

# SN75161B, SN75162B

## OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS005B – OCTOBER 1980 – REVISED MAY 1995

- Meets IEEE Standard 488-1978 (GPIB)
- 8-Channel Bidirectional Transceivers
- Power-Up/Power-Down Protection (Glitch Free)
- Designed to Implement Control Bus Interface
- SN75161B Designed for Single Controller
- SN75162B Designed for Multiple Controllers
- High-Speed, Low-Power Schottky Circuitry
- Low Power Dissipation . . . 72 mW Max Per Channel
- Fast Propagation Times . . . 22 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 ( $V_{CC} = 0$ )

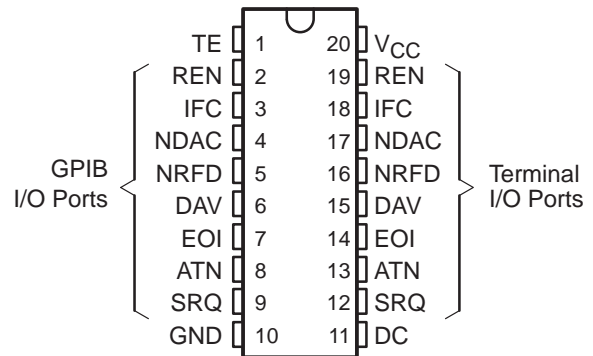
### description

The SN75161B and SN75162B eight-channel, general-purpose interface bus transceivers are monolithic, high-speed, low-power Schottky devices designed to meet the requirements of IEEE Standard 488-1978. Each transceiver is designed to provide the bus-management and data-transfer signals between operating units of a single- or multiple-controller instrumentation system. When combined with the SN75160B octal bus transceiver, the SN75161B or SN75162B provides the complete 16-wire interface for the IEEE-488 bus.

The SN75161B and SN75162B feature 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. A power-up/-down disable circuit is included on all bus and receiver outputs. This provides glitch-free operation during  $V_{CC}$  power up and power down.

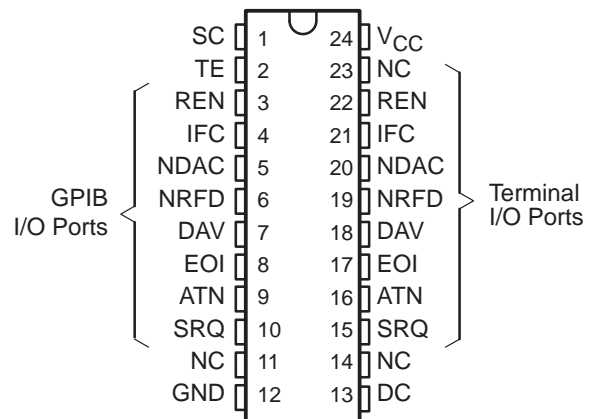
SN75161B . . . DW OR N PACKAGE

(TOP VIEW)



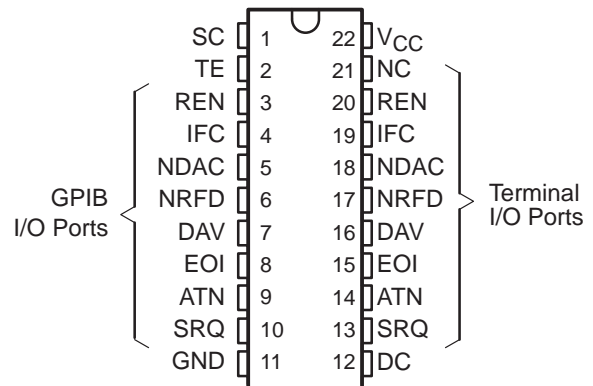
SN75162B . . . DW PACKAGE

(TOP VIEW)



SN75162B . . . N PACKAGE

(TOP VIEW)



NC – No internal connection



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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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# SN75161B, SN75162B OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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## description (continued)

The direction of data through these driver-receiver pairs is determined by the DC, TE, and SC (on SN75162B) enable signals. The SC input on the SN75162B allows the REN and IFC transceivers to be controlled independently.

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

The SN75161B and SN75162B are characterized for operation from 0°C to 70°C.

### Function Tables

SN75161B RECEIVE/TRANSMIT

CONTROLS			BUS-MANAGEMENT CHANNELS				DATA-TRANSFER CHANNELS			
DC	TE	ATN†	ATN†	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	T	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.

† 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.

SN75162B RECEIVE/TRANSMIT

CONTROLS				BUS-MANAGEMENT CHANNELS				DATA-TRANSFER CHANNELS					
SC	DC	TE	ATN†	ATN†	SRQ	REN	IFC	EOI	DAV	NDAC	NRFD		
				(Controlled by DC)		(Controlled by SC)			(Controlled by TE)				
	H	H	H	R	T			T	T	R	R		
	H	H	L					R					
	L	L	H	T	R			R	R	T	R	T	T
	L	L	L					T					
	H	L	X	R	T			R	R	T	T	T	
	L	H	X	T	R			R	T	T	R	R	
H						T	T						
L						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.

