



Aplus Flash Technology, Inc.

Proprietary Design IPs: Embedded Applications

Non-Volatile Memory

ROM/OTP/NTP/EEPROM/FLASH

Volatile Memory

SRAM

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Discrete vs. Embedded ROM/OTP/NTP/EEPROM/FLASH Design

	Discrete	Embedded
VDD	5V, 3V, 1.8V, (+/-10%)	2.4V – 5.5V (wide)
Option bits	Few	Many
Security bits	No	Yes
Pin-out	Standard	Non-standard
Read	90% Non-synchronous	Synchronous
Read bits	x8 or x16	xN
Read speed	Single clock rate	Multiple clock rates
Memory Density	Regular	Irregular
Current spec.	Few mA	Few uA at low frequency



Aplus' Embedded IP Process Technologies

Embedded	ROM	OTP	NTP
IP Position	Proprietary	Proprietary	Proprietary
Design Technology	0.8um, 0.5um ■ 0.35um ■ 1T, 2P2M2W	0.5um ■ 0.35um ■ 1T, 2P2M2W UV - EPROM	0.35um ■ 0.25um ■ 1T, 2P3M3W ETOX™ compatible
Program I/V	CHE, 200uA/cell VPP(10V,off-chip)	CHE, 200uA/cell VPP(10V,off-chip)	CHE, 200uA/cell VPP(10V)/VNN(-10V)
Erase scheme	UV-light, zero-I	UV-light, zero-I	Channel-FN,10pA/cell
Peri. Dual-OX	120A & 200A	120A & 200A	70A & 150A
Mask Number	18	18	26

■ Available

■ R & D

* ETOX™ is a trademark of Intel



Aplus' Embedded IP Process Technologies (cont.)

Embedded	EEPROM	FLASH	SRAM
IP Position	?	Proprietary	Proprietary
Design Technology	0.35 um ■ 3T, 3M2P2W	0.25um ■ 0.18um ■ 2T, 2P3M3W ETOX™ compatible	0.5um ■ 0.25um ■ 1T, 2P3M3W
Program I/V	CHE, 200uA/cell VPP(10V,off-chip)	FN, 10pA/cell +/-7V (on-chip pump)	CHE, 200uA/cell VPP(10V)/VNN(-10V)
Erase scheme	UV-light, zero-I	FN, 10pA/cell	Channel-FN,10pA/cell
Peri. Dual-OX	120A & 200A	30A & 120A	70A & 150A
Mask Number	18	26	26

■ Available ■ R & D



Aplus' Embedded IP Proprietary Designs

Embedded Aplus IP	ROM	OTP	NTP
Family Products	X8: 1K, 4K, 8K, 16K, 32K, 64K X16: 512, 2K, 4K, 8K, 16K ■	X8: 1K, 4K, 8K, 16K, 32K, 64K X16: 512, 2K, 4K, 8K, 16K ■	X8: 1K, 4K, 8K, 16K, 32K, 64K, 128K, 256K X16: 512, 2K, 4K, 8K, 16K-128K ■
NVM Test Mode	Yes	Yes	Yes
Security bit	Yes/Optional	Yes	Yes
VDD	2.4V – 5.5V	2.4V – 5.5V	2.4V – 6.0V
Standby current	zero	zero	zero

