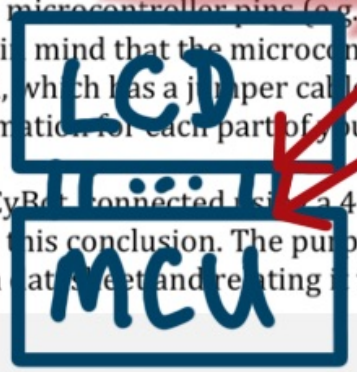
PRELAB: SYSTEM SKETCH

As you are developing software for the CyBot platform, it is important that you have a complete understanding of the hardware on which you will be deploying your embedded systems application. In this lab you will be using the CyBot's LCD screen to display text to a user. Complete the following prior to the start of lab:

1. Sketch a diagram that shows how the LCD screen of the CyBot platform connects to the CyBot microcontroller. You will need to use several documents from the Reference Files list, including the schematics, LCD datasheet, and LCD code. Treat this like a puzzle, and start putting together the pieces of the puzzle in your sketch. Your diagram might look like a block diagram that has blocks for the LCD and microcontroller packages (chips). Try to track down some details about the connections between the LCD board and microcontroller. It doesn't need to show all of the pins, wires and signals, but it should show some details, such as the package pin number and datasheet names of the LCD screen and how they connect to the microcontroller pins (e.g., pin number and actual port/pin names used on the microcontroller). Keep in mind that the microcontroller is on the Launchpad board, which is mounted on the CyBot baseboard, which has a jumper cable to the LCD board. List the documentation that provided information for each part of your sketch. There is no single right sketch.

2. Is the LCD screen, as set up on the CyBot, connected using a 4-bit or 8-bit Data Bus (DB) wiring interface? Explain how you came to this conclusion. The purpose of this question is to get you used to looking for specific information in a datasheet and relating it to other information.



