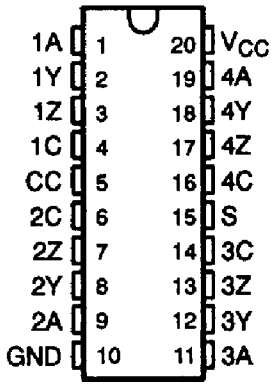
SN75151, SN75153
QUAD DIFFERENTIAL LINE DRIVERS WITH 3-STATE OUTPUTS

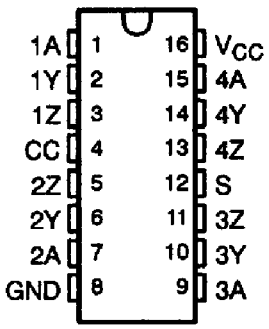
SLLS082A – D2453, DECEMBER 1978 – REVISED FEBRUARY 1993

- **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)



SN75153
N PACKAGE
(TOP VIEW)



SN75153
NOT RECOMMENDED FOR NEW DESIGN

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.

Function Tables

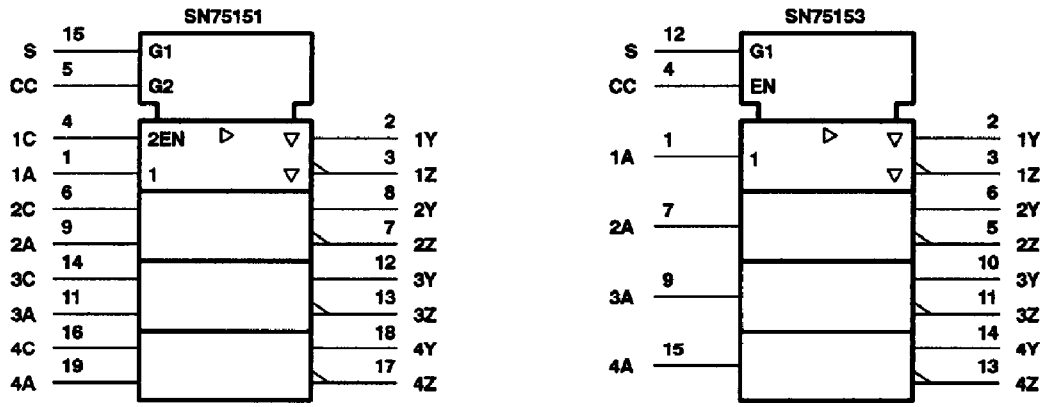
SN75151

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

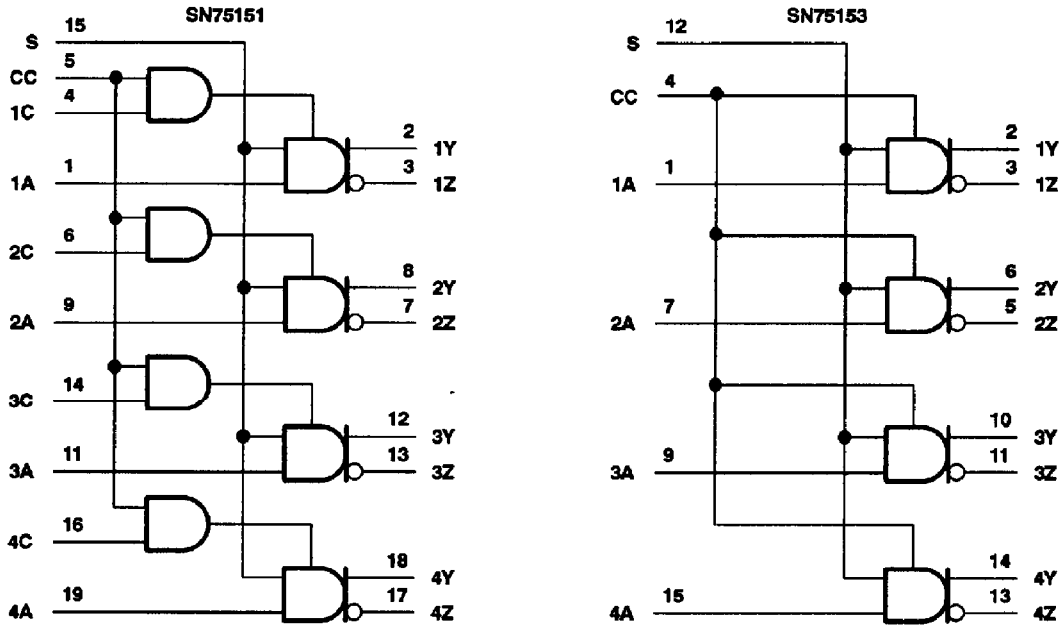
INPUTS			OUTPUTS	
ENABLE CC	STROBE S	DATA A	Y	Z
L	X	X	Z	Z
H	L	X	L	H
H	X	L	L	H
H	H	H	H	L

