# PERICOM

## 2.5V 20-Bit Buffer/Driver with 3-State Outputs

## Product Features

- PI74AVC**+** 16827 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 at –40°C to +85°C

- Available Packages:
  - 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 submicron CMOS technology, achieving industry leading speed.

The PI74AVC**+**16827, is a 20-bit non-inverting buffer/driver designed for 1.65V to 3.6V $V_{CC}$ operation.

A buffer/driver is composed of two 10-bit sections with separate output-enable signals. For either 10-bit buffer section, the two output-enable (1$\overline{OE}$1 and 1$\overline{OE}$2 or 2$\overline{OE}$1 and 2$\overline{OE}$2 inputs must both be low for the corresponding Y outputs to be active. If either output-enable input is HIGH, the output of that 10-bit buffer section 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 whose minimum value is determined by the current sinking capability of the driver.

## Logic Block Diagram
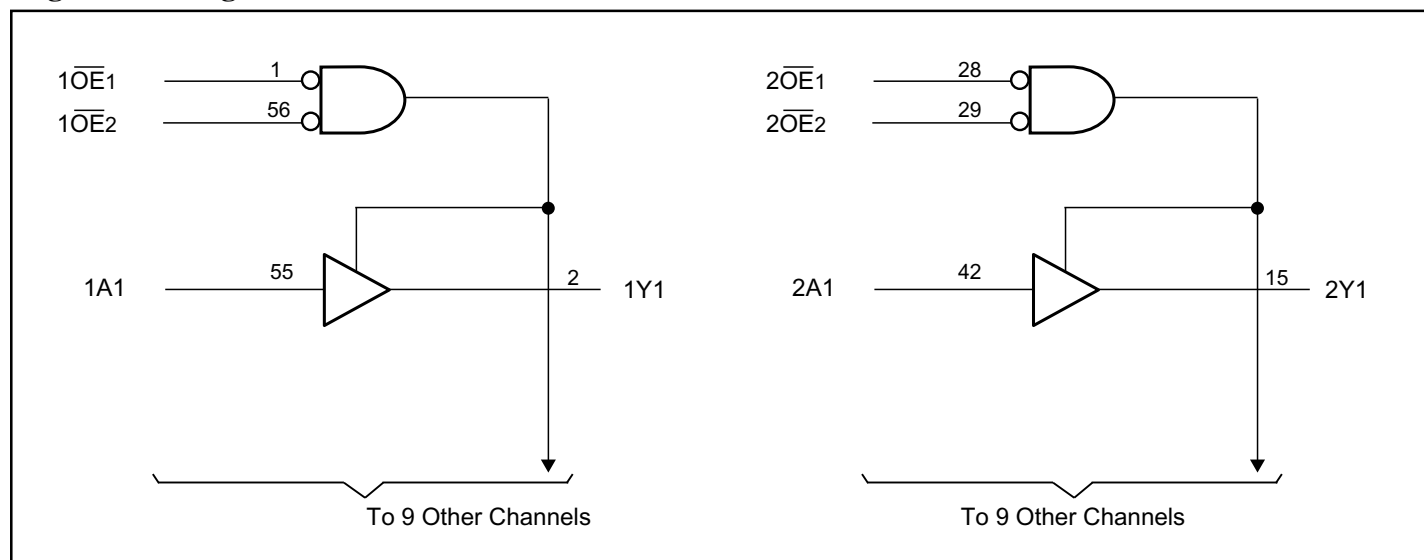
## Product Pin Description

| Pin Name | Description |
|---|---|
| $\overline{OE}$ | Output Enable Inputs (Active LOW) |
| Ax | Data Inputs |
| Yx | 3-State Outputs |
| GND | Ground |
| $V_{CC}$ | Power |

## Truth Table[1]

| Inputs | | | Outputs |
|---|---|---|---|
| $\overline{OE1}$ | $\overline{OE2}$ | A | Y |
| L | L | L | L |
| L | L | H | H |
| H | X | X | Z |
| X | H | X | Z |

