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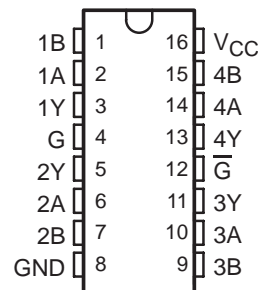
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## SN65LBC173, SN75LBC173 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

SLLS170E – OCTOBER 1993 – REVISED AUGUST 2000

- Meets or Exceeds the Requirements of ANSI Standards EIA/TIA-422-B, EIA/TIA-423-B, RS-485, and ITU Recommendations V.10 and V.11.
- Designed to Operate With Pulse Durations as Short as 20 ns
- Designed for Multipoint Bus Transmission on Long Bus Lines in Noisy Environments
- Input Sensitivity . . .  $\pm 200$  mV
- Low-Power Consumption . . . 20 mA Max
- Open-Circuit Fail-Safe Design
- Pin Compatible With SN75173 and AM26LS32

**D OR N PACKAGE  
(TOP VIEW)**



### description

The SN65LBC173 and SN75LBC173 are monolithic quadruple differential line receivers with 3-state outputs. Both are designed to meet the requirements of the ANSI standards EIA/TIA-422-B, EIA/TIA-423-B, RS-485, and ITU Recommendations V.10 and V.11. The devices are optimized for balanced multipoint bus transmission at data rates up to and exceeding 10 million bits per second. The four receivers share two ORed enable inputs, one active when high, the other active when low.

Each receiver features high input impedance, input hysteresis for increased noise immunity, and input sensitivity of  $\pm 200$  mV over a common-mode input voltage range of 12 V to  $-7$  V. Fail-safe design ensures that if the inputs are open circuited, the output is always high. Both devices are designed using the Texas Instruments proprietary LinBiCMOS™ technology that provides low power consumption, high switching speeds, and robustness.

These devices offer optimum performance when used with the SN75LBC172 or SN75LBC174 quadruple line drivers. The SN65LBC173 and SN75LBC173 are available in the 16-pin DIP (N) and SOIC (D) packages.

The SN65LBC173 is characterized over the industrial temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . The SN75LBC173 is characterized for operation over the commercial temperature range of  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**FUNCTION TABLE  
(each receiver)**

DIFFERENTIAL INPUTS A–B	ENABLES G $\overline{\text{G}}$		OUTPUT Y
$V_{\text{ID}} \geq 0.2 \text{ V}$	H X	X L	H H
$-0.2 \text{ V} < V_{\text{ID}} < 0.2 \text{ V}$	H X	X L	? ?
$V_{\text{ID}} \leq -0.2 \text{ V}$	H X	X L	L L
X	L	H	Z
Open Circuit	H X	X L	H H

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



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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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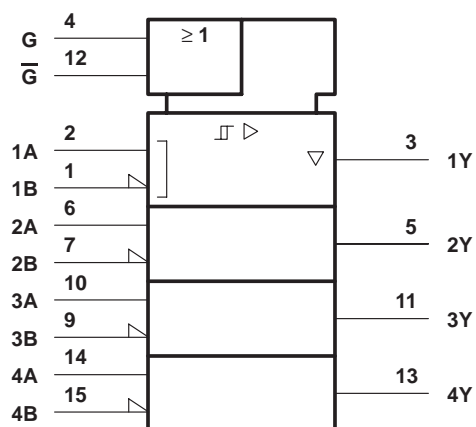
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# SN65LBC173, SN75LBC173

## QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

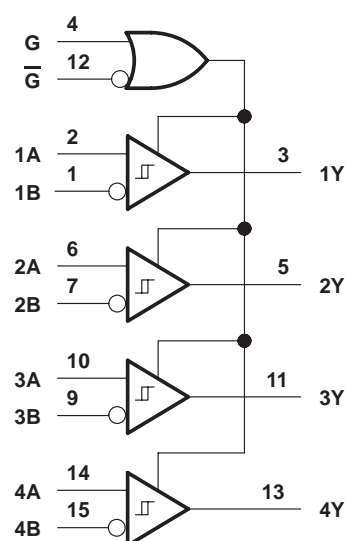
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### logic symbol†

