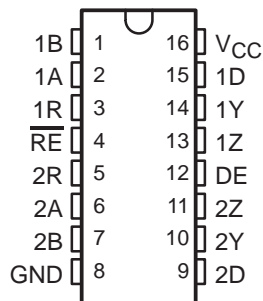


# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

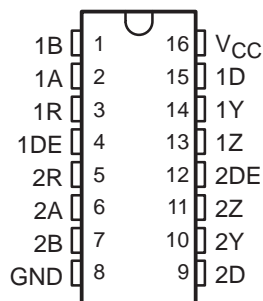
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- Meet or Exceed Standards EIA/TIA-422-B, RS-485, CCITT Recommendation V.11
- Designed for Multipoint Bus Transmission on Long Bus Lines in Noisy Environments
- Low Supply Current Requirement  
50 mA Max
- Driver Positive- and Negative-Current Limiting
- Driver Common-Mode Output Voltage Range of  $-7\text{ V}$  to  $12\text{ V}$
- Thermal Shutdown Protection
- Driver 3-State Outputs Active-High Enable
- Receiver Common-Mode Input Voltage Range of  $-12\text{ V}$  to  $12\text{ V}$
- Receiver Input Sensitivity . . .  $\pm 200\text{ mV}$
- Receiver Hysteresis . . .  $50\text{ mV Typ}$
- Receiver High Input Impedance  
 $12\text{ k}\Omega\text{ Min}$
- Receiver 3-State Outputs Active-Low Enable for SN75ALS1177 Only
- Operate From Single 5-V Supply

SN75ALS1177 . . . N OR NS<sup>†</sup> PACKAGE  
(TOP VIEW)



SN75ALS1178 . . . N OR NS<sup>†</sup> PACKAGE  
(TOP VIEW)



## description

The SN75ALS1177 and SN75ALS1178 dual differential drivers and receivers are monolithic integrated circuits designed for bidirectional data communication on multipoint bus transmission lines. They are designed for balanced transmission lines and meet standards EIA/TIA-422-B, RS-485, and CCITT Recommendation V.11.

The SN75ALS1177 combines dual 3-state differential line drivers and dual 3-state differential input line receivers, both of which operate from a single 5-V power supply. The drivers and receivers have active-high and active-low enables, respectively, which can be externally connected together to function as direction control. The SN75ALS1178 drivers each have an individual active-high enable. Fail-safe design ensures that when the receiver inputs are open, the receiver outputs are always high.

The SN75ALS1177 and SN75ALS1178 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

<sup>†</sup> The NS package is only available in left-end taped and reeled (SN75ALS1177NSLE and SN75ALS1178SNLE).



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  
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# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## Function Tables

SN75ALS1177, SN75ALS1178  
(each driver)

INPUT D	ENABLE DE	OUTPUTS	
		Y	Z
H	H	H	L
L	H	L	H
X	L	Z	Z

SN75ALS1177  
(each receiver)

DIFFERENTIAL A – B	ENABLE $\overline{RE}$	OUTPUT Y
$V_{ID} \geq 0.2 V$	L	H
$-0.2 V < V_{ID} < 0.2 V$	L	?
$V_{ID} \leq -0.2 V$	L	L
X	H	Z
Open	L	H

SN75ALS1178  
(each receiver)

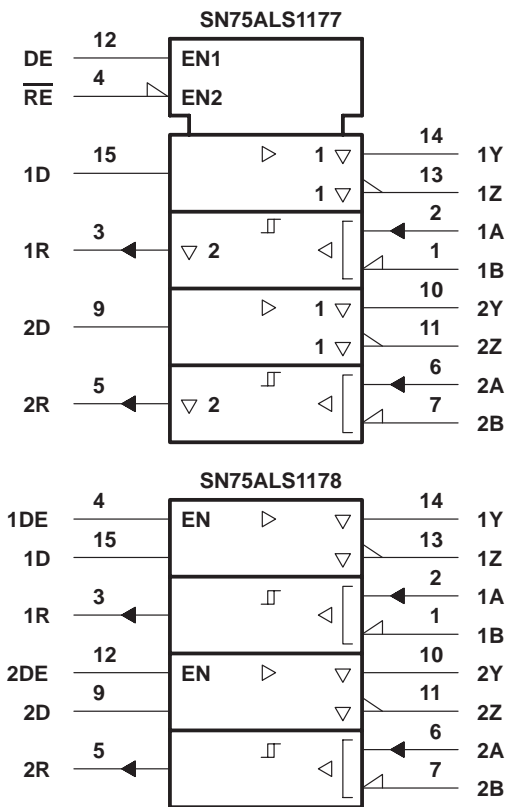
DIFFERENTIAL A – B	OUTPUT Y
$V_{ID} \geq 0.2 V$	H
$-0.2 V < V_{ID} < 0.2 V$	?
$V_{ID} \leq -0.2 V$	L
Open	H

