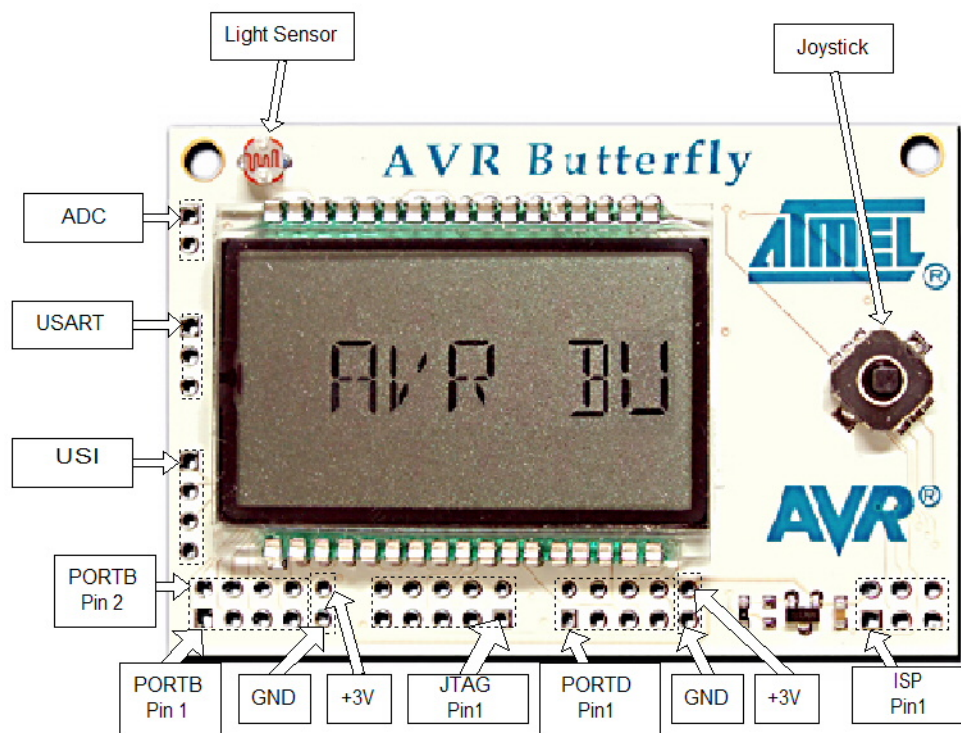


Butterfly Alternate Pin Uses

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Introduction

There seems to be a bit of confusion over which pins on the Butterfly can be used for general I/O. Most of the pins have alternate uses, for instance, the Port D pins can be used for either general I/O or to operate 8 segments of the LCD. The information is out there but not in an easy to find and use format. So I will present a brief discussion of the alternate functions of the available pins followed by illustrations showing the various uses for each pin and finally I'll present the Butterfly schematics enlarged so that you can read them without lasik surgery.

But Port D is also attached to the LCD

The problem is often first noticed when one uses Port D for output and notices that some of the LCD elements start to dance around in time to whatever is being output on the Port D pins. Well, that is because the LCD also uses the Port D pins. This usually freaks out the user who thinks they will fry their LCD, and they might, but probably won't. The LCD doesn't draw enough current to affect the I/O on the pin. Each element just acts like a parasitic indicator of the action on the pin. An LCD element may be damaged if too much voltage is applied, which you won't do since that might blow out the pin or the whole Butterfly. Being left on too long can also damage it, but I've not seen any such damage in my experiments. If you want to use Port D for I/O you cannot also use those segments of the LCD for outputting characters on the LCD.

So, as a rule of thumb, either use the LCD or Port D, but not both. You might write special code to use on the leftmost several LCD characters while using Port D pins for I/O.

Port B has some pins used by the Piezo, Joystick, DataFlash, and ISP

Oh good grief, what a mess! Well, not really actually – if you are careful you can use them all for general I/O.

If you use Port B pin 5 for I/O and you output a signal in the audible range you'll hear it on the Piezo – but it won't hurt a thing, unless you are particularly sensitive to annoying noises.

Port B pins 1, 2, and 3 are used for the SPI buss which is used to program the DataFlash and to program the Atmega169 via the ISP connector. The DataFlash will ignore the SPI bus as long as the Reset_Flash pin is held in the proper state.

The ISP just sits out there unless you hook it up to an ISP programmer in which case you won't be running a program anyway.

