

SN55ALS160, SN75ALS160 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

SUITABLE FOR IEEE STANDARD 488-1978 (GPIB)[†]

- 8-Channel Bidirectional Transceivers
- High-Speed Advanced Low-Power Schottky (ALS) Circuitry
- Low Power Dissipation:
SN55ALS160 . . . 56 mW Max Per Channel
SN75ALS160 . . . 46 mW Max Per Channel
- Fast Propagation Times . . . 20 ns Max
- High-Impedance pnp Inputs
- Receiver Hysteresis:
SN55ALS160 . . . 550 mV Typ
SN75ALS160 . . . 650 mV Typ
- Open-Collector Driver Output Option
- No Loading of Bus When Device Is Powered Down ($V_{CC} = 0$)
- Power-Up/Power-Down Protection (Glitch Free)

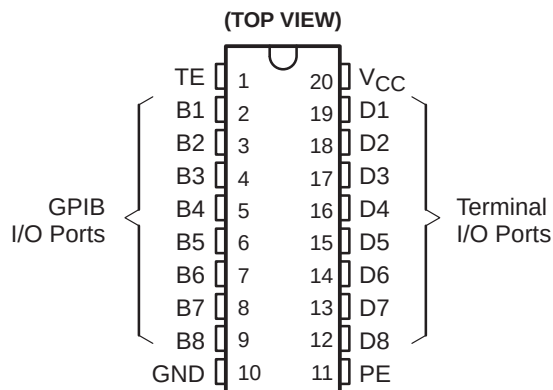
description

The SN55ALS160 and SN75ALS160 eight-channel general-purpose interface bus transceivers are monolithic, high-speed, advanced low-power Schottky (ALS) devices designed for two-way data communications over single-ended transmission lines. They are designed to meet the requirements of IEEE Standard 488-1978. The transceivers feature driver outputs that can be operated in either the passive-pullup or 3-state mode. If talk enable (TE) is high, these ports have the characteristics of passive-pullup outputs when pullup enable (PE) is low and of 3-state outputs when PE is high. Taking TE low places these ports in the high-impedance state. The driver outputs are designed to handle loads up to 48 mA of sink current.

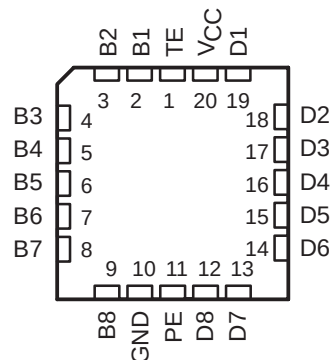
An active turn-off feature has been incorporated into the bus-terminating resistors so that the device exhibits a high impedance to the bus when $V_{CC} = 0$. When combined with the SN55ALS161, SN75ALS161, or SN75ALS162 bus management transceiver, the pair provides the complete 16-wire interface for the IEEE-488 bus.

The SN55ALS160 is characterized for operation from -55°C to 125°C . The SN75ALS160 is characterized for operation from 0°C to 70°C .

SN55ALS160 . . . J OR W PACKAGE
SN75ALS160 . . . DW OR N PACKAGE



SN55ALS160 . . . FK PACKAGE
(TOP VIEW)



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.

[†] The transceivers are suitable for IEEE Standard 896 applications to the extent of the operating conditions and characteristics specified in this data sheet. Certain limits contained in the IEEE specification are not met or cannot be tested over the entire military temperature range.

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

SN55ALS160, SN75ALS160

OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

Function Tables

EACH DRIVER

INPUTS			OUTPUT B
D	TE	PE	
H	H	H	H
L	H	X	L
H	X	L	Z [‡]
X	L	X	Z [‡]

