

**18-Bit Universal Bus Transceiver  
With 3-State Outputs**

**Product Features**

- PI74AVC+16501 is designed for low voltage operation,  $V_{CC} = 1.65V$  to  $3.6V$
- True  $\pm 24mA$  Balanced Drive @  $3.3V$
- $I_{OFF}$  supports partial Power-down operation
- $3.6V$  I/O Tolerant inputs and outputs
- All outputs contain a potential DDC (Dynamic Drive Control) that reduces noise without degrading propagation delay.
- Industrial operation at  $-40^{\circ}C$  to  $+85^{\circ}C$
- Packages available:
  - 56-pin 240 mil wide plastic TSSOP (A)
  - 56-pin 173 mil wide plastic TVSOP (K)

**Product Description**

Pericom Semiconductor's PI74AVC+ series of logic circuits are produced using the Company's advanced 0.35 micron CMOS technology, achieving industry leading speed.

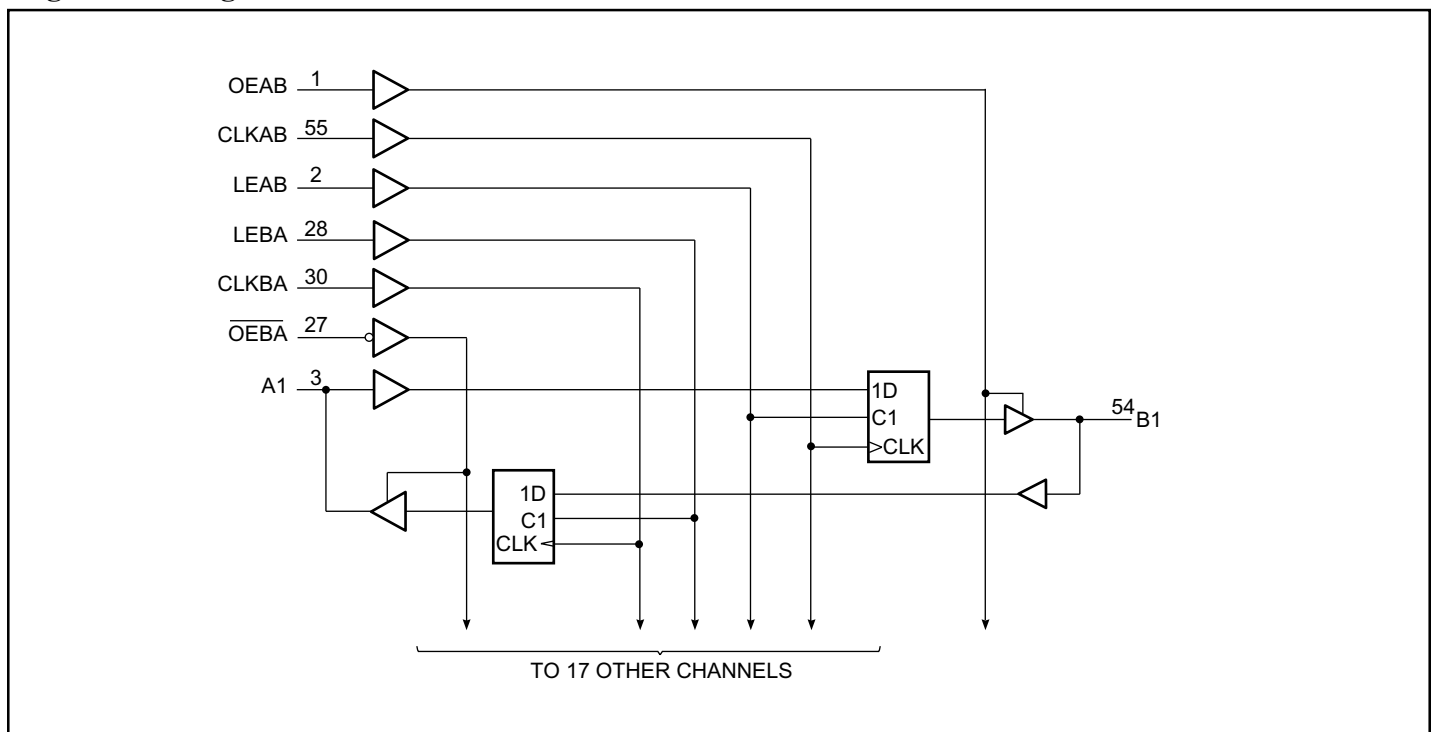
The 18-bit PI74AVC+ 16501 universal bus transceiver is designed for  $1.65V$  to  $3.6V$   $V_{CC}$  operation.

