Investor Presentation

Embedded wisely, Embedded widely

ememory

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Review of Operations

Q3 2020 Financial Results

The EPS of Q3 2020 was 2.26 NTD, ROE was 38.8%

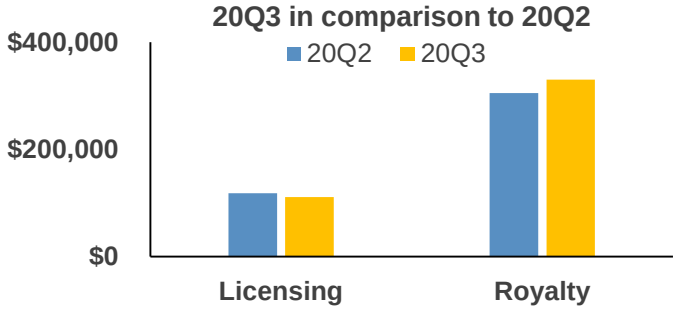
(thousands of NT dollars)

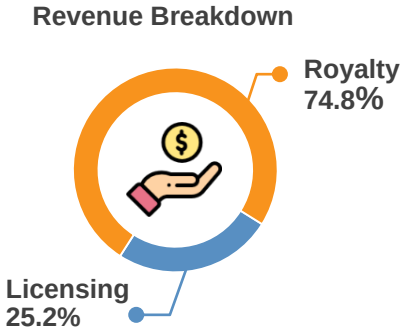
	Q3 2020	Q2 2020	Change (QoQ)	Q3 2019	Change (YoY)	Q1-Q3 2020	Q1-Q3 2019	Change (YoY)
Revenue	441,259	423,276	4.2%	336,587	31.1%	1,279,971	1,048,189	22.1%
Gross Margin	100%	100%	-	100%	-	100%	100%	-
Operating Expenses	243,913	227,364	7.3%	197,399	23.6%	692,740	586,376	18.1%
Operating Income	197,346	195,912	0.7%	139,188	41.8%	587,231	461,813	27.2%
Operating Margin	44.7%	46.3%	-1.6 ppts	41.4%	3.3 ppts	45.9%	44.1%	1.8 ppts
Net Income	168,581	169,317	-0.4%	120,170	40.3%	514,656	412,419	24.8%
Net Margin	38.2%	40.0%	-1.8 ppts	35.7%	2.5 ppts	40.2%	39.3%	0.9 ppt
EPS (Unit: NTD)	2.26	2.28	-0.9%	1.62	39.5%	6.92	5.56	24.5%
ROE	38.8%	41.9%	-3.1 ppts	29.1%	9.7 ppts	39.5%	33.3%	6.2 ppts

Note: Revenue of Q3 2020 in terms of US$ is US$14.96 mil, up 5.7% QoQ, and up 38.2% YoY.

Revenue in Different Stream

Q3 revenue up 38.2% YoY in US dollar terms





Revenue

NT$ Thousands	Q3 2020	Q2 2020	QoQ	Q3 2019	YoY	Q1-Q3 2020	Q1-Q3 2019	YoY
Licensing	111,125	118,062	-5.9%	103,689	7.2%	335,633	314,319	6.8%
Royalty	330,134	305,214	8.2%	232,898	41.8%	944,338	733,870	28.7%
Total	441,259	423,276	4.2%	336,587	31.1%	1,279,971	1,048,189	22.1%

US$ Thousands	Q3 2020	Q2 2020	QoQ	Q3 2019	YoY	Q1-Q3 2020	Q1-Q3 2019	YoY
Licensing	3,765	3,953	-4.8%	3,335	12.9%	11,260	10,146	11.0%
Royalty	11,195	10,196	9.8%	7,488	49.5%	31,727	23,763	33.5%
Total	14,960	14,149	5.7%	10,823	38.2%	42,987	33,909	26.8%

Revenue by Technology

The royalty of NeoFuse has a growth of 128.2% YoY in Q3

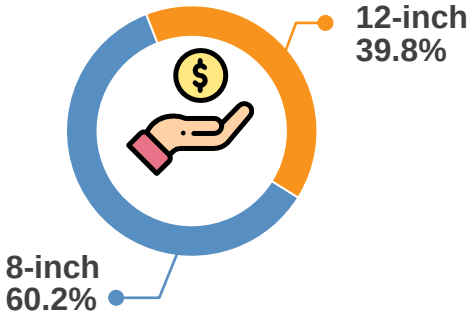
Technology	Q3 2020								
	Total Revenue			Licensing Revenue			Royalty Revenue		
	% of Q3 Revenue	Change (QoQ)	Change (YoY)	% of Q3 Licensing	Change (QoQ)	Change (YoY)	% of Q3 Royalty	Change (QoQ)	Change (YoY)
NeoBit	53.7%	7.3%	10.4%	22.4%	22.5%	-31.4%	64.2%	5.8%	18.9%
NeoFuse	39.8%	-2.4%	84.9%	61.7%	-18.2%	42.7%	32.4%	11.4%	128.2%
PUF-Based	1.4%	120.6%	100.0%	5.6%	120.6%	100.0%	0.0%	0.0%	0.0%
MTP	5.1%	13.6%	-16.1%	10.3%	3.0%	-40.9%	3.4%	26.9%	45.5%

