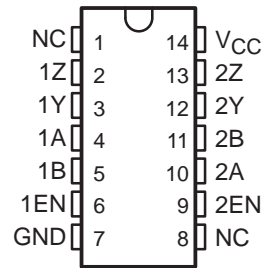


# SN75159 DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

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)



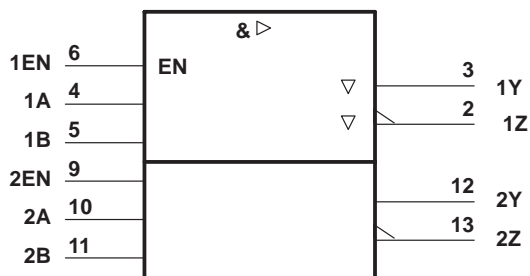
NC – No internal connection

## 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.

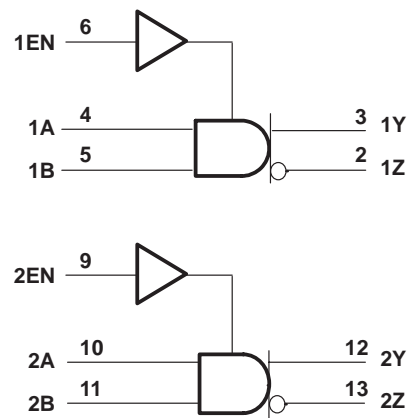
The SN75159 is characterized for operation from 0°C to 70°C.

## logic symbol†



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

## logic diagram (positive logic)



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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**

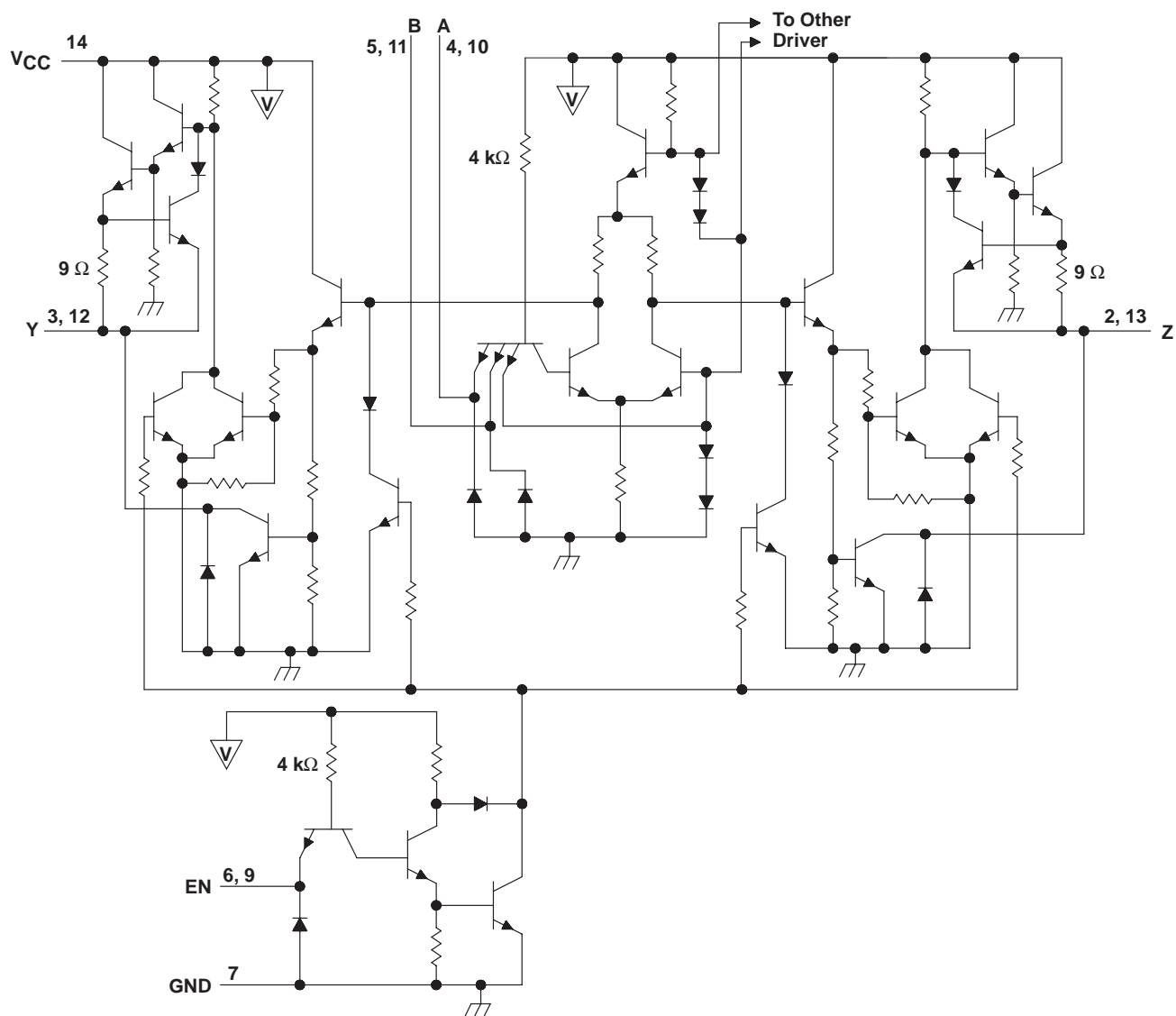
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# SN75159 DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

