ESPRESSIF
乐鑫科技

SHARE :: CONNECT :: INNOVATE

2023
ANNUAL
REPORT

Contents

About Espressif

Espressif Systems is a public, multinational, fabless, semiconductor company focused on developing cutting-edge, wireless-communication, low-power chipsets. By leveraging wireless computing, we provide green, versatile and cost-effective AIoT solutions. We have accomplished a hardware-and-software, closed-loop development cycle for a series of core technologies, including RF, Wi-Fi & Bluetooth LE network protocol stacks, RISC-V MCUs, AI instruction sets and algorithms, operating systems, toolchains, compilers, IoT software application frameworks, Cloud, etc.

We have a diverse team of engineers from around the world. All company branches employ about 625 members of staff from almost 30 countries and regions, +77% of whom are based in our Research & Development Department. We have eight R&D centers in five countries, including China, India, the Czech Republic, Brazil and Singapore. The company's increasing reputation in recent years has been instrumental in attracting talented engineers from across the world. Being united by our passion for technology, our diversity is our strength, as it allows the creative blending of different kinds of knowledge, perspectives and ways of thinking.

global Wi-Fi MCU
market leader

over 1 billion global
IoT chip shipments

millions of
developers

Our R&D Centers

China

- Shanghai
- Suzhou
- Hefei
- Wuxi

Brazil

- Campinas

India

- Pune

Czech Republic

- Brno

Singapore

Message from the CEO

"Espressif's strategic priorities are focused on sustaining growth momentum, expanding our market presence, and fostering innovation. Key initiatives include accelerating product development cycles, strengthening partnerships with key stakeholders, and enhancing operational efficiency through digital transformation initiatives."

Teo Swee Ann
Espressif's Founder & CEO

As the CEO of Espressif, I am pleased to present the 2023 Annual Report. Despite the various challenges, geopolitical uncertainties, and economic fluctuations, Espressif has maintained resilience and adaptability, further improving our position to achieve sustained success. Our revenue has grown by 12.74%, and net profit by 39.95%.

In 2023, we unveiled the ESP32-P4 at CES in Las Vegas, marking a significant advancement in our SoC product. This cutting-edge device, driven by our proprietary dual-core RISC-V CPU with AI instruction extensions, features an integrated H.264 encoder, a sophisticated memory subsystem for high throughput, and a comprehensive suite of high-speed peripherals.

Designed to focus on high-performance Human-Machine Interface (HMI) applications, the ESP32-P4 sets a new standard for security and performance. By developing our own RISC-V processor and H.264 capabilities, Espressif has positioned itself to differentiate from the competition, laying the groundwork for ongoing innovation in future generations.

This is Espressif's first SoC that does not integrate wireless connectivity and also our first chip to target the multimedia market. This makes possible for ESP32-P4 to be coupled with any of Espressif's broad range of connectivity chips, to adapt to different application scenarios, including Wi-Fi, Bluetooth, ZigBee and Matter, making this one of the most versatile platforms in the market.

Picture source: The Business Times © SPH Media Limited. Permission required for reproduction.

Our relatively new product lines, ESP32-S3 and ESP32-C3, has both achieved high growth in 2023. We anticipate these two product lines to continue on a similar growth trajectory in 2024. ESP32-S3 targets the human-machine interface market, while ESP32-C3 is geared towards lightweight IoT control with connectivity applications. As our product matrix expands, our commercialization efforts become more and more efficient, leveraging the synergy of our common software platform that serves these different chips.

With the Matter 1.2 release in 2023 extending protocol support to 9 new device types, we anticipate further adoption driven by new device type support and improved usability. Espressif's SoC portfolio offers the most comprehensive solutions covering Matter over Thread, Matter over Wi-Fi, Thread Border Routers and Matter bridge use cases. ESP32-H2 offers a cost-effective Matter over Thread solution whereas ESP32-C6, with its Wi-Fi 6 and Thread radio support, helps customers to build multi-protocol Matter products with the same SoC. We anticipate our SoCs to achieve significant growth in the second half of 2024 to enable various Matter products.

In response to the macroeconomic recession in 2023 and the demand for more cost-effective solutions, our investments in no-frills, low-cost chip products, such as the ESP32-C2 and ESP32-C3, have proven beneficial. For customers prioritizing cost reduction and seeking simplified functionalities, we have steered them towards these cost-effective product lines. This strategy has helped us maintain our market share and profit margins, despite price cuts by competitors.

Espressif continues to drive innovation, with sustained investments in research and development leading to significant technological advancements across our product portfolio. Key highlights include breakthroughs in AI-driven processing capabilities, advancements in wireless connectivity, and enhancements in energy efficiency and performance optimization. These innovations further solidified Espressif's position as a leader in cutting-edge IoT solutions.

Espressif remains committed to an innovation-driven growth strategy, leveraging its technological expertise and market insights to anticipate evolving customer needs and industry trends.

We recognized the increasing convergence of AI, IoT, and connectivity technologies as a pivotal driver of industry evolution. With the proliferation of smart devices and the growing demand for seamless connectivity and intelligent functionality, Espressif positioned itself to capitalize on emerging opportunities in AIoT, edge computing, and IoT ecosystems.

For the upcoming fiscal year, Espressif's strategic priorities are focused on sustaining growth momentum, expanding our market presence, and fostering innovation. Key initiatives include accelerating product development cycles, strengthening partnerships with key stakeholders, and enhancing operational efficiency through digital transformation initiatives.
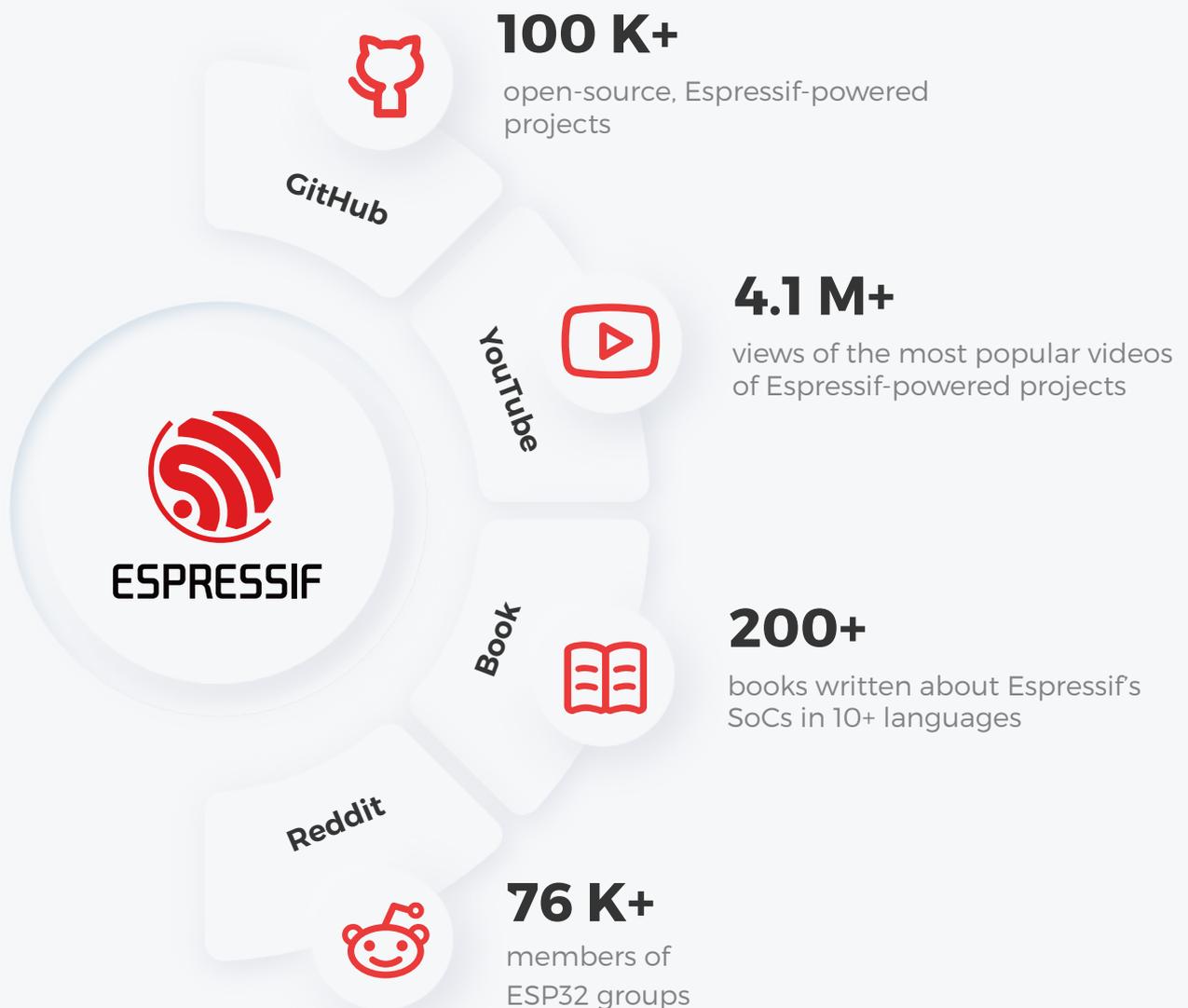
In the natural world, Darwinism underscores the relentless force of evolution, where only the fittest survive, especially when shocks are introduced to the system, displacing the equilibrium. This is gradually becoming evident in the business world where artificial intelligence, AR/VR and digitalization are disrupting many industries with unprecedented speed and scope. As these new technologies reshapes the way we live, work, and interact, it demands that all companies adapt to these rapid changes and reinvent themselves in order to thrive. Those who are unable to keep pace with the dynamic integration of AI risk obsolescence.

