

Document No.	
ECN No.	
Date of Issue	August 28, 1990
Status	Preliminary Specification
ACL Products	

# 74AC/ACT11648

## Octal transceiver/register with direction pin (3-State), INV

### FEATURES

- Octal bidirectional bus interface
- 3-State buffers
- Independent registers for A and B buses
- Multiplexed real-time and stored data
- Output capability:  $\pm 24$  mA
- CMOS (AC) and TTL (ACT) voltage level inputs
- $50\Omega$  incident wave switching
- Center-pin  $V_{CC}$  and ground configuration to minimize high-speed switching noise
- $I_{CC}$  category: MSI

### DESCRIPTION

The 74AC/ACT11648 high-performance CMOS devices combine very high speed and high output drive comparable to the most advanced TTL families.

The 74AC/ACT11648 device is an octal transceiver/register featuring inverting 3-State bus compatible outputs in both send and receive directions, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly

(continued)

### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS		TYPICAL		UNIT
		$T_{amb} = 25^\circ\text{C}; GND = 0V; V_{CC} = 5.0V$		AC	ACT	
$t_{PLH}/t_{PHL}$	Propagation delay $\bar{A}_n$ to $B_n$ , or $\bar{B}_n$ to $A_n$	$C_L = 50pF$		8.9	10.4	ns
$C_{PD}$	Power dissipation capacitance per transceiver <sup>1</sup>	$f = 1\text{MHz};$	Enabled	65	61	pF
		$C_L = 50pF$	Disabled	16	15	
$C_{IN}$	Input capacitance	$V_I = 0V$ or $V_{CC}$		4.5	4.5	pF
$C_{IO}$	I/O capacitance	$V_O = 0V$ or $V_{CC}$ ; Disabled		12	12	pF
$I_{LATCH}$	Latch-up current	Per Jeduc JC40.2 Standard 17		500	500	mA
$f_{MAX}$	Maximum clock frequency, $CP_{XX}$ to $\bar{A}$ or $\bar{B}$	$C_L = 50pF$		110	105	MHz

#### Note:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ):

$$P_D = C_{PD} \times V_{CC}^2 \times f_I + \sum (C_L \times V_{CC}^2 \times f_O) \text{ where:}$$

$f_I$  = input frequency in MHz,  $C_L$  = output load capacitance in pF,

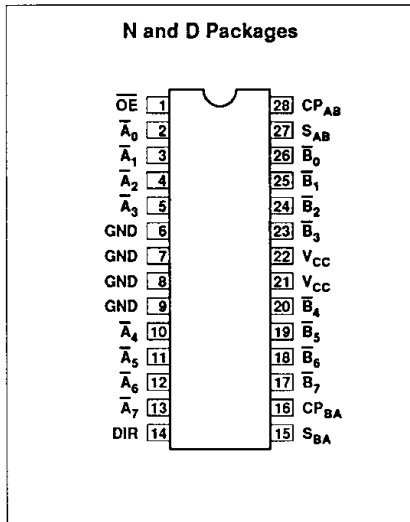
$f_O$  = output frequency in MHz,  $V_{CC}$  = supply voltage in V,

$\sum (C_L \times V_{CC}^2 \times f_O)$  = sum of outputs

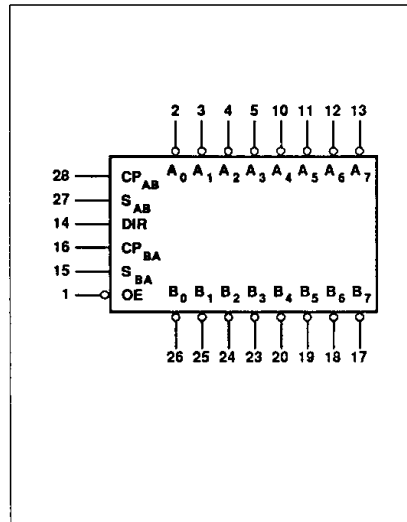
### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE
28-pin plastic DIP (300mil-wide)	-40°C to +85°C	74AC11648N 74ACT11648N
28-pin plastic SOL (300mil-wide)	-40°C to +85°C	74AC11648D 74ACT11648D

