



Investor Presentation

智慧財產權聲明

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eMemory, NeoBit, NeoFuse, NeoFlash, NeoEE, NeoMTP, NeoROM, EcoBit 與NeoPUF皆為力旺電子在台灣或其他國家之商標或服務標章。

投資安全聲明

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A hand is shown dropping a coin into a stack of coins. A small plant is growing from the stack of coins. The background is a warm, golden-brown color with a bokeh effect.

簡報大綱

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ememory

Embedded wisely, Embedded widely

營運回顧

Q1綜合損益表

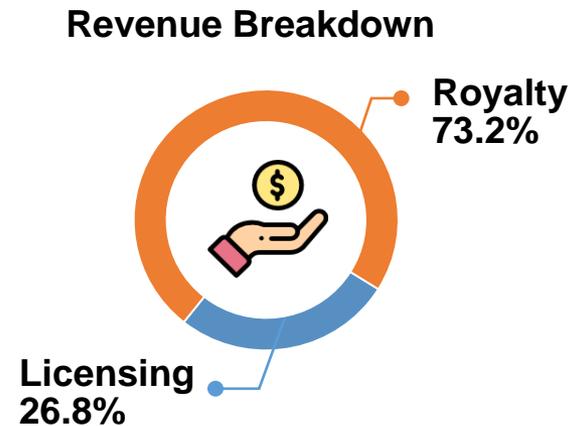
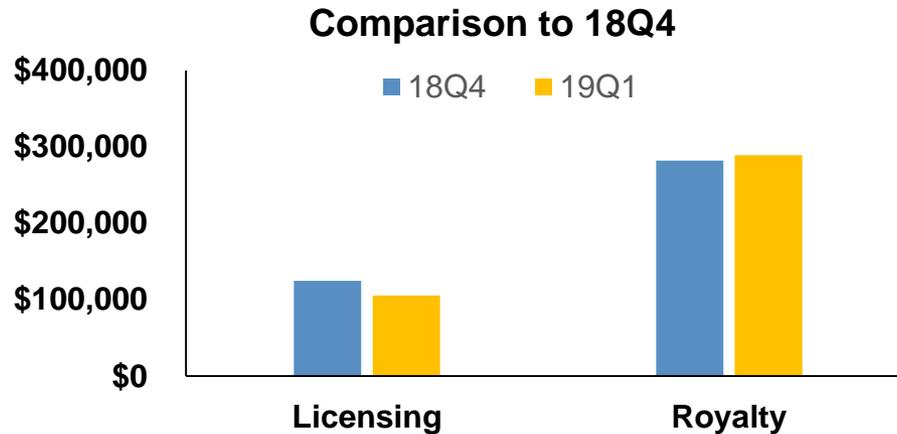
The EPS of 2019 Q1 was 2.39 NTD, ROE was 39%

(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營收貢獻分析

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 營收分析 – 產品線

Licensing revenue decreased by reason of prolonged contract negotiations

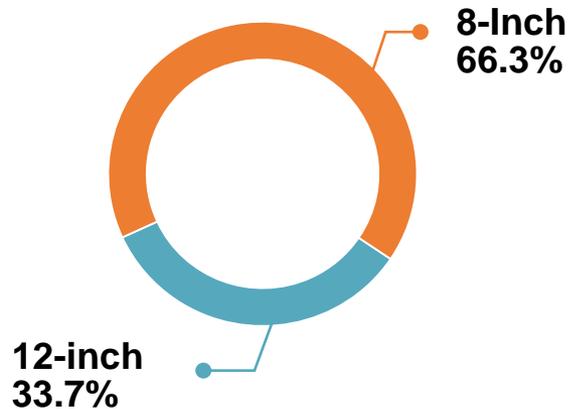
- ✓ The demand of NeoFuse continues to grow, as its licensing up 7.9% QoQ and 24.3% YoY. Its royalty revenue declined 43.4% QoQ, but increased 161.2% YoY. This is mainly due to DDI seasonal production factor, always prebuilt in two quarters and rest for the others.
- ✓ The royalty revenue of NeoBit increased 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% |

