

AI-KY-Z02 PCBA

AI Language Speaking Practice Platform

Product Specification

Product Overview

AI-KY-Z02 is a high-performance microcontroller development board designed by **YUMOU**. Its compact board format incorporates a 1.85-inch capacitive touchscreen TFT display for high-definition image display and human-machine interaction.

The PCBA integrates a main processing unit, wireless communication, a high-definition display module, audio capture and playback, and power management. It enables AI language speaking practice, intelligent question answering, voice interaction and learning content display, providing a stable and reliable hardware foundation for intelligent education products.

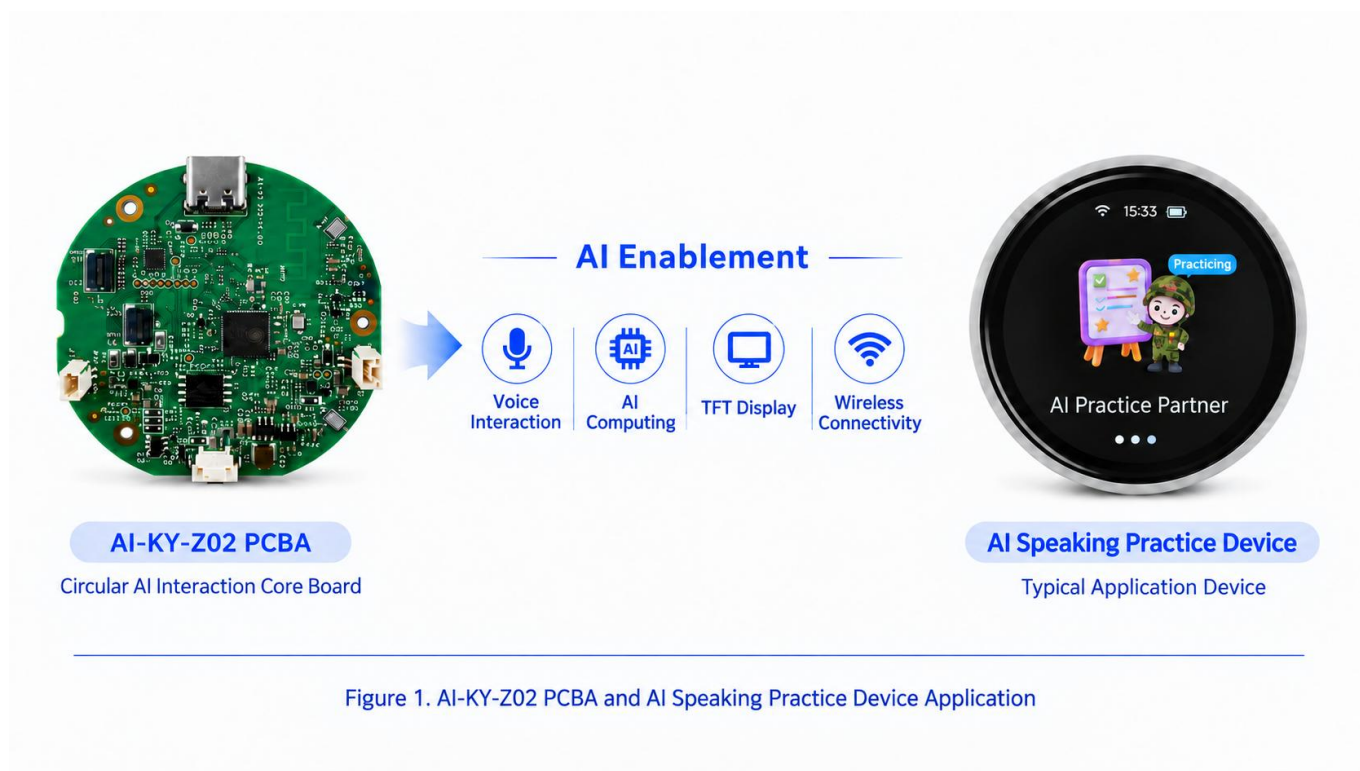


Figure 1. AI-KY-Z02 PCBA and AI Speaking Practice Device Application

Figure 1. AI-KY-Z02 PCBA and an AI language speaking practice device application.