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LCD connector
Microcontroller package pins and connection headers
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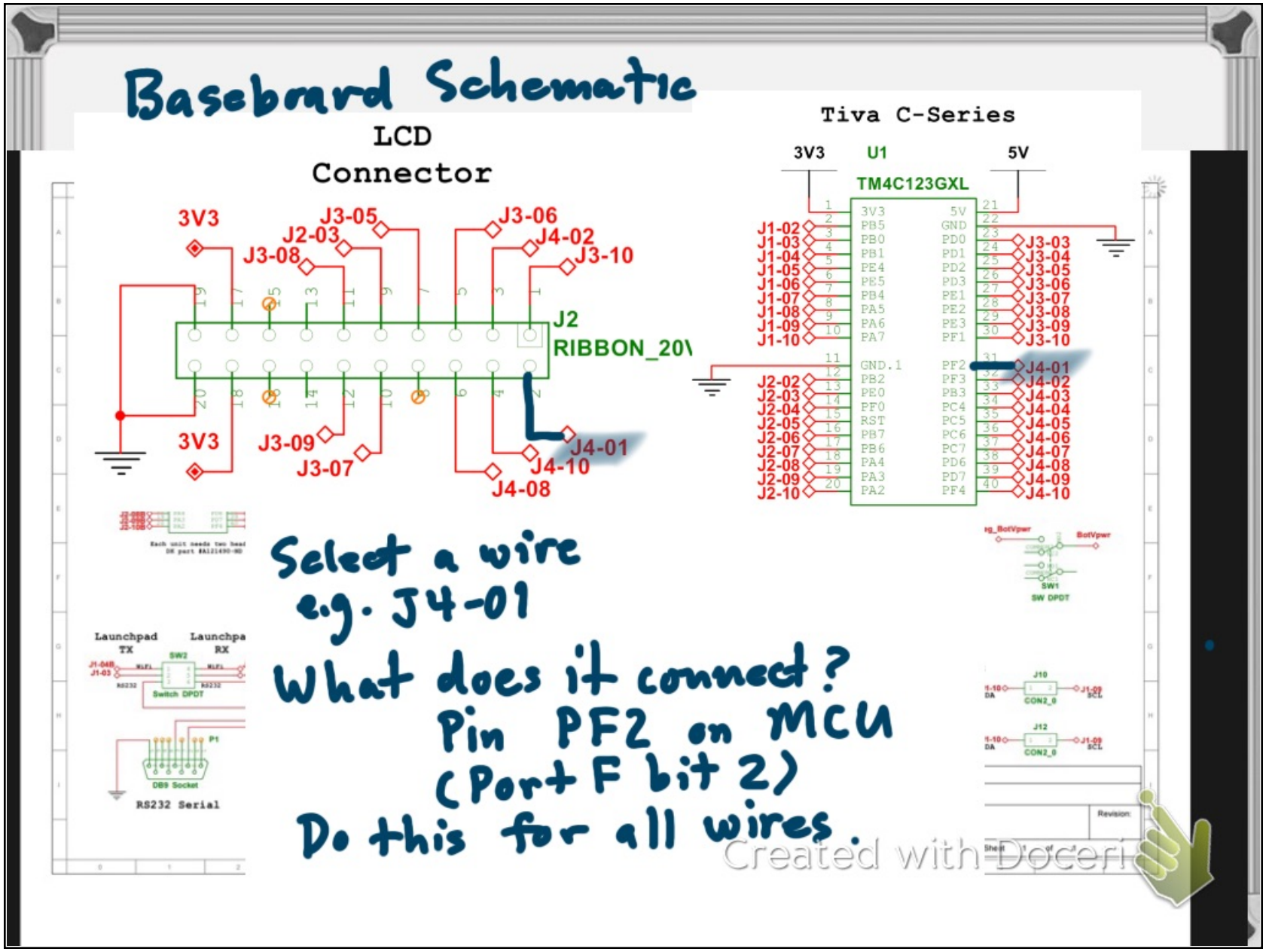
Basebrard Schematic
LCD
Connector
3V3
J3-05
J2-03
J3-08
J3-06
J4-02
J3-10
J2
RIBBON_20\
3V3
J3-09
J3-07
J4-08
J4-10
J4-01
Tiva C-Series
3V3
U1
5V
TM4C123GXL
J1-02
J1-03
J1-04
J1-05
J1-06
J1-07
J1-08
J1-09
J1-10
J2-02
J2-03
J2-04
J2-05
J2-06
J2-07
J2-08
J2-09
J2-10
J3-03
J3-04
J3-05
J3-06
J3-07
J3-08
J3-09
J3-10
J4-01
J4-02
J4-03
J4-04
J4-05
J4-06
J4-07
J4-08
J4-09
J4-10
Select a wire
e.g. J4-01
What does it connect?
Pin PF2 on MCU
(Port F bit 2)
Do this for all wires.
Launchpad
TX
Launchpa
RX
RS232 Serial
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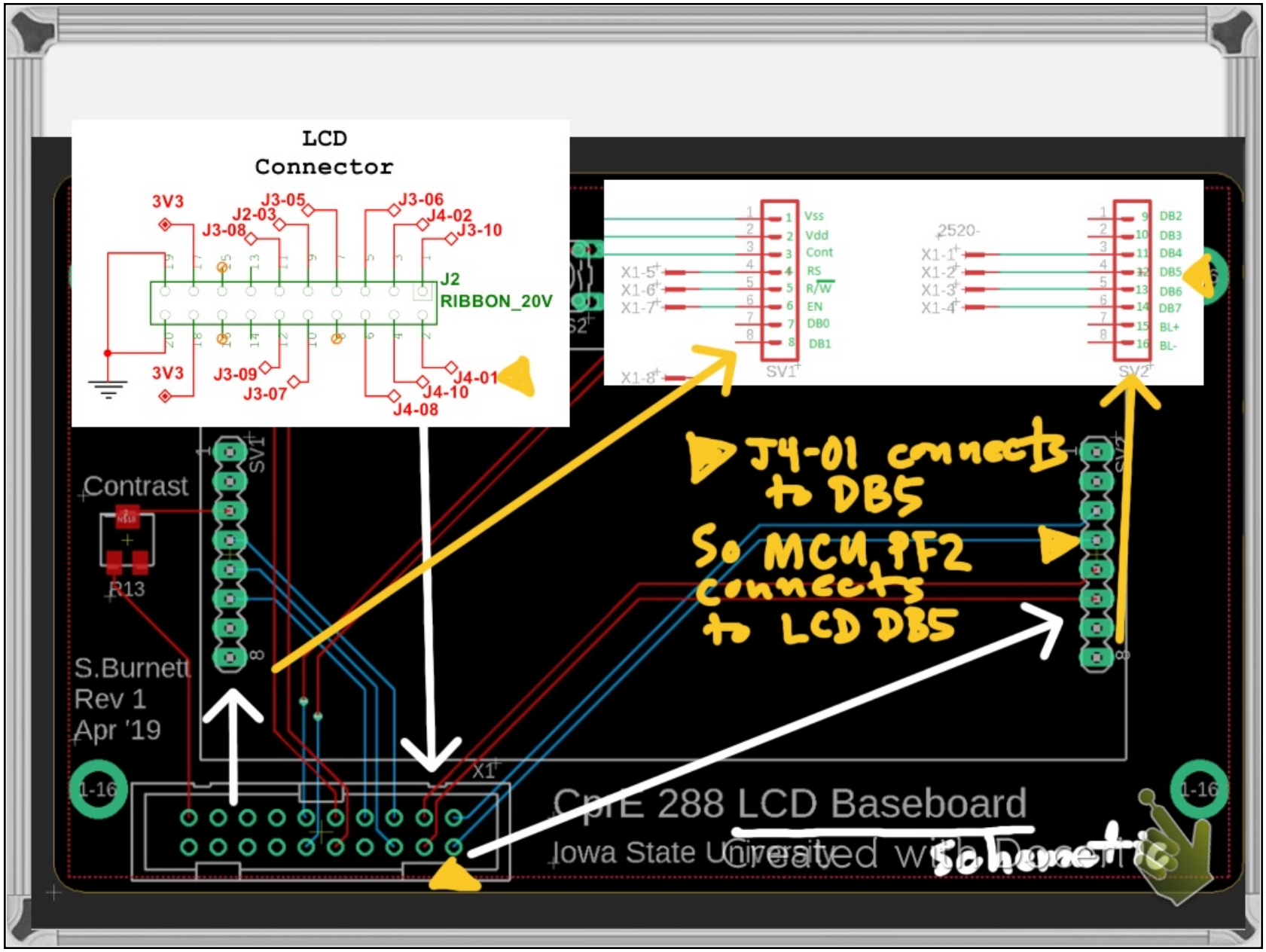
