FINAL

Am27X4096

4 Megabit (262,144 x 16-Bit) CMOS ExpressROM™ Device

Advanced Micro Devices

- **As an OTP EPROM alternative:**
  - — Factory optimized programming
  - — Fully tested and guaranteed
- **As a Mask ROM alternative:**
  - — Shorter leadtime
  - — Lower volume per code
- **Fast access time**
  - — 120 ns
- **Single +5 V power supply**
- **Compatible with JEDEC-approved EPROM pinout**
- **±10% power supply tolerance**
- **High noise immunity**
- **Low power dissipation**
  - — 100 µA maximum CMOS standby current
- **Available in Plastic Dual In-Line Package (PDIP) and Plastic Leaded Chip Carrier (PLCC)**
- **Latch-up protected to 100 mA from –1 V to Vcc +1 V**
- **Versatile features for simple interfacing**
  - — Both CMOS and TTL input/output compatibility
  - — Two line control functions

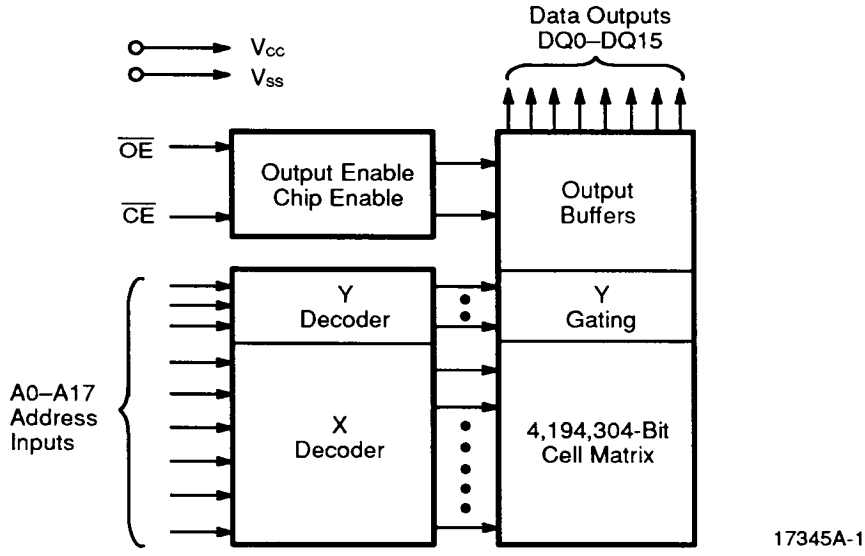
GENERAL DESCRIPTION

The Am27X4096 is a factory programmed and tested OTP EPROM. It is programmed after packaging prior to final test. Every device is rigorously tested under AC and DC operating conditions to your stable code. It is organized as 262,144 by 16 bits and is available in plastic dual in-line (PDIP) as well as plastic leaded chip carrier (PLCC) packages. ExpressROM devices provide a board-ready memory solution for medium to high volume codes with short leadtimes. This offers manufacturers a cost-effective and flexible alternative to OTP EPROMs and mask programmed ROMs.

Access times as fast as 120 ns allow operation with high-performance microprocessors with reduced WAIT states. The Am27X4096 offers separate Output Enable ($\overline{OE}$) and Chip Enable ($\overline{CE}$) controls, thus eliminating bus contention in a multiple bus microprocessor system.

AMD's CMOS process technology provides high speed, low power, and high noise immunity. Typical power consumption is only 150 mW in active mode, and 100 µW in standby mode.

