



# 8755A 16,384-BIT EPROM WITH I/O

- 2048 Words x 8 Bits
- Single +5V Power Supply ( $V_{CC}$ )
- Directly Compatible with 8085AH
- U.V. Erasable and Electrically Reprogrammable
- Internal Address Latch
- 2 General Purpose 8-Bit I/O Ports
- Each I/O Port Line Individually Programmable as Input or Output
- Multiplexed Address and Data Bus
- 40-Pin DIP
- Available in EXPRESS
  - Standard Temperature Range
  - Extended Temperature Range

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The Intel 8755A is an erasable and electrically reprogrammable ROM (EPROM) and I/O chip to be used in the 8085AH microprocessor systems. The EPROM portion is organized as 2048 words by 8 bits. It has a maximum access time of 450 ns to permit use with no wait states in an 8085AH CPU.

The I/O portion consists of 2 general purpose I/O ports. Each I/O port has 8 port lines, and each I/O port line is individually programmable as input or output.

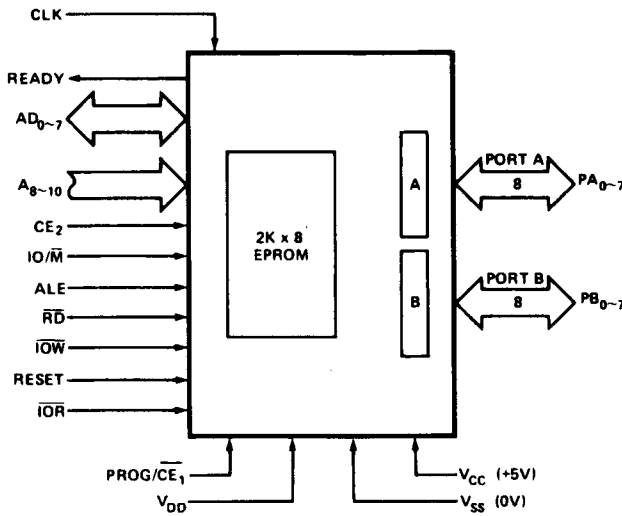


Figure 1. Block Diagram

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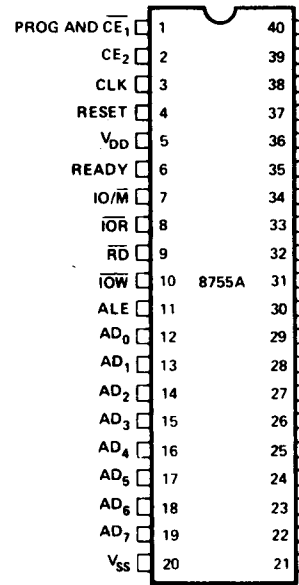