† 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.



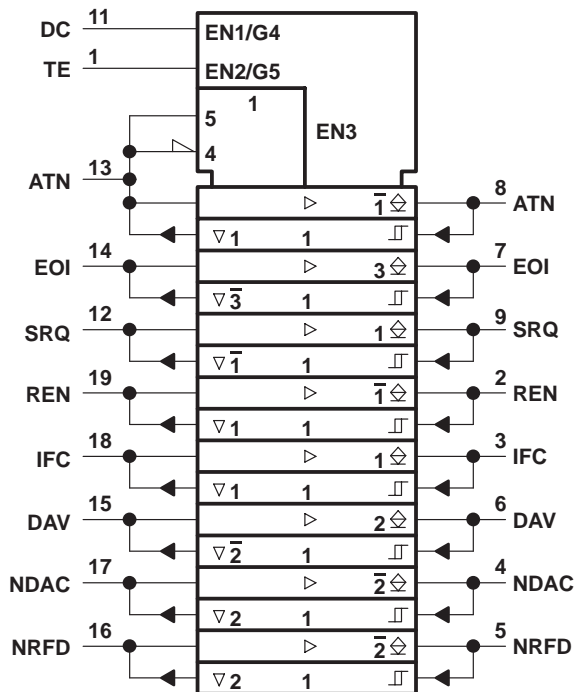
# SN75161B, SN75162B OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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**CHANNEL-IDENTIFICATION TABLE**

NAME	IDENTITY	CLASS
DC	Direction Control	Control
TE	Talk Enable	
SC	System Control (SN75162B only)	
ATN	Attention	
SRQ	Service Request	
REN	Remote Enable	Bus Management
IFC	Interface Clear	
EOI	End of Identity	Data Transfer
DAV	Data Valid	
NDAC	Not Data Accepted	
NRFD	Not Ready for Data	

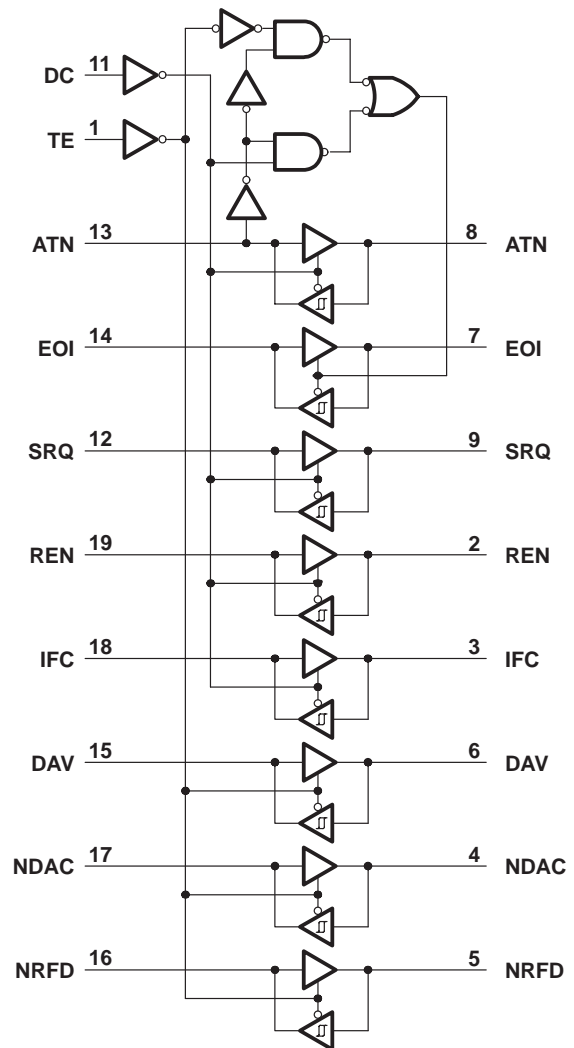
**SN75161B logic symbol†**



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

- ∇ Designates 3-state outputs
- ⊗ Designates passive-pullup outputs

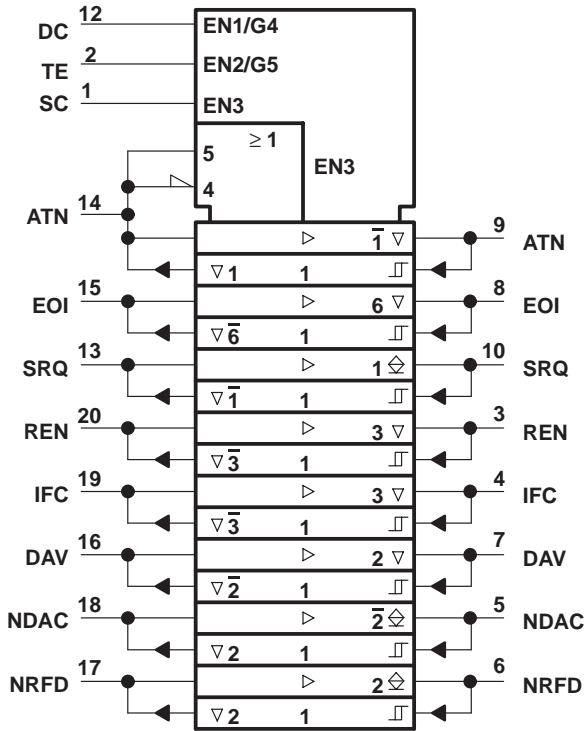
**SN75161B logic diagram (positive logic)**



