

## 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

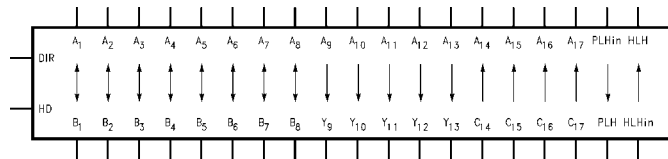
- Supports IEEE 1284 Level 1 and Level 2 signaling standards for bidirectional parallel communications between personal computers and printing peripherals
- Translation capability allows outputs on the cable side to interface with 5V signals
- All inputs have hysteresis to provide noise margin
- B and 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

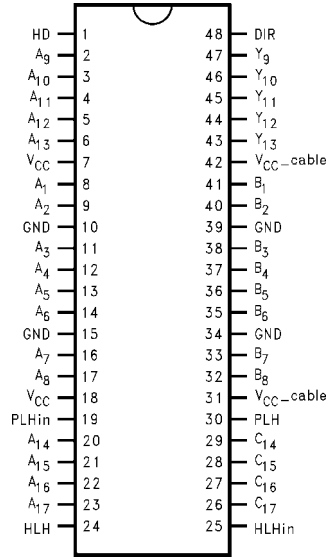
Order Number	Package Number	Package Description
74LVX161284MEA	MS48A	48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
74LVX161284MTD	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

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

### 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

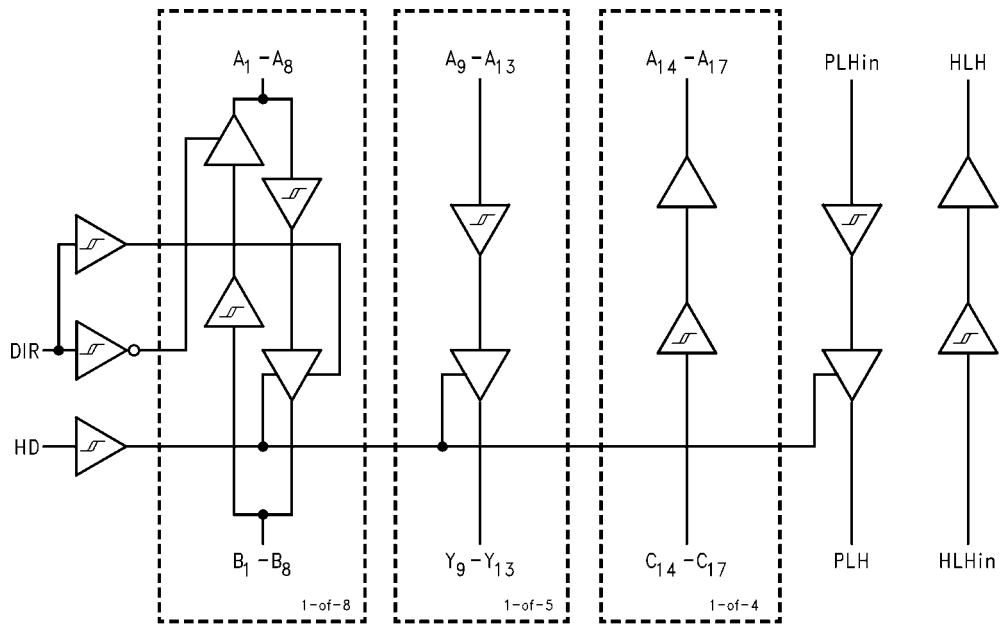
### Truth Table

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 A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub> (Note 1) C <sub>14</sub> -C <sub>17</sub> Data to A <sub>14</sub> -A <sub>17</sub> 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 A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub> 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) A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub> (Note 1) C <sub>14</sub> -C <sub>17</sub> Data to A <sub>14</sub> -A <sub>17</sub> PLH Open Drain Mode
H	H	A <sub>1</sub> -A <sub>8</sub> Data to B <sub>1</sub> -B <sub>8</sub> A <sub>9</sub> -A <sub>13</sub> Data to Y <sub>9</sub> -Y <sub>13</sub> 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



