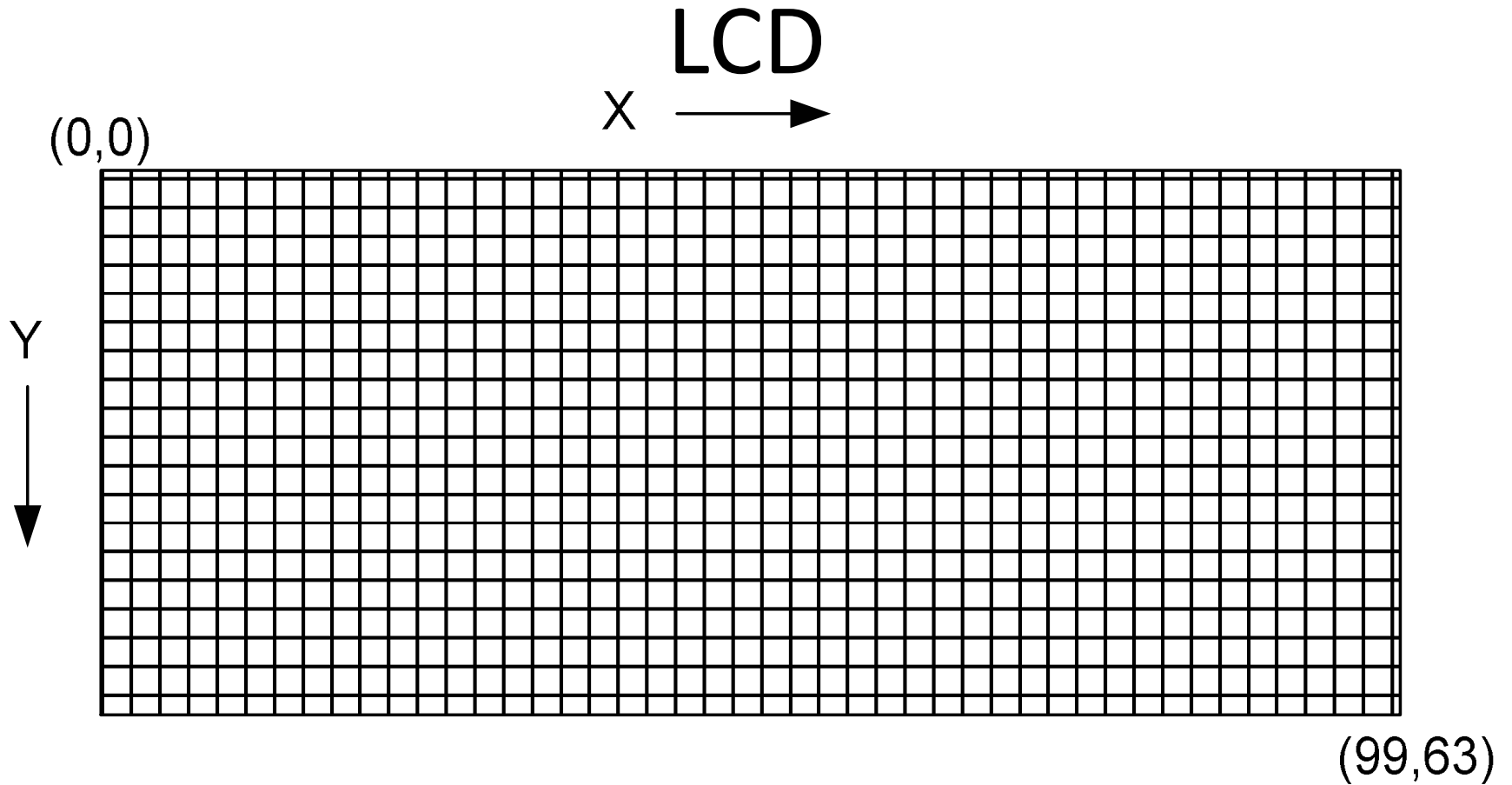


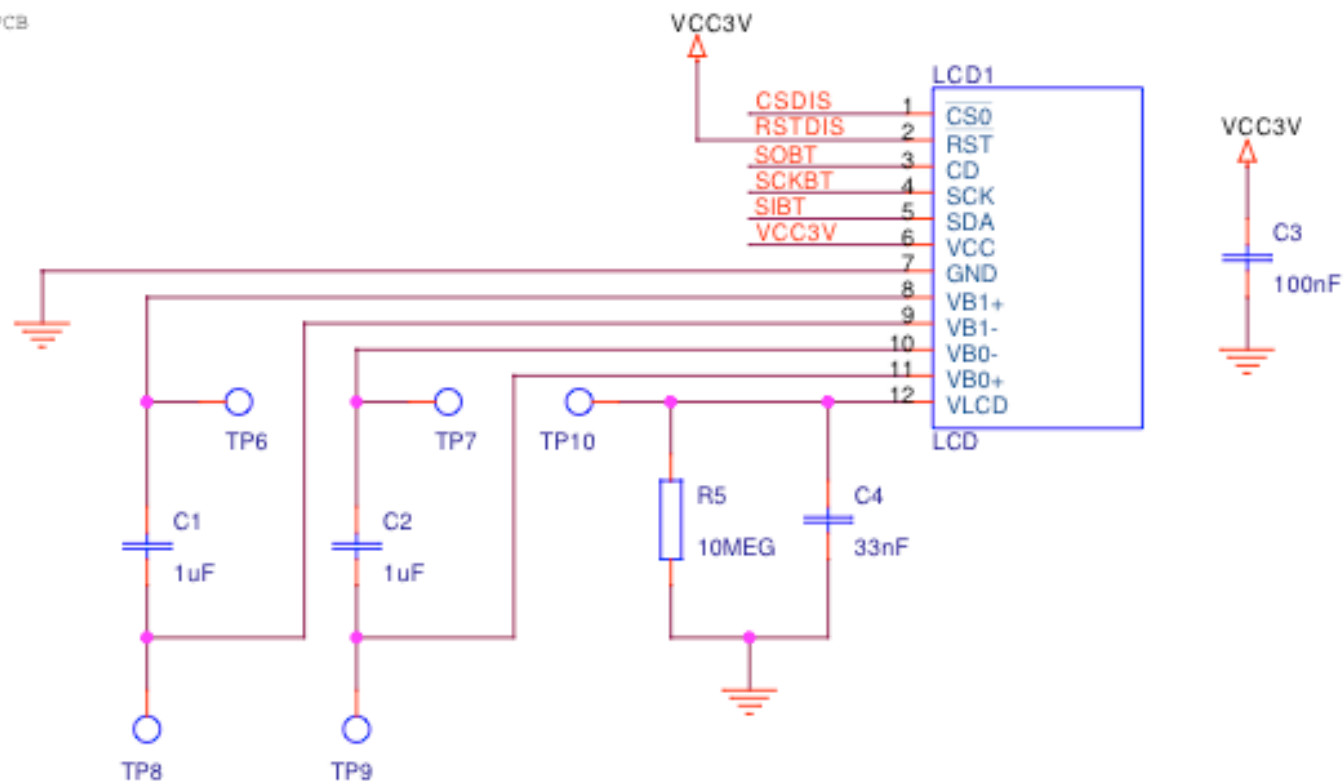
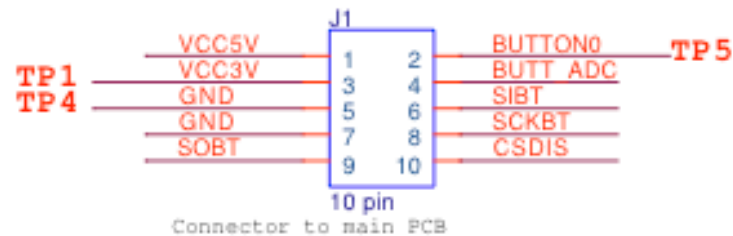
# HY428 – Lecture 8

