Al for Everyone, Everywhere







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The Future of **Al Computing**

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design company

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Openedges Technology at a Glance







Al for Everyone, Everywhere





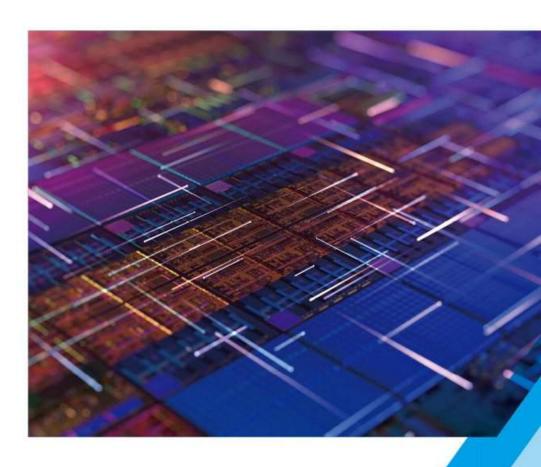






Prologue

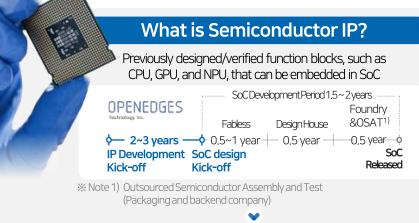
OPENEDGES Technology's Business Areas



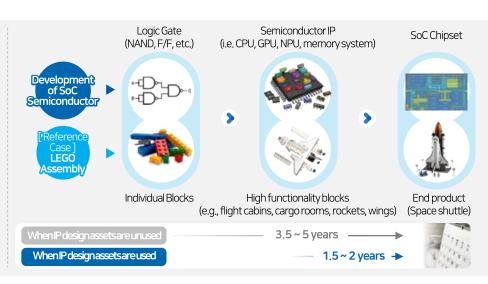


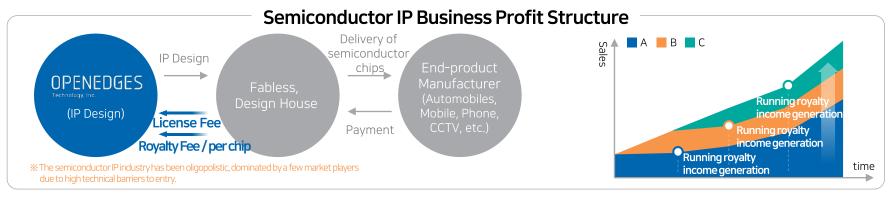
OPENEDGES Technology's Business Areas ①

Semiconductor IP is a ready-made solution requiring high-level technologies that enable faster development of SoC (System on Chip) such as AI semiconductors, reduce costs, and mitigate the risk of failure risks in development that can cost \$100 million



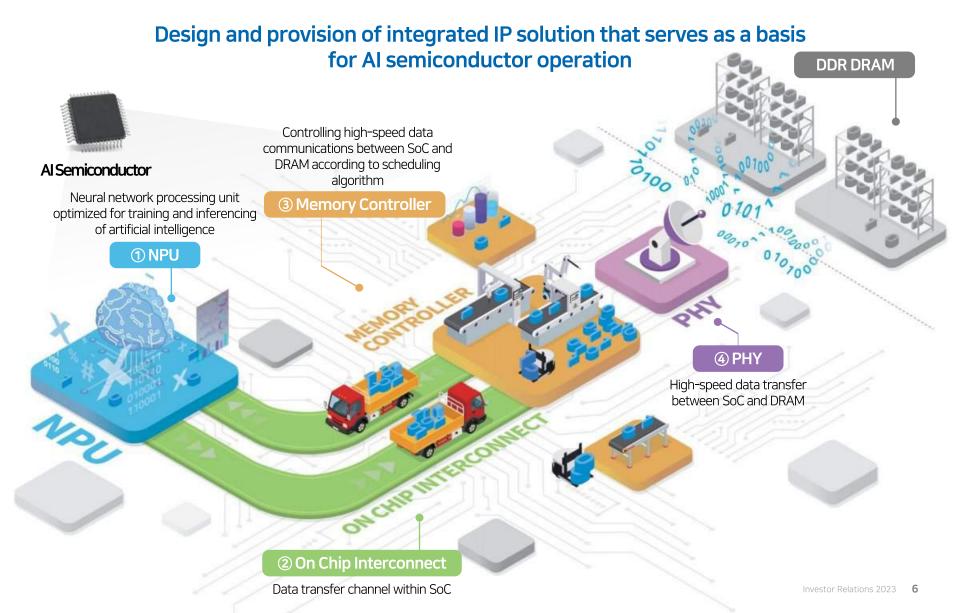
Reduction in SoC design time and cost for fabless companies







OPENEDGES Technology's Business Areas ②





O1 Structural Development of System Semiconductor Market

- 01. Growth of Al Semiconductor & IP Market
- 02. Roles of Semiconductor IP Design Company

