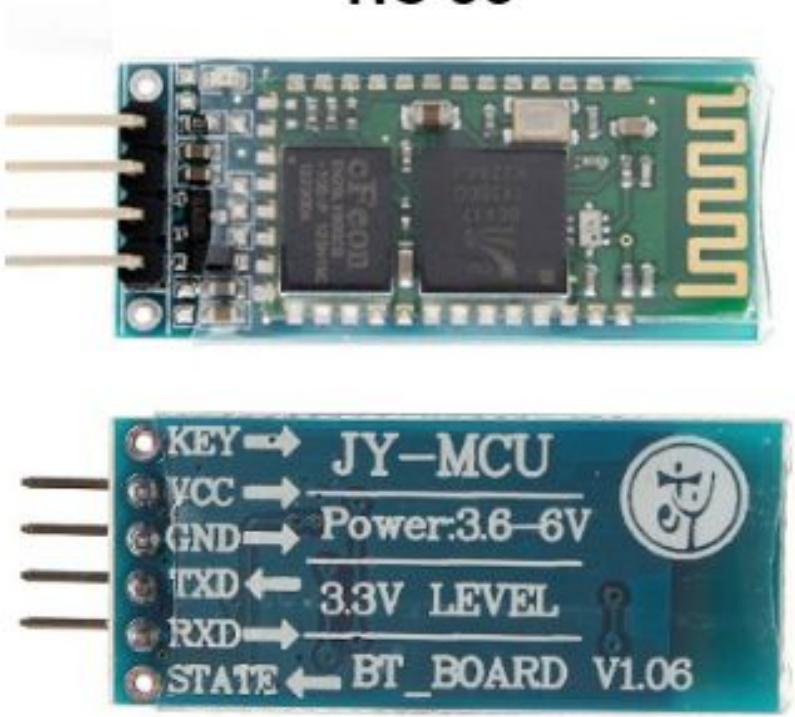
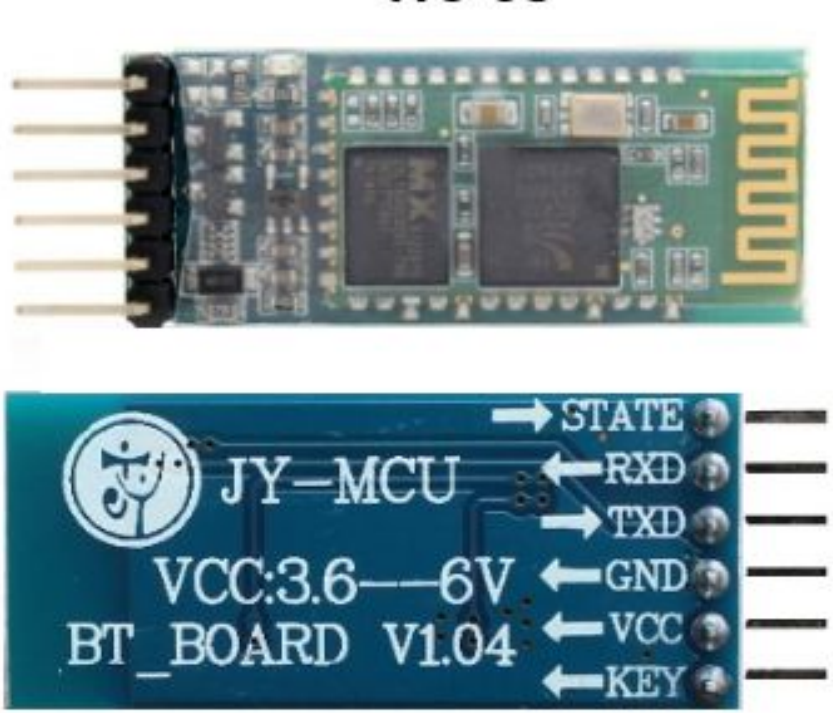
Bluetooth y módulos de adquisición de biopotenciales

HC-05 y HC-06

HC-06

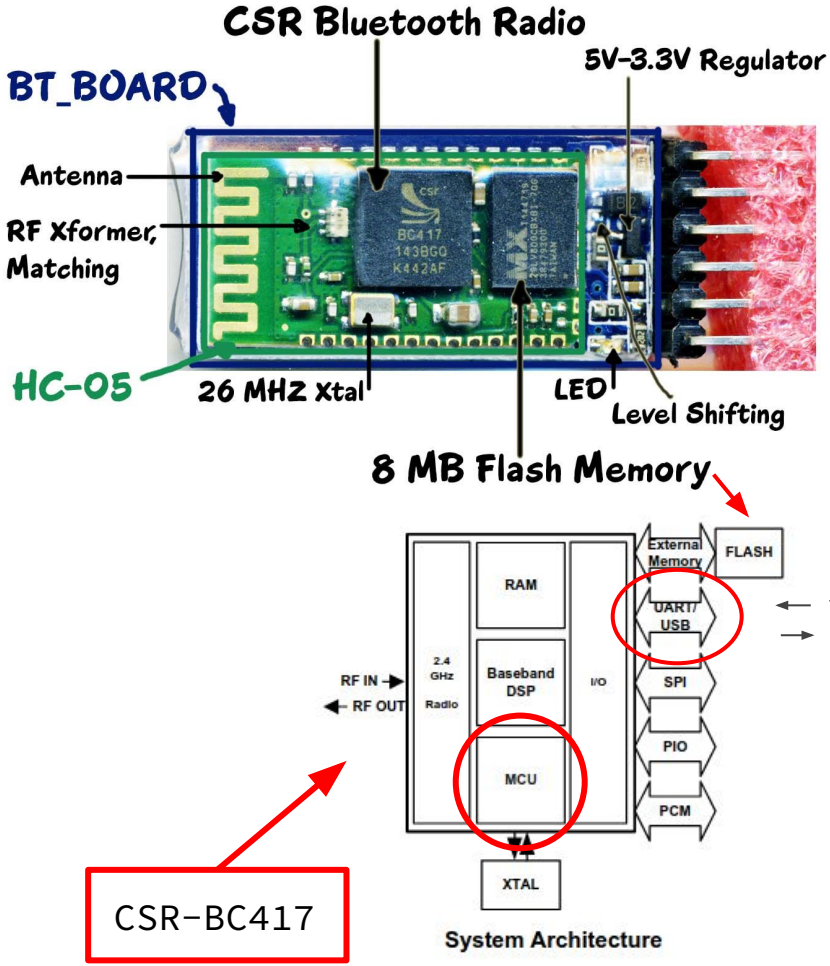


HC-05



HC-05

- Voltaje de alimentación: 3.3 - 6 VDC
- Corriente de entrada: 50 mA
- Perfil de comunicación serie
- Velocidad:
  - Asíncrona: 2.1Mbps(Max) / 160 kbps
  - Síncrona: 1Mbps/1Mbps
    - Baud rate por defecto 9600
- Configurable como maestro o esclavo
- Nombre por defecto HC-05, contraseña 1234 o 0000
- Soporta comandos AT



