

ATmega 328P development board with 16-channel PWM

This board is Arduino compatible ATmega 328P micro controller development board with PCA9685 16 channel pulse width modulation controller. It can be used for all sorts of LED lighting and servo motor controller applications.

Powering the board

Board can be powered from 5 – 15 V DC input (barrel jack plug with center positive or screw in terminal). Input voltage goes to PWM connectors for use as power for servo motors or leds. Sixteen PWM connectors along the edge of the board uses 3-pin servo motor style pin out.

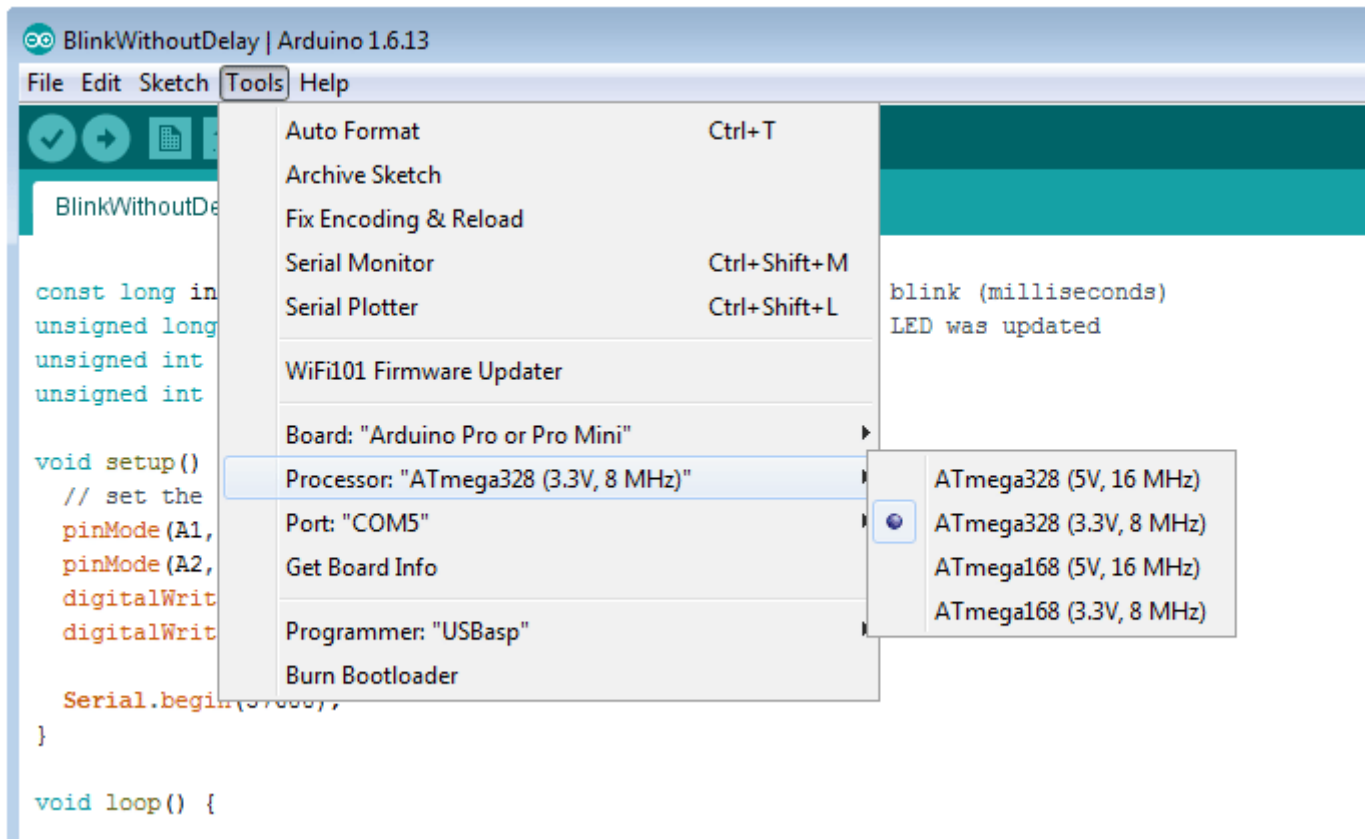
Micro controller and PWM ic runs from 3.3 V provided by on board regulator. 3.3V output is available on two pins near reset button and can provide up to 0.8 A output if required. Regulator ic will get rather hot at full power. It has thermal and short circuit protection. Power-on led lights up when 3.3V from regulator output is available.

On board 3.3 V regulator can be powered as well from serial or ICSP programming connectors 5V VCC pin. This can be used for programming and testing, but 5V from serial or ICSP connector is not connected to PWM connector voltage pins. DC input and 5V VCC on serial and ICSP connection can all be connected at the same time and board will switch power as needed.

