



## 64K × 8 ELECTRICALLY ERASABLE EPROM

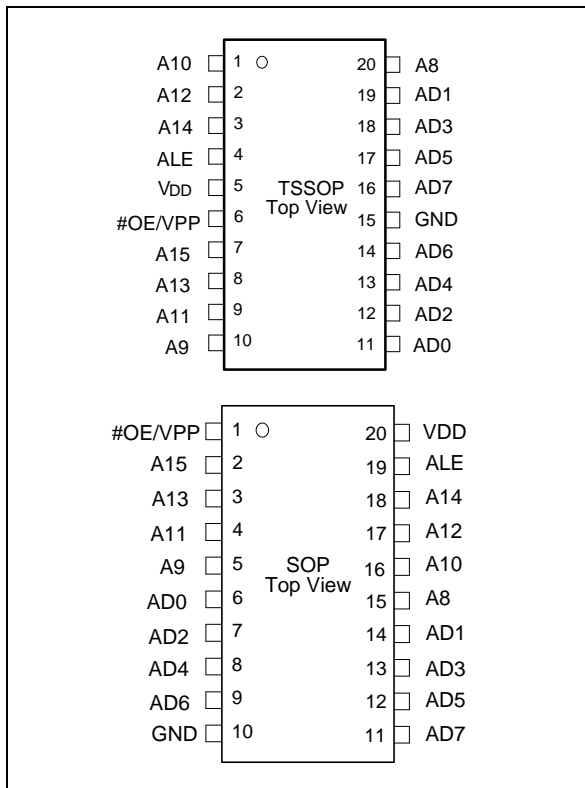
### 1. GENERAL DESCRIPTION

The W27C520 is a high speed, low power Electrically Erasable and Programmable Read Only Memory organized as 65,536 × 8 bits. It includes latches for the lower 8 address lines to multiplex with the 8 data lines. To cooperate with the MCU, this device could save the external TTL component, also cost and space. It requires only one supply in the range of 3.0V to 3.6V or 4.5V to 5.5V in normal read mode. The W27C520 provides an electrical chip erase function. It will be a great convenient when you need to change/update the contents in the device.

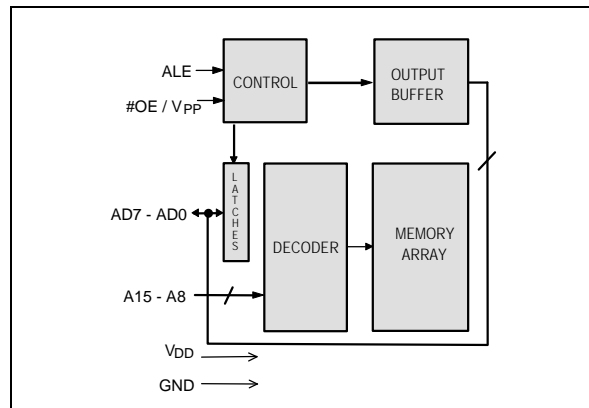
### 2. FEATURES

- High speed access time: 70/90 nS (max.)
- Read operating current: 8/20 mA (max.)
- Erase/Programming operating current 30 mA (max.)
- Standby current: 20/100 μA (max.)
- Unregulated battery power supply range, 3.0V to 3.6V and 4.5V to 5.5V
- +13V erase and programming voltage
- High Reliability CMOS Technology
  - 2K V ESD Protection
  - 200 mA Latchup Immunity
- Fully static operation
- All inputs and outputs directly LVTTTL/CMOS compatible
- Three-state outputs
- Available packages: 20-pin TSSOP and 20-pin SOP

### 3. PIN CONFIGURATIONS



### 4. BLOCK DIAGRAM



### 5. PIN DESCRIPTION

SYMBOL	DESCRIPTION
AD0 – AD7	Address/Data Inputs/Outputs
A8 – A15	Address Inputs
ALE	Address Latch Enable
#OE/VPP	Output Enable, Program/Erase Supply Voltage
VDD	Power Supply
GND	Ground



## **6. FUNCTIONAL DESCRIPTION**

### **Read Mode**

Unlike conventional UVEPROMs, which has #CE and #OE two control functions, the W27C520 has one #OE/VPP and one ALE (address\_latch\_enable) control functions. The ALE makes lower address A[7:0] to be latched in the chip when it goes from high to low, so that the same bus can be used to output data during read mode. i.e. lower address A[7:0] and data bus DQ[7:0] are multiplexed. #OE/VPP controls the output buffer to gate data to the output pins. When addresses are stable, the address access time (TACC) is equal to the delay from ALE to output (TCE), and data are available at the outputs TOE after the falling edge of #OE /VPP, if TACC and TCE timings are met.

### **Erase Mode**

The erase operation is the only way to change data from "0" to "1." Unlike conventional UVEPROMs, which use ultraviolet light to erase the contents of the entire chip (a procedure that requires up to half an hour), the W27C520 uses electrical erasure. Generally, the chip can be erased within 100 mS by using an EPROM writer with a special erase algorithm.

There are two ways to enter Erase mode. One is to raise #OE/VPP to VPE (13V), VDD = VDE (6.5V), A9 = VHH (13V), A10 = high A8&A11 = low, and all other address pins include AD[7:0] keep at fixed low or high. Pulsing ALE high starts the erase operation. The other way is somewhat like flash, by programming two consecutive commands into the device and then enter Erase mode. The two commands are loading Data = AA(hex) to Addr. = 5555(hex) and Data = 10(hex) to Addr. = 2AAA(hex). Be careful to note that the ALE pulse widths of these two commands are different: One is 50  $\mu$ S, while the other is 100 mS. Please refer to the Smart Erase Algorithm 1 & 2.

### **Erase Verify Mode**

The device will enter the Erase Verify Mode automatically after Erase Mode. Only power down the device can force the device enter Normal Read Mode again.

### **Program Mode**

Programming is the only way to change cell data from "1" to "0." The program mode is entered when #OE/VPP is raised to VPP (13V), VDD = VDP (6.5V), the address pins equal the desired addresses, and the input pins equal the desired inputs. Pulsing ALE high starts the programming operation.

### **Program Verify Mode**

The device will enter the Program Verify Mode automatically after Program Mode. Only power down the device can force the device enter Normal Read Mode again.

### **Erase/Program Inhibit**

Erase or program inhibit mode allows parallel erasing or programming of multiple chips with different data. When ALE low, erasing or programming of non-target chips is inhibited, so that except for the ALE and #OE/VPP pins, the W27C520 may have common inputs.

### **Standby Mode**

The standby mode significantly reduces VDD current. This mode is entered when ALE and #OE/VPP keep high. In standby mode, all outputs are in a high impedance state.