BLOCK DIAGRAM



17345A-1

Publication# 17345 Rev. A Amendment/0
Issue Date: July 1993

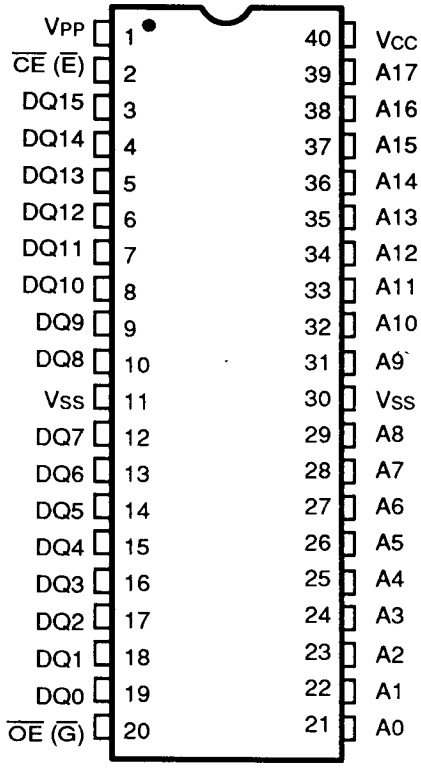
PRODUCT SELECTOR GUIDE

Family Part No	Am27X4096			
Ordering Part No:				
V_{CC} ±5%	-125			-255
V_{CC} ±10%	-120	-150	-200	
Max Access Time (ns)	120	150	200	250
$\overline{CE}$ ($\overline{E}$) Access (ns)	120	150	200	250
$\overline{OE}$ ($\overline{G}$) Access (ns)	50	65	75	100

CONNECTION DIAGRAMS

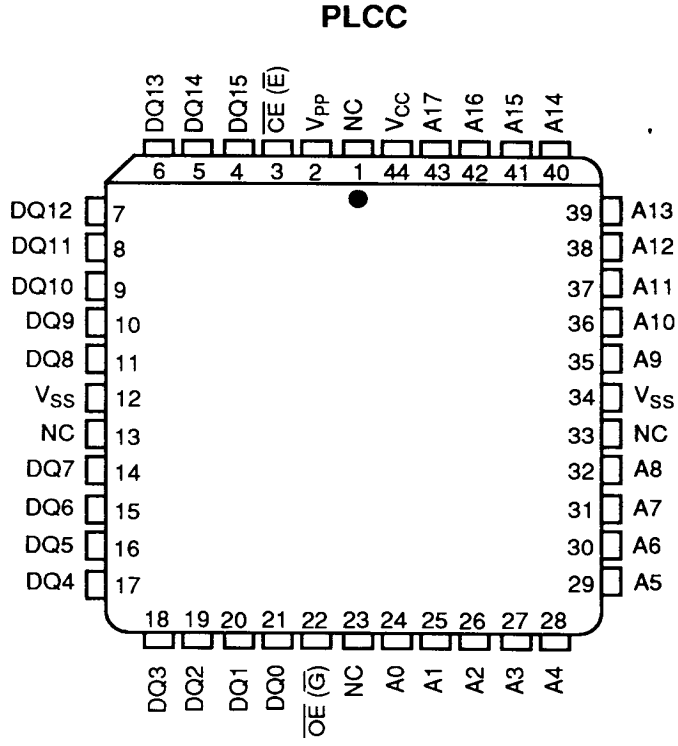
Top View

PDIP



17345A-2

PLCC



17345A-3

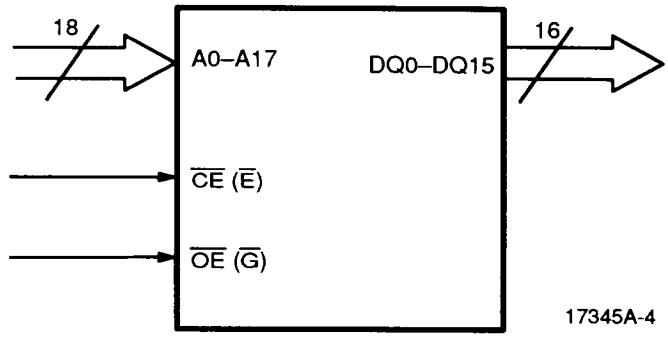
Note:

1. JEDEC nomenclature is in parentheses.

PIN DESIGNATIONS

A0–A17	=	Address Inputs
$\overline{CE}$ ($\overline{E}$)	=	Chip Enable Input
DQ0–DQ15	=	Data Inputs/Outputs
DU	=	No External Connection (Do Not Use)
NC	=	No Internal Connection
$\overline{OE}$ ($\overline{G}$)	=	Output Enable Input
V_{CC}	=	V_{CC} Supply Voltage
V_{PP}	=	Program Supply Voltage
V_{SS}	=	Ground