Key Features

Processing and memory

- ESP32-S3R8 dual-core AIoT processor supports high-performance edge computing for voice interaction, device control and other applications.
- Built-in high-performance memory with support for external Flash and PSRAM expansion accommodates AI programs, data and multimedia storage.

Wireless connectivity

- 2.4 GHz Wi-Fi and Bluetooth 5.0 (LE), with an integrated onboard antenna, enable network connectivity and interaction with cloud-based AI services.

Display and touch

- A 1.85-inch high-definition capacitive touchscreen TFT display presents text and images, AI conversation content, learning status and device interfaces for intuitive, smooth interaction.
- Integrated display driver and touch controller chips use high-speed interface communication, conserving main-processor GPIO resources and improving system integration.

Audio and voice interaction

- A dual-microphone array works with noise reduction and echo cancellation algorithms for accurate audio capture in speech recognition and far-field wake-up applications.
- An integrated high-performance audio codec module supports high-quality audio input and output across the complete capture, processing and playback chain.
- Supports multi-turn AI voice interaction integrating speech recognition, semantic understanding, AI dialogue and text-to-speech (TTS) synthesis for natural, smooth interaction.
- A speaker interface and audio power amplifier circuit support an external speaker for clear voice feedback and content playback.

Power and expansion

- A unified USB Type-C interface supports power input, firmware flashing, debugging and data transfer for convenient use and efficient development.
- Supports a 3.7 V lithium battery and includes charge/discharge management circuitry for portable AI devices.
- An efficient integrated power management module supports multiple voltage outputs to optimise system power consumption, battery life and operating stability.
- Peripheral expansion interfaces for display, audio, debugging and GPIO simplify feature expansion and further development.