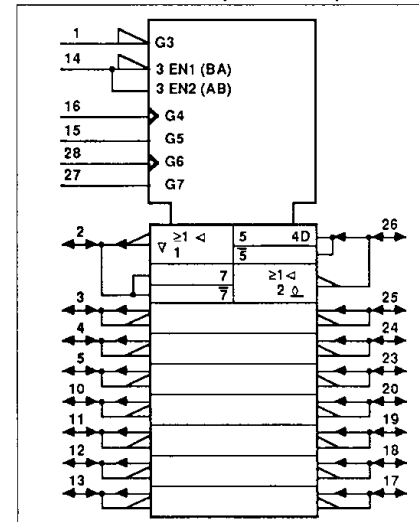
### PIN CONFIGURATION



### LOGIC SYMBOL



### LOGIC SYMBOL (IEEE/IEC)



# Octal transceiver/register with direction pin (3-State), INV

74AC/ACT11648

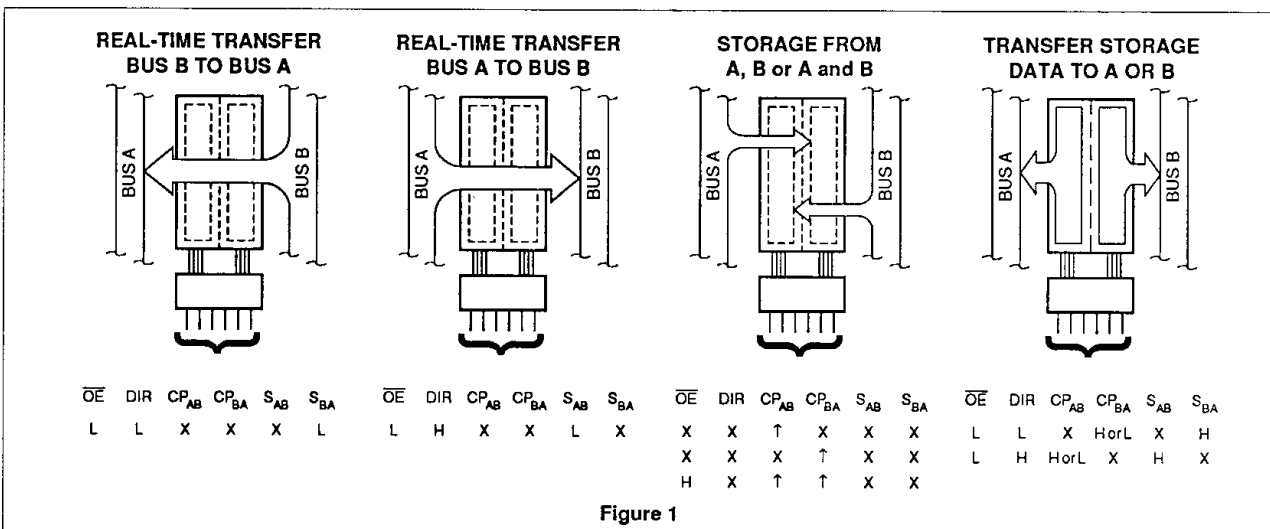
from the input bus or from internal registers. Data on the A or B bus will be clocked into the registers as the appropriate clock pin goes to a High logic level. Output Enable ( $\overline{OE}$ ) and DIR pins are provided to control the transceiver function. In the transceiver mode, data present at the High-impedance port may be stored in either the A or B register or both.

The Select inputs ( $S_x$ ) can multiplex stored and real-time (transparent mode) data. The DIR input determines which bus will receive data when the Output Enable is active (Low). In the isolation mode ( $\overline{OE}$  is High), A data may be stored in the B register and/or B data may be stored in the A register.

When an output function is disabled, the input function is still enabled and may be used to store and transmit data. Only one of the two buses, A or B, may be driven at a time. Figure 1 demonstrates the four fundamental bus-management functions that can be performed.

### PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	$\overline{OE}$	Output enable input (active Low)
28	$CP_{AB}$	A-to-B clock input
16	$CP_{BA}$	B-to-A clock input
27	$S_{AB}$	A-to-B select input
15	$S_{BA}$	B-to-A select input
14	DIR	Data flow directional control input
2, 3, 4, 5, 10, 11, 12, 13	$\overline{A}_0 - \overline{A}_7$	A side inputs/outputs (3-state)
26, 25, 24, 23, 20, 19, 18, 17	$\overline{B}_0 - \overline{B}_7$	B side inputs/outputs (3-state)
6, 7, 8, 9	GND	Ground (0V)
21, 22	$V_{CC}$	Positive supply voltage



