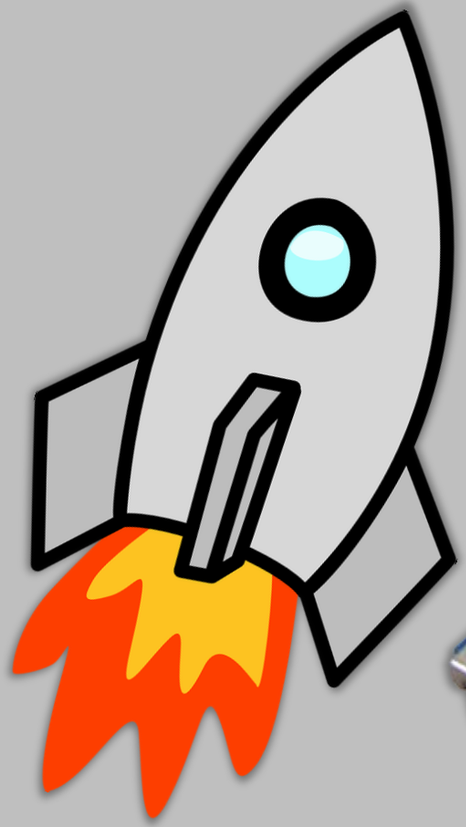
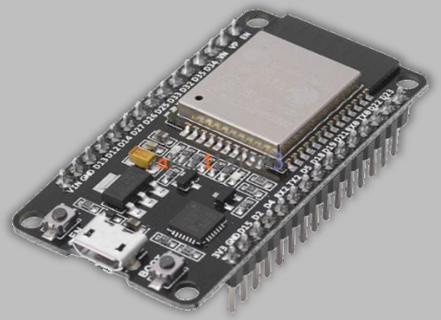
SpeedTest Arduinos – ESP32/8266s – STM32-ARM





Por Fernando Koyanagi

Objetivo do meu teste

Nosso principal objetivo será mostrar o tempo que cada um dos microcontroladores que nós temos trabalhado gastam para executar uma série de comandos (um programa simples).

Faremos um programa que executará um milhão de interações, e a partir da iteração cem mil, executaremos comandos para que o LED interno pisque.

Teste específico [Chester Lowrey]

Divide Float :
ESP32: 83.462 ms
Uno : 1.398 ms
59.7 vezes mais rápido
Outros parâmetros variam de 10x a 170x

