



## PI74ALVCH16952

### 16-Bit Registered Transceiver With 3-State Outputs

#### Product Features

- PI74ALVCH16952 is designed for low voltage operation
- $V_{CC} = 2.3V$  to  $3.6V$
- Hysteresis on all inputs
- Typical  $V_{OLP}$  (Output Ground Bounce)  
 $< 0.8V$  at  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  
 $< 2.0V$  at  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$
- Bus Hold retains last active bus state during 3-State eliminating the need for external pullup resistors
- Industrial operation at  $-40^\circ C$  to  $+85^\circ C$
- Packages available:
  - 56-pin 240 mil wide plastic TSSOP (A)
  - 56-pin 300 mil wide plastic SSOP (V)

#### Product Description

Pericom Semiconductor's PI74ALVCH series of logic circuits are produced using the Company's advanced 0.5 micron CMOS technology, achieving industry leading speed.

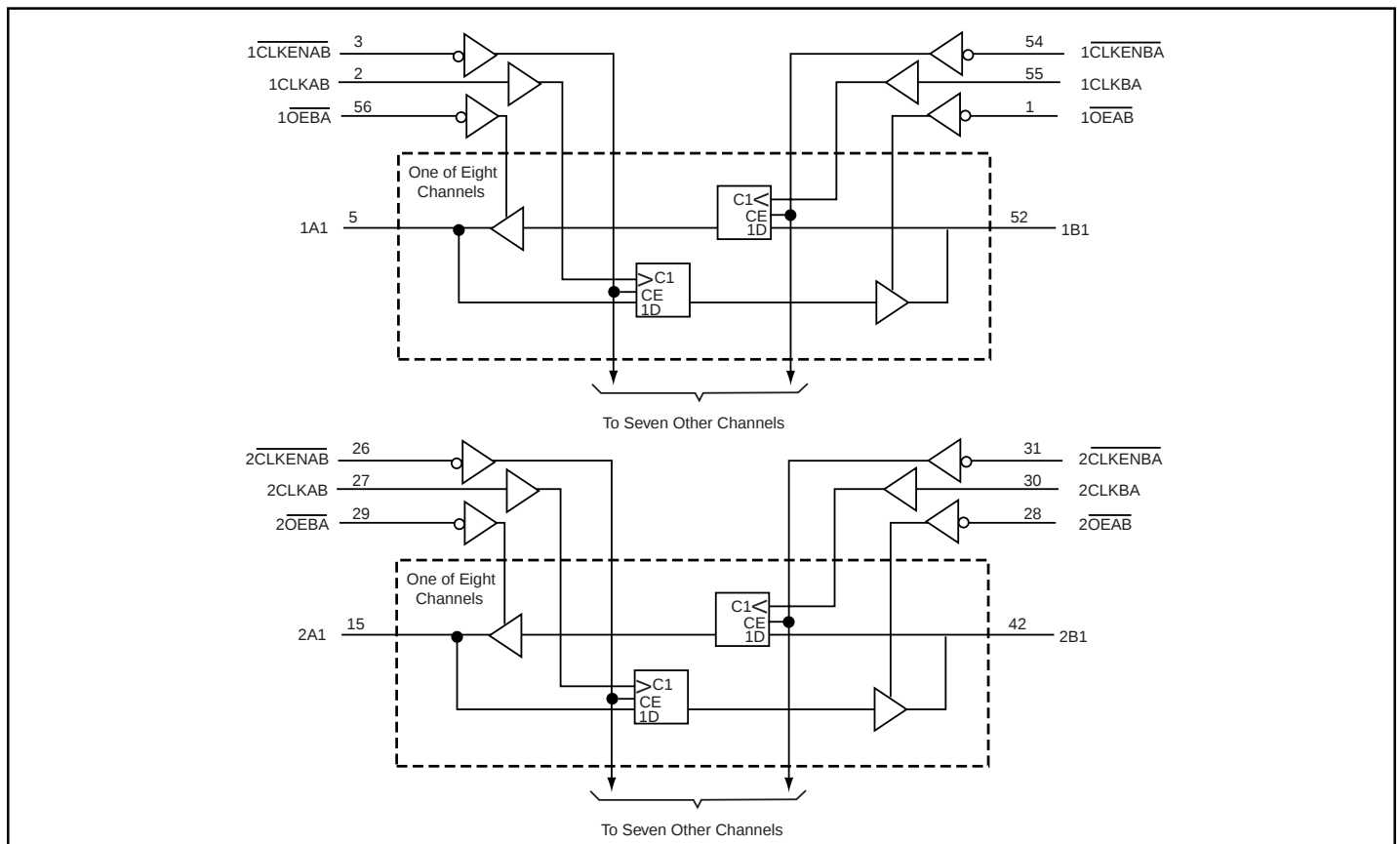
The PI74ALVCH16952 16-bit registered transceiver is designed for 2.3V to 3.6V  $V_{CC}$  operation.

