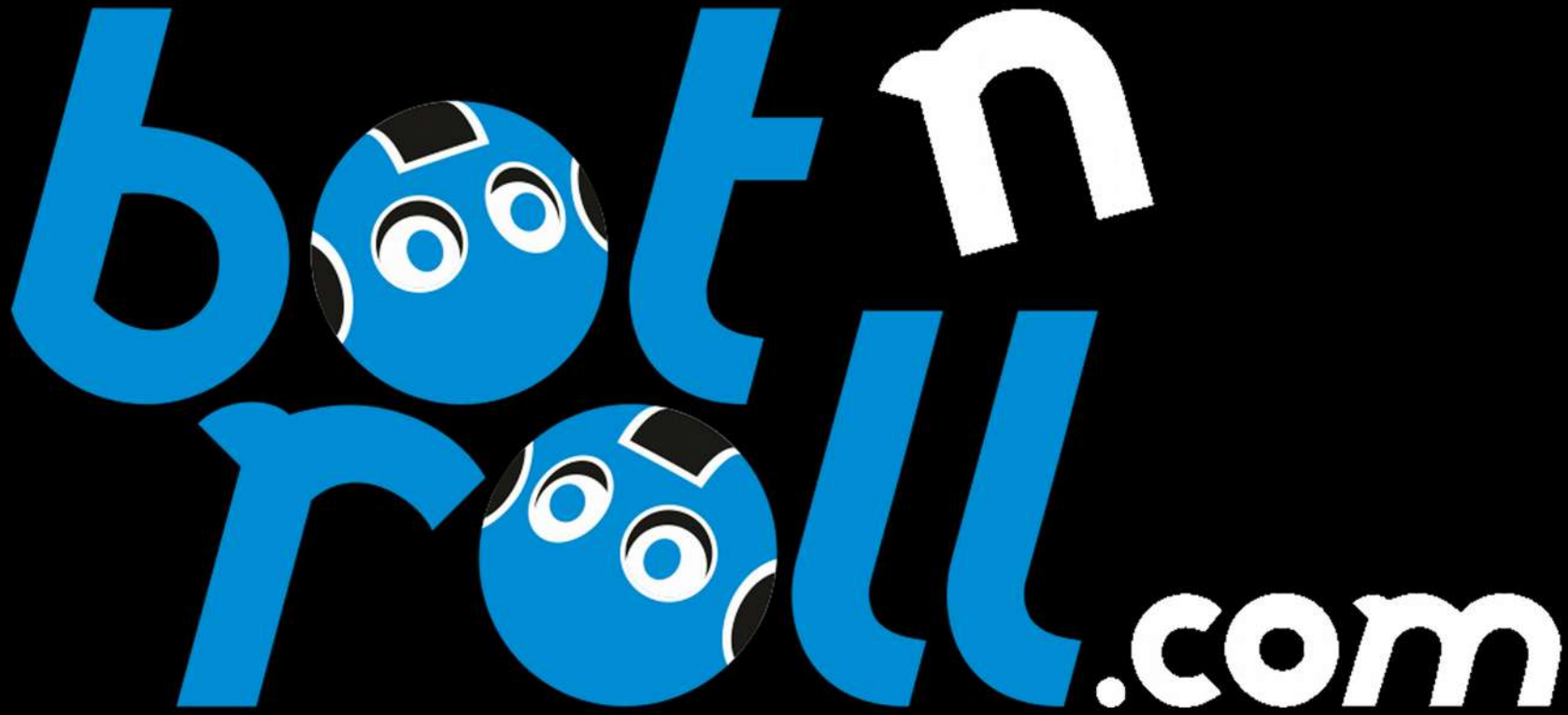

build your own robot

José Cruz

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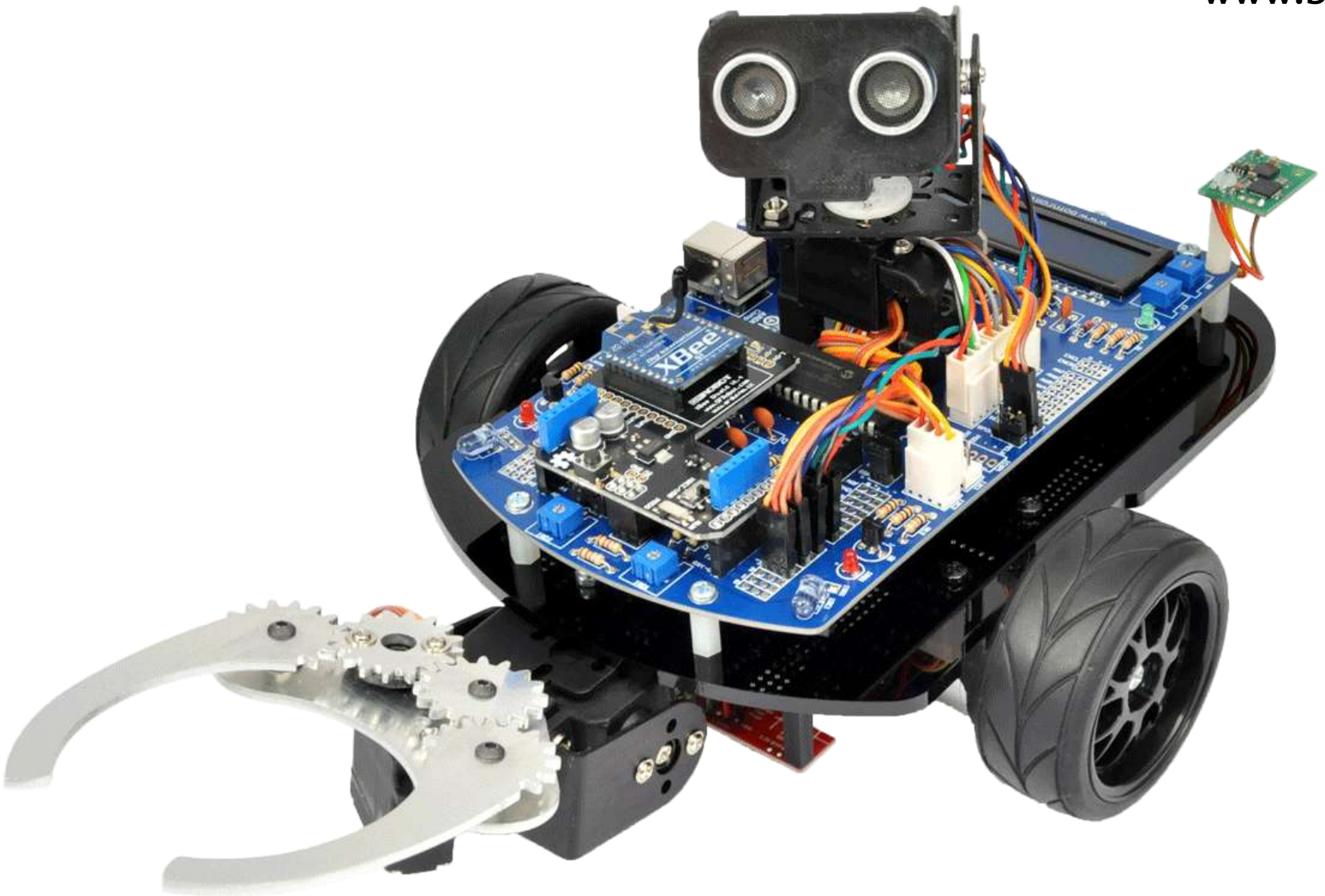

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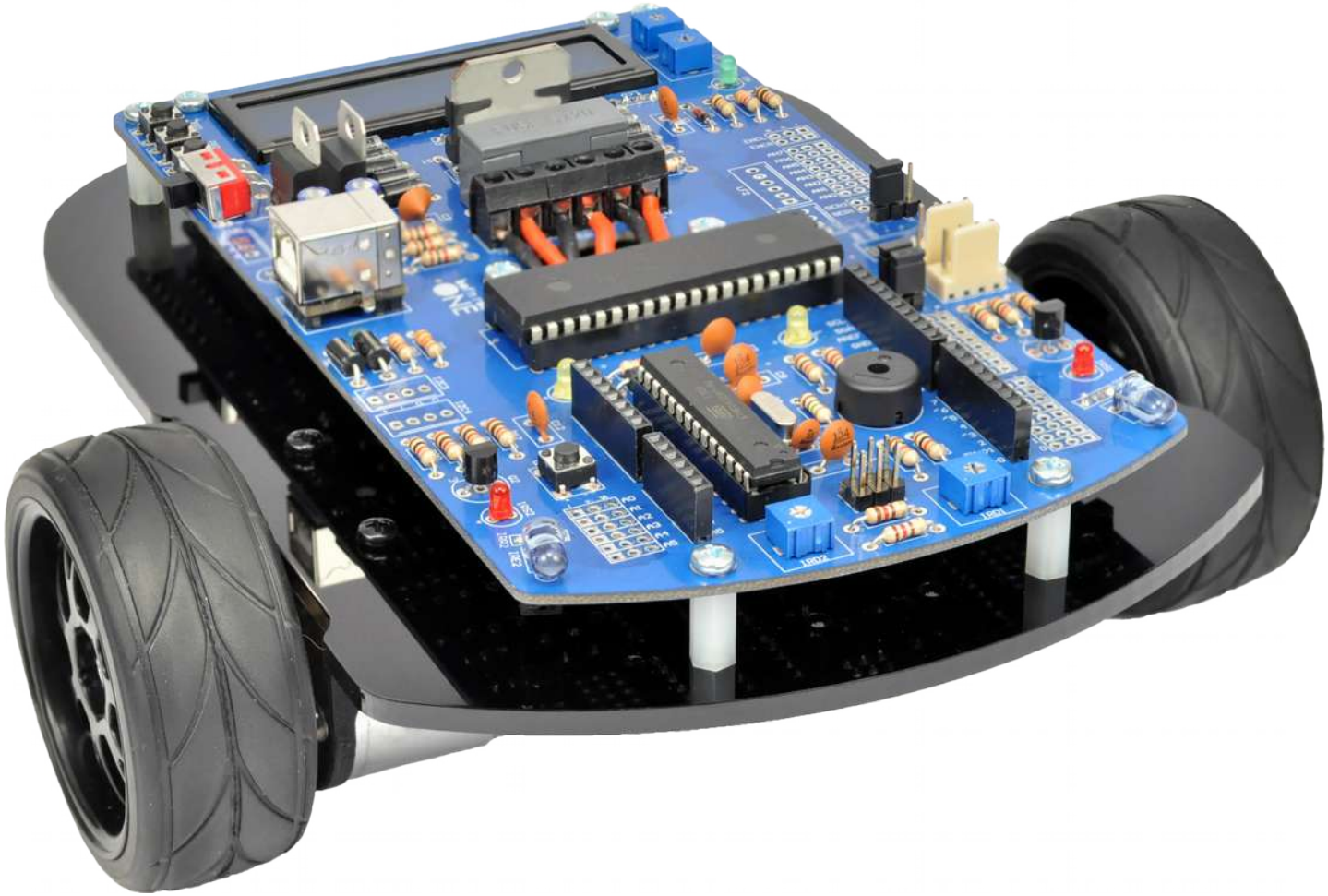

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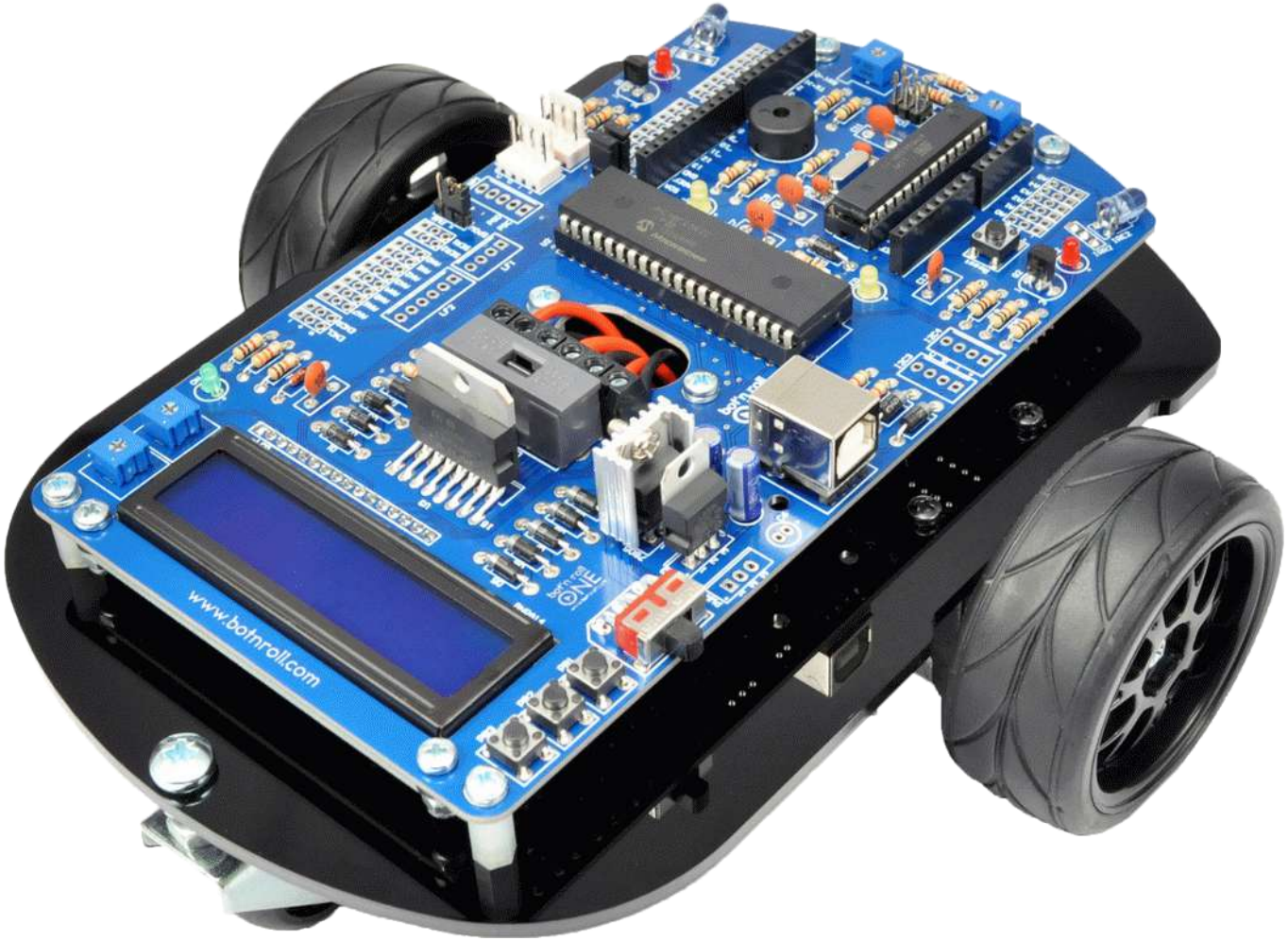

ONE A - Main Features

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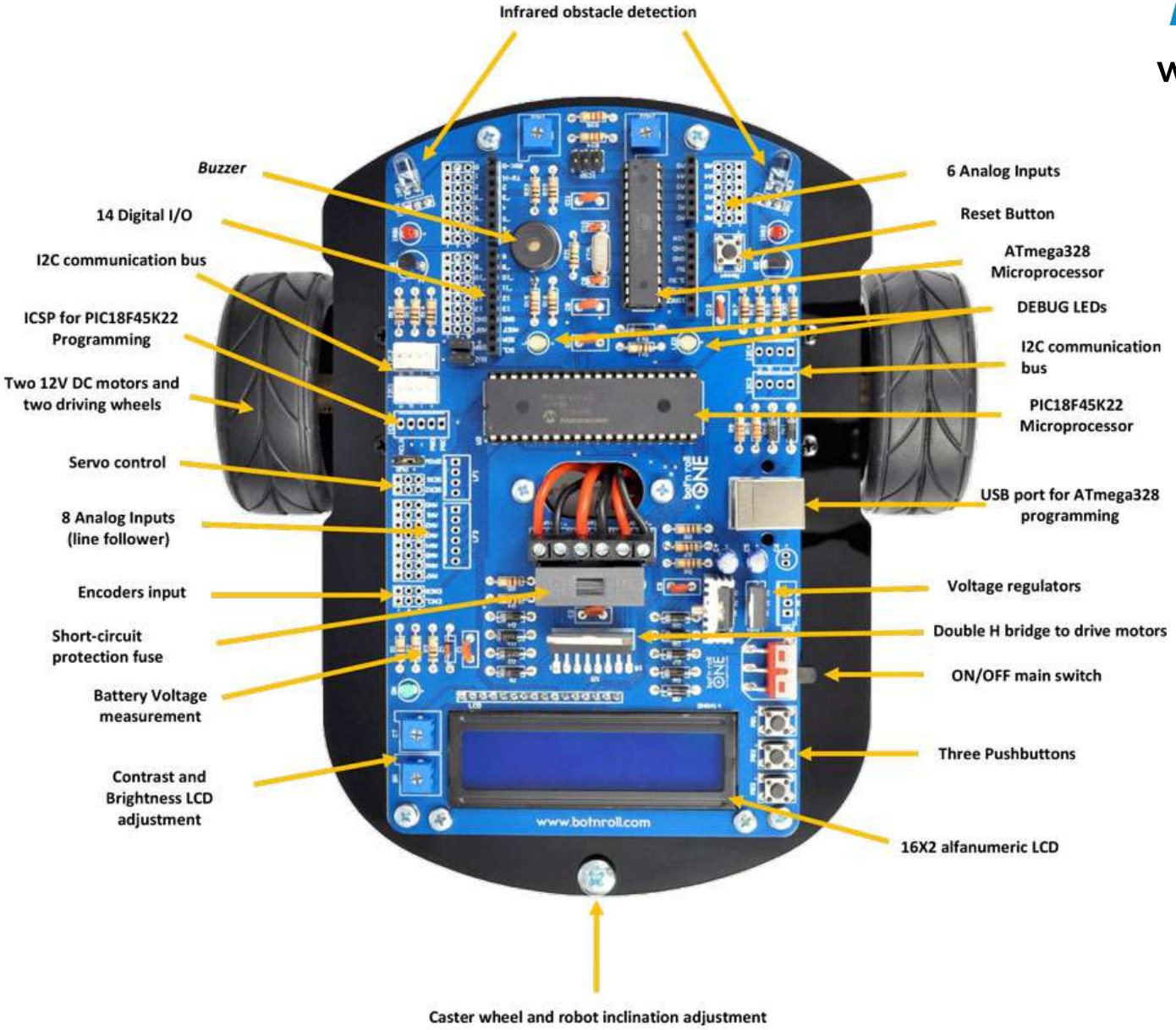
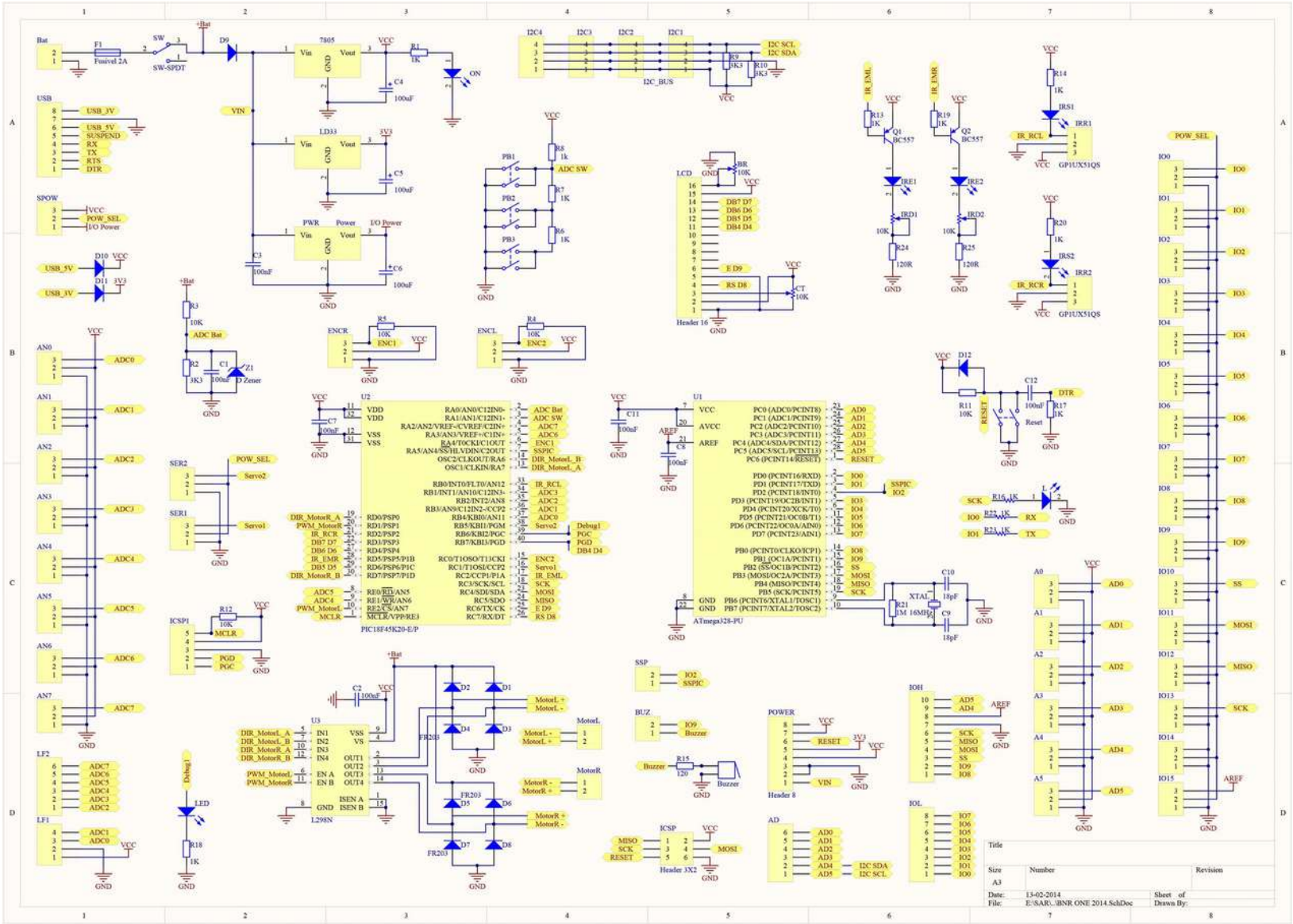
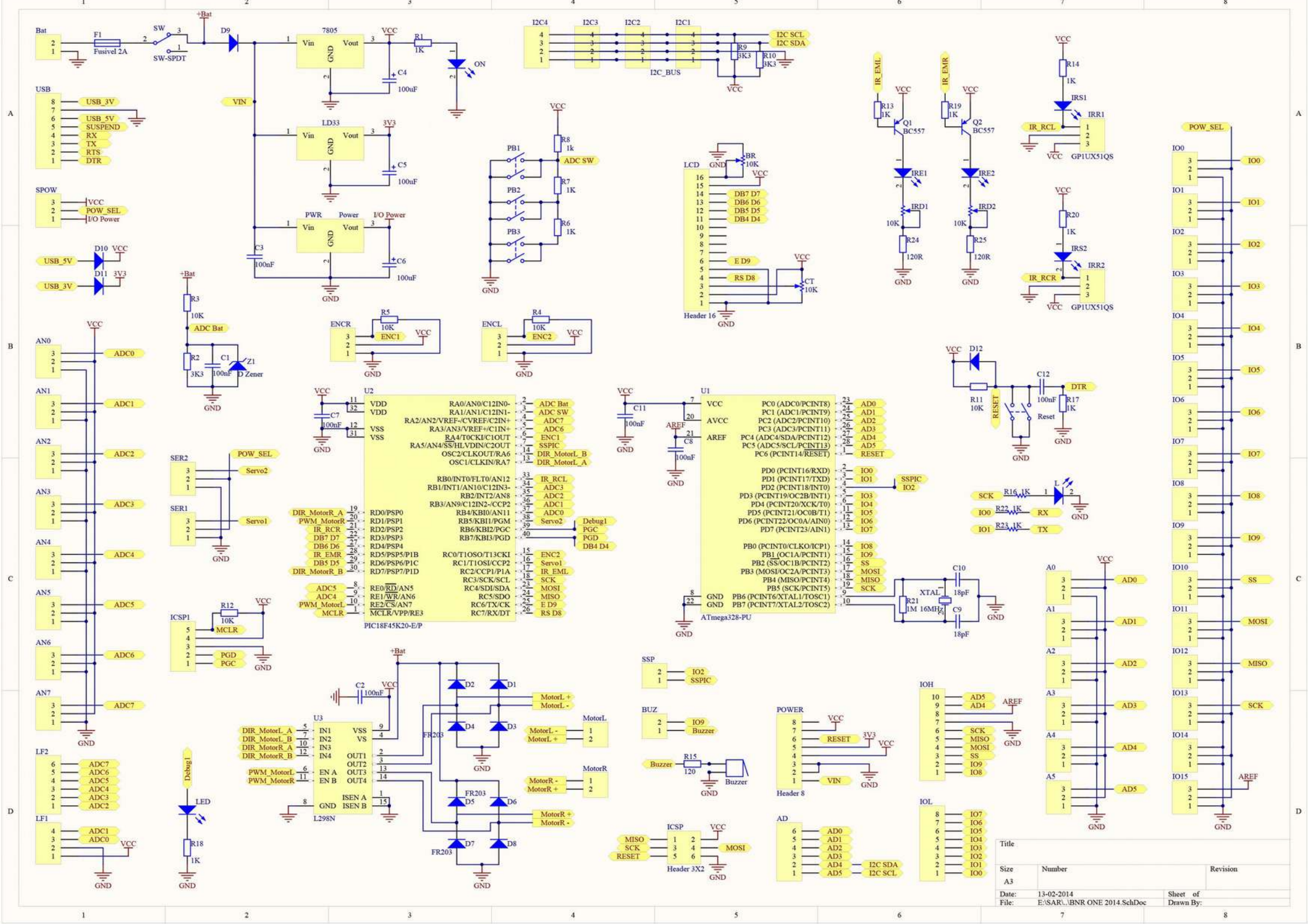


