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。

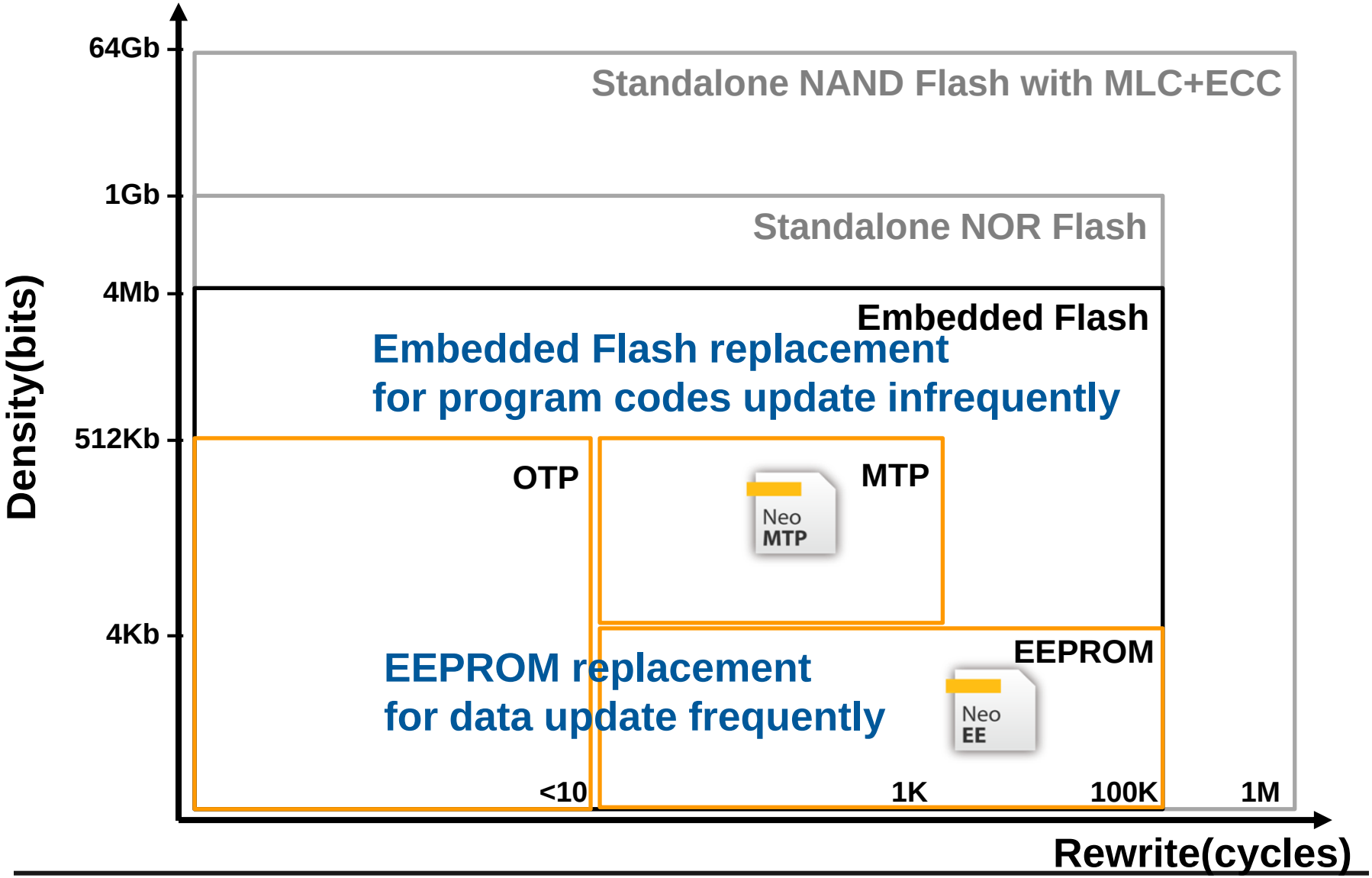
投資安全聲明

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。

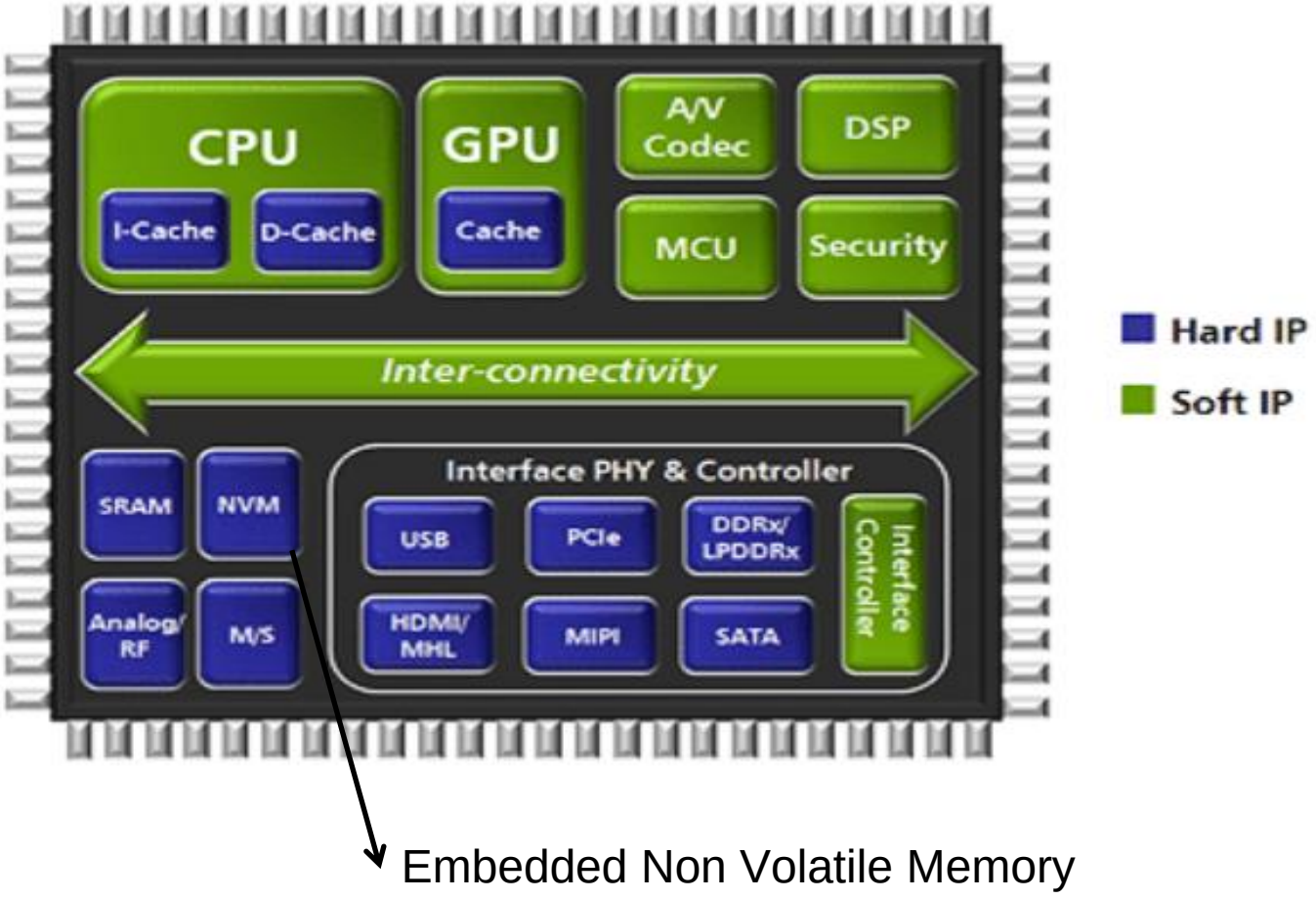
大綱

- 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

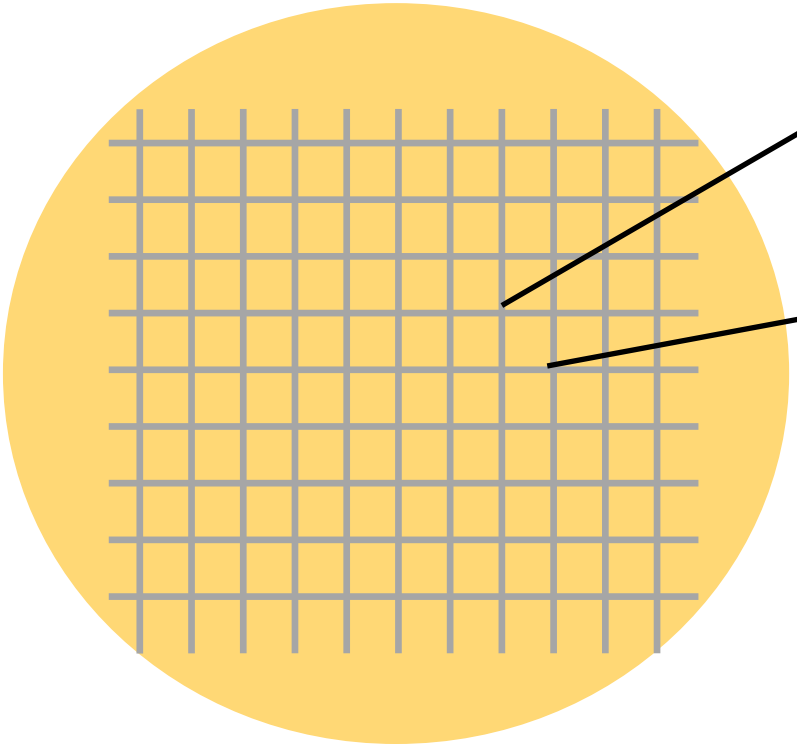


Source : tsmc

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

採用IP之考量



Customer Product

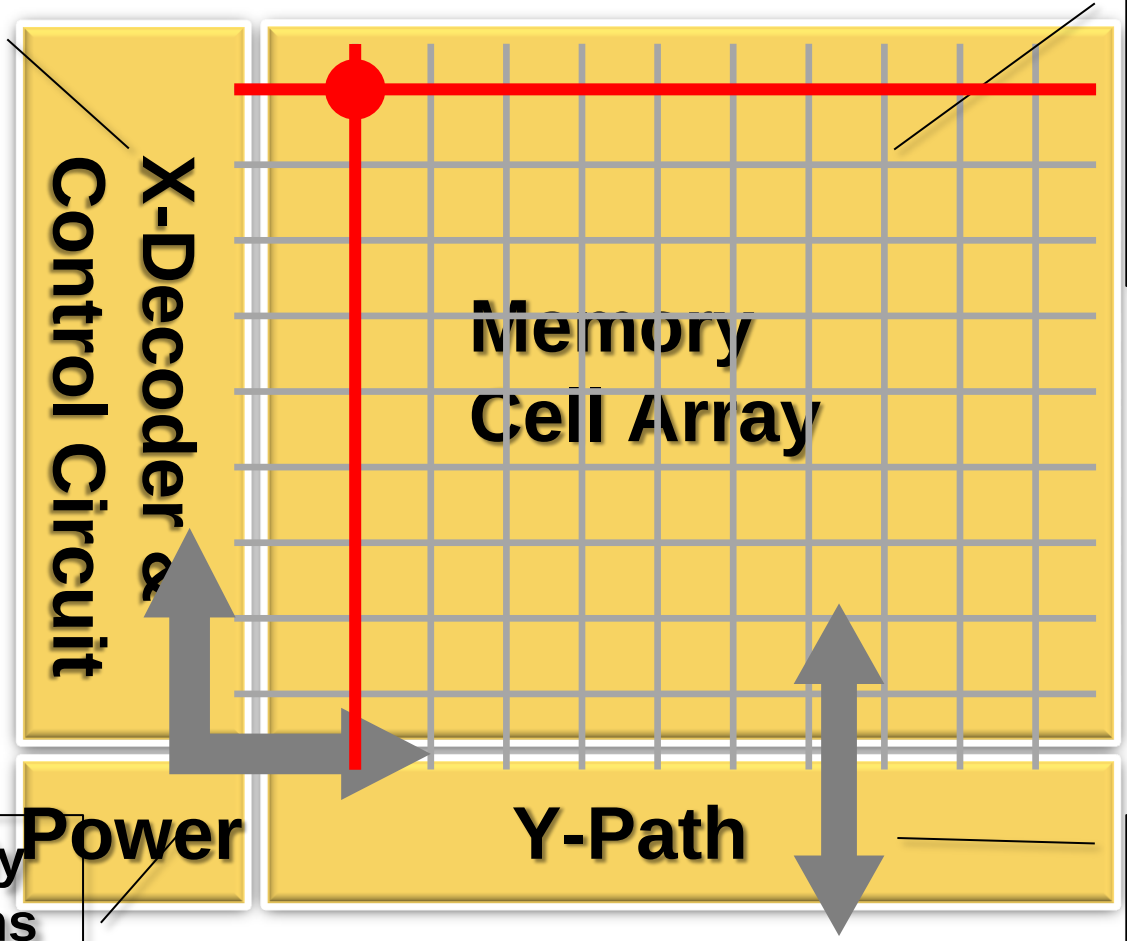
Generally, IP size is less than 10% of product size

