PI74AVC+16646

2.5V 16-Bit Bus Transceiver and Register with 3-State Outputs

Product Features

- PI74AVC+16646 is designed for low-voltage operation, V_{CC} = 1.65V to 3.6V
- True ±24mA Balanced Drive @ 3.3V
- I_{OFF} supports partial power-down operation
- 3.6V I/O Tolerant Inputs and Outputs
- All outputs contain a patented DDC (Dynamic DriveControl) circuit that reduces noise without degrading propagation delay.
- Industrial operation: –40°C to +85°C
- Packaging (Pb-free & Green available):
  – 56-pin 240 mil wide plastic TSSOP (A)

Product Description

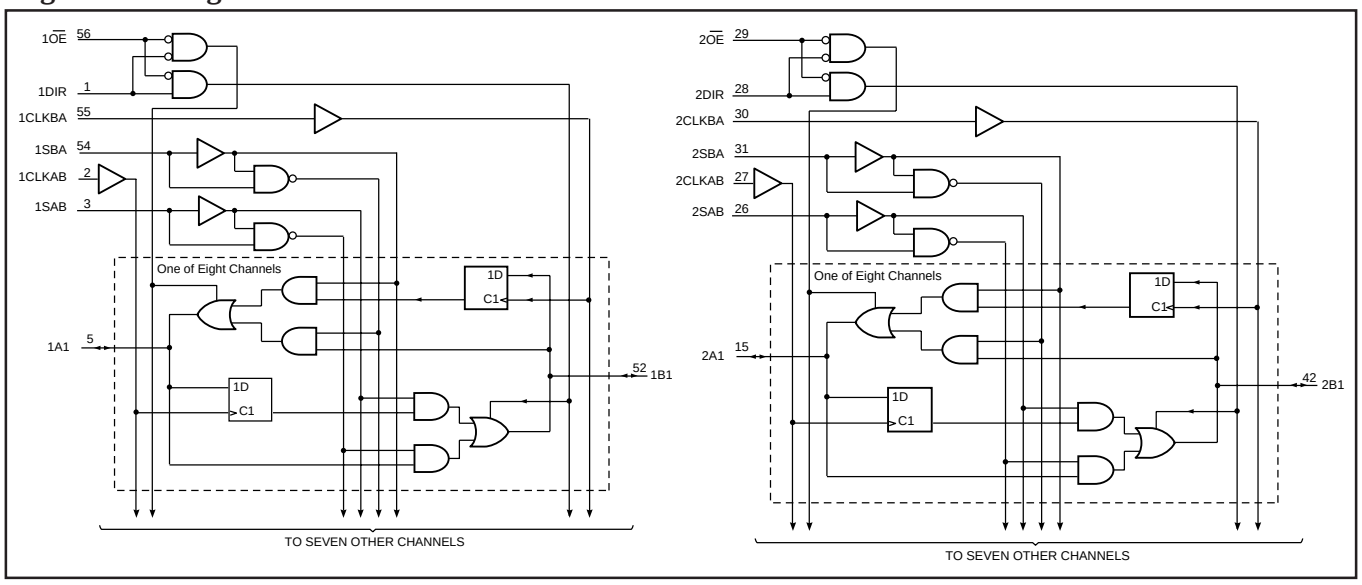
The PI74AVC+16646 is a 16-bit bus transceiver and register designed for 1.65V to 3.6V V_{CC} operation. It can be used as two 8-bit transceivers or one 16-bit transceiver. Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate Clock (CLKAB or CLKBA) input. Four fundamental bus-management functions can be performed.

