National Semiconductor

T-75-45-05

DS26LS32C/DS26LS32M/DS26LS32AC/DS26LS33C/ DS26LS33M/DS26LS33AC Quad Differential Line Receivers

General Description

The DS26LS32 and DS26LS32A are quad differential line receivers designed to meet the RS-422, RS-423 and Federal Standards 1020 and 1030 for balanced and unbalanced digital data transmission.

The DS26LS32 and DS26LS32A have an input sensitivity of 200 mV over the input voltage range of ±7V and the DS26LS33 and DS26LS33A have an input sensitivity of 500 mV over the input voltage range of ±15%V.

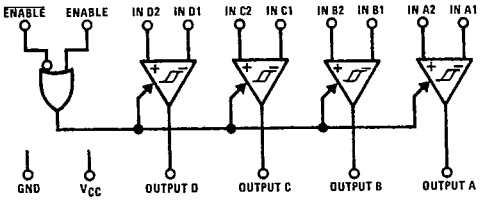
Both the DS26LS32A and DS26LS33A differ in function from the popular DS26LS32 and DS26LS33 in that input fail-safe circuitry is provided for each receiver, which causes the outputs to go to a logic "1" state when the inputs are open.

Each version provides an enable and disable function common to all four receivers and features TRI-STATE® outputs with 8 mA sink capability. Constructed using low power Schottky processing, these devices are available over the full military and commerical operating temperature ranges.

Features

- High differential or common-mode input voltage ranges of ±7V on the DS26LS32 and DS26LS32A and ±15V on the DS26LS33 and DS26LS33A
- ±0.2V sensitivity over the input voltage range on the DS26LS32 and DS26LS32A, ±0.5V sensitivity on the DS26LS33 and DS26LS33A
- Input fail-safe circuitry on the DS26LS32A and DS26LS33A
- DS26LS32 and DS26LS32A meet all requirements of RS-422 and RS-423
- 6k minimum input impedance
- 100 mV input hysteresis on the DS26LS32 and DS26LS32A, 200 mV on the DS26LS33 and DS26LS33A
- Operation from a single 5V supply
- TRI-STATE drive, with choice of complementary output enables for receiving directly onto a data bus
- Pin replacement for Advanced Micro Devices AM26LS32

Logic Diagram



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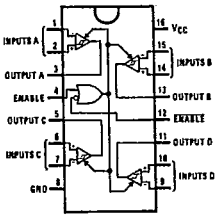
Connection Diagram

Dual-In-Line Package



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Top View

Truth Table

ENABLE	$\overline{\text{ENABLE}}$	Input	Output
1	1	X	Hi-Z
See Note Below		$V_{ID} \geq V_{TH}$ (Max)	1
		$V_{ID} \leq V_{TH}$ (Min)	0
		Open	1*

HI-Z = TRI-STATE

*DS26LS32A and DS26LS33A only

Note: Input conditions may be any combination not defined for ENABLE and $\overline{\text{ENABLE}}$.

Order Number DS26LS32MJ, DS26LS32CJ, DS26LS32CM, DS26LS32CN, DS26LS32ACJ, DS26LS32ACN, DS26LS32ACM, DS26LS33MJ, DS26LS33CJ, DS26LS33CN, DS26LS33ACJ or DS26LS33ACN

See NS Package Number J16A, M16A or N16A

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage	7V
Common-Mode Range	±25V
Differential Input Voltage	±25V
Enable Voltage	7V
Output Sink Current	50 mA
Maximum Power Dissipation* at 25°C	
Cavity Package	1433 mW
Molded Dip Package	1362 mW
SO Package DS26LS32	1002 mW
DS26LS232A	1051 mW
Storage Temperature Range	−65°C to +165°C
Lead Temperature (Soldering, 4 seconds)	260°C

*Derate cavity package 9.6 mW/°C above 25°C; derate molded DIP package 10.9 mW/°C above 25°C.

Derate SO Package 8.01 mW/°C for DS26LS32
8.41 mW/°C for DS26LS32A

Operating Conditions

	Min	Max	Units
Supply Voltage, (V_{CC})			
DS26LS32M, DS26LS33M (MIL)	4.5	5.5	V
DS26LS32C, DS26LS33C DS26LS32AC, DS26LS33AC (COML)	4.75	5.25	V
Temperature, (T_A)			
DS26LS32M, DS26LS33M (MIL)	−55	+125	°C
DS26LS32C, DS26LS33C DS26LS32AC, DS26LS33AC (COML)	0	+70	°C

