

SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

- Single 5-V Supply
- High-Input-Impedance, High-Threshold Receivers
- Common Driver Strobe
- TTL-Compatible Driver and Strobe Inputs With Clamp Diodes
- High-Speed Operation
- 100-mA Open-Collector Driver Outputs
- Four Independent Channels
- TTL-Compatible Receiver Output

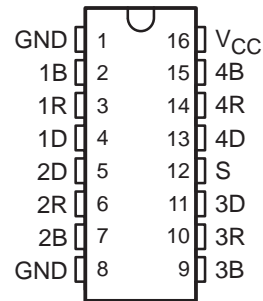
description

The SN55138 and SN75138 quadruple bus transceivers are designed for two-way data communication over single-ended transmission lines. Each of the four identical channels consists of a driver with TTL inputs and a receiver with a TTL output. The driver open-collector output is designed to handle loads up to 100-mA open collector. The receiver input is internally connected to the driver output, and has a high impedance to minimize loading of the transmission line. Because of the high driver-output current and the high receiver-input impedance, a very large number (typically hundreds) of transceivers may be connected to a single data bus.

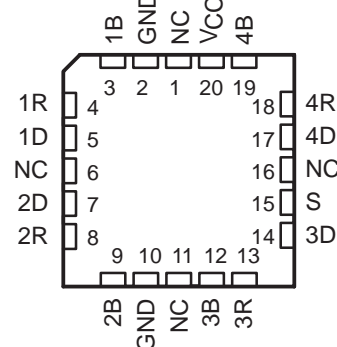
The receiver design also features a threshold of 2.3 V (typical), providing a wider noise margin than would be possible with a receiver having the usual TTL threshold. A strobe turns off all drivers (high impedance) but does not affect receiver operation. These circuits are designed for operation from a single 5-V supply and include a provision to minimize loading of the data bus when the power-supply voltage is zero.

The SN55138 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN75138 is characterized for operation from 0°C to 70°C .

SN55138 . . . J OR W PACKAGE
SN75138 . . . D OR N PACKAGE
(TOP VIEW)



SN55138 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1995, Texas Instruments Incorporated

SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

Function Tables

TRANSMITTING

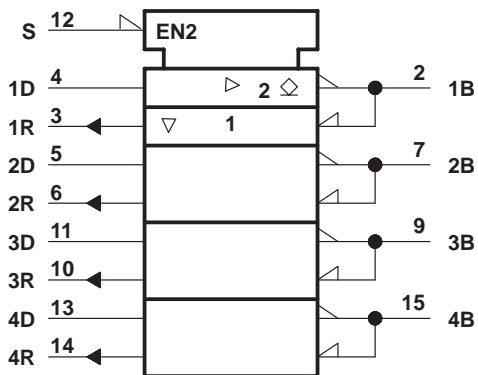
INPUTS		OUTPUTS	
S	D	B	R
L	H	L	H
L	L	H	L

RECEIVING

INPUTS			OUTPUT
S	B	D	R
H	H	X	L
H	L	X	H

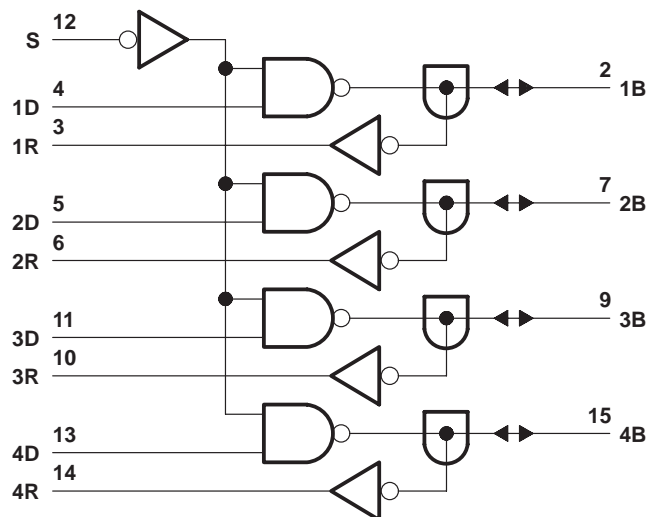
H = high level, L = low level, X = irrelevant

logic symbol†

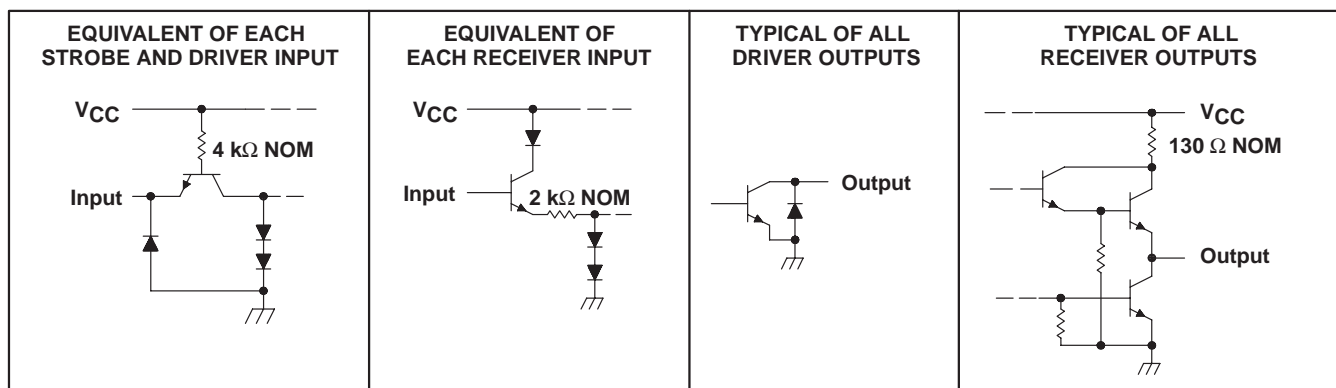


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

logic diagram (positive logic)



schematics of inputs and outputs



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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage, V_I	5.5 V
Driver off-state output voltage	7 V
Low-level output current into the driver output	150 mA
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A : SN55138	–55°C to 125°C
SN75138	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: D, N, or W package	260°C
Case temperature for 60 seconds, T_C : FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°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 are with respect to both ground terminals connected together.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 70^\circ\text{C}$	$T_A = 125^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	POWER RATING	POWER RATING
D	950 mW	7.6 mW/°C	608 mW	—
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 and J packages, the SN55138 chip is alloy mounted.

