

SN65LBC174A, SN75LBC174A QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

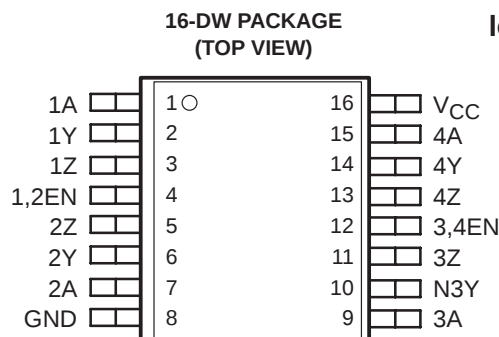
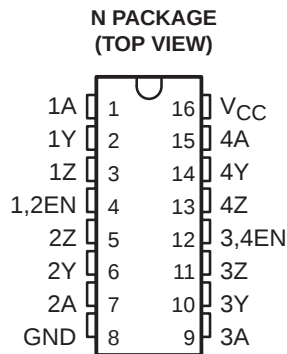
SLLS446C – OCTOBER 2000 – REVISED MAY 2003

- Designed for TIA/EIA-485, TIA/EIA-422 and ISO 8482 Applications
- Signaling Rates[†] up to 30 Mbps
- Propagation Delay Times < 11 ns
- Low Standby Power Consumption
1.5 mA Max
- Output ESD Protection Exceeds 13 kV
- Driver Positive- and Negative-Current Limiting
- Power-Up and Power-Down Glitch-Free for Line Insertion Applications
- Thermal Shutdown Protection
- Industry Standard Pin-Out, Compatible With SN75174, MC3487, DS96174, LTC487, and MAX3042

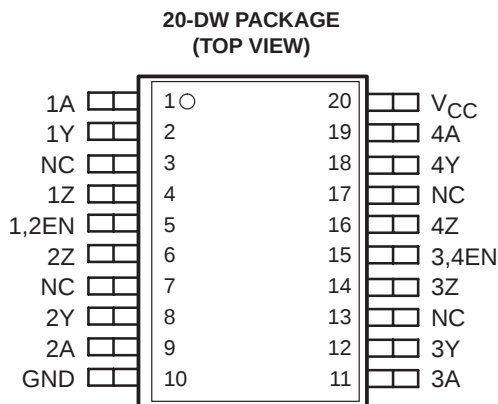
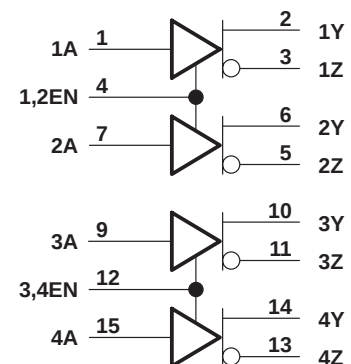
description

The SN65LBC174A and SN75LBC174A are quadruple differential line drivers with 3-state outputs, designed for TIA/EIA-485 (RS-485), TIA/EIA-422 (RS-422), and ISO 8482 applications.

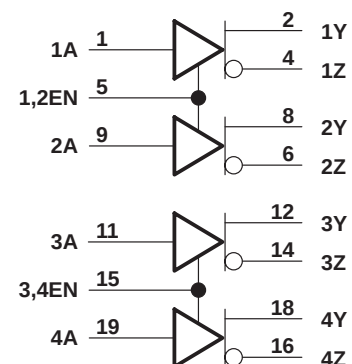
These devices are optimized for balanced multipoint bus transmission at signalling rates up to 30 million bits per second. The transmission media may be printed-circuit board traces, backplanes, or cables. The ultimate rate and distance of data transfer is dependent upon the attenuation characteristics of the media and the noise coupling to the environment.



logic diagram (positive logic)



logic diagram (positive logic)



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.

[†]The signaling rate of a line is the number of voltage transitions that are made per second expressed in the units bps (bits per second).

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2001 – 20003, Texas Instruments Incorporated

SN65LBC174A, SN75LBC174A

QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

description (continued)

Each driver features current limiting and thermal-shutdown circuitry making it suitable for high-speed multipoint applications in noisy environments. These devices are designed using LinBiCMOS™, facilitating low power consumption and robustness.

The two EN inputs provide pair-wise driver enabling, or can be externally tied together to provide enable control of all four drivers with one signal. When disabled or powered off, the driver outputs present a high-impedance to the bus for reduced system loading.

The SN75LBC174A is characterized for operation over the temperature range of 0°C to 70°C. The SN65LBC174A is characterized for operation over the temperature range of –40°C to 85°C.

AVAILABLE OPTIONS

T _A	PACKAGE		
	16-PIN PLASTIC SMALL OUTLINE† (JEDEC MS-013)	20-PIN PLASTIC SMALL OUTLINE† (JEDEC MS-013)	16-PIN PLASTIC THROUGH-HOLE (JEDEC MS-001)
0°C to 70°C	SN75LBC174A16DW	SN75LBC174ADW	SN75LBC174AN
	Marked as 75LBC174A		
–40°C to 85°C	SN65LBC174A16DW	SN65LBC174ADW	SN65LBC174AN
	Marked as 65LBC174A		

† Add R suffix for taped and reeled version.

