

**FAIRCHILD**  
SEMICONDUCTOR™

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## 74AC646 • 74ACT646

### Octal Transceiver/Register with 3-STATE Outputs

#### General Description

The AC/ACT646 consist of registered bus transceiver circuits, with outputs, D-type flip-flops and control circuitry providing multiplexed transmission of data directly from the input bus or from the internal storage registers. Data on the A or B bus will be loaded into the respective registers on the LOW-to-HIGH transition of the appropriate clock pin (CPAB or CPBA). The four fundamental data handling functions available are illustrated in Figures 1, 2, 3, and Figure 4.

#### Features

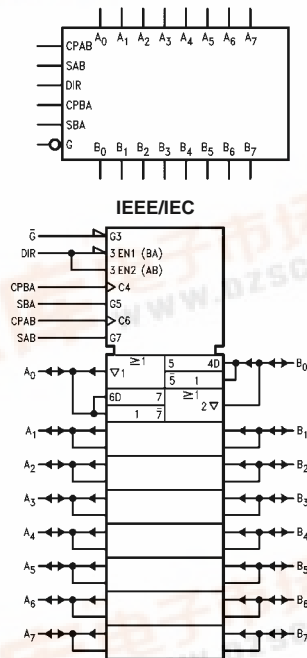
- Independent registers for A and B buses
- Multiplexed real-time and stored data transfers
- 3-STATE outputs
- 300 mil dual-in-line package
- Outputs source/sink 24 mA
- ACT646 has TTL compatible inputs

#### Ordering Code:

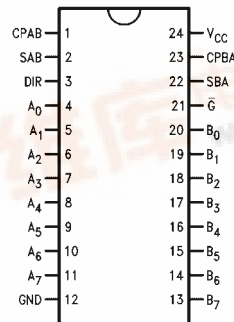
Order Number	Package Number	Package Description
74AC646SC	M24B	24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
74AC646SPC	N24C	24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
74ACT646SC	M24B	24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
74ACT646SPC	N24C	24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

#### Logic Symbols



#### Connection Diagram



#### Pin Descriptions

Pin Names	Description
A <sub>0</sub> -A <sub>7</sub>	Data Register A Inputs
B <sub>0</sub> -B <sub>7</sub>	Data Register A Outputs
	Data Register B Inputs
	Data Register B Outputs
CPAB, CPBA	Clock Pulse Inputs
SAB, SBA	Transmit/Receive Inputs
Ḡ	Output Enable Input
DIR	Direction Control Input

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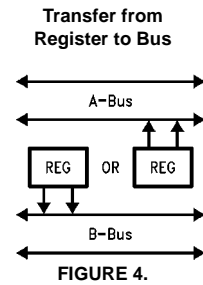
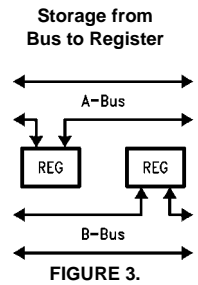
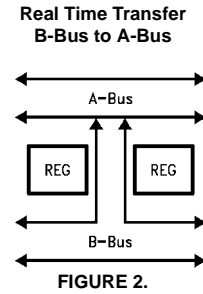
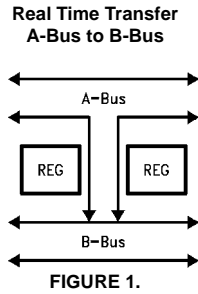