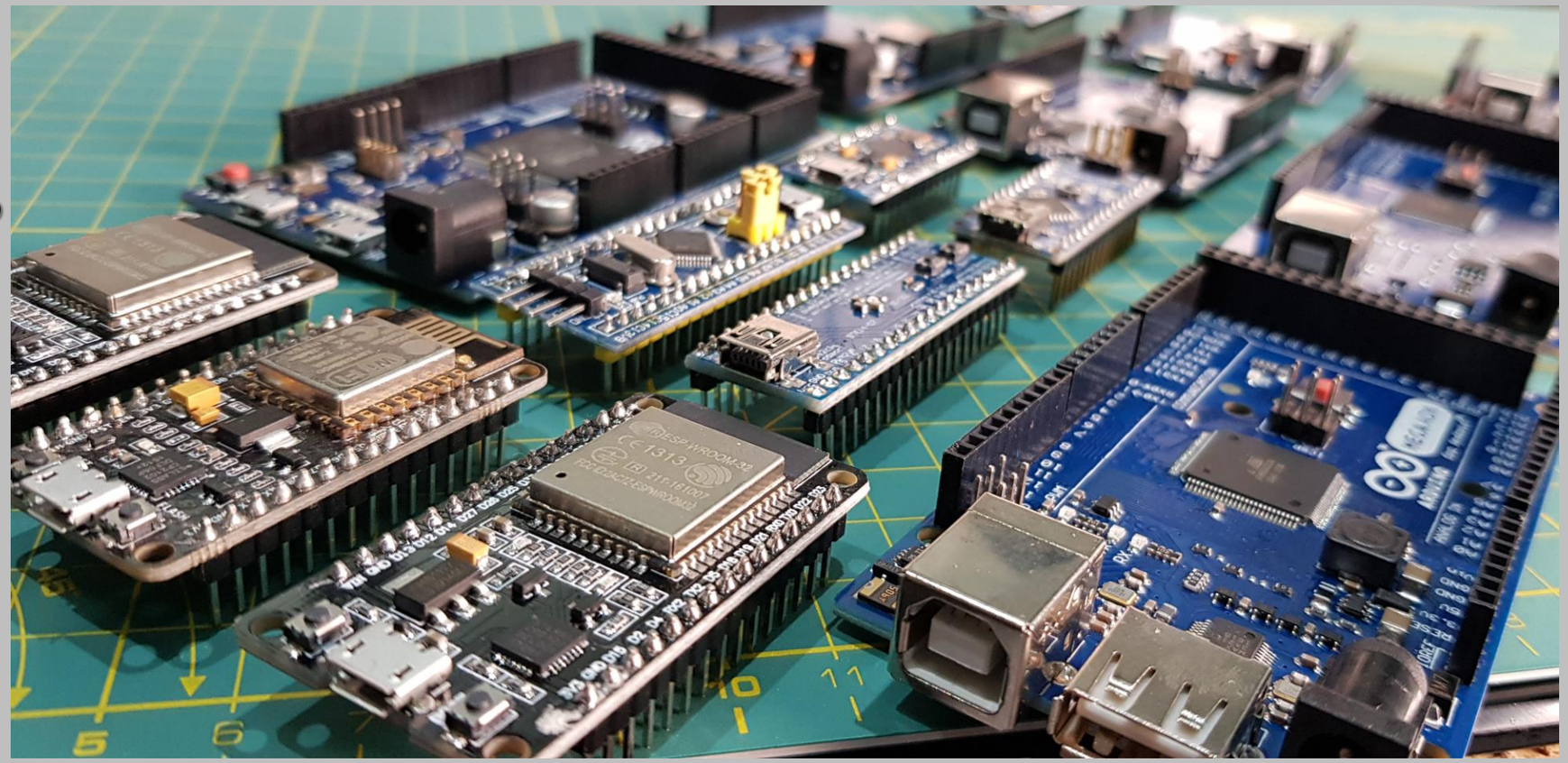
Arduino Speed Test

SOC IC Part #	ESP32 160mhz	ESP32 240mhz	ESP32 240mhz	ESP32 240mhz	STM32F767	MK66FX1M0VMD1	MK66FX1M0VMD1	ESP8266	ESP8266	ESP8266	ATSAM3X8E	NRF52832	NRF51822	STM32F401RE	STM32F103CBT	ATSAMD21G18	Intel Curie	ATMEGA32U4	ATMEGA328P	ATMEGA328P	ATMEGA2560
Amazon Board	ESP32 Thing	ESP32 Thing	ESP32 Thing	ESP32-devkit	STM32 Nucleo-F	Teensy 3.6	Teensy 3.6	D1 Mini	D1 Mini	Arduino Due	NRF52DK	BBC Microbit	Nucleo-F401RE	Maple Mini	Arduino Zero	Arduino 101	Leonardo	Arduino Uno	Pro Mini 3.3V	Arduino Mega	
Test Date	~2016-11-8	2016-12-1	2016-12-15	19.02.2017.	18.02.2017.	2017-12-27	2017-12-28	2016-12-1	2016-12-1	2016-12-1	2016-12-1	2016-12-1	2016-12-1	2016-12-1		2016-12-1	2016-12-1	2016-12-1	2016-12-1	2016-12-1	2016-12-1
Power Usage	120 ma with wifi	80ma/150ma	80ma/150ma	-/-	-/-			70 ma	70 ma	120ma	4 ma max ic only					60ma					
Arduino Source	github.com	github.com	github.com	github.com	developer.mbed.c	https://github.com	https://github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com	github.com
Arduino Core V		github.com						2.1	2.1	1.6.9	0.2.0	0.2.0			1.6.8	1.0.7	1.6.15	1.6.15	1.6.15	1.6.15	1.6.15
F_CPU	160 MHz	240 MHz	240 MHz	240 MHz	216 MHz	180 MHz	240 MHz	80 MHz	160 MHz	84 MHz	64 MHz	16 MHz	84 MHz	72 MHz	48 MHz	32 MHz	16 MHz	16 MHz	8 MHz	16 MHz	
1/F_CPU	0.0062 us	0.0042 us	0.0042 us	0.0042 us	0.0046 us	0.0056 us	0.0042 us	0.0125 us	0.0062 us	0.0119 us	0.0625 us	0.0625 us	0.0119 us	0.0139 us	0.0208 us	0.0313 us	0.0625 us	0.0625 us	0.1250 us	0.0625 us	
nop	0.006 us	0.004 us	0.004 us	0.004 us	0.005 us	0.005 us	0.004 us	0.013 us	0.006 us	0.012 us	0.062 us	0.062 us	0.012 us	0.014 us	0.021 us	0.031 us	0.063 us	0.063 us	0.125 us	0.063 us	
digitalRead	0.216 us	0.154 us	0.141 us	0.141 us	0.077 us	0.084 us	0.064 us	0.538 us	0.301 us	0.402 us	0.401 us	1.660 us	0.368 us	0.699 us	0.883 us	1.257 us	3.604 us	3.586 us	9.682 us	6.287 us	
digitalWrite	0.168 us	0.111 us	0.106 us	0.109 us	0.039 us	0.242 us	0.199 us	0.432 us	0.216 us	1.557 us	0.354 us	1.820 us	0.255 us	0.558 us	2.011 us	1.228 us	5.609 us	5.617 us	9.372 us	7.140 us	
pinMode	0.526 us	2.606 us	2.559 us	2.559 us	0.057 us	0.192 us	0.149 us	1.455 us	0.781 us	3.199 us	0.339 us	3.228 us	3.160 us	2.966 us	2.036 us	2.102 us	4.494 us	4.467 us	8.934 us	4.530 us	
multiply byte	0.056 us	0.037 us	0.037 us	0.036 us	0.030 us	0.039 us	0.029 us	0.100 us	0.050 us	0.116 us	0.160 us	0.510 us	0.116 us	0.110 us	0.202 us	0.318 us	0.635 us	0.631 us	1.263 us	0.632 us	
