

## FEATURES

- **Power-On Reset (POR) Prevents Printer Errors When Printer Is Turned On, But No Valid Signal Is at Pins A9–A13**
- **Operates From 3 V to 3.6 V**
- **1.4-kΩ Pullup Resistors Integrated on All Open-Drain Outputs Eliminate the Need for Discrete Resistors**
- **Designed for IEEE Std 1284-I (Level-1 Type) and IEEE Std 1284-II (Level-2 Type) Electrical Specifications**
- **Flow-Through Architecture Optimizes PCB Layout**
- **I<sub>off</sub> and Power-Up 3-State Support Hot Insertion**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - 4000-V Human-Body Model (A114-A)
  - 350-V Machine Model (A115-A)
  - 1500-V Charged-Device Model (C101)

## DESCRIPTION/ORDERING INFORMATION

The SN74LVCZ161284A is designed for 3-V to 3.6-V V<sub>CC</sub> operation. This device provides asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

This device has eight bidirectional bits; data can flow in the A-to-B direction when the direction-control (DIR) input is high and in the B-to-A direction when DIR is low. This device also has five drivers that drive the cable side and four receivers. The SN74LVCZ161284A has one receiver dedicated to the HOST LOGIC line and a driver to drive the PERI LOGIC line.

The output drive mode is determined by the high-drive (HD) control pin. When HD is high, the outputs are in a totem-pole configuration and in an open-drain configuration when HD is low. This meets the drive requirements as specified in the IEEE Std 1284-I (level-1 type) and IEEE Std 1284-II (level-2 type) parallel peripheral-interface specifications. Except for HOST LOGIC IN and peripheral logic out (PERI LOGIC OUT), all cable-side pins have a 1.4-kΩ integrated pullup resistor. The pullup resistor is switched off if the associated output driver is in the low state or if the output voltage is above V<sub>CC</sub> CABLE. If V<sub>CC</sub> CABLE is off, PERI LOGIC OUT is set to low.

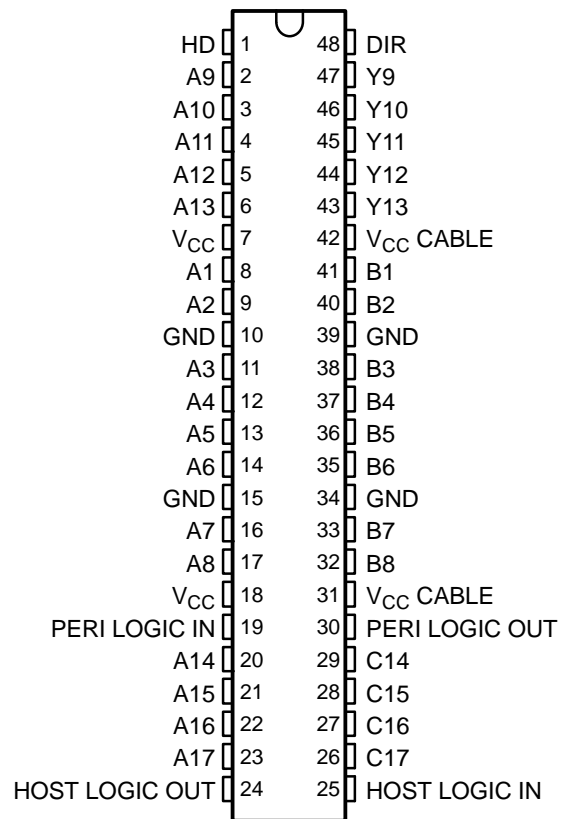
The device has two supply voltages. V<sub>CC</sub> is designed for 3-V to 3.6-V operation. V<sub>CC</sub> CABLE supplies the inputs and output buffers of the cable side only and is designed for 3-V to 3.6-V and for 4.7-V to 5.5-V operation. Even when V<sub>CC</sub> CABLE is 3 V to 3.6 V, the cable-side I/O pins are 5-V tolerant.

