FAIRCHILD SEMICONDUCTOR™

June 1999
Revised June 1999

74LVX161284A
Low Voltage IEEE 161284 Translating Transceiver

General Description

The LVX161284A 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, with the exception of output slew rate, 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 (± 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

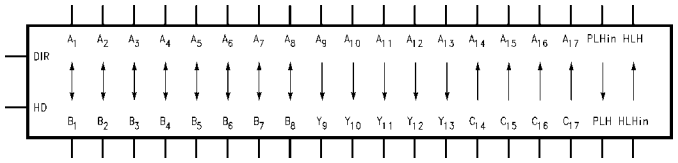
- Supports IEEE 1284 Level 1 and Level 2 signaling standards for bidirectional parallel communications between personal computers and printing peripherals with the exception of output slew rate
- Translation capability allows outputs on the cable side to interface with 5V signals
- All inputs have hysteresis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

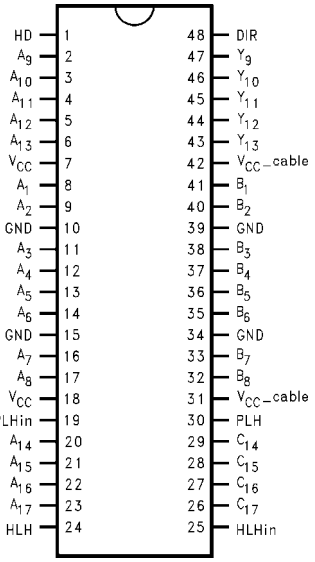
Order Number	Package Number	Package Description
74LVX161284AMTD	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

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_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_{IN}	Peripheral Logic High Input
PLH	Peripheral Logic High Output
HLH_{IN}	Host Logic High Input
HLH	Host Logic High Output

