Física Experimental VI – 4300314

1º Semestre de 2017

Instituto de Física
Universidade de São Paulo

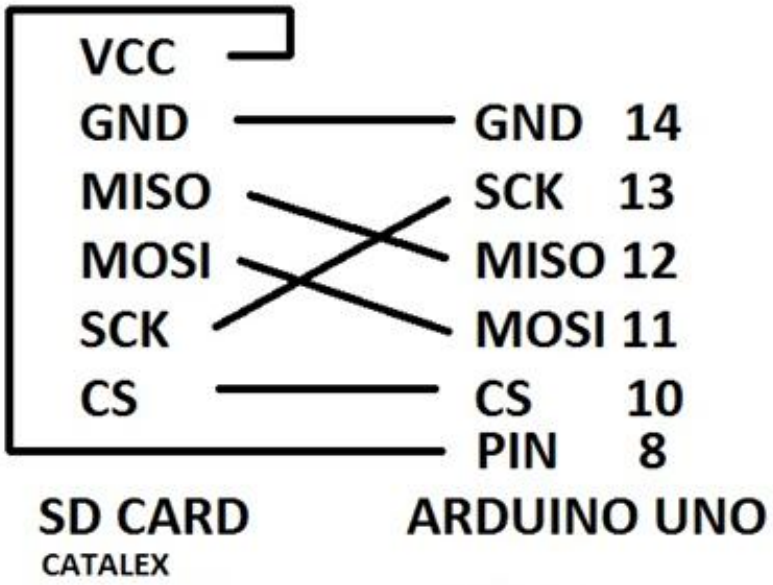
Professor: Antonio Domingues dos Santos

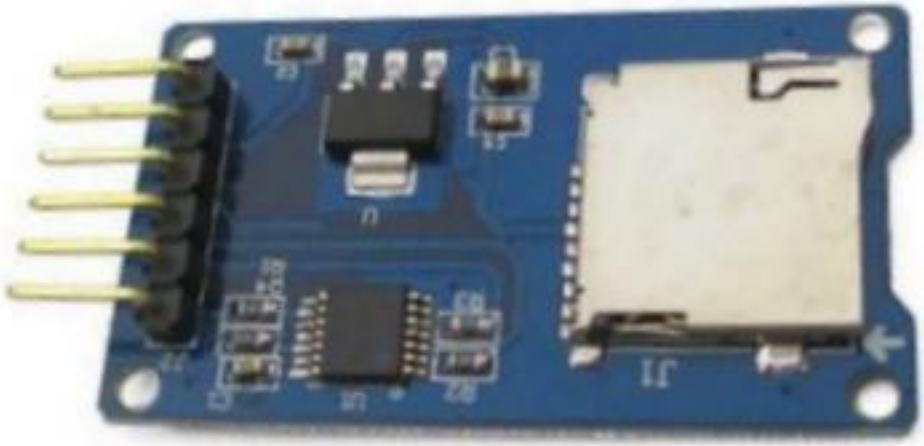
E-mail: adsantos@if.usp.br
Fone: 3091.6886

24 de maio

Arduino - cartão microSD

Protocolo de comunicação SPI



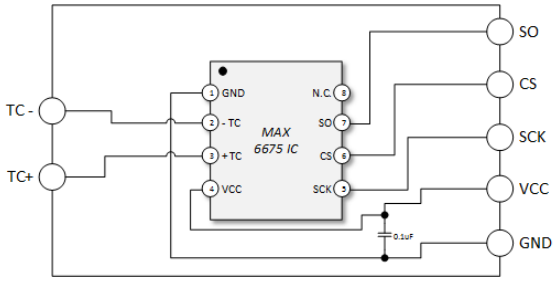


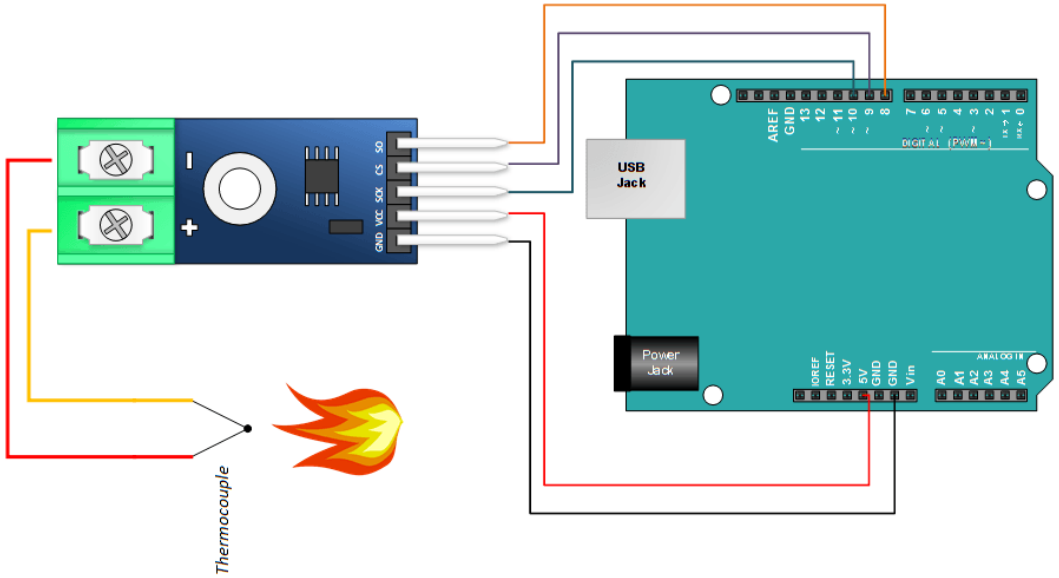
Cartões microSD podem ser obtidos em celulares antigos.

https://www.arduino.cc/en/reference/SD

Arduino – Termopar do tipo K e módulo Max6675

Protocolo de comunicação SPI





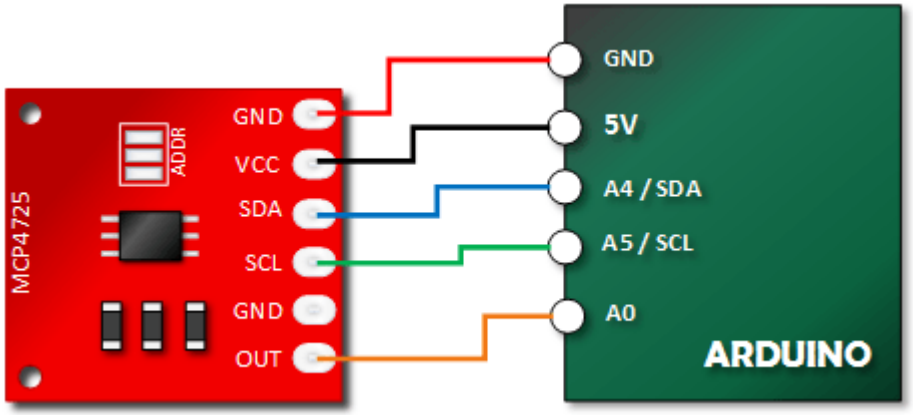
Supply Voltage	3.3. to 5 VDC
Operating Current	about 50mA
Measurement Range	0 to 1024 deg C (32 deg F to 1875 F)
Measurement Resolution	+/- 0.25 Deg C (+/- 0.45 Deg F)
Output	Uses a SPI Interface
Required SENSOR	K Thermocouple

Um pino para cada unidade.