Technology	Q1-Q3 2020					
	Total Revenue		Licensing Revenue		Royalty Revenue	
	% of Q1-Q3 Revenue	Change (YoY)	% of Q1-Q3 Licensing	Change (YoY)	% of Q1-Q3 Royalty	Change (YoY)
NeoBit	53.2%	3.6%	20.7%	-17.5%	64.7%	6.7%
NeoFuse	41.3%	71.8%	67.6%	27.1%	31.9%	133.7%
PUF-Based	0.7%	1,429.3%	2.9%	1,429.3%	0.0%	0.0%
MTP	4.8%	-25.9%	8.8%	-41.9%	3.4%	-0.3%

Royalty Revenue by Wafer Size

12-inch wafer increased 70.5% YoY

Q3 Royalty Breakdown



- ✓ 12-inch wafers contributed 39.8% of royalty, increased 19.8% sequentially and 70.5% YoY.
- ✓ 8-inch wafers contributed 60.2% of royalty, increased 1.7% sequentially and 27.6% YoY.

Royalty

Wafer Size	Q3 2020			Q1-Q3 2020	
	% of Q3	Change (QoQ)	Change (YoY)	% of Q1-Q3	Change (YoY)
8-Inch	60.2%	1.7%	27.6%	62.7%	16.9%
12-Inch	39.8%	19.8%	70.5%	37.3%	55.0%

Future Outlook

eMemory Embedded Everywhere

eMemory's IP seeks to penetrate across all the applications

Core Tech

✓ **Product Applications:**
eMemory's IP are already applied into different applications, which includes PMIC, LCD driver, Sensors, RFID, OLED Driver, Connectivity IC, DTV, STB, SSD Controller, Bluetooth, TDDI, MCU, Fingerprint Sensor, Smart Meters, Surveillance, ISP, CIS, DRAM, embedded Flash and FPGA.

✓ **Future Target:**
AP, GPU, CPU, Flash, IoT, AI, autonomous driving

Security

✓ **The Future in Security Chip IP:**
The rapid growth in AIoT and 5G drive the demand for hardware security. OTP and PUF are indispensable for root of trust in hardware security.

✓ **PUF-based Security Solutions:**
To satisfy the market needs, eMemory developed a new series of PUF-based security solution, including PUFrt, PUFiot, PUFse and PUFflash.

Our Perspectives

eMemory continue to create value for the industry and our shareholders

Licensing & Royalty

✓ **Licensing:**

- NeoFuse and NeoPUF will continue to grow due to increasing demand for design license activity and technology platforms that are continuously built among foundry partners.

✓ **Royalty:**

- 8” royalty will grow due to PMIC content increase in 5G smartphone and demand pick-up for automotive and IoT applications.
- 12” royalty will have a strong growth as customers are ramping up productions for ISP, OLED, Networking-related such as WiFi 6, Multimedia-related, DRAM, SSD controller and others.

New Application & Technology Development

✓ **For New Business Development:**

- NeoFuse in advanced process is adopted for secure key storage. We expect this will be a trend for security requirement.
- Business activities of PUF-based security solutions are in progress in applications of IoT, IIoT, AI, Blockchain, DPU, UFS, and automotives.
- Partnership with ARM and RISC-V will extend our PUF-based security platform.

