ESPRESSIF

Build Smart! Create with Espressif.

www.espressif.com

A World-Leading AI & IoT Full-Stack Platform

Espressif Systems (SSE: 688018.SH) pioneers full-stack platforms powering the next generation of intelligent, energy-efficient IoT and edge AI devices. Our open-source technologies are transforming industries by enabling scalable, secure, and cost-effective innovation—from consumer products to industrial IoT. The breakthrough integration of compute and connectivity in our SoCs reshaped the IoT landscape, making mass-scale smart devices accessible to all.

Global Leader
In Wi-Fi MCU Market

10,000+
Trusted Customers Worldwide

1.5 Billion+
IoT SoC Shipments

210+
AI & IoT Technology Patents

3 Million+
Active Ecosystem Developers

180 K+
GitHub Projects

160 K+
Reddit Members

20 M+
YouTube Views

Engineering Intelligent & Connected Systems

As a global semiconductor innovator, we deliver high-performance RISC-V SoCs and comprehensive solutions with integrated AI, in-house operating system, robust security, and seamless cloud integration—shaping the future of smart, connected systems.

ESP RAINMAKER® **ESP INSIGHTS**
ESP PRIVATE AGENTS matter

AI

ESP-SR Speech Recognition
ESP-WHO Image Recognition
ESP-DL Deep Learning

IoT

ESP-Brookesia AI-Powered UI Framework
ESP-GMF Audio&Video Processing
ESP-IoT-Solution Peripheral Integration

In-House

ESP-IDF Official IoT OS
Compilers & Tool Chains

Third-party and Community Driven

ARDUINO · WEBASSEMBLY · MicroPython · Zephyr

Connectivity

Wireless Communication
- Wi-Fi 7/6E/6 | 2.4/5/6 GHz Tri-band
- Bluetooth 6 (LE)
- IEEE 802.15.4

High-Speed Data Transmission
160 MHz Channel Bandwidth | 1024-QAM | 2x2 MIMO

Computing

Core
32-bit RISC-V
AI FPU | Instruction Set Extensions
Multimedia ISP | H.264 Encoder | JPEG Codec
High-Speed Interfaces PCIe | DDR | USB

Discover What's New in 2026

ESP32-E22

Next-Gen Tri-Band Wi-Fi 6E Co-Processor

2.4/5/6 GHz • Wi-Fi 6E/6 • 2x2 MIMO
Dual-Mode Bluetooth with BLE 5.4 + Classic BT

- **Ultra-Fast Data Rates**: Supports 1024-QAM and 160 MHz bandwidth, achieving data rates up to 2.4 Gbps.
- **Enhanced 6 GHz Capacity**: Features MU-MIMO, OFDMA, and Beamforming to reduce interference in dense environments.
- **High-Performance Architecture**: Powered by multi-core RISC-V technology engineered to handle high-throughput and low-latency demands.
- **Diverse Applications**: Optimized for bandwidth-intensive scenarios like multimedia streaming, wireless video, and gateways.

ESP32-H4

Next-Gen Low-Power Bluetooth SoC

Bluetooth 5.4 (LE) • LE Audio • PAwR • AoA/AoD
Integrated DC-DC for Extended Battery Life

- **Dual-Core RISC-V MCU**: Runs at 96 MHz with external PSRAM support for flexible memory expansion.
- **Bluetooth 5.4 (LE) Applications**: High-accuracy indoor positioning, wearables, healthcare devices, remote sensors, LE Audio accessories.
- **IEEE 802.15.4**: Native support for Matter-over-Thread and Zigbee smart home ecosystems.
- **Robust Security**: Built-in Secure Boot, Flash Encryption, and Crypto Accelerators to protect data.
- **Rich Peripherals**: Includes 40 GPIOs, USB-OTG, TWAI, and Touch Sensing for interactive HMI designs.

