

# SN65ALS172A, SN75ALS172A QUAD DIFFERENTIAL LINE DRIVERS

SLLS121B – D3554, AUGUST 1990 – REVISED MARCH 1993

- Meets EIA Standards RS-422-A and RS-485
- Meets CCITT Recommendations V.11 and X.27
- High-Speed Advanced Low-Power Schottky Circuitry
- Designed for 20-MBaud Operation in Both Serial and Parallel Applications
- Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments
- Low Supply Current Requirements  
55 mA Max
- Wide Positive and Negative Input/Output Bus Voltages Ranges
- Driver Output Capacity . . .  $\pm 60$  mA
- Thermal Shutdown Protection
- Driver Positive and Negative Current Limiting
- Functionally Interchangeable With SN75172

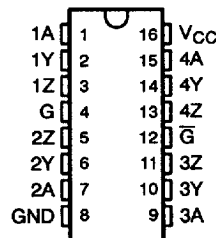
## description

The SN65ALS172A and SN75ALS172A are quad line drivers with 3-state differential outputs. They are designed to meet the requirements of EIA Standards RS-422-A and RS-485 and CCITT Recommendations V.11 and X.27. These devices are optimized for balanced multipoint bus transmission at rates of up to 20-Mbaud. Each driver features wide positive and negative common-mode output voltage ranges making them suitable for party-line applications in noisy environments.

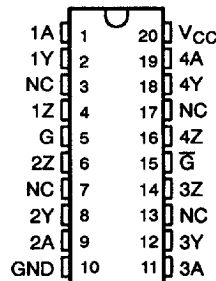
The SN65ALS172A and SN75ALS172A provide positive- and negative-current limiting and thermal shutdown for protection from line fault conditions on the transmission bus line. Shutdown occurs at a junction temperature of approximately 150°C.

The SN65ALS172A is characterized for operation from -40°C to 85°C and the SN75ALS172A is characterized for operation from 0°C to 70°C.

SN75ALS172A . . . N PACKAGE  
(TOP VIEW)



DW PACKAGE  
(TOP VIEW)



NC—No internal connection

FUNCTION TABLE  
(each driver)

INPUT A	ENABLES		OUTPUTS	
	G	$\bar{G}$	Y	Z
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Z	Z

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

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

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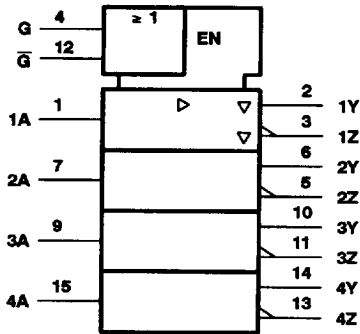
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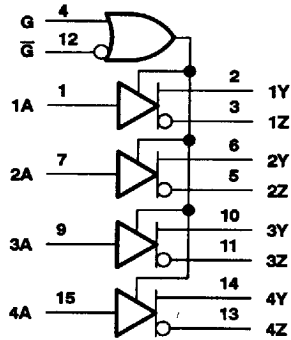
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## logic symbol†



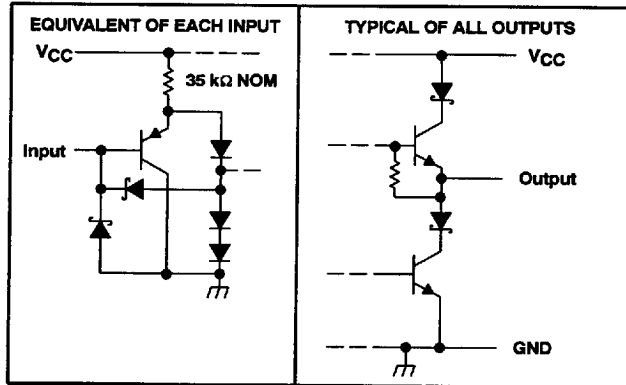
## logic diagram (positive logic)



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

Pin numbers shown are for the N package.

## 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, $V_I$	7 V
Output voltage range, $V_O$	–9 V to 14 V
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range: SN65ALS172A	–40°C to 85°C
SN75ALS172A	0°C to 70°C
Storage temperature range	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTE 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	$T_A = 85^\circ\text{C}$ POWER RATING
DW	1125 mW	9 mW/°C	720 mW	585 mW
N	1150 mW	9.2 mW/°C	736 mW	598 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
Common-mode output voltage, $V_{OC}$			+12 –7	V
High-level output current, $I_{OH}$			–60	mA
Low-level output current, $I_{OL}$			60	mA
Operating free-air temperature, $T_A$	SN65ALS172A		–40	85
	SN75ALS172A		0	70



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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 <sub>IK</sub>	Input clamp voltage	I <sub>I</sub> = −18 mA				−1.5	V
V <sub>O</sub>	Output voltage	I <sub>O</sub> = 0		0		6	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	1/2 V <sub>OD1</sub> or 2†			V
		R <sub>L</sub> = 54 Ω		1.5	2.5	5	
V <sub>OD3</sub>	Differential output voltage	See Note 2		1.5		5	V
Δ V <sub>OD</sub>	Change in magnitude of differential output voltage‡	R <sub>L</sub> = 54 Ω or 100 Ω, See Figure 1				±0.2	V
V <sub>OC</sub>	Common-mode output voltage§					+3 −1	V
Δ V <sub>OC</sub>	Change in magnitude of common-mode output voltage‡					±0.2	V
I <sub>O</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>I</sub> = 2.7 V				20	μA
I <sub>IL</sub>	Low-level input current	V <sub>I</sub> = 0.4 V				−100	μA
I <sub>OS</sub>	Short-circuit output current	V <sub>O</sub> = −7 V to 12 V				±250	mA
I <sub>CC</sub>	Supply current (all drivers)	No load	Outputs enabled	36	55	mA	
			Outputs disabled	15	30		

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

‡  $\Delta|V_{OD}|$  and  $\Delta|V_{OC}|$  are the changes in magnitude of  $V_{OD}$  and  $V_{OC}$  respectively, that occur when the input is changed from a high level to a low level.

