



# ADVANCED INFORMATION

## MX10FMAXDQC

### SINGLE-CHIP 8-BIT MICROCONTROLLER

#### FEATURE

- High performance CMOS MTP ROM CPU
- Operation Voltage 5V
- Up to 40MHz operation (3.5MHz to 40MHz)
- Three 16-bit timer/counters
- 256 Bytes of on-chip data RAM
- 64 Kbytes on-chip Flash memory
- 32 Programmable I/O lines
- 6 interrupt Sources
- Code protection
- Two priority levels
- Power saving Idle and power down modes
- 64 K external program memory space
- 64 K external data memory space
- Four 8-bit I/O ports
- Full-duplex enhanced UART compatible with the standard 80C51 and the 80C52

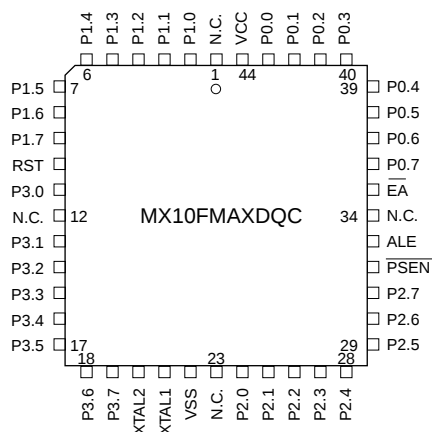
#### GENERAL DESCRIPTION

The single-chip 8-bit microcontroller is manufactured in MXIC's advanced CMOS process. This device uses the same powerful instruction set, has the same architecture, and is pin-to-pin compatible with the existing 80C51. The added features make it an even more powerful

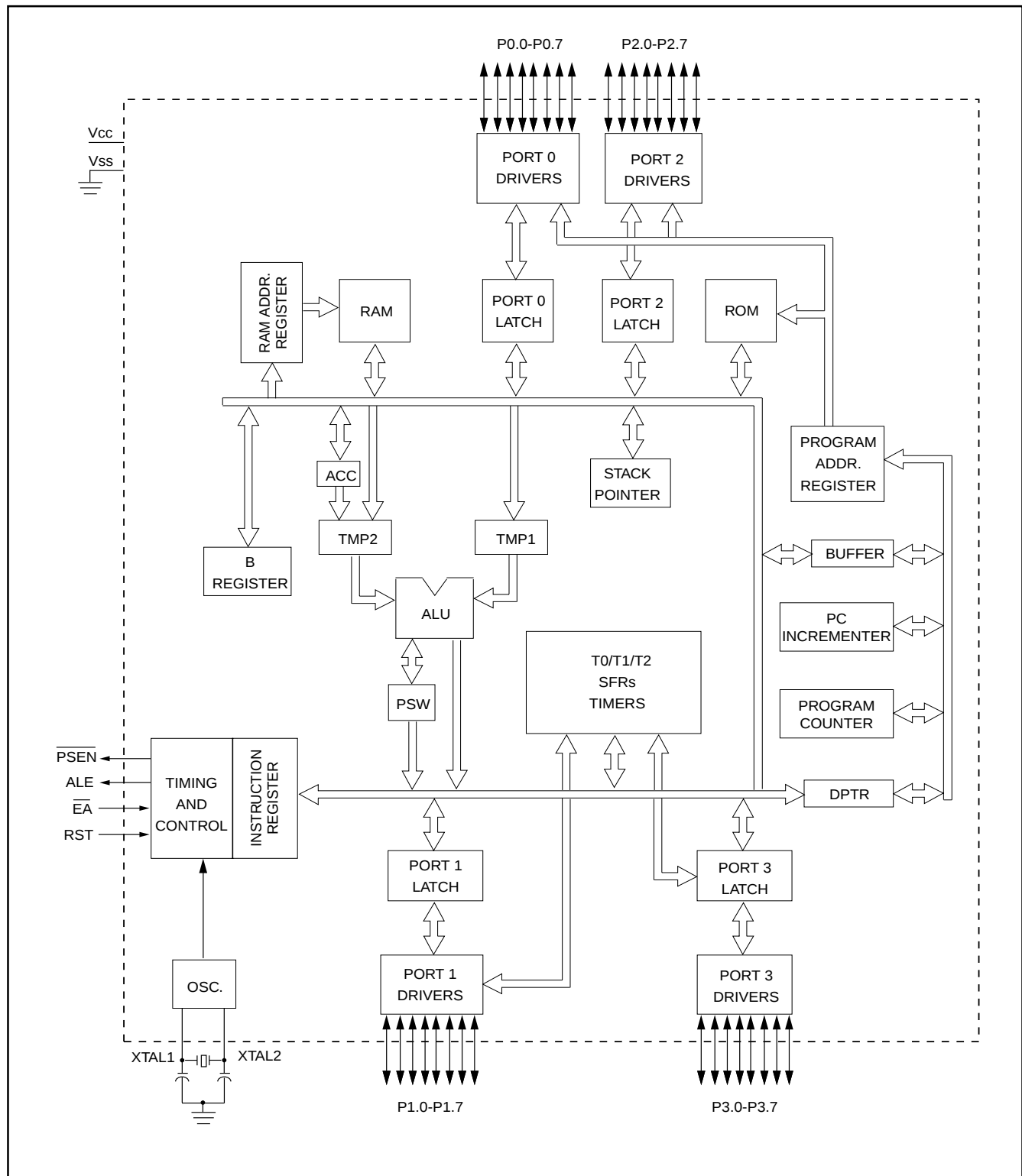
microcontroller for applications that require clock output, and up/down counting capabilities such as motor control. It also has a more versatile serial channel that facilitates multi-processor communications.

#### PIN CONFIGURATIONS

##### 44 PLCC



## BLOCK DIAGRAM



## PROCESS INFORMATION

This device is manufactured on a MXIC CMOS process.

## PIN DESCRIPTIONS

VCC : Supply voltage.

VSS : Circuit ground.

**Port 0 :** Port 0 is an 8-bit, open drain, bidirectional I/O port. As an output port each pin can sink several LS TTL inputs. Port 0 pins that have 1's written to them float, and in that state can be used as high-impedance inputs.

Port 0 is also the multiplexed low-order address and data bus during accesses to external Program and Data Memory. In this application it uses strong internal pullups when emitting 1's, and can source and sink several LS TTL inputs.

**Port 1 :** Port 1 is an 8-bit bidirectional I/O port with internal pullups. The port 1 output buffers can drive LS TTL inputs. Port 1 pins that have 1's written to them are pulled high by the internal pullups, and in that state can be used as inputs. As inputs, Port 1 pins that are externally pulled low will source current (IIL, on the data sheet) because of the internal pullups.

In addition, Port 1 serves the functions of the following special features of the MX10C805X :

| Port Pin | Alternate Function                                                  |
|----------|---------------------------------------------------------------------|
| P1.0     | T2 (External Count Input to Timer/Counter 2), Clock-Out             |
| P1.1     | T2EX (Timer/Counter 2 Capture/Reload Trigger and Direction Control) |

**Port 2 :** Port 2 is an 8-bit bidirectional I/O port with internal pullups. The port 2 output buffers can drive LS TTL inputs. Port 2 pins that have 1's written to them are pulled high by the internal pullups, and in that state can be used as inputs. As inputs, Port 2 pins that are externally pulled low will source current (IIL, on the data sheet) because of the internal pullups.

Port 2 emits the high-order address byte during fetches from external Program Memory and during accesses to external Data Memory that use 16-bit addresses (MOVX @DPTR). In this application it uses strong internal pullups when emitting 1's. During accesses to external Data Memory that use 8-bit addresses (MOVX @Ri), Port 2 emits the contents of the P2 Special Function Register.

**Port 3 :** Port 3 is an 8-bit bidirectional I/O port with internal pullups. The port 3 output buffers can drive LS TTL inputs. Port 3 pins that have 1's written to them are pulled high by the internal pullups, and in that state can be used as inputs. As inputs, Port 3 pins that are externally pulled low will source current (IIL, on the data sheet) because of the internal pullups.

Port 3 also serves the function of various special features of the 8051 Family, as listed below :

| Port Pin | Alternate Function                     |
|----------|----------------------------------------|
| P3.0     | RXD (serial input port)                |
| P3.1     | TXD (serial output port)               |
| P3.2     | INT0 (external interrupt 0)            |
| P3.3     | INT1 (external interrupt 1)            |
| P3.4     | T0 (Timer 0 external input)            |
| P3.5     | T1 (Timer 1 external input)            |
| P3.6     | WR (external data memory write strobe) |
| P3.7     | RD (external data memory read strobe)  |

**RST :** Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. The port pins will be driven to their reset condition when a minimum VIH voltage is applied whether the oscillator is running or not. An internal pulldown resistor permits a power-on reset with only a capacitor connected to VCC.

**ALE :** Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory.

In normal operation ALE is emitted at a constant rate of 1/6 the oscillator frequency, and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external Data Memory.

If desired, ALE operation can be disabled by setting bit 5 of SFR location 87H (PCON). With this bit set, the pin is weakly pulled high. However, the ALE disable feature will be suspended during a MOVX or MOVC instruction, idle mode, power down mode. The ALE disable feature will be terminated by reset. When the ALE disable feature is suspended or terminated, the ALE pin will no longer be pulled up weakly. Setting the ALE-disable bit has no affect if the microcontroller is in external execution mode.

Throughout the remainder of this data sheet, ALE will refer to the signal coming out of the ALE pin, and the pin will be referred to as the ALE pin.

**PSEN** : Program Store Enable is the read strobe to external Program Memory.

When the MX10FMAXDQC is executing code from external Program memory, **PSEN** is activated twice each machine cycle, except that two **PSEN** activations are skipped during each access to external Data memory.

**EA/VPP** : External Access enable. EA must be strapped to VSS in order to enable the twiceto fetch code from external Program Memory locations 0000H to 0FFFFH. EA will be internally latched on reset.

