

# OKI Semiconductor

1A

## MR27V1602D

1,048,576-Word x 16-Bit or 2,097,152-Word x 8-Bit One Time PROM

### DESCRIPTION

The MR27V1602D is a 16Mbit electrically Programmable Read-Only Memory whose configuration can be electrically switched between 1,048,576 word x 16bit and 2,097,152 word x 8bit. The MR27V1602D operates on a single +3V-3.3V power supply and is TTL compatible. Since the MR27V1602D operates asynchronously, external clocks are not required, making this device easy-to-use. The MR27V1602D is suitable as large-capacity fixed memory for microcomputers and data terminals. It is manufactured using a CMOS double silicon gate technology and is offered in 42-pin DIP, 44-pin SOP, 44-pin TSOP or 48-pin TSOP packages.

### FEATURES

- 1,048,576 word x 16bit / 2,097,152 word x 8bit electrically switchable configuration
- Single +3V-3.3V power supply
- Access time           100ns access time (Vcc=+3V)  
                              80ns access time (Vcc=+3.3V)
- Input / Output TTL compatible
- Three-state output
- Packages

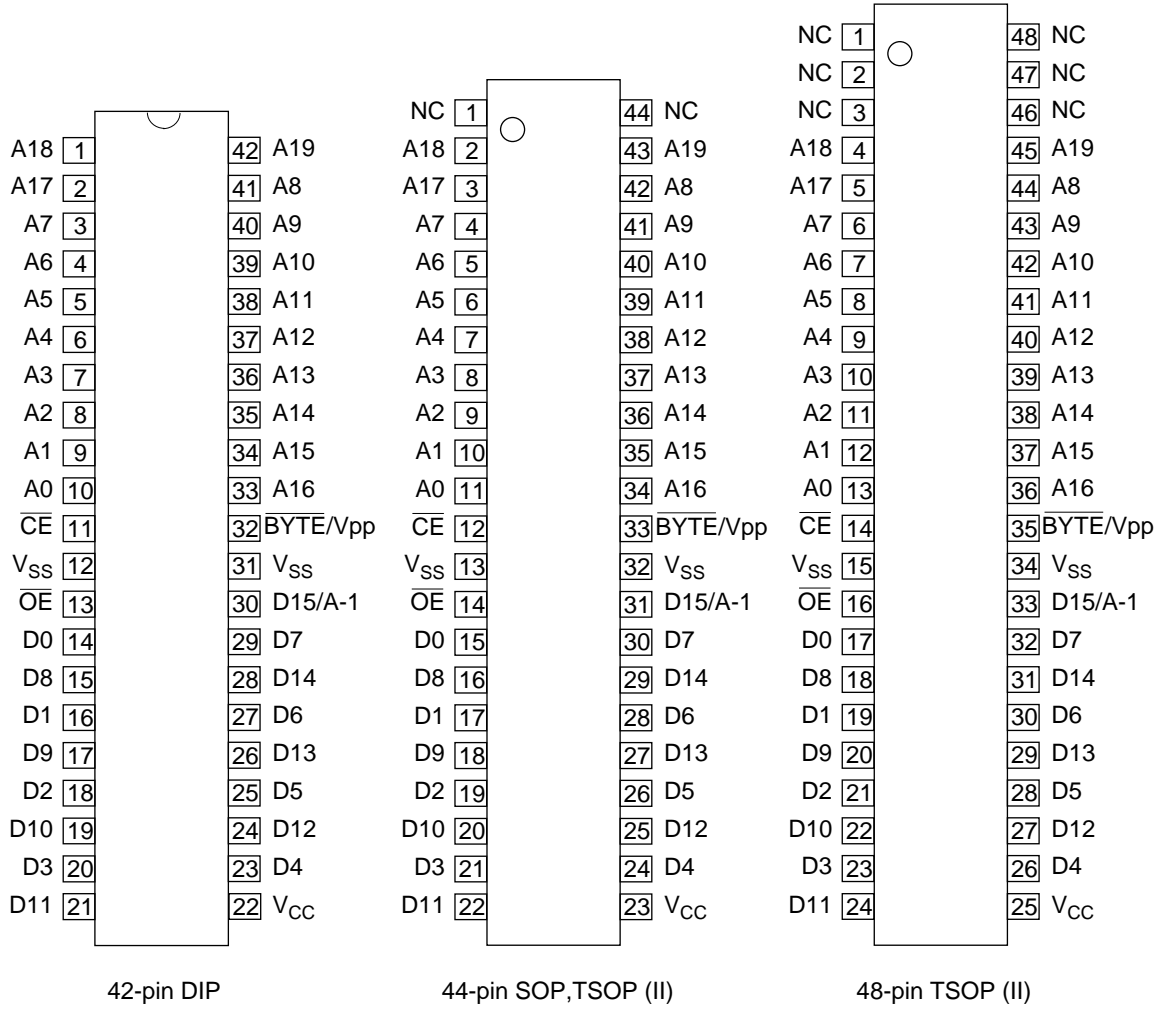
42-pin plastic DIP (DIP42-P-600-2.54)           (Product name : MR27V1602DRA)

