



## **NTP(Numerous -Time-Programming) Flash Memory Block 020/010/512**

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**2Mbit (256K Byte x 8bit)  
/ 1Mbit (128K Byte x 8bit)  
/ 512Kbit (64K Byte x 8bit)**

### **Distinctive Features & Characteristics:**

- Suitable for both 3V and 5V operating supply voltages:  
2.2V to 5.5V battery-supply and 1.8V to 5.5V power-supply read operation
- +10V and -10V external power supplies for patented write operation
- No internal high voltage charge pump circuits, reducing noise
- No internal state machine , reducing silicon area
- Fully compatible with 3.3V and 5.5V microprocessors.
- Density : 2Mbit (256K Byte x 8bit) / 1Mbit (128K Byte x 8bit) / 512Kbit (64K Byte x 8bit)
  
- Small die size: 2Mb/1Mb/512Kb=7.45 / 4.22 / 2.63 kmil<sup>2</sup>
- High process yield: over 90%
- Access Time: 60ns @ 3V and 400ns @ 2.2v (36 MHz cycle X 2 phase)
- Currents:  
Operating: 1mA for read operation  
Standby: 0μA
- Write Cycles: more than 1000 cycles
- Program Time: 20μs per byte
- Erase Time: 300ms whole array
- Technology: 0.35um 2P3M Flash technology.
- Compatibility with JEDEC standards.
- Package options:

### **General Description:**

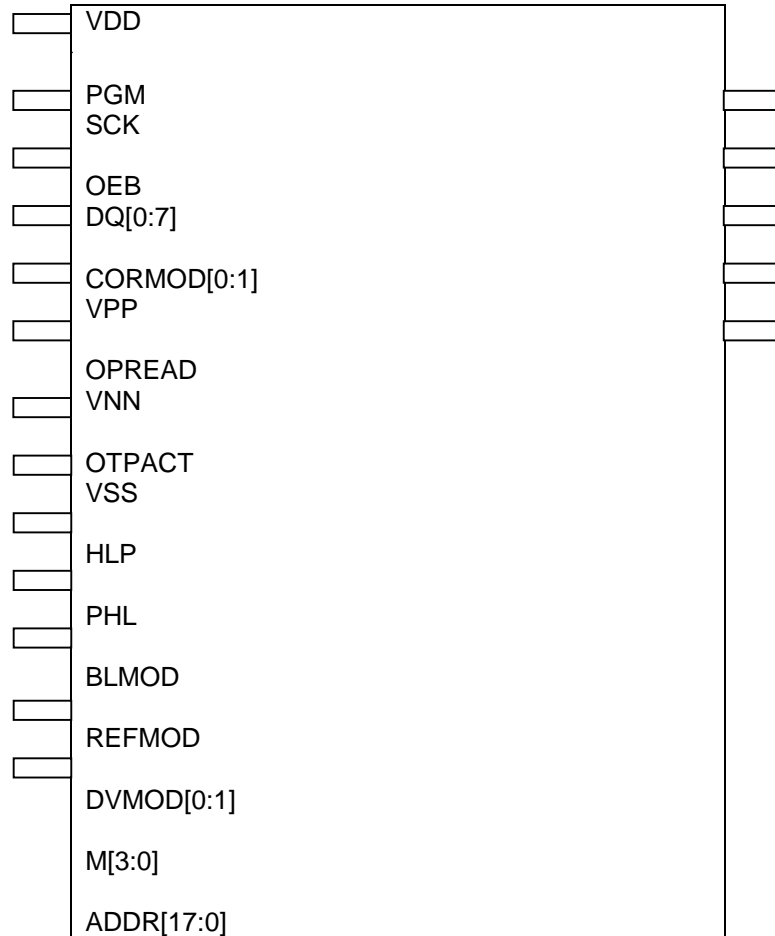
Aplus Flash Technology's SimFlash™ 020/010/512 is a low-cost, low-voltage embedded Flash memory organized as 256K/128K/64K bytes and 8 bits that is fully compatible with all 3.3V and 5.5V microprocessors. The device is designed to write data with a programmer approved by Aplus. Fast access time of 60ns allows the device to operate with high-speed microprocessor without wait states. For read operation, the device operates at 2.2V to 5.5V (battery) or 1.8V to 5.5V (power supply). For write operation, the device requires external high voltages of +10V and -10V. The SimFlash™ 020/010/512 provides word program time of 20us and chip erase time of 300ms with endurance of at least 1000 cycles. The SimFlash™ 020/010/512 is exceptionally suitable for low-voltage nonvolatile memory applications requiring infrequent writes. Manufactured with UMC's high-performance 0.35um Flash

technology, the device provides high yield, small die size, and numerous-time programming and erasing features. The SimFlash™ 020/010/512 provides immense improvement in flexibility and performance over current nonvolatile applications that use UV-erasable OTP EPROMs and masked ROMs, while still providing the same low cost.