HC-05 - AT Command Set

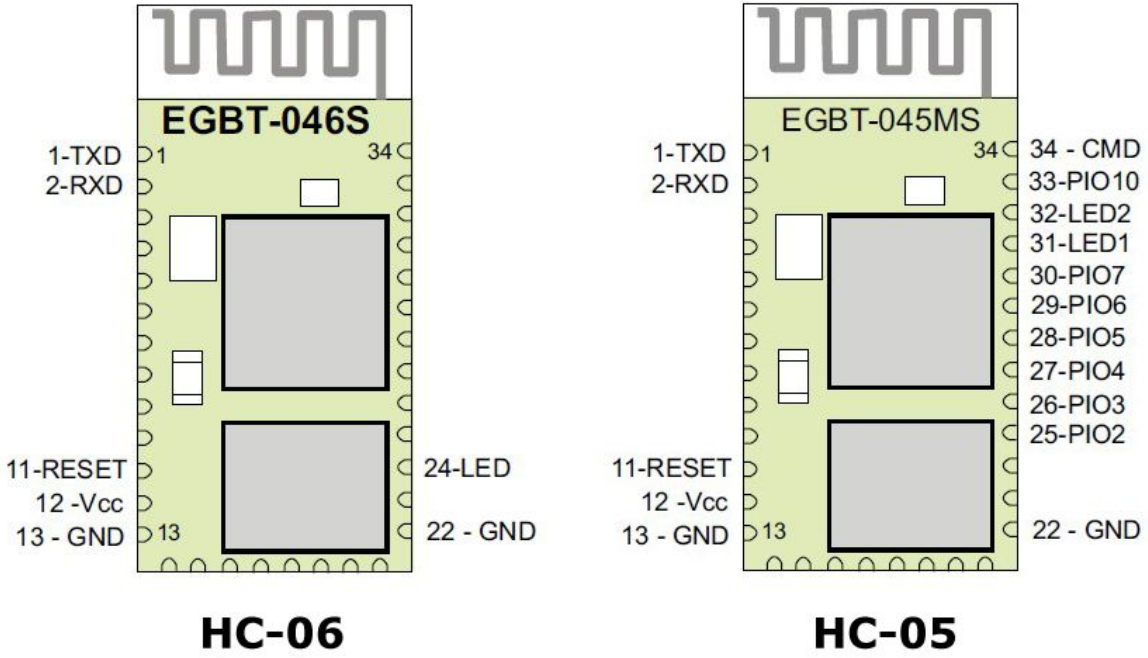
AT Command is case-sensitive, should end up with terminator "\r\n" (Carriage Return and New Line).

Function	AT Command	Response	Parameter	Observations	Examples
Test	AT	OK	None	-	*AT* OK
Reset	AT+RESET	OK	None	-	*AT+RESET* OK
Get the software version	AT+VERSION?	+VERSION:Param1 OK	Param1: Version number	-	*AT+VERSION\r\n* +VERSION:2.0-20100601 OK
Restore default status	AT+ORGL	OK	None	The parameter of default status: 1. Device type: 0 2. Inquire code: 0x009e8b33 3. Module work mode: Slave Mode 4. Connection mode: Connect to the Bluetooth device specified 5. Serial parameter: Baud rate: 38400 bits/s; Stop bit: 1 bit; Parity bit: None. 6. Passkey: "1234" 7. Device name: "H-C-2010-06-01"	*AT+ORGL* OK
Get module bluetooth address	AT+ADDR?	+ADDR:Param1 OK	Param1: Bluetooth address	Bluetooth address will show as this way: NAP: UAP: LAP(Hexadecimal)	*Module Bluetooth address: 12:34:56:ab:cd:ef.* *AT+ADDR?\r\n* +ADDR:1234:56:abcdef OK
Set/Inquire device's name	AT+NAME=Param1	OK	Param1: Bluetooth device name	Length up to 32 bytes; Supports special characters; AT+NAME="HC-05" Is the same as AT+NAME=HC-05 Default: "HC-05"	*Set the module device name to "HC-05":* *AT+NAME=HC-05\r\n* *OK* *AT+NAME?\r\n* +NAME:HC-05 OK
	AT+NAME?	*If Success:* +NAME:Param1 OK *If Failure:* FAIL			
Inquire remote bluetooth device's name	AT+RNAME?Param1	*If Success:* +NAME:Param2 OK *If Failure:* FAIL	Param1: Remote Bluetooth device address Param2: Remote Bluetooth device name	Bluetooth address will show as this way: NAP:UAP:LAP (Hexadecimal)	*Bluetooth device address: 00:02:72:od:22:24; device name: Bluetooth.* *AT+RNAME?0002,72,od2224\r\n* +RNAME:Bluetooth OK
Set/Inquire module role	AT+ROLE=Param1	OK	Param1: module role: 0 -> Slave 1 -> Master 2 -> Slave-Loop	*Role introduction:* *Slave:* Passive connection; *Slave-Loop:* Passive connection, receive the remote Bluetooth master device data and send it back to the master device; *Master:* Inquire the near SPP Bluetooth slave device, build connection with it positively, and build up the transparent data transmission between master and slave device. Default: 0	*Set the module device role to Slave:* *AT+ROLE=0* *OK* *AT+ROLE?* +ROLE=0 OK
		+ROLE:Param1 OK			
Set/Inquire device type	AT+CLASS=Param1	OK	Param1: Device type	Bluetooth device type is a 32-bit parameter indicates the device type and what type can be supported. For inquiring the custom Bluetooth device from around Bluetooth devices quickly and effectively, user can set the module to be non-standard Bluetooth device type, such as 0x1f1f (Hexadecimal). More information is provided at the appendix 1(device type introduction). Default: 0	-
	AT+ CLASS?	*If Success:* + CLASS:Param OK *If Failure:* FAIL			

