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## 74LVX161284

### Low Voltage IEEE 161284 Translating Transceiver

#### General Description

The LVX161284 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) to allow 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, all inputs (except HLH) and outputs on the cable side contain internal pull-up resistors connected to the  $V_{CC}$ -cable supply to provide proper termination and pull-ups for open drain 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.

#### Features

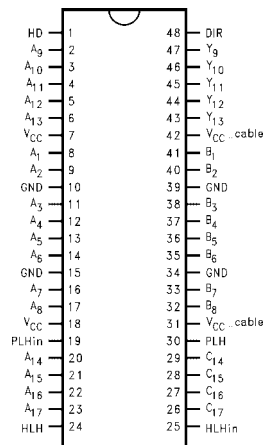
- Supports IEEE 1284 Level 1 and Level 2 signaling standards for bidirectional parallel communications between personal computers and printing peripherals
- Translation capability allows outputs on the cable side to interface with 5V signals
- All inputs have hysteresis to provide noise margin
- B and Y output resistance optimized to drive external cable
- B and Y outputs in high impedance mode during power down
- Inputs and outputs on cable side have internal pull-up resistors
- Flow-through pin configuration allows easy interface between the "Peripheral and Host"
- Replaces the function of two (2) 74ACT1284 devices

#### Ordering Code

| Order Number   | Package Number | Package Description                                                         |
|----------------|----------------|-----------------------------------------------------------------------------|
| 74LVX161284MEA | MS48A          | 48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide      |
| 74LVX161284MTD | MTD48          | 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide |

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

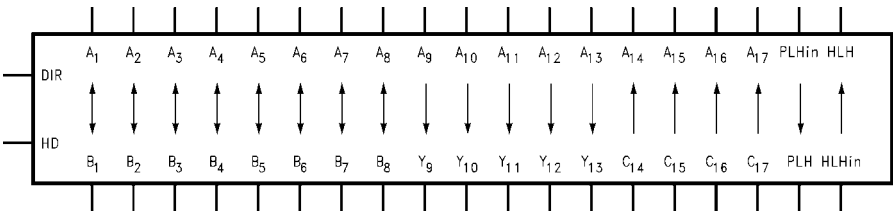
#### Connection Diagram



#### Pin Descriptions

| Pin Names           | Description                           |
|---------------------|---------------------------------------|
| HD                  | High Drive Enable Input (Active HIGH) |
| DIR                 | Direction Control Input               |
| $A_1$ - $A_8$       | Inputs or Outputs                     |
| $B_1$ - $B_8$       | Inputs or Outputs                     |
| $A_9$ - $A_{13}$    | Inputs                                |
| $Y_9$ - $Y_{13}$    | Outputs                               |
| $A_{14}$ - $A_{17}$ | Outputs                               |
| $C_{14}$ - $C_{17}$ | 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                |

