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。

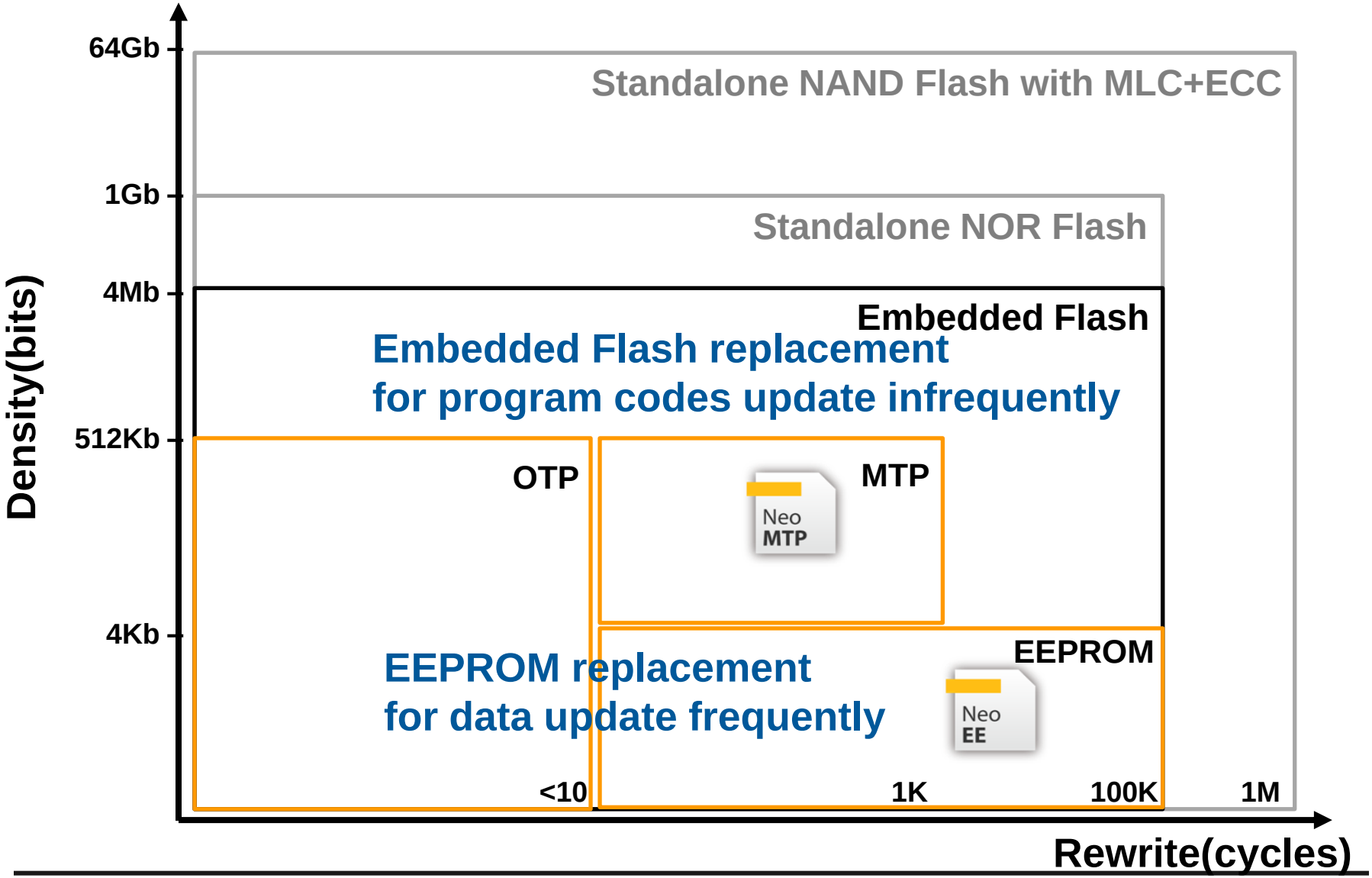
投資安全聲明

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。

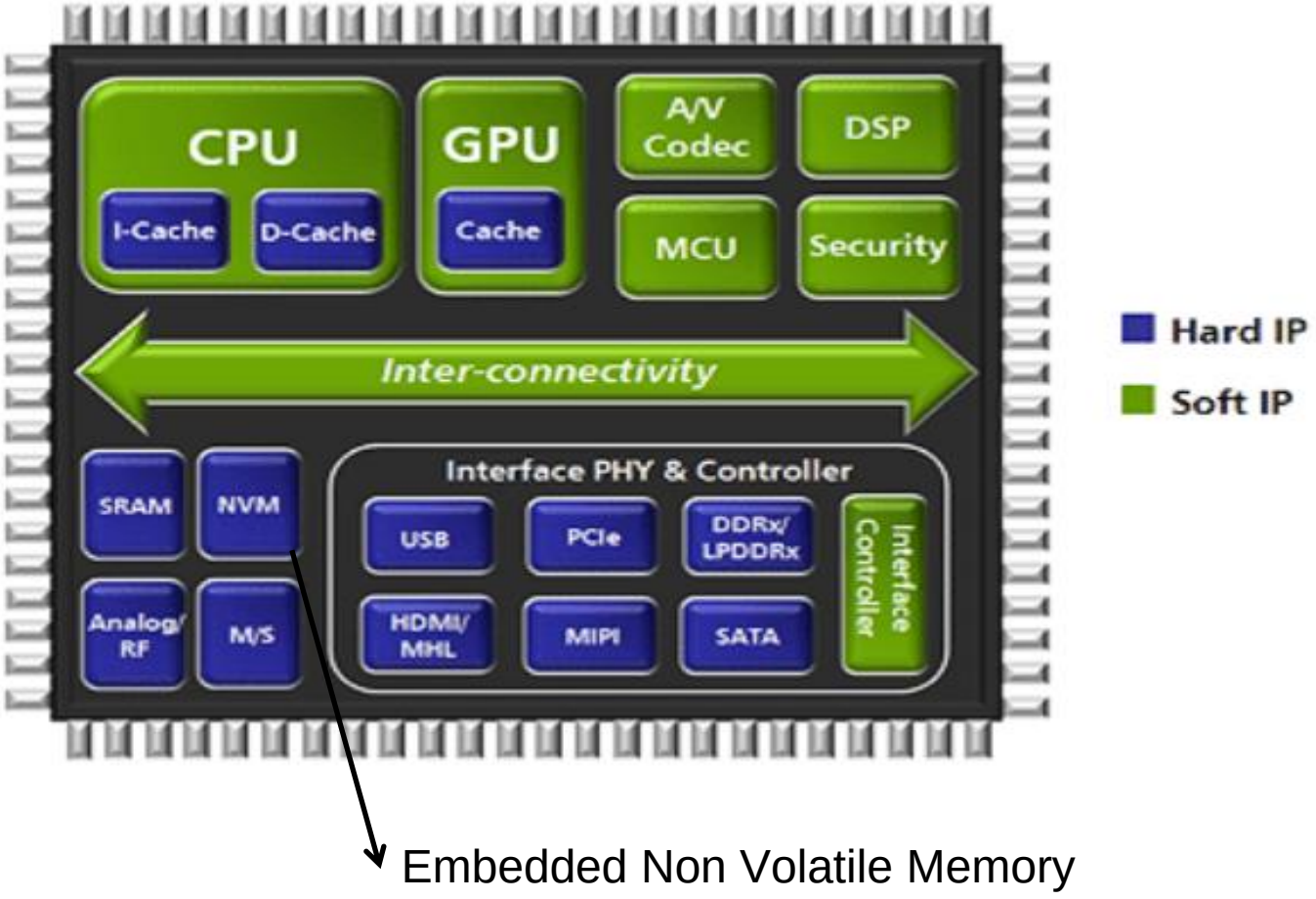
大綱

- 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



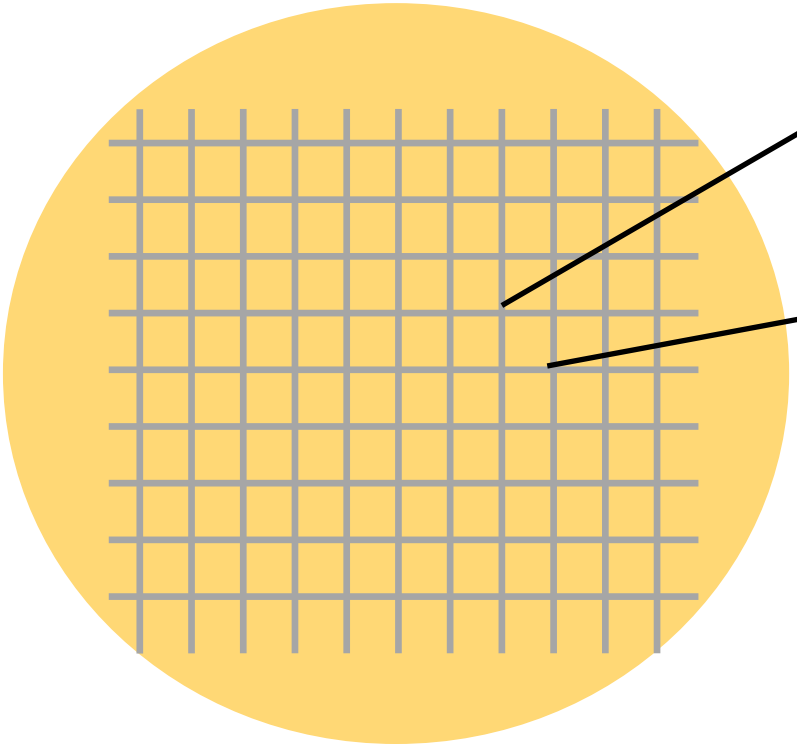
Source : tsmc

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



Customer Product

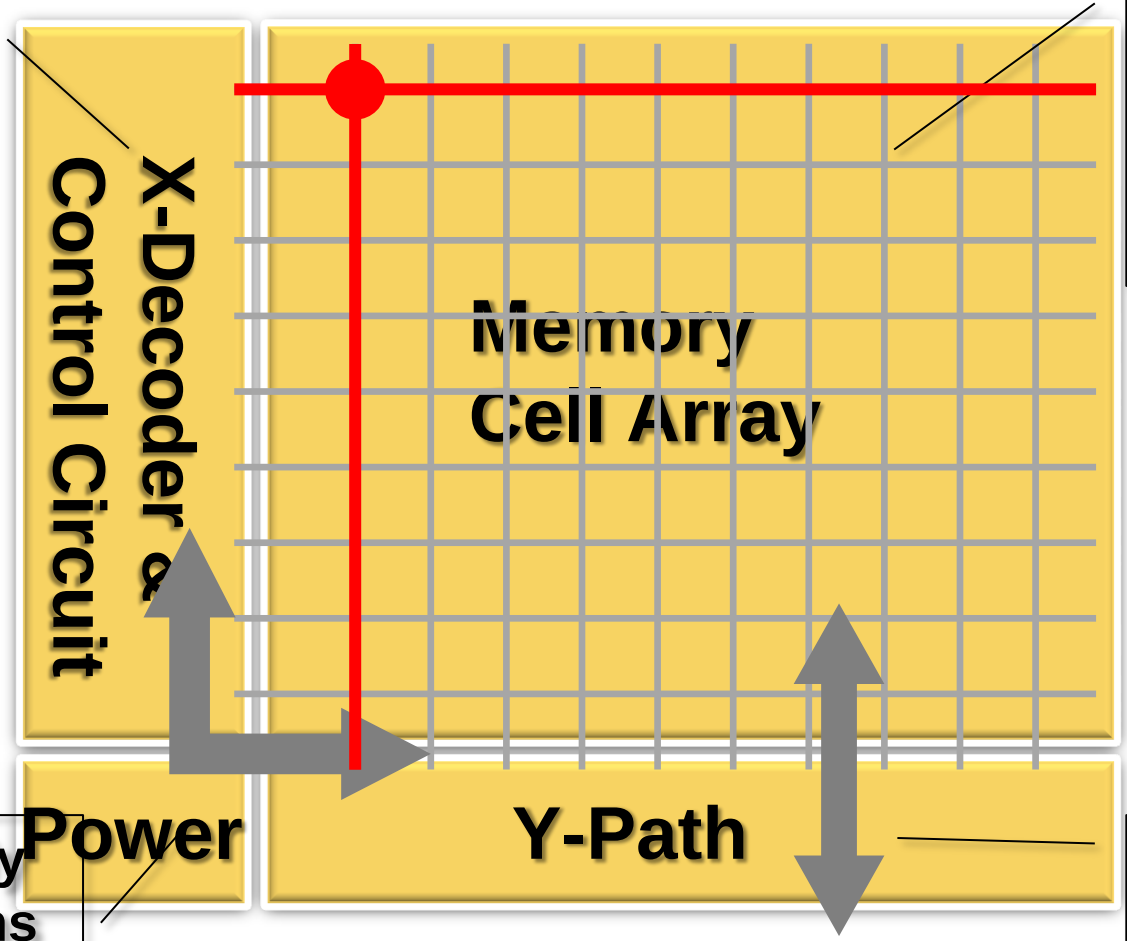
Generally, IP size is less than 10% of product size

