Projetando dispositivos comerciais
Integração Elétrica

TEX.com.br

Diagrama em blocos

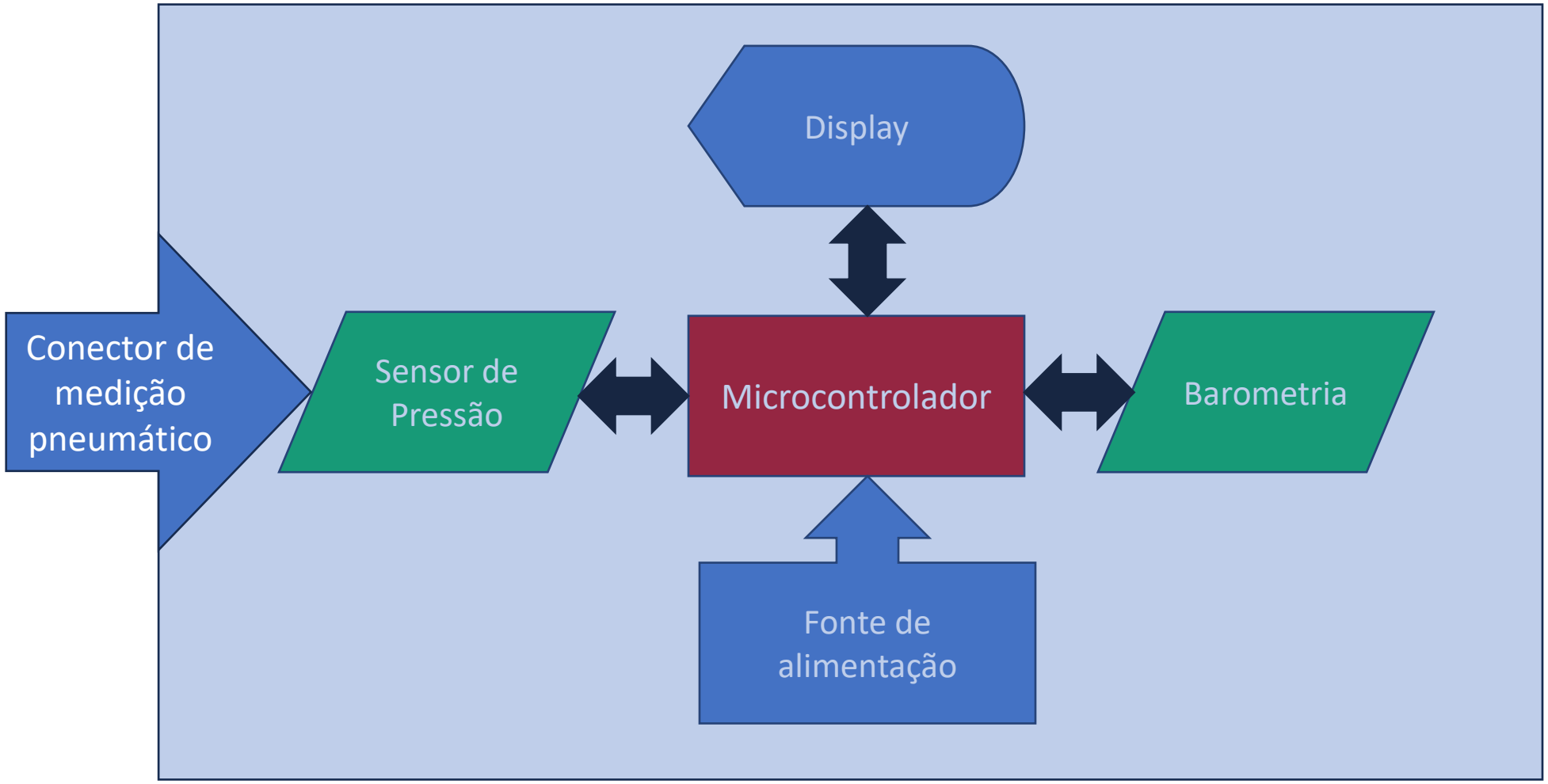
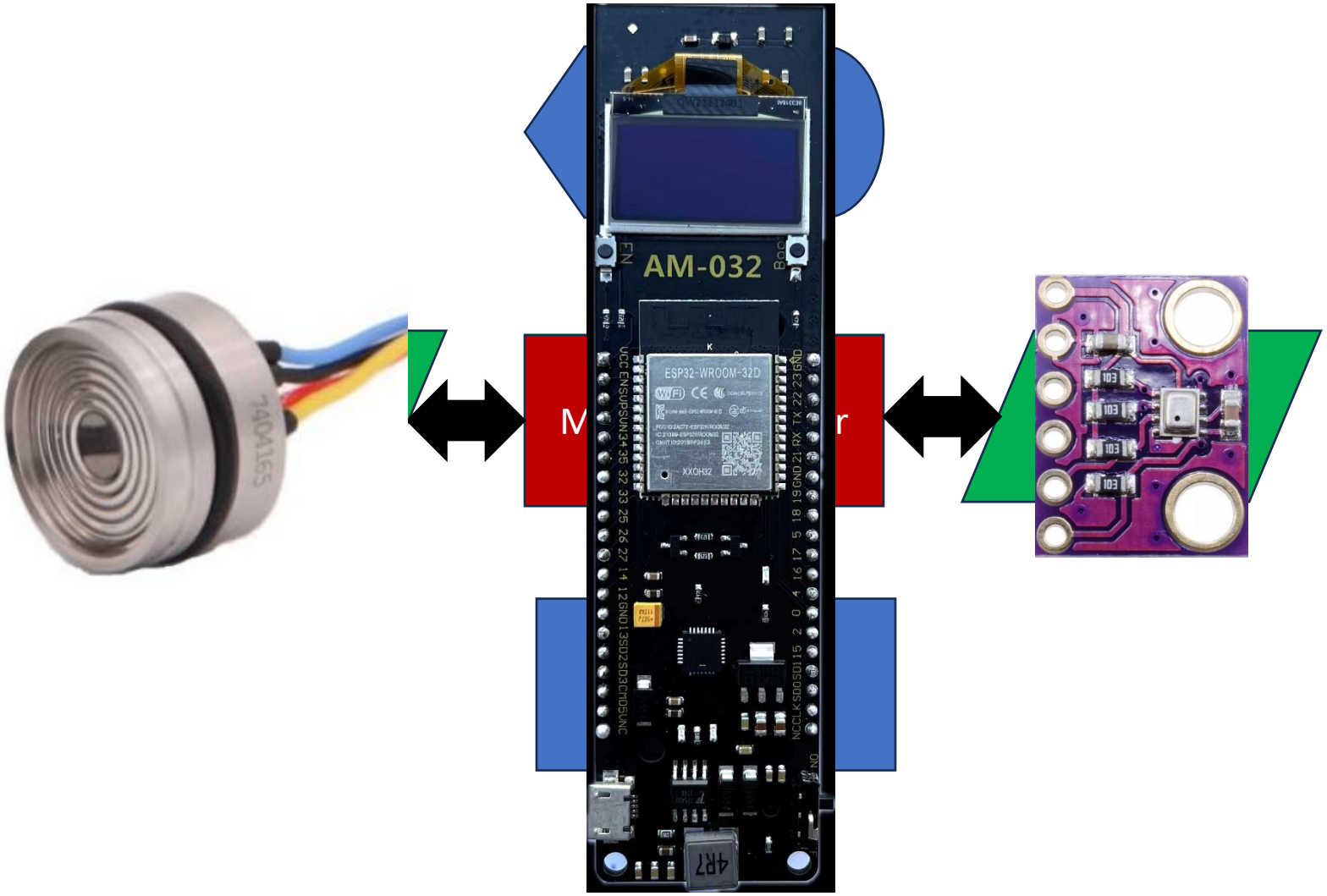
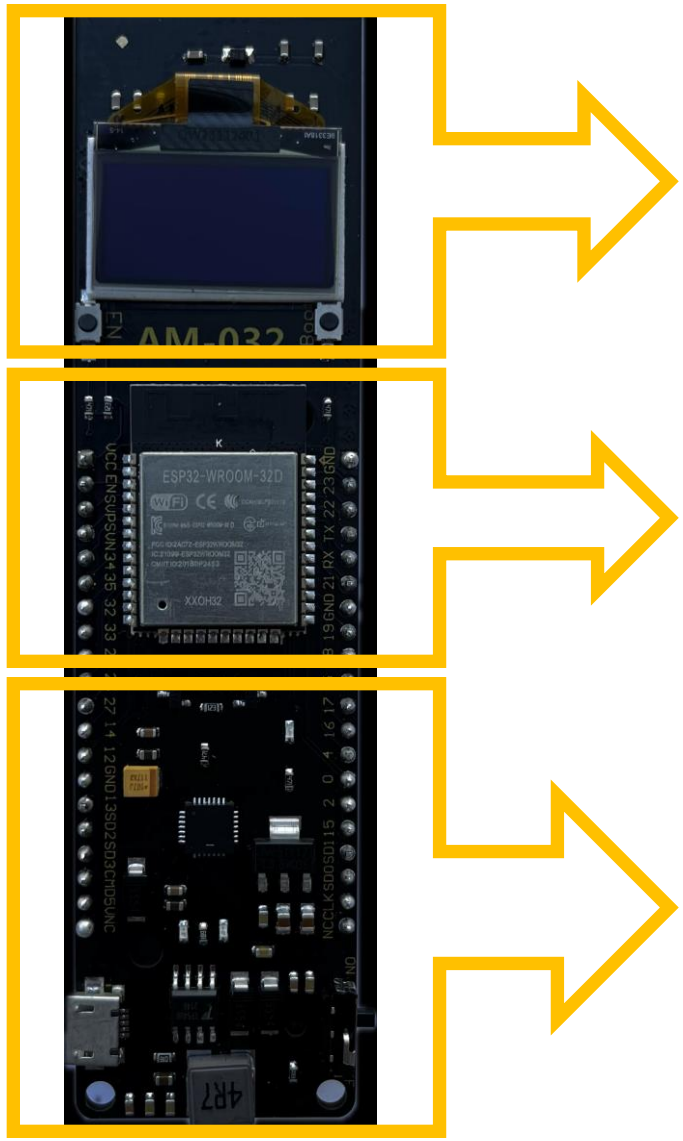