## System Considerations

An EPROM's power switching characteristics require careful device decoupling. System designers are interested in three supply current issues: standby current levels (ISB), active current levels (IDD), and transient current peaks produced by the falling and rising edges of ALE. Transient current magnitudes depend on the device output's capacitive and inductive loading. Proper decoupling capacitor selection will suppress transient voltage peaks. Each device should have a

0.1  $\mu$ F ceramic capacitor connected between its VDD and GND. This high frequency, low inherent-inductance capacitor should be placed as close as possible to the device. Additionally, for every eight devices, a 4.7  $\mu$ F electrolytic capacitor should be placed at the array's power supply connection between VDD and GND. The bulk capacitor will overcome voltage slumps caused by PC board trace inductances.

## 7. TABLE OF OPERATING MODES

(VPP = 13V, VPE = 13V, VHH = 12V, VDP = 6.5V, VDE = 6.5V, VDD = 3.3V or 5.0V, VDI = 5.0V, X = VIH or VIL)

MODE	PIN				
	ALE	#OE/VPP	OTHER ADDRESS	VDD	AD[7:0]
Address Latch Enable	VIH	VIH	A1N	VDD	A[7:0]
Read	VIL	VIL	A1N	VDD	DOUT
Output Disable	VIL/ VIH	VIH	X	VDD	High Z
Standby	VIH	VIH	X	VDD	A[7:0]
Program	VIH	VPP	A1N	VDP	D1N
Erase 1	VIH	VPE	A8&A11 = VIL, A9 = VPE, A10 = VIH, Others = X	VDE	X
Erase 2	VIH	VPE	First command: Addr. = 5555 (hex)	VDE	AA(hex)
			Second command: Addr. = 2AAA (hex)	VDE	10(hex)
Product Identifier- manufacturer	VIL	VIL	A8 = VIL, A9 = VHH, Others = X	VDI	DA(Hex)
Product Identifier-device	VIL	VIL	A8 = VIH, A9 = VHH, Others = X	VDI	1F(Hex)



## 8. DC CHARACTERISTICS

### Absolute Maximum Ratings

PARAMETER	RATING	UNIT
Ambient Temperature with Power Applied	-55 to +125	°C
Storage Temperature	-65 to +150	°C
Voltage on all Pins with Respect to Ground Except #OE/VPP, A9 and VDD Pins	-2.0 to +7.0	V
Voltage on #OE/VPP Pin with Respect to Ground	-2.0 to +7.0	V
Voltage on A9 Pin with Respect to Ground	-2.0 to +7.0	V
Voltage VDD Pin with Respect to Ground	-2.0 to +14.0	V

Notes:

- Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device.
- Minimum voltage is -0.6V DC which may undershoot to -2.0V for pulses of less than 20 nS. Maximum output pin voltage is  $V_{DD} + 0.75V$  DC which may overshoot to +7.0V for pulses of less than 20 nS.

### DC Erase Characteristics

( $T_A = 25^\circ C \pm 5^\circ C$ ,  $V_{DD} = 6.5V \pm 0.25V$ )

PARAMETER	SYM.	CONDITIONS	LIMITS			UNIT
			MIN.	TYP.	MAX.	
Input Load Current	ILI	$V_{IN} = V_{IL}$ or $V_{IH}$	-10	-	10	$\mu A$
VDD Erase Current	ICP	ALE = $V_{IH}$ , #OE/VPP = $V_{PE}$ A8 & A11 = $V_{IL}$ , A9 = $V_{PE}$ , A10 = $V_{IH}$ , Others = X	-	-	30	mA
VPP Erase Current	IPP	ALE = $V_{IH}$ , #OE/VPP = $V_{PE}$ A8 & A11 = $V_{IL}$ , A9 = $V_{PE}$ , A10 = $V_{IH}$ , Others = X	-	-	30	mA
Input Low Voltage	$V_{IL}$	-	-0.3	-	0.8	V
Input High Voltage	$V_{IH}$	-	2.4	-	$V_{DD} + 0.3$	V
Output Low Voltage (Verify)	$V_{OL}$	$I_{OL} = 2.1$ mA	-	-	0.45	V
Output High Voltage (Verify)	$V_{OH}$	$I_{OH} = -0.4$ mA	2.4	-	-	-
A9 SID Voltage	HH	$V_{DD} = 5V \pm 10\%$	11.5	12	12.5	V
A9 Erase Voltage	$V_{PE}$	-	12.75	13	13.25	V
VPP Erase Voltage	$V_{PE}$	-	12.75	13	13.25	V
VDD Supply Voltage (Erase & Erase Verify)	$V_{DE}$	-	6.25	6.5	6.75	V

Note:  $V_{DD}$  must be applied simultaneously or before  $V_{PP}$  and removed simultaneously or after  $V_{PP}$ .

### 9. CAPACITANCE

(V<sub>DD</sub> = 3.0V to 3.6V or 4.5V to 5.5V, T<sub>A</sub> = 25° C, f = 1 MHz)

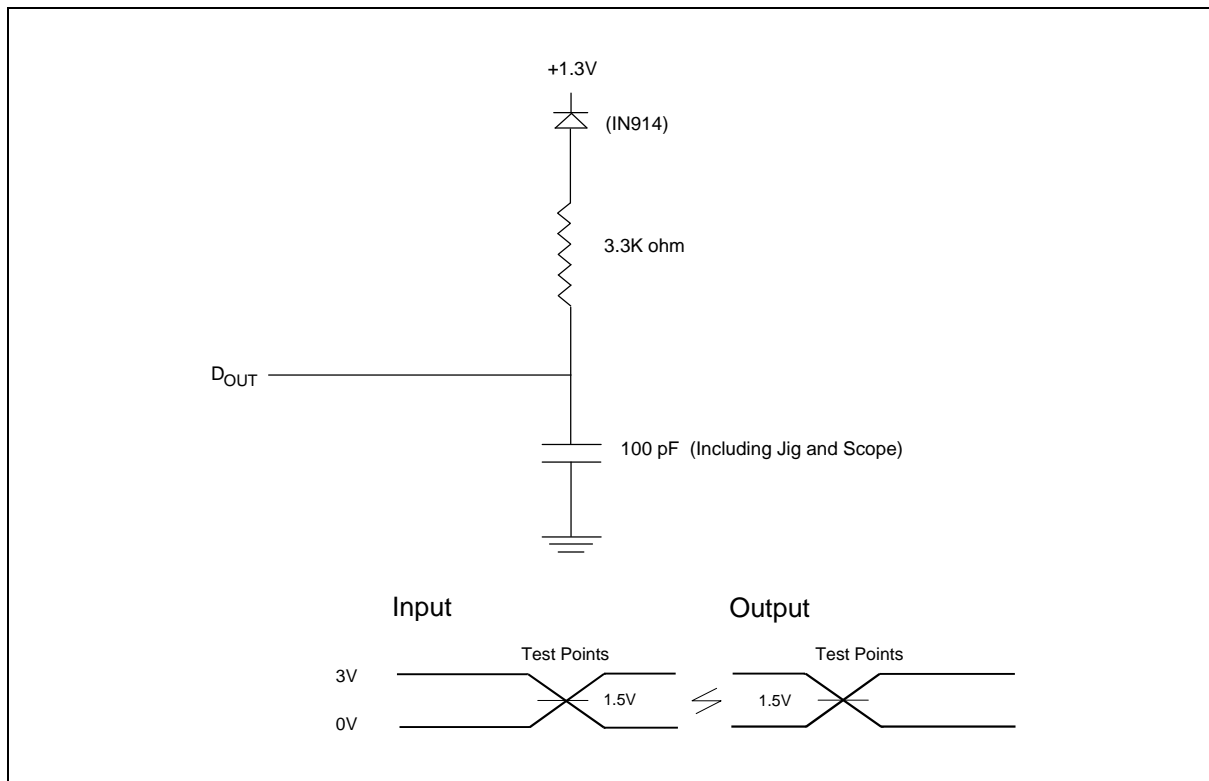
PARAMETER	SYMBOL		MAX.	UNIT
Input Capacitance	C <sub>IN</sub>	V <sub>IN</sub> = 0V	6	pF
Output Capacitance	C <sub>OUT</sub>	V <sub>OUT</sub> = 0V	12	pF

