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The Future of Al Computing

Table of Contents

Openedges Technology At a Glance Prologue

Structural Growth of System Semiconductor Market

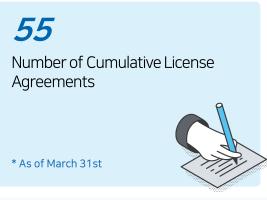
OPENEDGES Technology, as Korea's most renowned Al semiconductor IP design company **03**Business
Performance

Appendix



Openedges Technology at a Glance







Al for Everyone, Everywhere





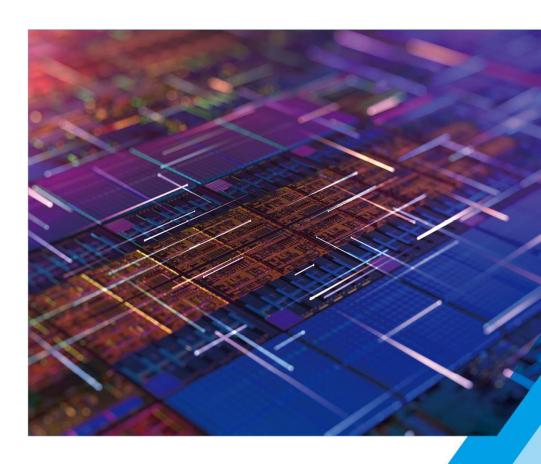






Prologue

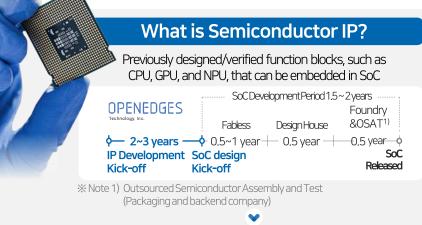
OPENEDGES Technology's Business Areas



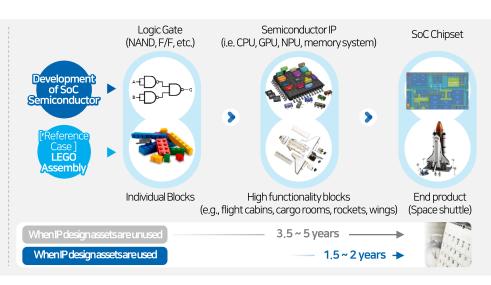


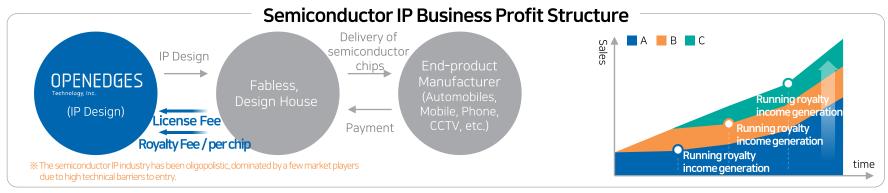
OPENEDGES Technology's Business Areas ①

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



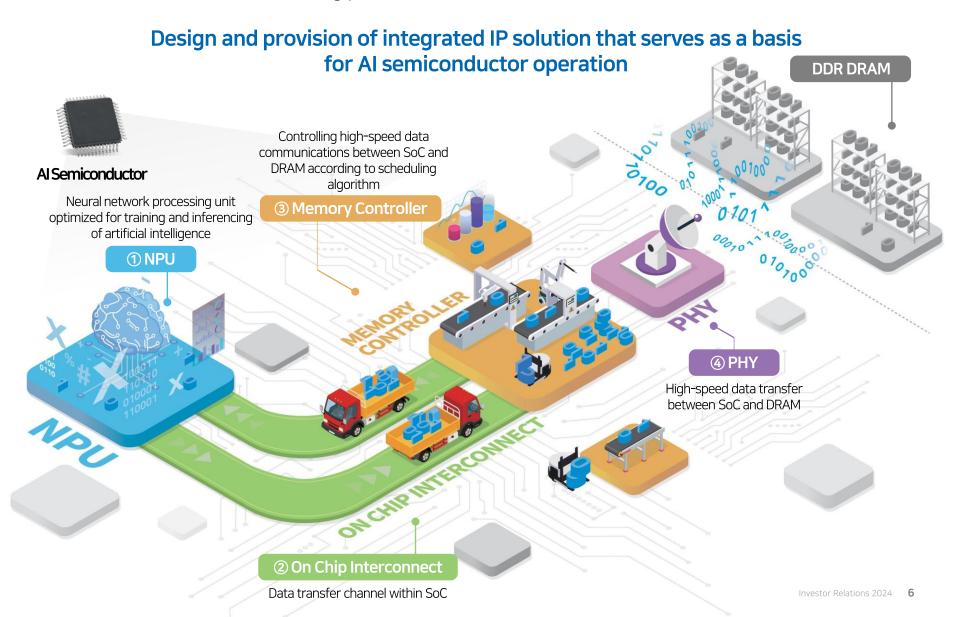
Reduction in SoC design time and cost for fabless companies







