ARDUINO ARCHITECTURE

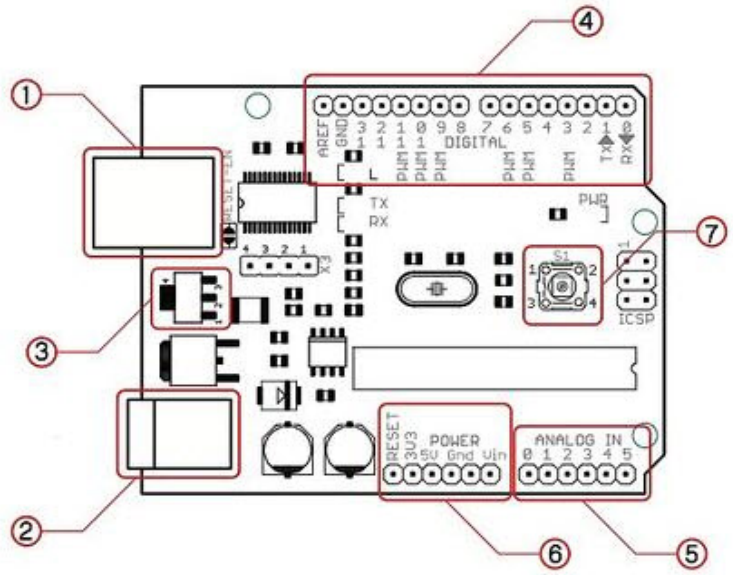
JUSTIN BYERS

WHAT IS AN ARDUINO?

- Microcontroller-based prototyping kit
- Easy to use, low cost board for students, hobbyists & professionals
- Many different board types and revisions exist
- Also – a software API and development environment
- Board layout and software is open source

TECHNOLOGY - UNO

- The Uno is one of the most popular Arduinos available
- Based on the Atmel ATmega328 microcontroller
- 14 I/O pins
- USB & power connectors
- 16MHz clock speed

