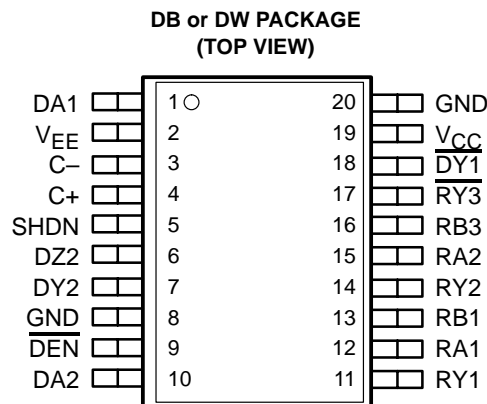


- **Single-Chip Interface Solution for the 9-terminal GeoPort™ Host (DTE)**
- **Designed to Operate up to 4 Mbit/s Full Duplex**
- **Single 5-V Supply Operation**
- **6-kV ESD Protection on All Terminals**
- **Backward compatible With AppleTalk™ and LocalTalk™**
- **Combines Multiple Components into a Single-chip Solution**
- **Complements the SN75LBC777 9-Terminal GeoPort Peripheral (DCE) Interface Device**
- **LinBiCMOS™ 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- μ F capacitors, two capacitors between the C+ and C- terminals and two capacitors between V_{EE} and ground.

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



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SN75LBC776 SINGLE-CHIP GeoPort™ TRANSCEIVER

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DRIVER FUNCTION TABLE†

INPUT DA1	INPUT DA2	ENABLE SHDN	ENABLE DEN	OUTPUT DY1	OUTPUT	
					DY2	DZ2
H	X	L	X	L	X	X
L	X	L	X	H	X	X
X	H	L	L	X	H	L
X	L	L	L	X	L	H
OPEN	OPEN	L	L	L	H	L
X	X	H	X	Z	Z	Z
X	X	X	H	X	Z	Z
X	X	OPEN	OPEN	Z	Z	Z

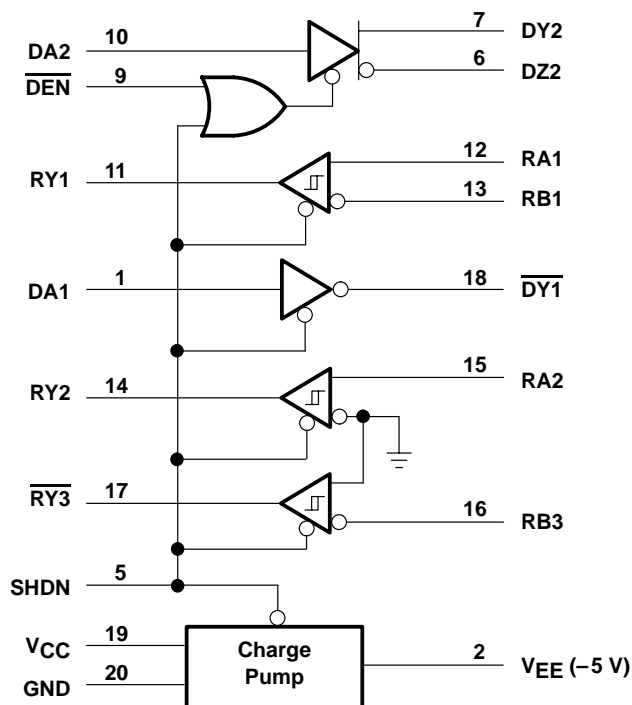
† H = high level L = low level X = irrelevant ? = indeterminate Z = high impedance (off)

RECEIVER FUNCTION TABLE†

INPUT RA1 RB1		INPUT RA2 & RB3	ENABLE SHDN	OUTPUT RY1	OUTPUT RY2	OUTPUT RY3
H	L	H	L	H	H	L
L	H	L	L	L	L	H
OPEN	OPEN	OPEN	L	H	H	H
SHORT‡	SHORT‡	SHORT‡	L	?	?	?
X	X	X	H	Z	Z	Z
X	X	X	OPEN	Z	Z	Z

† H = high level L = low level X = irrelevant ? = indeterminate Z = high impedance (off)
‡ $-0.2\text{ V} < V_{ID} < 0.2\text{ V}$

function logic diagram (positive logic)



