



# Investor Presentation

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A hand is shown placing a coin on top of a stack of coins. To the left, a small green plant with three leaves is growing out of another stack of coins. The background is a warm, golden-brown color with a bokeh effect. A large, semi-transparent arrow points from the coin stacks towards the right, where the table of contents is located.

# Contents

1 Review of Operations

2 Future Outlook

3 Q&A

4 Appendix





# Review of Operations

# Q1 Financial Results

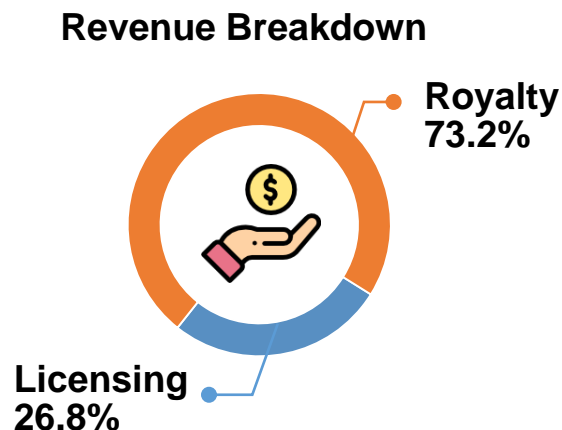
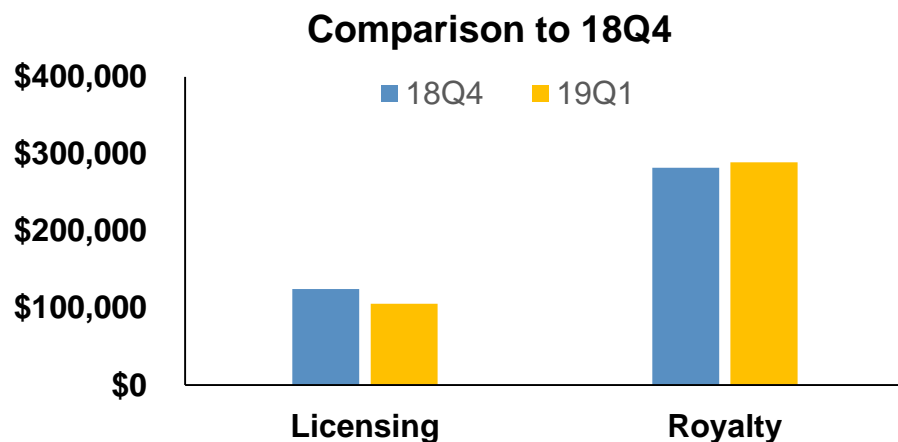
The EPS of 2019 Q1 was 2.39 NTD, ROE was 39%

(thousands of NT dollars)

	Q1 2019	Q4 2018	Q1 2018	change (QoQ)	change (YoY)
Revenue	395,061	406,752	374,466	-2.9%	5.5%
Gross Margin	100%	100%	100%	-	-
Operating Expenses	201,088	222,532	193,201	-9.6%	4.1%
Operating Income	193,973	184,220	181,265	5.3%	7.0%
Operating Margin	49.1%	45.3%	48.4%	3.8ppts	0.7ppts
Net Income	177,151	163,611	168,730	8.3%	5.0%
Net Margin	44.8%	40.2%	45.1%	4.6ppts	-0.3ppts
EPS (Unit: NTD)	2.39	2.20	2.23	8.6%	7.2%
ROE	38.9%	34.5%	31.3%	4.4ppts	7.6ppts

# Q1 Revenue in Different Stream

Revenue down 2.9% QoQ but up 5.5% YoY. Royalty reached record high.



## Revenue

NT \$ Thousands	Q1 2019	Q4 2018	Q1 2018	QoQ	YoY
Licensing	105,824	124,726	114,540	-15.2%	-7.6%
Royalty	289,237	282,026	259,926	2.6%	11.3%
Total	395,061	406,752	374,466	-2.9%	5.5%

# Q1 Revenue by technology

Licensing revenue decreased by reason of prolonged contract negotiations

- ✓ The demand of NeoFuse continues to grow, as its licensing up 7.9% QoQ and 24.3% YoY. Its royalty revenue declined 43.4% QoQ, but increased 161.2% YoY. This is mainly due to DDI seasonal production factor, always prebuilt in two quarters and rest for the others.
- ✓ The royalty revenue of NeoBit increased 15.4% QoQ and 6.5% YoY. The decrease in licensing revenue was due to its higher coverage in technology platforms, large accumulated IPs, hence more usage instead of NRE.
- ✓ The licensing revenue of MTP (NeoEE+NeoMTP) decreased 35.3% QoQ and 19.0% YoY due to higher base, while its royalty revenue increased 8.2% QoQ and decreased 33.4% YoY as a result of specific customer product transition.