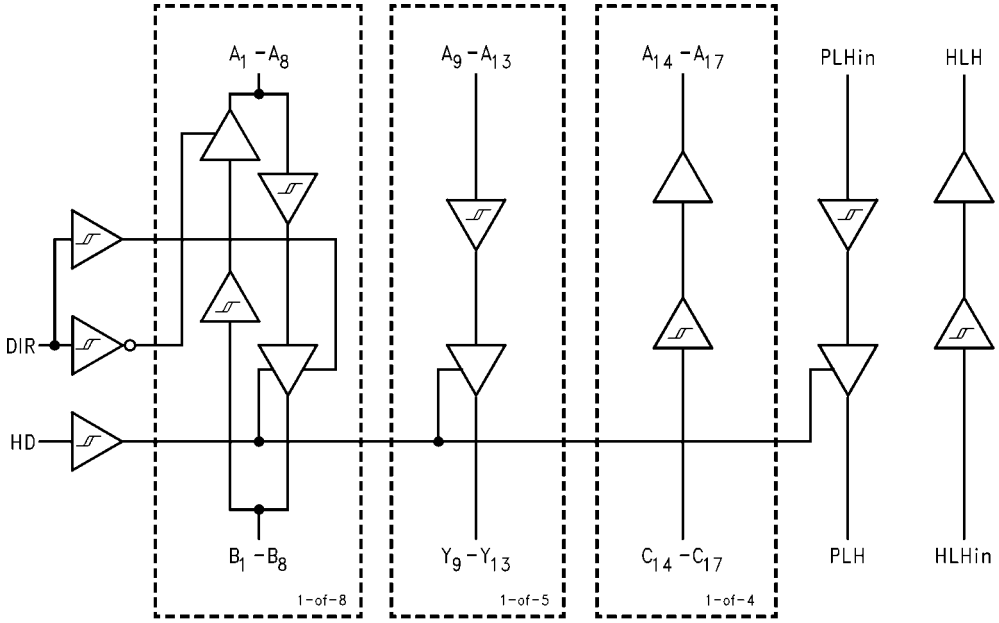
Truth Table

Inputs		Outputs
DIR	HD	
L	L	B_1–B_8 Data to A_1–A_8, and
		A_9–A_{13} Data to Y_9–Y_{13} (Note 1)
		C_{14}–C_{17} Data to A_{14}–A_{17}
		PLH Open Drain Mode
L	H	B_1–B_8 Data to A_1–A_8, and
		A_9–A_{13} Data to Y_9–Y_{13}
		C_{14}–C_{17} Data to A_{14}–A_{17}
H	L	A_1–A_8 Data to B_1–B_8 (Note 2)
		A_9–A_{13} Data to Y_9–Y_{13} (Note 1)
		C_{14}–C_{17} Data to A_{14}–A_{17}
		PLH Open Drain Mode
H	H	A_1–A_8 Data to B_1–B_8
		A_9–A_{13} Data to Y_9–Y_{13}
		C_{14}–C_{17} Data to A_{14}–A_{17}

Note 1: Y_9–Y_{13} Open Drain Outputs

Note 2: B_1–B_8 Open Drain Outputs

Logic Diagram



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 ≥ 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 ±25 mA
- B_1–B_8, Y_9–Y_{13} ±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 ±50 mA
- B_1–B_8, Y_9–Y_{13}, 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 continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum rated conditions is not implied.

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 = −40°C to +85°C Guaranteed Limits	Units	Conditions
V_{IK}	Input Clamp Diode Voltage		3.0	3.0	−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	V	
		C_n	3.0–3.6	3.0–5.5	2.3		
		HLH_{IN}	3.0–3.6	3.0–5.5	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	V	
		C_n	3.0–3.6	3.0–5.5	0.8		
		HLH_{IN}	3.0–3.6	3.0–5.5	1.6		
ΔV_T	Minimum Input Hysteresis	A_n, B_n, PLH_{IN}, DIR, HD	3.3	5.0	0.4	V	V_T^+–V_T^-
		C_n	3.3	5.0	0.8		V_T^+–V_T^-
		HLH_{IN}	3.3	5.0	0.2		V_T^+–V_T^-
V_{OH}	Minimum High Level Output Voltage	A_n, HLH	3.0	3.0	2.8	V	I_{OH} = −50 µA
			3.0	3.0	2.4		I_{OH} = −4 mA
		B_n, Y_n	3.0	3.0	2.0		I_{OH} = −14 mA
		B_n, Y_n	3.0	4.5	2.23		I_{OH} = −14 mA
		PLH	3.15	3.15	3.1		I_{OH} = −500 µA
V_{OL}	Maximum Low Level Output Voltage	A_n, HLH	3.0	3.0	0.2	V	I_{OL} = 50 µA
			3.0	3.0	0.4		I_{OL} = 4 mA
		B_n, Y_n	3.0	3.0	0.8		I_{OL} = 14 mA
		B_n, Y_n	3.0	4.5	0.77		I_{OL} = 14 mA
		PLH	3.0	3.0	0.95		I_{OL} = 84 mA
		PLH	3.0	4.5	0.9		I_{OL} = 84 mA
R_D	Maximum Output Impedance	B_1–B_8, Y_9–Y_{13}	3.3	3.3	60	Ω	(Note 5) (Note 7)
			3.3	5.0	55		
	Minimum Output Impedance	B_1–B_8, Y_9–Y_{13}	3.3	3.3	30		(Note 5) (Note 7)
			3.3	5.0	35		

DC Electrical Characteristics (Continued)