44-pin plastic SOP (SOP44-P-600-1.27-K)       (Product name : MR27V1602DMA)

44-pin plastic TSOP (TSOP II 44-P-400-0.80-K) (Product name : MR27V1602DTP)

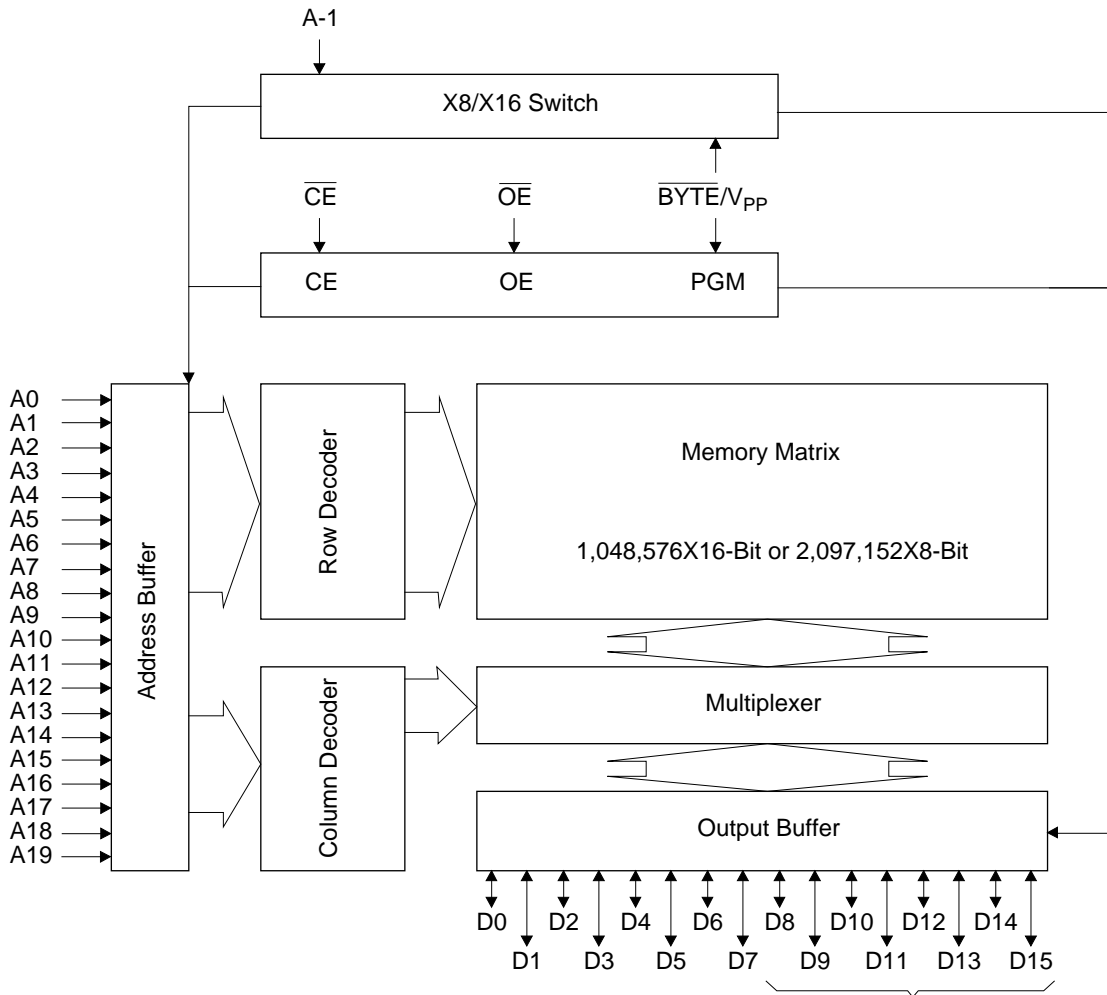
48-pin plastic TSOP (TSOP II 48-P-550-0.80-K) (Product name : MR27V1602DTA)

**PIN CONFIGURATION (TOP VIEW)**



PIN NAMES	FUNCTIONS
D15/A-1	Data output / Address input
A0-A19	Address input
D0-D14	Data output
CE	Chip enable
OE	Output enable
V <sub>CC</sub>	Power supply voltage
V <sub>SS</sub>	GND
BYTE/V <sub>PP</sub>	Mode switch / Program power supply voltage
NC	Non connection

**BLOCK DIAGRAM**



In 8-bit output mode, these pins are three-stated and pin D15 functions as the A-1 address pin.

