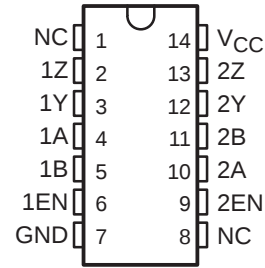


SN75159 DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

- Meets or Exceeds the Requirements of ANSI EIA/TIA-422-B and ITU Recommendation V.11
- Single 5-V Supply
- Balanced Line Operation
- TTL Compatible
- High-Impedance Output State for Party-Line Applications
- High-Current Active-Pullup Outputs
- Short-Circuit Protection
- Dual Channels
- Clamp Diodes at Inputs

D OR N PACKAGE
(TOP VIEW)



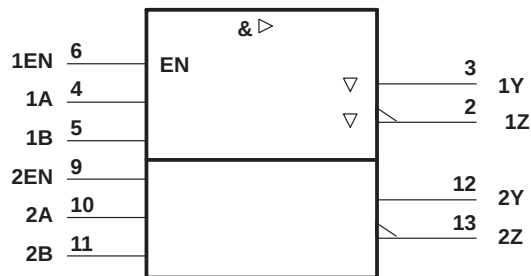
NC – No internal connection

description

The SN75159 dual differential line driver with 3-state outputs is designed to provide all the features of the SN75158 line driver with the added feature of driver output controls. There is an individual control for each driver. When the output control is low, the associated outputs are in a high-impedance state and the outputs can neither drive nor load the bus. This permits many devices to be connected together on the same transmission line for party-line applications.

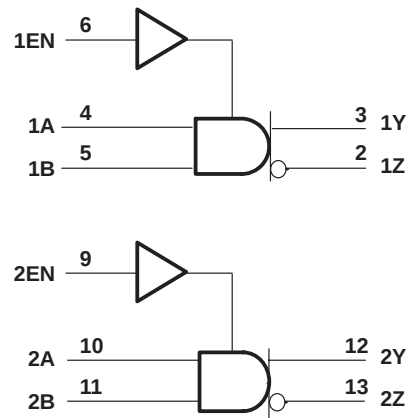
The SN75159 is characterized for operation from 0°C to 70°C.

logic symbol†



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

logic diagram (positive logic)



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1995, Texas Instruments Incorporated

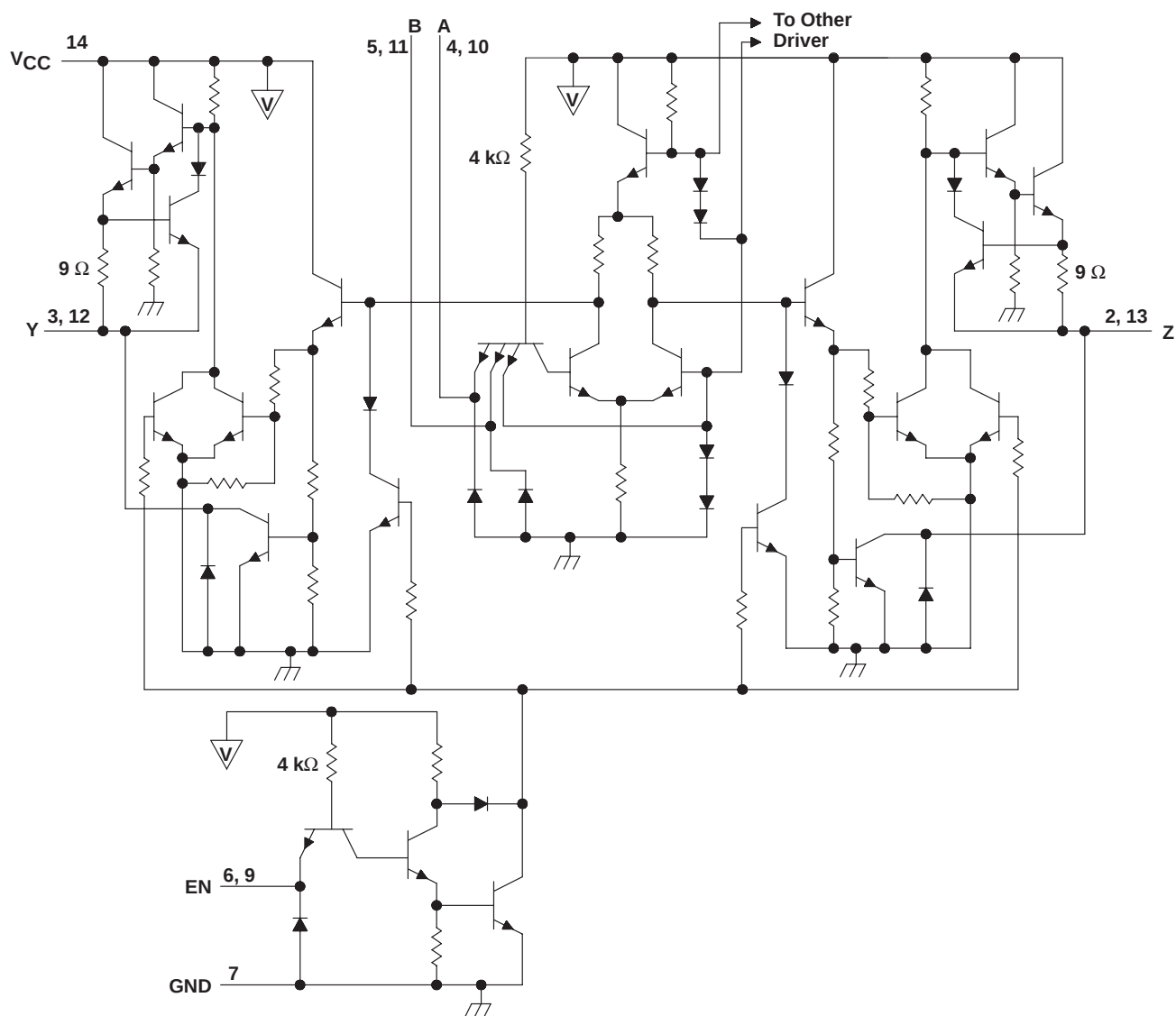
SN75159

DUAL DIFFERENTIAL LINE DRIVER

WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

schematic (each driver)



△ ... VCC bus

Resistor values shown are nominal.