The product contains two sets of D-type flip-flops for temporary storage of data flowing in either direction. The device can be used as two 8-bit transceivers or one 16-bit transceiver. Data on the A or B bus is stored in the registers on the low-to-high transition of the clock ( $\overline{CLKAB}$  or  $\overline{CLKBA}$ ) input provided that the clock-enable ( $\overline{CLKENAB}$  or  $\overline{CLKENBA}$ ) input is low. Taking the output-enable ( $\overline{OEAB}$  or  $\overline{OEBA}$ ) input low accesses the data on either port.

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

The PI74ALVCH16952 has "Bus Hold" which retains the data input's last state whenever the data input goes to high-impedance preventing "floating" inputs and eliminating the need for pullup/down resistors.

#### Logic Block Diagram



## Product Pin Description

| Pin Name                  | Description                      |
|---------------------------|----------------------------------|
| $\overline{\text{CLKEN}}$ | Clock Enable Input (Active LOW)  |
| $\overline{\text{OE}}$    | Output Enable Input (Active LOW) |
| CLK                       | Clock Input (Active HIGH)        |
| Ax                        | Data I/O                         |
| Bx                        | Data I/O                         |
| GND                       | Ground                           |
| VCC                       | Power                            |

## Truth Table<sup>(1)†</sup>

| Inputs  |       |      |   | Output<br>B      |
|---------|-------|------|---|------------------|
| CLKENAB | CLKAB | OEAB | A |                  |
| H       | X     | L    | X | B <sub>0</sub> ‡ |
| X       | L     | L    | X | B <sub>0</sub> ‡ |
| L       | ↑     | L    | L | L                |
| L       | ↑     | L    | H | H                |
| X       | X     | H    | X | Z                |

## Product Pin Configuration

|                              |    |    |                              |
|------------------------------|----|----|------------------------------|
| $\overline{1\text{OEAB}}$    | 1  | 56 | $\overline{1\text{OEBA}}$    |
| $\overline{1\text{CLKAB}}$   | 2  | 55 | $\overline{1\text{CLKBA}}$   |
| $\overline{1\text{CLKENAB}}$ | 3  | 54 | $\overline{1\text{CLKENBA}}$ |
| GND                          | 4  | 53 | GND                          |
| 1A1                          | 5  | 52 | 1B1                          |
| 1A2                          | 6  | 51 | 1B2                          |
| VCC                          | 7  | 50 | VCC                          |
| 1A3                          | 8  | 49 | 1B3                          |
| 1A4                          | 9  | 48 | 1B4                          |
| 1A5                          | 10 | 47 | 1B5                          |
| GND                          | 11 | 46 | GND                          |
| 1A6                          | 12 | 45 | 1B6                          |
| 1A7                          | 13 | 44 | 1B7                          |
| 1A8                          | 14 | 43 | 1B8                          |
| 2A1                          | 15 | 42 | 2B1                          |
| 2A2                          | 16 | 41 | 2B2                          |
| 2A3                          | 17 | 40 | 2B3                          |
| GND                          | 18 | 39 | GND                          |
| 2A4                          | 19 | 38 | 2B4                          |
| 2A5                          | 20 | 37 | 2B5                          |
| 2A6                          | 21 | 36 | 2B6                          |
| VCC                          | 22 | 35 | VCC                          |
| 2A7                          | 23 | 34 | 2B7                          |
| 2A8                          | 24 | 33 | 2B8                          |
| GND                          | 25 | 32 | GND                          |
| $\overline{2\text{CLKENAB}}$ | 26 | 31 | $\overline{2\text{CLKENBA}}$ |
| $\overline{2\text{CLKAB}}$   | 27 | 30 | $\overline{2\text{CLKBA}}$   |
| $\overline{2\text{OEAB}}$    | 28 | 29 | $\overline{2\text{OEBA}}$    |

### Note:

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  $\overline{\text{OEBA}}$ ,  $\overline{\text{CLKBA}}$ , and  $\overline{\text{CLKENBA}}$ .

‡ Output level of B before the indicated steady-state input conditions were established.