SO: The module's serial output. Your Arduino will read this output.
CS: Chip Select. Setting low, selects the Module and tells it to supply an output that is synchronize with a clock.
SCK: The Serial Clock… an input from your Arduino.
VCC: 5V supply.
GND: Ground.
– : The K thermocouple minus input (Az).
+ : The K Thermocouple plus input (Vm).

http://henrysbench.capnfatz.com/henrys-bench/arduino-temperature-measurements/max6675-temp-module-arduino-manual-and-tutorial/

Arduino – DAC 12 bits MCP4725
Protocolo de comunicação I²C

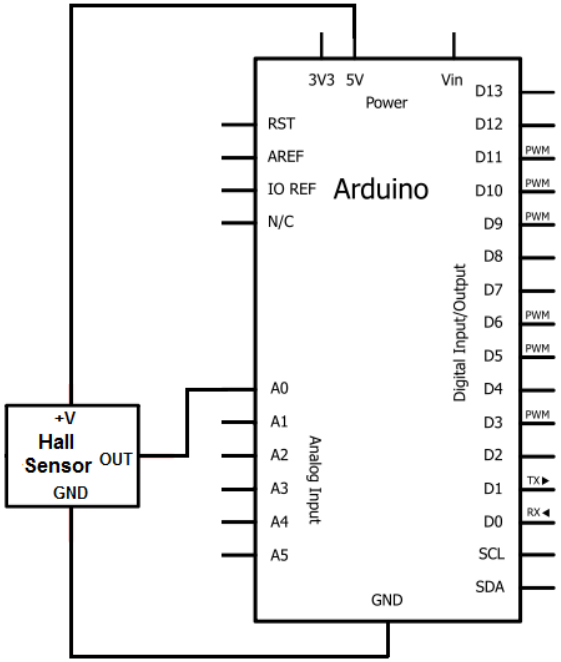


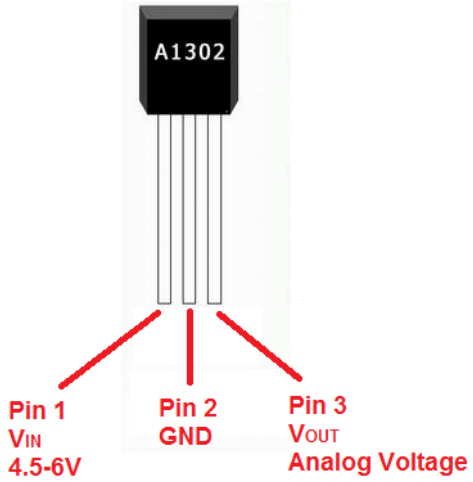
- CI: MCP4725;
- Tensão de operação: 2.7-5.5V;
- Resolução: 12-bit;
- Interface: I2C;
- Endereço I2C: 0x62 (pino A0 - LOW)
ou 0x63 (pino A0 - HIGH).

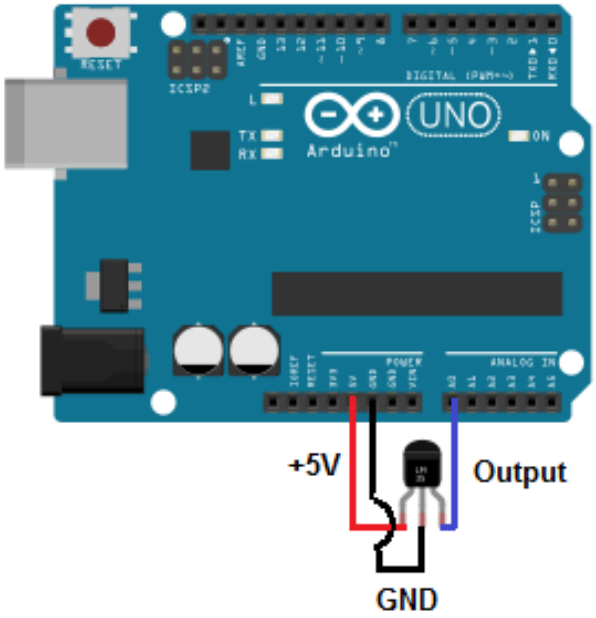
http://henrysbench.capnfatz.com/henrys-bench/arduino-output-devices/arduino-mcp4725-digital-to-analog-converter-tutorial/

Arduino – Sensor Hall A1302

Entrada analógica





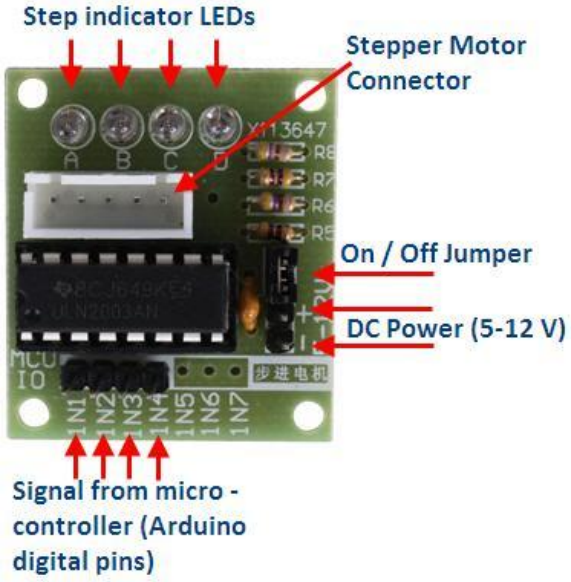


A sensibilidade do A1302 é 1.3 mV/G.
Mas, com 0 G correspondendo a $V_{cc}/2$.

http://www.learningaboutelectronics.com/Articles/Hall-effect-sensor-circuit.php /