**Note:**
1. H = High Signal Level
   L = Low Signal Level
   X = Irrelevant
   Z = High Impedance

## Product Pin Configuration

| Left | Pin | | Pin | Right |
|---|---|---|---|---|
| $1\overline{OE}_1$ | 1 | | 56 | $1\overline{OE}_2$ |
| $1Y_1$ | 2 | | 55 | $1A_1$ |
| $1Y_2$ | 3 | | 54 | $1A_2$ |
| GND | 4 | | 53 | GND |
| $1Y_3$ | 5 | | 52 | $1A_3$ |
| $1Y_4$ | 6 | | 51 | $1A_4$ |
| $V_{CC}$ | 7 | | 50 | $V_{CC}$ |
| $1Y_5$ | 8 | | 49 | $1A_5$ |
| $1Y_6$ | 9 | | 48 | $1A_6$ |
| $1Y_7$ | 10 | | 47 | $1A_7$ |
| GND | 11 | **56-Pin A, K** | 46 | GND |
| $1Y_8$ | 12 | | 45 | $1A_8$ |
| $1Y_9$ | 13 | | 44 | $1A_9$ |
| $1Y_{10}$ | 14 | | 43 | $1A_{10}$ |
| $2Y_1$ | 15 | | 42 | $2A_1$ |
| $2Y_2$ | 16 | | 41 | $2A_2$ |
| $2Y_3$ | 17 | | 40 | $2A_3$ |
| GND | 18 | | 39 | GND |
| $2Y_4$ | 19 | | 38 | $2A_4$ |
| $2Y_5$ | 20 | | 37 | $2A_5$ |
| $2Y_6$ | 21 | | 36 | $2A_6$ |
| $V_{CC}$ | 22 | | 35 | $V_{CC}$ |
| $2Y_7$ | 23 | | 34 | $2A_7$ |
| $2Y_8$ | 24 | | 33 | $2A_8$ |
| GND | 25 | | 32 | GND |
| $2Y_9$ | 26 | | 31 | $2A_9$ |
| $2Y_{10}$ | 27 | | 30 | $2A_{10}$ |
| $2\overline{OE}_1$ | 28 | | 29 | $2\overline{OE}_2$ |

## 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, $\theta_{JA}^{(3)}$: 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 curent rating are observed.
2. Output positive-voltage rating may be exceeded up to 4.6V maximum if theoutput 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 | |
| | | 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 |
| | | $V_{CC}$ = 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 | |
| | | $V_{CC}$ = 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 | mA |
| | | $V_{CC}$ = 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, $T_A = -40°C +85°C$)

| Parameters | | Test Conditions[1] | $V_{CC}$ | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_{OH}$ | | $I_{OH} = -100µA$ | 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 | | | |
| $V_{OL}$ | | $I_{OL} = 100µA$ | 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 | |
| $I_I$ | Control Inputs | $V_I = V_{CC}$ 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 | | |

**Note:** Typical values are measured at $T_A = 25°C$.

**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. | |
| $t_{pd}$ | A | Y | | | | | 0.9 | 3.0 | 0.8 | 2.1 | 1.5 | 1.9 | |
| $t_{en}$ | $\overline{OE}$ | Y | | | | | 2.1 | 8.0 | 1.4 | 5.6 | 1.2 | 5.1 | ns |
| $t_{dis}$ | $\overline{OE}$ | Y | | | | | 2.5 | 7.3 | 0.9 | 4.9 | 1.0 | 4.7 | |

**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 | |
| Cpd Power Dissipation Capacitance | Outputs Enabled | $C_L$ = 0pF, f = 10 MHz | 25 | 30 | 35 | pF |
| | Outputs Disabled | | 3 | 3 | 3 | |