FUNCTION TABLE (EACH DRIVER)

INPUT	ENABLE	OUTPUTS	
A	G	Y	Z
L	H	L	H
H	H	H	L
OPEN	H	H	L
L	OPEN	L	H
H	OPEN	H	L
OPEN	OPEN	H	L
X	L	Z	Z

H = high level, L = low level, X = irrelevant,
Z = high impedance (off)

LinBiCMOS is a trademark of Texas Instruments.

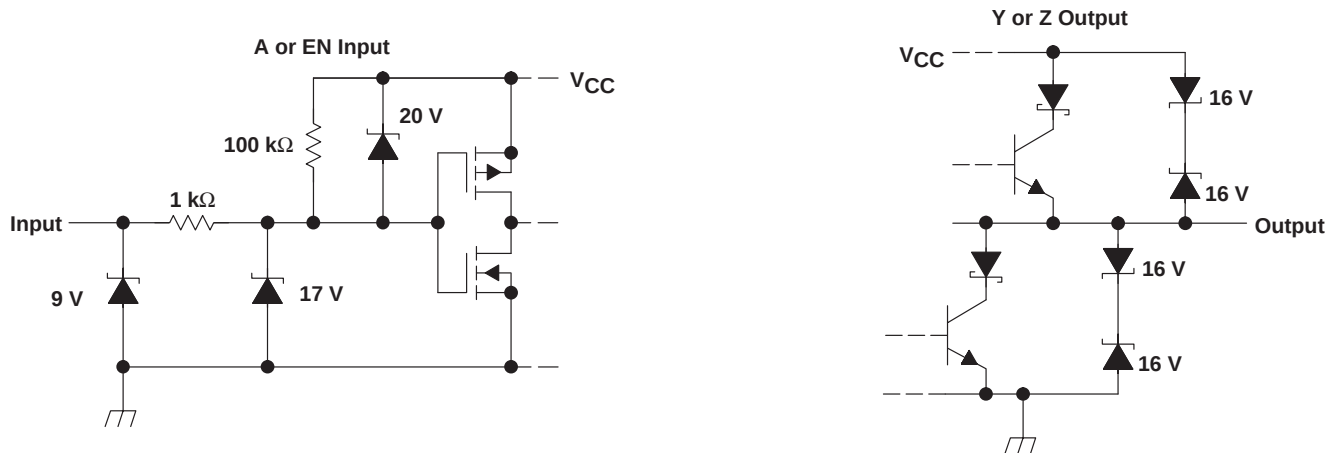


POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN65LBC174A, SN75LBC174A QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

equivalent input and output schematic diagrams



absolute maximum ratings[†]

Supply voltage range, V_{CC} (see Note 1)	–0.3 V to 6 V
Voltage range at any bus (DC)	–10 V to 15 V
Voltage range at any bus (transient pulse through 100 Ω , see Figure 8)	–30 V to 30 V
Input voltage range at any A or EN terminal, V_I	–0.5 V to $V_{CC} + 0.5$ V
Electrostatic discharge: Human body model (see Note 2)	Y, Z, and GND 13 kV
	All pins 5 kV
	Charged-device model (see Note 3) All pins 1 kV
Storage temperature range, T_{stg}	–65°C to 150°C
Continuous power dissipation	See Dissipation Rating Table
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

[†] 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.

- NOTES:
1. All voltage values, except differential I/O bus voltages, are with respect to GND.
 2. Tested in accordance with JEDEC standard 22, Test Method A114-A.
 3. Tested in accordance with JEDEC standard 22, Test Method C101.

DISSIPATION RATING TABLE

PACKAGE	JEDEC BOARD MODEL	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR [‡] ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING
16-PIN DW	Low K	1200 mW	9.6 mW/°C	769 mW	625 mW
	High K	2240 mW	17.9 mW/°C	1434 mW	1165 mW
20-PIN DW	Low K	1483 mW	11.86 mW/°C	949 mW	771 mW
	High K	2753 mW	22 mW/°C	1762 mW	1432 mW
16-PIN N	Low K	1150 mW	9.2 mW/°C	736 mW	598 mW

[‡] This is the inverse of the junction-to-ambient thermal resistance when board-mounted with no air flow.

SN65LBC174A, SN75LBC174A

QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V _{CC}		4.75	5	5.25	V
Voltage at any bus terminal	Y, Z	−7		12	V
High-level input voltage, V _{IH}	A, EN	2		V _{CC}	V
Low-level input voltage, V _{IL}		0		0.8	
Output current		−60		60	mA
Operating free-air temperature, T _A	SN75LBC174A	0		70	°C
	SN65LBC174A	−40		85	

electrical characteristics over recommended operating conditions

PARAMETER		TEST CONDITIONS		MIN	TYP [†]	MAX	UNIT
V_{IK}	Input clamp voltage	$I_I = -18$ mA		-1.5	-0.77		V
V_O	Open-circuit output voltage	Y or Z, No load		0		V_{CC}	V
$ V_{OD(SS)} $	Steady-state differential output voltage magnitude [‡]	No load (open circuit)		3		V_{CC}	V
		$R_L = 54 \Omega$, See Figure 1		1	1.6	2.5	
		With common-mode loading, See Figure 2		1	1.6	2.5	
$\Delta V_{OD(SS)}$	Change in steady-state differential output voltage between logic states	See Figure 1		-0.1		0.1	V
$V_{OC(SS)}$	Steady-state common-mode output voltage	See Figure 3		2	2.4	2.8	V
$\Delta V_{OC(SS)}$	Change in steady-state common-mode output voltage between logic states	See Figure 3		-0.02		0.02	V
I_I	Input current	A, G, $\overline{G}$		-50		50	μ A
I_{OS}	Short-circuit output current		$V_I = 0$ V	-200		200	mA
			$V_I = V_{CC}$				
I_{OZ}	High-impedance-state output current	$V_{TEST} = -7$ V to 12 V, See Figure 7	EN at 0 V	-50		50	μ A
$I_{O(OFF)}$	Output current with power off		$V_{CC} = 0$ V	-10		10	
I_{CC}	Supply current	$V_I = 0$ V or V_{CC} , No load	All drivers enabled			23	mA
			All drivers disabled			1.5	

