OKI Semiconductor

1A

MSM27C401CZ

524,288-Word x 8-Bit One Time PROM

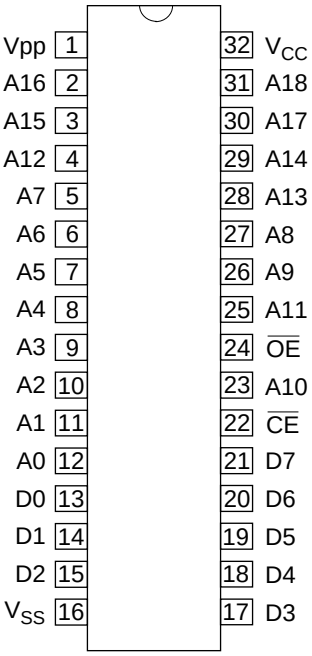
DESCRIPTION

The MSM27C401CZ is a 4Mbit electrically Programmable Read-Only Memory organized as 524,288 word x 8bit. The MSM27C401CZ operates on a single +3V-5V power supply and is TTL compatible. Since the MSM27C401CZ operates asynchronously , external clocks are not required , making this device easy-to-use. The MSM27C401CZ 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 32-pin DIP, 32-pin SOP or 32-pin TSOP packages.

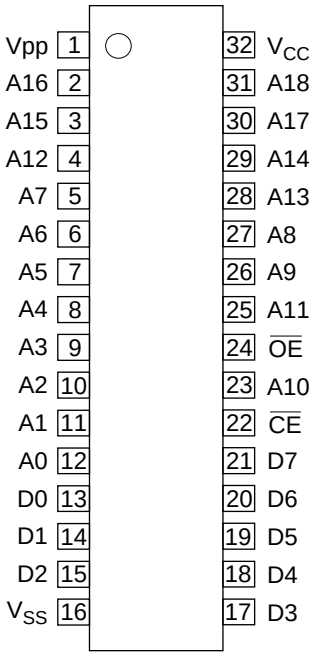
FEATURES

- 524,288 word x 8bit
- Single +3V-5V power supply
- Access time 150ns access time (Vcc=+3V)
  120ns access time (Vcc=+3.3V)
  80ns access time (Vcc=+5V)
- Input / Output TTL compatible
- Three-state output
- Packages 32-pin plastic DIP (DIP32-P-600-2.54)
  32-pin plastic SOP (SOP32-P-525-1.27-K)
  32-pin plastic TSOP (TSOP I 32-P-814-0.50-K)

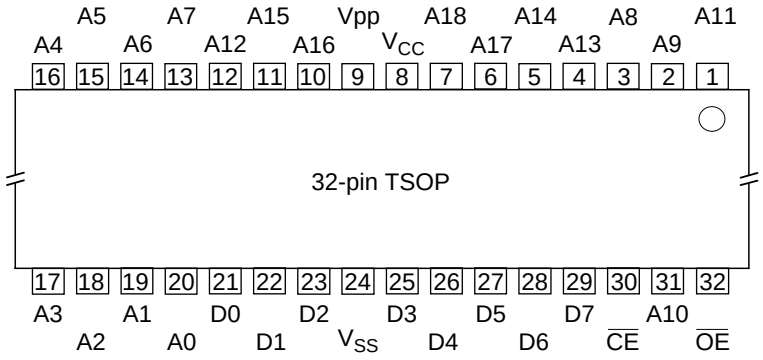
PIN CONFIGURATION (TOP VIEW)



