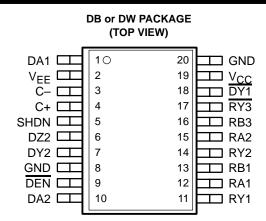
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- Single-Chip Interface Solution for the 9-terminal GeoPort<sup>™</sup> Host (DTE)
- Designed to Operate up to 4 Mbit/s Full Duplex
- Single 5-V Supply Operation
- 6-kV ESD Protection on All Terminals
- Backward compatible With AppleTalk<sup>™</sup> and LocalTalk<sup>™</sup>
- Combines Multiple Components into a Single-chip Solution
- Complements the SN75LBC777 9-Terminal GeoPort Peripheral (DCE) Interface Device
- LinBiCMOS<sup>™</sup> Process Technology

#### description



The SN75LBC776 is a low-power LinBiCMOS device that incorporates the drivers and receivers for a 9-pin GeoPort host interface. GeoPort combines hybrid EIA/TIA-422-B and EIA/TIA-423-B drivers and receivers to transmit data up to four megabits per second (Mbit/s) full duplex. GeoPort is a serial communications standard that is intended to replace the RS-232, Appletalk, and LocalTalk printer ports all in one connector in addition to providing real-time data transfer capability. It provides point-to-point connections between GeoPort-compatible devices with data transmission rates up to 4 Mbit/s full duplex and a hot-plug feature. Applications include connection to telephony, integrated services digital network (ISDN), digital sound and imaging, fax-data modems, and other serial and parallel connections. The GeoPort is backwardly compatible to both LocalTalk and AppleTalk.

While the SN75LBC776 is powered-off ( $V_{CC} = 0$ ) the outputs are in a high-impedance state. When the shutdown (SHDN) terminal is high, the charge pump is powered down and the outputs are in a high-impedance state. The driver enable ( $\overline{DEN}$ ) terminal sends the outputs of the differential driver into a high-impedance state with a high input signal. All drivers and receivers have fail-safe mechanisms to ensure a high output state when the inputs are left open.

A switched-capacitor voltage converter generates the negative voltage required from a single 5-V supply using four 0.1- $\mu$ F capacitors, two capacitors between the C+ and C- terminals and two capacitors between V<sub>EE</sub> and ground.

The SN75LBC776 is characterized for operation over the 0°C to 70°C temperature range.



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	DRIVER FUNCTION TABLE <sup>†</sup>									
INPUT	INPUT	ENABLE	ENABLE	OUTPUT	OUT	PUT				
DA1	DA2	SHDN	DEN	DY1	DY2	DZ2				
Н	Х	L	Х	L	Х	Х				
L	х	L	х	Н	Х	Х				
х	н	L	L	Х	н	L				
х	L	L	L	Х	L	Н				
OPEN	OPEN	L	L	L	н	L				
х	х	н	Х	Z	Z	Z				
х	х	х	н	Х	Z	Z				
х	х	OPEN	OPEN	Z	Z	Z				
TH – high level		– irrelevant 2 -	- indeterminate	Z – high im	hedance (	off)				

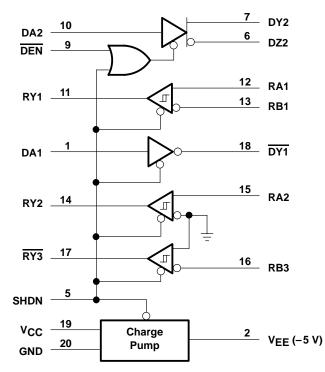
TH = high level L = low level X = irrelevant ? = indeterminate Z = high impedance (off)

<b>RECEIVER FUNCTION TABL</b>	.E†
-------------------------------	-----

INPUT RA1 RB1	INPUT RA2 & RB3	ENABLE SHDN	OUTPUT RY1	OUTPUT RY2	OUTPUT RY3
ΗL	Н	L	Н	Н	L
LH	L	L	L	L	Н
OPEN	OPEN	L	Н	Н	н
SHORT <sup>‡</sup>	SHORT <sup>‡</sup>	L	?	?	?
x x	х	н	Z	Z	Z
x x	х	OPEN	Z	Z	Z

<sup>†</sup> H = high level L = low level X = irrelevant ? = indeterminate Z = high impedance (off) <sup>‡</sup>-0.2 V < V<sub>ID</sub> < 0.2 V

