

Arduino Programming

Cheat Sheet

Primary source: Arduino Language Reference
<https://www.arduino.cc/reference/en/>

Structure & Flow

```
Basic Program Structure
void setup() {
  // Runs once when sketch starts
}
void loop() {
  // Runs repeatedly
}
Control Structures
if (x < 5) { ... } else { ... }
while (x < 5) { ... }
for (int i = 0; i < 10; i++) { ... }
break; // Exit a loop immediately
continue; // Go to next iteration
switch (var) {
  case 1:
    ...
  break;
  case 2:
    ...
  break;
  default:
    ...
}
return x; // x must match return type
return; // For void return type
```

Function Definitions
<ret. type> <name>(<params>) { ... }
e.g. int double(int x) {return x*2;}

Operators

General Operators
= assignment
+ add - subtract
* multiply / divide
% modulo
== equal to != not equal to
< less than > greater than
<= less than or equal to
>= greater than or equal to
&& and || or
! not

Compound Operators
++ increment
-- decrement
+= compound addition
-= compound subtraction
*= compound multiplication
/= compound division
&= compound bitwise and
|= compound bitwise or

Bitwise Operators
& bitwise and | bitwise or
^ bitwise xor ~ bitwise not
<< shift left >> shift right

Pointer Access
& reference: get a pointer
* dereference: follow a pointer

Built-in Functions

Pin Input/Output
Digital I/O - pins 0-13 A0-A5
pinMode(pin, {INPUT|OUTPUT|INPUT_PULLUP})
int digitalWrite(pin)
digitalWrite(pin, {HIGH|LOW})

Analog In - pins A0-A5
int analogRead(pin)
analogReference({DEFAULT|INTERNAL|EXTERNAL})

PWM Out - pins 3 5 6 9 10 11
analogWrite(pin, value) // 0-255

Advanced I/O
tone(pin, freq_Hz, [duration_msec])
noTone(pin)
shiftOut(dataPin, clockPin, {MSBFIRST|LSBFIRST}, value)
shiftIn(dataPin, clockPin, {MSBFIRST|LSBFIRST})
unsigned long pulseIn(pin, {HIGH|LOW}, [timeout_usec])

Time
unsigned long millis()
// Overflows at 50 days
unsigned long micros()
// Overflows at 70 minutes
delay(msec)
delayMicroseconds(usec)

Math
min(x, y) max(x, y) abs(x)
sin(rad) cos(rad) tan(rad)
sqrt(x) pow(base, exponent)
constrain(x, minval, maxval)
map(val, fromL, fromH, toL, toH)

Random Numbers
randomSeed(seed) // long or int
long random(max) // 0 to max-1
long random(min, max)

Bits and Bytes
lowByte(x) highByte(x)
bitRead(x, bitn)
bitWrite(x, bitn, bit)
bitSet(x, bitn)
bitClear(x, bitn)
bit(bitn) // bitn: 0=LSB 7=MSB

Type Conversions
char(val) byte(val)
int(val) word(val)
long(val) float(val)

External Interrupts
attachInterrupt(interrupt, func, {LOW|CHANGE|RISING|FALLING})
detachInterrupt(interrupt)
interrupts()
noInterrupts()

Libraries

Serial - comm. with PC or via RX/TX
begin(long speed) // Up to 115200
end()
int available() // #bytes available
int read() // -1 if none available
int peek() // Read w/o removing
flush()
print(data) println(data)
write(byte) write(char * string)
write(byte * data, size)
SerialEvent() // Called if data rdy

SoftwareSerial.h - comm. on any pin
SoftwareSerial(rxPin, txPin)
begin(long speed) // Up to 115200
listen() // Only 1 can listen
isListening() // at a time.
read, peek, print, println, write
// Equivalent to Serial library

EEPROM.h - access non-volatile memory
byte read(addr)
write(addr, byte)
EEPROM[index] // Access as array

