Everything for Memory

Longsys Company Profile

A Branded Semiconductor Memory Enterprise

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03 R&D Capability

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05 Business Model

01

Company Profile

Overview of Memory Industry Chain

longsys

Upstream

Memory Wafer Fabless and IDMs (Wafer Manufacturers)

长江存储
SK hynix
micron
SAMSUNG
KIOXIA
SOLIDIGM
CXMT 长鑫存储技术有限公司
Western Digital
dosilicon 东芯半导体
GigaDevice
longsys
Nor/SLC

Memory Controller (Longsys Involved)

SiliconMotion
MARVELL
PHISON
MaXio
YEESTOR
longsys

Packaging and Test (Longsys Involved)

日月光集團
KYEC
JCET
PTI
OSE
SPIL
HUA TIAN
TF 通富微电
深科技 KAIFA

longsys
Longforce Suzhou
Zilia Technologies

Memory IDMs (Module/Product Development)

SAMSUNG
Western Digital
KIOXIA

Memory IDMs (Brand Operation)

Memory Module/Product Suppliers

longsys
PHISON

Memory Brands

Lexar
Kingston
ADATA
FORESEE
Transcend
innodisk

Commercial Grade
Industrial/Automotive Grade
Enterprise Grade
OEM

Downstream Application Scenarios

Smart Devices
PC/Server
Photography/ Serucity
Wearable Devices
Automotive Electronics
Commercial/ Professional Devices
AI/Robotics
Networking

About Longsys

A Branded Semiconductor Memory Enterprise

- Founded in 1999 and engaged in the R&D, design, packaging & test, manufacture and sales of semiconductor memory products.
- Focuses on global industry applications and high-end consumer markets.
- Insists on R&D investment, leading the industry in patents and technology reserves.
- Won "Little giants", Guangdong province Top 500 Enterprises, 2024 Fortune China Tech 50 and many other honors.

2024 Q1-Q3 Revenue	YoY Growth	R&D Personnel
USD 1.893 billion	+101.86%	1000+

2023 Annual Revenue	YoY Growth
USD 1.427 billion	+21.55%

Data Source: 2023 Annual Report of Shenzhen Longsys Electronics Co., Ltd.
2024 HI Report of Shenzhen Longsys Electronics Co., Ltd.
Data as of June 30, 2024
The exchange rate is official rate on 30 September 2024

2 Brands

FORESEE®

Lexar®

4 Product Lines

- Embedded Storage
- Solid-State Drives
- Mobile Memory
- Memory Modules

Global Top 2 in 2022 — **Mobile Memory (Lexar memory cards)**

Data Source: Omdia (IHS Markit)

Global Top 4 in 2023 — **Embedded Storage (eMMC & UFS)**

Data Source: China Flash Market (CFM)

Global Top 4 in 2023 — **Embedded Storage (LPDDR)**

Data Source: China Flash Market (CFM)

Milestones

longsys

1999

Founded in 1999

longsys

2011

Established the industry storage brand FORESEE

FORESEE®

2017

Acquired Lexar, an international high-end storage brand

Lexar

2019

Initiated Series A financing

Opened the Zhongshan Storage Industrial Park

2020

Established the Shanghai Lingang R&D Center

2021

Established the Shanghai headquarter in Lingang, Shanghai

2022

Listed on the Shenzhen Stock Exchange with the stock code 301308.SZ

2023

Successfully mass produced the in-house memory controller, WM6000/WM5000, the controllers of eMMC and SD cards

Successfully acquired 70% equity stake in Longforce Suzhou

Longforce

Successfully acquired 81% stake in Zilia Technologies

zilia

2024

Publicly proposed two business models, TCM (Technology Contract Manufacturing) and PTM(Product Technology Manufacturing)

Selected for 2024 Fortune China Tech 50 list

Globalization

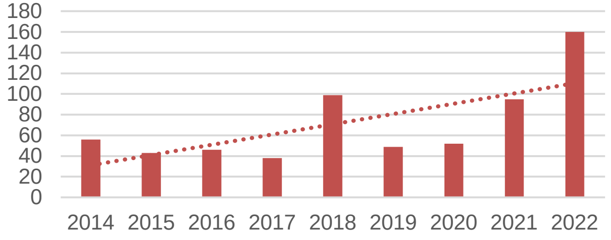
Longsys has now established a global structure, with branches in Hong Kong, Taiwan, the Americas, Europe, Japan, and other regions.

