

Product Features

- PI74AVC+16721 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 noise reduction circuitry reducing noise without speed degradation
- Industrial operation at $-40^{\circ}C$ to $+85^{\circ}C$
- Available Packages:
 - 56-pin 240 mil wide plastic TSSOP (A)
 - 56-pin 173 mil wide plastic TVSOP (TSSOP) (K)

Product Description

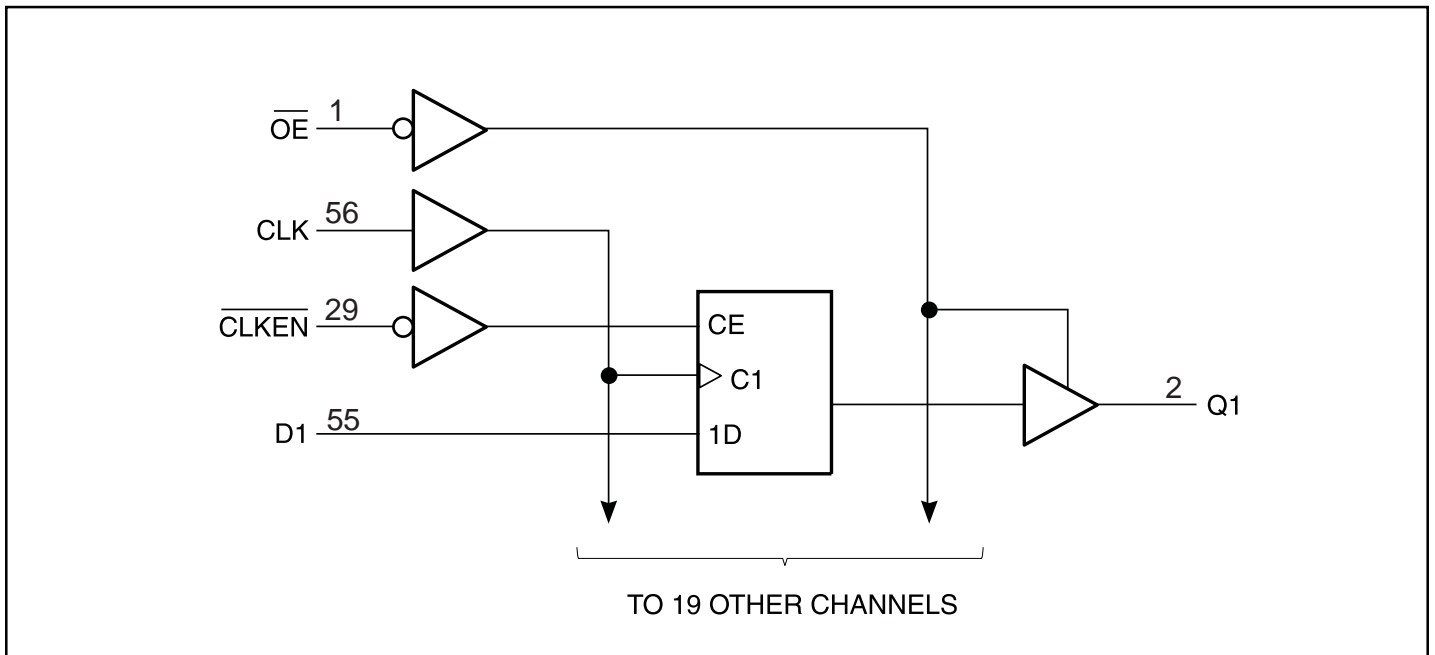
Pericom Semiconductor’s PI74AVC+ series of logic circuits are produced using the Company’s advanced submicron CMOS technology, achieving industry leading speed.

The PI74AVC+16721 is a 20-bit flip-flop with 3-state outputs designed specifically for $1.65V$ to $3.6V$ V_{CC} operation. The device is designed with edge-triggered D-type flip-flops with qualified clock storage. On the positive transition of clock (CLK) input, the device provides true data at the Q outputs, provided that the clock-enable (CLKEN) input is LOW. If CLKEN is HIGH, no data is stored.

