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A Leading Logic NVM Company

September, 2015

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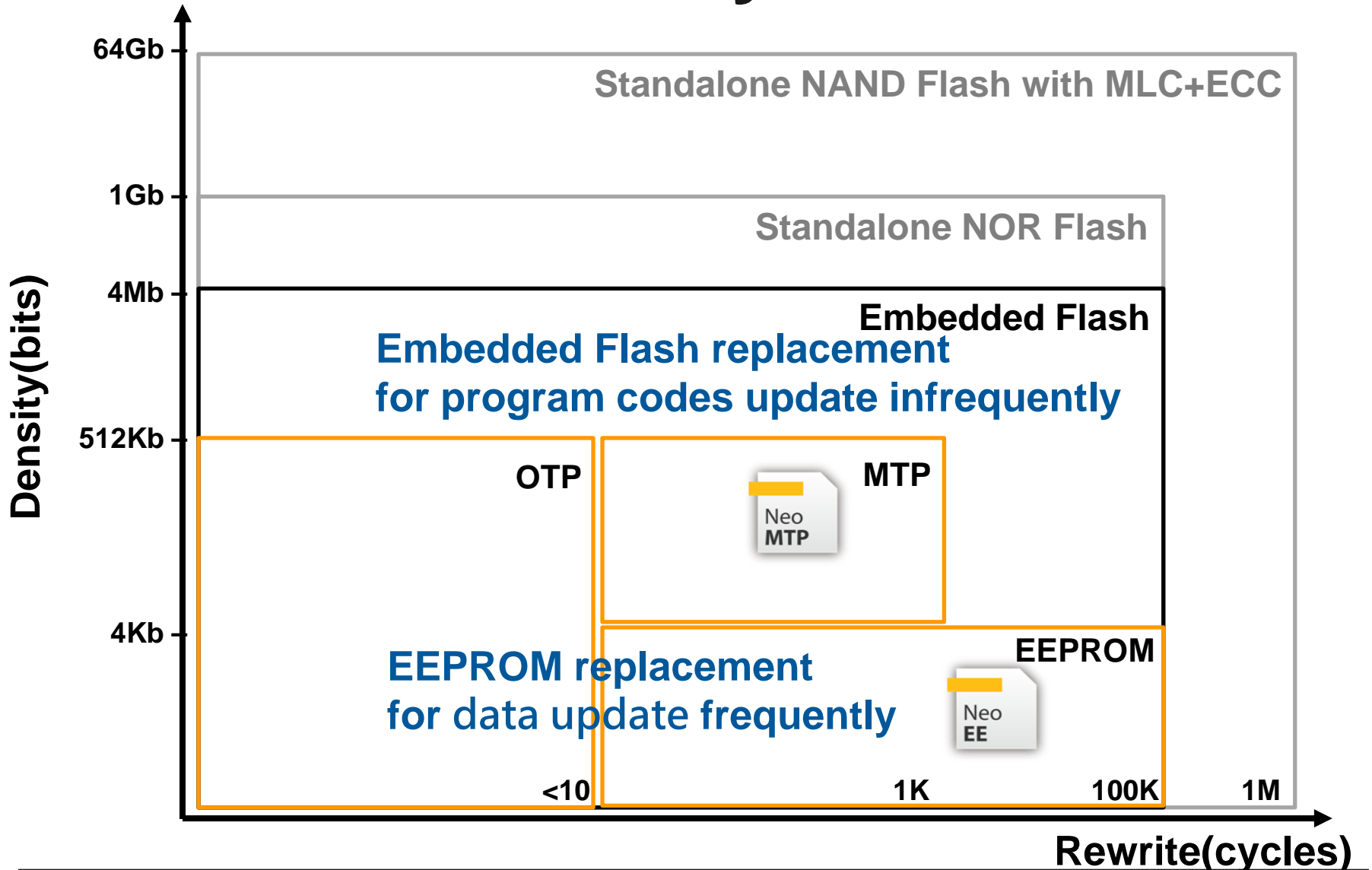
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Outline

- **Business Model**

- **Review of Operations**

- **Growth Opportunity and Future Outlook**

- **Q & A**

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Nonvolatile Memory Classifications

Density(bits)

- 64Gb — Standalone NAND Flash with MLC+ECC
- 1Gb — Standalone NOR Flash
- 4Mb — Embedded Flash

**Embedded Flash replacement
for program codes update infrequently**

- 512Kb — OTP   MTP

Neo
MTP

- 4Kb — EEPROM

**EEPROM replacement
for data update frequently**

Neo
EE

<10   1K   100K   1M

Rewrite(cycles)

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What's Logic Non-Volatile Memory (NVM)

Embedded NVM = LOGIC + 10 Masks
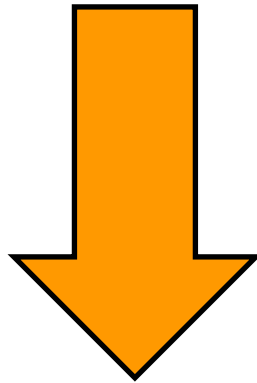
30% more cost reduction

Embedded LOGIC NVM = LOGIC

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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

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Considerations for IP Adoption

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

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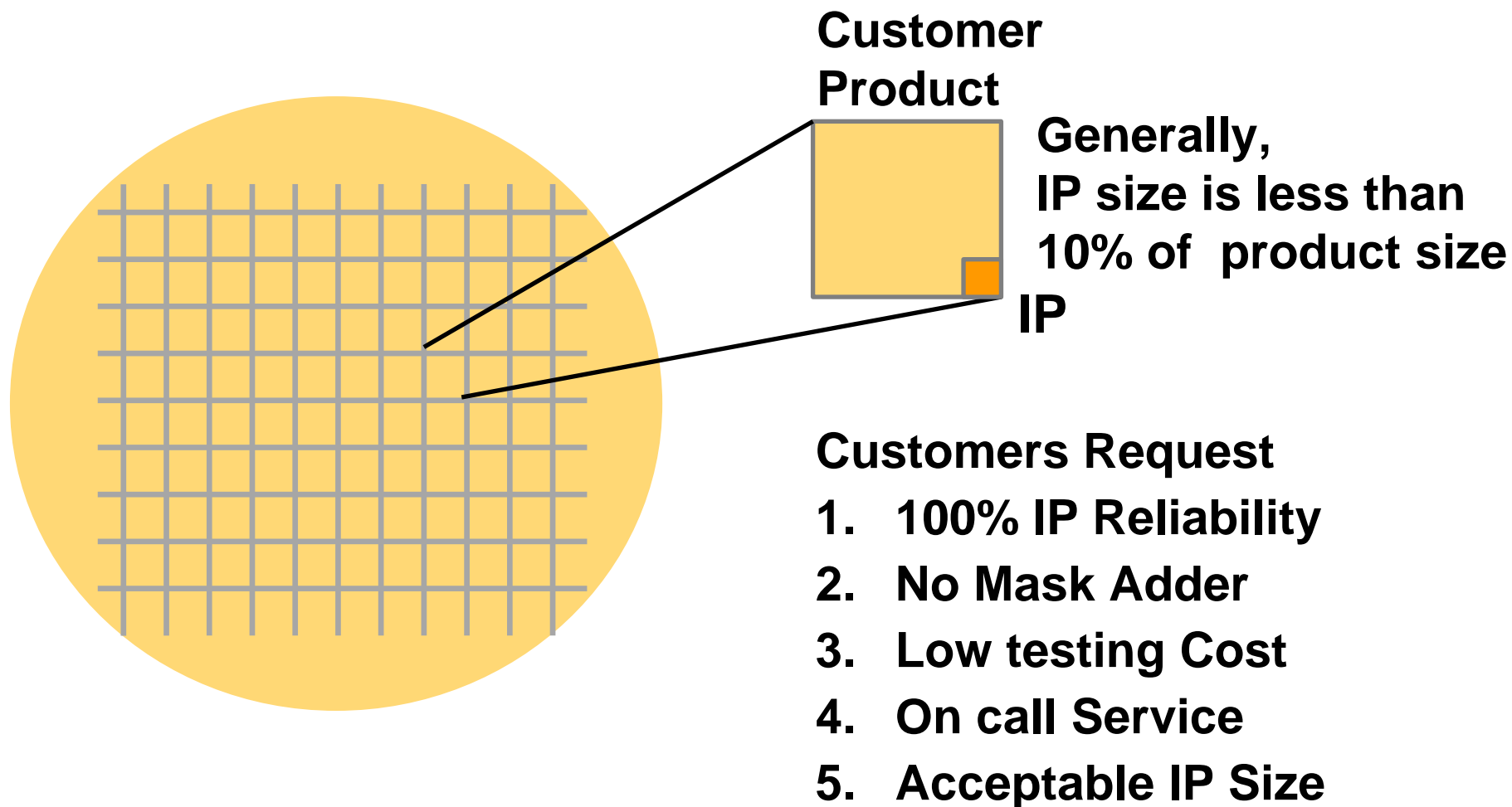
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Inside Nonvolatile Memory IP

Program, Erase and Read operation control

Where data is stored. Each cross point has a memory cell.

X-Decoder & Control Circuit

Memory Cell Array

Power

Power supply for operations

Y-Path

Data input & output

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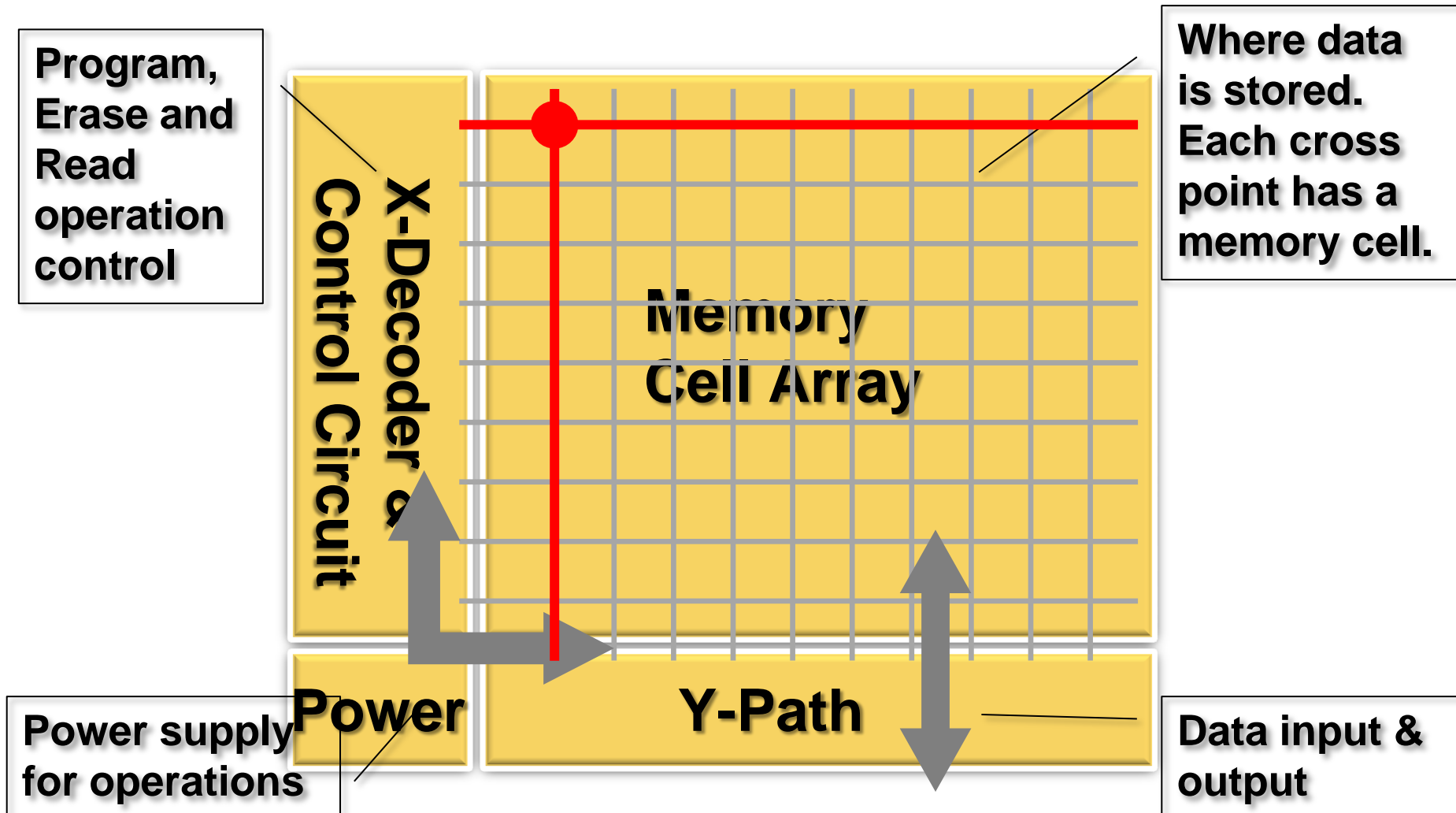
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What We Have Done

