

# TI-RSLK **MAX**

Texas Instruments Robotics System Learning Kit



# Module 11

Quiz: Interfacing Graphical Displays



# Quiz: Liquid Crystal Display

The SPI status register is located at **EUSCI\_A3->STATW** (bit 0 is **UCBUSY**)

The SPI flag register is located at **EUSCI\_A3->IFG** (bit 0 is **RXIFG**, and bit 1 is **TXIFG**)

The 8-bit output data register is located at **EUSCI\_A3->TXBUF**

The 8-bit input data register is located at **EUSCI\_A3->RXBUF**

## Q1 Busy-wait synchronization

Assume an output peripheral device is interfaced to UCA3 on the MSP432. The MSP432 is the master. Use busy-wait synchronization on **UCBUSY** to write a function that outputs an 8-bit value to the device.

- There are two options for busy-wait synchronization. 1) Wait for **UCBUSY** to be 0, then output. 2) Output, then wait for **UCBUSY** to be 0. Given a complex system with many tasks to perform, which option is more efficient?
- Write the function that has the following prototype is
  - `void SPI_OutByte(uint8_t data);`
- Write the function that outputs 100 bytes to the device. The function should have the following prototype is
  - `void SPI_OutBuffer(uint8_t buf[100]);`

## Q2 Busy-wait synchronization

Assume an input peripheral device is interfaced to UCA3 on the MSP432. The MSP432 is the master. Use busy-wait synchronization on **RXIFG** to write a function that inputs an 8-bit value to the device. Write the function that has the following prototype is

```
uint8_t SPI_InByte(void);
```

## Q3 Speed of SPI

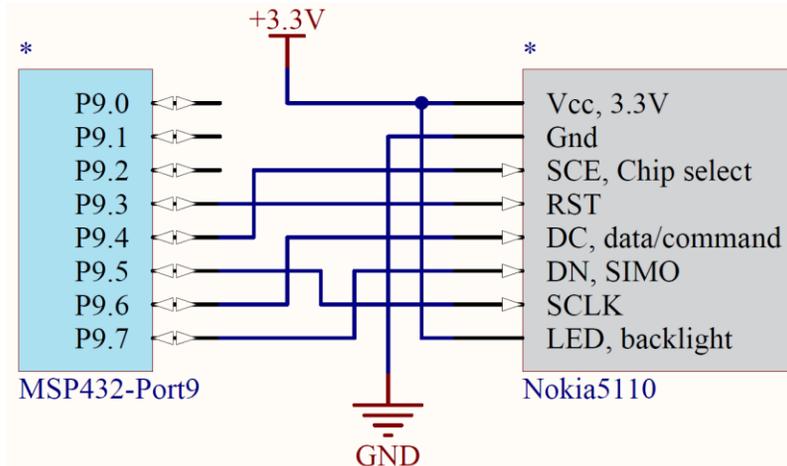
Assume the SPI clock is 12 MHz. In the Nokia5110.c software driver, there is an array that contains one 84 by 48 LCD image ( $48 \times 84 = 4,032$ )

```
#define SCREENW 84
#define SCREENH 48
uint8_t Screen[SCREENW*SCREENH/8];
```

The function **Nokia5110\_DisplayBuffer** sends this entire buffer to the LCD. Approximately how long does this function take to execute?

## 4 Fundamentals of SPI

Consider the MSP432 to Nokia5110 interface from lab.



Assume the SPI clock is 12 MHz. Make a rough sketch of the waveforms created as one data byte (value=0x12) is transmitted from MSP432 to LCD. RST will be high and DC will be high. Show the remaining 3 signals

```
SCE = P9.4 STE
DN/SIMO = P9.7 SIMO
SCLK = P9.5 CLK
// bit15 UCCKPH = 1; data shifts in on first edge, out on following edge
// bit14 UCCKPL = 0; clock is low when inactive
```

**[ti.com/rslk](https://ti.com/rslk)**

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale ([www.ti.com/legal/termsofsale.html](http://www.ti.com/legal/termsofsale.html)) or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2019, Texas Instruments Incorporated