Symbol	Parameter		V_{CC} (V)	$V_{CC—Cable}$ (V)	$T_A = -40°C$ to $+85°C$ Guaranteed Limits	Units	Conditions
R_P	Maximum Pull-Up Resistance	$B_1–B_8$, $Y_9–Y_{13}$,	3.3	3.3	1650	Ω	
		$C_{14}–C_{17}$	3.3	5.0	1650		
	Minimum Pull-Up Resistance	$B_1–B_8$, $Y_9–Y_{13}$	3.3	3.3	1150		
		$C_{14}–C_{17}$	3.3	5.0	1150		
I_{IH}	Maximum Input Current in High State	$A_9–A_{13}$, PLH_{IN}, HD, DIR, HLH_{IN}	3.6	3.6	1.0	µA	$V_I = 3.6V$
		$C_{14}–C_{17}$	3.6	3.6	50.0		$V_I = 3.6V$
		$C_{14}–C_{17}$	3.6	5.5	100		$V_I = 5.5V$
I_{IL}	Maximum Input Current in Low State	$A_9–A_{13}$, PLH_{IN}, HD, DIR, HLH_{IN}	3.6	3.6	−1.0	µA	$V_I = 0.0V$
		$C_{14}–C_{17}$	3.6	3.6	−3.5	mA	$V_I = 0.0V$
		$C_{14}–C_{17}$	3.6	5.5	−5.0	mA	$V_I = 0.0V$
I_{OZH}	Maximum Output Disable Current (High)	$A_1–A_8$	3.6	3.6	20	µA	$V_O = 3.6V$
		$B_1–B_8$	3.6	3.6	50	µA	$V_O = 3.6V$
		$B_1–B_8$	3.6	5.5	100	µA	$V_O = 5.5V$
I_{OZL}	Maximum Output Disable Current (Low)	$A_1–A_8$	3.6	3.6	−20	µA	$V_O = 0.0V$
		$B_1–B_8$	3.6	3.6	−3.5	mA	
		$B_1–B_8$	3.6	5.5	−5.0	mA	
I_{OFF}	Power Down Output Leakage	$B_1–B_8$, $Y_9–Y_{13}$, PLH	0.0	0.0	100	µA	$V_O = 5.5V$
I_{OFF}	Power Down Input Leakage	$C_{14}–C_{17}$, HLH_{IN}	0.0	0.0	100	µA	$V_I = 5.5V$
$I_{OFF—ICC}$	PowerDown Leakage to V_{CC}		0.0	0.0	250	µA	(Note 6)
$I_{OFF—ICC2}$	Power Down Leakage to $V_{CC—Cable}$		0.0	0.0	250	µA	(Note 6)
I_{CC}	Maximum Supply Current		3.6	3.6	45	mA	$V_I = V_{CC}$ or GND
			3.6	5.5	70		$V_I = V_{CC}$ 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_{CC} or $V_{CC—Cable}$ is tested by simultaneously forcing all pins on the cable-side ($B_1–B_8$, $Y_9–Y_{13}$, PLH, $C_{14}–C_{17}$ and HLH_{IN}) to 5.5V and measuring the resulting I_{CC} or $I_{CC—Cable}$.

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

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40°C$ to $+85°C$ $V_{CC} = 3.0V–3.6V$ $V_{CC—Cable} = 4.5V–5.5V$		Units	Fig. No.
		Min	Max		
t_{PHL}	$A_1–A_8$ to $B_1–B_8$	1.0	8.5	ns	1
t_{PLH}	$A_1–A_8$ to $B_1–B_8$	1.0	8.5	ns	2
t_{PHL}	$B_1–B_8$ to $A_1–A_8$	1.0	14.0	ns	3
t_{PLH}	$B_1–B_8$ to $A_1–A_8$	1.0	14.0	ns	3
t_{PHL}	$A_9–A_{13}$ to $Y_9–Y_{13}$	1.0	8.5	ns	1
t_{PLH}	$A_9–A_{13}$ to $Y_9–Y_{13}$	1.0	8.5	ns	2
t_{PHL}	$C_{14}–C_{17}$ to $A_{14}–A_{17}$	1.0	10.0	ns	3
t_{PLH}	$C_{14}–C_{17}$ to $A_{14}–A_{17}$	1.0	10.0	ns	3
t_{SKEW}	LH-LH or HL-HL		2.0	ns	(Note 9)
t_{PHL}	PLH_{IN} to PLH	1.0	8.5	ns	1
t_{PLH}	PLH_{IN} to PLH	1.0	8.5	ns	2
t_{PHL}	HLH_{IN} to HLH	1.0	10.0	ns	3
t_{PLH}	HLH_{IN} to HLH	1.0	12.0	ns	3
t_{PHZ}	Output Disable Time	1.0	10.0	ns	7
t_{PLZ}	DIR to $A_1–A_8$	1.0	10.0		
t_{PZH}	Output Enable Time	1.0	10.0	ns	8
t_{PZL}	DIR to $A_1–A_8$	1.0	10.0		
t_{PHZ}	Output Disable Time	1.0	13.0	ns	9
t_{PLZ}	DIR to $B_1–B_8$	1.0	10.0		
t_{pEN}	Output Enable Time HD to $B_1–B_8$, $Y_9–Y_{13}$	1.0	8.0	ns	2
t_{pDIS}	Output Disable Time HD to $B_1–B_8$, $Y_9–Y_{13}$	1.0	12.0	ns	2

