

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)

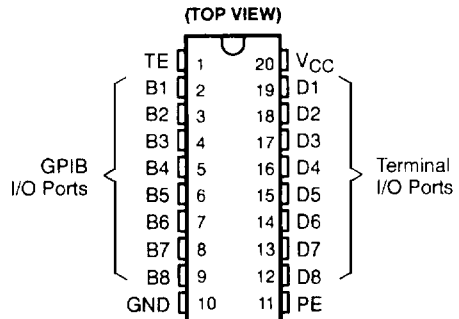
description

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.

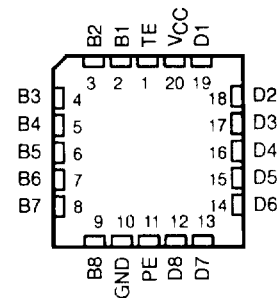
An active turn-off feature has been incorporated into the bus-terminating resistors so that the device exhibits a high impedance to the bus when $V_{CC} = 0$. When combined with the SN55ALS161, SN75ALS161, or SN75ALS162 bus management transceiver, the pair provides the complete 16-wire interface for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



Function Tables

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

EACH RECEIVER			
INPUTS			OUTPUT
B	TE	PE	D
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.

[†] 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.



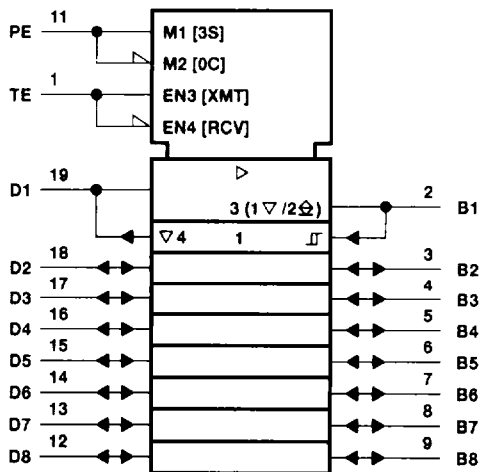
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logic symbol

