LOW-POWER DIFFERENTIAL LINE DRIVER AND RECEIVER PAIRS

FEATURES

- **High-Speed Low-Power LinBICMOS™ Circuitry Designed for Signaling Rates[1] of up to 30 Mbps**
- **Bus-Pin ESD Protection 15 kV HBM**
- **Low Disabled Supply-Current Requirements: 700 μA Maximum**
- **Designed for High-Speed Multipoint Data Transmission Over Long Cables**
- **Common-Mode Voltage Range of −7 V to 12 V**
- **Low Supply Current: 15 mA Max**
- **Compatible With ANSI Standard TIA/EIA-485-A and ISO 8482:1987(E)**
- **Positive and Negative Output Current Limiting**
- **Driver Thermal Shutdown Protection**

[1] Signaling rate by TIA/EIA-485-A definition restrict transition times to 30% of the bit duration, and much higher signaling rates may be achieved without this requirement as displayed in the *TYPICAL CHARACTERISTICS* of this device.

SN65LBC180AD (Marked as BL180A)
SN65LBC180AN (Marked as 65LBC180A)
SN75LBC180AD (Marked as LB180A)
SN75LBC180AN (Marked as 75LBC180A)
(TOP VIEW)

NC	1	14	V_{CC}
R	2	13	V_{CC}
$\overline{RE}$	3	12	A
DE	4	11	B
D	5	10	Z
GND	6	9	Y
GND	7	8	NC
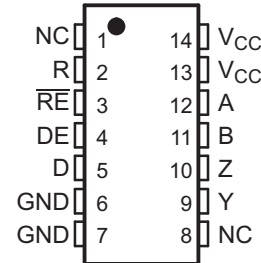
NC−No internal connection
Pins 6 and 7 are connected together internally
Pins 13 and 14 are connected together internally

DESCRIPTION

The SN65LBC180A and SN75LBC180A differential driver and receiver pairs are monolithic integrated circuits designed for bidirectional data communication over long cables that take on the characteristics of transmission lines. They are balanced, or differential, voltage mode devices that are compatible with ANSI standard TIA/EIA-485-A and ISO 8482:1987(E). The A version offers improved switching performance over its predecessors without sacrificing significantly more power.

These devices combine a differential line driver and differential input line receiver and operate from a single 5-V power supply. The driver differential outputs and the receiver differential inputs are connected to separate terminals for full-duplex operation and are designed to present minimum loading to the bus when powered off (V_{CC} = 0). These parts feature wide positive and negative common-mode voltage ranges, making them suitable for point-to-point or multipoint data bus applications. The devices also provide positive and negative current limiting for protection from line fault conditions. The SN65LBC180A is characterized for operation from −40°C to 85°C, and the SN75LBC180A is characterized for operation from 0°C to 70°C.

FUNCTION TABLE[1]

DRIVER				RECEIVER		
INPUT D	ENABLE DE	OUTPUTS		DIFFERENTIAL INPUTS A − B	ENABLE $\overline{RE}$	OUTPUT R
		Y	**Z**			
				$V_{ID} \geq 0.2$ V	L	H
H	H	H	L	-0.2 V < V_{ID} < 0.2 V	L	?
L	H	L	H	$V_{ID} \leq$ -0.2 V	L	L
X	L	Z	Z	X	H	Z
OPEN	H	H	L	Open circuit	L	H

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

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.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

LOGIC SYMBOL[1]
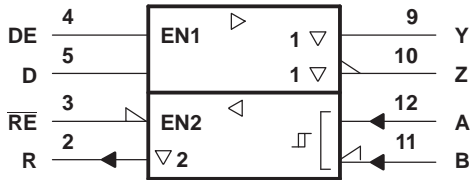
(1) This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

LOGIC DIAGRAM (POSITIVE LOGIC)
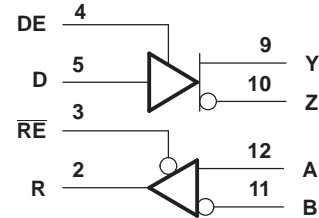
AVAILABLE OPTIONS[1]

	PACKAGE	
T_A	SMALL OUTLINE[2] (D)	PLASTIC DUAL-IN-LINE (N)
0°C to 70°C	SN75LBC180AD	SN75LBC180AN
−40°C to 85°C	SN65LBC180AD	SN65LBC180AN

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
(2) The D package is available taped and reeled. Add an R suffix to the part number (i.e., SN65LBC180ADR).