## Maximum Ratings

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

|                                              |                          |
|----------------------------------------------|--------------------------|
| Storage Temperature .....                    | -65°C to +150°C          |
| Ambient Temperature with Power Applied ..... | -40°C to +85°C           |
| Input Voltage Range, $V_{IN}$ .....          | -0.5V to $V_{CC} + 0.5V$ |
| Output Voltage Range, $V_{OUT}$ .....        | -0.5V to $V_{CC} + 0.5V$ |
| DC Input Voltage .....                       | -0.5V to +5.0V           |
| DC Output Current .....                      | 100mA                    |
| Power Dissipation .....                      | 1.0W                     |

### 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.

## Recommended Operating Conditions<sup>(1)</sup>

| Parameters | Description                    | Test Conditions           | Min. | Typ. | Max.     | Units |
|------------|--------------------------------|---------------------------|------|------|----------|-------|
| $V_{CC}$   | Supply Voltage                 |                           | 2.3  |      | 3.6      | V     |
| $V_{IH}$   | Input HIGH Voltage             | $V_{CC} = 2.3V$ to $2.7V$ | 1.7  |      |          |       |
|            |                                | $V_{CC} = 2.7V$ to $3.6V$ | 2.0  |      |          |       |
| $V_{IL}$   | Input LOW Voltage              | $V_{CC} = 2.3V$ to $2.7V$ |      |      | 0.7      |       |
|            |                                | $V_{CC} = 2.7V$ to $3.6V$ |      |      | 0.8      |       |
| $V_{IN}$   | Input Voltage                  |                           | 0    |      | $V_{CC}$ |       |
| $V_{OUT}$  | Output Voltage                 |                           | 0    |      | $V_{CC}$ |       |
| $I_{OH}$   | High-level Output Current      | $V_{CC} = 2.3V$           |      |      | -12      | mA    |
|            |                                | $V_{CC} = 2.7V$           |      |      | -12      |       |
|            |                                | $V_{CC} = 3.0V$           |      |      | -24      |       |
| $I_{OL}$   | Low-level Output Current       | $V_{CC} = 2.3V$           |      |      | 12       |       |
|            |                                | $V_{CC} = 2.7V$           |      |      | 12       |       |
|            |                                | $V_{CC} = 3.0V$           |      |      | 24       |       |
| $T_A$      | Operating Free-Air Temperature |                           | -40  |      | 85       | °C    |

### Note:

- Unused control inputs must be held HIGH or LOW to prevent them from floating.

**DC Electrical Characteristics** (Over the Operating Range,  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 10\%$ )

| Parameters                           | Test Conditions                                                             |                        | V <sub>CC</sub> <sup>(1)</sup> | Min.                 | Typ. <sup>(2)</sup> | Max. | Units |
|--------------------------------------|-----------------------------------------------------------------------------|------------------------|--------------------------------|----------------------|---------------------|------|-------|
| V <sub>OH</sub>                      | I <sub>OH</sub> = −100 μA                                                   |                        | Min. to Max.                   | V <sub>CC</sub> -0.2 |                     |      | V     |
|                                      | I <sub>OH</sub> = −6mA                                                      | V <sub>IH</sub> = 1.7V | 2.3V                           | 2.0                  |                     |      |       |
|                                      | I <sub>OH</sub> = −12mA                                                     | V <sub>IH</sub> = 1.7V | 2.3V                           | 1.7                  |                     |      |       |
|                                      |                                                                             | V <sub>IH</sub> = 2.0V | 2.7V                           | 2.2                  |                     |      |       |
|                                      |                                                                             | V <sub>IH</sub> = 2.0V | 3.0V                           | 2.4                  |                     |      |       |
|                                      | I <sub>OH</sub> = −24mA                                                     | V <sub>IH</sub> = 2.0V | 3.0V                           | 2.0                  |                     |      |       |
| V <sub>OL</sub>                      | I <sub>OL</sub> = 100μA                                                     |                        | Min. to Max.                   |                      |                     | 0.2  | V     |
|                                      | I <sub>OL</sub> = 6mA                                                       | V <sub>IL</sub> = 0.7V | 2.3V                           |                      |                     | 0.4  |       |
|                                      | I <sub>OL</sub> = 12mA                                                      | V <sub>IL</sub> = 0.7V | 2.3V                           |                      |                     | 0.7  |       |
|                                      |                                                                             | V <sub>IL</sub> = 0.8V | 2.7V                           |                      |                     | 0.4  |       |
|                                      | I <sub>OL</sub> = 24mA                                                      | V <sub>IL</sub> = 0.8V | 3.0V                           |                      |                     | 0.55 |       |
| I <sub>I</sub>                       | V <sub>I</sub> = V <sub>CC</sub> or GND                                     |                        | 3.6V                           |                      |                     | ±5   | μA    |
| I <sub>I</sub> (Hold) <sup>(3)</sup> | V <sub>I</sub> = 0.7V                                                       |                        | 2.3V                           | 45                   |                     |      |       |
|                                      | V <sub>I</sub> = 1.7V                                                       |                        |                                | −45                  |                     |      |       |
|                                      | V <sub>I</sub> = 0.8V                                                       |                        | 3.0V                           | 75                   |                     |      |       |
|                                      | V <sub>I</sub> = 2.0V                                                       |                        |                                | −75                  |                     |      |       |
|                                      | V <sub>I</sub> = 0 to 3.6V                                                  |                        | 3.6V                           |                      |                     | ±500 |       |
| I <sub>OZ</sub> <sup>(4)</sup>       | V <sub>O</sub> = V <sub>CC</sub> or GND                                     |                        | 3.6V                           |                      |                     | ±10  |       |
| I <sub>CC</sub>                      | V <sub>I</sub> = V <sub>CC</sub> or GND                                     | I <sub>O</sub> = 0     | 3.6V                           |                      |                     | 40   |       |
| ΔI <sub>CC</sub>                     | One input at V <sub>CC</sub> - 0.6V, Other inputs at V <sub>CC</sub> or GND |                        | 3V to 3.6V                     |                      |                     | 750  |       |
| C <sub>I</sub> Control Inputs        | V <sub>I</sub> = V <sub>CC</sub> or GND                                     |                        | 3.3V                           |                      | 3.5                 |      | pF    |
| C <sub>IO</sub> A or B ports         | V <sub>O</sub> = V <sub>CC</sub> or GND                                     |                        | 3.3V                           |                      | 8.5                 |      |       |

