

# SN55115, SN75115 DUAL DIFFERENTIAL RECEIVERS

SLLS072C – SEPTEMBER 1973 – REVISED MARCH 1997

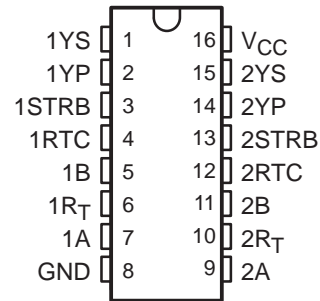
- Choice of Open-Collector or Active Pullup (Totem-Pole) Outputs
- Single 5-V Supply
- Differential Line Operation
- Dual-Channel Operation
- TTL Compatible
- $\pm 15$ -V Common-Mode Input Voltage Range
- Optional-Use Built-In 130- $\Omega$  Line-Terminating Resistor
- Individual Frequency Response Controls
- Individual Channel Strobes
- Designed for Use With SN55113, SN75113, SN55114, and SN75114 Drivers
- Designed to Be interchangeable With National DS9615 Line Receivers

## description

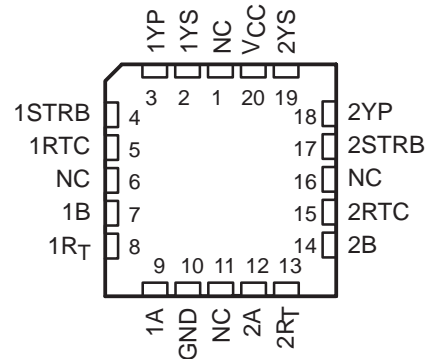
The SN55115 and SN75115 dual differential line receivers are designed to sense small differential signals in the presence of large common-mode noise. These devices give TTL-compatible output signals as a function of the differential input voltage. The open-collector output configuration permits the wire-ANDing of similar TTL outputs (such as SN5401/SN7401) or other SN55115/SN75115 line receivers. This permits a level of logic to be implemented without extra delay. The output stages are similar to TTL totem-pole outputs, but with sink outputs, 1YS and 2YS, and the corresponding active pullup terminals, 1YP and 2YP, available on adjacent package pins. The frequency response and noise immunity may be provided by a single external capacitor. A strobe input is provided for each channel. With the strobe in the low level, the receiver is disabled and the outputs are forced to a high level.

The SN55115 is characterized for operation over the full military range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN75115 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN55115 . . . J OR W PACKAGE  
SN75115 . . . N PACKAGE  
(TOP VIEW)



SN55114 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

STRB	DIFF INPUT (A AND B)	OUTPUT (YP AND YS TIED TOGETHER)
L	X	H
H	L	H
H	H	L

H =  $V_I \geq V_{IH \text{ min}}$  or  $V_{ID}$  more positive than  $V_{T+ \text{ max}}$   
L =  $V_I \leq V_{IL \text{ max}}$  or  $V_{ID}$  more negative than  $V_{T- \text{ max}}$   
X = irrelevant



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 **TEXAS  
INSTRUMENTS**

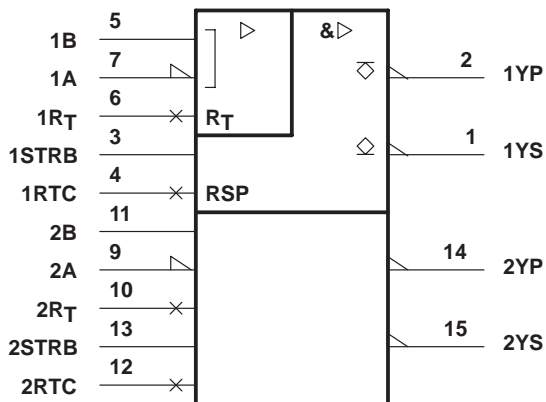
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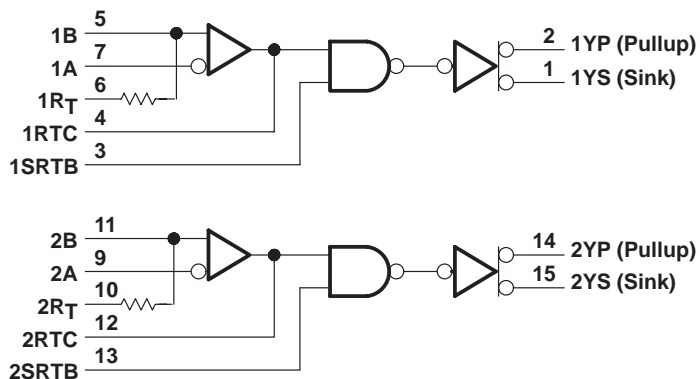
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## logic symbol†