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## schematic (each driver)



▽ ... VCC bus

Resistor values shown are nominal.

SN75159  
DUAL DIFFERENTIAL LINE DRIVER  
WITH 3-STATE OUTPUTS

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**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

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### 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‡	$V_{CC} = 4.75 \text{ V}$	$\pm 0.02$	$\pm 0.4$		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.

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## DUAL DIFFERENTIAL LINE DRIVER WITH 3-STATE OUTPUTS

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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	$C_L = 30\text{ pF}$ , $R_L = 100\text{ }\Omega$ , 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	$C_L = 30\text{ pF}$ , $R_L = 100\text{ }\Omega$ , 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	$C_L = 30\text{ pF}$ , $R_L = 180\text{ }\Omega$ , See Figure 3		7	20	ns
$t_{PZL}$ Output enable time to low level	$C_L = 30\text{ pF}$ , $R_L = 250\text{ }\Omega$ , See Figure 4		14	40	ns
$t_{PHZ}$ Output disable time from high level	$C_L = 30\text{ pF}$ , $R_L = 180\text{ }\Omega$ , See Figure 3		10	30	ns
$t_{PLZ}$ Output disable time from low level	$C_L = 30\text{ pF}$ , $R_L = 250\text{ }\Omega$ , See Figure 4		17	35	ns
Overshoot factor	$R_L = 100\text{ }\Omega$ , 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