### 10. AC CHARACTERISTICS

#### AC Test Conditions

PARAMETER	CONDITIONS
Input Pulse Levels	0V/3V
Input Rise and Fall Times	10 nS
Input and Output Timing Reference Level	1.5V/1.5V
Output Load	CL = 100 pF, I <sub>OH</sub> /I <sub>OL</sub> = -0.4 mA/2.1 mA

#### AC Test Load and Waveforms



## 11. READ OPERATION DC CHARACTERISTICS

(V<sub>DD</sub> = 3.0V to 3.6V or 4.5V to 5.5V, T<sub>A</sub> = 0 to 70° C)

PARAMETER	SYM.	CONDITIONS	LIMITS			UNIT
			MIN.	TYP.	MAX.	
Input Load Current	ILI	V <sub>IN</sub> = 0V to V <sub>DD</sub>	-5	-	5	μA
Output Leakage Current	ILO	V <sub>OUT</sub> = 0V to V <sub>DD</sub>	-5	-	5	μA
Standby V <sub>DD</sub> Current (CMOS input)	ISB	V <sub>DD</sub> = 3.0V to 3.6V	-	-	20	μA
		V <sub>DD</sub> = 4.5V to 5.5V			100	
V <sub>DD</sub> Operating Current	IDD	V <sub>DD</sub> = 3.0V to 3.6V	-	-	8	mA
		V <sub>DD</sub> = 4.5V to 5.5V			20	
Input Low Voltage	V <sub>IL</sub>	-	-0.6	-	0.8	V
Input High Voltage	V <sub>IH</sub>	-	2.0	-	V <sub>DD</sub> +0.3	V
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 2.1 mA	-	-	0.4	V
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -0.4 mA	2.4	-	-	V

## 12. READ OPERATION AC CHARACTERISTICS

(V<sub>DD</sub> = 3.0V to 3.6V or 4.5V to 5.5V, T<sub>A</sub> = 0 to 70° C)

PARAMETER	SYM.	W27C520-70		W27C520-90		UNIT
		MIN.	MAX.	MIN.	MAX.	
Address Latch Enable Access Time	TCE	-	70	-	90	nS
Address Latch Enable Width	TALE	45	-	45	-	nS
Address Access Time	TACC	-	70	-	90	nS
Address Setup Time	TAS	15	-	15	-	nS
Address Hold Time	TAH	15	-	15	-	nS
Output Enable Access Time	TOE	-	35	-	35	nS
#OE/V <sub>PP</sub> High to High-Z Output	TDF	-	25	-	25	nS
Output Hold from Address Change	TOH	0	-	0	-	nS

Note: V<sub>DD</sub> must be applied simultaneously or before V<sub>PP</sub> and removed simultaneously or after V<sub>PP</sub>.



### 13. DC PROGRAMMING CHARACTERISTICS

(V<sub>DD</sub> = 6.5V ±0.25V, T<sub>A</sub> = 25° C ±5° C)

PARAMETER	SYM.	CONDITIONS	LIMITS			UNIT
			MIN.	TYP.	MAX.	
Input Load Current	I <sub>LI</sub>	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>	-10	-	10	μA
V <sub>DD</sub> Program Current	I <sub>CP</sub>	ALE = V <sub>IH</sub> , #OE/V <sub>PP</sub> = V <sub>PP</sub>	-	-	30	mA
V <sub>PP</sub> Program Current	I <sub>PP</sub>	ALE = V <sub>IH</sub> , #OE /V <sub>PP</sub> = V <sub>PP</sub>	-	-	30	mA
Input Low Voltage	V <sub>IL</sub>	-	-0.3	-	0.8	V
Input High Voltage	V <sub>IH</sub>	-	2.4	-	V <sub>DD</sub> +0.5	V
Output Low Voltage (Verify)	V <sub>OL</sub>	I <sub>OL</sub> = 2.1 mA	-	-	0.45	V
Output High Voltage (Verify)	V <sub>OH</sub>	I <sub>OH</sub> = -0.4 mA	2.4	-	-	V
A9 Silicon I.D. Voltage	V <sub>HH</sub>	V <sub>DD</sub> = 5V ±10%	11.5	12.0	12.5	V
V <sub>PP</sub> Program Voltage	V <sub>PP</sub>	-	12.75	13.0	13.25	V
V <sub>DD</sub> Supply Voltage (Program)	V <sub>DP</sub>	-	6.25	6.5	6.75	V

### 14. AC PROGRAMMING/ERASE CHARACTERISTICS

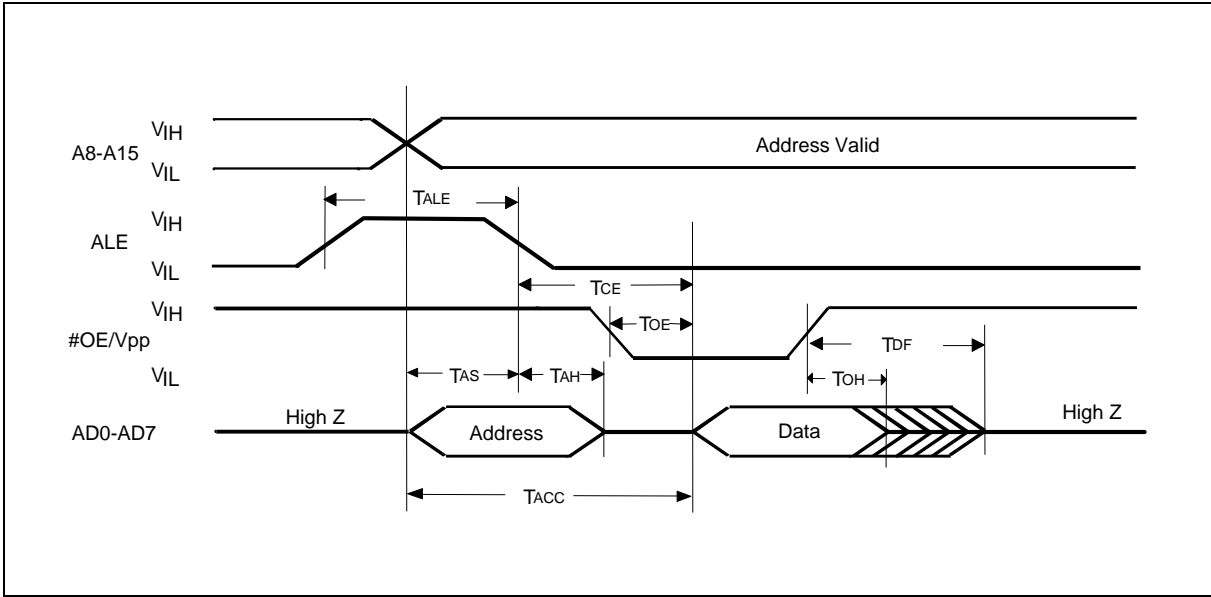
(V<sub>DD</sub> = 6.5V ±0.25V, T<sub>A</sub> = 25° C ±5° C)