## ORDERING INFORMATION

T <sub>A</sub>	PACKAGE <sup>(1)</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	TSSOP – DGG Tape and reel	SN74LVCZ161284AGR	LVCZ161284A

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

**DGG PACKAGE**  
**(TOP VIEW)**



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**SN74LVCZ161284A**  
**19-BIT IEEE STD 1284 TRANSLATION TRANSCEIVER**  
**WITH ERROR-FREE POWER UP**



SCES358B–SEPTEMBER 2001–REVISED MAY 2005

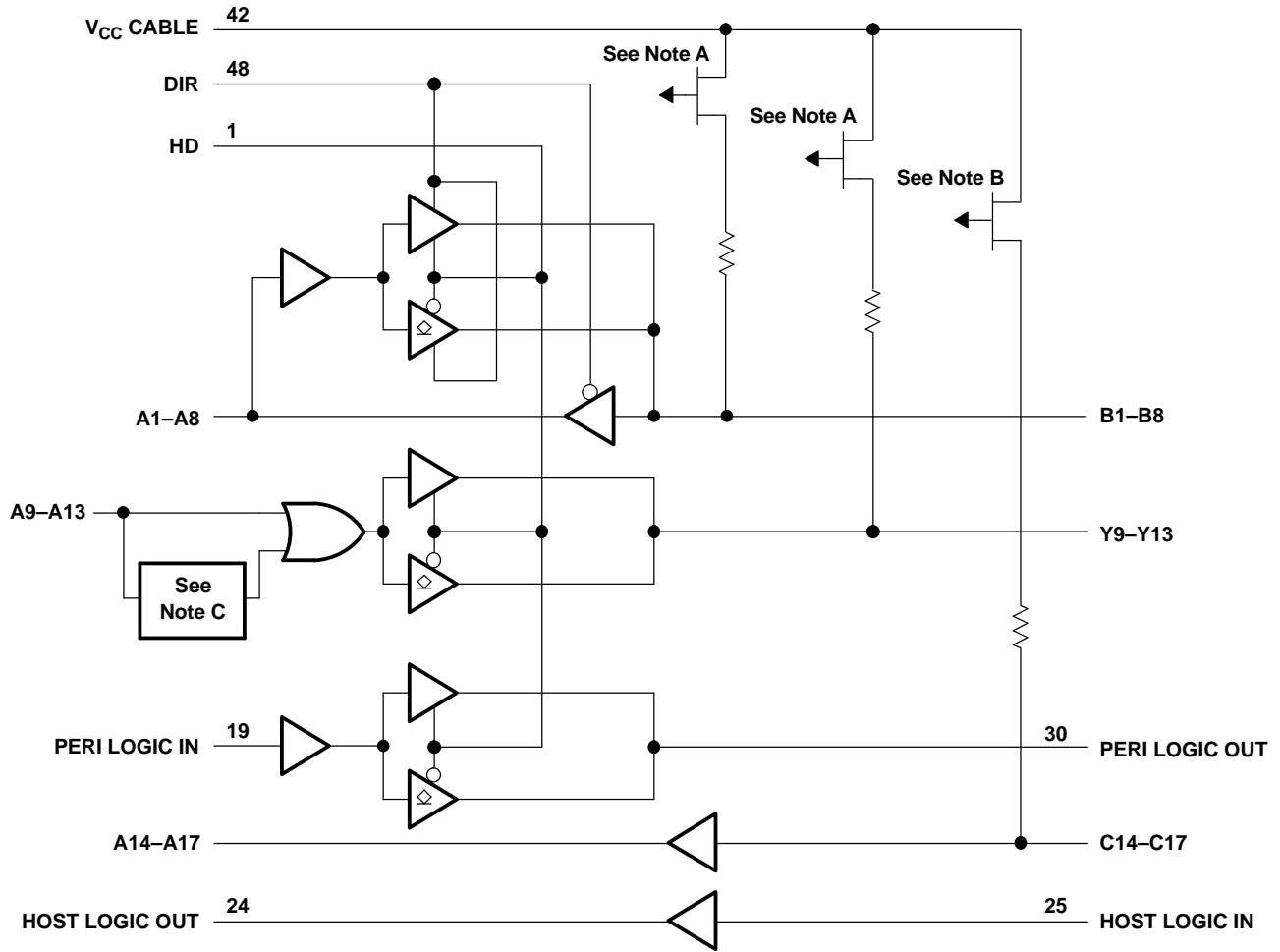
**DESCRIPTION/ORDERING INFORMATION (CONTINUED)**