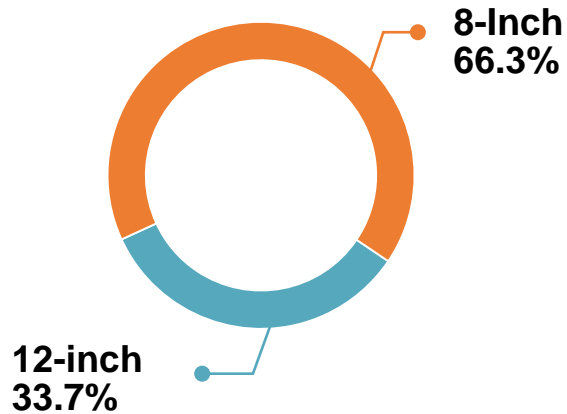
Technology	Q1 2019								
	Total Revenue			Licensing Revenue			Royalty Revenue		
	% of Q1 Revenue	Change (QoQ)	Change (YoY)	% of Q1 Licensing	Change (QoQ)	Change (YoY)	% of Q1 Royalty	Change (QoQ)	Change (YoY)
NeoBit	66.3%	9.5%	-0.6%	18.9%	-32.5%	-45.2%	83.7%	15.4%	6.5%
NeoFuse	25.0%	-17.8%	51.7%	61.3%	7.9%	24.3%	11.8%	-43.4%	161.2%
NeoEE	6.8%	-0.5%	-8.3%	14.6%	-3.2%	32.1%	3.9%	3.5%	-35.2%
NeoMTP	1.9%	-58.4%	-55.2%	5.2%	-66.4%	-60.9%	0.6%	49.3%	-19.7%



# Royalty Revenue by Wafer Size

Royalty from 12 inch increased due to continuous strong demand in advanced nodes.

## Q1 Royalty Breakdown



- ✓ 12 inch royalty revenue increased 22.0% year-on-year and 8.3% quarter-on-quarter.
- ✓ Royalty contribution from 12 inch increased mainly due to growing product tape-out activities from advanced nodes (55nm, 40nm, and 28nm) over the prior years in mass production.

## Royalty (thousands of NT dollars)

Q1 2019			
Wafer Size	% of Q1	Change (QoQ)	Change (YoY)
8-Inch	66.3%	- 0.1%	6.5%
12-Inch	33.7%	8.3%	22.0%

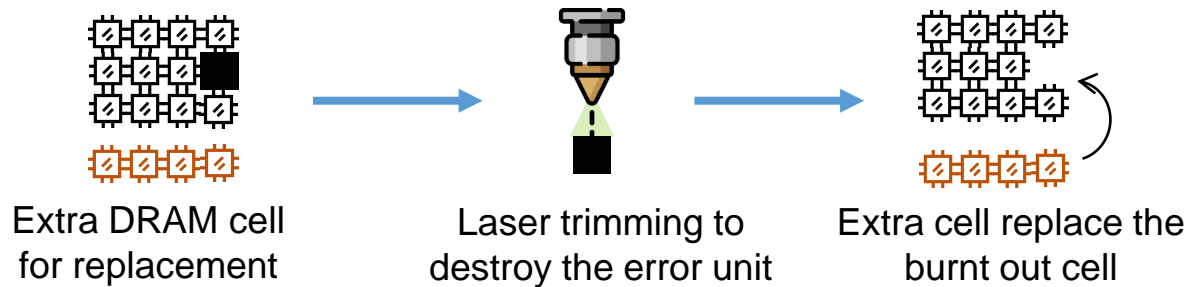
# Future Outlook



# NeoFuse for DRAM Repair

NeoFuse can optimize the DRAM manufacturing & improve yield significantly.

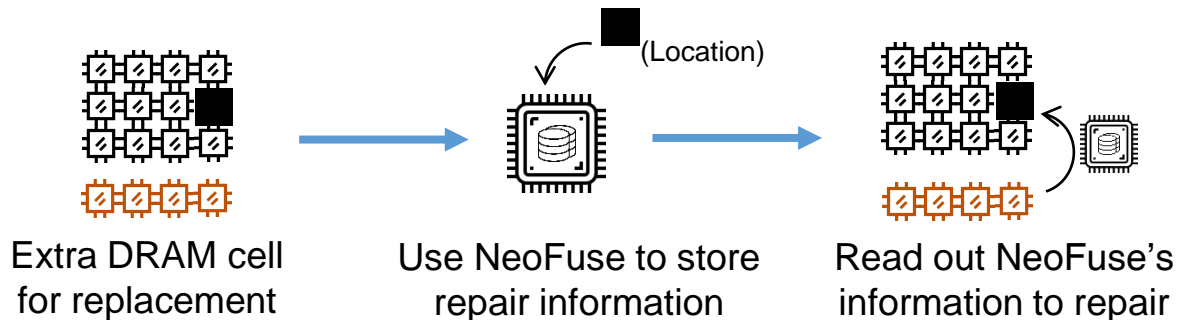
## DRAM Repair by Laser Trimming



Disadvantage:

- High cost for laser machine
- One-time repair only
- Manufacturing complexity

## DRAM Repair by NeoFuse



Advantage:

- Reduce the cost for laser trimming
- Multi-time repair
- Short repair setup time
- Improve yield significantly