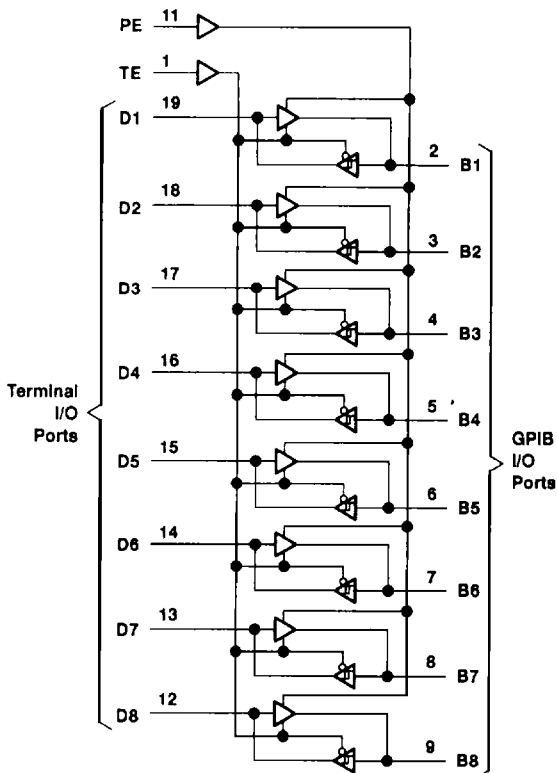


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

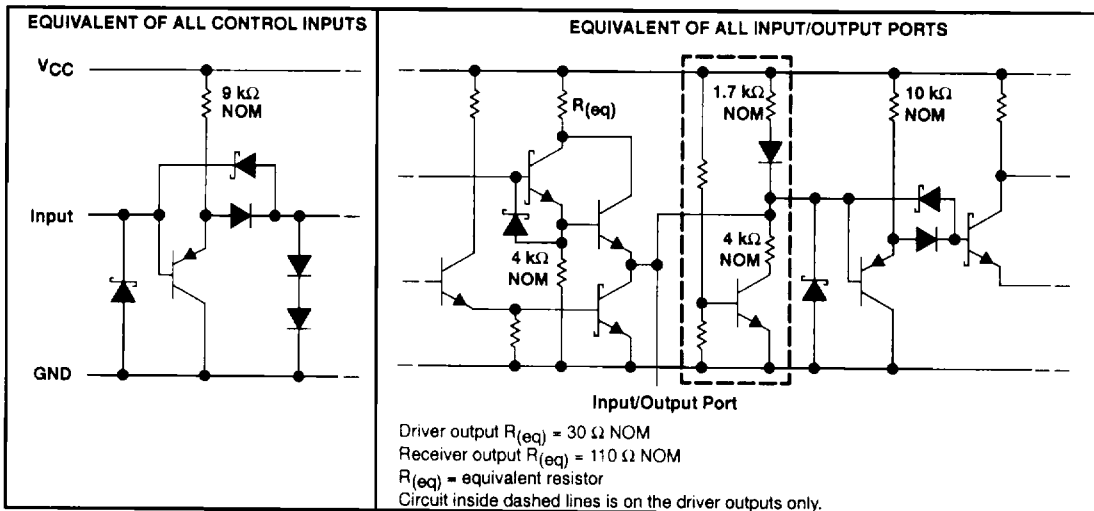
▽ Designates 3-state outputs

⊕ Designates open-collector outputs with passive pullup

logic diagram (positive logic)



schematics of inputs and outputs



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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.

NOTES: 1. All voltage values are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ 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 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	°C



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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			μ A
Low-level output current, I_{OL}	Bus ports	48			mA
	Terminal ports	16			
Operating free-air temperature, T_A		0	70		$^{\circ}$ C



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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‡
V_{IK}	Input clamp voltage	$I_I = -18 \text{ mA}$, $V_{CC} = \text{MIN}$		-0.8	-1.5	V	
V_{hys}	Hysteresis voltage ($V_{IT+} - V_{IT-}$)	$V_{CC} = 5 \text{ V}$, $T_A = -55^\circ\text{C}$ and 25°C		0.4	0.55	V	
		$V_{CC} = 5 \text{ V}$, $T_A = 125^\circ\text{C}$		0.25			
$V_{OH}\$$	High-level output voltage	Terminal	$I_{OH} = -800 \mu\text{A}$, TE at 0.8 V, $V_{CC} = \text{MIN}$	2.7	3.5	V	
		Bus	PE and TE at 2 V, $V_{CC} = \text{MIN}$	2.5	3.3	V	
V_{OL}	Low-level output voltage	Terminal	$I_{OL} = 16 \text{ mA}$, TE at 0.8 V, $V_{CC} = \text{MIN}$	0.3	0.5	V	
		Bus	TE at 2 V, $V_{CC} = \text{MIN}$	0.35	0.5	V	
I_I	Input current at maximum input voltage	Terminal	$V_I = 5.5 \text{ V}$, $V_{CC} = \text{MAX}$	0.2	100	μA	
I_{IH}	High-level input current	Terminal, PE, or TE	$V_I = 2.7 \text{ V}$, $V_{CC} = \text{MAX}$	0.1	20	μA	
I_{IL}	Low-level input current		$V_I = 0.5 \text{ V}$, $V_{CC} = \text{MAX}$	-30	-100	μA	
$V_{I/O}(\text{bus})$	Voltage at bus port	Driver disabled, $V_{CC} = 5 \text{ V}$ (SN55†)	$I_I(\text{bus}) = 0$	2.5	3	3.7	V
			$I_I(\text{bus}) = -12 \text{ mA}$				-1.5
$I_{I/O}(\text{bus})$	Current into bus port	Power on $V_{CC} = 5 \text{ V}$ (SN55†)	$V_I(\text{bus}) = -1.5 \text{ V}$ to 0.4 V	-1.3			
			$V_I(\text{bus}) = 0.4 \text{ V}$ to 2.5 V	0	-3.2	0	-3.2
			$V_I(\text{bus}) = 2.5 \text{ V}$ to 3.7 V		2.5		2.5
			$V_I(\text{bus}) = 3.7 \text{ V}$ to 5 V		-3.2		-3.2
LOS	Short-circuit output current	Power off $V_{CC} = 0$	$V_I(\text{bus}) = 3.7 \text{ V}$ to 5 V	0	2.5	2.5	mA
			$V_I(\text{bus}) = 5 \text{ V}$ to 5.5 V	0.7	2.5	0.7	2.5
ICC	Supply current	Terminal	$V_I(\text{bus}) = 0$ to 2.5 V	40			μA
			Bus	$V_{CC} = \text{MAX}$	-15	-35	-75
$C_{I/O}(\text{bus})$	Bus-port capacitance	No load, $V_{CC} = \text{MAX}$	Terminal outputs low and enabled	-25	-50	-125	mA
			Bus outputs low and enabled	42	56	65	mA
		$V_{CC} = 0$ to 5 V , $V_{I/O} = 0$ to 2 V , $f = 1 \text{ MHz}$		30			pF