Arduino – Motor de passo com driver ULN2003

Saídas digitais

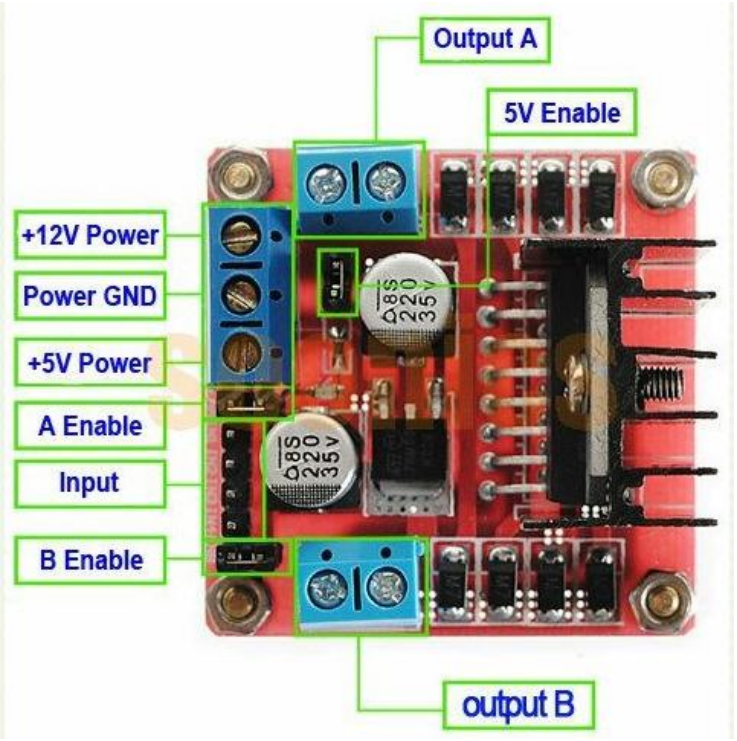


Motor Type	Unipolar stepper motor
Connection Type5 controller)	Wire Connection (to the motor
Voltage	5-12 Volts DC
Frequency	100 Hz
Step mode	Half-step mode recommended (8 step control signal sequence)
Step angle	**Half-step mode: 8 step control signal sequence (recommended)** 5.625 degrees per step / 64 steps per one revolution of the internal motor shaft**Full Step mode: 4 step control signal sequence** 11.25 degrees per step / 32 steps per one revolution of the internal motor shaft

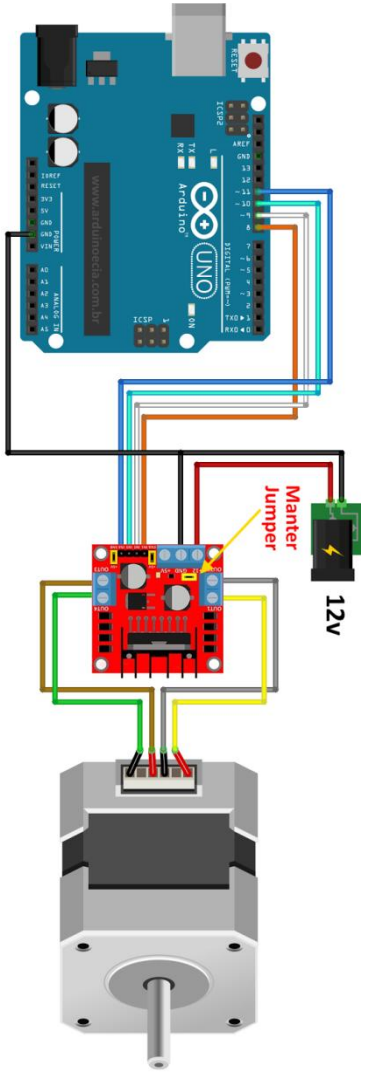
http://42bots.com/tutorials/28byj-48-stepper-motor-with-uln2003-driver-and-arduino-uno/

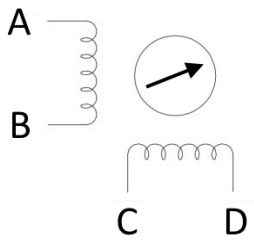
Arduino – Motor dc com driver L298n

Saídas digitais



The L298N H-bridge module can be used with motors that have a voltage of between 5 and 35V DC. With the module used in this tutorial, there is also an onboard 5V regulator, so if your supply voltage is up to 12V you can also source 5V from the board.





		Bobinas			
		A	B	C	D
Passos	1	1	0	0	1
	2	0	1	0	1
	3	0	1	1	0
	4	1	0	1	0

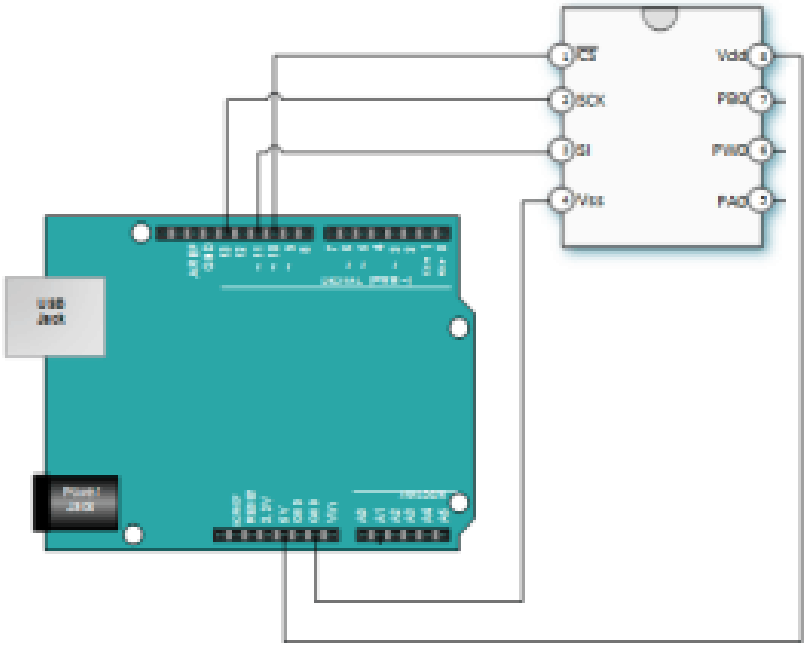
Control also a Stepper Motor with Arduino and L298N

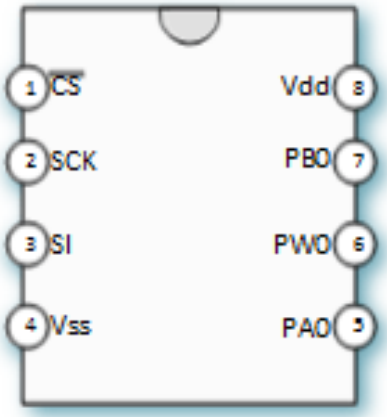
http://www.arduinoecia.com.br/2014/08/ponte-h-l298n-motor-de-passo.html
http://www.instructables.com/id/Control-DC-and-stepper-motors-with-L298N-Dual-Moto/

