SLLS460A - NOVEMBER 2000 - REVISED FEBRUARY 2001

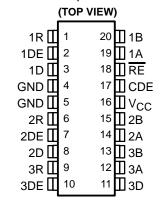
- Three Differential Transceivers in One Package
- Signaling Rates¹ Up to 30 Mbps
- Low Power and High Speed
- Designed for TIA/EIA-485, TIA/EIA-422, ISO 8482, and ANSI X3.277 (HVD SCSI Fast-20) Applications
- Common-Mode Bus Voltage Range
 7 V to 12 V
- ESD Protection on Bus Terminals Exceeds 12 kV
- Driver Output Current up to ±60 mA
- Thermal Shutdown Protection
- Driver Positive and Negative Current Limiting
- Power-Up, Power-Down Glitch-Free Operation
- Pin-Compatible With the SN75ALS171
- Available in Shrink Small-Outline Package

description

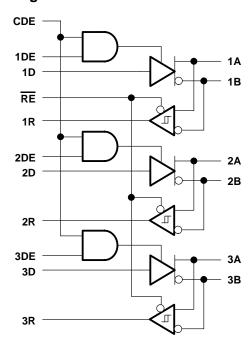
The SN65LBC171 and SN75LBC171 are monolithic integrated circuits designed for bidirectional data communication on multipoint bus-transmission lines. Potential applications include serial or parallel data transmission, cabled peripheral buses with twin axial, ribbon, or twisted-pair cabling. These devices are suitable for FAST–20 SCSI and can transmit or receive data pulses as short as 25 ns, with skew less than 3 ns.

These devices combine three 3-state differential line drivers and three differential input line receivers, all of which operate from a single 5-V power supply.

SN65LBC171DB (Marked as BL171) SN75LBC171DB (Marked as LB171) SN65LBC171DW (Marked as 65LBC171) SN75LBC171DW (Marked as 75LBC171)



logic diagram



The driver differential outputs and the receiver differential inputs are connected internally to form three differential input/output (I/O) bus ports that are designed to offer minimum loading to the bus whenever the driver is disabled or $V_{CC} = 0$. These ports feature a wide common-mode voltage range making the device suitable for party-line applications over long cable runs.

The SN75LBC171 is characterized for operation over the temperature range of 0°C to 70°C. The SN65LBC171 is characterized for operation over the temperature range of –40°C to 85°C.



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.

¹The signaling rate of a line is the number of voltage transitions that are made per second expressed in the units bps (bits per second).



AVAILABLE OPTIONS[†]

	PACKAGE				
TA	PLASTIC SHRINK SMALL-OUTLINE (JEDEC MO-150)				
0°C to 70°C	SN75LBC171DW	SN75LBC171DB			
-40°C to 85°C	SN65LBC171DW	SN65LBC171DB			

[†] Add R suffix for taped and reel

Function Tables

EACH DRIVER

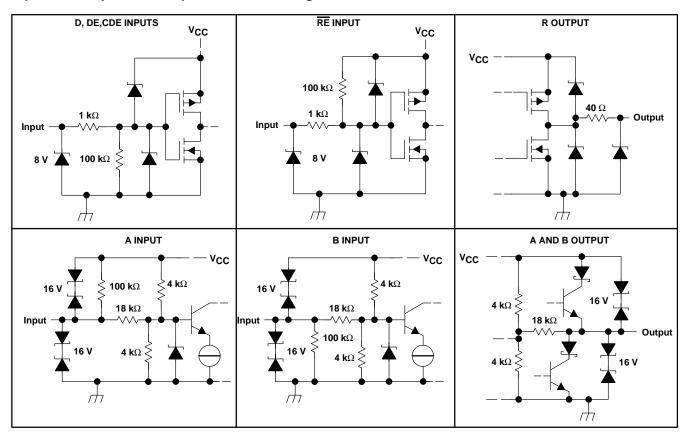
INPUT	EN/	ABLE	OUT	PUTS
D	DE	CDE	Α	В
Н	Н	Н	Н	L
L	Н	Н	L	Н
OPEN	Н	Н	L	Н
Х	L	Χ	Z	Z
Х	Х	L	Ζ	Z
Х	OPEN	Χ	Ζ	Z
Х	Х	OPEN	Ζ	Z

