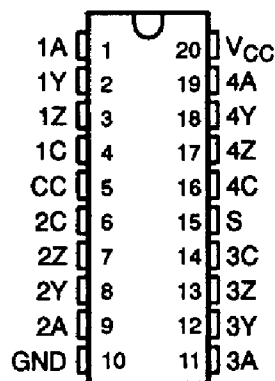


# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

SLLS082A - D2453, DECEMBER 1978 - REVISED FEBRUARY 1993

- Meets EIA Standard RS-422-A
- High-Impedance Output State for Party-Line Operation
- High Output Impedance in Power-Off Condition
- Low Input Current to Minimize Loading
- Single 5-V Supply
- 40-mA Sink- and Source-Current Capability
- High-Speed Schottky Circuitry
- Low Power Requirements

**SN75151**  
DW OR N PACKAGE  
(TOP VIEW)

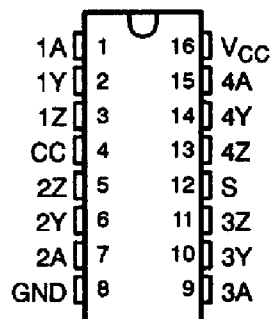


## description

These line drivers are designed to provide differential signals with high current capability on balanced lines. These circuits provide strobe and enable inputs to control all four drivers, and the SN75151 provides an additional enable input for each driver. The output circuits have active pullup and pulldown and are capable of sinking or sourcing 40 mA.

The SN75151 and SN75153 meet all requirements of EIA Standard RS-422-A and Federal Standard 1020. They are characterized for operation from 0°C to 70°C.