## **Related Aplus Patents**

- **“Approach to provide High External Voltage for Flash Memory Erase”  
U.S. Patent 06240027, granted May 29, 2001.**
- **“Approach to provide High External Voltage for Flash Memory Erase”  
U.S. Patent 06166961, granted December 26, 2000.**
- **“Novel Method to turn a Flash Memory into a Versatile, low-cost NTP EEPROM” (patent pending).**

## Block Diagram:



## Connector Description: User modes

Connector name	Direction	Description
Addr[17:0]	I	Provide memory addresses
DQ[0:7]	I/O	Data input during program, data output during read, tri-state when OEB is high
OEB	I	Output Enable
PGMB	I	Controls program, erase, or correction time.
VPP	I	Positive high voltage during erase, program, or correction operations
VNN	I	Negative high voltage during erase, program or correction operations.
M[3:0]	I	Selects codes for all user's and test modes.
CORMOD[1:0]	I	Select corresponding word line voltage during correction operation.
VDD	I	Power supply
VSS	I	Ground

**Test Modes:**

Connector name	Direction	Description
SCK	O	Serial clock for test mode
PH1, HLP	I	Provides serial clock and controls sense amp
OTPACT	I	Used with PH1 or HLP for test mode.
DVMOD[1:0]	I	Controls different bias on bit lines.
BLMOD	I	Used with DVMOD[1:0]
REFMOD	I	Provides loading options for reference bit line.
OPREAD	I	Read option word line.

**DC Operating Conditions**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Battery-supply voltage	VDD	2.2	3 - 5	5.5	V
Power-supply voltage	VDD	1.8	3 - 5	5.5	V
Ground	VSS	0	0	0	V

**DC Electrical Characteristics**

Parameter	Symbol	SimFlash 020/010/512		Unit	Conditions
		Min.	Max.		
Operating current Read Program Erase	IDD1	-	5 20 20	mA mA mA	36 MHz cycle X 2 phase
Static Read Current	IDD2	-	1	mA	
Standby Power Supply Current	ISB	-	0	μA	

## Truth Table

Mode	M[3:0]	OEB	PGMB	VNN	VPP	RC[7:0]	ADDR[17:0]
Standby	---	H	H	Vss	Vdd	High Z	X
Read	---	L	H	Vss	Vdd	Dout	Ain
Program	1h	H	L	Vss	10v	Din	Ain
Erase	2h	H	L	-10v	10v	High Z	X
Everify	3h	L	H	-10v	Vdd	Dout	Ain
Correction	4h	H	L	-10v	10v	High Z	X

