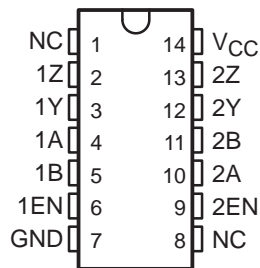


# SN75159 DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

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)



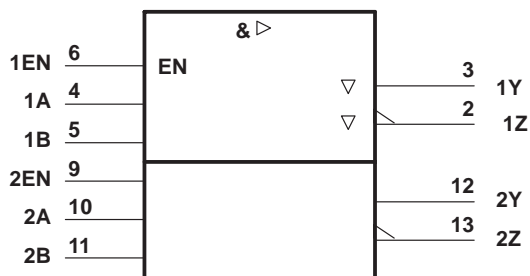
NC—No internal connection

## 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.

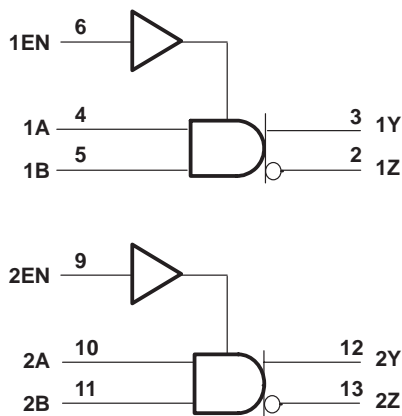
The SN75159 is characterized for operation from 0°C to 70°C.

## 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**

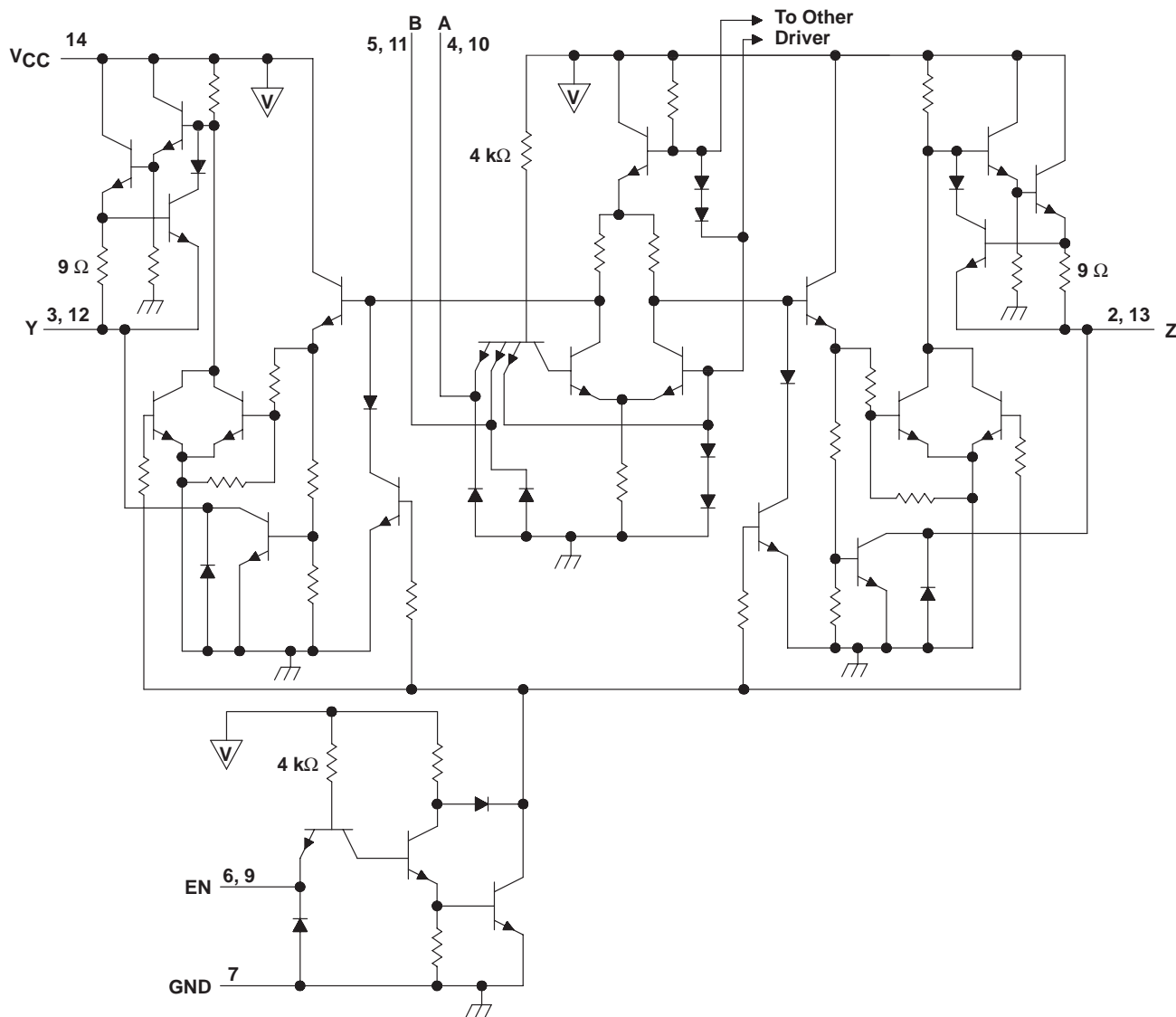
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

