

# SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

SLLS171C – OCTOBER 1993 – REVISED APRIL 2000

- Meet or Exceed the EIA Standards RS-422-A, RS-423-A, RS-485, and CCITT Recommendation V.11
- Designed to Operate With Pulse Durations as Short as 20 ns
- Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments
- Input Sensitivity . . .  $\pm 200$  mV
- Low-Power Consumption . . . 20 mA Max
- Open-Circuit Fail-Safe Design
- Common-Mode Input Voltage Range of  $-7$  V to 12 V
- Pin Compatible With SN75175 and MC3486

## description

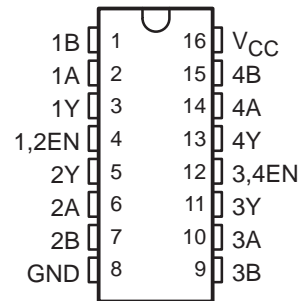
The SN65LBC175 and SN75LBC175 are monolithic, quadruple, differential line receivers with 3-state outputs and are designed to meet the requirements of the EIA standards RS-422-A, RS-423-A, RS-485, and CCITT Recommendation V.11. The devices are optimized for balanced multipoint bus transmission at data rates up to and exceeding 10 million bits per second. The receivers are enabled in pairs, with an active-high enable input. Each differential receiver input features high impedance, hysteresis for increased noise immunity, and sensitivity of  $\pm 200$  mV over a common-mode input voltage range of 12 V to  $-7$  V. The fail-safe design ensures that when the inputs are open-circuited, the outputs are always high. Both devices are designed using the TI proprietary LinBiCMOS™ technology allowing low power consumption, high switching speeds, and robustness.

These devices offer optimum performance when used with the SN75LBC172 or SN75LBC174 quadruple line drivers. The SN65LBC175 and SN75LBC175 are available in the 16-pin DIP (N) and small-outline inline circuit (SOIC) D packages.

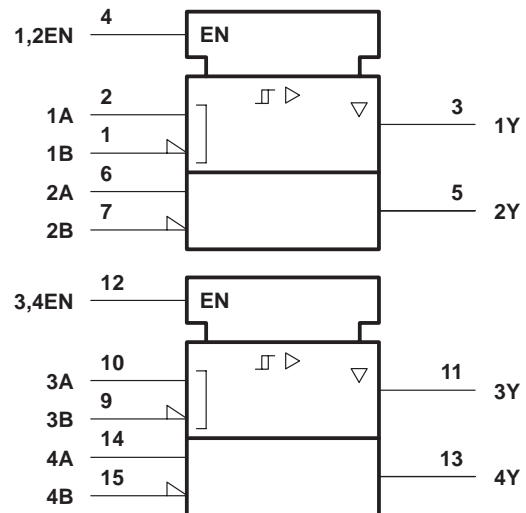
The SN65LBC175 is characterized over the industrial temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . The SN75LBC175 is characterized for operation over the commercial temperature range of  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

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D OR N PACKAGE  
(TOP VIEW)

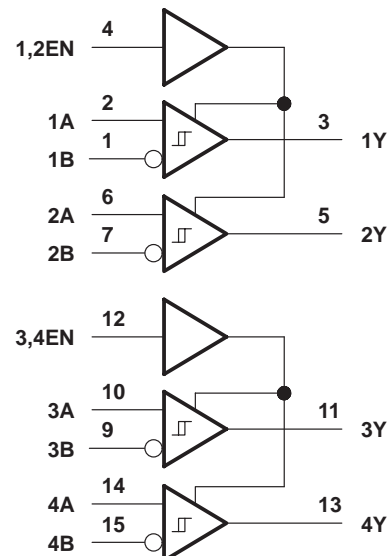


## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)



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.

