

ememory

**A Leading Logic NVM
Company**

IPR Notice

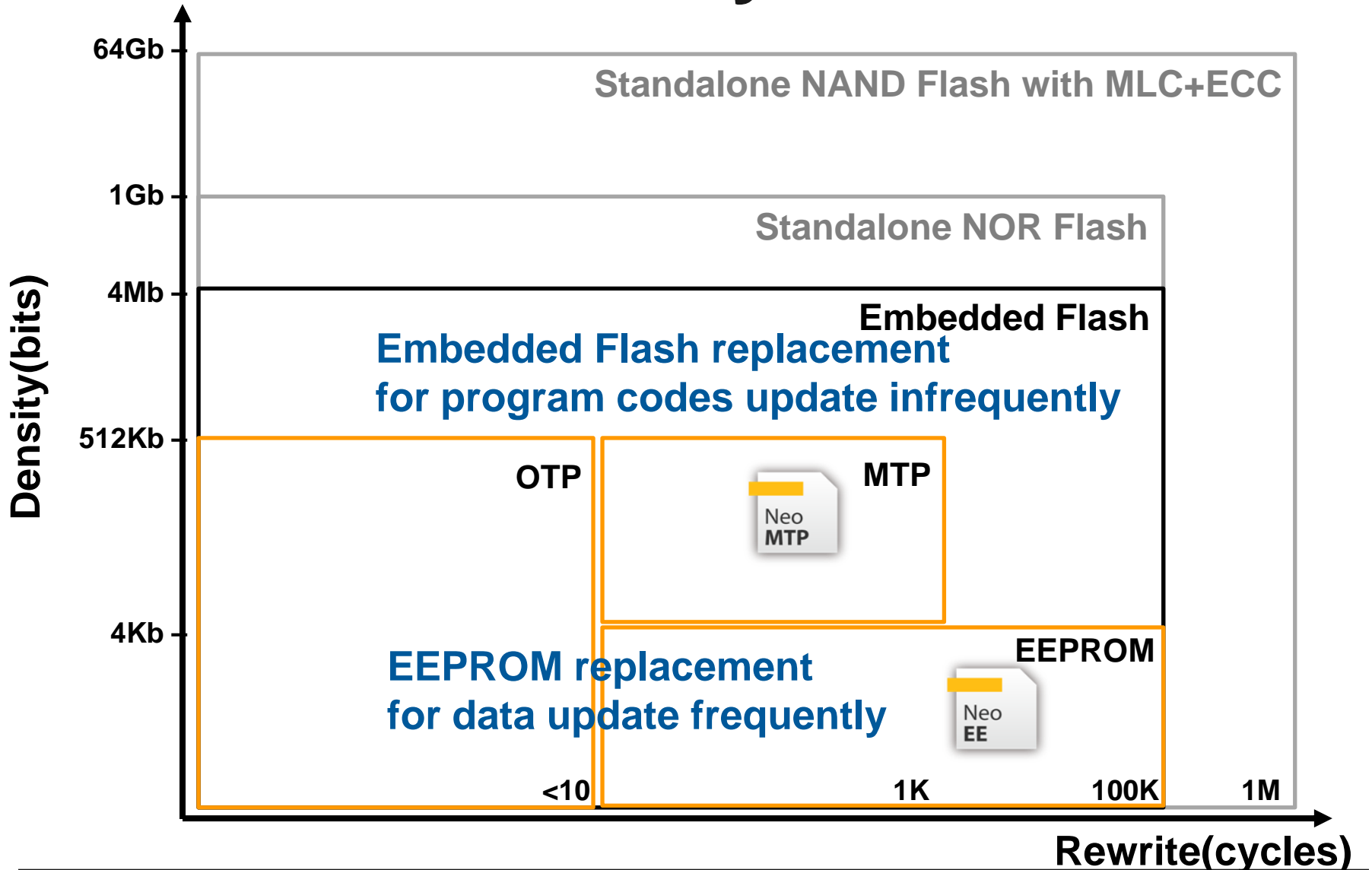
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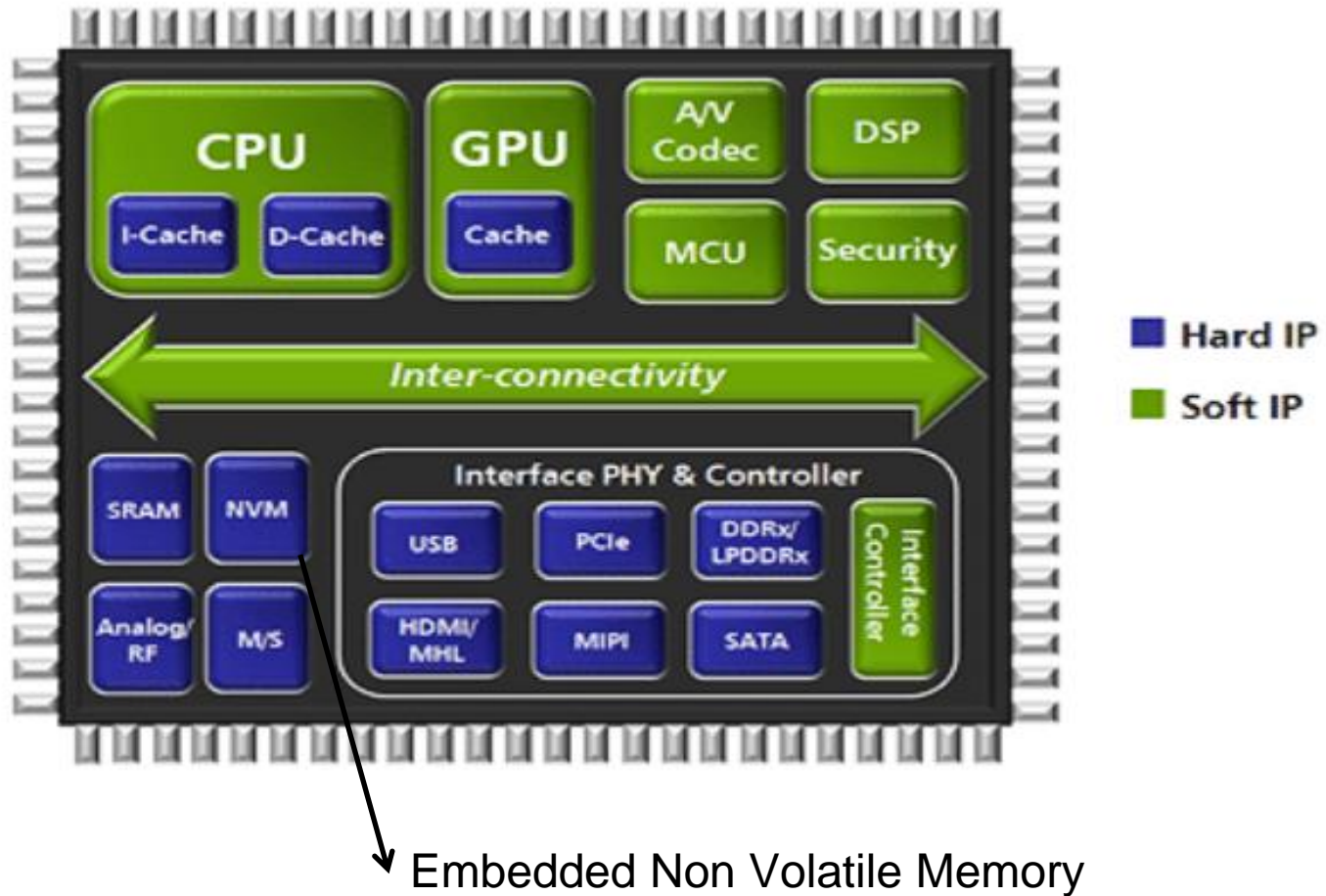
Outline