# Octal transceiver/register with direction pin (3-State), INV

74AC/ACT11648

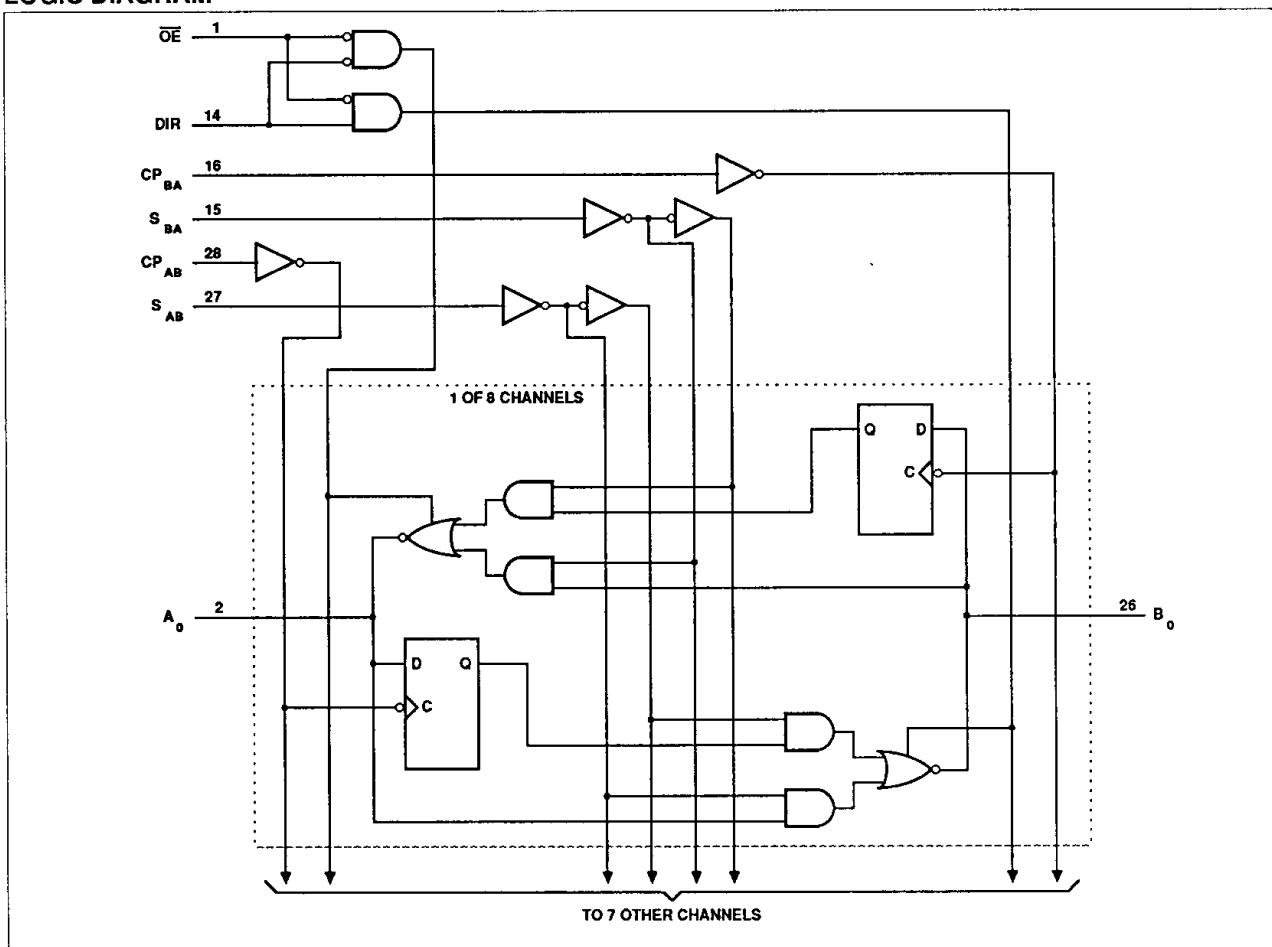
## FUNCTION TABLE

INPUTS						DATA I/O*		OPERATING MODE
$\overline{OE}$	DIR	$CP_{AB}$	$CP_{BA}$	$S_{AB}$	$S_{BA}$	$\overline{A}_0 - \overline{A}_7$	$\overline{B}_0 - \overline{B}_7$	
X	X	↑	X	X	X	Input	un*	Store A, B unspecified*
X	X	X	↑	X	X	un*	Input	Store B, A unspecified*
H	X	↑	↑	X	X	Input	Input	Store A and B Data Isolation, hold storage
L	L	X	X	X	L	Output	Input	Real time $\overline{B}$ data to A bus Stored $\overline{B}$ Data to A Bus
L	H	X	X	L	X	Input	Output	Real time $\overline{A}$ data to B bus Stored $\overline{A}$ data to B bus

\* The data output functions may be enabled or disabled by various signals at the  $\overline{OE}$  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 clock.