Output Enable ($\overline{OE}$) and Direction Control (DIR) inputs are provided to control the transceiver functions. In the transceiver mode, data present at the high-impedance port may be stored in either register or in both. The Select Control (SAB and SBA) inputs can multiplex stored and real-time (transparent mode) data. Circuitry used for Select Control eliminates the typical decoding glitch that occurs in a multiplexer during the transition between stored and real-time data. DIR determines which bus receives data when $\overline{OE}$ is LOW. In the isolation mode ($\overline{OE}$ HIGH), A data may be stored in one register and/or B data may be stored in the other 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, can be driven at a time.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Logic Block Diagrams



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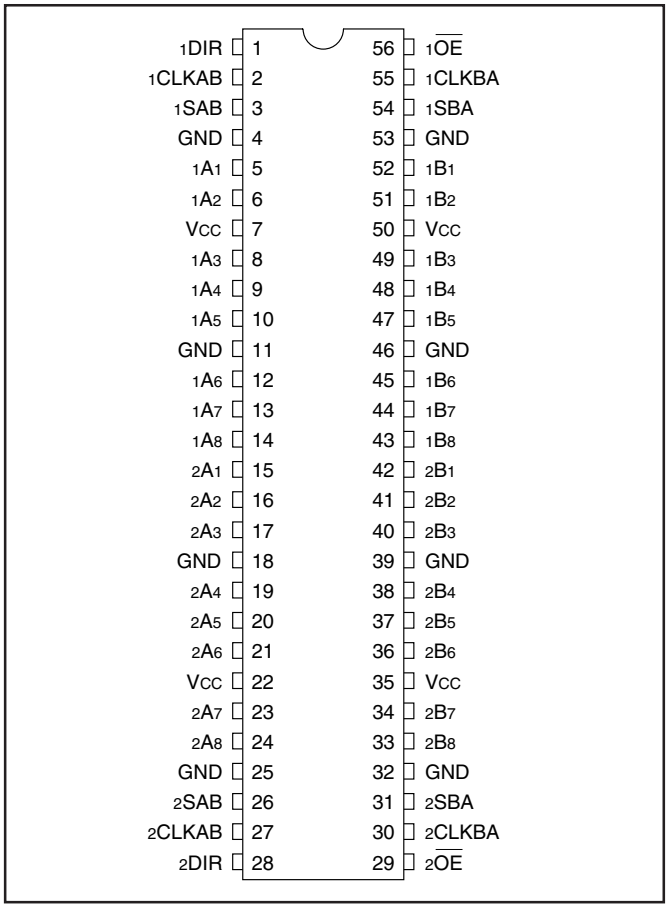
Pin Configuration



Product Pin Description

Pin Name	Description
x$\overline{OE}$	Output Enable Inputs (Active LOW)
xDIR	Direction Control
xCLKAB, xCLKBA	Clock Pulse Inputs
xSAB, xSBA	Select Control Inputs
xAx	Data Register A Inputs Data Register B Outputs
xBx	Data Register B Inputs Data Register A Outputs
GND	Ground
V_{CC}	Power

Truth Table

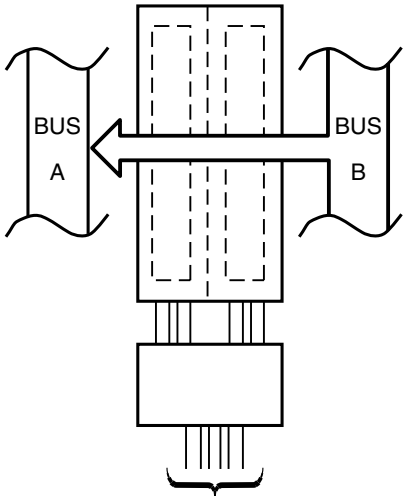
Function	Inputs						Data I/O	
	x$\overline{OE}$	xDIR	xCLKAB	xCLKBA	xSAB	xSBA	xAx	xBx
Store A, B Unspecified(1)	X	X	↑	X	X	X	Input	Unspecified(1)
Store B, A Unspecified(1)	X	X	X	↑	X	X	Unspecified(1)	Input
Isolation, Hold Storage	H	X	H or L	H or L	X	X	Input Disable	Input Disable
Store A and B Data	H	X	↑	↑	X	X	Input	Input
Real Time A Data to B Bus	L	H	X	X	L	X	Input	Output
Stored A Data to B Bus	L	H	H or L	X	H	X	Input	Output
Real Time B Data to A Bus	L	L	X	X	X	L	Output	Input
Stored B Data toA Bus	L	L	X	H or L	X	H	Output	Input

Notes:

1. The data output functions may be enabled or disabled by various signals at the x$\overline{OE}$ or xDIR inputs. Data input functions are always enabled, i.e., data at the bus pins will be stored on every LOW-to-HIGH transition on the clock inputs.