A buffered output-enable (\overline{OE}) input can be used to place the 20 outputs in either a normal logic state (HIGH or LOW level) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capacity to drive bus lines without the need for interface or pullup components. \overline{OE} does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

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 Diagram



Product Pin Description

Pin Name	Description
\overline{OE}	Output Enable Input (Active LOW)
\overline{CLKEN}	Clock Enable Input (Active LOW)
CLK	Clock Input (Active HIGH)
Dx	Data Inputs
Qx	3-State Outputs
GND	Ground
VCC	Power

Truth Table⁽¹⁾

Inputs				Outputs
\overline{OE}	\overline{CLKEN}	CLK	Dx	Qx
L	H	X	X	Q ₀
L	L	–	H	H
L	L	–	L	L
L	L	L or H	X	Q ₀
H	X	X	X	Z

Notes:

- H = High Signal Level
 L = Low Signal Level
 X = Don't Care or Irrelevant
 Z = High Impedance
 ↑ = LOW-to-HIGH Transition

Product Pin Configuration

\overline{OE}	□ 1		56	□ CLK
Q1	□ 2		55	□ D1
Q2	□ 3		54	□ D2
GND	□ 4		53	□ GND
Q3	□ 5		52	□ D3
Q4	□ 6		51	□ D4
VCC	□ 7		50	□ VCC
Q5	□ 8		49	□ D5
Q6	□ 9		48	□ D6
Q7	□ 10		47	□ D7
GND	□ 11		46	□ GND
Q8	□ 12		45	□ D8
Q9	□ 13		44	□ D9
Q10	□ 14	56-Pin A,V	43	□ D10
Q11	□ 15		42	□ D11
Q12	□ 16		41	□ D12
Q13	□ 17		40	□ D13
GND	□ 18		39	□ GND
Q14	□ 19		38	□ D14
Q15	□ 20		37	□ D15
Q16	□ 21		36	□ D16
VCC	□ 22		35	□ VCC
Q17	□ 23		34	□ D17
Q18	□ 24		33	□ D18
GND	□ 25		32	□ GND
Q19	□ 26		31	□ D19
Q20	□ 27		30	□ D20
NC	□ 28		29	□ \overline{CLKEN}

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	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.
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	$\pm 50mA$	
Continuous current through each V_{CC} or GND	$\pm 100mA$	
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	

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⁽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 $1.95V$	$0.65 \times V_{CC}$		
	$V_{CC} = 2.3V$ 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 the Operating Range ($T_A = -40^\circ\text{C} + 85^\circ\text{C}$)

Parameters		Test Conditions ⁽¹⁾	V_{CC}	Min.	Typ.	Max.	Units
V_{OH}		$I_{OH} = -100\mu\text{A}$	1.65V to 3.6V	$V_{CC} - 0.2\text{V}$			V
		$I_{OH} = -6\text{mA}$ $V_{IH} = 1.07\text{V}$	1.65V	1.2			
		$I_{OH} = -12\text{mA}$ $V_{IH} = 1.7\text{V}$	2.3V	1.75			
		$I_{OH} = -24\text{mA}$ $V_{IH} = 2\text{V}$	3V	2.0			
V_{OL}		$I_{OL} = 100\mu\text{A}$	1.65V to 3.6V			0.2	
		$I_{OL} = 6\text{mA}$ $V_{IH} = 0.57\text{V}$	1.65V			0.45	
		$I_{OL} = 12\text{mA}$ $V_{IH} = 0.7\text{V}$	2.3V			0.55	
		$I_{OL} = 24\text{mA}$ $V_{IH} = 0.8\text{V}$	3V			0.8	
I_I	Control Inputs	$V_I = V_{CC}$ or GND	3.6V			± 2.5	μA
I_{OFF}		V_I or $V_O = 3.6\text{V}$	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		