**FUNCTION TABLE**

MODE	$\overline{CE}$	$\overline{OE}$	$\overline{BYTE/V_{PP}}$	$V_{CC}$	D0 - D7	D8 - D14	D15/A-1
READ (16-Bit)	L	L	H	3.0V to 3.3V	$D_{OUT}$		
READ (8-Bit)	L	L	L		$D_{OUT}$	Hi-Z	L/H
OUTPUT DISABLE	L	H	H		Hi-Z		*
			L				
STAND-BY	H	*	H	Hi-Z		*	
			L				
PROGRAM	L	H	9.75V	$D_{IN}$			
PROGRAM INHIBIT	H	H		Hi-Z			
PROGRAM VERIFY	H	L		$D_{OUT}$			

\*: Don't Care

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Condition	Value	Unit
Operating temperature under bias	T <sub>opr</sub>	-	0 to 70	°C
Storage temperature	T <sub>stg</sub>		-55 to 125	°C
Input voltage	V <sub>I</sub>	relative to V <sub>SS</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
Output voltage	V <sub>O</sub>		-0.5 to V <sub>CC</sub> +0.5	V
Power supply voltage	V <sub>CC</sub>		-0.5 to 5	V
Program power supply voltage	V <sub>PP</sub>		-0.5 to 11.5	V
Power dissipation per package	P <sub>D</sub>	-	1.0	W

**RECOMMENDED OPERATING CONDITIONS**(T<sub>a</sub>=0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
V <sub>CC</sub> power supply voltage	V <sub>CC</sub>	V <sub>CC</sub> =2.7V-3.6V	2.7	-	3.6	V
V <sub>PP</sub> power supply voltage	V <sub>PP</sub>		-0.5	-	V <sub>CC</sub> +0.5	V
Input "H" level	V <sub>IH</sub>		2.2	-	V <sub>CC</sub> +0.5*	V
Input "L" level	V <sub>IL</sub>		-0.5**	-	0.6	V

Voltage is relative to V<sub>SS</sub>\* : V<sub>CC</sub>+1.5V (Max.) when pulse width of overshoot is less than 10nS.

\*\* : -1.5V (Min.) when pulse width of undershoot is less than 10nS.

**ELECTRICAL CHARACTERISTICS (Read operation)****DC Characteristics 1**(V<sub>CC</sub>=3V±0.3V, T<sub>a</sub>=0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I <sub>LI</sub>	V <sub>I</sub> =0 to V <sub>CC</sub>	-	-	10	μA
Output leakage current	I <sub>LO</sub>	V <sub>O</sub> =0 to V <sub>CC</sub>	-	-	10	μA
V <sub>CC</sub> power supply current (Standby)	I <sub>CCSC</sub>	$\overline{CE}=V_{CC}$	-	-	50	μA
	I <sub>CCST</sub>	$\overline{CE}=V_{IH}$	-	-	1	mA
V <sub>CC</sub> power supply current (Read)	I <sub>CCA</sub>	$\overline{CE}=V_{IL}, \overline{OE}=V_{IH}$ tc=100ns	-	-	35	mA
V <sub>PP</sub> power supply current	I <sub>PP</sub>	V <sub>PP</sub> =V <sub>CC</sub>	-	-	10	μA
Input "H" level	V <sub>IH</sub>	-	2.2	-	V <sub>CC</sub> +0.5*	V
Input "L" level	V <sub>IL</sub>	-	-0.5**	-	0.6	V
Output "H" level	V <sub>OH</sub>	I <sub>OH</sub> =-400uA	2.4	-	-	V
Output "L" level	V <sub>OL</sub>	I <sub>OL</sub> =2.1mA	-	-	0.4	V

Voltage is relative to V<sub>SS</sub>\* : V<sub>CC</sub>+1.5V (Max.) when pulse width of overshoot is less than 10nS.

\*\* : -1.5V (Min.) when pulse width of undershoot is less than 10nS.