32-pin DIP

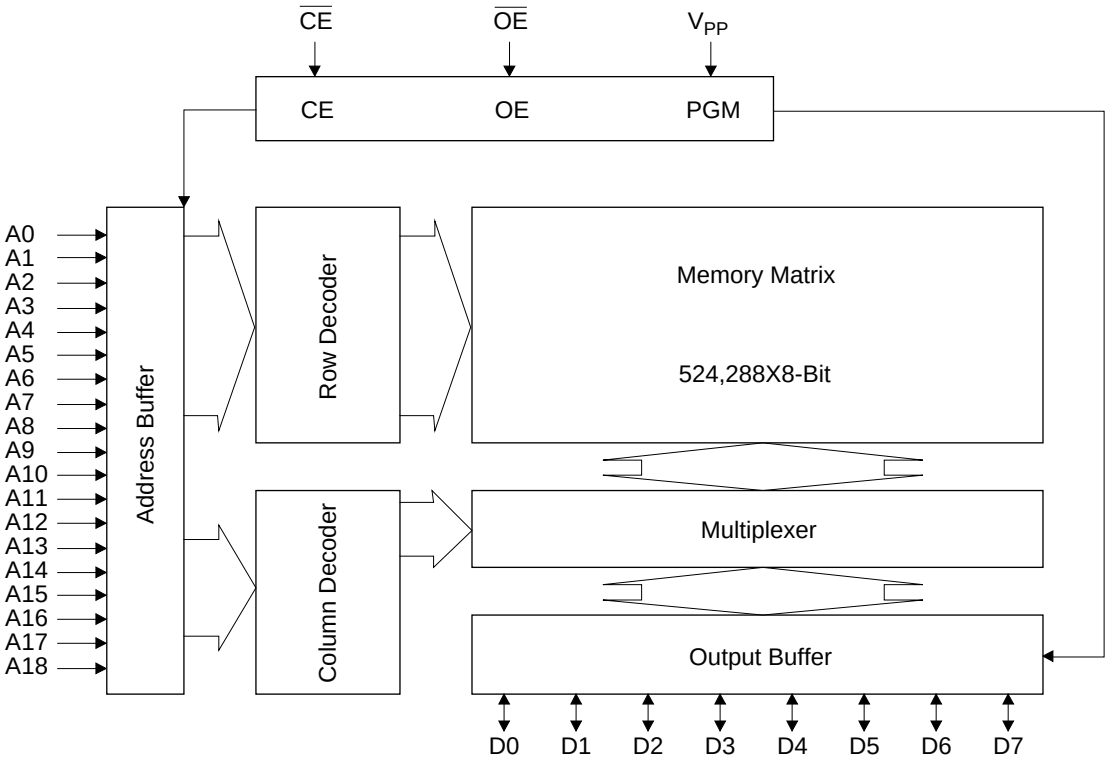


32-pin SOP



PIN NAMES	FUNCTIONS
A0 - A18	Address input
D0 - D7	Data output
$\overline{CE}$	Chip enable
$\overline{OE}$	Output enable
V_{CC}	Power supply voltage
V_{SS}	GND
V_{PP}	Program Power supply voltage

BLOCK DIAGRAM



FUNCTION TABLE

MODE	$\overline{CE}$	$\overline{OE}$	V_{PP}	V_{CC}	D0 - D7
READ	L	L	*	2.7V to 5.5V	D_{OUT}
OUTPUT DISABLE	L	H			Hi-Z
STAND-BY	H	*			Hi-Z
PROGRAM	L	H	11.5V	6.25V	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	Topr	-	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}=2.7V - 5.5V	2.7	-	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	-	0.6	V

Voltage is relative to Vss

ELECTRICAL CHARACTERISTICS (Read operation)

DC Characteristics 1

(V_{CC}=3V±0.3V, Ta=0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I_{LI}	V_I=0 to Vcc	-	-	10	µA
Output leakage current	I_{LO}	V_O=0 to Vcc	-	-	10	µA
V_{CC} power supply current (Standby)	I_{CS1}	$\overline{CE}$=V_{CC}	-	-	10	µA
	I_{CS2}	$\overline{CE}$=V_{IH}	-	-	1	mA
V_{CC} power supply current (Read)	I_{CCA}	$\overline{CE}$=V_{IL} , $\overline{OE}$=V_{IH} tc=150ns	-	-	15	mA
V_{PP} power supply current	I_{PP}	V_{PP}=V_{CC}	-	-	10	µA
Input "H" level	V_{IH}	-	2.0	-	V_{CC}+0.5	V
Input "L" level	V_{IL}	-	-0.5	-	0.6	V
Output "H" level	V_{OH}	I_{OH}=-200µA	V_{CC}-0.4	-	-	V
Output "L" level	V_{OL}	I_{OL}=1mA	-	-	0.4	V

