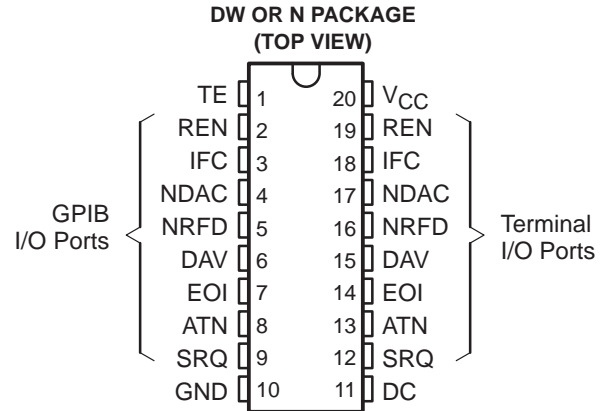


# SN75ALS161

## OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS019F – JUNE 1986 – REVISED JULY 2004

- Suitable for IEEE Standard 488-1978 (GPIB)
- 8-Channel Bidirectional Transceivers
- Designed to Implement Control Bus Interface
- Designed for Single Controller
- High-Speed Advanced Low-Power Schottky Circuitry
- Low Power Dissipation . . . 46 mW Max Per Channel
- Fast Propagation Times . . . 20 ns Max
- High-Impedance pnp Inputs
- Receiver Hysteresis . . . 650 mV Typ
- Bus-Terminating Resistors Provided on Driver Outputs
- No Loading of Bus When Device Is Powered Down ( $V_{CC} = 0$ )
- Power-Up/Power-Down Protection (Glitch Free)



**CHANNEL-IDENTIFICATION TABLE**

NAME	IDENTITY	CLASS
DC	Direction Control	Control
TE	Talk Enable	
ATN	Attention	Bus Management
SRQ	Service Request	
REN	Remote Enable	
IFC	Interface Clear	
EOI	End or Identify	
DAV	Data Valid	Data Transfer
NDAC	Not Data Accepted	
NRFD	Not Ready for Data	

### description/ordering information

The SN75ALS161 eight-channel general-purpose interface bus transceivers are high-speed, advanced low-power Schottky-process devices designed to provide the bus-management and data-transfer signals between operating units of a single-controller instrumentation system. When combined with the SN75ALS160 octal bus transceivers, this device provides a complete 16-wire interface for the IEEE 488 bus.

The SN75ALS161 device features eight driver-receiver pairs connected in a front-to-back configuration to form input/output (I/O) ports at both the bus and terminal sides. The direction of data through these driver-receiver pairs is determined by the direction-control (DC) and talk-enable (TE) signals.

The driver outputs general-purpose interface bus (GPIB I/O ports) feature active bus-terminating resistor circuits designed to provide a high impedance to the bus when  $V_{CC} = 0$ . The drivers are designed to handle sink-current loads up to 48 mA. Each receiver features pnp transistor inputs for high input impedance and hysteresis of 400 mV on the commercial part, and 250 mV on the military part, minimum, for increased noise immunity. All receivers have 3-state outputs, to present a high impedance to the terminal when disabled.

The SN75ALS161 is characterized for operation from 0°C to 70°C.

### ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP (N)	Tube of 20	SN75ALS161N	SN75ALS161N
	SOIC (DW)	Tube of 25	SN75ALS161DW	75ALS161
		Reel of 2000	SN75ALS161DWR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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# SN75ALS161

## OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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FUNCTION TABLE  
RECEIVE/TRANSMIT

CONTROLS			BUS-MANAGEMENT CHANNELS				DATA-TRANSFER CHANNELS			
DC	TE	ATN <sup>†</sup>	ATN <sup>†</sup>	SRQ	REN	IFC	EOI	DAV	NDAC	NRFD
			(CONTROLLED BY DC)				(CONTROLLED BY TE)			
H	H	H	R	T	R	R	T	T	R	R
H	H	L					R			
L	L	H	T	R	T	T	R	R	T	T
L	L	L					T			
H	L	X	R	T	R	R	R	R	T	T
L	H	X	T	R	T	T	T	T	R	R

H = high level, L = low level, R = receive, T = transmit, X = irrelevant

Direction of data transmission is from the terminal side to the bus side, and the direction of data receiving is from the bus side to the terminal side.