Figure 2. Pin Configuration

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Table 1. Pin Description

| Symbol                                     | Type | Name and Function  |
|--|------|--|
| ALE  | I    | <b>ADDRESS LATCH ENABLE:</b> When Address Latch Enable goes <i>high</i> , AD <sub>0-7</sub> , IO/ $\overline{M}$ , A <sub>8-10</sub> , CE <sub>2</sub> , and $\overline{CE}_1$ enter the address latches. The signals, (AD, IO/ $\overline{M}$ , AD <sub>8-10</sub> , CE <sub>2</sub> , $\overline{CE}_1$ ) are latched in at the trailing edge of ALE.  |
| AD <sub>0-7</sub>                          | I    | <b>BIDIRECTIONAL ADDRESS/DATA BUS:</b> The lower 8 bits of the PROM or I/O address are applied to the bus lines when ALE is high. During an I/O cycle, Port A or B is selected based on the latched value of AD <sub>0</sub> . If $\overline{RD}$ or $\overline{IOR}$ is low when the latched Chip Enables are active, the output buffers present data on the bus.   |
| AD <sub>8-10</sub>                         | I    | <b>ADDRESS BUS:</b> These are the high order bits of the PROM address. They do not affect I/O operations.  |
| PROG/ $\overline{CE}_1$<br>CE <sub>2</sub> | I    | <b>CHIP ENABLE INPUTS:</b> $\overline{CE}_1$ is active low and CE <sub>2</sub> is active high. The 8755A can be accessed only when <i>both</i> Chip Enables are active at the time the ALE signal latches them up. If either Chip Enable input is not active, the AD <sub>0-7</sub> , and READY outputs will be in a high impedance state. $\overline{CE}_1$ is also used as a programming pin. (See section on programming.)  |
| IO/ $\overline{M}$                         | I    | <b>I/O MEMORY:</b> If the latched IO/ $\overline{M}$ is high when $\overline{RD}$ is low, the output data comes from an I/O port. If it is low the output data comes from the PROM.  |
| $\overline{RD}$                            | I    | <b>READ:</b> If the latched Chip Enables are active when $\overline{RD}$ goes low, the AD <sub>0-7</sub> output buffers are enabled and output either the selected PROM location or I/O port. When both $\overline{RD}$ and $\overline{IOR}$ are high, the AD <sub>0-7</sub> output buffers are 3-stated.  |
| $\overline{IOW}$                           | I    | <b>I/O WRITE:</b> If the latched Chip Enables are active, a low on $\overline{IOW}$ causes the output port pointed to by the latched value of AD <sub>0</sub> to be written with the data on AD <sub>0-7</sub> . The state of IO/ $\overline{M}$ is ignored.   |
| CLK  | I    | <b>CLOCK:</b> The CLK is used to force the READY into its high impedance state after it has been forced low by $\overline{CE}_1$ low, CE <sub>2</sub> high, and ALE high.  |
| READY                                      | O    | <b>READY</b> is a 3-state output controlled by $\overline{CE}_1$ , CE <sub>2</sub> , ALE and CLK. READY is forced low when the Chip Enables are active during the time ALE is high, and remains low until the rising edge of the next CLK. (See Figure 6c.)  |
| PA <sub>0-7</sub>                          | I/O  | <b>PORT A:</b> These are general purpose I/O pins. Their input/output direction is determined by the contents of Data Direction Register (DDR). Port A is selected for write operations when the Chip Enables are active and $\overline{IOW}$ is low and a 0 was previously latched from AD <sub>0</sub> , AD <sub>1</sub> . Read Operation is selected by either $\overline{IOR}$ low and active Chip Enables and AD <sub>0</sub> and AD <sub>1</sub> low, or IO/ $\overline{M}$ high, $\overline{RD}$ low, active Chip Enables, and AD <sub>0</sub> and AD <sub>1</sub> low. |
| PB <sub>0-7</sub>                          | I/O  | <b>PORT B:</b> The general purpose I/O port is identical to Port A except that it is selected by a 1 latched from AD <sub>0</sub> and a 0 from AD <sub>1</sub> .   |
| RESET                                      | I    | <b>RESET:</b> In normal operation, an input high on RESET causes all pins in Ports A and B to assume input mode (clear DDR register).  |
| $\overline{IOR}$                           | I    | <b>I/O READ:</b> When the Chip Enables are active, a low on $\overline{IOR}$ will output the selected I/O port onto the AD bus. $\overline{IOR}$ low performs the same function as the combination of IO/ $\overline{M}$ high and $\overline{RD}$ low. When $\overline{IOR}$ is not used in a system, $\overline{IOR}$ should be tied to V <sub>CC</sub> ("1").  |
| V <sub>CC</sub>                            |      | <b>POWER:</b> +5V supply.  |
| V <sub>SS</sub>                            |      | <b>GROUND:</b> Reference.  |
| V <sub>DD</sub>                            |      | <b>POWER SUPPLY:</b> V <sub>DD</sub> is a programming voltage, and must be tied to V <sub>CC</sub> when the 8755A is being read. For programming, a high voltage is supplied with V <sub>DD</sub> = 25V, typical. (See section on programming.)  |

## FUNCTIONAL DESCRIPTION

### PROM Section

The 8755A contains an 8-bit address latch which allows it to interface directly to MCS<sup>®</sup>-48 and MCS<sup>®</sup>-85 processors without additional hardware.

The PROM section of the chip is addressed by the 11-bit address and the Chip Enables. The address,  $\overline{CE}_1$  and  $\overline{CE}_2$  are latched into the address latches on the falling edge of ALE. If the latched Chip Enables are active and  $\overline{IO/\overline{M}}$  is low when  $\overline{RD}$  goes low, the contents of the PROM location addressed by the latched address are put out on the  $AD_{0-7}$  lines (provided that  $V_{DD}$  is tied to  $V_{CC}$ ).

### I/O Section

The I/O section of the chip is addressed by the latched value of  $AD_{0-1}$ . Two 8-bit Data Direction Registers (DDR) in 8755A determine the input/output status of each pin in the corresponding ports. A "0" in a particular bit position of a DDR signifies that the corresponding I/O port bit is in the input mode. A "1" in a particular bit position signifies that the corresponding I/O port bit is in the output mode. In this manner the I/O ports of the 8755A are bit-by-bit programmable as inputs or outputs. The table summarizes port and DDR designation. DDR's cannot be read.