IP

Customers Request

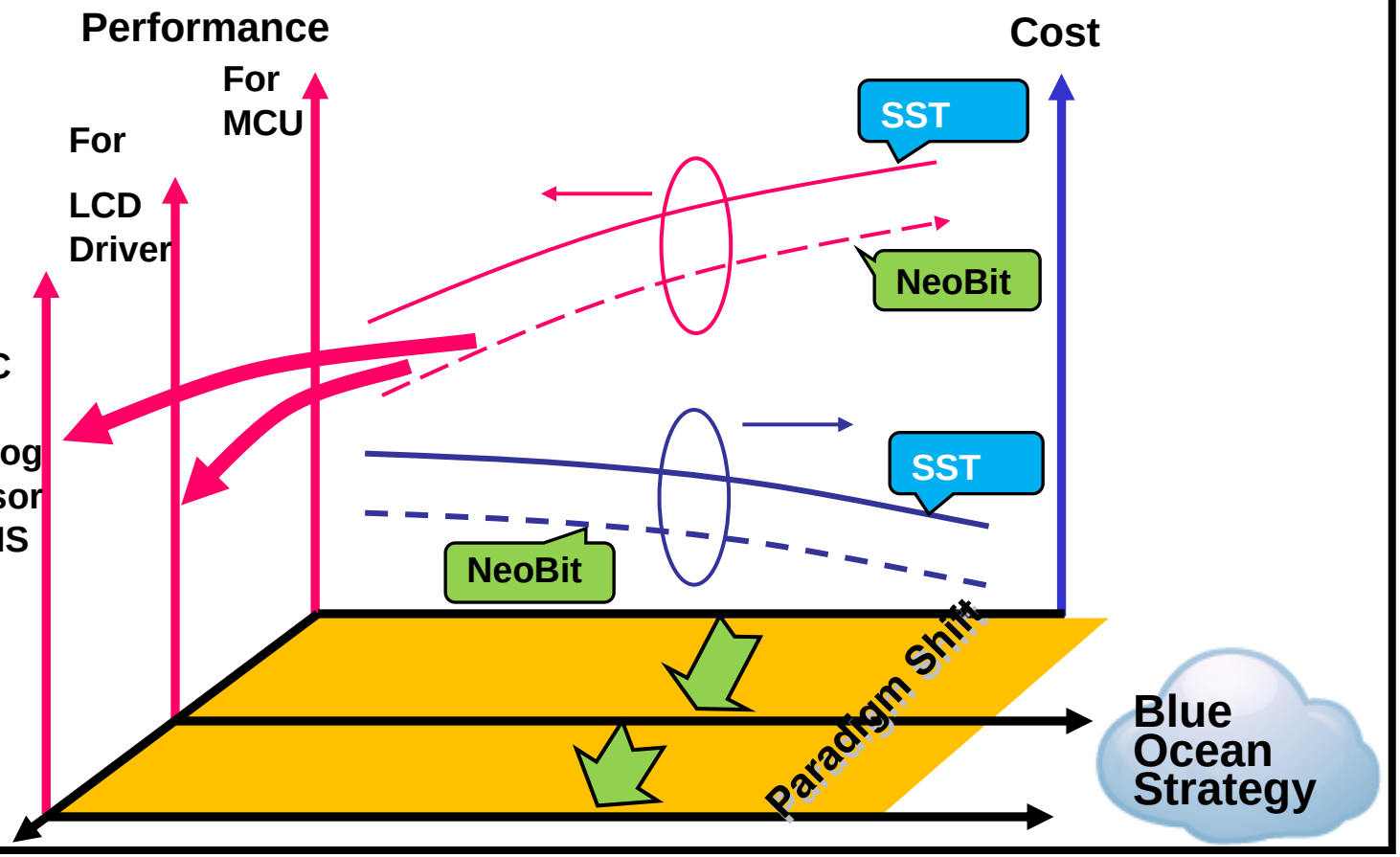
1. **100% IP Reliability**
2. **No Mask Adder**
3. **Low Testing Cost**
4. **On call Service**
5. **Acceptable IP Size**

Nonvolatile Memory IP 內部

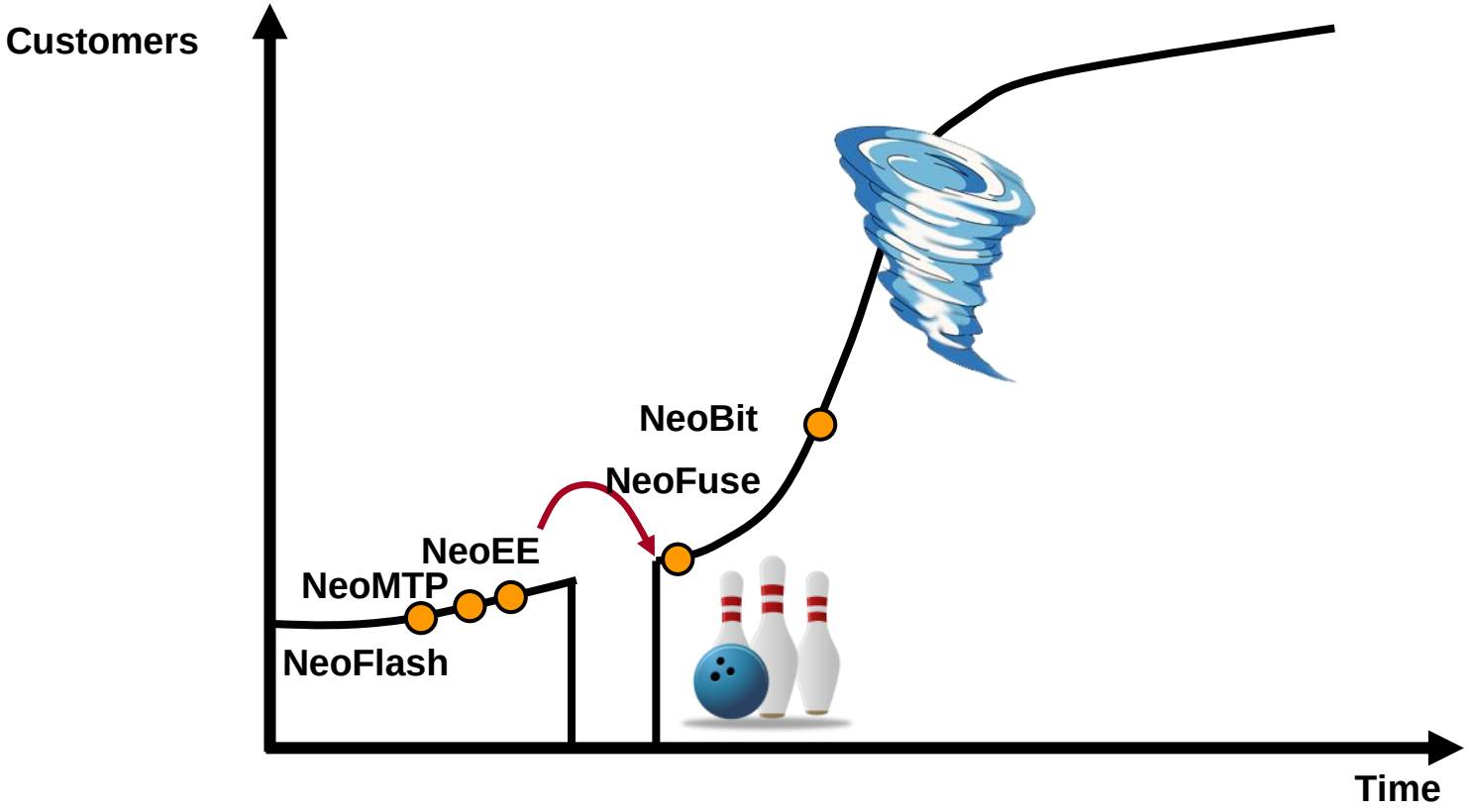


破壞性創新

- *Innovation, Innovation, and Innovation !*

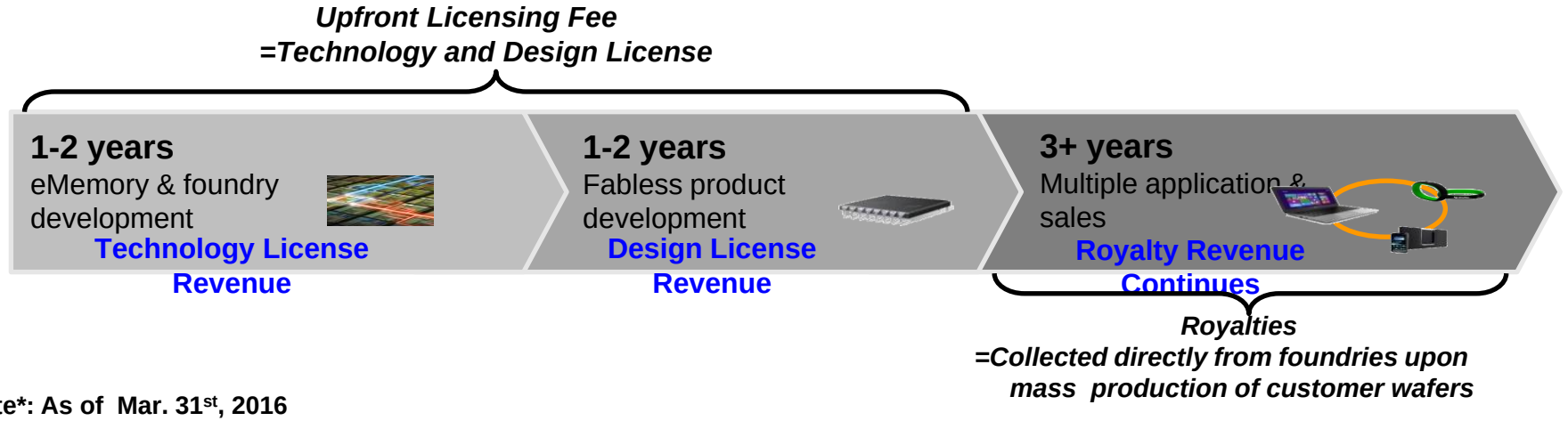


跨越鴻溝



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, 224 employees (157 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 Mar. 31st, 2016

