What is a Microcontroller?

Your printable reference for Episode 1 — keep it beside you while you watch.

EP 01

What is a Microcontroller?

A microcontroller is a tiny computer on a single chip. Unlike the CPU in your laptop, it is designed to run one program — embedded inside a device — and interact directly with the physical world through its pins. Everything your code needs is on-chip:

CPU	Runs your code — the brain.
Flash Memory	Stores your program permanently (survives power-off).
RAM	Working memory while your code runs.
GPIO Pins	Connect to LEDs, sensors, conductive fabric — the physical world.
Peripherals	Built-in helpers: I2C, SPI, UART, ADC, timers, touch.

Microcontroller vs Microprocessor
A microprocessor (like in your laptop) needs external RAM, storage, and chips. A microcontroller has everything on one chip.

Why the ESP32?

The ESP32 is made by Espressif. It is the go-to chip for wearable and maker projects.

Processor	Dual-core Xtensa LX6, up to 240 MHz
RAM	520 KB SRAM on-chip
Flash	Typically 4 MB (external, on the module)
WiFi	802.11 b/g/n — built in, no extra module needed
Bluetooth	BT Classic + BLE 4.2 — built in
GPIO	Up to 34 pins — digital in/out, ADC, DAC, touch, PWM
Touch pins	10 capacitive touch channels — works with conductive fabric
Logic level	3.3 V — do not connect directly to 5 V signals
Typical cost	CAD $4 – $12 depending on module variant

Wearable Pin Cheat Sheet — ESP32 DevKit

These are the pins to reach for first on every wearable build. Screenshot or print this page.

NeoPixels / Addressable LEDs (WS2812B)

GPIO 16, 17, 25, 26, 27

Solid and predictable — no boot-time conflicts.

Use any one of these as your DATA pin.

Tip: add a 330 Ohm resistor on the data line.

I2C — Sensors, OLEDs, Accelerometers

GPIO 21 (SDA) + GPIO 22 (SCL)

These are the dedicated I2C pins. Always use them.

Up to 127 devices can share one I2C bus.

Episode 12 covers I2C in depth.

Capacitive Touch — Conductive Fabric & Thread

GPIO 4, 13, 14, 27, 32, 33

No extra hardware needed — the ESP32 does it in software.

Works directly with conductive fabric and thread.

Episode 15 covers touch sensing and fabric connections.

Analog Input — Battery Voltage, Sensors

GPIO 32 or GPIO 33 (ADC1 channel)

Use ADC1 pins (32-39) — ADC2 conflicts with WiFi.

12-bit resolution: reads 0 – 4095 for 0 – 3.3 V.

Episode 10 covers analog GPIO.

Pins to Avoid at the Start

GPIO 0, 2, 15 — strapping pins that affect boot mode. Usable, but tricky for beginners.

GPIO 6 – 11 — connected to the internal flash chip. Do not use.

ADC2 pins (GPIO 0, 2, 4, 12, 13, 15, 25, 26, 27) — unreliable when WiFi is active.

Quick Vocabulary

GPIO	General Purpose Input/Output — any pin that can be input or output.
ADC	Analog to Digital Converter — reads a variable voltage as a number.
PWM	Pulse Width Modulation — simulates analog output by switching fast.
I2C	2-wire serial protocol for sensors and displays. SDA + SCL.
SPI	4-wire high-speed protocol for displays and SD cards.
UART	Serial TX/RX — used for debugging and some sensors.