

SN55113, SN75113 DUAL DIFFERENTIAL LINE DRIVERS

SLLS070C – SEPTEMBER 1973 – REVISED MARCH 1997

- Choice of Open-Collector, Open-Emitter, or 3-State Outputs
- High-Impedance Output State for Party-Line Applications
- Single-Ended or Differential AND/NAND Outputs
- Single 5-V Supply
- Dual Channel Operation
- Compatible With TTL
- Short-Circuit Protection
- High-Current Outputs
- Common and Individual Output Controls
- Clamp Diodes at Inputs and Outputs
- Easily Adaptable to SN55114 and SN75114 Applications
- Designed for Use With SN55115 and SN75115

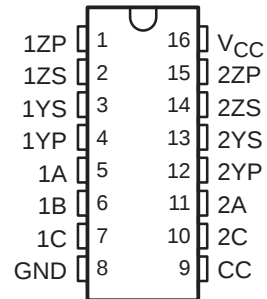
description

The SN55113 and SN75113 dual differential line drivers with 3-state outputs are designed to provide all the features of the SN55114 and SN75114 line drivers with the added feature of driver output controls. Individual controls are provided for each output pair, as well as a common control for both output pairs. If any output is low, the associated output is in a high-impedance state and the output can neither drive nor load the bus. This permits many devices to be connected together on the same transmission line for party-line applications.

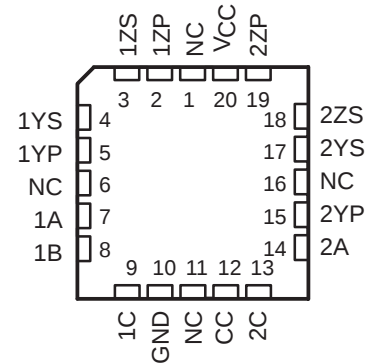
The output stages are similar to TTL totem-pole outputs, but with the sink outputs, YS and ZS, and the corresponding active pullup terminals, YP and ZP, available on adjacent package pins.

The SN55113 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN75113 is characterized for operation over the temperature range of 0°C to 70°C .

SN55113 . . . J OR W PACKAGE
SN75113 . . . N PACKAGE
(TOP VIEW)



SN55113 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection



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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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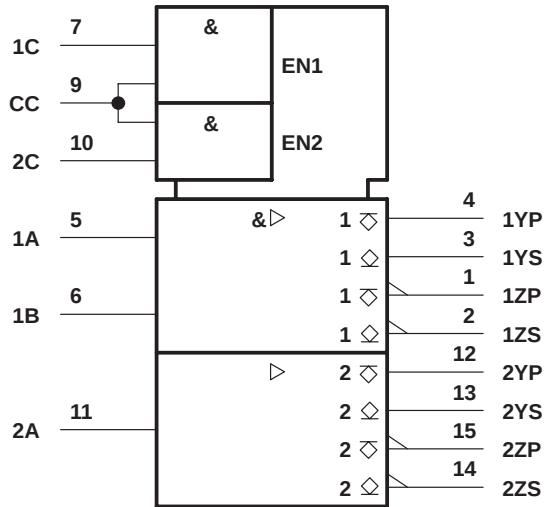
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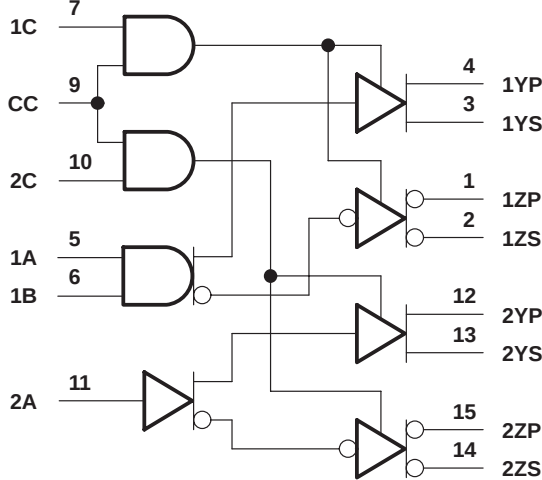
FUNCTION TABLE					
INPUTS			OUTPUTS		
OUTPUT C	CONTROL CC	DATA		AND Y	NAND Z
		A	B†		
L	X	X	X	Z	Z
X	L	X	X	Z	Z
H	H	L	X	L	H
H	H	X	L	L	H
H	H	H	H	H	L

H = high level, L = low level, X = irrelevant,
 Z = high impedance (off)
 † B input and 4th line of function table are applicable only to
 driver number 1.

logic symbol‡



logic diagram (positive logic)



‡ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
 Pin numbers shown are for the J, N, and W packages.

The schematic diagram illustrates the internal circuitry of a 16-pin logic device. The pins and their functions are as follows:

- Pin 1:** NAND Pullup 1ZP
- Pin 2:** NAND Sink Output 1ZS
- Pin 3:** AND Sink Output 1YS
- Pin 4:** AND Pullup 1YP
- Pin 5:** Input 1A
- Pin 6:** Input 1B
- Pin 7:** Output Control 1C
- Pin 8:** GND
- Pin 9:** Common Output Control CC
- Pin 10:** Output Control 2C
- Pin 11:** Input 2A
- Pin 12:** AND Pullup 2YP
- Pin 13:** AND Output 2YS
- Pin 14:** NAND Pullup 2ZP
- Pin 15:** NAND Output 2ZS
- Pin 16:** VCC

The internal circuitry includes several logic gates (AND, NAND), pullup/pulldown networks, and output drivers. Key components and their values are:

- Resistors:** 1 kΩ, 4 kΩ, 900 Ω, 90 Ω, 500 Ω, 100 Ω, 600 Ω, 333 Ω, 9 Ω, 5 kΩ, 1.6 kΩ, 1 kΩ.
- Capacitors:** 600 Ω (likely a typo for 600 pF or nF).
- Logic Gates:** AND gates (AND Sink Output 1YS, AND Pullup 1YP, AND Pullup 2YP, AND Output 2YS), NAND gates (NAND Sink Output 1ZS, NAND Pullup 1ZP, NAND Pullup 2ZP, NAND Output 2ZS).
- Output Drivers:** Transistors and diodes connected to pins 1, 2, 13, and 15.
- Input/Output Buffers:** Transistors and diodes connected to pins 5, 6, 7, 10, and 11.

The diagram also shows a VCC bus symbol at the bottom left.

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 power dissipation (see Note 2)	See Dissipation Rating Table
Operating free-air temperature range, T_A : SN55113	–55°C to 125°C
SN75113	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: N package	260°C
Case temperature for 60 seconds: FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or W package	300°C

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C	T _A = 70°C POWER RATING	T _A = 125°C POWER RATING
FK	1375 mW	11.0 mW/°C	880 mW	275 mW
J	1375 mW	11.0 mW/°C	880 mW	275 mW
N	1150 mW	9.2 mW/°C	736 mW	N/A
W	1000 mW	8.0 mW/°C	640 mW	200 mW

SN55113, SN75113

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recommended operating conditions

	SN55113			SN75113			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level input voltage, V_{IH}	2			2			V
Low-level input voltage, V_{IL}			0.8			0.8	V
High-level output current, I_{OH}			– 40			– 40	mA
Low-level output current, I_{OL}			40			40	mA
Operating free-air temperature, T_A	–55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS [†]		SN55113			SN75113			UNIT
				MIN	TYP [‡]	MAX	MIN	TYP [‡]	MAX	
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$		–0.9		–1.5	–0.9		–1.5	V
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$	$V_{IH} = 2 \text{ V}$, $I_{OH} = -10 \text{ mA}$	2.4	3.4		2.4	3.4		V
			$I_{OH} = -40 \text{ mA}$	2	3.0		2	3.0		
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}$, $I_{OL} = 40 \text{ mA}$	$V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$		0.23	0.4		0.23	0.4	V
V_{OK}	Output clamp voltage	$V_{CC} = \text{MAX}$, $I_O = -40 \text{ mA}$		–1.1		–1.5	–1.1		–1.5	V
$I_{O(\text{off})}$	Off-state open-collector output current	$V_{CC} = \text{MAX}$	$V_{OH} = 12 \text{ V}$, $T_A = 25^\circ\text{C}$		1	10				μA
			$T_A = 125^\circ\text{C}$			200				
			$V_{OH} = 5.25 \text{ V}$, $T_A = 25^\circ\text{C}$					1	10	
			$T_A = 70^\circ\text{C}$						20	
I_{OZ}	Off-state (high-impedance-state) output current	$V_{CC} = \text{MAX}$, Output controls at 0.8 V	$T_A = 25^\circ\text{C}$, $V_O = 0 \text{ to } V_{CC}$			± 10			± 10	μA
			$V_O = 0$			–150			–20	
			$V_O = 0.4 \text{ V}$			± 80			± 20	
			$V_O = 2.4 \text{ V}$			± 80			± 20	
			$V_O = V_{CC}$			80			20	
I_I	Input current at maximum input voltage	A, B, C	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$			1			1	mA
		CC				2			2	
I_{IH}	High-level input current	A, B, C	$V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$			40			40	μA
		CC				80			80	
I_{IL}	Low-level input current	A, B, C	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$			–1.6			–1.6	mA
		CC				–3.2			–3.2	
I_{OS}	Short-circuit output current [§]	$V_{CC} = \text{MAX}$, $V_O = 0$, $T_A = 25^\circ\text{C}$		–40	–90	–120	–40	–90	–120	mA
I_{CC}	Supply current (both drivers)	All inputs at 0 V, No load, $T_A = 25^\circ\text{C}$	$V_{CC} = \text{MAX}$		47	65		47	65	mA
			$V_{CC} = 7 \text{ V}$		65	85		65	85	

[†] All parameters with the exception of off-state open-collector output current are measured with the active pullup connected to the sink output. 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 $V_{CC} = 5 \text{ V}$, with the exception of V_{CC} at 7 V.

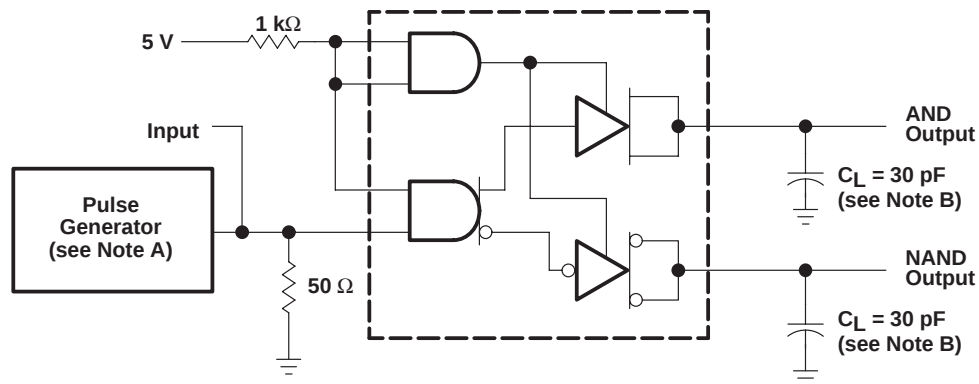
[§] Only one output should be shorted at a time, and duration of the short-circuit should not exceed one second.