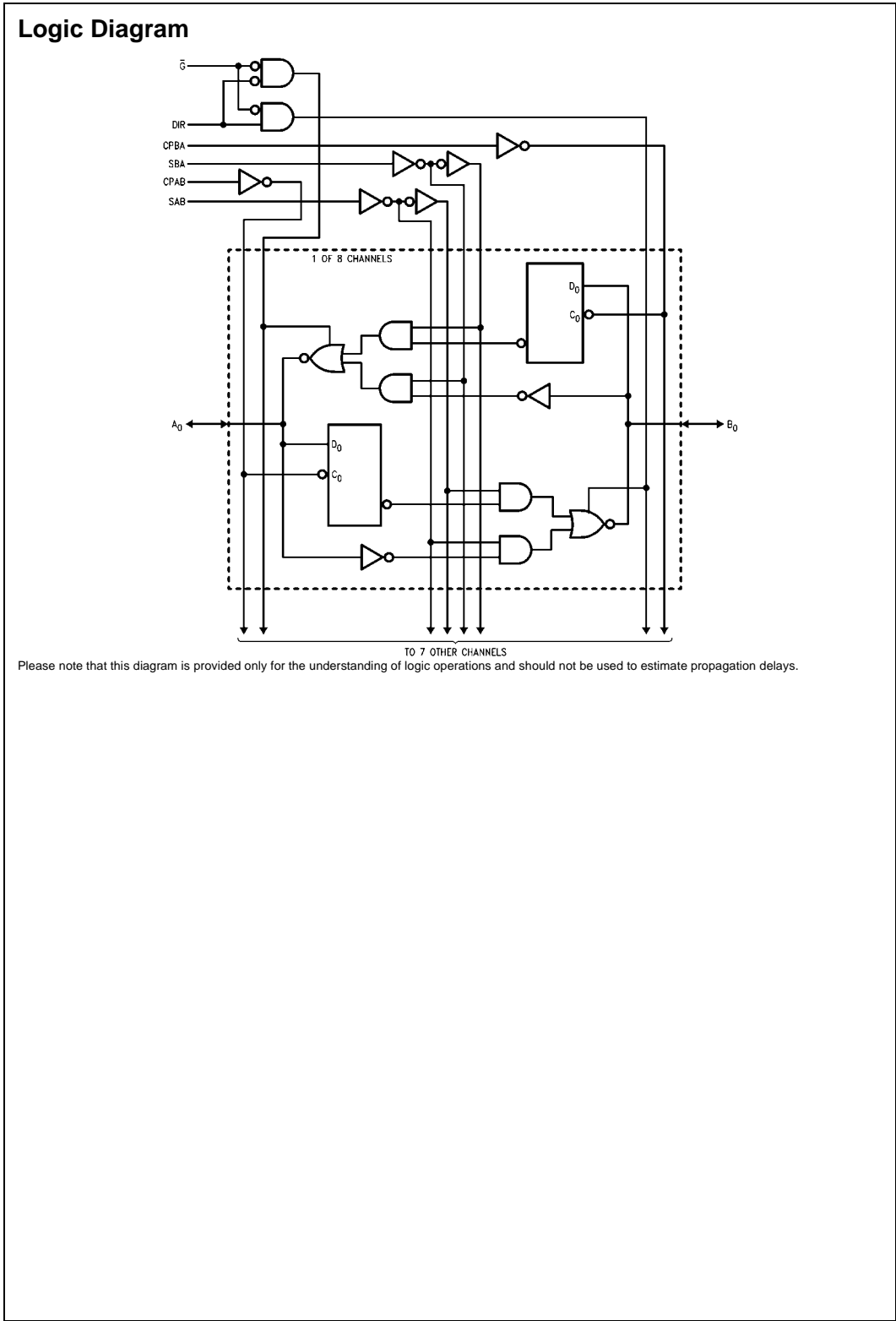
Function Table

Inputs						Data I/O (Note 1)		Function
$\overline{G}$	DIR	CPAB	CPBA	SAB	SBA	A <sub>0</sub> -A <sub>7</sub>	B <sub>0</sub> -B <sub>7</sub>	
H	X	H or L	H or L	X	X			Isolation
H	X	↔	X	X	X	Input	Input	Clock A <sub>n</sub> Data into A Register Clock B <sub>n</sub> Data into B Register
L	H	X	X	L	X	Input	Output	A <sub>n</sub> to B <sub>n</sub> —Real Time (Transparent Mode)
L	H	↔	X	L	X			Clock A <sub>n</sub> Data into A Register
L	H	H or L	X	H	X			A Register to B <sub>n</sub> (Stored Mode)
L	H	↔	X	H	X			Clock A <sub>n</sub> Data into A Register and Output to B <sub>n</sub>
L	L	X	X	X	L	Output	Input	B <sub>n</sub> to A <sub>n</sub> —Real Time (Transparent Mode)
L	L	X	↔	X	L			Clock B <sub>n</sub> Data into B Register
L	L	X	H or L	X	H			B Register to A <sub>n</sub> (Stored Mode)
L	L	X	↔	X	H			Clock B <sub>n</sub> Data into B Register and Output to A <sub>n</sub>

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
↔ = LOW-to-HIGH Transition

Note 1: The data output functions may be enabled or disabled by various signals at the  $\overline{G}$  and DIR inputs. Data input functions are always enabled; i.e., data at the bus pins will be stored on every LOW-to-HIGH transition of the appropriate clock inputs.





