Investor Presentation

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ememory

IPR Notice

Cautionary Statement

This presentation contains forward-looking statements, which are subject to risk factors associated with semiconductor and intellectual property business. It is believed that the expectations reflected in these statements are reasonable. But they may be affected by a variety of variables, many of which are beyond our control. These variables could cause actual results or trends to differ materially which include, but are not limited to: wafer price fluctuation, actual demand, rapid technology change, delays or failures of customers' tape-outs into wafer production, our ability to negotiate, monitor and enforce agreements for the determination and payment of royalties, any bug or fault in our technology which leads to significant damage to our technology and reputation, actual or potential litigation, semiconductor industry cycle and general economic conditions. Except as required by law, eMemory undertakes no obligation to update or revise any forward-looking statements, whether as a result of new information, future events, or otherwise.

Contents

Review of Operations

Q2 2020 Financial Results

The EPS of Q2 2020 was 2.28 NTD, ROE was 41.9%

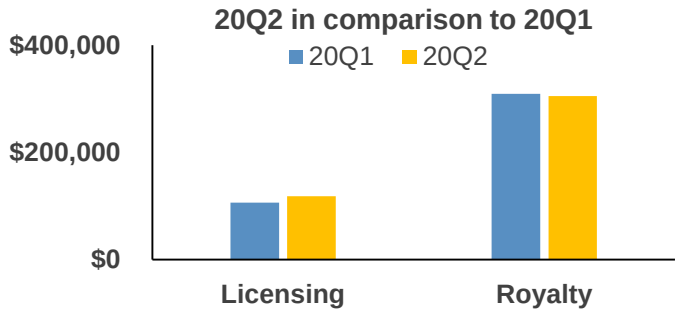
(thousands of NT dollars)

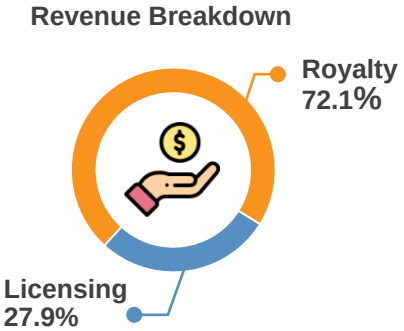
	Q2 2020	Q1 2020	Change (QoQ)	Q2 2019	Change (YoY)	H1 2020	H1 2019	Change (YoY)
Revenue	423,276	415,436	1.9%	316,541	33.7%	838,712	711,602	17.9%
Gross Margin	100%	100%	-	100%	-	100%	100%	-
Operating Expenses	227,364	221,463	2.7%	187,889	21.0%	448,827	388,977	15.4%
Operating Income	195,912	193,973	1.0%	128,652	52.3%	389,885	322,625	20.8%
Operating Margin	46.3%	46.7%	-0.4ppt	40.6%	5.7ppts	46.5%	45.3%	1.2ppts
Net Income	169,317	176,758	-4.2%	115,098	47.1%	346,075	292,249	18.4%
Net Margin	40.0%	42.5%	-2.5ppts	36.4%	3.6ppts	41.3%	41.1%	0.2ppt
EPS (Unit: NTD)	2.28	2.38	-4.2%	1.55	47.1%	4.66	3.94	18.3%
ROE	41.9%	39.5%	2.4ppts	29.0%	12.9ppts	42.8%	36.9%	5.9ppts

Note: Revenue of Q2 2020 in terms of US$ is US$14.1 mil, up 2.0% QoQ, and up 38.1% YoY.

Revenue in Different Stream

Q2 revenue up 38.1% YoY in US dollar terms





Revenue

NT$ Thousands	Q2 2020	Q1 2020	QoQ	Q2 2019	YoY	H1 2020	H1 2019	YoY
Licensing	118,062	106,446	10.9%	104,806	12.6%	224,508	210,630	6.6%
Royalty	305,214	308,990	-1.2%	211,735	44.1%	614,204	500,972	22.6%
Total	423,276	415,436	1.9%	316,541	33.7%	838,712	711,602	17.9%