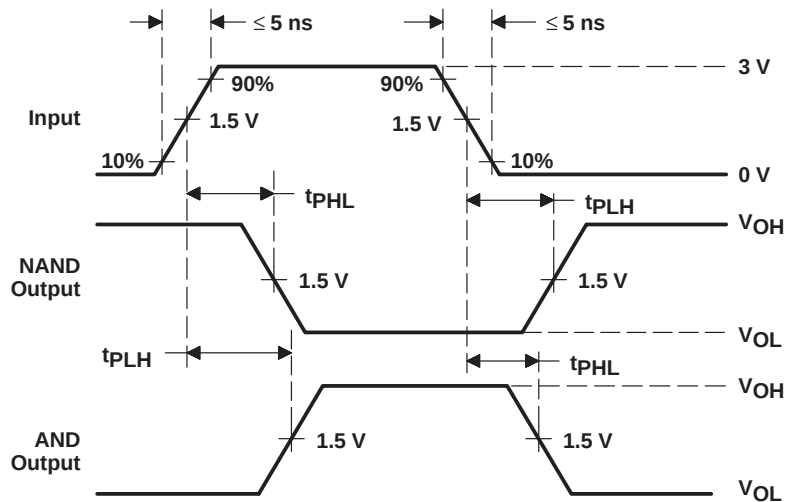
switching characteristics, $V_{CC} = 5\text{ V}$, $C_L = 30\text{ pF}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	SN55113			SN75113			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH} Propagation delay time, low-to-high level output	See Figure 1		13	20		13	30	ns
t_{PHL} Propagation delay time, high-to-low-level output			12	20		12	30	ns
t_{PZH} Output enable time to high level	$R_L = 180\ \Omega$, See Figure 2		7	15		7	20	ns
t_{PZL} Output enable time to low level	$R_L = 250\ \Omega$, See Figure 3		14	30		14	40	ns
t_{PHZ} Output disable time from high level	$R_L = 180\ \Omega$, See Figure 2		10	20		10	30	ns
t_{PLZ} Output disable time from low level	$R_L = 250\ \Omega$, See Figure 3		17	35		17	35	ns

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

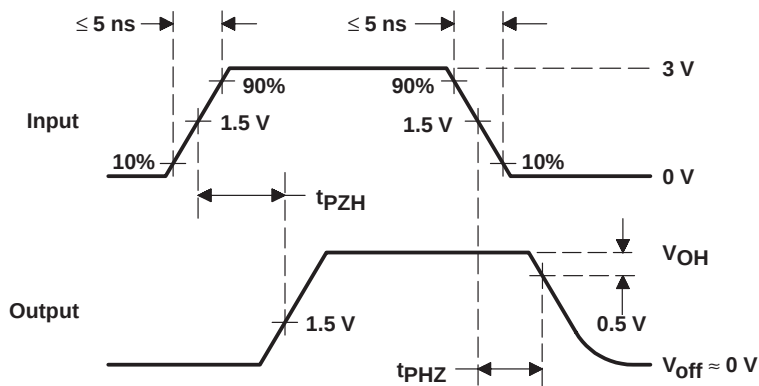
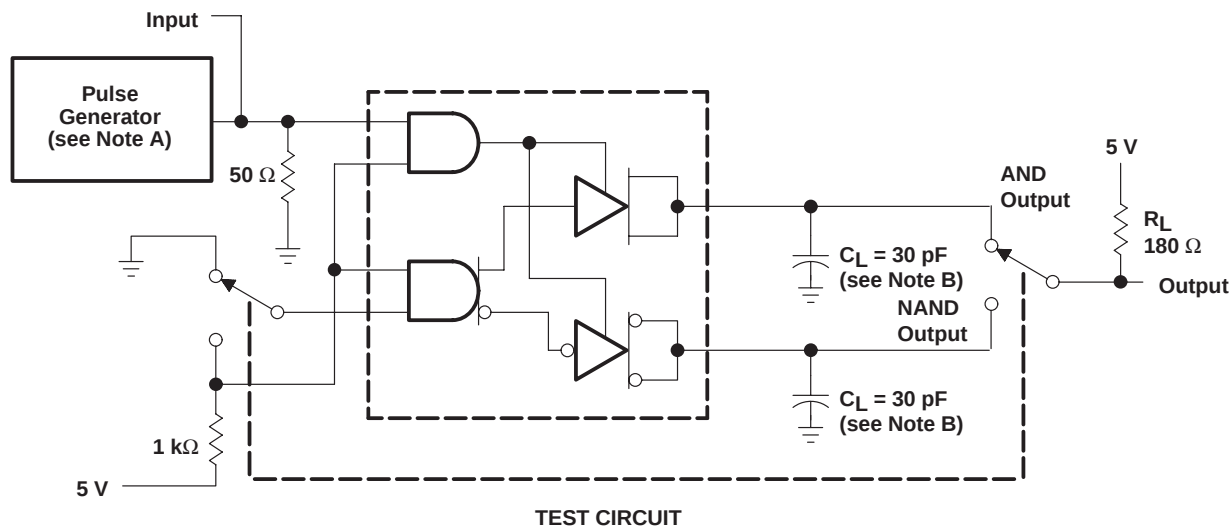
- NOTES: A. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, $PRR \leq 500\text{ kHz}$, $t_w = 100\text{ ns}$.
B. C_L includes probe and jig capacitance.