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	$V_{CC} = 4.75\text{ V}$ ,	$I_I = -12\text{ mA}$		-0.9	-1.5	V
$V_{OH}$	High-level output voltage	$V_{CC} = 4.75\text{ V}$ , $V_{IH} = 2\text{ V}$ ,	$V_{IL} = 0.8\text{ V}$ , $I_{OH} = -40\text{ mA}$	2.4	3		V
$V_{OL}$	Low-level output voltage	$V_{CC} = 4.75\text{ V}$ , $V_{IH} = 2\text{ V}$ ,	$V_{IL} = 0.8\text{ V}$ , $I_{OL} = 40\text{ mA}$		0.25	0.4	V
$V_{OK}$	Output clamp voltage	$V_{CC} = 5.25\text{ V}$ ,	$I_O = -40\text{ mA}$		-1.1	-1.5	V
$V_O$	Output voltage	$V_{CC} = 4.75\text{ V to }5.25\text{ V}$ ,	$I_O = 0$	0		6	V
$ V_{OD1} $	Differential output voltage	$V_{CC} = 5.25\text{ V}$ ,	$I_O = 0$		3.5	$2V_{OD2}$	V
$ V_{OD2} $	Differential output voltage	$V_{CC} = 4.75\text{ V}$		2	3		V
$\Delta V_{OD} $	Change in magnitude of differential output voltage‡	$V_{CC} = 4.75\text{ V}$	$R_L = 100\ \Omega$ , See Figure 1		$\pm 0.02$	$\pm 0.4$	V
$V_{OC}$	Common-mode output voltage§	$V_{CC} = 5.25\text{ V}$		1.8	3	V	
		$V_{CC} = 4.75\text{ V}$		1.5	3		
$\Delta V_{OC} $	Change in magnitude of common-mode output voltage‡	$V_{CC} = 4.75\text{ V to }5.25\text{ V}$			$\pm 0.01$	$\pm 0.4$	V
$I_O$	Output current with power off	$V_{CC} = 0$	$V_O = 6\text{ V}$	0.1	100	$\mu\text{A}$	
			$V_O = -0.25\text{ V}$	-0.1	-100		
			$V_O = -0.25\text{ V to }6\text{ V}$		$\pm 100$		
$I_{OZ}$	Off-state (high-impedance state) output current	$V_{CC} = 5.25\text{ V}$ , Output controls at 0.8 V	$T_A = 25^\circ\text{C}$	$V_O = 0\text{ to }V_{CC}$	$\pm 10$	$\mu\text{A}$	
			$T_A = 70^\circ\text{C}$	$V_O = 0$	-20		
				$V_O = 0.4\text{ V}$	$\pm 20$		
				$V_O = 2.4\text{ V}$	$\pm 20$		
				$V_O = V_{CC}$	20		
$I_I$	Input current at maximum input voltage	$V_{CC} = 5.25\text{ V}$ ,	$V_I = 5.5\text{ V}$		1	mA	
$I_{IH}$	High-level input current	$V_{CC} = 5.25\text{ V}$ ,	$V_I = 2.4\text{ V}$		40	$\mu\text{A}$	
$I_{IL}$	Low-level input current	$V_{CC} = 5.25\text{ V}$ ,	$V_I = 0.4\text{ V}$		-1	-1.6	mA
$I_{OS}$	Short-circuit output current¶	$V_{CC} = 5.25\text{ V}$		-40	-90	-150	mA
$I_{CC}$	Supply current (both drivers)	$V_{CC} = 5.25\text{ V}$ , $T_A = 25^\circ\text{C}$ ,	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