The joystick uses Port B pins 4, 6, and 7, but as long as nobody touches the joystick, you can use these pins with no problem. Note that touching the joystick can cause the pin to connect to ground, so keep that in mind in your circuit design.

JTAG

The JTAG connector is meant to be connected on the bottom of the Butterfly thus, unlike Ports B and D, the JTAG pin 1 is on the right. If you disable the JTAG port in software you can use Port F pins 4, 5, 6, and 7 for their normal functions – which include most notably as Analog to Digital Converters: ADC4, ADC5, ADC6, and ADC7. You disable the JTAG by either changing the JTAG enable fuse via ISP or by setting the JTD bit in the MCUSCR register in software at application startup.

Voltage Reader

The input on this pin is dropped across a voltage divider before being fed to Port F pin, which is normally used as an ADC to measure the voltage. You use this for I/O if your circuit accounts for the voltage divider.

USART

The RXD and TXD lines are connected to Port E pins 0 and 1 respectively and can be configured in software to be either used by the USART or for I/O, but you need to look at the schematic and consider the level shifters before such use.

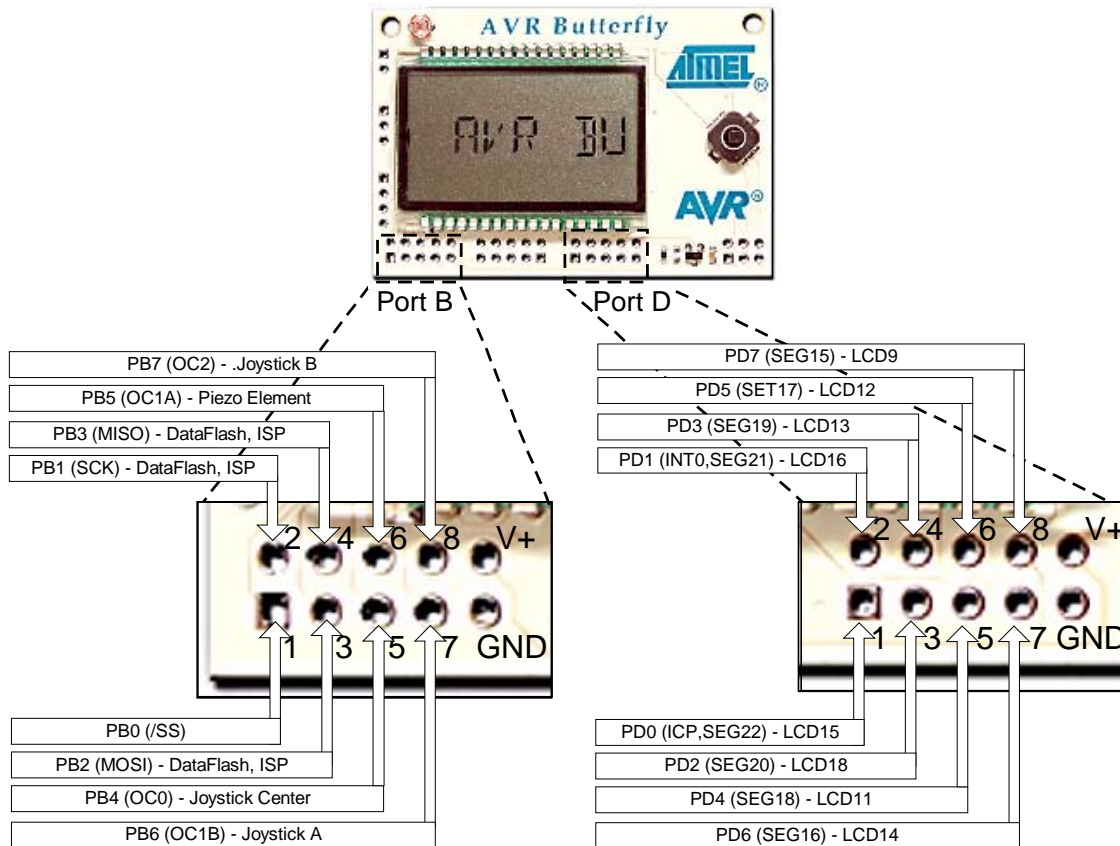
USI

The USI lines are connected to Port E pins 4, 5, and 6 respectively and can be configured in software to be either used by the USI or for I/O.