Figure 1. Test Circuit and Voltage Waveforms t_{PLH} and t_{PHL}

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PARAMETER MEASUREMENT INFORMATION



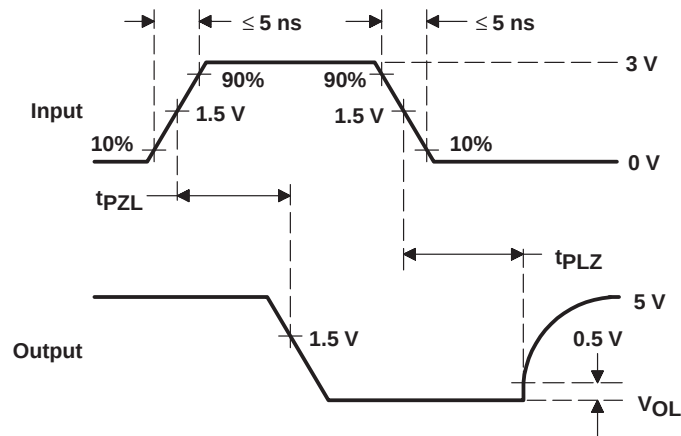
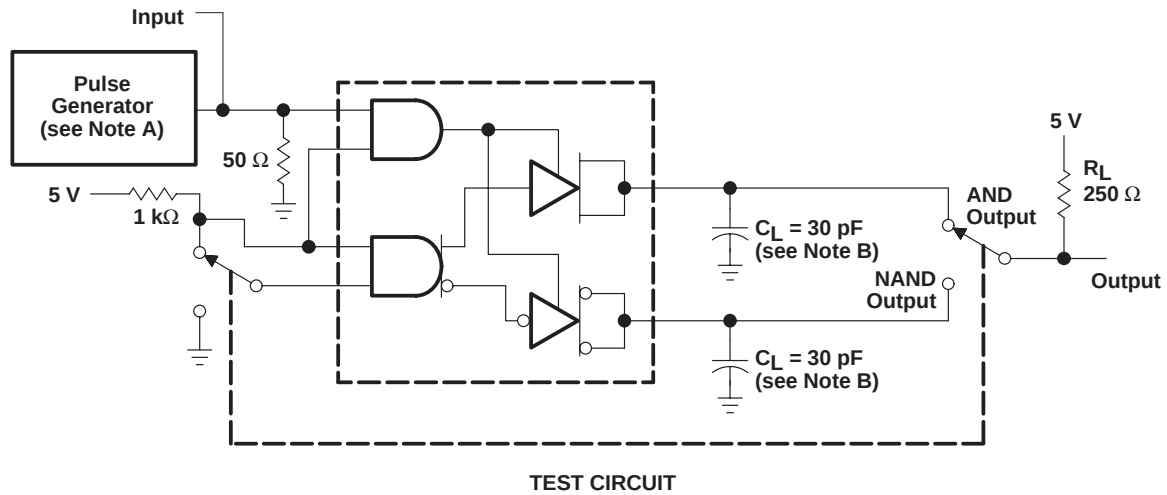
VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics: $Z_0 = 50 \, \Omega$, $PRR \leq 500 \, \text{kHz}$, $t_w = 100 \, \text{ns}$.

B. C_L includes probe and jig capacitance.

Figure 2. Test Circuit and Voltage Waveforms t_{PZH} and t_{PHZ}

PARAMETER MEASUREMENT INFORMATION



VOLTAGE WAVEFORMS

- NOTES: A. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, $PRR \leq 500\ \text{kHz}$, $t_W = 100\ \text{ns}$.
B. C_L includes probe and jig capacitance.