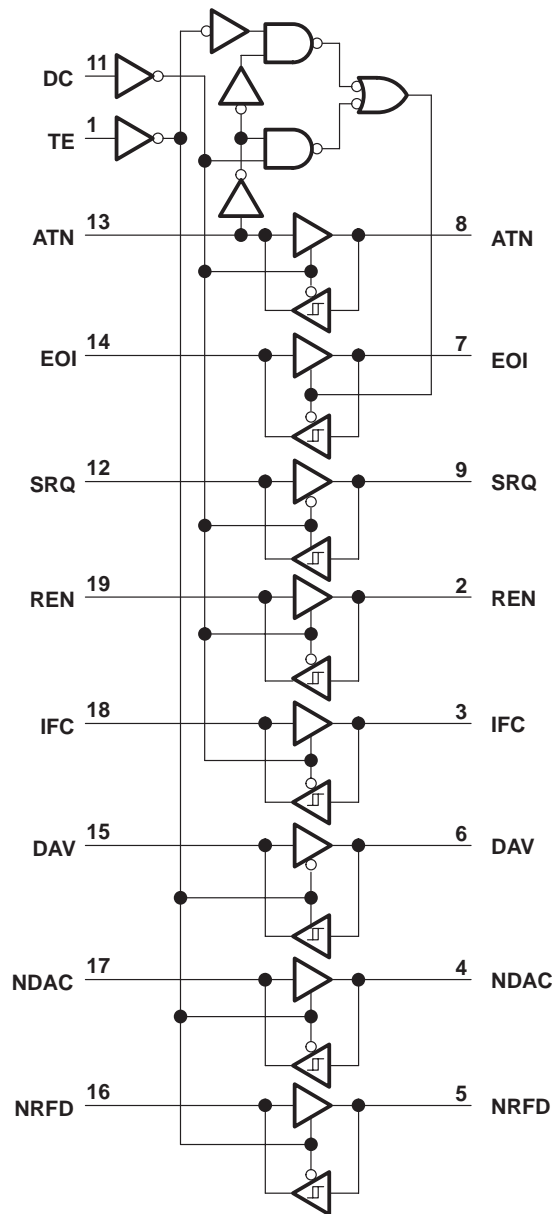
Data transfer is noninverting in both directions.

<sup>†</sup> ATN is a normal transceiver channel that functions additionally as an internal direction control or talk enable for EOI whenever the DC and TE inputs are in the same state. When DC and TE are in opposite states, the ATN channel functions as an independent transceiver only.

# SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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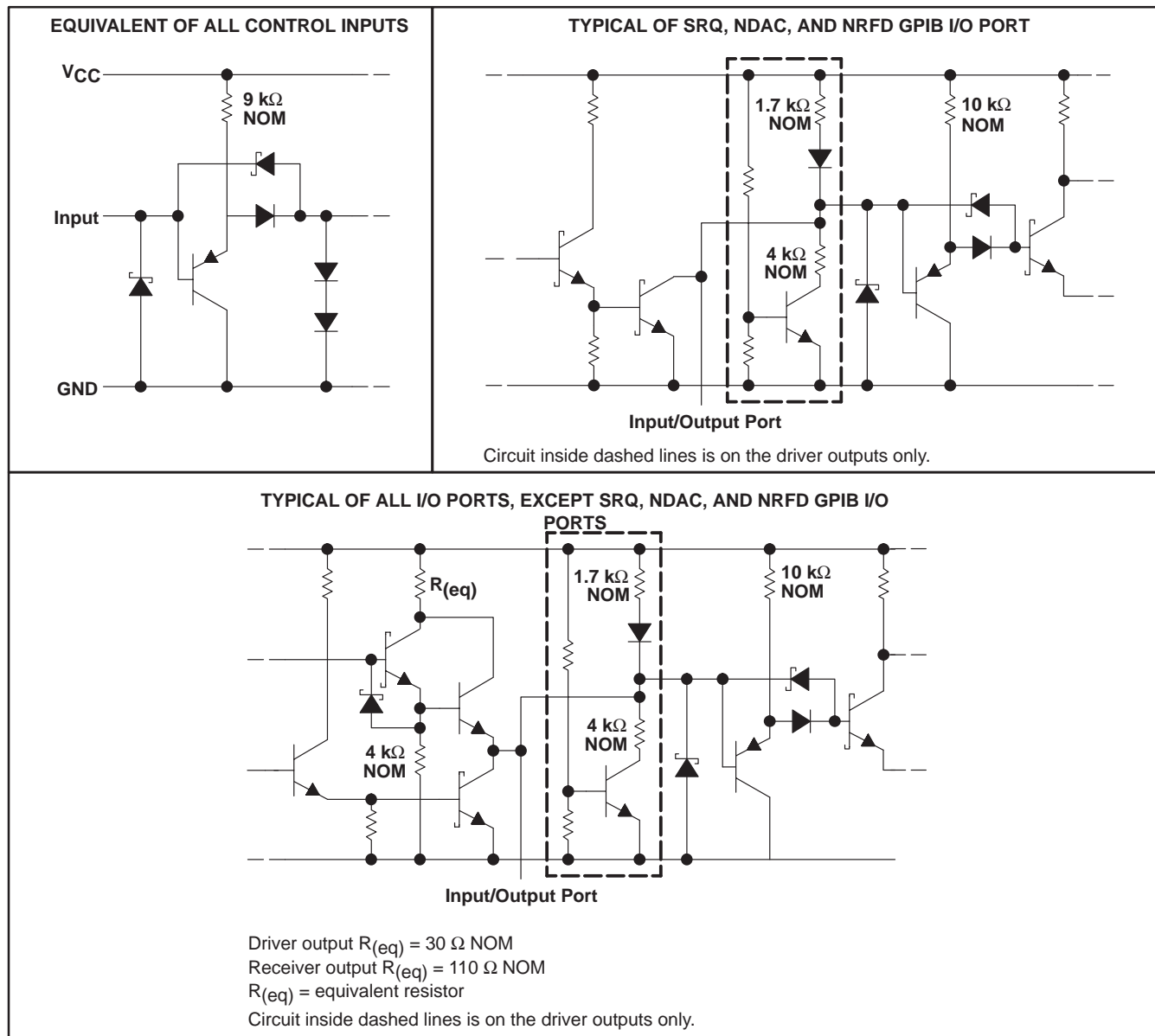
logic diagram (positive logic)



# SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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## schematics of inputs and outputs



# SN75ALS161

## OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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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
Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): DW package .....	58°C/W
N package .....	69°C/W
Operating virtual junction temperature, $T_J$ .....	150°C
Storage temperature range, $T_{Stg}$ .....	–65°C to 150°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.  
 2. Maximum power dissipation is a function of  $T_{J(max)}$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_{J(max)} - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.  
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{OH}$	High-level output current	Bus ports with pullups active		– 5.2	mA
		Terminal ports		– 800	μA
$I_{OL}$	Low-level output current	Bus ports		48	mA
		Terminal ports		16	
$T_A$	Operating free-air temperature	0		70	°C



# SN75ALS161

## OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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

PARAMETER		TEST CONDITIONS†		MIN	TYP‡	MAX	UNIT		
$V_{IK}$	Input clamp voltage	$I_I = -18 \text{ mA}$		-0.8	-1.5		V		
$V_{hys}$	Hysteresis voltage ( $V_{IT+} - V_{IT-}$ )	Bus		0.4	0.65		V		
$V_{OH}§$	High-level output voltage	Terminal	$I_{OH} = -800 \mu\text{A}$ , $V_{CC} = \text{MIN}$	$T_A = 25^\circ\text{C}$ and MAX		2.7	3.5	V	
				$T_A = \text{MIN}$		2.7	3.5		
		Bus	$I_{OH} = -5.2 \text{ mA}$ , $V_{CC} = \text{MIN}$	$T_A = 25^\circ\text{C}$ and MAX		2.2			
				$T_A = \text{MIN}$		2.2			
$V_{OL}$	Low-level output voltage	Terminal	$I_{OL} = 16 \text{ mA}$ , $V_{CC} = \text{MIN}$		0.3	0.5	V		
		Bus	$I_{OL} = 48 \text{ mA}$ , $V_{CC} = \text{MIN}$		0.35	0.5			
$I_I$	Input current at maximum input voltage	Terminal	$V_I = 5.5 \text{ V}$ , $V_{CC} = \text{MAX}$		0.2	100	$\mu\text{A}$		
$I_{IH}$	High-level input current	Terminal and control inputs	$V_I = 2.7 \text{ V}$ , $V_{CC} = \text{MAX}$		0.1	20	$\mu\text{A}$		
$V_{I/O}$	Voltage at GPIB I/O port	$I_I(\text{bus}) = 0$		2.5	3	3.7	V		
		$I_I(\text{bus}) = 0$		2.5	3	3.7			
		$I_I(\text{bus}) = -12 \text{ mA}$				-1.5			
$I_{IL}$	Low-level input current	Terminal and control inputs	$V_I = 0.5 \text{ V}$ , $V_{CC} = \text{MAX}$		-10	-100	$\mu\text{A}$		
$I_{I/O}$	Current into GPIB I/O port	Power on	$V_I(\text{bus}) = -1.5 \text{ V to } 0.4 \text{ V}$		-1.3		mA		
			$V_I(\text{bus}) = 0.4 \text{ V to } 2.5 \text{ V}$		0			-3.2	
			$V_I(\text{bus}) = 2.5 \text{ V to } 3.7 \text{ V}$					2.5	-3.2
			$V_I(\text{bus}) = 3.7 \text{ V to } 5 \text{ V}$		0			2.5	
			$V_I(\text{bus}) = 5 \text{ V to } 5.5 \text{ V}$		0.7			2.5	
		Power off	$V_{CC} = 0$	$V_I(\text{bus}) = 0 \text{ to } 2.5 \text{ V}$				40	$\mu\text{A}$
$I_{OS}§$	Short-circuit output current	Terminal	$V_{CC} = \text{MAX}$		-15	-35	-75	mA	
		Bus	$V_{CC} = \text{MAX}$		-25	-50	-125		
$I_{CC}$	Supply current	No load, TE and DC low, $V_{CC} = \text{MAX}$			55	75	mA		
$C_{I/O}$	GPIB I/O port capacitance	$V_{CC} = 0 \text{ to } 5 \text{ V}$ , $V_{I/O} = 0 \text{ to } 2 \text{ V}$ , $f = 1 \text{ MHz}$			30		pF		