Logic Symbol



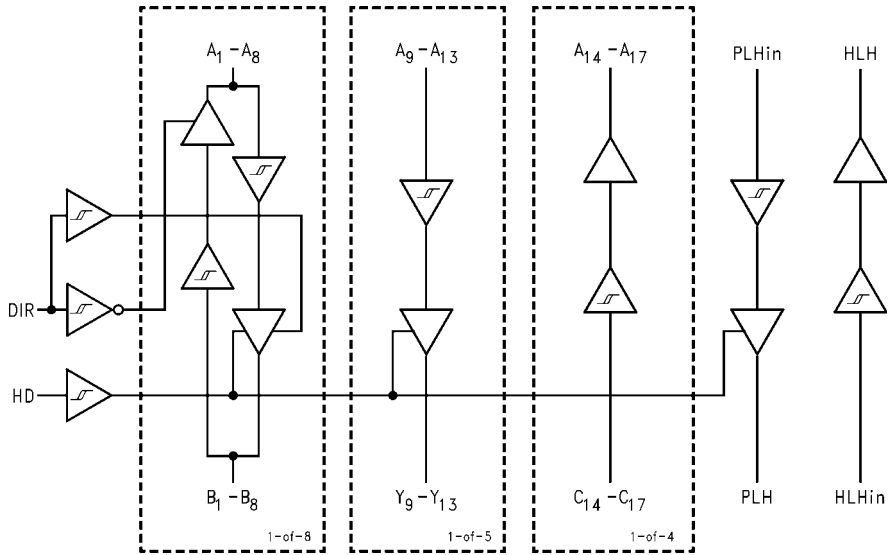
Truth Table

| 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

Note 2: B<sub>1</sub>–B<sub>8</sub> Open Drain Outputs

Logic Diagram



**Absolute Maximum Ratings**(Note 3)

## Supply Voltage

|                                             |                |
|---------------------------------------------|----------------|
| $V_{CC}$                                    | -0.5V to +4.6V |
| $V_{CC}-\text{Cable}$                       | -0.5V to +7.0V |
| $V_{CC}-\text{Cable}$ Must Be $\geq V_{CC}$ |                |

Input Voltage ( $V_i$ )—(Note 4)

|                                                 |                          |
|-------------------------------------------------|--------------------------|
| $A_1-A_{13}$ , PLH <sub>IN</sub> , DIR, HD      | -0.5V to $V_{CC} + 0.5V$ |
| $B_1-B_8$ , $C_{14}-C_{17}$ , HLH <sub>IN</sub> | -0.5V to +5.5V (DC)      |
| $B_1-B_8$ , $C_{14}-C_{17}$ , HLH <sub>IN</sub> | -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 (HBM) Last Passing Voltage

2000V

**Recommended Operating Conditions**

## Supply Voltage

|                       |              |
|-----------------------|--------------|
| $V_{CC}$              | 3.0V to 3.6V |
| $V_{CC}-\text{Cable}$ | 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 <sub>CC</sub><br>(V) | V <sub>CC</sub> —Cable<br>(V) | T <sub>A</sub> = 0°C<br>to +70°C | T <sub>A</sub> = -40°C<br>to +85°C | Units | Conditions                                               |
|-----------------|-----------------------------------------|----------------------------------------------------------------|------------------------|-------------------------------|----------------------------------|------------------------------------|-------|----------------------------------------------------------|
|                 |                                         |                                                                |                        |                               | Guaranteed Limits                |                                    |       |                                                          |
| V <sub>IK</sub> | Input Clamp<br>Diode Voltage            |                                                                | 3.0                    | 3.0                           | -1.2                             | -1.2                               | V     | I <sub>I</sub> = -18 mA                                  |
| V <sub>IH</sub> | Minimum                                 | A <sub>n</sub> , B <sub>n</sub> , PLH <sub>IIN</sub> , DIR, HD | 3.0-3.6                | 3.0-5.5                       | 2.0                              | 2.0                                | V     |                                                          |
|                 | HIGH Level                              | C <sub>n</sub>                                                 | 3.0-3.6                | 3.0-5.5                       | 2.3                              | 2.3                                |       |                                                          |
|                 | Input Voltage                           | HLH <sub>IIN</sub>                                             | 3.0-3.6                | 3.0-5.5                       | 2.6                              | 2.6                                |       |                                                          |