IP Moats

Technology Innovation

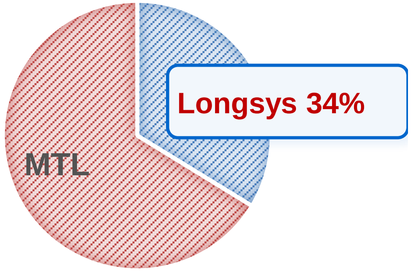
Continuous transformation of R&D achievements
Invention patent applications grow by an average of 14%

High-quality patent applications



Standard Essential Patents (SEPs)

Longsys has obtained the license globally, which cover eMMC, UFS, SD&SSD



Memory Technology LLC SEP Patent Assets Schematic
(Non-Asia Pacific patents remain with MTL)

SD Key Player

Longsys joined SD Associations, involved in SD standard (Lexar), and reached strategic cooperation with SD-3C to build the fair market environment.

China memory card standard

As one of the co-founder of the ITMA, Longsys actively promotes NM Card and jointly build the ITM patent pool to create an innovative and win-win NM Card ecosystem.

560
Valid granted patents

104
International patents

119
Software copyrights

221
Invention patents

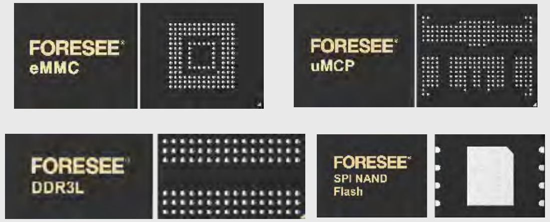
7
Integrated circuit layout designs

Data as of June 30, 2024

Overview of Product Lines

longsys

Embedded Storage



FORESEE

- eMMC
- UFS
- LPDDR
- DDR
- eMCP
- uMCP
- ePOP
- SLC NAND flash
- NAND-based MCP

Mobile Memory

FORESEE **Lexar**

- Micro UDP/UDP 3.0
- USB 3.0 flash drive
- Fingerprint encryption USB drive
- Consumer SD/microSD card
- Industrial SD/microSD card
- Network storage

Solid-State Drives

FORESEE **Lexar**

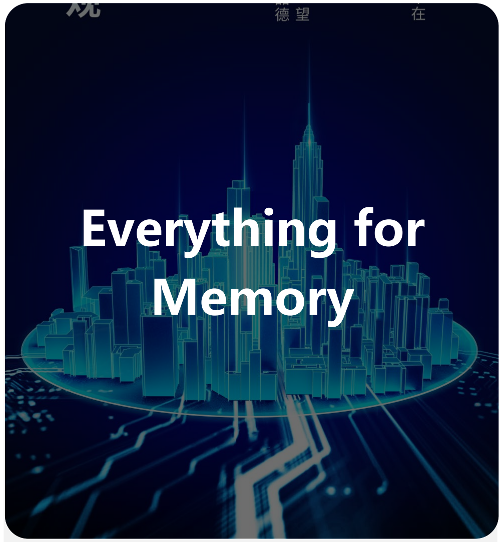
- 2.5inch SSD
- mSATA SSD
- M.2 SSD
- BGA SSD
- PSSD

Memory Modules

FORESEE **Lexar**

- DDR4 UDIMM
- DDR4 SODIMM
- DDR4 RDIMM
- DDR5 UDIMM
- DDR5 SODIMM
- DDR5 RDIMM
- CXL 2.0 Memory Expansion Module
- LPCAMM2

Company Culture



Everything for Memory

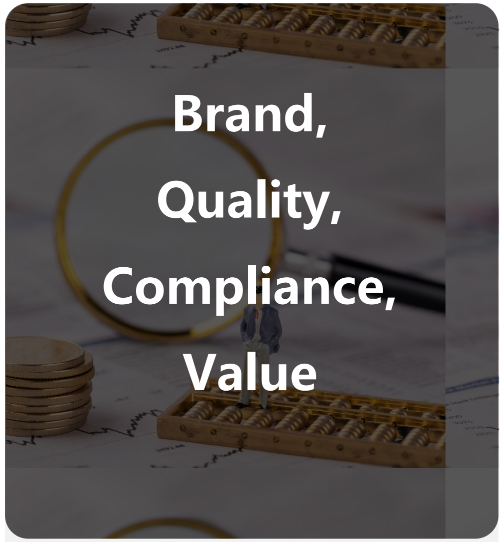
Vision

Being pragmatic, Independent innovation, Joint entrepreneurship

Values

Brand, Quality, Integrity, Exceeding customer expectations

Missions



Brand, Quality, Compliance, Value

Principles

02

Product Brands Introduction

Lexar-Consumer Storage Brand

Brand Introduction

Establishment Time	Birthplace	Acquisition Time
1996	United States	Acquired by Longsys in 2017

Business Overview

Serving Countries or Regions

50+

Market Status

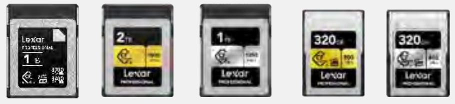
- Lexar SSD: Global Top 3 in 2022
- Lexar SSD: Top 1 in Poland in Q3 2023
- Lexar SSD: Top 1 in Vietnam in Q3 2024

