

## 74LVXZ161284

### Low Voltage IEEE 161284 Translating Transceiver with Power-Up Protection

#### General Description

The LVXZ161284 contains eight bidirectional data buffers and eleven control/status buffers to implement a full IEEE 1284 compliant interface. The device supports the IEEE 1284 standard and is intended to be used in an Extended Capabilities Port mode (ECP). The pinout allows for easy connection from the Peripheral (A-side) to the Host (cable side).

Outputs on the cable side can be configured to be either open drain or high drive ( $\pm 14$  mA) and are connected to a separate power supply pin ( $V_{CC-Cable}$ ) that allows these outputs to be driven by a higher supply voltage than the A-side. The pull-up and pull-down series termination resistance of these outputs on the cable side is optimized to drive an external cable. In addition, the C inputs and the B and Y outputs on the cable side contain internal pull-up resistors connected to the  $V_{CC-Cable}$  supply to provide proper input termination and pull-ups for open drain output mode.

Outputs on the Peripheral side are standard low-drive CMOS outputs designed to interface with 3V logic. The DIR input controls data flow on the  $A_1-A_8/B_1-B_8$  transceiver pins.

This device also has an added power-up protection feature which forces the Y outputs ( $Y_9 - Y_{13}$ ) to a high state after power-on until one of the associated inputs ( $A_9 - A_{13}$ ) goes HIGH. When an associated input ( $A_9 - A_{13}$ ) goes HIGH, all Y outputs ( $Y_9 - Y_{13}$ ) are activated.

#### Features

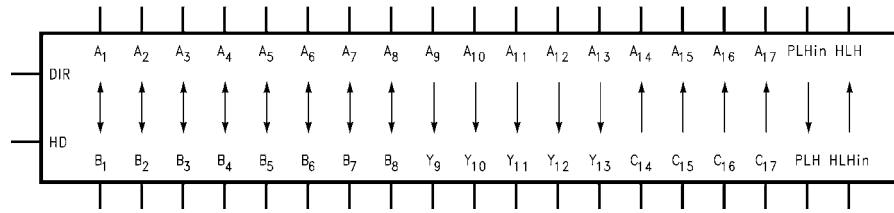
- Supports IEEE 1284 Level 1 and Level 2 signaling standards for bidirectional parallel communications between personal computers and printing peripherals
- Translation capability allows outputs on the cable side to interface with 5V signals
- All inputs have hysteresis to provide noise margin
- B and Y output resistance optimized to drive external cable
- B and Y outputs in high impedance mode during power down
- C inputs and B, Y outputs on cable side have internal 1.4 k $\Omega$  pull-up resistors
- Flow-through pin configuration allows easy interface between the "Peripheral and Host"
- Replaces the function of two (2) 74ACT1284 devices
- Power-up protection prevents errors when the printer is powered on but no valid signal is at the input pins ( $A_9 - A_{13}$ ).

#### Ordering Code

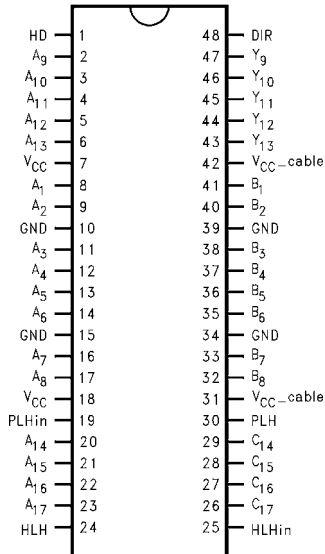
| Order Number    | Package Number | Package Description   |
|-----------------|----------------|---|
| 74LVXZ161284MEA | MS48A          | 48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide [RAIL]               |
| 74LVXZ161284MEX | MS48A          | 48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide [TAPE and REEL]      |
| 74LVXZ161284MTD | MTD48          | 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide [RAIL]          |
| 74LVXZ161284MTX | MTD48          | 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide [TAPE and REEL] |

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### Logic Symbol



### Connection Diagram



### Pin Descriptions

| Pin Names                        | Description                           |
|----------------------------------|---------------------------------------|
| HD                               | High Drive Enable Input (Active HIGH) |
| DIR                              | Direction Control Input               |
| A <sub>1</sub> -A <sub>8</sub>   | Inputs or Outputs                     |
| B <sub>1</sub> -B <sub>8</sub>   | Inputs or Outputs                     |
| A <sub>9</sub> -A <sub>13</sub>  | Inputs                                |
| Y <sub>9</sub> -Y <sub>13</sub>  | Outputs                               |
| A <sub>14</sub> -A <sub>17</sub> | Outputs                               |
| C <sub>14</sub> -C <sub>17</sub> | Inputs                                |
| PLH <sub>IN</sub>                | Peripheral Logic HIGH Input           |
| PLH                              | Peripheral Logic HIGH Output          |
| HLH <sub>IN</sub>                | Host Logic HIGH Input                 |
| HLH                              | Host Logic HIGH Output                |