**SN75153**  
N PACKAGE  
(TOP VIEW)



**SN75153**  
NOT RECOMMENDED FOR NEW DESIGN

## Function Tables

**SN75151**

INPUTS				OUTPUTS	
ENABLE CC	ENABLE C	STROBE S	DATA A	Y	Z
L	X	X	X	Z	Z
X	L	X	X	Z	Z
H	H	L	X	L	H
H	H	X	L	L	H
H	H	H	H	H	L

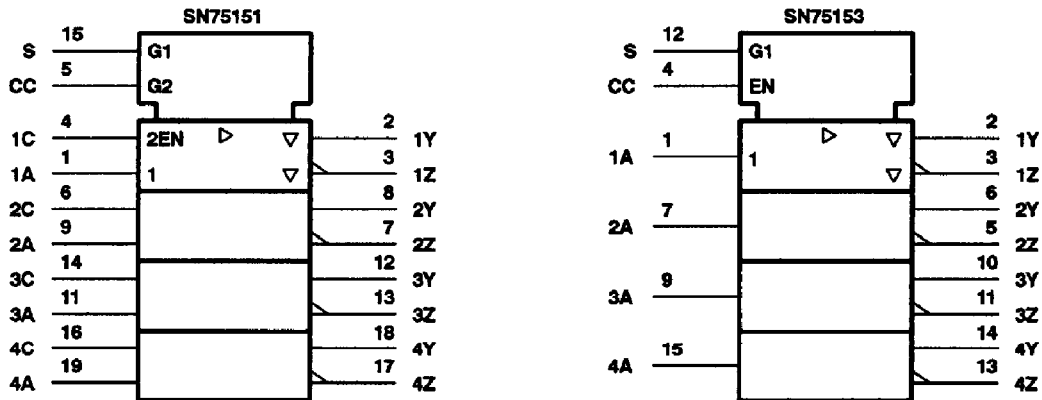
**SN75153**

INPUTS			OUTPUTS	
ENABLE CC	STROBE S	DATA A	Y	Z
L	X	X	Z	Z
H	L	X	L	H
H	X	L	L	H
H	H	H	H	L

# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

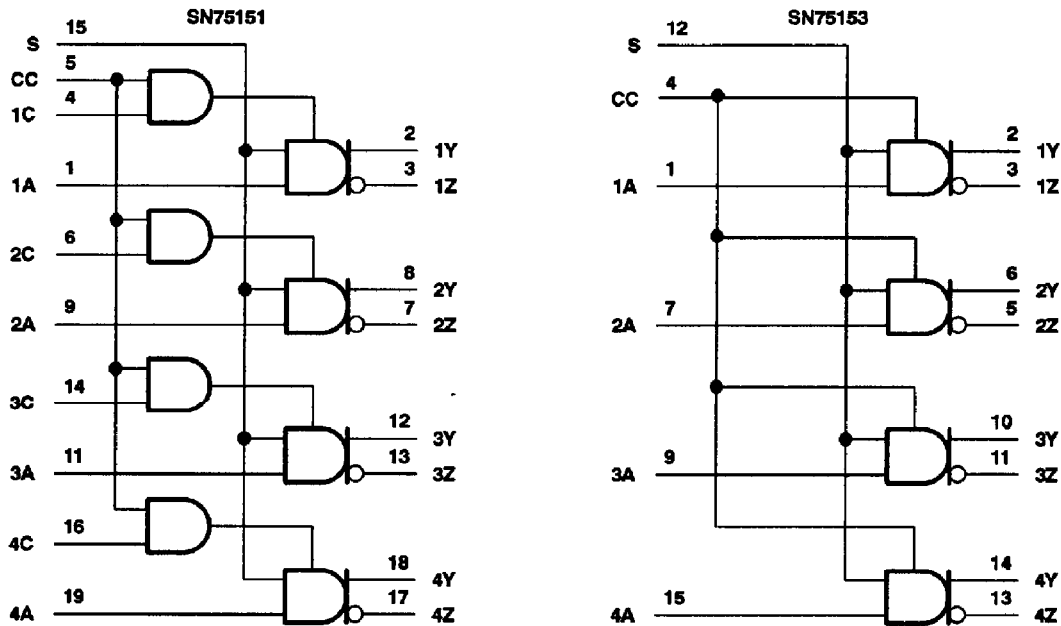
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## logic symbols†



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

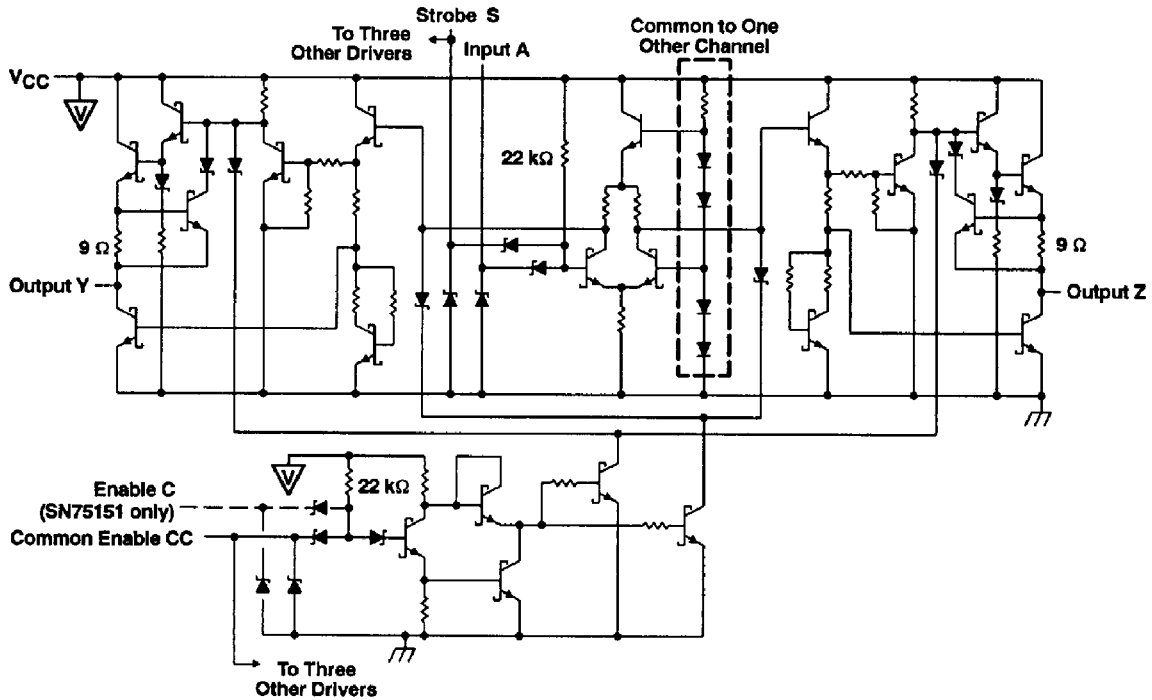
## logic diagrams (positive logic)



# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

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**schematic**



Resistor values shown are nominal.