The power-on reset (POR) ensures that the Y outputs (Y9–Y13) stay in the high state after power on until an associated input (A9–A13) goes high. When an associated input goes high, all Y outputs are activated, and noninverting signals of the associated inputs are driven through Y outputs. This special feature prevents printer system errors caused by deasserting the BUSY signal in the cable at power on.

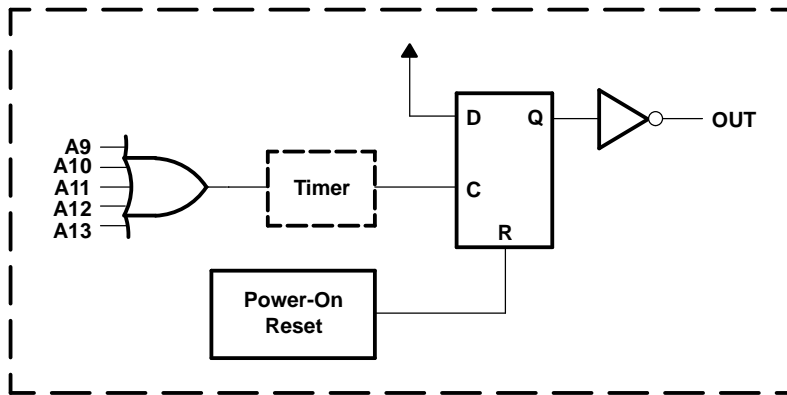
**FUNCTION TABLE**

INPUTS		OUTPUT	MODE
DIR	HD		
L	L	Open drain	A9–A13 to Y9–Y13 and PERI LOGIC IN to PERI LOGIC OUT
		Totem pole	B1–B8 to A1–A8 and C14–C17 to A14–A17
L	H	Totem pole	B1–B8 to A1–A8, A9–A13 to Y9–Y13, PERI LOGIC IN to PERI LOGIC OUT, and C14–C17 to A14–A17
H	L	Open drain	A1–A8 to B1–B8, A9–A13 to Y9–Y13, and PERI LOGIC IN to PERI LOGIC OUT
		Totem pole	C14–C17 to A14–A17
H	H	Totem pole	A1–A8 to B1–B8, A9–A13 to Y9–Y13, C14–C17 to A14–A17, and PERI LOGIC IN to PERI LOGIC OUT

**LOGIC DIAGRAM**



- NOTES: A. The PMOS transistors prevent backdriving current from the signal pins to  $V_{CC}$  CABLE when  $V_{CC}$  CABLE is open or at GND. The PMOS transistor is turned off when the associated driver is in the low state.
- B. The PMOS transistor prevents backdriving current from the signal pins to  $V_{CC}$  CABLE when  $V_{CC}$  CABLE is open or at GND.
- C. Active input detection circuit forces Y9–Y13 to the high state after power on, until one of the A9–A13 pins goes high (see below).