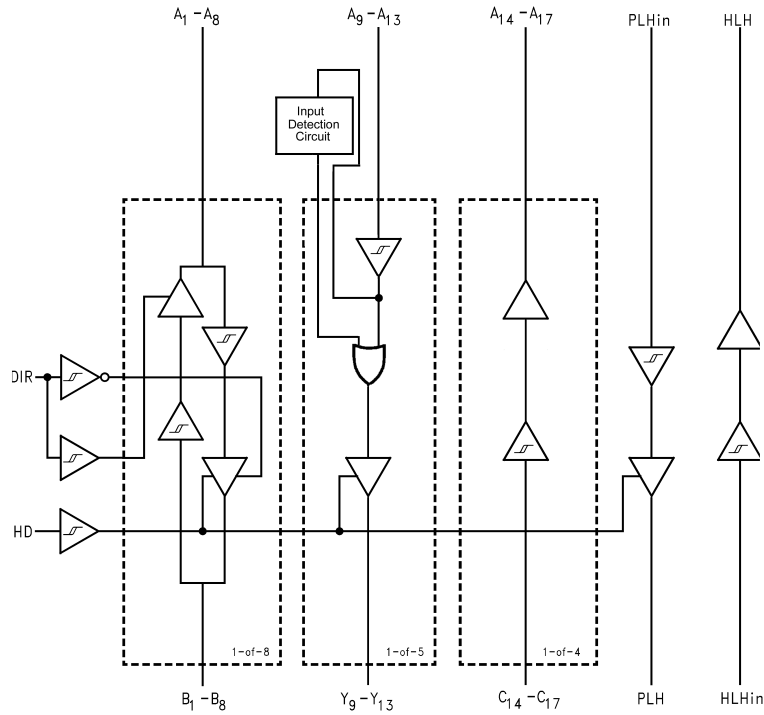
### Truth Table

| Inputs |    | Outputs  |
|--------|----|--|
| DIR    | HD |  |
| L      | L  | B <sub>1</sub> -B <sub>8</sub> Data to A <sub>1</sub> -A <sub>8</sub> , and<br>A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub> (Note 1)<br>C <sub>14</sub> -C <sub>17</sub> Data to A <sub>14</sub> -A <sub>17</sub><br>PLH Open Drain Mode    |
| L      | H  | B <sub>1</sub> -B <sub>8</sub> Data to A <sub>1</sub> -A <sub>8</sub> , and<br>A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub><br>C <sub>14</sub> -C <sub>17</sub> Data to A <sub>14</sub> -A <sub>17</sub>                                    |
| H      | L  | A <sub>1</sub> -A <sub>8</sub> Data to B <sub>1</sub> -B <sub>8</sub> (Note 2)<br>A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub> (Note 1)<br>C <sub>14</sub> -C <sub>17</sub> Data to A <sub>14</sub> -A <sub>17</sub><br>PLH Open Drain Mode |
| H      | H  | A <sub>1</sub> -A <sub>8</sub> Data to B <sub>1</sub> -B <sub>8</sub><br>A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub><br>C <sub>14</sub> -C <sub>17</sub> Data to A <sub>14</sub> -A <sub>17</sub>  |

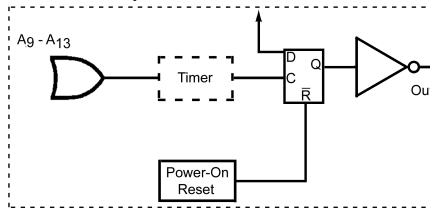
**Note 1:** Y<sub>9</sub>-Y<sub>13</sub> Open Drain Outputs with 1.4 kΩ pullups

**Note 2:** B<sub>1</sub>-B<sub>8</sub> Open Drain Outputs with 1.4 kΩ pullups

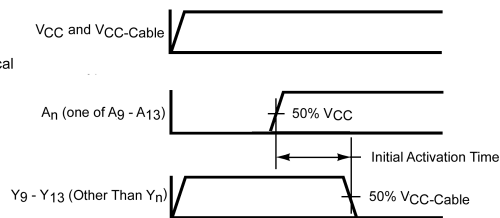
Logic Diagrams



Input Detection Circuit



$V_{CC} = 3.3V$   
 $V_{CC-Cable} = 5V$   
 $T_A = 25^\circ C$   
 Initial Activation Time = 140ns typical



$A_n$  (One of  $A_9 - A_{13}$ ) is Switched as Shown Above and Other Four Inputs are Forced at Low State

FIGURE 1. Input Detection Circuit Timing

**Absolute Maximum Ratings** (Note 3)

|   |  |                          |
|---|--|--------------------------|
| Supply Voltage  |  |                          |
| $V_{CC}$  |  | -0.5V to +4.6V           |
| $V_{CC}$ —Cable   |  | -0.5V to +7.0V           |
| $V_{CC}$ —Cable Must Be $\geq V_{CC}$                     |  |                          |
| Input Voltage ( $V_I$ )—(Note 4)                          |  |                          |
| $A_1$ – $A_{13}$ , $PLH_{IN}$ , DIR, HD                   |  | -0.5V to $V_{CC} + 0.5V$ |
| $B_1$ – $B_8$ , $C_{14}$ – $C_{17}$ , $HLH_{IN}$          |  | -0.5V to +5.5V (DC)      |
| $B_1$ – $B_8$ , $C_{14}$ – $C_{17}$ , $HLH_{IN}$          |  | -2.0V to +7.0V*          |
|   |  | *40 ns Transient         |
| Output Voltage ( $V_O$ )                                  |  |                          |
| $A_1$ – $A_8$ , $A_{14}$ – $A_{17}$ , HLH                 |  | -0.5V to $V_{CC} + 0.5V$ |
| $B_1$ – $B_8$ , $Y_9$ – $Y_{13}$ , PLH                    |  | -0.5V to +5.5V (DC)      |
| $B_1$ – $B_8$ , $Y_9$ – $Y_{13}$ , PLH                    |  | -2.0V to +7.0V*          |
|   |  | *40 ns Transient         |
| DC Output Current ( $I_O$ )                               |  |                          |
| $A_1$ – $A_8$ , HLH                                       |  | $\pm 25$ mA              |
| $B_1$ – $B_8$ , $Y_9$ – $Y_{13}$                          |  | $\pm 50$ mA              |
| PLH (Output LOW)  |  | 84 mA                    |
| PLH (Output HIGH)   |  | -50 mA                   |
| Input Diode Current ( $I_{IK}$ )—(Note 4)                 |  |                          |
| DIR, HD, $A_9$ – $A_{13}$ , PLH, HLH, $C_{14}$ – $C_{17}$ |  | -20 mA                   |
| Output Diode Current ( $I_{OK}$ )                         |  |                          |
| $A_1$ – $A_8$ , $A_{14}$ – $A_{17}$ , HLH                 |  | $\pm 50$ mA              |
| $B_1$ – $B_8$ , $Y_9$ – $Y_{13}$ , PLH                    |  | -50 mA                   |
| DC Continuous $V_{CC}$ or Ground Current                  |  |                          |
|   |  | $\pm 200$ mA             |
| Storage Temperature                                       |  |                          |
|   |  | -65°C to +150°C          |
| ESD   |  |                          |
| Human Body Model  |  | 4000V                    |
| Machine Model   |  | 200V                     |
| Charged Device Model                                      |  | 2000V                    |