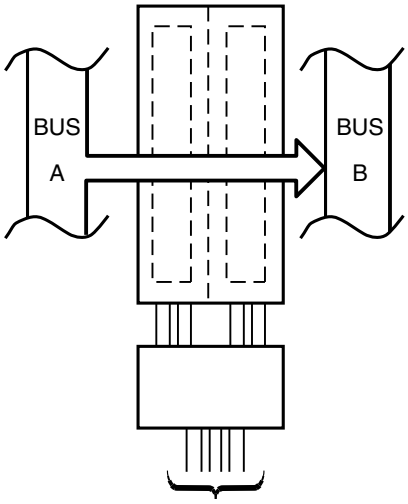
•. H = High Voltage Level
X = Don't Care
L = Low Voltage Level
↑ = LOW-to-HIGH transition

REAL-TIME TRANSFER
BUS B to A



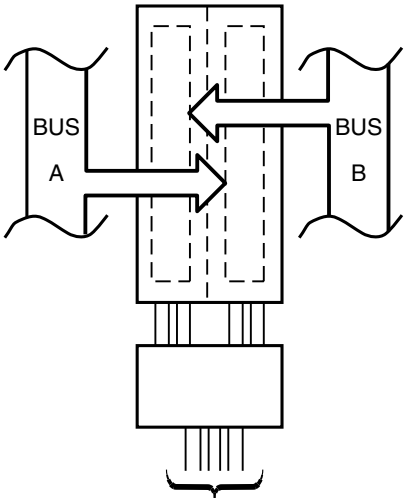
xDIR	$\overline{xOE}$	xCLKAB	xCLKBA	xSAB	xSBA
L	L	X	X	X	L

REAL-TIME TRANSFER
BUS A to B



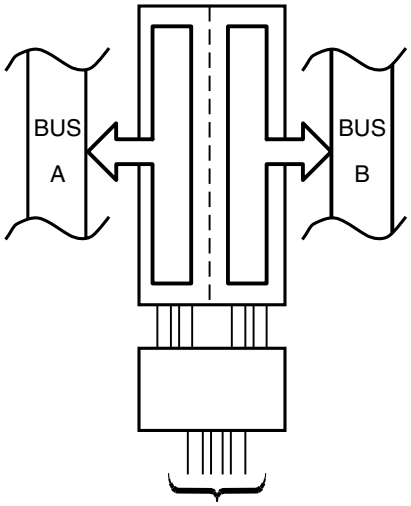
xDIR	$\overline{xOE}$	xCLKAB	xCLKBA	xSAB	xSBA
H	L	X	X	L	X

STORAGE FROM
A,B, or A and B



xDIR	$\overline{xOE}$	xCLKAB	xCLKBA	xSAB	xSBA
X	X	↑	X	X	X
X	X	X	↑	X	X
X	H	↑	↑	X	X

TRANSFER STORED
DATA to A and/or B



xDIR	$\overline{xOE}$	xCLKAB	xCLKBA	xSAB	xSBA
L	L	X	H or L	X	H
H	L	H or L	X	H	X

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Supply voltage range, V_{CC} ..... –0.5V to +4.6V
Input voltage range, V_I ..... –0.5V to +4.6V
Voltage range applied to any output in the high-impedance or power-off state, V_O[1] ..... –0.5V to +4.6V
Voltage range applied to any output in the high or low state, V_O[1,2] ..... –0.5V to V_{CC}+0.5V
Input clamp current, I_{IK} (V_I <0) ..... –50mA
Output clamp current, I_{OK} (V_O <0) ..... –50mA
Continuous output current, I_O ..... ±50mA
Continuous current through each V_{CC} or GND ..... ±100mA
Package thermal impedance, θ_{JA}[3] ..... 64°C/W
Storage Temperature range, T_{stg} ..... –65°C to 150°C

Notes:
Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and 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 to absolute maximum rating conditions for extended periods may affect reliability.