Innovation, Innovation, and Innovation！

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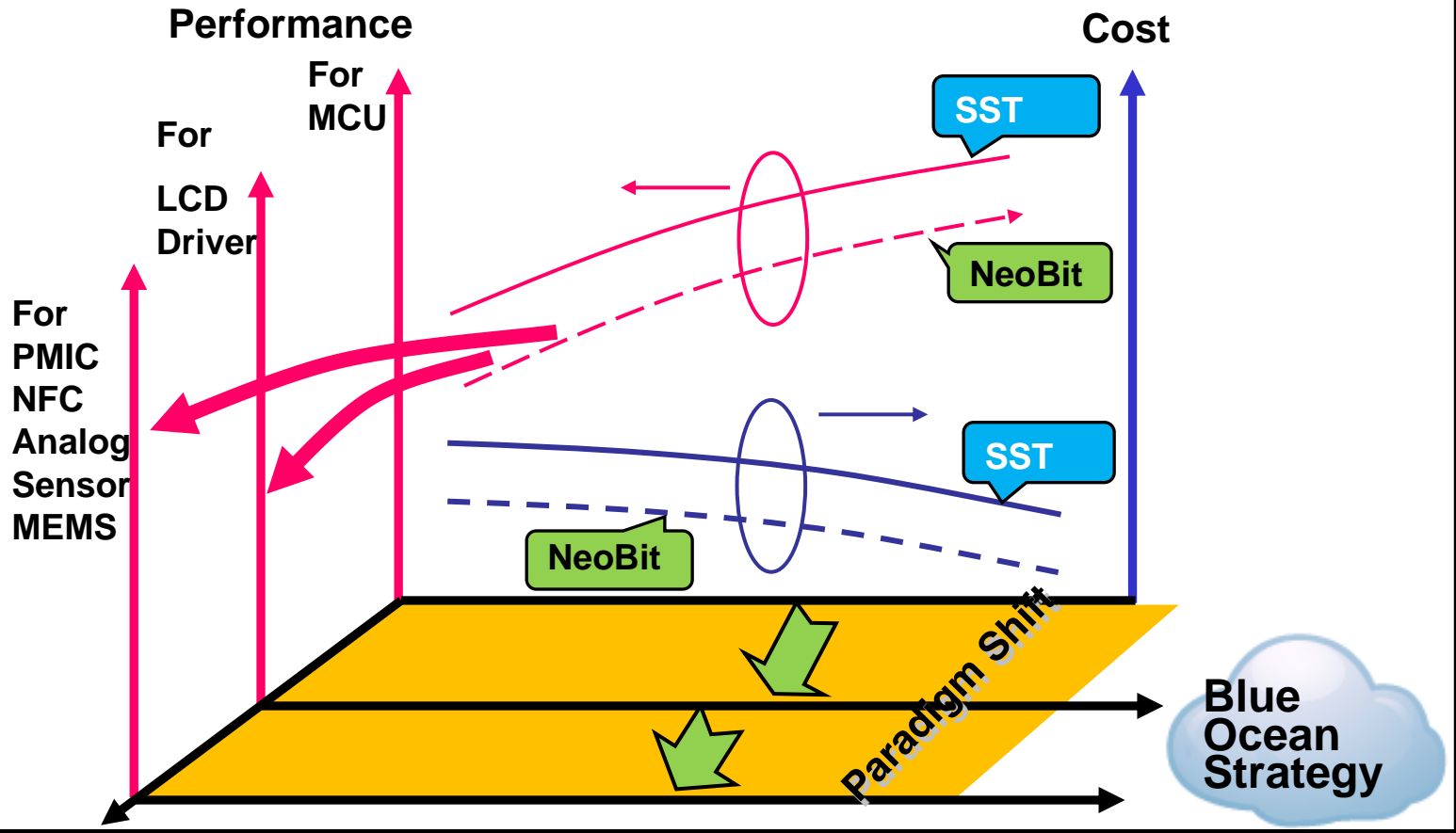
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Crossing the Chasm
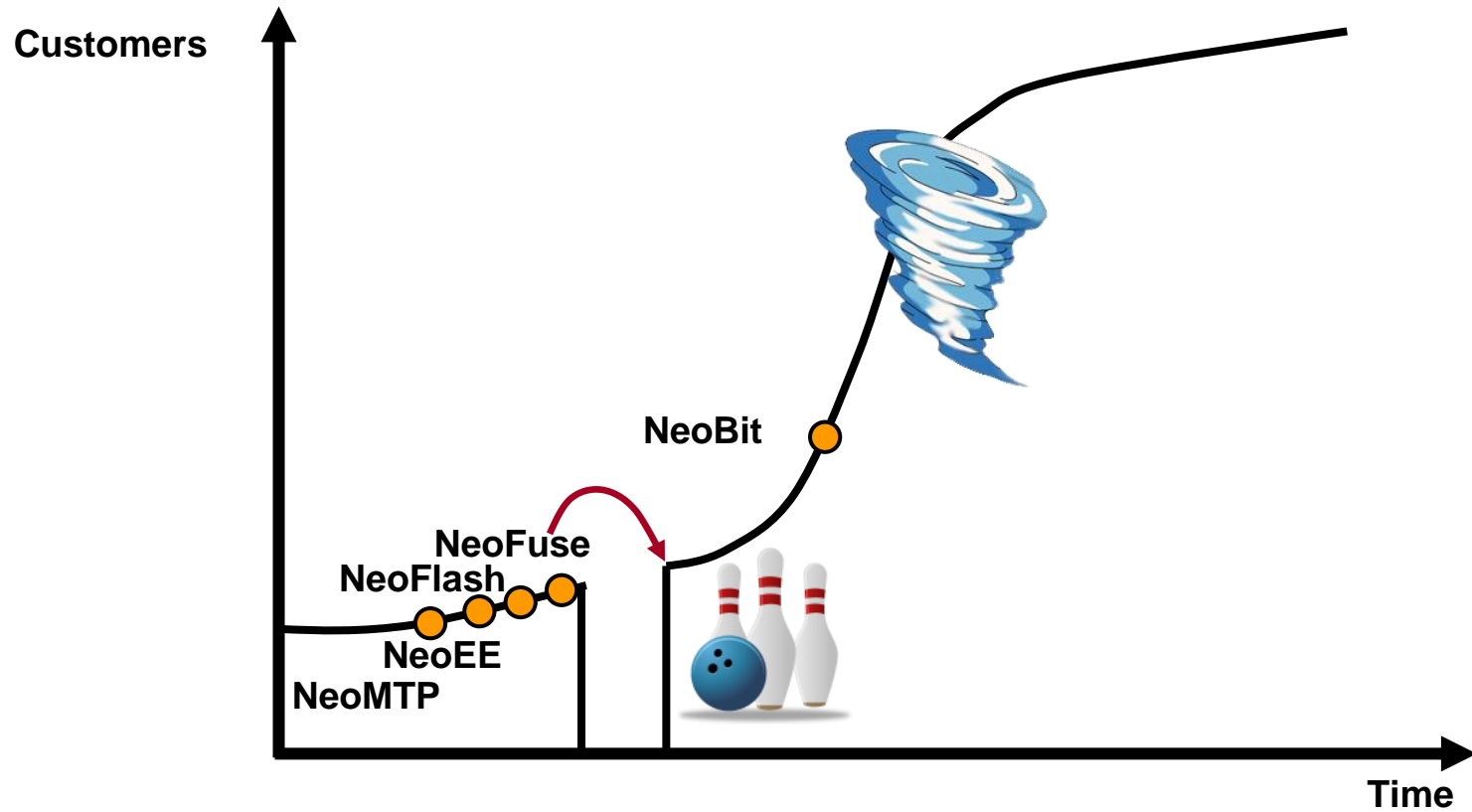
Business Model

- **Founded in 2000. First customer engaged in 2002. Achieved profitability in 2005 and IPO in 2011. The largest logic non-volatile memory IP company, 223 employees (152 R&D)*.**

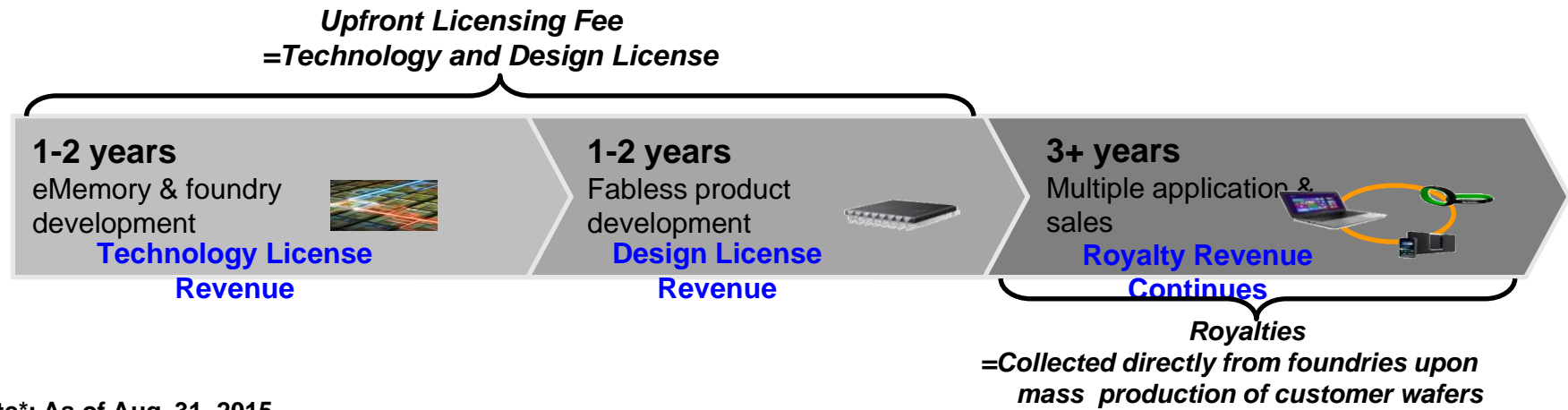- **Since its IPO, the company initiated no new fund raising or bank debt, and has distributed in excess of 100% of earnings in cash dividends.**

- **Growth Indices: 1) No. of on-going technology platforms**
  2) No. of design licenses
  3) Royalty

Upfront Licensing Fee
=Technology and Design License

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

Royalties
=Collected directly from foundries upon mass production of customer wafers

Note*: As of Aug. 31, 2015

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Worldwide Customers

Foundry

tsmc · UMC · VIS · SILTERRA · HG 华虹宏力 · 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 · NXP

	Taiwan	China	Korea	Japan	North America	Europe	Others
Foundry	5	6	3	2	1	1	1
IDM	0	0	0	8	2	1	0
Fabless	237	351	51	36	181	94	40

