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## MSM27C1655CZ

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524,288-Double Word x 32-Bit or 1,048,576-Word x 16-Bit

4-Double Word x 32-Bit or 8-Word x 16-Bit Page Mode One Time PROM

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### DESCRIPTION

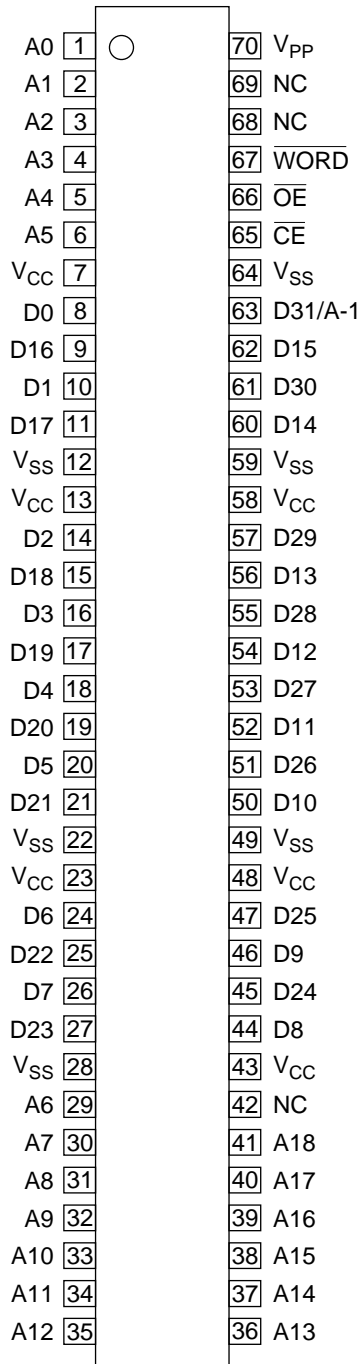
The MSM27C1655CZ is a 16Mbit electrically Programmable Read-Only Memory with page mode. Its configuration can be electrically switched between 524,288 double word x 32bit and 1,048,576 word x 16bit. The MSM27C1655CZ operates on a single +5V power supply and is TTL compatible. The MSM27C1655CZ provides Page mode which can greatly reduce the read access time. Since the MSM27C1655CZ operates asynchronously, external clocks are not required, making this device easy-to-use. The MSM27C1655CZ 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 70-pin SSOP, 70-pin TSOP packages.

### FEATURES

- 524,288 double word x 32bit / 1,048,576 word x 16bit electrically switchable configuration
- Single +5V power supply
- Access time 100ns
  - Page mode access time 30ns
- Input / Output TTL compatible
- Three-state output
- Packages

70-pin plastic SSOP (SSOP70-P-500-0.80-K)  
70-pin plastic TSOP (TSOP1170-P-400-0.65-K)

