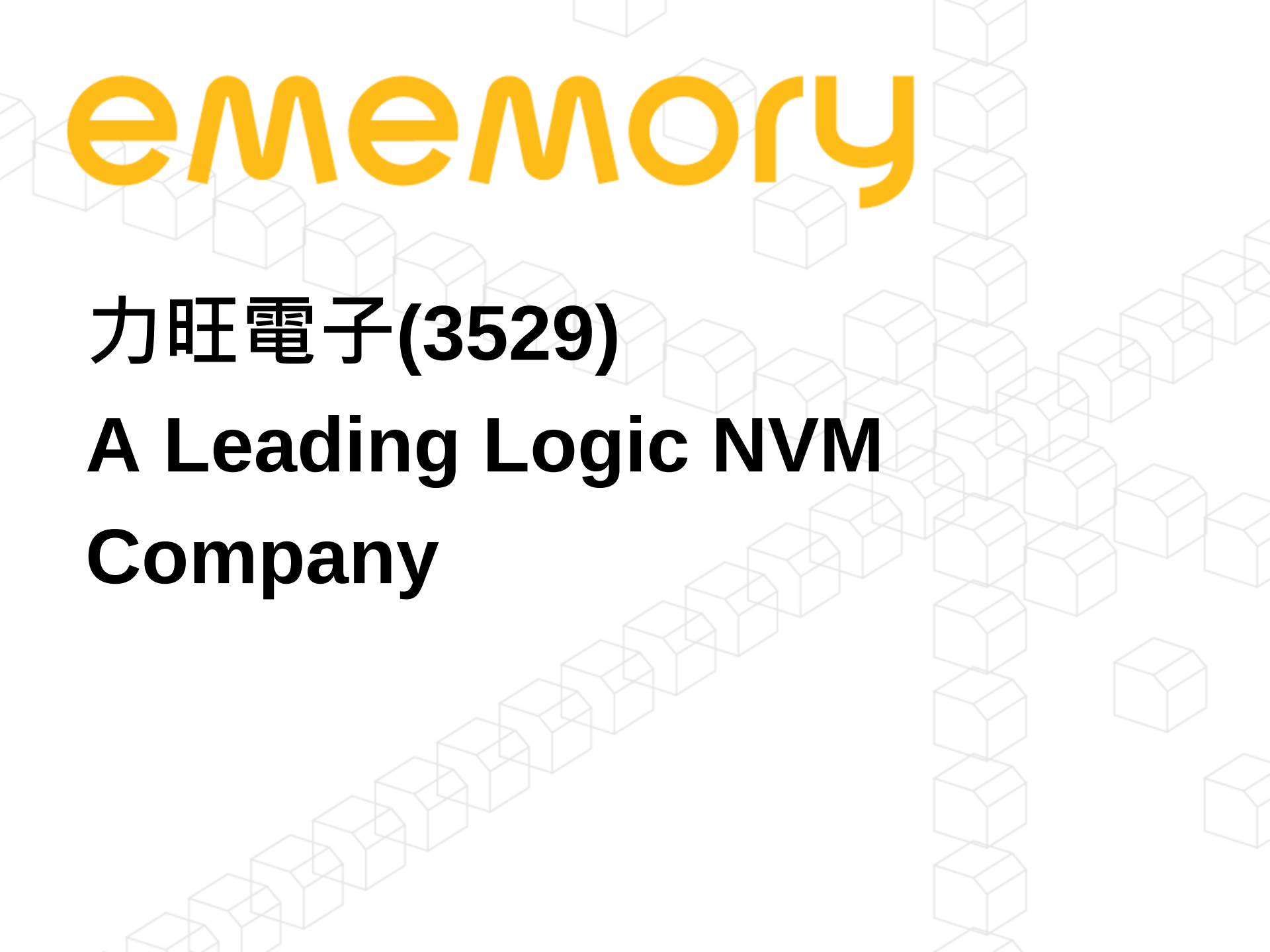


The background of the slide is a light gray pattern of 3D cubes. Some cubes are solid white, while others are outlined in gray. They are arranged in a way that creates a sense of depth and perspective, with some cubes appearing to be in the foreground and others receding into the background.

