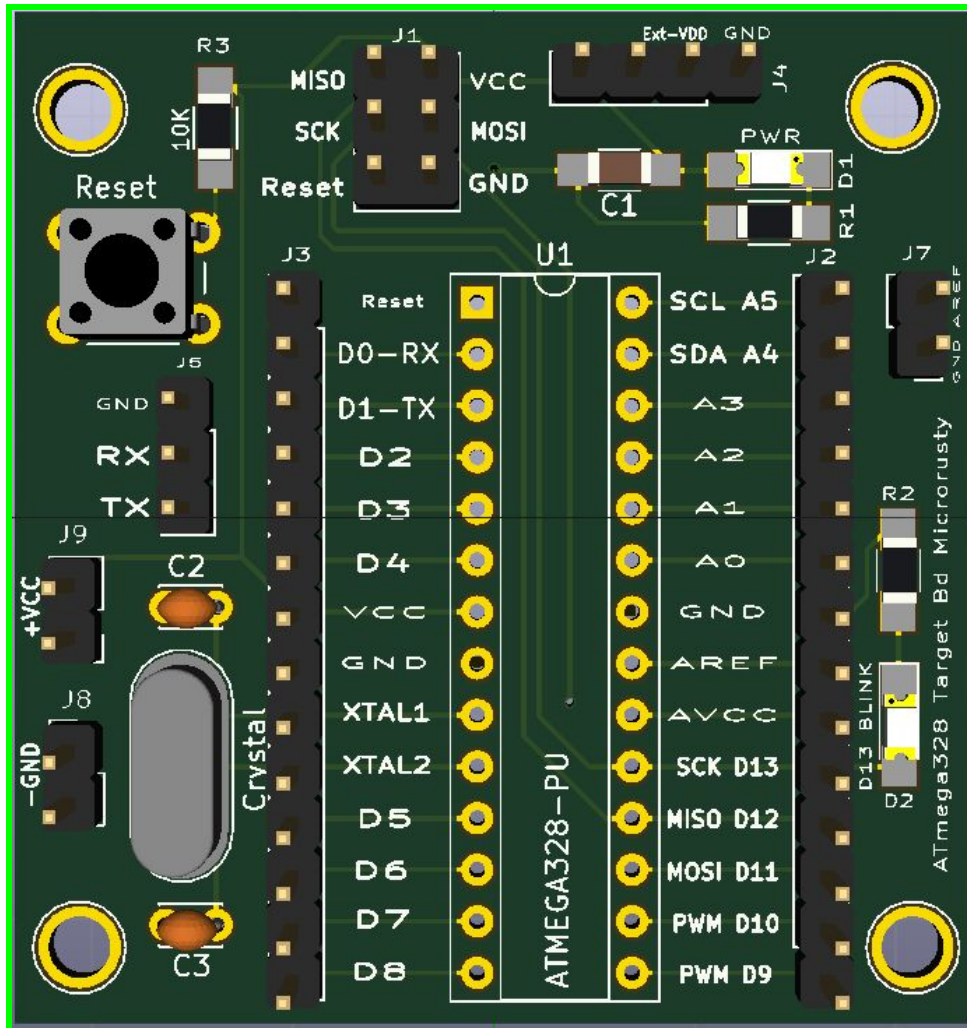


ATmega328p Target board by Microrusty



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Target board was designed to enable quick ATmega328p prototyping using ISP interface.

The design goals for this project were to make an inexpensive printed circuit board version of the minimalist target board for the ATmega328P that connects the Microcontroller to the 6-pin ISP header. Provide the capability of a breakout board with external pins to tap into the pins of the ATmega328P and provide labels for every pin. Fit in small amount of extra flexibility by including a RS232 Serial interface, Reset button, AREF jumper and external power jumper.

This board can be used for the following functions:

- Transfer program code to the ATmega328p microcontroller.
- Select the clock source and clocking frequency for the microcontroller.
- Read internal Flash program code and EEPROM content.
- Delete or erase program code. Clear data and reset back to default.
- Protect the chip against reading of its content.