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} = 1.2 V		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		180		180	MHz
t _w	Pulse duration, CLK high or low					6.0		3.0		3.0		ns
t _{su}	Setup time	Data before CLK↑				5.7		3.5		2.4		
		$\overline{\text{CLKEN}}$ before CLK↑				2.2		2.0		1.6		
t _h	Hold time	Data after CLK↑				0		0		0		
		$\overline{\text{CLKEN}}$ after CLK↑				1.2		1.0		1.0		

Switching Characteristics over recommended operating free-air temperature range

(unless otherwise noted, see Figures 1 thru 4)

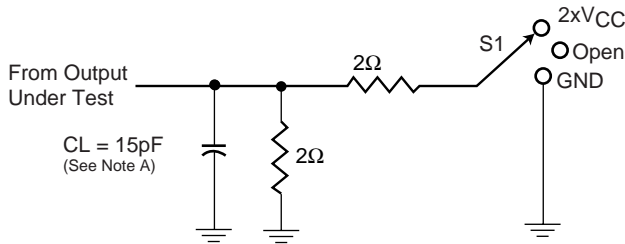
Parameters	From (Input)	To (Output)	V _{CC} = 1.2V		V _{CC} = 1.5V ±0.1V		V _{CC} = 1.8V ±0.15V		V _{CC} = 2.5V ±0.2V		V _{CC} = 3.3V ±0.3V		Units
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
f _{max}							150		180		180		MHz
t _{pd}	CLK	Q						4.3		3.0		2.6	ns
t _{en}	$\overline{\text{OE}}$	Q						5.8		4.8		4.0	
t _{dis}	$\overline{\text{OE}}$	Q						4.8		3.6		3.4	

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	65	80	100	pF
	Outputs Disabled		40	50	75	

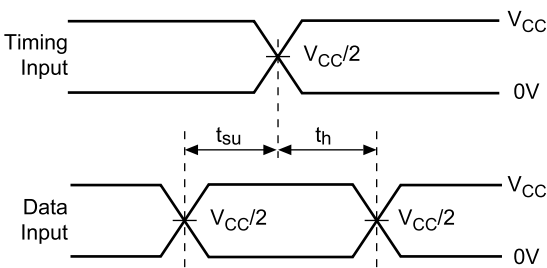
PARAMETER MEASUREMENT INFORMATION

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

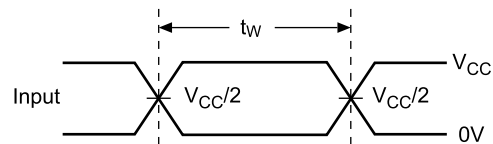


Load Circuit

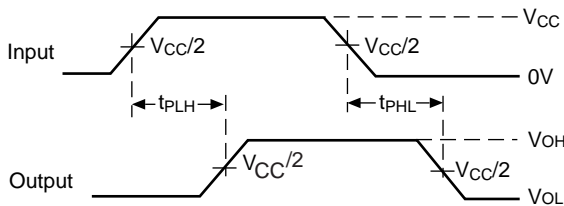
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t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	Open $2 \times V_{CC}$ GND



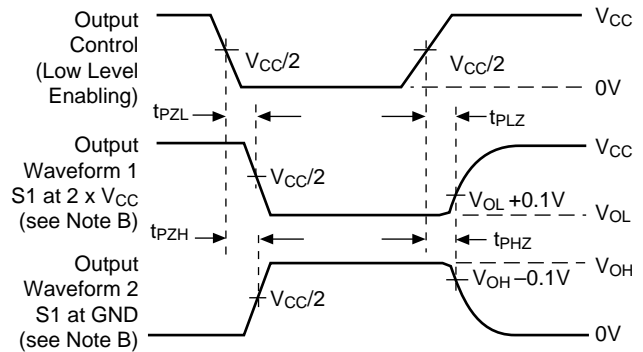
Voltage Waveforms
Setup and Hold Times



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

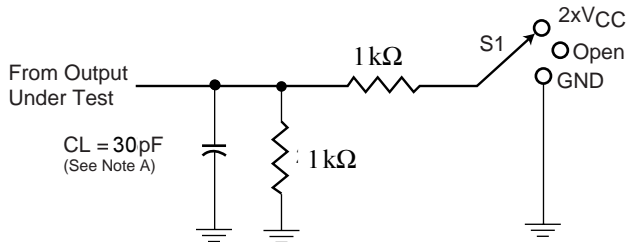
Figure 1. Load Circuit and Voltage Waveforms