US$ Thousands	Q2 2020	Q1 2020	QoQ	Q2 2019	YoY	H1 2020	H1 2019	YoY
Licensing	3,953	3,542	11.6%	3,373	17.2%	7,495	6,811	10.0%
Royalty	10,196	10,336	-1.4%	6,870	48.4%	20,532	16,275	26.2%
Total	14,149	13,878	2.0%	10,243	38.1%	28,027	23,086	21.4%

Q2 Revenue by Technology

The royalty of NeoFuse has a growth of 100.4% YoY

- ✓ The licensing revenue of NeoFuse increased 12.3% QoQ and 27.6% YoY. Its royalty revenue decreased 2.3% QoQ but increased 100.4% YoY.
- ✓ The licensing revenue of NeoBit decreased 15.6% QoQ and 26.7% YoY. Its royalty revenue increased 0.5% QoQ and 31.0% YoY.
- ✓ The licensing revenue of MTP (NeoEE+NeoMTP) increased 56.3% QoQ and 3.3% YoY; while its royalty revenue decreased 22.2% QoQ and 18.3% YoY.
- ✓ PUF-based has not contributed to any royalty but its licensing revenue has an increased of 364.7% QoQ and 347.0% YoY.

Technology	Q2 2020								
	Total Revenue			Licensing Revenue			Royalty Revenue		
	% of Q2 Revenue	Change (QoQ)	Change (YoY)	% of Q2 Licensing	Change (QoQ)	Change (YoY)	% of Q2 Royalty	Change (QoQ)	Change (YoY)
NeoBit	52.1%	-1.2%	22.1%	17.2%	-15.6%	-26.7%	65.6%	0.5%	31.0%
NeoFuse	42.5%	4.0%	58.3%	71.0%	12.3%	27.6%	31.5%	-2.3%	100.4%
PUF-Based	0.7%	364.7%	347.0%	2.4%	364.7%	347.0%	0.0%	0.0%	0.0%
MTP	4.7%	7.8%	-7.6%	9.4%	56.3%	3.3%	2.9%	-22.2%	-18.3%

H1 Revenue by Technology

The royalty of NeoFuse has a growth of 136.8% YoY

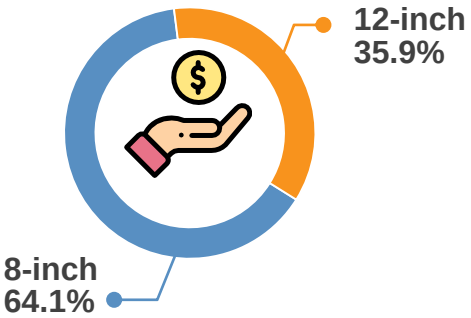
- ✓ The licensing revenue of NeoFuse increased 21.4% YoY. Its royalty revenue increased 136.8% YoY.
- ✓ The licensing revenue of NeoBit decreased 6.9% YoY. Its royalty revenue increased 1.2% YoY.
- ✓ The licensing revenue of MTP (NeoEE+NeoMTP) decreased 42.6% YoY; while its royalty revenue decreased 15.2% YoY.
- ✓ PUF-based has not contributed to any royalty but its licensing revenue has an increased of 443.2% YoY.

Technology	H1 2020					
	Total Revenue		Licensing Revenue		Royalty Revenue	
	% of H1 Revenue	Change (YoY)	% of H1 Licensing	Change (YoY)	% of H1 Royalty	Change (YoY)
NeoBit	52.9%	0.3%	19.8%	-6.9%	65.1%	1.2%
NeoFuse	42.1%	65.9%	70.6%	21.4%	31.6%	136.8%
PUF-Based	0.4%	443.2%	1.5%	443.2%	0.0%	0.0%
MTP	4.6%	-30.7%	8.1%	-42.6%	3.3%	-15.2%

Royalty Revenue by Wafer Size

12-inch wafer increased 109.4% YoY

Q2 Royalty Breakdown



- ✓ 12-inch wafers contributed 35.9% of royalty, decreased 1.2% sequentially but increased 109.4% YoY.
- ✓ 8-inch wafers contributed 64.1% of royalty, decreased 1.2% sequentially but increased 22.7% YoY.