divide byte	0.056 us	0.036 us	0.036 us	0.049 us	0.059 us	0.039 us	0.029 us	0.403 us	0.201 us	0.114 us	0.161 us	1.728 us	0.114 us	0.114 us	0.623 us	1.408 us	5.439 us	5.412 us	10.819 us	5.534 us	
add byte	0.050 us	0.033 us	0.033 us	0.032 us	0.021 us	0.039 us	0.029 us	0.100 us	0.050 us	0.104 us	0.145 us	0.510 us	0.104 us	0.105 us	0.340 us	0.284 us	0.571 us	0.569 us	1.137 us	0.568 us	
multiply integer	0.080 us	0.053 us	0.053 us	0.053 us	0.014 us	0.033 us	0.025 us	0.148 us	0.074 us	0.083 us	0.126 us	0.446 us	0.083 us	0.082 us	0.170 us	0.347 us	1.394 us	1.388 us	2.772 us	1.388 us	
divide integer	0.083 us	0.054 us	0.054 us	0.054 us	0.037 us	0.039 us	0.029 us	0.453 us	0.224 us	0.094 us	0.141 us	1.723 us	0.094 us	0.096 us	0.871 us	1.385 us	14.357 us	14.277 us	28.554 us	14.467 us	
add integer	0.080 us	0.053 us	0.053 us	0.053 us	0.008 us	0.033 us	0.025 us	0.135 us	0.068 us	0.081 us	0.126 us	0.446 us	0.081 us	0.083 us	0.169 us	0.284 us	0.888 us	0.883 us	1.766 us	0.883 us	
multiply long	0.078 us	0.051 us	0.051 us	0.054 us	0.017 us	0.032 us	0.024 us	0.148 us	0.074 us	0.082 us	0.126 us	0.445 us	0.082 us	0.084 us	0.168 us	0.347 us	6.137 us	6.102 us	12.202 us	6.366 us	
divide long	0.073 us	0.049 us	0.049 us	0.049 us	0.027 us	0.040 us	0.024 us	0.472 us	0.224 us	0.099 us	0.141 us	1.708 us	0.099 us	0.096 us	0.871 us	1.400 us	38.882 us	38.662 us	77.324 us	38.882 us	
add long	0.080 us	0.053 us	0.053 us	0.053 us	0.011 us	0.033 us	0.024 us	0.135 us	0.068 us	0.080 us	0.126 us	0.446 us	0.080 us	0.083 us	0.169 us	0.284 us	1.773 us	1.763 us	3.527 us	1.763 us	
multiply float	0.078 us	0.054 us	0.051 us	0.054 us	0.024 us	0.044 us	0.034 us	0.738 us	0.359 us	0.902 us	0.186 us	7.165 us	0.902 us	0.986 us	2.808 us	0.377 us	7.529 us	7.487 us	14.977 us	7.739 us	
divide float	1.398 us	0.924 us	0.824 us	0.224 us	0.052 us	0.099 us	0.074 us	3.772 us	1.874 us	4.644 us	0.341 us	36.268 us	4.644 us	0.996 us	12.240 us	0.350 us	80.612 us	80.162 us	160.299 us	83.462 us	
add float	0.078 us	0.054 us	0.049 us	0.054 us	0.017 us	0.044 us	0.034 us	0.683 us	0.344 us	1.244 us	0.158 us	7.288 us	1.244 us	1.241 us	2.378 us	0.380 us	9.487 us	9.412 us	18.839 us	9.607 us	
itoa()	1.083 us	0.719 us	0.644 us	0.704 us	/	0.604 us	0.449 us	1.268 us	0.634 us	1.504 us	3.045 us	34.728 us	0.988 us		4.326 us	4.565 us	13.027 us	12.962 us	25.914 us	12.957 us	