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

Positive supply voltage range, V_{CC} (see Note 1)	–0.5 to 7 V
Negative supply voltage range, V_{EE} (see Note 1)	–7 to 0.5 V
Receiver input voltage range (RA, RB)	–15 V to 15 V
Receiver differential input voltage range, V_{ID}	–12 to 12 V
Receiver output voltage range (RY)	–0.5 V to 5.5 V
Driver output voltage range (Power Off) ($\overline{DY1}$, DY2, DZ2)	–15 V to 15 V
Driver output voltage range (Power On) ($\overline{DY1}$, DY2, DZ2)	–11 V to 11 V
Driver input voltage range (DA, SHND, \overline{DEN})	–0.5 V to $V_{CC} + 0.4$ V
Continuous total power dissipation	See Dissipation Rating Table
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_A	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 network ground terminal unless otherwise noted.
2. This parameter is measured in accordance with MIL-STD-883C, Method 3015.7.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	OPERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING
DB	1035 mW	8.3 mW/°C	660 mW
DW	1125 mW	9.0 mW/°C	720 mW

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recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		4.75	5	5.25	V
High-level input voltage, V_{IH}	DA, SHDN, \overline{DEN}	2		5.25	V
Low-level input voltage, V_{IL}	DA, SHDN, \overline{DEN}			0.8	V
Receiver common-mode input voltage, V_{IC}		-7		7	V
Receiver differential input voltage, V_{ID}		-12		12	V
Voltage-converter filter capacitance		0.2			μ F
Voltage-converter filter-capacitor equivalent series resistance (ESR)				0.2	Ω
Operating free-air temperature, T_A		0		70	$^{\circ}$ C

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	Single ended, See Figure 1	$R_L = 12\text{ k}\Omega$	3.6	4.53		V
			$R_L = 120\ \Omega$	2	3.63		V
V_{OL}	Low-level output voltage		$R_L = 12\text{ k}\Omega$		-4.53	-3.6	V
			$R_L = 120\ \Omega$		-2.7	-1.8	V
$ V_{OD} $	Magnitude of differential output voltage $ V(DY) - V(DZ) $	$R_L = 120\ \Omega$, See Figure 2		4			V
$\Delta V_{OD} $	Change in differential voltage magnitude				250		mV
V_{OC}	Common-mode output voltage	See Figure 3		-1		3	V
$ \Delta V_{OC(SS)} $	Magnitude of change, common-mode steady state output voltage					200	mV
$ \Delta V_{OC(PP)} $	Magnitude of change, common-mode peak-to-peak output voltage				700		mV
I_{CC}	Supply current	SHDN = $\overline{DEN} = 0\text{ V}$, No load			7	15	mA
		SHDN = $\overline{DEN} = 5\text{ V}$, No load				100	μ A
I_{OZ}	High-impedance output current	$V_O = -10\text{ V to }10\text{ V}$, $V_{CC} = 0\text{ or }5\text{ V}$				± 100	μ A
I_{OS}	Short-circuit output current (see Note 3)	$V_O = -5\text{ V to }5\text{ V}$			± 170	± 450	mA

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

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
t _{PHL}	Propagation delay time, high-to-low level output	Single ended, See Figure 4		42	75	ns	
t _{PLH}	Propagation delay time, low-to-high level output			41	75	ns	
t _{PZL}	Driver output enable time to low-level output		SHDN		25	100	μs
t _{PZH}	Driver output enable time to high-level output				25	100	μs
t _{PLZ}	Driver output disable time from low-level output		SHDN		28	100	ns
t _{PHZ}	Driver output disable time from high-level output				37	100	ns
t _r	Rise time			10	25	75	ns
t _f	Fall time			10	23	75	ns
t _{PHL}	Propagation delay time, high-to-low level output		Differential, See Figure 5		40	75	ns
t _{PLH}	Propagation delay time, low-to-high level output				42	75	ns
t _{PZL}	Driver output enable time to low-level output	SHDN			25	100	μs
		$\overline{\text{DEN}}$			29	150	ns
t _{PZH}	Driver output enable time to high-level output	SHDN			25	100	μs
		$\overline{\text{DEN}}$			35	150	ns
t _{PLZ}	Driver output disable time from low-level output	SHDN			28	100	ns
		$\overline{\text{DEN}}$			34	100	ns
t _{PHZ}	Driver output disable time from high-level output	SHDN			37	100	ns
		$\overline{\text{DEN}}$			34	100	ns
t _r	Rise time			10	27	75	ns
t _f	Fall time			10	26	75	ns
t _{SK(p)}	Pulse skew, t _{PLH} – t _{PHL}					22	ns