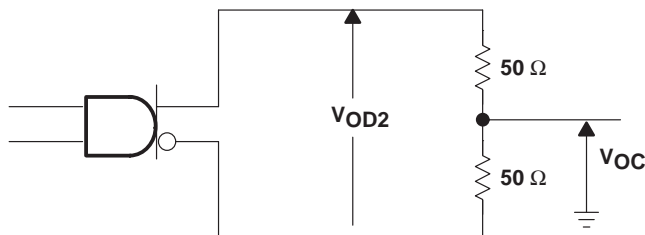
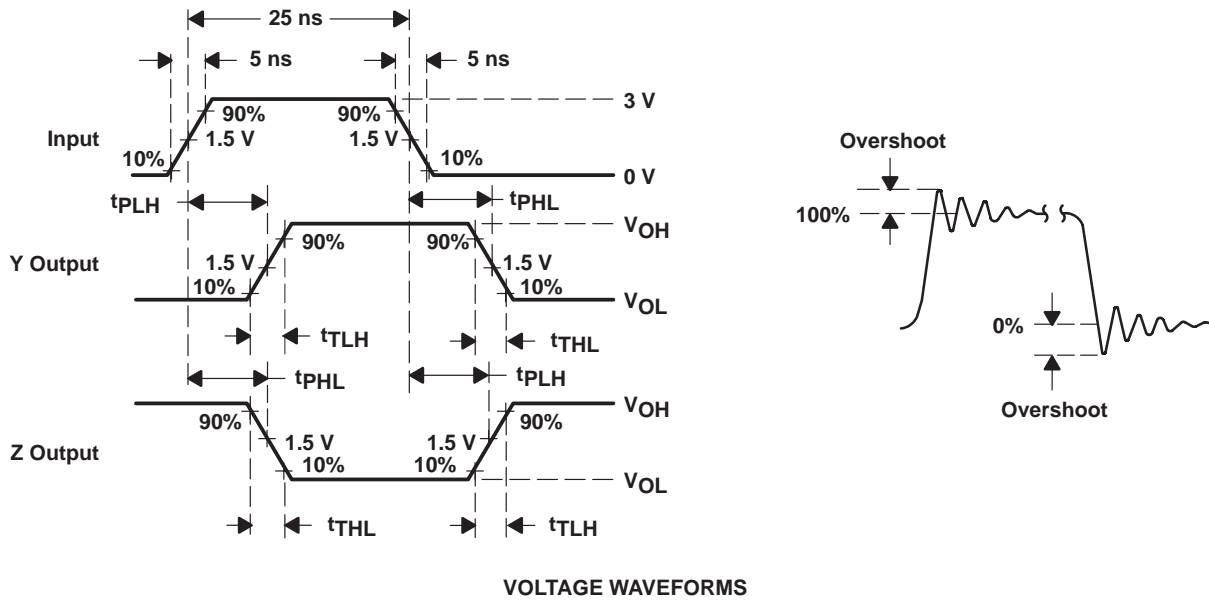
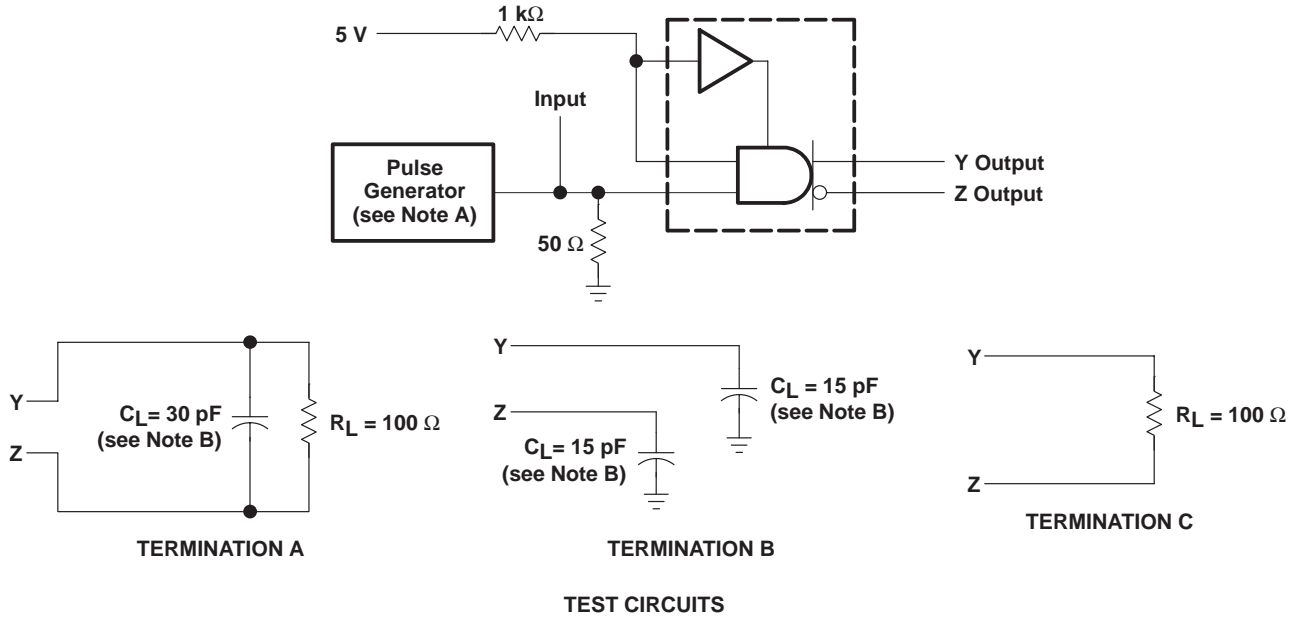


