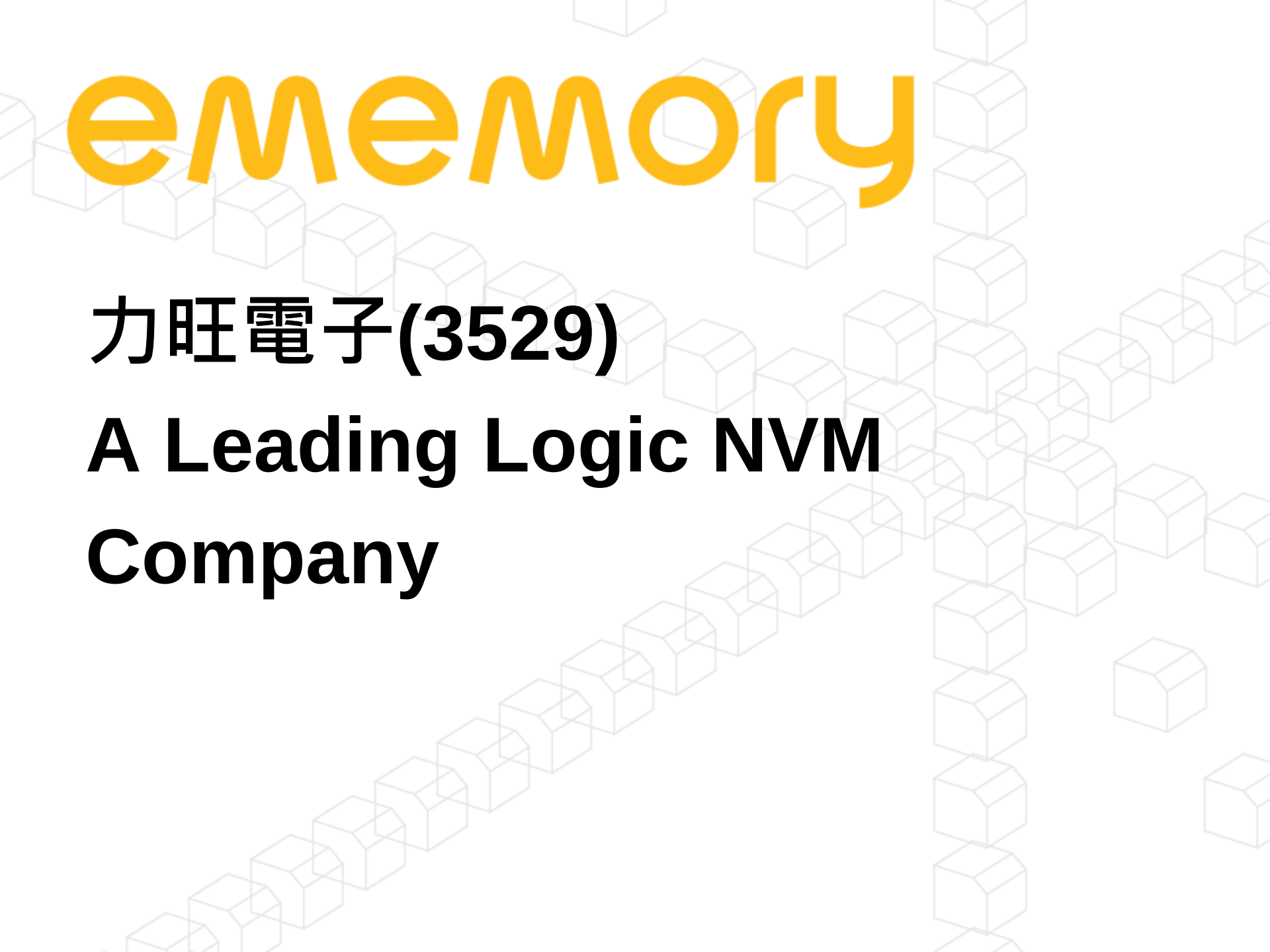




ememory

力旺電子(3529)

**A Leading Logic NVM
Company**

智慧財產權聲明

本文件內之資訊，包括文字、圖片、圖表、表格或其他檔案等，其所有權利或利益，包括但不限於所有權及智慧財產權，皆屬力旺電子所有，請尊重智慧財產權。本文件之內容包含力旺電子之機密資訊。部分內容可參見 2014 年出版之 Logic Non-Volatile Memory (The NVM solutions from eMemory) 一書。任何在此之資訊在未經力旺電子書面同意，不得影印、散佈、複製、使用本文件或將其揭露予第三人。

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

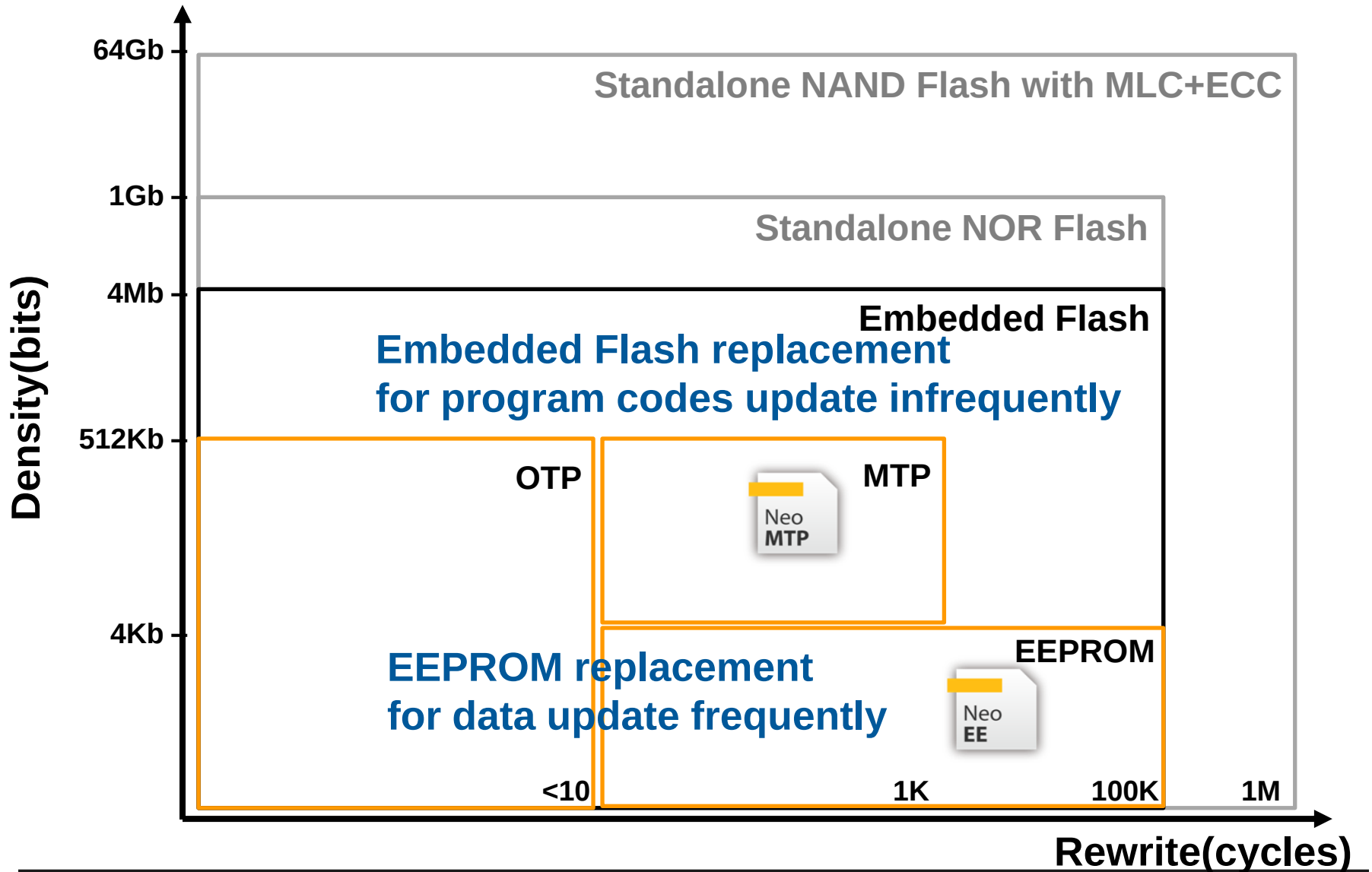
投資安全聲明

除簡報內所提供之歷史信息外，簡報事項係屬預測性陳述，受到風險及不確定性因素影響，可能造成實際結果與陳述內容發生不符，這些不確定性因素包括：技術平台是否順利導入利用、IP是否被客戶接受、客戶產品大量量產之能力及時間、產業及市場對半導體產品之供給及需求移轉、終端市場之穩定性及其他風險等。