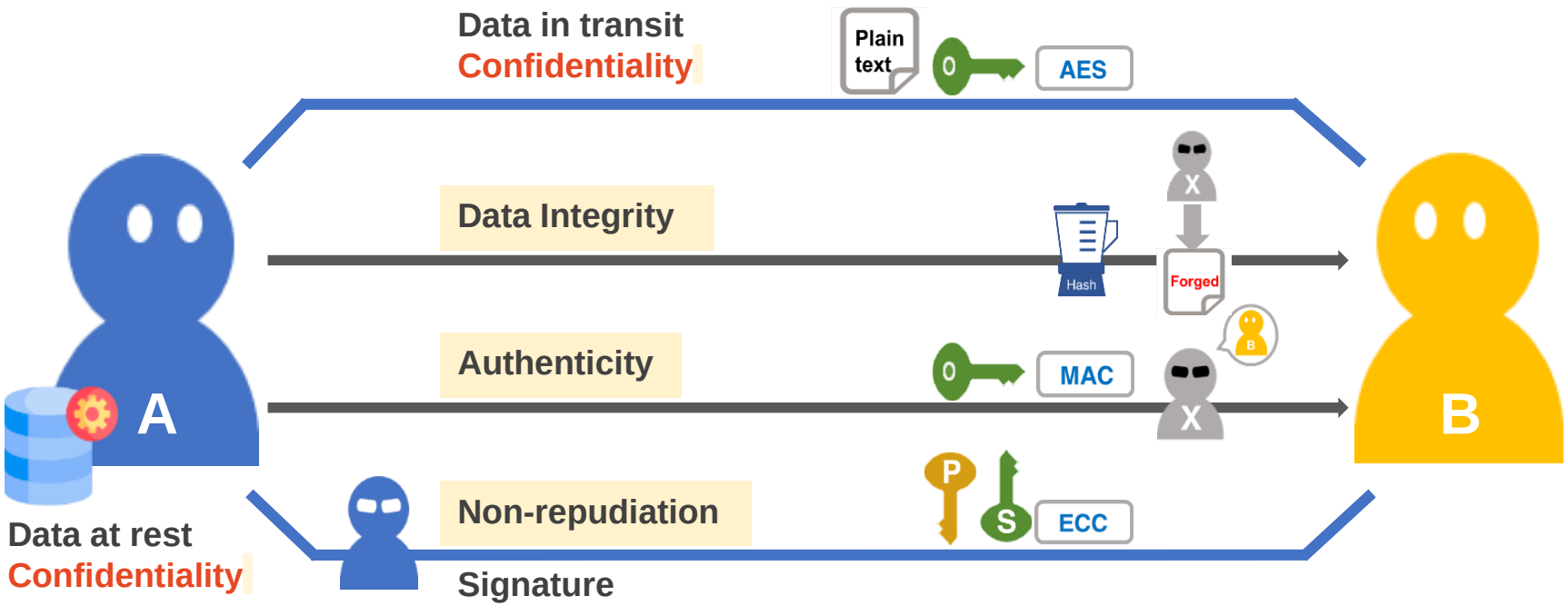
✓ **For New IP Technology Development:**

- Developing 6nm and 5nm plus (N5P) technology with leading foundry partners; demonstrated 6nm silicon results successfully.
- Announced crypto processor, PUFiot
- Develop PUF-based solution to be implemented in HSM.

How PUF Works for AI Security

Typical AI Security Concerns We Face

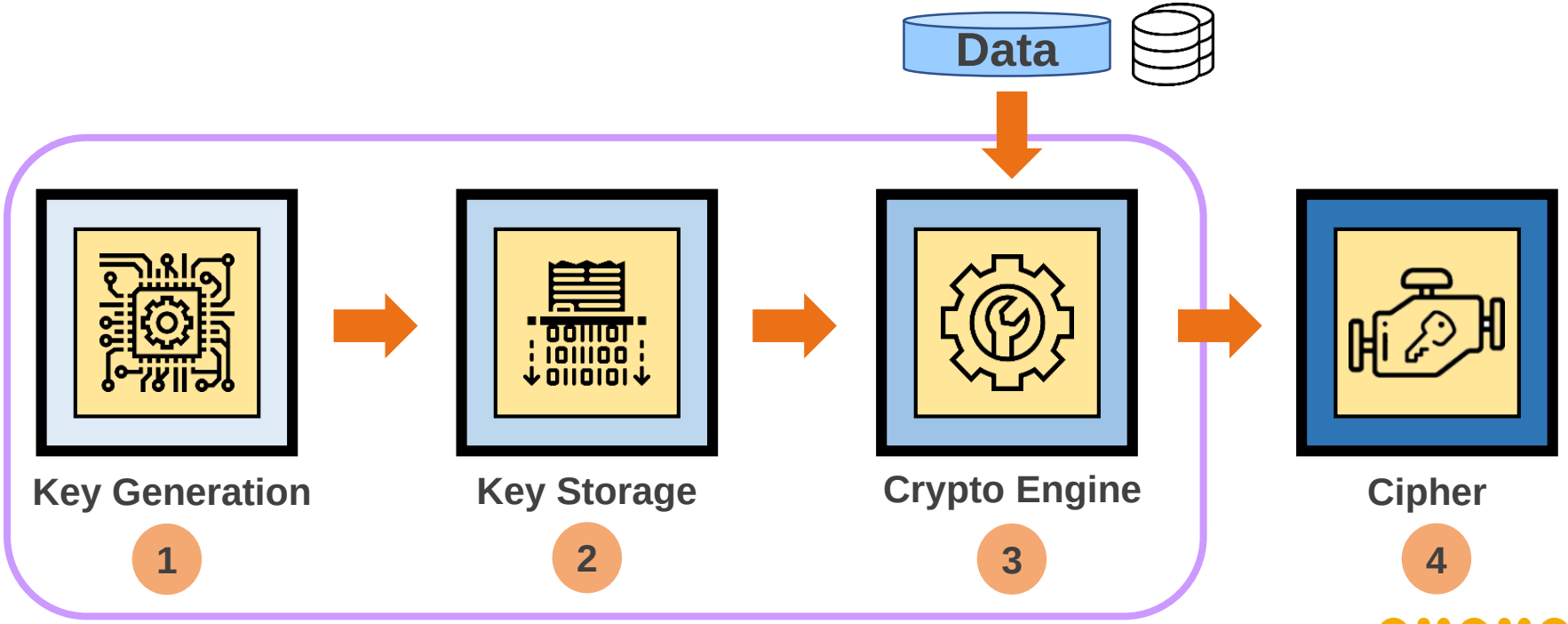
We utilize cryptographic operations and keys to ensure security