**Active Input Detection Circuit**

# SN74LVCZ161284A

## 19-BIT IEEE STD 1284 TRANSLATION TRANSCEIVER WITH ERROR-FREE POWER UP

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### Absolute Maximum Ratings<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT	
V <sub>CC CABLE</sub>	Supply voltage range	–0.5	7	V	
V <sub>CC</sub>	Supply voltage range	–0.5	4.6	V	
V <sub>I</sub> V <sub>O</sub>	Input and output voltage range	Cable side <sup>(2)(3)</sup>	–2	7	V
		Peripheral side <sup>(2)</sup>	–0.5	V <sub>CC</sub> + 0.5	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0	–20	mA	
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0	–50	mA	
I <sub>O</sub>	Continuous output current	Except PERI LOGIC OUT	±50	mA	
		PERI LOGIC OUT	±100		
Continuous current through each V <sub>CC</sub> or GND			±200	mA	
I <sub>SK</sub>	Output high sink current	V <sub>O</sub> = 5.5 V and V <sub>CC CABLE</sub> = 3 V	65	mA	
θ <sub>JA</sub>	Package thermal impedance <sup>(4)</sup>		70	°C/W	
T <sub>stg</sub>	Storage temperature range		–65	150	°C

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The ac input voltage pulse duration is limited to 40 ns if the amplitude is greater than –0.5 V.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

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

		MIN	MAX	UNIT	
V <sub>CC CABLE</sub>	Supply voltage for the cable side, V <sub>CC CABLE</sub> ≥ V <sub>CC</sub>	3	5.5	V	
V <sub>CC</sub>	Supply voltage	3	3.6	V	
V <sub>IH</sub>	High-level input voltage	A, B, DIR, and HD	2	V	
		C14–C17	2.3		
		HOST LOGIC IN	2.6		
		PERI LOGIC IN	2		
V <sub>IL</sub>	Low-level input voltage	A, B, DIR, and HD	0.8	V	
		C14–C17	0.8		
		HOST LOGIC IN	1.6		
		PERI LOGIC IN	0.8		
V <sub>I</sub>	Input voltage	Peripheral side	0	V <sub>CC</sub>	V
		Cable side	0	5.5	
V <sub>O</sub>	Open-drain output voltage	HD low	0	5.5	V
I <sub>OH</sub>	High-level output current	HD high, B and Y outputs	–14	mA	
		A outputs and HOST LOGIC OUT	–4		
		PERI LOGIC OUT	–0.5		
I <sub>OL</sub>	Low-level output current	B and Y outputs	14	mA	
		A outputs and HOST LOGIC OUT	4		
		PERI LOGIC OUT	84		
T <sub>A</sub>	Operating free-air temperature	0	70	°C	

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

**Electrical Characteristics**

 over recommended operating free-air temperature range,  $V_{CC}$  CABLE = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	$V_{CC}$	MIN	TYP <sup>(1)</sup>	MAX	UNIT
$\Delta V_t$ Hysteresis ( $V_{T+} - V_{T-}$ )	All inputs except C inputs and HOST LOGIC IN		3.3 V	0.4		V	
	HOST LOGIC IN			0.2			
	C inputs			0.8			
$V_{OH}$	HD high, B and Y outputs	$I_{OH} = -14$ mA	3 V	2.23		V	
			3.3 V <sup>(2)</sup>	2.4			
	HD high, A outputs, and HOST LOGIC OUT	$I_{OH} = -4$ mA	3 V	2.4			
		$I_{OH} = -50$ $\mu$ A		2.8			
PERI LOGIC OUT	$I_{OH} = -0.5$ mA	3.15 V	3.1				
		3.3 V <sup>(2)</sup>	4.5				
$V_{OL}$	B and Y outputs	$I_{OL} = 14$ mA	3 V	0.77		V	
		$I_{OL} = 50$ $\mu$ A		0.2			
	A outputs and HOST LOGIC OUT	$I_{OL} = 4$ mA		0.4			
		$I_{OL} = 84$ mA		0.9			
$I_i$	C inputs	$V_i = V_{CC}$	3.6 V <sup>(3)</sup>	50		$\mu$ A	
		$V_i = GND$ (pullup resistors)		-3.5		mA	
	All inputs except B or C inputs	$V_i = V_{CC}$ or GND	3.6 V	$\pm 1$		$\mu$ A	
$I_{OZ}$	A1–A8	$V_O = V_{CC}$ or GND	3.6 V	$\pm 20$		$\mu$ A	
	B outputs	$V_O = V_{CC}$ CABLE	3.6 V	50		$\mu$ A	
		$V_O = GND$ (pullup resistors)	3.6 V <sup>(3)</sup>	-3.5		mA	
	Open-drain Y outputs	$V_O = GND$ (pullup resistors)	3.6 V <sup>(3)</sup>	-3.5		mA	
$I_{OZPU}$	B and Y outputs	$V_O = 5.5$ V	0 to 1.5 V <sup>(4)</sup>	350		$\mu$ A	
		$V_O = GND$		-5		mA	
$I_{OZPD}$	B and Y outputs	$V_O = 5.5$ V	0 to 1.5 V <sup>(4)</sup>	350		$\mu$ A	
		$V_O = GND$		-5		mA	
$I_{off}$	Power-down input leakage, except A1–A8 or B1–B8 inputs	$V_i$ or $V_O = 0$ to 3.6 V	0 <sup>(3)</sup>	100		$\mu$ A	
	Power-down output leakage, B1–B8 and Y9–Y13 outputs	$V_i$ or $V_O = 0$ to 5.5 V		100			
$I_{CC}$		$V_i = GND$ (12 x pullup)	3.6 V <sup>(5)</sup>	45		mA	
			3.6 V	70			
		$V_i = V_{CC}$ , $I_O = 0$	3.6 V	0.8			
$C_i$	All inputs	$V_i = V_{CC}$ or GND	3.3 V	3		pF	
$C_{io}$	I/O ports	$V_O = V_{CC}$ or GND	3.3 V	7		pF	
$Z_O$	Cable side	$I_{OH} = -35$ mA	3.3 V	45		$\Omega$	
R pullup	Cable side	$V_O = 0$ V (in high-impedance state)	3.3 V	1.15		1.65	k $\Omega$