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

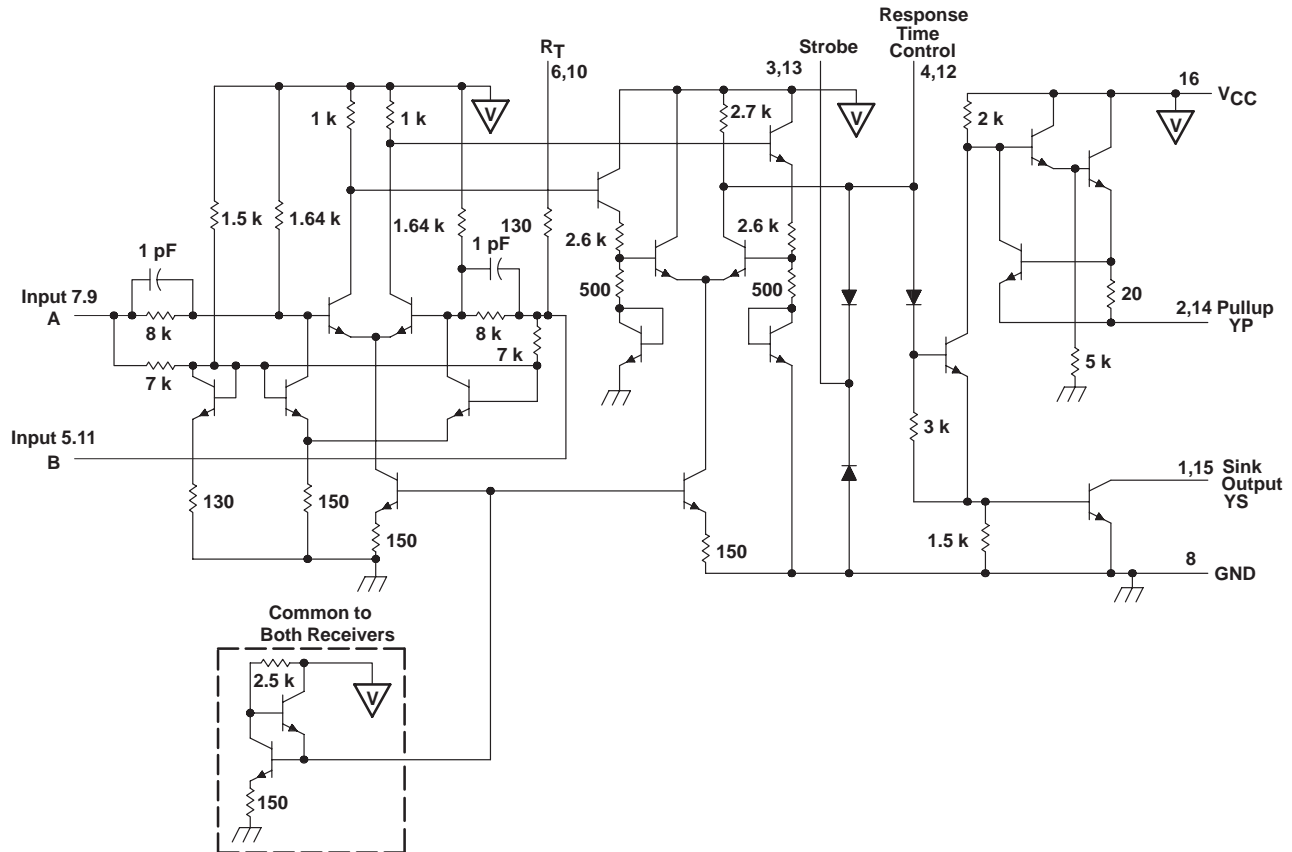
## logic diagram (positive logic)



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## schematic (each receiver)



Resistor values are nominal and in ohms.  
Pin numbers shown are for J, N, and W packages.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

	SN55115	SN75115	UNIT
Supply voltage, $V_{CC}$ (see Note 1)	7	7	V
Input voltage, $V_I$ (A, B, and $R_T$ )	$\pm 25$	$\pm 25$	V
Input voltage, $V_I$ (STRB)	5.5	5.5	V
Off-state voltage applied to open-collector outputs	14	14	V
Continuous total power dissipation	See Dissipation Rating Table		
Operating free-air temperature range, $T_A$	-55 to 125	0 to 70	$^{\circ}\text{C}$
Storage temperature range, $T_{stg}$	-65 to 150	-65 to 150	$^{\circ}\text{C}$
Case temperature for 60 seconds: FK package	260		$^{\circ}\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or W package	300		$^{\circ}\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: N package		260	$^{\circ}\text{C}$

† 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 input voltage, are with respect to network ground terminal.