74LVX161284

**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 <sub>1</sub> –A <sub>13</sub> , PLH <sub>IN</sub> , DIR, HD	-0.5V to $V_{CC} + 0.5V$	
B <sub>1</sub> –B <sub>8</sub> , C <sub>14</sub> –C <sub>17</sub> , HLH <sub>IN</sub>	-0.5V to +5.5V (DC)	
B <sub>1</sub> –B <sub>8</sub> , C <sub>14</sub> –C <sub>17</sub> , HLH <sub>IN</sub>	-2.0V to +7.0V*	
	*40 ns Transient	
Output Voltage ( $V_O$ )		
A <sub>1</sub> –A <sub>8</sub> , A <sub>14</sub> –A <sub>17</sub> , HLH	-0.5V to $V_{CC} + 0.5V$	
B <sub>1</sub> –B <sub>8</sub> , Y <sub>9</sub> –Y <sub>13</sub> , PLH	-0.5V to +5.5V (DC)	
B <sub>1</sub> –B <sub>8</sub> , Y <sub>9</sub> –Y <sub>13</sub> , PLH	-2.0V to +7.0V*	
	*40 ns Transient	
DC Output Current ( $I_O$ )		
A <sub>1</sub> –A <sub>8</sub> , HLH	±25 mA	
B <sub>1</sub> –B <sub>8</sub> , Y <sub>9</sub> –Y <sub>13</sub>	±50 mA	
PLH (Output LOW)	84 mA	
PLH (Output HIGH)	-50 mA	
Input Diode Current ( $I_{IK}$ )—(Note 4)		
DIR, HD, A <sub>9</sub> –A <sub>13</sub> , PLH, HLH, C <sub>14</sub> –C <sub>17</sub>	-20 mA	

Output Diode Current ( $I_{OK}$ )

A <sub>1</sub> –A <sub>8</sub> , A <sub>14</sub> –A <sub>17</sub> , HLH	±50 mA
B <sub>1</sub> –B <sub>8</sub> , Y <sub>9</sub> –Y <sub>13</sub> , PLH	-50 mA
DC Continuous $V_{CC}$ or Ground Current	±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
$V_{CC}$ —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		$V_{CC}$ (V)	$V_{CC}$ —Cable (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	$I_I = -18\text{ mA}$
$V_{IH}$	Minimum	A <sub>n</sub> , B <sub>n</sub> , PLH <sub>IN</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>IN</sub>	3.0–3.6	3.0–5.5	2.6	2.6		
$V_{IL}$	Maximum	A <sub>n</sub> , B <sub>n</sub> , PLH <sub>IN</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>IN</sub>	3.0–3.6	3.0–5.5	1.6	1.6		
$\Delta V_T$	Minimum Input Hysteresis	A <sub>n</sub> , B <sub>n</sub> , PLH <sub>IN</sub> , DIR, HD	3.3	5.0	0.4	0.4	V	$V_T^+ - V_T^-$
		C <sub>n</sub>	3.3	5.0	0.8	0.8		$V_T^+ - V_T^-$
		HLH <sub>IN</sub>	3.3	5.0	0.2	0.2		$V_T^+ - V_T^-$
$V_{OH}$	Minimum High Level Output Voltage	A <sub>n</sub> , HLH	3.0	3.0	2.8	2.8	V	$I_{OH} = -50\ \mu\text{A}$
		B <sub>n</sub> , Y <sub>n</sub>	3.0	3.0	2.4	2.4		$I_{OH} = -4\ \text{mA}$
		B <sub>n</sub> , Y <sub>n</sub>	3.0	3.0	2.0	2.0		$I_{OH} = -14\ \text{mA}$
		B <sub>n</sub> , Y <sub>n</sub>	3.0	4.5	2.23	2.23		$I_{OH} = -14\ \text{mA}$
		PLH	3.15	3.15	3.1	3.1		$I_{OH} = -500\ \mu\text{A}$
$V_{OL}$	Maximum Low Level Output Voltage	A <sub>n</sub> , HLH	3.0	3.0	0.2	0.2	V	$I_{OL} = 50\ \mu\text{A}$
		B <sub>n</sub> , Y <sub>n</sub>	3.0	3.0	0.4	0.4		$I_{OL} = 4\ \text{mA}$
		B <sub>n</sub> , Y <sub>n</sub>	3.0	3.0	0.8	0.8		$I_{OL} = 14\ \text{mA}$
		B <sub>n</sub> , Y <sub>n</sub>	3.0	4.5	0.77	0.77		$I_{OL} = 14\ \text{mA}$
		PLH	3.0	3.0	0.85	0.95		$I_{OL} = 84\ \text{mA}$
		PLH	3.0	4.5	0.8	0.9		$I_{OL} = 84\ \text{mA}$
$R_D$	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)
			3.3	5.0	55	55		(Note 7)
	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)
			3.3	5.0	35	35	(Note 7)	