recommended operating conditions

		SN55138			SN75138			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5		5.5	4.75	5	5.25	V
High-level input voltage, V_{IH}	Driver or strobe	2			2			V
	Receiver	3.2			2.9			
Low-level input voltage, V_{IL}	Driver or strobe			0.8			0.8	V
	Receiver			1.5			1.8	
High-level output current, I_{OH}	Receiver output			–400			–400	μA
Low-level output current, I_{OL}	Driver output			100			100	mA
	Receiver output			16			16	
Operating free-air temperature, T_A		–55		125	0		70	°C

SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

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

PARAMETER			TEST CONDITIONS†		SN55138			SN75138			UNIT	
					MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V _{IK}	Input clamp voltage	Driver or strobe	V _{CC} = MIN,	I _I = -12 mA			-1.5			-1.5	V	
V _{OH}	High-level output voltage	Receiver	V _{CC} = MIN, V _{IL(R)} = V _{IL} max,	V _{IH(S)} = 2 V, I _{OH} = -400 μA	2.4	3.5		2.4	3.5		V	
V _{OL}	Low-level output voltage	Driver	V _{CC} = MIN, V _{IL(S)} = 0.8 V,	V _{IH(D)} = 2 V, I _{OL} = 100 mA			0.45			0.45	V	
		Receiver	V _{CC} = MIN, V _{IH(S)} = 2 V,	V _{IH(R)} = V _{IH} min, I _{OL} = 16 mA			0.4			0.4		
I _{I(max)}	Input current at maximum input voltage	Driver or strobe	V _{CC} = MAX,	V _I = V _{CC}			1			1	mA	
I _{IH}	High-level input current	Driver or strobe	V _{CC} = MAX,	V _I = 2.4 V			40			40	μA	
		Receiver	V _{CC} = 5 V, V _{I(S)} = 2 V	V _{I(R)} = 4.5 V,			25	300		25		300
I _{IL}	Low-level input current	Driver or strobe	V _{CC} = MAX,	V _I = 0.4 V			-1	-1.6		-1	-1.6	mA
		Receiver	V _{CC} = MAX, V _{I(S)} = 2 V	V _{I(R)} = 0.45 V,				-50			-50	μA
I _{I(off)}	Input current with power off	Receiver	V _{CC} = 0,	V _I = 4.5 V			1.1	1.5		1.1	1.5	mA
I _{OS}	Short-circuit output current§	Receiver	V _{CC} = MAX				-20	-55		-18	-55	mA
I _{CC}	Supply current	All driver outputs low	V _{CC} = MAX, V _{I(S)} = 0.8 V	V _{I(D)} = 2 V,			50	65		50	65	mA
		All driver outputs high	V _{CC} = MAX, V _{I(S)} = 2 V, Receiver outputs open	V _{I(R)} = 3.5 V,			42	55		42	55	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions. Parenthetical letters D, R, and S used with V_I refer to the driver input, receiver input, and strobe input, respectively.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS			MIN	TYP	MAX	UNIT
t _{PLH}	Driver	Driver	C _L = 50 pF, R _L = 50 Ω,	See Figure 1		15	24	ns	
t _{PHL}						14	24		
t _{PLH}	Strobe	Driver					18	28	ns
t _{PHL}						22	32		
t _{PLH}	Receiver	Receiver	C _L = 15 pF, R _L = 400 Ω,	See Figure 2		7	15	ns	
t _{PHL}						8	15		

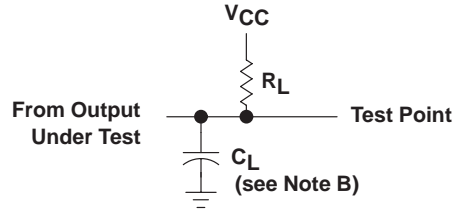
† t_{PLH} = propagation delay time, low- to high-level output

t_{PHL} = propagation delay time, high- to low-level output

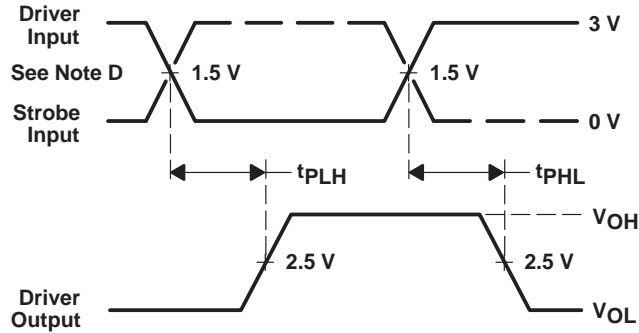


POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

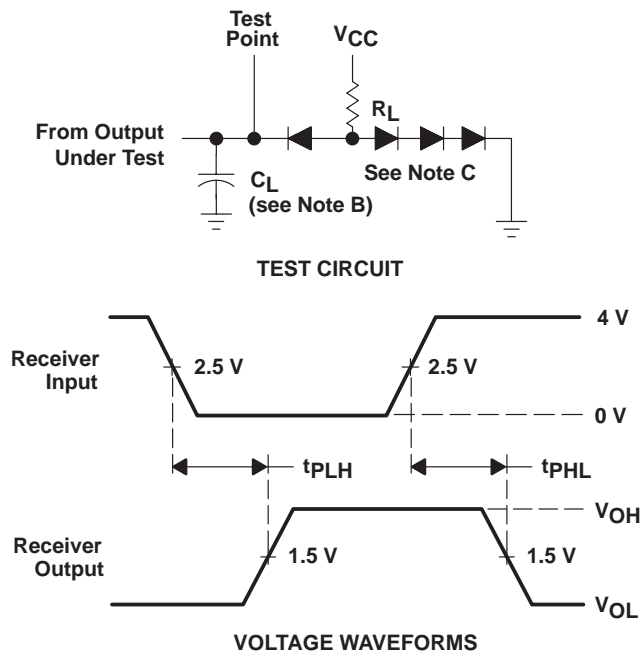
- NOTES: A. Input pulses are supplied by generators having the following characteristics: $t_w = 100$ ns, $PRR \leq 1$ MHz, $t_r \leq 10$ ns, $t_f \leq 10$ ns, $Z_O \approx 50 \Omega$.
 B. C_L includes probe and jig capacitance.
 C. All diodes are 1N916 or 1N3064.
 D. When testing driver input (solid line) strobe must be low; when testing strobe input (dashed line) driver input must be high.