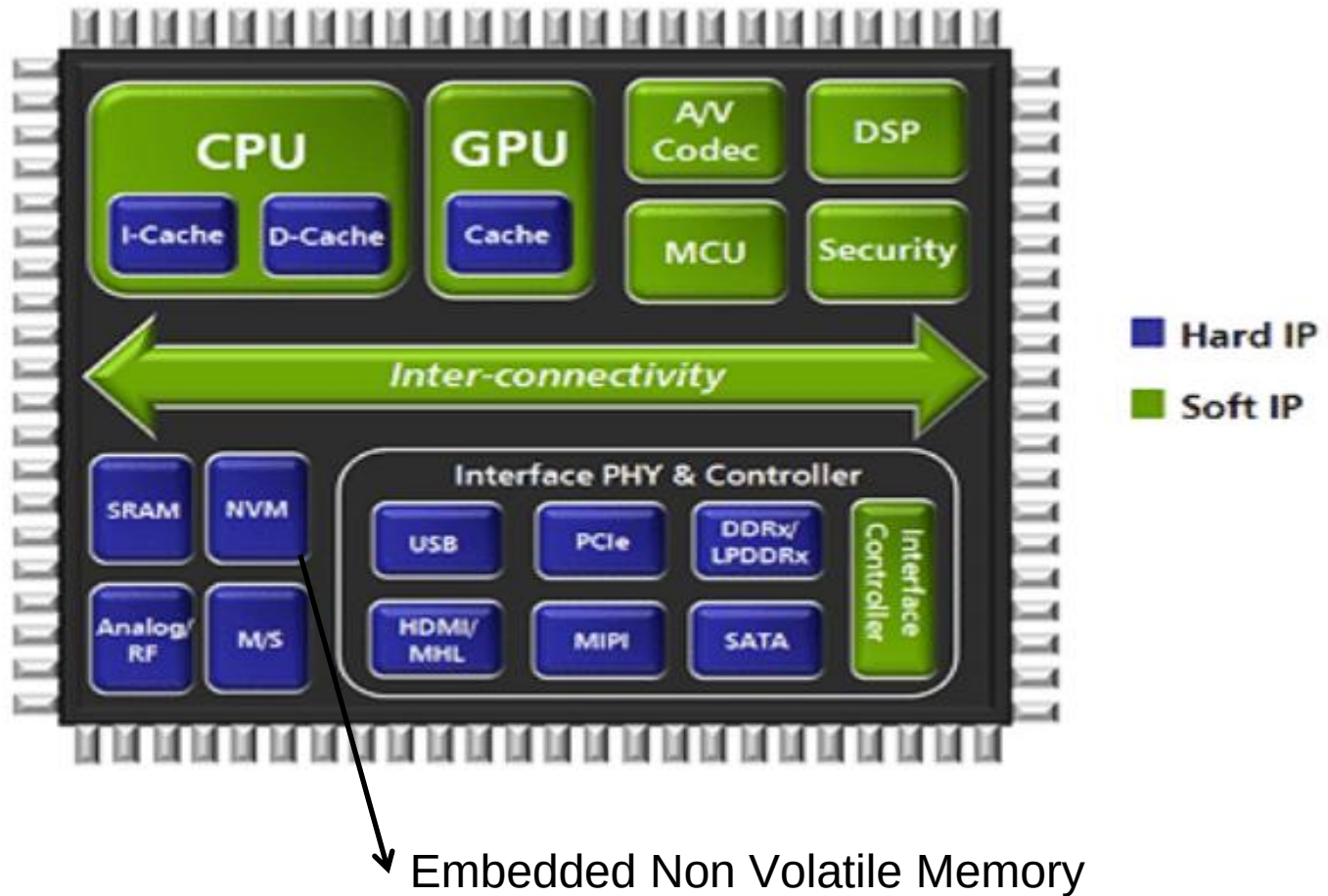
大綱

- 公司營運模式
- 營運回顧
- 成長機會與未來展望
- 問題與回答

嵌入式非揮發性記憶體分類



SOC Block Diagram



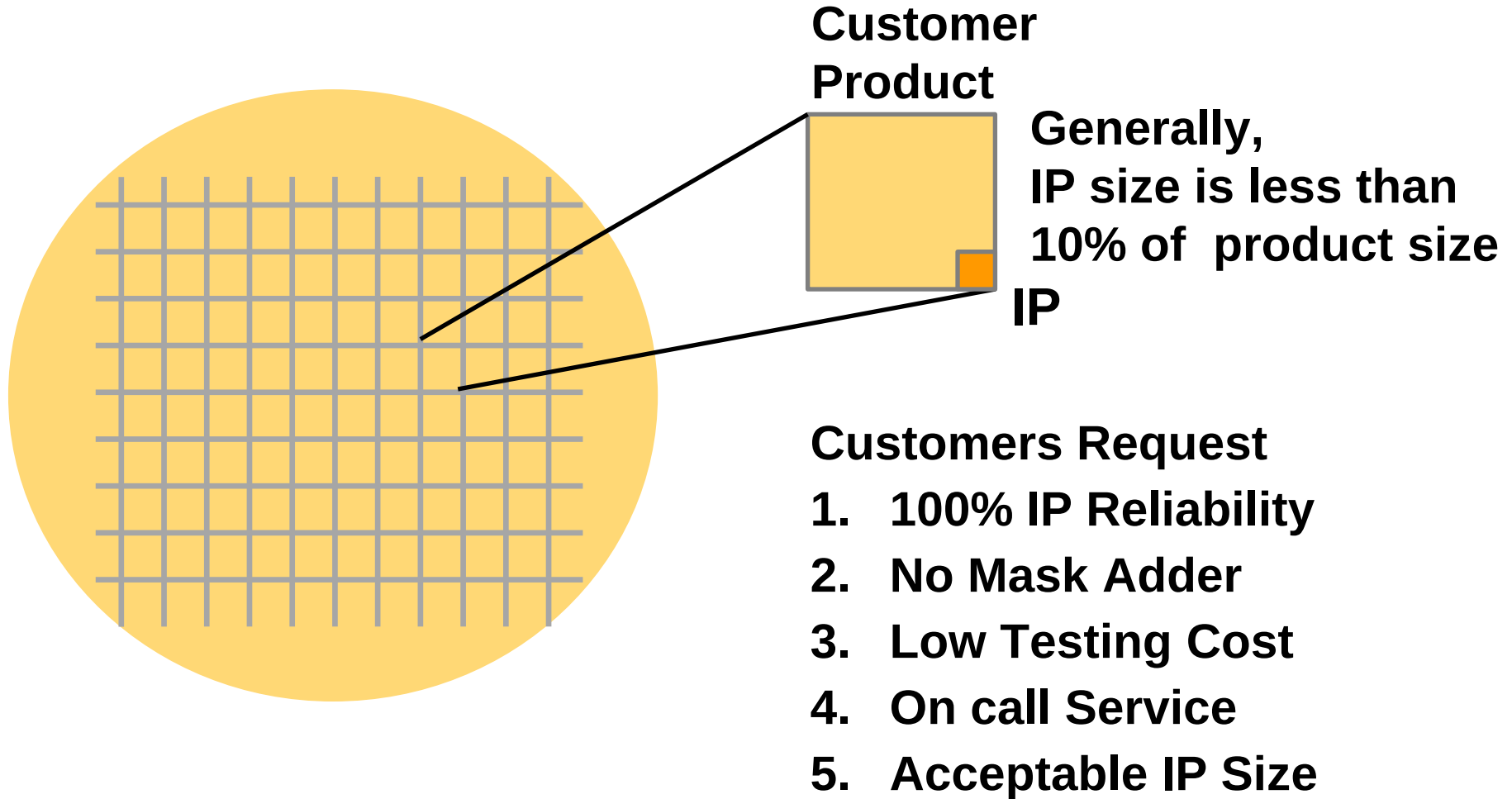
Source : tsmc

嵌入式非揮發性記憶體技術

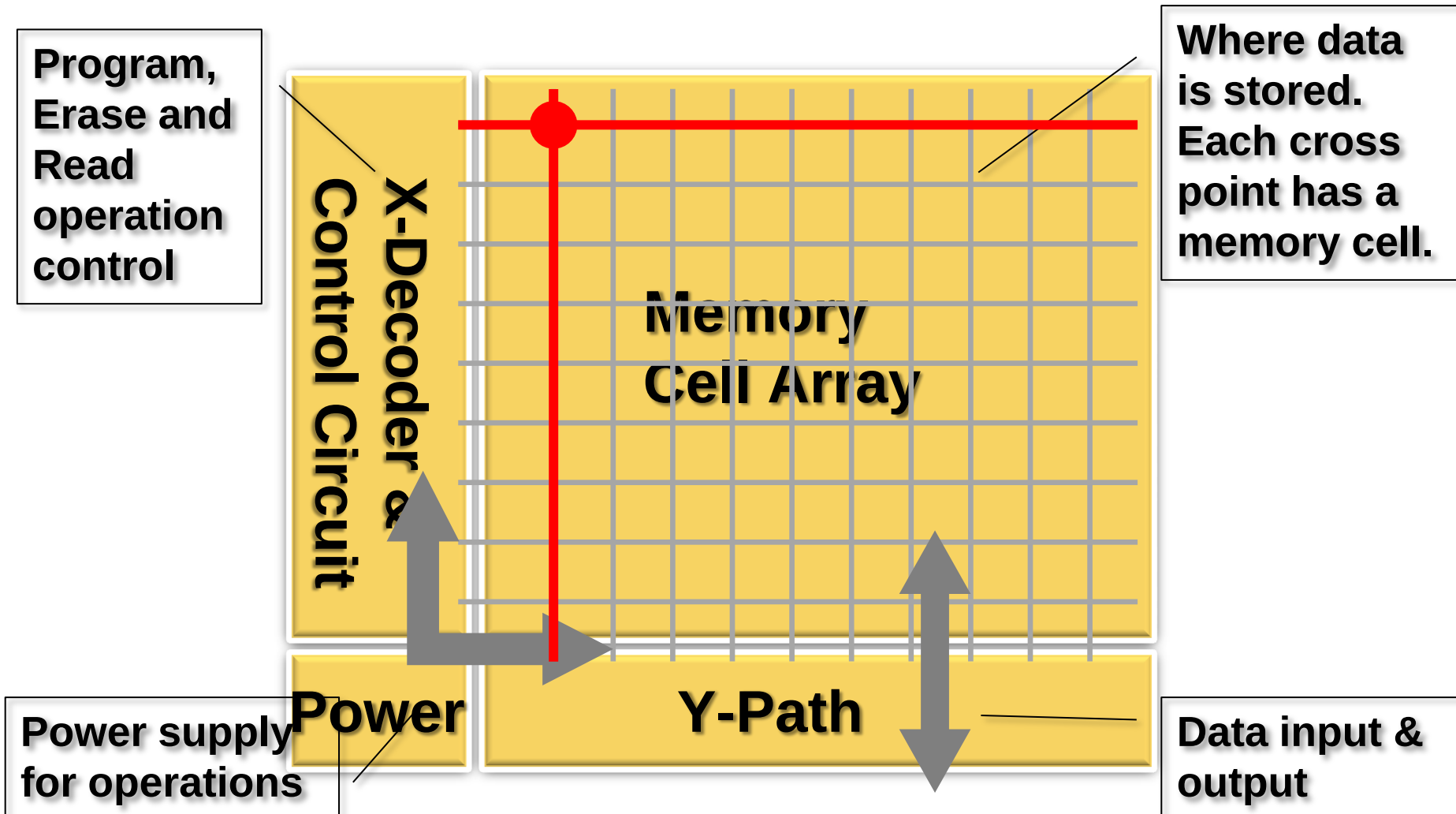
	ROM	eFuse (OTP)	Antifuse (OTP)	CMOS Floating Gate (OTP)	CMOS Floating Gate (MTP)	Embedded Flash
Cell Structure	Transistor	Poly Fuse	Antifuse	Floating Gate	Floating Gate	Floating Gate
Standard CMOS Compatible	Yes	Yes	Yes	Yes	Yes	No
Bitcell Area	< 1	50	1	2	4	1
Endurance	No	No	< 10	< 10	10K-100K	100-1000K
Density	4Kb-1Mb	256bit-4Kb	16bit-1Mb	16Kb-1Mb	1Kb-2M	64Kb-4Mb
Security	Low	Low	High	High	High	High
Additional Steps	None	None	None	None	None	+10 Mask

- ROM not programmable, eFuse cannot scale beyond 16Kb, embedded flash expensive and cannot scale after 40 nm
- eMemory's IPs: OTP (antifuse, floating gate) and MTP (floating gate)

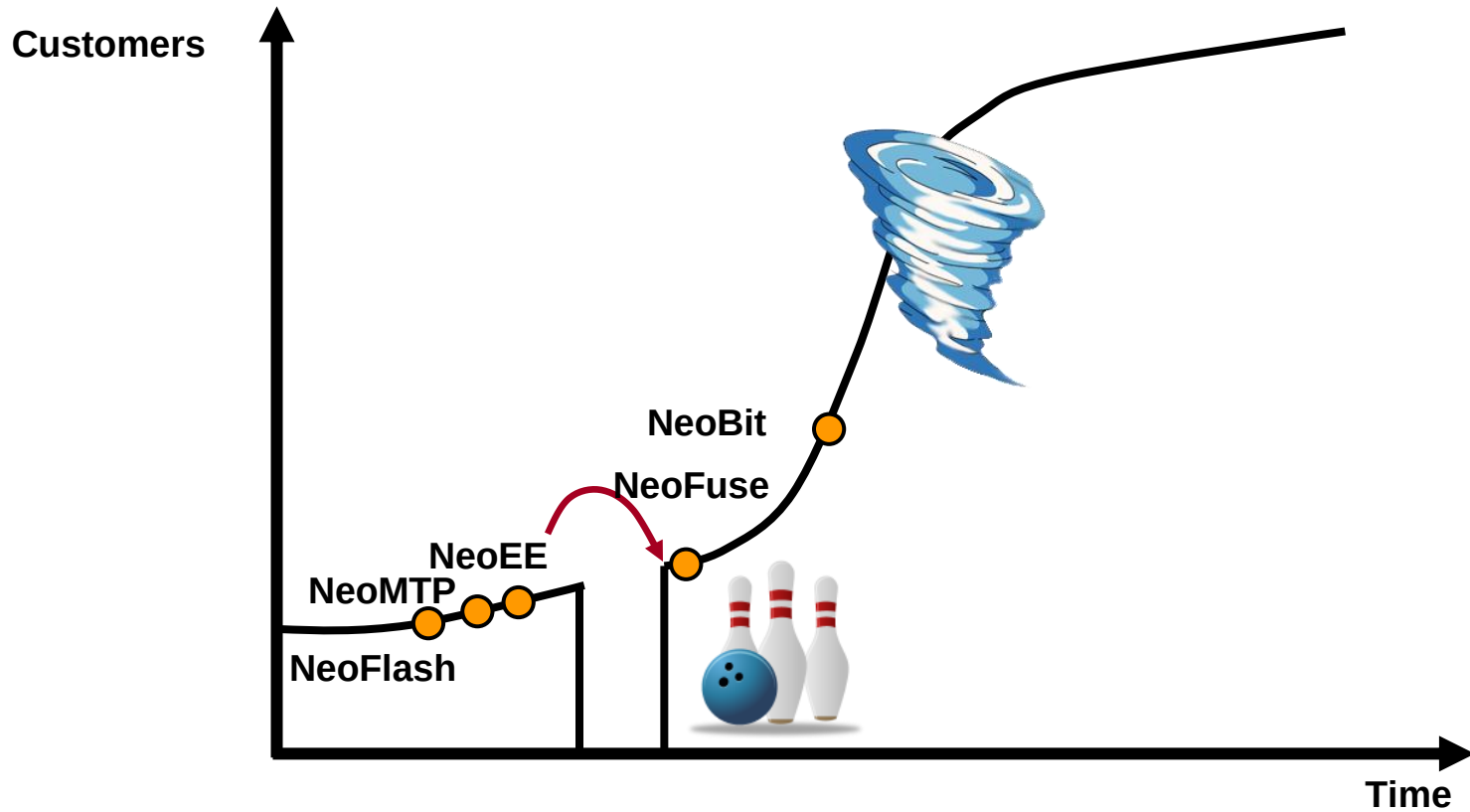
採用IP之考量



Nonvolatile Memory IP 内部



跨越鴻溝



關於力旺



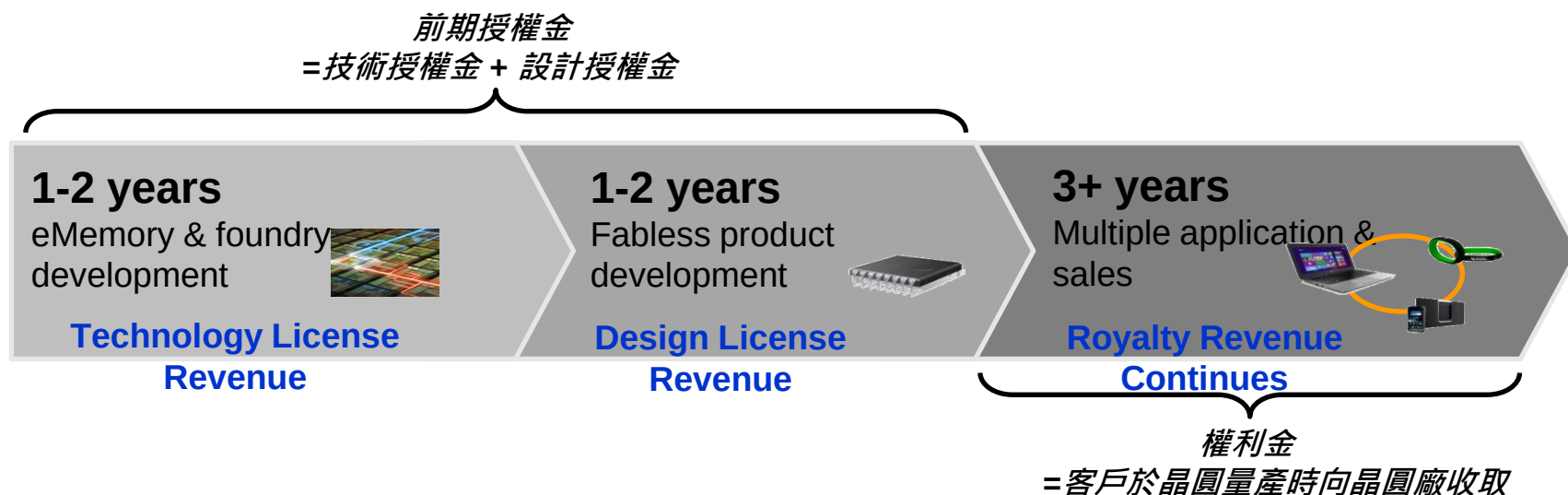
- 全世界最大的邏輯非揮發性記憶體IP公司
- 233位員工，其中162位為研發人員*
- 2011年掛牌以來，無市場籌資，無銀行借款
- 每年的現金配息率超過90%