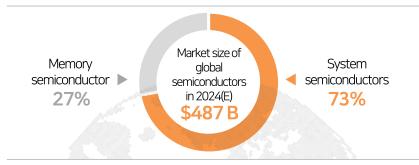




01 | Growth of Global System Semiconductor Market

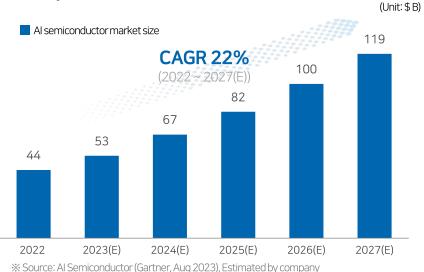
Contrary to memory semiconductors, system semiconductors are continuing their steady growth

Prospects for Global Semiconductor Market 2024

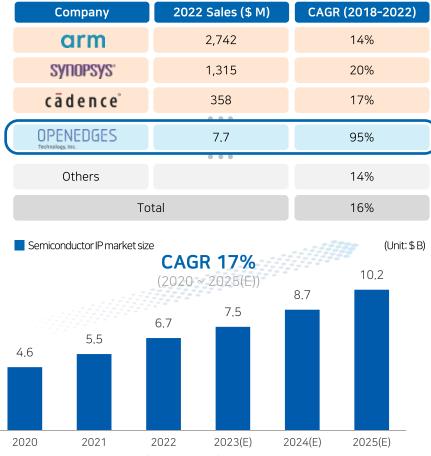


Source: WSTS, Nov 2023 (Excluding Optoelectronics, Discrete Semiconductors and sensors)

Prospects of Global AI Semiconductor Market



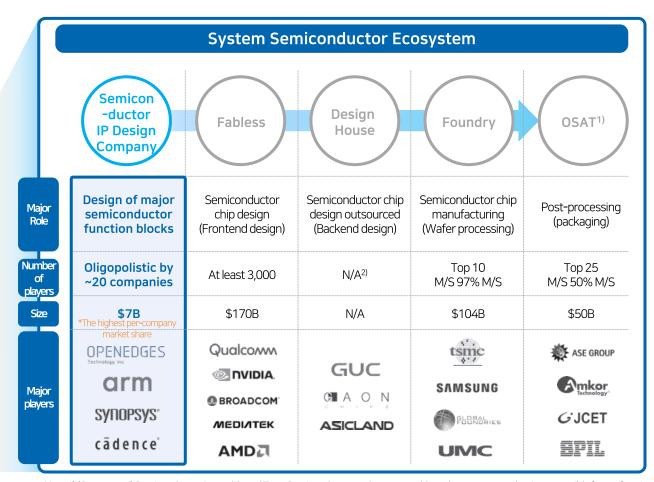
Global Semiconductor IP market forecast

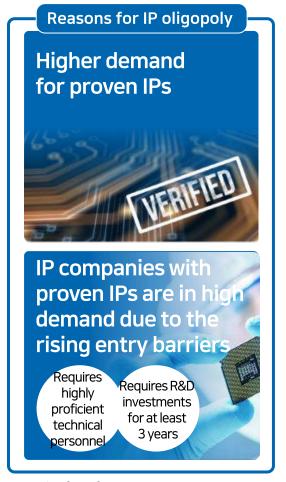




03 | Roles of Semiconductor IP Design Companies

Semiconductor IP companies aim to develop and supply function blocks as needed by Fabless and Design House in a proactive manner.



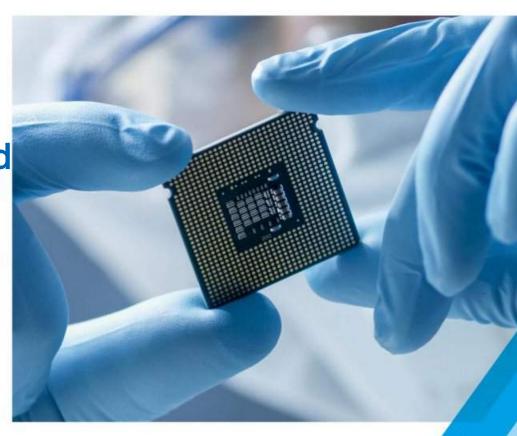




02

OPENEDGES Technology, as Korea's most renowned Al semiconductor IP design company

- O1. The Overview of OPENEDGES's Core Competitiveness
- 02. A Global Team of Professionals
- 03. Industry's Highest Technological Competitiveness
- 04. Verified Global Track Records
- 05. Business Partnership with Global Enterprises