Figure 1. Differential and Common-Mode Output Voltages

**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:  $Z_O = 50 \Omega$ ,  $PRR \leq 10 \text{ MHz}$ .  
 B.  $C_L$  includes probe and jig capacitance.

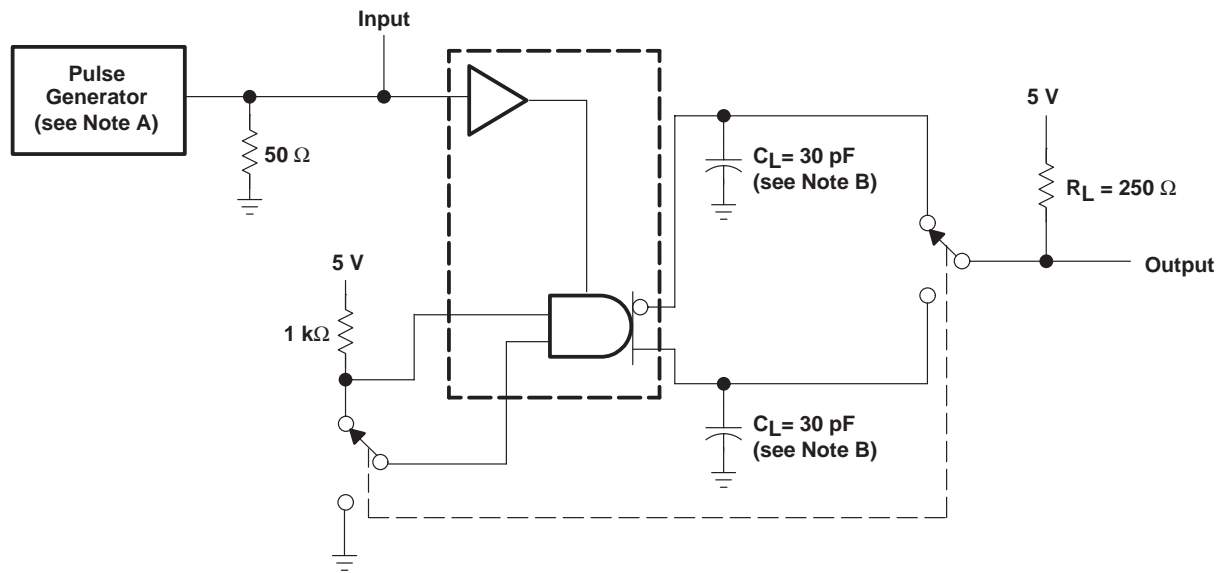
**Figure 2. Test Circuits, Voltage Waveforms, and Overshoot Factor**



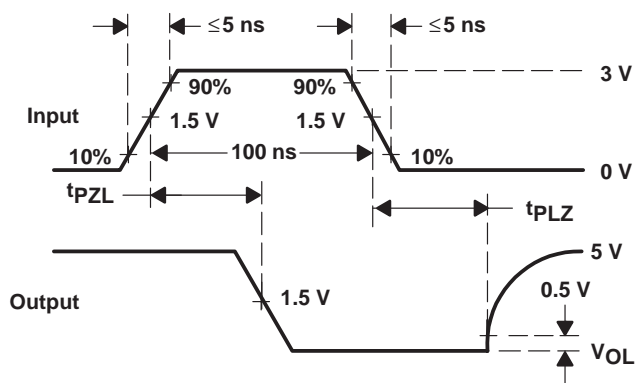
# SN75159 DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

