A Leading Logic NVM Company

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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	Νο
Bitcell Area	< 1	50	1	2	4	1
Endurance	Νο	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



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Crossing the Chasm



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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, 232 employees (162 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



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Worldwide Customers



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Patent Portfolio

	Q3 16	Q4 16	Diff.
Pending	204	218	+ 14
Issued	371	389	+ 18
Total	575	607	+ 32



Note*: As of Dec. 31st, 2016

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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.

250.000 229,494 240.849 225,341 220.858 212.651 201,860 197,330 193.311 189.727 200.000 183,266 172.450 168.696 172.773 150,000 100.000 65,444 70,240 66,583 64.583 56.240 53.556 51,673 49,992 45,634 44,<u>718</u>_ 45.204 43.652 47.809 40.969 50,000 38.609 31,546 27,527 25,691 25,545 28.13<mark>2</mark> 23.926 21,919 17,177 13.870 13,300 0 A-Mar. 14.Apr. AMAY . Ardun. 1 Ar Jul 14-4119. 14:5eP. 14.1404. A.Dec. 15.Feb. 15-Mar. 15 419 16.181. 16.Feb. 16.Mar. 16.May 16.111 16-111. 16-449. 16:5eP. 14.Feb. A.Oct. 184 JUN 15-JUI 16 API. 16.NOV. 16.Dec. 16.0ct. 17.1817. 17.Feb. 14-1817. 15 APT. May 19: 500. 000. 25. NON. Dec.

Unit: NTD Thousands

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Q4 Revenue Breakdown

Unit: NTD thousands

	Q4 2016	Q3 2016	QoQ	Q4 2015	YoY	2016	2015	YoY
Licensing	79,684	86,712	-8.10%	69,307	1 4.97%	330,087	267,512	23.39%
Royalty	226,543	222,655	1.75%	231,571	-2.17%	885,372	824,108	7.43%
Total	306,227	309,367	-1.01%	300,878	1.78%	1,215,459	1,091,620	11.34%

Unit: Number of contracts

		Q4 2016	Q3 2016	2016	2015
Technology Licenses		10	6	43	28
Design	NRE	12	18	56	57
Licenses	Usage	73	81	311	349



Financial Income Statement

(Unit: NTD thousands)	Q4 2016	Q4 2015	% change	2016	2015	% change
Revenue	306,227	300,878	1.8%	1,215,459	1,091,620	11.3%
Gross Margin	100%	100%	-	100%	100%	-
Operating Expenses	171,681	156,216	9.9%	685,650	570,403	20.2%
Operating Margin	43.9%	48.1%	-4.2ppts	43.6%	47.7%	-4.1ppts
Net Income	132,361	128,090	3.3%	534,917	479,111	11.6%
Net Margin	43.2%	42.6%	+0.6ppts	44.0%	43.9%	+0.1ppts
EPS (Unit: NTD)	1.75	1.69	3.6%	7.06	6.32	11.7%
ROE	28.3%	28.4%	-0.1ppts	28.6%	26.6%	+2.0ppts



Technology License

Unit: Number of contract

Year	2013	2014	2015	2016
License number	19	21	28	43

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 Dec.) : 104
- 19 for NeoBit, 43 for NeoFuse, 22 for NeoEE, and 20 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	13	
NeoFuse	2	3	8	6	10	5	6	3	-
NeoFlash	-	-	-	-	-	-	-	-	-
NeoEE	-	-	-	-	-	-	5	17	-
NeoMTP	-	-	-	-	1	2	5	12	-

Current Technology Development Platforms

12" Fabs	Production	Development	NVM Type	Process Type
7/10nm	0	2	ОТР	FF
14/16nm	1	3	ОТР	FF+
28nm	6	8	ОТР	LP/HPM, HLP/HPM, LPS
40nm	4	6	ОТР, МТР	HV-DDI, LP
55/65nm	14	11	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	8	2	OTP, Flash	HV-DDI, BCD, Generic
0.18um	1	0	ОТР	BCD