Features:

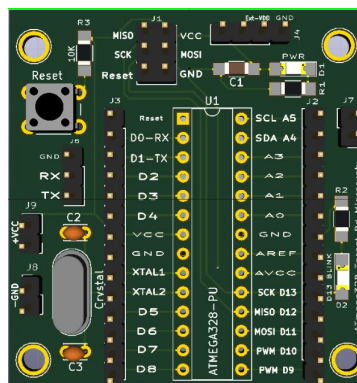
- Arduino Uno pinout version with additional 5 volt and Ground for breadboard support.
- Operating/Input Voltage: 5 Volts Max. External Auxiliary input voltage jumper.
- Power on LED. **No in circuit voltage regulator use external power regulator.**
- Processor: ATmega328p, Atmega328P-PU 8 bit AVR family microcontroller.
- EEPROM 1K, SRAM 2K, Flash 32K
- Clock Speed: 16 MHz, 8 MHz, 1 MHz. Pins XTAL1 XTAL2 with 22pf to GND.

Pin Description

- **Analog Input:** 6 pins A0 – A5
- **Digital IO:** 14 pins D0 – D13
- **PWM:** 6 pins - D3, D5, D6 D9, D10, D11
- **External Interrupt** Pins D2 and D3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **Built in LED** Pin D13

Interfaces:

- **RS232 Serial interface** with 3 pin 1 UART. Serial Pins D0 (RX) and D1 (TX) GND: RX and TX pins are used to receive and transmit TTL serial data.
- **J1 - ISP Interface.** MISO, MOSI, SCK, Reset, VCC, GND
- **SPI interface:** Used for SPI communication. D13 SCK, D12 MISO, D11 MOSI, D10 SS
- **TWI I2C.** Used for TWI communication. A4 SDA, A5 SCL
- **Reset Button:** Push button to reset the microcontroller.
- **J7 AREF** Not populated: To provide reference voltage for input voltage.



How to use ATmega328P Target Board

The **ATmega328P Target board** was designed to be used with the USBTiny, USBasp and Atmel Ice Programmers and uses the six pin ISP ([In-System Programming](#)) interface located at J1. The Target board can be programmed by any IDE that incorporates Avrdude. If the AVR ATmega328P chips are not pre-loaded with bootloader firmware the ISP method can be used to load the program into the chips. The Target board was designed to be used with the Arduino IDE for ease of use and the large amount of supporting libraries. For additional information on the ATmega328P use the following link.

Refer to ATmega328P DataSheet: <https://www.microchip.com/wwwproducts/en/ATMEGA328P>

The difference between ATmega328P and ATmega328P-PU is ATmega328P-PU has the Atmel picoPower technology while ATmega328P does not have. The identification signature of ATmega328P and ATmega328P-PU are different too. ATmega328P has the signature of `0x1E 0x95 0x14` while ATmega328P-PU has the signature of `0x1E 0x95 0x0FB`. Other than that, ATmega328P and ATmega328P-PU are the same every sense architecturally. To upload sketches into ATmega328P, some modification of configuration is needed.

Connecting ATmega328P Target board to USB programmer

Before proceeding to the next step, make sure you install the programmer driver into your PC.

Before connecting Target Bd to a specific programmer read and understand specific programmer.

[Connect the six pin cable from the programmer to the ISP port found at location J1](#)

You will notice the PWR LED is ON. If it is not check the connection between cable head and ISP header.

The ISP header consist of 2×3 pins.



For specific use reference [How to use Manual](#)

Using Avrdude with the ATmega328P Target Board

Download Avrdude URL: <http://savannah.nongnu.org/projects/avrdude/>

AVRDUDE is a very popular command-line program for programming AVR chips.

The latest version AVRDUDE 6.3 released.

Commands for AVRdude Usage: avrdude [options]

Options:

- -p <partno> Specify AVR device. -p m328p
- -c <programmer> Specify programmer type. -c usbtiny
- -v Verbose output. -v -v for more.
- -e Perform a chip erase.
- -t Enter terminal mode.