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) $A_1–A_8$ to $B_1–B_8$, $A_9–A_{13}$ to $Y_9–Y_{13}$

(ii) $B_1–B_8$ to $A_1–A_8$

(iii) $C_{14}–C_{17}$ to $A_{14}–A_{17}$

Note 10: Pulse Generator for all pulses; Rate ≤1.0 MHz; $Z_O \leq 50\Omega$; $t_f \leq 2.5$ ns, $t_r \leq 2.5$ ns.

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	3	pF	V_{CC} = 0.0V (HD, DIR, $A_9–A_{13}$, $C_{14}–C_{17}$, PLH_{IN} and HLH_{IN})
$C_{I/O}$ (Note 11)	I/O Pin Capacitance	5	pF	V_{CC} = 3.3V

Note 11: $C_{I/O}$ is measured at frequency = 1 MHz, per MIL-STD-883B, Method 3012

AC Loading and Waveforms

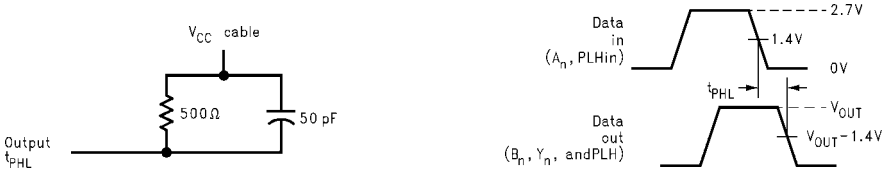


FIGURE 1. t_{PHL} Test Load and Waveforms
A_1–A_8 to B_1–B_8
A_9–A_{13} to Y_9–Y_{13}
PLHin to PLH

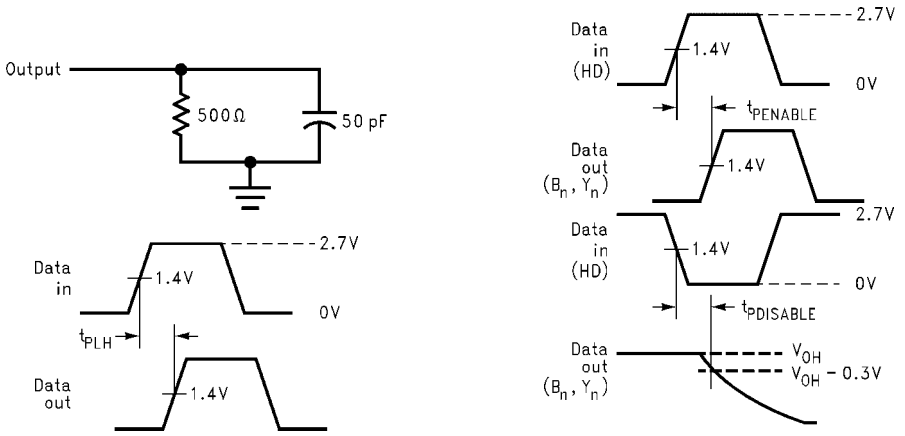


FIGURE 2. t_{PLH}, t_{pEn}, t_{pDis} Test Load and Waveforms
A_1–A_8 to B_1–B_8, A_9–A_{13} to Y_9–Y_{13}
PLHin to PLH, HD to B_1–B_8, Y_9–Y_{13}, PLH