ONE A – Open Source Schematics

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Fusivel 2A
SW
SW-SPDT
+Bat
D9
7805
Vin
GND
Vout
VCC
R1
1K
C4
100uF
ON
VIN
LD33
3V3
C5
100uF
PWR
Power
I/O Power
C3
100nF
C6
100uF
GND
USB
USB_3V
USB_5V
SUSPEND
RX
TX
RTS
DTR
SPOW
VCC
POW_SEL
I/O Power
D10
D11
3V3
R3
10K
ADC Bat
R2
3K3
C1
100nF
Z1
D Zener
I2C4
I2C3
I2C2
I2C1
I2C SCL
I2C SDA
I2C_BUS
R9
3K3
R10
3K3
PB1
PB2
PB3
R8
1k
ADC SW
R7
1K
R6
1K
LCD
BR
10K
DB7 D7
DB6 D6
DB5 D5
DB4 D4
E D9
RS D8
CT
10K
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IR_EML
IR_EMR
R13
1K
R19
1K
Q1
BC557
Q2
BC557
IRE1
IRE2
IRD1
IRD2
10K
R24
120R
R25
120R
R14
1K
IRS1
IRR1
IR_RCL
GP1UX51QS
R20
1K
IRS2
IRR2
IR_RCR
ENCR
ENCL
R5
10K
ENC1
R4
10K
ENC2
U2
PIC18F45K20-E/P
U1
ATmega328-PU
C7
100nF
C11
100nF
C8
100nF
AREF
D12
R11
10K
RESET
C12
100nF
DTR
R17
1K
Reset
SCK
IO0
IO1
R16
1K
R22
1K
R23
1K
RX
TX
L
SSPIC
IO2
C10
18pF
C9
18pF
XTAL
R21
1M
16MHz
SER2
Servo2
SER1
Servo1
ICSP1
R12
10K
MCLR
PGD
PGC
C2
100nF
U3
L298N
FR203
MotorL +
MotorL -
MotorR +
MotorR -
MotorL
MotorR
Debug1
LED
R18
1K
SSP
BUZ
Buzzer
R15
120
POWER
Header 8
RESET
VIN
IOH
IOL
AD
ICSP
Header 3X2
MISO
SCK
MOSI
RESET
AN0
AN1
AN2
AN3
AN4
AN5
AN6
AN7
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ADC1
ADC2
ADC3
ADC4
ADC5
ADC6
ADC7
LF1
LF2
A0
A1
A2
A3
A4
A5
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AD1
AD2
AD3
AD4
AD5
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IO1
IO2
IO3
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MOSI
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Drawn By:

ONE A - Assembling

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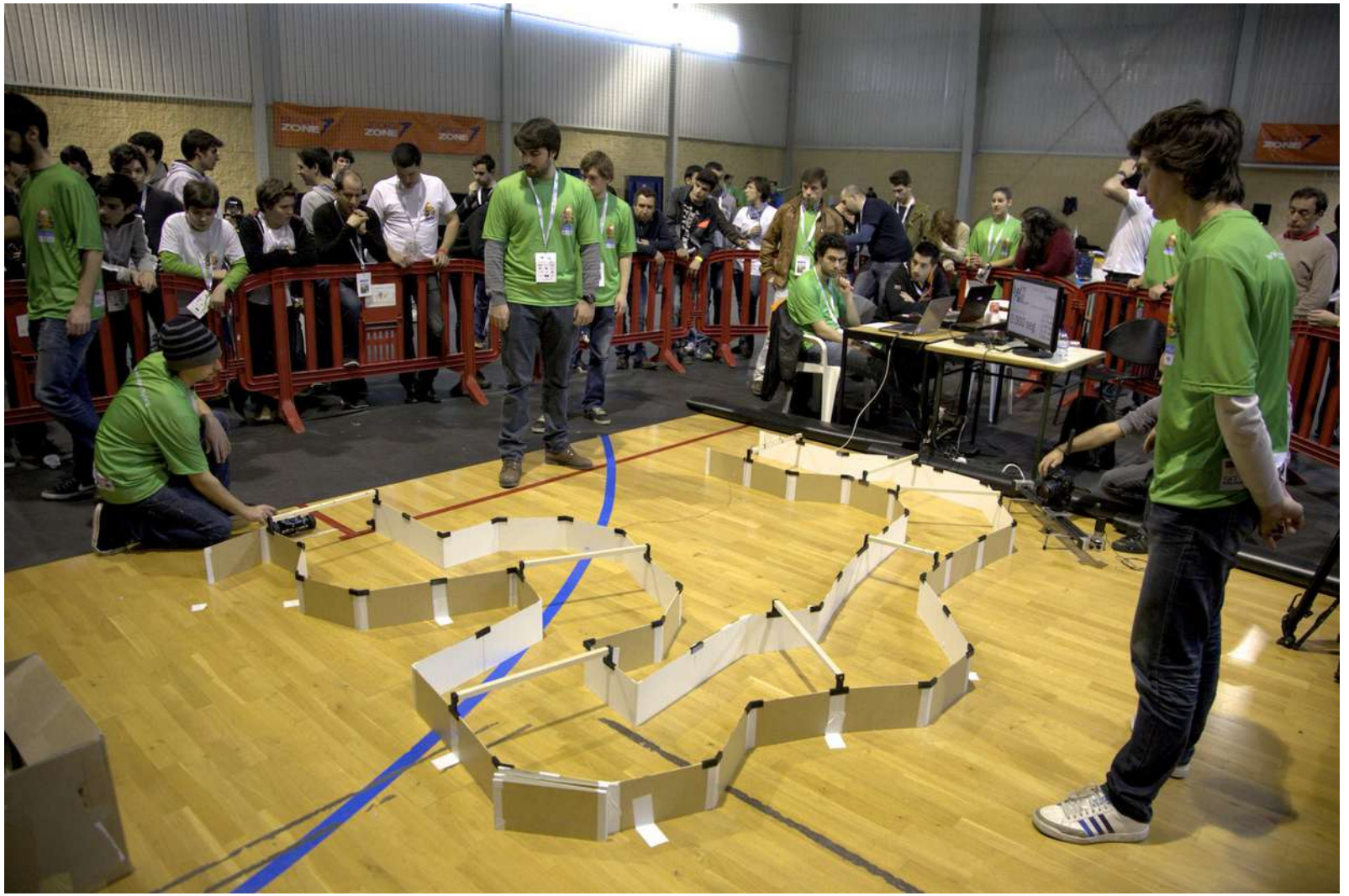

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ONE A - Manuals

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ONE A - Mechanics

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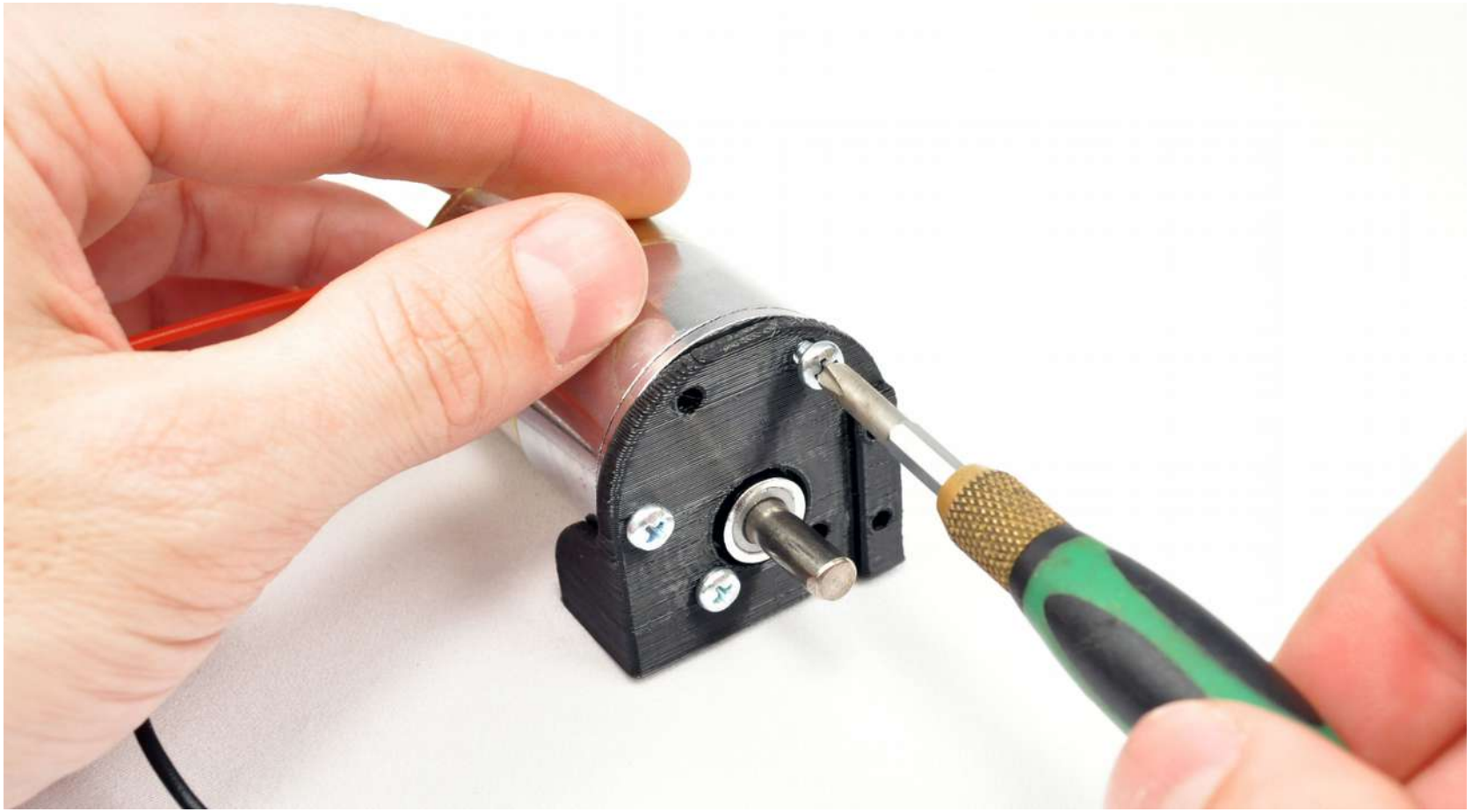

ONE A - Mechanics

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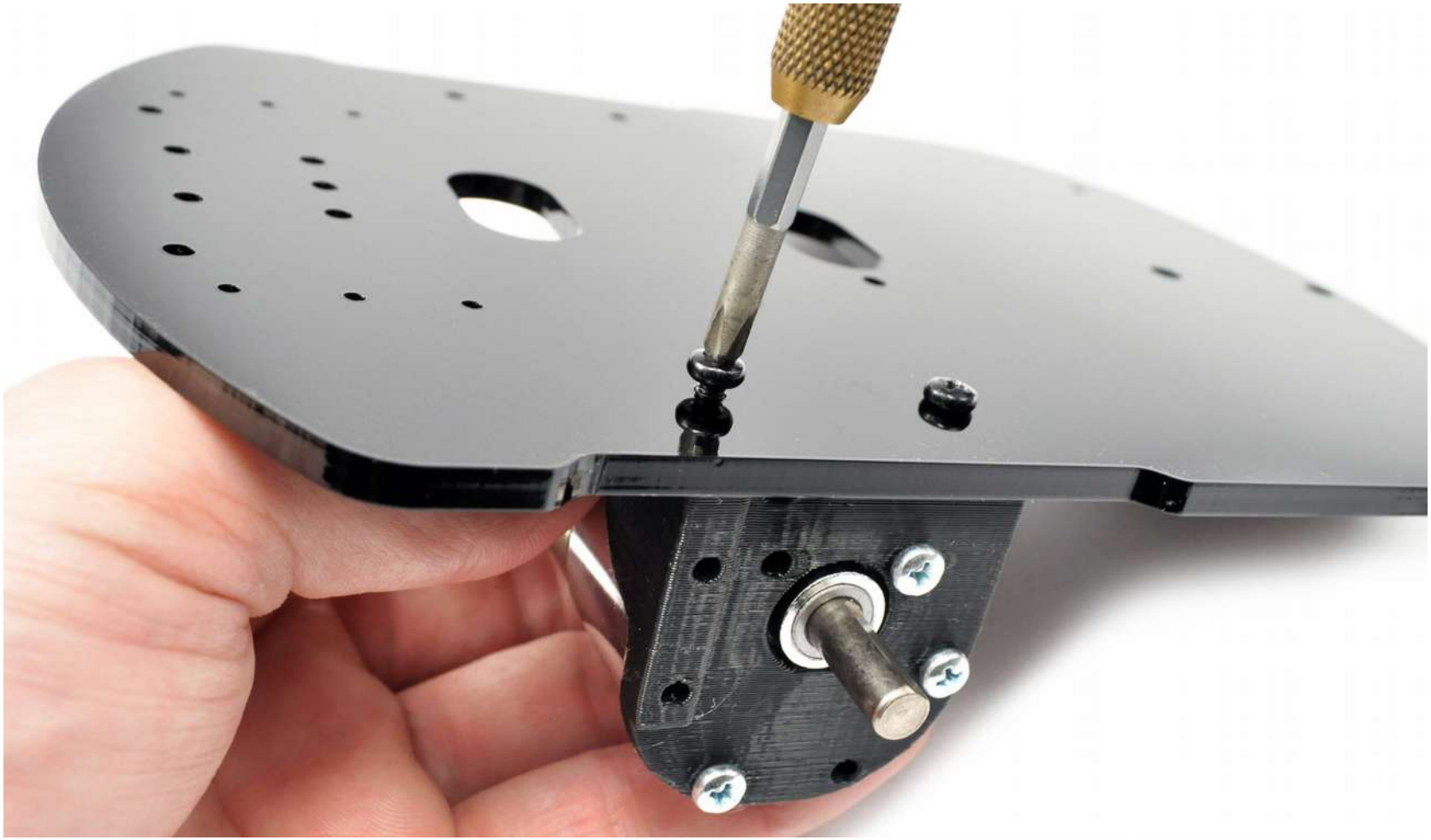

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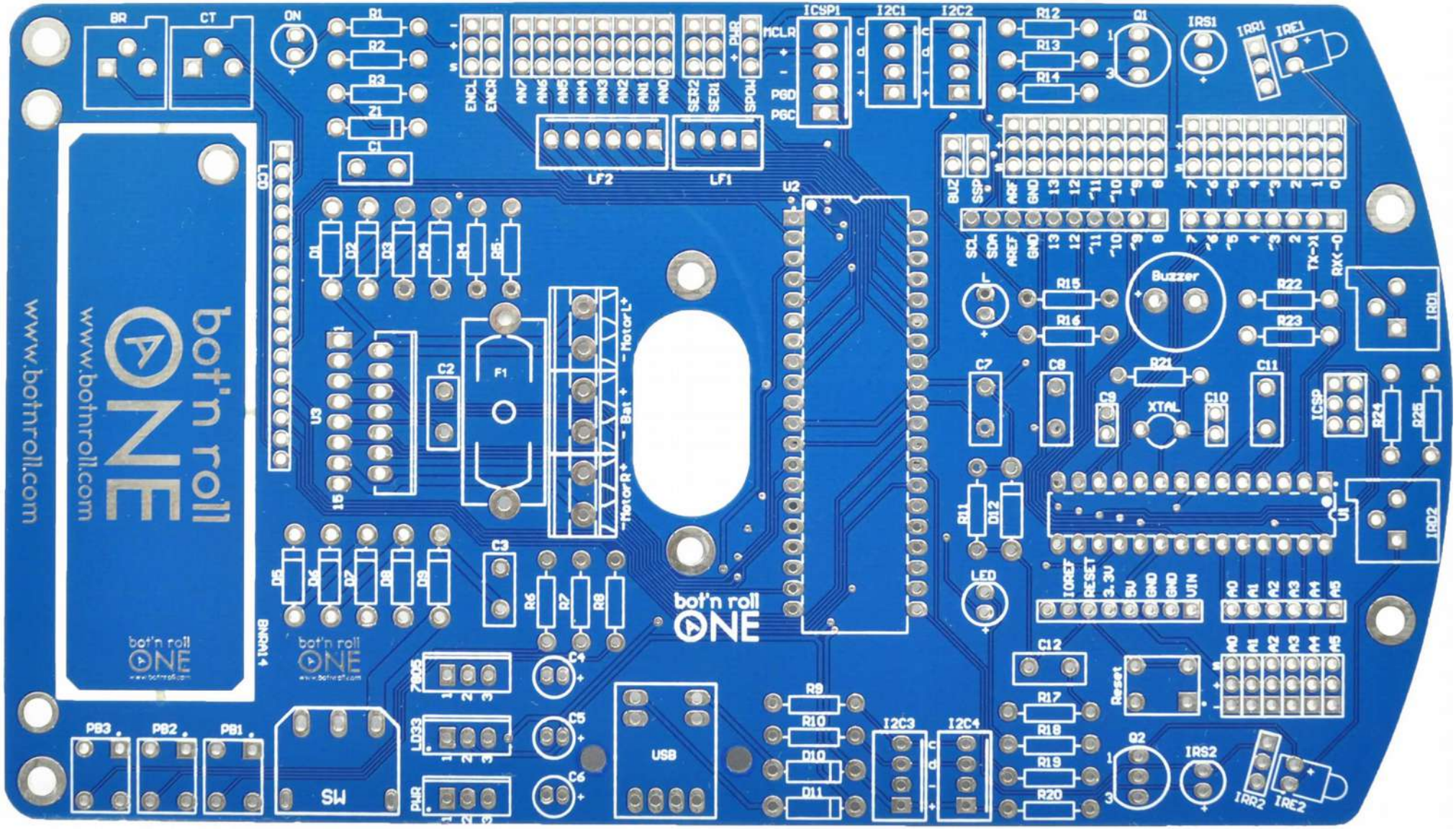