Product Folder Link(s): *SN65LBC180A SN75LBC180A*

SCHEMATICS OF INPUTS AND OUTPUTS
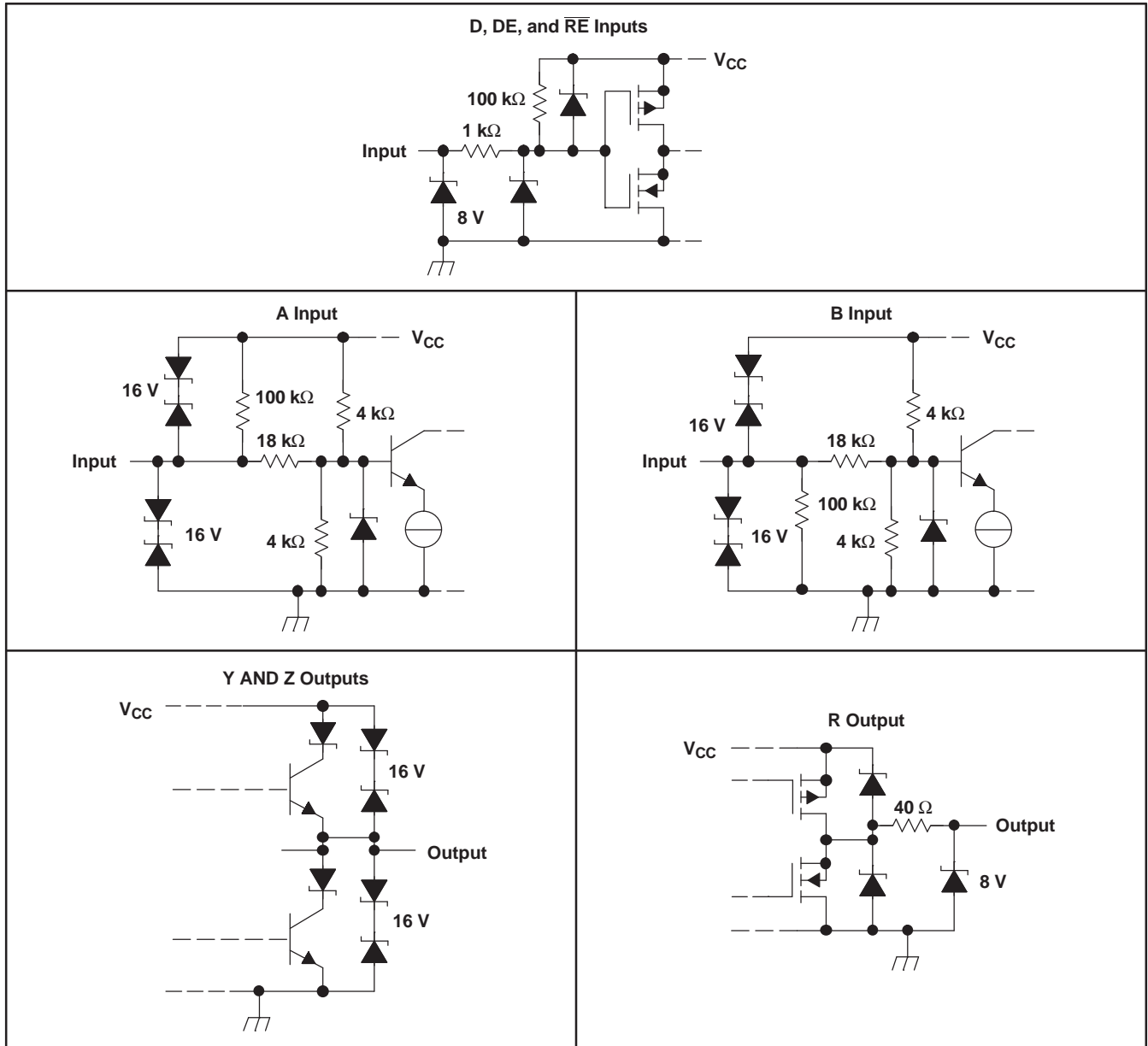
ABSOLUTE MAXIMUM RATINGS[1]

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

			UNIT
V_{CC}	Supply voltage range[2]		−0.3 V to 6 V
V_I	Input voltage range	A, B	−10 V to 15 V
	Voltage range	D, R, DE, $\overline{RE}$	−0.3 V to V_{CC} + 0.5 V
I_O	Receiver output current		±10 mA
	Continuous total power dissipation[3]		Internally limited
	Total power dissipation		See Dissipation Rating Table
ESD	Bus terminals and GND	HBM (Human Body Model) EIA/JESD22-A114[4]	±15 kV
	All pins	HBM (Human Body Model) EIA/JESD22-A114[4]	±3 kV
		MM (Machine Model) EIA/JESD22-A115	±400 V
		CDM (Charge Device Model) EIA/JESD22-C101	±1.5 kV

(1) 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.
(2) All voltage values are with respect to GND except for differential input or output voltages.
(3) The maximum operating junction temperature is internally limited. Use the dissipation rating table to operate below this temperature.
(4) Tested in accordance with MIL-STD-883C, Method 3015.7.