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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	$T_A = 125^\circ\text{C}$ 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	—
W†	1000 mW	8.0 mW/°C	640 mW	200 mW

† In the FK, J, and W packages, SN55115 chips are either silver glass or alloy mounted. SN75115 chips are glass mounted.

## recommended operating conditions

	SN55115			SN75115			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 at STRB, $V_{IH}$	2.4			2.4			V
Low-level input voltage at STRB, $V_{IL}$			0.4			0.4	V
High-level output current, $I_{OH}$			-5			-5	mA
Low-level output current, $I_{OL}$			15			15	mA
Operating free-air temperature, $T_A$	-55		125	0		70	°C



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

PARAMETER	TEST CONDITIONS†	SN55115			SN75115			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{IT+}$ §	Positive-going threshold voltage $V_O = 0.4$ V, $I_{OL} = 15$ mA, $V_{IC} = 0$	500			500			mV
$V_{IT-}$ §	Negative-going threshold voltage $V_O = 2.4$ V, $I_{OH} = -5$ mA, $V_{IC} = 0$	-500¶			-500¶			mV
$V_{ICR}$	Common-mode input voltage range $V_{ID} = \pm 1$ V	+15 to -15	+24 to -19		+15 to -15	+24 to -19		V
$V_{OH}$	High-level output voltage $V_{CC} = \text{MIN}$ , $I_{OH} = -5$ mA, $V_{ID} = -0.5$ V	$T_A = \text{MIN}$			2.4			V
		$T_A = 25^\circ\text{C}$			2.4	3.4		
		$T_A = \text{MAX}$			2.4			
$V_{OL}$	Low-level output voltage $V_{CC} = \text{MIN}$ , $I_{OL} = 15$ mA, $V_{ID} = -0.5$ V	0.22 0.4			0.22 0.45			V
$I_{IL}$	Low-level input current $V_{CC} = \text{MAX}$ , $V_I = 0.4$ V, Other input at 5.5 V	$T_A = \text{MIN}$			-0.9			mA
		$T_A = 25^\circ\text{C}$			-0.5	-0.7		
		$T_A = \text{MAX}$			-0.7			
$I_{SH}$	High-level strobe current $V_{CC} = \text{MIN}$ , $V_{strobe} = 4.5$ V, $V_{ID} = -0.5$ V	$T_A = 25^\circ\text{C}$			2 5			$\mu\text{A}$
		$T_A = \text{MAX}$			5 10			
$I_{SL}$	Low-level strobe current $V_{CC} = \text{MAX}$ , $V_{strobe} = 0.4$ V, $V_{ID} = 0.5$ V	$T_A = 25^\circ\text{C}$			-1.15	-2.4		mA
$I_{(RTC)}$	Response-time-control current $V_{CC} = \text{MAX}$ , $V_{ID} = 0.5$ V, $V_{RC} = 0$	$T_A = 25^\circ\text{C}$			-1.2	-3.4		mA
$I_{O(\text{off})}$	Off-state open-collector output current $V_{CC} = \text{MIN}$ , $V_{ID} = -4.5$ V, $V_{OH} = 12$ V	$T_A = 25^\circ\text{C}$			100			$\mu\text{A}$
		$T_A = \text{MAX}$			200			
		$T_A = 25^\circ\text{C}$						
		$T_A = \text{MAX}$						
$R_T$	Line-terminating resistance $V_{CC} = 5$ V	$T_A = 25^\circ\text{C}$			77	130	167	$\Omega$
					74	130	179	
$I_{OS}$	Supply-circuit output current# $V_{CC} = \text{MAX}$ , $V_{ID} = -0.5$ V, $V_O = 0$	$T_A = 25^\circ\text{C}$			-15	-40	-80	mA
$I_{CC}$	Supply current (both receivers) $V_{CC} = \text{MAX}$ , $V_{ID} = 0.5$ V, $V_{IC} = 0$	$T_A = 25^\circ\text{C}$			32 50			mA

† Unless otherwise noted,  $V_{strobe} = 2.4$  V. All parameters with the exception of off-state open-collector output current are measured with the active pull-up connected to the sink output.

‡ All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$ , and  $V_{IC} = 0$ .

§ Differential voltages are at the B input terminal with respect to the A input terminal.

¶ The algebraic convention, in which the less positive (more negative) limit is designated as minimum, is used in this data sheet for threshold voltages only.