Data Sources: TrendForce, GFK, Vietnam Customs Import and Export Data

Honors and Awards

Overview of Lexar Products

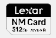
Memory Cards



CFexpress

SDHC/SDXC

microSDHC/SDXC



NM Card

Portable Storage

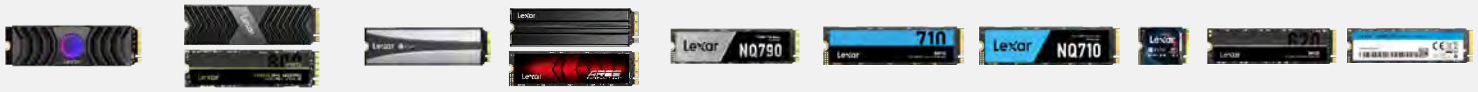
Portable SSD

Portable SSD with hub

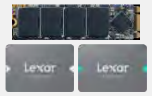
USB 3.2 Gen 1

USB 3.2/Fingerprint

SSD



M.2 SSD



SATA SSD

Memory Module

DDR5

DDR4

Accessories

Card Reader

Enclosure

workflow

FORESEE-Industry Storage Brand

Brand Introduction

Establishment Time	**Product Lines**
2011	Embedded Storage, mobile memory, solid-state drives (SSDs), and memory modules

Multiple Reliability Standards **Cover Wide Range of Applications**

Industry-grade, industrial-grade, automotive-grade and enterprise-grade

Business Overview

Market Status	**Products and Services**
eMMC and UFS: Global Top 4 in 2023	In-house firmware Customized Service

Data Source: Data of China Flash Market (CFM)

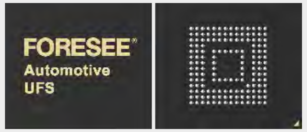
Honors and Awards


中国芯
CHINACHIP
2022年第十七届“中国芯”
优秀技术创新产品
企业名称：深圳市江波龙电子股份有限公司
芯片名称/型号：FORESEE 512Mb SPI NAND Flash
产品类别：存储芯片
CCID赛迪 中国电子信息产业发展研究院


证　书
2022 中国国际社会公共安全产品博览会
创新产品优等奖

Overview of FORESEE Products

Industrial/Automotive



Automotive UFS

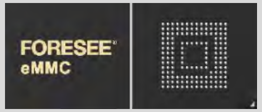
Automotive eMMC

Industrial wide-temperature eMMC

Industrial eMMC

SPI NAND flash

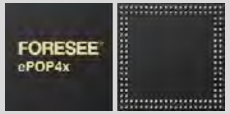
Embedded storage



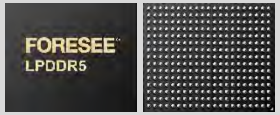
eMMC

UFS

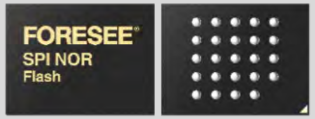
uMCP



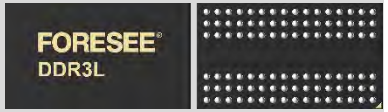
ePOP



LPDDR



SPI NOR Flash



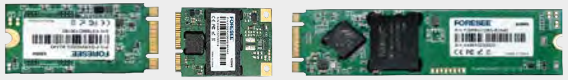
DDR3L

SSDs

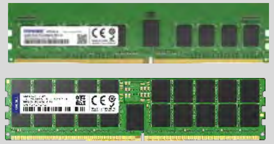
SATA SSD

PCIe SSD

SATA/PCIe eSSD


Industrial SSD

Memory Module


Enterprise DDR4/DDR5


Commercial DDR4/DDR5


Industrial DDR4


LPCAMM2


CXL2.0 Memory Expansion Module

SD Cards

EPLUS V30 SD

Industrial SD

Industrial WT SD

Industrial WT microSD

Industrial pSLC microSD

03

R&D Capability

In-house Memory Controller Superior reliability, performance and power consumption

In-house LDPC algorithm, Supports SRAM error detection, Adopts 28nm process of Samsung, Cumulative Sales ＞10 million dies

eMMC 5.1 memory controller

Sequential read speed ≥345MB/s	Sequential write speed ≥310MB/s
Random read speed ≥220MB/s	Random write speed ≥190MB/s

The read and write performance is based on a 128GB product.

SD 6.1 memory controller

Read speed ≥200MB/s	Write speed ≥150MB/s

The read and write performance is based on a 128GB product.