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

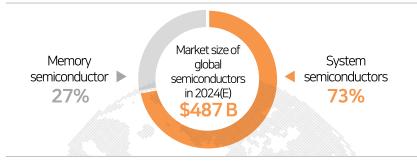




01 | Growth of Global System Semiconductor Market

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

Prospects for Global Semiconductor Market 2024

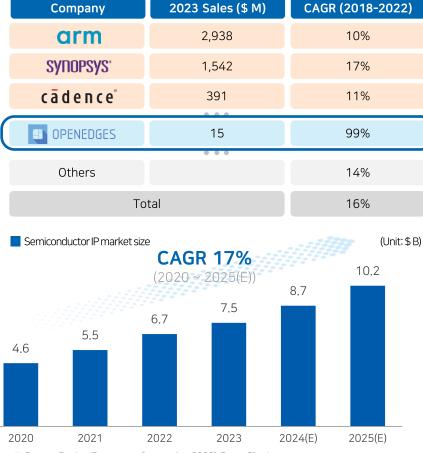


Source: WSTS, Nov 2023 (Excluding Optoelectronics, Discrete Semiconductors and sensors)

Prospects of Global AI Semiconductor Market



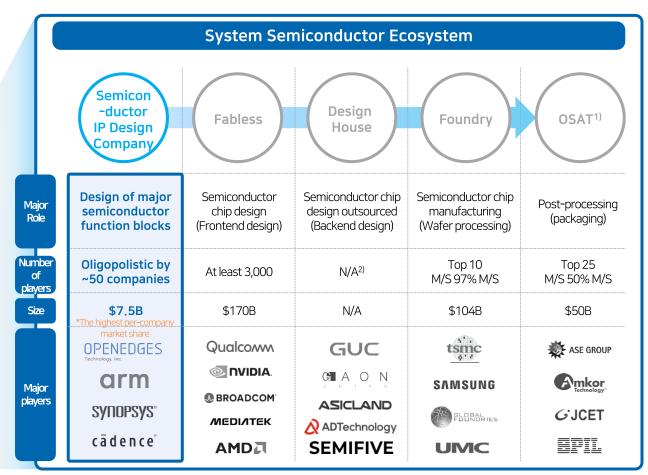
Global Semiconductor IP market forecast





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.