PDF completo: [Link]

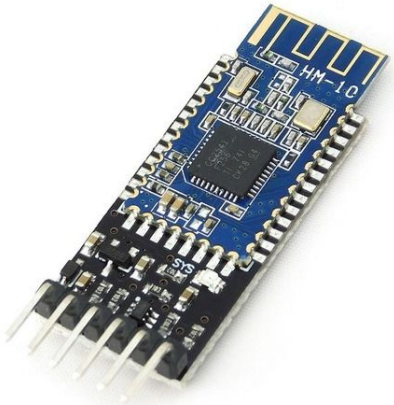
HC-06

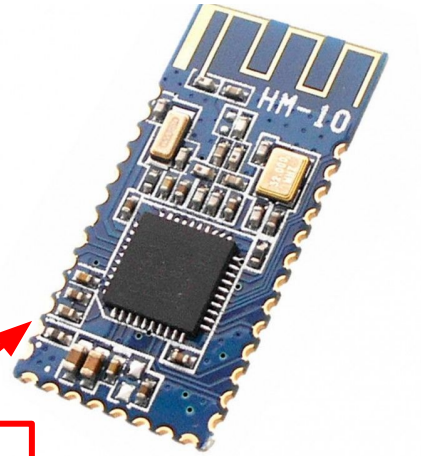
- Solo modo esclavo
- Mismo hardware que HC-05, diferente firmware



HM-10

- Bluetooth 4.0
- BLE (Bluetooth Low Energy)
  - La mayor parte del tiempo en modo sleep o suspendido
  - Dispositivos centrales o periferico
- Voltaje de operación: 2.0V - 3.6V (3.9V Máx)
- Muy bajo consumo (235 uA)





CC2541

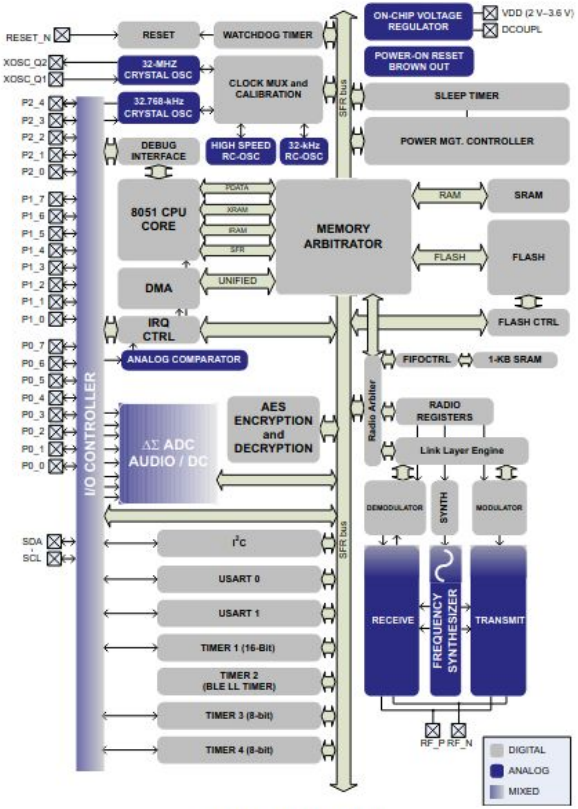
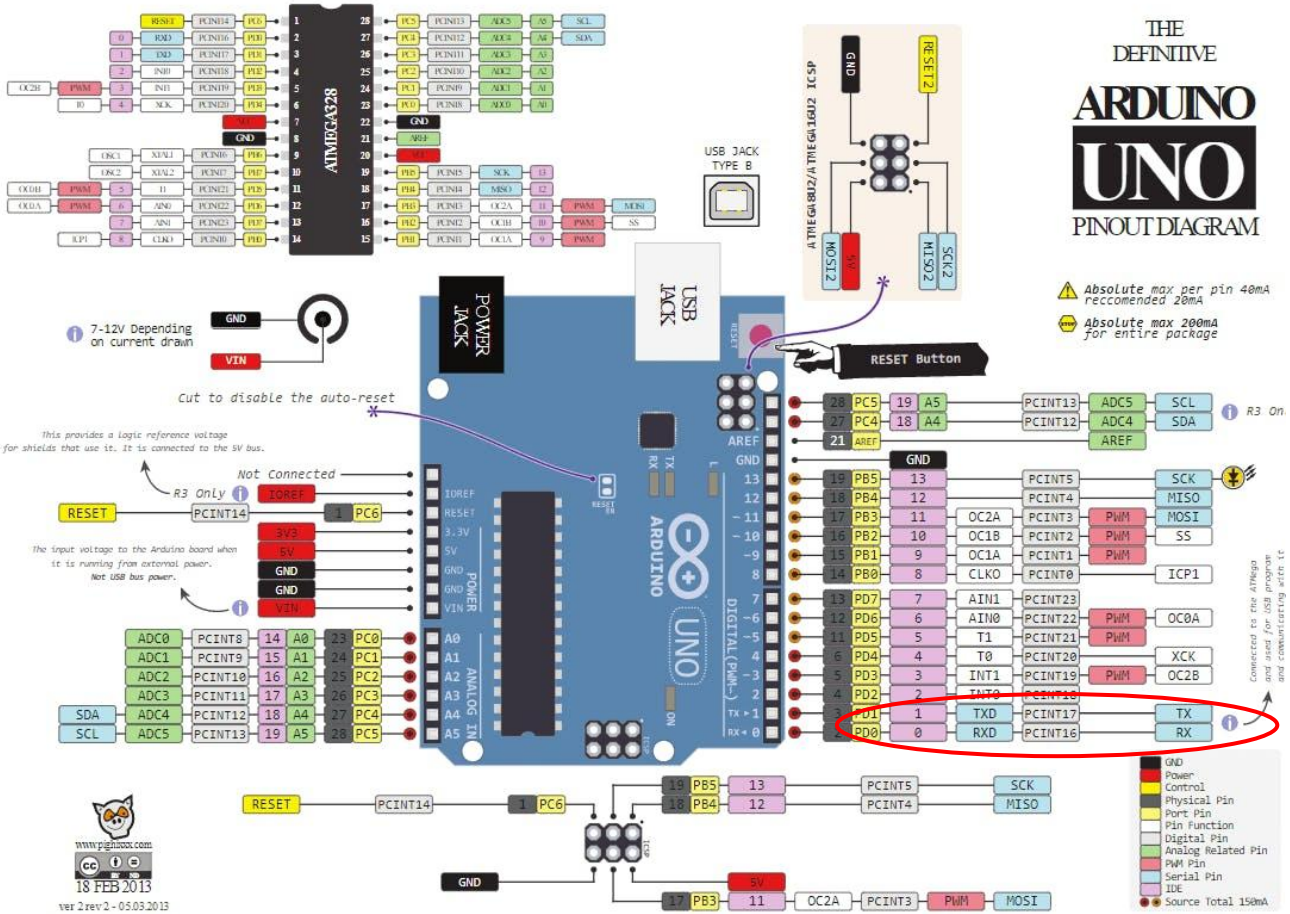