Today, Espressif stands at the forefront of the IOT revolution, wielding an comprehensive arsenal of innovations that align perfectly with the demands of this new era. Espressif deep expertise in areas such as scalable and affordable wireless connectivity, human-machine interfaces (HMI), video processing, processor hardware, and cloud platform frameworks, low code solutions, along with a robust collection of tools and application software, has helped foster a vibrant ecosystem of software developers who are in tune with the current technological zeitgeist, leveraging collective insights and trends to drive progress.

This strategic positioning enables Espressif to significantly influence the evolution of AIoT and assist customers in unlocking new value. Through collaboration with various partners, the company is dedicated to designing and refining AI and IoT strategies. This commitment ensures that our partners are not just prepared to meet today's challenges but are also at the forefront of tomorrow's innovations.

By forging these strategic partnerships, Espressif is laying the groundwork for a future in which technology is intricately woven into the very fabric of our daily lives.

Facts About Espressif

8
R&D centers

77 %
R&D employees

625
employees

30
employee nationalities

34 %
female employees

GitHub

100 K+
open-source, Espressif-powered projects

YouTube

4.1 M+
views of the most popular videos of Espressif-powered projects

ESPRESSIF

Book

200+
books written about Espressif's SoCs in 10+ languages

Reddit

76 K+
members of ESP32 groups

Core Technologies

SoCs

ESP8266, ESP32, ESP32-S, ESP32-C, ESP32-H and ESP32-P Series

Espressif offers integrated, reliable, and energy-efficient SoCs for Wi-Fi, Bluetooth Low Energy, Thread and Zigbee to various segments of the IoT market.

OS

ESP-IDF

Espressif's official IoT Development Framework.

It provides a self-sufficient SDK for any generic application-development on these platforms, using programming languages such as C and C++.

ESP-IDF currently powers millions of devices in the field, and enables building a variety of network-connected products, ranging from simple light bulbs and toys to major appliances and industrial devices.

AI

AFE (Audio Front-End) Algorithms

qualified as a "Software Audio Front-End Solution" for Amazon Alexa Built-in devices.

3A Audio Algorithms

including Acoustic Echo Cancelation (AEC), Audio Noise Suppression (ANS) and Automatic Gain Control (AGC), which significantly reduce noise and echo in calls, keeping high-quality voice intercoms stable at all times.

Cloud

ESP RainMaker

A comprehensive, development-free and maintenance-free AIoT solution for private Cloud deployment.

It is an all-inclusive solution that covers everything from the underlying chip to device firmware, third-party voice-assistant integrations, mobile apps and the dashboard.

Customers can build their own AIoT devices and ecosystem, with ESP RainMaker.

Software

With our open-source software, such as Espressif's IoT Development Framework ESP-IDF, Audio Development Framework ESP-ADF, Mesh Development Framework ESP-MDF, Cloud Connectivity Platform ESP RainMaker, Facial Recognition Development Framework ESP-WHO, and Voice-Controlled Assistant ESP-Skainet, we have developed a framework for building AIoT applications, which is both complete and innovative.

Matter

One-stop Matter Solution

This is the culmination of Espressif's ongoing contribution to the Matter platform in various areas, including protocol formulation, core stack implementation and certification test events.

Business Highlights

Key Financial Data

	Fiscal Year		
CNY	**2023**	**2022**	**2021**
Consolidated Statement of Income Data			
Revenue	1,433,064,911	1,271,127,201	1,386,371,541
Gross profit	581,248,531	508,251,068	549,025,732
Selling expenses	52,583,650	49,323,100	41,815,693
General and administrative expenses	61,618,348	59,639,944	55,485,146
Research and development expenses	403,713,557	337,121,814	271,689,981
Net income	136,204,637	97,323,103	198,427,708
Earnings per share:			
Basic	1.7012	1.2129	2.4775
Diluted	1.6929	1.2127	2.4566
Consolidated Balance Sheet Data			
Cash, cash equivalents and financial investments	1,397,511,953	1,200,219,436	1,114,558,363
Working capital	999,068,356	1,518,383,808	1,749,605,271
Total assets	2,203,800,366	2,082,796,825	2,129,056,143
Long-term obligations	74,166,946	65,591,788	68,244,392
Total shareholders' equity	1,913,000,228	1,826,677,535	1,823,017,913
Consolidated Cash Flow Data			
Net cash provided by operating activities	302,597,343	71,321,658	31,460,857
Non-GAAP Adjustment			
Stock-based compensation	18,737,416	14,726,019	21,787,964
Non-GAAP net income	154,942,053	112,049,122	220,215,672

Key Financial Indicators

	Fiscal Year		
	2023	**2022**	**2021**
Gross margin	40.56%	39.98%	39.60%
R&D-to-sales ratio	28.17%	26.52%	19.60%
EBITDA margin	10.01%	9.29%	16.78%
Weighted ROE	7.14%	5.36%	11.52%
Number of Espressif employees as of December 31	625	578	517

Financial Analysis

Espressif's total revenue in 2023 was CNY1,433 million, marking an increase of 12.74% from CNY1,271 million in 2022. Some of the existing customers saw growth while others experienced declines, leading to overall performance remaining steady compared to 2022. The company's performance growth in 2023 was primarily attributed to securing design wins with new customers. Therefore, the net income was CNY 136 million, which marked an increase of 39.95% year-on-year, mainly due to our increased revenue.

The overall gross margin was 40.6%, in which the gross margin for IoT chips was 46.9%. The overall gross margin is basically flat in comparison with the previous year. We established a mid-term target of 40% for our overall gross margin to facilitate funding for our future R&D expenses.

Revenue by Area

74.0%

● China's Mainland   ● Rest of the World
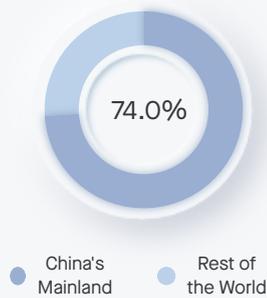
Revenue by Sales Mode

69.8%

● Direct   ● Indirect

Top-5 Customer Concentration Rate

51.0% 42.2% 29.0% 26.4% 28.1%

2019 2020 2021 2022 2023

Revenue by Product Category

■ Chip   ■ Module   ■ Others

	Chip	Module	Others
2023	38.2%	60.8%	1.0%
2022	31.9%	67.2%	0.9%

Key Financial Indicators

■ 2022   ■ 2023

	Overall GM	Chip GM	Module GM	EBITDA Margin	SG&A as % of sales	R&D as % of sales
2022	40.0%	47.3%	36.3%	9.3%	8.6%	26.5%
2023	40.6%	46.9%	36.4%	10.0%	8.0%	28.2%
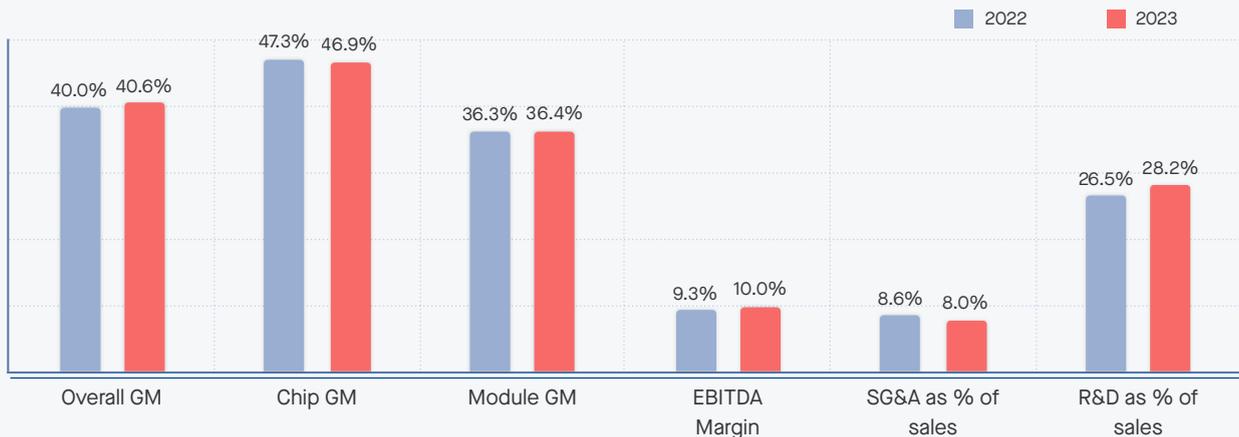
As our product portfolio continues to expand, Espressif's cost-effective and high-performance product lines are becoming increasingly diverse to meet the varying needs of users. During the reporting period, both the cost-effective and high-performance product lines showed growth trends.