Onboard Components and Interfaces

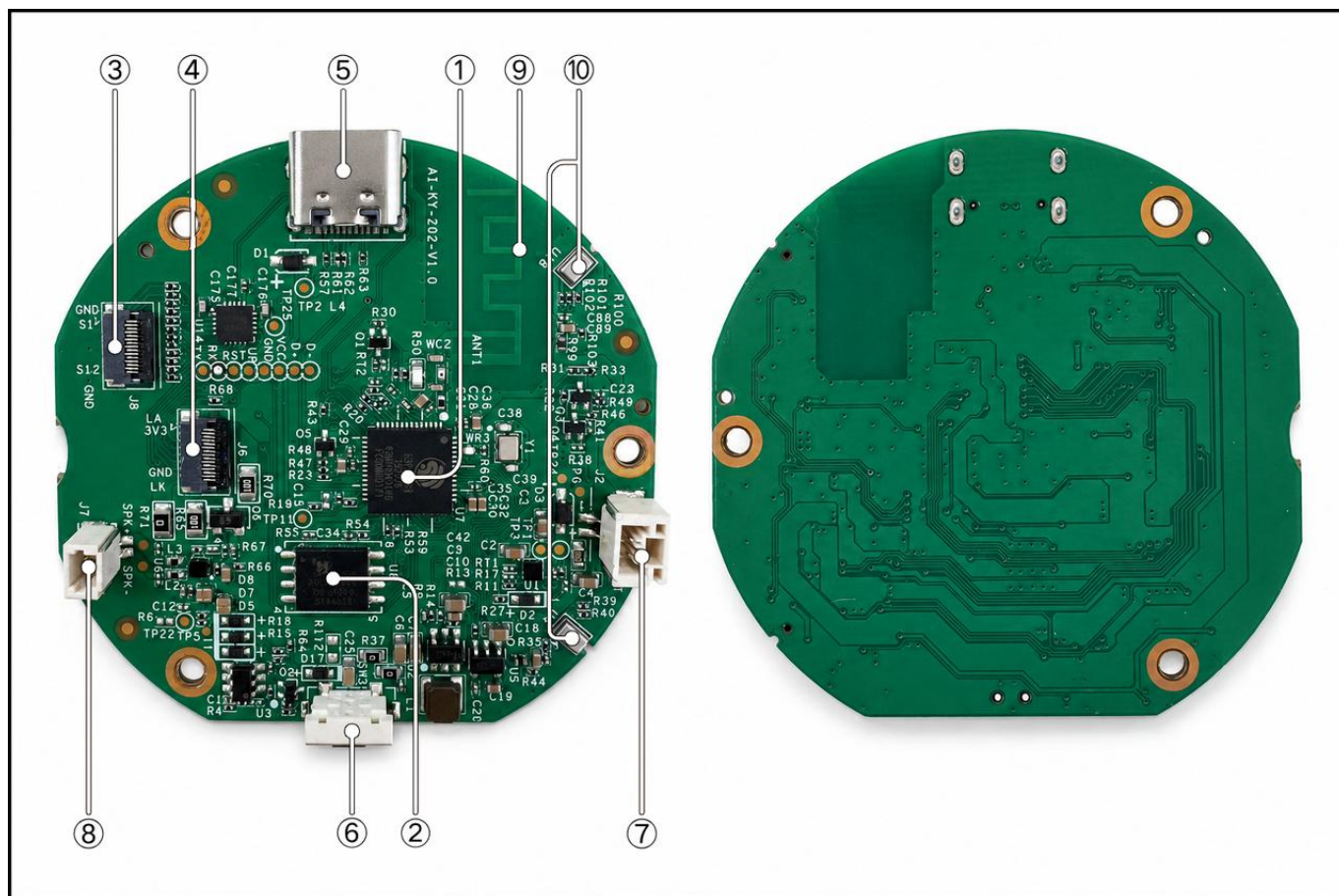


Figure 2. Original annotated PCBA image, with front and rear views. Numbering follows the source.

Numbered component guide

No.	Component or interface	No.	Component or interface
1	ESP32-S3R8 SoC	6	Power and function button
2	128 Mbit Flash	7	Battery interface
3	Touch panel interface	8	SPK audio interface
4	Display interface	9	Onboard antenna
5	USB Type-C charging port	10	Onboard digital microphones

The full descriptions on the following page retain the original component numbering and part numbers.

Onboard Component Details

No.	Component or interface	Description
1	ESP32-S3R8 SoC	Wi-Fi and Bluetooth SoC operating at 240 MHz, with 8 MB in-package PSRAM.
2	128 Mbit Flash	Provides 16 MB of storage for program code, system resources and user data.
3	Touch panel interface	Supports a capacitive touchscreen connection for accurate touch signal acquisition and human-machine interaction control.
4	Display interface	Uses the FH35C-15S-0.3SHW(50) connector for a 1.85-inch TFT display. Supports high-contrast image output to clearly present AI interaction and device status.
5	USB Type-C charging port	Uses the DLDUSB-TYPE-C-16P board-mounted connector with four mounting legs. Combines power input, firmware flashing, data transfer and debugging for convenient, efficient use.
6	Power and function button	Uses DLD-AJ0306-35CN for device power on/off control and quick access to core functions.
7	Battery interface	Supports a 3.7 V lithium battery for mobile use in portable AI devices.
8	SPK audio interface	Uses the SH2-1.0-2P-LT surface-mount socket and integrated power amplifier output circuitry. Supports 4 Ω / 8 Ω speakers and high-quality audio playback.
9	Onboard antenna	Integrated Wi-Fi/Bluetooth dual-mode antenna supports 2.4 GHz Wi-Fi and Bluetooth 5.0 BLE for network connectivity and data exchange.
10	Onboard digital microphones	LMD2718B261-A1 digital microphones form a dual-microphone array. Supports PDM digital audio capture at a 48 kHz sampling rate. Works with noise reduction and echo cancellation algorithms to improve far-field speech recognition and wake-up accuracy.