Voltage is relative to Vss

DC Characteristics 2

(V_{CC}=3.3V±0.3V, Ta=0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I_{LI}	V_I=0 to Vcc	-	-	10	µA
Output leakage current	I_{LO}	V_O=0 to Vcc	-	-	10	µA
V_{CC} power supply current (Standby)	I_{CS1}	$\overline{CE}$=V_{CC}	-	-	10	µA
	I_{CS2}	$\overline{CE}$=V_{IH}	-	-	1	mA
V_{CC} power supply current (Read)	I_{CCA}	$\overline{CE}$=V_{IL} , $\overline{OE}$=V_{IH} tc=120ns	-	-	20	mA
V_{PP} power supply current	I_{PP}	V_{PP}=V_{CC}	-	-	10	µA
Input "H" level	V_{IH}	-	2.0	-	V_{CC}+0.5	V
Input "L" level	V_{IL}	-	-0.5	-	0.6	V
Output "H" level	V_{OH}	I_{OH}=-200µA	V_{CC}-0.4	-	-	V
Output "L" level	V_{OL}	I_{OL}=1mA	-	-	0.4	V

Voltage is relative to Vss

DC Characteristics 3

(V_{CC}=5V±0.5V, Ta=0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I_{LI}	V_I=0 to Vcc	-	-	10	µA
Output leakage current	I_{LO}	V_O=0 to Vcc	-	-	10	µA
V_{CC} power supply current (Standby)	I_{CS1}	$\overline{CE}$=V_{CC}	-	-	50	µA
	I_{CS2}	$\overline{CE}$=V_{IH}	-	-	1	mA
V_{CC} power supply current (Read)	I_{CCA}	$\overline{CE}$=V_{IL} , $\overline{OE}$=V_{IH} tc=80ns	-	-	35	mA
V_{PP} power supply current	I_{PP}	V_{PP}=V_{CC}	-	-	10	µA
Input "H" level	V_{IH}	-	2.2	-	V_{CC}+0.5	V
Input "L" level	V_{IL}	-	-0.5	-	0.8	V
Output "H" level	V_{OH}	I_{OH}=-400µA	2.4	-	-	V
Output "L" level	V_{OL}	I_{OL}=2.1mA	-	-	0.45	V

Voltage is relative to Vss

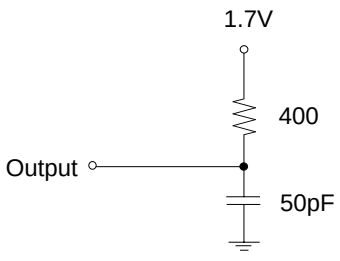
AC Characteristics 1

(V_{CC}=3V±0.3V, Ta=0 to 70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Access cycle time	T_C	-	150	-	ns
Address access time	T_{ACC}	$\overline{CE}$=$\overline{OE}$=V_{IL}	-	150	ns
$\overline{CE}$ access time	T_{CE}	$\overline{OE}$=V_{IL}	-	150	ns
$\overline{OE}$ access time	T_{OE}	$\overline{CE}$=V_{IL}	-	80	ns
Output disable time	T_{CHZ}	$\overline{OE}$=V_{IL}	0	70	ns
	T_{OHZ}	$\overline{CE}$=V_{IL}	0	65	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 ---------- 50pF
Output timing reference level ---------- 0.8V/2.0V