User Portrait

- Focus on processing performance
- Sophisticated software solutions

Hybrid

- Focus on connectivity
- Lightweight software applications

Product Selection

High-Performance

Maintain or enhance functionality

Streamline functionality to reduce cost

Choose High-Performance products to meet functional requirements
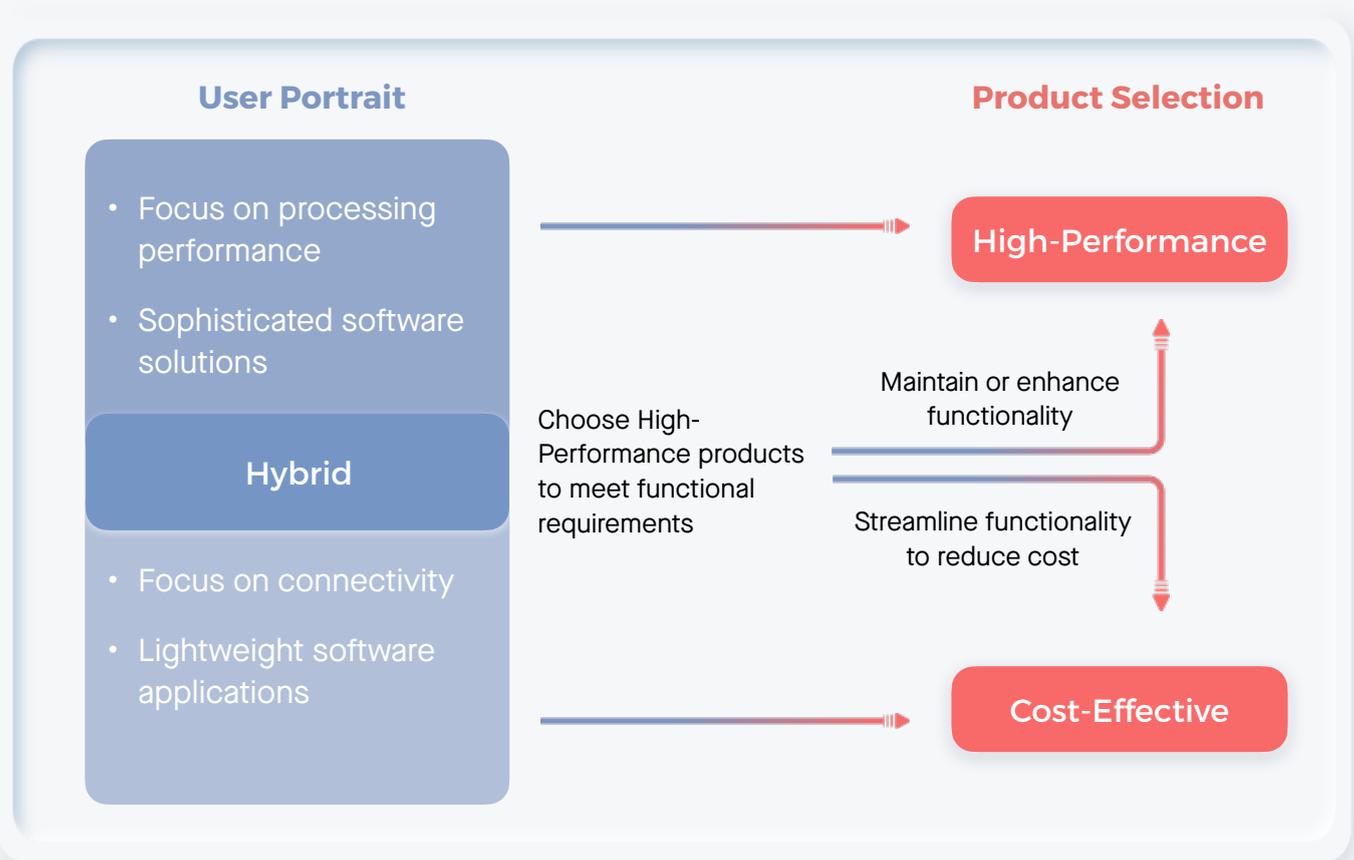
Cost-Effective

- The growth of the **cost-effective** product line in 2023 was particularly notable. This was driven by the market acceptance of the Wi-Fi+BLE combo ESP32-C3 and ESP32-C2 series, replacing the previous flagship product, the single Wi-Fi MCU ESP8266 (sold for 10 years), thereby becoming the main growth driver.

- In the **high-performance** product line, the classic ESP32 has been continuously sold for 8 years. Some customers have cost-reduction requirements, which were smoothly transitioned to the ESP32-C3 business. Incremental sales mainly came from the new ESP32-S3 series, with its applications in HMI driving business growth.
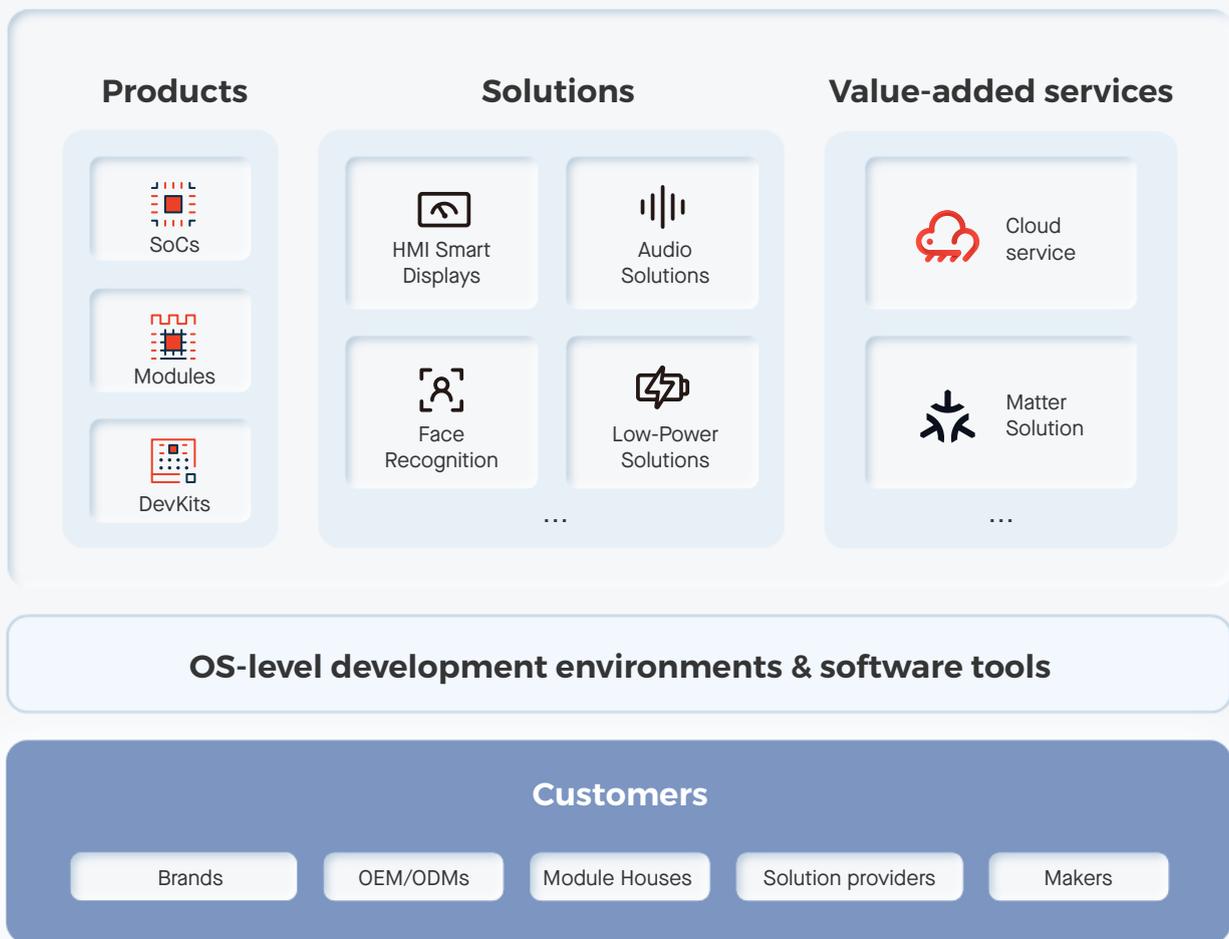
Sales Trends

Revenue by user's portrait, m

Total

High-Performance

Cost-Effective

Others

1600 · 1200 · 800 · 400 · 0

2019 · 20 · 21 · 22 · 23
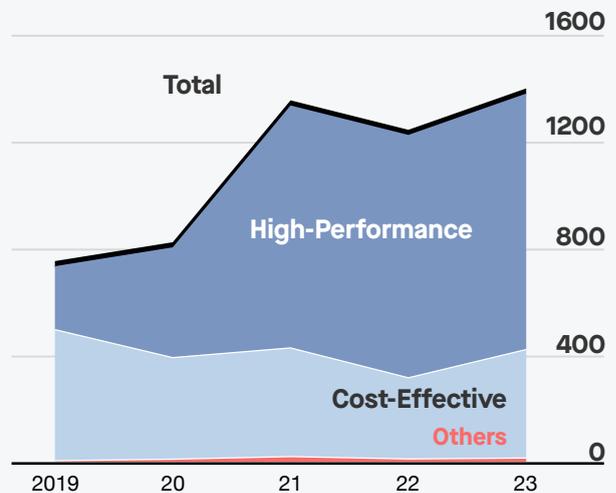
Management Report

Business Strategy

Espressif Systems' business strategy emanates from our service/product areas and our engagement with the developer ecosystem.

Our product and service areas include AIoT chips, OS-level development environments, software tools, application solutions, and value-added services, such as Cloud and Matter. The above-mentioned products ensure that we are in the heart of numerous commercial AIoT applications in different markets, including smart home, consumer electronics, industrial automation, healthcare, etc.

Products	Solutions		Value-added services
SoCs	HMI Smart Displays	Audio Solutions	Cloud service
Modules	Face Recognition	Low-Power Solutions	Matter Solution
DevKits	...		...