Figure 3. Test Circuit and Voltage Waveforms, t_{pZL} and t_{pLZ}

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TYPICAL CHARACTERISTICS†

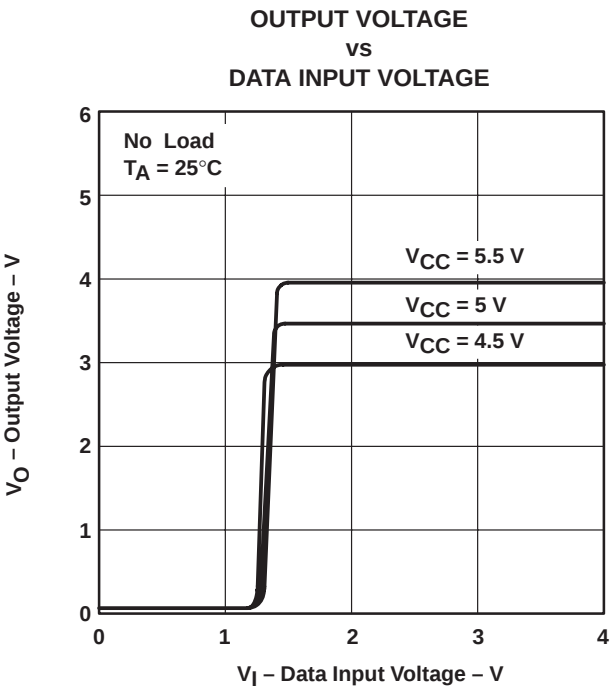


Figure 4

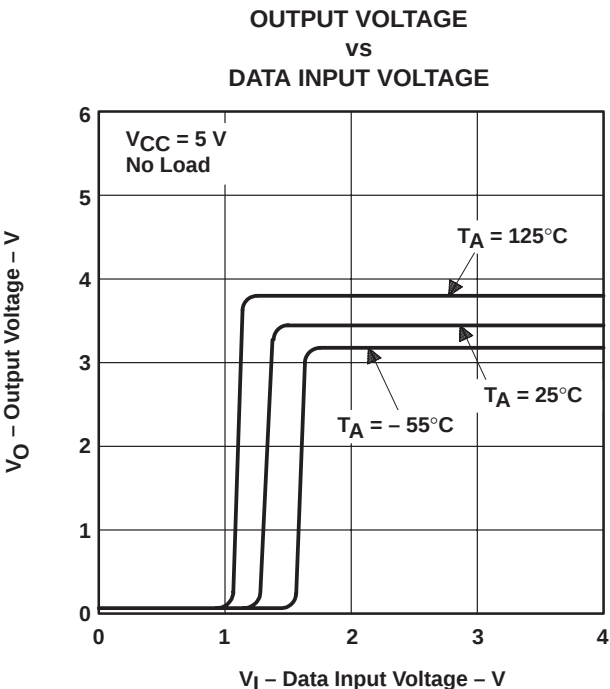


Figure 5

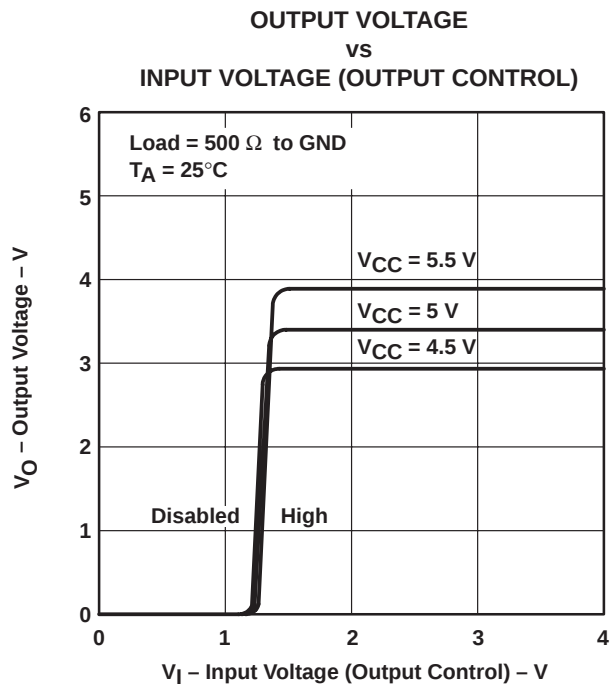


Figure 6

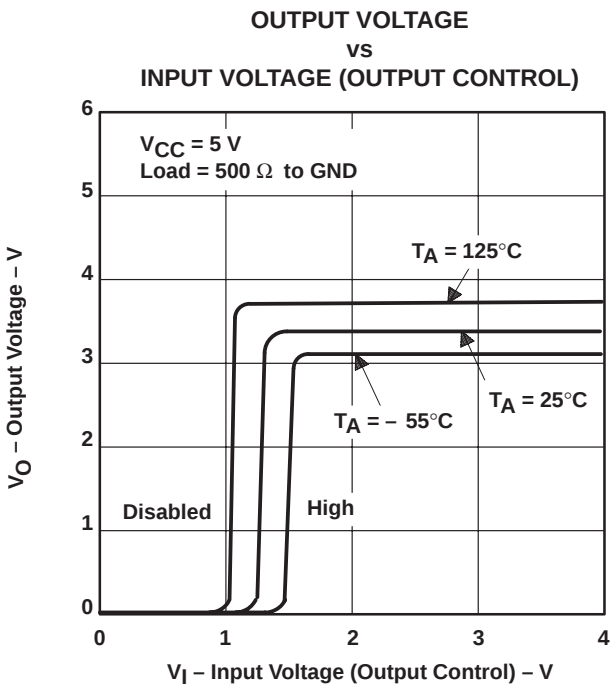


Figure 7

† Data for temperatures below 0°C and above 70°C and for supply voltages below 4.75 V and above 5.25 V are applicable to SN55113 circuits only. These parameters were measured with the active pullup connected to the sink output.