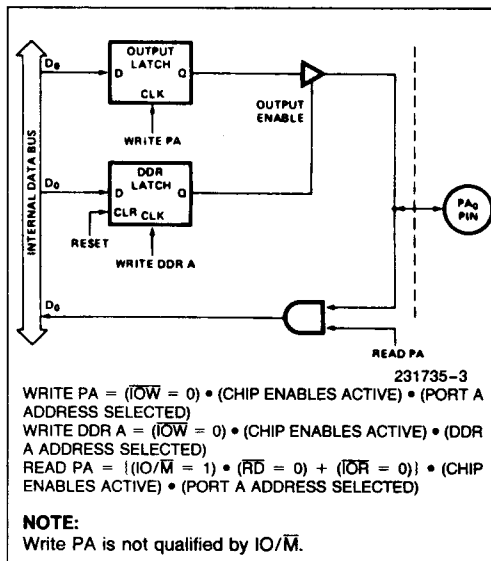
| $AD_1$ | $AD_0$ | Selection                              |
|--------|--------|--|
| 0      | 0      | Port A                                 |
| 0      | 1      | Port B                                 |
| 1      | 0      | Port A Data Direction Register (DDR A) |
| 1      | 1      | Port B Data Direction Register (DDR B) |

When  $\overline{IOW}$  goes low and the Chip Enables are active, the data on the  $AD_{0-7}$  is written into I/O port selected by the latched value of  $AD_{0-1}$ . During this operation all I/O bits of the selected port are affected, regardless of their I/O mode and the state of  $\overline{IO/\overline{M}}$ . The actual output level does not change until  $\overline{IOW}$  returns high. (Glitch free output.)

A port can be read out when the latched Chip Enables are active and either  $\overline{RD}$  goes low with  $\overline{IO/\overline{M}}$  high, or  $\overline{IOR}$  goes low. Both input and output mode bits of a selected port will appear on lines  $AD_{0-7}$ .

To clarify the function of the I/O Ports and Data Direction Registers, the following diagram shows the configuration of one bit of PORT A and DDR A. The same logic applies to PORT B and DDR B.

### 8755A ONE BIT OF PORT A AND DDR A



Note that hardware RESET or writing a zero to the DDR latch will cause the output latch's output buffer to be disabled, preventing the data in the Output Latch from being passed through to the pin. This is equivalent to putting the port in the input mode. Note also that the data can be written to the Output Latch even though the Output Buffer has been disabled. This enables a port to be initialized with a value prior to enabling the output.

The diagram also shows that the contents of PORT A and PORT B can be read even when the ports are configured as outputs.

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## ERASURE CHARACTERISTICS

The erasure characteristics of the 8755A are such that erasure begins to occur when exposed to light with wavelengths shorter than approximately 4000 Angstroms ( $\text{\AA}$ ). It should be noted that sunlight and certain types of fluorescent lamps have wavelengths in the 3000–4000 $\text{\AA}$  range. Data show that constant exposure to room level fluorescent lighting could erase the typical 8755A in approximately 3 years while it would take approximately 1 week to cause erasure when exposed to direct sunlight. If the 8755A is to be exposed to these types of lighting conditions for extended periods of time, opaque labels are available from Intel which should be placed over the 8755A window to prevent unintentional erasure.

The recommended erasure procedure for the 8755A is exposure to shortwave ultraviolet light which has a wavelength of 2537 Angstroms ( $\text{\AA}$ ). The integrated dose (i.e., UV intensity x exposure time) for erasure should be a minimum of 15W-sec/cm<sup>2</sup>. The erasure time with this dosage is approximately 15 to 20 minutes using an ultraviolet lamp with a 12000  $\mu\text{W}/\text{cm}^2$  power rating. The 8755A should be placed within one inch from the lamp tubes during erasure. Some lamps have a filter on their tubes and this filter should be removed before erasure.

## PROGRAMMING

Initially, and after each erasure, all bits of the EPROM portions of the 8755A are in the "1" state. Information is introduced by selectively programming "0" into the desired bit locations. A programmed "0" can only be changed to a "1" by UV erasure.

The 8755A can be programmed on the Intel Universal Programmer (iUP), and iUPF8744A programming module.

The program mode itself consists of programming a single address at a time, giving a single 50 msec pulse for every address. Generally, it is desirable to have a verify cycle after a program cycle for the same address as shown in the attached timing diagram. In the verify cycle (i.e., normal memory read cycle) 'V<sub>DD</sub>' should be at +5V.