Data flow in each direction is controlled by Output Enable (OEAB and  $\overline{OEBA}$ ), Latch Enable (LEAB and LEBA), and CLOCK (CLKAB and CLKBA) inputs. For A-to-B data flow, the device operates in the transparent mode when LEAB is HIGH. When LEAB is LOW, the A data is latched if CLKAB is held at a high or low logic level. If LEAB is LOW, the A-bus data is stored in the latch/flip-flop on the low-to-high transition of CLKAB. When OEAB is HIGH, the outputs are active. When OEAB is LOW, the outputs are in the high-impedance state.

Data flow for B to A is similar to that of A to B but uses  $\overline{OEBA}$ , LEBA, and CLKBA. The Output Enables are complementary (OEAB is active HIGH and  $\overline{OEBA}$  is active LOW)

To ensure the high-impedance state during power up or power down, OEBA should be tied to  $V_{CC}$  through a pull-up resistor and OEAB should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

**Logic Block Diagram**



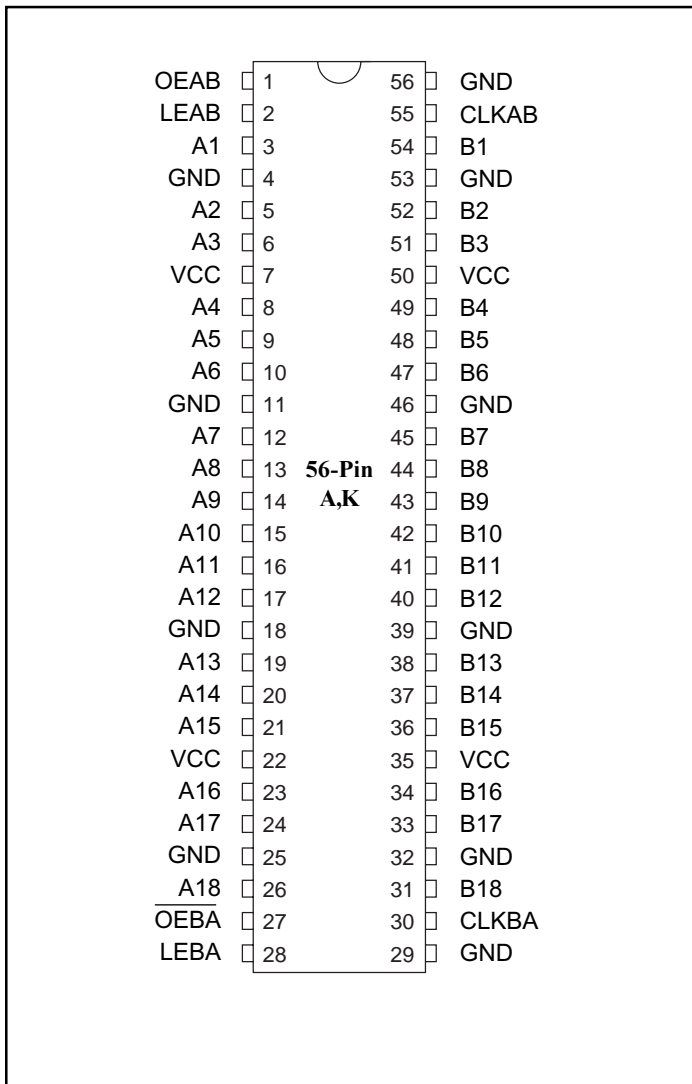
### Product Pin Description

Pin Name	Description
$\overline{OE}$	Output Enable Input (Active HIGH)
LE	Latch Enable (Active HIGH)
CLK	Clock Input (Active HIGH)
Ax	Data I/O
Bx	Data I/O
GND	Ground
Vcc	Power

