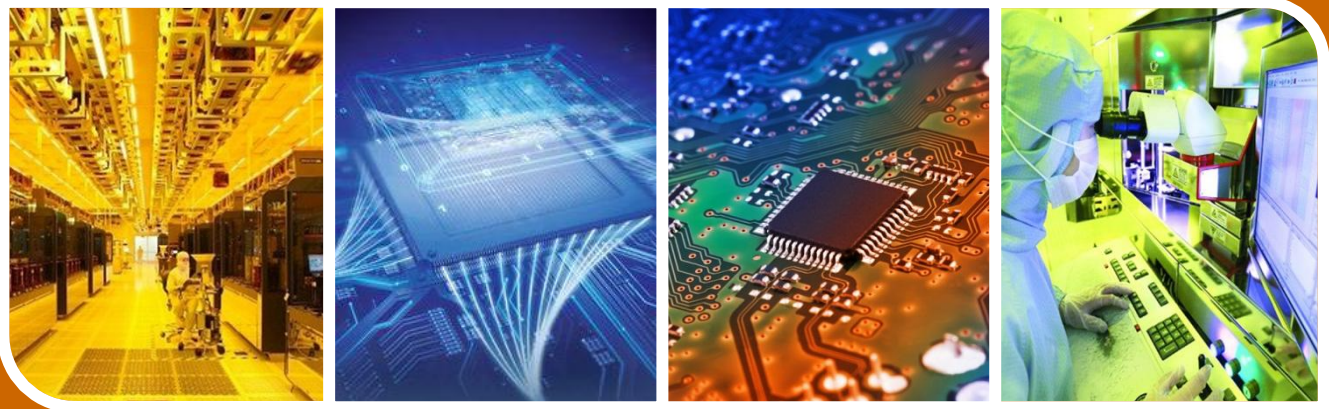


Corporation Introduction

July, 2017

Puya Semiconductor Co. ,Ltd.

1 Company Overview

2 ULP SPI Flash Memory

3 Serial EEPROM Memory

4 WLCSP Product

Introduction – Puya Semiconductor

- **Founded in 2012**
  - Registered capital of 20 million RMB
  - National IC Design Company from 2014
- **Location**
  - Headquarter in Shanghai
  - Subsidiary in Shenzhen for sales and service
  - Subsidiary in Wuxi
- **Patents**
  - 10+ (China), 2 (US, pending)
- **Positioning**
  - Fabless design house
- **Business focus**

  Standalone nonvolatile memory (SNVM)
  - Ultra low power Flash Memories
  - High reliability EEPROM

CQC

QUALITY MANAGEMENT SYSTEM CERTIFICATE

Certificate No.: 00116Q27352R0S/3100

We hereby certify that

PUYA SEMICONDUCTOR(Shanghai) CO.,LTD.

Organization Code Certificate: MA1K35P5-7

Registration Address: Room A676-22, Building 2, No.351, Guoshoujing Road, China(Shanghai) Pilot Free Trade Zone

Operation Address: Room 402, 406, 407, No.560 Shengxia Road, Pudong, Shanghai, P.R.China

by reason of its Quality Management System

has been awarded this certificate for compliance with the standard

ISO9001: 2008 GB/T19001-2008

The Quality Management System Applies in the following area:

Design and Service of High Reliable Non-Volatile Memory and High Performance Magnetic Sensor Integrate Circuit

Certified since: Aug. 08, 2016 Valid from: Aug. 08, 2016 Valid until: Aug. 07, 2019

After a surveillance cycle, the certificate is valid only when used together with an Acceptance Notice of Surveillance Audit issued by CQC. Please access www.cqc.com.cn for checking validity of the certificate.

This certificate and its relevant information can query in the website of Certification and Accreditation Administration of the People's Republic of China (www.cnca.gov.cn).

(The validity of the ISO9001:2008 certificates expires on 15/09/2018. Please transfer to new edition certificates before that time.)

IAF CNAS MANAGEMENT SYSTEM CNAS C001-M IQNet

Signed by: Wang Kejiao

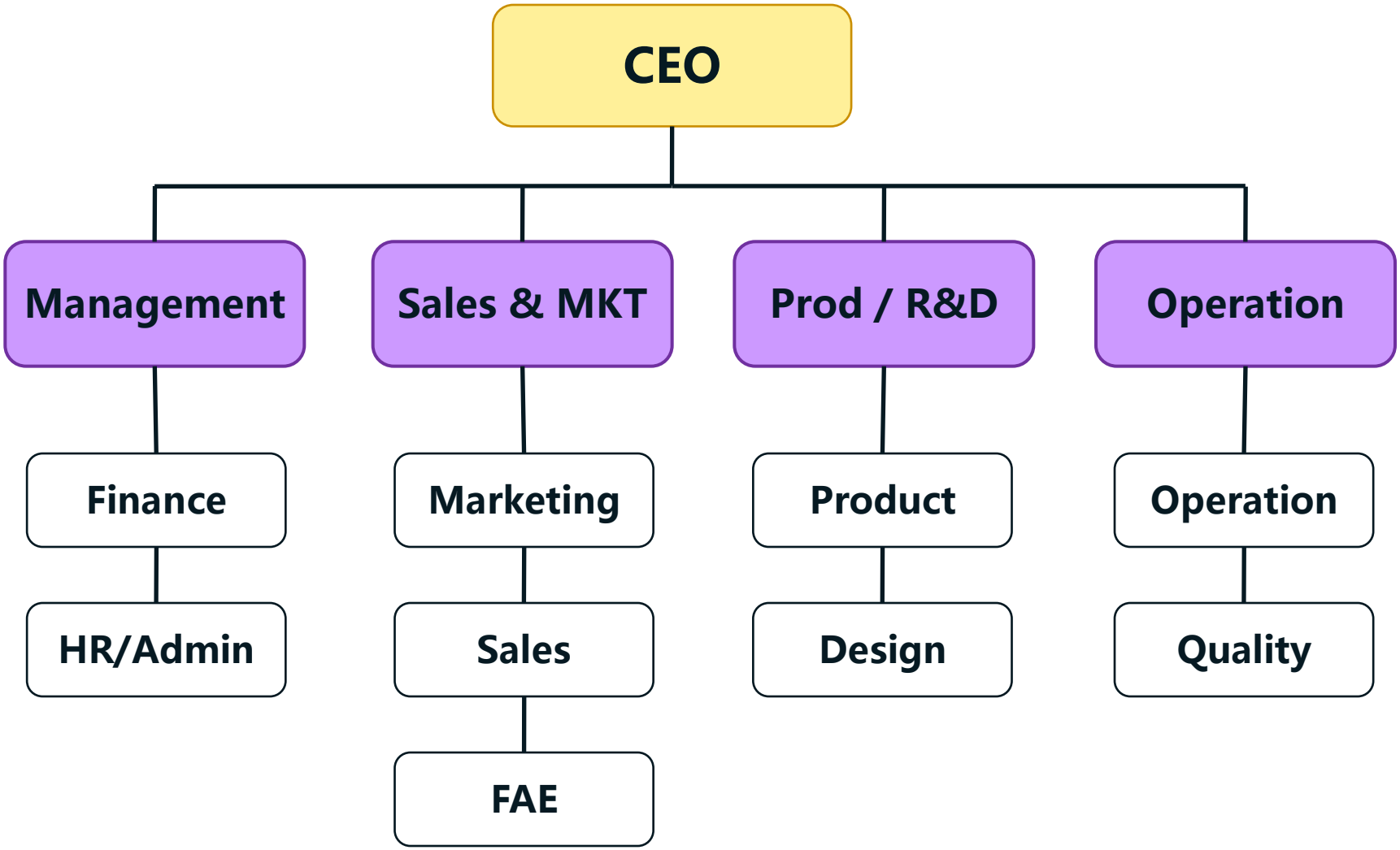
CHINA QUALITY CERTIFICATION CENTRE

Section 9, No.188, Nansihuan(the South Fourth Ring Road) Xilu(West Road), Beijing 100070,China