8" Fabs	Development	NVM Type	Process Type
0.13/0.11um	20	OTP, MTP, Flash	HV-DDI, BCD, LP, RF, CIS, LL
0.18/0.16/0.152um	45	OTP, MTP	Generic, LP, LL, MR, HV, Green, BCD
0.25um	0	OTP, MTP	BCD
0.35um	0	ОТР	UHV

Note*: As of Dec. 31st, 2016



Quarterly Design Licensing (New Tape Out)

- Total 367 NTO as of 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 — eMemroy 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.

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Cumulative Licenses Drive Future Royalties



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Wafer Production Volume



embedded eMemory IP in T Company (\$revenue); * % of Process node in T company total revenue in Q4 2016

	Process node	*% of T	Q4 16	Q3 16	2016	2015
8"	0.25/0.35	2%	26.80%	26.44%	28.15%	33.49%
	0.15/0.18	10%	10.93%	13.07%	12.43%	8.73%
	0.11/0.13	2%	58.06%	40.96%	42.61%	29%
12"	90nm	5%	14.8%	3.83%	12.50%	19.85%
	65nm	11%	3.9%	3.85%	3.59%	0.55%
	40/45nm	12%	0	0	0.00%	0%
	28nm	24%	0.70%	0.61%	0.55%	0.05%
	16/20nm	33%	0%	0	0.00%	0%
8"		15%	18.60%	20.1%	18.86%	16.64%
12"		85%	1.56%	0.87%	1.44%	1.87%
Total		100%	4.12%	3.95%	4.27%	4.76%

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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	07	ГР		MTP	
Technology	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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Opportunity at all Price Points





eMemory IP in Smart Phone



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Benefits from Using eMemory IPs

Package/FT level



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



Invisible Hardware Key : Data is hard to be detected

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eFuse Key: Data is easily observed

Security & Protection

Authorized Product

Fake Product



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OTP for security storage



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Security with eMemory IPs



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NVM IP Demand in IoT



Autotronics with eMemory IPs



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Imager Module with eMemory IPs



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Advanced LCD Driver ICs

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



Code	2 Timing Control Pattorn
Storage	2. Thining Control Fattern
U	3. Color Engine Enhancemen

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
Application PMIC			Trimming	DC/DC, Bandgap
Processor	2Kb~4Kb	ОТР	Parameter Setting	Design flexibility & Performance optimization
			Code Storage	Start-up behavior & smart power saving algorithm
Base Band IC	PMIC	Neo Bit		

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Touch Panel Controller ICs

Process Technology : 0.16um HV/0.11um G



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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	ОТР	Trimming	Accuracy
			Code Storage	Gamma Table
16K8~32K8	<1000	MTP	Code Storage	Touch F/W Code
			Parameter setting	Performance Optimization

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CMOS Image Sensor

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



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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

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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

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MCU

MCU

MCU Applications with EEPROM



storage for ID, trimming, encryption...

One-time



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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

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Wafer Demand by IC Type

ІС Туре	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 2017

- In license revenues :
 - Strong demand for building advanced process and MTP platform in worldwide foundry partners will increase technology license and design license revenues.
- In royalty revenues :
 - > 8" wafer royalty will grow further due to multiple fingerprint customers are ramping up production and more customers will start volume production later this year.
 - > PMIC related royalty will increase due to new chips in fast charger
 ` wireless charger, and our largest US customer ramping up their new generation of PMIC in second half of 2017.
 - > Automotive platforms have been successfully built and customers already start small volume production

Outlook for 2017

- > For 12" wafer royalty, the volume production of TDDI, OLED, STB/ DTV, CIS and security have continuously increased.
- > We had first 16nm tape-out in 2016. The 10nm IP have been successfully verified and 7nm test chip is expected to tape out in Feb. All these will increase our penetration rate in 12" fab.

Key Growth Drivers





Q & A



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