ltoa()	1.098 us	0.599 us	0.699 us	0.599 us	/	0.899 us	0.699 us	9.297 us	4.599 us	3.194 us	4.441 us	75.583 us	2.298 us		41.996 us	17.300 us	126.787 us	126.087 us	252.074 us	126.087 us	
dtostrf()	17.198 us	11.449 us	11.449 us	11.124 us	/	15.524 us	11.649 us	45.347 us	22.574 us					94.571 us		40.275 us	81.112 us	80.712 us	161.424 us	80.912 us	
random()	0.573 us	0.446 us	0.324 us	0.474 us	0.377 us	0.374 us	0.274 us	2.548 us	1.299 us	1.494 us	1.886 us	28.458 us	1.023 us	1.571 us	10.421 us	4.400 us	93.137 us	92.587 us	185.224 us	93.112 us	
y |= (1<<x) (bv)	0.067 us	0.045 us	0.045 us	0.045 us	0.007 us	0.027 us	0.021 us	0.110 us	0.055 us				0.060 us	0.069 us		0.191 us	0.571 us	0.569 us	1.137 us	0.569 us	
bit(bit)	0.067 us	0.045 us	0.045 us	0.045 us	/	0.028 us	0.021 us	0.111 us	0.055 us	0.071 us	0.117 us	0.318 us			0.124 us	0.191 us	0.572 us	0.569 us	1.138 us	0.569 us	
analogRead()			5.399 us	5.649 us	2.852 us	0.849 us	0.649 us	0.748 us	0.449 us	4.494 us		80.783 us		8.896 us	423.046 us	28.000 us	112.137 us	112.037 us	112.024 us	112.037 us	
analogWrite() PWM				/	1.942 us	0.399 us	0.319 us	10.872 us	5.314 us	3.659 us		6.198 us		4.146 us	5.686 us	2.385 us	11.632 us	11.442 us	22.134 us	8.992 us	
ESP32 DACWrite()				5.554 us	0.357 us																
ESP32 SigmaDelta				6.699 us	/																
delay_ms(1)	999.998 us	999.999 us	999.999 us	999.999 us	1000.002 us	999.999 us	999.999 us	1029.497 us	1009.999 us	999.904 us	1000.041 us	999.983 us	999.998 us	1001.998 us	999.996 us	1002.500 us	1007.987 us	1007.987 us	1018.974 us	1008.987 us	
delay_ms(100)	100000.000 us	100000.000 us	100000.000 us	100000.000 us	100000.000 us	100000.000 us	100000.000 us	100050.000 us	100025.000 us	99999.992 us	100000.047 us	99999.984 us	100000.000 us	100199.992 us	99999.992 us	100000.000 us	100024.984 us	100024.984 us	99999.976 us	99999.984 us	
delay_us(2)	2.010 us	2.007 us	2.006 us	2.007 us	2.002 us	2.003 us	2.001 us	2.563 us	2.325 us	2.001 us	2.106 us	2.004 us		2.012 us	2.034 us	2.208 us	0.782 us	0.787 us	-0.026 us	0.759 us	
delay_us(5)		4.999 us	4.999 us	4.999 us	5.002 us	4.999 us	4.999 us	5.568 us	5.319 us	5.004 us	5.211 us	5.103 us		5.018 us	5.046 us	5.240 us	3.797 us	3.777 us	3.024 us	3.777 us	
delay_us(100)		99.999 us	99.999 us	99.999 us	100.002 us	100.099 us	100.099 us	100.647 us	100.299 us	100.244 us	103.841 us	103.283 us		99.998 us	100.546 us	100.200 us	99.887 us	99.387 us	98.824 us	99.337 us	