http://www.cqc.com.cn

Q 0020649 2015年版

Introduction – Organization



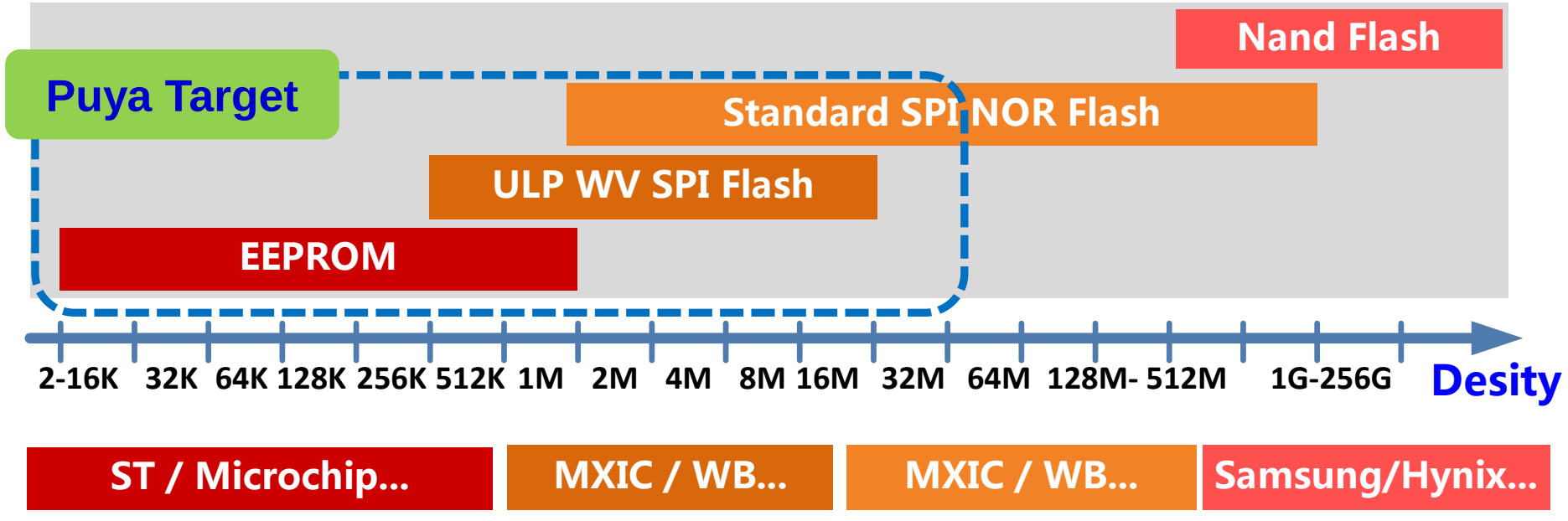
Positioning – Serial Nonvolatile Memories

- **Leading Serial EEPROM & ULP SPI Flash Supplier**
  - Focus on: High reliability, Ultra low power & Competitiveness

Customer / Applications

Industry / Wearable | IoT / Consumer | Mobile / Code | Data

Nonvolatile Memories



Application –Target markets

Automotive

Dashboard Instrument

Entertainment

Consumer

Flat Panel TV

Digital Camera

CCD Surveillances

STB

Blue Ray Player

Remote Control

DVD Recorders

Game pad

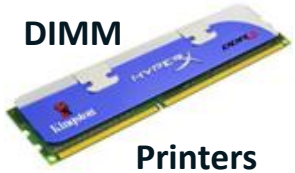
Industrial

Energy Meter

Water Meter

Computing

DIMM



Printers

Monitors

Web Cam

Data Communications

Modems & Routers

WiMax Cards

Bluetooth Modules

Customers – Industry & Consumer

Applications	Customers
Industry	PHILIPS SIEMENS Amphenol INDUSTRIAL PRODUCTS GROUP solaredge
Network Device	中国电信 CHINA TELECOM
Household Appliances	美的 Midea SUPOR FOTILE SAMSUNG
Bluetooth	mi MEIZU QCY KISS communications 歌尔声学 have sound, will travel
Set-top Box	CHANGHONG 长虹
Smart Meter	CLOU
MCP	RDA AppoTech 卓荣科技 Eastsoft. analogix Bring Vision to Life

Supply Chain – Partners

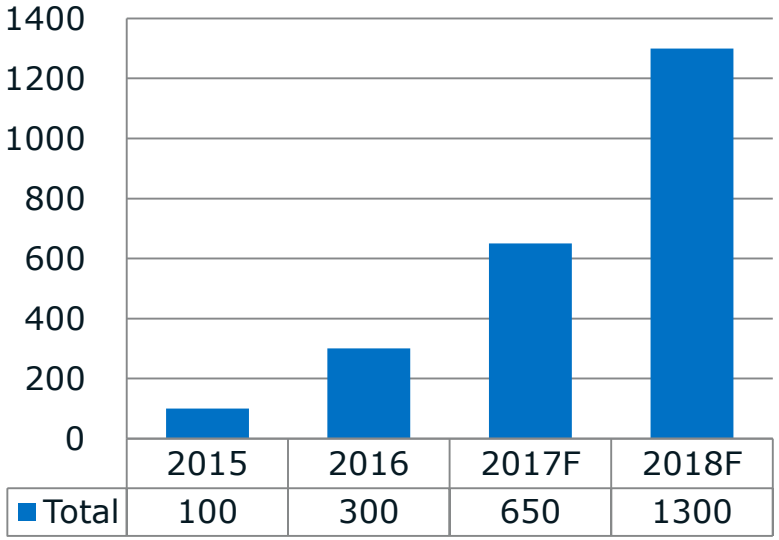
- **Strategic foundry partner with HLMC and SMIC**
  - Innovative 28-55nm Flash memory
  - Customized 90-130nm Standalone EEPROM product platform

Wafer fabrication	CP / Package / FT
HLMC 上海华力微电子有限公司 Shanghai Huali Microelectronics Corporation Shanghai 300mm Fab  SMIC 	华天科技 HUA TIAN TF 通富微電 SMIC 长电科技 CHANGJIANG ELEC.TECH.

