

# ememory

**A Leading Logic NVM  
Company**

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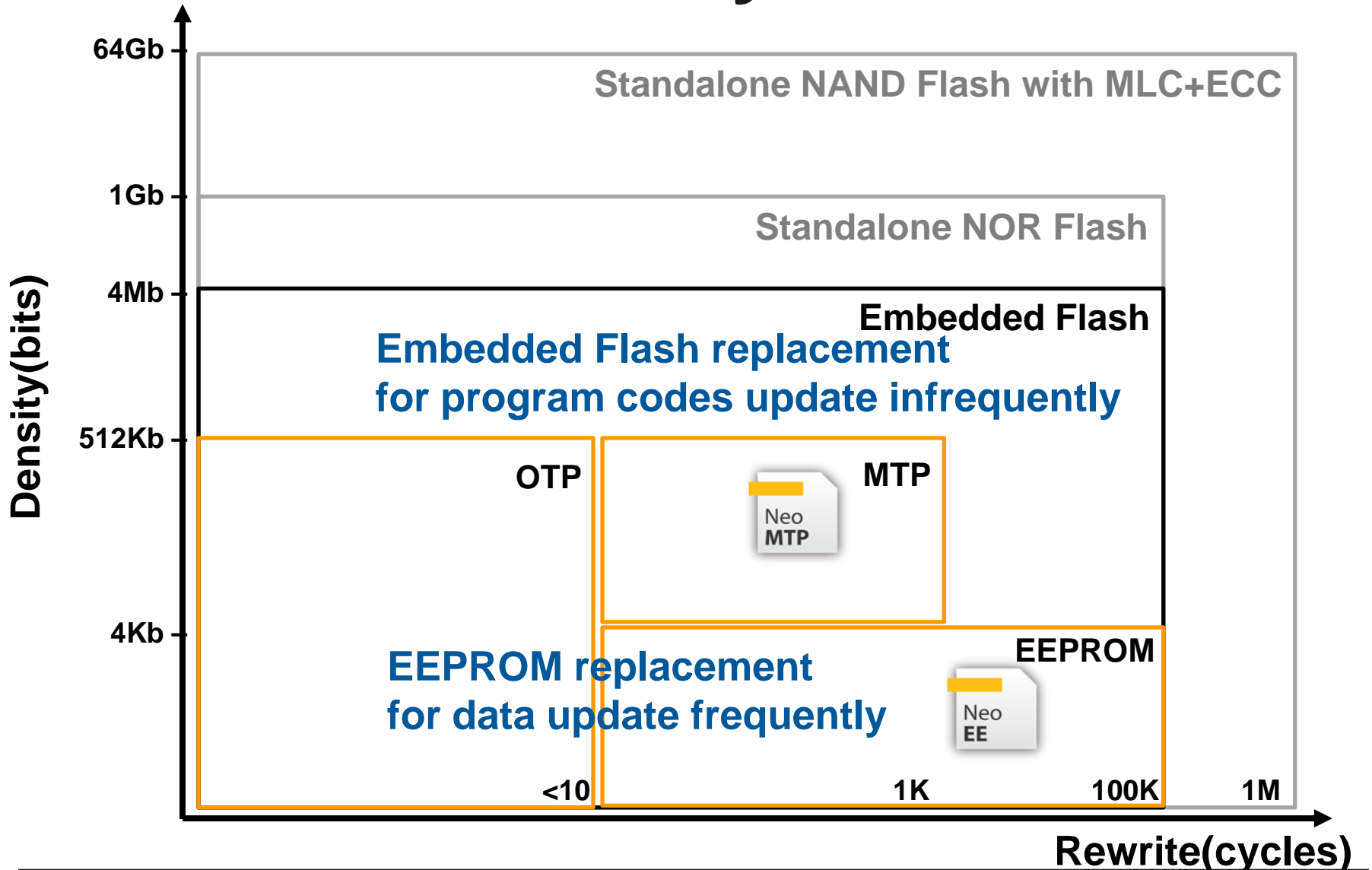
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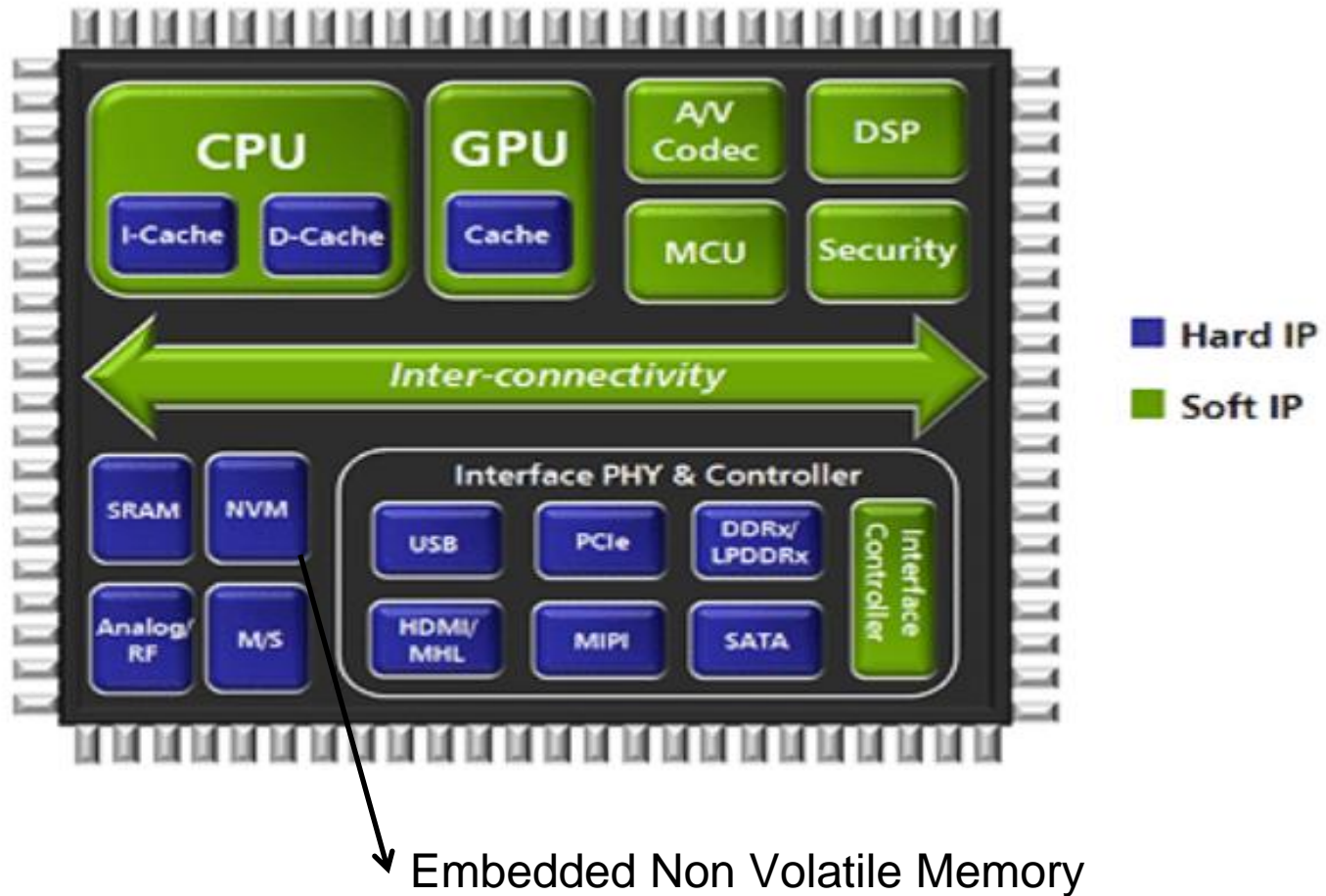
# Outline

- **Business Model**
- **Review of Operations**
- **Growth Opportunity and Future Outlook**
- **Q & A**

# Nonvolatile Memory Classifications



# SOC Block Diagram



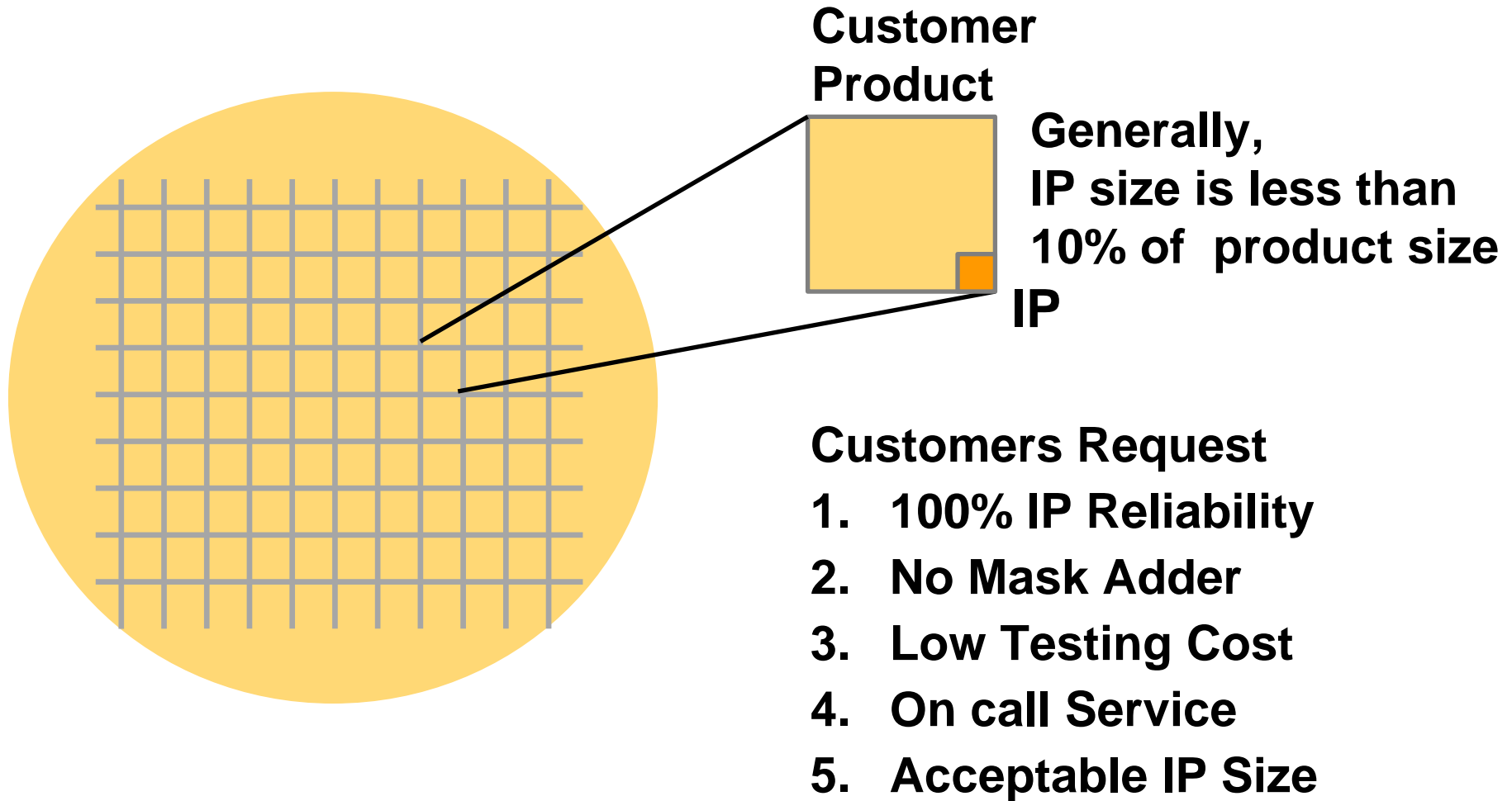
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# Embedded NVM Technologies