SN75159
DUAL DIFFERENTIAL LINE DRIVER
WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage, V_I	5.5 V
Off-state voltage applied to open-collector outputs	12 V
Continuous total dissipation	See Dissipation Rating Table
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.

NOTE 1: All voltage values except differential output voltage V_{OD} are with respect to the network ground terminal. V_{OD} is at the Y output with respect to the Z output.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW
N	1150 mW	9.2 mW/°C	736 mW

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	4.75	5	5.25	V
High-level input voltage, V_{IH}	2			V
Low-level input voltage, V_{IL}			0.8	V
High-level output voltage, I_{OH}			–40	mA
Low-level output current, I_{OL}			40	mA
Operating free-air temperature, T_A	0		70	°C



SN75159

DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

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

PARAMETER		TEST CONDITIONS		MIN	TYP [†]	MAX	UNIT	
V _{IK}	Input clamp voltage	V _{CC} = 4.75 V, I _I = −12 mA			−0.9	−1.5	V	
V _{OH}	High-level output voltage	V _{CC} = 4.75 V, V _{IH} = 2 V,	V _{IL} = 0.8 V, I _{OH} = −40 mA	2.4	3		V	
V _{OL}	Low-level output voltage	V _{CC} = 4.75 V, V _{IH} = 2 V,	V _{IL} = 0.8 V, I _{OL} = 40 mA		0.25	0.4	V	
V _{OK}	Output clamp voltage	V _{CC} = 5.25 V, I _O = −40 mA			−1.1	−1.5	V	
V _O	Output voltage	V _{CC} = 4.75 V to 5.25 V, I _O = 0		0		6	V	
V _{OD1}	Differential output voltage	V _{CC} = 5.25 V, I _O = 0			3.5	2V _{OD2}	V	
V _{OD2}	Differential output voltage	V _{CC} = 4.75 V		2	3		V	
Δ V _{OD}	Change in magnitude of differential output voltage [‡]	V _{CC} = 4.75 V	R _L = 100 Ω, See Figure 1		±0.02	±0.4	V	
V _{OC}	Common-mode output voltage [§]	V _{CC} = 5.25 V			1.8	3	V	
		V _{CC} = 4.75 V			1.5	3		
Δ V _{OC}	Change in magnitude of common-mode output voltage [‡]	V _{CC} = 4.75 V to 5.25 V			±0.01	±0.4	V	
I _O	Output current with power off	V _{CC} = 0	V _O = 6 V		0.1	100	μA	
			V _O = −0.25 V		−0.1	−100		
			V _O = −0.25 V to 6 V			±100		
I _{OZ}	Off-state (high-impedance state) output current	V _{CC} = 5.25 V, Output controls at 0.8 V	T _A = 25°C	V _O = 0 to V _{CC}		±10	μA	
			T _A = 70°C	V _O = 0		−20		
				V _O = 0.4 V		±20		
				V _O = 2.4 V		±20		
				V _O = V _{CC}		20		
I _I	Input current at maximum input voltage	V _{CC} = 5.25 V, V _I = 5.5 V				1	mA	
I _{IH}	High-level input current	V _{CC} = 5.25 V, V _I = 2.4 V				40	μA	
I _{IL}	Low-level input current	V _{CC} = 5.25 V, V _I = 0.4 V			−1	−1.6	mA	
I _{OS}	Short-circuit output current [¶]	V _{CC} = 5.25 V		−40	−90	−150	mA	
I _{CC}	Supply current (both drivers)	V _{CC} = 5.25 V, T _A = 25°C,	Inputs grounded, No load			47	65	mA

[†] All typical values are at $V_{CC} = 5 \text{ V}$ and $T_A = 25^\circ\text{C}$ except for V_{OC} , for which V_{CC} is as stated under test conditions.

[‡] $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitudes of V_{OD} and V_{OC} , respectively, that occur when the input is changed from a high level to a low level.

[§] In ANSI Standard EIA/TIA-422-B, V_{OC} , which is the average of the two output voltages with respect to GND, is called output offset voltage, V_{OS} .

[¶] Only one output should be shorted at a time, and duration of the short circuit should not exceed one second.