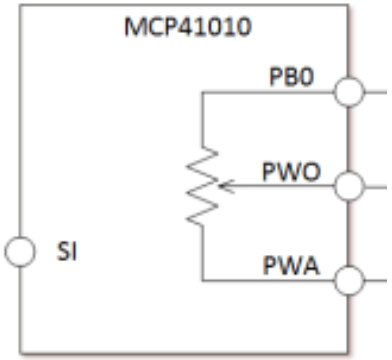
Arduino – Potenciômetro Digital – MCP41010

(256 níveis em um total de 10 kΩ)

Protocolo de comunicação SPI







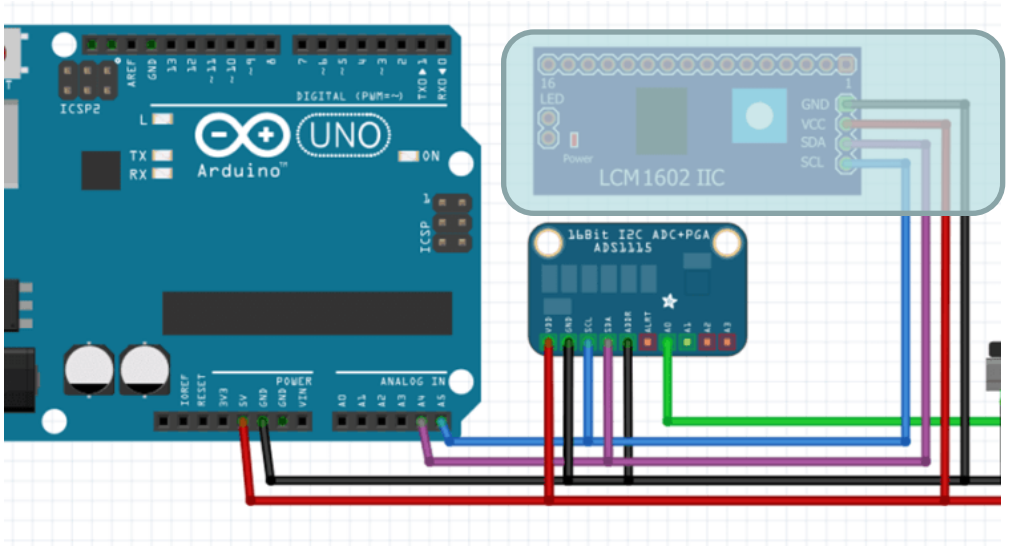
Pin 1 – CS – Chip Select. When low, the chip will receive commands from serial Input at pin 3.

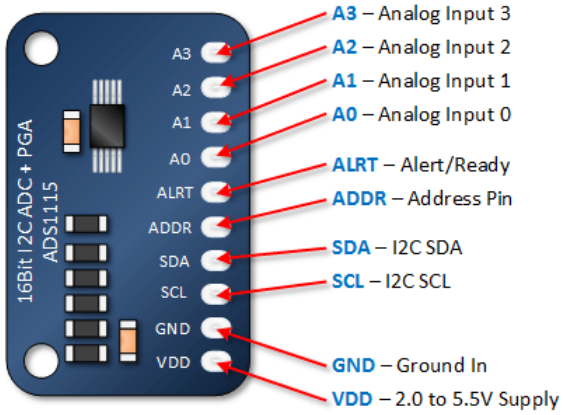
Pin 2 – SCK – Serial Clock. Clock input from the micro-controller that synchronizes serial communications. (porta 13 do Arduino Uno)

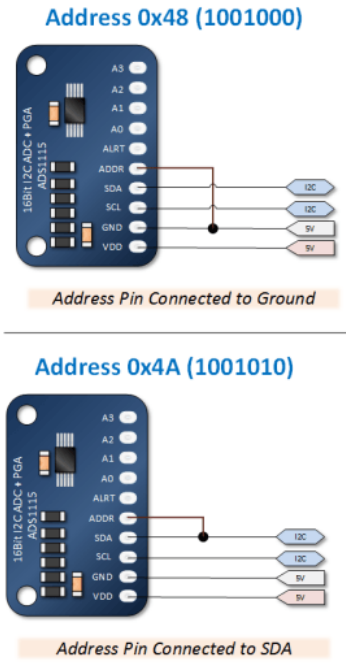
Pin 3 – SI – Serial Input. Receives commands from the micro-controller when CS at pin 1 is low. (porta 11 do Arduino Uno)

http://henrysbench.capnfatz.com/henrys-bench/arduino-output-devices/mcp41010-digital-potentiometer-arduino-user-manual/

Arduino – ADC + PGA (12 bits/4canais) ADS1115 (Adafruit)
Protocolo de comunicação I²C







http://henrysbench.capnfatz.com/henrys-bench/arduino-voltage-measurements/arduino-ads1115-module-getting-started-tutorial/

Arduino – Plotter

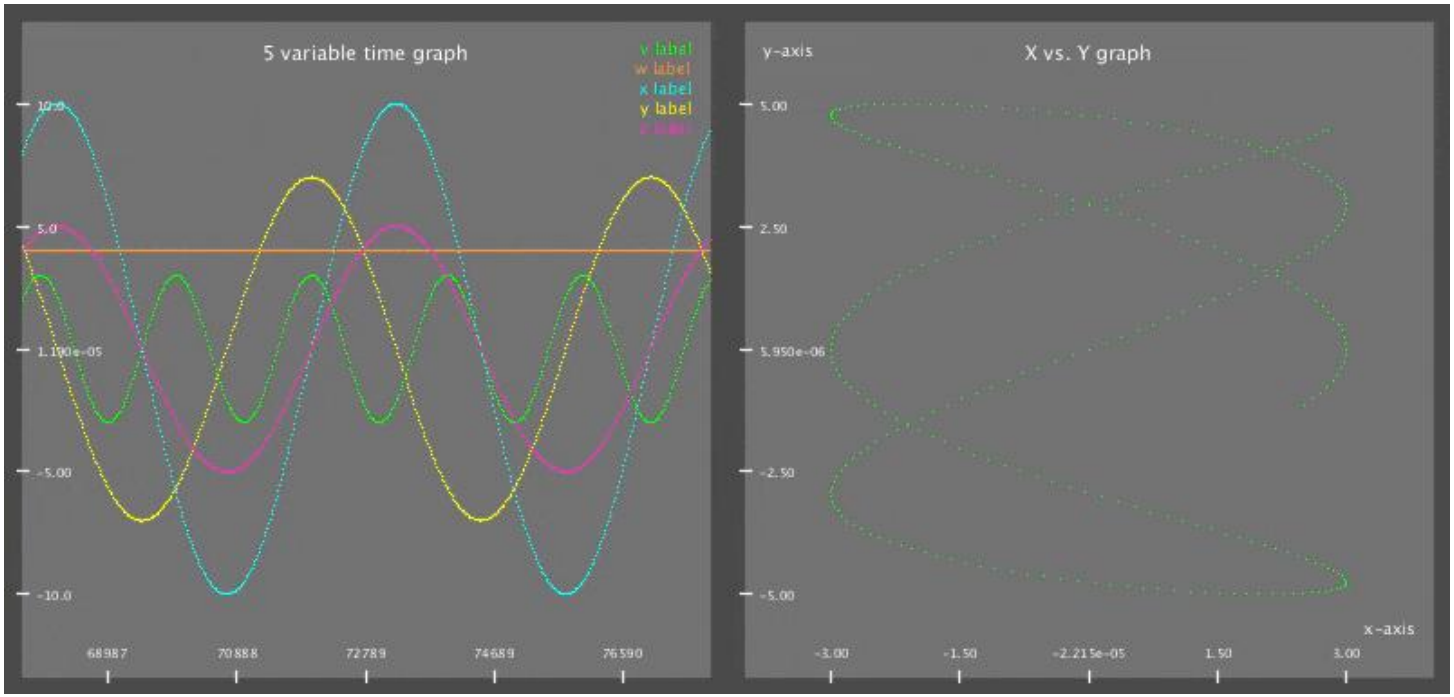
An Arduino library for easy plotting on host computer via serial communication
by: Devin Conley_
COPY OF REPOSITORY FOR ARDUINO LIBRARY MANAGER
For more information, quick-start guide, documentation and listeners, please go to:
https://github.com/devinaconley/arduino-plotter