EACH RECEIVER

DIFFERENTIAL INPUT (V _A -V _B)	ENABLE RE	OUTPUT R
V _{ID} ≥ 0.2 V	L	Н
$-0.2 \text{ V} < \text{V}_{1D} < 0.2 \text{ V}$	L	?
$V_{ID} \le -0.2 V$	L	L
X	Н	Z
OPEN	L	Н

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

equivalent input and output schematic diagrams



SLLS460A - NOVEMBER 2000 - REVISED FEBRUARY 2001

absolute maximum ratings†

Supply voltage, V _{CC} (see Note 1)	0.3 V to 6 V
Voltage range at any bus I/O terminal (steady state)	–10 V to 15 V
Voltage input range, A and B, (transient pulse through 100 Ω , see Figure	e 12)30 V to 30 V
Voltage range at any DE, RE, or CDE terminal	$-0.5 \text{ V to V}_{CC} + 0.5 \text{ V}$
Electrostatic discharge: Human body model (A, B, GND) (see Note 2)	12 kV
All pins	5 kV
Charged-device model (all pins) (see Note 3) .	1 kV
Continuous total power dissipation	See Power Dissipation Rating Table
Storage temperature range, T _{stq}	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	

[†] 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 network ground terminal.
 - 2. Tested in accordance with JEDEC Standard 22, Test Method A114-A.
 - 3. Tested in accordance with JEDEC Standard 22, Test Method C101.

POWER DISSIPATION RATING TABLE

PACKAGE	$T_{\mbox{$A$}} \leq 25^{\circ}\mbox{$C$}$ POWER RATING	DERATING FACTOR [‡] ABOVE T _A = 25°C	T _A = 70°C POWER RATING	T _A = 85°C POWER RATING
DB	995 mW	8.0 mW/°C	635 mW	515 mW
DW	1480 mW	11.8 mW/°C	950 mW	770 mW

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

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V _{CC}		4.75	5	5.25	V
Voltage at any bus I/O terminal	А, В	-7		12	V
High-level input voltage, VIH	DE, CDE, RE	2		VCC	V
Low-level input voltage, V _{IL}	DE, CDE, RE	0		0.8	V
Differential input voltage, V _{ID}	A with respect to B	-12		12	V
Output ourroat	Driver	-60		60	A
Output current	Receiver	-8		8	mA
Operating free cir temperature T.	SN75LBC171	0		70	°C
Operating free-air temperature, T _A	SN65LBC171	-40		85	ب

DRIVER SECTION

electrical characteristics over recommended operating conditions

	PARAMETER	TEST CO	TEST CONDITIONS			MAX	UNIT
VIK	Input clamp voltage D, DE, CDE	I _I = 18 mA		-1.5	-0.7		V
٧o	Open-circuit output voltage (single-ended)	A or B, No load		0		VCC	V
		No load		3.8	4.3	VCC	V
Vod(ss)	Steady-state differential output voltage magnitude‡	$R_L = 54 \Omega$,	See Figure 1	1	1.6	2.4	V
	magnitude	With common-mode	1	1.6	2.4	V	
$\Delta V_{ extsf{OD}}$	Change in differential output voltage magnitude, V _{OD(H)} - V _{OD(L)}			-0.2		0.2	V
Voc(ss)	Steady-state common-mode output voltage	$R_L = 54 \Omega$, $C_L = 50 pF$	See Figure 1	2	2.4	2.8	V
ΔVOC(SS)	Change in steady-state common-mode output voltage $(V_{OC(H)} - V_{OC(L)})$	ос – 30 рг		-0.2		0.2	V
lį	Input current	D, DE, CDE		-100		100	μΑ
lo	Output current with power off	$V_{CC} = 0 V$,	$V_0 = -7 \text{ V to } 12 \text{ V}$	-700		900	μΑ
los	Short-circuit output current	$V_0 = -7 \text{ V to } 12 \text{ V},$	See Figure 7	-250		250	mA
ICC	Supply current (driver enabled)	D at 0 V or V _{CC} ,	CDE, DE, RE at V _{CC} , No load		14	20	mA