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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50\Omega$, $t_R \leq 2.0\text{ns}$, $t_F \leq 2.0\text{ns}$.
- 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}

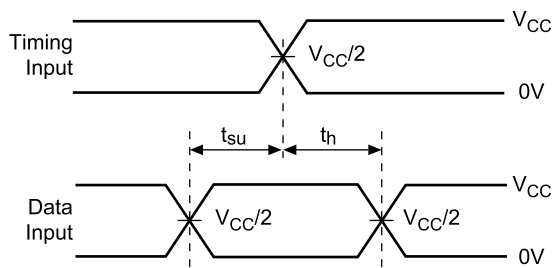
PARAMETER MEASUREMENT INFORMATION

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

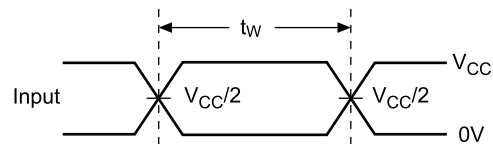


Load Circuit

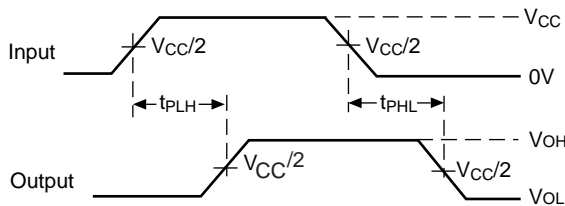
Test	S1
t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	Open 2 x VCC GND



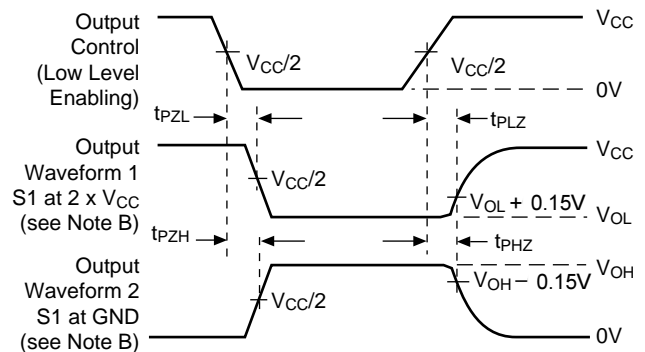
Voltage Waveforms
Setup and Hold Times



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

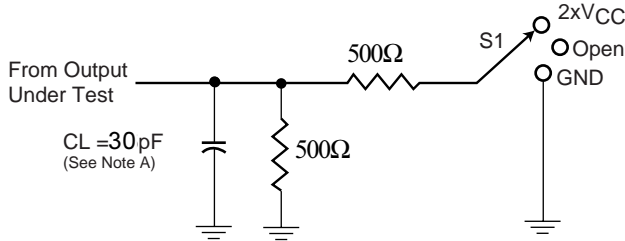
Figure 2. Load Circuit and Voltage Waveforms

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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50\Omega$, $t_R \leq 2.0ns$, $t_F \leq 2.0ns$.
- 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}