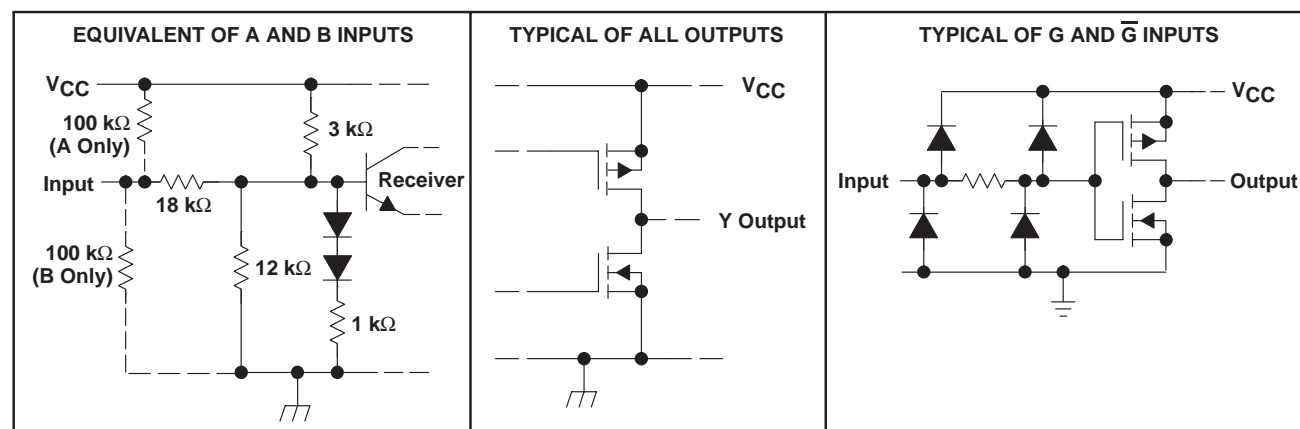


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

### logic diagram (positive logic)



### schematics of inputs and outputs



## SN65LBC173, SN75LBC173 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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

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, G, $\overline{G}$	–0.3 V to $V_{CC} + 0.5$ V
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ : SN65LBC173	–40°C to 85°C
SN75LBC173	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

<sup>†</sup> 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	708 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, $V_{IH}$	G inputs	2			V
Low-level input voltage, $V_{IL}$				0.8	V
High-level output current, $I_{OH}$				–8	mA
Low-level output current, $I_{OL}$				8	mA
Operating free-air temperature, $T_A$	SN65LBC173	–40		85	°C
	SN75LBC173	0		70	



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## SN65LBC173, SN75LBC173 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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

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

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PHL}$	Propagation delay time, high- to low-level output	$V_{ID} = -1.5\text{ V to } 1.5\text{ V}$ , 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		35	45	ns
$t_{PLZ}$	Output disable time from low level	See Figure 3		25	40	ns
$t_{sk(p)}$	Pulse skew ( $ t_{PHL} - t_{PLH} $ )	See Figure 2		0.5	6	ns
$t_t$	Transition time	See Figure 1		5	10	ns

## SN65LBC173, SN75LBC173 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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### PARAMETER MEASUREMENT INFORMATION