Diagrama em blocos



Kit proposto para a solução MVP

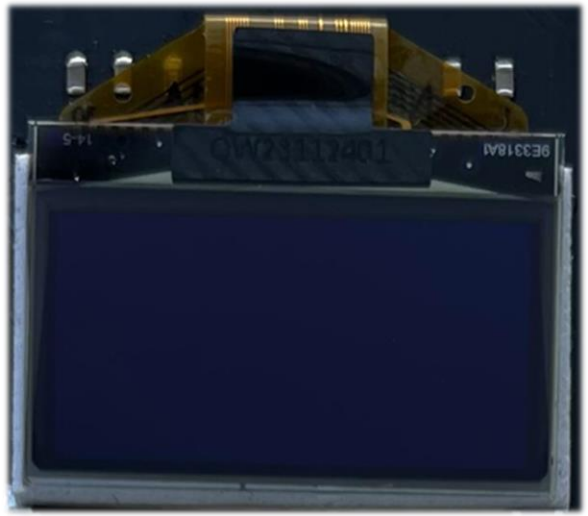


Display gráfico

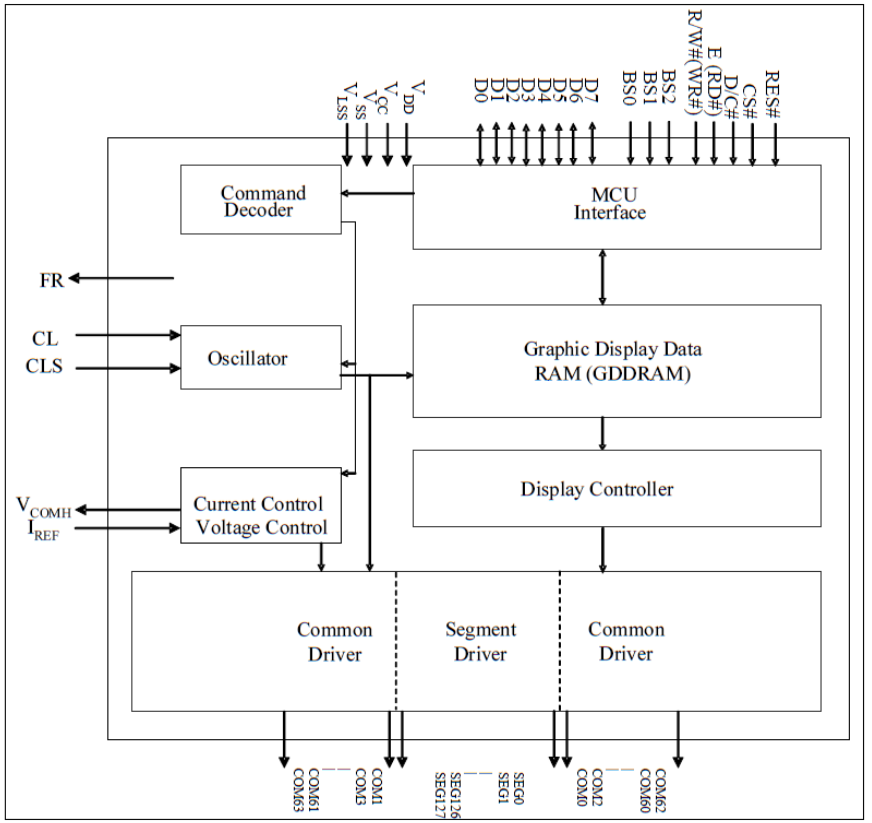
Módulo ESP32

Interface micro USB (V8)
Circuito carregador de bateria

Display



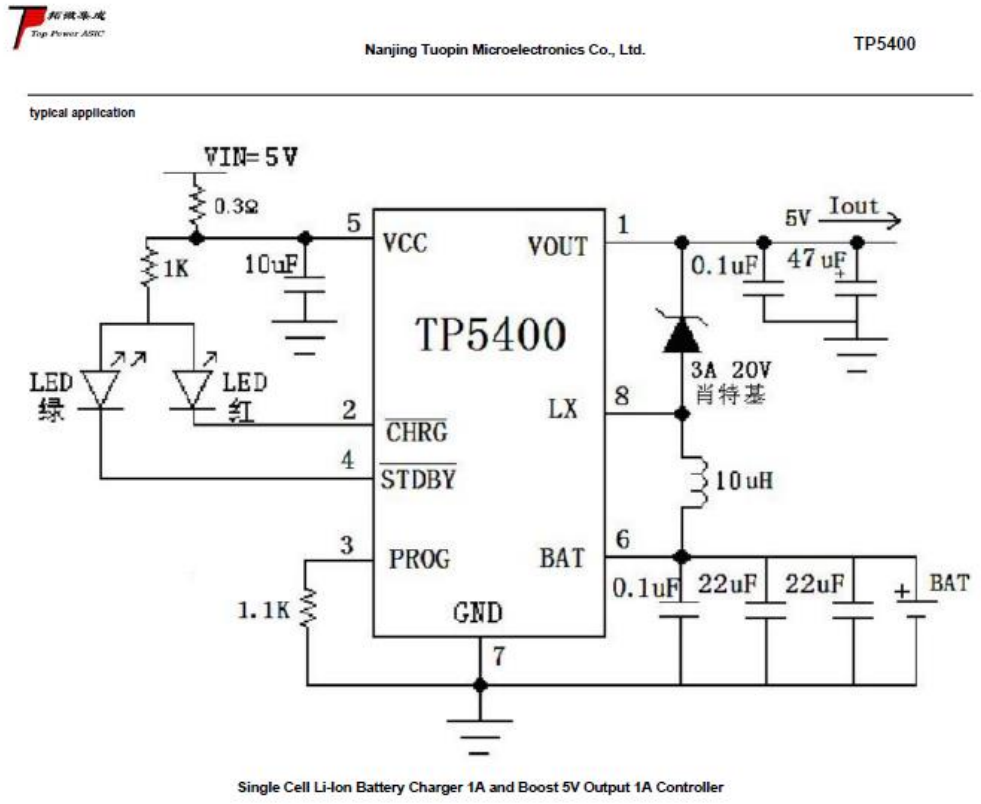
- 128 x 64 Dot Matrix OLED
- Driver SSD1306
- Interface I2C (endereço 0x3C)



Carregador e bateria integrada

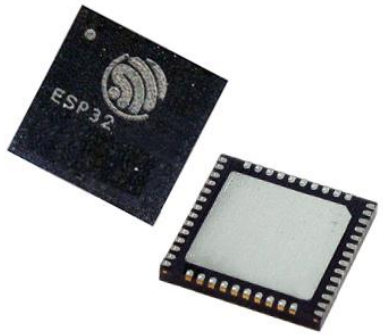
- **Bateria recarregável de íons de lítio (Célula 18650)**

Item	Condition / Note	Specification
2.1 Energy (Power)	Std. charge / discharge	Nominal 3200 mAh Minimum 3100 mAh
2.2 Nominal Voltage	Average	3.63V
2.3 Standard Charge (Refer to 4.1.1)	Constant current Constant voltage End current(Cut off)	0.5C (1550mA) 4.2V 50mA
2.4 Max. Charge Voltage		4.2 ± 0.05V
2.5 Max. Charge Current		1.0 C (3100mA)
2.6 Standard Discharge (Refer to 4.1.2)	Constant current End voltage(Cut off)	0.2C (620mA) 2.5V
2.7 Max. Discharge Current		10A
2.8 Weight	Approx.	Max. 49.0 g
2.9 Operating Temperature	Charge Discharge	0 ~ 45℃ -20 ~ 60℃
2.10 Storage Temperature (for shipping state)	1 month 3 month 1 year	-20 ~ 60℃ -20 ~ 45℃ -20 ~ 20℃