logic symbols†

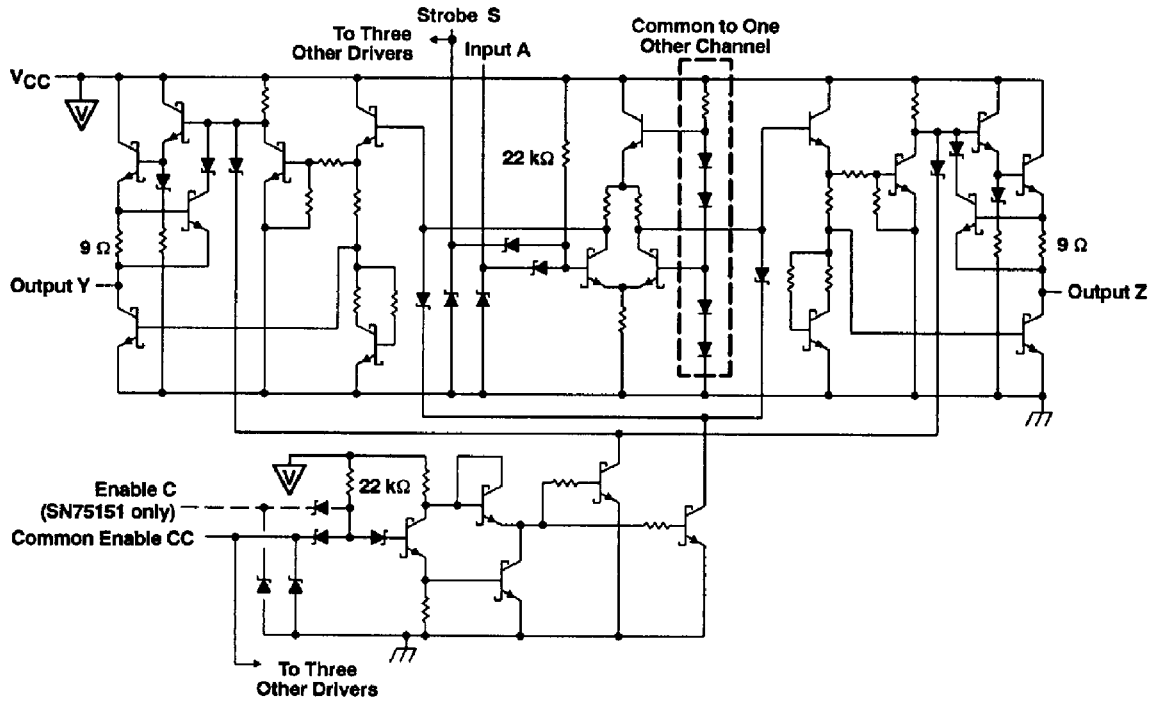


† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagrams (positive logic)