Test connection to the Target Board

- **Test Device:** avrdude -c usbtiny -p m328p -v
- **Test Device:** avrdude -c usbtiny -p atmega328p -v
- **Test Device:** avrdude -c usbasp -p m328p -v

Flash Write Examples: -U <memtype>:r|w|v:<filename>[:format]:

- avrdude -c usbtiny -p m328p -U flash:w:blink.hex
- avrdude -c usbtiny -p atmega328p -U flash:w:blink.hex

Using Terminal Mode: avrdude -c usbtiny -p m328p -t

Commands for AVRdude **terminal mode**:

- dump : dump memory : dump <memtype> <addr> <N-Bytes>
- read : alias for dump
- write : write memory : write <memtype> <addr> <b1> <b2> ... <bN>
- erase : perform a chip erase
- sig : display device signature bytes
- part : display the current part information
- pgm : return to programming mode
- help : help
- ? : help
- quit : quit

Please refer to the Avrdude manual for more in depth instructions.

Flash the Target Board using the Arduino IDE

Arduino IDE

The whole process of loading and flashing the code, burning the fuses properly to the ATmega328P microcontroller is managed by the Arduino Software (IDE). The IDE uses AVRdude in the background to complete the flashing process.

The Arduino IDE provides a menu of specific items that allows the use of a variety of programmers. Among the programmers, the “USBTiny” or the “USBasp” are the cheapest and most practical solution to flash the code on an ATmega328P Target board.

URL location for Arduino IDE: <https://www.arduino.cc/en/Main/Software>

Configuration:

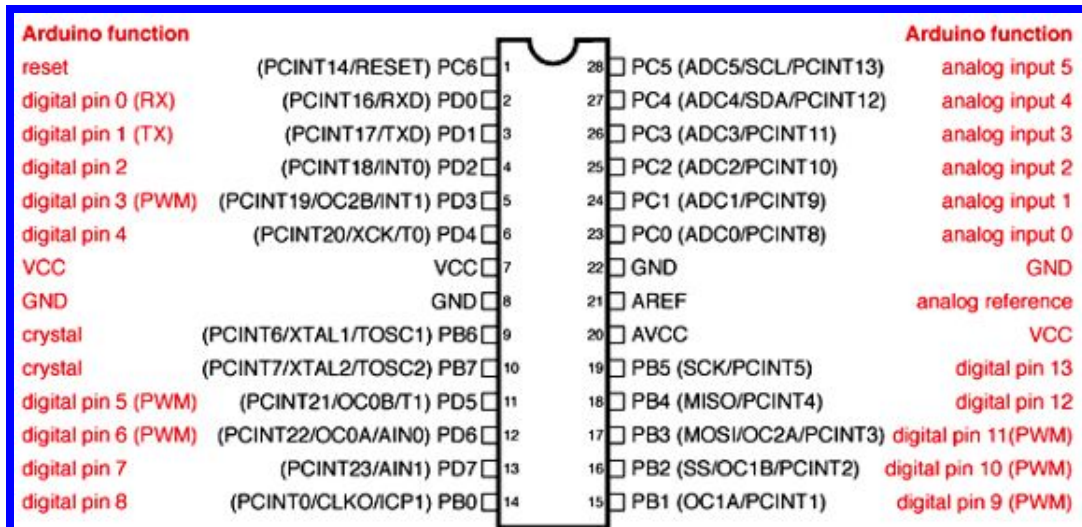
Use the following settings under the **Tools** tab:

- **Board:** “Arduino/Genuino Uno”
- **Programmer:** “USBtinyISP”
- **Programmer:** “USBasp”