 (1) Typical values are measured at  $V_{CC} = 3.3$  V,  $V_{CC}$  CABLE = 5 V, and  $T_A = 25^\circ\text{C}$ .

 (2)  $V_{CC}$  CABLE = 4.7 V

 (3)  $V_{CC}$  CABLE = 3.6 V

 (4) Connect the  $V_{CC}$  pin and the  $V_{CC}$  CABLE pin.

 (5)  $V_{CC}$  CABLE = 4.7 V

# SN74LVCZ161284A

## 19-BIT IEEE STD 1284 TRANSLATION TRANSCEIVER

### WITH ERROR-FREE POWER UP

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### Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 2 and Figure 3)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	MIN	TYP <sup>(1)</sup>	MAX	UNIT
$t_{PLH}$	Totem pole	A1–A8	B1–B8	1		22	ns
$t_{PHL}$				1	22		
$t_{PLH}$	Totem pole	A9–A13	Y9–Y13	1		20	ns
$t_{PHL}$				1	20		
$t_{PLH}$	Totem pole	B1–B8	A1–A8	1		10	ns
$t_{PHL}$				1	10		
$t_{PLH}$	Totem pole	C14–C17	A14–A17	1		11	ns
$t_{PHL}$				1	11		
$t_{PLH}$	Totem pole	PERI LOGIC IN	PERI LOGIC OUT	1		13	ns
$t_{PHL}$				1	13		
$t_{PLH}$	Totem pole	HOST LOGIC IN	HOST LOGIC OUT	1		13	ns
$t_{PHL}$				1	13		
$t_{slew}$	Totem pole	B1–B8 and Y9–Y13 outputs		0.05		0.4	V/ns
$t_{PZH}$		HD	B1–B8, Y9–Y13, and PERI LOGIC OUT	1		20	ns
$t_{PHZ}$				1	15		
$t_{en}-t_{dis}$		DIR	A1–A8	1		15	ns
$t_{PHZ}$		DIR	B1–B8	1		15	ns
$t_{PLZ}$				1	15		
$t_r, t_f$	Open drain	A1–A13	B1–B8 or Y9–Y13	1		120	ns
$t_{sk(o)}$ <sup>(2)</sup>		A1–A8 or B1–B8	B1–B8 or A1–A8		2.5	10	ns

(1) Typical values are measured at  $V_{CC} = 3.3$  V,  $V_{CC\ CABLE} = 5$  V, and  $T_A = 25^\circ\text{C}$ .