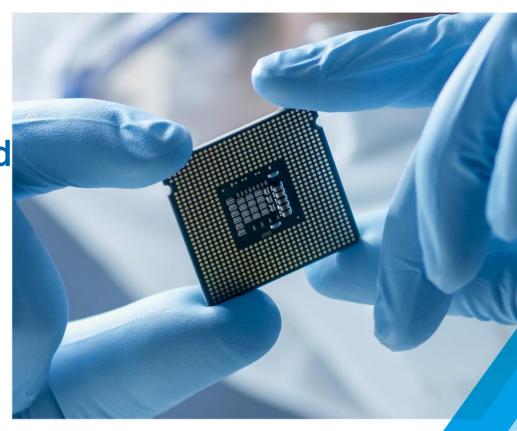




02

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





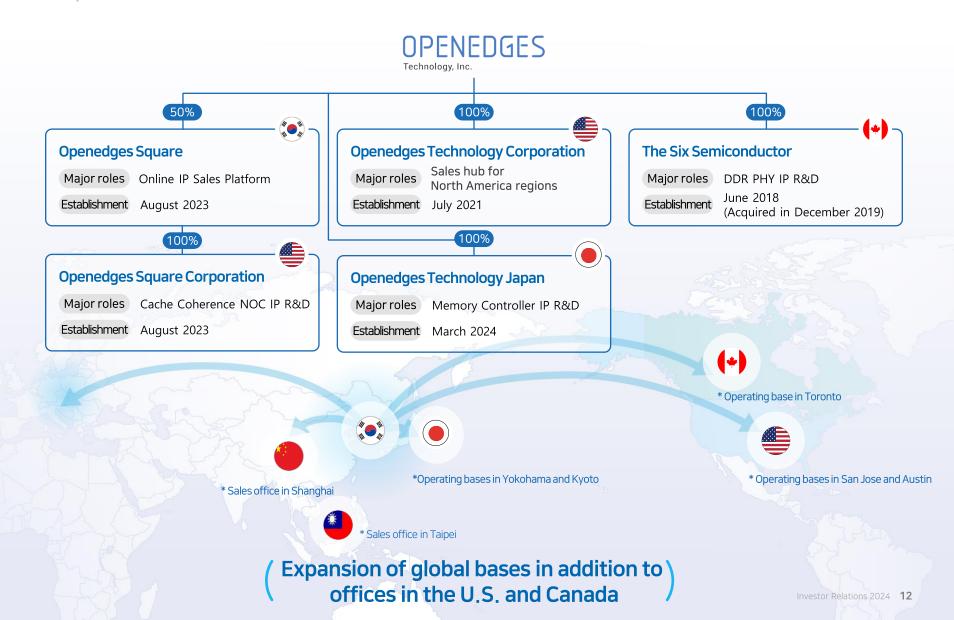
Industry's highest technological competitiveness







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 (166 team members)

86%

143 **R&D** personnel

Percentage of Ph.D. and Ph.D. M,S, degree holders (72 members) among the R&D personnel **50**%





Korea Canada (110 members) (44members)







Representative

Director/CEO

Ph.D. Candidate in Electrical and Computer Engineering, Seoul National University

'17-Present: Representative Director, OPENEDGES Technology,

'08~'15: Principal Researcher, Samsung Electronics (Exynos Development) '07~'08: Samsung Advanced Institute of Technology



Jake Choi NPUTeam Head



SAMSUNG SAMSUNG STATESTICAL OF TECHNOLOGY

SK hynix | SAMSUNG

Ph.D. in Electrical and Computer Engineering, Purdue University '18 ~ Present: NPU Team Head, OPENEDGES Technology, Inc.

'15~'18: Principal Researcher, SK Hynix

'09 ~ '14: Architecture Lab Part Head, Samsung Electronics



Richard Fund TSS/CEO

AMD | PERASO

M.S. in Electrical and Electronic Engineering, Univ. of Toronto

'18 ~ Present: CEO, The Six Semiconductor

'12~'18: Silicon Director, etc., Peraso Technologies

'00~'11: PHY Analog Design Manager, AMD



OSC/VP

of Engineering

ARTERÍS [AMD]



M.S. in Electrical and Electronic Engineering, Univ. of Memphis '22 ~ Present: VP of Engineering, OPENEDGES SQUARE

'20~'22: Arteris IP Senior Director of Engineering

'00 ~ '21: Intel. Juniper Networks, AMD 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



Takashi Yamada OTJ/Reginal VP

socionext Panasonic

B,A in Electrical Engineering, University of Tokyo Denki '24~ Present Openedges Technology Japan Regional VP '15~'24 SOCIONEXT Inc., Principal Engineer '88~'15 PANASONIC Corporation



Ricky Lau TSS/CTO

AMD SYNOPSYS*

M.S. in Electrical and Electronic Engineering, Univ. of Toronto '18-Present: CTO, The Six Semiconductor '14~'18: PHY Digital Design Engineer, Synopsys '03 ~ '14: PHY Analog Design Engineer, etc., AMD