# NeoPUF's Application for FPGA

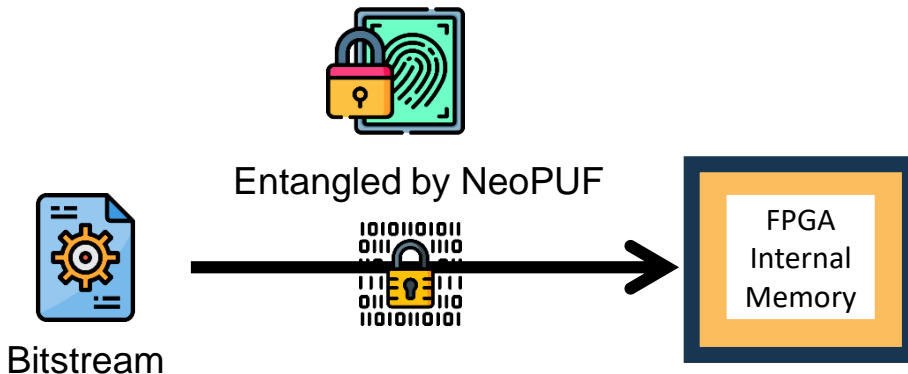
NeoPUF provide the bit stream protection for FPGA.

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- Field Programmable Gate Array (FPGA) is designed to be configured by customers after manufacturing.
- When FPGA are booted, it loads the design bitstream from its memory.  
If the protection is insufficient, it leads to
  1. bitstream tampering, causing backdoor attack or system crash.
  2. product cloning, causing venders and customers' enormous loss.

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NeoPUF can be the hardware root of trust for **bitstream protection**.



- ✓ With NeoPUF entanglement, the bitstream can be protected with higher speed compared to other FPGAs.
- ✓ With the uniqueness of NeoPUF, FPGA cannot be cloned by hackers.

# PUF-based Hardware Security IP

NeoPUF provide the foundation for developing eMemory's security function IPs.

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**PUFkeygen**

## Key Generations

Each device can generate its own key from embedded NeoPUF.



**PUFkeyst**

## Invisible Key Storage

NeoFuse is an invisible one time key storage memory.



**PUFuid**

## On Chip Unique ID

NeoPUF generates a unique code similar to a fingerprint ID for each chip.



**PUFtrng**

## True Random Number Generator

NeoPUF based true random number generator(tRNG) with the best randomness.



**PUFauth**

## Authentication

Authentication process can be applied by using PUF key.