01 | The Overview of OPENEDGES' Core Competitiveness

OPENEDGES holds the key success factors

to become a global leader in the AI semiconductor IP market





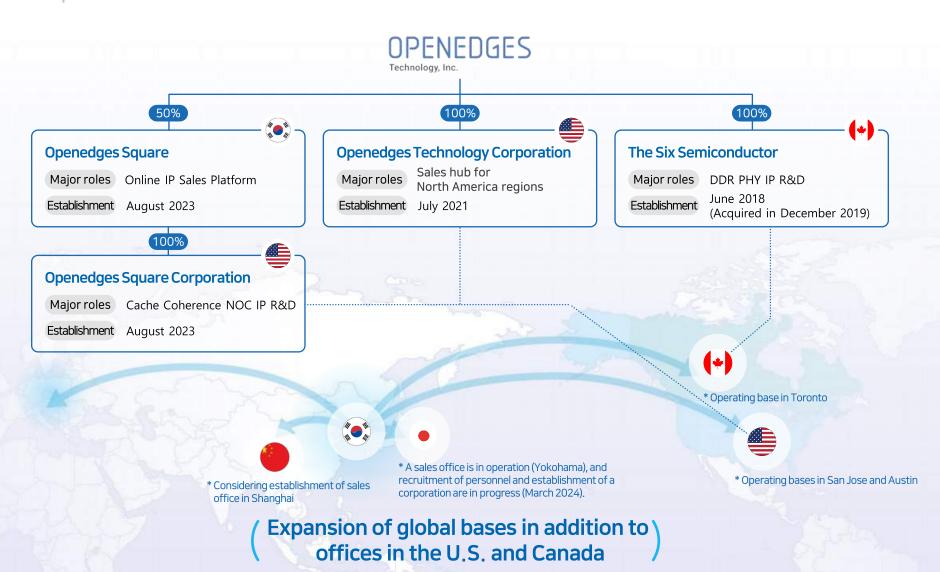


Industry's highest technological competitiveness





02 | A Global Team of Professionals – Global Presence





02 A Global Team of Professionals

Leadership of industry-leading experts with over 20 years of experience from Samsung Electronics/SK Hynix, and more.



R&D personnel

Among the total personnel (152 team members)

86%

130 **R&D** personnel

Percentage of Ph.D. and Ph.D. M.S. degree holders (71 members) among the R&D personnel **47**%

61

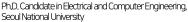






Sean Lee Representative Director/CEO





- 2017-Present: Representative Director, OPENEDGES Technology, Inc.
- 2008-2015: Principal Researcher, Samsung Electronics (Exynos Development)
- 2007-2008: Samsung Advanced Institute of Technology



Jake Choi NPUTeam Head



- Ph.D. in Electrical and Computer Engineering, Purdue University
- 2018-Present: NPU Team Head, OPENEDGES Technology, Inc.
- 2015-2018: Principal Researcher, SK Hynix
- 2009-2014: Architecture Lab Part Head, Samsung Electronics



Richard Fund TSS/CFO

AMD PERASO

M.S. in Electrical and Electronic Engineering, Univ. of Toronto 2018-Present: CEO. The Six Semiconductor

- 2012-2018: Silicon Director, etc., Peraso Technologies
- 2000-2011: PHY Analog Design Manager, AMD



ARTERIS MAGMA SYNOPSYS'



- Ph.D. in Computer Science, INPG Univ.
- 2021-Present: S/W Group Head, U.S. entity of OPENEDGES Technology
- 2018–2021: Principal S/W Architect, Arteris IP
- 1995-2017: Synopsys, Magma Design Automation, etc.



Cody Hwang R&D Center Head / CTO / Co-founder







- M.S.in Electrical Engineering, Seoul National University • 2017- Present: CTO, OPENEDGES Technology, Inc.
- 2010-2015; CTO. CodeHolics
- 2000-2010: Daewoo Electronics, Chips & Media



Henry Moon Memorycontroller Team Head





- M.S.in Computer Engineering, Seoul National University
- 2018-Present: MC Team Head, OPENEDGES Technology, Inc.
- 2017-2018: Memory System Laboratory Part Head, SK Hynix
- 2000-2016: AP Development Team Part Head, Samsung Electronics



Ricky Lau TSS/CTO

AMD SYNOPSYS

- M.S. in Electrical and Electronic Engineering, Univ. of Toronto
- 2018-Present: CTO, The Six Semiconductor
- 2014-2018: PHY Digital Design Engineer, Synopsys
- 2003-2014: PHY Analog Design Engineer, etc., AMD



Roger Jennings OTC/VP of Engineering







M.S. in Electrical and Electronic Engineering, Univ. of Memphis 2022-Present: VP of Engineering, U.S. entity of OPENEDGES Technology, Inc.

- 2020-2022: Arteris IP Senior Director of Engineering
- 2000-2021: Intel, Juniper Networks, AMD etc.

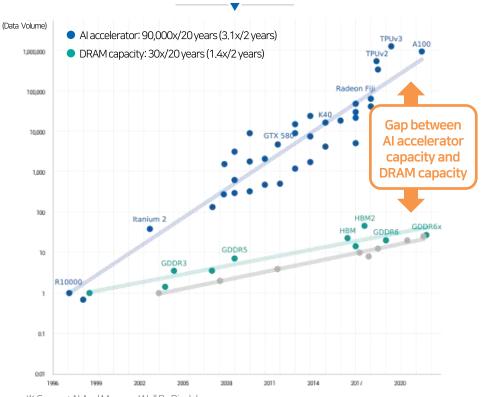


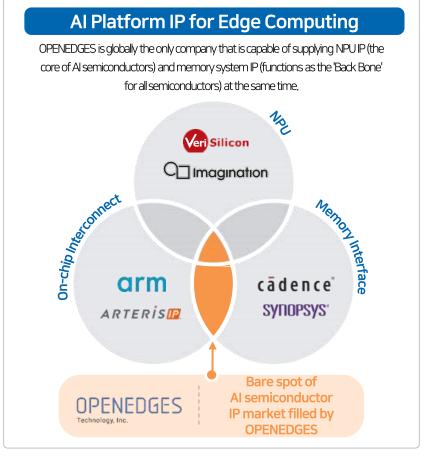
03 | Industry's Highest Technological Competitiveness ①