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

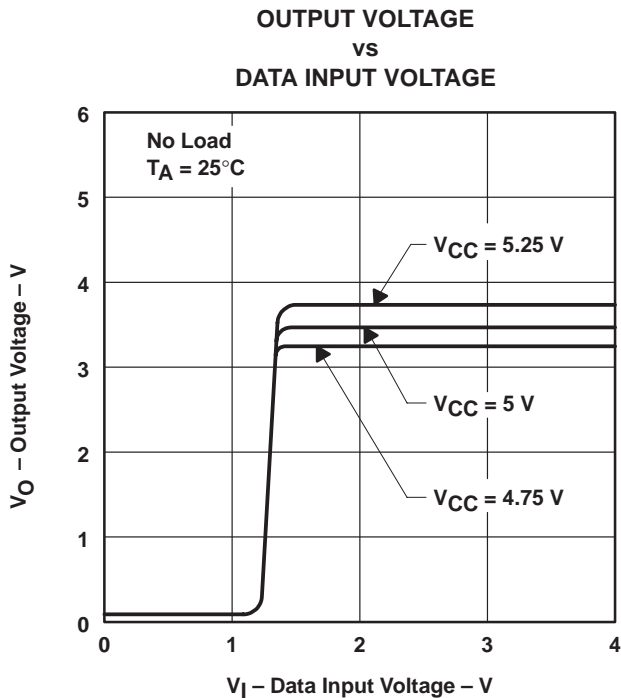


Figure 5

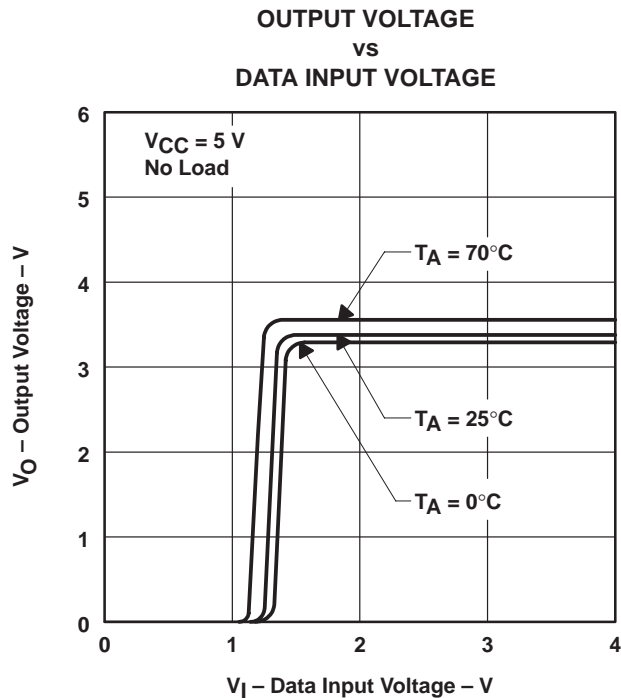


Figure 6

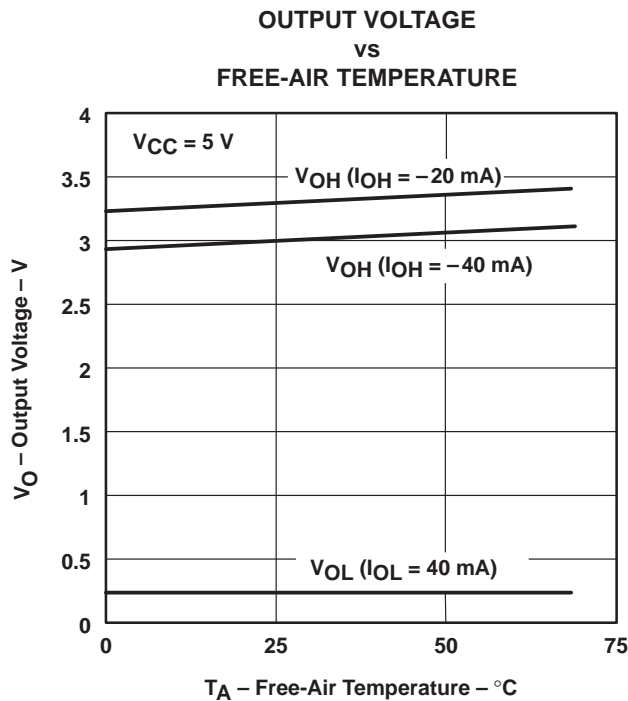


Figure 7