LCD
Connector
3V3
J3-05
J3-06
J2-03
J4-02
J3-08
J3-10
J2
RIBBON_20V
3V3
J3-09
J4-01
J3-07
J4-10
J4-08
Vss
Vdd
Cont
RS
R/W
EN
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
BL+
BL-
SV1
SV2
X1
Contrast
R13
S.Burnett
Rev 1
Apr '19
J4-01 connects to DB5
So MCU PF2 connects to LCD DB5
CprE 288 LCD Baseboard
Iowa State University
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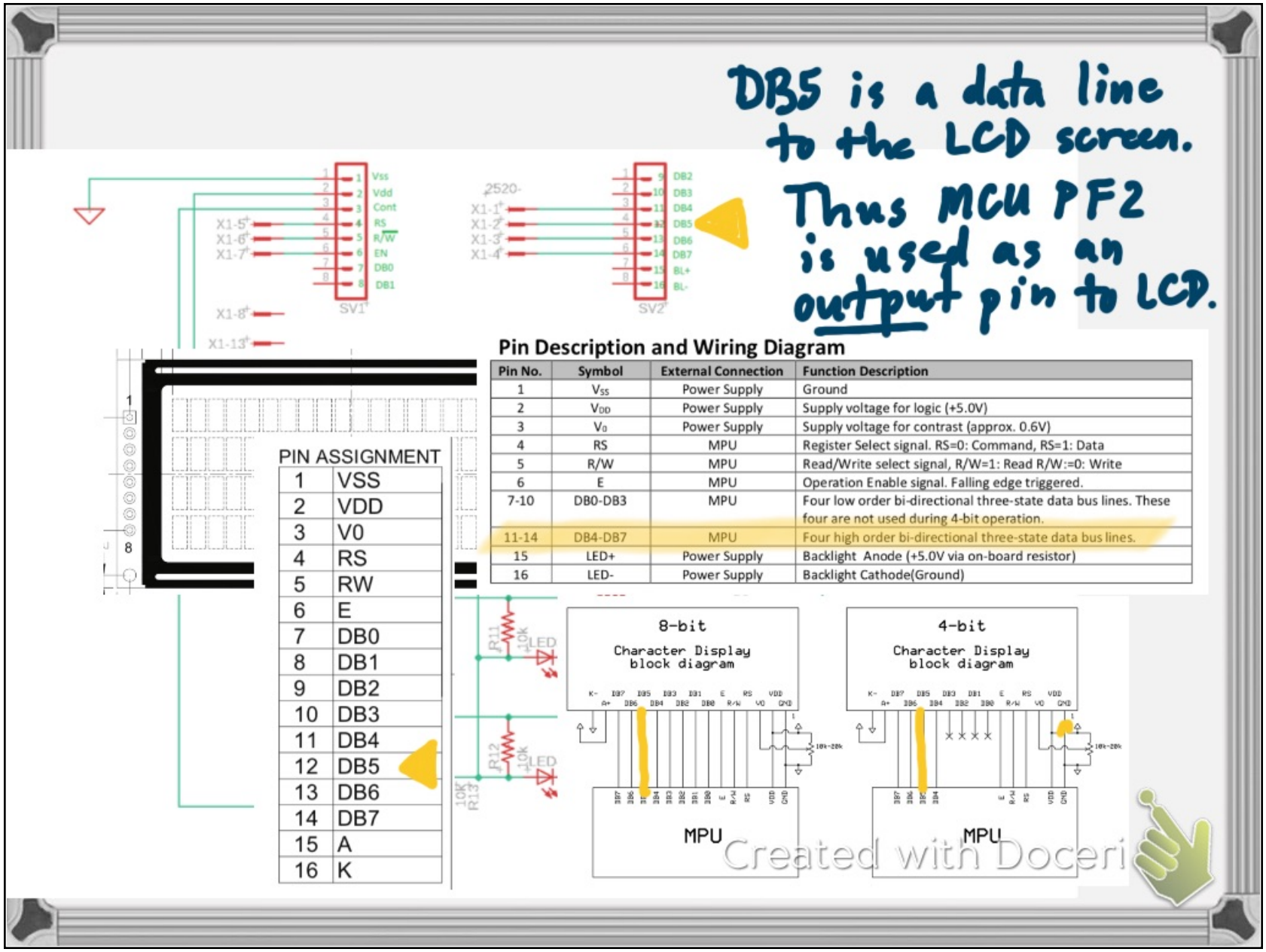
DB5 is a data line to the LCD screen.
Thus MCU PF2 is used as an output pin to LCD.
Vss
Vdd
Cont
RS
R/W
EN
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
BL+
BL-
SV1
SV2
Pin Description and Wiring Diagram
Pin No. | Symbol | External Connection | Function Description
1 | Vss | Power Supply | Ground
2 | VDD | Power Supply | Supply voltage for logic (+5.0V)