# SN75161B, SN75162B OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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SN75162B logic symbol†

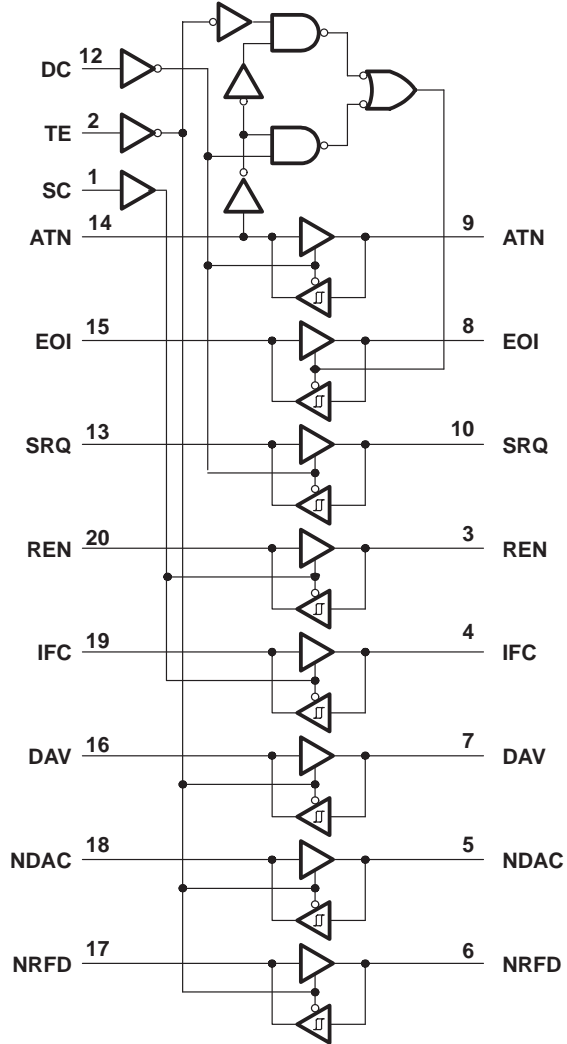


†This symbol is in accordance with IEEE Std 91-1984 and IEC Publication 617-12.

∇ Designates 3-state outputs

⊕ Designates passive-pullup outputs

SN75162B logic diagram (positive logic)