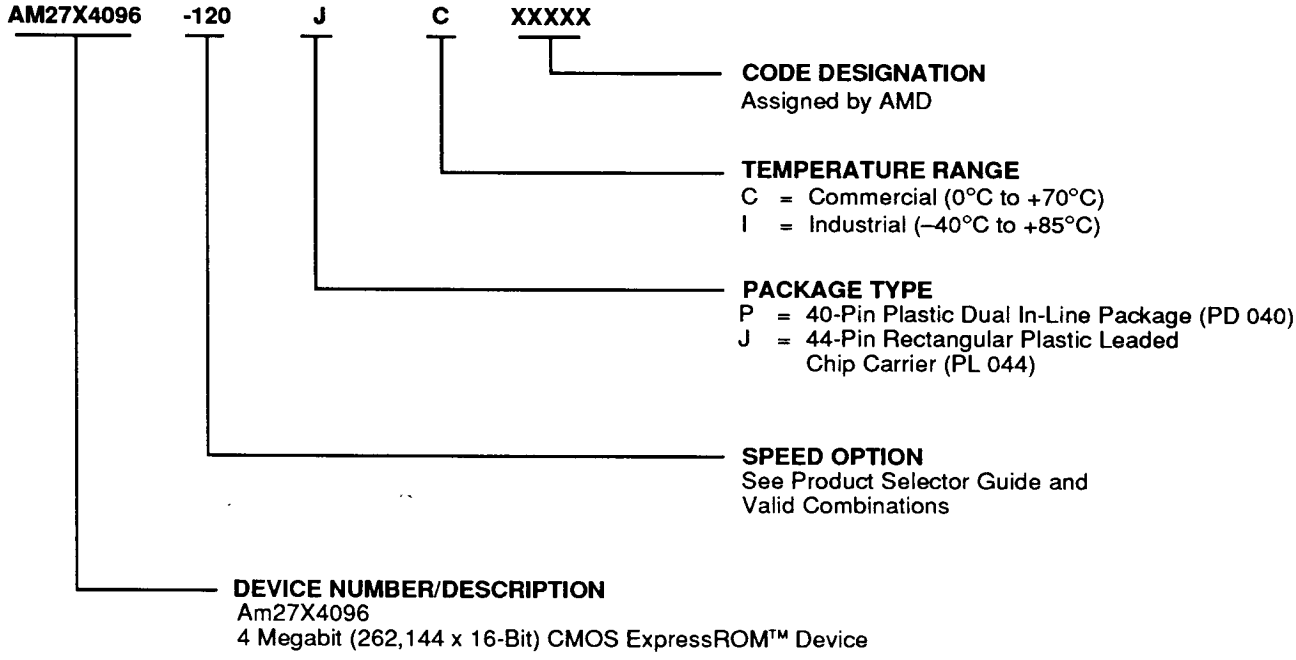
LOGIC SYMBOL



17345A-4

ORDERING INFORMATION
Standard Products

AMD standard products are available in several packages and operating ranges. The ordering number (Valid Combination) is formed by a combination of:



Valid Combinations	
AM27X4096-120	PC, JC, PI, JI
AM27X4096-125	
AM27X4096-150	
AM27X4096-200	
AM27X4096-255	

Valid Combinations

Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations and to check on newly released combinations.

FUNCTIONAL DESCRIPTION

Read Mode

The Am27X4096 has two control functions, both of which must be logically satisfied in order to obtain data at the outputs. Chip Enable ($\overline{CE}$) is the power control and should be used for device selection. Output Enable ($\overline{OE}$) is the output control and should be used to gate data to the output pins, independent of device selection. Assuming that addresses are stable, address access time (t_{ACC}) is equal to the delay from $\overline{CE}$ to output (t_{CE}). Data is available at the outputs t_{OE} after the falling edge of $\overline{OE}$, assuming that $\overline{CE}$ has been LOW and addresses have been stable for at least $t_{ACC}-t_{OE}$.