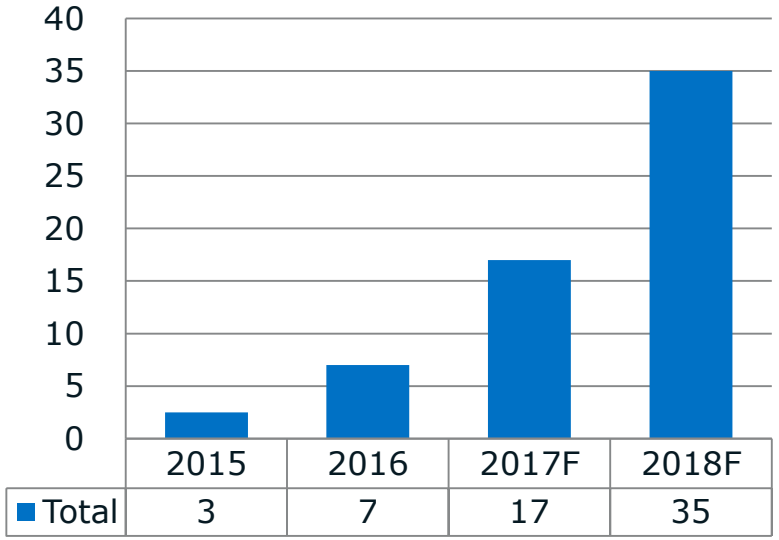
Growth – Shipment & Revenue

- **Fast growth by core memory business**
  - **Annually more than doubled shipment**
  - **Annually more than doubled revenue**

Nonvolatile Memory Shipment (Million PCS)



Nonvolatile Memory Revenue (Million USD)



1 Company Overview

2 ULP SPI Flash Memory

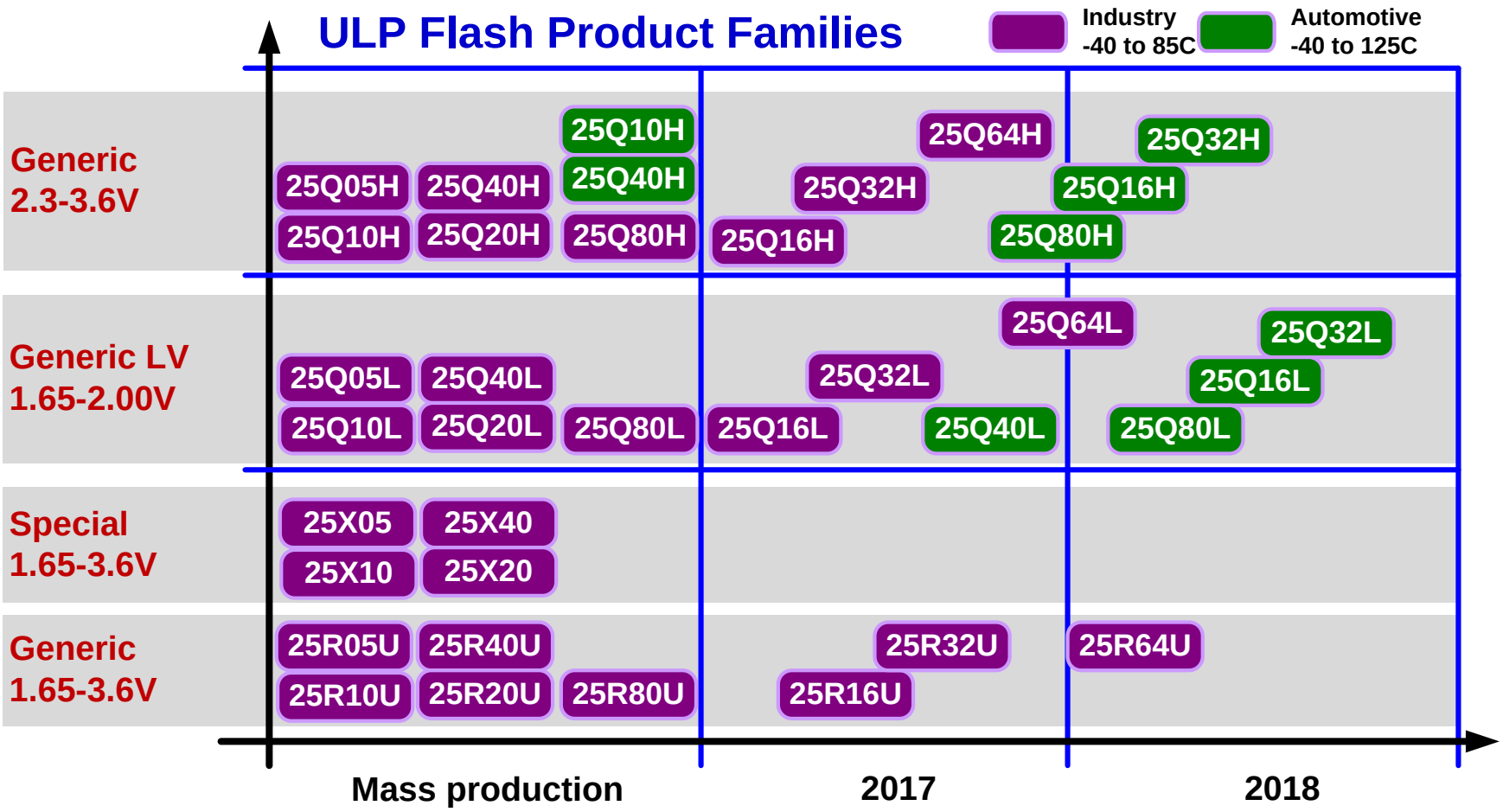
3 Serial EEPROM Memory

4 WLCSP Product

Overall – Ultra low power SPI Flash

- **Features**
  - **Density from 512Kb to 32Mb, for code and data storage**
    - U series, wide supply : 1.65 to 3.60V
    - L series, low voltage : 1.65 to 2.00V
    - H series, high voltage : 2.30 to 3.60V
  - **Ultra low power (ULP)**
    - Deep power down 100nA at 1.8V, 500nA at 3.3V
    - Program/Erase 2mA
  - **Flexible program and erase**
    - Support Page Erase
    - Support Dual page (8/16M) or Quad page (32M) Program / Erase
  - **High reliability**
    - 200K cycling, 20 Year data retention
- **Application**
  - **Emphasis on Blue tooth, Portable devices, and IoT**
    - **Very suitable for MCP (SiP) with SoC main-chip**
  - **Compatible & competitive for universal applications**

Roadmap – Ultra low power SPI Flash



- **Strong emphasis on ULP, wide voltage and high reliability**

Product List – Ultra low power SPI Flash

Product	Part #	Density	Max CLK	Supply	Temp.	IO Bus	UID	Status
H series Industry Level	P25Q05H	512Kb	104MHz	2.30-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q10H	1Mb	104MHz	2.30-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q20H	2Mb	104MHz	2.30-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q40H	4Mb	104MHz	2.30-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q80H	8Mb	104MHz	2.30-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
L series Industry Level	P25Q05L	512Kb	70MHz	1.65-2.00V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q10L	1Mb	70MHz	1.65-2.00V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q20L	2Mb	70MHz	1.65-2.00V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q40L	4Mb	70MHz	1.65-2.00V	-40 to 85C	Single/Dual/Quad	O	MP
	P25Q80L	8Mb	70MHz	1.65-2.00V	-40 to 85C	Single/Dual/Quad	O	MP
U series Industry Level	P25R05U	512Kb	104MHz	1.65-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
	P25R10U	1Mb	104MHz	1.65-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
	P25R20U	2Mb	104MHz	1.65-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
	P25R40U	4Mb	104MHz	1.65-3.60V	-40 to 85C	Single/Dual/Quad	O	MP
H series Automotive Level	P25Q10H-E	1Mb	85MHz	2.30-3.60V	-40 to 125C	Single/Dual/Quad	O	MP
	P25Q40H-E	4Mb	85MHz	2.30-3.60V	-40 to 125C	Single/Dual/Quad	O	MP