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

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

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



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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	T_A †	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	Terminal	Bus	See Figure 1	25°C		10	14	ns
				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	Bus	Terminal	See Figure 2	25°C		8	15	ns
				Full range			18	
t_{pZH} Output enable time to high level	TE	Bus	See Figure 3	25°C		24	30	ns
t_{pHZ} Output disable time from high level				Full range		41		
				25°C		9	14	
t_{pZL} Output enable time to low level				Full range		16	28	
				25°C		12	19	
t_{pLZ} Output disable time from low level				Full range		34		
				Full range		24		
t_{pZH} Output enable time to high level				TE	Terminal	See Figure 4	25°C	
	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	
25°C					9	16		
Full range						20		

† Full range is -55°C to 125°C .

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



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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	$C_L = 30\text{ pF}$, See Figure 1	7	20	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	$C_L = 30\text{ pF}$, See Figure 2	7	14	14	ns
t_{PHL}	Propagation delay time, high- to low-level output				9	14		
t_{PZH}	Output enable time to high level	TE	Bus	$C_L = 15\text{ pF}$, See Figure 3	19	30	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	$C_L = 15\text{ pF}$, See Figure 4	13	30	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	$C_L = 15\text{ pF}$, See Figure 5	11	22	22	ns
t_{dis}	Output pullup disable time				6	12		

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



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PARAMETER MEASUREMENT INFORMATION