全球客戶

Foundry

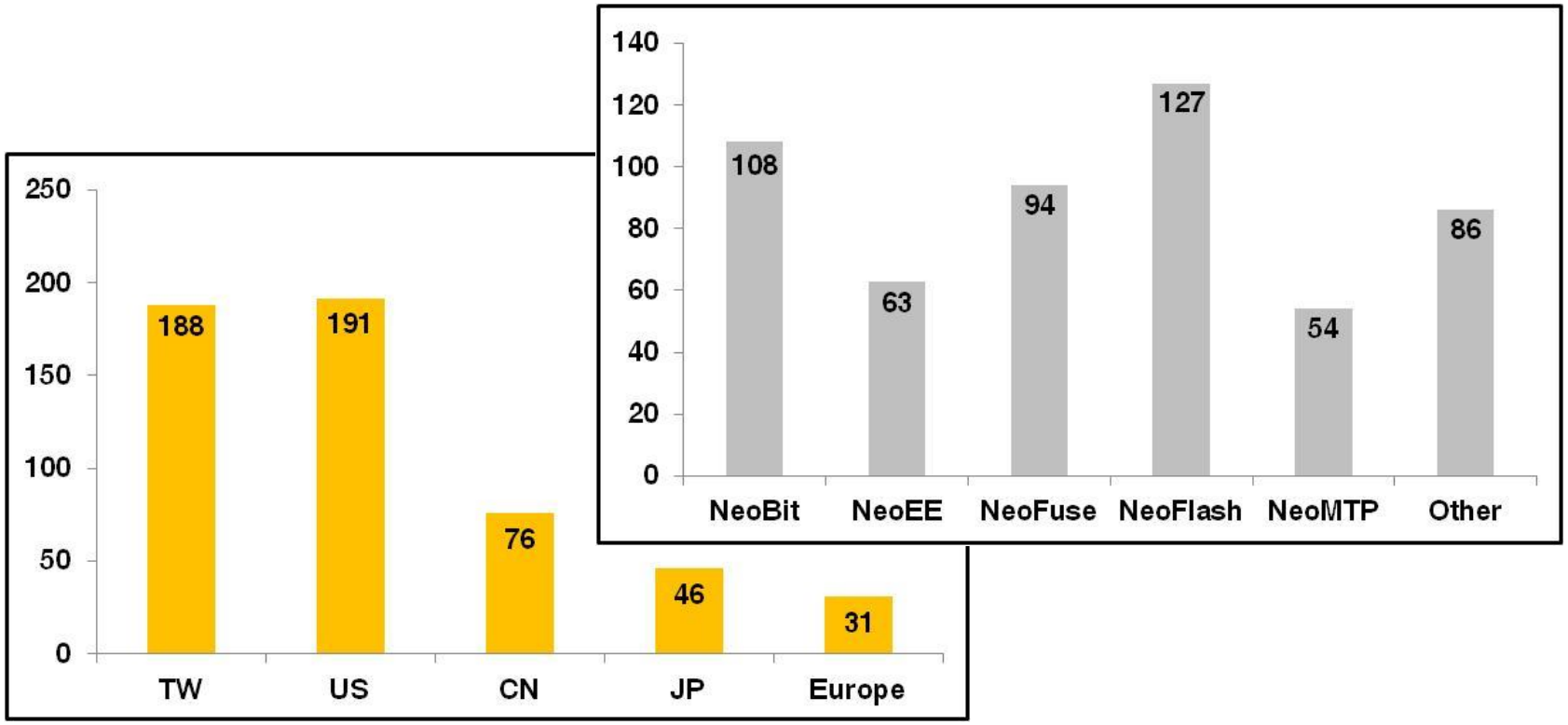
IDM

	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

Note*: As of Mar. 31st, 2016

專利佈局

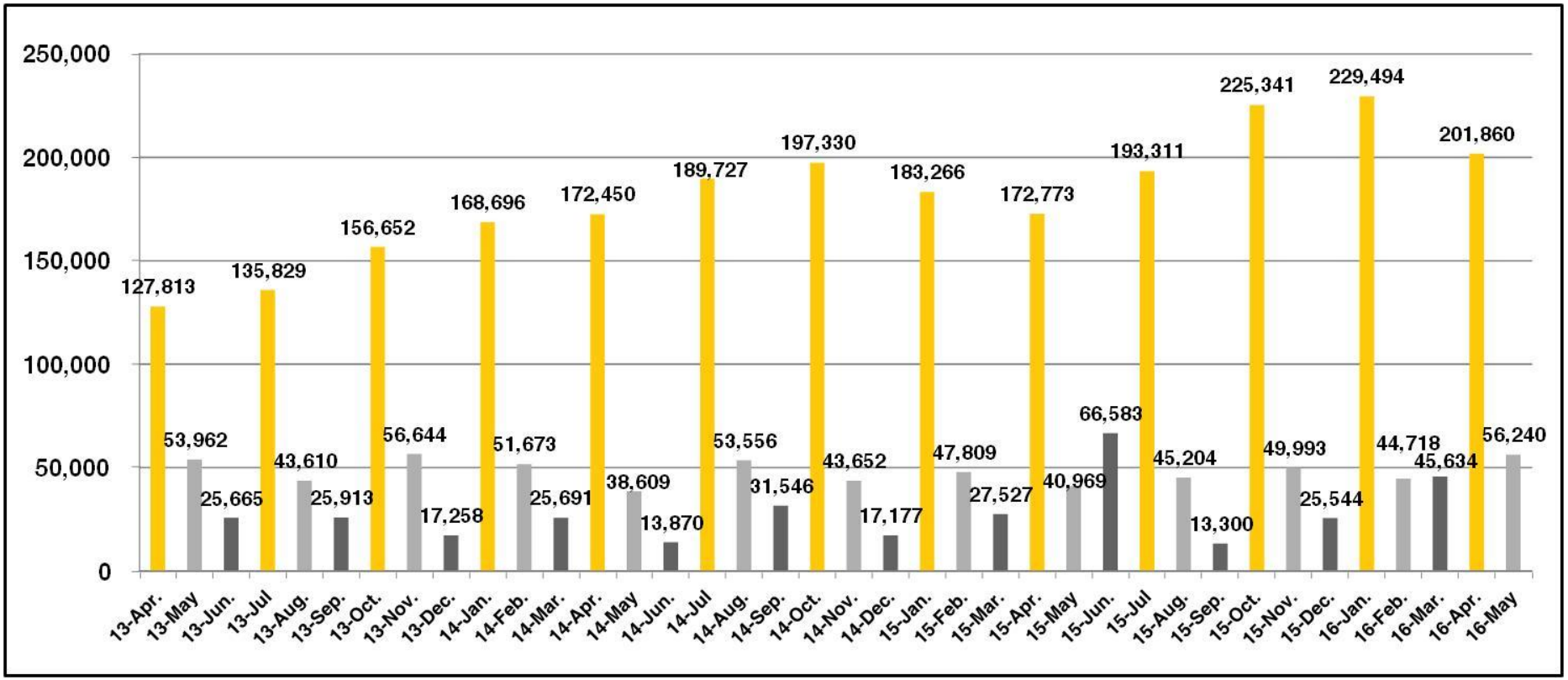
	Q4 15	Q1 16	Diff.
Pending	187	187	-
Issued	325	345	+20
Total	**512**	**532**	**+20**



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。

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

第一季各項營收

單位：新台幣仟元

	Q1 2016	Q4 2015	QoQ	Q1 2015	YoY
授權費	85,976	69,307	24.05%	64,056	34.22%
權利金	233,870	231,571	0.99%	194,546	20.21%
合計	319,846	300,878	6.30%	258,602	23.68%

單位：合約數

		Q1 2016	Q4 2015	2015	2014
技術授權數		13	11	28	21
設計授權數	NRE	13	9	57	82
	使用費	69	104	349	363

綜合損益表

(單位:新台幣仟元)	Q1 2016	Q4 2015	% change	Q1 2015	% change
營業收入淨額	319,846	300,878	6.3%	258,602	23.7%
營業毛利率	100%	100%	-	100%	-
營業費用	177,088	156,216	13.4%	128,976	37.3%
營業淨利率	44.6%	48.1%	-3.5ppts	50.1%	-5.5ppts
本期淨利	166,012	128,090	29.6%	114,423	45.1%
純益率	51.9%	42.6%	+9.3ppts	44.2%	+7.7ppts
每股盈餘 (單位: 新台幣元)	2.19	1.69	29.6%	1.51	45.0%
權益報酬率	34.9%	28.4%	+6.5ppts	24.8%	+10.1ppts

Note 1: The employee stock option was recognized under compensation cost in Q1 2016; therefore, the operating expenses increased by NT$2.281 million while the operating margin was down 0.71ppts.

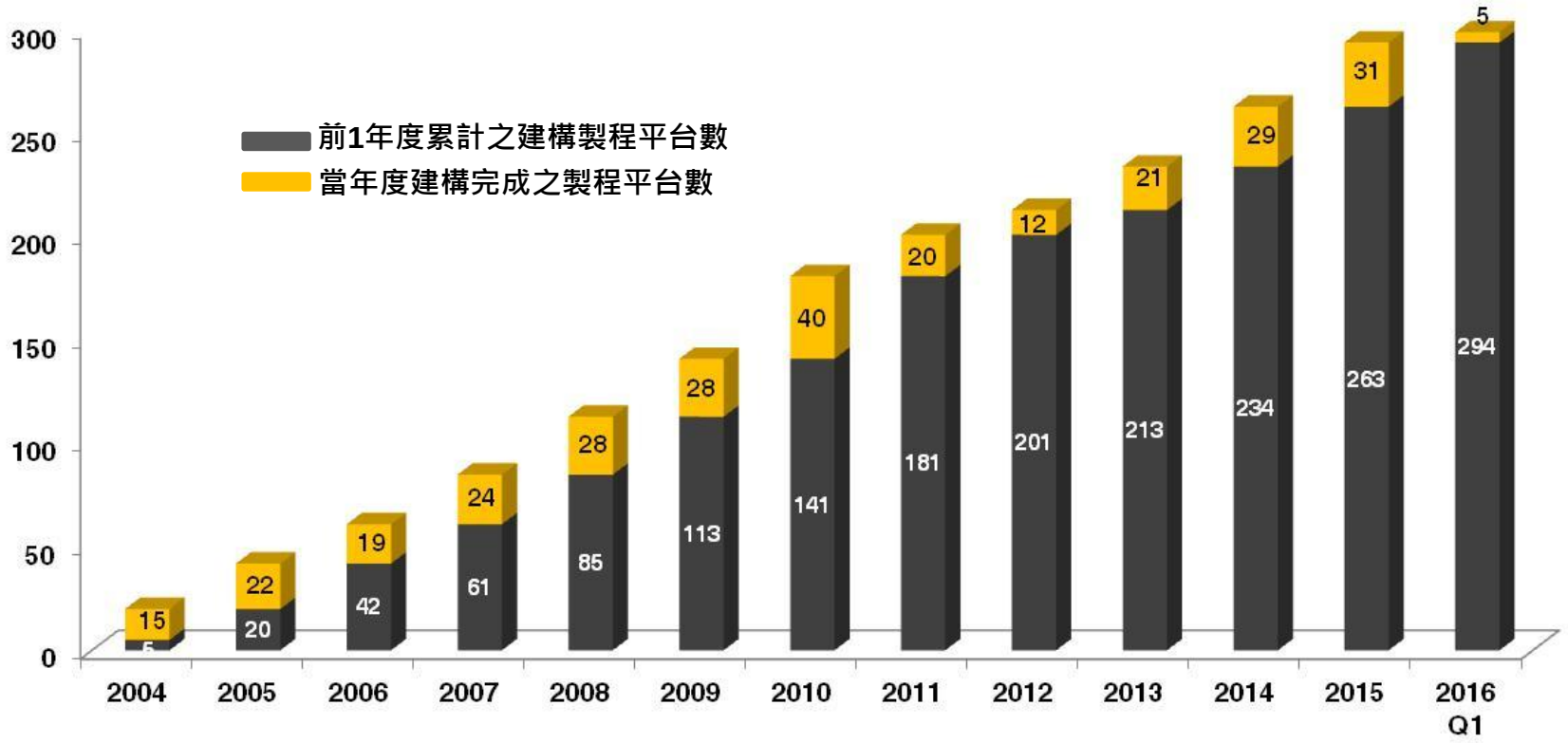
Note 2: Due to the disposal of financial assets in Q1 2016, the related cost from profit sharing to employees by non-operating income increased by NT$7.389 million which affected the operating margin by 2.31ppts.

技術授權合約

單位：合約數

Year	2013	2014	2015	2016 Q1
License number	19	21	28	13

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 Mar.) : 100
- 18 for NeoBit, 40 for NeoFuse, 23 for NeoEE, and 19 for NeoMTP.