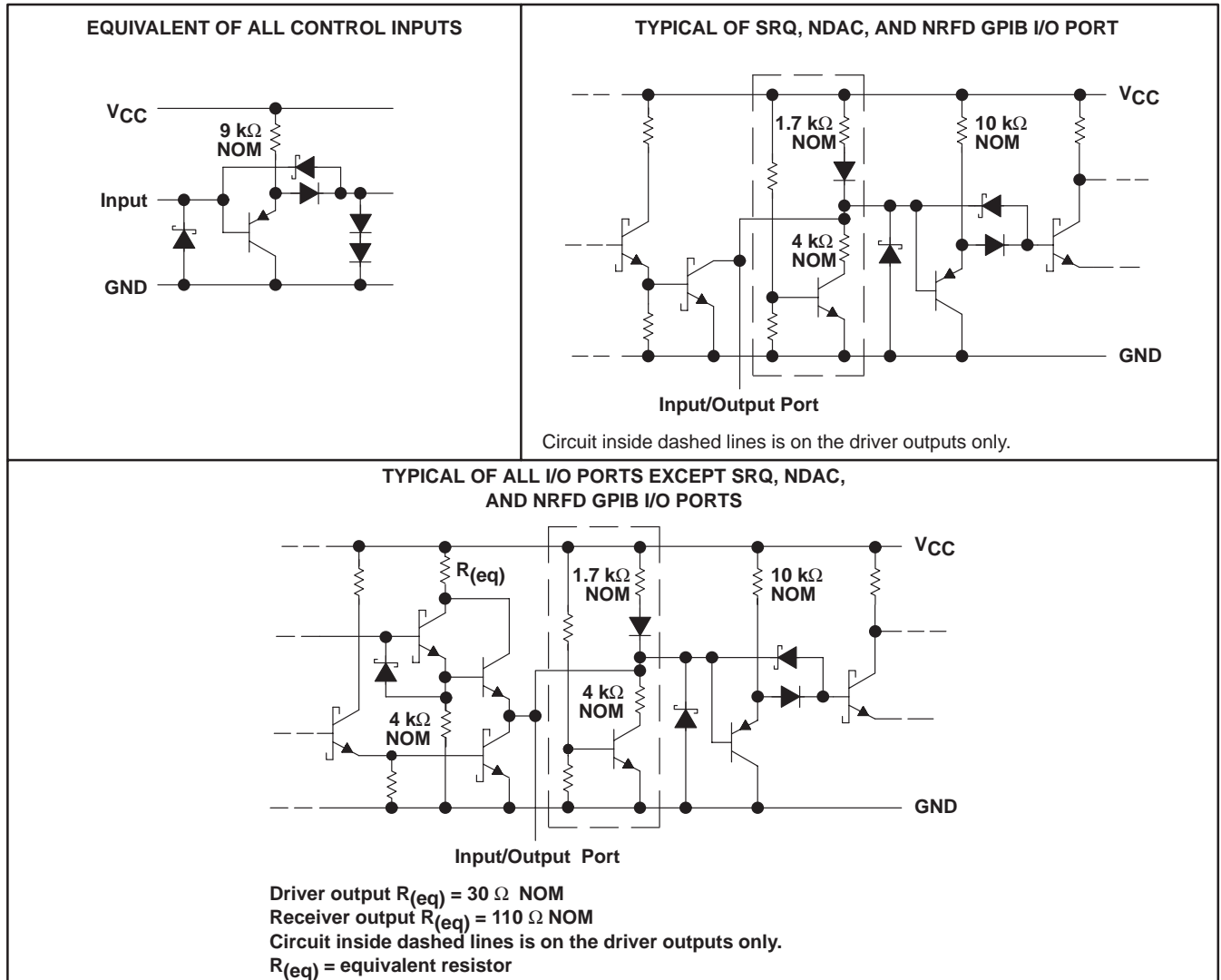


Pin numbers shown are for the N package.

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## schematics of inputs and outputs



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

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 power dissipation .....	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ .....	0°C to 70°C
Storage temperature range, $T_{stg}$ .....	-65°C to 150°C
Lead temperature 1,6 mm (1/16) inch from the case for 10 seconds .....	260°C

<sup>†</sup> 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.

# SN75161B, SN75162B OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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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
DW (20 pin)	1125 mW	9.0 mW/°C	720 mW
DW (24 pin)	1350 mW	10.8 mW/°C	864 mW
N (20 pin)	1150 mW	9.2 mW/°C	736 mW
N (22 pin)	1700 mW	13.6 mW/°C	1088 mW

## 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 3-state outputs	-5.2			mA
	Terminal ports	-800			$\mu\text{A}$
Low-level output current, $I_{OL}$	Bus ports	48			mA
	Terminal ports	16			
Operating free-air temperature, $T_A$		0	70		°C



# SN75161B, SN75162B

## 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	See Figure 7	0.4	0.65		V
$V_{OH}‡$	High-level output voltage	Terminal	$I_{OH} = -800 \mu\text{A}$	2.7	3.5		V
		Bus	$I_{OH} = -5.2 \text{ mA}$	2.5	3.3		
$V_{OL}$	Low-level output voltage	Terminal	$I_{OL} = 16 \text{ mA}$		0.3	0.5	V
		Bus	$I_{OL} = 48 \text{ mA}$		0.35	0.5	
$I_I$	Input current at maximum input voltage	Terminal	$V_I = 5.5 \text{ V}$		0.2	100	$\mu\text{A}$
$I_{IH}$	High-level input current	Terminal and control inputs	$V_I = 2.7 \text{ V}$		0.1	20	$\mu\text{A}$
$I_{IL}$	Low-level input current		$V_I = 0.5 \text{ V}$		-10	-100	$\mu\text{A}$
$V_{I/O(\text{bus})}$	Voltage at bus port	Driver disabled	$I_{I(\text{bus})} = 0$	2.5	3.0	3.7	V
			$I_{I(\text{bus})} = -12 \text{ mA}$			-1.5	
$I_{I/O(\text{bus})}$	Current into bus port	Power on	Driver disabled	$V_{I(\text{bus})} = -1.5 \text{ V to } 0.4 \text{ V}$	-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	
				$V_{I(\text{bus})} = 3.7 \text{ V to } 5 \text{ V}$	0	-3.2	
				$V_{I(\text{bus})} = 5 \text{ V to } 5.5 \text{ V}$	0.7	2.5	
		Power off	$V_{CC} = 0, V_{I(\text{bus})} = 0 \text{ V to } 2.5 \text{ V}$		-40	$\mu\text{A}$	
$I_{OS}$	Short-circuit output current	Terminal		-15	-35	-75	mA
		Bus		-25	-50	-125	
$I_{CC}$	Supply current		No load, TE, DE, and SC low			110	mA
$C_{I/O(\text{bus})}$	Bus-port capacitance		$V_{CC} = 5 \text{ V to } 0, V_{I/O} = 0 \text{ to } 2 \text{ V}, f = 1 \text{ MHz}$		16		pF

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

‡  $V_{OH}$  applies for 3-state outputs only.