ONE A - Tools

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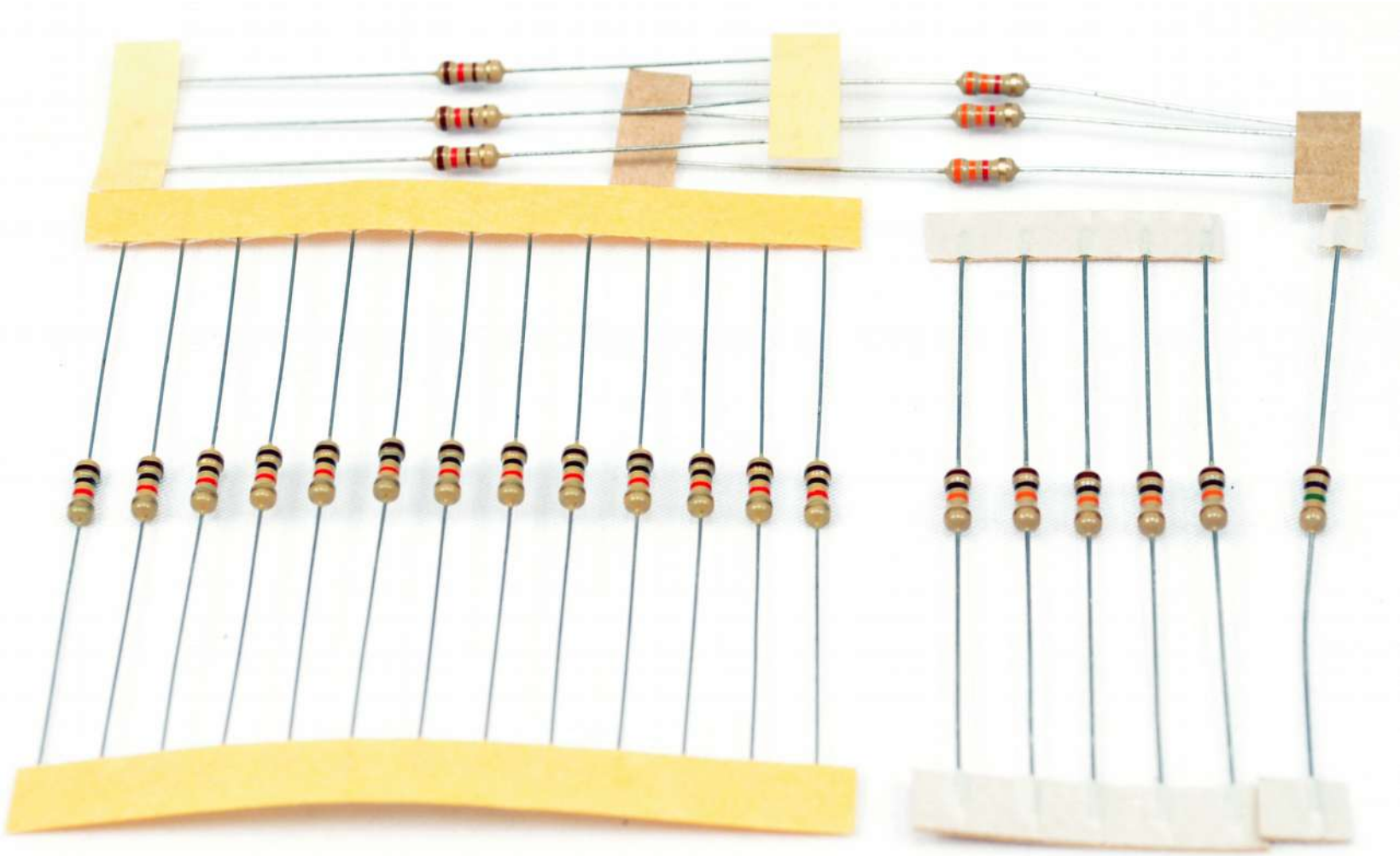

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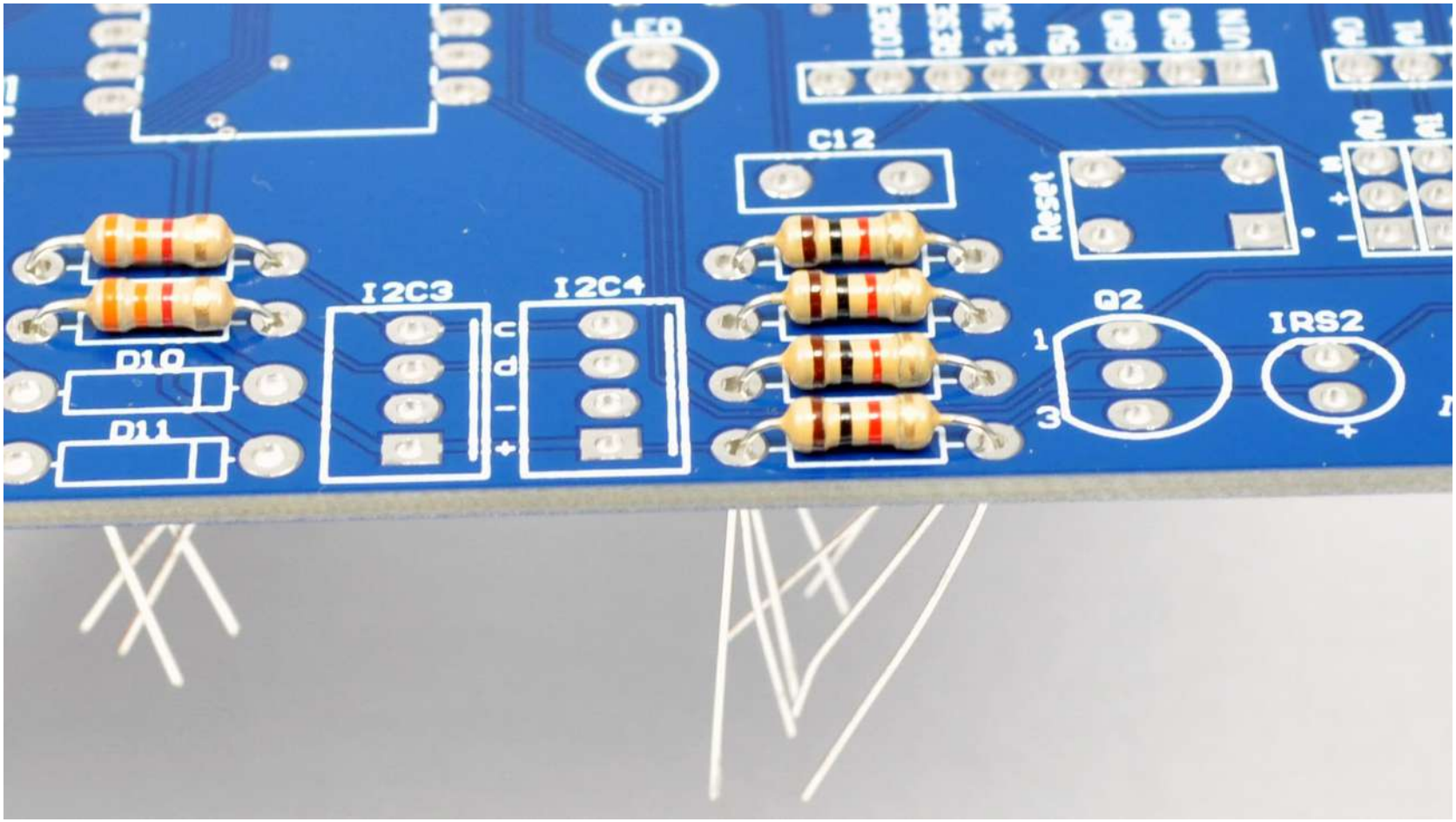

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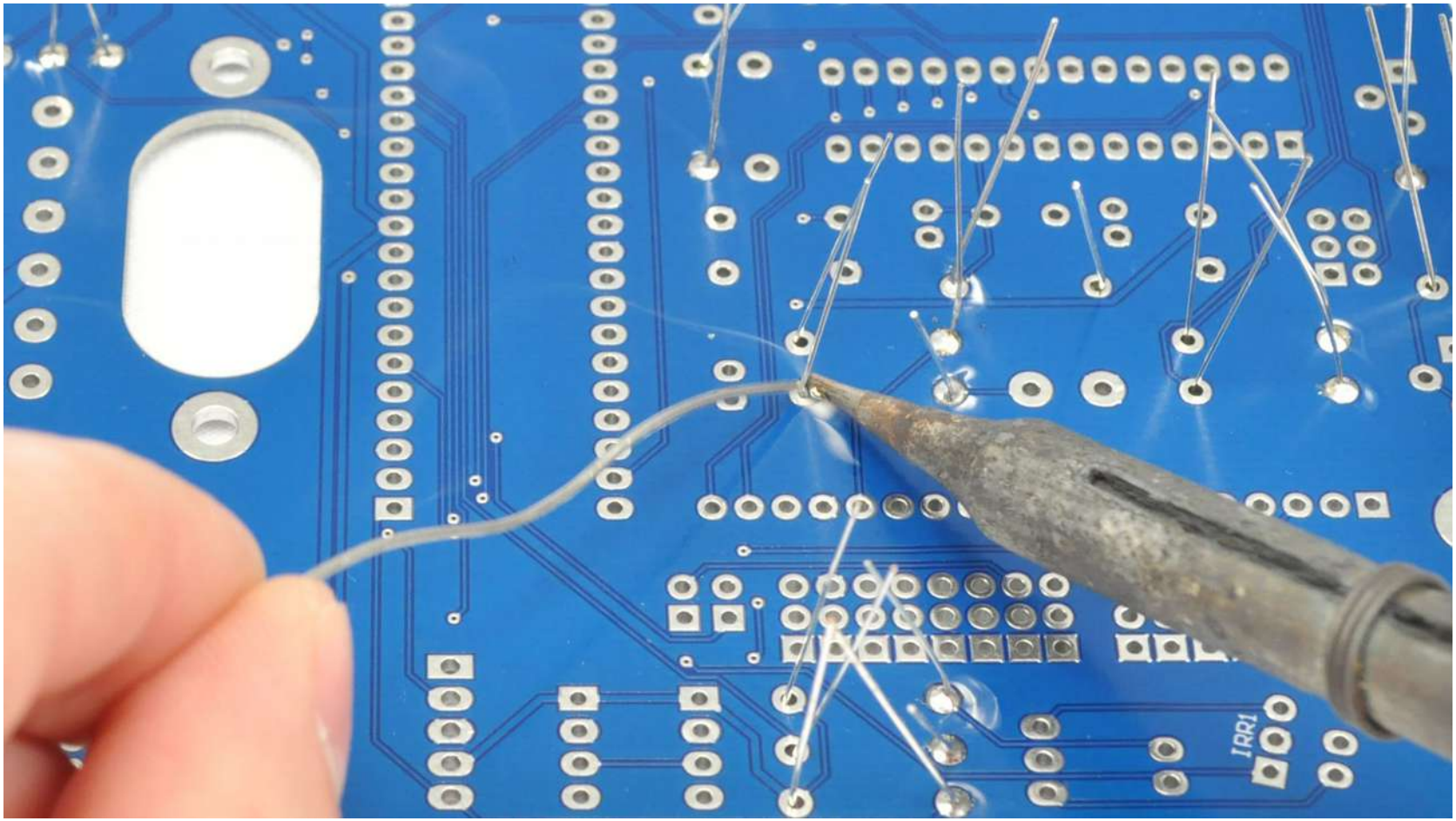

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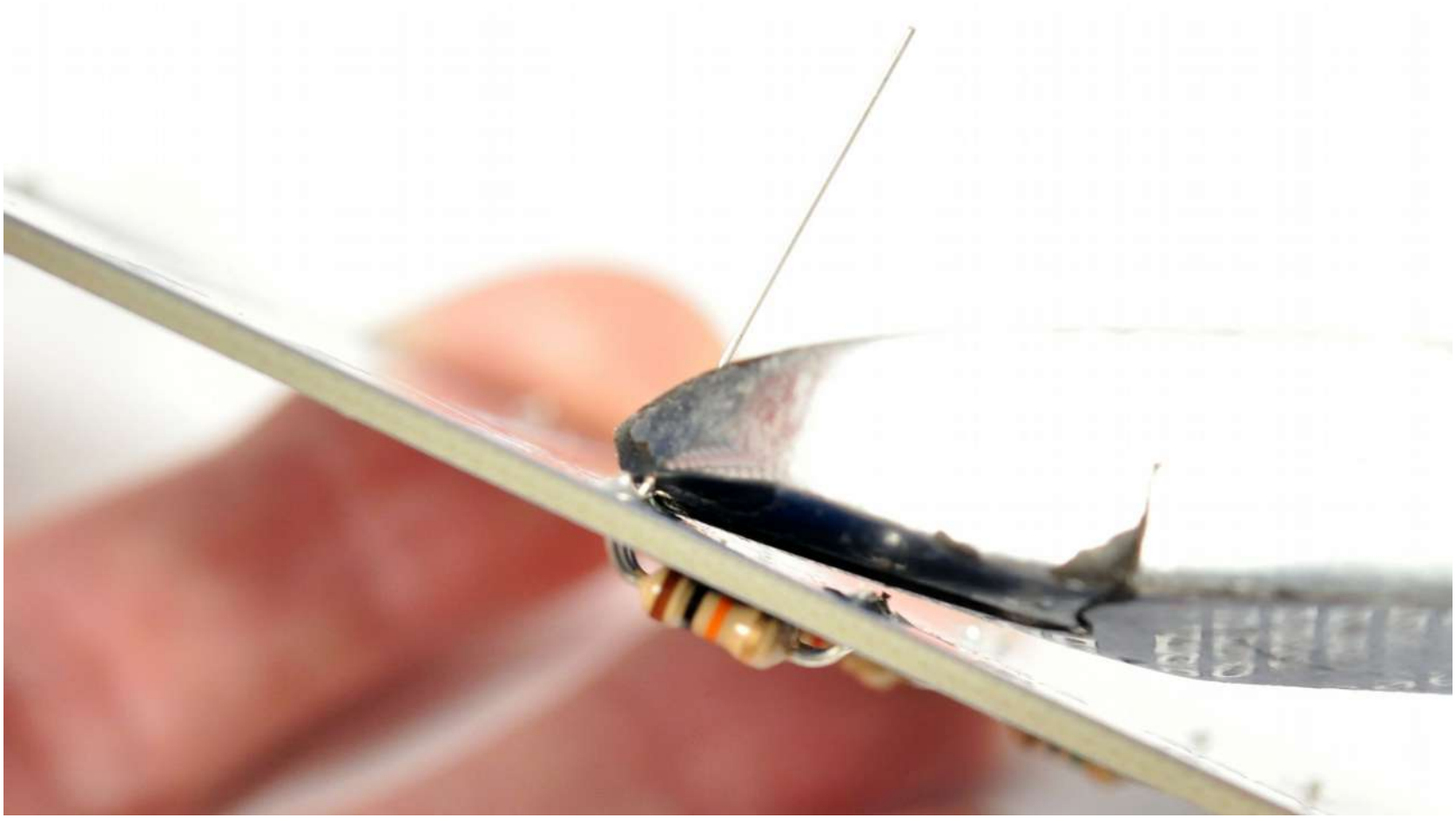

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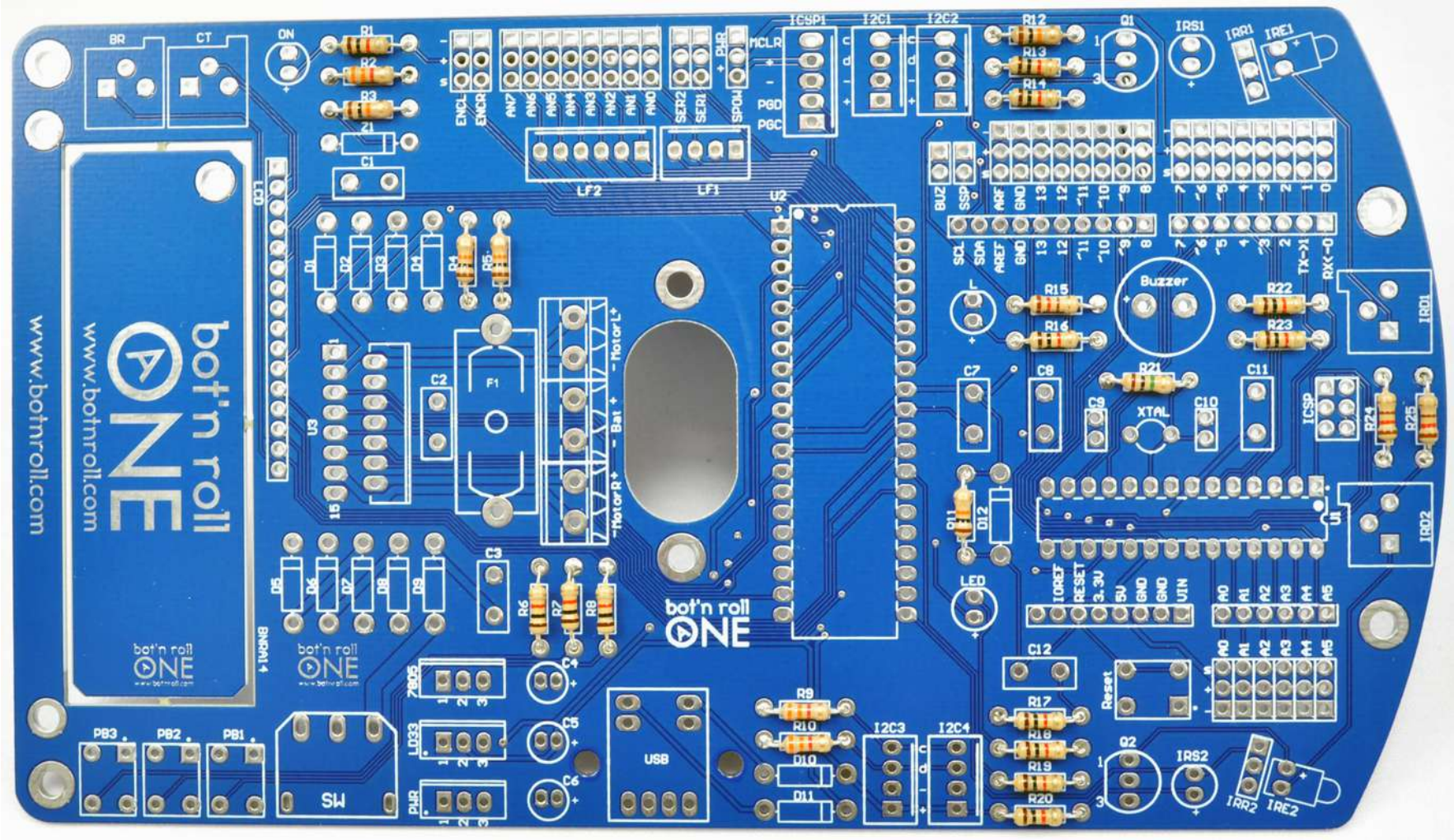

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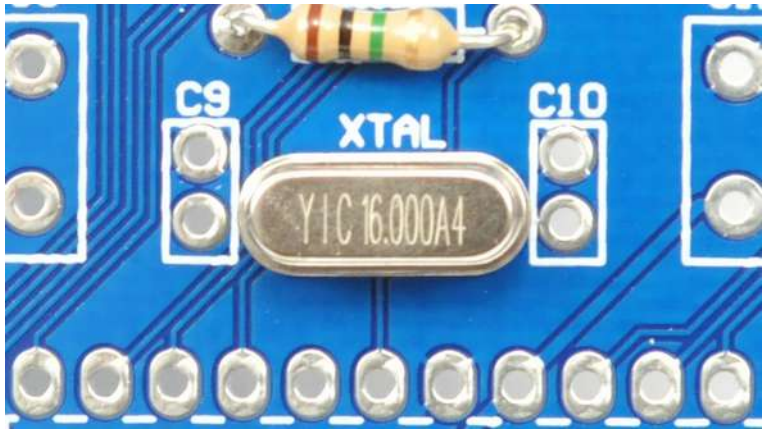

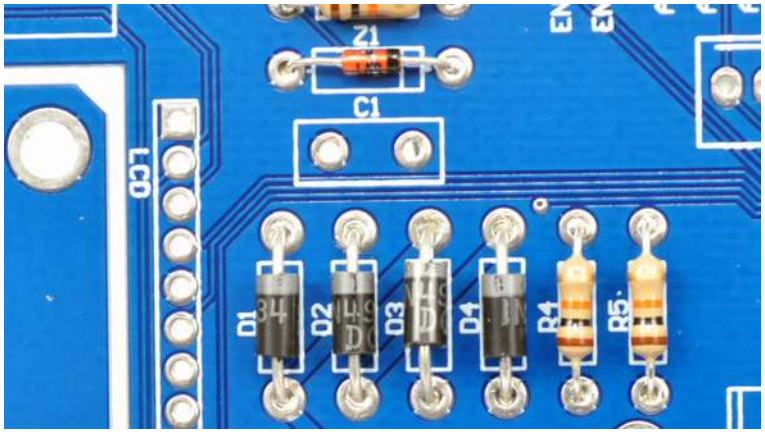

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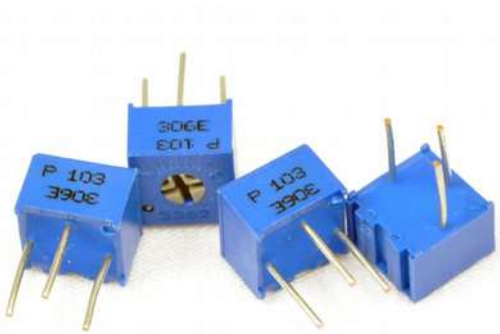

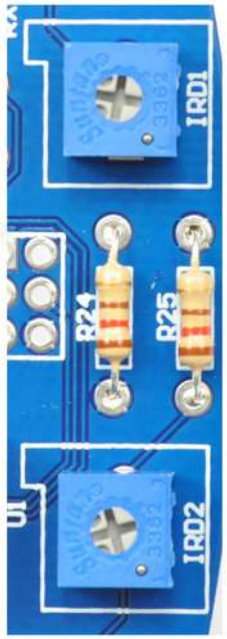

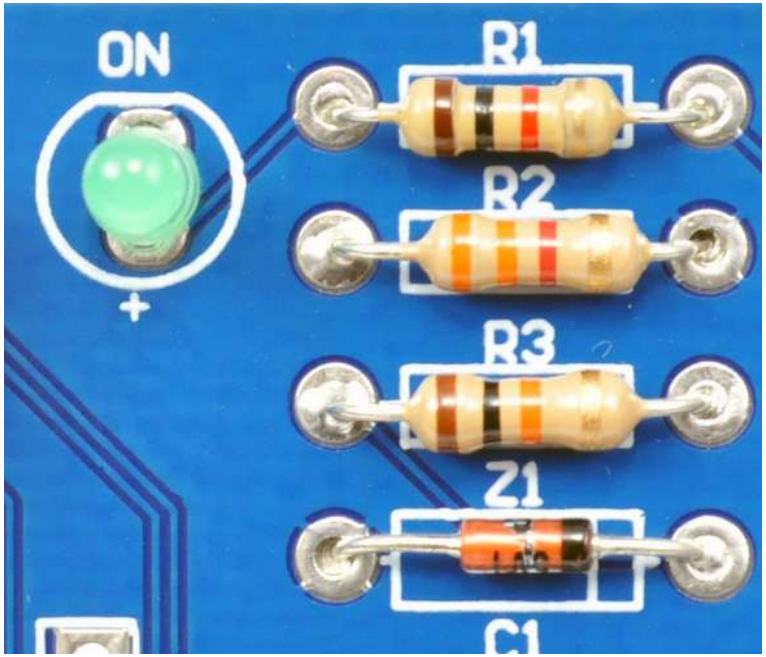

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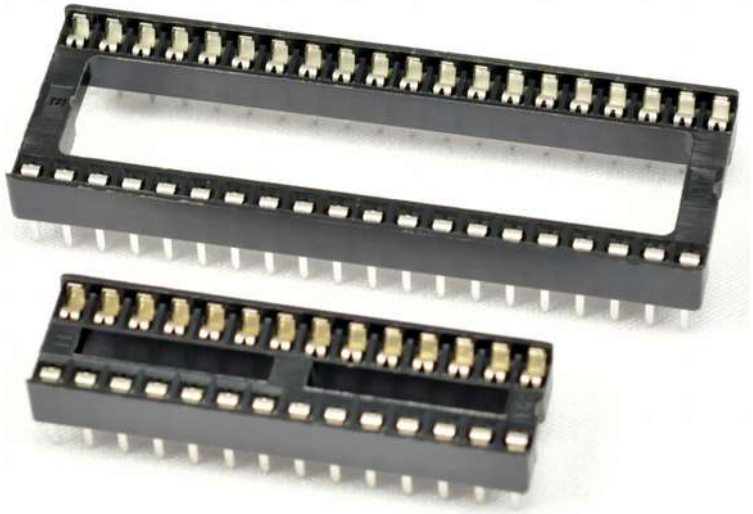