H = high level, L = low level,  
? = indeterminate, X = irrelevant,  
Z = high impedance (off)

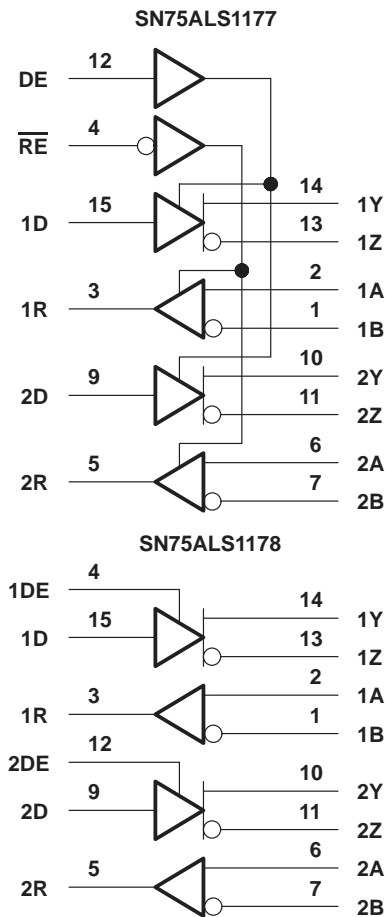
# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## logic symbol†