# Only one output should be shorted to ground at a time, and duration of the short circuit should not exceed one second.



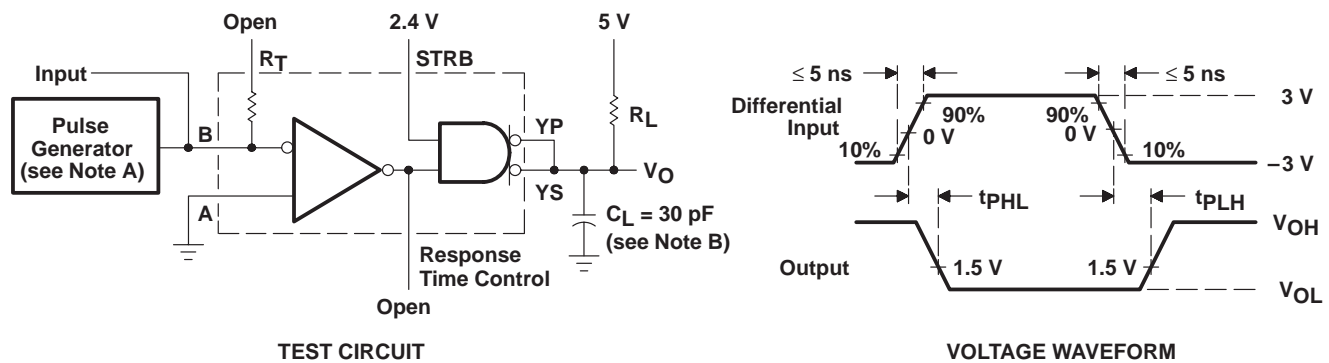
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switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 30\text{ pF}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	SN55115			SN75115			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$t_{PLH}$ Propagation delay time, low-to-high level output	$R_L = 3.9\text{ k}\Omega$ , See Figure 1		18	50		18	75	ns
$t_{PHL}$ Propagation delay time, high-to-low level output	$R_L = 390\ \Omega$ , See Figure 1		20	50		20	75	ns