## SYSTEM APPLICATIONS

### System Interface with 8085AH

A system using the 8755A can use either one of the two I/O Interface techniques:

- Standard I/O
- Memory Mapped I/O

If a standard I/O technique is used, the system can use the feature of both  $\overline{\text{CE}}_2$  and  $\overline{\text{CE}}_1$ . By using a combination of unused address lines  $A_{11-15}$  and the Chip Enable inputs, the 8085AH system can use up to 5 8755A's without requiring a CE decoder. See Figure 4.

If a memory mapped I/O approach is used the 8755A will be selected by the combination of both the Chip Enables and  $\text{IO}/\overline{\text{M}}$  using  $\text{AD}_{8-15}$  address lines. See Figure 3.

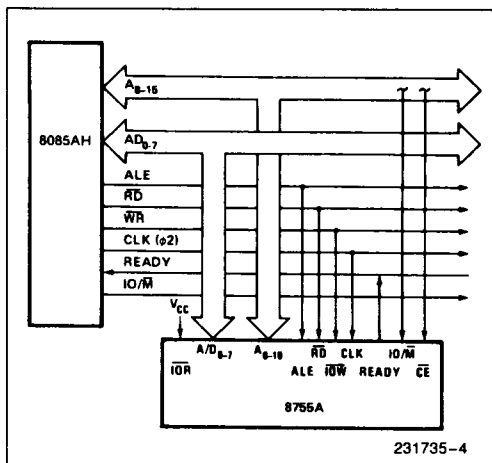
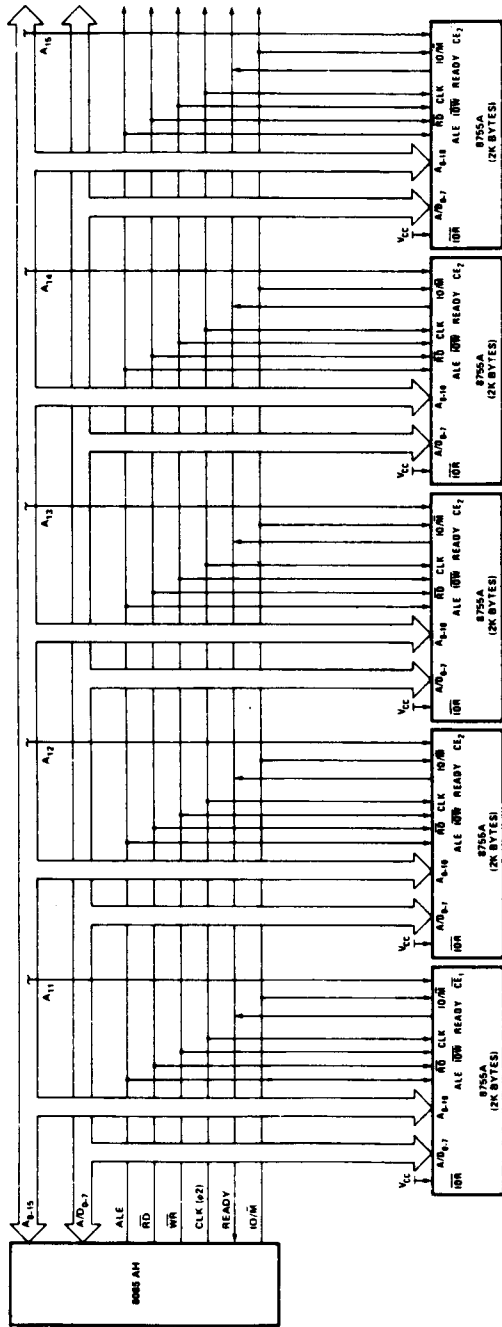


Figure 3. 8755A in 8085AH System  
(Memory-Mapped I/O)



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**NOTE:** Use  $\overline{CE}_1$  for the first 8755A in the system, and  $\overline{CE}_2$  for the other 8755A's in a system without CE decoder.

Figure 4. 8755A in 8085AH System (Standard I/O)

## ABSOLUTE MAXIMUM RATINGS\*

Temperature Under Bias ..... 0°C to +70°C  
 Storage Temperature ..... -65°C to +150°C  
 Voltage on any Pin  
   with Respect to Ground ..... -0.5V to +7V  
 Power Dissipation ..... 1.5W

NOTICE: This is a production data sheet. The specifications are subject to change without notice.