Al semiconductors are characterized as 'Data Intensive Computing' → Most optimize NPU and memory systems in edge AI with limited resources

OPENEDGES is the only global leading AI semiconductor IP platform provider

The gap between the required data processing volume and the capacity provided by DRAMs has increased due to the development of AI accelerator technologies

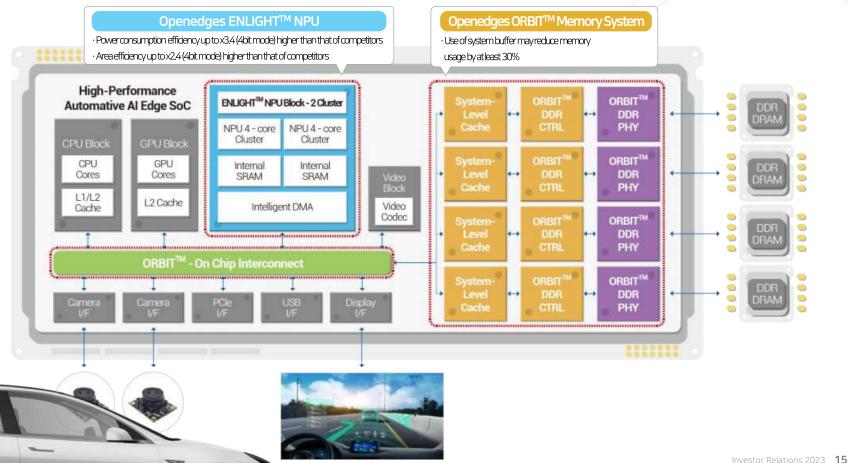




03 | Industry's Highest Technological Competitiveness 2

A leading AI semiconductor IP platform provider, OPENEDGES provides higher efficiencies in power, size, and memory compared to its competitors

[Examples showing OPENEDGES' integrated IP solutions applied to the AI semiconductor for autonomous driving vehicles]





03 | Industry's Highest Technological Competitiveness ③

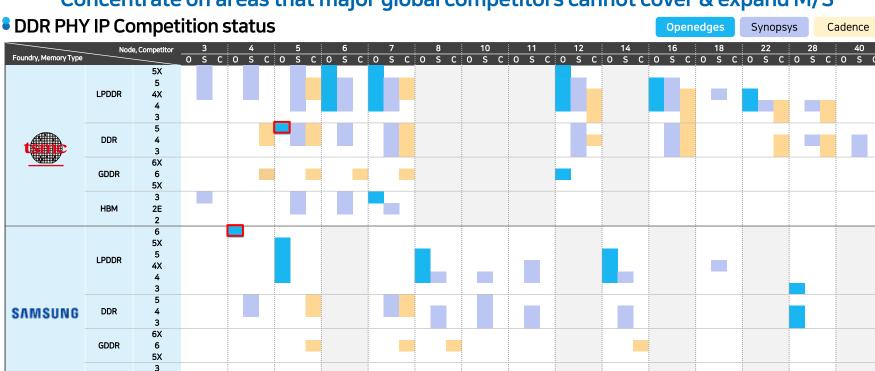
Leading the market through the development of cutting-edge technology

Division	IP	Description	Development status	Remark
Al Platform IP Solution for Edge Computing	ENLIGHT™ (Neural Processing Unit)	ENLIGHT™-L(1st gen. a.k.a v1.0)	Now	Lightweight IoT applications (Keyword recognition, security camera application)
		ENLIGHT™-R(2nd gen. a.k.a v2.0)	Now	Intermediate IoT applications (ADAS)
		ENLIGHT™-P(3rd gen. a.k.a v3.0)	In the process ('24 1H release)	Automotive high-performance applications (Level 3 or higher self-driving vehicle application)
		ENLIGHT™-X(4th gen. a.k.a v4.0)	In the future	Automotive high-performance applications (Level 4 or higher self-driving vehicle application)
		DDR4/3, LPDDR4X/4/3	Now	Current Mainstream Technology
		LPDDR5X/5/4X/4	Now	Next-generation Mainstream Technology
	OMC™	НВМ3	Now	Server and ultra-high-performance products
	(DDR Memory	DDR5	Now	Next-generation Mainstream Technology
	Controller)	GDDR6	Now	High-performance Al product
		GDDR7	In the future	High-performance Al product
		LPDDR6	Near future('24)	Next-generation Mainstream Technology
	OPHY™ (DDR PHY)	LPDDR4X/4	Now	TSMC 22nm Nodes
		LPDDR5/4X/4	Now	TSMC 16nm Nodes
Total Memory		LPDDR4X/4, LPDDR5/4X/4	Now	TSMC 12nm Nodes
System		GDDR6	Now	TSMC 12nm Nodes
Solution IP		LPDDR5X/5/4X/4	Now	TSMC 6/7nm Nodes
(ORBIT™)		НВМ3	Now	TSMC 6/7nm Nodes
(ORBIT)		DDR5	Near future('24)	TSMC 5nm Nodes
		LPDDR6	In the future	TSMC 4nm(or less) Nodes
		LPDDR3, DDR4/3	Now	Samsung 28nm Nodes
		LPDDR4X/4, LPDDR5/4X/4	Now	Samsung 14nm Nodes
		LPDDR5/4X/4	Now	Samsung 8nm Nodes
		LPDDR5X/5/4X/4	Now	Samsung 5nm Nodes
		LPDDR6	Near future('24)	Samsung 4nm(or less) Nodes
		GDDR7	In the future	
	OIC™	OIC™	Now (v2 released in '24)	Non- Cache-Coherent NoC
	(On-Chip-Interconnect)	OIC™-AI	In the process	Cache-Coherent NoC