Technical Specifications

Parameter	Specification
Wi-Fi standard	802.11 b/g/n (2.4 GHz)
Bluetooth standard	Bluetooth 5.0 (BLE)
Processor	ESP32-S3R8 dual-core AIoT processor @ 240 MHz
SRAM	512 KB
PSRAM	8 MB
Flash	128 Mbit (16 MB)
Input voltage	USB Type-C 5 V / 3.7 V lithium battery input
Operating voltage	3.7 V
Charging current	300 mA @ 5 V
System power consumption	<60 mA @ 5 V (sleep mode)
Speaker	8 Ω , 1.5 W
Microphones	Dual digital silicon microphones; 48 kHz sampling
USB interface	USB Type-C: power / firmware flashing / debugging / data transfer
Button interface	Power on/off and function button
Peripheral interfaces	GPIO, display, audio and debugging interfaces
Product dimensions	50.11 mm $\times$ 49.36 mm
Operating temperature	-10 $^{\circ}$ C to 60 $^{\circ}$ C
ESD protection	Air discharge ± 4 kV; contact discharge ± 2 kV
Environmental protection	Not waterproof

Board Dimensions

Board dimensions: 50.11 mm × 49.36 mm.

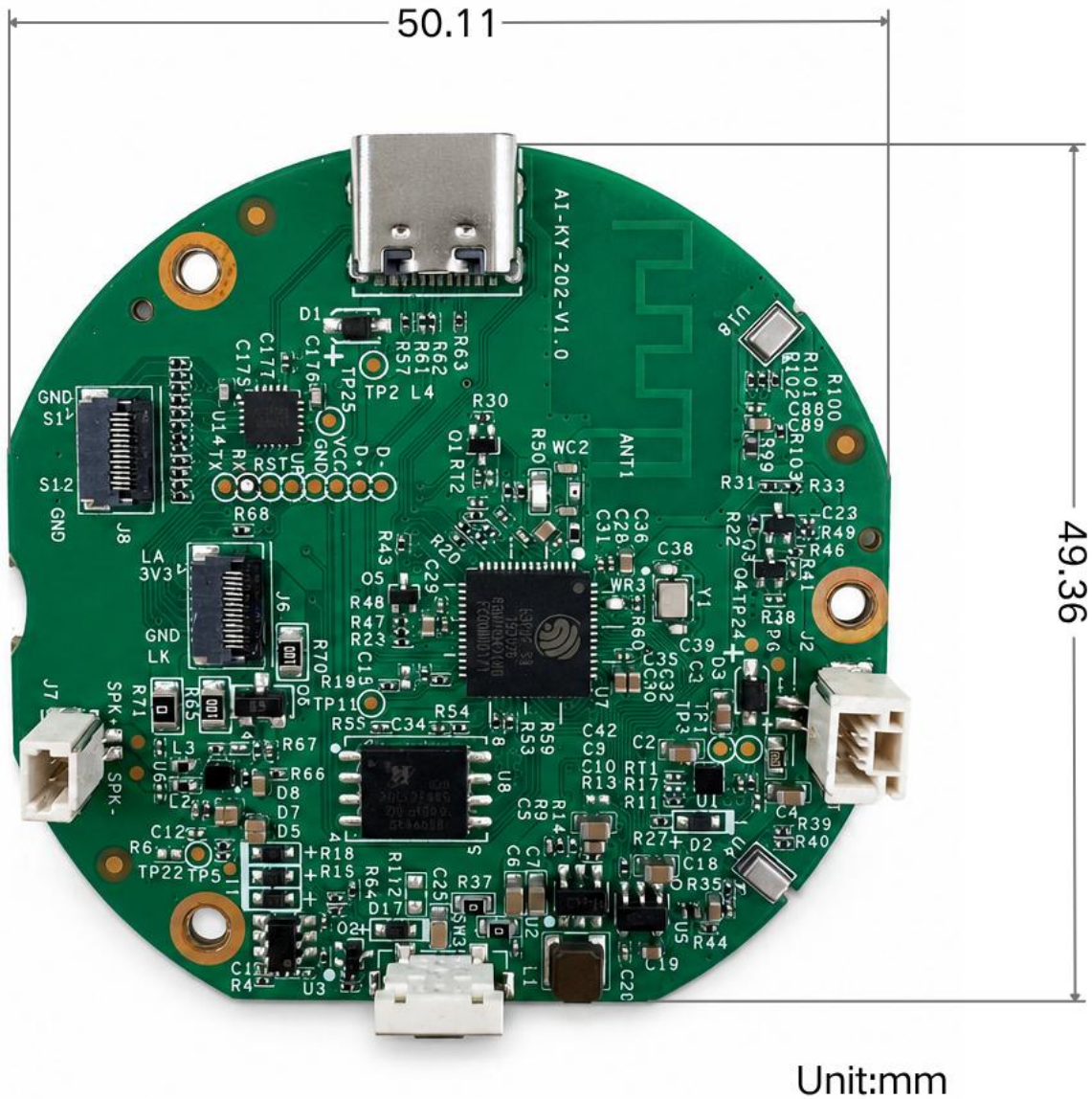


Figure 3. Original board dimension image. All dimensions are in millimetres.