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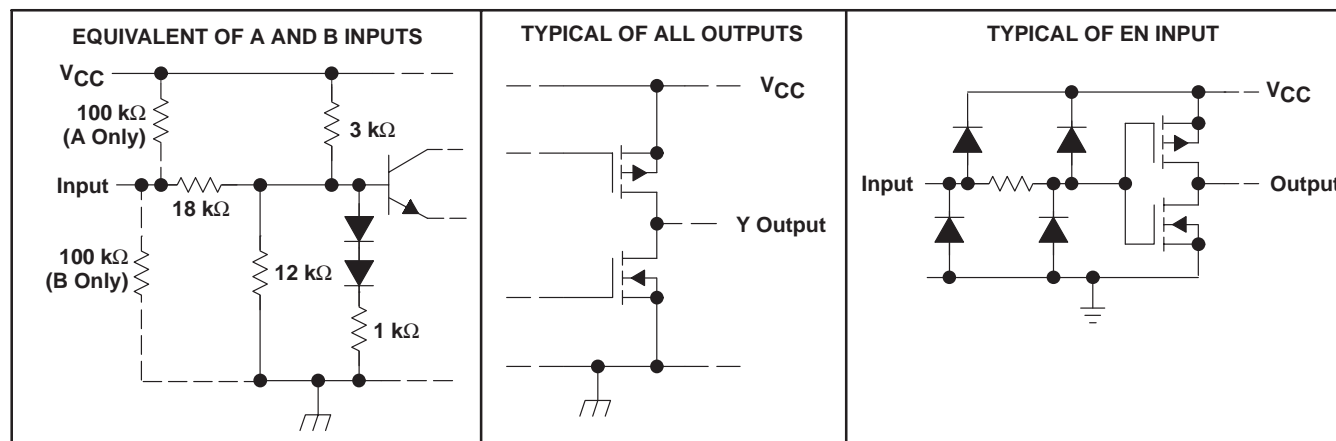
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**FUNCTION TABLE**  
(each receiver)

DIFFERENTIAL INPUTS A-B	ENABLE	OUTPUT Y
$V_{ID} \geq 0.2\text{ V}$	H	H
$-0.2\text{ V} < V_{ID} < 0.2\text{ V}$	H	?
$V_{ID} \leq -0.2\text{ V}$	H	L
X	L	Z
Open circuit	H	H

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

## schematics of inputs and outputs



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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, $V_{CC}$ (see Note 1)	–0.3 V to 7 V
Input voltage, $V_I$ (A or B inputs)	±25 V
Differential input voltage, $V_{ID}$ (see Note 2)	±25 V
Voltage range at Y, 1/2EN, 3/4EN	–0.3 V to $V_{CC} + 0.5$ V
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ : SN65LBC175	–40°C to 85°C
SN75LBC175	0°C to 70°C
Storage temperature range, $T_{stg}$	–65°C to 150°C
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 are with respect to GND.  
2. Differential input voltage is measured at the noninverting input with respect to the corresponding inverting input.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ 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
D	1100 mW	8.7 mW/°C	709 mW	578 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW

## recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, $V_{CC}$		4.75	5	5.25	V
Common-mode input voltage, $V_{IC}$		–7		12	V
Differential input voltage, $V_{ID}$				±6	V
High-level input voltage, $V_{IH}$	EN inputs	2			V
Low-level input voltage, $V_{IL}$				0.8	V
High-level output current, $I_{OH}$				–8	mA
Low-level output current, $I_{OL}$				16	mA
Operating free-air temperature, $T_A$	SN65LBC175	–40		85	°C
	SN75LBC175	0		70	

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**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)**

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{IT+}$	Positive-going input threshold voltage	$I_O = -8$ mA			0.2	V
$V_{IT-}$	Negative-going input threshold voltage	$I_O = 16$ mA	-0.2			V
$V_{hys}$	Hysteresis voltage ( $V_{IT+} - V_{IT-}$ )			45		mV
$V_{IK}$	Enable input clamp voltage	$I_I = -18$ mA	-0.9	-1.5		V
$V_{OH}$	High-level output voltage	$V_{ID} = 200$ mV, $I_{OH} = -8$ mA	3.5	4.5		V
$V_{OL}$	Low-level output voltage	$V_{ID} = -200$ mV, $I_{OL} = 8$ mA		0.3	0.5	V
$I_{OZ}$	High-impedance-state output current	$V_O = 0$ V to $V_{CC}$			$\pm 20$	$\mu$ A
$I_I$	Bus input current	A or B inputs	$V_{IH} = 12$ V, $V_{CC} = 5$ V, Other inputs at 0 V	0.7	1	mA
			$V_{IH} = 12$ V, $V_{CC} = 0$ V, Other inputs at 0 V	0.8	1	mA
			$V_{IH} = -7$ V, $V_{CC} = 5$ V, Other inputs at 0 V	-0.5	-0.8	mA
			$V_{IH} = -7$ V, $V_{CC} = 0$ V, Other inputs at 0 V	-0.4	-0.8	mA
$I_{IH}$	High-level enable input current	$V_{IH} = 5$ V			$\pm 20$	$\mu$ A
$I_{IL}$	Low-level enable input current	$V_{IL} = 0$ V			-20	$\mu$ A
$I_{OS}$	Short-circuit output current	$V_O = 0$	-80	-120		mA
$I_{CC}$	Supply current	Outputs enabled, $I_O = 0$ , $V_{ID} = 5$ V		11	20	mA
		Outputs disabled	0.9	1.4		