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Absolute Maximum Ratings (Note 2)		Recommended Operating Conditions	
Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V	Supply Voltage ( $V_{CC}$ )	AC 2.0V to 6.0V
DC Input Diode Current ( $I_{IK}$ )		ACT	4.5V to 5.5V
$V_I = -0.5V$	-20 mA	Input Voltage ( $V_I$ )	0V to $V_{CC}$
$V_I = V_{CC} + 0.5V$	+20 mA	Output Voltage ( $V_O$ )	0V to $V_{CC}$
DC Input Voltage ( $V_I$ )	-0.5V to $V_{CC} + 0.5V$	Operating Temperature ( $T_A$ )	-40°C to +85°C
DC Output Diode Current ( $I_{OK}$ )		Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
$V_O = -0.5V$	-20 mA	AC Devices	
$V_O = V_{CC} + 0.5V$	+20 mA	$V_{IN}$ from 30% to 70% of $V_{CC}$	
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$	$V_{CC}$ @ 3.3V, 4.5V, 5.5V	125 mV/ns
DC Output Source or Sink Current ( $I_O$ )	$\pm 50$ mA	Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ )	$\pm 50$ mA	ACT Devices	
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C	$V_{IN}$ from 0.8V to 2.0V	
Junction Temperature ( $T_J$ )		$V_{CC}$ @ 4.5V, 5.5V	125 mV/ns
PDIP	140°C	<b>Note 2:</b> Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, with- out exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation of FACT™ circuits outside databook specifications.	

DC Electrical Characteristics for AC								
Symbol	Parameter	$V_{CC}$ (V)	$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units	Conditions
			Typ	Guaranteed Limits				
$V_{IH}$	Minimum HIGH Level Input Voltage	3.0	1.5	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	3.15	3.15			
		5.5	2.75	3.85	3.85			
$V_{IL}$	Maximum LOW Level Input Voltage	3.0	1.5	0.9	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	1.35	1.35			
		5.5	2.75	1.65	1.65			
$V_{OH}$	Minimum HIGH Level Output Voltage	3.0	2.99	2.9	2.9	V	$I_{OUT} = -50 \mu A$	
		4.5	4.49	4.4	4.4			
		5.5	5.49	5.4	5.4			
			3.0		2.56	2.46	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -12$ mA $I_{OH} = -24$ mA $I_{OH} = -24$ mA (Note 3)
			4.5		3.86	3.76		
			5.5		4.86	4.76		
$V_{OL}$	Maximum LOW Level Output Voltage	3.0	0.002	0.1	0.1	V	$I_{OUT} = 50 \mu A$	
		4.5	0.001	0.1	0.1			
		5.5	0.001	0.1	0.1			
			3.0		0.36	0.44	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = 12$ mA $I_{OL} = 24$ mA $I_{OH} = 24$ mA (Note 3)
			4.5		0.36	0.44		
5.5		0.36	0.44					
$I_{IN}$ (Note 5)	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$	$\mu A$	$V_I = V_{CC}, GND$	
$I_{OLD}$	Minimum Dynamic	5.5			75	mA	$V_{OLD} = 1.65V$ Max	
$I_{OHD}$	Output Current (Note 4)	5.5			-75	mA	$V_{OHD} = 3.85V$ Min	
$I_{CC}$ (Note 5)	Maximum Quiescent Supply Current	5.5		8.0	80.0	$\mu A$	$V_{IN} = V_{CC}$ or GND	
$I_{OZT}$	Maximum I/O Leakage Current	5.5		$\pm 0.6$	$\pm 6.0$	$\mu A$	$V_I$ (OE) = $V_{IL}, V_{IH}$ $V_I = V_{CC}, GND$ $V_O = V_{CC}, GND$	

**Note 3:** All outputs loaded; thresholds on input associated with output under test.  
**Note 4:** Maximum test duration 2.0 ms, one output loaded at a time.  
**Note 5:**  $I_{IN}$  and  $I_{CC}$  @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V  $V_{CC}$ .