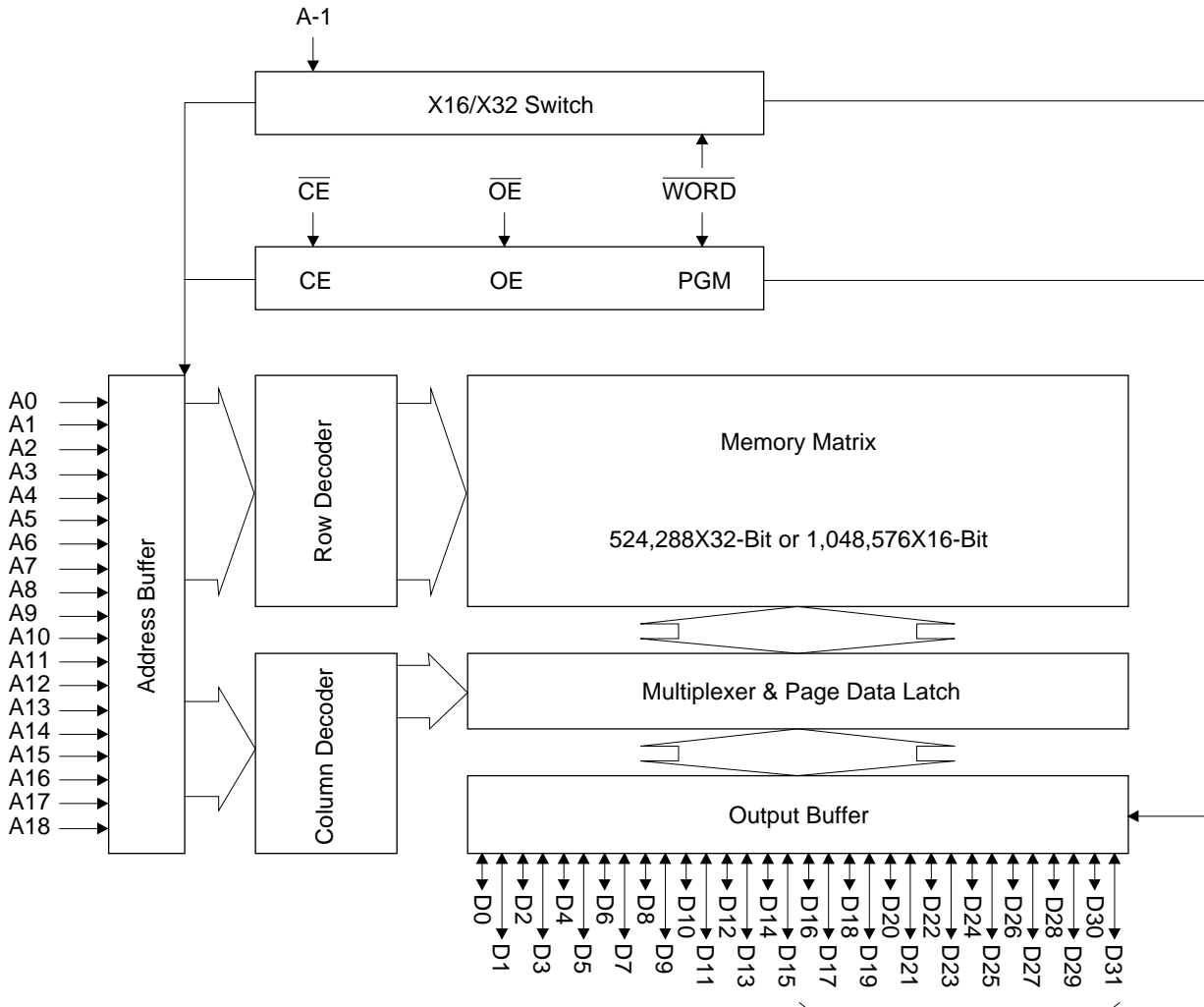
## PIN CONFIGURATION (TOP VIEW)



70-pin SSOP , TSOP

PIN NAMES	FUNCTIONS
D31/A-1	Data output / Address input
A0 - A18	Address input
D0 - D30	Data output
CE	Chip enable
OE	Output enable
V <sub>CC</sub>	Power supply voltage
V <sub>SS</sub>	GND
WORD	Mode switch
V <sub>PP</sub>	Program power supply voltage
NC	Non connection

**BLOCK DIAGRAM**



In 16-bit output mode, these pins are three-stated and pin D31 functions as the A-1 address pin.

**FUNCTION TABLE**

MODE	CE	OE	WORD	V <sub>PP</sub>	V <sub>CC</sub>	D0 - D15	D16 - D30	D31/A-1
READ (32-Bit)	L	L	H	*	4.5V to 5.5V	D <sub>OUT</sub>		
READ (16-Bit)	L	L	L			D <sub>OUT</sub>	Hi-Z	L/H
OUTPUT DISABLE	L	H	H			Hi-Z		*
			L			Hi-Z		*
STAND-BY	H	*	H	Hi-Z		*		
			L	Hi-Z		*		
PROGRAM	L	H	L	11.5V	6.25V	D <sub>IN</sub>	Hi-Z	L/H
PROGRAM INHIBIT	H	H				Hi-Z		
PROGRAM VERIFY	H	L				D <sub>OUT</sub>	Hi-Z	L/H