1) Add a multi-variable graph vs. time

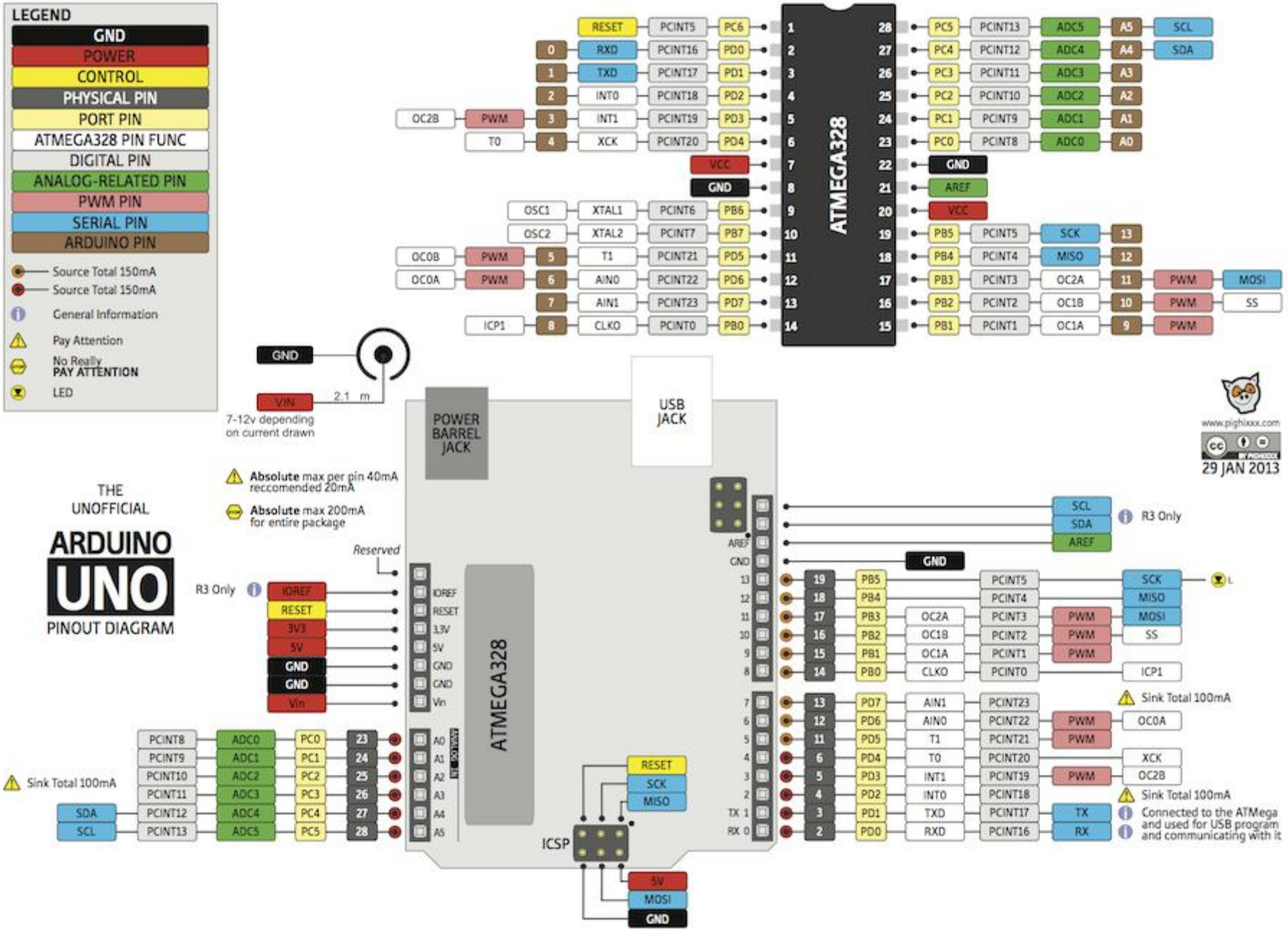
void AddTimeGraph(String title, int pointsDisplayed, String label1, Variable1Type variable1, String label2, Variable2Type variable2, ...)