IP

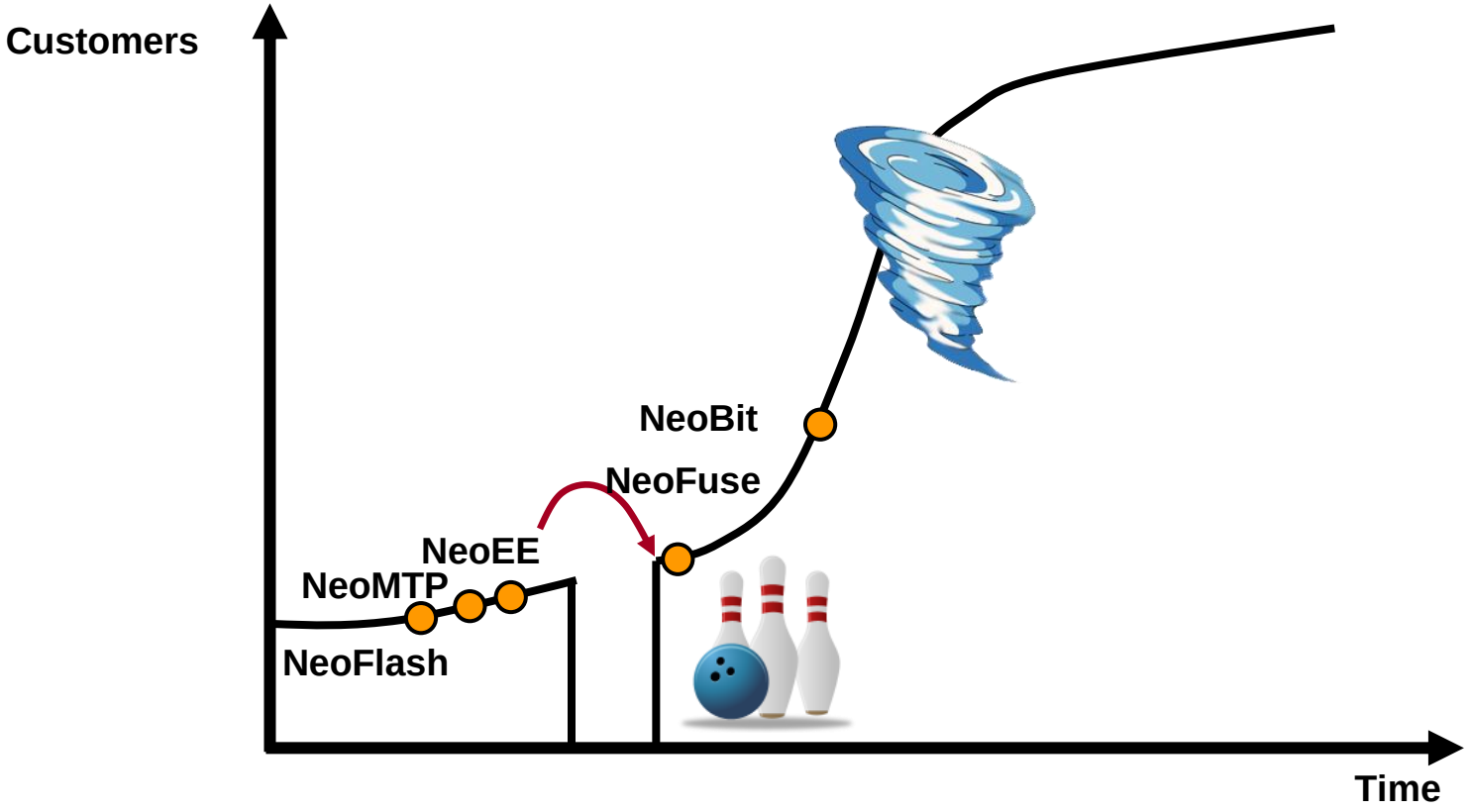
Customers Request

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



跨越鴻溝



營運模式

- **2000年成立，2002年第一個客戶，2005年開始獲利，2011年掛牌上市， 掛牌以來，無市場籌資，無銀行借款，現金配息率超過100%。**
- **全世界最大的logic non volatile Memory IP公司，230位員工，160位研發人員*。**
- **成長性指標: 1) 正在晶圓廠建構的製程平台數**
  2) 設計授權數
  3) 權利金

前期授權金
=技術授權金 + 設計授權金

1-2 years
eMemory & foundry development

Technology License Revenue

1-2 years
Fabless product development

Design License Revenue

3+ years
Multiple application & sales

Royalty Revenue Continues

權利金
=客戶於晶圓量產時向晶圓廠收取

Note*: 截至 2016/09/30

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

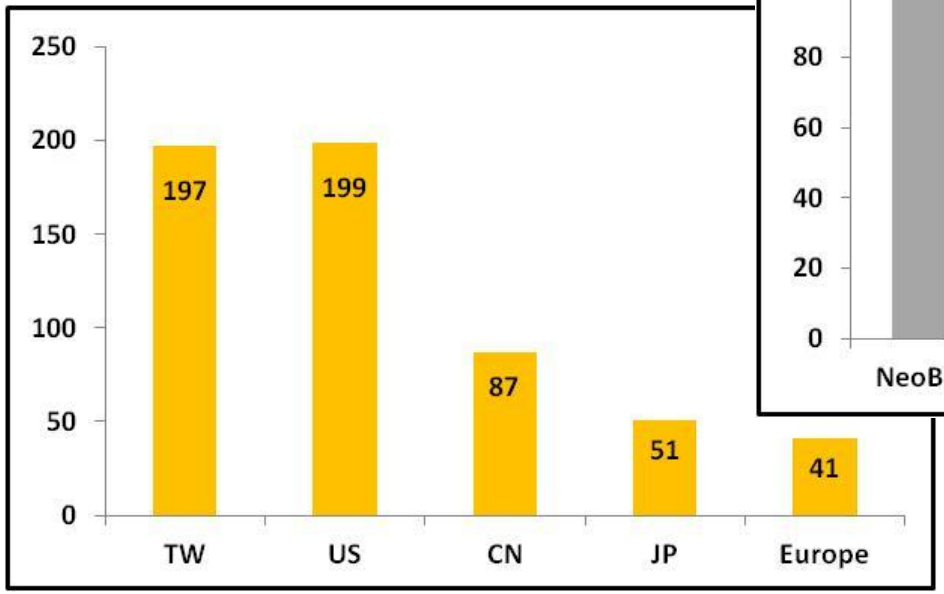
tsmc UMC VIS SILTERRA
華虹宏力 GLOBALFOUNDRIES SMIC
MagnaChip Maxchip 鉅晶電子
ROHM SEMICONDUCTOR SK hynix Dongbu HiTek HEJIAN
FUJITSU Powerchip 力晶科技
CSMC A LEADING ANALOG FOUNDRY HLMC asmc Advanced Semiconductor Manufacturing Corporation Limited Altis

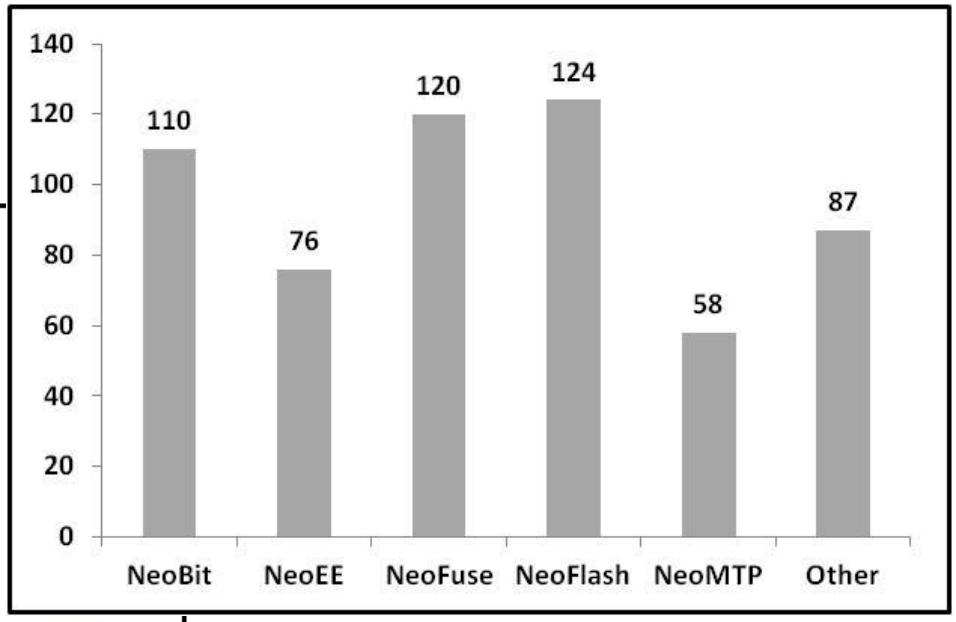
IDM

FUJITSU OKI MITSUMI
MITSUBISHI ELECTRIC Changes for the Better JRC MAXIM
RICOH RENESAS SII
TOSHIBA ON Semiconductor ON NXP