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

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

§  $V_{OH}$  and  $I_{OS}$  apply to 3-state outputs only.



# SN75ALS161

## OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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

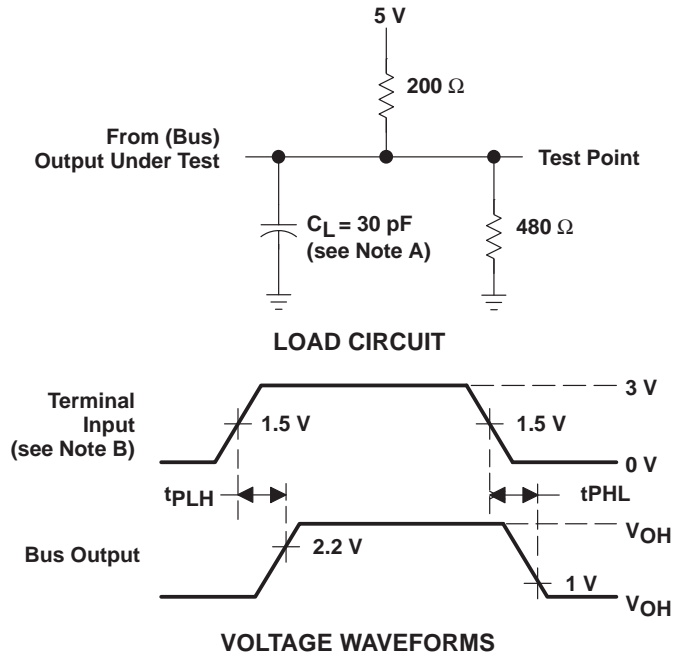
PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$t_{PLH}$	Propagation delay time, low- to high-level output	Terminal	Bus	$C_L = 30\text{ pF}$ , See Figure 1		10	20	ns
$t_{PHL}$	Propagation delay time, high- to low-level output					12	20	
$t_{PLH}$	Propagation delay time, low- to high-level output	Bus	Terminal	$C_L = 30\text{ pF}$ , See Figure 2		5	10	ns
$t_{PHL}$	Propagation delay time, high- to low-level output					7	14	
$t_{PZH}$	Output enable time to high level	TE or DC	Bus (ATN, EOI, REN, IFC, and DAV)	$C_L = 15\text{ pF}$ , See Figure 3			30	ns
$t_{PHZ}$	Output disable time from high level						20	
$t_{PZL}$	Output enable time to low level						45	
$t_{PLZ}$	Output disable time from low level						20	
$t_{PZH}$	Output enable time to high level	TE or DC	Terminal	$C_L = 15\text{ pF}$ , See Figure 4			30	ns
$t_{PHZ}$	Output disable time from high level						25	
$t_{PZL}$	Output enable time to low level						30	
$t_{PLZ}$	Output disable time from low level						25	

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

# SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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## PARAMETER MEASUREMENT INFORMATION