LCD

Some folks have applied horrific vivisection on their Butterflies and removed the LCD panel so that they can use ~30 pins of Ports A, C, D, and G for I/O. This butchery actually provides 22 extras since you can get to 8 of them via Port D. The numbers may be off a little since I've never felt sadistic enough to do this to any of my poor little Butterflies. But if you need the I/O and not the LCD, why not?

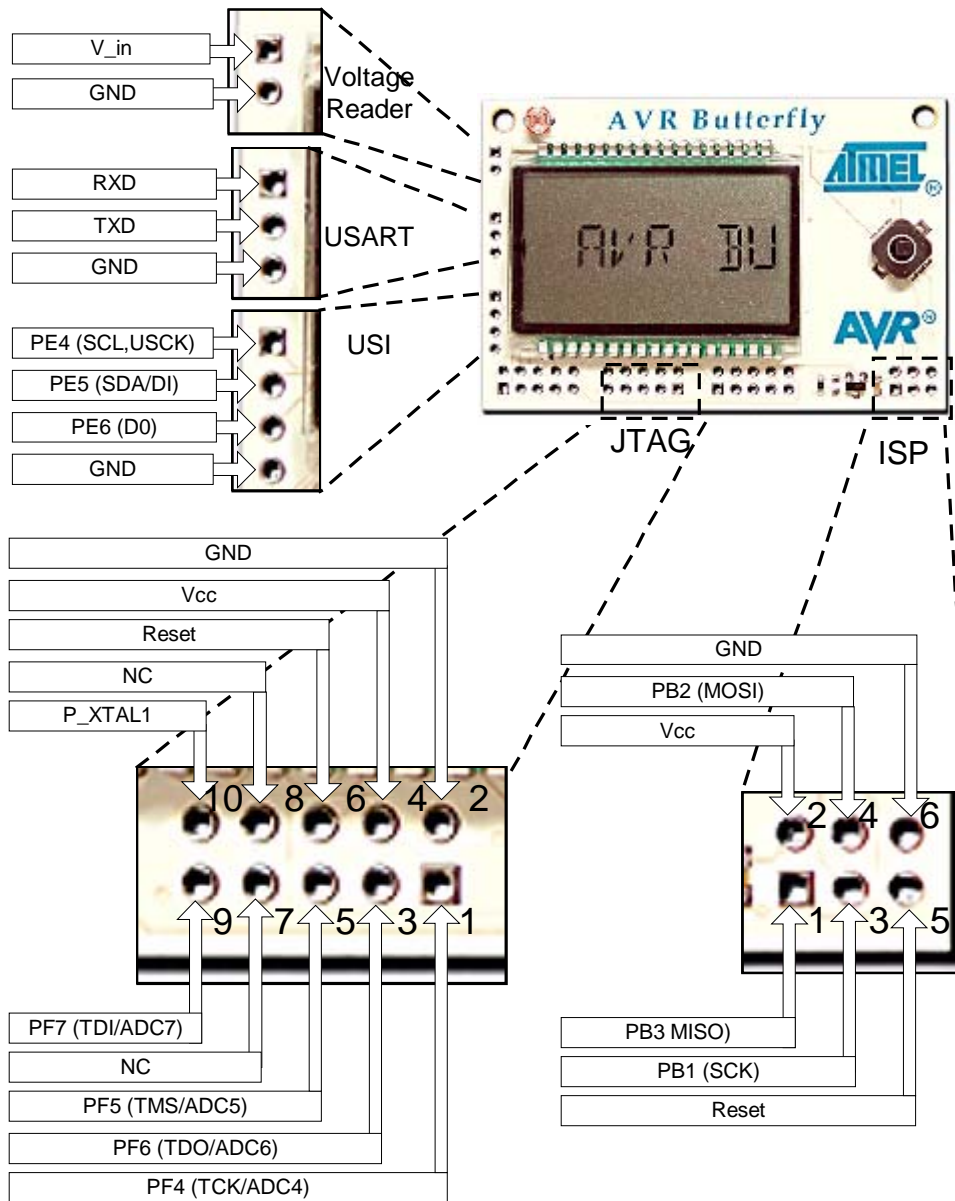
Port B and Port D Illustrated



Notice that the thru-hole pads for each port are numbered beginning with 1, whereas the actual ports are numbered beginning with 0. This is done to confuse you and because hardware and software people hate each other. Folks who do both are self-loathing and write guides like this. Just remember when thinking about '1', the real question is '1' what – pad or port pin – and they ain't the same?