Figure 1. Block Diagram

Conexionado

Los pines 0 y 1 de Arduino UNO corresponden a la UART (TX y RX) y se inicializan al llamar a Serial.begin()

Si se requiere usar el USB mientras el programa está funcionando, no es posible conectar el HC-05 a la UART



SoftwareSerial

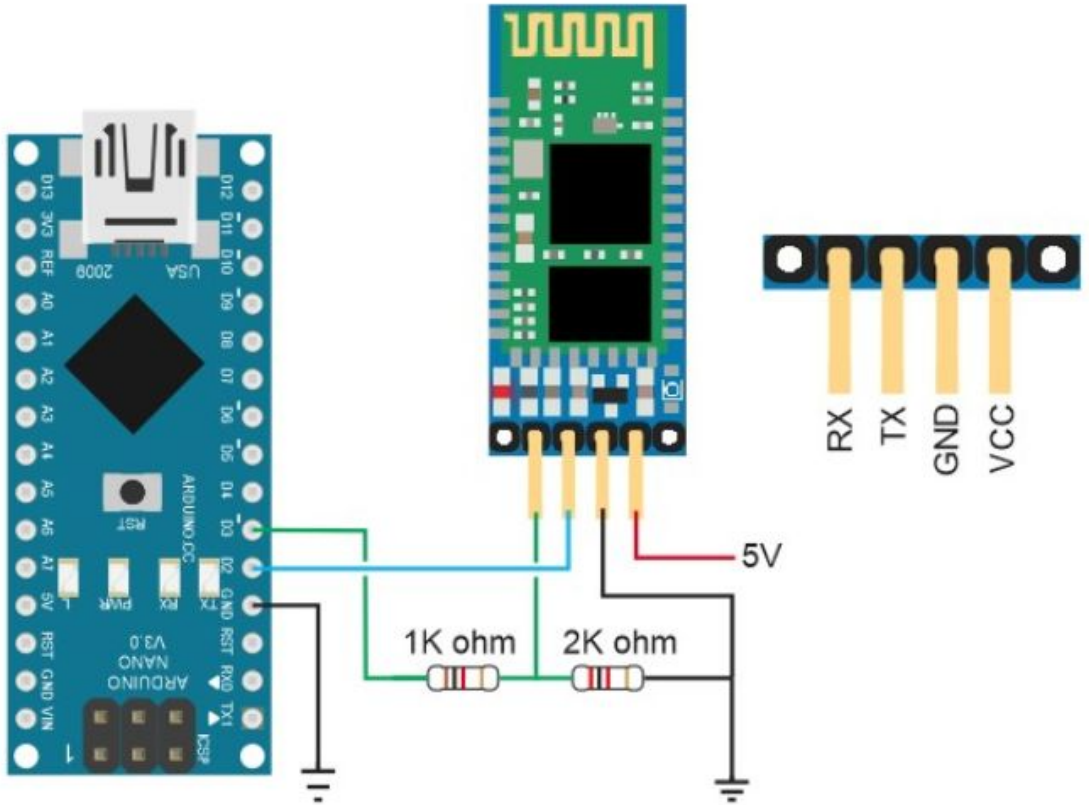
- Biblioteca que simula una UART utilizando dos pines digitales de Arduino.
- Se utiliza cuando se quieren establecer múltiples comunicaciones serie
- Mismas funciones que biblioteca Serial
- Baudrate hasta 115200

```
#include <SoftwareSerial.h>

SoftwareSerial mySerial(2, 3); // RX, TX

void setup()
{
  // Open serial communications and wait for port to open:
  Serial.begin(115200);
  while (!Serial) {
    ; // wait for serial port to connect. Needed for Native USB only
  }


  Serial.println("Goodnight moon!");

  // set the data rate for the SoftwareSerial port
  mySerial.begin(38400);
  mySerial.println("Hello, world?");
}

void loop() // run over and over
{
  if (mySerial.available())
    Serial.write(mySerial.read());
  if (Serial.available())
    mySerial.write(Serial.read());
}
```