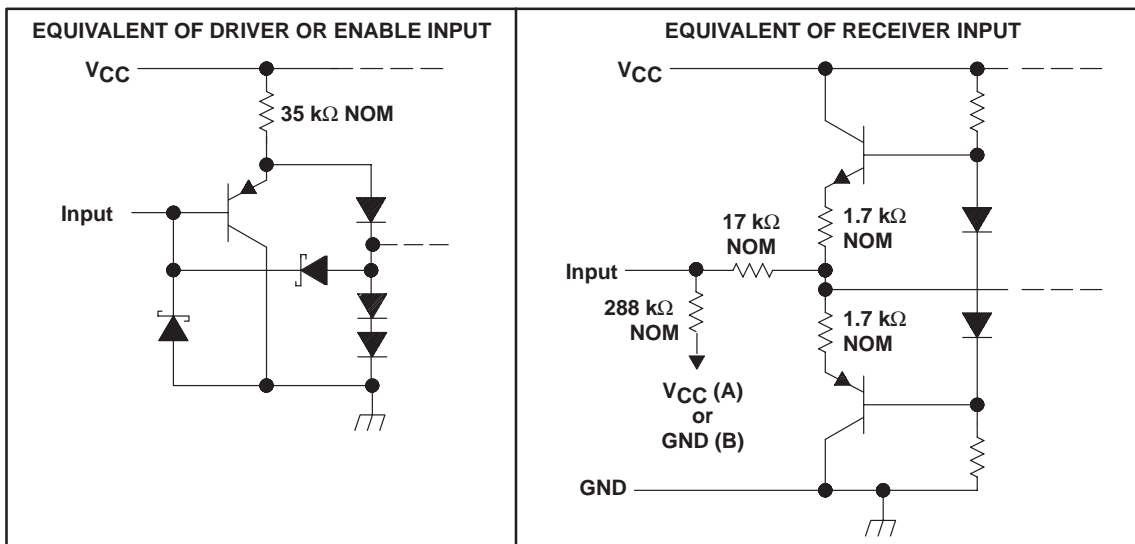


## logic diagram (positive logic)



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

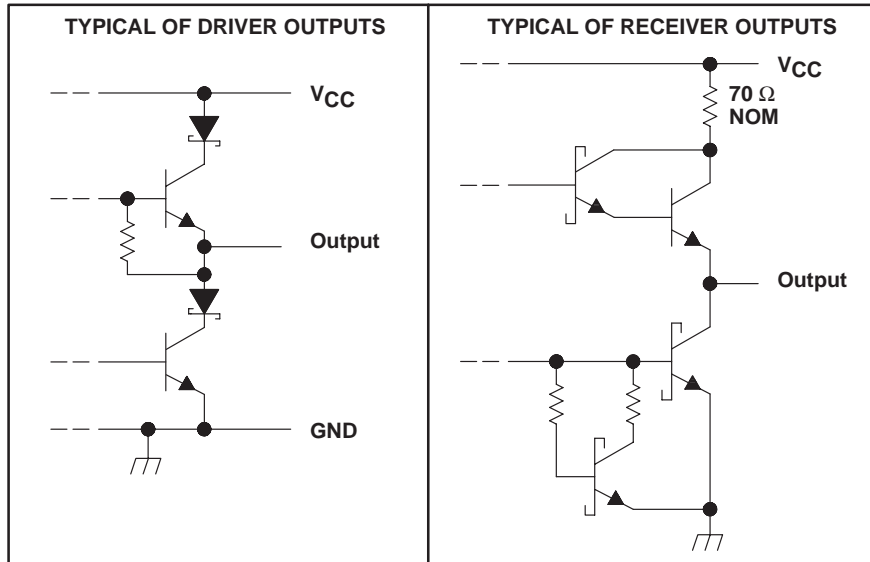
## equivalent schematics



# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## schematics of outputs



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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage, $V_I$ (DE, $\overline{RE}$ , and D inputs)	7 V
Output voltage range, $V_O$ (Driver)	-9 V to 14 V
Input voltage range, Receiver	-14 V to 14 V
Receiver differential-input voltage range (see Note 2)	-14 V to 14 V
Receiver low-level output current	50 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 case for 10 seconds	260°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, except differential input voltage, are with respect to the network ground terminal.  
2. Differential input voltage is measured at the noninverting terminal with respect to the inverting terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	OPERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING
N	1150 mW	9.2 mW/°C	736 mW
NS	625 mW	4.0 mW/°C	445 mW

# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, $V_{CC}$		4.75	5	5.25	V
Differential input voltage, $V_{ID}$	Receiver			$\pm 12$	V
Common-mode output voltage, $V_{OC}$	Driver	$-7^\dagger$		12	V
Common-mode input voltage, $V_{IC}$	Receiver			$\pm 12$	V
High-level input voltage, $V_{IH}$	DE, $\overline{RE}$ , D	2			V
Low-level input voltage, $V_{IL}$	DE, $\overline{RE}$ , D			0.8	V
High-level output current, $I_{OH}$	Driver			-60	mA
	Receiver			-400	$\mu$ A
Low-level output current, $I_{OL}$	Driver			60	mA
	Receiver			8	
Operating free-air temperature, $T_A$		0		70	$^\circ$ C

<sup>†</sup> The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for common-mode output and threshold voltage level only.

# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## DRIVER SECTION

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

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT	
V <sub>IK</sub> Input clamp voltage	I <sub>I</sub> = -18 mA			-1.5	V	
V <sub>OH</sub> High-level output voltage	V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -33 mA		3.3		V	
V <sub>OL</sub> Low-level output voltage	V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 33 mA		1.1		V	
V <sub>OD1</sub>   Differential output voltage	I <sub>O</sub> = 0	1.5		6	V	
V <sub>OD2</sub>   Differential output voltage	V <sub>CC</sub> = 5 V, R <sub>L</sub> = 100 Ω See Figure 1 R <sub>L</sub> = 54 Ω	1/2 V <sub>OD1</sub>		V		
		2				
		1.5	5			
V <sub>OD3</sub>   Differential output voltage	See Note 3	1.5		5	V	
Δ V <sub>OD</sub>   Change in magnitude of differential output voltage (see Note 4)	R <sub>L</sub> = 54 Ω or 100 Ω, See Figure 1			±0.2	V	
V <sub>OC</sub> Common-mode output voltage			-1‡	3	V	
Δ V <sub>OC</sub>   Change in magnitude of common-mode output voltage (see Note 4)					±0.2	V
I <sub>O(OFF)</sub> Output current with power off	V <sub>CC</sub> = 0, V <sub>O</sub> = -7 V to 12 V			±100	μA	
I <sub>OZ</sub> High-impedance-state output current	V <sub>O</sub> = -7 V to 12 V			±100	μA	
I <sub>IH</sub> High-level input current	V <sub>IH</sub> = 2.7 V			100	μA	
I <sub>IL</sub> Low-level input current	V <sub>IL</sub> = 0.4 V			-100	μA	
I <sub>OS</sub> Short-circuit output current	V <sub>O</sub> = -7 V			-250	mA	
	V <sub>O</sub> = V <sub>CC</sub>			250		
	V <sub>O</sub> = 12 V			250		
	V <sub>O</sub> = 0 V			150		
I <sub>CC</sub> Supply current (total package)	No load	Outputs enabled		35	50	mA
		Outputs disabled		20	50	