Standby Mode

The Am27X4096 has a CMOS standby mode which reduces the maximum V_{CC} current to 100 µA. It is placed in CMOS-standby when $\overline{CE}$ is at V_{CC} ± 0.3 V. The Am27X4096 also has a TTL-standby mode which reduces the maximum V_{CC} current to 1.0 mA. It is placed in TTL-standby when $\overline{CE}$ is at V_{IH}. When in standby mode, the outputs are in a high-impedance state, independent of the $\overline{OE}$ input.

Output OR-Tieing

To accommodate multiple memory connections, a two-line control function is provided to allow for:

- Low memory power dissipation
- Assurance that output bus contention will not occur

It is recommended that $\overline{CE}$ be decoded and used as the primary device-selecting function, while $\overline{OE}$ be made a common connection to all devices in the array and connected to the READ line from the system control bus. This assures that all deselected memory devices are in their low-power standby mode and that the output pins are only active when data is desired from a particular memory device.

System Applications

During the switch between active and standby conditions, transient current peaks are produced on the rising and falling edges of Chip Enable. The magnitude of these transient current peaks is dependent on the output capacitance loading of the device. At a minimum, a 0.1 µF ceramic capacitor (high frequency, low inherent inductance) should be used on each device between V_{CC} and V_{SS} to minimize transient effects. In addition, to overcome the voltage drop caused by the inductive effects of the printed circuit board traces on ExpressROM device arrays, a 4.7 µF bulk electrolytic capacitor should be used between V_{CC} and V_{SS} for each eight devices. The location of the capacitor should be close to where the power supply is connected to the array.

MODE SELECT TABLE

Mode \ Pins	$\overline{CE}$	$\overline{OE}$	V_{PP}	Outputs
Read	V_{IL}	V_{IL}	X	DOUT
Output Disable	X	V_{IH}	X	Hi-Z
Standby (TTL)	V_{IH}	X	X	Hi-Z
Standby (CMOS)	V_{CC} ± 0.3 V	X	X	Hi-Z

Note:

1. X = Either V_{IH} or V_{IL}

ABSOLUTE MAXIMUM RATINGS

Storage Temperature
- OTP Products . . . . . –65°C to +125°C
- All Other Products . . . . . –65°C to +150°C

Ambient Temperature with Power Applied . . . . . –55°C to +125°C

Voltage with Respect to V_{SS}
- All pins except V_{CC} . . . . . –0.6 V to V_{CC} + 0.6 V
- V_{CC} . . . . . –0.6 V to +7.0 V

Note:

1. *Minimum DC voltage on input or I/O pins is –0.5 V. During transitions, the inputs may overshoot V_{SS} to –2.0 V for periods of up to 20 ns. Maximum DC voltage on input and I/O pins is V_{CC} + 0.5 V which may overshoot to V_{CC} + 2.0 V for periods up to 20 ns.*

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure of the device to absolute maximum rating conditions for extended periods may affect device reliability.

OPERATING RANGES

Commercial (C) Devices

Case Temperature (T_C) . . . . . 0°C to +70°C

Industrial (I) Devices

Case Temperature (T_C) . . . . . –40°C to +85°C

Supply Read Voltages

V_{CC} for Am27X4096-XX5 . . . . +4.75 V to +5.25 V

V_{CC} for Am27X4096-XX0 . . . . +4.50 V to +5.50 V

Operating ranges define those limits between which the functionality of the device is guaranteed.