ESP32

- **Core: ESP32-D0WD**
  - **Xtensa dual-core 32-bit LX6 microprocessors at 240 MHZ (RISC)**
  - **448 KB ROM**
  - **520 KB SRAM**
  - **16 KB SRAM in RTC**
  - **QSPI supports multiple flash/SRAM chips**



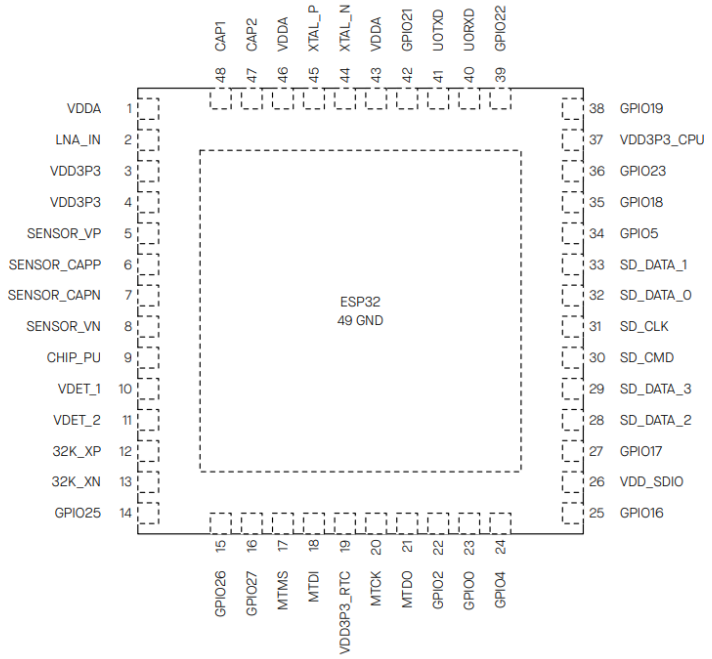
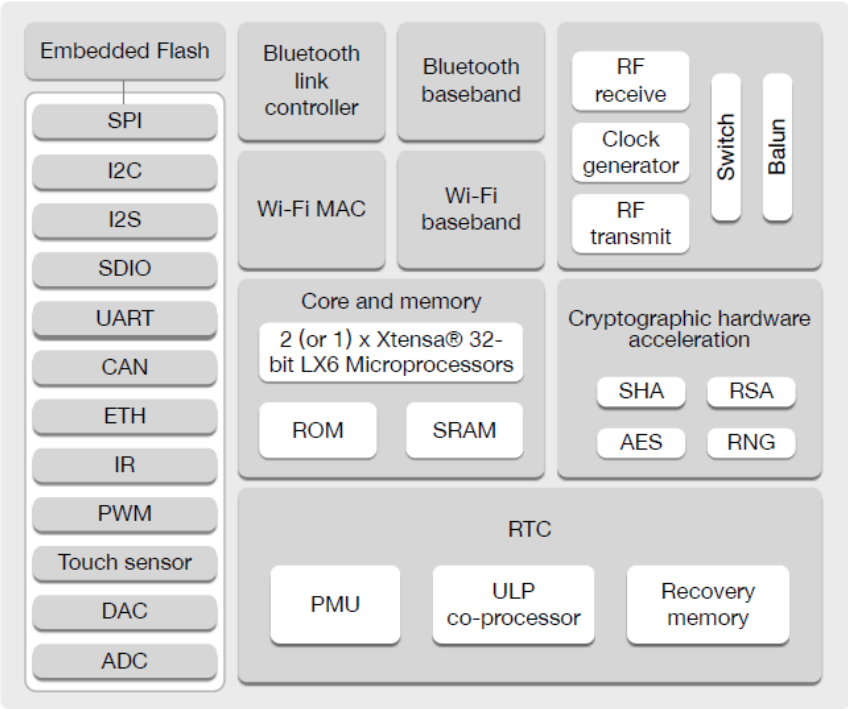
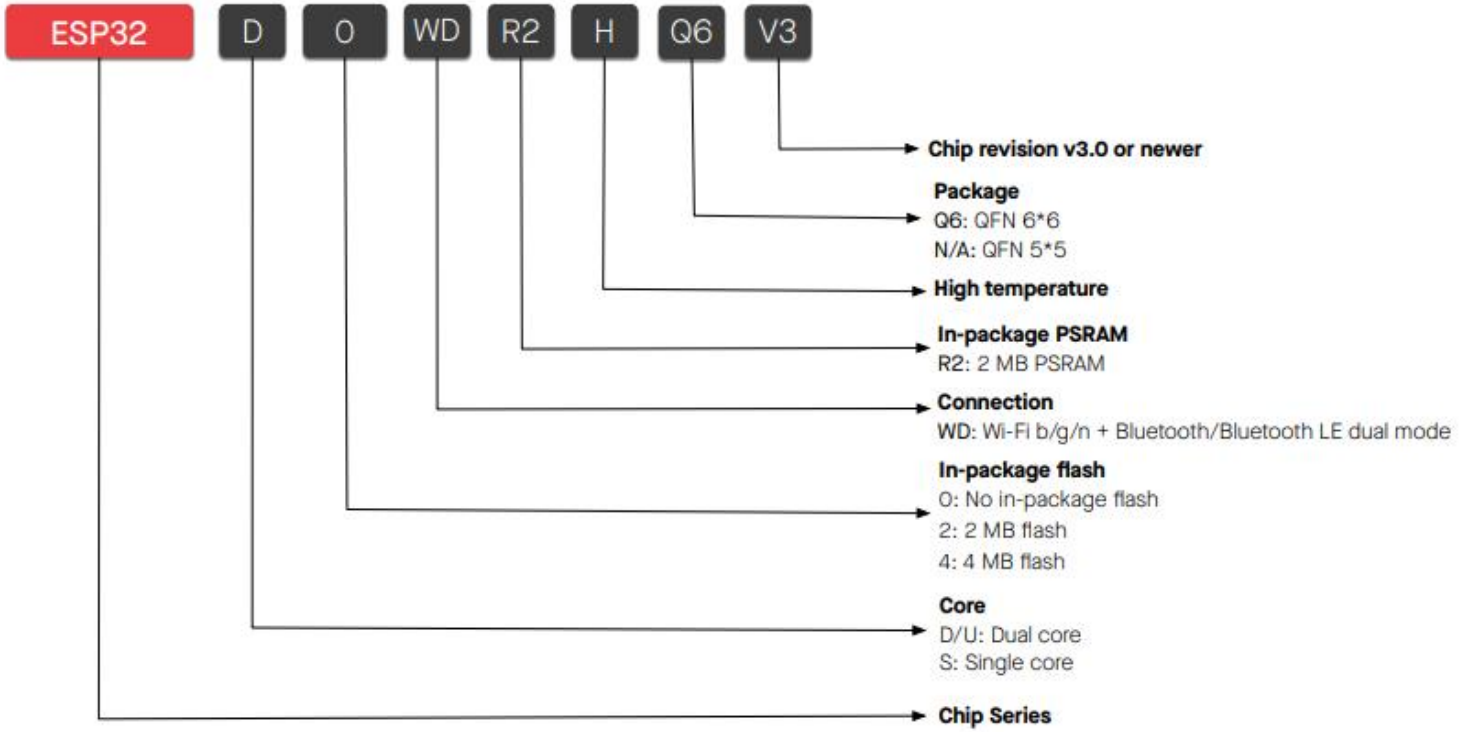


Figure 2-2. ESP32 Pin Layout (QFN 5*5, Top View)