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。

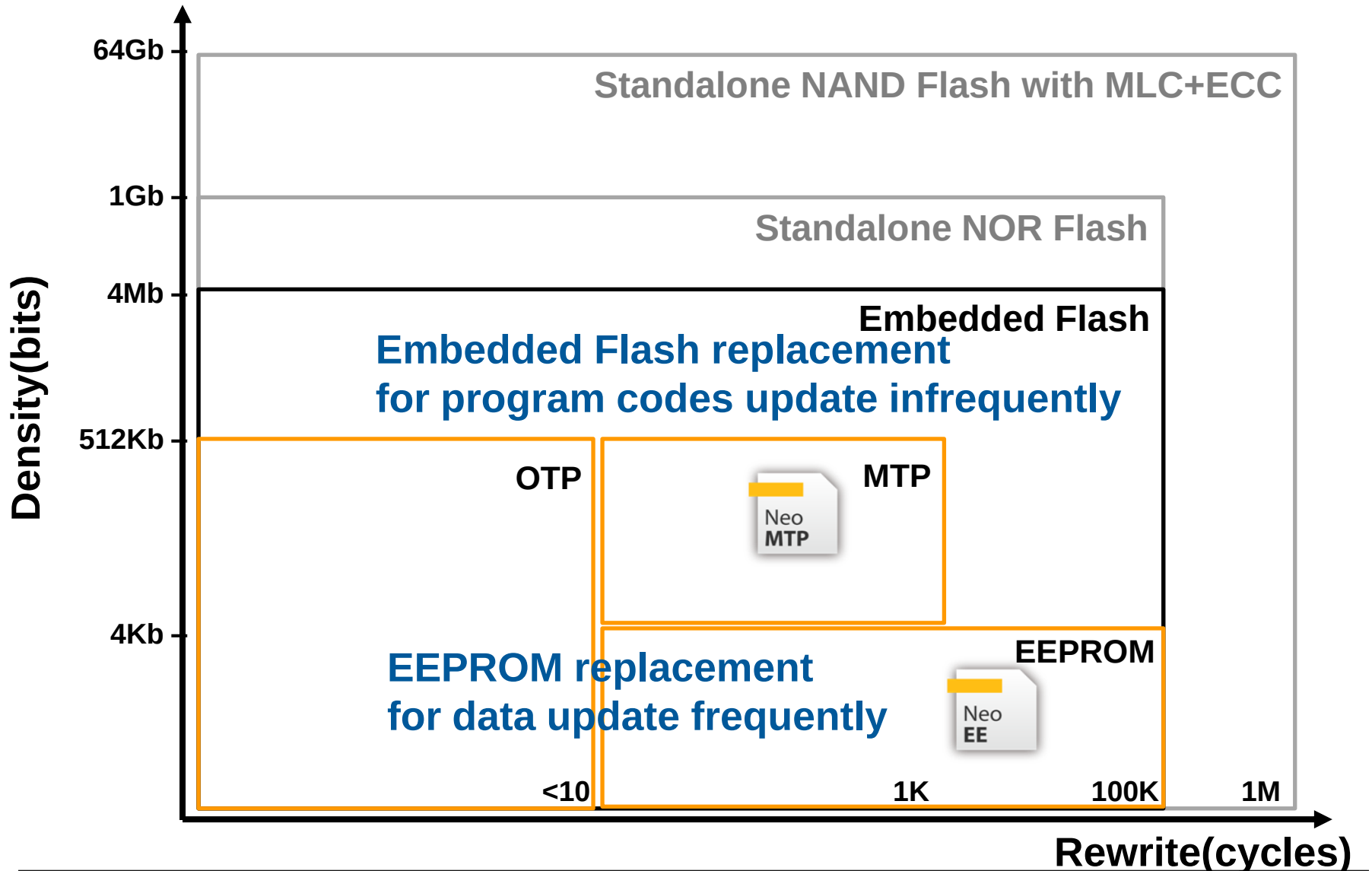
投資安全聲明

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。

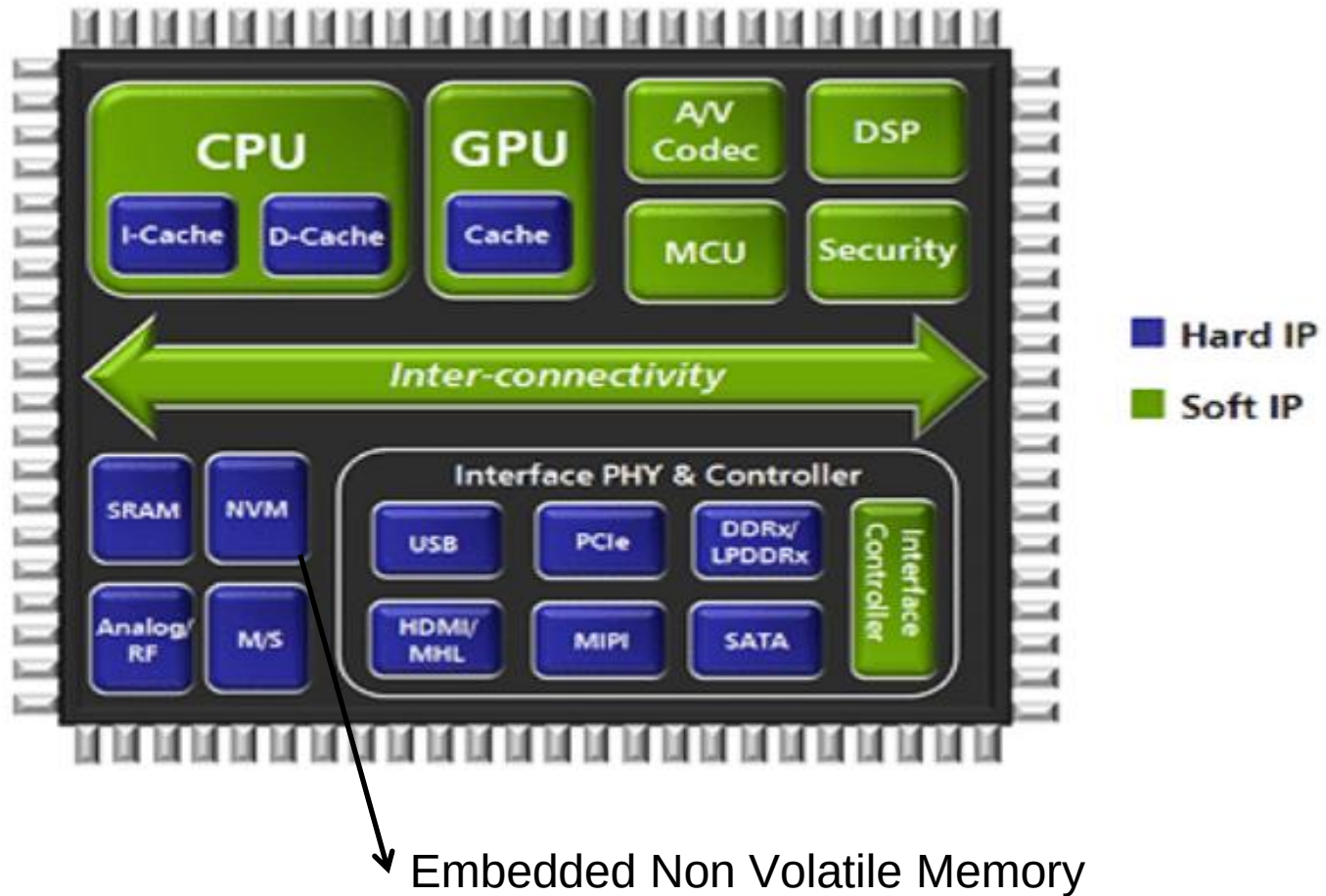
大綱

- 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



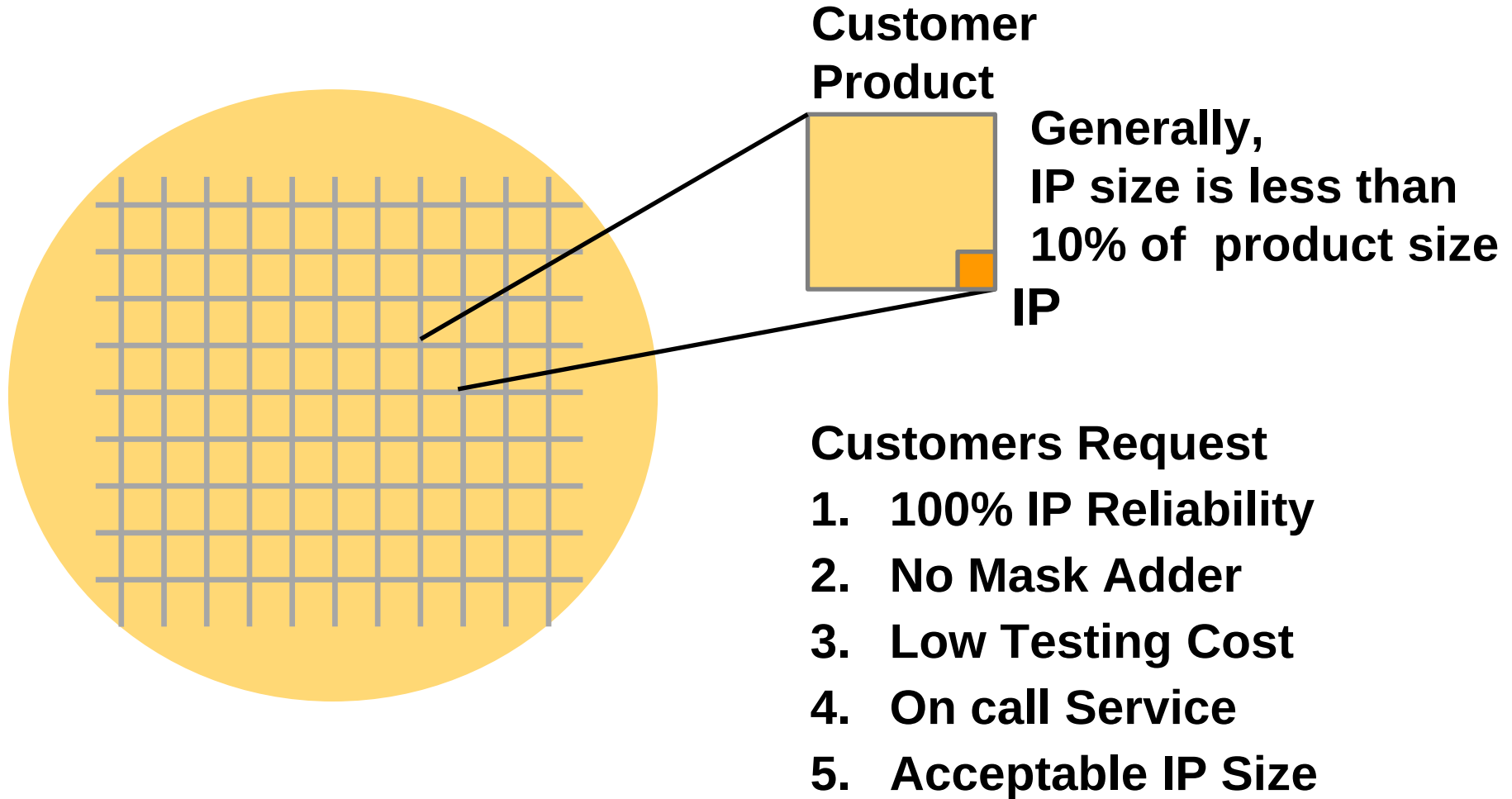
Source : tsmc

嵌入式非揮發性記憶體技術

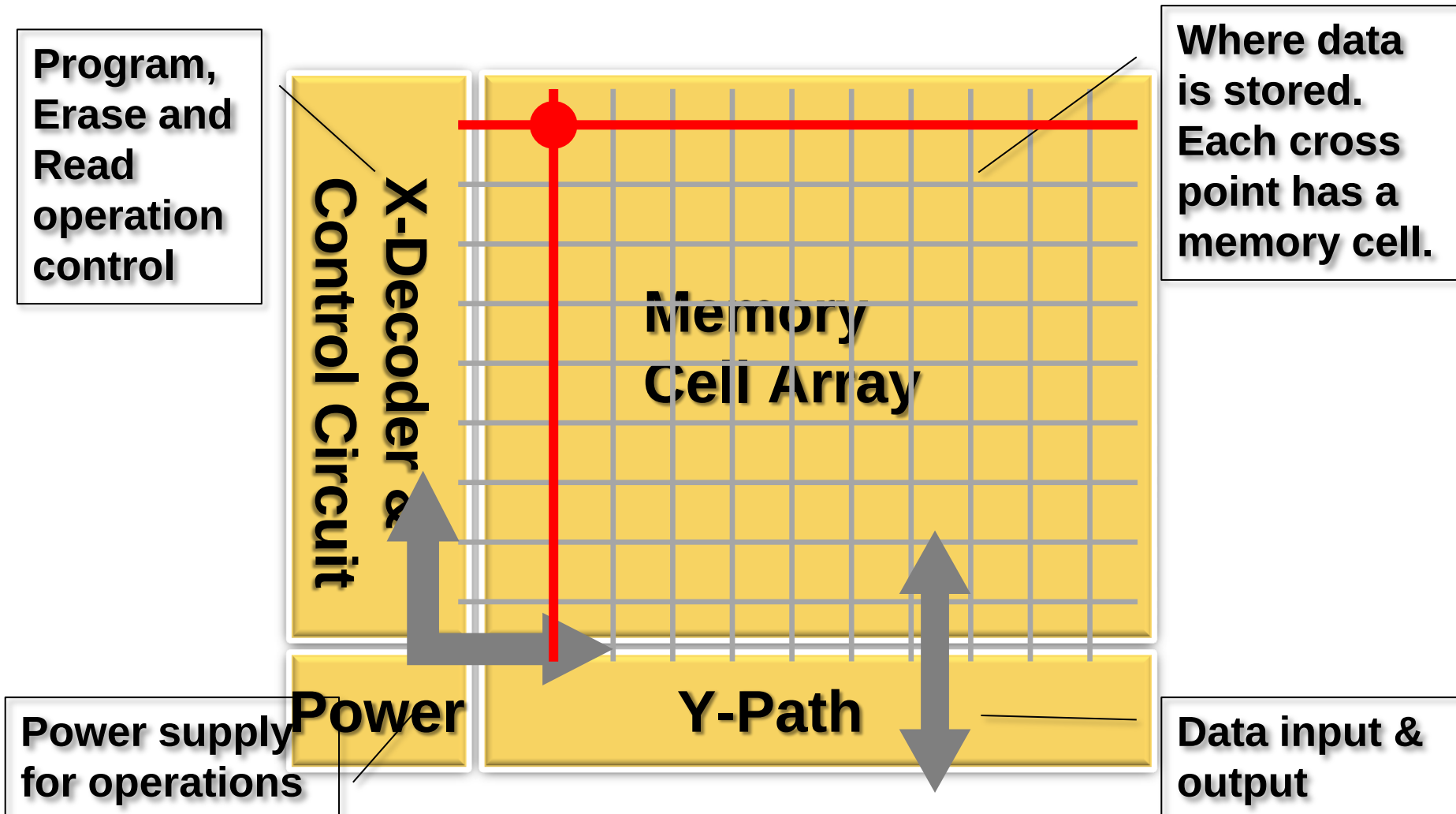
	ROM	eFuse (OTP)	Antifuse (OTP)	CMOS Floating Gate (OTP)	CMOS Floating Gate (MTP)	Embedded Flash
Cell Structure	Transistor	Poly Fuse	Antifuse	Floating Gate	Floating Gate	Floating Gate
Standard CMOS Compatible	Yes	Yes	Yes	Yes	Yes	No
Bitcell Area	< 1	50	1	2	4	1
Endurance	No	No	< 10	< 10	10K-100K	100-1000K
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)

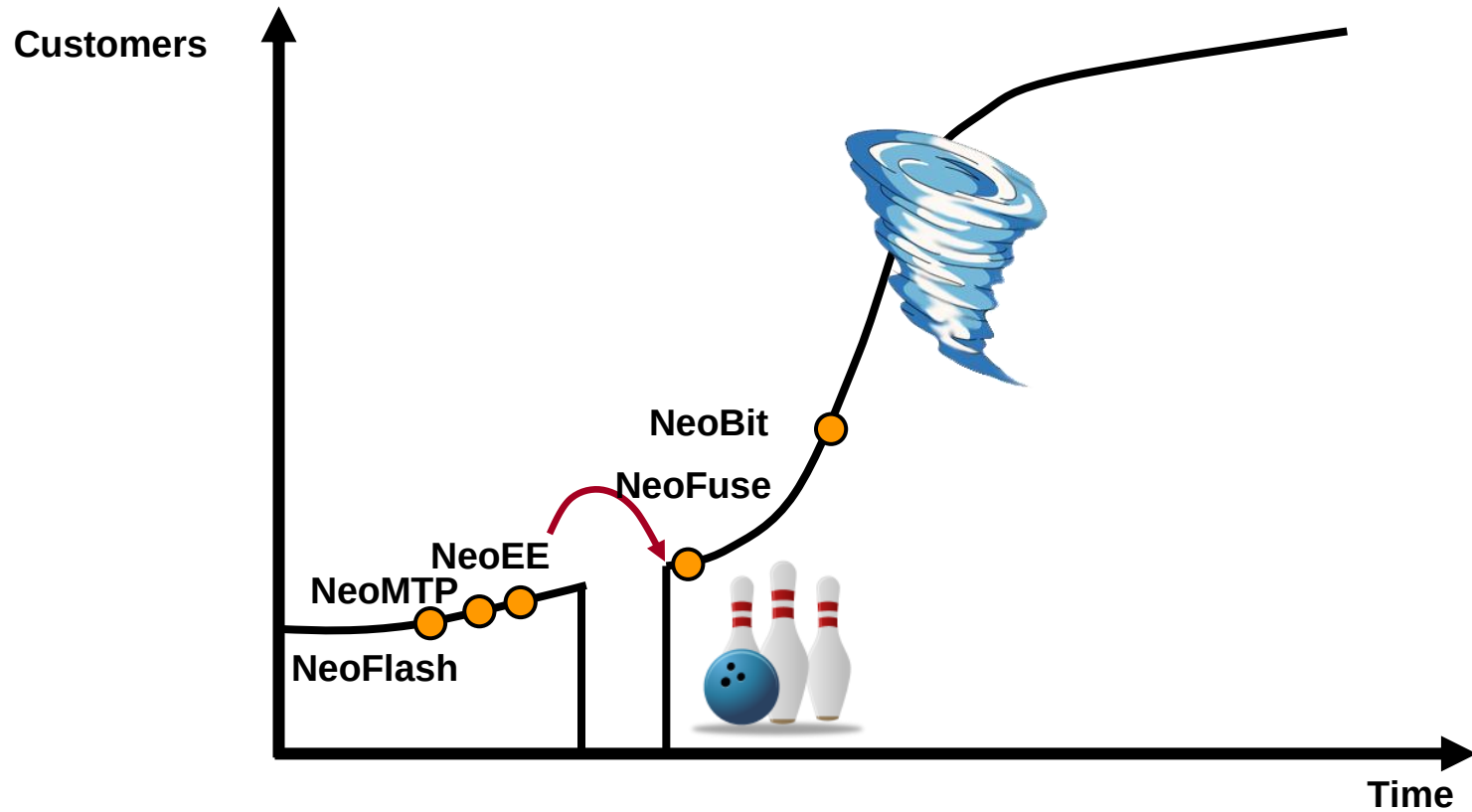
採用IP之考量



Nonvolatile Memory IP 内部



跨越鴻溝



營運模式

- Founded in 2000. First customer engaged in 2002. Achieved profitability in 2005 and IPO in 2011. The largest logic non-volatile memory IP company, 228 employees (159 R&D)*.
- Since its IPO, the company initiated no new fund raising or bank debt, and has distributed in excess of 100% of earnings in cash dividends.
- **Growth Indices:** 1) No. of on-going technology platforms
2) No. of design licenses
3) Royalty



Note*: As of Jun. 30th, 2016

全球客戶



	Taiwan	China	Korea	Japan	North America	Europe	Others
Foundry	5	7	3	2	1	1	1
IDM	0	0	0	8	2	1	0
Fabless	251	409	59	47	191	107	42