■ Available



Aplus' Embedded IP Proprietary Designs

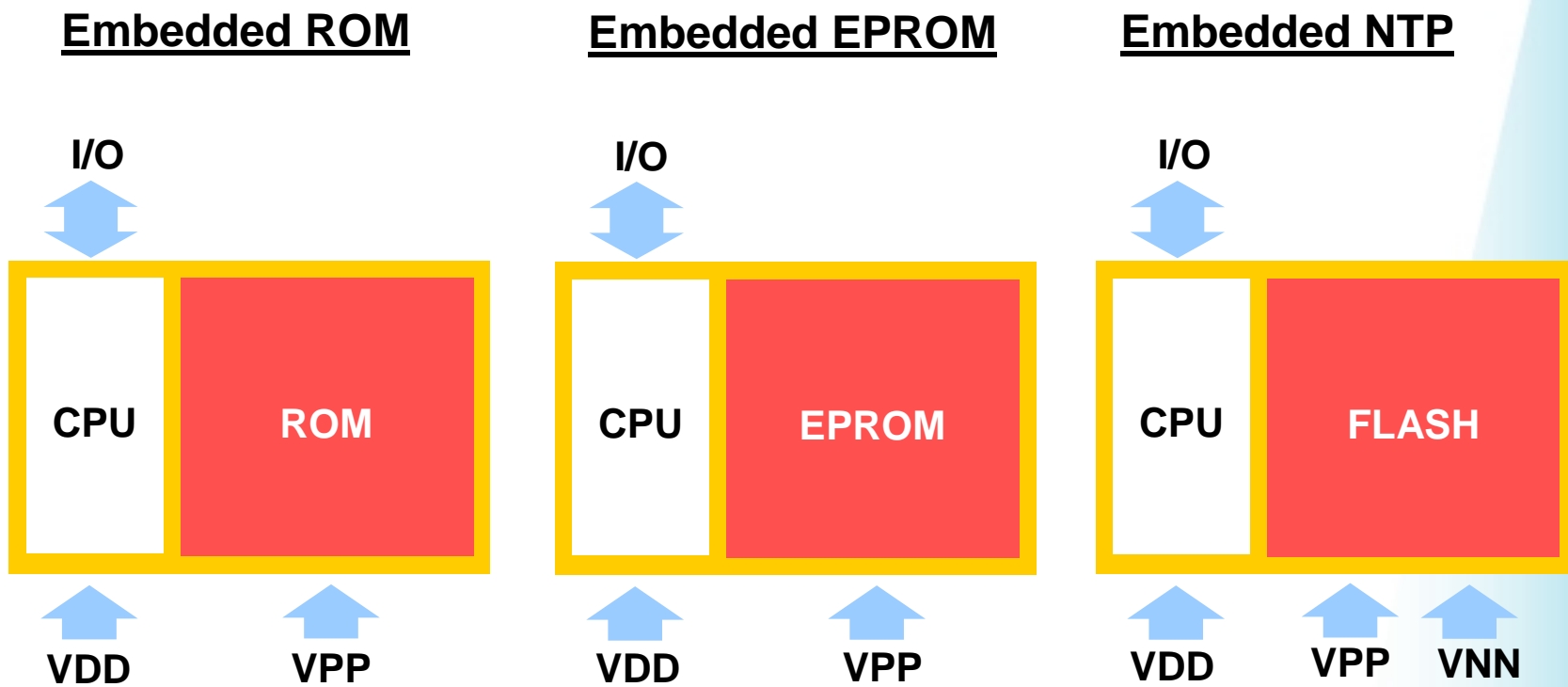
Embedded Aplus IP	EEPROM	FLASH	SRAM
Family Products	X8: 1K, 4K, 8K, 16K, 32K, 64K X16: 512, 2K, 4K, 8K, 16K ■	128K x 8 ■	X8: 1K, 4K, 8K, 16K, 32K, 64K, 128K, 256K X16: 512, 2K, 4K, 8K, 16K-128K ■
NVM Test Mode	Yes	Yes	Yes
Security bit	Yes	Yes	Yes
VDD	1.8V, 3V, 5V	1.8V – 5.5V	2.4V – 6.0V
Standby current	zero	zero	zero