DISSIPATION RATINGS

PACKAGE	T_A ≤ 25°C POWER RATING	DERATING FACTOR[1] ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 85°C POWER RATING
D	950 mW	7.6 mW/°C	608 mW	494 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW

(1) 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
V_{CC}	Supply voltage		4.75	5	5.25	V
V_{IH}	High-level input voltage	D, DE, and $\overline{RE}$	2		V_{CC}	V
V_{IL}	Low-level input voltage	D, DE, and $\overline{RE}$	0		0.8	V
V_{ID}	Differential input voltage[1]		−12[2]		12	V
V_O V_I V_{IC}	Voltage at any bus terminal (separately or common mode)	A, B, Y, or Z	−7		12	V
I_{OH}	High-level output current	Y or Z	−60			mA
		R	−8			
I_{OL}	Low-level output current	Y or Z			60	mA
		R			8	
T_A	Operating free-air temperature	SN65LBC180A	−40		85	°C
		SN75LBC180A	0		70	

(1) Differential input/output bus voltage is measured at the noninverting terminal with respect to the inverting terminal.
(2) The algebraic convention, where the least positive (more negative) limit is designated minimum, is used in this data sheet.

DRIVER ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP[1]	MAX	UNIT
V_{IK}	Input clamp voltage	$I_I = -18$ mA		−1.5	−0.8		V
$|V_{OD}|$	Differential output voltage magnitude	$R_L = 54$ Ω, See Figure 1	SN65LBC180A	1	1.5	3	V
			SN75LBC180A	1.1	1.5	3	
		$R_L = 60$ Ω, See Figure 2	SN65LBC180A	1	1.5	3	V
			SN75LBC180A	1.1	1.5	3	
$\Delta|V_{OD}|$	Change in magnitude of differential output voltage[2]	See Figure 1 and Figure 2		−0.2		0.2	V
$V_{OC(ss)}$	Steady-state common-mode output voltage	See Figure 1		1.8	2.4	2.8	V
ΔV_{OC}	Change in steady-state common-mode output voltage[2]			−0.1		0.1	V
I_O	Output current with power off	$V_{CC} = 0$, $V_O = -7$ V to 12 V		−10		10	µA
I_{IH}	High-level input current	$V_I = 2$ V		−100			µA
I_{IL}	Low-level input current	$V_I = 0.8$ V		−100			µA
I_{OS}	Short-circuit output current	-7 V ≤ V_O ≤ 12 V		−250	±70	250	mA
I_{CC}	Supply current	$V_I = 0$ or V_{CC}, No load	Receiver disabled and driver enabled		5.5	9	mA
			Receiver disabled and driver disabled		0.5	1	
			Receiver enabled and driver enabled		8.5	15	

(1) All typical values are at $V_{CC} = 5$ V, $T_A = 25$°C.
(2) $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in the steady-state magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.

DRIVER SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	$R_L = 54$ Ω, $C_L = 50$ pF, See Figure 3	2	6	12	ns
t_{PHL}	Propagation delay time, high-to-low-level output		2	6	12	ns
$t_{sk(p)}$	Pulse skew ($| t_{PLH} - t_{PHL} |$)			0.3	1	ns
t_r	Differential output signal rise time		4	7.5	11	ns
t_f	Differential output signal fall time		4	7.5	11	ns
t_{PZH}	Propagation delay time, high-impedance-to-high-level output	$R_L = 110$ Ω, See Figure 4		12	22	ns
t_{PZL}	Propagation delay time, high-impedance-to-low-level output	$R_L = 110$ Ω, See Figure 5		12	22	ns
t_{PHZ}	Propagation delay time, high-level-to-high-impedance output	$R_L = 110$ Ω, See Figure 4		12	22	ns
t_{PLZ}	Propagation delay time, low-level-to-high-impedance output	$R_L = 110$ Ω, See Figure 5		12	22	ns

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RECEIVER ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP[1]	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	$I_O = -8$ mA				0.2	V
V_{IT-}	Negative-going input threshold voltage	$I_O = 8$ mA		−0.2			V
V_{hys}	Hysteresis voltage ($V_{IT+} - V_{IT-}$)				50		mV
V_{IK}	Enable-input clamp voltage	$I_I = -18$ mA		−1.5	−0.8		V
V_{OH}	High-level output voltage	$V_{ID} = 200$ mV, $I_{OH} = -8$ mA		4	4.9		V
V_{OL}	Low-level output voltage	$V_{ID} = -200$ mV, $I_{OL} = 8$ mA			0.1	0.8	V
I_{OZ}	High-impedance-state output current	$V_O = 0$ V to V_{CC}		−1		1	µA
I_{IH}	High-level enable-input current	$V_{IH} = 2.4$ V		−100			µA
I_{IL}	Low-level enable-input current	$V_{IL} = 0.4$ V		−100			µA
I_I	Bus input current	$V_I = 12$ V, $V_{CC} = 5$ V	Other input at 0 V		0.4	1	mA
		$V_I = 12$ V, $V_{CC} = 0$			0.5	1	
		$V_I = -7$ V, $V_{CC} = 5$ V		−0.8	−0.4		
		$V_I = -7$ V, $V_{CC} = 0$		−0.8	−0.3		
I_{CC}	Supply current	$V_I = 0$ or V_{CC}, No load	Receiver enabled and driver disabled		4.5	7.5	mA
			Receiver disabled and driver disabled		0.5	1	
			Receiver enabled and driver enabled		8.5	15	

(1) All typical values are at $V_{CC} = 5$ V and $T_A = 25°C$.

