SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

SLLS171G - OCTOBER 1993 - REVISED MARCH2009

- Meets or Exceeds 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 . . . ±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 LTC489

D, DW, OR N PACKAGE (TOP VIEW) 16 VCC 1В [1А Г 2 15 4B 3 1Y 🛮 14∏ 4A 1,2EN [] 4 13 **1** 4Y 2Y [5 123,4EN 11 3Y 2A 🛮 2B 🛮 7 10 3A 9**∏** 3B 8 GND [

description

The SN65LBC175 and SN75LBC175 are monolithic, quadruple, differential line receivers with 3-state outputs 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 ±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 is available in the 16-pin DIP (N), small-outline package (D), and the wide small-outline package (DW). The SN75LBC175 is available in the 16-pin DIP (N) and the small-outline package (D).

The SN65LBC175 is characterized over the industrial temperature range of –40°C to 85°C. The SN75LBC175 is characterized for operation over the commercial temperature range of 0°C to 70°C.

AVAILABLE OPTIONS

DACKACE	TEMPERATURE RANGE						
PACKAGE	0°C to 70°C	-40°C to 85°C					
SOIC	SN75LBC175D	SN65LBC175D					
Wide SOIC	_	SN65LBC175DW					
PDIP	SN75LBC175N	SN65LBC175N					



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.

LinBiCMOS is a trademark of Texas Instruments.

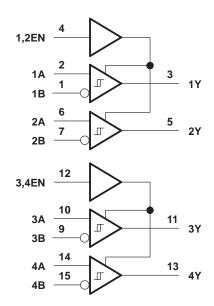


logic symbol†

1,2EN ΕN ⅎ 1A 1Y 1 1B 2A 7 2Y 2B 12 3,4EN ΕN ⅎ 10 11 3A 3Y 9 3B 14 4A 13 15 4B

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

logic diagram (positive logic)



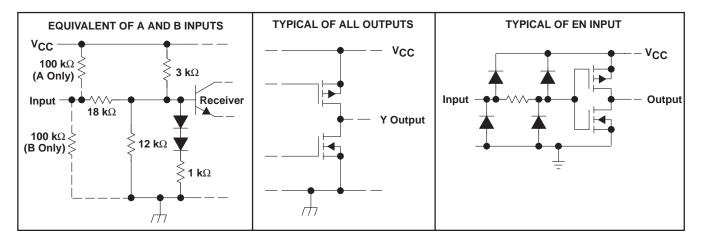
FUNCTION TABLE (each receiver)

DIFFERENTIAL INPUTS A-B	ENABLE	OUTPUT Y
V _{ID} ≥ 0.2 V	Н	Н
$-0.2 \text{ V} < \text{V}_{\text{ID}} < 0.2 \text{ V}$	Н	?
$V_{ID} \le -0.2 V$	Н	L
X	L	Z
Open circuit	Н	Н

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} (se	Differential input voltage, V _{ID} (see Note 2)					
		$-0.3 \text{ V to V}_{CC} + 0.5 \text{ V}$				
Continuous total dissipation		See Dissipation Rating Table				
Operating free-air temperature ra	ange, T _A : SN65LBC175	–40°C to 85°C				
	SN75LBC175	0°C to 70°C				
Storage temperature range, T _{sto}		–65°C to 150°C				
Electrostatic Discharge (ESD):						
5 , ,	Machine Model (MM)					
		1.5 kV				

[†] 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.

DISSIPATION RATING TABLE

PACKAGE	$T_{\mbox{A}} \le 25^{\circ}\mbox{C}$ POWER RATING			T _A = 85°C POWER RATING
D	1100 mW	8.7 mW/°C	709 mW	578 mW
DW	1200 mW	9.6 mW/°C	770 mW	625 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, VIH	FALCONIA	2			V
Low-level input voltage, V _{IL}	EN inputs			8.0	V
High-level output current, IOH				-8	mA
Low-level output current, IOL				8	mA
Operating free-air temperature, T _A	SN65LBC175	-40		85	00
	SN75LBC175	0	•	70	°C

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.