■ Available

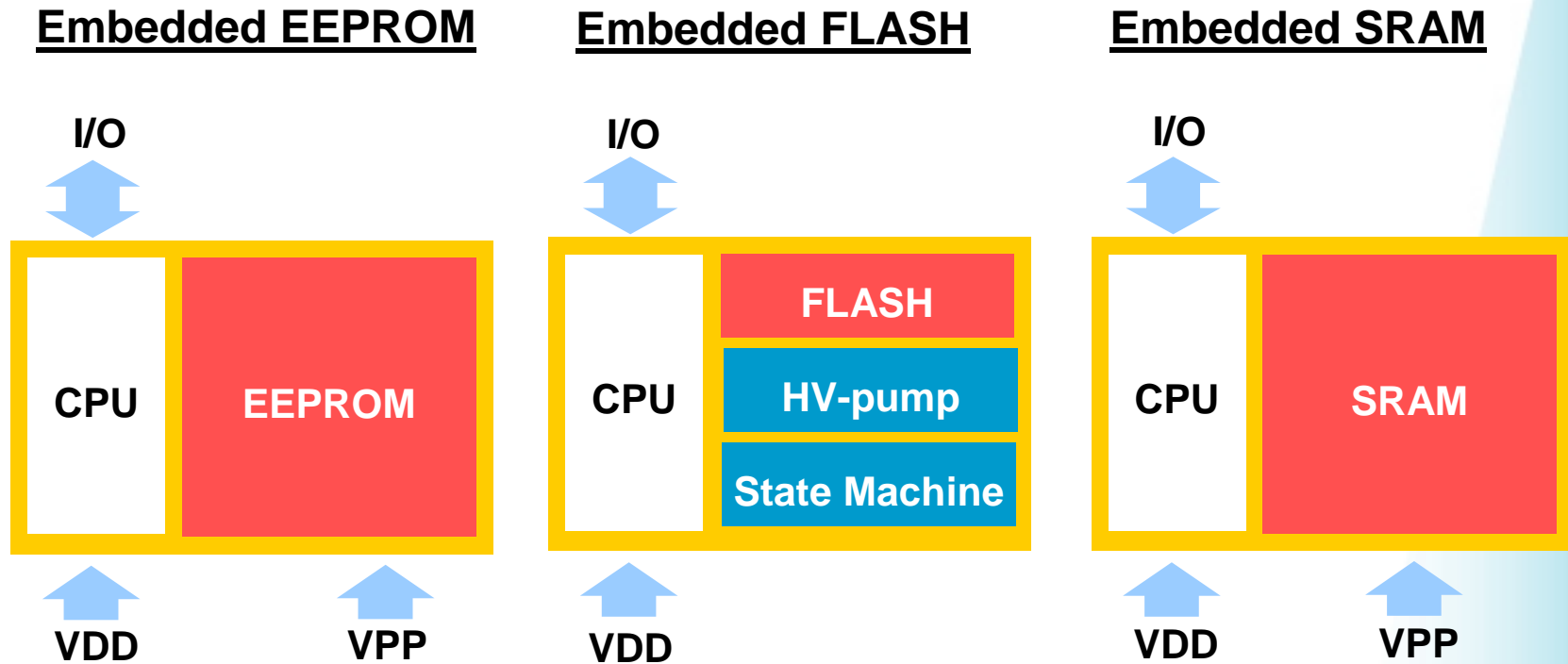
■ R & D



Aplus' Embedded IP Memory Blocks



Aplus' Embedded IP Memory Blocks



Feature Comparison of Aplus' Embedded IP Systems

Embedded NVM System	On-chip State Machine	On-Chip Pump	P/E Cycle	Cell Scalability
ROM	No	No	1	Scalable
OTP	No	No	1	Less Scalable
NTP	No	No	$>10^3$	Scalable
EEPROM	Yes	Yes	$>10^3$	Scalable
Flash (MaxFlash)	Yes	Yes	$>10^6$	Scalable
SRAM	No	No	1	Scalable



Comparison of PGM/ERASE Operations Aplus' Embedded IP Systems

Embedded NVM System	In-System Reprogrammability	Power Supply
ROM	No	VDD, VPP
OTP	No	VDD, VPP
NTP	No	VDD, VPP, VNN
EEPROM	Yes	VDD, VPP
Flash (MaxFlash)	Yes	VDD
SRAM	No	VDD, VPP



Aplus' Embedded IP Licensees

- ROM
 - Sharp, Winland, Mosel-Vitec, etc.
 - Speech synthesizers, dictionaries, electronic games, micro-controllers, etc.
- OTP
 - Winbond, Mosel-Vitec, HMC, Elan, Novatek, Syntek, Synaptics, Sonix, Huako, Megawin, Sitronix, King Billion, SunLink, E-CMOS, Gerent, Mosart, Smartchip, etc.
 - Micro-controllers, speech synthesizers, etc.
- NTP
 - Elan, etc.
 - Micro-controllers



Aplus' Embedded IP Licensees

- **EEPROM**
 - DaTang, Silone MagCard, etc.
 - Smart Card, etc.
- **FLASH**
 - Under development
- **SRAM**
 - Smartchip, etc.
 - Micro-controllers



Aplus' Embedded NVM & VM IP Offerings

Aplus can service ALL your embedded NVM needs and more!

ROM

0.8um – 0.25um

Patented

OTP

0.5um – 0.35um

Patented

NTP

0.35um – 0.25um

Patented

EEPROM

0.35um

FLASH

0.25um – 0.13um

Patent Pending

SRAM*

0.5um

Aplus is an established, proven, global leader in embedded designs

* SRAM is a volatile memory.



9. OTP/NTP/Flash Update

OTP

- **Companies using a Conventional Metal-bitline approach:**
 - USA: Intel, AMD, Atmel, Microchip, Cypress, Microchip, Catalyst
 - Europe: STM
 - Japan: All companies
 - Korea: Samsung, Hyundai
 - Singapore: Chartered (Foundry company)
 - Taiwan: UMC, TSMC (Foundry companies)
- **Companies using a BN+ bitline approach: (Foundry incompatible)**
 - Taiwan: Macronix
 - Europe: Saifun

NTP

- USA: Aplus (ETOX-compatible)



Aplus as YOUR Embedded Partner

- **Aplus is a Leader in the Embedded Non-Volatile Memory Industry, offering a complete line of ROM, OTP, NTP, EEPROM, Flash & SRAM embedded solutions**
- **Aplus has a long list of design IP licensees that proves our superior technology position**
- **Aplus is focused on our core competency – memory. We don't compete with your products!**
- **Aplus offers turnkey foundry services for your manufacturing capacity and flexibility**



Aplus' Competitive Advantages

- **Over 60 Patented Designs that offer Best Solutions**
- **State-of-the-Art Non-Volatile-Memory Design in Embedded IP**
- **Excellent, Silicon-proven Design Experience**
- **Quick Turn Around**
- **Smaller Die Sizes**
- **Most Cost Effective with Lowest Total Costs**
- **Customized Designs available**