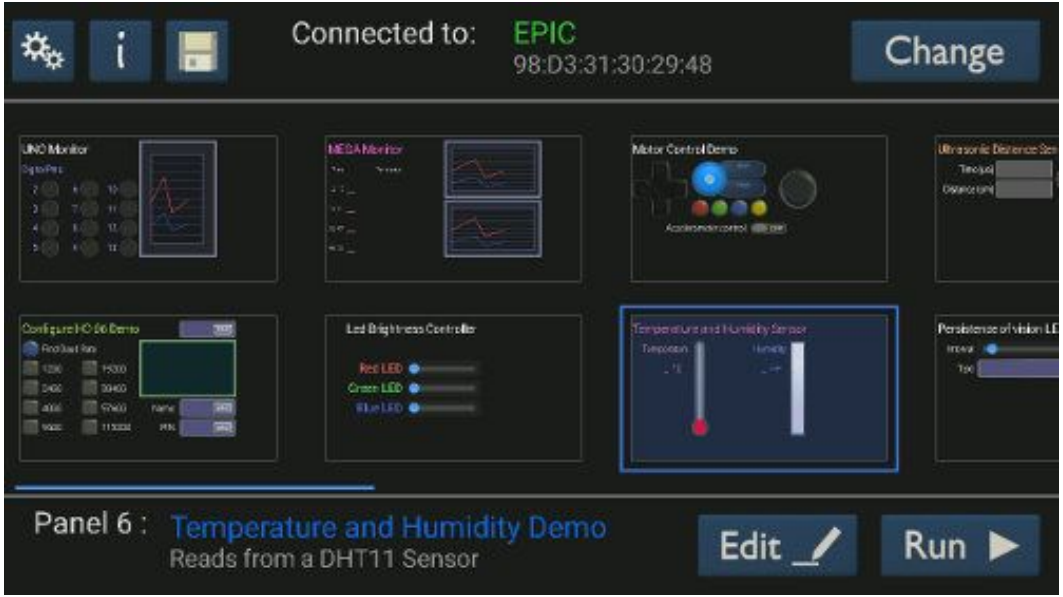
HC-05

Conexionado

- RX recibe la señal enviada desde TX de Arduino (5V). Es necesario implementar un divisor resistivo para adecuar el voltaje
- TX envía la señal a un adecuado voltaje lógico (3.3 V), se puede conectar directamente