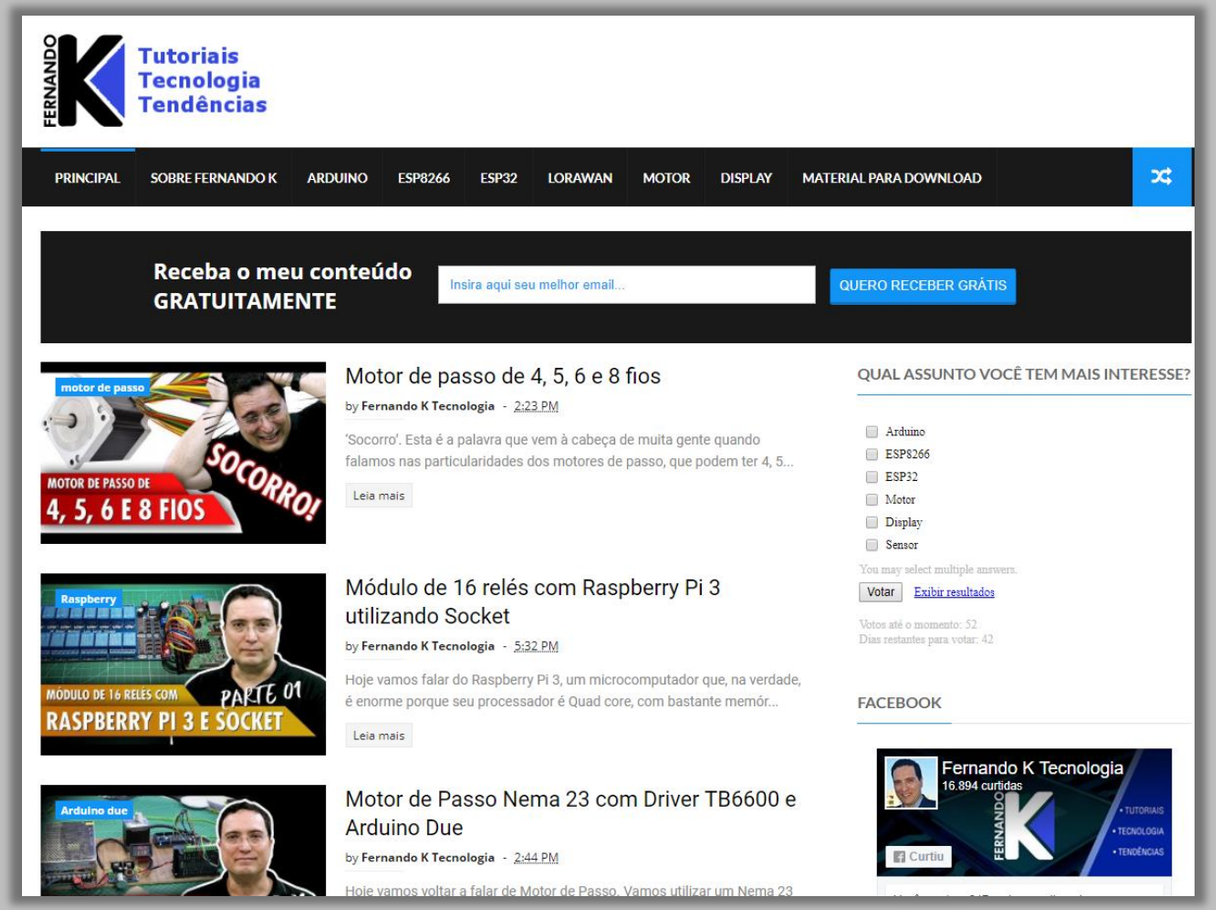
https://hilo90mhz.com/arduino-esp32-esp8266-101-speed-test-comparison-chart/