營收分析 - 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)

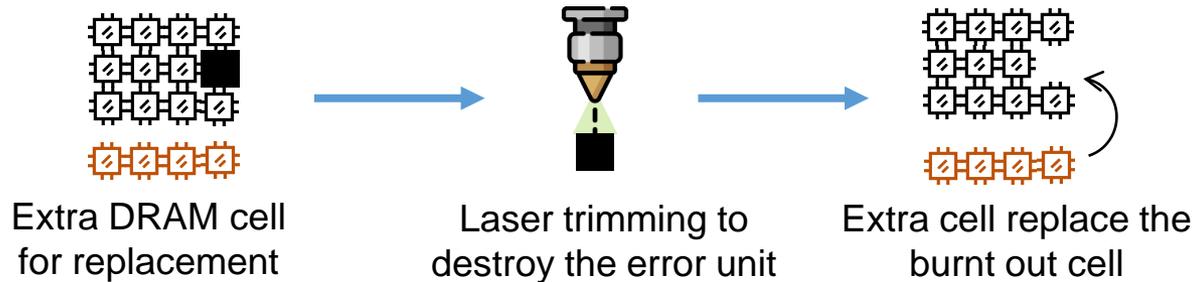
| Q1 2019 | | | |
|------------|---------|--------------|--------------|
| Wafer Size | % of Q1 | Change (QoQ) | Change (YoY) |
| 8-Inch | 66.3% | - 0.1% | 6.5% |
| 12-Inch | 33.7% | 8.3% | 22.0% |

未來展望

NeoFuse 在 DRAM Repair 的應用

NeoFuse can optimize the DRAM manufacturing & improve yield significantly.

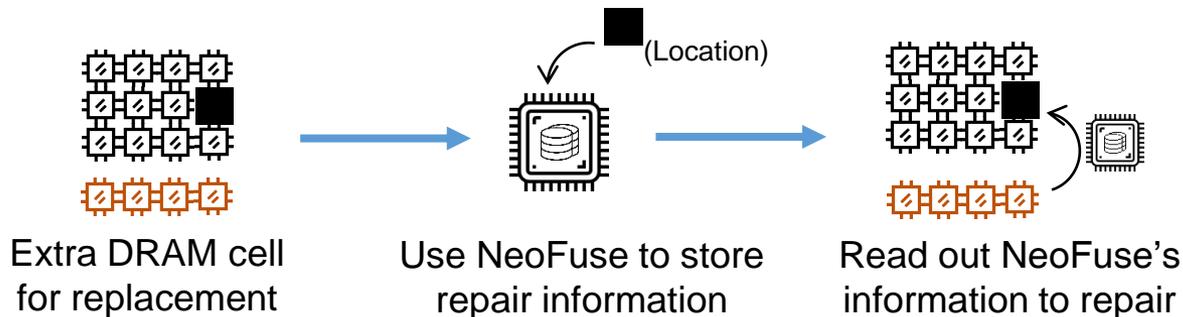
DRAM Repair by Laser Trimming



Disadvantage:

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

DRAM Repair by NeoFuse



Advantage:

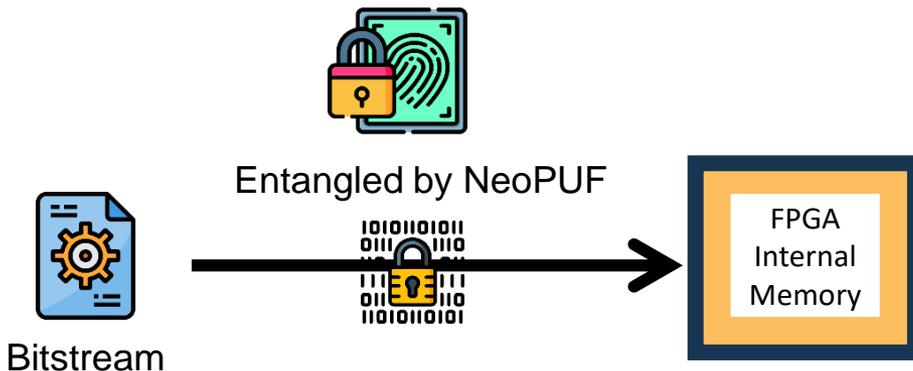
- Reduce the cost for laser trimming
- Multi-time repair
- Short repair setup time
- Improve yield significantly

NeoPUF's在FPGA的應用

NeoPUF provide the bit stream protection for FPGA.

- 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.

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.



PUFkeygen

Key Generations

Each device can generate its own key from embedded NeoPUF.



PUFtrng

True Random Number Generator

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



PUFkeyst

Invisible Key Storage

NeoFuse is an invisible one time key storage memory.



PUFauth

Authentication

Authentication process can be applied by using PUF key.