- un = unspecified
- H = Highvoltage level
- L = Low voltage level
- X = Don't care
- ↑ = Low-to-High clock transition

## LOGIC DIAGRAM



# Octal transceiver/register with direction pin (3-State), INV

74AC/ACT11648

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	74AC11648			74ACT11648			UNIT
		Min	Nom	Max	Min	Nom	Max	
$V_{CC}$	DC supply voltage	3.0 <sup>1</sup>	5.0	5.5	4.5	5.0	5.5	V
$V_I$	Input voltage	0		$V_{CC}$	0		$V_{CC}$	V
$V_O$	Output voltage	0		$V_{CC}$	0		$V_{CC}$	V
$\Delta t/\Delta v$	Input transition rise or fall rate	0		10	0		10	ns/V
$T_{amb}$	Operating free-air temperature range	-40		+85	-40		+85	°C

## NOTE:

- No electrical or switching characteristics are specified at  $V_{CC} < 3V$ . Operation between 2V and 3V is not recommended, but within that range, a device output will maintain a previously established logic state.

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

SYMBOL	PARAMETER	TEST CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 TO +7.0	V
$I_{IK}$ or $V_I$	DC input diode current <sup>2</sup>	$V_I < 0$	-20	mA
		$V_I > V_{CC}$	20	
	DC input voltage		-0.5 to $V_{CC} + 0.5$	V
$I_{OK}$ or $V_O$	DC output diode current <sup>2</sup>	$V_O < 0$	-50	mA
		$V_O > V_{CC}$	50	
	DC output voltage		-0.5 to $V_{CC} + 0.5$	V
$I_O$	DC output source or sink current per output pin	$V_O = 0$ to $V_{CC}$	$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ current		$\pm 200$	mA
	DC ground current		$\pm 200$	
$T_{STG}$	Storage temperature		-65 to 150	°C
$P_{TOT}$	Power dissipation per package	Above 70°C; derate linearly by 8mW/K	500	mW
	Power dissipation per package Plastic surface mount (SO)	Above 70°C; derate linearly by 8mW/K	400	mW

## NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

# Octal transceiver/register with direction pin (3-State), INV

## 74AC/ACT11648

### DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	74AC11648				74ACT11648				UNIT	
				T <sub>amb</sub> = +25°C		T <sub>amb</sub> = -40°C to +85°C		T <sub>amb</sub> = +25°C		T <sub>amb</sub> = -40°C to +85°C			
				Min	Max	Min	Max	Min	Max	Min	Max		
V <sub>IH</sub>	High-level input voltage		3.0	2.10		2.10						V	
			4.5	3.15		3.15		2.0		2.0			
			5.5	3.85		3.85		2.0		2.0			
V <sub>IL</sub>	Low-level input voltage		3.0		0.90		0.90					V	
			4.5		1.35		1.35		0.8		0.8		
			5.5		1.65		1.65		0.8		0.8		
V <sub>OH</sub>	High-level output voltage	V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>	I <sub>OH</sub> = -50μA	3.0	2.9		2.9					V	
				4.5	4.4		4.4		4.4		4.4		
				5.5	5.4		5.4		5.4		5.4		
			I <sub>OH</sub> = -4mA	3.0	2.58		2.48						
				4.5	3.94		3.8		3.94		3.8		
				5.5	4.94		4.8		4.94		4.8		
I <sub>OH</sub> = -75mA <sup>1</sup>	5.5			3.85				3.85					
V <sub>OL</sub>	Low-level output voltage	V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub>	I <sub>OL</sub> = 50μA	3.0		0.1		0.1				V	
				4.5		0.1		0.1		0.1			0.1
				5.5		0.1		0.1		0.1			0.1
			I <sub>OL</sub> = 12mA	3.0		0.36		0.44					
				4.5		0.36		0.44		0.36			0.44
				5.5		0.36		0.44		0.36			0.44
I <sub>OL</sub> = 75mA <sup>1</sup>	5.5				1.65				1.65				
I <sub>I</sub>	Input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5		±0.1		±1.0		±0.1		±1.0	μA	
I <sub>oz</sub>	3-State output off-state current	V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub> , V <sub>O</sub> = V <sub>CC</sub> or GND	5.5		±0.5		5.0		±0.5		5.0	μA	
I <sub>CC</sub>	Quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0mA	5.5		8.0		80		8.0		80	μA	
ΔI <sub>CC</sub>	Supply current, TTL inputs High <sup>2</sup>	One input at 3.4V, other inputs at V <sub>CC</sub> or GND	5.5						0.9		1.0	mA	

#### NOTES:

- Not more than one output should be tested at a time, and the duration of the test should not exceed 10ms.
- This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0V or V<sub>CC</sub>.