Microcontroladores que utilizaremos

Arduino Uno
Arduino Nano Atmega 328p
Arduino Leonardo Pro Micro
Arduino Mega ADK
Arduino Mega 2560
Arduino Due
STM32F103C8T6
STM32 Maple Mini
ESP12 ESP8266
ESP32 NodeS



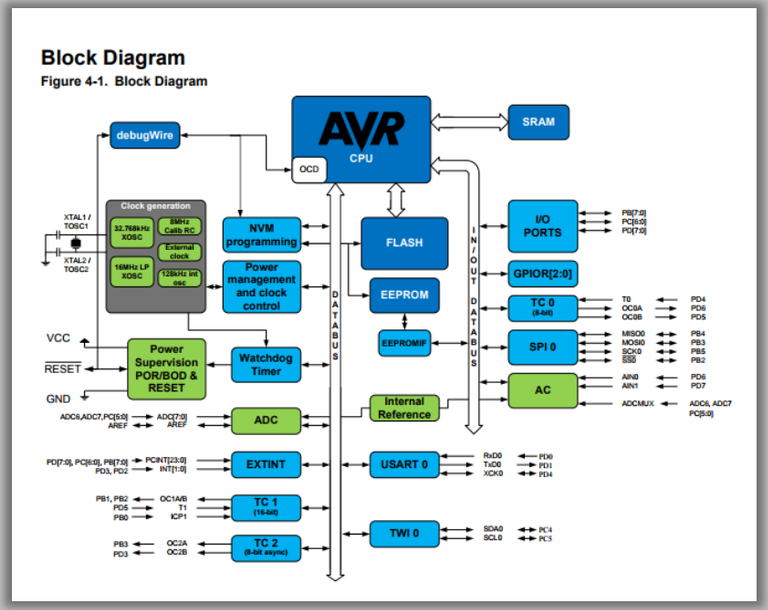
www.fernandok.com



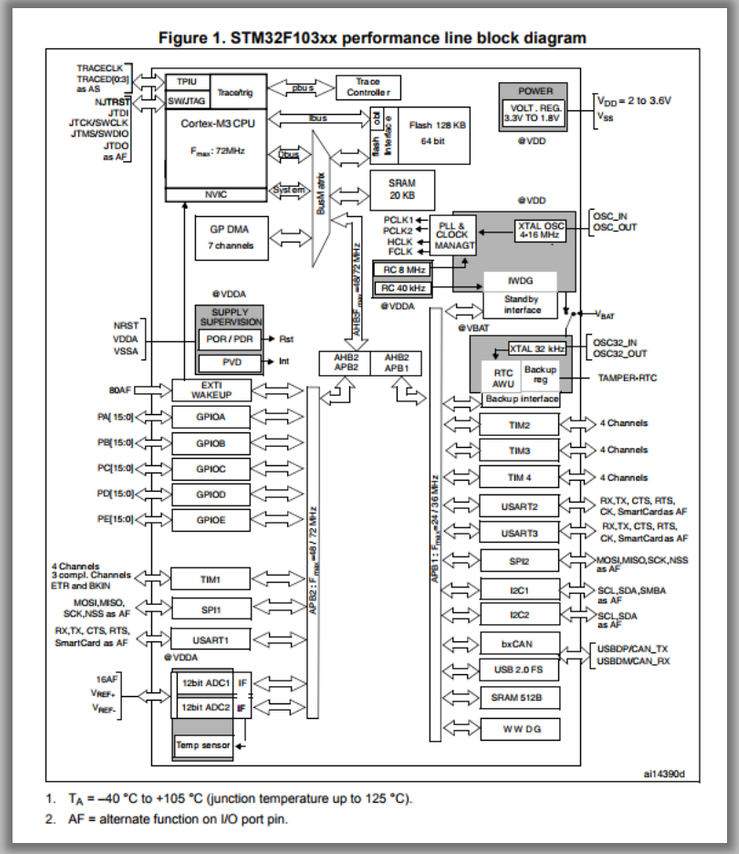
Diferentes Arquiteturas rodando o mesmo código