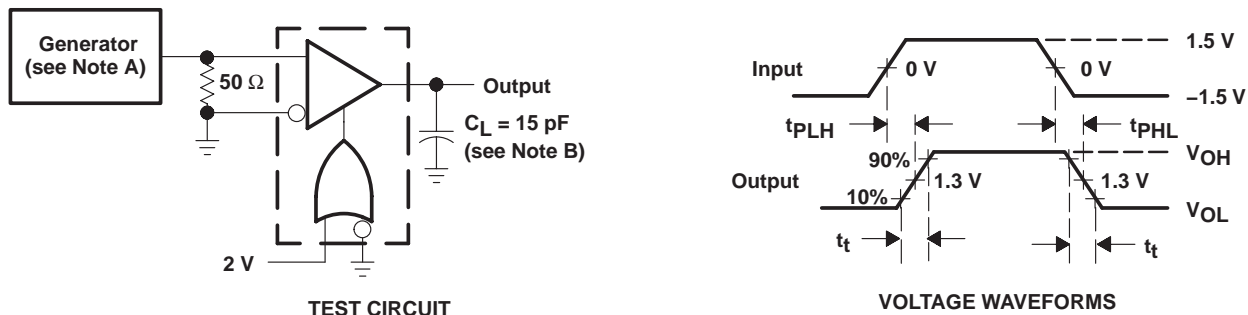
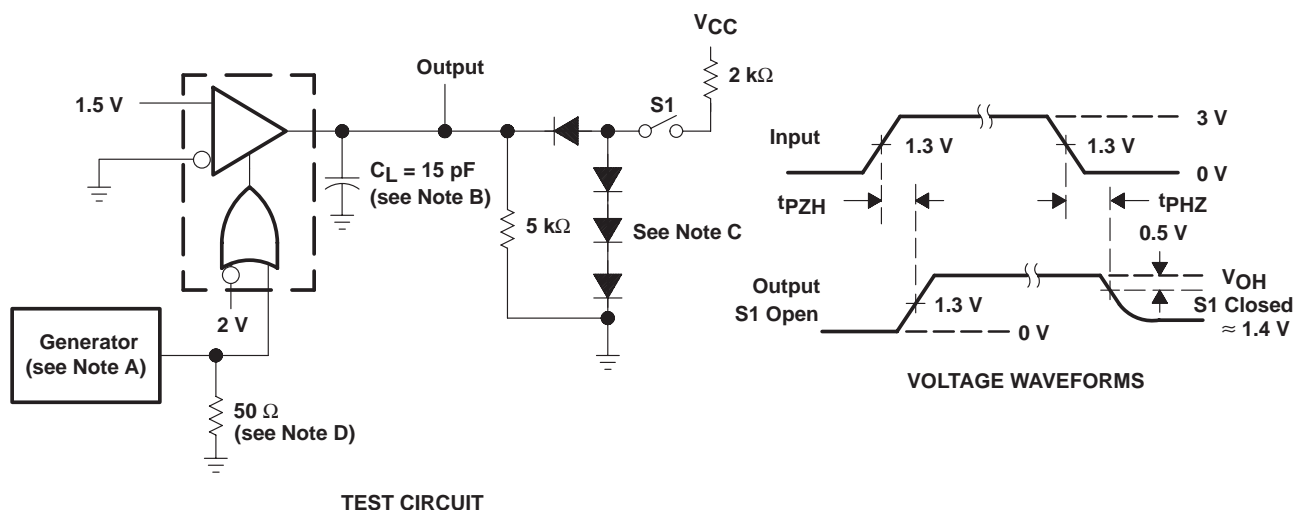


Figure 1.  $t_{pd}$  and  $t_t$  Test Circuit and Voltage Waveforms



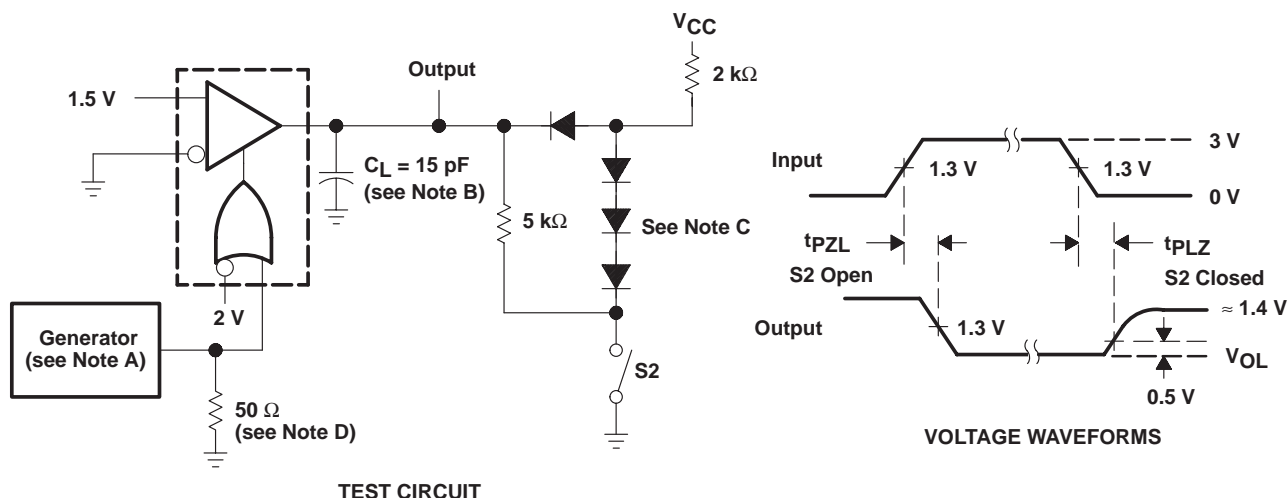
- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .  
B.  $C_L$  includes probe and jig capacitance.  
C. All diodes are 1N916 or equivalent.  
D. To test the active-low enable  $\overline{G}$ , ground G and apply an inverted input waveform to  $\overline{G}$ .