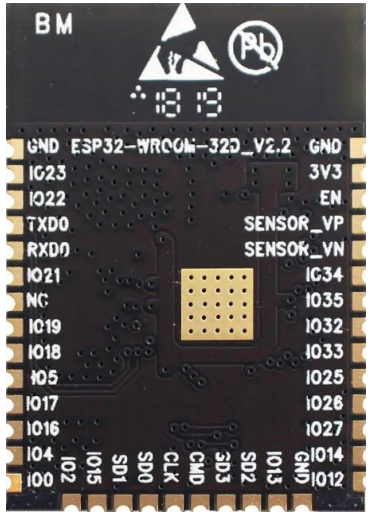
ESP32

- **Core: ESP32-D0WD**





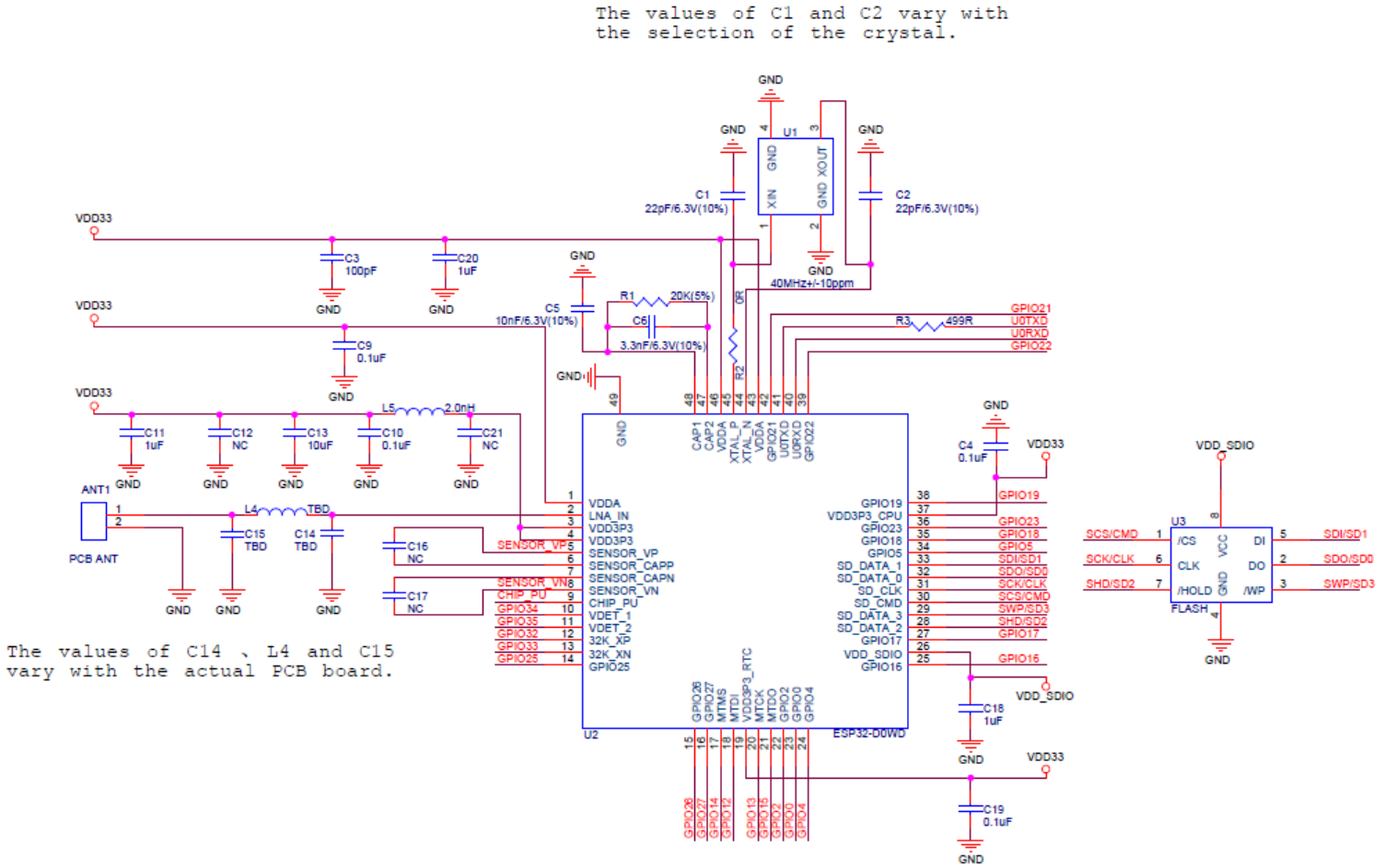
Módulo ESP32



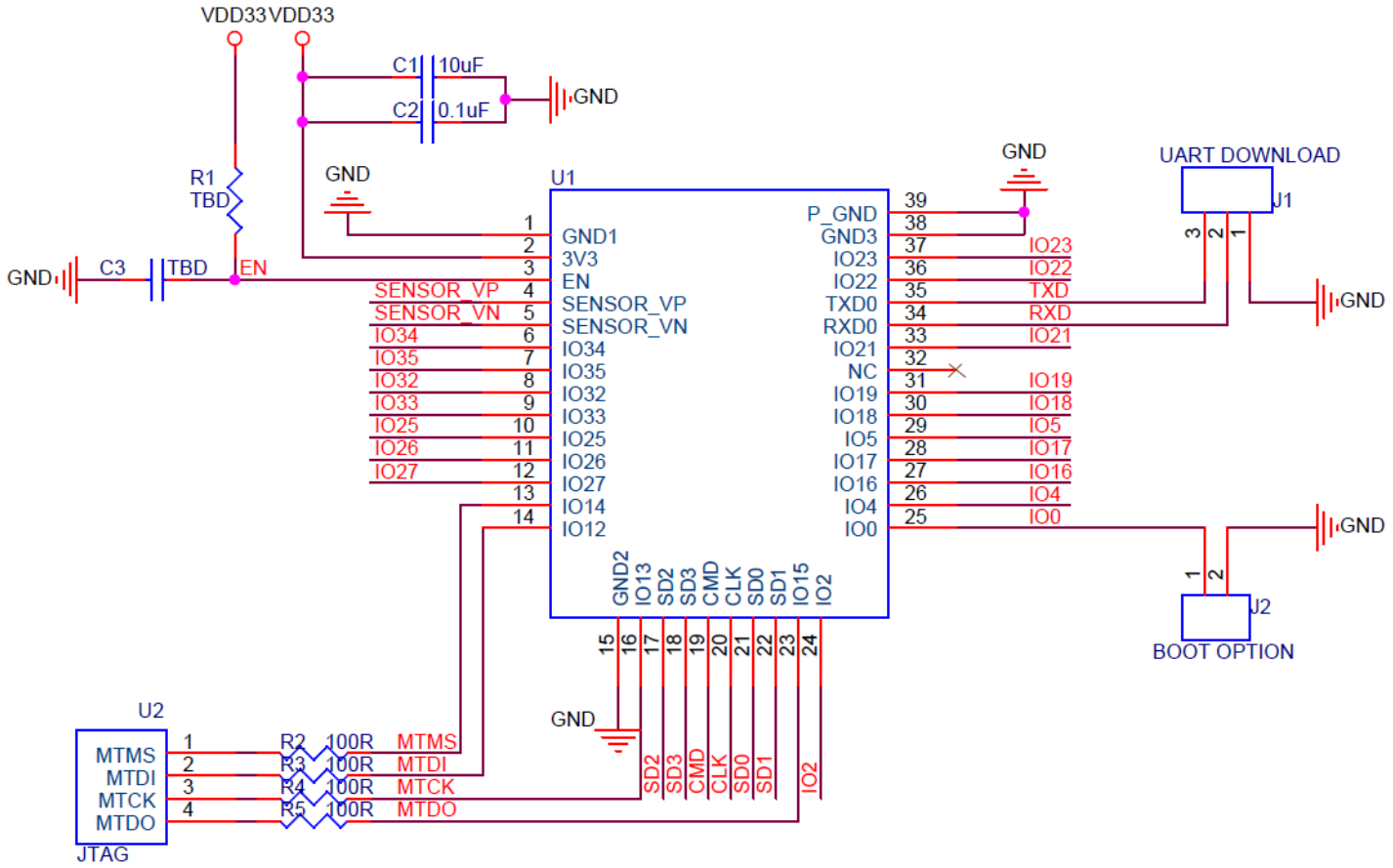
- **Módulo ESP32-WROOM-32D**

Categories	Items	Specifications
Certification	RF Certification	FCC/CE-RED/IC/TELEC/KCC/SRRC/NCC
	Wi-Fi Certification	Wi-Fi Alliance
	Bluetooth certification	BQB
	Green Certification	REACH/RoHS
Test	Reliablity	HTOL/HTSL/uHAST/TCT/ESD
Wi-Fi	Protocols	802.11 b/g/n (802.11n up to 150 Mbps)
		A-MPDU and A-MSDU aggregation and 0.4 μs guard interval support
	Frequency range	2.4 GHz ~ 2.5 GHz
Bluetooth	Protocols	Bluetooth v4.2 BR/EDR and BLE specification
	Radio	NZIF receiver with –97 dBm sensitivity
		Class-1, class-2 and class-3 transmitter
		AFH
	Audio	CVSD and SBC
Hardware	Module interfaces	SD card, UART, SPI, SDIO, I²C, LED PWM, Motor PWM, I²S, IR, pulse counter, GPIO, capacitive touch sensor, ADC, DAC, Two-Wire Automotive Interface (TWAI®), compatible with ISO11898-1 (CAN Specification 2.0)
	On-chip sensor	Hall sensor
	Integrated crystal	40 MHz crystal
	Integrated SPI flash [1]	4 MB
	Operating voltage/Power supply	3.0 V ~ 3.6 V
	Operating current	Average: 80 mA
	Minimum current delivered by power supply	500 mA
	Recommended operating temperature range [2]	–40 °C ~ +85 °C
	Moisture sensitivity level (MSL)	Level 3

Módulo ESP32-WROOM-32D



Módulo ESP32-WROOM-32D



Sensor de pressão

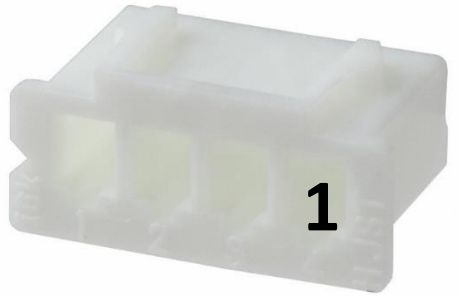
- **Modelo SMP3011 500kPa (Xi'an Sensors CO., LTD)**