V_{MO} = 50% V_{CC}

FIGURE 3. t_{PHL}, t_{PLH} Test Load and Waveforms
B_1–B_8 to A_1–A_8, C_{14}–C_{17} to A_{14}–A_{17}, HLHin to HLH

AC Loading and Waveforms (Continued)

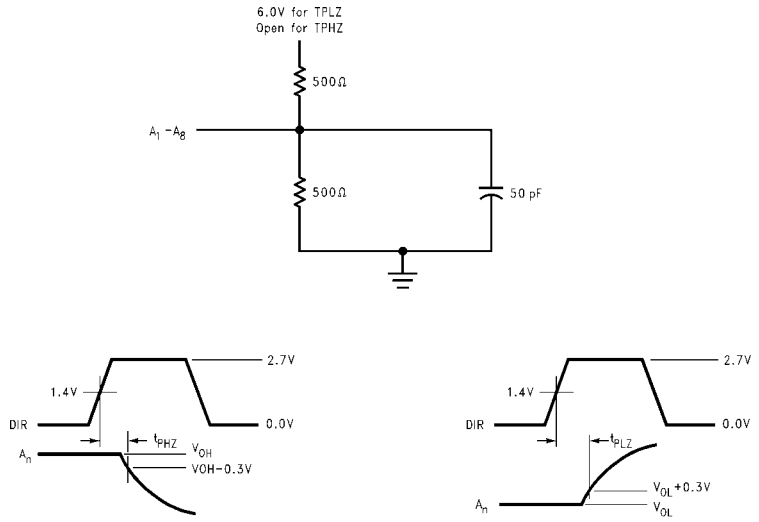


FIGURE 4. t_{PHZ} and t_{PLZ} Test Load and Waveforms, DIR to A_1–A_8

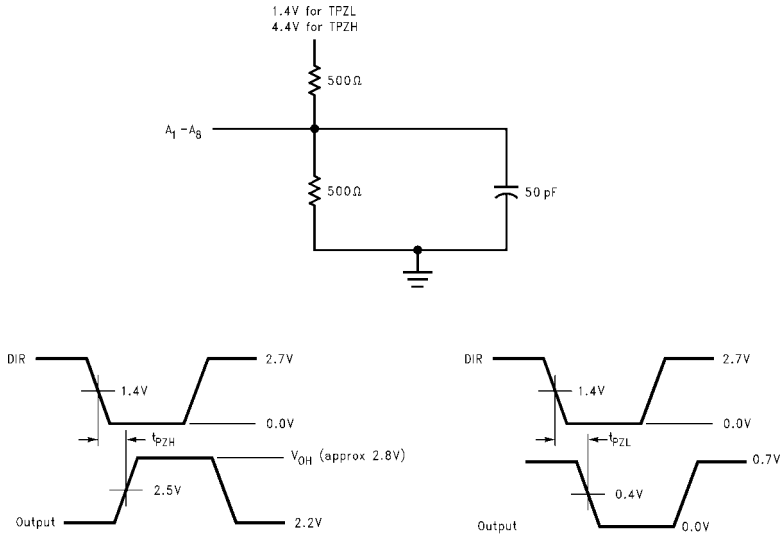


FIGURE 5. t_{PZH} and t_{PZL} Test Load and Waveforms, DIR to A_1–A_8

AC Loading and Waveforms (Continued)

