BBM432
Embedded Systems

week-2

Computers, Microcontrollers and Arduino UNO - Atmel ATMega328P

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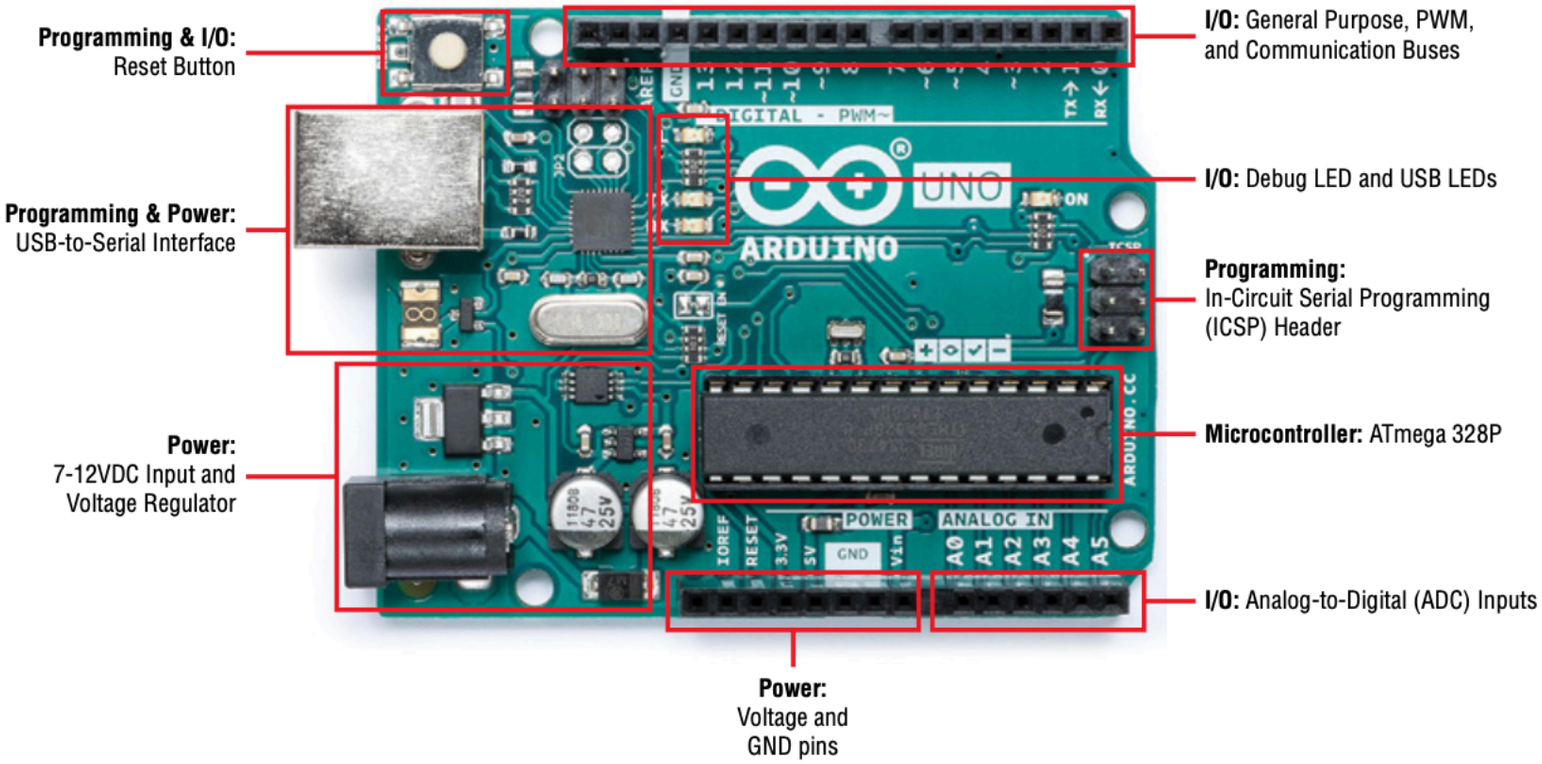
2021