Port B			Port D		
Pads	Port Pin	Use	Pads	Port Pin	Use
Pad 1	PB0 (/SS)		Pad 1	PD0 (ICP,SEG22)	LCD15
Pad 2	PB1(SCK)	DataFlash, ISP	Pad 2	PD1(INT0,SEG21)	LCD16
Pad 3	PB2(MOSI)	DataFlash, ISP	Pad 3	PD2(SEG20)	LCD18
Pad 4	PB3(MISO)	DataFlash, ISP	Pad 4	PD3(SEG19)	LCD13
Pad 5	PB4 (OC0)	Joystick Center	Pad 5	PD4 (SEG18)	LCD11
Pad 6	PB5(OC1A)	Piezo Element	Pad 6	PD5(SEG17)	LCD12
Pad 7	PB6(OC1B)	Joystick A	Pad 7	PD6(SEG16)	LCD14
Pad 8	PB7(OC2)	Joystick B	Pad 8	PD7(SEG15)	LCD9
Pad 9		GND	Pad 9		GND
Pad 10		V+ External	Pad10		V+ External

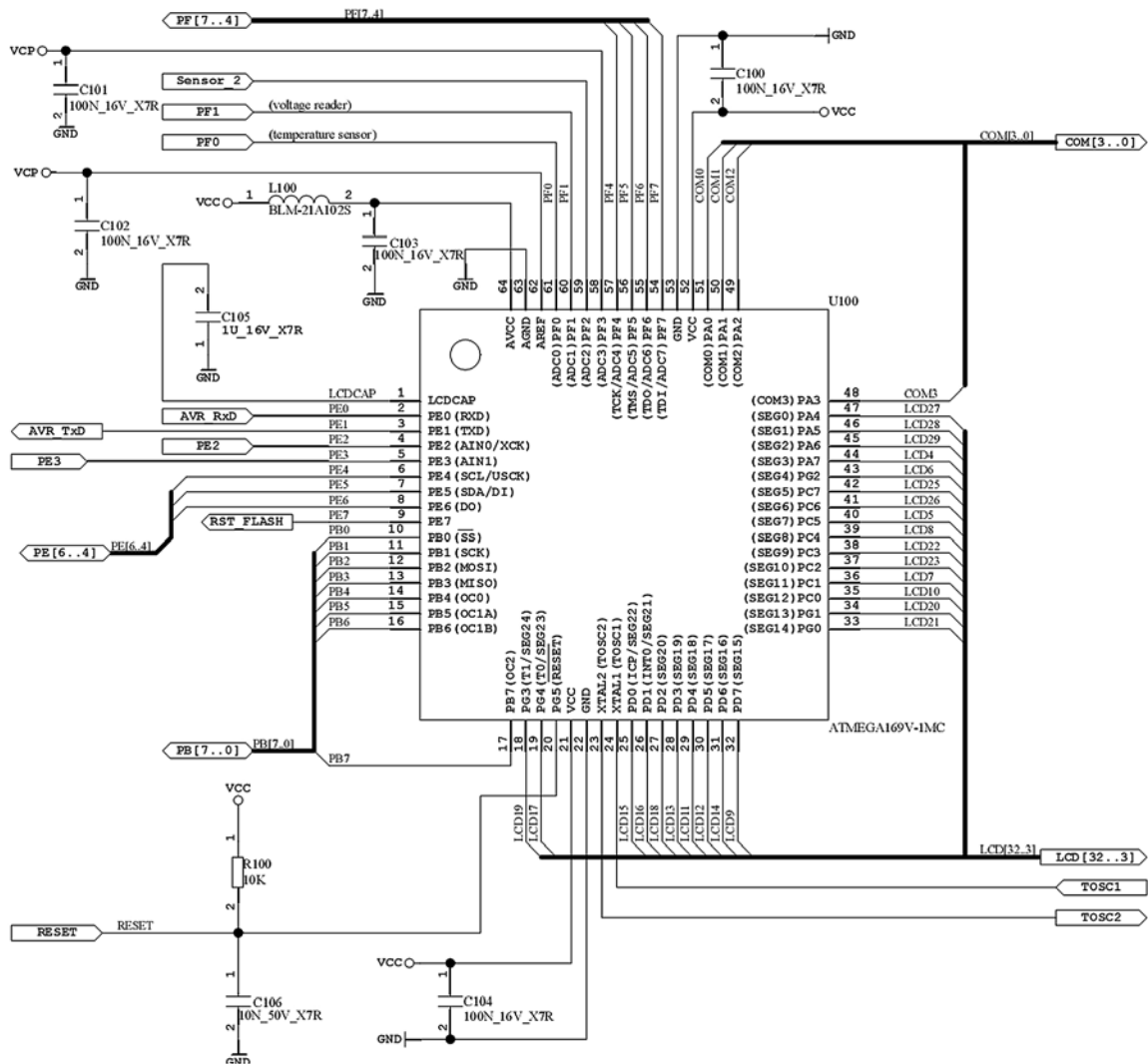
Vin, USART, USI, JTAG, and ISP Illustrated