† All typical values are at  $V_{CC} = 5$  V and  $T_A = 25^\circ\text{C}$ .

**switching characteristics,  $V_{CC} = 5$  V,  $C_L = 15$  pF,  $T_A = 25^\circ\text{C}$**

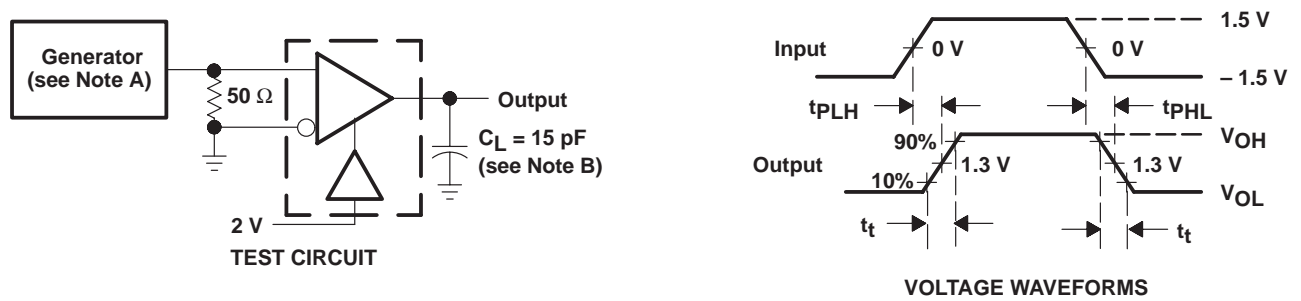
PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$t_{PHL}$	Propagation delay time, high- to low-level output	$V_{ID} = -1.5$ V to 1.5 V, See Figure 1	11	22	30	ns
$t_{PLH}$	Propagation delay time, low- to high-level output		11	22	30	ns
$t_{PZH}$	Output enable time to high level	See Figure 2		17	30	ns
$t_{PZL}$	Output enable time to low level	See Figure 3		18	30	ns
$t_{PHZ}$	Output disable time from high level	See Figure 2		30	40	ns
$t_{PLZ}$	Output disable time from low level	See Figure 3		23	30	ns
$t_{sk(p)}$	Pulse skew ( $ t_{PHL} - t_{PLH} $ )	See Figure 2		4	6	ns
$t_t$	Transition time	See Figure 1		3	10	ns