Arduino IDE “GCC”

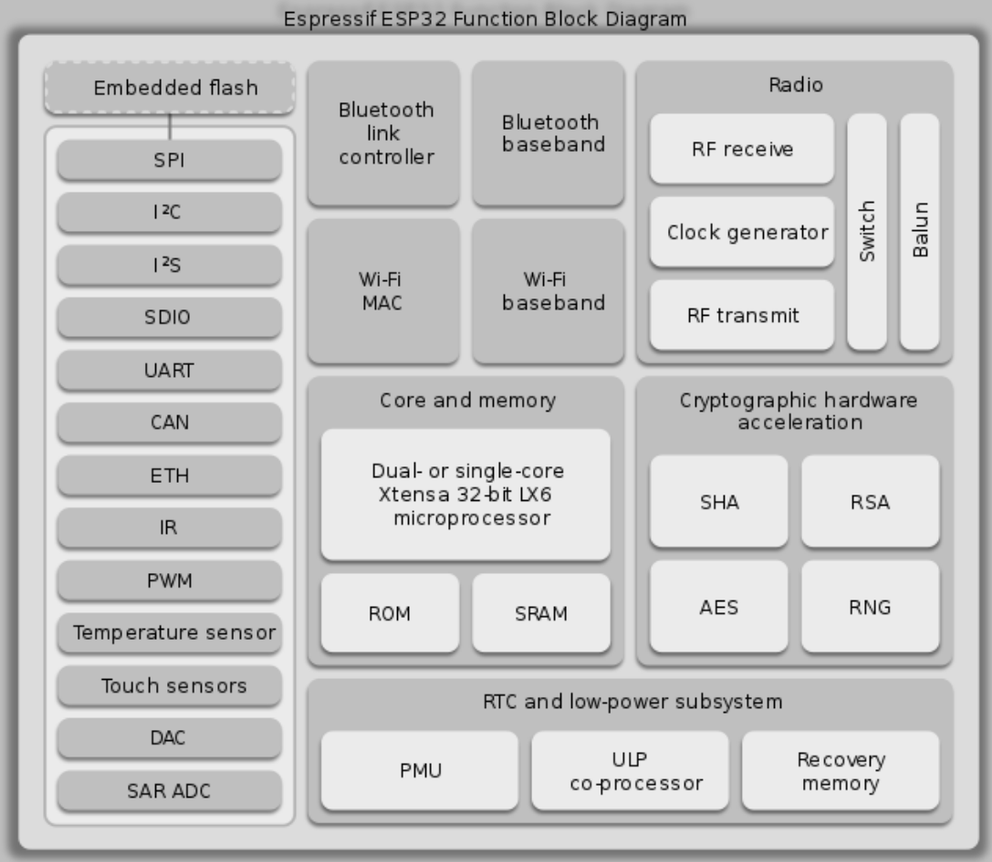
Atmega328



ARM M3 STM32F103



Esp32

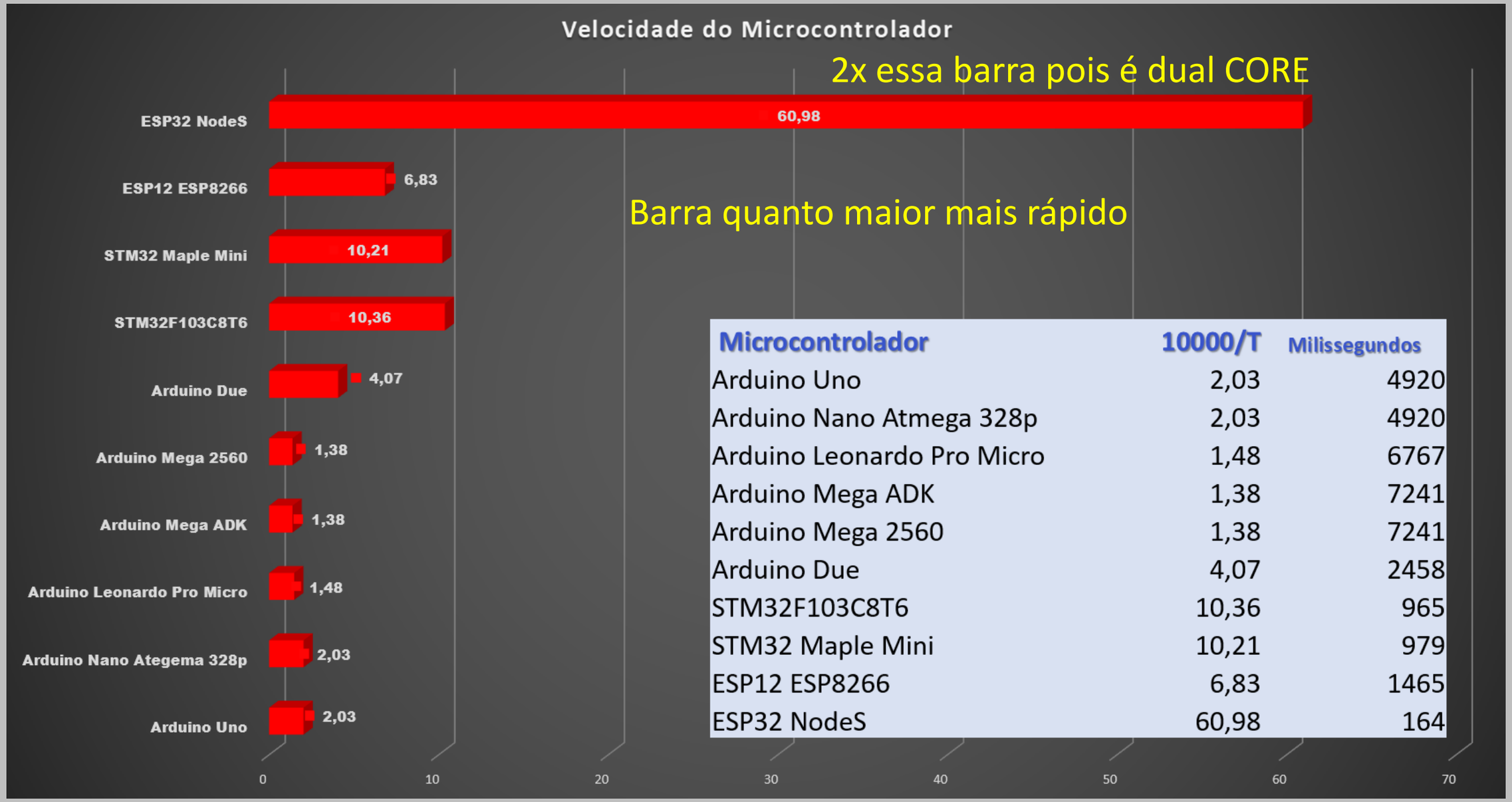


Diferentes Arquiteturas rodando o mesmo código

Arduino IDE “GCC”