TYPICAL CHARACTERISTICS†

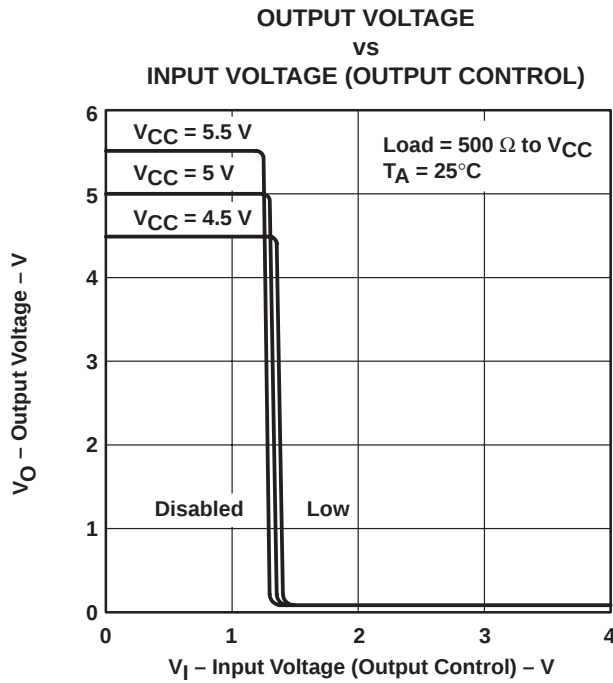


Figure 8

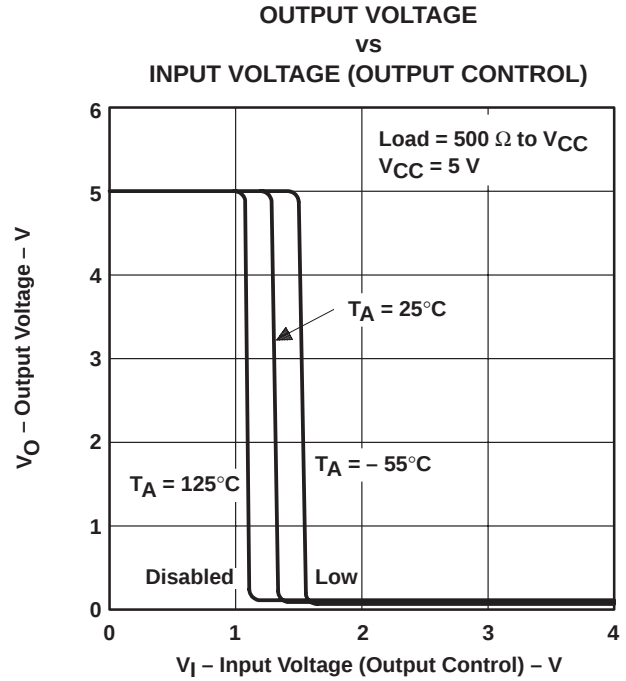


Figure 9

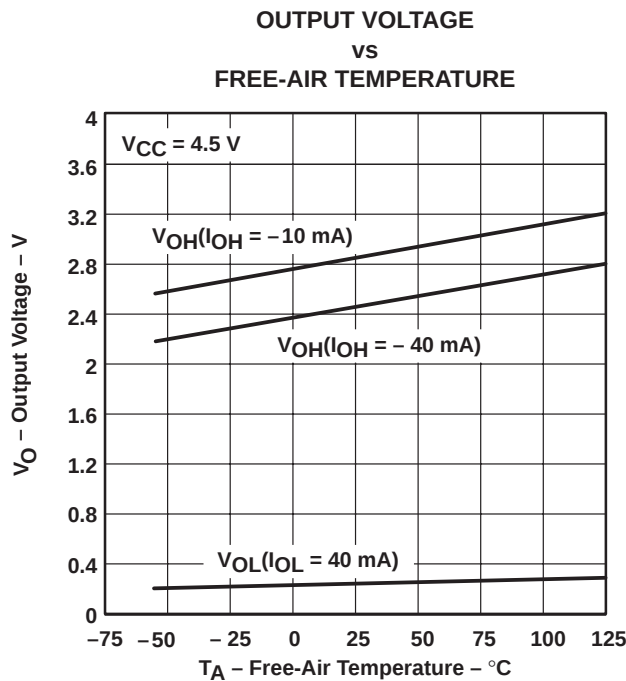


Figure 10

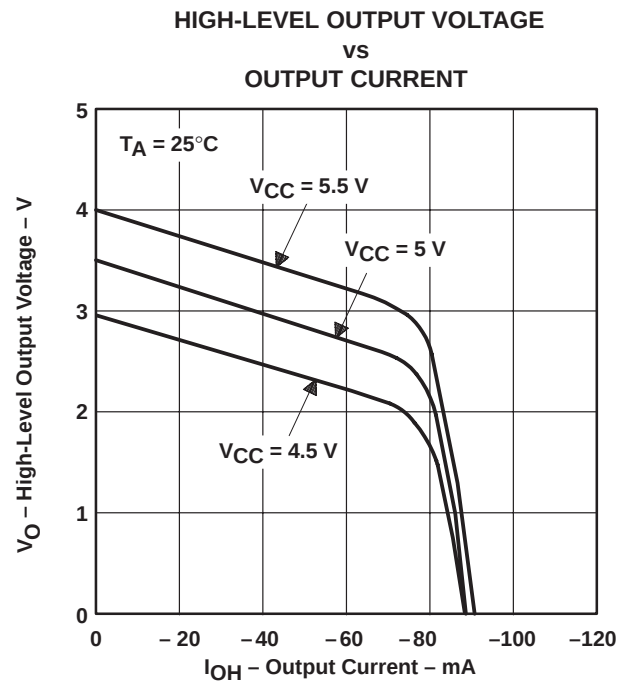


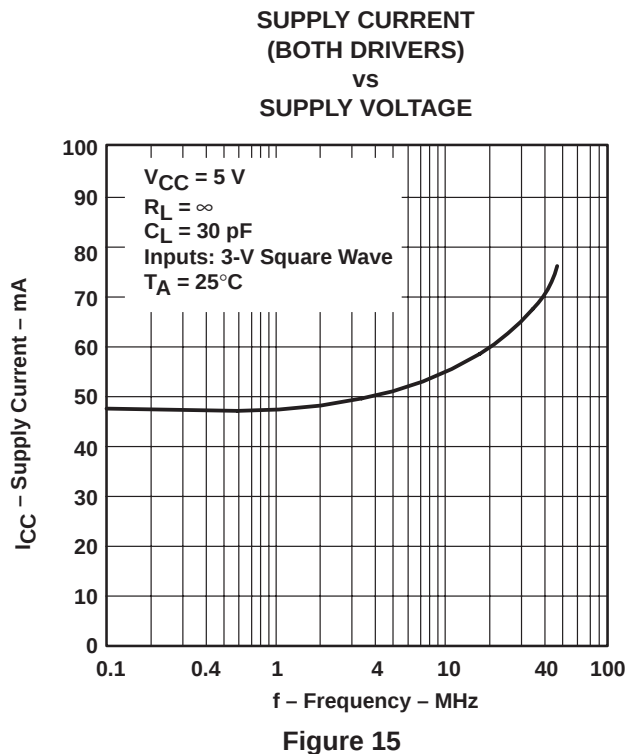
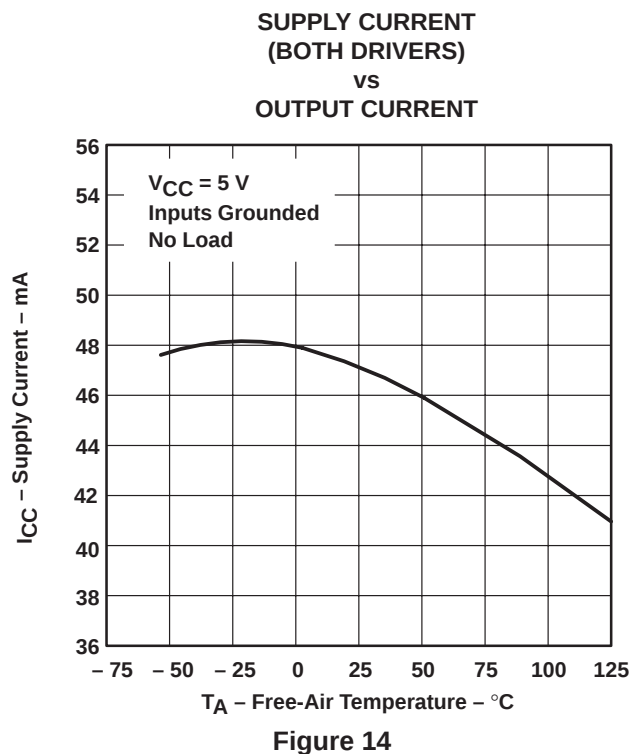