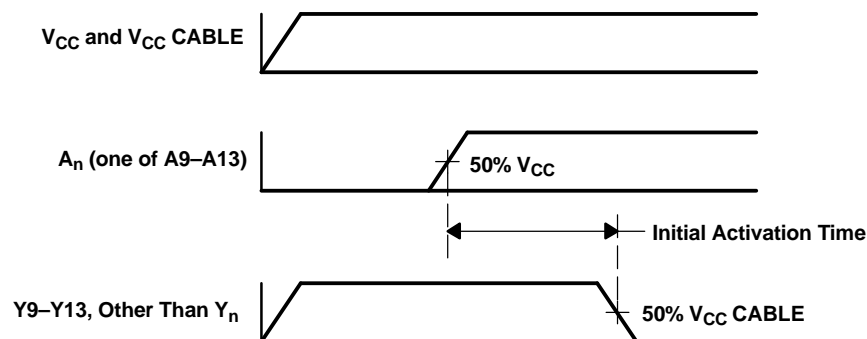
(2) Skew is measured at  $1/2 (V_{OH} + V_{OL})$  for signals switching in the same direction.

### Operating Characteristics

$V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
$C_{pd}$	Power dissipation capacitance	Outputs enabled $C_L = 0$ , $f = 10$ MHz	45	pF

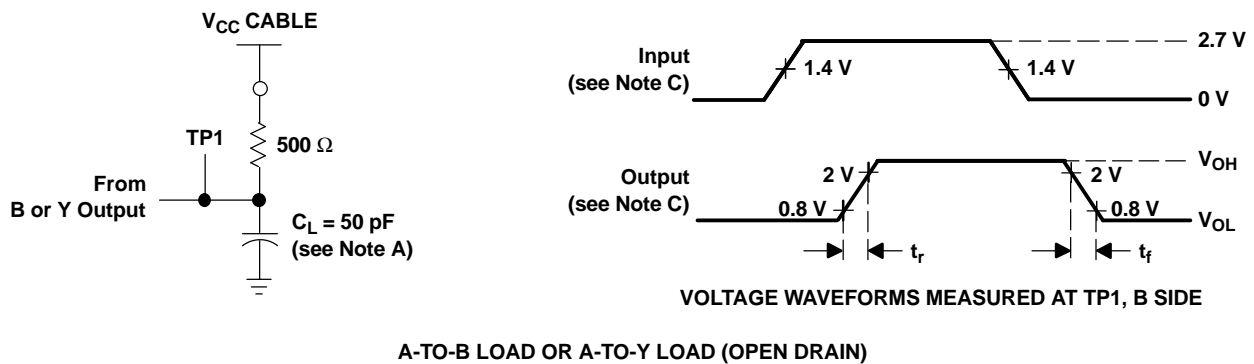
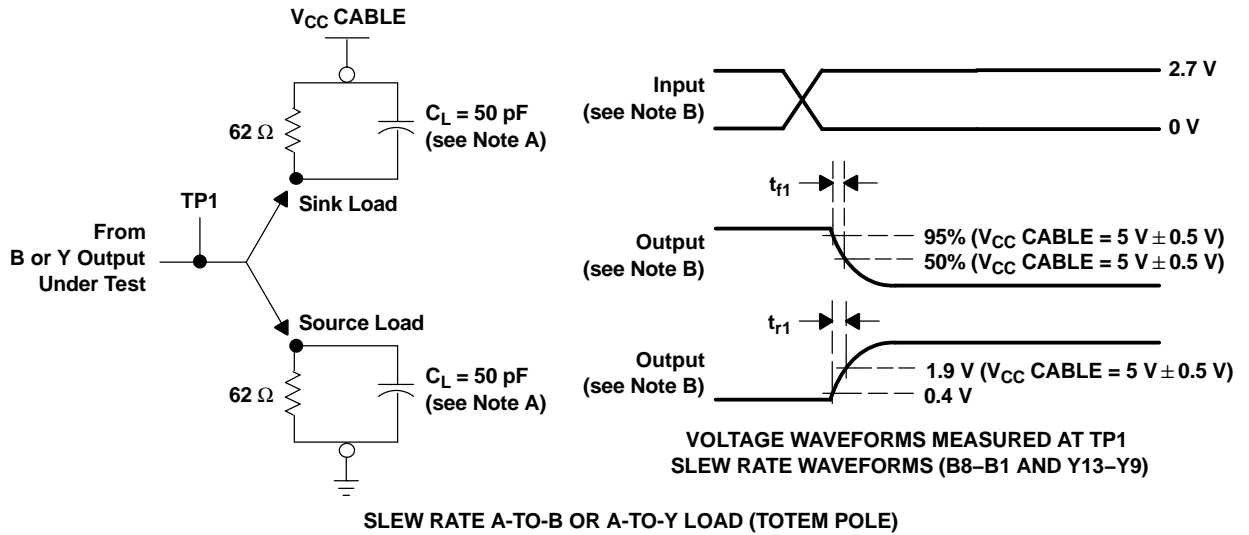
$V_{CC} = 3.3$  V  
 $V_{CC\ CABLE} = 5$  V  
 $T_A = 25^\circ\text{C}$   
TYP = 80 ns