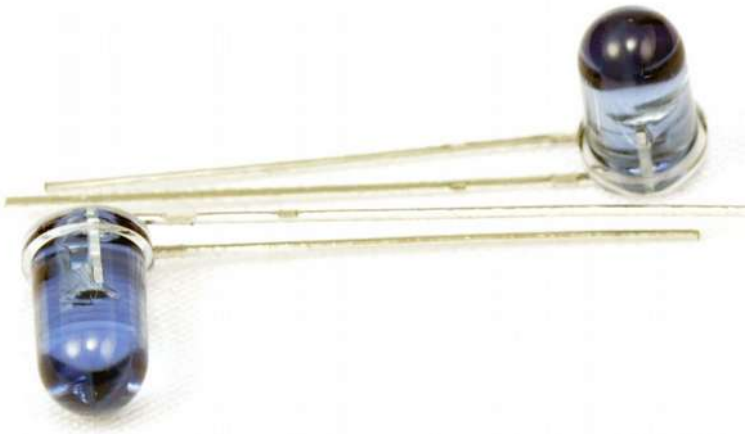

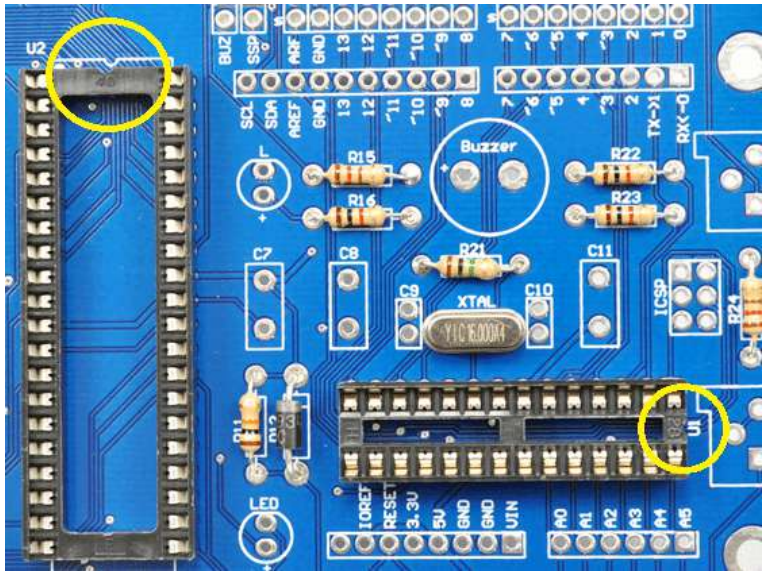

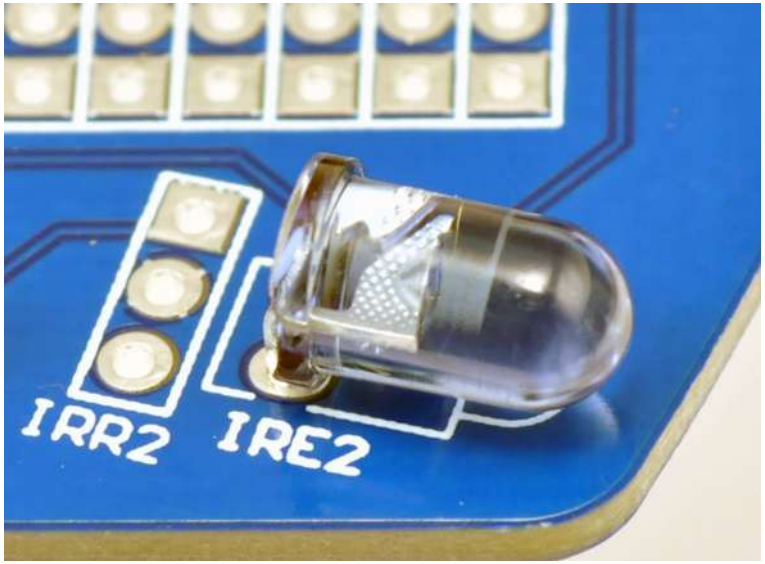

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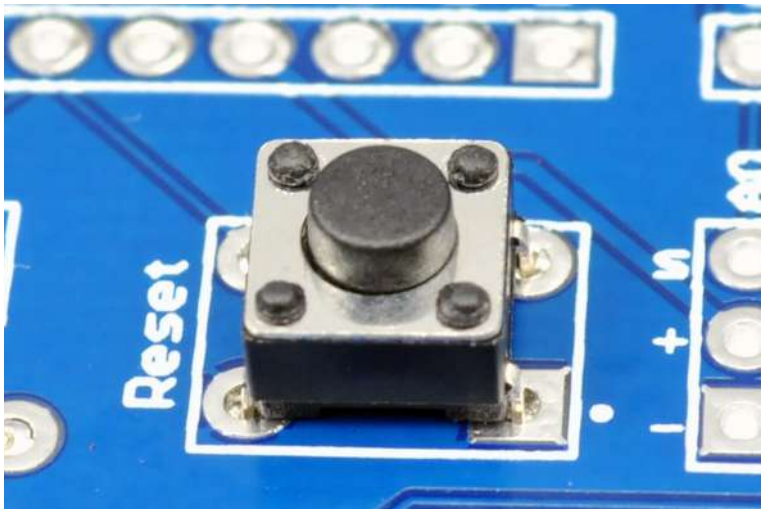

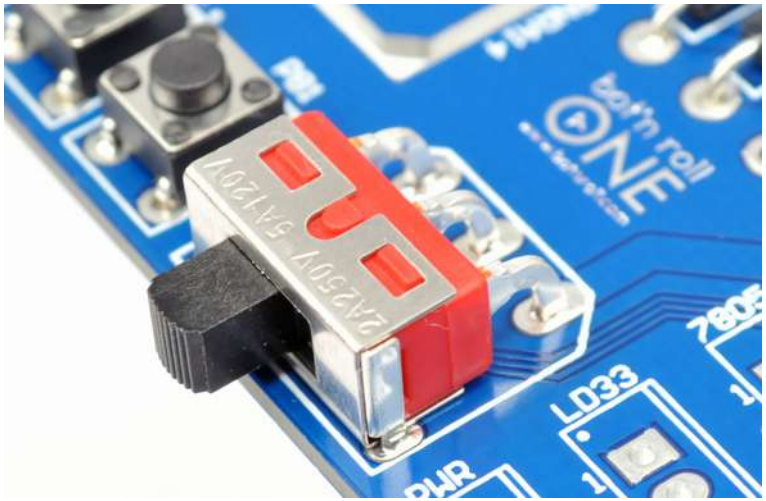

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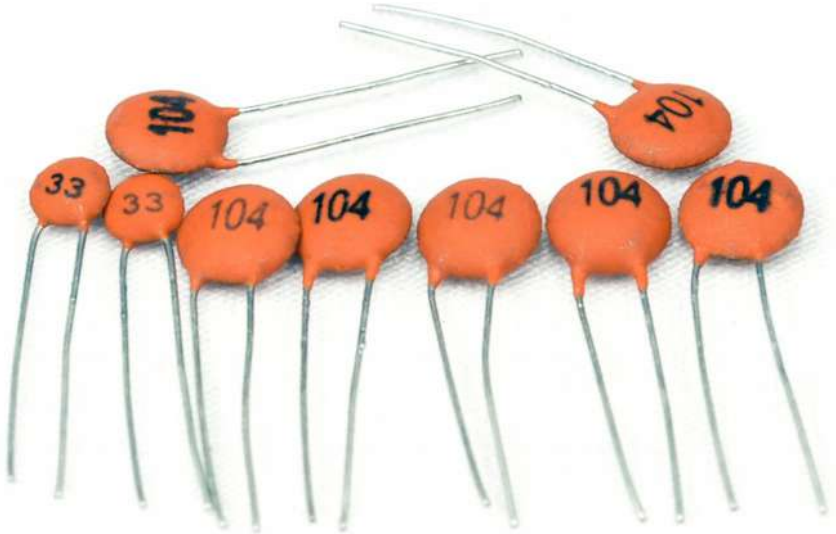

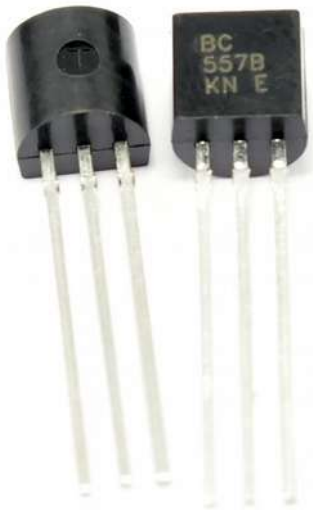

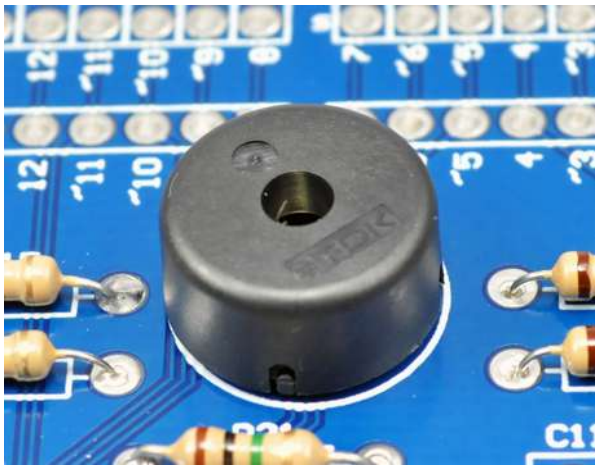

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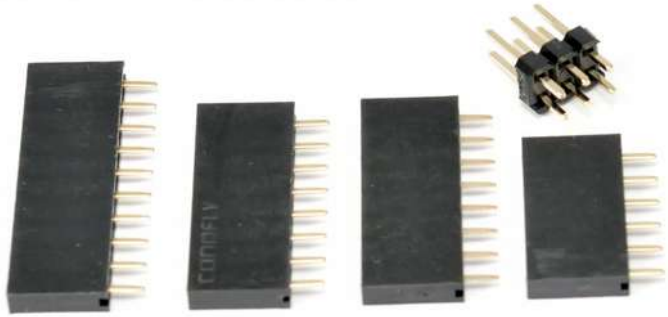

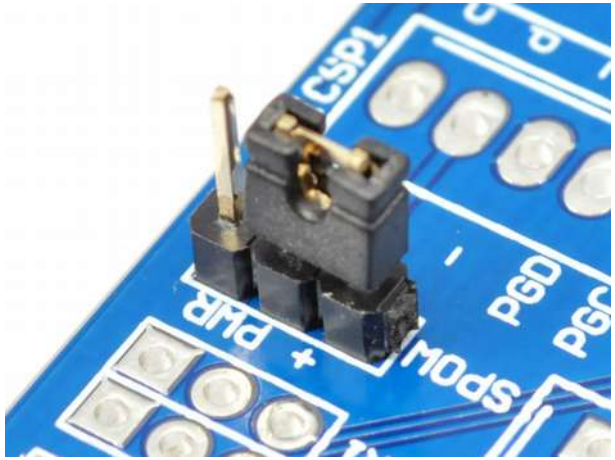

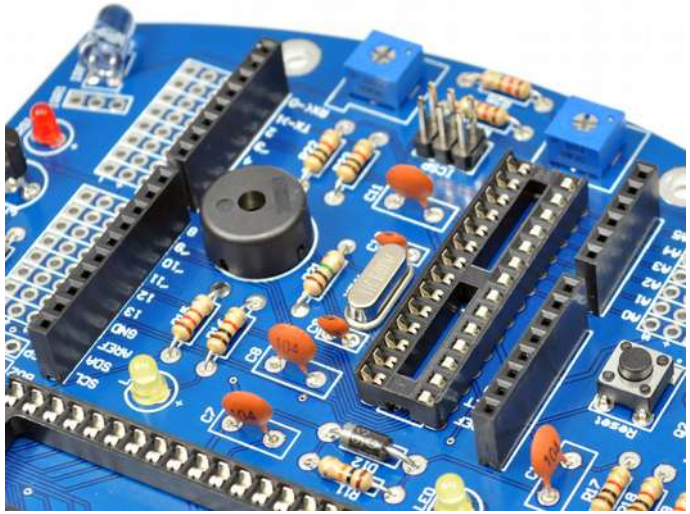

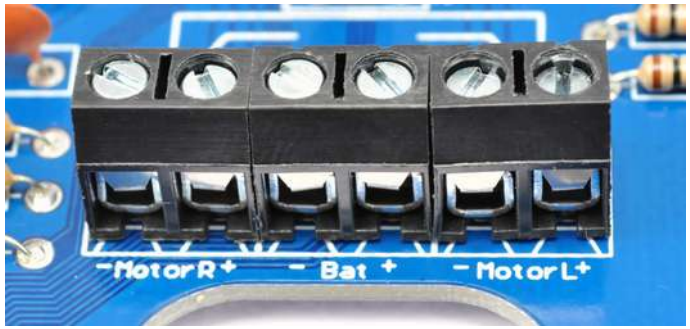

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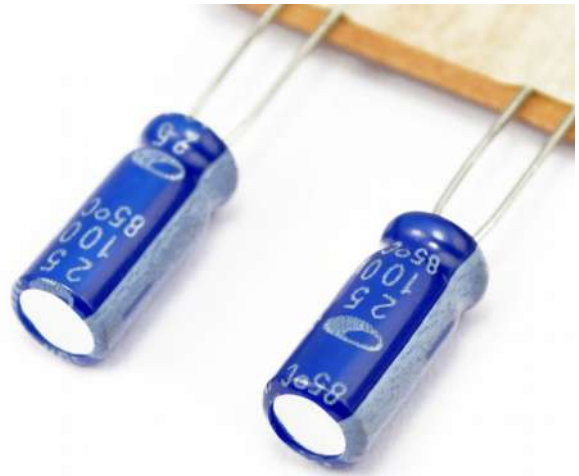

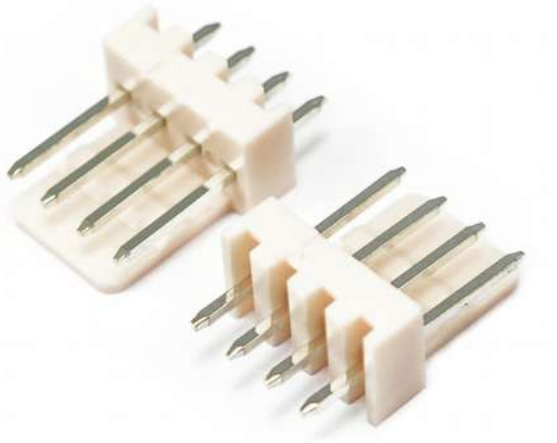

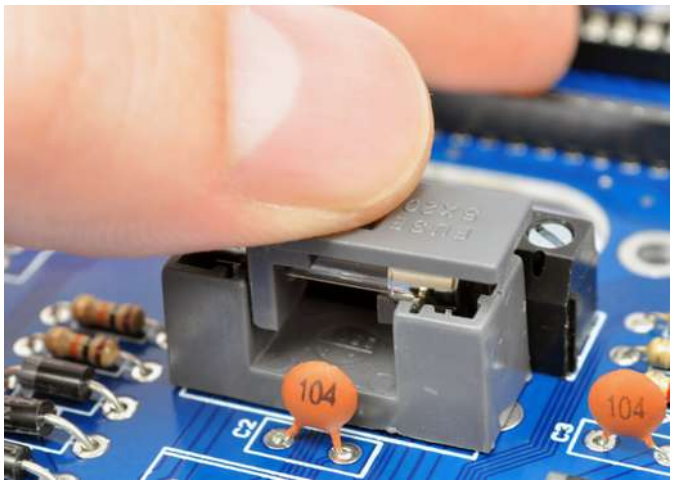

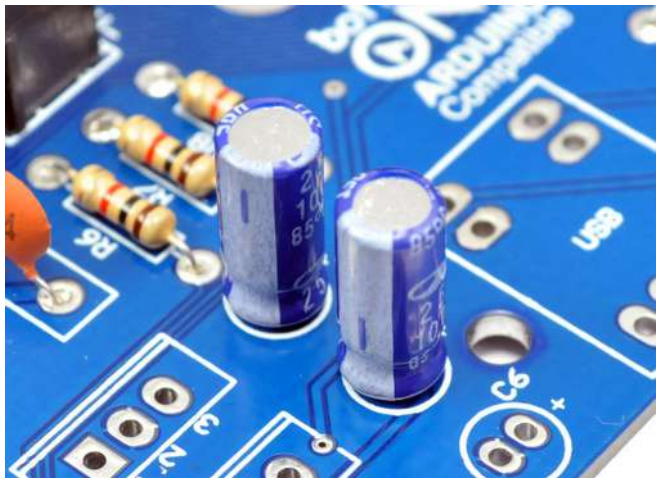

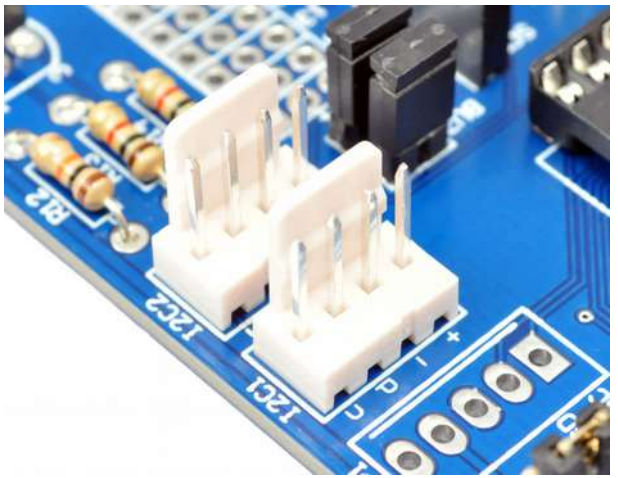

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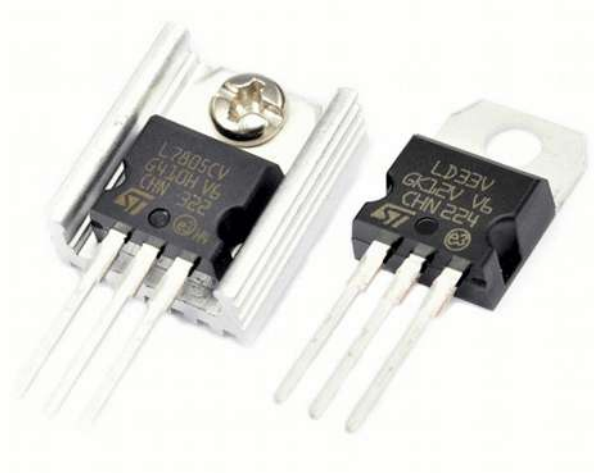

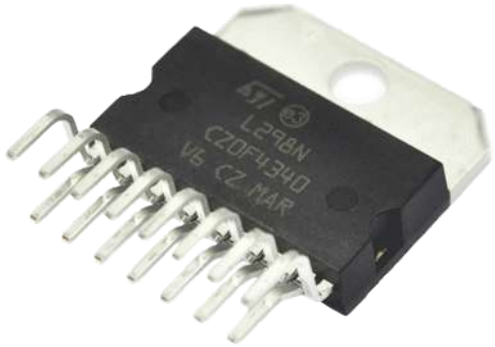

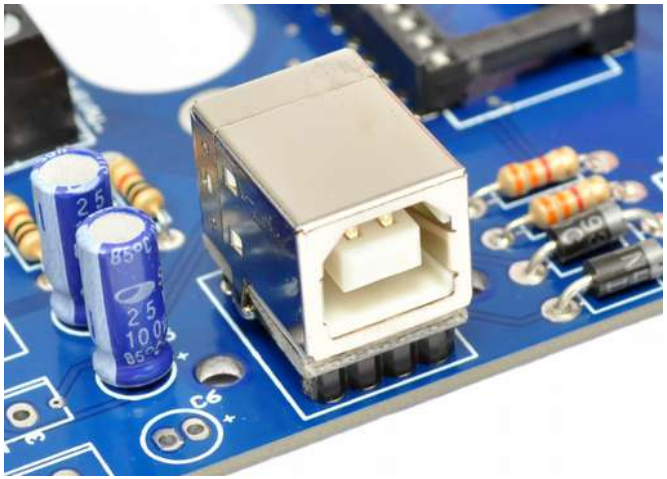

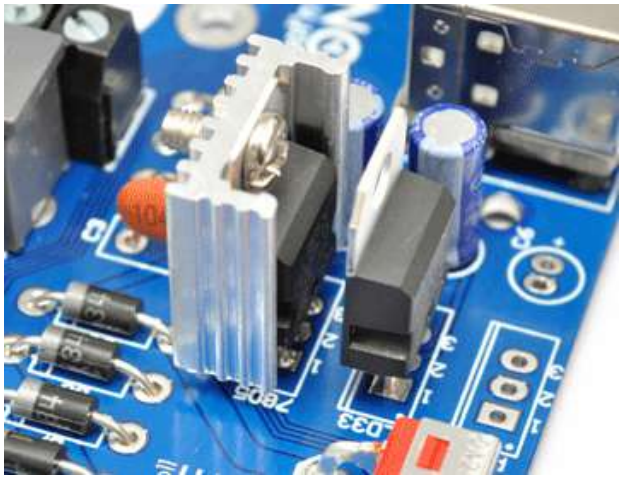

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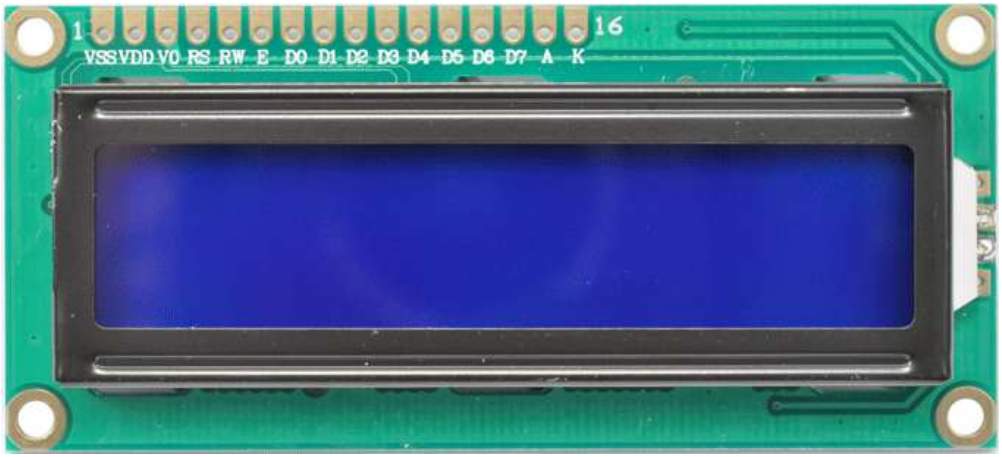