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

Nonvolatile Memory Classifications



SOC Block Diagram



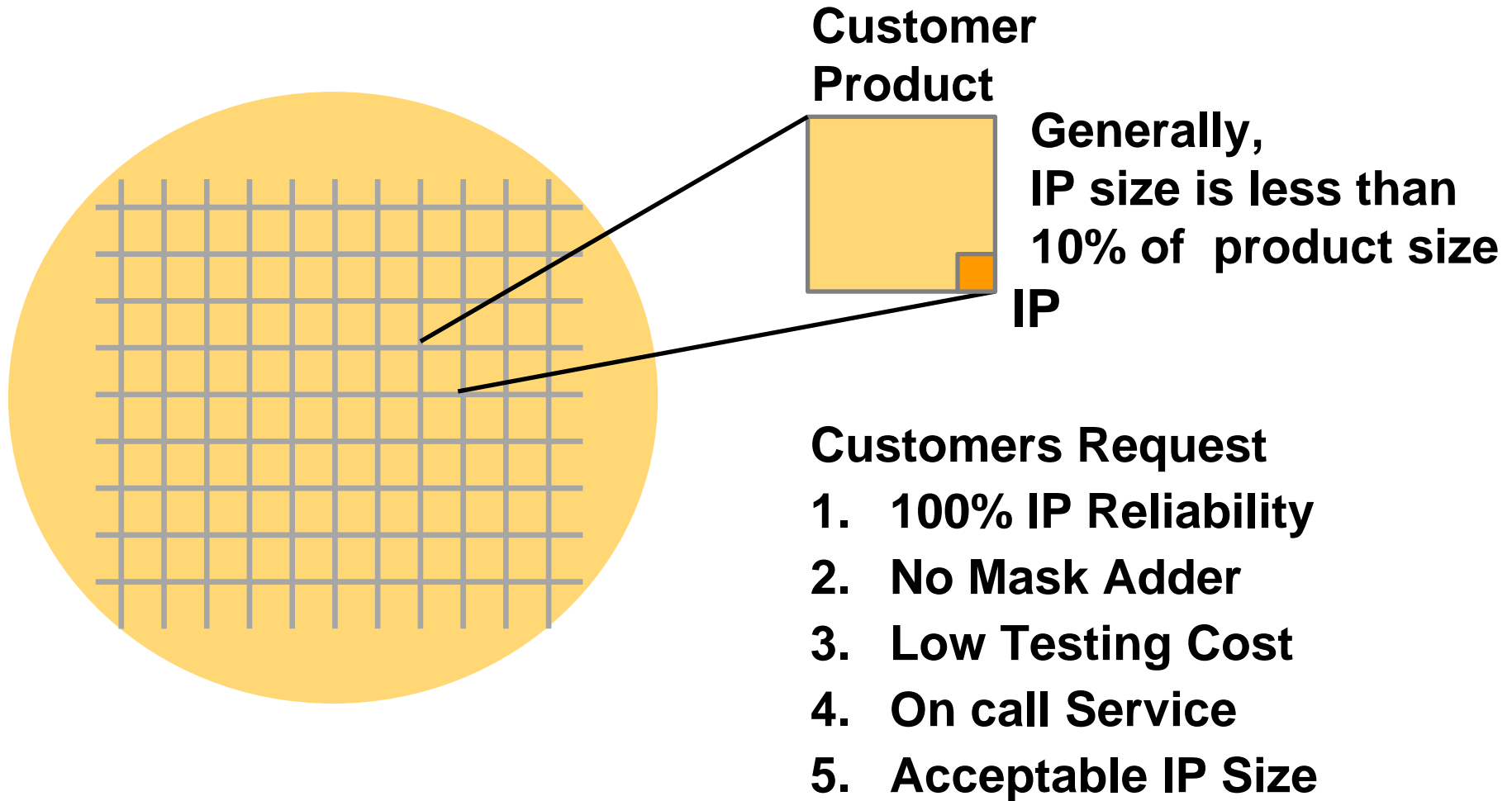
Source : tsmc

Embedded NVM Technologies

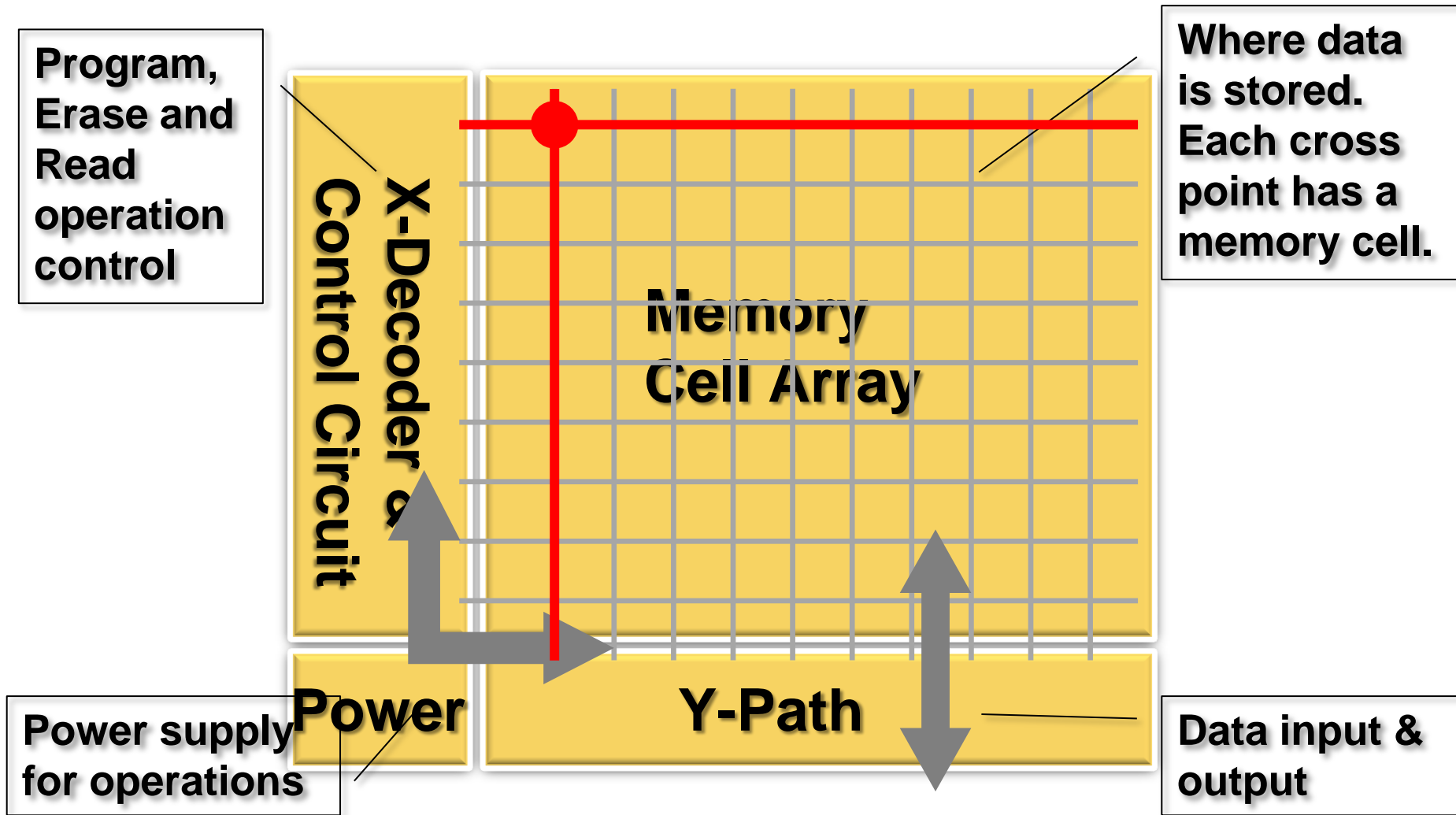
| | ROM | eFuse (OTP) | Antifuse (OTP) | CMOS Floating Gate (OTP) | CMOS Floating Gate (MTP) | Embedded Flash |
|---------------------------------|------------|-------------|----------------|--------------------------|--------------------------|----------------|
| Cell Structure | Transistor | Poly Fuse | 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

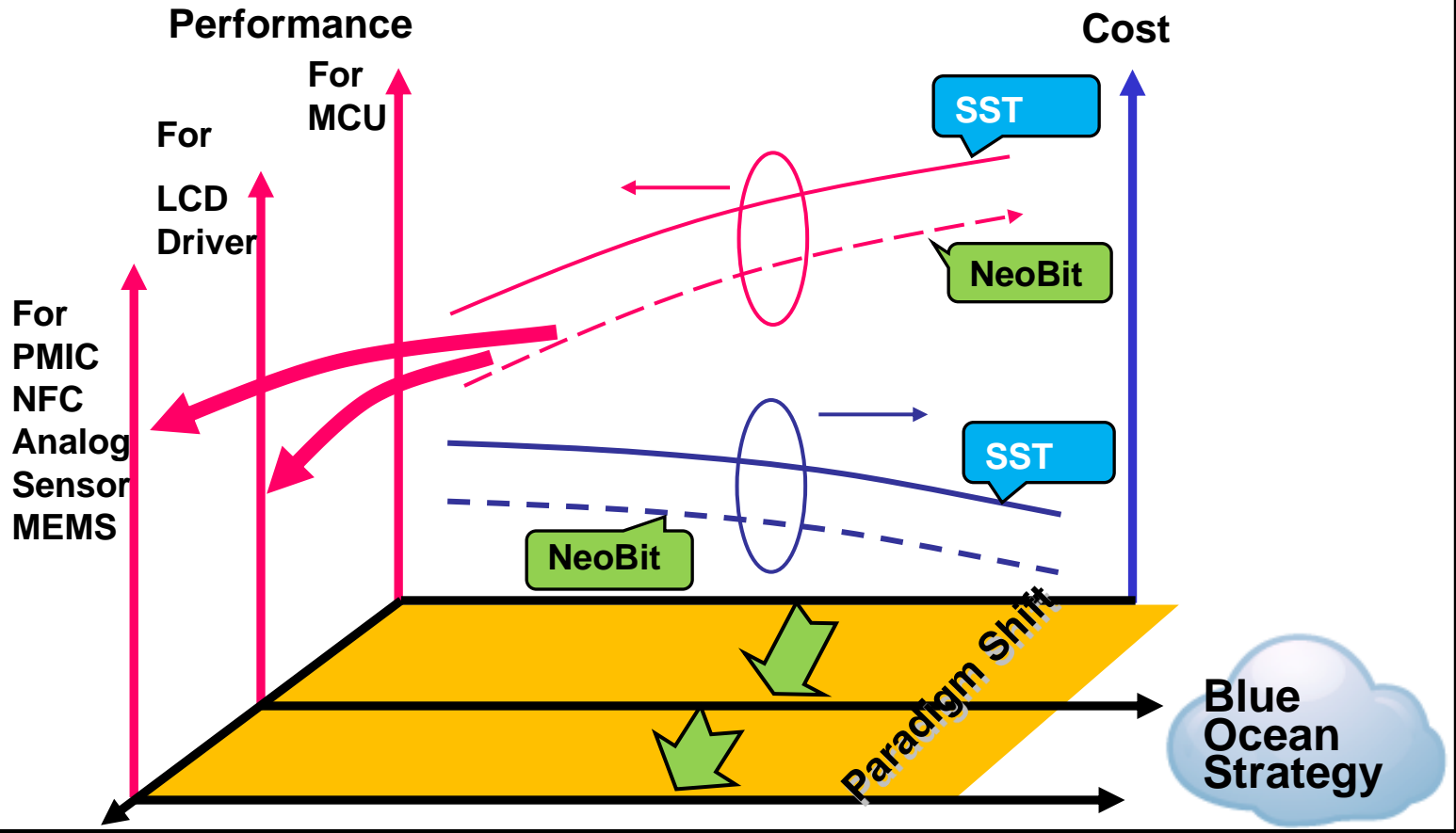


Inside Nonvolatile Memory IP

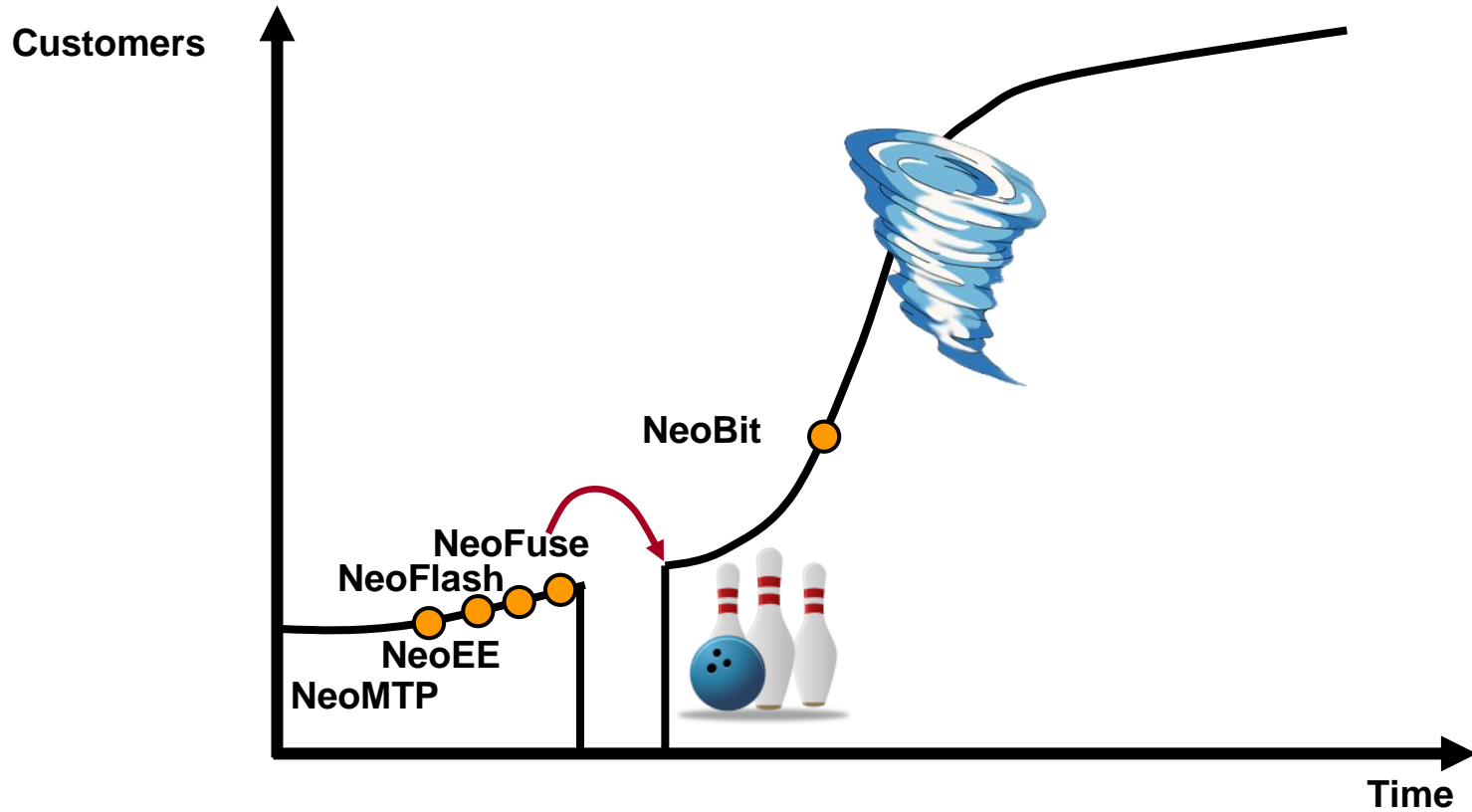


What We Have Done

● *Innovation, Innovation, and Innovation !*



Crossing the Chasm

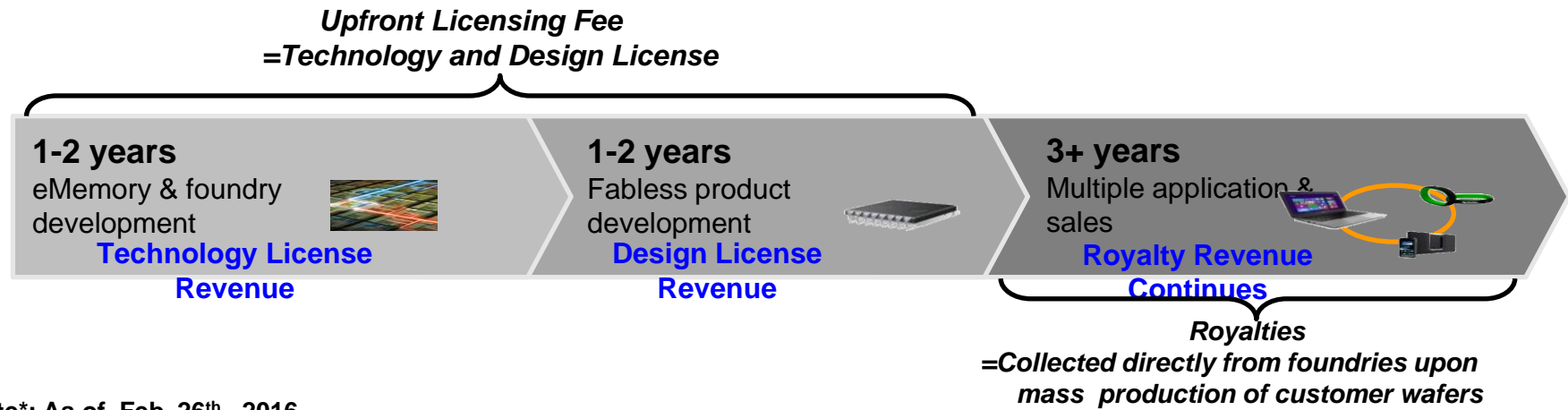


2016 Technology Development

| | Mass Production | Qualification | IP develop. | Device develop. |
|----------|--------------------------------------|------------------------|-------------------|-----------------|
| NeoBit | 0.6um-0.11um logic process | 0.11um auto HV process | | |
| | 0.25um-0.13um BCD process | | | |
| | 0.18-0.13um auto BCD process | | | |
| | 0.35um-55nm HV process | | | |
| | 0.18um auto HV process | | | |
| | 3.3V & 5V green shrink version | | | |
| | 0.11um CIS process | | | |
| | 0.18um SiGe process | | | |
| NeoFuse | 16nm FF+/FFC process | 10nm FF process | 7nm FF process | |
| | 28nm HPM/ HPC+ process | 65nm CIS Process | 14nm FF process | |
| | 55-28nm LP process | | | |
| | 55-28nm ULP process | | | |
| | 90-40nm HV process | | | |
| | 130-55nm eFlash | | | |
| | 63nm DRAM process | | | |
| | 0.15/0.13um BCD process | | | |
| | 0.11um/55nm CIS process | | | |
| | 0.15um no MV process | | | |
| | | | | |
| NeoEE | 0.11um RFID | 0.11um BCD process | 0.18um LP process | |
| | 0.11um Logic process | | | |
| | 0.13/0.11um LP process | | | |
| | 0.18-0.153um logic process | | | |
| | 0.18um 3.3V;5V Green process | | | |
| | 0.3/0.18/0.13um BCD process | | | |
| | 0.18um auto BCD process | | | |
| | | | | |
| NeoMTP | 110-55nm HV process | | 55nm HV (shrink) | |
| | 0.11um/0.18um logic process | | | |
| | 0.153um/0.18um 3.3V;5V Green process | | | |
| | 0.13 um/0.18um BCD | | | |
| NeoFlash | 0.18um logic process | | | |
| | 0.18/0.16um HV process | | | |
| | 0.11um logic process | | | |