One of pins A9–A13 is switched as shown above, and the other four inputs are forced at low state.

Figure 1. Error-Free Circuit Timing

PARAMETER MEASUREMENT INFORMATION



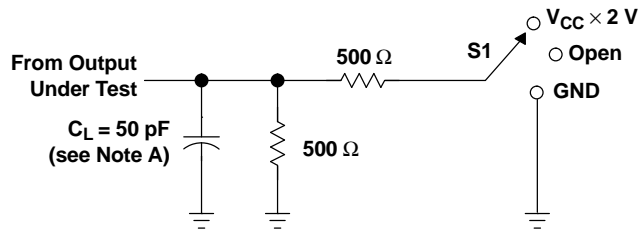
- NOTES: A. C<sub>L</sub> includes probe and jig capacitance.  
 B. When V<sub>CC</sub> CABLE is 3.3 V ± 0.3 V, slew rate is measured between 0.4 V and 0.9 V for the rising edge and between 2.4 V and 1.9 V for the falling edge. When V<sub>CC</sub> CABLE is 5 V ± 0.5 V, slew rate is measured between 0.4 V and 1.9 V for the rising edge and between 95% V<sub>CC</sub> CABLE and 50% V<sub>CC</sub> CABLE for the falling edge.

$$t_{\text{slew fall}} = V_{\text{CC}} \left( \frac{95\% - 50\%}{t_{f1}} \right) \quad t_{\text{slew rise}} = \left( \frac{1.9 \text{ V} - 0.4 \text{ V}}{t_{r1}} \right)$$

- C. Input rise (t<sub>r</sub>) and fall (t<sub>f</sub>) times are 3 ns. Rise and fall times (open drain) are <120 ns.  
 D. The outputs are measured one at a time, with one transition per measurement.  
 E. t<sub>PLZ</sub> and t<sub>PHZ</sub> are the same as t<sub>dis</sub>.  
 F. t<sub>PZL</sub> and t<sub>PZH</sub> are the same as t<sub>en</sub>.  
 G. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd</sub>.