Royalty

Wafer Size	Q2 2020			H1 2020	
	% of Q2	Change (QoQ)	Change (YoY)	% of H1	Change (YoY)
8-Inch	64.1%	-1.2%	22.7%	64.1%	12.1%
12-Inch	35.9%	-1.2%	109.4%	35.9%	47.1%

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 advanced technology platforms and more comprehensive PUF-based security IPs.
- ✓ Royalty:
  - 8” wafers – 2 to 3 times PMIC content increase in 5G smartphones. Expect the EV automotive applications to drive further growth momentum.
  - 12” wafers – more than 300 tape outs in the pipelines ready for productions, applications including TDDI, OLED, ISP, CIS, Bluetooth, TWS, Networking-related IC, SSD controllers, video processor, STB, DTV, surveillance, and DRAM.

New Application & Technology Development

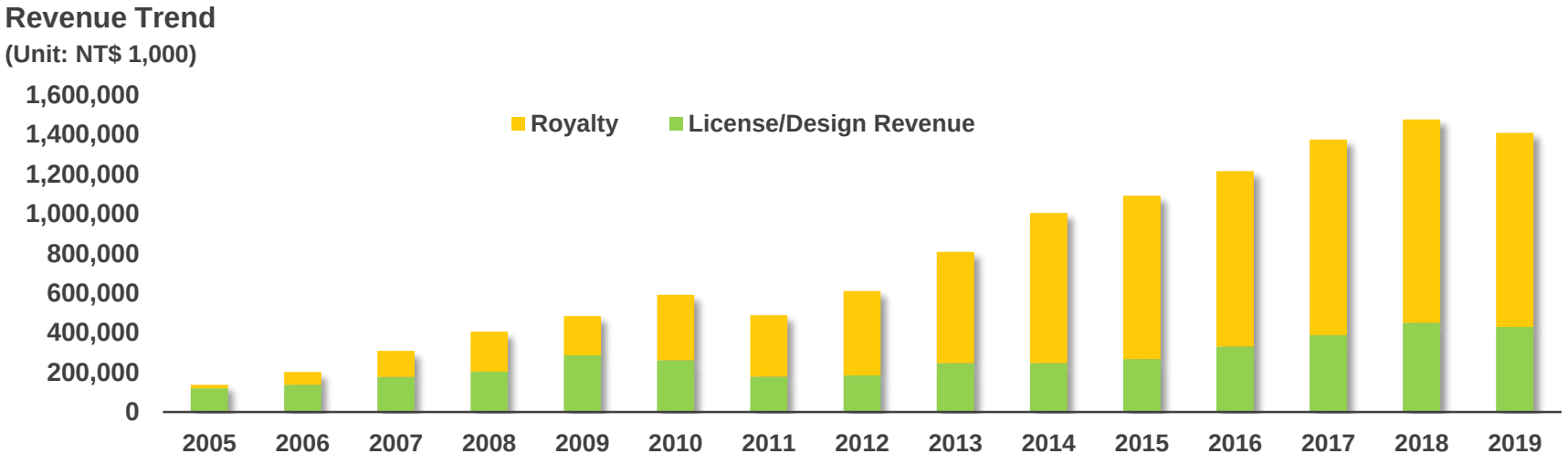
- ✓ For new applications:
  - PUF-based security IPs adopted by customers in AI, IoT, FGPA, Blockchain, and industrial automation.
  - Security platform cooperation with ARM.
- ✓ For new technology development:
  - Developed 6nm and 5nm plus (N5P) technology with leading foundry partners; demonstrated 6nm silicon results successfully; 7nm has been adopted into automotive application.
  - PUF-based IoT security solution, security elements and hardware security module IPs are under development.
  - Built PUF-based hardware security IP open platform, by integrating OTP, PUF, security-functioned IPs, and cryptographic algorithm IPs.

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 30M wafers shipped.

700+

Patents Issued

265 pending patents. 281 employees with 68% R&D personnel.

Best IP Partner

With TSMC

TSMC Best IP Partner Award since 2010.