Foundry

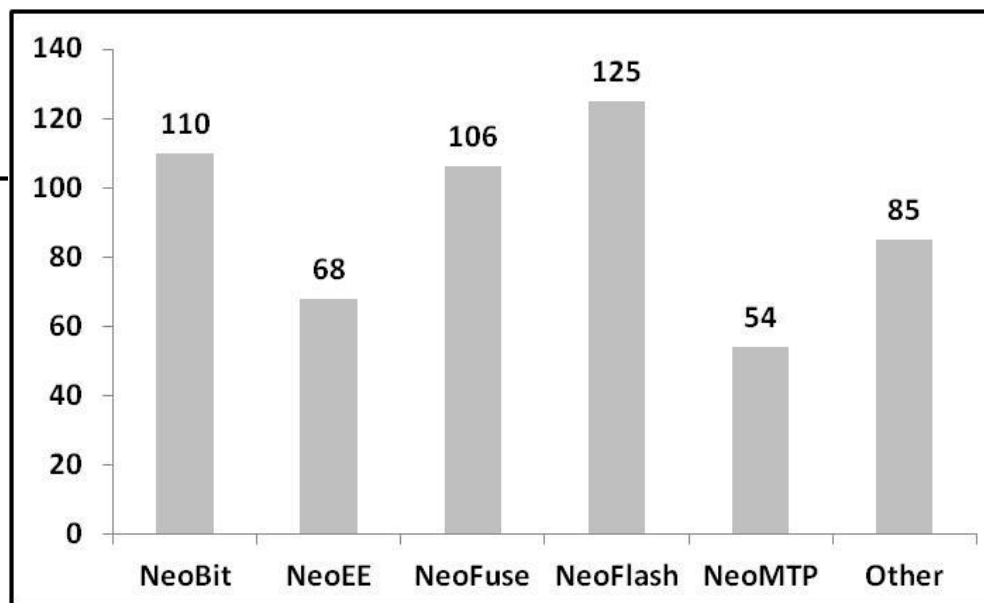
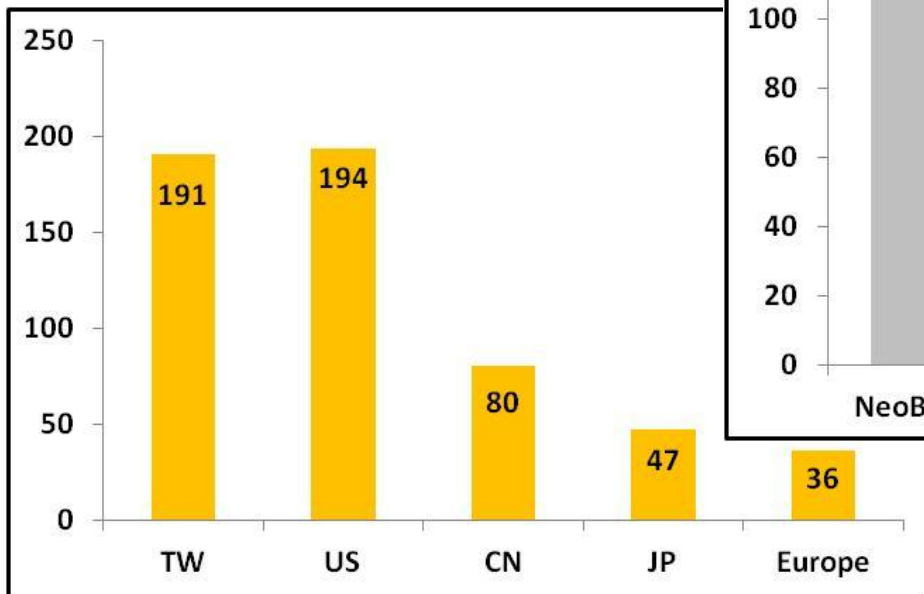


IDM



專利佈局

	Q1 16	Q2 16	Diff.
Pending	185	193	+ 8
Issued	345	355	+ 10
Total	530	548	+ 18

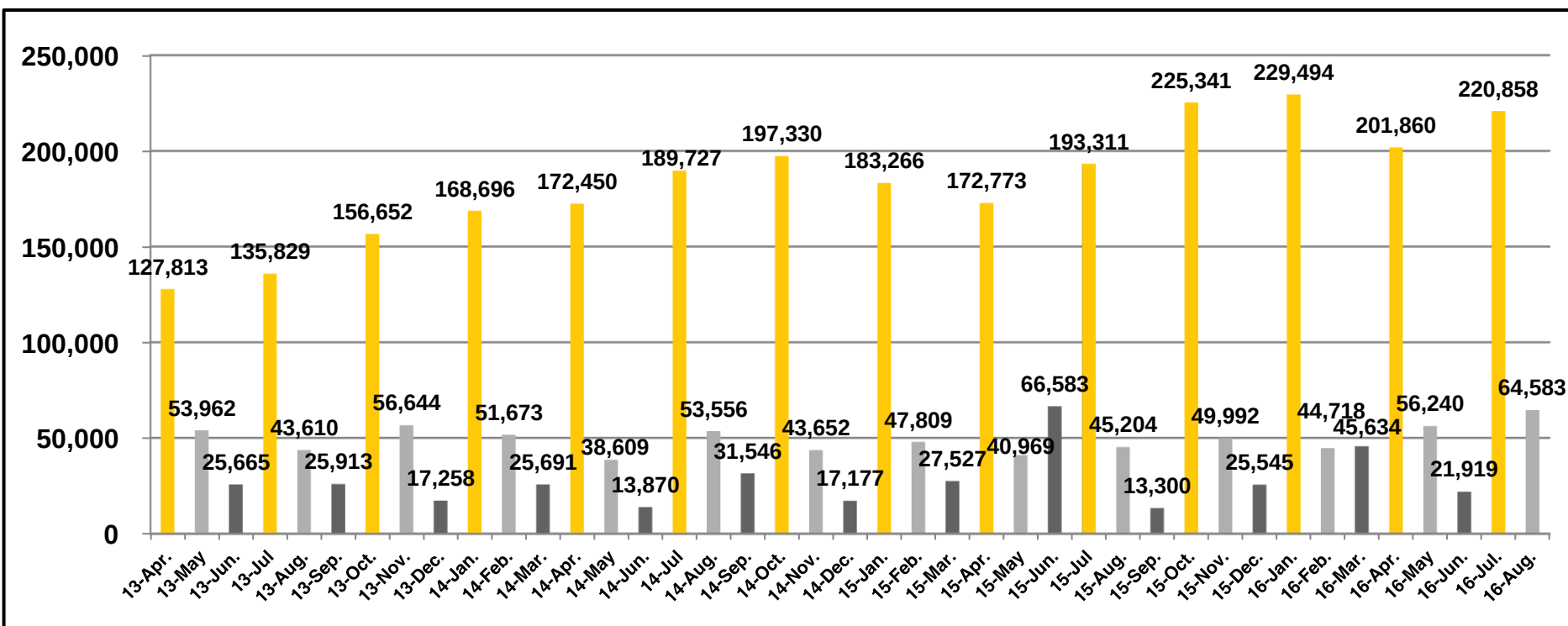


Note*: As of Jun. 30th, 2016

每季營收模式

- The quarterly royalty from most of foundries are collected at first month of each quarter and from some other foundries are collected at second month, and none at third month.

Unit : NTD Thousands



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

第二季各項營收

單位：新台幣仟元

	Q2 2016	Q1 2016	QoQ	Q2 2015	YoY	H1 2016	H1 2015	YoY
授權費	77,715	85,976	-9.61%	95,982	-19.03%	163,691	160,038	2.28%
權利金	202,304	233,870	-13.50%	184,343	9.74%	436,174	378,889	15.12%
合計	280,019	319,846	-12.45%	280,325	-0.11%	599,865	538,927	11.31%

單位：合約數

		Q2 2016	Q1 2016	2015	2014
技術授權數		14	13	28	21
設計 授權數	NRE	14	13	57	82
	使用費	96	69	349	363

綜合損益表

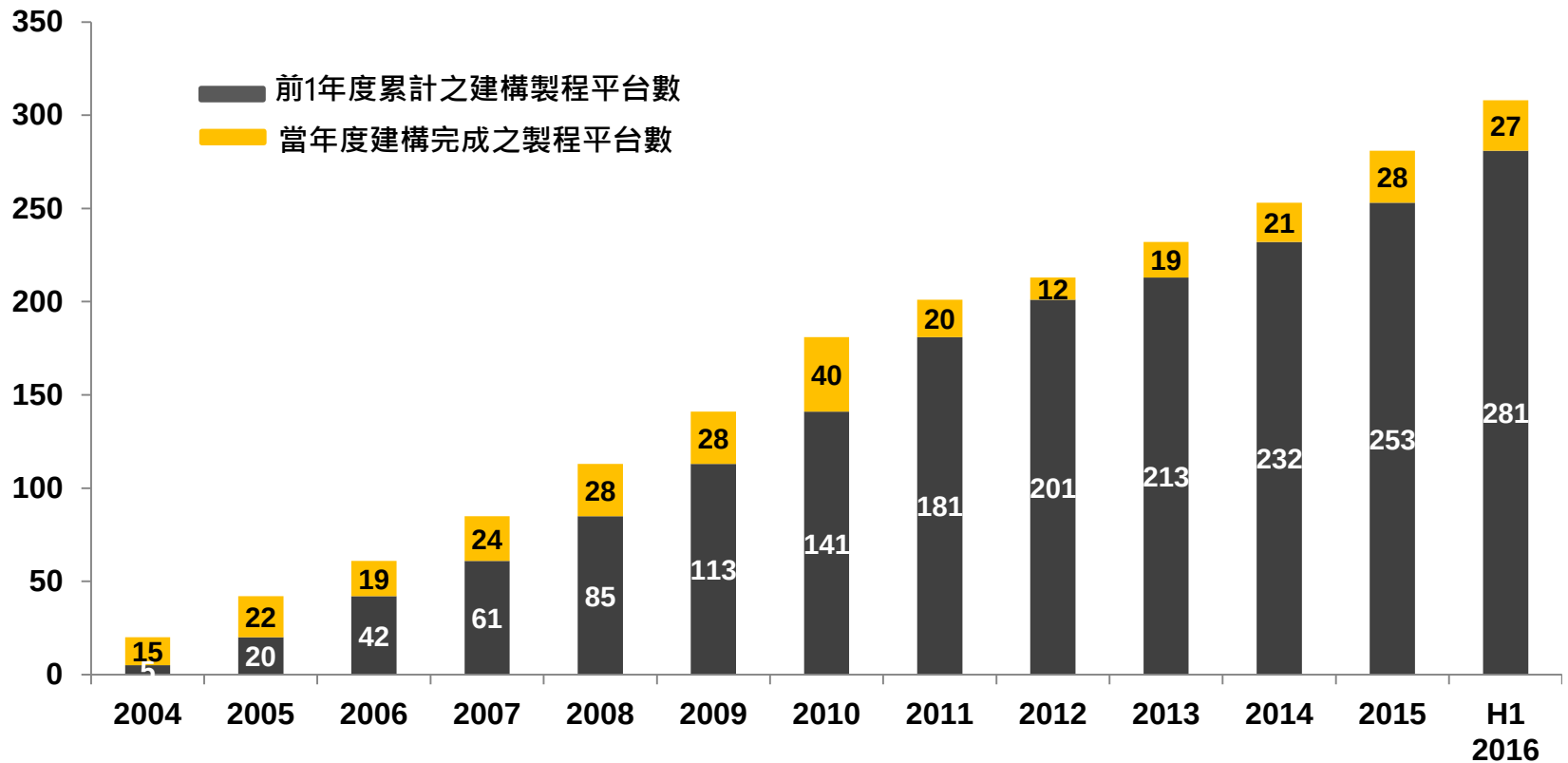
(單位:新台幣仟元)	Q2 2016	Q1 2016	% change	Q2 2015	% change
營業收入淨額	280,019	319,846	-12.5%	280,325	-0.1%
營業毛利率	100%	100%	-	100%	-
營業費用	163,276	177,088	-7.8%	141,435	15.4%
營業淨利率	41.7%	44.6%	-2.9ppts	49.5%	-7.8ppts
本期淨利	106,245	166,012	-36.0%	130,297	-18.5%
純益率	37.9%	51.9%	-14.0ppts	46.5%	-8.6ppts
每股盈餘 (單位: 新台幣元)	1.40	2.19	-36.1%	1.72	-18.6%
權益報酬率	24.5%	34.9%	-10.4ppts	30.9%	-6.4ppts

技術授權合約

單位：合約數

Year	2013	2014	2015	H1 2016
License number	19	21	28	27

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。



技術授權合約及累計平台數

- Total (As of June) : **108**
- **20** for NeoBit, **46** for NeoFuse, **21** for NeoEE, and **21** for NeoMTP.