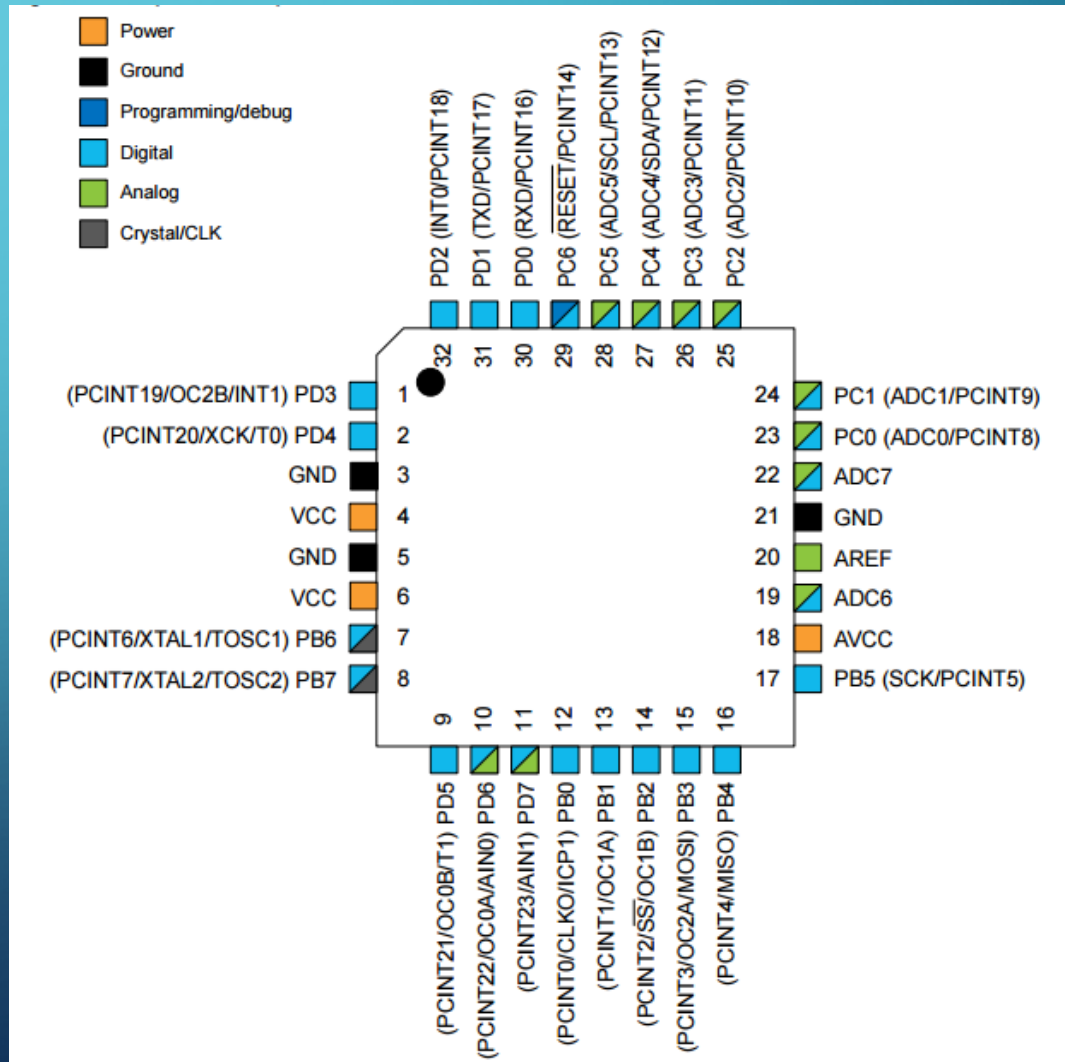


The most important parts on the Arduino board high lighted in red:

1: USB connector
2: Power connector
3: Automatic power switch
4: Digital pins
5: Analog pins
6: Power pins
7: Reset switch