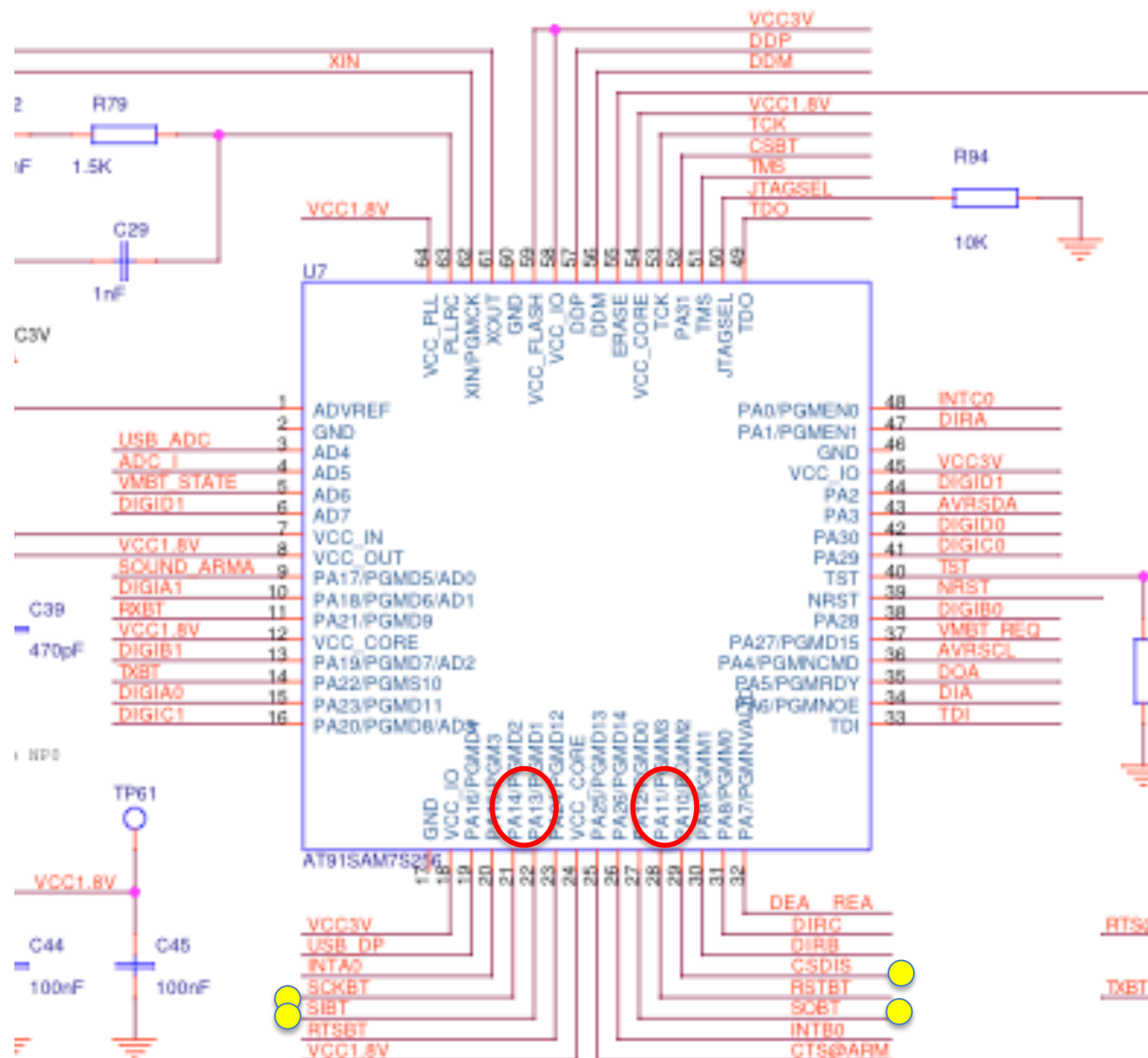
## LCD Connectivity



**Figure 5: Bitmapping within the display**

Resolution: 100 x 64, organized in a specific manner





## 10.4 PIO Controller A Multiplexing

**Table 10-3.** Multiplexing on PIO Controller A (AT91SAM7S512/256/128/64/321)

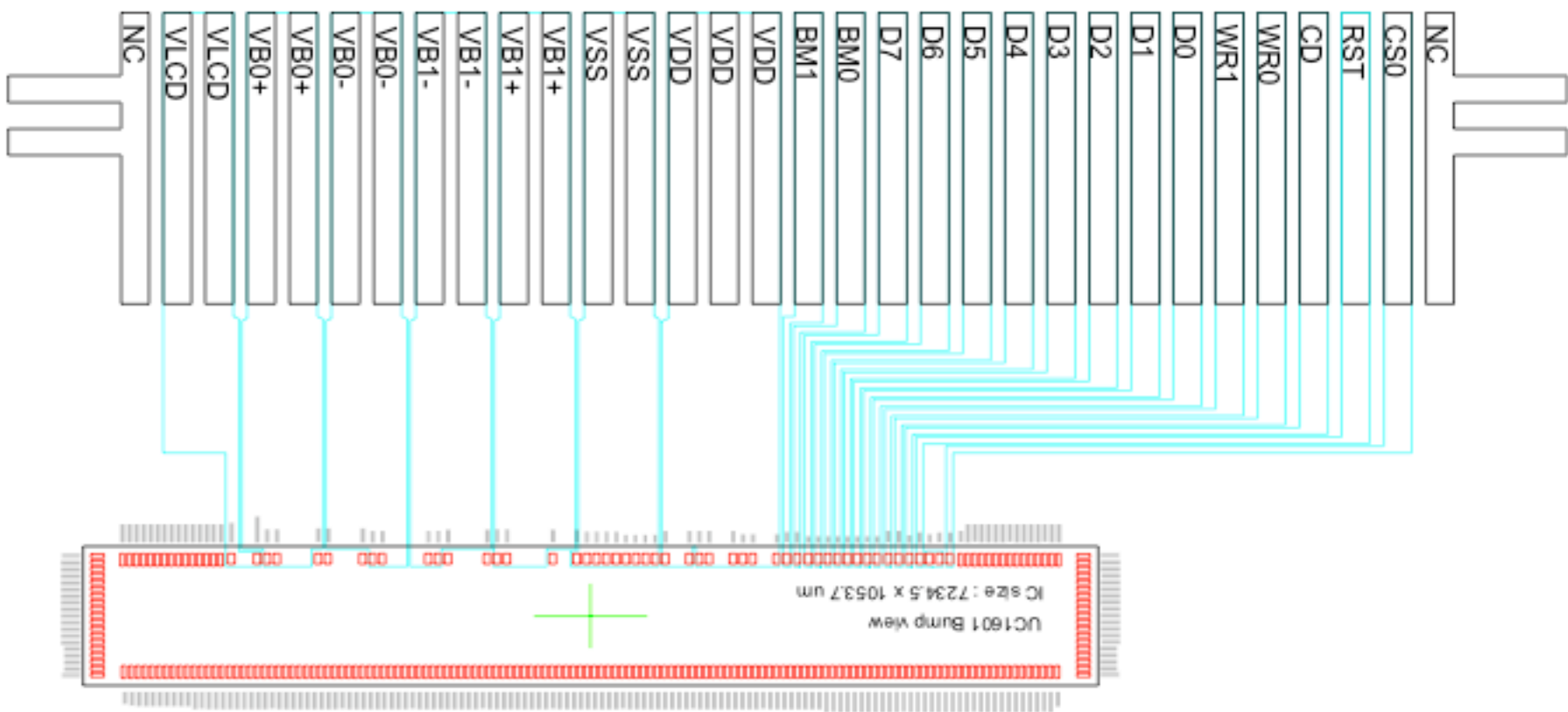
PIO Controller A				Application Usage	
I/O Line	Peripheral A	Peripheral B	Comments	Function	Comments
PA0	PWM0	TIOA0	High-Drive		
PA1	PWM1	TIOB0	High-Drive		
PA2	PWM2	SCK0	High-Drive		
PA3	TWD	NPCS3	High-Drive		
PA4	TWCK	TCLK0			
PA5	RXD0	NPCS3			
PA6	TXD0	PCK0			
PA7	RTS0	PWM3			
PA8	CTS0	ADTRG			
PA9	DRXD	NPCS1			
PA10	DTXD	NPCS2			
PA11	NPCS0	PWM0			
PA12	MISO	PWM1			
PA13	MOSI	PWM2			
PA14	SPCK	PWM3			
PA15	TF	TIOA1			
PA16	TK	TIOB1			
PA17	TD	PCK1	AD0		
PA18	RD	PCK2	AD1		
PA19	RK	FIQ	AD2		
PA20	RF	IRQ0	AD3		
PA21	RXD1	PCK1			
PA22	TXD1	NPCS3			
PA23	SCK1	PWM0			
PA24	RTS1	PWM1			
PA25	CTS1	PWM2			
PA26	DCD1	TIOA2			
PA27	DTR1	TIOB2			
PA28	DSR1	TCLK1			
PA29	RI1	TCLK2			
PA30	IRQ1	NPCS2			
PA31	NPCS1	PCK2			