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, 225 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 Feb. 26th, 2016

Worldwide Customers



Foundry



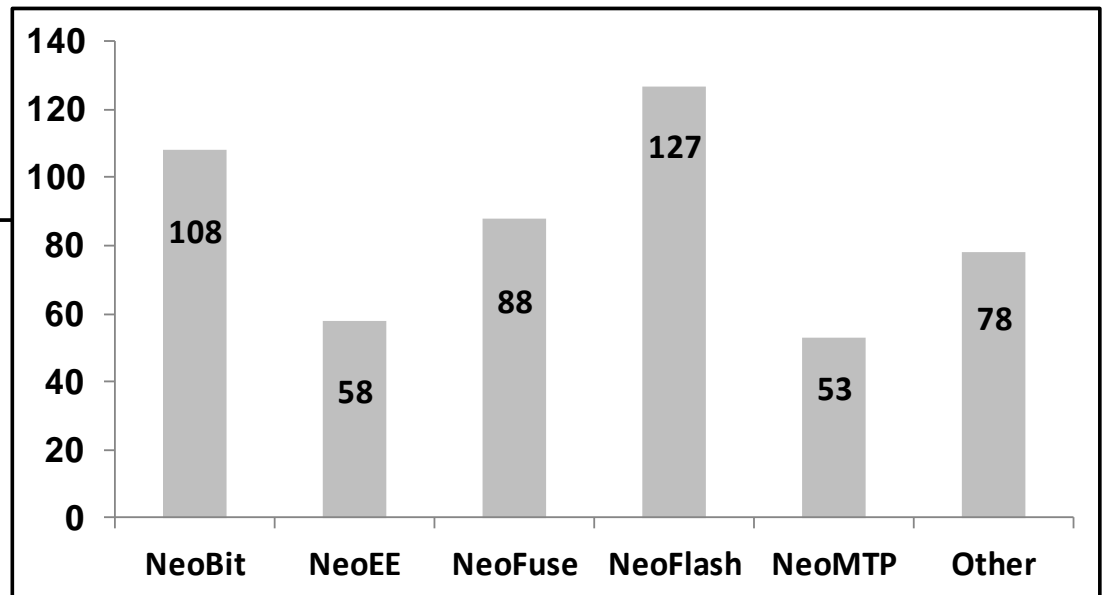
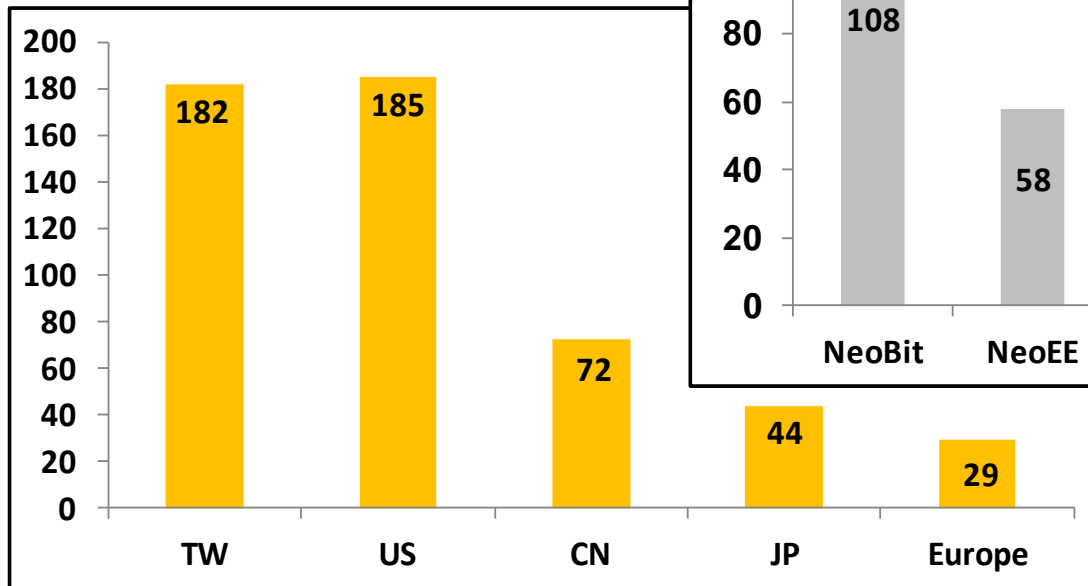
IDM



| | 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 | 237 | 351 | 51 | 36 | 181 | 94 | 40 |

Patent Portfolio

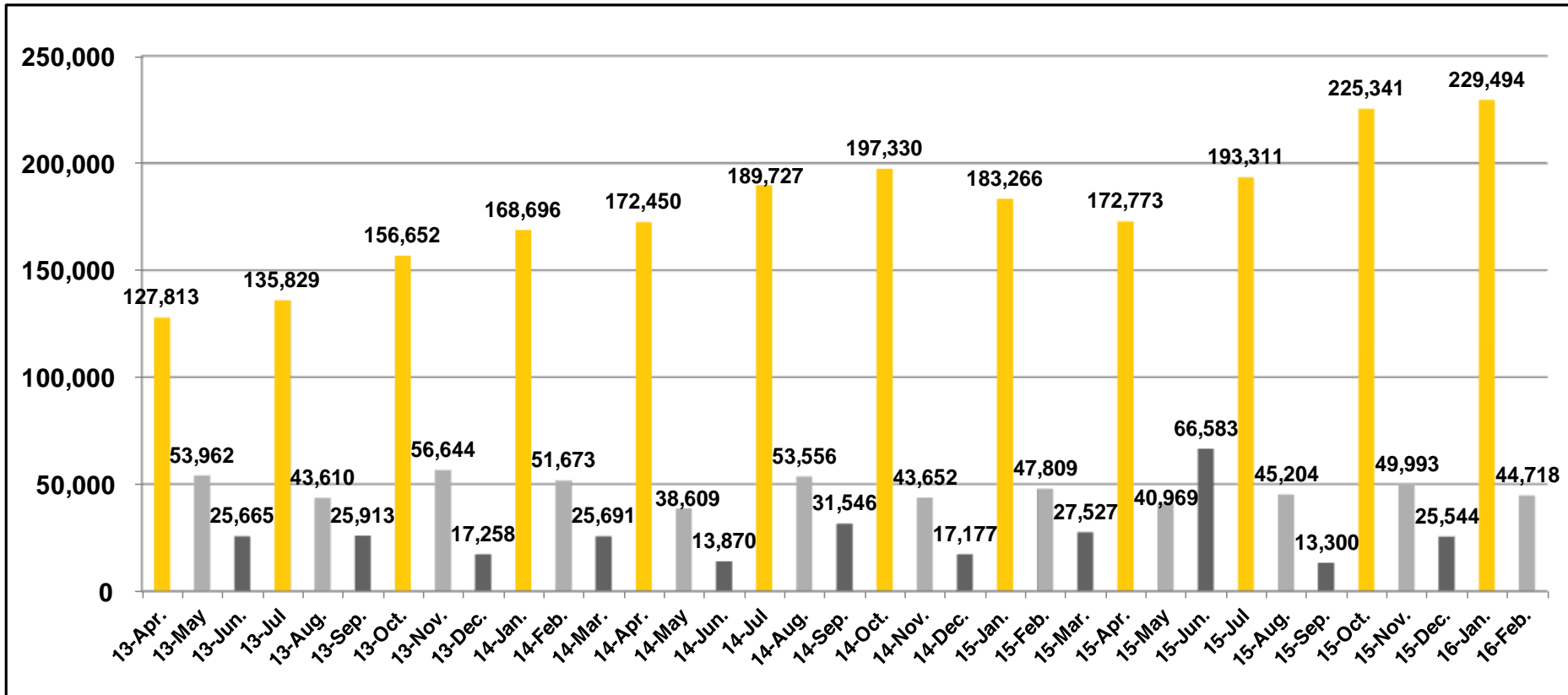
| | Q3 15 | Q4 15 | Diff. |
|---------|-------|-------|-------|
| Pending | 187 | 187 | - |
| Issued | 304 | 325 | +21 |
| Total | 491 | 512 | +21 |



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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Q4 Revenue Breakdown

Unit: NTD thousands

| | 2015 Q4 | 2015 Q3 | QoQ | 2014 Q4 | YoY | 2015 | 2014 | YoY |
|-----------|---------|---------|--------|---------|--------|-----------|-----------|-------|
| Licensing | 69,307 | 38,167 | 81.59% | 51,849 | 33.67% | 267,512 | 246,073 | 8.71% |
| Royalty | 231,571 | 213,648 | 8.39% | 206,310 | 12.24% | 824,108 | 757,904 | 8.74% |
| Total | 300,878 | 251,815 | 19.48% | 258,159 | 16.55% | 1,091,620 | 1,003,977 | 8.73% |

Unit: Number of contracts

| | | 2015 Q4 | 2015 Q3 | 2015 | 2014 |
|---------------------|-------|---------|---------|------|------|
| Technology Licenses | | 11 | 4 | 28 | 21 |
| Design Licenses | NRE | 9 | 10 | 57 | 82 |
| | Usage | 104 | 76 | 349 | 363 |

Financial Income Statement

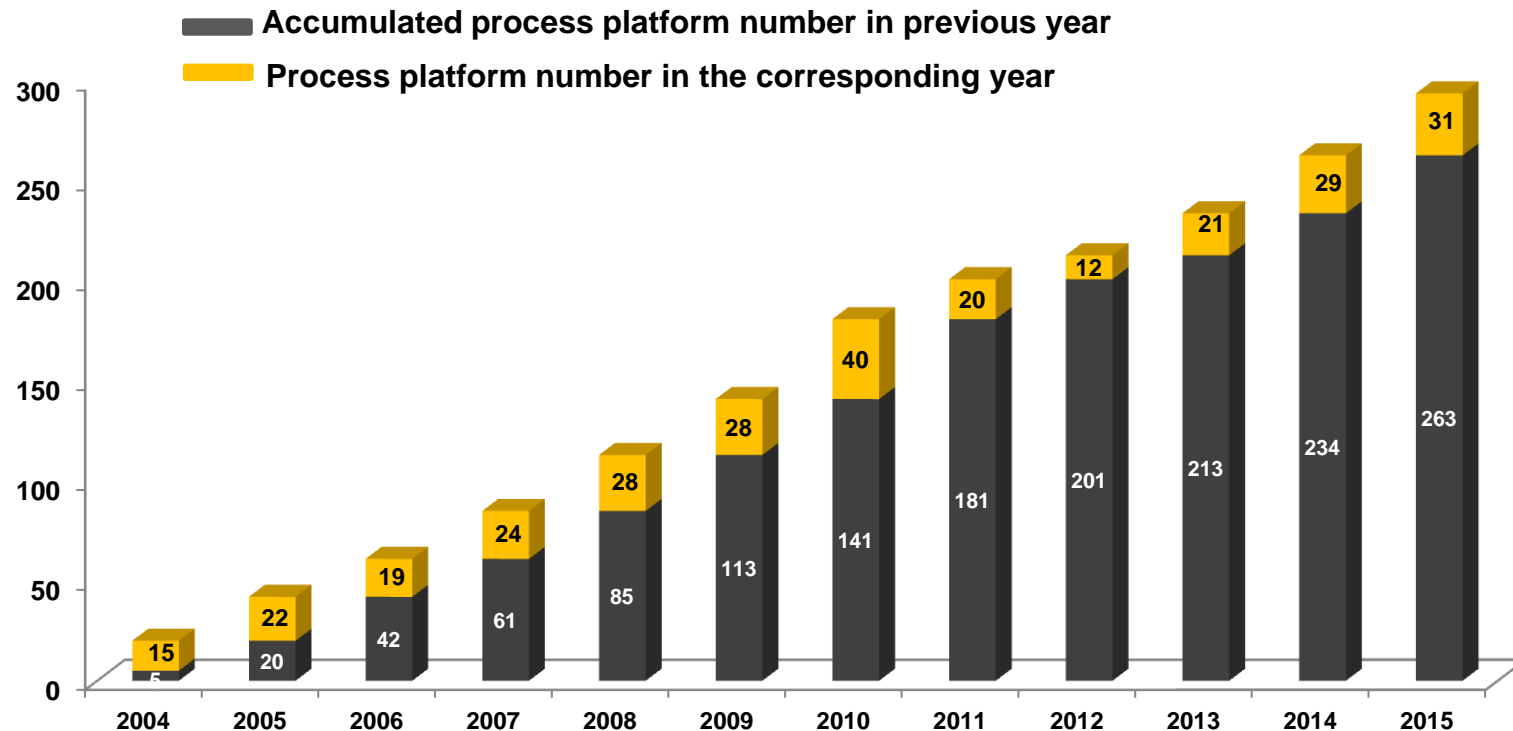
| (Unit: NTD thousands) | Q4 15 | Q4 14 | % change | 2015 | 2014 | % change |
|-----------------------|---------|---------|----------|-----------|-----------|----------|
| Revenue | 300,878 | 258,159 | 16.5% | 1,091,620 | 1,003,977 | 8.7% |
| Gross Margin | 100% | 100% | - | 100% | 100% | - |
| Operating Expenses | 156,216 | 148,466 | 5.2% | 570,403 | 540,286 | 5.6% |
| Operating Margin | 48.1% | 42.5% | +5.6ppts | 47.7% | 46.2% | +1.5ppts |
| Net Income | 128,090 | 100,931 | 26.9% | 479,111 | 418,604 | 14.5% |
| Net Margin | 42.6% | 39.1% | +3.5ppts | 43.9% | 41.7% | +2.2ppts |
| EPS (Unit: NTD) | 1.69 | 1.33 | 27.1% | 6.32 | 5.52 | 14.5% |
| ROE | 28.4% | 23.4% | +5.0ppts | 26.6% | 24.3% | +2.3ppts |