† All typical values are at V<sub>CC</sub> = 5 V and T<sub>A</sub> = 25°C.

‡ The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for common-mode output and threshold voltage levels only.

NOTES: 3. See EIA Standard RS-485 Figure 3.5, test termination measurement 2.

4. Δ|V<sub>OD</sub>| and Δ|V<sub>OC</sub>| are the changes in magnitude of V<sub>OD</sub> and V<sub>OC</sub>, respectively, that occur when the input is changed from a high level to a low level.

switching characteristics at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub> Propagation delay time, high- to low-level output	R <sub>L</sub> = 60 Ω, C <sub>L1</sub> = C <sub>L2</sub> = 100 pF, See Figure 3	9	15	22	ns
t <sub>PHL</sub> Propagation delay time, low- to high-level output		9	15	22	ns
t <sub>sk</sub> Output-to-output skew		0	2	8	ns
t <sub>pZH</sub> Output enable time to high level	C <sub>L</sub> = 100 pF, See Figure 4	30	35	50	ns
t <sub>pZL</sub> Output enable time to low level	C <sub>L</sub> = 100 pF, See Figure 5	5	15	25	ns
t <sub>PHZ</sub> Output disable time from high level	C <sub>L</sub> = 15 pF, See Figure 4	7	15	30	ns
t <sub>PLZ</sub> Output disable time from low level	C <sub>L</sub> = 15 pF, See Figure 5	7	15	30	ns



# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## RECEIVER SECTION

**electrical characteristics over recommended ranges of common-mode input voltage, supply voltage, and operating free-air temperature (unless otherwise noted)**

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
$V_{IT+}$	Positive-going input threshold voltage	$V_O = 2.7\text{ V}$ ,	$I_O = -0.4\text{ mA}$			0.2	V
$V_{IT-}$	Negative-going input threshold voltage	$V_O = 0.5\text{ V}$ ,	$I_O = 8\text{ mA}$	-0.2‡			V
$V_{hys}$	Input hysteresis voltage ( $V_{IT+} - V_{IT-}$ )				50		mV
$V_{IK}$	Enable input clamp voltage	SN75ALS1177	$I_I = -18\text{ mA}$			-1.5	V
$V_{OH}$	High-level output voltage	$V_{ID} = 200\text{ mV}$ , See Figure 2	$I_{OH} = -400\text{ }\mu\text{A}$ ,	2.7			V
$V_{OL}$	Low-level output voltage	$V_{ID} = 200\text{ mV}$ , See Figure 2	$I_{OL} = 8\text{ mA}$ ,			0.45	V
$I_{OZ}$	High-impedance-state output current	SN75ALS1177	$V_O = 0.4\text{ V to }2.4\text{ V}$			$\pm 20$	$\mu\text{A}$
$I_I$	Line input current (see Note 5)		Other input at 0 V	$V_I = 12\text{ V}$		1	mA
				$V_I = -7\text{ V}$		-0.8	
$I_{IH}$	High-level input current, $\overline{RE}$	SN75ALS1177	$V_{IH} = 2.7\text{ V}$			20	$\mu\text{A}$
$I_{IL}$	Low-level input current, $\overline{RE}$	SN75ALS1177	$V_{IL} = 0.4\text{ V}$			-100	$\mu\text{A}$
$r_i$	Input resistance			12			k $\Omega$
$I_{OS}$	Short-circuit output current	$V_O = 0\text{ V}$ ,	See Note 6	-15		-85	mA
$I_{CC}$	Supply current (total package)	No load,	Outputs enabled		35	50	mA

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

‡ The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for common-mode output and threshold voltage levels only.