## PARAMETER MEASUREMENT INFORMATION



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

Figure 1. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS†

INPUT CURRENT  
vs  
INPUT VOLTAGE

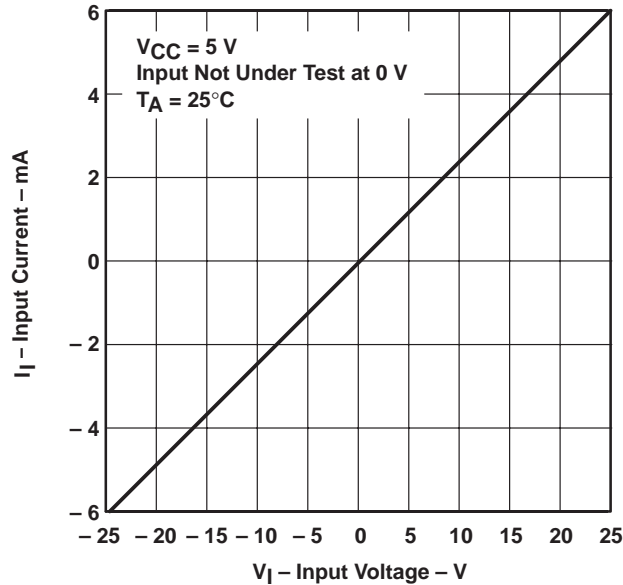


Figure 2

OUTPUT VOLTAGE  
vs  
FREE-AIR TEMPERATURE