2) Add an X vs Y graph

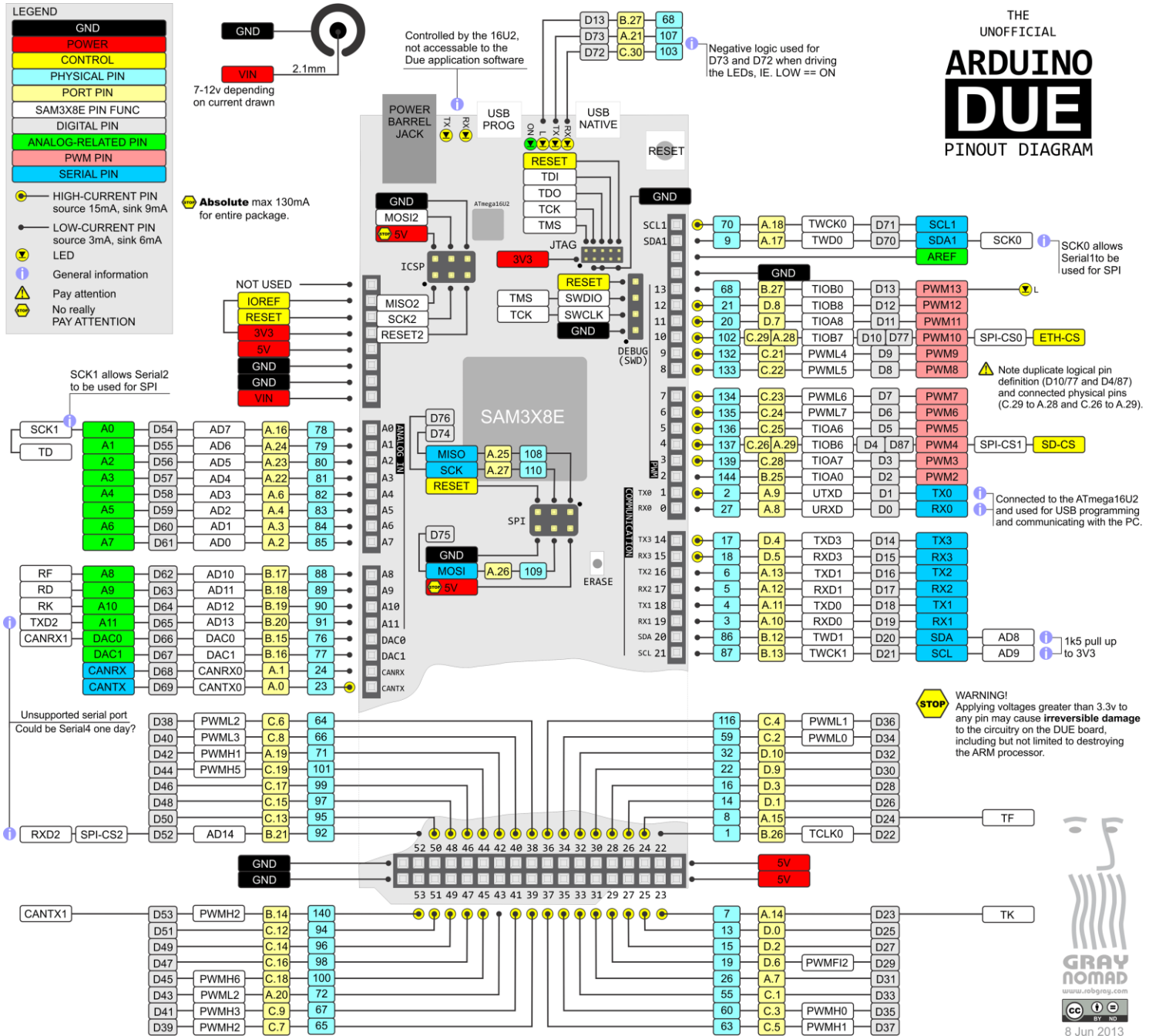
void AddXYGraph(String title, int pointsDisplayed, String labelX, VariableTypeX variableX, String labelY, VariableTypeY variableY)