Figure 1. Propagation Delay Times From Data and Strobe Inputs

SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. Input pulses are supplied by generators having the following characteristics: $t_W = 100$ ns, $PRR \leq 1$ MHz, $t_r \leq 10$ ns, $t_f \leq 10$ ns, $Z_O \approx 50 \Omega$.
- B. C_L includes probe and jig capacitance.
- C. All diodes are 1N916 or 1N3064.
- D. When testing driver input (solid line) strobe must be low; when testing strobe input (dashed line) driver input must be high.

Figure 2. Propagation Delay Times From Receiver Input

TYPICAL CHARACTERISTICS†

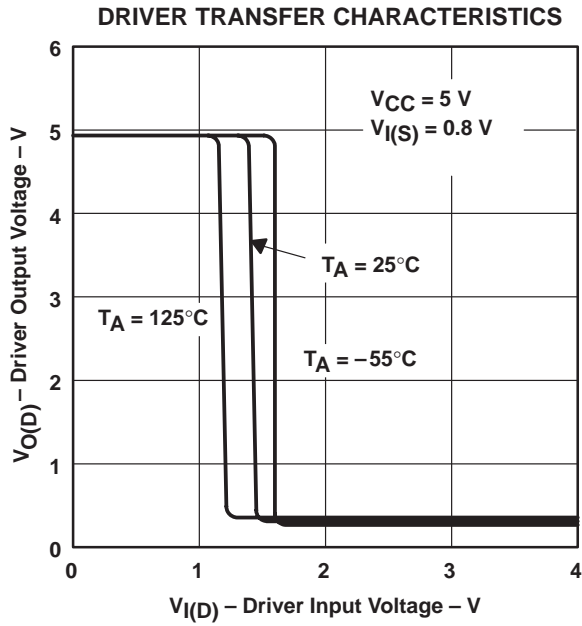


Figure 3

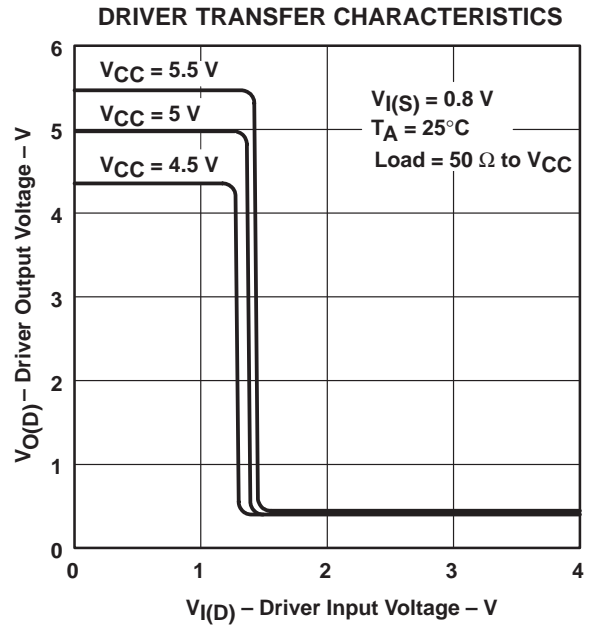


Figure 4

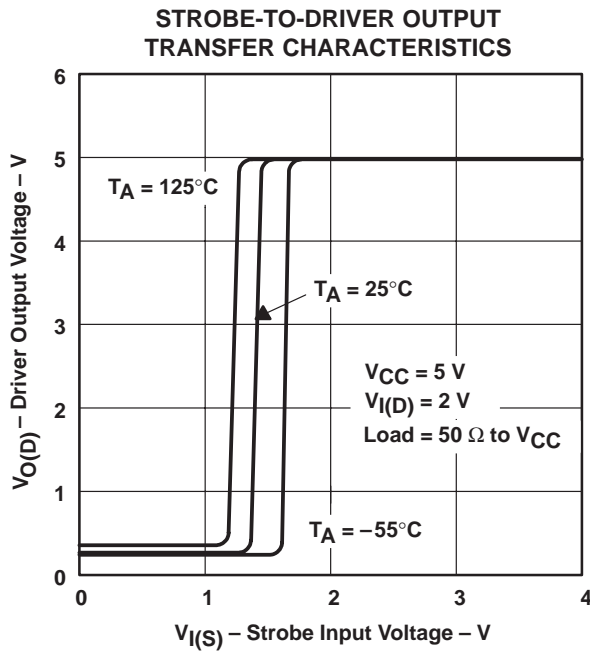


Figure 5

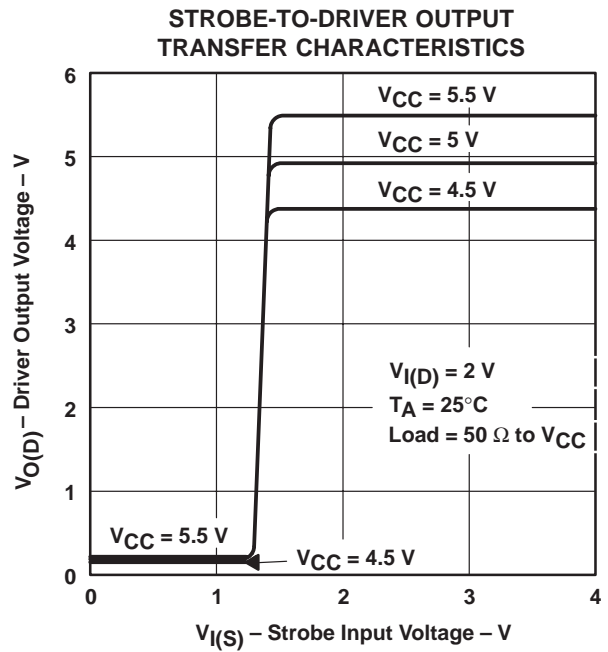


Figure 6

† Data for temperatures below 0°C and above 70°C is applicable to SN55138 circuits only.

SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

TYPICAL CHARACTERISTICS†

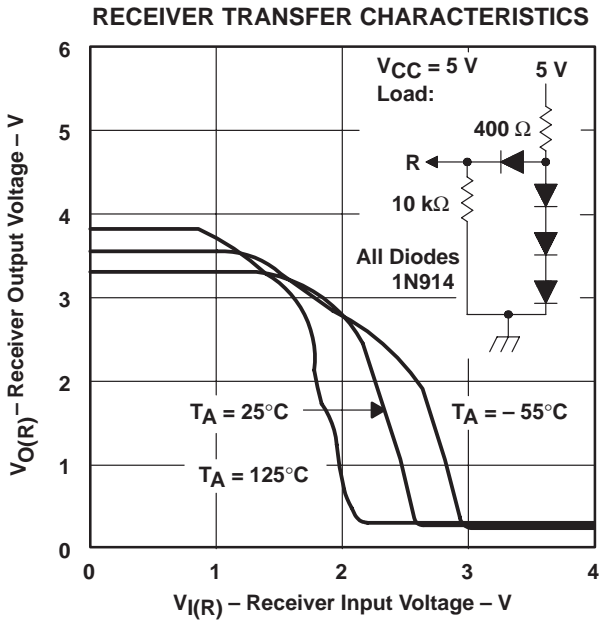


Figure 7

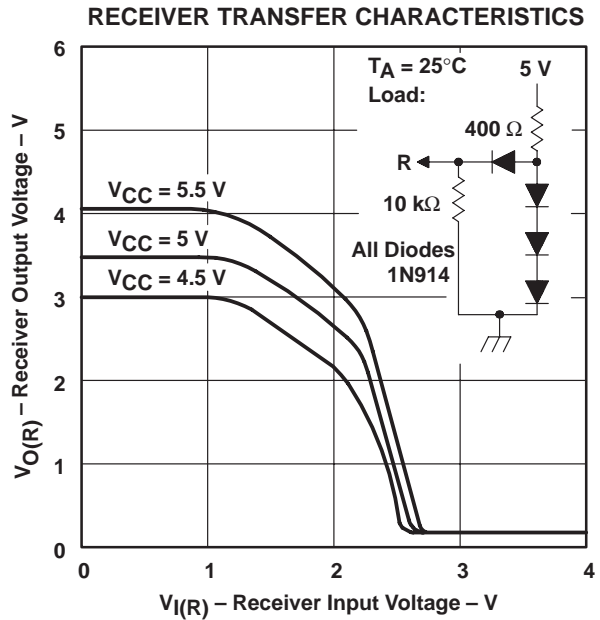


Figure 8

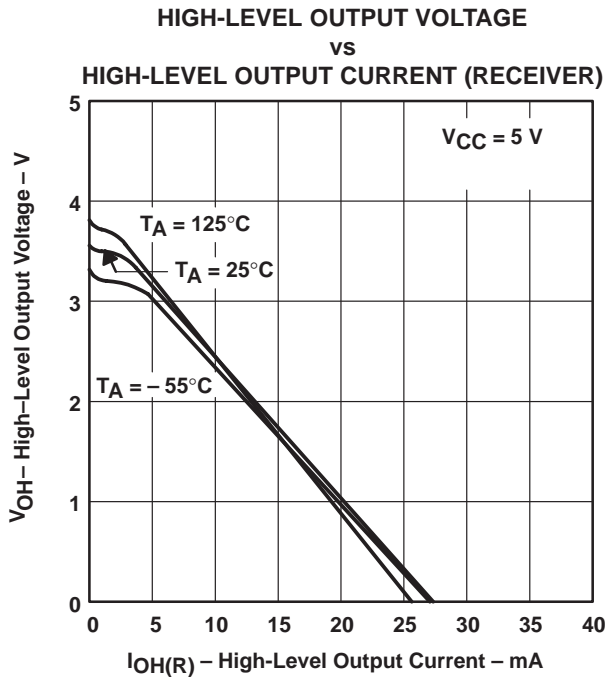


Figure 9

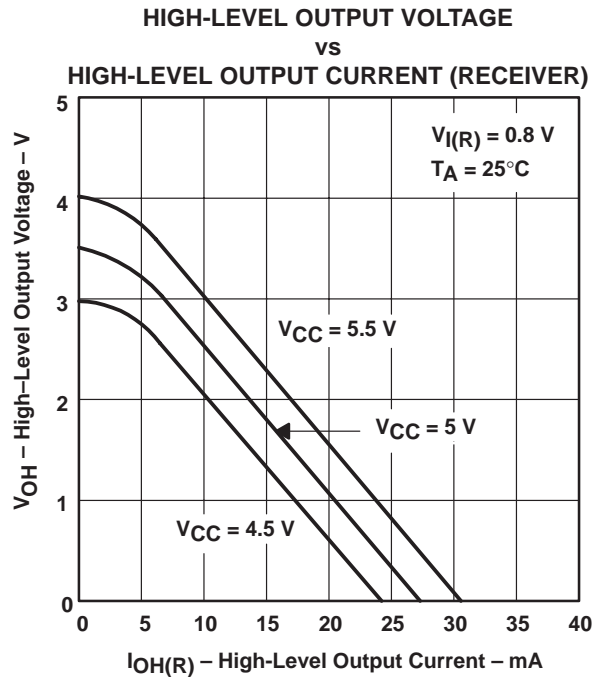


Figure 10

† Data for temperatures below 0°C and above 70°C is applicable to SN55138 circuits only.