*\*WARNING: Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability.*

## D.C. CHARACTERISTICS

$T_A = 0^\circ\text{C to } 70^\circ\text{C}$ ,  $V_{CC} = V_{DD} = 5V \pm 5\%$

| Symbol    | Parameter                   | Min  | Max            | Unit          | Test Conditions                  |
|-----------|-----------------------------|------|----------------|---------------|----------------------------------|
| $V_{IL}$  | Input Low Voltage           | -0.5 | 0.8            | V             | $V_{CC} = 5.0V$                  |
| $V_{IH}$  | Input High Voltage          | 2.0  | $V_{CC} + 0.5$ | V             | $V_{CC} = 5.0V$                  |
| $V_{OL}$  | Output Low Voltage          |      | 0.45           | V             | $I_{OL} = 2\text{ mA}$           |
| $V_{OH}$  | Output High Voltage         | 2.4  |                | V             | $I_{OH} = -400\ \mu\text{A}$     |
| $I_{IL}$  | Input Leakage               |      | 10             | $\mu\text{A}$ | $V_{SS} \leq V_{IN} \leq V_{CC}$ |
| $I_{LO}$  | Output Leakage Current      |      | $\pm 10$       | $\mu\text{A}$ | $0.45V \leq V_{OUT} \leq V_{CC}$ |
| $I_{CC}$  | $V_{CC}$ Supply Current     |      | 180            | mA            |                                  |
| $I_{DD}$  | $V_{DD}$ Supply Current     |      | 30             | mA            | $V_{DD} = V_{CC}$                |
| $C_{IN}$  | Capacitance of Input Buffer |      | 10             | pF            | $f_C = 1\ \mu\text{Hz}$          |
| $C_{I/O}$ | Capacitance of I/O Buffer   |      | 15             | pF            | $f_C = 1\ \mu\text{Hz}$          |

## D.C. CHARACTERISTICS—PROGRAMMING

$T_A = 0^\circ\text{C to } 70^\circ\text{C}$ ,  $V_{CC} = 5V \pm 5\%$ ,  $V_{SS} = 0V$ ,  $V_{DD} = 25V \pm 1V$

| Symbol   | Parameter                                   | Min | Typ | Max | Unit |
|----------|---|-----|-----|-----|------|
| $V_{DD}$ | Programming Voltage (during Write to EPROM) | 24  | 25  | 26  | V    |
| $I_{DD}$ | Prog Supply Current                         |     | 15  | 30  | mA   |

**A.C. CHARACTERISTICS**
 $T_A = 0^{\circ}\text{C to } 70^{\circ}\text{C}, V_{CC} = 5\text{V} \pm 5\%$ 

| Symbol     | Parameter                               | 8755A |     | Unit |
|------------|---|-------|-----|------|
|            |   | Min   | Max |      |
| $t_{CYC}$  | Clock Cycle Time                        | 320   |     | ns   |
| $T_1$      | CLK Pulse Width                         | 80    |     | ns   |
| $T_2$      | CLK Pulse Width                         | 120   |     | ns   |
| $t_r, t_f$ | CLK Rise and Fall Time                  |       | 30  | ns   |
| $t_{AL}$   | Address to Latch Set Up Time            | 50    |     | ns   |
| $t_{LA}$   | Address Hold Time after Latch           | 80    |     | ns   |
| $t_{LC}$   | Latch to READ/WRITE Control             | 100   |     | ns   |
| $t_{RD}$   | Valid Data Out Delay from READ Control* |       | 170 | ns   |
| $t_{AD}$   | Address Stable to Data Out Valid**      |       | 450 | ns   |
| $t_{LL}$   | Latch Enable Width                      | 100   |     | ns   |
| $t_{RDF}$  | Data Bus Float after READ               | 0     | 100 | ns   |
| $t_{CL}$   | READ/WRITE Control to Latch Enable      | 20    |     | ns   |
| $t_{CC}$   | READ/WRITE Control Width                | 250   |     | ns   |
| $t_{DW}$   | Data in Write Set Up Time               | 150   |     | ns   |
| $t_{WD}$   | Data in Hold Time after WRITE           | 30    |     | ns   |
| $t_{WP}$   | WRITE to Port Output                    |       | 400 | ns   |
| $t_{PR}$   | Port Input Set Up Time                  | 50    |     | ns   |
| $t_{RP}$   | Port Input Hold Time to Control         | 50    |     | ns   |
| $t_{RYH}$  | READY HOLD Time to Control              | 0     | 160 | ns   |
| $t_{ARY}$  | ADDRESS (CE) to READY                   |       | 160 | ns   |
| $t_{RV}$   | Recovery Time between Controls          | 300   |     | ns   |
| $t_{RDE}$  | READ Control to Data Bus Enable         | 10    |     | ns   |

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**NOTES:**
 $C_{LOAD} = 150\text{ pF}$ .