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _{IT+}	Positive-going input threshold voltage	See Figure 6			200	mV
V _{IT-}	Negative-going input threshold voltage			-200		
V _{hys}	Differential input voltage hysteresis (V _{IT+} – V _{IT-})				50	mV
V _{OH}	High-level output voltage (see Note 4)	V _{IC} = 0, I _{OH} = -2 mA, See Figure 6	2	4.9		V
V _{OL}	Low-level output voltage	V _{IC} = 0, I _{OL} = 2 mA, See Figure 6		0.2	0.8	V
I _{OS}	Short-circuit output current	V _O = 0	-85	-45		mA
		V _O = V _{CC}		47	+85	
R _I	Input resistance	V _{CC} = 0 or 5.25 V, V _I = -12 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.

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PHL}	Propagation delay time, high-to-low-level output	R _L = 2 kΩ, See Figure 6	C _L = 15 pF,	31	75	ns
t _{PLH}	Propagation delay time, low-to-high level output			30	75	ns
t _r	Rise time			15	30	ns
t _f	Fall time			15	30	ns
t _{SK(P)}	Pulse skew t _{PLH} –t _{PHL}				20	ns
t _{PZL}	Receiver output enable time to low level output	Differential, See Figure 7	C _L =50 pF,	35	100	ns
t _{PZH}	Receiver output enable time to high level output			32	100	ns
t _{PLZ}	Receiver output disable time from low level output			21	100	ns
t _{PHZ}	Receiver output disable time from high level output			21	100	ns
t _{PZL}	Receiver output enable time to low level output	Single ended, See Figure 7	C _L =50 pF,	12	25	μs
t _{PZH}	Receiver output enable time to high level output			12	25	μs
t _{PLZ}	Receiver output disable time from low level output			25	100	ns
t _{PHZ}	Receiver output disable time from high level output			125	400	ns