專利佈局

	Q2 16	Q3 16	Diff.
Pending	193	204	+ 11
Issued	355	371	+ 16
Total	548	575	+ 27



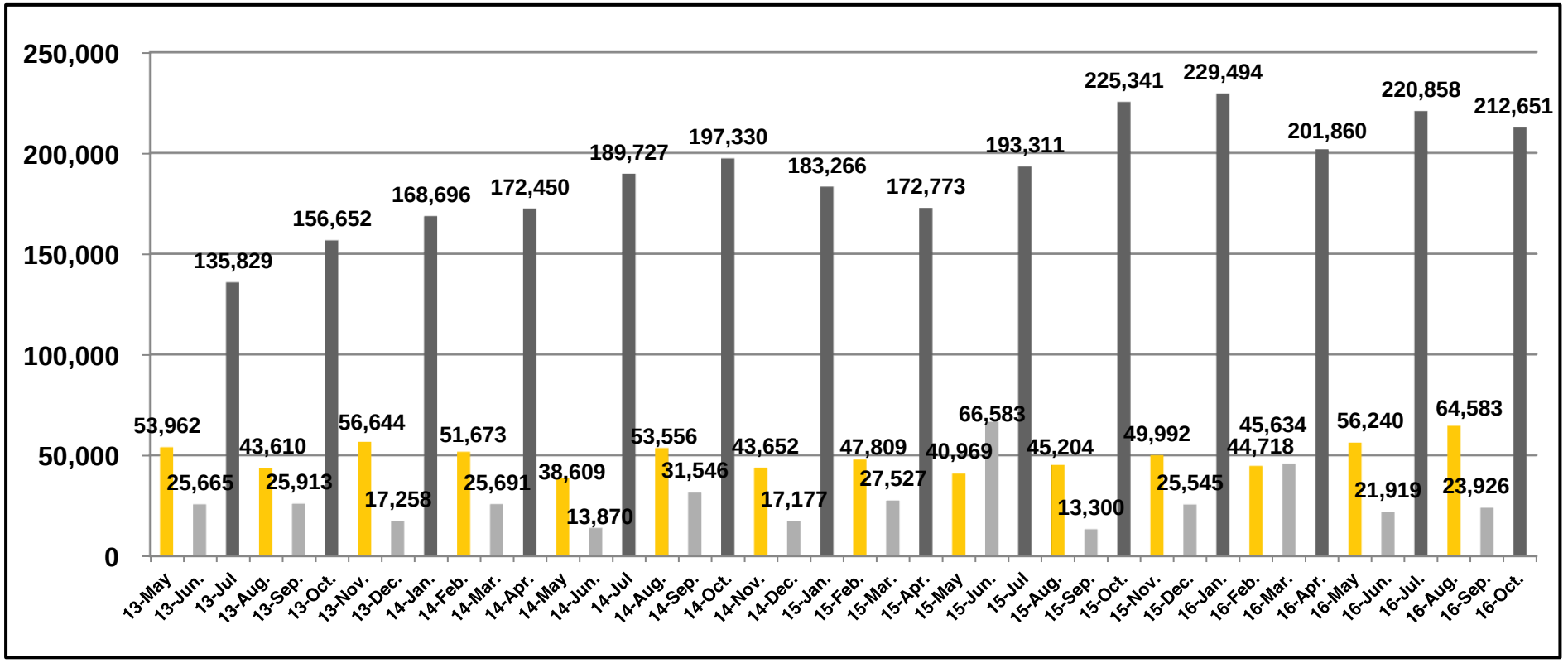


Note*:截至2016/09/30

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

第三季各項營收

單位：新台幣仟元

	Q3 2016	Q2 2016	QoQ	Q3 2015	YoY	Q1-Q3 2016	Q1-Q3 2015	YoY
授權費	86,712	77,715	11.58%	38,167	127.19%	250,403	198,205	26.34%
權利金	222,655	202,304	10.06%	213,648	4.22%	658,829	592,537	11.19%
合計	309,367	280,019	10.48%	251,815	22.85%	909,232	790,742	14.98%

單位：合約數

		Q3 2016	Q2 2016	2015	2014
技術授權數		6	14	28	21
設計授權數	NRE	18	14	57	82
	使用費	81	94	349	363

綜合損益表

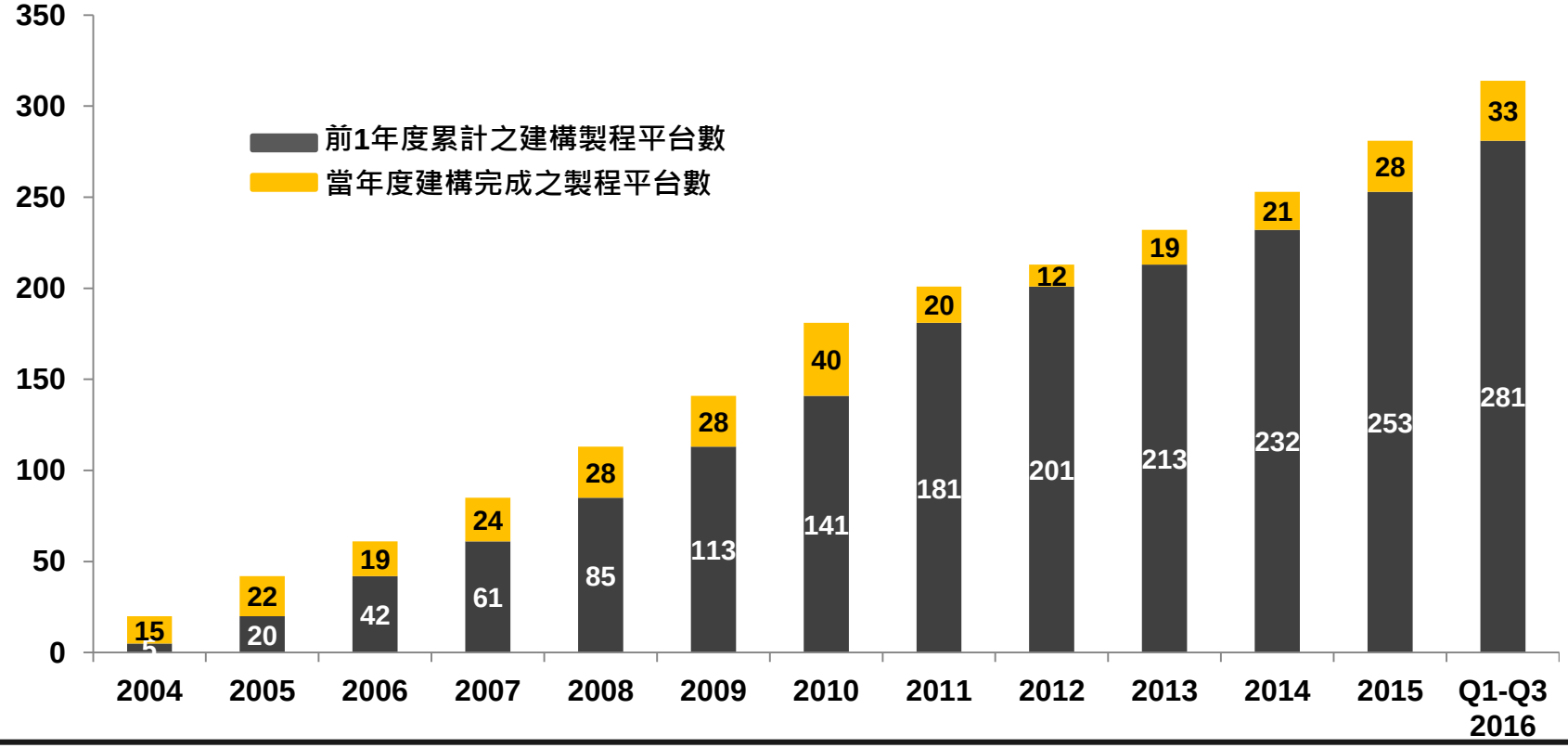
(單位:新台幣仟元)	Q3 2016	Q2 2016	% change	Q3 2015	% change
營業收入淨額	309,367	280,019	10.5%	251,815	22.9%
營業毛利率	100%	100%	-	100%	-
營業費用	173,605	163,276	6.3%	143,776	20.7%
營業淨利率	43.9%	41.7%	2.2ppts	42.9%	1.0ppts
本期淨利	130,299	106,245	22.6%	106,301	22.6%
純益率	42.1%	37.9%	4.2ppts	42.2%	-0.1ppts
每股盈餘 (單位: 新台幣元)	1.72	1.40	22.9%	1.40	22.9%
權益報酬率	28.9%	24.5%	4.4ppts	24.5%	4.4ppts

技術授權合約

單位：合約數

Year	2013	2014	2015	Q1-Q3 2016
License number	19	21	28	33

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 Sep.) : 111
- 20 for NeoBit, 46 for NeoFuse, 22 for NeoEE, and 23 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	14	
NeoFuse	2	3	9	6	12	4	6	4	-
NeoFlash	-	-	-	-	-	-	-	-	-
NeoEE	-	-	-	-	-	1	4	17	-
NeoMTP	-	-	-	-	2	2	6	13	-

目前正在建構的技術製程平台

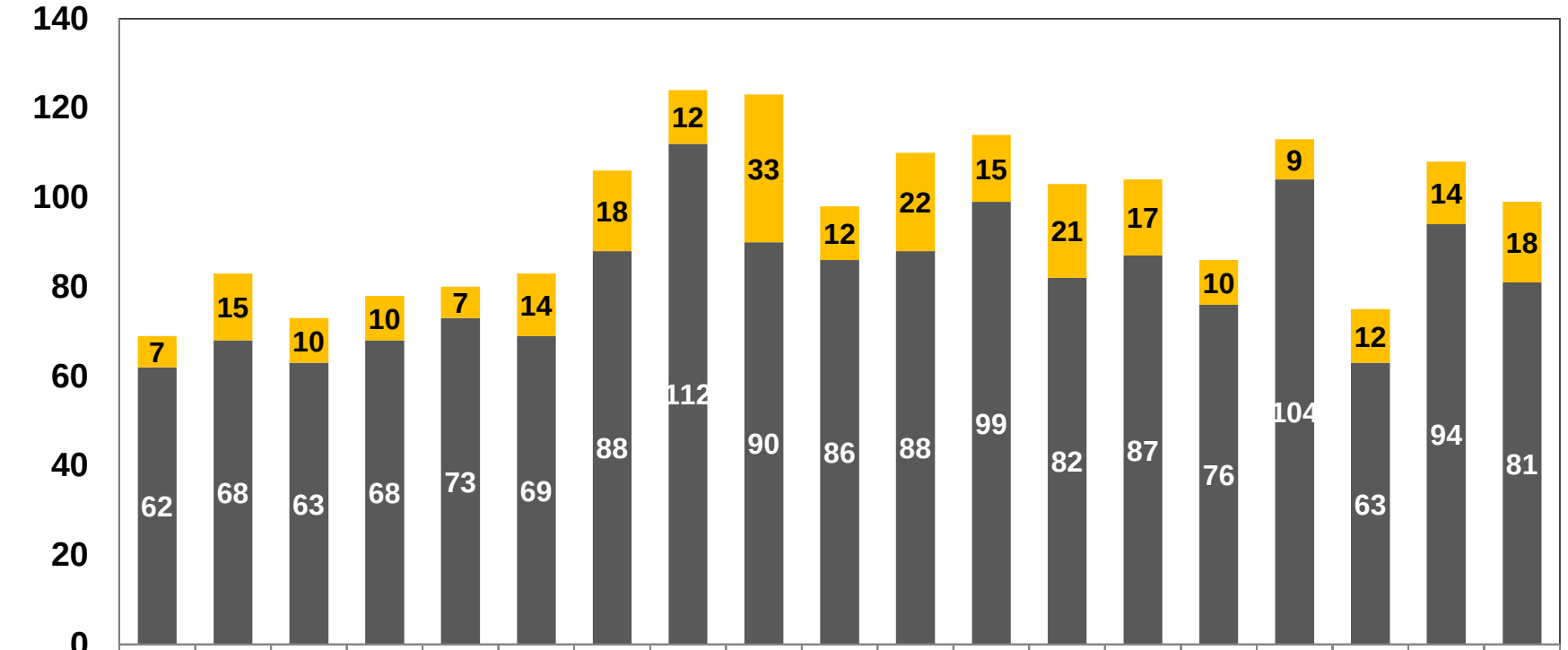
12" Fabs	Production	Development	NVM Type	Process Type
7/10nm	0	2	OTP	FF
14/16nm	1	3	OTP	FF+
28nm	5	9	OTP	LP/HPM, HLP/HPM, LPS
40nm	4	6	OTP, MTP	HV-DDI, LP
55/65nm	12	14	OTP, MTP, Flash	LP, HV-DDI, HV-OLED, DRAM, CIS
80/90nm	6	7	OTP, MTP	HV-DDI, HV-OLED, LP
0.13/0.11um	6	3	OTP, Flash	HV-DDI, BCD, Generic
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	48	OTP, MTP	Generic, LP, LL, MR, HV, Green, BCD
0.25um	0	OTP, MTP	BCD
0.35um	0	OTP	UHV