**Notes:**

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at  $V_{CC} = 3.3\text{V}$ ,  $+25^{\circ}\text{C}$  ambient and maximum loading.
3. Bus Hold maximum dynamic current required to switch the input from one state to another.
4. For I/O ports, the  $I_{OZ}$  includes the input leakage current.

**Timing Requirements over Operating Range**

| Parameters                    | Description                   | V <sub>CC</sub> = 2.5V ± 0.2V |      | V <sub>CC</sub> = 2.7V |      | V <sub>CC</sub> = 3.3V ± 0.3V |      | Units |
|-------------------------------|-------------------------------|-------------------------------|------|------------------------|------|-------------------------------|------|-------|
|                               |                               | Min.                          | Max. | Min.                   | Max. | Min.                          | Max. |       |
| f <sub>CLOCK</sub>            | Clock frequency               | 0                             | 150  | 0                      | 150  | 0                             | 150  | MHz   |
| t <sub>w</sub> Pulse Duration | CLKEN high                    | 3.3                           |      | 3.3                    |      | 3.3                           |      | ns    |
|                               | CLK high or low               | 3.3                           |      | 3.3                    |      | 3.3                           |      |       |
| t <sub>SU</sub> Setup time    | Data before CLK               | 1.7                           |      | 1.9                    |      | 1.5                           |      |       |
|                               | CLKEN before CLK              | 1.2                           |      | 1.0                    |      | 1.0                           |      |       |
| t <sub>H</sub> Hold time      | Data after CLK                | 0.6                           |      | 0.6                    |      | 0.8                           |      |       |
|                               | CLKEN after CLK               | 1.1                           |      | 0.9                    |      | 1.1                           |      |       |
| Δt/Δv <sup>(1)</sup>          | Input Transition Rise or Fall | 0                             | 10   | 0                      | 10   | 0                             | 10   | ns/V  |

**Notes:**

1. See test circuit and waveforms.

**Switching Characteristics Over Operating Range<sup>(1)</sup>**

| Parameters       | From (Input) | To (Output) | V <sub>CC</sub> = 2.5V ± 0.2V |      | V <sub>CC</sub> = 2.7V |      | V <sub>CC</sub> = 3.3V ± 0.3V |      | Units |
|------------------|--------------|-------------|-------------------------------|------|------------------------|------|-------------------------------|------|-------|
|                  |              |             | Min. <sup>(2)</sup>           | Max. | Min. <sup>(2)</sup>    | Max. | Min. <sup>(2)</sup>           | Max. |       |
| f <sub>MAX</sub> |              |             | 150                           |      | 150                    |      | 150                           |      | MHz   |
| t <sub>PD</sub>  | CLK          | A or B      | 1.0                           | 4.1  |                        | 4.6  | 1.0                           | 3.9  | ns    |
| t <sub>EN</sub>  | OEBA or OEAB |             |                               | 5.4  |                        | 5.3  | 1.0                           | 4.4  |       |
| t <sub>DIS</sub> | OEBA or OEAB |             |                               | 5.3  |                        | 4.4  | 1.1                           | 4.0  |       |

**Notes:**

1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.

**Operating Characteristics, T<sub>A</sub> = 25°C**

| Parameter                                     |                  | Test Conditions                     | V <sub>CC</sub> = 2.5V ± 0.2V | V <sub>CC</sub> = 3.3V ± 0.3V | Units |
|-----------------------------------------------|------------------|-------------------------------------|-------------------------------|-------------------------------|-------|
|                                               |                  |                                     | Typical                       |                               |       |
| C <sub>PD</sub> Power Dissipation Capacitance | Outputs Enabled  | C <sub>L</sub> = 50pF<br>f = 10 MHz | 53                            | 71                            | pF    |
|                                               | Outputs Disabled |                                     | 34                            | 40                            |       |