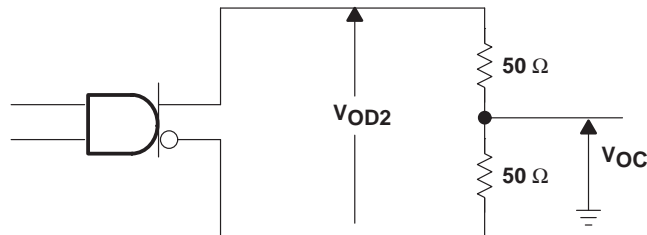
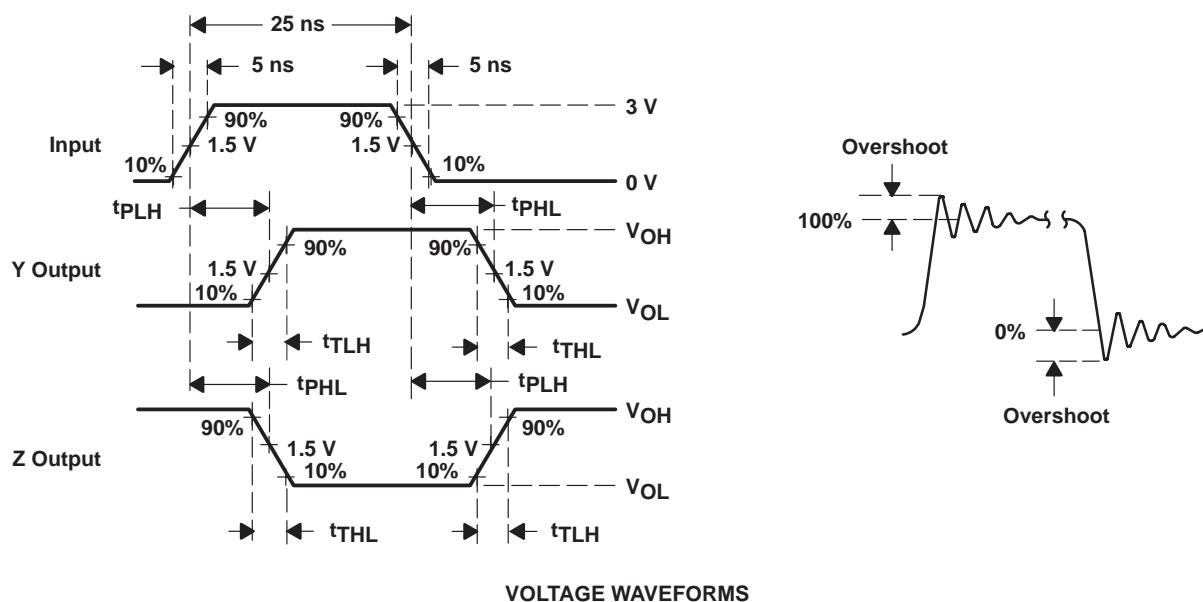
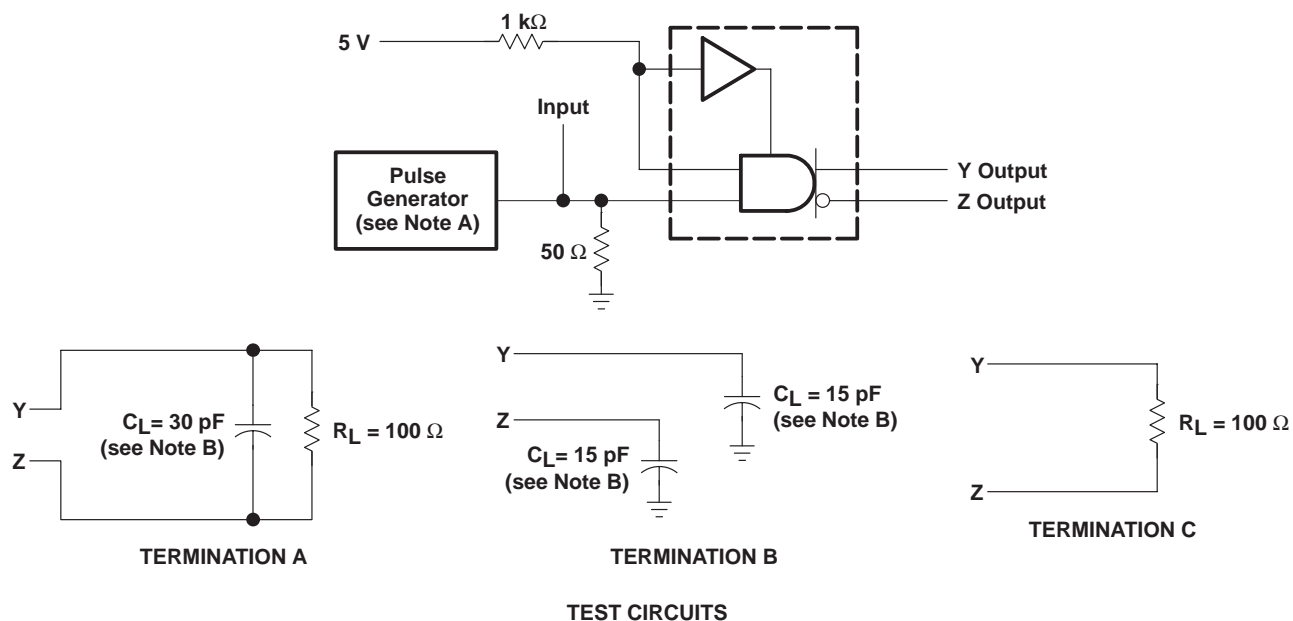