PARAMETER MEASUREMENT INFORMATION

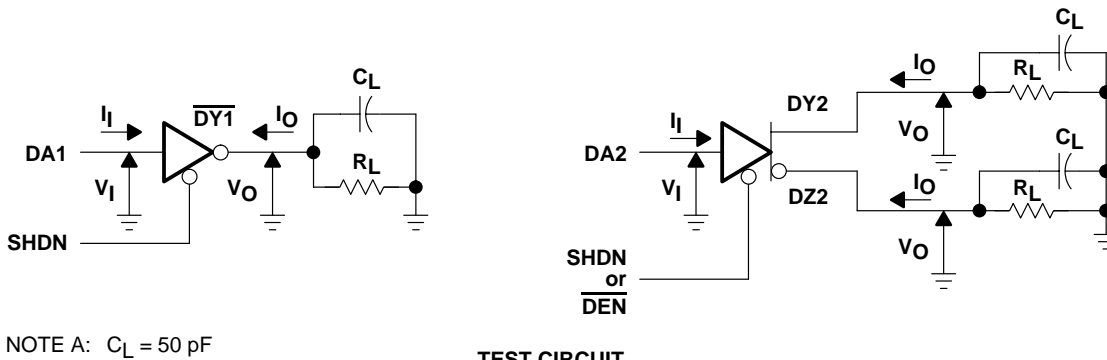


Figure 1. Single-Ended Driver DC Parameter Test

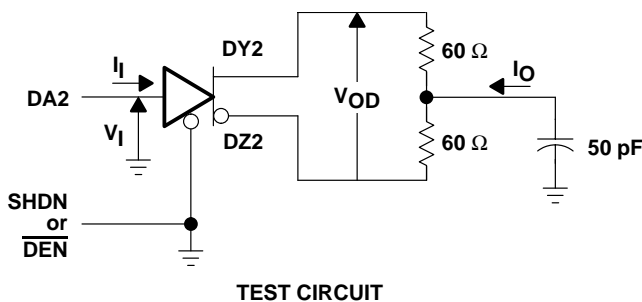
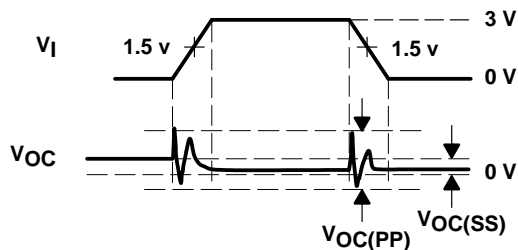
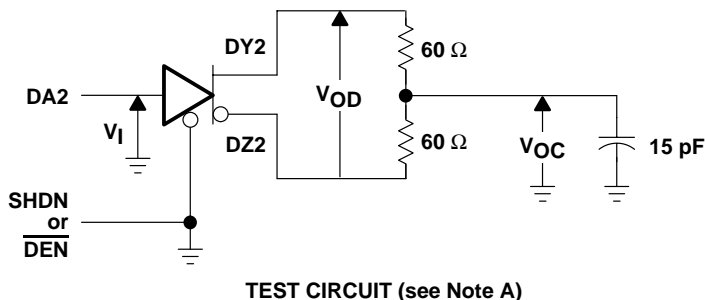