Benchmark –1.8V 4Mb SPI Flash

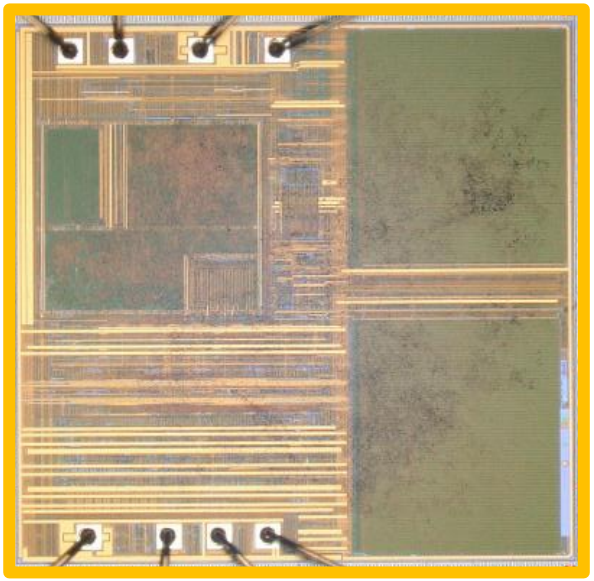
Comparison Items	Puya P25Q40L	M* 4033	W* Q40BW
Process	**55nm**	75-110nm	65nm
Supply voltage	1.65-2.00V	1.65-2.00V	1.65-1.95V
Quad SPI	Support	Support	Support
Deep PD current	**0.1uA**	1uA	5uA
Prog./Ers. current	**2mA**	5mA	20mA
Read current at 30MHz	**2mA**	5mA	6mA
Page Program Time max	3ms	3ms	3ms
Page Erase Mode	**Support**	Not support	Not support
Sector Erase Time (before cycling)	**6ms**	40ms	30ms
Sector Erase Time (after 100K)	**10ms**	200ms	200ms
Chip Erase Time	**12ms**	1700ms	1000ms
Endurance	**200K**	100K	100K
Data retention	20Y	20Y	20Y
Over Erase Risk	**Free**	Challenge	Challenge
LTDR failure	**Free**	OK	OK
ESD (HBM)	**4KV**	N.A.	N.A.

Benchmark –3.3V 4Mb SPI Flash

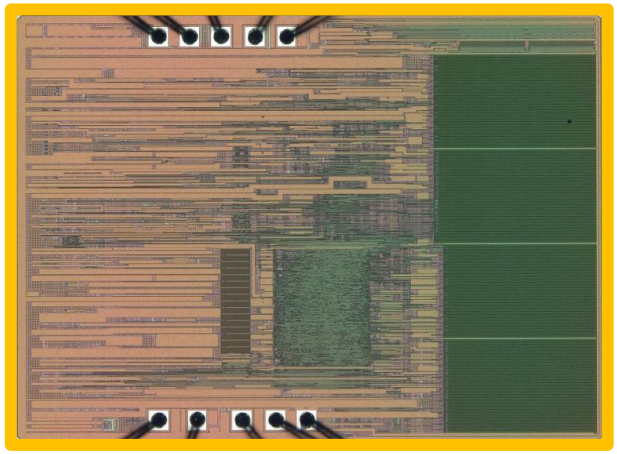
Comparison Items	Puya P25Q40H	M* 25L4006	W* 25X40CL
Process	**55nm**	75-110nm	65nm
Supply voltage	**2.30-3.60V**	2.70-3.60V	2.30-3.60V
Quad SPI	Support	Not Support	Not Support
Deep PD current	**0.5uA**	2uA	1uA
Prog./Ers. current	**2mA**	15mA	10mA
Read current at 30MHz	**2mA**	4mA	5mA
Page Program Time （typical）	1.4ms	**0.6ms**	**0.8ms**
Page Erase Mode	**8ms**	Not support	Not support
Sector Erase Time (before cycling)	**8ms**	40ms	30ms
Sector Erase Time (after 100K)	**10ms**	200ms	300ms
Chip Erase Time	**12ms**	1700ms	1000ms
Endurance	**200K**	100K	100K
Data retention	20Y	20Y	20Y
Over Erase Risk	**Free**	Challenge	Challenge
LTDR failure	**Free**	OK	OK
ESD (HBM)	**4KV**	N.A.	N.A.

Benchmark – Leading Technology

- 4Mb die photo benchmark with major competitors



Company A*



Company M*

Puya Semiconductor

-40% die size by

- Leading technology
- Design innovation

- Best for MCP/SiP

Reliability– Key result summary

- **Nonvolatile Memory behavior**
  - Endurance passed 200K at -40C, 25C and 85C
  - Data retention passed 150C 1000H with no data loss
- **Life time reliability test**
  - HTOL passed 1000H at 125C
- **ESD / Latch-up**
  - HBM passed 4KV
  - CDM passed 1KV
  - Latch-up passed 200mA, 1.5*Vccmax
- **Other reliability items**
  - NO LTDR risk
  - No over erase for life time
  - Sector erase time <8ms after 200K cycling