### Truth Table<sup>(1)†</sup>

Inputs				Output B
OEAB	LEAB	CLKAB	A	
L	X	X	X	Z
H	H	X	L	L
H	H	X	H	H
H	L	↑	L	L
H	L	↑	H	H
H	L	H	X	B0‡
H	L	L	X	B0§

### Product Pin Configuration



#### Notes:

1. H = High Signal Level  
L = Low Signal Level  
Z = High Impedance  
↑ = LOW-to-HIGH Transition
- † A-to-B data flow is shown: B-to-A flow is similar but uses OEBA, LEBA, CLKBA.
- ‡ Output level before the indicated steady-state input conditions were established, provided that CLKAB is HIGH before LEAB goes LOW.
- § Output level before the indicated steady-state input conditions were established.

**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, $I_O$ .....	$\pm 50$ mA
Continuous current through each $V_{CC}$ or GND .....	$\pm 100$ mA
Package thermal impedance, $\theta_{JA}^{(3)}$ : package A .....	64°C/W
package K .....	48°C/W
Storage Temperature range, $T_{stg}$ .....	-65°C to 150°C

**Note:**

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.

**Notes:**

1. Input & output negative-voltage ratings may be exceeded if the input and output current 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<sup>(1)</sup>**

		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	$0.65 \times V_{CC}$		
	$V_{CC} = 2.3V$ 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		$0.35 \times V_{CC}$	
	$V_{CC} = 2.3V$ 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 Operating Range,  $T_A = -40^{\circ}\text{C} + 85^{\circ}\text{C}$ )

Parameters		Test Conditions <sup>(1)</sup>	V <sub>CC</sub>	Min.	Max.	Units
V <sub>OH</sub>		I <sub>OH</sub> = -100μA	1.65V to 3.6V	V <sub>CC</sub> - 0.2V		V
		I <sub>OH</sub> = -6mA    V <sub>IH</sub> = 1.07V	1.65V	1.2		
		I <sub>OH</sub> = -12mA    V <sub>IH</sub> = 1.7V	2.3V	1.75		
		I <sub>OH</sub> = -24mA    V <sub>IH</sub> = 2V	3V	2.0		
V <sub>OL</sub>		I <sub>OL</sub> = 100μA	1.65V to 3.6V		0.2	
		I <sub>OL</sub> = 6mA    V <sub>IH</sub> = 0.57V	1.65V		0.45	
		I <sub>OL</sub> = 12mA    V <sub>IH</sub> = 0.7V	2.3V		0.55	
		I <sub>OL</sub> = 24mA    V <sub>IH</sub> = 0.8V	3V		0.8	
I <sub>I</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND	3.6V		±2.5	μA
I <sub>OFF</sub>		V <sub>I</sub> or V <sub>O</sub> = 3.6V	0		±10	
I <sub>OZ</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND	3.6V		±10	
I <sub>CC</sub>		V <sub>O</sub> = V <sub>CC</sub> or GND    I <sub>O</sub> = 0	3.6V		40	
C <sub>I</sub>	Control Inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	2.5V		4	pF
			3.3V		4	
	Data Inputs		2.5V		6	
			3.3V		6	
C <sub>O</sub>	Outputs	V <sub>O</sub> = V <sub>CC</sub> or GND	2.5V		8	
			3.3V		8	

**Note:** Typical values are measured at  $T_A = 25^{\circ}\text{C}$ .

### Timing Requirements

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

		$V_{CC} = 1.2V$		$V_{CC} = 1.5V \pm 0.1V$		$V_{CC} = 1.8V \pm 0.15V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 3.3V \pm 0.3V$		Units
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
$f_{clock}$ Clock Frequency							150		250		350	MHz
$t_w$ Pulse Duration	LE High					3.3		2.0		1.4		ns
	CLK High or Low					3.3		2.0		1.4		
$t_{su}$ Setup Time	Data before CLK $\uparrow$	2.1		1.6		1.3		0.9		0.9		
	Data before LE $\downarrow$	CLK High	0.1		0.1		0.1		0.1		0.1	
		CLK Low	0.1		0.1		0.1		0.1		0.1	
$t_h$ Hold Time	Data before CLK $\uparrow$	1.2		1.0		0.8		0.5		0.5		
	Data after LE $\downarrow$	CLK High or Low	2.3		2.3		1.4		1.2		1.2	