[†] All typical values are at $V_{CC} = 5$ V and 25°C.

[‡] The minimum V_{OD} may not fully comply with TIA/EIA-485-A at operating temperatures below 0°C. System designers should take the possibly of lower output signal into account in determining the maximum signal transmission distance.

SN65LBC174A, SN75LBC174A QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

switching characteristics over recommended operating conditions

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH} Propagation delay time, low-to-high level output	$R_L = 54 \Omega$, $C_L = 50 \text{ pF}$, See Figure 4	5.5	8	11	ns
t_{PHL} Propagation delay time, high-to-low level output		5.5	8	11	ns
t_r Differential output voltage rise time		3	7.5	11	ns
t_f Differential output voltage fall time		3	7.5	11	ns
$t_{sk(p)}$ Pulse skew $ t_{PLH} - t_{PHL} $			0.6	2	ns
$t_{sk(o)}$ Output skew [†]				2	
$t_{sk(pp)}$ Part-to-part skew [‡]				3	ns
t_{PZH} Propagation delay time, high-impedance-to-high-level output	See Figure 5			25	ns
t_{PHZ} Propagation delay time, high-level-output-to-high impedance				25	ns
t_{PZL} Propagation delay time, high-impedance-to-low-level output	See Figure 6			30	ns
t_{PLZ} Propagation delay time, low-level-output-to-high impedance				20	ns

[†] Output skew ($t_{sk(o)}$) is the magnitude of the time delay difference between the outputs of a single device with all of the inputs connected together.

[‡] Part-to-part skew ($t_{sk(pp)}$) is the magnitude of the difference in propagation delay times between any specified terminals of two devices when both devices operate with the same input signals, the same supply voltages, at the same temperature, and have identical packages and test circuits.

SN65LBC174A, SN75LBC174A QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

PARAMETER MEASUREMENT INFORMATION

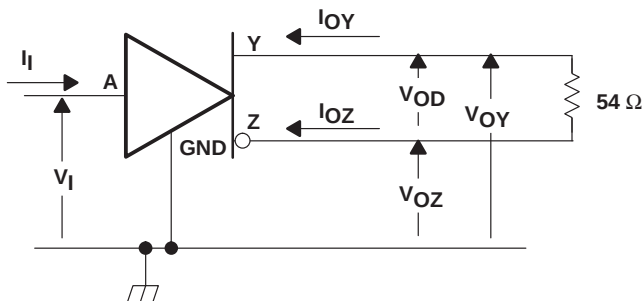


Figure 1. Test Circuit, V_{OD} Without Common-Mode Loading

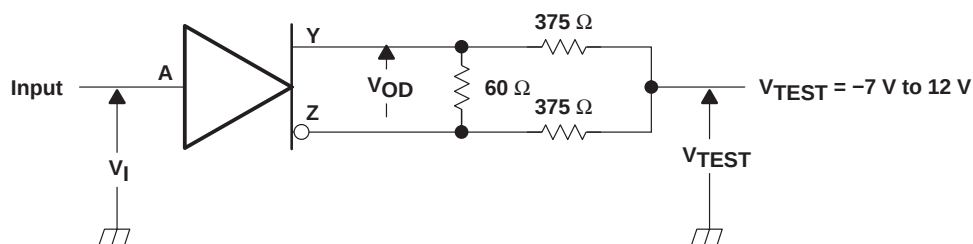
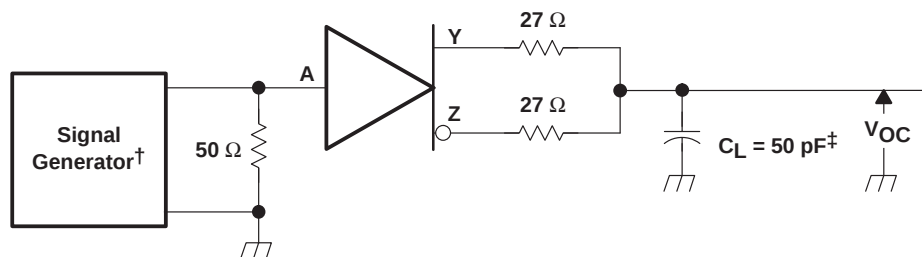