Technology License

Unit: Number of contract

| Year | 2013 | 2014 | 2015 |
|----------------|------|------|------|
| License number | 19 | 21 | 28 |

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 Dec.) : **100**
- **16** for NeoBit, **38** for NeoFuse, **26** for NeoEE, and **20** for NeoMTP.

| | 10nm | 14/16nm | 28nm | 40nm | 55/65nm | 80/90nm | 0.11~ 0.13um | 0.15~ 0.18um | >0.25 um | Total |
|----------|------|---------|------|------|---------|---------|-----------------|-----------------|-------------|-------|
| NeoBit | - | - | - | - | - | - | 5 | 11 | - | 16 |
| NeoFuse | 1 | 3 | 9 | 4 | 9 | 3 | 6 | 3 | - | 38 |
| NeoFlash | - | - | - | - | - | - | - | - | - | 0 |
| NeoEE | - | - | - | 2 | - | 1 | 6 | 17 | - | 26 |
| NeoMTP | - | - | - | 1 | 2 | 2 | 4 | 11 | - | 20 |

Current Technology Development Platforms

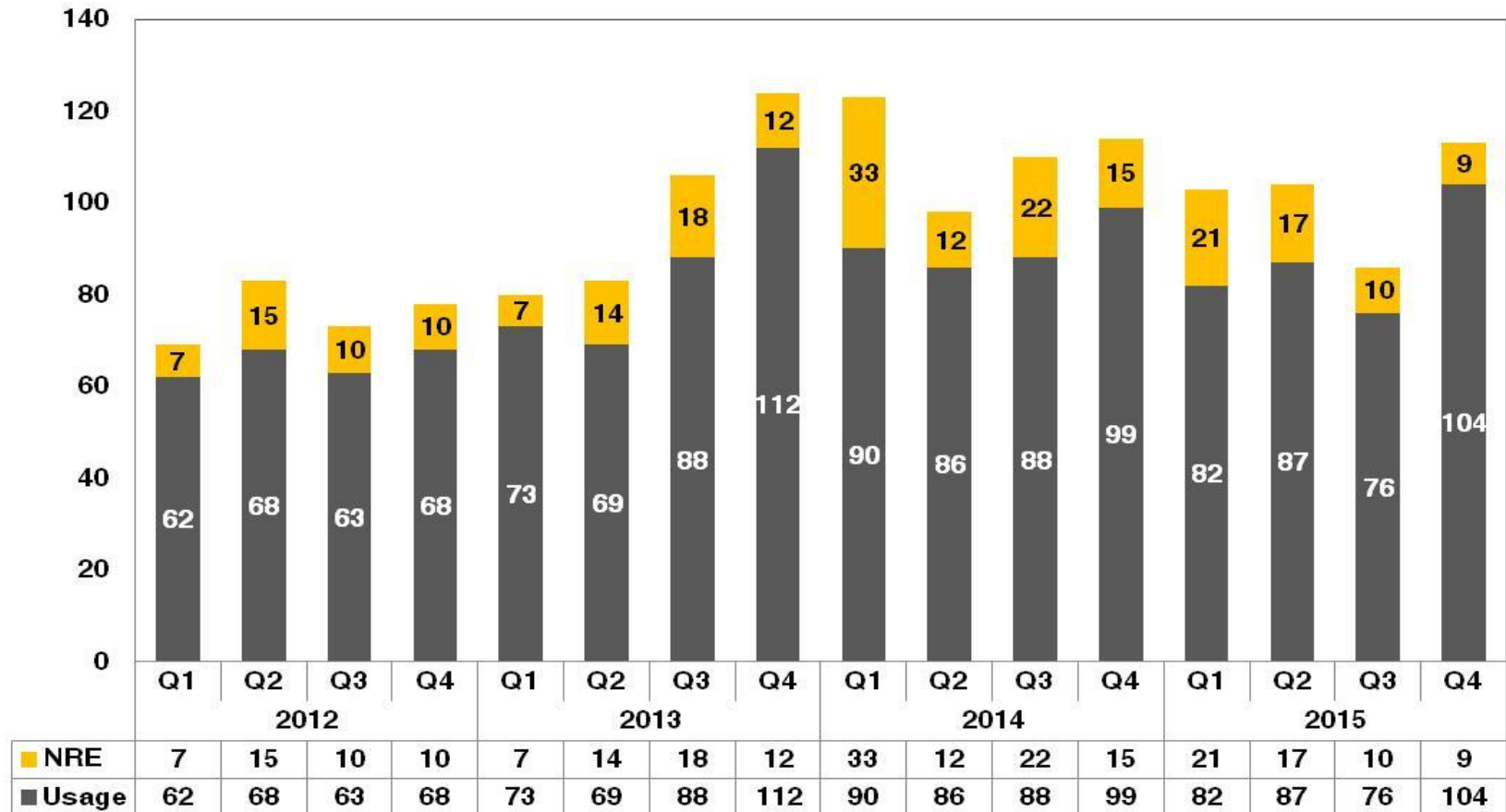
| 12" Fabs | Production | Development | NVM Type | Process Type |
|-------------|------------|-------------|-----------------|--------------------------------|
| 10nm | 0 | 1 | OTP | FF |
| 14/16nm | 0 | 3 | OTP | FF+ |
| 28nm | 5 | 9 | OTP | LP/HPM, HLP/HPM, LPS |
| 40nm | 2 | 7 | OTP, MTP | HV-DDI, LP |
| 55/65nm | 10 | 11 | OTP, MTP, Flash | LP, HV-DDI, HV-OLED, DRAM, CIS |
| 80/90nm | 5 | 6 | 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 | 17 | OTP, MTP, Flash | HV-DDI, BCD, LP, RF, CIS, LL |
| 0.18/0.16/0.152um | 42 | OTP, MTP | Generic, LP, LL, MR, HV, Green, BCD |
| 0.25um | 0 | OTP, MTP | BCD |
| 0.35um | 0 | OTP | UHV |

*As of Dec. 31, 2015

Quarterly Design Licensing (New Tape Out)

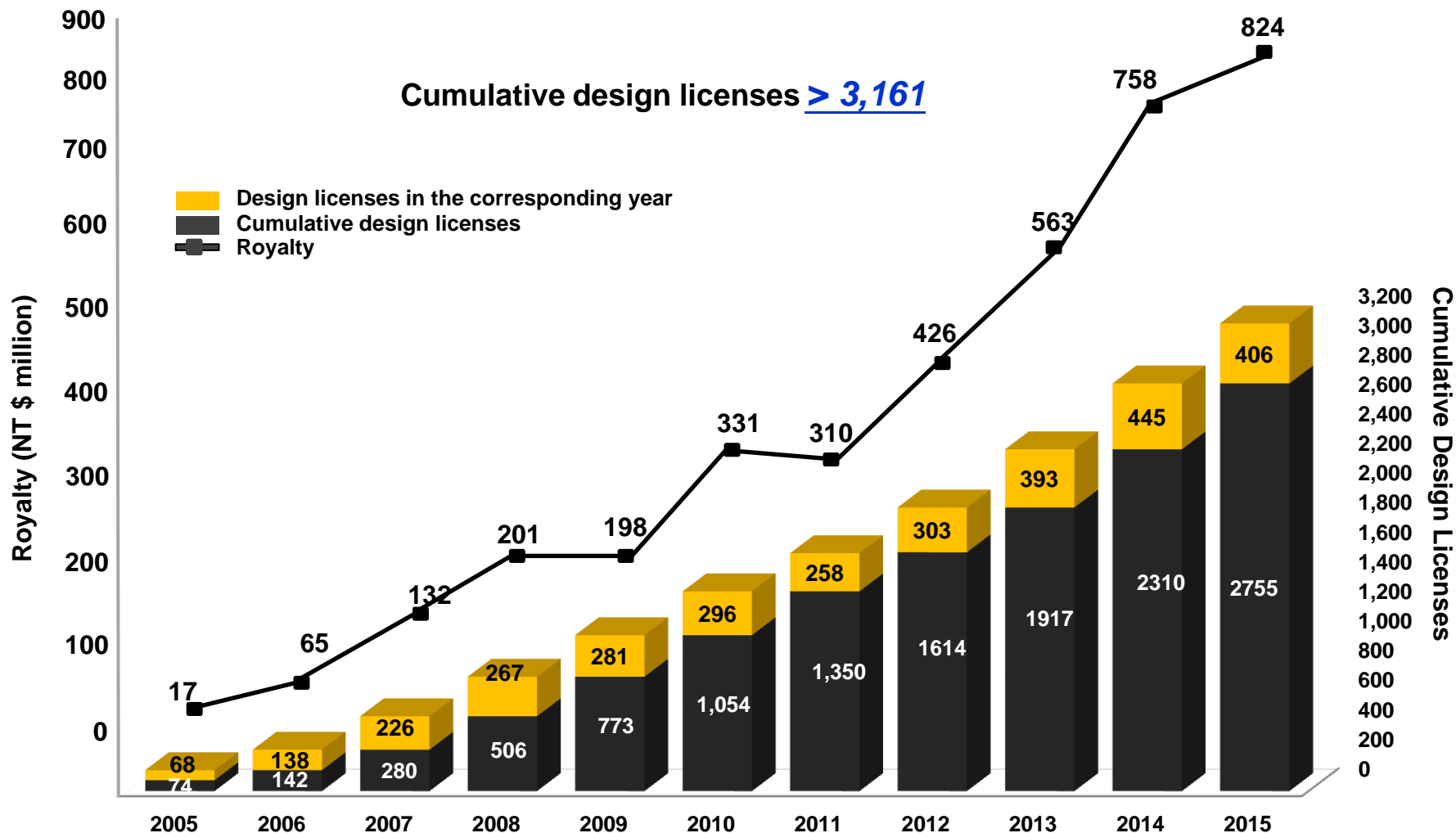
- Total **406** NTO in 2015 (**445**@2014 **393**@2013, **303**@2012, **258**@2011)



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.

Cumulative Licenses Drive Future Royalties

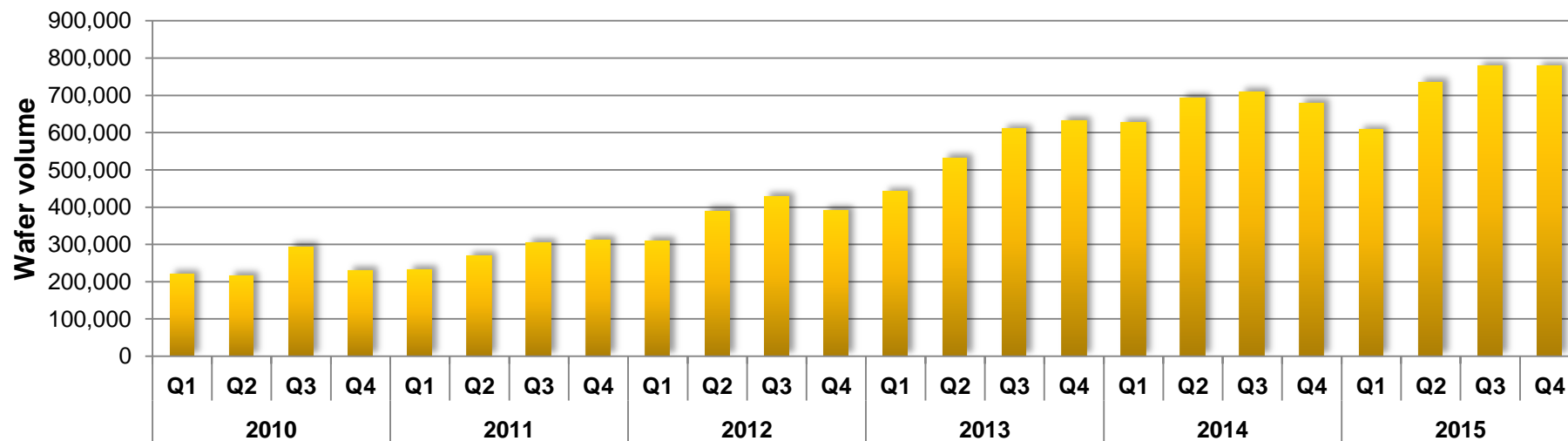


note 1: Due to the 2009 recession, royalty income was down annually 1.5%.

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%.