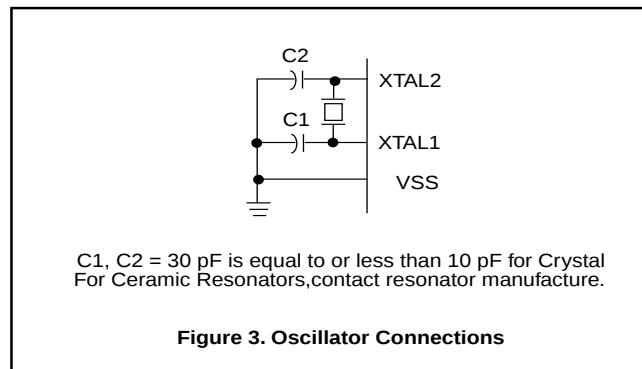
EA should be strapped to VCC for internal program executions.

**XTAL1** : Input to the inverting oscillator amplifier.

**XTAL2** : Output from the inverting oscillator amplifier.

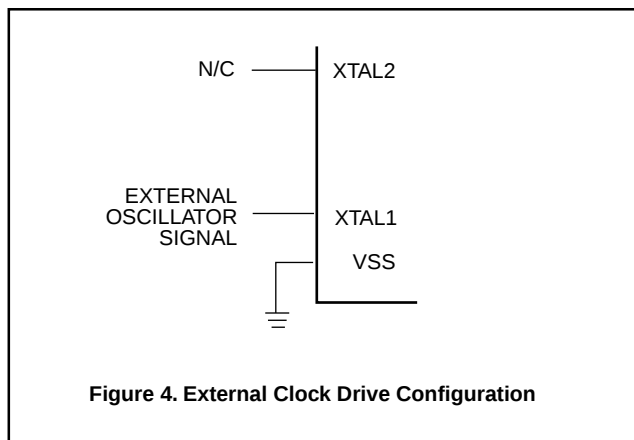
## OSCILLATOR CHARACTERISTICS

XTAL1 and XTAL2 are the input and output, respectively, of a inverting amplifier which can be configured for use as an on-chip oscillator, as shown in Figure 3. Either a quartz crystal or ceramic resonator may be used.



To drive the device from an external clock source, XTAL1 should be driven, while XTAL2 floats, as shown in Figure 4. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maximum high and low times specified on the data sheet must be observed.

An external oscillator may encounter as much as a 100 pF load at XTAL1 when it starts up. This is due to interaction between the amplifier and its feedback capacitance. Once the external signal meets the VIL and VIH specifications the capacitance will not exceed 20 pF.



## IDLE MODE

The user's software can invoke the Idle Mode. When the microcontroller is in this mode, power consumption is reduced. The Special Function Registers and the onboard RAM retain their values during Idle, but the processor stops executing instructions. Idle Mode will be exited if the chip is reset or if an enabled interrupt occurs.

## ABSOLUTE MAXIMUM RATING\*

|                                 |                   |
|---------------------------------|-------------------|
| Ambient Temperature Under Bias  | 0 °C to 70 °C     |
| Storage Temperature             | -65 °C to +150 °C |
| Voltage on Any Other Pin to VSS | -0.5V to +6.5V    |
| IOL Per I/O Pin                 | 15mA              |
| Power Dissipation               | 1.5W              |

(Based on PACKAGE heat transfer limitations, not device consumption)

**Table 2. Status of the External Pins during Idle and Power Down**

| Mode       | Program Memory | ALE | PSEN | PORT0 | PORT1 | PORT2   | PORT3 |
|------------|----------------|-----|------|-------|-------|---------|-------|
| Idle       | Internal       | 1   | 1    | Data  | Data  | Data    | Data  |
| Idle       | External       | 1   | 1    | Float | Data  | Address | Data  |
| Power Down | Internal       | 0   | 0    | Data  | Data  | Data    | Data  |
| Power Down | External       | 0   | 0    | Float | Data  | Data    | Data  |

## POWER DOWN MODE

To save even more power, a Power Down mode can be invoked by software. If this mode, the oscillator is stopped and the instruction that invoked Power Down is the last instruction executed. The on-chip RAM and Special Function Registers retain their values until the Power Down mode is terminated.

On the MX10C805X either a hardware reset or an external interrupt can cause an exit from Power Down. Reset redefines all the SFRs but does not change the on-chip RAM. An external interrupt allows both the SFRs and on-chip RAM to retain their values.

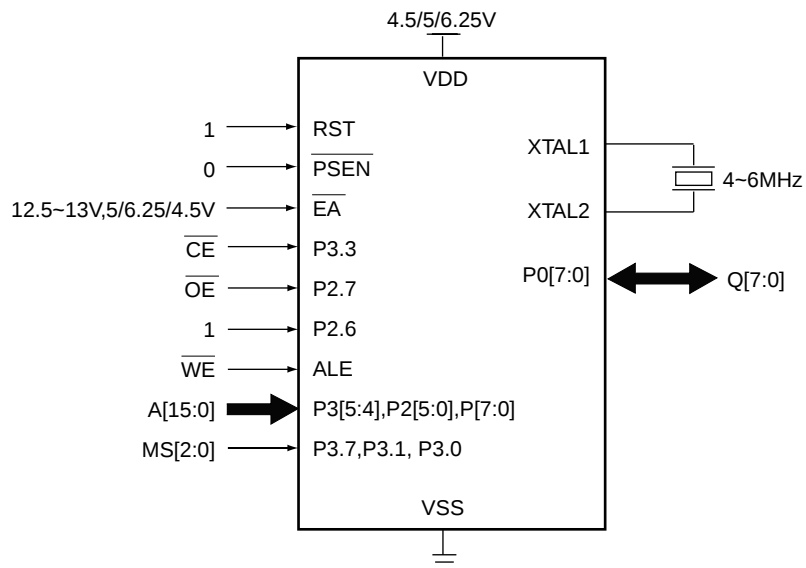
To properly terminate Power Down, the reset or external interrupt should not be executed before VCC is restored to its normal operating level, and must be held active long enough for the oscillator to restart and stabilize (normally less than 10 ms).

With an external interrupt, INT0 and INT1 must be enabled and configured as level-sensitive. Holding the pin low restarts the oscillator but bringing the pin back high completes the exit. Once the interrupt is serviced, the next instruction to be executed after RETI will be the one following the instruction that put the device into Power Down.

## 5. PROGRAMMING SPECIFICATION

P89C138/238 has two programming modes, which depends on the P2.6 pin. If P2.6 = 1, then it is in parallel programming mode, if not, then it is in serial programming mode.

### 5.1 Parallel Programming Mode



| PIN NAME                 | SYMBOL              | FUNCTION                              |
|--------------------------|---------------------|---------------------------------------|
| P1.0 ~ P1.7              | A0 ~ A7             | Input low order address bits          |
| P2.0 ~ P2.5, P3.4 ~ P3.5 | A8 ~ A13, A14 ~ A15 | Input high order address bits         |
| P0.0 ~ P0.7              | Q0 ~ Q7             | Data Input/Output                     |
| P3.3                     | $\overline{CE}$     | Chip Enable Input                     |
| P2.7                     | $\overline{OE}$     | Output Enable Input                   |
| ALE                      | $\overline{WE}$     | Write Enable Input                    |
| $\overline{EA}$          | Vpp                 | Program Supply Voltage, 12.5 ~13Volts |
| P3.7, P3.1, P3.0         | MS2 ~ MS0           | Flash Mode Selection                  |
| VDD                      | VDD                 | Power Supply Voltage (+5V)            |
| GND                      | GND                 | Ground Pin                            |