\*: Don't Care

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Condition	Value	Unit
Operating temperature under bias	$T_{opr}$	-	0 to 70	°C
Storage temperature	$T_{stg}$	-	-55 to 125	°C
Input voltage	$V_I$	relative to $V_{SS}$	-0.5 to $V_{CC} + 0.5$	V
Output voltage	$V_O$		-0.5 to $V_{CC} + 0.5$	V
Power supply voltage	$V_{CC}$		-0.5 to 7	V
Program power supply voltage	$V_{PP}$		-0.5 to 12.5	V
Power dissipation per package	$P_D$	-	1.0	W

**RECOMMENDED OPERATING CONDITIONS FOR READ**

(Ta=0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
$V_{CC}$ power supply voltage	$V_{CC}$	$V_{CC}=4.5V-5.5V$	4.5	-	5.5	V
$V_{PP}$ power supply voltage	$V_{PP}$		-0.5	-	$V_{CC}+0.5$	V
Input "H" level	$V_{IH}$		2.2	-	$V_{CC}+0.5$	V
Input "L" level	$V_{IL}$		-0.5	-	0.8	V

Voltage is relative to  $V_{SS}$

**ELECTRICAL CHARACTERISTICS (Read operation)****DC Characteristics**(V<sub>CC</sub>=5V±0.5V, 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>CS1</sub>	$\overline{CE}=V_{CC}$	-	-	50	μA
	I <sub>CS2</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	-	-	120	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	-	0.8	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

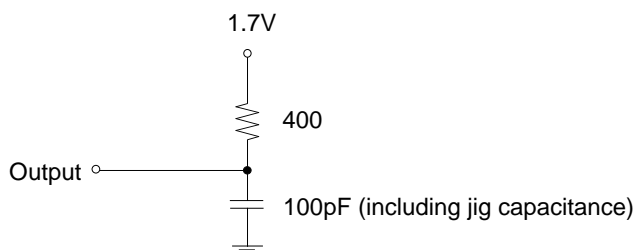
Voltage is relative to V<sub>SS</sub>**AC Characteristics**(V<sub>CC</sub>=5V±0.5V, T<sub>a</sub>=0 to 70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Address access cycle time	T <sub>C</sub>	-	100	-	ns
Address access time	T <sub>ACC</sub>	$\overline{CE}=\overline{OE}=V_{IL}$	-	100	ns
Page set up time	T <sub>PSET</sub>	NOTE(1)	120	-	ns
Page access cycle time	T <sub>PC</sub>	-	30	-	ns
Page access time	T <sub>PAC</sub>	-	-	30	ns
$\overline{CE}$ access time	T <sub>CE</sub>	$\overline{OE}=V_{IL}$	-	100	ns
$\overline{OE}$ access time	T <sub>OE</sub>	$\overline{CE}=V_{IL}$	-	30	ns
Output disable time	T <sub>CHZ</sub>	$\overline{OE}=V_{IL}$	0	30	ns
	T <sub>OHZ</sub>	$\overline{CE}=V_{IL}$	0	25	ns
Output hold time	T <sub>OH</sub>	$\overline{CE}=\overline{OE}=V_{IL}$	0	-	ns

NOTE(1) T<sub>PSET</sub> is defined as the end of either  $\overline{CE}$  trailing edge or address transition in random access term until the first page address transition.