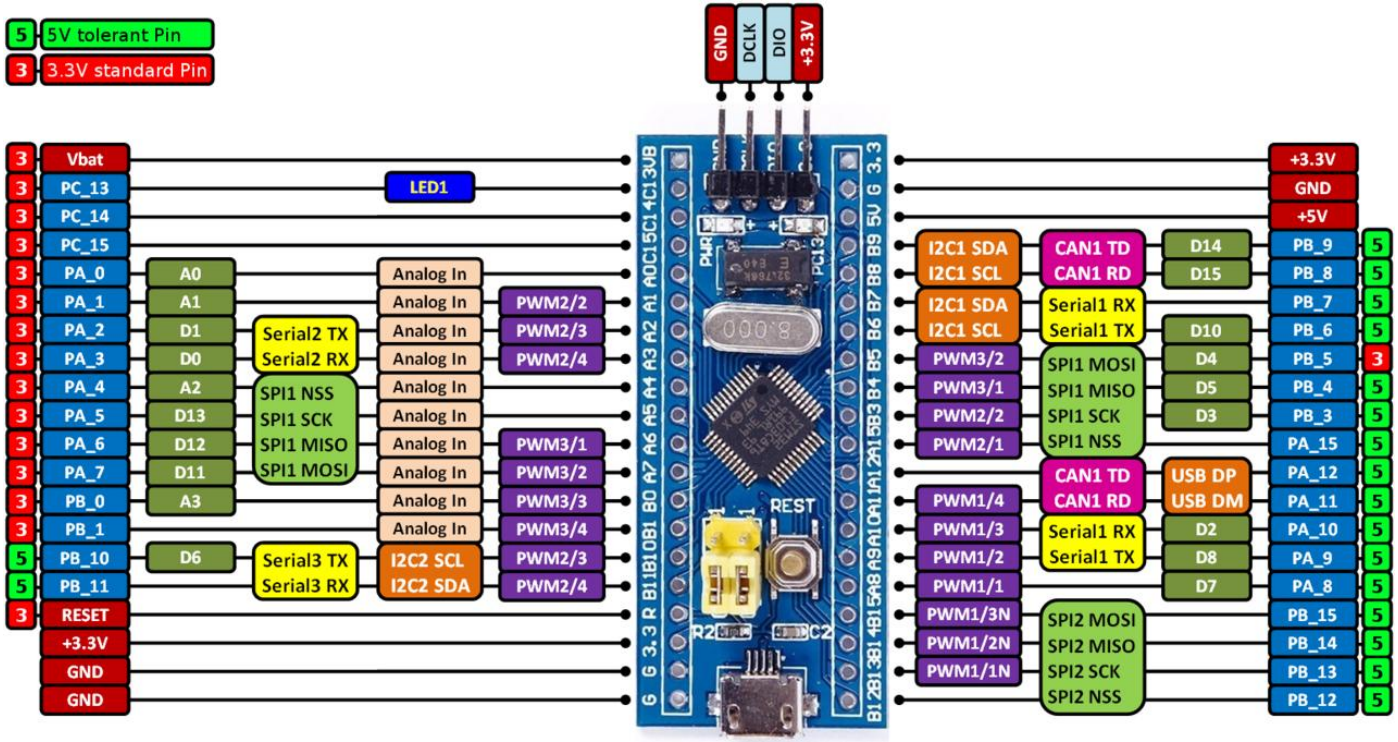
Arduino – UNO

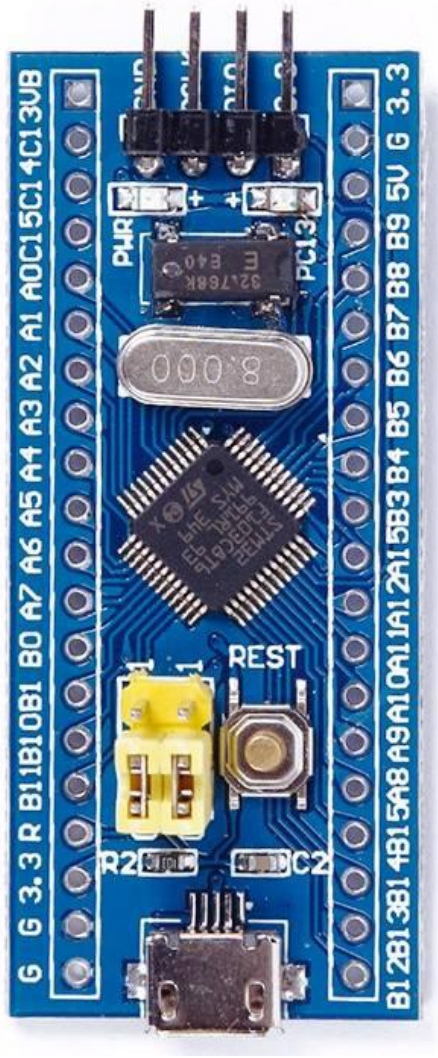

LEGEND
GND
POWER
CONTROL
PHYSICAL PIN
PORT PIN
ATMEGA328 PIN FUNC
DIGITAL PIN
ANALOG-RELATED PIN
PWM PIN
SERIAL PIN
ARDUINO PIN
Source Total 150mA
Source Total 150mA
General Information
Pay Attention
No Really PAY ATTENTION
LED
ATMEGA328
RESET PCINT5 PC6 1
RXD PCINT16 PD0 0
TXD PCINT17 PD1 1
INT0 PCINT18 PD2 2
OC2B PWM INT1 PCINT19 PD3 3
T0 XCK PCINT20 PD4 4
VCC 7
GND 8
OSC1 XTAL1 PCINT6 PB6 9
OSC2 XTAL2 PCINT7 PB7 10
OC0B PWM T1 PCINT21 PD5 5
OC0A PWM AIN0 PCINT22 PD6 6
AIN1 PCINT23 PD7 7
ICP1 CLKO PCINT0 PB0 8
28 PC5 PCINT13 ADC5 A5 SCL
27 PC4 PCINT12 ADC4 A4 SDA
26 PC3 PCINT11 ADC3 A3
25 PC2 PCINT10 ADC2 A2
24 PC1 PCINT9 ADC1 A1
23 PC0 PCINT8 ADC0 A0
22 GND
21 AREF
20 VCC
19 PB5 PCINT5 SCK 13
18 PB4 PCINT4 MISO 12
17 PB3 PCINT3 OC2A 11 PWM MOSI
16 PB2 PCINT2 OC1B 10 PWM SS
15 PB1 PCINT1 OC1A 9 PWM
14 PB0 PCINT0 CLKO ICP1
GND
VIN
2.1 m
7-12v depending on current drawn
POWER BARREL JACK
USB JACK
www.pighixxx.com
29 JAN 2013
THE UNOFFICIAL
ARDUINO UNO
PINOUT DIAGRAM
Absolute max per pin 40mA reccomended 20mA
Absolute max 200mA for entire package
Reserved
R3 Only
IOREF
RESET
3V3
5V
GND
GND
Vin
ATMEGA328
A0 A1 A2 A3 A4 A5
Sink Total 100mA
SDA SCL
PCINT8 PCINT9 PCINT10 PCINT11 PCINT12 PCINT13
ADC0 ADC1 ADC2 ADC3 ADC4 ADC5
PC0 PC1 PC2 PC3 PC4 PC5
23 24 25 26 27 28
ICSP
RESET SCK MISO
5V MOSI GND
AREF GND 13 12 11 10 9 8
SCL SDA AREF
R3 Only
GND
19 18 17 16 15 14
PB5 PB4 PB3 PB2 PB1 PB0
OC2A OC1B OC1A CLKO
PCINT5 PCINT4 PCINT3 PCINT2 PCINT1 PCINT0
PWM PWM PWM
SCK MISO MOSI SS ICP1
7 6 5 4 3 2 TX 1 RX 0
13 12 11 6 5 4 3 2
PD7 PD6 PD5 PD4 PD3 PD2 PD1 PD0
AIN1 AIN0 T1 T0 INT1 INT0 TXD RXD
PCINT23 PCINT22 PCINT21 PCINT20 PCINT19 PCINT18 PCINT17 PCINT16
PWM PWM PWM
OC0A XCK OC2B
TX RX
Sink Total 100mA
Sink Total 100mA
Connected to the ATMega and used for USB program and communicating with it

Arduino – Due


LEGEND
GND
POWER
CONTROL
PHYSICAL PIN
PORT PIN
SAM3X8E PIN FUNC
DIGITAL PIN
ANALOG-RELATED PIN
PWM PIN
SERIAL PIN
HIGH-CURRENT PIN source 15mA, sink 9mA
LOW-CURRENT PIN source 3mA, sink 6mA
LED
General information
Pay attention
No really PAY ATTENTION
GND
VIN
2.1mm
7-12v depending on current drawn
Absolute max 130mA for entire package.
Controlled by the 16U2, not accessable to the Due application software
Negative logic used for D73 and D72 when driving the LEDs, IE. LOW == ON
THE UNOFFICIAL
ARDUINO DUE
PINOUT DIAGRAM
POWER BARREL JACK
USB PROG
USB NATIVE
RESET
TDI
TDO
TCK
TMS
JTAG
ICSP
MISO2
SCK2
RESET2
SWDIO
SWCLK
DEBUG (SWD)
3V3
5V
NOT USED
IOREF
SAM3X8E
ATmega16U2
SCK1 allows Serial2 to be used for SPI
SCK0 allows Serial1to be used for SPI
Note duplicate logical pin definition (D10/77 and D4/87) and connected physical pins (C.29 to A.28 and C.26 to A.29).
Connected to the ATmega16U2 and used for USB programming and communicating with the PC.
1k5 pull up to 3V3
SPI
ERASE
SPI-CS0
ETH-CS
SPI-CS1
SD-CS
Unsupported serial port
Could be Serial4 one day?
WARNING!
Applying voltages greater than 3.3v to any pin may cause irreversible damage to the circuitry on the DUE board, including but not limited to destroying the ARM processor.
TF
TK
GRAY NOMAD
www.robgray.com
8 Jun 2013