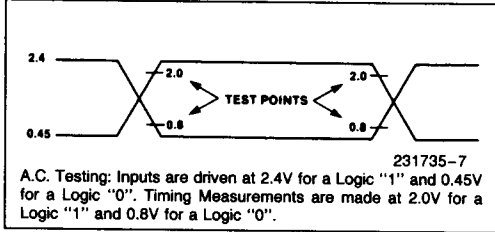
 \*Or  $T_{AD} - (T_{AL} + T_{LC})$ , whichever is greater.

 \*\*Defines ALE to Data Out Valid in conjunction with  $T_{AL}$ .

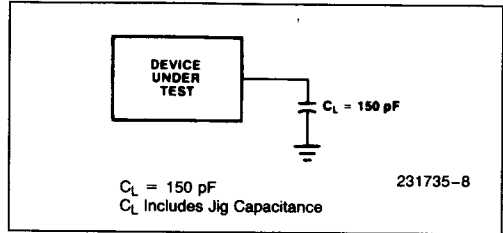
**A.C. CHARACTERISTICS—PROGRAMMING**
 $T_A = 0^{\circ}\text{C to } 70^{\circ}\text{C}, V_{CC} = 5\text{V} \pm 5\%, V_{SS} = 0\text{V}, V_{DD} = 25\text{V} \pm 1\text{V}$ 

| Symbol    | Parameter             | Min  | Typ | Max | Unit          |
|-----------|-----------------------|------|-----|-----|---------------|
| $t_{PS}$  | Data Setup Time       | 10   |     |     | ns            |
| $t_{PD}$  | Data Hold Time        | 0    |     |     | ns            |
| $t_S$     | Prog Pulse Setup Time | 2    |     |     | $\mu\text{s}$ |
| $t_H$     | Prog Pulse Hold Time  | 2    |     |     | $\mu\text{s}$ |
| $t_{PR}$  | Prog Pulse Rise Time  | 0.01 | 2   |     | $\mu\text{s}$ |
| $t_{PF}$  | Prog Pulse Fall Time  | 0.01 | 2   |     | $\mu\text{s}$ |
| $t_{PRG}$ | Prog Pulse Width      | 45   | 50  |     | ms            |