AC Characteristics 2

(V_{CC}=3.3V±0.3V, Ta=0 to 70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Access cycle time	T_C	-	120	-	ns
Address access time	T_{ACC}	$\overline{CE}$=$\overline{OE}$=V_{IL}	-	120	ns
$\overline{CE}$ access time	T_{CE}	$\overline{OE}$=V_{IL}	-	120	ns
$\overline{OE}$ access time	T_{OE}	$\overline{CE}$=V_{IL}	-	70	ns
Output disable time	T_{CHZ}	$\overline{OE}$=V_{IL}	0	60	ns
	T_{OHZ}	$\overline{CE}$=V_{IL}	0	55	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

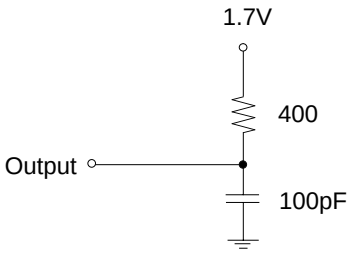
AC Characteristics 3

(V_{CC}=5V±0.5V, Ta=0 to 70°C)

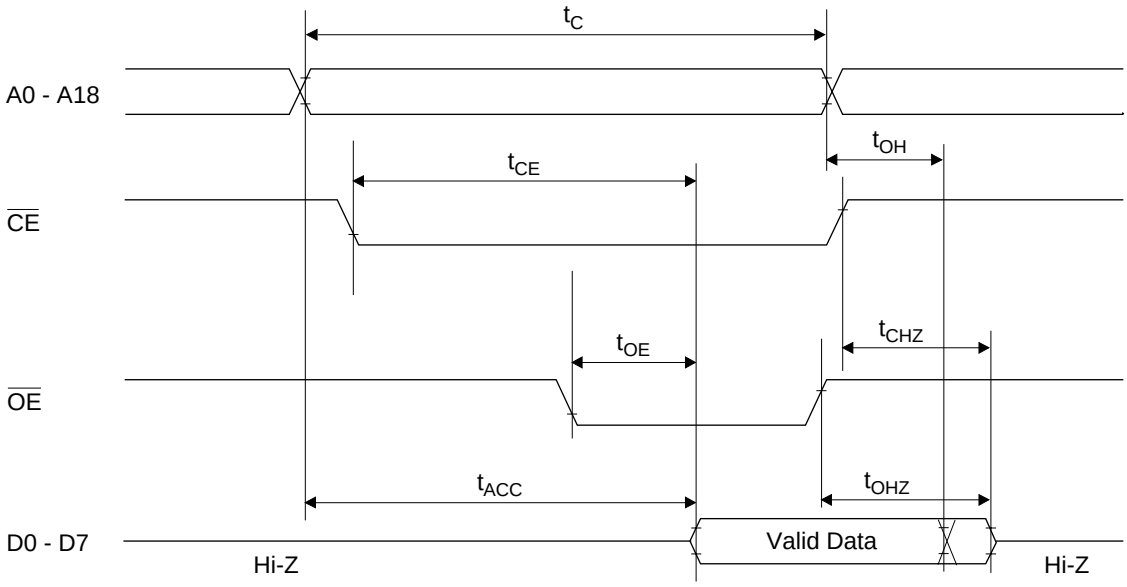
Parameter	Symbol	Condition	Min.	Max.	Unit
Access cycle time	T_C	-	80	-	ns
Address access time	T_{ACC}	$\overline{CE}$=$\overline{OE}$=V_{IL}	-	80	ns
$\overline{CE}$ access time	T_{CE}	$\overline{OE}$=V_{IL}	-	80	ns
$\overline{OE}$ access time	T_{OE}	$\overline{CE}$=V_{IL}	-	50	ns
Output disable time	T_{CHZ}	$\overline{OE}$=V_{IL}	0	40	ns
	T_{OHZ}	$\overline{CE}$=V_{IL}	0	35	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 ---------- 1TTL gate + 100pF
Output timing reference level ---------- 0.8V/2.0V



TIMING CHART (READ CYCLE)