ESP32-H21

Low-Power Bluetooth SoC

Ultra-Low Power & High Tx Power (20 dBm)

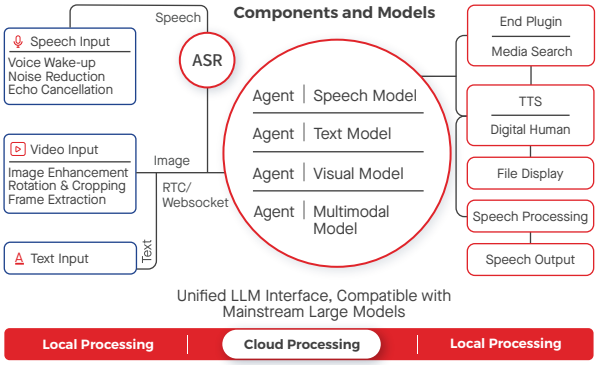
- **Efficient Processing**: Powered by a 96 MHz single-core RISC-V processor with 320 KB SRAM (full retention) and external flash support.
- **Multi-Protocol Connectivity**: Native support for IEEE 802.15.4 (Thread/Zigbee).
- **Extended Range**: Features up to 20 dBm Tx power, ensuring robust wireless connections even in challenging environments.
- **Battery Optimized**: Engineered with enhanced sleep modes and ultra-low power consumption specifically for battery-powered devices.

AI COMPUTING

EDGE AI

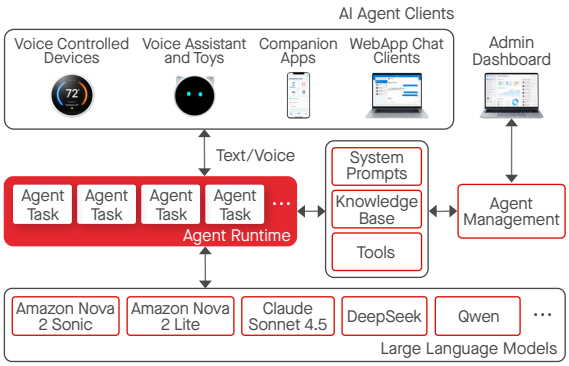
Large Language Models (LLM)

Espressif enables edge devices to access advanced AI capabilities through secure, low-latency connections to cloud-based large language models.



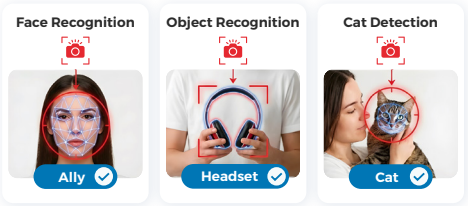
ESP Private Agents Platform

The ESP Private Agents Platform enables IoT device makers to deploy AI agents entirely within their own AWS environments. With a ready-to-use runtime, flexible LLM support, and a unified dashboard, it simplifies agent development and lifecycle management for secure, scalable IoT products.



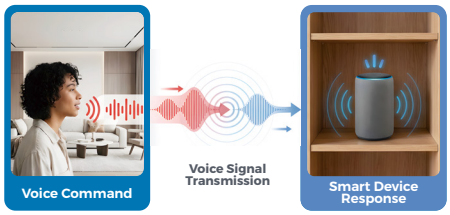
ESP-WHO Image Recognition Framework

A vision framework supporting face detection, recognition, liveness, and gestures. It delivers real-time edge inference for smart cameras and access control systems.



ESP-SR Speech Recognition Framework

A low-power speech solution integrating Acoustic Front-End (AFE), wake word, and command recognition. Enables fast, accurate, and ready-to-use voice interaction for edge devices.



ESP-DL Deep-Learning Library for AIoT

A lightweight neural network inference framework optimized for Espressif ESP-series SoCs. It enables efficient on-device AI by providing APIs to load, debug, and run AI models with low memory and high performance.

ESP-VoCat

AI Development Kit

ESP-VoCat connects to LLMs from OpenAI and XiaoZhi AI, and has seamless connection to the ESP Private Agents Platform—delivering full-duplex voice interaction, multimodal recognition, and intelligent agent control at the edge.

ESP32-S3

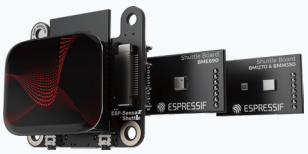
ESP-SensairShuttle

Multi-Scenario Sensing Platform

A multimodal sensing platform supports dual-band Wi-Fi 6 (2.4 GHz / 5 GHz), Bluetooth 5 (LE), and IEEE 802.15.4. The platform enables real-time behavior understanding and intelligent feedback for next-generation edge devices.