§ In EIA Standard RS-422-A,  $V_{OC}$ , which is the average of the two output voltages with respect to ground, is called output offset voltage,  $V_{OS}$ .

† The minimum  $V_{OD2}$  with a  $100\text{-}\Omega$  load is either  $1/2 V_{OD1}$  or  $2 \text{ V}$ , whichever is greater.

NOTE 2: See EIA Standard RS-485, Figure 3-5, Test Termination Measurement 2.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50 \text{ pF}$**

PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
$t_{dD}$ Differential-output delay time	$R_L = 54 \Omega$ ,	See Figure 2	9	15	22	ns
$t_{pZH}$ Output enable time to high level	$R_L = 110 \Omega$ ,	See Figure 3	30	45	70	ns
$t_{pZL}$ Output enable time to low level	$R_L = 110 \Omega$ ,	See Figure 4	25	40	65	ns
$t_{pHZ}$ Output disable time from high level	$R_L = 110 \Omega$ ,	See Figure 3	10	20	35	ns
$t_{pLZ}$ Output disable time from low level	$R_L = 110 \Omega$ ,	See Figure 4	10	30	45	ns

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

## PARAMETER MEASUREMENT INFORMATION

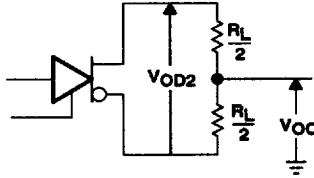
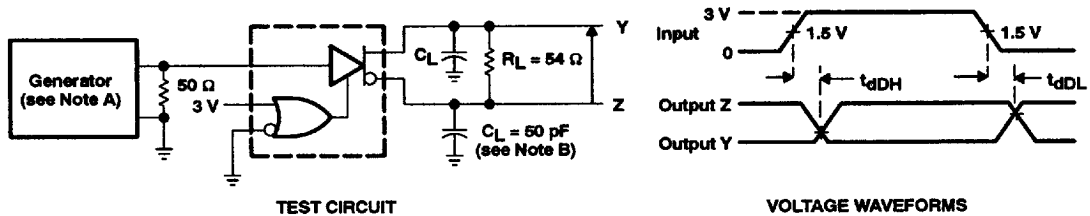


Figure 1. Differential and Common-Mode Output Voltages



NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz,  $Z_O = 50 \Omega$ , duty cycle = 50%,  $t_r \leq 5$  ns,  $t_f \leq 5$  ns.  
B.  $C_L$  includes probe and stray capacitance.

Figure 2. Differential Output Test Circuit and Voltage Waveforms

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## PARAMETER MEASUREMENT INFORMATION

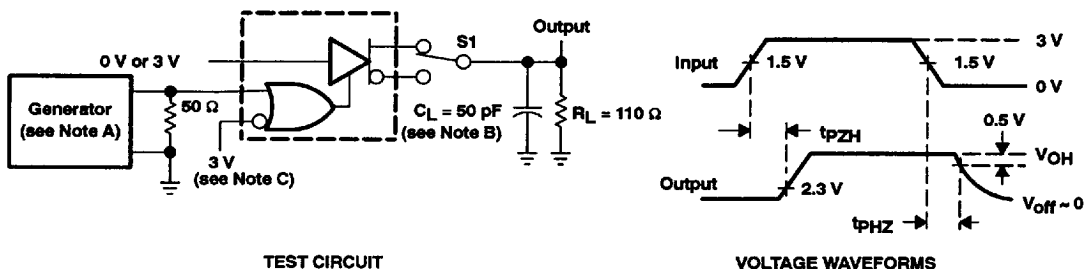


Figure 3. Test Circuit and Voltage Waveforms,  $t_{pZH}$  and  $t_{PHZ}$

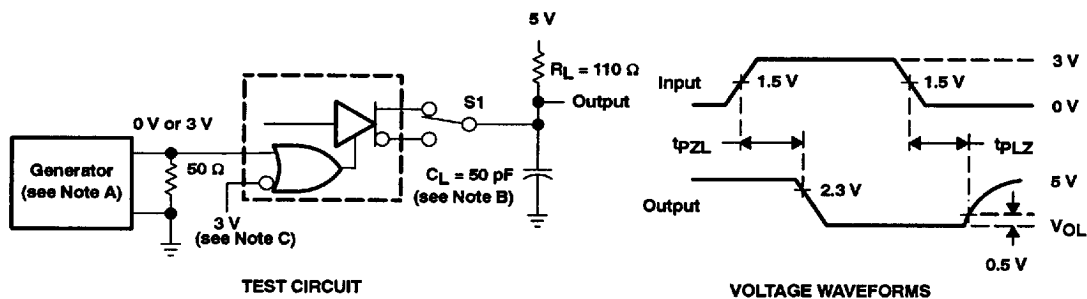


Figure 4. Test Circuit and Voltage Waveforms,  $t_{pZL}$  and  $t_{PLZ}$

- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz,  $Z_O = 50 \Omega$ , duty cycle = 50%,  $t_f \leq 5 \text{ ns}$ .  
 B.  $C_L$  includes probe and stray capacitance.  
 C. To test the active-low enable  $\overline{G}$ , ground G and apply an inverted input waveform to  $\overline{G}$ .