**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
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range	0°C to 70°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTES: 1. All voltage values, except differential output voltage  $V_{OD}$ , are with respect to network ground terminal.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A = 25^\circ\text{C}$	OPERATING FACTOR	$T_A = 70^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	POWER RATING
DW	1125 mW	9.0 mW/°C	720 mW
N	1150 mW	9.2 mW/°C	736 mW



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# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

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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, $V_{IH}$	2			V
Low-level input voltage, $V_{IL}$			0.8	V
Common-mode output voltage, $V_{OC}$	-0.25		6	V
High-level output current, $I_{OH}$			-40	mA
Low-level output current, $I_{OL}$			40	mA
Operating free-air temperature, $T_A$	0		70	°C

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

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$	CC, S		-2	V
		All others	-0.9	-1.5	
$V_{OH}$ High-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IL} = \text{MAX}$ , $V_{IH} = 2 \text{ V}$	$I_{OH} = -20 \text{ mA}$	2.5		V
		$I_{OH} = -40 \text{ mA}$	2.4		
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IL} = \text{MAX}$ , $I_{OL} = 40 \text{ mA}$			0.5	V
$ V_{OD1} $ Differential output voltage	$V_{CC} = \text{MAX}$ , $I_O = 0$		3.4	$2V_{OD2}$	V
$ V_{OD2} $ Differential output voltage	$V_{CC} = \text{MIN}$	2	2.8		V
$\Delta V_{OD} $ Change in magnitude of differential output voltage§	$V_{CC} = \text{MIN}$		$\pm 0.01$	$\pm 0.4$	V
$V_{OC}$ Common-mode output voltage¶	$V_{CC} = \text{MAX}$ $V_{CC} = \text{MIN}$	$R_L = 100 \Omega$ , See Figure 1	1.8	3	V
			1.6	3	
$\Delta V_{OC} $ Change in magnitude of common-mode output voltage§	$V_{CC} = \text{MIN or MAX}$		$\pm 0.02$	$\pm 0.4$	V
$I_{OZ}$ Off-state (high-impedance state) output current	$V_{CC} = \text{MAX}$ , Enable at 0.8 V	$V_O = 0.5 \text{ V}$		-20	$\mu\text{A}$
		$V_O = 2.5 \text{ V}$		20	
		$V_O = V_{CC}$		20	
$I_O$ 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	
		$V_O = -0.25 \text{ V to } 6 \text{ V}$		$\pm 100$	
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			0.1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$	C(SN75151), A		20	$\mu\text{A}$
		CC, S		80	
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	C(SN75151), A		-0.36	mA
		CC, S		-1.6	
$I_{OS}$ Short-circuit output current#	$V_{CC} = \text{MAX}$	-50	-90	-150	mA
$I_{CC}$ Supply current (both drivers)	$V_{CC} = \text{MAX}$ , No load	Outputs disabled	30	60	mA
		Outputs enabled	60	80	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5 \text{ V}$  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 EIA Standard RS-422-A,  $V_{OC}$ , which is the average of the two output voltages with respect to ground, 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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**switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
t <sub>PLH</sub> Propagation delay time, low-to-high-level output	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 100 Ω, See Figure 2, Termination A		15	30	ns
t <sub>PHL</sub> Propagation delay time, high-to-low-level output			15	30	ns
t <sub>PLH</sub> Propagation delay time, low-to-high-level output	C <sub>L</sub> = 30 pF, See Figure 2, Termination B		13	25	ns
t <sub>PHL</sub> Propagation delay time, high-to-low-level output			13	25	ns
t <sub>TLH</sub> Transition time, low-to-high-level output	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 100 Ω, See Figure 2, Termination A		12	20	ns
t <sub>THL</sub> Transition time, high-to-low-level output			12	20	ns
t <sub>PZH</sub> Output enable time to high level	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 60 Ω, See Figure 3		18	35	ns
t <sub>PZL</sub> Output enable time to low level	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 111 Ω, See Figure 4		20	35	ns
t <sub>PHZ</sub> Output disable time from high level	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 60 Ω, See Figure 3		19	30	ns
t <sub>PLZ</sub> Output disable time from low level	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 111 Ω, See Figure 4		13	30	ns
Overshoot factor	R <sub>L</sub> = 100 Ω, See Figure 2, Termination C			10	%

† All typical values are at T<sub>A</sub> = 25°C.