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	$T_A \leq 25°C$ POWER RATING	OPERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
DW	1125 mW	9.0 mW/°C	720 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
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} = MIN, I_I = −12 mA	CC, S			−2	V
			All others		−0.9	−1.5	
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IL} = MAX, V_{IH} = 2 V	I_{OH} = −20 mA	2.5			V
			I_{OH} = −40 mA	2.4			
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IL} = MAX, V_{IH} = 2 V, I_{OL} = 40 mA				0.5	V
$\|V_{OD1}\|$	Differential output voltage	V_{CC} = MAX, I_O = 0			3.4	$2V_{OD2}$	V
$\|V_{OD2}\|$	Differential output voltage	V_{CC} = MIN	R_L = 100 Ω, See Figure 1	2	2.8		V
$\Delta\|V_{OD}\|$	Change in magnitude of differential output voltage§	V_{CC} = MIN			±0.01	±0.4	V
V_{OC}	Common-mode output voltage¶	V_{CC} = MAX			1.8	3	V
		V_{CC} = MIN			1.6	3	
$\Delta\|V_{OC}\|$	Change in magnitude of common-mode output voltage§	V_{CC} = MIN or MAX			±0.02	±0.4	V
I_{OZ}	Off-state (high-impedance state) output current	V_{CC} = MAX, Enable at 0.8 V	V_O = 0.5 V			−20	μA
			V_O = 2.5 V			20	
			V_O = V_{CC}			20	
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_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V				0.1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.4 V	C(SN75151), A			20	μA
			CC, S			80	
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V	C(SN75151), A			−0.36	mA
			CC, S			−1.6	
I_{OS}	Short-circuit output current#	V_{CC} = MAX		−50	−90	−150	mA
I_{CC}	Supply current (both drivers)	V_{CC} = 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°C and V_{CC} = 5 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.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V (unless otherwise noted)

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

† All typical values are at T_A = 25°C.

PARAMETER MEASUREMENT INFORMATION

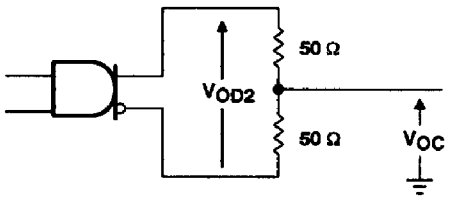
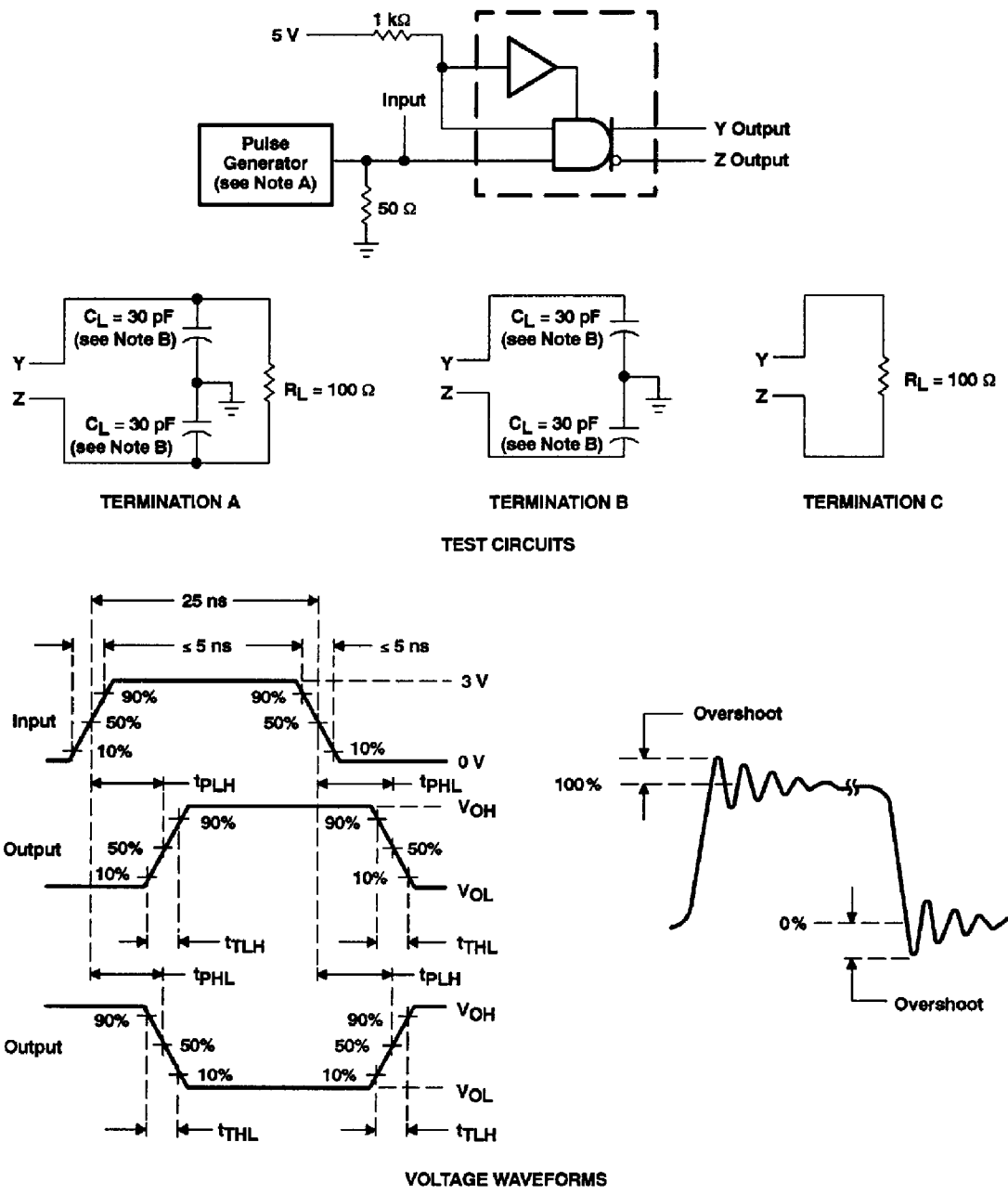