Note*: 截至 2017/03/31

營運模式

- 成長性指標:

- › 正在晶圓廠建構的製程平台數
- › 設計授權數
- › 權利金



全球客戶



	Taiwan	China	Korea	Japan	North America	Europe	Others
Foundry	5	7	3	3	1	2	1
IDM	0	0	0	8	2	1	0
Fabless	264	496	66	51	226	111	50

Foundry

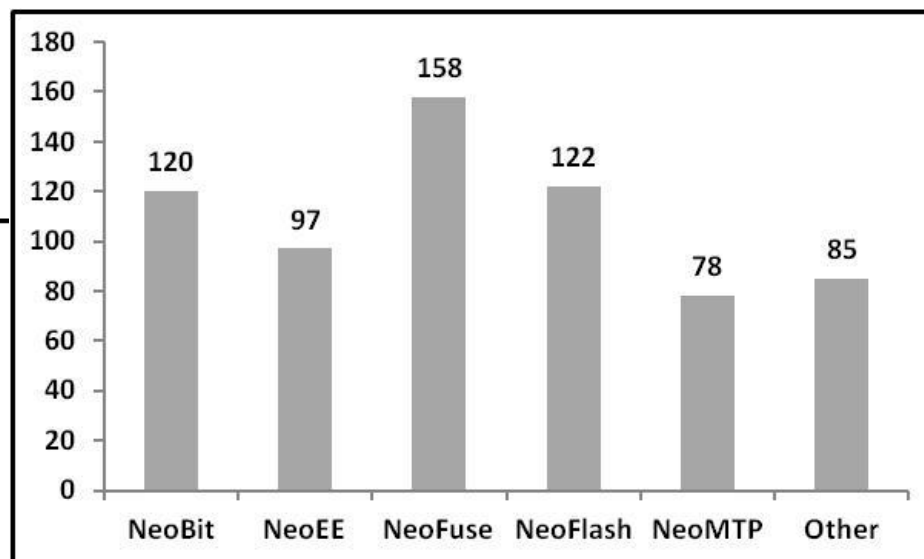
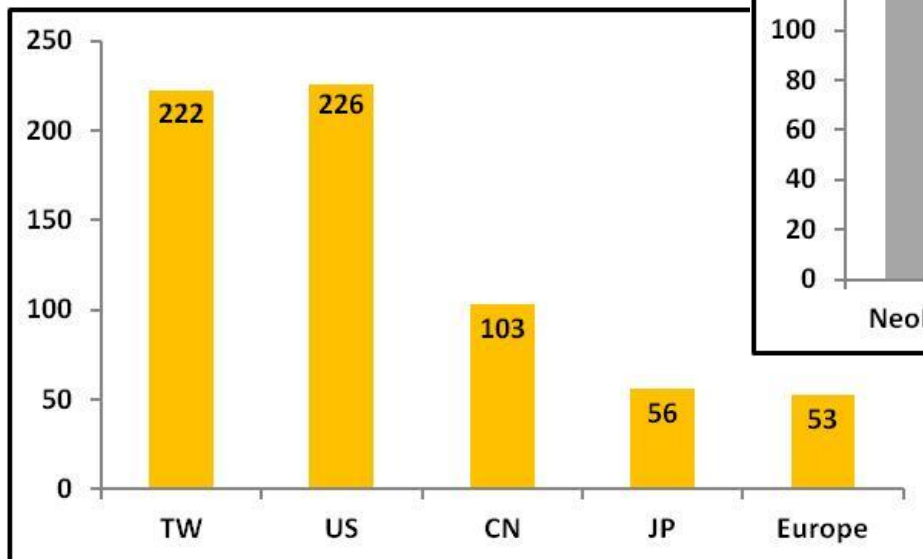


IDM



專利佈局

	4Q 16	1Q 17	Change
Pending	218	244	+ 26
Issued	389	416	+ 27
Total	607	660	+ 53

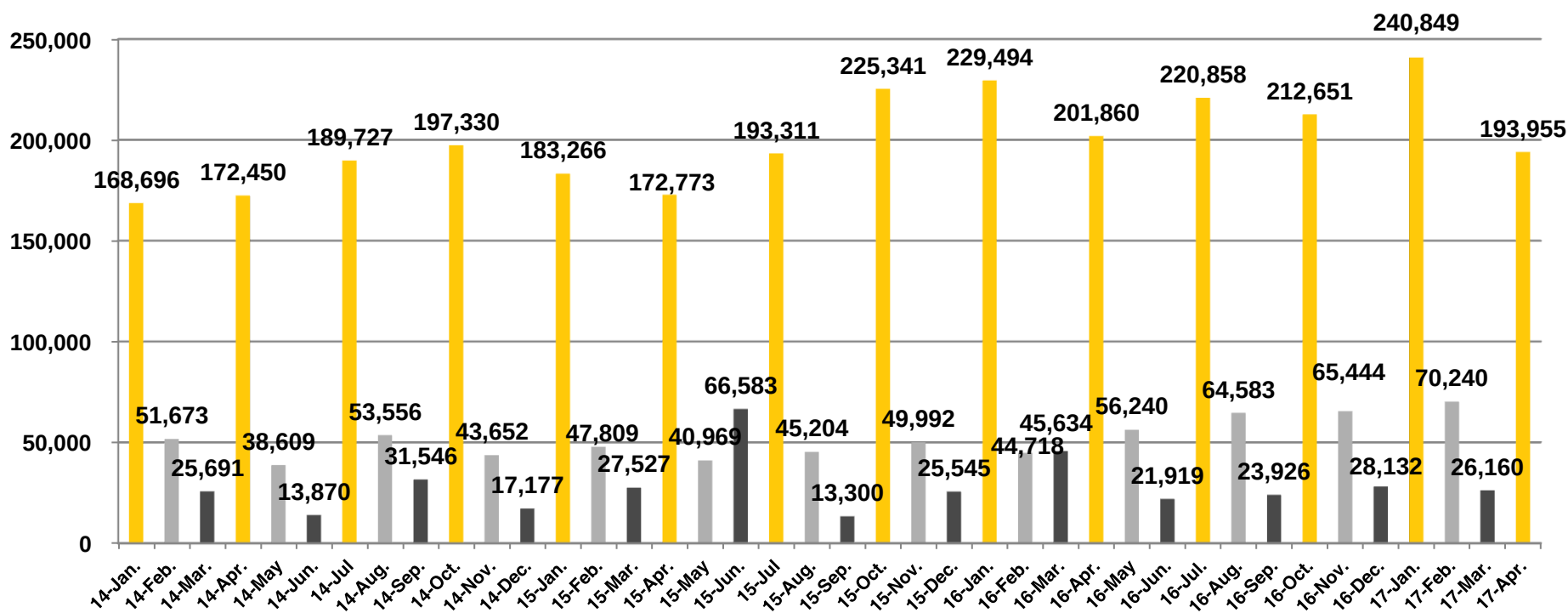


Note:截至 2017/03/31

每季營收模式

- 每季第一個月認列絕大部份晶圓廠前一季使用本公司IP的出貨晶圓權利金及當月產生的技術授權金及設計授權金；第二個月則是少部份晶圓廠權利金及當月授權金；第三個月則無權利金收入，只有授權金。

單位：台幣仟元



大綱

- 公司營運模式
- 營運回顧
- 成長機會與未來展望
- 問題與回答

第一季各項營收

單位：新台幣仟元

	Q1 2017	Q4 2016	QoQ	Q1 2016	YoY	2016	2015	YoY
授權費	74,146	79,684	-6.95%	85,976	-13.76%	330,087	267,512	23.39%
權利金	263,103	226,543	16.14%	233,870	12.50%	885,372	824,108	7.43%
合計	337,249	306,227	10.13%	319,846	5.44%	1,215,459	1,091,620	11.34%

單位：合約數

		Q1 2017	Q4 2016	2016	2015
技術授權數		5	10	43	28
設計 授權數	NRE	8	12	56	57
	使用費	88	73	311	349

綜合損益表

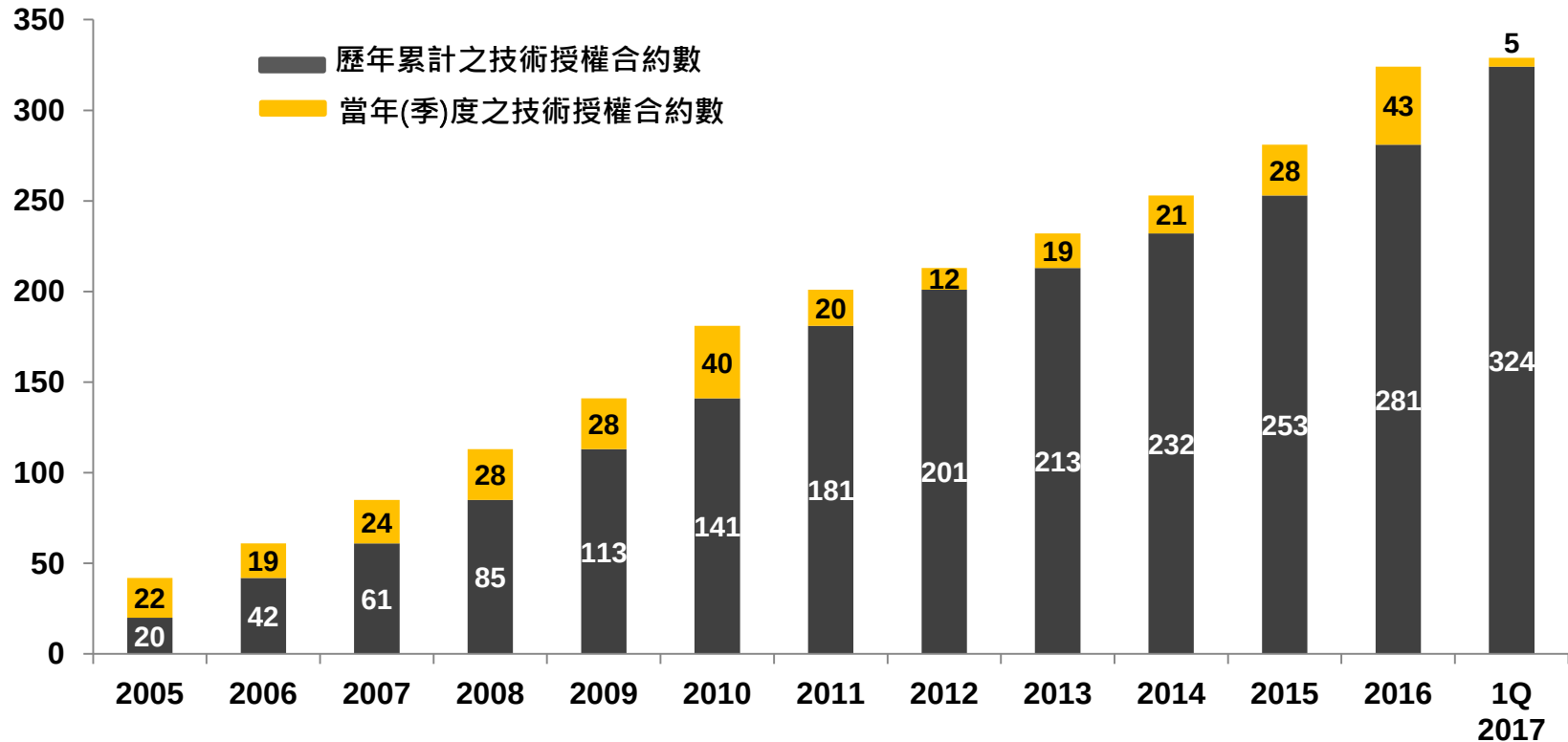
(單位:新台幣仟元)	Q1 2017	Q4 2016	Q1 2016	change (QoQ)	change (YoY)
營業收入淨額	337,249	306,227	319,846	10.1%	5.4%
營業毛利率	100%	100%	100%	-	-
營業費用	193,603	171,681	177,088	12.8%	9.3%
營業淨利率	42.6%	43.9%	44.6%	-1.3ppts	-2.0ppts
本期淨利	151,378	132,361	166,012	14.4%	-8.8%
純益率	44.9%	43.2%	51.9%	+1.7ppts	-7.0ppts
每股盈餘 (單位: 新台幣元)	2.00	1.75	2.19	14.3%	-8.7%
權益報酬率	30.2%	28.3%	34.9%	+1.9ppts	-4.7ppts

技術授權合約

單位：合約數

Year	2014	2015	2016	1Q 2017
License number	21	28	43	5

註：與晶圓廠簽訂的技術授權合約所含的技術製程及授權金視合約內容而定，無特別季節性因素。



目前正在建構的技術製程平台

- Total (As of Mar.) : **111**
- **19** for NeoBit, **48** for NeoFuse, **24** for NeoEE, and **20** for NeoMTP.