Figure 2. Differential Driver DC Parameter Test



NOTE A: Measured 3dB bandwidth = 300 MHz

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

PARAMETER MEASUREMENT INFORMATION

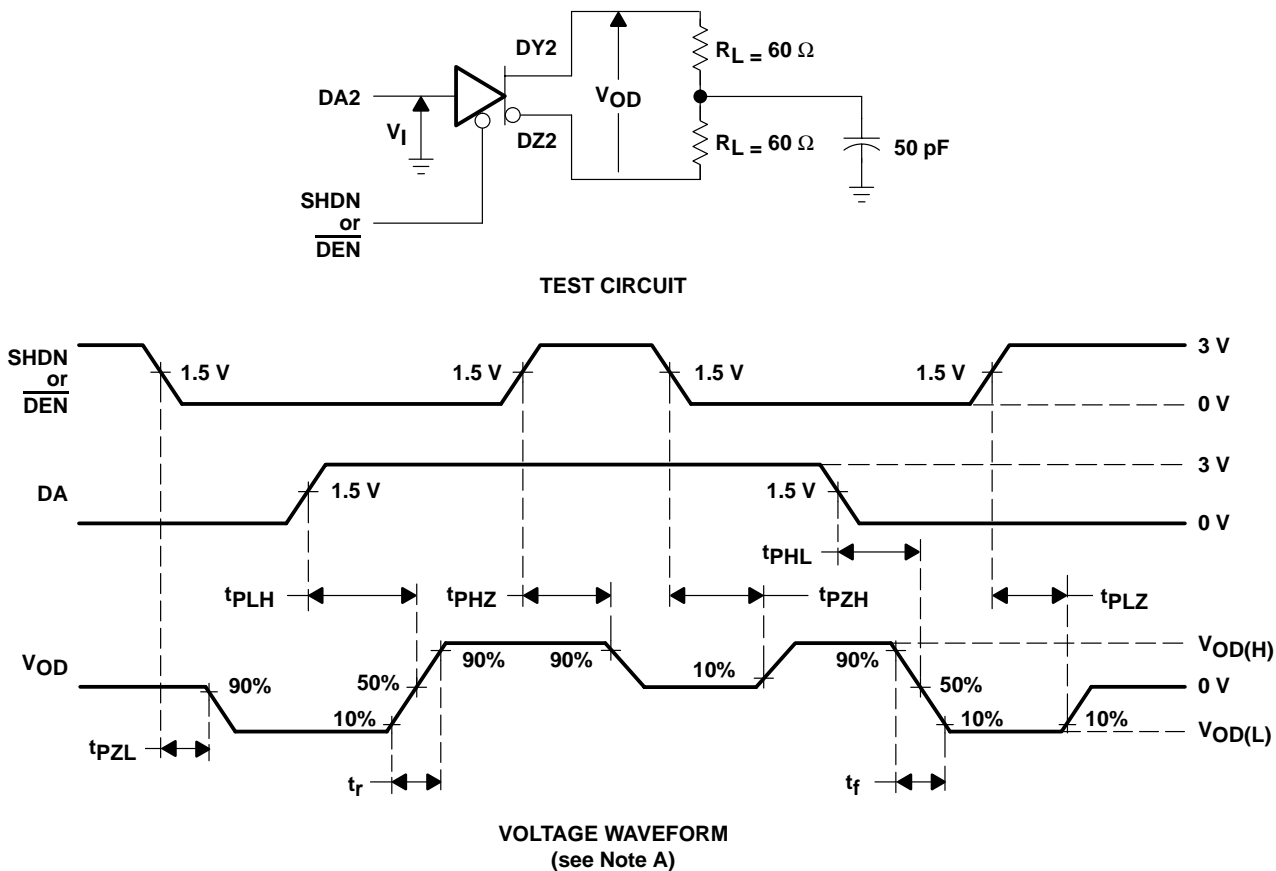


Figure 5. Differential Driver Propagation and Transition Times

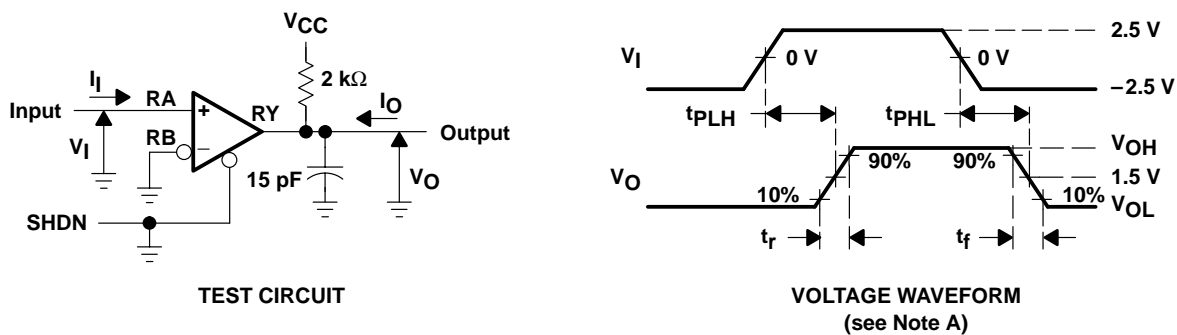


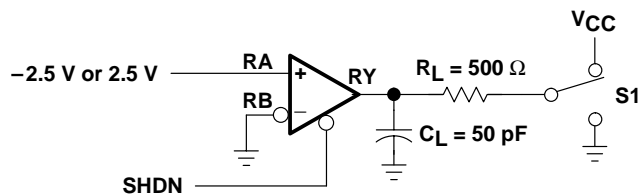
Figure 6. Receiver Propagation and Transition Times

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

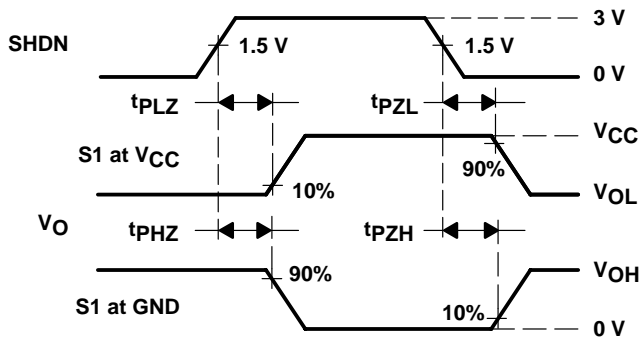
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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

