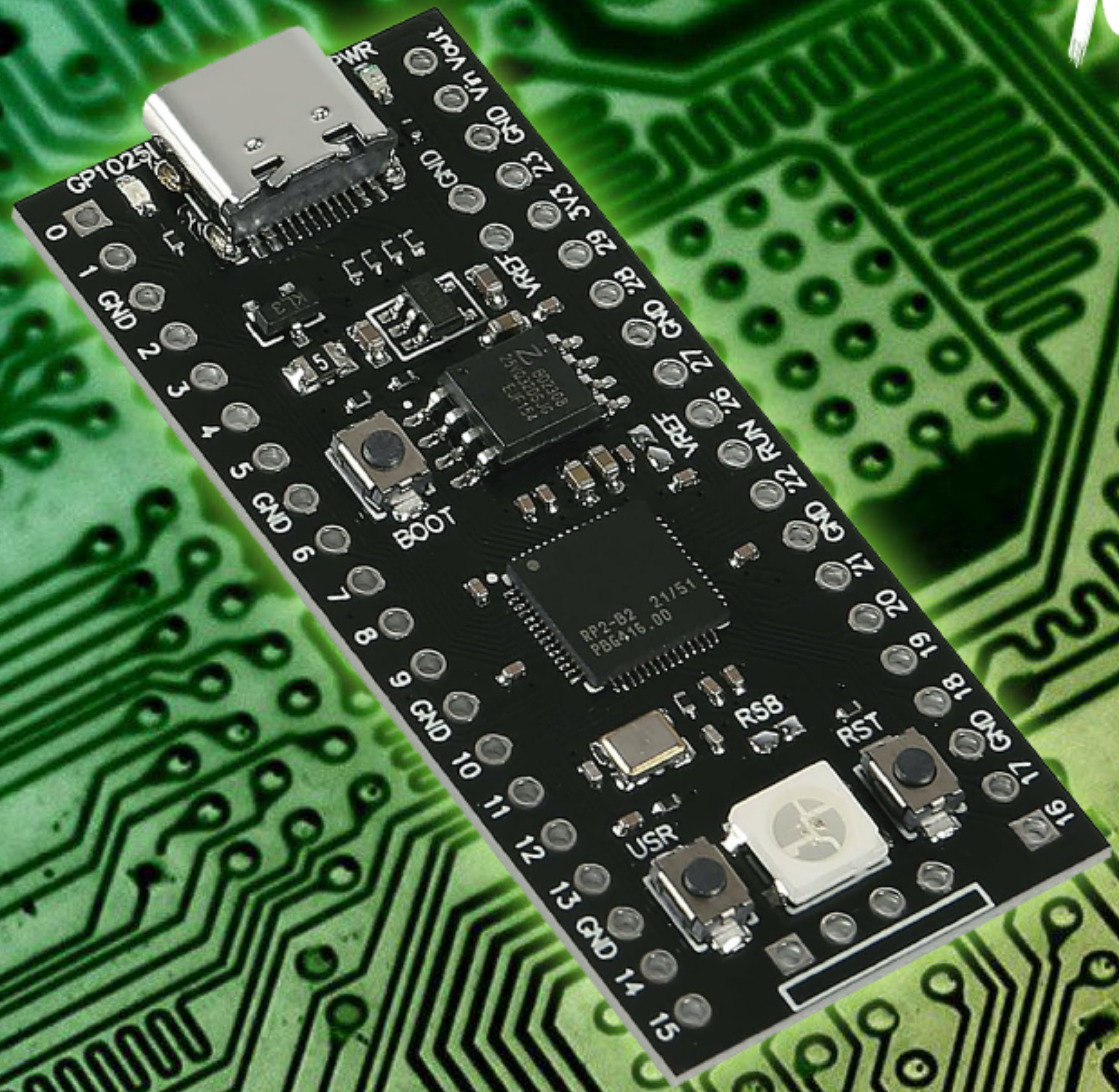
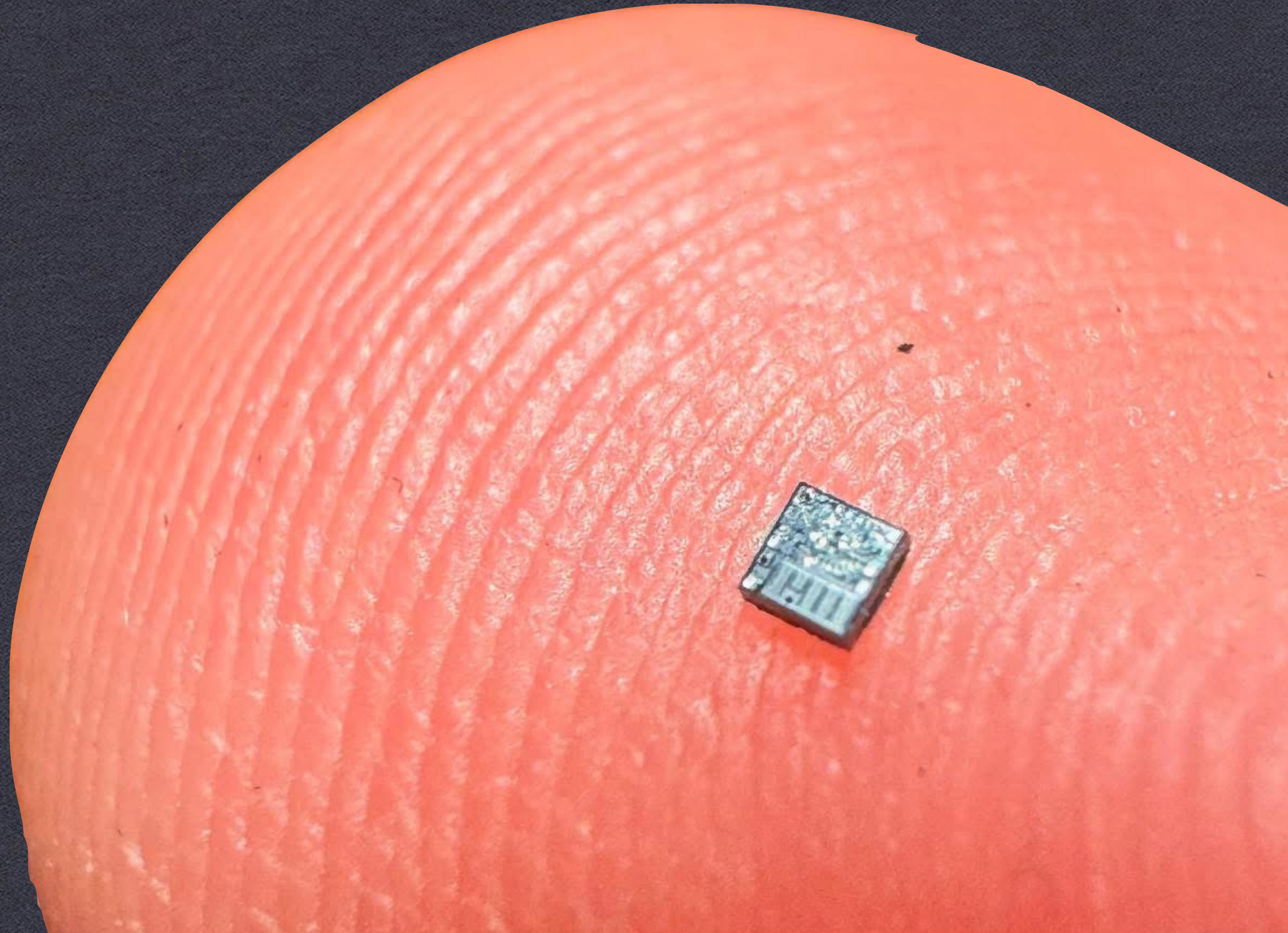
MICROCONTROLLER MASTERY



01 START

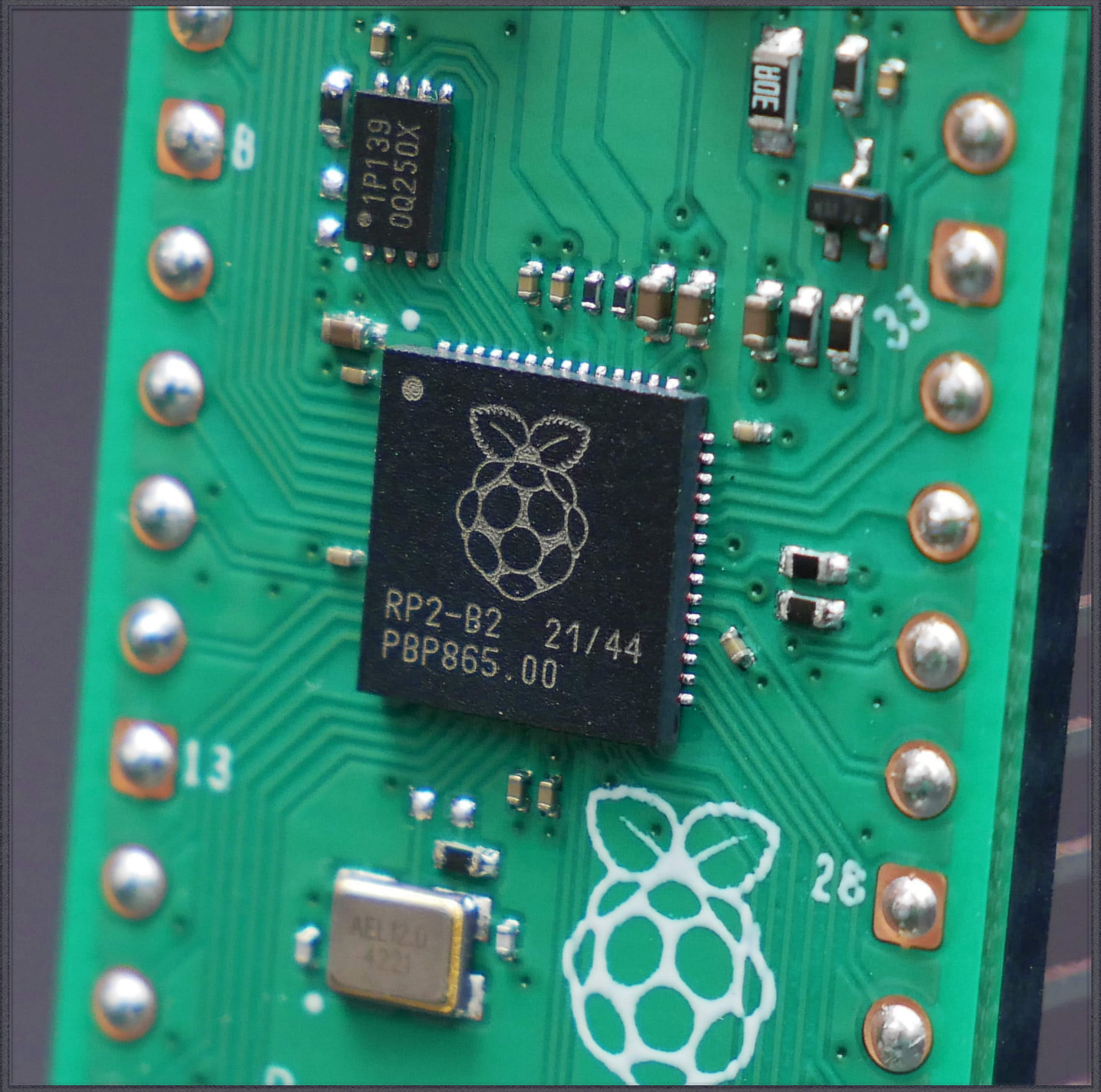
WHAT IS A MICROCONTROLLER?



WHAT IS A MICROCONTROLLER?

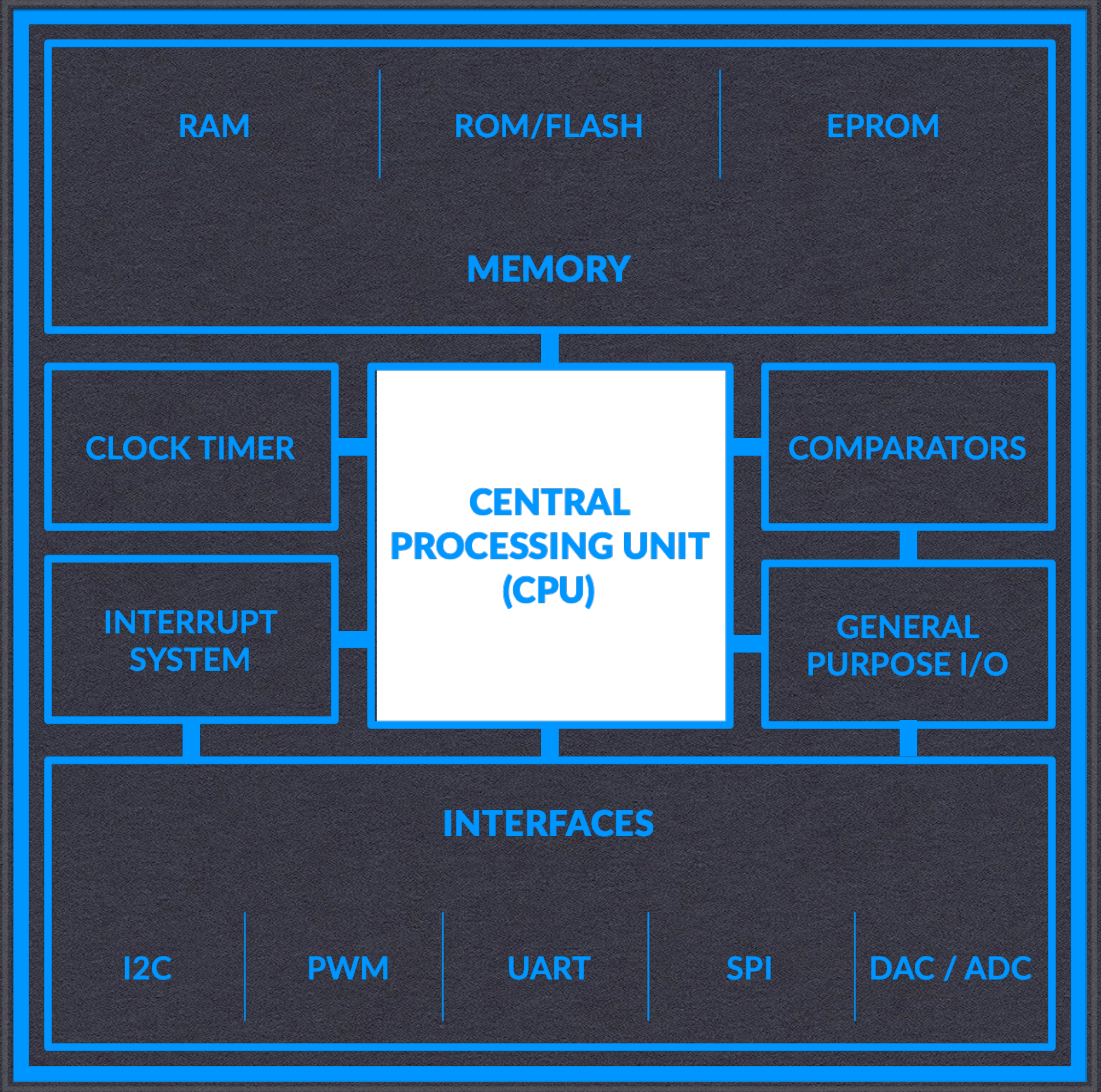
A SMALL, SELF-CONTAINED COMPUTER THAT ACTS AS THE "BRAIN" INSIDE MANY ELECTRONIC DEVICES. IT'S A CHIP THAT CAN PROCESS DATA AND CONTROL OTHER PARTS OF A SYSTEM.