OS-level development environments & software tools

Customers

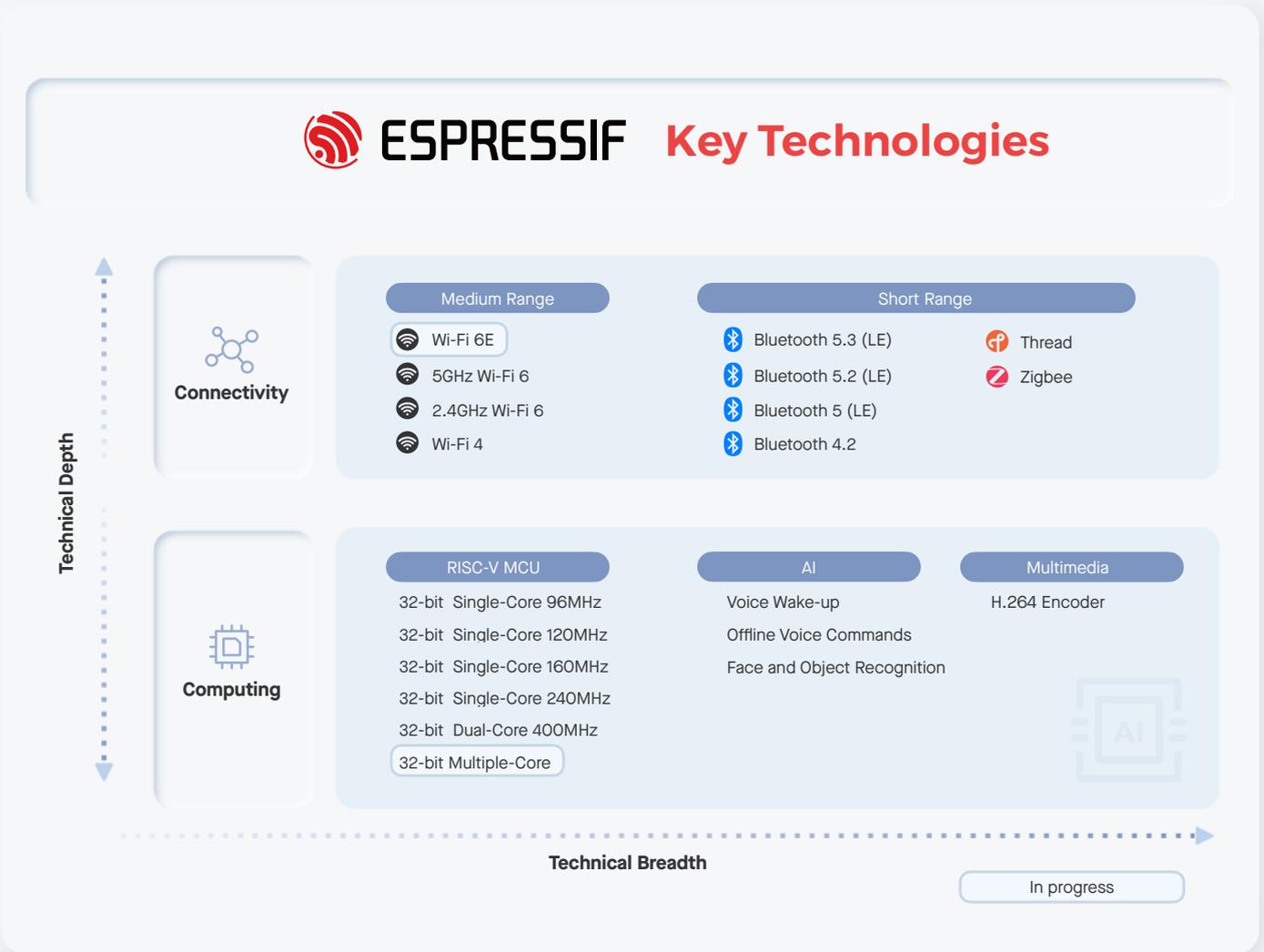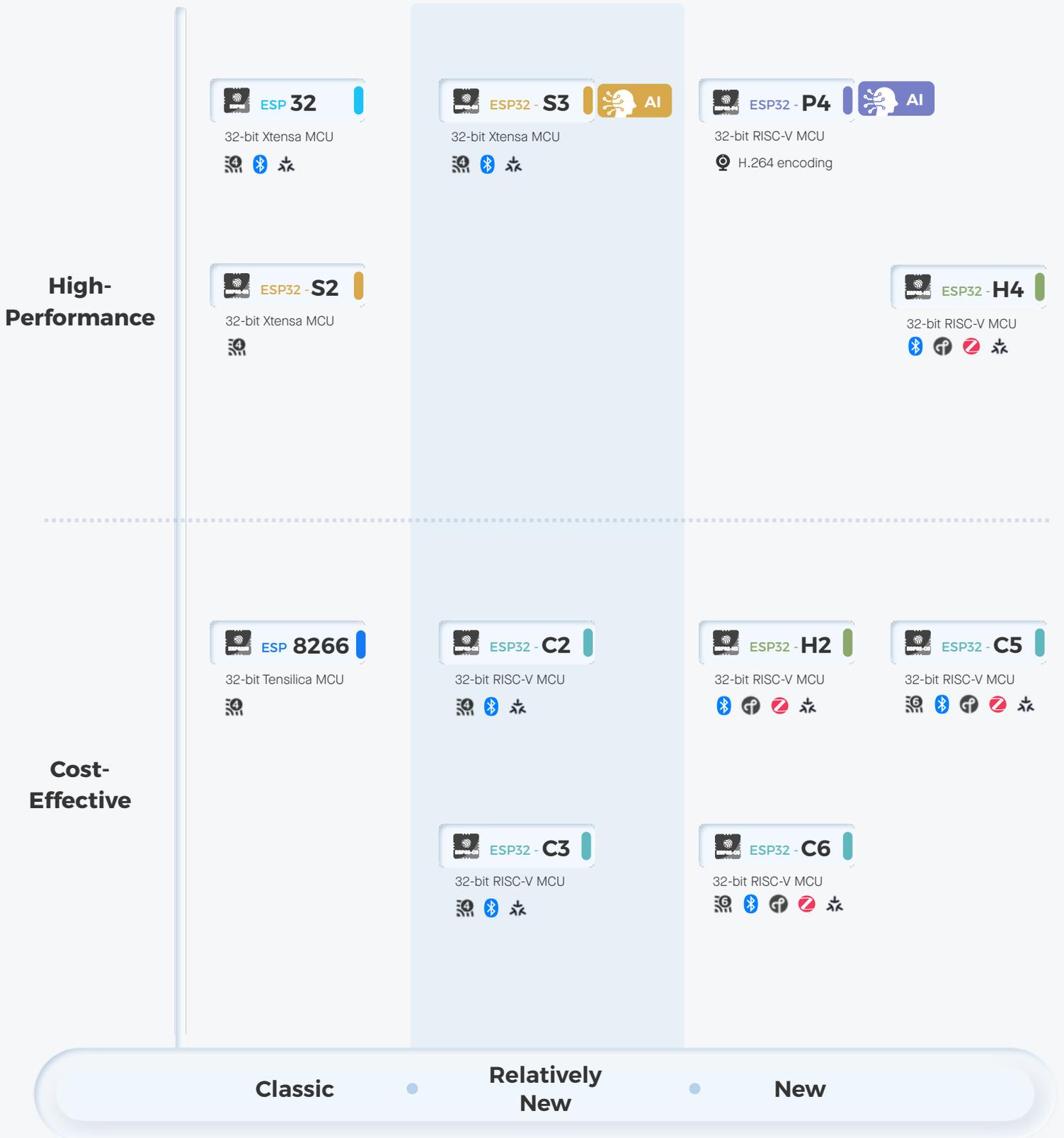| Brands	OEM/ODMs	Module Houses	Solution providers	Makers

Key Products - IoT Chips

Espressif is recognized as a market leader in the field of Wi-Fi MCUs. We released our first Wi-Fi MCU in 2014, and our first Wi-Fi/Bluetooth LE combo chip in 2016. In 2020, we successfully developed our own RISC-V MCU core, adding it to our product portfolio, while in 2021 we released our first Thread/Zigbee/Bluetooth LE 5 combo chip and a 2.4GHz Wi-Fi 6 chip. In 2022, we released our first 2.4 & 5GHz Wi-Fi 6 chip and our product range has expanded to Wireless SoCs. In 2023, we released our first RISC-V multimedia SoC, integrated H.264 encoder, featuring AI instructions extension.

In fact, we have been constantly diversifying our product portfolio, introducing new solutions through our numerous investments. Thus, we now have various product lines in the main short- and medium-range connectivity technologies. Our core technologies are self-developed, including connectivity IPs, RF components, RISC-V IPs, software frameworks, tools, AI functions etc.

We also provide IoT modules based on our chips. The benefit for customers is that they can get direct support from us, shortening and optimizing their supply chain, even in case of chip shortages.

ESPRESSIF **Key Technologies**

Technical Depth

Connectivity

Medium Range	Short Range	
Wi-Fi 6E	Bluetooth 5.3 (LE)	Thread
5GHz Wi-Fi 6	Bluetooth 5.2 (LE)	Zigbee
2.4GHz Wi-Fi 6	Bluetooth 5 (LE)	
Wi-Fi 4	Bluetooth 4.2	

Computing

RISC-V MCU	AI	Multimedia
32-bit Single-Core 96MHz	Voice Wake-up	H.264 Encoder
32-bit Single-Core 120MHz	Offline Voice Commands	
32-bit Single-Core 160MHz	Face and Object Recognition	
32-bit Single-Core 240MHz		
32-bit Dual-Core 400MHz		
32-bit Multiple-Core		

Technical Breadth

In progress

Key Products - Product Map

High-Performance

ESP **32**
32-bit Xtensa MCU

ESP32 - **S3** | AI
32-bit Xtensa MCU

ESP32 - **P4** | AI
32-bit RISC-V MCU
H.264 encoding

ESP32 - **S2**
32-bit Xtensa MCU

ESP32 - **H4**
32-bit RISC-V MCU

Cost-Effective

ESP **8266**
32-bit Tensilica MCU

ESP32 - **C2**
32-bit RISC-V MCU

ESP32 - **H2**
32-bit RISC-V MCU

ESP32 - **C5**
32-bit RISC-V MCU

ESP32 - **C3**
32-bit RISC-V MCU

ESP32 - **C6**
32-bit RISC-V MCU

Classic • Relatively New • New

Market

The market for wireless SoCs is truly diverse, including applications for smart homes (e.g., smart lights, air conditioners, ovens, coffee machines, etc.), consumer electronics (e.g., smart speakers, drones, etc.), industrial automation (e.g., mechanical arms), smart agriculture (e.g., soil PH detector, CO_2 detector, etc.), healthcare (e.g., monitoring devices for diabetes, blood pressure, etc.), energy control (solar energy devices, EV chargers, etc.), the internet of vehicles (OBD devices, dashboards, etc.), and education (talking pens, interactive whiteboards, etc.).

Due to macroeconomic fluctuations, certain existing clients saw growth while others experienced decline, contributing to overall stability in their business in 2023. Nonetheless, the company's overall performance growth was mainly propelled by business from new clients.