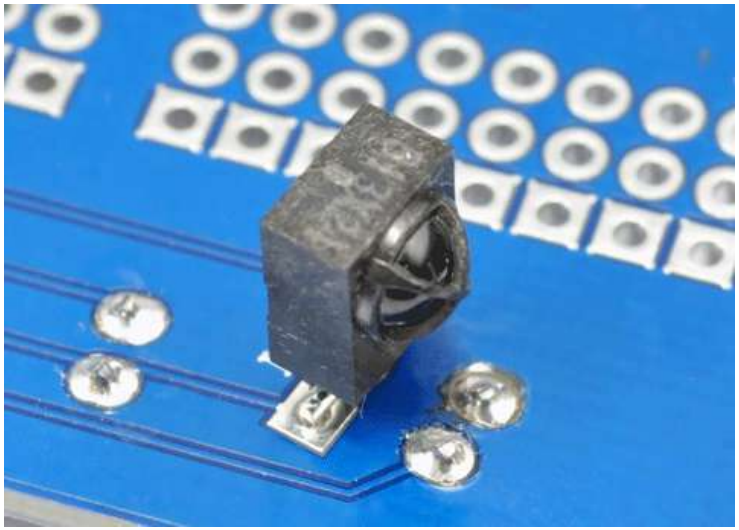

ONE A – Wiring & Testing

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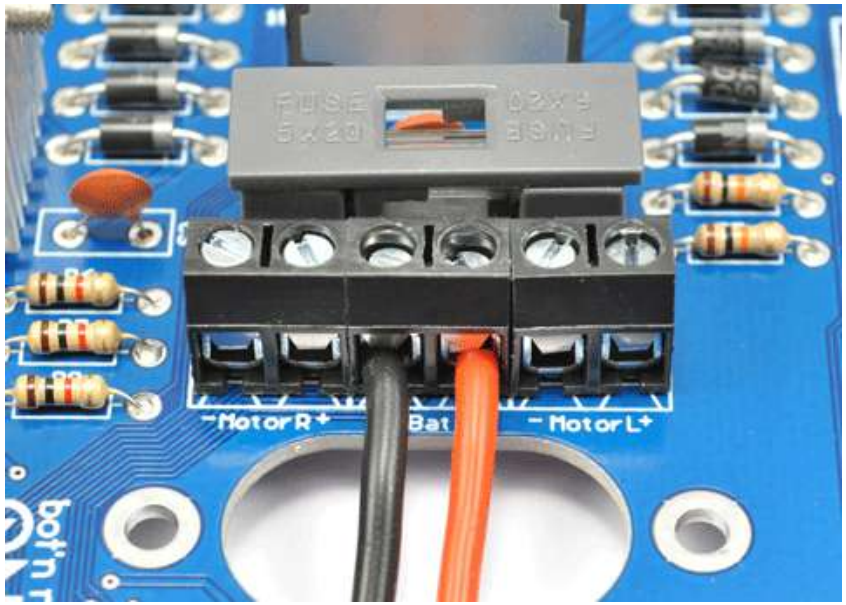

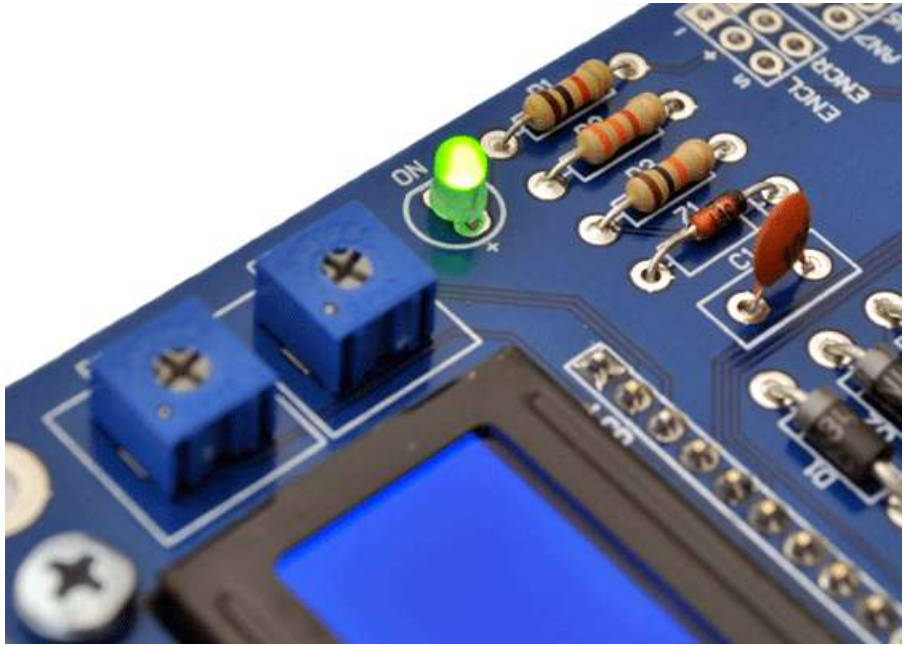

ONE A – Assembling Finish

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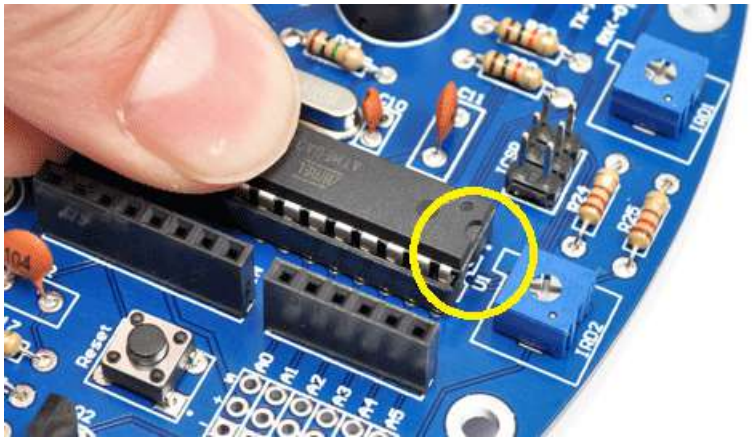

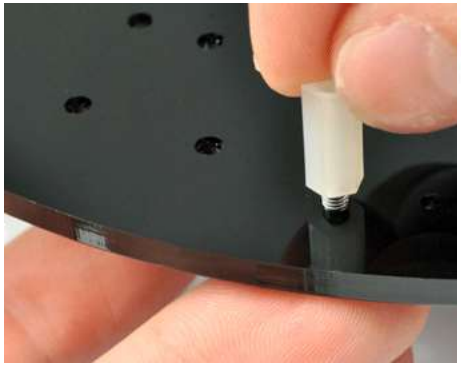

ONE A – Connect to PC

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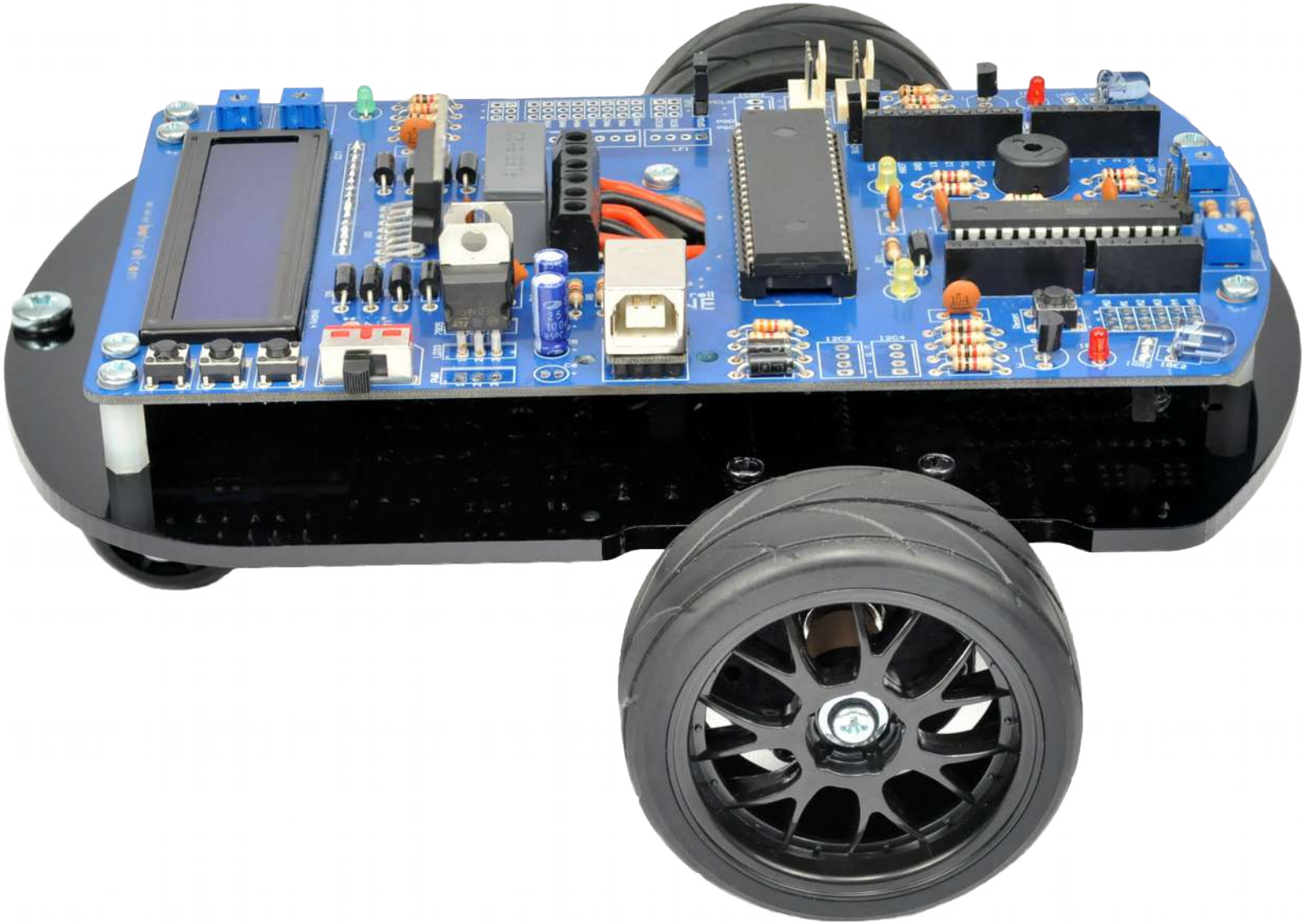
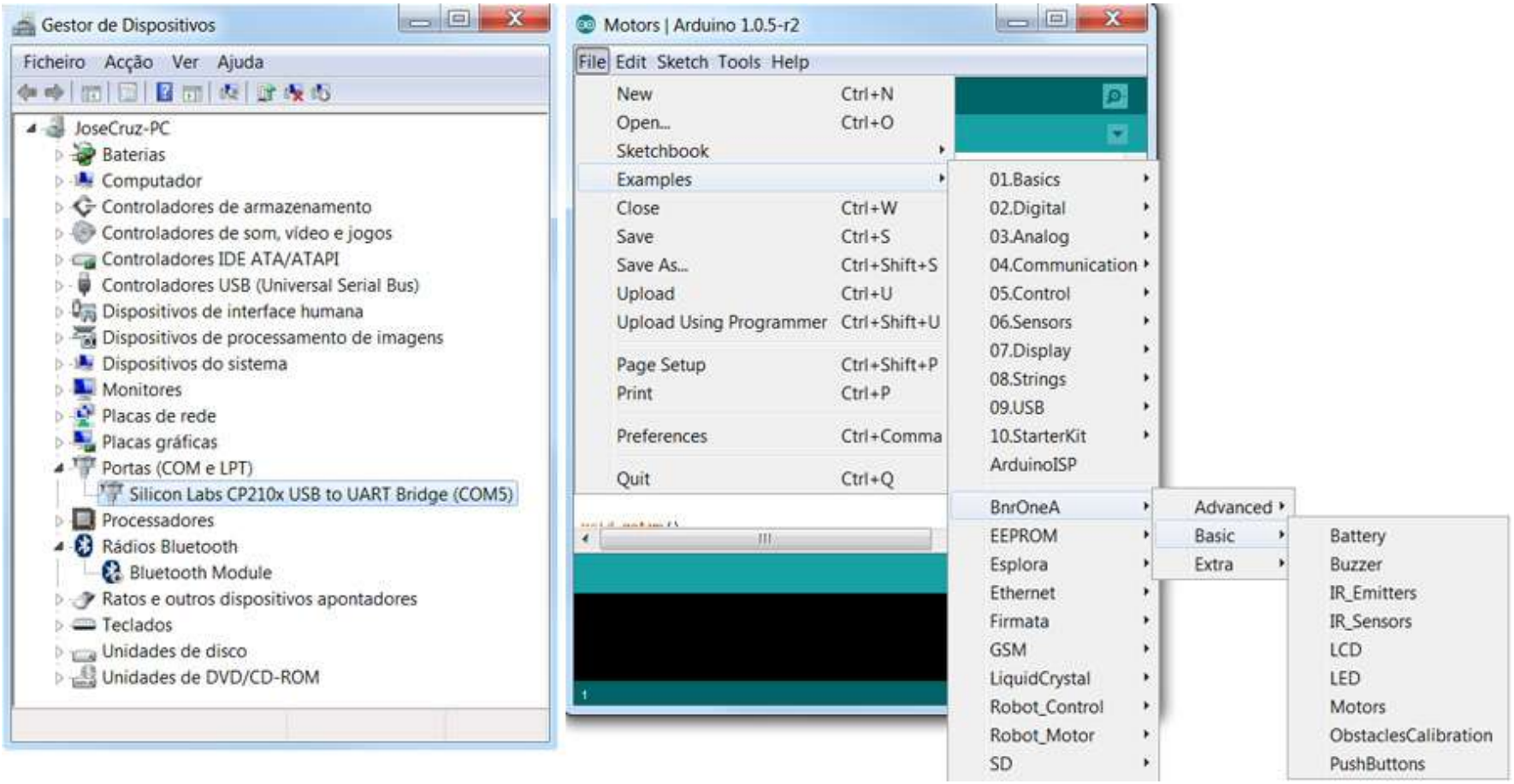


ONE A – USB Drivers & Arduino IDE

www.botnroll.com



Programming Software: Arduino IDE

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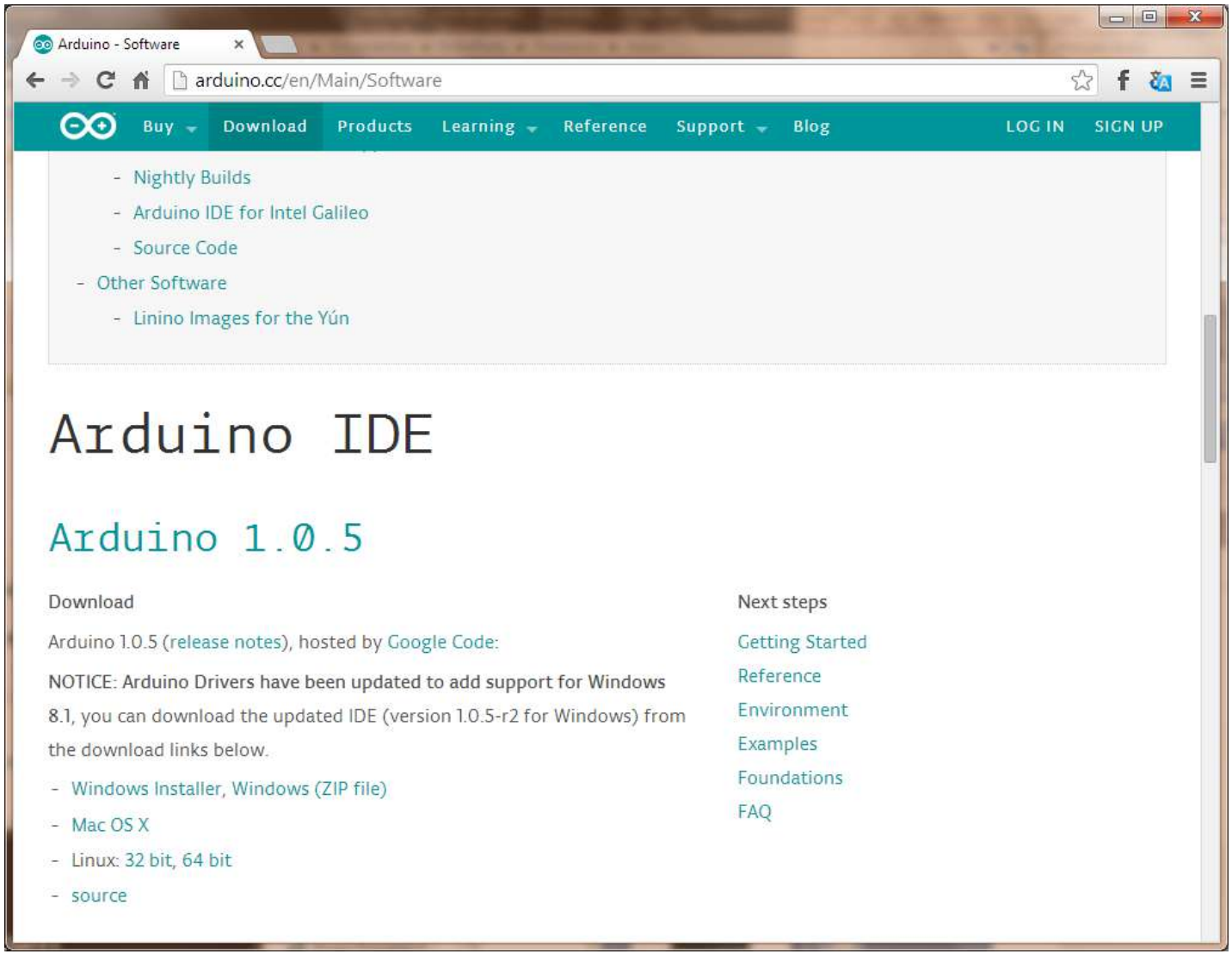
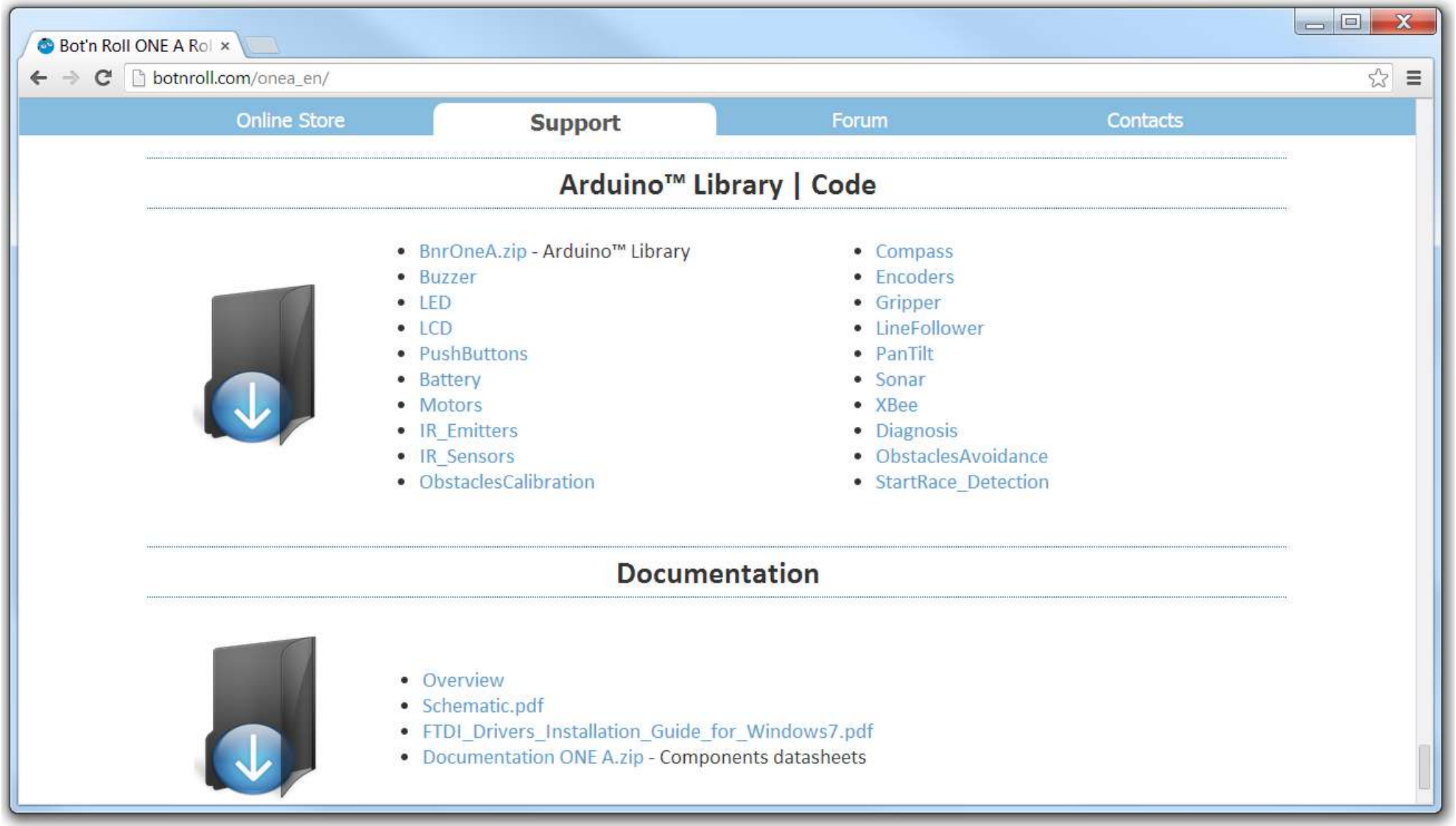


