

# DESIGN NOTES

## Photoflash Capacitor Charger Has Fast Efficient Charging and Low-Battery Drain – Design Note 303

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### Introduction

The LT<sup>®</sup>3420 is designed to charge large-valued capacitors—such as those used for the strobe flashes of digital and film cameras—to high voltages. These photoflash, or strobe, capacitors range in value from a hundred microfarads to over a millifarad, with target output voltages above 300V. Traditional strobe capacitor charging methods are either inefficient or require software overhead. The LT3420 provides a compact, simple to use and efficient charger solution that requires no software, saving space, battery life, design time and cost.

LT3420 charger circuits typically achieve efficiencies greater than 75%. The LT3420 includes important features such as automatic capacitor charge refresh and control/indicator pins which make it highly flexible and easy to use. Its versatility allows it to be used in applications that require a simple standalone photoflash charger as well as applications where it is completely controlled by a microprocessor (described below). No voltage divider is needed on the high voltage output.

Figure 1a shows a typical LT3420 circuit that can charge a 220 $\mu$ F photoflash capacitor to 320V in 3.5 seconds from a 5V input. Figure 1b shows the charge time as a function of battery voltage. In Figure 1a, the circuitry to the right of C4 shows a typical method to generate the light pulse once the photoflash capacitor is charged. When the SCR is fired, the flying lead along the glass envelope of the Xenon bulb reaches many kilovolts in potential. This ionizes the gas inside the bulb forming a low impedance path across the bulb. The energy stored in the photoflash capacitor quickly flows through the Xenon bulb, producing the burst of light needed for flash photography.

### Features

The LT3420 includes an integrated 1.4A power switch and utilizes a patent-pending control technique. Precise control of the switching current is achieved by sensing both the primary and secondary currents of transformers, a method which prolongs battery life. Figure 2 shows the

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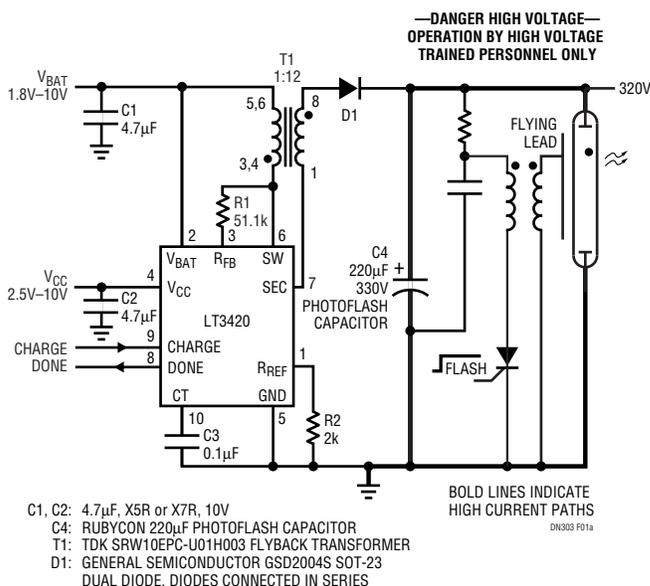


Figure 1a. 320V Photoflash Capacitor Charging Circuit

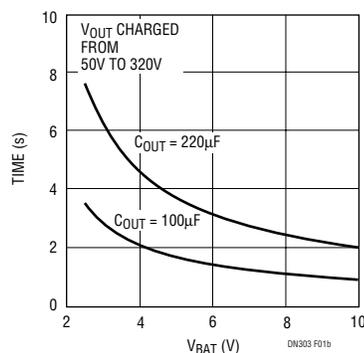


Figure 1b. Charge Time

relevant waveforms when the output has reached 300V in the circuit of Figure 1a. The peak primary current is limited to 1.4A (typical), while the primary current when the power switch turns on is 480mA (typical). By operating the part in Continuous Conduction Mode (CCM), charge time is minimized. The output voltage is detected via the flyback waveform on the primary of the transformer— $V_{SW}$  in Figure 2. The target output voltage is controlled by two resistors, R1 and R2. This flyback detection scheme removes the need for a resistor divider string from the high voltage output to ground, thus eliminating the associated power loss found in many competing flash modules.

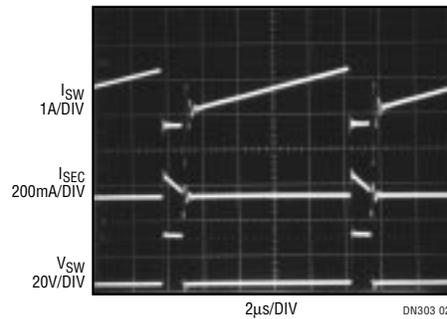
Once the target output voltage is reached, the device enters a refresh mode where the quiescent current of the device is reduced to 90 $\mu$ A (typical). The LT3420 has a user programmable refresh timer built in. The value of C3 determines the time period after which the part comes out of the refresh mode and recharges the output to the target voltage. This process repeats to maintain the output at the desired voltage. Figure 3 shows the different modes of the LT3420 from shutdown, to charging and finally refresh.

### Interfacing to a Microcontroller

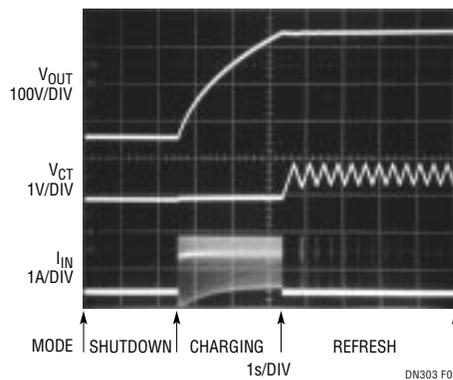
The LT3420 can be easily interfaced to the microcontroller found in digital cameras. The CHARGE and DONE pins are the control and mode indicator pins, respectively, for the part. By utilizing these pins, the LT3420 can be selectively disabled and enabled at any time. Figure 4 shows the LT3420 circuit being selectively disabled when the CHARGE pin is driven low midway through the charge cycle. This might be necessary during a sensitive operation in a digital camera. Once the CHARGE pin is returned to the high state, the charging continues from where it left off.

### Conclusion

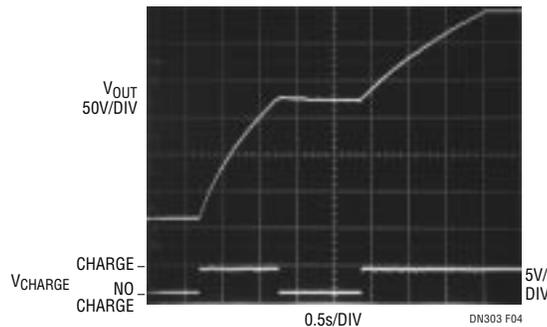
The LT3420 provides a highly efficient and integrated standalone solution for charging photoflash capacitors. Many important features are incorporated into the device, including automatic refresh, tightly controlled currents and an integrated power switch, thus reducing external parts count. The LT3420 comes in a small, low profile, MSOP-10 package, making a complete solution that takes significantly less PC board space than traditional methods.



**Figure 2. Switching Waveforms with  $V_{OUT} = 300V$ ,  $V_{CC} = V_{BAT} = 3.3V$**



**Figure 3. The Three Operating Modes of the LT3420: Shutdown, Charging and Refresh of the Photoflash Capacitor**



**Figure 4. Halting the Charge Cycle at Any Time**

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<http://www.linear.com/go/dnLT3420>

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