| V <sub>IL</sub> | Maximum                                 | A <sub>n</sub> , B <sub>n</sub> , PLH <sub>IIN</sub> , DIR, HD | 3.0-3.6                | 3.0-5.5                       | 0.8                              | 0.8                                | V     |                                                          |
|                 | LOW Level                               | C <sub>n</sub>                                                 | 3.0-3.6                | 3.0-5.5                       | 0.8                              | 0.8                                |       |                                                          |
|                 | Input Voltage                           | HLH <sub>IIN</sub>                                             | 3.0-3.6                | 3.0-5.5                       | 1.6                              | 1.6                                |       |                                                          |
| ΔV <sub>T</sub> | Minimum Input<br>Hysteresis             | A <sub>n</sub> , B <sub>n</sub> , PLH <sub>IIN</sub> , DIR, HD | 3.3                    | 5.0                           | 0.4                              | 0.4                                | V     | V <sub>T</sub> <sup>+</sup> -V <sub>T</sub> <sup>-</sup> |
|                 |                                         | C <sub>n</sub>                                                 | 3.3                    | 5.0                           | 0.8                              | 0.8                                |       | V <sub>T</sub> <sup>+</sup> -V <sub>T</sub> <sup>-</sup> |
|                 |                                         | HLH <sub>IIN</sub>                                             | 3.3                    | 5.0                           | 0.2                              | 0.2                                |       | V <sub>T</sub> <sup>+</sup> -V <sub>T</sub> <sup>-</sup> |
| V <sub>OH</sub> | Minimum HIGH<br>Level Output<br>Voltage | A <sub>n</sub> , HLH                                           | 3.0                    | 3.0                           | 2.8                              | 2.8                                | V     | I <sub>OH</sub> = -50 μA                                 |
|                 |                                         |                                                                | 3.0                    | 3.0                           | 2.4                              | 2.4                                |       | I <sub>OH</sub> = -4 mA                                  |
|                 |                                         | B <sub>n</sub> , Y <sub>n</sub>                                | 3.0                    | 3.0                           | 2.0                              | 2.0                                |       | I <sub>OH</sub> = -14 mA                                 |
|                 |                                         | B <sub>n</sub> , Y <sub>n</sub>                                | 3.0                    | 4.5                           | 2.23                             | 2.23                               |       | I <sub>OH</sub> = -14 mA                                 |
|                 |                                         | PLH                                                            | 3.15                   | 3.15                          | 3.1                              | 3.1                                |       | I <sub>OH</sub> = -500 μA                                |