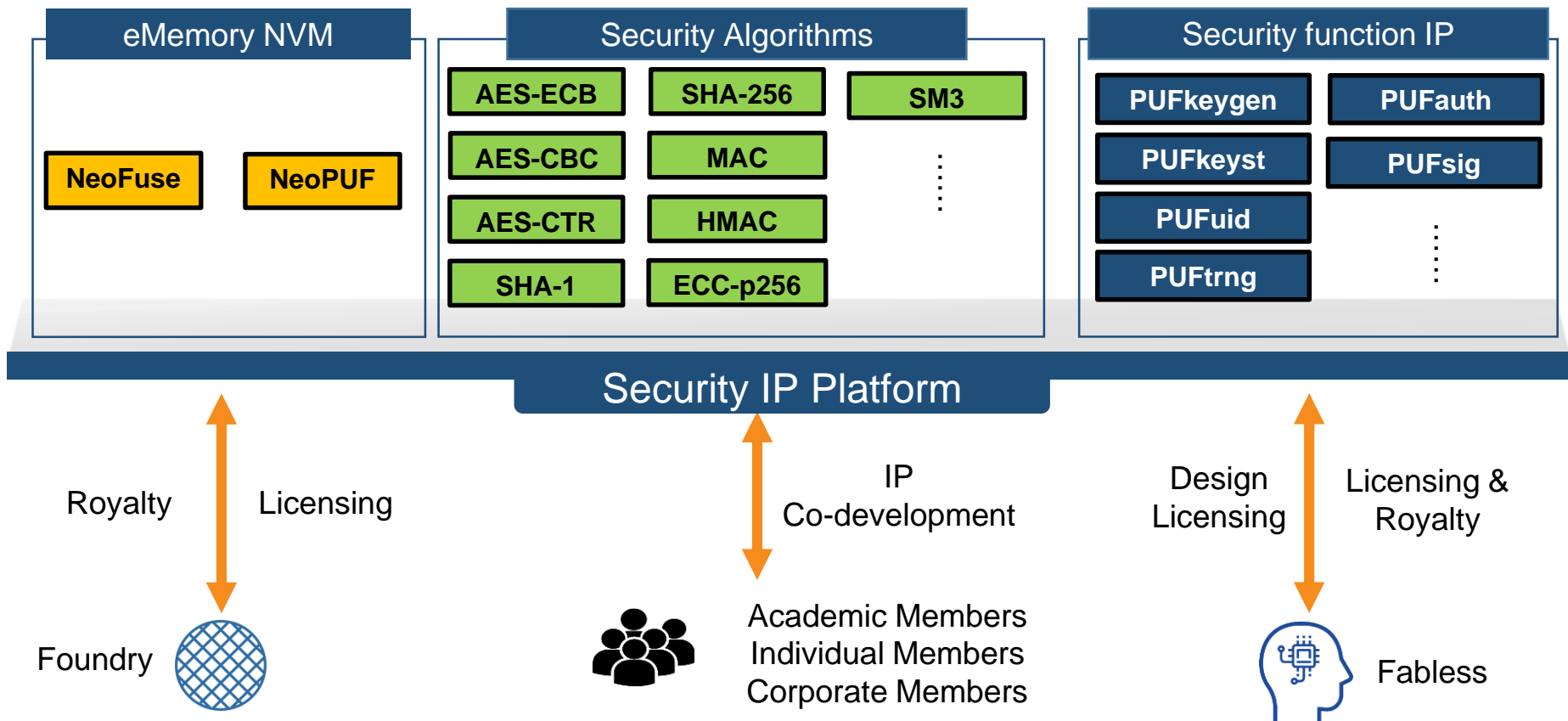
**PUFenc**

## Firmware Protection

NeoPUF can protect firmware using local secure key, which is from inborn NeoPUF secret.

# Our Security Function IP Platform

eMemory's security IP blocks enable a wide range of different security functions.





# Applications for Security Functions

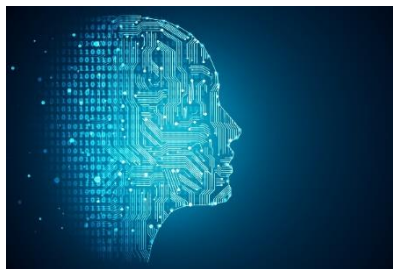
PUF-based security function IP has a wide range of applications.

## IoT



With the growth of the IoT, PUF-based security can provide low power security functions to protect users' privacy.

## Artificial Intelligence



AI applications include training and inference. Both are expensive and valuable intellectual property to protect by PUF-based security.

## Automotive



In smart cars, PUF-based security can provide a robust root of trust to protect drivers from the malicious attacks.

## Fintech



PUF-based inborn secret unique ID provide the trustworthy devices for fintech services, e.g. block chain, transaction, etc.

## PUF become a must for new semiconductor industry arena.

# eMemory Embedded Everywhere

eMemory's IP seeks to penetrate across all the applications.

## Core Tech



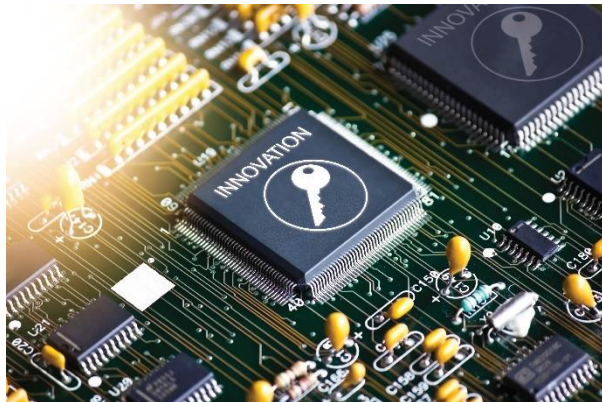
### ✓ **Product Applications:**

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

### ✓ **Future Target**

1. Application Processor
2. CPU
3. GPU
4. NAND Flash

## Security



### ✓ **The Future in Hardware Security Market**

The rapid growth in IoT drives the demand for the security market. All the connected devices need to build security capability quickly.

### ✓ **PUF-based Hardware Security IP:**

In order to satisfy the need for the market, eMemory developed a new series of PUF-based hardware security IP, which include  $PUF_{kengen}$ ,  $PUF_{uid}$ ,  $PUF_{trng}$ ,  $PUF_{Kst}$ ,  $PUF_{auth}$ ,  $PUF_{enc}$ .

**eMemory**

Embedded wisely, Embedded widely

# Our Perspectives for the Year

eMemory continue create value for the industry and our shareholders.



## Licensing & Royalty

- ✓ Licensing:
  - Continuous strong demand of NeoFuse among foundries and IDMs will drive licensing growth in the future. We expect current contracts negotiations to be final and contribute the license fee growth.
- ✓ Royalty :
  - 8 inch royalty will grow as largest US customers are ramping up PMIC rapidly.
  - Multiple new products in the pipeline will drive 12 inch royalty to grow further, ie. Bluetooth and TDDI in 55nm, OLED DDI in 40nm, switch, DTV, Setup box, surveillance and SSD controller in 28nm. 25nm DRAM is expected to ramping up production by the end of the year.



## New Technology Development

- ✓ Develop 7nm & 5nm technology platform.
- ✓ Work with leading IDMs on emerging memory MRAM and ReRAM.
- ✓ Partnership with largest IP company to embed NeoFuse and NeoPUF as root of trust into secure processor.
- ✓ Cooperation with leading customers for NeoPUF based hardware security IPs.
- ✓ Our PUF<sub>TRNG</sub>, the critical IP in hardware security, with higher performance and much lower price, will be the killer application.