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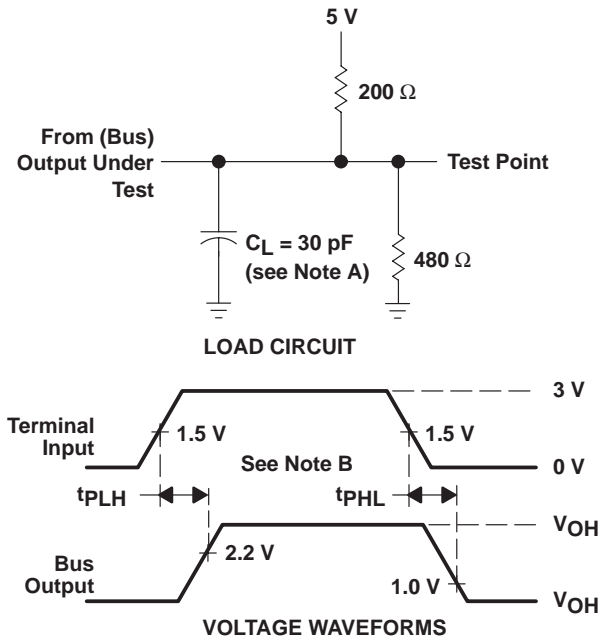
switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 15\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time, low- to high-level output	Terminal	Bus	C <sub>L</sub> = 30 pF, See Figure 1		14	20	ns
t <sub>PHL</sub>	Propagation delay time, high- to low-level output					14	20	
t <sub>PLH</sub>	Propagation delay time, low- to high-level output	Terminal	Bus (SRQ, NDAC, NRFD)	C <sub>L</sub> = 30 pF, See Figure 1		29	35	ns
t <sub>PLH</sub>	Propagation delay time, low- to high-level output	Bus	Terminal	C <sub>L</sub> = 30 pF, See Figure 2		10	20	ns
t <sub>PHL</sub>	Propagation delay time, high- to low-level output					15	22	
t <sub>PZH</sub>	Output enable time to high level	TE,DC, or SC	Bus (ATN, EOI, REN, IFC, and DAV)	See Figure 3			60	ns
t <sub>PHZ</sub>	Output disable time from high level						45	
t <sub>PZL</sub>	Output enable time to low level						60	
t <sub>PLZ</sub>	Output disable time from low level						55	
t <sub>PZH</sub>	Output enable time to high level	TE,DC, or SC	Terminal	See Figure 4			55	ns
t <sub>PHZ</sub>	Output disable time from high level						50	
t <sub>PZL</sub>	Output enable time to low level						45	
t <sub>PLZ</sub>	Output disable time from low level						55	