PUFuid

On Chip Unique ID

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



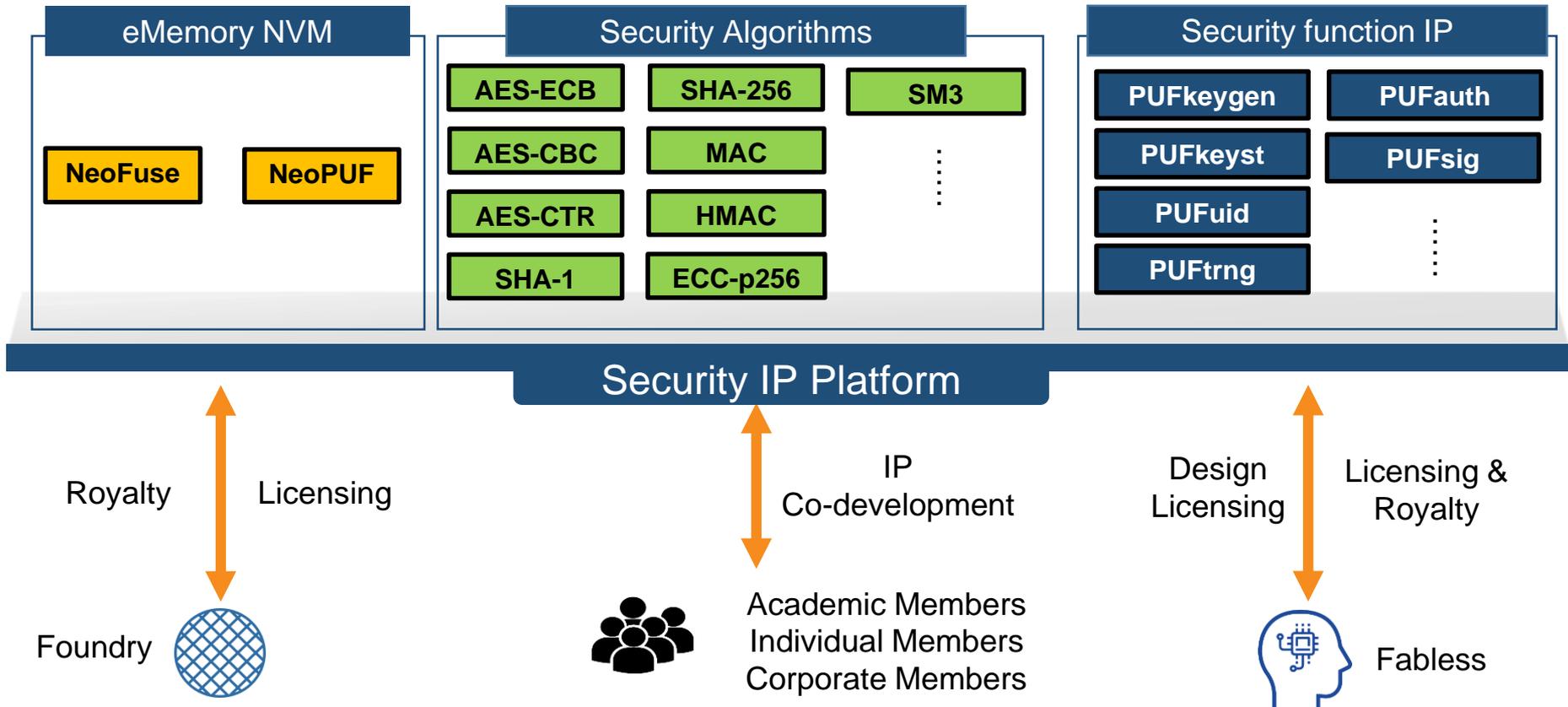
PUFenc

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

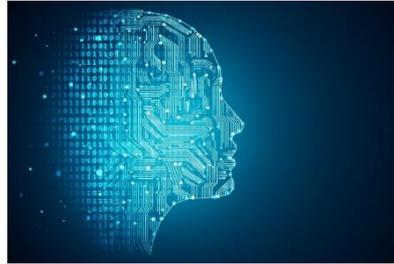
PUF-based security function IP has a wide range of applications.

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} .

未來展望

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_{TRNG}, the critical IP in hardware security, with higher performance and much lower price, will be the killer application.



Q&A



附錄

ememory

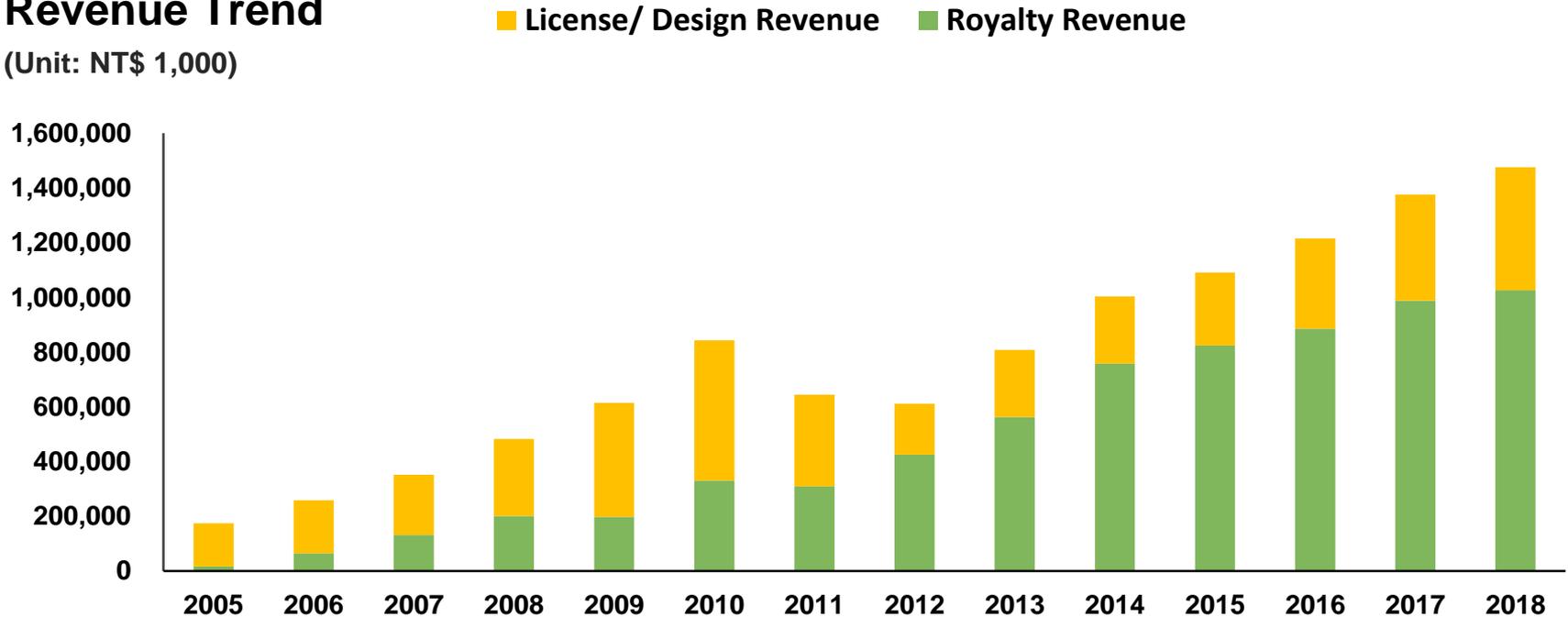
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公司簡介