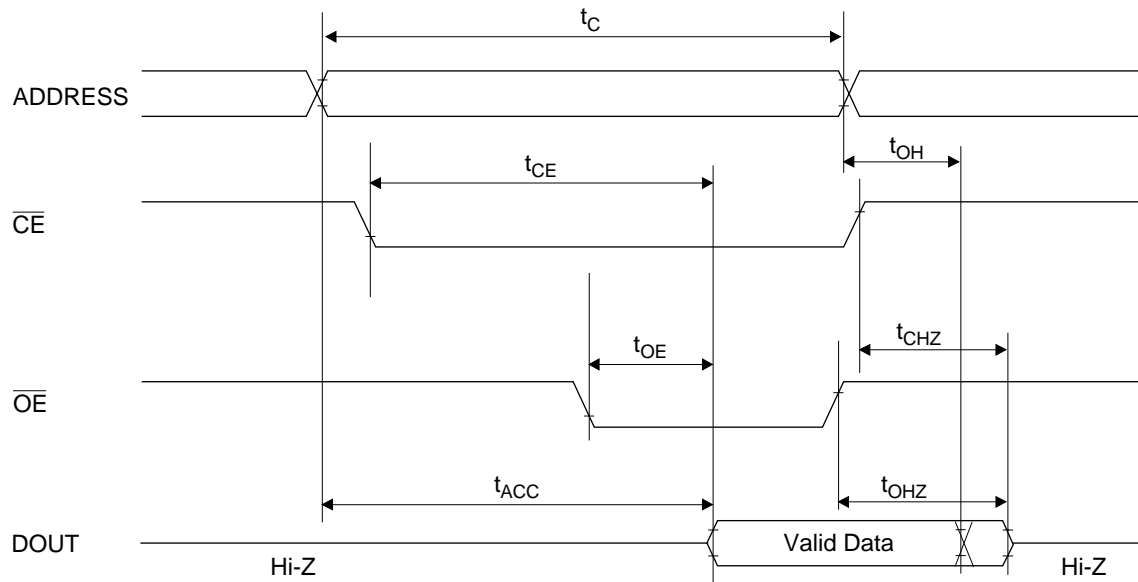
## Measurement conditions

Input signal level	-----	0V/3V
Input timing reference level	-----	0.8V/2.0V
Output load	-----	1TTL gate + 100pF
Output timing reference level	-----	0.8V/2.0V