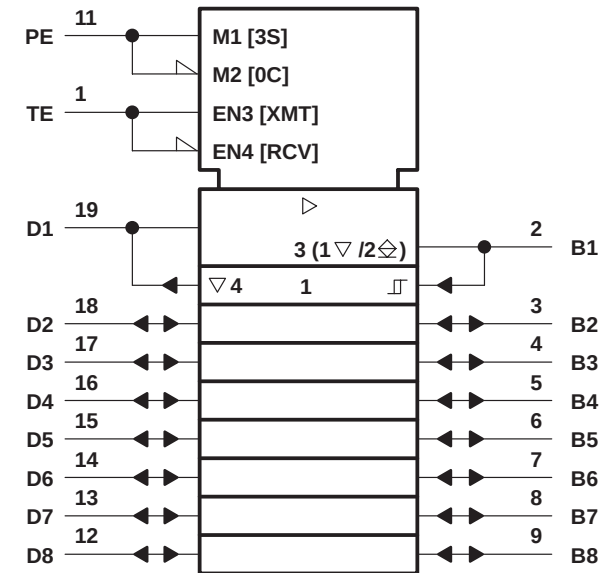
EACH RECEIVER

INPUTS			OUTPUT D
B	TE	PE	
L	L	X	L
H	L	X	H
X	H	X	Z

H = high level, L = low level, X = irrelevant,
Z = high-impedance state

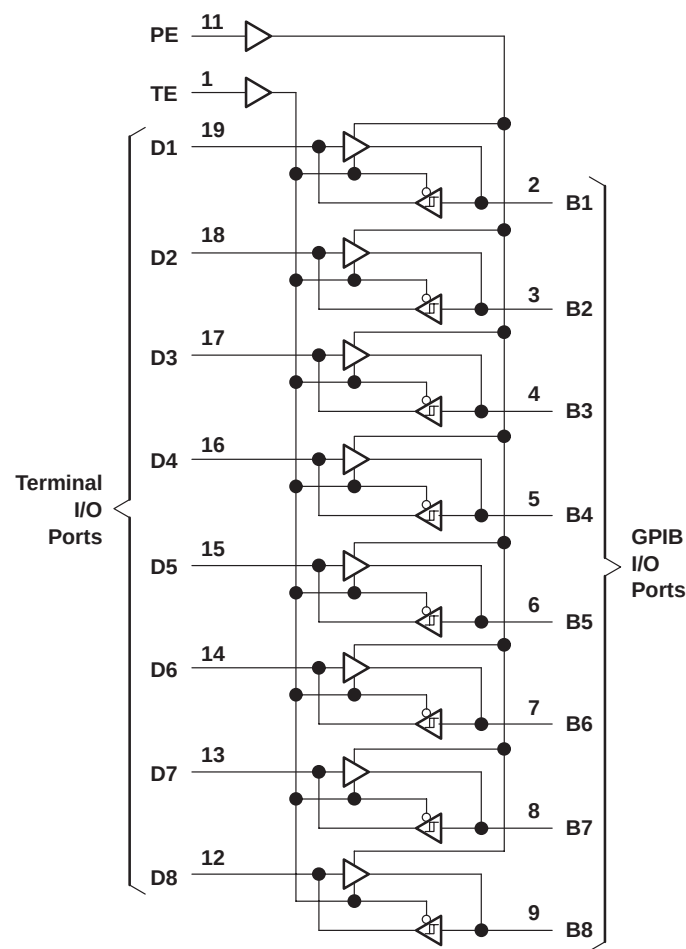
[†] This is the high-impedance state of a normal 3-state output modified by the internal resistors to V_{CC} and GND.

logic symbol[‡]



[‡] This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
[∇] Designates 3-state outputs
[⊕] Designates open-collector outputs with passive pullup

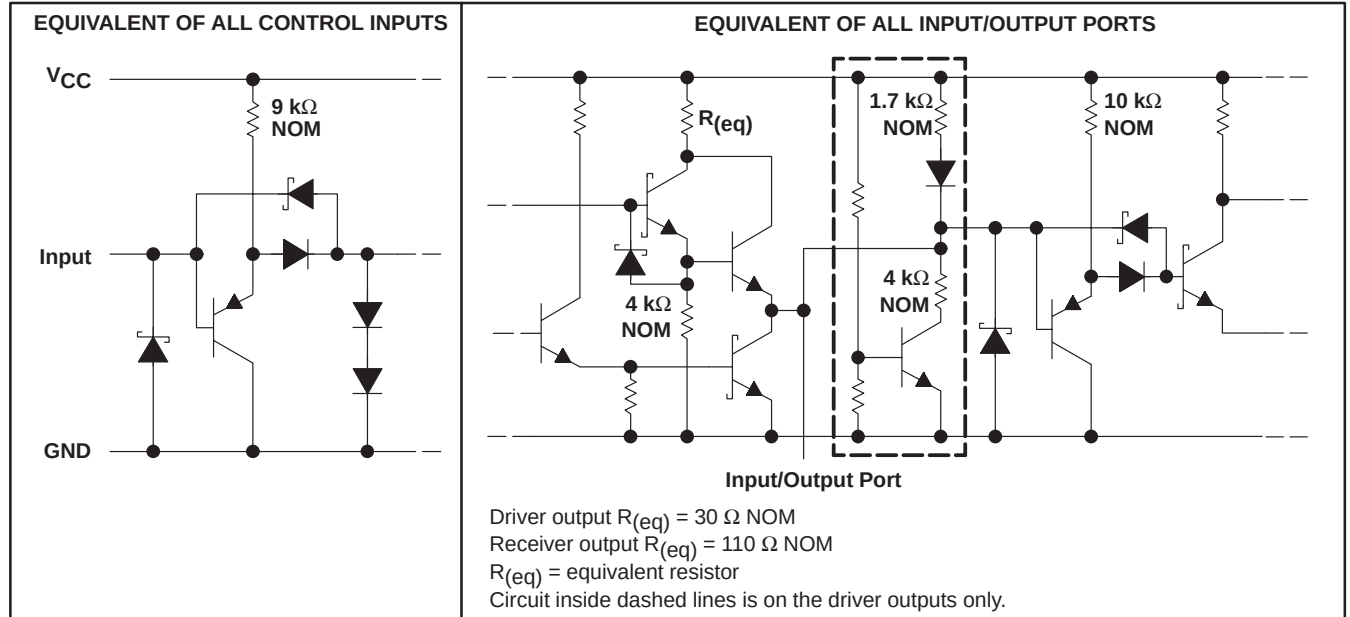
logic diagram (positive logic)