TYPICAL CHARACTERISTICS†

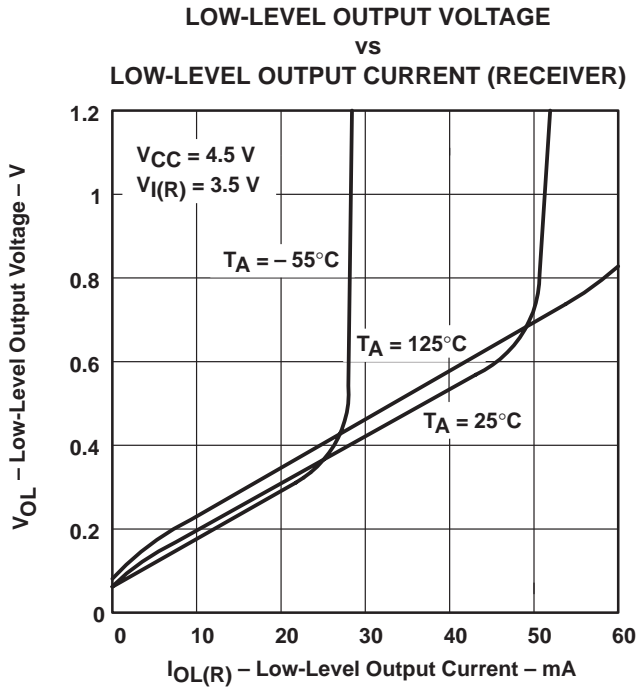


Figure 11

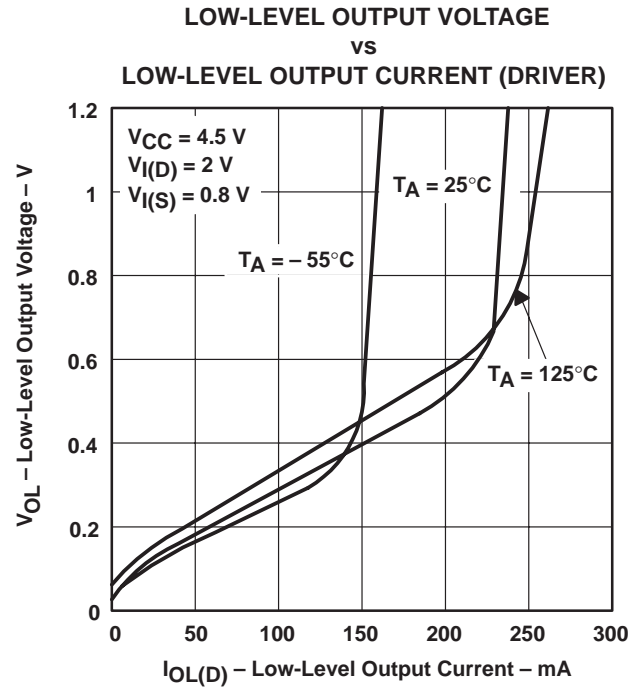


Figure 12

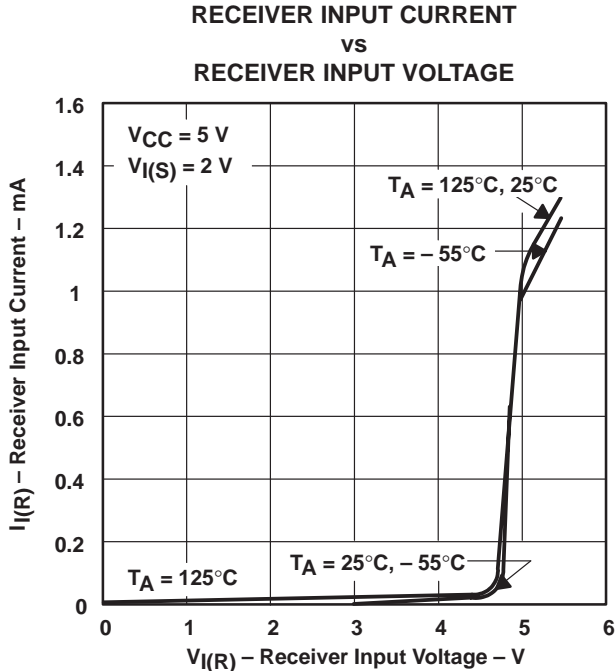


Figure 13

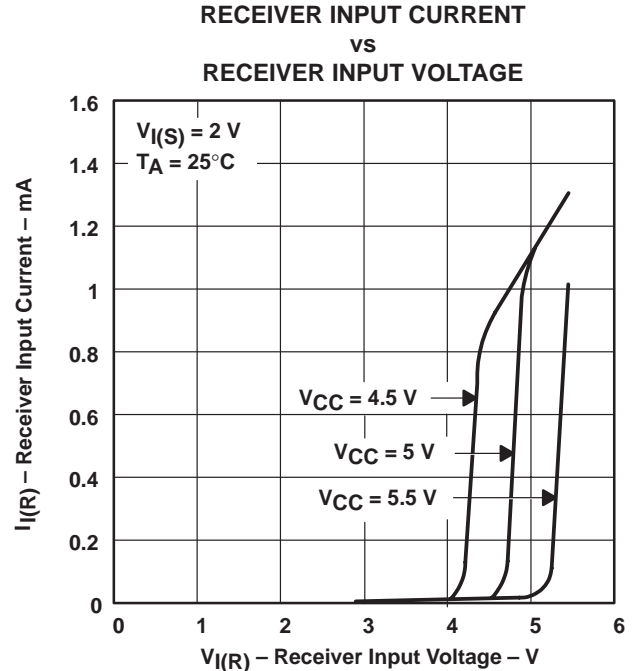


Figure 14

† Data for temperatures below 0°C and above 70°C is applicable to SN55138 circuits only.

