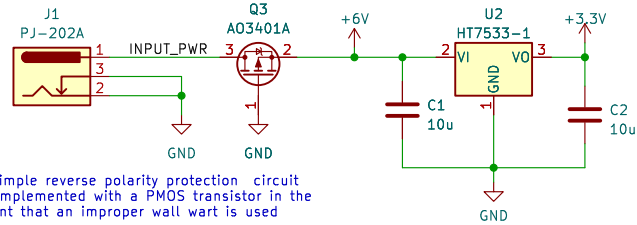


Input interface

Power input is through a 5.5mm barrel jack
Device is designed to accept a 7.5V wall wart with a barrel plug

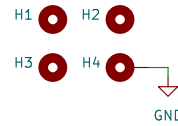


A simple reverse polarity protection circuit is implemented with a PMOS transistor in the event that an improper wall wart is used

A 3.3V regulator is used to generate a supply rail for the MCU, LEDs, and pushbuttons

Mounting holes

Four 0.116" mounting holes are used
One is connected to the ground plane

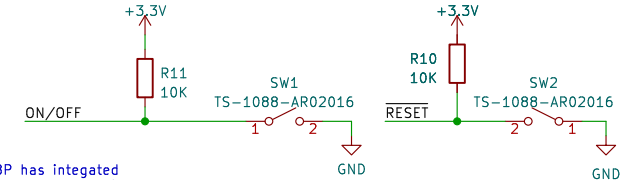


Pushbuttons

Two pushbuttons are used on the board

One is connected to the ATmega328P reset pin to allow a manual reset

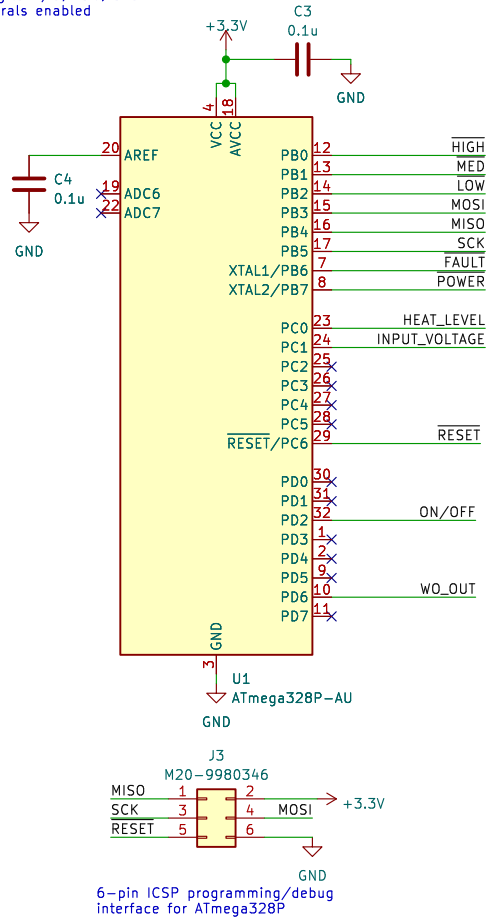
The other is connected to the digital I/O of the ATmega328P and used to enable output to the sock.



Although ATmega328P has integrated pull-up resistors, there was enough PCB real estate and the cost was low enough to include discrete resistors

Microcontroller

ATmega328P microcontroller with digital I/O, ADC, and PWM peripherals enabled

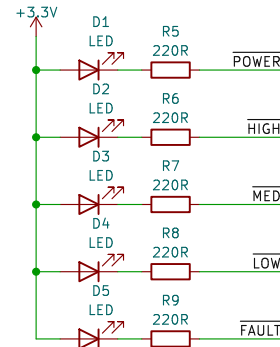


LEDs

ATmega328P-controlled LEDs to indicate device states, including power state, activity state, and output power level

LEDs are driven directly by ATmega328P output drivers

All LEDs are red, so estimated current draw is $(3.3V - 1.8V) / 220\Omega = -6.8mA$



Output interface

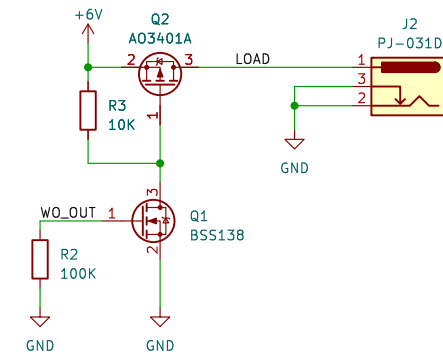
The restriction to use only JLCPCB basic/promotional items has resulted in a circuit design using a PMOS/NMOS pair to gate output power to the sock.

The sock connects directly to J2 through a 3.5mm barrel plug.

The PWM output from the ATmega328P drives a BSS138 (good NMOS for 3.3V logic), which in turn drives an AO3401A PMOS. The PWM duty cycle from ATmega328P dictates the average current through Q2 and therefore the average current through the sock.

The AO3401A has reasonably low R_{ds} ($< 0.08 \text{ ohm}$) and is rated for up to $I_{ds} = 4.0A$. A 10K pull-up was used to reduce the amount of time to discharge the gate of Q2.

The sock has a nominal resistance of 5 ohms, which means that a 7.5A input through J1 will result in no more than $7.5A / 5.0A = 1.5A$ through Q2.



ADC voltage dividers

A 100K potentiometer is read by the ATmega328P ADC and used to set the output power level through PWM. As the 3.3V rail is both the ADC voltage reference and input to potentiometer, it works well

A 1:3 voltage divider is used to normalize the input voltage to a value suitable for the 3.3V ADC voltage reference and is used to prevent output when input voltage is too high



Zachary Murtishi

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File: SockTrimmer.kicad_sch

Title: Heated Sock Power Controller

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