# 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<br>to +70°C | T <sub>A</sub> = –40°C<br>to +85°C | Units | Conditions                              |
|-----------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------|------------------------------|----------------------------------|------------------------------------|-------|-----------------------------------------|
|                       |                                             |                                                                                                        |                        |                              | 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                                 |       | (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                   |
|                       |                                             |                                                                                                        | 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                   |
|                       |                                             |                                                                                                        | 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                               | mA    | V <sub>I</sub> = 0.0V                   |
| 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                                 | μA    | V <sub>O</sub> = 3.6V                   |
|                       |                                             | B <sub>1</sub> –B <sub>8</sub>                                                                         | 3.6                    | 5.5                          | 100                              | 100                                | μA    | 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                               | mA    |                                         |
| 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                                 | mA    | 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.

## AC Electrical Characteristics

| Symbol                              | Parameter                                                                                                                       | T <sub>A</sub> = 0°C to +70°C<br>V <sub>CC</sub> = 3.0V–3.6V<br>V <sub>CC—Cable</sub> = 3.0V–5.5V |            | T <sub>A</sub> = –40°C to +85°C<br>V <sub>CC</sub> = 3.0V–3.6V<br>V <sub>CC—Cable</sub> = 3.0V–5.5V |            | Units | Figure Number         |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------|------------|-------|-----------------------|
|                                     |                                                                                                                                 | Min                                                                                               | Max        | Min                                                                                                 | Max        |       |                       |
|                                     |                                                                                                                                 |                                                                                                   |            |                                                                                                     |            |       |                       |
| t <sub>PHL</sub>                    | 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 1              |
| t <sub>PLH</sub>                    | 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 <sub>PHL</sub>                    | 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 3              |
| t <sub>PLH</sub>                    | 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 3              |
| t <sub>PHL</sub>                    | 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 1              |
| t <sub>PLH</sub>                    | 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              |
| t <sub>PHL</sub>                    | 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 3              |
| t <sub>PLH</sub>                    | 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 3              |
| t <sub>SKEW</sub>                   | LH–LH or HL–HL                                                                                                                  |                                                                                                   | 10.0       |                                                                                                     | 12.0       | ns    | (Note 9)              |
| t <sub>PHL</sub>                    | PLH <sub>IN</sub> to PLH                                                                                                        | 2.0                                                                                               | 40.0       | 2.0                                                                                                 | 44.0       | ns    | Figure 1              |
| t <sub>PLH</sub>                    | PLH <sub>IN</sub> to PLH                                                                                                        | 2.0                                                                                               | 40.0       | 2.0                                                                                                 | 44.0       | ns    | Figure 2              |
| t <sub>PHL</sub>                    | HLH <sub>IN</sub> to HLH                                                                                                        | 2.0                                                                                               | 40.0       | 2.0                                                                                                 | 44.0       | ns    | Figure 3              |
| t <sub>PLH</sub>                    | HLH <sub>IN</sub> to HLH                                                                                                        | 2.0                                                                                               | 40.0       | 2.0                                                                                                 | 44.0       | ns    | Figure 3              |
| t <sub>PHZ</sub>                    | Output Disable Time                                                                                                             | 2.0                                                                                               | 15.0       | 2.0                                                                                                 | 18.0       | ns    | Figure 7              |
| t <sub>PLZ</sub>                    | DIR to A <sub>1</sub> –A <sub>8</sub>                                                                                           | 2.0                                                                                               | 15.0       | 2.0                                                                                                 | 18.0       |       |                       |
| t <sub>PZH</sub>                    | Output Enable Time                                                                                                              | 2.0                                                                                               | 50.0       | 2.0                                                                                                 | 50.0       | ns    | Figure 8              |
| t <sub>PZL</sub>                    | DIR to A <sub>1</sub> –A <sub>8</sub>                                                                                           | 2.0                                                                                               | 50.0       | 2.0                                                                                                 | 50.0       |       |                       |
| t <sub>PHZ</sub>                    | Output Disable Time                                                                                                             | 2.0                                                                                               | 50.0       | 2.0                                                                                                 | 50.0       | ns    | Figure 9              |
| t <sub>PLZ</sub>                    | DIR to B <sub>1</sub> –B <sub>8</sub>                                                                                           | 2.0                                                                                               | 50.0       | 2.0                                                                                                 | 50.0       |       |                       |
| t <sub>PEN</sub>                    | Output Enable Time                                                                                                              | 2.0                                                                                               | 25.0       | 2.0                                                                                                 | 28.0       | ns    | Figure 2              |
|                                     | 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       |       |                       |
| t <sub>PDIS</sub>                   | Output Disable Time                                                                                                             | 2.0                                                                                               | 25.0       | 2.0                                                                                                 | 28.0       | ns    | Figure 2              |
|                                     | 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       |       |                       |
| t <sub>PEN</sub> –t <sub>PDIS</sub> | Output Enable–Output Disable                                                                                                    |                                                                                                   | 10.0       |                                                                                                     | 12.0       | ns    |                       |
| t <sub>SLEW</sub>                   | Output Slew Rate                                                                                                                |                                                                                                   |            |                                                                                                     |            | V/ns  | Figure 5              |
| t <sub>PLH</sub>                    | 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 5              |
| t <sub>PHL</sub>                    |                                                                                                                                 | 0.05                                                                                              | 0.40       | 0.05                                                                                                | 0.40       |       | Figure 4              |
| t <sub>r</sub> , t <sub>f</sub>     | t <sub>RISE</sub> and t <sub>FALL</sub><br>B <sub>1</sub> –B <sub>8</sub> (Note 8),<br>Y <sub>9</sub> –Y <sub>13</sub> (Note 8) |                                                                                                   | 120<br>120 |                                                                                                     | 120<br>120 | ns    | Figure 6<br>(Note 10) |

**Note 8:** Open Drain

**Note 9:** t<sub>SKEW</sub> 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 10:** This parameter is guaranteed but not tested, characterized only.

## Capacitance

| Symbol                     | Parameter           | Typ | Units | Conditions                                                                                                                                      |
|----------------------------|---------------------|-----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| C <sub>IN</sub>            | Input Capacitance   | 3   | pF    | V <sub>CC</sub> = 0.0V (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 <sub>I/O</sub> (Note 11) | I/O Pin Capacitance | 5   | pF    | V <sub>CC</sub> = 3.3V                                                                                                                          |