Note*:截至 2016/09/30

每季設計授權數(New Tape Out)

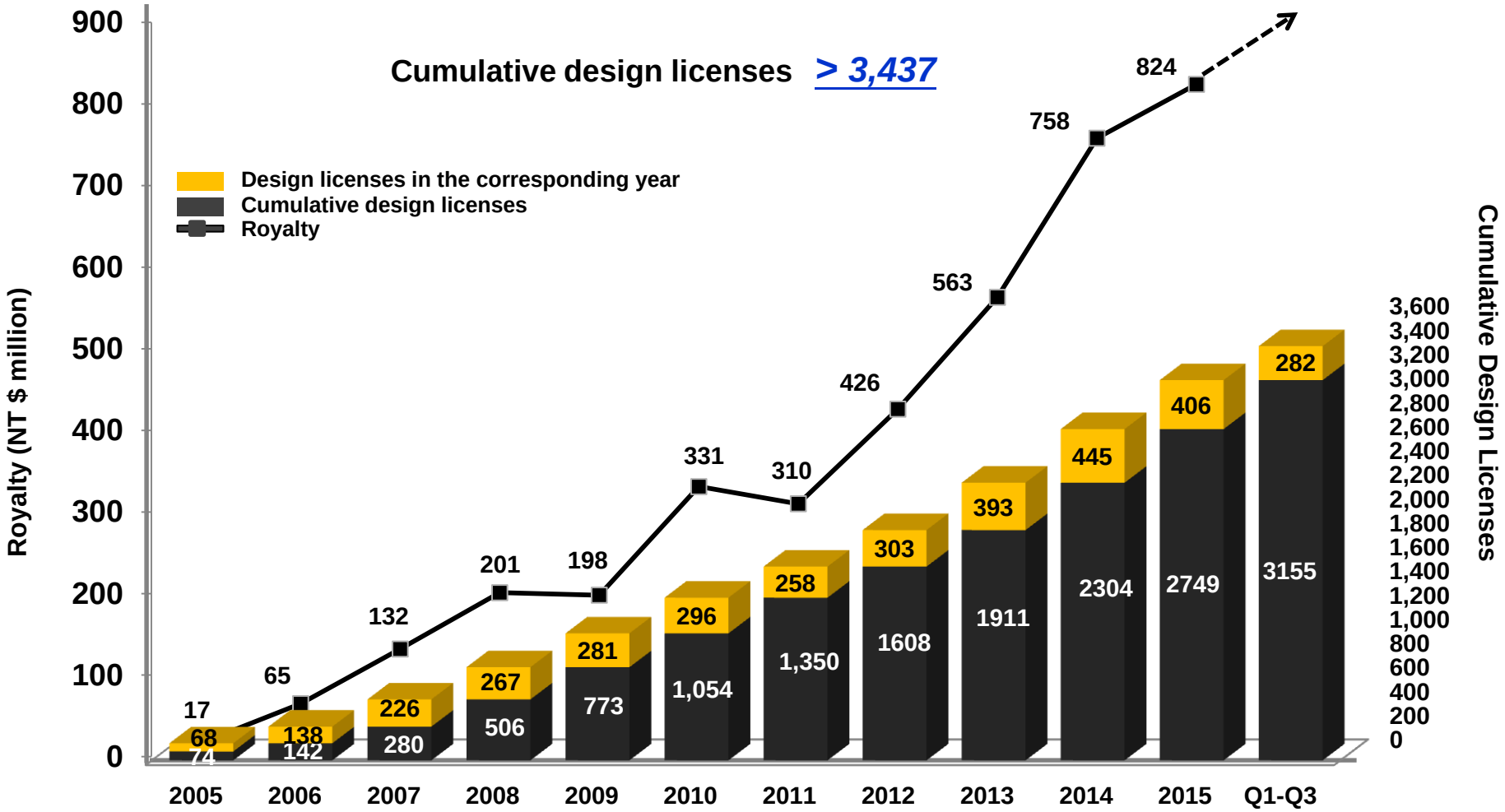
- *Total* ***282*** **NTO as of Q1-Q3 2016(** ***406*****@2015,*****445*****@2014,*** ***393*****@2013,*** ***303*****@2012)**



	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
	2012				2013				2014				2015				2016		
NRE	7	15	10	10	7	14	18	12	33	12	22	15	21	17	10	9	12	14	18
Usage	62	68	63	68	73	69	88	112	90	86	88	99	82	87	76	104	63	94	81

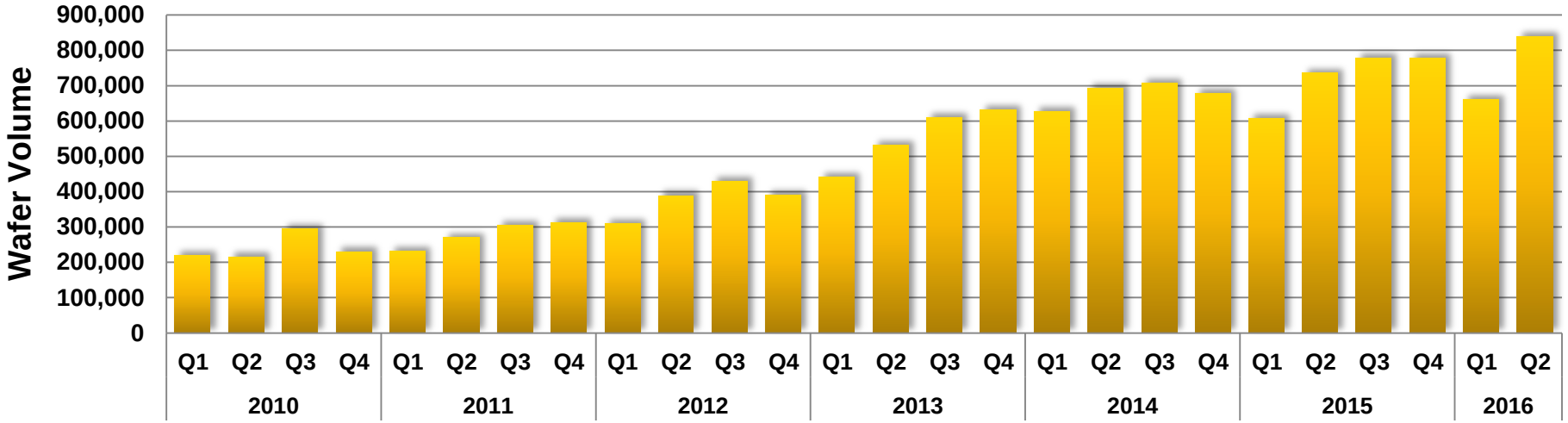
Note*: 客戶在各代工廠的諸多MCU NTO已陸續進入量產，加上與主要Green process代工廠的商業模式商業模式調整為直接license IP cell 給代工廠, 由代工廠提供設計服務給客戶，造成tape out 數減少，但仍對使用IP cell 的晶片支付權利金. 雖然MCU的NTO數量有明顯減少，但是相關的晶圓產出和權利金收入還是持續增加。

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 Q3 2016

	Process node	*% of T	Q3 16	Q2 16	2015	2014
8”	0.25/0.35	3%	26.44%	18.44%	33.49%	30.5%
	0.15/0.18	9%	13.07%	12.32%	8.73%	11.9%
	0.11/0.13	3%	40.96%	43.90%	29%	20.8%
12”	90nm	5%	* 3.83%	11.33%	19.85%	16.3%
	65nm	11%	3.85%	3.76%	0.55%	0%
	40/45nm	13%	0	0%	0%	0%
	28nm	24%	0.61%	0.41%	0.05%	0%
	16/20nm	31%	0	0	0%	0%
8”		16%	20.1%	16.39%	16.64%	15.6%
12”		84%	0.87%	1.36%	1.87%	1.4%
Total		100%	3.95%	3.92%	4.76%	4.5%