Figure 2. Test Circuit, V_{OD} With Common-Mode Loading

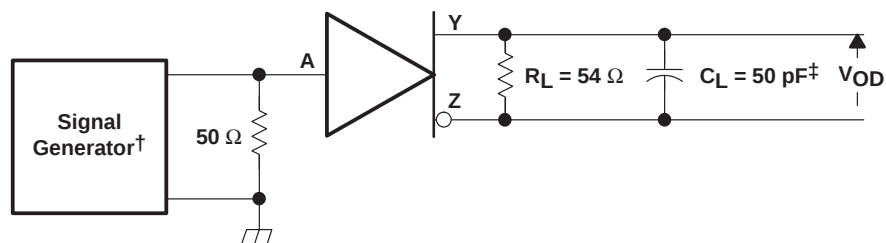


† PRR = 1 MHz, 50% duty cycle, $t_r < 6$ ns, $t_f < 6$ ns, $Z_O = 50 \Omega$

‡ Includes probe and jig capacitance

Figure 3. V_{OC} Test Circuit

PARAMETER MEASUREMENT INFORMATION



† PRR = 1 MHz, 50% duty cycle, $t_r < 6$ ns, $t_f < 6$ ns, $Z_O = 50 \Omega$

‡ Includes probe and jig capacitance

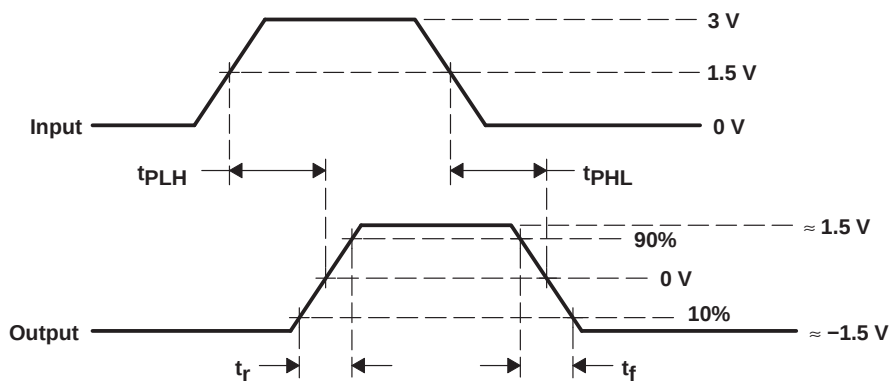
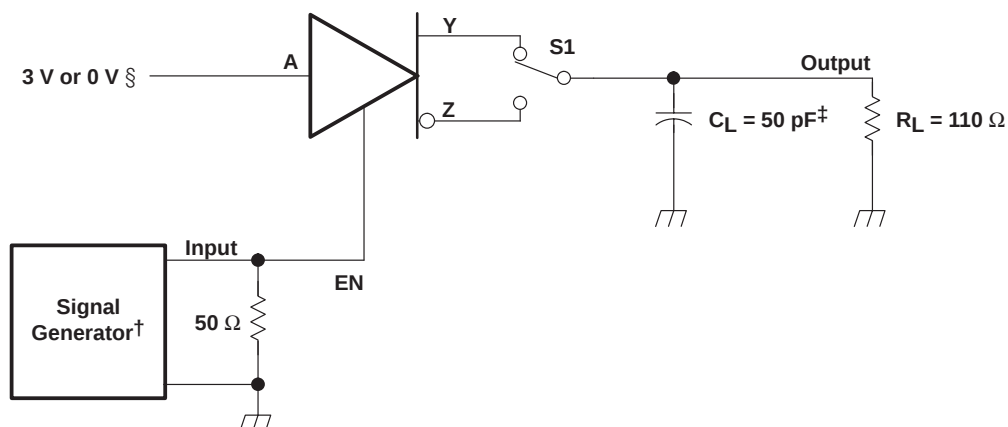


Figure 4. Output Switching Test Circuit and Waveforms

SN65LBC174A, SN75LBC174A QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

PARAMETER MEASUREMENT INFORMATION



† PRR = 1 MHz, 50% duty cycle, $t_r < 6 \text{ ns}$, $t_f < 6 \text{ ns}$, $Z_O = 50 \text{ } \Omega$

‡ Includes probe and jig capacitance

§ 3 V if testing Y output, 0 V if testing Z output

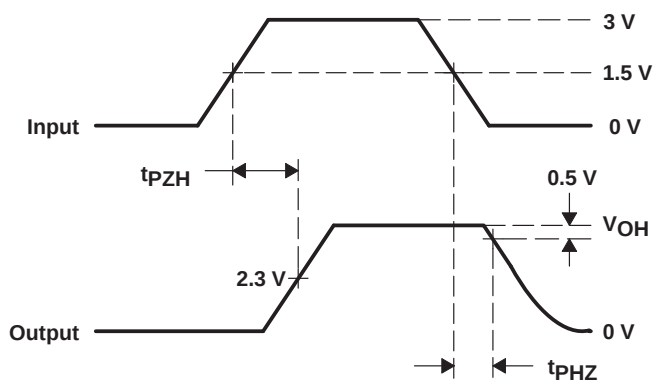
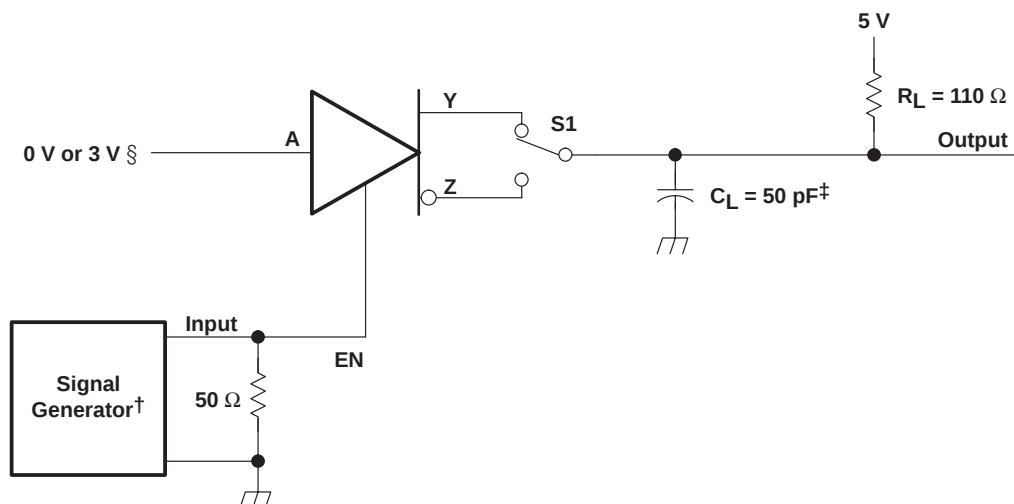