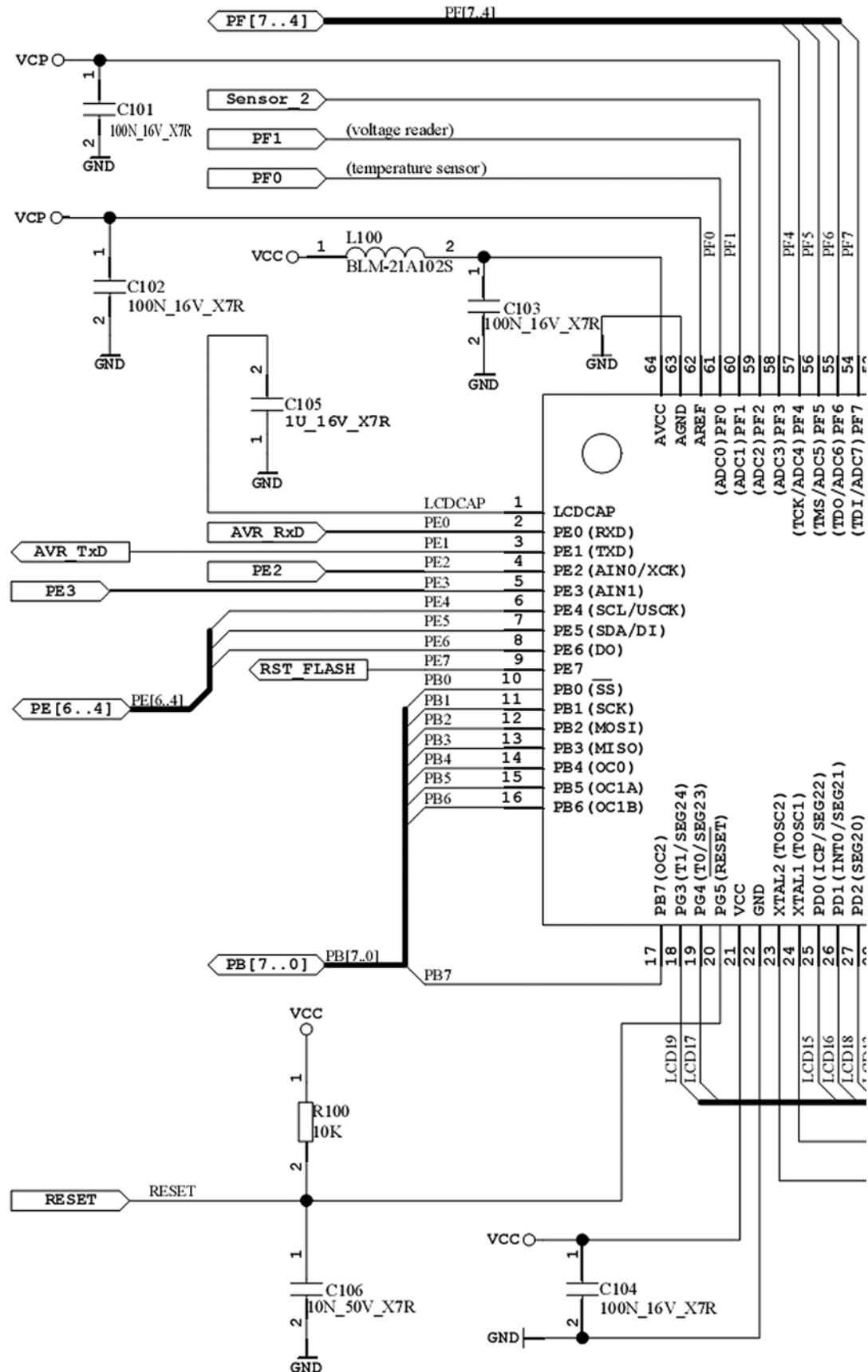


Schematics

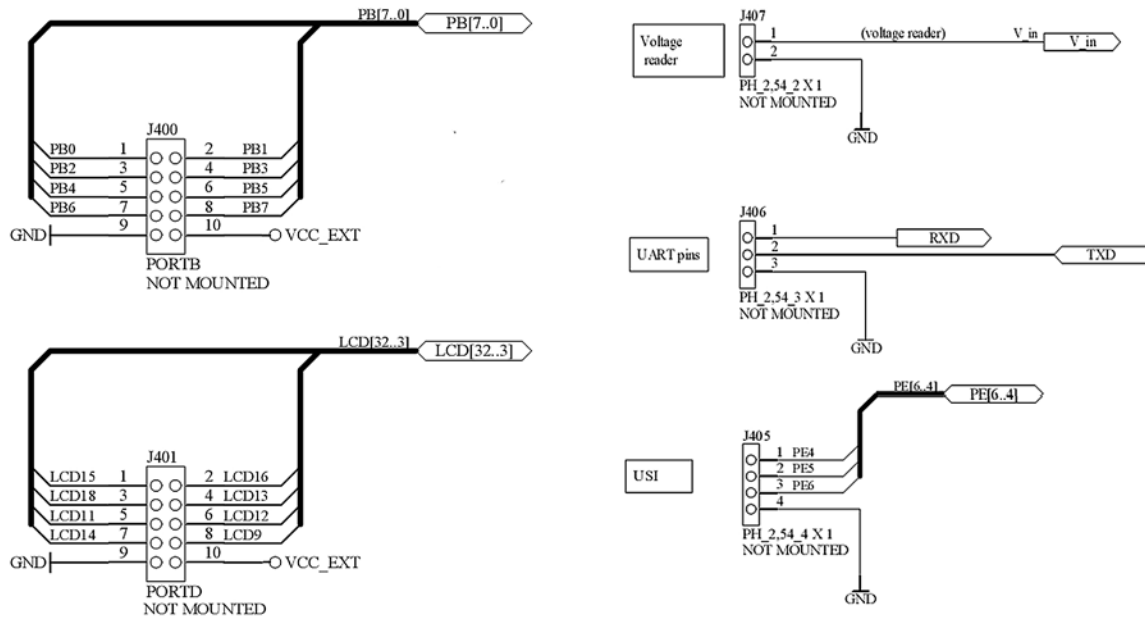
The Butterfly schematics provided by Atmel are a bit of an eye-chart and I have to use a jeweler's loop to read the darn things. So I photoshopped them into something more readable for me. The Atmega169 schematic follows and then is enlarged showing the left and right halves on separate pages. Following these are the rest of the relevant schematics also enlarged.