PARAMETER	SYM.	LIMITS			UNIT
		MIN.	TYP.	MAX.	
#OE/V <sub>PP</sub> Pulse Rise Time	TPRT	50	-	-	nS
Address Latch Enable Width	TALE	500	-	-	nS
ALE Program Pulse Width	TPPW	47.5	50	52.5	μS
ALE Erase Pulse Width	TEPW	95	100	105	mS
ALE Erase Pulse Width 1	TEPW1	47.5	50	52.5	μS
ALE Erase Pulse Width 2	TEPW2	95	100	105	mS
Latched Address Setup Time	TLAS	100	-	-	nS
Latched Address Hold Time	TLAH	100	-	-	nS
Address Setup Time	TAS	2.0	-	-	μS
Address Hold Time	TAH	0	-	-	μS
#OE/V <sub>PP</sub> Setup Time	TOES	2.0	-	-	μS
#OE /V <sub>PP</sub> Hold Time	TOEH	2.0	-	-	μS
Data Setup Time	T <sub>DS</sub>	2.0	-	-	μS
Data Hold Time	T <sub>DH</sub>	2.0	-	-	μS
Data Valid from #OE/V <sub>PP</sub> Low during Erase Verify	TEOE	-	-	150	nS
Data Valid from #OE/V <sub>PP</sub> Low during Program Verify	TPOE	-	-	150	nS
#OE/V <sub>PP</sub> High to Output High Z	TDFP	0	-	130	nS
#OE/V <sub>PP</sub> High Voltage Delay After ALE Low	TVS	2.0	-	-	μS
#OE/V <sub>PP</sub> Recovery Time	TVR	2.0	-	-	μS

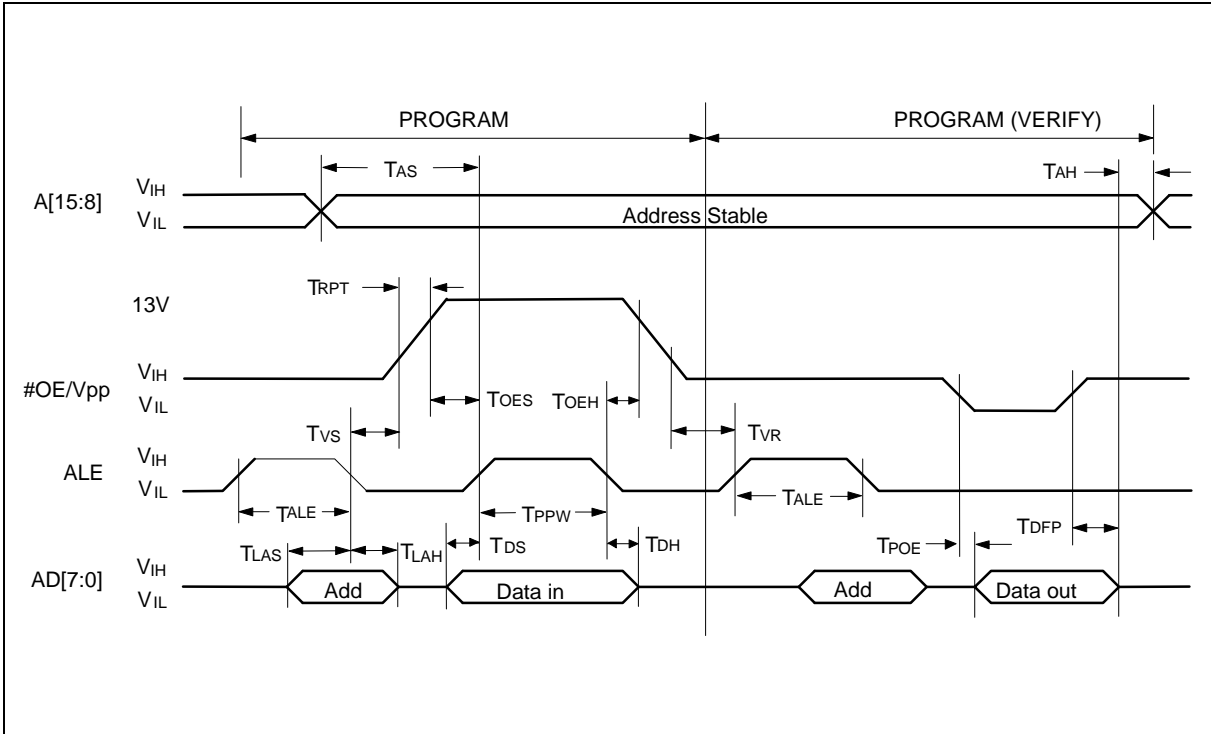
Note: V<sub>DD</sub> must be applied simultaneously or before V<sub>PP</sub> and removed simultaneously or after V<sub>PP</sub>.