Figure 1. Differential and Common-Mode Output Voltages

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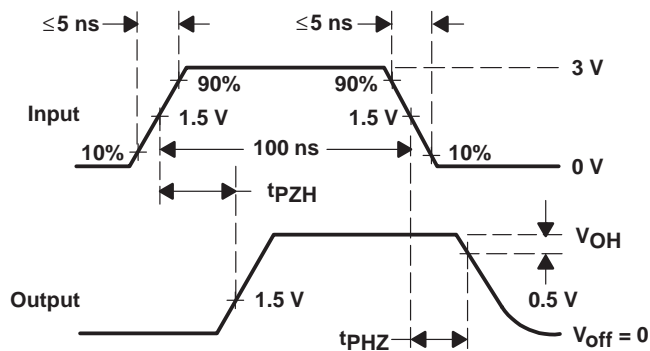
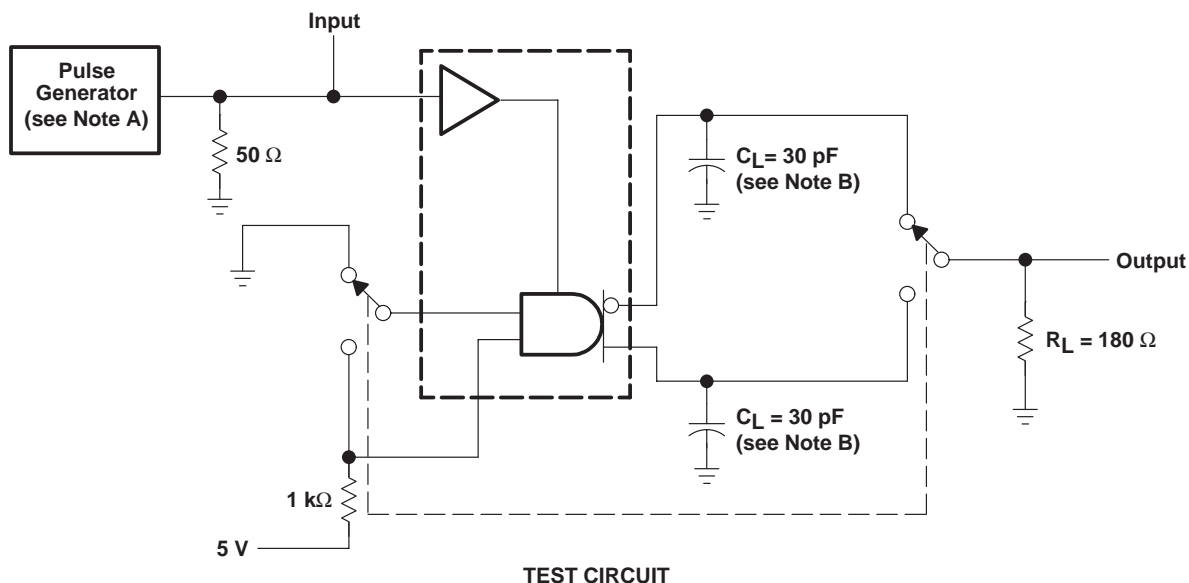
## PARAMETER MEASUREMENT INFORMATION