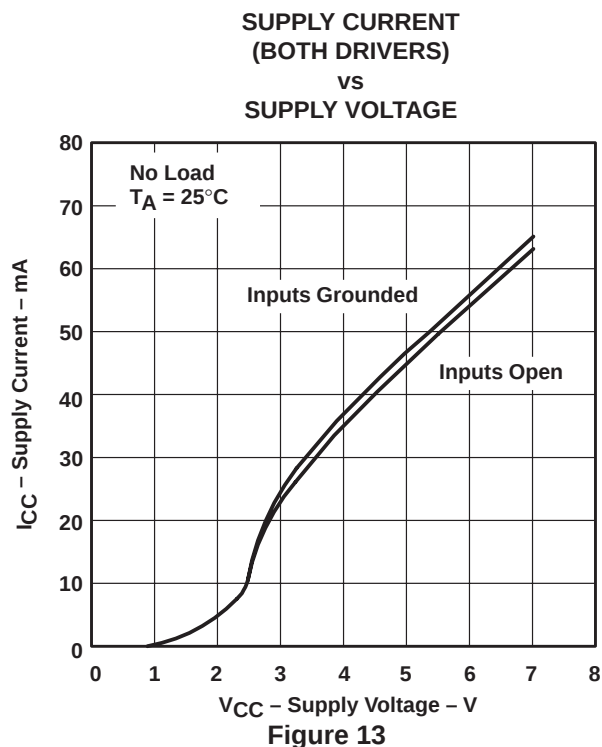
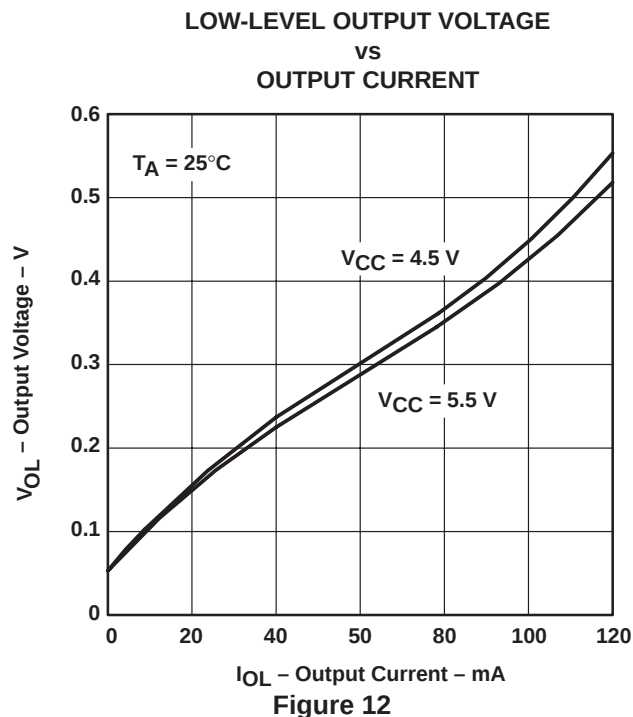
Figure 11

† Data for temperatures below 0°C and above 70°C and for supply voltages below 4.75 V and above 5.25 V are applicable to SN55113 circuits only. These parameters were measured with the active pullup connected to the sink output.