RECEIVER SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	$V_{ID} = -1.5$ V to 1.5 V, See Figure 7	7	13	20	ns
t_{PHL}	Propagation delay time, high-to-low-level output		7	13	20	ns
$t_{sk(p)}$	Pulse skew ($\| t_{PHL} - t_{PLH} \|$)			0.5	1.5	ns
t_r	Output signal rise time			2.1	3.3	ns
t_f	Output signal fall time	See Figure 7		2.1	3.3	ns
t_{PZH}	Output enable time to high level	$C_L = 10$ pF, See Figure 8		30	45	ns
t_{PZL}	Output enable time to low level			30	45	ns
t_{PHZ}	Output disable time from high level			20	40	ns
t_{PLZ}	Output disable time from low level			20	40	ns

PARAMETER MEASUREMENT INFORMATION
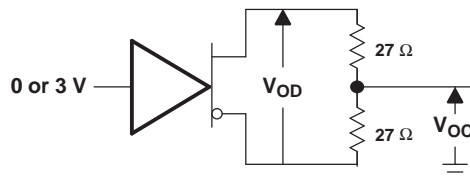
Figure 1. Driver V_{OD} and V_{OC}

Product Folder Link(s): SN65LBC180A SN75LBC180A

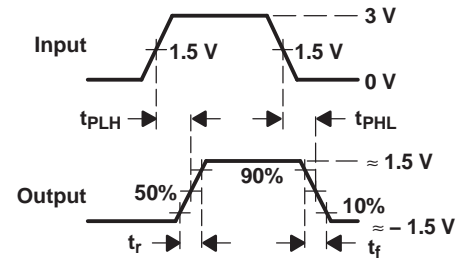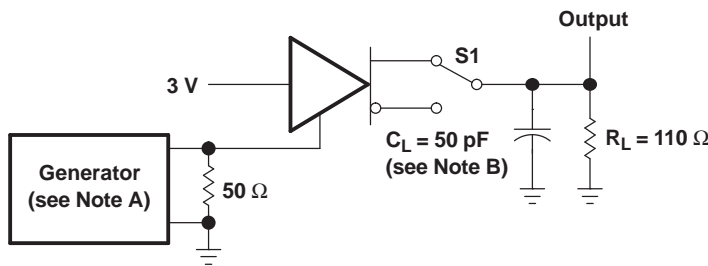## PARAMETER MEASUREMENT INFORMATION (continued)
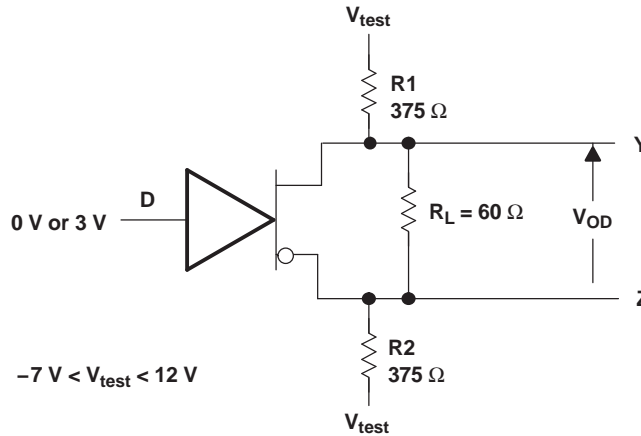
Figure 2. Driver V$_{OD}$
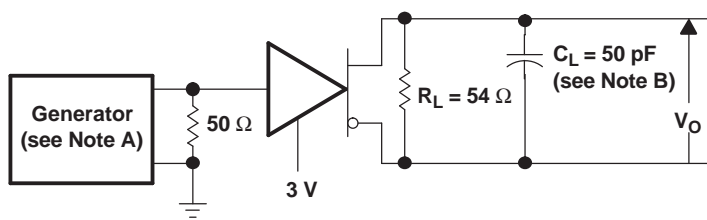
TEST CIRCUIT