Figure 2.  $t_{PHZ}$  and  $t_{PZH}$  Test Circuit and Voltage Waveforms

## SN65LBC173, SN75LBC173 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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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.  
D. To test the active-low enable  $\overline{G}$ , ground  $\overline{G}$  and apply an inverted input waveform to  $\overline{G}$ .

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

### TYPICAL CHARACTERISTICS

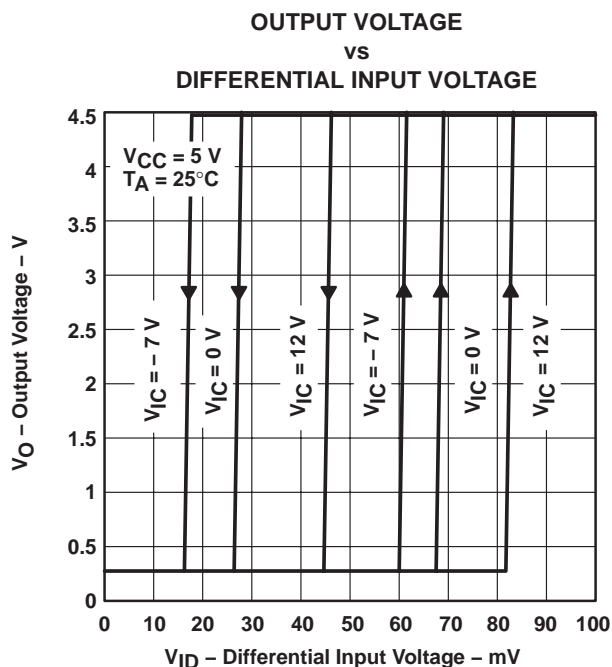


Figure 4

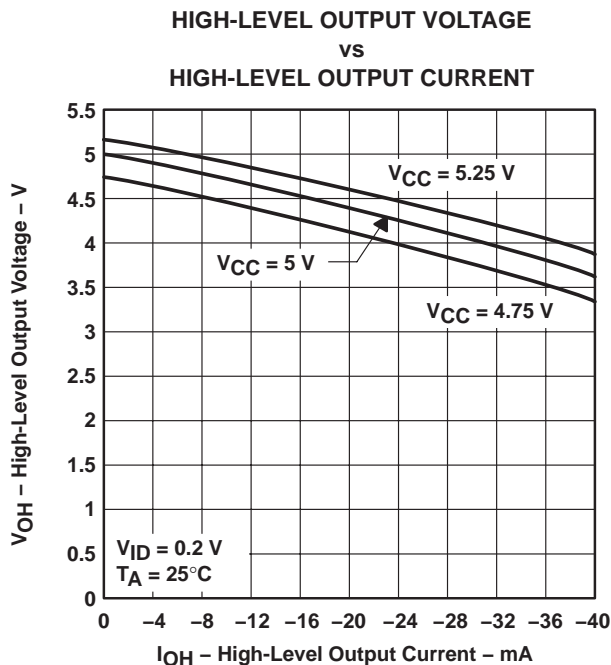


Figure 5

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## TYPICAL CHARACTERISTICS

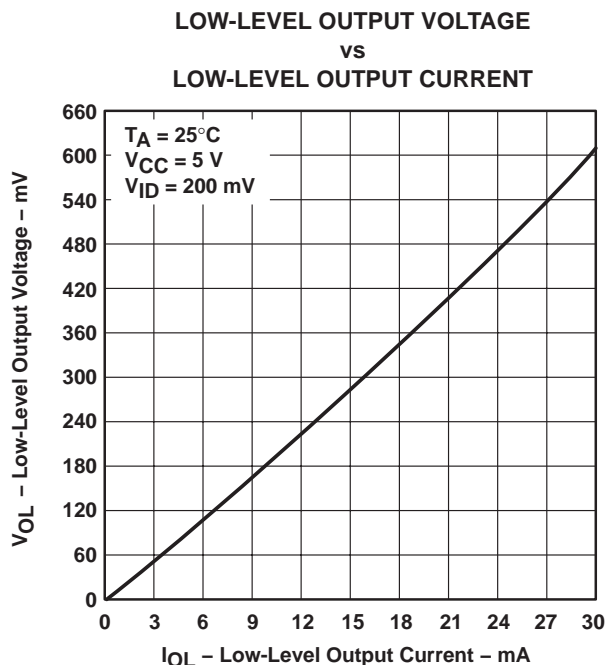