SN55ALS160, SN75ALS160 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

schematics of inputs and outputs



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
Low-level driver output current, I _{OL}	100 mA
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, T _A : SN55ALS160	–55°C to 125°C
SN75ALS160	0°C to 70°C
Storage temperature range, T _{stg}	–65°C to 150°C
Case temperature for 60 seconds, T _C : FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from the case for 10 seconds: DW or N package	260°C
Lead temperature 1,6 mm (1/16 inch) from the case for 60 seconds: J or W 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 network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR	T _A = 70°C POWER RATING	T _A = 125°C POWER RATING
DW	1125 mW	9.0 mW/°C	720 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

SN55ALS160, SN75ALS160

OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

SN55ALS160 recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		4.75	5	5.25	V
High-level input voltage, V_{IH}	TE and PE at $T_A = -55^{\circ}\text{C}$ to 125°C	2			V
	Bus and terminal at $T_A = 25^{\circ}\text{C}$ to 125°C	2			
	Bus and terminal at $T_A = -55^{\circ}\text{C}$	2.1			
Low-level input voltage, V_{IL}	TE and PE at $T_A = -55^{\circ}\text{C}$ to 125°C			0.8	V
	Bus and terminal at $T_A = 25^{\circ}\text{C}$ to -55°C			0.8	
	Bus and terminal at $T_A = 125^{\circ}\text{C}$			0.7	
High-level output current, I_{OH}	Bus ports with pullups active ($V_{CC} = 5\text{ V}$)			- 5.2	mA
	Terminal ports			- 800	μA
Low-level output current, I_{OL}	Bus ports			48	mA
	Terminal ports			16	
Operating free-air temperature, T_A		-55		125	$^{\circ}\text{C}$

SN75ALS160 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
High-level output current, I_{OH}	Bus ports with pullups active			- 5.2	mA
	Terminal ports			- 800	μA
Low-level output current, I_{OL}	Bus ports			48	mA
	Terminal ports			16	
Operating free-air temperature, T_A		0		70	$^{\circ}\text{C}$



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		SN55ALS160			SN75ALS160			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}	Input clamp voltage	I _I = –18 mA, V _{CC} = MIN		–0.8	–1.5		–0.8	–1.5		V
V _{hys}	Hysteresis voltage (V _{IT+} – V _{IT–})	Bus					0.4	0.65		V
		Bus	V _{CC} = 5 V, T _A = –55°C and 25°C	0.4	0.55					
			V _{CC} = 5 V, T _A = 125°C	0.25						
V _{OH} §	High-level output voltage	Terminal	I _{OH} = –800 µA, TE at 0.8 V, V _{CC} = MIN	2.7	3.5		2.7	3.5		V
		Bus	I _{OH} = –5.2 mA, PE and TE at 2 V, V _{CC} = MIN	2.5	3.3		2.5	3.3		
V _{OL}	Low-level output voltage	Terminal	I _{OL} = 16 mA, TE at 0.8 V, V _{CC} = MIN	0.3	0.5		0.3	0.5		V
		Bus	I _{OL} = 48 mA, TE at 2 V, V _{CC} = MIN	0.35	0.5		0.35	0.5		
I _I	Input current at maximum input voltage	Terminal	V _I = 5.5 V, V _{CC} = MAX	0.2	100		0.2	100		µA
I _{IH}	High-level input current	Terminal, PE, or TE	V _I = 2.7 V, V _{CC} = MAX	0.1	20		0.1	20		µA
I _{IL}	Low-level input current		V _I = 0.5 V, V _{CC} = MAX	–30	–100		–10	–100		µA
V _{I/O(bus)}	Voltage at bus port	Driver disabled, V _{CC} = 5 V (SN55*)	I _{I(bus)} = 0	2.5	3	3.7	2.5	3	3.7	V
			I _{I(bus)} = –12 mA			–1.5			–1.5	
I _{I/O(bus)}	Current into bus port	Power on	Driver disabled, V _{CC} = 5 V (SN55*)	V _{I(bus)} = –1.5 V to 0.4 V		–1.3	–1.3			mA
				V _{I(bus)} = 0.4 V to 2.5 V		0	–3.2		–3.2	
				V _{I(bus)} = 2.5 V to 3.7 V			2.5		2.5	
				V _{I(bus)} = 3.7 V to 5 V		0	2.5		2.5	
				V _{I(bus)} = 5 V to 5.5 V		0.7	2.5		2.5	
		Power off	V _{CC} = 0	V _{I(bus)} = 0 to 2.5 V		40	40			µA
I _{OS}	Short-circuit output current	Terminal	V _{CC} = MAX	–15	–35	–75	–15	–35	–75	mA
		Bus	V _{CC} = MAX	–25	–50	–125	–25	–50	–125	
I _{CC}	Supply current	No load, V _{CC} = MAX	Terminal outputs low and enabled	42	56		42	65		mA
			Bus outputs low and enabled	52	85		52	80		
C _{I/O(bus)}	Bus-port capacitance	V _{CC} = 0 to 5 V, V _{I/O} = 0 to 2 V, f = 1 MHz		30			30			pF

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

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

§ V_{OH} applies to 3-state outputs only.