03 | Industry's Highest Technological Competitiveness @

Concentrate on areas that major global competitors cannot cover & expand M/S



IP to be developed

нвм

2E

M/S expansion strategy

- $\checkmark\,$ Synopsys and Cadence are focusing on TSMC 5nm and below leading-edge processes
- ✓ OE is the only one who provides LPDDR5X/5 PHY IP for supporting the SSF 5nm process
- ✓ OE is expecting customer pool through the development of PHY IP for SF 4nm & TSMC 5nm processes
- ✓ OE's PHY IP requires area less than 50% compared to competitors by providing through the test chips

03 | Industry's Highest Technological Competitiveness ⑤



Maximize first-mover advantage of AI semiconductor integrated IP solutions



03 | Industry's Highest Technological Competitiveness (6)

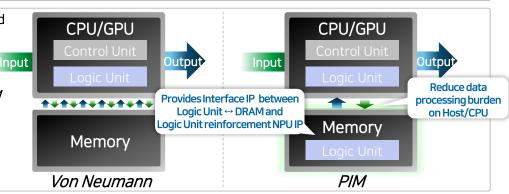


Leading the next generation of high value-added semiconductor technology expected to grow rapidly

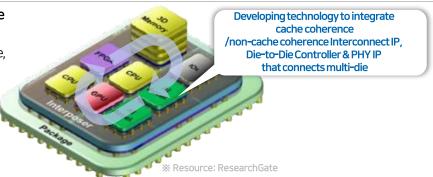
- CXL interface can flexibly expand memory without limitations on memory standard capacity and performance dependent on existing Host/CPU
 - → Effectively supports data intensive highperformance calculations such as AI chips
- supplies IP for the design of the CXL Controller chip, the core of the CXL Memory Expander.

Memory Controller and DDR Memory Controller and DDR PHY IP are also required when developing the CXL Controller chip PHY IP provided when that controls the CXL Memory Expander. developing SoC CXI. Memory Expande DDR5 DRAMs Host/CPU Controller [CXL memory configuration]

- PIM off-loads some of the computational functions handled by the Host/CPU (von Neumann structure) and processes them in the PIM.
 - → Speed ↑, Power ↓ by simultaneous calculation & storage ** Samsung is using HBM and SK Hynix is using GDDR6 for developing PIM
- Supplies Memory System IP, which is responsible for the data interface between Logic Unit and DRAM in PIM semiconductors, and NPU IP required to improve the performance of Logic Unit.



- A chiplet is a SoC that is manufactured by dividing high-performance SoC functions into multiple dies and then packaging them.
 - → SoC development cost & Risk ↓: Optimal process selection for each die, net die increase by reducing chip area
 - → Development period ↓: Independent design for each die, use of previously verified chiplets possible
- provides 'On-chip & Chip-to-Chip Interconnect IP Solution' that can implement multi-die interconnect technology beyond single-die standard interconnect IP.





04 | Verified Global Track Records

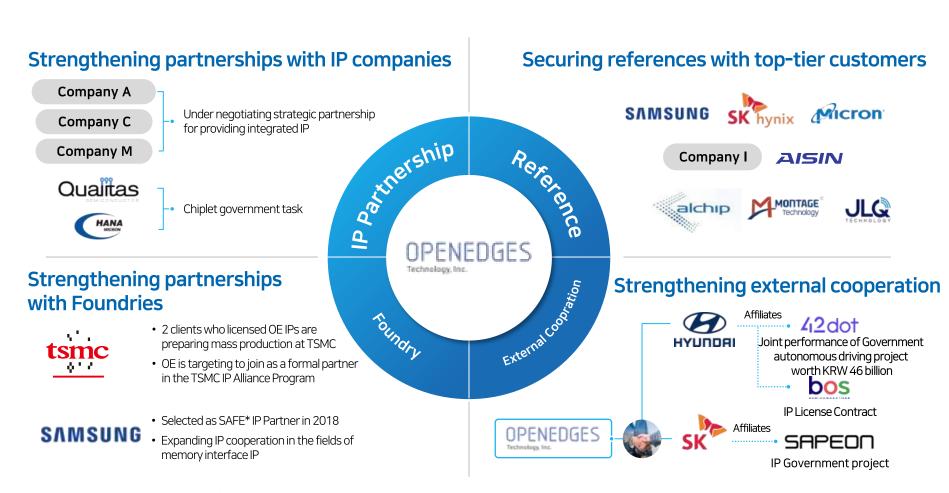
Expanding global track record as value recognized as the essential solution in various industries