	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

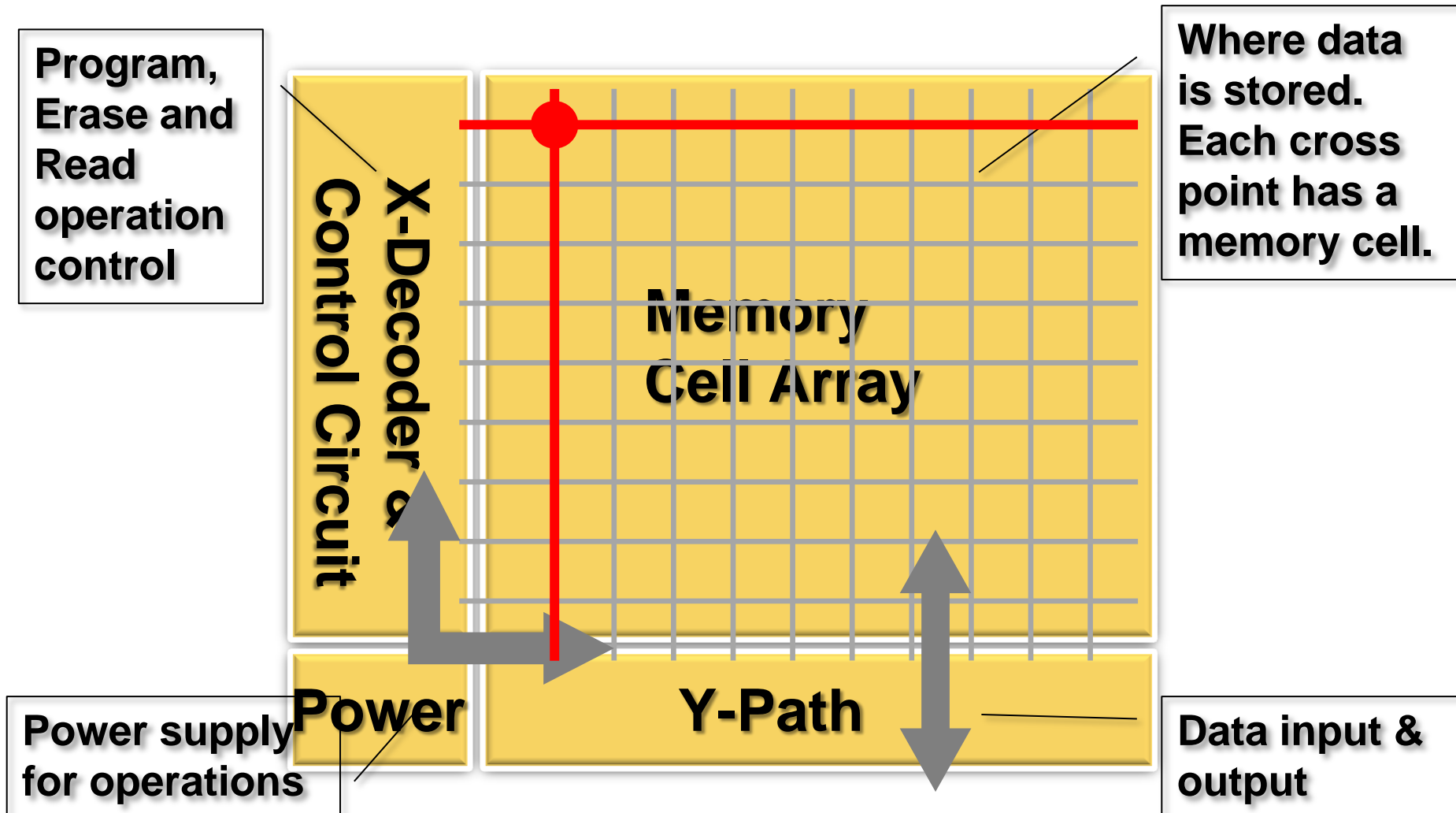
- ROM not programmable, eFuse cannot scale beyond 16Kb, embedded flash expensive and cannot scale after 40 nm
- eMemory's IPs: OTP (antifuse, floating gate) and MTP (floating gate)

# Considerations for IP Adoption

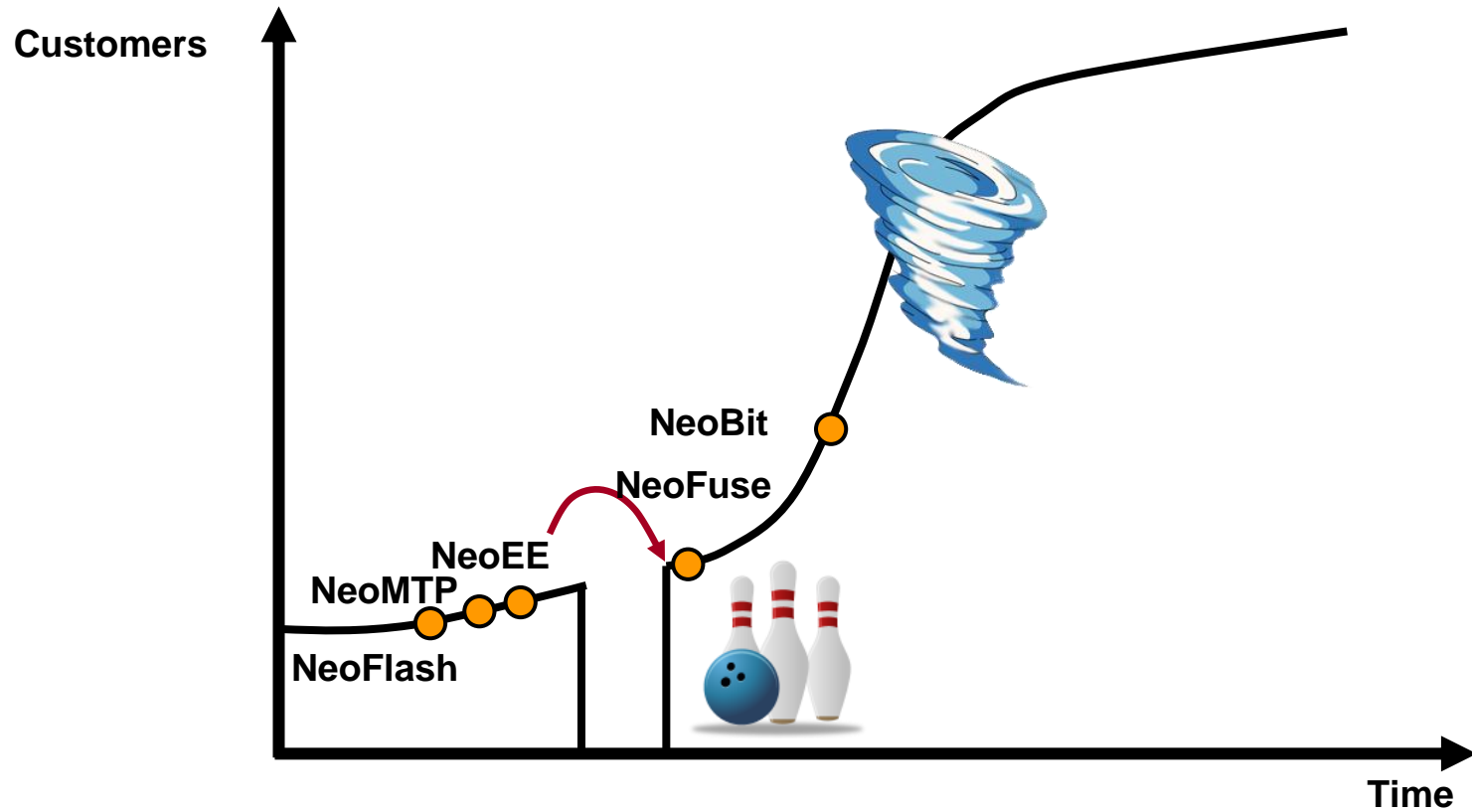




# Inside Nonvolatile Memory IP

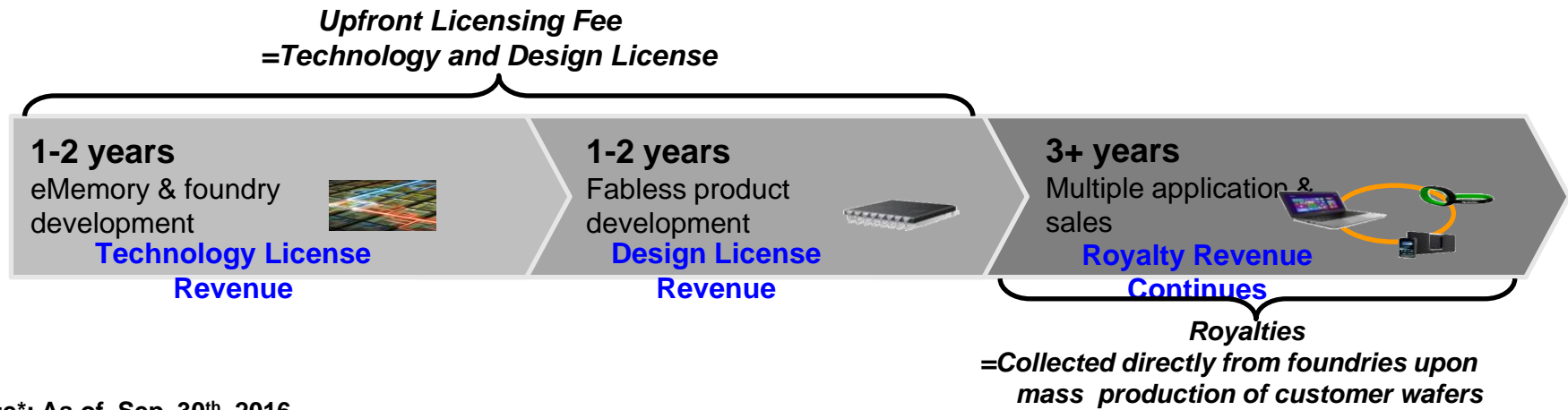


# Crossing the Chasm



# Business Model

- Founded in 2000. First customer engaged in 2002. Achieved profitability in 2005 and IPO in 2011. The largest logic non-volatile memory IP company, 230 employees (160 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 Sep. 30<sup>th</sup>, 2016

# Worldwide Customers



## Foundry



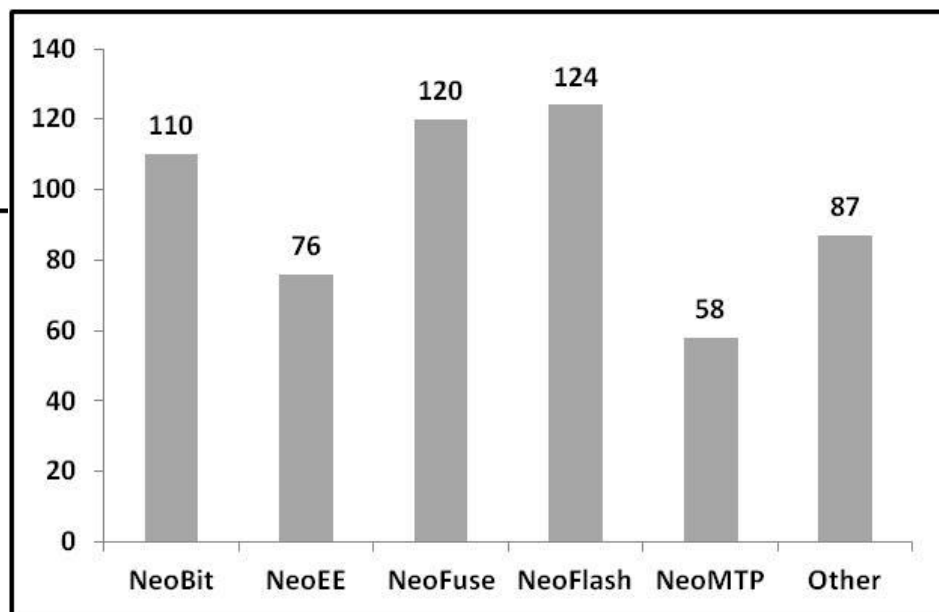
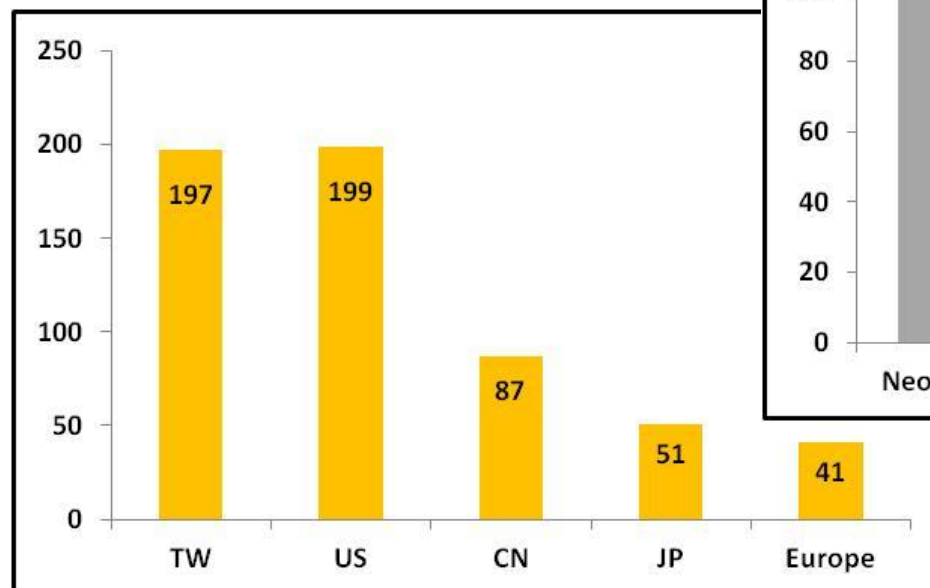
## IDM