SN55ALS160, SN75ALS160

OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

switching characteristics at $V_{CC} = 4.75\text{ V}$, 5 V , and 5.25 V , $C_L = 50\text{ pF}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	$T_A^\dagger$	MIN	TYP ‡	MAX	UNIT
t_{PLH} Propagation delay time, low- to high-level output	Terminal	Bus	See Figure 1	25°C		10	17	ns
				Full range			20	
t_{PHL} Propagation delay time, high- to low-level output				25°C		10	14	
				Full range			16	
t_{PLH} Propagation delay time, low- to high-level output	Bus	Terminal	See Figure 2	25°C		8	15	ns
				Full range			18	
t_{PHL} Propagation delay time, high- to low-level output				25°C		8	15	
				Full range			18	
t_{PZH} Output enable time to high level	TE	Bus	See Figure 3	25°C		24	30	ns
				Full range			41	
t_{PHZ} Output disable time from high level				25°C		9	14	
				Full range			16	
t_{PZL} Output enable time to low level				25°C		16	28	
				Full range			34	
t_{PLZ} Output disable time from low level				25°C		12	19	
				Full range			24	
t_{PZH} Output enable time to high level	TE	Terminal	See Figure 4	25°C		24	36	ns
				Full range			50	
t_{PHZ} Output disable time from high level				25°C		10	18	
				Full range			23	
t_{PZL} Output enable time to low level				25°C		15	26	
				Full range			30	
t_{PLZ} Output disable time from low level				25°C		15	24	
				Full range			31	
t_{en} Output pullup enable time	PE	Bus	See Figure 5	25°C		16	24	ns
				Full range			25	
t_{dis} Output pullup disable time				25°C		9	16	
				Full range			20	

† Full range is -55°C to 125°C .

‡ All typical values are at $V_{CC} = 5\text{ V}$.



SN55ALS160, SN75ALS160

OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

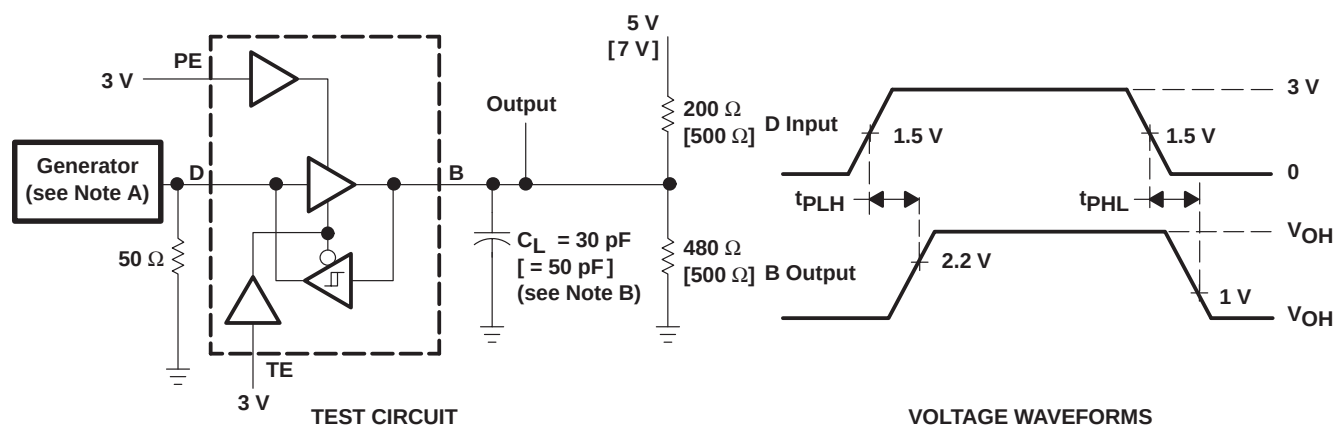
SLLS018D – JUNE 1986 – REVISED MAY 1995

switching characteristics over recommended range of operating free-air temperature, $V_{CC} = 5\text{ V}$

PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
t _{PLH}	Propagation delay time, low- to high-level output	Terminal	Bus	C _L = 30 pF, See Figure 1		7	20	ns
t _{PHL}	Propagation delay time, high- to low-level output					8	20	
t _{PLH}	Propagation delay time, low- to high-level output	Bus	Terminal	C _L = 30 pF, See Figure 2		7	14	ns
t _{PHL}	Propagation delay time, high- to low-level output					9	14	
t _{PZH}	Output enable time to high level	TE	Bus	C _L = 15 pF, See Figure 3		19	30	ns
t _{PHZ}	Output disable time from high level					5	12	
t _{PZL}	Output enable time to low level					16	35	
t _{PLZ}	Output disable time from low level					9	20	
t _{PZH}	Output enable time to high level	TE	Terminal	C _L = 15 pF, See Figure 4		13	30	ns
t _{PHZ}	Output disable time from high level					12	20	
t _{PZL}	Output enable time to low level					12	20	
t _{PLZ}	Output disable time from low level					11	20	
t _{en}	Output pullup enable time	PE	Bus	C _L = 15 pF, See Figure 5		11	22	ns
t _{dis}	Output pullup disable time					6	12	

[†] Typical values are at $T_A = 25^\circ\text{C}$.

