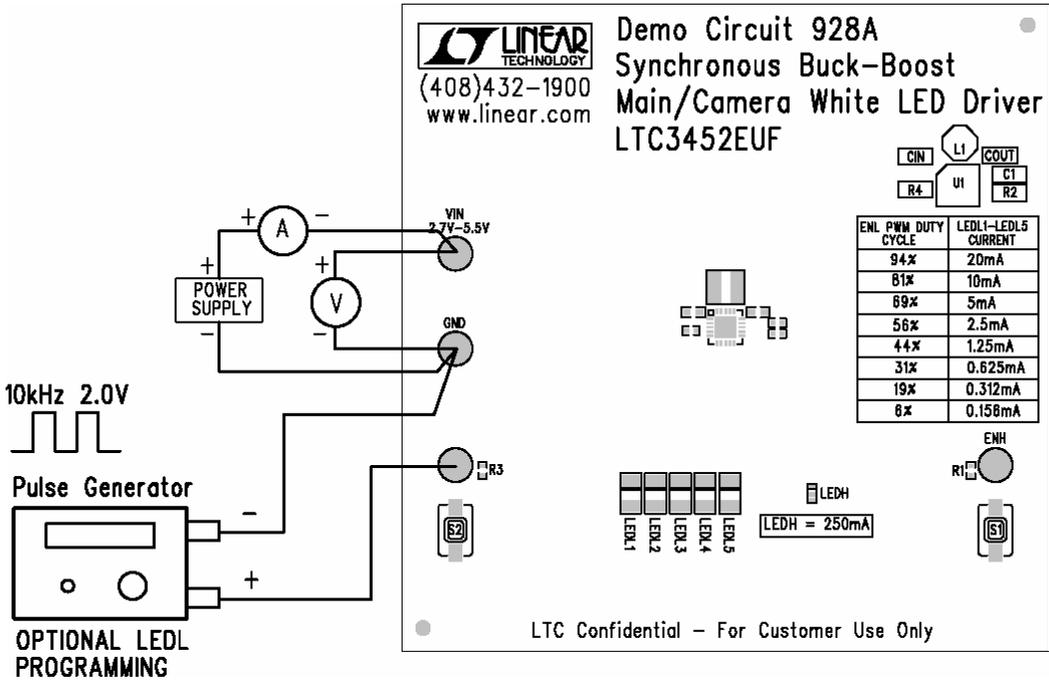


Figure 1. Proper Measurement Equipment Setup

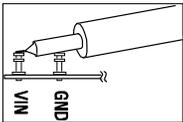
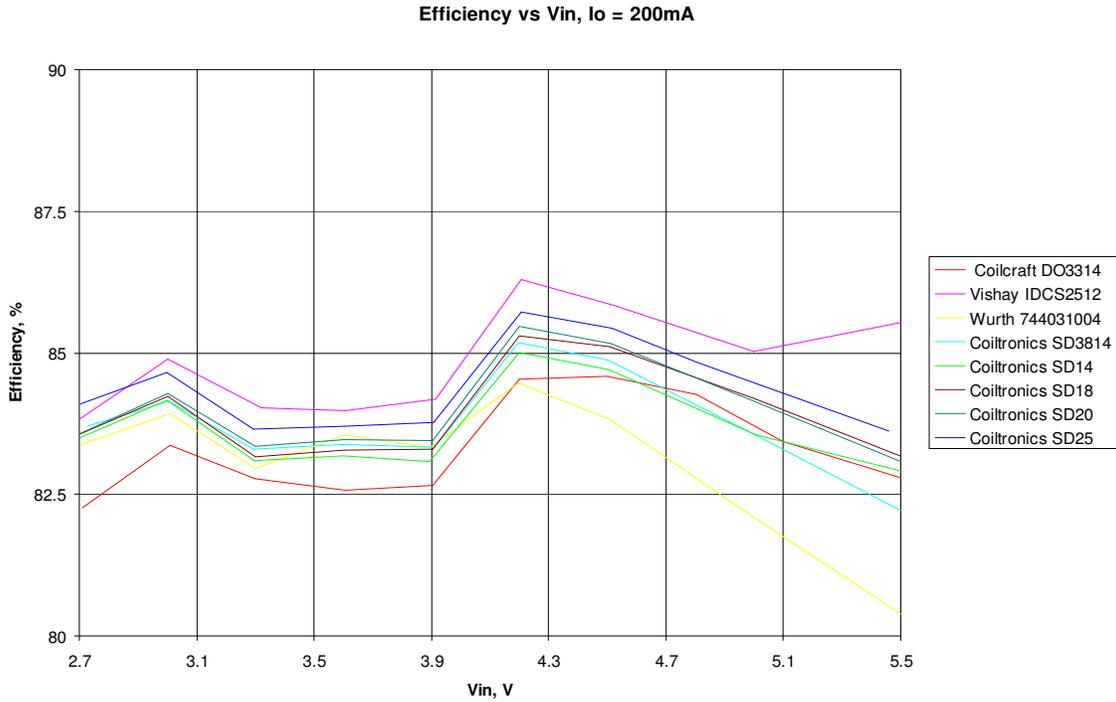
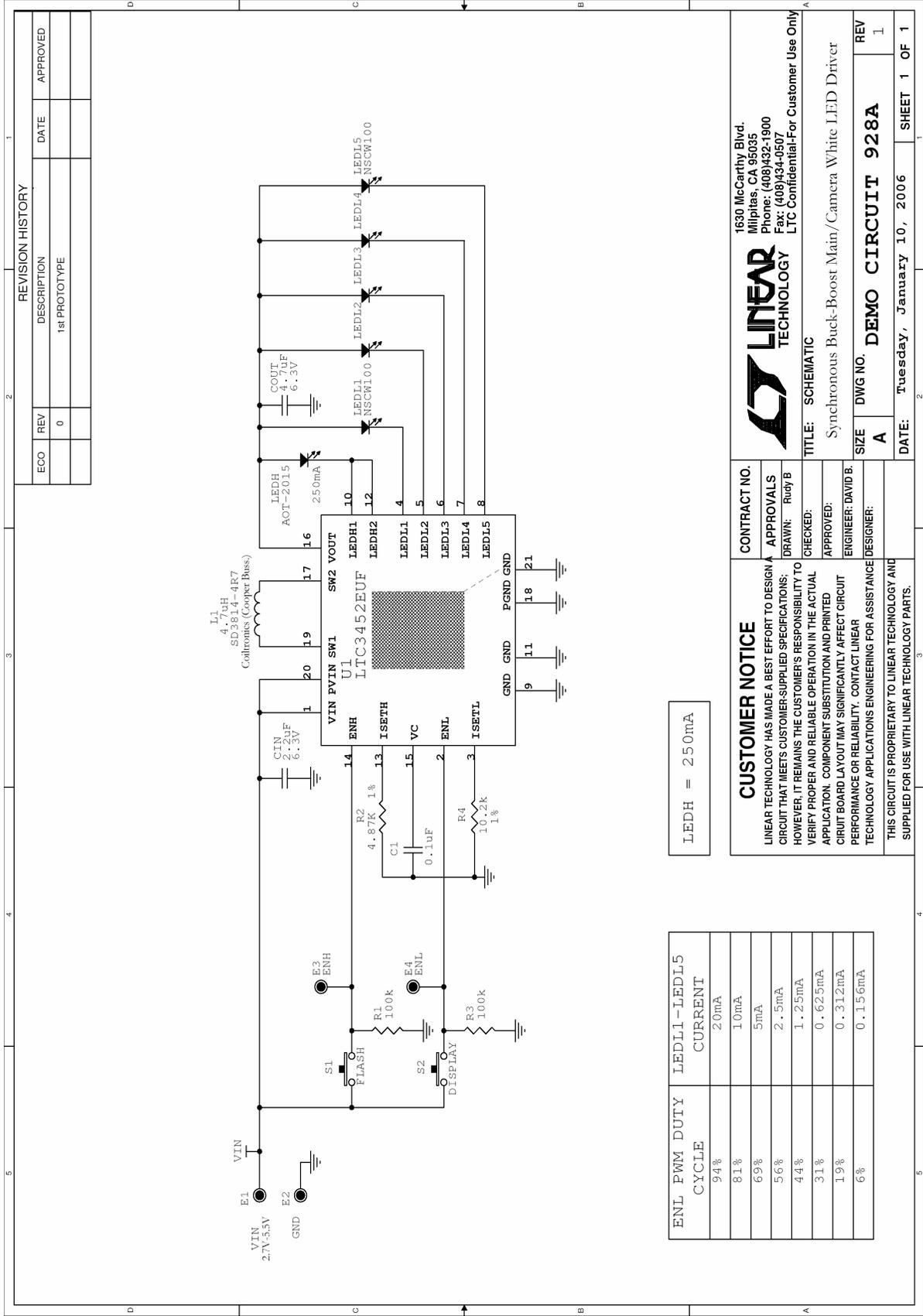


Figure 2. Measuring Input or Output Ripple



**Figure 3. Efficiency**



| REVISION HISTORY |     |               |
|------------------|-----|---------------|
| ECO              | REV | DESCRIPTION   |
|                  | 0   | 1st PROTOTYPE |
|                  |     | DATE          |
|                  |     | APPROVED      |

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**TITLE: SCHEMATIC**  
 Synchronous Buck-Boost Main/Camera White LED Driver

**CONTRACT NO.**  
**APPROVALS**  
 DRAWN: Rudy B  
 CHECKED:  
 APPROVED:  
 ENGINEER: DAVID B.  
 DESIGNER:

**SIZE** A **DWG NO.** DEMO CIRCUIT 928A **REV** 1  
**DATE:** Tuesday, January 10, 2006 **SHEET** 1 OF 1

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 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 OR RELIABILITY ENGINEERING FOR ASSISTANCE.  
 THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

LEDH = 250mA

| ENL PWM DUTY CYCLE | LED1-LED5 CURRENT |
|--------------------|-------------------|
| 94%                | 20mA              |
| 81%                | 10mA              |
| 69%                | 5mA               |
| 56%                | 2.5mA             |
| 44%                | 1.25mA            |
| 31%                | 0.625mA           |
| 19%                | 0.312mA           |
| 6%                 | 0.156mA           |