**Note 11:** C<sub>I/O</sub> 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.

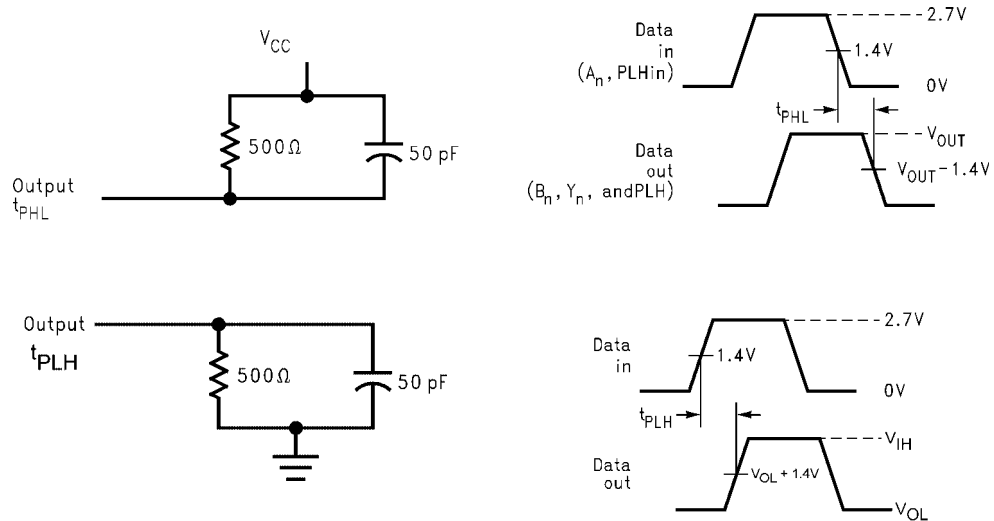


FIGURE 1. Port A to B and A to Y Propagation Delay Waveforms

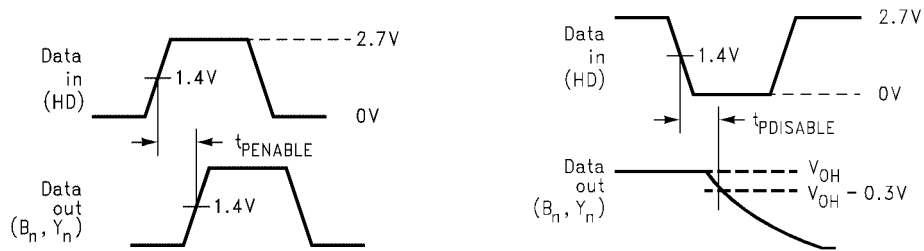


FIGURE 2. Port A to B and A to Y Output Waveforms