	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

# Patent Portfolio

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

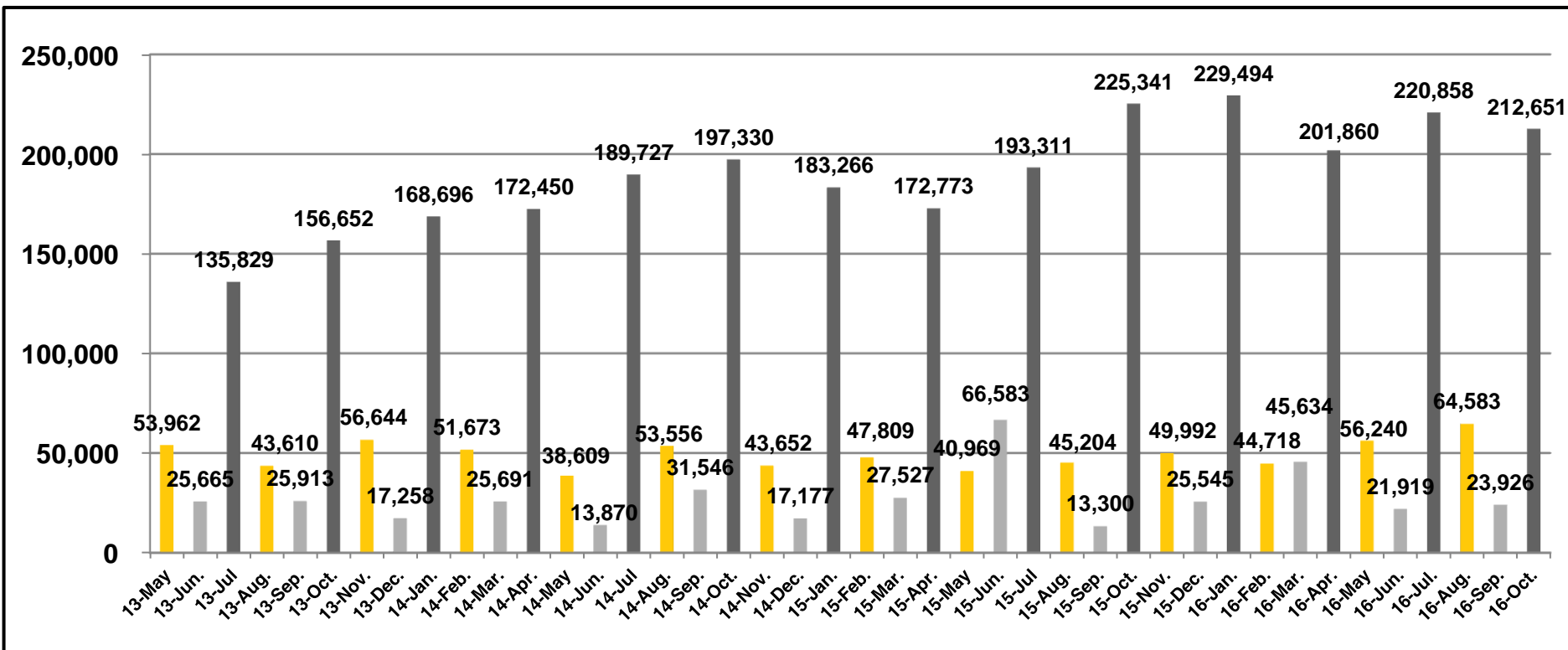


Note\*: As of Sep. 30<sup>th</sup>, 2016

# Quarterly Revenue Pattern

- 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



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# Q3 Revenue Breakdown

Unit: NTD thousands

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

Unit: Number of contracts

		Q3 2016	Q2 2016	2015	2014
Technology Licenses		6	14	28	21
Design Licenses	NRE	18	14	57	82
	Usage	81	94	349	363



# Financial Income Statement

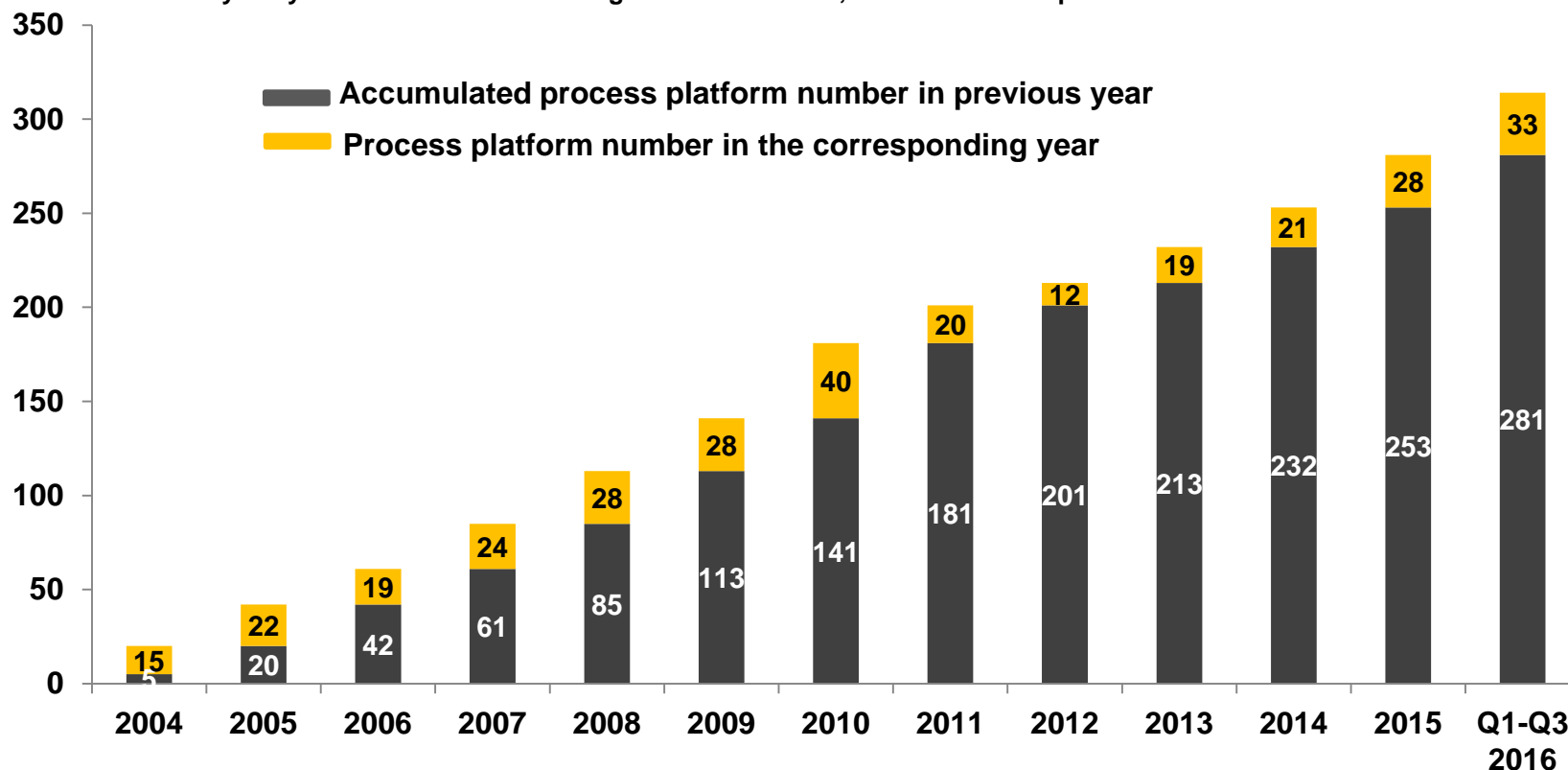
(Unit: NTD thousands)	Q3 2016	Q2 2016	% change	Q3 2015	% change
Revenue	309,367	280,019	10.5%	251,815	22.9%
Gross Margin	100%	100%	-	100%	-
Operating Expenses	173,605	163,276	6.3%	143,776	20.7%
Operating Margin	43.9%	41.7%	2.2ppts	42.9%	1.0ppts
Net Income	130,299	106,245	22.6%	106,301	22.6%
Net Margin	42.1%	37.9%	4.2ppts	42.2%	-0.1ppts
EPS (Unit: NTD)	1.72	1.40	22.9%	1.40	22.9%
ROE	28.9%	24.5%	4.4ppts	24.5%	4.4ppts

# Technology License

Unit: Number of contract

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

Note: The 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.



# Current Technology Development Platforms

- 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	-

# Current Technology Development Platforms

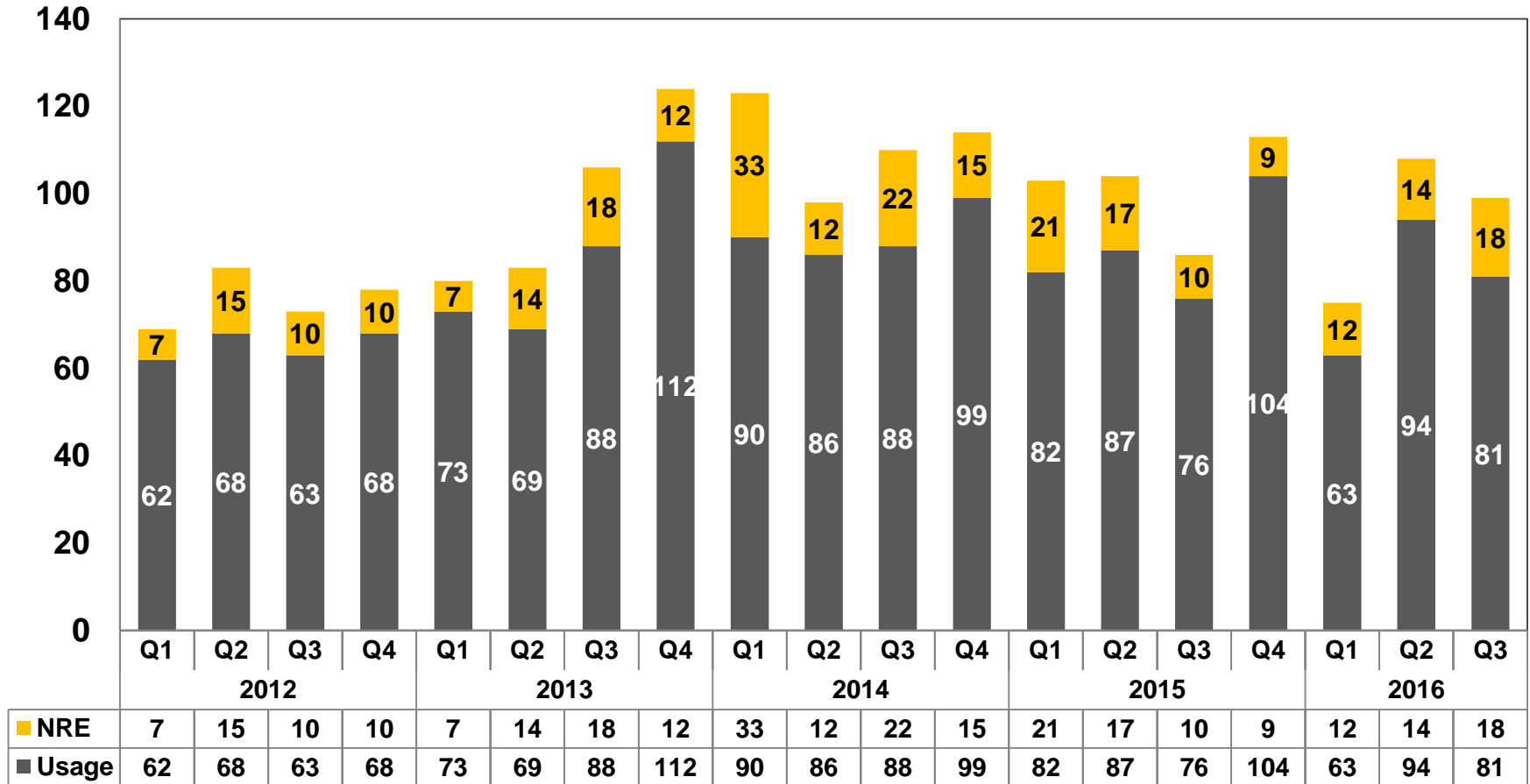
12" Fabs	Production	Development	NVM Type	Process Type
7/10nm	0	2	OTP	FF
14/16nm	1	3	OTP	FF+
28nm	5	9	OTP	LP/HPM, HLP/HPM, LPS
40nm	4	6	OTP, MTP	HV-DDI, LP
55/65nm	12	14	OTP, MTP, Flash	LP, HV-DDI, HV-OLED, DRAM, CIS
80/90nm	6	7	OTP, MTP	HV-DDI, HV-OLED, LP
0.13/0.11um	6	3	OTP, Flash	HV-DDI, BCD, Generic
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\*: As of Sep. 30<sup>th</sup>, 2016