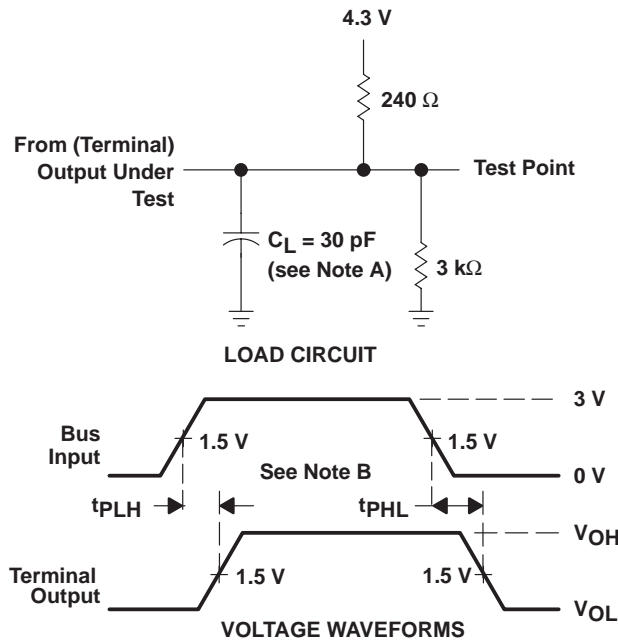


**PARAMETER MEASUREMENT INFORMATION**



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



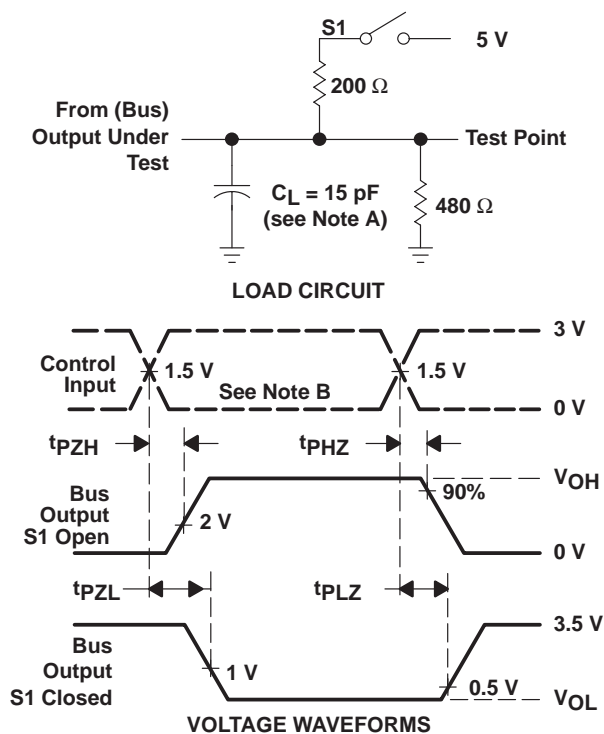
- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 1$  MHz, 50% duty cycle,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .

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

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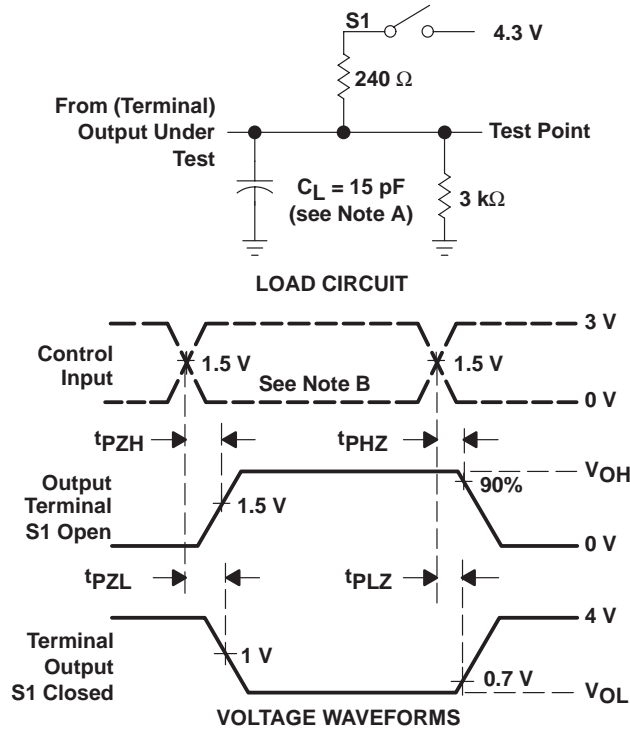
## PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C<sub>L</sub> includes probe and jig capacitance.  
 B. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t<sub>r</sub> ≤ 6 ns, t<sub>f</sub> ≤ 6 ns, Z<sub>O</sub> = 50 Ω.

**Figure 3. Bus Enable and Disable Times 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 4. Terminal Enable and Disable Times Load Circuit and Voltage Waveforms

# SN75161B, SN75162B OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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## TYPICAL CHARACTERISTICS