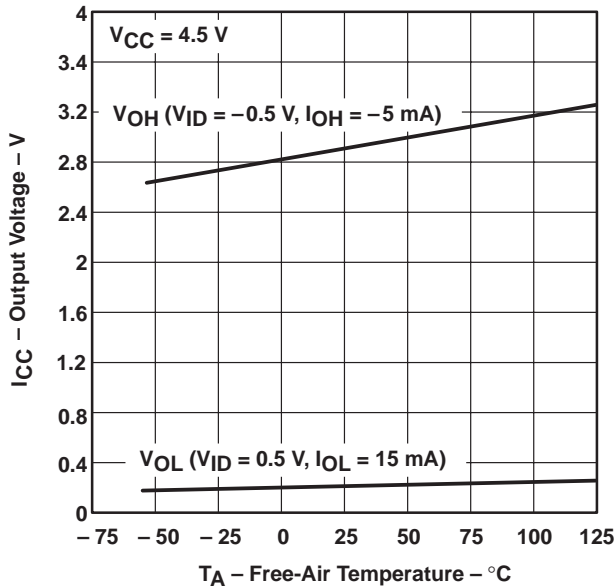


Figure 3

OUTPUT VOLTAGE  
vs  
COMMON-MODE INPUT VOLTAGE

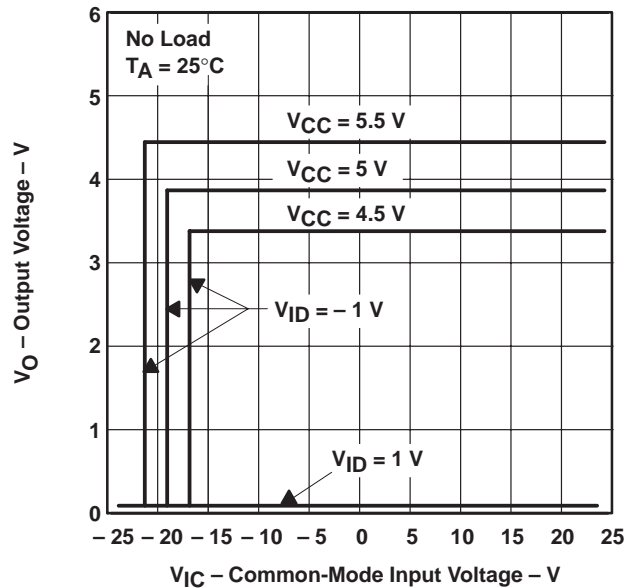


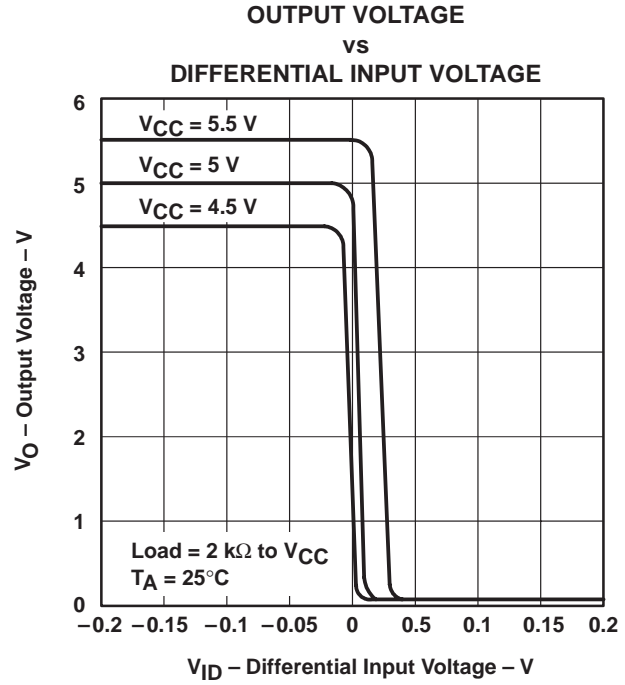
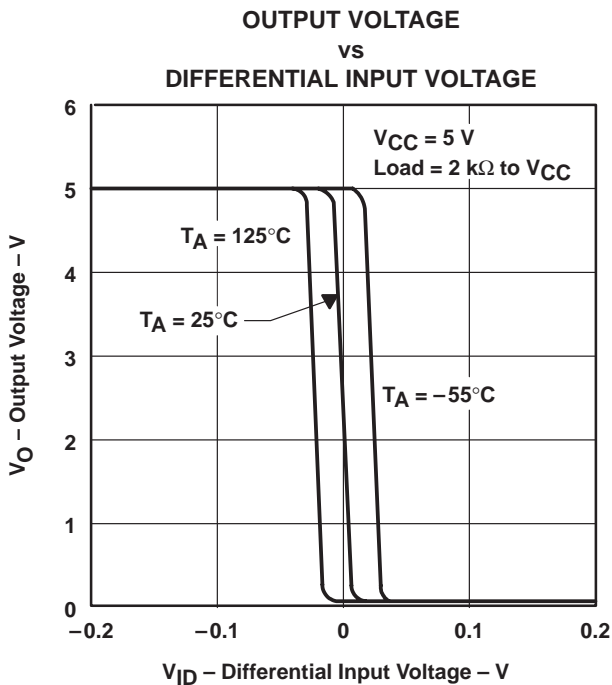
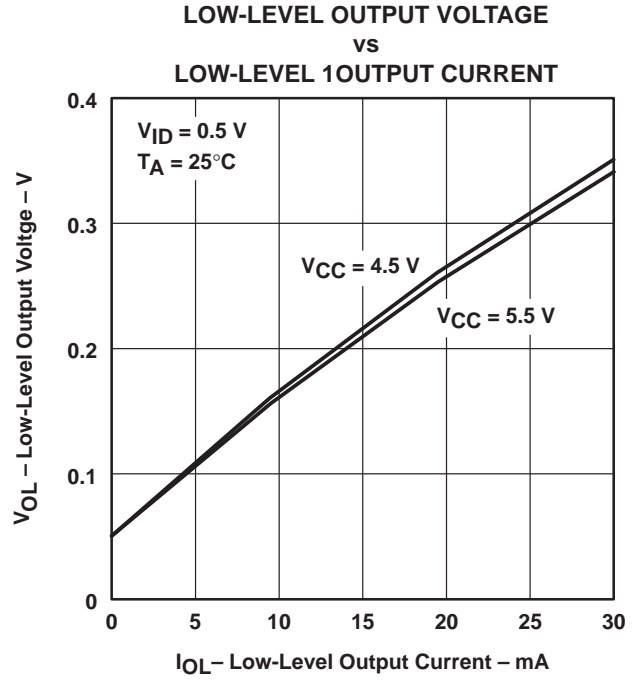
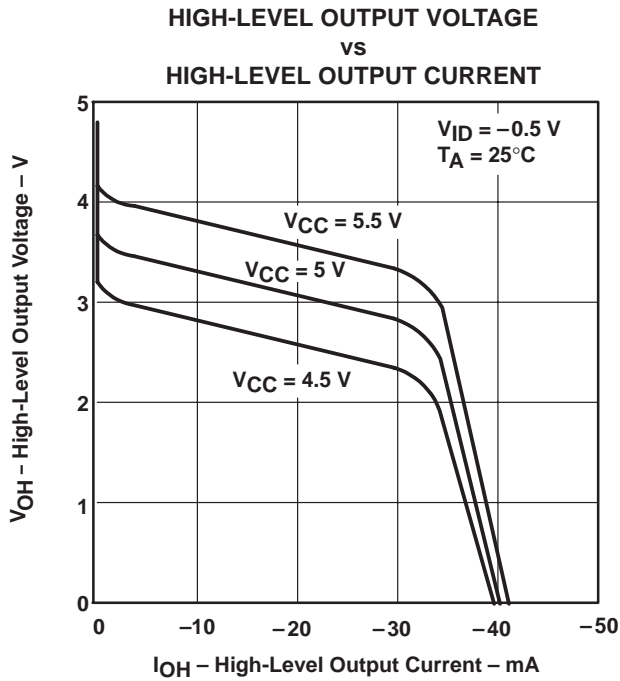
Figure 4