	7/10nm	14/16nm	28nm	40nm	55/65nm	80/90nm	0.11~ 0.13um	0.15~ 0.18um	>0.25 um
NeoBit	-	-	-	-	-	-	6	13	1
NeoFuse	2	3	9	6	11	5	7	3	-
NeoFlash	-	-	-	-	-	-	-	-	-
NeoEE	-	-	-	-	-	1	5	15	-
NeoMTP	-	-	-	-	2	2	6	11	-

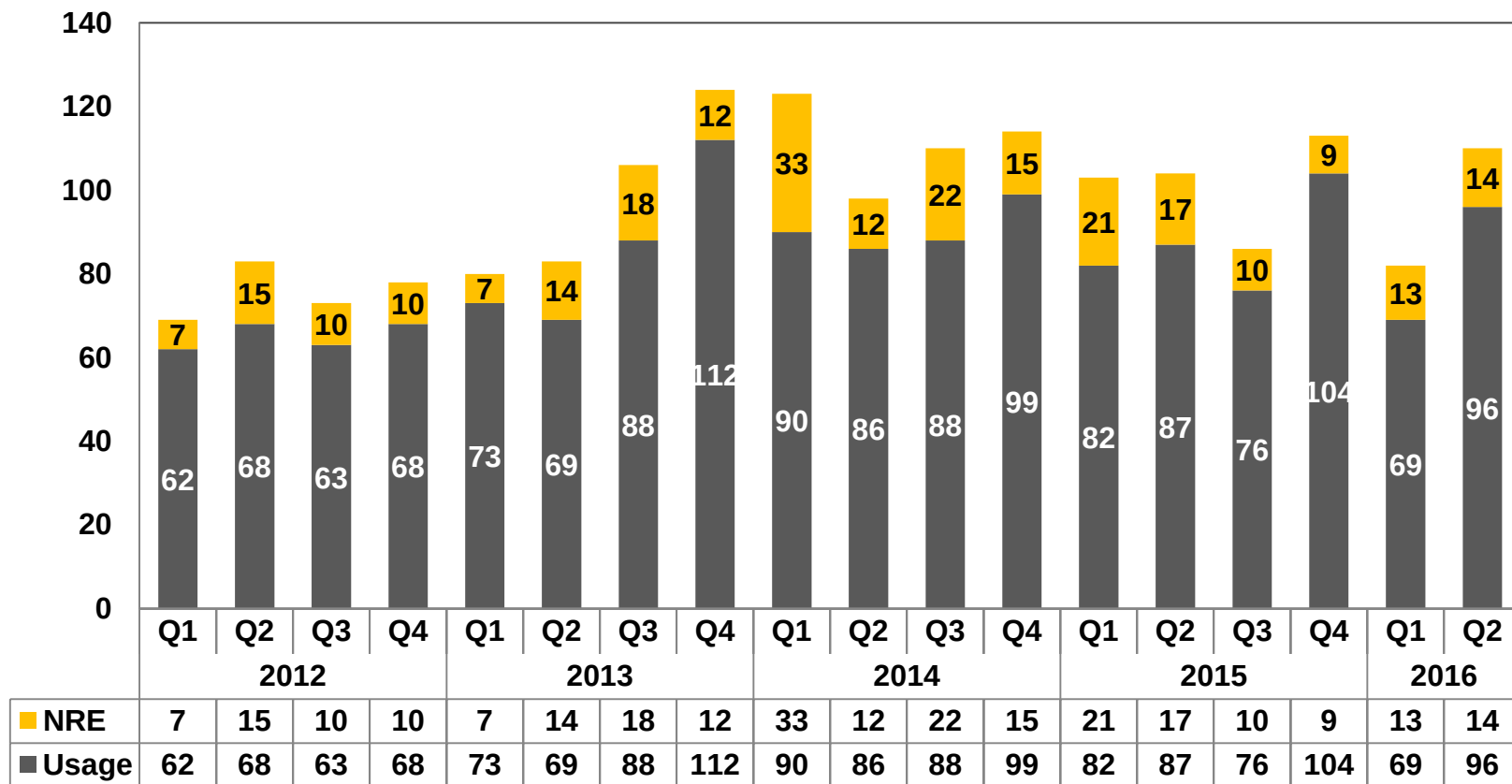
目前正在建構的技術製程平台

12" Fabs	Production	Development	NVM Type	Process Type
7/10nm	0	2	OTP	FF
14/16nm	1	3	OTP	FF+
28nm	5	9	OTP	LP/HPM, HLP/HPM, LPS
40nm	4	6	OTP, MTP	HV-DDI, LP
55/65nm	11	13	OTP, MTP, Flash	LP, HV-DDI, HV-OLED, DRAM, CIS
80/90nm	5	8	OTP, MTP	HV-DDI, HV-OLED, LP
0.13/0.11um	6	4	OTP, Flash	HV-DDI, BCD, Generic
0.18um	1	0	OTP	BCD

8" Fabs	Development	NVM Type	Process Type
0.13/0.11um	20	OTP, MTP, Flash	HV-DDI, BCD, LP, RF, CIS, LL
0.18/0.16/0.152um	42	OTP, MTP	Generic, LP, LL, MR, HV, Green, BCD
0.25um	1	OTP, MTP	BCD
0.35um	0	OTP	UHV

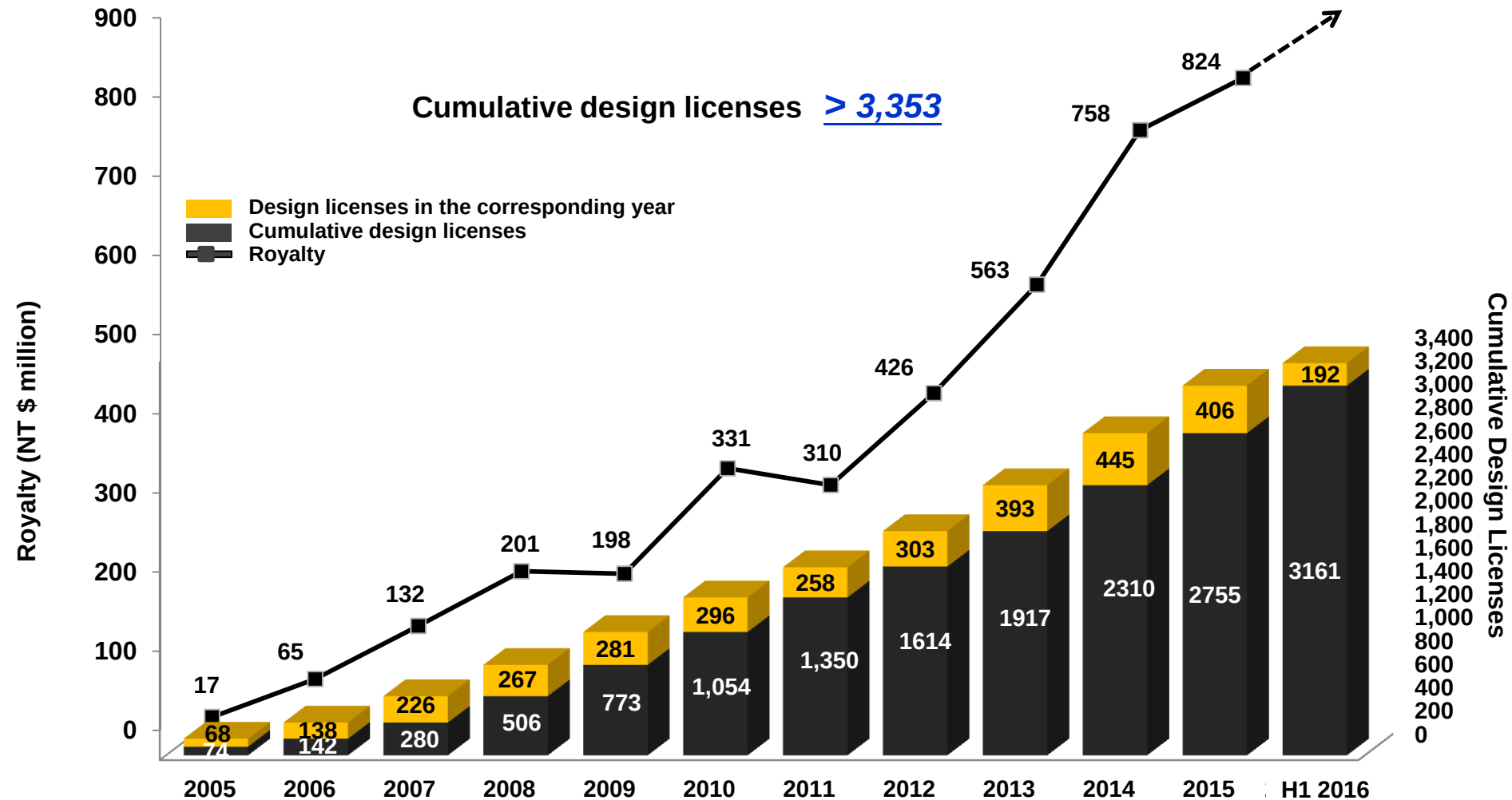
每季設計授權數 (New Tape Out)

- Total **192** NTO as of H1 2016(**406**@2015,**445**@2014, **393**@2013, **303**@2012)



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目

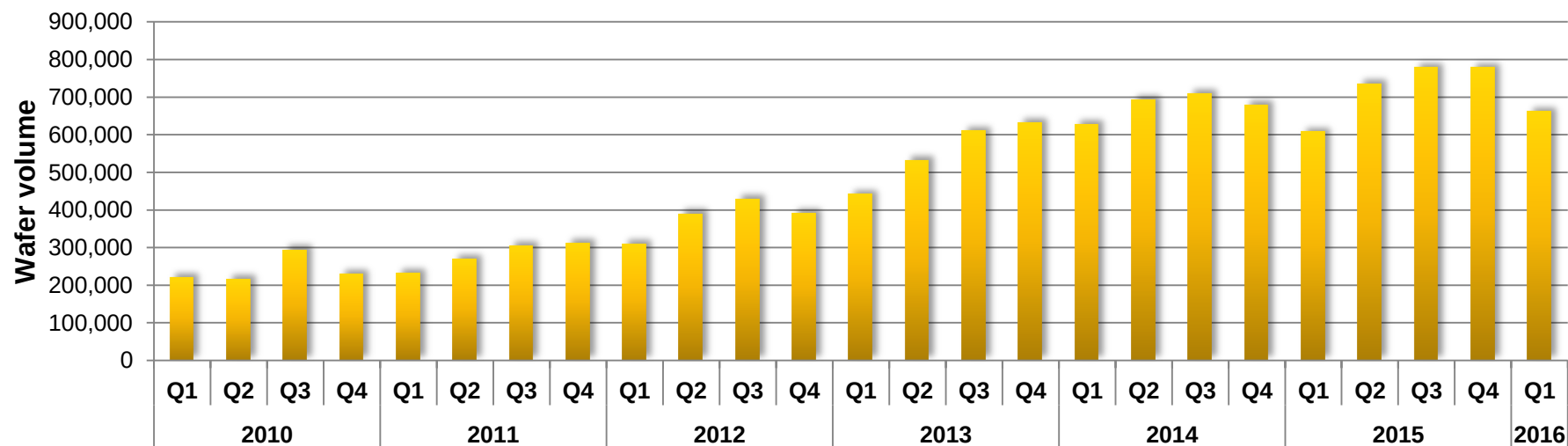


註1. 2009年因整體半導體景氣衰退，權利金年衰退1.5%。

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 Q2 2016

	Process node	*% of T	Q2 16	Q1 16	2015	2014
8"	0.25/0.35	3%	* 18.44%	40.91%	33.49%	30.5%
	0.15/0.18	11%	12.32%	13.41%	8.73%	11.9%
	0.11/0.13	2%	43.90%	27.53%	29%	20.8%
12"	90nm	5%	* 11.33%	20.04%	19.85%	16.3%
	65nm	12%	3.76%	2.91%	0.55%	0%
	40/45nm	15%	0%	0%	0%	0%
	28nm	28%	0.41%	0.46%	0.05%	0%
	16/20nm	23%	0	0%	0%	0%
8"		17%	16.39%	20.33%	16.64%	15.6%
12"		83%	1.36%	1.97%	1.87%	1.4%
Total		100%	3.92%	5.09%	4.76%	4.5%

* Due to Inventory correction of iOS related customers in Q2.