## DC Electrical Characteristics (Continued)

Symbol	Parameter		V <sub>CC</sub> (V)	V <sub>CC-Cable</sub> (V)	T <sub>A</sub> = 0°C	T <sub>A</sub> = -40°C	Units	Conditions
					to +70°C	to +85°C		
Guaranteed Limits								
R <sub>P</sub>	Maximum Pull-Up Resistance	B <sub>1</sub> -B <sub>8</sub> , Y <sub>9</sub> -Y <sub>13</sub> , 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> 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> , 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> , 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	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> , 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>	PowerDown 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	$T_A = 0^\circ\text{C to } +70^\circ\text{C}$ $V_{CC} = 3.0\text{V}-3.6\text{V}$ $V_{CC-Cable} = 3.0\text{V}-5.5\text{V}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{CC} = 3.0\text{V}-3.6\text{V}$ $V_{CC-Cable} = 3.0\text{V}-5.5\text{V}$		Units	Fig. No.
		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		
$t_{PLH}$	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	2
$t_{PHL}$	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	3
$t_{PLH}$	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	3
$t_{PHL}$	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	1
$t_{PLH}$	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	2
$t_{PHL}$	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	3
$t_{PLH}$	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	3
$t_{SKEW}$	LH-LH or HL-HL		10.0		12.0	ns	(Note 9)
$t_{PHL}$	PLH <sub>IN</sub> to PLH	2.0	40.0	2.0	44.0	ns	1
$t_{PLH}$	PLH <sub>IN</sub> to PLH	2.0	40.0	2.0	44.0	ns	2
$t_{PHL}$	HLH <sub>IN</sub> to HLH	2.0	40.0	2.0	44.0	ns	3
$t_{PLH}$	HLH <sub>IN</sub> to HLH	2.0	40.0	2.0	44.0	ns	3
$t_{PHZ}$	Output Disable Time	2.0	15.0	2.0	18.0	ns	7
$t_{PLZ}$	DIR to A <sub>1</sub> -A <sub>8</sub>	2.0	15.0	2.0	18.0		
$t_{pZH}$	Output Enable Time	2.0	50.0	2.0	50.0	ns	8
$t_{pZL}$	DIR to A <sub>1</sub> -A <sub>8</sub>	2.0	50.0	2.0	50.0		
$t_{PHZ}$	Output Disable Time	2.0	50.0	2.0	50.0	ns	9
$t_{PLZ}$	DIR to B <sub>1</sub> -B <sub>8</sub>	2.0	50.0	2.0	50.0		
$t_{pEN}$	Output Enable Time	2.0	25.0	2.0	28.0	ns	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		
$t_{pDIS}$	Output Disable Time	2.0	25.0	2.0	28.0	ns	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		
$t_{pEN}-t_{pDIS}$	Output Enable- Output Disable		10.0		12.0	ns	
$t_{SLEW}$	Output Slew Rate						
$t_{PLH}$	B <sub>1</sub> -B <sub>8</sub> , Y <sub>9</sub> -Y <sub>13</sub>	0.05	0.40	0.05	0.40	V/ns	5
$t_{PHL}$		0.05	0.40	0.05	0.40		4
$t_r, t_f$	$t_{RISE}$ and $t_{FALL}$ B <sub>1</sub> -B <sub>8</sub> (Note 8), Y <sub>9</sub> -Y <sub>13</sub> (Note 8)		120		120	ns	6
			120		120		(Note 10)

**Note 8:** Open Drain

**Note 9:**  $t_{SKEW}$  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 10:** This parameter is guaranteed but not tested, characterized only.

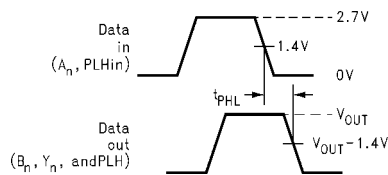
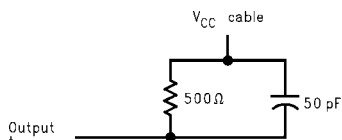
**Note 11:** Pulse Generator for all pulses; Rate  $\leq 1.0$  MHz;  $Z_0 \leq 50\Omega$ ;  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.