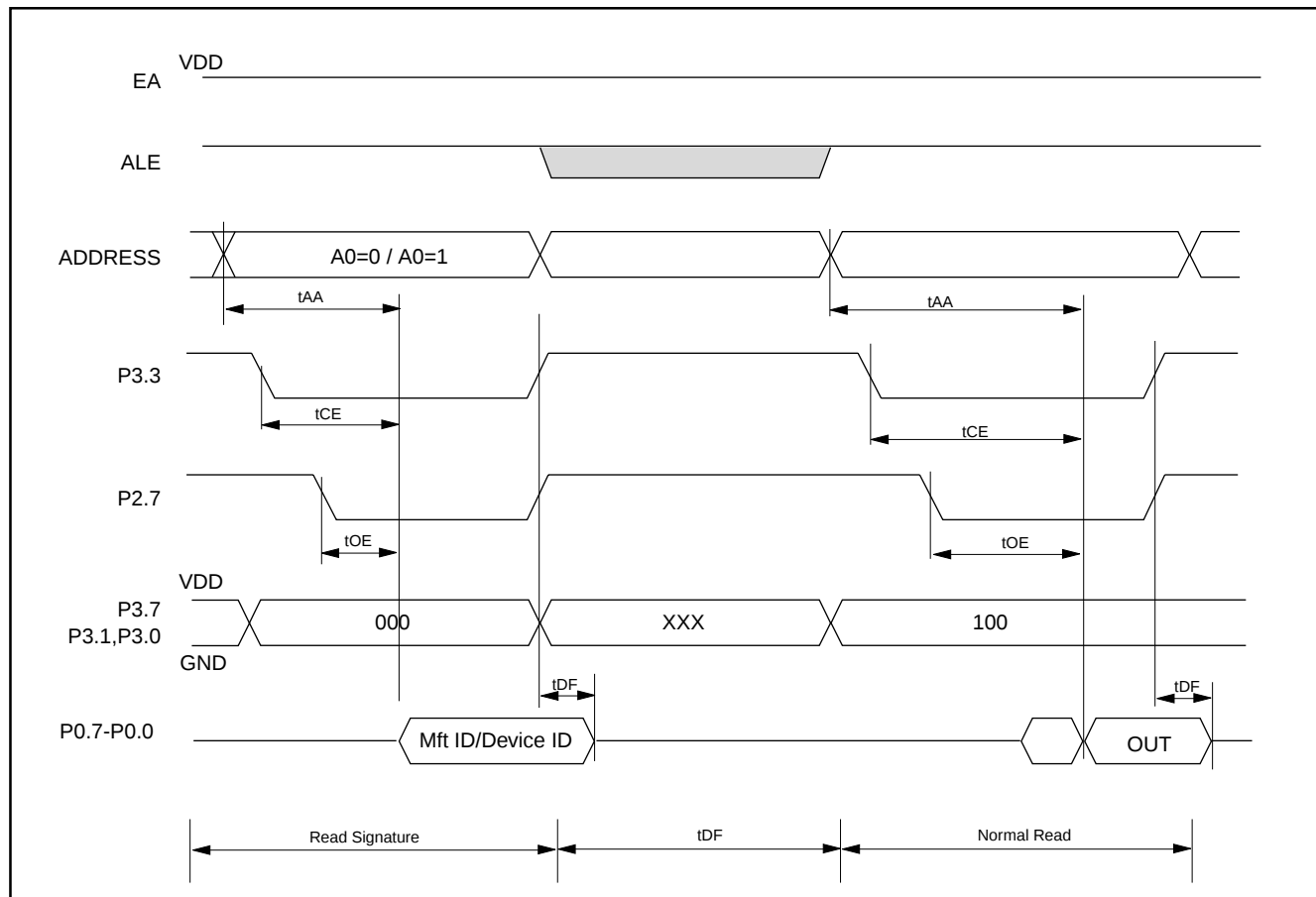
Notice for speed programming

**5.1.1 Table of parallel programming modes**

| External Pin           | EA       | VDD   | P3.3 | P2.7 | ALE          | P3[5:4],<br>P2[5:0],<br>P1[7:0] | P3.7,<br>P3.1,<br>P3.0 | P0[7:0]               |
|------------------------|----------|-------|------|------|--------------|---------------------------------|------------------------|-----------------------|
| Standby                | X        | 5V    | 1    | X    | X            | X                               | X                      | Z                     |
| Read Signature         | 5V       | 5V    | 0    | 0    | 1            | P1.0=0<br>P1.0=1                | 000                    | MftID=C2H<br>DID=F0H  |
| Program                | 12.5~13V | 6.25V | 0    | 1    | 100us pulses | address                         | 011                    | DATA                  |
| Program Verify         | 12.5~13V | 6.25V | 0    | 0    | 1            | address                         | 010                    | DATA                  |
| Pgm Lock bit #1        | 12.5~13V | 6.25V | 0    | 1    | 100us pulses | X                               | 111                    | X                     |
| Pgm Lock bit #2        | 12.5~13V | 6.25V | 0    | 1    | 100us pulses | X                               | 110                    | X                     |
| Pgm Lock bit #3        | 12.5~13V | 6.25V | 0    | 1    | 100us pulses | X                               | 100                    | X                     |
| Pgm verify Lock bits   | 6.25V    | 6.25V | 0    | 0    | 1            | X                               | 101                    | P0[3:1]=<br>LOCK[3:1] |
| Erase verify LOCK bits | 4.5V     | 4.5V  | 0    | 0    | 1            | X                               | 101                    | P0[3:1]=<br>LOCK[3:1] |
| Chip Erase             | 12.5~13V | 6.25V | 0    | 1    | 0.5sec pulse | X                               | 010                    | X                     |
| Erase Verify           | 12.5~13V | 4.5V  | 0    | 0    | 1            | address                         | 011                    | DATA                  |
| Normal Read            | X        | 5V    | 0    | 0    | 1            | address                         | 100                    | DATA                  |

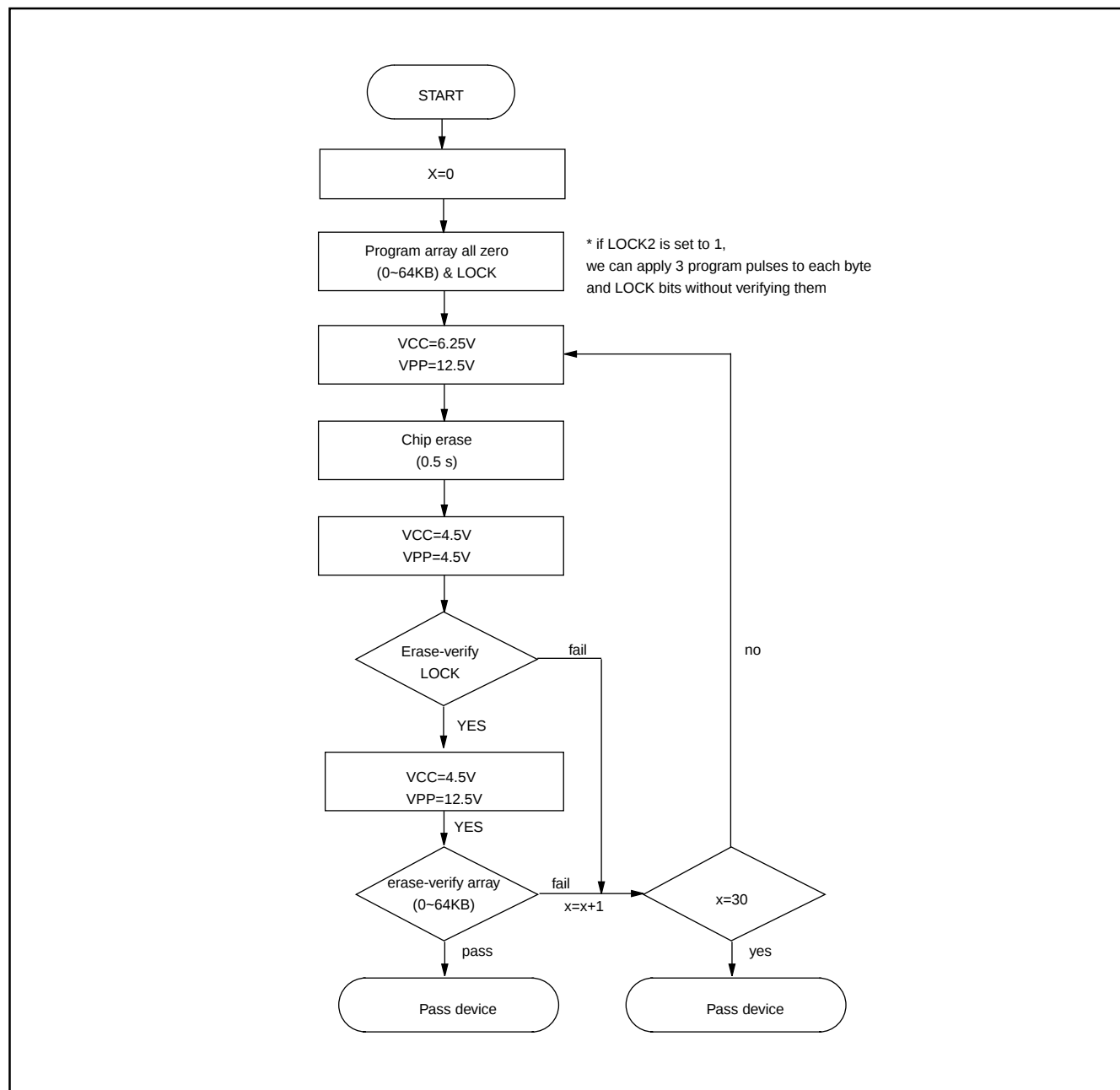
## 5.1.2 Timing Waveform in Parallel Programming Mode