# Octal transceiver/register with direction pin (3-State), INV

## 74AC/ACT11648

### AC ELECTRICAL CHARACTERISTICS AT 3.3V ±0.3V

SYMBOL	PARAMETER	WAVEFORM	74AC11648					UNIT
			T <sub>amb</sub> = +25°C			T <sub>amb</sub> = -40°C to +85°C		
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum clock frequency	1	40	65		40		MHz
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay CP <sub>AB</sub> or CP <sub>BA</sub> to $\overline{A}_n$ or $\overline{B}_n$	1	4.3 5.2	10.1 11.5	15.6 17.6	4.3 5.2	17.6 19.4	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay $\overline{A}_n$ or $\overline{B}_n$ to $\overline{B}_n$ or $\overline{A}_n$	3	3.0 3.8	8.7 9.3	12.6 14.4	3.0 3.8	14.3 15.9	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay (A <sub>n</sub> or B <sub>n</sub> High) S <sub>BA</sub> or S <sub>AB</sub> to $\overline{A}_n$ or $\overline{B}_n$	2	3.7 4.5	9.1 10.3	14.1 15.9	3.7 4.5	15.8 17.4	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay (A <sub>n</sub> or B <sub>n</sub> Low) S <sub>BA</sub> or S <sub>AB</sub> to $\overline{A}_n$ or $\overline{B}_n$	3	3.2 4.6	8.6 10.3	13.6 15.6	3.2 4.6	15.3 17.1	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable time OE to $\overline{A}_n$ or $\overline{B}_n$	5	5.0 5.2	11.1 12.8	17.2 20.5	5.0 5.2	19.4 23.0	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable time DIR to $\overline{A}_n$ or $\overline{B}_n$	5	4.9 5.2	11.6 14.2	18.2 21.6	4.9 5.2	20.6 24.3	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output disable time OE to $\overline{A}_n$ or $\overline{B}_n$	5	4.1 3.7	7.2 6.5	9.9 9.1	4.1 3.7	10.6 9.7	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output disable time DIR to $\overline{A}_n$ or $\overline{B}_n$	5	3.8 3.5	7.1 6.5	10.1 9.3	3.8 3.5	10.9 10.1	ns
t <sub>s</sub>	Setup time (High or Low) $\overline{A}_n$ or $\overline{B}_n$ to CP <sub>AB</sub> or CP <sub>BA</sub>	4	6.5			6.5		ns
t <sub>h</sub>	Hold time (High or Low) $\overline{A}_n$ or $\overline{B}_n$ to CP <sub>AB</sub> or CP <sub>BA</sub>	4	0.0			0.0		ns
t <sub>w</sub>	Pulse width (High or Low) CP <sub>AB</sub> or CP <sub>BA</sub>	1	12.5			12.5		ns