15. TIMING WAVEFORMS

AC Read Waveform



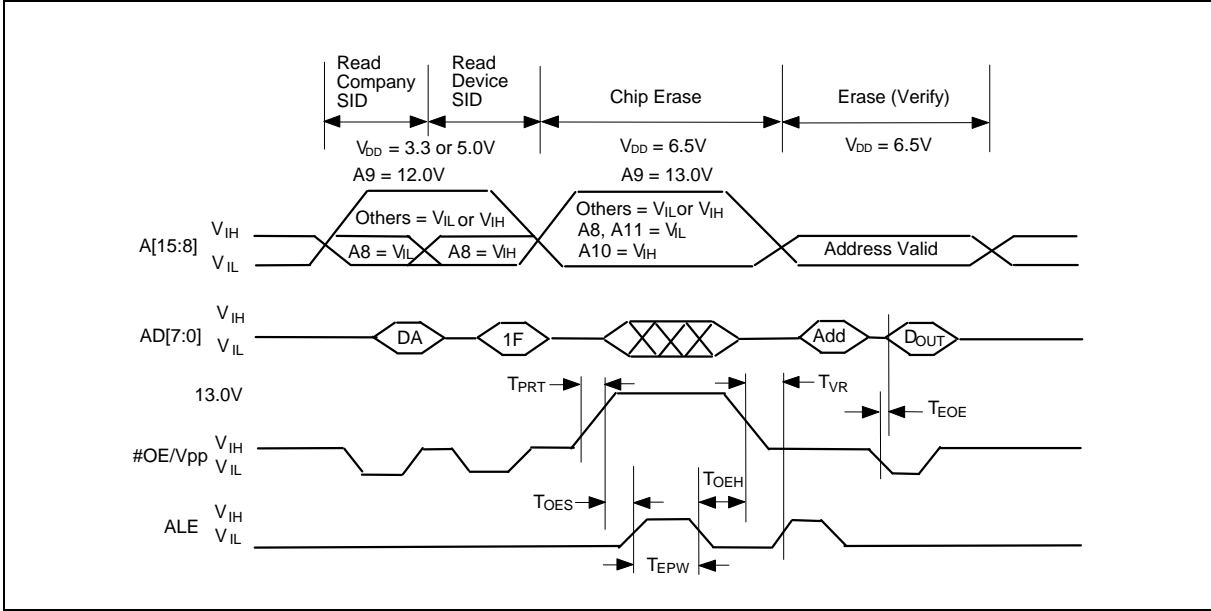
Programming Waveform



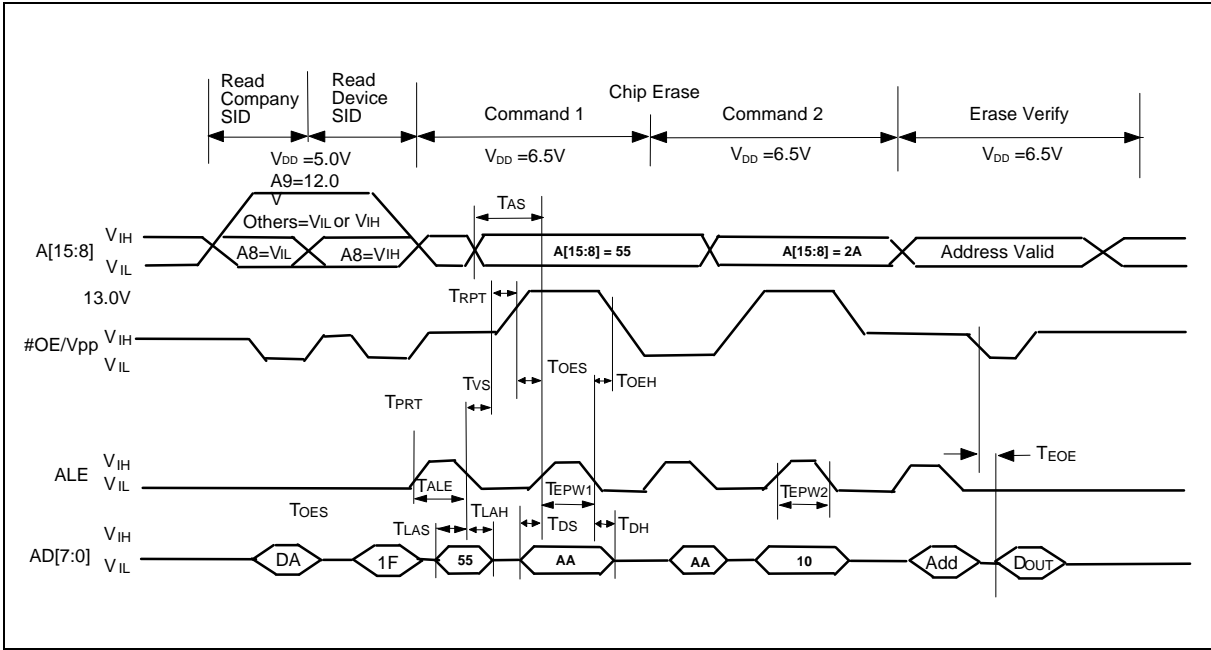


Timing Waveforms, continued

Erase Waveform 1