Aplicaciones de Android



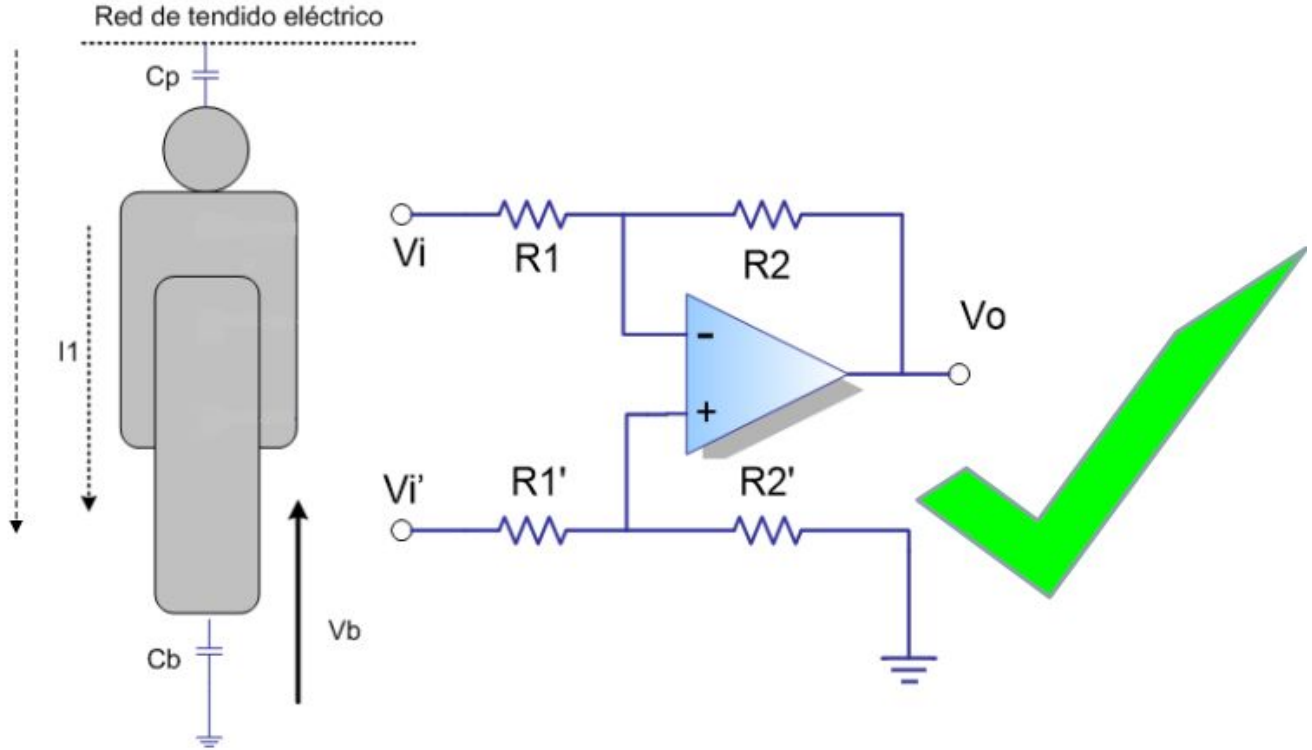
Bluetooth Electronics

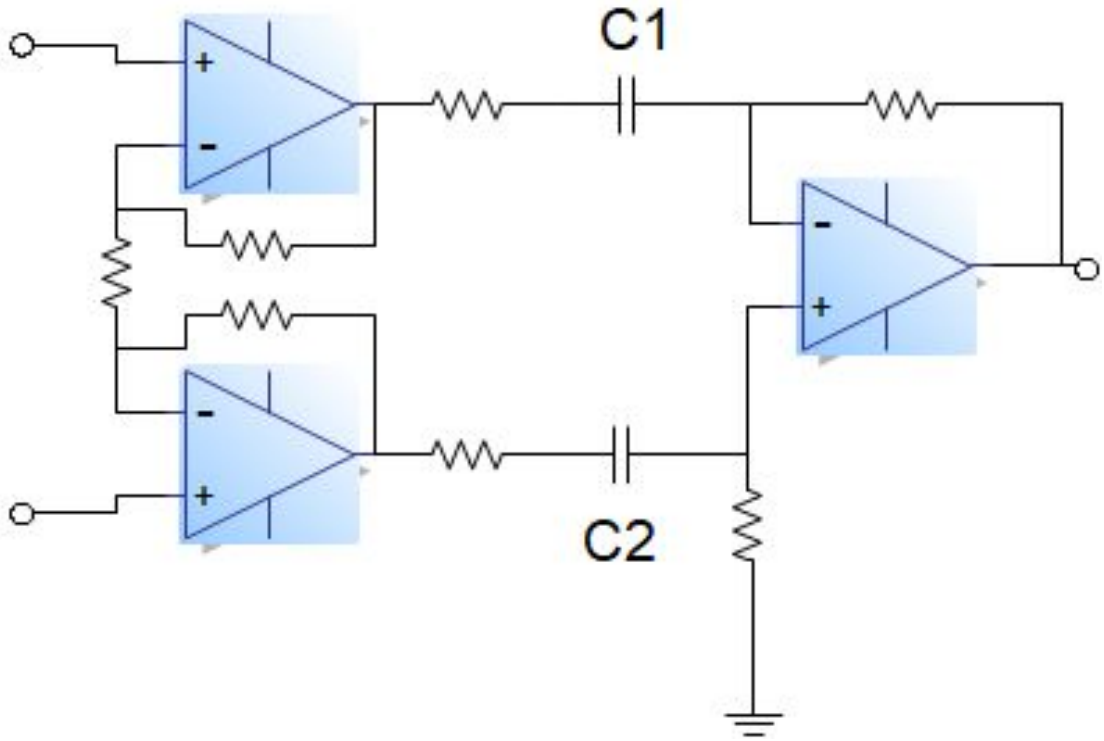
Bluetooth Terminal HC-05

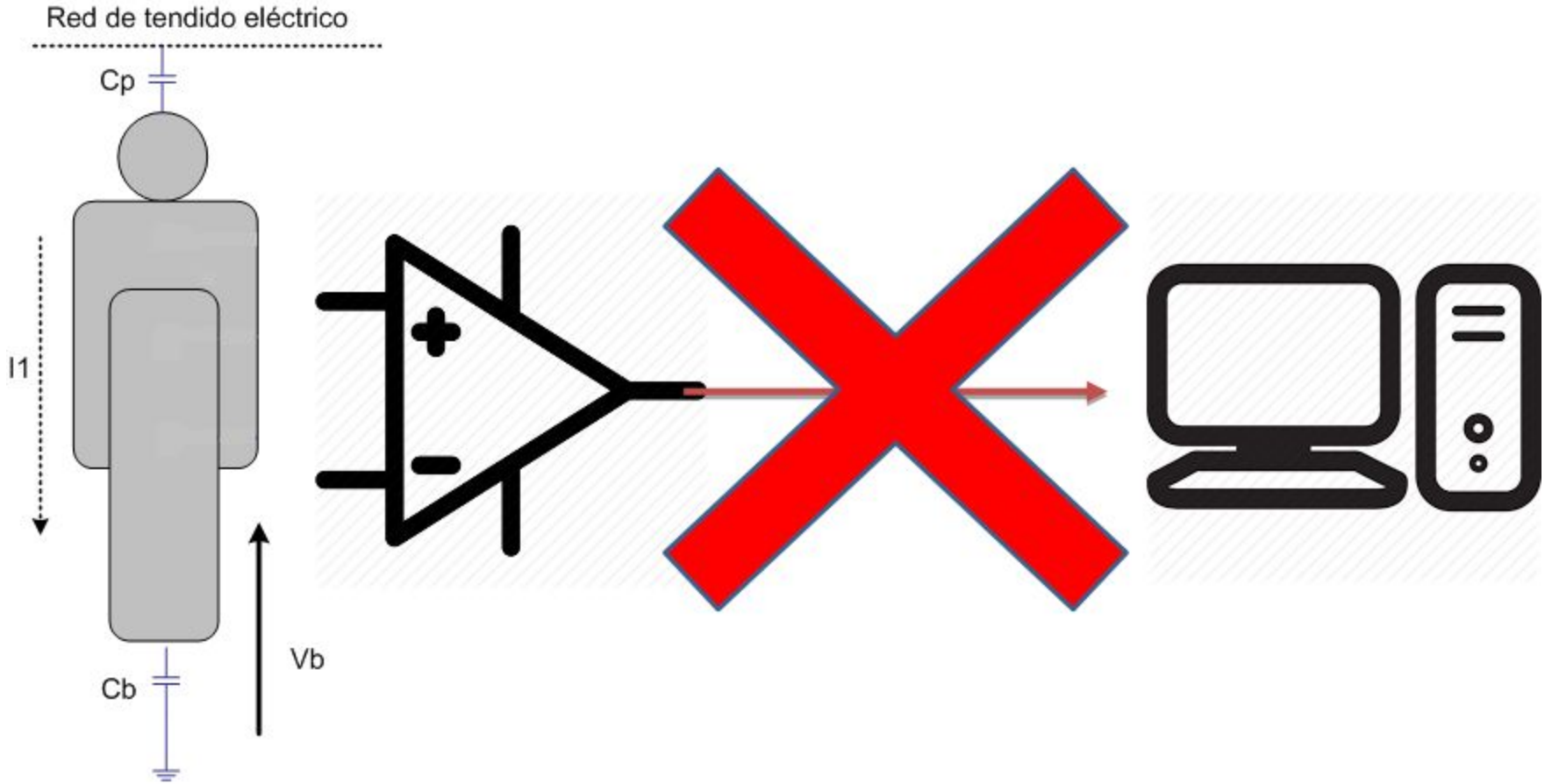