### function logic diagram (positive logic)





## SN75LBC776 SINGLE-CHIP GeoPort<sup>™</sup> TRANSCEIVER

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

Positive supply voltage range, V <sub>CC</sub> (see Note 1)	–0.5 to 7 V
Negative supply voltage range, V <sub>EE</sub> (see Note 1)	
Receiver input voltage range (RA, RB)	
Receiver differential input voltage range, V <sub>ID</sub>	
Receiver output voltage range (RY)	
Driver output voltage range (Power Off) (DY1, DY2, DZ2)	
Driver output voltage range (Power On) (DY1, DY2, DZ2)	
Driver input voltage range (DA, SHND, DEN)	
Continuous total power dissipation	
Electrostatic discharge (see Note 2): (Bus terminals), Class 3, A	6 kV
(Bus terminals), Class 3, B	500 V
(All terminals), Class 3, A	6 kV
(All terminals), Class 3, B	500 V
Operating free-air temperature range, T <sub>A</sub>	
Storage temperature range, T <sub>stg</sub>	
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	
<sup>†</sup> Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the de	
functional operation of the device at these or any other conditions beyond those indicated under "reco	
interiorial operation of the device at these of any other conditions beyond those indicated under rect	sininenaca 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 network ground terminal unless otherwise noted.

2. This parameter is measured in accordance with MIL-STD-883C, Method 3015.7.

DISSIPATION RATING TABLE	
$\label{eq:ckage} \begin{array}{c} T_{A} \leq 25^\circ C & OPERATING \ FACTOR \\ POWER \ RATING & ABOVE \ T_{A} = 25^\circ C \end{array}$	R T <sub>A</sub> = 70° POWER RA

PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	OPERATING FACTOR ABOVE T <sub>A</sub> = 25°C	T <sub>A</sub> = 70°C POWER RATING
DB	1035 mW	8.3 mW/°C	660 mW
DW	1125 mW	9.0 mW/°C	720 mW



#### recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V <sub>CC</sub>		4.75	5	5.25	V
High-level input voltage, VIH	DA, SHDN, DEN	2		5.25	V
Low-level input voltage, VIL	DA, SHDN, DEN			0.8	V
Receiver common-mode input	voltage, V <sub>IC</sub>	-7		7	V
Receiver differential input volta	ge, VID	-12		12	V
Voltage-converter filter capacita	ance	0.2			μF
Voltage-converter filter-capacitor equivalent series resistance (ESR)			0.2	Ω	
Operating free-air temperature	, T <sub>A</sub>	0		70	°C

# driver electrical characteristics over operating free-air temperature range (unless otherwise noted)

	PARAMETER	TEST CONE	TEST CONDITIONS			MIN TYP MAX		
Vau	High lovel output veltage		$R_L = 12 \ k\Omega$	3.6	4.53		V	
VOH	High-level output voltage	Single ended,	$R_L = 120 \Omega$	2	3.63		V	
Ve	Low-level output voltage	See Figure 1	$R_L = 12 \ k\Omega$		-4.53	-3.6	V	
VOL	Low-level output voltage		$R_L = 120 \Omega$		-2.7	-1.8	V	
VOD	Magnitude of differential output voltage $ (V(DY) - V(DZ) $	R <sub>I</sub> = 120 Ω,	See Figure 2	4			V	
$\Delta  V_{OD} $	Change in differential voltage magnitude		_			250	mV	
Voc	Common-mode output voltage			-1		3	V	
∆VOC(SS)	Magnitude of change, common-mode steady state output voltage	See Figure 3			200	mV		
∆VOC(PP)	Magnitude of change, common-mode peak-to-peak output voltage			700		mV		
	Currente currente	SHDN = $\overline{\text{DEN}}$ = 0 V,	No load		7	15	mA	
ICC	Supply current	SHDN = $\overline{\text{DEN}}$ = 5 V,	No load			100	μA	
IOZ	High-impedance output current	$V_{O} = -10 \text{ V to } 10 \text{ V},$	$V_{CC} = 0 \text{ or } 5 \text{ V}$			±100	μA	
IOS	Short-circuit output current (see Note 3)	$V_{O} = -5 V$ to 5 V			±170	±450	mA	

NOTE 3: Not more than one output should be shorted at one time.



	PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<sup>t</sup> PHL	Propagation delay time, high-to-low level output				42	75	ns
<sup>t</sup> PLH	Propagation delay time, low-to-high level output				41	75	ns
t <sub>PZL</sub>	Driver output enable time to low-level output				25	100	μs
<sup>t</sup> PZH	Driver output enable time to high-level output		Single ended,		25	100	μs
<sup>t</sup> PLZ	Driver output disable time from low-level output	SHUN	See Figure 4		28	100	ns
<sup>t</sup> PHZ	Driver output disable time from high-level output	SHDN SHDN DEN SHDN DEN SHDN DEN	HDN Single ended, See Figure 4 HDN EN HDN Differential, See Figure 5 EN HDN		37	100	ns
t <sub>r</sub>	Rise time			10	25	75	ns
t <sub>f</sub>	Fall time			10	23	75	ns
<sup>t</sup> PHL	Propagation delay time, high-to-low level output				40	75	ns
<sup>t</sup> PLH	Propagation delay time, low-to-high level output				42	75	ns
too	Driver output enable time to low-level output	SHDN			25	100	μs
<sup>t</sup> PZL		DEN			29	150	ns
t	Driver output enable time to high-level output	SHDN	DEN SHDN DEN Differential, SHDN See Figure 5 DEN		25	100	μs
<sup>t</sup> PZH		DEN	Differential,		35	150	ns
<b>4</b>	Driver evenut dischle time from level even etter	SHDN	See Figure 5		28	100	ns
<sup>t</sup> PLZ	Driver output disable time from low-level output	DEN	HDN See Figure 4		34	100	ns
4	Driver evenut dischle time from high level evenut	SHDN			37	100	ns
<sup>t</sup> PHZ	Driver output disable time from high-level output	DEN	]		34	100	ns
t <sub>r</sub>	Rise time	-	]	10	27	75	ns
t <sub>f</sub>	Fall time		]	10	26	75	ns
<sup>t</sup> SK(p)	Pulse skew,  tpLH - tpHL					22	ns

# driver switching characteristics over operating free-air temperature range (unless otherwise noted)

# receiver electrical characteristics over operating free-air temperature range (unless otherwise noted)

	PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
VIT+	Positive-going input threshold voltage						200	mV
VIT-	Negative-going input threshold voltage	See Figure 6			-200			IIIV
V <sub>hys</sub>	Differential input voltage hysteresis ( $V_{IT+} - V_{IT-}$ )					50		mV
VOH	High-level output voltage (see Note 4)	V <sub>IC</sub> = 0,	I <sub>OH</sub> = -2 mA,	See Figure 6	2	4.9		V
VOL	Low-level output voltage	$V_{IC} = 0,$	I <sub>OL</sub> = 2 mA,	See Figure 6		0.2	0.8	V
	Short aircuit output ourreat	VO = 0			-85	-45		mA
los	Short-circuit output current	VO = ACC				47	+85	mA
RI	Input resistance	$V_{CC} = 0 \text{ or}$ $V_{I} = -12 \text{ V}$	5.25 V, to 12 V		6	30		kΩ

NOTE 4: When the inputs are left unconnected, receivers one and two interpret these as high-level inputs and receiver three interprets these as low-level inputs so that all outputs are at a high level.



# receiver switching characteristics over operating free-air temperature range (unless otherwise noted)

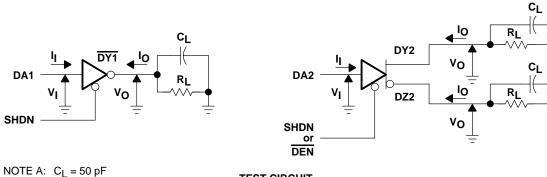
	PARAMETER	TEST C	ONDITIONS	MIN	TYP	MAX	UNIT
<sup>t</sup> PHL	Propagation delay time, high-to-low-level output				31	75	ns
<sup>t</sup> PLH	Propagation delay time, low-to-high level output				30	75	ns
t <sub>r</sub>	Rise time	$R_L = 2 k\Omega$ , See Figure 6	C <sub>L</sub> = 15 pF,		15	30	ns
t <sub>f</sub>	Fall time				15	30	ns
<sup>t</sup> SK(P)	Pulse skew  tpLH-tpHL	1				20	ns
<sup>t</sup> PZL	Receiver output enable time to low level output	Differential,			35	100	ns
<sup>t</sup> PZH	Receiver output enable time to high level output		C <sub>L</sub> =50 pF,		32	100	ns
<sup>t</sup> PLZ	Receiver output disable time from low level output	See Figure 7		21	100	ns	
<sup>t</sup> PHZ	Receiver output disable time from high level output	1			21	100	ns
<sup>t</sup> PZL	Receiver output enable time to low level output				12	25	μs
<sup>t</sup> PZH	Receiver output enable time to high level output	Single ended,	C <sub>L</sub> =50 pF,		12	25	μs
<sup>t</sup> PLZ	Receiver output disable time from low level output	See Figure 7			25	100	ns
<sup>t</sup> PHZ	Receiver output disable time from high level output	1			125	400	ns