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

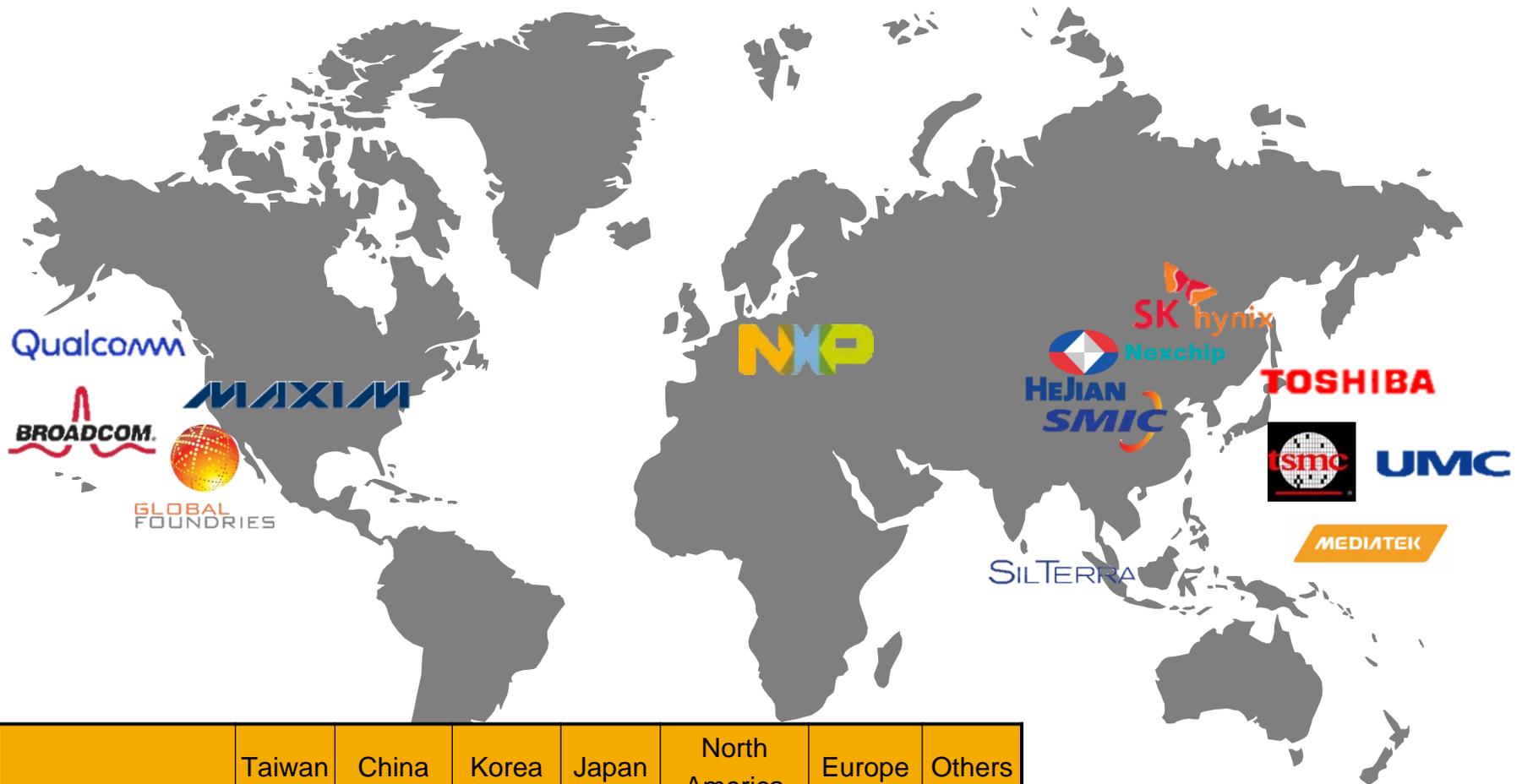
TSMC Best IP Partner Award
since 2010.