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

16nm

28nm

40nm

55/65nm

80/90nm

110/130nm

160/180nm

250nm

350nm

NeoBit

NeoFuse

NeoFlash

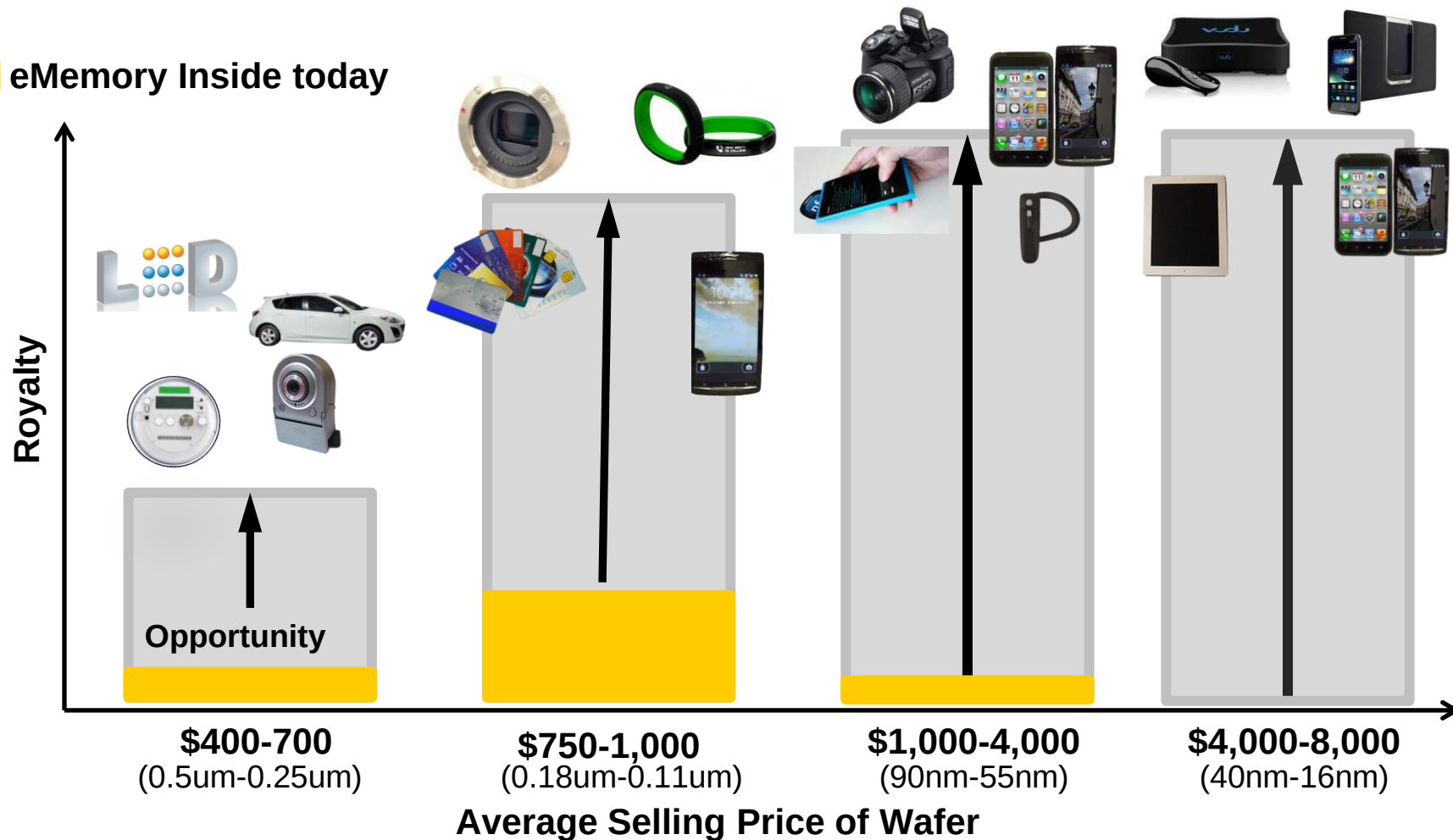
NeoEE

NeoMTP



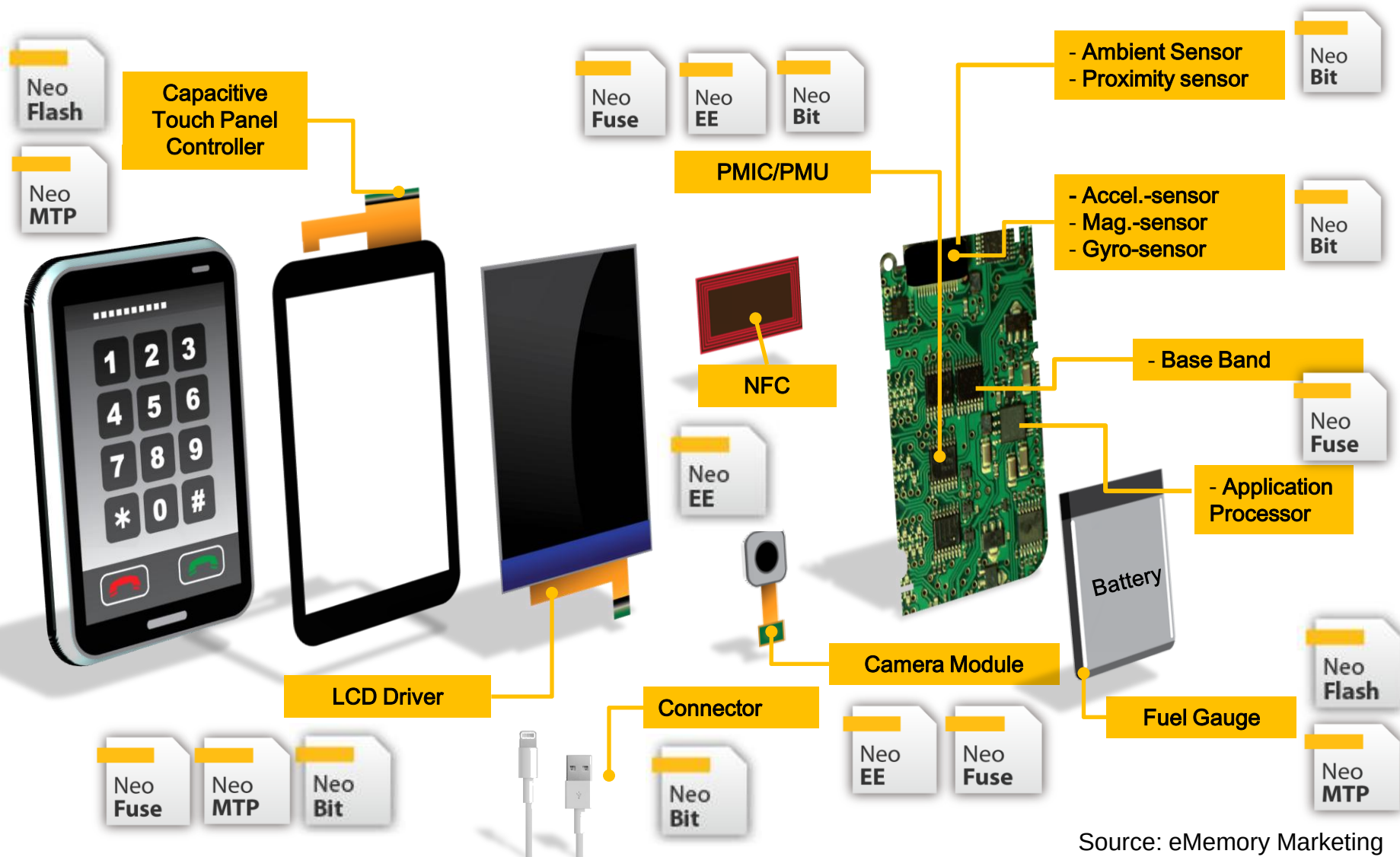
商機與潛力

 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



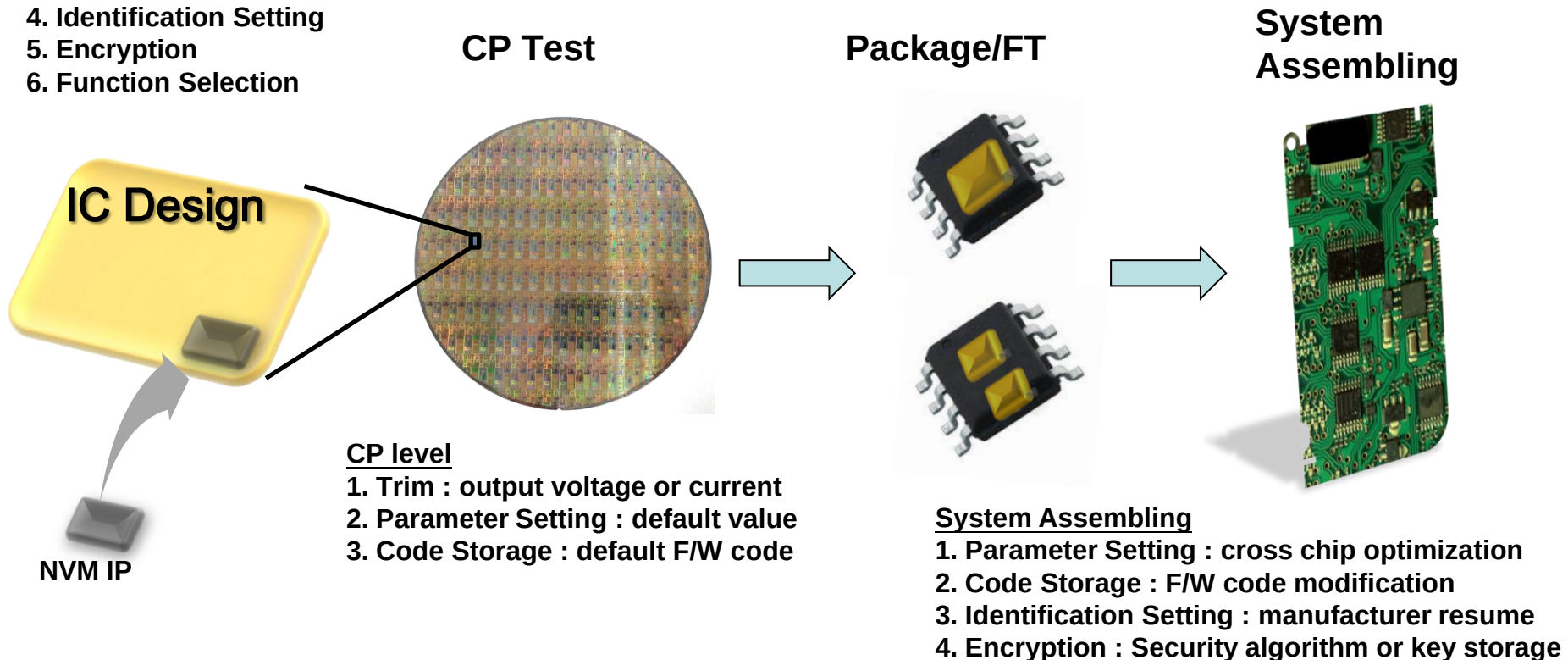
Benefits from Using eMemory IPs

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



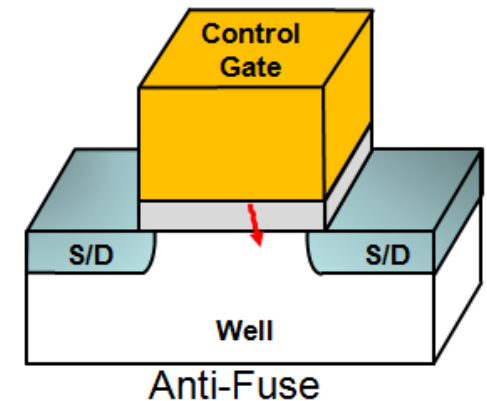
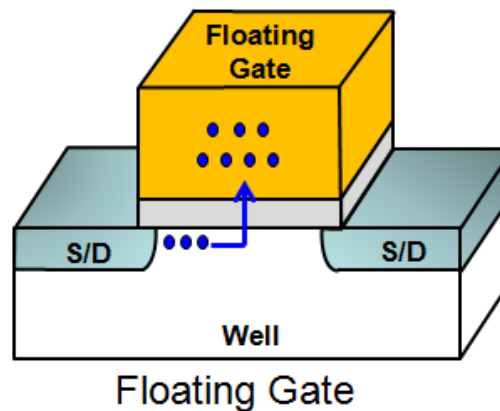
高機密性的安全設定