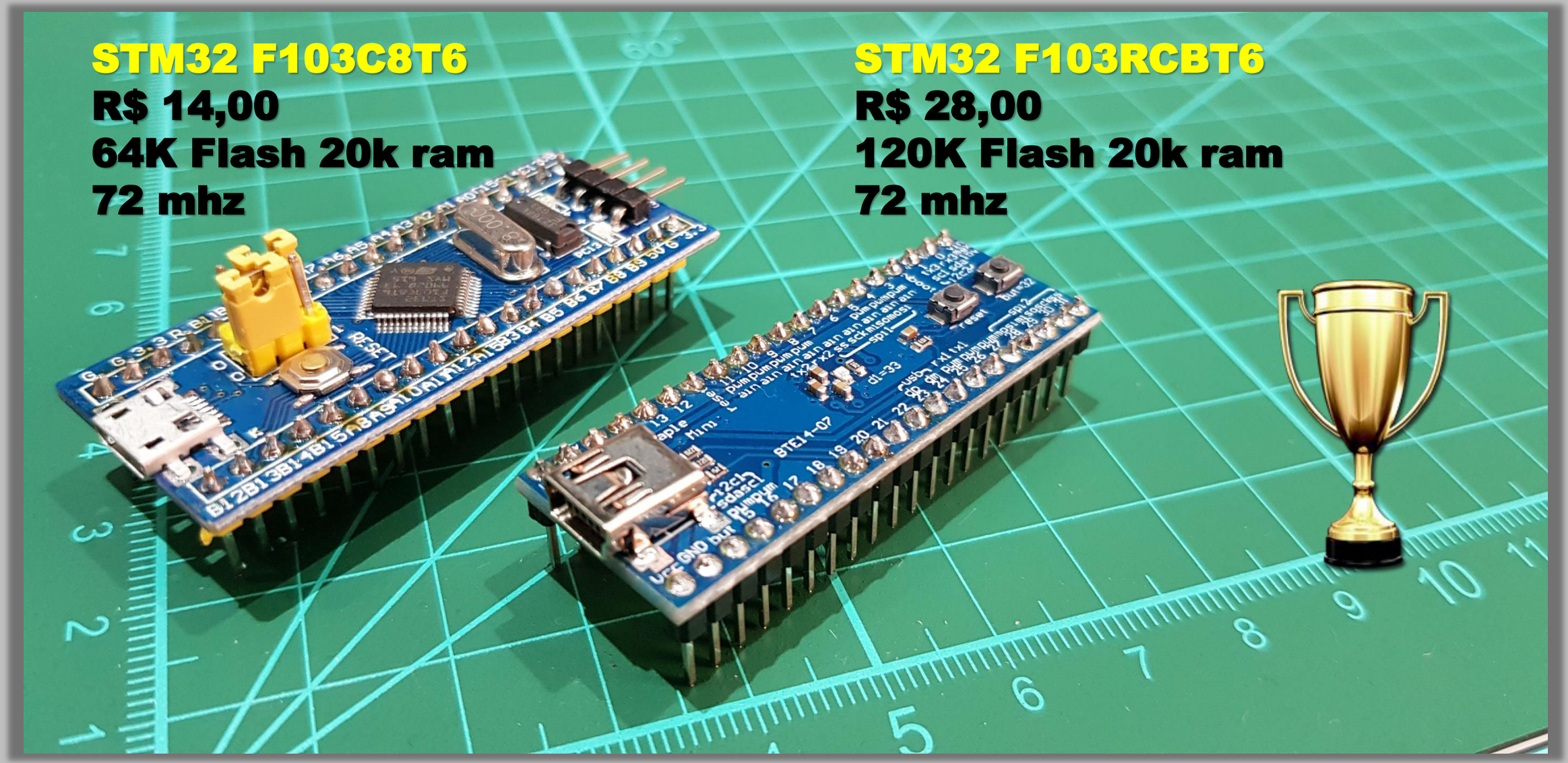
```
unsigned long inicio, tempoTotal;
unsigned long contador = ITERACOES;
long int LEDcounter = 0; //contador de piscadas do
LED
boolean alternador = false; //controlador para
alternar a ativação do LED
digitalWrite(LED_BUILTIN, LOW); //desliga o LED
long int i;
inicio = millis();//guarda o tempo de inicio da
execução do algoritmo
//iterações
for ( i = 0; i < contador; i++) {
     if (i+1 > FLASH)
     {
     LEDcounter++;
     if (alternador) {
          digitalWrite(LED_BUILTIN, HIGH);
          alternador = false;
          } else {
          digitalWrite(LED_BUILTIN, LOW);
          alternador = true;
           }
       }
  }
tempoTotal = millis() - inicio; //calcula o tempo
gasto na execução do algortimo (resultado em ms)
```

Arduinos – ESP32/8266s – STM32

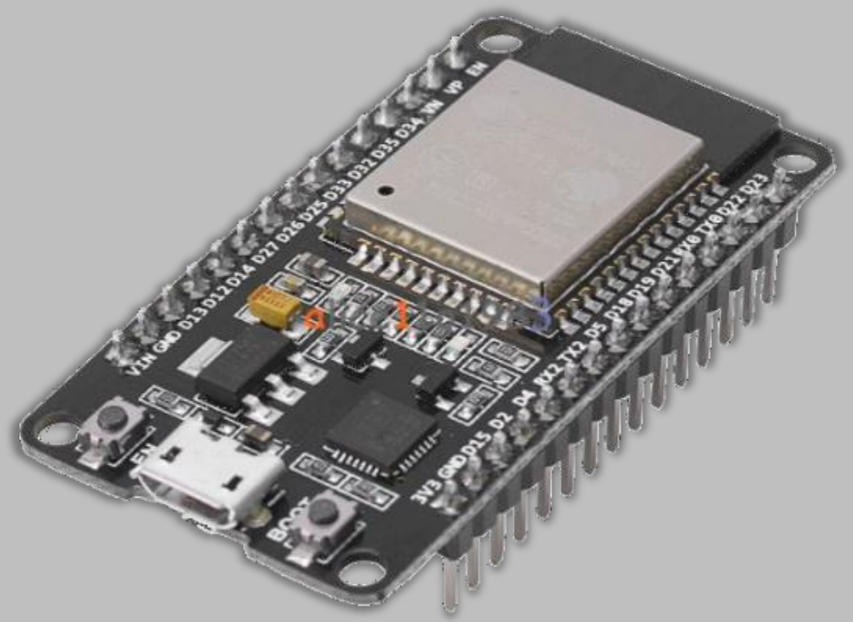


Microcontrolador	10000/T	Milissegundos
Arduino Uno	2,03	4920
Arduino Nano Atmega 328p	2,03	4920
Arduino Leonardo Pro Micro	1,48	6767
Arduino Mega ADK	1,38	7241
Arduino Mega 2560	1,38	7241
Arduino Due	4,07	2458
STM32F103C8T6	10,36	965
STM32 Maple Mini	10,21	979
ESP12 ESP8266	6,83	1465
ESP32 NodeS	60,98	164

Destaques do teste



O mais rápido



Em www.fernandok.com

Download arquivo PDF dos diagramas
Download arquivo INO do código fonte