Servo.h - control servo motors
attach(pin, [min_usec, max_usec])
write(angle) // 0 to 180
writeMicroseconds(us)
// 1000-2000; 1500 is midpoint
int read() // 0 to 180
bool attached()
detach()

Wire.h - I²C communication.
begin() // Join a master
begin(addr) // Join a slave @ addr
requestFrom(addr, count)
beginTransmission(addr) // Step 1
send(byte) // Step 2
send(char * string)
send(byte * data, size) // Step 3
endTransmission() // #bytes available
int available() // Get next byte
byte receive() // Get next byte
onReceive(handler)
onRequest(handler)

Variables, Arrays, and Data

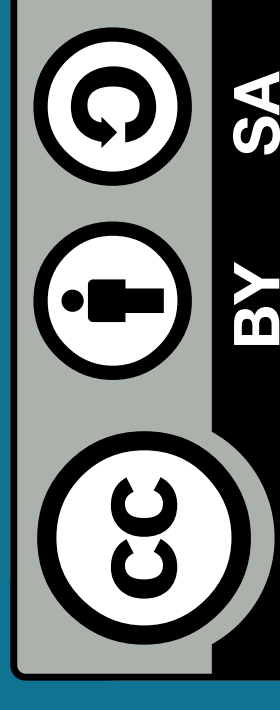
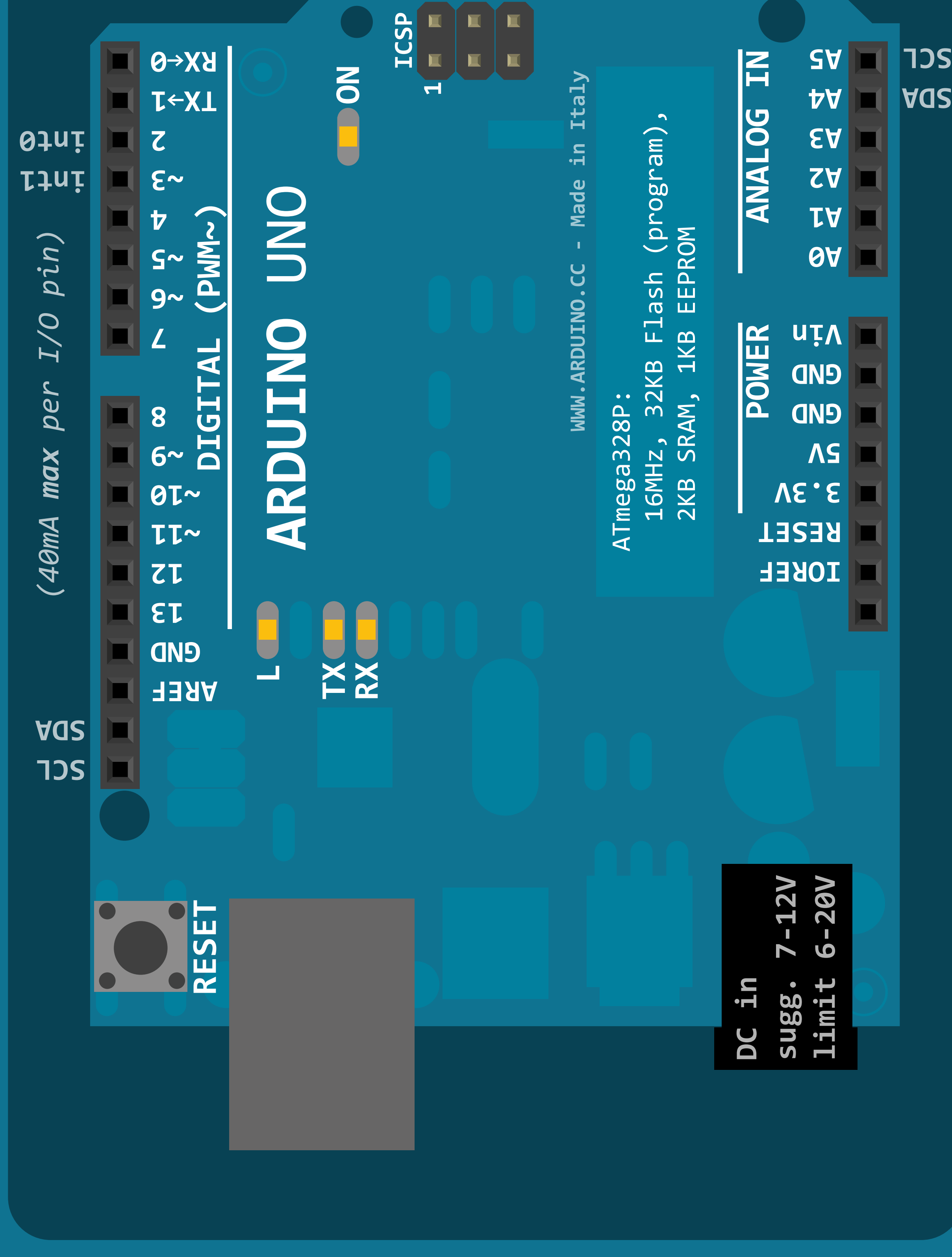
Data Types
bool true | false
char -128 - 127, 'a' '\$' etc.
unsigned char 0 - 255
byte 0 - 255
int -32768 - 32767
unsigned int 0 - 65535
word 0 - 65535
long -2147483648 - 2147483647
unsigned long 0 - 4294967295
float -3.4028e+38 - 3.4028e+38
double currently same as float
void return type: no return value