## PARAMETER MEASUREMENT INFORMATION

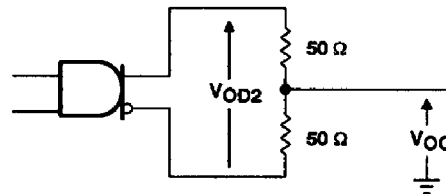


Figure 1. Differential and Common-Mode Output Voltages

**TEXAS  
INSTRUMENTS**

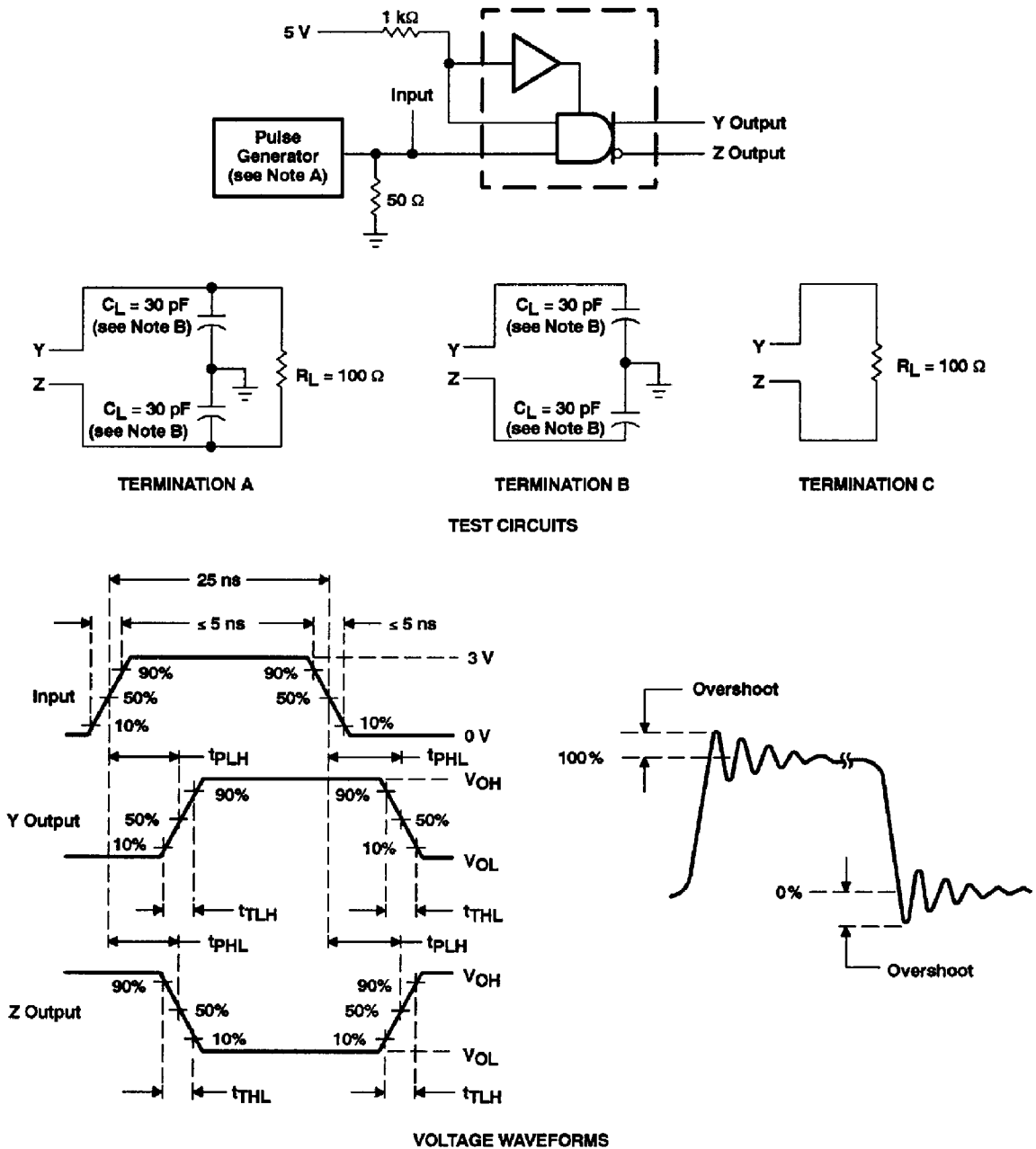
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# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