# Octal transceiver/register with direction pin (3-State), INV

## 74AC/ACT11648

### AC ELECTRICAL CHARACTERISTICS AT 5.0V $\pm 0.5V$

SYMBOL	PARAMETER	WAVEFORM	74AC11648					UNIT
			$T_{amb} = +25^{\circ}C$			$T_{amb} = -40^{\circ}C$ to $+85^{\circ}C$		
			Min	Typ	Max	Min	Max	
$f_{MAX}$	Maximum clock frequency	1	90	110		90		MHz
$t_{PLH}$ $t_{PHL}$	Propagation delay $CP_{AB}$ or $CP_{BA}$ to $\bar{A}_n$ or $\bar{B}_n$	1	3.6 4.3	6.9 8.0	10.0 11.4	3.6 4.3	11.4 12.8	ns
$t_{PLH}$ $t_{PHL}$	Propagation delay $\bar{A}_n$ or $\bar{B}_n$ to $\bar{B}_n$ or $\bar{A}_n$	3	2.6 3.2	5.6 5.4	8.3 9.4	2.6 3.2	9.5 10.6	ns
$t_{PLH}$ $t_{PHL}$	Propagation delay ( $A_n$ or $B_n$ High) $S_{BA}$ or $S_{AB}$ to $\bar{A}_n$ or $\bar{B}_n$	2	3.1 3.8	6.2 7.6	9.2 10.4	3.1 3.8	10.4 11.6	ns
$t_{PLH}$ $t_{PHL}$	Propagation delay ( $A_n$ or $B_n$ Low) $S_{BA}$ or $S_{AB}$ to $\bar{A}_n$ or $\bar{B}_n$	3	2.8 3.8	6.1 7.3	8.9 10.4	2.8 3.8	10.1 11.6	ns
$t_{PZH}$ $t_{PZL}$	Output Enable time $\bar{OE}$ to $\bar{A}_n$ or $\bar{B}_n$	5	4.2 4.1	7.8 8.1	11.3 12.0	4.2 4.1	12.8 13.6	ns
$t_{PZH}$ $t_{PZL}$	Output Enable time DIR to $\bar{A}_n$ or $\bar{B}_n$	5	4.0 4.1	8.0 8.4	11.9 12.7	4.0 4.1	13.4 14.4	ns
$t_{PHZ}$ $t_{PLZ}$	Output disable time $\bar{OE}$ to $\bar{A}_n$ or $\bar{B}_n$	5	3.8 3.5	6.3 5.7	8.6 7.8	3.8 3.5	9.2 8.4	ns
$t_{PHZ}$ $t_{PLZ}$	Output disable time DIR to $\bar{A}_n$ or $\bar{B}_n$	5	3.5 3.4	6.1 5.9	8.5 7.8	3.5 3.4	9.1 8.4	ns
$t_s$	Setup time (High or Low) $\bar{A}_n$ or $\bar{B}_n$ to $CP_{AB}$ or $CP_{BA}$	4	4.5			4.5		ns
$t_h$	Hold time (High or Low) $\bar{A}_n$ or $\bar{B}_n$ to $CP_{AB}$ or $CP_{BA}$	4	0.0			0.0		ns
$t_w$	Pulse width (High or Low) $CP_{AB}$ or $CP_{BA}$	1	5.6			5.6		ns

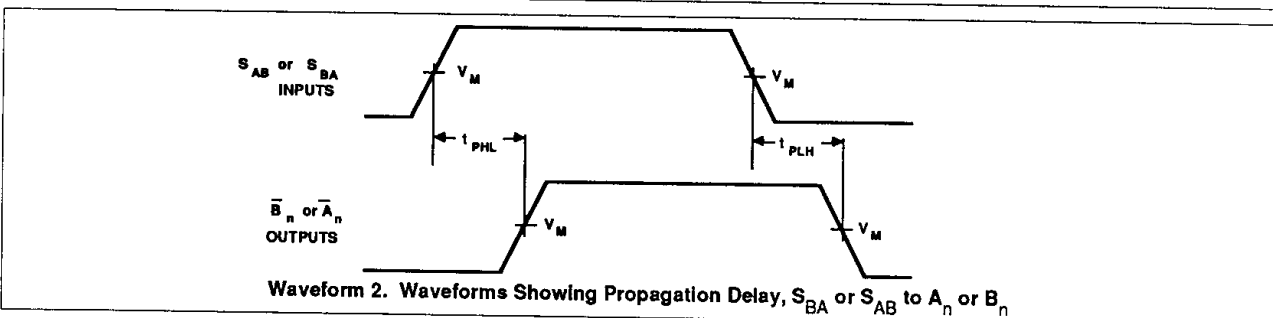
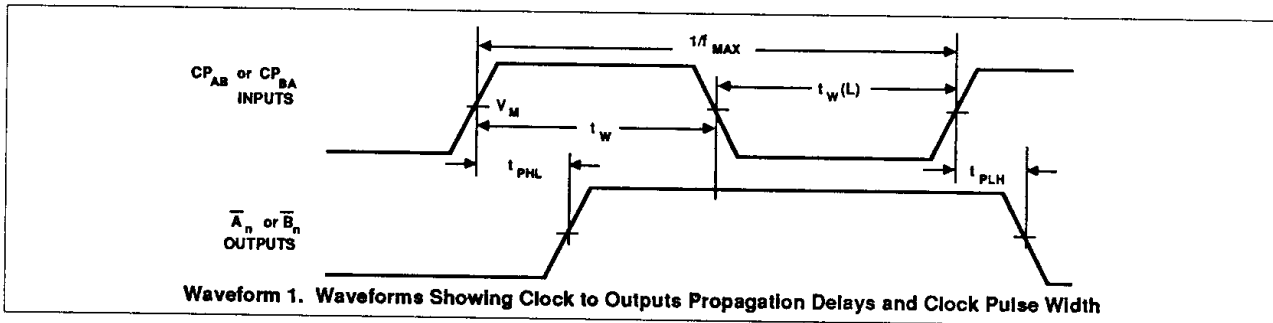
# Octal transceiver/register with direction pin (3-State), INV