Based on the same HS400 test platform

eMMC Comparison		**3DV6+ Mainstream controller**	***3DV6 + WM6000***
Performance (Seq. R/W) (MB/s)	32GB	335/200	*345/215*
	64GB	335/205	*345/220*
	128GB	335/280	*345/310*
Performance (Ran. R/W) (MB/s)	32GB	110/85	*205/170*
	64GB	110/85	*205/170*
	128GB	170/100	*220/190*
Active Power Consumption ICC/ICCQ (mA)	32GB	70/95	*75/70*
	64GB	70/95	*80/75*
	128GB	90/100	*90/85*

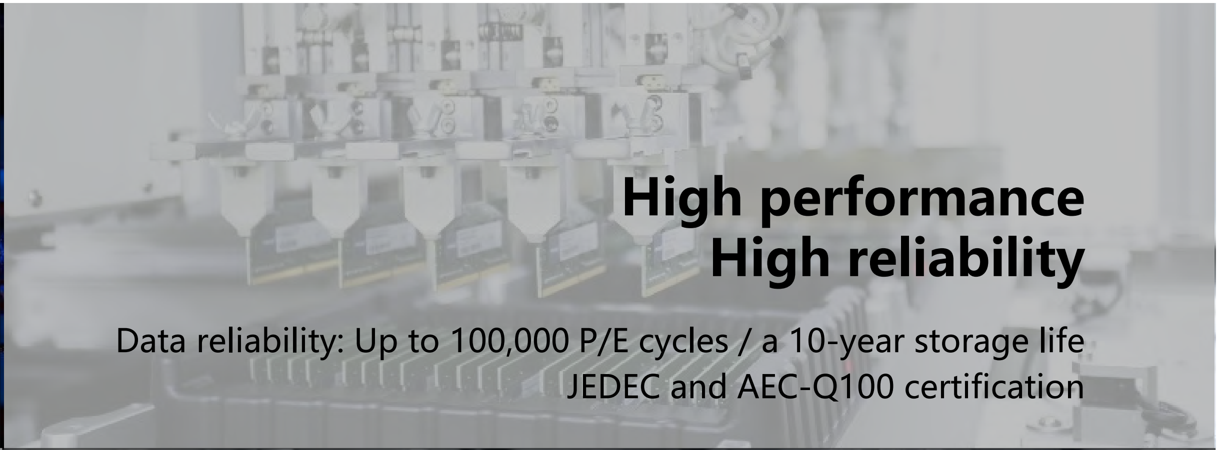
15%-30% advantages vs. competitor

In-house SLC NAND Flash

Unlocks Flash technology to provide innovative small capacity memory solutions, cumulative shipments > 100 million dies

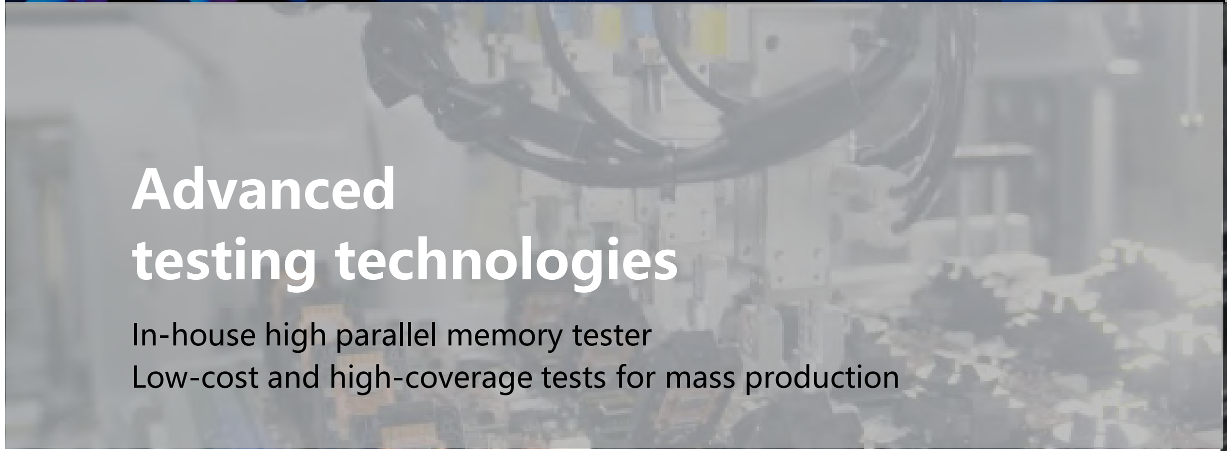
Product diversification

Capacity : 512Mb ~ 8Gb. First 512Mb SPI NAND in mainland China.
Packaging: TSOP/BGA/WSON



High performance High reliability

Data reliability: Up to 100,000 P/E cycles / a 10-year storage life
JEDEC and AEC-Q100 certification



Advanced testing technologies

In-house high parallel memory tester
Low-cost and high-coverage tests for mass production