### Switching Characteristics

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

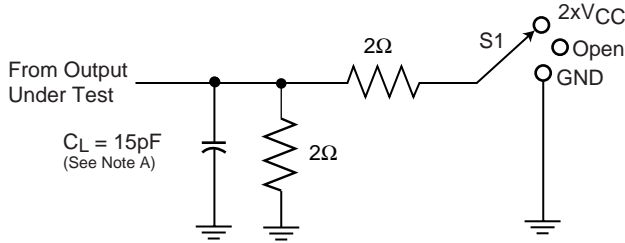
Parameters	From (Input)	To (Output)	$V_{CC} = 1.2V$		$V_{CC} = 1.5V \pm 0.1V$		$V_{CC} = 1.8V \pm 0.15V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 3.3V \pm 0.3V$		Units
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
$f_{max}$							150		150		150		MHz
$t_{pd}$	A or B	B or A		5.2		3.7		3.5		3.0		2.5	ns
	LE	A or B		6.2		4.3		4.0		3.3		3.0	
	CLK			7.0		4.6		4.4		3.3		3.0	
$t_{en}$	OEAB	B		6.3		4.1		3.9		3.3		3.0	
$t_{dis}$	OEAB	B		6.3		4.7		4.3		3.3		3.3	
$t_{en}$	$\overline{OEBA}$	A		6.8		4.6		4.2		3.6		3.3	
$t_{dis}$	$\overline{OEBA}$	A		7.0		5.0		4.5		3.9		3.6	

### Operating Characteristics, $T_A = 25^\circ C$

Parameters		Test Conditions	$V_{CC} = 1.8V \pm 0.2V$	$V_{CC} = 2.5V \pm 0.2V$	$V_{CC} = 3.3V \pm 0.3V$	Units
			Typ.	Typ.	Typ.	
$C_{pd}$ Power Dissipation Capacitance	Outputs Enabled	$C_L = 0pF,$ $f = 10 MHz$	21	24	30	pF
	Outputs Disabled		2	4	7	

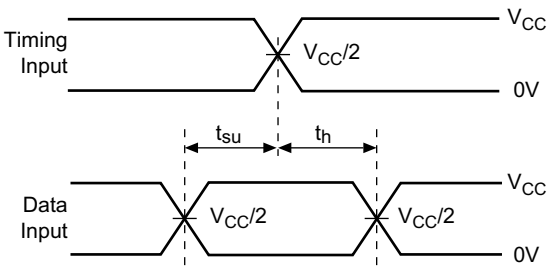
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 1.2V$  AND  $1.5V \pm 0.1V$

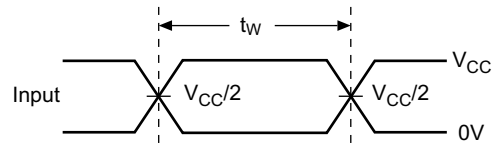


Load Circuit

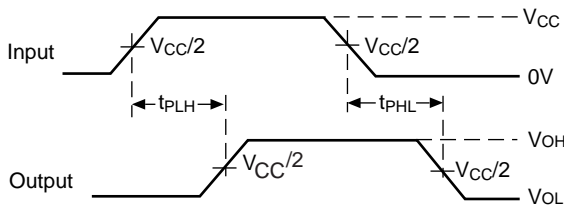
Test	S1
$t_{pd}$ $t_{PLZ}/t_{PZL}$ $t_{PHZ}/t_{PZH}$	Open $2 \times V_{CC}$ GND



