LED Back Light Driving Methods

I. Introduction:

LED back lights on LCD modules are generally driven with a dc voltage through a current limiting resistor. This simple approach is perfectly acceptable for most applications. When the primary consideration is an extra bright display, the lowest possible power consumption, or a back light that can be controlled over a very wide brightness range another method is needed. The purpose of the paper is to describe this method.

II. Description:

By using a pulse width modulation scheme several advantages can be realized over the simple dc voltage method. The main advantage is in efficiency. The LED's are pulsed with a high current for a short period of time. For example consider the HDM16216L-7. The nominal LED driving current for this display is 120ma which produces a typical brightness of 50 NIT. If, instead of a dc or constant current, we apply 5 times the current, 600ma, for 1/5 of the time, the average current is the same, 120ma. See Figure #1. The average brightness of the LED would also be the same if measured electronicly. The difference is in the perceived brightness.

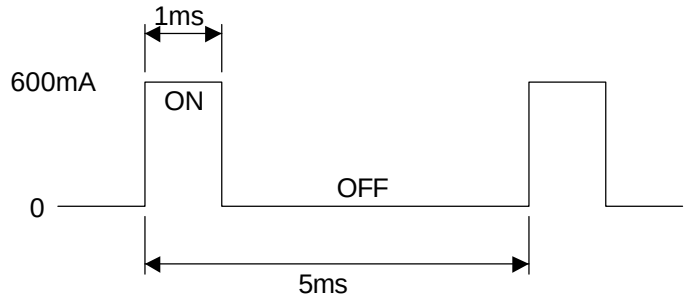

Figure #1

The human eye has a certain amount of persistence. If exposed to a bright light the eye will "remember" the light for a short period of time. This allows us to vue a motion picture or TV screen as a steady image when in fact it is flickering at 24 to 30 times a second. When the LED is flashed on brightly for a short time and then turned off the eye "remembers" the light at the high brightness level. The result is that the perceived brightness of the back light is closer to the high pulsed brightness than to the lower dc brightness.

This effect can be used to advantage in several ways. If the **brightest possible** back

light is needed the display can be pulsed at a 1:4 on/off ratio with 5 times the typical current. The pulse repetition frequency should be greater than 100Hz so the flickering is not perceptible to the eye but not greater than about 1kHz.

This technique can also be used to give a "normal" looking brightness level to the display but at a **lower average current** to save power. The average power can be cut by a factor of at least 50% to produce a given perceived brightness level. This can be a big advantage in battery operated equipment.

The third use of this method is to facilitate a **wide range brightness control** for the LED back light. By varying the on/off ratio a very wide range of brightness can be achieved while maintaining a very even appearing back light. See Figure #2. One can also very the brightness by simply varring the dc current to the LED's but at low current the individual LED emitters start to become visable resulting in an uneven looking back light. To implement this technique the peak current should be set at the specified typical current for the display and the on/off ration of the pulses varied from near 100% on to near 0% on.

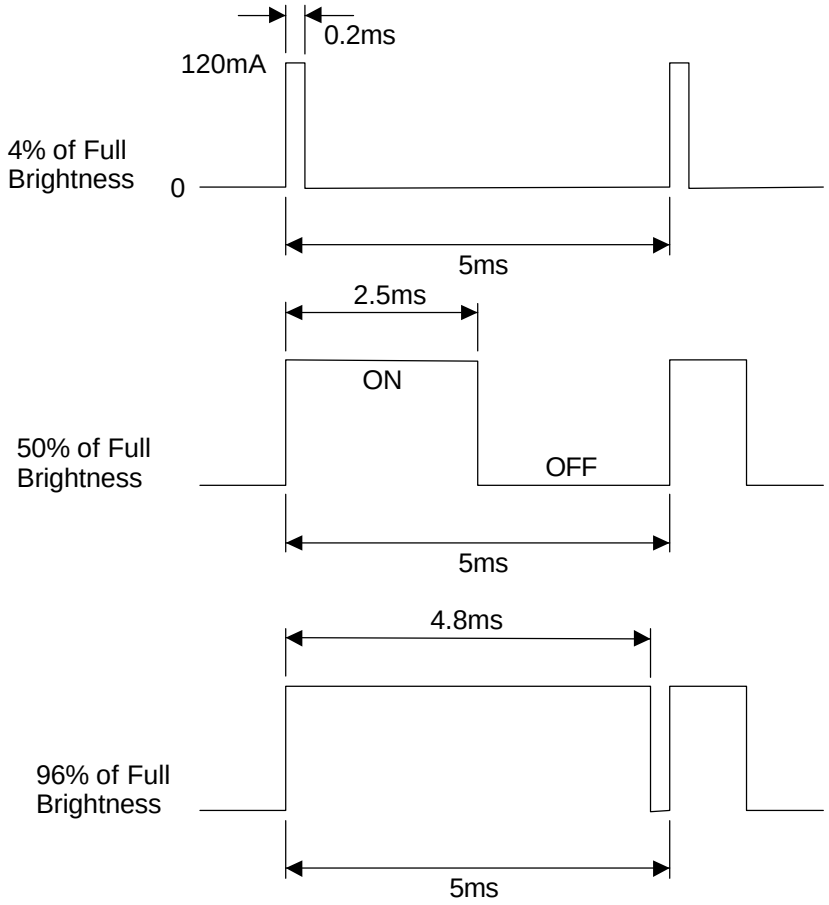

Figure #2