Features

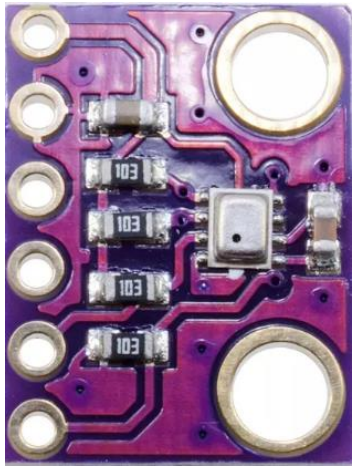
- Ranges: -100kPa...0 ~ 20kPa···70MPa
- 24-bit High precision analog to digital conversion
- Real-time compensation
- Isolated structure for multiple media
- Out put: 15%~85%
- I^2C Bus protocol

Item	definition	Wire color
1	V+	Red
2	V-	Black
3	SCL	Blue
4	SDA	Yellow

Invertido no conector para facilitar a montagem



Sensor barométrico

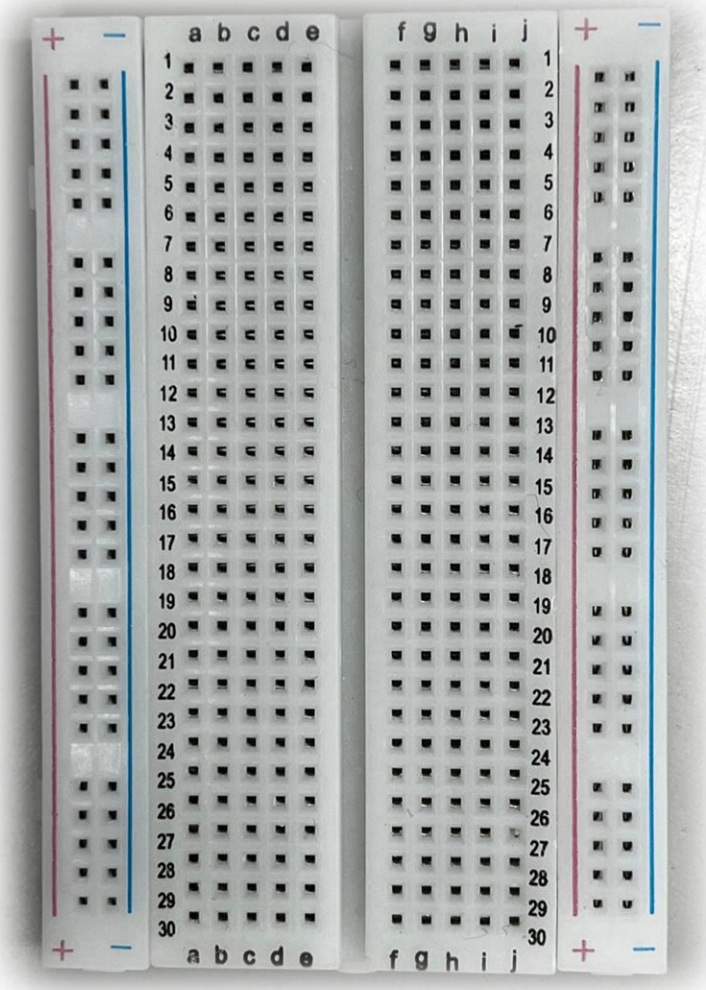


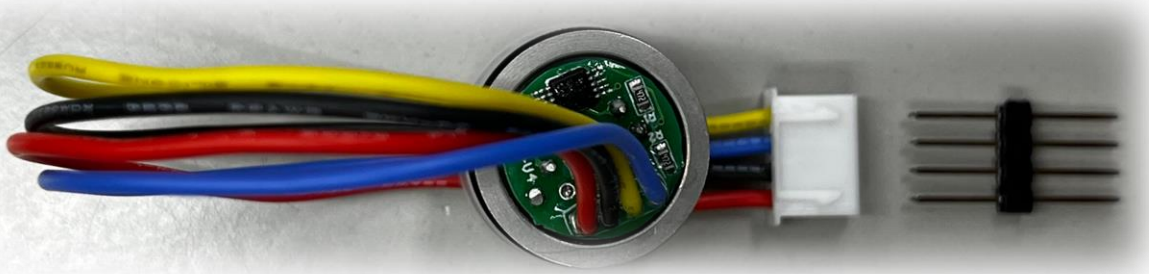
- **Modelo BMP280 (BOSCH)**

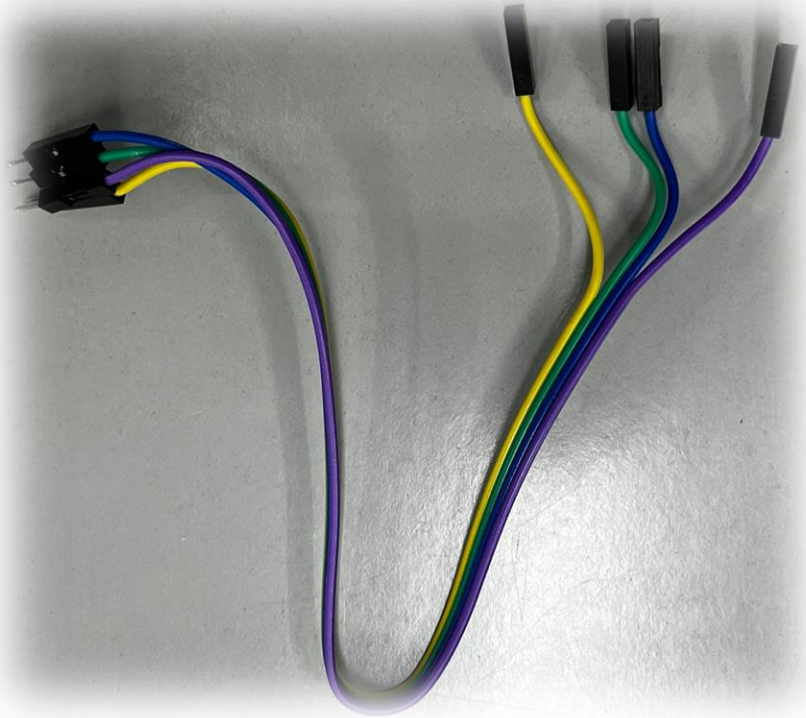
Key parameters

Pressure range	300 ... 1100 hPa (equiv. to +9000...-500 m above/below sea level)
Package	8-pin LGA metal-lid Footprint : 2.0 × 2.5 mm², height: 0.95 mm
Relative accuracy (700 ... 900hPa @25°C)	±0.12 hPa, equiv. to ±1 m
Absolute accuracy (950 ...1050 hPa, 0 ...+40 °C)	typ. ±1 hPa
Temperature coefficient offset (25 ... 40°C @900hPa)	1.5 Pa/K, equiv. to 12.6 cm/K
Digital interfaces	I²C (up to 3.4 MHz) SPI (3 and 4 wire, up to 10 MHz)
Current consumption	2.7µA @ 1 Hz sampling rate
Temperature range	-40 ... +85 °C
RoHS compliant, halogen-free	
MSL 1	