**Recommended Operating Conditions**

|                                 |  |                |
|---------------------------------|--|----------------|
| Supply Voltage                  |  |                |
| $V_{CC}$                        |  | 3.0V to 3.6V   |
| $V_{CC}$ —Cable                 |  | 3.0V to 5.5V   |
| DC Input Voltage ( $V_I$ )      |  |                |
|                                 |  | 0V to $V_{CC}$ |
| Open Drain Voltage ( $V_O$ )    |  |                |
|                                 |  | 0V to 5.5V     |
| Operating Temperature ( $T_A$ ) |  |                |
|                                 |  | -40°C to +85°C |

**Note 3:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Fairchild does not recommend operation outside the databook specifications.

**Note 4:** Either voltage limit or current limit is sufficient to protect inputs.

**DC Electrical Characteristics**

| Symbol            | Parameter                         |                               | $V_{CC}$<br>(V) | $V_{CC}$ —Cable<br>(V) | $T_A = 0^\circ\text{C}$ | $T_A = -40^\circ\text{C}$ | Units | Conditions                    |
|-------------------|-----------------------------------|-------------------------------|-----------------|------------------------|-------------------------|---------------------------|-------|-------------------------------|
|                   |                                   |                               |                 |                        | to +70°C                | to +85°C                  |       |                               |
| Guaranteed Limits |                                   |                               |                 |                        |                         |                           |       |                               |
| $V_{IK}$          | Input Clamp Diode Voltage         |                               | 3.0             | 3.0                    | -1.2                    | -1.2                      | V     | $I_I = -18$ mA                |
| $V_{IH}$          | Minimum HIGH Level Input Voltage  | $A_n, B_n, PLH_{IN}, DIR, HD$ | 3.0–3.6         | 3.0–5.5                | 2.0                     | 2.0                       | V     |                               |
|                   |                                   | $C_n$                         | 3.0–3.6         | 3.0–5.5                | 2.3                     | 2.3                       |       |                               |
|                   |                                   | $HLH_{IN}$                    | 3.0–3.6         | 3.0–5.5                | 2.6                     | 2.6                       |       |                               |
| $V_{IL}$          | Maximum LOW Level Input Voltage   | $A_n, B_n, PLH_{IN}, DIR, HD$ | 3.0–3.6         | 3.0–5.5                | 0.8                     | 0.8                       | V     |                               |
|                   |                                   | $C_n$                         | 3.0–3.6         | 3.0–5.5                | 0.8                     | 0.8                       |       |                               |
|                   |                                   | $HLH_{IN}$                    | 3.0–3.6         | 3.0–5.5                | 1.6                     | 1.6                       |       |                               |
| $\Delta V_T$      | Minimum Input Hysteresis          | $A_n, B_n, PLH_{IN}, DIR, HD$ | 3.3             | 5.0                    | 0.4                     | 0.4                       | V     | $V_T^+ - V_T^-$               |
|                   |                                   | $C_n$                         | 3.3             | 5.0                    | 0.8                     | 0.8                       |       | $V_T^+ - V_T^-$               |
|                   |                                   | $HLH_{IN}$                    | 3.3             | 5.0                    | 0.2                     | 0.2                       |       | $V_T^+ - V_T^-$               |
| $V_{OH}$          | Minimum HIGH Level Output Voltage | $A_n, HLH$                    | 3.0             | 3.0                    | 2.8                     | 2.8                       | V     | $I_{OH} = -50$ $\mu\text{A}$  |
|                   |                                   |                               | 3.0             | 3.0                    | 2.4                     | 2.4                       |       | $I_{OH} = -4$ mA              |
|                   |                                   | $B_n, Y_n$                    | 3.0             | 3.0                    | 2.0                     | 2.0                       |       | $I_{OH} = -14$ mA             |
|                   |                                   | $B_n, Y_n$                    | 3.0             | 4.5                    | 2.23                    | 2.23                      |       | $I_{OH} = -14$ mA             |
|                   |                                   | PLH                           | 3.15            | 3.15                   | 3.1                     | 3.1                       |       | $I_{OH} = -500$ $\mu\text{A}$ |