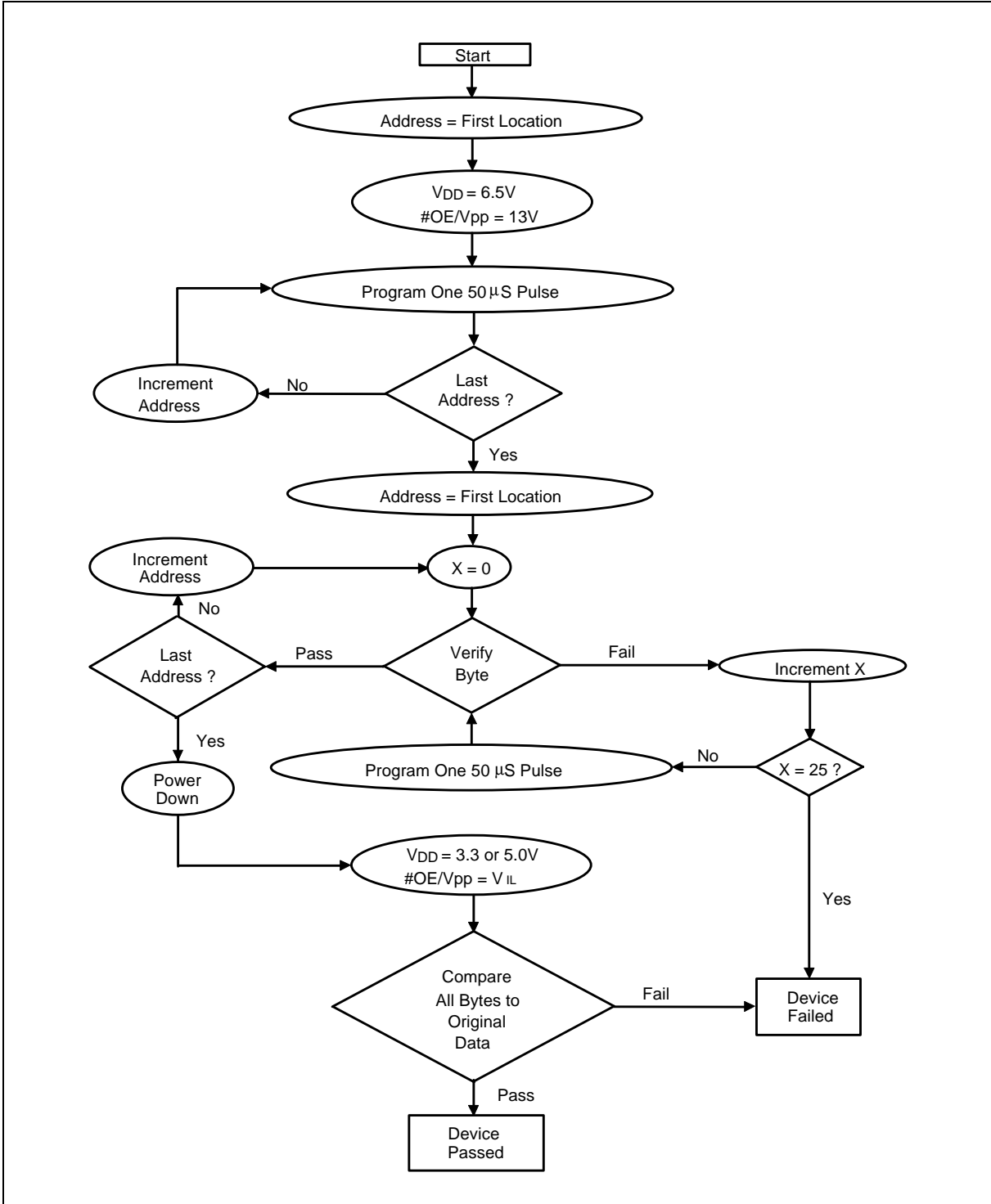


Erase Waveform 2



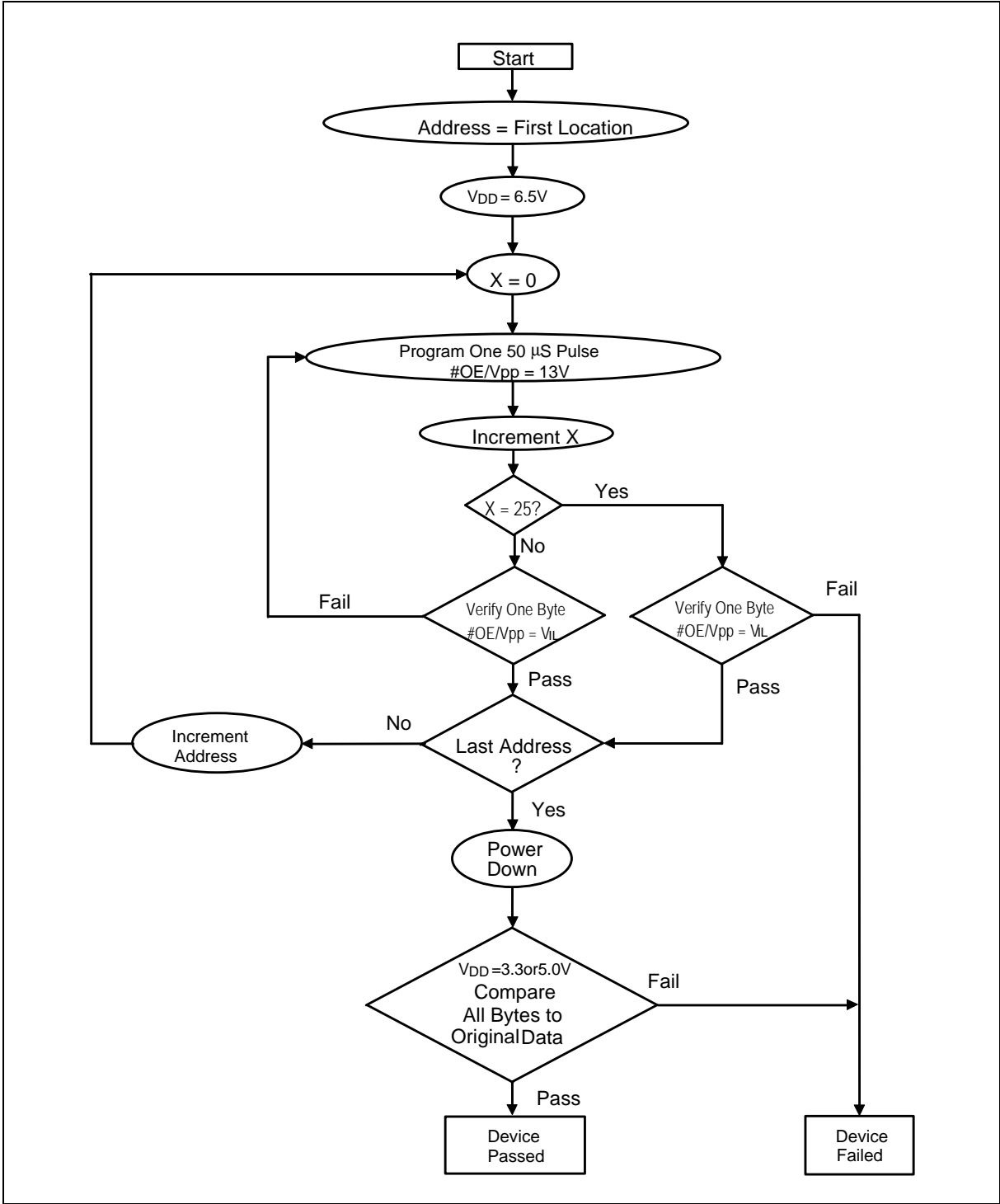
Note: First command Address = 5555(hex) with Data = AA(hex)  
 Second command Address = 2AAA(hex) with Data = 10(hex)