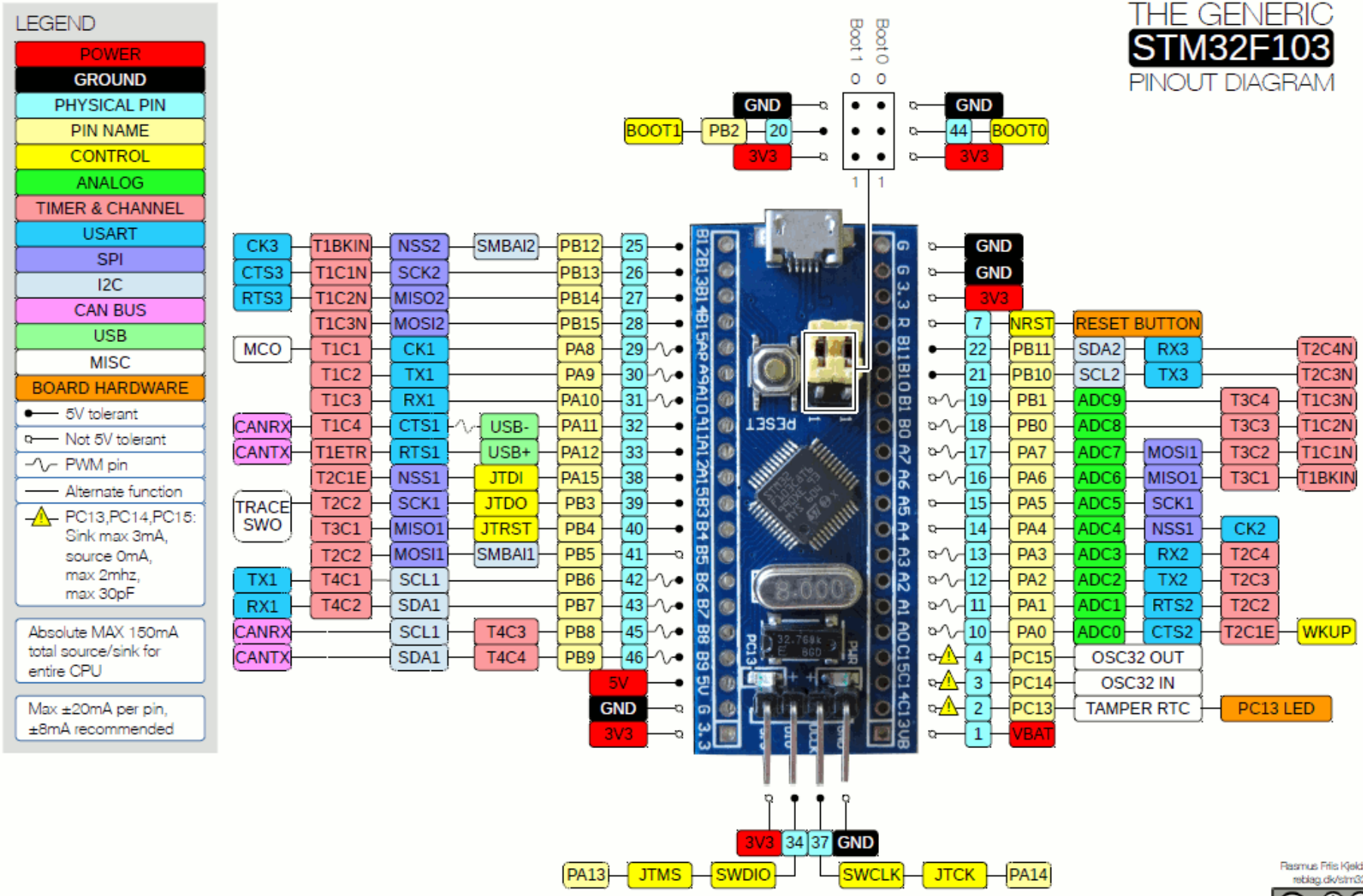
Arduino – STM32F103C8T6





github.com/rogerclarkmelbourne/Arduino_STM32

Arduino – STM32F103C8T6

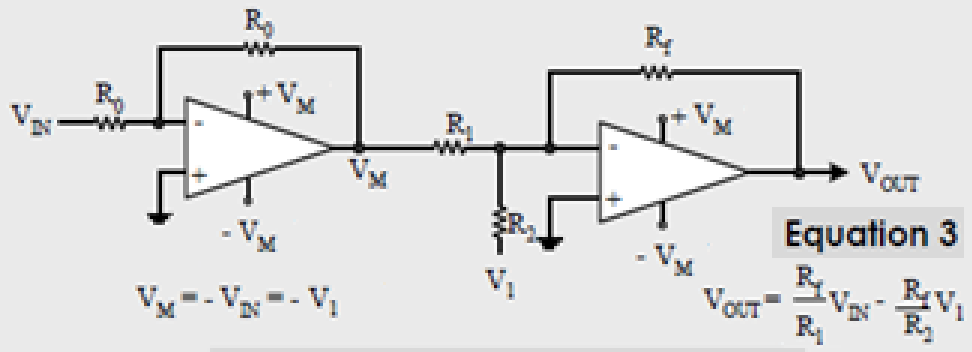


github.com/rogerclarkmelbourne/Arduino_STM32

Arduino – Due/STM32F103C8T6 p/ usar o ADC em sinal bipolar

Voltage Translation Circuit

- Some transducer has output voltage in the range from V_1 to V_2 ($V_2 > V_1$).
- The accuracy of the A/D conversion will be more accurate if this voltage can be scaled and shifted to 0 ~ V_{DD}.
- The circuit shown can shift and scale the voltage from V_1 to V_2 to the range of 0~V_{DD}.



Equation 3

Level shifting and scaling circuit

Example

Choose appropriate resistor values and the adjusting voltage so that the circuit shown in the previous figure can shift the voltage from the range of –1.2 V ~ 3.0 V to the range of 0V ~ 5V.

Solution: Applying Equation 3:

$$0 = -1.2 \times (R_f/R_1) - (R_f/R_2) \times V_1$$
$$5 = 3.0 \times (R_f/R_1) - (R_f/R_2) \times V_1$$

- By choosing $R_0 = R_1 = 10\ K\Omega$, $R_2 = 100\ K\Omega$, $R_f = 12\ K\Omega$, and $V_1 = -12V$, one can translate and scale the voltage to the desired range.

Para V_{in}= -10 a 10 V
VM= ± 10 V e V_1= -10 V
$R_1 = R_2 = 4\ R_f$ (usar R_1= ~100 kΩ)

Cronograma de encerramento do semestre

Diurno	Noturno	Atividades
21 e 28/06	22 e 29/06	Completar o desenvolvimento do projeto
05/07	06/07	Entrega do trabalho escrito (eu estarei ausente)
12/07	13/07	Apresentações dos trabalhos