	7/10nm	12/14/16nm	28nm	40nm	55/65nm	80/90nm	0.11~ 0.13um	0.15~ 0.18um	>0.25 um
NeoBit	-	-	-	-	-	-	6	13	
NeoFuse	3	3	10	5	10	6	6	5	-
NeoEE	-	-	-	-	-	-	5	19	-
NeoMTP	-	-	-	-	1	2	5	12	-

目前正在建構的技術製程平台

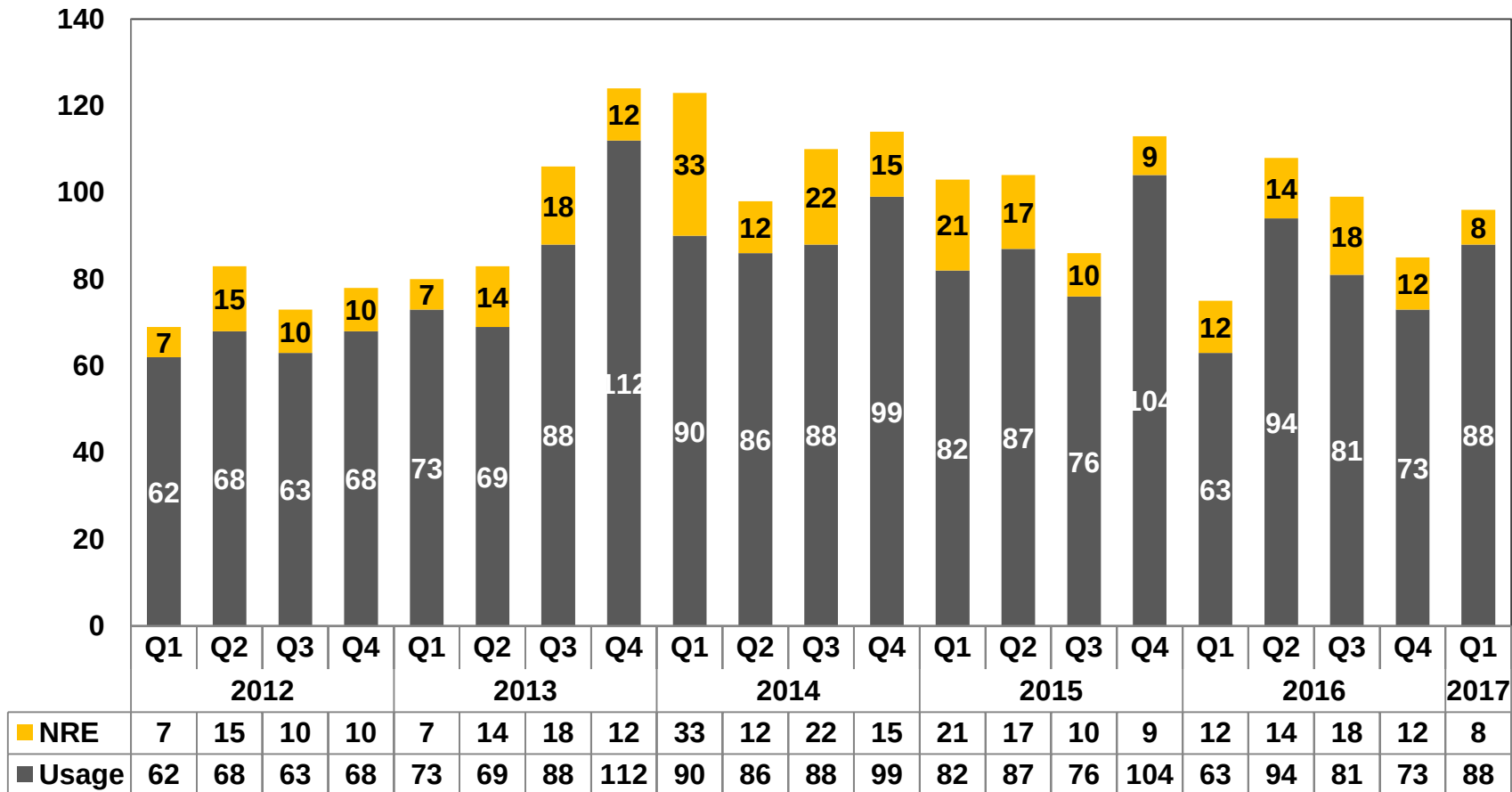
12" Fabs	Production	Developing	NVM Type	Process Type
7/10nm	0	3	OTP	FF
14/16nm	2	3	OTP	FF+
28nm	6	10	OTP	LP/HPM, HLP/HPM, LPS
40nm	6	5	OTP, MTP	HV-DDI, LP
55/65nm	14	11	OTP, MTP, Flash	LP, HV-DDI, HV-OLED, DRAM, CIS
80/90nm	6	5	OTP, MTP	HV-DDI, HV-OLED, LP
0.13/0.11um	8	2	OTP, Flash	HV-DDI, BCD, Generic
0.18um	1	0	OTP	BCD
Total	43	39		

8" Fabs	Developing	NVM Type	Process Type
90nm	3		
0.13/0.11um	20	OTP, MTP, Flash	HV-DDI, BCD, LP, RF, CIS, LL
0.18/0.16/0.152um	49	OTP, MTP	Generic, LP, LL, MR, HV, Green, BCD
0.25um	0	OTP, MTP	BCD
0.35um	0	OTP	UHV
Total	72		Note: As of Mar. 31 st , 2017

Confidential

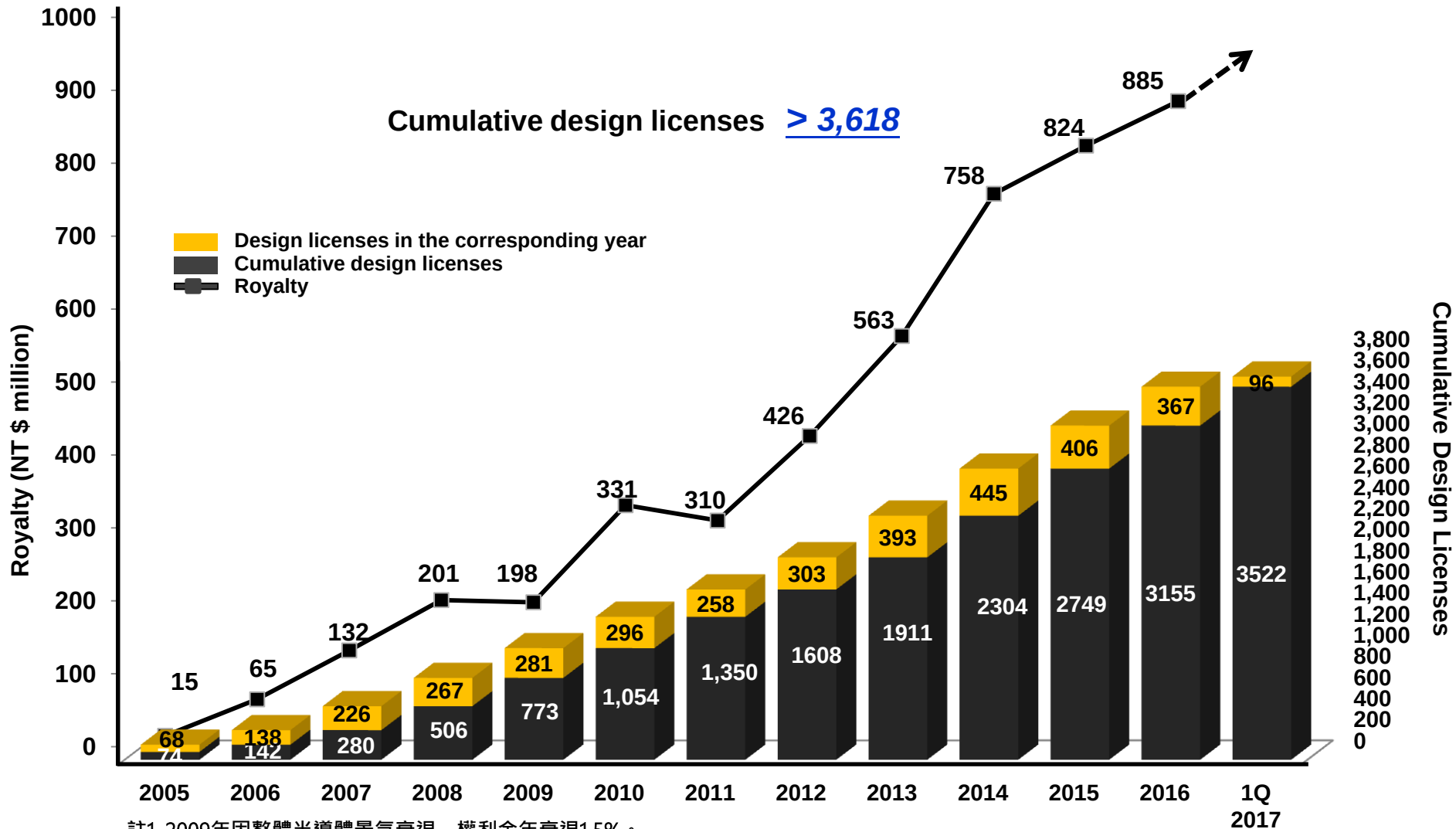
每季設計授權數(New Tape-Out)

- A total of **96** NTO in 1Q 2017 (**367**@2016,**406**@2015,**445**@2014, **393**@2013)



Note*: 客戶在各代工廠的諸多MCU NTO已陸續進入量產，加上與主要Green process代工廠的商業模式調整為直接license IP cell 給代工廠，由代工廠提供設計服務給客戶，造成tape out 數減少，但仍對使用IP cell 的晶片支付權利金。雖然MCU的NTO數量有明顯減少，但是相關的晶圓產出和權利金收入還是持續增加。

權利金取決於過去累積的設計授權數

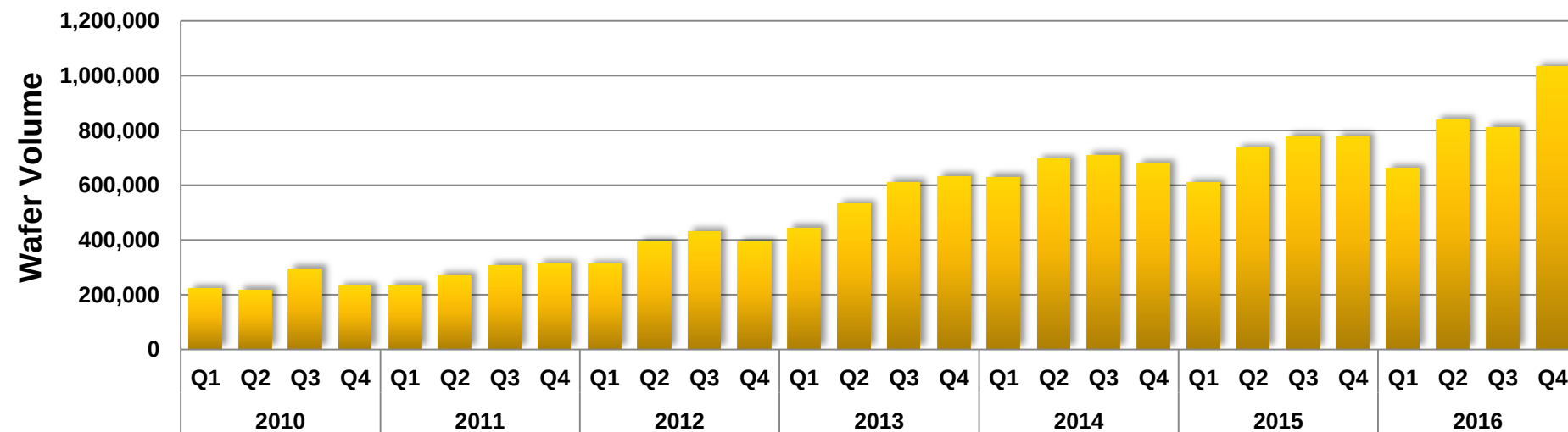


註1. 2009年因整體半導體景氣衰退，權利金年衰退1.5%。

註2. 2011年因2010年單一客戶預付權利金，導致2010年成長67%，2011年年衰退6.3%。

註3. 2009-2013年權利金年複合成長率為30%。

每季量產晶圓片數



embedded eMemory IP in T Company (\$revenue); * % of Process node in T company total revenue in Q1 2017

	Process node	*% of T	Q1 17	Q4 16	2016	2015
8"	0.25/0.35	2%	37.05%	26.80%	28.15%	33.49%
	0.15/0.18	11%	9.10%	10.93%	12.43%	8.73%
	0.11/0.13	2%	41.92%	58.06%	42.61%	29%
12"	90nm	4%	10.96%	14.8%	12.50%	19.85%
	65nm	11%	3.50%	3.9%	3.59%	0.55%
	40/45nm	13%	0%	0%	0.00%	0%
	28nm	25%	0.56%	0.70%	0.55%	0.05%
	16/20nm	31%	0%	0%	0.00%	0%
8"		16%	16.13%	18.60%	18.86%	16.64%
12"		84%	1.15%	1.56%	1.44%	1.87%
Total		100%	3.54%	4.12%	4.27%	4.76%

大綱

- 公司營運模式
- 營運回顧
- 成長機會與未來展望
- 問題與回答

力旺之NVM技術

- **Logic NVM portfolio offers one-stop-shop solution.**
 - › Compatible to any process
 - › Robust structure
 - › Low process cost
 - › Competitive macro sizes
 - › Easy integration
 - › Easy porting

eMemory's NVM Technology	OTP			MTP	
	NeoBit	NeoFuse	NeoFlash	NeoEE	NeoMTP
Product Type	OTP	OTP	Flash	EEPROM	MTP
Endurance (Cycles)	10	10	1K~10K	10K~100K	1K~10K
Additional Mask Steps	0	0	2-3	0	0
Technology	Floating gate	Anti-Fuse	SONOS	Floating gate	Floating gate
Scalability	Simple	Simple	Simple	Simple	Simple
Memory Density	HD < 512Kb GHD < 16Mb	< 4Mb	< 2Mb	< 4Kb	< 512Kb

力旺IP的應用

12"							8"			
7nm	10nm	12nm/16nm	28nm	40nm	55/65nm	80/90nm	110/130nm	160/180nm	250nm	350nm