1. Input & output negative-voltage ratings may be exceeded if the input and output curent rating are observed.
2. Output positive-voltage rating may be exceeded up to 4.6V maximum if the output current rating is observed.
3. The package thermal impedance is calculated in accordance with JESD 51.

Recommended Operating Conditions[1]

		Min.	Max.	Units
V_{CC} Supply Voltage	Operating	1.65	3.6	V
	Data retention only	1.2		
V_{IH} High-level Input Voltage	V_{CC} = 1.2V	V_{CC}		
	V_{CC} = 1.65V to 1.95V	0.65 x V_{CC}		
	V_{CC} = 2.3V to 2.7V	1.7		
	V_{CC} = 3V to 3.6V	2		
V_{IL} Low-level Input Voltage	V_{CC} = 1.2V		Gnd	
	V_{CC} = 1.65V to 1.95V		0.35 x V_{CC}	
	V_{CC} = 2.3V to 2.7V		0.7	
	V_{CC} = 3V to 3.6V		0.8	
V_I Input Voltage		0	3.6	
V_O Output Voltage	Active State	0	V_{CC}	
	3-State	0	3.6	
I_{OH} High-level output current	V_{CC} = 1.65V to 1.95V		– 6	mA
	V_{CC} = 2.3V to 2.7V		– 12	
	V_{CC} = 3V to 3.6V		– 24	
I_{OL} Low-level output current	V_{CC} = 1.65V to 1.95V		6	
	V_{CC} = 2.3V to 2.7V		12	
	V_{CC} = 3V to 3.6V		24	
$\Delta t/\Delta v$ Input transition rise or fall rate	V_{CC} = 1.65V to 3.6V		5	ns/V
T_A Operating free-air temperature		–40	85	°C

Notes:
1. All unused inputs must be held at V_{CC} or GND to ensure proper device operation.

DC Electrical Characteristics (Over the Operating Range, $T_A = –40°C$ to $+85°C$)

Parameters		Test Conditions[1]	V_{CC}	Min.	Max.	Units
V_{OH}		$I_{OH} = –100\mu A$	1.65V to 3.6V	$V_{CC} –0.2V$		V
		$I_{OH} = –6mA$ $V_{IH} = 1.07V$	1.65V	1.2		
		$I_{OH} = –12mA$ $V_{IH} = 1.7V$	2.3V	1.75		
		$I_{OH} = –24mA$ $V_{IH} = 2V$	3V	2.0		
V_{OL}		$I_{OL} = 100\mu A$	1.65V to 3.6V		0.2	
		$I_{OL} = 6mA$ $V_{IH} = 0.57V$	1.65V		0.45	
		$I_{OL} = 12mA$ $V_{IH} = 0.7V$	2.3V		0.55	
		$I_{OL} = 24mA$ $V_{IH} = 0.8V$	3V		0.8	
I_I		$V_I = V_{CC}$ or GND	3.6V		±2.5	µA
I_{OFF}		V_I or $V_O = 3.6V$	0		±10	
I_{OZ}		$V_I = V_{CC}$ or GND	3.6V		±10	
I_{CC}		$V_O = V_{CC}$ or GND $I_O = 0$	3.6V		40	
C_I	Control Inputs	$V_I = V_{CC}$ or GND	2.5V		4	pF
			3.3V		4	
	Data Inputs		2.5V		6	
			3.3V		6	
C_O	Outputs	$V_O = V_{CC}$ or GND	2.5V		8	
			3.3V		8	

Notes:
1. Typical values are measured at $T_A = 25°C$.