	10nm	14/16nm	28nm	40nm	55/65nm	80/90nm	0.11~ 0.13um	0.15~ 0.18um	>0.25 um	Total
NeoBit	-	-	-	-	-	-	6	12	-	18
NeoFuse	1	3	9	5	8	4	7	3	-	40
NeoFlash	-	-	-	-	-	-	-	-	-	0
NeoEE	-	-	-	1	-	1	5	16	-	23
NeoMTP	-	-	-	-	2	2	5	10	-	19

目前正在建構的技術製程平台

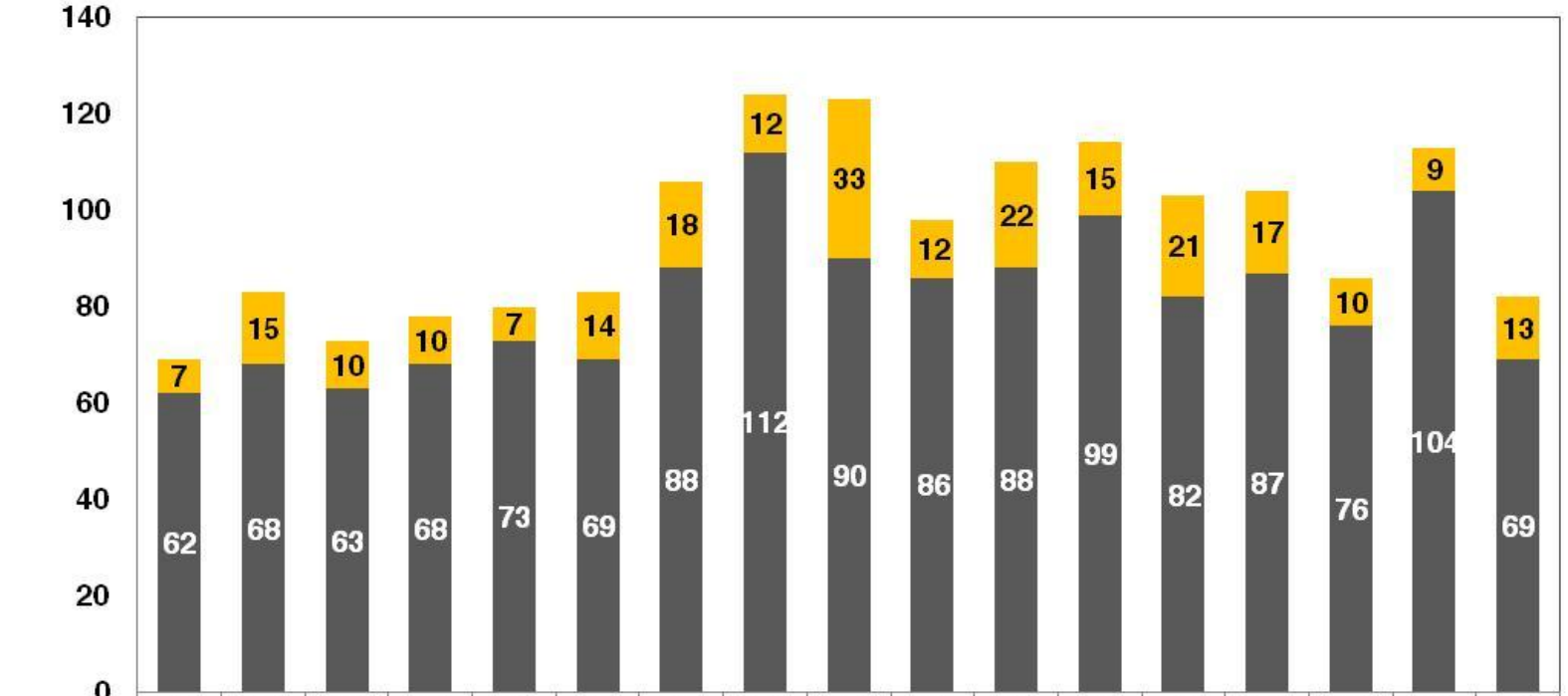
12" Fabs	Production	Development	NVM Type	Process Type
10nm	0	1	OTP	FF
14/16nm	0	3	OTP	FF+
28nm	5	9	OTP	LP/HPM, HLP/HPM, LPS
40nm	2	6	OTP, MTP	HV-DDI, LP
55/65nm	11	10	OTP, MTP, Flash	LP, HV-DDI, HV-OLED, DRAM, CIS
80/90nm	5	7	OTP, MTP	HV-DDI, HV-OLED, LP
0.13/0.11um	6	4	OTP, Flash	HV-DDI, BCD, Generic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

8" Fabs	Development	NVM Type	Process Type
0.13/0.11um	19	OTP, MTP, Flash	HV-DDI, BCD, LP, RF, CIS, LL
0.18/0.16/0.152um	41	OTP, MTP	Generic, LP, LL, MR, HV, Green, BCD
0.25um	0	OTP, MTP	BCD
0.35um	0	OTP	UHV

*As of Mar. 31st, 2016

每季設計授權數(New Tape Out)

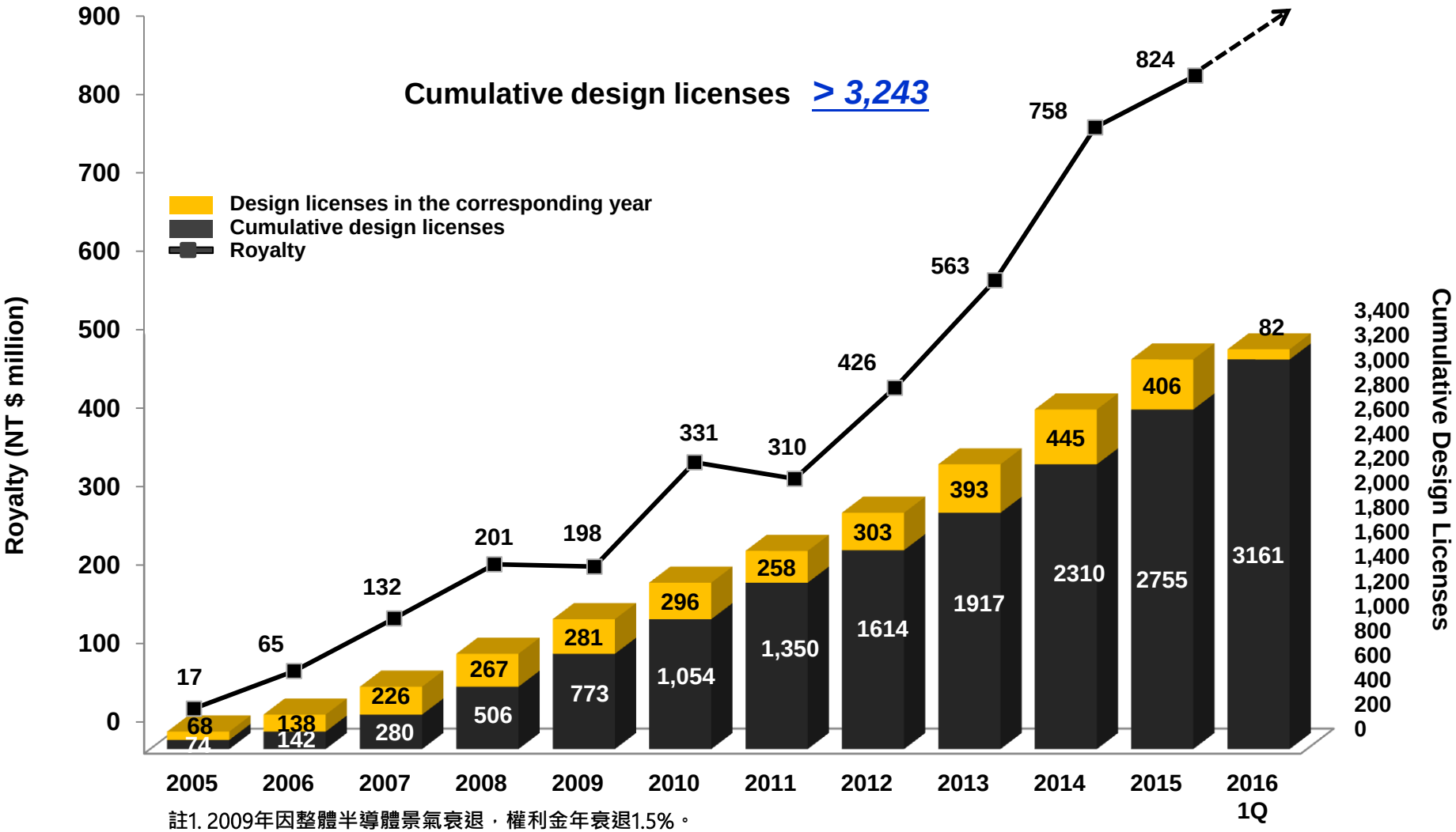
- *Total 82 NTO as of in Q1 2016(406@2015,445@2014, 393@2013, 303@2012)*



	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
	2012				2013				2014				2015				2016
NRE	7	15	10	10	7	14	18	12	33	12	22	15	21	17	10	9	13
Usage	62	68	63	68	73	69	88	112	90	86	88	99	82	87	76	104	69

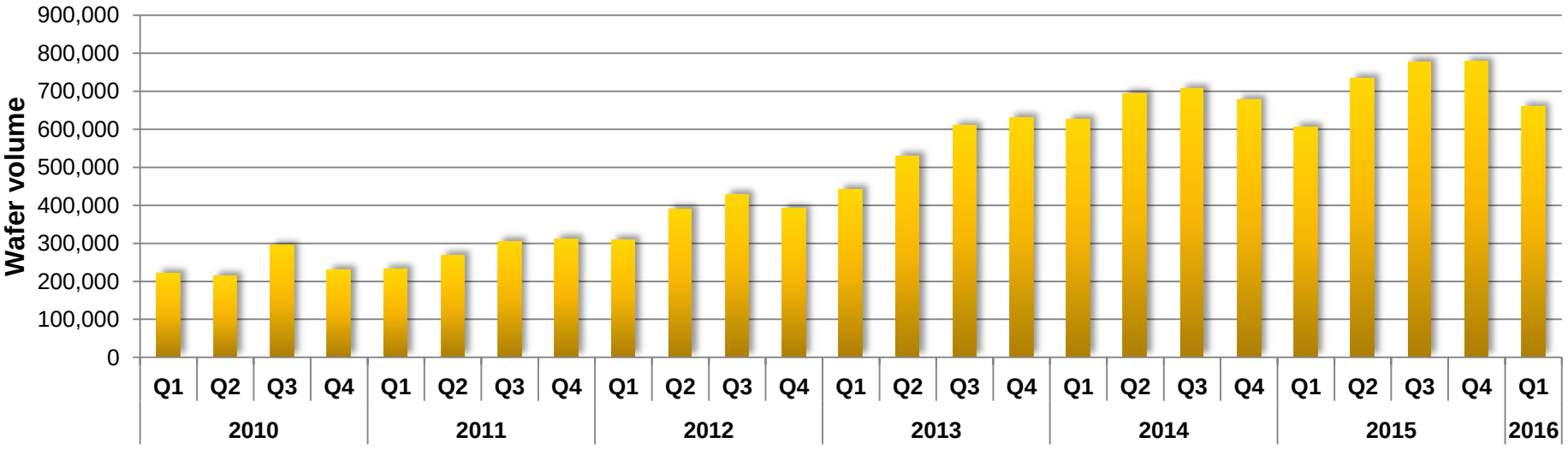
Note*: 客戶在各代工廠的諸多MCU NTO已陸續進入量產，加上與主要Green process代工廠的商業模式商業模式調整為直接license IP cell 給代工廠, 由代工廠提供設計服務給客戶，造成tape out 數減少，但仍對使用IP cell 的晶片支付權利金. 使得2016 Q1 MCU tape out數相較於2015 Q1下降25個. 雖然MCU的NTO數量有明顯減少，但是相關的晶圓產出和權利金收入還是持續增加。

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 Q1 2016

	Process node	*% of T	Q1 16	Q4 15	2015	2014
8”	0.25/0.35	3%	40.91%	47.61%	33.49%	30.5%
	0.15/0.18	11%	13.41%	10.11%	8.73%	11.9%
	0.11/0.13	2%	27.53%	29.24%	29%	20.8%
12”	90nm	6%	20.04%	20.20%	19.85%	16.3%
	65nm	10%	2.91%	0.61%	0.55%	0%
	40/45nm	14%	0%	0%	0%	0%
	28nm	30%	0.46%	0.18%	0.05%	0%
	16/20nm	23%	0%	0%	0%	0%
8”		17%	20.33%	21.64%	16.64%	15.6%
12”		83%	1.97%	1.88%	1.87%	1.4%
Total		100%	5.09%	5.42%	4.76%	4.5%