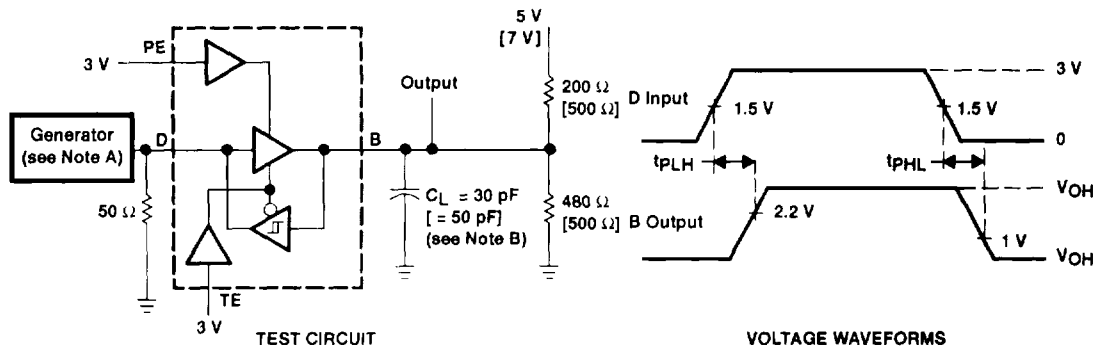


Figure 1. Terminal-to-Bus Test Circuit and Voltage Waveforms

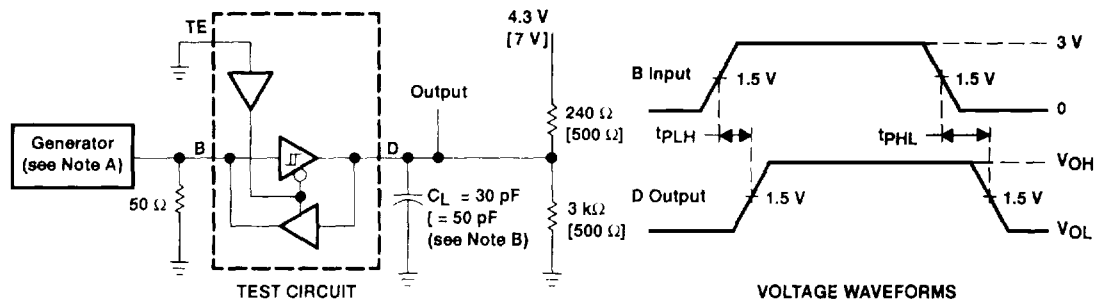


Figure 2. Bus-to-Terminal Test Circuit and Voltage Waveforms

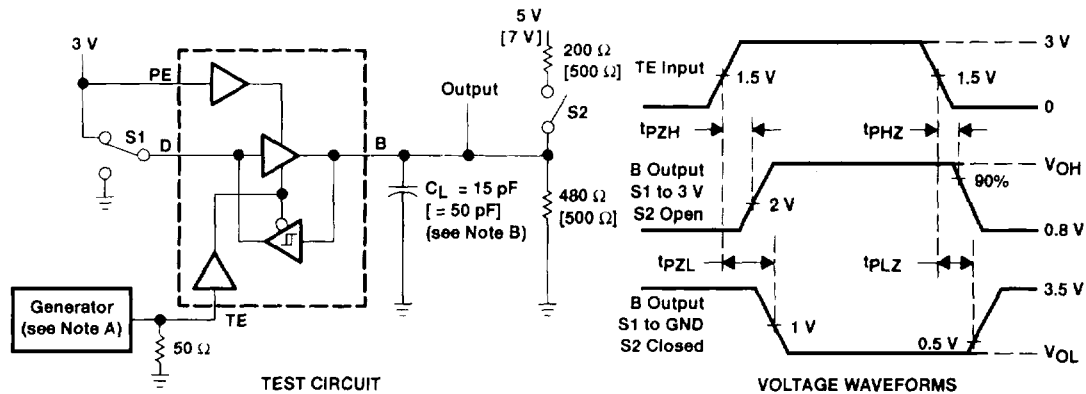


Figure 3. TE-to-Bus Test Circuit and Voltage Waveforms

[] 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.

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PARAMETER MEASUREMENT INFORMATION