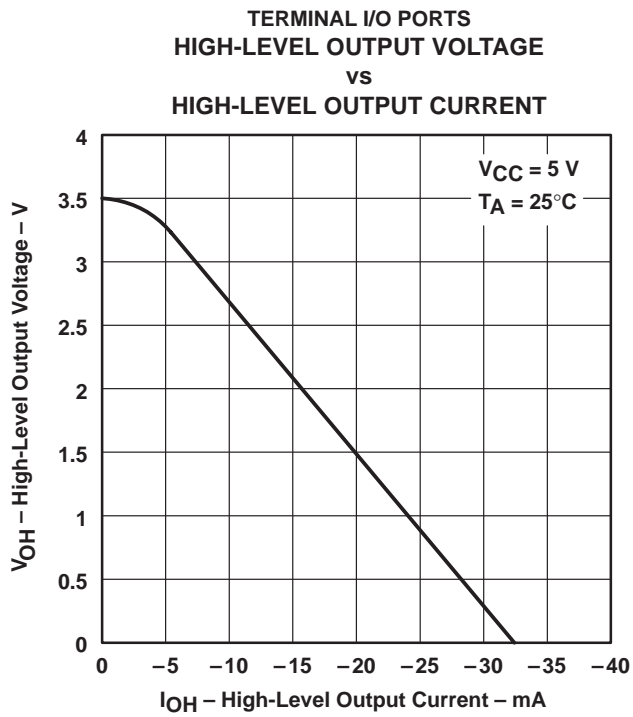


Figure 5

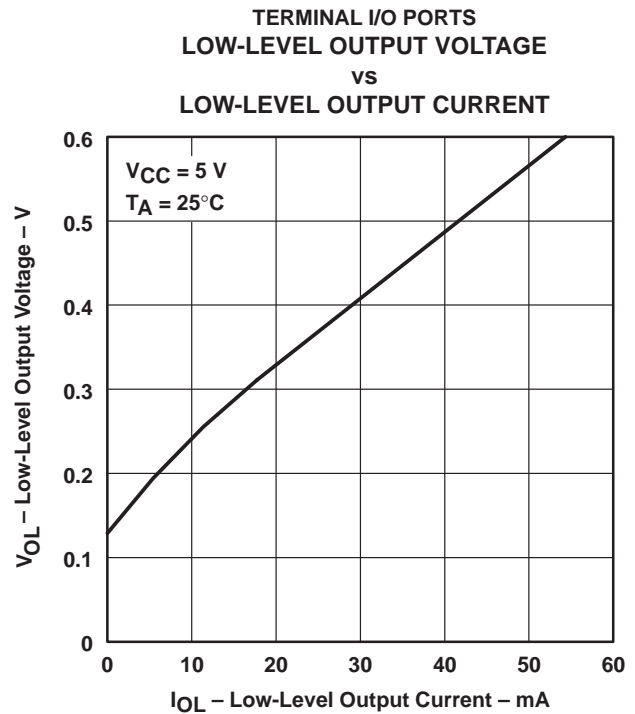


Figure 6

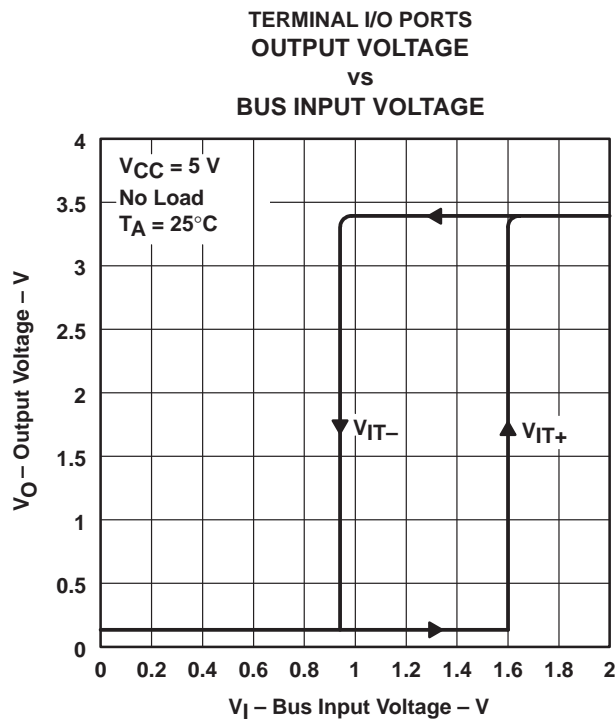


Figure 7



# SN75161B, SN75162B OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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## TYPICAL CHARACTERISTICS