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

switching characteristics over recommended operating conditions

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
^t PLH	Differential output propagation delay, low-to high		4	8.5	12	
^t PHL	Differential output propagation delay, high-to-low	7	4	8.5	11	
t _r	Differential output rise time	7	3	7.5	11	
t _f	Differential output fall time	$R_L = 54 \Omega$, $C_L = 50 pF$, See Figure 3	3	7.5	11	ns
tsk(p)	Pulse skew (tpLH - tpHL)	Gee rigule 3			2	
tsk(o)	Output skew§	7			1.5	
tsk(pp)	Part-to-part skew¶	7			2	
tPLH	Differential output propagation delay, low-to high		3	7	10	
^t PHL	Differential output propagation delay, high-to-low	7	3	7.5	10	
t _r	Differential output rise time	7,	3	7.5	12	
t _f	Differential output fall time	See Figure 4, (HVD SCSI double-terminated load)	3	7.5	12	ns
tsk(p)	Pulse skew (tpLH - tpHL)	(11VD 3C3) double-terminated load)			3	
tsk(o)	Output skew§	7			1.5	
tsk(pp)	Part-to-part skew¶	7			2.5	
^t PZH	Output enable time to high level	Con Figure 5		15	25	
^t PHZ	Output disable time from high level	See Figure 5		18	25	ns
^t PZL	Output enable time to low level	See Figure 6		10	25	
^t PLZ	Output disable time from low level	See Figure 6		17	25	ns

[§] Output skew (t_{sk(0)}) 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.



[‡] 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 lower output signal into account in determining the maximum signal-transmission distance.

RECEIVER SECTION

electrical characteristics over recommended operating conditions

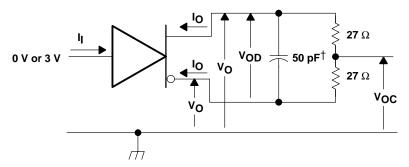
	PARAMETER	TEST CON	IDITIONS	MIN	TYP†	MAX	UNIT
V _{IT+}	Positive-going differential input voltage threshold					0.2	V
V _{IT} –	Negative-going differential input voltage threshold			-0.2			V
V _{hys}	Hysteresis voltage (V _{IT+} – V _{IT} –)				40		mV
Vон	High-level output voltage	V_{ID} = 200 mV, I_{OH} = -	V _{ID} = 200 mV, I _{OH} = -8 mA, see Figure 10		4.7	VCC	V
VOL	Low-level output voltage	$V_{ID} = -200 \text{ mV}, I_{OL} = -200 \text{ mV}$	–8 mA, see Figure 10	0	0.2	0.4	V
Ī.	Line input current	Other input = 0 V	V _I = 12 V			0.9	mA
11	Line input current	Other input = 0 v	V _I = −7 V	-0.7		mA	
II	Input current	RE		-100		100	μΑ
R _I	Input resistance	A, B		12			kΩ
Icc	Supply current (receiver enabled)	A, B, D open, RE, D	E, and CDE at 0 V			16	mA

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

switching characteristics over recommended operating conditions

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
tPLH	Propagation delay time, low-to-high level output		7		16	ns
^t PHL	Propagation delay time, high-to-low level output	\\ 3\\ to 3\\ Soo Figure 0	7		16	ns
t _r	Receiver output rise time	$V_{ID} = -3 \text{ V to } 3 \text{ V, See Figure } 9$		1.3	3	ns
t _f	Receiver output fall time	1		1.3	3	ns
^t PZH	Receiver output enable time to high level	See Figure 10		26	40	
^t PHZ	Receiver output disable time from high level	See Figure 10			40	ns
tPZL	Receiver output enable time to low level	Con Figure 44		29	40	
tPLZ	Receiver output enable time to high level	See Figure 11			40	ns
tsk(p)	Pulse skew ((tpLH - tpHL)				2	ns
t _{sk(o)}	Output skew [‡]				1.5	ns
t _{sk(pp)}	Part-to-part skew§				3	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.