ONE A – Support



ONE A - Arduino

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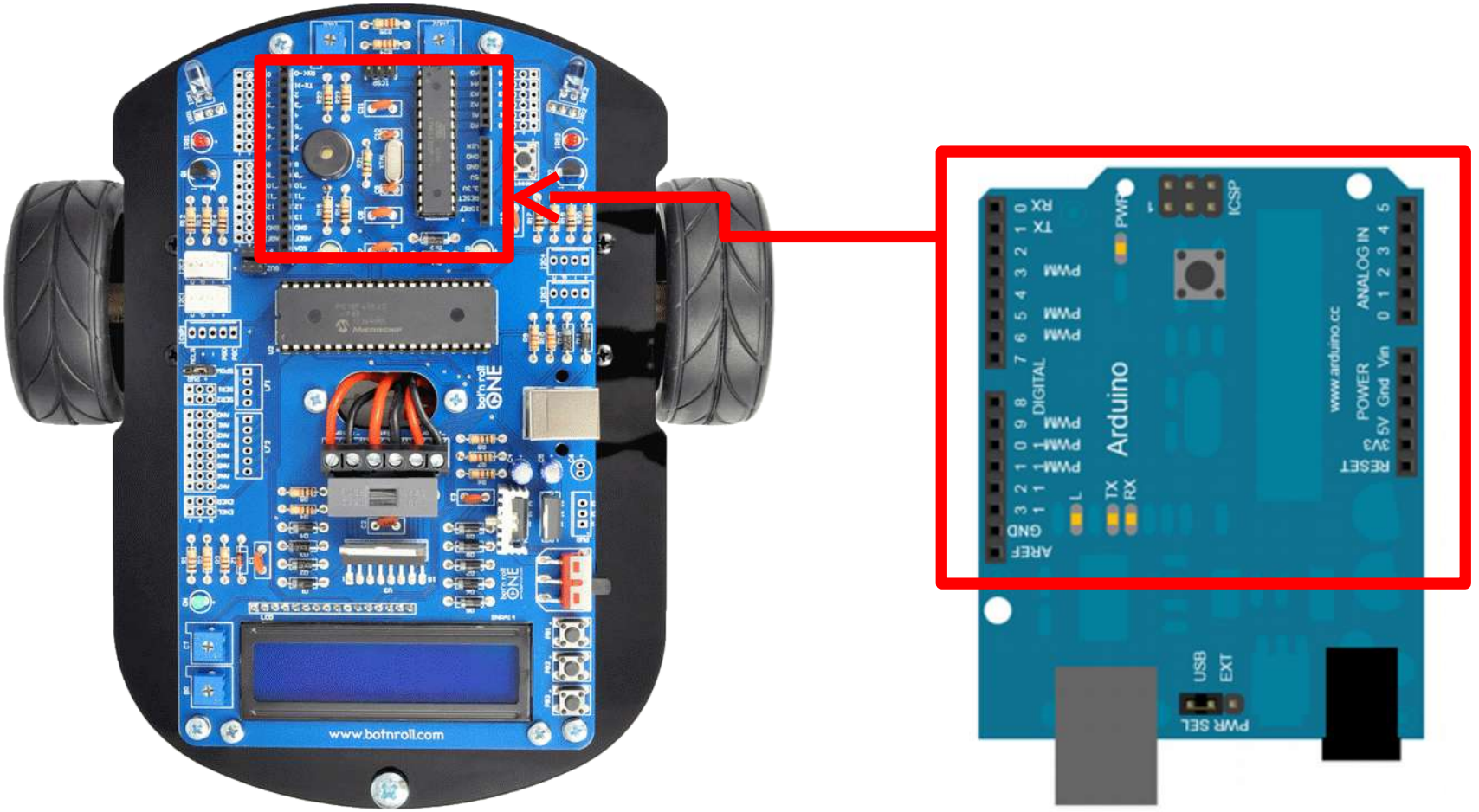

Arduino – What is it?

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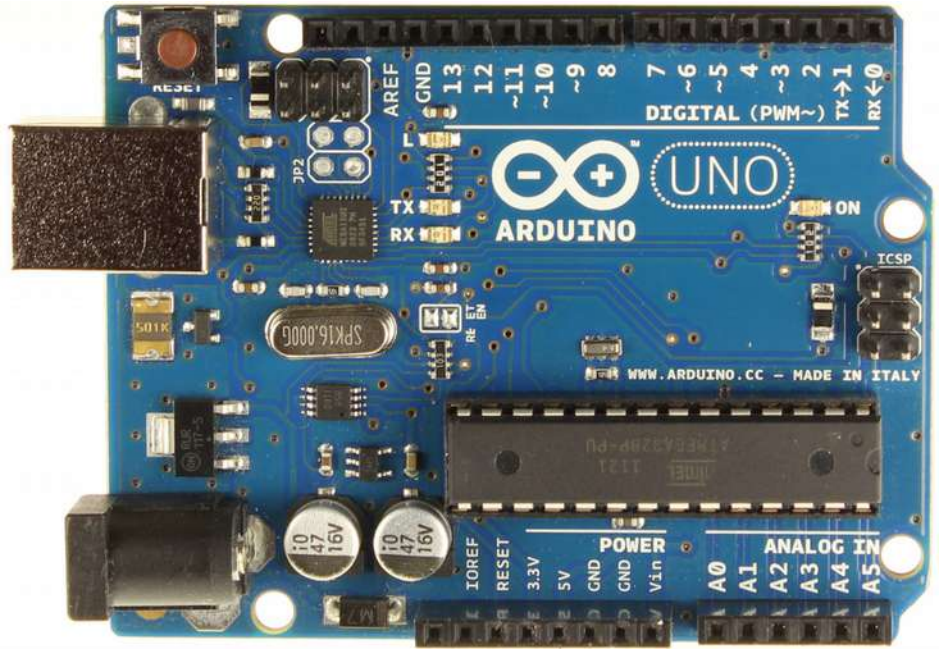
Arduino is an Open-Source electronic prototyping platform, based on simple hardware and easy to use.



Arduino Uno

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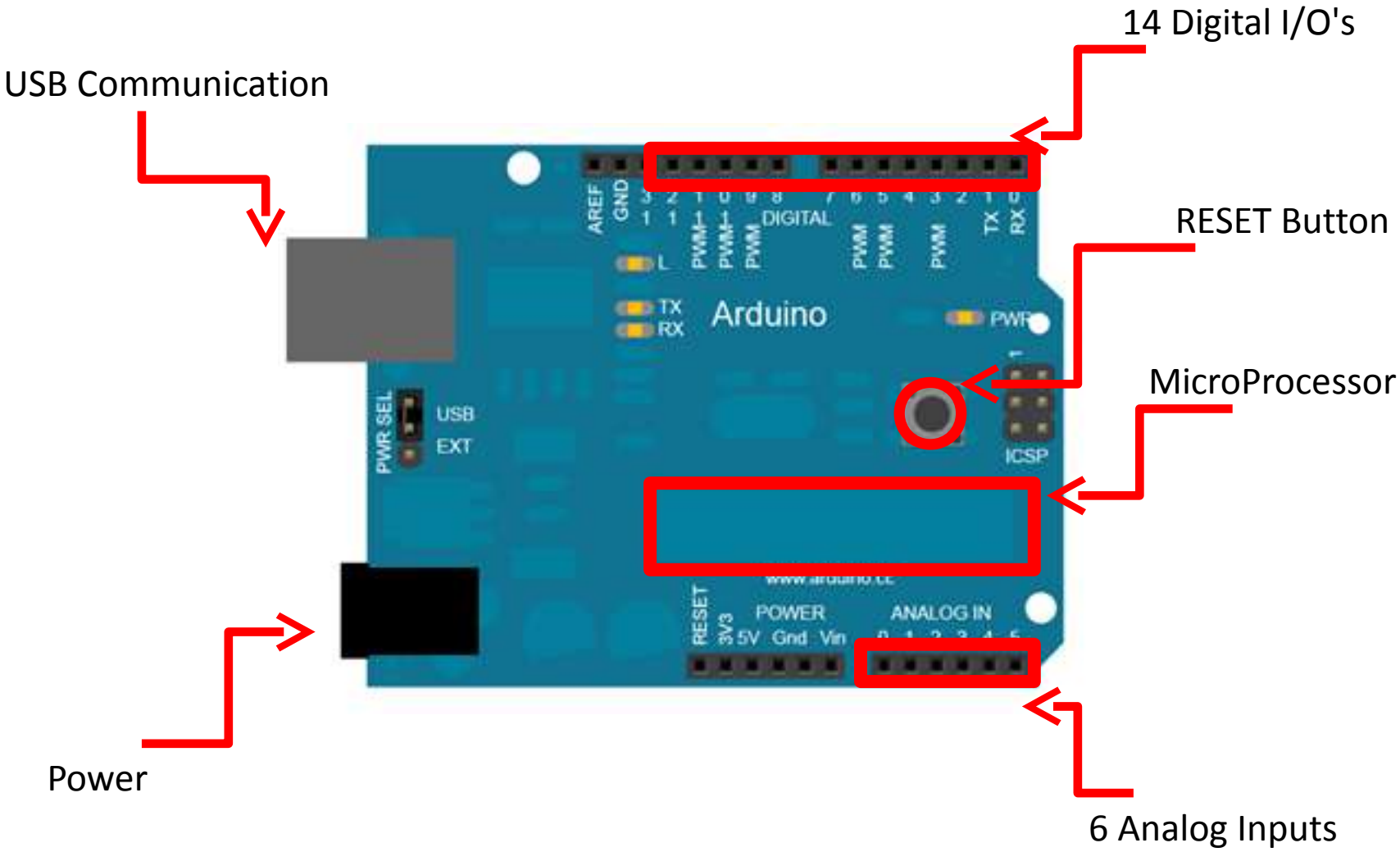

ONE A - Arduino

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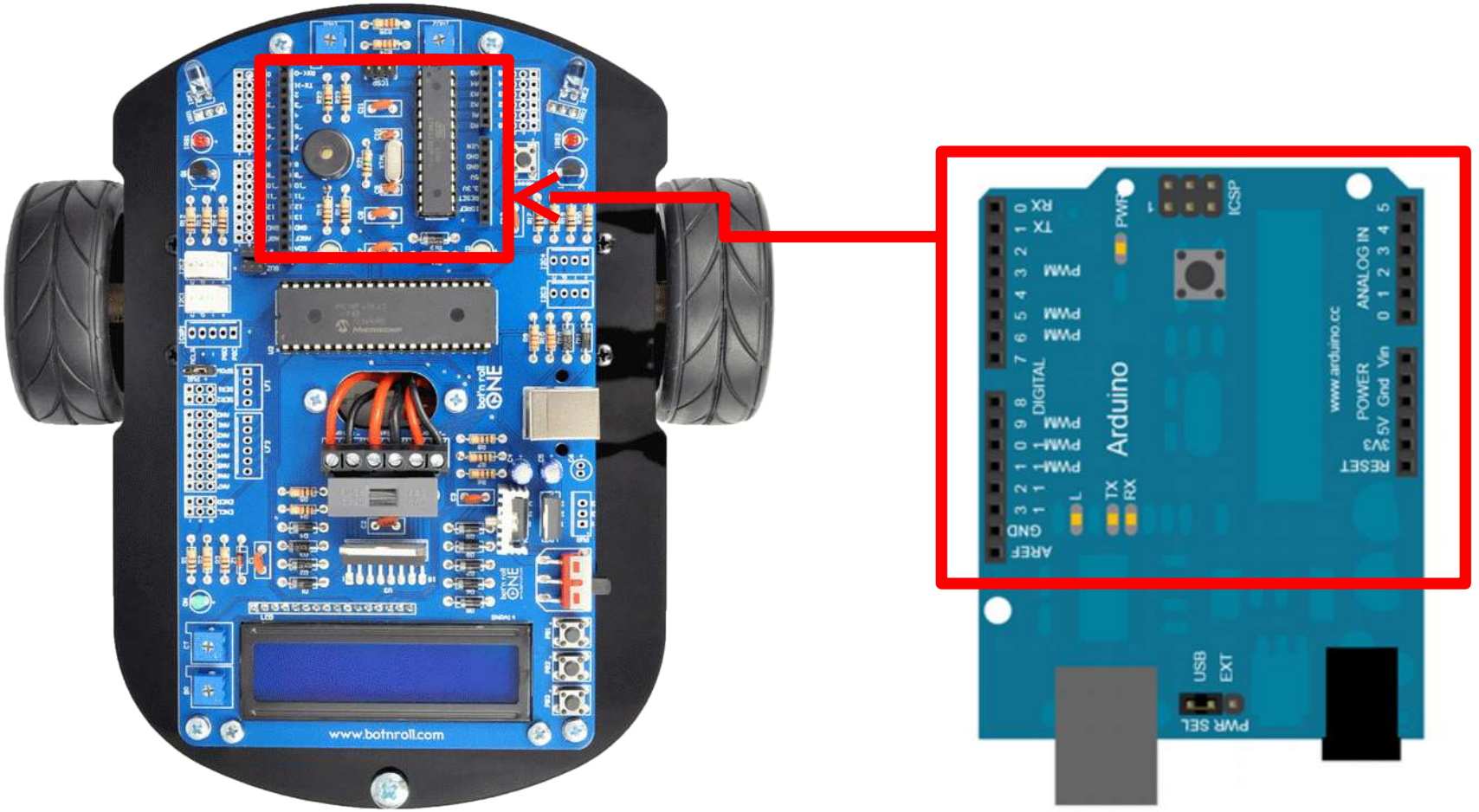

ONE A – Two Processors

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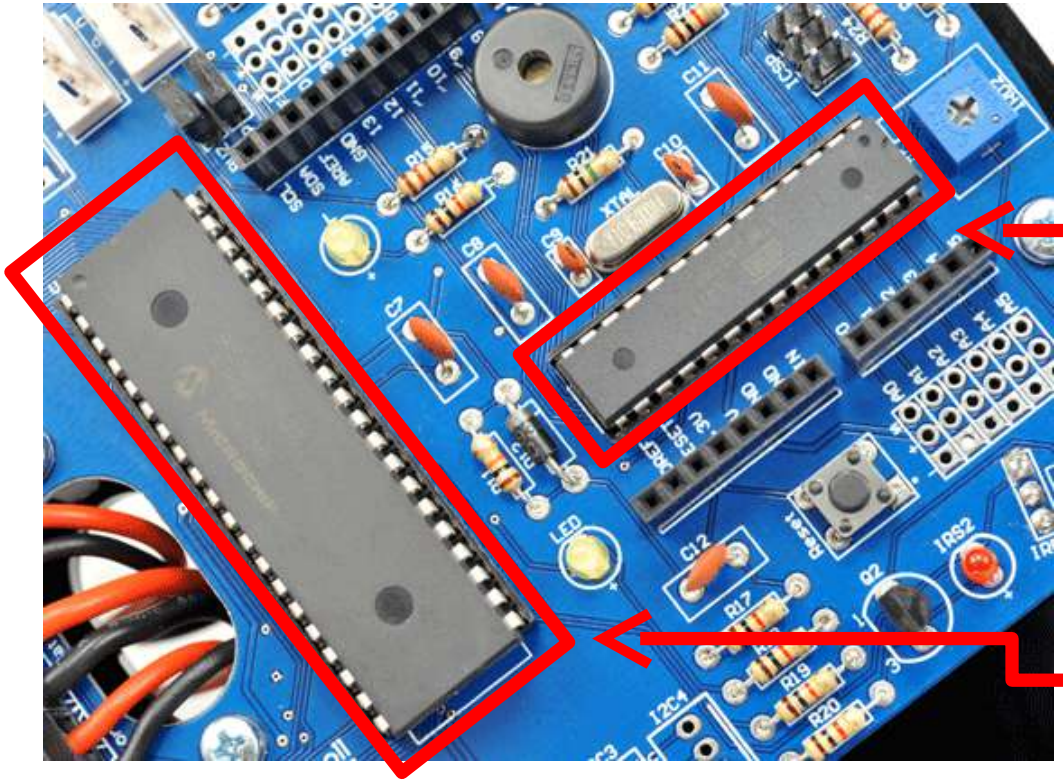
SPI Communication

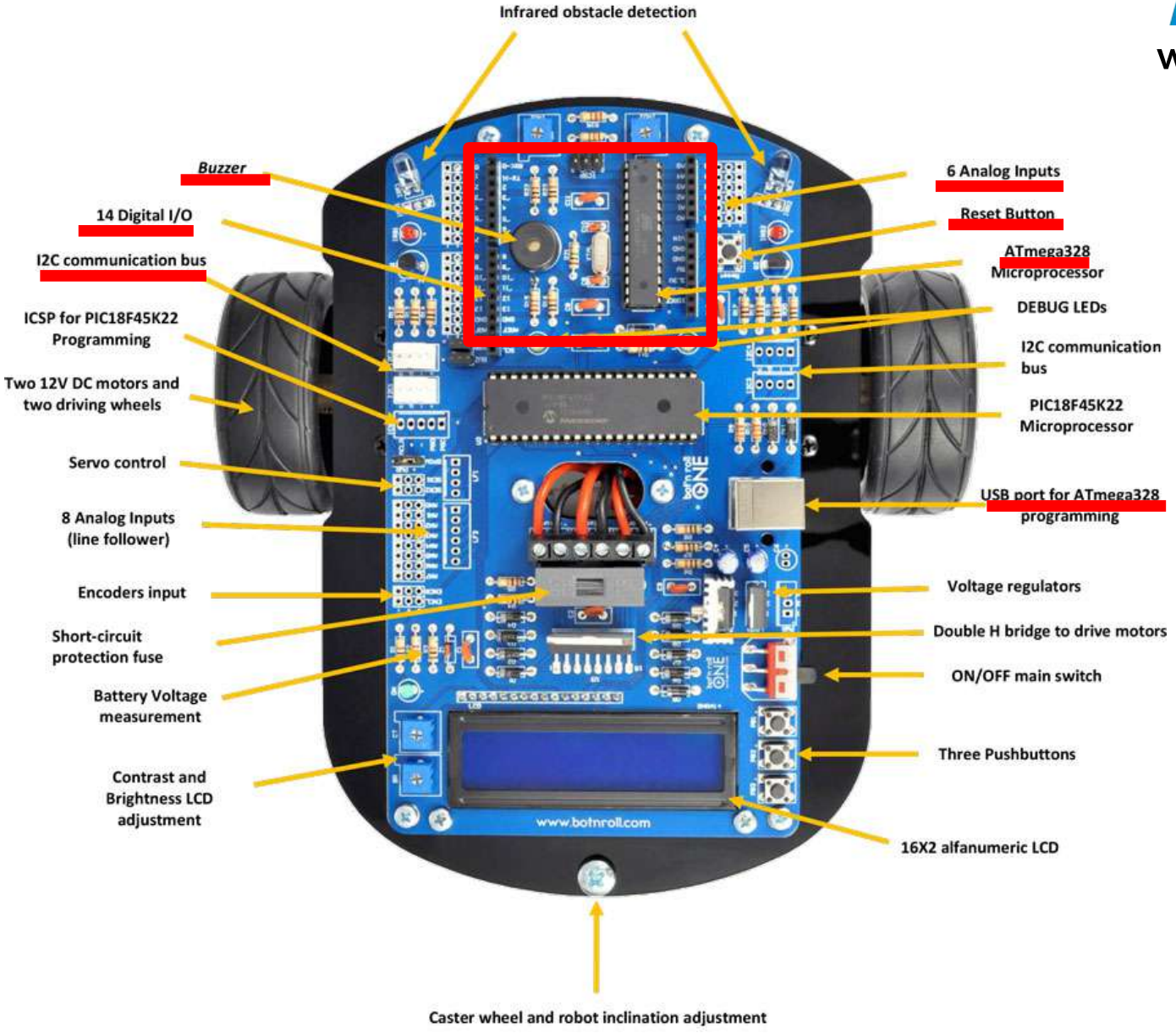


Atmega328
SPI Master

PIC18F45K22
SPI Slave

ONE A - Main Features

www.botnroll.com



Arduino

PIC

BnrOneA – Arduino Library

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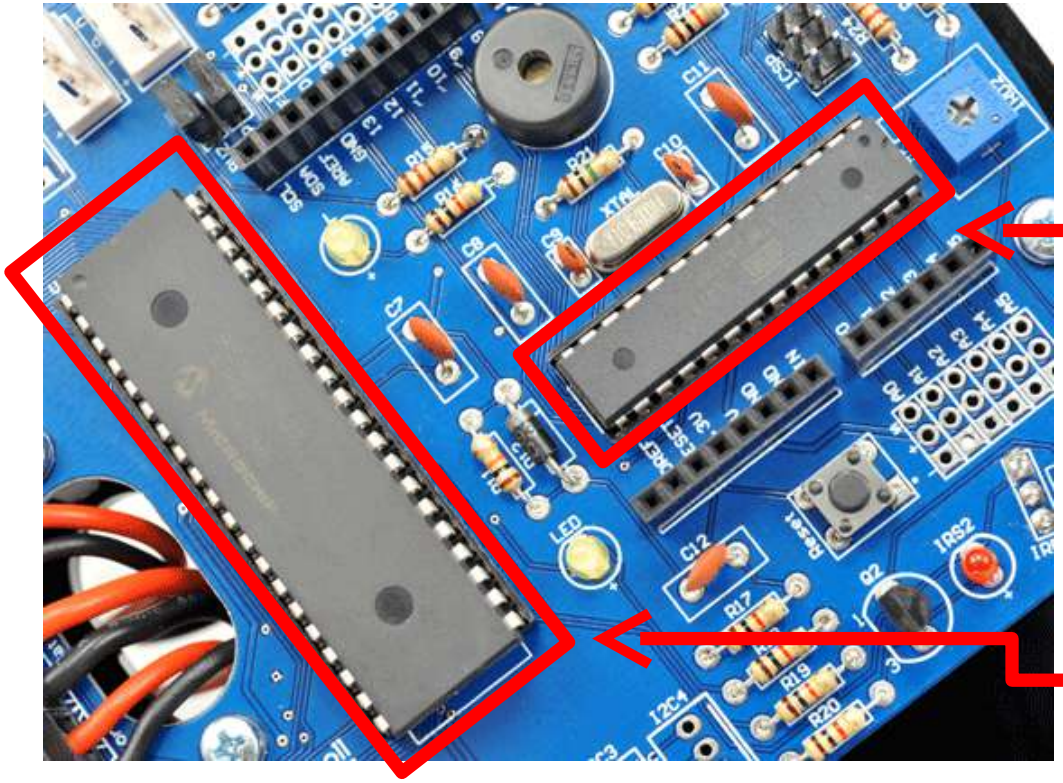
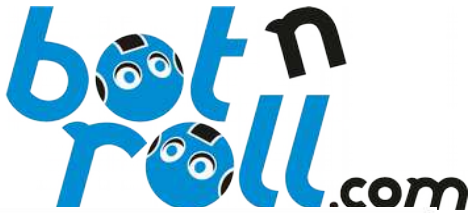
SPI Interface between the two processors