### READ SIGNATURE AND NORMAL READ WAVEFORM

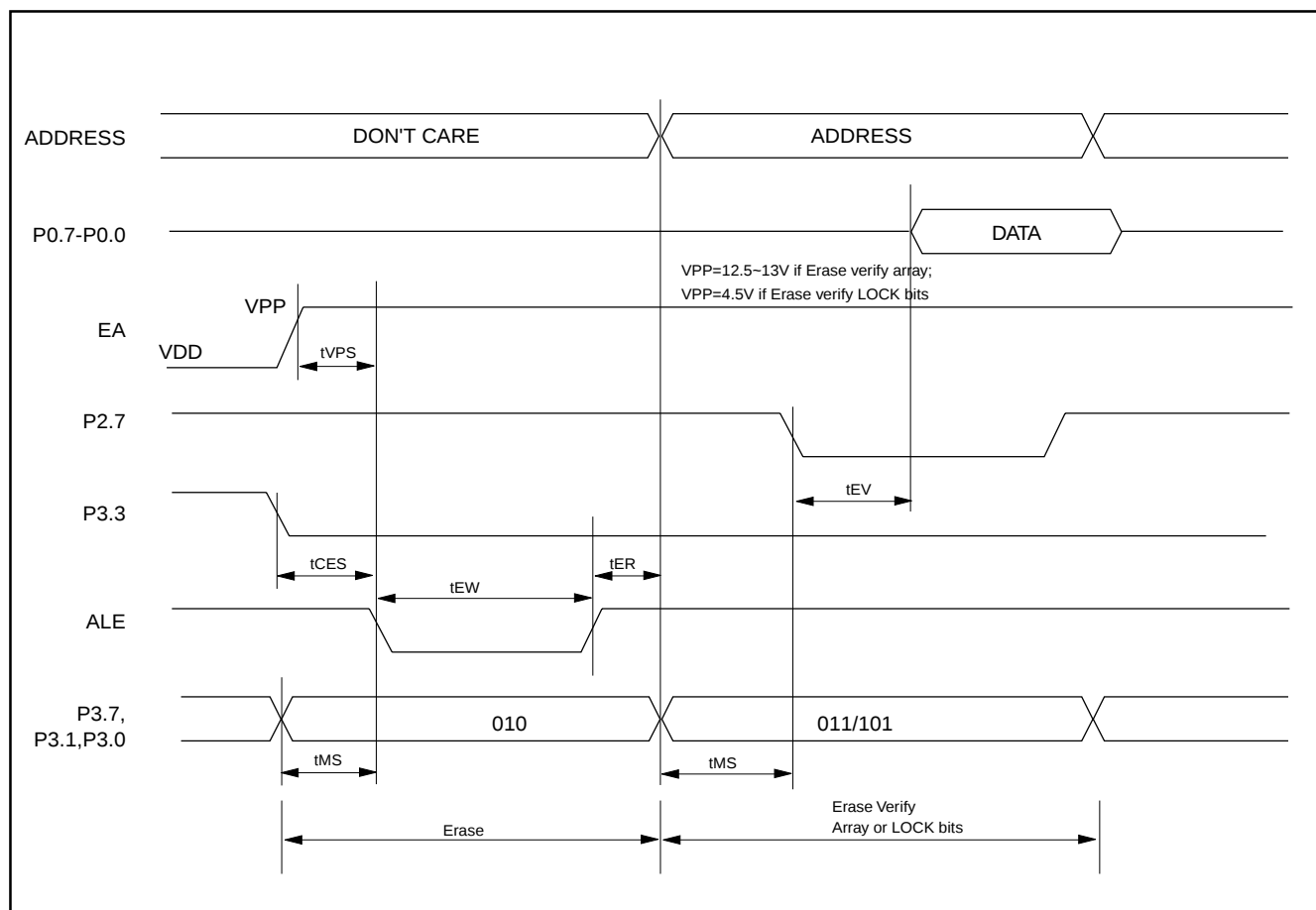


|      | $t_{AA}$ | $t_{CE}$ | $t_{OE}$ | $t_{DF}$ |
|------|----------|----------|----------|----------|
| Mim. |          |          |          | 0        |
| Max. | 120      | 120      | 70       | 20       |
| unit | ns       | ns       | ns       | ns       |

## ERASE AND VERIFY FLOWCHART

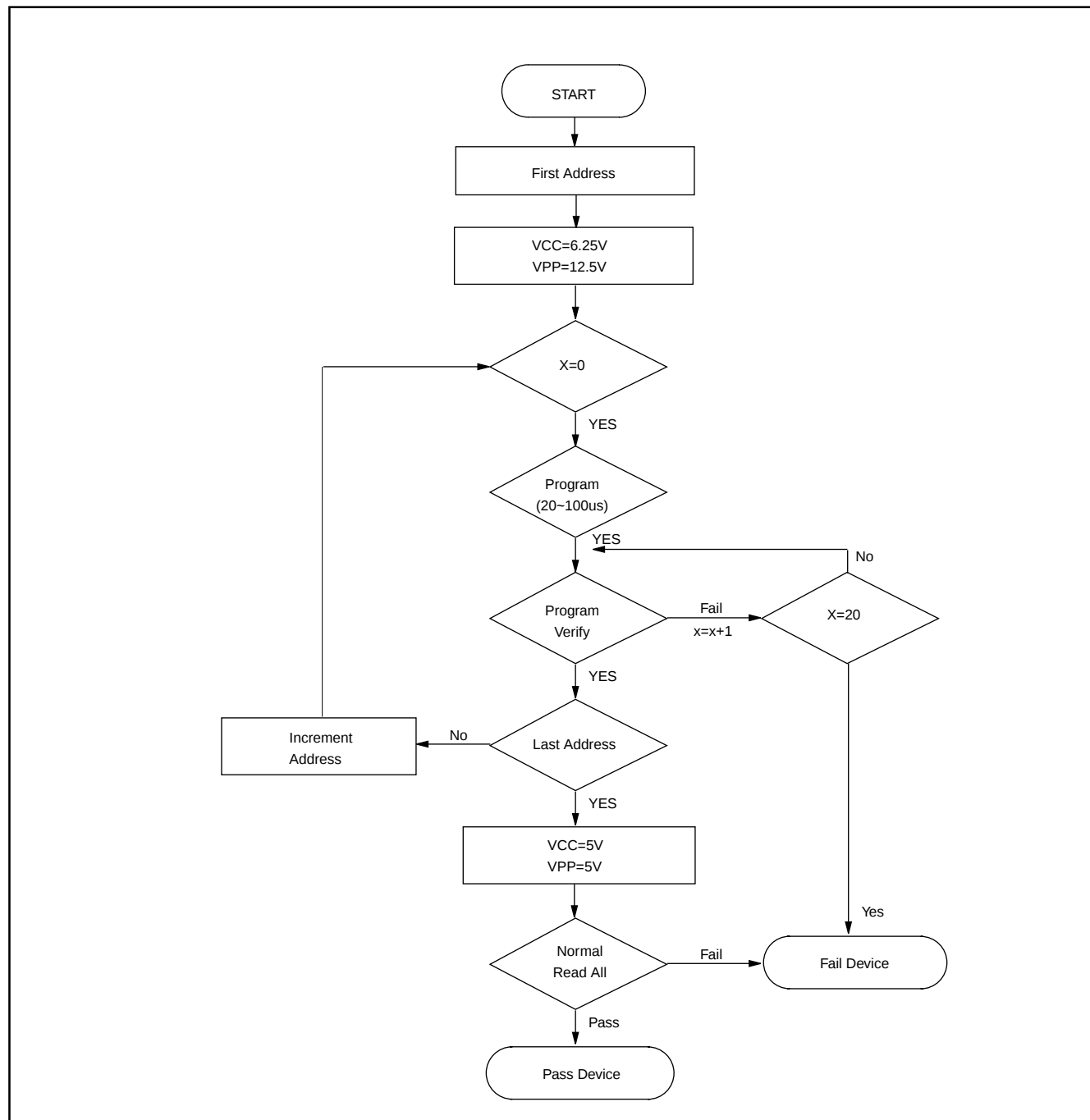


## ERASE AND ERASE VERIFY WAVEFORM

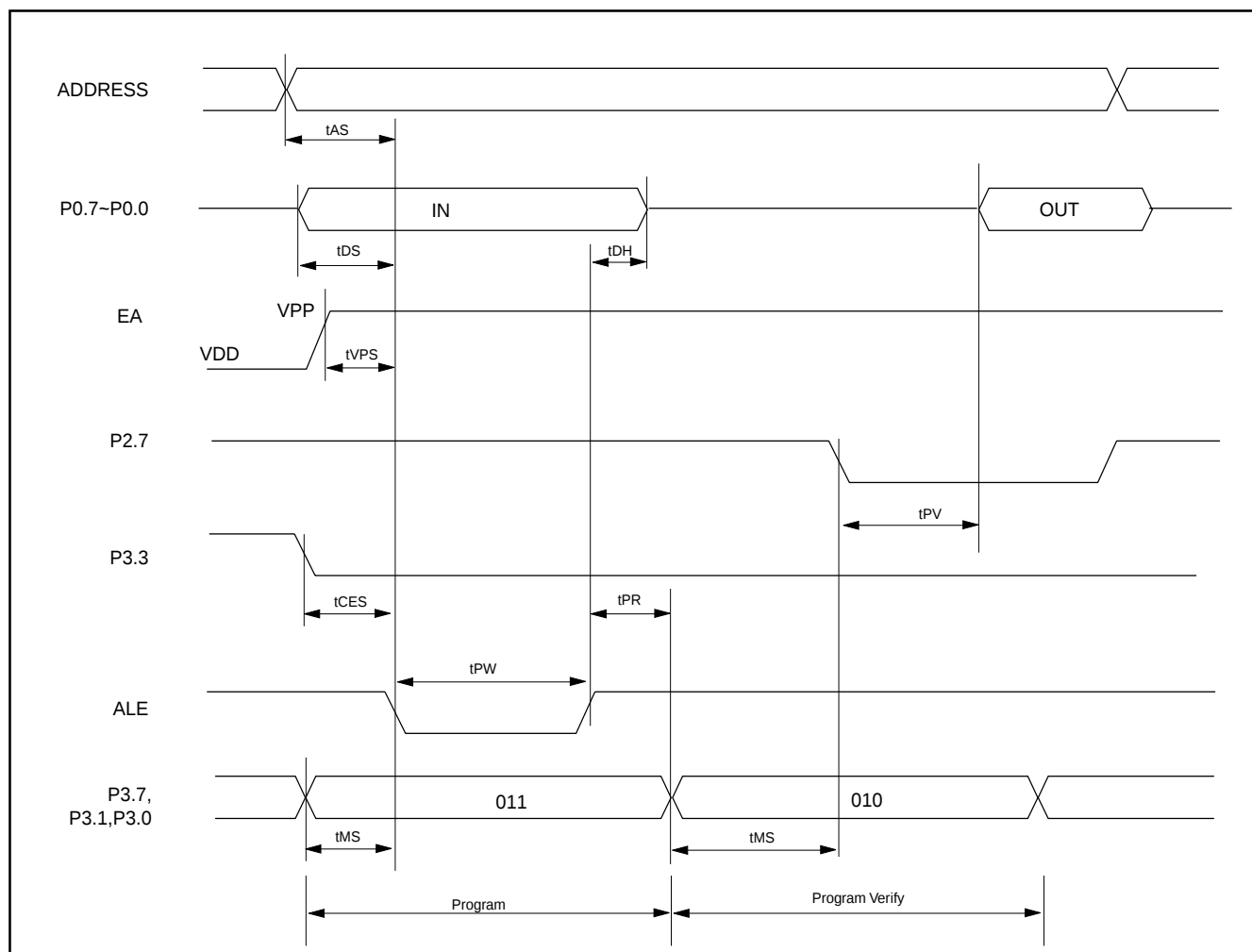


|      | tDS | tDH | tVPS | tMS | tCES | tER | tEW  | tEV |
|------|-----|-----|------|-----|------|-----|------|-----|
| Mim. | 2   | 2   | 2    | 2   | 2    | 0.5 | 0.45 |     |
| Max. |     |     |      |     |      |     | 0.55 | 240 |
| unit | us  | us  | us   | us  | us   | s   | s    | ns  |