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

PARAMETER			TE	MIN	TYP [†]	MAX	UNIT		
V _{IT+}	Positive-going input three	shold voltage	$I_O = -8 \text{ mA}$			0.2	V		
VIT-	Negative-going input three	eshold voltage	IO = 8 mA			-0.2			V
V _{hys}	Hysteresis voltage (VIT-	- VIT_)					45		mV
VIK	Enable input clamp volta	ge	I _I = –18 mA				-0.9	-1.5	V
Vон	High-level output voltage		V _{ID} = 200 mV,	I _{OH} = -8 m/	A	3.5	4.5		V
VOL	Low-level output voltage		$V_{ID} = -200 \text{ mV},$	$I_{OL} = 8 \text{ mA}$			0.3	0.5	V
loz	High-impedance-state or	tput current	$V_O = 0 V \text{ to } V_{CC}$					±20	μΑ
			V _{IH} = 12 V,	$V_{CC} = 5 V$	Other inputs at 0 V		0.7	1	
١.			V _{IH} = 12 V,	$V_{CC} = 0 V$	Other inputs at 0 V		0.8	1	
11	Bus input current	A or B inputs	$V_{IH} = -7 V$,	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	
lн	High-level enable input of	urrent	V _{IH} = 5 V					±20	μΑ
IIL	I _{IL} Low-level enable input current		V _{IL} = 0 V					-20	μΑ
los	IOS Short-circuit output current		V _O = 0				-80	-120	mA
laa			Outputs enabled,	I _O = 0,	V _{ID} = 5 V		11	20	m ^
ICC	Supply current		Outputs disabled				0.9	1.4	mA

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

switching characteristics, V_{CC} = 5 V, C_L = 15 pF, T_A = 25°C

	PARAMETER	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
tPHL	Propagation delay time, high- to low-level output	$V_{ID} = -1.5 \text{ V to } 1.5 \text{ V},$	11	22	30	ns
tPLH	Propagation delay time, low- to high-level output	See Figure 1	11	22	30	ns
^t PZH	Output enable time to high level	See Figure 2		17	30	ns
tPZL	Output enable time to low level	See Figure 3		18	30	ns
tPHZ	Output disable time from high level	See Figure 2		30	40	ns
tPLZ	Output disable time from low level	See Figure 3		23	30	ns
tsk(p)	Pulse skew (tpHL - tpLH)	See Figure 2		4	6	ns
t _t	Transition time	See Figure 1		3	10	ns

PARAMETER MEASUREMENT INFORMATION

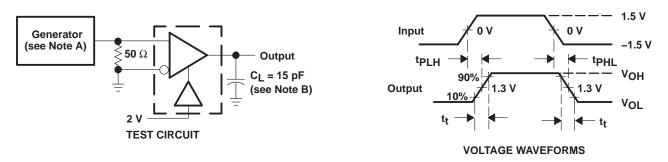
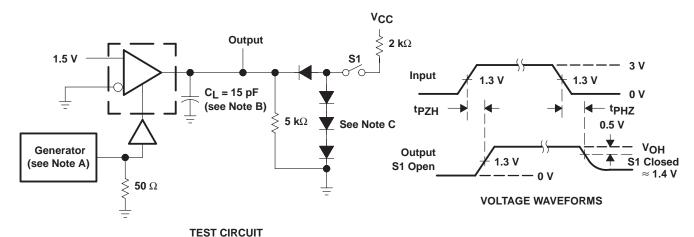


Figure 1. t_{PLH} and t_{PHL} Test Circuit and Voltage Waveforms

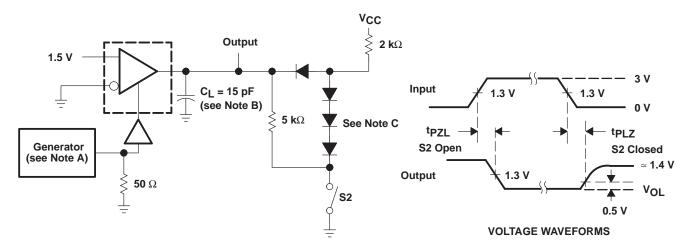


NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%, $t_{\Gamma} \le 6$ ns, $t_$

- 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

PARAMETER MEASUREMENT INFORMATION



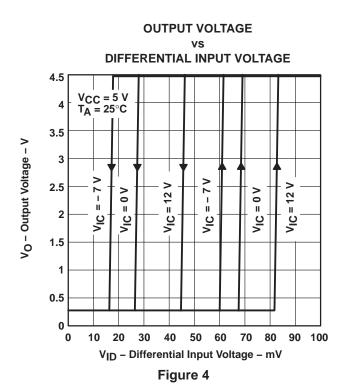
TEST CIRCUIT

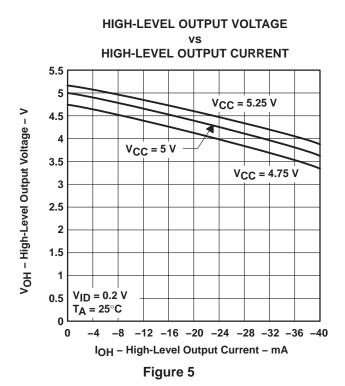
NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%, $t_{\Gamma} \le 6$ ns, $t_$

- B. C_L includes probe and jig capacitance.
- C. All diodes are 1N916 or equivalent.