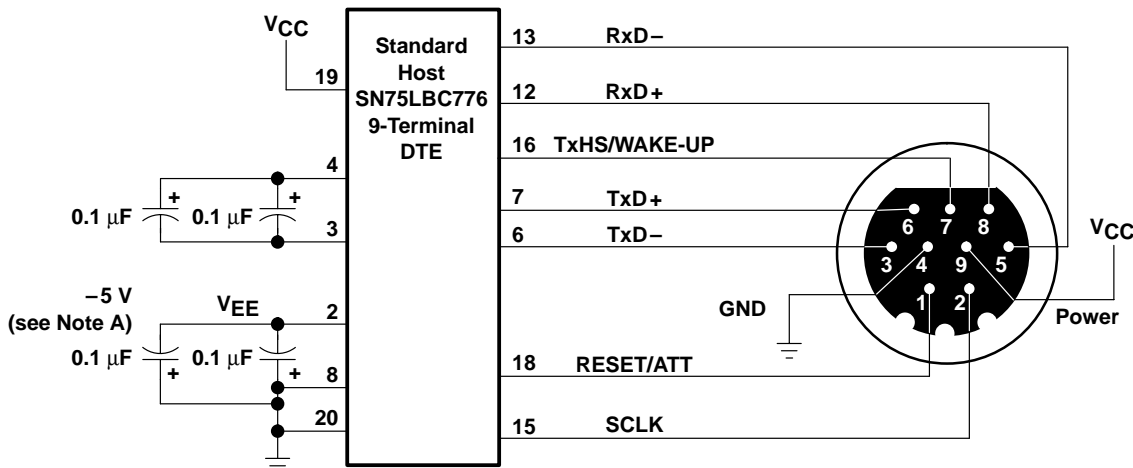
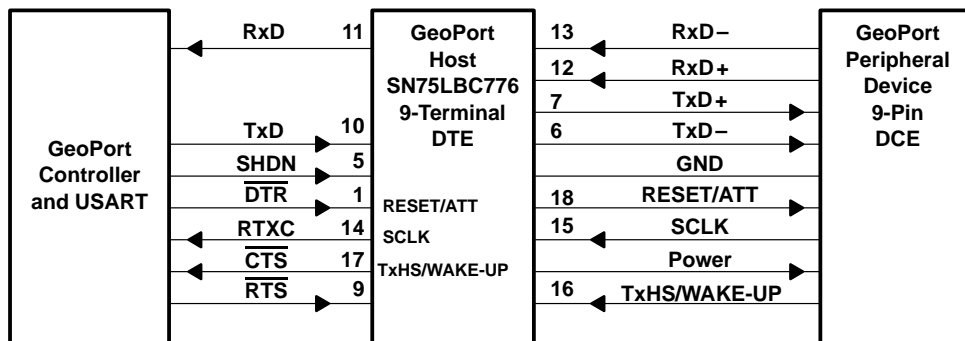


VOLTAGE WAVEFORM
(see Note A)

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

Figure 7. Receiver Enable and Disable Test Circuit and Waveforms

APPLICATION INFORMATION



NOTE A: The AVX 0603YC104MATXA or equivalent is one of the possible capacitors that can be used as the charge pump capacitor.

Figure 8. GeoPort 9-Terminal DTE Connection Application

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APPLICATION INFORMATION

generator characteristics

PARAMETER	TEST CONDITIONS	EIA/TIA-232/V.28		EIA/TIA-423/V.10		562		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
V _O	Open circuit		25	4	6		13.2	V
	3 kΩ ≤ R _L ≤ 7 kΩ	5	15	NA		3.7		V
	R _L = 450 Ω	NA		3.6		NA		V
V _O (RING)	Output voltage ringing	NA			10%		5%	
I _{OS}	Short-circuit output current	V _O = 0	100		150		60	mA
I _O (OFF)	Power-off output current	V _{CC} = 0, V _O < 2 V	300	NA		300		Ω
		V _{CC} = 0, V _O < 6 V	NA		±100	NA		μA
SR	Output voltage slew rate		30	NA		4	30	V/μs
t _t	Transition time	±3.3 V to ±3.3 V	NA	NA		0.22	2.1	μs
		±3 V to ±3 V		0.04	NA	NA		ui†
		10% to 90%	NA			0.3	NA	ui†

† ui is the unit interval and is the inverse of the signaling rate (bit transmit time).