Figure 6

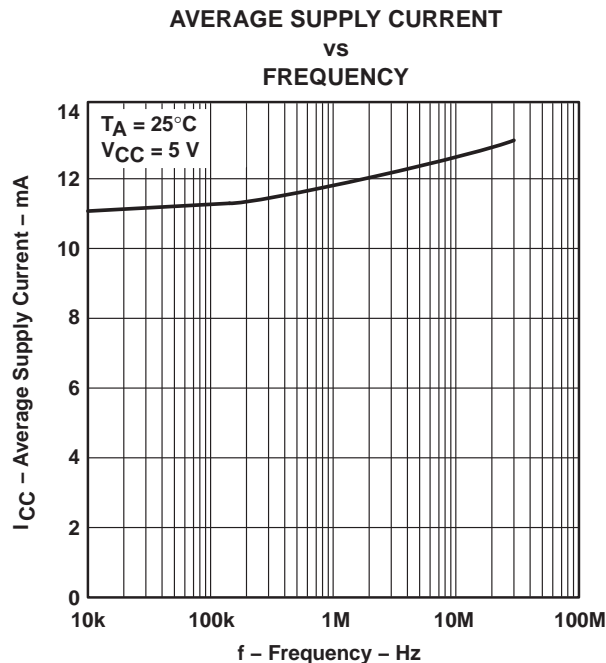


Figure 7

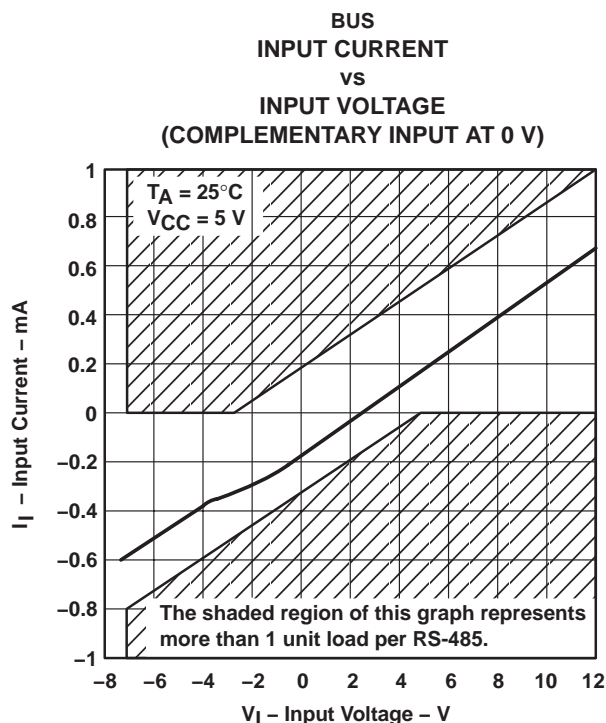


Figure 8

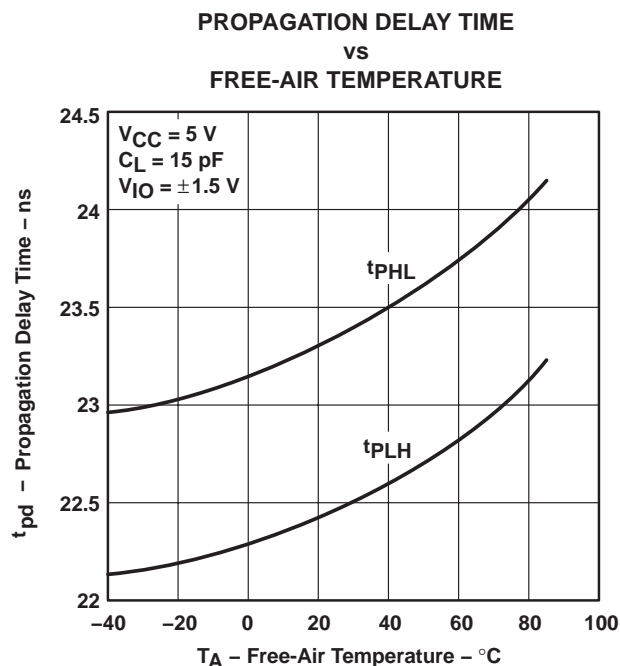


Figure 9



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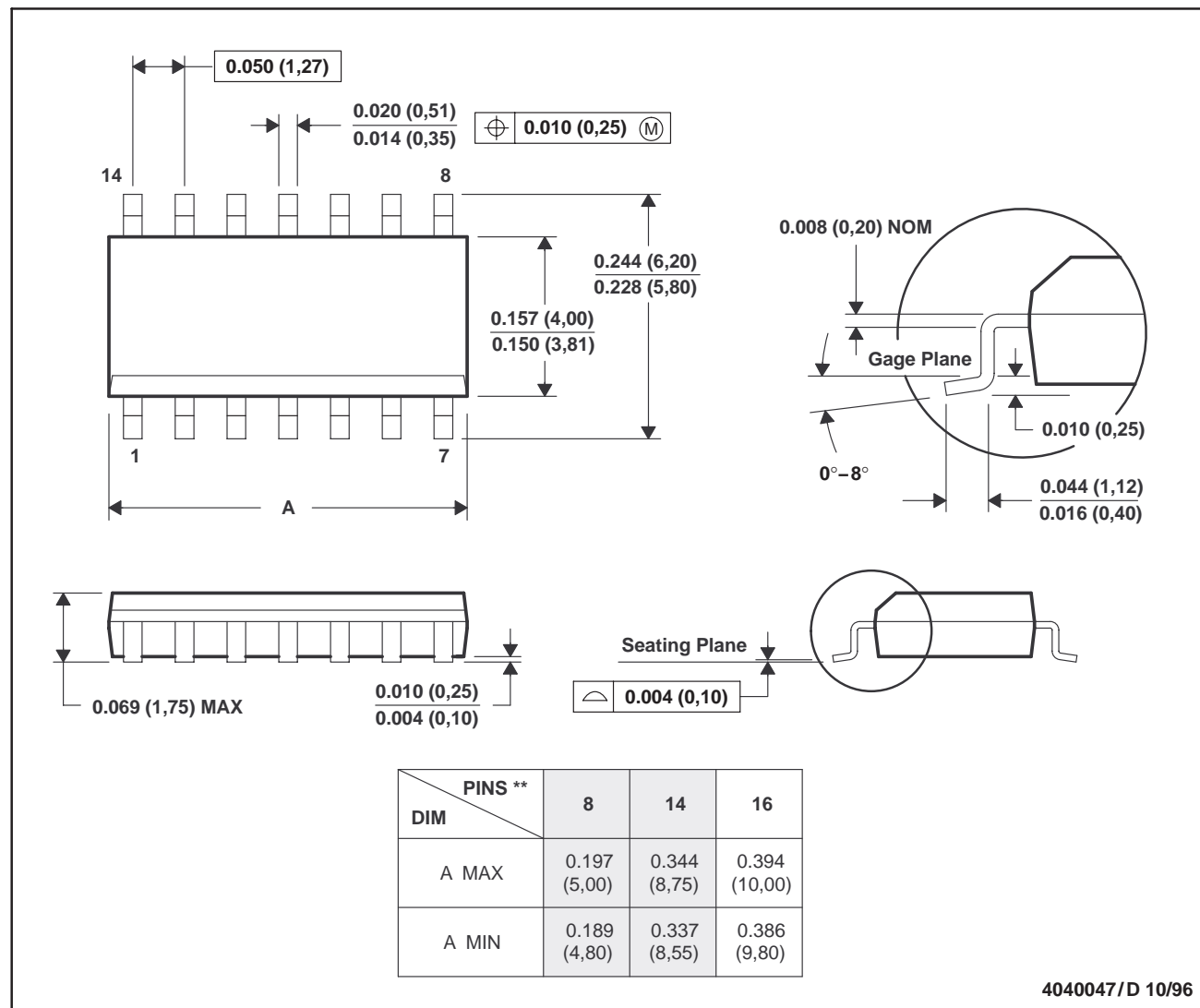
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## **MECHANICAL DATA**