## **SN75LBC776** SINGLE-CHIP GeoPort<sup>™</sup> TRANSCEIVER

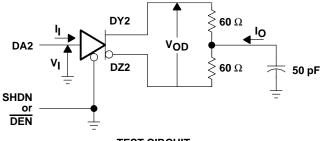
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## PARAMETER MEASUREMENT INFORMATION



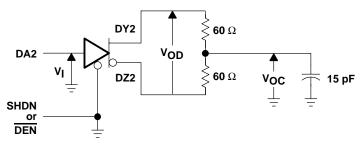
**TEST CIRCUIT** 

#### Figure 1. Single-Ended Driver DC Parameter Test

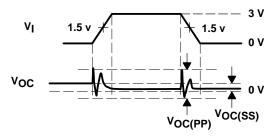


**TEST CIRCUIT** 

#### Figure 2. Differential Driver DC Parameter Test







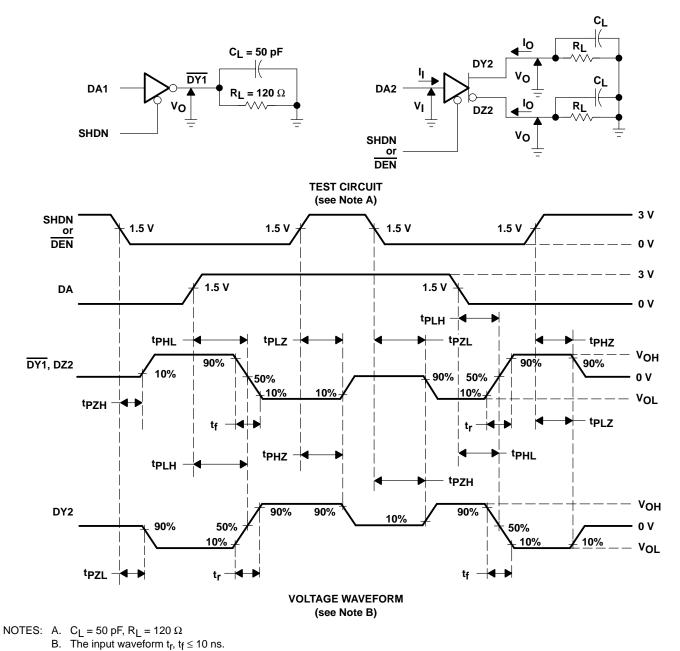
**VOLTAGE WAVEFORM** 

NOTE A: Measured 3dB bandwidth = 300 MHz

Figure 3. Differential-Driver Common-Mode Output Voltage Tests



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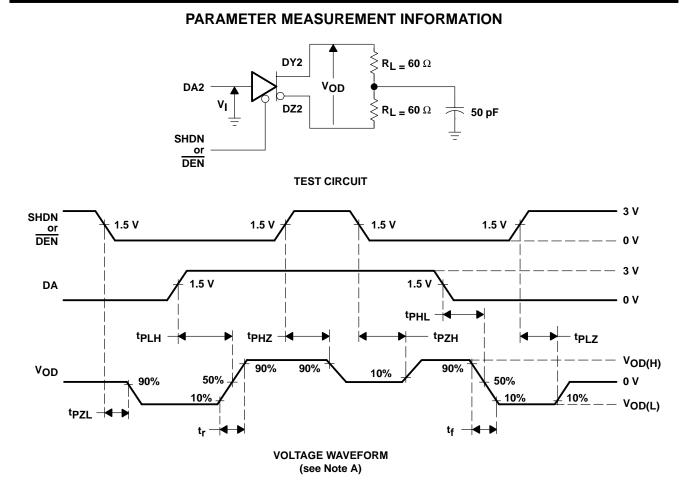


#### PARAMETER MEASUREMENT INFORMATION

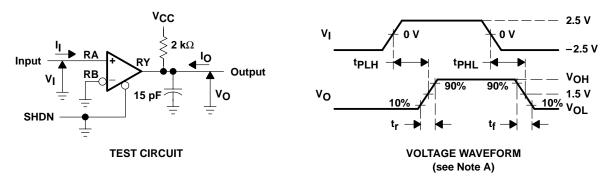


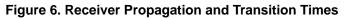


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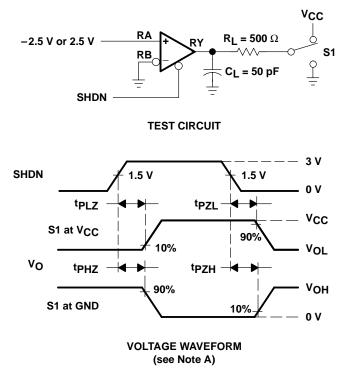




NOTE A: The input waveform  $t_r$ ,  $t_f \le 10$  ns.