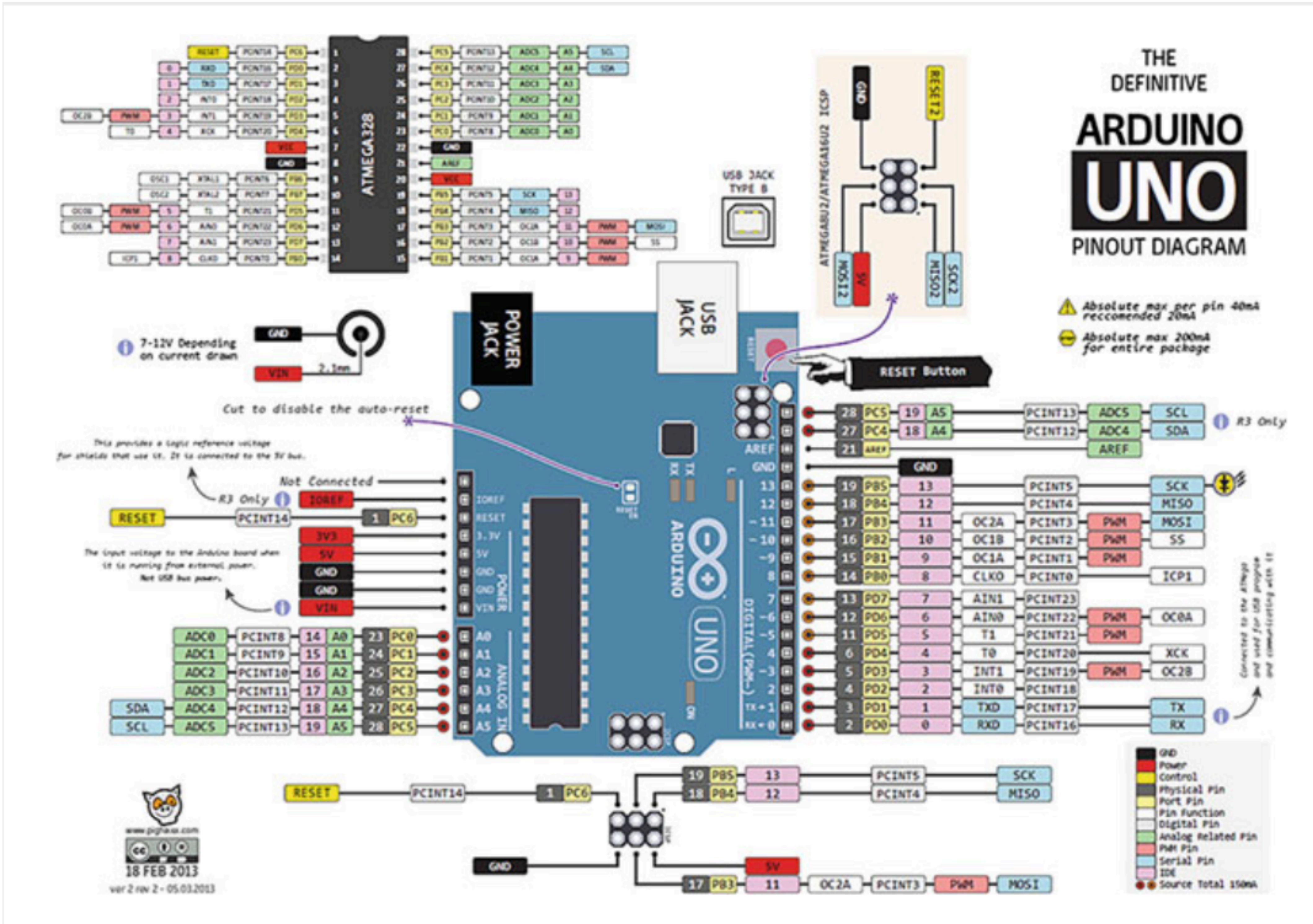
- **Microcontroller: At the heart of every Arduino is a microcontroller. This is the brain of your Arduino. ATMega386P**

- **Programming: Programming interfaces enable you to load software onto your Arduino.**

- **I/O: Input/Output (I/O) circuitry is what enables your Arduino interface with sensors, actuators, etc.**

- **Power: There are a variety of ways to supply power to an Arduino. Most Arduino boards can automatically switch between power from multiple sources (such as USB and a battery).**


Programming & I/O: Reset Button
Programming & Power: USB-to-Serial Interface
Power: 7-12VDC Input and Voltage Regulator
I/O: General Purpose, PWM, and Communication Buses
I/O: Debug LED and USB LEDs
Programming: In-Circuit Serial Programming (ICSP) Header
Microcontroller: ATmega 328P
I/O: Analog-to-Digital (ADC) Inputs
Power: Voltage and GND pins
DIGITAL - PWM~
UNO
ARDUINO
POWER
ANALOG IN
IOREF
RESET
3.3V
5V
GND
Vin
A0
A1
A2
A3
A4
A5