NeoBit

NeoFuse

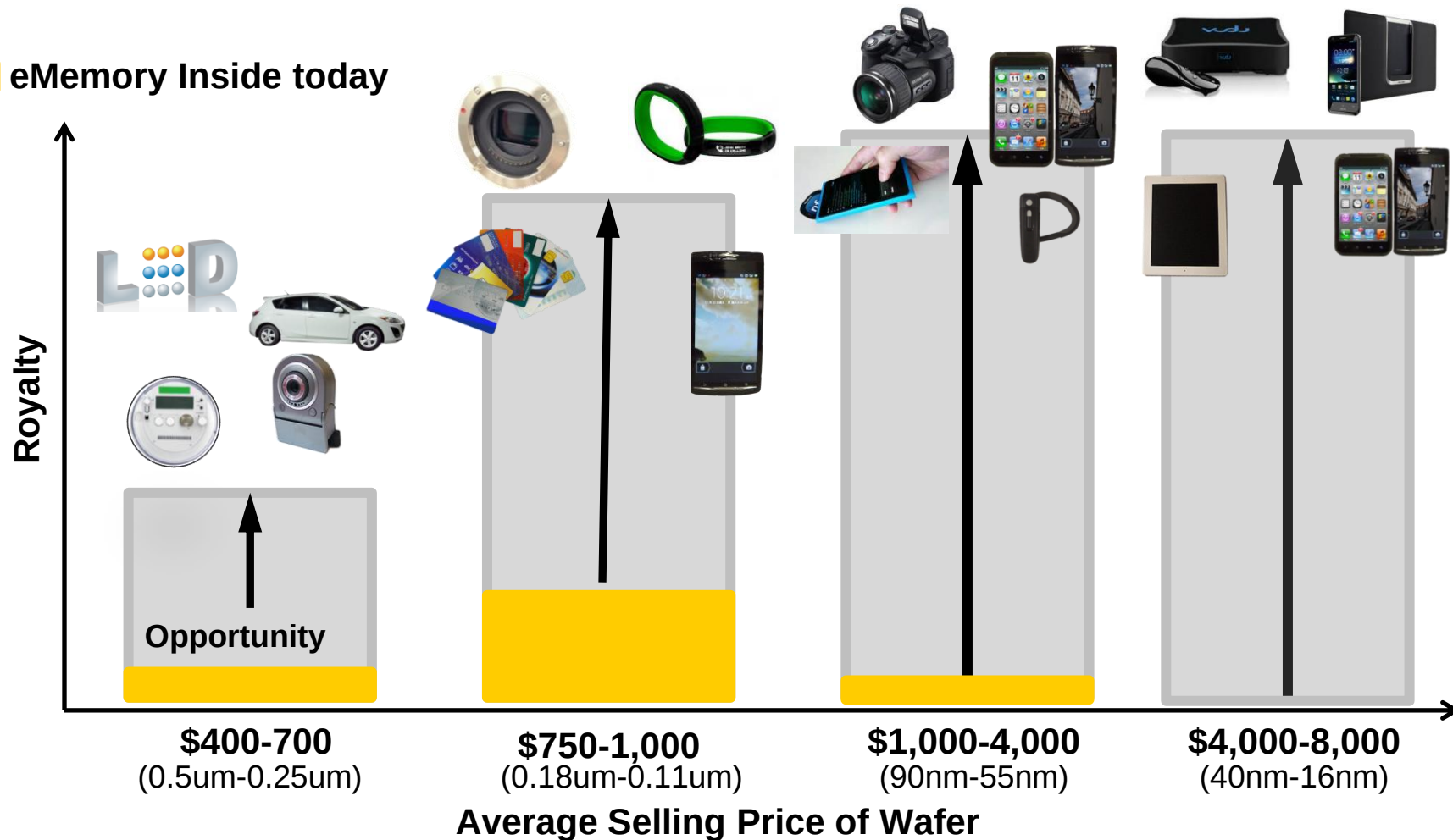
NeoFlash

NeoEE

NeoMTP

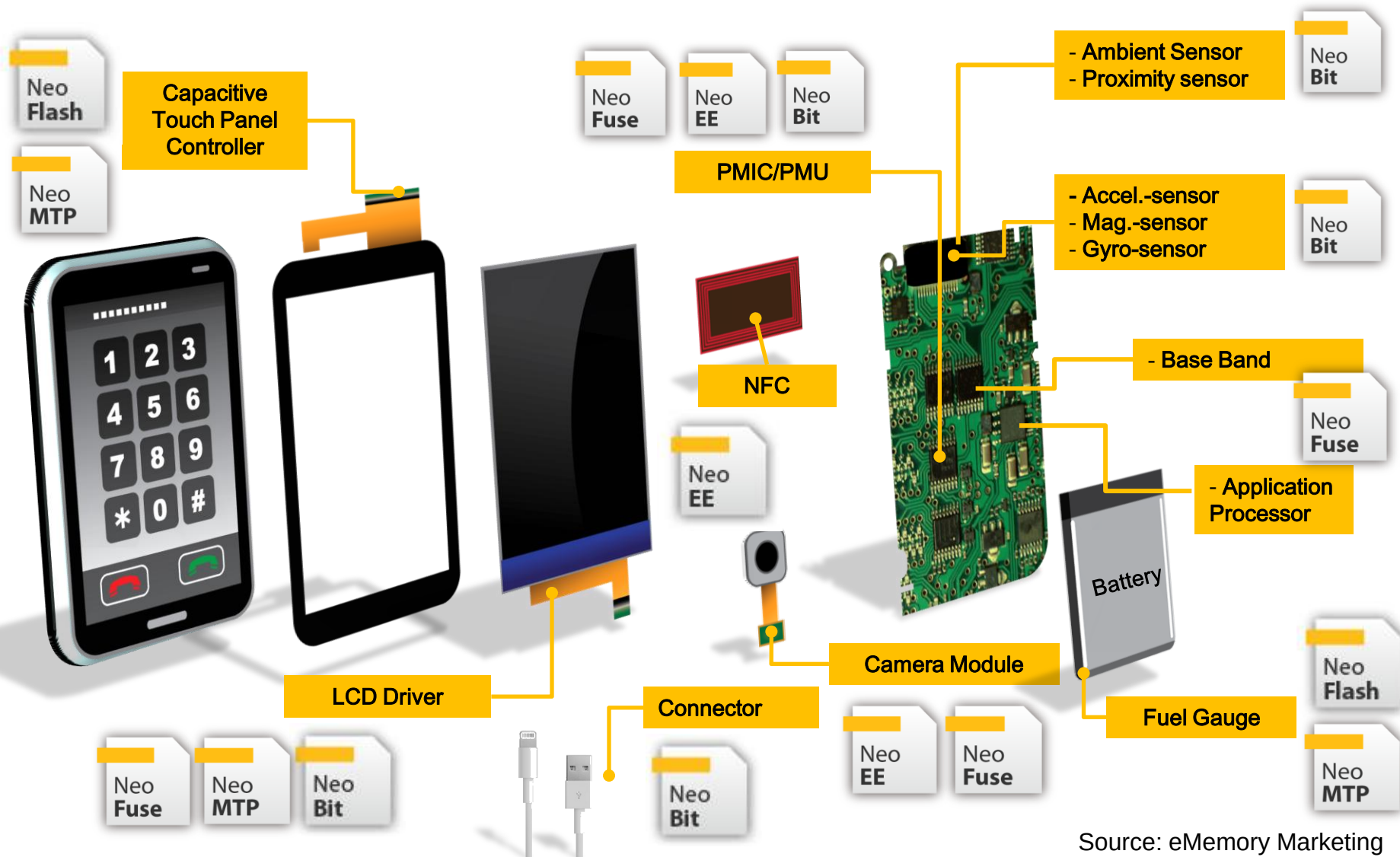
商機與潛力

 eMemory Inside today



Note: 2.2 million 8" equivalent wafers with eMemory IP were shipped in 2013. (~5% of WW foundry shipment)

智慧型手機中力旺 IP 的應用



Benefits from Using eMemory IPs

Design-in for

1. Trimming
2. Parameter Setting
3. Code Storage
4. Identification Setting
5. Encryption
6. Function Selection

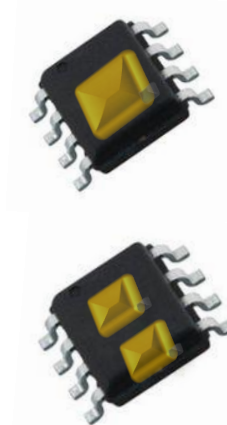
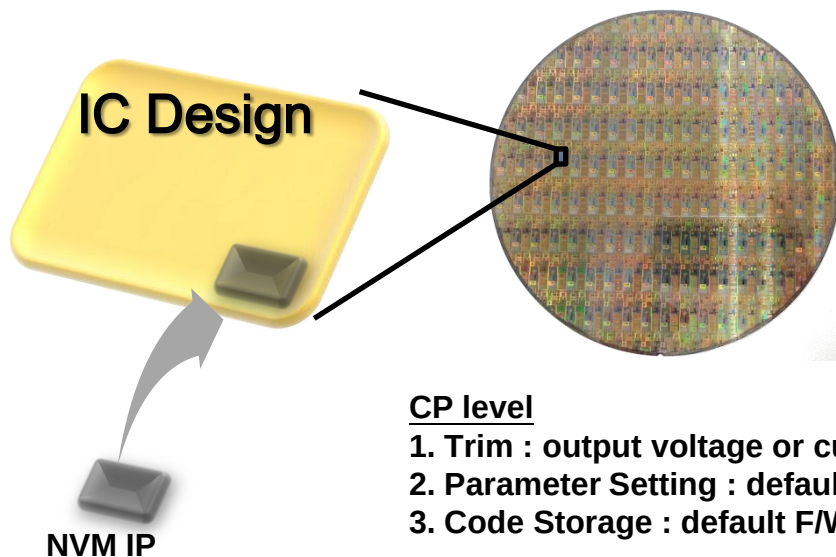
Package/FT level

1. Trim : SPEC shift
2. Parameter Setting : cross chip optimization
3. Identification Setting : manufacturer resume
4. Function Selection : setting for target market

CP Test

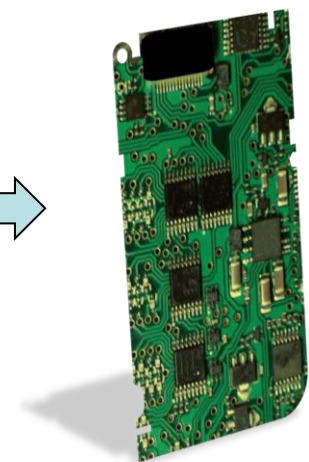
Package/FT

System Assembling



System Assembling

1. Parameter Setting : cross chip optimization
2. Code Storage : F/W code modification
3. Identification Setting : manufacturer resume
4. Encryption : Security algorithm or key storage



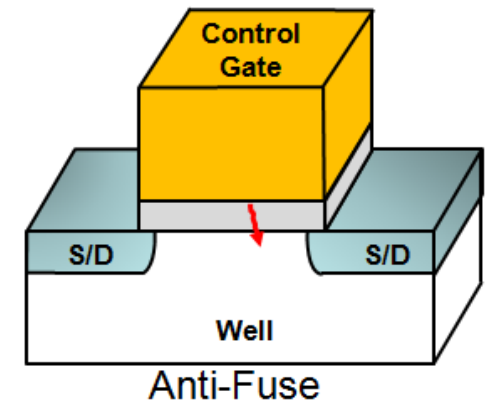
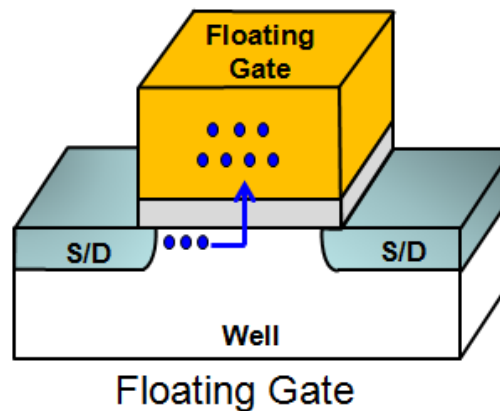
高機密性的安全設定