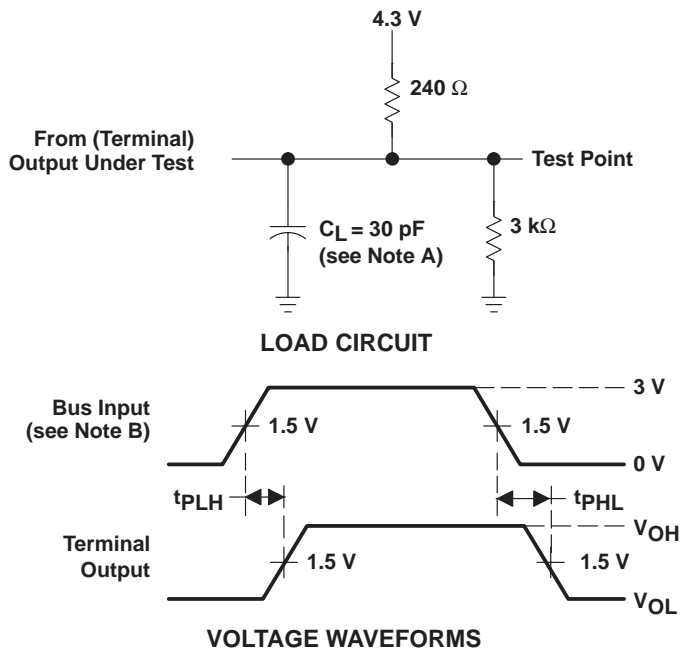


- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 1 \text{ MHz}$ , 50% duty cycle,  $t_r \leq 6 \text{ ns}$ ,  $t_f \leq 6 \text{ ns}$ ,  $Z_O = 50 \Omega$ .

**Figure 1. Terminal-to-Bus Load Circuit and Voltage Waveforms**



**PARAMETER MEASUREMENT INFORMATION**



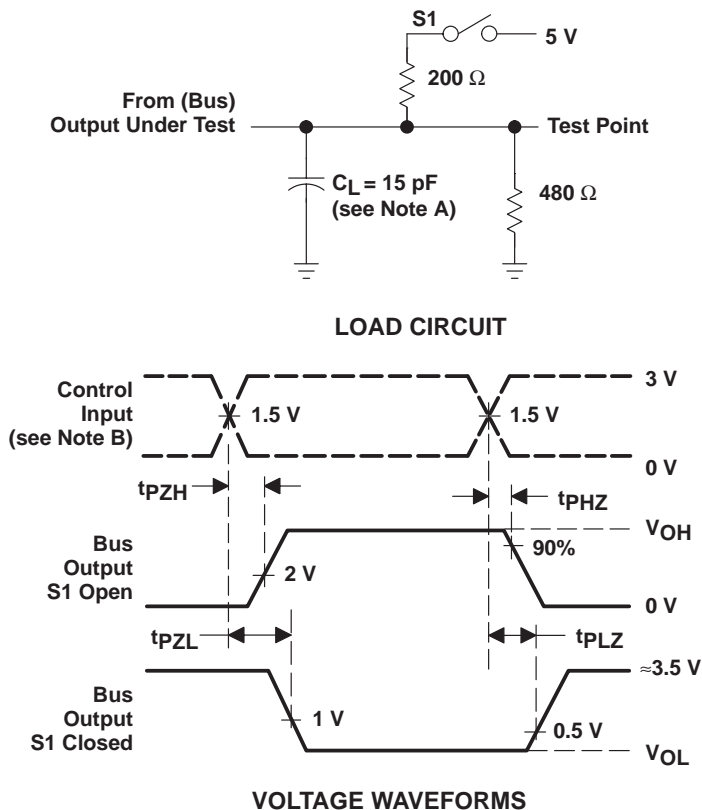
- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 1$  MHz, 50% duty cycle,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .

**Figure 2. Bus-to-Terminal Load Circuit and Voltage Waveforms**

# SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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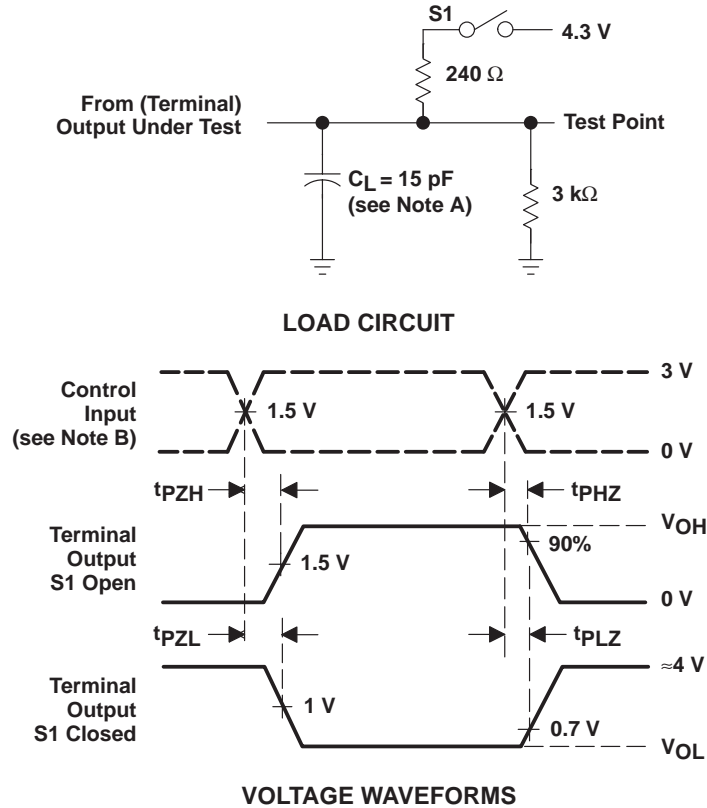
## PARAMETER MEASUREMENT INFORMATION