Figure 5. Enable Timing Test Circuit and Waveforms, t_{pZH} and t_{pHZ}

PARAMETER MEASUREMENT INFORMATION



† PRR = 1 MHz, 50% duty cycle, $t_r < 6$ ns, $t_f < 6$ ns, $Z_O = 50 \Omega$

‡ Includes probe and jig capacitance

§ 3 V if testing Y output, 0 V if testing Z output

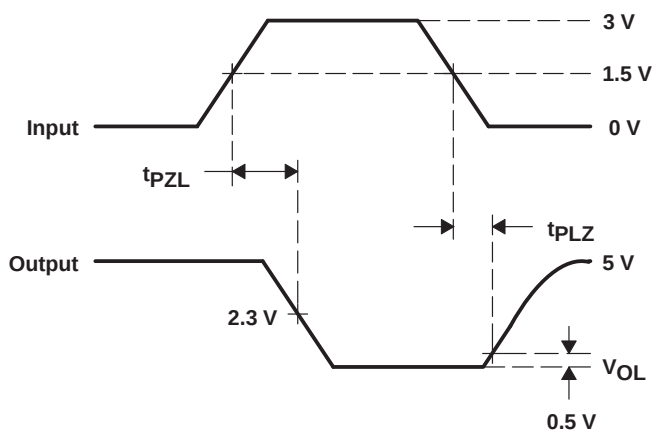


Figure 6. Enable Timing Test Circuit and Waveforms, t_{PZL} and t_{PLZ}

SN65LBC174A, SN75LBC174A
QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

PARAMETER MEASUREMENT INFORMATION