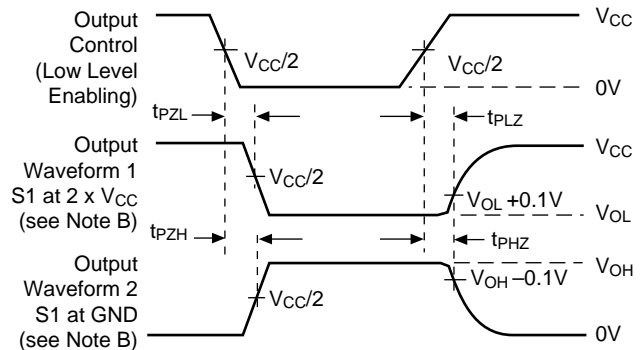
Voltage Waveforms  
Setup and Hold Times



Voltage Waveforms  
Pulse Duration



Voltage Waveforms  
Propagation Delay Times



Voltage Waveforms  
Enable and Disable Times

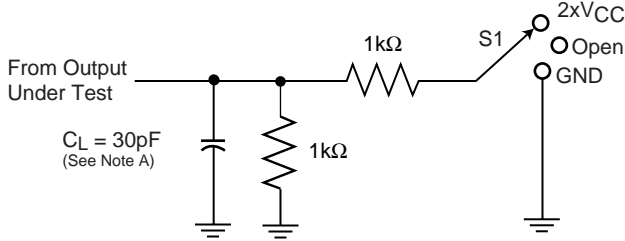
Figure 1. Load Circuit and Voltage Waveforms

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

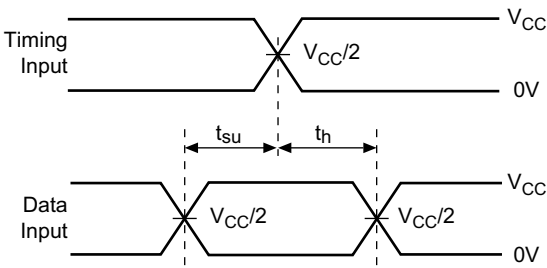
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 1.8V \pm 0.15V$

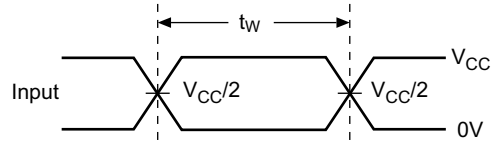


Load Circuit

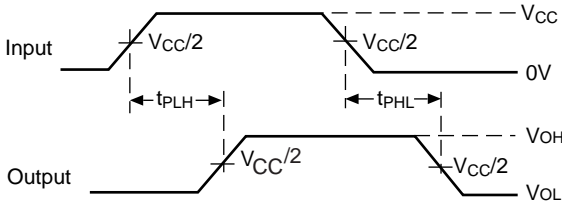
Test	S1
$t_{pd}$ $t_{PLZ}/t_{PZL}$ $t_{PHZ}/t_{PZH}$	Open $2 \times V_{CC}$ GND



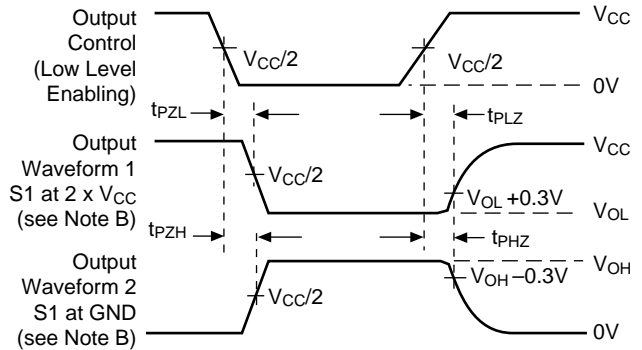
Voltage Waveforms  
Setup and Hold Times