## PROGRAM AND PROGRAMVERIFY FLOWCHART

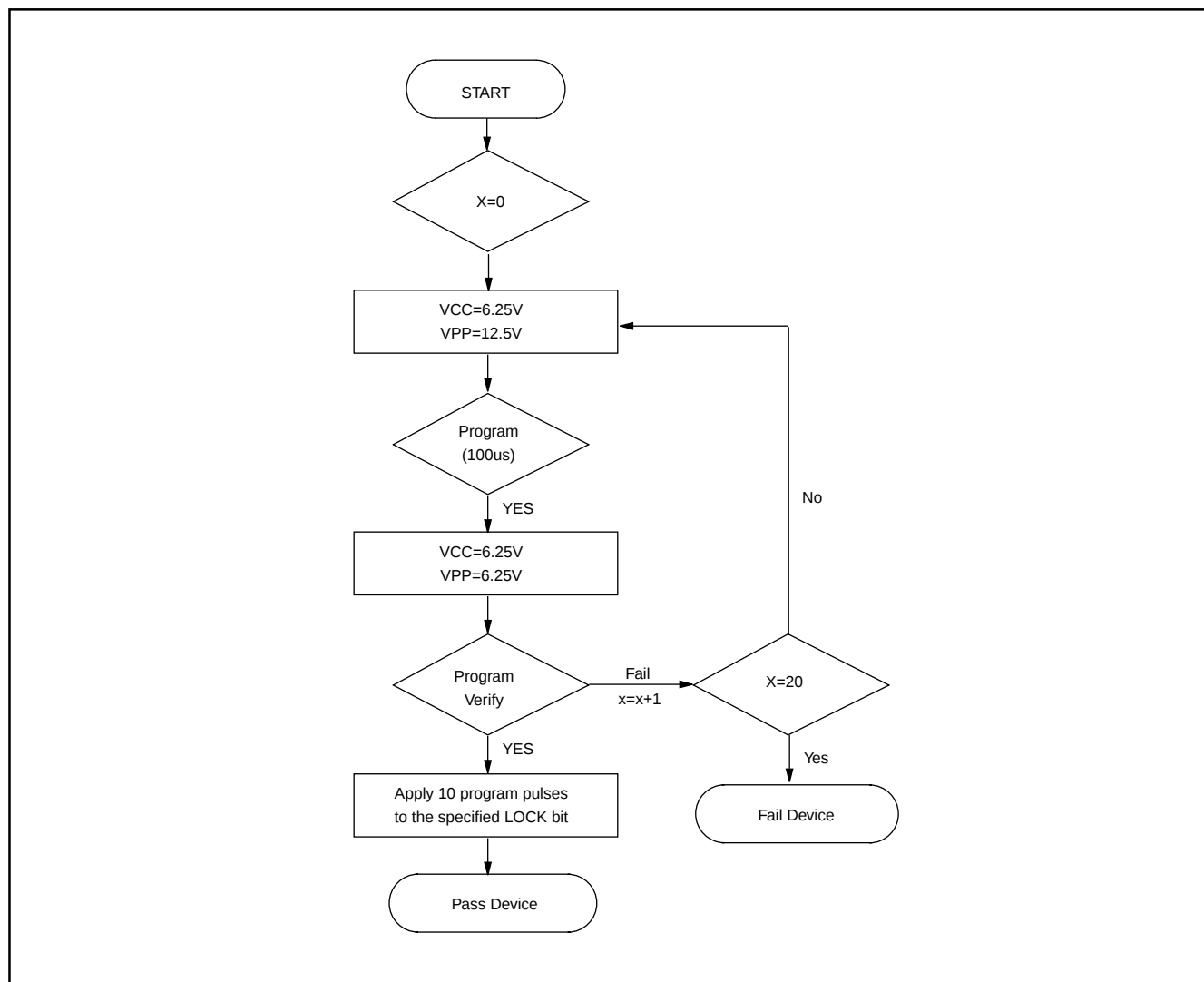


## PROGRAM AND PROGRAM VERIFY FLOWCHART

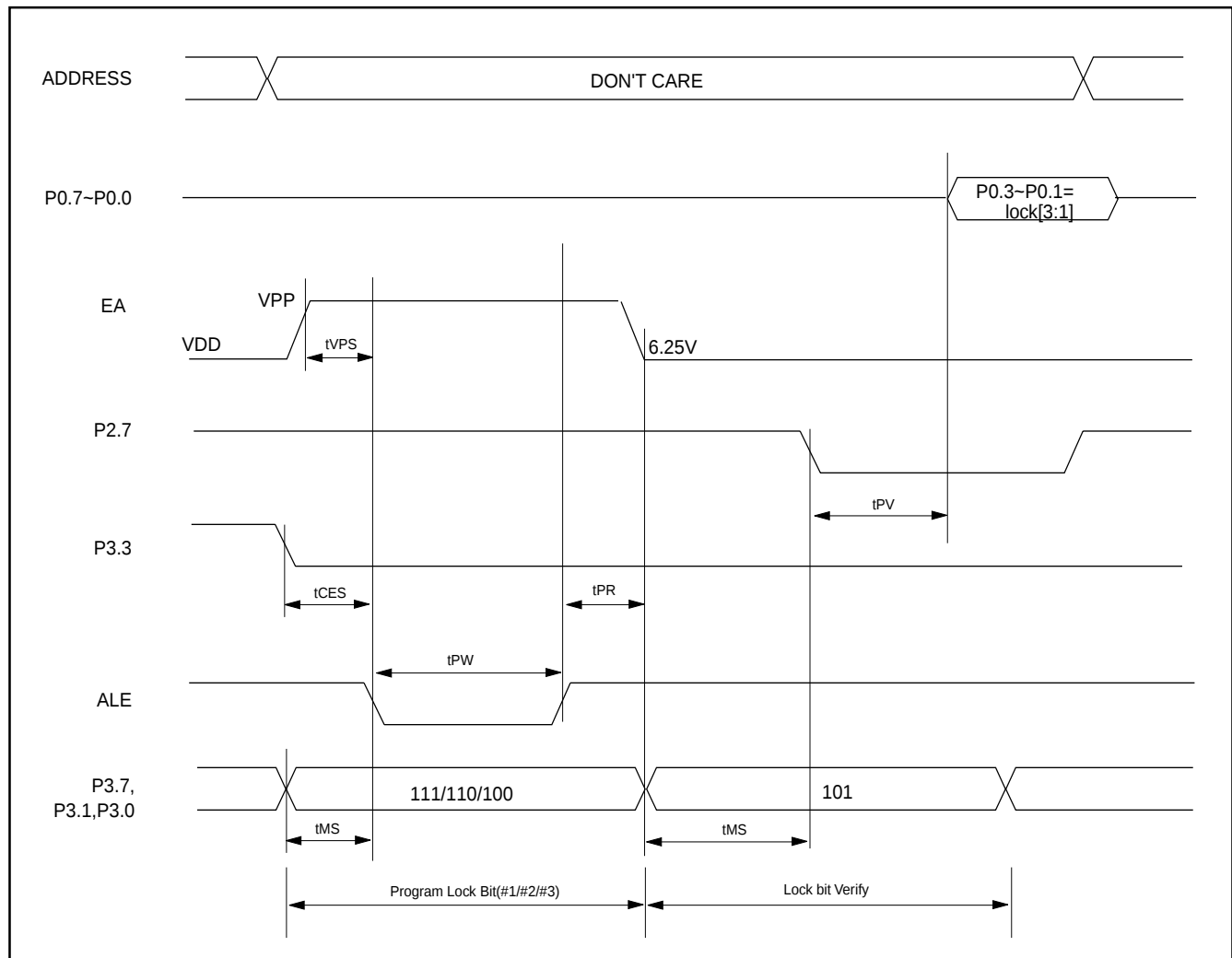


|      | tAS | tDS | tDH | tVPS | tCES | tMS | tPR | tPW | tPV |
|------|-----|-----|-----|------|------|-----|-----|-----|-----|
| Mim. | 2   | 2   | 2   | 2    | 2    | 2   | 2   | 20  |     |
| Max. |     |     |     |      |      |     |     | 105 | 240 |
| unit | us  | us  | us  | us   | us   | us  | us  | us  | ns  |

## PROGRAM LOCK BITS AND PROGRAM VERIFY LOCK BITS FLOWCHART



## PROGRAM LOCK BITS AND PROGRAM VERIFY LOCK BITS WAVEFORM



|      | tVPS | tCES | tMS | tPR | tPW | tPV |
|------|------|------|-----|-----|-----|-----|
| Mim. | 2    | 2    | 2   | 2   | 20  |     |
| Max. |      |      |     |     | 105 | 240 |
| unit | us   | us   | us  | us  | us  | ns  |

**OPERATING CONDITIONS**

| Symbol | Description                                  | Min | Max | Units |
|--------|----------------------------------------------|-----|-----|-------|
| TA     | Ambient Temperature Under Bias<br>Commerical | 0   | +70 | °C    |
| VCC    |                                              | 4.5 | 5.5 | V     |
| fOSC   | Oscillator Frequency                         | 3.5 | 40  | MHz   |

**DC CHARACTERISTICS (Over Operating Conditions)**

All parameter values apply to all devices unless otherwise indicated.

