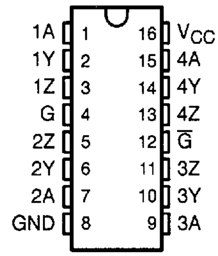
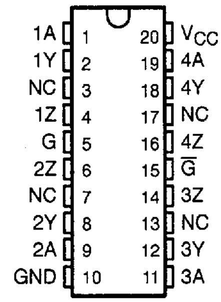
SN75172 QUADRUPLE DIFFERENTIAL LINE DRIVER

- **Meets or Exceeds the Requirements of ANSI Standards EIA/TIA-422-B and RS-485 and ITU Recommendation V.11**
- **Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments**
- **3-State Outputs**
- **Common-Mode Output Voltage Range of –7 V to 12 V**
- **Active-High and Active-Low Enables**
- **Thermal Shutdown Protection**
- **Positive- and Negative-Current Limiting**
- **Operates From Single 5-V Supply**
- **Logically Interchangeable With AM26LS31**

N PACKAGE (TOP VIEW)



DW PACKAGE (TOP VIEW)



NC – No internal connection

description

The SN75172 is a monolithic quadruple differential line driver with 3-state outputs. It is designed to meet the requirements of ANSI Standards EIA/TIA-422-B and RS-485 and ITU Recommendation V.11. The device is optimized for balanced multipoint bus transmission at rates of up to 4 megabaud. Each driver features wide positive and negative common-mode output voltage ranges, making it suitable for party-line applications in noisy environments.

The SN75172 provides 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. This device offers optimum performance when used with the SN75173 or SN75175 quadruple differential line receivers.

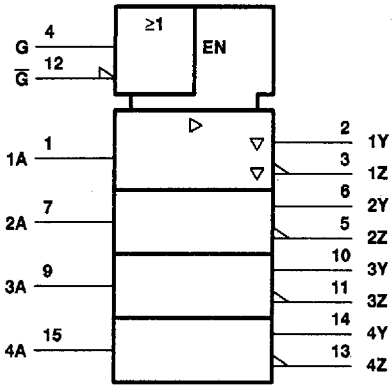
The SN75172 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE (each driver)

INPUT	ENABLES		OUTPUTS	
A	G	$\overline{G}$	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

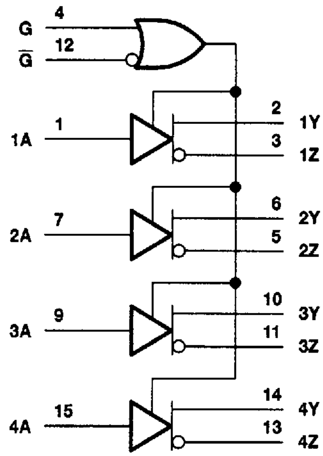
H = high level, L = low level,
X = irrelevant, Z = high impedance (off)

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Terminal numbers shown are for the N package.

logic diagram (positive logic)



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

Supply voltage, V_{CC} (see Note 1) .... 7 V
Voltage range at any bus terminal .... −10 V to 15 V
Input voltage, V_I .... 5.5 V
Continuous total 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.

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

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
DW	1125 mW	9.0 mW/°C	720 mW
N	1150 mW	9.2 mW/°C	736 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}			−7 to 12	V
High-level output current, I_{OH}			−60	mA
Low-level output current, I_{OL}			60	mA
Operating free-air temperature, T_A	0		70	°C

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	$I_I = -18$ mA					−1.5	V
V_O	Output voltage	$I_O = 0$			0		6	V
V_{OH}	High-level output voltage	$V_{IH} = 2$ V,	$V_{IL} = 0.8$ V,	$I_{OH} = -33$ mA		3.7		V
V_{OL}	Low-level output voltage	$V_{IH} = 2$ V,	$V_{IL} = 0.8$ V,	$I_{OH} = 33$ mA		1.1		V
$\lvert V_{OD1}\rvert$	Differential output voltage	$I_O = 0$			1.5		6	V
$\lvert V_{OD2}\rvert$	Differential output voltage	$R_L = 100\ \Omega$,	See Figure 1		1/2 V_{OD1} or 2‡			V
		$R_L = 54\ \Omega$,	See Figure 1		1.5	2.5	5	V
V_{OD3}	Differential output voltage	See Note 2			1.5		5	V
$\Delta\lvert V_{OD}\rvert$	Change in magnitude of differential output voltage§	$R_L = 54\ \Omega$ or $100\ \Omega$,		See Figure 1			±0.2	V
V_{OC}	Common-mode output voltage¶						+3 −1	V
$\Delta\lvert V_{OC}\rvert$	Change in magnitude of common-mode output voltage§						±0.2	V
I_O	Output current with power off	$V_{CC} = 0$,	$V_O = -7$ V to 12 V				±100	μA
I_{OZ}	High-impedance-state output current	$V_O = -7$ V to 12 V					±100	μA
I_{IH}	High-level input current	$V_I = 2.7$ V					20	μA
I_{IL}	Low-level input current	$V_I = 0.5$ V					−360	μA
I_{OS}	Short-circuit output current	$V_O = -7$ V					−180	mA
		$V_O = V_{CC}$					180	mA
		$V_O = 12$ V					500	mA
I_{CC}	Supply current (all drivers)	No load	Outputs enabled			38	60	mA
			Outputs disabled			18	40	mA