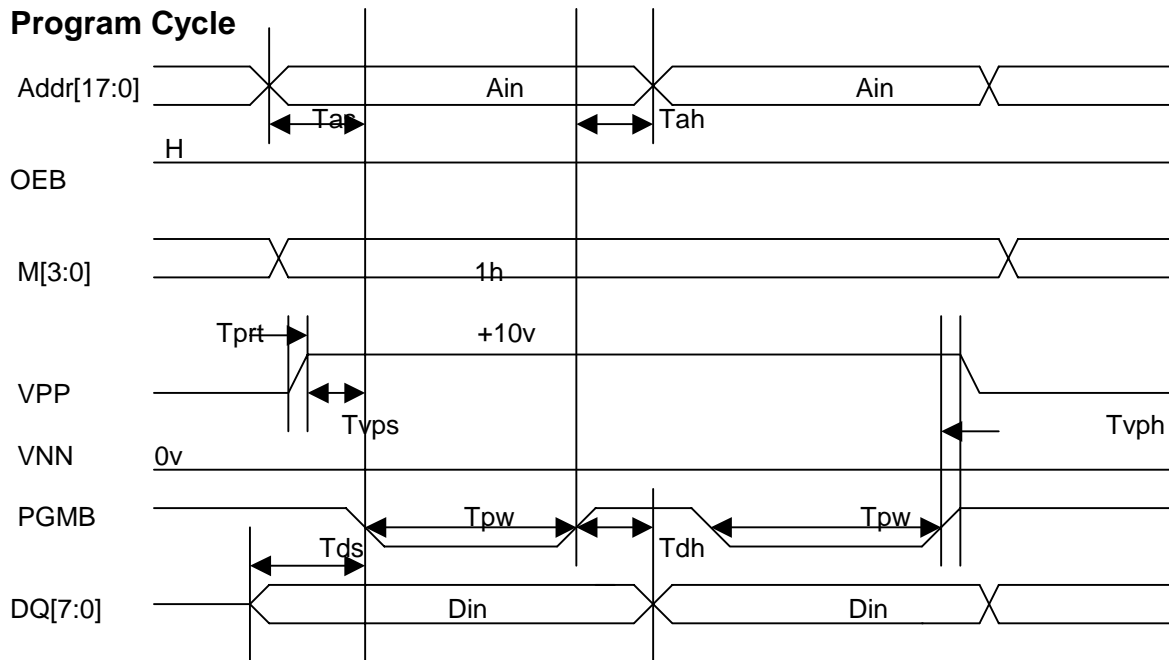
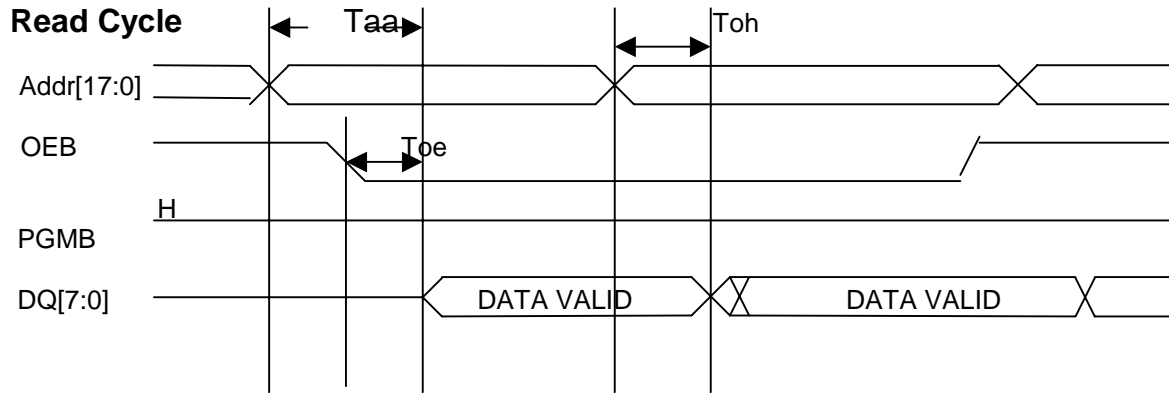
## Capacitance

Parameter	Symbol	Min	Max	Unit
Address & Control Input Capacitance	Cin	-	0.2	pF
Data Output Pin Capacitance	Cout	-	0.3	pF

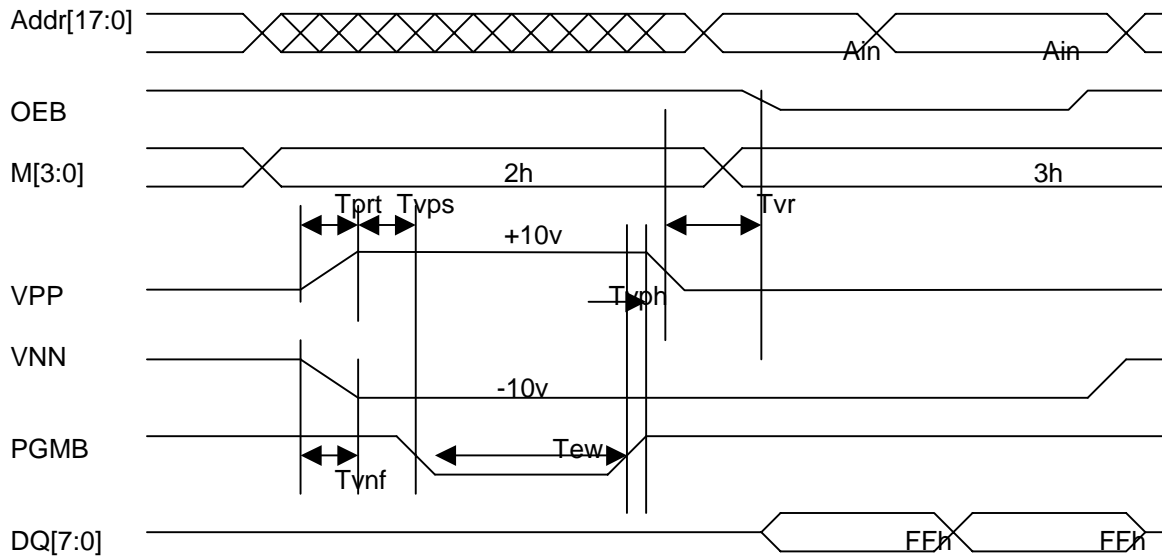
## Timing AC Parameters (T=0°C to 70°C; Vdd=3.0V)