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全球客戶

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

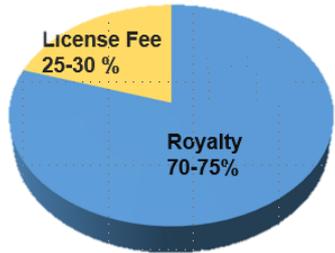


| | Taiwan | China | Korea | Japan | North America | Europe | Others |
|---------|--------|-------|-------|-------|---------------|--------|--------|
| Foundry | 5 | 7 | 4 | 3 | 1 | 2 | 1 |
| IDM | 1 | 0 | 0 | 7 | 1 | 1 | 0 |
| Fabless | 269 | 632 | 79 | 56 | 268 | 127 | 69 |

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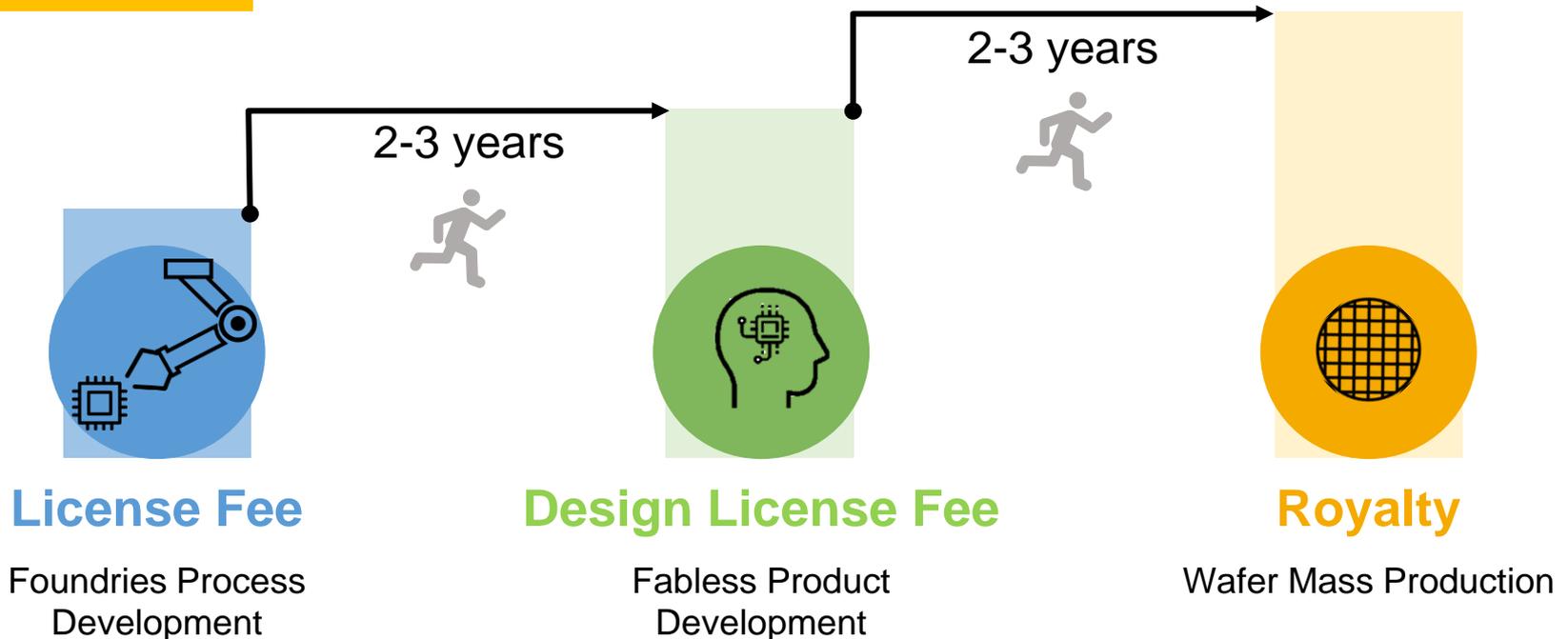
營運模式