Figure 1. Differential and Common-Mode Output Voltages

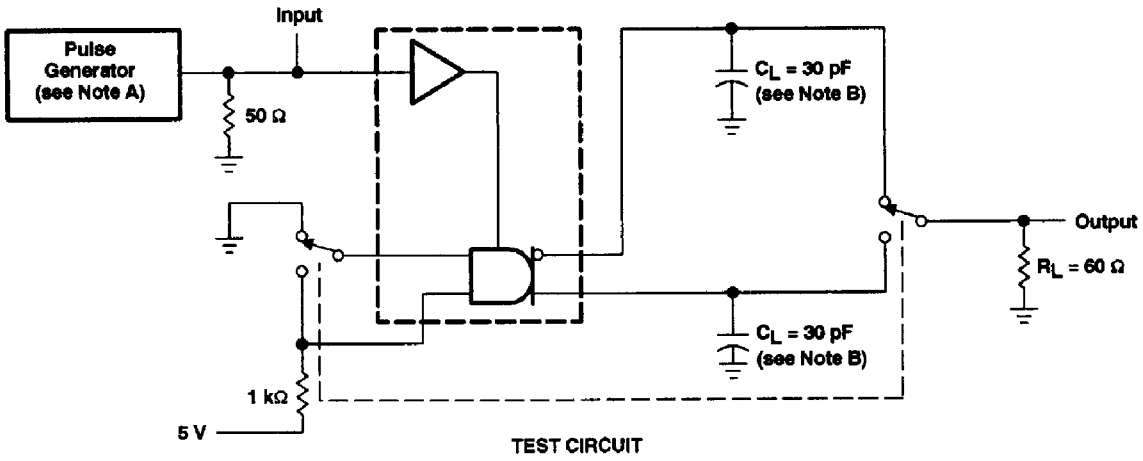
PARAMETER MEASUREMENT INFORMATION



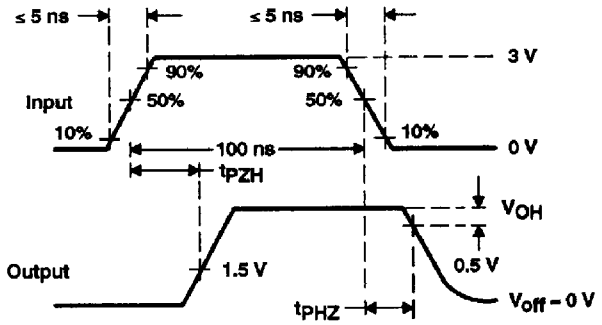
NOTES: A. The pulse generator has the following characteristics: Z_O = 50 Ω, PRR ≤ 10 MHz.
B. C_L includes probe and jig capacitance.