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Patent Portfolio

	1Q15	2Q15	Diff.
Pending	175	181	+6
Issued	278	287	+9
Total	453	468	+15

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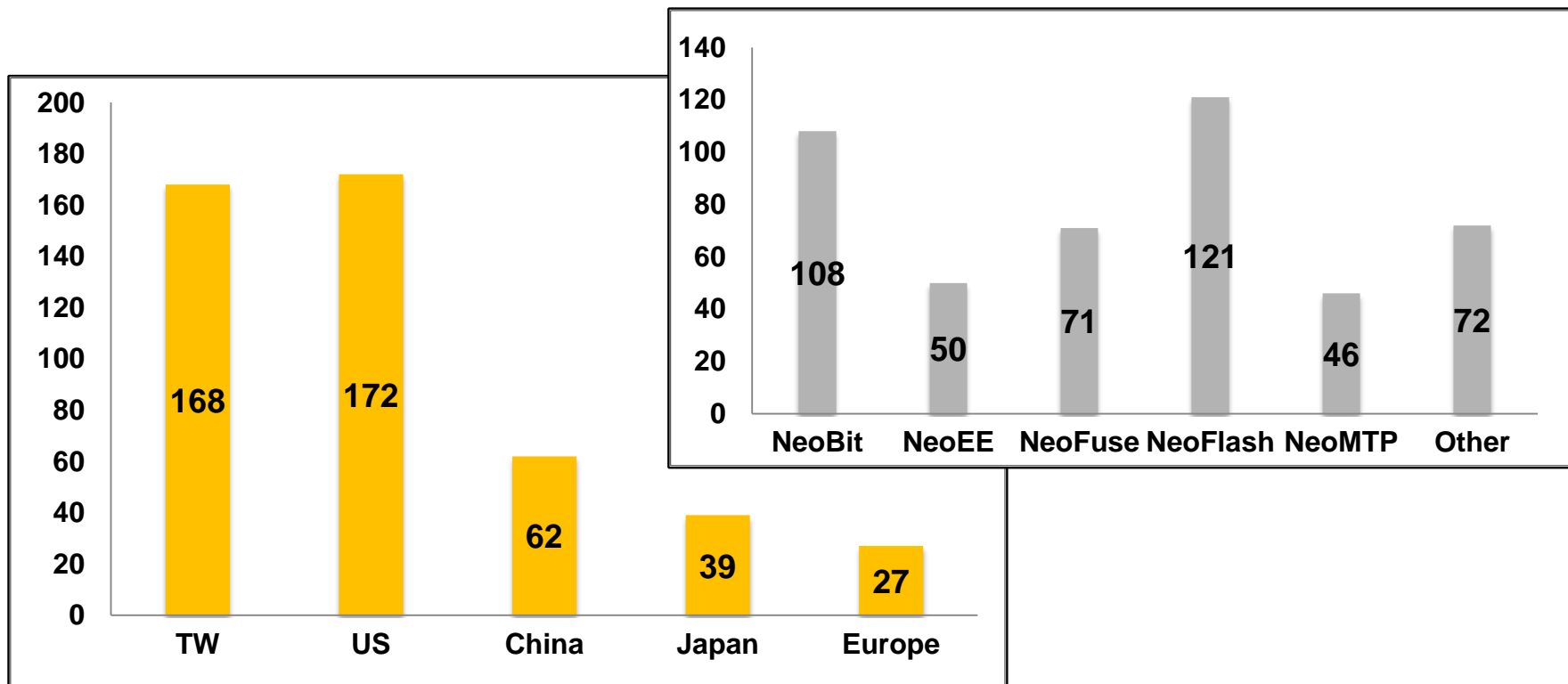
Quarterly Revenue Pattern

- **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

Chart data (NTD Thousands):

Month	Value 1 (yellow)	Value 2 (gray)	Value 3 (dark)
13-Apr.	127,813		
13-May		53,962	
13-Jun.			25,665
13-Jul.	135,829		
13-Aug.		43,610	
13-Sep.			25,913
13-Oct.	156,652		
13-Nov.		56,644	
13-Dec.			17,258
14-Jan.	168,696		
14-Feb.		51,673	
14-Mar.			25,691
14-Apr.	172,450		
14-May		38,609	
14-Jun.			13,870
14-Jul.	189,727		
14-Aug.		53,556	
14-Sep.			31,546
14-Oct.	197,330		
14-Nov.		43,652	
14-Dec.			17,177
15-Jan.	183,266		
15-Feb.		47,809	
15-Mar.			27,527
15-Apr.	172,773		
15-May		40,969	
15-Jun.			66,583
15-Jul.	193,311		

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2Q Revenue Breakdown

Unit: NTD thousands

	Q215	Q115	% change	Q214	% change	2015H1	2014H1	% change
Licensing	95,982	64,056	49.84%	57,198	67.81%	160,038	132,243	21.02%
Royalty	184,343	194,546	-5.24%	167,731	9.90%	378,889	338,746	11.85%
Total	280,325	258,602	8.40%	224,929	24.63%	538,927	470,989	14.42%

Unit: Number of contracts

		Q215	Q115	2014	2013
Technology Licenses		8	5	21	19
Design Licenses	**NRE**	17	21	82	51
	Usage	87	82	363	342

Financial Income Statement

(Unit: NTD thousands)	Q215	Q115	% change	Q214	% change
Revenue	280,325	258,602	8.40%	224,929	24.63%
Gross Margin	100%	100%	-	100%	-
Operating Expenses	141,435	128,976	9.66%	129,406	9.30%
Operating Margin	49.5%	50.1%	-0.6ppts	42.5%	+7.0ppts
Net Income	130,297	114,423	13.87%	82,385	58.16%
Net Margin	46.5%	44.2%	+2.3ppts	36.6%	+9.9ppts
EPS (Unit: NTD)	1.72	1.51	13.91%	1.09	57.80%
ROE	30.9%	24.8%	+6.1ppts	20.5%	+10.4ppts

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Technology License

Unit: Number of contract

Year	2013	2014	2015H1
License number	19	21	13

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.

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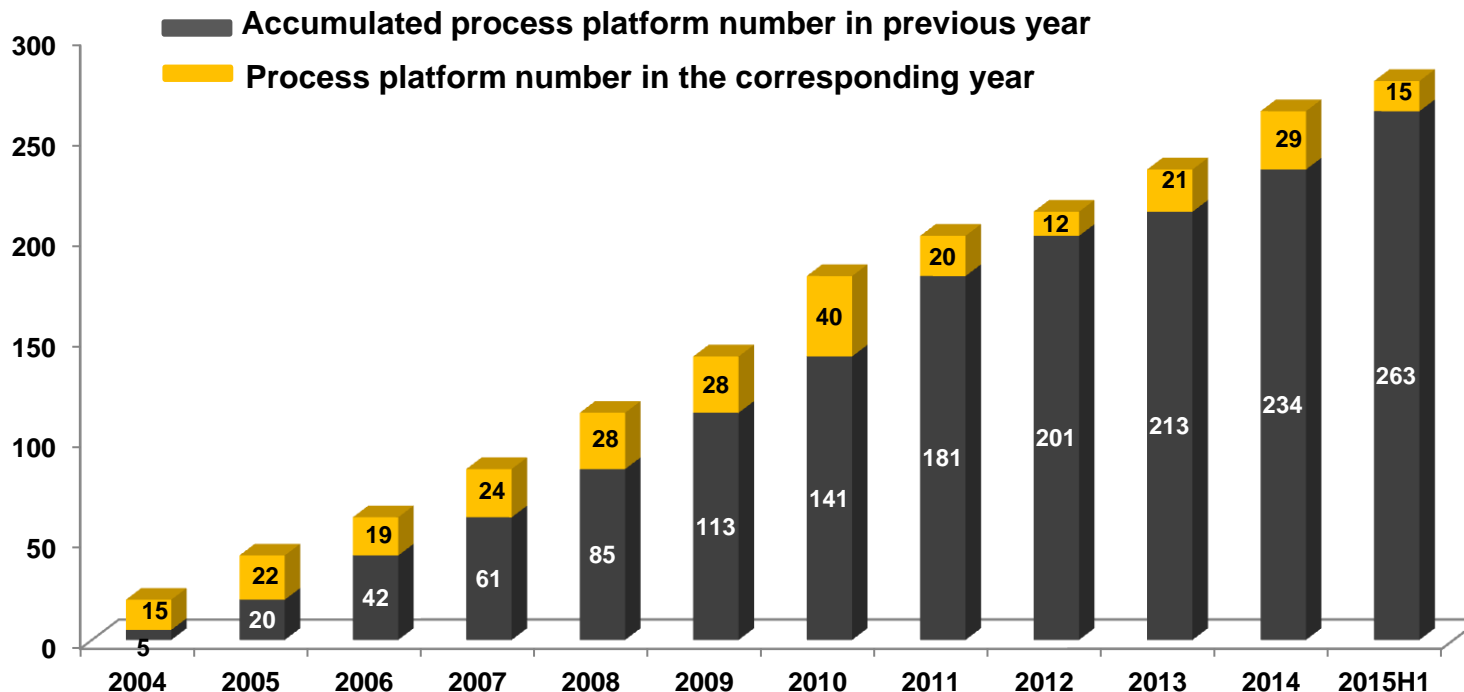
Current Technology Development Platforms

- **Total (As of Jun.) : 80***

- **20 for NeoBit, 26 for NeoFuse, 20 for NeoEE, and 14 for NeoMTP.**

	16nm	28nm	40nm	55/65nm	80/90nm	0.11~0.13um	0.15~0.18um	>0.25 um	Total
NeoBit	-	-	-	-	-	6	12	2	20
NeoFuse	1	7	4	8	1	3	2	-	26
NeoFlash	-	-	-	-	-	-	-	-	-
NeoEE	-	-	2	-	1	6	10	1	20
NeoMTP	-	-	1	1	2	3	7	-	14

Note*: 6 platforms qualified in 2Q; 8 platforms kicked off in 2Q

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Current Technology Development Platforms

12" Fabs	Production	Development	NVM Type	Process Type
16nm	0	1	OTP	FF+
28nm	3	7	OTP	LP/HPM, HLP/HPM, LPS
40nm	2	7	OTP, MTP	HV-DDI, LP
55/65nm	10	9	OTP, MTP, Flash	LP, HV-DDI, HV-OLED, DRAM, CIS
80/90nm	5	4	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	15	OTP, MTP, Flash	HV-DDI, BCD, LP, RF, CIS, LL
0.18/0.16/0.152um	31	OTP, MTP	Generic, LP, LL, MR, HV, Green, BCD
0.25um	2	OTP, MTP	BCD
0.35um	1	OTP	UHV

*As of Jun. 30, 2015

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Quarterly Design Licensing (New Tape Out)

- Total *207* NTO as of H1 2015 (*445* @2014 *393* @2013, *303* @2012, *258* @2011)