†Includes probe and jig capacitance

Figure 1. Driver Test Circuit, $V_{\mbox{\scriptsize OD}}$ and $V_{\mbox{\scriptsize OC}}$ Without Common-Mode Loading

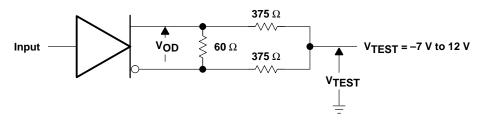
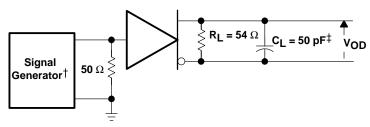


Figure 2. Driver Test Circuit, $V_{\mbox{\scriptsize OD}}$ With Common-Mode Loading



† PRR = 1 MHz, 50% Duty Cycle, $t_{\rm f}$ < 6 ns, $t_{\rm f}$ < 6 ns, $Z_{\rm O}$ = 50 Ω ‡ Includes Probe and Jig Capacitance

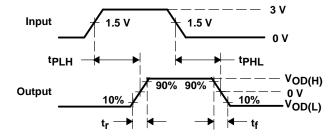
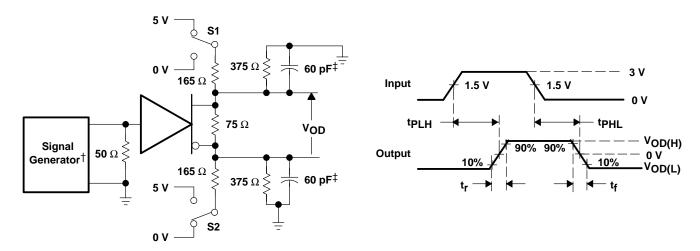
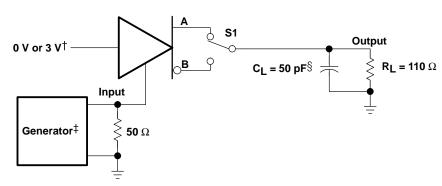


Figure 3. Driver Switching Test Circuit and Waveforms, 485-Loading



- † PRR = 1 MHz, 50% Duty Cycle, t_{f} < 6 ns, t_{f} < 6 ns, Z_{O} = 50 Ω
- ‡ Includes Probe and Jig Capacitance

Figure 4. Driver Switching Test Circuit and Waveforms, HVD SCSI-Loading (double terminated)



- † 3 V if testing A output, 0 V if testing B output
- ‡ PRR = 1 MHz, 50% Duty Cycle, t_r < 6 ns, t_f < 6 ns, Z_0 = 50 Ω
- § Includes Probe and Jig Capacitance

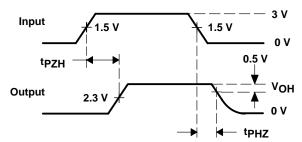
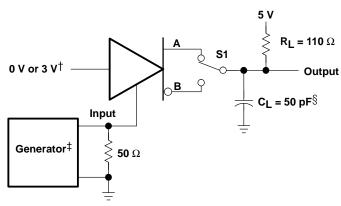
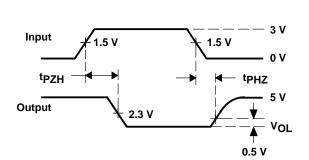


Figure 5. Driver Enable/Disable Test, High Output





- † 0 V if testing A output, 3 V if testing B output
- ‡ PRR = 1 MHz, 50% Duty Cycle, t_r < 6 ns, t_f < 6 ns, Z_O = 50 Ω
- § Includes Probe and Jig Capacitance