Quality management system

SPC, SYL, and SBL
Granular process traceability

Industry-Leading Firmware Capabilities

Products

- **20 years** of independent firmware development experience, covering **eMMC/UFS/cSSD/eSSD/SD/USB/CFE**
- A unified firmware platform across product lines, and leading algorithms and architecture allow fast adaptation to new media, protocols, and controllers
- Outstanding customization capabilities to meet non-standard specifications needs from customers

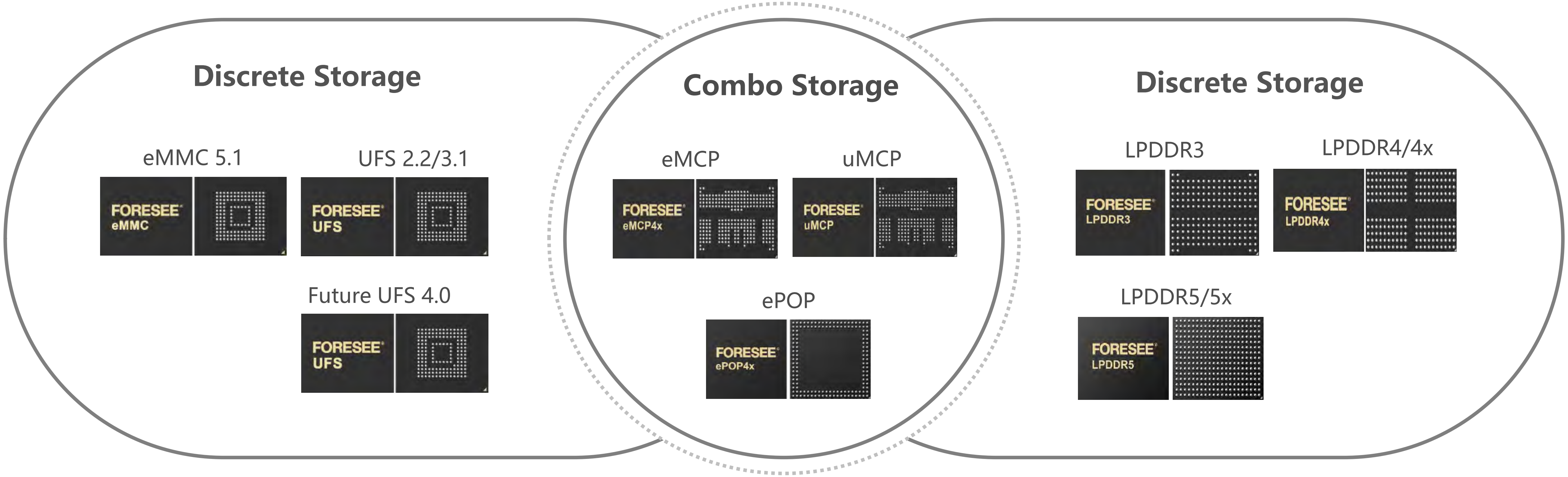
Test Coverage

- **5,000+/5,000+** eMMC and UFS white/black box test cases
- **3,000+/5,000+** eSSD white/black box test cases
- Comprehensive coverage of protocols, algorithms, performance, power consumption, high/low temperature, compatibility, electrical, reliability, NAND, hardware, and more.
- High efficiency and reliability production line test cases.
- Well-established testing processes, including daily integration testing, test coverage, code branch unit testing, customer testing, system testing, error and exception scenario testing, and more, along with stringent code quality control.

Team Strength

- **400+** firmware engineers
- **100+** hardware and engineering team engineers
- **30+** Flash research engineers
- **200+** test engineers
- Most of the senior architects and firmware engineers have more than **15 years** of R&D experience, with experience in developing many Flash products that have achieved great success in the marketplace

Embedded Storage



Discrete Storage

eMMC 5.1

UFS 2.2/3.1

Future UFS 4.0

Combo Storage

eMCP

uMCP

ePOP

Discrete Storage

LPDDR3

LPDDR4/4x

LPDDR5/5x

FORESEE has been working on embedded storage products for 13 years, and such products are widely applied in various fields such as consumer smartphones, tablets, smart TVs, and set-top boxes. The eMMC products feature in-house memory controller, packaging factory, software technologies, and other core technologies.

WM6000, its eMMC in-house memory controller, is now available to customers. FORESEE has also established long-term cooperation with Qualcomm, MediaTek, UNISOC, and other ICs suppliers.