	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
	2010				2011				2012				2013				2014				2015	
TOTAL	62	85	77	72	54	52	67	85	69	83	73	78	80	83	106	124	123	98	110	114	103	104
USAGE	53	70	68	53	50	45	59	67	62	68	63	68	73	69	88	112	90	86	88	99	82	87
NRE	9	15	9	19	4	7	8	18	7	15	10	10	7	14	18	12	33	12	22	15	21	17
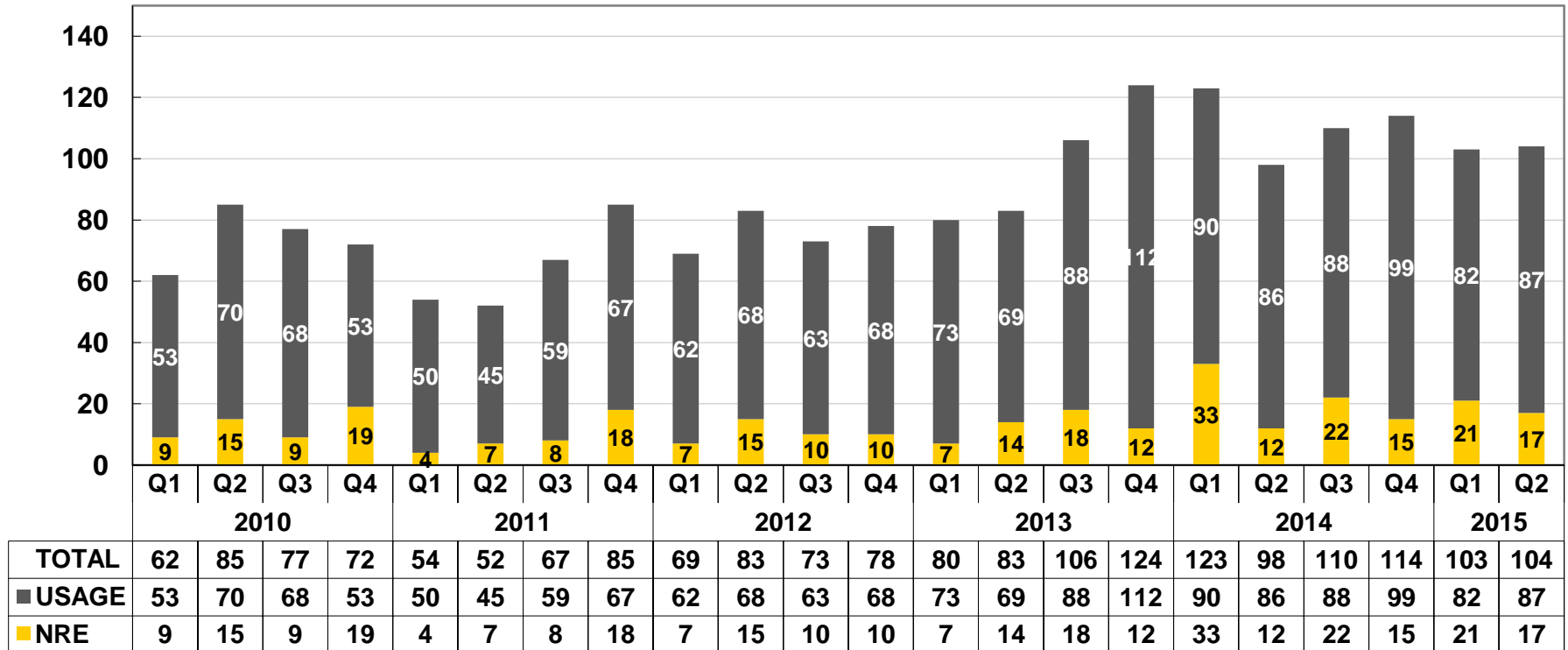
Usage：Usage of pre-qualified and verified IP (charged by per product tape out or annual package), the cycle time from
design implementation to royalty payments for mass production is faster, typically less than one year.

NRE: NRE covers the customization of IP that must undergo new verification or qualification. It typically requires 1 to 1.5
years before resulting in royalty revenue.

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Cumulative Licenses Drive Future Royalties
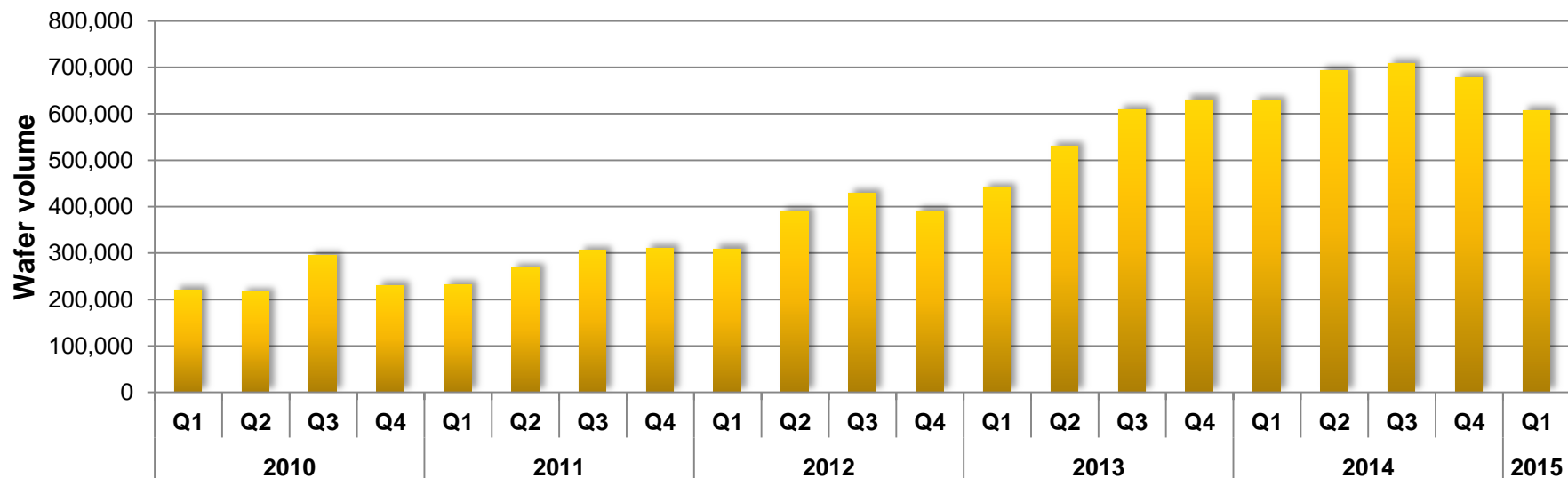
Cumulative design licenses _> 2,962_
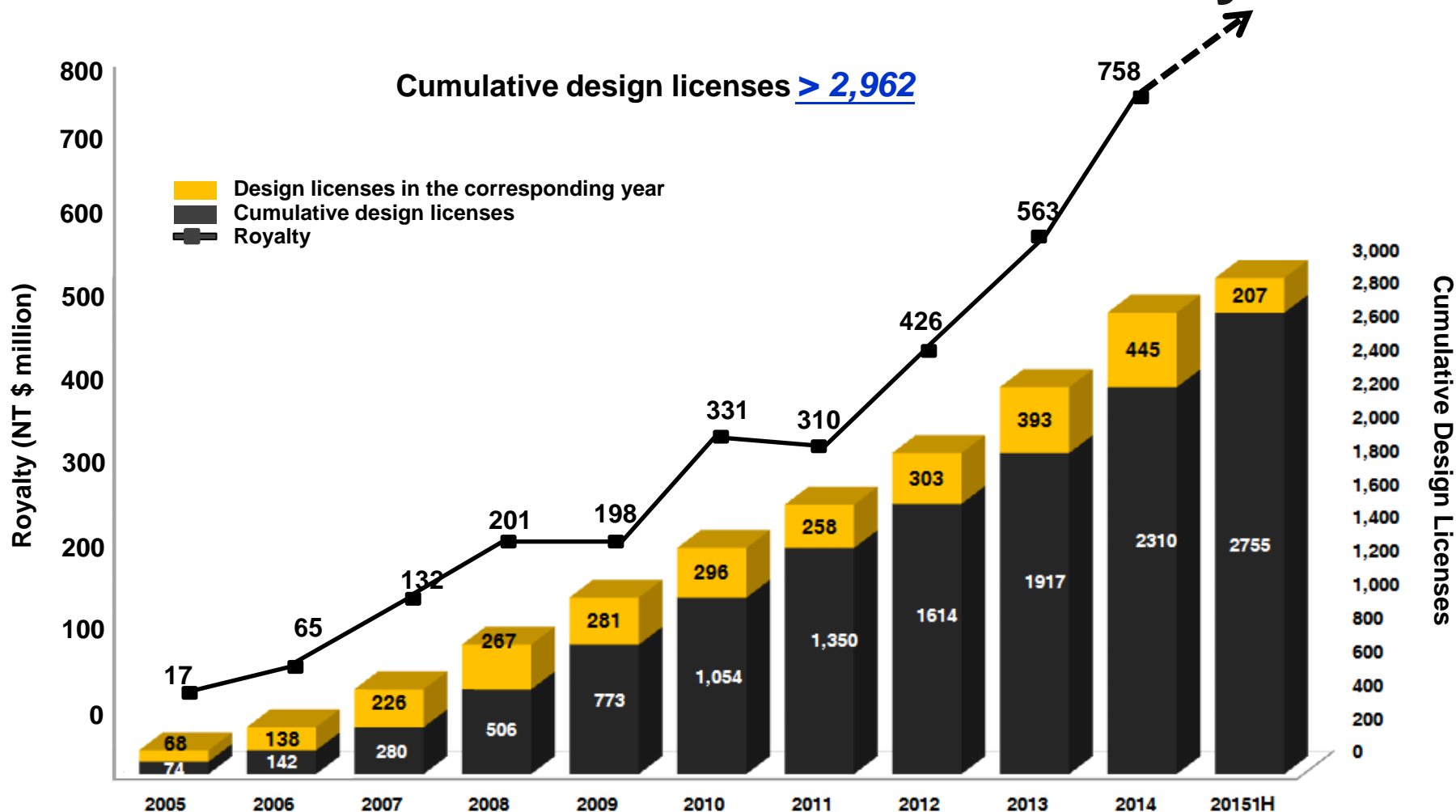
note 1: Due to the 2009 recession, royalty income was down annually 1.5%.
note 2: Pre-payment of royalty fees by a single customer contributed to 2010 annual growth of 67%,
          causing a drop of 6.3% in the following year, 2011.
note 3: CAGR for 2009-2013 was 30%.

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Wafer Production Volume

embedded eMemory IP in T Company ($revenue); * % of Process node in T company total revenue in Q215

	Process node	*% of T	Q215	Q115	2014	2013
8"	0.25/0.35	4%	34.4%	32.1%	30.5%	27.3%
	0.15/0.18	13%	8.9%	8%	11.9%	10.7%
	0.11/0.13	3%	17.0%	20.5%	20.8%	19.1%
12"	90nm	7%	19.2%	18.2%	16.3%	4.8%
	65nm	11%	0.4%	0.3%	0%	0%
	40/45nm	14%	0%	0%	0%	0%
	28nm	27%	0.01%	0%	0%	0%
	20nm	20%	0%	0%	0%	0%
8"		21%	14.5%	14.1%	15.6%	14.2%
12"		79%	1.8%	1.5%	1.4%	0.69%
Total		100%	4.5%	4.1%	4.5%	4.1%

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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

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Applications by Technology

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

NeoBit

NeoFuse

NeoFlash

NeoEE

NeoMTP

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Opportunity at all Price Points

eMemory Inside today

Royalty

Opportunity

| $400-700 | $750-1,000 | $1,000-4,000 | $4,000-8,000 |
| (0.5um-0.25um) | (0.18um-0.11um) | (90nm-55nm) | (40nm-16nm) |