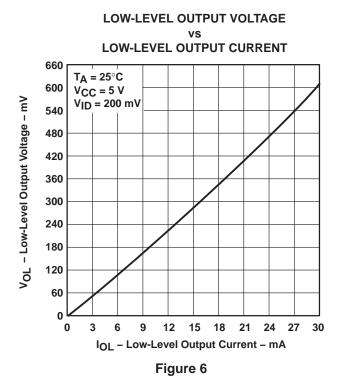
Figure 3. tpzL and tpLZ Test Circuit and Voltage Waveforms

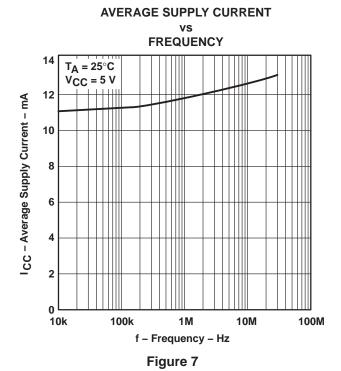
TYPICAL CHARACTERISTICS



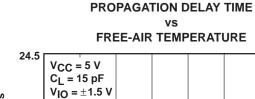


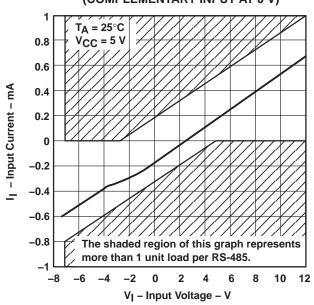
TYPICAL CHARACTERISTICS





INPUT CURRENT vs **INPUT VOLTAGE** (COMPLEMENTARY INPUT AT 0 V)





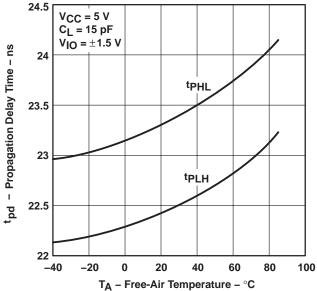


Figure 8

Figure 9





24-Apr-2015

PACKAGING INFORMATION

Orderable Device	Status	Package Type	Package	Pins	Package	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
SN65LBC175D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	65LBC175	Samples
SN65LBC175DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	65LBC175	Samples
SN65LBC175DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	65LBC175	Samples
SN65LBC175DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	65LBC175	Samples
SN65LBC175DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	65LBC175	Samples
SN65LBC175DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	65LBC175	Samples
SN65LBC175DWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	65LBC175	Samples
SN65LBC175N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	SN65LBC175N	Samples
SN75LBC175D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	75LBC175	Samples
SN75LBC175DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	75LBC175	Samples
SN75LBC175DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	75LBC175	Samples
SN75LBC175DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	75LBC175	Samples
SN75LBC175N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN75LBC175N	Samples

⁽¹⁾ 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.



PACKAGE OPTION ADDENDUM

24-Apr-2015

(2) 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)

- (3) MSL, Peak Temp. The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.
- (5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.
- (6) Lead/Ball Finish Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF SN75LBC175:

Military: SN55LBC175

NOTE: Qualified Version Definitions:

• Military - QML certified for Military and Defense Applications

PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





A0	Dimension designed to accommodate the component width
	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN65LBC175DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN65LBC175DWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
SN75LBC175DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

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*All dimensions are nominal

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Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65LBC175DR	SOIC	D	16	2500	333.2	345.9	28.6
SN65LBC175DWR	SOIC	DW	16	2000	367.0	367.0	38.0
SN75LBC175DR	SOIC	D	16	2500	333.2	345.9	28.6

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.



D (R-PDS0-G16)

PLASTIC SMALL OUTLINE



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AC.



D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.

- 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.



DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Refer to IPC7351 for alternate board design.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC—7525
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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