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

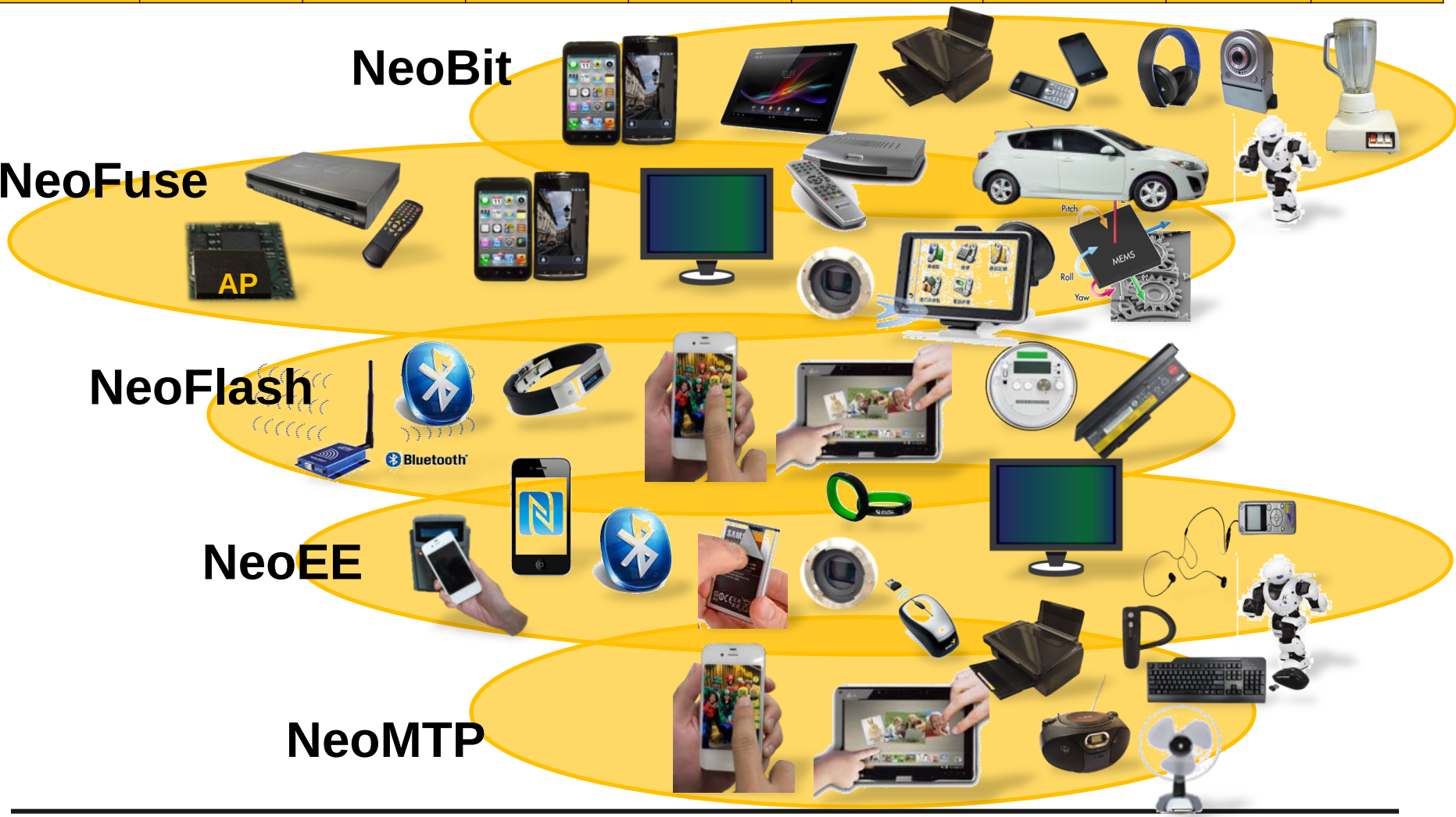
力旺之NVM技術

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

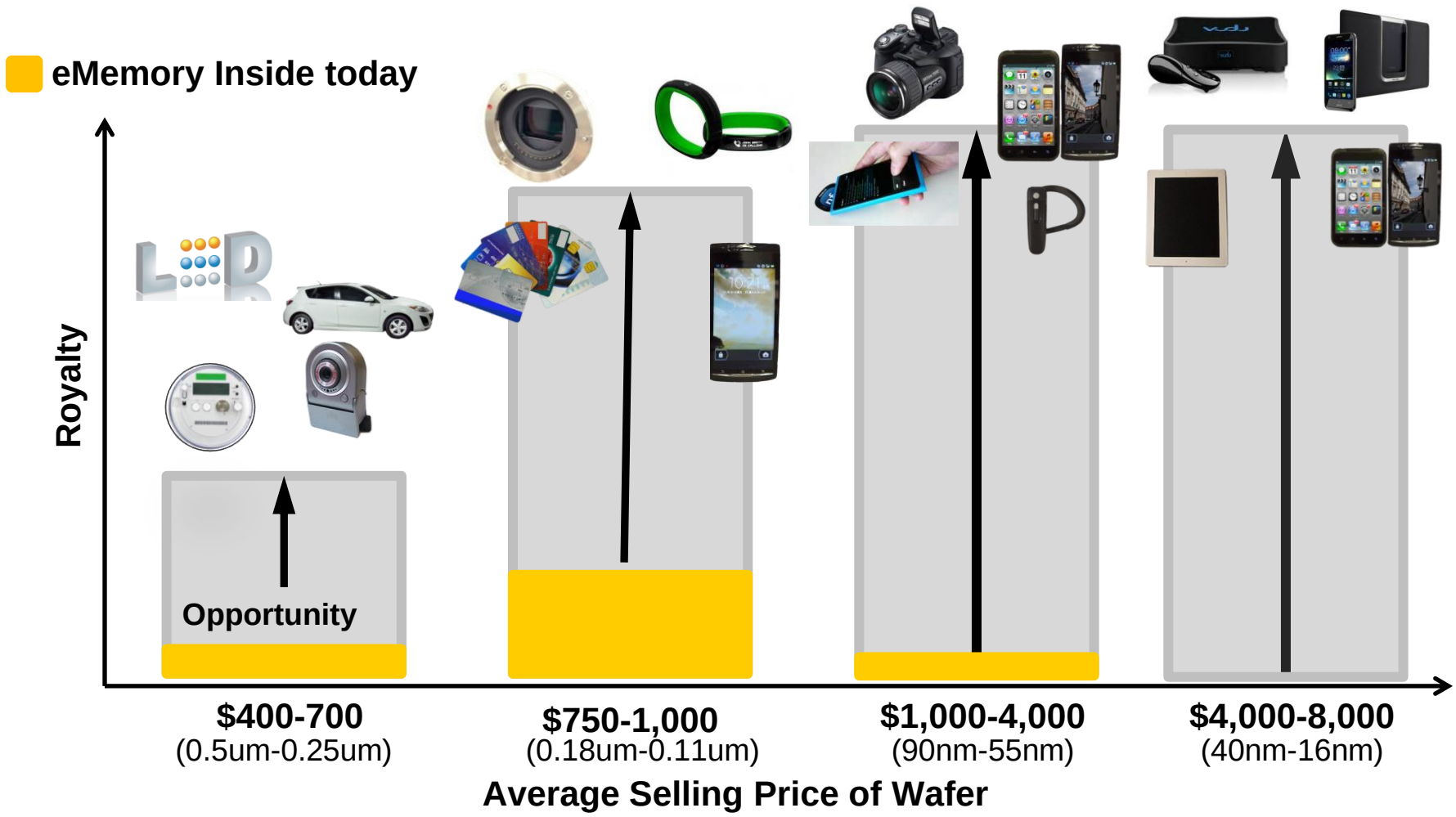
eMemory's NVM Technology	OTP		MTP		
	NeoBit	NeoFuse	NeoFlash	NeoEE	NeoMTP
Product Type	OTP	OTP	Flash	EEPROM	MTP
Endurance (Cycles)	10	10	1K~10K	10K~100K	1K~10K
Additional Mask Steps	0	0	2-3	0	0
Technology	Floating gate	Anti-Fuse	SONOS	Floating gate	Floating gate
Scalability	Simple	Simple	Simple	Simple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

力旺IP的應用

12"						8"		
16/20nm	28nm	40nm	55/65nm	80/90nm	110/130nm	160/180nm	250nm	350nm

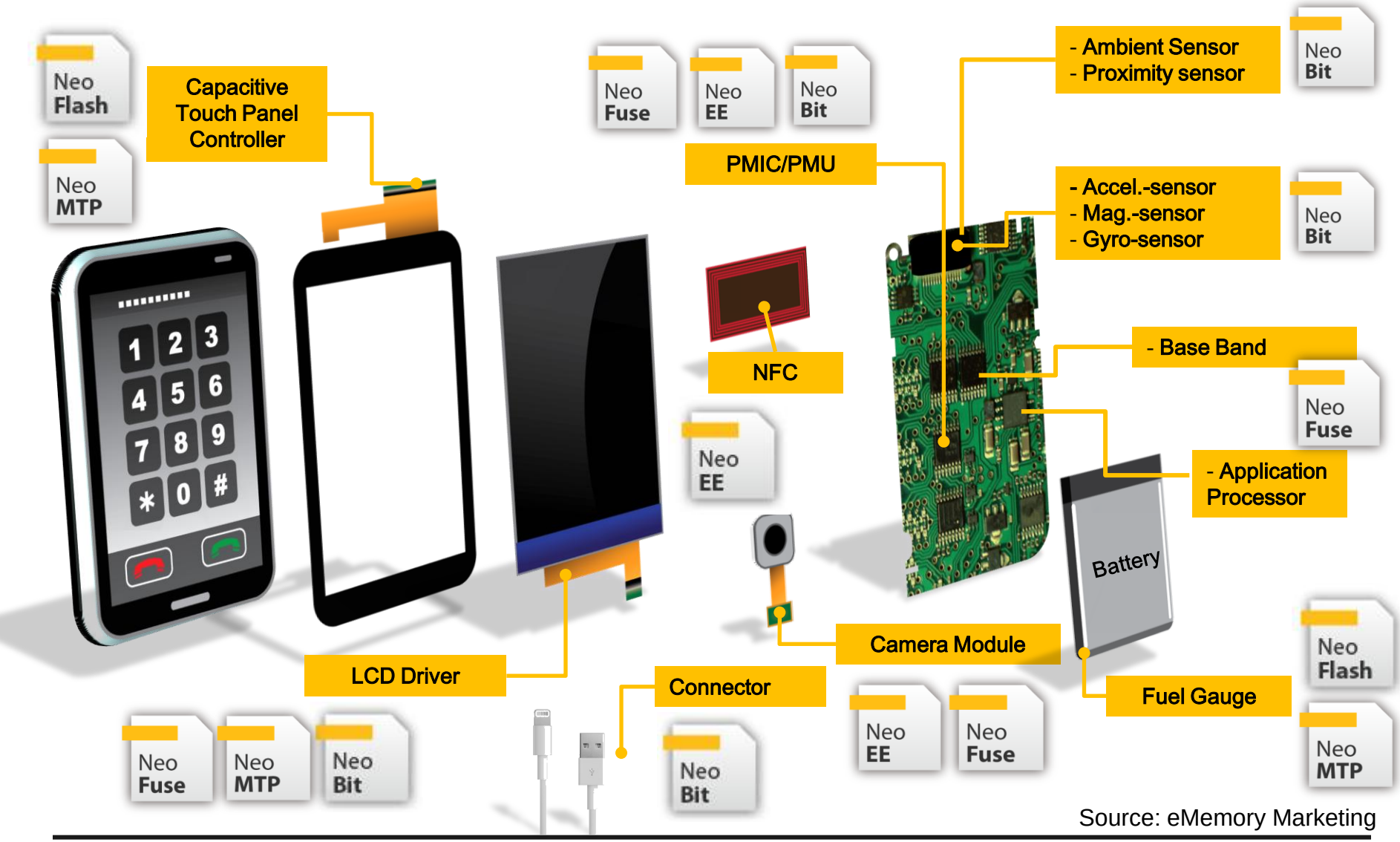


商機與潛力



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



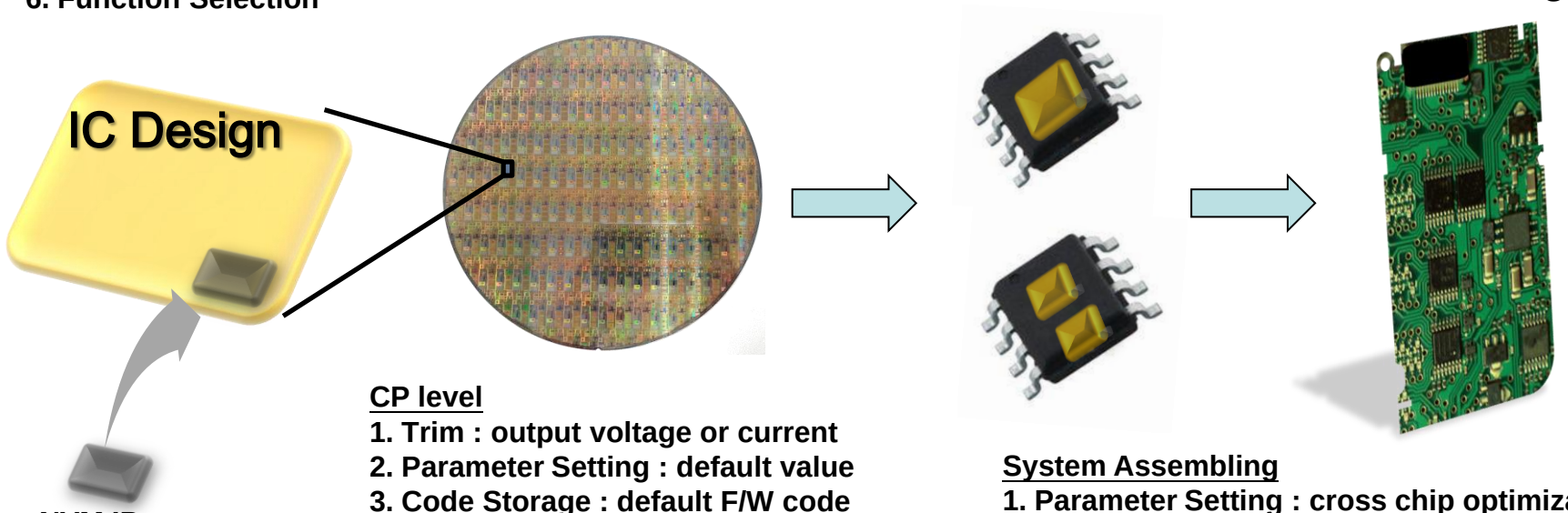
Source: eMemory Marketing

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**



CP level
1. Trim : output voltage or current
2. Parameter Setting : default value
3. Code Storage : default F/W code