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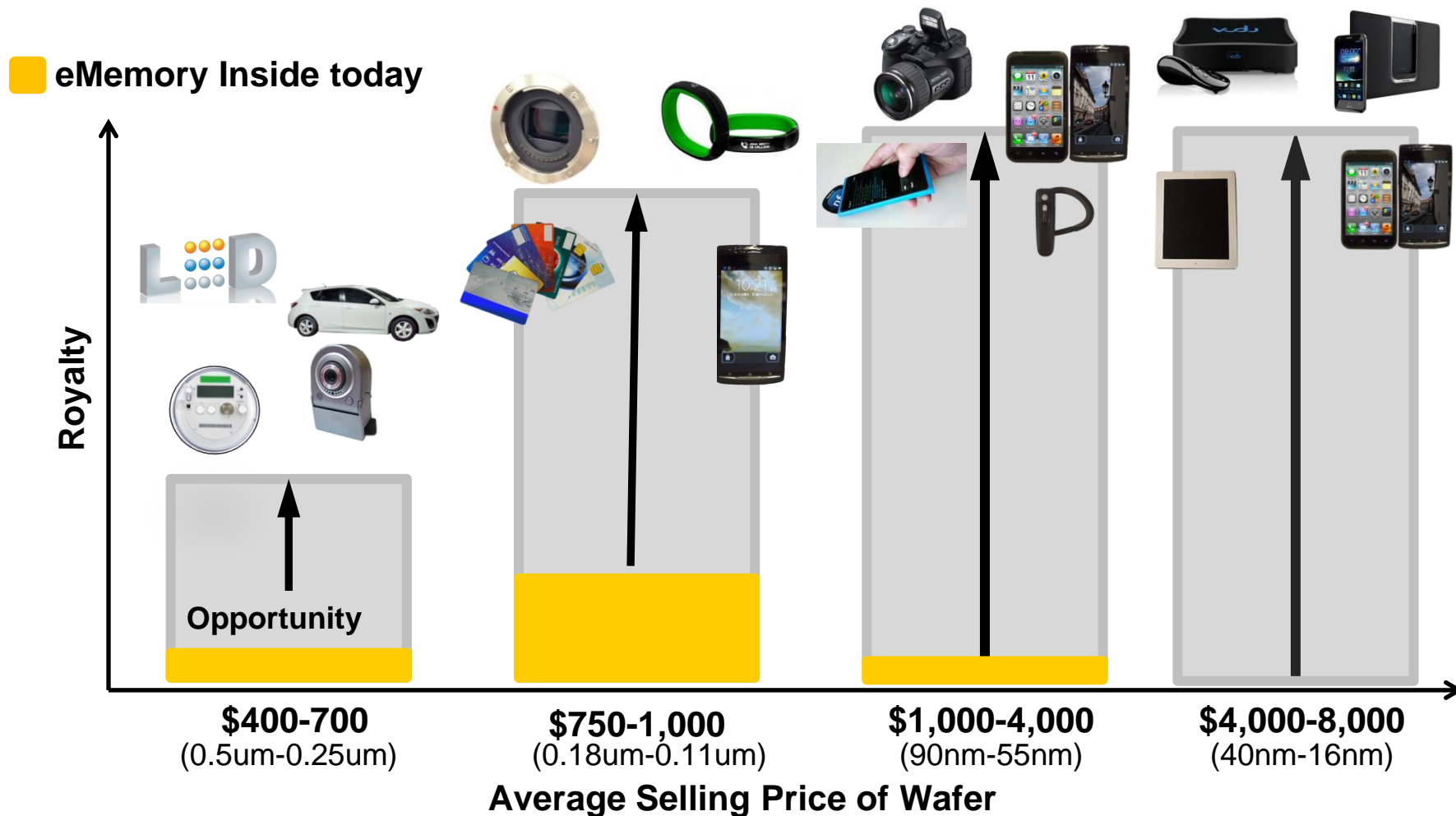
Note: 2.2 million 8" equivalent wafers with eMemory IP were shipped in 2013. (~5% of WW foundry shipment)

eMemory IP in Smart Phone

Neo **Flash**

Neo **MTP**

Capacitive Touch Panel Controller

Neo **Fuse**

Neo **EE**

Neo **Bit**

PMIC/PMU

-Ambient Sensor
- Proximity sensor

Neo **Bit**

- Accel.-sensor
- Mag.-sensor
- Gyro-sensor

Neo **Bit**

NFC

Neo **EE**

-Base Band

Neo **Fuse**

-Application Processor

Battery

LCD Driver

Connector

Camera Module

Fuel Gauge

Neo **Bit**

Neo **Fuse**

Neo **MTP**

Neo **Bit**

Neo **EE**

Neo **Fuse**

Neo **Flash**

Neo **MTP**
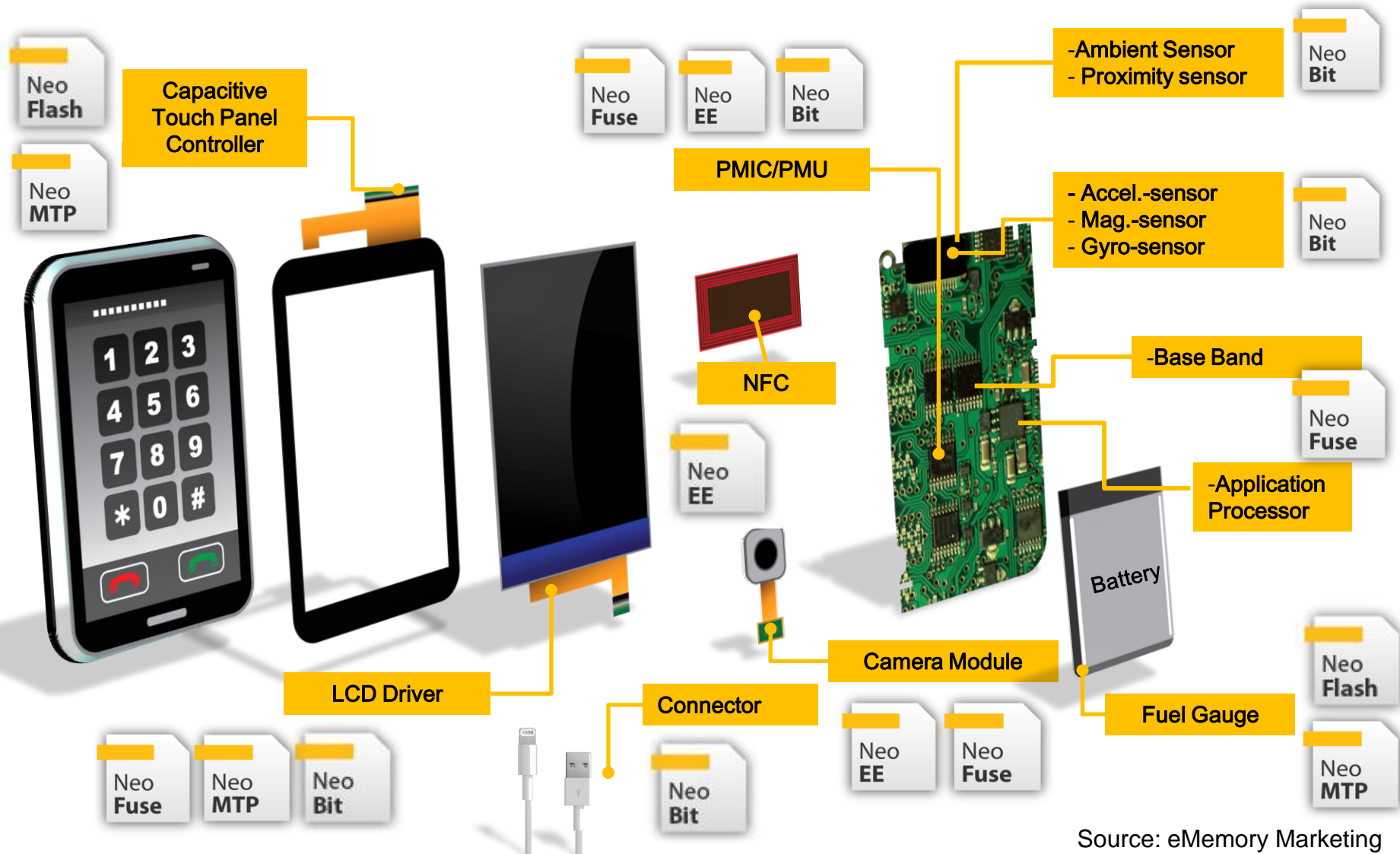
Source: eMemory Marketing

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Benefits from Using eMemory IPs

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**

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

CP Test

Package/FT

System Assembling

IC Design

NVM IP
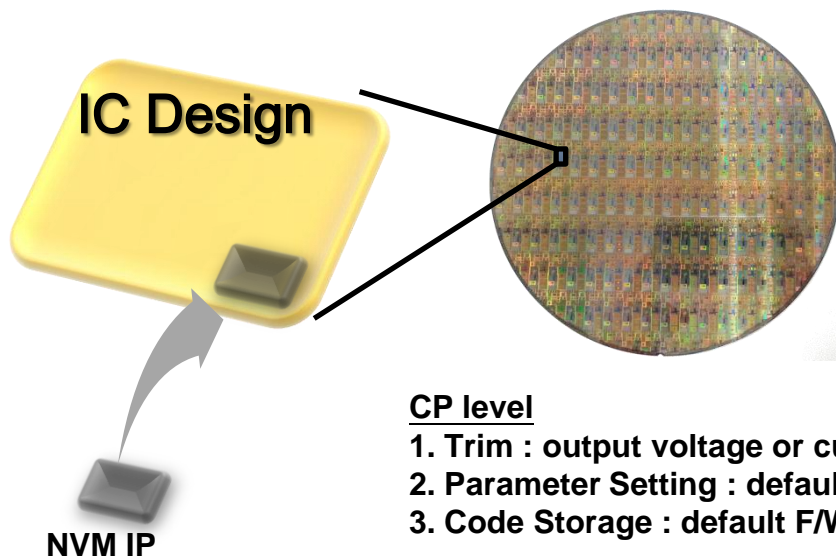
CP level
1. **Trim : output voltage or current**
2. **Parameter Setting : default value**
3. **Code Storage : default F/W code**
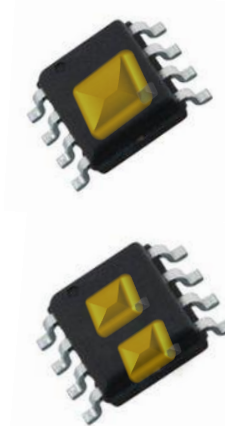
System Assembling
1. **Parameter Setting : cross chip optimization**
2. **Code Storage : F/W code modification**
3. **Identification Setting : manufacturer resume**
4. **Encryption : Security algorithm or key storage**

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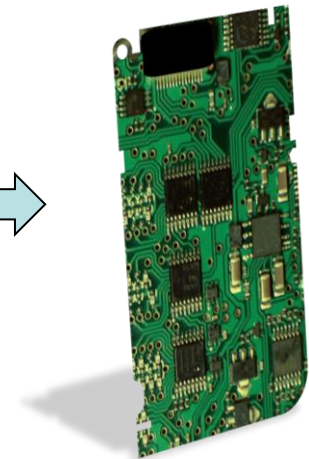
Invisibility for Security

- **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

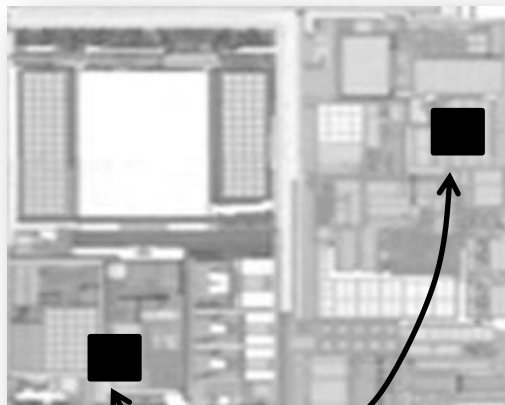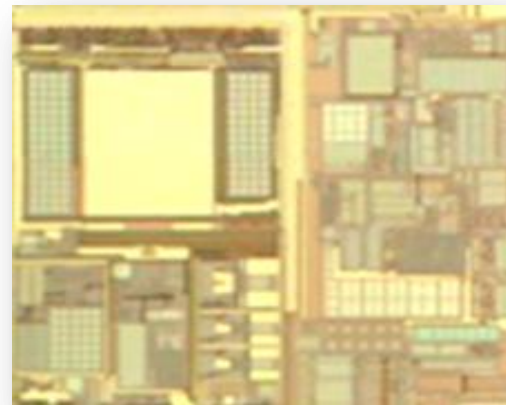Invisible Hardware Key : Data is hard to be detected

Floating Gate

Anti-Fuse

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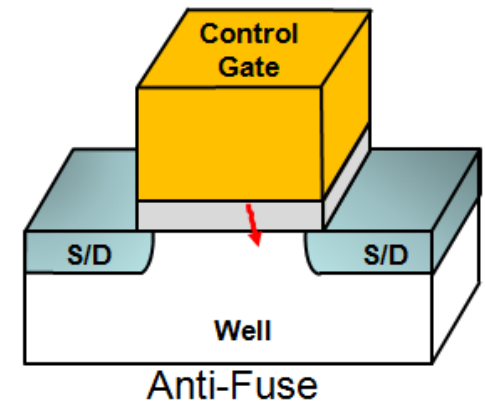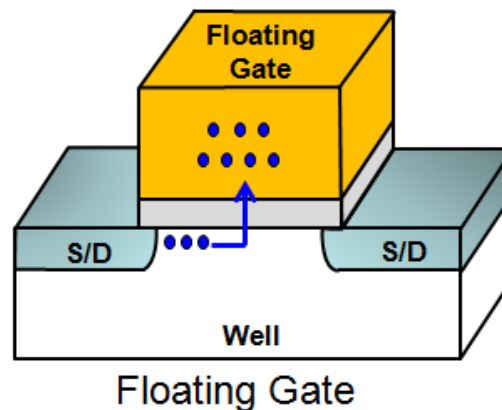
Security & Protection