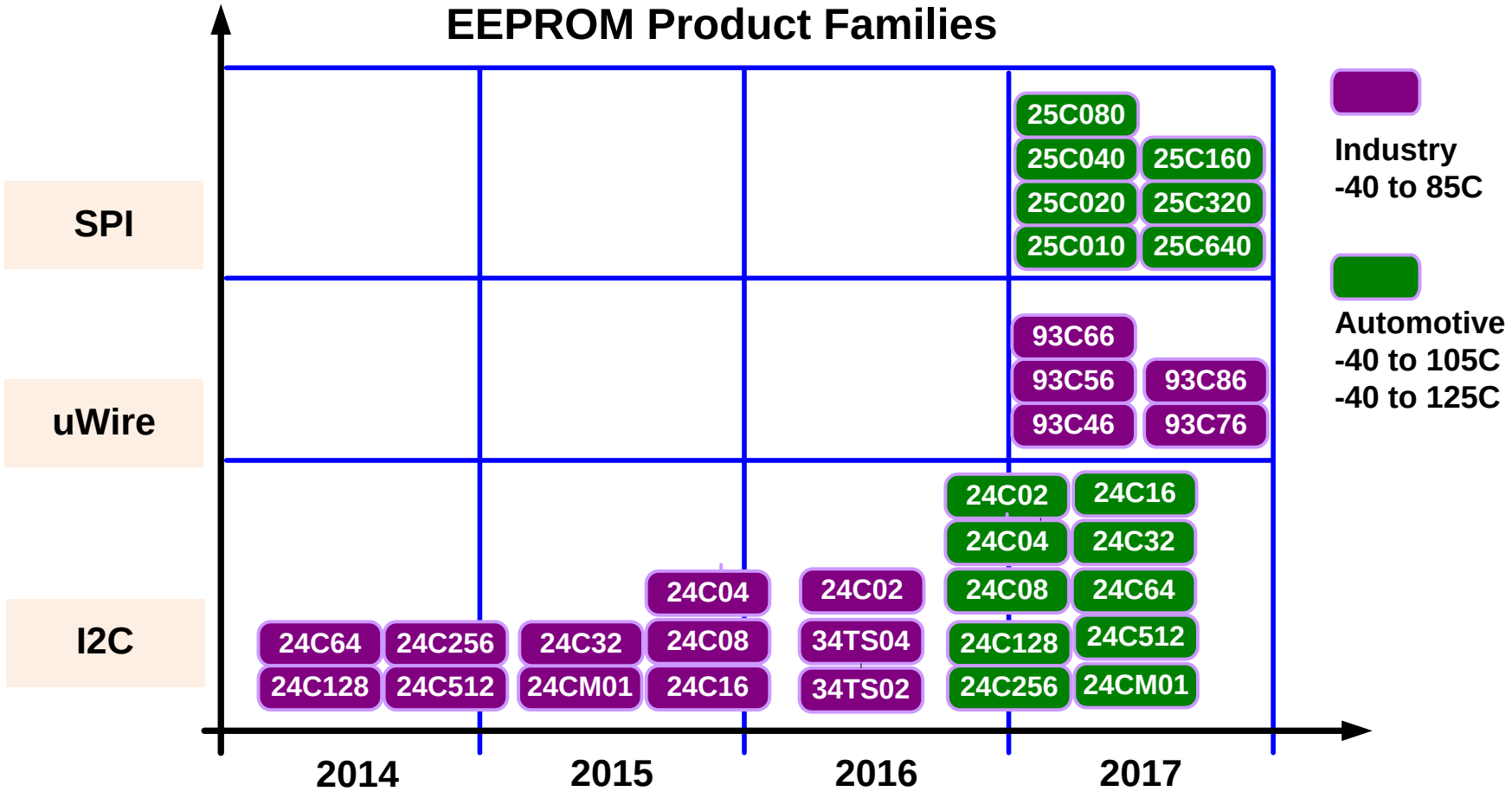
1 Company Overview

2 ULP SPI Flash Memory

3 Serial EEPROM

4 CSP Product

Roadmap– Serial EEPROM

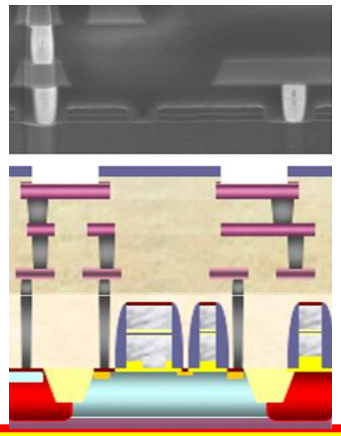


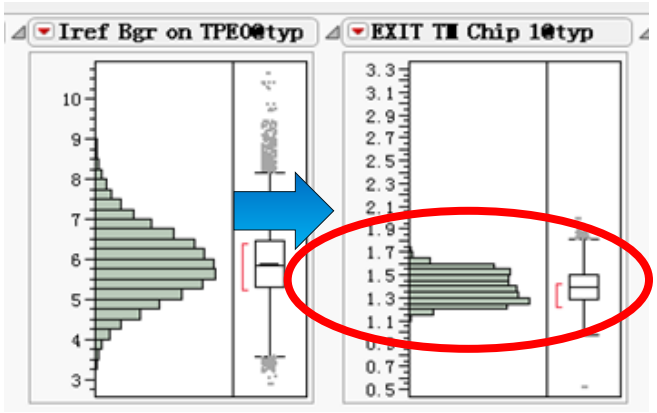
- **Strong emphasis on reliability**

Product List– Serial EEPROM

Product Category	Puya Part #	Memory Density	Page size	Max CLK	Supply Range	Temp. Range	Cycling	Data Retention	ID page	JEDEC UID	ESD (HBM)	Supported Package types
Industrial Level	P24CM01B-MI	1Mb	256B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	-	6KV	TDFN, TSSOP, SOP
	P24C512B-MI	512Kb	128B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	-	6KV	UDFN, TSSOP, SOP
	P24C256B-MI	256Kb	64B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	-	6KV	UDFN, TSSOP, SOP, SOT23
	P24C128B-MI	128Kb	64B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	-	6KV	UDFN, TSSOP, SOP, SOT23
	P24C64C-MI	64Kb	32B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	O	6KV	UDFN, TSSOP, SOP, SOT23
	P24C32C-MI	32Kb	32B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	O	6KV	UDFN, TSSOP, SOP, SOT23
	P24C16C-MI	16Kb	16B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	O	6KV	UDFN, TSSOP, SOP, SOT23
	P24C08C-MI	8Kb	16B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	O	6KV	UDFN, TSSOP, SOP, SOT23
	P24C04C-MI	4Kb	16B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	O	6KV	UDFN, TSSOP, SOP, SOT23
	P24C02C-MI	2Kb	16B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	O	O	6KV	UDFN, TSSOP, SOP, SOT23
	P24C02A-MI	2Kb	8B	1MHz	1.7-5.5V	-40 to 85C	1M	100Y	-	-	4KV	UDFN, TSSOP, SOP, SOT23
Ultra-high Reliability	P24C512-MI	512Kb	128B	1MHz	1.7-5.5V	-40 to 85C	4M	200Y	O	-	6KV	UDFN, TSSOP, SOP
	P24C256-MI	256Kb	64B	1MHz	1.7-5.5V	-40 to 85C	4M	200Y	O	-	6KV	UDFN, TSSOP, SOP
	P24C128-MI	128Kb	64B	1MHz	1.7-5.5V	-40 to 85C	4M	200Y	O	-	6KV	UDFN, TSSOP, SOP
	P24C64-MI	64Kb	32B	1MHz	1.7-5.5V	-40 to 85C	4M	200Y	O	-	6KV	UDFN, TSSOP, SOP
Auto-motive Level*	P24C512B-NK	512Kb	128B	1MHz	1.8-5.5V	-40 to 105C	1M	100Y	O	-	6KV	TSSOP, SOP
	P24C256B-NK	256Kb	64B	1MHz	1.8-5.5V	-40 to 105C	1M	100Y	O	-	6KV	TSSOP, SOP
	P24C128B-NK	128Kb	64B	1MHz	1.8-5.5V	-40 to 105C	1M	100Y	O	-	6KV	TSSOP, SOP
	P24C64B-NK	64Kb	32B	1MHz	1.8-5.5V	-40 to 105C	1M	100Y	O	-	6KV	TSSOP, SOP

Benchmark– Competitiveness





Advanced nonvolatile process with high reliability (co-development)	High ESD performance by novel design	Smart Trimming Technique for preferable margin

Key SPEC	Puya	Domestic Competitors	W/W Competitors
Process	**Customized 130nm**	Conventional 180nm/130nm FG	Customized 180nm/150nm FG
Minimum supply	**1.5-1.7V**	1.7-1.8V	1.7V
Temperature	**-40C~85/105C**	-40C~85C	-40C~85/105C
Data retention	**200 Year**	40-100Year	40-100Year
Endurance	**4 Million**	0.4-1.0 Million	1-4 Million
ESD (HBM)	**>6KV**	2-4KV	4-6KV
Cell VT check	**100% at RT /HT**	No	Full/Partial check