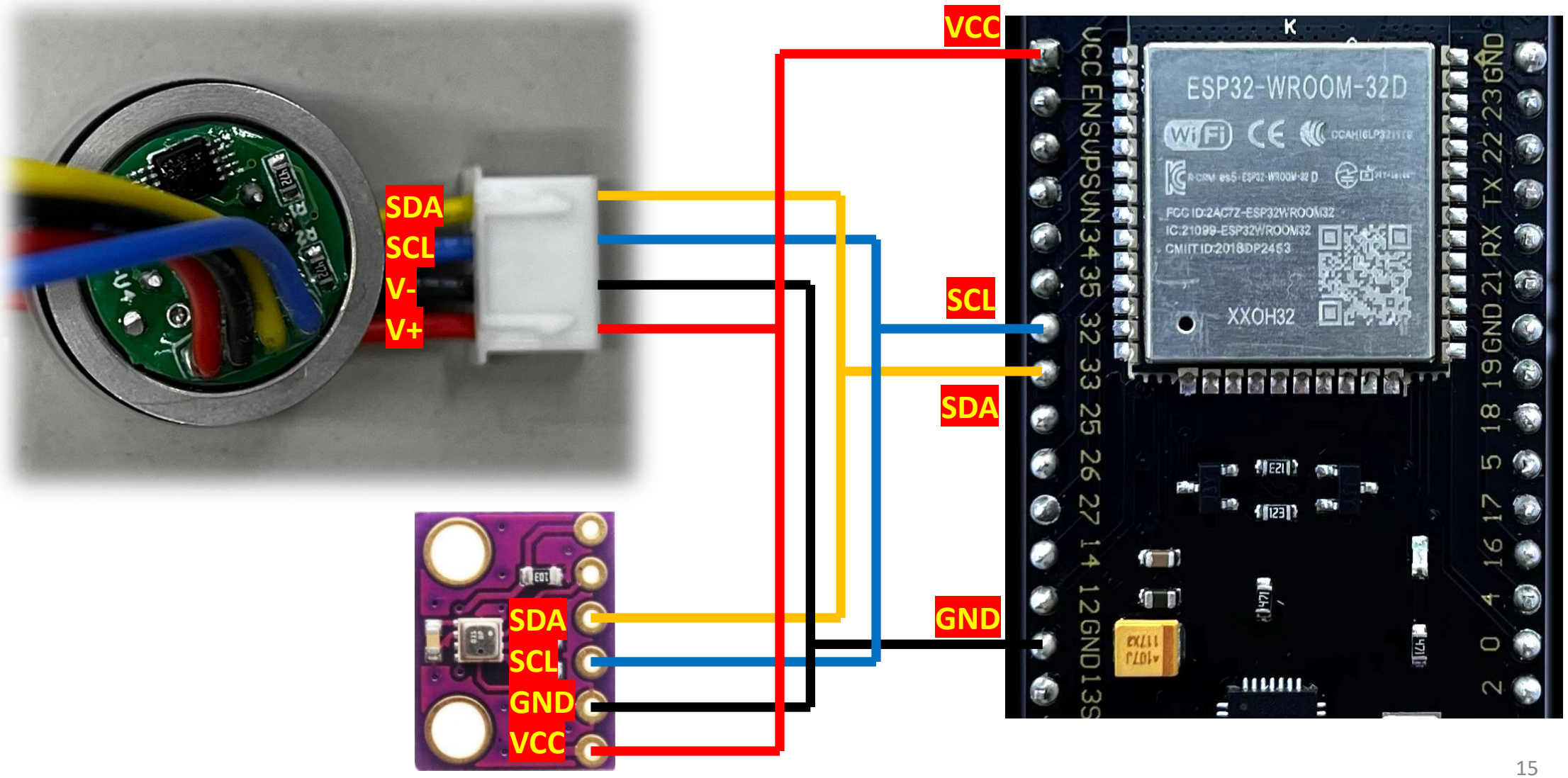
Integrando o MVP



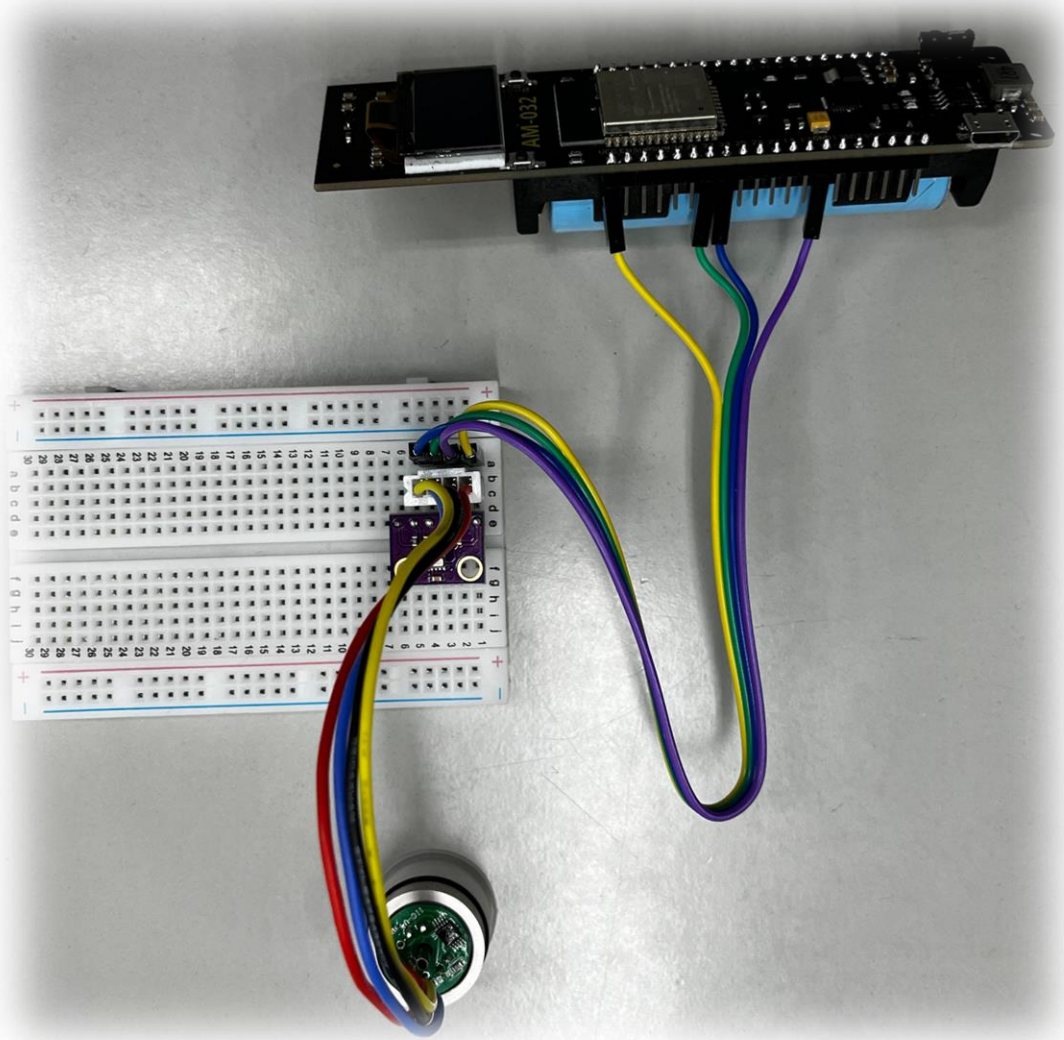




Integrando o MVP



Integrando o MVP



Funções dos botões e chave

EN: RESET

Boot: Modo de gravação

ON: Liga

OFF: Desliga

Compatibilidade Eletromagnética

EMC (Eletromagnetic Compatibility) é a capacidade de um sistema eletrônico funcionar sem sofrer interferências eletromagnéticas do ambiente e também não ser uma fonte de emissão. Ou seja, o produto deve operar corretamente e não afetar os outros em seu ambiente.

Norma	Descrição
IEC 61000-4-2	Imunidade de descarga eletrostática
IEC 61000-4-3	Imunidade de campo eletromagnético de radiofrequência irradiado
IEC 61000-4-4	Imunidade a transiente elétrico rápido
IEC 61000-4-5	Imunidade a surtos
IEC 61000-4-6	Imunidade a perturbação conduzida, induzida por campos de radiofrequência
IEC 61000-4-8	Imunidade ao campo magnético de frequência de potência (50 e 60Hz)
IEC 61000-4-11	Imunidade a quedas, curtas interrupções e variações de tensão
CISPR11	Características das perturbações de radiofrequência

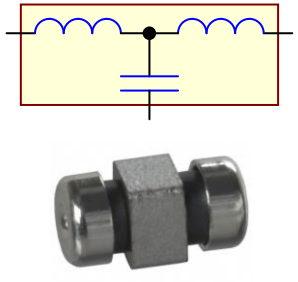
Como mitigar os efeitos colaterais da EMI?