3 | V0 | Power Supply | Supply voltage for contrast (approx. 0.6V)
4 | RS | MPU | Register Select signal. RS=0: Command, RS=1: Data
5 | R/W | MPU | Read/Write select signal, R/W=1: Read R/W:=0: Write
6 | E | MPU | Operation Enable signal. Falling edge triggered.
7-10 | DB0-DB3 | MPU | Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
11-14 | DB4-DB7 | MPU | Four high order bi-directional three-state data bus lines.
15 | LED+ | Power Supply | Backlight Anode (+5.0V via on-board resistor)
16 | LED- | Power Supply | Backlight Cathode(Ground)
PIN ASSIGNMENT
1 VSS
2 VDD
3 V0
4 RS
5 RW
6 E
7 DB0
8 DB1
9 DB2
10 DB3
11 DB4
12 DB5
13 DB6
14 DB7
15 A
16 K
8-bit Character Display block diagram
4-bit Character Display block diagram
MPU
MPU
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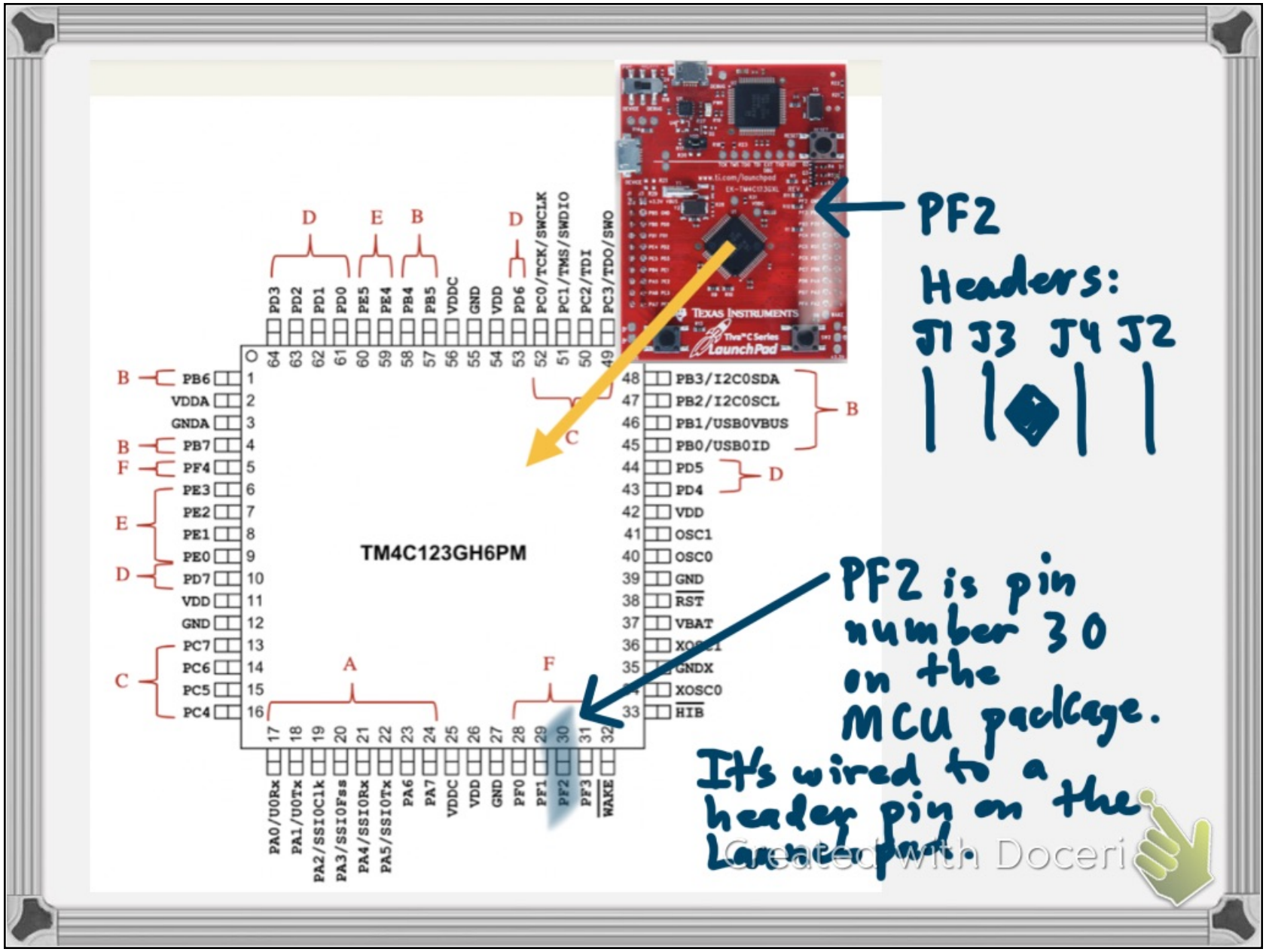
PF2
Headers:
J1 J3 J4 J2
TM4C123GH6PM
PF2 is pin number 30 on the MCU package.
It's wired to a header pin on the Launchpad.
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GPIO Port D		
Pin 7:	ADDR_JMP_4	
Pin 6:	LCD_RW	
Pin 3:	LCD_RS	
Pin 2:	LCD_EN	
Pin 1:	Connected to other ports through R9 and R10	
Pin 0:		
GPIO Port E	PUSH BUTTONS	
Pin 5:	AIN8	
Pin 4:	AIN9	
Pin 3:	PB_SW4	
Pin 2:	PB_SW3	
Pin 1:	PB_SW2	
Pin 0:	PB_SW1	
GPIO Port F		
Pin 4:	LCD DATA7	
Pin 3:	LCD DATA6	
Pin 2:	LCD DATA5	
Pin 1:	LCD DATA4	
Pin 0:	USR_SW2	OI shutoff

PF2 (MCU)

DB5

List of MCU pin assignments confirms the connection.

Note the set of LCD pins.

Inspecting lcd.c code will also confirm ports

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