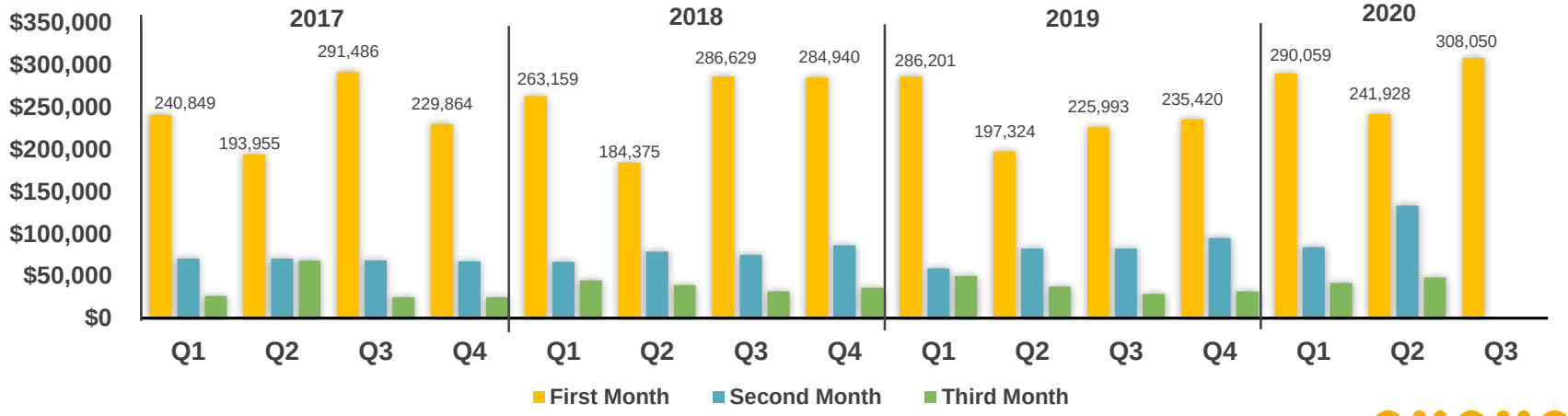
Quarterly Revenue Pattern

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)



