

Am29C983/Am29C983A

9-Bit x 4-Port Multiple Bus Exchange



Advanced
Micro
Devices

DISTINCTIVE CHARACTERISTICS

- **Four bidirectional I/O ports with latches**
 - Replaces several bidirectional latches and transceivers
 - Permits multiple bus communication
 - Allows two independent communication channels
 - TTL compatibility
- **9 bit-wide ports to handle byte parity**
- **Two selection inputs per port**
 - Independent port interconnect control
 - Increased flexibility in data routing
- **Matched port decoding**
 - Simplifies external decode logic
 - Easily cascadable for wider buses
- **Latches for incoming and outgoing data**
 - Independent controls permit selective data capture
 - Ideal for stored operation
 - Readback feature for system diagnostics
- **Glitch-free outputs during power-up/down**
 - No power-up sequencing needed
 - Ideal for card-edge interface
- **48 mA output drive**
 - High-capacitance bus driving
- **High-performance CMOS**
 - Low stand-by power consumption
- **Two speeds available**
 - Am29C983
 - 9 ns (typ) port-to-port delay
 - 10 ns (typ) select-to-port delay
 - Am29C983A
 - 6 ns (typ) port-to-port delay
 - 7 ns (typ) select-to-port delay
- **Available in 68-pin PLCC package and 80-pin PQFP package for commercial applications**
- **Available in 68-pin PGA package for military applications (Am29C983 only)**

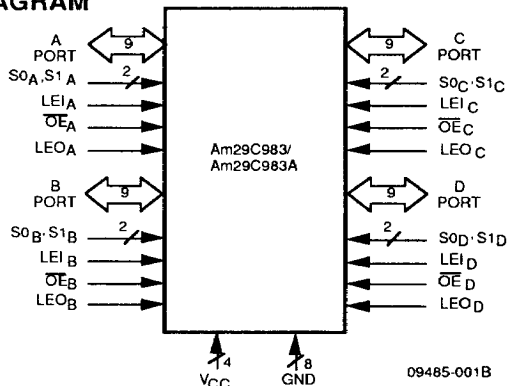
GENERAL DESCRIPTION

The Am29C983/A is a high-speed Multiple Bus Exchange device. It is organized as four 9-bit wide TTL-compatible I/O ports with Output Enable control for each port. Any port can serve either as a source (Input) port or as a destination (Output) port. When the output drivers of a port are disabled (high-impedance state), the port serves as a source port. When the drivers are enabled, the port serves as a destination port. Source port selection is made by two independent Select inputs at each port. This organization offers flexibility in implementing the Am29C983/A as a digital cross-point switch for multiple bus communication in a multiprocessing environment.