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

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

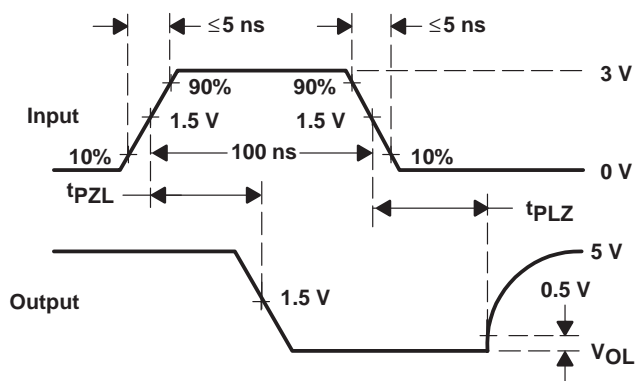
## PARAMETER MEASUREMENT INFORMATION



- 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

## TEST CIRCUIT

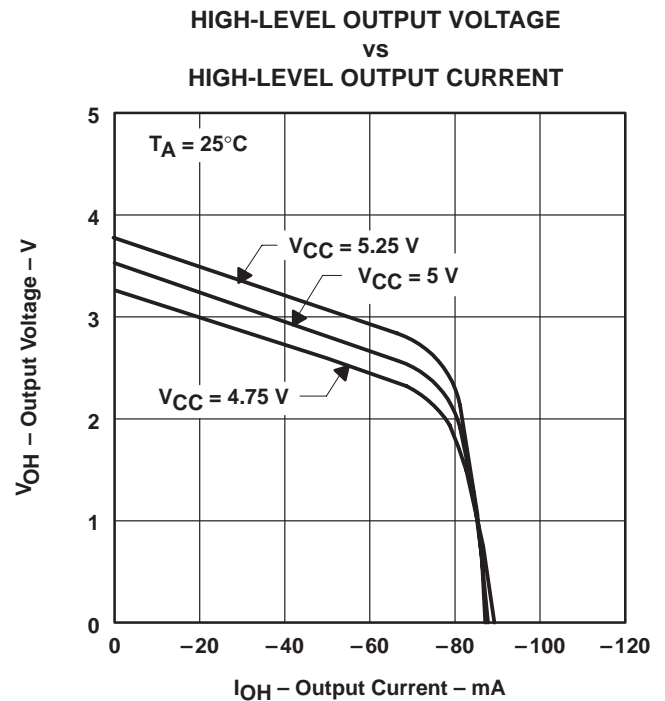
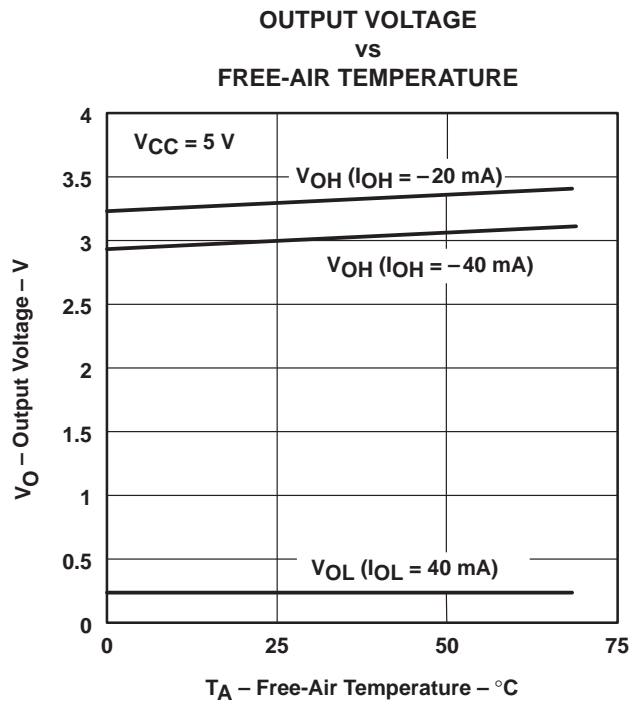
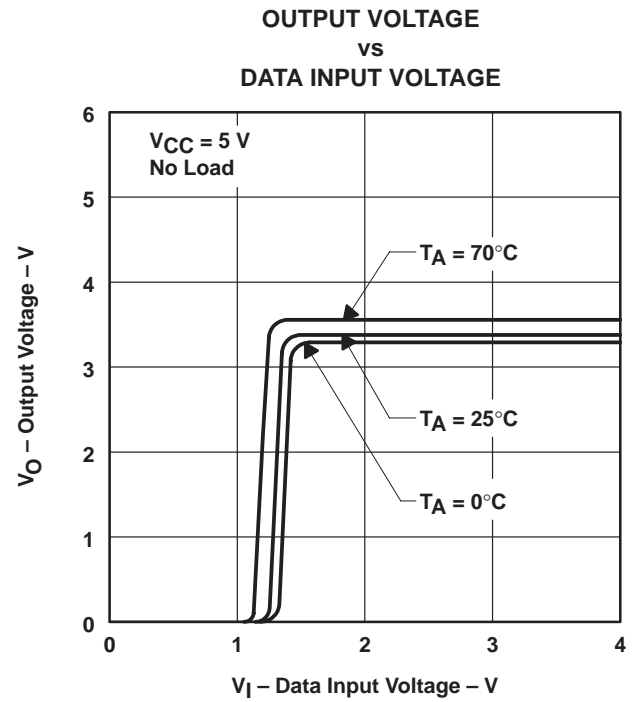
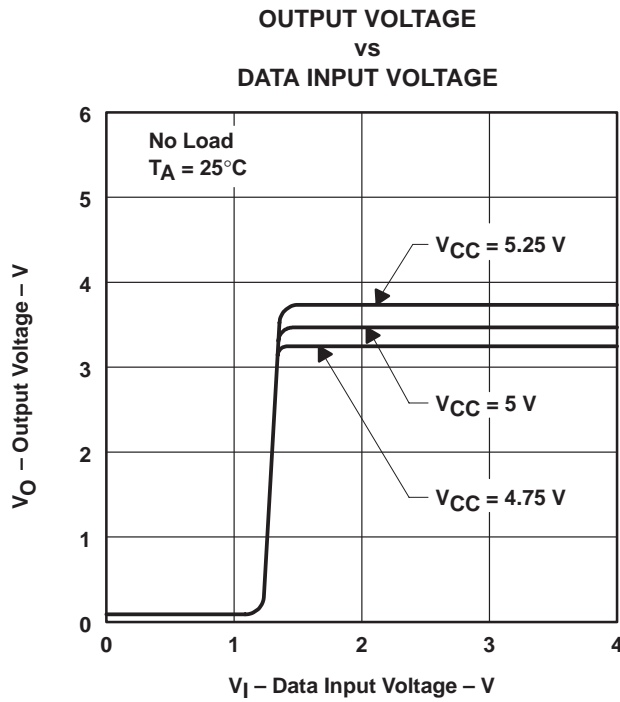