SN75159

DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

switching characteristics over operating free-air temperature range, $V_{CC} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
t_{PLH} Propagation delay time, low-to-high-level output	$C_L = 30\text{ pF}$, $R_L = 100\ \Omega$, See Figure 2, Termination A		16	25	ns
t_{PHL} Propagation delay time, high-to-low-level output			11	20	ns
t_{PLH} Propagation delay time, low-to-high-level output	$C_L = 15\text{ pF}$, See Figure 2, Termination B		13	20	ns
t_{PHL} Propagation delay time, high-to-low-level output			9	15	ns
t_{TLH} Transition time, low-to-high-level output	$C_L = 30\text{ pF}$, $R_L = 100\ \Omega$, See Figure 2, Termination A		4	20	ns
t_{THL} Transition time, high-to-low-level output			4	20	ns
t_{PZH} Output enable time to high level	$C_L = 30\text{ pF}$, $R_L = 180\ \Omega$, See Figure 3		7	20	ns
t_{PZL} Output enable time to low level	$C_L = 30\text{ pF}$, $R_L = 250\ \Omega$, See Figure 4		14	40	ns
t_{PHZ} Output disable time from high level	$C_L = 30\text{ pF}$, $R_L = 180\ \Omega$, See Figure 3		10	30	ns
t_{PLZ} Output disable time from low level	$C_L = 30\text{ pF}$, $R_L = 250\ \Omega$, See Figure 4		17	35	ns
Overshoot factor	$R_L = 100\ \Omega$, See Figure 2, Termination C			10%	

[†] All typical values are at $T_A = 25^\circ\text{C}$.

SYMBOL EQUIVALENTS

DATA-SHEET PARAMETER	EIA/TIA-422-B
V_O	V_{Oa}, V_{Ob}
$ V_{OD1} $	V_O
$ V_{OD2} $	V_t
$\Delta V_{OD} $	$ V_t - \bar{V}_t $
V_{OC}	$ V_{os} $
$\Delta V_{OC} $	$ V_{os} - \bar{V}_{os} $
I_{OS}	$ I_{sa} , I_{sb} $
I_O	$ I_{xa} , I_{xb} $

PARAMETER MEASUREMENT INFORMATION

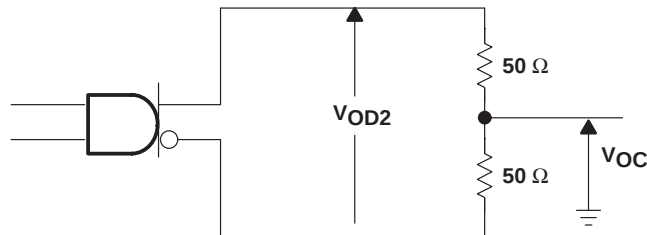
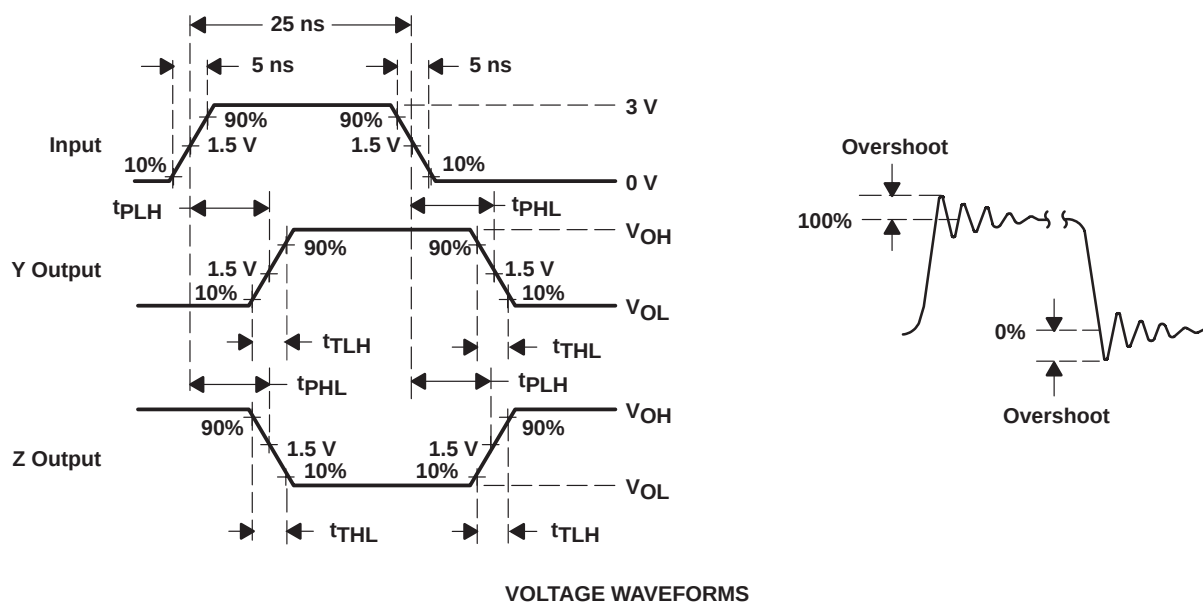
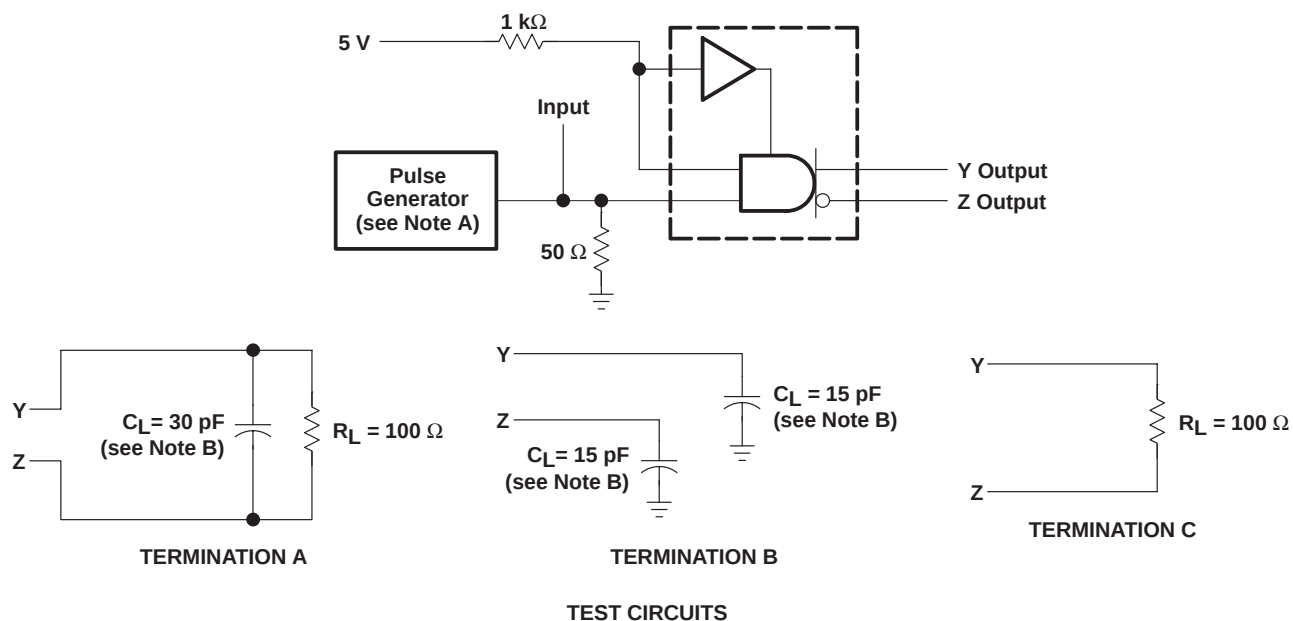