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

Figure 3. Bus Load Circuit and Voltage Waveforms

**PARAMETER MEASUREMENT INFORMATION**



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

**Figure 4. Terminal Load Circuit and Voltage Waveforms**

# SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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## TYPICAL CHARACTERISTICS†

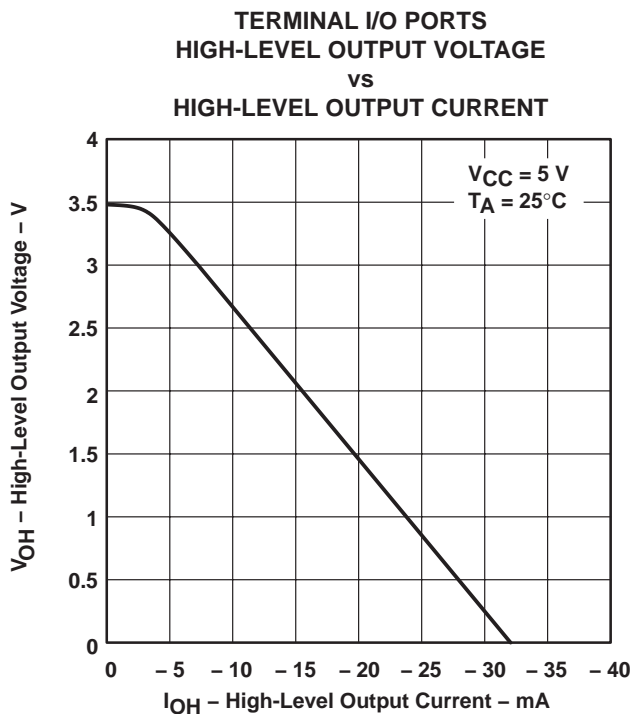


Figure 5

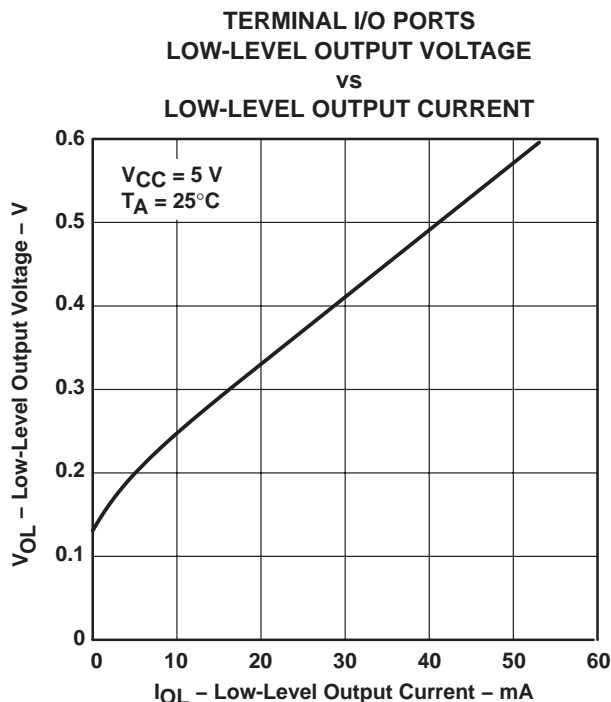


Figure 6

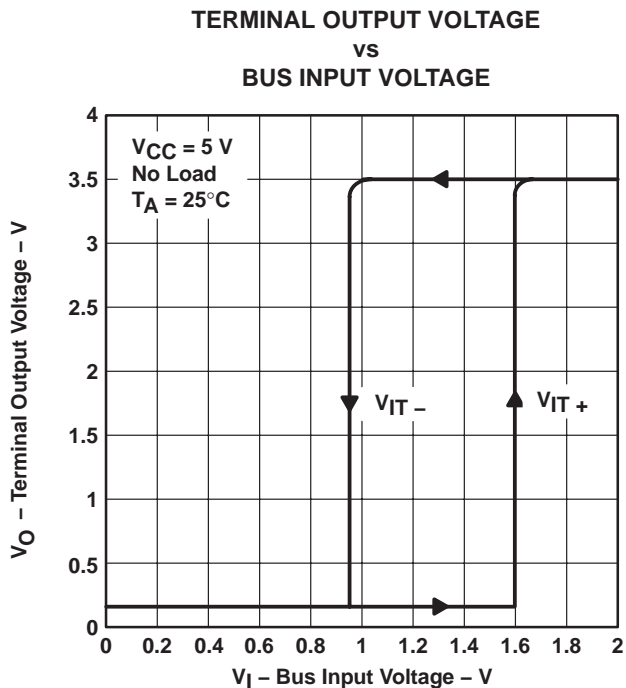


Figure 7

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

### TYPICAL CHARACTERISTICS†

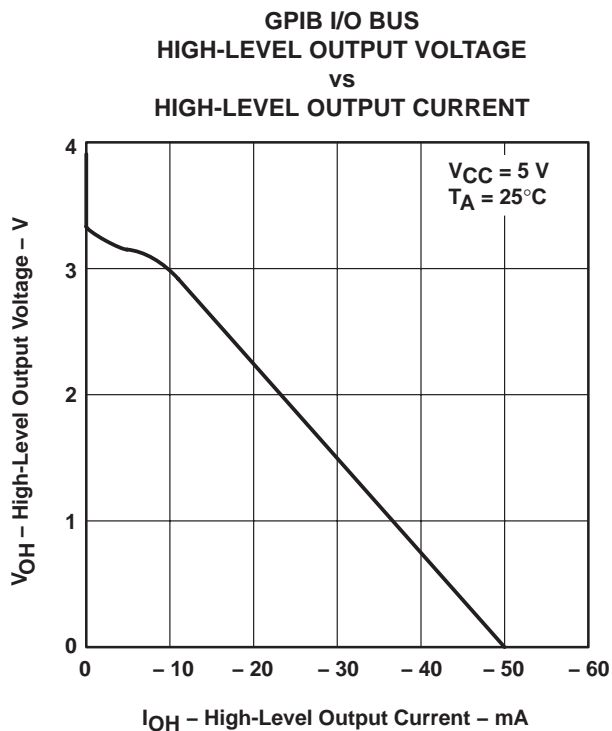