Smart Home	Consumer Electronics	Industrial Automation	Smart Agriculture
Smart Ovens	Smart Speakers	Mechanical Arms	Soil PH Detector

Healthcare	Energy Management	Internet of Vehicles	Education
Medical Detectors	Smart Solar Panels	Intelligent instrument panel	Talking Pens

Core Competitiveness

Chip

Connectivity Technology
Chip Design Capability

System

Operating Systems
Development Environment
Software Tools

Ecosystem

Documentation
Developer Communities
Internet Platforms

Software

Software Solutions
Business Applications
Cloud Services

ESPRESSIF

Chip Competitiveness

Espressif takes pride in the invaluable experience that our R&D team leaders have in the field of wireless-communication chips. For example, Espressif's founder and CEO, Mr Teo Swee-Ann, has over 20 years of experience in the semiconductor industry, having also registered over 40 IC and IoT-related patents under his name.

After the huge success of our initial series of Wi-Fi MCUs, our company expanded to other wireless-connectivity technologies, including Bluetooth LE and Thread/Zigbee. This development has further enhanced our Company's high-tech offerings, thus increasing our market opportunities, while also keeping our customers spoiled for choice.

Our products are renowned for their high level of integration, small size, low power consumption, great computing power, large memory space and strong security mechanisms. They are being used by independent developers and big companies alike, while Espressif is recognized as a leading force in the AIoT chip industry.

System Competitiveness

ESP-IDF is Espressif's official IoT Development Framework for all the ESP32 series of SoCs. It provides a self-sufficient SDK for any generic application development with the above-mentioned SoCs, using programming languages such as C and C++. ESP-IDF currently powers millions of devices in the field, and enables building a variety of network-connected products ranging from simple light bulbs and toys to big appliances and industrial devices.

ESP-IDF has established a fastidious release process, and a support policy which ensures that customers can choose a stable release, while also getting important updates. Each stable release undergoes a rigorous QA process that ensures production readiness at all times. Also, ESP-IDF comes with an extensive documentation for its software components not only at the usage level but also at the design level. This helps developers to fully understand what ESP-IDF offers, and select whatever suits their applications best.

Furthermore, ESP-IDF supports a large number of software components, including RTOS, peripheral drivers, network stacks, protocol implementations, and examples of common use cases. These components help developers focus on their business logic, while the SDK provides most of the building blocks required for typical applications. Open-source and freely-available developer tools, as well as officially supported Eclipse and VSCode IDEs, ensure ease-of-use for developers.

Software Competitiveness

The company provides numerous software solutions, including AI-related ones (e.g., offline/online voice recognition and smart control, AI image recognition, etc.), Wi-Fi Mesh, BLE Mesh, HMI functions, various peripheral drivers and other functions covering all the development needs of our customers. These solutions greatly reduce the cost of application development for our customers.

Espressif's AI Lab has developed Audio Front-End (AFE) algorithms that have been qualified as a "Software Audio Front-End Solution" to Amazon-Alexa Built-in devices. This is the result of Espressif's incessant focus not just on the connectivity of its own AIoT solutions, but also on high-performance Machine Learning on the edge. Furthermore, our AI Lab launched the so-called 3A Audio Algorithms, i.e., Acoustic Echo Cancelation (AEC), Audio Noise Suppression (ANS), and Automatic Gain Control (AGC). Based on Espressif's 3A audio algorithms, Espressif-powered Real-Time Communication applications benefit from significantly reduced noise and echo in calls, and sustained stability in high-quality voice intercoms.

Our newly-launched, one-stop Matter solution, including the fully-customized ESP-Matter SDK and Cloud services, can simplify and accelerate the development process of Matter-compatible products significantly. This is the culmination of our ongoing contribution to the Matter platform in various areas, including protocol formulation, core stack implementation and certification test events.

Furthermore, ESP RainMaker® is a one-stop, development-free and maintenance-free AIoT solution for private Cloud deployment, which reduces R&D costs and accelerates time-to-market. More specifically, this is a complete system for building AIoT products with a minimal amount of code, which enables our customers to deploy and develop secure, customized AIoT solutions. It covers all of Espressif's chips and modules, device firmware, voice-assistant integrations, phone apps and Cloud backend. This helps our customers avoid expensive investments in Cloud capabilities, gain independence and focus on innovating their core-value offerings.

Ecosystem Competitiveness

Our company has brought together professionals and companies from across the AIoT industry, e.g., hardware and software developers, business applications, and Cloud platforms, as well as maker communities. Espressif's own software development platforms and the accompanying documentation are entirely open-source, thus making our innovative products available to people from all walks of life.

As a result, thousands of third-party projects have been based on Espressif's technologies. For example, on GitHub, which is the largest provider of Internet hosting for software development, there are more than 100,000 open-source projects based on Espressif's IoT chips. Furthermore, the popularity of our products has stimulated an increasing number of authors who have produced teaching resources based on Espressif chipsets in above 10 languages including English, Chinese, German, Portuguese, Italian, Japanese, Russian, Serbo-Croatian, Thai Language etc. There are more than 200 digital and physical books about Espressif's SoCs in more than ten languages.

Developer Community Content

ITEM	Dec 31, 2023	Dec 31, 2022	change%
GitHub (Worldwide open-source development platform)			
ESP32 Projects	59,100	41,891	41%
ESP8266 Projects	43,700	39,294	11%
Gitee (Chinese open-source development platform)			
ESP32 Projects	3,153	2,629	20%
ESP8266 Projects	2,068	1,868	11%
CSDN (Chinese Tech-blog platform)			
Search results for ESP32	121,840	93,242	31%
Search results for ESP8266	48,213	36,286	33%
Hackaday (open-source hardware platform)			
ESP32 projects	5,691	4,702	21%
ESP8266 projects	6,252	6,101	2%
Reddit			
ESP32 group members	76,046	59,619	28%
ESP8266 group members	60,961	59,004	3%
bilibili (Chinese video-sharing platform)			
Official account followers	30,261	24,064	26%
Official account views	942,075	658,235	43%
YouTube			
Official account subscribers	18,800	14,800	27%
Official account views	968,573	810,523	19%
ESP32 community videos	819,109	641,926	28%
ESP8266 community videos	872,026	778,090	12%
Views of most watched ESP32 community video	around 4.1m	around 3.4m	
Views of most watched ESP8266 community video	around 1.7m	around 1.6m	

N.B.:
Statistical data derived from different platforms may be based on different collecting methods. It is possible for certain platforms to modify their algorithms from time to time and, therefore, impact the resulting statistical data. The above-mentioned data resulted from the Company's research at the end of each quarter reported here, unless otherwise stated.

The search results of the keyword "ESP32" include the ESP32 series, ESP32-C series, ESP32-S series, and ESP32-H series.

Business Model
Business-to-Developer-to-Business (B2D2B)

Espressif has deployed the Business-to-Developer type of marketing, not only because it has gained prominence in recent years, but also because it has proven to be more effective since the influence of developers on organizations of all sizes has gained traction. In other words, most developers are R&D employees in various companies and bring forth business opportunities from the companies they work for.

This way, the developer ecosystem we have created at Espressif demonstrates how the value of networks can grow exponentially:

· The more developers we attract as customers, the more hardware and software solutions we generate.

· The more successful hardware and software solutions we create, the more our reputation spreads with positive feedback from happy customers/developers.

· The above-mentioned interaction between people in our network prompts the creation of more content, which -in turn- attracts more users/developers searching for new content.

· Likewise, other third-party development platforms join our ecosystem and bring in new developers, as our influence continues to grow.

Having successfully applied the B2D2B model, Espressif can now focus on R&D investments, while maintaining a small business team that supports a large number of customers directly. In fact, most of our revenue is gained through direct sales.

Books about ESP Products

More than 200 books on how to use ESP products can be found in the developer community and cover over a dozen languages.

Research and Development

R&D Investment

R&D investment is at the heart of Espressif Systems' development. During the reporting period, R&D cost CNY 404 million, which marked a 19.75% increase compared with that of 2022. At the same time, the R&D-to-sales ratio was 28.17% in 2023.

Espressif's escalating R&D investment cost can be attributed to the increase in the number of R&D staff and their subsequent compensation level, which increased significantly year-over-year.

CNY	Fiscal Year		
	2023	2022	change (%)
R&D Expenses	403,713,557	337,121,814	19.75
R&D-to-sales ratio	28.17%	26.52%	

Intellectual Property

We seek to protect our technologies through a combination of patents, software copyright and trade secrets. By the end of 2023, the Company had been granted 167 patents. We continue to submit new patent applications relating to our recent R&D innovations.

250 Applied for

167 Granted

List of Intellectual Property Rights Applied and Granted

	2023		Cumulative number	
	Applied for	Granted	Applied for	Granted
Invention patents	17	17	136	89
Utility model patents	1	0	27	26
Design patents	0	0	1	1
Software copyright	0	2	23	23
Others	8	7	63	28
Total	**26**	**26**	**250**	**167**

N.B.: The number of patents that have been "applied for" does not include the rejected applications in China, or the PCT patent applications not submitted to any particular country, or any patent applications beyond the reporting period. The number of "granted" patents includes those with expired IP rights. The category of "others" includes overseas (non-Chinese) patent applications, i.e. the PCT patent applications, U.S. patent applications through the PCT route or the Paris Convention route, as well as patent applications in India.
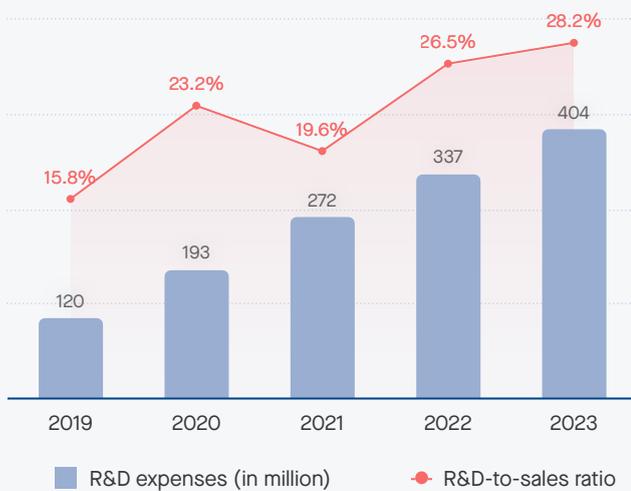
R&D Employees

We are proud of our talented, diverse and multicultural workforce. By December 31, 2023, across our eight branches worldwide, we had employed 625 people, more than 77% of whom are in engineering roles. Meanwhile, we have expanded our business beyond Wi-Fi MCUs, thus offering innovative solutions to wireless connectivity and processing, including AI, RISC-V MCU, Wi-Fi 6, Bluetooth LE, Thread, Zigbee and other IoT-related technologies.