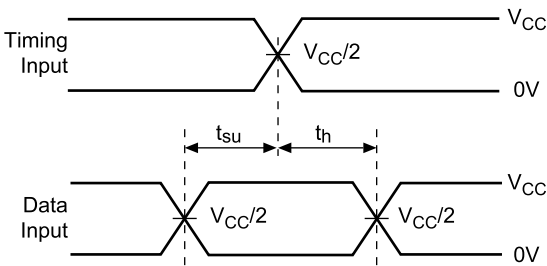
PARAMETER MEASUREMENT INFORMATION

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

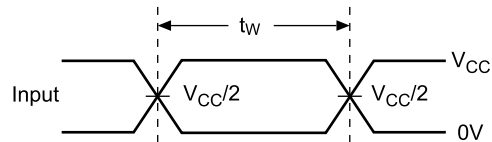


Load Circuit

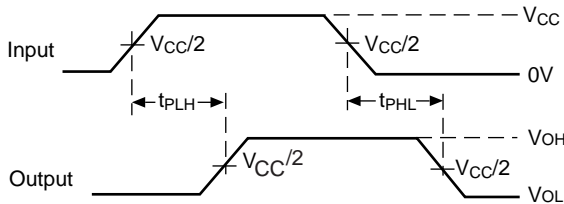
Test	S1
t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	Open $2 \times V_{CC}$ GND



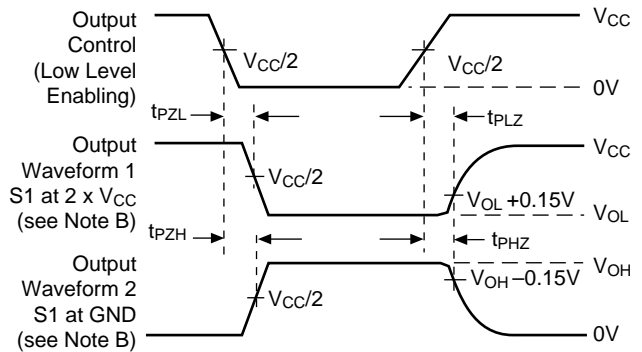
**Voltage Waveforms
Setup and Hold Times**



**Voltage Waveforms
Pulse Duration**



**Voltage Waveforms
Propagation Delay Times**



**Voltage Waveforms
Enable and Disable Times**

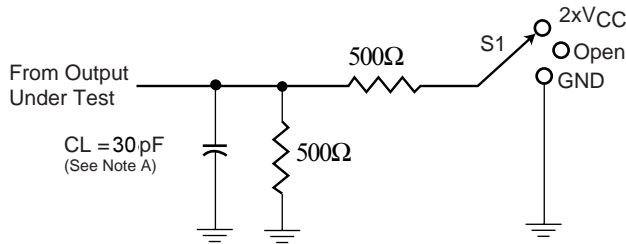
Figure 3. Load Circuit and Voltage Waveforms

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}

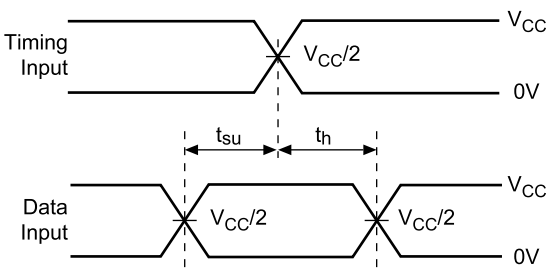
PARAMETER MEASUREMENT INFORMATION

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

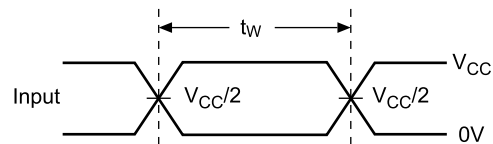


Load Circuit

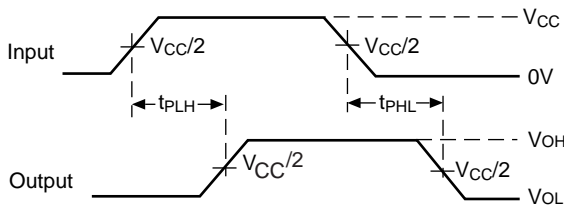
Test	S1
t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH}	Open $2 \times V_{CC}$ GND