Wafer Production Volume



embedded eMemory IP in T Company (\$revenue); * % of Process node in T company total revenue in Q4 15

| | Process node | *% of T | Q4 15 | Q3 15 | 2015 | 2014 |
|-------|--------------|---------|--------|-------|--------|-------|
| 8" | 0.25/0.35 | 4% | 47.61% | 38.2% | 33.49% | 30.5% |
| | 0.15/0.18 | 11% | 10.11% | 7.9% | 8.73% | 11.9% |
| | 0.11/0.13 | 3% | 29.24% | 30.9% | 29% | 20.8% |
| 12" | 90nm | 7% | 20.20% | 21.8% | 19.85% | 16.3% |
| | 65nm | 11% | 0.61% | 0.9% | 0.55% | 0% |
| | 40/45nm | 14% | 0% | 0% | 0% | 0% |
| | 28nm | 25% | 0.18% | 0.02% | 0.05% | 0% |
| | 16/20nm | 24% | 0% | 0% | 0% | 0% |
| 8" | | 19% | 21.64% | 16.3% | 16.64% | 15.6% |
| 12" | | 81% | 1.88% | 2.3% | 1.87% | 1.4% |
| Total | | 100% | 5.42% | 5.0% | 4.76% | 4.5% |

Outline

- **Business Model**
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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"

16/20nm

28nm

40nm

55/65nm

80/90nm

110/130nm

160/180nm

250nm

350nm

NeoBit

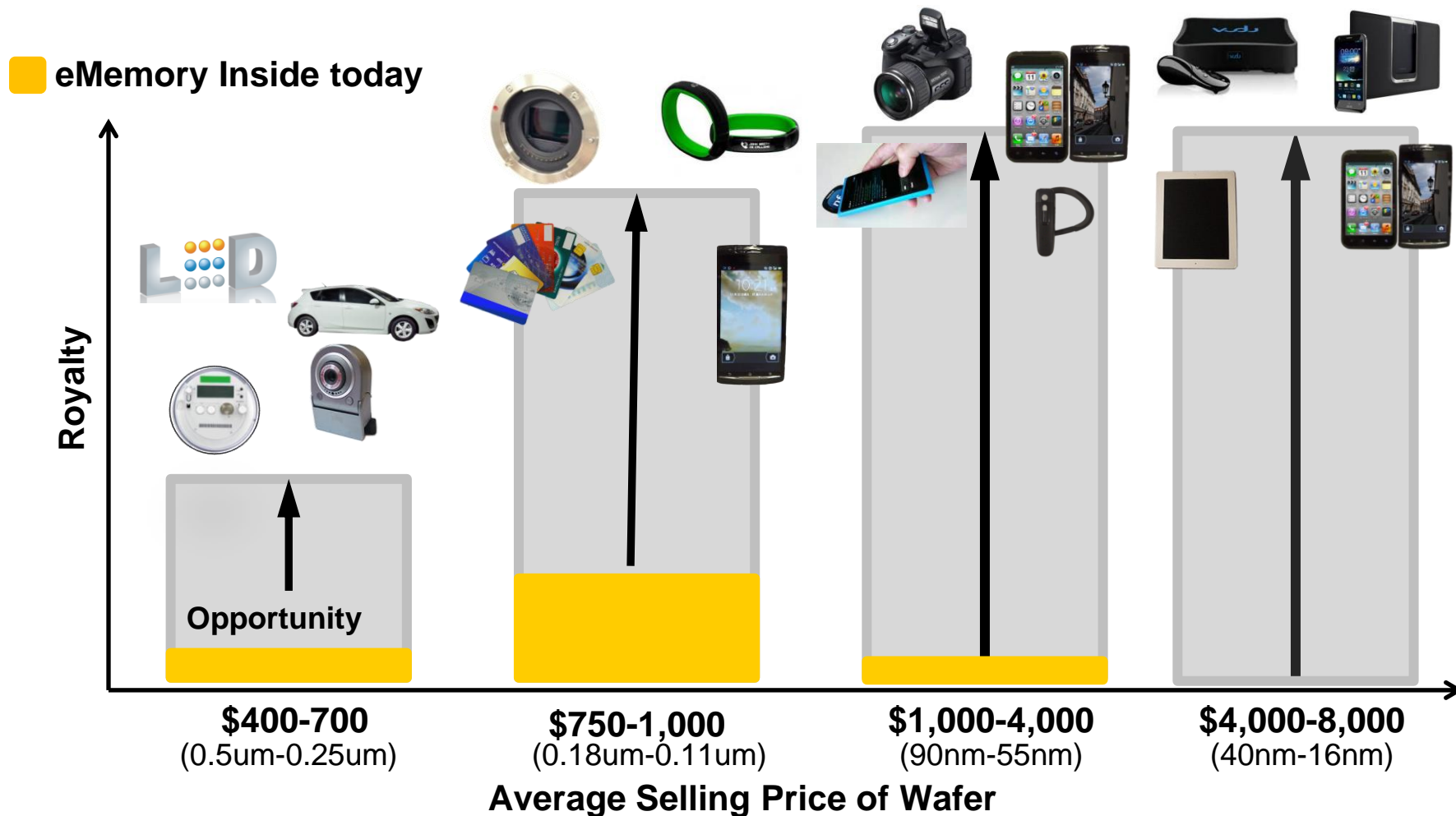
NeoFuse

NeoFlash

NeoEE

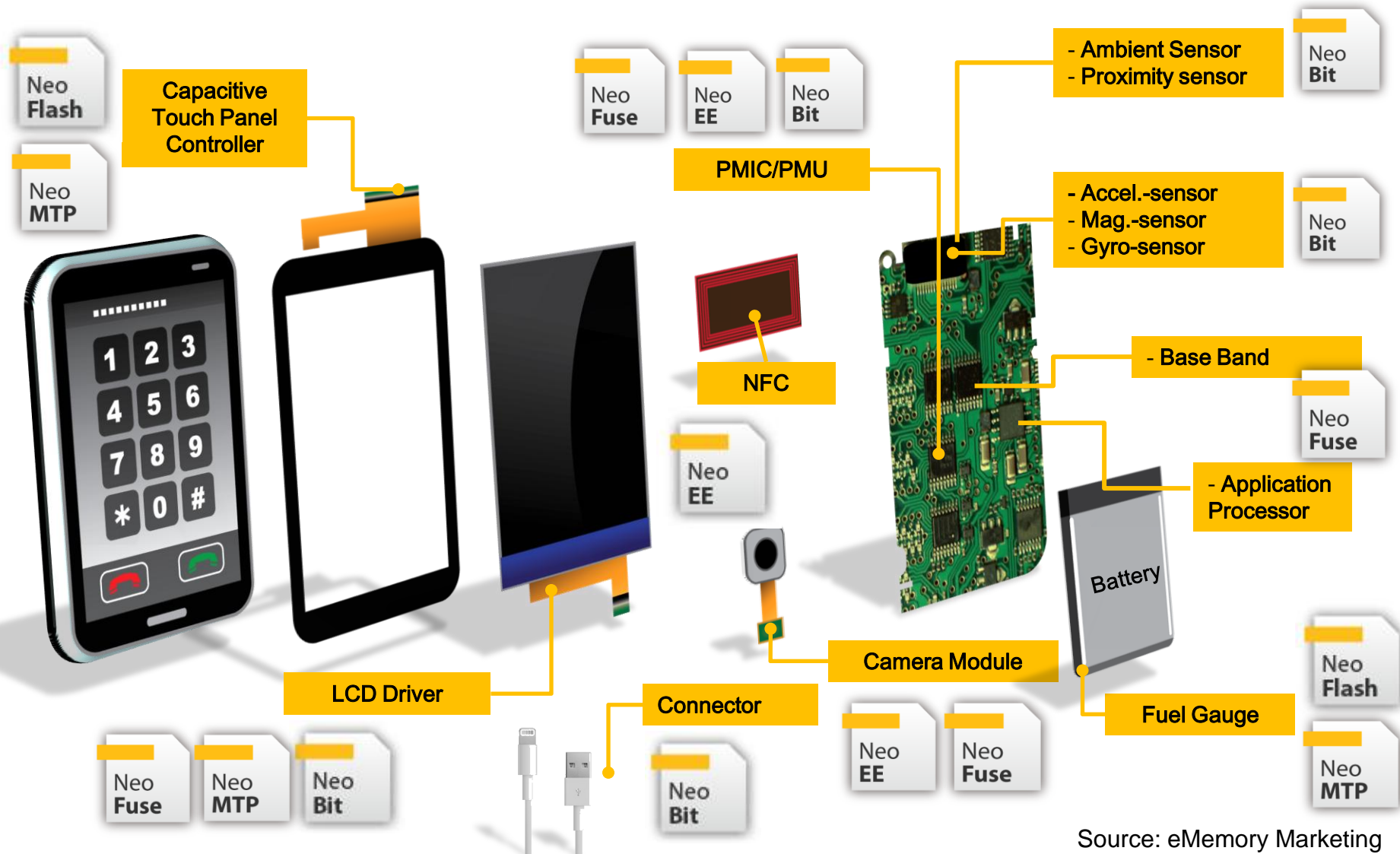
NeoMTP

Opportunity at all Price Points



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

eMemory IP in Smart Phone



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

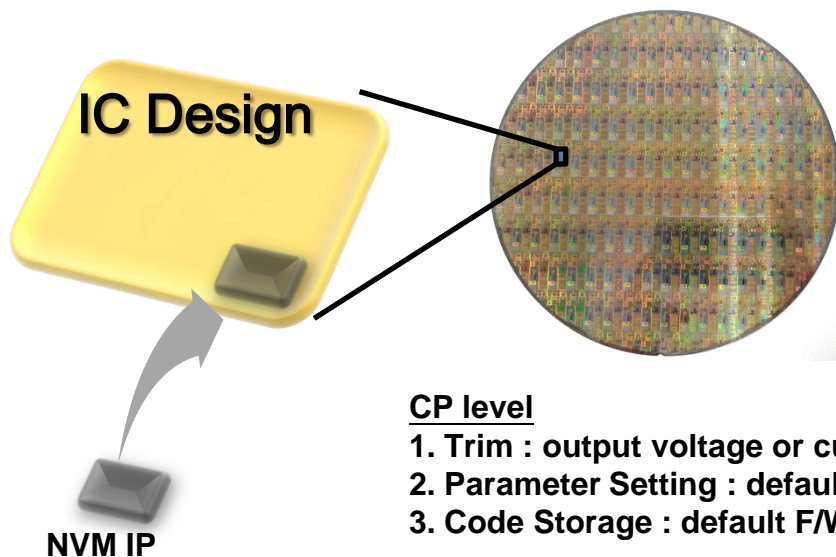
Package/FT level

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

CP Test

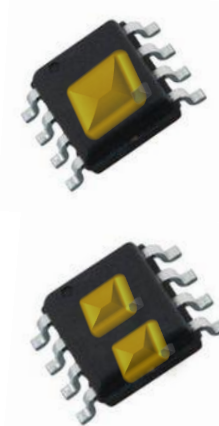
Package/FT

System Assembling



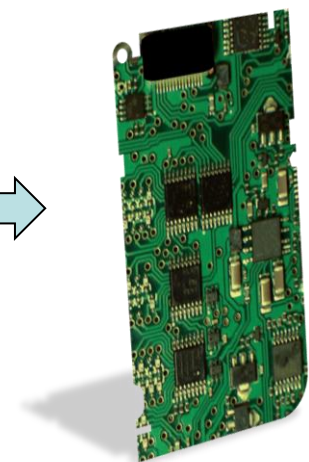
CP level

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



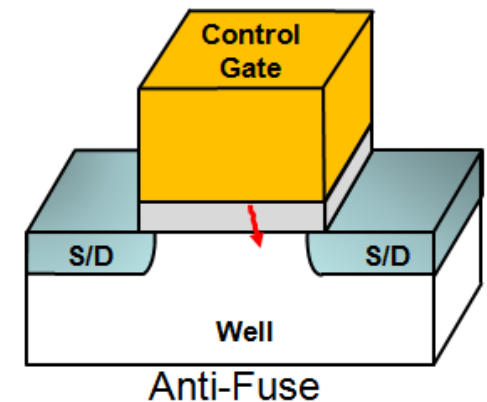
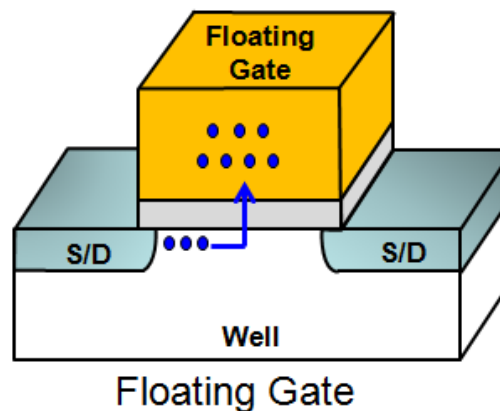
Invisibility for Security