Electrical Characteristics over the operating temperature range unless otherwise specified (Notes 2, 3 and 4)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
V_{TH}	Differential Input Voltage	$V_{OUT} = V_{OH}$ or V_{OL}	DS26LS32, DS26LS32A, $-7V \le V_{CM} \le +7V$	−0.2	±0.07	0.2	V
			DS26LS33, DS26LS33A, $-15V \le V_{CM} + 15V$	−0.5	±0.14	0.5	V
R_{IN}	Input Resistance	$-15V \le V_{CM} \le +15V$ (One Input AC GND)		6.0	8.5		kΩ
I_{IN}	Input Current (Under Test)	$V_{IN} = 15V$, Other Input $-15V \le V_{IN} \le +15V$				2.3	mA
		$V_{IN} = -15V$, Other Input $-15V \le V_{IN} \le +15V$				−2.8	mA
V_{OH}	Output High Voltage	V_{CC} = MIN, $\Delta V_{IN} = 1V$, $V_{\overline{ENABLE}} = 0.8V$, $I_{OH} = -440\ \mu A$	Commercial	2.7	4.2		V
			Military	2.5	4.2		V
V_{OL}	Output Low Voltage	V_{CC} = Min, $\Delta V_{IN} = -1V$, $V_{\overline{ENABLE}} = 0.8V$	I_{OL} = 4 mA			0.4	V
			I_{OL} = 8 mA			0.45	V
V_{IL}	Enable Low Voltage					0.8	V
V_{IH}	Enable High Voltage			2.0			V
V_I	Enable Clamp Voltage	V_{CC} = Min, $I_{IN} = -18$ mA				−1.5	V
I_O	OFF-State (High Impedance) Output Current	V_{CC} = Max	V_O = 2.4V			20	μA
			V_O = 0.4V			−20	μA
I_{IL}	Enable Low Current	$V_{IN} = 0.4V$				−0.36	mA
I_{IH}	Enable High Current	$V_{IN} = 2.7V$				20	μA
I_{SC}	Output Short-Circuit Current	$V_O = 0V$, V_{CC} = Max, $\Delta V_{IN} = 1V$		−15		−85	mA
I_{CC}	Power Supply Current	V_{CC} = Max, All V_{IN} = GND, Outputs Disabled	DS26LS32, DS26LS32A		52	70	mA
			DS26LS33, DS26LS33A		57	80	mA
I_I	Input High Current	$V_{IN} = 5.5V$				100	μA
V_{HYST}	Input Hysteresis	$T_A = 25°C$, $V_{CC} = 5V$, $V_{CM} = 0V$	DS26LS32, DS26S32A		100		mV
			DS26LS33, DS26LS33A		200		mV

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: All currents into device pins are shown as positive, all currents out of device pins are shown as negative, all voltages are referenced to ground, unless otherwise specified. All values shown as max or min are so classified on absolute value basis.

Note 3: All typical values are $V_{CC} = 5V$, $T_A = 25°C$.

Note 4: Only one output at a time should be shorted.

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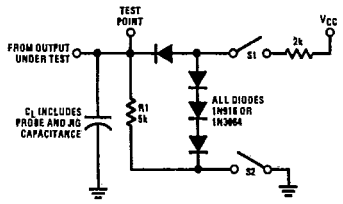
Switching Characteristics $V_{CC} = 5V, T_A = 25°C$

Symbol	Parameter	Conditions	DS26LS32/DS26LS33			DS26LS32A/DS26LS33A			Units
			Min	Typ	Max	Min	Typ	Max	
t_{PLH}	Input to Output	C_L = 15 pF		17	25		23	35	ns
t_{PHL}				17	25		23	35	ns
t_{LZ}	ENABLE to Output	C_L = 5 pF		20	30		15	22	ns
t_{HZ}				15	22		20	25	ns
t_{ZL}	ENABLE to Output	C_L = 15 pF		15	22		14	22	ns
t_{ZH}				15	22		15	22	ns

AC Test Circuit and Switching Time Waveforms

Load Test Circuit for TRI-STATE Outputs



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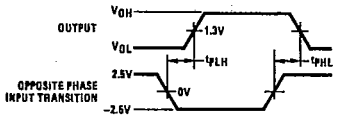
Propagation Delay (Notes 1 and 3)



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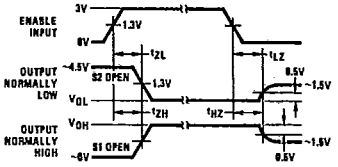
Enable and Disable Times (Notes 2 and 3)



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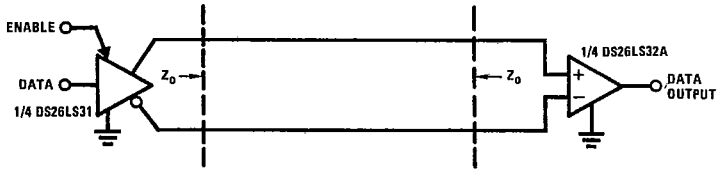
Note 1: Diagram shown for $\overline{\text{ENABLE}}$ low.

Note 2: S1 and S2 of load circuit are closed except where shown.

Note 3: Pulse generator for all pulses: Rate ≤ 1.0 MHz; Z_O = 50Ω; t_r ≤ 15 ns; t_f ≤ 6.0 ns.

Typical Applications

Two-Wire Balanced Systems, RS-422



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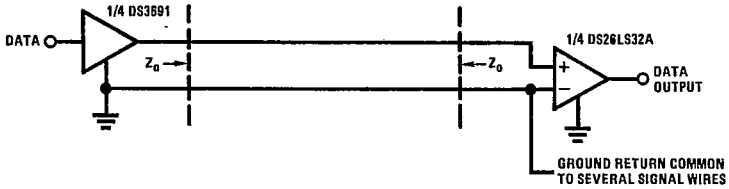
Single Wire with Common Ground Unbalanced Systems, RS-423



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