PARAMETER MEASUREMENT INFORMATION



[] denotes the SN55ALS160 military test conditions.

NOTES: A. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 1\text{ MHz}$, 50% duty cycle, $t_r \leq 6\text{ ns}$, $t_f \leq 6\text{ ns}$, $Z_O = 50\text{ }\Omega$.

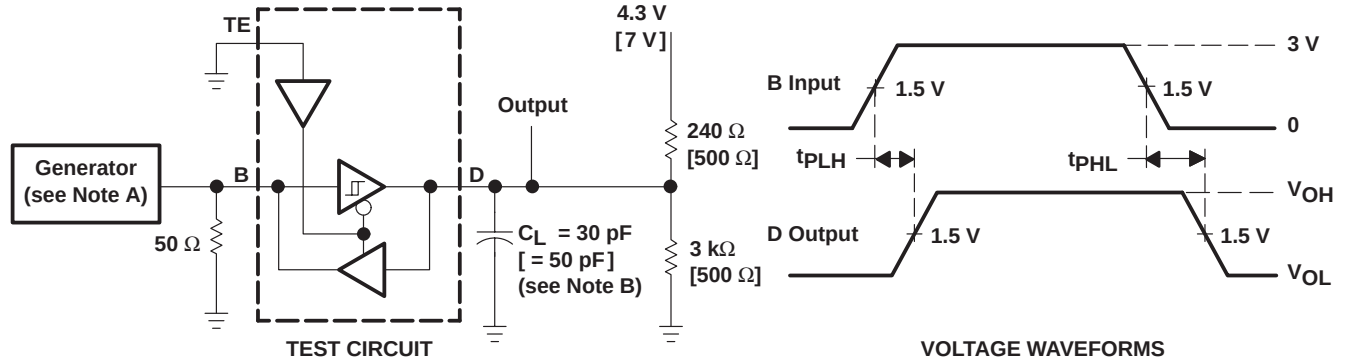
B. C_L includes probe and jig capacitance.

Figure 1. Terminal-to-Bus Test Circuit and Voltage Waveforms

SN55ALS160, SN75ALS160 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

PARAMETER MEASUREMENT INFORMATION

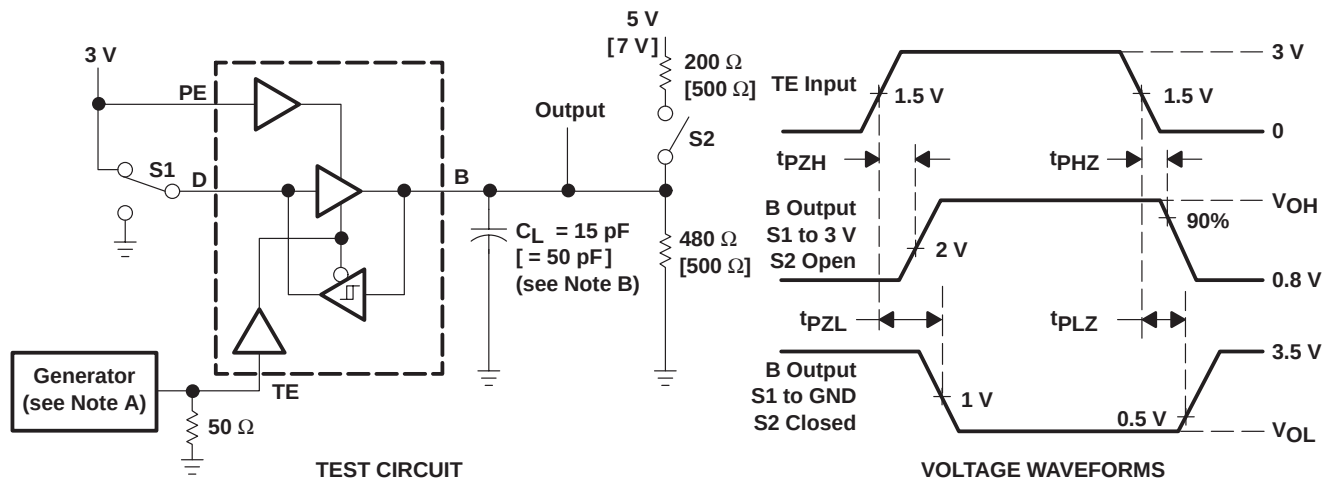


[] denotes the SN55ALS160 military test conditions.

NOTES: A. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 1$ MHz, 50% duty cycle, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50$ Ω .

B. C_L includes probe and jig capacitance.

Figure 2. Bus-to-Terminal Test Circuit and Voltage Waveforms



[] denotes the SN55ALS160 military test conditions.

NOTES: A. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 1$ MHz, 50% duty cycle, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50$ Ω .