NOTES: 5. Refer to EIA standards RS-422-A, RS-423-A, and RS-485-A for exact conditions.

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

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$t_{PLH}$	Propagation delay time, low- to high-level output	$C_L = 15\text{ pF}$ ,	See Figure 6	15	25	37	ns
$t_{PHL}$	Propagation delay time, high- to low-level output			15	25	37	
$t_{PZH}$	Output enable time to high level	SN75ALS1177	$C_L = 100\text{ pF}$ ,	10	20	30	ns
$t_{PZL}$	Output enable time to low level	SN75ALS1177	$C_L = 100\text{ pF}$ ,	10	20	30	ns
$t_{PHZ}$	Output disable time from high level	SN75ALS1177	$C_L = 15\text{ pF}$ ,	5	12	16	ns
$t_{PLZ}$	Output disable time from low level	SN75ALS1177	$C_L = 15\text{ pF}$ ,	5	12	16	ns

# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## PARAMETER MEASUREMENT INFORMATION

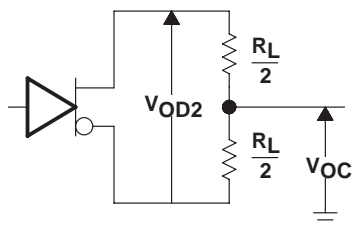


Figure 1. Driver Test Circuit,  $V_{OD}$  and  $V_{OC}$

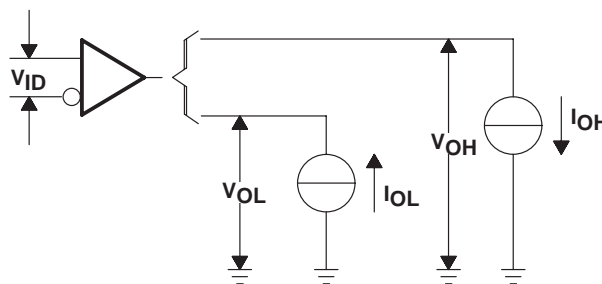
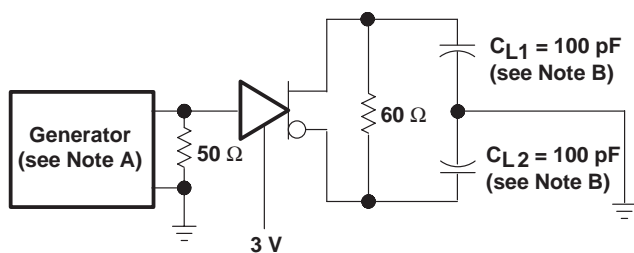
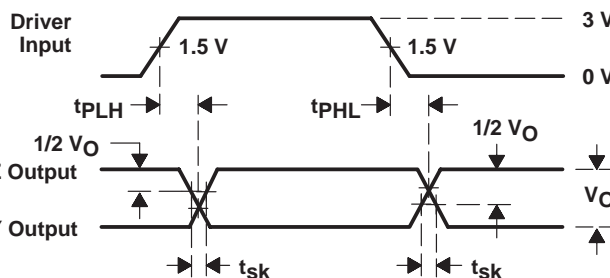


Figure 2. Receiver Test Circuit,  $V_{OH}$  and  $V_{OL}$



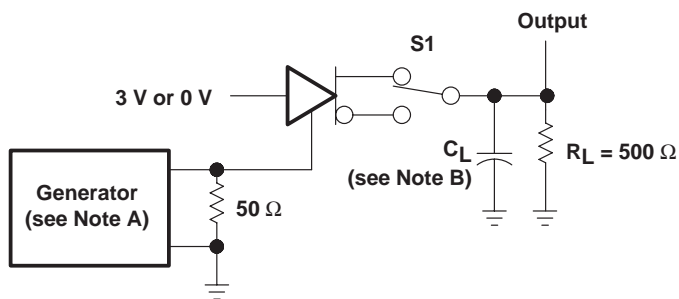
DRIVER TEST CIRCUIT



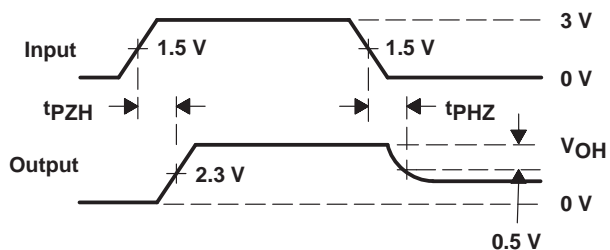
DRIVER VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics:  $PRR \leq 1$  MHz, 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns.  
B.  $C_L$  includes probe and jig capacitance.