- Provide “Invisible Hardware Key” for invisible storage
- Prevent reverse-engineering to detect content of security key
- Protect firmware and hardware of ICs from pirating
- Extend & protect customer’s business

eFuse Key: Data is easily observed



Invisible Hardware Key : Data is hard to be detected



硬體設計防護

Authorized Product



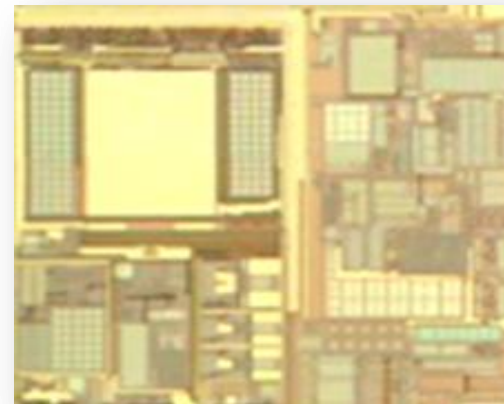
reverse
copy

re-produce



without protection

Fake Product



reverse
copy

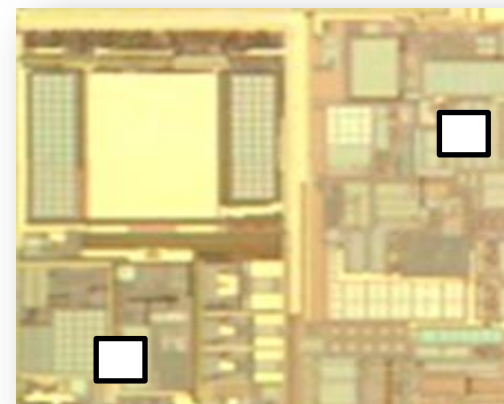
re-produce



with protection

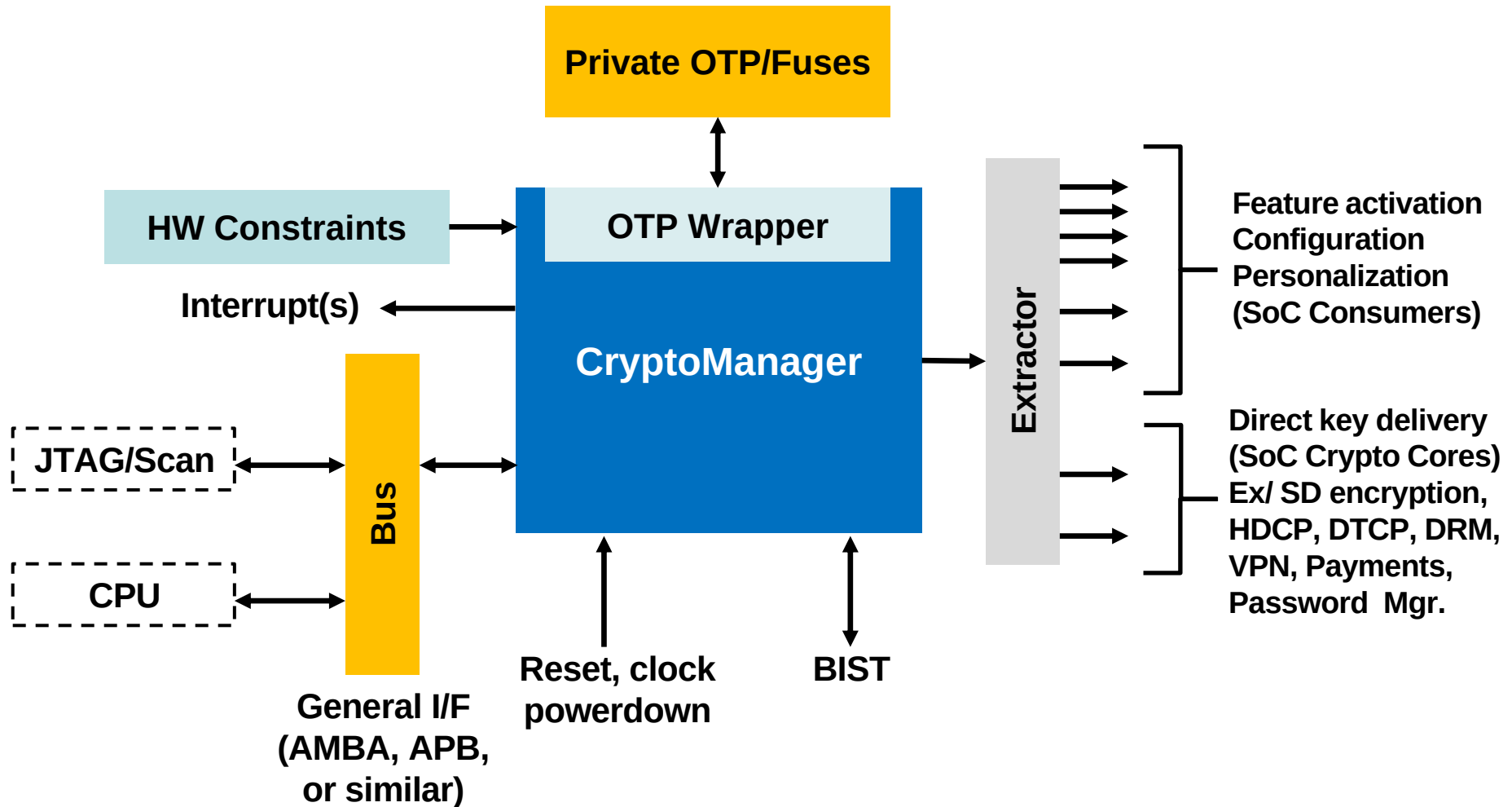


Security IP/Code by
Authorized Use



Can NOT Work w/o
Security IP/Code

OTP在加密儲存應用

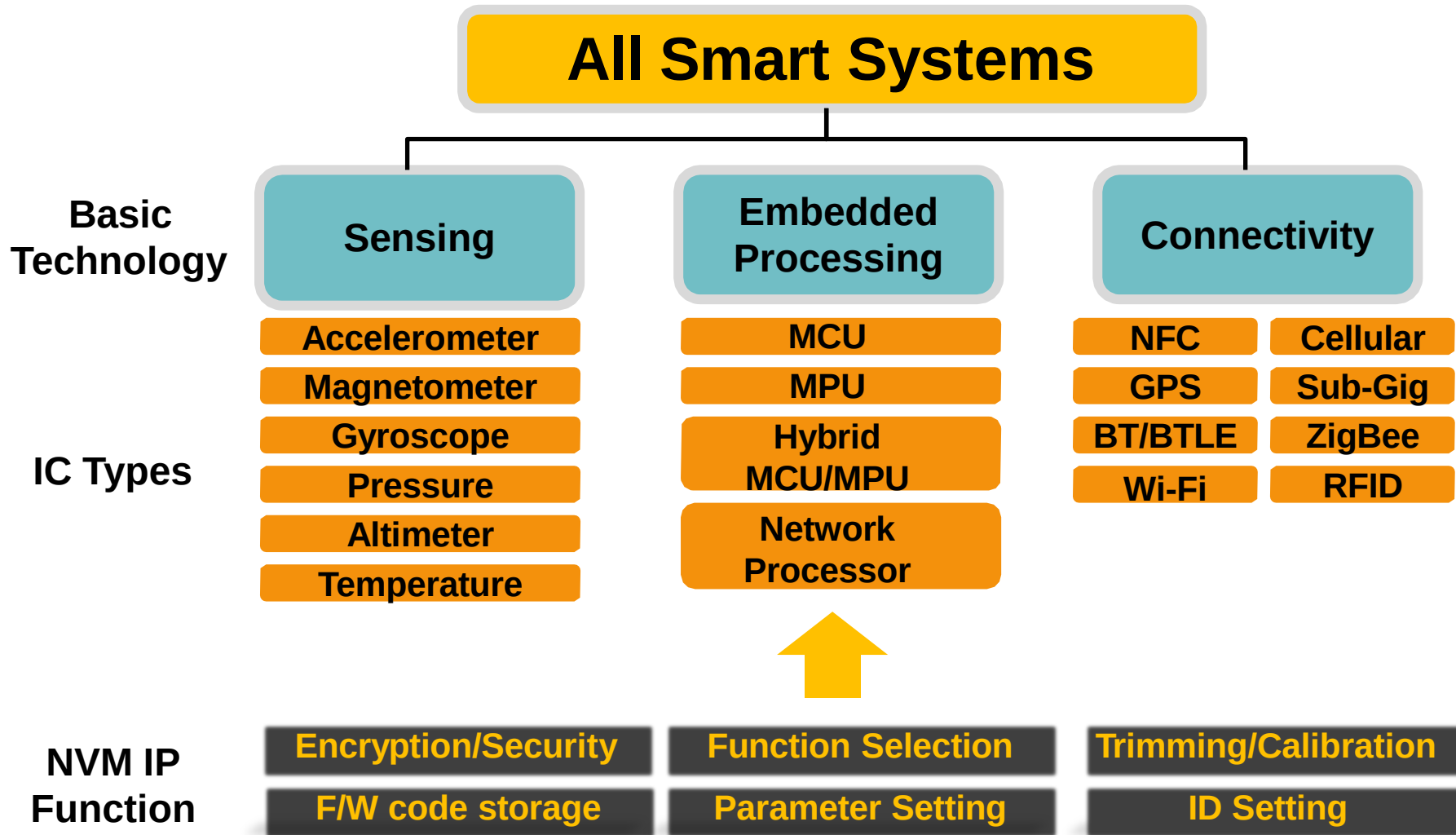


Source : Rambus crypto manager platform

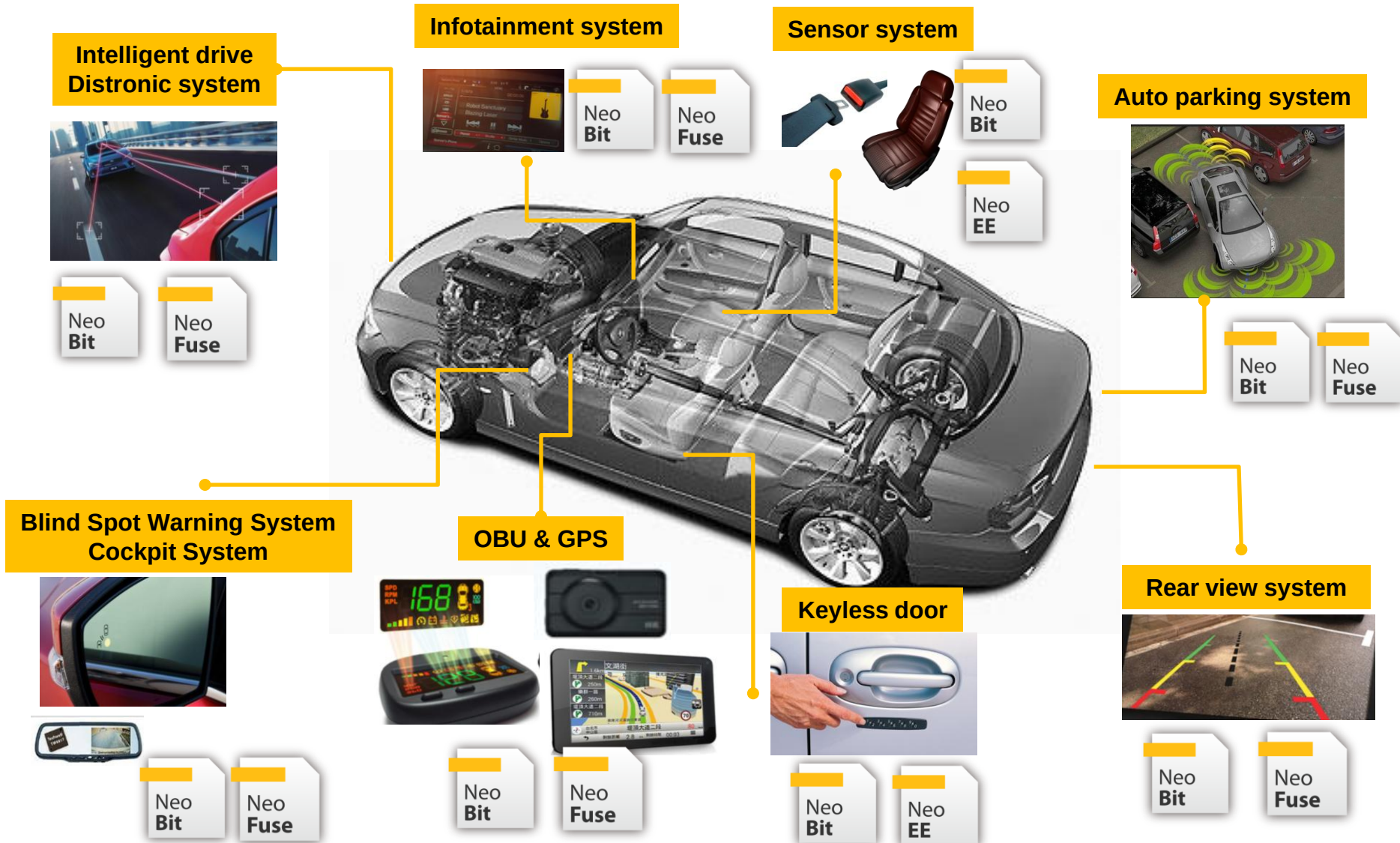
力旺矽智財引領高安全性應用



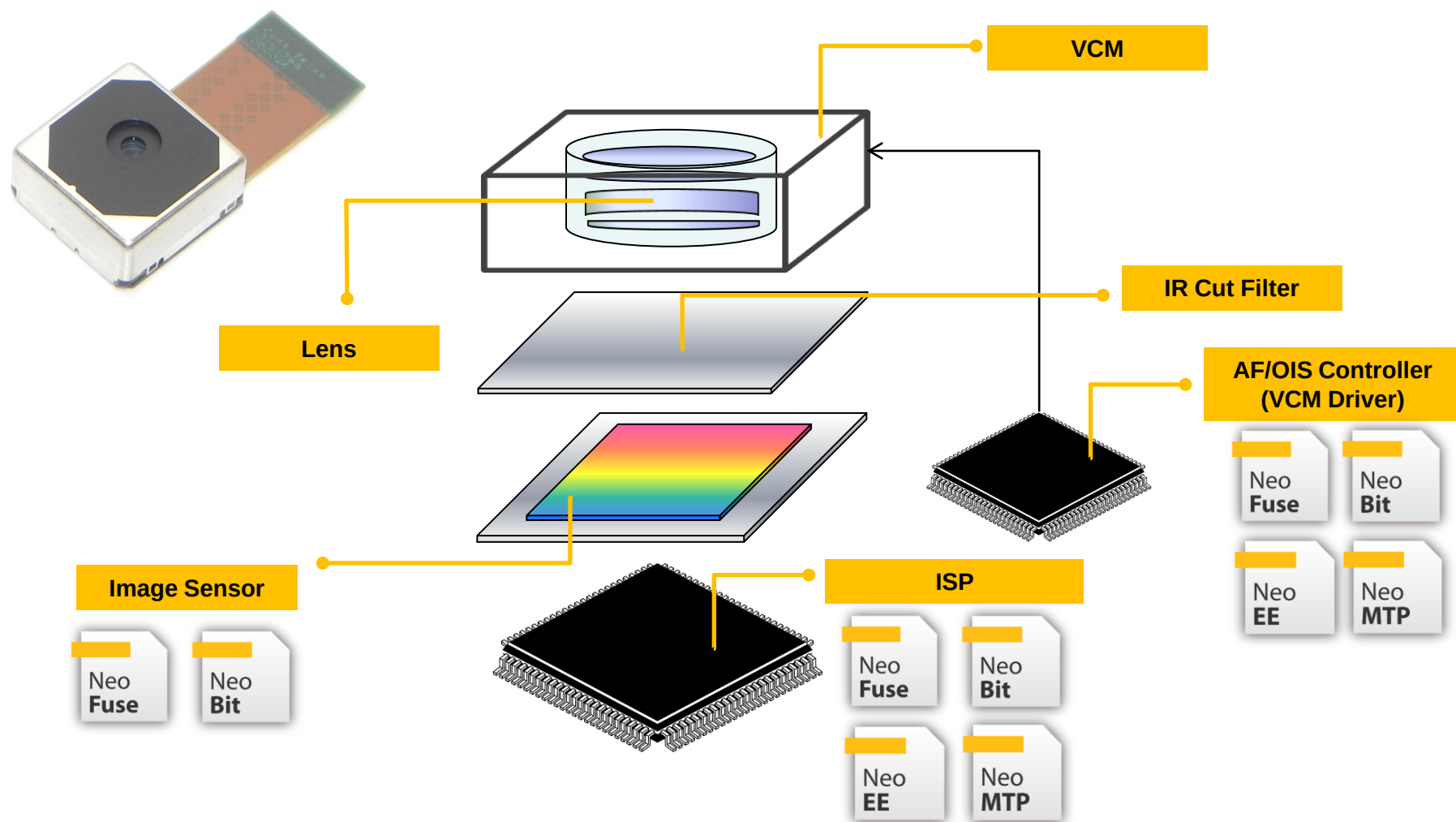
在IoT中之NVM IP 需求



Autotronics with eMemory IPs



Imager Module with eMemory IPs



先進液晶顯示驅動晶片

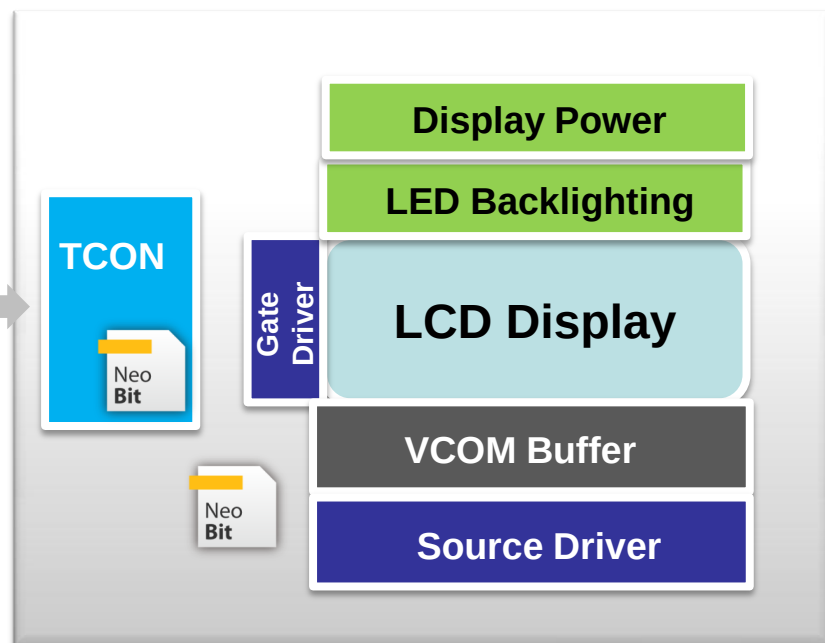
Process Technology : 0.11um HV/80nm HV/55nm HV



I/F
(LVDS, MIPI,...)



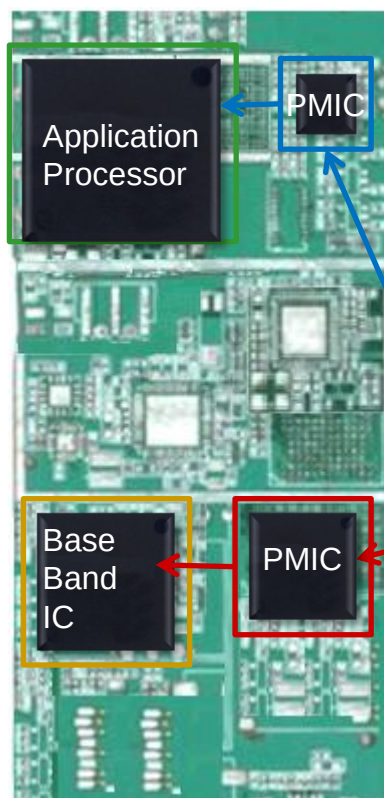