## VOLTAGE WAVEFORMS

### Figure 4. Test Circuit and Voltage Waveform



## TYPICAL CHARACTERISTICS



# SN75159

## DUAL DIFFERENTIAL LINE DRIVER

### WITH 3-STATE OUTPUTS

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#### TYPICAL CHARACTERISTICS

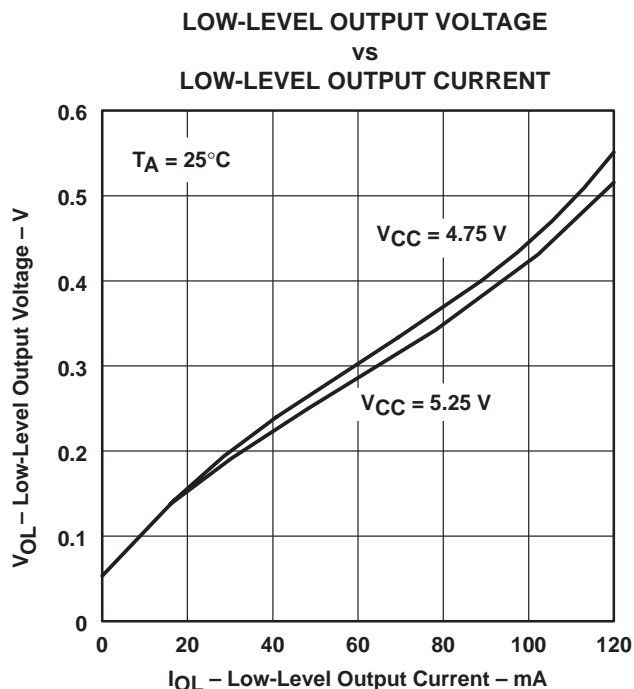


Figure 9