IT IS A SPECIAL TYPE OF COMPUTER DESIGNED FOR SPECIFIC TASKS, LIKE TURNING ON A LIGHT, CONTROLLING A ROBOT, OR READING DATA FROM A SENSOR.



https://www.circuitstate.com/tutorials/getting-started-with-raspberry-pi-pico-rp2040-microcontroller-board-pinout-schematic-and-programming-tutorial/

WHAT IS A MICROCONTROLLER?



https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

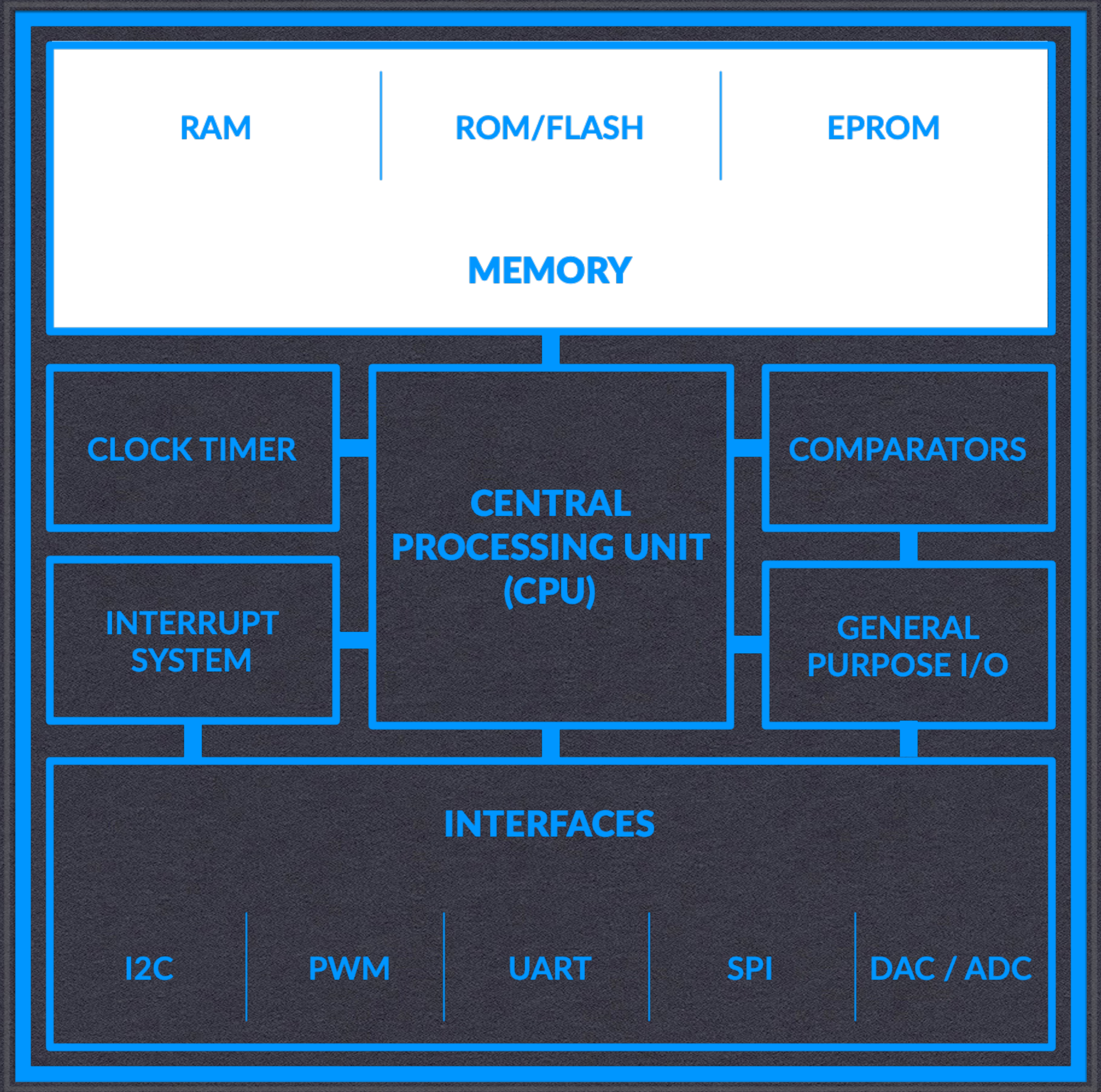
PROCESSOR (CPU)

ALSO KNOWN AS THE CENTRAL PROCESSING UNIT, IT IS THE PART THAT PERFORMS CALCULATIONS AND MAKES DECISIONS.

WHAT IS A MICROCONTROLLER?

MEMORY

WHERE DATA AND INSTRUCTIONS ARE STORED FOR LATER USE. DIFFERENT TYPES ARE FASTER AND STORE INFORMATION LONGER.

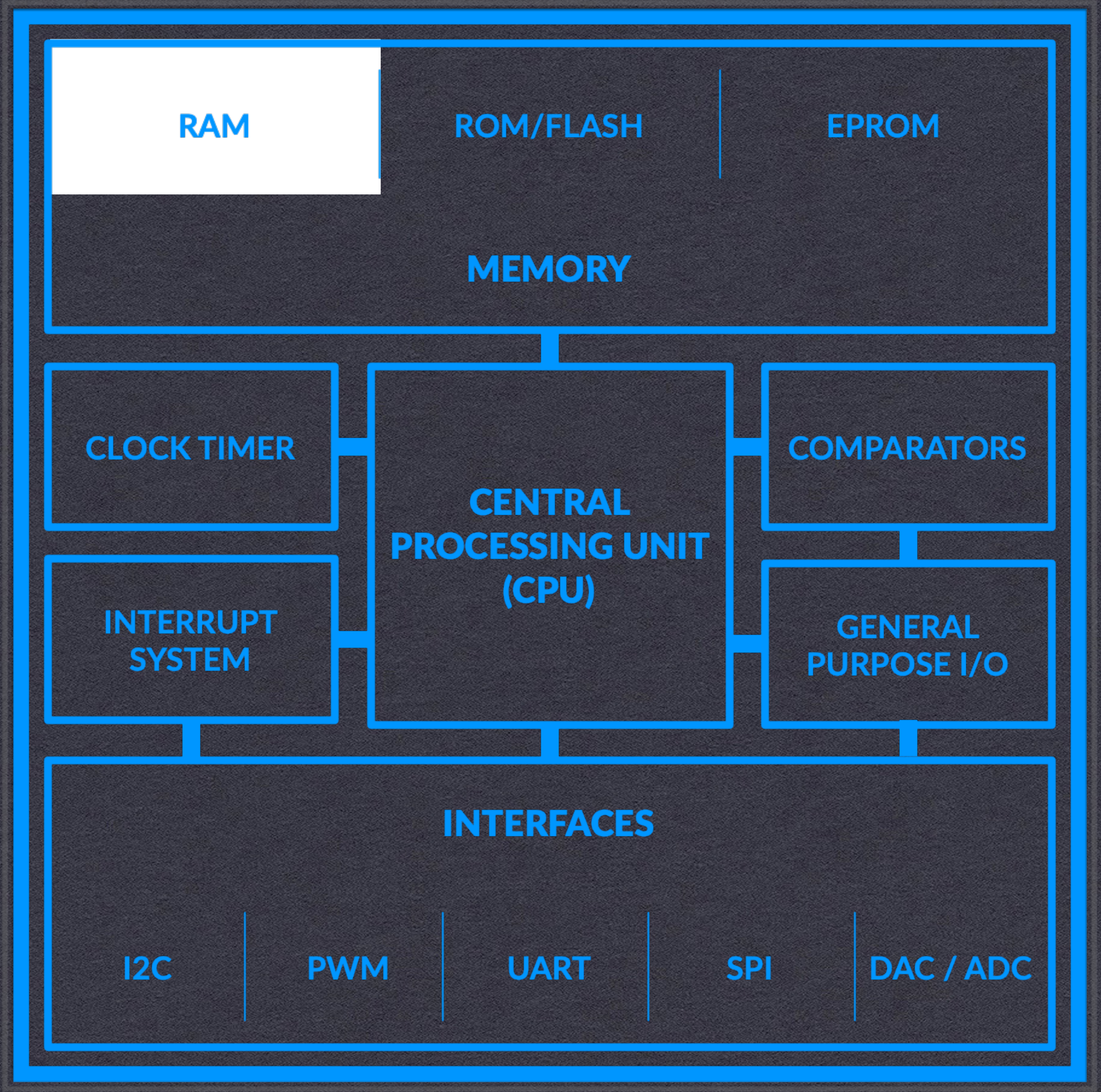


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

MEMORY - RAM

ALSO KNOWN AS RANDOM ACCESS MEMORY, THIS MEMORY IS VERY FAST AND “VOLATILE”, ONLY KEEPING DATA WHILE POWERED ON.



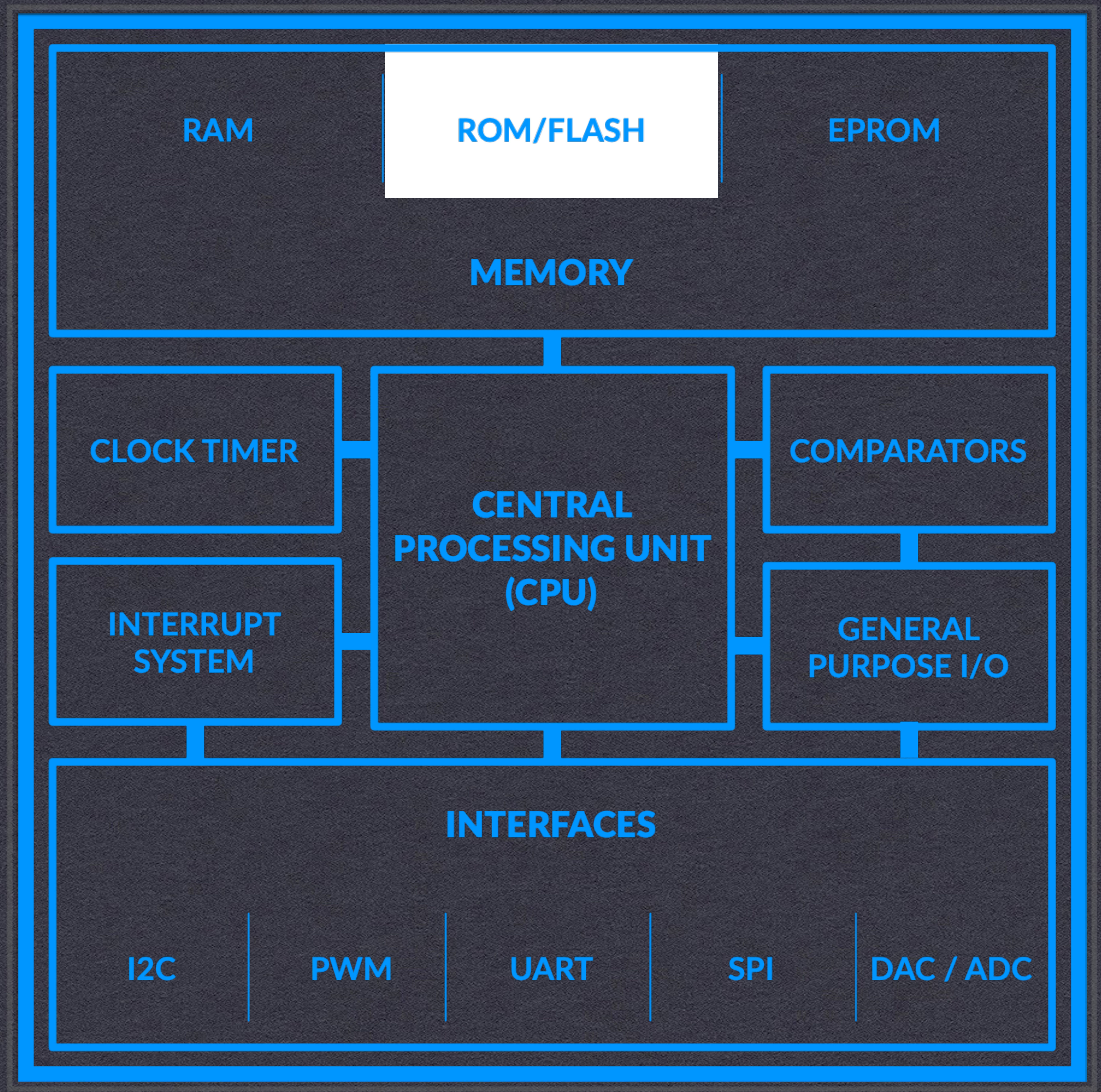
https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

MEMORY - ROM/FLASH

ALSO KNOWN AS READ ONLY MEMORY, THIS MEMORY IS SLOWER THAN RAM, AND USED TO HOLD PROGRAM CODE EVEN WHEN THE DEVICE IS OFF.

ROM CANNOT BE CHANGED WITHOUT SPECIAL TOOLS OR SOFTWARE, IF AT ALL.