THE DEFINITIVE
ARDUINO
UNO
PINOUT DIAGRAM
Absolute max per pin 40mA reccomended 20mA
Absolute max 200mA for entire package
ATMEGA328
ATMEGA8U2/ATMEGA16U2 ICSP
GND
RESET2
5V
MOSI2
MISO2
SCK2
USB JACK TYPE B
POWER JACK
USB JACK
RESET Button
7-12V Depending on current drawn
GND
VIN
2.1mm
Cut to disable the auto-reset
This provides a logic reference voltage for shields that use it. It is connected to the 5V bus.
Not Connected
R3 Only
IOREF
RESET
PCINT14
PC6
3V3
5V
GND
VIN
The input voltage to the Arduino board when it is running from external power. Not USB bus power.
ADC0
ADC1
ADC2
ADC3
ADC4
ADC5
SDA
SCL
PCINT8
PCINT9
PCINT10
PCINT11
PCINT12
PCINT13
A0
A1
A2
A3
A4
A5
PC0
PC1
PC2
PC3
PC4
PC5
POWER
ANALOG IN
ARDUINO
UNO
DIGITAL (PWM~)
AREF
GND
PC5
PC4
A5
A4
ADC5
ADC4
SCL
SDA
R3 Only
PB5
PB4
PB3
PB2
PB1
PB0
PD7
PD6
PD5
PD4
PD3
PD2
PD1
PD0
OC2A
OC1B
OC1A
CLKO
AIN1
AIN0
T1
T0
INT1
INT0
TXD
RXD
PCINT5
PCINT4
PCINT3
PCINT2
PCINT1
PCINT0
PCINT23
PCINT22
PCINT21
PCINT20
PCINT19
PCINT18
PCINT17
PCINT16
PWM
SCK
MISO
MOSI
SS
ICP1
OC0A
XCK
OC2B
TX
RX
GND
Power
Control
Physical Pin
Port Pin
Pin Function
Digital Pin
Analog Related Pin
PWM Pin
Serial Pin
IDE
Source Total 150mA
www.pighixxx.com
18 FEB 2013
ver 2 rev 2 - 05.03.2013