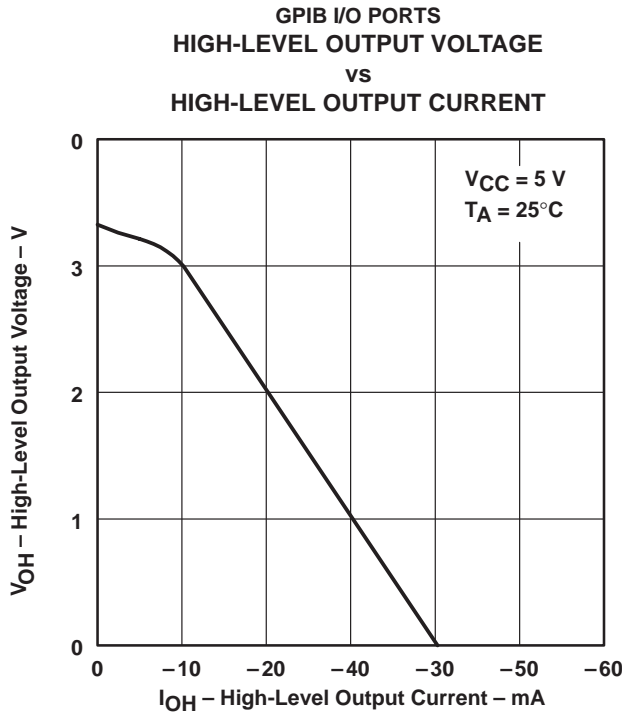


Figure 8

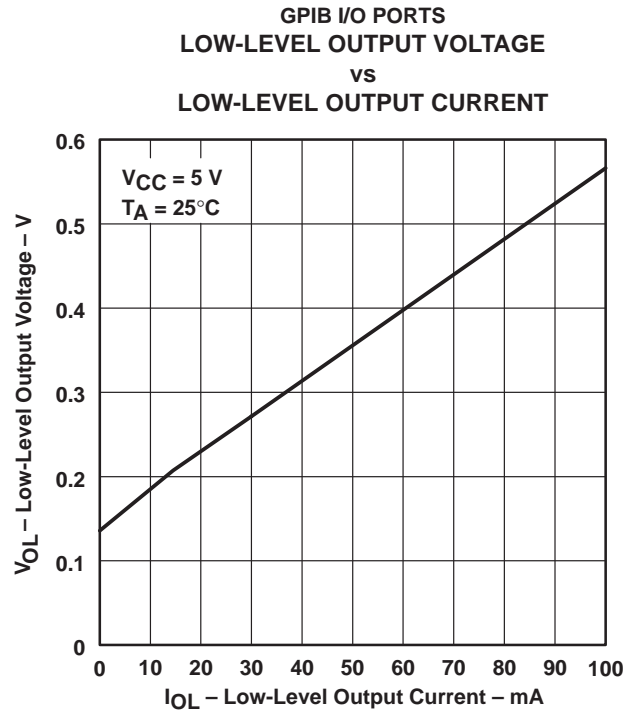


Figure 9

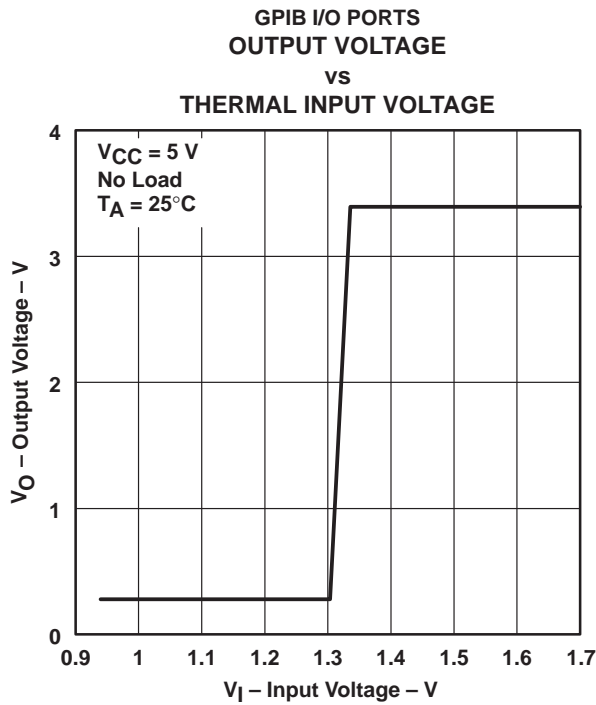


Figure 10

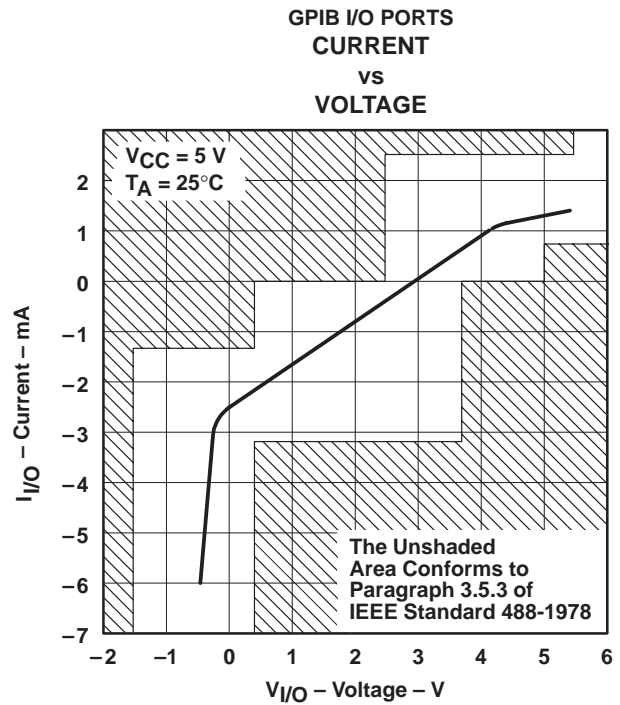


Figure 11

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN75161BDW	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75161B	<a href="#">Samples</a>
SN75161BDWG4	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75161B	<a href="#">Samples</a>
SN75161BDWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75161B	<a href="#">Samples</a>
SN75161BDWRG4	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75161B	<a href="#">Samples</a>
SN75161BN	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	SN75161BN	<a href="#">Samples</a>
SN75161BNE4	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	SN75161BN	<a href="#">Samples</a>
SN75162BDW	ACTIVE	SOIC	DW	24	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75162B	<a href="#">Samples</a>
SN75162BDWR	ACTIVE	SOIC	DW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75162B	<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.

**OBSELETE:** 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.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material 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
SN75161BDWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN75162BDWR	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	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)
SN75161BDWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN75162BDWR	SOIC	DW	24	2000	350.0	350.0	43.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN75161BDW	DW	SOIC	20	25	507	12.83	5080	6.6
SN75161BDW	DW	SOIC	20	25	506.98	12.7	4826	6.6
SN75161BDWG4	DW	SOIC	20	25	506.98	12.7	4826	6.6
SN75161BDWG4	DW	SOIC	20	25	507	12.83	5080	6.6
SN75161BN	N	PDIP	20	20	506	13.97	11230	4.32
SN75161BNE4	N	PDIP	20	20	506	13.97	11230	4.32
SN75162BDW	DW	SOIC	24	25	506.98	12.7	4826	6.6

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AD.

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



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### 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

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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

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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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