Voltage Waveforms  
Pulse Duration



Voltage Waveforms  
Propagation Delay Times



Voltage Waveforms  
Enable and Disable Times

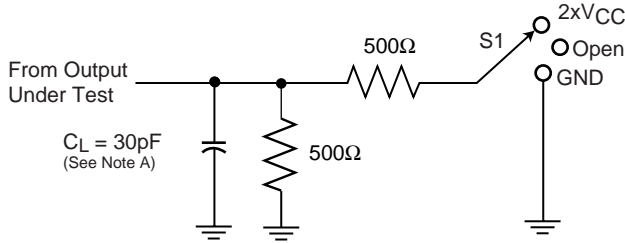
Figure 2. Load Circuit and Voltage Waveforms

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

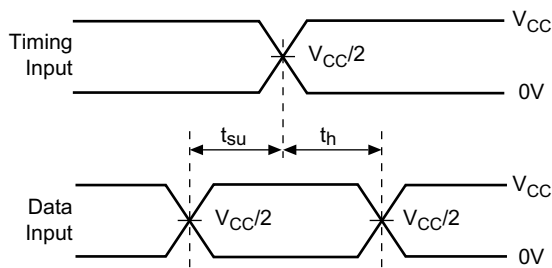
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.5V \pm 0.2V$

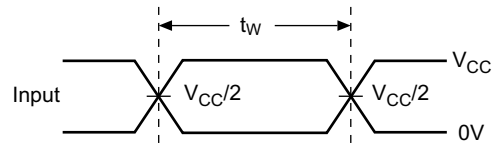


Load Circuit

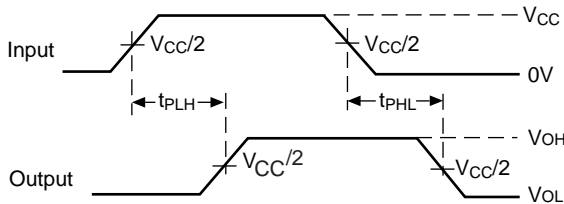
Test	S1
$t_{pd}$ $t_{PLZ}/t_{PZL}$ $t_{PHZ}/t_{PZH}$	Open $2 \times V_{CC}$ GND



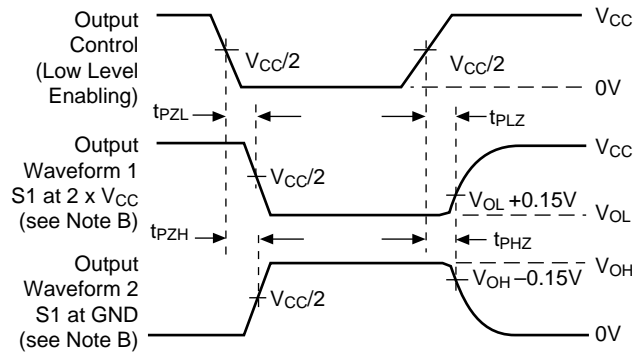
Voltage Waveforms  
Setup and Hold Times



Voltage Waveforms  
Pulse Duration



Voltage Waveforms  
Propagation Delay Times



Voltage Waveforms  
Enable and Disable Times

Figure 3. Load Circuit and Voltage Waveforms

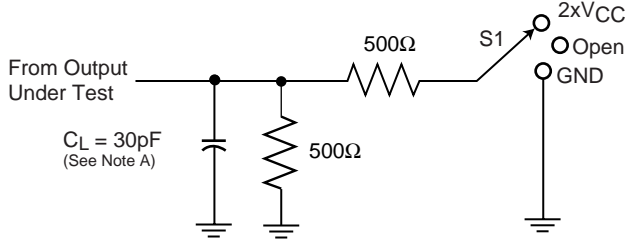
Notes:

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



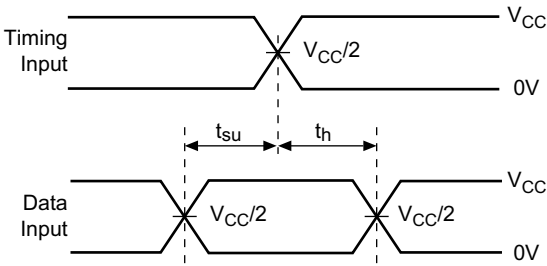
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 3.3V \pm 0.3V$