† All typical values are at $V_{CC} = 5$ V and $T_A = 25°C$.
‡ The minimum V_{OD2} with a 100-Ω load is either 1/2 V_{OD1} or 2 V, whichever is greater.
§ $\Delta\lvert V_{OD}\rvert$ and $\Delta\lvert V_{OC}\rvert$ 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 ANSI Standard EIA/TIA-422-B, V_{OC}, which is the average of the two output voltages with respect to ground, is called output offset voltage, V_{OS}.
NOTE 2: See Figure 3-5 of EIA Standard RS-485.

SYMBOL EQUIVALENTS

DATA SHEET PARAMETER	EIA/TIA-422-B	RS-485
V_O	V_{oa}, V_{ob}	V_{oa}, V_{ob}
$\lvert V_{OD1}\rvert$	V_o	V_o
$\lvert V_{OD2}\rvert$	V_t ($R_L = 100\ \Omega$)	V_t ($R_L = 54\ \Omega$)
$\lvert V_{OD2}\rvert$		V_t (Test Termination) Measurement 2)
$\Delta\lvert V_{OD}\rvert$	$\lvert\lvert V_t\rvert - \lvert\overline{V}_t\rvert\rvert$	$\lvert\lvert V_t\rvert - \lvert\overline{V}_t\rvert\rvert$
V_{OC}	$\lvert V_{os}\rvert$	$\lvert V_{os}\rvert$
$\Delta\lvert V_{OC}\rvert$	$\lvert V_{os} - \overline{V}_{os}\rvert$	$\lvert V_{os} - \overline{V}_{os}\rvert$
I_{OS}	$\lvert I_{sa}\rvert, \lvert I_{sb}\rvert$	
I_O	$\lvert I_{xa}\rvert, \lvert I_{xb}\rvert$	I_{ia}, I_{ib}

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$t_{d(OD)}$	Differential-output delay time	R_L = 54 Ω,	See Figure 2		45	65	ns
$t_{t(OD)}$	Differential-output transition time				80	120	ns
t_{PZH}	Output enable time to high level	R_L = 110 Ω,	See Figure 3		80	120	ns
t_{PZL}	Output enable time to low level	R_L = 110 Ω,	See Figure 4		45	80	ns
t_{PHZ}	Output disable time from high level	R_L = 110 Ω,	See Figure 3		78	115	ns
t_{PLZ}	Output disable time from low level	R_L = 110 Ω,	See Figure 4		18	30	ns

PARAMETER MEASUREMENT INFORMATION

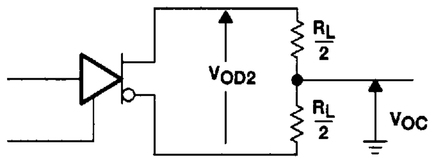
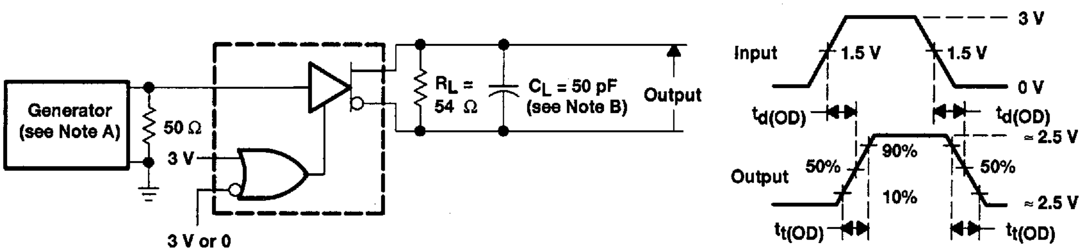