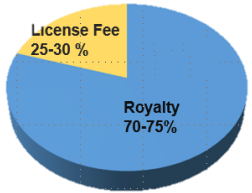
Worldwide Customers

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

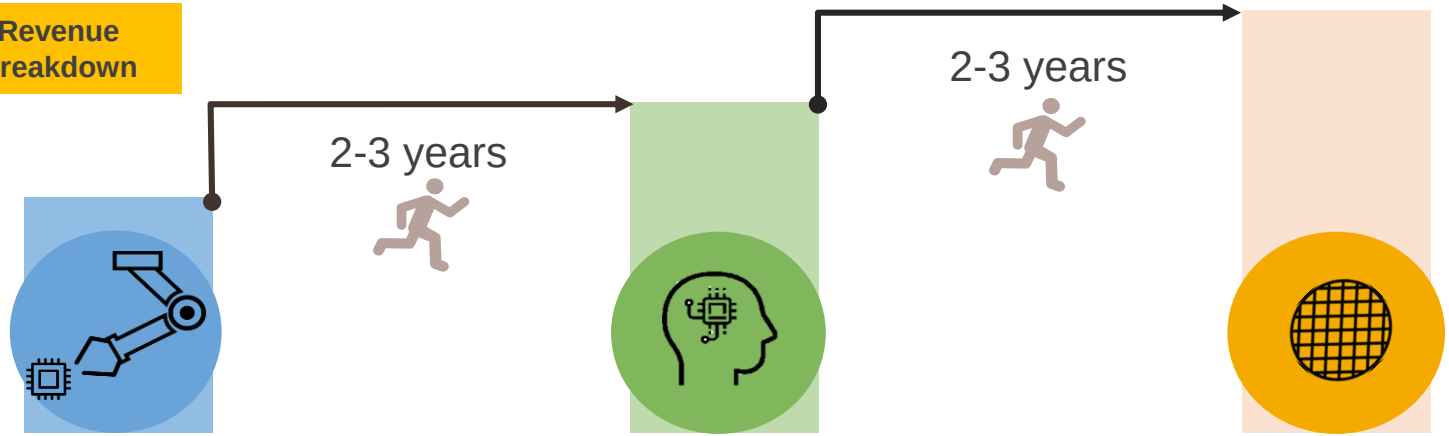
Business Model

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

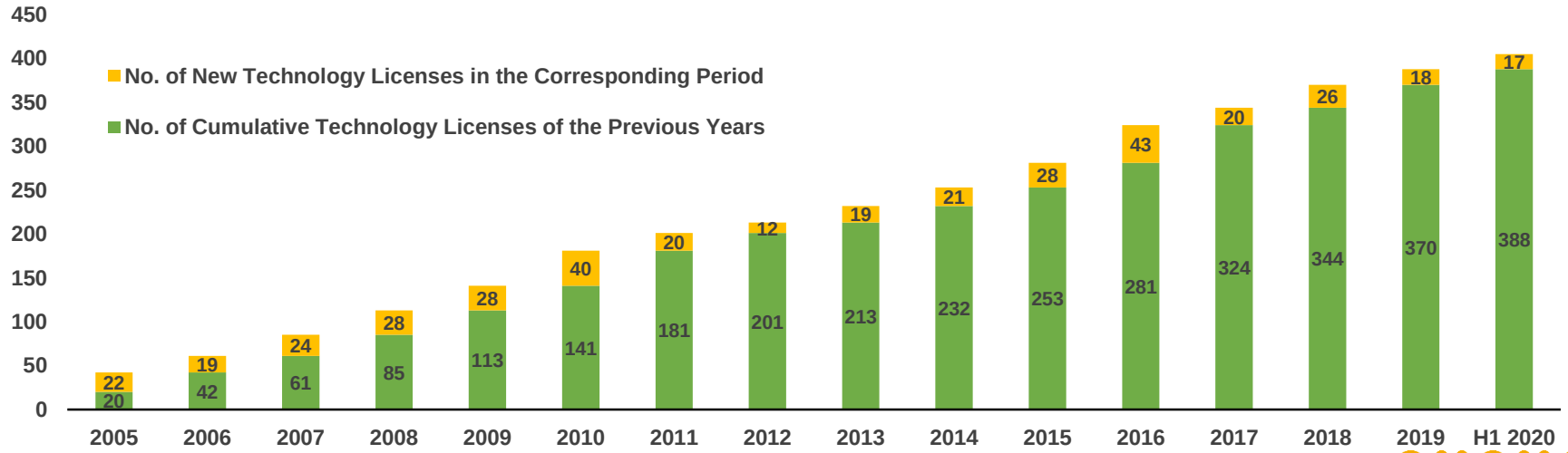
Technology Licenses

Cumulative technology licenses

Number of Licenses

Year	2016	2017	2018	2019	H1 2020
License	43	20	26	18	17

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 93 platforms by Q2 2020.
- ✓ 12 licensing contracts were signed, 1 for NeoBit and 11 for NeoFuse.

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	9	9	1
NeoFuse	2	1	3	11	4	11	6	-	1	-
PUF-Based	1	-	-	3	2	1	-	-	-	-
MTP	-	-	-	-	-	2	5	8	10	-

Note: As of June 30th, 2020

Technology Development

Developments by process nodes

12" Fabs	Production	Development	IP Type	Process Type
5/6nm	0	3	OTP, PUF	FF
7/10nm	2	1	OTP, PUF	FF, FF+
12/16nm	3	3	OTP	FF, FF+
22/28nm	27	14	OTP, PUF, MTP	LP/ULP/ULL, HPC/HPC+, HV-OLED, DRAM, SOI
40nm	14	6	OTP, PUF, MTP	LP/ULP, E-Flash, HV-DDI/OLED
55/65nm	24	15	OTP, PUF, MTP	LP/ULP, E-Flash, HV-DDI/OLED, DRAM, CIS, BCD, PM
80/90nm	16	12	OTP, MTP	HV-DDI/OLED, LP, Generic, BCD, CIS
0.11/0.13um	17	5	OTP, MTP	HV-DDI, BCD, Generic
0.18um	1	2	OTP	BCD, Generic
Total	104	61		

8" Fabs	Development	IP Type	Process Type
90nm	1	OTP	HV-DDI, LL, BCD
0.11/0.13um	12	OTP, MTP, PUF	HV/HV-MR, BCD, LP/LL, CIS, Green, Flash, SOI, Generic
0.152/0.16/0.18um	18	OTP, MTP	HV/HV-MR, BCD, LP/LL, CIS, Green, Generic
0.25um	1	OTP	BCD
0.35um	0	OTP	UHV
Total	32		