- 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



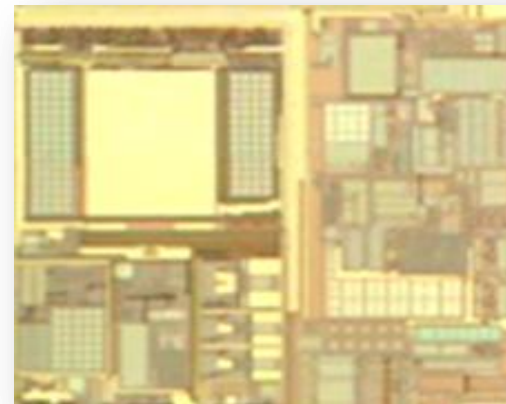
reverse
copy

re-produce



without protection

Fake Product



reverse
copy

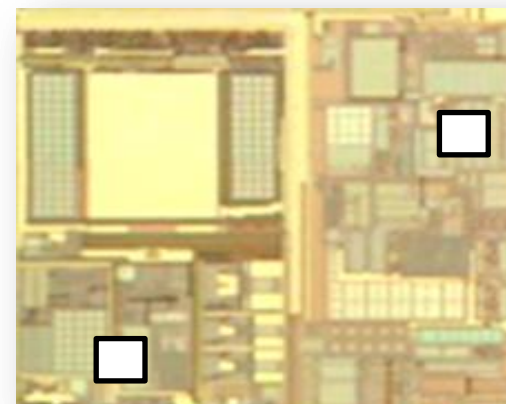
re-produce



with protection

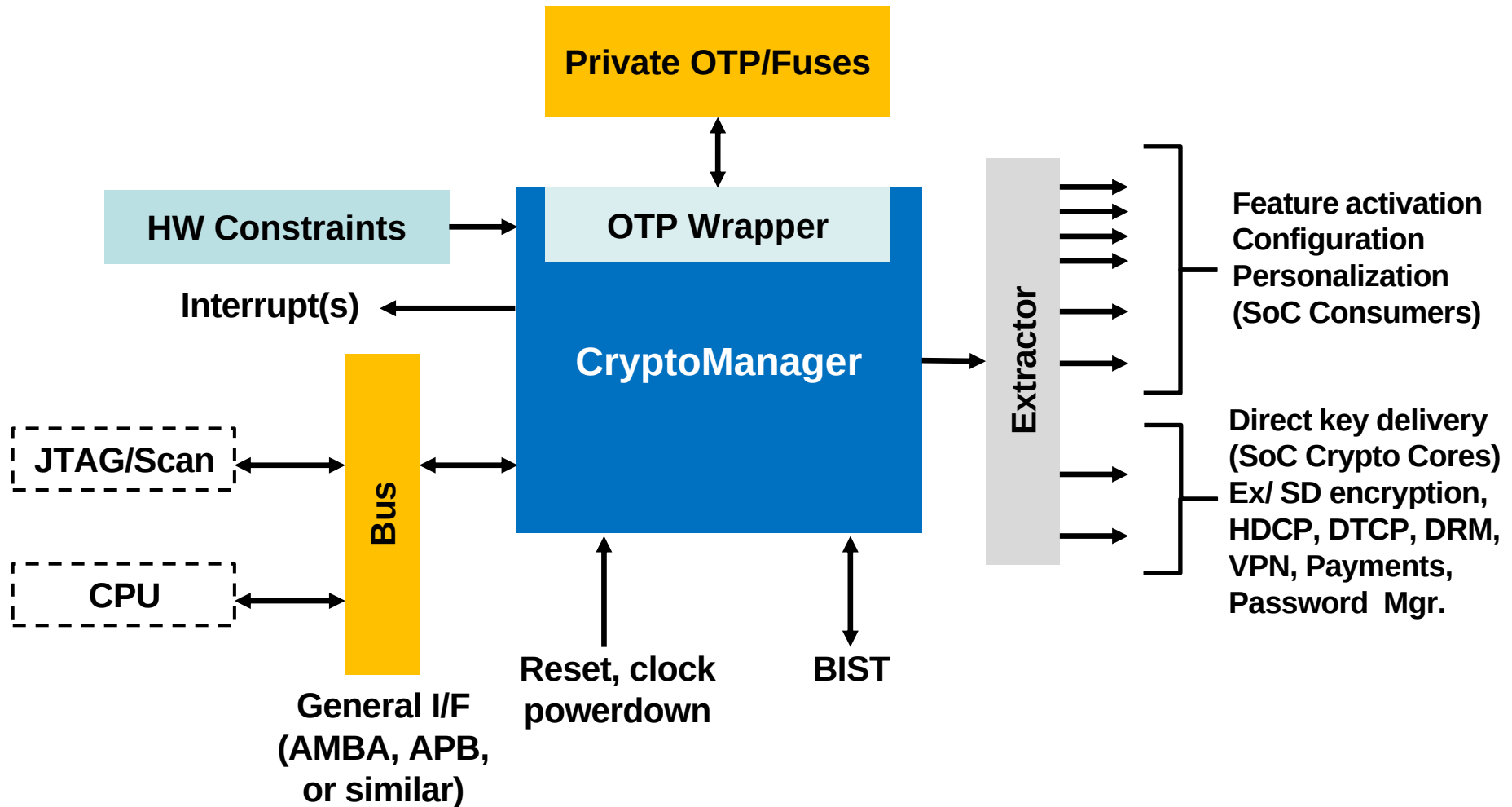


Security IP/Code by
Authorized Use



Can NOT Work w/o
Security IP/Code

OTP在加密儲存應用

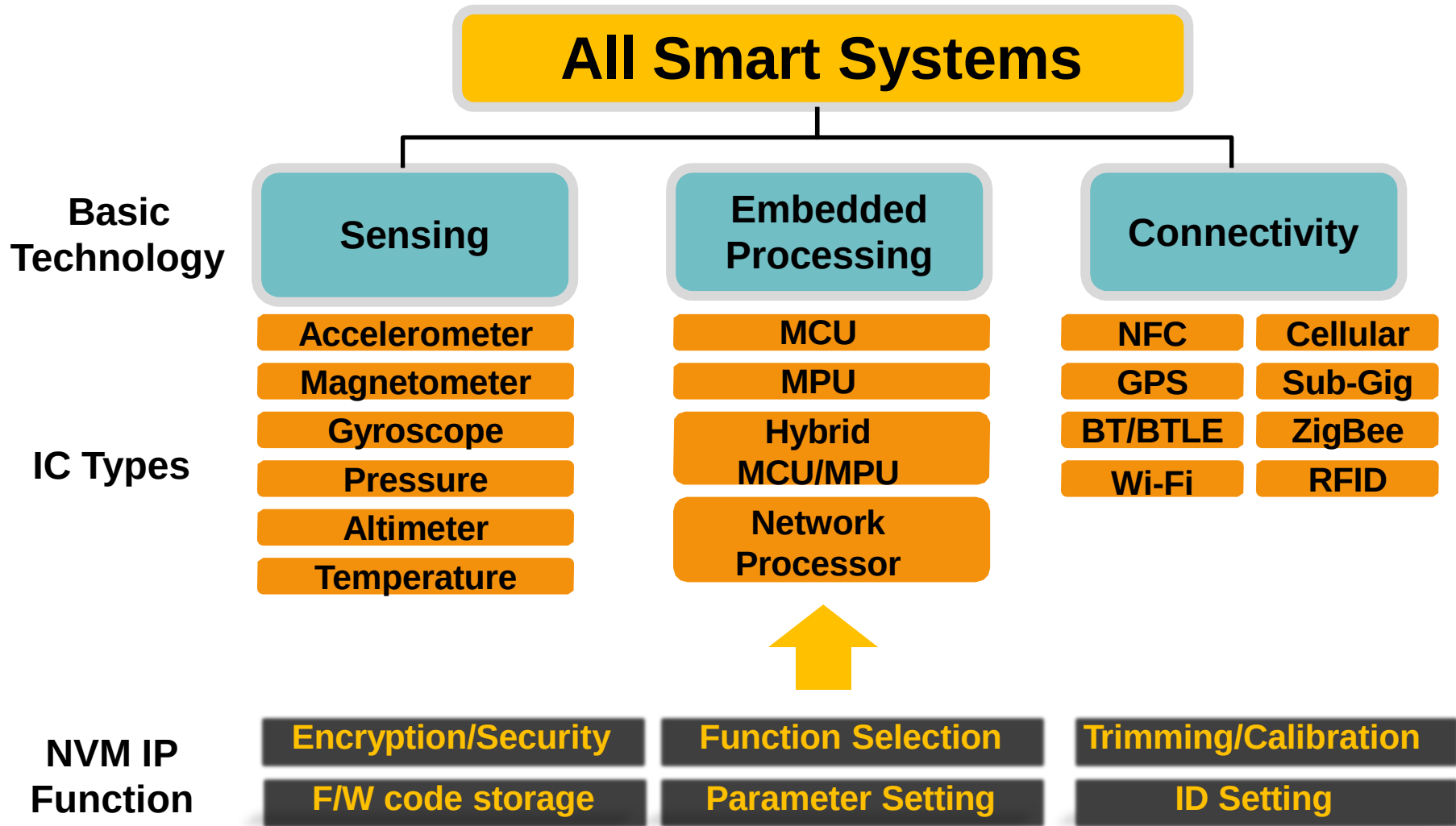


Source : Rambus crypto manager platform

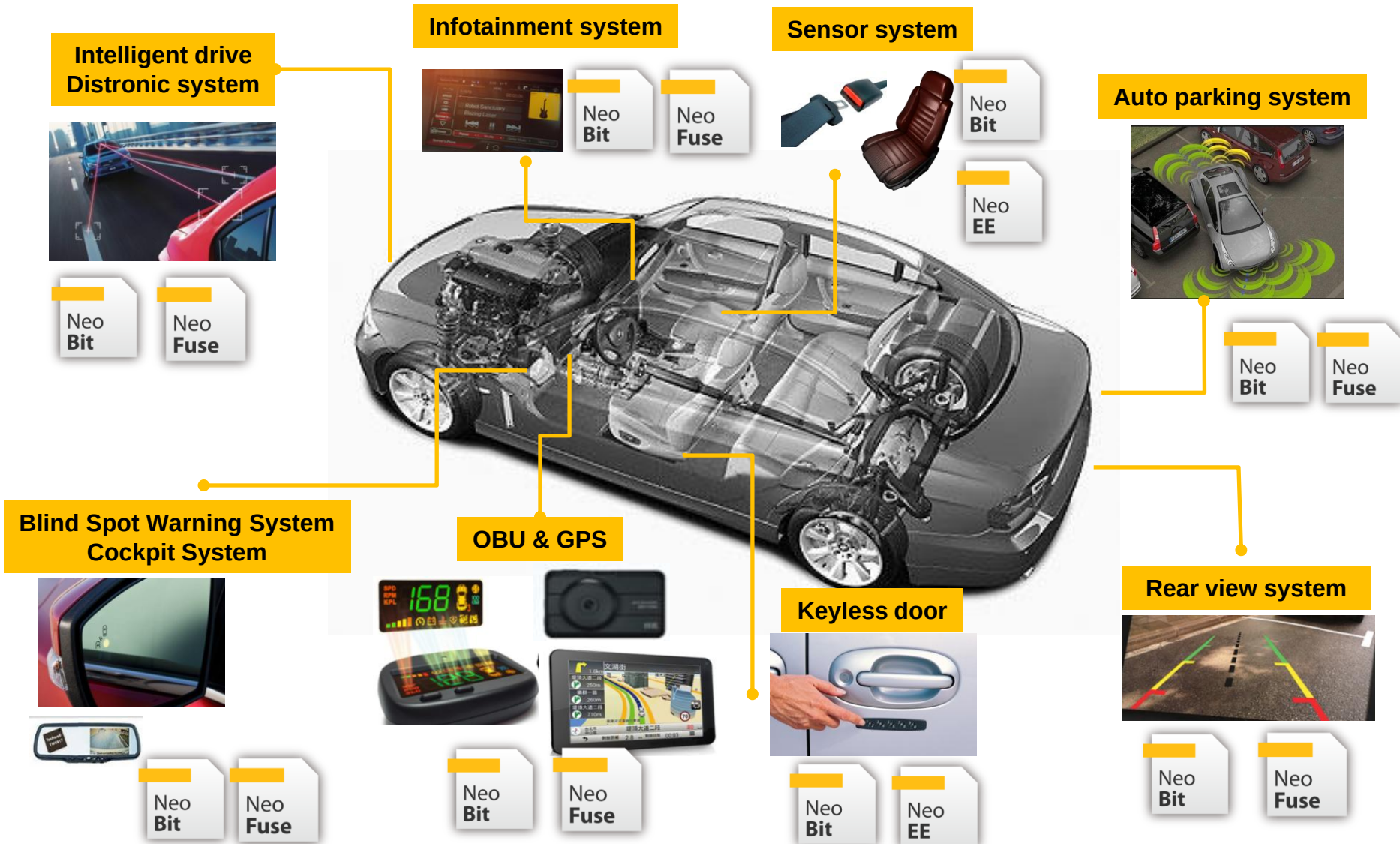
力旺矽智財引領高安全性應用



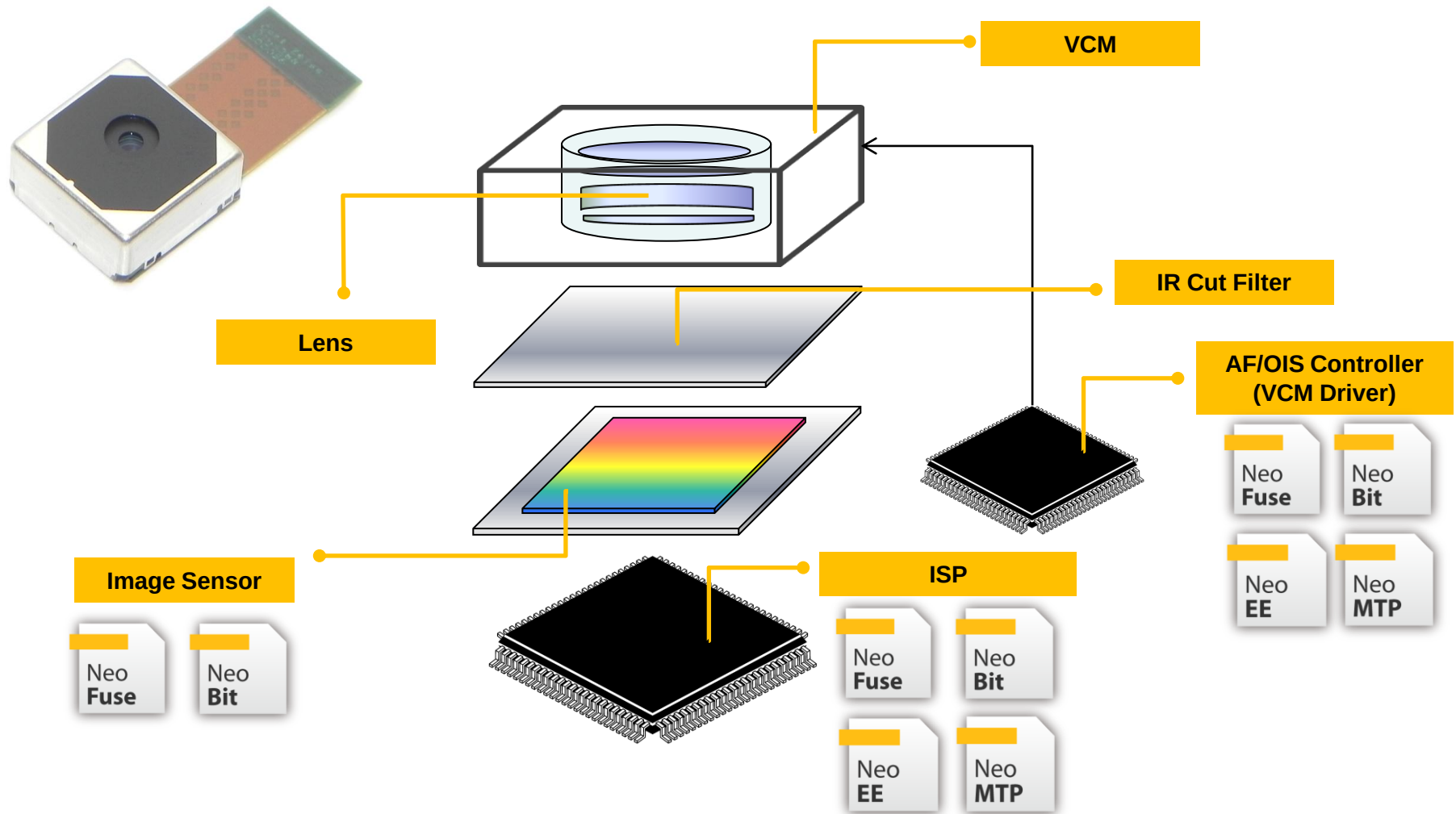
在IoT中之NVM IP 需求



Autotronics with eMemory IPs



Imager Module with eMemory IPs



先進液晶顯示驅動晶片

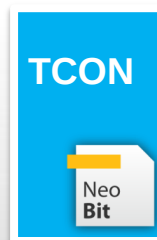