| Symbol | Parameter                                                                     | Min         | Typ | Max<br>(Note 4) | Unit  | Test Conditions     |
|--------|-------------------------------------------------------------------------------|-------------|-----|-----------------|-------|---------------------|
| VIL    | Input Low Voltage                                                             | -0.5        |     | 0.2 VCC-0.1     | V     |                     |
| VIL1   | Input Low Voltage $\overline{EA}$                                             | 0           |     | 0.2 VCC-0.3     | V     |                     |
| VIH    | Input High Voltage<br>(Except XTAL1, RST)                                     | 0.2 VCC+0.9 |     | VCC+0.5         | V     |                     |
| VIH1   | Input High Voltage<br>(XTAL1, RST)                                            | 0.7 VCC     |     | VCC+0.5         | V     |                     |
| VOL    | Output Low Voltage (Note 5)<br>(Ports 1, 2, and 3)                            |             |     | 0.4             | V     | IOL=1.6 mA (Note 1) |
| VOL1   | Output Low Voltage (Note 5)<br>(Port 0, ALE, PSEN)                            |             |     | 0.4             | V     | IOL=3.2 mA (Note 1) |
| VOH    | Output High Voltage $\overline{\hspace{1cm}}$<br>(Port 1, 2 and 3, ALE, PSEN) | 0.9 VDD     |     |                 | V     | IOH=-10 uA          |
|        |                                                                               | 0.75 VDD    |     |                 | V     | IOH=-30 uA          |
|        |                                                                               | 0.5 VDD     |     |                 | V     | IOH=-60uA           |
| VOH1   | Output High Voltage<br>(Port 0 in External Bus Mode)                          | 0.9 VDD     |     |                 | V     | IOH=-80 uA          |
|        |                                                                               | 0.75 VDD    |     |                 | V     | IOH=-300 uA         |
|        |                                                                               | 0.5 VDD     |     |                 | V     | IOH=-800 uA         |
| IIL    | Logical 0 Input Current<br>(Ports 1, 2 and 3)                                 |             |     | -50             | uA    | VIN=0.4V            |
| ILI    | Input leakage Current (Port 0)                                                |             |     | ±10             | uA    | VIN=VIL or VIH      |
| ITL    | Logical 1 to 0 Transition Current<br>(Ports 1, 2 and 3)<br>Industrial         |             |     | -750            | uA    | VIN=2V              |
| PRST   | RST Pulldown Resistor                                                         | 15          |     | 150             | K ohm |                     |
| CIO    | Pin Capacitance                                                               |             | 10  |                 | pF    | @1 MHz, 25°C        |
| ICC    | Power Supply Current:                                                         |             |     |                 |       | (Note 3)            |
|        | Active Mode at 40 MHz                                                         |             |     | 60              | mA    |                     |
|        | Idle Mode at 40 MHz(70°C 5.5V)                                                |             |     | 40              | mA    |                     |
|        | Power Down Mode                                                               |             |     | 100             | uA    |                     |

## NOTES:

1. Capacitive loading on Ports 0 and 2 may cause noise pulses above 0.4V to be superimposed on the VOLs of ALE and Ports 1, 2 and 3. The noise is due to external bus capacitance discharging into the Port 0 and Port 2 pins when these pins change from 1 to 0. In applications where capacitive loading exceeds 100 pF, the noise pulses on these signals may exceed 0.8V. It may be desirable to qualify ALE or other signals with a Schmitt Triggers, or CMOS-level input logic.
2. Capacitive loading on Ports 0 and 2 cause the VOH on ALE and  $\overline{\text{PSEN}}$  to drop below the 0.9 VCC specification when the address lines are stabilizing.
3. Minimum VCC for Power Down is 2V.
4. Typicals are based on a limited number of samples and are not guaranteed. The values listed are room temperature and 5V.
5. Under steady state (non-transient) conditions, IOL must be externally limited as follows:

Maximum IOL per port pin: 10mA

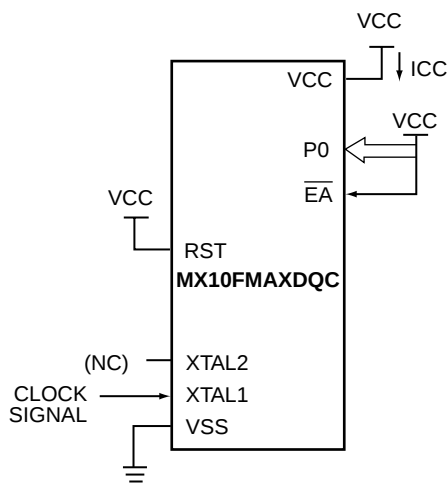
Maximum IOL per 8-bit port:

Port 0: 26mA

Ports 1, 2 and 3: 15mA

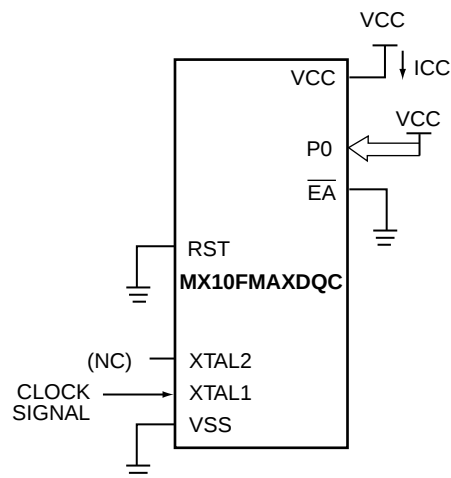
Maximum total IOL for all output pins: 71mA

If IOL exceeds the test condition, VOL may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test conditions.



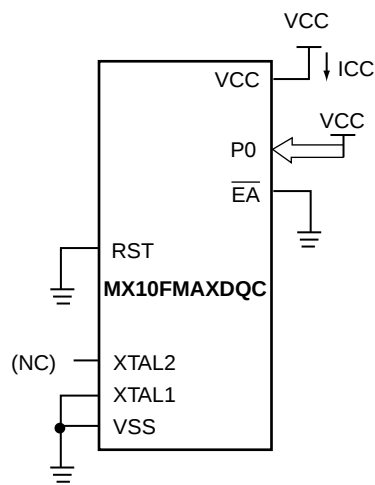
All other pins disconnected  
TCLCH = TCHCL = 5ns

Figure 6. ICC Test Condition, Active Mode



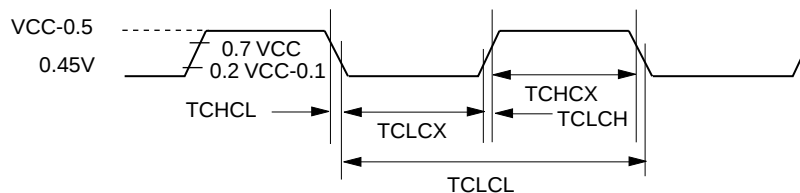
All other pins disconnected  
TCLCH = TCHCL = 5ns

Figure 7. ICC Test Condition Idle Mode



All other pins disconnected

**Figure 8. ICC Test Condition, Power Down Mode**  
VCC=2.0V to 6.0V



**Figure 9. Clock Signal Waveform for ICC Tests in Active and Idle Modes.**  
TCLCH = TCHCL = 5 ns

## EXPLANATION OF THE AC SYMBOLS

Each timing symbol has 5 characters. The first character is always a "T" (stands for time). The other characters, depending on their positions, stand for the name of a signal or the logical status of that signal. The following is a list of all the characters and what they stand for.

- A: Address
- C: Clock
- D: Input Data
- H: Logic level HIGH
- L: Logic level LOW, or ALE
- P: PSEN

- Q: Output Data
- R: RD signal
- T: Time
- V: Valid
- W: WR signal
- X: No longer a valid logic level
- Z: Float

For example,

TAVLL = Time from Address Valid to ALE Low  
TLLPL = Time from ALE Low to PSEN Low

## AC CHARACTERISTICS

(Over Operating Conditions, Load Capacitance for Port 0, ALE/PROG and PSEN = 100 pF, Load Capacitance for All Other Outputs = 80 pF)

tCK min. = 1/f max. (maximum operating frequency); tCK=clock period

| SYMBOL                  | PARAMETER                                                     | 33 MHz |     | UNIT |
|-------------------------|---------------------------------------------------------------|--------|-----|------|
|                         |                                                               | MIN    | MAX |      |
| EXTERNAL PROGRAM MEMORY |                                                               |        |     |      |
| TLHLL                   | ALE PULSE DURATION                                            | 20     | -   | NS   |
| TAVLL                   | ADDRESS SET-UP TIME TO ALE                                    | 17     | -   | NS   |
| TLLAX                   | ADDRESS HOLD TIME AFTER ALE                                   | 10     | -   | NS   |
| TLLIV                   | TIME FROM ALE TO VALID INSTRUCTION INPUT                      | -      | 55  | NS   |
| TLLPL                   | TIME FROM ALE TO CONTROL PULSE $\overline{\text{PSEN}}$       | 17     | -   | NS   |
| TPLPH                   | CONTROL PULSE DURATION $\overline{\text{PSEN}}$               | 70     | -   | NS   |
| TPLIV                   | TIME FROM $\overline{\text{PSEN}}$ TO VALID INSTRUCTION INPUT | -      | 12  | NS   |
| TPXIX                   | INPUT INSTRUCTION HOLD TIME AFTER $\overline{\text{PSEN}}$    | 0      | -   | NS   |
| TPXIZ                   | INPUT INSTRUCTION FLOAT DELAY AFTER $\overline{\text{PSEN}}$  | -      | 20  | NS   |
| TAVIV                   | ADDRESS TO VALID INSTRUCTION INPUT                            | -      | 95  | NS   |
| TPLAZ                   | TO $\overline{\text{PSEN}}$ ADDRESS FLOAT TIME                | -      | 10  | NS   |
| EXTERNAL DATA MEMORY    |                                                               |        |     |      |
| TLHLL                   | ALE PULSE DURATION                                            | 20     | -   | NS   |
| TAVLL                   | ADDRESS SET-UP TIME TO ALE                                    | 17     | -   | NS   |
| TLLAX                   | ADDRESS HOLD TIME AFTER ALE                                   | 10     | -   | NS   |
| TRLRH                   | RD PULSE DURATION                                             | 80     | -   | NS   |
| TWLWH                   | WR PULSE DURATION                                             | 80     | -   | NS   |
| TRLDV                   | RD TO VALID DATA INPUT                                        | -      | 60  | NS   |
| TRHDX                   | DATA HOLD TIME AFTER RD                                       | 0      | -   | NS   |
| TRHDZ                   | DATA FLOAT DELAY AFTER RD                                     | 32     | -   | NS   |
| TLLDV                   | TIME FROM ALE TO VALID DATA INPUT                             | -      | 90  | NS   |
| TAVDV                   | ADDRESS TO VALID INPUT                                        | -      | 105 | NS   |
| TLLWL                   | TIME FROM ALE TO RD OR WR                                     | 40     | 140 | NS   |
| TAVWL                   | TIME FROM ADDRESS TO RD OR WR                                 | 45     | -   | NS   |
| TWHLH                   | TIME FROM RD OR WR HIGH TO ALE HIGH                           | 10     | 55  | NS   |
| TQVWX                   | DATA VALID TO WR TRANSITION                                   | 10     | -   | NS   |
| TQVWH                   | DATA SET-UP TIME BEFORE WR                                    | 125    | -   | NS   |
| TWHQX                   | DATA HOLD TIME AFTER WR                                       | 10     | -   | NS   |
| TRLAZ                   | ADDRESS FLOAT DELAY AFTER RD                                  | -      | 0   | NS   |