DC CHARACTERISTICS over operating range unless otherwise specified (Notes 1, 2 and 4)

Parameter Symbol	Parameter Description	Test Conditions	Min	Max	Unit
V_{OH}	Output HIGH Voltage	$I_{OH} = -400\ \mu A$	2.4		V
V_{OL}	Output LOW Voltage	$I_{OL} = 2.1$ mA		0.45	V
V_{IH}	Input HIGH Voltage		2.0	$V_{CC} + 0.5$	V
V_{IL}	Input LOW Voltage		–0.5	+0.8	V
I_{LI}	Input Load Current	$V_{IN} = 0$ V to $+V_{CC}$		1.0	µA
I_{LO}	Output Leakage Current	$V_{OUT} = 0$ V to $+V_{CC}$		5.0	µA
I_{CC1}	V_{CC} Active Current (Note 3)	$\overline{CE} = V_{IL}$, f = 5 MHz, $I_{OUT} = 0$ mA		50	mA
I_{CC2}	V_{CC} TTL Standby Current	$\overline{CE} = V_{IH}$		1.0	mA
I_{CC3}	V_{CC} CMOS Standby Current	$\overline{CE} = V_{CC} \pm 0.3$ V		100	µA

Notes:

1. *V_{CC} must be applied simultaneously or before V_{PP}, and removed simultaneously or after V_{PP}.*
2. ***Caution:** The Am27X4096 must not be removed from (or inserted into) a socket when V_{CC} or V_{PP} is applied.*
3. *I_{CC1} is tested with $\overline{OE} = V_{IH}$ to simulate open outputs.*
4. *Minimum DC Input Voltage is –0.5 V during transactions, the inputs may overshoot to –2.0 V for periods less than 20 ns. Maximum DC Voltage on output pins is V_{CC} +0.5 V, which may overshoot to V_{CC} +2.0 V for periods less than 20 ns.*

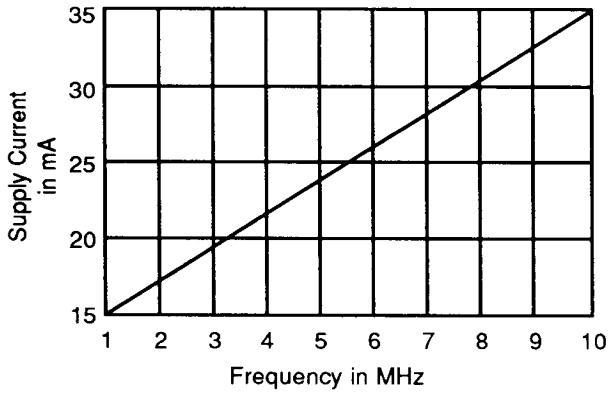


Figure 1. Typical Supply Current vs. Frequency
V_{CC} = 5.5 V, T = 25°C

17345A-5

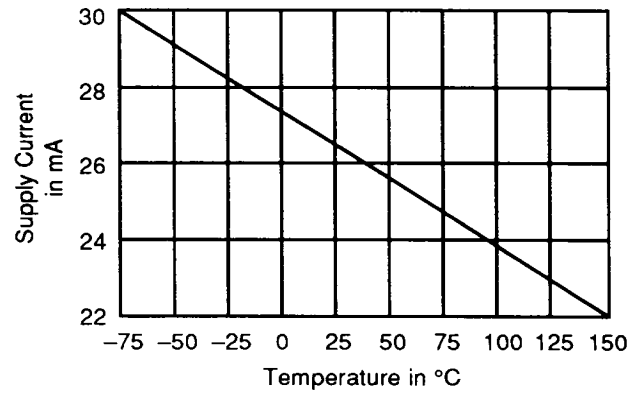


Figure 2. Typical Supply Current vs. Temperature
V_{CC} = 5.5 V, f = 5 MHz

17345A-6

CAPACITANCE

Parameter Symbol	Parameter Description	Test Conditions	PD 040		PL 044		Unit
			Typ	Max	Typ	Max	
C_{IN}	Input Capacitance	V_{IN} = 0 V	6	8	10	13	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0 V	8	10	12	14	pF

Notes:

1. *This parameter is only sampled and not 100% tested.*
2. *T_A = +25°C, f = 1 MHz.*