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

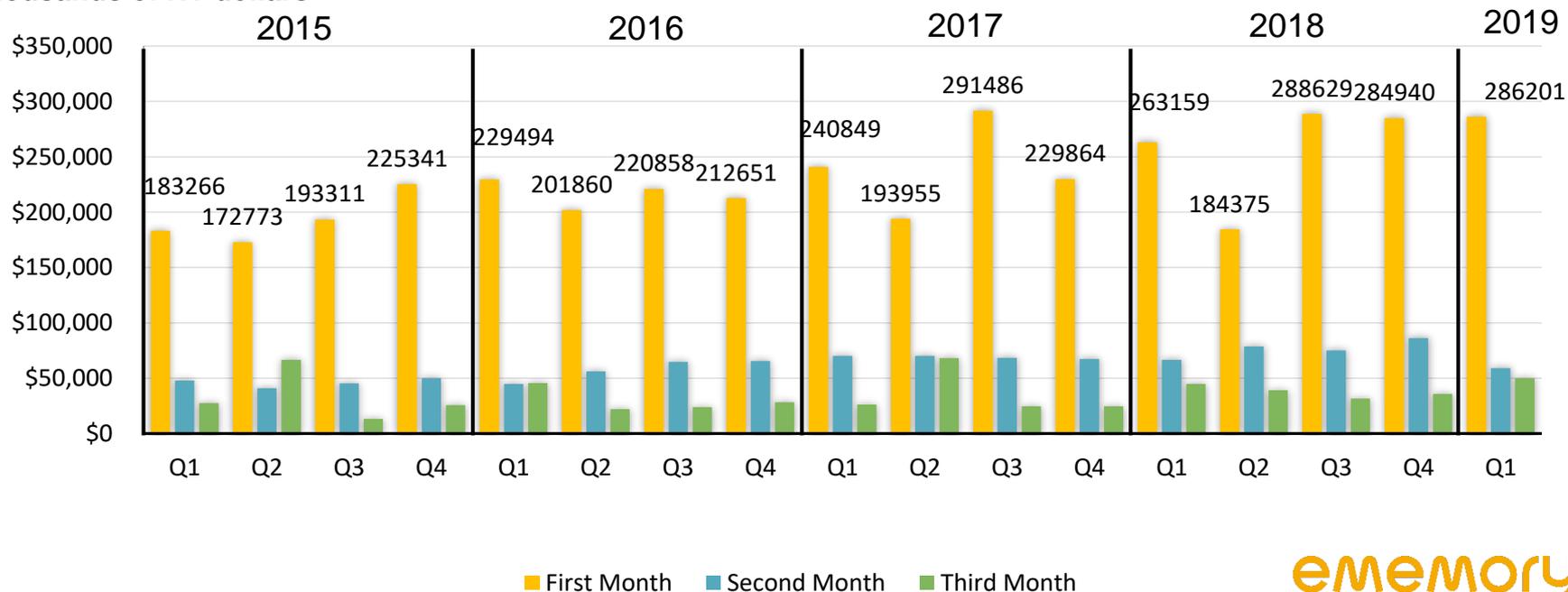


每季營收

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

- ✓ 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**.
- ✓ Two foundries pay royalty semiannually, reported in Jan and July Revenue.