Figure 8

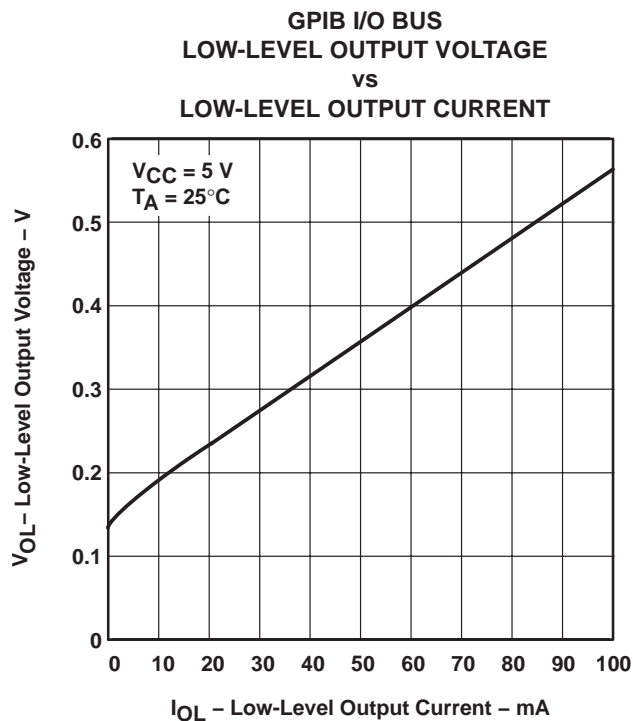


Figure 9

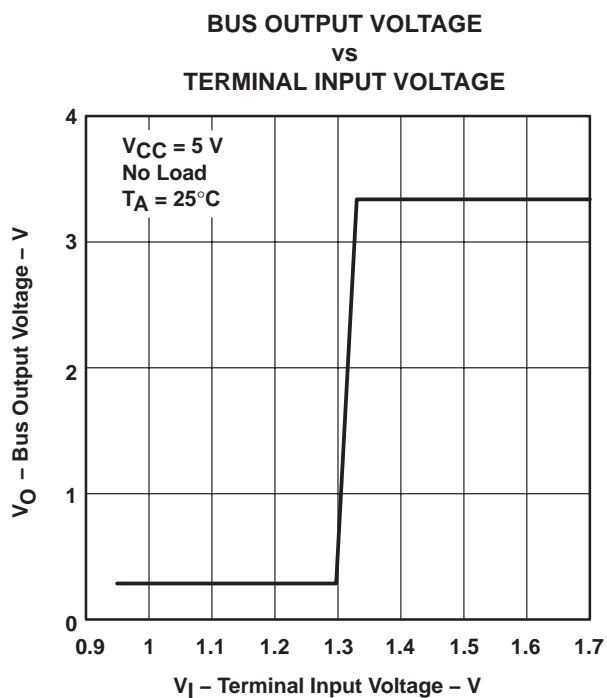


Figure 10

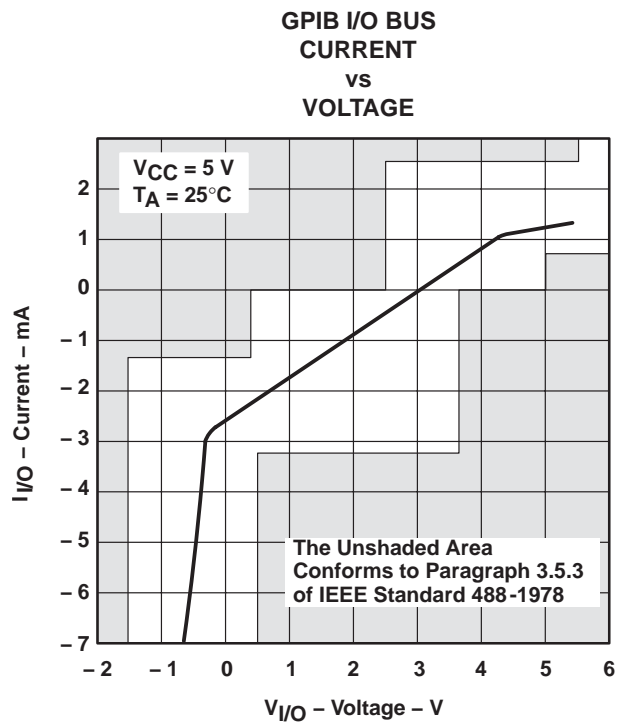


Figure 11

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN75ALS161DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	75ALS161	<a href="#">Samples</a>
SN75ALS161DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	75ALS161	<a href="#">Samples</a>
SN75ALS161DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	75ALS161	<a href="#">Samples</a>
SN75ALS161DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	75ALS161	<a href="#">Samples</a>