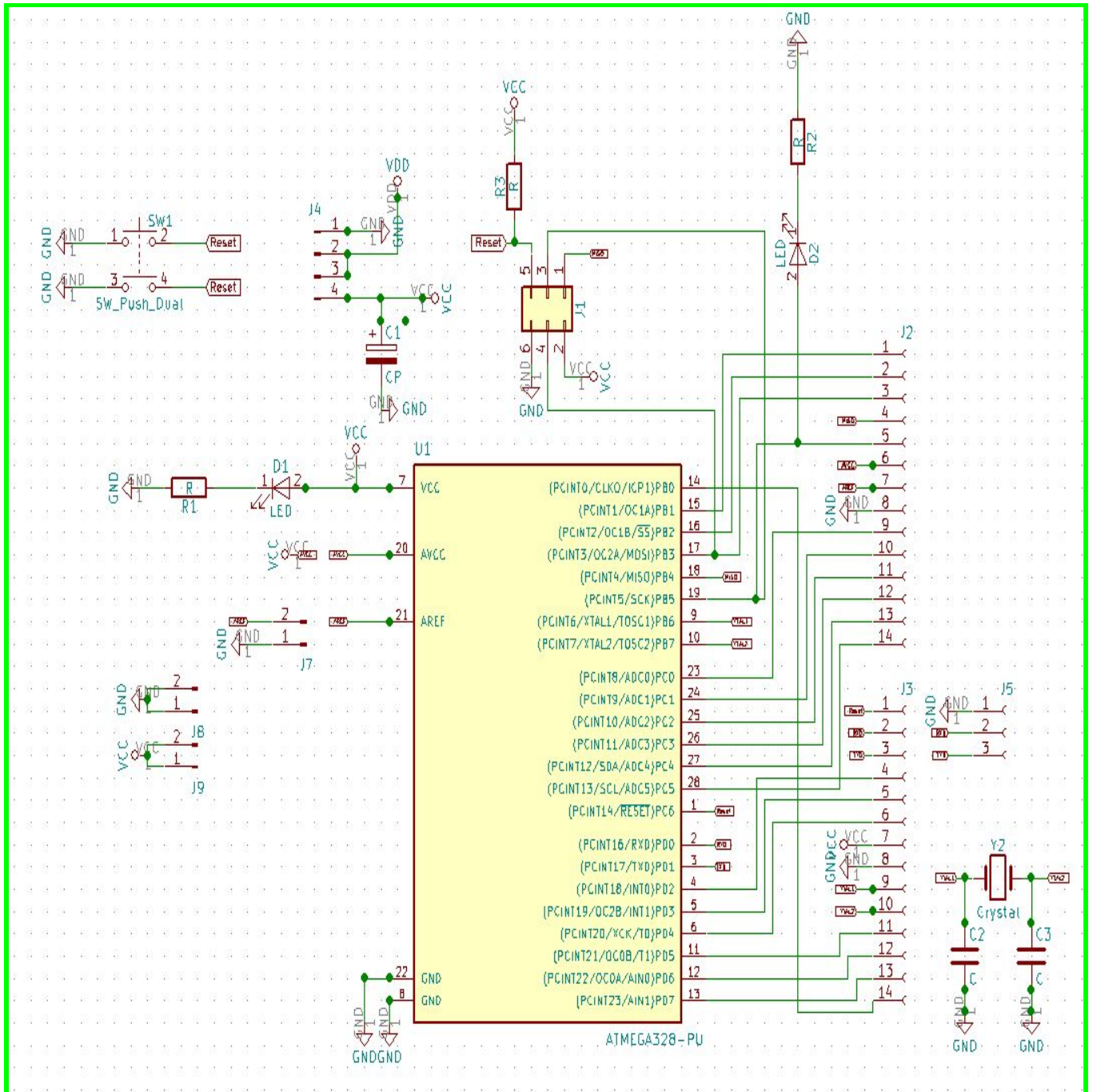
Under **Sketch** Tab use the following when flashing the board:

- **Export compiled Binary** Ctrl+Alt+S. This writes a copy of the hex file to the folder that can be used with Avrdude.
- **Upload Using programmer** Ctrl+Shift+U. This flashes the hex file to the board using Avrdude.