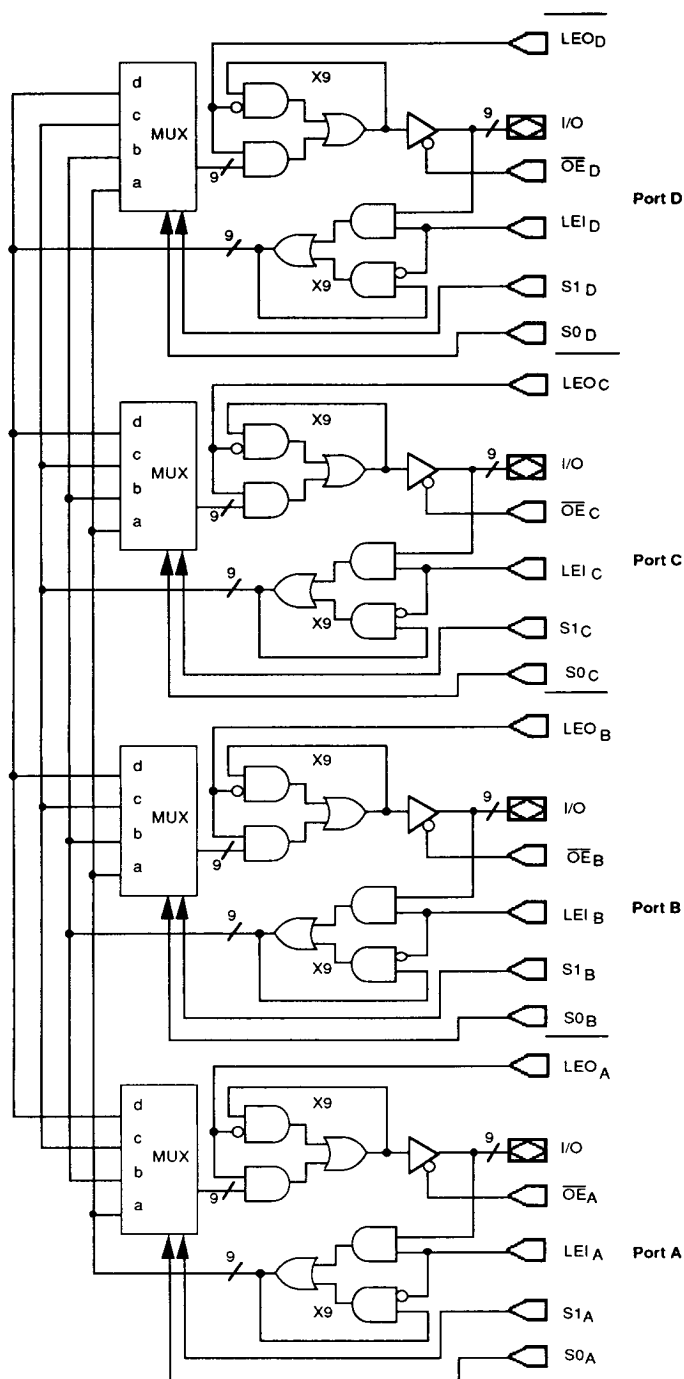
Each I/O port has an input latch to capture incoming data and an output latch to capture outgoing data. All input and output latches are independently controlled by active-HIGH Latch Enable inputs. This feature can be used to perform stored operation for byte-word compression and expansion to communicate between buses of different widths.

Independent port control permits cascading of Am29C983/As for wider buses. All I/O ports go into high-impedance state upon power-down. This feature makes the device ideally suited for card-edge applications.

SIMPLIFIED BLOCK DIAGRAM



DETAILED BLOCK DIAGRAM

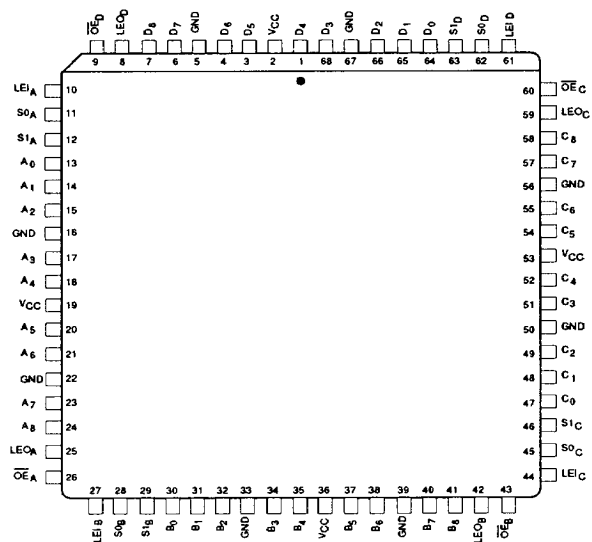


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CONNECTION DIAGRAMS

PLCC

(Top View)



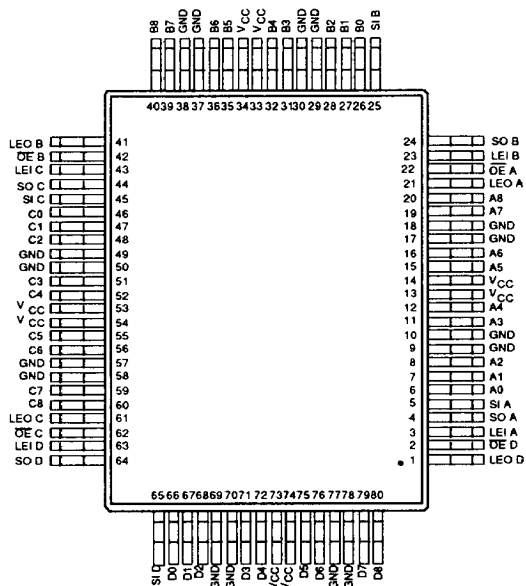
Note:

Pin 1 is marked for orientation.