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## PARAMETER MEASUREMENT INFORMATION



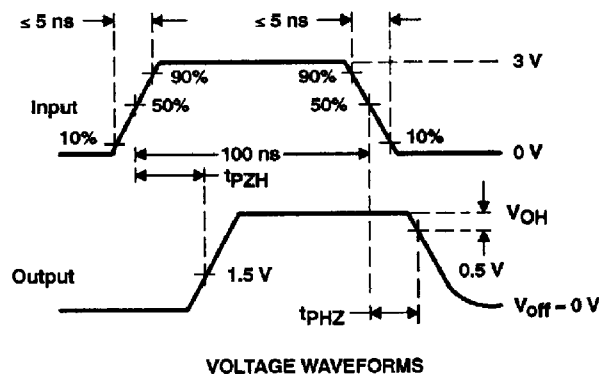
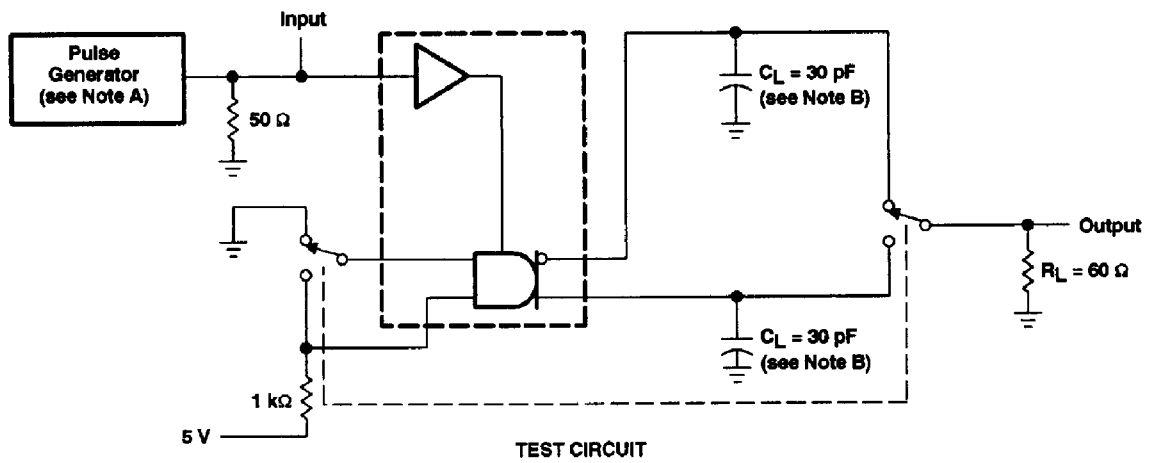
NOTES: A. The pulse generator has the following characteristics:  $Z_0 = 50 \Omega$ ,  $PRR \leq 10 \text{ MHz}$ .  
 B.  $C_L$  includes probe and jig capacitance.

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

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## PARAMETER MEASUREMENT INFORMATION



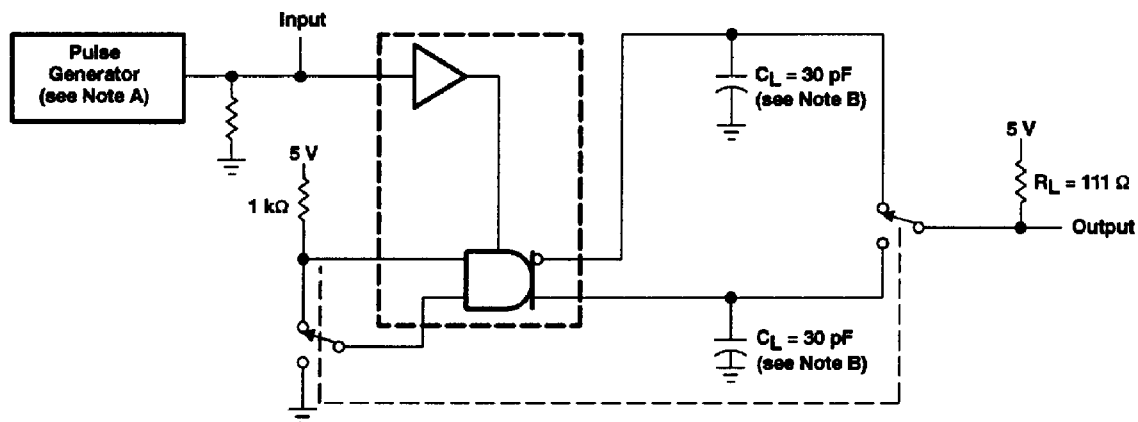
- NOTES: A. The pulse generator has the following characteristics:  $Z_O = 50 \Omega$ ,  $PRR \leq 500 \text{ kHz}$ .  
 B.  $C_L$  includes probe and jig capacitance.