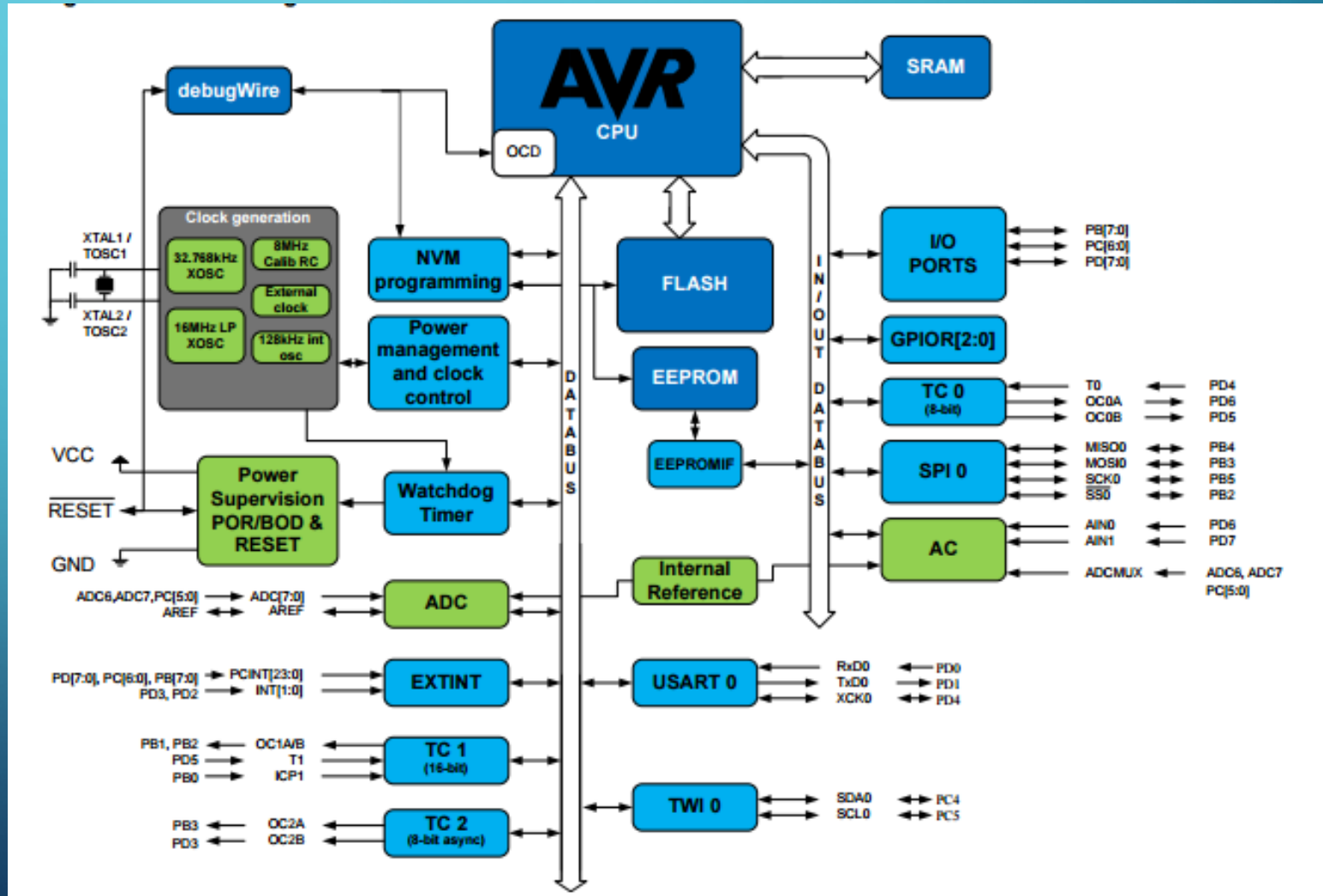
ATMEGA328

- 8-bit AVR RISC-based microcontroller
- 32KB program flash memory
- 1KB EEPROM
- 2KB SRAM
- 20MHz max clock frequency
- 23 GPIO pins



ATMEGA328 – CONTINUED

- 32 general purpose registers
- 3 timers/counters
- Internal & external interrupts
- USUART
- 2-wire serial interface
- SPI port
- 6-channel 10-bit A2D



AVR ARCHITECTURE

- Harvard architecture
  - Separate memories & buses for program and data
- Instructions executed in single-level pipeline
- Fast-access register file
  - 32 x 8 bit general purpose registers
  - Single clock cycle access time
    - Single cycle ALU operation

AVR ARCHITECTURE - ISA

- Supports arithmetic and logic operations between registers or between a register and a constant
- Supports single register operations
- Updates status register after arithmetic operations
- Most AVR instructions are 16-bit but can support 32-bit instructions
- Interrupts and subroutines
  - PC stored on the stack
    - Allocated in SRAM
    - Only limited by total SRAM size
    - User programs MUST initialize the SP in reset routine

AVR ARCHITECTURE – PROGRAM MEMORY

- Split into boot and application memory
- Boot Memory
  - Contains the primary reset vector & starts on chip power up
  - Configures hardware are branches into application memory
  - Can program the application flash memory
- Application Memory
  - Contains the user program
  - Has separate reset vector branched to by boot memory

AVR USAGE IN ARDUINO BOARDS

- ATmega8
- ATmega168
- ATmega328
- ATmega1280
- ATmega2560
- Many different Arduino boards with different Atmega microcontrollers
- All are based on the AVR architecture

DIFFERENCE BETWEEN ARDUINO BOARDS

- Microcontroller used
  - Memory
  - Clock speed
  - Max program size
  - Available RAM
- # of and type of pins
  - Digital
  - Analog
  - PWM
- Board features

REFERENCES

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- https://en.wikipedia.org/wiki/Arduino