Process Technology : 0.11um HV/80nm HV/55nm HV



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



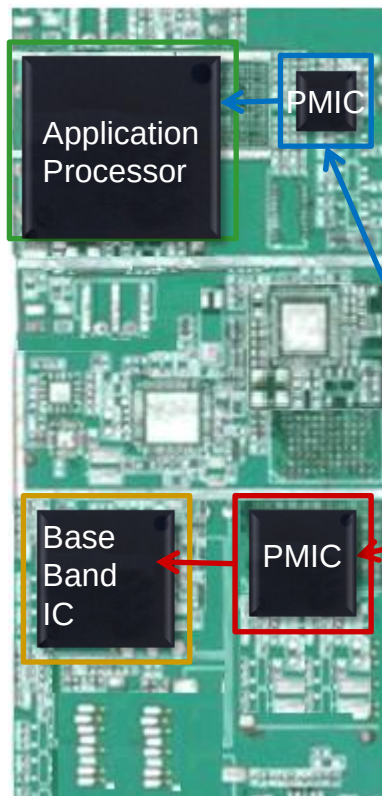
DDI



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

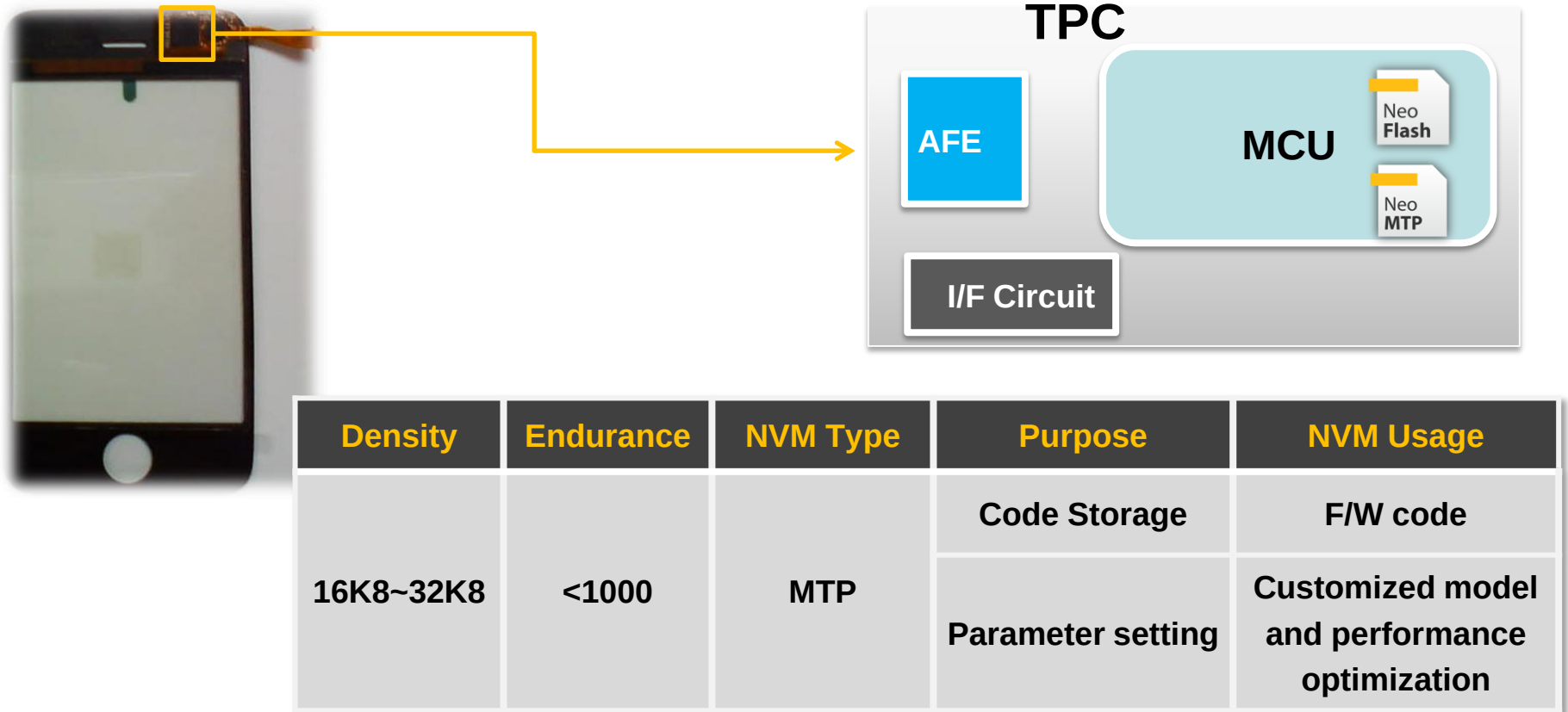


Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	DC/DC, Bandgap
		Parameter Setting	Design flexibility & Performance optimization
		Code Storage	Start-up behavior & smart power saving algorithm



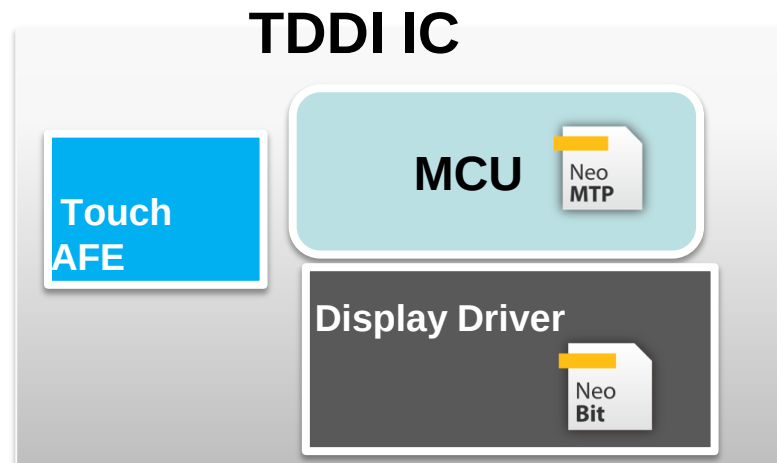
觸控面板控制器晶片

Process Technology : 0.16um HV/0.11um G



內嵌式觸控面板控制器晶片

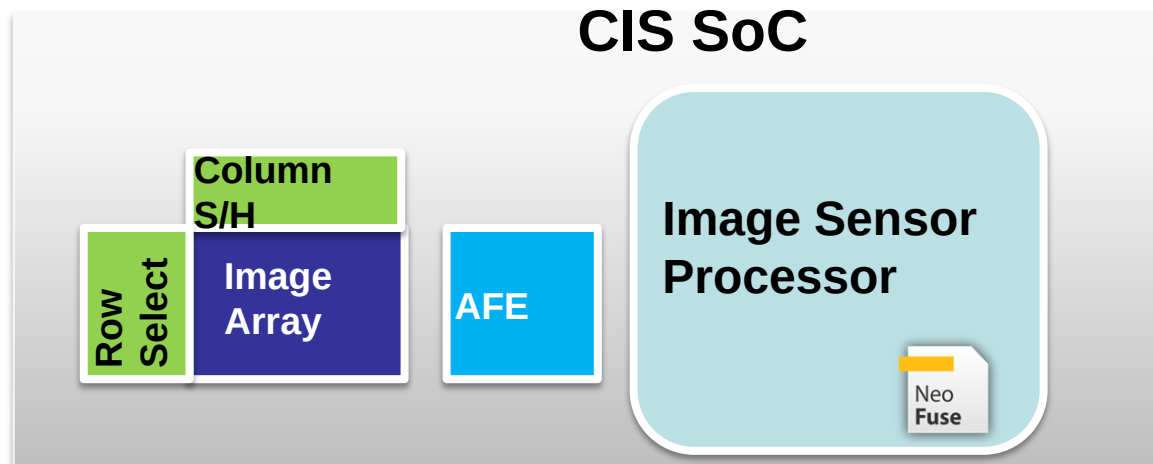
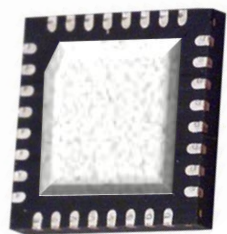
Process Technology : 0.11um HV/80nm HV/55nm HV