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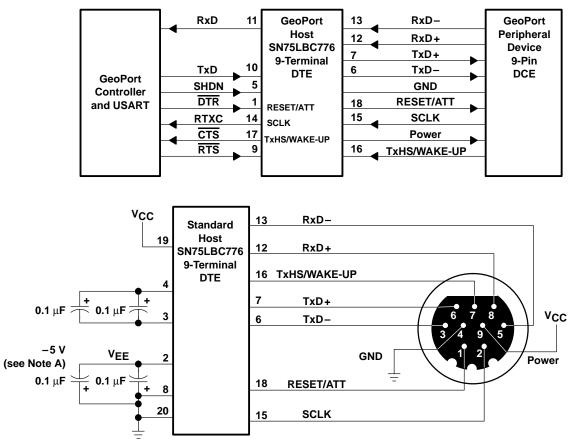


#### PARAMETER MEASUREMENT INFORMATION

NOTE A: The input waveform  $t_f$ ,  $t_f \le 10$  ns.

Figure 7. Receiver Enable and Disable Test Circuit and Waveforms





**APPLICATION INFORMATION** 

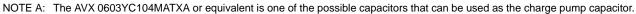


Figure 8. GeoPort 9-Terminal DTE Connection Application



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### **APPLICATION INFORMATION**

### generator characteristics

PARAMETER TEST		TEST CONDITIONS	EIA/TIA-	232/V.28	EIA/TIA-4	423/V.10	56	2	UNIT
	PARAMETER	TEST CONDITIONS	MIN	MAX	MIN	MAX	MIN	MIN MAX	
		Open circuit		25	4	6		13.2	V
IVOI	Output voltage magnitude	$3 \ k\Omega \le R_L \le 7 \ k\Omega$	5	15	NA		3.7		V
		R <sub>L</sub> = 450 Ω	NA		3.6		NA		V
VO(RING)	Output voltage ringing		NA			10%		5%	
IOS	Short-circuit output current	VO = 0		100		150		60	mA
	Dower off output ourroat	$V_{CC} = 0,  V_O  < 2 V$	300		NA		300		Ω
lO(OFF)	Power-off output current	V <sub>CC</sub> = 0,  V <sub>O</sub>   < 6 V	NA			±100	NA		μA
SR	Output voltage slew rate			30	NA		4	30	V/µs
	Transition time	$\pm 3.3$ V to $\pm 3.3$ V	NA		NA		0.22	2.1	μs
tt		$\pm 3$ V to $\pm 3$ V		0.04	NA		NA		ui†
		10% to 90%	NA			0.3	NA		ui†

 $\overline{1}$  ui is the unit interval and is the inverse of the signaling rate (bit transmit time).

#### receiver characteristics

	PARAMETER	TEST CONDITIONS	EIA/TIA-232/V.28		EIA/TIA-423/V.10		562		UNIT
FARAMETER		TEST CONDITIONS	MIN	MAX	MIN	MAX	MIN	MAX	UNIT
V	Input voltage magnitude			25		10		25	V
V	Input voltage threshold	V   < 15 V	-3	3	NA		-3	3	V
VIT		V   < 10 V	NA		-0.2	0.2	NA		v
Rı	Input resistance	3 V <  V   < 15 V	3	7	NA		3	7	kΩ
		V <sub>I</sub>   < 10 V	NA		4		NA		kΩ





10-Jun-2014

## 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)	
SN75LBC776DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		75LB776	Samples

<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.

<sup>(4)</sup> 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.

(<sup>6)</sup> 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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# PACKAGE OPTION ADDENDUM

10-Jun-2014

# PACKAGE MATERIALS INFORMATION

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### TAPE AND REEL INFORMATION

#### REEL DIMENSIONS

TEXAS INSTRUMENTS





#### TAPE DIMENSIONS



A0	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

## TAPE AND REEL INFORMATION

\*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
SN75LBC776DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1

TEXAS INSTRUMENTS

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# PACKAGE MATERIALS INFORMATION

14-Jul-2012



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75LBC776DBR	SSOP	DB	20	2000	367.0	367.0	38.0

# **MECHANICAL DATA**

MSSO002E - JANUARY 1995 - REVISED DECEMBER 2001

## DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



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



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