*iOS 客戶權利金認列時程在2017 Q1 。

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

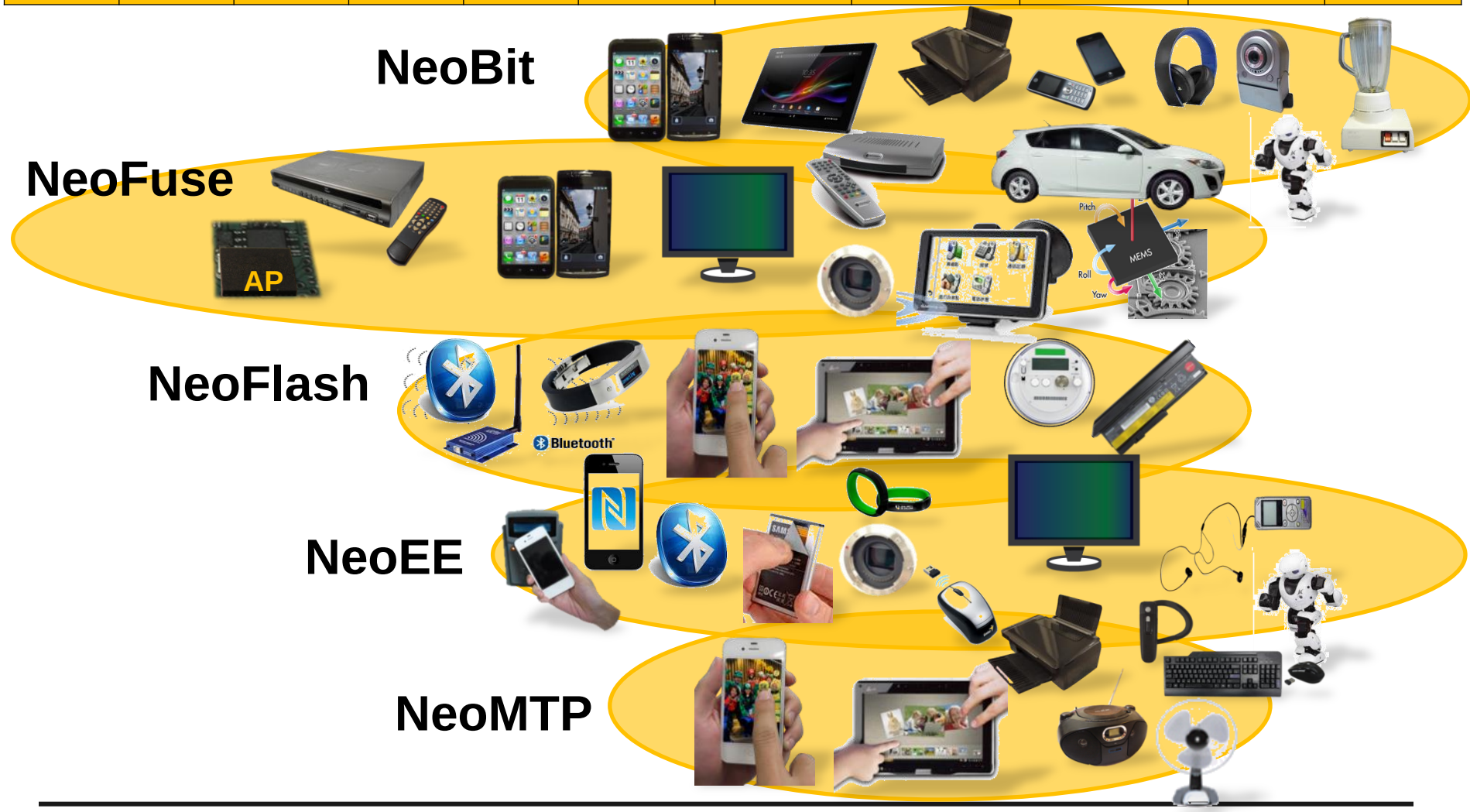
力旺之NVM技術

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

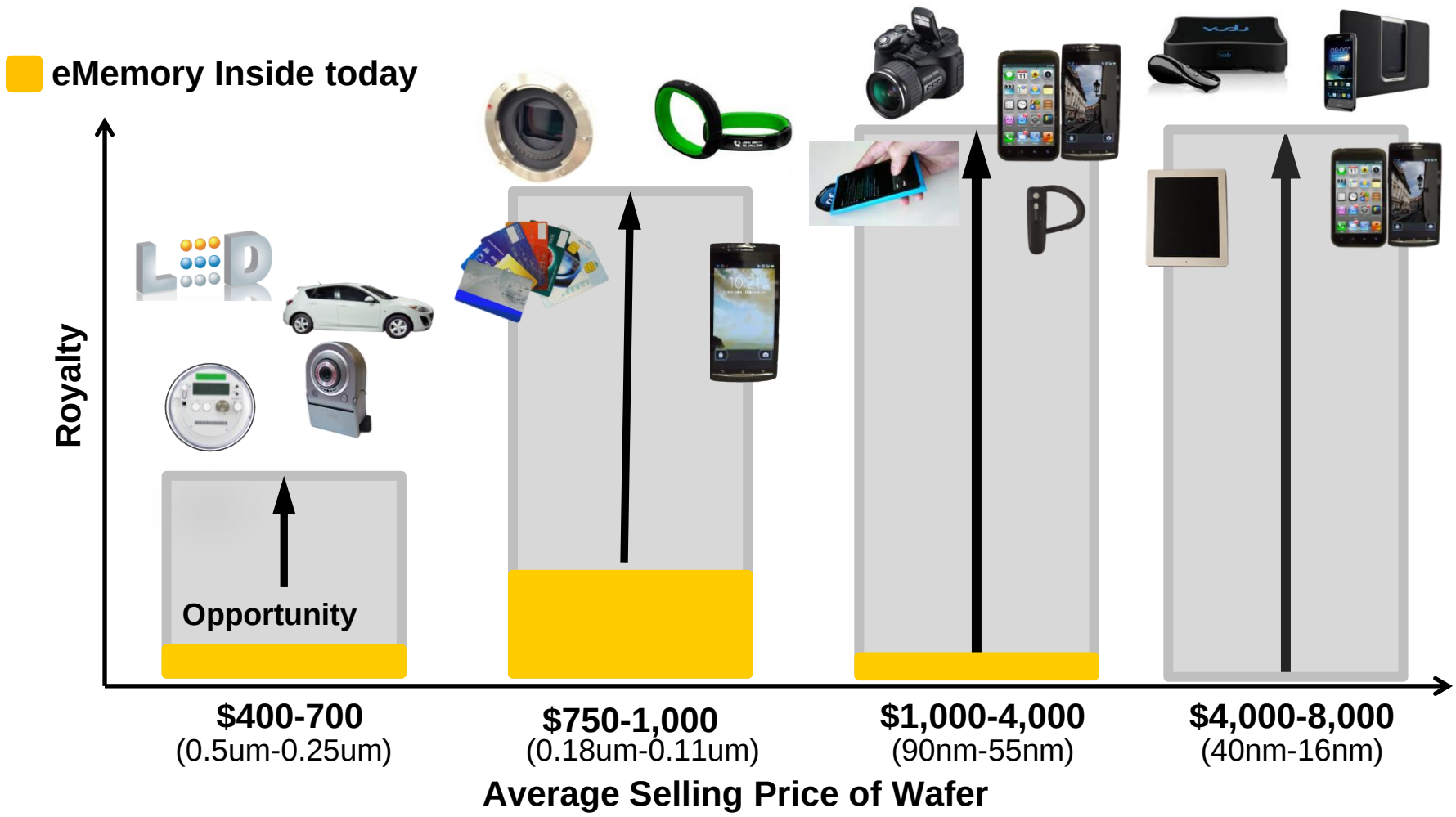
eMemory's NVM Technology	OTP		MTP		
	NeoBit	NeoFuse	NeoFlash	NeoEE	NeoMTP
Product Type	OTP	OTP	Flash	EEPROM	MTP
Endurance (Cycles)	10	10	1K~10K	10K~100K	1K~10K
Additional Mask Steps	0	0	2-3	0	0
Technology	Floating gate	Anti-Fuse	SONOS	Floating gate	Floating gate
Scalability	Simple	Simple	Simple	Simple	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

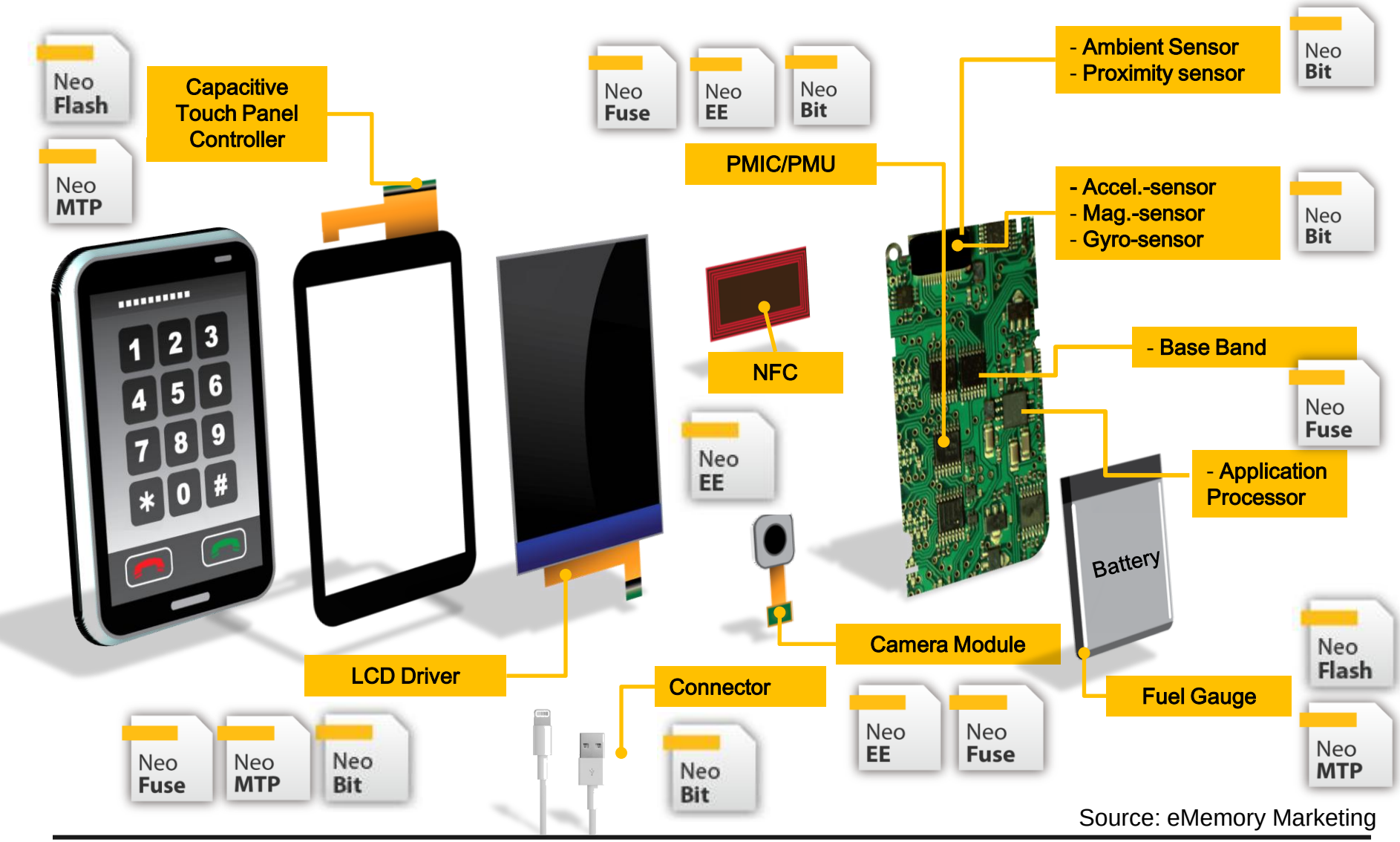


商機與潛力



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

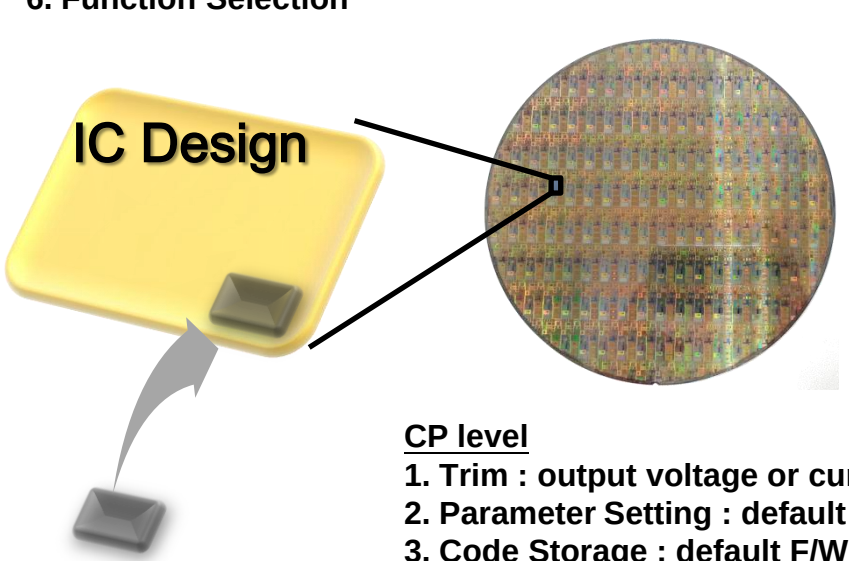
Design-in for
1. Trimming
2. Parameter Setting
3. Code Storage
4. Identification Setting
5. Encryption
6. Function Selection

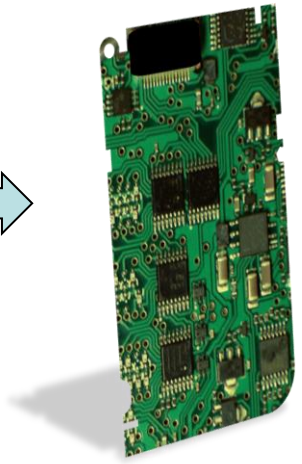
Package/FT level
1. Trim : SPEC shift
2. Parameter Setting : cross chip optimization
3. Identification Setting : manufacturer resume
4. Function Selection : setting for target market

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

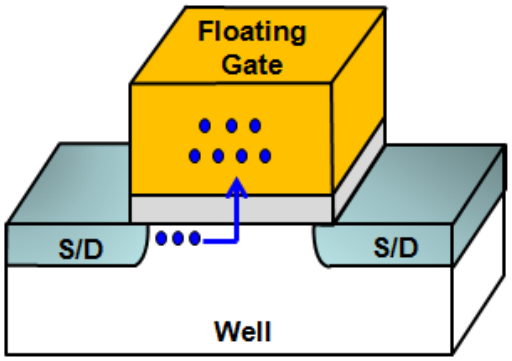
System Assembling
1. Parameter Setting : cross chip optimization
2. Code Storage : F/W code modification
3. Identification Setting : manufacturer resume
4. Encryption : Security algorithm or key storage