| DC Electrical Characteristics (Continued) |   |   |                        |                              |                      |                        |       |   |                       |
|---|---|---|------------------------|------------------------------|----------------------|------------------------|-------|---|-----------------------|
| Symbol                                    | Parameter                                   |   | V <sub>CC</sub><br>(V) | V <sub>CC-Cable</sub><br>(V) | T <sub>A</sub> = 0°C | T <sub>A</sub> = -40°C | Units | Conditions                              |                       |
|   |   |   |                        |                              | to +70°C             | to +85°C               |       |   |                       |
| Guaranteed Limits                         |   |   |                        |                              |                      |                        |       |   |                       |
| V <sub>OL</sub>                           | Maximum LOW Level Output Voltage            | A <sub>n</sub> , HLH  | 3.0                    | 3.0                          | 0.2                  | 0.2                    | V     | I <sub>OL</sub> = 50 μA                 |                       |
|   |   |   | 3.0                    | 3.0                          | 0.4                  | 0.4                    |       | I <sub>OL</sub> = 4 mA                  |                       |
|   |   | B <sub>n</sub> , Y <sub>n</sub>   | 3.0                    | 3.0                          | 0.8                  | 0.8                    |       | I <sub>OL</sub> = 14 mA                 |                       |
|   |   | B <sub>n</sub> , Y <sub>n</sub>   | 3.0                    | 4.5                          | 0.77                 | 0.77                   |       | I <sub>OL</sub> = 14 mA                 |                       |
|   |   | PLH   | 3.0                    | 3.0                          | 0.85                 | 0.95                   |       | I <sub>OL</sub> = 84 mA                 |                       |
|   |   | PLH   | 3.0                    | 4.5                          | 0.8                  | 0.9                    |       | I <sub>OL</sub> = 84 mA                 |                       |
| R <sub>D</sub>                            | Maximum Output Impedance                    | B <sub>1</sub> - B <sub>8</sub> , Y <sub>9</sub> - Y <sub>13</sub>  | 3.3                    | 3.3                          | 60                   | 60                     | Ω     | (Note 5)(Note 7)                        |                       |
|   |   |   | 3.3                    | 5.0                          | 55                   | 55                     |       |   |                       |
|   | Minimum Output Impedance                    | B <sub>1</sub> - B <sub>8</sub> , Y <sub>9</sub> - Y <sub>13</sub>  | 3.3                    | 3.3                          | 30                   | 30                     | Ω     | (Note 5)(Note 7)                        |                       |
|   |   |   | 3.3                    | 5.0                          | 35                   | 35                     |       |   |                       |
| R <sub>P</sub>                            | Maximum Pull-Up Resistance                  | B <sub>1</sub> - B <sub>8</sub> , Y <sub>9</sub> - Y <sub>13</sub> ,<br>C <sub>14</sub> - C <sub>17</sub> | 3.3                    | 3.3                          | 1650                 | 1650                   | Ω     |   |                       |
|   |   |   | 3.3                    | 5.0                          | 1650                 | 1650                   |       |   |                       |
|   | Minimum Pull-Up Resistance                  | B <sub>1</sub> - B <sub>8</sub> , Y <sub>9</sub> - Y <sub>13</sub> ,<br>C <sub>14</sub> - C <sub>17</sub> | 3.3                    | 3.3                          | 1150                 | 1150                   | Ω     |   |                       |
|   |   |   | 3.3                    | 5.0                          | 1150                 | 1150                   |       |   |                       |
| I <sub>IH</sub>                           | Maximum Input Current in HIGH State         | A <sub>9</sub> - A <sub>13</sub> , PLH <sub>IN</sub> ,<br>HD, DIR, HLH <sub>IN</sub>                      | 3.6                    | 3.6                          | 1.0                  | 1.0                    | μA    | V <sub>I</sub> = 3.6V                   |                       |
|   |   | C <sub>14</sub> - C <sub>17</sub>   | 3.6                    | 3.6                          | 50.0                 | 50.0                   |       | V <sub>I</sub> = 3.6V                   |                       |
|   |   | C <sub>14</sub> - C <sub>17</sub>   | 3.6                    | 5.5                          | 100                  | 100                    |       | V <sub>I</sub> = 5.5V                   |                       |
| I <sub>IL</sub>                           | Maximum Input Current in LOW State          | A <sub>9</sub> - A <sub>13</sub> , PLH <sub>IN</sub> ,<br>HD, DIR, HLH <sub>IN</sub>                      | 3.6                    | 3.6                          | -1.0                 | -1.0                   | μA    | V <sub>I</sub> = 0.0V                   |                       |
|   |   | C <sub>14</sub> - C <sub>17</sub>   | 3.6                    | 3.6                          | -3.5                 | -3.5                   |       | mA                                      | V <sub>I</sub> = 0.0V |
|   |   | C <sub>14</sub> - C <sub>17</sub>   | 3.6                    | 5.5                          | -5.0                 | -5.0                   |       |   |                       |
| I <sub>OZH</sub>                          | Maximum Output Disable Current (HIGH)       | A <sub>1</sub> - A <sub>8</sub>   | 3.6                    | 3.6                          | 20                   | 20                     | μA    | V <sub>O</sub> = 3.6V                   |                       |
|   |   | B <sub>1</sub> - B <sub>8</sub>   | 3.6                    | 3.6                          | 50                   | 50                     |       | V <sub>O</sub> = 3.6V                   |                       |
|   |   | B <sub>1</sub> - B <sub>8</sub>   | 3.6                    | 5.5                          | 100                  | 100                    |       | V <sub>O</sub> = 5.5V                   |                       |
| I <sub>OZL</sub>                          | Maximum Output Disable Current (LOW)        | A <sub>1</sub> - A <sub>8</sub>   | 3.6                    | 3.6                          | -20                  | -20                    | μA    | V <sub>O</sub> = 0.0V                   |                       |
|   |   | B <sub>1</sub> - B <sub>8</sub>   | 3.6                    | 3.6                          | -3.5                 | -3.5                   |       |   | mA                    |
|   |   | B <sub>1</sub> - B <sub>8</sub>   | 3.6                    | 5.5                          | -5.0                 | -5.0                   |       |   |                       |
| I <sub>OZPU</sub>                         | Maximum Power-Up Disable Current            | Y <sub>9</sub> - Y <sub>13</sub>  | 0 to 1.5               | 0 to 1.5                     | 350                  | 350                    | μA    | V <sub>O</sub> = 5.5V                   |                       |
|   |   | B <sub>1</sub> - B <sub>8</sub>   | (Note 8)               | (Note 8)                     | -5                   | -5                     |       | mA                                      | V <sub>O</sub> = 0.0V |
| I <sub>OZPD</sub>                         | Maximum Power-Down Disable Current          | Y <sub>9</sub> - Y <sub>13</sub>  | 0 to 1.5               | 0 to 1.5                     | 350                  | 350                    | μA    | V <sub>O</sub> = 5.5V                   |                       |
|   |   | B <sub>1</sub> - B <sub>8</sub>   | (Note 8)               | (Note 8)                     | -5                   | -5                     |       | mA                                      | V <sub>O</sub> = 0.0V |
| I <sub>OFF</sub>                          | Power Down Output Leakage                   | B <sub>1</sub> - B <sub>8</sub> , Y <sub>9</sub> - Y <sub>13</sub> ,<br>PLH                               | 0.0                    | 0.0                          | 100                  | 100                    | μA    | V <sub>O</sub> = 5.5V                   |                       |
| I <sub>OFF</sub>                          | Power Down Input Leakage                    | C <sub>14</sub> -C <sub>17</sub> , HLH <sub>IN</sub>  | 0.0                    | 0.0                          | 100                  | 100                    | μA    | V <sub>I</sub> = 5.5V                   |                       |
| I <sub>OFF-ICC</sub>                      | Power Down Leakage to V <sub>CC</sub>       |   | 0.0                    | 0.0                          | 250                  | 250                    | μA    | (Note 6)                                |                       |
| I <sub>OFF-ICC2</sub>                     | Power Down Leakage to V <sub>CC-Cable</sub> |   | 0.0                    | 0.0                          | 250                  | 250                    | μA    | (Note 6)                                |                       |
| I <sub>CC</sub>                           | Maximum Supply Current                      |   | 3.6                    | 3.6                          | 45                   | 45                     | mA    | V <sub>I</sub> = V <sub>CC</sub> or GND |                       |
|   |   |   | 3.6                    | 5.5                          | 70                   | 70                     |       | V <sub>I</sub> = V <sub>CC</sub> or GND |                       |