Figure 2. Load Circuits and Voltage Waveforms

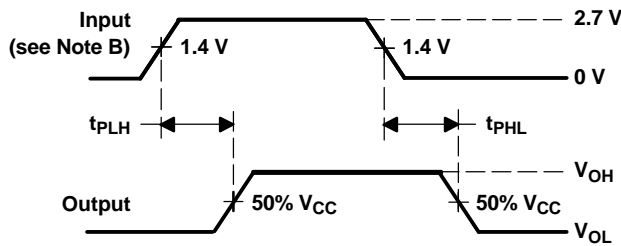
PARAMETER MEASUREMENT INFORMATION



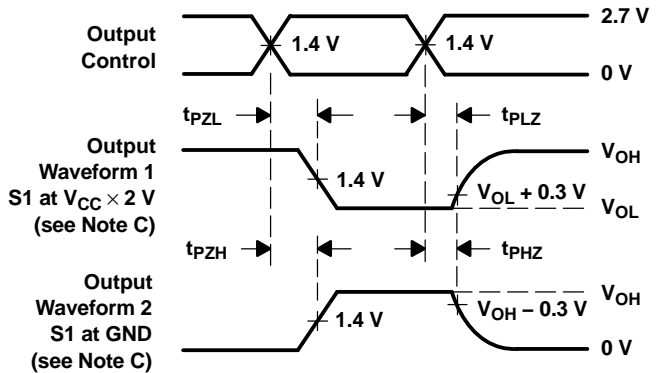
LOAD CIRCUIT

When Measuring the Cable Side,  $V_{CC} \text{ CABLE} \times 2 \text{ V}$

TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{CC} \times 2 \text{ V}$
$t_{PHZ}/t_{PZH}$	GND

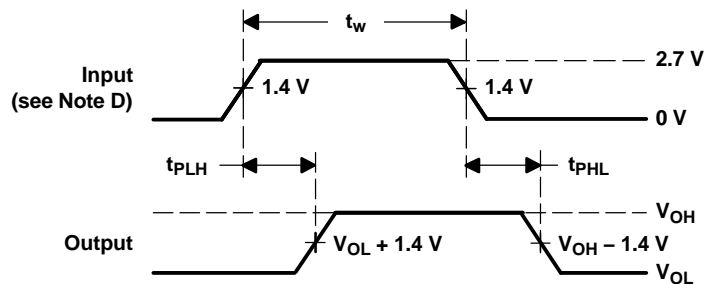
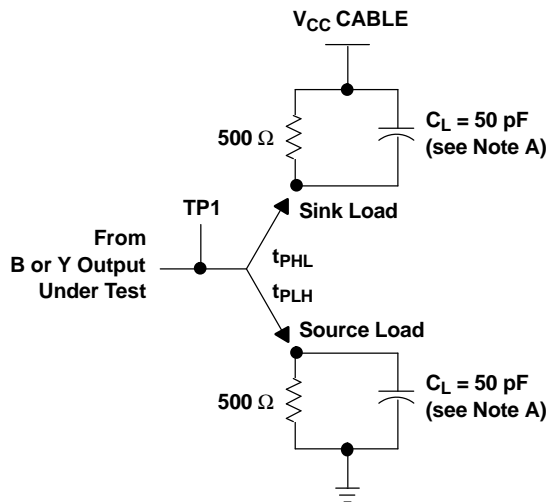


VOLTAGE WAVEFORMS  
 PROPAGATION DELAY TIMES (B to A)



VOLTAGE WAVEFORMS  
 ENABLE AND DISABLE TIMES

B-TO-A LOAD (TOTEM POLE)



VOLTAGE WAVEFORMS MEASURED AT TP1  
 PROPAGATION DELAY TIMES (A to B)

A-TO-B LOAD OR A-TO-Y LOAD (TOTEM POLE)

- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Input rise and fall times are 3 ns.
  - C. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - D. Input rise and fall times are 3 ns. Pulse duration is  $150 \text{ ns} < t_w < 10 \mu\text{s}$ .
  - E. The outputs are measured one at a time, with one transition per measurement.
  - F.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - G.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - H.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 3. Load Circuits and Voltage Waveforms



**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
74LVCZ161284AGRG4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVCZ161284AGR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBsolete:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVCZ161284AGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	15.8	1.8	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVCZ161284AGR	TSSOP	DGG	48	2000	346.0	346.0	41.0

DGG (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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