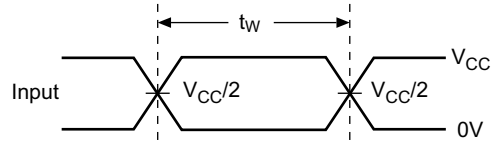


Load Circuit

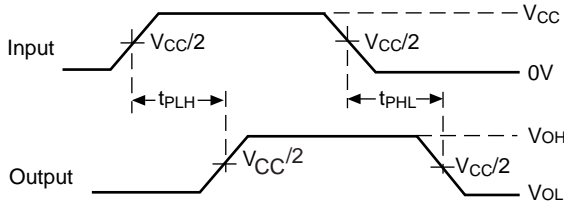
Test	S1
$t_{pd}$ $t_{PLZ}/t_{PZL}$ $t_{PHZ}/t_{PZH}$	Open $2 \times V_{CC}$ GND



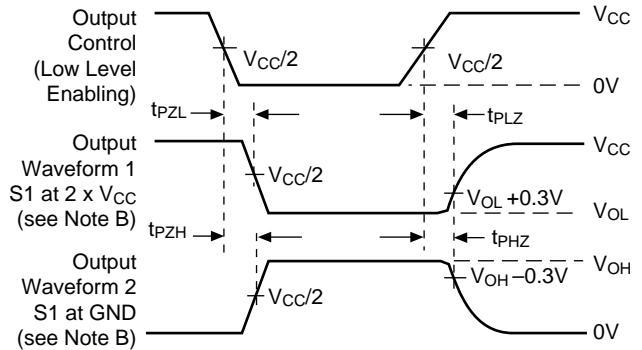
Voltage Waveforms  
Setup and Hold Times



Voltage Waveforms  
Pulse Duration



Voltage Waveforms  
Propagation Delay Times



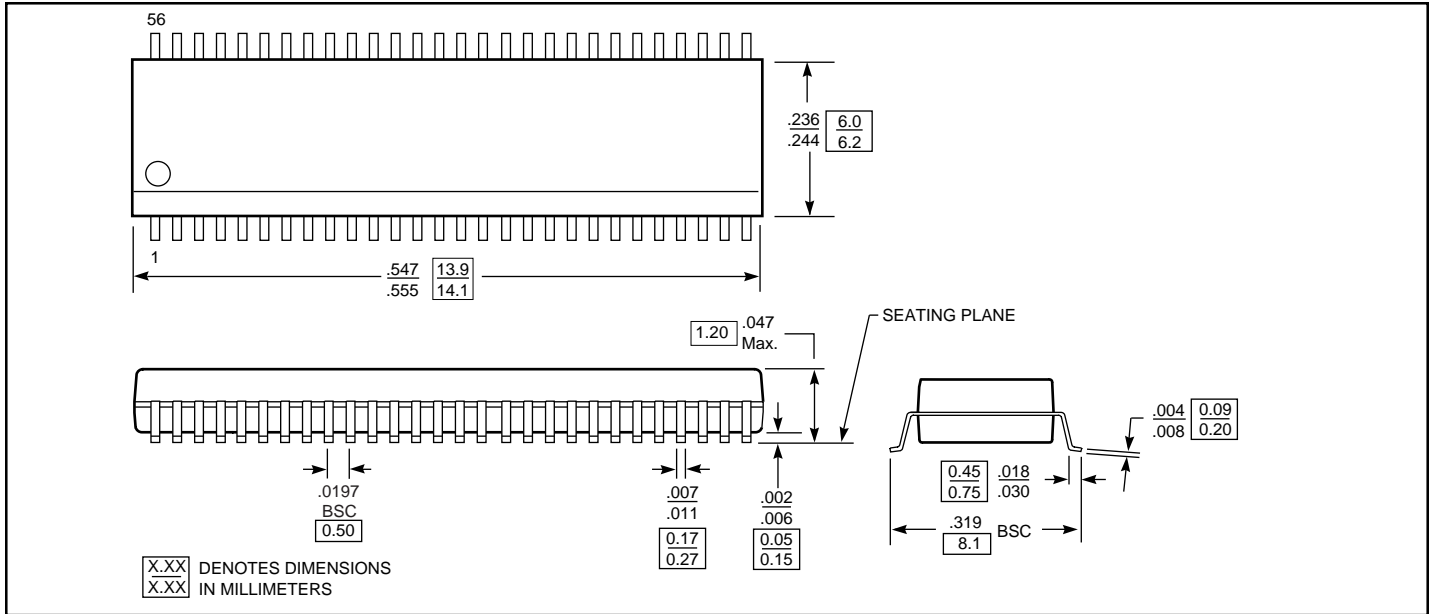
Voltage Waveforms  
Enable and Disable Times