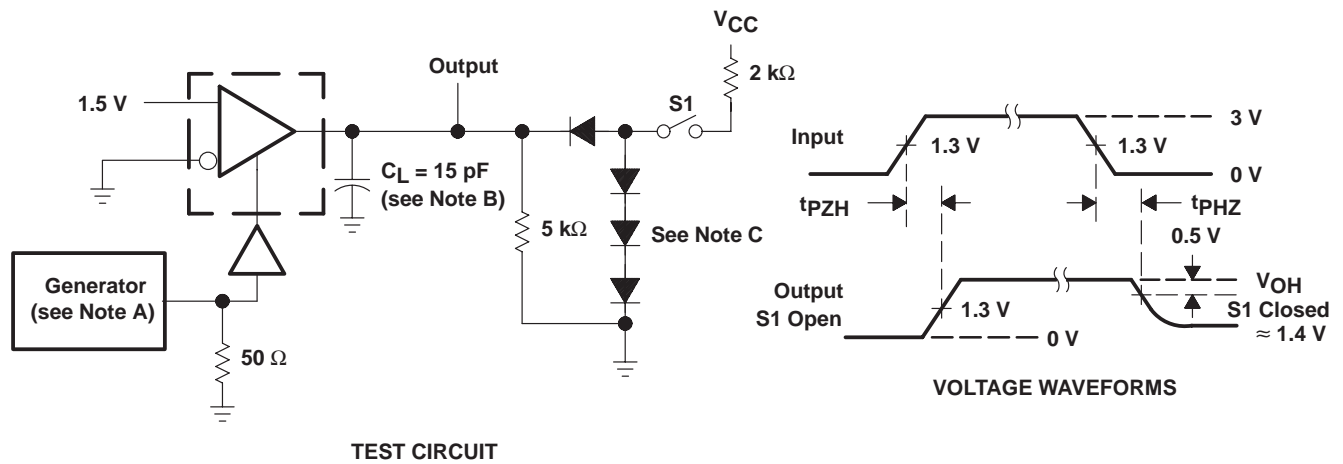
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## PARAMETER MEASUREMENT INFORMATION



**Figure 1.  $t_{pLH}$  and  $t_{pHL}$  Test Circuit and Voltage Waveforms**



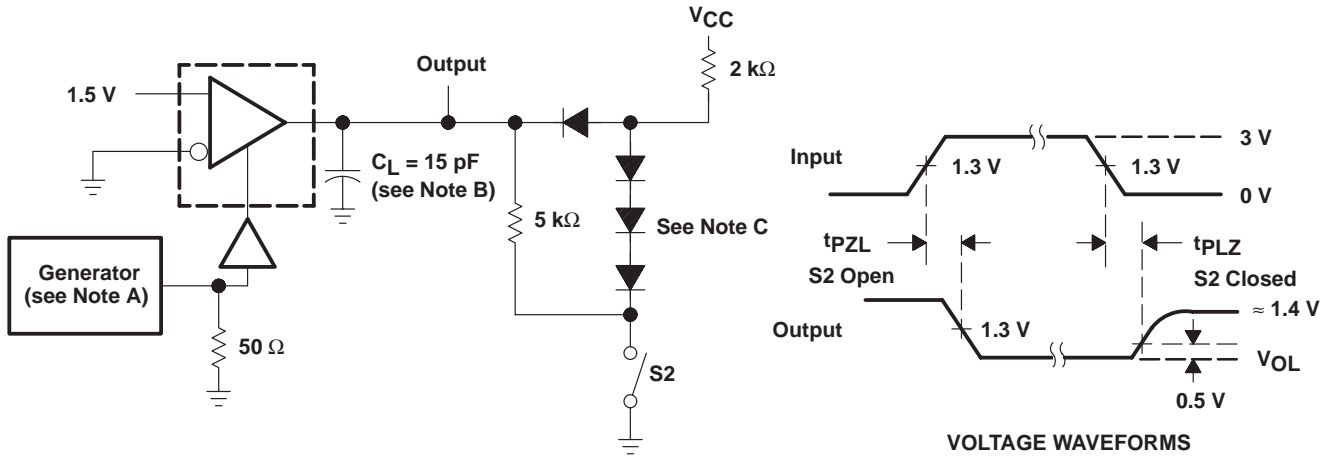
- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .  
 B.  $C_L$  includes probe and jig capacitance.  
 C. All diodes are 1N916 or equivalent.

**Figure 2.  $t_{pHZ}$  and  $t_{pZH}$  Test Circuit and Voltage Waveforms**

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## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .  
 B.  $C_L$  includes probe and jig capacitance.  
 C. All diodes are 1N916 or equivalent.