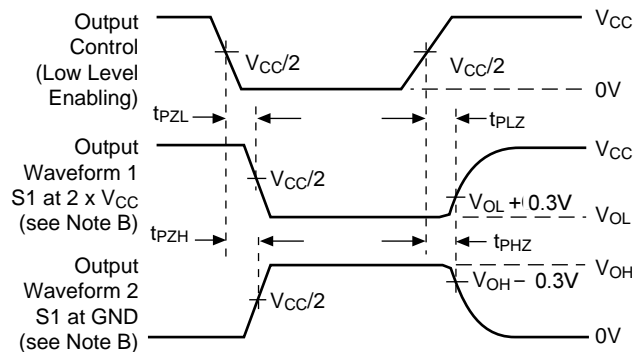
Voltage Waveforms
Setup and Hold Times



Voltage Waveforms
Pulse Duration



Voltage Waveforms
Propagation Delay Times



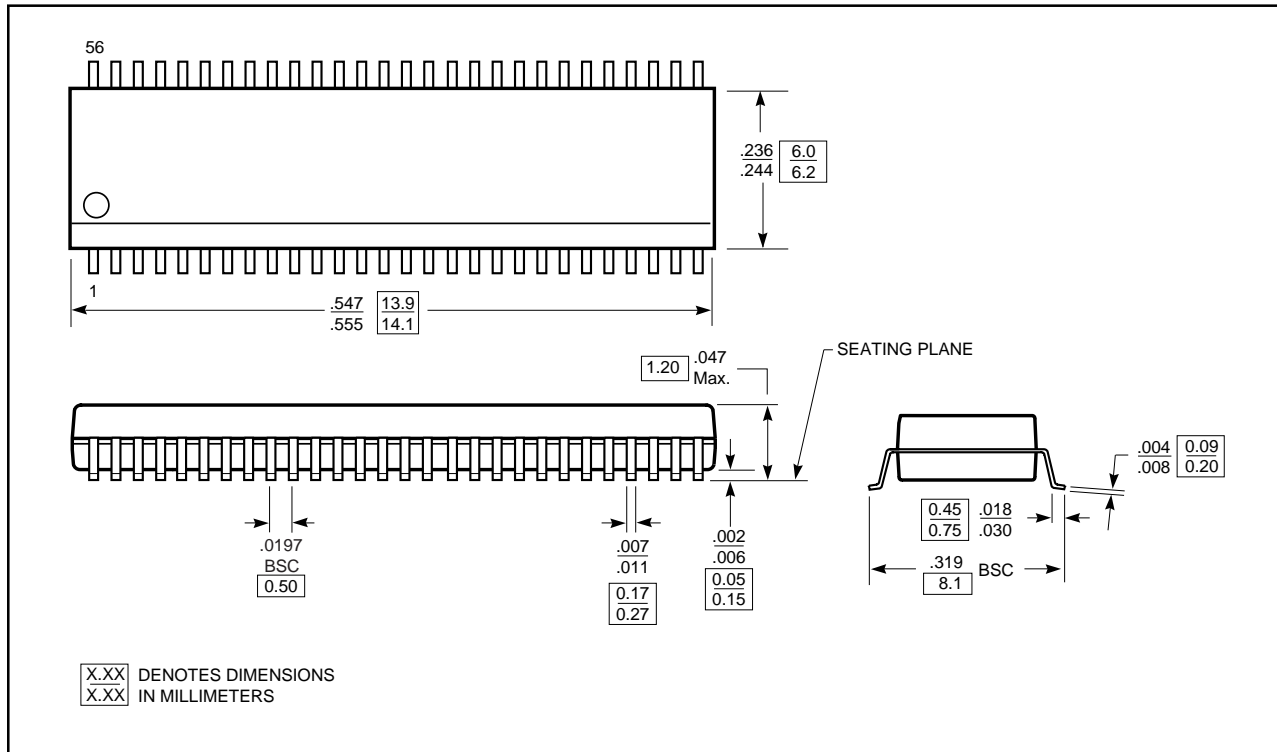
Voltage Waveforms
Enable and Disable Times

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}

Package Diagram : 56-pin 240-mil, Wide Plastic TSSOP (A)



Package Diagram : 56-pin 173-mil, Wide Plastic TVSOP (TSSOP) (K)