Timing Requirements

(Over recommended operating free-air temperature range, unless otherwise noted, see Figures 1 thru 4)

	V_{CC} = 1.2V		V_{CC} = 1.5V ±0.1V		V_{CC} = 1.8V ±0.15V		V_{CC} = 2.5V ±0.2V		V_{CC} = 3.3V ±0.3V		Units
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
f_{clock} Clock Frequency						150		250		350	MHz
t_w Pulse duration, CLKAB or CLKBA high or low					3.0		2.0		1.4		ns
t_{su} Setup time, A before CLKAB↑, or B before CLKBA↑					1.9		0.9		0.8		ns
t_h Hold time, A after CLKAB↑, or B after CLKBA↑					0.8		0.5		0.6		ns

Switching Characteristics

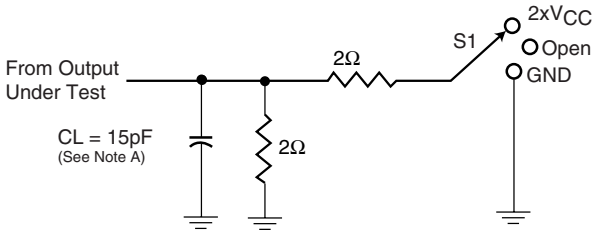
(Over recommended operating free-air temperature range, unless otherwise noted, see Figures 1 thru 4)

Parameters	From (Input)	To (Output)	V_{CC} = 1.2V		V_{CC} = 1.5V ±0.1V		V_{CC} = 1.8V ±0.15V		V_{CC} = 2.5V ±0.2V		V_{CC} = 3.3V ±0.3V		Units
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
f_{max}							150		250		350		MHz
t_{pd}	A or B	B or A					1.5	3.5	1.2	2.5	0.9	2.0	ns
	CLKAB or CLKBA	A or B					1.9	4.2	1.3	2.8	1.0	2.5	
	SAB or SBA						1.9	3.8	1.8	3.0	1.5	2.5	
t_{en}	$\overline{OE}$						1.9	4.5	1.4	3.5	1.0	3.0	
t_{dis}							1.9	4.0	1.4	3.5	1.0	3.0	
t_{en}	DIR						1.9	4.5	1.4	3.5	1.0	3.0	
t_{dis}							1.9	4.0	1.4	3.0	1.0	3.0	

Operating Characteristics T_A=25°C

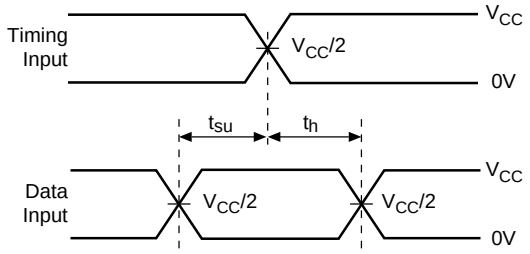
Parameters		Test Conditions	V_{CC} = 1.8V ±0.15V	V_{CC} = 2.5V ±0.2V	V_{CC} = 3.3V ±0.3V	Units
			Typical	Typical	Typical	
C_{pd} Power Dissipation Capacitance	Outputs Enabled	C_L = 0pF, f = 10 MHz	23	25	30	pF
	Outputs Disabled		5	6	10	

PARAMETER MEASUREMENT INFORMATION
V_{CC} = 1.2V and 1.5V ±0.1V

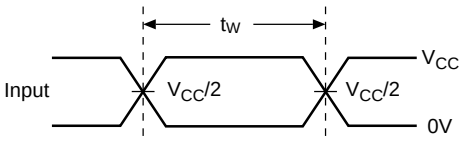


Test	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	2 x V_{CC}
t_{PHZ}/t_{PZH}	GND

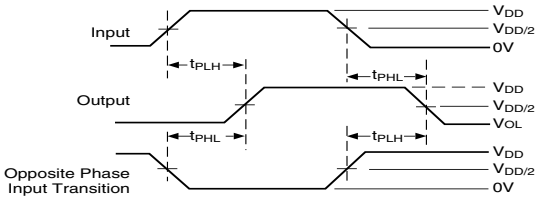
Load Circuit



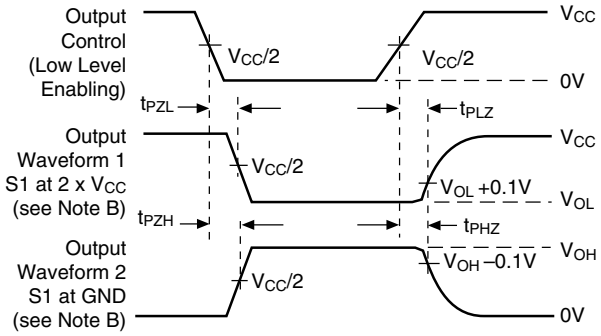
Voltage Waveforms
Setup and Hold Times



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

Figure 1. Load Circuit and Voltage Waveforms

Notes:

A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

- All input impulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω, t_R ≤ 2.0ns, t_F ≤ 2.0ns.
- The outputs are measured one at a time with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{dis}
- t_{PZL} and t_{PZH} are the same as t_{en}
- t_{PLH} and t_{PHL} are the same as t_{pd}

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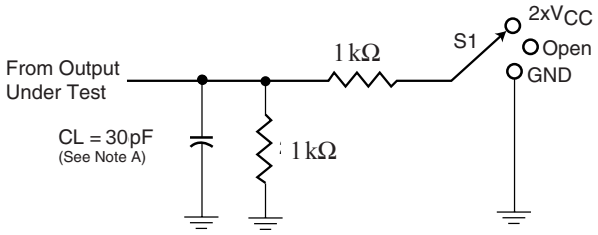
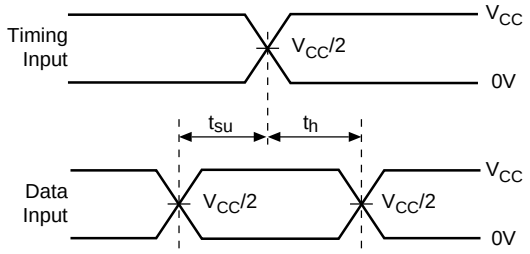
PARAMETER MEASUREMENT INFORMATION
V_{CC} = 1.8V ±0.15V

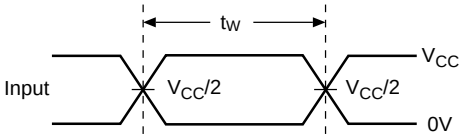


Test	S1
t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	Open 2 x V_{CC} GND

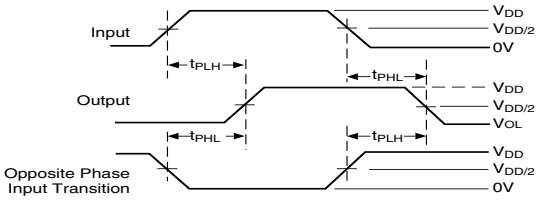
Load Circuit



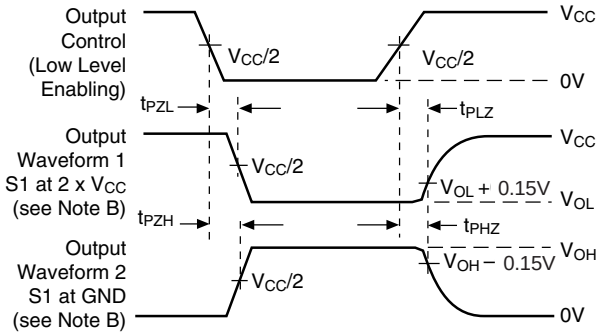
Voltage Waveforms
Setup and Hold Times



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

Figure 2. Load Circuit and Voltage Waveforms

Notes:

A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

- All input impulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω, t_R ≤ 2.0ns, t_F ≤ 2.0ns.
- The outputs are measured one at a time with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{dis}
- t_{PZL} and t_{PZH} are the same as t_{en}
- t_{PLH} and t_{PHL} are the same as t_{pd}

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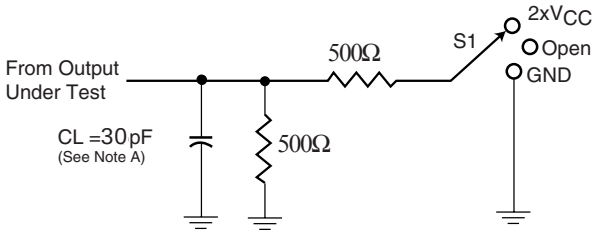
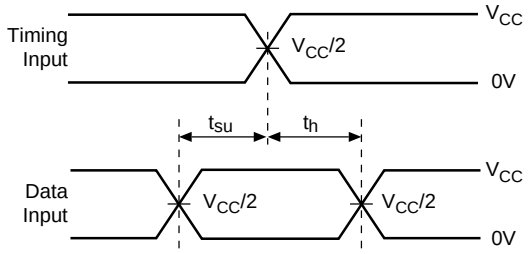
PARAMETER MEASUREMENT INFORMATION
V_{CC} = 2.5V ±0.2V