The Foundation of AI Security: RoT

We refer to the anchor of secure device as Root-of-Trust (RoT)

- Protecting keys right from generation is therefore pivotal



Towards a RoT for AI Security

Generating key, storing key and using key in cryptographic operation

- It all comes down to 3 essential problems to solve.

How can we generate secret key?

Utilize process variation → Chip Fingerprint

How can we store keys securely?

Static & Dynamic Entropy from Root-of-Trust

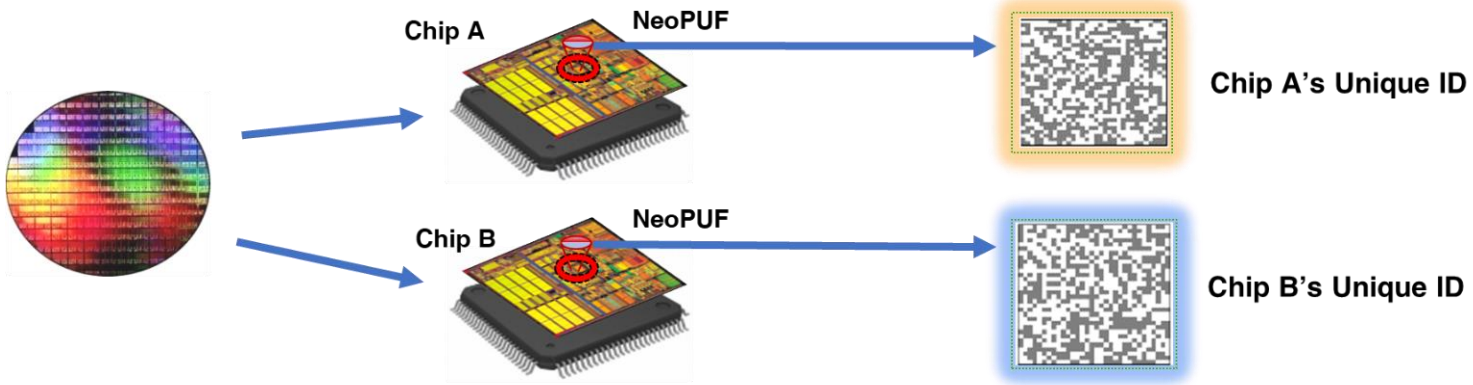
How can we secure key usage in operations?

Equip Root-of-Trust with complete set of algorithms

NeoPUF: The Inborn Chip Fingerprint

A truly random sequences for applications with high security requirements can be generated

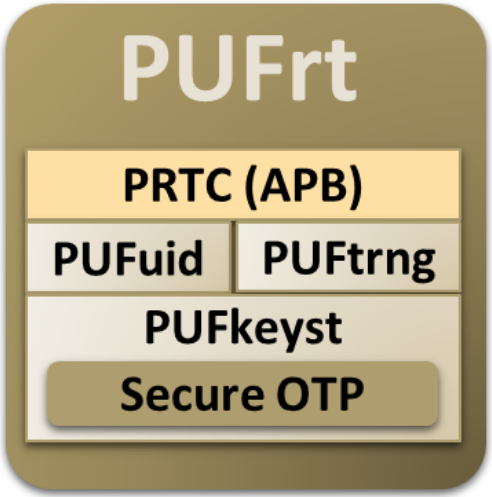
- NeoPUF utilizes Quantum Tunneling mechanism to generate a one-and-only “biometric identifier” of each and every chip



Unique **Random** **Reliable** **Untraceable**

PUFrt: A PUF-based Hardware RoT

PUFrt integrates altogether key generation, key storage, and entropies to protect operations