### NOTE:

1. The maximum operating frequency is limited to 40 MHz and the minimum to 3.5 MHz.

## External clock drive XTAL

| SYMBOL | PARAMETER                 | VARIABLE CLOCK |           | UNIT |
|--------|---------------------------|----------------|-----------|------|
|        |                           | MIN            | MAX       |      |
| fCLK   | clock frequency           | 1.2            | 40        | MHz  |
| tCLCL  | clock period              | 63             | 833       | ns   |
| tCHCX  | HIGH time                 | 20             | tCK-tCLCX | ns   |
| tCLCX  | LOW time                  | 20             | tCK-tCHCX | ns   |
| tCLCH  | RISE time                 | -              | 20        | ns   |
| tCHCL  | FALL time                 | -              | 20        | ns   |
| tCY    | cycle time (tCY = 12 tCK) | 0.75           | 10        | ms   |

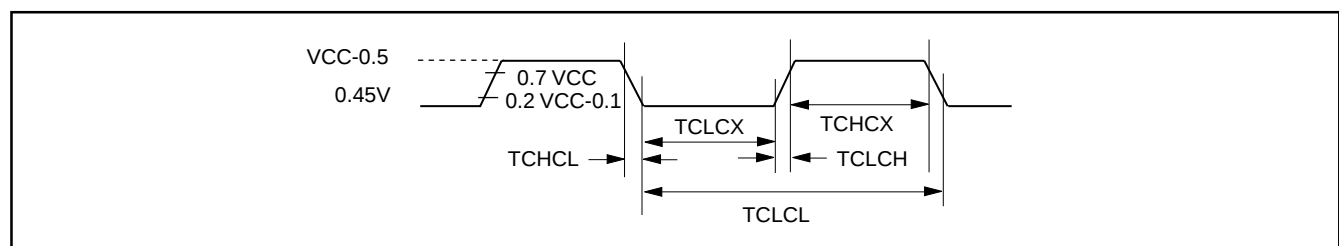
## SERIAL PORT CHARACTERISTICS

### Serial Port Timing : Shift Register Mode

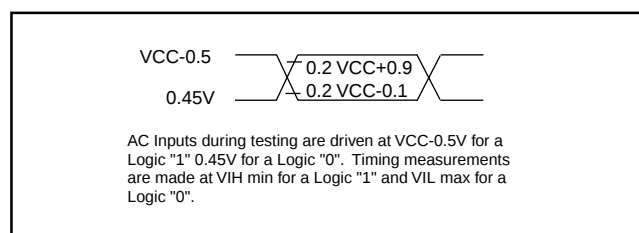
VDD = 5V±10%; VSS = 0V; Tamb=0°C; Load Capacitance = 80 pF

| SYMBOL | PARAMETER                                | 33 MHz OSCILLATOR |     | UNIT |
|--------|------------------------------------------|-------------------|-----|------|
|        |                                          | MIN               | MAX |      |
| tLXL   | Serial Port clock cycle time             | 360               | -   | ns   |
| tQVXH  | Output data setup to clock rising edge   | 167               | -   | ns   |
| tXHQX  | Output data hold after clock rising edge | 5                 | -   | ns   |
| tXHDX  | Input data hold after clock rising edge  | 0                 | -   | ns   |
| tXHDV  | Clock rising edge to input data valid    | -                 | 167 | ns   |

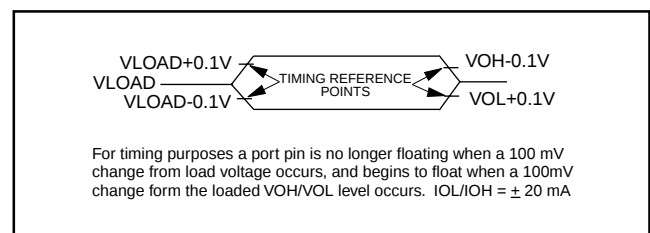
## EXTERNAL CLOCK DRIVE WAVEFORM

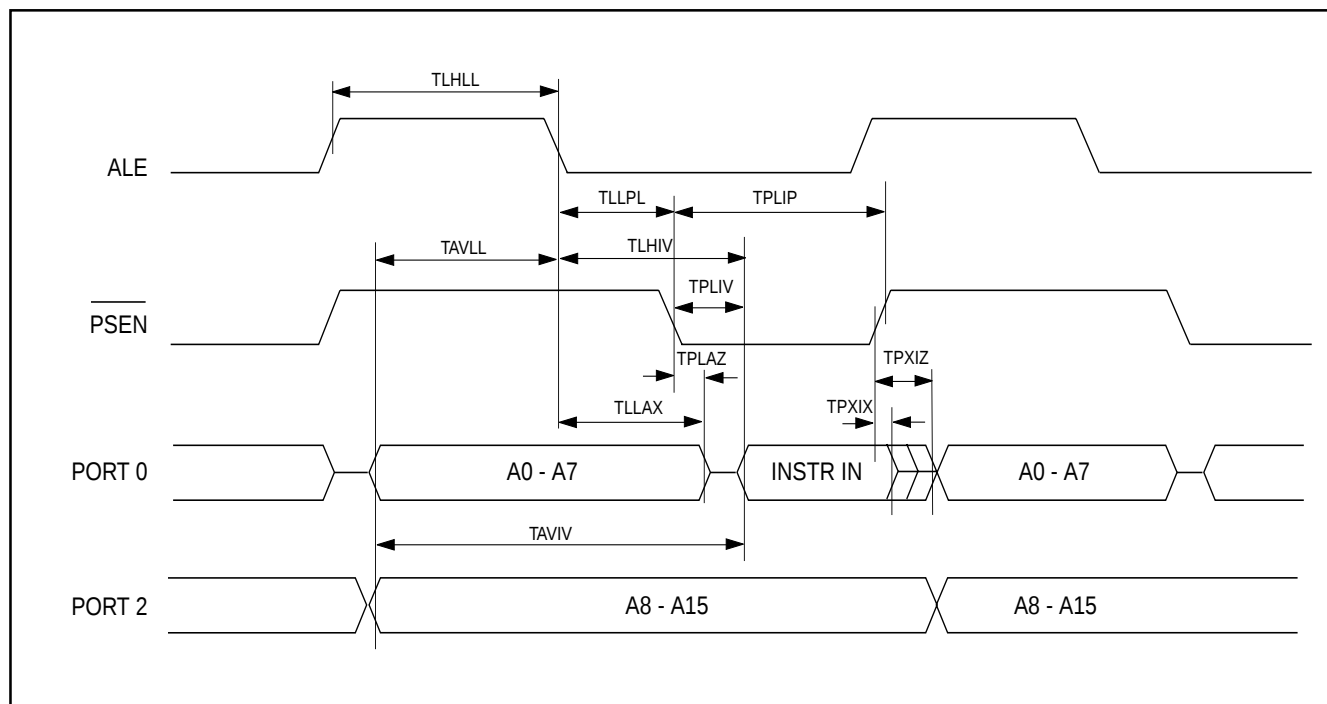
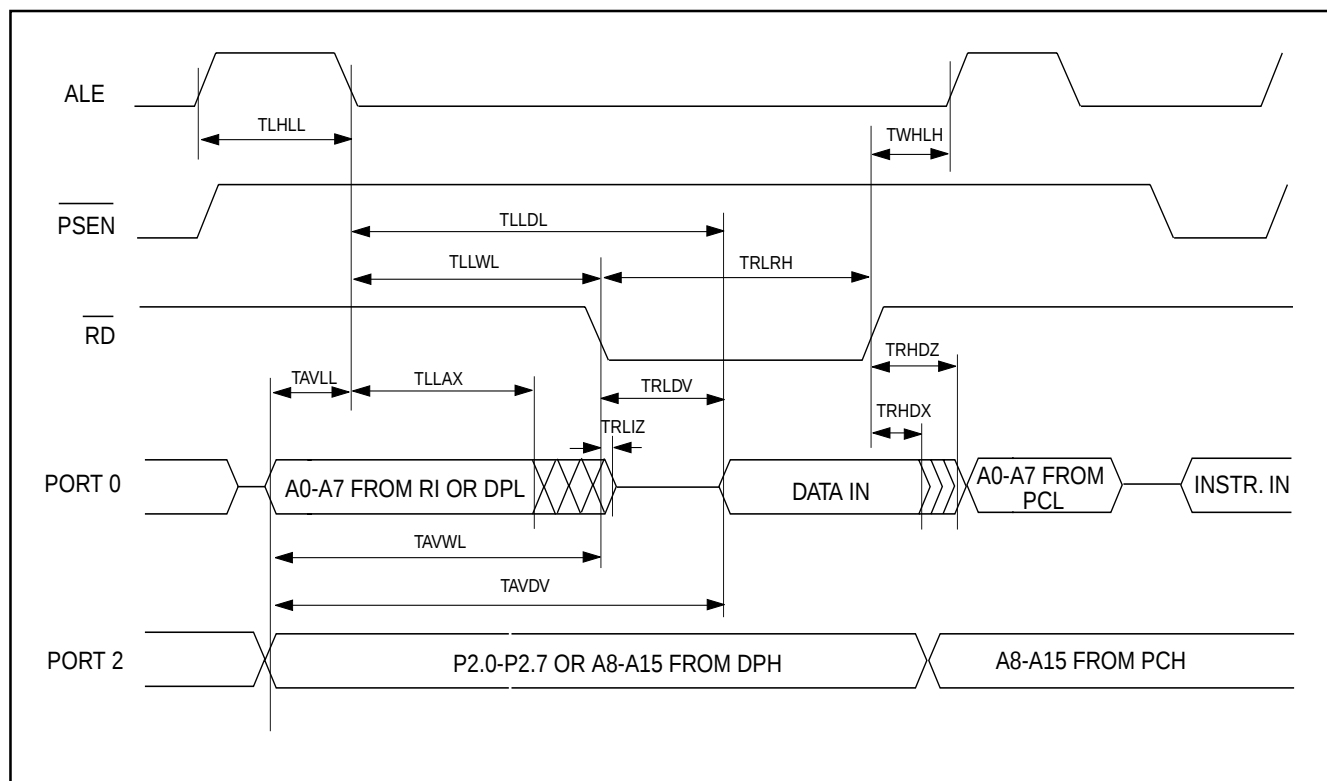