TYPICAL CHARACTERISTICS†

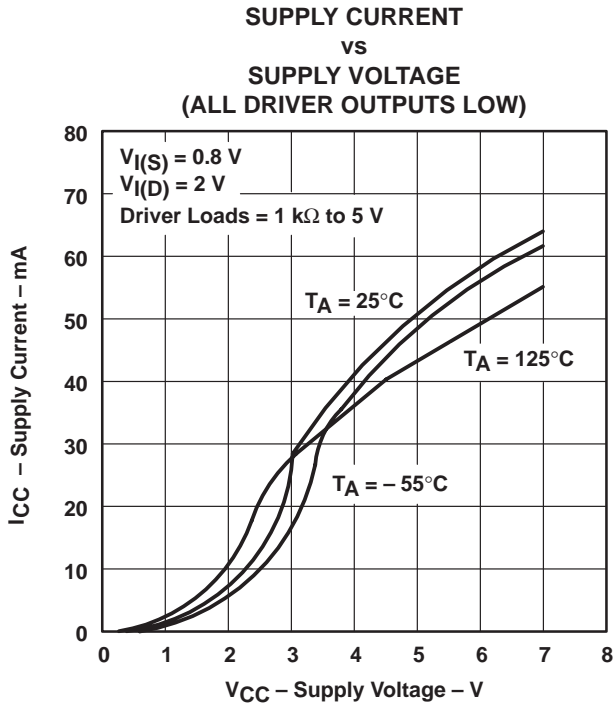


Figure 15

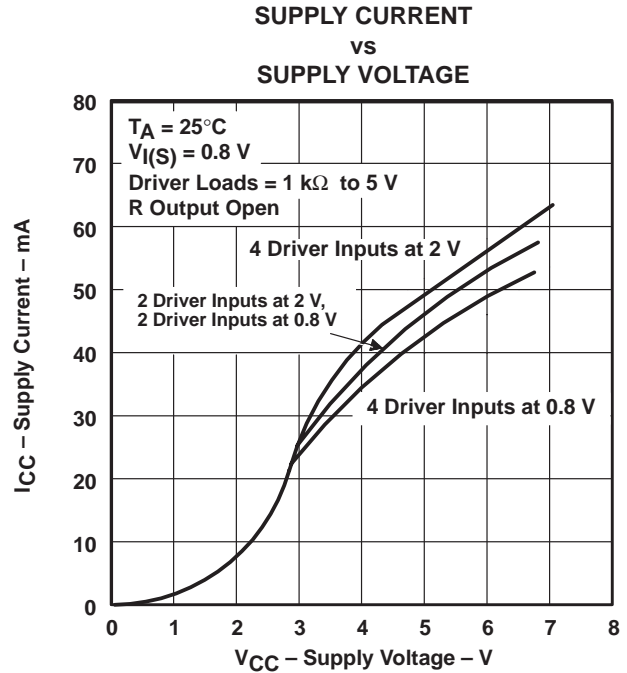


Figure 16

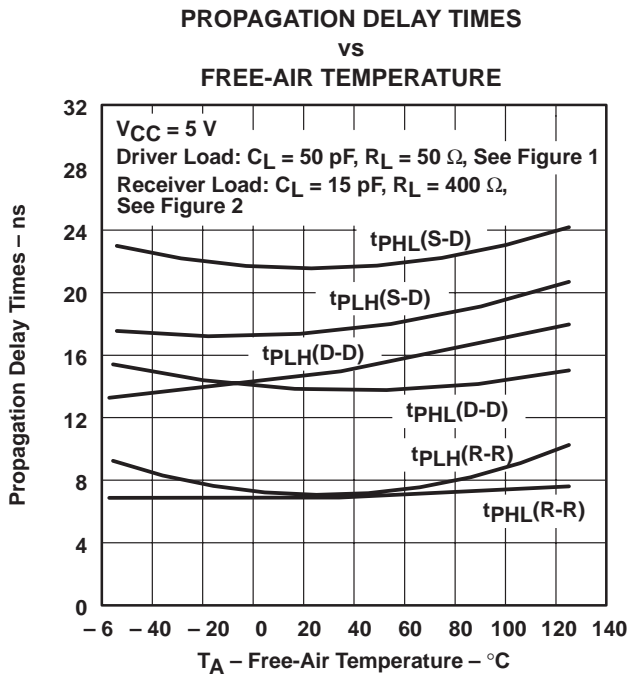


Figure 17

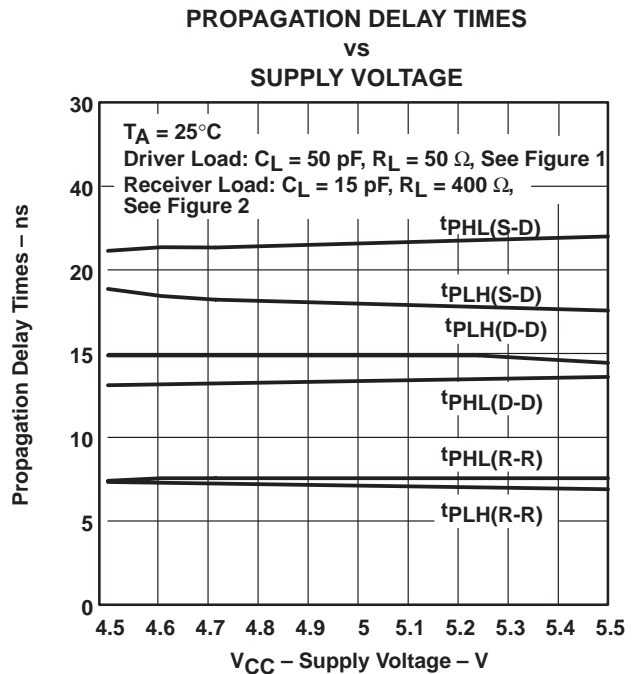
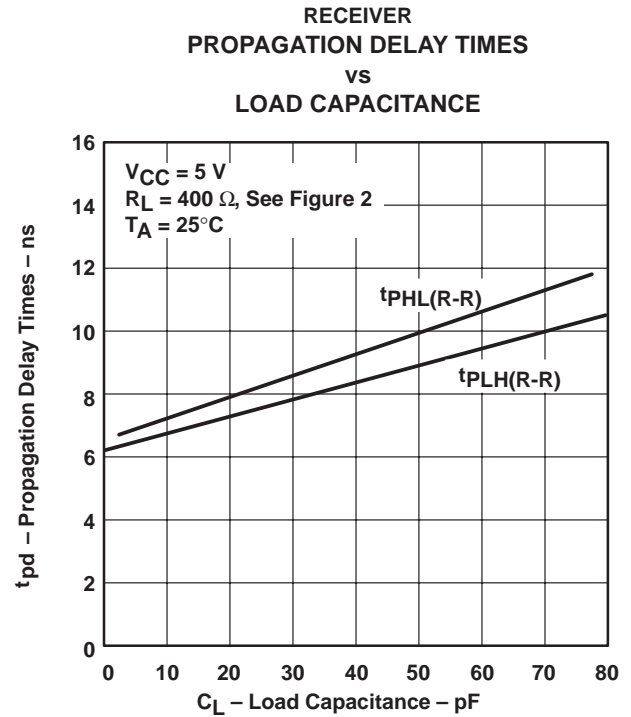