ESP32-C5

Dual Band 6



CONNECTIVITY | INTERACTION | CLOUD

Smart Sensing

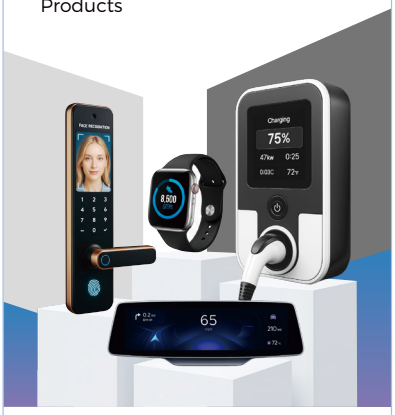
Environmental monitoring, human activity detection, and meter-level positioning.

- Wi-Fi CSI Sensing
- Wi-Fi FTM Ranging

HMI

Data visualization, touch, rotary knob, and voice interaction.

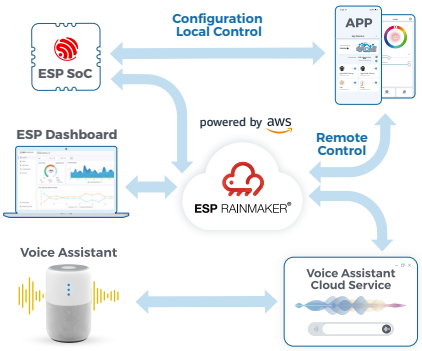
- HMI Smart Displays
- ESP-Brookesia: A System Framework for Building UI and AI-Interactive Products



ESP RainMaker

Seamless Edge-to-Cloud integration with AI Agents.

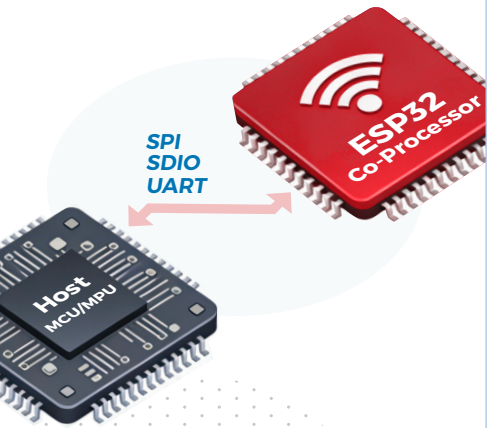
- AI Agents | Cloud Backend | Firmware SDK | Reference Moblie App | Dashboard & CLI | Voice Assistant Integration



Connectivity Co-Processor

Co-processor connections for high-speed host–ESP SoC data exchange, AT commands, multi-network interconnection and bridging for complex IoT scenarios.

- ESP-Hosted: ESP SoC as High-Speed Wireless Co-Processor
- ESP-AT: AT-Command-Based Quick Application Integration for ESP SoC
- ESP-IoT-Bridge: Multi-Interface Bridging for Flexible IoT Networking



Multimedia

Rich multimedia frameworks with built-in codecs and effect algorithms support WebRTC, RTMP, RTSP, VoIP, and UPnP, helping developers bring products to market faster.

- ESP-GMF: Audio & Video Processing
- ESP-ADF: Multimedia Framework
- Multimedia Transmission Protocols

ESP Matter Solution

Matter solution covers the full stack—from SoCs and software to services—simplifying interoperable smart-home device development.

- Hardware: Wi-Fi/Thread/Ethernet End Device, Matter Bridge
- Espressif's SDK/ACK SDK for Matter
- ESP-ZeroCode: Out-of-the-Box Solution

Product Security

Security is at the core of everything we build. Our in-house innovations safeguard IoT products against evolving threats, ensuring reliability and trust at every level.

Hardware

ESP SoCs with Xtensa® and RISC-V combine Secure Boot, Memory Encryption, Hardware Isolation, and Digital Signature Peripheral for robust protection against physical and remote threats.

Network

With encrypted and authenticated communication across Wi-Fi, Bluetooth, and Thread, the ESP SDK safeguards data against eavesdropping and spoofing at every layer.

Device

Secure OTA, Encrypted Storage, and Secure APIs are built into ESP-IDF, protecting the entire device lifecycle while simplifying compliance and certification.

Trusted Execution

ESP-TEE for RISC-V isolates sensitive tasks like key management and crypto processing, ensuring critical data stays secure even if the main app is compromised.

Manufacturing

Each module or SoC can be provisioned securely with a unique device certificate establishing a cryptographic identity. Flexible manufacturing allows diverse certificate signing authorities.