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## PARAMETER MEASUREMENT INFORMATION
### $V_{CC}$ = 1.2V AND 1.5V ± 0.1V
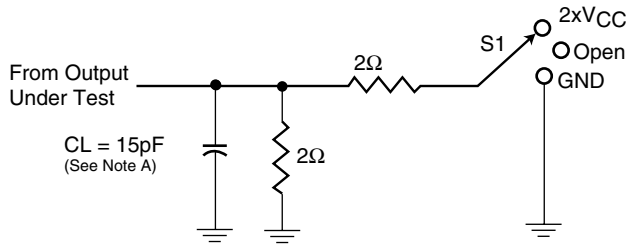


**Load Circuit**

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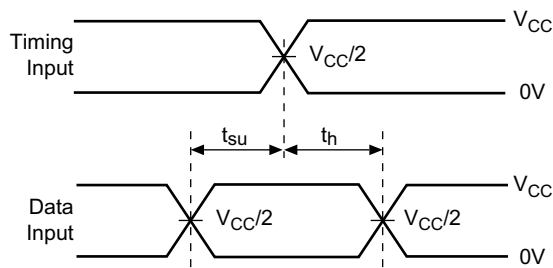


**Voltage Waveforms**
**Setup and Hold Times**
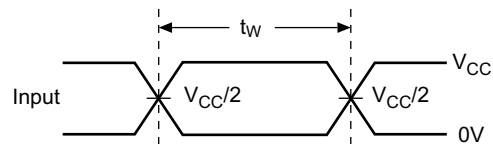


**Voltage Waveforms**
**Pulse Duration**
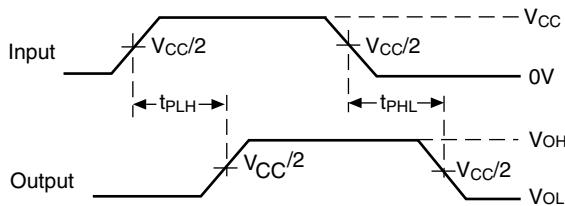


**Voltage Waveforms**
**Propagation Delay Times**
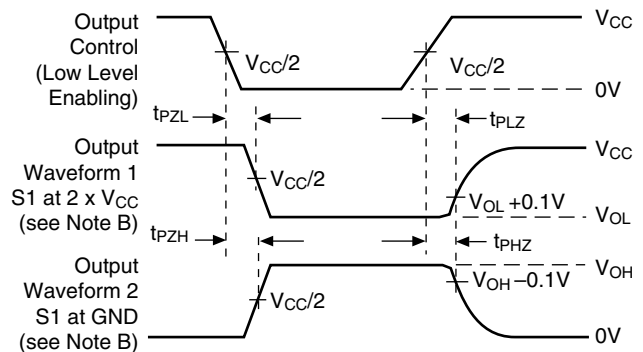


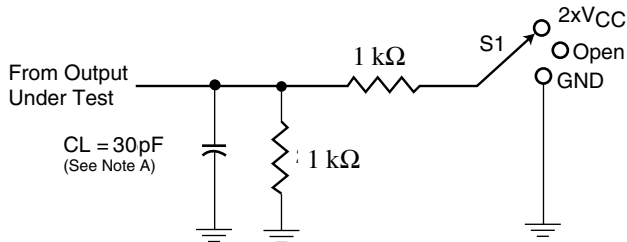**Voltage Waveforms**
**Enable and Disable Times**

**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 ≤10 MHz, $Z_O$ = 50Ω, $t_R$ ≤2.0ns, $t_F$ ≤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 $t_{en}$

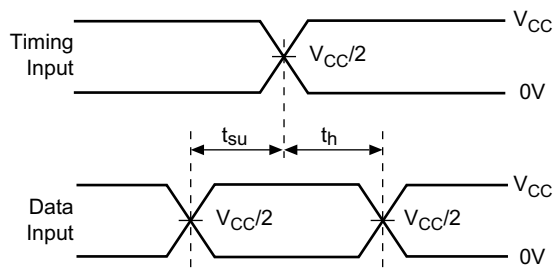G. $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$