**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

**SN65LBC173, SN75LBC173**  
**QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS**

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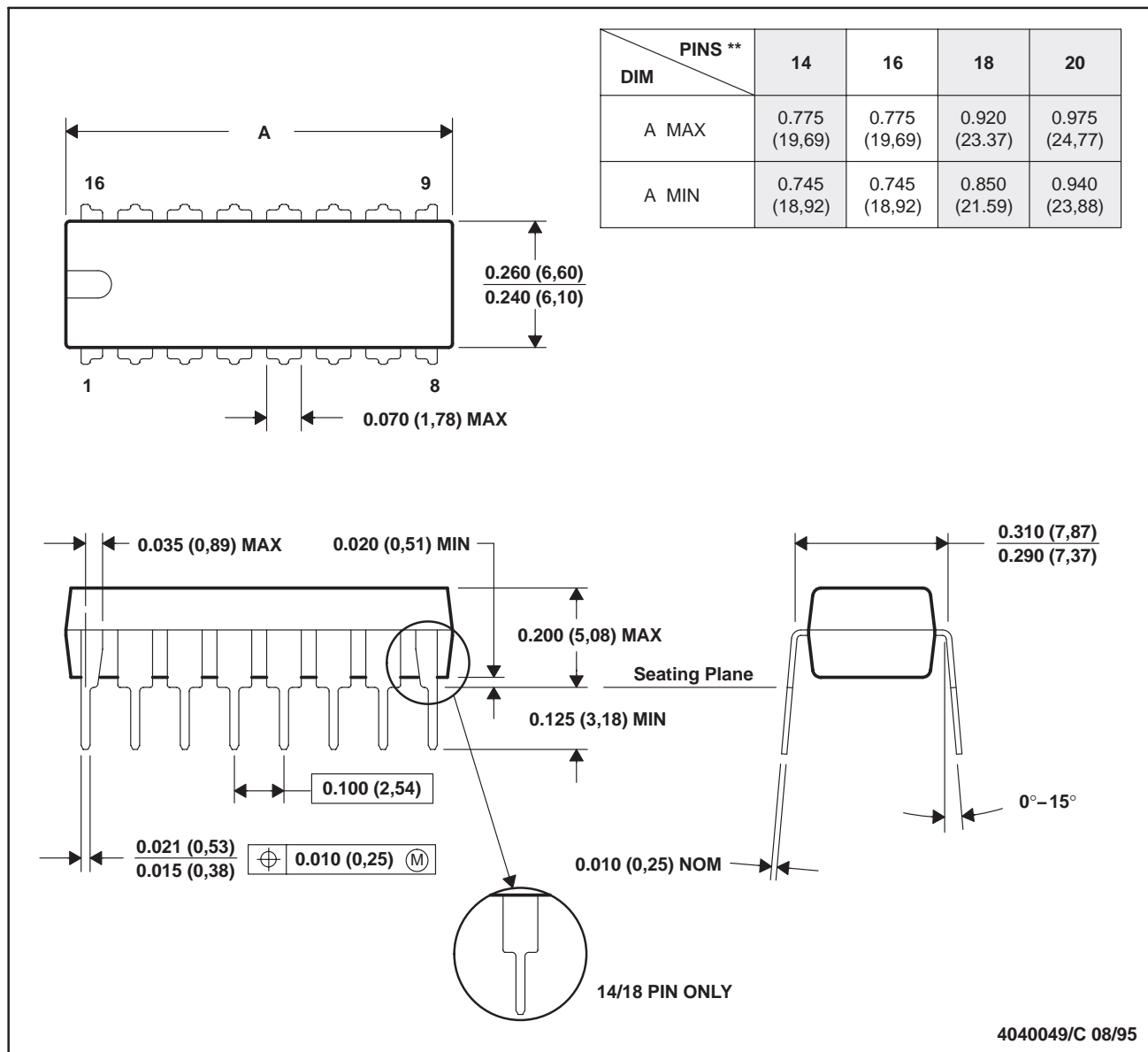
## MECHANICAL DATA

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

**16 PIN SHOWN**

## PLASTIC DUAL-IN-LINE PACKAGE

<b>PINS **</b> <b>DIM</b>	<b>14</b>	<b>16</b>	<b>18</b>	<b>20</b>
<b>A MAX</b>	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	0.975 (24,77)
<b>A MIN</b>	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)



- 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 then MS-001.)

### 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>
SN65LBC173D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC173DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC173DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC173DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC173N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN65LBC173NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75LBC173D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC173DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC173DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC173DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC173N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75LBC173NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