Figure 1. Differential and Common-Mode Output Voltages

SN75159 DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

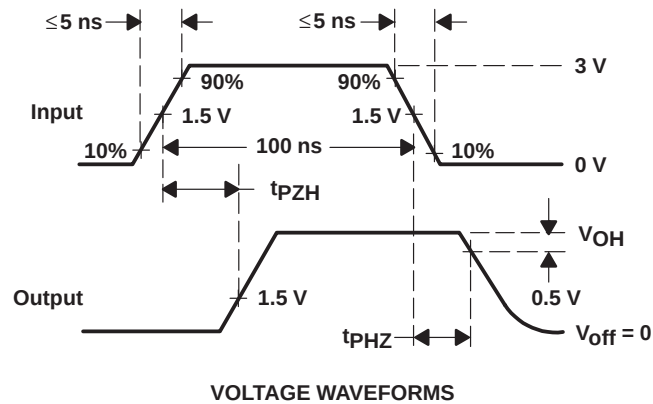
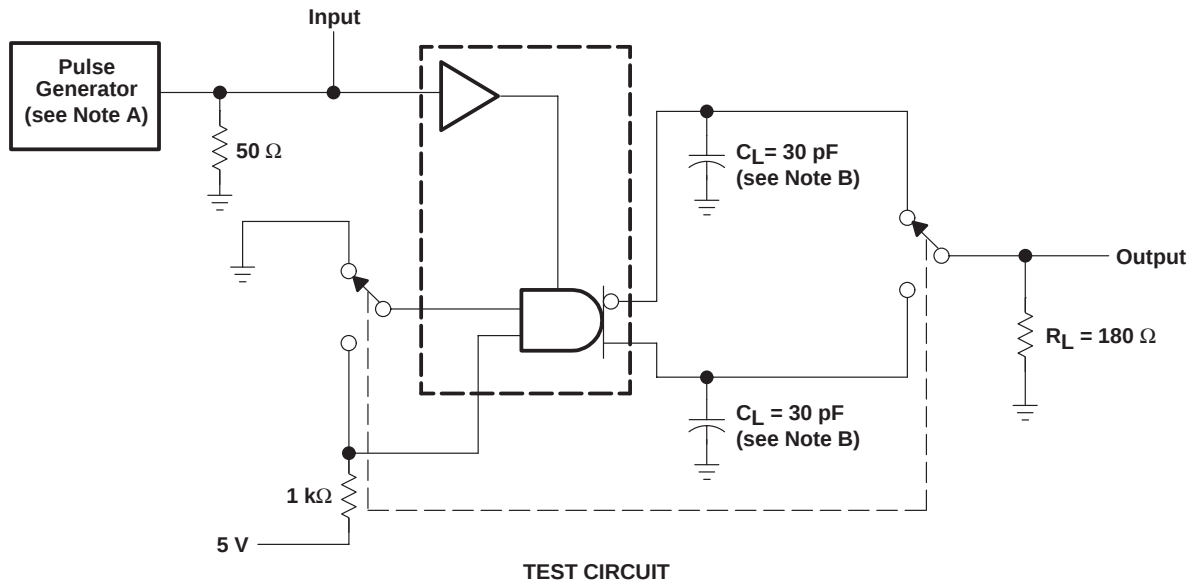
PARAMETER MEASUREMENT INFORMATION



- NOTES: A. The pulse generator has the following characteristics: $Z_O = 50$ Ω , $PRR \leq 10$ MHz.
B. C_L includes probe and jig capacitance.