**Table 10-4.** Multiplexing on PIO Controller A (SAM7S32)

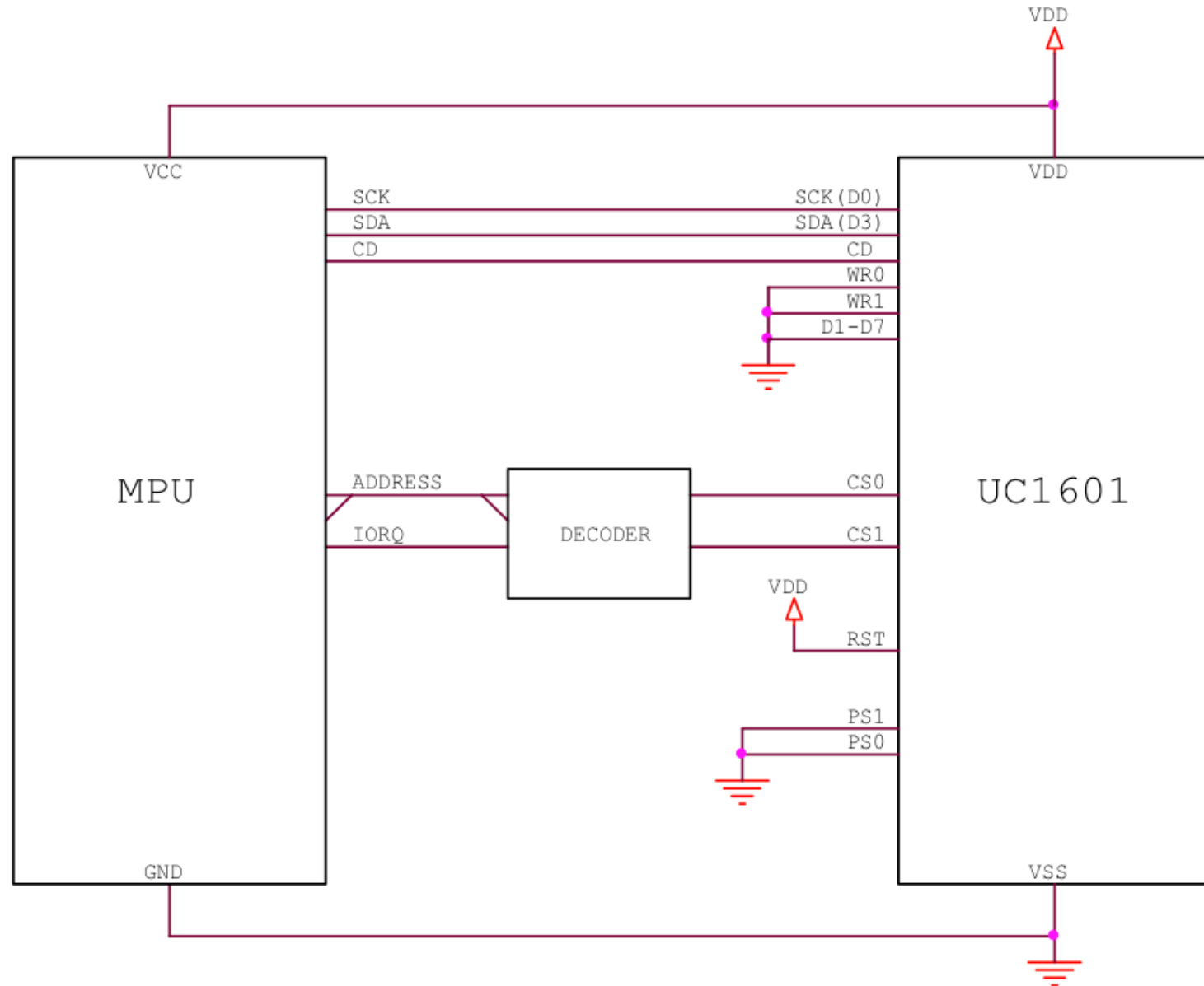
PIO Controller A				Application Usage	
I/O Line	Peripheral A	Peripheral B	Comments	Function	Comments
PA0	PWM0	TIOA0	High-Drive		
PA1	PWM1	TIOB0	High-Drive		
PA2	PWM2	SCK0	High-Drive		
PA3	TWD	NPCS3	High-Drive		
PA4	TWCK	TCLK0			
PA5	RXD0	NPCS3			
PA6	TXD0	PCK0			
PA7	RTS0	PWM3			
PA8	CTS0	ADTRG			
PA9	DRXD	NPCS1			
PA10	DTXD	NPCS2			
PA11	NPCS0	PWM0			
PA12	MISO	PWM1			
PA13	MOSI	PWM2			
PA14	SPCK	PWM3			
PA15	TF	TIOA1			
PA16	TK	TIOB1			
PA17	TD	PCK1	AD0		
PA18	RD	PCK2	AD1		
PA19	RK	FIQ	AD2		
PA20	RF	IRQ0	AD3		