# Q&A

# Appendix

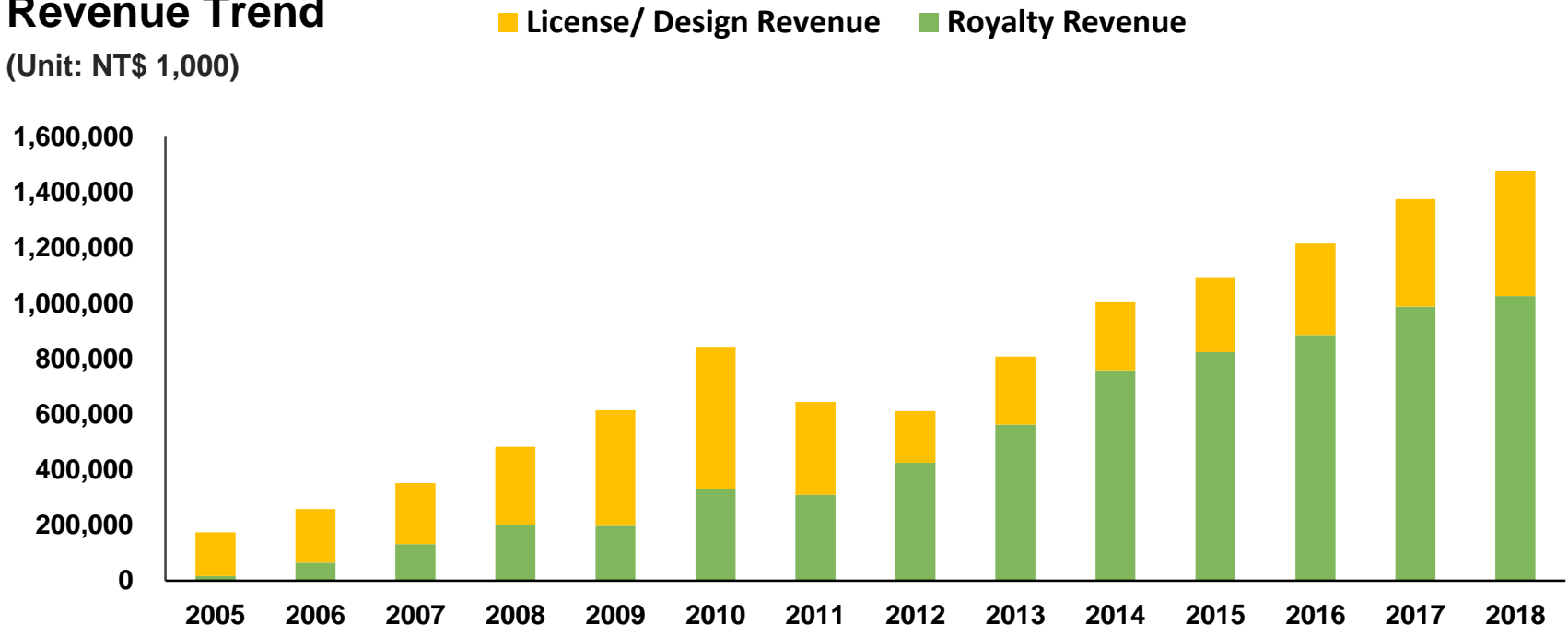


# Company Overview

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

## Revenue Trend

(Unit: NT\$ 1,000)



**Founded**  
**In 2000**

Based in Hsinchu, Taiwan.  
IPO in 2011

**600+**  
**Patents Issued**

232 pending patents. 250  
employees with 70% R&D  
personnel

**Best IP Partner**  
**With TSMC**

TSMC Best IP Partner Award  
since 2010.