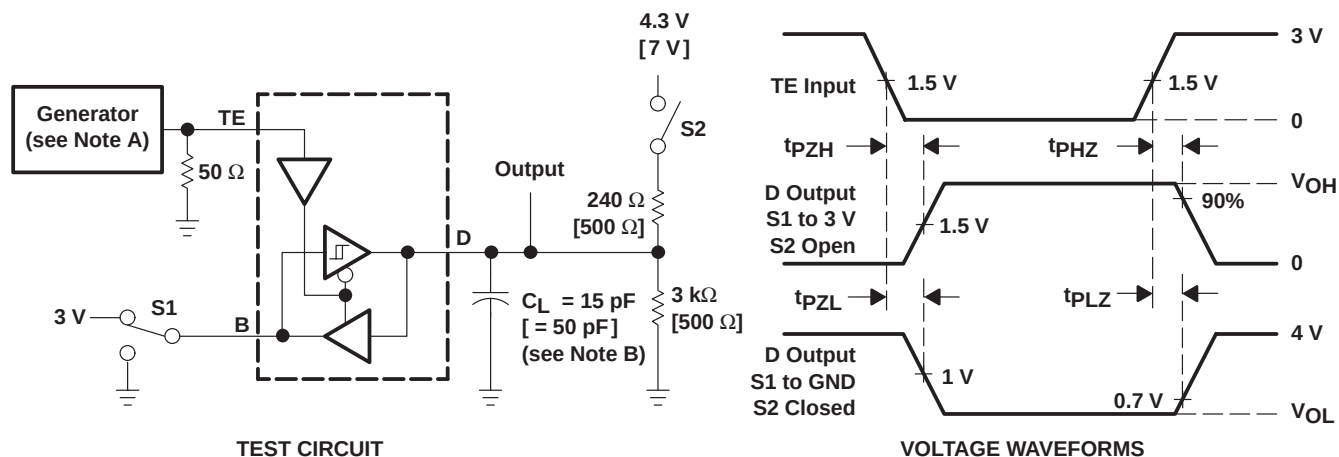
B. C_L includes probe and jig capacitance.

Figure 3. TE-to-Bus Test Circuit and Voltage Waveforms

SN55ALS160, SN75ALS160 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

PARAMETER MEASUREMENT INFORMATION

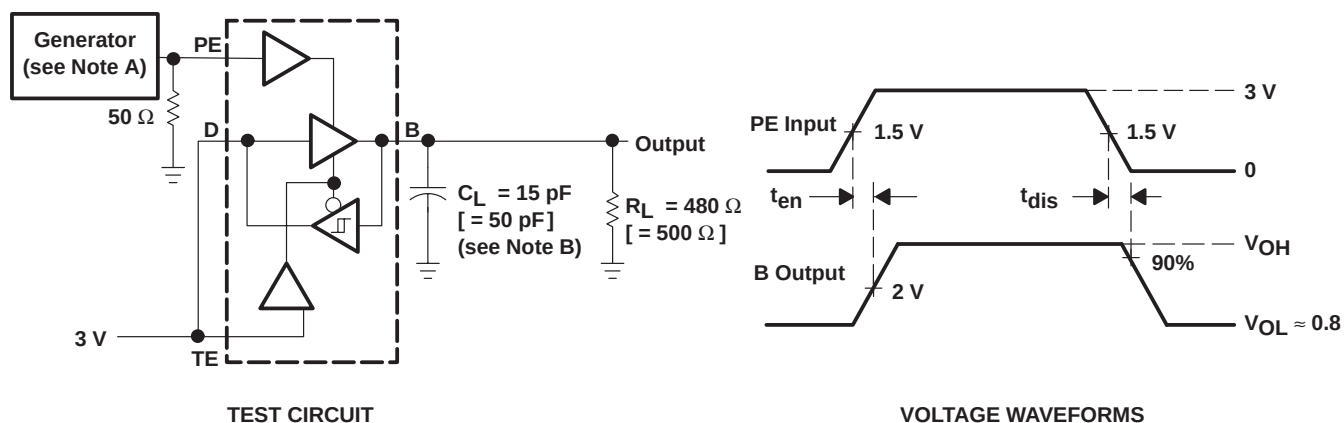


[] denotes the SN55ALS160 military test conditions.

NOTES: A. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 1$ MHz, 50% duty cycle, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50 \Omega$.

B. C_L includes probe and jig capacitance.

Figure 4. TE-to-Terminal Test Circuit and Voltage Waveforms



[] denotes the SN55ALS160 military test conditions.

NOTES: A. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 1$ MHz, 50% duty cycle, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50 \Omega$.