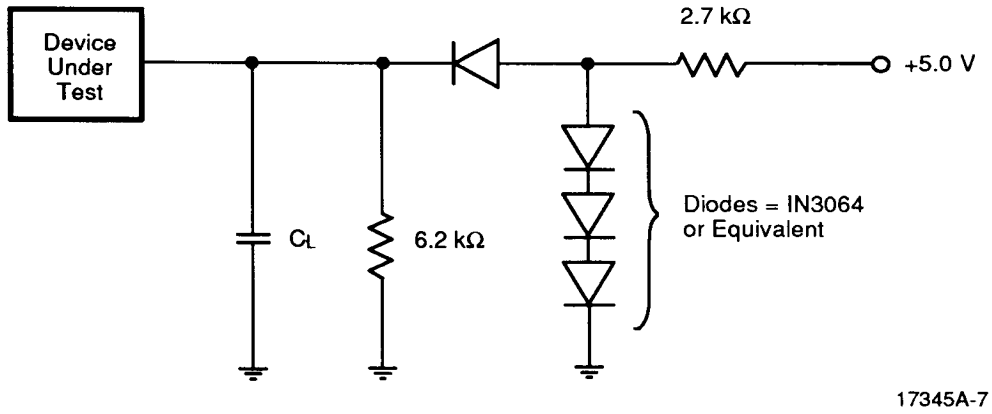
SWITCHING CHARACTERISTICS over operating range unless otherwise specified (Notes 1, 3 and 4)

Parameter Symbols		Parameter Description	Test Conditions		Am27X4096				Unit
JEDEC	Standard				-125 -120	-150	-200	-255	
t_{AVQV}	t_{RCC}	Address to Output Delay	$\overline{CE}$ = $\overline{OE}$ = V_{IL}	Min	–	–	–	–	ns
				Max	120	150	200	250	
t_{ELQV}	t_{CE}	Chip Enable to Output Delay	$\overline{OE}$ = V_{IL}	Min	–	–	–	–	ns
				Max	120	150	200	250	
t_{GLQV}	t_{OE}	Output Enable to Output Delay	$\overline{CE}$ = V_{IL}	Min	–	–	–	–	ns
				Max	50	55	60	60	
t_{EHQZ} t_{GHQZ}	t_{DF} (Note 2)	Chip Enable HIGH or Output Enable HIGH, whichever comes first, to Output Float		Min	0	0	0	0	ns
				Max	40	40	40	60	
t_{AXQX}	t_{OH}	Output Hold from Addresses, $\overline{CE}$, or $\overline{OE}$, whichever occurred first		Min	0	0	0	0	ns
				Max	–	–	–	–	

Notes:

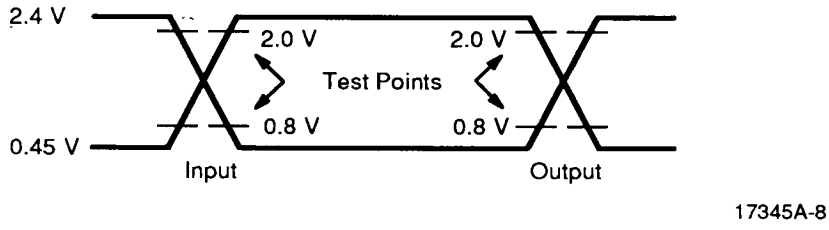
1. *V_{CC} must be applied simultaneously or before V_{PP}, and removed simultaneously or after V_{PP}.*
2. *This parameter is only sampled and not 100% tested.*
3. ***Caution:** The Am27X4096 must not be removed from (or inserted into) a socket or board when V_{PP} or V_{CC} is applied.*
4. *Output Load: 1 TTL gate and C_L = 100 pF*
   Input Rise and Fall Times: 20 ns
   Input Pulse Levels: 0.45 V to 2.4 V
   Timing Measurement Reference Level: 0.8 V and 2 V for inputs and outputs