Strings
char str1[8] = {'A','r','d','u','i','n','o','\0'};
// Includes \0 null termination
char str2[8] = {'A','r','d','u','i','n','o'};
// Compiler adds null termination
char str3[] = "Arduino";
char str4[8] = "Arduino";

Numeric Constants
123 decimal
0b0111011 binary
0173 octal - base 8
0x7B hexadecimal - base 16
123U force unsigned
123L force long
123UL force unsigned long
123.0 force floating point
1.23e6 1.23*10^6 = 1230000

Qualifiers
static persists between calls
volatile in RAM (nice for ISR)
const read-only
PROGRAMM in flash

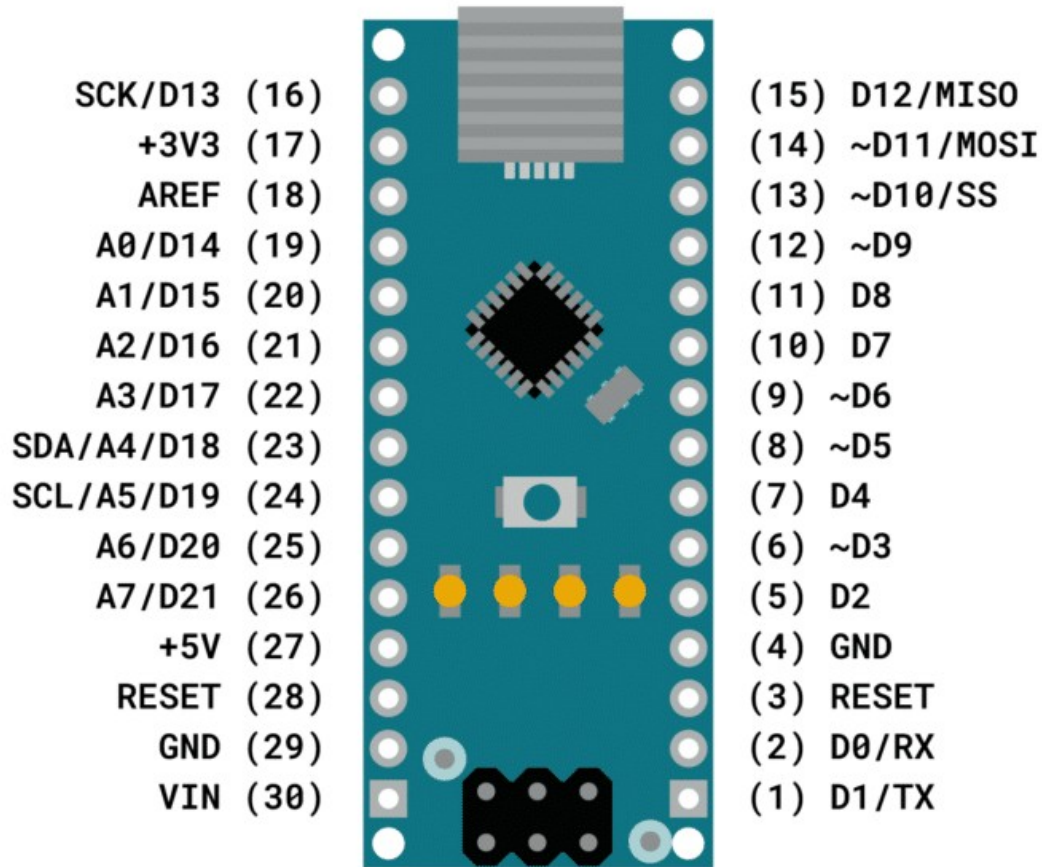
Arrays
byte myPins[] = {2, 4, 8, 3, 6};
int myInts[6]; // Array of 6 ints
myInts[0] = 42; // Assigning first
// index of myInts
myInts[6] = 12; // ERROR! Indexes
// are 0 though 5