- 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



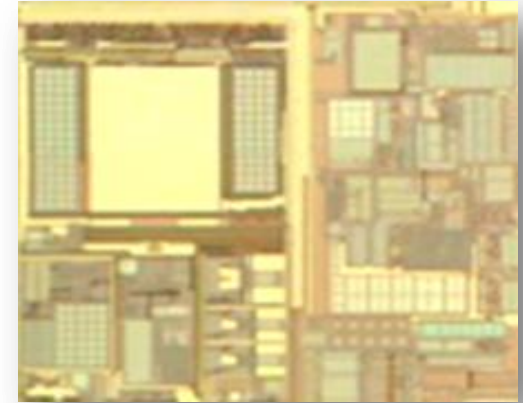
reverse
copy

re-produce



without protection

Fake Product

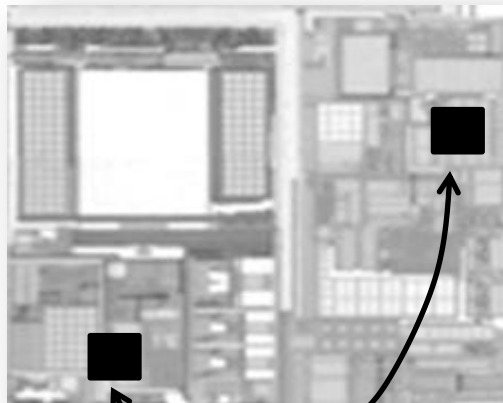


reverse
copy

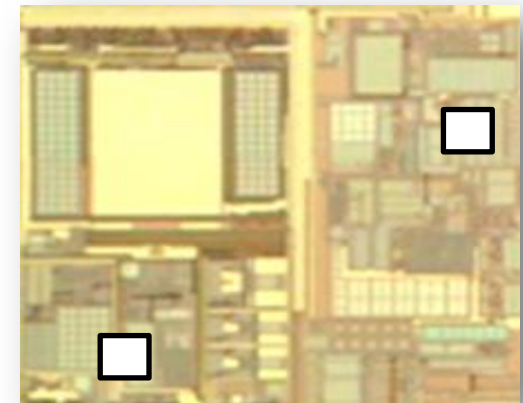
re-produce



with protection

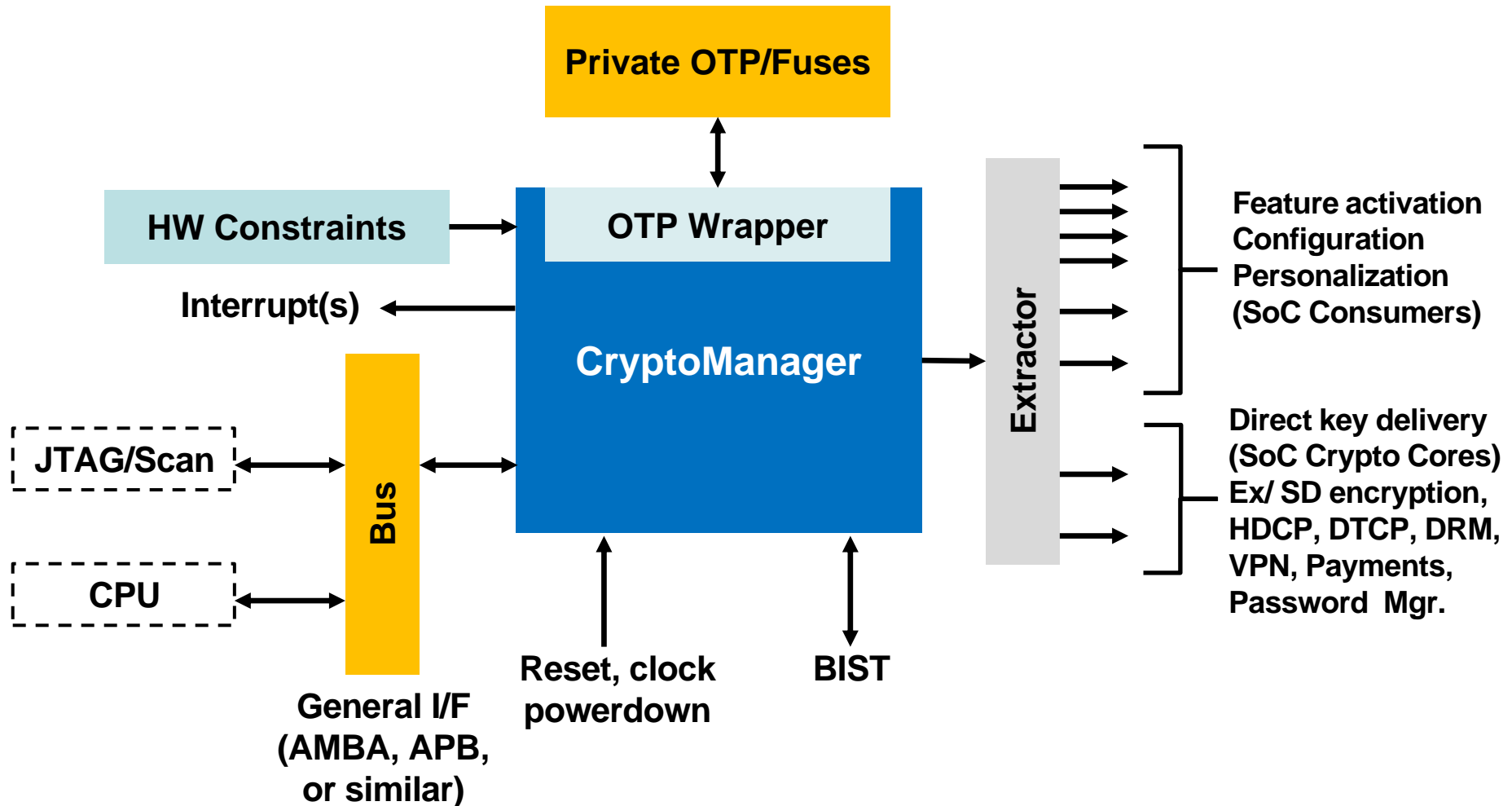


Security IP/Code by
Authorized Use



Can NOT Work w/o
Security IP/Code

OTP for security storage

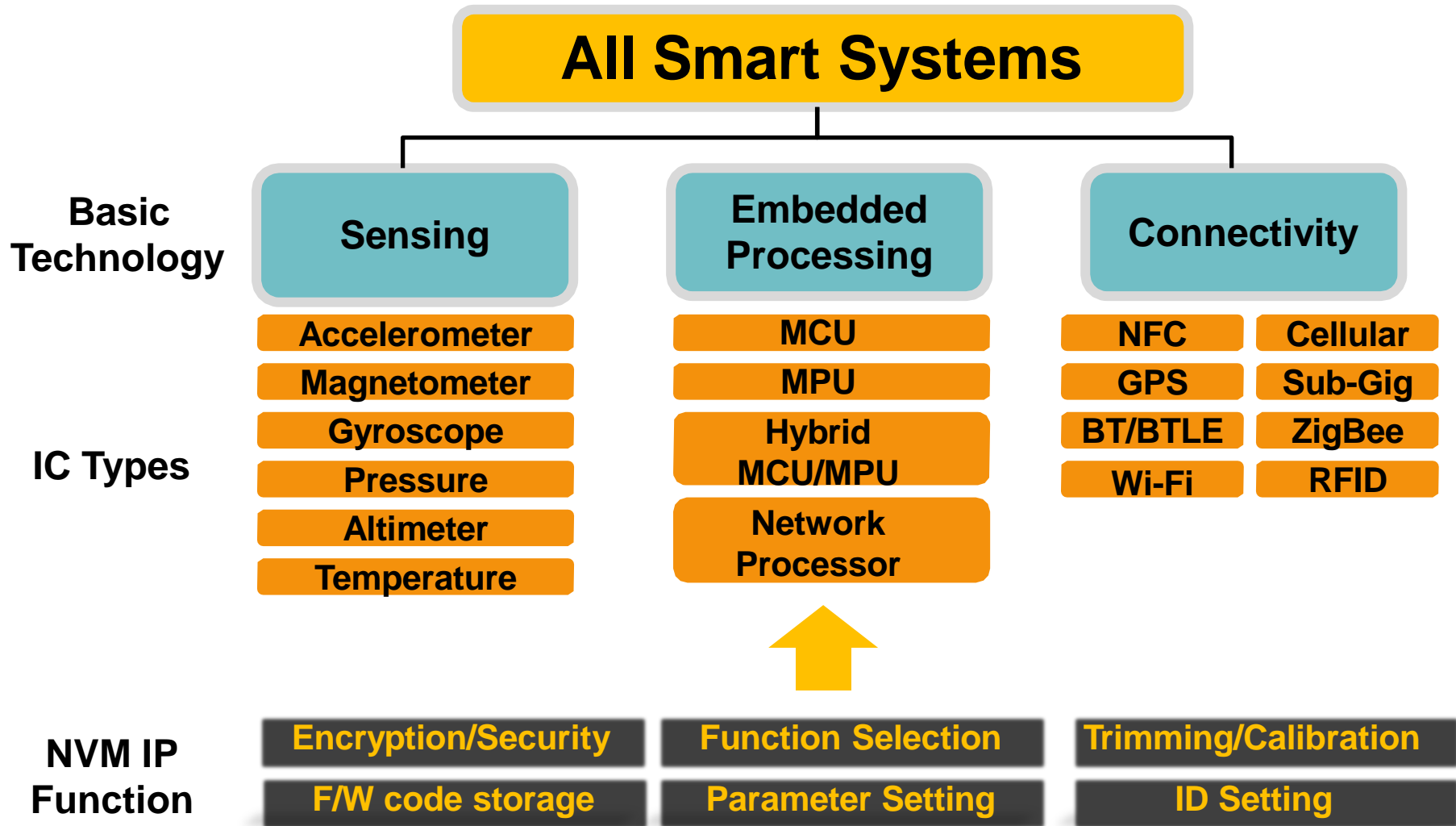


Source : Rambus crypto manager platform

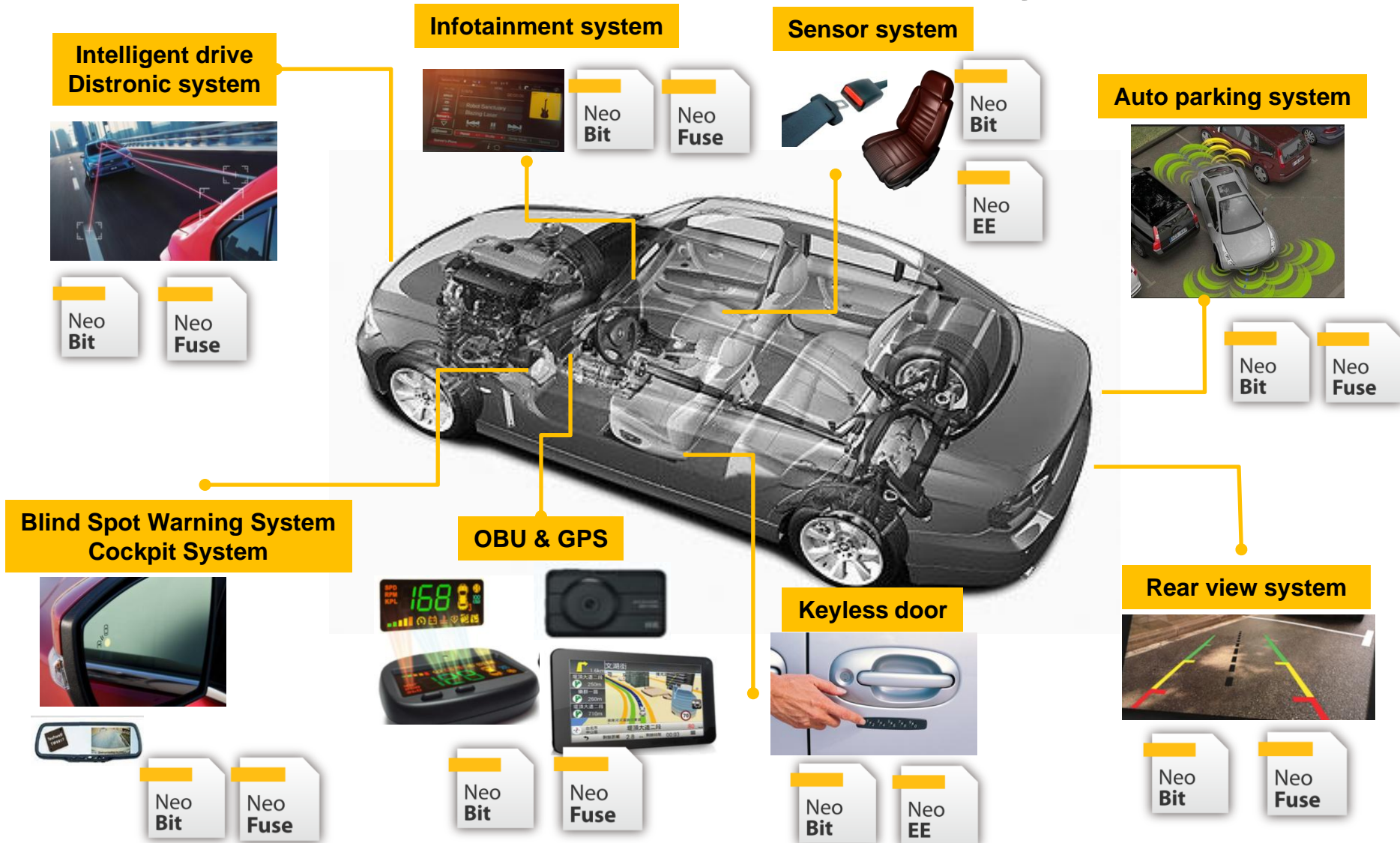
Security with eMemory IPs



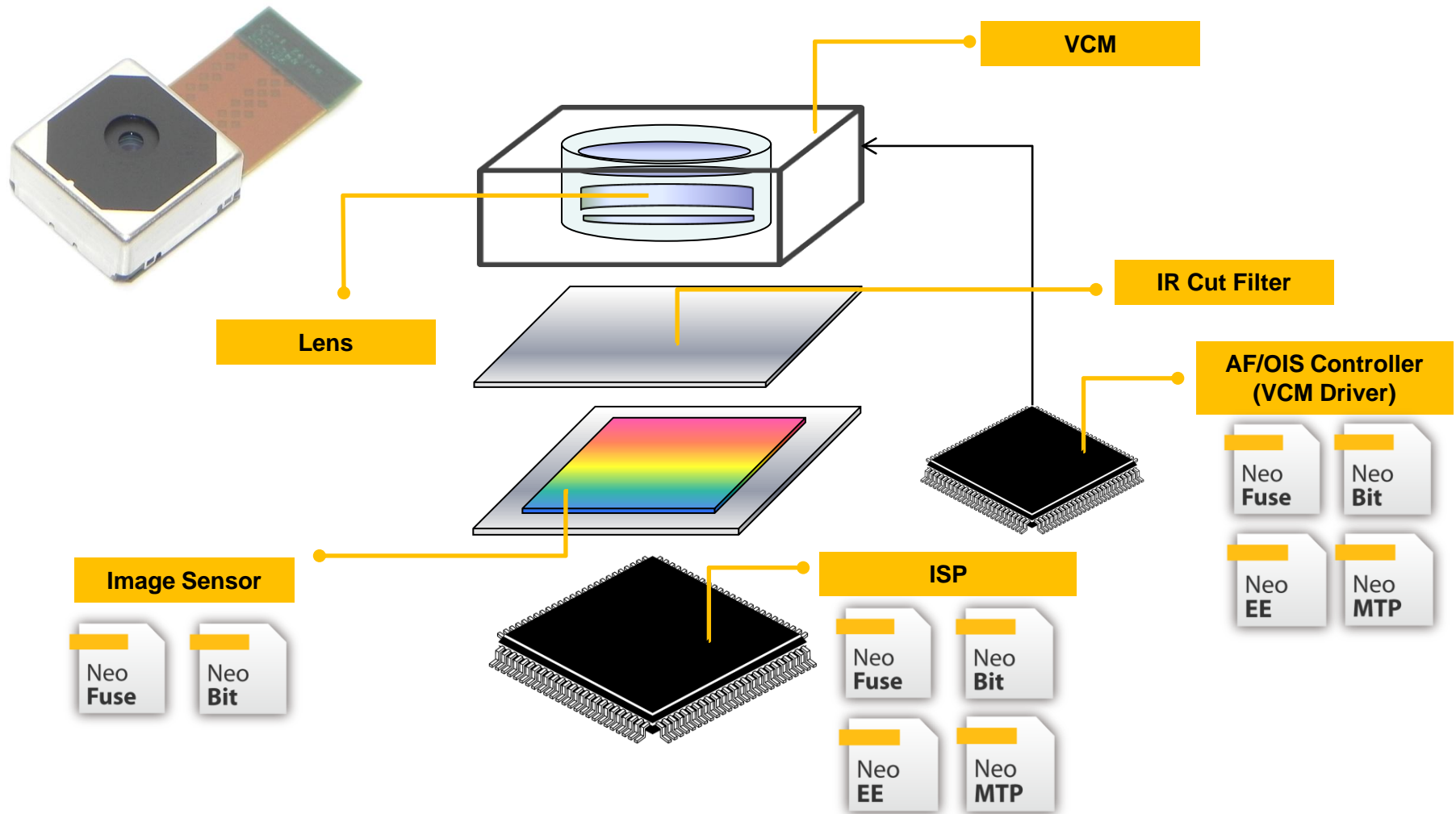
NVM IP Demand in IoT



Autotronics with eMemory IPs

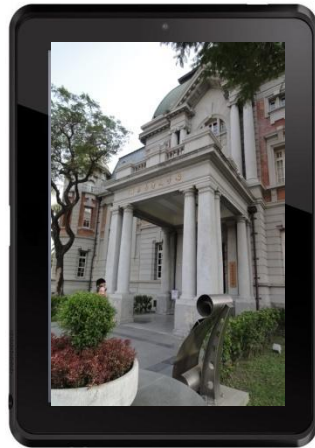


Imager Module with eMemory IPs



Advanced LCD Driver ICs

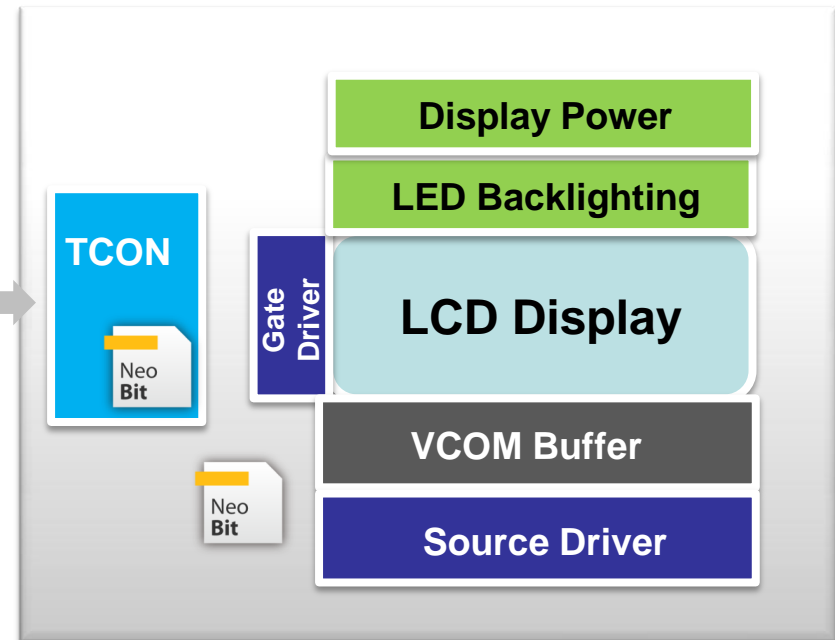