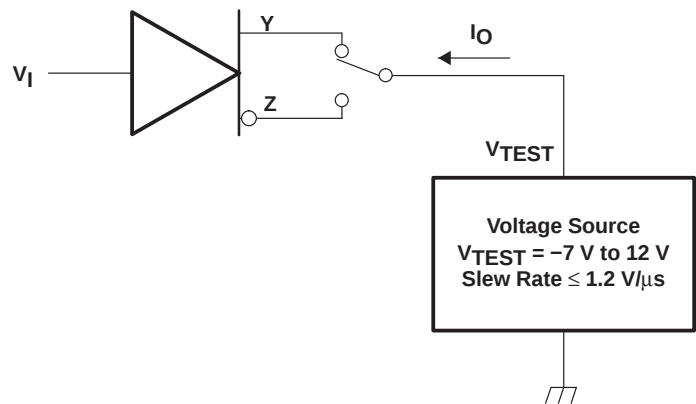


Figure 7. Test Circuit, Short-Circuit Output Current

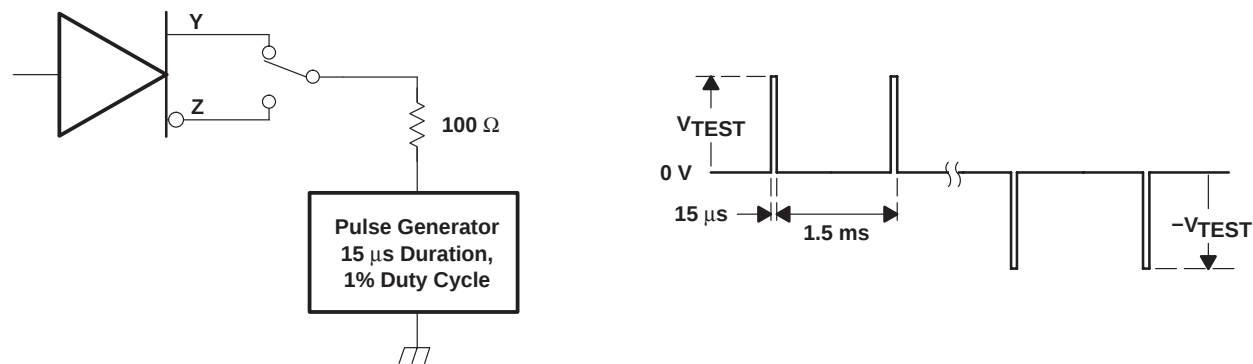


Figure 8. Test Circuit Waveform, Transient Over-Voltage Test

SN65LBC174A, SN75LBC174A QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

TYPICAL CHARACTERISTICS

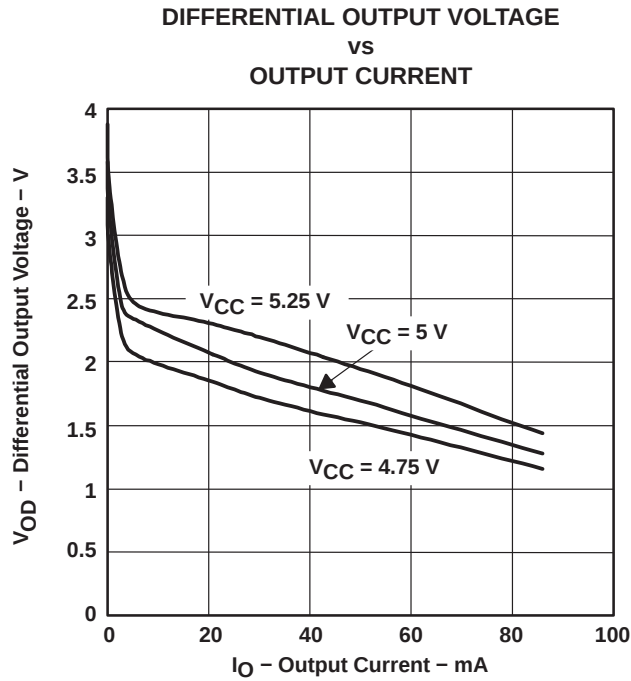


Figure 9

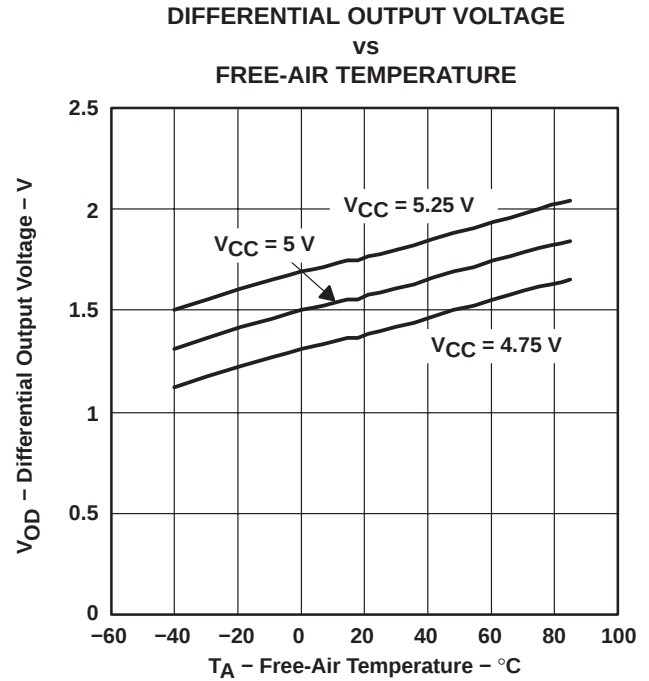


Figure 10

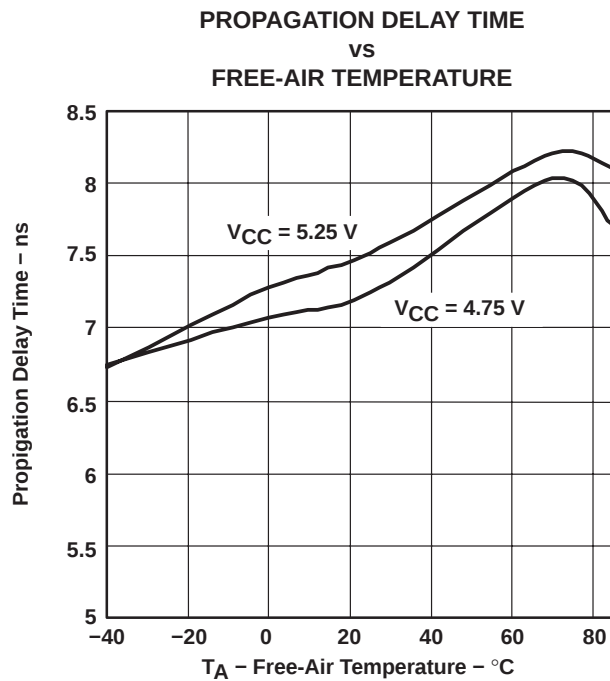


Figure 11