Benchmark– for Domestic Smart Meter

Item	Description	Condition	P24C256B	AT24C256C	Unit
VCC min	Minimum VCC	Fscl=1MHz, E/P	**1.55**	1.90	Volt
Isb	Standby current	5.5V, 25C	**0.68**	2.40	uA
		5.5V, 85C	**0.77**	2.50	uA
		5.5V, 125C	**1.50**	3.50	uA
Icc1	Write current	400KHz, 5V, 3ms	**680**	1406	uA
Icc2	Read current	400KHz, 5V	**105**	240	uA
Vol	Output low level	1.7V, 1.5mA	**0.04**	0.098	Volt
ILI	Input leakage	Input leakage at 5.5V, 25C	0.05	<0.1	uA
Twr	Write time	Write time at 1.7V	2.46	2.69	ms
		Write time at 2.5V	2.43	2.67	ms
		Write time at 5.5V	2.36	1.95	ms
Fscl max	Max frequency	1.7V, 25C & 85C	**1.0**	0.4	MHz
EDR	Endurance (cycling)	at 5.5V 25C	**6M**	1M *	Cycles
		at 5.5V 85C	**>1M**	N.A.	Cycles
		at 5.5V -40C	**>1M**	N.A.	Cycles
DRET	Data retention	at 25C	**>200**	40 *	Years
		at 85C	**>200**	N.A.	Years
HBM	Human body model	MIL-STD-883J	**8K**	3K	Volt
MM	Machine model	ANSI/ESD S5.2-2009	**350**	200	Volt
Latch-up	RT latch up	JESD78D (at 25C)	200	200	mA
	HT latch up	JESD78D (at 125C)	**200**	N.A.	mA
ID page	Identification page	64 bytes special information	**Available**	Not support	-

Note: * from datasheet (not tested)

Reliability – High Endurance

- **Endurance: Pass 6 million-cycles both for 25C and 85C**

2.4.1 User mode Endurance Test

Table 2-4-1. Endurance testing requirement

Flow	JESD22-A117
Testing items	Standby current, and leakage current
Sample size	61 PCS
Criterion	Pass/Fail=0/1

Table 2-4-2. Endurance testing result

Temperature	Sample size	Fail at 1	Fail at 500K	Fail at 1M	Fail at 2M	Pass /Fail
25C	51	0	0	0	0	PASS
-40C	5	0	0	0	Not tested	PASS
85C	5	0	0	0	Not tested	PASS

2.4.2 Extreme Endurance Test

Table 2-4-3. Extreme Endurance testing conditions

Flow	JESD22-A117
Testing items	Standby current, and leakage current
Sample size	22 PCS
Criterion	Pass/Fail=0/1

Table 2-4-4. Endurance testing result

Temperature	Sample size	Fail at 1M	Fail at 2M	Fail at 4M	Fail at 6M	Pass /Fail
25C	11	0	0	0	0	PASS
85C	11	0	0	0	0	PASS

Reliability – Superior Data Retention

- **Retention: Pass 200 Years for 85C application**
  - Pass: Industrial standard by Vt degradation
  - Pass: JEDEC standard 150C 1000H

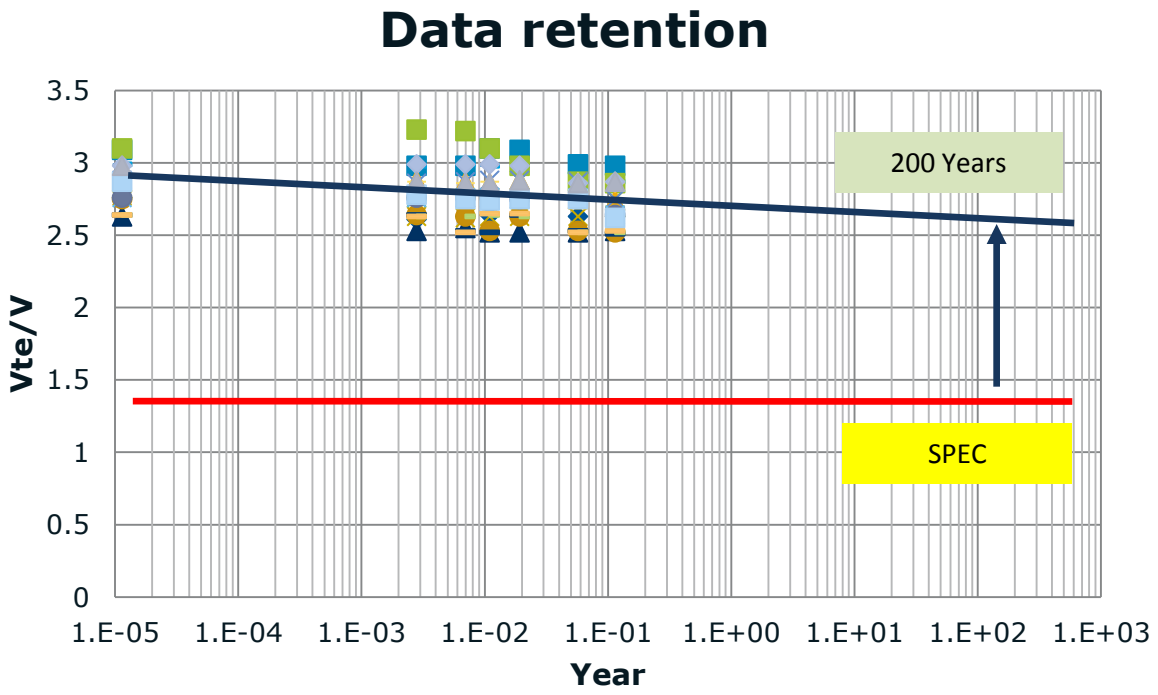


Figure. Data retention at 125C

Application – Target markets

Start to work with oversea automotive vendors

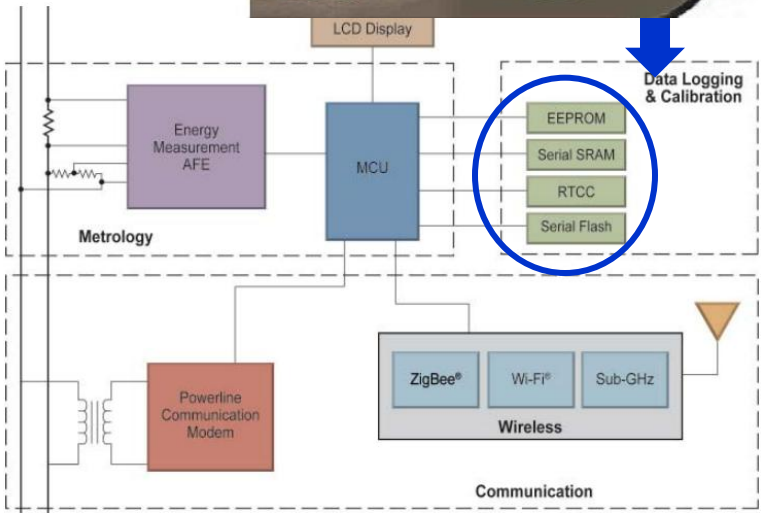
Blue tooth application, work both for single-chip and MCP (SiP)