09-405-003A

PQFP

(Top View)



09485-013A

PGA
(Bottom View)

	A	B	C	D	E	F	G	H	J	K	L
1	D ₈	GND	D ₅	D ₄	GND	D ₂	D ₀	S ₀	D	$\overline{OE}_C$	
2	$\overline{OE}_D$	LEO _D	D ₇	D ₆	V _{CC}	D ₃	D ₁	S ₁	LEI _D	LEO _C	C ₈
3	S ₀ _A	LEI _A								C ₇	GND
4	A ₀	S ₁ _A								C ₆	C ₅
5	A ₂	A ₁								C ₄	V _{CC}
6	A ₃	GND								C ₃	GND
7	A ₄	V _{CC}								C ₁	C ₂
8	A ₅	A ₆								S ₁ _C	C ₀
9	GND	A ₇								LEI _C	S ₀ _C
10	A ₈	LEO _A	LEI _B	S ₁ _B	B ₁	B ₃	V _{CC}	B ₆	B ₇	LEO _B	$\overline{OE}_B$
11	$\overline{OE}_A$	S ₀ _B	B ₀	B ₂	GND	B ₄	B ₅	GND	B ₈		

Note: Notch indicates orientation.

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PIN DESIGNATIONS
(Sorted by Pin Number)

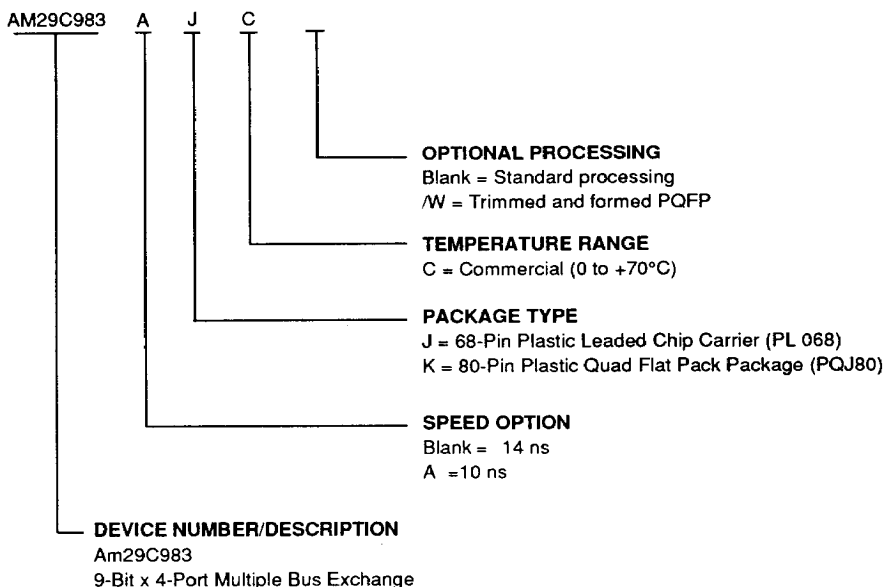
PIN NO.	PIN NAME	PIN NO.	PIN NAME	PIN NO.	PIN NAME	PIN NO.	PIN NAME
A-2	$\overline{OE}_D$	B-9	A ₇	F-10	B ₃	K-4	C ₆
A-3	S ₀ _A	B-10	LEO _A	F-11	GND	K-5	C ₄
A-4	A ₀	B-11	$\overline{OE}_A$	G-1	D ₂	K-6	C ₃
A-5	A ₂	C-1	GND	G-2	D ₁	K-7	C ₁
A-6	A ₃	C-2	D ₇	G-10	V _{CC}	K-8	S ₁ _C
A-7	A ₄	C-10	LEI _B	G-11	B ₄	K-9	LEI _C
A-8	A ₅	C-11	S ₀ _B	H-1	D ₆	K-10	LEO _B
A-9	GND	D-1	D ₅	H-2	S ₁ _D	K-11	B ₈
A-10	A ₈	D-2	D ₆	H-10	B ₆	L-2	C ₅
B-1	D ₈	D-10	S ₁ _B	H-11	B ₅	L-3	GND
B-2	LEO _D	D-11	B ₀	J-1	S ₀ _D	L-4	C ₅
B-3	LEI _A	E-1	D ₄	J-2	LEI _D	L-5	V _{CC}
B-4	S ₁ _A	E-2	V _{CC}	J-10	B ₇	L-6	GND
B-5	A ₁	E-10	B ₁	J-11	GND	L-7	C ₂
B-6	GND	E-11	B ₂	K-1	$\overline{OE}_C$	L-8	C ₀
B-7	V _{CC}	F-1	GND	K-2	LEO _C	L-9	S ₀ _C
B-8	A ₆	F-2	D ₃	K-3	C ₇	L-10	$\overline{OE}_B$