Application Scenarios

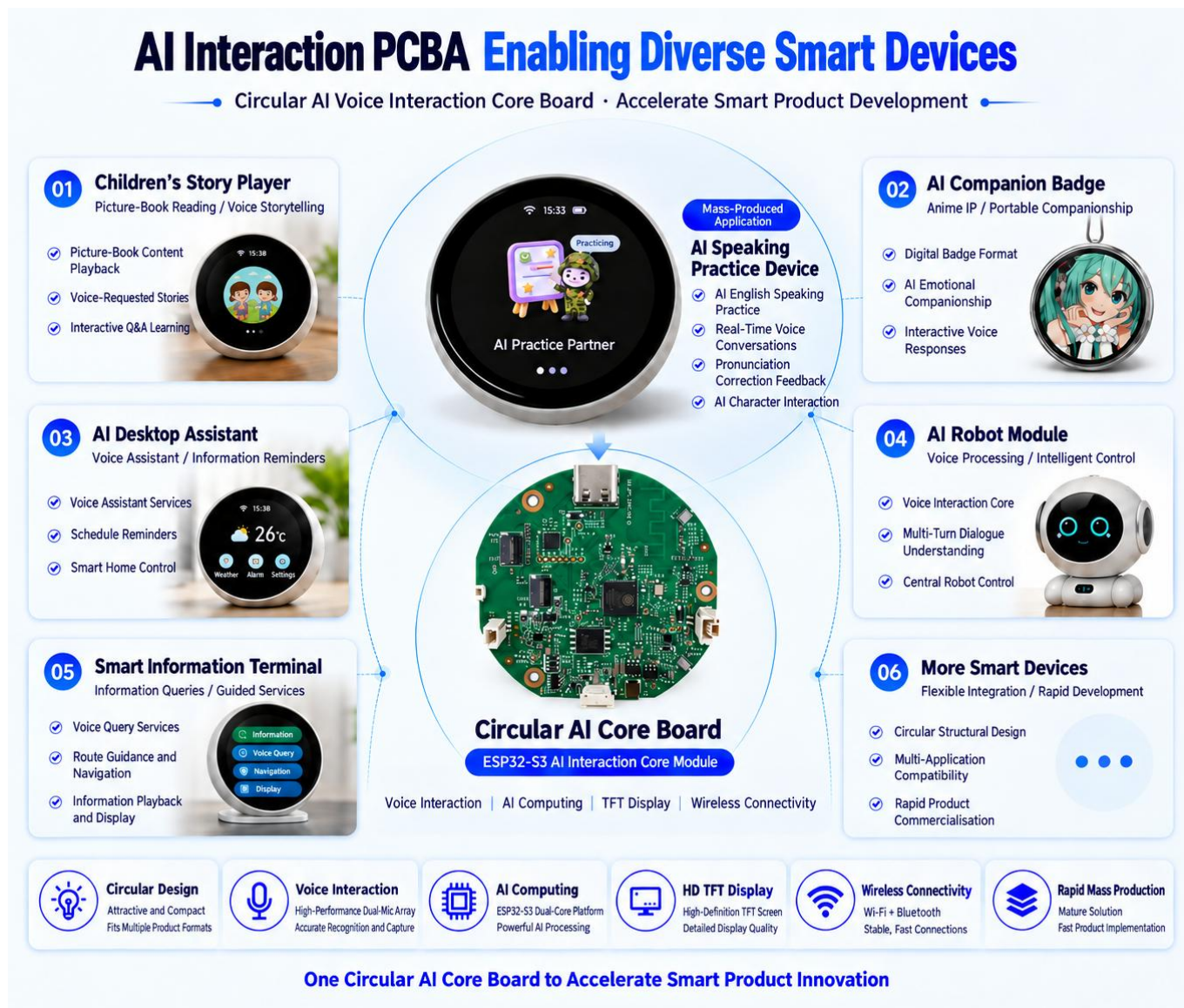


Figure 4. Original application overview.

Learning and Companion Applications

1 AI language speaking practice and intelligent learning devices

The ESP32-S3 dual-core processing platform, high-performance microphone array and wireless connectivity can work with cloud-based AI dialogue services to enable AI English speaking practice, real-time voice conversations, intelligent pronunciation correction feedback and AI character interaction.

The 1.85-inch high-definition touchscreen TFT display can show learning content, AI conversation information, pronunciation feedback and device status in sync, providing a natural and intuitive learning experience. Applications include English speaking practice, language learning, home education and intelligent learning terminals.

2 Children's story players and reading devices

Integrated audio capture and playback, voice interaction and TFT display capabilities enable picture-book content playback, voice-requested stories and interactive question-and-answer learning.

The screen can simultaneously present picture-book illustrations, subtitles and interactive content. Suitable products include children's story players, picture-book readers and early learning devices, providing rich interaction for children's reading and early language learning.

3 AI companion badges and intelligent companion devices

The circular PCBA is naturally suited to compact formats such as digital character badges and smart badges. High-definition display solutions (TFT/OLED), combined with voice interaction and cloud-based AI, can enable anime-style character display, AI emotional companionship and interactive voice responses.

A portable power solution supports on-the-go and personalised use. Applications include anime and character IP merchandise, designer-toy accessories and portable intelligent companion products.

Assistant and Device Integration Applications

4 AI desktop assistants and intelligent interaction terminals