Figure 3. Driver Propagation Delay Times



DRIVER TEST CIRCUIT



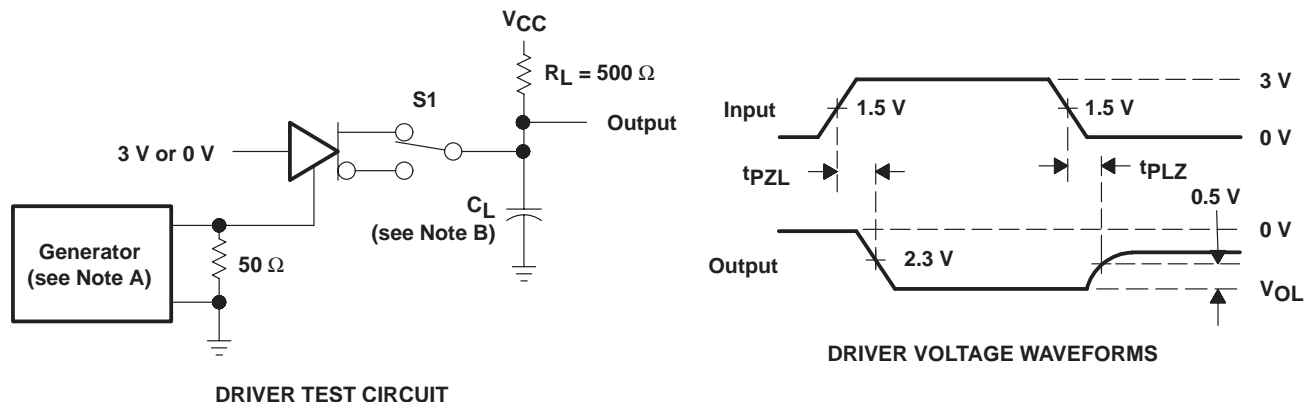
DRIVER VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics:  $PRR \leq 1$  MHz, 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns.  
B.  $C_L$  includes probe and jig capacitance.

Figure 4. Driver Enable and Disable Times

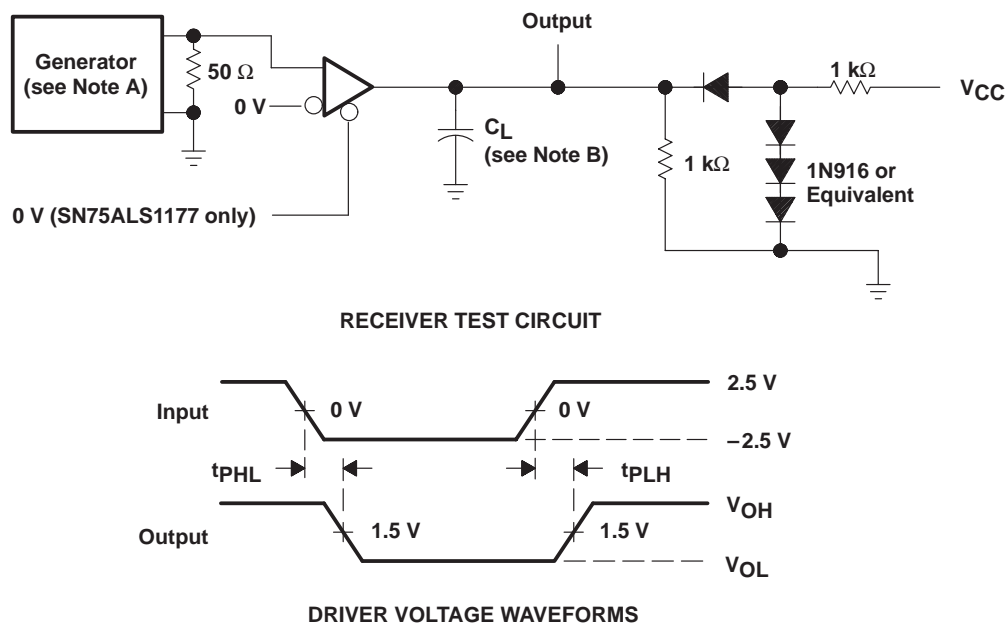


PARAMETER MEASUREMENT INFORMATION



NOTES: A. The pulse generator has the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t<sub>r</sub> ≤ 10 ns, t<sub>f</sub> ≤ 10 ns.  
B. C<sub>L</sub> includes probe and jig capacitance.