Figure 4. Load Circuit and Voltage Waveforms

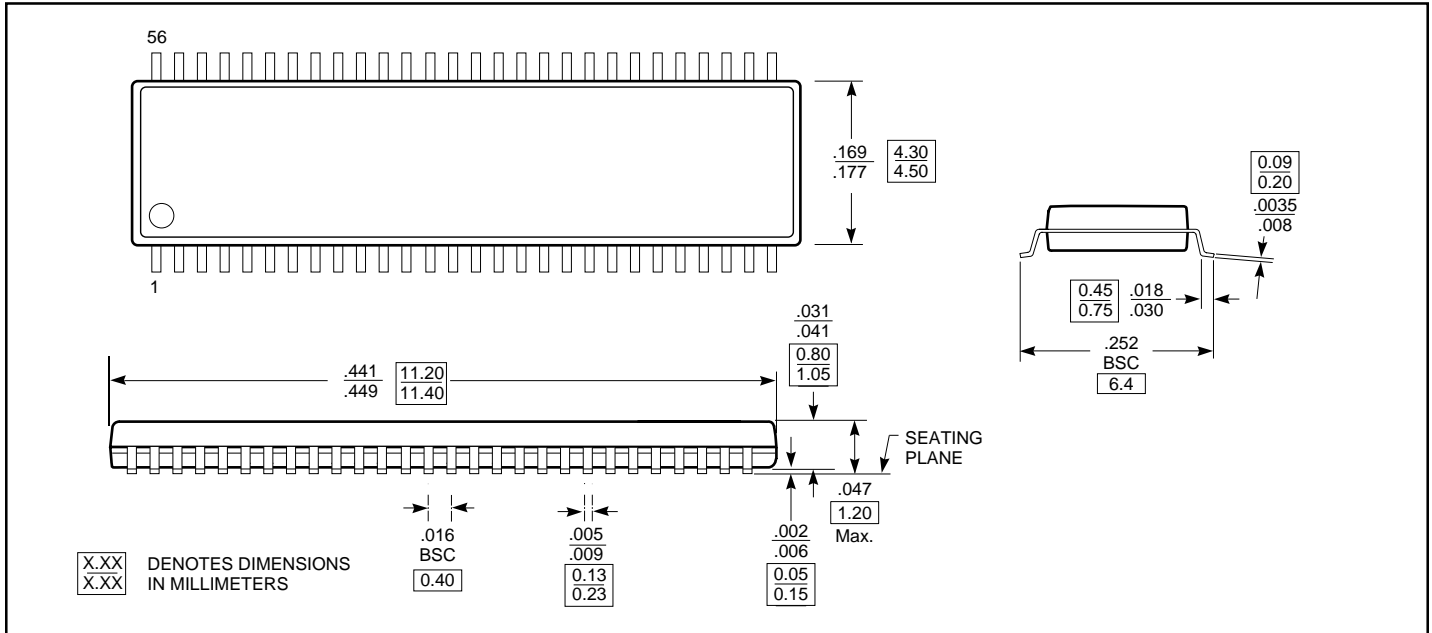
Notes:

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

### Packaging Mechanical - 56-pin TSSOP (A package)



### Packaging Mechanical - 56-pin TVSOP (K package)



### Ordering Information

Ordering Information	Description
PI74AVC+16501A	56-pin, 240-mil wide plastic TSSOP
PI74AVC+16501K	56-pin, 173-mil wide plastic TVSOP