Process Technology : 0.11um HV/80nm HV/55nm HV



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



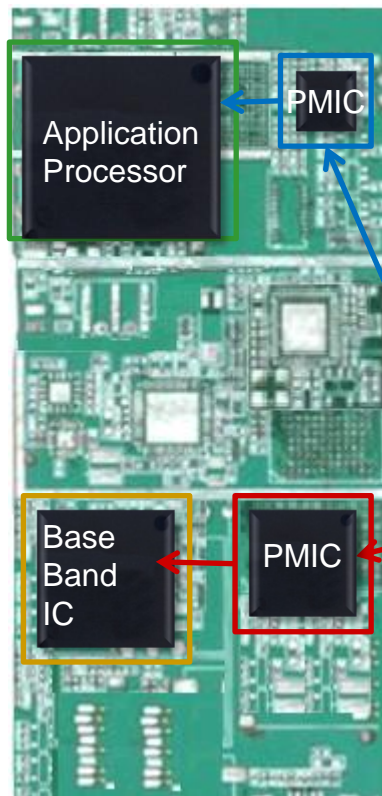
DDI



| 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

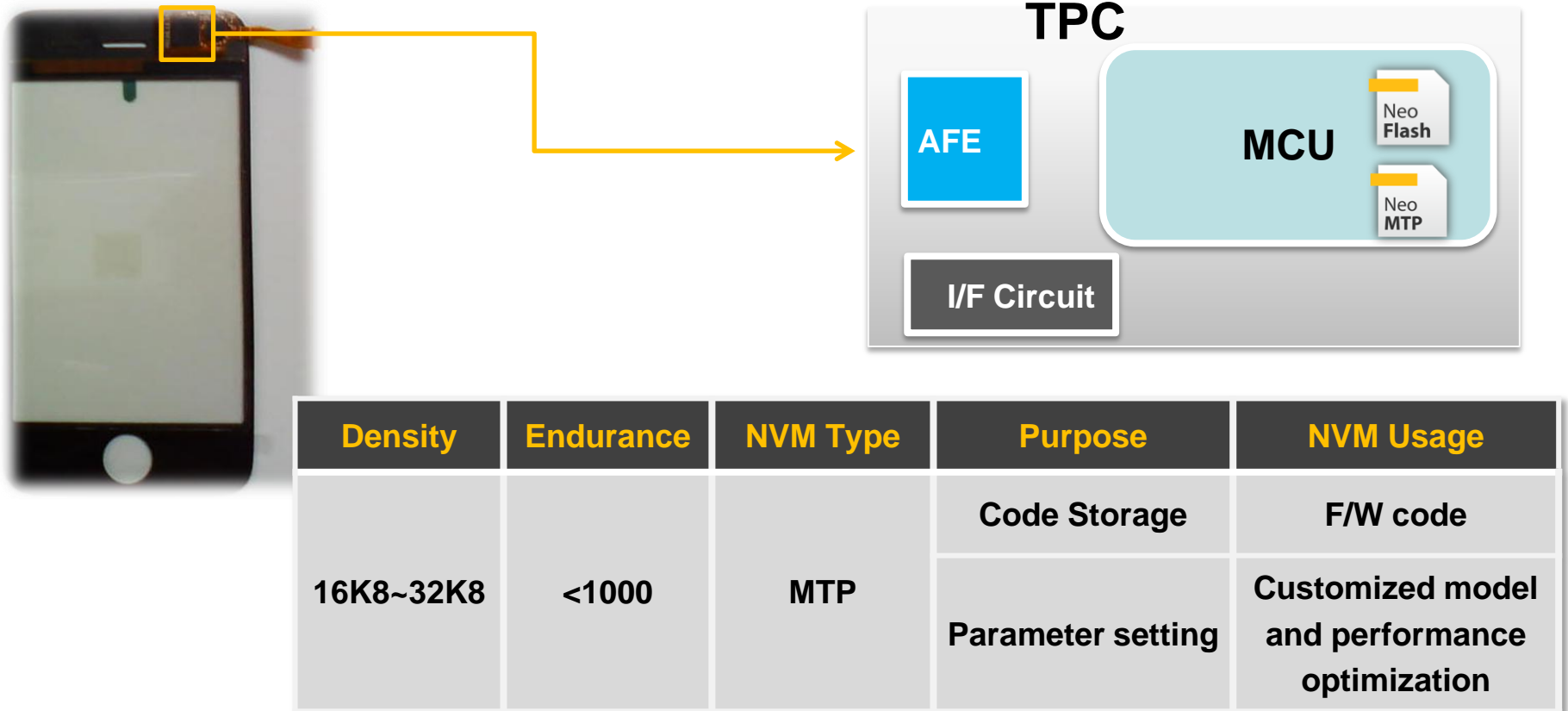


| Density | NVM Type | Purpose | NVM Usage |
|---------|----------|-------------------|--|
| 2Kb~4Kb | OTP | Trimming | DC/DC, Bandgap |
| | | Parameter Setting | Design flexibility & Performance optimization |
| | | Code Storage | Start-up behavior & smart power saving algorithm |



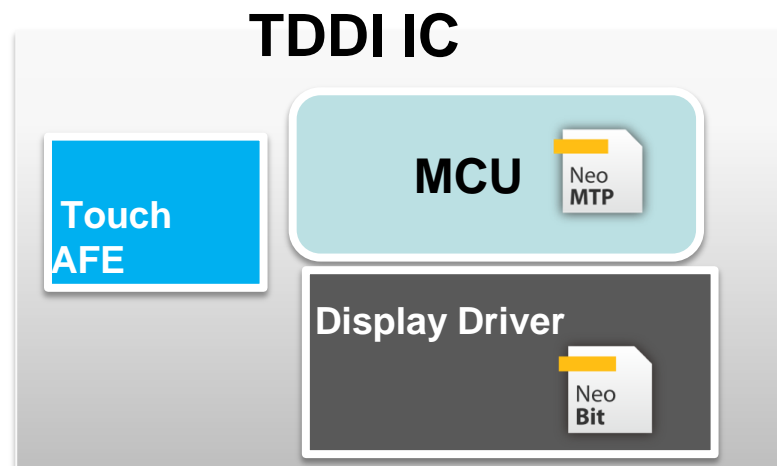
Touch Panel Controller ICs

Process Technology : 0.16um HV/0.11um G



In-Cell Touch Panel Controllers ICs

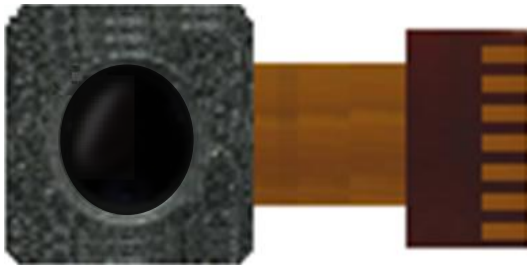
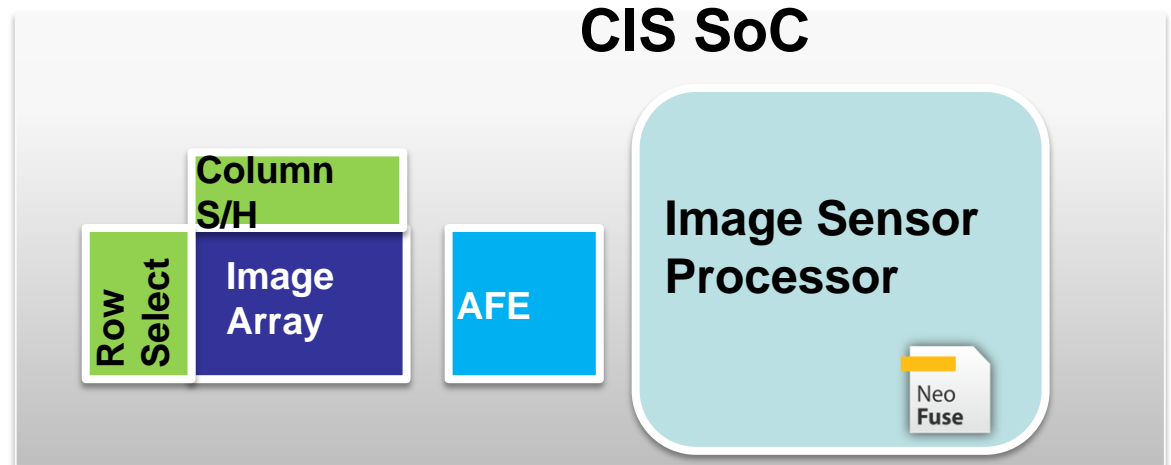
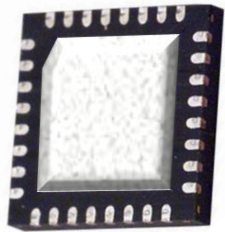
Process Technology : 0.11um HV/80nm HV/55nm HV