Figure 5. Driver Enable and Disable Times



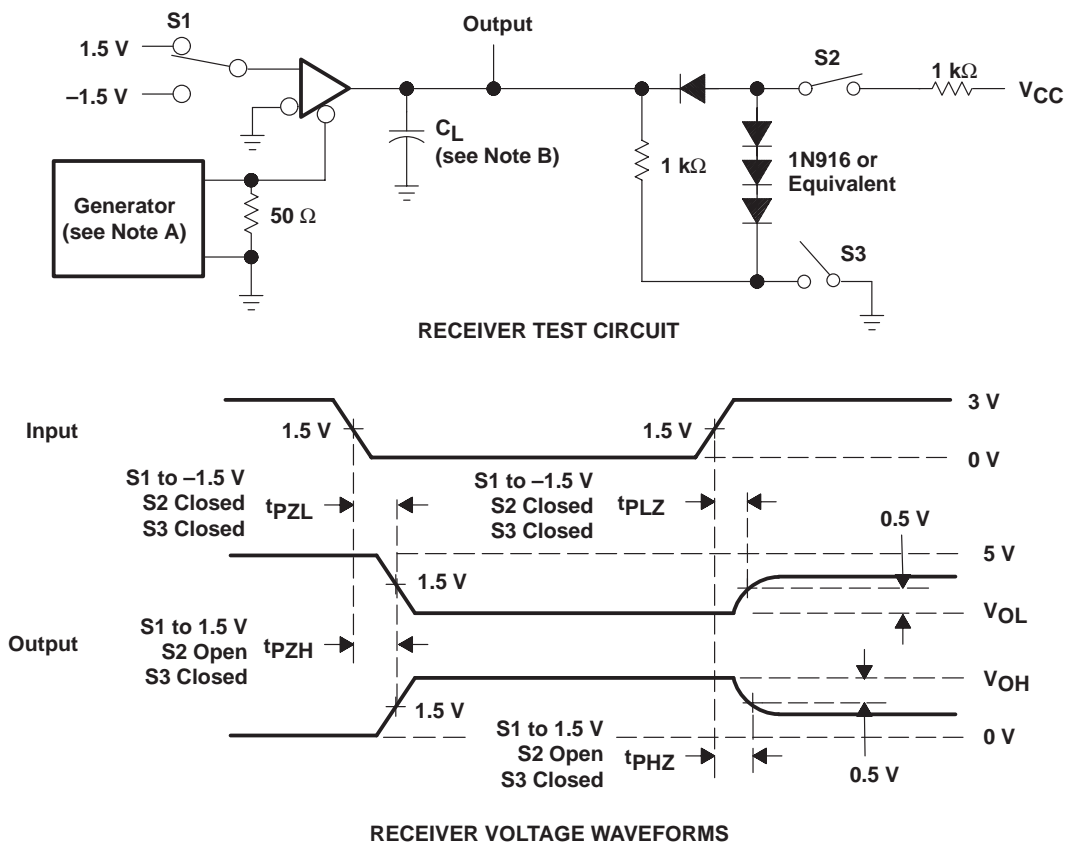
NOTES: A. The pulse generator has the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t<sub>r</sub> ≤ 10 ns, t<sub>f</sub> ≤ 10 ns.  
B. C<sub>L</sub> includes probe and jig capacitance.

Figure 6. Receiver Propagation Delay Times

# SN75ALS1177, SN75ALS1178 DUAL DIFFERENTIAL DRIVERS AND RECEIVERS

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## PARAMETER MEASUREMENT INFORMATION



- NOTES: A. The pulse generator has the following characteristics:  $PRR \leq 1\text{ MHz}$ , 50% duty cycle,  $t_r \leq 10\text{ ns}$ ,  $t_f \leq 10\text{ ns}$ .  
 B.  $C_L$  includes probe and jig capacitance.

Figure 7. Receiver Output Enable and Disable Times

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