# LCD controller: UC1601

RECOMMENDED COG LAYOUT



# SPI mode

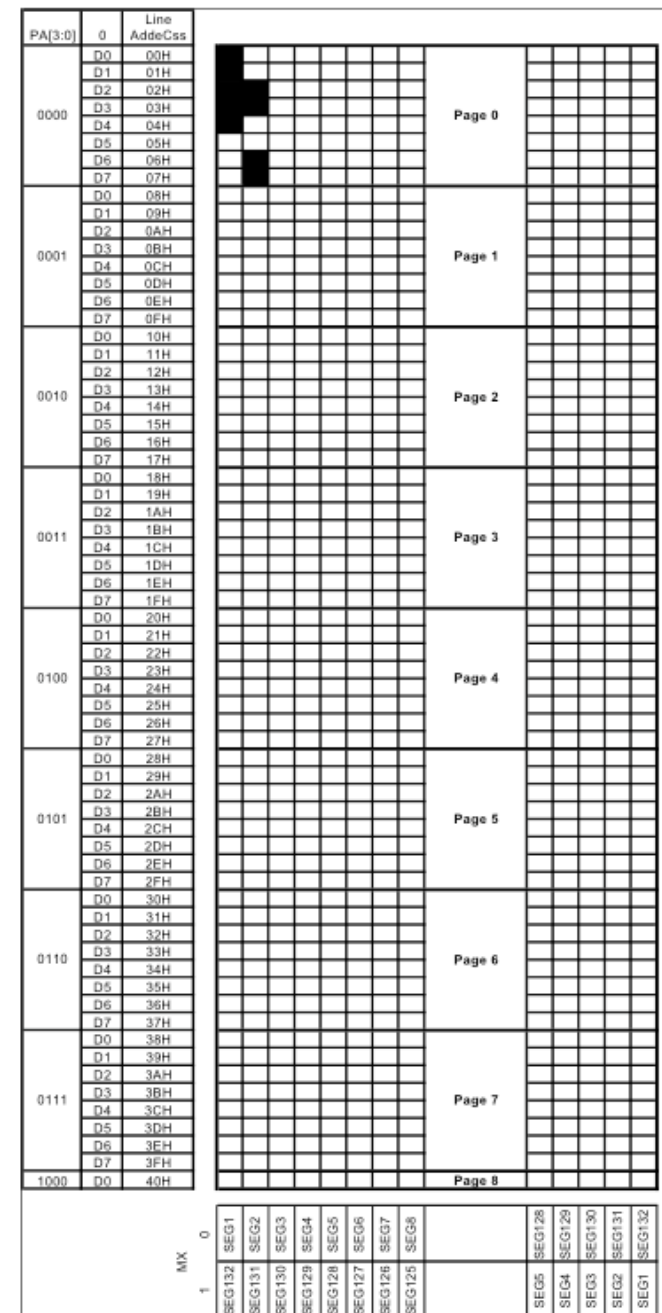


**FIGURE 8:** Serial-8 serial mode reference circuit



# LCD organization

- 100x64 pixels organized in 8 pages
- Each page 8x100 pixels
- Makes it easy to print text
- A byte over SPI corresponds to 8 pixels of a column
- Select page, specify column, write data



Example for memory mapping: let MX = 0, MY = 0, SL = 0, according to th

⇒ Page 0 SEG 1: 00011111b

⇒ Page 0 SEG 2: 11001100b

## COMMAND TABLE

The following is a list of host commands supported by UC1601

C/D: 0: Control, 1: Data  
W/R: 0: Write Cycle, 1: Read Cycle

# Useful Data bits  
- Don't Care

# Commands vs. Data over SPI

Page 15 of LCD manual

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1.	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2.	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3.	Get Status	0	1	-	MX	MY	RS	WA	DE			N/A	
4.	Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA [3:0]	0
	Set Column Address MSB	0	0	0	0	0	1	#	#	#	#	Set CA [7:4]	0
5.	Set Multiplexing Rate	0	0	0	0	1	0	0	0	#	#	Set MR [1:0]	11b: 65
6.	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	00b: -0.05%/°C
7.	Set Panel Loading	0	0	0	0	1	0	1	0	0	#	Set PC[0]	0b: < 15nF
8.	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC[2:1]	11b
9.	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	0	0	R	Set APC[R][7:0], R = 0, or 1	N/A