Atmega328
SPI Master

PIC18F45K22
SPI Slave

BnrOneA – Library Routines



Listagem das funções da biblioteca BnrOneA

Setup routines	Reading routines
void spiConnect(byte sspin);	byte obstacleSensors();
void minBat(float batmin);	byte readIRSensors();
void obstacleEmitters(boolean state);	IntreadAdc(byte);
	int readAdc0();
	int readAdc1();
	int readAdc2();
Writing routines	int readAdc3();
void servo1(byte position);	int readAdc4();
void servo2(byte position);	int readAdc5();
void led(boolean state);	int readAdc6();
void move(intspeedL,intspeedR);	int readAdc7();
void stop();	intreadButton();
void brake(byte torqueL,bytetorqueR);	float readBattery();
void resetEncL();	intreadEncL();
void resetEncR();	intreadEncR();
	intreadEncLInc();
	intreadEncRInc();
LCD Line 1 write routines	**LCD Line 2 write routines**
void lcd1(byte string[]);	void lcd2(byte string[]);
void lcd1(const char string[]);	void lcd2(const char string[]);
void lcd1(int number);	void lcd2(int number);
void lcd1(unsigned int number);	void lcd2(unsigned int number);
void lcd1(long int number);	void lcd2(long int number);

ONE A – Code Initialization

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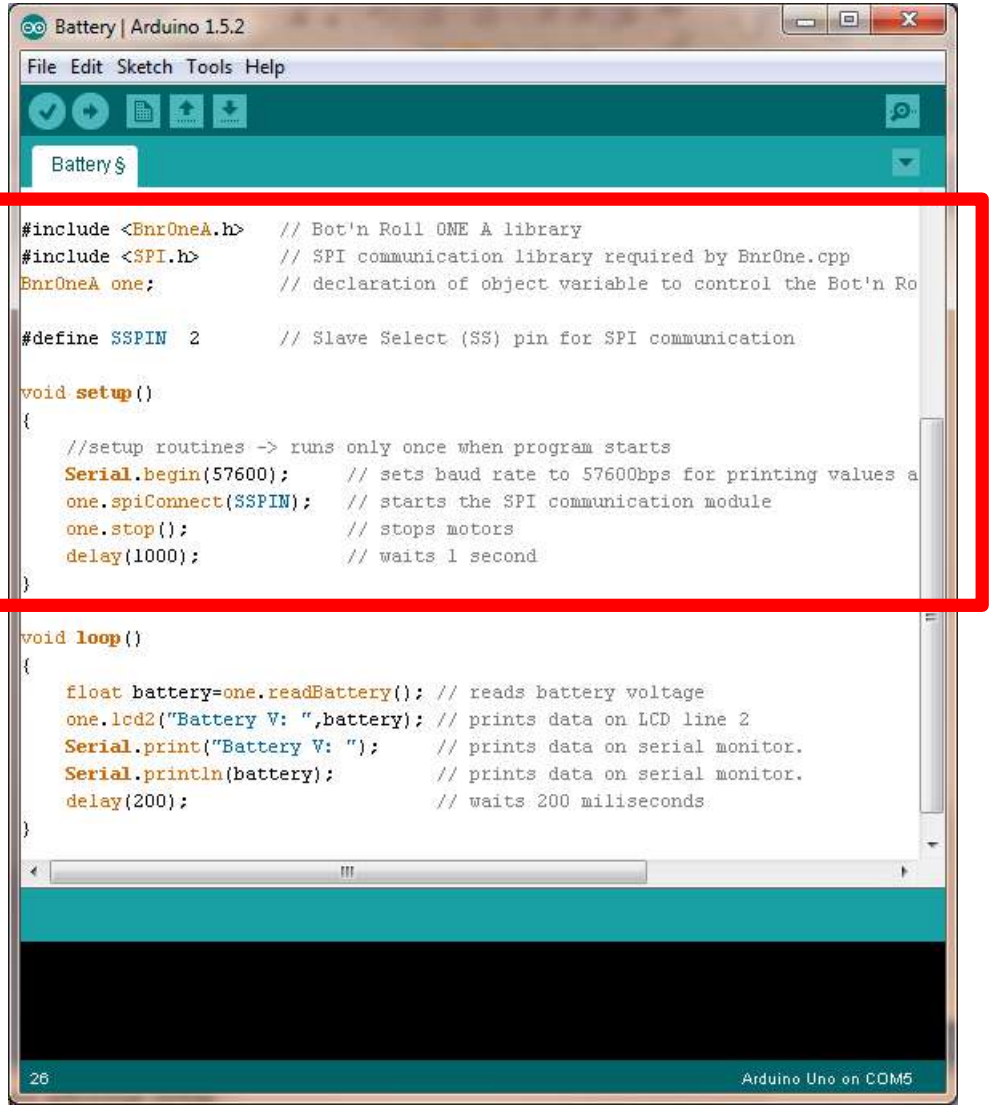
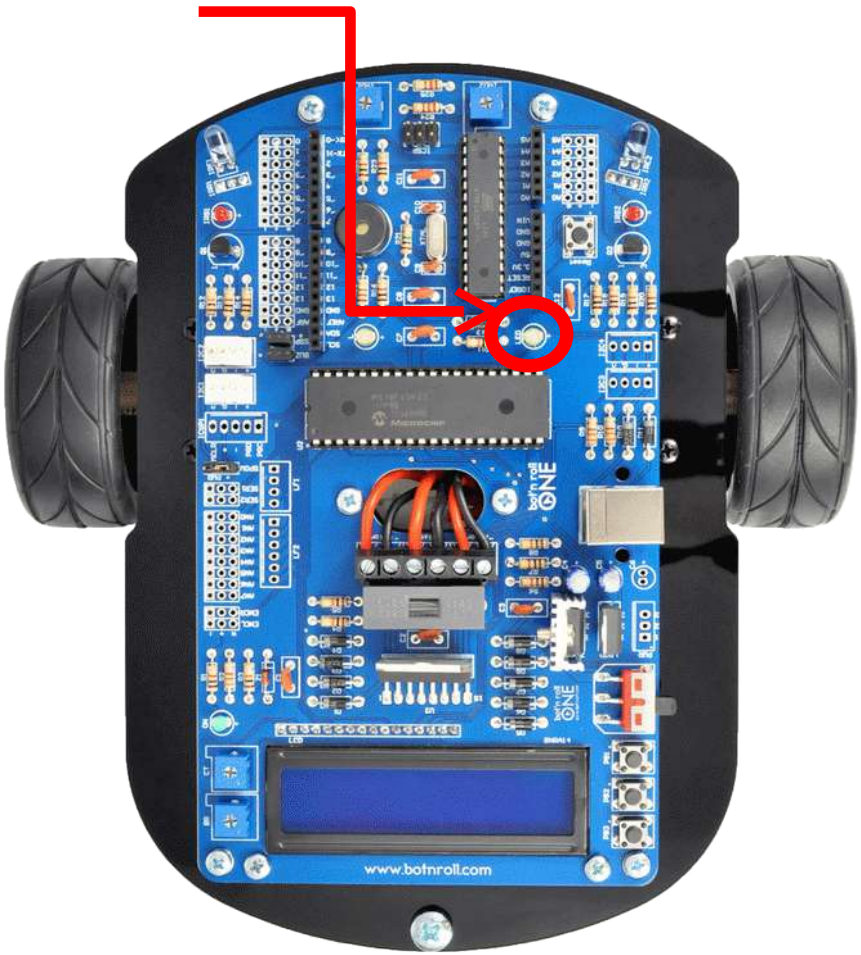


ONE A - LED



LED | Arduino 1.5.2

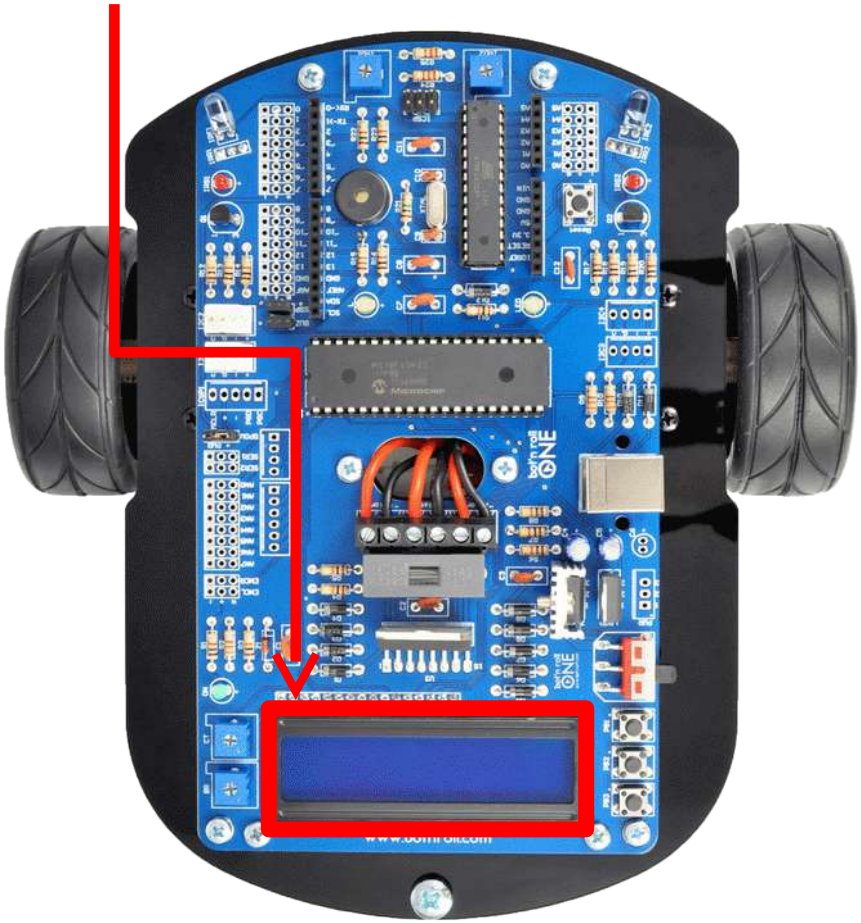
File Edit Sketch Tools Help

LED §

```
#include <BnrOneA.h>    // Bot'n Roll ONE A library
#include <SPI.h>        // SPI communication library required by Bn
BnrOneA one;            // declaration of object variable to contro

//constants definition
#define SSPIN  2        // Slave Select (SS) pin for SPI communicat

void setup()
{
    Serial.begin(57600);     // sets baud rate to 57600bps for pri
    one.spiConnect(SSPIN);   // starts the SPI communication modul
    one.stop();              // stops motors
    delay(1000);             // waits 1 second
}

void loop()
{
    one.led(HIGH);              // turns LED ON
    Serial.println("LED ON");   // prints data on serial monitor.
    delay(1000);                // waits 1 second
    one.led(LOW);               // turns LED OFF
    Serial.println("LED OFF");  // prints data on serial monitor.
    delay(1000);                // waits 1 second
}
```

40 Arduino Uno on COM5

ONE A - LCD



LCD | Arduino 1.5.2

File Edit Sketch Tools Help

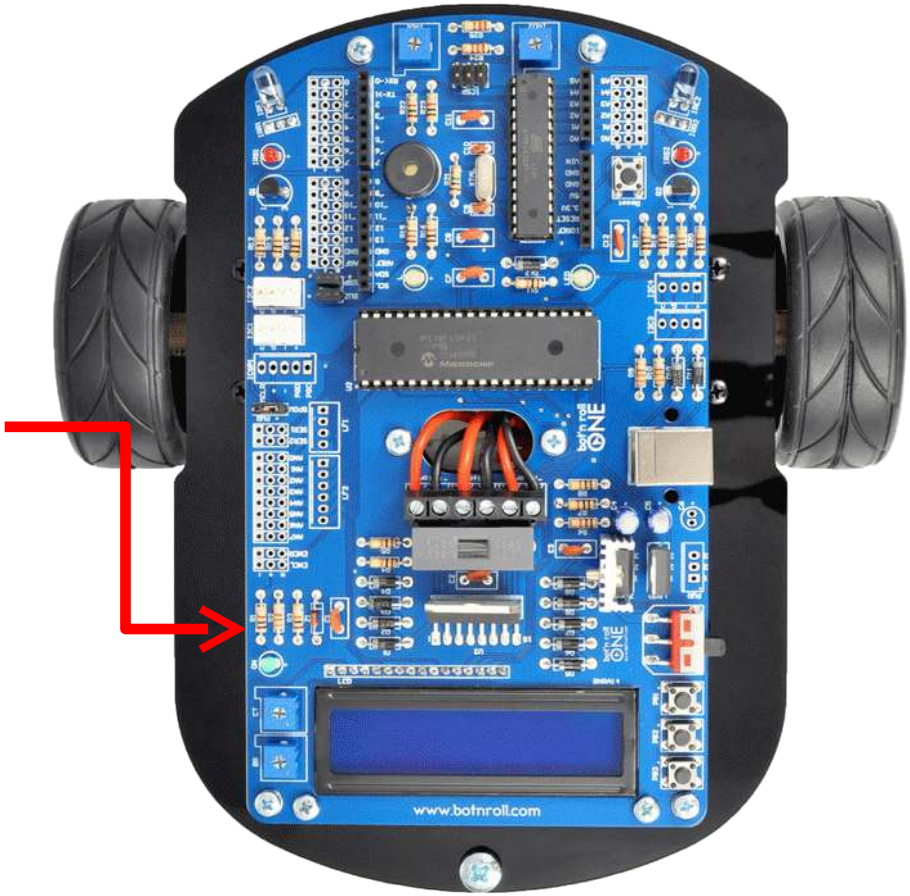
LCD §

```
#include <BnrOneA.h>    // Bot'n Roll ONE A library
#include <SPI.h>        // SPI communication library required by Bn
BnrOneA one;            // declaration of object variable to contro

//constants definition
#define SSPIN  2        // Slave Select (SS) pin for SPI communicat

void setup()
{
    Serial.begin(57600);      // sets baud rate to 57600bps for pri
    one.spiConnect(SSPIN);    // starts the SPI communication modul
    one.stop();               // stops motors
    delay(1000);              // waits 1 second
}

void loop()
{
    one.lcd1(" LCD Test OK !! "); // prints data on LCD line 1
    one.lcd2("www.botnroll.com"); // prints data on LCD line 2
    Serial.println("Message sent to LCD!");  // prints data on ser
    delay(1000);                  // wait 1 second
}
```

39 Arduino Uno on COM5

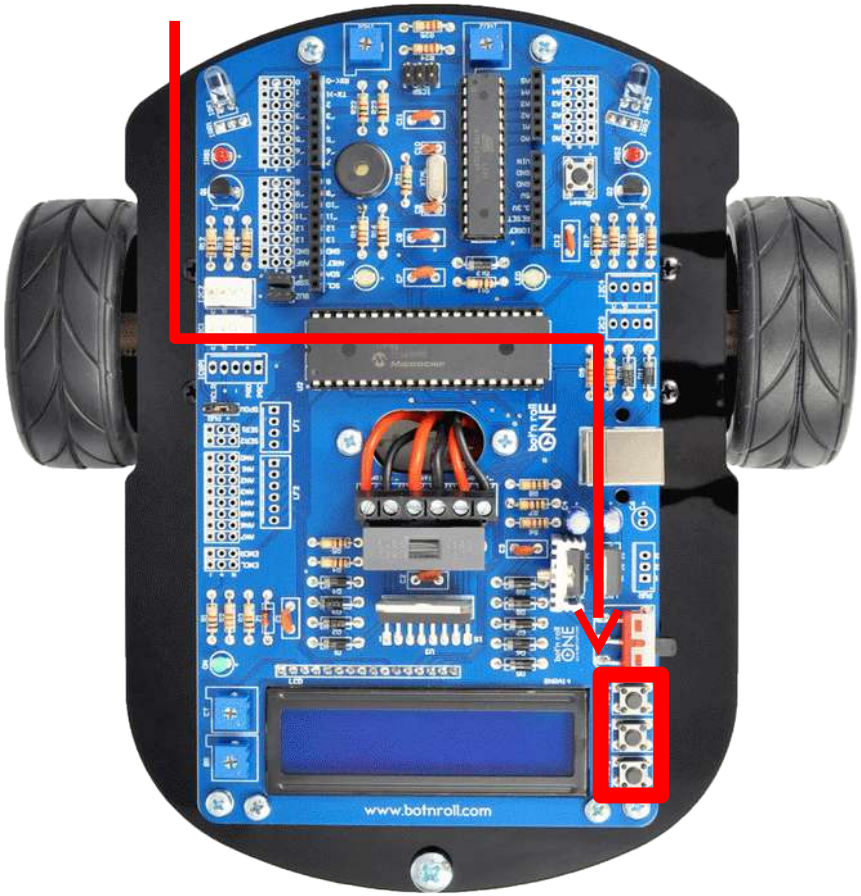
botnroll.com

ONE A - Battery



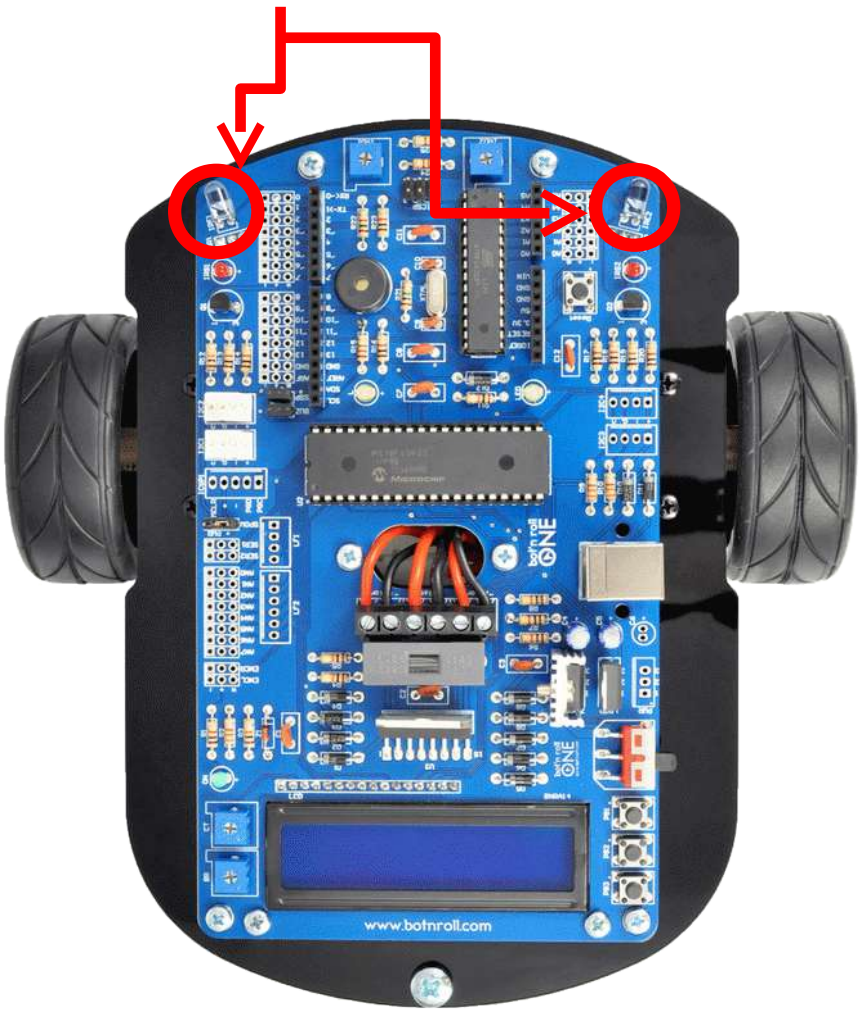

```
Battery | Arduino 1.5.2
File  Edit  Sketch  Tools  Help
Battery

#include <BnrOneA.h>    // Bot'n Roll ONE A library
#include <SPI.h>        // SPI communication library required by Bnr
BnrOneA one;            // declaration of object variable to control

//constants definition
#define SSPIN  2        // Slave Select (SS) pin for SPI communicati

void setup()
{
    //setup routines -> runs only once when program starts
    Serial.begin(57600);      // sets baud rate to 57600bps for prir
    one.spiConnect(SSPIN);    // starts the SPI communication module
    one.stop();               // stops motors
    one.minBat(8.5);          // defines de minimum battery voltage.
    delay(1000);              // waits 1 second
}

void loop()
{
    float battery=one.readBattery(); // reads battery voltage
    one.lcd2("Battery V: ",battery); // prints data on LCD line 2
    Serial.print("Battery V: ");     // prints data on serial monit
    Serial.println(battery);         // prints data on serial monit
    delay(200);                      // waits 200 miliseconds
}

1                                    Arduino Uno on COM5
```