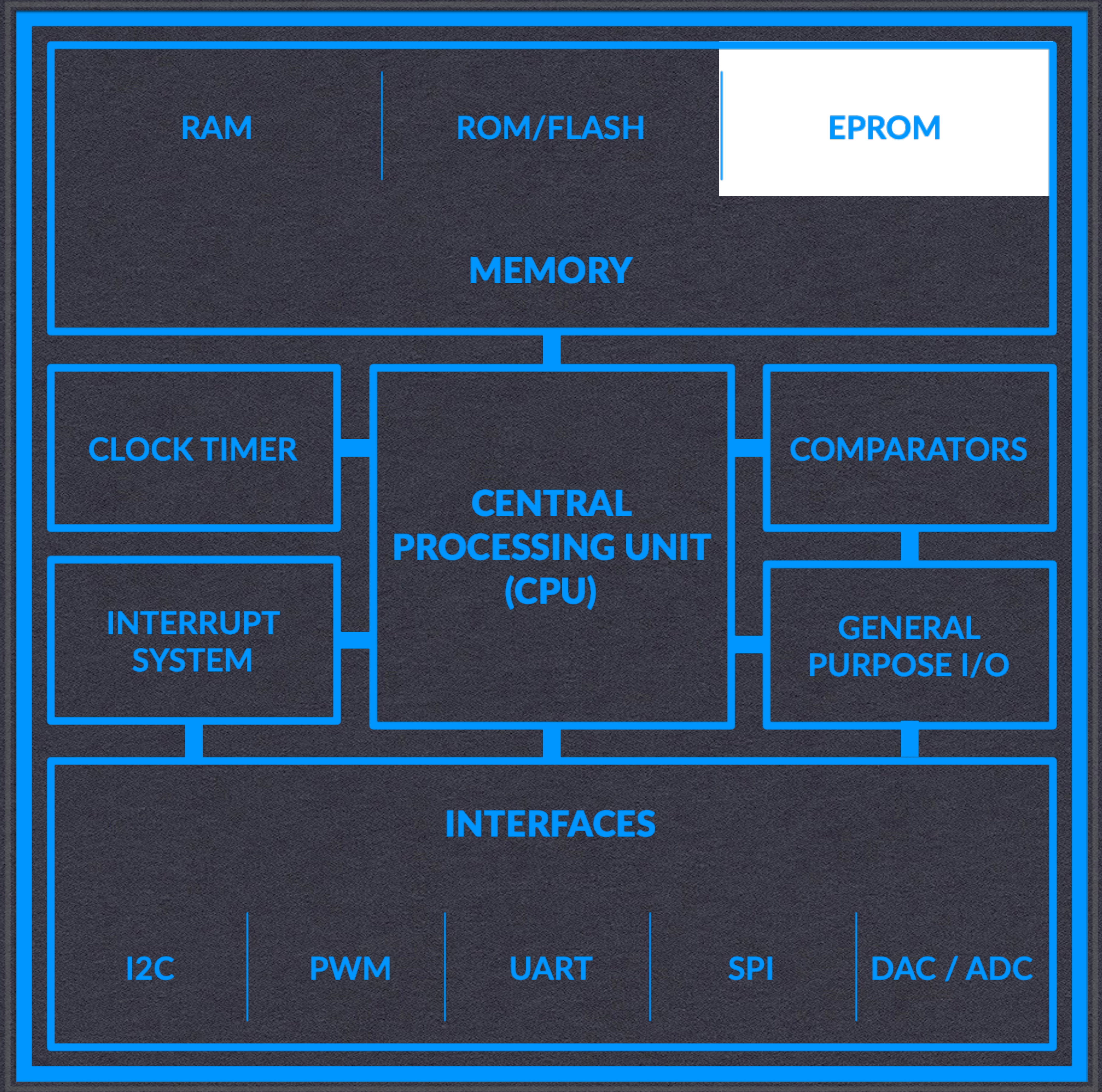
https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

MEMORY - EPROM

NOT IN EVERY MICROCONTROLLER, ERASABLE PROGRAMMABLE READ-ONLY MEMORY IS GENERALLY SLOWER THAN ROM AND CAN STORE DATA EVEN WHEN THE DEVICE IS OFF.

AN EPROM CAN BE MODIFIED USING SPECIALIZED TOOLS.