高機密性的安全設定

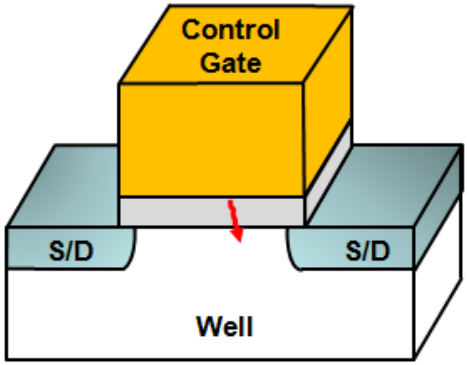
- **Provide “Invisible Hardware Key” for invisible storage**
- **Prevent reverse-engineering to detect content of security key**
- **Protect firmware and hardware of ICs from pirating**
- **Extend & protect customer’s business**

eFuse Key: Data is easily observed

Invisible Hardware Key : Data is hard to be detected



Floating Gate



Anti-Fuse

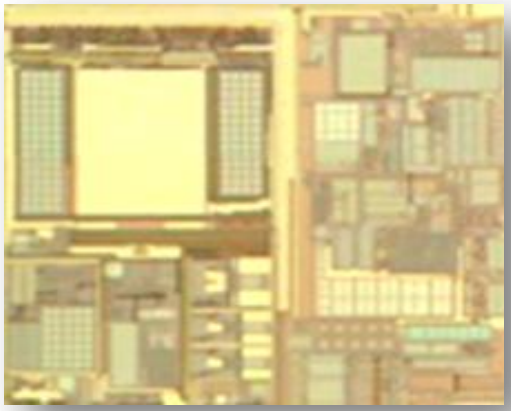
硬體設計防護

Authorized Product

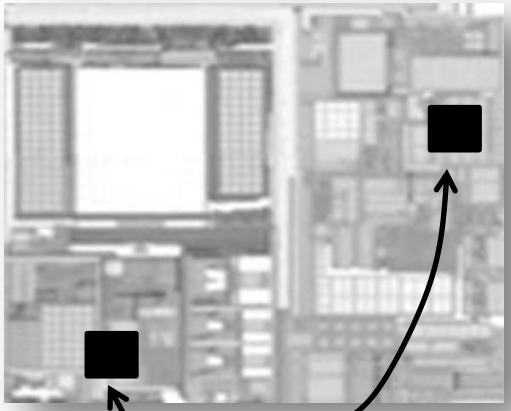
Fake Product

reverse copy

re-produce

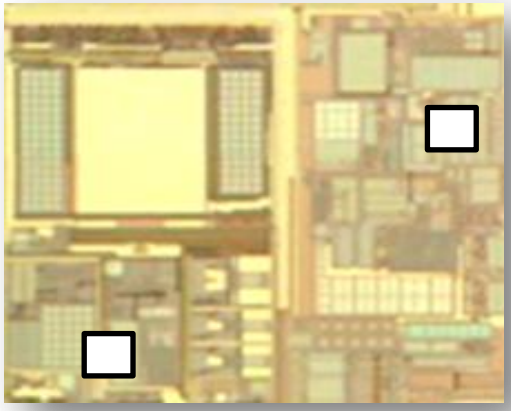


without protection



reverse copy

re-produce

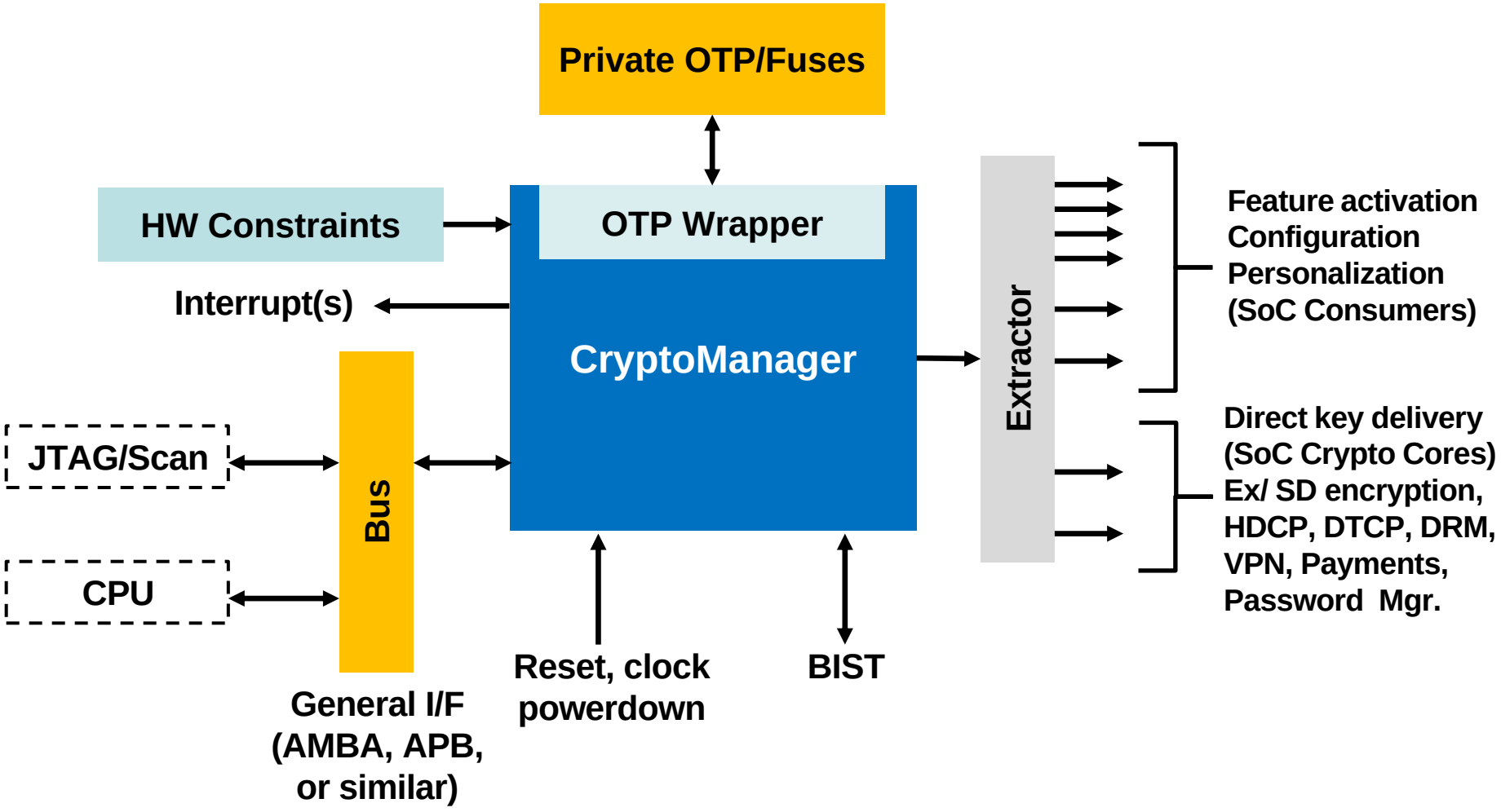


with protection

Security IP/Code by Authorized Use

Can NOT Work w/o Security IP/Code

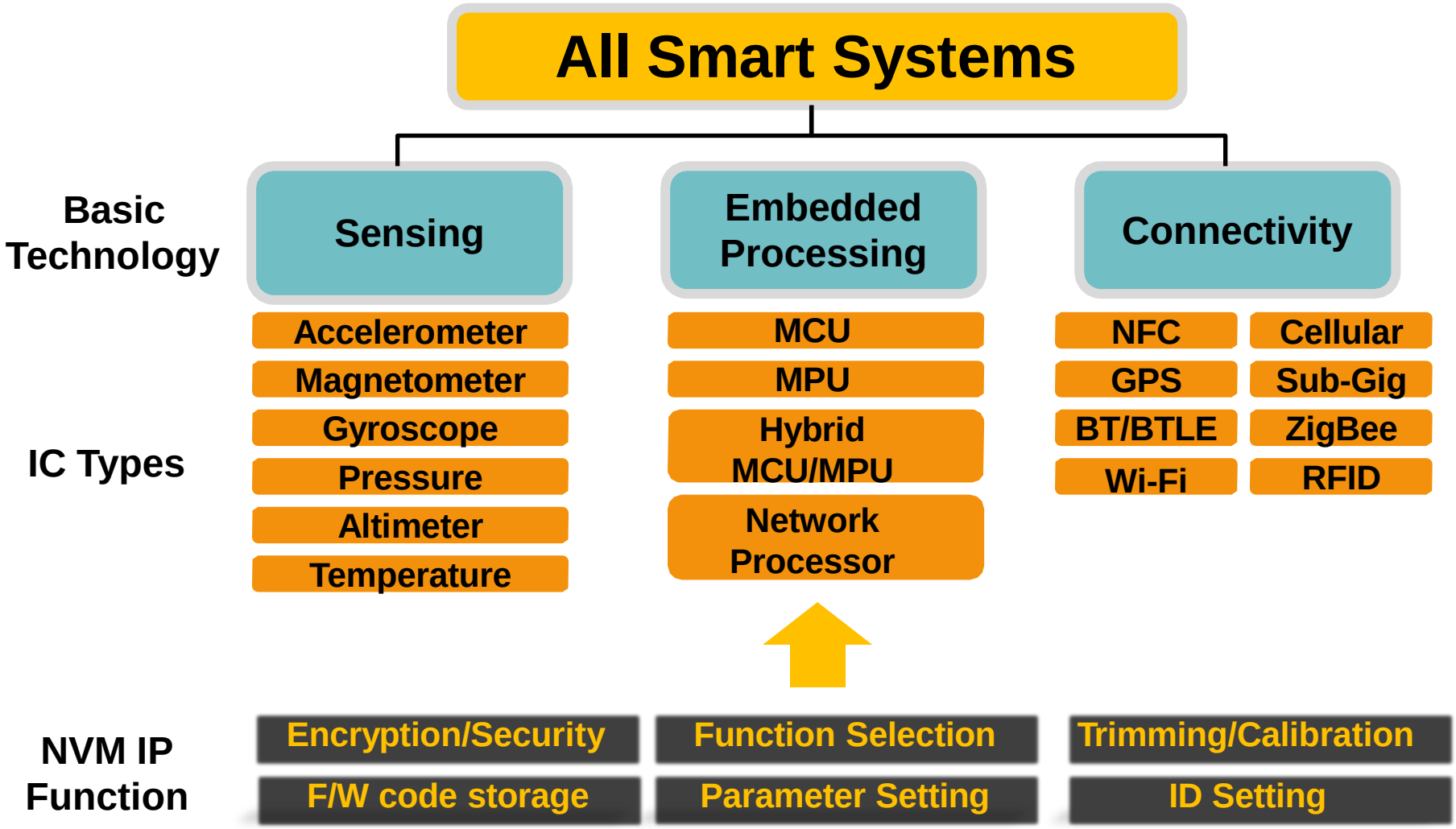
OTP在加密儲存應用



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

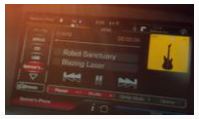


Autotronics with eMemory IPs

Intelligent drive
Distronic system

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

Infotainment system

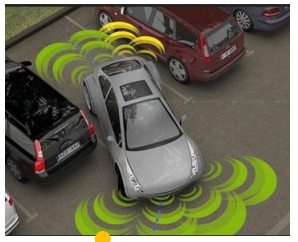


Neo **Bit** Neo **Fuse**

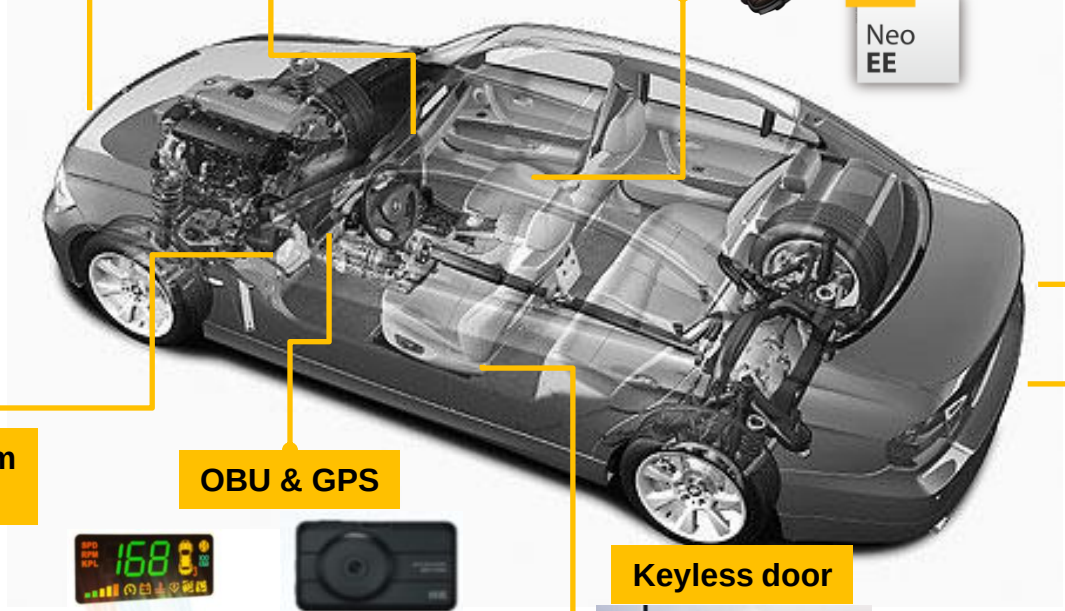
Sensor system

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

Auto parking system