ORDERING INFORMATION

Standard Products

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

Device Number
Speed Option (If applicable)
Package Type
Temperature Range
Optional Processing



Valid Combinations	
AM29C983	JC
AM29C983A	JC, KC/W

Valid Combinations

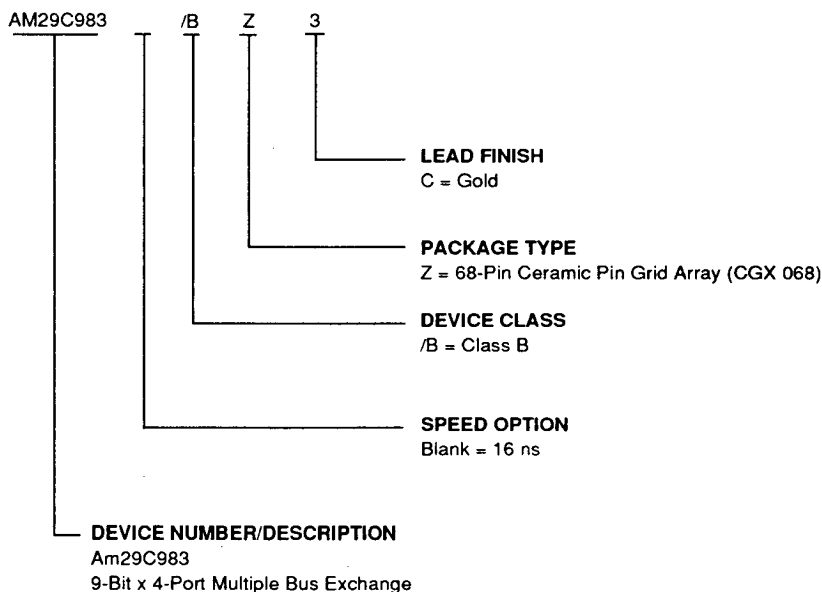
Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, to check on newly released combinations, and to obtain additional data on AMD's standard military grade products.

ORDERING INFORMATION

APL Products

AMD products for Aerospace and Defense applications are available in several packages and operating ranges. APL (Approve Products List) products are fully compliant with MIL-STD-883C requirements. The order number (Valid Combination) is formed by a combination of:

Device Number
Speed Option (if applicable)
Package Type
Temperature Range
Optional Processing



Valid Combinations	
AM29C983	BZC

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, to check on newly released combinations, and to obtain additional data on AMD's standard military grade products.

Group A Tests

Group A tests consists of Subgroups 1, 2, 3, 7, 8, 9, 10, 11.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC})	-0.5 to 7.0 V
DC Input Diode Current (I_{IK}) ($V_{IN} < 0$ V)	-20 mA
($V_{IN} > V_{CC}$ if applicable)	+20 mA
DC Input Voltage (V_{IN})	-0.5 to 7 V
DC Output Diode Current (I_{OK}) ($V_{OUT} < 0$ V)	-50 mA
($V_{OUT} > V_{CC}$ if applicable)	+50 mA
DC Output Current per Output Pin:	
I_{SINK}	+70 mA
I_{SOURCE}	-30 mA
DC Output Voltage (V_{OUT})	-0.5 to 7 V
Total DC Ground Current (I_{GND})	1750 mA
Total DC V_{CC} Current (I_{CC})	575 mA
Storage Temperature	-65 to +150°C

Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

OPERATING RANGES

Commercial (C) Devices

Temperature (T_A)	0 to +70°C
Supply Voltage (V_{CC})	+4.5 to +5.5 V

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

DC CHARACTERISTICS over operating range unless otherwise specified

Am29C983						
Parameter Symbol	Parameter Description	Test Conditions		Min	Max	Unit
V_{OH}	Output HIGH Voltage	$V_{CC} = 4.5$ V $V_{IN} = V_{IL}$ or V_{IH}	$I_{OH} = -15$ mA	2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = 4.5$ V $V_{IN} = V_{IL}$ or V_{IH}	$I_{OL} = 48$ mA		0.5	V
V_{IH}	Input HIGH Voltage	(Note 1)		2.0		V
V_{IL}	Input LOW Voltage	(Note 1)			0.8	V
V_{IC}	Input Clamp Voltage	$V_{CC} = 4.5$ V, $I_{IN} = -18$ mA			-1.2	V
I_{IL}	Input LOW Current (Select Inputs)	$V_{CC} = 5.5$ V, $V_{IN} = 0$ V			-10	μ A
I_{IH}	Input HIGH Current (Select Inputs)	$V_{CC} = 5.5$ V, $V_{IN} = 5.5$ V			10	μ A
I_{OZL}	Off-State Leakage Current (I/O Ports)	$V_{CC} = 5.5$ V, $V_{OUT} = 0$ V			-20	μ A
I_{OZH}	Off-State Leakage Current (I/O Ports)	$V_{CC} = 5.5$ V, $V_{OUT} = 5.5$ V			20	μ A
I_{SC}	Output Short-Circuit Current	$V_{CC} = 5.5$ V, $V_{OUT} = 0$ V (Note 2)		-60		mA
I_{CCO}	Quiescent Power Supply Current (Note 4)	$V_{CC} = 5.5$ V, $V_{IN} = 5.5$ V or GND Outputs Open			1.5	mA

DC CHARACTERISTICS (Continued)

Parameter Symbol	Parameter Description	Test Conditions	Min.	Max.	Unit
I_{CCT}	Power Supply Current TTL Input HIGH (Note 4)	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 2.4 \text{ V}$ Other Inputs at V_{CC} or GND		3.0	mA/ Input
I_{CCD}	Dynamic Power Supply Current (Note 4)	$V_{CC} = 5.5 \text{ V}$, Outputs Open One Output Toggling (Note 3)		500	$\mu\text{A}/$ MHz/Bit

Am29C983A

Parameter Symbol	Parameter Description	Test Conditions	Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	$V_{CC} = 4.5 \text{ V}$ $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -15 \text{ mA}$	2.4		V
V_{OL}	Output LOW Voltage	$V_{CC} = 4.5 \text{ V}$ $V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = 48 \text{ mA}$		0.5	V
V_{IH}	Input HIGH Voltage	(Note 1)	2.0		V
V_{IL}	Input LOW Voltage	(Note 1)		0.8	V
V_{IC}	Input Clamp Voltage	$V_{CC} = 4.5 \text{ V}$, $I_{IN} = -18 \text{ mA}$		-1.2	V
I_{IL}	Input LOW Current (Select Inputs)	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 0 \text{ V}$		-10	μA
I_{IH}	Input HIGH Current (Select Inputs)	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 5.5 \text{ V}$		10	μA
I_{OZL}	Off-State Leakage Current (I/O Ports)	$V_{CC} = 5.5 \text{ V}$, $V_{OUT} = 0 \text{ V}$		-20	μA
I_{OZH}	Off-State Leakage Current (I/O Ports)	$V_{CC} = 5.5 \text{ V}$, $V_{OUT} = 5.5 \text{ V}$		20	μA
I_{SC}	Output Short-Circuit Current	$V_{CC} = 5.5 \text{ V}$, $V_{OUT} = 0 \text{ V}$ (Note 2)	-60		mA
I_{CCO}	Quiescent Power Supply Current (Note 4)	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 5.5 \text{ V}$ or GND Outputs Open		1.5	mA
I_{CCT}	Power Supply Current TTL Input HIGH (Note 4)	$V_{CC} = 5.5 \text{ V}$, $V_{IN} = 2.4 \text{ V}$ Other Inputs at V_{CC} or GND		3.0	mA/ Input
I_{CCD}	Dynamic Power Supply Current (Note 4)	$V_{CC} = 5.5 \text{ V}$, Outputs Open One Output Toggling (Note 3)		500	$\mu\text{A}/$ MHz/Bit