Authorized Product

Fake Product
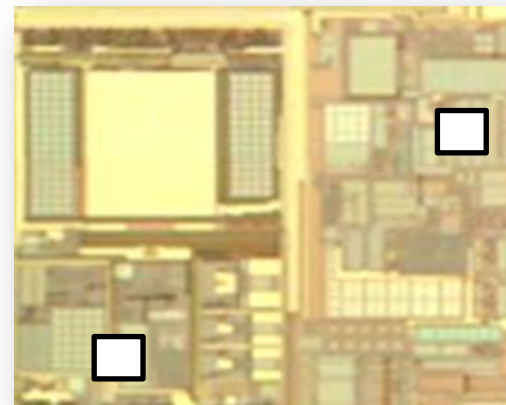
reverse copy

re-produce

without protection

reverse copy

re-produce

with protection

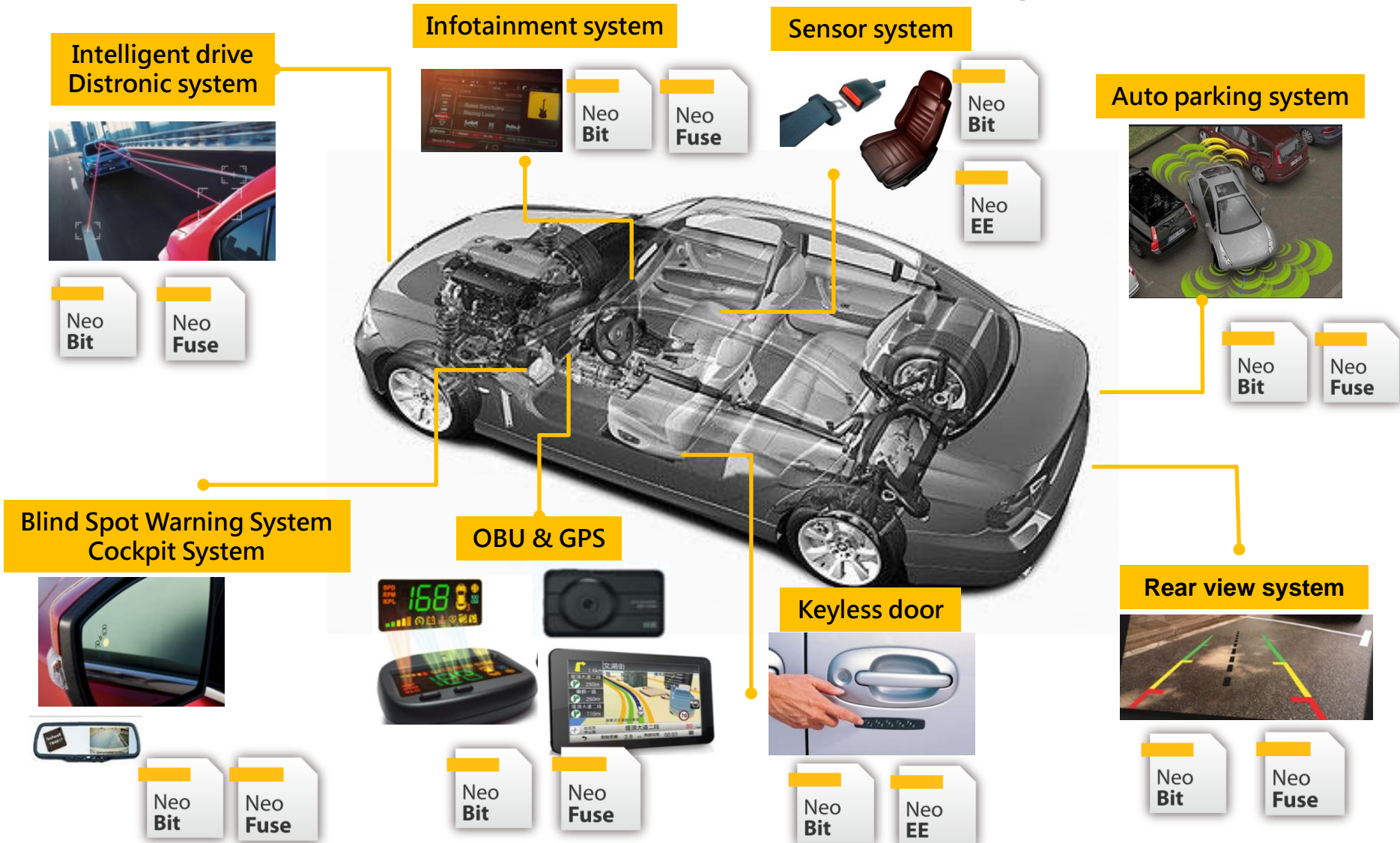**Security IP/Code by Authorized Use**
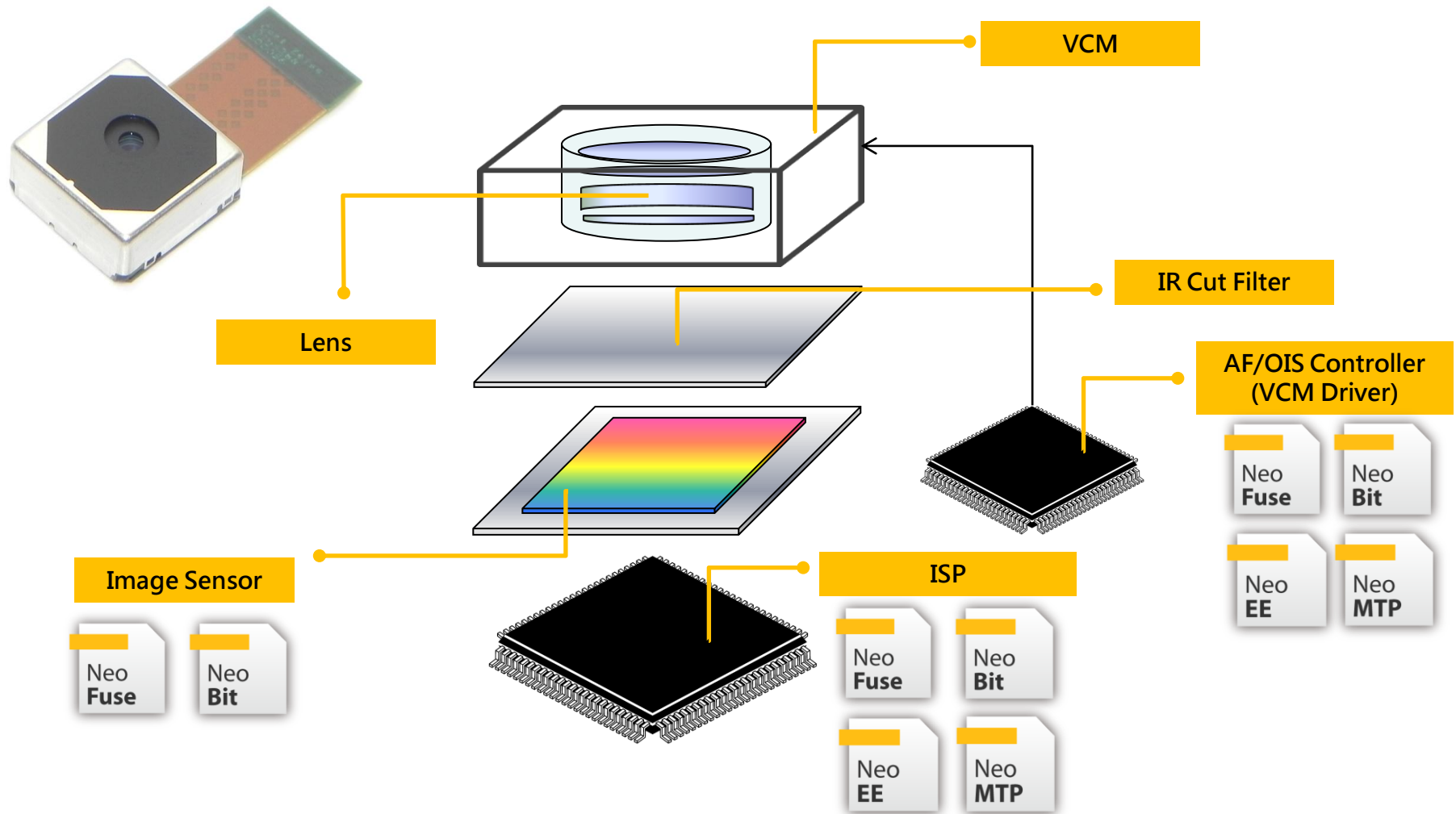
Can NOT Work w/o Security IP/Code

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Security with eMemory IPs

Security for System Service

Cloud Processing

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

HW-SW/FW Lock

HW Key

ID & Authentication
Data Integrity
Access Control

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

Security Lock

FW (OS) with
security key

SoC

HW Protection
Invisible Key for
Anti-Cloning

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

Security IP/Code by
Authorized Use

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NVM IP Demand in IoT

All Smart Systems

Basic Technology	Sensing	Embedded Processing	Connectivity

IC Types

Sensing	Embedded Processing	Connectivity	
Accelerometer	MCU	NFC	Cellular
Magnetometer	MPU	GPS	Sub-Gig
Gyroscope	Hybrid MCU/MPU	BT/BTLE	ZigBee
Pressure		Wi-Fi	RFID
Altimeter	Network Processor		
Temperature			

NVM IP Function

Encryption/Security	Function Selection	Trimming/Calibration
F/W code storage	Parameter Setting	ID Setting

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Autotronics with eMemory IPs

Intelligent drive Distronic system

Infotainment system

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

Sensor system

Neo **Bit**

Neo **EE**

Auto parking system

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

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

Blind Spot Warning System Cockpit System

OBU & GPS

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

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

Keyless door

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

Rear view system

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

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Imager Module with eMemory IPs

VCM

IR Cut Filter

Lens

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**

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Advanced LCD Driver ICs

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

I/F
(LVDS, MIPI,…)

TCON
Neo Bit

DDI

Neo Bit

Display Power

LED Backlighting

Gate Driver

LCD Display

VCOM Buffer

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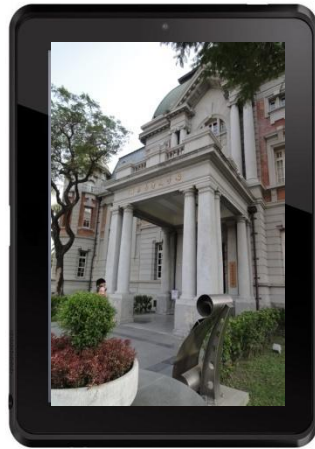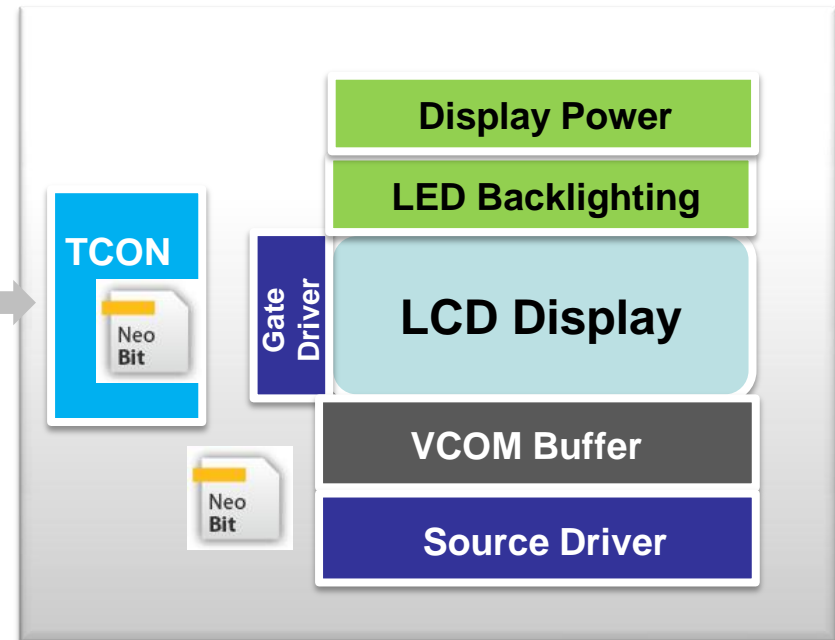
Density	Endurance	NVM Type	Purpose	NVM Usage
2K8~4K8	1	OTP	Trimming	1. Accuracy enhancement 2. Mismatch cancellation
			Code Storage	1. Gamma Correction Table 2. Timing Control Pattern 3. Color Engine Enhancement