| 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

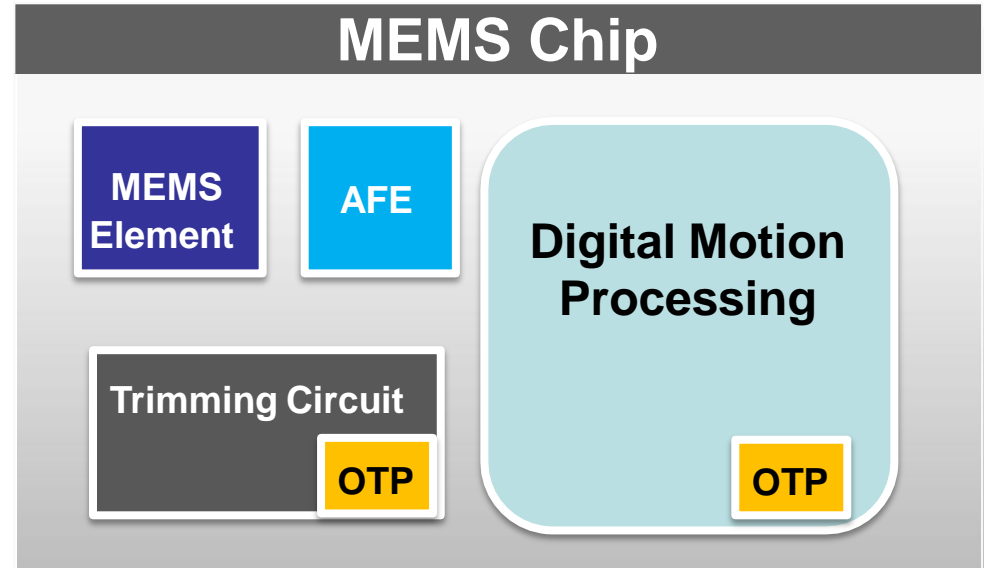
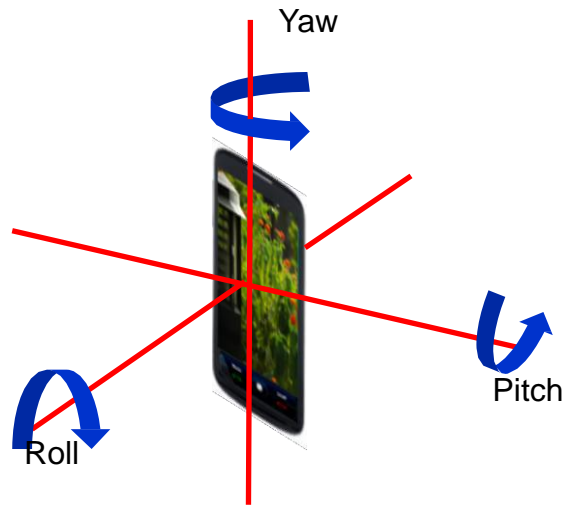
Process Technology : 0.11um CIS/90nm CIS/65nm CIS



| 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

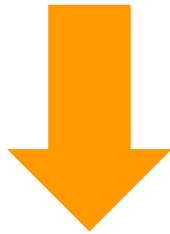


| Density | NVM Type | Purpose | NVM Usage |
|---------|----------|-------------------|-----------------------|
| 2Kb~4Kb | OTP | Trimming | Factory trimming |
| | | Parameter Setting | Signal filtering |
| | | Code Storage | Geometric computation |

Replacement of Embedded Flash for Competitiveness Improvement

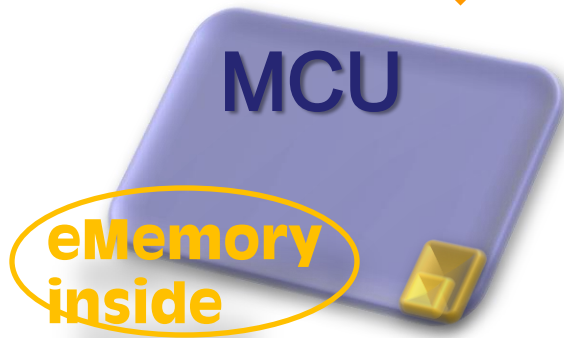


product design & manufacturing by
embedded Flash
Logic Process + 10 Masks



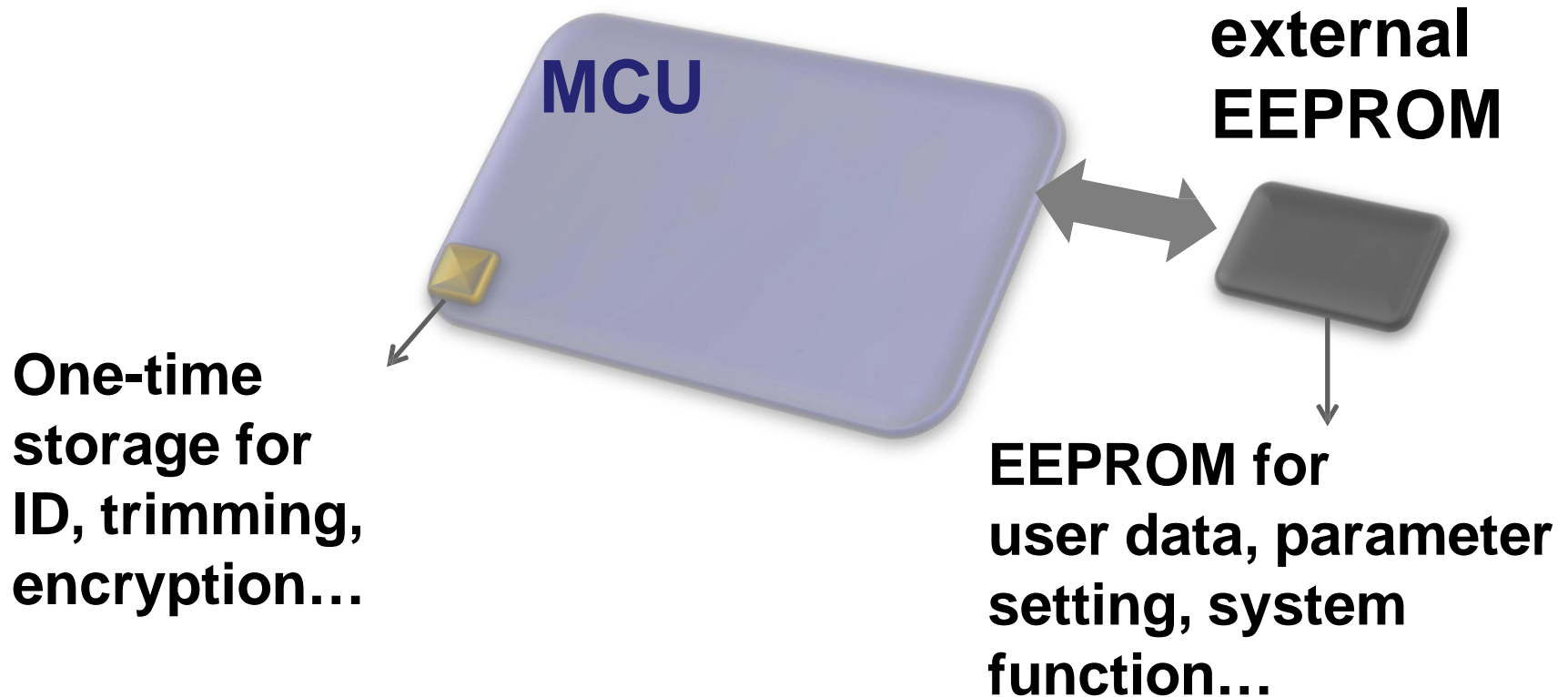
*30% more
cost reduction*

*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 | 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

Prospect for the future

- License fee expected to grow due to the successful development in advanced nodes.
- PMIC continually extends to the application of wireless charger and fast charger related products.
- 55nm DDI continues volume production. More than 50 tape out were done in past two years.
- 28nm Set-top Box processor starts to volume production. There are more customers will tape out new products in Q1 2016.

Prospect for the future

- **Fingerprint and CIS customers start to small volume production.**
- **The qualification of 16nm FF+ started and expected to be completed at end of March 2016.**
- **16nm FFC verification is successful. Qualification will be started in Q1 2016.**
- **10nm FF IP will tape out in March and already has customer engagement.**
- **More projects on automotive, the applications extend from PMIC to LCD Driver.**

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.

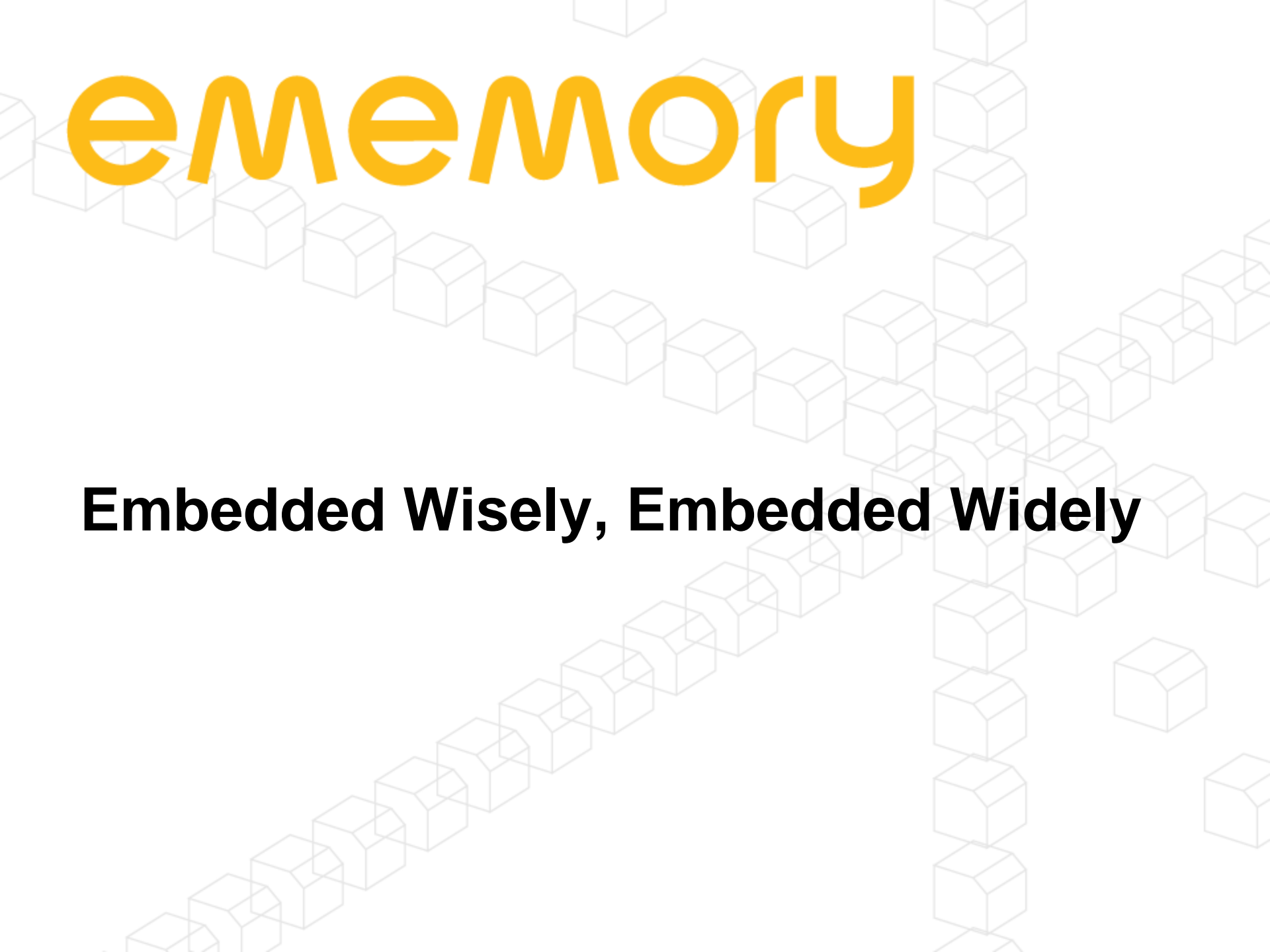
Growth in advanced technology

- 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