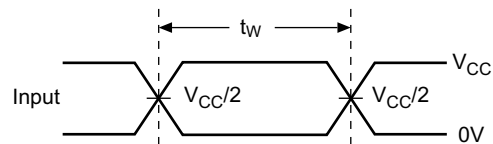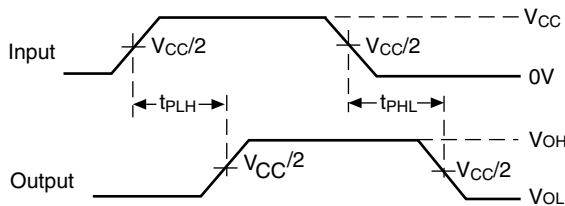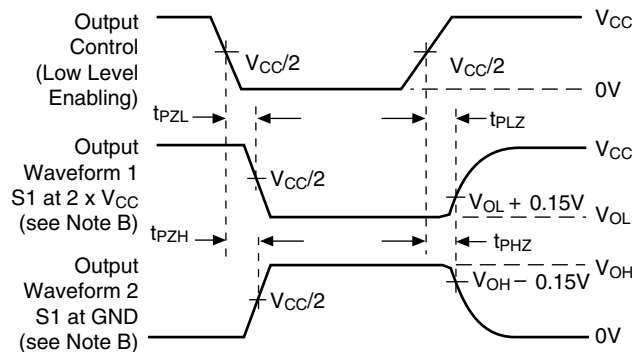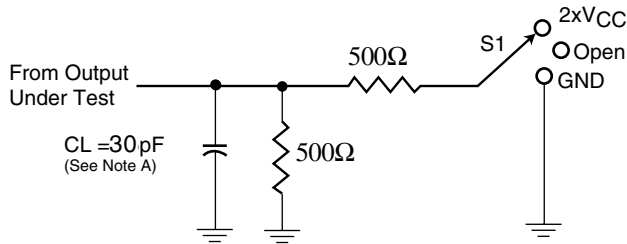## PARAMETER MEASUREMENT INFORMATION
### $V_{CC} = 1.8V \pm 0.15V$

From Output Under Test

1 kΩ

S1

2xV$_{CC}$
Open
GND

$C_L = 30pF$
(See Note A)

1 kΩ

**Load Circuit**

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

Timing Input

$V_{CC}$
0V
$V_{CC}/2$

$t_{su}$  $t_h$

Data Input

$V_{CC}$
0V
$V_{CC}/2$  $V_{CC}/2$

**Voltage Waveforms**
**Setup and Hold Times**

Input

$t_W$

$V_{CC}/2$  $V_{CC}/2$

$V_{CC}$
0V

**Voltage Waveforms**
**Pulse Duration**

Input

$V_{CC}/2$  $V_{CC}/2$

$V_{CC}$
0V

$t_{PLH}$  $t_{PHL}$

Output

$V_{CC}/2$  $V_{CC}/2$

$V_{OH}$
$V_{OL}$

**Voltage Waveforms**
**Propagation Delay Times**

Output Control (Low Level Enabling)

$V_{CC}/2$  $V_{CC}/2$

$V_{CC}$
0V

$t_{PZL}$  $t_{PLZ}$

Output Waveform 1 S1 at 2 x V$_{CC}$ (see Note B)

$V_{CC}/2$

$V_{CC}$
$V_{OL} + 0.15V$  $V_{OL}$

$t_{PZH}$  $t_{PHZ}$

Output Waveform 2 S1 at GND (see Note B)