Since the research and development of software and hardware are inextricably intertwined, we constantly invest in software technology, too. Hence, we are currently focused on AIoT technologies, including toolchains, compilers, operating systems, application frameworks, AI algorithms, Cloud products, apps, etc. Our aim is to make Espressif a one-stop solution-provider offering anything relating to hardware, software and the Cloud.

	Fiscal Year	
	December 31, 2023	December 31, 2022
R&D employees	484	440
R&D employees as a percentage of total employees	77.44%	76.12%
Total compensation of R&D employees (CNY in thousands)	311,955	270,083
Average compensation of R&D employees (CNY in thousands)	675	652

R&D Expenses

R&D expenses (in million)   •— R&D-to-sales ratio

R&D Employees

R&D employees   •— R&D employees %
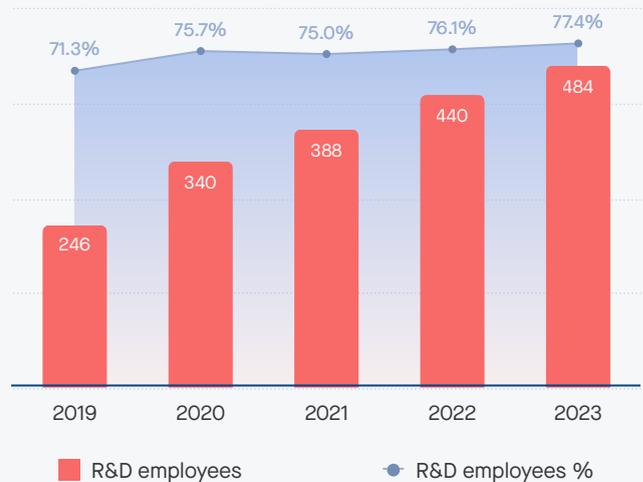
Ownership of Securities
Basic information of securities

Share types	Ordinary share
Share capital	80,789,724 (as of December 31, 2023)
Listing	Shanghai Stock Exchange (SSE)
Ticker	688018.SH
Listing Date	2019-07-22

Shareholder Structure as of December 31, 2023

Shareholder	Share Numbers	Percentage (%)
Espressif (Hong Kong) Investment Ltd.	33,047,244	40.91
Hong Kong Securities Clearing Company Limited	2,422,305	3.00
Shinvest Holding Ltd.	2,226,179	2.76
Dajia Life Insurance Co., Ltd. – Universal Products	1,978,918	2.45
Ningbo Meishan Free Trade Port Le Tun Investment Management Partnership (Limited Partnership)	1,046,030	1.29
SPD - Debang Semiconductor Industry Hybrid Initiated Securities Investment Fund	702,322	0.87
GTJA Futures - Guolian An CSI Semiconductor Products and Equipment Tradable Open-ended Index Securities Investment Fund	693,996	0.86
Wisdomshire Asset Management Co., Ltd. - Wisdomshire Youfu Private Equity Securities Investment Fund No.1	588,266	0.73
Wisdomshire Asset Management Co., Ltd. - Wisdomshire Youfu Private Equity Securities Investment Fund No.3	493,595	0.61
BOC - Zhong Ou High-quality Enterprise Mixed Fund	489,956	0.61
Top 10 shareholders	**43,688,811**	**54.09**
Espressif Systems (Shanghai) Co., Ltd. Repurchase Special Securities Account	1,473,900	1.82
Other public shareholders	37,100,913	45.91
Total of outstanding shares	**80,789,724**	**100.00**

Stock-Based Compensation

Espressif has four ongoing restricted stock incentive plans. The fair value of the restricted stock incentive plans is calculated by using the Black-Scholes model. The following table presents details of stock-based compensation costs acknowledged in the Consolidated Statements of Income.

Restricted Stock Incentive Plans

Plan	Award Type	Number of Underlying Shares	Ratio of Underlying Shares (%)	Number of Employees in the Plan	Proportion of Awarded Employees to Total (%)	Grant Price (CNY)
2019 restricted stock incentive plan	Class II restricted	189,700	0.2348	18	2.88	62.025
2020 restricted stock incentive plan	Class II restricted	140,193	0.1735	120	19.20	92.025
2021 restricted stock incentive plan	Class II restricted	670,319	0.8297	199	31.84	92.900
2022 restricted stock incentive plan	Class II restricted	811,814	1.0048	148	23.68	118.400
2023 I restricted stock incentive plan	Class II restricted	62,478	0.0773	22	3.52	60
2023 II restricted stock incentive plan	Class II restricted	551,130	0.6822	53	8.48	40
2023 III restricted stock incentive plan	Class II restricted	67,434	0.0835	7	1.12	64.5

N.B.:

The above-mentioned numbers were calculated on December 31, 2023.

The grant price has been adjusted due to dividend distribution.

Stock-Based Compensation

CNY	Fiscal Year	
	December 31, 2023	**December 31, 2022**
Selling expenses	828,040	669,137
G&A expenses	172,349	1,398,357
R&D expenses	17,737,027	12,658,526
Total stock-based compensation	18,737,416	14,726,019

Risks and Uncertainties

Financial Risk

The Company performs periodic credit evaluations of its customers' financial condition and generally requires of its customers no collateral. The Company provides an allowance for expected credit losses, based on the net amount expected to be collected on such receivables. Losses have not been significant for any of the periods presented in this report.

R&D Risk

Espressif's research and development strategy is focused on leveraging new technologies for the creation of innovative AIoT products. Any delays or changes in the development of these technologies by our industry partners, or a failure of our products to achieve market acceptance, could compromise our competitive position.

Competitors

As the market for AIoT products grows, we face an increasing antagonism from relatively large competitors, such as Realtek, MediaTek, Infineon, NXP, Qualcomm and others. Intense competition from current players, as well as new entrants, such as Silicon Labs and Nordic, may reduce our product sales and market share.

Suppliers

A significant portion of the Company's products is fabricated by the Taiwan Semiconductor Manufacturing Company Limited (TSMC). The inability of TSMC to deliver wafers to the Company in a timely manner could impact the production of the Company's products for a certain period of time, which could have an adverse effect on the Company's business, financial condition, results of operations and cash flow.

Customers

The Company sells directly to end customers, distributors, solution providers and contract manufacturers. Our customers are a mix of several big customers and numerous small customers. The concentration ratio for our top-five customers was 28.1% in 2023.

Consolidated Financial Statements
Consolidated Balance Sheet

CNY	Dec 31, 2023	Jan 1, 2023	Dec 31, 2022
Assets			
Current assets:			
Cash and cash equivalents	464,011,234	350,677,354	350,677,354
Held for trading financial assets	90,315,219	461,223,082	461,223,082
Notes receivable	42,082,006	789,099	789,099
Accounts receivable, net	251,641,263	198,406,116	198,406,116
Accounts receivable financing		1,441,520	1,441,520
Prepayments	9,802,407	9,724,045	9,724,045
Other receivables	9,157,910	9,578,753	9,578,753
Including: Interest receivable		838,168	838,168
Inventories	242,352,587	448,981,896	448,981,896
Other current assets	106,338,922	228,089,444	228,089,444
Total current assets	**1,215,701,548**	**1,708,911,310**	**1,708,911,310**
Non-current assets:			
Debt investment	753,024,500	212,484,600	212,484,600
Investment in other equity assets	36,079,840	35,340,648	35,340,648
Other non-current financial assets	34,879,347	19,879,347	19,879,347
Fixed assets	76,401,004	60,243,507	60,243,507
Right-of-use assets	15,937,207	21,692,767	21,692,767
Intangible assets	1,633,298	2,412,317	2,412,317
Long-term deferred expenses	9,337,814	6,565,887	6,565,887
Deferred income tax assets	60,805,808	16,205,653	15,266,444
Total assets	**2,203,800,366**	**2,083,736,034**	**2,082,796,825**

Consolidated Balance Sheet

CNY	Dec 31, 2023	Jan 1, 2023	Dec 31, 2022
Liabilities & Shareholders' Equity			
Current liabilities:			
Accounts payable	79,841,809	77,918,867	77,918,867
Contract liabilities	13,318,710	9,044,287	9,044,287
Payroll payable	102,238,914	85,041,335	85,041,335
Taxes payable	615,415	5,211,995	5,211,995
Other payable	11,525,208	2,925,552	2,925,552
Non-current liabilities due within one year	8,591,447	9,607,030	9,607,030
Other current liabilities	501,689	778,437	778,437
Total current liabilities	**216,633,192**	**190,527,502**	**190,527,502**
Non-current liabilities:			
Lease liabilities	8,454,747	12,839,126	12,839,126
Provisions	627,089		
Deferred income tax liabilities	65,085,110	53,691,871	52,752,662
Total liabilities	**290,800,138**	**257,058,499**	**256,119,290**
Owners' equity (or shareholders' equity):			
Share capital	80,789,724	80,484,430	80,484,430
Capital reserves	1,358,508,382	1,309,813,001	1,309,813,001
Less: Treasury stock	146,969,563	40,966,012	40,966,012
Other comprehensive income	24,067,306	16,946,374	16,946,374
Surplus reserves	55,460,195	46,570,910	46,570,910
Retained earnings	541,144,184	413,828,832	413,828,832
Total shareholders' equity	**1,913,000,228**	**1,826,677,535**	**1,826,677,535**
Total liabilities and shareholders' equity	**2,203,800,366**	**2,083,736,034**	**2,082,796,825**