Note: As of June 30th, 2020

NeoFuse Mechanism

Programming and Read Mechanism

Programming Mechanism

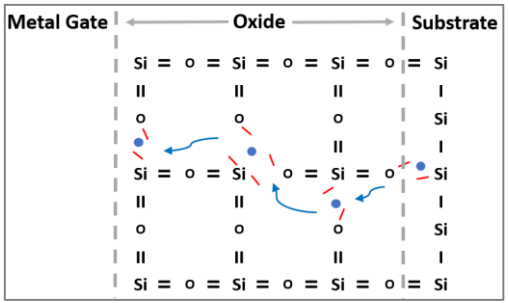
- Apply one high voltage, V^{+++}, to form a Quantum Tunneling path.

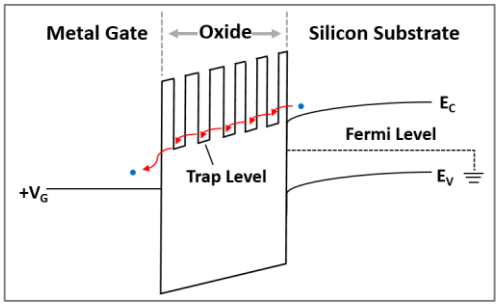
Read Mechanism

- Apply a normal operation voltage, V_R, to read the current flow through the tunneling path.

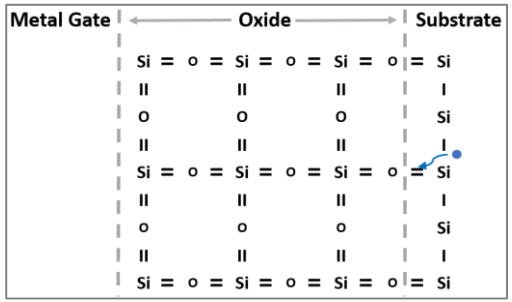
Quantum Tunneling Mechanism

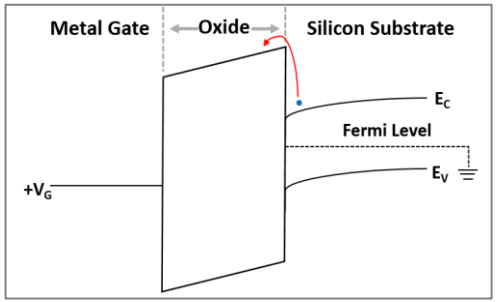
Quantum Tunneling Phenomenon of NeoFuse and NeoPUF





- Electrons transport from Si substrate to metal gate through dangling bonds (oxide traps)
- Electron tunneling through the gate oxide if there are many dangling bonds (oxide traps) in the oxide



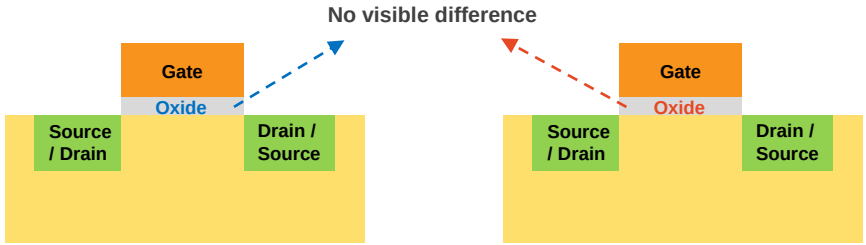


- If no dangling bonds are in the oxide, the probability for electron to transport in the oxide is very small
- It is very difficult for electrons to tunnel through the oxide if no traps in the oxide

NeoFuse vs. eFuse

NeoFuse's invisibility ensures no exposure risk from invasive attack

NeoFuse



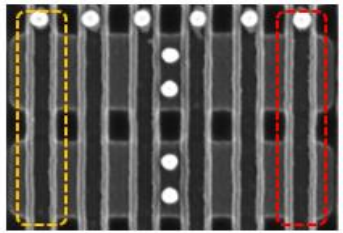
Un-programmed "0"

Programmed "1"

- Invisible
- Untraceable
- Reliable

NeoFuse under SEM

Un-programmed "0" Programmed "1"



e-Fuse

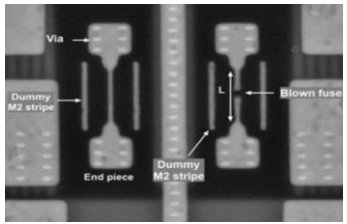
Un-programmed "0"