Smart Meter: partner with State Grid, 256K/512K in Mass production

Automotive application

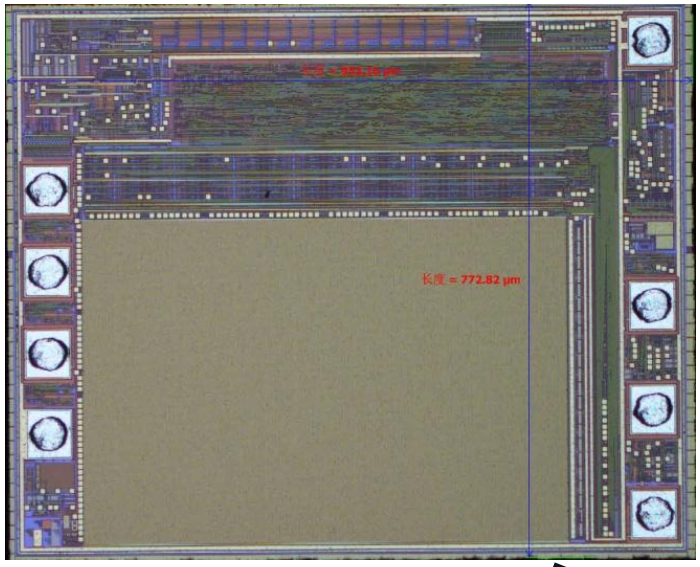
Commercial market

Industrial application



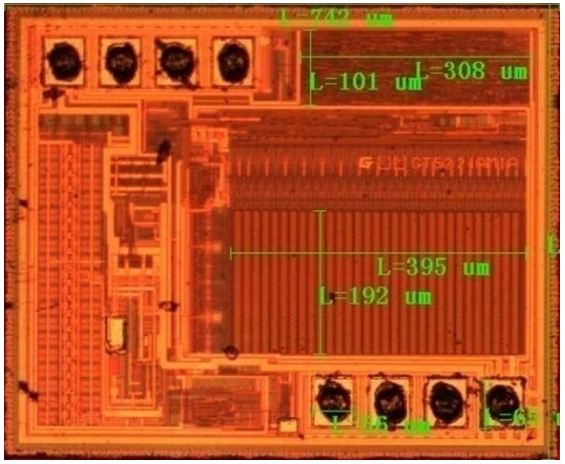
Instruments **Entertainment**

Benchmark – Smallest die in industry

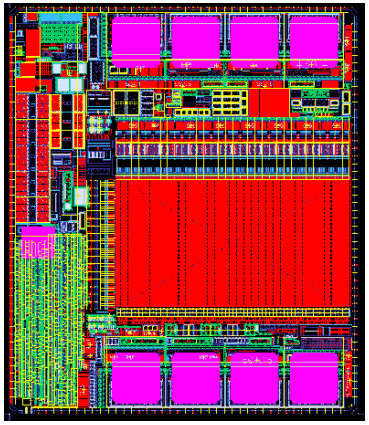


US competitor A*
24C32, 180nm
production from 2015

Competitor G*
24C32, 130nm
Production from 2015



60% die size of the closest competitor by advanced technology and design innovation



Puya Semiconductor
P24C32C, 130nm with enhancement
Production from 2015

1 Company Overview

2 ULP SPI Flash Memory

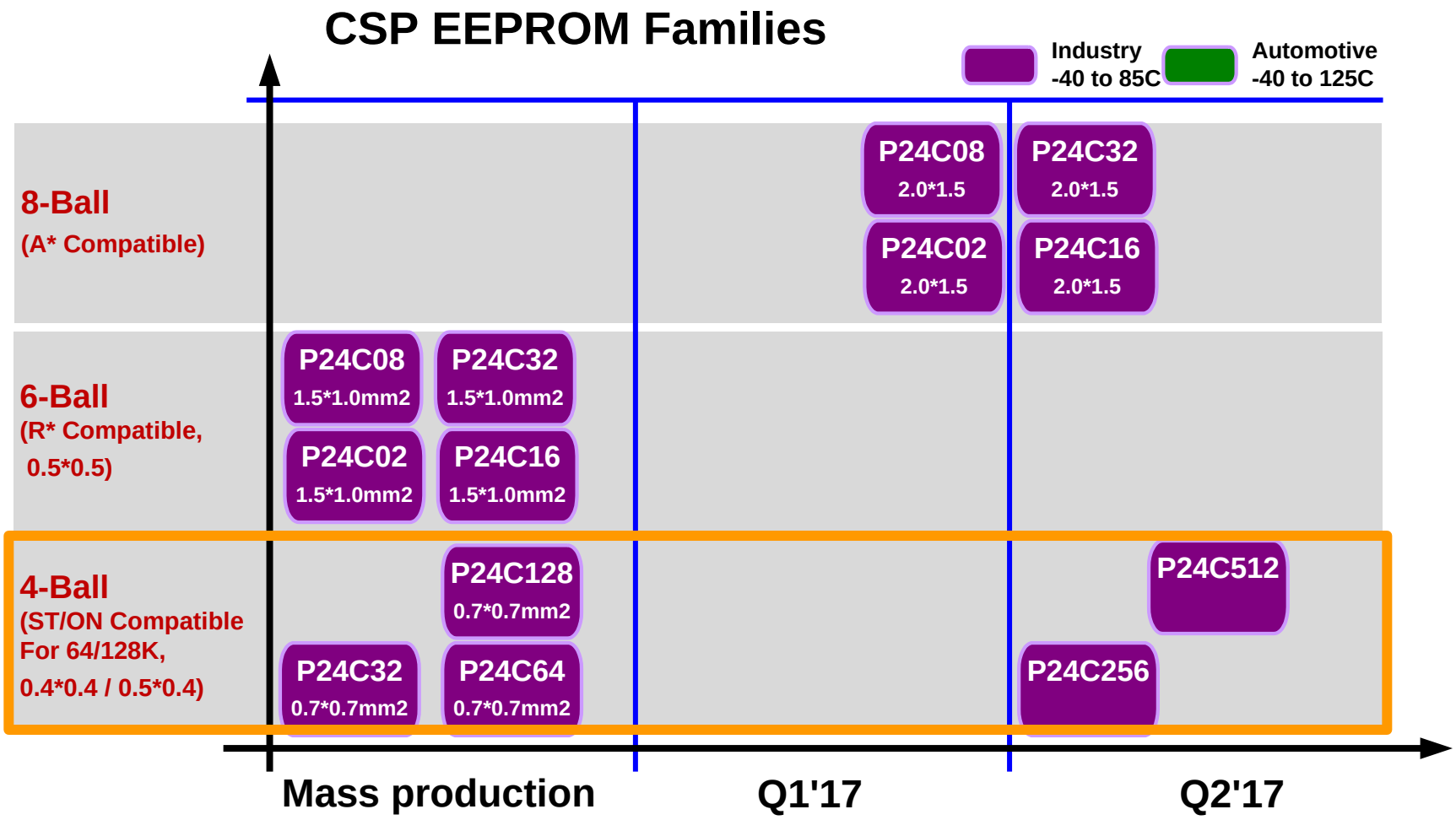
3 Serial EEPROM Memory

4 WLCSP Product

Overall – WLCSP for Lens module

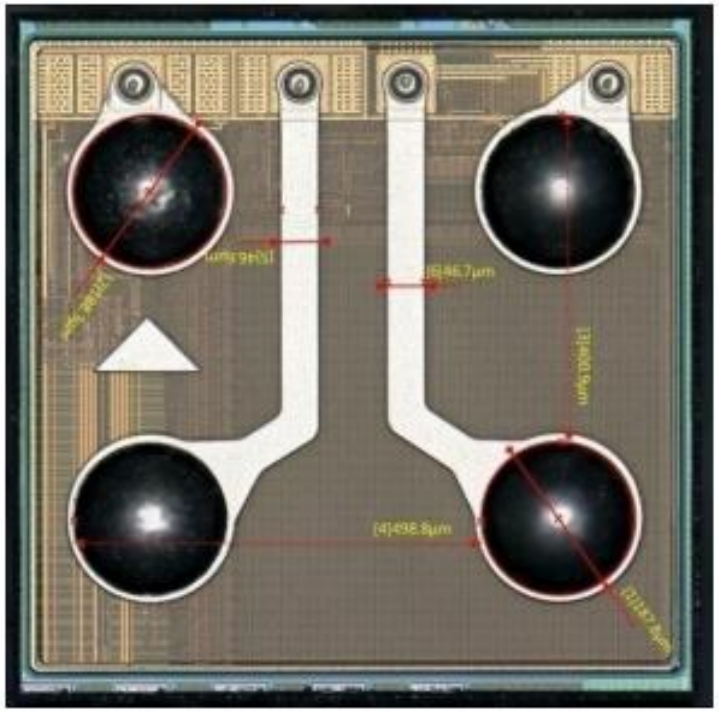
- **EEPROM**
  - 4-ball CSP solution with SWP function
  - Lower cost and higher density
  - Unique design technique for highly reliable WLCSP
  - Density focus: 128K, 64K, 32K and 16Kb
- **Driver – Open-loop**
  - Sampling by Q2, 2017
- **Driver – Closed-loop**
  - Sampling by Q4, 2017