## 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	$V_{CC} = 3.3\text{V}$

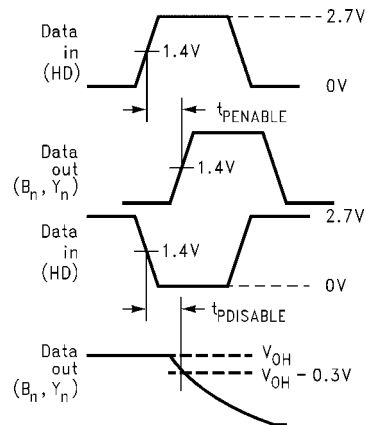
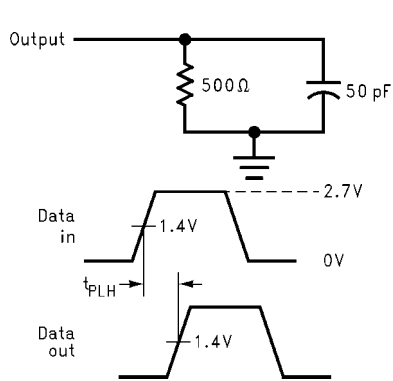
**Note 12:**  $C_{I/O}$  is measured at frequency = 1 MHz, per MIL-STD-883B, Method 3012

### AC Loading and Waveforms



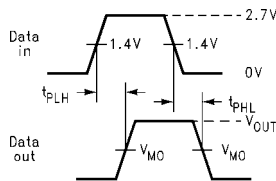
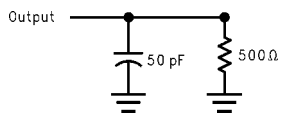
**FIGURE 1.  $t_{PHL}$  Test Load and Waveforms**

**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>  
PLHin to PLH**



**FIGURE 2.  $t_{PLH}$ ,  $t_{pEn}$ ,  $t_{pDis}$  Test Load and Waveforms**

**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>  
PLHin to PLH, HD to B<sub>1</sub>-B<sub>8</sub>, Y<sub>9</sub>-Y<sub>13</sub>, PLH**

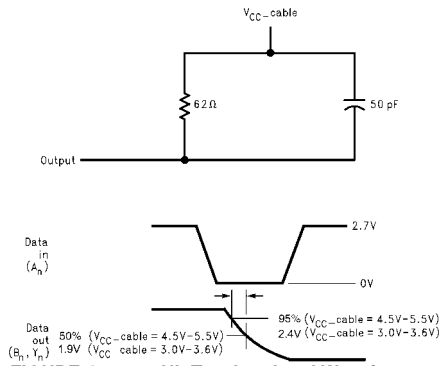


$V_{MO} = 50\% V_{CC}$

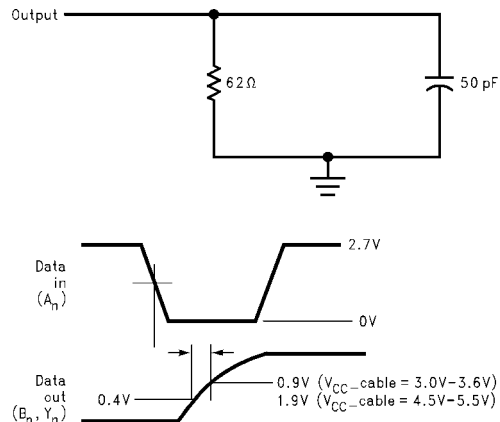
**FIGURE 3.  $t_{PHL}$ ,  $t_{PLH}$  Test Load and Waveforms**

**B<sub>1</sub>-B<sub>8</sub> to A<sub>1</sub>-A<sub>8</sub>, C<sub>14</sub>-C<sub>17</sub> to A<sub>14</sub>-A<sub>17</sub>, HLHin to HLH**

AC Loading and Waveforms (Continued)

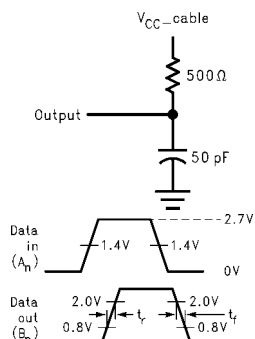


**FIGURE 4.  $t_{SLEW}$  HL Test Load and Waveforms**  
**A<sub>1</sub>-A<sub>8</sub> to B<sub>1</sub>-B<sub>8</sub>**  
**A<sub>9</sub>-A<sub>13</sub> to Y<sub>9</sub>-Y<sub>13</sub>**



**FIGURE 5.  $t_{SLEW}$  LH Test Load and Waveforms**  
**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>**

AC Loading and Waveforms (Continued)