Figure 2. Test Circuits, Voltage Waveforms, and Overshoot Factor

PARAMETER MEASUREMENT INFORMATION



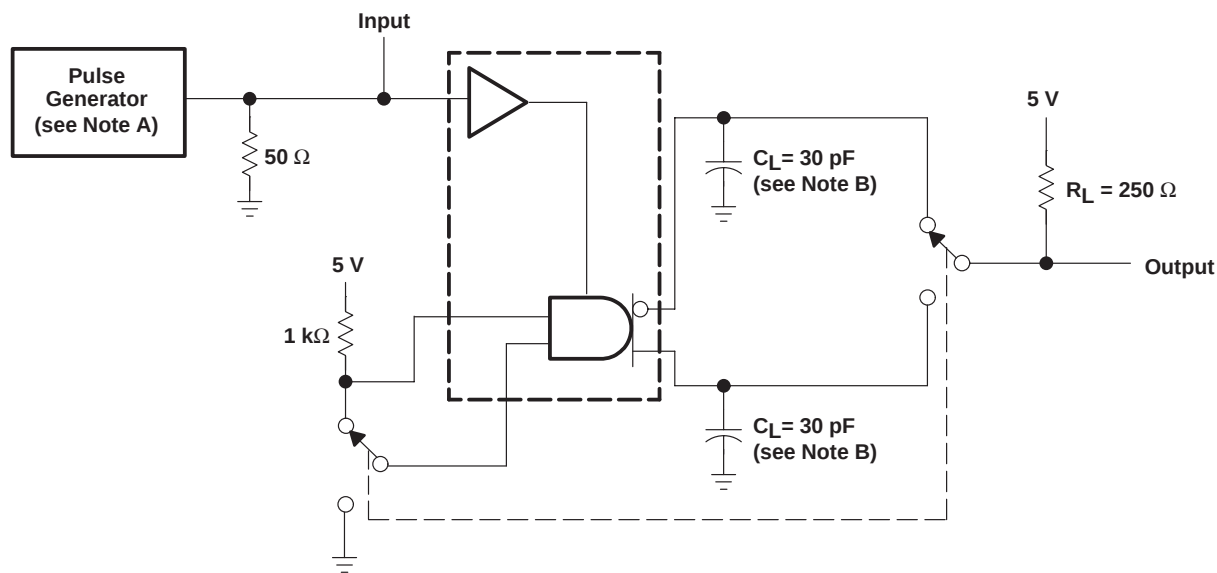
- NOTES: A. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, $PRR \leq 500\text{ kHz}$.
B. C_L includes probe and jig capacitance.

Figure 3. Test Circuit and Voltage Waveforms

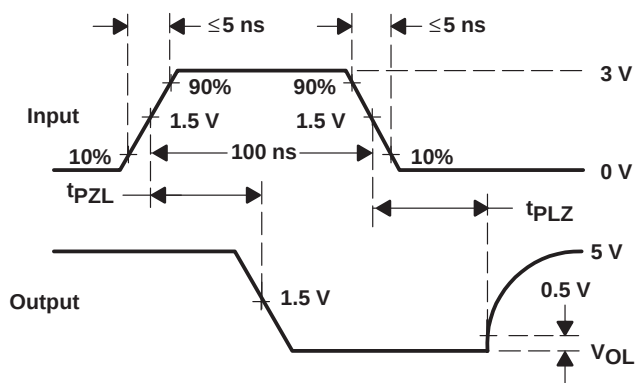
SN75159 DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