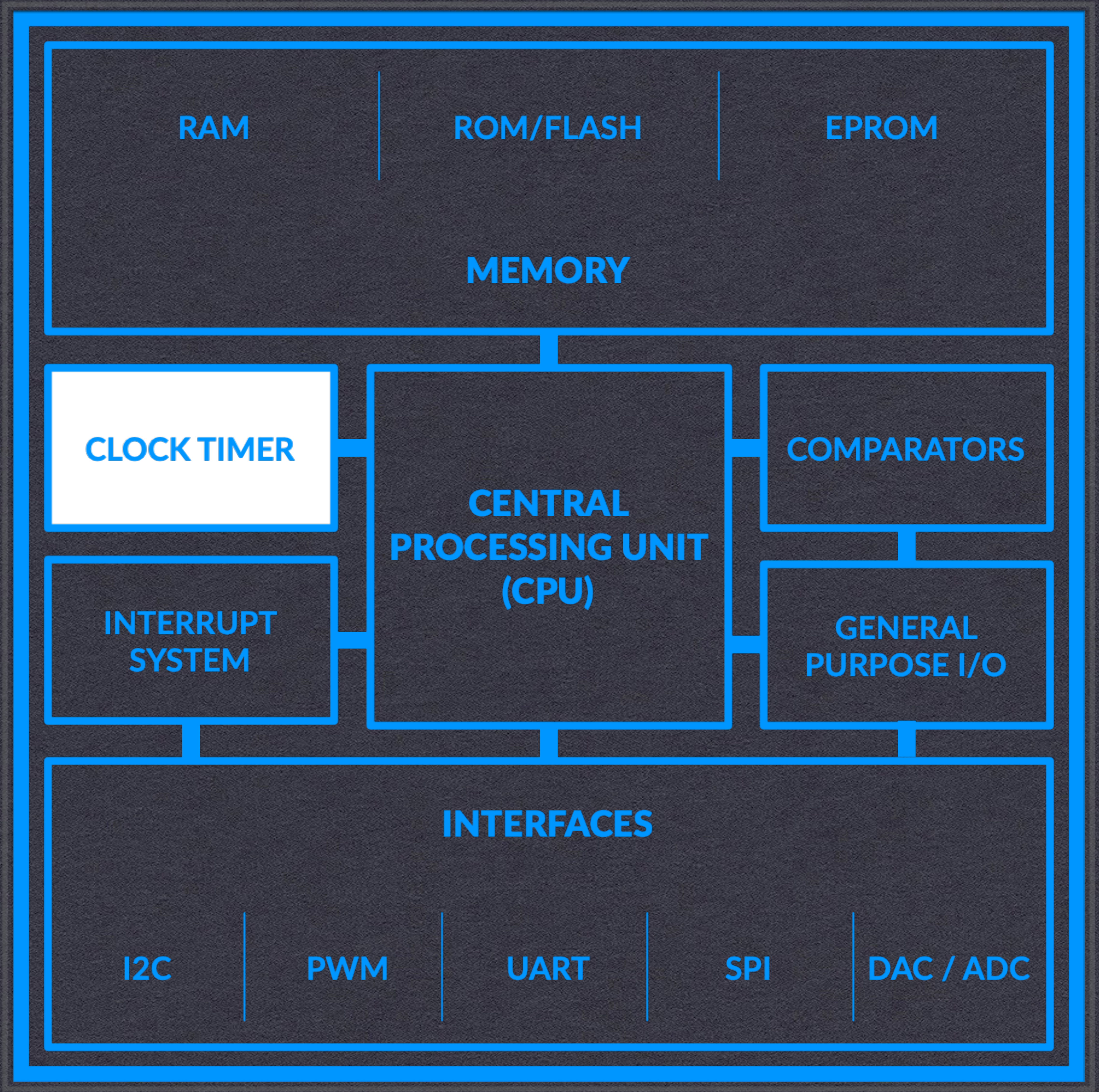


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

CLOCK TIMER

PROVIDES TIMING TO THE MICROCONTROLLER AND ALLOWS FOR MULTIPLE JOBS TO BE DONE AT ONCE

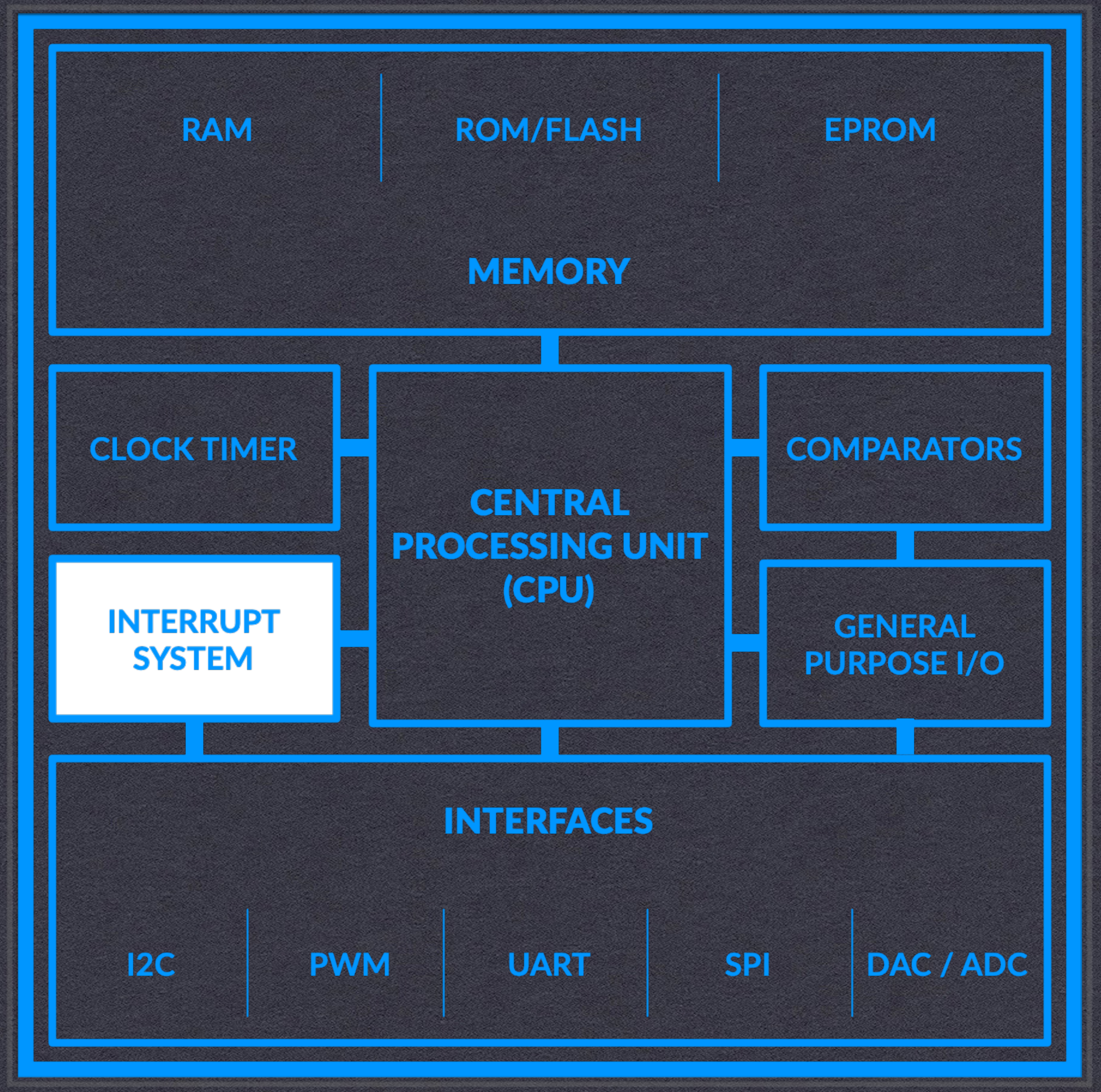


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

INTERRUPT SYSTEM

ALLOWS MICROCONTROLLER TO STOP A CURRENT TASK TO DO SOMETHING ELSE

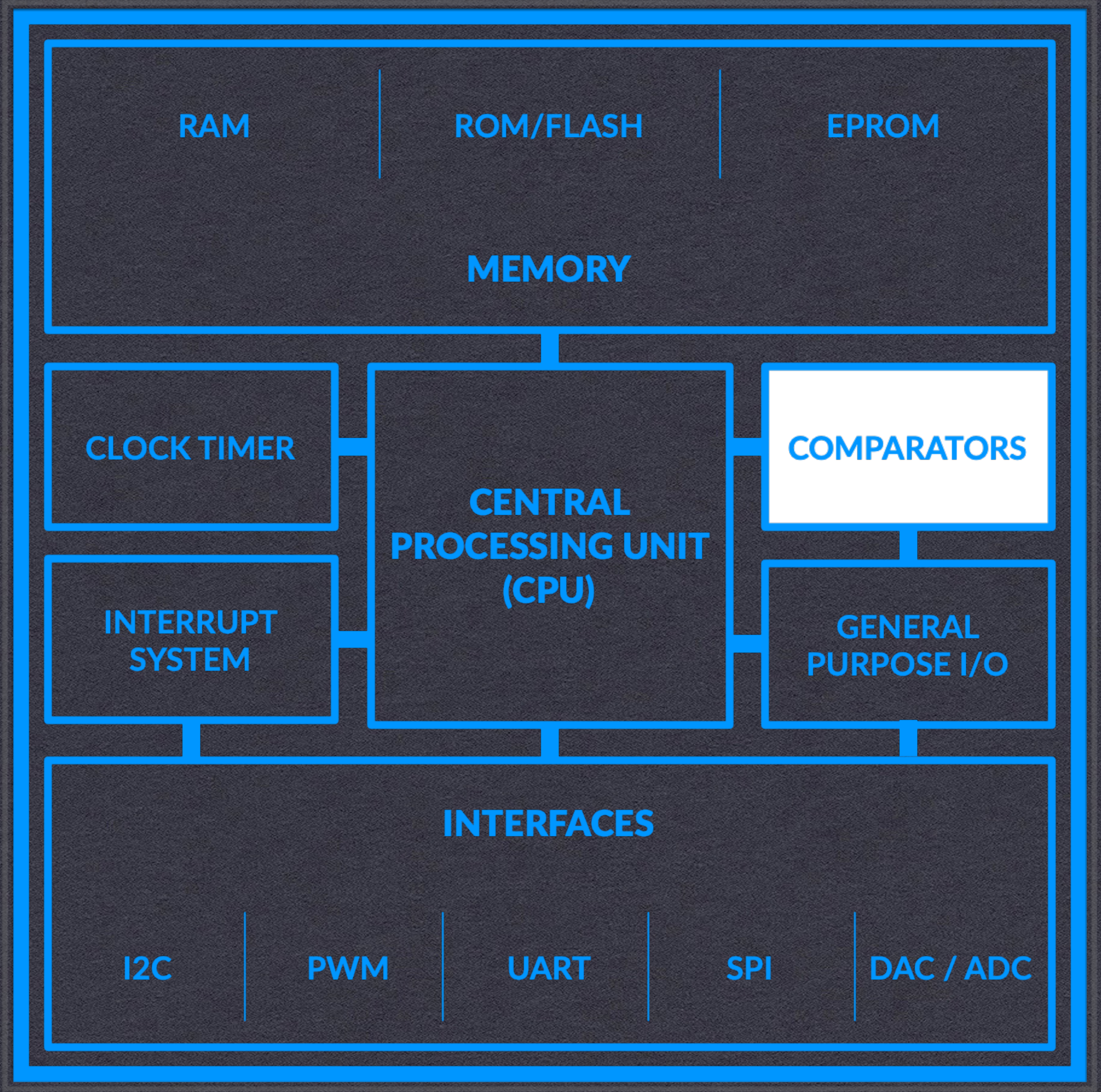


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

COMPARATORS

CHECKS DIFFERENT VOLTAGES

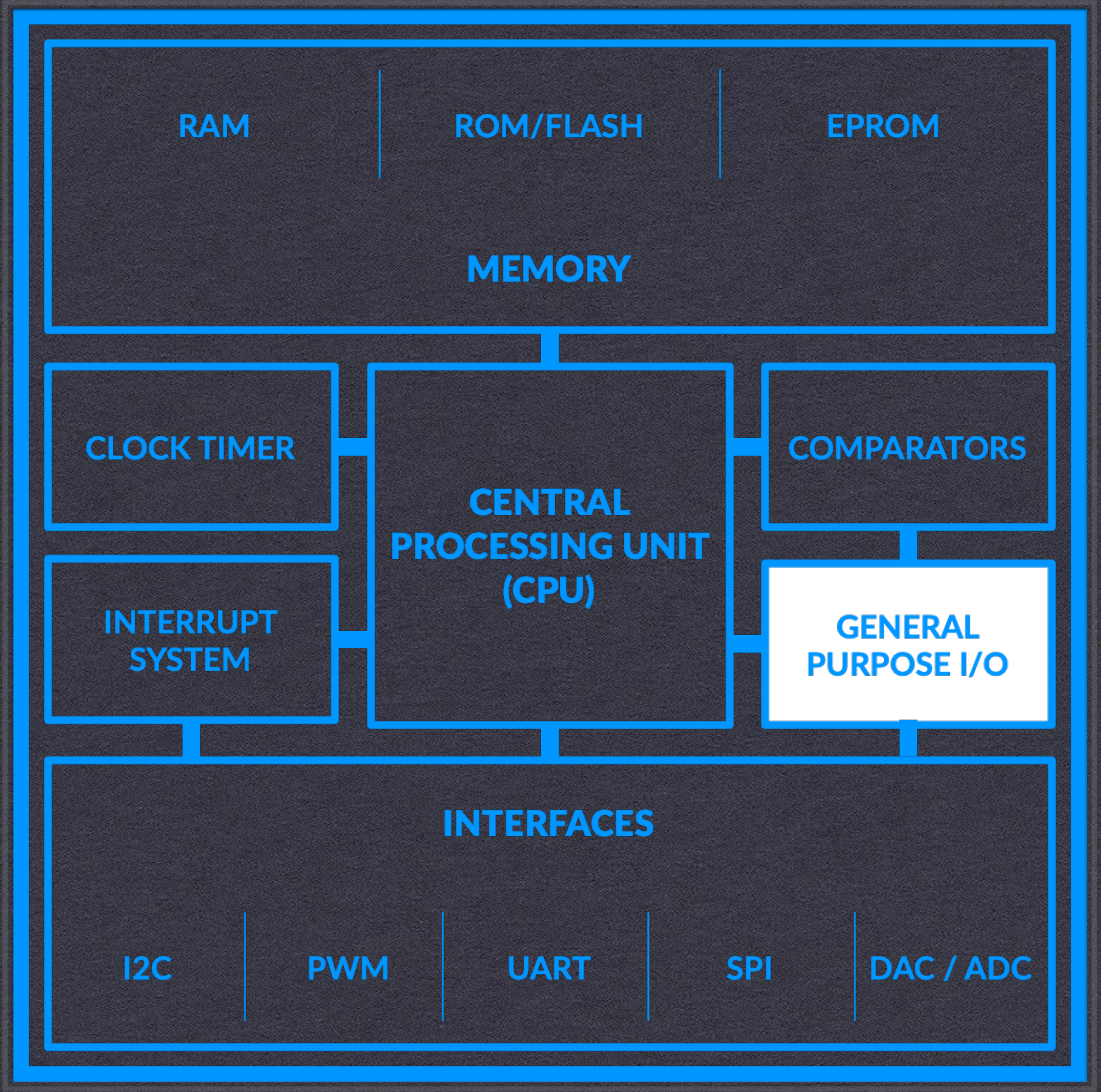


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

GENERAL PURPOSE I/O

ALLOWS MICROCONTROLLER TO INTERACT WITH THE OUTSIDE WORLD GETTING INPUT AND SENDING OUTPUT USING THE MICROCONTROLLER'S DIFFERENT PINS

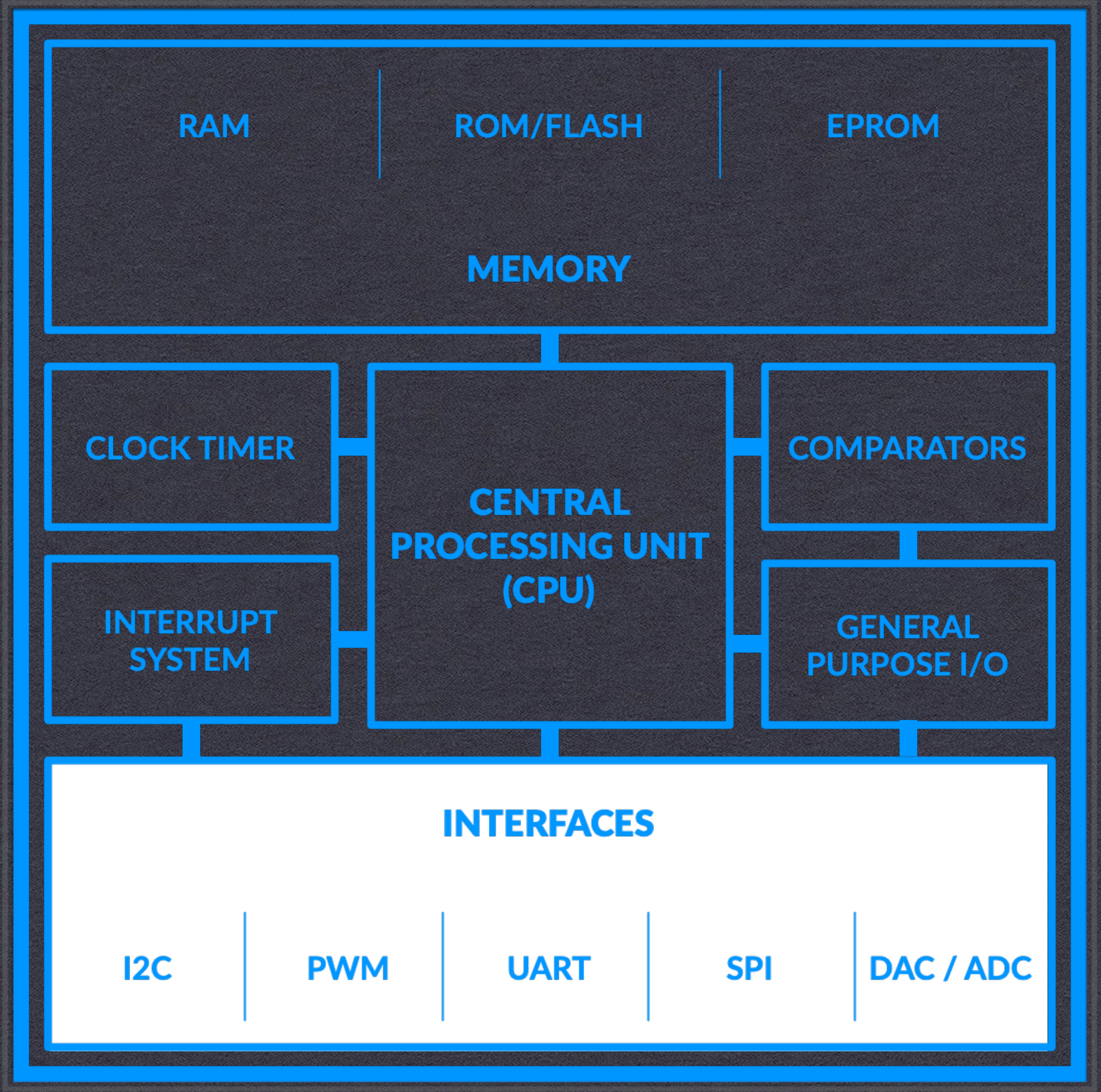


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

INTERFACES

DIFFERENT WAYS TO "TALK" TO DEVICES (PERIPHERALS) USING AGREED UPON METHODS. DEPENDING ON THE INTERFACE, THE WAY TO COMMUNICATE MIGHT TAKE MORE OR LESS WIRES.

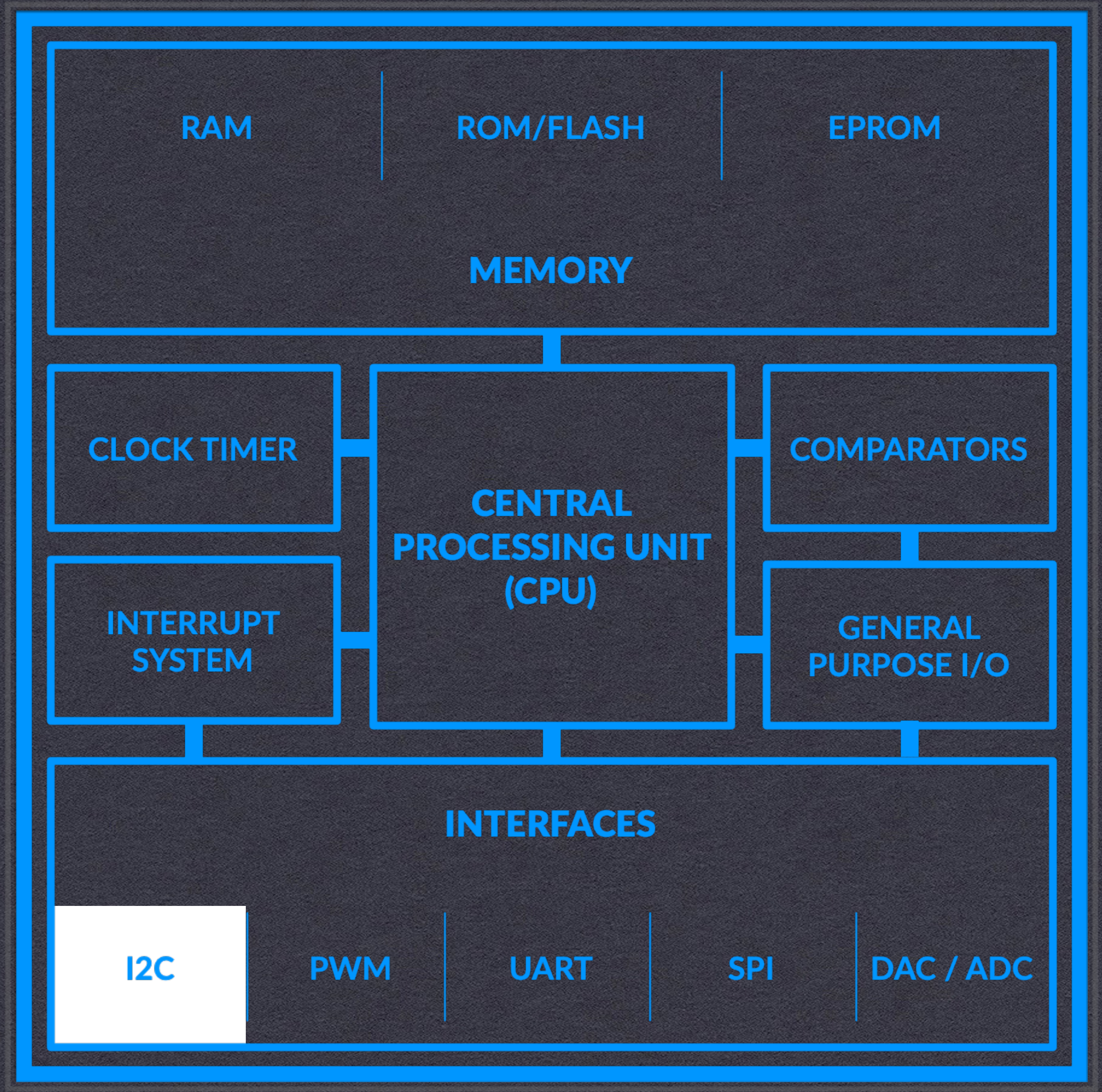


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

INTERFACES - I2C

ALSO KNOWN AS I^2C OR INTER-INTEGRATED CIRCUIT. THIS INTERFACE ALLOWS CONNECTING MULTIPLE DEVICES.

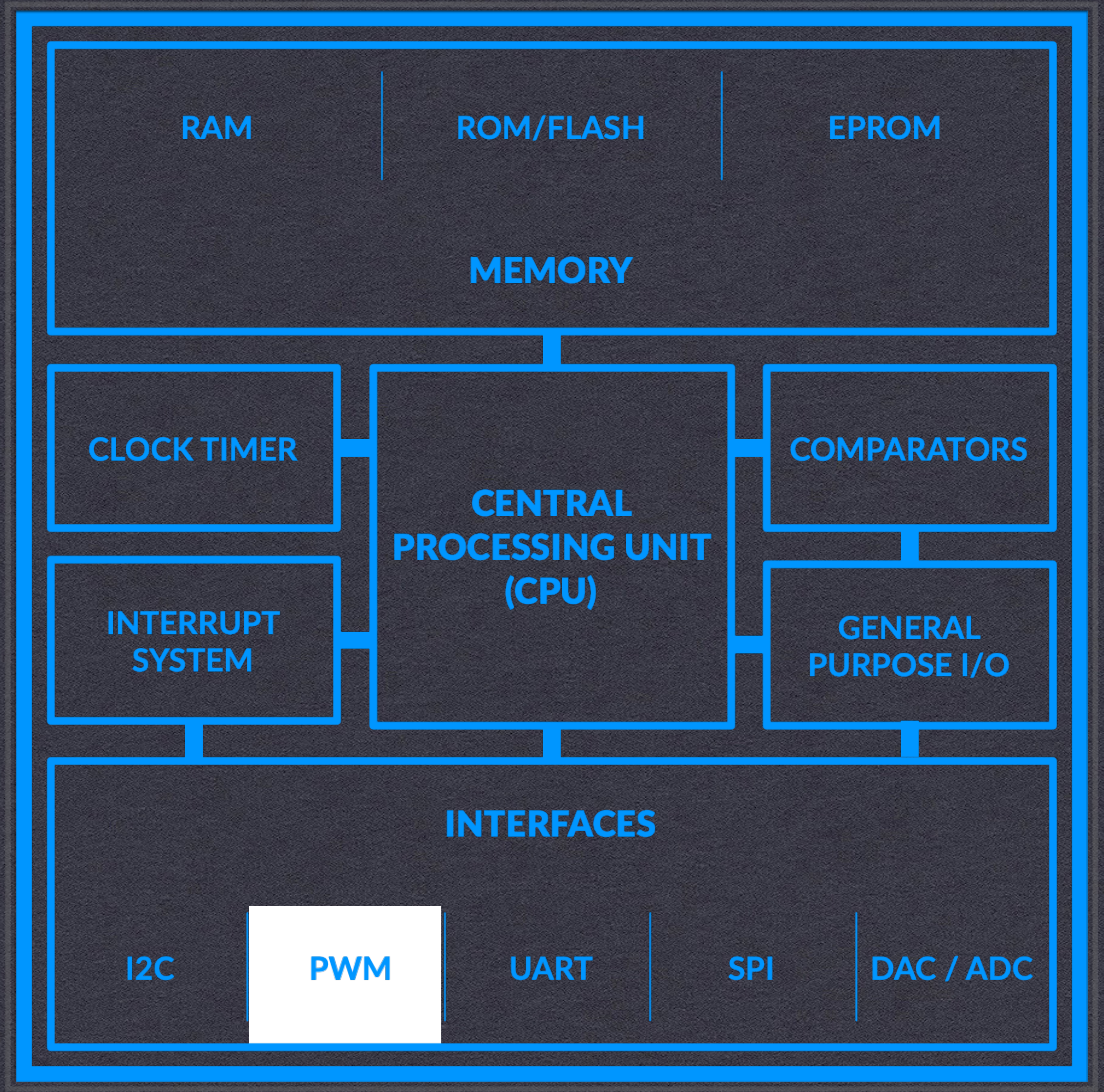


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

INTERFACES - PWM

PULSE-WIDTH MODULATION IS AN INTERFACE VERY COMMONLY USED WITH MOTORS.