Figure 3.  $t_{pZL}$  and  $t_{PLZ}$  Test Circuit and Voltage Waveforms

## TYPICAL CHARACTERISTICS

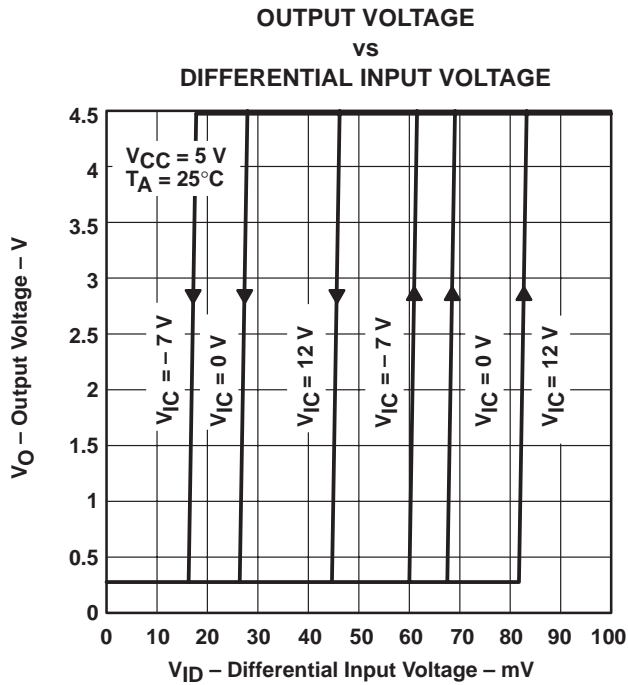


Figure 4

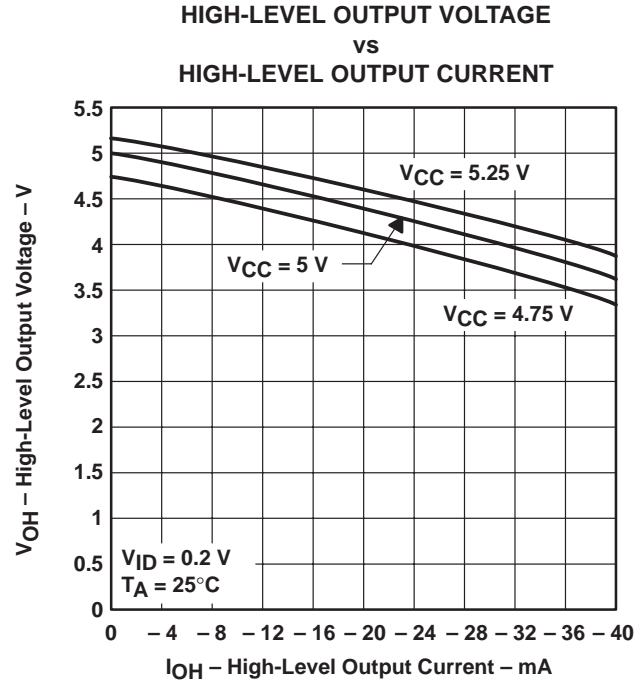


Figure 5

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## TYPICAL CHARACTERISTICS