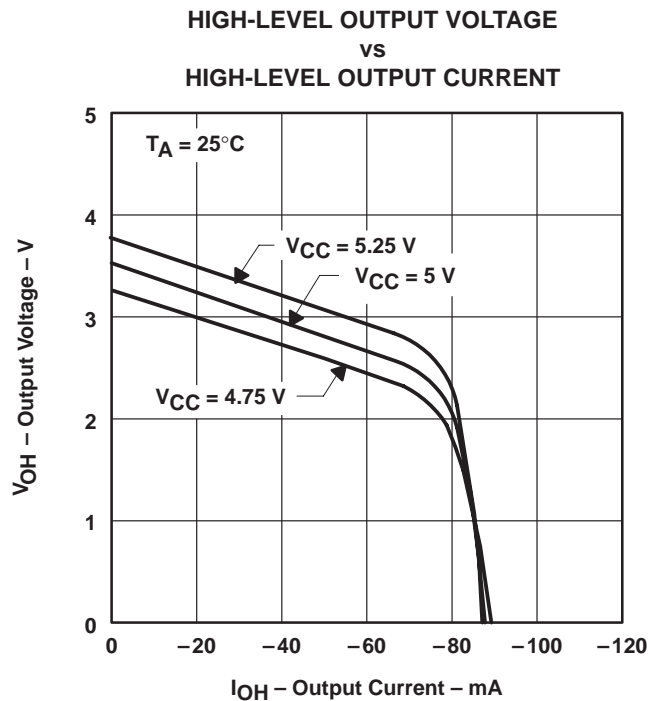
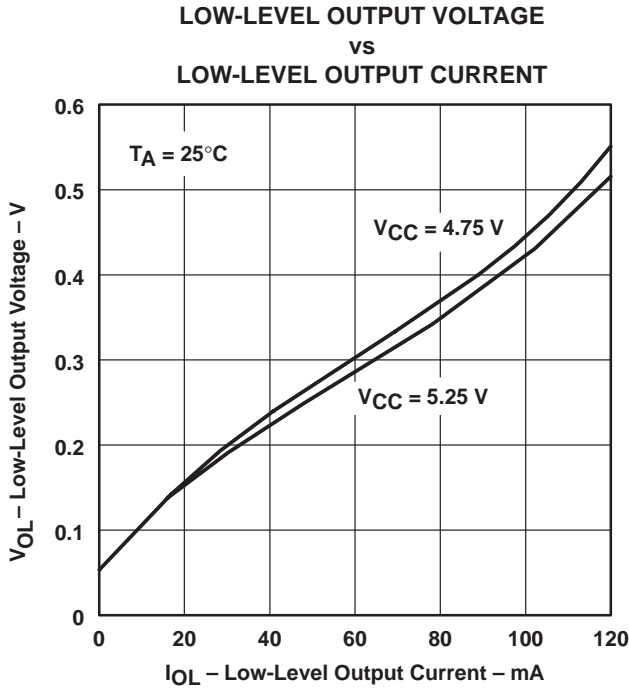


Figure 8

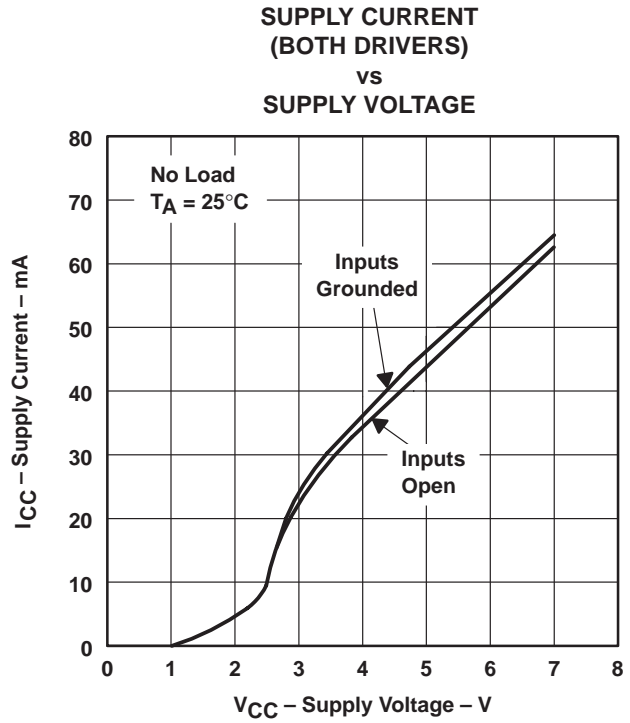
**SN75159**  
**DUAL DIFFERENTIAL LINE DRIVER**  
**WITH 3-STATE OUTPUTS**