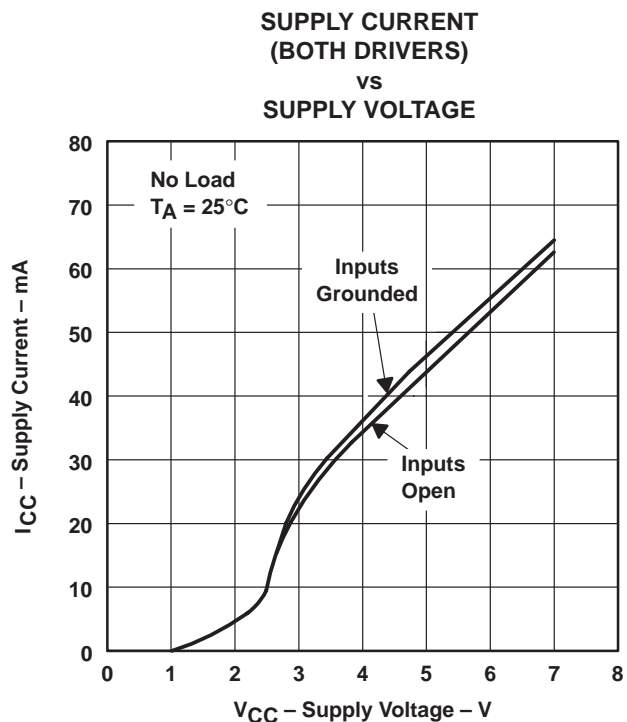


Figure 10

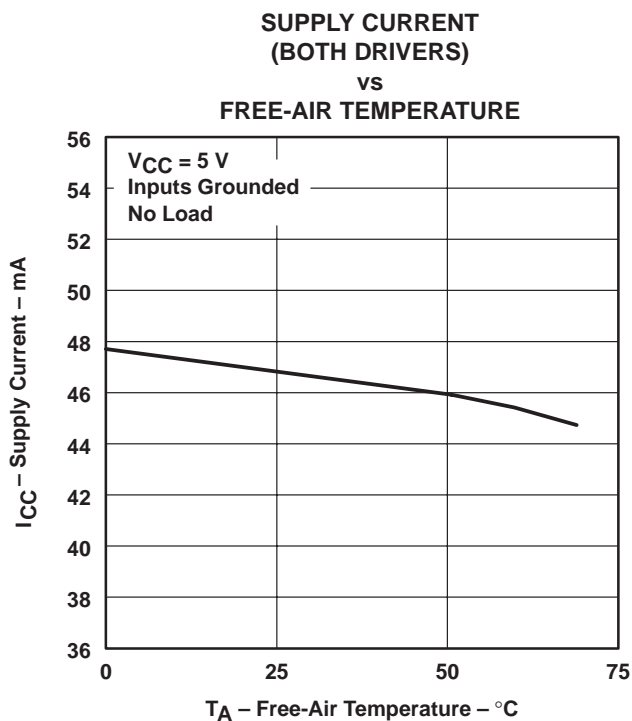


Figure 11

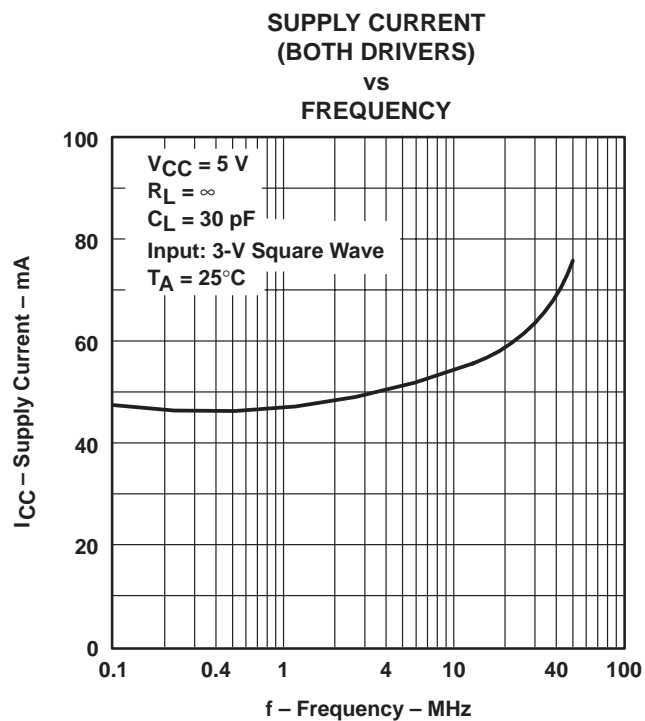
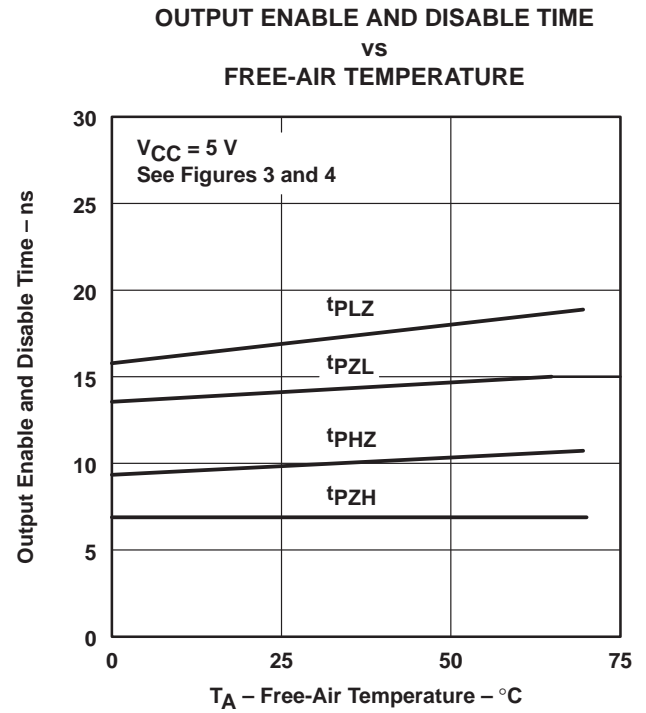
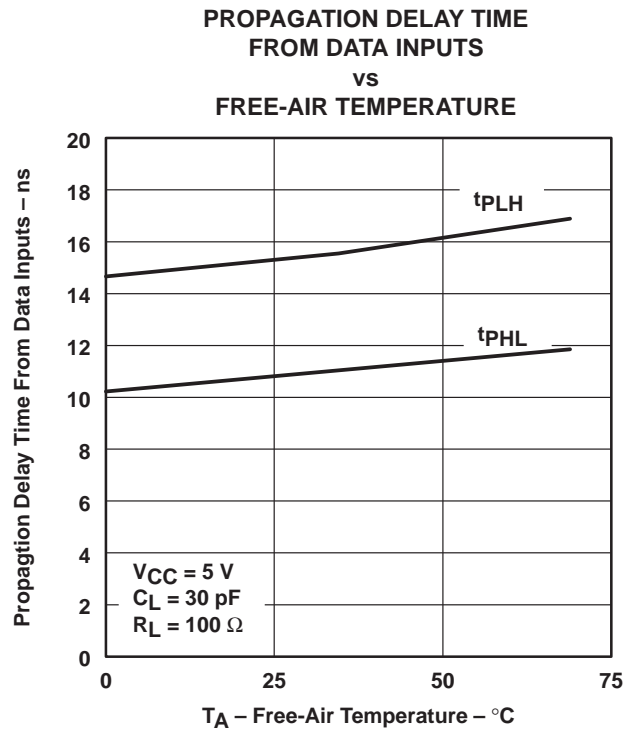


Figure 12

## TYPICAL CHARACTERISTICS



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