B. C_L includes probe and jig capacitance.

Figure 5. PE-to-Bus Test Circuit and Voltage Waveforms

SN55ALS160, SN75ALS160 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

TYPICAL CHARACTERISTICS

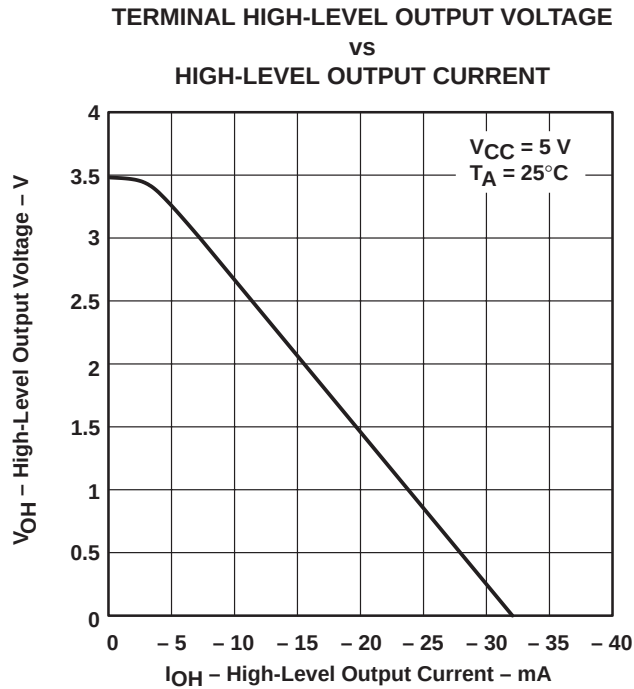


Figure 6

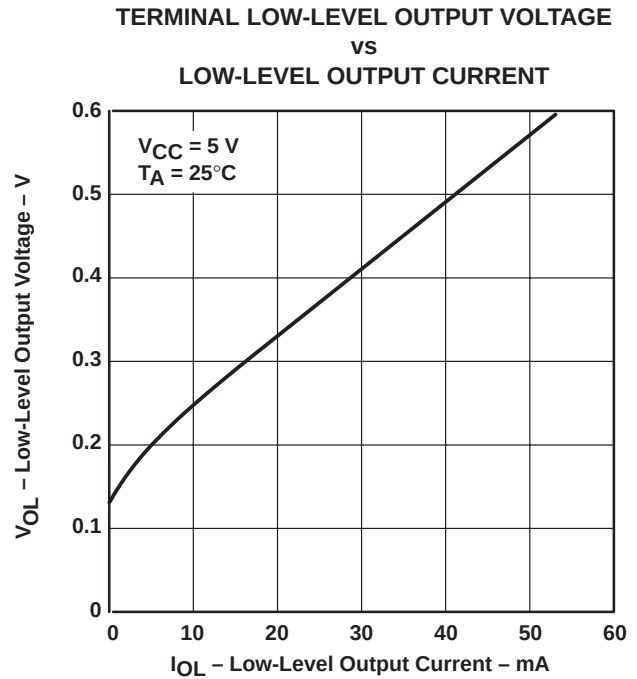


Figure 7

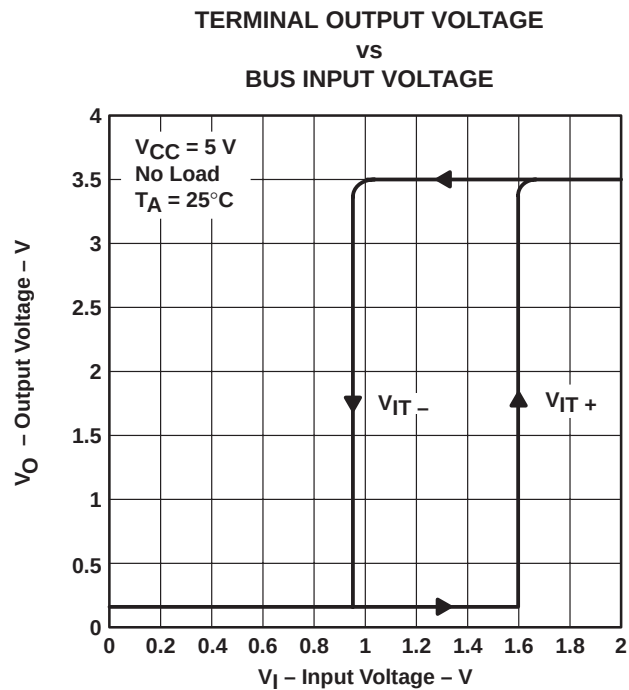


Figure 8

SN55ALS160, SN75ALS160
OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS018D – JUNE 1986 – REVISED MAY 1995