SLLS088B – JANUARY 1977 – REVISED MAY 1995

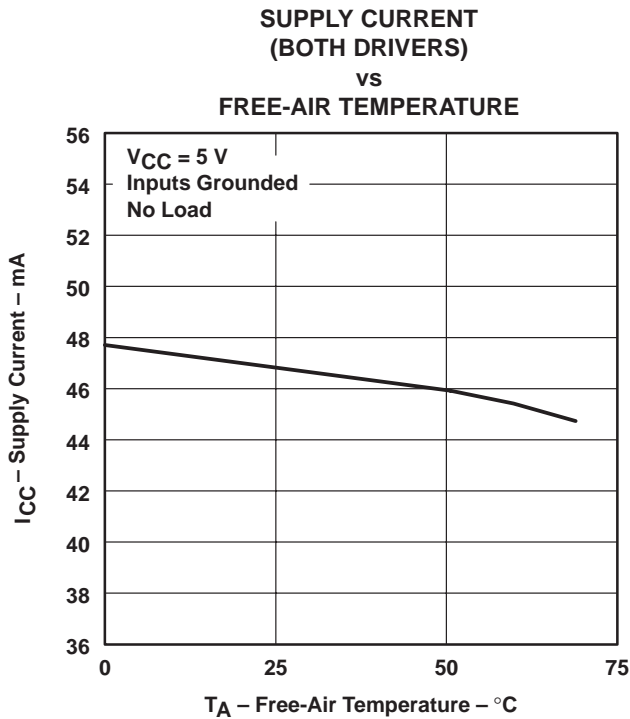
**TYPICAL CHARACTERISTICS**



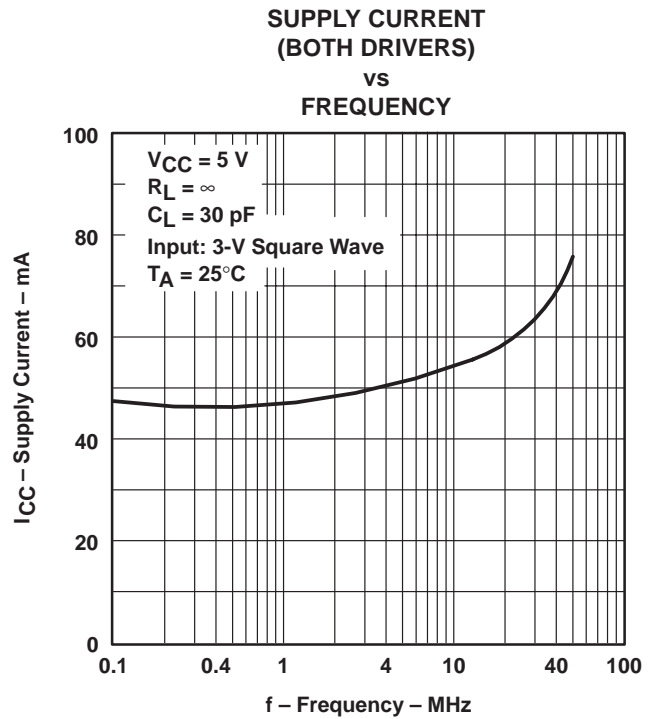
**Figure 9**



**Figure 10**



**Figure 11**



**Figure 12**



TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME  
 FROM DATA INPUTS  
 vs  
 FREE-AIR TEMPERATURE

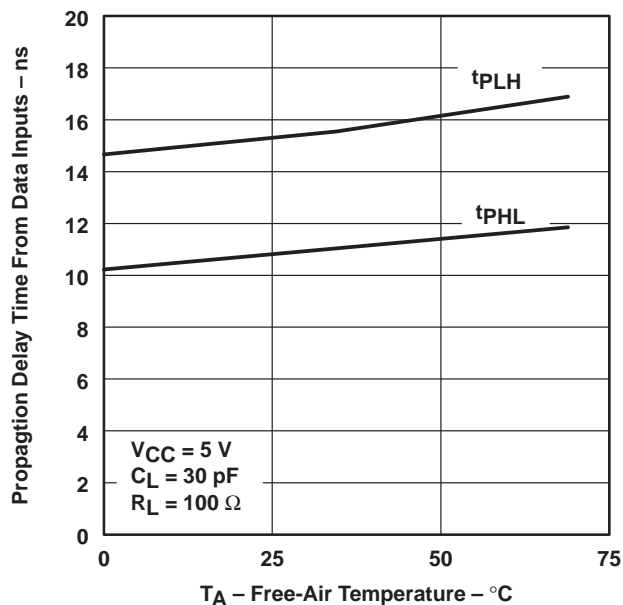


Figure 13

OUTPUT ENABLE AND DISABLE TIME  
 vs  
 FREE-AIR TEMPERATURE

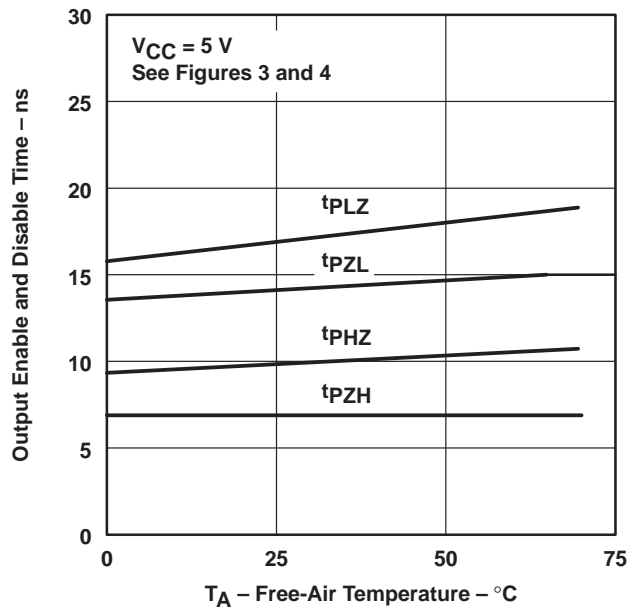


Figure 14

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN75159D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75159DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75159DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75159N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75159NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

<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.