Aplicaciones de Android

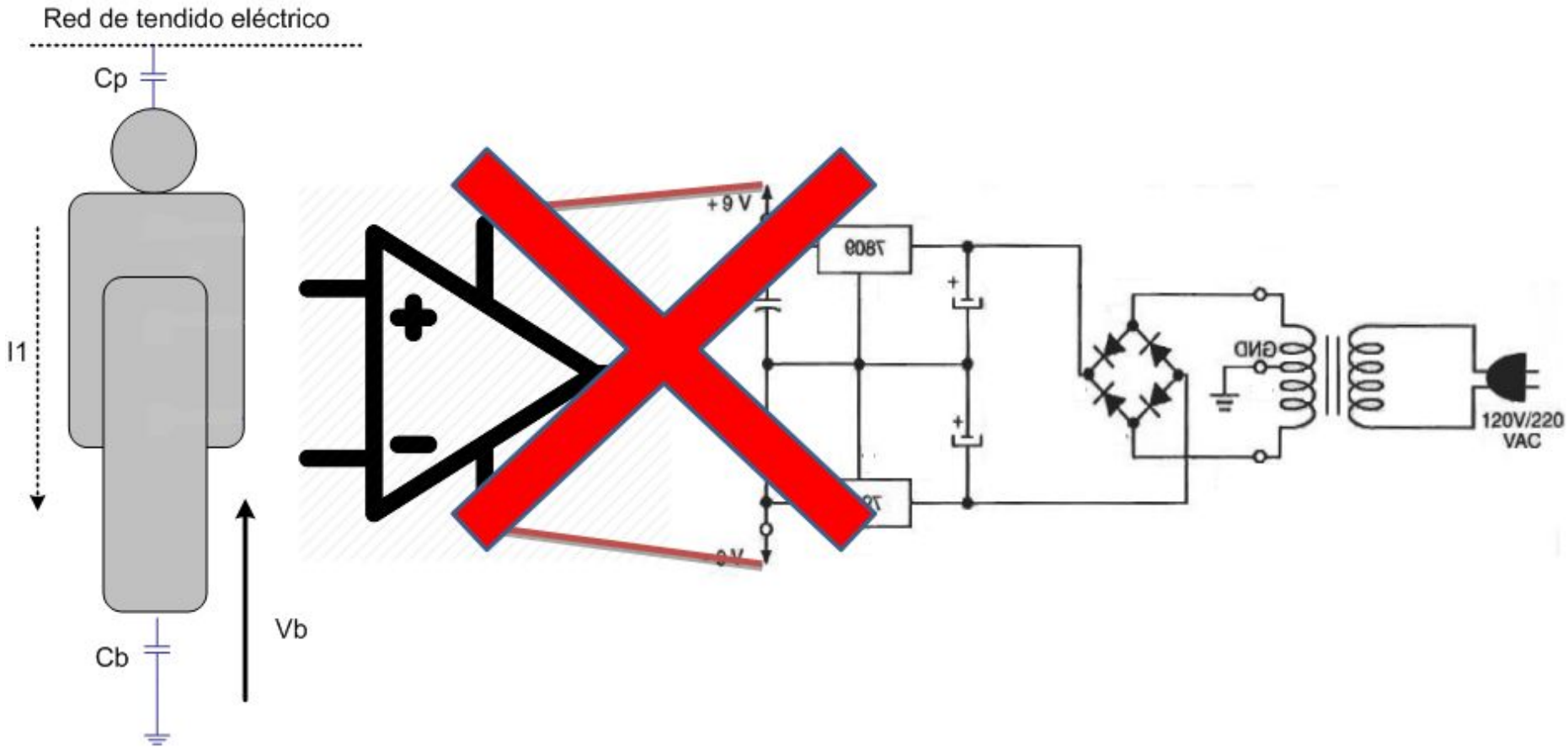
Módulo de adquisición de biopotenciales

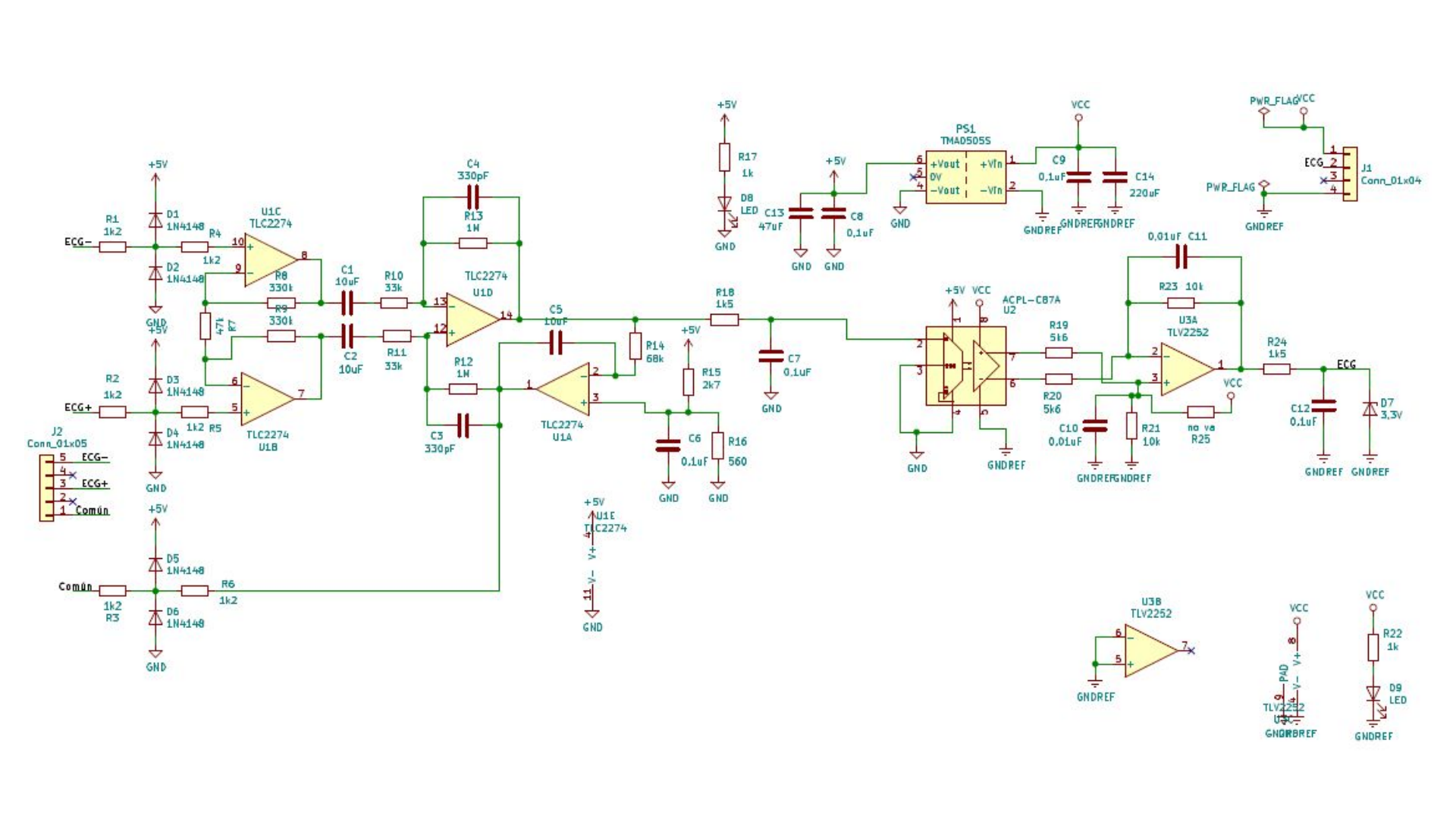
Que tipo de amplificador usamos?