Enterprise Storage

Enterprise PCIe 4.0 NVMe SSD

Meets the needs of high-density reading and writing applications in data centers, capacity included:
standard DWPD for 1.92TB/3.84TB/7.68TB
ultra-high DWPD for 1.6TB/3.2TB/6.4TB

Enterprise SATA SSD

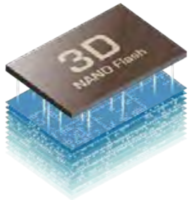
Meets the storage needs of data centers for startup disk and data disks, including 480GB/960GB/1.92TB/3.84TB/7.68TB

Enterprise RDIMM

32GB/64GB DDR4
32GB/64GB/96GB DDR5

Multiple Types of NAND and DRAM

Adopts NAND and DRAM



CXL Memory Expansion Module

Supports CXL2.0 protocol, E3.s/AIC physical interface and form factor. Supports multiple capacity options, available in 128GB/192GB/256GB/512GB

Compatible with mainstream server system platforms

First-mover Advantage in Automotive Storage Products

Automotive eMMC
Debut in mainland China

Automotive UFS
Debut in mainland China

Automotive LPDDR4x

Automotive SPI NAND Flash

Industrial SSD

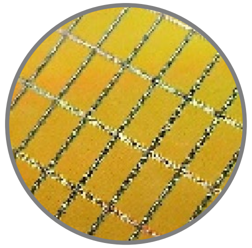
Industrial DIMM

Industrial DDR3L

Industrial/Industrial Wide-Temperature SD/microSD

Video Recorders SATA SSD

In-Vehicle Data Backup



Multiple Types of NAND
SLC/pSLC
2D MLC / 3D NAND

Industrial SD/microSD

Vehicle Data Black Box
AES encryption references EU black box standards for small and medium sized aircraft
EUROCAE ED-155:2009

Localization services, 8+ years of stable supply capability, 24/7 on-site support services, Mass production capability, Serving 20+ global automotive brands, 10+ in-vehicle applications (including DVR, ADAS, cockpit, IVI, instrumentation, and T-box) , Passed the tests of 20+ SOC main control platforms.

04

Packaging & Test Manufacturing Capability

Comprehensive Layout in Global Supply Chains

Zhongshan Storage Industrial Park

Zhongshan, China

Suzhou Packaging and Test Manufacturing Base

Suzhou, China

South America Manufacturing Operation Center

Atibaia, Brazil

Manaus, Brazil

Zhongshan Storage Industrial Park

Zhongshan Storage Industrial Park, located near the exit of the Shenzhen-Zhongshan Bridge. Covering an area of approximately 75 acres and integrating **product R&D, testing, cultural displays, and a living space for employees**, this park is devoted to **data center storage products**.

Phase I: Opened in 2019

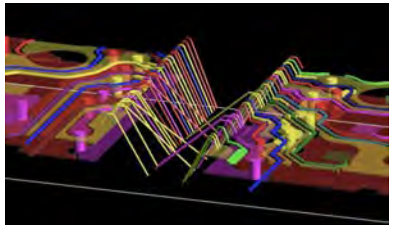
Covering an area of around 60,000m², this area currently holds 500+ employees, over 400 of whom are engineers. It is divided into four sections: the office area, test area, display area, and living area.

Phase II: Will be operational in April 2025

The construction area of the Phase II project is about 110,000m². The main zones include an R&D building, an embedded storage test center, a data center storage line, an intelligent logistics and warehousing area, and other functional areas.

Innovation Labs in Zhongshan Storage Industrial Park

This facility combines R&D design, failure analysis, engineering verification, and joint development, serving as a crucial quality assurance and technical service platform for Longsys.


Design simulation


Reliability analysis


Signal analysis

Failure analysis


Chip analysis


Material analysis

Testing Center in Zhongshan Storage Industrial Park

- An automated production line from chip sorting to SLT testing of finished products.
- The in-house automated test system can achieve functional testing of more than ten kinds of storage products and testing capabilities at a scale of tens of millions.
- The digital platform can track the whole process.



Suzhou Packaging & Test Manufacturing Base-Longforce

- Specializes in ICs packaging design, signal simulation, and process development.
- As the first advanced packaging company with multi-layer wafer stacking technology in mainland China, it has taken the lead in the mass production of several uMCP, ePOP, LPDDR, eUFS, uSSD, and other products.
- Strong technical support from the shareholder, Powertech Technology(a global leader in storage OSAT)

Predecessors

AMD and Spansion

2009

Became a wholly-owned subsidiary of Powertech Technology

2023

Longsys acquired a 70% equity stake in Powertech Technology (Suzhou) and changed the name to Longforce (Suzhou) Limited.