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



Blind Spot Warning System
Cockpit System

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

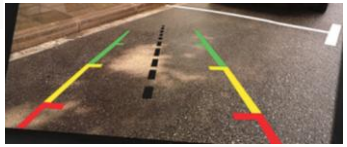
OBU & GPS

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

Keyless door

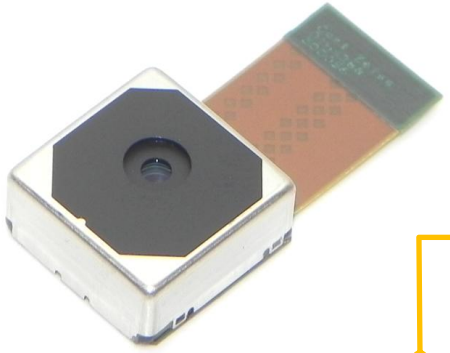
Neo **Bit** Neo **EE**

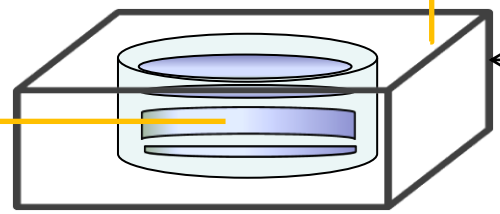
Rear view system

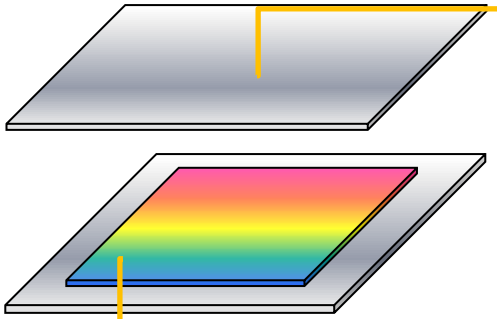


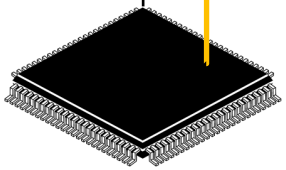
Neo **Bit** Neo **Fuse**

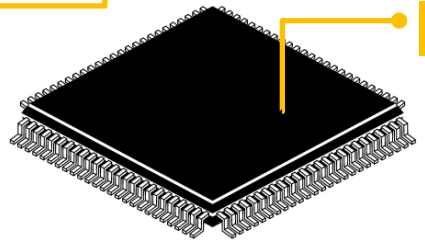
Imager Module with eMemory IPs











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

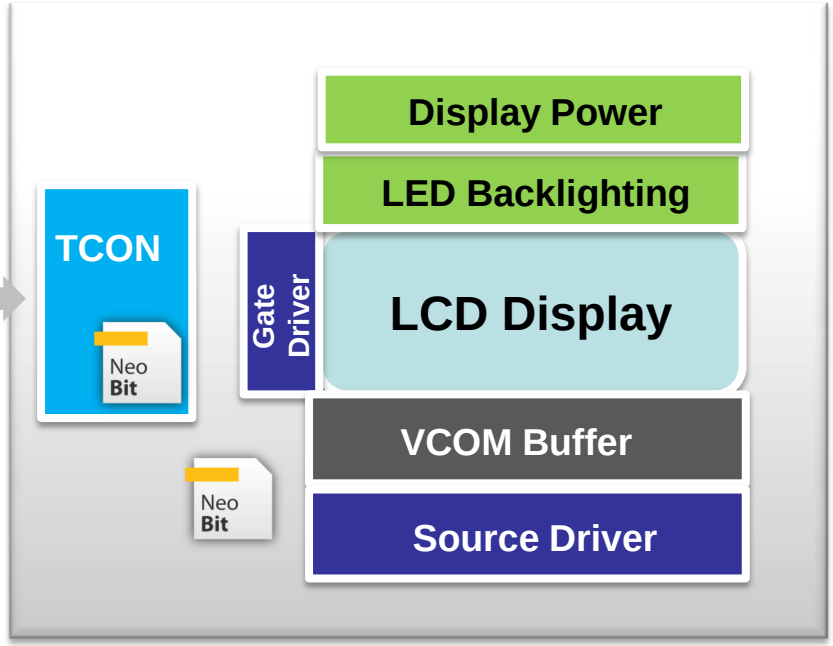
Neo MTP

先進液晶顯示驅動晶片

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

I/F
(LVDS, MIPI,…)

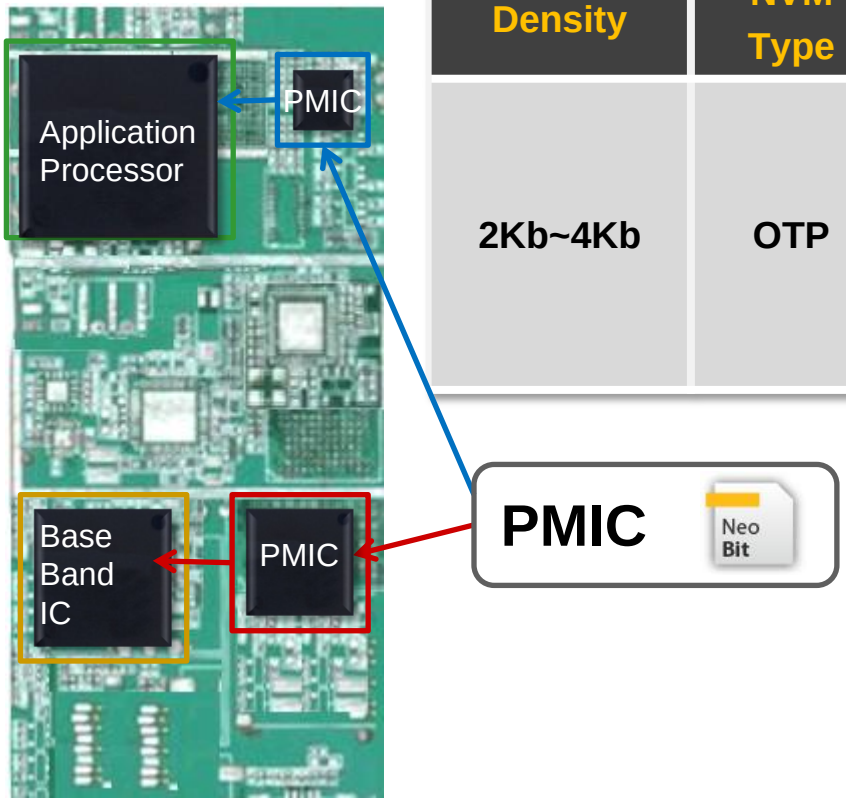
DDI



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

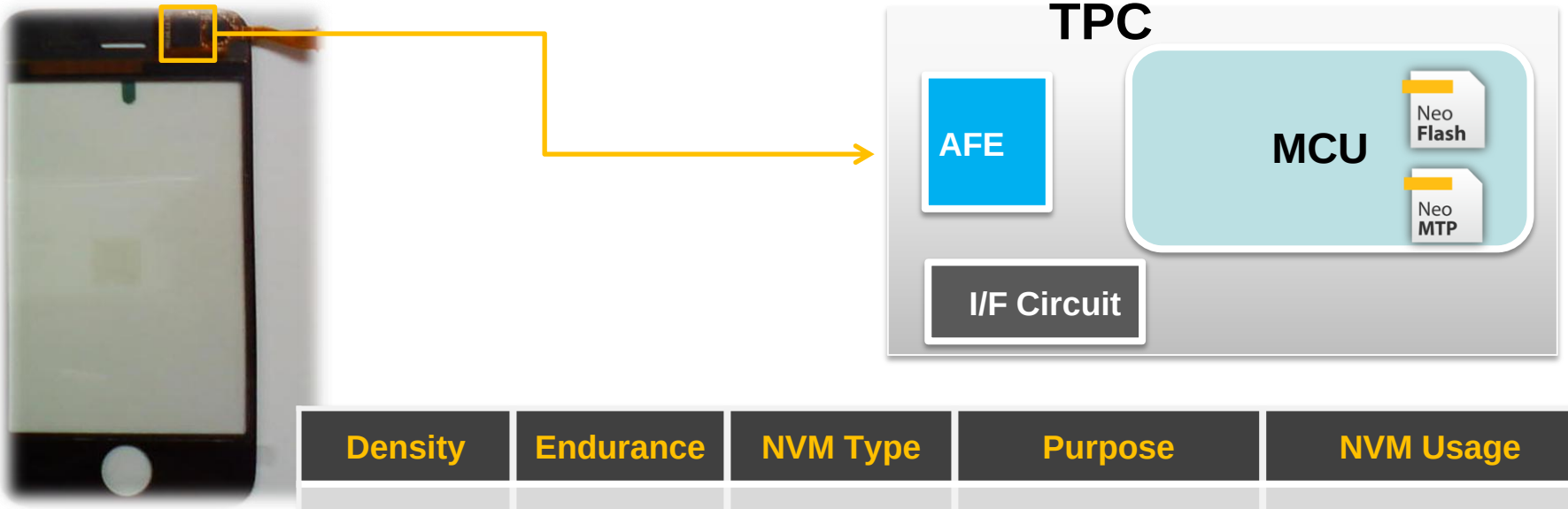
Process Technology : Advanced 0.25um BCD/ 0.18um BCD/ 0.13um BCD
Mature 0.18um/0.16um/0.152um Logic



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

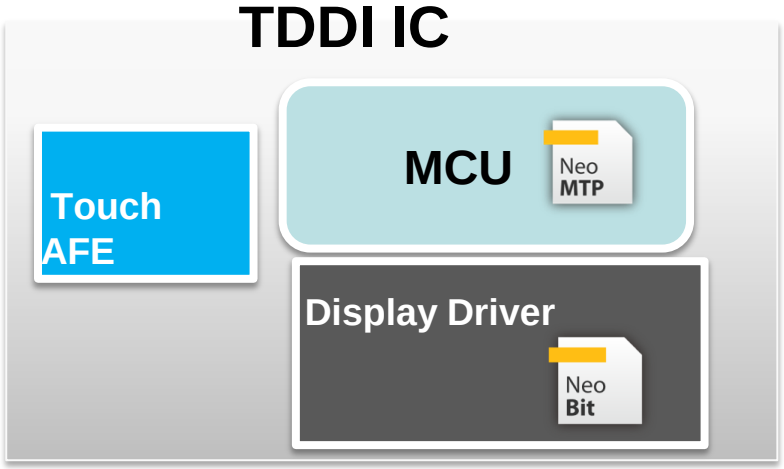
Process Technology : 0.16um HV/0.11um G



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

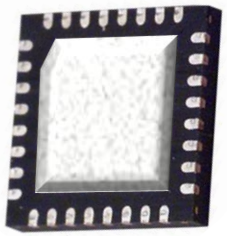
Process Technology : 0.11um HV/80nm HV/55nm HV