A Highly Integrated PUF-based HRoT with complete Anti-tampering Design

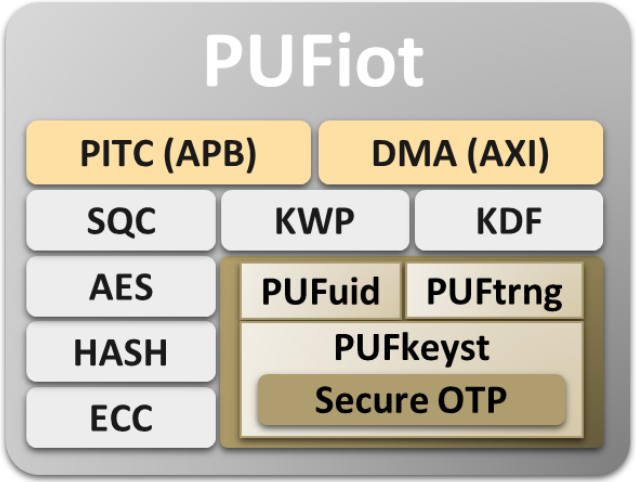
On-chip UIDs for Authentication

PUF-based TRNG for crypto usages

Secure Key storage for asset protection

PUFiot: A PUF-based Security Crypto Processor

PUFiot incorporates crypto-algorithms, enabling all security functions



A HW Crypto processor with entropy protection on data, keys and crypto operations

- Key Generation
- Key Wrapping

- Symm. & Asymm. Authentication

- Integrity Check
- Encryption

- Secure Boot
- TLS
- Key mgmt.

PUF-based Solutions Secure All AI Operations

PUFrt and PUFiot enhance security functions during AI operations

Security / AI Operation	Threat Model	Countermeasure	Security Function	Security Solution
Device Boot & Authentication	• Malicious FW loaded • Unauthorized device	• Secure Booting • Authentication and Provisioning	• Secure key storage • Unique Identifier (UID)	**PUFrt** **PUF-based Root of Trust**
Model Training & Deployment	• Training Data stolen • Model stolen from edge • Data/Model Modified	• Protect data-in-transit • Protect deployed model • Integrity Check	• Data/Model Encryption • Hashing and Signature	**PUFiot** **PUF-based Crypto Processor**
Input & Inference	• Unauthorized user • User data privacy leak • Input/Result tampered	• Authentication and Provisioning • Protect data-at-rest • Ensure integrity/source	• Unique Identifier (UID) • Data Encryption • Hashing and Signature	**PUFiot** **PUF-based Crypto Processor**

Summary: PUF-based Solutions for AI Security

The underlying benefit of using a PUF in cryptography is its “uniqueness” and “unpredictability”

NeoPUF-based Hardware Root of Trust, containing NeoPUF and OTP, provides

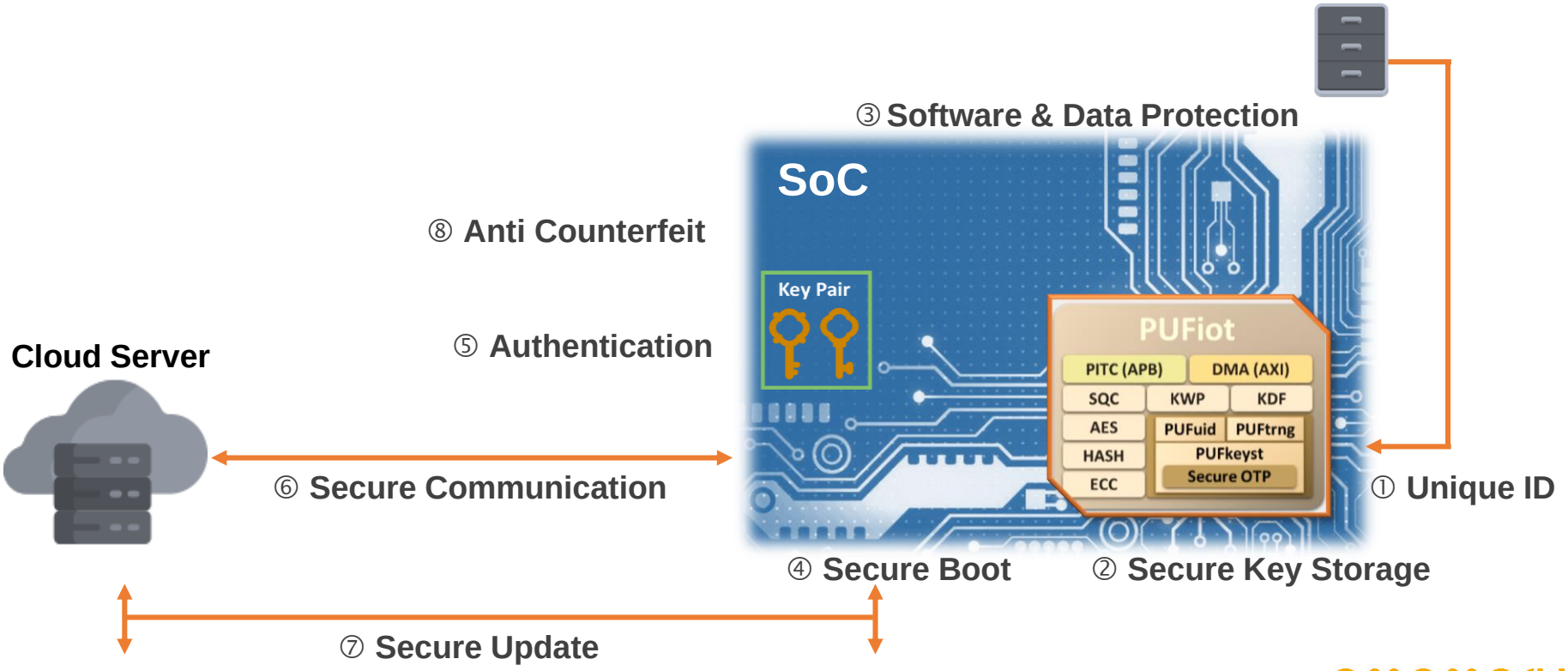
- **Unique Identity**
- **Secure Key Storage**
- **True Random Number Generator**
- **Anti-Tampering Solutions**