Roadmap – WLCSP Memories

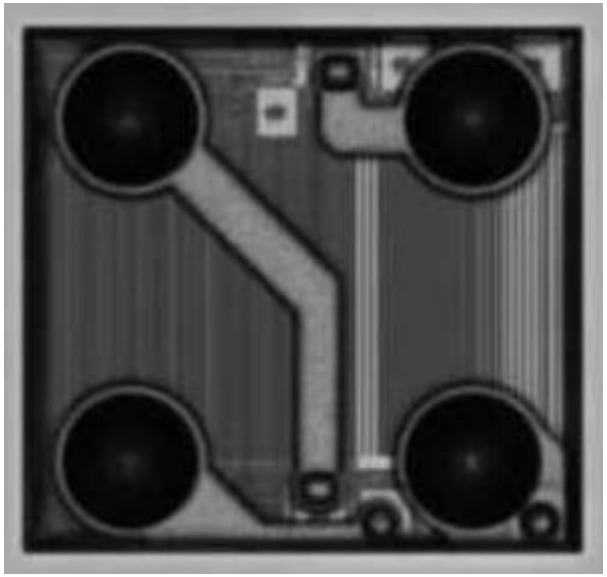


- **Emphasis on ULP and high reliability**

Benchmark –Technology and Die size

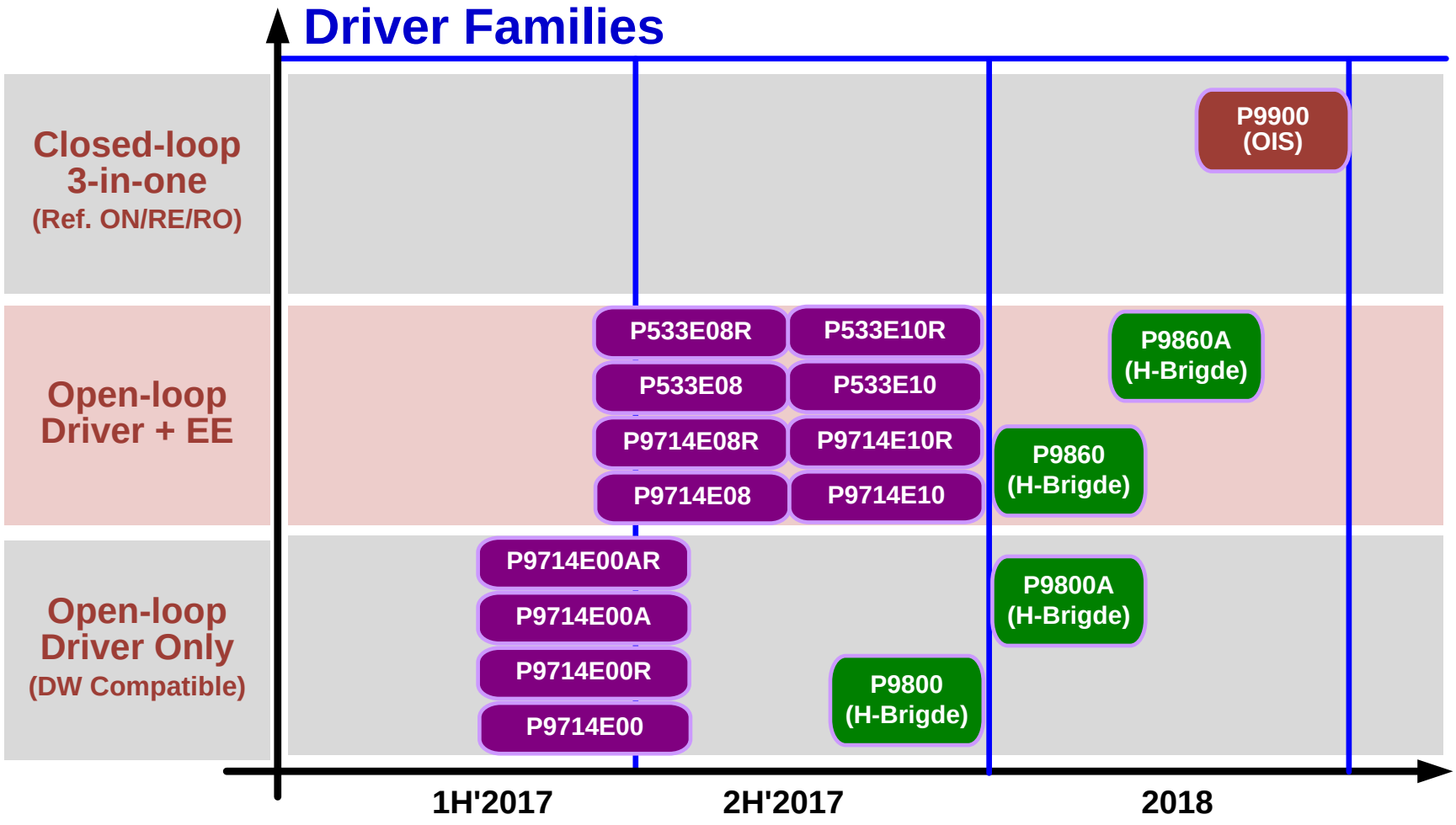


S*
24C128, 150nm
production from Q2, 2016
Die size: 0.87*0.87= 0.76mm2



Puya
24C128, 130nm (w/ customization)
risk production from Q4, 2016
Die size: 0.7*0.7 =0.49mm2
(50%+ more gross dies per wafer)

Roadmap – VCM Drivers



Features– Open-loop driver with EEPROM

- **3 Product Series**
  - High performance standalone VCM Drivers (compatible with DW*)
  - Cost effective VCM Driver + EEPROM (64K/80K/128Kb Optional)
  - High performance VCM Driver + EEPROM (compatible to ZC*)
- **High Performance Design**
  - First support: Fast+ Mode 3.4MHz
  - Wider supply range：2.4-4.8V；
  - High order algorithm and flexible configurations
  - Embedded EEPROM (64K/80K/128K Optional)
- **High Reliability**
  - 1 Million-cycling EEPROM embedded
  - 8KV ESD protection
  - Unique technique for highly reliable WLCSP
- **User Friendly Configuration**
  - SDA/SCL Changeable，ID configurable and SWP function
- **Low profile**
  - 6-Ball with EEPROM (0.4 pitch 0.18*0.18 Ball)，Smallest die size

Thank you!

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