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TYPICAL CHARACTERISTICS†



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TYPICAL CHARACTERISTICS†

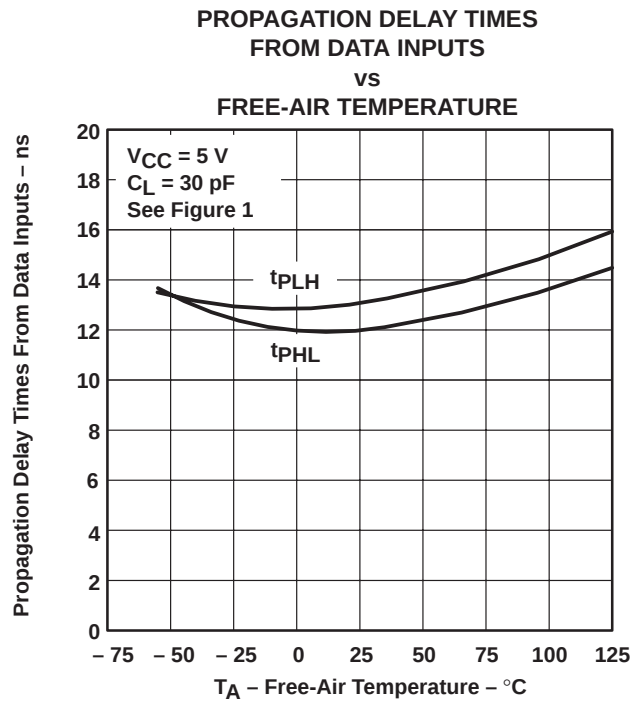


Figure 16

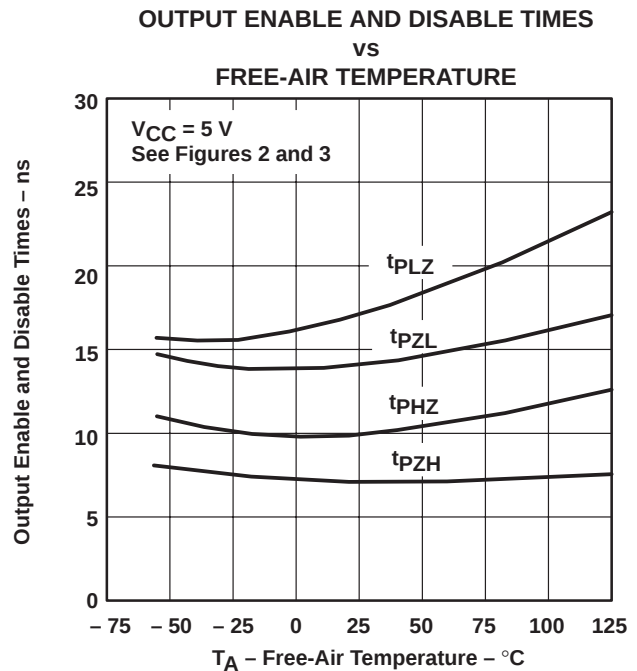
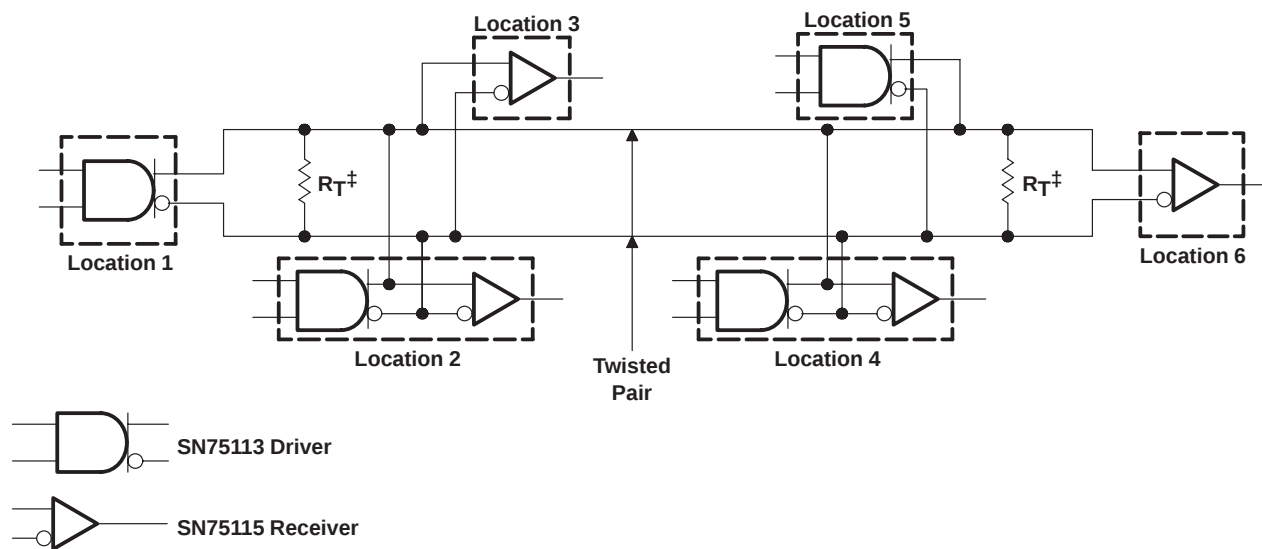


Figure 17

† Data for temperatures below 0°C and above 70°C and for supply voltages below 4.75 V and above 5.25 V are applicable to SN55113 circuits only. These parameters were measured with the active pullup connected to the sink output.

APPLICATION INFORMATION



† $R_T = Z_0$. A capacitor may be connected in series with R_T to reduce power dissipation.

Figure 18. Basic Party-Line or Data-Bus Differential Data Transmission

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