Plus

- **High Manufacturability**
- **Ultra Low Cost**

A High Value Proposition for Secure AI Applications

PUF-based Solutions Safeguard Products Throughout Entire Lifecycle

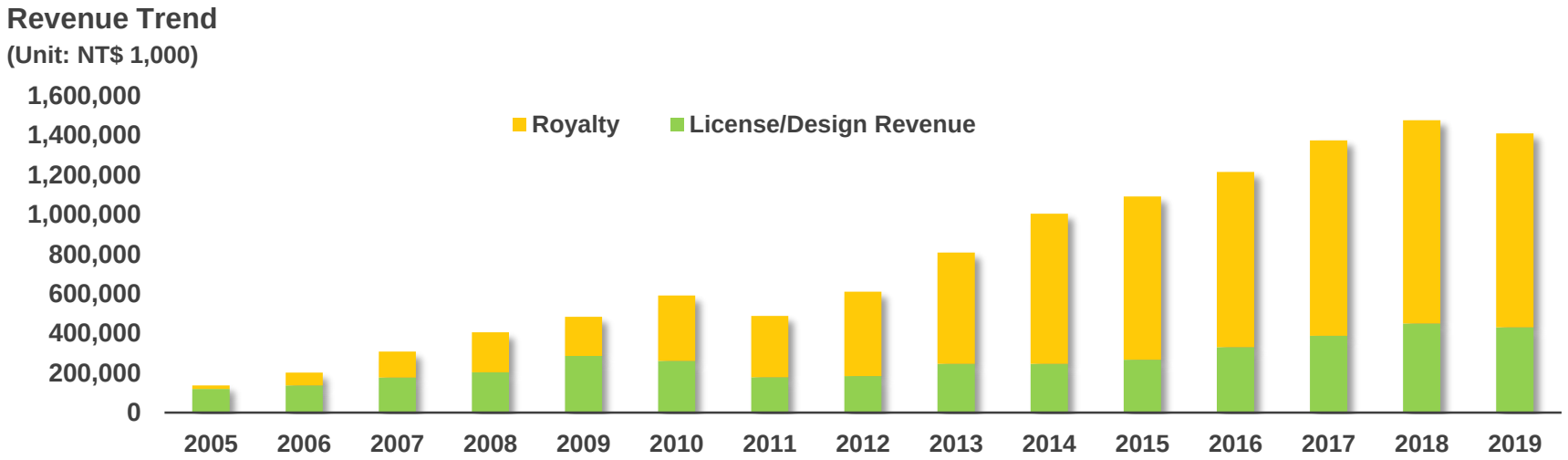


Q&A

Appendix

Company Overview

eMemory is the global leader of embedded non-volatile memory IP



Founded

In 2000

Based in Hsinchu, Taiwan. IPO in 2011. Over 31M wafers shipped.

800+

Patents Issued

263 pending patents. 286 employees with 67% R&D personnel.

Best IP Partner

With TSMC

TSMC Best IP Partner Award since 2010.