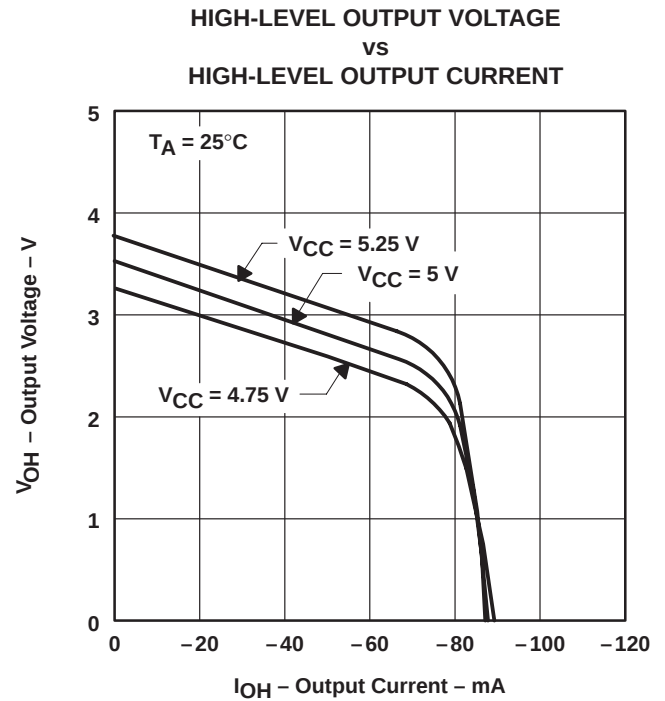
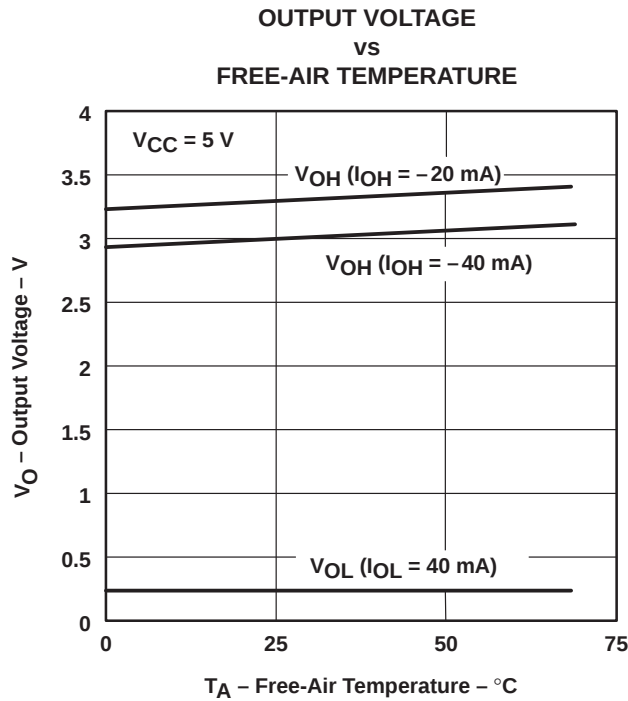
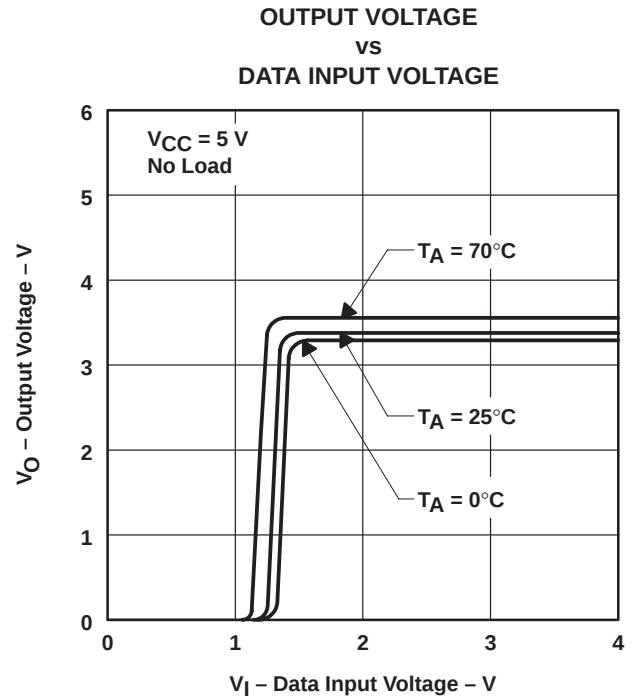
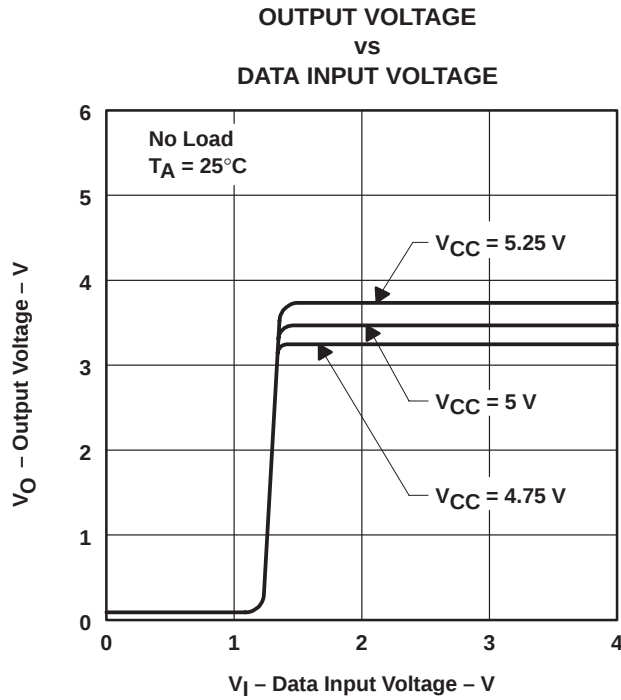


VOLTAGE WAVEFORMS

- NOTES: A. The pulse generator has the following characteristics: $Z_O = 50 \Omega$, $PRR \leq 500 \text{ kHz}$.
B. C_L includes probe and jig capacitance.