Niranian Coorav OSC/Chief Architect

(intel

M, S, in Electrical and Computer Engineering, Northeastern University

'24 ~ Present: OPENEDGES SQUARE, Chief Architect

'95 ~ '24: Intel, Principal Engineer

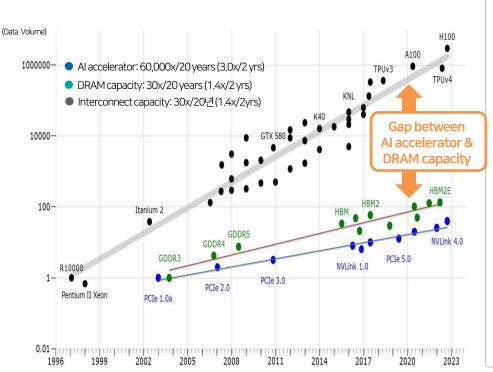


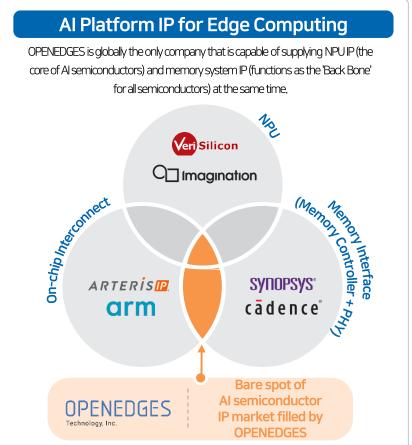
03 | Industry's Highest Technological Competitiveness ①

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







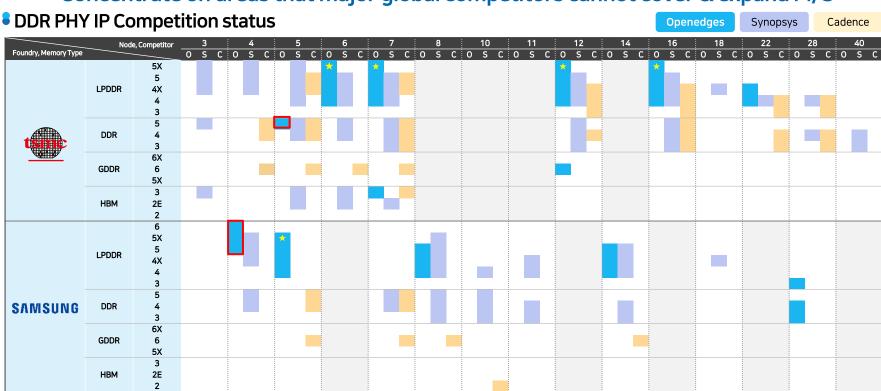
03 | Industry's Highest Technological Competitiveness ③ Leading the market through the development of cutting-edge technology

Division	IP	Description	Development status	Remark
		ENLIGHT™-Light (0.25 ~ 2 TOPS)	Now	Lightweight IoT applications (Keyword recognition, security camera application)
Al Platform IP Solution	ENLIGHT™ (Neural Processing Unit)	ENLIGHT™-Classic (2 ~ 16 TOPS)	Now	Intermediate IoT applications (ADAS)
for Edge Computing		ENLIGHT™-Pro (16 ~ 250 TOPS)	Now (Released in Apr. '24)	Automotive high-performance applications (Level 3 or higher self-driving vehicle application)
		ENLIGHT™-Hyper (250 ~ 1000 TOPS)	In the future	Automotive high-performance applications (Level 4 or higher self-driving vehicle application)
		DDR4/3, LPDDR4X/4/3	Now	
		LPDDR5X/5/4X/4	Now	Current Mainstream Technology
	ОМС™	НВМ3	Now	Server and ultra-high-performance products
	(DDR Memory	DDR5	Now	Current Mainstream Technology
	Controller)	GDDR6	Now	High-performance AI product
		GDDR7	In the future	Next-generation High-performance AI product
		LPDDR6	In the process	Next-generation Mainstream Technology
		LPDDR4X/4	Now	TSMC 22nm Nodes
		LPDDR5X/5/4X/4	Now	TSMC 16nm Nodes
Total Memory System Solution IP		LPDDR5X/5/4X/4	Now	TSMC 12nm Nodes
		GDDR6	Now	TSMC 12nm Nodes
		LPDDR5X/5/4X/4	Now	TSMC 6/7nm Nodes
(ORBIT™)		НВМ3	Now	TSMC 6/7nm Nodes
(ONDIT)	OPHY™	DDR5	Near future(~'25)	TSMC 5nm Nodes
	(DDR PHY)	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(~'25)	Samsung 4nm Nodes
		GDDR7	In the future	-
	OICTM	OICTM	Now	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