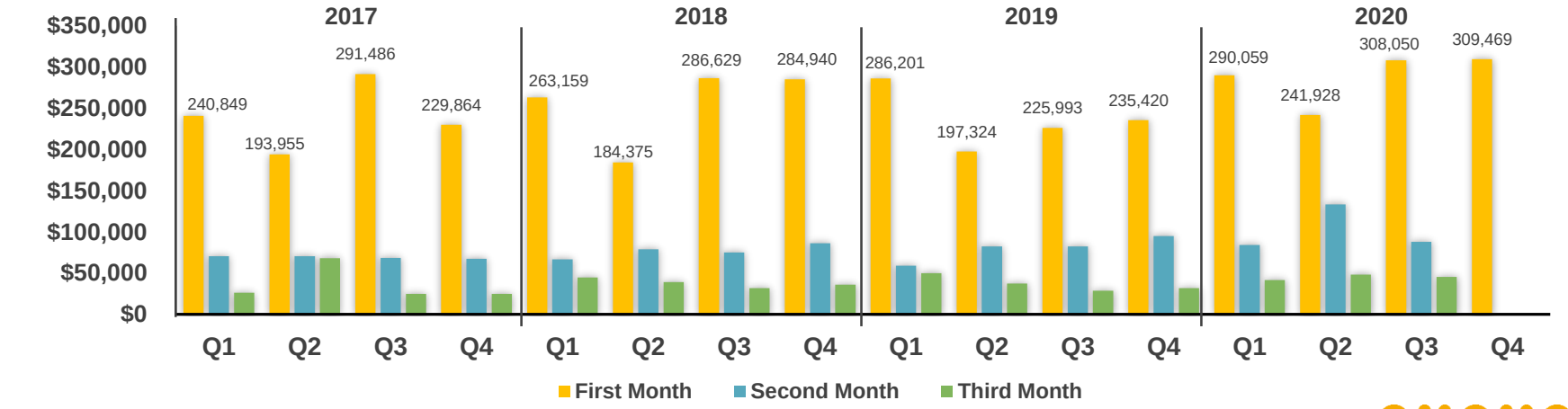
Quarterly Revenue Pattern

eMemory's quarterly revenue pattern

- ✓ 1st month: Receive License Fees of the month and Royalty from most foundries on previous quarter's wafer shipments.
- ✓ 2nd month: Receive License Fees of the month and Royalty from other foundries.
- ✓ 3rd month: License Fees Only.

Note: One foundry pays royalty semiannually, reported in Jan and July revenue.

(Unit: NT$ 1,000)



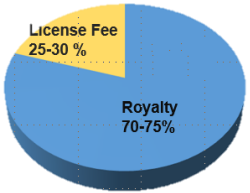
Worldwide Customers

Our IP solutions are adopted by leading foundries, IDMs and fabless worldwide

Country	Foundry	IDM	Fabless
Taiwan	4	1	302
China	8	0	812
Korea	4	0	87
Japan	4	7	64
North America	1	1	306
Europe	2	1	177
Others	1	0	76

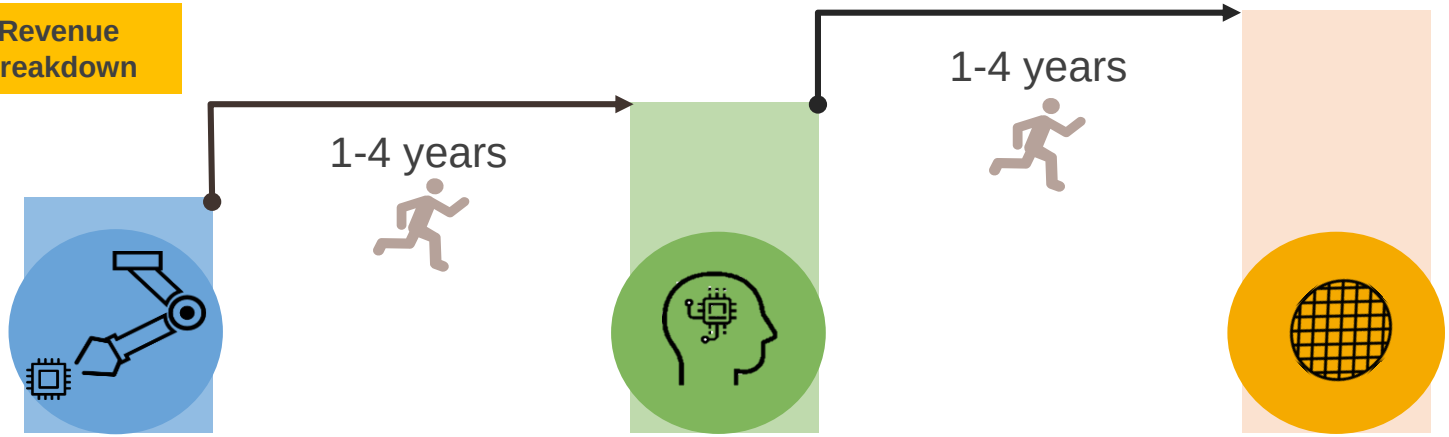
Business Model

Recurring royalty is the backbone of our business



Revenue Breakdown

- ✓ 70-75% revenue are from royalty based on wafer production
- ✓ More adoption = more volume shipment
- ✓ More advanced node wafers = higher ASP per wafer