Notes:

- Input thresholds are tested in combination with other DC parameters or by correlation.
- Not more than one output shorted at a time. Duration of short-circuit test not to exceed 100 milliseconds.
- Measured at a frequency of < 10 MHz with 50% duty cycle. Unused inputs are at V_{CC} or GND.
- Calculation of total device I_{CC} : $I_{CC} = I_{CCO} + I_{CCT} \times M_T \times D_H + I_{CCD} \times ((C_L + 91) + 91) \times f \times N$
 Where
 C_L = Load Capacitance in pF per output
 f = Frequency in MHz
 N = Average number of outputs switching
 M_T = Number of inputs at logic HIGH
 D_H = Duty cycle for each input HIGH

SWITCHING CHARACTERISTICS over COMMERCIAL operating range unless otherwise specified

Am29C983			Test Conditions	Commercial		
No.	Parameter Symbol	Parameter Description		Min	Max	Unit
1	t_{PLH}	Propagation Delay Port to Port	$C_L = 50 \text{ pF}$ $R_1 = 500 \text{ Ohms}$ $R_2 = 500 \text{ Ohms}$	1.5	14	ns
2	t_{PHL}	LEI = HIGH, LEO = HIGH		1.5	14	ns
3	t_{PLH}	Propagation Delay Select Input to Port LEO = HIGH		1.5	18	ns
4	t_{PHL}			1.5	18	ns
5	t_{PLH}	Propagation Delay LEI to Port		1.5	18	ns
6	t_{PHL}	LEO = HIGH		1.5	18	ns
7	t_{PLH}	Propagation Delay LEO to Port		1.5	14	ns
8	t_{PHL}			1.5	14	ns
9	t_{PZH}	Output Enable Time $\overline{OE}$ to Port		1	14	ns
10	t_{PZL}			1	14	ns
11	t_{PHZ}	Output Disable Time $\overline{OE}$ to Port		0	12	ns
12	t_{PLZ}			0	12	ns
13	t_s	Port to LEI Setup		2		ns
14	t_h	Port to LEI Hold		3		ns
15	t_s	Port to LEO Setup		4.5		ns
16	t_h	Port to LEO Hold		1.5		ns
17	t_s	Select to LEO Setup		6		ns
18	t_h	Select to LEO Hold		0		ns
19	t_s	LEI to LEO Setup		6		ns
20	t_h	LEI to LEO Hold		0		ns
21	t_{PWH}	LEI, LEO Pulse Width HIGH		6		ns

SWITCHING CHARACTERISTICS over MILITARY operating range unless otherwise specified (for APL products, Group A, Subgroups 9, 10, 11 are tested unless otherwise noted)