# Quarterly Design Licensing (New Tape Out)

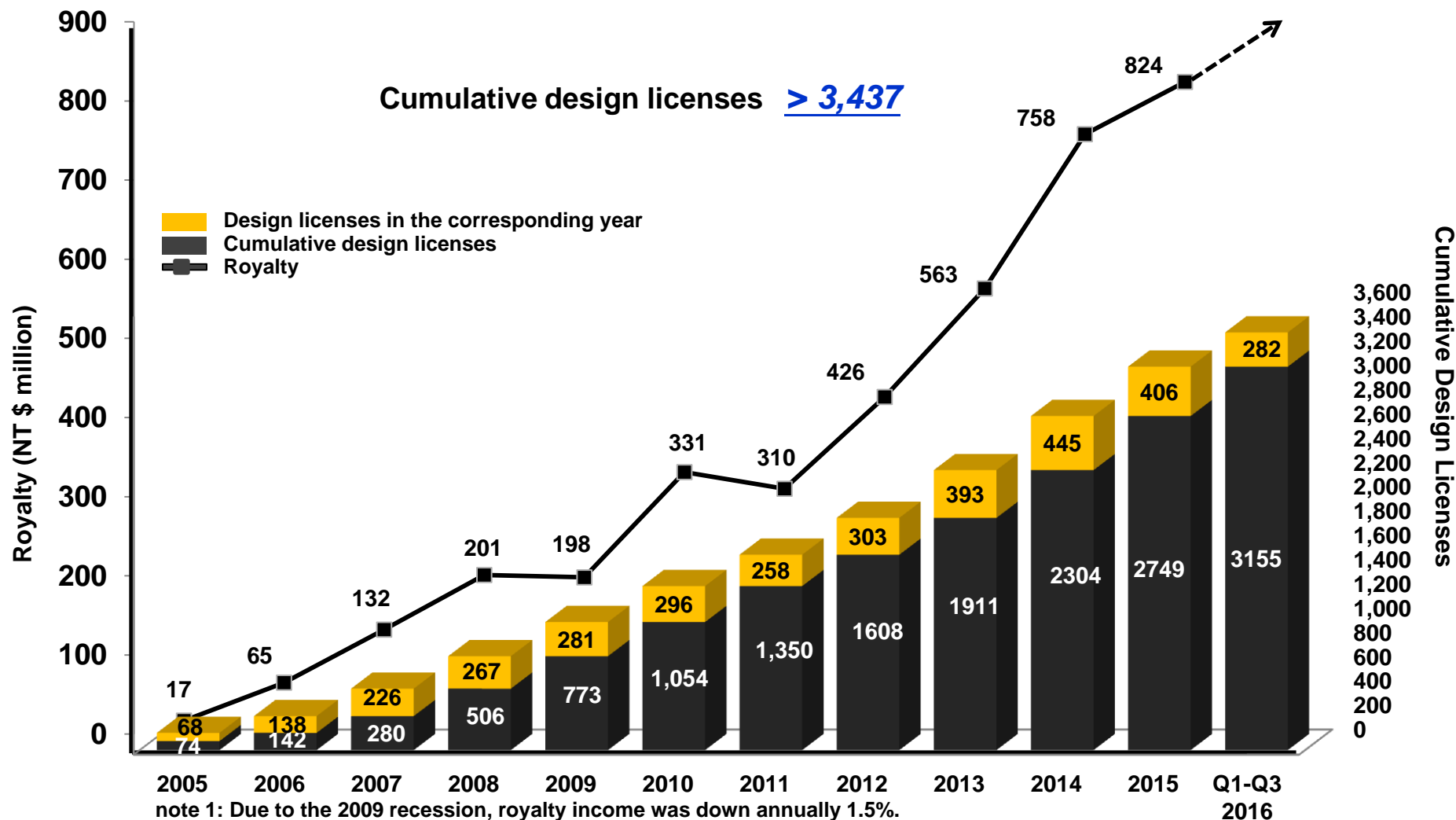
- Total **282** NTO as of Q1-Q3 2016( **406**@2015,**445**@2014, **393**@2013, **303**@2012)



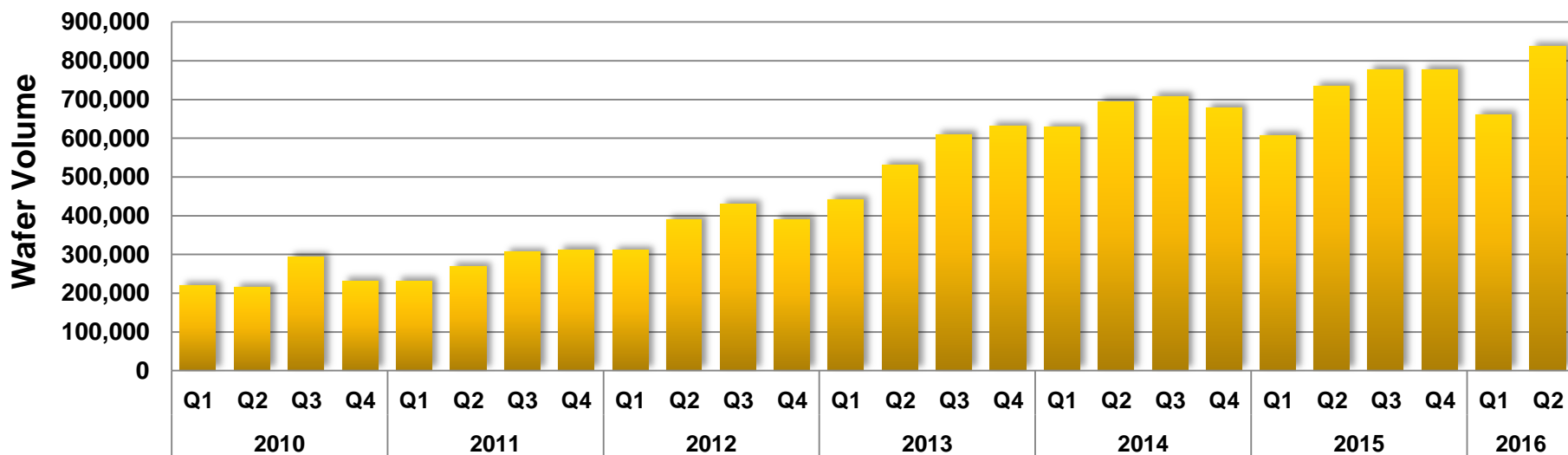
Note\*: As the applications of MCU at several foundries have gradually entered mass production, and the business model of the main foundry partner which provides green process has shifted to — eMemory licenses IP cell to the foundry for it to provide direct design service to customers — as the result, the new tape out number of MCU has been affected, but the royalty coming from IP cell usage continues to roll in.

In summary, even the new tape out number of MCU is lower than before; the corresponding wafer output and royalty continue to grow.

# Cumulative Licenses Drive Future Royalties



# Wafer Production Volume



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 customer royalty recognition to 2017 Q1.

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# eMemory's NVM Technologies

- **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

# Applications by Technology

12"

8"

7nm	10nm	16nm	28nm	40nm	55/65nm	80/90nm	110/130nm	160/180nm	250nm	350nm
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**NeoBit**