Total Space	Standard Clean Room Area	Annual Packaging and Test Capacity
42,600m^2	20,000m^2	>550 million pieces

Advanced Packaging and Test Equipment

BSG, DB, WB, MD, FC,
ATE (T5503HS2, B6700), SDBG

Advanced Error-proofing Systems

MES system, comprehensive RMS, 2DID system, and more

Flexible and Efficient Production Capabilities

SiP, FCBGA, and uMCP production capabilities,
the mass production of 8D eUFS, 16D technical capabilities

Quality Control System

Recognized by global leading customers

Core Research and Development

Packaging and test R&D and simulation team

South America Manufacturing Operation Center-Zilia

longsys

2002
Acquired NEC Brazil memory division

2006
Packaged and Tested ICs mass production in Brazil

2023
Start Zilia Technologies after acquired by Longsys

2024
Launches Longsys product line and announces new investment program

Global Customers

SAMSUNG Lenovo acer ASUS DIEBOLD POSITIVO

DELL hp LG DATEN COMPUTADORES Hewlett Packard Enterprise CISCO laager TECNOLOGIAS SUSTENTÁVEIS

Technologies

SMT TSOP FBGA DDP Die-stacking Flip-chip

Stealth Dicing SDBG 11-Die-stacking

Products

DRAM Modules DRAM IC SSDs uMCP/UFS eMCP eMMC Flash IC

NVMe SSD LPDRAM IoT Module /SiP Wi-Fi/BT microSD USB drive

ATIBAIA

- 14,500m² total space, 5,100m² clean room area
- 150 million dies/year
- DRAM, Flash, MCP Products
- IC Packaging – Assembly, Test
- Certifications - ISO 9001, ISO 14001, ISO 45001, ESD S20.20, Samsung ECO Partner, RBA Membership

MANAUS

- 4,600m² space
- 7 million memory modules/year
- DRAM Modules, SSDs, Connectivity Modules
- SMT assembly with Functional and Industrial testing
- Certifications - ISO 9001, ISO 14001, ISO 45001, ESD S20.20, Samsung ECO Partner, RBA Membership

R&D Center

- Advanced Packaging R&D line – Assembly, Test
- 500m² space in Campinas, SP
- Product Development & Prototype building
- IC Packaging

05

Business Model

Upgraded Non-owner-brand Cooperation Model

DMS
Design Module Services

OEM
Original Equipment Manufacturer

ODM
Original Design Manufacturer

Model Upgrades

asset-heavy/low-tech → asset-light/high-tech

a sales model → a value partnership

TCM
Technology Contract Manufacturing

&

PTM
Product Technology Manufacturing

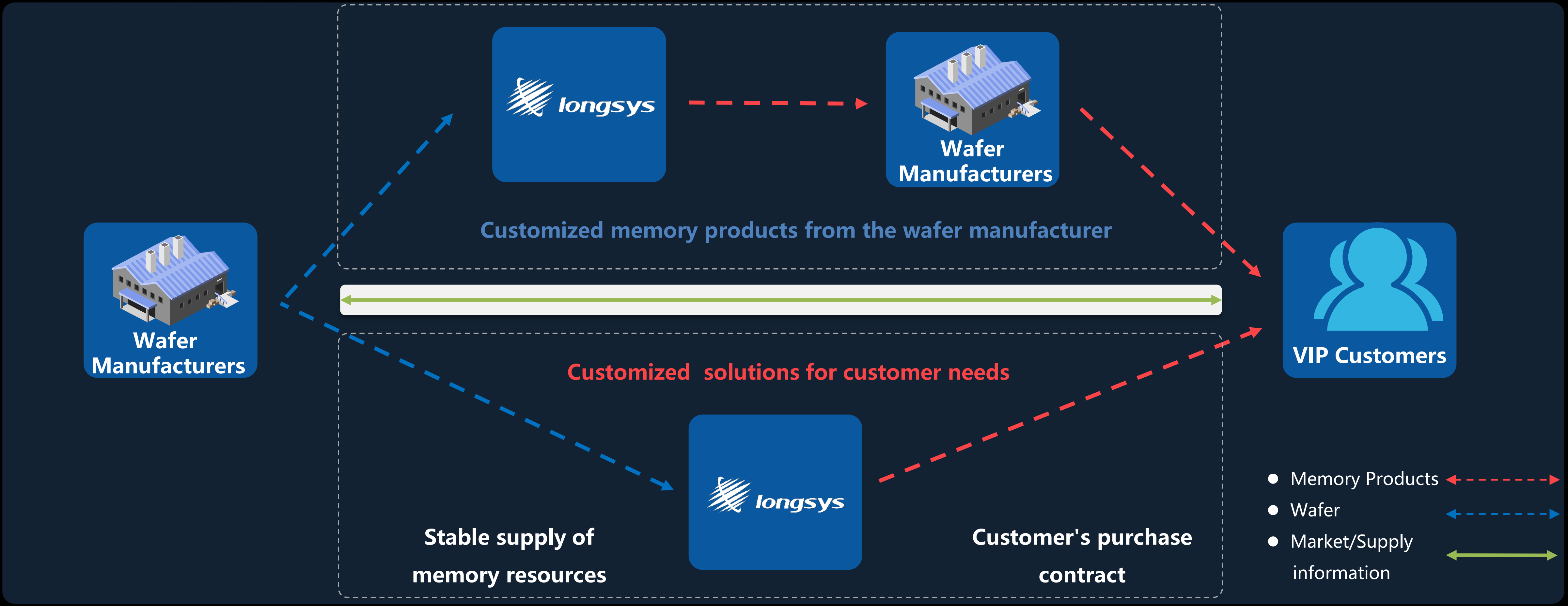
MESTOR

Mestor

Subsidiary of the Longsys specializing in traditional customization business

Technology Contract Manufacturing (TCM)