PWM signal from PCA9685 ic can power small leds directly. PWM signal pins can source up to 10 mA or sink up to 25 mA. There are 330 ohm current limiting resistors in series with PWM signal pins so that they are protected from short circuit and leds can be connected without additional resistors. PWM signal pins can be configured as open drain outputs. In this mode if current limit of 25 mA is not exceeded and voltage on PWM pin does not rise above 5V pins can directly control small power 12V LED strips. There are more details in PCA9685 datasheet section "Using the PCA9685 with and without external drivers". If you need help with any specific configuration I might be able to help.

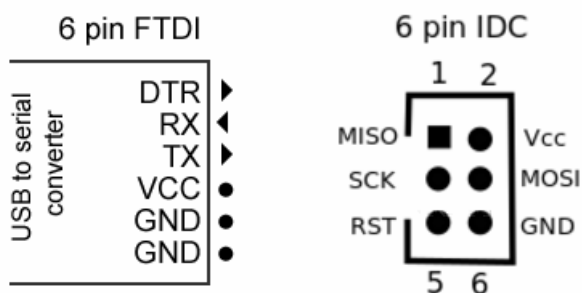
Programming and using the board

Micro controller runs at 3.3V volts and uses 8 Mhz oscillator as clock source. All MCU pins are available along the side of the board and are labeled according to Arduino pin names. These pins can be used with 3.3V signals only. Applying 5V to these pins will most likely damage inputs. For programming with Arduino IDE use USB to serial connector and select the board as "Arduino Pro or Pro Mini" with ATmega328 8Mhz processor.



Both serial and ICSP programming connectors can use 3.3V or 5V signals. There are signal level converters on board for these two connections, so in any case ATmega receives 3.3V signal levels. Level converters are powered from corresponding VCC pin on serial or ICSP connector and this means that for connection to work VCC voltage must be present on corresponding connector. If ICSP programmer does not provide voltage to VCC pin, connection will not work. AVRISP mkII is one of programmers that do not provide voltage output on ICSP VCC pin.

Serial connection uses 6 pin Sparkfun FTDI style pin out and ICSP connection uses standard 6 pin IDC programming pin out. Verify correct orientation of FTDI adapter. Pin 1 on ICSP connection is marked by dot.



For USB serial adapters using FTDI chip drivers can be found here:
<https://www.ftdichip.com/Drivers/VCP.htm>

Pin functions and DIP switch for setting I2C address

PCA9685 ic has separate output enable input that is wired to D2 pin labeled as D2 OE on board. Output enable of PCA9685 is active low. There is pull down resistor connected to this line and by default outputs of PCA9685 are enabled. To use output enable or disable function from code configure Arduino D2 pin as output and set it high to disable PCA9685 outputs all at once. This also means that D2 pin cannot be used for any other function. If pin is not configured as output, connecting D2 OE pin straight to 3.3V output pin can be used to disable all PWM outputs in case of some error.

Pins A4 and A5 are tied to I2C connection with pull up resistors. These pins cannot be used for any function other than I2C. By using on board dip switch PCA9685 I2C address can be changed in the range from 0x40 to 0x47. With all dip switches off I2C address is 0x40.

I2C addr	SW3	SW2	SW1
0x40	0	0	0
0x41	0	0	1
0x42	0	1	0
0x43	0	1	1
0x44	1	0	0
0x45	1	0	1
0x46	1	1	0
0x47	1	1	1

Pin D0 has micro controller UART RX function and pin D1 has micro controller UART TX function. Led is connected to pin D13 that is also SPI and programming SCK. Pins D11, 12, 13 are used form SPI and ICSP programming connection. These all are standard Arduino pin connections.

For coding PCA9685 Adafruit PWM Servo Driver Library can be used, however, registers can be written to PCA9685 using Arduino Wire class without any custom library. There are several example Arduino sketches files provided. Schematic and example files are available in GitHub page: https://github.com/kristspo/ATmega328P_with_PCA9685 .

Led fade PCA.ino – fades leds connected to pwm outputs in and out without using custom library. Can use linear or adjusted fade curve.

Servo PCA Knob.ino – controls one or more servos from potentiometer attached to analog pin. Uses Adafruit PWM Servo Driver Library.

Servo PCA fom SD.ino – controls one or more servos from data file located on SD card using Arduino SD class. Uses Adafruit PWM Servo Driver Library.

If you need to develop custom code using Arduino IDE or Atmel Studio, let me know and I might be able to help. Thanks for interest in this product and I hope you will find this board useful for your projects.