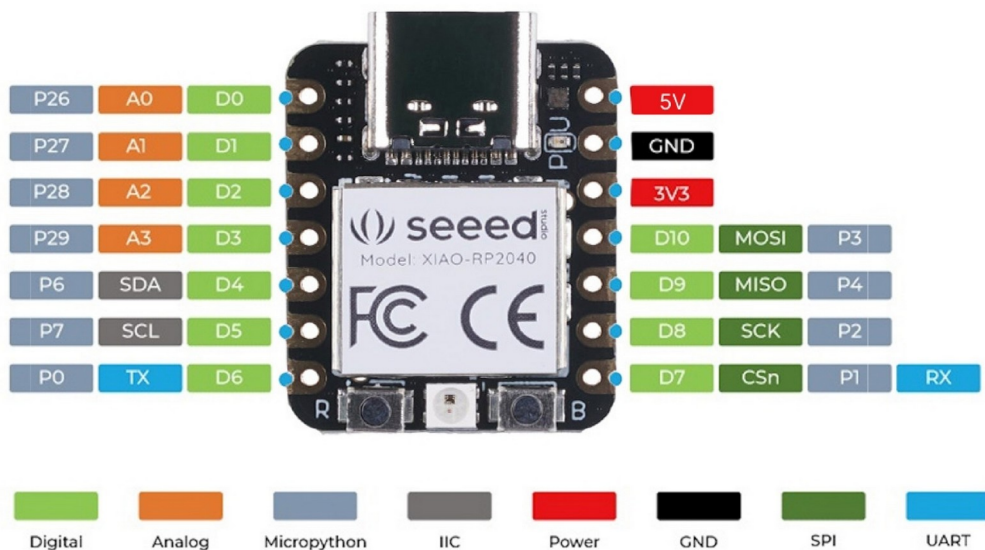
by Mark Liffiton
version: 2024-02-14

source: <https://github.com/liffiton/Arduino-Cheat-Sheet/>
Adapted from:
- Original: Gavin Smith
- SVG version: Frederic Dufourg
- Arduino board drawing: Fritzing.org

Arduino Nano Pinout



Seed Studio Xiao RP2040 Pinout



Phil's Useful Web Links

- Arduino Cookbook: <https://tech.munts.com/cookbook>
- Arduino Framework for ARM MCU Platforms: <https://github.com/pmunts/arm-mcu/tree/main/arduino>
- Arduino Framework for AVR MCU Platforms: <https://git.munts.com/avr-mcu/arduino>