05 | Business Partnership with Global Enterprises

Securing stable IP demands + Proactive response to advanced technologies and market trends



^{*} SAFE (Samsung Advanced Foundry Ecosystem)



03

2023 Business Performance

- 01. Sales
- 02. Operating Profit(Loss)
- 03. Contract Status
- 04. Sales revenue Breakdown

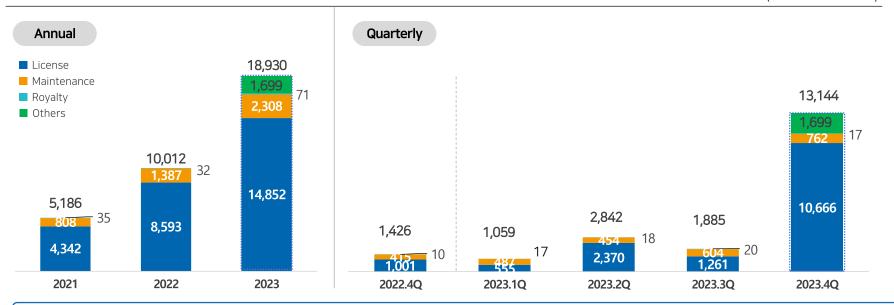




Sales Revenue

Annual sales of KRW 18.9 billion due to growth in license sales (YoY 89%), the 4th quarter also achieved the highest ever quarterly sales (YoY 822%, QoQ 597%). Continued high growth expected in 2024 based on already secured IP product competitiveness

Sales status (Unit: KRW 1 million)



Sales **Analysis**

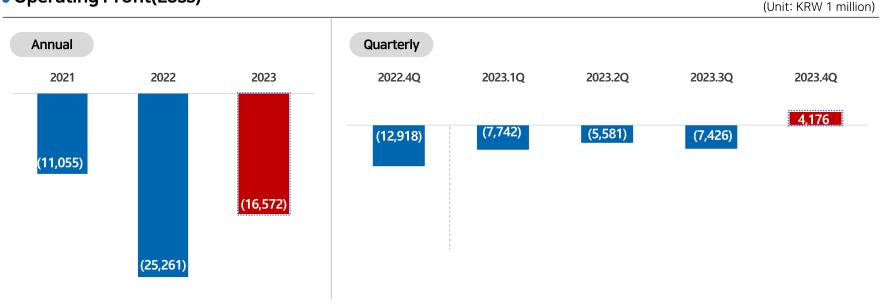
- ✓ **License**: Due to increase in license since 1H of 2023, sales were recognized in earnest from the 4Q23
- ✓ **Maintenance:** Sales are being generated from a total 28 projects
- ✓ **Royalty:** Expected to continue to grow in the future due to increased mass production of chips by customers
- ✓ Others: Sales for operational and technical support services for Openedges Square



01 | Operating Profit(Loss)

An annual operating loss of KRW 16.6 billion, improved by KRW 8.7 billion YoY First quarterly surplus in the 4Q23 due to significant growth in sales. Expecting to improve Profitability significantly in 2024 due to sales growth.

Operating Profit(Loss)



Operating **Profit Anlaysis**

- ✓ Costs in 4Q23 stabilized, sales grew significantly, achieved company's first quarterly surplus.
- ✓ Most of the R&D expenses are for developing new IP, are being managed stably at around KRW 8 to 9. billion per quarter without burdening large one-off costs.
- ✓ Profitability is expected to improve significantly in 2024 due to stable costs and increased sales from IP licensing.



Contract Status

Sales growth slowed in the first half due to the delays in signing license contracts, but expected to grow from the 4Q based on gradually improved market situation

Financial and contract status

(Unit: KRW 1 million)

78	Quarter					
구분 -	23.4Q	23.3Q	QoQ(%)	22.4Q	YoY(%)	
Sales	13,144	1,885	597%	1,426	822%	
Operating Profit (Loss)	4,176	(7,426)	N/A	(12,918)	N/A	
Net Income (Loss)	4,955	(7,310)	N/A	(12,745)	N/A	

Contract status

(Unit: case/\$M)	License Contract (FY2023)	License Contract (FY2022)	Note
Numbers	12	13	-
Sum of Contract value	\$15.5M	\$7.5M	2x growth

Performance Analysis and outlook

2023 Results

Significant growth in sales by providing IP tailored to advanced processes & the latest memory standards

- Sales and profitability continue to improve due to ASP increase
- → ASP increase due to provision of advanced process IP such as Samsung 5nm, TSMC 6nm, etc.
- First quarterly surplus and preparing for preemptive market response through continuous IP development
 - → Efforts to dominate the market through the development of market leading IPs such as NPU V3.0, LP6 related IPs

2024 Outlook

Expect high sales growth and improved profitability due to IP licensing

- Steady improvements in opportunities to secure contracts from 2H23
- Negotiating with more than 30 customers, including global top-tiers

Expansion of collaboration in technology such as CXL, PIM, & Chiplet

- 3 projects related to CXL ordered in 2023 are in progress
- In 2024, customized projects in the next semiconductor field such as CXL, PIM, and Chiplet are expected to further expand.