Aterramento

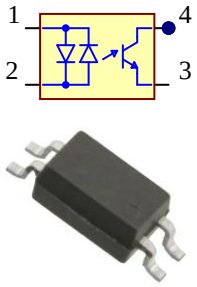
Ferrites

Blindagem

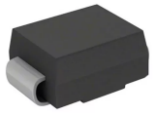
Filtros



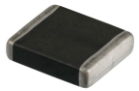
Isoladores



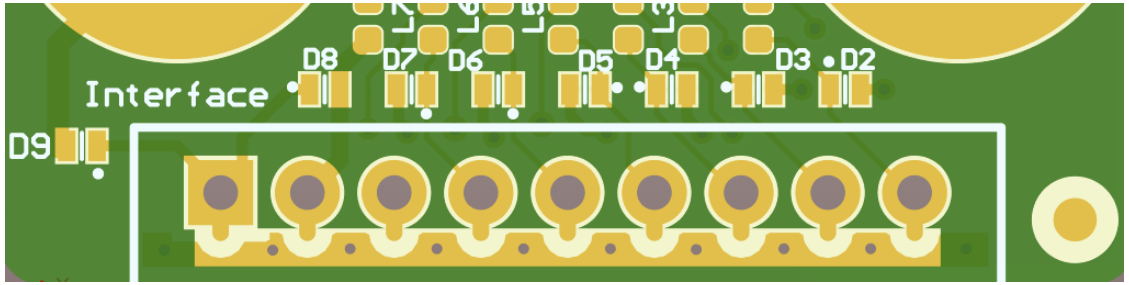
TVSs



Varistores

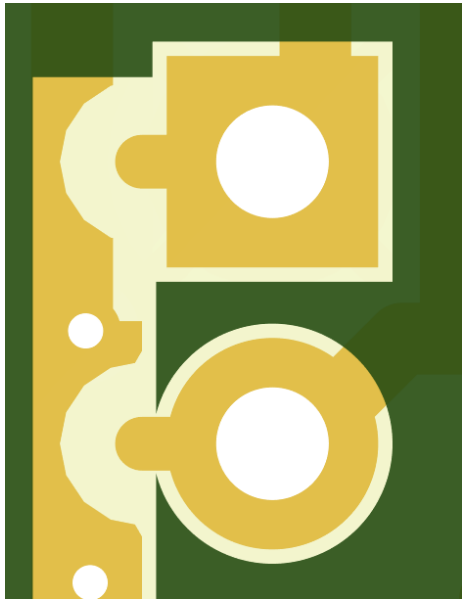


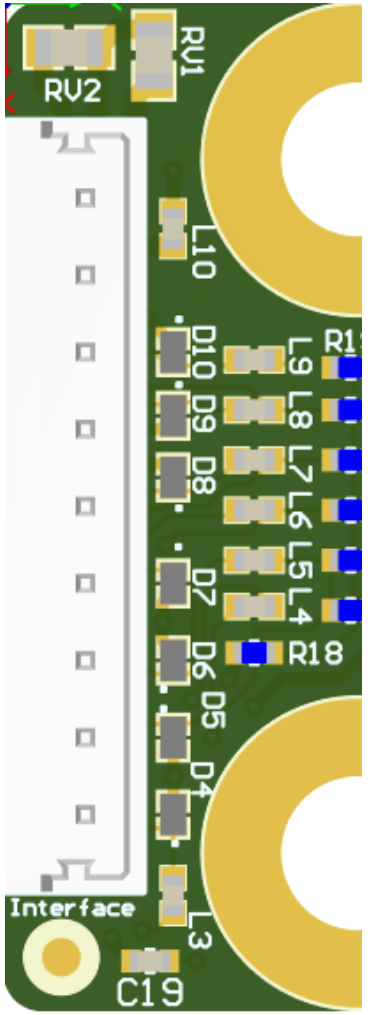
Layout da PCB



Proteção elétrica na prática

- Spark gap

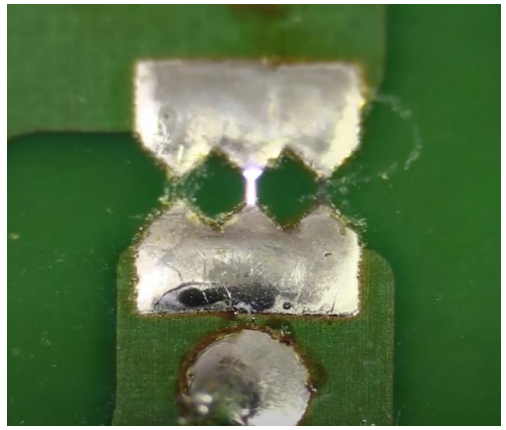




$$V = (3000 \times \text{Pressure}_{(\text{atmospheres})} \times \text{Distance}_{(\text{mm})}) + 1350$$

0·1mm = 1650 V

0·2mm = 1950 V



Proteção elétrica na prática

- Diodo TVS (Transient Voltage Suppressors)

DIODES INCORPORATED

Lead-free Green

DESD3V3S1BL

LOW CAPACITANCE BIDIRECTIONAL TVS DIODES

Features

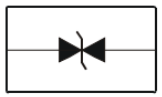
- Low Profile Package (0.53mm Max) and Ultra-Small PCB Footprint Area (1.08 * 0.68mm Max) Suitable for Compact Portable Electronics
- Provides ESD Protection per IEC 61000-4-2 Standard: Air ±30kV, Contact ±25kV
- 1 Channel of ESD Protection
- Low Channel Input Capacitance
- Typically Used in Cellular Handsets, Portable Electronics, Communication Systems, Computers and Peripherals
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.**

Mechanical Data

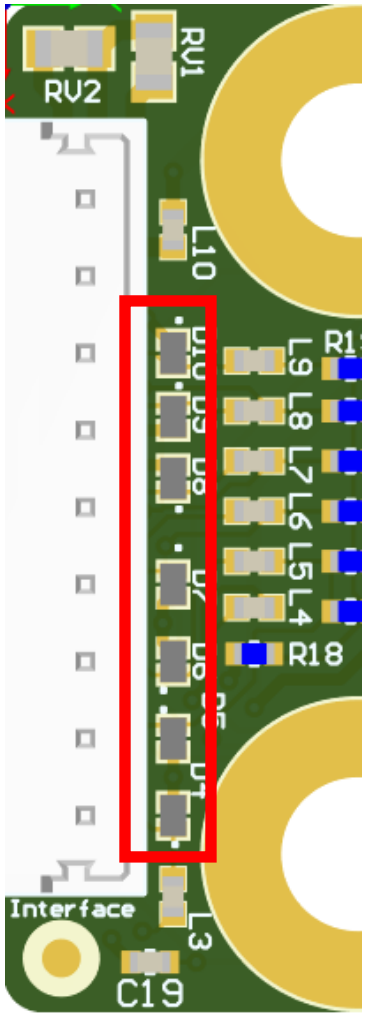
- Case: X1-DFN1006-2
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: NiPdAu over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e4
- Polarity: Cathode Band
- Weight: 0.001 grams (Approximate)

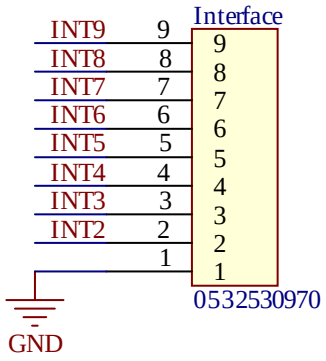
- Provides ESD Protection per IEC 61000-4-2 Standard: Air ±30kV, Contact ±25kV