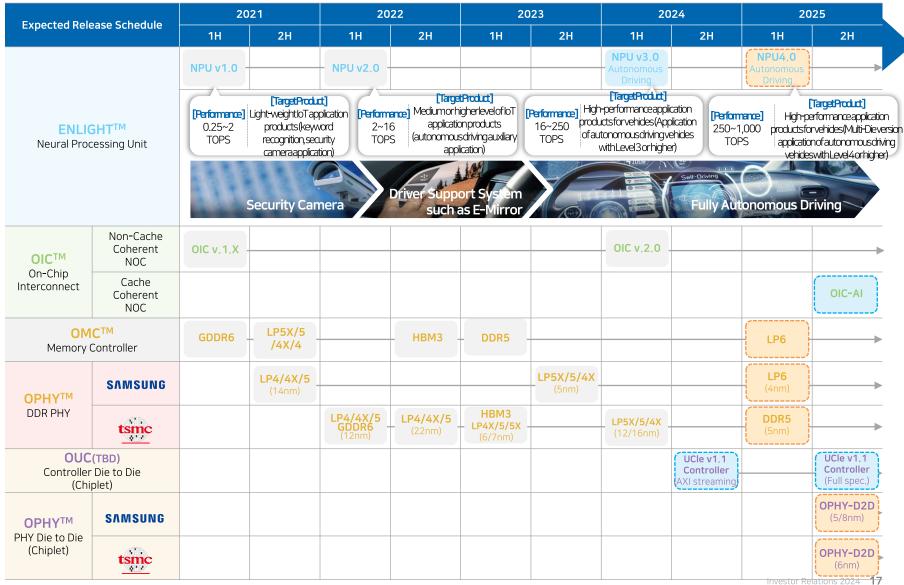
🔲 IP to be developed, 🔀: Sole Provider

M/S expansion strategy

- ✓ Synopsys and Cadence are focusing on TSMC 5nm and below leading-edge processes
- ✓ OE is the only one provides LPDDR5X/5 PHY IP for various nodes
- ✓ 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





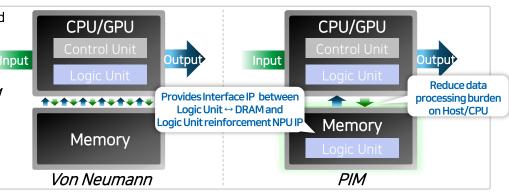
03 | Industry's Highest Technological Competitiveness (6)

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

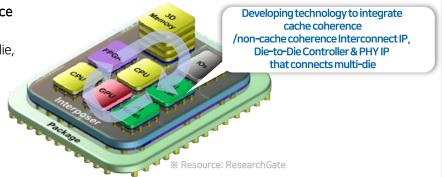
- CXL interface can flexibly expand memory without limitations on memory standard capacity and performance dependent on existing Host/CPU
 - → Effectively supports data intensive highperformance calculations such as AI chips
- supplies IP for the design of the CXL Controller chip, the core of the CXL 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 CXL Memory Expande Device Memory DDR5 DRAMS Host/CPU Controller Device [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 X 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

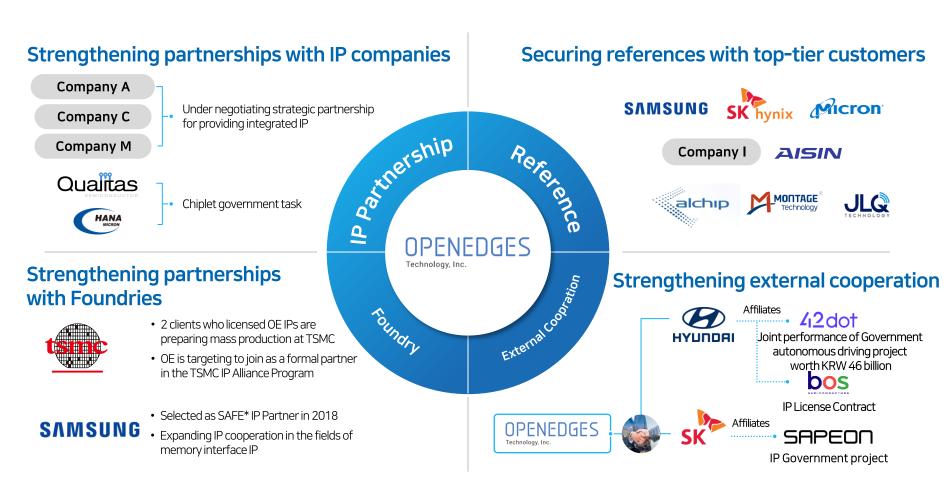
Expanding global track record as value recognized as the essential solution in various industries