04 | Sales revenue Breakdown

Approximately doubles every year, and sales volume by industry also steadily increases

Generates various sales such as automotive and storage devices Sales growth begins in earnest after '21 Autonomous driving/ In-vehicle face recognition (Unit: KRW) Server/storage devices 2019~2023 2023 YoY Sales: '22, 2,6bil. → '23, 12,4bil. Sales: '22, 2,7bil → '23, 3,3bil **CAGR** (Shares): (26%) (Shares): (27%) (19%)+98% +89% (Unit: KRW 1 million) 18,930 10,012 5,186 Sales: '22, 1,9bil → '23, 1,3bil Sales: '22, 2,1bil → '23, 0,2bil Sales: '22. 0.8bil → '23. 0.1bil 1,238 1,089 (Shares): (19%) (7%)(Shares): (21%) (1%)(Shares): (8%) Intelligent security IoT / Mobile Display / Drons

camera

2019

2020

2021

2022

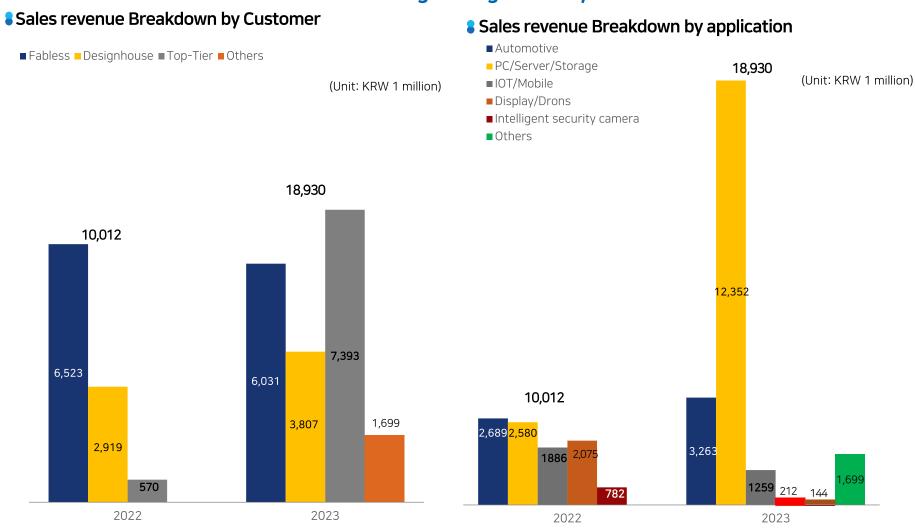
2023

^{*} Excluding other sales (Openedges Square operating and technical support service sales)



04 | Sales revenue Breakdown

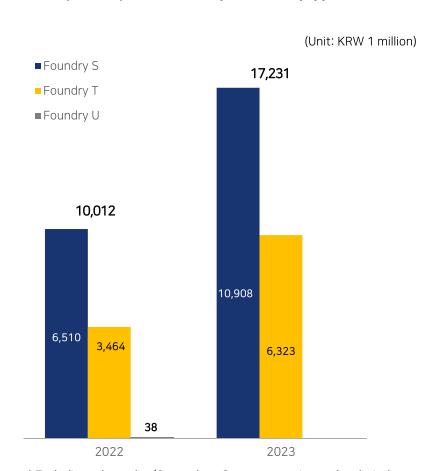
As server needs, such as those related to data centers and CXL, increase, related sales grow significantly.



04 | Sales revenue Breakdown

Sales volume for both of foundry S and T is growing rapidly YoY

Sales by foundry (based on SoC producers equipped with our IP)



Breakdown of Openedges sales revenue by foundry

☐ Continued growth in sales volume of the two major foundries

Foundry S: Growth continues due to increased sales of Ip5x related PHY IP

Foundry T: Rapid increase in related IP sales even before joining IP Alliance

* After joining the IP Alliance of T, orders from T's customers are expected to surge

'21~'23 Openedges sales revenue by Foundries

	'21	'22	'23	YoY	CAGR ('21~'23)
S	3,182	6,510	10,908	67.6%	85%
(%)	(61%)	(65%)	(63%)		
Т	1,661	3,464	6,323	82.5%	95%
(%)	(32%)	(35%)	(37%)		
U	343	38	-	-	
Total	5,186	10,012	17,231	-	-

^{*} Excluding other sales (Openedges Square operating and technical support service sales)



04

Appendix

- 01. Shareholders
- 02. Openedges Square
- 03. Financial Statements Summary

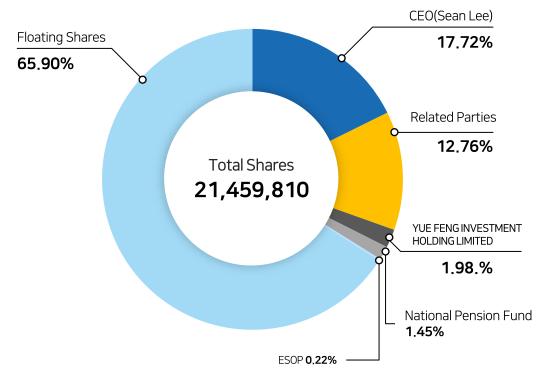




01 | Shareholders

Sean Lee(including related parties) owns a stake of 30.45%, securing management rights through stable ownership.