† Data for temperatures below  $0^{\circ}\text{C}$  and above  $70^{\circ}\text{C}$  and for supply voltages below  $4.75\text{ V}$  and above  $5.25\text{ V}$  are applicable to SN55115 circuits only. These parameters were measured with the active pullup connected to the sink output.

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## TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS†

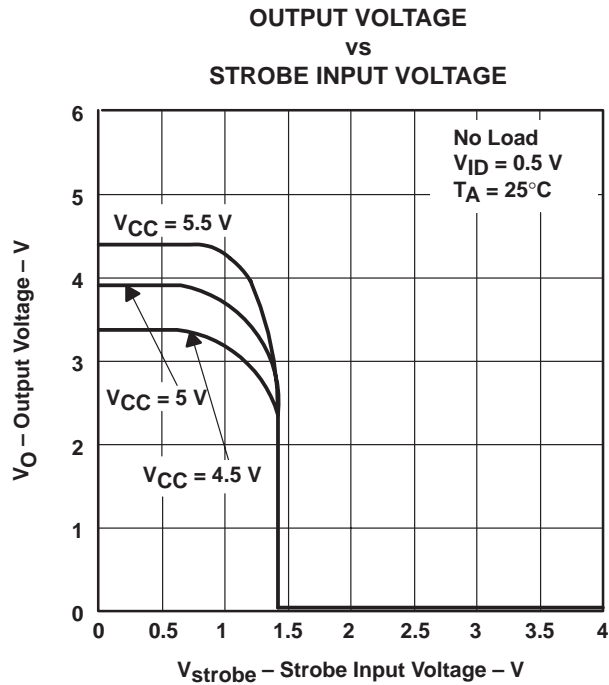


Figure 9

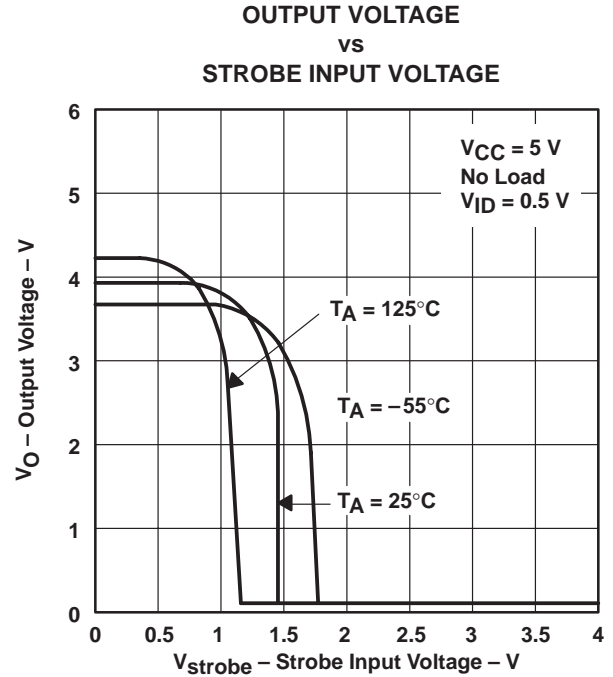


Figure 10

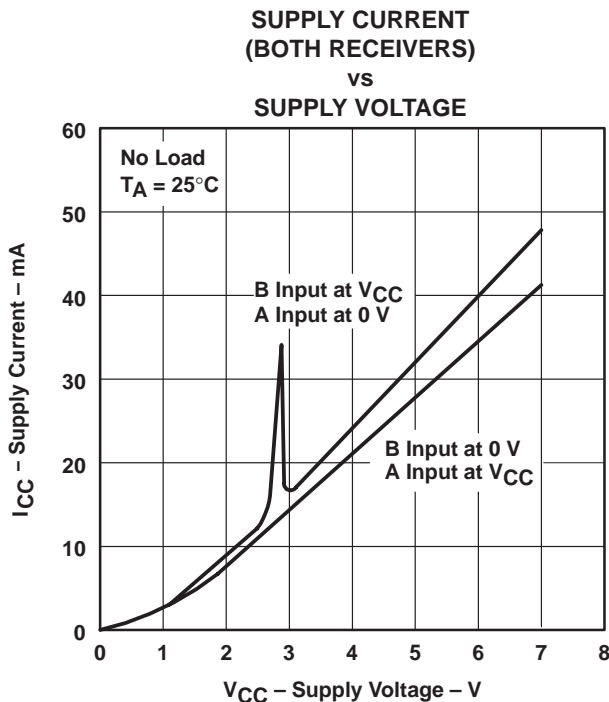


Figure 11

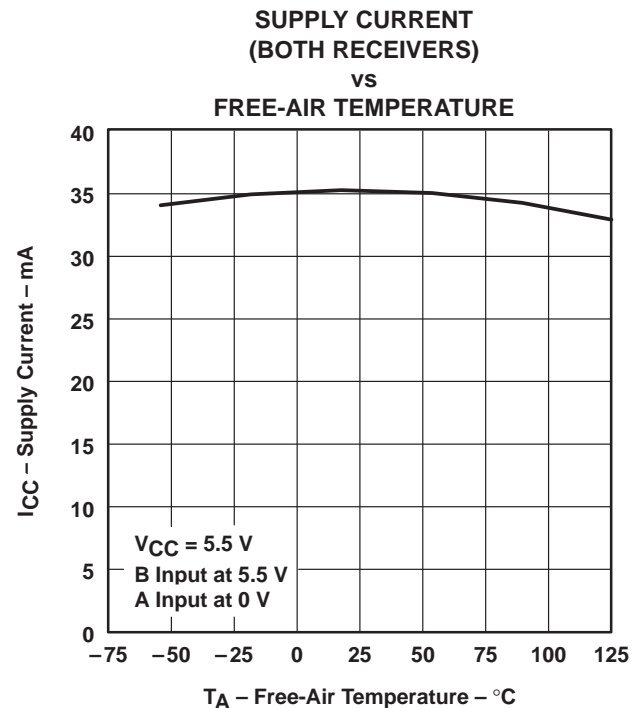


Figure 12

† Data for temperatures below  $0^\circ\text{C}$  and above  $70^\circ\text{C}$  and for supply voltages below 4.75 V and above 5.25 V are applicable to SN55115 circuits only. These parameters were measured with the active pullup connected to the sink output.