ELECTRICAL CHARACTERISTICS (Programming operation)

DC Characteristics

(Ta=25°C±5°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I_{LI}	$V_I=V_{CC}+0.5V$	-	-	10	µA
V_{PP} power supply current (Program)	I_{PP2}	$\overline{CE}=V_{IL}$	-	-	50	mA
V_{CC} power supply current	I_{CC}	-	-	-	80	mA
Input "H" level	V_{IH}	-	2.2	-	$V_{CC}+0.5$	V
Input "L" level	V_{IL}	-	-0.5	-	0.8	V
Output "H" level	V_{OH}	$I_{OH}=-400µA$	2.4	-	-	V
Output "L" level	V_{OL}	$I_{OL}=2.1mA$	-	-	0.45	V
Program voltage	V_{PP}	-	11.25	11.5	11.75	V
V_{CC} power supply voltage	V_{CC}	-	6.0	6.25	6.5	V

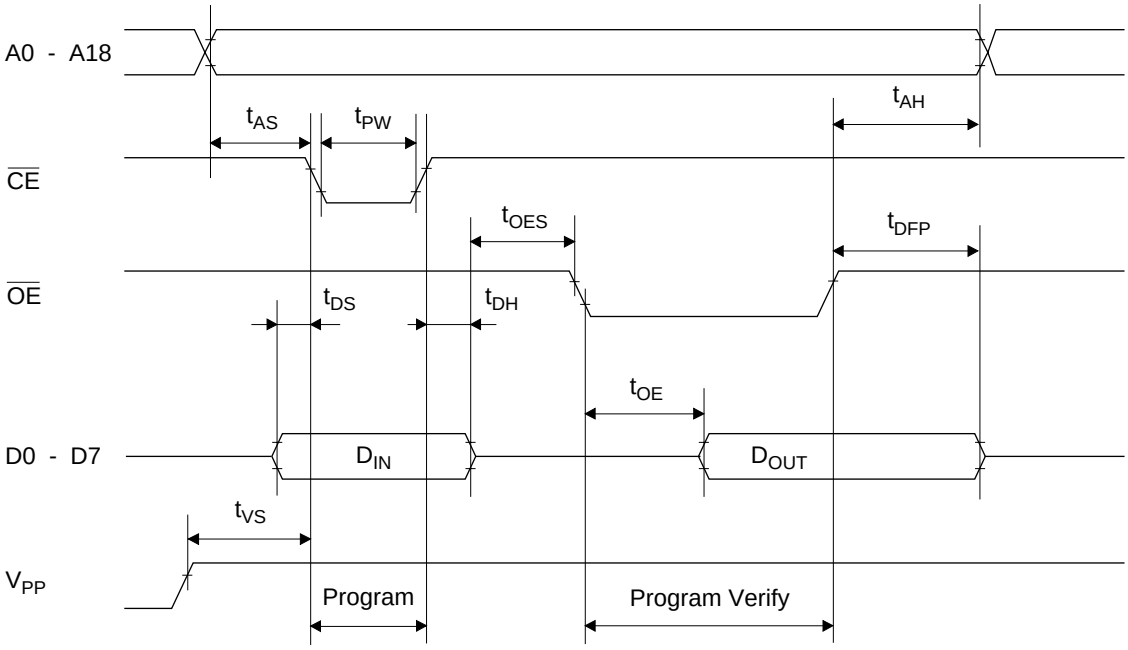
Voltage is relative to Vss

AC Characteristics

(V_{cc}=6.25V±0.25V,V_{pp}=11.5V±0.25V,Ta=25°C±5°C)