Lifecycle

SBOM tools, vulnerability tracking, and incident response ensure continuous protection, regulatory compliance, and long-term product trust.

Industry Standards Compliance

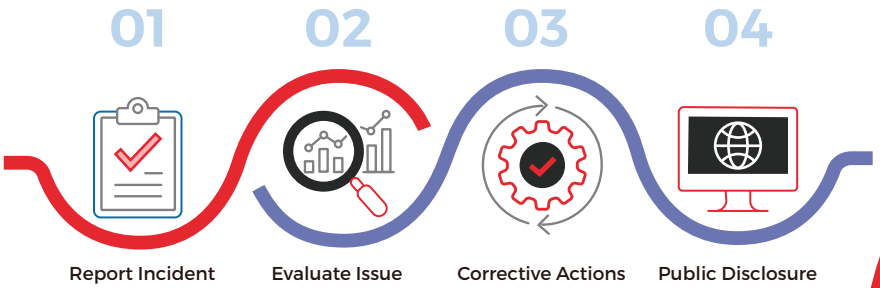
Espressif SoC (based on Xtensa® and RISC-V) and solutions are formally certified for variety of globally recognized security certifications and regulations.

- **Compliance with RED-DA (EN 18031) Regulation**
- **PSA-L1**: ESP32-C3, ESP32-H2, ESP32-S3
- **PSA-L2**: ESP32-C6
- **CLS-Ready**: ESP32-C3
- **CSA Verified**: Product Security, ESP-ZeroCode

RED-DA process assistance and automated documentation wizard to accelerate regulatory compliance.

Security Incident Response Process

Espressif is dedicated to building secure, trusted products. Our incident response process ensures fast mitigation and continuous alignment with global best practices.



Espressif SoC Portfolio

High-Performance SoCs with Connectivity, AI and HMI

		CONNECTIVITY	CPU	RAM Optional PSRAM	GPIO
ESP32-E22	2.4/5/6 GHz 2x2 MIMO Dual-Mode Bluetooth	Wi-Fi 6E, Wi-Fi 6, BT	2x Core @500 MHz	1 MB	41
ESP32-P4	AI Extensions		2x HP Core @400 MHz 1x LP Core @40 MHz	768 KB ✓	55
ESP32-H4	Ultra-Low Power	BT, Thread, Zigbee	2x Core @96 MHz	384 KB ✓	40
ESP32-H21	Ultra-Low Power	BT, Thread, Zigbee	1x Core @96 MHz	320 KB	19
ESP32-H2		BT, Thread, Zigbee	1x Core @96 MHz	320 KB	19
ESP32-C61		Wi-Fi 6, BT	1x Core @160 MHz	320 KB ✓	30
ESP32-C6		Wi-Fi 6, BT, Thread, Zigbee	1x HP Core @160 MHz 1x LP Core @20 MHz	512 KB	30 or 22
ESP32-C5	2.4/5 GHz	Wi-Fi 6, BT, Thread, Zigbee	1x HP Core @240 MHz 1x LP Core @40 MHz	384 KB ✓	29
ESP32-C3		Wi-Fi 4, BT	1x Core @160 MHz	400 KB	22 or 16
ESP32-C2		Wi-Fi 4, BT	1x Core @120 MHz	272 KB	14
ESP32-S3	AI Extensions	Wi-Fi 4, BT	2x HP Core @240 MHz 1x ULP Core @17.5 MHz	512 KB ✓	45
ESP32-S2		Wi-Fi 4	1x Core @240 MHz	320 KB ✓	43
ESP32	Dual-Mode Bluetooth	Wi-Fi 4, BT	2x HP Core @240 MHz 1x ULP Core @8 MHz	520 KB ✓	34

RISC-V

Customized Manufacturing

We provide customers with one-stop, professional, secure and customizable manufacturing services.

- Customer Firmware Pre-Programming
- Flash Encryption and Secure Boot enabled Firmware Pre-Programming
- Matter DAC Pre-Provisioning
- Unique Device Credentials and Custom MAC Address Pre-Programming
- Non-Matter Pre-Provisioning (X.509 Certificate)

Global Certification

We're committed to helping customers achieve global compliance by simplifying the certification process and ensuring their products meet international standards.

Wi-Fi CERTIFIED · Bluetooth · matter · THREAD · zigbee

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