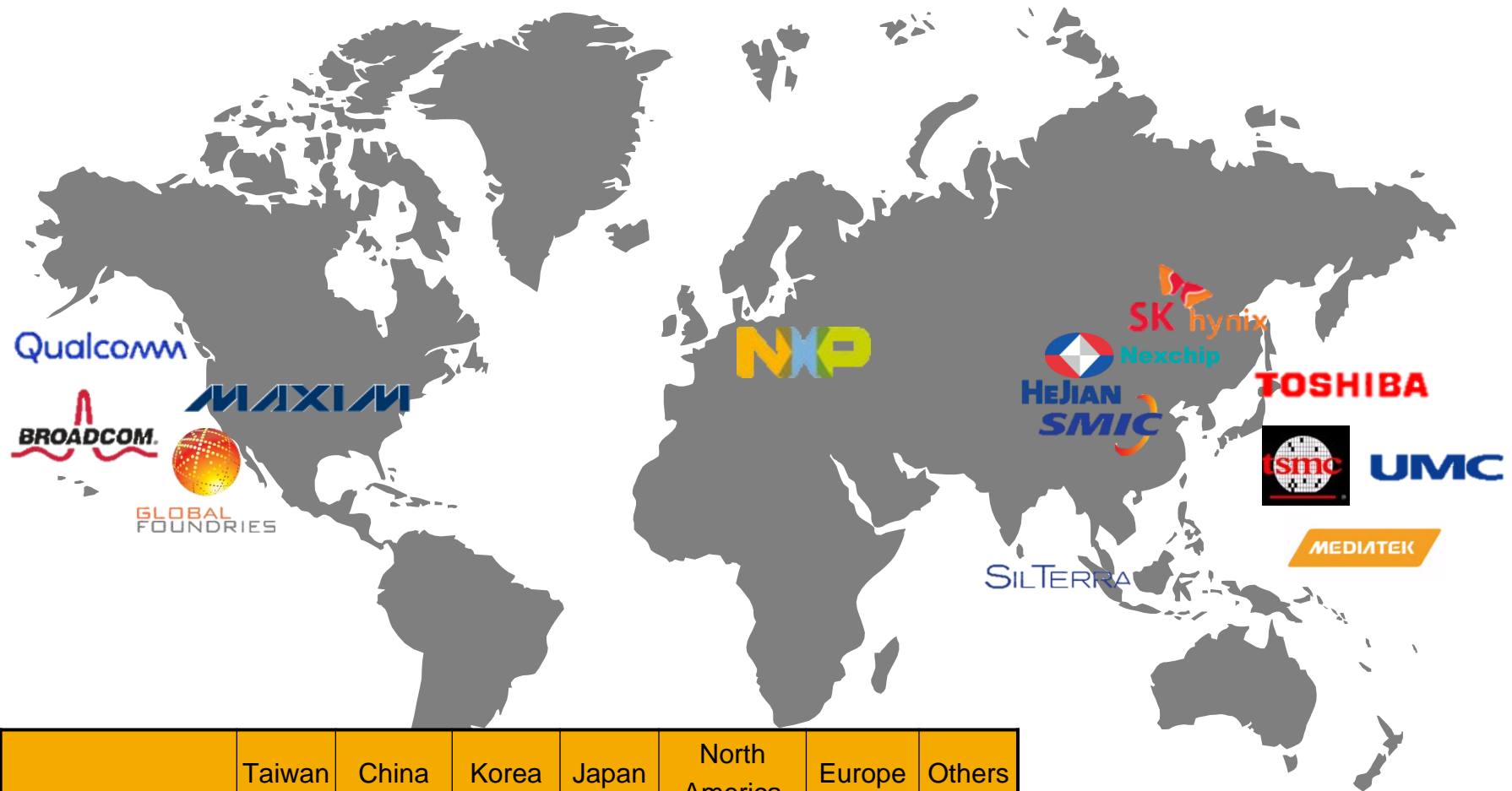
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# Worldwide Customers

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



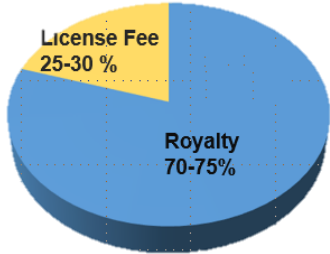
	Taiwan	China	Korea	Japan	North America	Europe	Others
Foundry	5	7	4	3	1	2	1
IDM	1	0	0	7	1	1	0
Fabless	269	632	79	56	268	127	69

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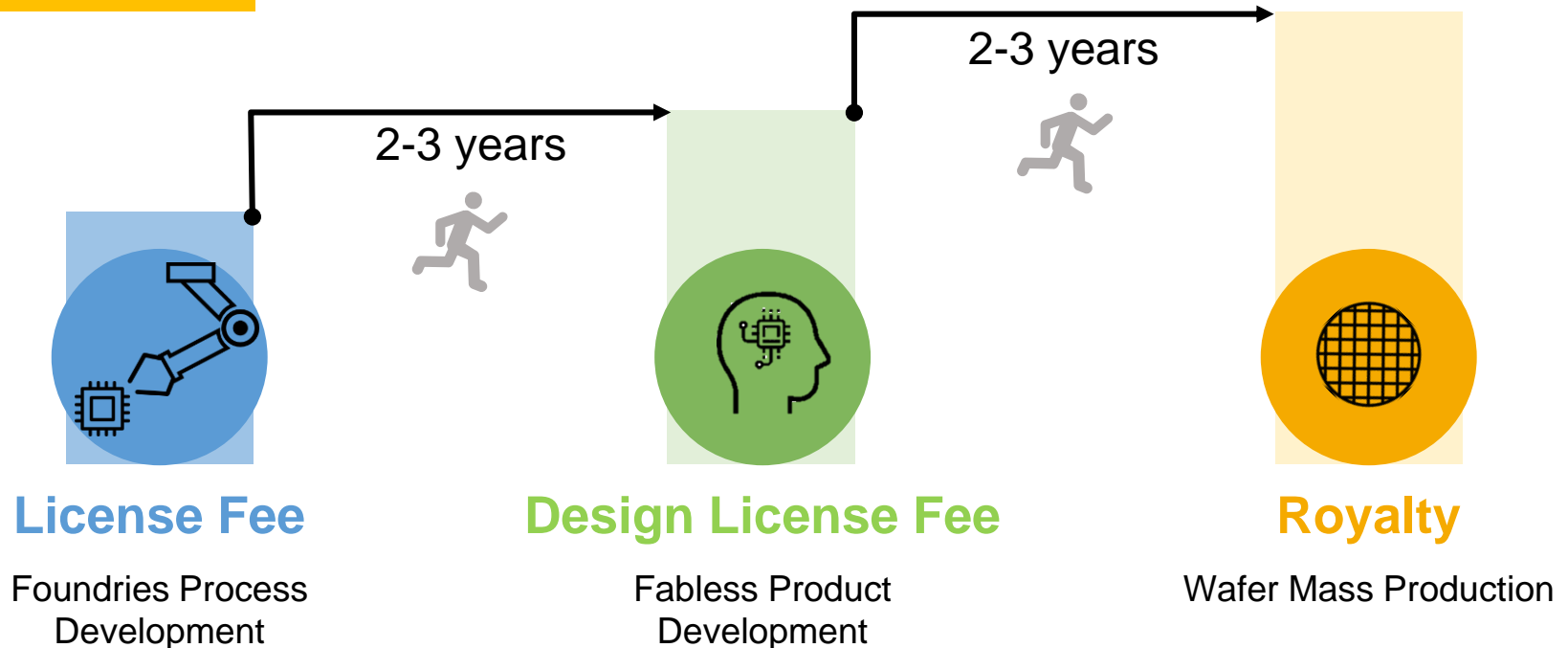
# Business Model