SN75ALS161N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	NIPDAU	N / A for Pkg Type	0 to 70	SN75ALS161N	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBsolete:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75ALS161DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1



TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75ALS161DWR	SOIC	DW	20	2000	350.0	350.0	43.0

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

**NOTES:**

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

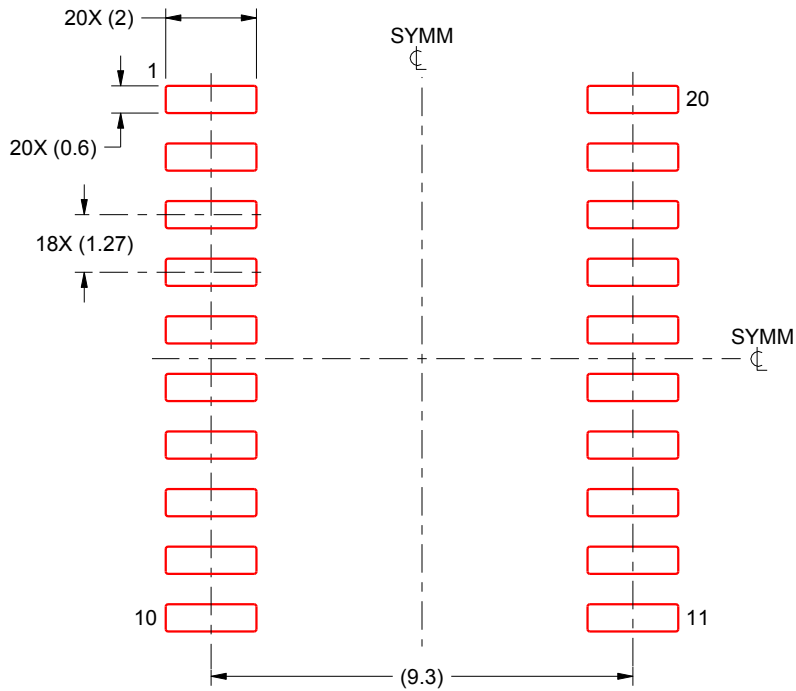
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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