**Note 5:** Output impedance is measured with the output active LOW and active HIGH (HD = HIGH).

**Note 6:** Power-down leakage to V<sub>CC</sub> or V<sub>CC-Cable</sub> is tested by simultaneously forcing all pins on the cable-side (B<sub>1</sub>-B<sub>8</sub>, Y<sub>9</sub>-Y<sub>13</sub>, PLH, C<sub>14</sub>-C<sub>17</sub> and HLH<sub>IN</sub>) to 5.5V and measuring the resulting I<sub>CC</sub> or I<sub>CC-Cable</sub>.

**Note 7:** This parameter is guaranteed but not tested, characterized only.

**Note 8:** Connect all V<sub>CC</sub> pins and V<sub>CC-Cable</sub> pins when forcing voltage applied, DIR = HD = 0V.

## AC Electrical Characteristics

| Symbol                           | Parameter   | $T_A = 0^\circ\text{C to } +70^\circ\text{C}$       |      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$     |      | Units | Figure Number         |
|----------------------------------|---|---|------|---|------|-------|-----------------------|
|                                  |   | $V_{CC} = 3.0\text{V} - 3.6\text{V}$                |      | $V_{CC} = 3.0\text{V} - 3.6\text{V}$                |      |       |                       |
|                                  |   | $V_{CC} - \text{Cable} = 3.0\text{V} - 5.5\text{V}$ |      | $V_{CC} - \text{Cable} = 3.0\text{V} - 5.5\text{V}$ |      |       |                       |
|                                  |   | Min   | Max  | Min   | Max  |       |                       |
| $t_{PHL}$                        | A <sub>1</sub> -A <sub>8</sub> to B <sub>1</sub> -B <sub>8</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 2              |
| $t_{PLH}$                        | A <sub>1</sub> -A <sub>8</sub> to B <sub>1</sub> -B <sub>8</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 3              |
| $\bar{t}_{PHL}$                  | B <sub>1</sub> -B <sub>8</sub> to A <sub>1</sub> -A <sub>8</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 4              |
| $\bar{t}_{PLH}$                  | B <sub>1</sub> -B <sub>8</sub> to A <sub>1</sub> -A <sub>8</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 4              |
| $t_{PHL}$                        | A <sub>9</sub> -A <sub>13</sub> to Y <sub>9</sub> -Y <sub>13</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 2              |
| $\bar{t}_{PLH}$                  | A <sub>9</sub> -A <sub>13</sub> to Y <sub>9</sub> -Y <sub>13</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 3              |
| $t_{PHL}$                        | C <sub>14</sub> -C <sub>17</sub> to A <sub>14</sub> -A <sub>17</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 4              |
| $\bar{t}_{PLH}$                  | C <sub>14</sub> -C <sub>17</sub> to A <sub>14</sub> -A <sub>17</sub>  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 4              |
| $\bar{t}_{SKEW}$                 | LH-LH or HL-HL  |   | 10.0 |   | 12.0 | ns    | (Note 10)             |
| $t_{PHL}$                        | PLH <sub>IN</sub> to PLH  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 2              |
| $\bar{t}_{PLH}$                  | PLH <sub>IN</sub> to PLH  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 3              |
| $\bar{t}_{PHL}$                  | HLH <sub>IN</sub> to HLH  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 4              |
| $\bar{t}_{PLH}$                  | HLH <sub>IN</sub> to HLH  | 2.0   | 40.0 | 2.0   | 44.0 | ns    | Figure 4              |
| $t_{PHZ}$                        | Output Disable Time   | 2.0   | 15.0 | 2.0   | 18.0 | ns    | Figure 8              |
| $\bar{t}_{PLZ}$                  | DIR to A <sub>1</sub> -A <sub>8</sub>   | 2.0   | 15.0 | 2.0   | 18.0 | ns    | Figure 8              |
| $t_{PZH}$                        | Output Enable Time  | 2.0   | 50.0 | 2.0   | 50.0 | ns    | Figure 9              |
| $\bar{t}_{PZL}$                  | DIR to A <sub>1</sub> -A <sub>8</sub>   | 2.0   | 50.0 | 2.0   | 50.0 | ns    | Figure 9              |
| $\bar{t}_{PHZ}$                  | Output Disable Time   | 2.0   | 50.0 | 2.0   | 50.0 | ns    | Figure 10             |
| $\bar{t}_{PLZ}$                  | DIR to B <sub>1</sub> -B <sub>8</sub>   | 2.0   | 50.0 | 2.0   | 50.0 | ns    | Figure 10             |
| $t_{pEN}$                        | Output Enable Time  | 2.0   | 25.0 | 2.0   | 28.0 | ns    | Figure 3              |
|                                  | HD to B <sub>1</sub> -B <sub>8</sub> , Y <sub>9</sub> -Y <sub>13</sub>  | 2.0   | 25.0 | 2.0   | 28.0 | ns    | Figure 3              |
| $t_{pDIS}$                       | Output Disable Time   | 2.0   | 25.0 | 2.0   | 28.0 | ns    | Figure 3              |
|                                  | HD to B <sub>1</sub> -B <sub>8</sub> , Y <sub>9</sub> -Y <sub>13</sub>  | 2.0   | 25.0 | 2.0   | 28.0 | ns    | Figure 3              |
| $\bar{t}_{pEN} - \bar{t}_{pDIS}$ | Output Enable-<br>Output Disable  |   | 10.0 |   | 12.0 | ns    |                       |
| $t_{SLEW}$                       | Output Slew Rate  |   |      |   |      | V/ns  |                       |
| $t_{PLH}$                        | B <sub>1</sub> -B <sub>8</sub> , Y <sub>9</sub> -Y <sub>13</sub>  | 0.05  | 0.40 | 0.05  | 0.40 |       | Figure 6              |
| $t_{PHL}$                        |   | 0.05  | 0.40 | 0.05  | 0.40 |       | Figure 5              |
| $t_r, t_f$                       | $t_{RISE}$ and $t_{FALL}$<br>B <sub>1</sub> -B <sub>8</sub> (Note 9),<br>Y <sub>9</sub> -Y <sub>13</sub> (Note 9) |   | 120  |   | 120  | ns    | Figure 7<br>(Note 11) |
|                                  |   |   | 120  |   | 120  | ns    | (Note 11)             |