Figure 1. Differential and Common-Mode Output Voltages



TEST CIRCUIT

VOLTAGE WAVEFORMS

Figure 2. Differential-Output Test Circuit and Voltage Waveforms

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

PARAMETER MEASUREMENT INFORMATION

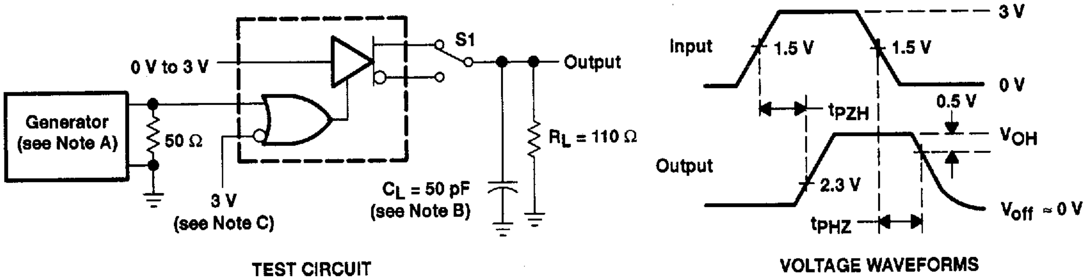


Figure 3. Test Circuit and Voltage Waveforms

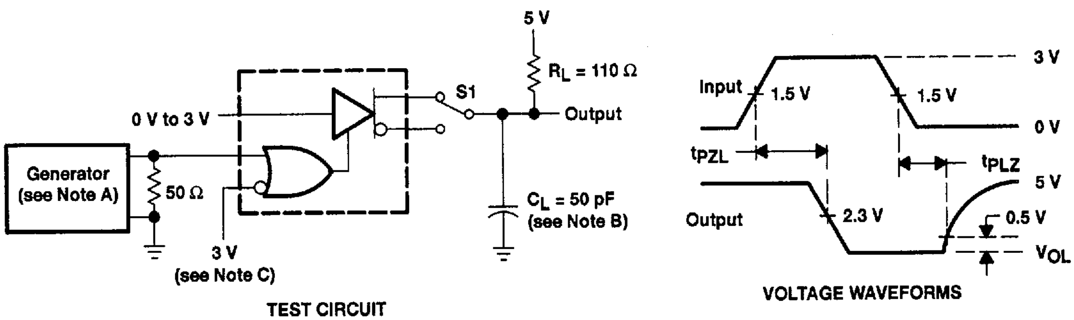


Figure 4. Test Circuit and Voltage Waveforms

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

TYPICAL CHARACTERISTICS

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

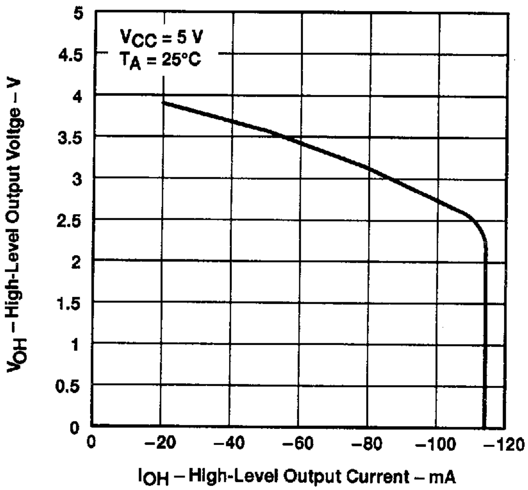


Figure 5

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

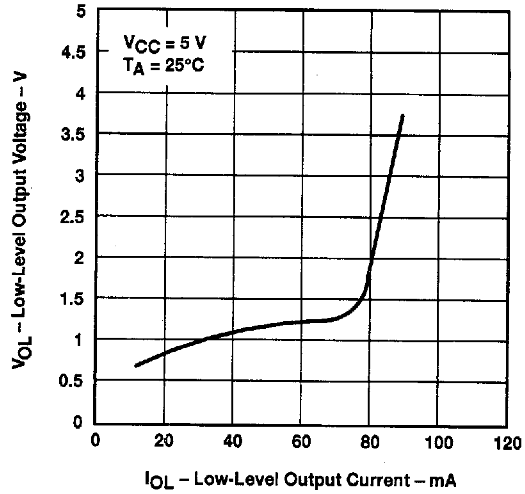