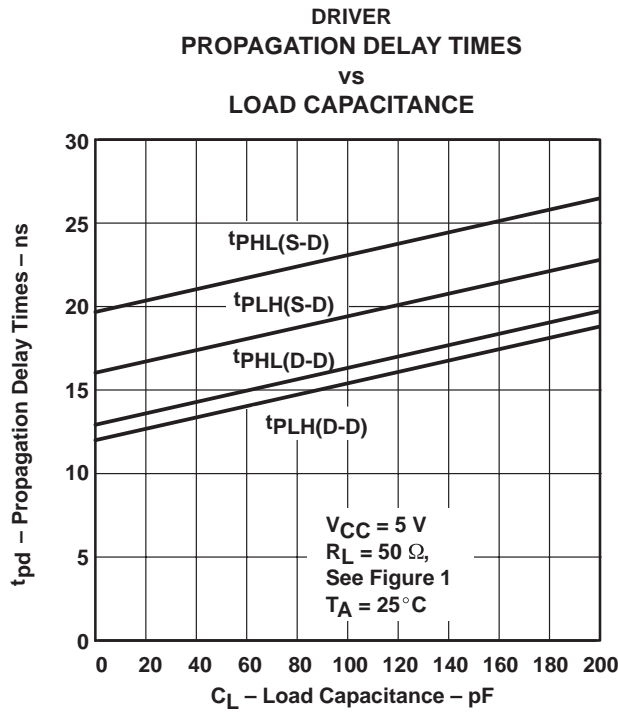


Figure 18

† Data for temperatures below 0°C and above 70°C is applicable to SN55138 circuits only.

TYPICAL CHARACTERISTICS



APPLICATION INFORMATION

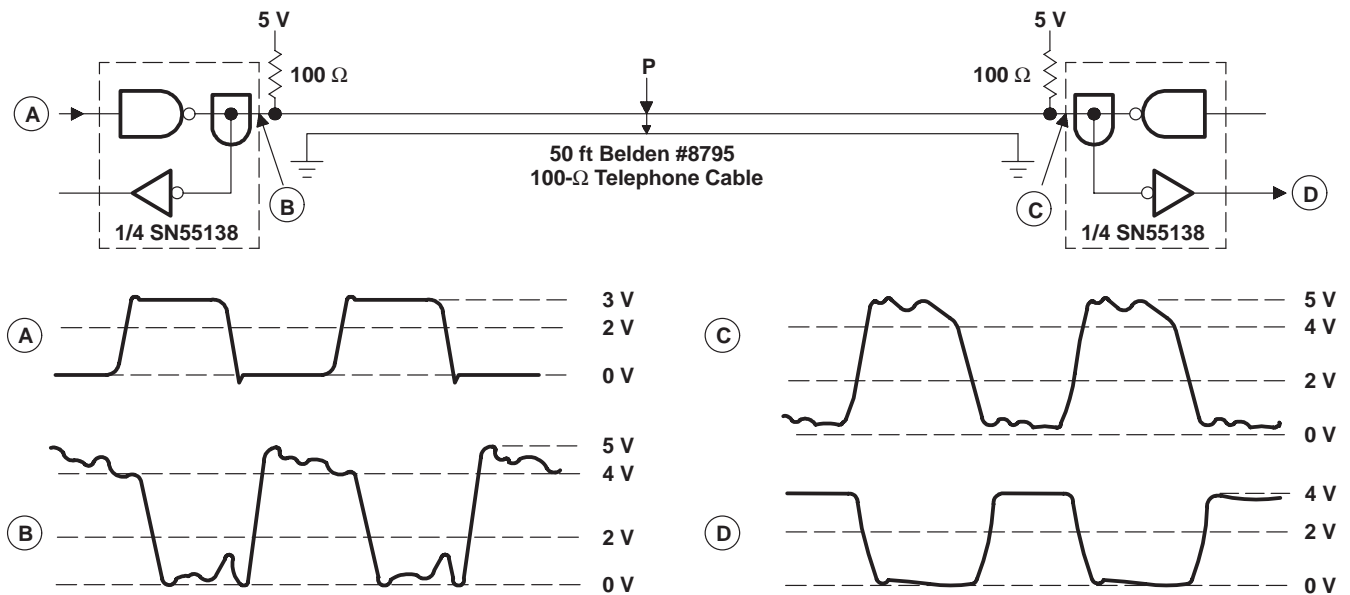
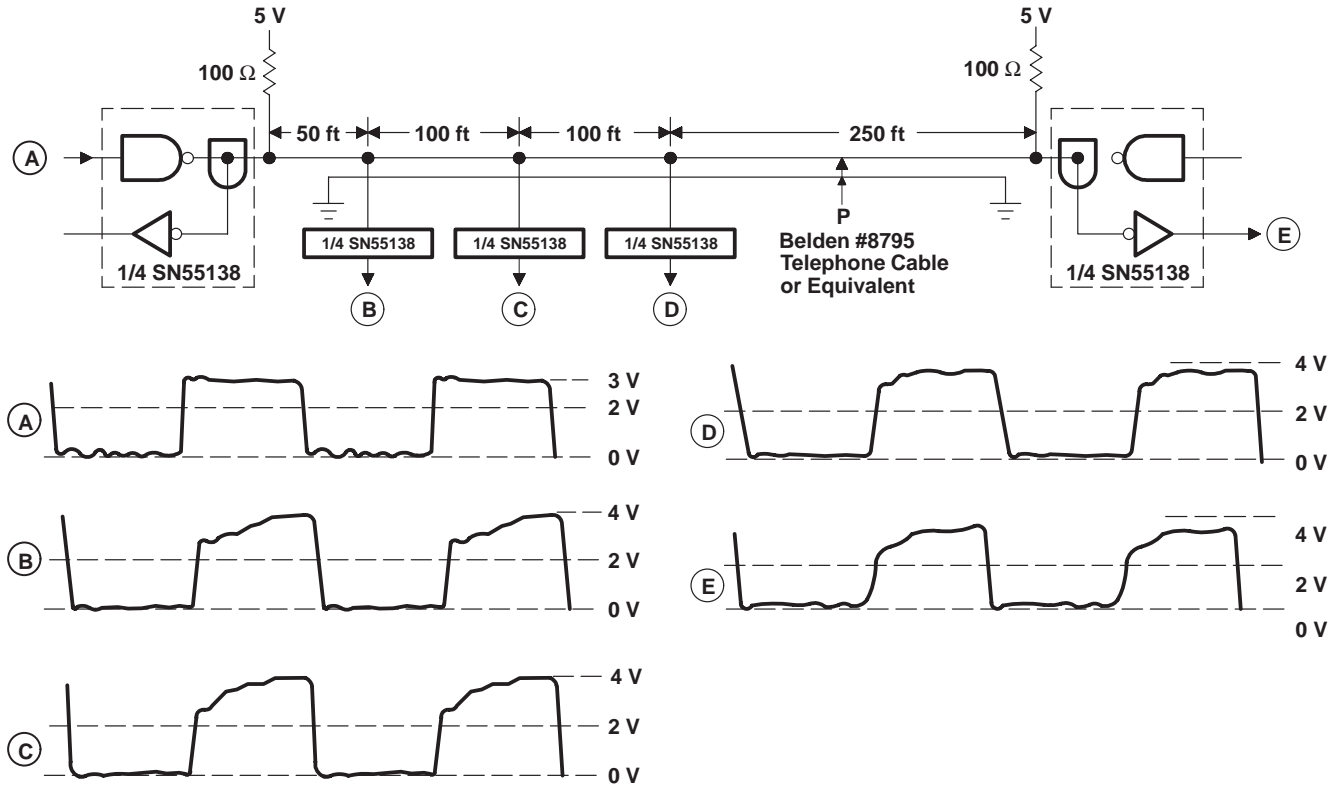