SWITCHING TEST CIRCUIT



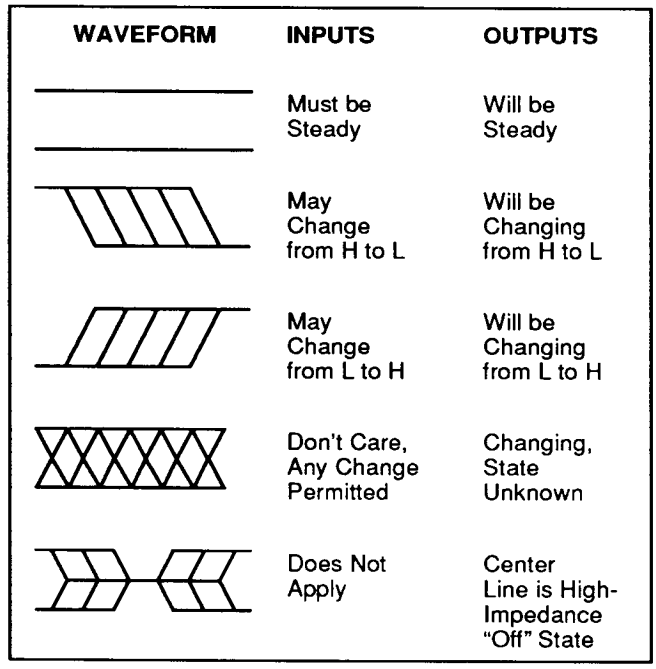
C_L = 100 pF including jig capacitance

SWITCHING TEST WAVEFORM



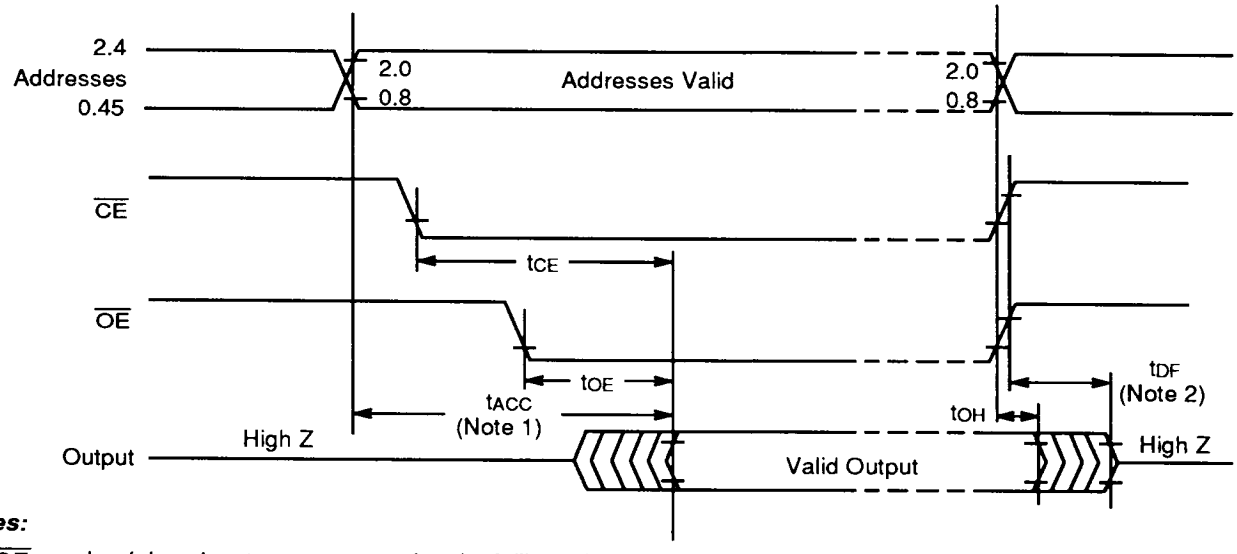
AC Testing: Inputs are driven at 2.4 V for a Logic "1" and 0.45 V for a Logic "0". Input pulse rise and fall times are ≤ 20 ns.

KEY TO SWITCHING WAVEFORMS



KS000010

SWITCHING WAVEFORMS



Notes:

1. *$\overline{OE}$ may be delayed up to $t_{ACC} - t_{OE}$ after the falling edge of the addresses without impact on t_{ACC}.*
2. *t_{DF} is specified from $\overline{OE}$ or $\overline{CE}$, whichever occurs first.*

17345A-9