DDI



Density	Endurance	NVM Type	Purpose	NVM Usage
2K8~4K8	1	OTP	Trimming	1. Accuracy enhancement 2. Mismatch cancellation
			Code Storage	1. Gamma Correction Table 2. Timing Control Pattern 3. Color Engine Enhancement

應用於Baseband與Application Processor的電源管理晶片

Process Technology : Advanced 0.25um BCD/ 0.18um BCD/ 0.13um BCD
Mature 0.18um/0.16um/0.152um Logic

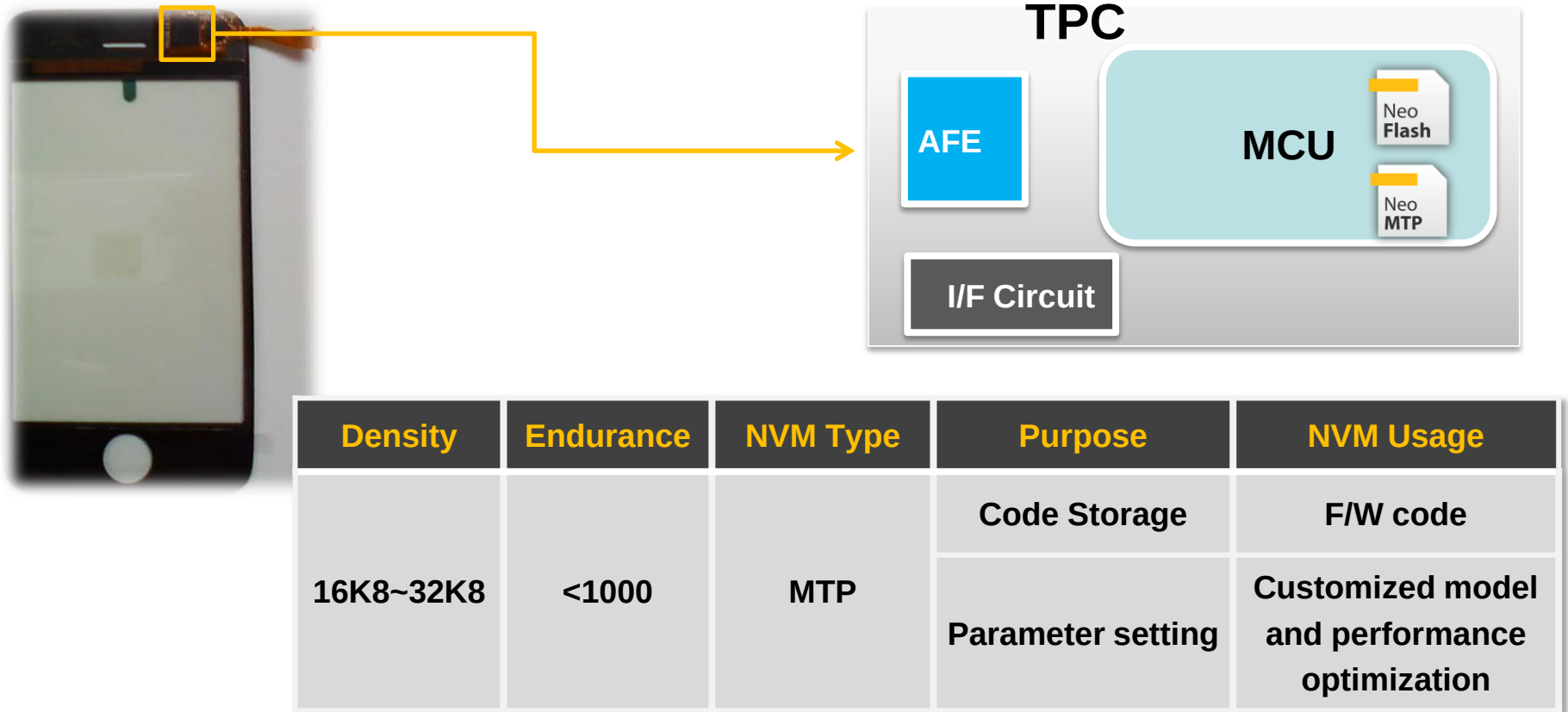


Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	DC/DC, Bandgap
		Parameter Setting	Design flexibility & Performance optimization
		Code Storage	Start-up behavior & smart power saving algorithm



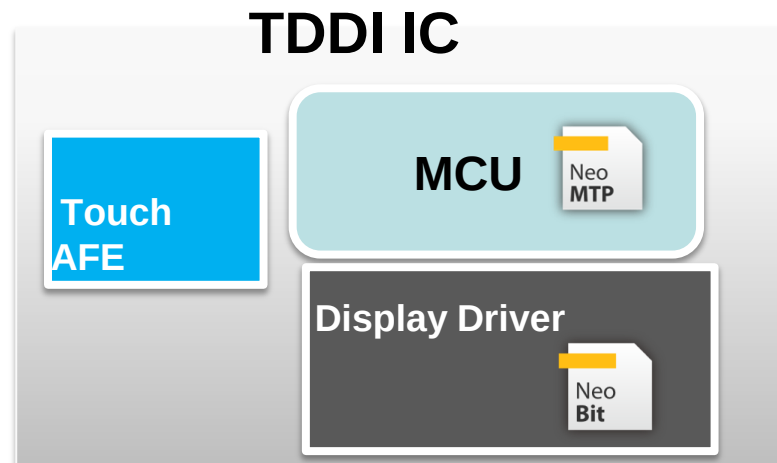
觸控面板控制器晶片

Process Technology : 0.16um HV/0.11um G



內嵌式觸控面板控制器晶片

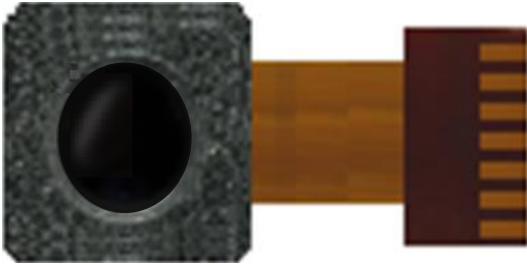
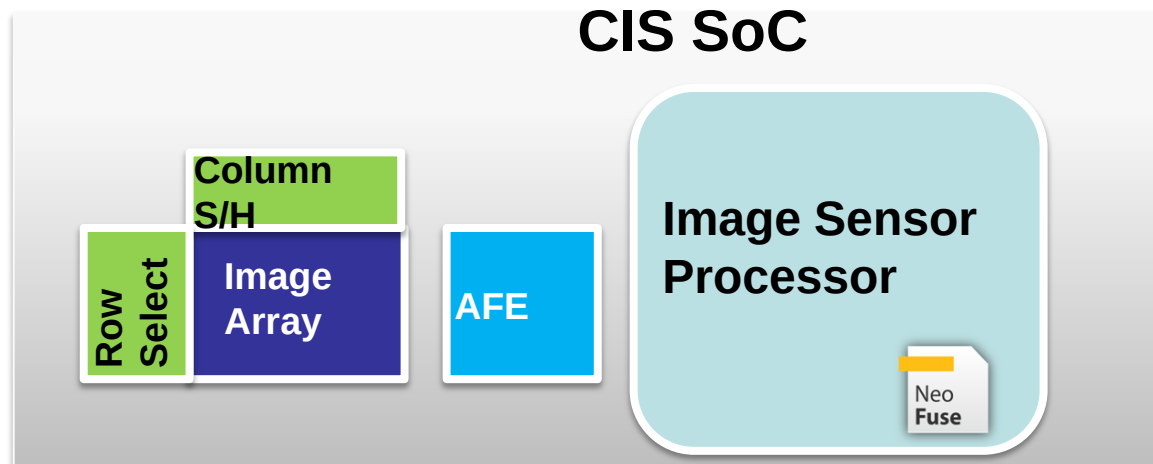
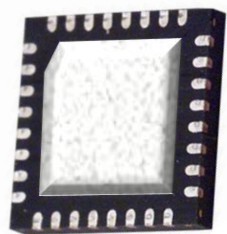
Process Technology : 0.11um HV/80nm HV/55nm HV



Density	Endurance	NVM Type	Purpose	NVM Usage
2K8~4K8	1	OTP	Trimming	Accuracy
			Code Storage	Gamma Table
16K8~32K8	<1000	MTP	Code Storage	Touch F/W Code
			Parameter setting	Performance Optimization