Figure 6. Driver Enable/Disable Test, Low Output

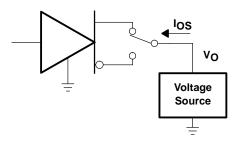


Figure 7. Driver Short-Circuit Test

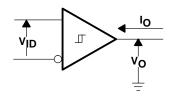
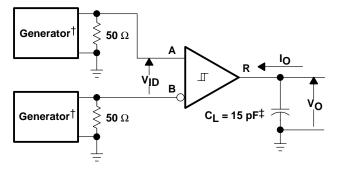


Figure 8. Receiver DC Parameters



- † PRR = 1 MHz, 50% Duty Cycle, $t_{\rm f}$ < 6 ns, $t_{\rm f}$ < 6 ns, $Z_{\rm O}$ = 50 Ω
- ‡ Includes Probe and Jig Capacitance

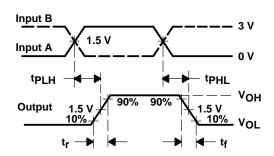
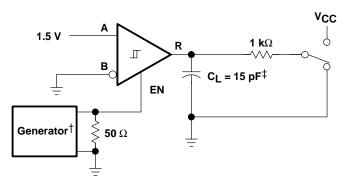
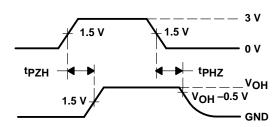


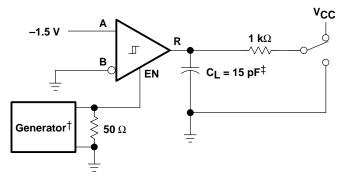
Figure 9. Receiver Switching Test Circuit and Waveforms

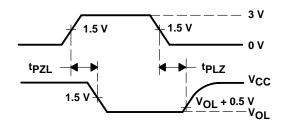




- † PRR = 1 MHz, 50% Duty Cycle, t_{f} < 6 ns, t_{f} < 6 ns, Z_{O} = 50 Ω
- ‡ Includes Probe and Jig Capacitance

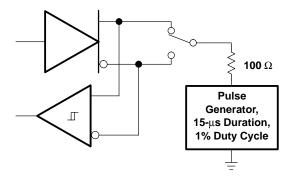
Figure 10. Receiver Enable/Disable Test, High Output





- † PRR = 1 MHz, 50% Duty Cycle, $t_{\rm f}$ < 6 ns, $t_{\rm f}$ < 6 ns, $Z_{\rm O}$ = 50 Ω
- ‡ Includes Probe and Jig Capacitance

Figure 11. Receiver Enable/Disable Test, Low Output



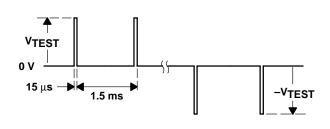
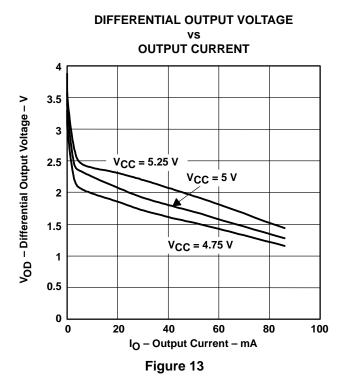
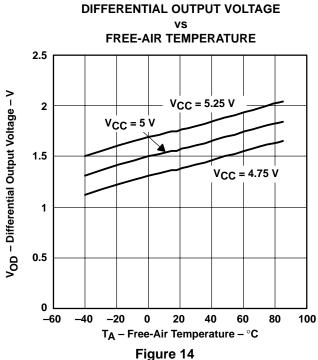
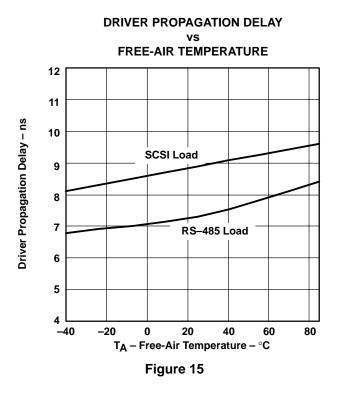
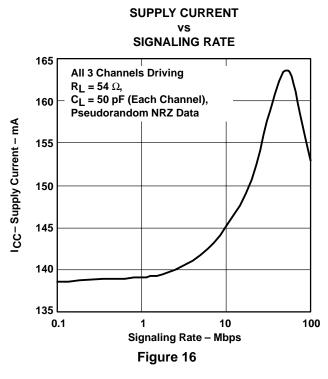