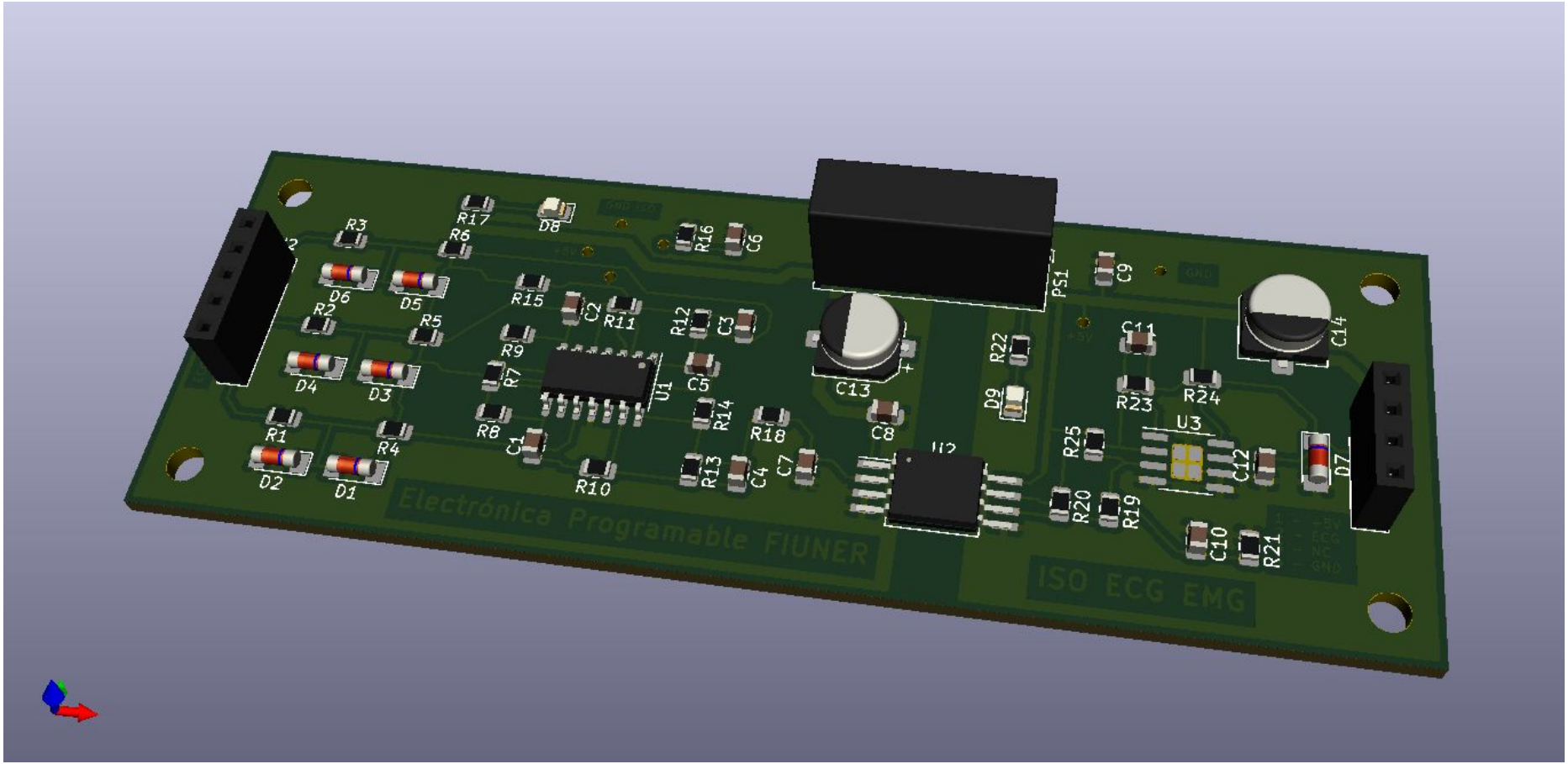



C1
C2


Red de tendido eléctrico
Cp
I1
Vb
Cb


Red de tendido eléctrico
Cp
I1
Vb
Cb
+9 V
7809
GND
120V/220
VAC


+5V
R17
1k
D8
LED
GND
PS1
TMA0505S
+Vout
0V
-Vout
+Vin
-Vin
VCC
C9
0,1uF
C14
220uF
C13
47uF
C8
0,1uF
GNDREF
PWR_FLAG
J1
Conn_01x04
ECG
R1
1k2
D1
1N4148
D2
1N4148
U1C
TLC2274
R4
1k2
R8
330k
R9
330k
R7
47k
C1
10uF
C2
10uF
R10
33k
R11
33k
C4
330pF
R13
1M
TLC2274
U1D
R12
1M
C3
330pF
C5
10uF
TLC2274
U1A
R14
68k
R15
2k7
C6
0,1uF
R16
560
R18
1k5
C7
0,1uF
ECG-
R2
1k2
D3
1N4148
D4
1N4148
R5
1k2
TLC2274
U1B
ECG+
J2
Conn_01x05
Común
R3
1k2
D5
1N4148
D6
1N4148
R6
1k2
U1E
TLC2274
ACPL-C87A
U2
R19
5k6
R20
5k6
C10
0,01uF
R21
10k
no va
R25
0,01uF C11
R23 10k
U3A
TLV2252
R24
1k5
C12
0,1uF
D7
3,3V
U3B
TLV2252
PAD
R22
1k
D9
LED


Electrónica Programable FIUNER
ISO ECG EMG
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
D1
D2
D3
D4
D5
D6
D8
D9
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
U1
U2
U3
R19
R20
R21
R22
R23
R24
R25
D7
P51