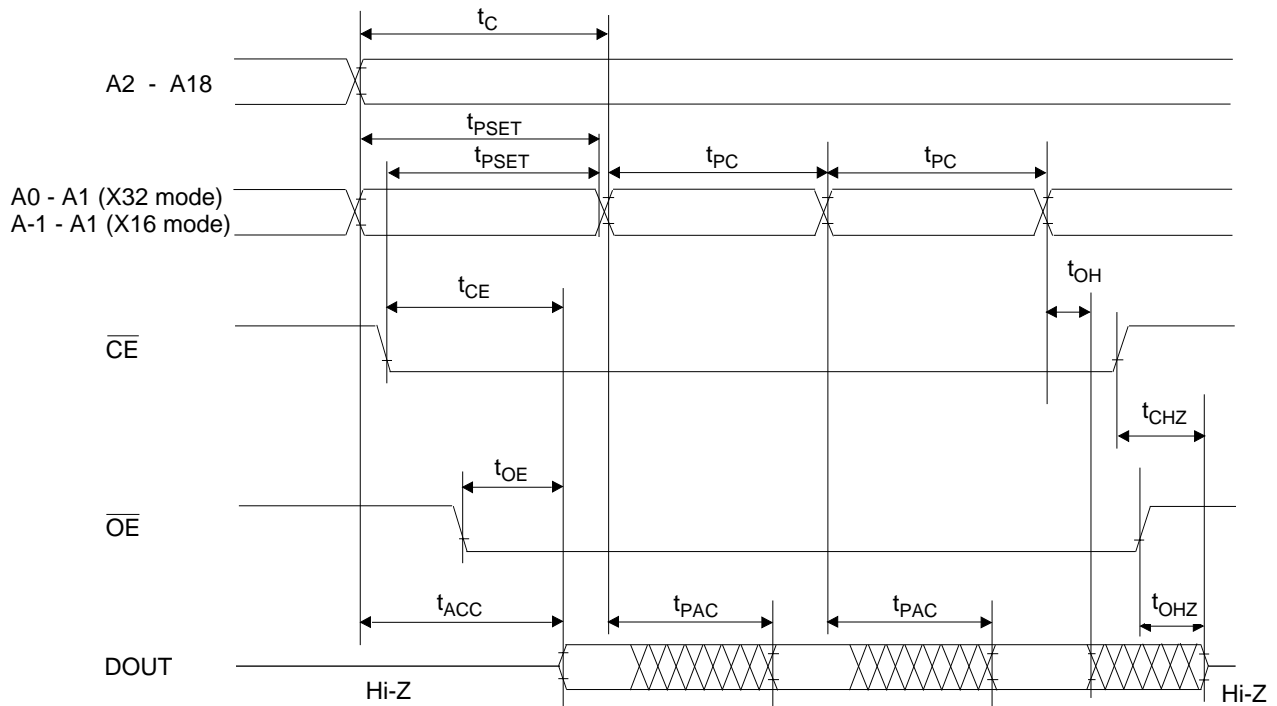


## TIMING CHART

## NORMAL MODE READ CYCLE



## PAGE MODE READ CYCLE



**ELECTRICAL CHARACTERISTICS (Programming operation)****DC Characteristics**

(Ta=25°C±5°C)

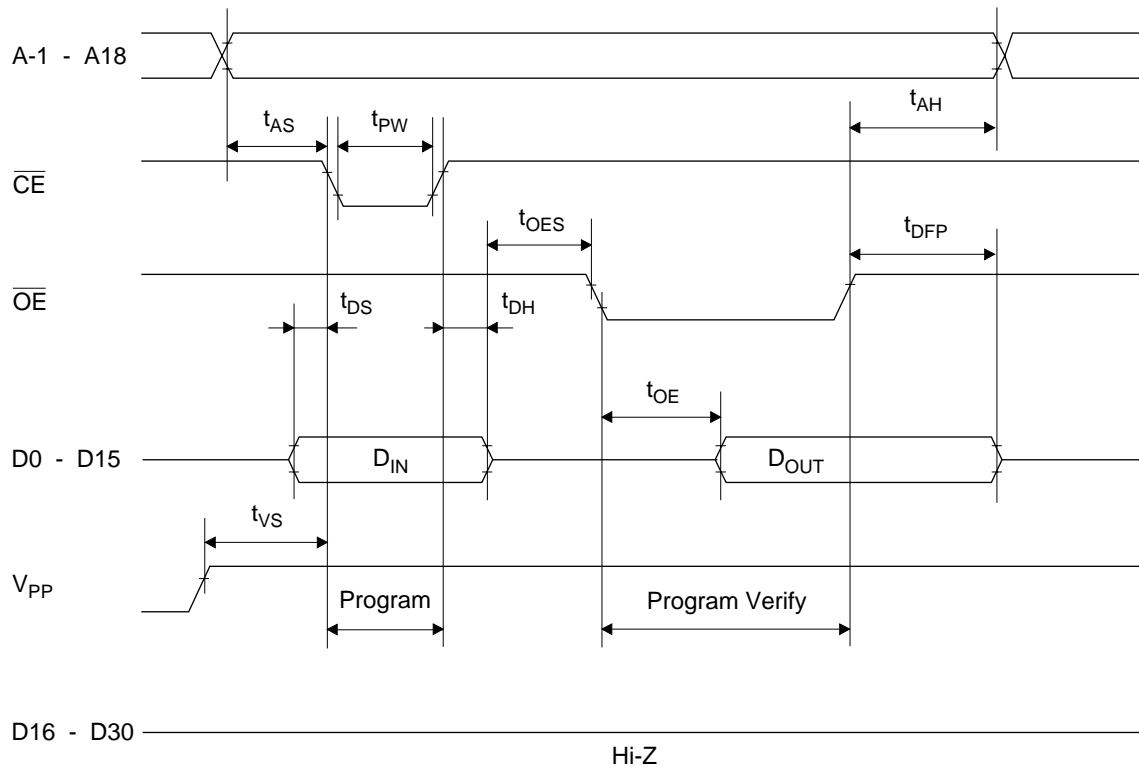
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I <sub>LI</sub>	V <sub>I</sub> =V <sub>CC</sub> +0.5V	-	-	10	μA
V <sub>PP</sub> power supply current (Program)	I <sub>PP2</sub>	$\overline{CE}=V_{IL}$	-	-	50	mA
V <sub>CC</sub> power supply current	I <sub>CC</sub>	-	-	-	100	mA
Input "H" level	V <sub>IH</sub>	-	2.2	-	V <sub>CC</sub> +0.5	V
Input "L" level	V <sub>IL</sub>	-	-0.5	-	0.8	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>	-	11.25	11.5	11.75	V
V <sub>CC</sub> power supply voltage	V <sub>CC</sub>	-	6.0	6.25	6.5	V