Shareholders



Name	Туре	# of shares	%
CEO(Sean Lee)	Common	3,796,314	17.72%
Related Parties	Common	2,738,293	12.76%
YUE FENG INVESTMENT HOLDING LIMITED	Common	425,000	1.98%
National Pension Fund	Common	311,095	1.45%
ESOP	Common	47,999	0.22%
Floating Shares	Common	14,141,109	65.90%
Total		21,459,810	100.00%

: As of Dec. 31, 2023



02 | Openedges Square - Summary

Company Profile

Name	OPENEDGES Square
CEO	Sean Lee
Establishment	August 2023
Capital	36 bil.(Openedges I8 bil. Investment in kind)
	(2 financial investors: 18 bil. Investment in cash)
Employees	7 people (as of November 1, 2023)
Workplace	Headquarters: 10th floor, Hyeonjuk Building, 114 Yeoksam-ro, Gangnam-gu, Seoul
Key points	Openedges HQ holds a call option for 35% of the financial investor's shares.

Shareholders



18 billion(KRW) investment in kind Cash investment of 18 billion(KRW)

Business Status

OPENEDGES

Tarteting fast commercialization and make stable growth through the synergy with the current Openedges' IP product portfolio

"OPENEDGES Square"

Multi-core Processor based IP development Processor's computation burden within Al semiconductors

→ Target to develop core functional blocks to reduce the burden

IP Sales platform business To change the current resource-consuming SoC design paradigm,

→ Target to develop and supply IP Sales platform



02 | Openedges Square - Main business areas

Multi-core processor-based IP development business Cache-Coherent NoC(CC NoC) Necessity As semiconductor design becomes more complex, data transmission inconsistencies between each processor cause calculation errors. Cache Core Requires cache memory Memory Coherency coherence in multicore Resource Cache Core A core functional block within the AI semiconductor responsible for maintaining the same cache data between multi-cores. IP development IP development to prevent and success factors calculation errors Multi-core Chip----IP development Market entry through **Technology success DNA** existing sales channels • Sales personnel & 9 overseas · 4 Core IPs in AI chip market

sales agents

• Total solution can be supplied

by linking with existing IP

• Technological correlation with

NCC-NoC from Openedges

IP sales platform business

The need for an IP sales platform due to the exhaustive IP licensing process

Face-to-face contact Fabless. **IP Companies Design House**

Thousands of companies

resent

Future

IP sales platform

· Platform usage fee

OPENEDGES

· Commission based on some portion of orders

Sales Opportunity Check order information

Efficiently connect

supply and demand

Fabless, **Design House**

comparing various IPs → Reduce cost

IP Companies

Expansion of customer pool Reduces assessment resources

Success factors for web-based SoC design platform

Memory System IP edges can be actively utilized

Openedges enables effective market entry targeting existing customers

Efficient operation possible through shared service agreement with Openedges



03 | Financial Statements Summary

Summary of Financial Statements (Unit: KRW 1 million)

		(Unit: KRVV 1 mil		
	2023	2022	2021	2020
Current Assets	29,903	44,304	29,020	6,216
Non-current Assets	14,447	9,552	7,077	4,075
Total Assets	44,350	53,855	36,097	10,291
Current Liabilities	19,704	18,318	9,171	5,477
Non-current Liabilities	4,762	3,288	6,374	31,551
Total Liabilities	24,466	21,606	15,545	37,028
Capital	2,146	2,116	1,653	15
Capital Surplus	98,259	96,376	58,927	-
Other Capital	3,578	2,026	3,007	1,697
Retained earnings	-84,099	-68,269	-43,035	-28,449
Total Equity	19,884	32,249	20,553	-26,737

Based on consolidated financial statements

Summary of Income Statements

	2023	2022	Change	Change(%)
Sales	18,930	10,012	8,918	89.1
Sales Management Expenses	35,502	35,273	229	0.6
Operating Profits	-16,572	-25,261	8,689	N/A
Financial Profits	1,502	1,409	93	6.6
Financial Costs	1,248	1,067	181	17.0
Other Profits	789	476	313	65.8
Other Costs	26	402	-377	-93.6
Net Profit before Corporate Tax Costs	-15,556	-24,846	9,291	N/A
Corporate Tax Costs	-12	380	-393	N/A
Current Net Income	-15,543	-25,227	9,683	N/A

^{**} Based on consolidated financial statements