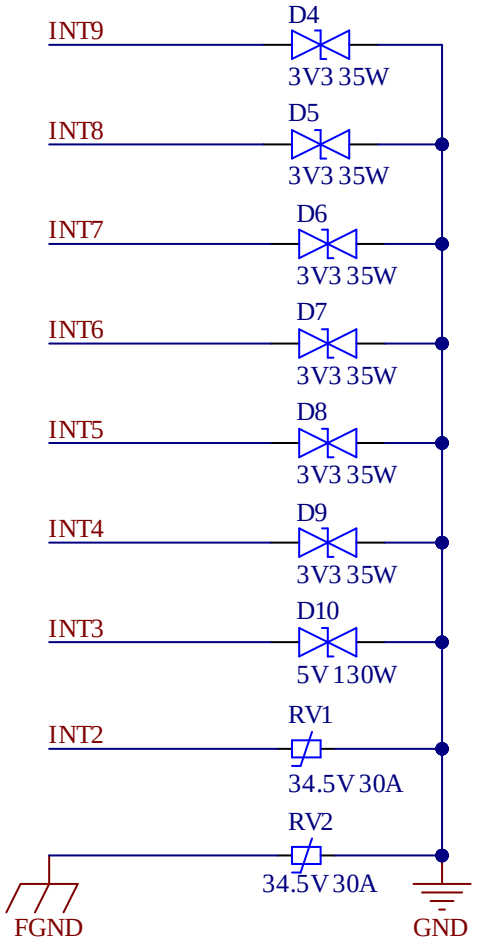
Bottom View



Device Schematic







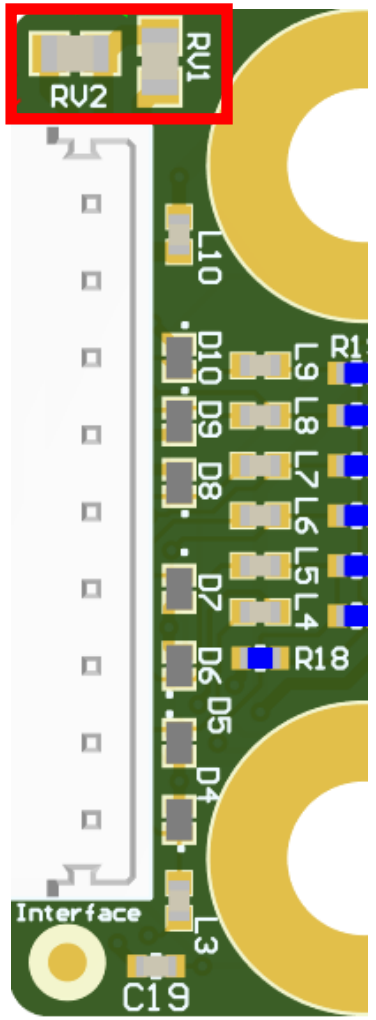
Proteção elétrica na prática

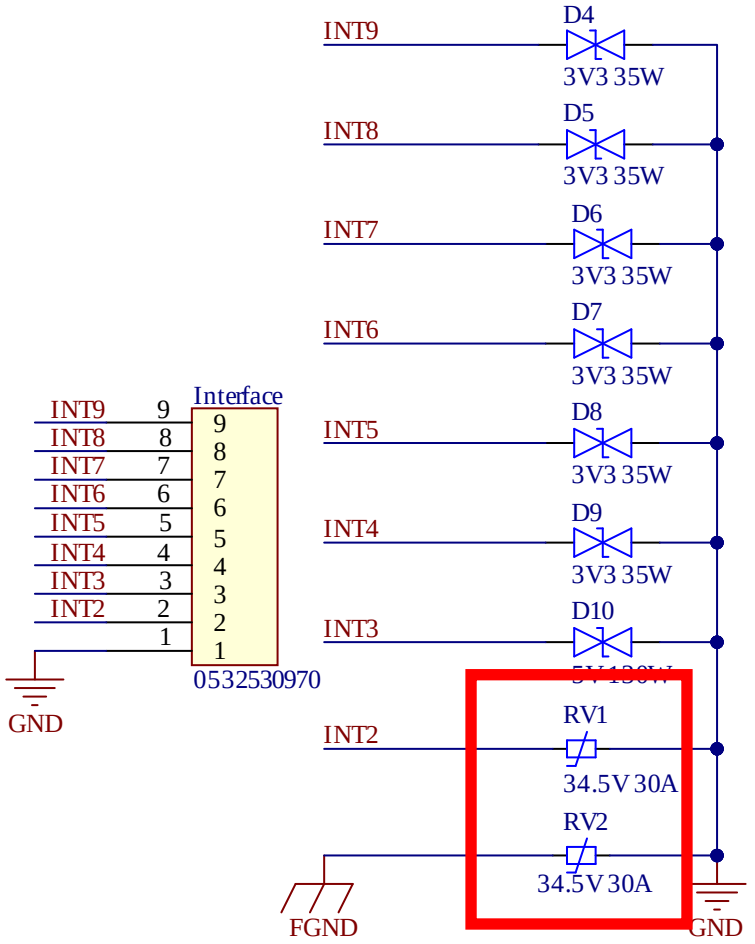
- Varistor

MLA Varistor Series

Surface Mount Multilayer Varistors (MLVs)

The MLA Series family of transient voltage surge suppression devices is based on the Littelfuse Multilayer fabrication technology. These components are designed to suppress a variety of transient events, including those specified in IEC 61000-4-2 or other standards used for Electromagnetic Compliance (EMC). The MLA Series is typically applied to protect integrated circuits and other components at the circuit board level.

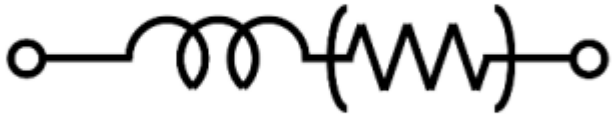




Proteção elétrica na prática

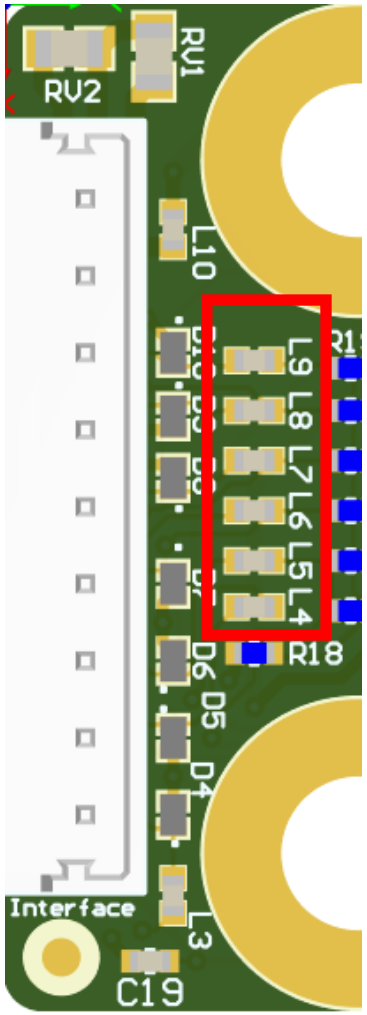
- **Ferrite bead**

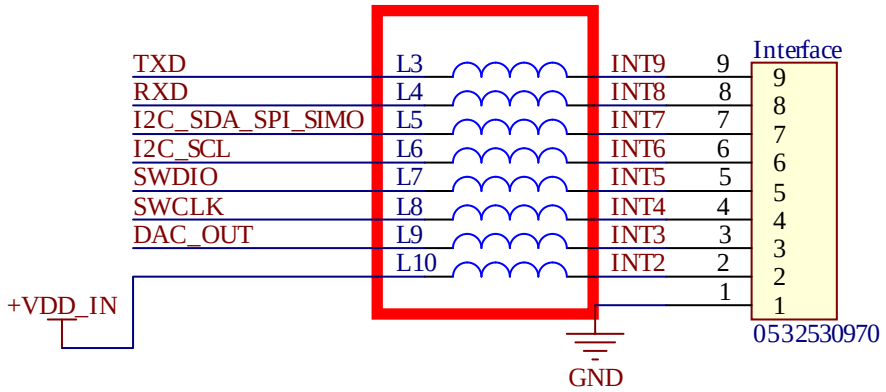
Equivalent circuit



(Resistance element becomes dominant at high frequencies.)

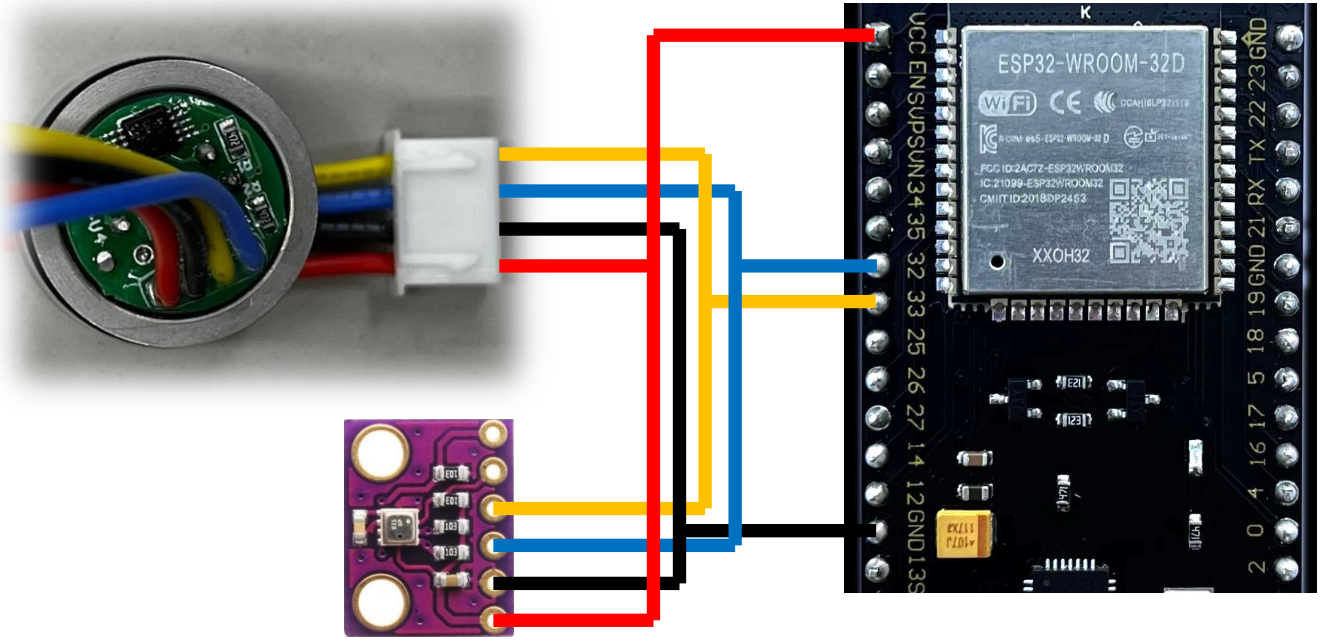
$$XL = 2\pi * F * L$$

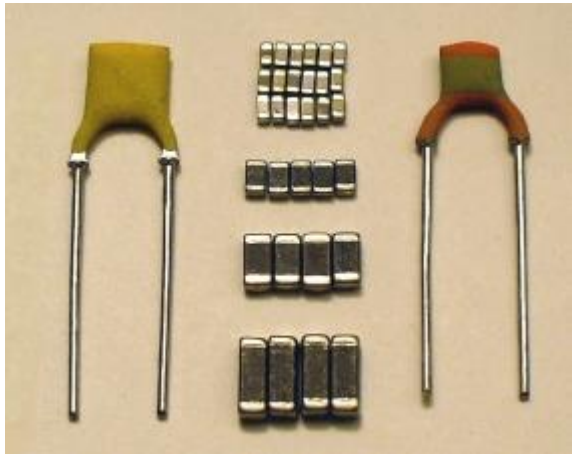




Poderei aplicar proteções no projeto?

- Claro! No protótipo do produto.





PENSAMENTO

"Seu futuro é criado pelo que você faz hoje, não pelo que você deixa para amanhã"

(Robert Kiyosaki)

Muito OBRIGADO!

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