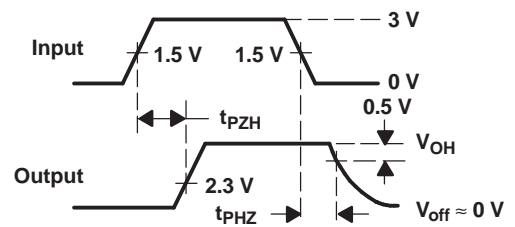**VOLTAGE WAVEFORMS**

A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

B. C_L includes probe and jig capacitance.

Figure 3. Driver Test Circuit and Voltage Waveforms

TEST CIRCUIT

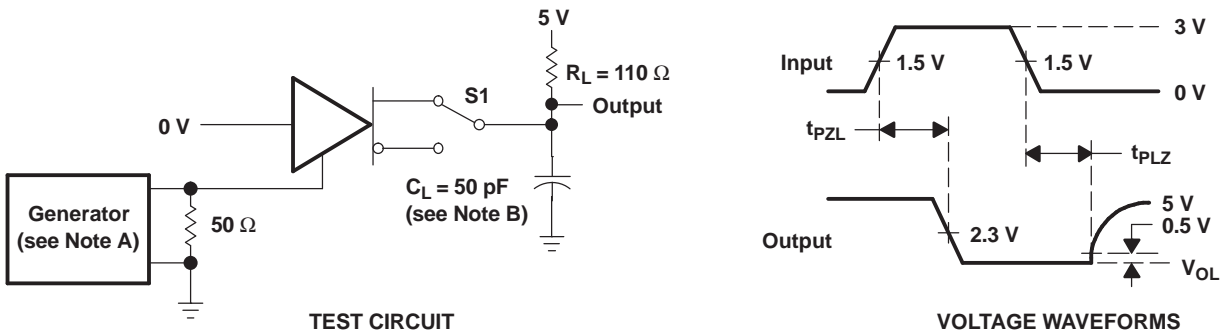**VOLTAGE WAVEFORMS**

A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

B. C_L includes probe and jig capacitance.

Figure 4. Driver Test Circuit and Voltage Waveforms

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PARAMETER MEASUREMENT INFORMATION (continued)

A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

B. C_L includes probe and jig capacitance.

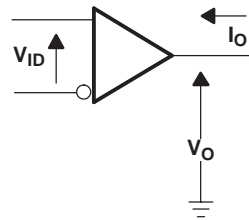**Figure 5. Driver Test Circuit and Voltage Waveforms**
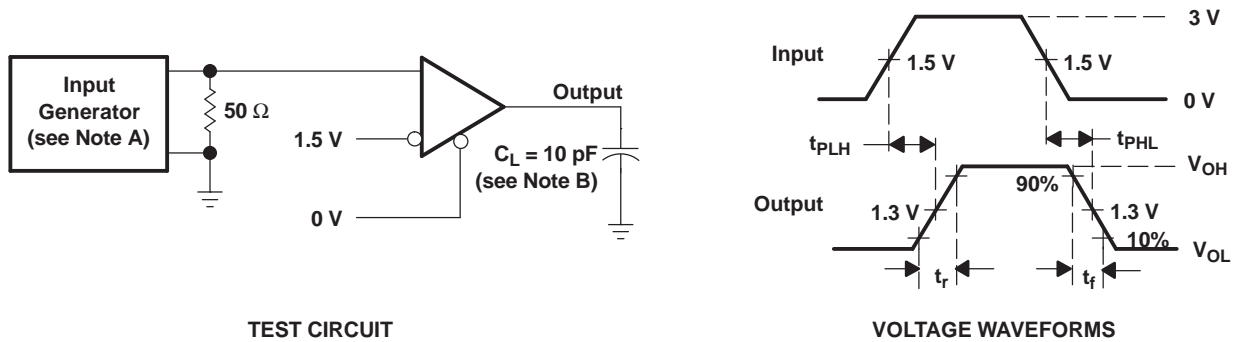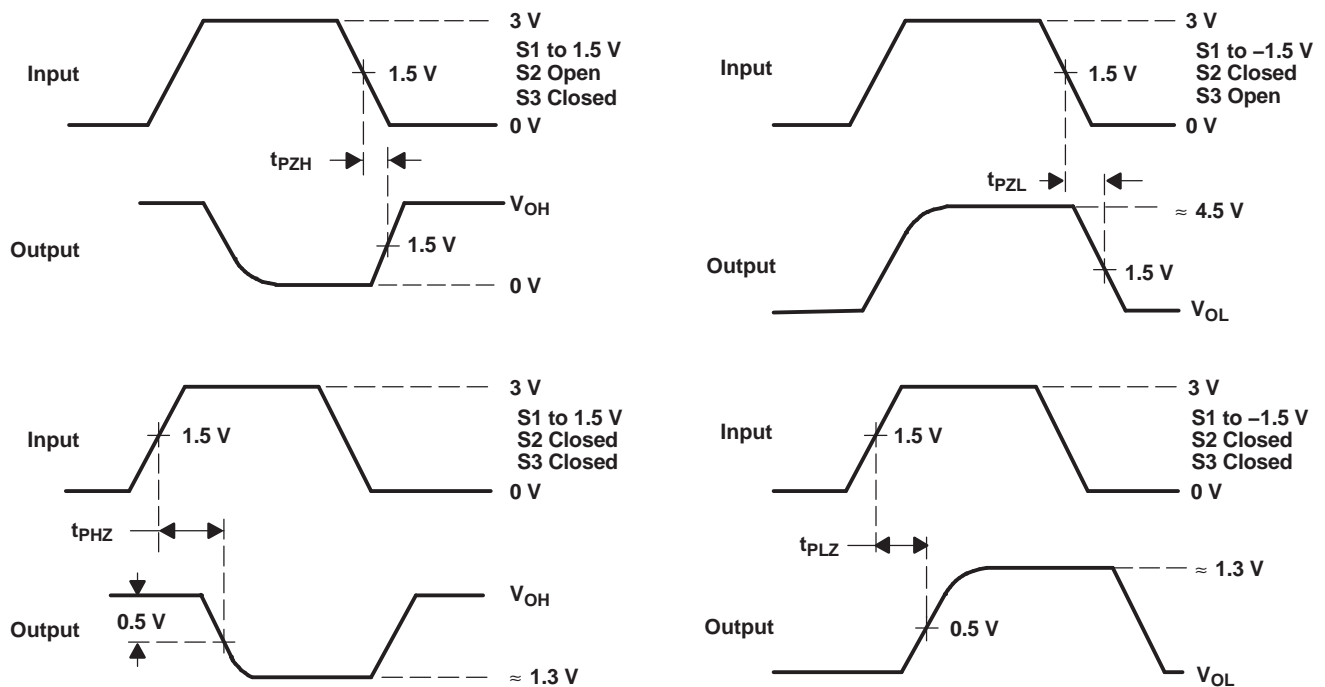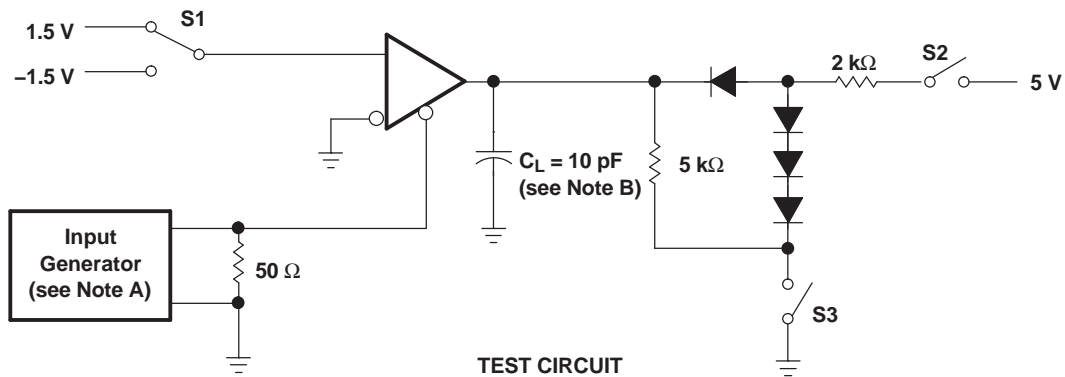