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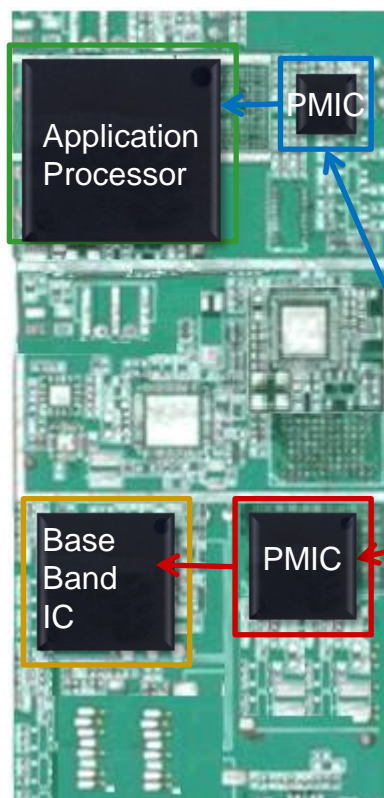
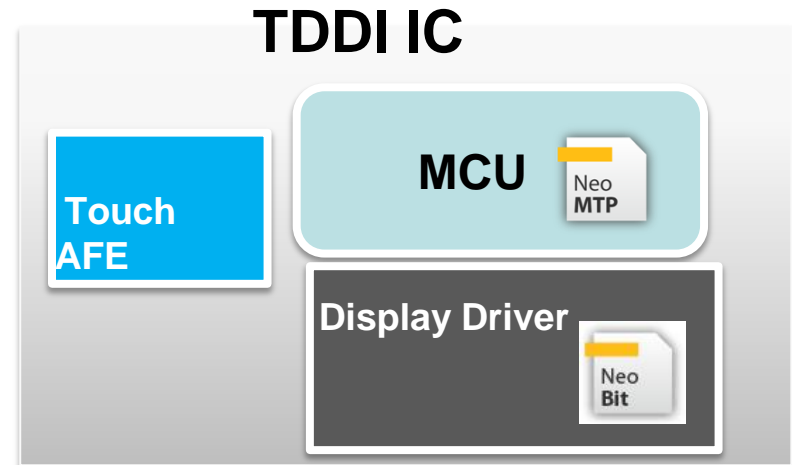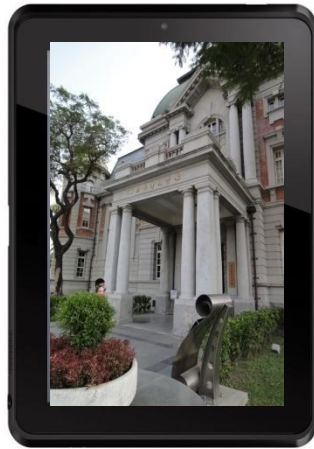| Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	DC/DC, Bandgap
		Parameter Setting	Design flexibility & Performance optimization
		Code Storage	Start-up behavior & smart power saving algorithm

Application Processor

PMIC

Base Band IC

PMIC

PMIC Neo Bit

Touch Panel Controller ICs

Process Technology : 0.16um HV/0.11um G

TPC

AFE

MCU

Neo Flash

Neo MTP

I/F Circuit

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

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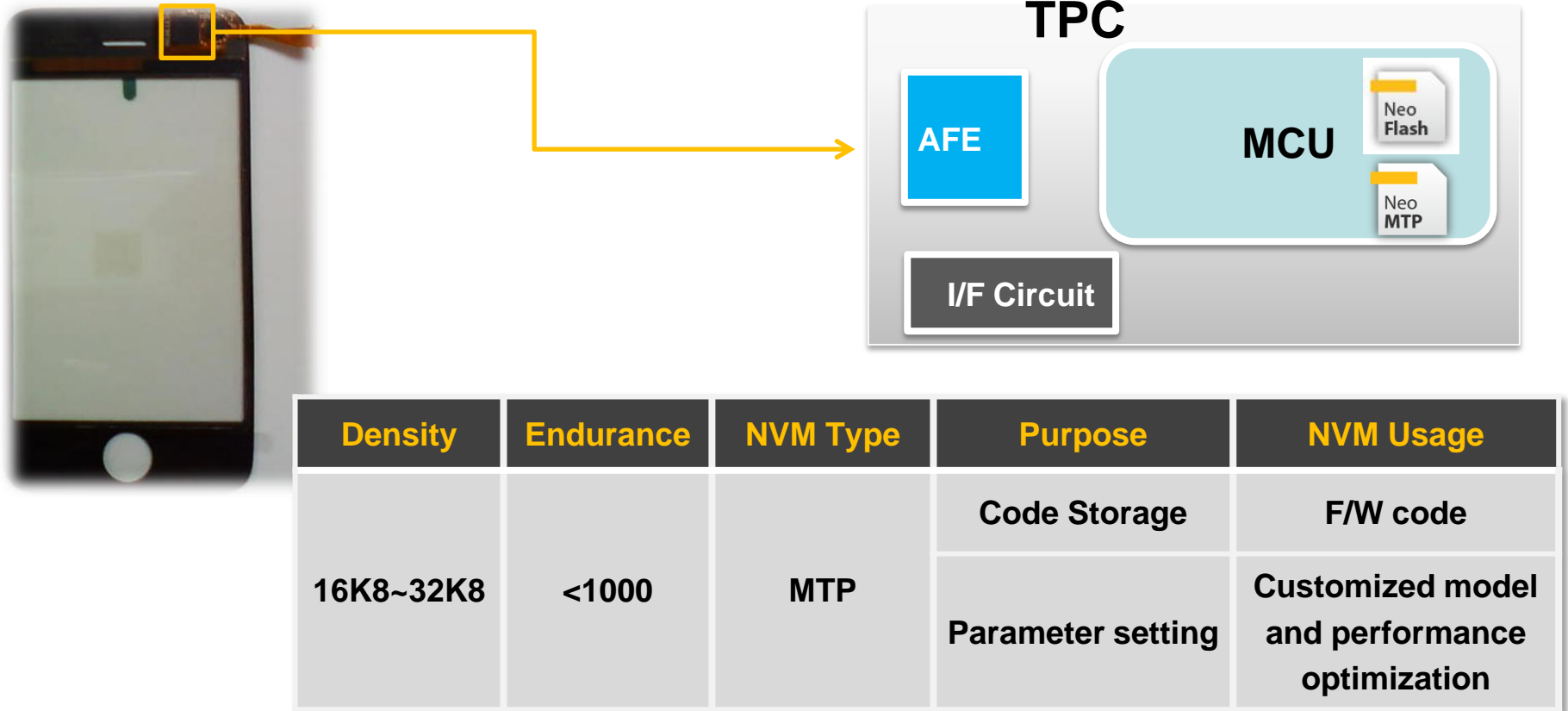
In-Cell Touch Panel Controllers ICs
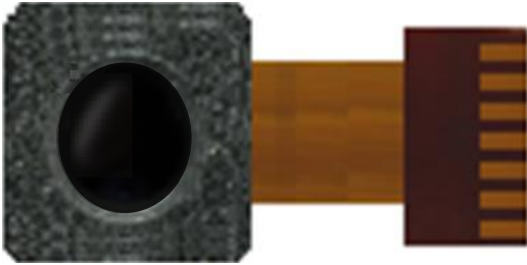
Process Technology : 0.11um HV/80nm HV/55nm HV

TDDI IC

Touch AFE

MCU — Neo MTP

Display Driver — Neo Bit

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

Embedded Wisely, Embedded Widely

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CMOS Image Sensor

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

CIS SoC

Column S/H

Row Select

Image Array

AFE

Image Sensor Processor

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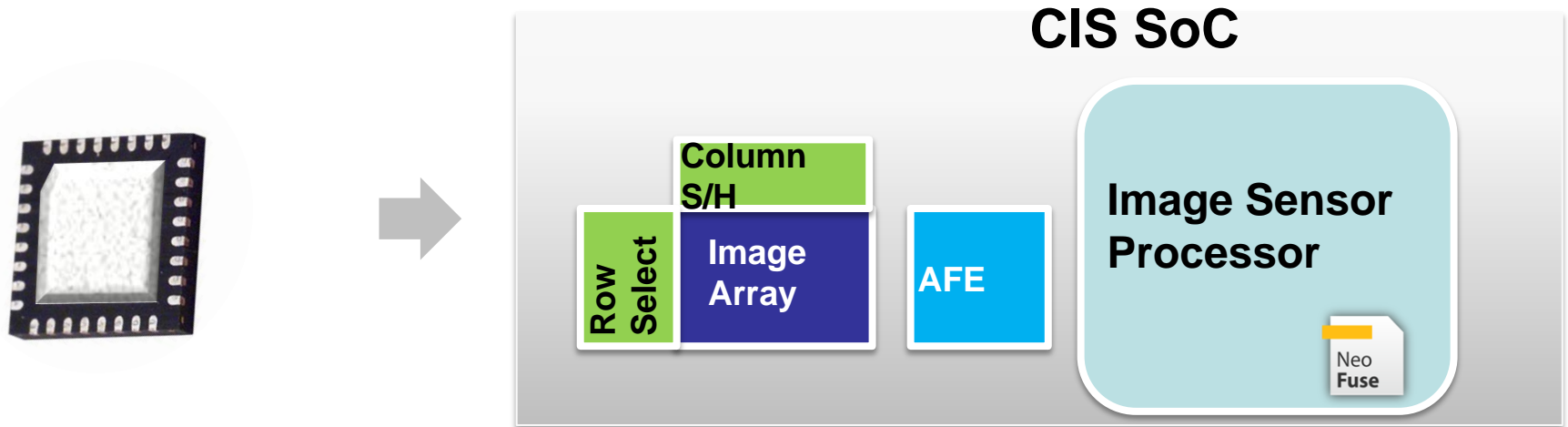
Density	Endurance	NVM Type	Purpose	NVM Usage
2Kb~4Kb	1	OTP	Identification Setting	Product Code
			Parameter Setting	Start-up Initial Setting
32K8	1	OTP/ROM	Code Storage	Boot Load