TYPICAL CHARACTERISTICS

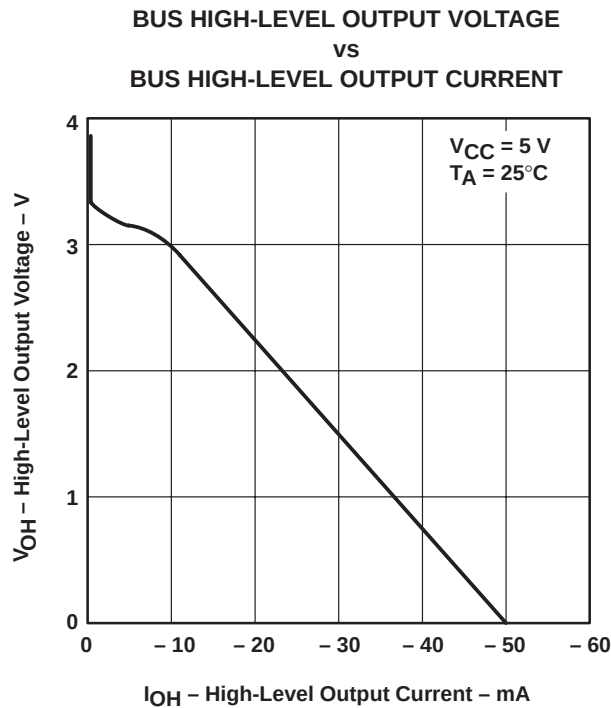


Figure 9

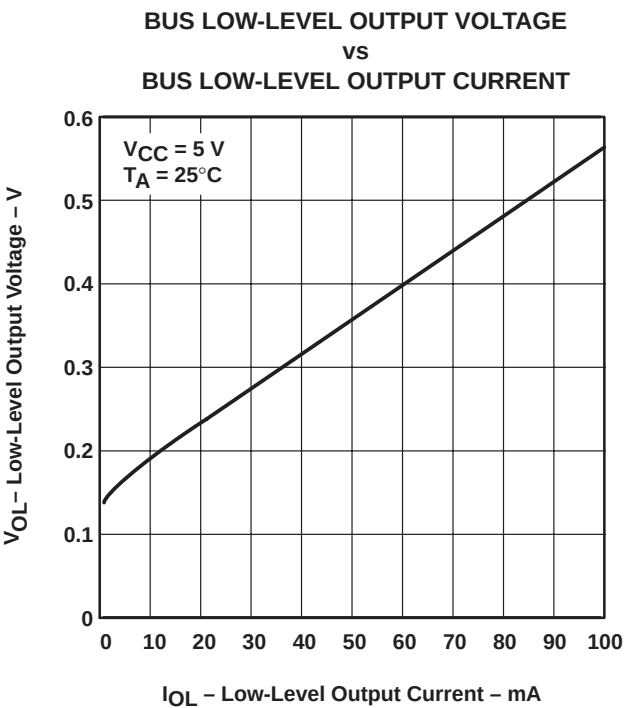


Figure 10

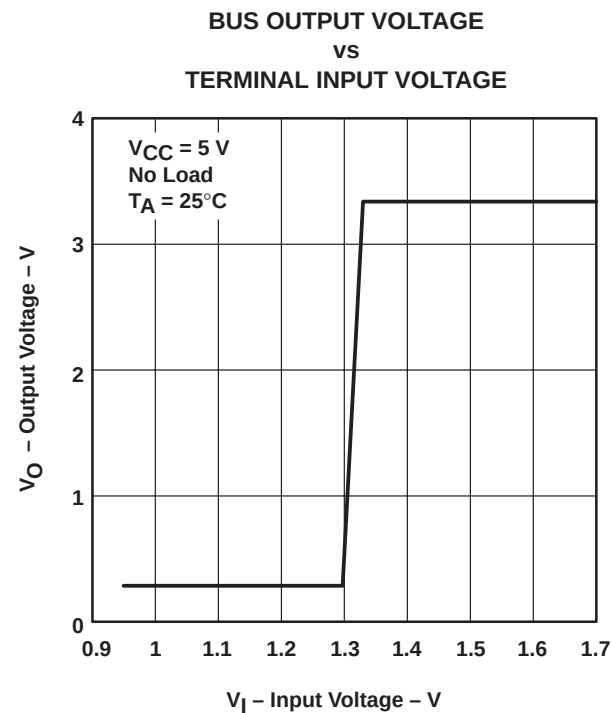


Figure 11

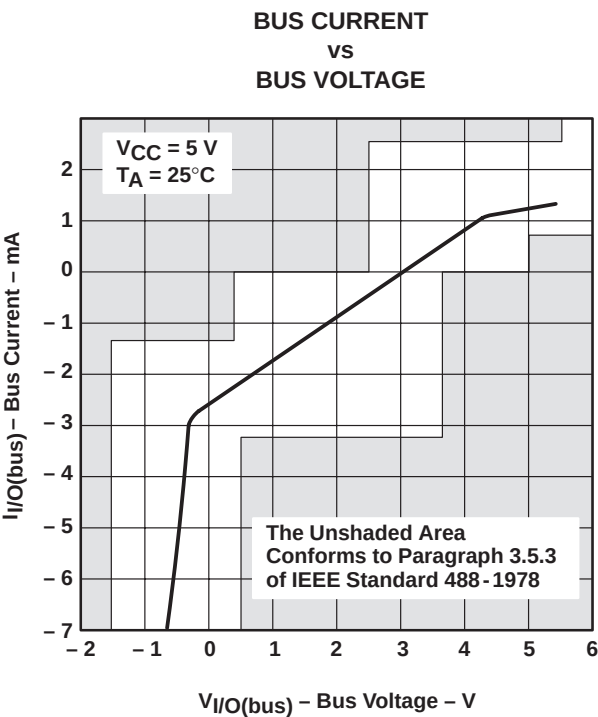


Figure 12

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.