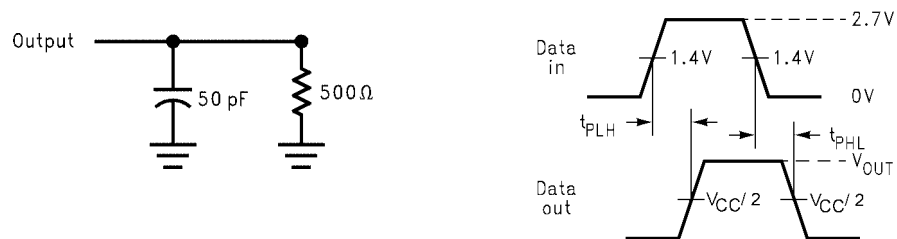


FIGURE 3. Port B to A, C to A and HLH in to HLH Propagation Delay Waveforms

## AC Loading and Waveforms (Continued)

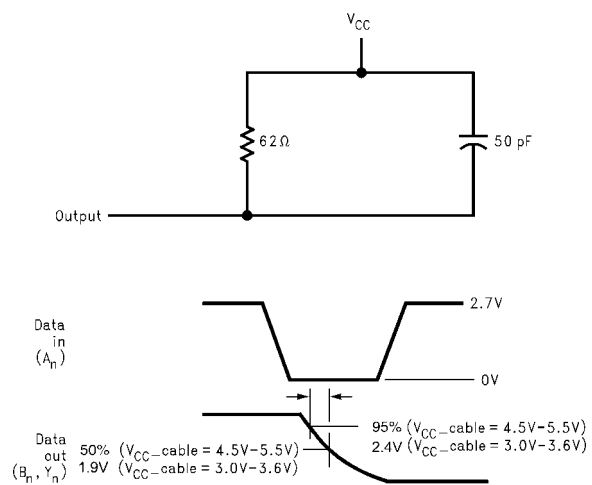


FIGURE 4. Port A to B and A to Y HL Slew Test Load and Waveforms

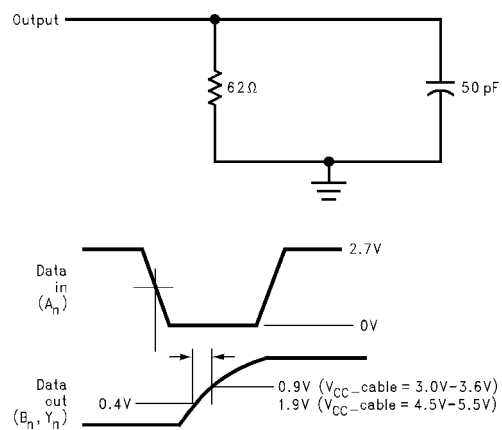