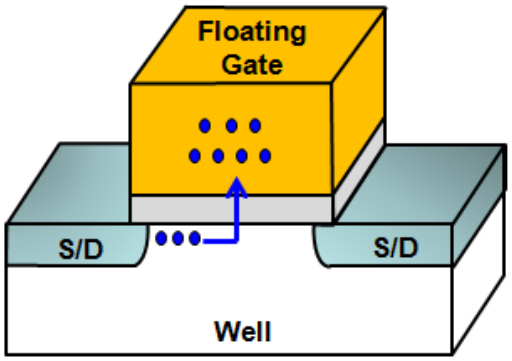
System Assembling
1. Parameter Setting : cross chip optimization
2. Code Storage : F/W code modification
3. Identification Setting : manufacturer resume
4. Encryption : Security algorithm or key storage

高機密性的安全設定

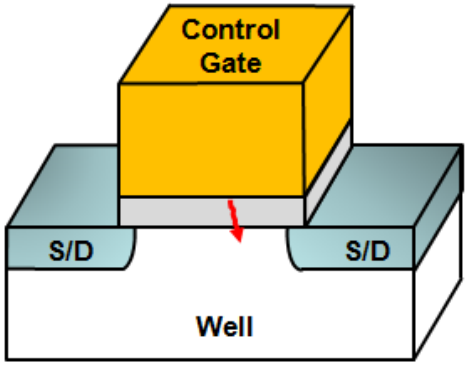
- **Provide “Invisible Hardware Key” for invisible storage**
- **Prevent reverse-engineering to detect content of security key**
- **Protect firmware and hardware of ICs from pirating**
- **Extend & protect customer’s business**