N.B.:

Starting from 2023, the company will implement the "Accounting Treatment for Deferred Income Tax Related to Asset and Liability Arising from a Single Transaction That Does Not Qualify for Initial Recognition Exemption" as stipulated in Interpretation No. 16 of the Enterprise Accounting Standards issued by the Ministry of Finance. The company will adjust the application of this standard to single transactions that occurred between the beginning of the earliest period reported in the financial statements and the date of the first implementation of this standard. This includes adjusting the lease liabilities, right-of-use assets, estimated liabilities related to disposal obligations and corresponding related assets that were recognized due to the application of this standard on the initial period reported in the financial statements when the standard was first implemented. If there are temporary differences that result in taxable or deductible amounts related to the above-mentioned adjustments, the cumulative impact on retained earnings and other relevant financial statement items at the beginning of the reporting period will be adjusted according to the provisions of this standard and Enterprise Accounting Standard No. 18 - Income Taxes. So, the amount of deferred income tax assets of January 1, 2023 exceeds the amount of December 31, 2022 disclosed in the 2022 annual report by CNY 939,209. The amount of deferred income tax liabilities is also the same.

Consolidated Income Statement

	End of Year	
CNY	**December 31, 2023**	**December 31, 2022**
Revenue	1,433,064,911	1,271,127,201
Cost of Revenue	851,816,379	762,876,133
Gross Profit	581,248,531	508,251,068
Taxes and surcharges	6,096,400	5,269,680
Selling expenses	52,583,650	49,323,100
General and administrative expenses	61,618,348	59,639,944
Research and development expenses	403,713,557	337,121,814
Financial expenses	-9,630,438	1,370,257
Including: Interest expenses	918,131	768,965
Interest income	11,687,008	3,903,309
Add: Other income	13,750,216	10,304,212
Investment income (mark"-" for loss)	27,879,002	24,156,207
Income from changes in fair value (mark"-" for loss)	315,219	1,223,082
Credit impairment losses (mark"-" for loss)	-312,780	-105,594
Assets impairment losses (mark"-" for loss)	-3,230,539	-4,981,614
Assets disposal income (mark"-" for loss)	-9,237	
Operating Income	105,258,896	86,122,566
Add: Non-operating revenue	164,572	58,946
Less: Non-operating expenses	27,721	93,817
Income before income taxes	105,395,747	86,087,694
Provision (benefit) for income taxes	-30,808,890	-11,235,408
Net Income	136,204,637	97,323,103
Earnings per share		
Basic	1.7012	1.2129
Diluted	1.6929	1.2127

	End of Year	
CNY	**December 31, 2023**	**December 31, 2022**
Net Income	136,204,637	97,323,103
Other comprehensive income (loss), after tax		
Changes to the fair value of investment in other equity instruments	278,938	-1,269,304
Currency translation reserves	6,841,994	33,927,257
Other comprehensive income (loss)	7,120,932	32,657,953
Comprehensive income	143,325,569	129,981,056

Consolidated Cash Flow Statement

	End of Year	
CNY	December 31, 2023	December 31, 2022
Operating Activities		
Cash from sales of merchandise and provision of services	1,503,910,409	1,493,812,070
Tax refund	65,278,538	66,050,716
Other received cash related to operational activities	17,610,269	18,771,365
Subtotal of cash inflow from operational activities	1,586,799,216	1,578,634,151
Cash paid for merchandise and services	757,071,099	1,042,903,737
Cash paid to and for employees	363,845,426	312,650,430
Cash paid for taxes and surcharges	69,135,539	62,356,050
Other paid cash related to operational activities	94,149,809	89,402,275
Subtotal of cash outflow from operational activities	1,284,201,873	1,507,312,493
Net cash provided by operating activities	302,597,343	71,321,658
Investing activities		
Cash arising from the disposal of investments	1,838,441,681	2,938,975,287
Cash arising from investment income	6,953,903	6,724,461
Net cash arising from the disposal of fixed assets, intangible assets and other long-term assets	29,128	
Other received cash relating to investment activities	2,415,500	1,936,000
Subtotal of cash inflow from investment activities	1,847,840,212	2,947,635,748
Cash paid for the purchase and construction of fixed assets, intangible assets and other long-term assets	49,360,096	26,220,587
Cash paid for investments	1,901,160,000	2,867,100,000
Other paid cash relating to investment activities	2,100,000	2,050,000
Subtotal of cash outflow from investment activities	1,952,620,096	2,895,370,587
Net cash provided by investment activities	-104,779,884	52,265,160
Financing activities		
Cash arising from the issuance of common stock	30,263,258	28,641,415
Including: Cash arising from subsidiaries absorbing investments by minority shareholders		
Subtotal of cash inflow from financing activities	30,263,258	28,641,415
Cash paid for the distribution of dividends and profits, or payment of interests		128,722,856
Including: dividends and profits paid to minority shareholders by subsidiaries		
Other paid cash relating to financing activities	120,112,997	51,360,071
Subtotal of cash outflow from financing activities	120,112,997	180,082,927
Net cash used for financing activities	-89,849,738	-151,441,512
Impact of fluctuation in exchange rates on cash and cash equivalents	920,652	11,389,321
Net increase in cash and cash equivalents	108,888,373	-16,465,372
Add: Cash and cash equivalent at the commencement of the period	350,677,354	367,142,726
Cash and cash equivalents at the end of the period	459,565,727	350,677,354

Consolidated Cash Flow Statement
- **Indirect Method**

	End of Year	
CNY	December 31, 2023	December 31, 2022
Additional information		
Net income	136,204,637	97,323,103
Adjustments to cash provided by operating activities, for the purpose of reconciling net income:		
Add: provision for the impairment of assets	3,230,539	4,981,614
Credit impairment provision	312,780	105,594
Depreciation of fixed assets	18,992,639	16,066,265
Depreciation of right-of-use assets	12,623,244	10,994,590
Amortization of intangible assets	779,019	779,019
Amortization of long-term prepaid expenses	4,751,710	3,351,764
Losses on disposal of fixed assets, intangible assets and other long-term assets (mark"-" for income)	9,237	
Losses on scrapping of fixed assets (mark"-" for income)	1,391	
Losses on fair value changes（mark"-" for income)	-315,219	-1,223,082
Financial expenses（mark"-" for income)	1,528,459	4,960,685
Losses on investment（mark"-" for income)	-27,879,002	-24,156,207
Decrease on deferred income tax assets（mark"-" for increase)	-45,184,664	-8,891,574
Increase on deferred income tax liabilities（mark"-" for decrease)	11,526,848	-3,375,693
Changes in operating assets and liabilities:		
Decrease in inventories（mark"-" for increase)	205,787,792	-118,521,370
Decrease in operational receivables（mark"-" for increase)	-66,257,845	122,514,414
Increase in operational payables（mark"-" for decrease)	27,748,362	-48,313,483
Others	18,737,416	14,726,019
Net cash flow provided by operating activities	302,597,343	71,321,658

Consolidated Statement of Changes in Equity

CNY	Share capital	Capital reserves	Less: Treasury stock	Other comprehensive income	Surplus reserves	Retained earnings	Total equity
Balance as of December 31, 2021	80,158,963	1,266,771,034		-15,711,579	33,462,951	458,336,543	1,823,017,913
Comprehensive income, net of tax							
Net Income						97,323,103	97,323,103
Other comprehensive income				32,657,953			32,657,953
Transactions with owners							
Capital increase	325,467	40,420,694	40,966,012				-219,850
Stock-based compensation		2,621,273					2,621,273
Surplus reserves					13,107,959	-13,107,959	
Dividends						-128,722,856	-128,722,856
Balance as of December 31, 2022	80,484,430	1,309,813,001	40,966,012	16,946,374	46,570,910	413,828,832	1,826,677,535
Comprehensive income, net of tax							
Net Income						136,204,637	136,204,637
Other comprehensive income				7,120,932			7,120,932
Transactions with owners							
Capital increase	305,294	39,167,386	106,003,551				-66,530,872
Stock-based compensation		9,527,995					9,527,995
Surplus reserves					8,889,285	-8,889,285	
Dividends							
Balance as of December 31, 2023	80,789,724	1,358,508,382	146,969,563	24,067,306	55,460,195	541,144,184	1,913,000,228

Further Information
Terms and Conditions of the Report

Responsibility Statement

The Board of Directors, the Board of Supervisors and the executive management of the Company warrant that the contents of this report are true, accurate and complete, and do not contain any false information, misleading statements or material omissions, severally and jointly accepting any legal responsibility thereof.

Shanghai, 22 March 2024
Espressif Systems

Board of Directors

Teo Swee Ann
Founder and Chairman

Ng Pei Chi
Information Technology Officer

Wang Jue
Deputy General Manager

Teo Teck Leong
Shareholder-elected

Lan Yuzhe
Independent Director

Koh Chuan Koon
Independent Director

Lee Sze Chin
Independent Director

Board of Supervisors

Lv Zhihua
Employee-elected

Fu Hanyu
Shareholder-elected

Wang Yiwen
Shareholder-elected

Executive Management

Teo Swee Ann
Founder and CEO

Wang Jue
Deputy General Manager

Shao Jingbo
Financial Director

Forward-looking Statements

This report contains forward-looking statements and/or assessments about the business, financial condition, performance and strategy of the Espressif Group. These statements and/or assessments are based on assumptions and management expectations resting upon currently available information and current estimates. These are subject to a multitude of uncertainties and risks, many of which are partially or entirely beyond Espressif's control. Espressif's actual business development, financial condition, performance and strategy may, therefore, differ from what is discussed in this report.