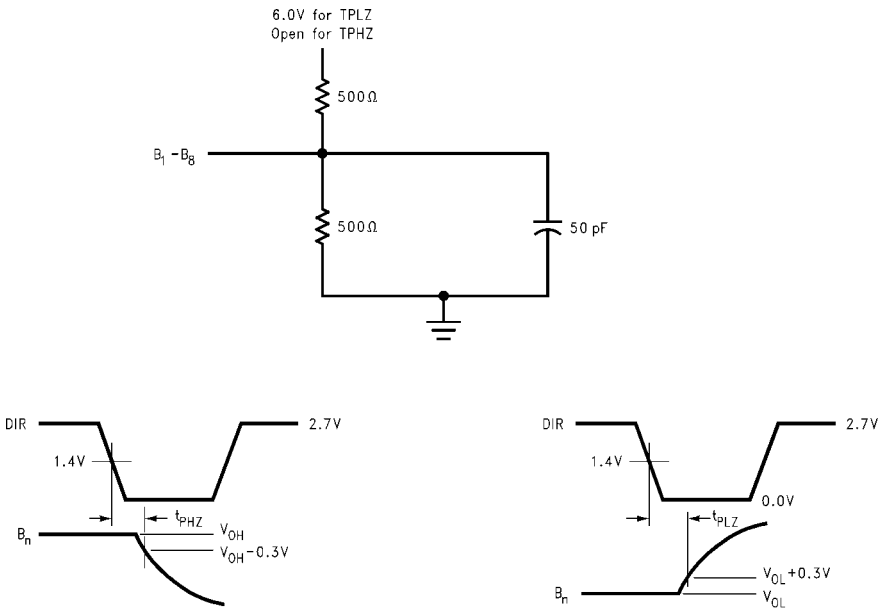
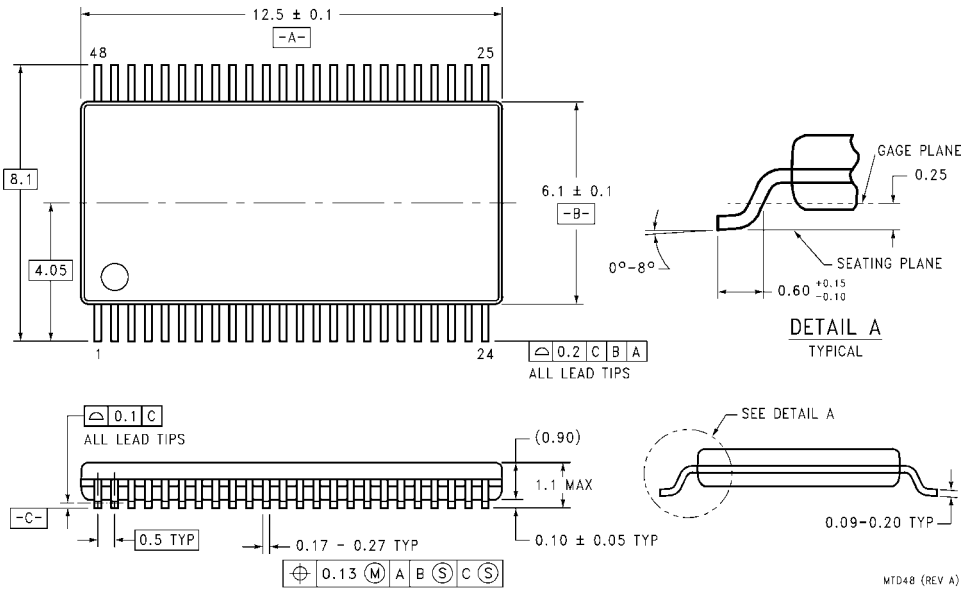


FIGURE 6. t_{PHZ} and t_{PLZ} Test Load and Waveforms
DIR to B_1–B_8

Physical Dimensions inches (millimeters) unless otherwise noted



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