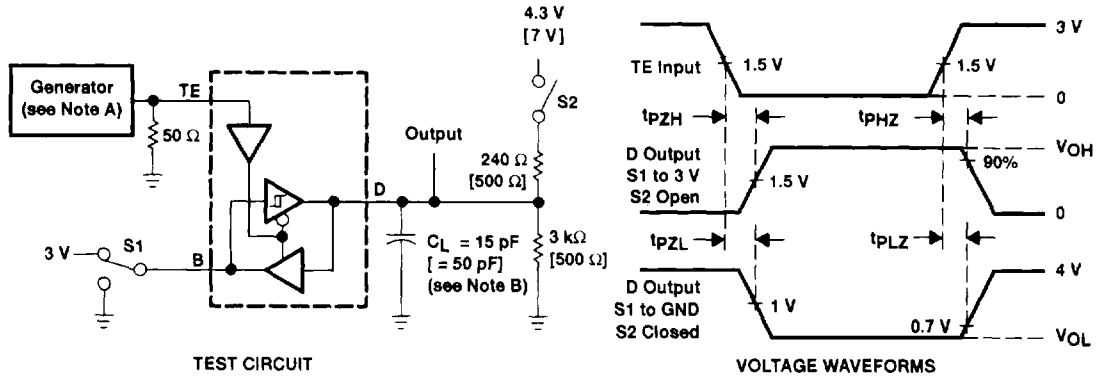


Figure 4. TE-to-Terminal Test Circuit and Voltage Waveforms

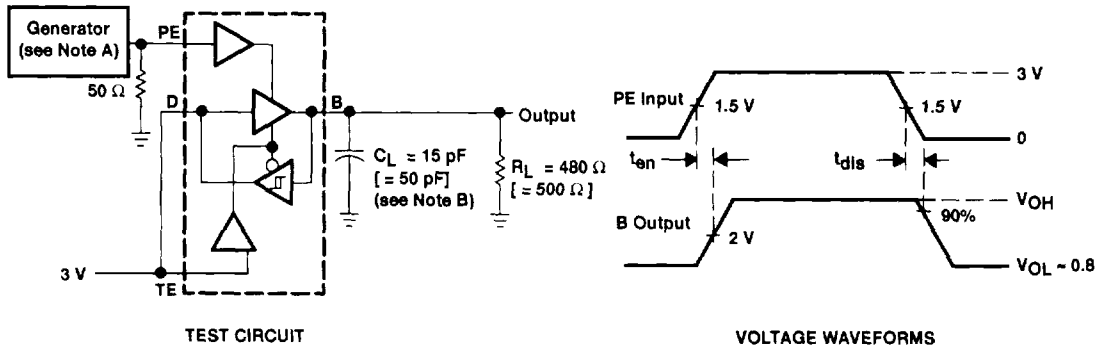


Figure 5. PE-to-Bus Test Circuit and Voltage Waveforms

[] 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, $Z_0 = 50 \Omega$.