**DC Characteristics 2**(V<sub>CC</sub>=3.3V±0.3V, T<sub>a</sub>=0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I <sub>LI</sub>	V <sub>I</sub> =0 to V <sub>CC</sub>	-	-	10	μA
Output leakage current	I <sub>LO</sub>	V <sub>O</sub> =0 to V <sub>CC</sub>	-	-	10	μA
V <sub>CC</sub> power supply current (Standby)	I <sub>CCSC</sub>	$\overline{CE}=V_{CC}$	-	-	50	μA
	I <sub>CCST</sub>	$\overline{CE}=V_{IH}$	-	-	1	mA
V <sub>CC</sub> power supply current (Read)	I <sub>CCA</sub>	$\overline{CE}=V_{IL}, \overline{OE}=V_{IH}$ tc=80ns	-	-	40	mA
V <sub>PP</sub> power supply current	I <sub>PP</sub>	V <sub>PP</sub> =V <sub>CC</sub>	-	-	10	μA
Input "H" level	V <sub>IH</sub>	-	2.2	-	V <sub>CC</sub> +0.5*	V
Input "L" level	V <sub>IL</sub>	-	-0.5**	-	0.6	V
Output "H" level	V <sub>OH</sub>	I <sub>OH</sub> =-400uA	2.4	-	-	V
Output "L" level	V <sub>OL</sub>	I <sub>OL</sub> =2.1mA	-	-	0.4	V

Voltage is relative to V<sub>SS</sub>\* : V<sub>CC</sub>+1.5V (Max.) when pulse width of overshoot is less than 10nS.

\*\* : -1.5V (Min.) when pulse width of undershoot is less than 10nS.

### AC Characteristics 1

( $V_{CC}=3V\pm 0.3V$ ,  $T_a=0$  to  $70^\circ C$ )

Parameter	Symbol	Condition	Min.	Max.	Unit
Address cycle time	$T_C$	-	100	-	ns
Address access time	$T_{ACC}$	$\overline{CE}=\overline{OE}=V_{IL}$	-	100	ns
$\overline{CE}$ access time	$T_{CE}$	$\overline{OE}=V_{IL}$	-	100	ns
$\overline{OE}$ access time	$T_{OE}$	$\overline{CE}=V_{IL}$	-	50	ns
Output disable time	$T_{CHZ}$	$\overline{OE}=V_{IL}$	0	30	ns
	$T_{OHZ}$	$\overline{CE}=V_{IL}$	0	25	ns
Output hold time	$T_{OH}$	$\overline{CE}=\overline{OE}=V_{IL}$	0	-	ns

#### Measurement conditions

Input signal level	-----	0V/3V
Input timing reference level	-----	0.8V/2.0V
Output load	-----	100pF
Output timing reference level	-----	0.8V/2.0V

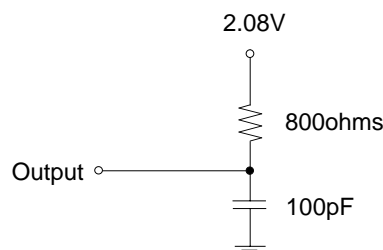
### AC Characteristics 2

( $V_{CC}=3.3V\pm 0.3V$ ,  $T_a=0$  to  $70^\circ C$ )

Parameter	Symbol	Condition	Min.	Max.	Unit
Address cycle time	$T_C$	-	80	-	ns
Address access time	$T_{ACC}$	$\overline{CE}=\overline{OE}=V_{IL}$	-	80	ns
$\overline{CE}$ access time	$T_{CE}$	$\overline{OE}=V_{IL}$	-	80	ns
$\overline{OE}$ access time	$T_{OE}$	$\overline{CE}=V_{IL}$	-	40	ns
Output disable time	$T_{CHZ}$	$\overline{OE}=V_{IL}$	0	30	ns
	$T_{OHZ}$	$\overline{CE}=V_{IL}$	0	25	ns
Output hold time	$T_{OH}$	$\overline{CE}=\overline{OE}=V_{IL}$	0	-	ns