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

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

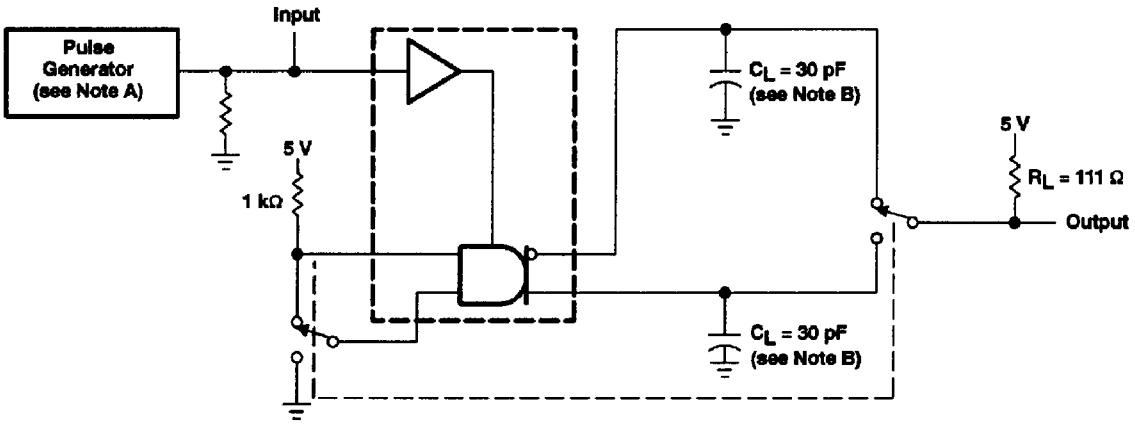


VOLTAGE WAVEFORMS

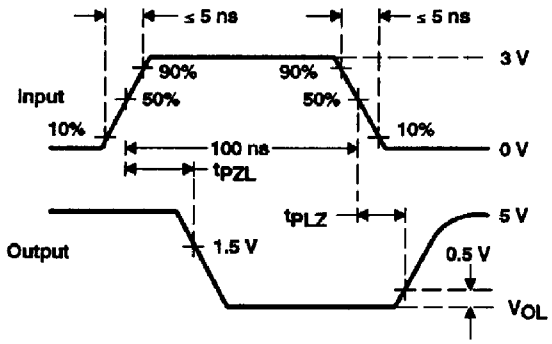
NOTES: A. The pulse generator has the following characteristics: Z_O = 50 Ω, PRR ≤ 500 kHz.
B. C_L includes probe and jig capacitance.

Figure 3. Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. The pulse generators have the following characteristics: Z_O = 50 Ω, PRR ≤ 500 kHz.
B. C_L includes probe and jig capacitance.

Figure 4. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

Y OUTPUT VOLTAGE
vs
DATA INPUT VOLTAGE

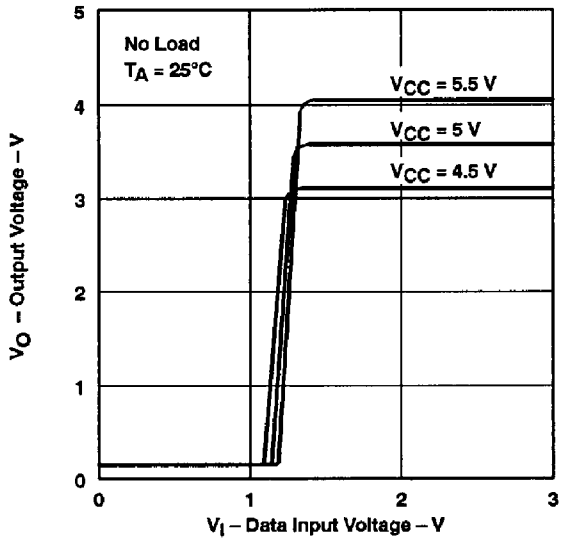
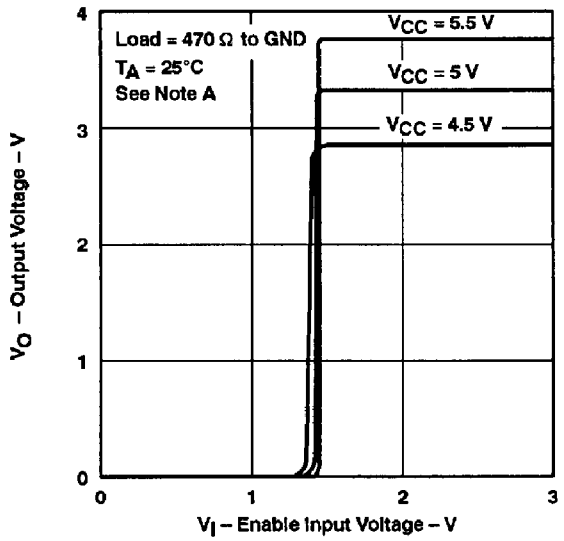