**Note 9:** Open Drain

**Note 10:**  $t_{SKEW}$  is measured for common edge output transitions and compares the measured propagation delay for a given path type:

- (i) A<sub>1</sub>-A<sub>8</sub> to B<sub>1</sub>-B<sub>8</sub>, A<sub>9</sub>-A<sub>13</sub> to Y<sub>9</sub>-Y<sub>13</sub>
- (ii) B<sub>1</sub>-B<sub>8</sub> to A<sub>1</sub>-A<sub>8</sub>
- (iii) C<sub>14</sub>-C<sub>17</sub> to A<sub>14</sub>-A<sub>17</sub>

**Note 11:** This parameter is guaranteed but not tested, characterized only.

## Capacitance

| Symbol              | Parameter           | Typ | Units | Conditions  |
|---------------------|---------------------|-----|-------|---|
| $C_{IN}$            | Input Capacitance   | 3   | pF    | $V_{CC} = 0.0\text{V}$ (HD, DIR, A <sub>9</sub> -A <sub>13</sub> , C <sub>14</sub> -C <sub>17</sub> , PLH <sub>IN</sub> and HLH <sub>IN</sub> ) |
| $C_{I/O}$ (Note 12) | I/O Pin Capacitance | 5   | pF    | $V_{CC} = 3.3\text{V}$  |

**Note 12:**  $C_{I/O}$  is measured at frequency = 1 MHz, per MIL-STD-883B, Method 3012

### AC Loading and Waveforms

Pulse Generator for all pulses: Rate  $\leq 1.0$  MHz;  $Z_O \leq 50\Omega$ ;  $t_f \leq 2.5$  ns,  $t_r \leq 2.5$  ns.

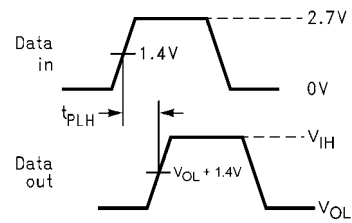
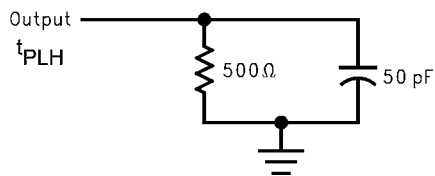
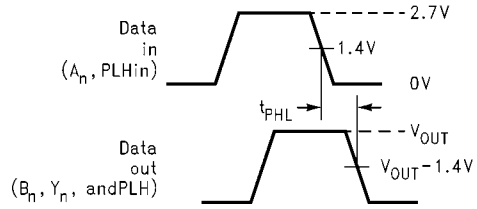
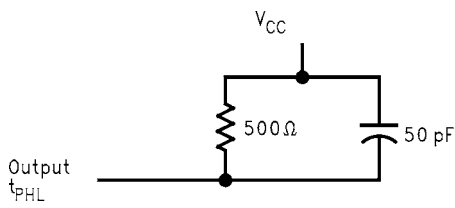


FIGURE 2. Port A to B and A to Y Propagation Delay Waveforms

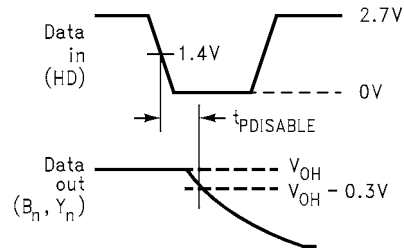
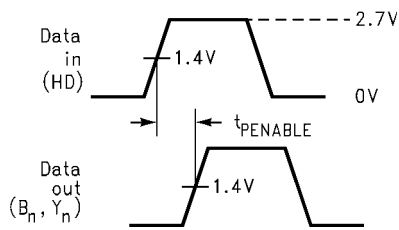