Figure 6. Receiver V_{OH} and V_{OL}

A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

B. C_L includes probe and jig capacitance.

Figure 7. Receiver Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (continued)

TEST CIRCUIT

VOLTAGE WAVEFORMS

A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

B. C_L includes probe and jig capacitance.

Figure 8. Receiver Output Enable and Disable Times

TYPICAL CHARACTERISTICS
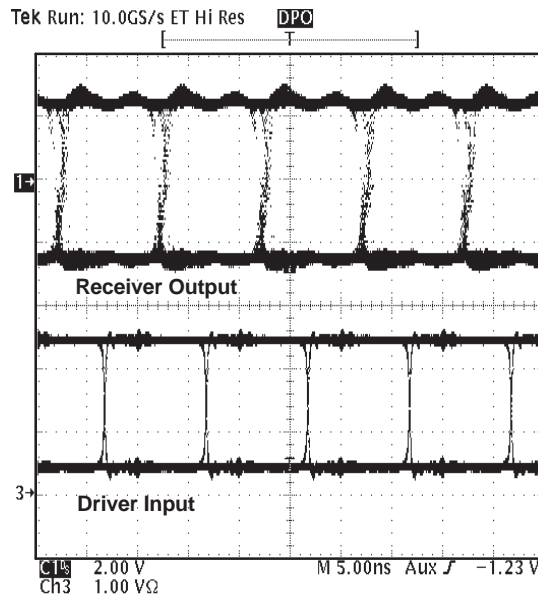
Figure 9. Typical Waveform of Nonreturn-to-Zero (NRZ), Pseudorandom Binary Sequence (PRBS) Data at 100 Mbps Through 15m, of CAT 5 Unshielded Twisted Pair (UTP) Cable

TIA/EIA-485-A defines a maximum signaling rate as that in which the transition time of the voltage transition of a logic-state change remains less than or equal to 30% of the bit length. Transition times of greater length perform quite well even though they do not meet the standard by definition.