**Figure 3. Test Circuit and Voltage Waveforms**

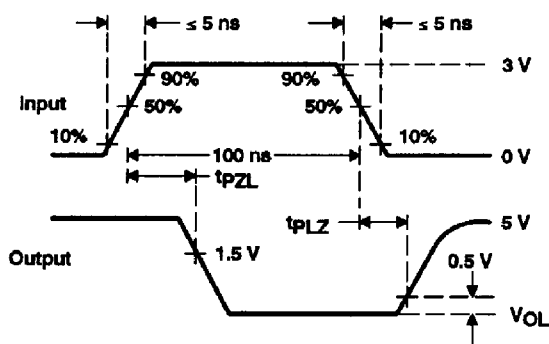
# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

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## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES: A. The pulse generators have 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 Waveforms



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## TYPICAL CHARACTERISTICS

Y OUTPUT VOLTAGE  
vs  
DATA INPUT VOLTAGE

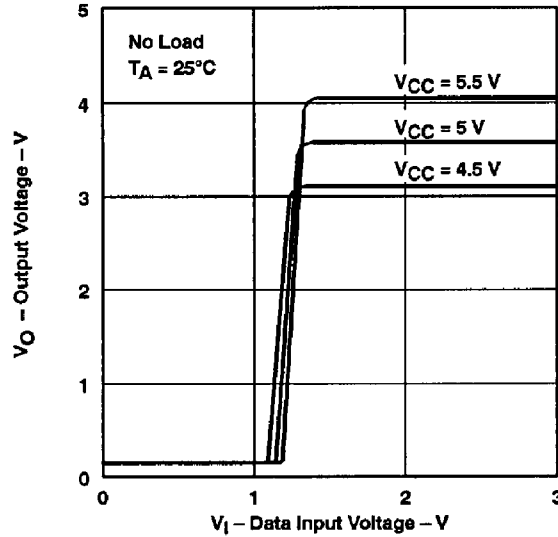
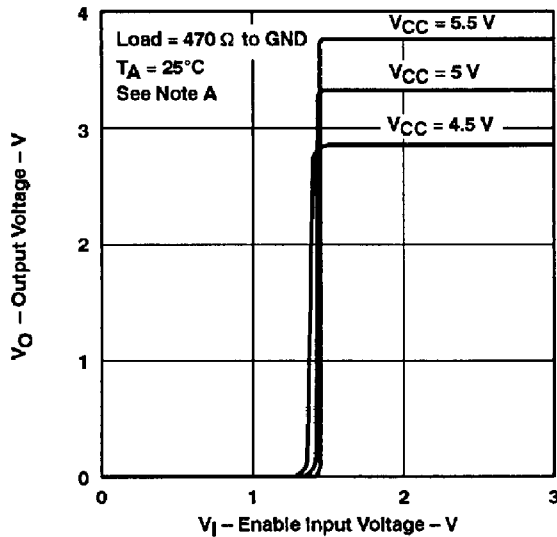


Figure 5

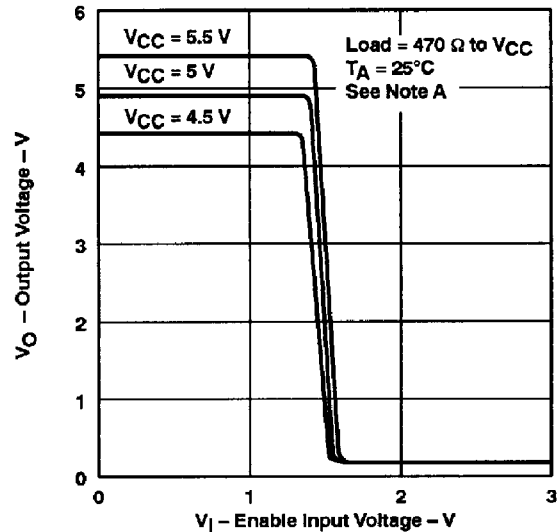
Y OR Z OUTPUT VOLTAGE  
vs  
ENABLE INPUT VOLTAGE



NOTE A: The A input is connected to  $V_{CC}$  during the testing of the Y outputs and to ground during testing of the Z outputs.