$t_r$  = Output Rise Time, Open Drain

$t_f$  = Output Fall Time, Open Drain

FIGURE 6.  $t_{RISE}$  and  $t_{FALL}$  Test Load and Waveforms for Open Drain Outputs  $A_1$ - $A_8$  to  $B_1$ - $B_8$ ,  $A_9$ - $A_{13}$  to  $Y_9$ - $Y_{13}$

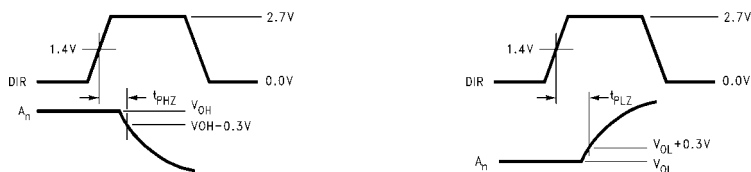
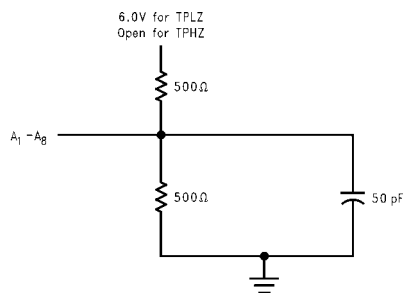


FIGURE 7.  $t_{PHZ}$  and  $t_{PLZ}$  Test Load and Waveforms, DIR to  $A_1$ - $A_8$

AC Loading and Waveforms (Continued)

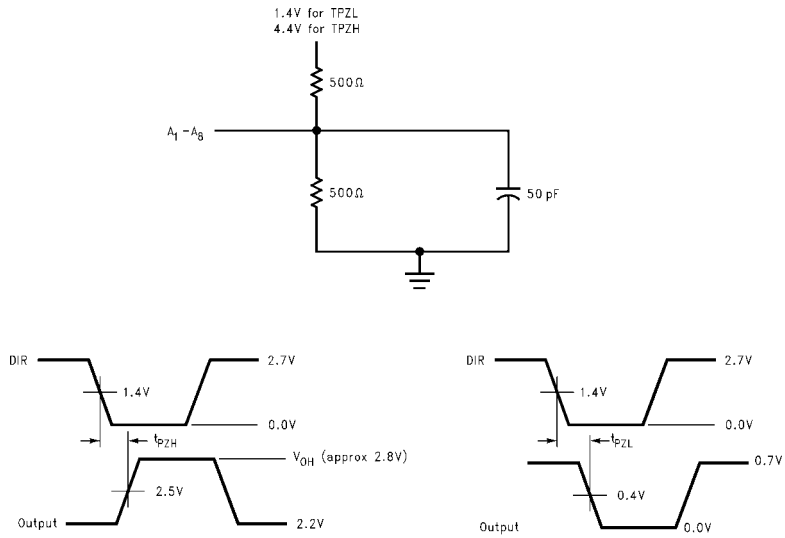


FIGURE 8. t<sub>pZH</sub> and t<sub>pZL</sub> Test Load and Waveforms, DIR to A<sub>1</sub>-A<sub>8</sub>