Figure 4. Test Circuit and Voltage Waveform

TYPICAL CHARACTERISTICS



SN75159

DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

SLLS088B – JANUARY 1977 – REVISED MAY 1995

TYPICAL CHARACTERISTICS

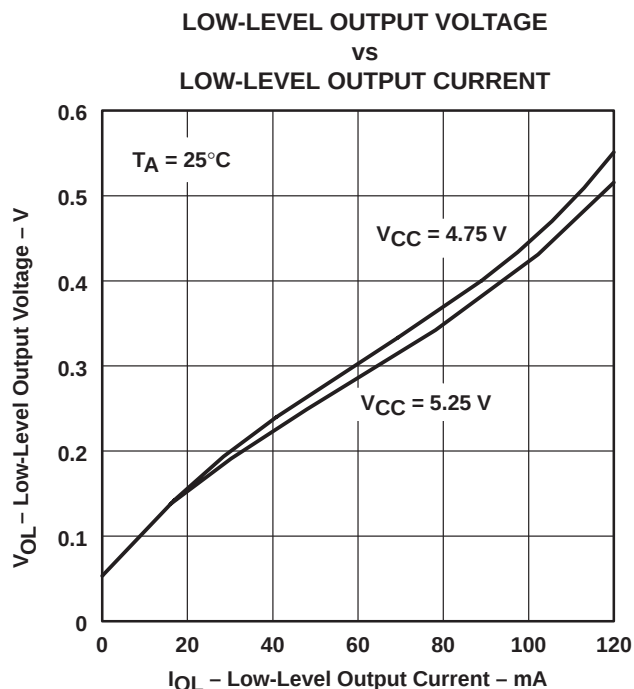


Figure 9

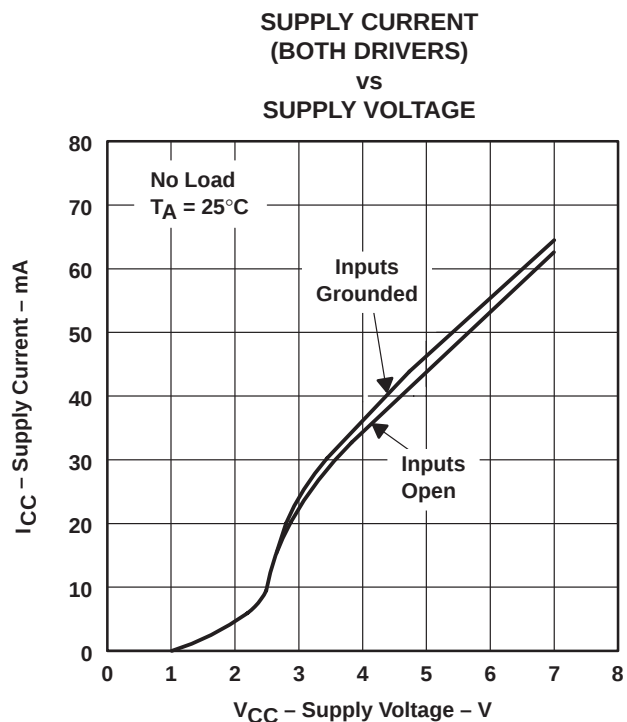


Figure 10

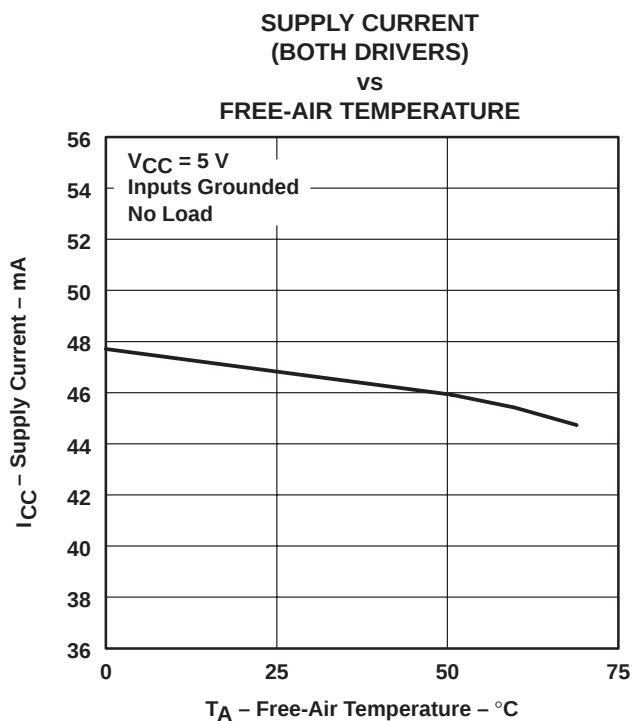


Figure 11

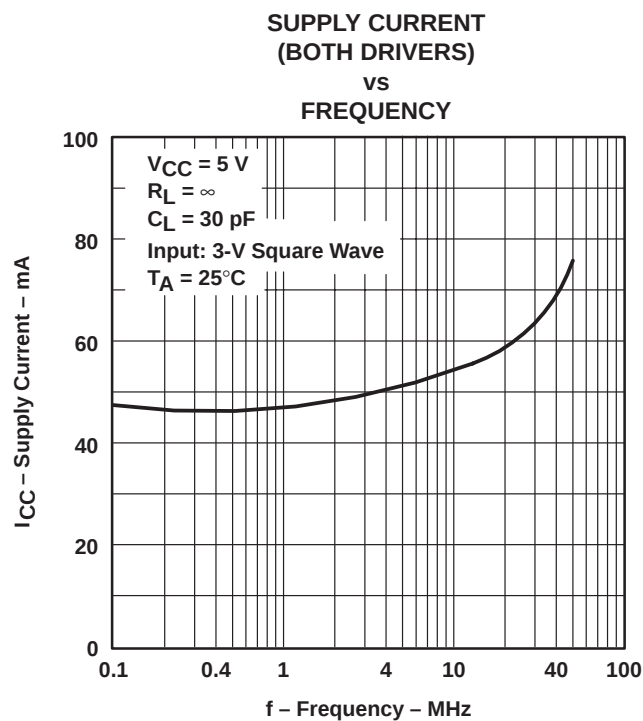
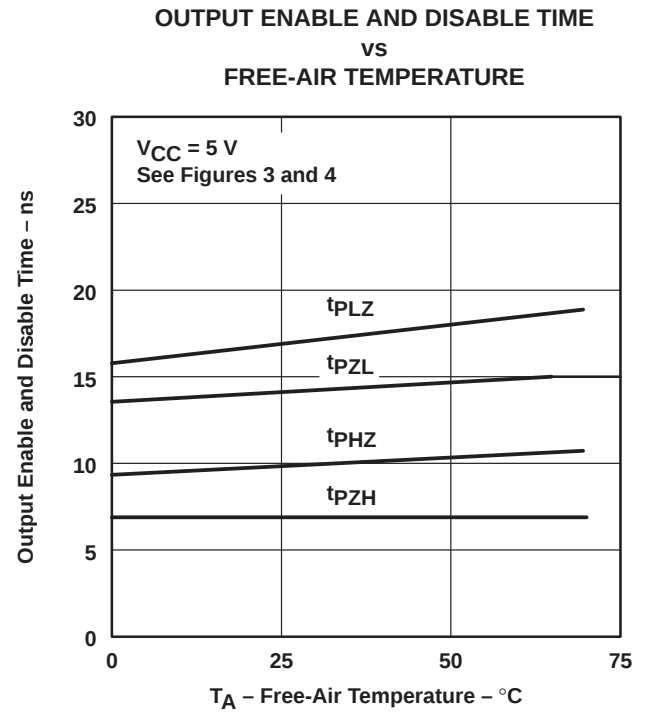
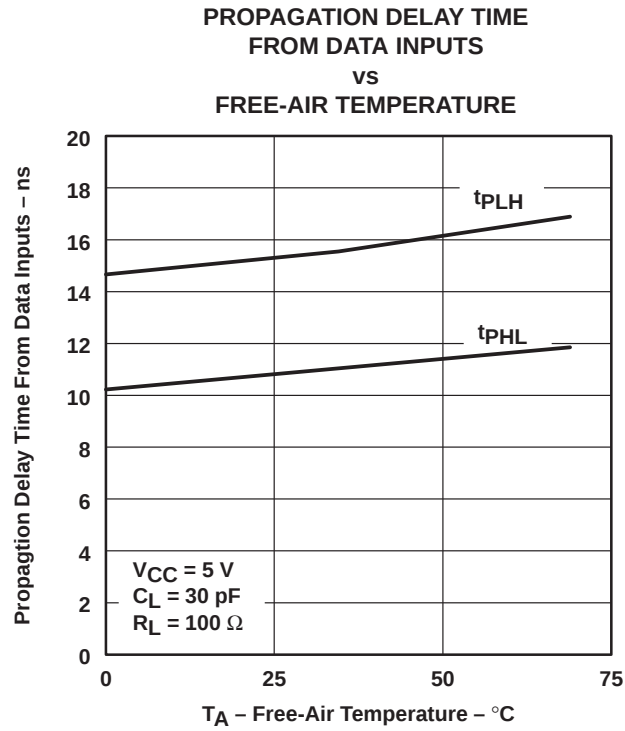