Figure 21. Point-to-Point Communication Over 50 Feet of Twisted Pair at 5 MHz

SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

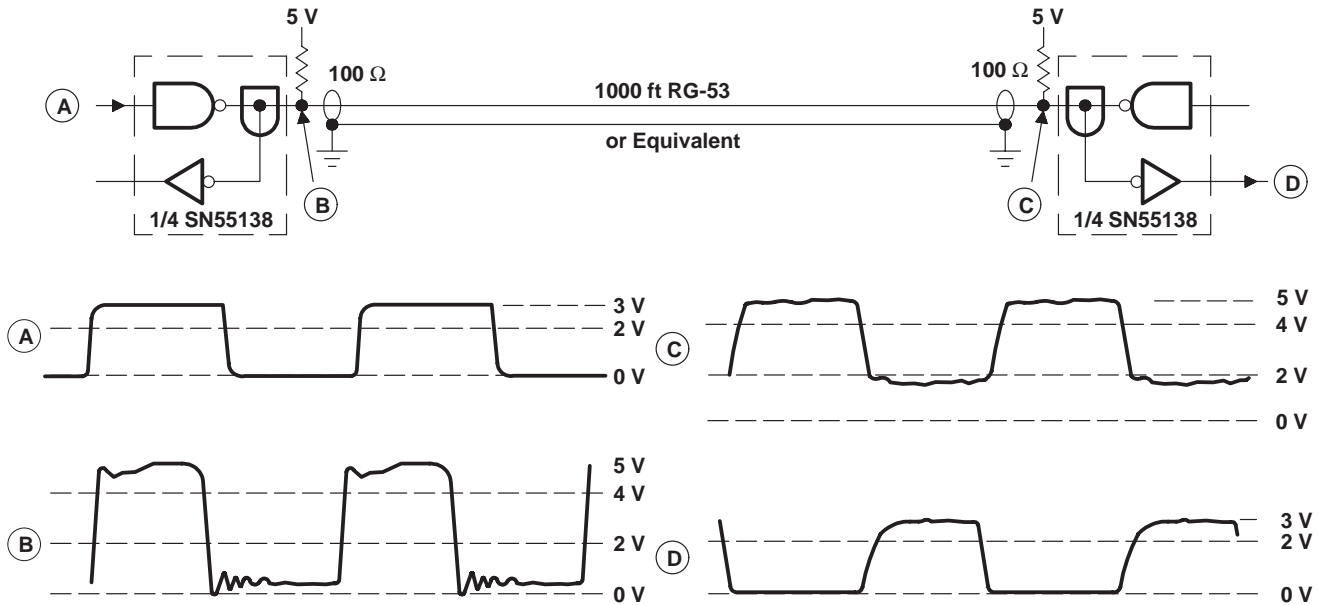
SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

APPLICATION INFORMATION



TYPICAL VOLTAGE WAVEFORMS

Figure 22. Party-Line Communication on 500 Feet of Twisted Pair at 1 MHz



TYPICAL VOLTAGE WAVEFORMS

Figure 23. Point-to-Point Communication Over 1000 Feet of Coaxial Cable at 1 MHz

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.