## 74AC/ACT11648

### AC ELECTRICAL CHARACTERISTICS AT 5.0V ±0.5V

SYMBOL	PARAMETER	WAVEFORM	74ACT11648					UNIT
			T <sub>amb</sub> = +25°C			T <sub>amb</sub> = -40°C to +85°C		
			Min	Typ	Max	Min	Max	
t <sub>MAX</sub>	Maximum clock frequency	1	75	105		75		MHz
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay CP <sub>AB</sub> or CP <sub>BA</sub> to $\bar{A}_n$ or $\bar{B}_n$	1	5.2 6.0	9.4 10.5	12.0 13.5	5.2 6.0	13.7 15.2	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay $\bar{A}_n$ or $\bar{B}_n$ to $\bar{B}_n$ or $\bar{A}_n$	3	2.4 4.4	6.5 8.5	9.5 11.3	2.4 4.4	10.7 12.7	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay (A <sub>n</sub> or B <sub>n</sub> High) S <sub>BA</sub> or S <sub>AB</sub> to $\bar{A}_n$ or $\bar{B}_n$	2	4.7 3.8	8.6 8.6	11.3 12.0	4.7 3.8	12.9 13.4	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay (A <sub>n</sub> or B <sub>n</sub> Low) S <sub>BA</sub> or S <sub>AB</sub> to $\bar{A}_n$ or $\bar{B}_n$	3	2.6 5.4	7.1 9.7	10.2 12.6	2.6 5.4	11.5 14.1	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable time $\overline{OE}$ to $\bar{A}_n$ or $\bar{B}_n$	5	4.2 4.3	9.2 9.8	13.0 13.9	4.2 4.3	14.6 15.6	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable time DIR to $\bar{A}_n$ or $\bar{B}_n$	5	3.9 3.9	9.8 10.8	14.9 15.1	3.9 3.9	16.9 17.2	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output disable time $\overline{OE}$ to $\bar{A}_n$ or $\bar{B}_n$	5	5.7 5.3	8.7 8.1	11.3 10.5	5.7 5.3	12.2 11.4	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output disable time DIR to $\bar{A}_n$ or $\bar{B}_n$	5	4.5 3.9	8.2 7.3	10.6 9.6	4.5 3.9	11.5 11.3	ns
t <sub>s</sub>	Setup time (High or Low) $\bar{A}_n$ or $\bar{B}_n$ to CP <sub>AB</sub> or CP <sub>BA</sub>	4	5.0			5.0		ns
t <sub>h</sub>	Hold time (High or Low) $\bar{A}_n$ or $\bar{B}_n$ to CP <sub>AB</sub> or CP <sub>BA</sub>	4	2.0			2.0		ns
t <sub>w</sub>	Pulse width (High or Low) CP <sub>AB</sub> or CP <sub>BA</sub>	1	6.7			6.7		ns