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MEMS

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

Yaw

Pitch

Roll

MEMS Chip

| MEMS Element | AFE | Digital Motion Processing |

Trimming Circuit — **OTP**

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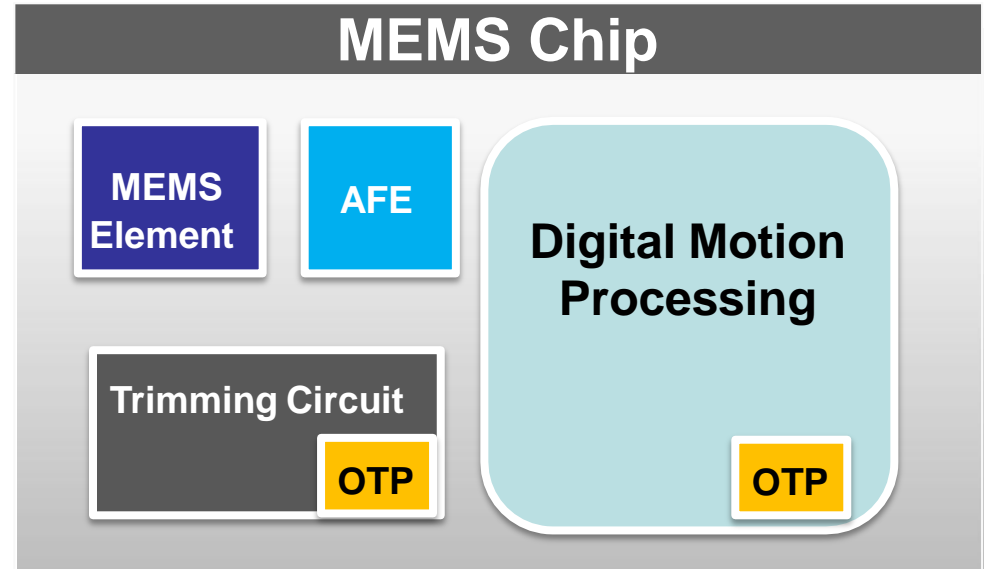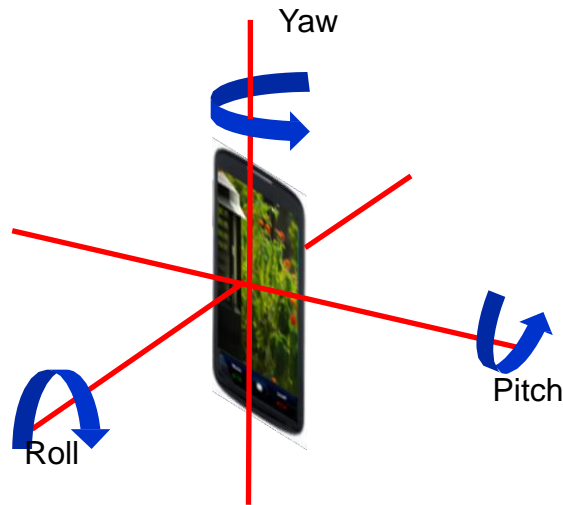
Density	NVM Type	Purpose	NVM Usage
2Kb~4Kb	OTP	Trimming	Factory trimming
		Parameter Setting	Signal filtering
		Code Storage	Geometric computation

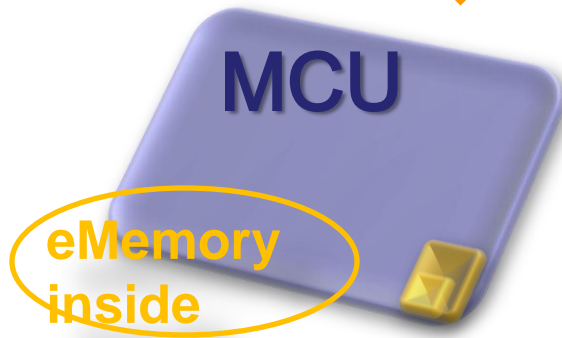# Replacement of Embedded Flash for Competitiveness Improvement

MCU

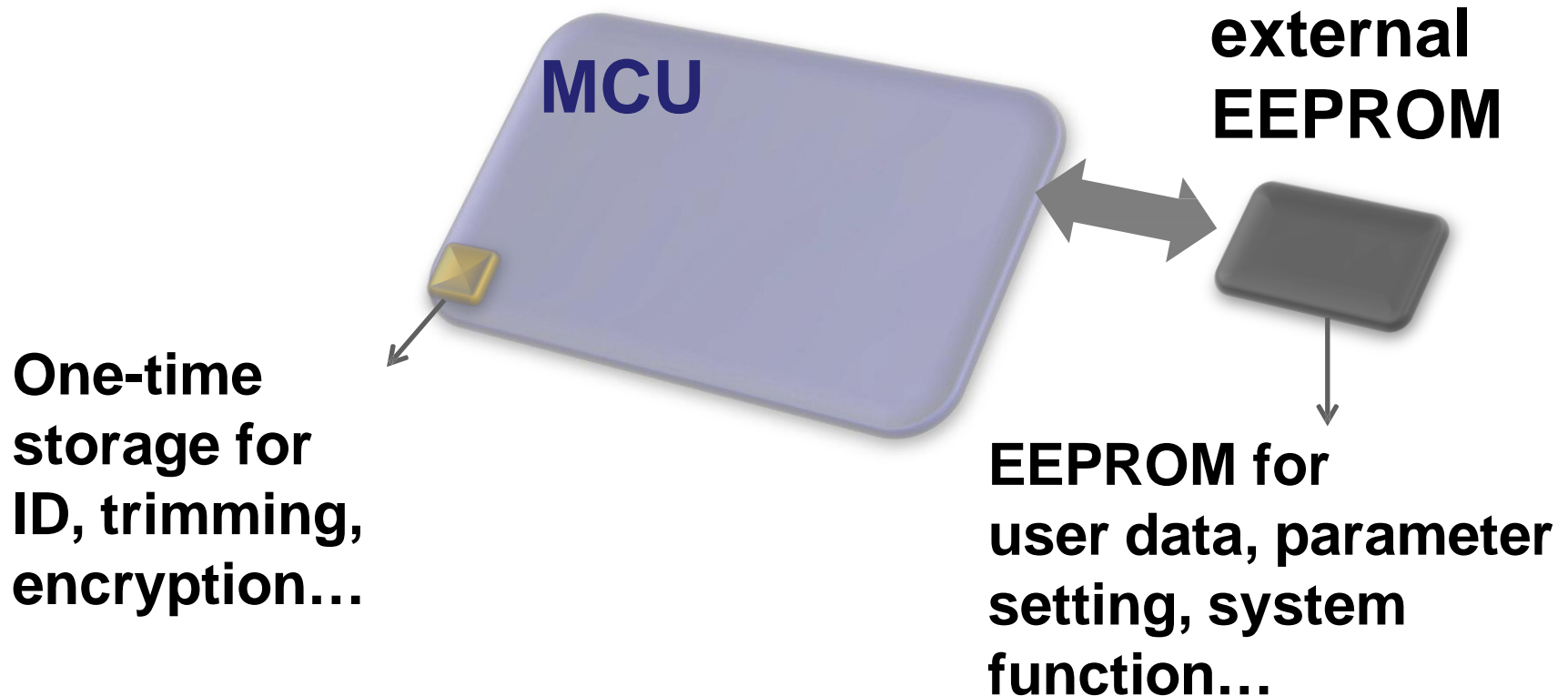**product design & manufacturing by embedded Flash**
Logic Process + 10 Masks

30% more cost reduction   (*wafer cost & testing time*)

MCU

eMemory inside

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

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MCU Applications with EEPROM

MCU

external EEPROM

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

MCU

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

Wafer Demand by IC Type

IC Type	Equ. to 8-inch wafer (K)
AP	4964
PMU	4756
CIS sensor	4226
Fingerprint	4000
Smart card controller	3000
Base Band	2935
LCD driver (with TCON)	2013
Gauge IC	627
Touch panel controller (C)	556
Connectivity	395
STB controller	335
TV controller	327
Wifi controller	245
LED driver	243
DC-DC/AC-DC	176
Accelerator sensor controller	124
Light snesor	121
Bluetooth controller	121
Gyroscope sensor controller	104
TAG IC	76
DVD controller	67
MCU (8bits, LV/3.3V)	56
MCU (8bits, LV/3.3V)	56
P-Gamma	52
MCU (8bits, pure 5V)	51
NB CAM controller	42
Pressure sensor controller	20
Touch pad controller	18
PC CAM controller	15
Touch panel controller (R)	5
TCON (w/o driver)	4

2014.8.29 updated

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Outlook for 3Q and Beyond

- Applications in major smart phone customer continue their momentum and expand to wearable devices.

- PMICs in Chinese smart phone continue to increase production and expand to new power management applications , such as fast charger and wireless charger.

- TDDI and 55nm LCD Drivers start to ramp up.

- Applications in STB, Fingerprints, and CIS will ramp up in 2H of 2015.

- Due to security requirement and yield issue, replacement of e-fuse by NeoFuse is accelerating in the advanced process nodes.

- Co-work with leading foundry and European auto-electronic customers to provide automotive grade IP.

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Key Growth Drivers

|	
Growth in value 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 more advanced technology	• Higher royalty per wafer is contributed from more advanced technology nodes.
IoT great era	• Embedded Logic NVM will be a must.

Q & A
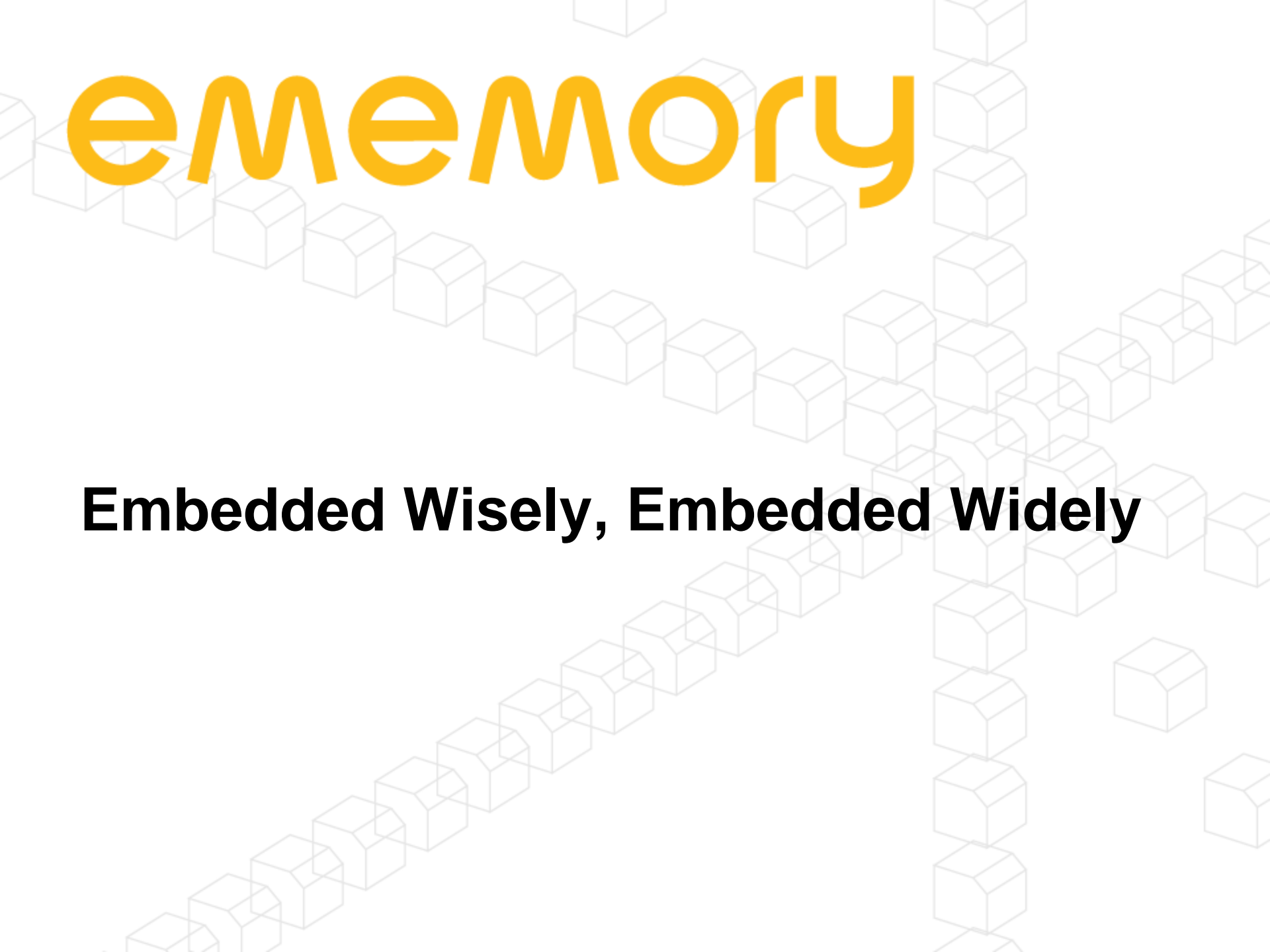
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