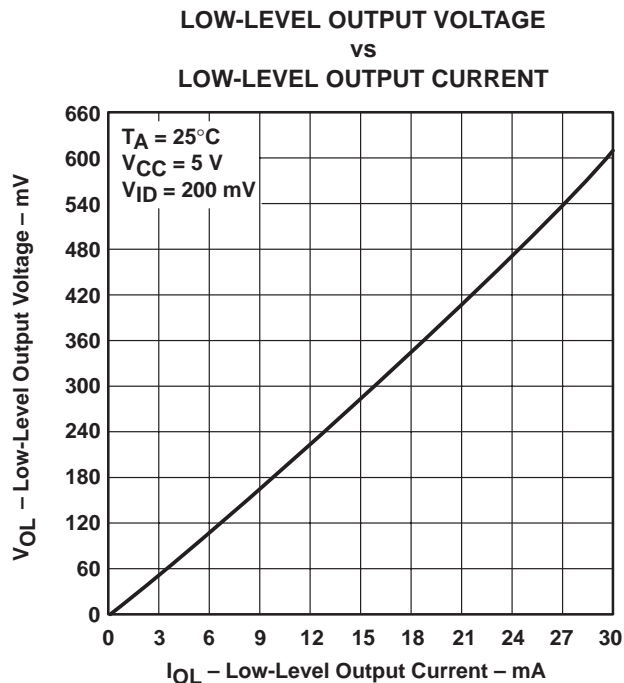


Figure 6

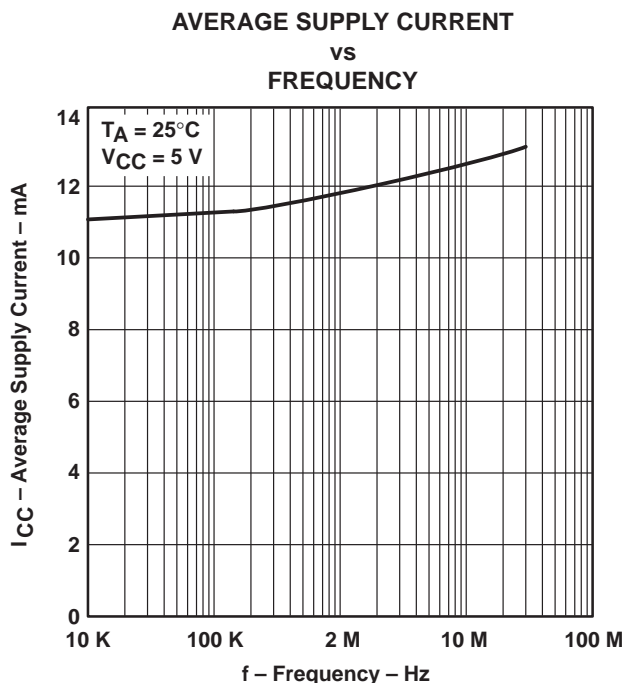


Figure 7

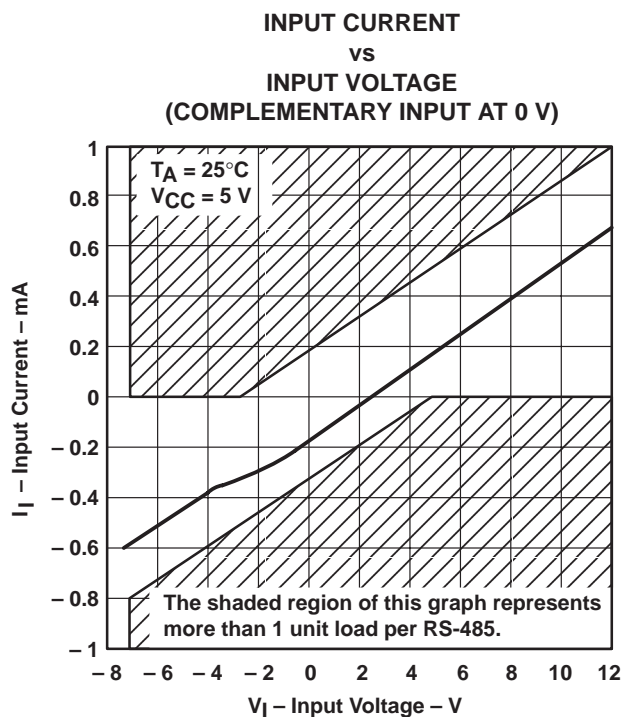


Figure 8

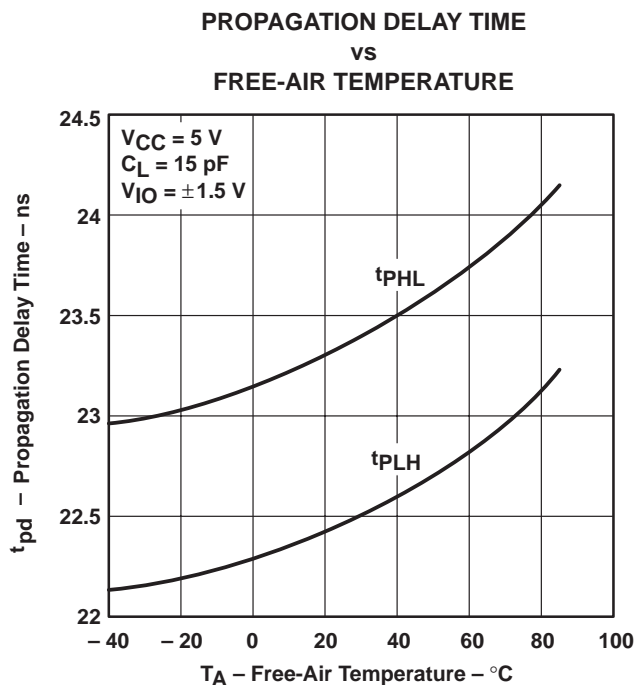


Figure 9

# SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

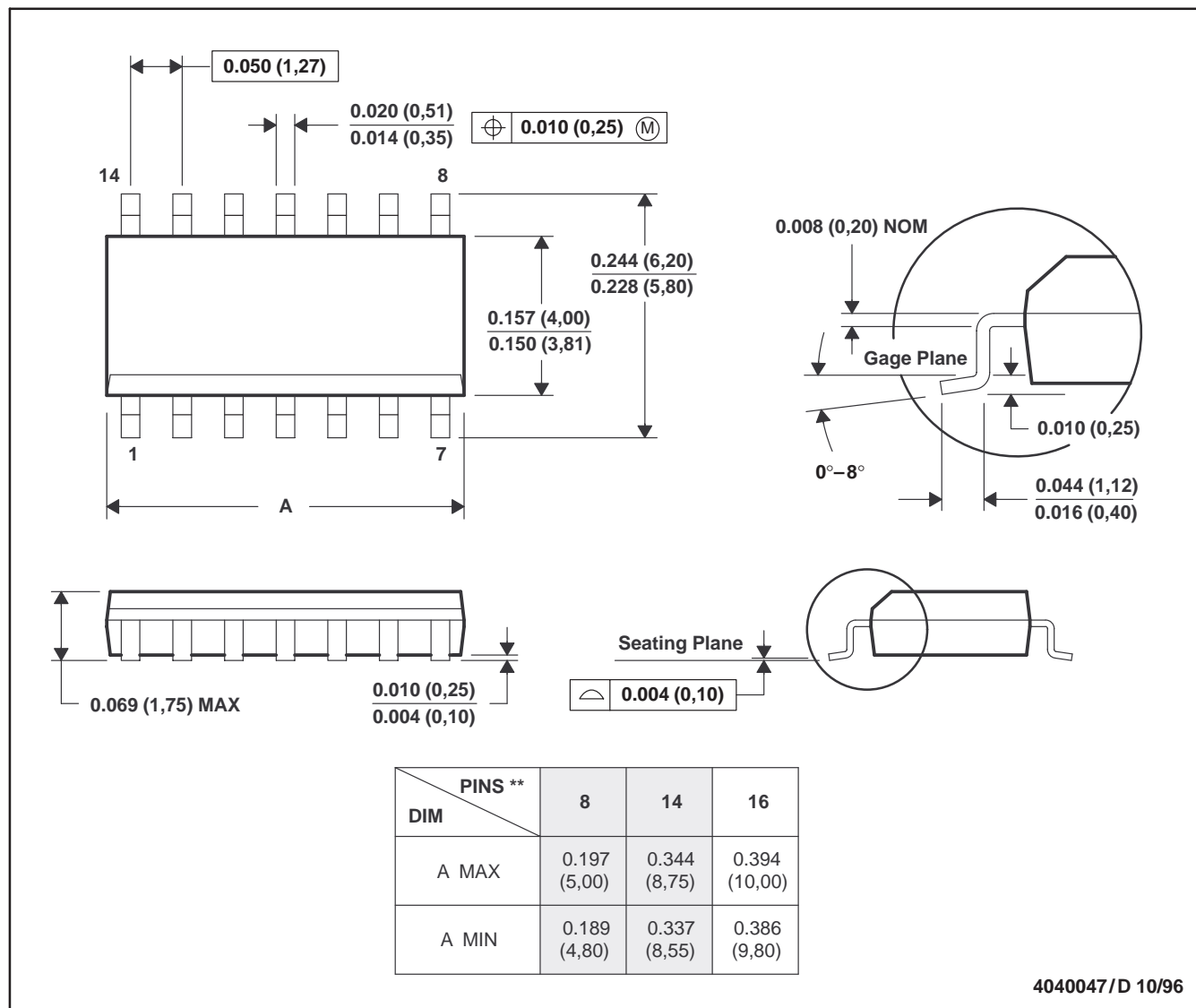
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## MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- 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-012