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

Programming Waveform

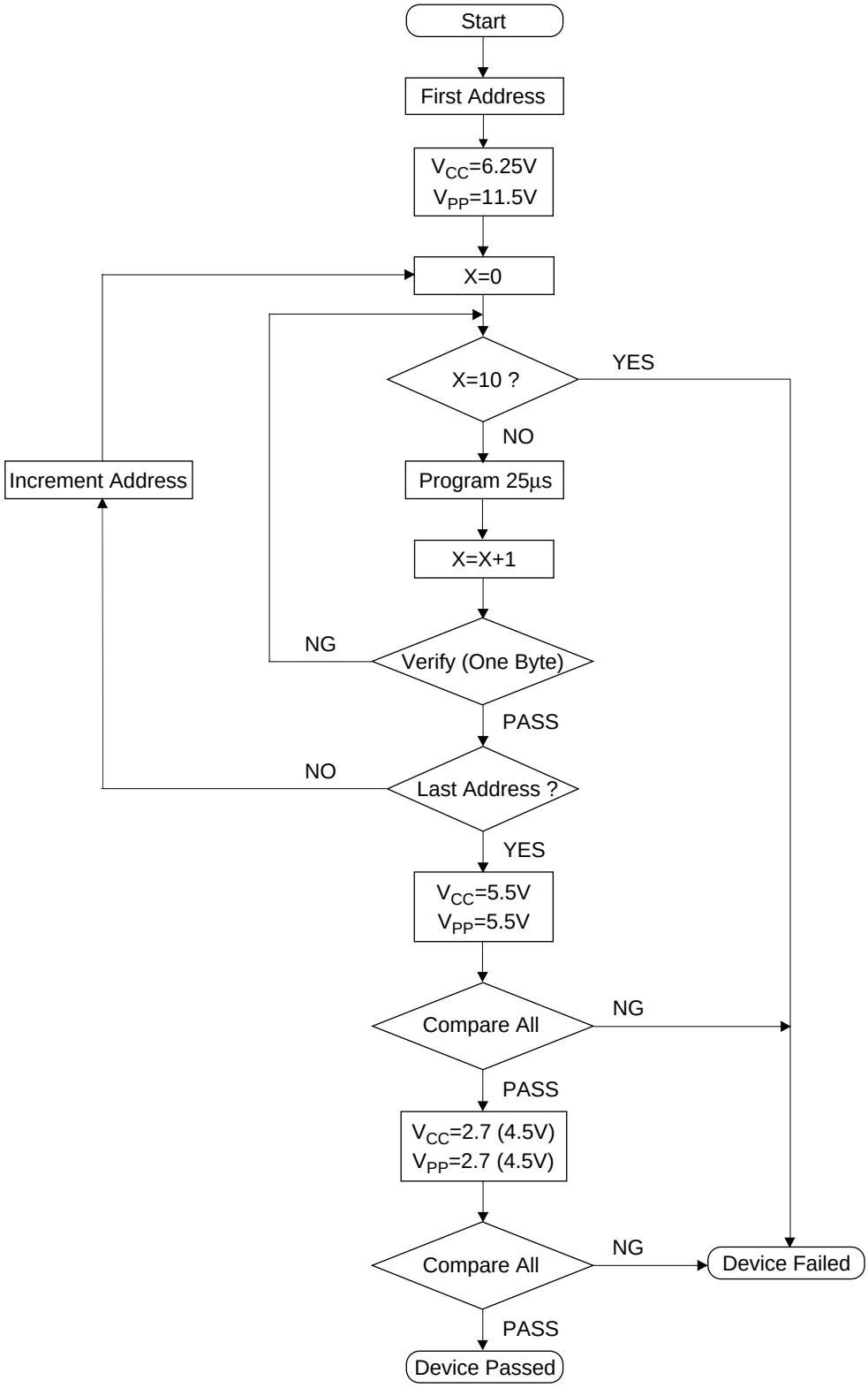


PIN Capacitance

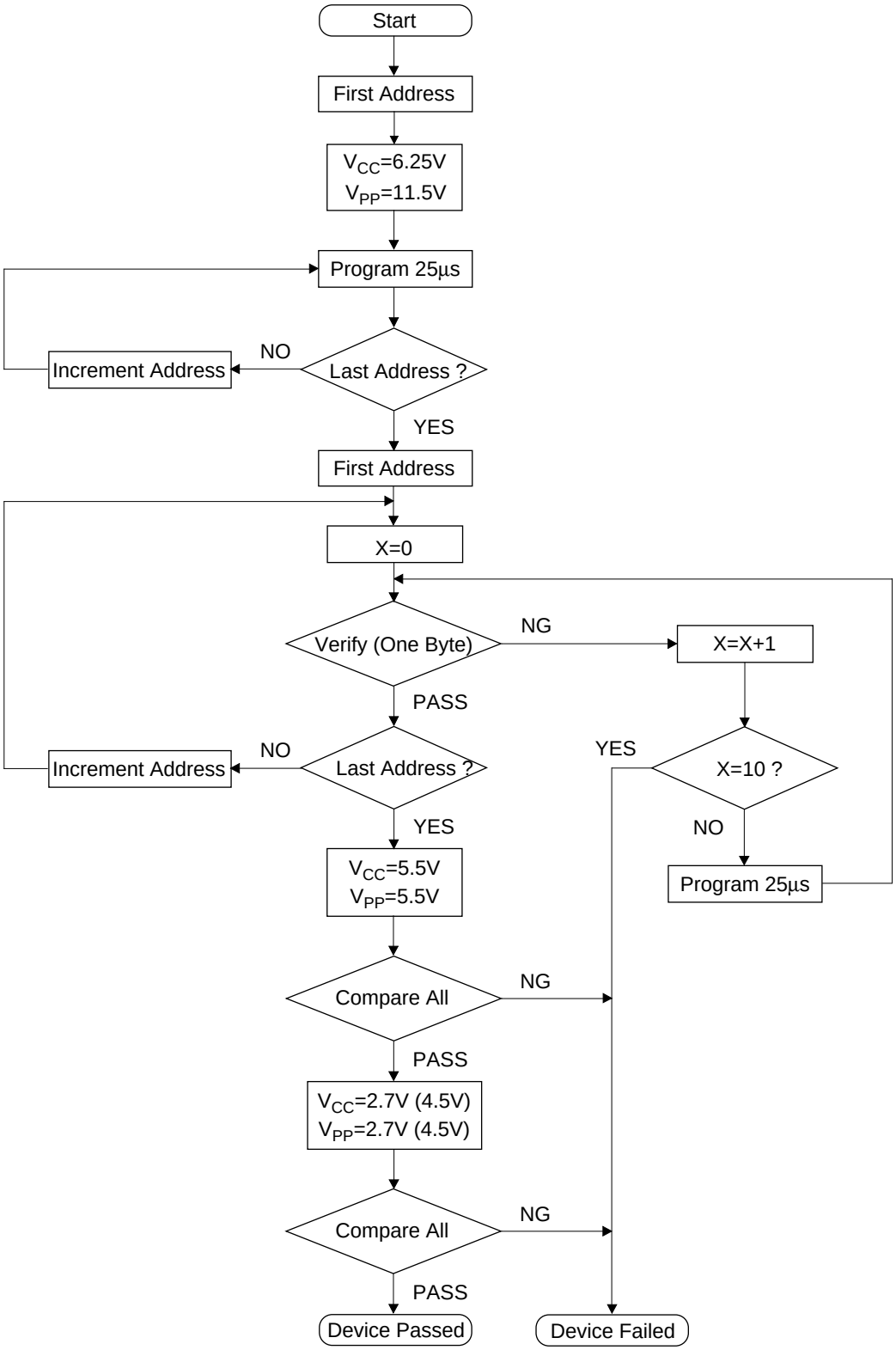
(V_{CC}=5V, Ta=25°C, f=1MHz)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input	C_{IN}	V_I=0V	-	-	12	pF
Output	C_{OUT}	V_O=0V	-	-	15	

High Speed Programming Algorithm (I)



High Speed Programming Algorithm (II)



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