FIGURE 5. Port A to B and A to Y LH Slew Test Load and Waveforms

## AC Loading and Waveforms (Continued)

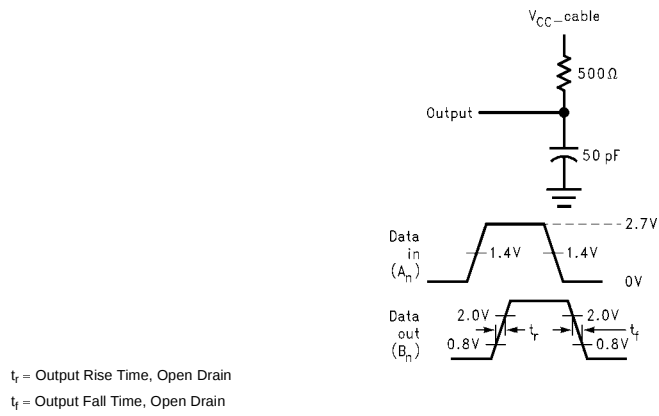
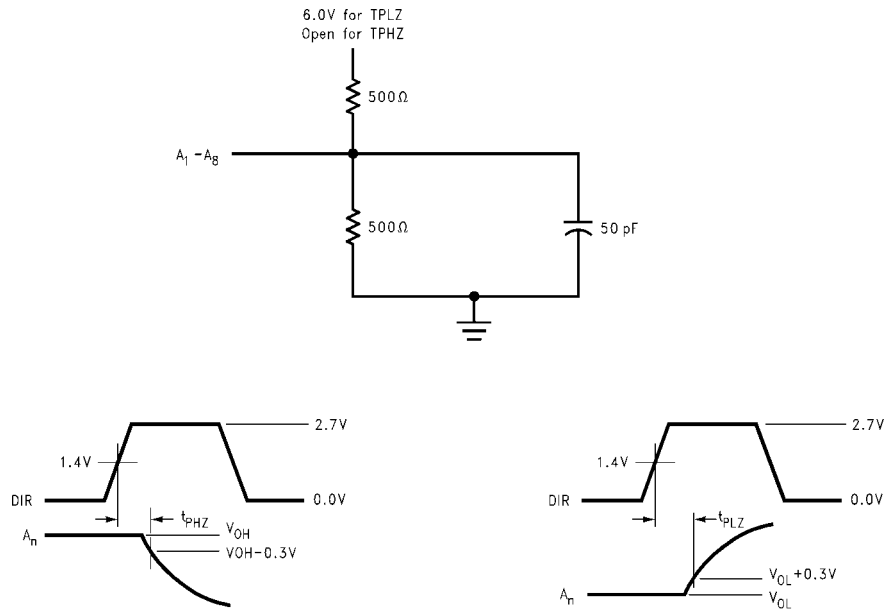
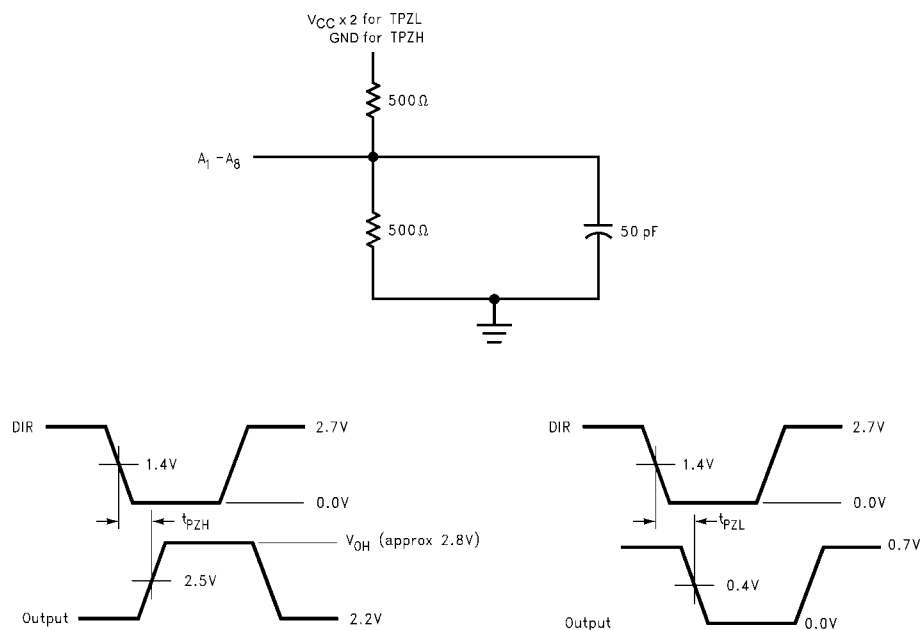
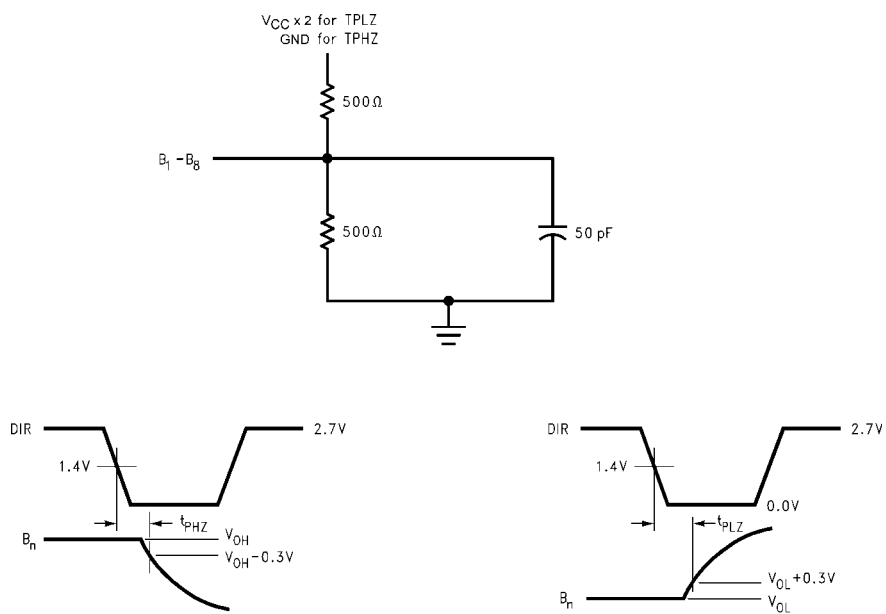
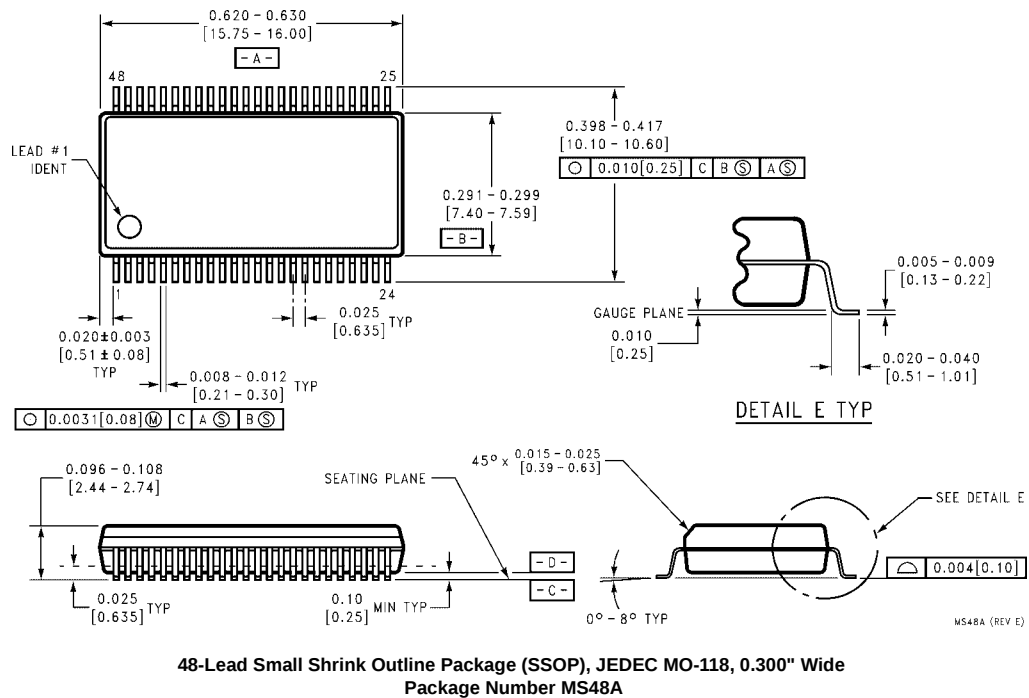