Figure 6

Y OR Z OUTPUT VOLTAGE  
vs  
ENABLE INPUT VOLTAGE



NOTE A: The A input is connected to  $V_{CC}$  during the testing of the Y outputs and to  $V_{CC}$  during the testing of the Z outputs.

Figure 7



# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

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## TYPICAL CHARACTERISTICS

HIGH-LEVEL OUTPUT VOLTAGE  
vs  
FREE-AIR TEMPERATURE

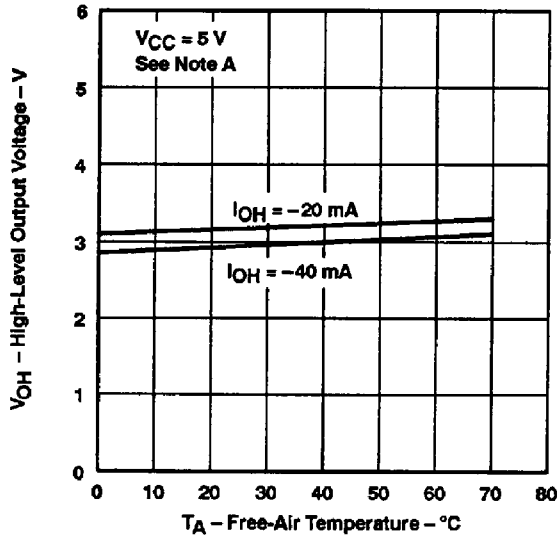


Figure 8

HIGH-LEVEL OUTPUT VOLTAGE  
vs  
OUTPUT CURRENT

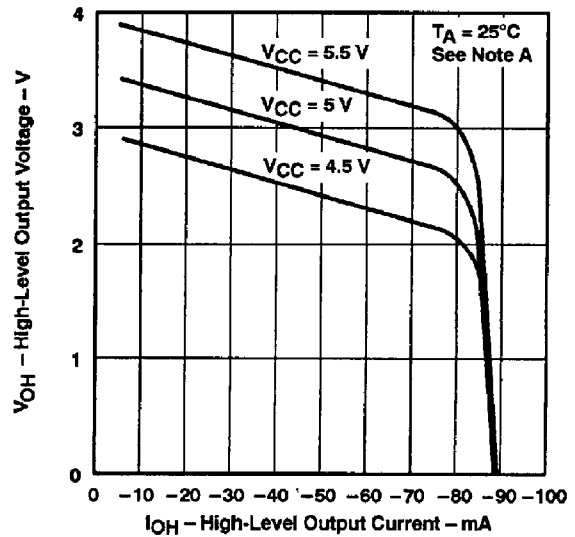


Figure 9

NOTE A: The A input is connected to  $V_{CC}$  during the testing of the Y outputs and to ground during testing of the Z outputs.