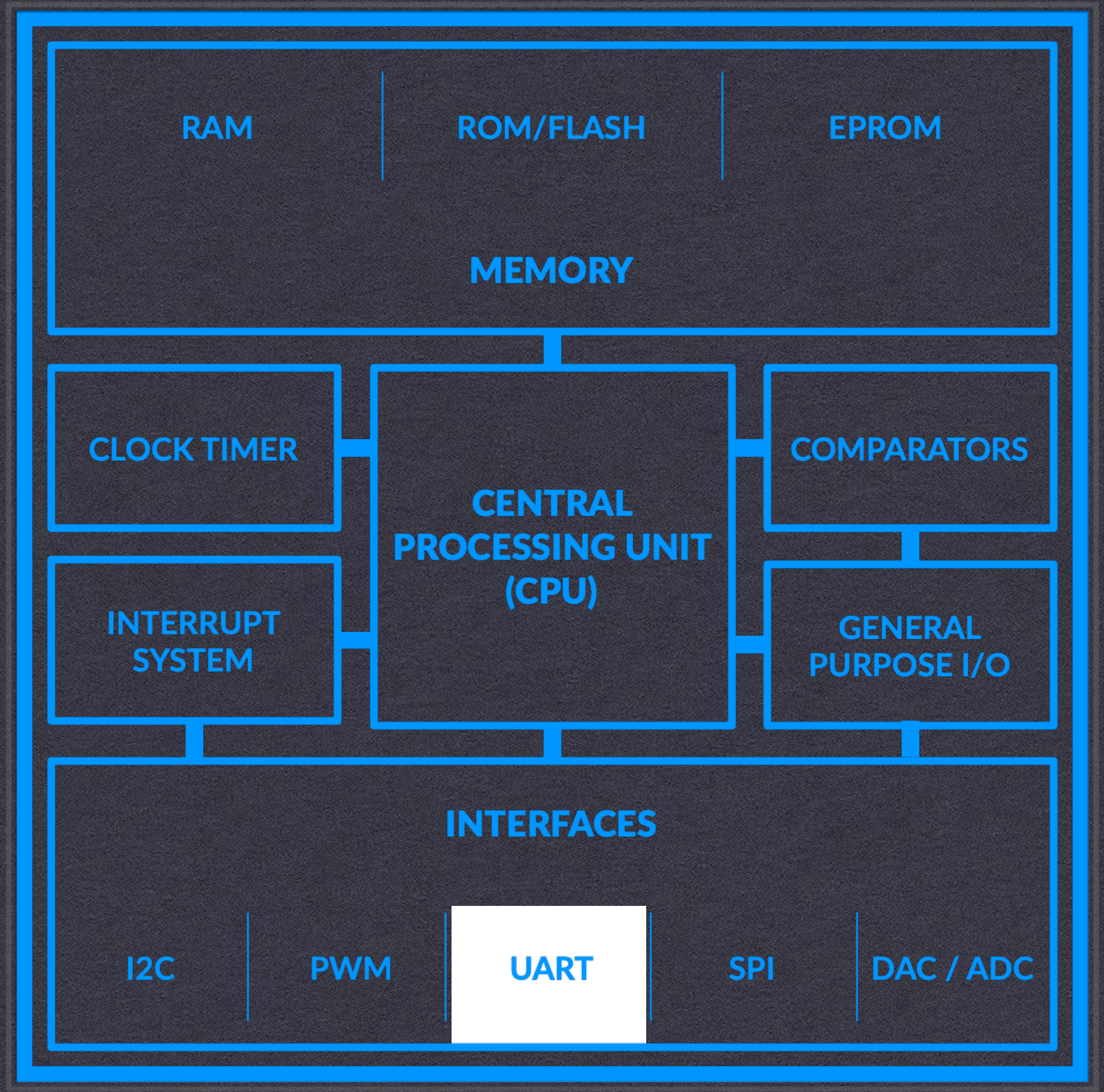


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

INTERFACES - UART

UNIVERSAL ASYNCHRONOUS RECEIVER-TRANSMITTER IS USED FOR SENDING DATA ONE PIECE AT A TIME (SERIALLY).

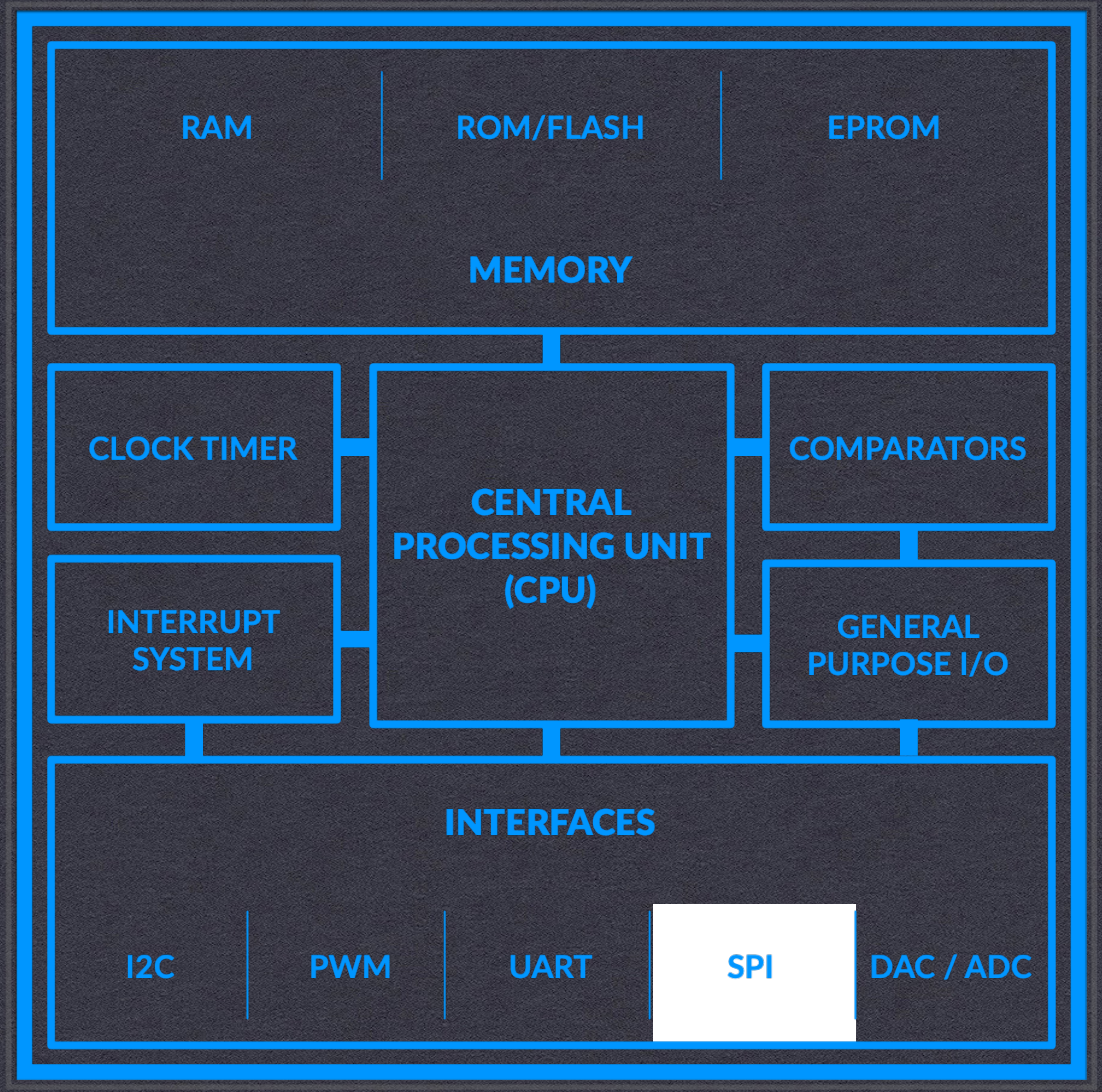


https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

INTERFACES - SPI

SERIAL PERIPHERAL INTERFACE IS USED FOR SENDING DATA ONE PIECE AT A TIME (SERIALLY) USING A CLOCK SIGNAL.



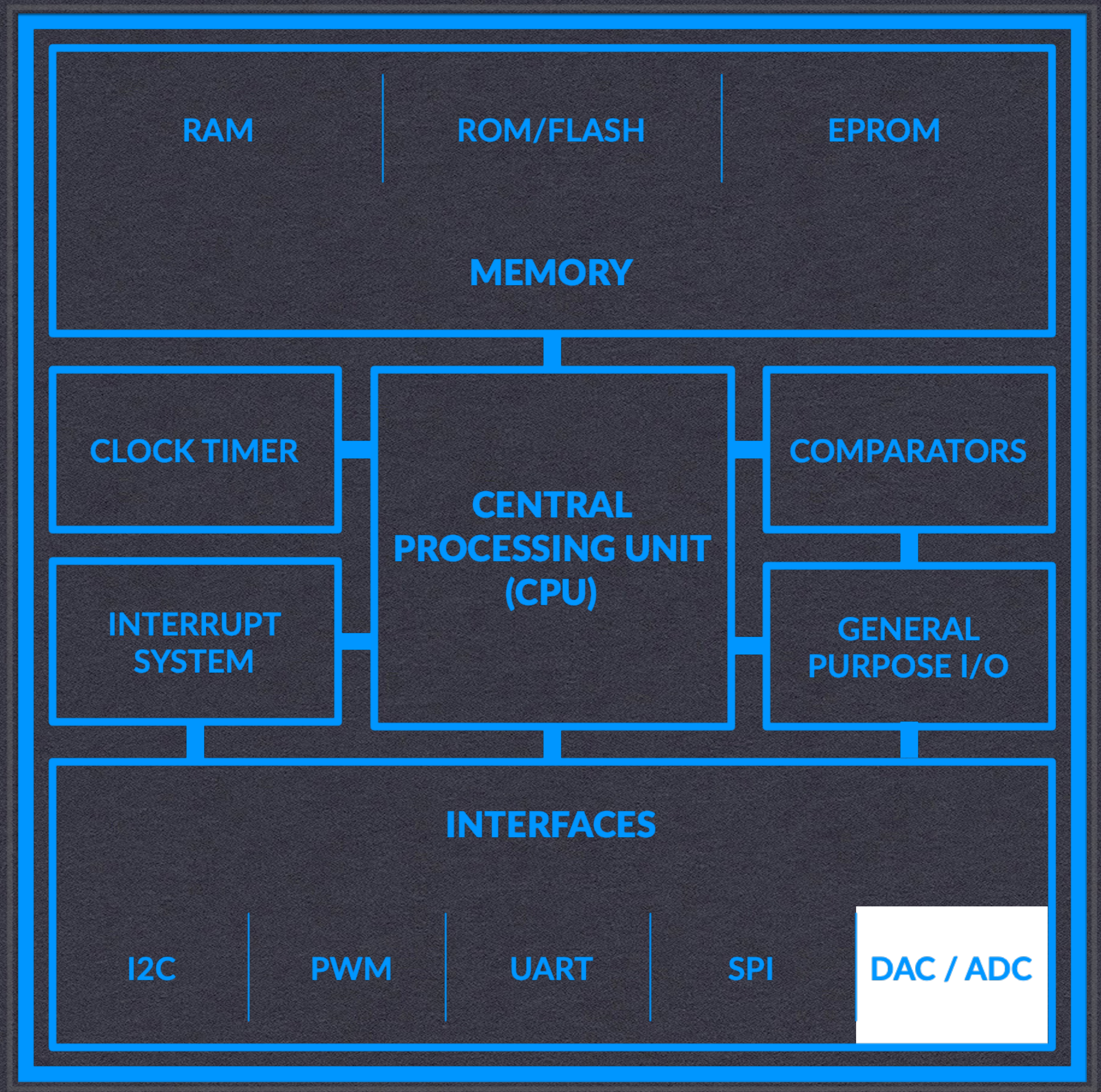
https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html

WHAT IS A MICROCONTROLLER?

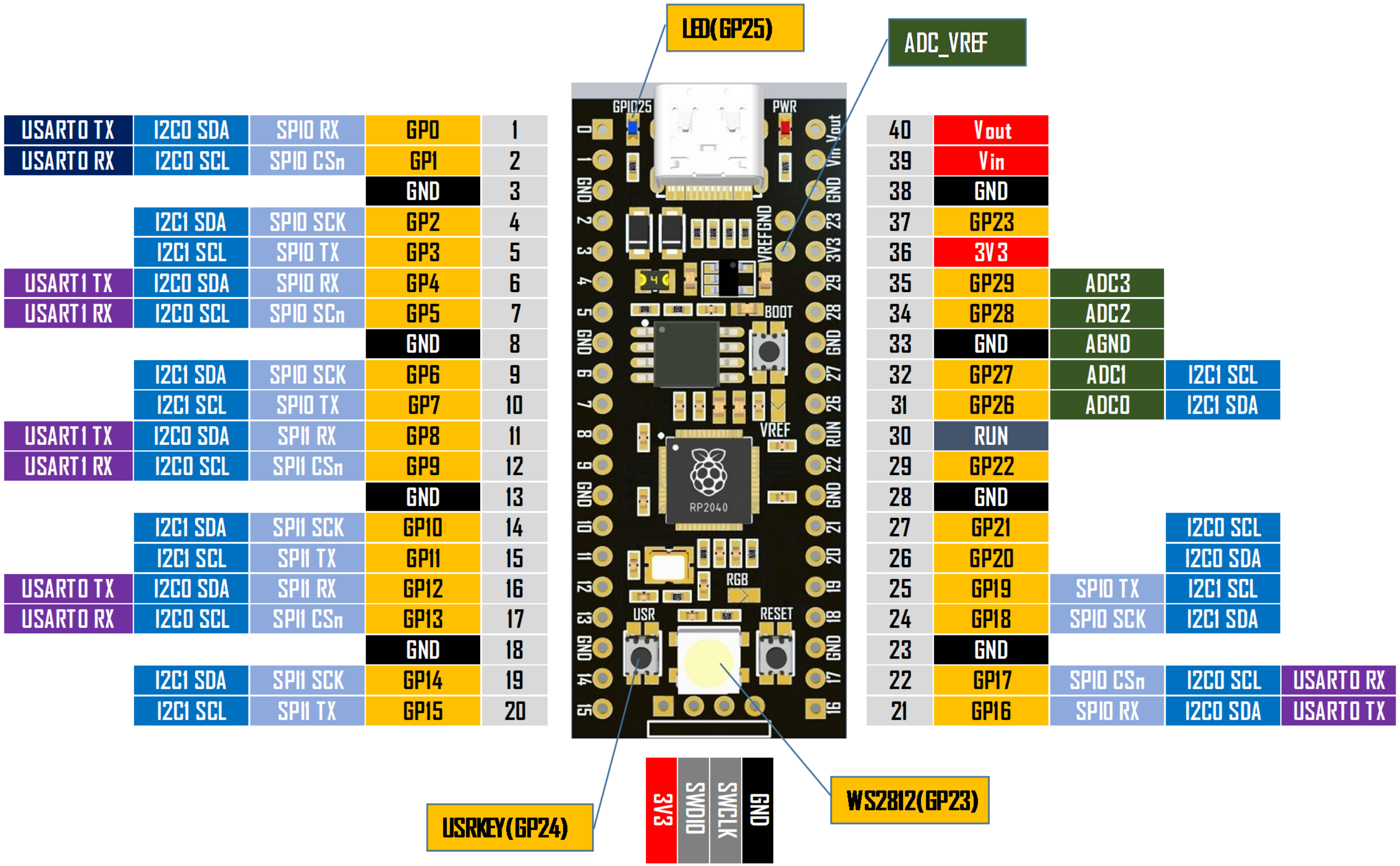
INTERFACES - DAC/ADC

A DIGITAL-TO-ANALOG CONVERTER (DAC) TAKES DIGITAL DATA AND CONVERTS IT TO ANALOG SIGNALS (LIKE A SPEAKER).