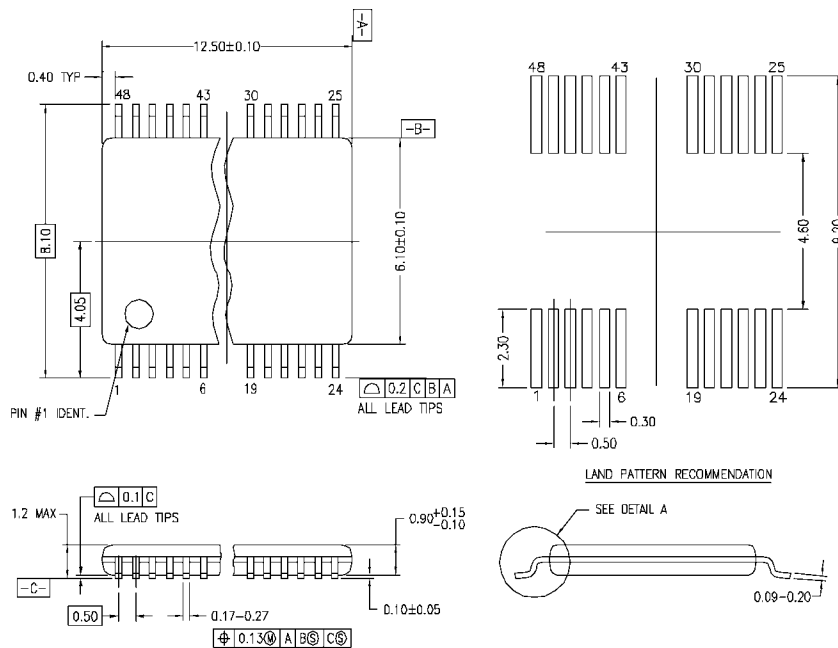
FIGURE 6. Ports A to B and A to Y Rise and Fall Test Load and Waveforms for Open Drain Outputs

FIGURE 7.  $t_{PHZ}$  and  $t_{PLZ}$  Test Load and Waveforms, DIR to  $A_1$ - $A_8$

## AC Loading and Waveforms (Continued)

FIGURE 8.  $t_{PZH}$  and  $t_{PZL}$  Test Load and Waveforms, DIR to A<sub>1</sub>-A<sub>8</sub>FIGURE 9.  $t_{PHZ}$  and  $t_{PLZ}$  Test Load and Waveforms  
DIR to B<sub>1</sub>-B<sub>8</sub>



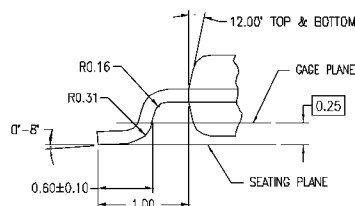
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

DIMENSIONS ARE IN MILLIMETERS

NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION ED,  
DATE 4/97.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH,  
AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTD48REV C



DETAIL A

**48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide  
Package Number MTD48**

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