Arduino Uno to ATmega328 Pin Mapping

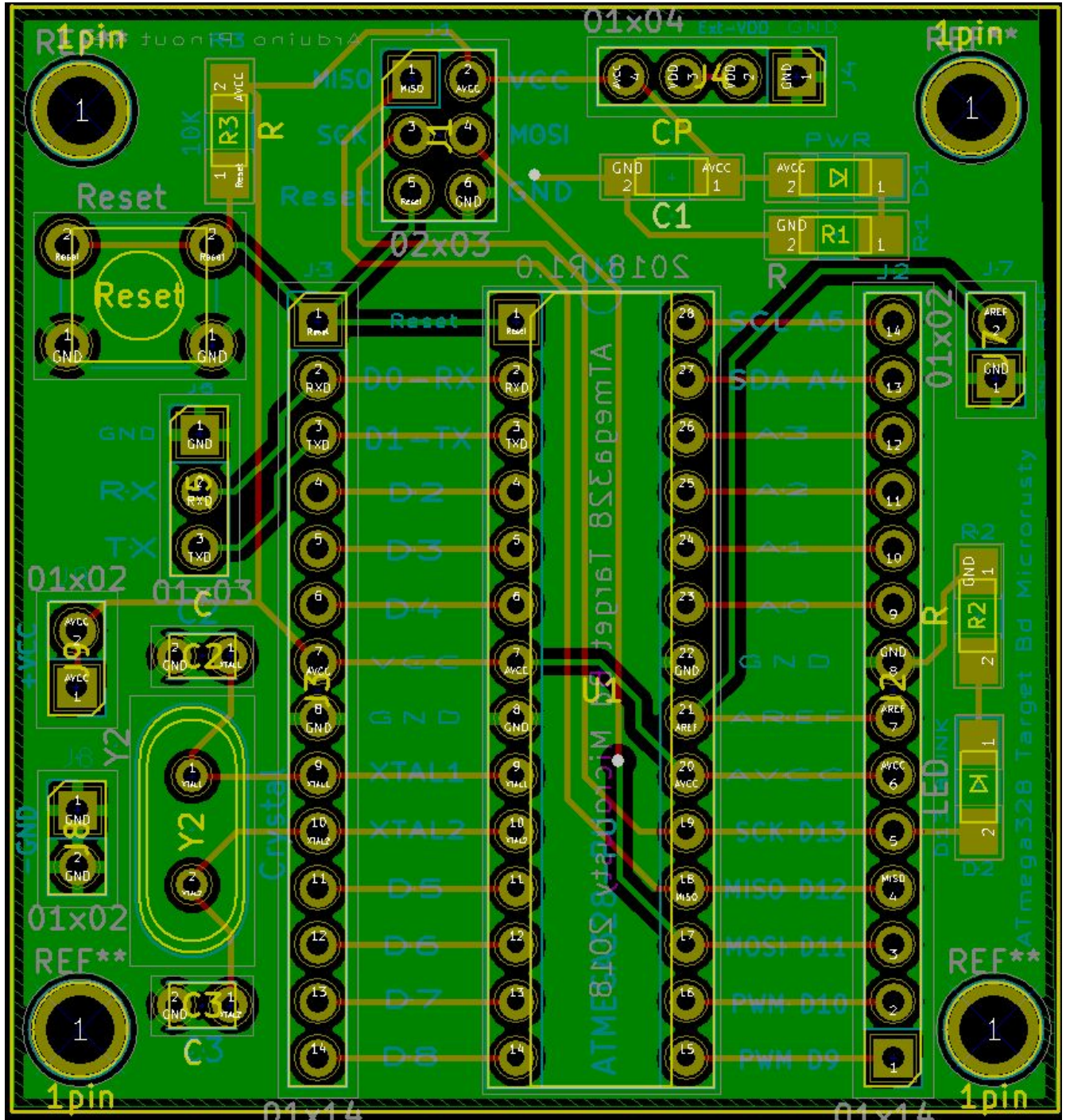


ATmega328p Target board Schematic 2018



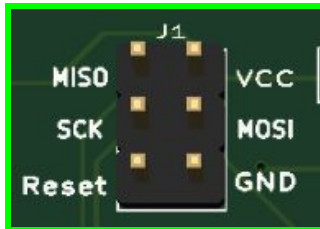
ATmega328p Target board Microrusty 2018

ATmega328p Target board PCB 2018



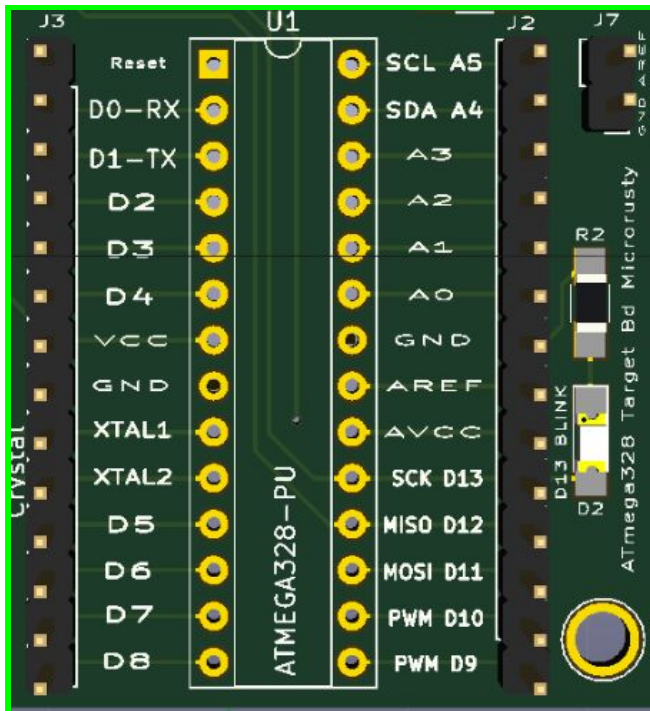
Jumpers

J1 - ISP Interface



J3 - Pins D0 - D8, XTAL1, XTAL2, VCC, GND

J2 - Pins D9 -13 A0 - A5, AREF, AVCC, GND

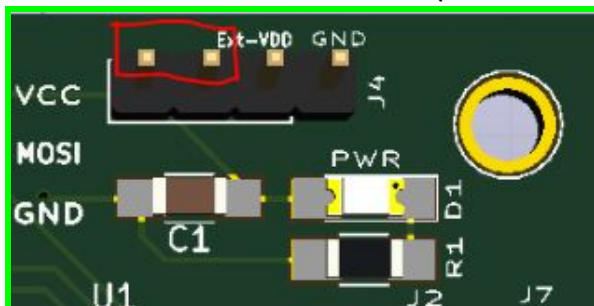


J4 - External power & GND with Jumper

Connect a jumper on Pin 1 and 2. To use External Voltage (Circled in Red in photo)

Connect +5 VCC on Pin 3 (Use 5 volt regulated power supply)

Connect - GND on Pin 4 (Use 5 volt regulated power supply)



Jumpers

J5 - RS232 TX, RX, GND - Found below Reset button



J6 - NA

J7 - AREF Voltage & Ground (Unpopulated)



J8 - 2 Pins used for external GND to breadboard or attached sensors

J9 - 2 Pins used for external +5 VCC to breadboard or attached sensors



TWI (I2C) Pins SCL & SDA



Troubleshooting Guide

No Power	Check Jumper J1 ISP to programmer cable is connected correctly.
No External Power	Check Jumper J4 for a jumper between Pins 1 & 2 next to VCC & GND
I2C Not working	Check for VCC pull up resistor. Check Microcontroller Clock speed
RS232 Not working	Check Microcontroller Clock speed Check Baud rate matches Check Cable pin TX connects to target board RX Check Cable pin RX connects to target board TX Check Cable Ground pin connects target board ground pin.
Sensors Not working	Check Clock speed