CMOS 影像感測器

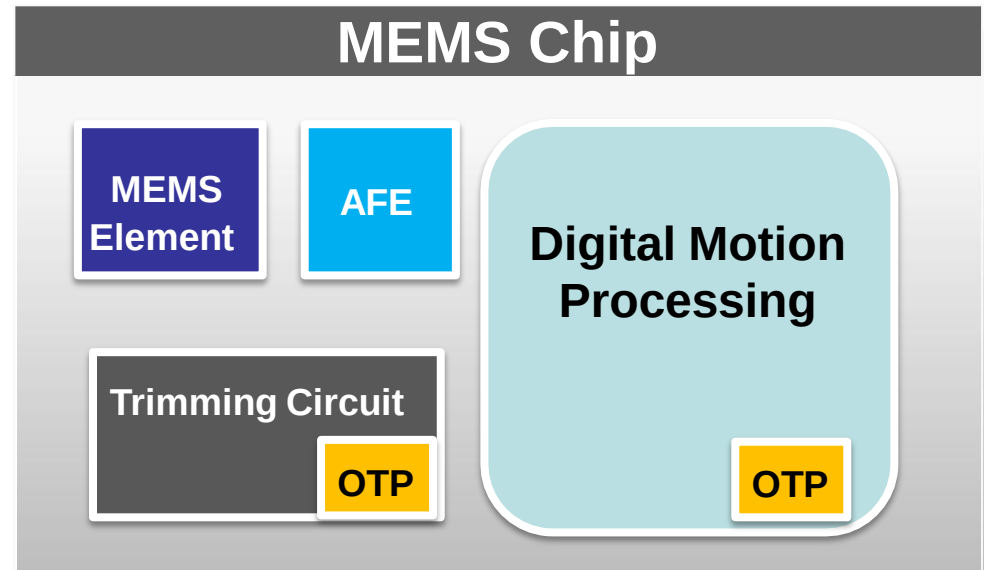
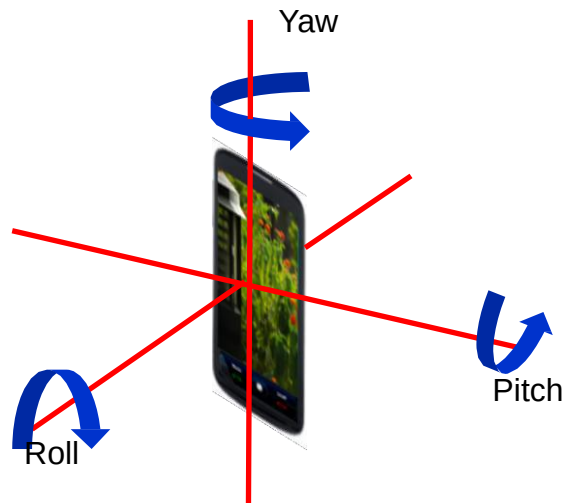
Process Technology : 0.11um CIS/90nm CIS/65nm CIS



Density	Endurance	NVM Type	Purpose	NVM Usage
2Kb~4Kb	1	OTP	Identification Setting	Product Code
			Parameter Setting	Start-up Initial Setting
32K8	1	OTP/ROM	Code Storage	Boot Load

微機電系統(MEMS)

180/160/15x nm HV/Logic for MEMS Controller

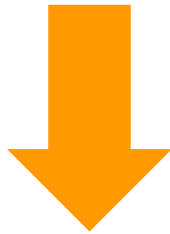


Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	Factory trimming
		Parameter Setting	Signal filtering
		Code Storage	Geometric computation

取代嵌入式快閃記憶體之競爭優勢

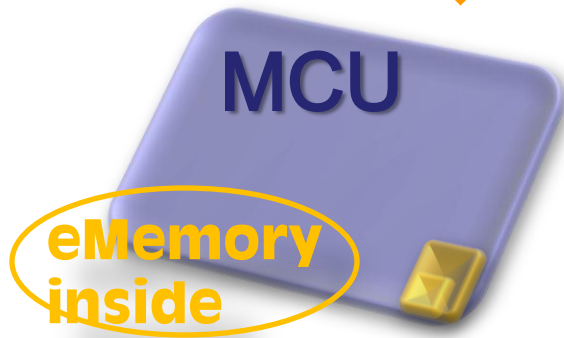


product design & manufacturing by
embedded Flash
Logic Process + 10 Masks



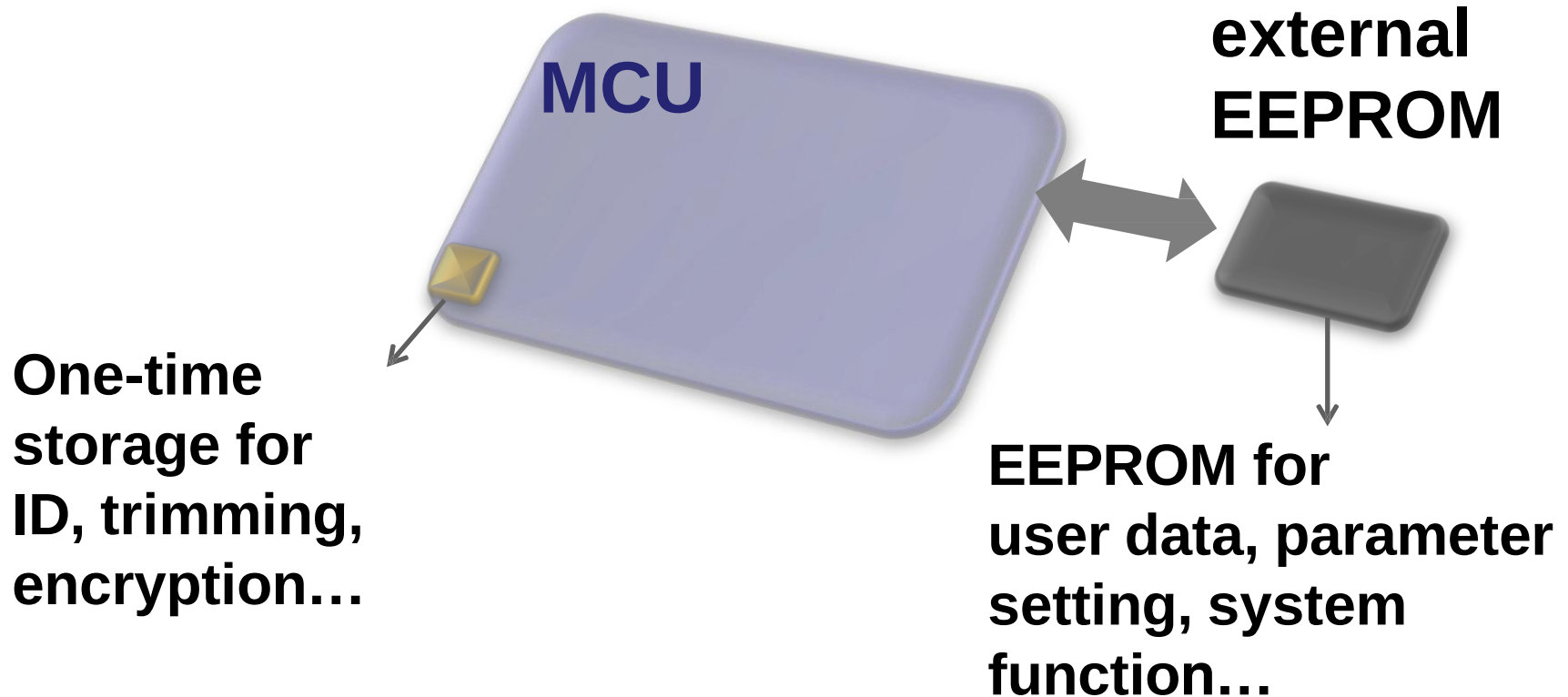
***30% more
cost reduction***

***wafer cost &
testing time***



product design & manufacturing by
Embedded Logic NVM (OTP/MTP)
Logic Process

EEPROM應用於MCU



NeoBit + NeoEE

Hybrid NVM solution (NeoBit + NeoEE) with customized SPEC & optimized size



- **One single IP by integration of NeoBit & NeoEE**
- **Help for system size reduction**

IC種類之晶圓需求

IC Type	Equa to 8-inch wafer (K)
AP	4926
PMU	4508
Smart card controller	3667
Base Band controller	2429
CIS sensor	1975
LCD driver (int with TCON)	1892
Fingerprint	744
Gauge IC	670
Touch panel controller (C)	581
TV controller	579
Connectivity (Combo)	437
STB controller	330
Wifi controller	293
DC-DC/AC-DC	190
LED driver	141
BT controller	132
Light sensor	123
Accelerator sensor controller	114
TAG IC	100
ISP	98
Gyroscope sensor controller	90
MCU (8bits, pure 5V)	65
P-Gamma	40
MCU (8bits, LV/3.3V)	39
NB CAM controller	36
Pressure sensor controller	21
PC CAM controller	8
TCON (w/o driver)	3

2016 Q3 updated

未來展望

預期下半年營收的成長動能將會持續加速，原因如下：

- 技術授權金：

- › 各大代工廠持續進行先進製程及MTP的平台開發，及累計IP library數的增加，將帶動技術授權金及設計授權金的成長。

- 權利金：

- › 更多Fingerprint客戶導入量產，權利金貢獻將顯著增加。
- › 下半年新機晶片數的導入增加及美國最大客戶新產品線的量產，來自PMIC的權利金會維持成長動能。
- › 高階DDI及TDDI應用的量產持續，將為權利金成長帶來貢獻。
- › 更多客戶在28奈米 tape-out新產品，可望為權利金的成長帶來新的動能。

未來展望

- 技術研發：

- › 12奈米預計8月份有客戶tape-out，7奈米的IP順利在3月份tape-out，8月份將在另一代工廠tape-out IP。
- › 加密相關的新技術 - NeoPUF預計今年會有客戶導入設計。
- › 車用電子的技術平台已建置完成，客戶已開始量產。

成長驅動力

Growth in application per mobile devices

- More chip applications per smartphone/tablet product.

Growth into more markets

- From consumer electronics and mobile devices to wearable devices.
- Adding new NVM product lines further enable more product applications.

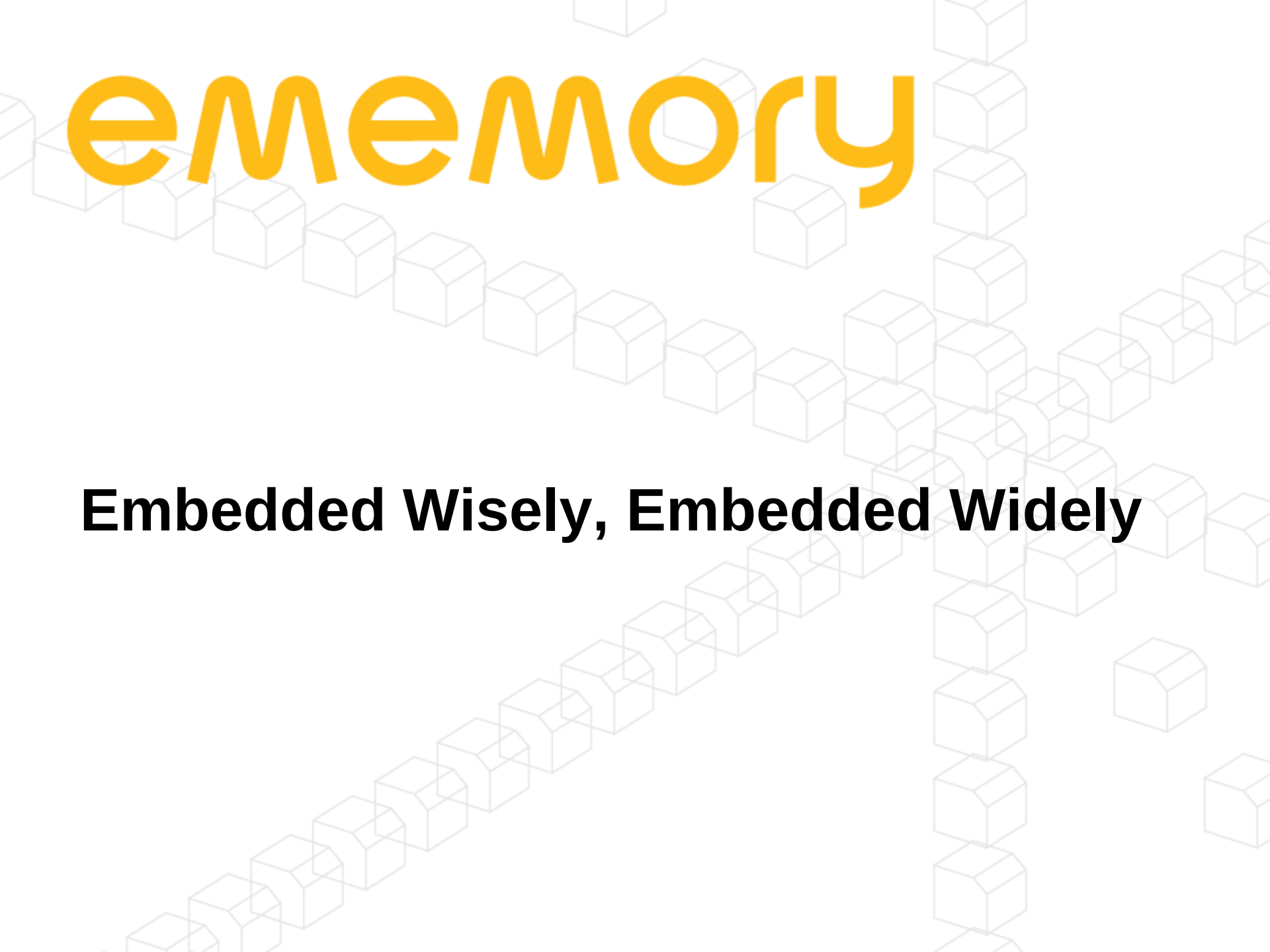
Growth in advanced technology

- Higher royalty per wafer is contributed from more advanced technology nodes.

Great IoT era

- Embedded Logic NVM will be a must.

Q & A



ememory

Embedded Wisely, Embedded Widely