AN ANALOG-TO-DIGITAL CONVERTOR (ADC) TAKES ANALOG DATA AND CONVERTS IT TO DIGITAL SIGNALS (LIKE A MICROPHONE).



https://www.kevsrobots.com/resources/how_it_works/microcontrollers.html



VCC-GND® Studio
源地®工作室

	Power
	Ground
	USART
	USART (default)
	GPIO and PIO
	ADC
	SPI
	I2C
	SYS Control
	Debugging

PROJECT

POWERING THE MICROCONTROLLER

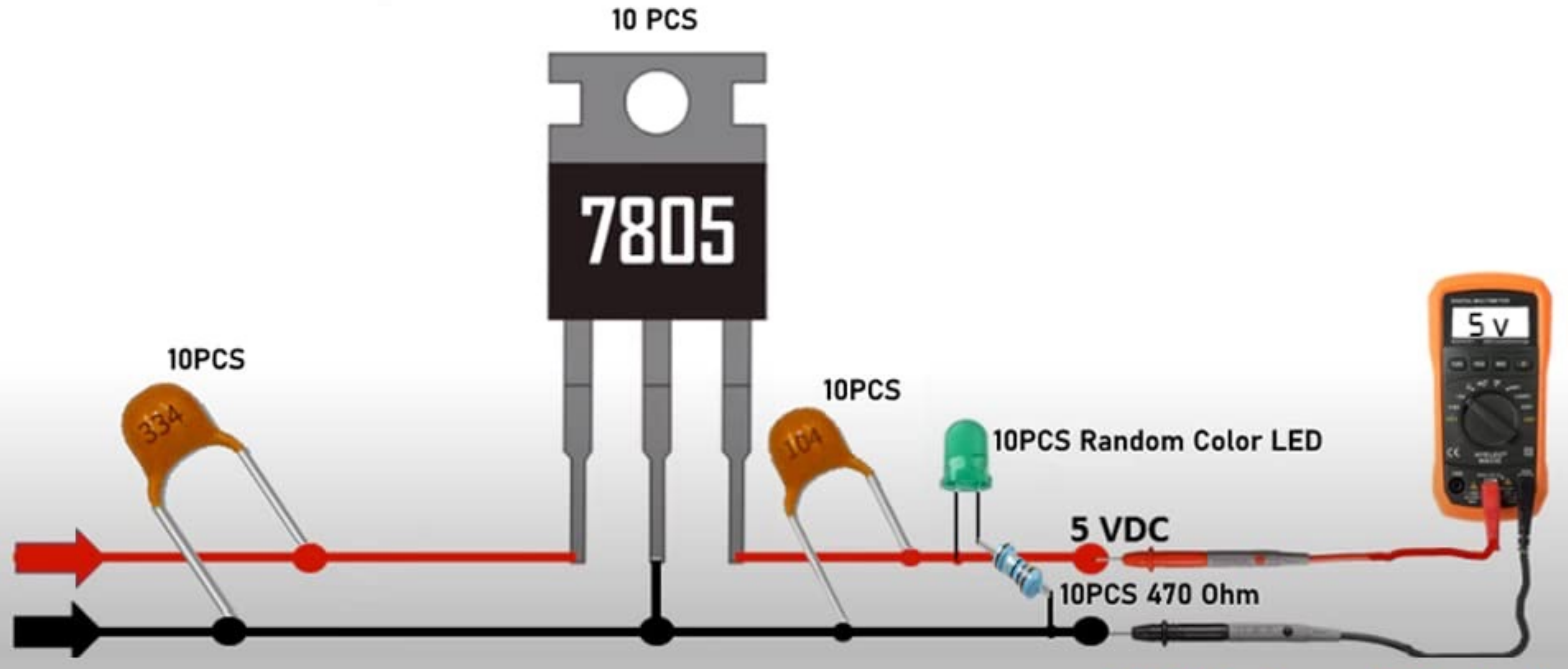
LAB	1	MATERIALS	VOLTAGE REGULATOR, 3x WIRE

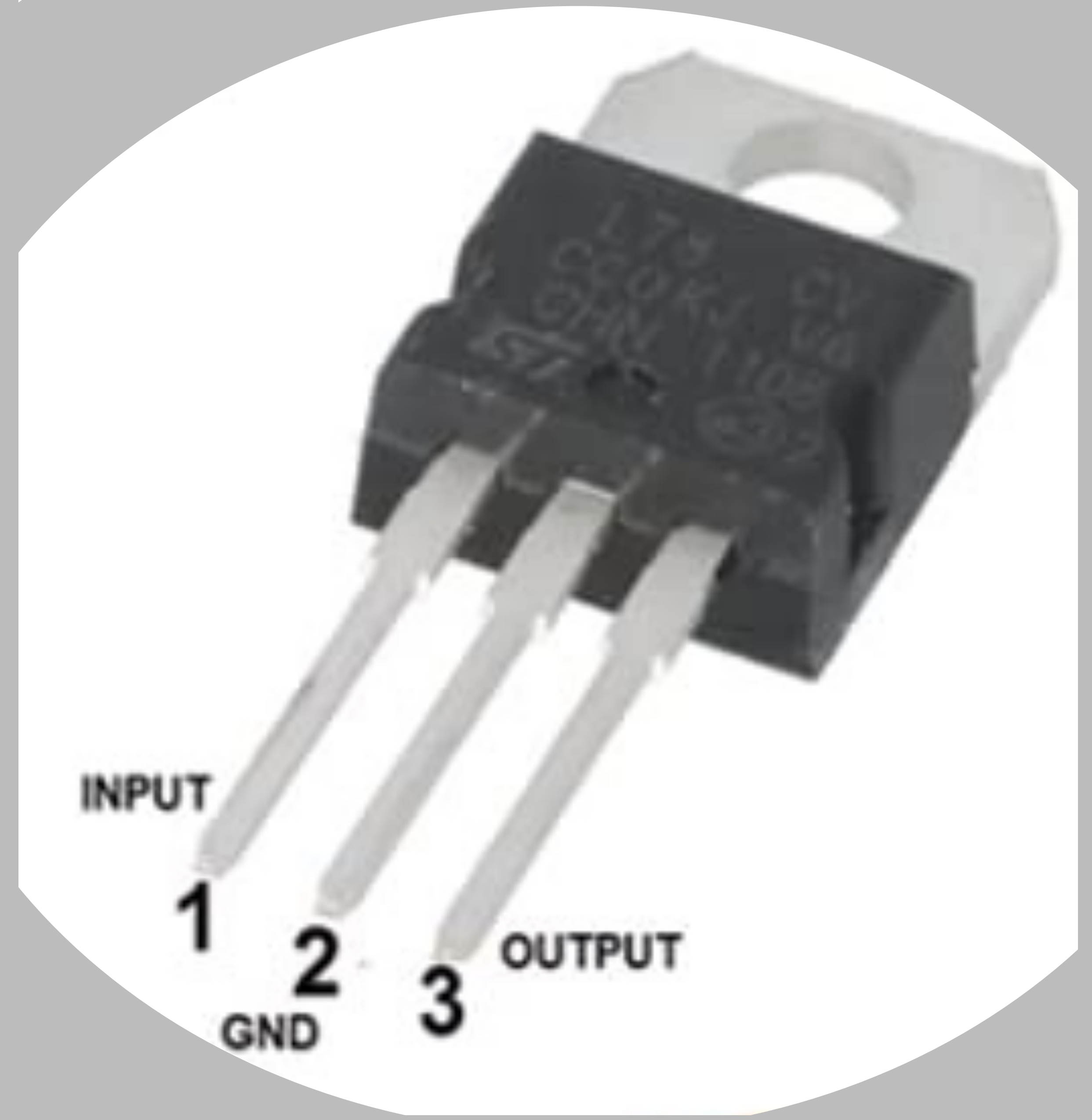
V_I = 11 V, I_O = 1 A, T_J = 0 to 125 °C (L7806AC), T_J = -40 to 125 °C (L7806AB), unless otherwise specified[(b)].

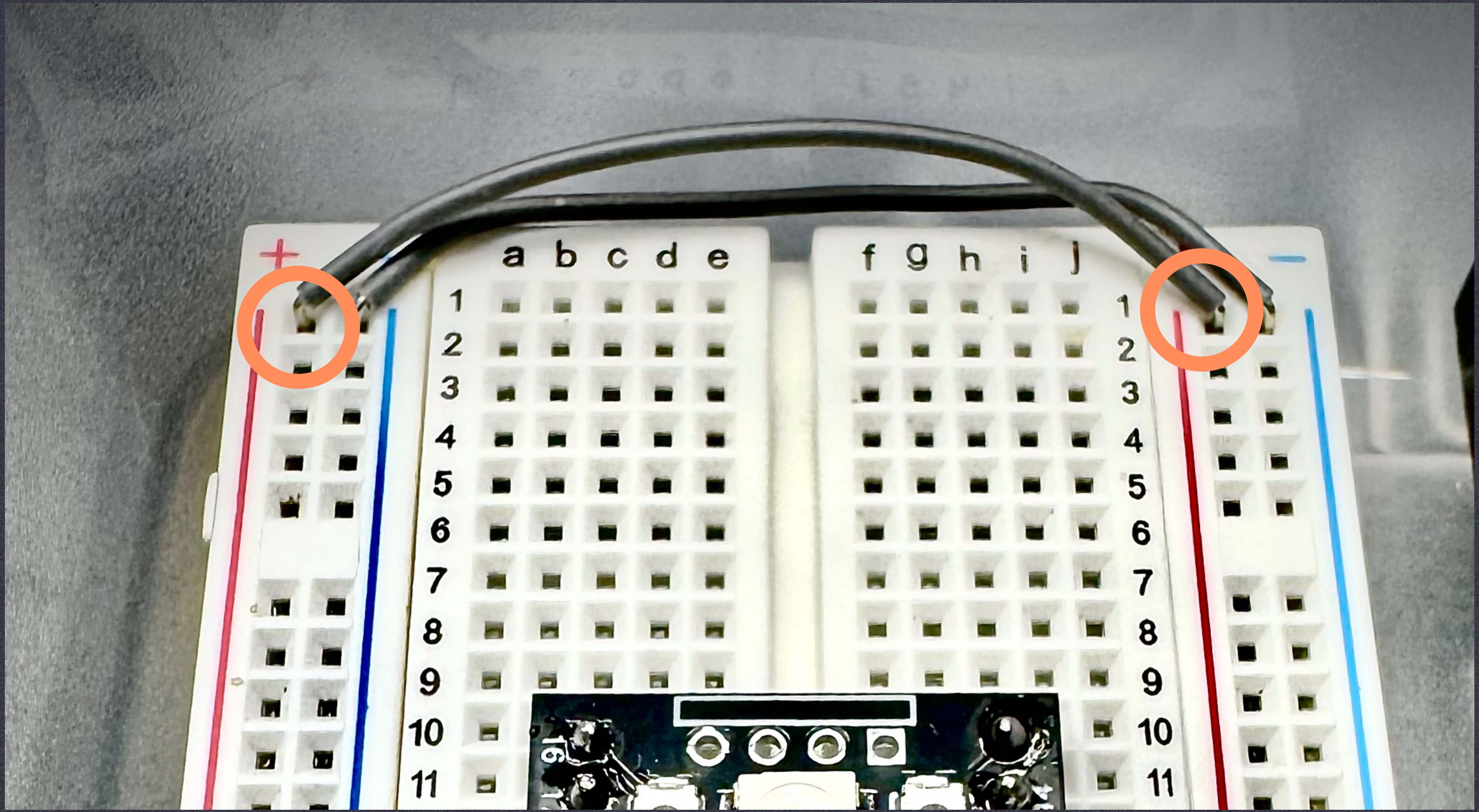
Table 4. Electrical characteristics of L7806A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	5.88	6	6.12	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 8.6 to 19 V	5.76	6	6.24	V
V_O	Output voltage	I_O = 1 A, V_I = 19 to 21 V, T_J = 25°C	5.76	6	6.24	V
ΔV_O (1)	Line regulation	V_I = 8.6 to 25 V, I_O = 500 mA, T_J = 25°C		9	60	mV
		V_I = 9 to 13 V		11	60	mV
		V_I = 9 to 13 V, T_J = 25°C		3	30	mV
		V_I = 8.3 to 21 V, T_J = 25°C		9	60	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25°C		30	100	
		I_O = 250 to 750 mA		10	50	
I_q	Quiescent current	T_J = 25°C		4.3	6	mA
					6	mA
ΔI_q	Quiescent current change	V_I = 9 to 24 V, I_O = 500 mA			0.8	mA
		V_I = 8.6 to 21 V, T_J = 25°C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 9 to 19 V, f = 120 Hz, I_O = 500 mA		65		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C		2		V
eN	Output noise voltage	T_A = 25°C, B =10 Hz to 100 kHz		10		$\mu V/V_O$
R_O	Output resistance	f = 1 kHz		17		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25°C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25°C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-0.8		mV/°C

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.