**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.

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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

4040049/E 12/2002

D (R-PDSO-G14)

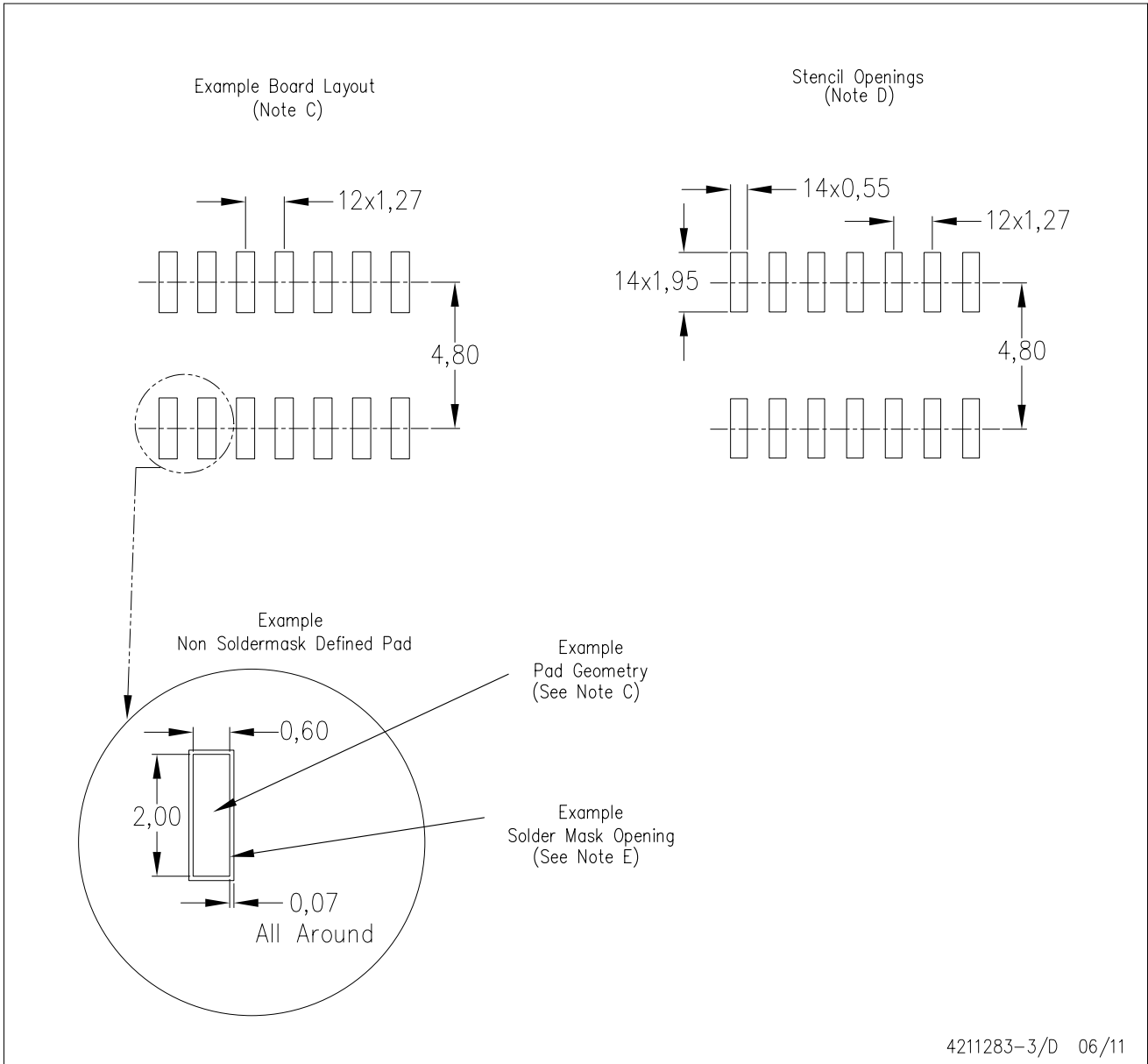
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  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.
  -  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.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information 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.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered 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.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Transportation and Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless-apps">www.ti.com/wireless-apps</a>

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2011, Texas Instruments Incorporated