TYPICAL CHARACTERISTICS (continued)

AVERAGE SUPPLY CURRENT
vs
FREQUENCY

Driver

$R_L = 54 \, \Omega$
$C_L = 50 \, pF$

$V_{CC} = 5 \, V$
$T_A = 25°C$
50% Duty Cycle

$C_L = 10 \, pF$ Receiver

I_{CC} – Average Supply Current – mA

f – Frequency – MHz

Figure 10.

LOGIC INPUT CURRENT
vs
INPUT VOLTAGE

$V_{CC} = 5 \, V$
$T_A = 25°C$

I_I – Logic Input Current – μA

V_I – Input Voltage – V

Figure 11.

BUS INPUT CURRENT
vs
INPUT VOLTAGE

$V_{CC} = 5 \, V$
$T_A = 25°C$

I_I – Bus Input Current – μA

V_I – Input Voltage – V

Figure 12.

DRIVER LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

$V_{CC} = 5 \, V$
$T_A = 25°C$

V_{OL} – Driver Low-Level Output Voltage – V

I_{OL} – Low-Level Output Current – mA

Figure 13.

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Product Folder Link(s): SN65LBC180A SN75LBC180A

TYPICAL CHARACTERISTICS (continued)

DRIVER HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

Figure 14.

PROPAGATION DELAY TIME
vs
CASE TEMPERATURE

Figure 15.

Product Folder Link(s): *SN65LBC180A SN75LBC180A*

APPLICATION INFORMATION

SN65LBC180A
SN75LBC180A

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SN75LBC180A

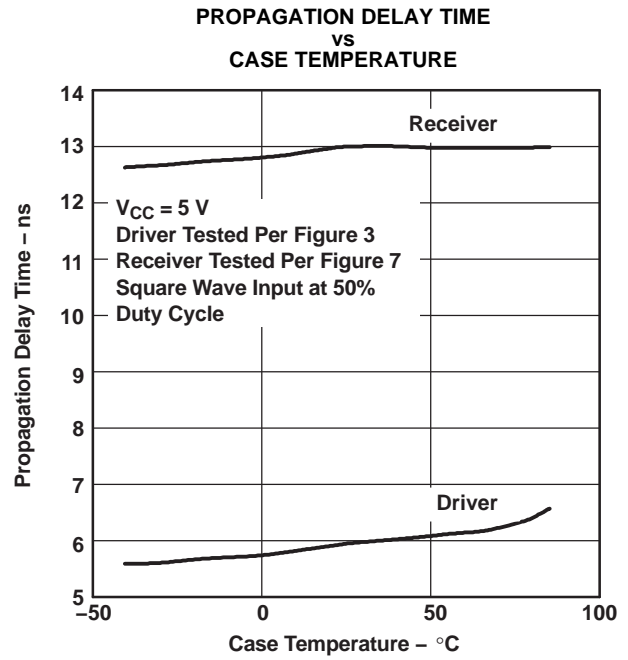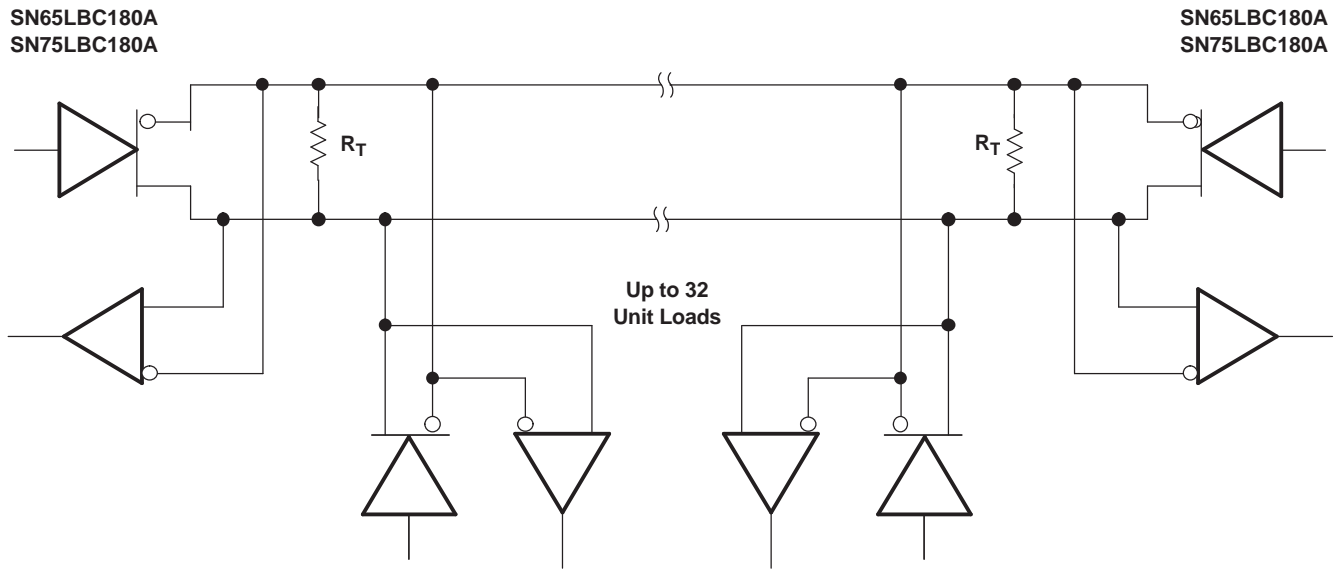A.   The line should be terminated at both ends in its characteristic impedance ($R_T = Z_O$). Stub lengths off the main line should be kept as short as possible. One SN65LBC180A typically represents less than one unit load.