Arduino(TM) UNO Rev3

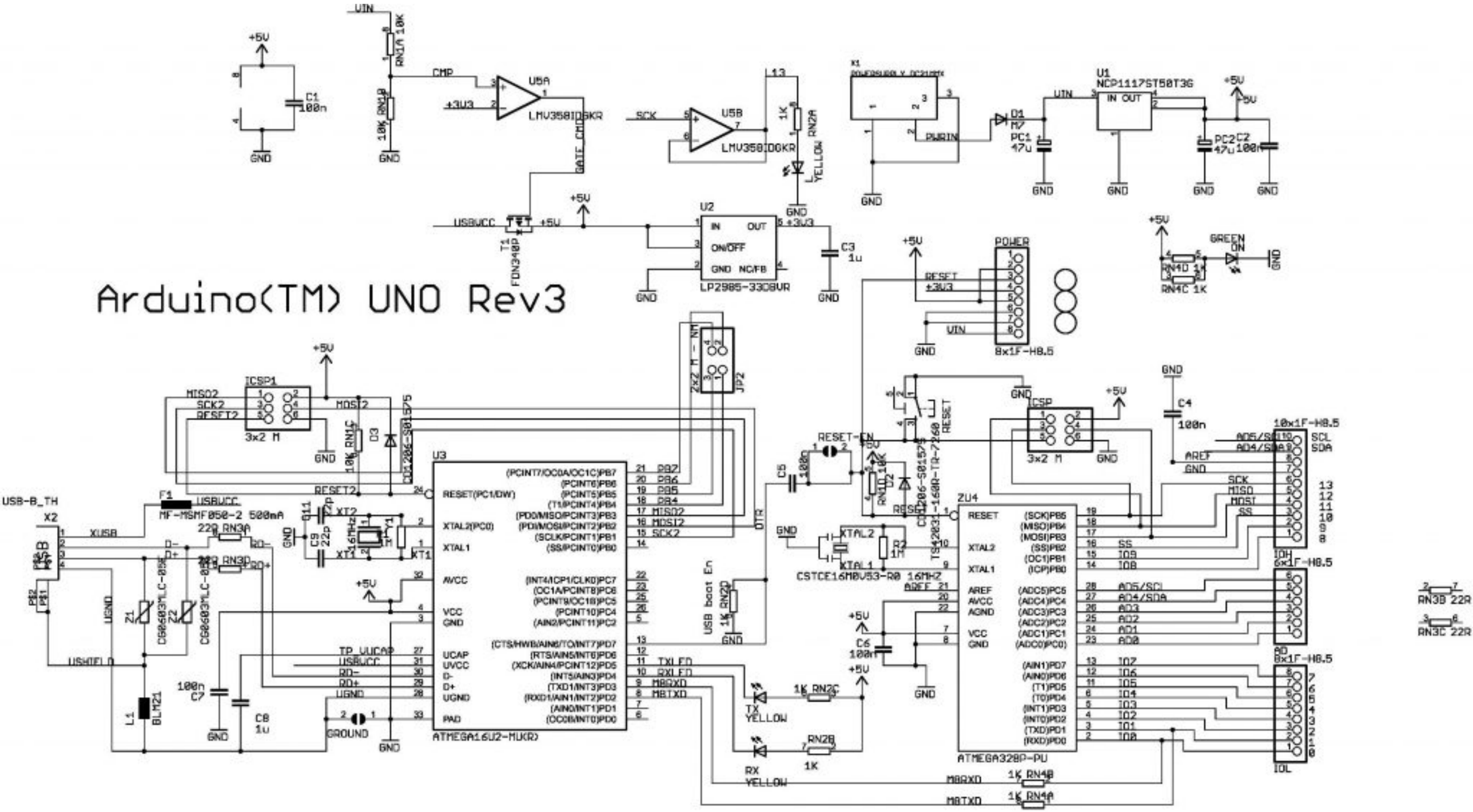


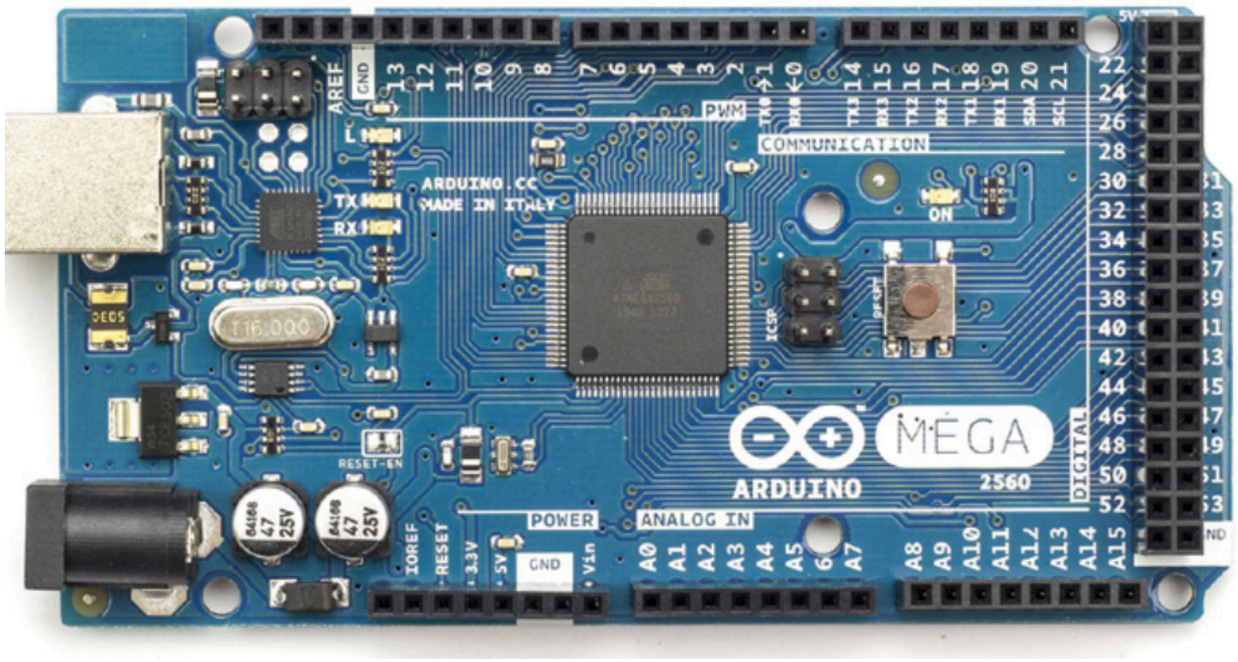
Figure 1-2: AVRISP mkII programmer

Credit: © Microchip Technology Incorporated. Used with permission.