$V_{CC}/2$

$V_{OH} - 0.15V$  $V_{OH}$
0V

**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 ≤10 MHz, $Z_O = 50Ω$, $t_R$ ≤2.0ns, $t_F$ ≤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 $t_{en}$
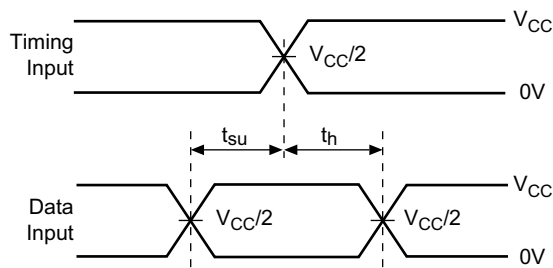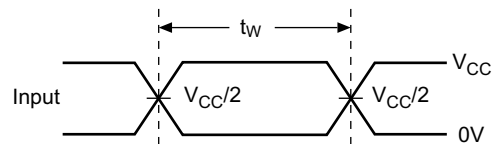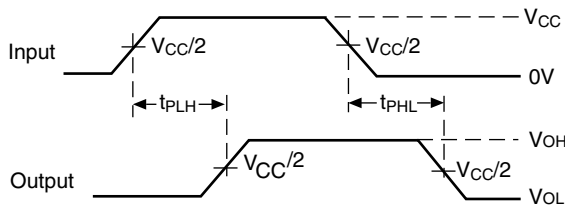
G.  $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$

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## PARAMETER MEASUREMENT INFORMATION
### $V_{CC} = 2.5V \pm 0.2V$

**Load Circuit**

From Output Under Test
$500\Omega$
S1
$2 \times V_{CC}$
Open
GND
$C_L = 30\,pF$ (See Note A)
$500\Omega$

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

**Voltage Waveforms**
**Setup and Hold Times**

Timing Input — $V_{CC}$ — $V_{CC}/2$ — 0V
$t_{su}$   $t_h$
Data Input — $V_{CC}$ — $V_{CC}/2$ — $V_{CC}/2$ — 0V

**Voltage Waveforms**
**Pulse Duration**

$t_W$
Input — $V_{CC}$ — $V_{CC}/2$ — $V_{CC}/2$ — 0V

**Voltage Waveforms**
**Propagation Delay Times**

Input — $V_{CC}$ — $V_{CC}/2$ — $V_{CC}/2$ — 0V
$t_{PLH}$   $t_{PHL}$
Output — $V_{OH}$ — $V_{CC}/2$ — $V_{CC}/2$ — $V_{OL}$

**Voltage Waveforms**
**Enable and Disable Times**

Output Control (Low Level Enabling) — $V_{CC}$ — $V_{CC}/2$ — $V_{CC}/2$ — 0V
$t_{PZL}$   $t_{PLZ}$
Output Waveform 1 S1 at $2 \times V_{CC}$ (see Note B) — $V_{CC}$ — $V_{CC}/2$ — $V_{OL} +0.15V$ — $V_{OL}$
$t_{PZH}$   $t_{PHZ}$
Output Waveform 2 S1 at GND (see Note B) — $V_{OH}$ — $V_{OH} -0.15V$ — $V_{CC}/2$ — 0V
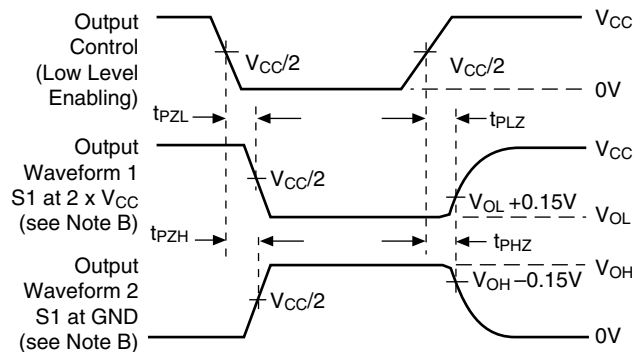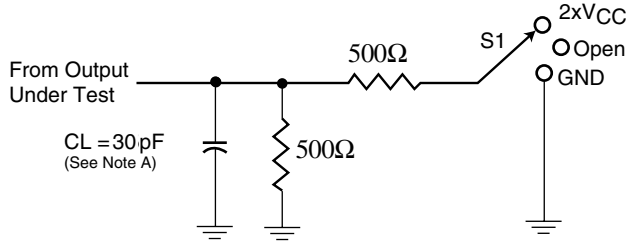
**Figure 3. Load Circuit and Voltage Waveforms**