ONE A - Buttons




```
PushButtons | Arduino 1.5.2
File  Edit  Sketch  Tools  Help
PushButtons §

#include <BnrOneA.h>    // Bot'n Roll ONE A library
#include <SPI.h>        // SPI communication library required by Bn
BnrOneA one;            // declaration of object variable to contro

//constants definition
#define SSPIN  2        // Slave Select (SS) pin for SPI communicat

void setup()
{
    Serial.begin(57600);      // sets baud rate to 57600bps for pri
    one.spiConnect(SSPIN);    // starts the SPI communication modul
    one.stop();               // stops motors
    delay(1000);              // waits 1 second
}

void loop()
{
    int pbutton=one.readButton();        // reads the Push Button v
    one.lcd2(" Push Button: ",pbutton); // prints data on LCD line
    Serial.print(" Push Button: ");      // prints data on serial m
    Serial.println(pbutton);             // prints data on serial m
    delay(100);                          // waits 100 miliseconds
}

40                                  Arduino Uno on COM5
```

ONE A – IR Emitters



IR_Emitters | Arduino 1.5.2

File Edit Sketch Tools Help

IR_Emitters §

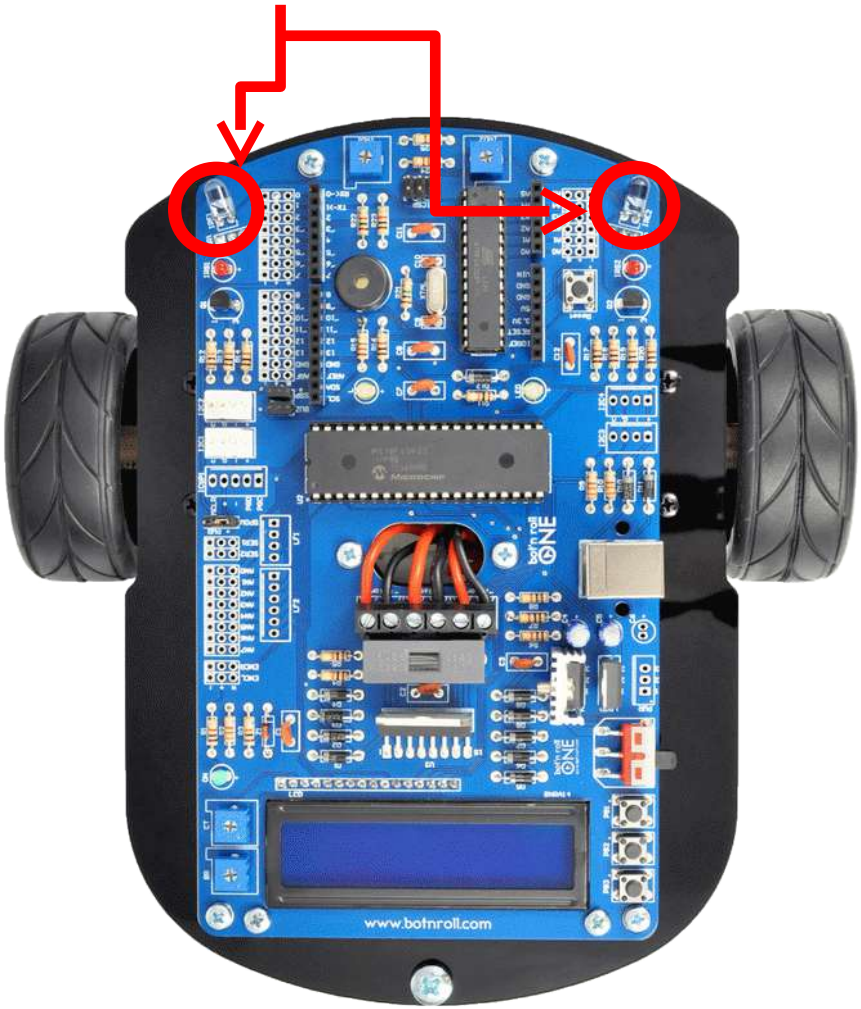
```
#include <BnrOneA.h>    // Bot'n Roll ONE A library
#include <SPI.h>        // SPI communication library required by Bn
BnrOneA one;            // declaration of object variable to contro

//constants definition
#define SSPIN  2        // Slave Select (SS) pin for SPI communicat

void setup()
{
    Serial.begin(57600);      // sets baud rate to 57600bps for pri
    one.spiConnect(SSPIN);    // starts the SPI communication modul
    one.stop();               // stops motors
    delay(1000);              // waits 1 second
}

void loop()
{
    one.obstacleEmitters(ON);           // activates IR emitter LED
    Serial.println("IR Emitters ON ");  // prints data on serial mo
    one.lcd2(" IR Emitters ON ");       // prints text on LCD line
    delay(1000);                        // waits 1 second
    one.obstacleEmitters(OFF);          // deactivates IR emitter L
    Serial.println("IR Emitters OFF");  // prints data on serial mo
    one.lcd2(" IR Emitters OFF ");      // prints text on LCD line
    delay(1000);                        // waits 1 second
}
```

45

Arduino Uno on COM5

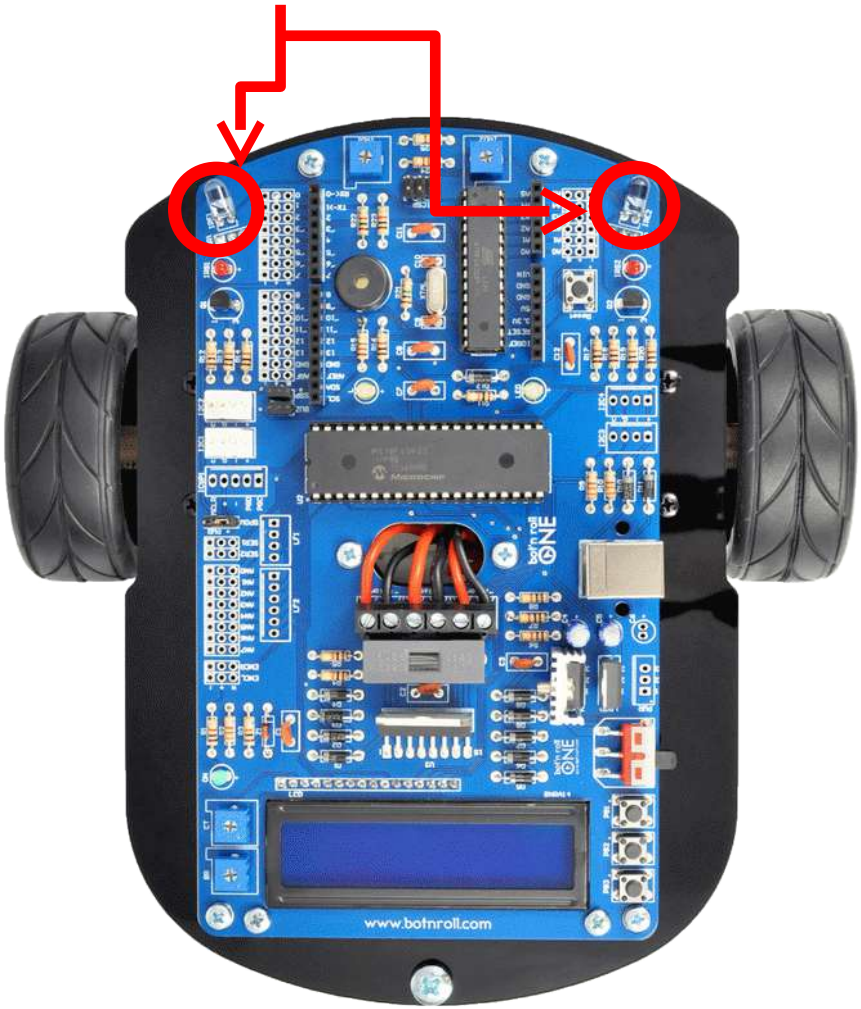
botnroll.com

ONE A – IR Sensors



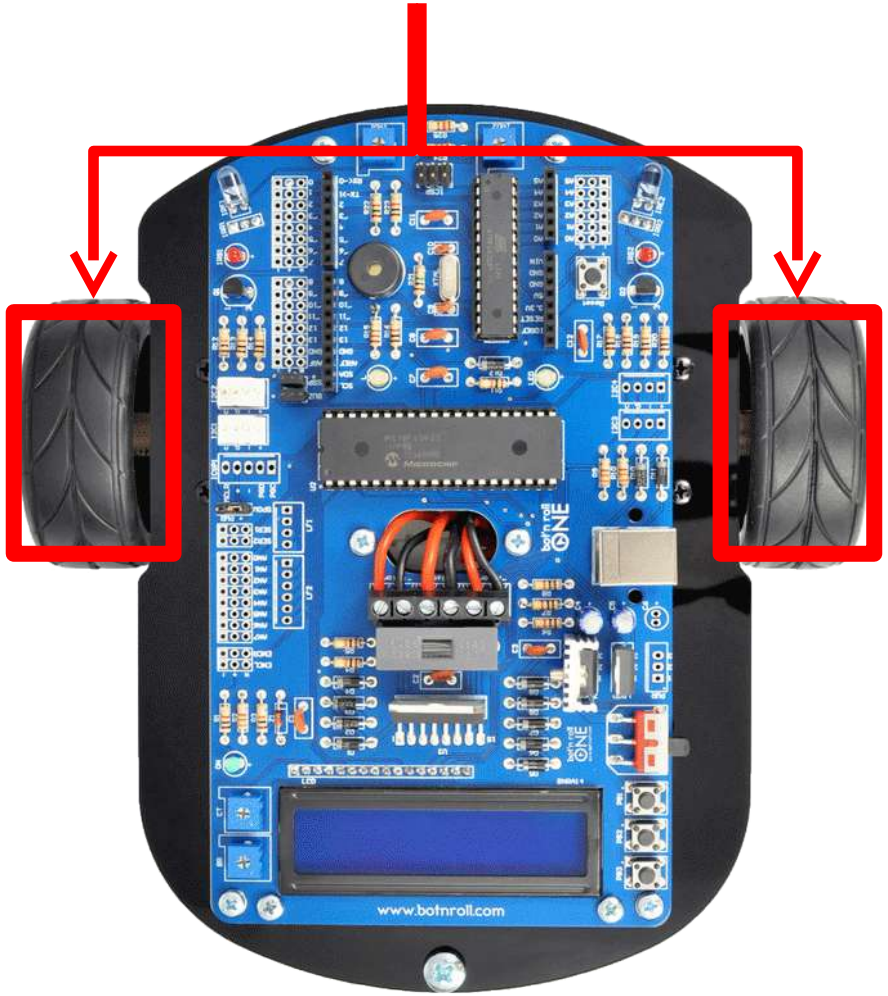

```
IR_Sensors | Arduino 1.5.2
File  Edit  Sketch  Tools  Help
IR_Sensors §

#include <BnrOneA.h>    // Bot'n Roll ONE A library
#include <SPI.h>        // SPI communication library required by Bn
BnrOneA one;            // declaration of object variable to contro

//constants definition
#define SSPIN  2        // Slave Select (SS) pin for SPI communicat

void setup()
{
    Serial.begin(57600);      // sets baud rate to 57600bps for pri
    one.spiConnect(SSPIN);    // starts the SPI communication modul
    one.stop();               // stops motors
    one.obstacleEmitters(ON);// activates IR emitter LEDs
    delay(1000);              // waits 1 second
}

void loop()
{
byte ir_sensors=0;

    ir_sensors=one.readIRSensors();       // read actual IR sensors
    Serial.print("IR Sensors ");          // prints data on serial
    Serial.println(ir_sensors);           // prints data on serial
    one.lcd2("IR Sensors:", ir_sensors); // prints text on LCD lin
    delay(1000);                          // waits 1 second
}

44                                  Arduino Uno on COM5
```

ONE A – IR Calibration




```
ObstaclesCalibration | Arduino 1.5.2
File  Edit  Sketch  Tools  Help
ObstaclesCalibration

void loop()
{
    byte obstacle=one.obstacleSensors(); // reads obstacle sensors
    switch(obstacle) // test variable
    {
        case 0:      // no obstacle detected
            one.lcd2(" No Obstacles: ",obstacle);
            Serial.print("No Obstacles: ");Serial.println(obstacle
            break;
        case 1:      // obstacle detected on Left sensor
            one.lcd2(" Left  Sensor: ",obstacle);
            Serial.print("Left  Sensor: ");Serial.println(obstacle
            break;
        case 2:      // obstacle detected on Right sensor
            one.lcd2(" Right Sensor: ",obstacle);
            Serial.print("Right Sensor: ");Serial.println(obstacle
            break;
        case 3:      // obstacle detected on both sensors
            one.lcd2(" Both Sensors: ",obstacle);
            Serial.print("Both Sensors: ");Serial.println(obstacle
            break;
        default:     // in case of reading error
             one.lcd2(" Error: ",obstacle);
            Serial.print("Error: ");Serial.println(obstacle);
            break;
    }
    delay(5);
}

1                                   Arduino Uno on COM5
```

ONE A - Motors



Motors | Arduino 1.5.2

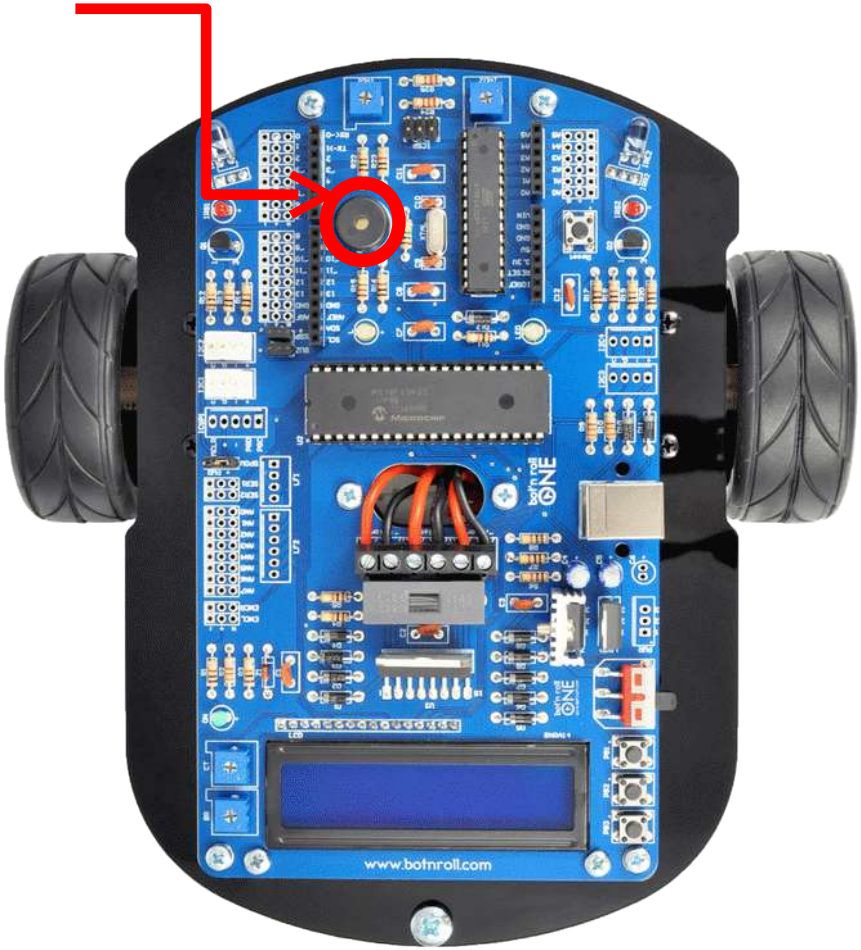
File Edit Sketch Tools Help

Motors

```
#include <BnrOneA.h>    // Bot'n Roll ONE A library
#include <SPI.h>        // SPI communication library required by Bn
BnrOneA one;            // declaration of object variable to contro

//constants definition
#define SSPIN  2        // Slave Select (SS) pin for SPI communicat

void setup()
{
    Serial.begin(57600);      // sets baud rate to 57600bps for pri
    one.spiConnect(SSPIN);    // starts the SPI communication modul
    one.stop();               // stops motors
    delay(1000);              // waits 1 second
}

void loop()
{
    one.lcd2("    Forward "); // prints data on LCD line 2
    one.move(50,50);          // Forward
    delay(1000);              // wait 1 second
    one.lcd2("     Stop   ");
    one.stop();               // Stop Motors
    delay(500);
    one.lcd2("   Backwards ");
    one.move(-50,-50);        // Backwards
    delay(1000);
    one.lcd2("     Stop   ");
    one.move(0,0);            // Stop Motors
```

1 Arduino Uno on COM5

ONE A - Buzzer



Buzzer | Arduino 1.5.2

File Edit Sketch Tools Help

Buzzer pitches.h

```
#include "pitches.h"

// notes in the melody:
int melody[] = { NOTE_C4, NOTE_G3, NOTE_G3, NOTE_A3, NOTE_G3, 0, N

// note durations: 4 = quarter note, 8 = eighth note, etc.:
int noteDurations[] = { 4, 8, 8, 4, 4, 4, 4, 4 };

void setup()
{
  // iterate over the notes of the melody:
  for (int thisNote = 0; thisNote < 8; thisNote++)
  {
    // to calculate the note duration, take one second
    // divided by the note type.
    //e.g. quarter note = 1000 / 4, eighth note = 1000/8, etc.
    int noteDuration = 1000/noteDurations[thisNote];
    tone(9, melody[thisNote],noteDuration);

    // to distinguish the notes, set a minimum time between them.
    // the note's duration + 30% seems to work well:
    int pauseBetweenNotes = noteDuration * 1.30;
    delay(pauseBetweenNotes);
    // stop the tone playing:
    noTone(9);
  }
}

void loop()
```

1 Arduino Uno on COM5

ONE A – Main routines

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```
// LED
one.led(ON);                    // ligar LED
one.led(FF);                    // desligar LED

// LCD
one.lcd1(" Olá Bot'n Roll");    // linha de cima
one.lcd2("www.botnroll.com");   // linha de baixo

// Bateria
bateria=one.readBattery();      // devolve voltagem da bateria

// botões de pressão
botao=one.readButton();         // devolve um valor (0, 1, 2, 3)

// Infravermelhos
one.obstacleEmitters(ON);       // liga os emissores
one.obstacleEmitters(OFF);      // desliga os emissores

// Buzzer (coluna)
tone(9, nota, duracao);         // toca "nota" durante determinada "duracao"

// Motores
one.move(50,-50)                // move os motores: Esquerda 50, Direita -50
one.stop();                     // Para os motores
```

ONE A – Other routines


```
//read routines
void read_firmware(byte*,byte*,byte*);

int read_encL();
int read_encR();
int read_encL_inc();
int read_encR_inc();

// write routines
void servo1(byte position);
void servo2(byte position);
void reset_encL();
void reset_encR();
void minBat(float batmin);
```

ONE A – Other routines


```
//read routines
void read_firmware(byte*,byte*,byte*);

int read_encL();
int read_encR();
int read_encL_inc();
int read_encR_inc();

// write routines
void servo1(byte position);
void servo2(byte position);
void reset_encL();
void reset_encR();
void minBat(float batmin);
```

ONE A – Videos

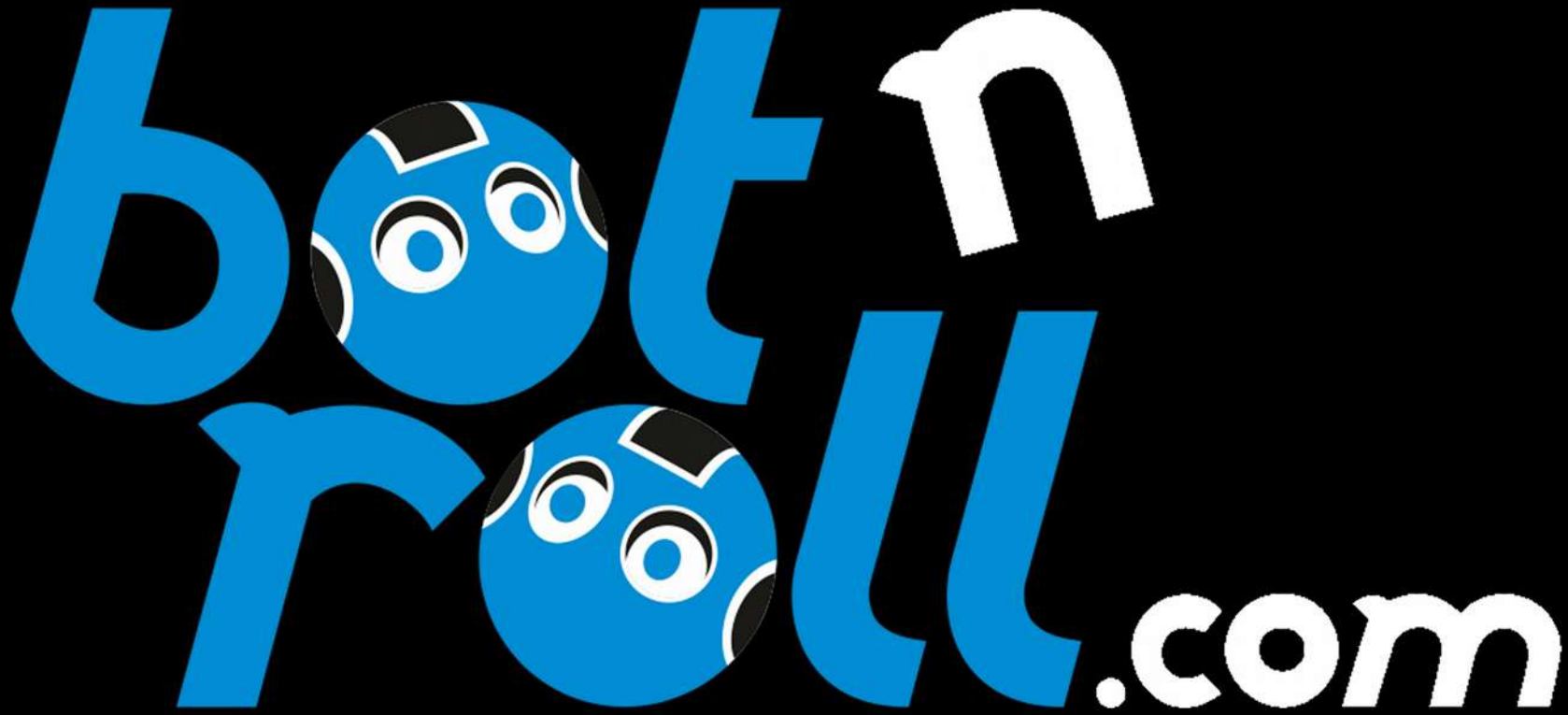
www.botnroll.com

Line Follower

https://www.youtube.com/watch?v=td7RJuLAIb4

RoboParty® Preview

https://www.youtube.com/watch?v=ke4N7EJMcVY



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Thanks for your attention!