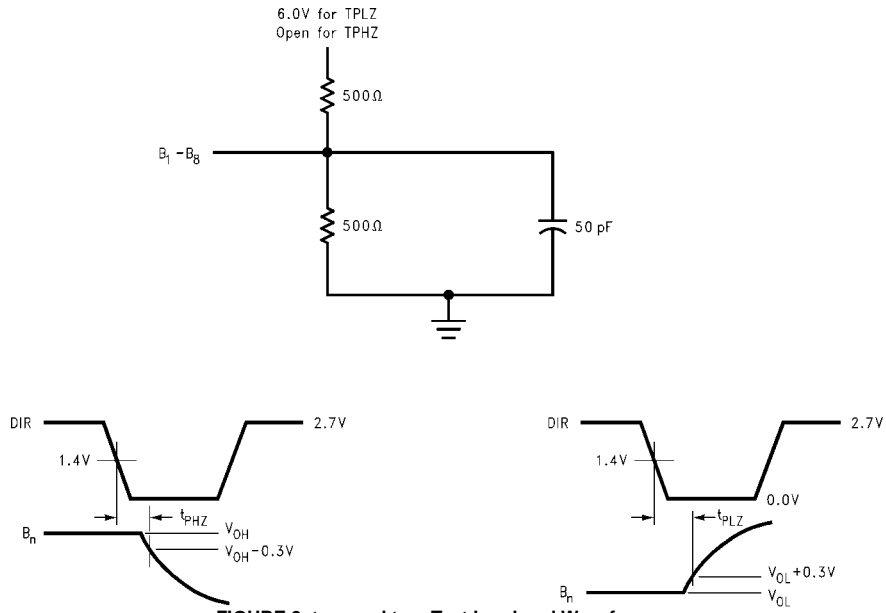
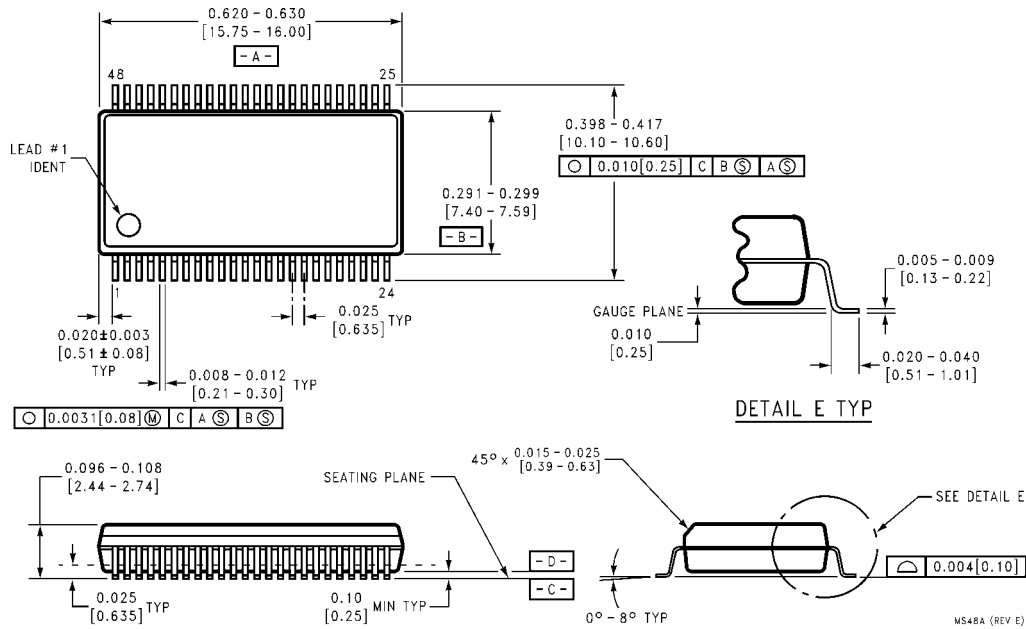
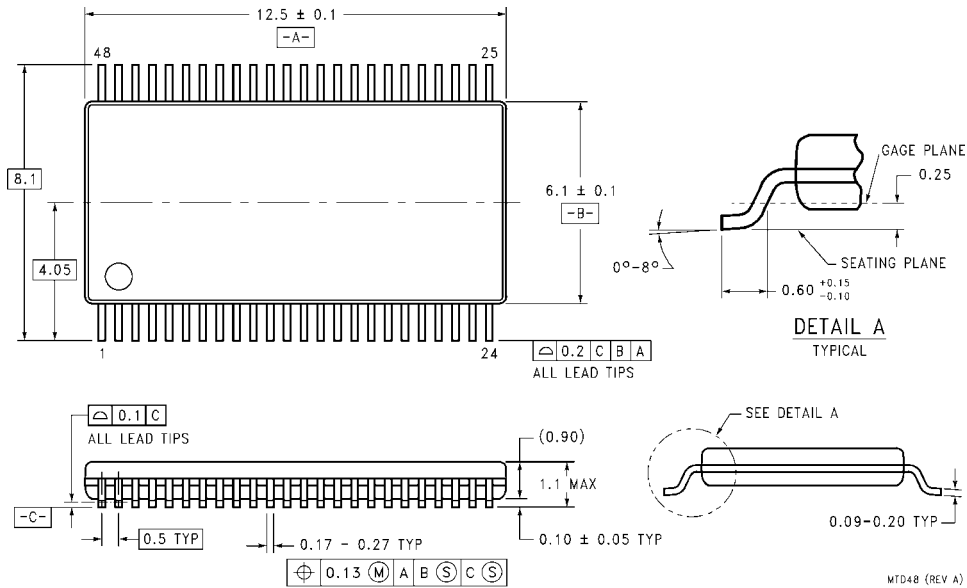


FIGURE 9. t<sub>pHZ</sub> and t<sub>pLZ</sub> Test Load and Waveforms DIR to B<sub>1</sub>-B<sub>8</sub>

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



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



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

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