In order to provide customers with more stable supply and efficient storage customization solution services, Longsys, in collaboration with upstream memory wafer fab, jointly proposed to upgrade from traditional product sales model to TCM(Technology Contract Manufacturing) cooperation model.



Customized memory products from the wafer manufacturer

Customized solutions for customer needs

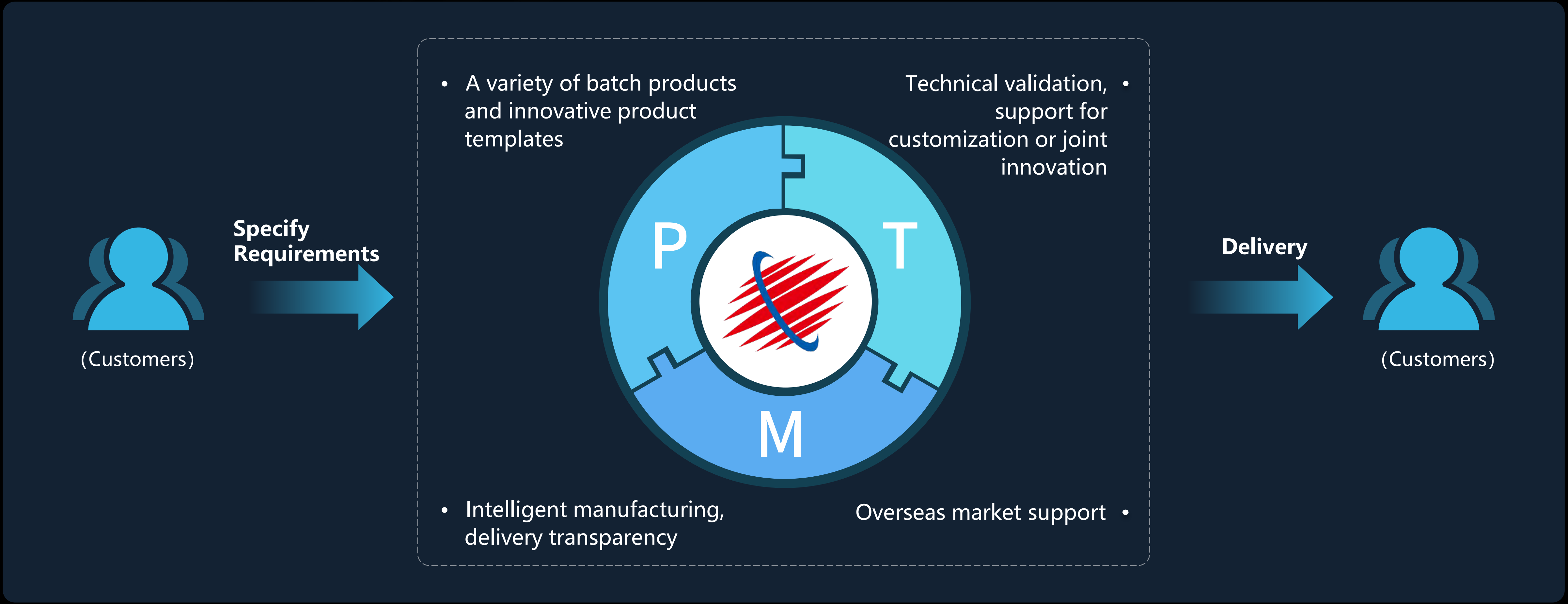
Stable supply of memory resources

Customer's purchase contract

- Memory Products
- Wafer
- Market/Supply information

Product Technology Manufacturing (PTM)

- The innovative PTM model proposed by Longsys includes: Product, Technology and Manufacturing.
- Unlike traditional sourcing methods, PTM rapidly delivers memory products to customers through technology customization and joint innovation and high-quality intelligent manufacturing in a memory industry Foundry model.



(Customers)

Specify Requirements

- A variety of batch products and innovative product templates
- Technical validation, support for customization or joint innovation
- Intelligent manufacturing, delivery transparency
- Overseas market support

Delivery

(Customers)

Everything for Memory

THANK YOU

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