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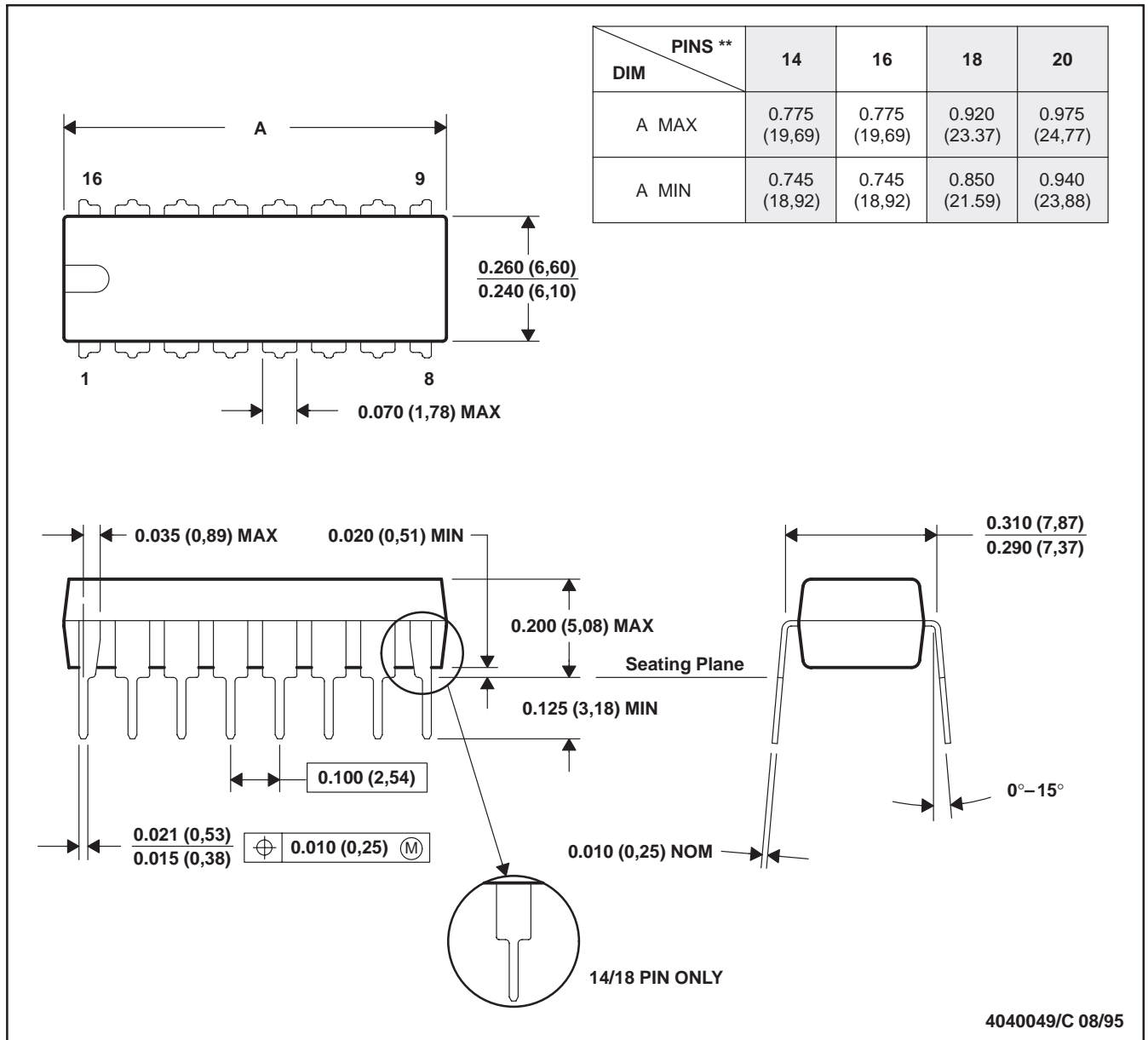
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## MECHANICAL DATA

**N (R-PDIP-T\*\*)**

**PLASTIC DUAL-IN-LINE PACKAGE**

16 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001 (20 pin package is shorter than MS-001.)

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