Microcontroller

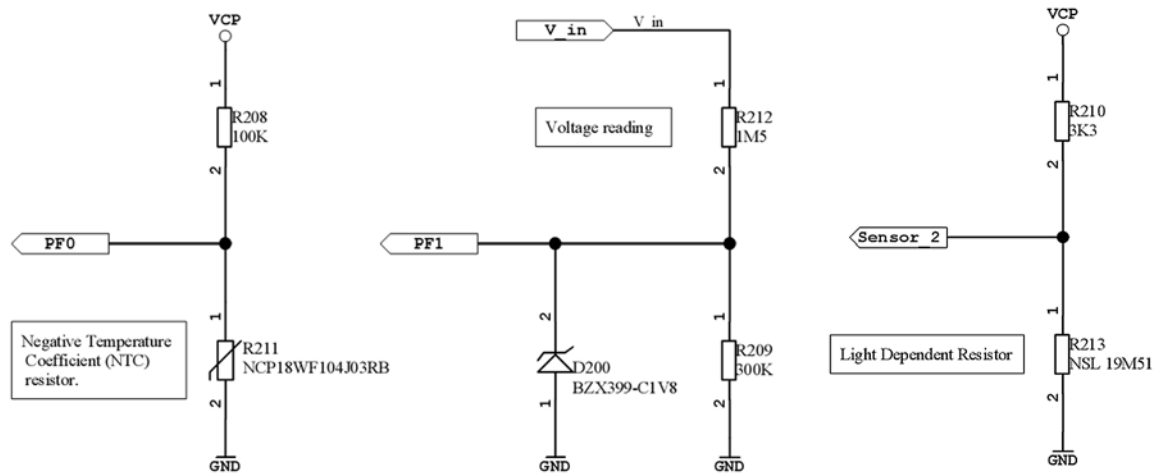




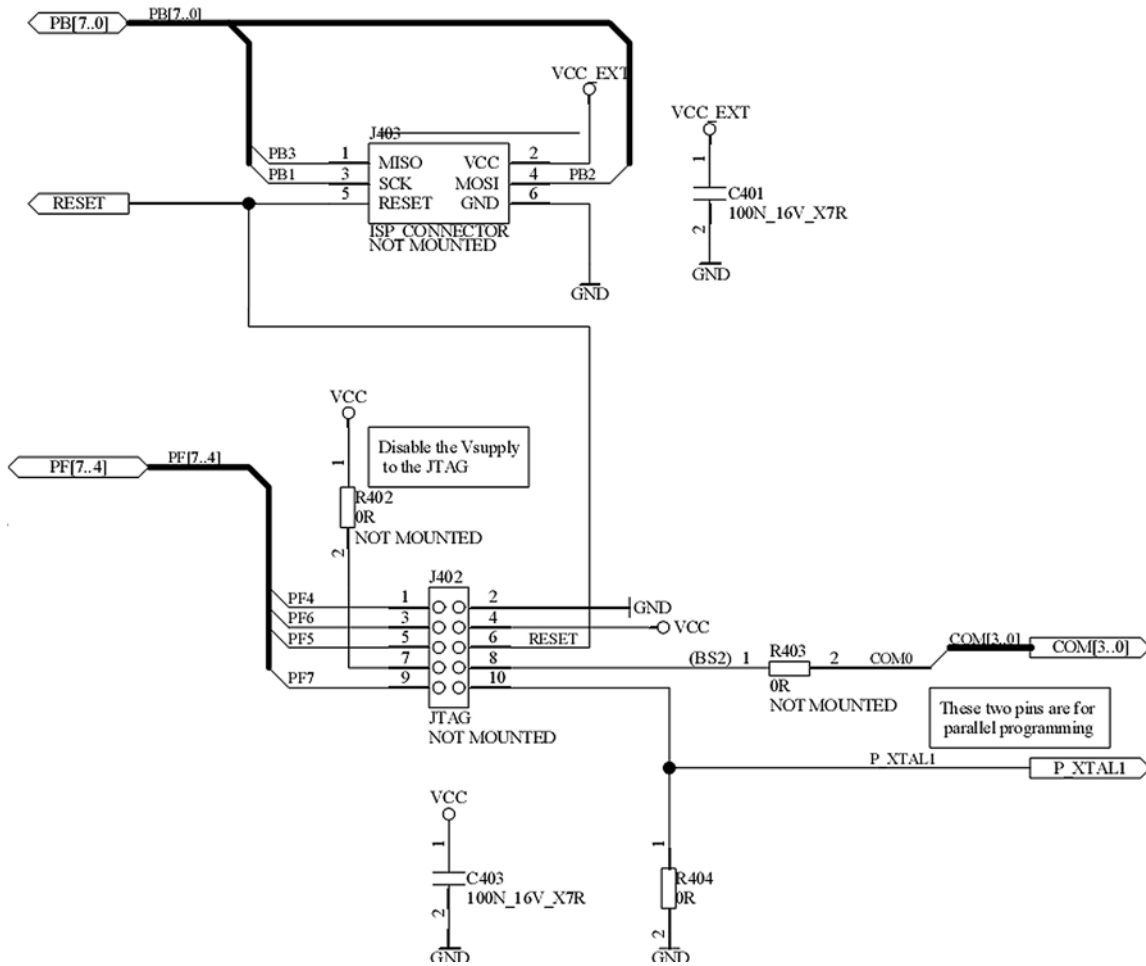
Pads



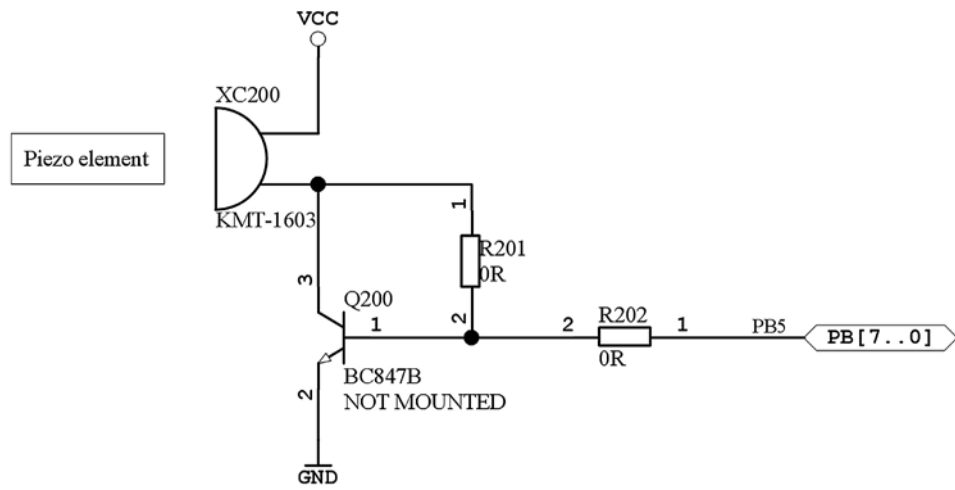