Figure 12. Test Circuit and Waveform, Transient Over Voltage Test









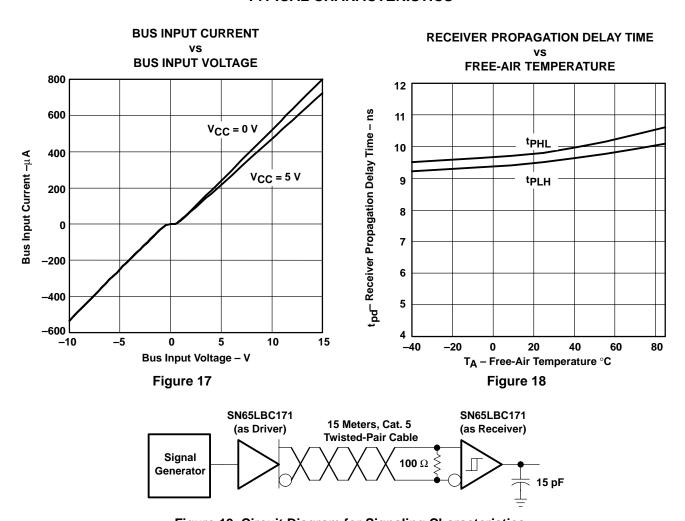


Figure 19. Circuit Diagram for Signaling Characteristics

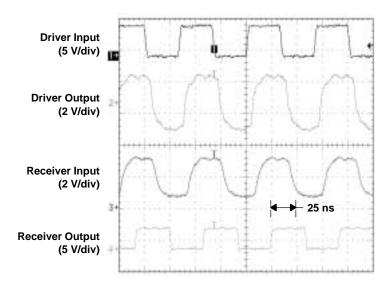


Figure 20. Signal Waveforms at 30 Mbps

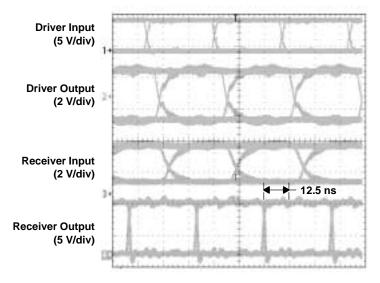


Figure 21. Eye Patterns, Pseudorandom Data at 30 Mbps

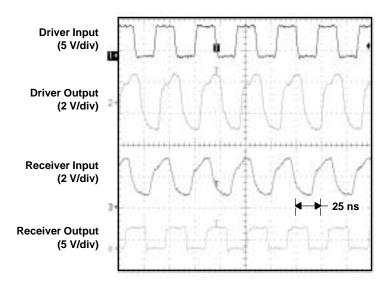


Figure 22. Signal Waveforms at 50 Mbps

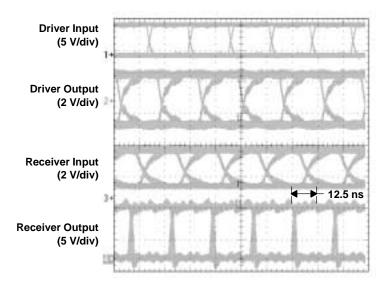


Figure 23. Eye Patterns, Pseudorandom Data at 50 Mbps

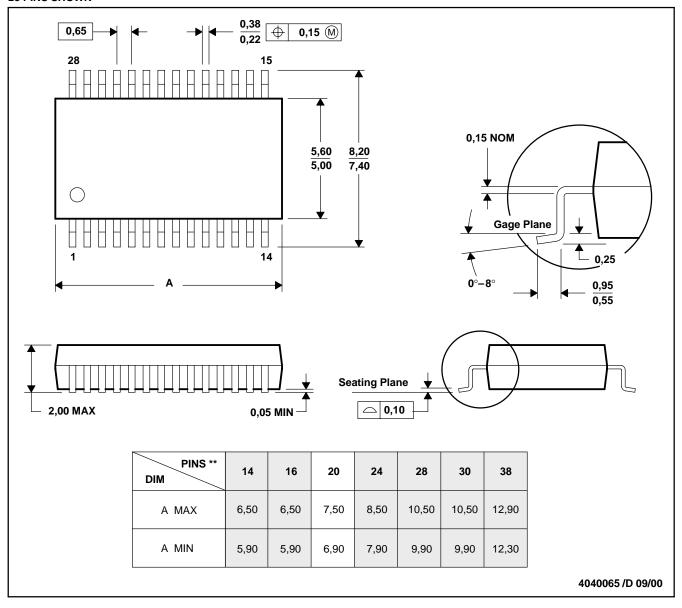
SLLS460A - NOVEMBER 2000 - REVISED FEBRUARY 2001

MECHANICAL DATA

DB (R-PDSO-G**)

28 PINS SHOWN

PLASTIC SMALL-OUTLINE



NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.

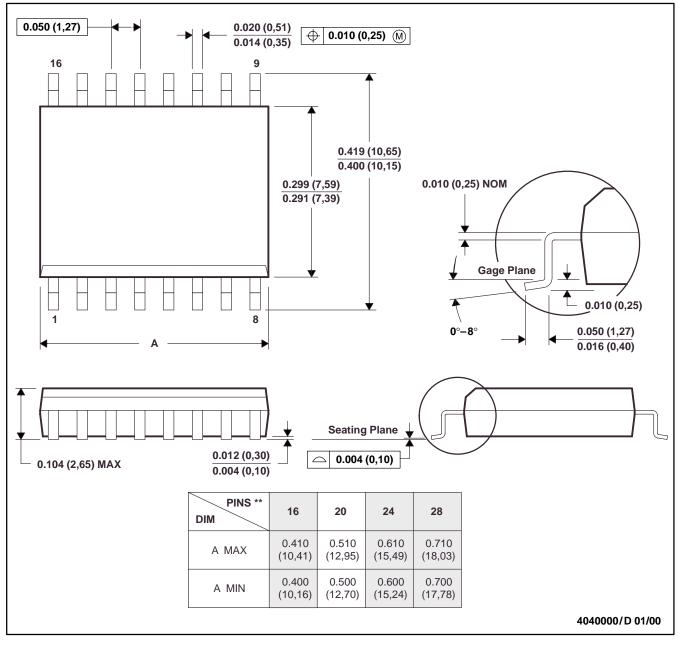
D. Falls within JEDEC MO-150

MECHANICAL DATA

DW (R-PDSO-G**)

16 PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



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



PACKAGE OPTION ADDENDUM

www.ti.com 27-Aug-2009

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Packag Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN65LBC171DB	ACTIVE	SSOP	DB	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC171DBG4	ACTIVE	SSOP	DB	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC171DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC171DBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC171DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC171DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC171DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC171DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC171DB	ACTIVE	SSOP	DB	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC171DBG4	ACTIVE	SSOP	DB	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC171DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC171DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽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.

(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.

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PACKAGE OPTION ADDENDUM

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PACKAGE MATERIALS INFORMATION

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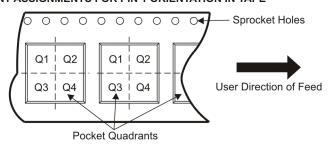
TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
B0	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
SN65LBC171DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN65LBC171DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1

www.ti.com 29-Jul-2009



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65LBC171DBR	SSOP	DB	20	2000	346.0	346.0	33.0
SN65LBC171DWR	SOIC	DW	20	2000	346.0	346.0	41.0

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