### AC WAVEFORMS

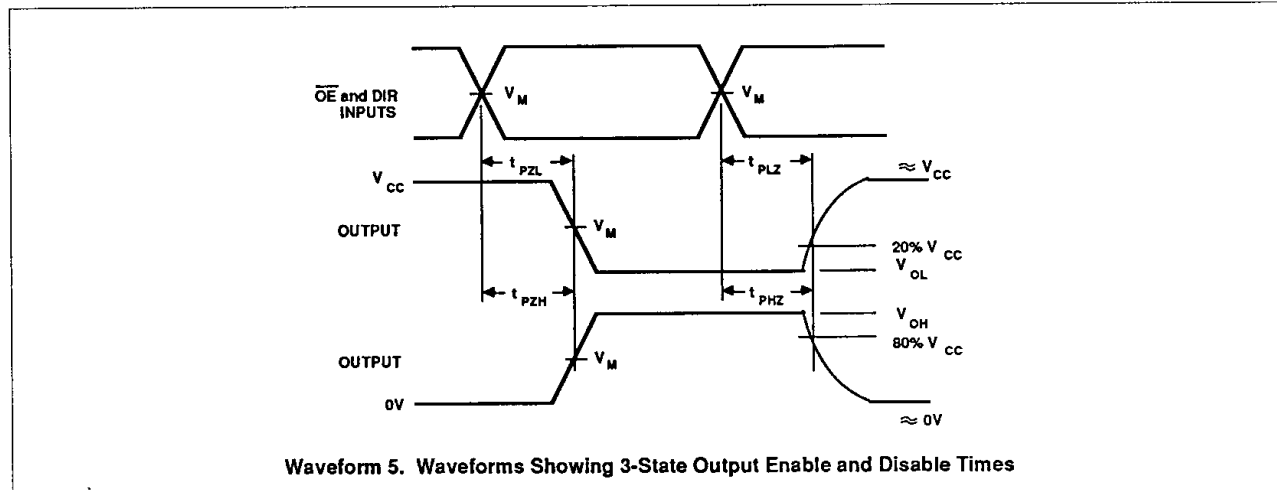
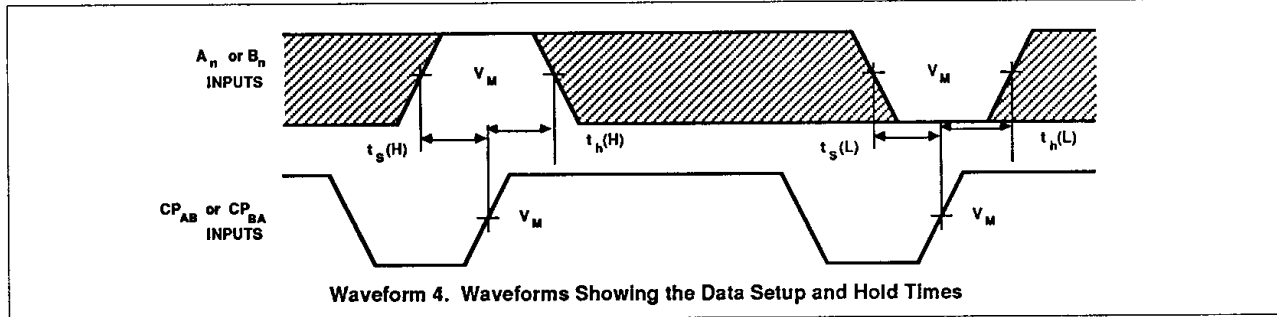
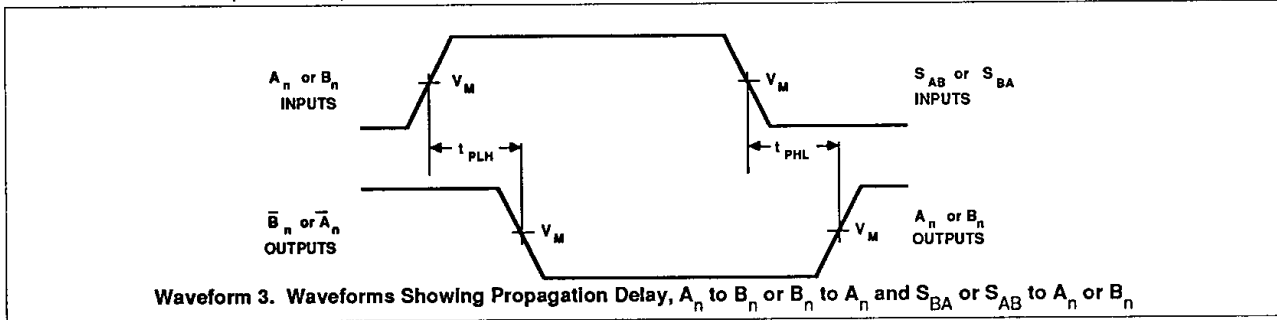




# Octal transceiver/register with direction pin (3-State), INV

74AC/ACT11648

## AC WAVEFORMS (Continued)



# Octal transceiver/register with direction pin (3-State), INV

## 74AC/ACT11648

### WAVEFORM CONDITIONS

	INPUTS	OUTPUTS
AC	$V_{IN} = \text{GND to } V_{CC}$ $V_M = 50\% V_{CC}$	$V_{OUT} = V_{OL} \text{ to } V_{OH}$
ACT	$V_{IN} = \text{GND to } 3.0V$ $V_M = 1.5V$	$V_M = 50\% V_{CC}$

### TEST CIRCUIT