FIGURE 3. Port A to B and A to Y Output Waveforms

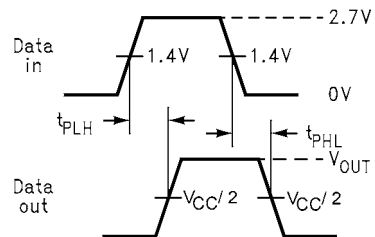
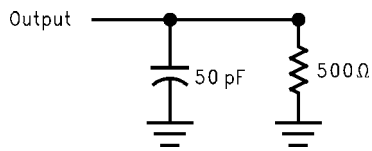


FIGURE 4. Port B to A, C to A and HLHin to HLH Propagation Delay Waveforms

AC Loading and Waveforms (Continued)

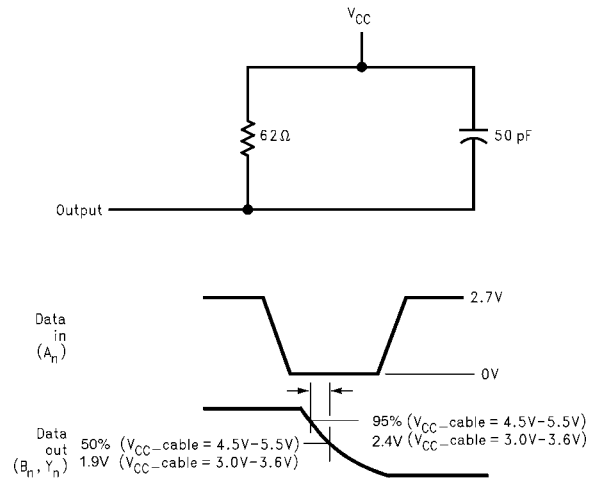


FIGURE 5. Port A to B and A to Y HL Slew Test Load and Waveforms

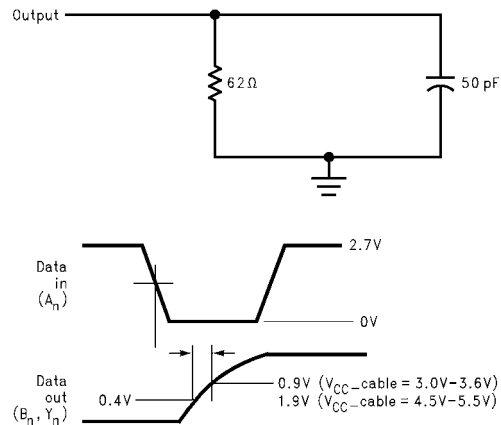
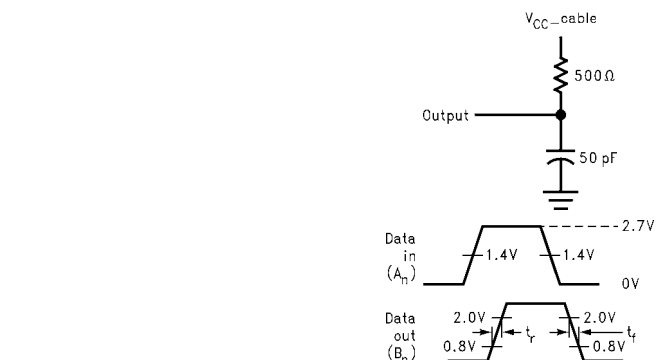


FIGURE 6. Port A to B and A to Y LH Slew Test Load and Waveforms



AC Loading and Waveforms (Continued)



$t_r$  = Output Rise Time, Open Drain  
 $t_f$  = Output Fall Time, Open Drain

FIGURE 7. Ports A to B and A to Y Rise and Fall Test Load and Waveforms for Open Drain Outputs

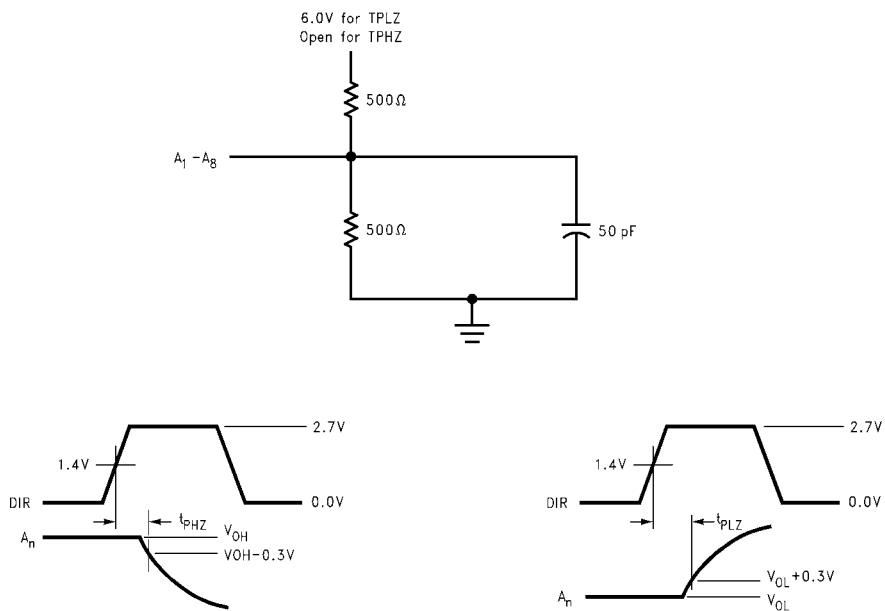


FIGURE 8.  $t_{pHZ}$  and  $t_{pLZ}$  Test Load and Waveforms, DIR to A<sub>1</sub>-A<sub>8</sub>

AC Loading and Waveforms (Continued)