Thousands of NT dollars



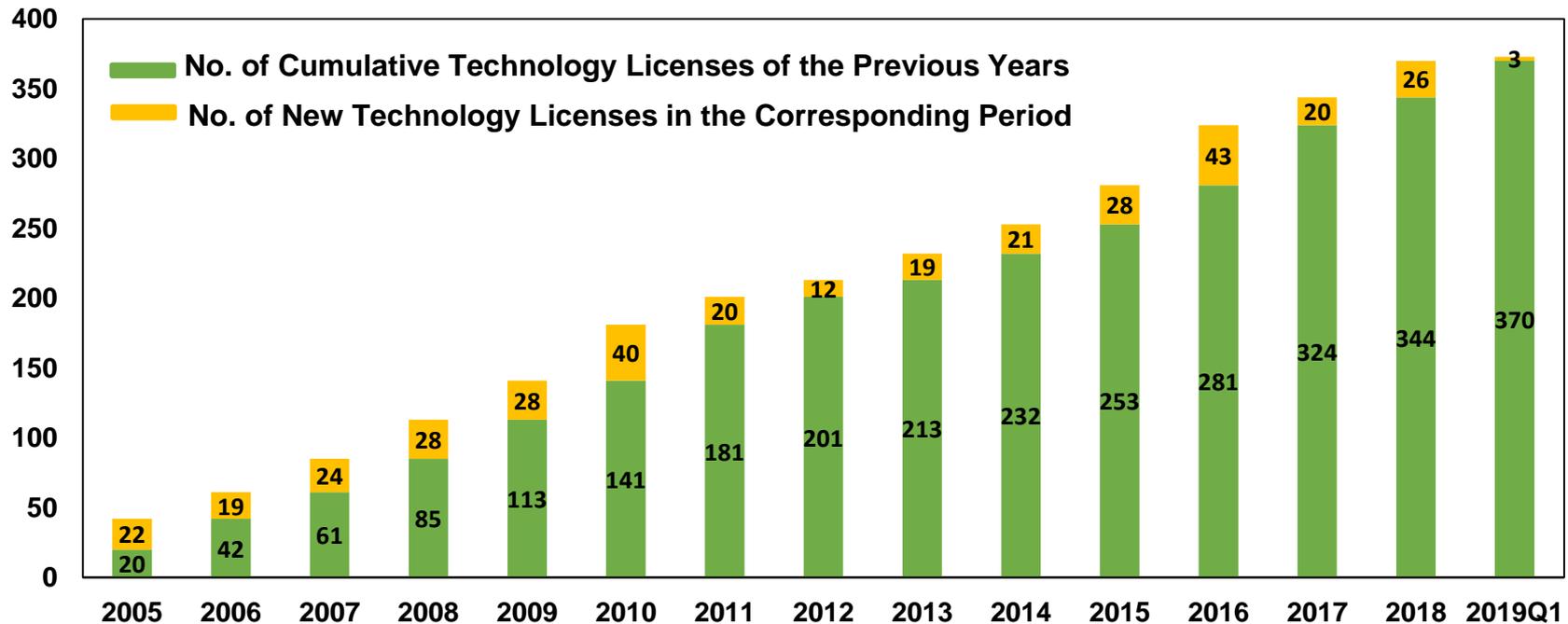
技術授權合約

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.



建構中的技術製程平台

Products in different process nodes

- 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 31st, 2019

建構中的技術製程平台

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 31st, 2019



THANKS

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