		0	0	#	#	#	#	#	#	#	#		
10.	Set Scroll Line	0	0	0	1	#	#	#	#	#	#	Set SL[5:0]	0
11.	Set Page Address	0	0	1	0	1	1	#	#	#	#	Set PA[3:0]	0
12.	Set V <sub>BIAS</sub> Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	C0H
		0	0	#	#	#	#	#	#	#	#		
13.	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
14.	Set Frame Rate	0	0	1	0	1	0	0	0	0	#	Set LC[3]	0b
15.	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0
16.	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0
17.	Set Display Enable	0	0	1	0	1	0	1	1	1	#	Set DC[2]	0
18.	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	0	Set LC[2:1]	0
19.	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
20.	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
21.	Set Test Control (double-byte command)	0	0	1	1	1	0	0	1	TT		For testing only.	N/A
		0	0	#	#	#	#	#	#	#	#	Do not use.	
22.	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b: 9
23.	Reset Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	AC[3]=0, CA=CR	N/A
24.	Set Cursor Update Mode	0	0	1	1	1	0	1	1	1	1	AC[3]=1, CR=CA	N/A

\* Any bit patterns other than what is listed above may result in NOP (No Operation).

# Write LCD

- Write full display as 8 lines
  - Each line is 8 pixels high and 100 wide
- Send command eg to select page, column
  - Set PIO bit for CD line/pin
  - Write a command byte to SPI
- Send data
  - Clear PIO bit (to set display in data mode)
  - Write bytes 0xxxxxxx to SPI