Figure 5

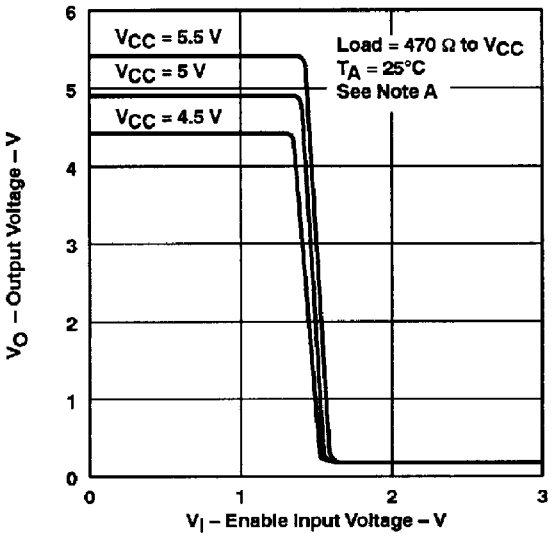
Y OR Z OUTPUT VOLTAGE
vs
ENABLE INPUT VOLTAGE



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 GND during the testing of the Y outputs and to V_{CC} during the testing of the Z outputs.

Figure 7

TYPICAL CHARACTERISTICS

HIGH-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

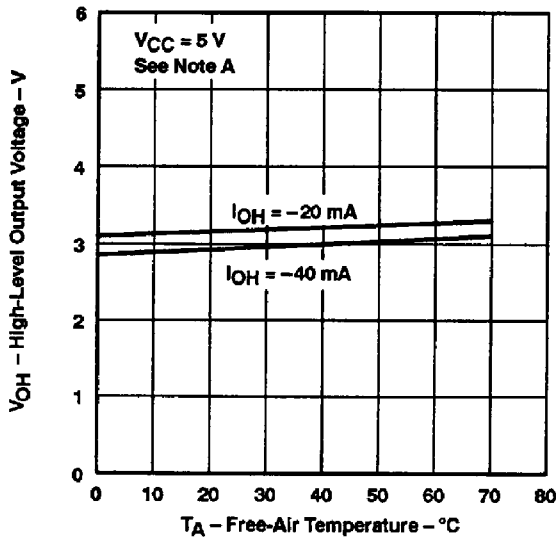


Figure 8

HIGH-LEVEL OUTPUT VOLTAGE
vs
OUTPUT CURRENT

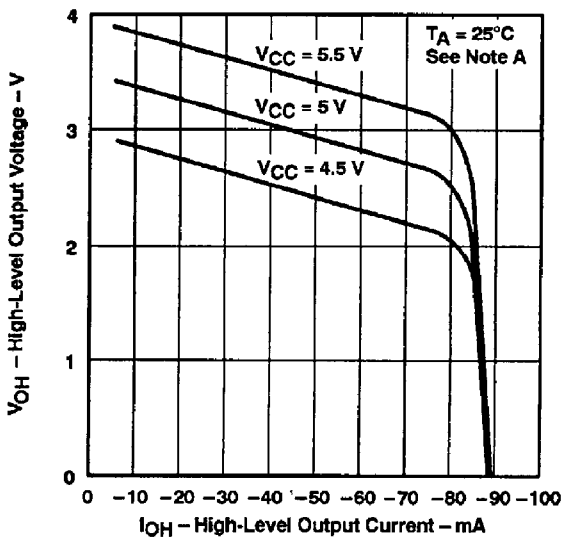


Figure 9