eFuse Key: Data is easily observed

Invisible Hardware Key : Data is hard to be detected



Floating Gate



Anti-Fuse

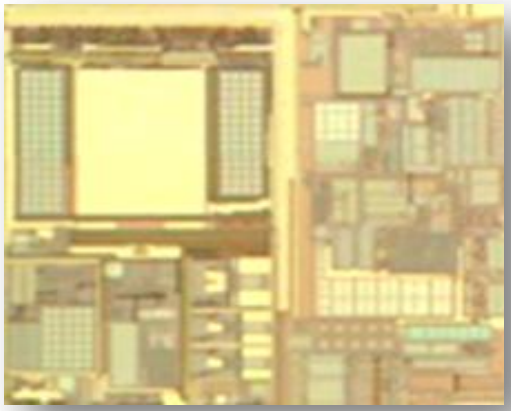
硬體設計防護

Authorized Product

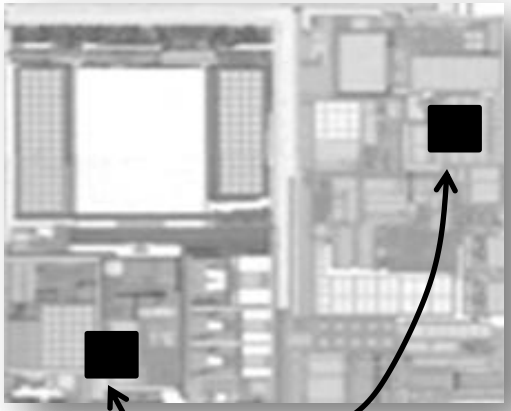
Fake Product

reverse copy

re-produce

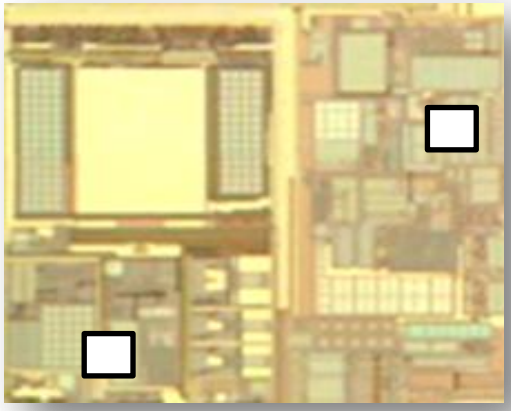


without protection



reverse copy

re-produce

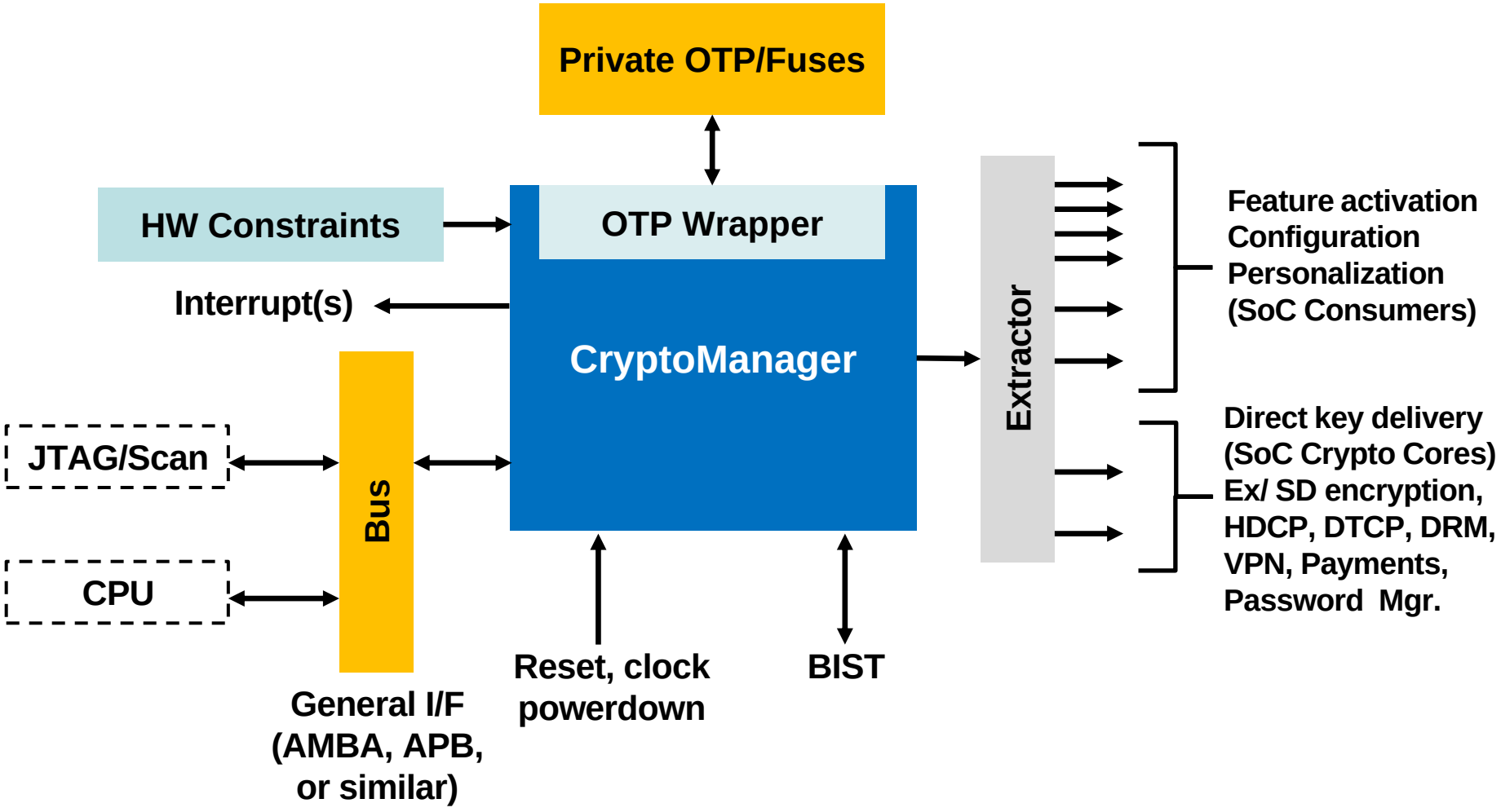


with protection

Security IP/Code by Authorized Use

Can NOT Work w/o Security IP/Code

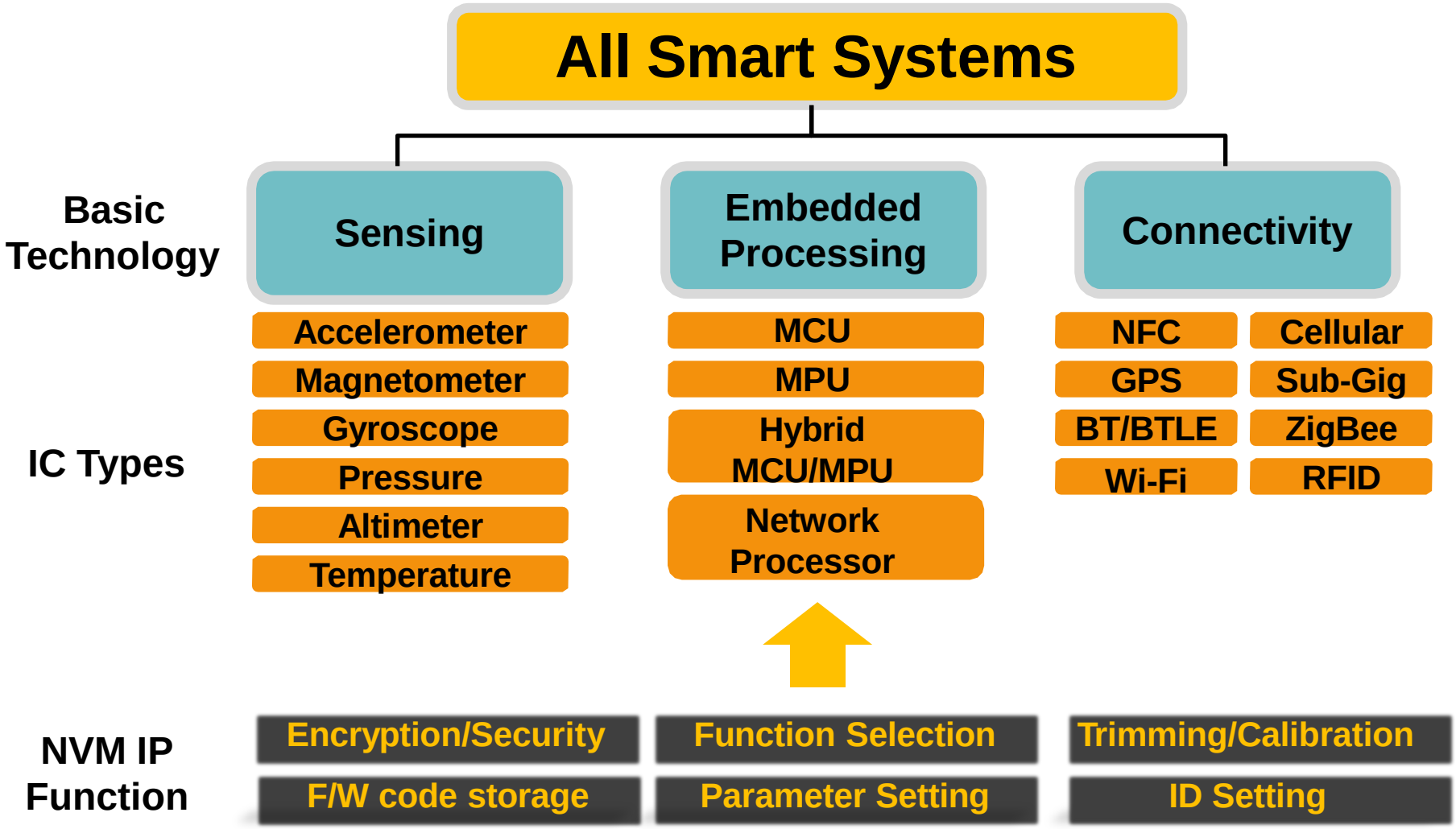
OTP在加密儲存應用



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

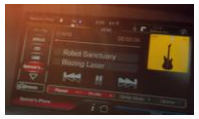


Autotronics with eMemory IPs

Intelligent drive
Distronic system

Neo **Bit** Neo **Fuse**

Infotainment system

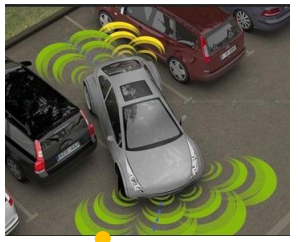


Neo **Bit** Neo **Fuse**

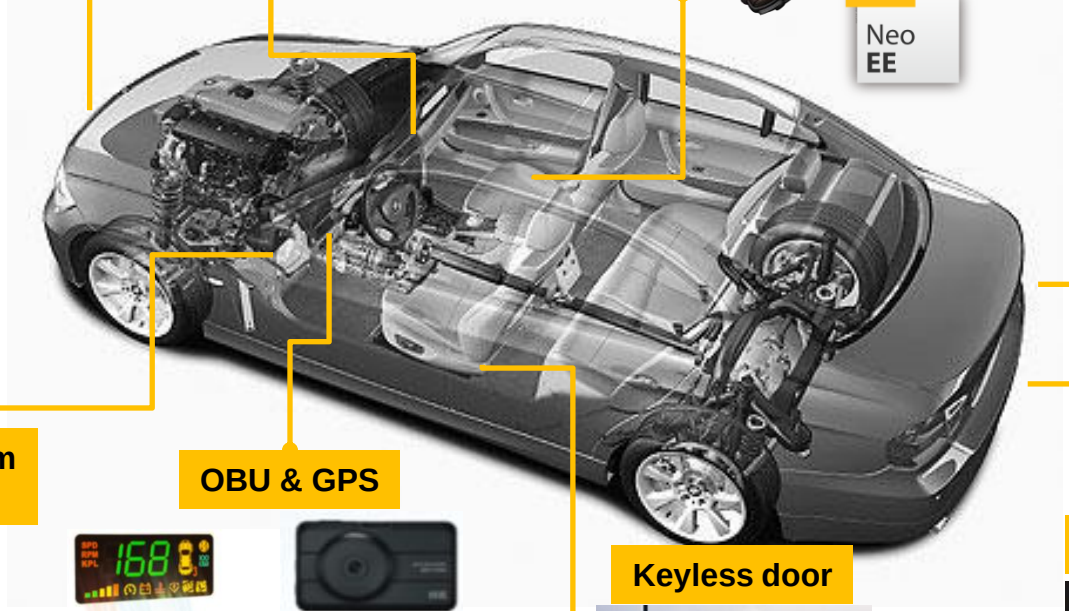
Sensor system

Neo **Bit** Neo **EE**

Auto parking system



Neo **Bit** Neo **Fuse**



Blind Spot Warning System
Cockpit System

Neo **Bit** Neo **Fuse**

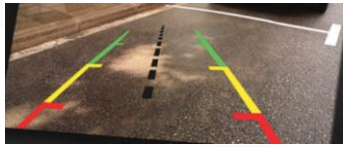
OBU & GPS

Neo **Bit** Neo **Fuse**

Keyless door

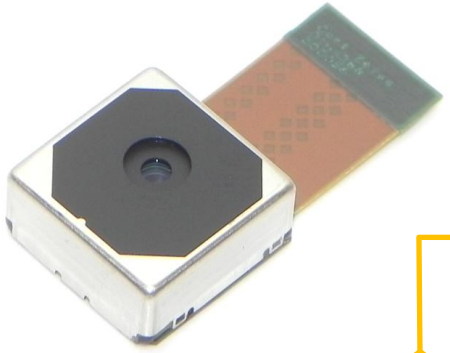
Neo **Bit** Neo **EE**

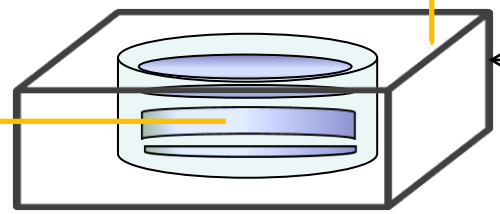
Rear view system

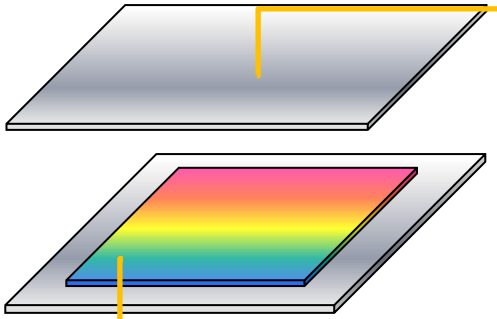


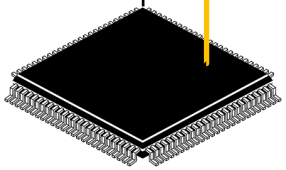
Neo **Bit** Neo **Fuse**

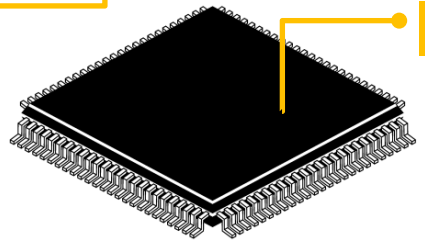
Imager Module with eMemory IPs











VCM

Lens

IR Cut Filter

AF/OIS Controller
(VCM Driver)

Neo Fuse

Neo Bit

Neo EE

Neo MTP

Image Sensor

Neo Fuse

Neo Bit

ISP

Neo Fuse

Neo Bit

Neo EE

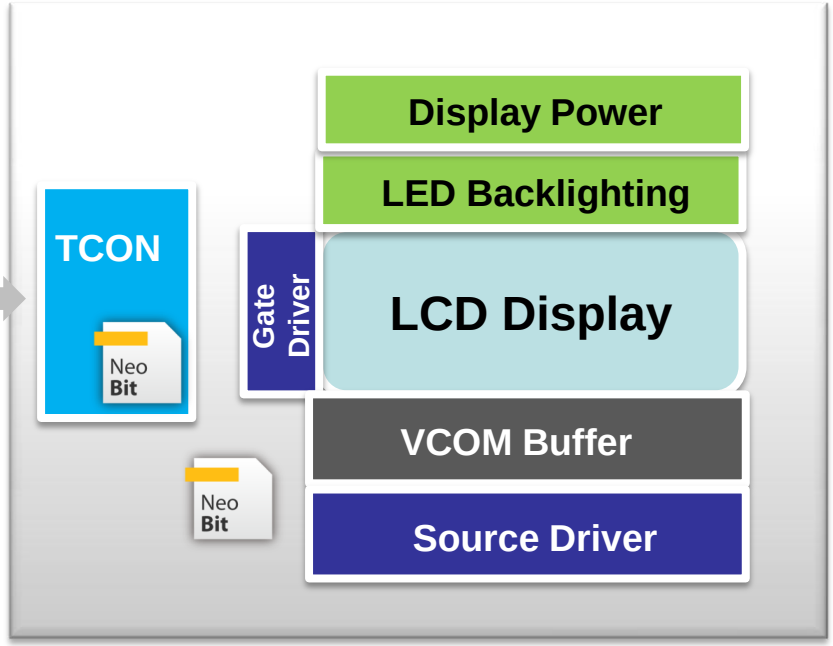
Neo MTP

先進液晶顯示驅動晶片

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

I/F
(LVDS, MIPI,…)

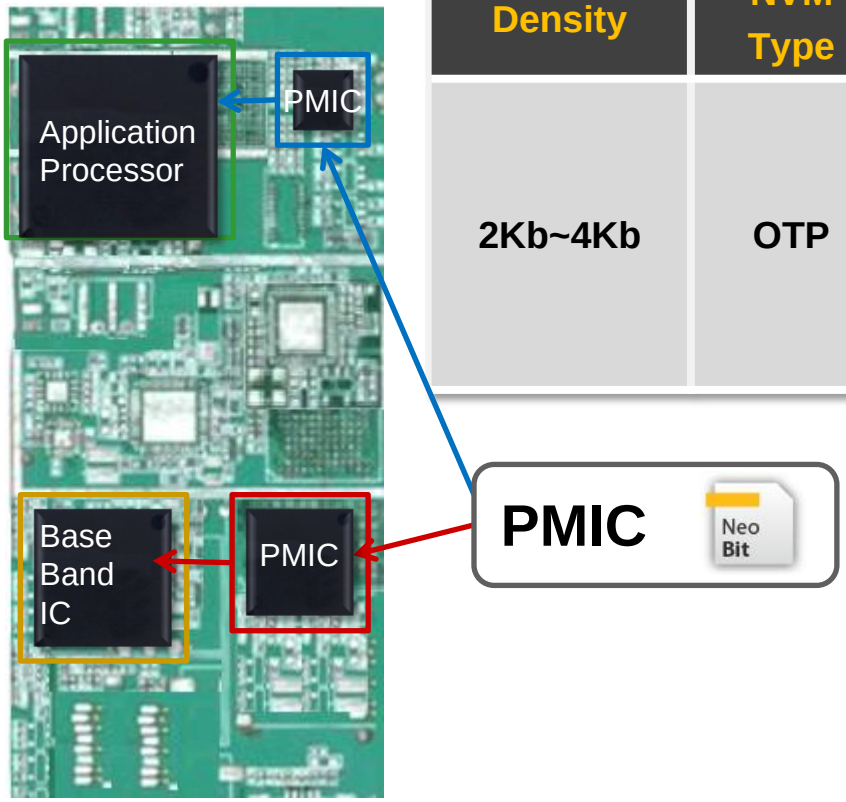
DDI



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

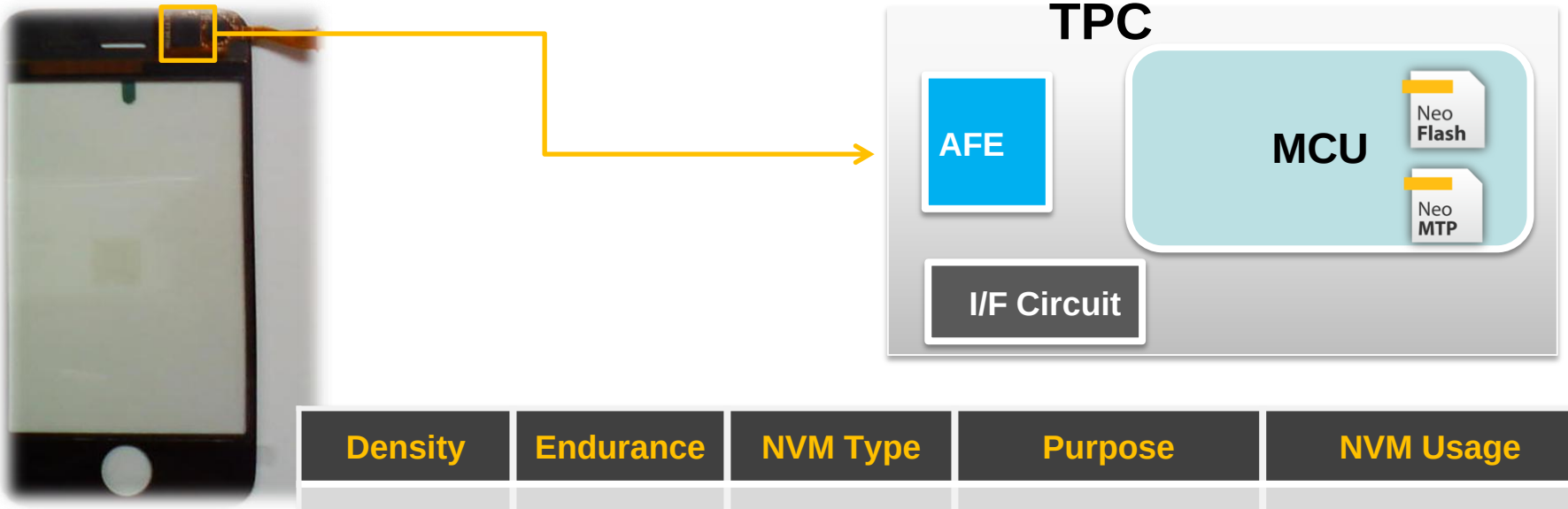
Process Technology : Advanced 0.25um BCD/ 0.18um BCD/ 0.13um BCD
Mature 0.18um/0.16um/0.152um Logic