**NeoFuse**

**NeoFlash**

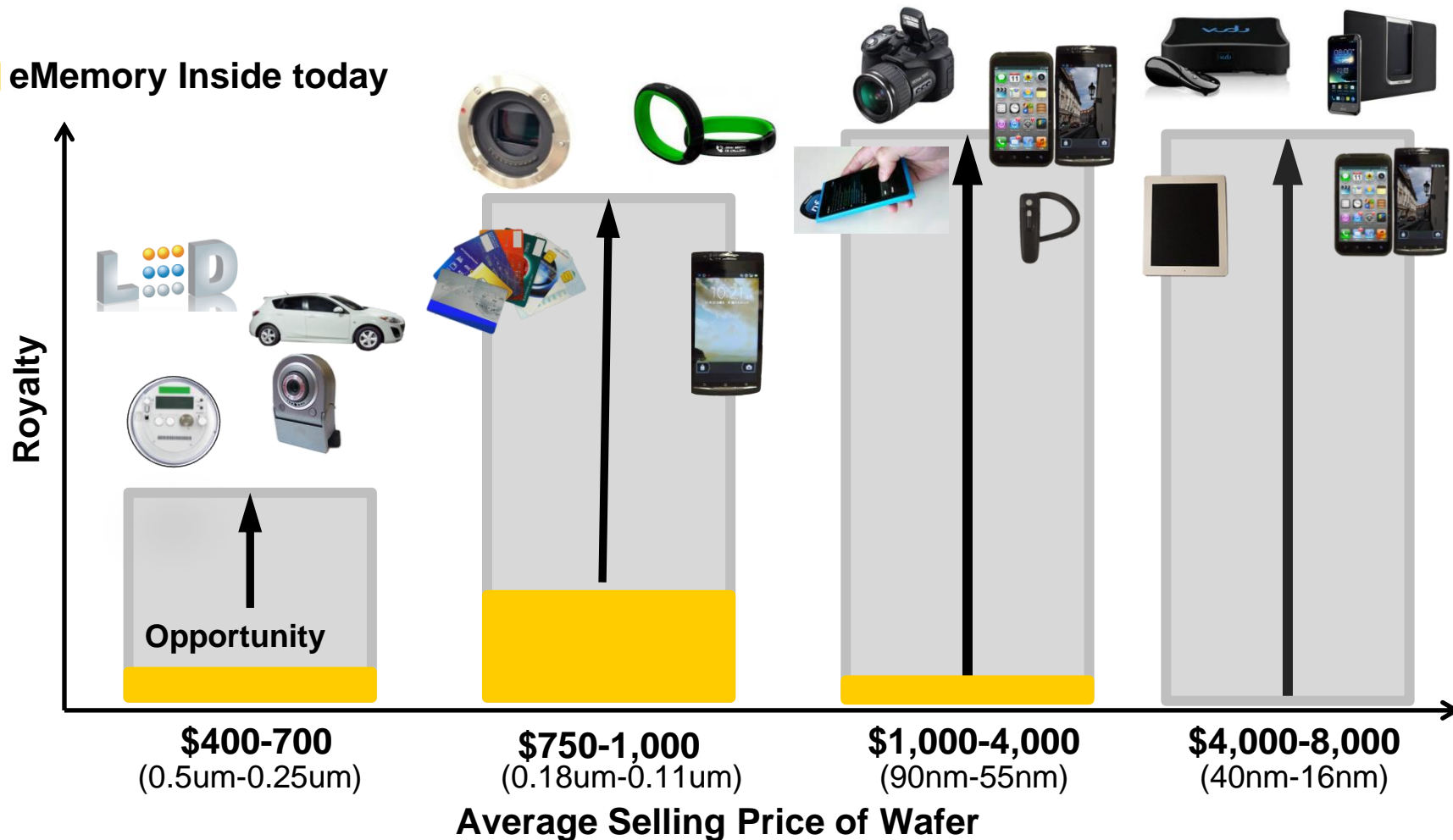
**NeoEE**

**NeoMTP**



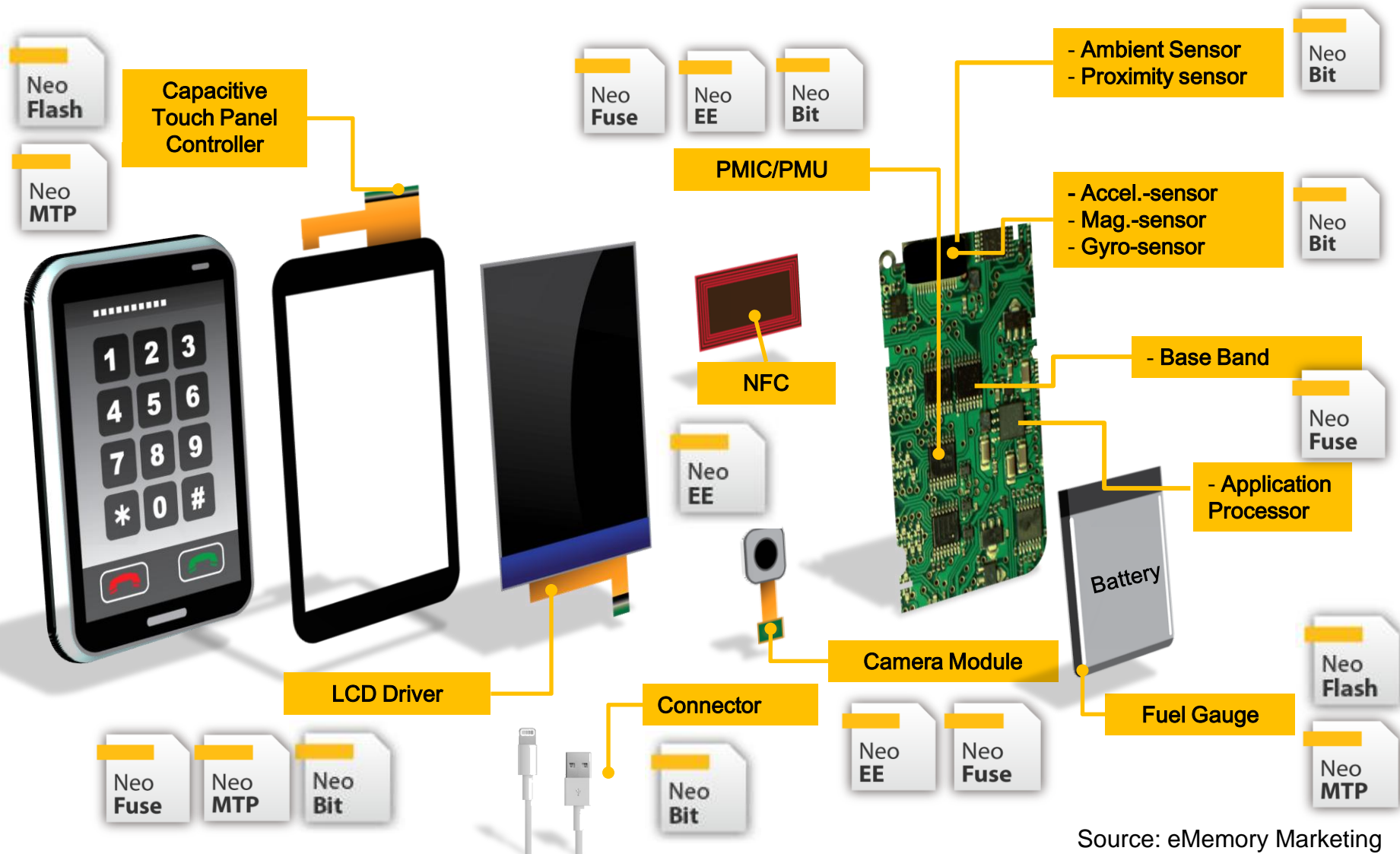
# Opportunity at all Price Points

 eMemory Inside today



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

# eMemory IP in Smart Phone



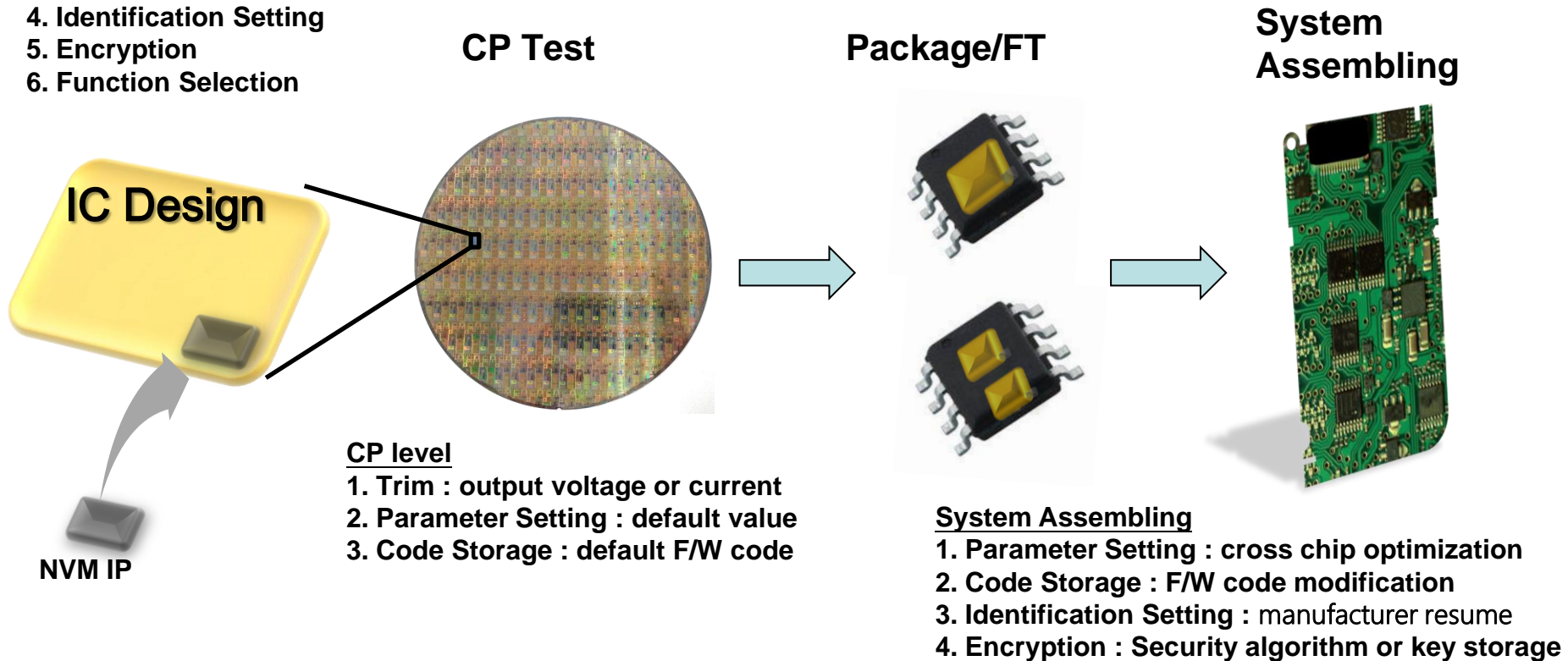
# Benefits from Using eMemory IPs

## 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



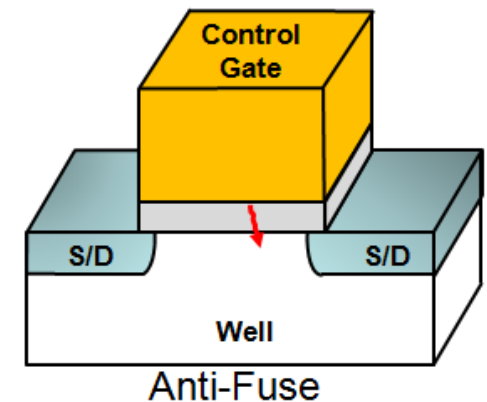
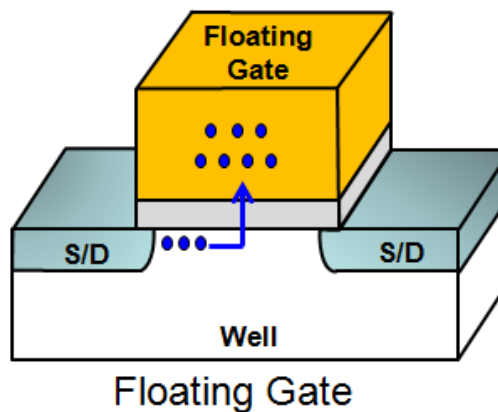
# Invisibility for Security