DC Electrical Characteristics for ACT							
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C	Units	Conditions
			Typ	Guaranteed Limits			
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	4.5	1.5	2.0	2.0	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	1.5	2.0	2.0		
V <sub>IL</sub>	Maximum LOW Level Input Voltage	4.5	1.5	0.8	0.8	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	1.5	0.8	0.8		
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	4.5	4.49	4.4	4.4	V	I <sub>OUT</sub> = -50 μA
		5.5	5.49	5.4	5.4		
		4.5		3.86	3.76	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -24 mA (Note 6)
V <sub>OL</sub>	Maximum LOW Level Output Voltage	4.5	0.001	0.1	0.1	V	I <sub>OUT</sub> = 50 μA
		5.5	0.001	0.1	0.1		
		4.5		0.36	0.44	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 24 mA (Note 6)
I <sub>IN</sub>	Maximum Input Leakage Current	5.5		± 0.1	± 1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5	0.6		1.5	mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1V
I <sub>OLD</sub>	Minimum Dynamic	5.5			75	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>	Output Current (Note 7)	5.5			-75	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		8.0	80.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND
I <sub>OZT</sub>	Maximum I/O Leakage Current	5.5		±0.6	±6.0	μA	V <sub>I</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub> V <sub>I</sub> = V <sub>CC</sub> , GND V <sub>O</sub> = V <sub>CC</sub> , GND

**Note 6:** All outputs loaded; thresholds on input associated with output under test.

**Note 7:** Maximum test duration 2.0 ms, one output loaded at a time.

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AC Electrical Characteristics for AC								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 8)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Min	Typ	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay	3.3	4.0	10.5	16.5	3.0	18.5	ns
	Clock to Bus	5.0	2.5	7.5	12.0	2.0	13.0	
t <sub>PHL</sub>	Propagation Delay	3.3	3.0	9.5	14.5	2.5	16.0	ns
	Clock to Bus	5.0	2.0	6.5	10.5	1.5	11.5	
t <sub>PLH</sub>	Propagation Delay	3.3	2.5	7.5	12.0	2.0	13.5	ns
	Bus to Bus	5.0	1.5	5.0	8.0	1.0	9.0	
t <sub>PHL</sub>	Propagation Delay	3.3	1.5	7.5	12.5	1.5	13.5	ns
	Bus to Bus	5.0	1.5	5.0	9.0	1.0	9.5	
t <sub>PLH</sub>	Propagation Delay	3.3	2.0	8.5	13.5	1.5	15.5	ns
	SBA or SAB to A <sub>n</sub> or B <sub>n</sub> (w/ A <sub>n</sub> or B <sub>n</sub> HIGH or LOW)	5.0	1.5	6.0	10.0	1.5	11.0	
t <sub>PHL</sub>	Propagation Delay	3.3	1.5	8.5	13.5	1.5	15.0	ns
	SBA or SAB to A <sub>n</sub> or B <sub>n</sub> (w/ A <sub>n</sub> or B <sub>n</sub> HIGH or LOW)	5.0	1.5	6.0	10.0	1.5	11.0	
t <sub>PZH</sub>	Enable Time	3.3	2.5	7.0	11.5	2.0	12.5	ns
	$\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	1.5	5.0	8.5	1.5	9.0	
t <sub>PZL</sub>	Enable Time	3.3	2.5	7.5	12.5	2.0	14.0	ns
	$\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	1.5	5.5	9.0	1.5	10.0	
t <sub>PHZ</sub>	Disable Time	3.3	3.0	8.0	12.5	2.5	13.5	ns
	$\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	2.0	6.5	10.0	2.0	11.0	
t <sub>PLZ</sub>	Disable Time	3.3	2.0	7.5	12.0	2.0	13.5	ns
	$\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	1.5	6.0	9.5	1.5	10.5	
t <sub>PZH</sub>	Enable Time	3.3	2.0	6.5	11.0	1.5	12.0	ns
	DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	1.5	5.0	7.5	1.0	8.5	
t <sub>PZL</sub>	Enable Time	3.3	2.5	7.0	11.5	2.0	13.0	ns
	DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	1.5	5.0	8.0	1.0	9.0	
t <sub>PHZ</sub>	Disable Time	3.3	2.5	7.5	11.5	1.5	12.5	ns
	DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	1.5	5.5	9.5	1.5	10.0	
t <sub>PLZ</sub>	Disable Time	3.3	1.5	7.5	12.0	1.5	13.5	ns
	DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	1.5	5.5	9.5	1.5	10.5	