16. SMART PROGRAMMING ALGORITHM 1

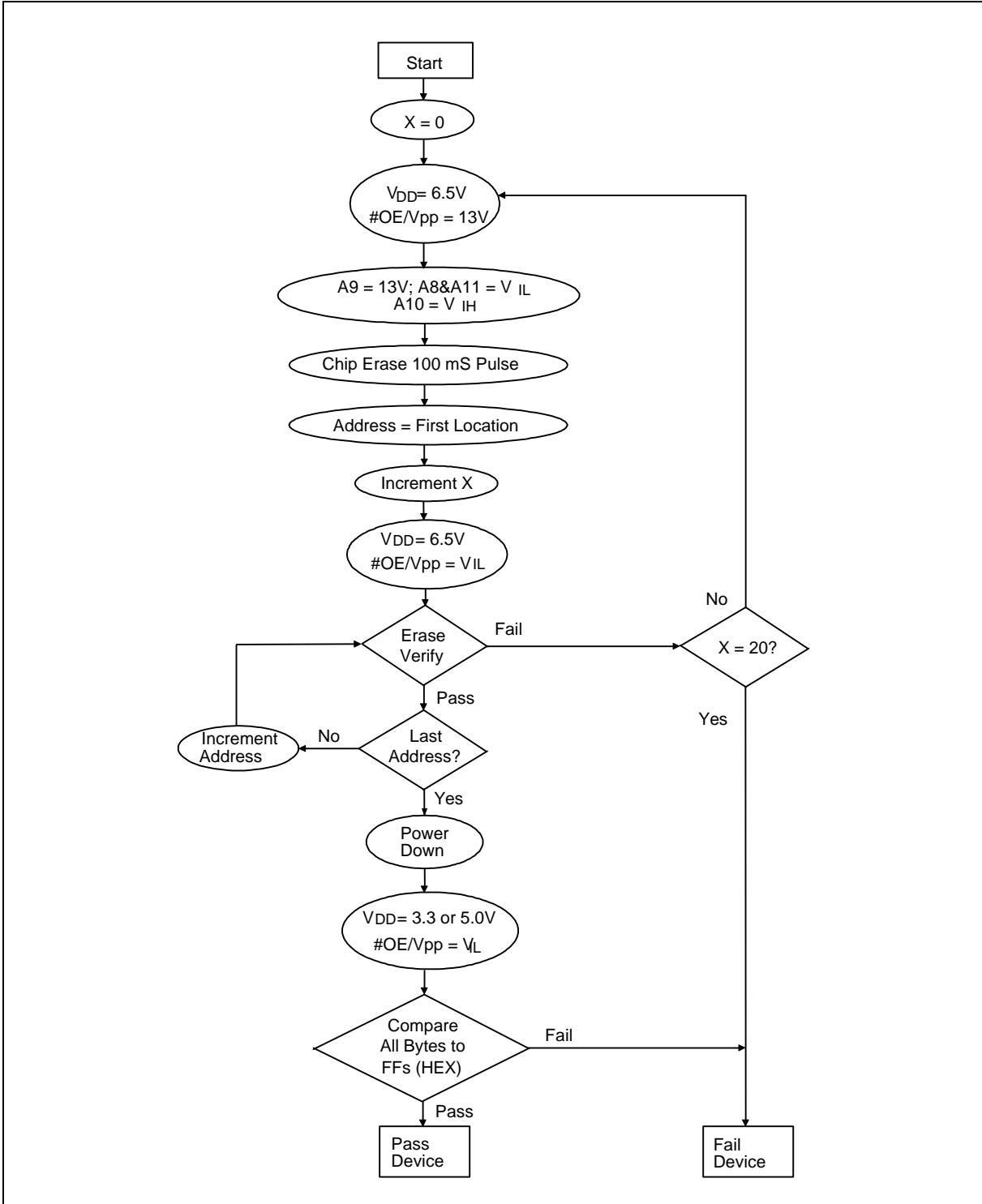




17. SMART PROGRAMMING ALGORITHM 2

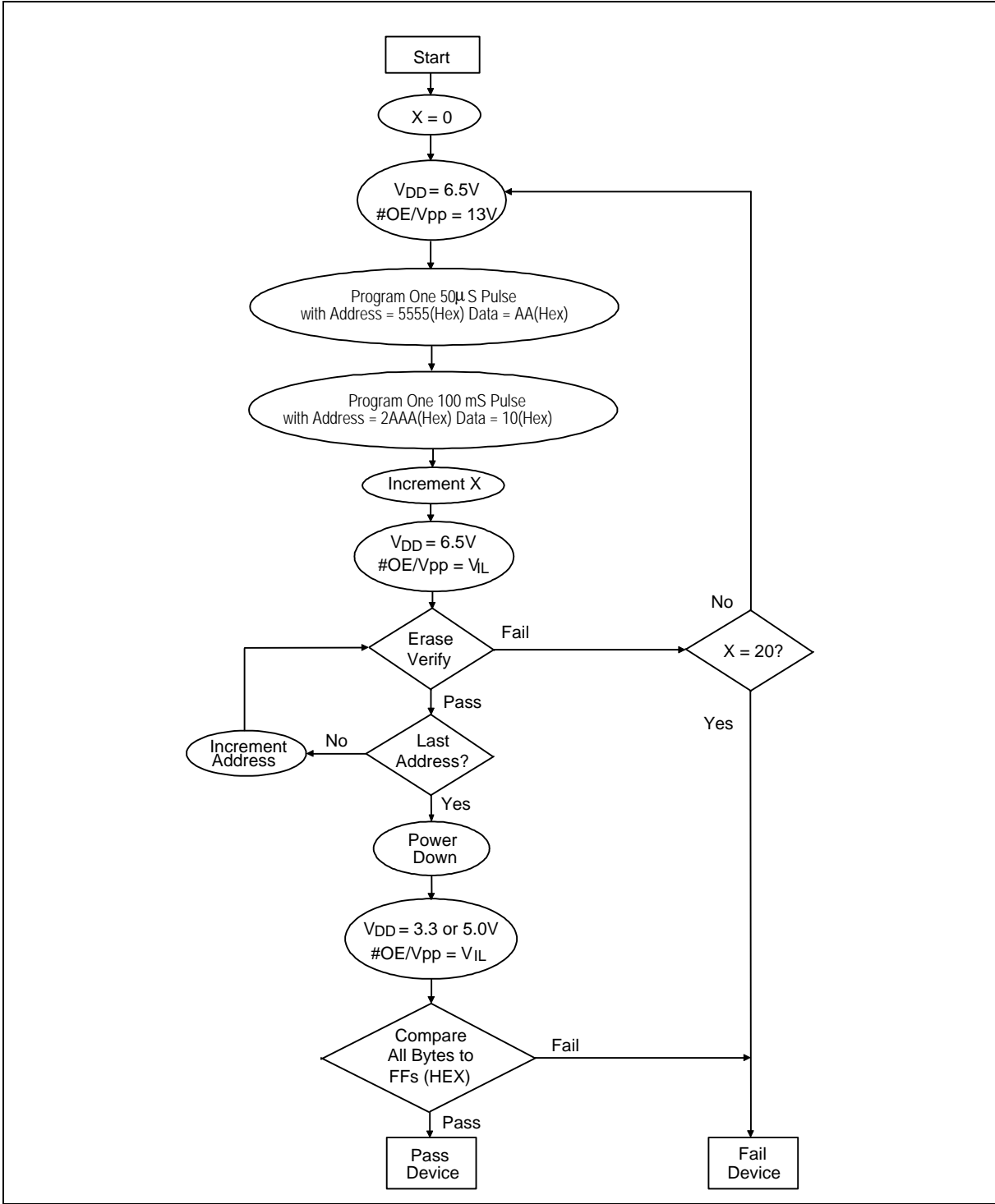


18. SMART ERASE ALGORITHM 1





19. SMART ERASE ALGORITHM 2





## 20. ORDERING INFORMATION

PART NO.	ACCESS TIME (nS)	OPERATING CURRENT MAX. (mA)	STANDBY CURRENT MAX. (mA)	PACKAGE
W27C520W-70*	70	8/20	20/100	173 mil TSSOP
W27C520W-90	90	8/20	20/100	173 mil TSSOP
W27C520S-70*	70	8/20	20/100	300 mil SOP
W27C520S-90	90	8/20	20/100	300 mil SOP