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

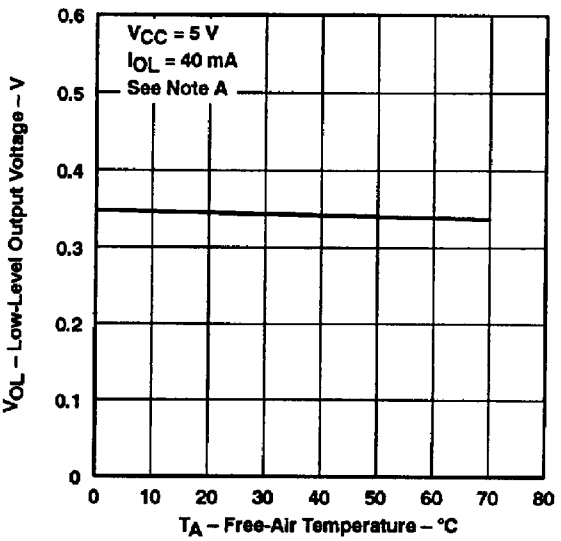


Figure 10

LOW-LEVEL OUTPUT VOLTAGE
vs
OUTPUT CURRENT

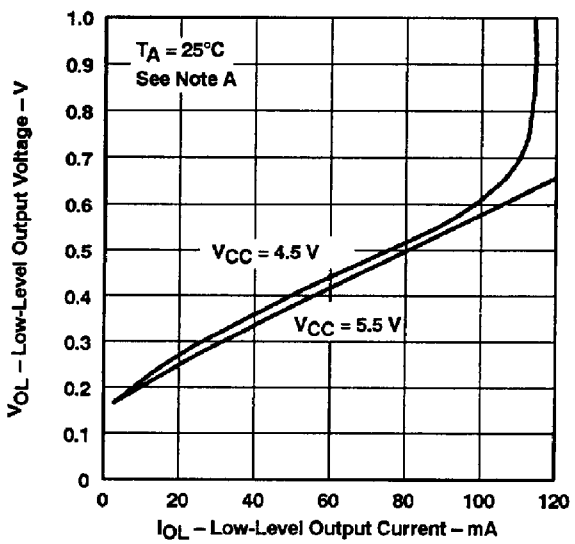


Figure 11

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.

TYPICAL CHARACTERISTICS

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

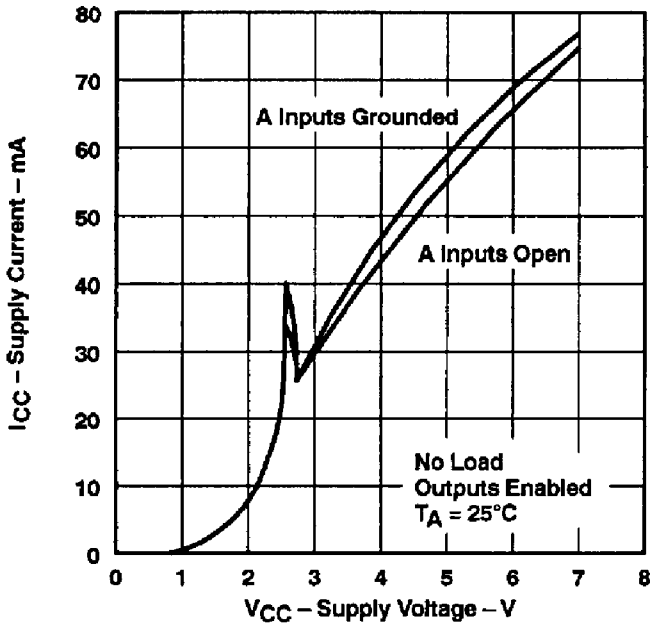


Figure 12

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

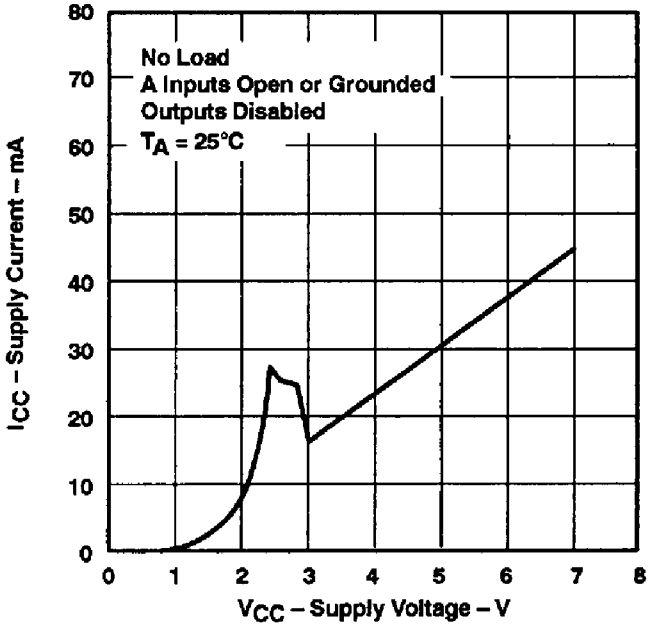


Figure 13