B. C_L includes probe and jig capacitance.

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TYPICAL CHARACTERISTICS

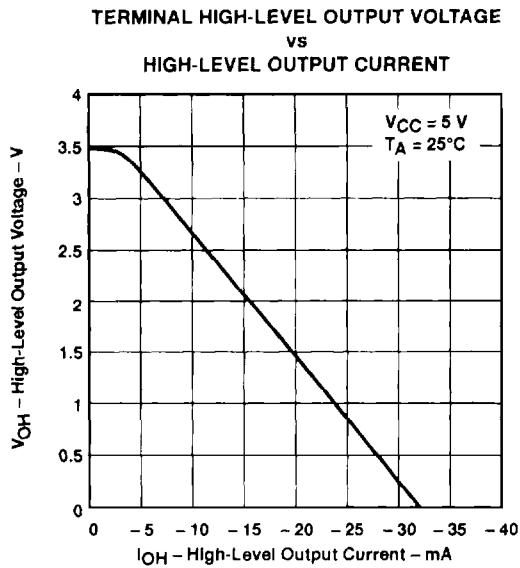


Figure 6

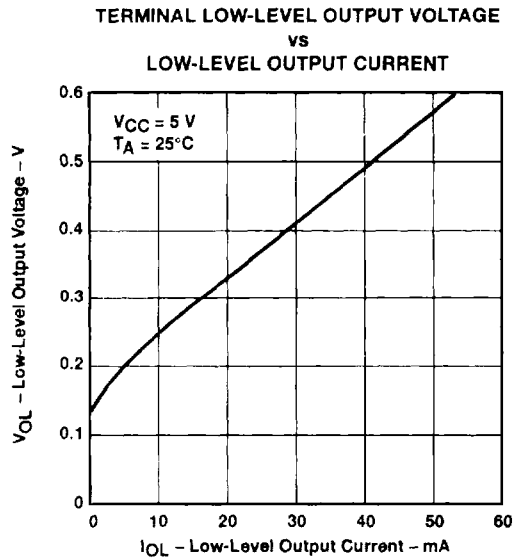


Figure 7

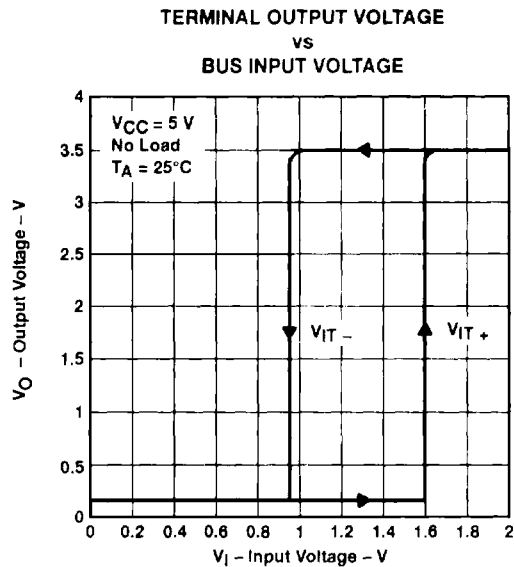


Figure 8

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TYPICAL CHARACTERISTICS

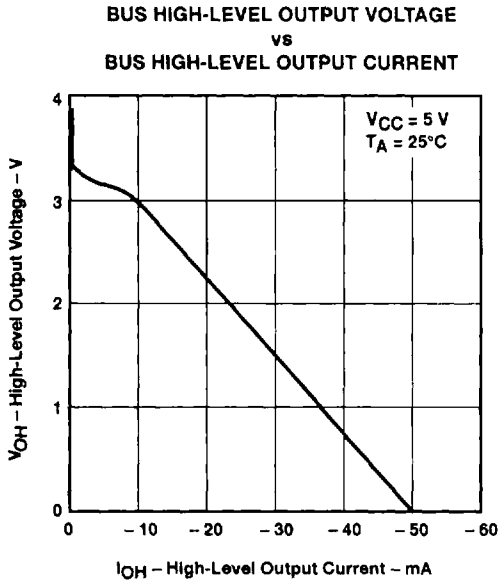


Figure 9

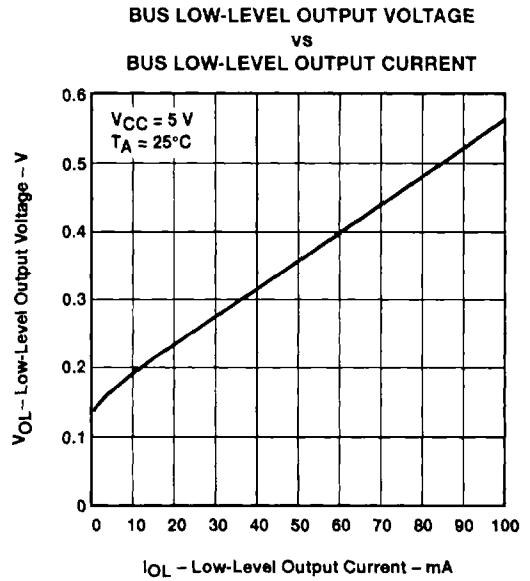


Figure 10

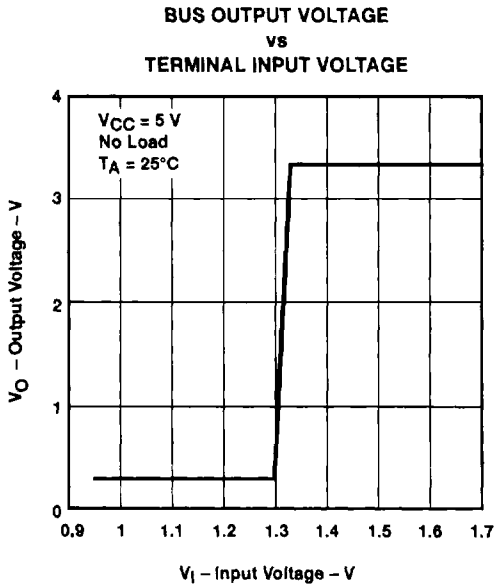


Figure 11

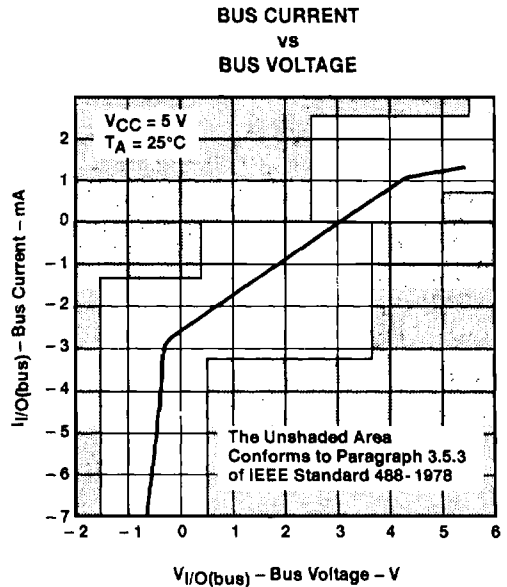


Figure 12