LOW-LEVEL OUTPUT VOLTAGE  
vs  
FREE-AIR TEMPERATURE

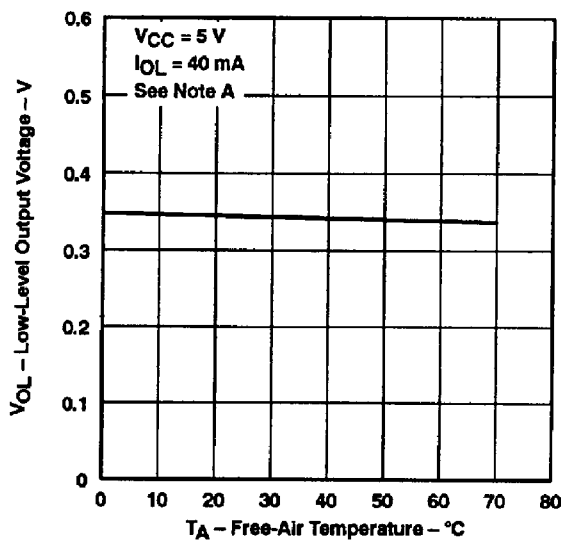


Figure 10

LOW-LEVEL OUTPUT VOLTAGE  
vs  
OUTPUT CURRENT

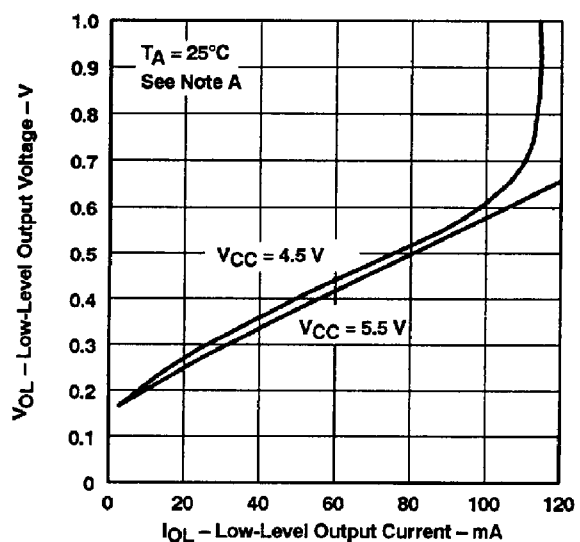


Figure 11

NOTE A: The A input is connected to GND during the testing of the Y outputs and to  $V_{CC}$  during the testing of the Z outputs.

# SN75151, SN75153 QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

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## TYPICAL CHARACTERISTICS

SUPPLY CURRENT  
vs  
SUPPLY VOLTAGE

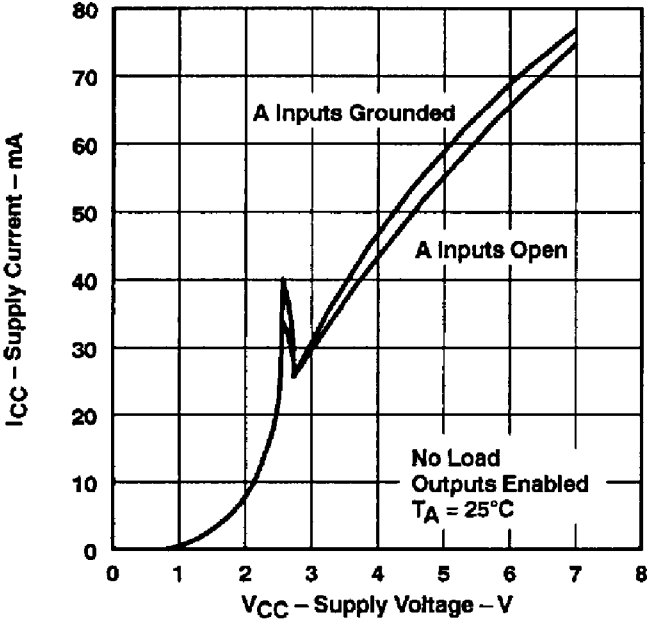


Figure 12

SUPPLY CURRENT  
vs  
SUPPLY VOLTAGE

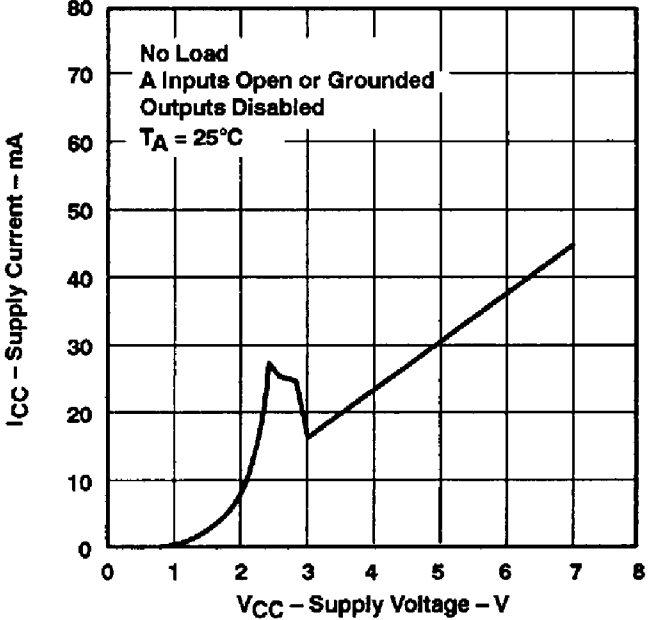


Figure 13