Programmed "1"

- Visible
- Insecure

eFuse under SEM

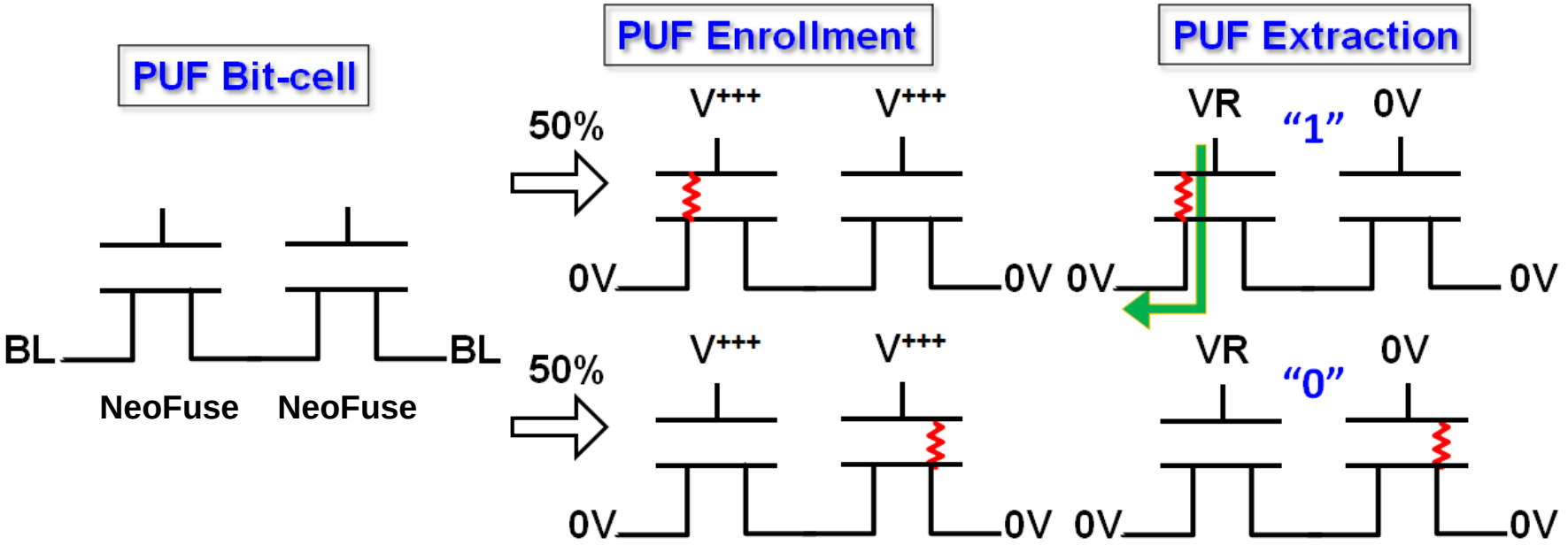
Un-programmed "0" Programmed "1"