**A.C. TESTING INPUT, OUTPUT WAVEFORM**

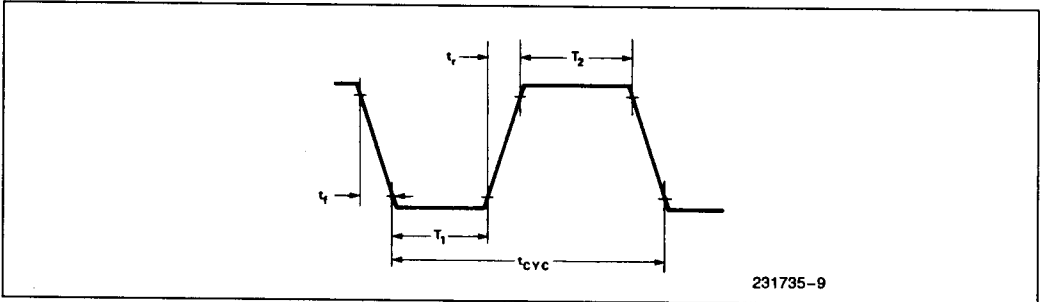


**A.C. TESTING LOAD CIRCUIT**

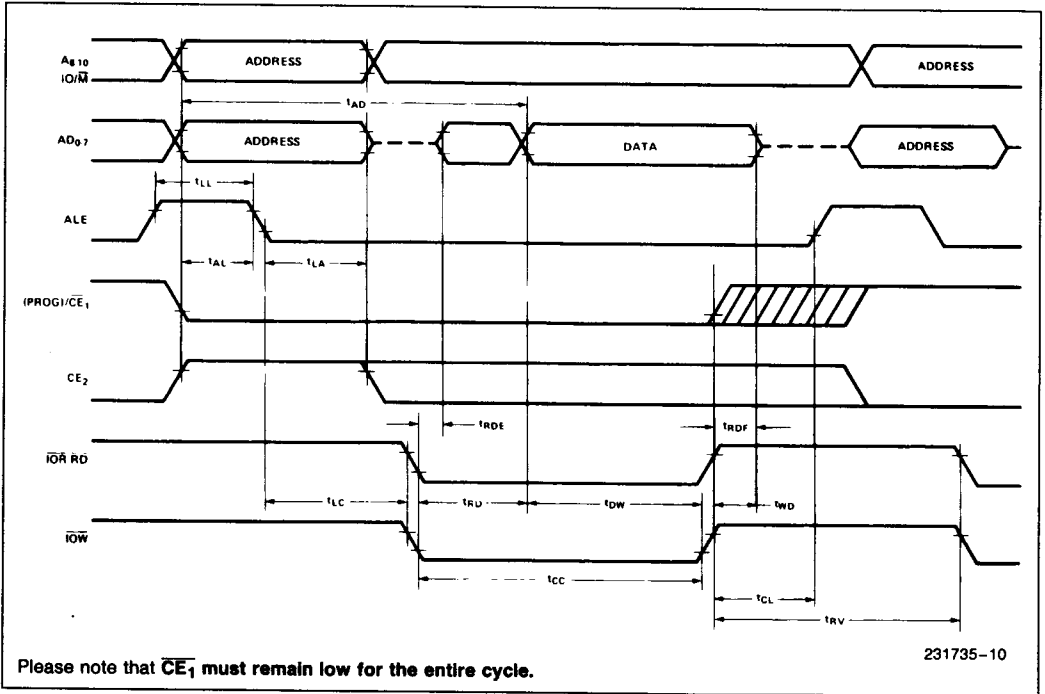


**WAVEFORMS**

**CLOCK SPECIFICATION FOR 8755A**



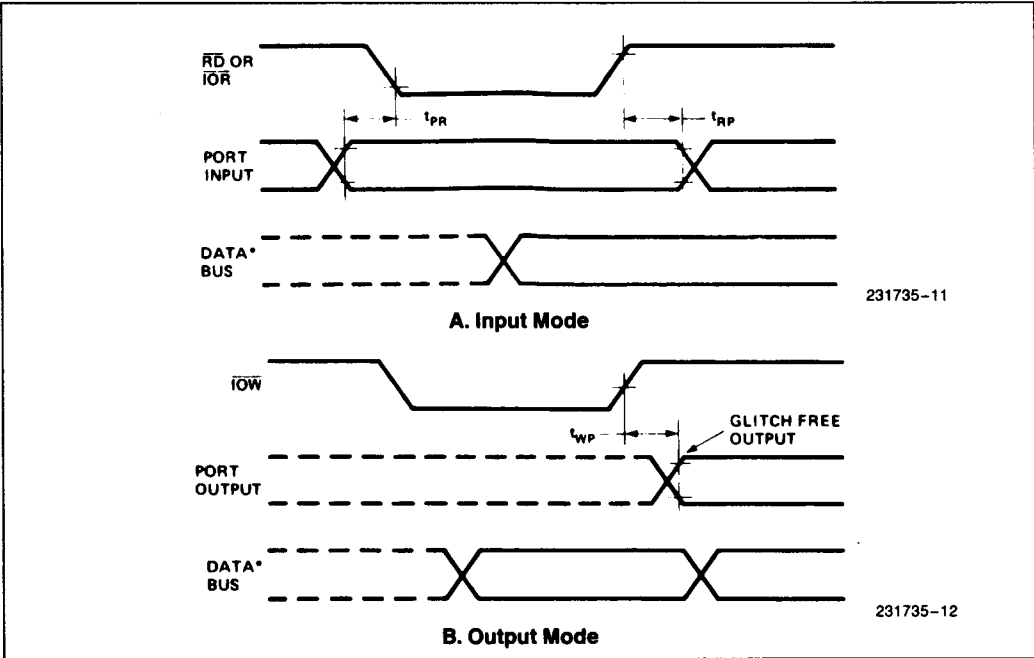
**PROM READ, I/O READ AND WRITE**





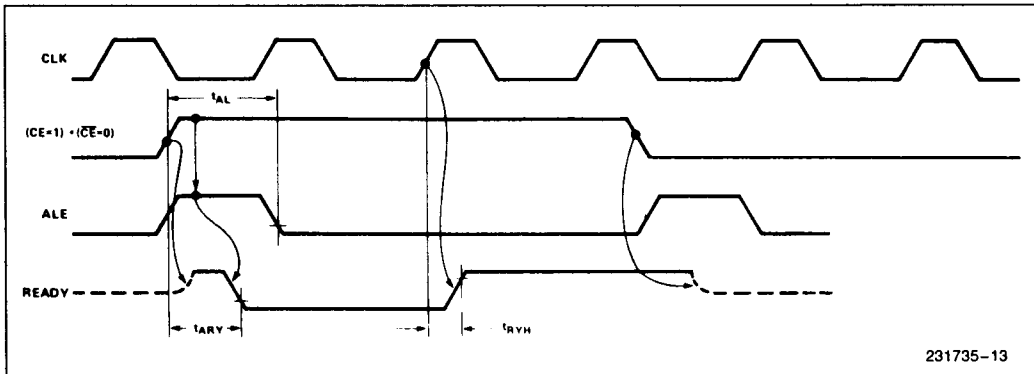