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

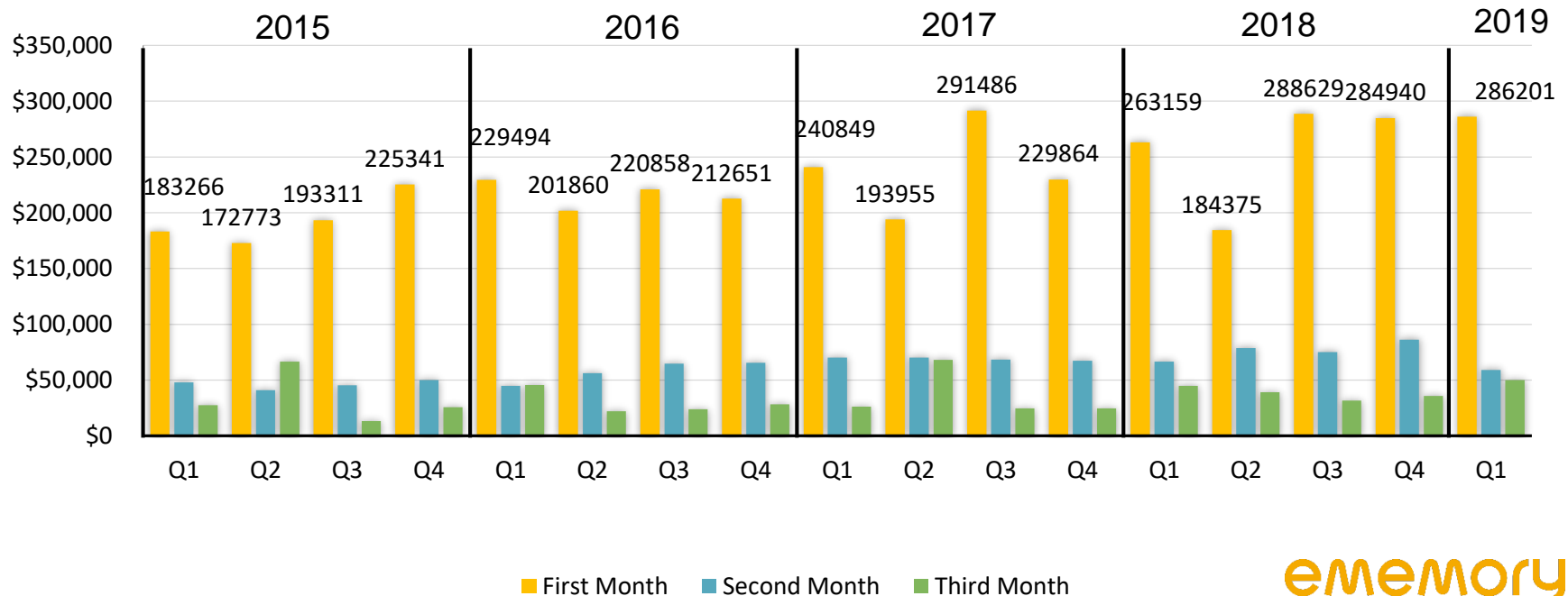


# Quarterly Revenue Pattern

eMemory's revenue are mostly received in the first month of the quarter

- ✓ 1<sup>st</sup> month: Receive **License Fees** of the month and **Royalty** from most foundries on previous quarter's wafer shipments
- ✓ 2<sup>nd</sup> month: Receive **License Fees** of the month and **Royalty** from other foundries
- ✓ 3<sup>rd</sup> month: **License Fees** Only.
- ✓ Two foundries pay royalty semiannually, reported in Jan and July Revenue.