NeoPUF Mechanism

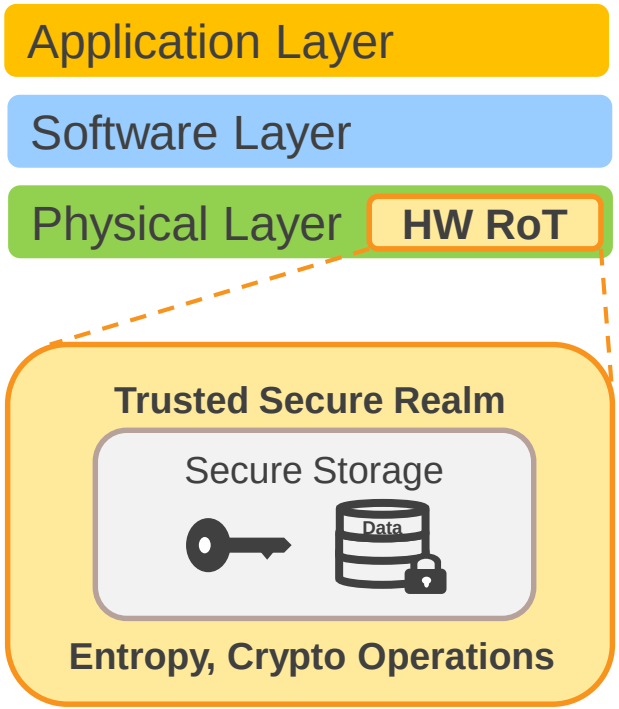
Enrollment and Extraction

- A path of oxide quantum tunneling would be located at either left or right one after high voltage is applied to a pair of NeoFuse in parallel, which depends on the micro-difference in oxide quality variations.
- Awarded 2018 ISSCC outstanding paper



HW Root-of-Trust (HRoT)

OTP, PUF and TRNG are the basis of HRoT



A Trusted HW RoT should have:

- **Secure Storage** to store the sensitive data (key)
- **Protected Realm** to further protect key/cryptographic

Secure Storage:

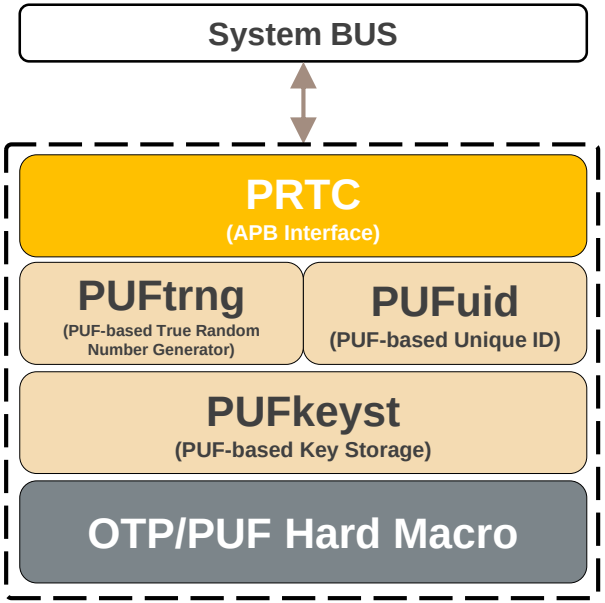
- Invisible OTP with anti-tampering design

Protected Realm:

- Entropy to hide crypto operations using TRNG
- Entropy to hide storage/bus using TRNG/PUF

PUFrt

A trusted macro meets all the needs of HRoT



PUFrt Integrated Macro

A Highly Integrated PUF-based HRoT

- PRTC: R/W Access Authority Control Interface
- PUFuid: Instant Ready On-chip UIDs
- PUFtrng: Instant Ready PUF-based TRNG
- PUFkeyst: Trusted Self-encrypted Storage
- Complete Anti-Tampering Design

PUF Series Articles

Press release and articles regarding security with NeoPUF

Press Release:

8/4 PUFsecurity Launches Unique Quantum-Tunneling PUF-based Root-of-Trust
Link: https://blog.pufsecurity.com/2020/08/04/pufsecurity-launches-unique-quantum-tunneling-puf-based-root-of-trust/

6/2 PUFsecurity Launches IP Open Source Program: Bridging the Gap in Chip Security
Link: https://blog.pufsecurity.com/2020/06/02/pufsecurity-ip-open-source-program-bridging-the-gap-in-chip-security/

Technical Articles:

PUF Series 4：Why a True Hardware PUF is more Reliable as RooT of Trust
Link: https://blog.pufsecurity.com/2020/06/22/puf-series-4%ef%bc%9asoftware-post-processing-makes-sram-puf-vulnerable-as-rot/

PUF Series 3: The Quantum Tunneling Mechanism of NeoPUF
Link: https://blog.pufsecurity.com/2020/06/16/puf-series-3-the-quantum-tunneling-mechanism-of-neopuf/

PUF Series 2: NeoPUF, A Reliable and Non-traceable Quantum Tunneling PUF
Link: https://blog.pufsecurity.com/2020/03/27/neopuf-a-reliable-and-non-traceable-quantum-tunneling-puf/

PUF Series 1: SRAM PUF is Increasingly Vulnerable
Link: https://blog.pufsecurity.com/2020/02/19/sram-puf-is-increasingly-vulnerable/

Q&A

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