

Using the PSoC to Drive the NKK Smartswitch

Abstract

Introduction

The NKK Smartswitch™ is a single pole normally open pushbutton switch with an LCD screen mounted in the button head. The LCD is configured in the form of a 36-pixel (columns) by 24-pixel (rows) dot matrix with both red and green LEDs as a backlight. The interface to this device requires that the pixels for each row are shifted into the device and then each row is activated in sequence. The versatility of the peripheral set of the PSoC allows for a very simple hardware interface to the switch display. The software driver allows for bit manipulation individually and as a block, graphics and text presentation. It is also possible to set the color of the backlight, turn it and flash it.

This design is not a stand-alone product. It is designed so that a complete application including the NKK Smartswitch can be hosted on the same. Such a project could be as simple as a serial interface or as complex as a Data Acquisition device.

Display Interface

The hardware interface to the NKK switch is via a 40-bit shift register. 40 bits of data are shifted in for every 36-pixel line. This shift register is buffered so the buffer can be updated while the current shift register is being displayed. The buffer must be transferred at periodic intervals to prevent flicker. The whole display system has a synchronization signal to indicate the start of the first line.

The shift register interface is realized using the data out and clock signals of the SPIM peripheral. An interrupt is generated at the end of every byte transmitted from the SPIM. In the associated interrupt routine, a new byte is deposited into the SPIM buffer and this can be done as quickly as necessary provided that the 5 bytes are shifted out before the LCD buffer must be updated.

The accuracy of the LCD register update is maintained through an 8-bit timer peripheral. The hardware output of the timer is used to toggle the output associated with this update. The interrupt routine from the timer also flags the background program that the update has occurred so that then next 40 bits can be shifted out. The background software function also maintains a record of when to synchronize the display setting the synchronization output as necessary.

The LED backlight is simply driven by two output lines.

Software Features

The application software interfaces to the LCD driver by placing an instruction and data in reserved RAM locations and then sets a flag. The LCD driver software clears this flag when it has completed processing the instruction.

Using the instruction set, it is possible to set or clear any pixel or number of pixels on a line. In order to save the host software from creating a large number of commands when a rectangular block is desired, the LCD driver will accept a command to set or clear a block of pixels of any size anywhere within the LCD matrix. It is also possible to invert all the pixels in a block creating a reverse video affect. Graphic symbols stored in Flash Memory can be loaded to any block on the display. Finally, it is also possible to write ASCII text to the display starting at any pixel. The character generator has two character sets for different text sizes.

Additional commands allow the LED backlight color to be set to green, red or yellow, as well as flashing or off.

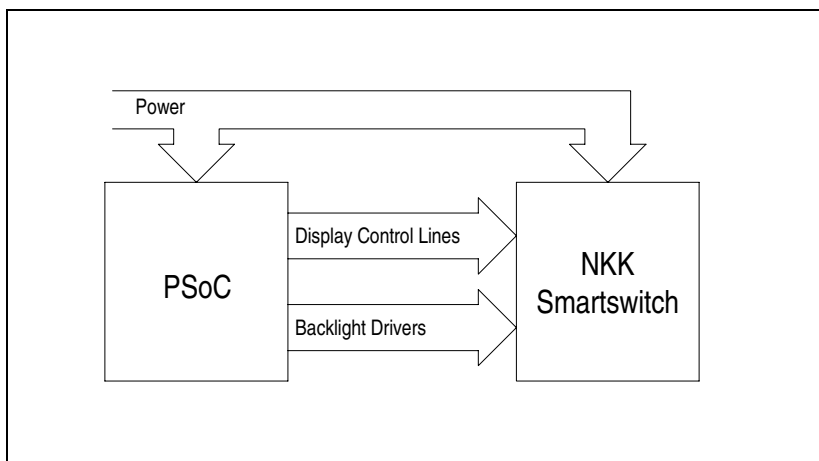


Figure 1: Project Block Diagram