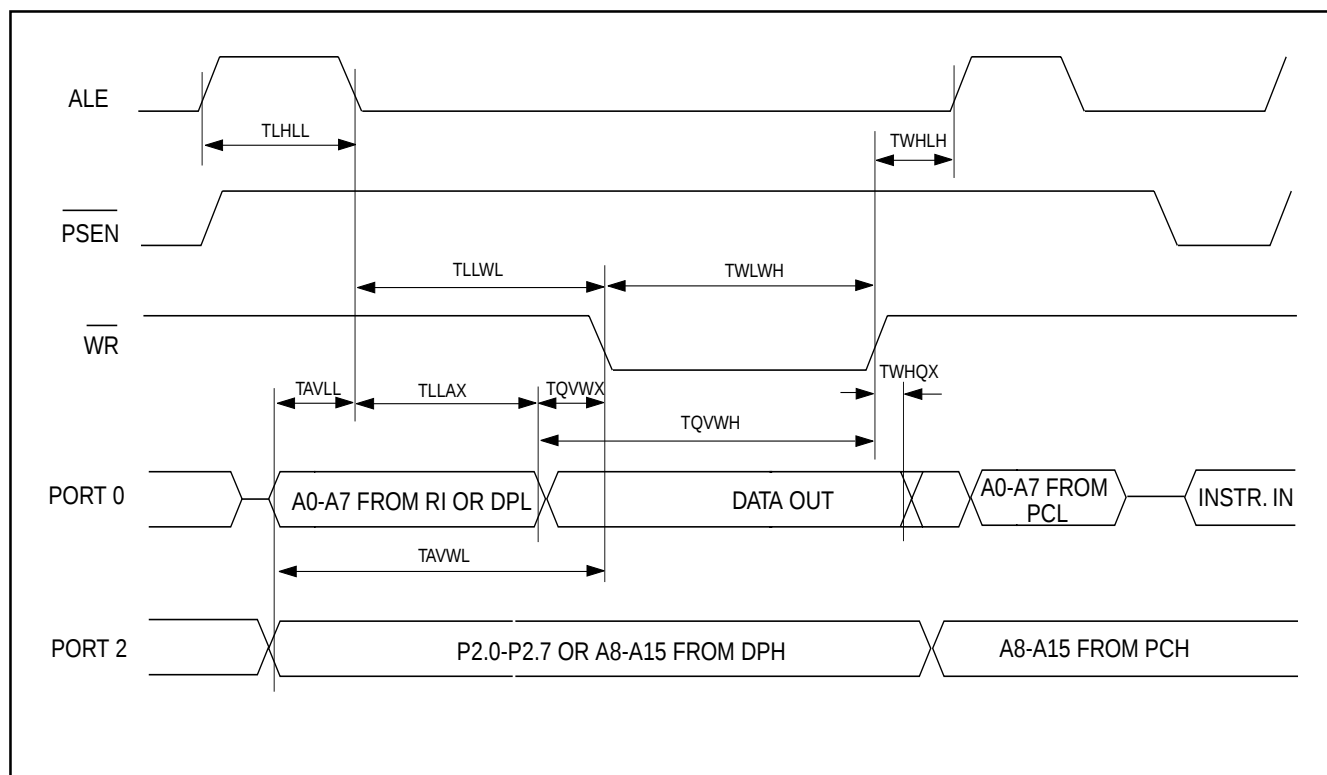
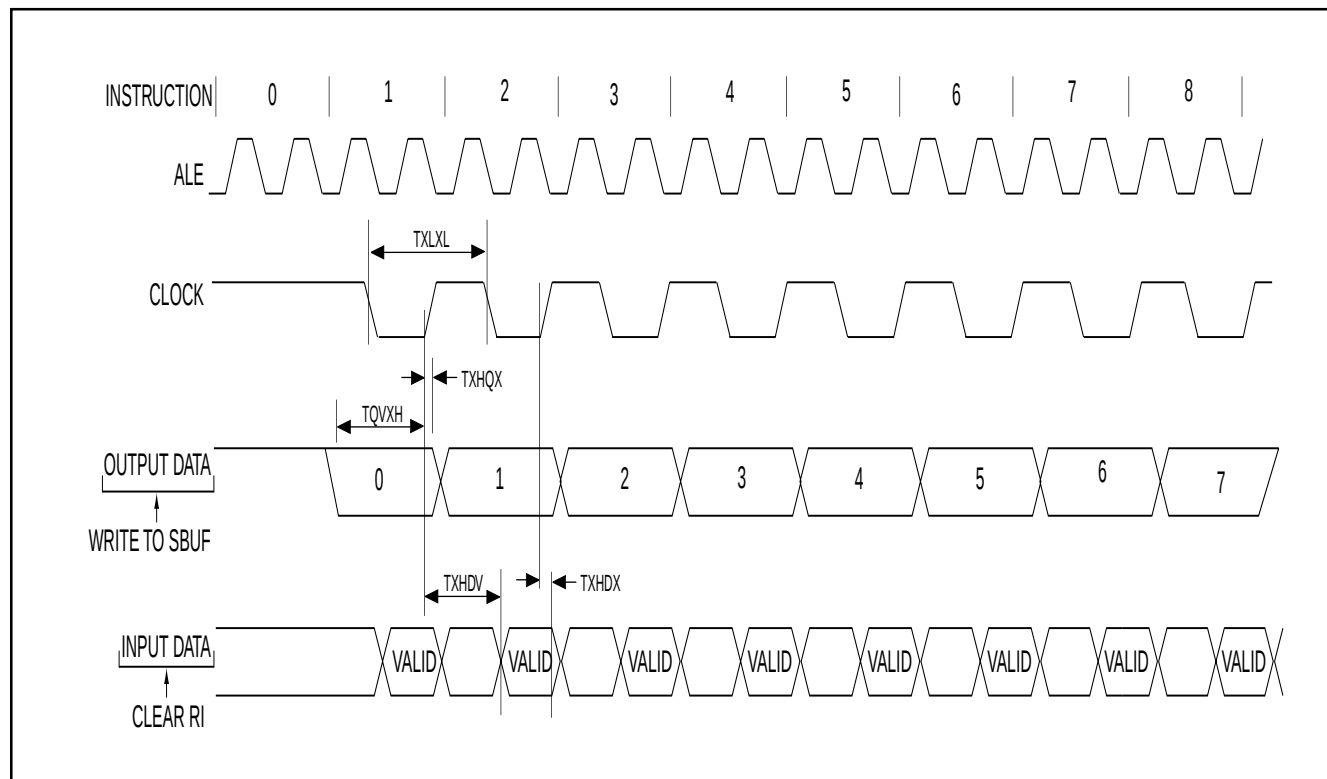
## AC TESTING INPUT, OUTPUT WAVEFORMS



## FLOAT WAVEFORM



**EXTERNAL PROGRAM MEMORY READ CYCLE**

**EXTERNAL DATA MEMORY READ CYCLE**


**EXTERNAL DATA MEMORY WRITE CYCLE**

**SHIFT REGISTER MODE TIMING WAVEFORMS**




**MX10FMAXDQC**

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## **MACRONIX INTERNATIONAL CO., LTD.**

**HEADQUARTERS:**

TEL: +886-3-578-8888

FAX: +886-3-578-8887

**EUROPE OFFICE:**

TEL: +32-2-456-8020

FAX: +32-2-456-8021

**JAPAN OFFICE:**

TEL: +81-44-246-9100

FAX: +81-44-246-9105

**SINGAPORE OFFICE:**

TEL: +65-747-2309

FAX: +65-748-4090

**TAIPEI OFFICE:**

TEL: +886-3-509-3300

FAX: +886-3-509-2200

**MACRONIX AMERICA, INC.**

TEL: +1-408-453-8088

FAX: +1-408-453-8488

**CHICAGO OFFICE:**

TEL: +1-847-963-1900

FAX: +1-847-963-1909

**[http : //www.macronix.com](http://www.macronix.com)**