Figure 16. Typical Application Circuit

Revision History

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN65LBC180AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BL180A	Samples
SN65LBC180ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BL180A	Samples
SN65LBC180ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BL180A	Samples
SN65LBC180AN	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type	-40 to 85	65LBC180A	Samples
SN75LBC180AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	LB180A	Samples
SN75LBC180ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	LB180A	Samples
SN75LBC180ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	LB180A	Samples
SN75LBC180ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	LB180A	Samples
SN75LBC180AN	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type	0 to 70	75LBC180A	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.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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.
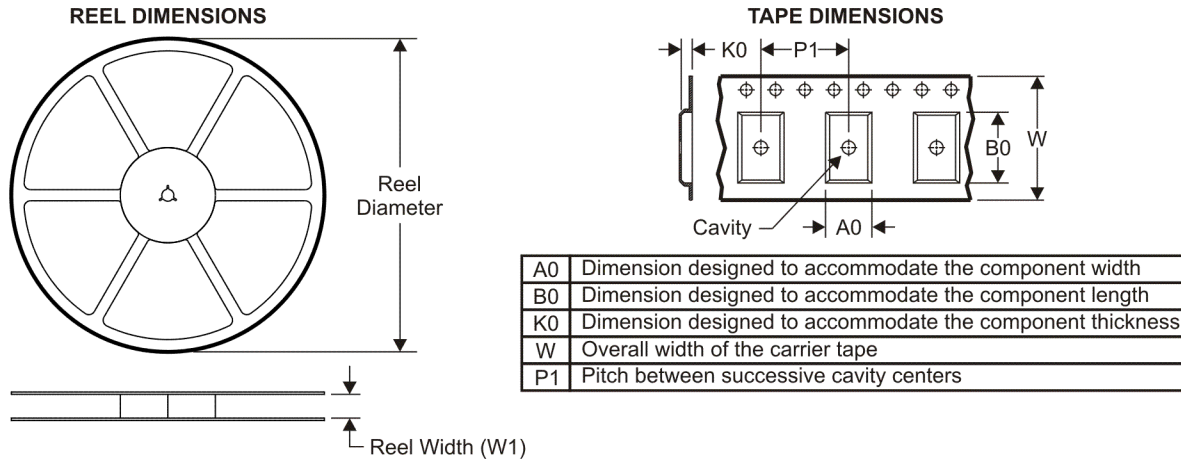
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(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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PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

*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
SN65LBC180ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN75LBC180ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	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)
SN65LBC180ADR	SOIC	D	14	2500	333.2	345.9	28.6
SN75LBC180ADR	SOIC	D	14	2500	333.2	345.9	28.6

D (R−PDSO−G14)   PLASTIC SMALL OUTLINE

0.344 (8,75)
0.337 (8,55)
△C

14   8

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80) △D

1   7

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.005 (0,13)

0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)   0°–8°

0.050 (1,27)
0.016 (0,40)

4040047−5/M   06/11

NOTES: A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
       △C.   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.
       △D.   Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
         E.   Reference JEDEC MS−012 variation AB.

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D (R–PDSO–G14)   PLASTIC SMALL OUTLINE

Example Board Layout
(Note C)

Stencil Openings
(Note D)

12x1,27

14x0,55

12x1,27

14x1,50

5,40

5,40

Example
Non Soldermask Defined Pad

Example
Pad Geometry
(See Note C)

0,60

1,55

Example
Solder Mask Opening
(See Note E)

0.07
All Around

4211283–3/E 08/12

NOTES: 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.

N (R−PDIP−T)**

16 PINS SHOWN

PLASTIC DUAL−IN−LINE PACKAGE

DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS−001 VARIATION	AA	BB	AC	AD

0.260 (6,60) / 0.240 (6,10)

0.070 (1,78) / 0.045 (1,14)

0.045 (1,14) / 0.030 (0,76)

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53) / 0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

0.325 (8,26) / 0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

14/18 Pin Only
20 Pin vendor option

4040049/E   12/2002

NOTES: A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
         C.   Falls within JEDEC MS−001, except 18 and 20 pin minimum body length (Dim A).
         D.   The 20 pin end lead shoulder width is a vendor option, either half or full width.

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