- 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





# Security & Protection

Authorized Product



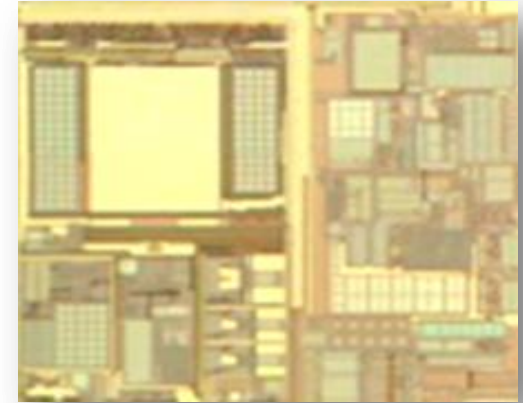
reverse  
copy

re-produce



without protection

Fake Product

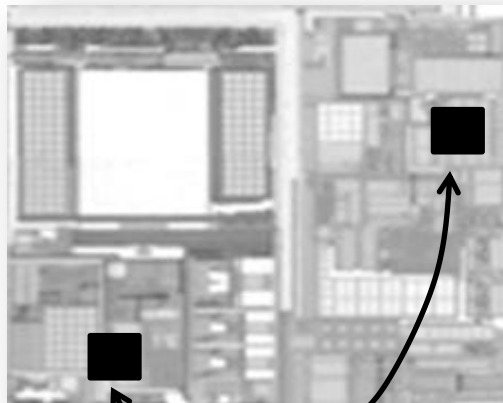


reverse  
copy

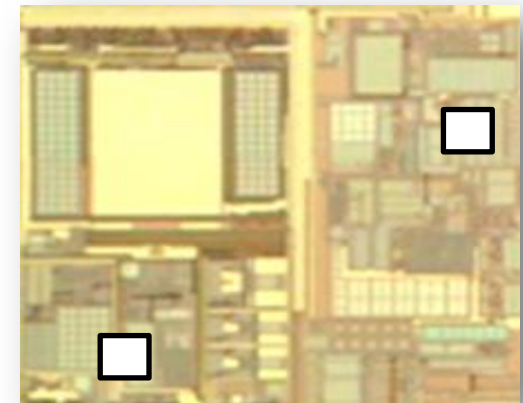
re-produce



with protection

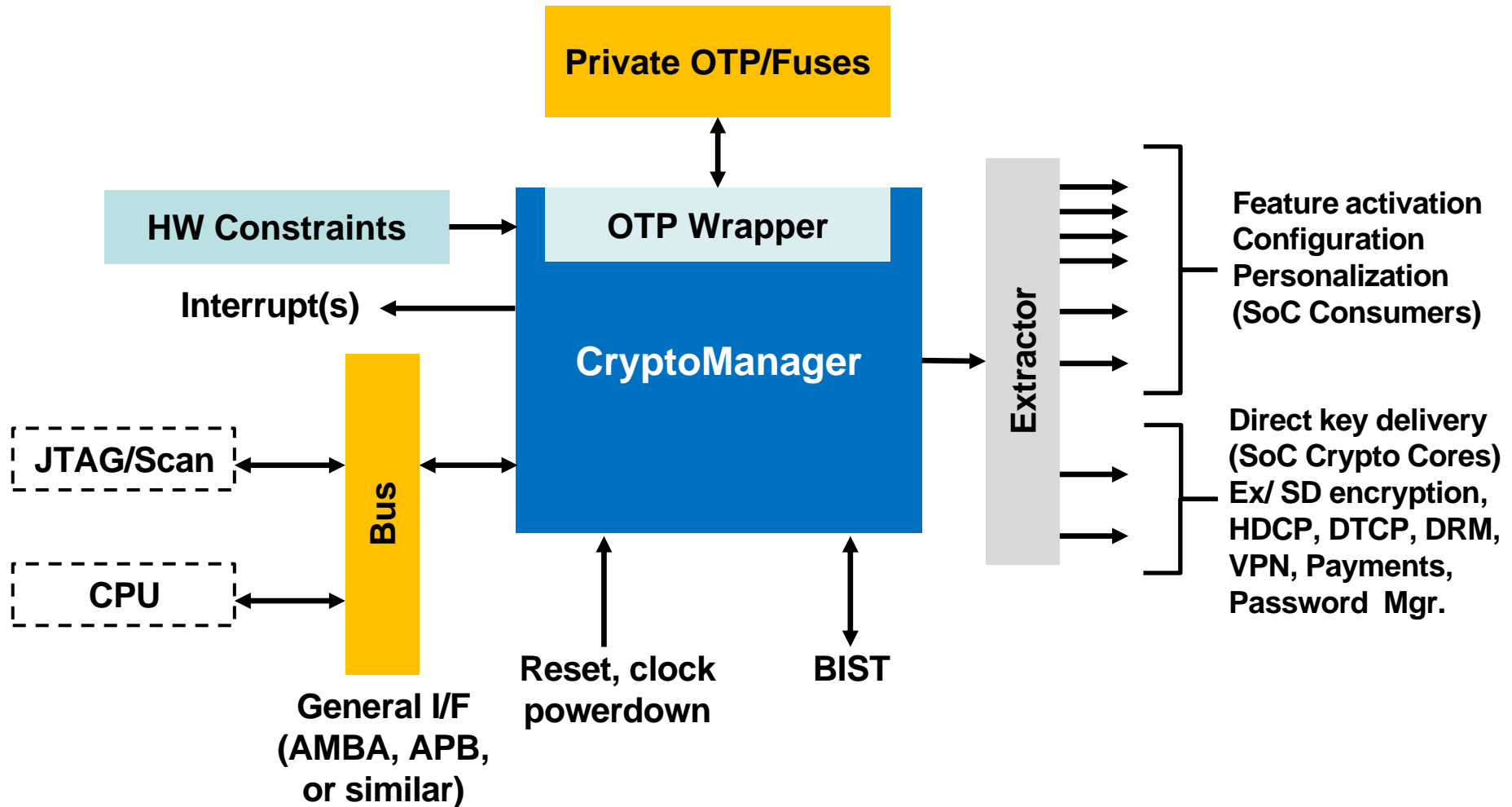


Security IP/Code by  
Authorized Use



Can NOT Work w/o  
Security IP/Code

# OTP for security storage



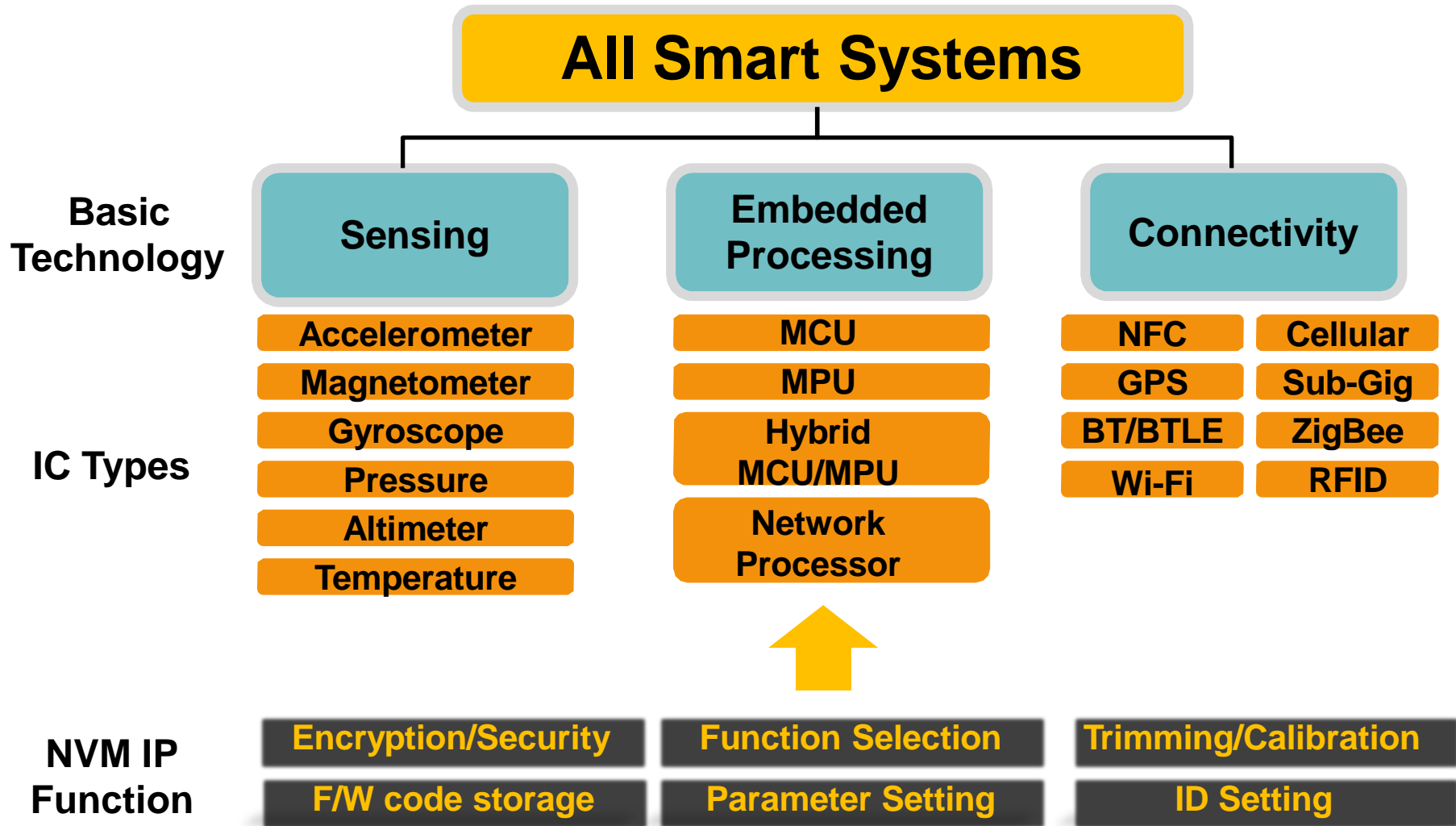
Source : Rambus crypto manager platform



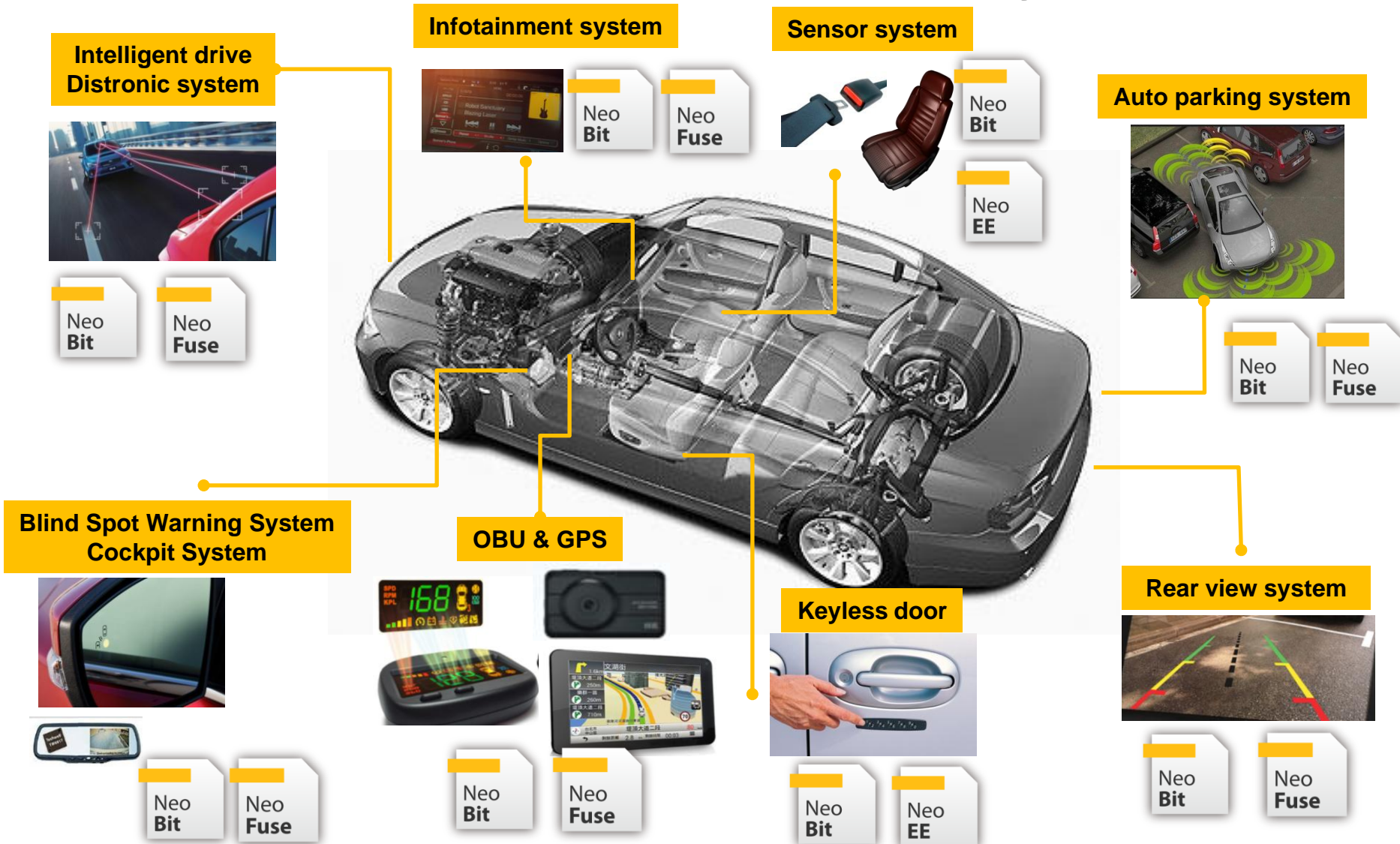
# Security with eMemory IPs



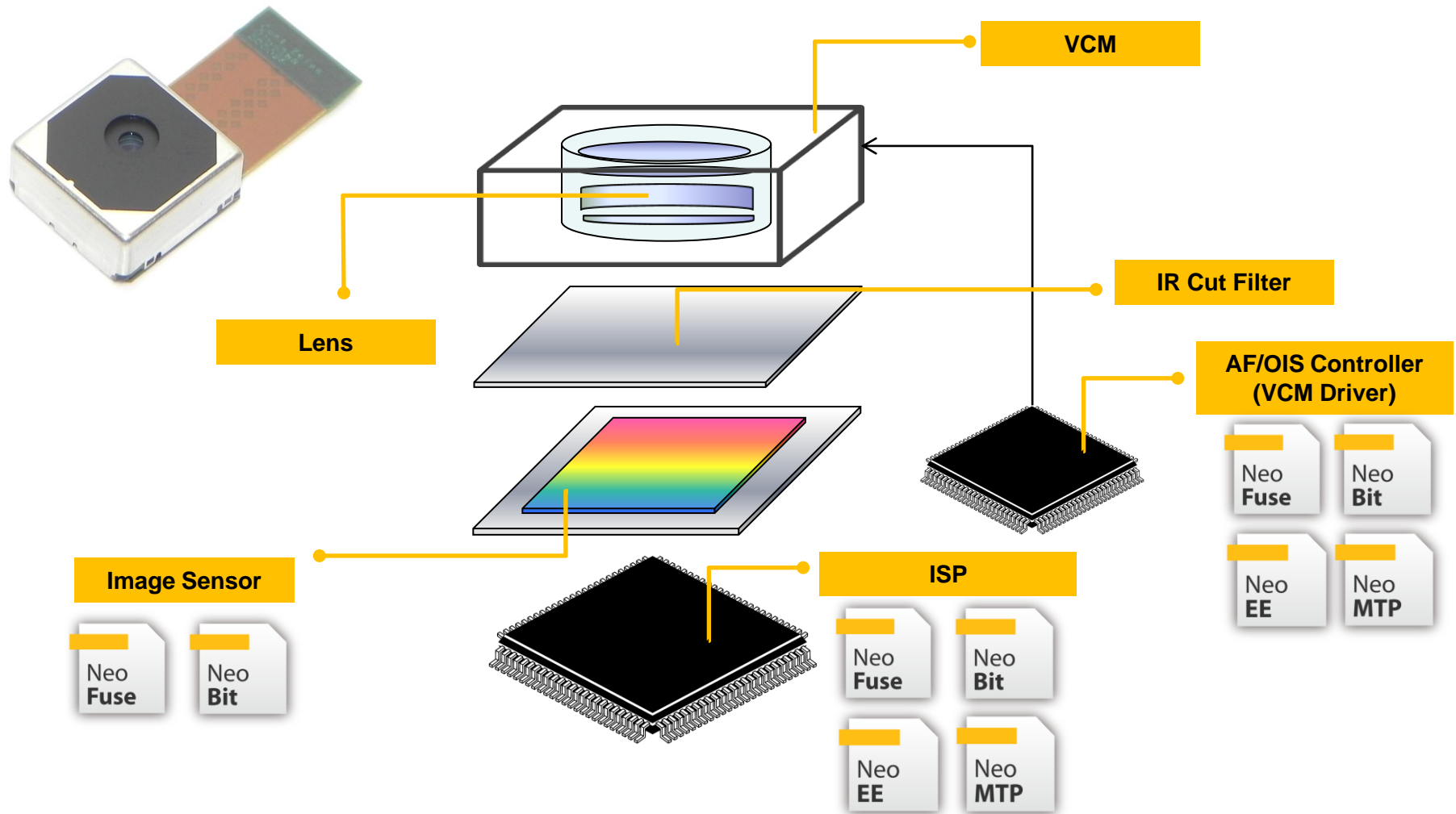
# NVM IP Demand in IoT



# Autotronics with eMemory IPs

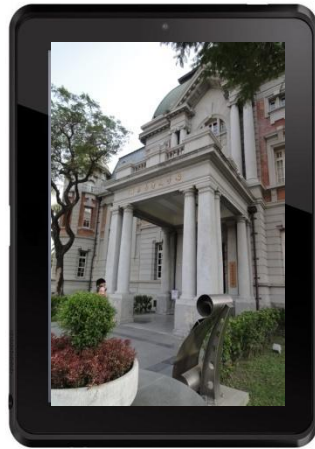


# Imager Module with eMemory IPs



# Advanced LCD Driver ICs

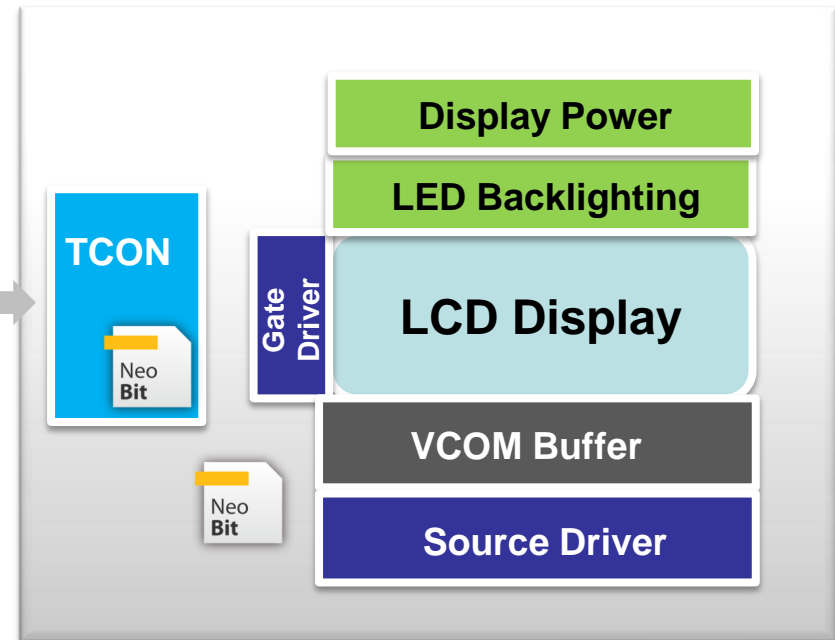
Process Technology : 0.11um HV/80nm HV/55nm HV



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



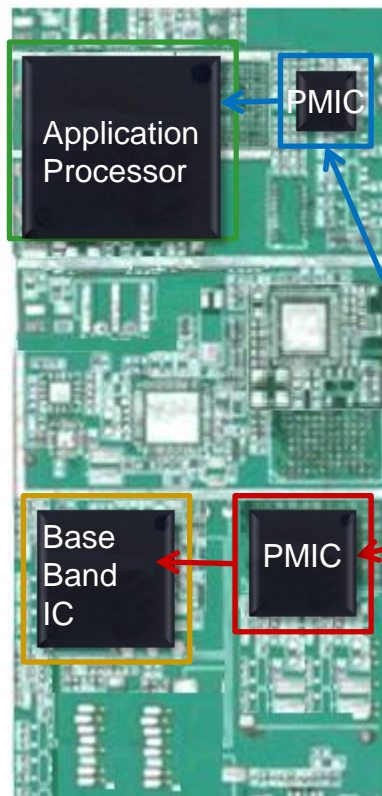
DDI



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