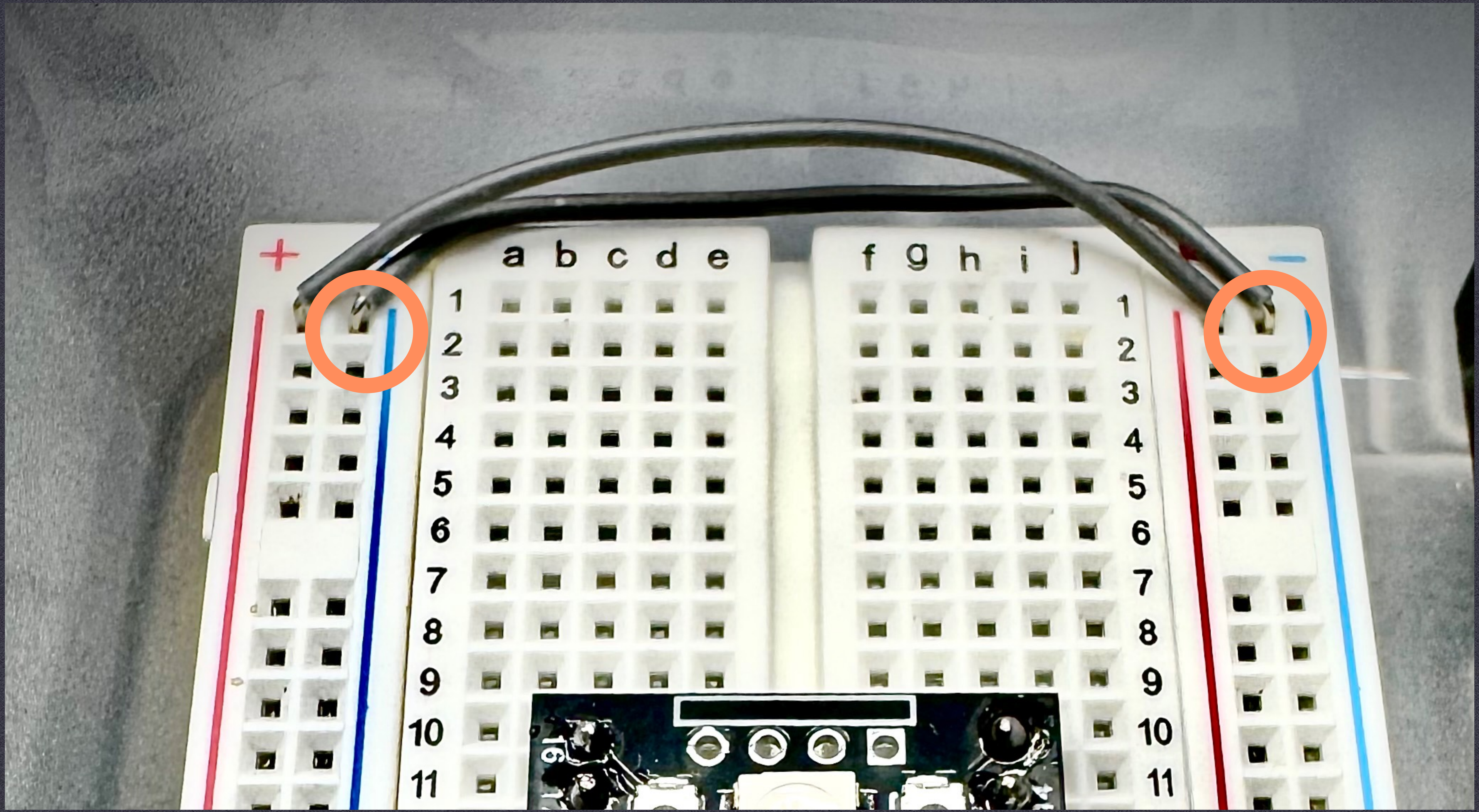


TASK

CONNECT POSITIVE RAILS TOGETHER

(+ TO +)

STEP	1	MATERIALS	2x WIRE (MEDIUM)

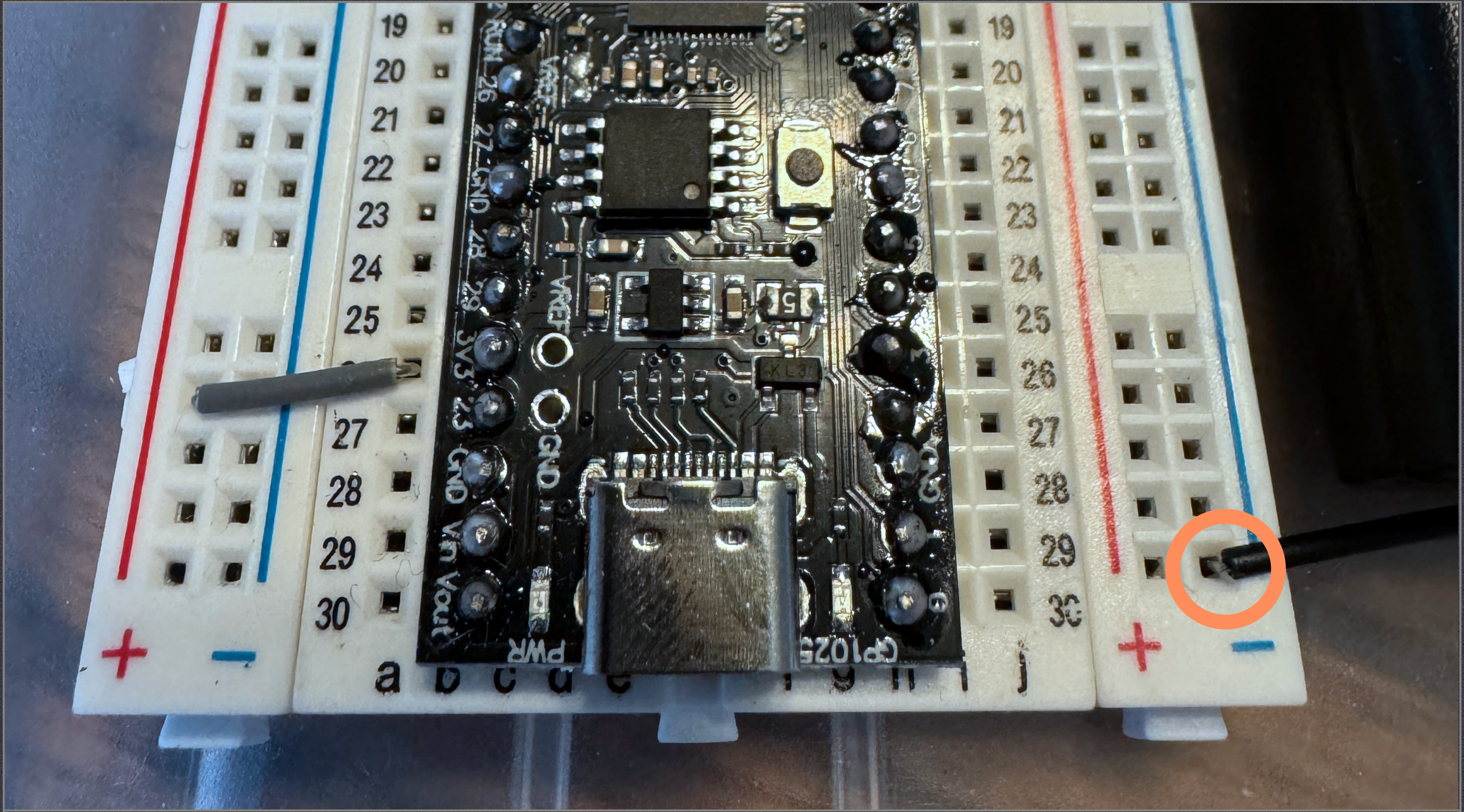


TASK

CONNECT NEGATIVE RAILS TOGETHER
(- TO -)

STEP 2

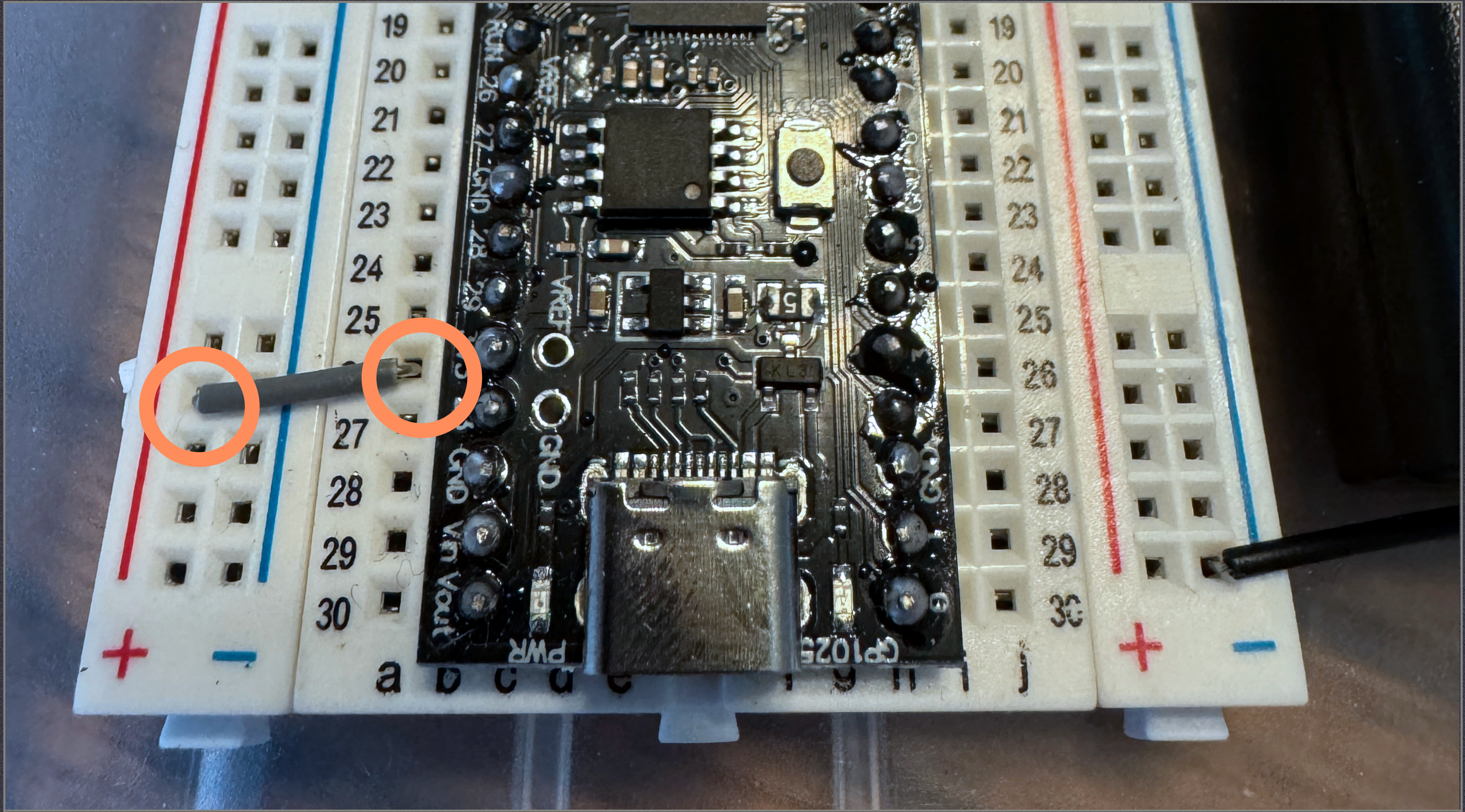
MATERIALS 2x WIRE (MEDIUM)



TASK

ATTACH NEGATIVE WIRE (- TO - BATTERY WIRE)

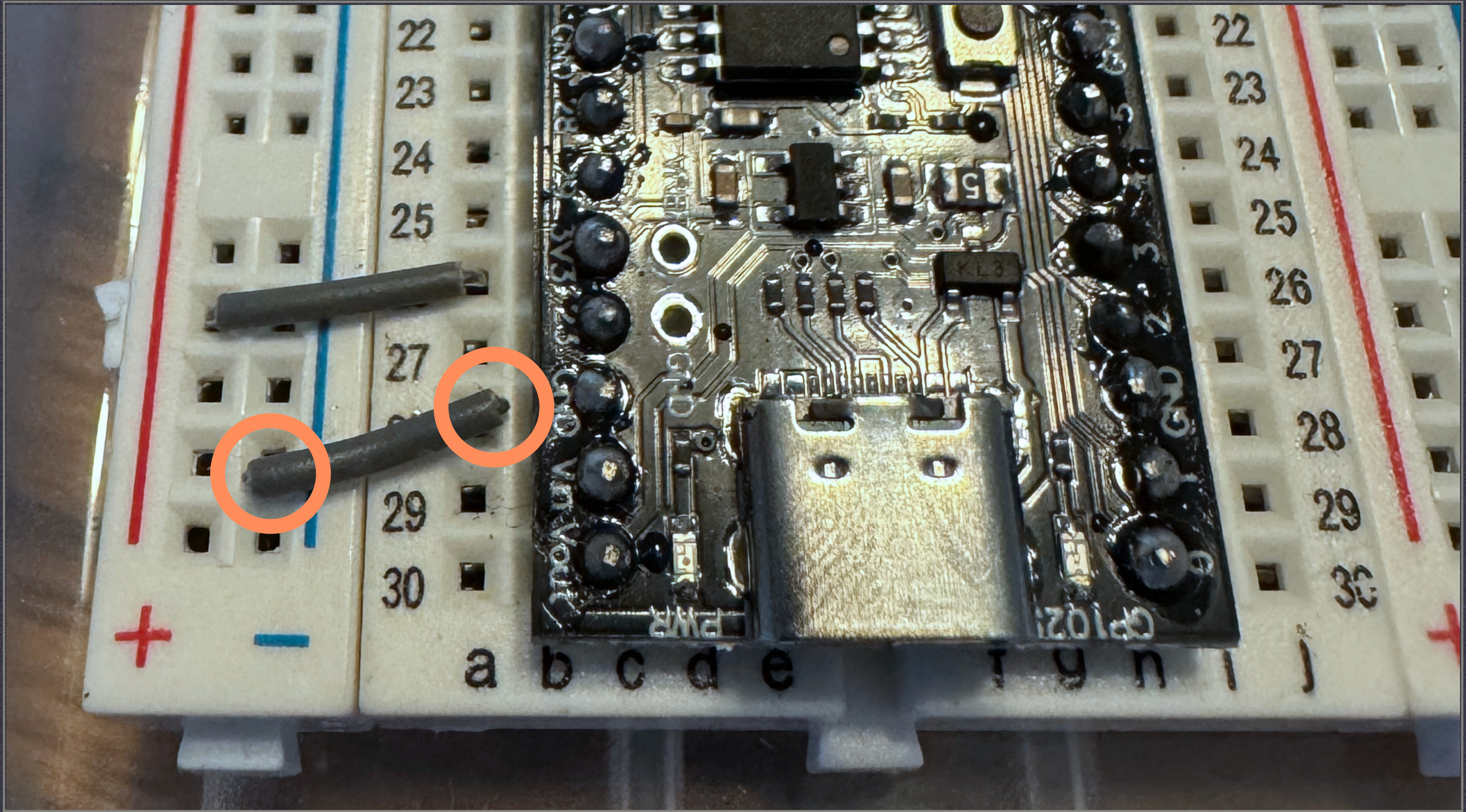
STEP	3	MATERIALS	1x WIRE (TINY)



TASK

ATTACH POSITIVE WIRE (+ TO 26a)