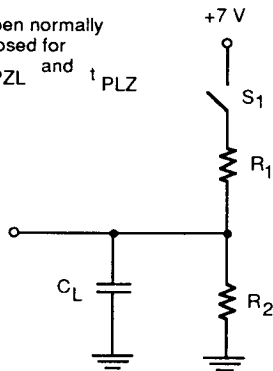
Am29C983				Military		
No.	Parameter Symbol	Parameter Description	Test Conditions	Min	Max	Unit
1	t_{PLH}	Propagation Delay Port to Port	$C_L = 50 \text{ pF}$ $R_1 = 500 \text{ Ohms}$ $R_2 = 500 \text{ Ohms}$	1.0	16	ns
2	t_{PHL}	LEI = HIGH, LEO = HIGH		1.0	16	ns
3	t_{PLH}	Propagation Delay Select Input to		1.0	20	ns
4	t_{PHL}	Port LEO = HIGH		1.0	20	ns
5	t_{PLH}	Propagation Delay LEI to Port		1.0	20	ns
6	t_{PHL}	LEO = HIGH		1.0	20	ns
7	t_{PLH}	Propagation Delay		1.0	16	ns
8	t_{PHL}	LEO to Port		1.0	16	ns
9	t_{PZH}	Output Enable Time		1.5	16	ns
10	t_{PZL}	$\overline{OE}$ to Port		1.0	16	ns
11	t_{PHZ}	Output Disable Time		0	14	ns
12	t_{PLZ}	$\overline{OE}$ to Port		0	14	ns
13	t_s	Port to LEI Setup		3		ns
14	t_h	Port to LEI Hold		4		ns
15	t_s	Port to LEO Setup		5.5		ns
16	t_h	Port to LEO Hold		2.5		ns
17	t_s	Select to LEO Setup		7		ns
18	t_h	Select to LEO Hold		1		ns
19	t_s	LEI to LEO Setup		7		ns
20	t_h	LEI to LEO Hold		1		ns
21	t_{PWH}	LEI, LEO Pulse Width HIGH		7		ns

SWITCHING CHARACTERISTICS over COMMERCIAL operating range unless otherwise specified

Am29C983A				Commercial		
No.	Parameter Symbol	Parameter Description	Test Conditions	Min	Max	Unit
1	t_{PLH}	Propagation Delay Port to Port	$C_L = 50 \text{ pF}$ $R_1 = 500 \text{ Ohms}$ $R_2 = 500 \text{ Ohms}$	1.5	10	ns
2	t_{PHL}	LEI = HIGH, LEO = HIGH		1.5	10	ns
3	t_{PLH}	Propagation Delay Select Input to Port LEO = HIGH		1.5	11	ns
4	t_{PHL}			1.5	11	ns
5	t_{PLH}	Propagation Delay LEI to Port		1.5	12	ns
6	t_{PHL}	LEO = HIGH		1.5	12	ns
7	t_{PLH}	Propagation Delay LEO to Port		1.5	10	ns
8	t_{PHL}			1.5	10	ns
9	t_{PZH}	Output Enable Time $\overline{OE}$ to Port		1	10	ns
10	t_{PZL}			1	10	ns
11	t_{PHZ}	Output Disable Time $\overline{OE}$ to Port		0	9	ns
12	t_{PLZ}			0	9	ns
13	t_s	Port to LEI Setup		2		ns
14	t_h	Port to LEI Hold		3		ns
15	t_s	Port to LEO Setup		4.5		ns
16	t_h	Port to LEO Hold		1.5		ns
17	t_s	Select to LEO Setup		6		ns
18	t_h	Select to LEO Hold		0		ns
19	t_s	LEI to LEO Setup		6		ns
20	t_h	LEI to LEO Hold		0		ns
21	t_{PWH}	LEI, LEO Pulse Width HIGH		6		ns