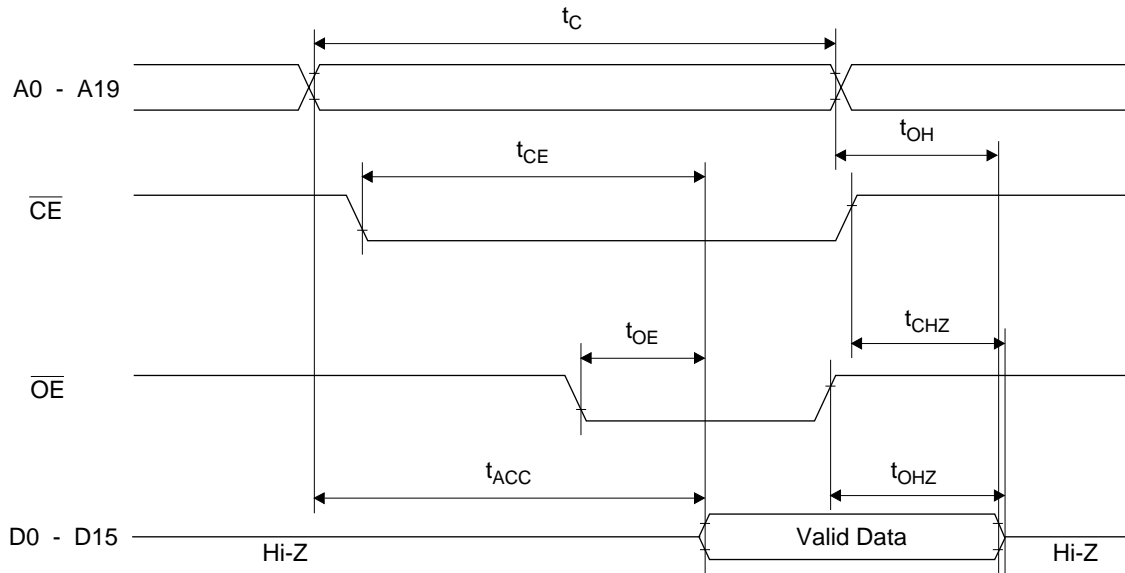
#### Measurement conditions

Input signal level	-----	0V/3V
Input timing reference level	-----	0.8V/2.0V
Output load	-----	100pF
Output timing reference level	-----	0.8V/2.0V