WAVEFORMS (Continued)

I/O PORT



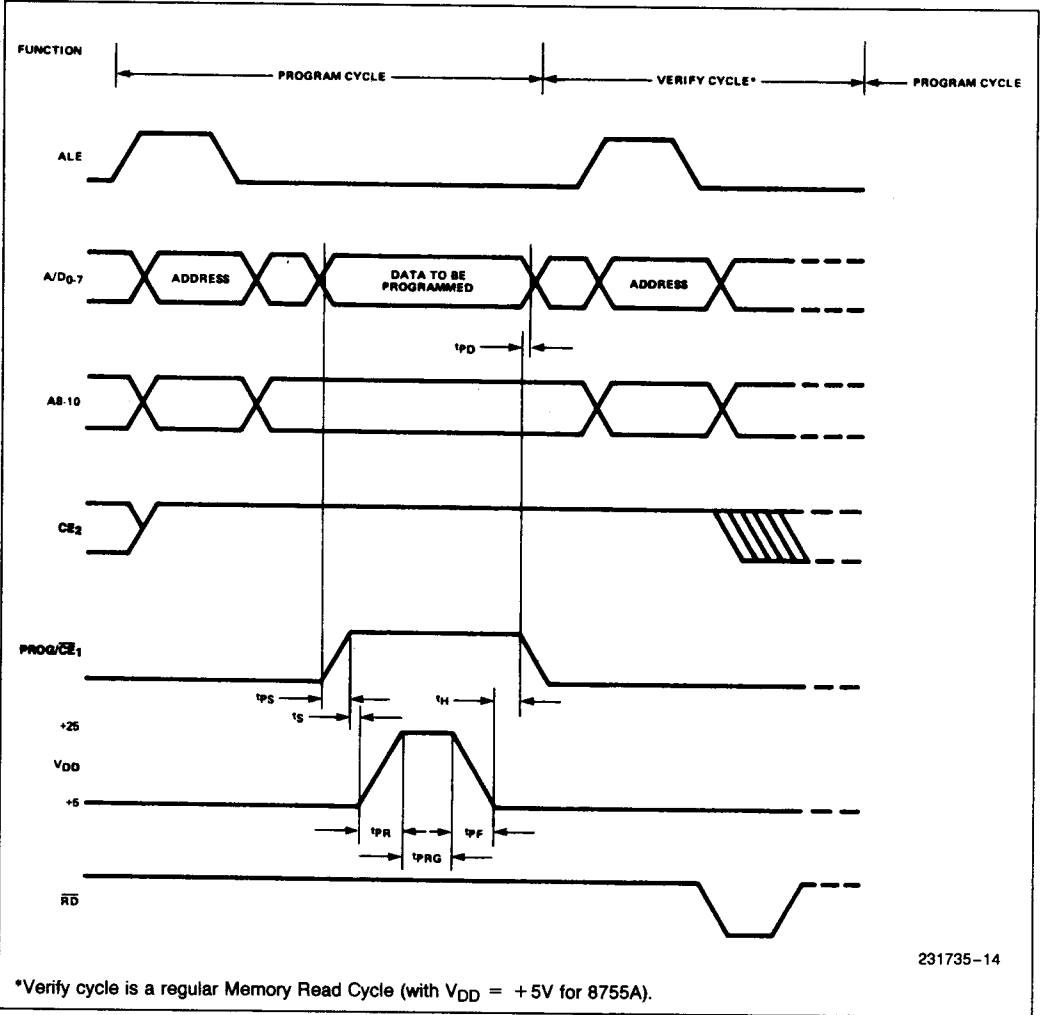
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WAIT STATE (READY = 0)



WAVEFORMS (Continued)

8755A PROGRAM MODE



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