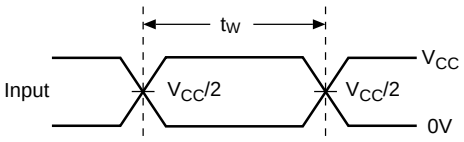


Test	S1
t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	Open 2 x V_{CC} GND

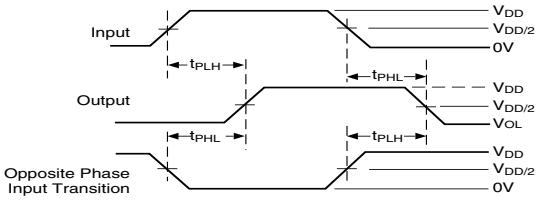
Load Circuit



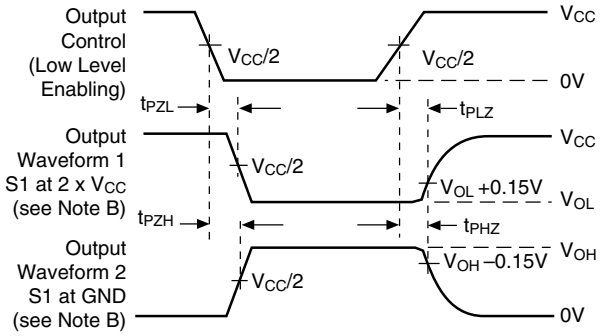
Voltage Waveforms
Setup and Hold Times



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

Figure 3. Load Circuit and Voltage Waveforms

Notes:

A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

- All input impulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω, t_R ≤ 2.0ns, t_F ≤ 2.0ns.
- The outputs are measured one at a time with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{dis}
- t_{PZL} and t_{PZH} are the same as t_{en}
- t_{PLH} and t_{PHL} are the same as t_{pd}

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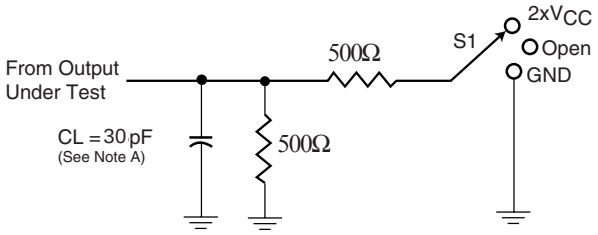
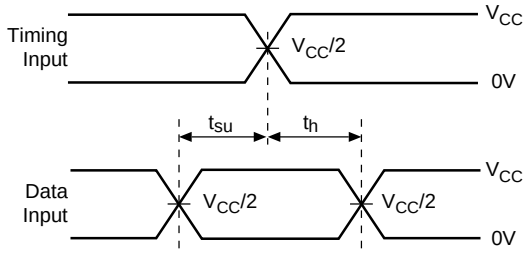
PARAMETER MEASUREMENT INFORMATION
V_{CC} = 3.3V ±0.3V

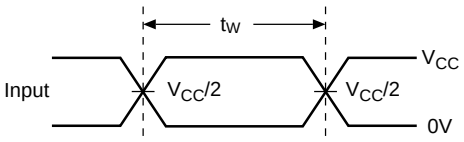


Test	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	2 x V_{CC}
t_{PHZ}/t_{PZH}	GND