05 | Business Partnership with Global Enterprises

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



^{*} SAFE (Samsung Advanced Foundry Ecosystem)



03

'24 1Q Business Performance

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

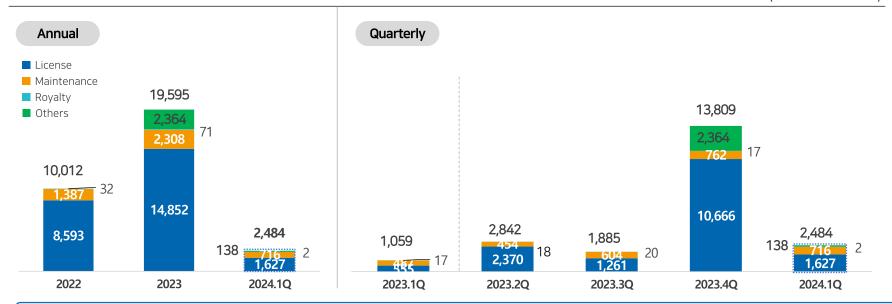




Sales Revenue

Recorded KRW 2.5 billion due to delays in new contracts (\triangle 82%, QoQ). Significant growth compared to the same period last year (135%, YoY) and expecting growth after closing license contracts currently under negotiation.

Sales status (Unit: KRW 1 million)



Sales **Analysis**

- ✓ License: Due to Delay of new contracts, Sales decreased compared to 4Q23, but increased YoY
- ✓ **Maintenance:** Sales are being generated from a total 27 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





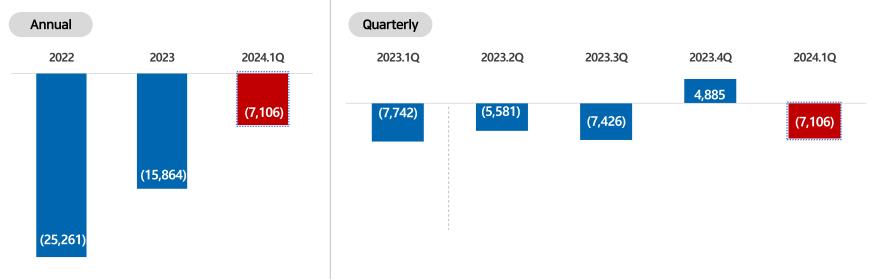
02 | Operating Profit(Loss)

An operating loss of KRW 7.1 billion due to a decrease in sales, while managing R&D costs at KRW 8 to 9 bn. Quarterly.

Securing contracts under discussion will improve profitability in the near term

Operating Profit(Loss)

(Unit: KRW 1 million)



Operating Profit Anlaysis

- ✓ Loss due to decline in license sales, expecting turnaround when securing orders under negotiation
- ✓ 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.
- ✓ As a number of license contracts are currently being discussed, expecting that sales will increase, and profitability will continue to improve.



03 | Contract Status

'24.1Q recorded unsatisfactory performance due to the delay in signing the license contracts However, expecting to increase license contracts from '24.2Q

Contract Status

(Unit: USD 1 million)

- ☐ '24.1Q: 3 new license contracts, worth \$1.6M
 - The average price per contract is 0.5M\$,
 - a low-performance/low-price IP-centered contracts
- ☐ As of May 16th: 5 cumulative license contracts, worth \$3.2M
 - * '24.1Q Earning release date
 - The average price per contract is \$0.6M
 - Price slightly higher compared to the first quarter.