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

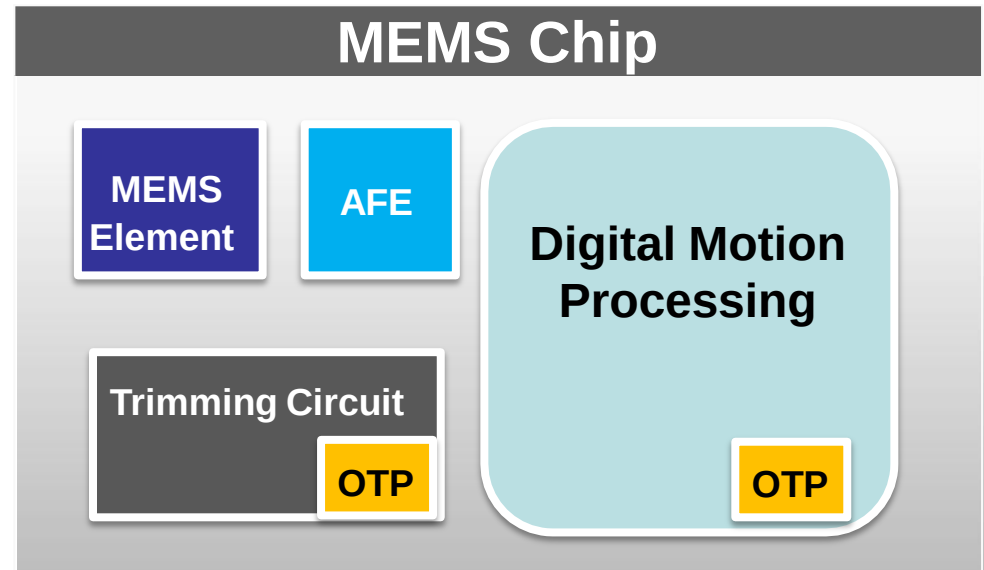
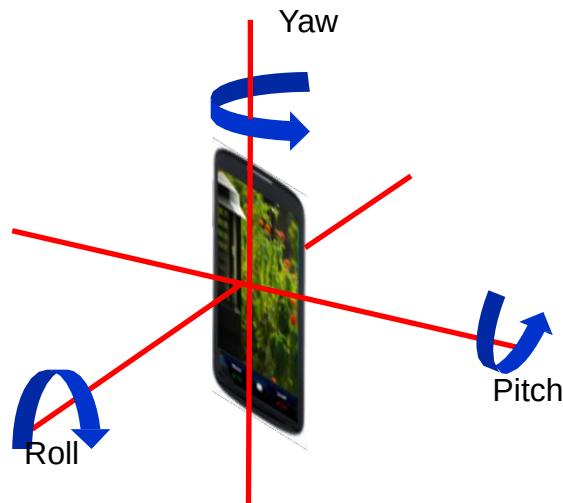
Process Technology : 0.11um CIS/90nm CIS/65nm CIS



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

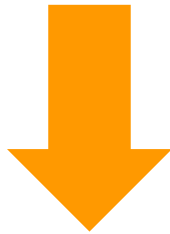


Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	Factory trimming
		Parameter Setting	Signal filtering
		Code Storage	Geometric computation

取代嵌入式快閃記憶體之競爭優勢

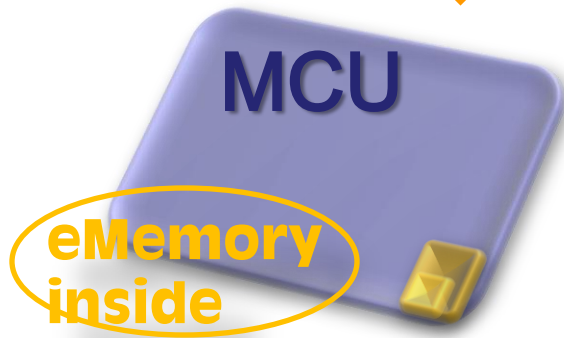


product design & manufacturing by
embedded Flash
Logic Process + 10 Masks



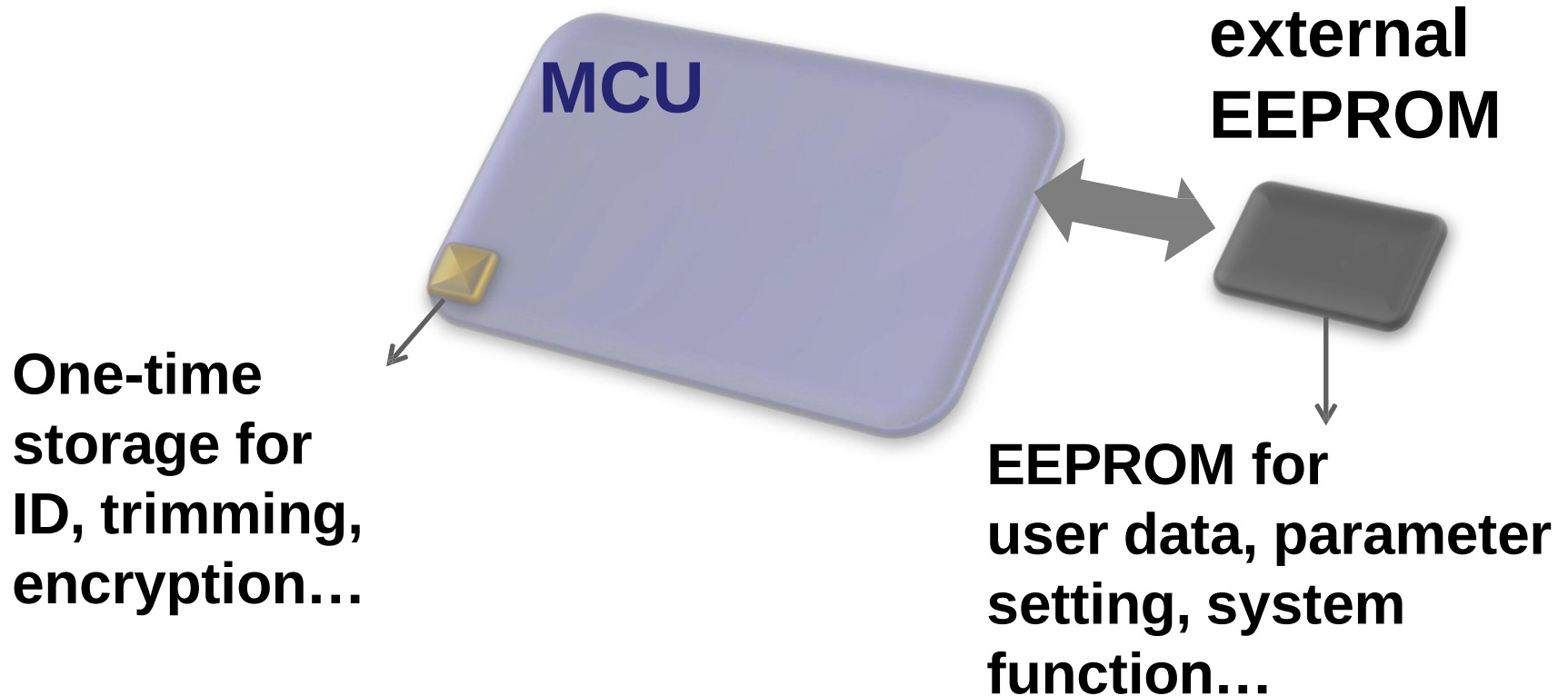
***30% more
cost reduction***

***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	5740
PMU	5255
Base Band controller	2945
Smart card controller	2683
Fingerprint	2500
CIS sensor	2215
LCD driver (int with TCON)	1955
Gauge IC	708
TV controller	619
Touch panel controller (C)	602
Connectivity	463
STB controller	348
DC-DC/AC-DC	239
Wifi controller	231
Accelator sensor controller	166
LED driver	140
Light snesor	126
Gyroscope sensor controller	120
BT controller	107
TAG IC	104
MCU (8bits, LV/3.3V)	90
MCU (8bits, pure 5V)	88
ISP	82
DVD controller	67
P-Gamma	47
NB CAM controller	38
Pressure sensor controller	23
Touch pad controller	16
PC CAM controller	14
Touch panel controller (R)	3
TCON (w/o driver)	3
Speech controller	0

2015 Q3 updated

未來展望

- **iOS**相關應用客戶在庫存調整後，第三季晶圓投片量已回升，將貢獻第四季權利金成長。
- 更多客戶持續導入**PMIC**相關應用，後續成長動能依然強勁。
- **55nm TDDI**晶片量產持續擴大。
- **Fingerprint**客戶第二季已開始量產，貢獻7月份權利金4%。更多客戶導入**fingerprint** 之應用並轉量產，對權利金之貢獻將持續成長。
- **28nm DTV**晶片客戶，已取得終端客戶認證，下半年開始放量生產，貢獻第四季權利金成長。另有2個**STB**晶片客戶已於2016上半年tape-out。

未來展望

- 7個OLED之技術平台正在各大晶圓廠開發驗證，第二季已有2個客戶tape-outs, 預計下半年會有更多tape-outs。
- 2個16nm FFC設計授權導入，預計下半年tape-out。
- 與加密應用相關的新技術NeoPUF，將於9月份tape-out IP。
- 持續開發更多技術平台在車用電子相關應用於各大晶圓廠，已有歐洲及日本客戶tape-outs.

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.

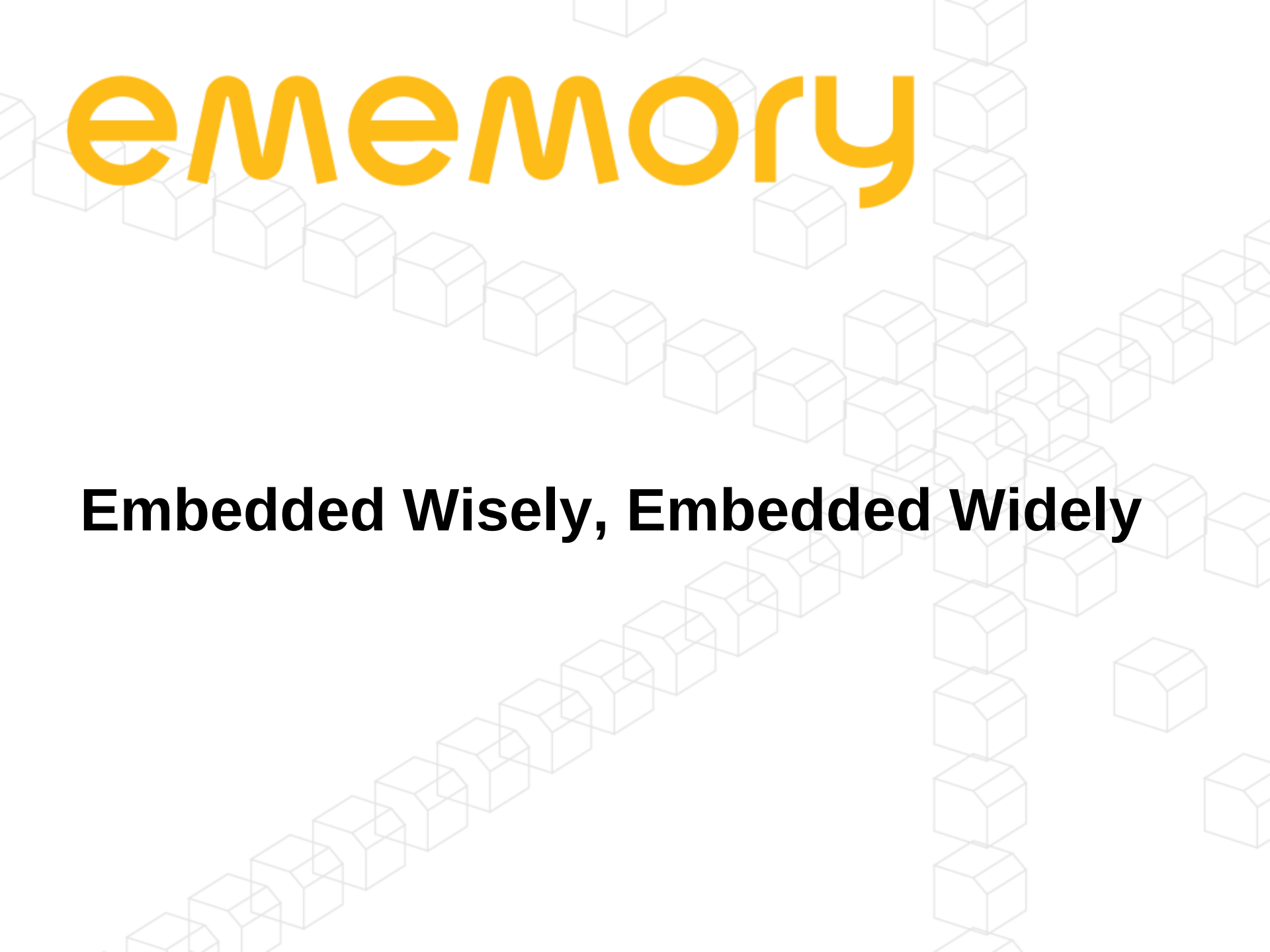
Growth in advanced technology

- 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