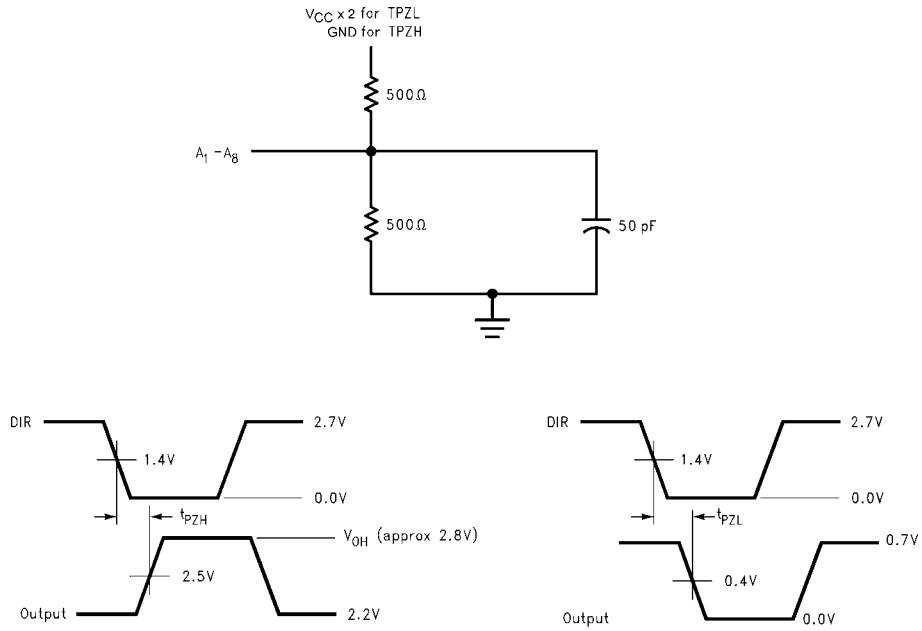


FIGURE 9.  $t_{PZH}$  and  $t_{PZL}$  Test Load and Waveforms, DIR to  $A_1 - A_8$

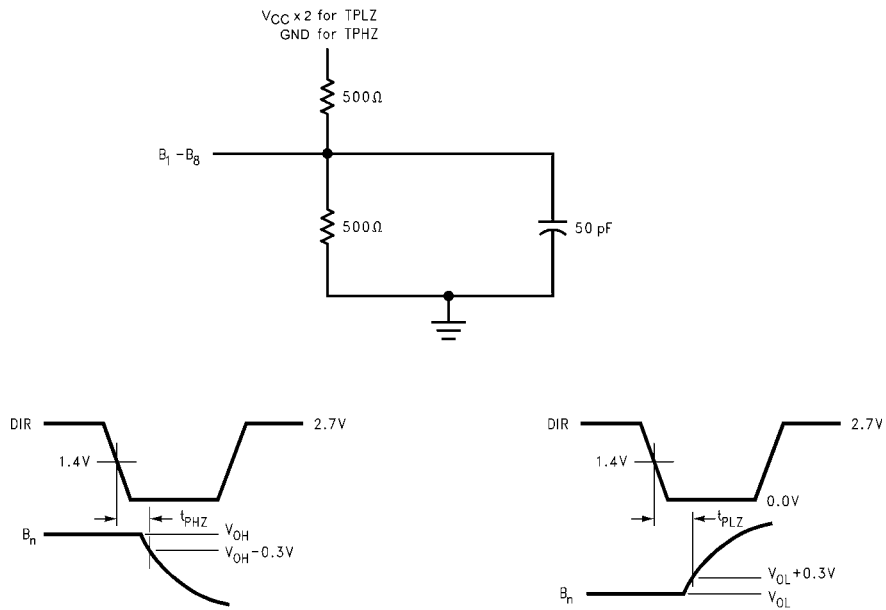
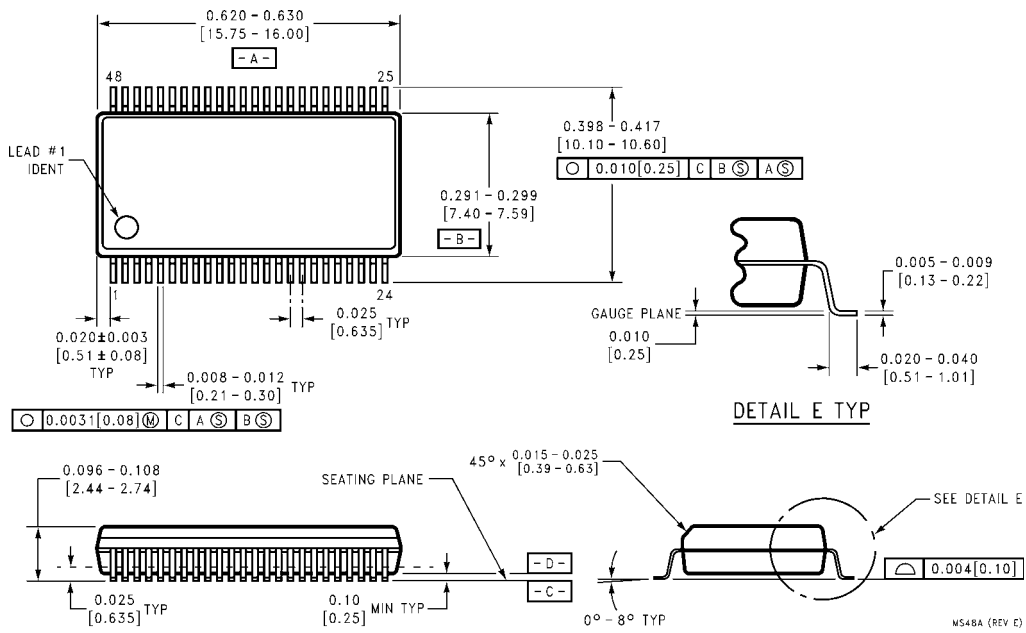


FIGURE 10.  $t_{PHZ}$  and  $t_{PLZ}$  Test Load and Waveforms DIR to  $B_1 - B_8$

**Physical Dimensions** inches (millimeters) unless otherwise noted



**48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide  
Package Number MS48A**