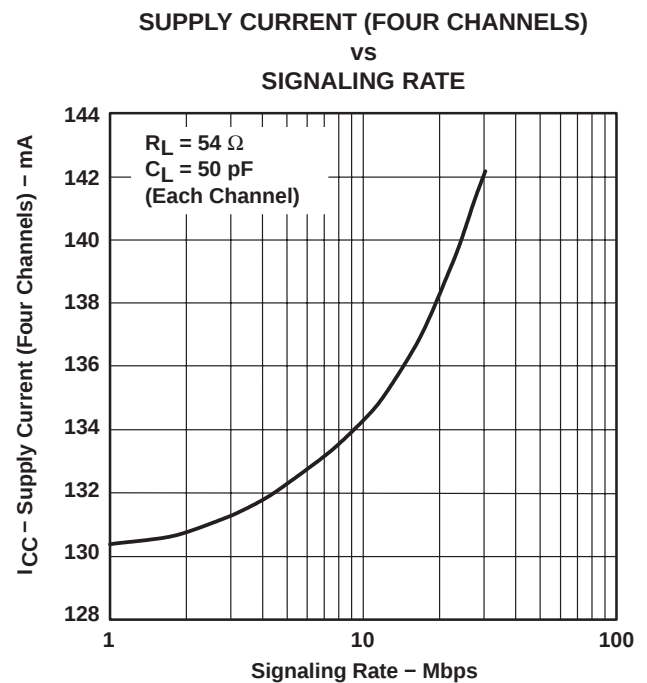


Figure 12

SN65LBC174A, SN75LBC174A
QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

TYPICAL CHARACTERISTICS

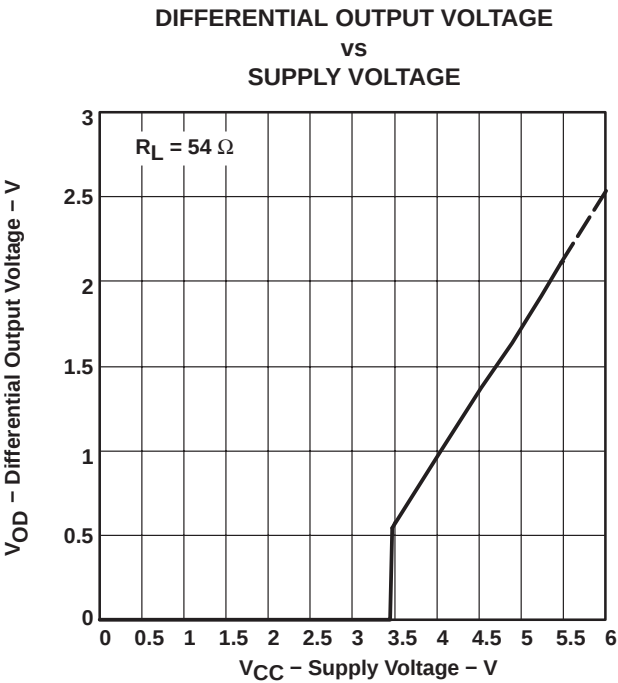


Figure 13

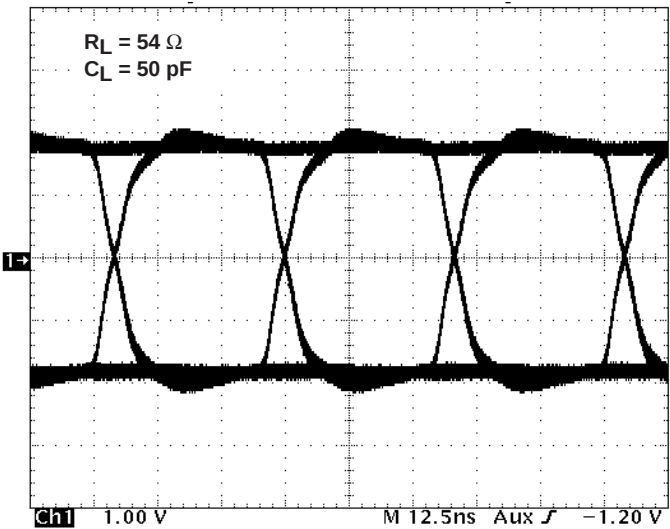


Figure 14. Eye Pattern, Pseudorandom Data at 30 Mbps

SN65LBC174A, SN75LBC174A QUADRUPLE RS-485 DIFFERENTIAL LINE DRIVERS

SLLS446C – OCTOBER 2000 – REVISED MAY 2003

APPLICATION INFORMATION

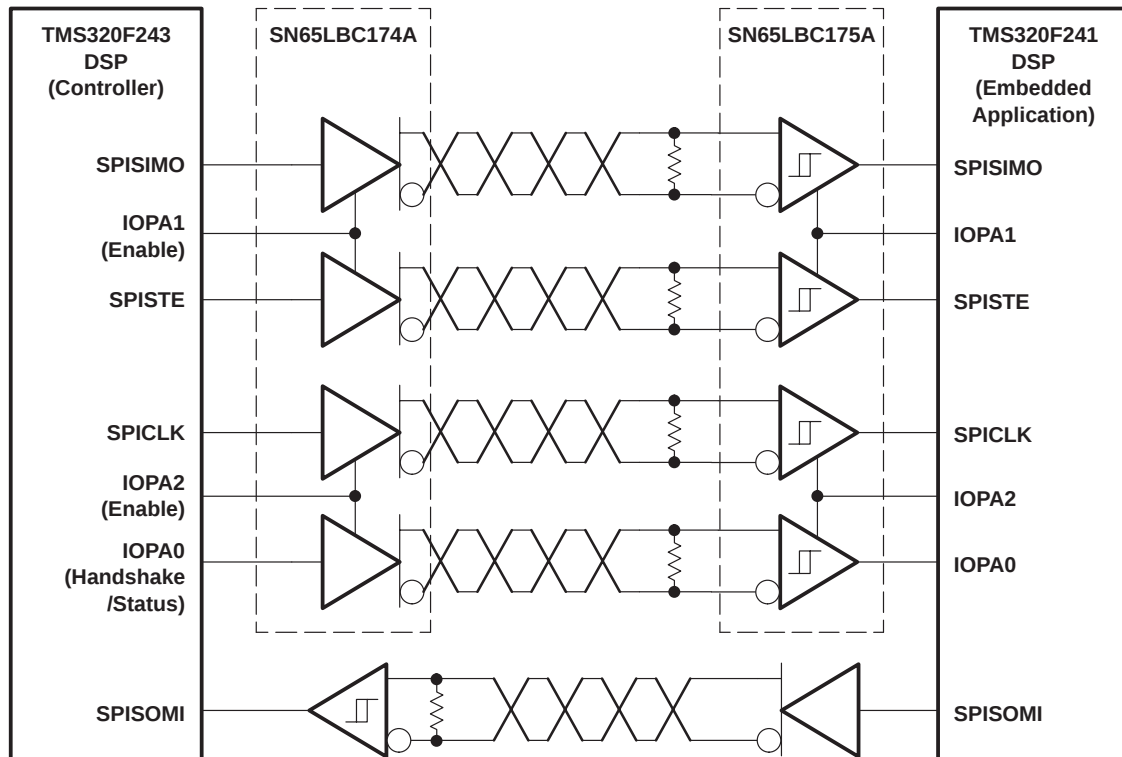