Parameter	Symbol	SimFlash 020/010/512		Unit
		Min	Max	
Address access time	Taa	-	60	ns
OEB access time	Toe	-	30	ns
Output hold from address change time	Toh	0	-	ns
PGMB program pulse width	Tpw	10	15	μs
PGMB erase pulse width	Tew	300	350	ms
PGMB correction width	Tcw	10	15	μs
Address setup time	Tas	1	-	ns
Address hold time	Tah	1	-	ns
VPP pulse rise time	Tprt	50	-	ns
VNN pulse fall time	Tvnf	50	-	ns
VPP setup time	Tvps	1	-	us
VPP hold time	Tvph	1	-	μs
VNN setup time	Tvns	1	-	μs
VNN hold time	Tvnh	1	-	μs
Data setup time	Tds	1	-	μs
Data hold time	Tdh	1	-	μs
VPP,VNN recovery time	Tvr	1	-	μs

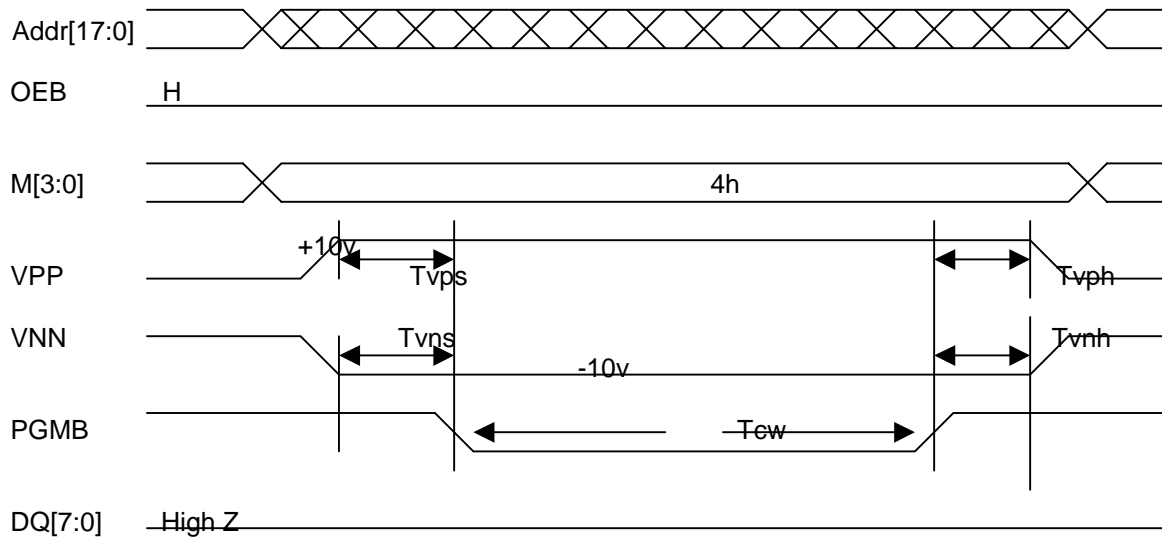
## Timing Waveforms



### Erase & Erase Verify Cycle



### Correction Cycle



## Die Size

Product	X ( $\mu\text{m}$ )	Y ( $\mu\text{m}$ )	Die Size (K mil <sup>2</sup> )
SimFlash 020	1855	2737	7.45
SimFlash 010	1855	1555	4.22
SimFlash 512	1855	969	2.63
SimFlash 256	660	1535	1.48
SimFlash 128	660	935	0.90

## REVISIONS

Version Number	Description	Page	Date
0.1	First Preliminary Draft		2/08/02
0.2	Second Preliminary Draft	1	5/28/03

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