**Note 8:** Voltage Range 3.3 is 3.3V ± 0.3V  
Voltage Range 5.0 is 5.0V ± 0.5V

AC Operating Requirements for AC						
Symbol	Parameter	V <sub>CC</sub> (V) (Note 9)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF	Units
			Typ	Guaranteed Minimum		
t <sub>S</sub>	Setup Time, HIGH or LOW	3.3	2.0	5.0	5.5	ns
	Bus to Clock	5.0	1.5	4.0	4.5	
t <sub>H</sub>	Hold Time, HIGH or LOW	3.3	-1.5	0	0	ns
	Bus to Clock	5.0	-0.5	0.5	1.0	
t <sub>W</sub>	Clock Pulse Width	3.3	2.0	3.5	4.5	ns
	HIGH or LOW	5.0	2.0	3.5	3.5	

**Note 9:** Voltage Range 3.3 is 3.3V ± 0.3V  
Voltage Range 5.0 is 5.0V ± 0.5V

AC Electrical Characteristics for ACT								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 10)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Min	Typ	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay Clock to Bus	5.0	3.5	12.0	14.5	3.0	16.0	ns
t <sub>PHL</sub>	Propagation Delay Clock to Bus	5.0	4.0	12.0	14.5	3.5	16.0	ns
t <sub>PLH</sub>	Propagation Delay Bus to Bus	5.0	3.0	8.5	10.5	2.5	11.5	ns
t <sub>PHL</sub>	Propagation Delay Bus to Bus	5.0	2.5	8.5	10.5	2.0	11.5	ns
t <sub>PLH</sub>	Propagation Delay SBA or SAB to A <sub>n</sub> to B <sub>n</sub> (w/A <sub>n</sub> or B <sub>n</sub> , HIGH or LOW)	5.0	3.0	9.5	11.5	2.5	12.5	ns
t <sub>PHL</sub>	Propagation Delay SBA or SAB to A <sub>n</sub> to B <sub>n</sub> (w/A <sub>n</sub> or B <sub>n</sub> , HIGH or LOW)	5.0	3.0	9.5	11.5	2.5	12.5	ns
t <sub>PZH</sub>	Enable Time $\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	2.0	9.0	11.0	1.5	12.0	ns
t <sub>PZL</sub>	Enable Time $\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	3.5	9.0	11.0	3.0	12.0	ns
t <sub>PHZ</sub>	Disable Time $\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	5.0	10.5	13.0	4.5	14.5	ns
t <sub>PLZ</sub>	Disable Time $\overline{G}$ to A <sub>n</sub> or B <sub>n</sub>	5.0	3.5	10.0	12.5	3.0	14.0	ns
t <sub>PZH</sub>	Enable Time DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	2.0	6.5	10.5	1.5	11.5	ns
t <sub>PZL</sub>	Enable Time DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	3.5	6.5	10.5	3.0	11.5	ns
t <sub>PHZ</sub>	Disable Time DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	5.0	8.5	12.5	4.5	13.5	ns
t <sub>PLZ</sub>	Disable Time DIR to A <sub>n</sub> or B <sub>n</sub>	5.0	3.5	8.5	12.5	3.0	13.5	ns
<b>Note 10:</b> Voltage Range 5.0 is 5.0V ± 0.5V								
AC Operating Requirements for ACT								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 11)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units	
			Typ	Guaranteed Minimum				
t <sub>S</sub>	Setup Time, HIGH or LOW BUS to Clock	5.0	2.5	7.0	8.0		ns	
t <sub>H</sub>	Hold Time, HIGH or LOW Bus to Clock	5.0	0	2.5	2.5		ns	
t <sub>W</sub>	Clock Pulse Width HIGH or LOW	5.0	4.5	7.0	8.0		ns	
<b>Note 11:</b> Voltage Range 5.0 is 5.0V ± 0.5V								
Capacitance								
Symbol	Parameter	Typ	Units	Conditions				
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = OPEN				
C <sub>I/O</sub>	Input/Output Capacitance	15.0	pF	V <sub>CC</sub> = 5.0V				
C <sub>PD</sub>	Power Dissipation Capacitance	60.0	pF	V <sub>CC</sub> = 5.0V				

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