Figure 15. Typical Application Circuit, DSP-to-DSP Link via Serial Peripheral Interface

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE

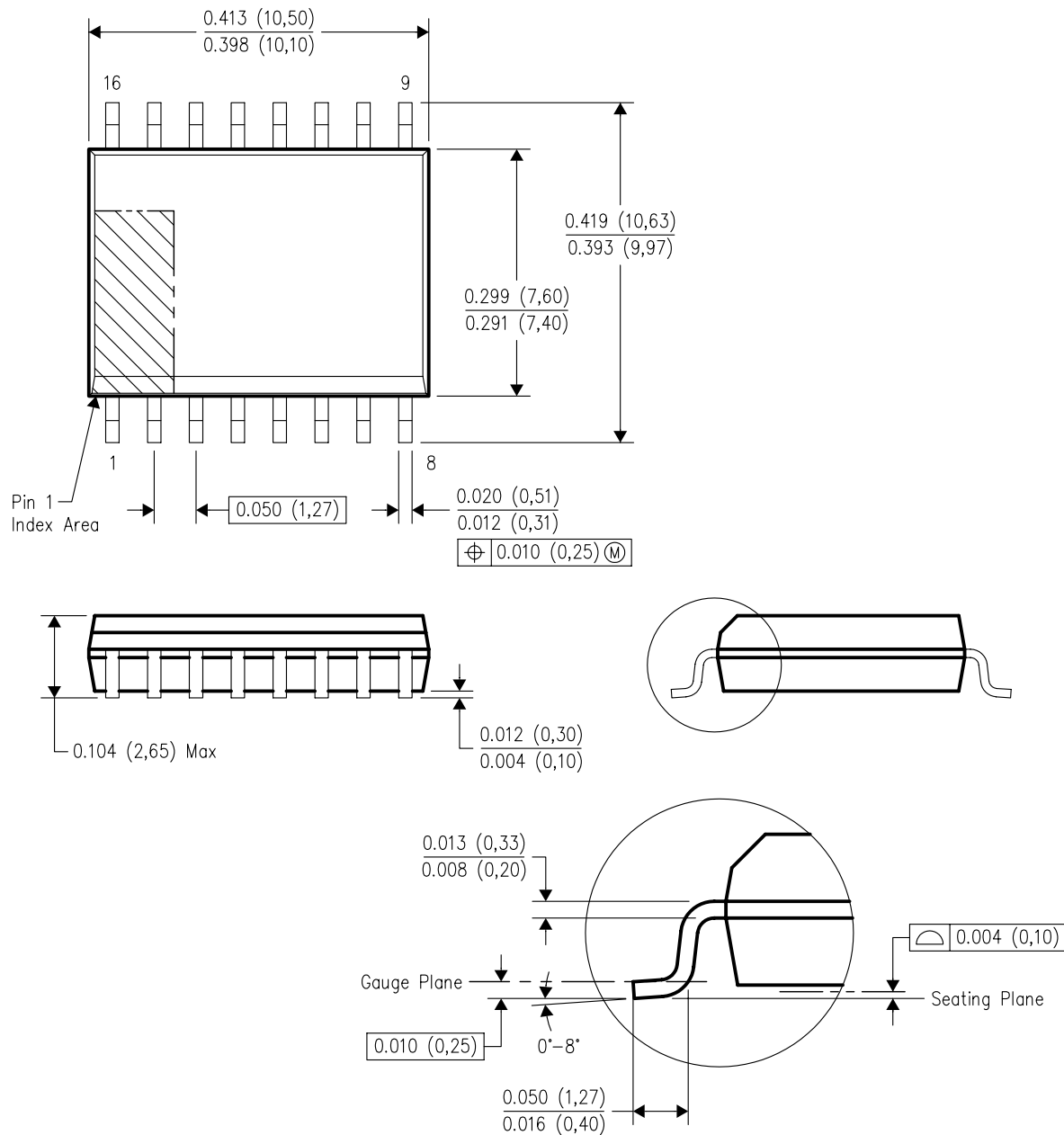


4040000-4/F 06/2004

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-013 variation AC.

DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-2/F 06/2004

- NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013 variation AA.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2004, Texas Instruments Incorporated