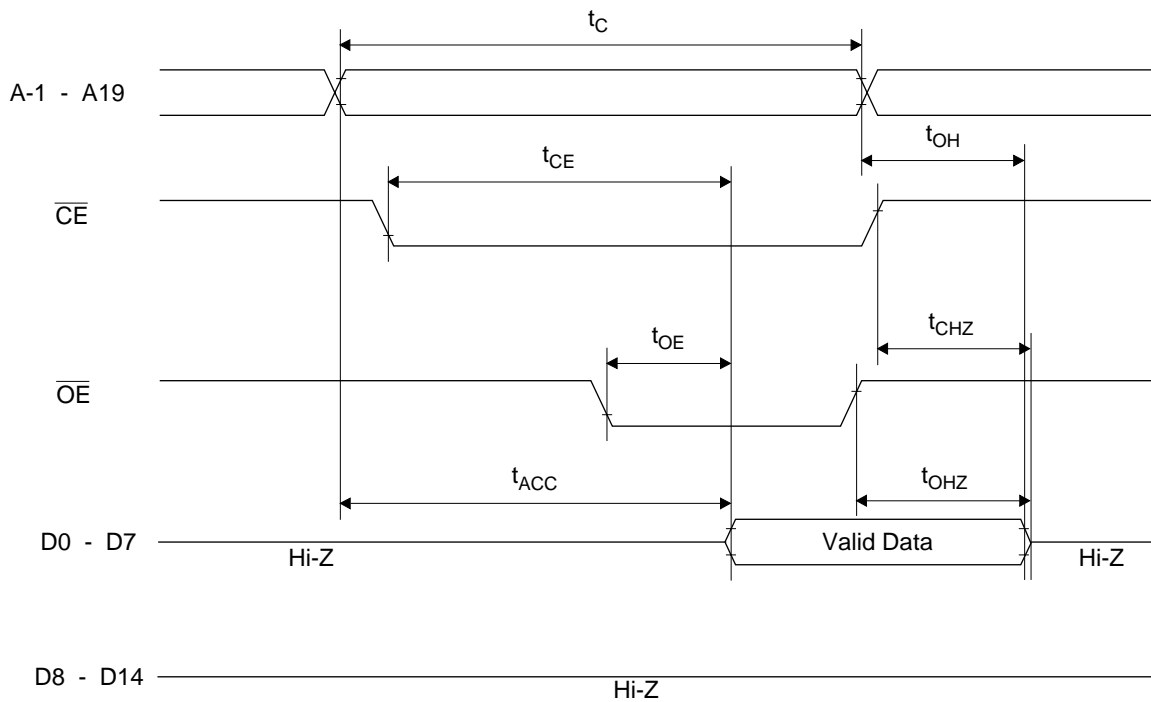


**TIMING CHART (READ CYCLE)**

**16-Bit Read Mode ( $\overline{\text{BYTE}}=V_{IH}$ )**



**8-Bit Read Mode ( $\overline{\text{BYTE}}=V_{IL}$ )**



## ELECTRICAL CHARACTERISTICS (Programming operation)

### DC Characteristics

(Ta=25°C±5°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I <sub>LI</sub>	V <sub>I</sub> =V <sub>CC</sub> +0.5V	-	-	10	μA
V <sub>PP</sub> power supply current (Program)	I <sub>PP2</sub>	$\overline{CE}=V_{IL}$	-	-	50	mA
V <sub>CC</sub> power supply current	I <sub>CC</sub>	-	-	-	50	mA
Input "H" level	V <sub>IH</sub>	-	3.0	-	V <sub>CC</sub> +0.5	V
Input "L" level	V <sub>IL</sub>	-	-0.5	-	0.8	V
Output "H" level	V <sub>OH</sub>	I <sub>OH</sub> =-400μA	2.4	-	-	V
Output "L" level	V <sub>OL</sub>	I <sub>OL</sub> =2.1mA	-	-	0.45	V
Program voltage	V <sub>PP</sub>	-	9.5	9.75	10.0	V
V <sub>CC</sub> power supply voltage	V <sub>CC</sub>	-	3.9	4.0	4.1	V

Voltage is relative to V<sub>SS</sub>

### AC Characteristics

(V<sub>CC</sub>=4.0V±0.1V, V<sub>pp</sub>=9.75V±0.25V, Ta=25°C±5°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Address set-up time	T <sub>AS</sub>	-	100	-	-	ns
$\overline{OE}$ set-up time	T <sub>OES</sub>	-	2	-	-	μs
Data set-up time	T <sub>DS</sub>	-	100	-	-	ns
Address hold time	T <sub>AH</sub>	-	2	-	-	μs
Data hold time	T <sub>DH</sub>	-	100	-	-	ns
Output float delay from $\overline{OE}$	T <sub>OHZ</sub>	-	0	-	100	ns
V <sub>PP</sub> voltage set-up time	T <sub>VS</sub>	-	2	-	-	μs
Program pulse width	T <sub>PW</sub>	-	9	10	11	μs
Data valid from $\overline{OE}$	T <sub>OE</sub>	-	-	-	100	ns
Address hold from $\overline{OE}$ high	T <sub>AHO</sub>	-	0	-	-	ns

### Pin Check Function

Pin Check Function is to check contact between each device-pin and each socket-lead with EPROM programmer.

Setting up address as the following condition call the preprogrammed codes on device outputs.

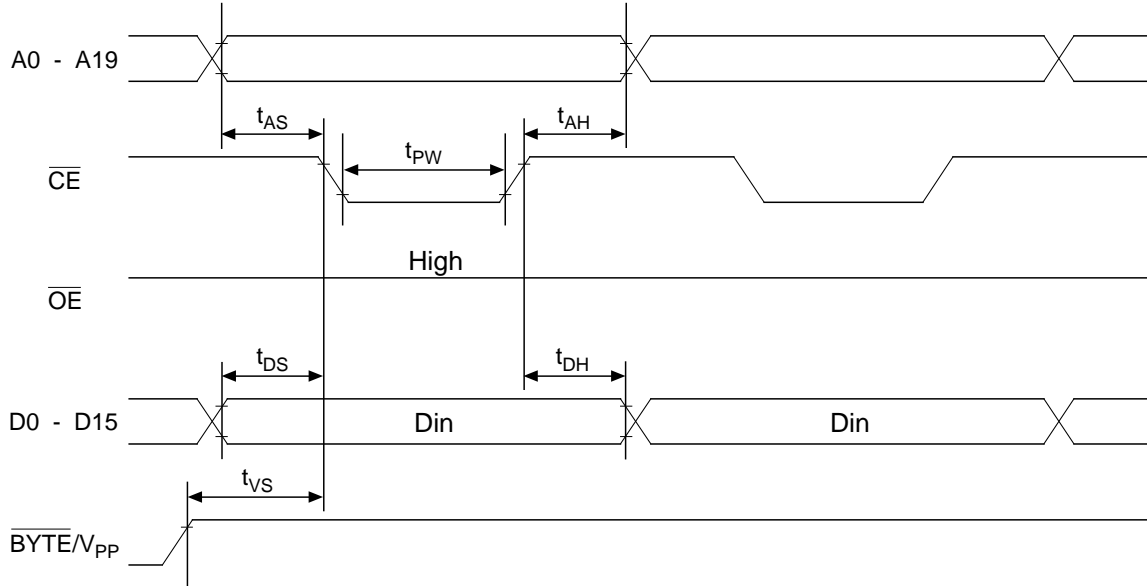
(V<sub>CC</sub>=3.3V±0.3V,  $\overline{CE}=\overline{OE}=V_{IL}$ ,  $\overline{BYTE}/V_{pp}=V_{IH}$ , Ta=25°C±5°C)