Figure 6

DIFFERENTIAL OUTPUT VOLTAGE
vs
OUTPUT CURRENT

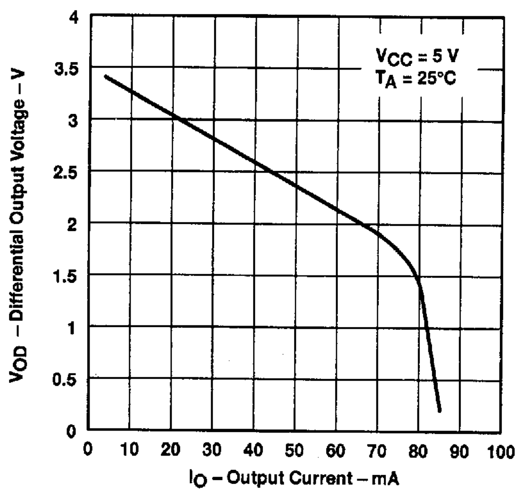


Figure 7

OUTPUT CURRENT
vs
OUTPUT VOLTAGE

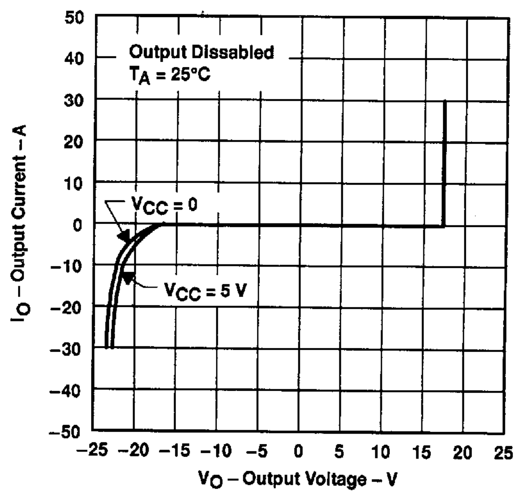


Figure 8

TYPICAL CHARACTERISTICS

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

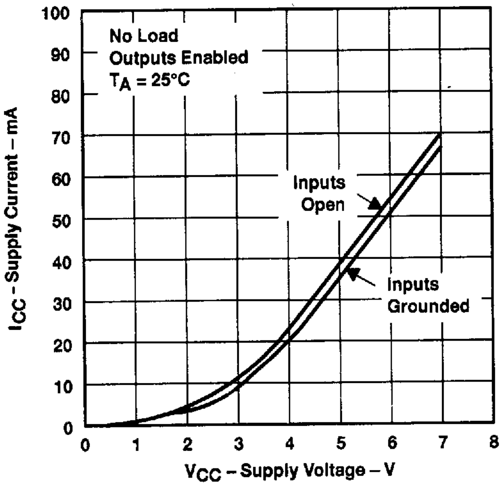


Figure 9

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

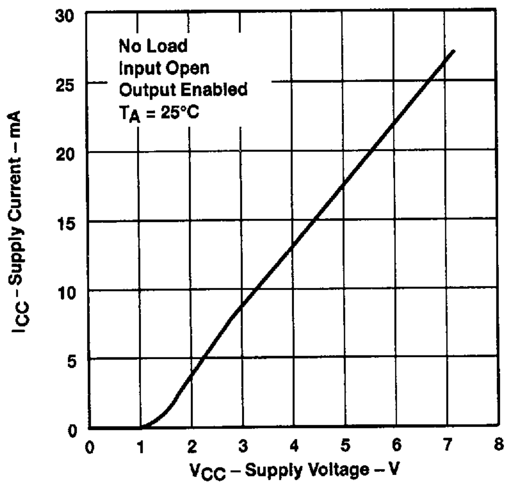
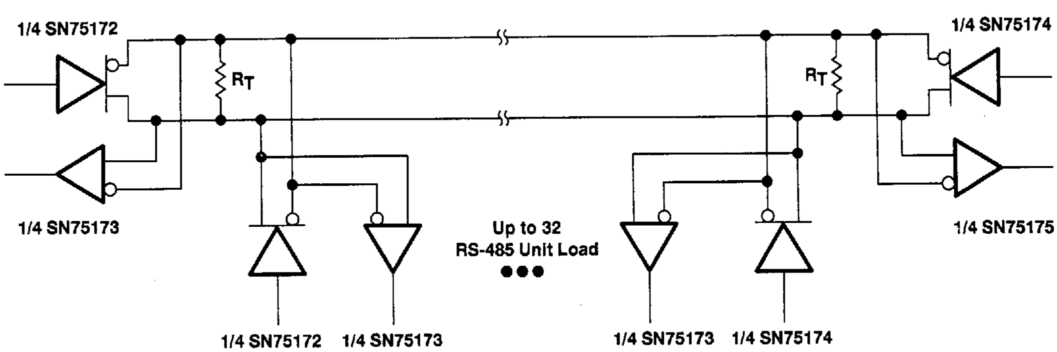


Figure 10

APPLICATION INFORMATION



NOTE A: The line length should be terminated at both ends in its characteristic impedance ($R_T = Z_O$). Stub lengths off the main line should be kept as short as possible.

Figure 11