Thousands of NT dollars



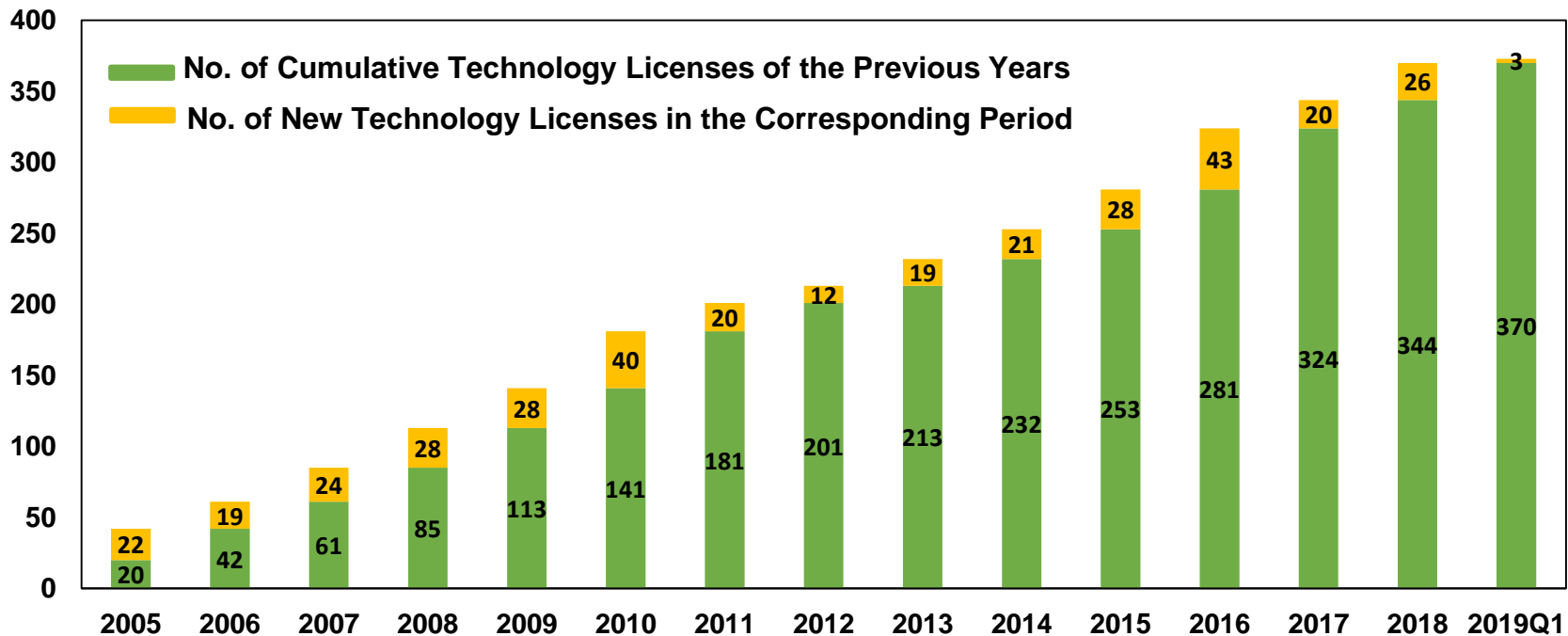
# Technology Licenses

## Cumulative technology licenses

### Number of Licenses

Year	2016	2017	2018	2019 Q1
License	43	20	26	3

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

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- New technologies being developed for 97 platforms by Q1 2019.
- 3 licensing contracts were signed, 2 for NeoBit, 1 for NeoFuse.

	7/10nm	12/14/16nm	22/28nm	40nm	55/65nm	80/90nm	0.11~ 0.13um	0.15~ 0.18um
NeoBit	-	-	-	-	1	1	8	8
NeoFuse	3	2	12	6	7	9	3	1
NeoPUF	-	-	3	2	2	-	-	-
NeoEE	-	-	-	-	-	2	3	7
NeoMTP	-	-	-	-	2	2	5	8

As of March 31<sup>st</sup>, 2019

# Technology Development

Developments by process node

12" Fabs	Production	Development	IP Type	Process Type
7/10nm	0	3	OTP, PUF	FF, FF+
12/14/16nm	3	2	OTP	FF, FF+
22/28nm	17	15	PUF, OTP	LP/ULP/ULL, HPC/HPC+, HV-OLED, DRAM, SOI
40nm	10	8	PUF, OTP, MTP	LP/ULP, HV-DDI/OLED, eFlash
55/65nm	19	12	PUF, OTP, MTP	LP/ULP, HV-DDI/OLED, CIS, eFlash, DRAM, BCD, PM
80/90nm	11	9	OTP, MTP	HV-DDI/OLED, LP, eFlash, Generic
0.13/0.11um	12	6	OTP, MTP	HV-DDI, BCD, Generic
0.18um	1	0	OTP	BCD, Generic
Total		55		

8" Fabs	Development	IP Type	Process Type
90nm	5	OTP	HV-DDI, LL, BCD
0.13/0.11um	13	PUF, OTP, MTP	HV/HV-MR, BCD, LP/LL, CIS, Green, Flash, SOI
0.18/0.16/0.152um	24	OTP, MTP	HV/HV-MR, BCD, LP/LL, CIS, Green, Generic
0.25um	0	OTP, MTP	BCD
0.35um	0	OTP	UHV
Total	42		

Note: As of March 31<sup>st</sup>, 2019



A hand is shown dropping a coin into a stack of coins. A small plant is growing out of the stack. The background is a warm, golden-yellow color with a blue and white brushstroke effect on the left side.

THANKS

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