A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	DATA
0	1	0	1	0	1	0	1	0	VH*	0	1	0	1	0	1	0	0	1	1	FF00
1	0	1	0	1	0	1	0	1	VH*	1	0	1	0	1	0	1	1	0	0	00FF
Other conditions																				FFFF

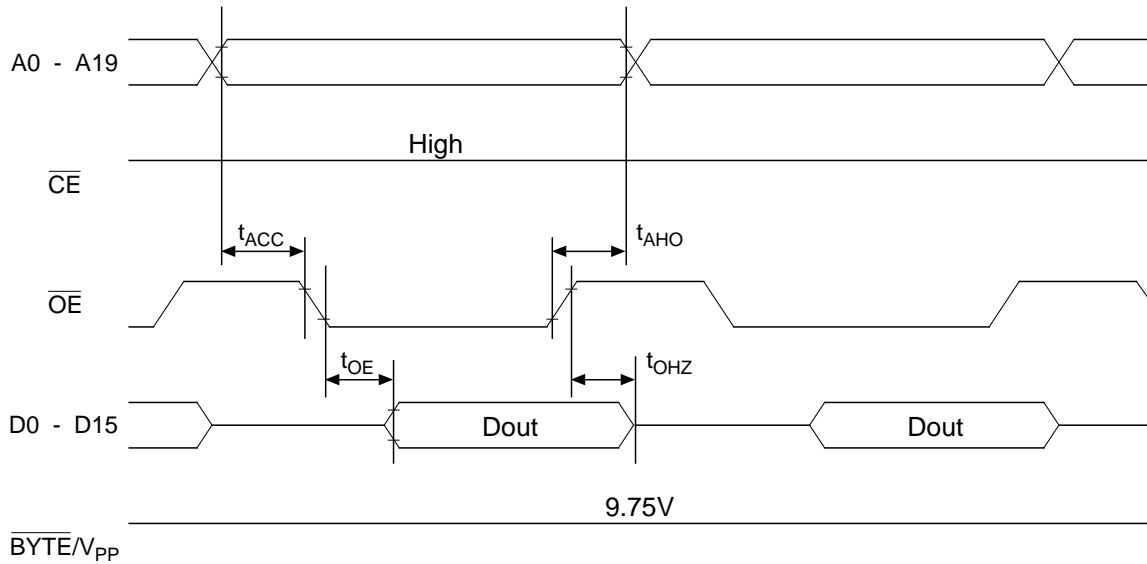
\* :VH=8V±0.25V



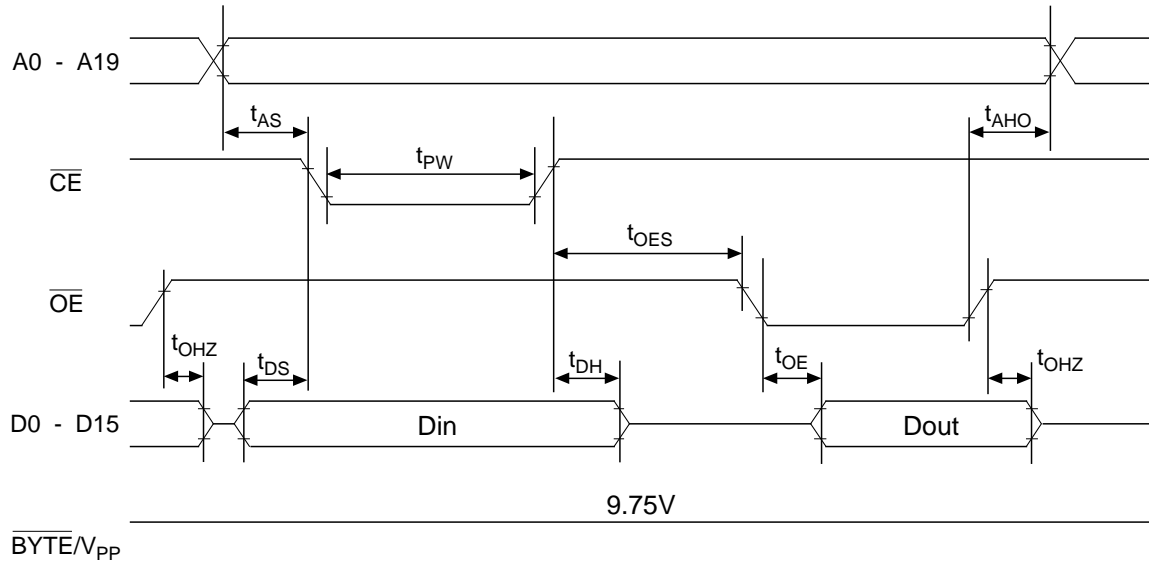
**Consecutive Programming Waveforms**



**Consecutive Program Verify Waveforms**



**Program