License Fee
Foundries Process Development

Design License Fee
Fabless Product Development

Royalty
Wafer Mass Production

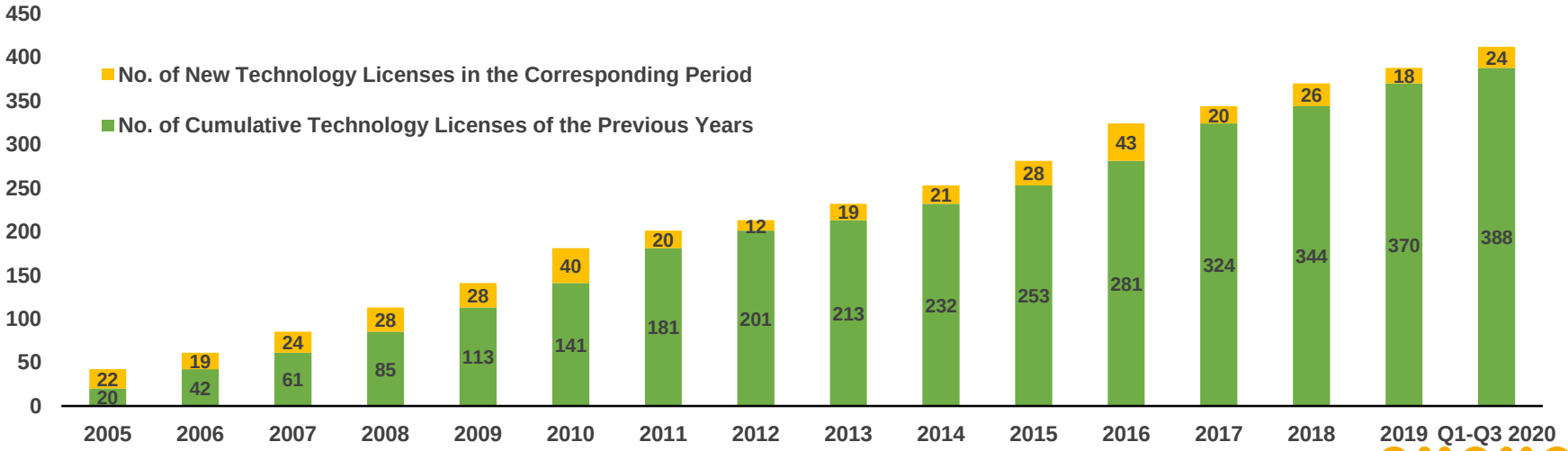
Technology Licenses

Cumulative technology licenses

Number of Licenses

Year	2016	2017	2018	2019	Q1-Q3 2020
License	43	20	26	18	24

Note: Terms (including number of process platforms and licensing fees) for each technology license are set contractually. Payments are made according to set milestones, and there are no particular seasonal factors involved.



New Technology Under Development

Products in different process nodes

- ✓ New technologies are being developed for 98 platforms by Q3 2020.
- ✓ 7 licensing contracts were signed, 6 for NeoFuse and 1 for NeoMTP.

Technology	5/6nm	7/10nm	12/16nm	22/28nm	40nm	55/65nm	80/90nm	0.11~ 0.13um	0.15~ 0.18um	>0.25um
NeoBit	-	-	-	-	-	1	2	10	10	1
NeoFuse	2	1	3	9	3	11	8	1	1	-
PUF-Based	2	-	2	2	2	1	-	-	-	-
MTP	-	-	-	-	-	2	6	9	9	-

Note: As of Sep 30th, 2020

Technology Development

Developments by process nodes

12" Fabs	Production	Development	IP Type	Process Type
5/6nm	0	4	OTP, PUF	FF
7/10nm	2	1	OTP, PUF	FF, FF+
12/16nm	3	5	OTP, PUF	FF, FF+
22/28nm	31	11	OTP, PUF, MTP	LP/ULP/ULL, HPC/HPC+, HV-OLED, DRAM, SOI
40nm	15	5	OTP, PUF, MTP	LP/ULP, E-Flash, HV-DDI/OLED
55/65nm	25	15	OTP, PUF, MTP	LP/ULP, E-Flash, HV-DDI/OLED, DRAM, CIS, BCD, PM
80/90nm	16	15	OTP, MTP	HV-DDI/OLED, LP, Generic, BCD, CIS
0.11/0.13um	17	3	OTP, MTP	HV-DDI, BCD, Generic
0.18um	1	3	OTP	BCD, Generic
Total	110	62		

8" Fabs	Development	IP Type	Process Type
90nm	1	OTP	HV-DDI, LL, BCD
0.11/0.13um	17	OTP, MTP	HV/HV-MR, BCD, LP/LL, CIS, Green, Flash, SOI, Generic
0.152/0.16/0.18um	17	OTP, MTP	HV/HV-MR, BCD, LP/LL, CIS, Green, Generic
0.25um	1	OTP	BCD
0.35um	0	OTP	UHV
Total	36		

Note: As of Sep 30th, 2020

THANKS

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