Bootloaders;

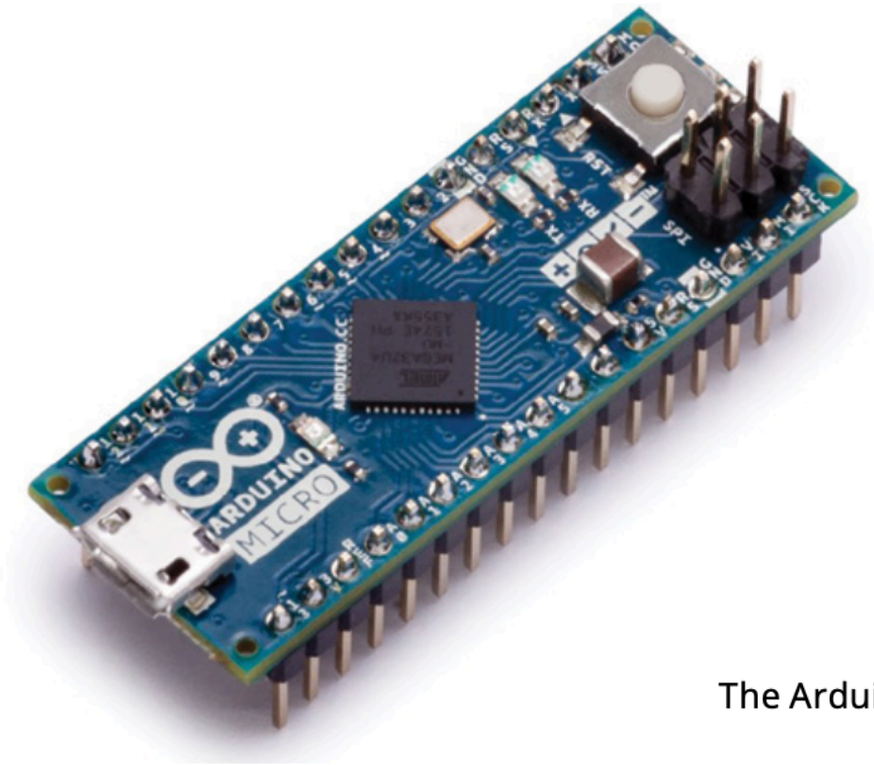
Enable simple programming via USB with no external hardware.

- Valuable program space. 2 KB of space taken up by the bootloader.
- Using a bootloader means that your program will always be delayed by afew seconds at bootup as the bootloader checks for a programming request.
  If you have a programmer, you can remove the bootloader from your ATmega and program it directly by connecting your programmer to the ICSP header and using the Upload “Using Programmer “ command from within the IDE.