and Program Verify Cycle Waveforms**



**PIN Capacitance**

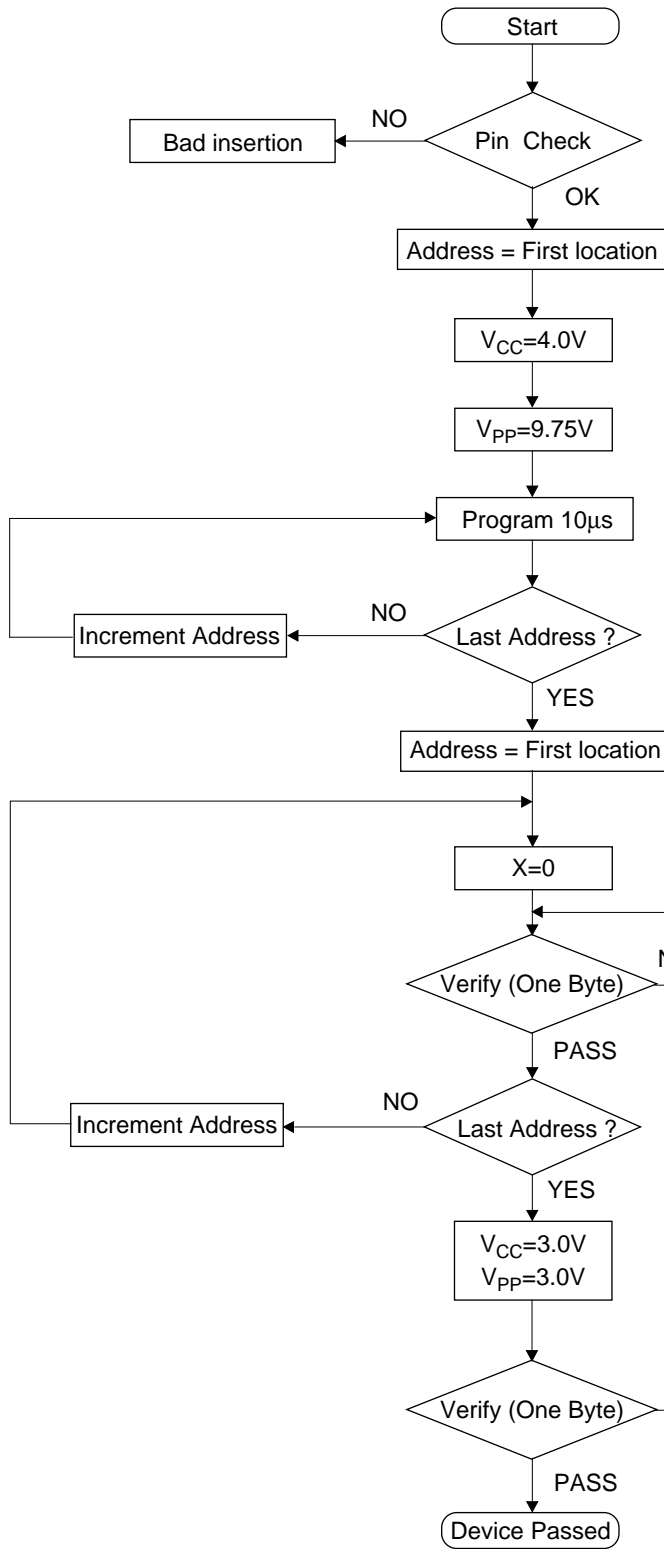
( $V_{CC}=3.3V, T_a=25^\circ C, f=1MHz$ )

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input	$C_{IN1}$	$V_I=0V$	-	-	8 (10)	pF
$\overline{BYTE}/V_{PP}$	$C_{IN2}$		-	-	120	
Output	$C_{OUT}$	$V_O=0V$	-	-	10 (12)	

( ) : DIP only

Programming / Verify Flow Chart

Programming



Verify