Sensors



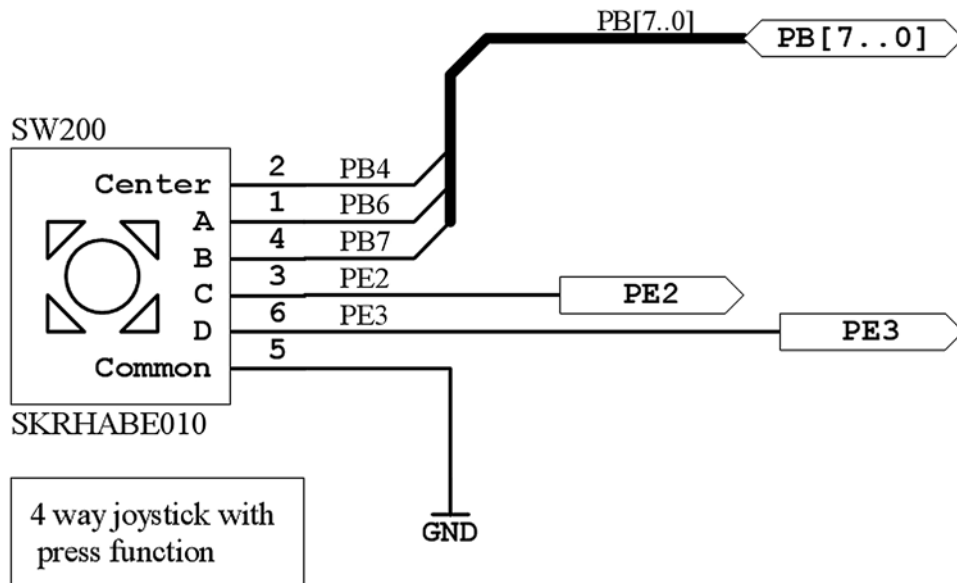
JTAG and ISP



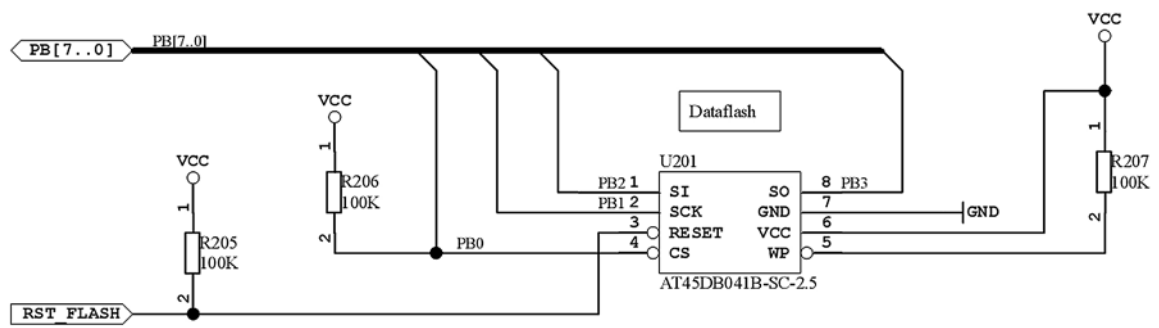
Piezo Element



Joystick



DataFlash



LCD