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## TYPICAL CHARACTERISTICS†

PROPAGATION DELAY TIMES  
vs  
FREE-AIR TEMPERATURE

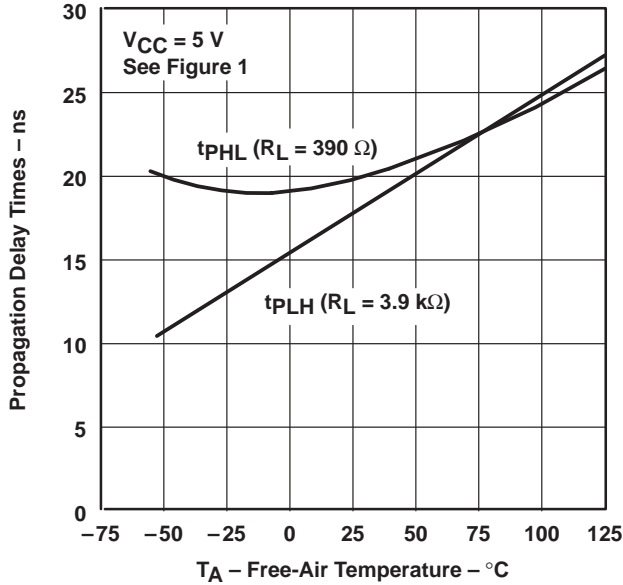


Figure 13

MAXIMUM OPERATING FREQUENCY  
vs  
RESPONSE-TIME-CONTROL CAPACITANCE

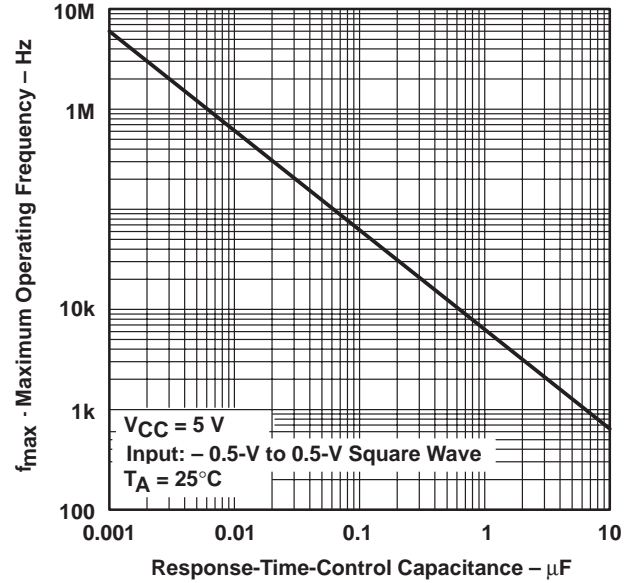
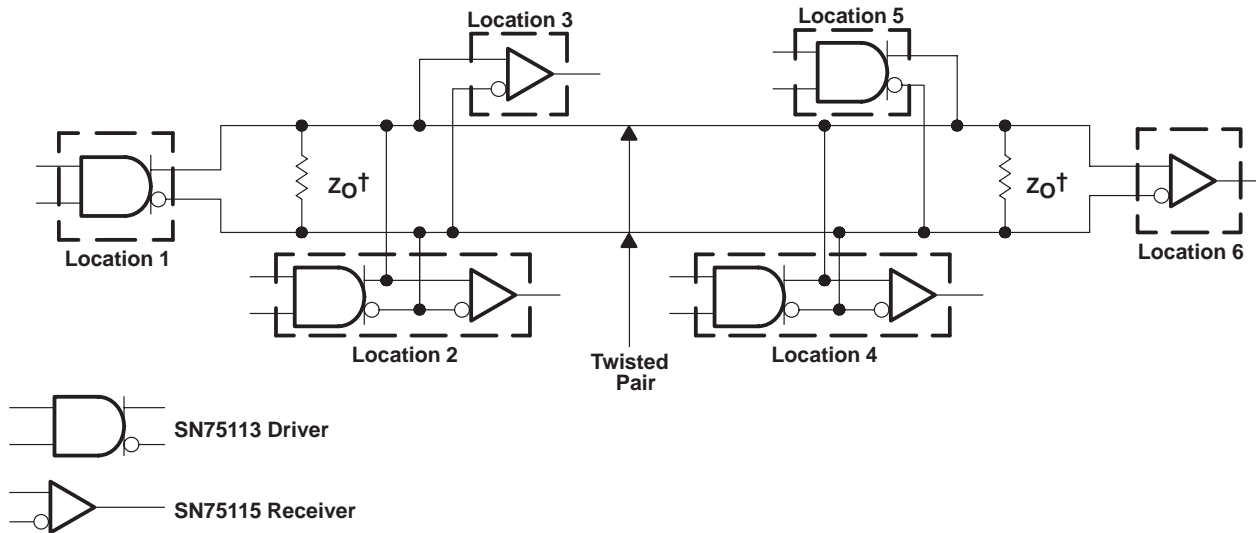


Figure 14

† 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 SN55115 circuits only. These parameters were measured with the active pullup connected to the sink output.

## APPLICATION INFORMATION



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

Figure 15. Basic Party-Line or Data-Bus Differential Data Transmission

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