**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 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 $t_{en}$

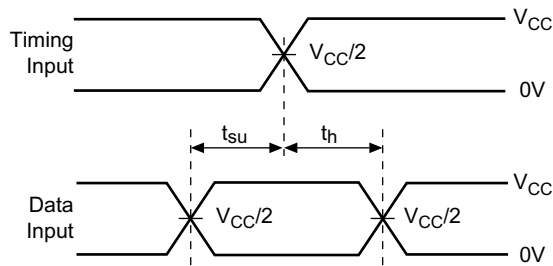G. $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$

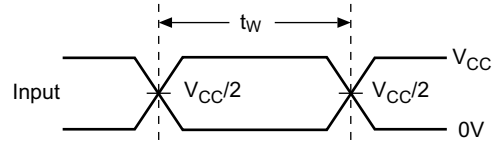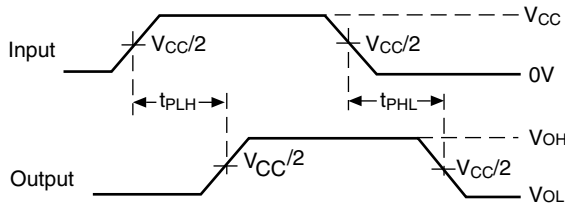# PARAMETER MEASUREMENT INFORMATION
## $V_{CC} = 3.3V \pm 0.3V$



**Load Circuit**

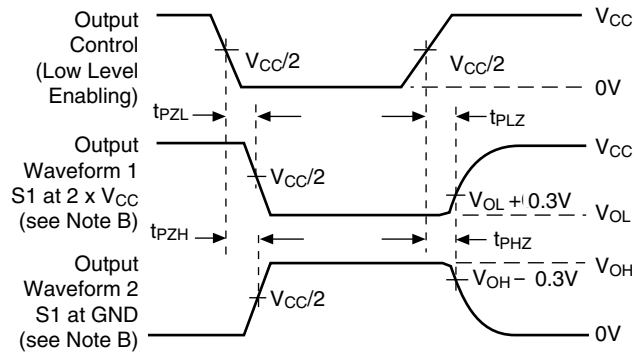| Test | S1 |
|------|-----|
| $t_{pd}$ | Open |
| $t_{PLZ}/t_{PZL}$ | $2 \times V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND |



**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 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 $t_{pd}$

## 56-Pin TSSOP (A)  Package Drawing
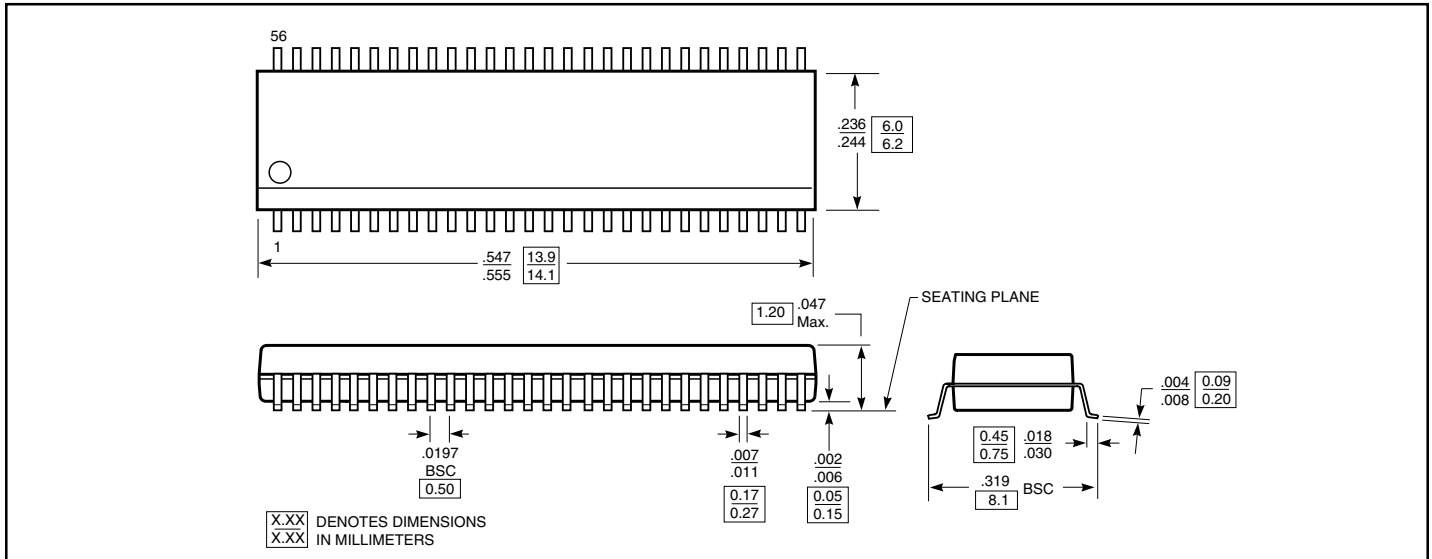


## 56-Pin TVSOP (K) Package Drawing
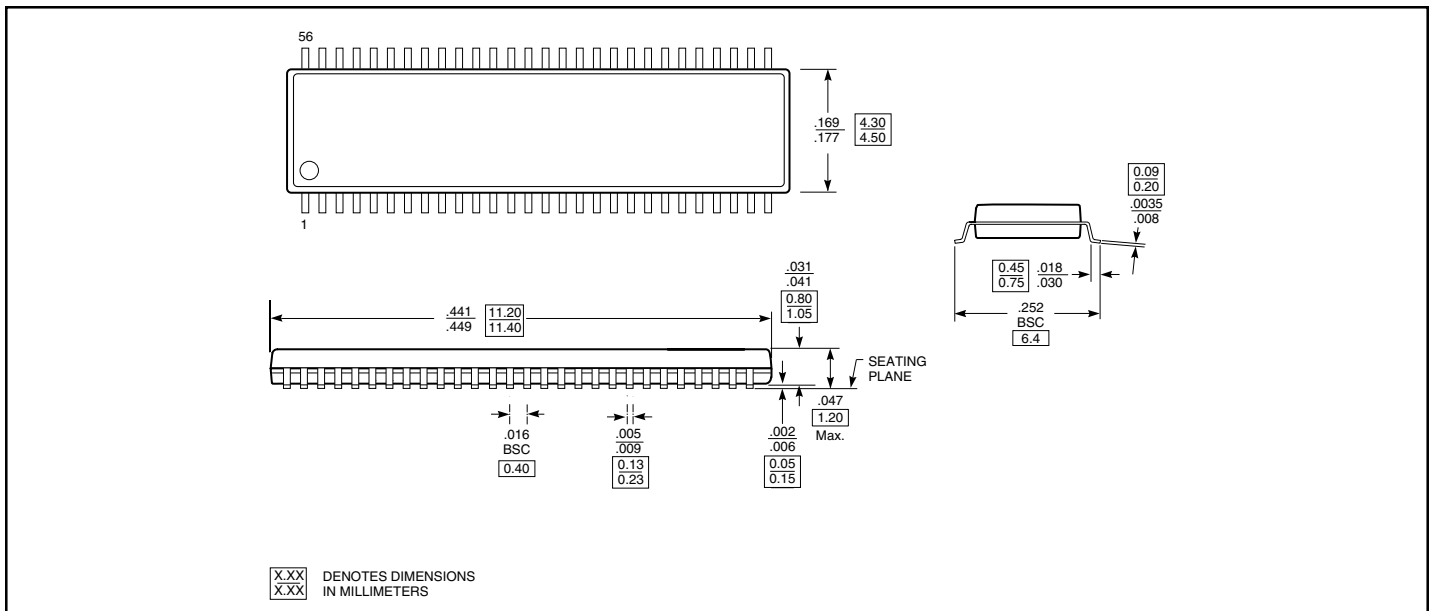


## Ordering Information

| Part | Pin-Package | Temperature |
|---|---|---|
| PI74AVC+16827A | 56 - TSSOP(A) | –40°C to +85°C |
| PI74AVC+16827K | 56 - TVSOP(K) | |

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