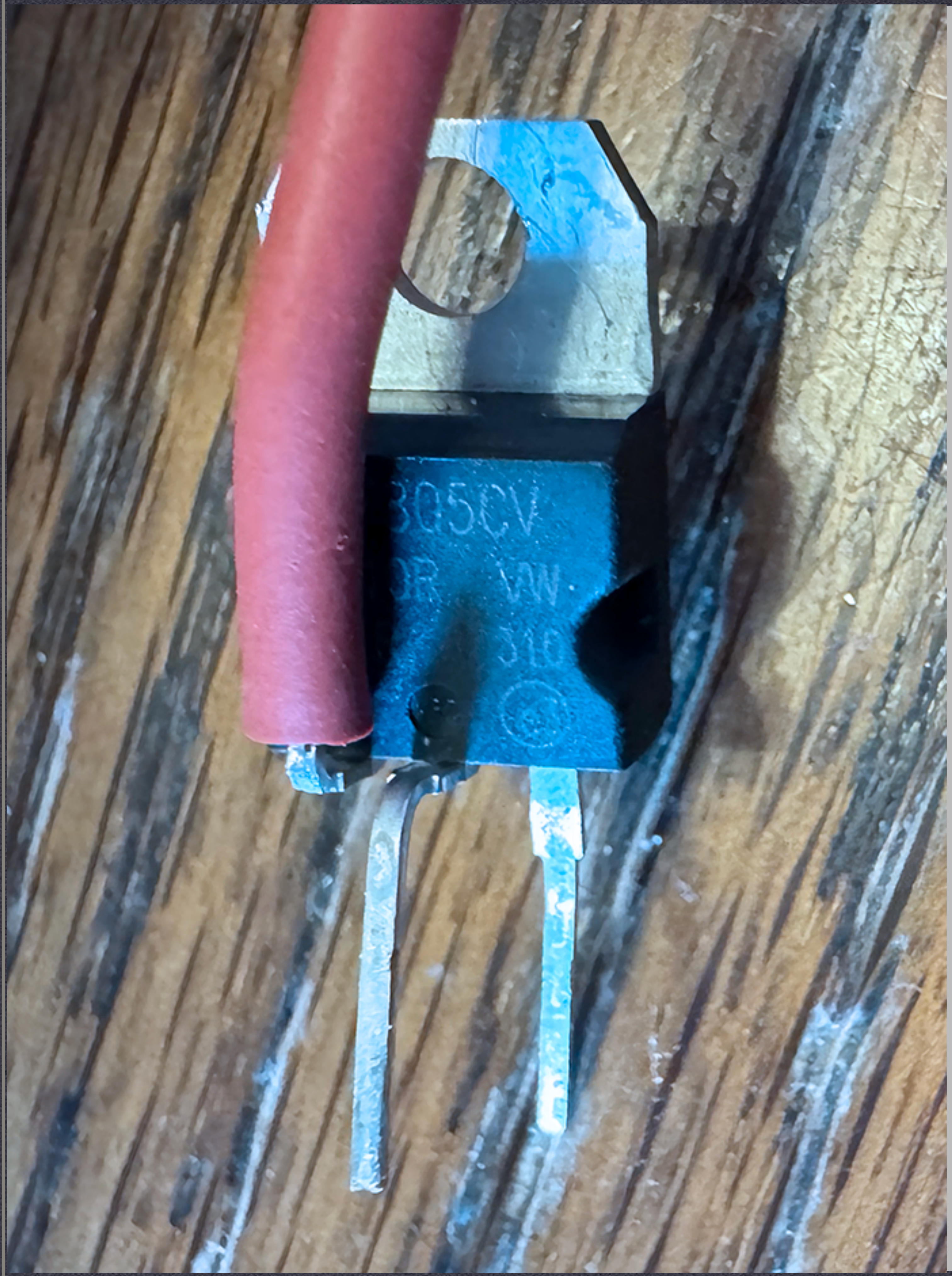
STEP	4	MATERIALS	1x WIRE (TINY)

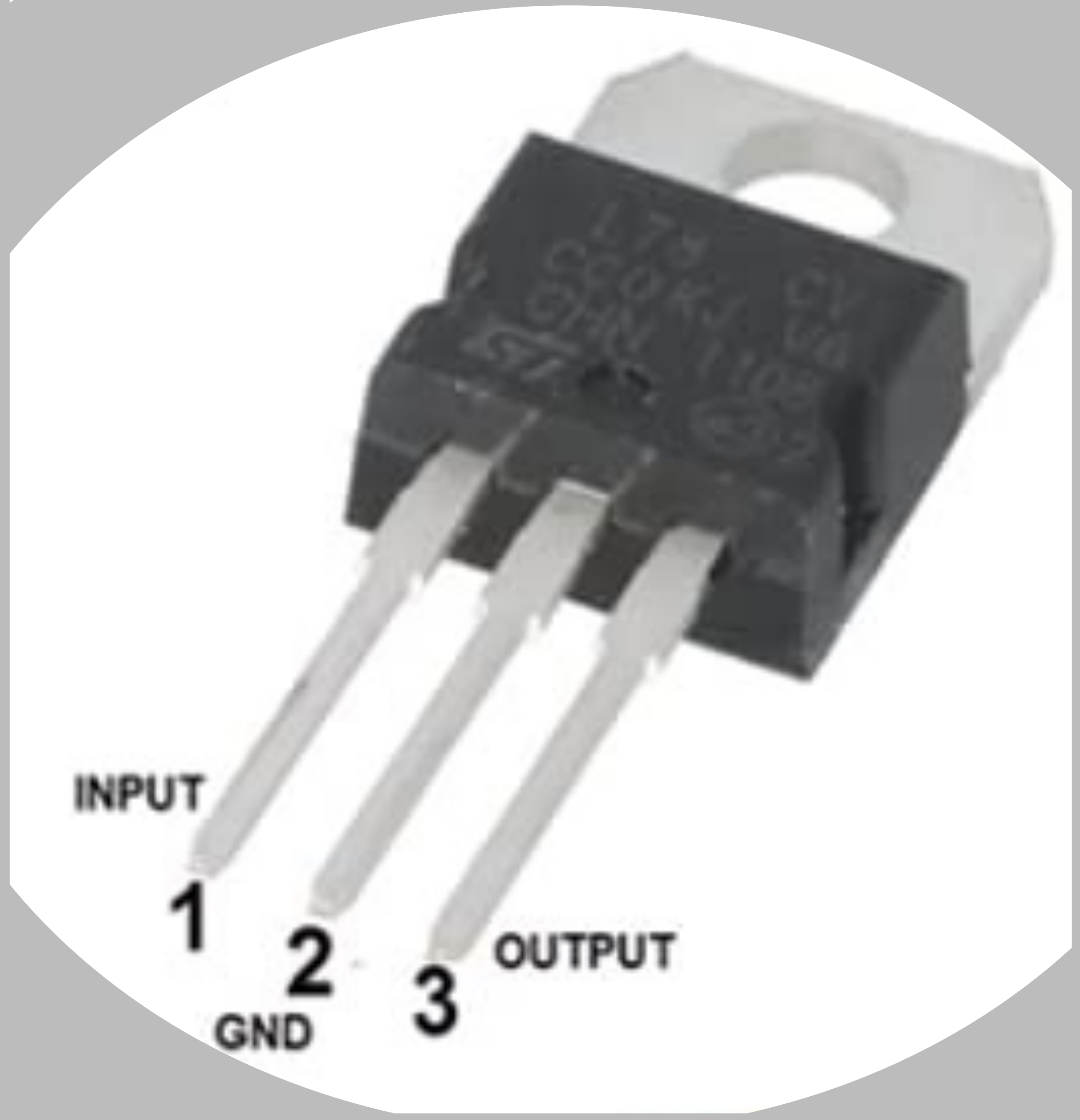


TASK

ATTACH NEGATIVE WIRE (- TO 28a)

STEP	5	MATERIALS	1x WIRE (TINY)





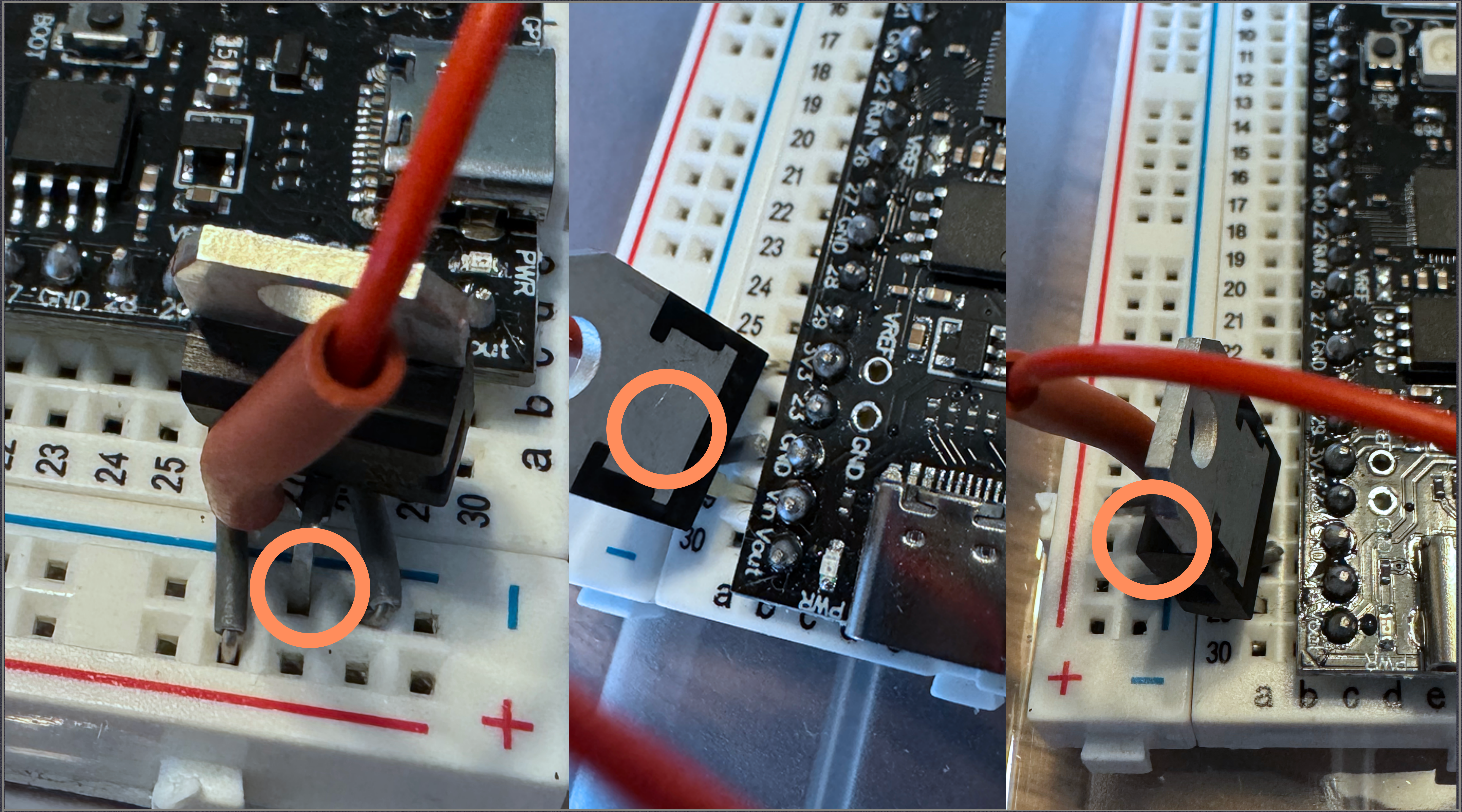
TASK

CONNECT REGULATOR TO BATTERY

“INPUT” PIN HOOKS TO + BATTERY WIRE

STEP 6

MATERIALS VOLTAGE REGULATOR (LM7805)



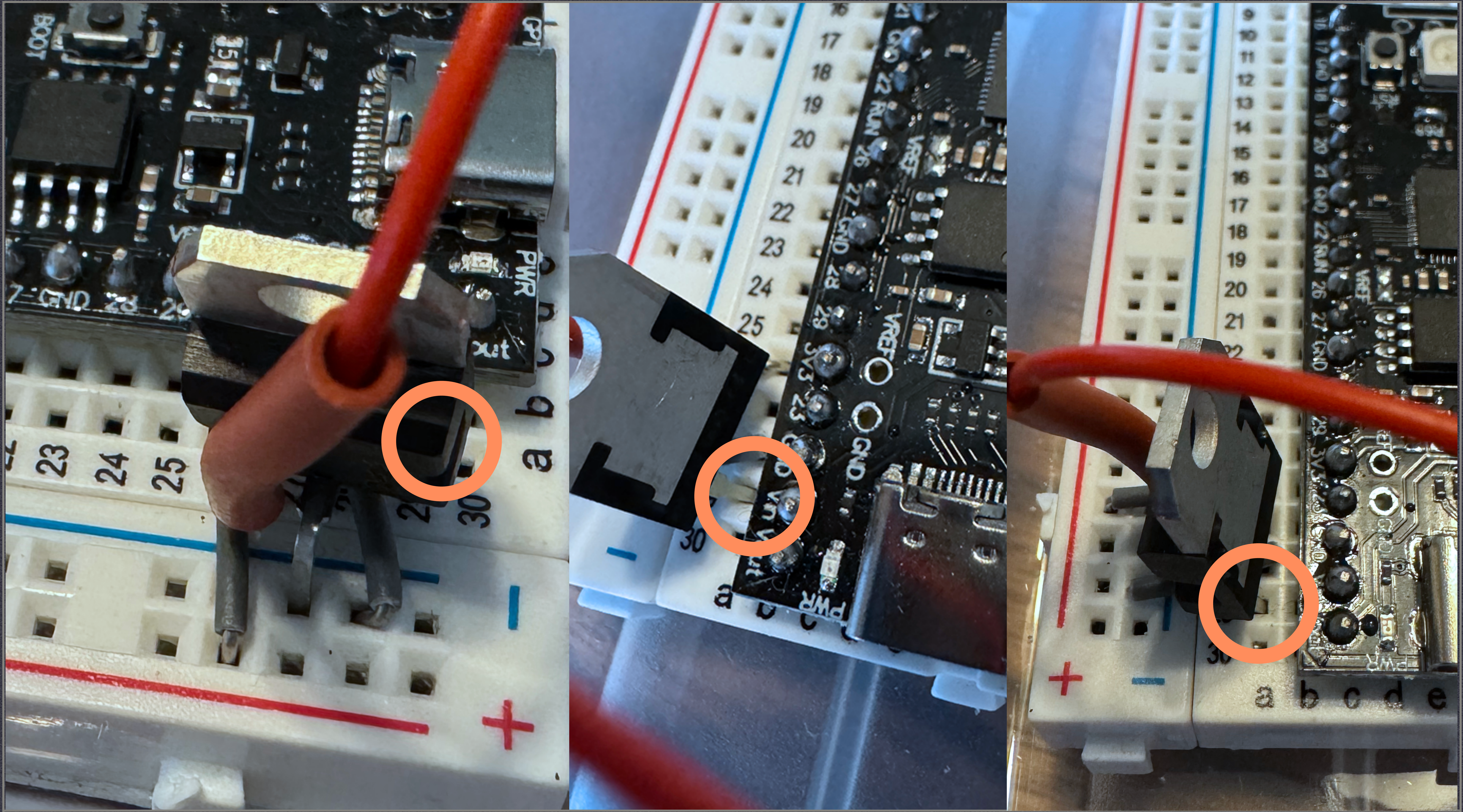
TASK

ATTACH REGULATOR TO BOARD

“GND” PIN HOOKS TO -

STEP 7

MATERIALS VOLTAGE REGULATOR (LM7805)



TASK

ATTACH REGULATOR TO BOARD

“OUTPUT” PIN HOOKS TO 29a

STEP	7	MATERIALS	VOLTAGE REGULATOR (LM7805)

TASK

TURN ON BATTERY PACK

(IF THERE IS NOT AN IMMEDIATE RESPONSE, TURN OFF)

STEP **9**

MATERIALS **BATTERY PACK**