Speech recognition, AI dialogue, wireless networking and TFT display capabilities can enable voice assistant functions, schedule reminders, weather and information display, and smart home control. The compact circular structure simplifies integration into desktop terminals, providing convenient voice and visual interaction for home, office and personal assistant applications.

5 AI robot modules and voice interaction cores

The core board integrates AI processing capability, audio capture and playback, display and wireless communication. It can serve as the voice interaction and intelligent control core of an AI robot, enabling voice wake-up, multi-turn AI dialogue, status display and device control.

It is suitable for educational, companion and service robots, providing a hardware foundation for rapid integration of AI interaction and helping shorten product development cycles.

6 Smart information terminals and guidance devices

Voice queries, wireless networking, information playback, and text and image display can enable information lookup, route guidance, content playback and intelligent guided services. The high-definition TFT screen can simultaneously present navigation, menus and service information.

Applications include information terminals and guidance devices for exhibition halls, scenic attractions, shopping venues and public service locations, improving interaction efficiency and the user experience.

7 Other intelligent devices and rapid product development

The circular structure and highly integrated hardware and software solution allow AI-KY-Z02 PCBA to accommodate a variety of intelligent device formats. AI dialogue, voice interaction, TFT display, wireless connectivity and device control can be expanded to suit different application requirements.

The board provides a general-purpose core platform for intelligent hardware products, helping customers reduce development complexity, shorten R&D cycles and accelerate commercialisation.