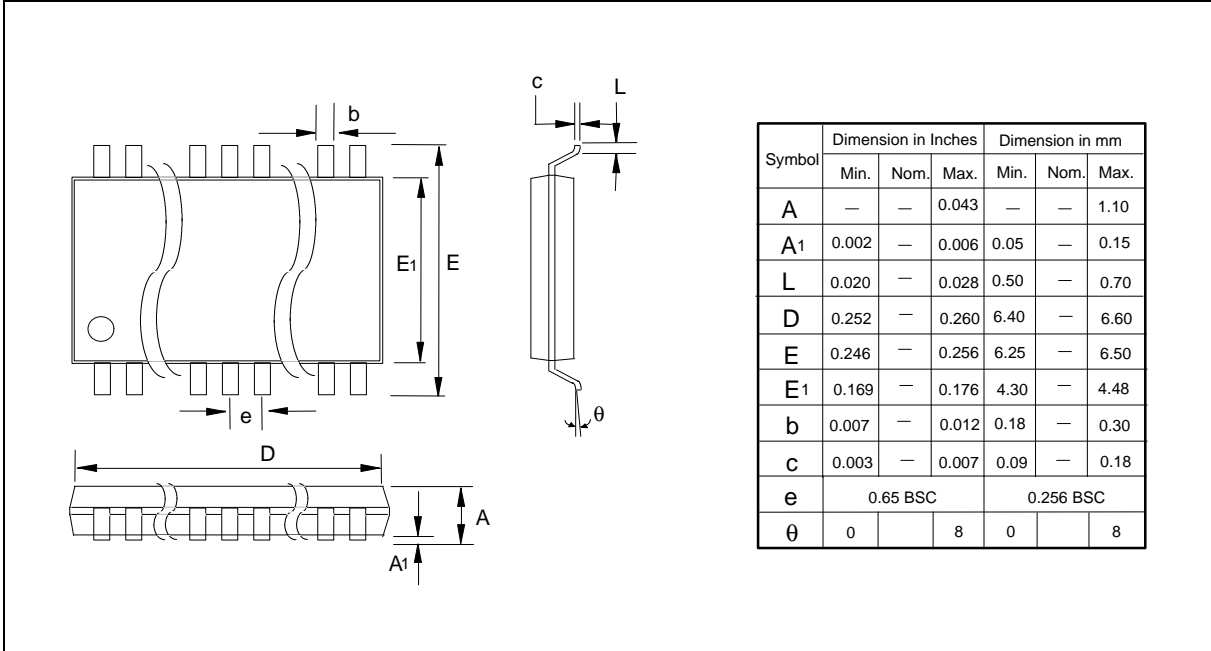
Notes:

1. The power supply for 70nS parts is 4.5V – 5.5V.
2. The Part No is preliminary and might be changed after project is consoled.
3. Winbond reserves the right to make changes to its products without prior notice.
4. Purchasers are responsible for performing appropriate quality assurance testing on products intended for use in applications where personal injury might occur as a consequence of product failure.

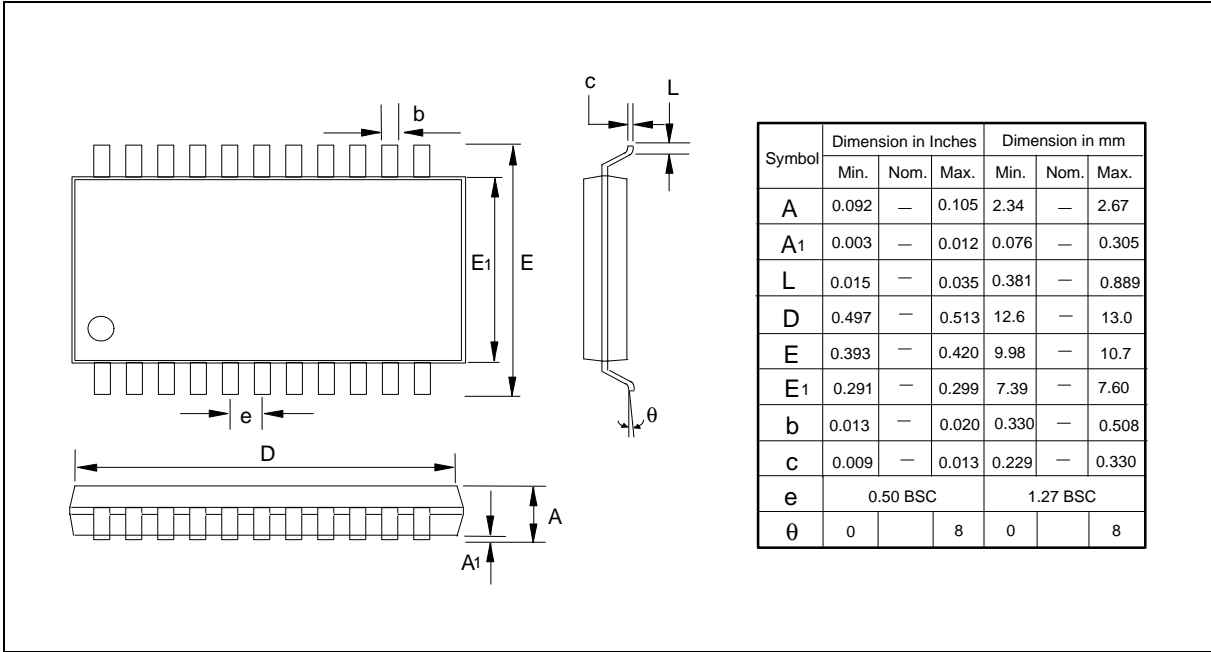


21. PACKAGE DIMENSIONS

20-pin TSSOP



20-pin SOP



**22. VERSION HISTORY**

VERSION	DATE	PAGE	DESCRIPTION
A1	Sept. 2000	-	Initial Issued
A2	May 28, 2002	17	Modify power supply for 70 nS parts as 4.5 – 5.5V



**Headquarters**  
 No. 4, Creation Rd. III,  
 Science-Based Industrial Park,  
 Hsinchu, Taiwan  
 TEL: 886-3-5770066  
 FAX: 886-3-5665577  
<http://www.winbond.com.tw/>

**Taipei Office**  
 9F, No.480, Rueiguang Rd.,  
 Neihu Chiu, Taipei, 114,  
 Taiwan, R.O.C.  
 TEL: 886-2-8177-7168  
 FAX: 886-2-8751-3579

**Winbond Electronics Corporation America**  
 2727 North First Street, San Jose,  
 CA 95134, U.S.A.  
 TEL: 1-408-9436666  
 FAX: 1-408-5441798

**Winbond Electronics Corporation Japan**  
 7F Daini-ueno BLDG, 3-7-18  
 Shinyokohama Kohoku-ku,  
 Yokohama, 222-0033  
 TEL: 81-45-4781881  
 FAX: 81-45-4781800

**Winbond Electronics (Shanghai) Ltd.**  
 27F, 2299 Yan An W. Rd. Shanghai,  
 200336 China  
 TEL: 86-21-62365999  
 FAX: 86-21-62365998

**Winbond Electronics (H.K.) Ltd.**  
 Unit 9-15, 22F, Millennium City,  
 No. 378 Kwun Tong Rd.,  
 Kowloon, Hong Kong  
 TEL: 852-27513100  
 FAX: 852-27552064

*Please note that all data and specifications are subject to change without notice.  
 All the trade marks of products and companies mentioned in this data sheet belong to their respective owners.*