# Power Management ICs for Baseband and Application Processor

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

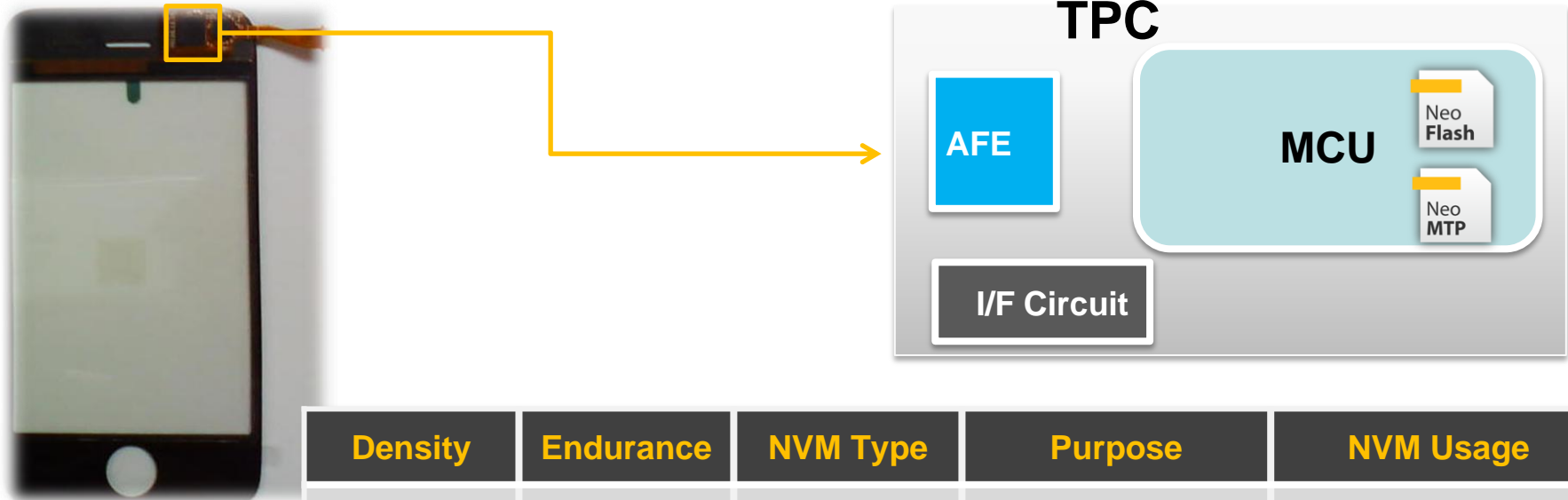


Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	DC/DC, Bandgap
		Parameter Setting	Design flexibility & Performance optimization
		Code Storage	Start-up behavior & smart power saving algorithm



# Touch Panel Controller ICs

Process Technology : 0.16um HV/0.11um G

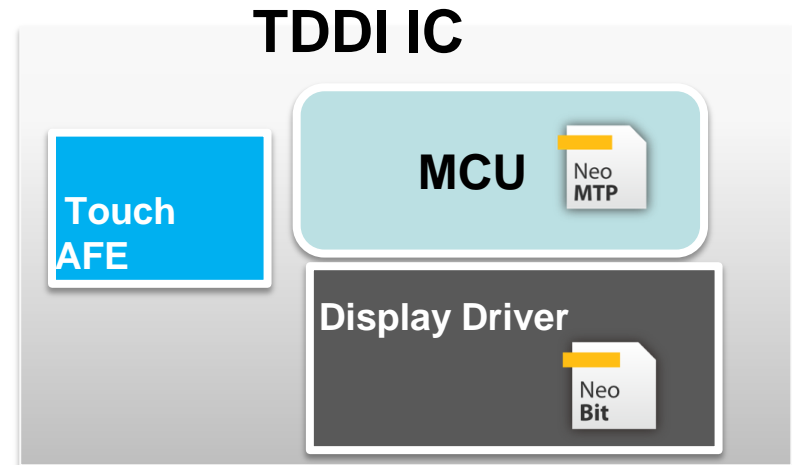
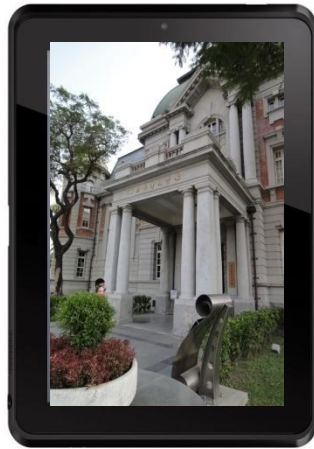


Density	Endurance	NVM Type	Purpose	NVM Usage
16K8~32K8	<1000	MTP	Code Storage	F/W code
			Parameter setting	Customized model and performance optimization



# In-Cell Touch Panel Controllers ICs

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

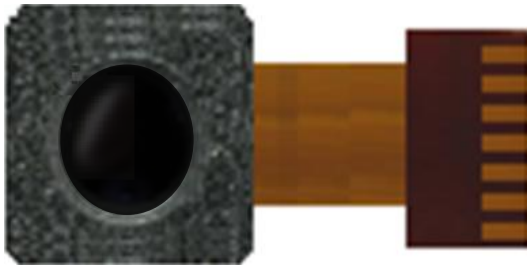
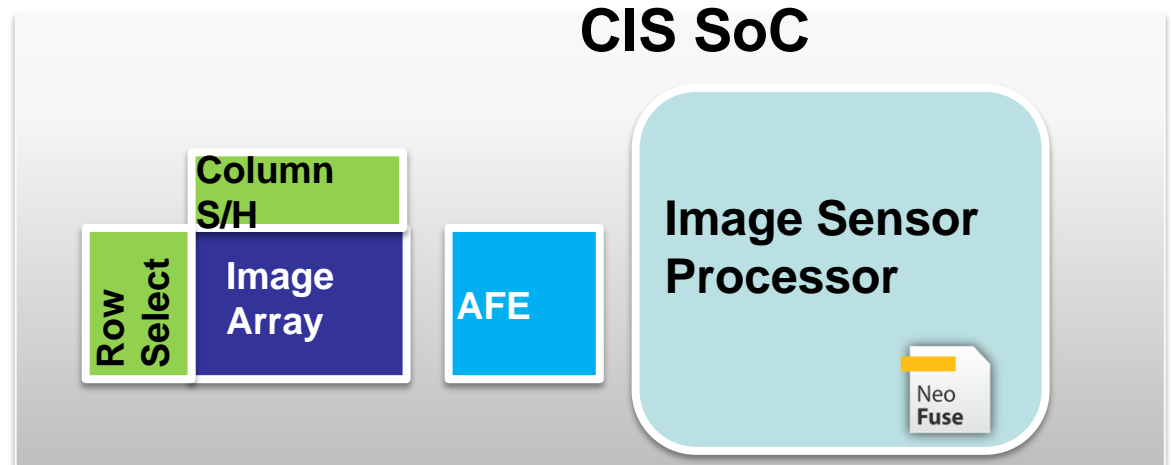
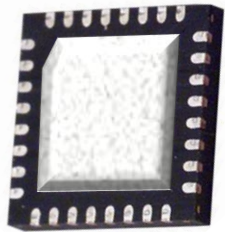


Density	Endurance	NVM Type	Purpose	NVM Usage
2K8~4K8	1	OTP	Trimming	Accuracy
			Code Storage	Gamma Table
16K8~32K8	<1000	MTP	Code Storage	Touch F/W Code
			Parameter setting	Performance Optimization