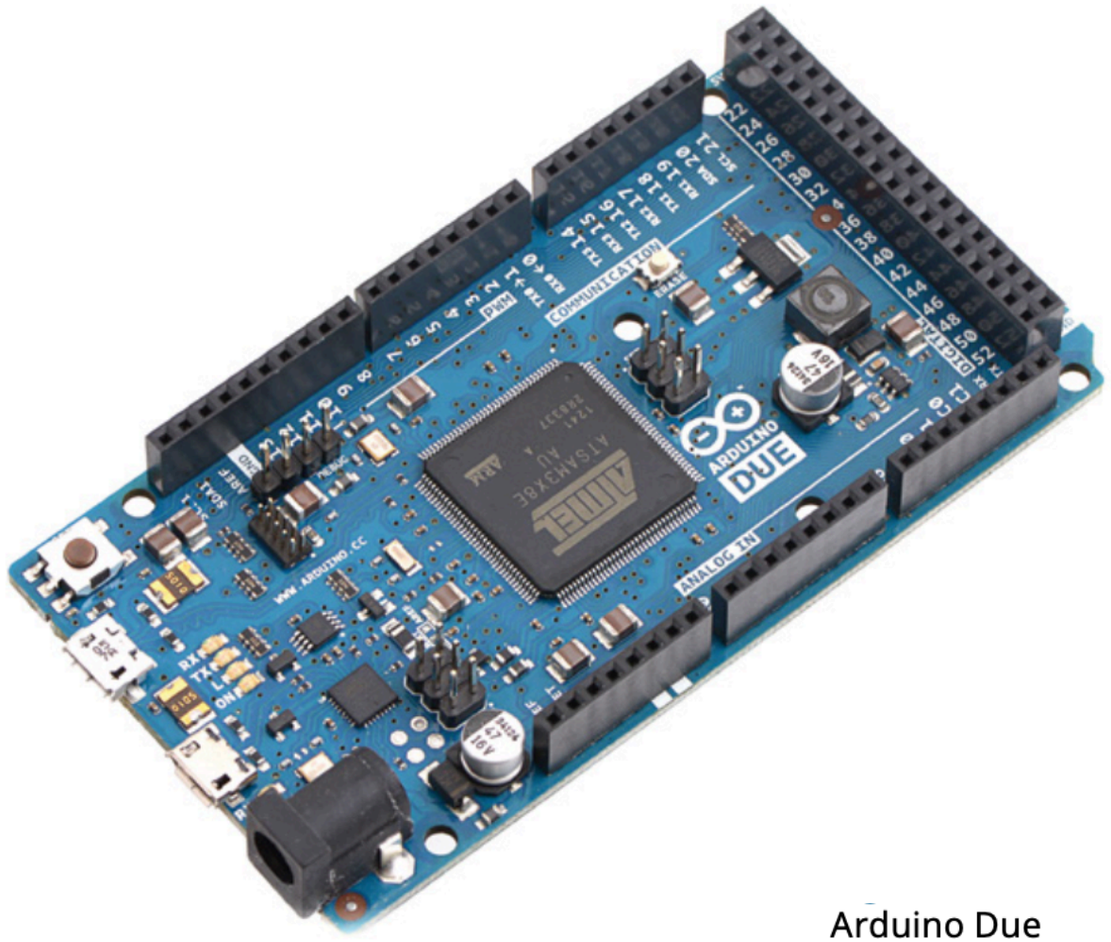


The Arduino Mega 2560

The Arduino Leonardo

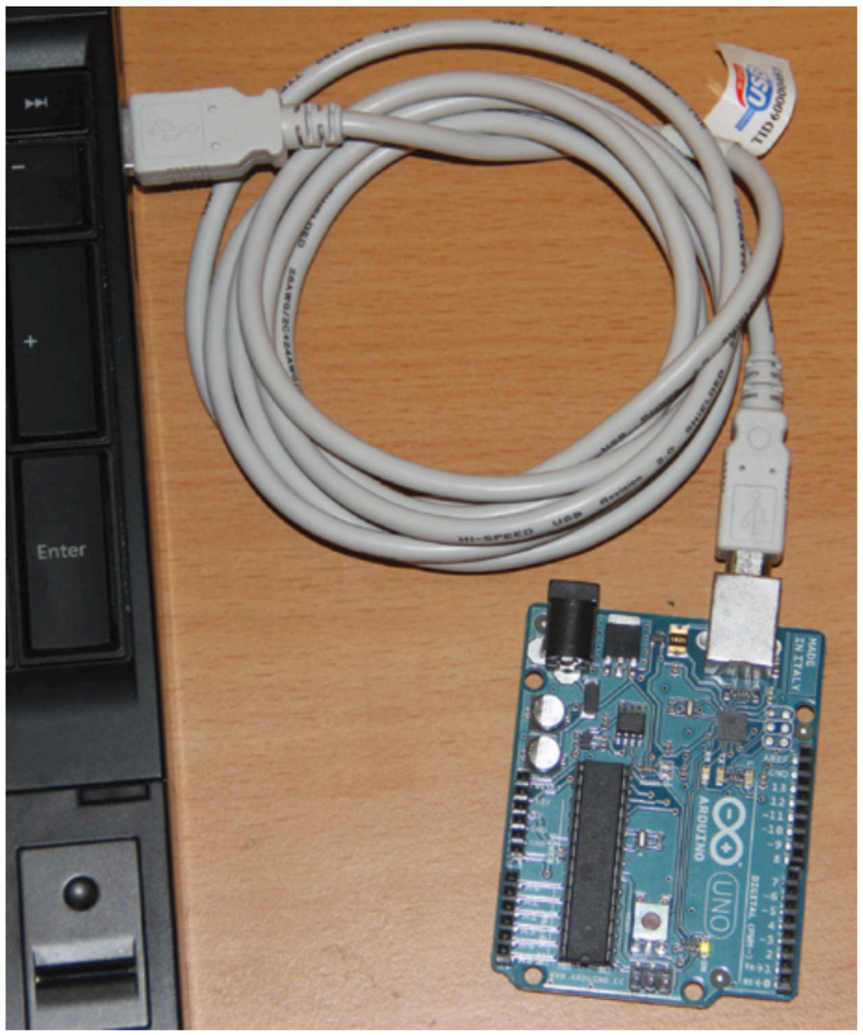


The Arduino Micro

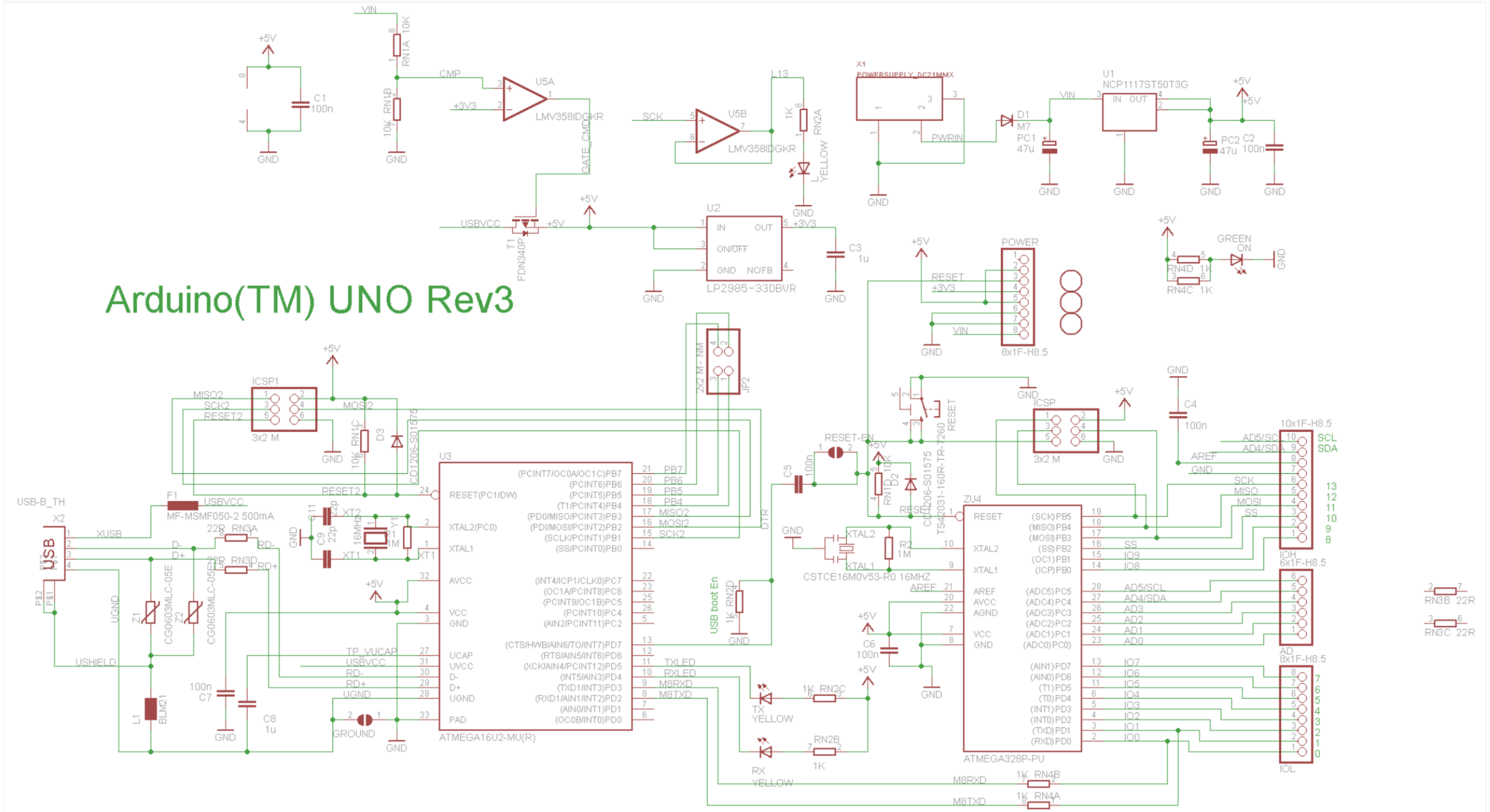

ARDUINO
DUE
ATMEL
ATSAM3X8E
ANALOG IN
COMMUNICATION
DIGITAL
PWM
WWW.ARDUINO.CC

Arduino Due

The Arduino.cc page where you can download the Arduino IDE



Arduino Uno connected to a computer via USB

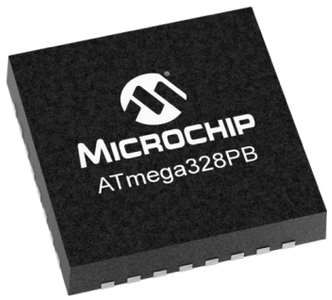


Atmel

8-bit AVR Microcontrollers

ATmega328/P

DATASHEET COMPLETE



ATmega328PB ☆

Status: In Production

View Datasheets

Features:

- 131 Powerful Instructions
- Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Fully Static Operation
- Up to 20 MIPS Throughput at 20MHz
- On-Chip 2-Cycle Multiplier

Introduction

The Atmel® picoPower® ATmega328/P is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328/P achieves throughputs close to 1MIPS per MHz. This empowers system designer to optimize the device for power consumption versus processing speed.