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

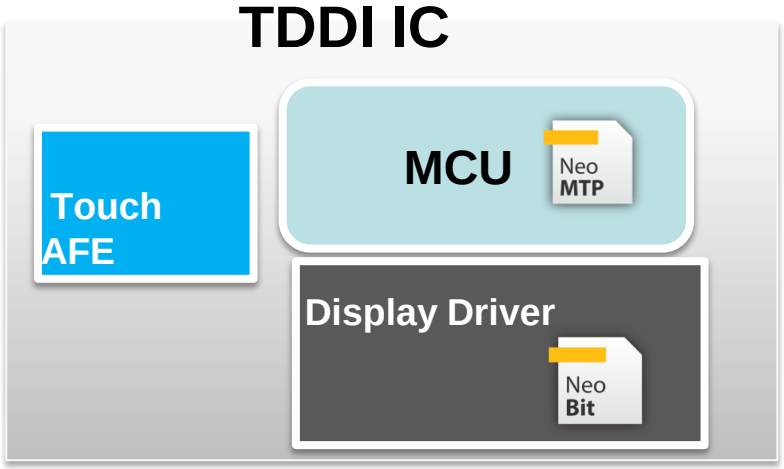
Process Technology : 0.16um HV/0.11um G



Density	Endurance	NVM Type	Purpose	NVM Usage
16K8~32K8	<1000	MTP	Code Storage	F/W code
			Parameter setting	Customized model and performance optimization

內嵌式觸控面板控制器晶片

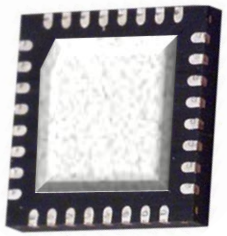
Process Technology : 0.11um HV/80nm HV/55nm HV

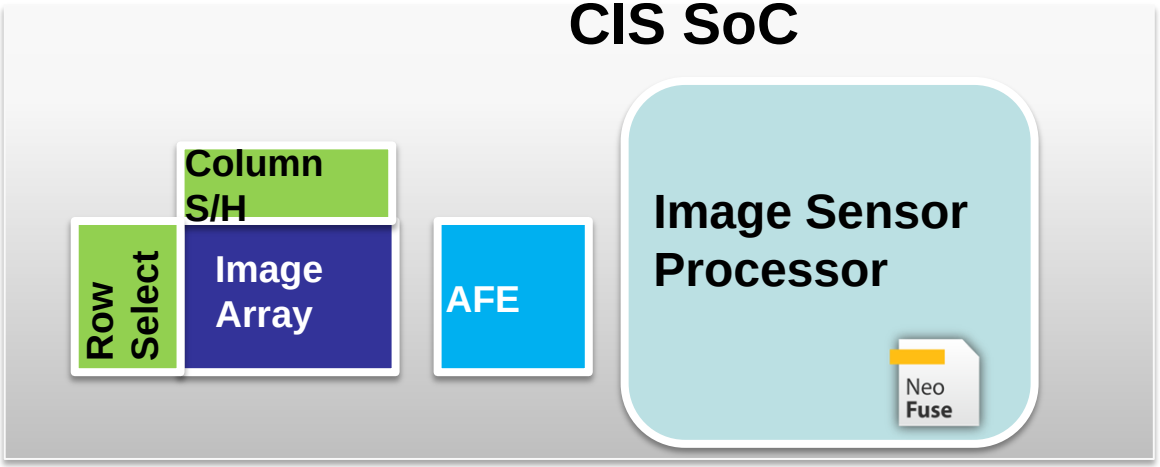


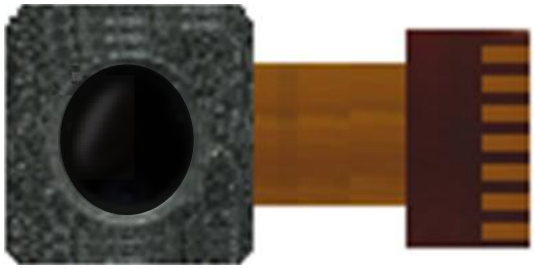
Density	Endurance	NVM Type	Purpose	NVM Usage
2K8~4K8	1	OTP	Trimming	Accuracy
			Code Storage	Gamma Table
16K8~32K8	<1000	MTP	Code Storage	Touch F/W Code
			Parameter setting	Performance Optimization

CMOS 影像感測器

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



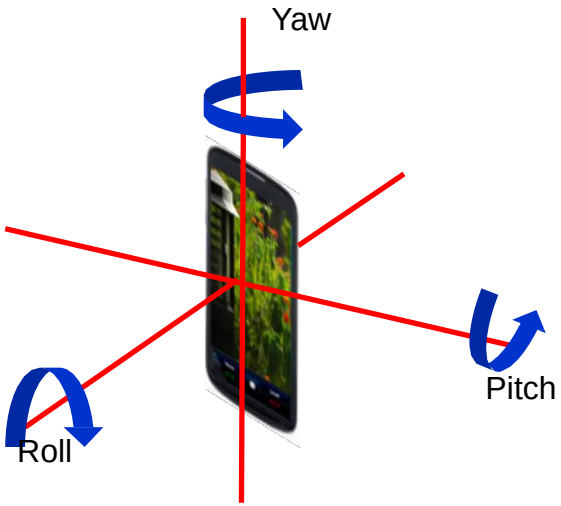


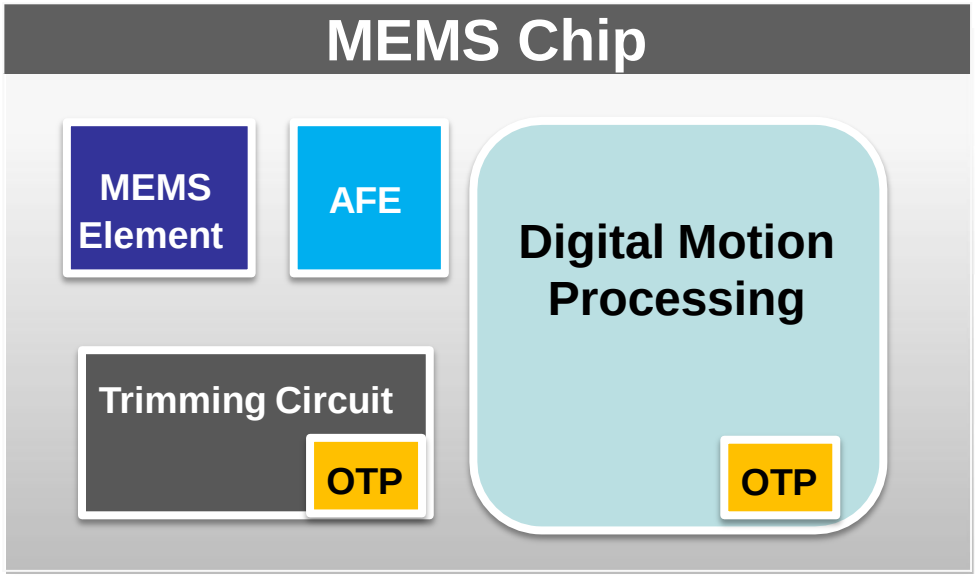


Density	Endurance	NVM Type	Purpose	NVM Usage
2Kb~4Kb	1	OTP	Identification Setting	Product Code
			Parameter Setting	Start-up Initial Setting
32K8	1	OTP/ROM	Code Storage	Boot Load

微機電系統(MEMS)

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





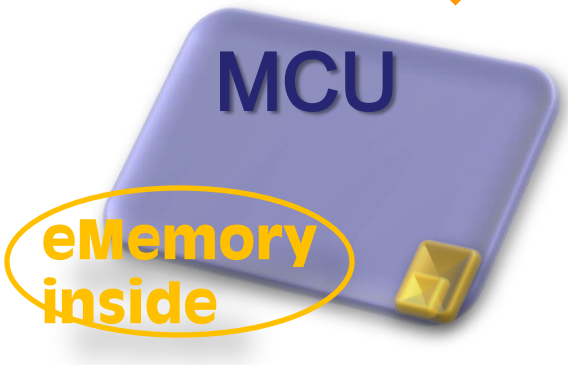
Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	Factory trimming
		Parameter Setting	Signal filtering
		Code Storage	Geometric computation

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

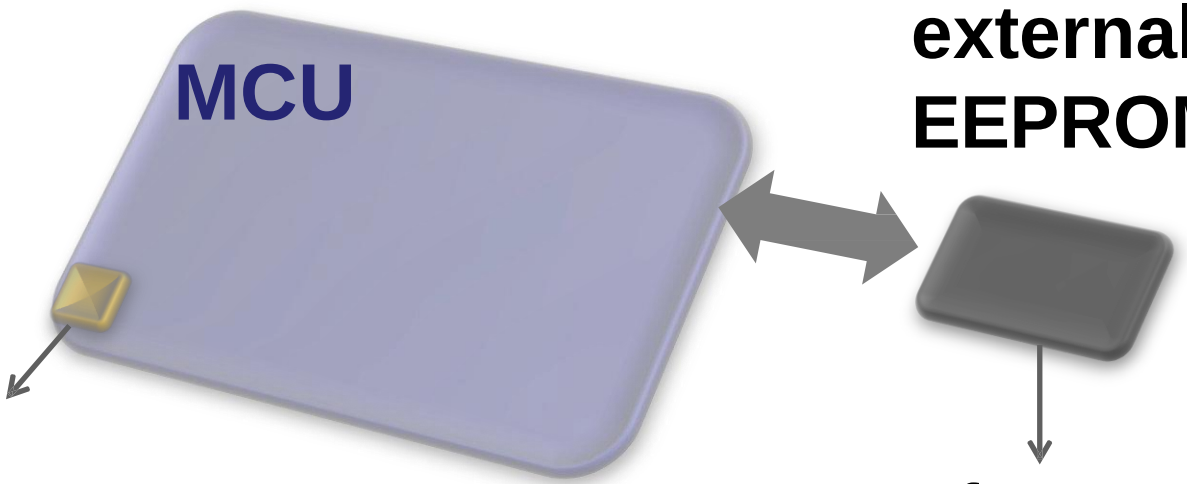
30% more cost reduction

wafer cost & testing time



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

EEPROM應用於MCU

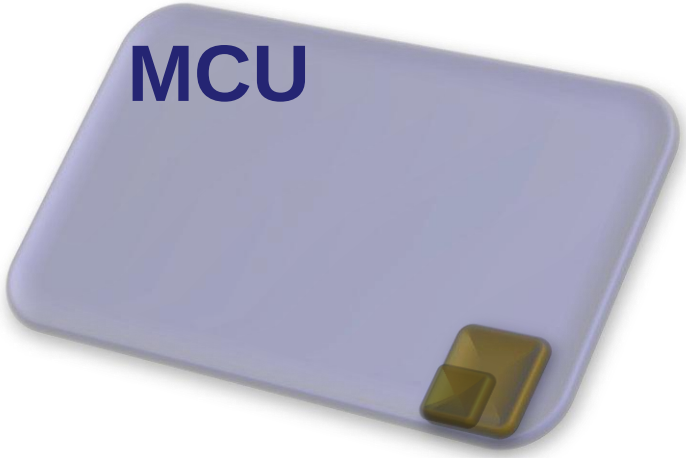


One-time storage for ID, trimming, encryption…

EEPROM for user data, parameter setting, system function…

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

- **NeoFuse在先進製程上開展順利，加上新的MTP技術，對於授權費的成長仍是相當樂觀。**
- **PMIC 的應用持續擴大導入 wireless charger、fast charger 相關電源管理應用。**
- **55nm高階 TDDI 量產持續，並與幾個主要代工廠合作開發 40nm OLED DDI。**
- **28nm Set-top Box 客戶已順利量產，有更多的客戶在2016 Q2 即將 tape-out 新產品。**
- **Fingerprint 及 CIS 客戶在2016 Q2已開始量產。**

未來展望

- **16nm FF+已於3月底完成可靠性測試，16nm FFC 在Q2會開始進行可靠性測試。**
- **10nm FF 預計Q2 tape-out IP。**
- **客戶對NeoMTP及NeoEE的需求增溫，預計2016年簽署技術授權合約，權利金將於2017年後開始發酵。**
- **Security相關應用的新技術NeoPUF，已進入開發階段。**
- **車用電子的應用持續tape-out。**

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