# CMOS Image Sensor

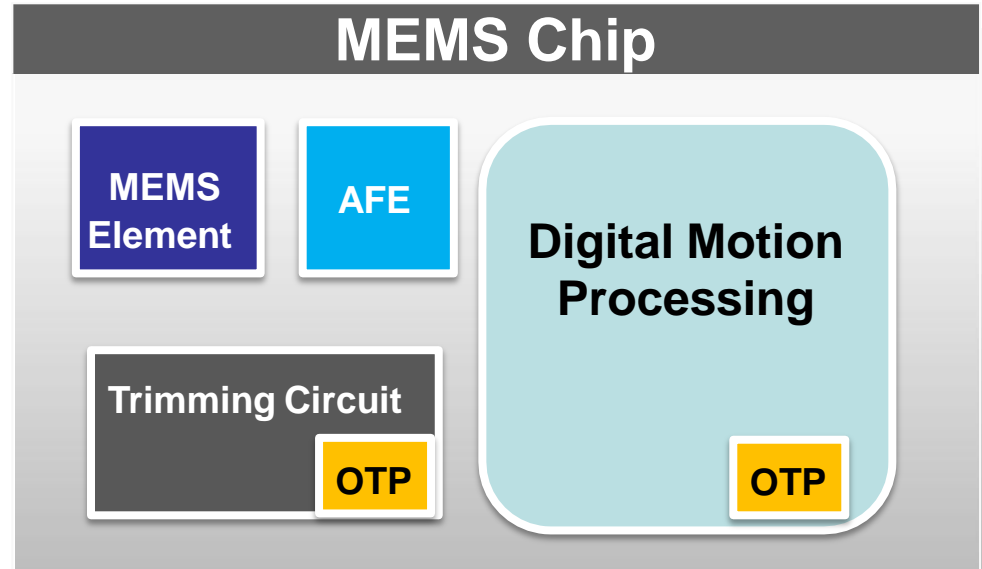
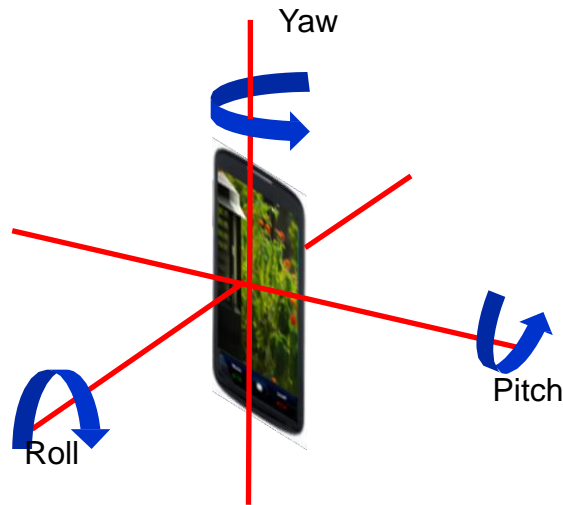
Process Technology : 0.11um CIS/90nm CIS/65nm CIS



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

# 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

# Replacement of Embedded Flash for Competitiveness Improvement

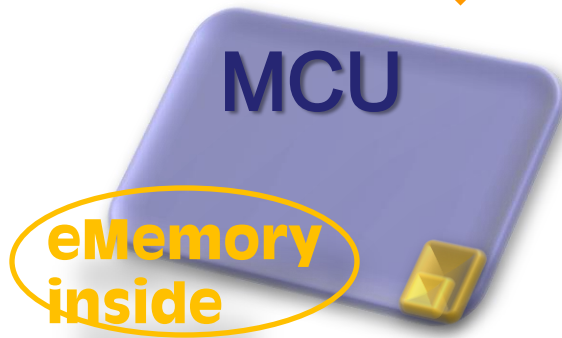


product design & manufacturing by  
embedded Flash  
Logic Process + 10 Masks



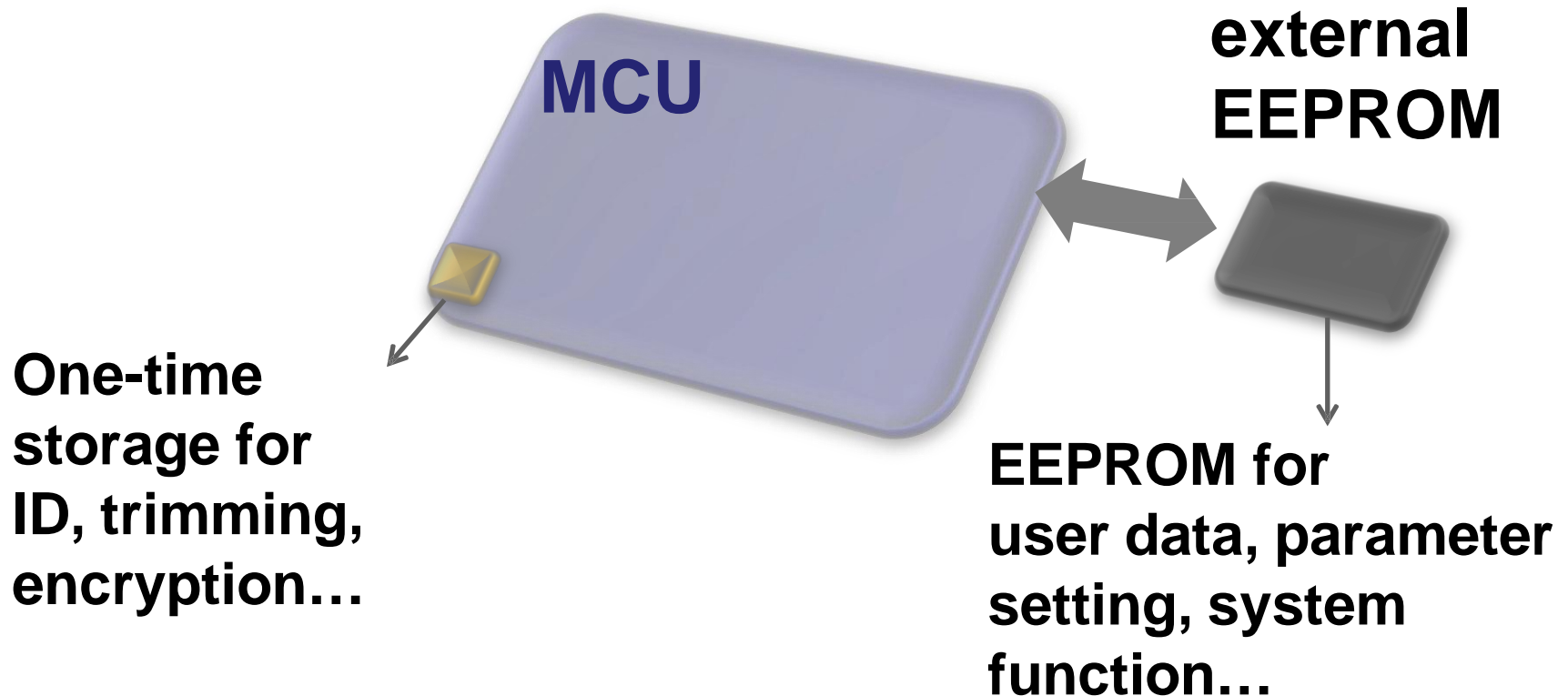
*30% more  
cost reduction*

*wafer cost &  
testing time*



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

# MCU Applications with EEPROM



# 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**

# Wafer Demand by IC Type

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

# Outlook for Q4 and Beyond

- We expect that Q4 will be better than Q3, and that growth momentum will speed up in 2017 for the following reasons:
- For PMIC applications, there are three factors which drive continuous growth.
  1. A new contractual agreement with our biggest PMIC customer.
  2. We have engaged with another large US customer and taped-out products.
  3. Existing customers are expanding their product portfolio.
- For TDDI, we expect 55nm TDDI will contribute to growth in 2017 as some DDI production will switch to TDDI. TDDI adds touch functionality to DDI resulting in larger chip sizes and increased ASP. A customer win with the largest Korea smart phone maker through our US customer should lead to significant growth in 2017 and 2018.

# Outlook for Q4 and Beyond

- For Fingerprint Sensor applications, in the second half of 2016 volume production began and we expect revenue to continue increasing into 2017. One US fingerprint sensor supplier and one Chinese supplier have started to tape-out its CIS fingerprint sensors, which will contribute to growth in 2017 and beyond.
- For 28nm, one DTV customer continues in production, and there are two other customers ready for production in 2017.
- For OLED Driver applications, our customers supplying to Korean panel makers has taped-out products.
- For CIS, one big customer has begun production ramp up.



# Outlook for Q4 and Beyond

- **Advanced technology nodes will drive our future growth:**
  1. For 16nm, one security related application customer is already planning to tape-out.
  2. For 10nm, our first IP has been successfully verified.
  3. Our 7nm project has already kicked-off.
- **NeoPUF, our new technology platform for security applications taped-out 55nm IP in October.**
- **Automotive applications continue their platform build and have started production.**
- **Increasing demand in MTP technology for USB type-c related applications.**

# Key Growth Drivers

## **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.

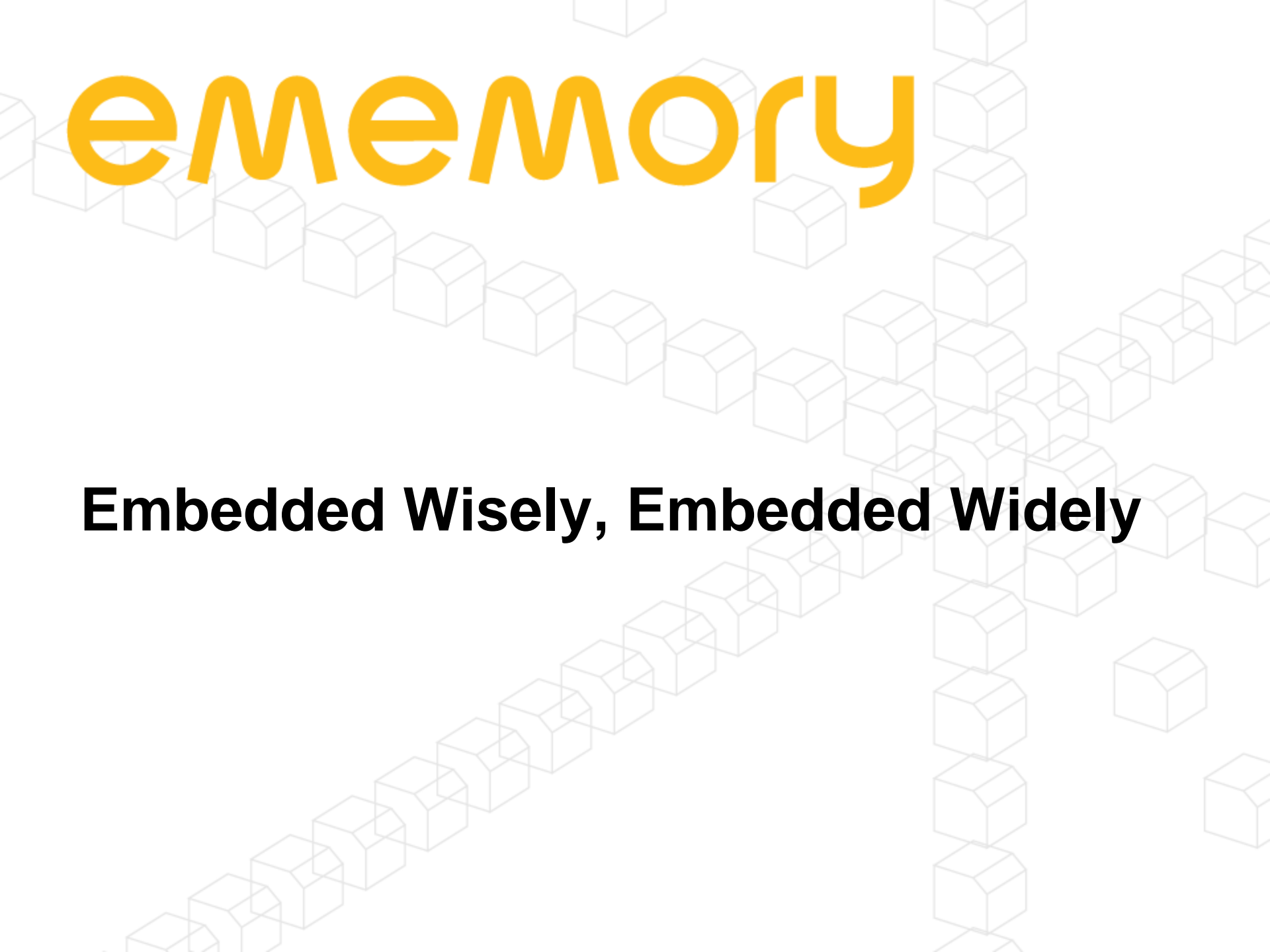
## **Growth in advanced technology**

- 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**