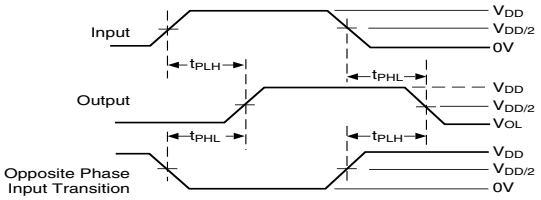
Load Circuit



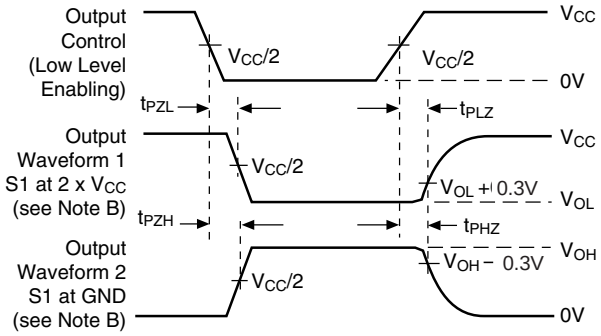
Voltage Waveforms
Setup and Hold Times



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

Figure 4. Load Circuit and Voltage Waveforms

Notes:

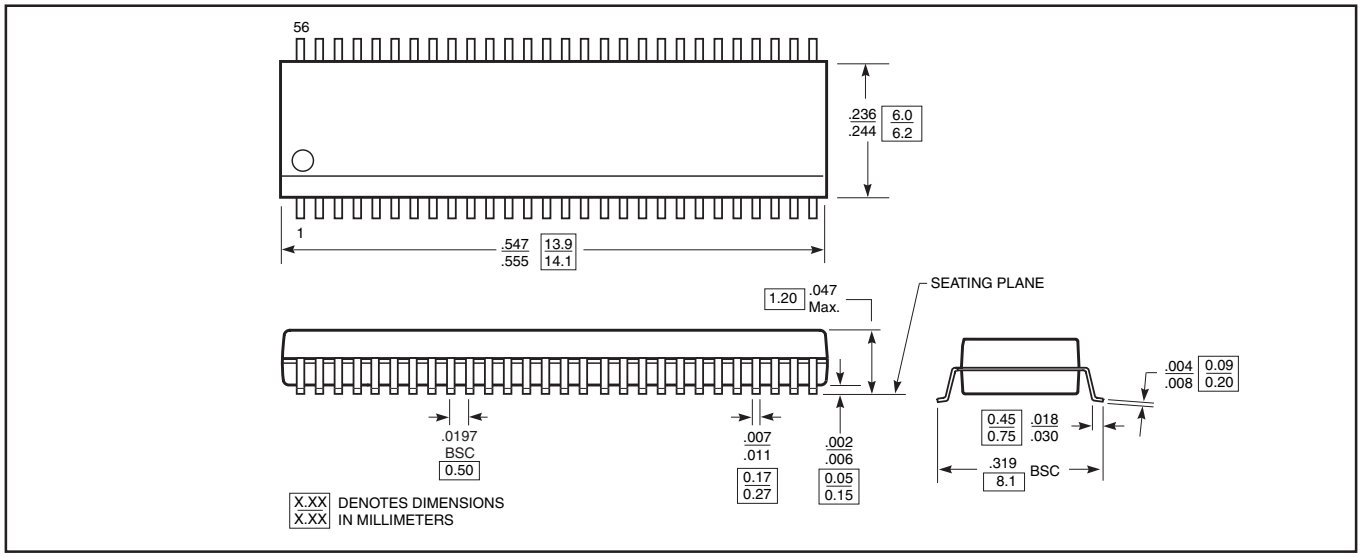
A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

- All input impulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω, t_R ≤ 2.0ns, t_F ≤ 2.0ns.
- The outputs are measured one at a time with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{dis}
- t_{PZL} and t_{PZH} are the same as t_{en}
- t_{PLH} and t_{PHL} are the same as t_{pd}

06-0170

Packaging Mechanical: 56-Pin TSSOP (A)



Ordering Information

Ordering Code	Package Type	Package Description
PI74AVC+16646A	A	56-pin, 240 mil wide plastic TSSOP
PI74AVC+16646AE	A	Pb-free & Green, 56-pin, 240 mil wide plastic TSSOP

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- E = Pb-free & Green
- Adding an X suffix = Tape/Reel