

# User's Manual

## Camera Phone Flash Evaluation Board

### Dual Cell APPEB1007



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### Board Features

FLASH mode with adjustable voltage and current  
TORCH/MOVIE/GPRS mode with adjustable voltage and current  
VOUT/GND connector to evaluate GPRS Power Amplifier  
On-board or External triggering  
On-board or External white LEDs  
LED and inductor current measurement ability  
Auto run for flash or torch

### Quick Setup

The following jumpers should be in place J1, J4, J5, J8, J9, J10, J12 and J15. Connect the positive terminal of a single cell Lithium Ion rechargeable battery (3.3V-4.2V) to any pin on J2 and connect the negative terminal to any pin of J3. The red LED (D2) should come on immediately.

#### *TORCH*

Flick the toggle switch (SW2) to the left (towards the TORCH pushbutton SW1). Pressing SW1 will now cause 100mA (factory set) to flow through each of the white LEDs (D5 & D6). With the factory setting of 100mA per white LED, SW1 can be held down continuously.

#### *FLASH*

Flick the toggle switch (SW2) to the right (towards the FLASH pushbutton SW3). Pressing SW3 will now cause 1A (factory set) to flow through each of the white LEDs (D5 & D6) for approximately 80ms. If the button is held down continuously the flash will retrigger approximately every 2.5s. This duty cycle is imposed due to the thermal constraints of the white LED.

#### *GPRS*

GPRS mode is the same as TORCH mode, ie flick the toggle switch (SW2) to the left (towards the TORCH pushbutton SW1). The factory set output voltage is 3.8V and it is available on the orange connector (TB1) to be connected to a Power Amplifier or other pulsed load.

### Circuit Description (refer to schematics at the end of this manual)

#### Input Voltage

The circuit is designed to operate from an external Li ion battery (4.2V-3.3V). Vbat is the node connected to the battery via J2.

J2 is to be connected to battery positive terminal. Pins 1 and 2 of J2 are joined.  
J3 is to be connected to battery negative terminal. Pins 1 and 2 of J3 are joined.

A current limiting MOSFET (M1) is not currently installed on the PCB and as such the bypass jumper (J15) needs to be installed.

#### Indicating LED

D2 is a red LED that indicates a source voltage is present.

#### Buck/Boost Converter

J1 needs to be jumpered for normal operation. This jumper has been included so a wire loop can easily be inserted to measure the inductor current. By measuring the inductor current and monitoring the voltage of pin 6 of U1 the average output current can also be determined.



The controller is an LTC3442 from Linear Technology. Its “Soft Start” and “Burst” features are not currently utilized and as such J4 and J5 need to be jumpered to disable these features.

#### *Inrush Current*

A discharged supercapacitor presents itself as a short circuit and therefore inrush current needs to be managed. The LTC3442 has an average input current limiting feature and this has been set to approximately 1.5Amps by selecting R11 = 47K $\Omega$ .

#### *FLASH MODE*

For FLASH mode, Vout is factory set to 4.5V. This voltage can be reduced by turning R21 (a 100k pot) anticlockwise.

#### *TORCH MODE*

The continuous current required for TORCH is << FLASH current (typically 200mA Vs 2A). Therefore the voltage dropped across the white LEDs will be less. To increase efficiency (and to reduce thermal stress on the current limiting MOSFET (M4)) Vout should also be reduced. Vout can be adjusted using R22 (a 1M pot). Vout is factory set to 3.8V. The FLASH mode voltage needs to be adjusted prior to the TORCH mode voltage because the FLASH setting affects the TORCH setting but not vice versa. If Jumper J12 is removed then the TORCH / GPRS mode voltage is the same as that set in Flash Mode above and R22 has no effect.

#### *GPRS MODE*

GPRS mode is the same as TORCH mode (factory set to 3.8V). The Vout setting (adjusted using R22) has to satisfy both the external Power Amplifier and have enough voltage headroom to drive the white LEDs in TORCH mode for the TORCH Mode current selected.

### **Current Control**

#### *FLASH MODE*

The FLASH current is factory set to 2.0 Amps (shared between two white LEDs). It can be reduced by turning R33 (10k pot) anti-clockwise. The current in a single white LED should not exceed 1 Amp so if only one LED is to be used then the FLASH current should be reduced to 1 Amp or less prior to driving the single LED. The FLASH current needs to be adjusted prior to the TORCH current because the FLASH setting affects the TORCH setting but not vice versa.

#### *TORCH MODE*

The TORCH current is factory set at 200mA. It can be reduced by turning R34 (2k pot) anti-clockwise or increased by turning R34 clockwise. Care should be taken not to increase Torch mode current > 400mA total (200mA per LED) so as not to overheat and destroy the LEDs.

#### *GPRS MODE*

The maximum average load current is determined by the average input current limit which is set at 1.5Amps on the LTC3442 Buck/Boost controller. Assuming 85% efficiency, maximum average load current =  $1.5A \times V_{bat} / (V_{out} \text{ in TORCH mode}) \times 85\%$ . Providing the DC:DC converter provides sufficient average load current, the supercapacitor will provide the peak currents.



### **External FLASH LED**

An External white LED (or other load) can be connected to the board across Jumper J7 (pin2 is +ve). When doing this, also remove Jumpers J8 and J9 to disconnect the on-board LEDs (D5 & D6). Alternatively, more white LEDs (Lumileds LXCL-PWF1) can be connected in parallel to D5 & D6 across J7 with Jumpers J8 and J9 in place.

### **External FLASH/TORCH/GPRS MODE Control**

An external control signal (3V) connected to pin 2 of J13 will select TORCH MODE.

### **Flash PulseTimers/External FLASH Pulse Control**

There are two on-board 555 timers. One generates the FLASH on-time and the other generates the off-time. The FLASH trigger from these timers is connected to the Current Control circuitry via J10. J10 is jumpered for normal operation. An external triggering circuit can be connected by removing the jumper from J10 and connecting the external signal to pin 1 of J10. There is a 33k pull down resistor on this pin. A logic high signal on this pin will take a FLASH. Make sure that this signal is < 100ms long and does not occur for at least another 2s otherwise the thermal limits of the white LEDs will be violated and they will be destroyed.

### **Auto Flash**

If J14 is jumpered then the two 555 timers will be continuously triggered to generate an 80ms flash pulse every 2.5s. Jumpering J14 has the same effect as pressing SW3 continuously.

### **Further Information**

CAP-XX will be pleased to provide further information on the applications described here, and on the use of supercapacitors in any application. Please use the contact details on the header page, or visit the CAP-XX web site.

# Schematics