Contract status

(Unit: case/\$M)	'24.1Q	As of 16.May (Cumulative)	FY2023								
Numbers	3	5	12								
Sum of Contract value	\$1.6M	\$3.2M	\$15.5M								
Average price of Contract	(\$0.5M)	(\$0.6M)	(\$1.3M)								

Performance Analysis and outlook

'24 10 Results

- ☐ Delay in signing high-performance/high-price IP contract
 - High-performance SoC projects considering Samsung 5nm and TSMC 6/7 nm are delayed
- ☐ Delay in completion of customization design project
 - Negotiation about customized IPs that supports the latest DRAMs such as HBM3 and DDR5 took longer than expected

2024 Outlook

- ☐ Expect high growth in normal license sales and improve profitability
 - Steady improvements in opportunities to secure contracts from 2H23
 - Sales and profitability growth through high-performance IP contracts
- ☐ Expand due to demand for next-generation and customization
 - In addition to CXL, expanding collaboration to reduce the performance gap between AI semiconductors and DRAM, such as PIM and Chiplet
 - In addition to normal licenses, we plan to respond quickly to customization IP licenses with global top-tier companies



04 | Financial Statements(Consolidated)

Statement of Financial Position

(Unit: KRW 1 million)

			(Unit: KRW 1 million						
	1Q24	2023	2022	2021					
Current Assets	25,086	29,843	44,304	29,020					
Non-current Assets	12,218	14,849	9,552	7,077					
Total Assets	37,305	44,692	53,855	36,097					
Current Liabilities	18,939	19,750	18,318	9,171					
Non-current Liabilities	4,103	4,371	3,288	6,374					
Total Liabilities	23,041	24,121	21,606	15,545					
Capital	2,173	2,146	2,116	1,653					
Capital Surplus	99,315	98,259	96,376	58,927					
Other Capital	3,293	3,577	2,026	3,007					
Retained earnings	-90,517	-83,412	-68,269	-43,035					
Total Equity	14,263	20,571	32,249	20,553					

Income Statements

(Unit: KRW 1 million)

	1Q24	4Q23	Change	Change(%)	
Sales Revenue	2,484	13,809	-11,325	-82.0	
Operating Expenses	9,589	8,924	665	7.5	
R&D Cost	7,543	6,439	1,104	17	
Selling General & Admin. Expense	2,046	2,485	-439	-18	
Operating Profit	-7,106	4,885	-11,991	N/A	
Financial Income	380	357	23	6.4	
Financial Expenses	416	303	113	37.3	
Other Income	37	1,061	-1,024	-96.5	
Other Costs	0	0	0	0.0	
Profit before Income Tax Expense	-7,106	5,999	-13,105	N/A	
Income Tax Expense	0	358	-358	N/A	
NetIncome	-7,106	5,642	-12,748	N/A	





05 | Financial Summary

Financial Summary

(Unit: KRW 1 Million)

Consolidated	2018	2019	2020	2021	1Q22	2Q22	3Q22	4Q22	2022	1Q23	2Q23	3Q23	4Q23	2023	1Q24
Revenue	588	1,238	1,089	5,186	3,033	3,975	1,577	1,426	10,012	1,059	2,842	1,885	13,809	19,595	2,484
License fee	524	990	660	4,342	2,798	3,619	1,175	1,001	8,593	555	2,370	1,261	10,666	14,852	1,627
Maintenance	65	249	423	808	230	350	392	415	1,387	487	454	604	762	2,308	716
Royalty			6	35	5	7	10	10	32	17	18	20	17	71	2
Others													2,363	2,363	138
:	·														
Cost and Expense	1,029	4,422	8,896	16,241	5,792	7,293	7,844	14,344	35,273	8,801	8,422	9,311	8,924	35,458	9,589
R&D Cost	208	2,347	6,623	10,654	3,937	5,361	6,063	12,349	27,710	7,052	6,546	7,146	6,439	27,184	7,543
Selling General & Admin Expense	821	2,075	2,273	5,587	1,855	1,932	1,782	1,995	7,563	1,749	1,876	2,165	2,485	8,275	2,046
Operating Income	△441	△3,183	△7,807	△11,055	△2,759	△3,317	△6,267	△12,918	△25,261	△7,742	△5,581	△7,426	4,885	△15,864	△7,106
Net Profit before Corporate Tax Costs	△355	△8,487	△18,729	△14,524	△2,906	△3,398	△6,181	△12,362	△24,846	△7,634	△5,559	△7,317	6,000	△14,510	△7,106
Net Income	∆374	△8,487	△18,729	△14,608	△2,906	△3,398	△6,178	△12,745	△25,227	△7,631	△5,557	△7,310	5,642	△14,856	△7,106

^{**} Numbers are based on consolidated financial statements.