<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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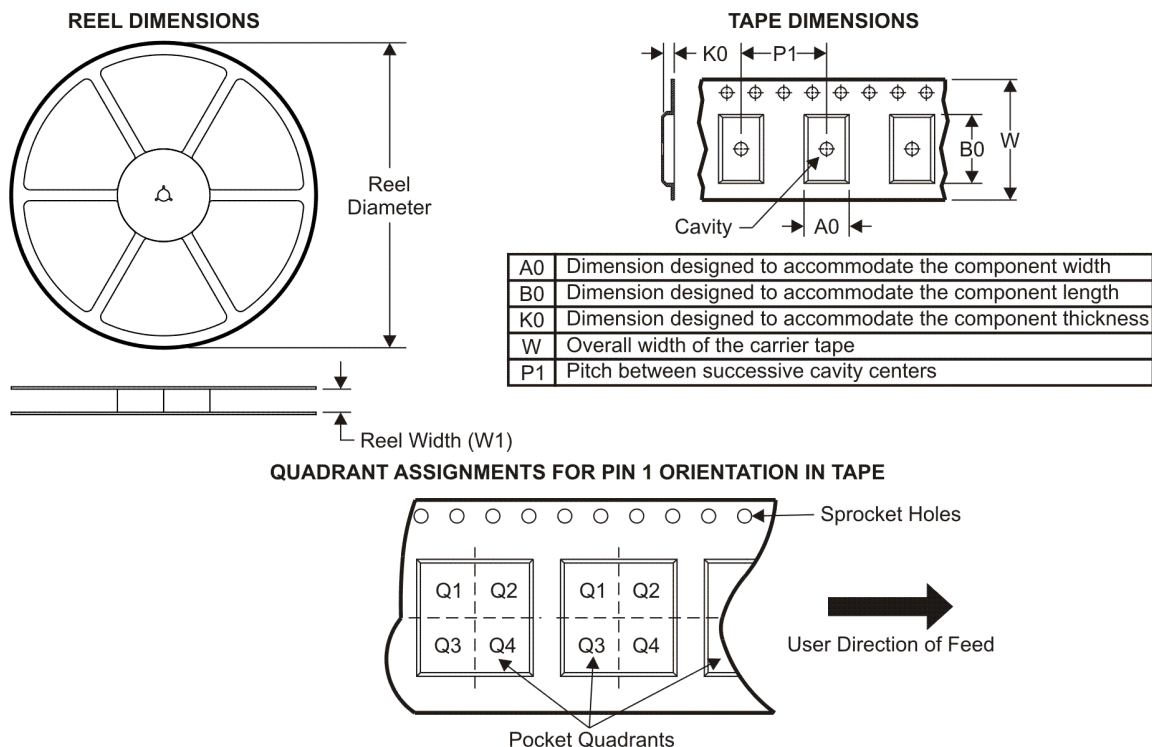
**OTHER QUALIFIED VERSIONS OF SN75LBC173 :**

- Military: [SN55LBC173](#)

NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications

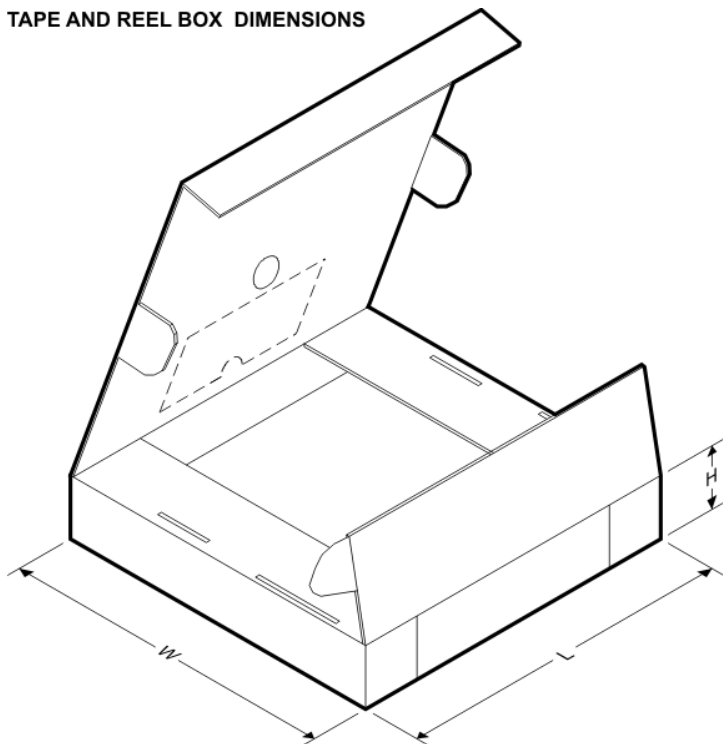
**TAPE AND REEL INFORMATION**



\*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
SN65LBC173DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN65LBC173DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN75LBC173DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN75LBC173DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65LBC173DR	SOIC	D	16	2500	333.2	345.9	28.6
SN65LBC173DR	SOIC	D	16	2500	346.0	346.0	33.0
SN75LBC173DR	SOIC	D	16	2500	346.0	346.0	33.0
SN75LBC173DR	SOIC	D	16	2500	333.2	345.9	28.6

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