Independent Auditor's Report

To the Shareholders of
Espressif Systems (shanghai) Co., Ltd.
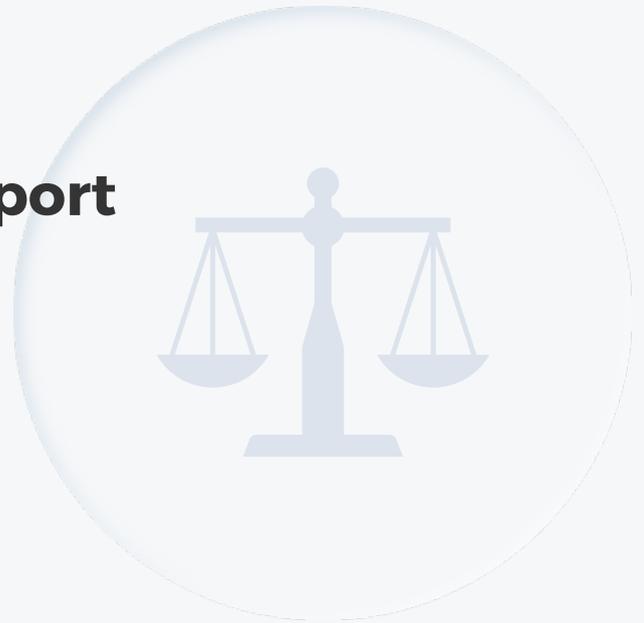
Opinion

We have audited the financial statements of Espressif Systems (Shanghai) Co., Ltd. ("the Company"), which comprise the consolidated balance sheet and balance sheet as of December 31, 2023, the consolidated income statement, the income statement, the consolidated cash flow statement, the cash flow statement, the consolidated statement of changes in equity, and the statement of changes in equity for the year then ended, and the notes to the financial statements.

In our opinion, the enclosed financial statements were prepared in accordance with the Accounting Standards for Business Enterprises (the "ASBE") in all material aspects, and present fairly the consolidated and other financial positions of the company as of December 31, 2023, the consolidated and other results of company operations, and the consolidated and other cash flows of the company for the year then ended.

Basis For the Opinion

We conducted our audit in accordance with China's Standards on Auditing (the "CSA"). Our responsibilities under those standards are further described in the section of our report detailing the "Auditor's responsibilities for the audit of the financial statements". We are independent of the Company, in accordance with the CSA's Code of Ethics for Professional Accountants (the "Code"), and we have fulfilled our other ethical responsibilities, again, in accordance with the Code. We believe that the audit evidence we have obtained is sufficient and appropriate for providing the basis of our opinion.

Key Audit Matters

Key audit matters are those matters that, in our professional judgement, were of the greatest significance in our auditing of the financial statements for the financial year from January 1, 2023 to December 31, 2023. These matters were addressed in the context of our audit of the financial statements as a whole, and in forming our opinion thereon, we do not provide a separate opinion on these matters.

Key Audit Matter	How our audit addressed the Key Audit Matter

Revenue Recognition

Espressif's main business includes the sales of chips and modules, which created a revenue of CNY 1,433,064,911 in 2023.

Since the operating revenue is a key performance indicator, there is an inherent management risk when adjusting the time point of revenue recognition, in order for it to coincide with certain goals or expectations. Therefore, we identify revenue recognition, too, as a key auditing matter.

Our main auditing procedures for revenue recognition are as follows:

> Understanding and evaluating the effectiveness of the internal control design relating to the revenue recognition of product sales, and testing the effectiveness of the critical control point.

> Evaluating the appropriateness of the sales revenue recognition policy by interviewing the management, reviewing the main terms of the sales contracts and the time point of major control transfers relating to the revenue recognition.

> Checking the origin of revenue by performing analytical procedures for the operating revenue, including monthly sales analysis, as well as gross profit analysis categorized by customers and products.

> Checking the authenticity of revenue by sampling supporting documents related to revenue recognition, such as sales contracts, shipping records and customer receipts.

> Performing a confirmation procedure on the current amount of sales by using the sampling method.

> Checking commercial information and the transaction prices paid by important customers, in order to determine whether any abnormal transactions were made by the company.

> Performing a cut-off test to check whether the revenue recognition is recorded within the correct accounting period.

Inventory

As of December 31, 2023, the inventory balance amounts to CNY 254,206,520 with provision for inventory impairment CNY 11,853,933, and a net book value amount of CNY 242,352,587.

Since most inventories are stored in warehouses entrusted by external processors and third parties, and the determination of provision for inventory impairment involves significant management judgment and estimation, we identify the existence of inventories and the provision for inventory impairments as key matters.

Our main auditing procedures for the inventory are as follows:

> Evaluating the effectiveness of the internal control design of the inventory management, and testing the effectiveness of the critical control point.

> Analyzing the rationality of the inventory balance fluctuation at the end of the reporting period by investigating its production cycle and stock policy.

> Performing a confirmation procedure on the third-party warehouse.

> Implementing a supervision on the inventory check at the end of the reporting period.

> Evaluating whether the provision for inventory impairment at the end of the reporting period is fully accrued by conducting storage age analysis and by reviewing the calculation model and the results of provision for inventory impairment.

> Calculating the inventory turnover and making a comparison to other similar companies.

Other Information

The management of Espressif Systems (Shanghai) Co., Ltd. (henceforth, "the management") is responsible for any information on all aspects of the 2023 company report, apart from the financial statements and the auditor's report on them.

Our opinions on the financial statements and the group management report do not cover the rest of the information provided here, and consequently we do not express an opinion or any other form of assurance conclusion thereof.

In connection with our audit, our responsibility is to read the rest of the information provided and, in so doing, consider whether this information:

> is materially inconsistent with the consolidated financial statements, with the group management report information audited for content or our knowledge obtained in the audit, or

> appears to be materially misstated.

If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact. However, we have nothing to report in this regard.

Management's Responsibilities for the Financial Statements

The management is responsible for the preparation of financial statements that give a true and fair view, in accordance with the ASBE, and for the design, implementation and maintenance of such internal controls as the management deems necessary, to enable the preparation of financial statements that are free from material misstatements, whether due to fraud or error.

In preparing the financial statements, the management is responsible for assessing the Company's ability to continue its operation, disclosing, as applicable, any matters related to ongoing concerns and using them as the basis of accounting, unless the management either intends to liquidate the Company or cease its operations, having no realistic alternative but to do so.

Auditor's Responsibilities for the Auditing of the Financial Statements

Our objectives are to obtain reasonable assurances about whether the financial statements as a whole are free from material misstatements, due to either fraud or errors, and to issue an auditor's report that includes our true opinion. Reasonable assurances provide a high level of confidence, but are not a guarantee that an audit conducted in accordance with CSAs will always detect a material misstatement when and where it exists.

Misstatements can arise from fraud or errors and are considered substantial if, individually or in aggregate, they could reasonably be expected to influence the economic decisions of users, taken on the basis of these financial statements.

As part of an audit in accordance with CSAs, we exercise our professional judgment and maintain professional skepticism throughout the audit. We also:

> Identify and assess the risks of substantial financial misstatements, due to either fraud or errors; design and perform auditing procedures in response to those risks, and obtain auditing evidence that is sufficient and appropriate for providing a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal controls.

> Obtain an understanding of internal controls relevant to the audit, in order to design auditing procedures that are appropriate to the circumstances.

> Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the management.

> Conclude on the appropriateness of the management's use of a growing concern as the basis of accounting and, according to the auditing evidence obtained, determine whether a substantial uncertainty exists about events or conditions that may cast a significant doubt on the Company's ability to continue its operation. If we conclude that there is substantial uncertainty, we are required to draw users' attention to our auditor's report on the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the auditing evidence obtained up until the date of our auditor's report. However, future events or conditions may force the Company to cease its operation altogether.

> Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and determine whether the financial statements represent the underlying transactions and events in a manner that achieves a fair presentation.

> Obtain sufficient and appropriate auditing evidence about the financial information of entities or business activities of the Company, in order to express our auditing opinion on the Company's consolidated financial statements. We are responsible for directing, supervising and executing group audits and assume full responsibility for auditing opinions.

We communicate with those charged with governance, among other matters, on the planned auditing scope, timing and significant audit findings, including any significant deficiencies in internal controls that we may identify during our audit.

We also provide those charged with governance with a statement that we have complied with all relevant ethical requirements regarding our independence, and we also communicate with them all relationships and other matters that may reasonably be thought to bear on our independence and, where applicable, any other related protections.

From the matters communicated to those charged with governance, we determine which matters are of the highest significance in the auditing of the financial statements of the current period and are, therefore, the key auditing findings. We describe these findings in our auditor's report, unless a law or regulation prohibits such public disclosure about those findings, or when -in extremely rare circumstances- we determine that a finding should not be communicated in our report, because the adverse consequences of its disclosure would reasonably be expected to outweigh the benefits of such communication for the public interest.

Beijing, 22 March 2024

Baker Tilly China

Ma Gang   Yu Yanli

Chinese Certified Public Accountant   Chinese Certified Public Accountant

List of abbreviations

AI	Artificial Intelligence
AIoT	Artificial Intelligence and Internet of Things
Bluetooth LE	Bluetooth Low Energy
CEO	Chief Executive Officer
CES	Consumer Electronics Show
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
Espressif	ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD.
G&A	General and Administrative
GM	Gross Margin
HMI	Human-Machine Interaction
IC	Integrated Circuit
IoT	Internet of Things
MCU	Microcontroller Unit
OBD	On-Board Diagnostics
R&D	Research and Development
RF	Radio Frequency
RISC-V	Reduced Instruction Set Computer-V
ROE	Return on Earnings
RTOS	Real-Time Operating System
SG&A	Selling, General and Administrative
SH	Shanghai
SoCs	System on Chips
YoY	Year-on-Year

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