Voltage is relative to Vss

**AC Characteristics**(V<sub>CC</sub>=6.25V±0.25V, V<sub>pp</sub>=11.5V±0.25V, Ta=25°C±5°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Address set-up time	T <sub>AS</sub>	-	2	-	-	μs
$\overline{OE}$ set-up time	T <sub>OES</sub>	-	2	-	-	μs
Data set-up time	T <sub>DS</sub>	-	2	-	-	μs
Address hold time	T <sub>AH</sub>	-	0	-	-	μs
Data hold time	T <sub>DH</sub>	-	2	-	-	μs
Output float delay from $\overline{OE}$	T <sub>DFP</sub>	-	0	-	130	ns
V <sub>PP</sub> voltage set-up time	T <sub>VS</sub>	-	2	-	-	μs
Program pulse width	T <sub>PW</sub>	-	23	25	27	μs
Data valid from $\overline{OE}$	T <sub>OE</sub>	-	-	-	150	ns

### Programming Waveform



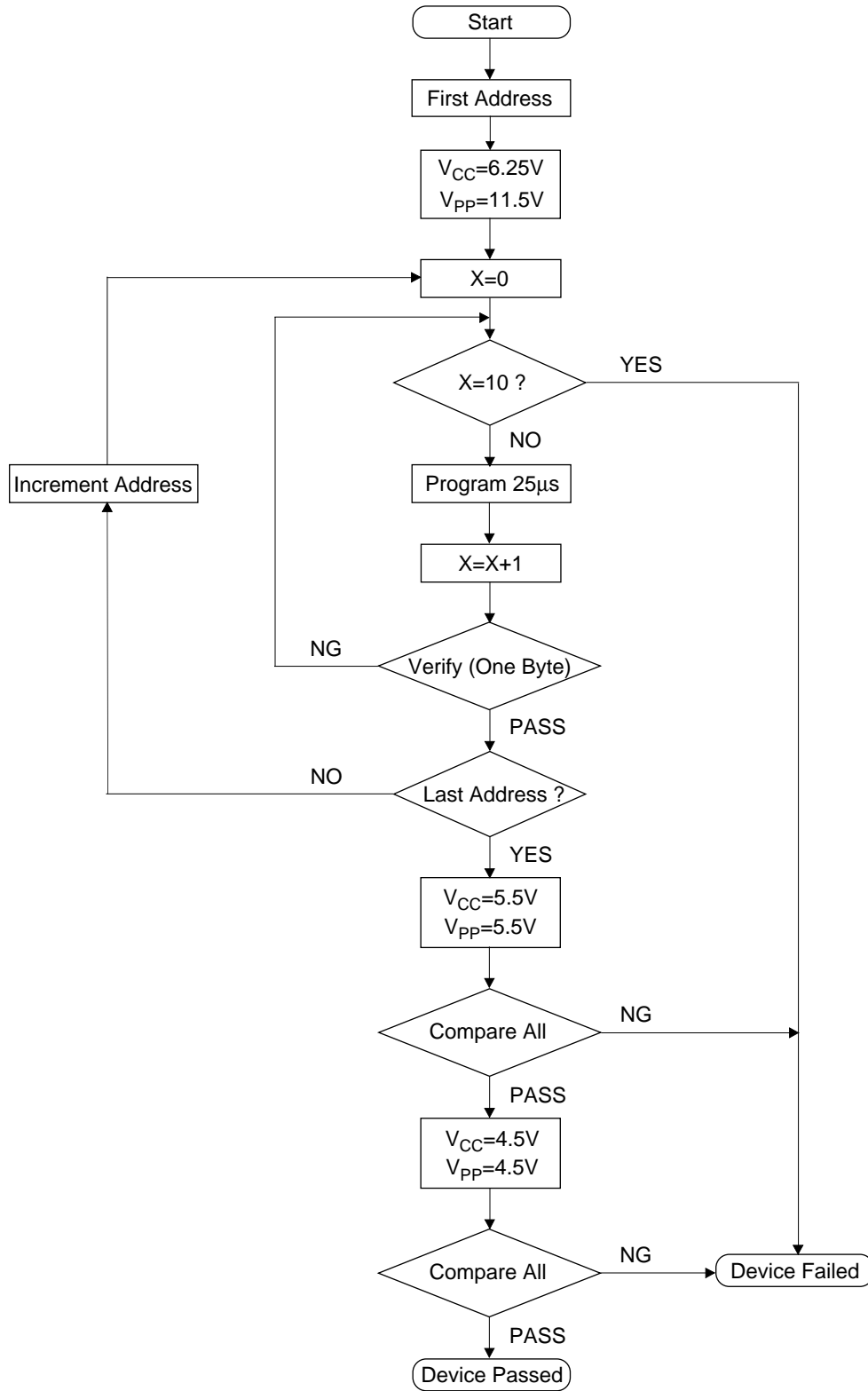
### PIN Capacitance

( $V_{CC}=5V$ ,  $T_a=25^{\circ}C$ ,  $f=1MHz$ )

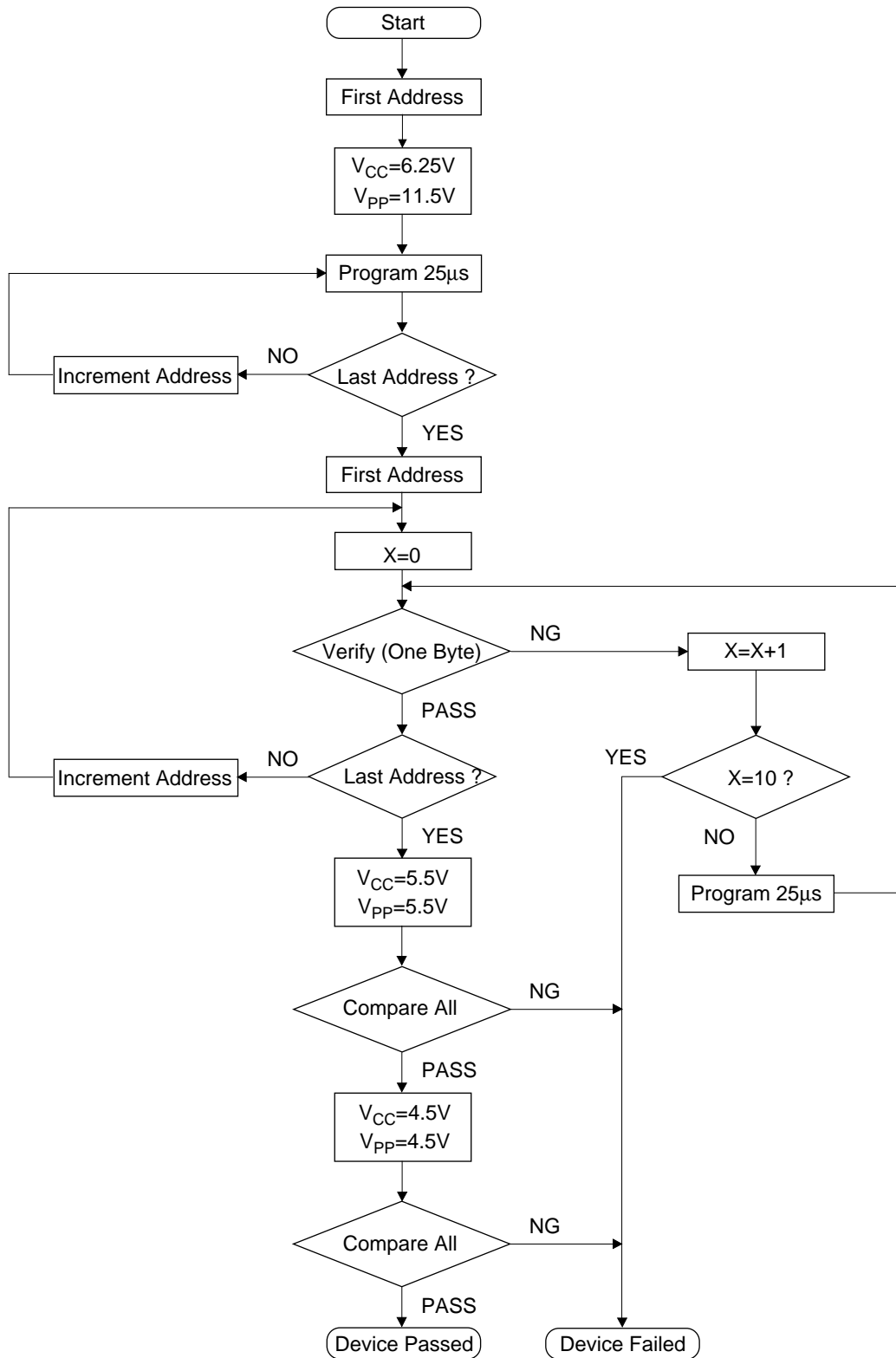
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input	$C_{IN1}$	$V_I=0V$	-	-	12	pF
$V_{PP}$	$C_{IN2}$		-	-	60	
Output	$C_{OUT}$	$V_O=0V$	-	-	15	