receiver characteristics

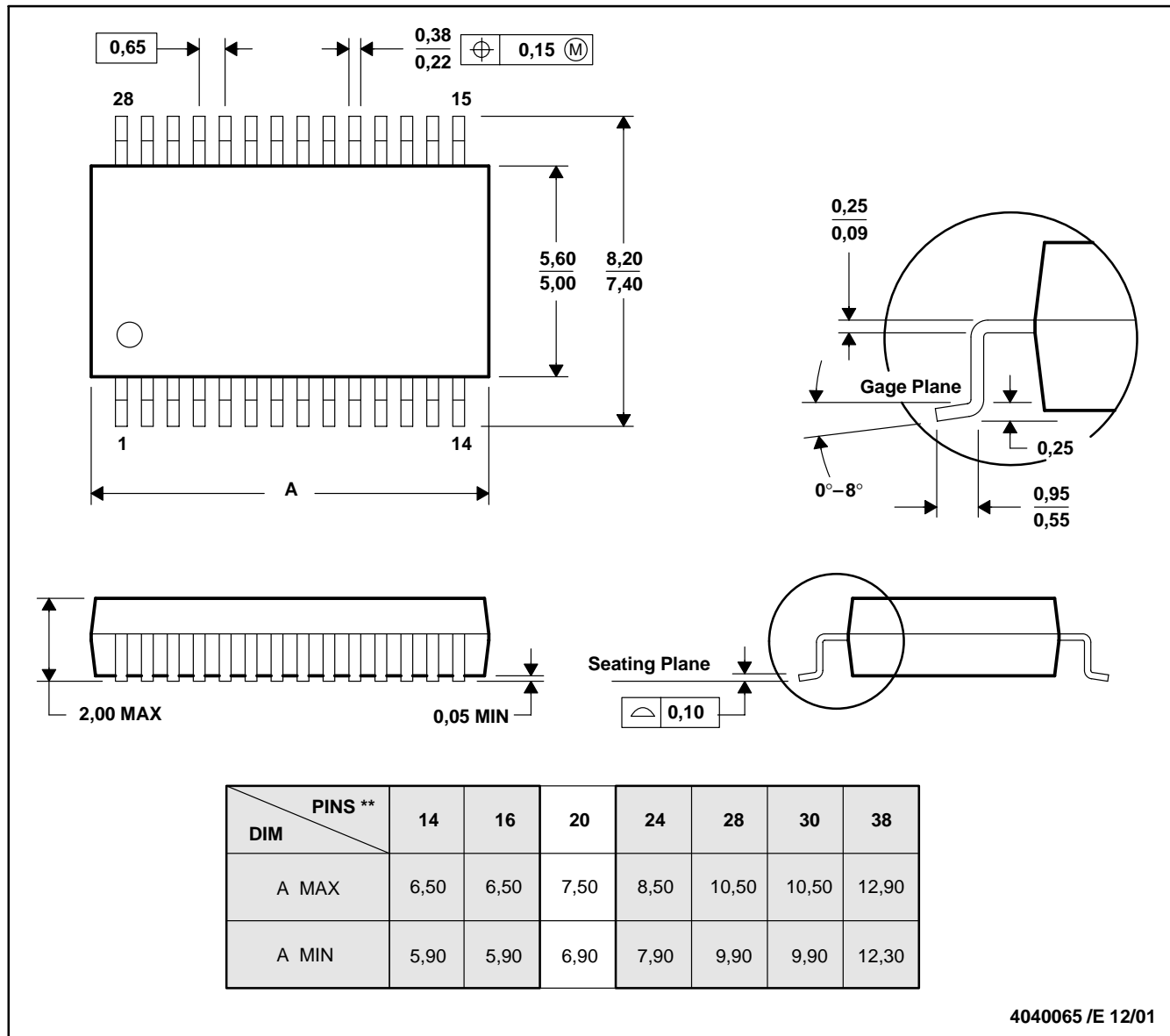
PARAMETER	TEST CONDITIONS	EIA/TIA-232/V.28		EIA/TIA-423/V.10		562		UNIT	
		MIN	MAX	MIN	MAX	MIN	MAX		
V _I	Input voltage magnitude		25		10		25	V	
V _{IT}	Input voltage threshold	V _I < 15 V	-3	3	NA		-3	3	V
		V _I < 10 V	NA		-0.2	0.2	NA		
R _I	Input resistance	3 V < V _I < 15 V	3	7	NA		3	7	kΩ
		V _I < 10 V	NA		4		NA		kΩ