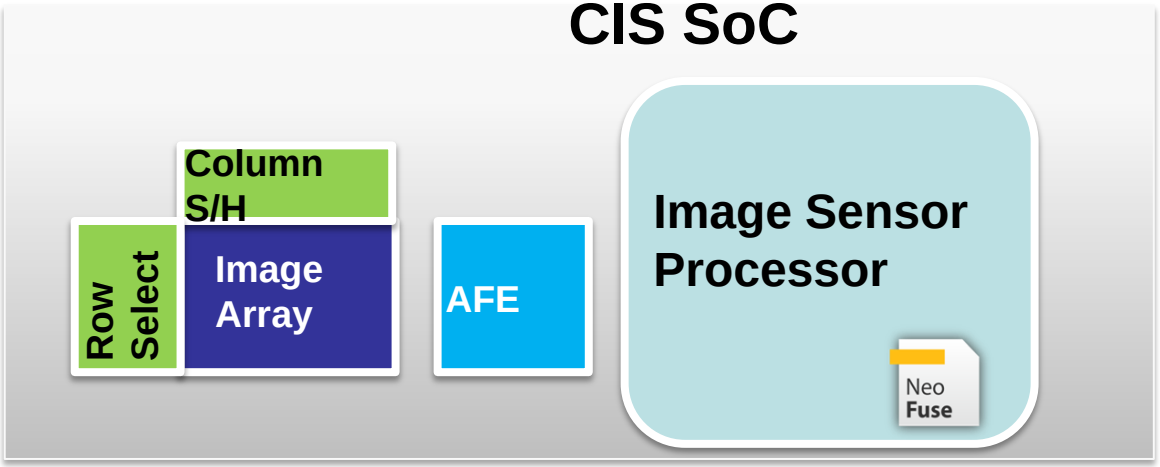


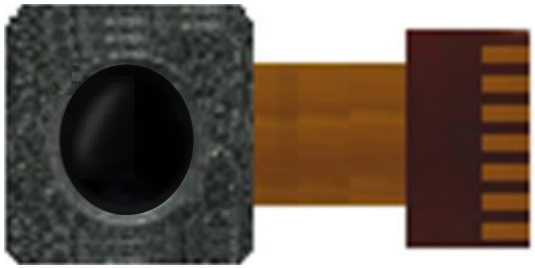
Density	Endurance	NVM Type	Purpose	NVM Usage
2K8~4K8	1	OTP	Trimming	Accuracy
			Code Storage	Gamma Table
16K8~32K8	<1000	MTP	Code Storage	Touch F/W Code
			Parameter setting	Performance Optimization

CMOS 影像感測器

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



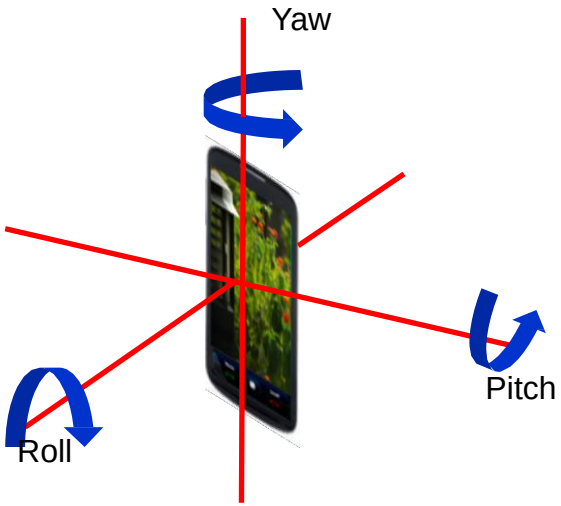


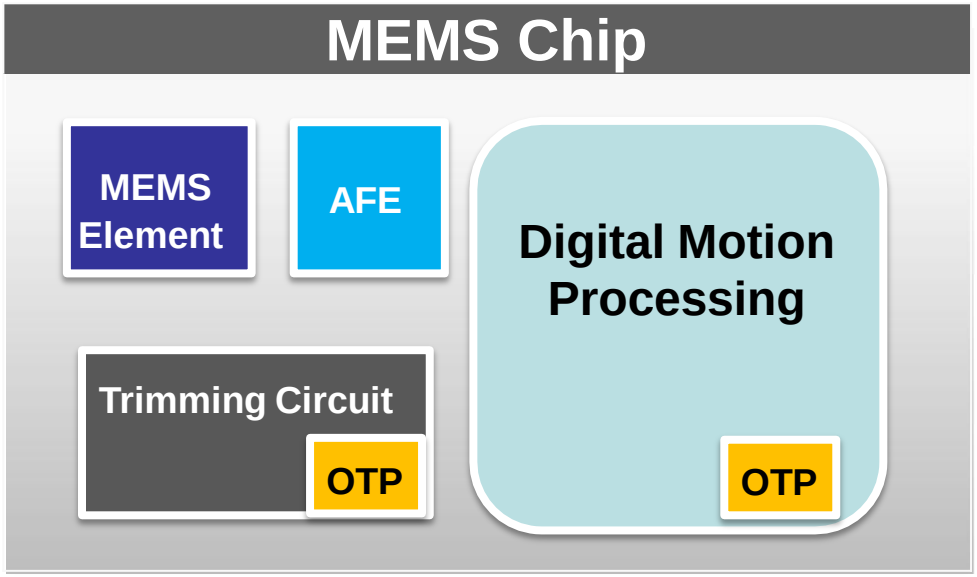


Density	Endurance	NVM Type	Purpose	NVM Usage
2Kb~4Kb	1	OTP	Identification Setting	Product Code
			Parameter Setting	Start-up Initial Setting
32K8	1	OTP/ROM	Code Storage	Boot Load

微機電系統(MEMS)

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





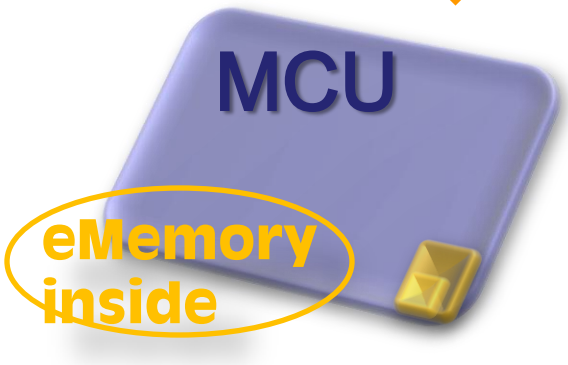
Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	Factory trimming
		Parameter Setting	Signal filtering
		Code Storage	Geometric computation

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

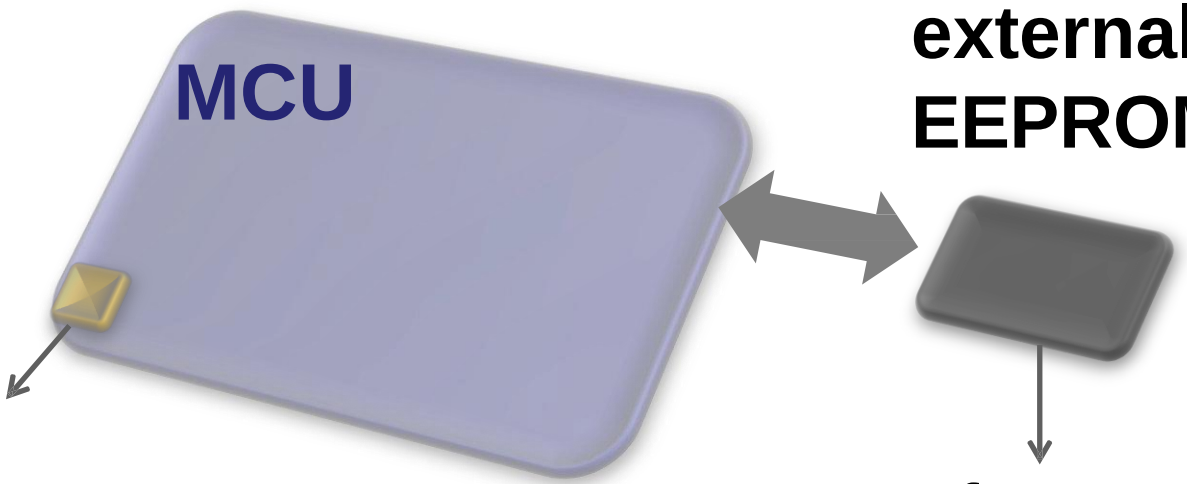
30% more cost reduction

wafer cost & testing time



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

EEPROM應用於MCU

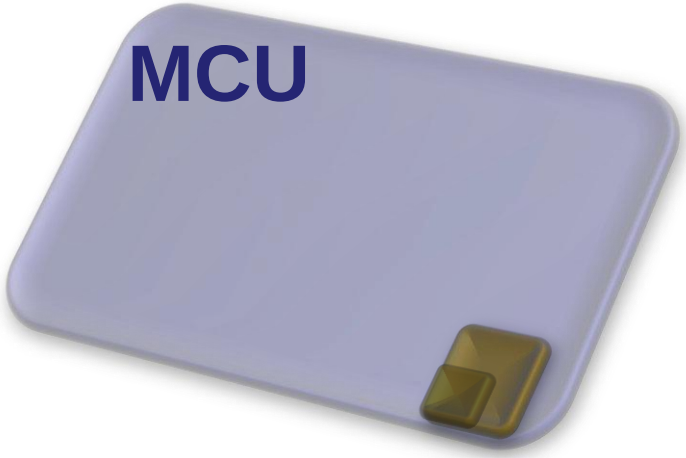


One-time storage for ID, trimming, encryption…

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	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

- 預期第四季將會比第三季好，明年成長動能加速。
- PMIC部分，有三個主要因素會繼續維持成長動能。
  - 美國最大PMIC客戶商務模式改變，將在明年下半年度有量產貢獻。
  - 現有客戶產品線持續增加。
  - 美國另外一家大公司也成為我們的新客戶，並已有產品推出。
- DDI部分，TDDI將帶動整體權利金成長，主要因爲在DDI加入touch之功能，所以chip size變大，而且是在55nm的製程，晶圓ASP及每顆權利金收入大幅成長，客戶主要供應中國和韓國手機，因為滲透率及ASP提高，預計明年TDDI大幅成長。

未來展望

- **Fingerprint sensor部分，今年下半年客戶開始導入量產，預計明年會有倍數成長，下一代CIS製程的fingerprint ,已經有一家中國和一家美國公司taped-out, 預計2017年量產。**
- **在28奈米之應用，目前攻入DTV之客戶已開始加速量產，另外兩家客戶預計在2017年導入量產。**
- **在CIS的應用，經過幾年的努力，已看到成長，客戶量產規模已開始增溫。**
- **在OLED Driver方面的應用，已有韓國最大面板的供應商taped-out產品，而且我們也持續增加在各大代工廠的平台開發。**

未來展望

- 16奈米Security的相關應用已有一個客戶準備要tape-out。
- 10奈米FinFet的第一個IP驗證成功，已有客戶洽談規格。
- 7奈米的開發計畫已開始進行。
- 加密應用相關的新技術NeoPUF，已於10月份taped-out 55奈米IP。
- 持續開發車用電子相關之技術平台，客戶持續量產中。
- MTP的技術在USB type-c的應用需求持續增溫。

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