High Speed Programming Algorithm ( I )



## High Speed Programming Algorithm ( II )



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## ADDRESSES & SEMICONDUCTOR WEB SITES

### **OKI Electric Industry Co., Ltd.,**

Device Business Group,  
10-3, Shibaura, 4-chome,  
Minato-ku, Tokyo 108, Japan,  
Tel.: +81-(0)3-5445-6327,  
Fax.: +81-(0)3-5445-6328,  
<http://www.oki.co.jp/OKI/DBG/english/index.htm>  
(NOTE: URL is case sensitive)

### **OKI Semiconductor Group,**

785 North Mary Avenue,  
Sunnyvale, CA 94086, U.S.A.,  
Tel.: +1-408-720-1900,  
Fax.: +1-408-720-1918,  
<http://www.okisemi.com/>

### **OKI Electric Europe GmbH,**

Head Office Europe,  
Hellersbergstrasse 2,  
D-41460 Neuss, Germany,  
Tel: +49-2131-15960,  
Fax: +49-2131-103539,  
<http://www.oki-europe.de/>

### **OKI Electronics (Hong Kong) Ltd.,**

Suite 1901-1&19, Tower 3,  
China Hong Kong City,  
33 Canton Road, Tsimshatsui,  
Kowloon, Hong Kong,  
Tel.: +852-2-736-2336,  
Fax.: +852-2-736-2395

### **OKI Semiconductor (Asia) Pte. Ltd.,**

78 Shenton Way 09-01,  
Singapore 0207,  
Tel.: +65-221-3722,  
Fax.: +65-323-5376

### **OKI Semiconductor (Asia) Pte. Ltd.,**

Taipei Branch,  
7th Fl. No.260, Tun Hwa North Road,  
Taipei, Taiwan, R.O.C.,  
Sumitomo-Flysun Building,  
Tel.: +886-2-2719-2561,  
Fax.: +886-2-2715-2892  
<http://www.oki.net.tw/>

*For further information, please contact:*

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