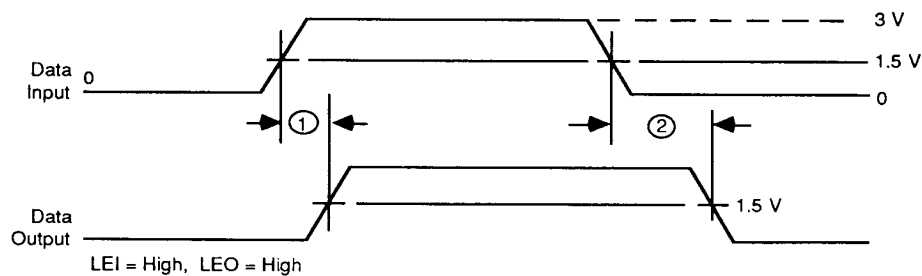
SWITCHING TEST CIRCUIT

S_1 = Open normally
 S_1 = Closed for t_{PZL} and t_{PLZ}



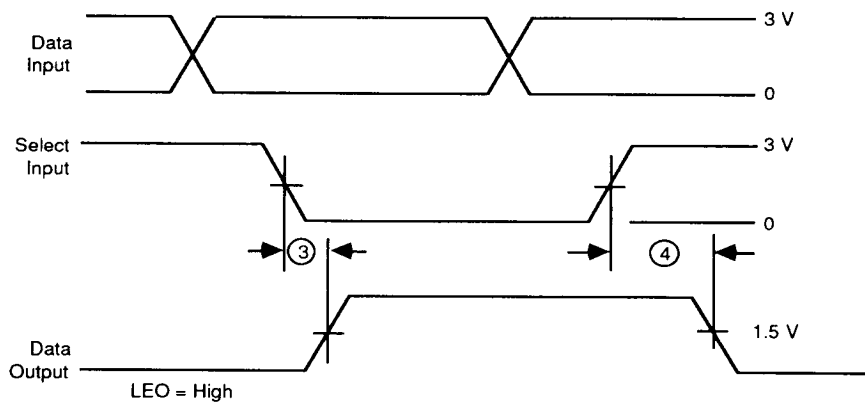
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SWITCHING TEST WAVEFORMS



Propagation Delay—Port-to-Port

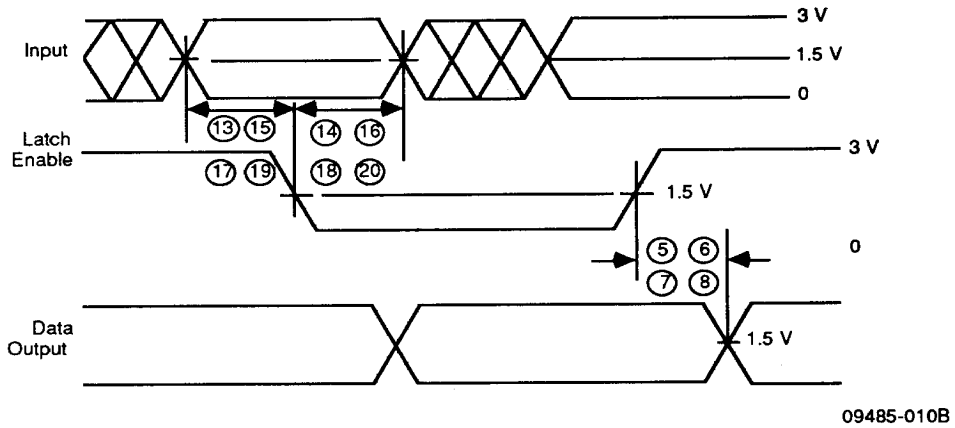
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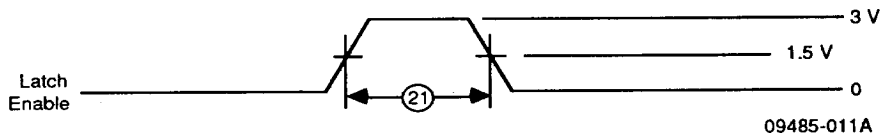
Propagation Delay—Select-to-Port

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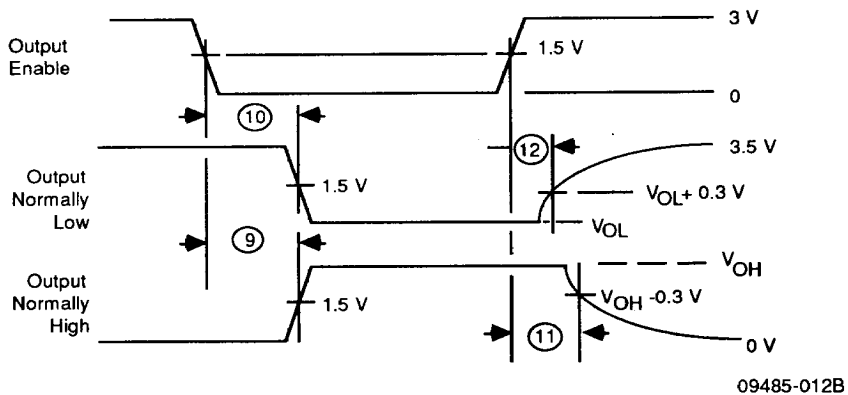
SWITCHING TEST WAVEFORMS



Input and Output Latch Propagation Delay, Setup and Hold Times



Minimum Latch Enable Pulse Width



Enable and Disable Times