Figure 12

TYPICAL CHARACTERISTICS



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
SN75159D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75159	Samples
SN75159N	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN75159N	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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



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.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE

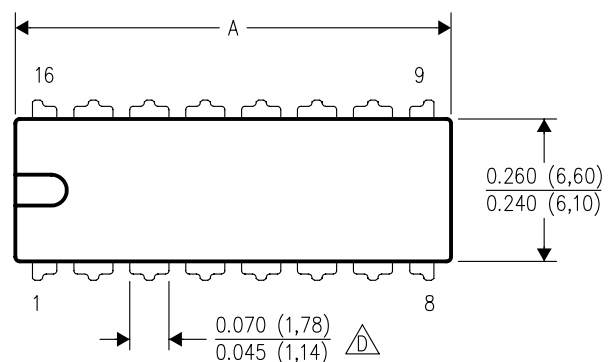


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should 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.

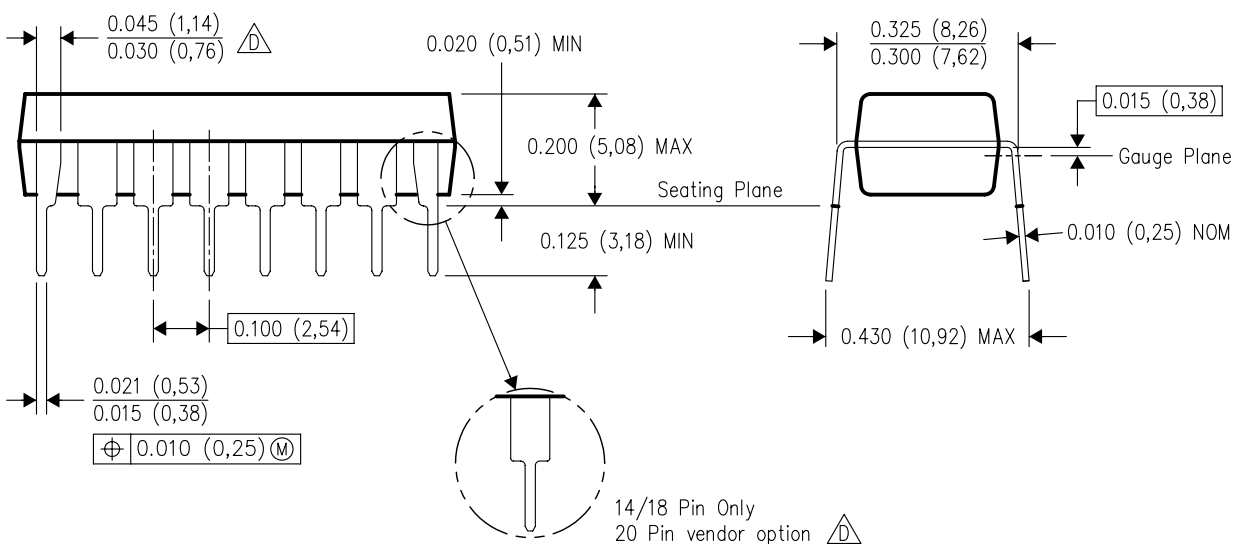
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	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



4040049/E 12/2002

- NOTES:
- 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.

IMPORTANT NOTICE

Texas Instruments Incorporated (TI) reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

TI's published terms of sale for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.