MECHANICAL INFORMATION

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

MECHANICAL DATA

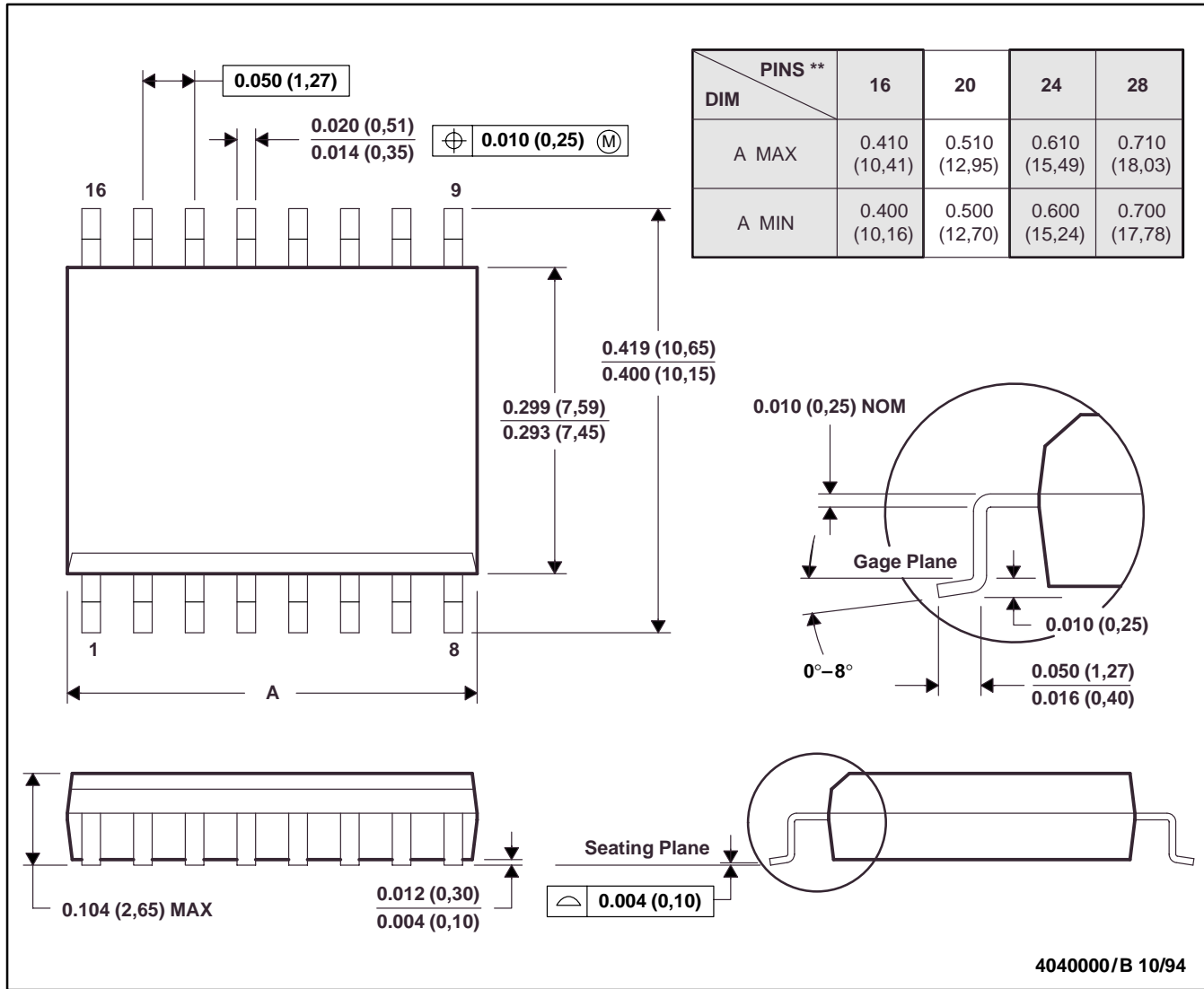
MSS0002E – JANUARY 1995 – REVISED DECEMBER 2001

MECHANICAL INFORMATION

DW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

16 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-013

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN75LBC776DB	ACTIVE	SSOP	DB	20	70	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
SN75LBC776DBR	ACTIVE	SSOP	DB	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
SN75LBC776DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC776DWR	ACTIVE	SOIC	DW	20	2000	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) 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.

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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