Feature

High Performance, Low Power Atmel®AVR® 8-Bit Microcontroller Family

- Advanced RISC Architecture
  - 131 Powerful Instructions
  - Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 20 MIPS Throughput at 20MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
  - 32KBytes of In-System Self-Programmable Flash program Memory
  - 1KBytes EEPROM
  - 2KBytes Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data Retention: 20 years at 85°C/100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
  - Programming Lock for Software Security
- Atmel® QTouch® Library Support
  - Capacitive Touch Buttons, Sliders and Wheels
  - QTouch and QMatrix® Acquisition
  - Up to 64 sense channels

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13

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Application Notes

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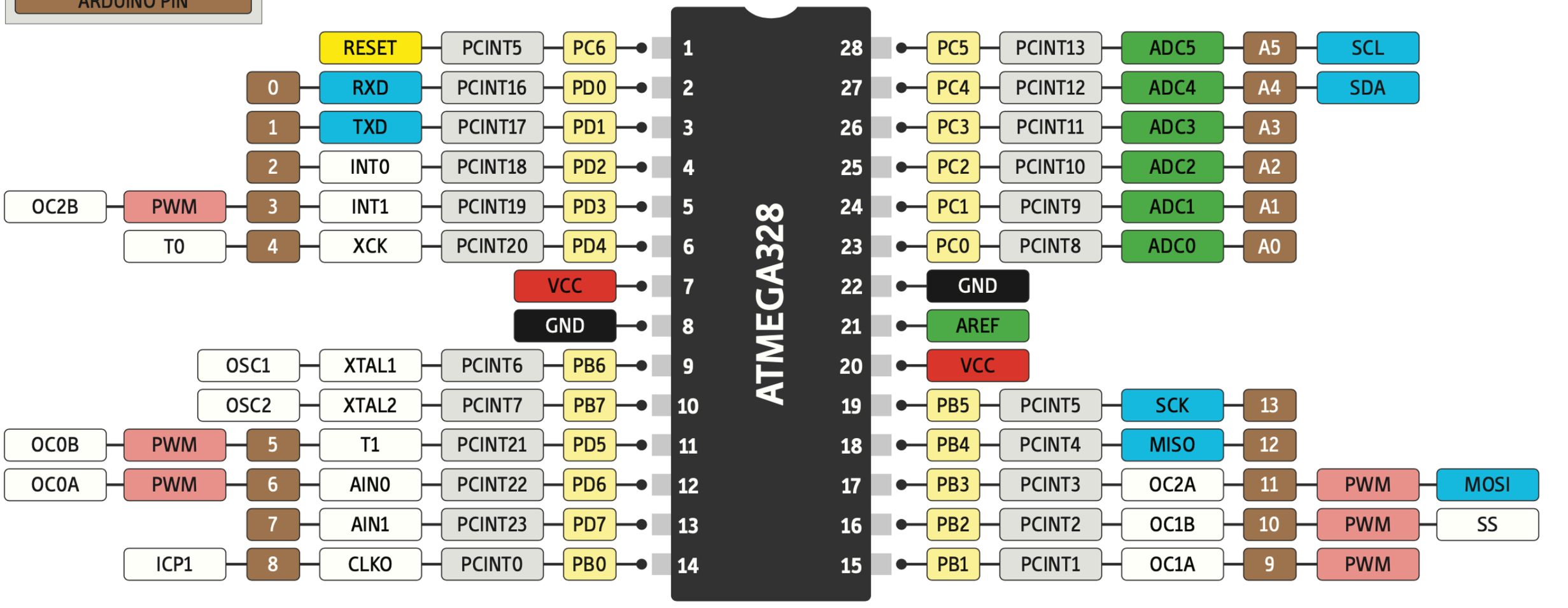
LEGEND

- GND
- POWER
- CONTROL
- PORT PIN
- ATMEGA328 PIN FUNC
- DIGITAL PIN
- ANALOG-RELATED PIN
- PWM PIN
- SERIAL PIN
- ARDUINO PIN

THE UNOFFICIAL ARDUINO & ATMEGA328 PINOUT DIAGRAM



In this lecture you learned about the following:

- All of the components that comprise an Arduino board
- HowtheArduinobootloaderallowsyoutoprogramArduinofirmwareovera USB connection
- The differences between the various Arduino boards
- How to connect and install the Arduino with your system
- How to load and run your first program