

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 $\pm 7V$ and the DS26LS33 and DS26LS33A have an input sensitivity of 500 mV over the input voltage range of $\pm 15V$.

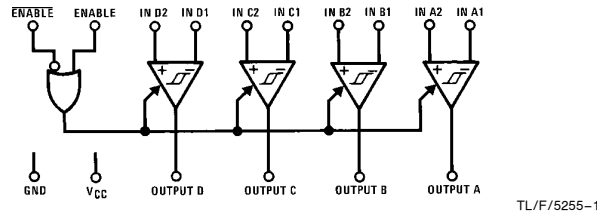
Both the DS26LS32A and DS26LS33A differ in function from the popular DS26LS32 and DS26LS33 in that input pull-up and pull-down resistors are included which prevent output oscillation on unused channels.

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 commercial operating temperature ranges.

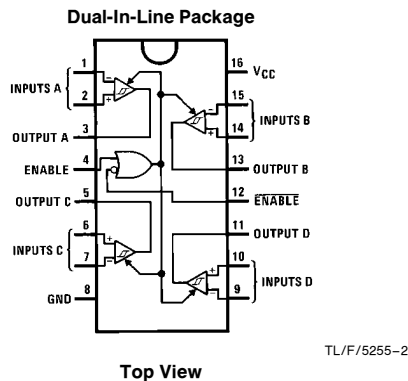
Features

- High differential or common-mode input voltage ranges of $\pm 7V$ on the DS26LS32 and DS26LS32A and $\pm 15V$ on the DS26LS33 and DS26LS33A
- $\pm 0.2V$ sensitivity over the input voltage range on the DS26LS32 and DS26LS32A, $\pm 0.5V$ sensitivity on the DS26LS33 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 outputs, with choice of complementary output enables for receiving directly onto a data bus

Logic Diagram



Connection Diagram



Truth Table

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

HI-Z = TRI-STATE

Note: Input conditions may be any combination not defined for ENABLE and ENABLE.

Order Number DS26LS32CM, DS26LS32CN, DS26LS32MJ, DS26LS32ACM, DS26LS32ACN, DS26LS33CN, DS26LS33MJ or DS26LS33ACN
See NS Package Number J16A, M16A or N16A

For Complete Military 883 Specifications, See RETS Data Sheet.

Order Number DS26LS32MJ/883, DS26LS32MW/883, DS26LS33MJ/883, DS26LS33MW/883
See NS Package Number J16A or W16A

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Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please 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 |
| DS26LS32A | 1051 mW |

*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

| | |
|---|-----------------|
| Storage Temperature Range | -65°C to +165°C |
| Lead Temperature (Soldering, 4 seconds) | 260°C |

Operating Conditions

| | Min | Max | Units |
|------------------------------------|------|------|-------|
| Supply Voltage, (V _{CC}) | | | |
| DS26LS32M, DS26LS33M (MIL) | 4.5 | 5.5 | V |
| DS26LS32C, DS26LS33C (COML) | 4.75 | 5.25 | V |
| Temperature, (T _A) | | | |
| DS26LS32M, DS26LS33M (MIL) | -55 | +125 | °C |
| DS26LS32C, DS26LS33C (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 ≤ V _{CM} ≤ +7V | -0.2 | ±0.07 | 0.2 | V | |
| | | DS26LS33, DS26LS33A, -15V ≤ V _{CM} + 15V | -0.5 | ±0.14 | 0.5 | V | |
| R _{IN} | Input Resistance | -15V ≤ V _{CM} ≤ +15V (One Input AC GND) | 6.0 | 8.5 | | kΩ | |
| I _{IN} | Input Current (Under Test) | V _{IN} = 15V, Other Input -15V ≤ V _{IN} ≤ +15V | | | 2.3 | mA | |
| | | V _{IN} = -15V, Other Input -15V ≤ V _{IN} ≤ +15V | | | -2.8 | mA | |
| V _{OH} | Output High Voltage | V _{CC} = MIN, ΔV _{IN} = 1V, V _{ENABLE} = 0.8V, I _{OH} = -440 μA | Commercial | 2.7 | 4.2 | | V |
| | | | Military | 2.5 | 4.2 | | V |
| V _{OL} | Output Low Voltage | V _{CC} = Min, ΔV _{IN} = -1V, V _{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, ΔV _{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.

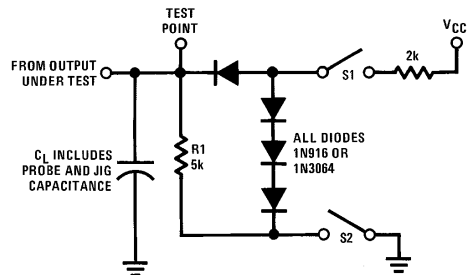
Note 4: Only one output at a time should be shorted.

Switching Characteristics $V_{CC} = 5V, T_A = 25^\circ C$

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

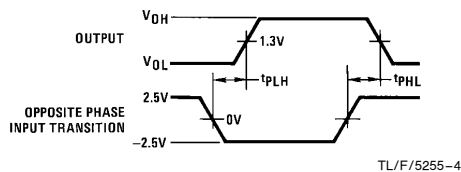
AC Test Circuit and Switching Time Waveforms

Load Test Circuit for TRI-STATE Outputs



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Propagation Delay (Notes 1 and 3)



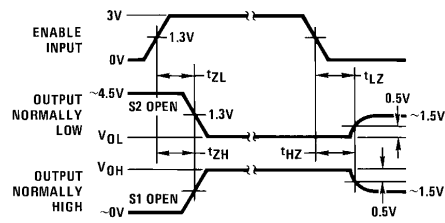
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Note 1: Diagram shown for ENABLE low.

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

Note 3: Pulse generator for all pulses: Rate = 1.0 MHz; $Z_O = 50\Omega$; $t_r \leq 6\text{ ns}$; $t_f \leq 6.0\text{ ns}$.

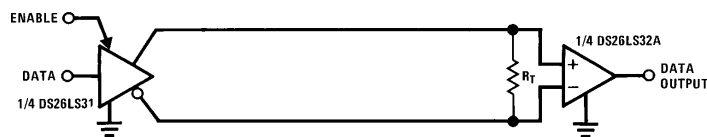
Enable and Disable Times (Notes 2 and 3)



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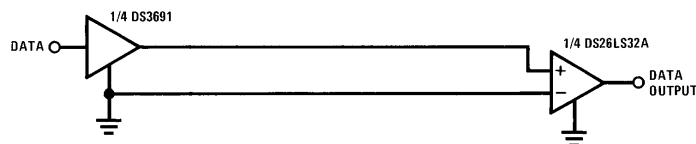
Typical Applications

Two-Wire Balanced Interface—RS-422



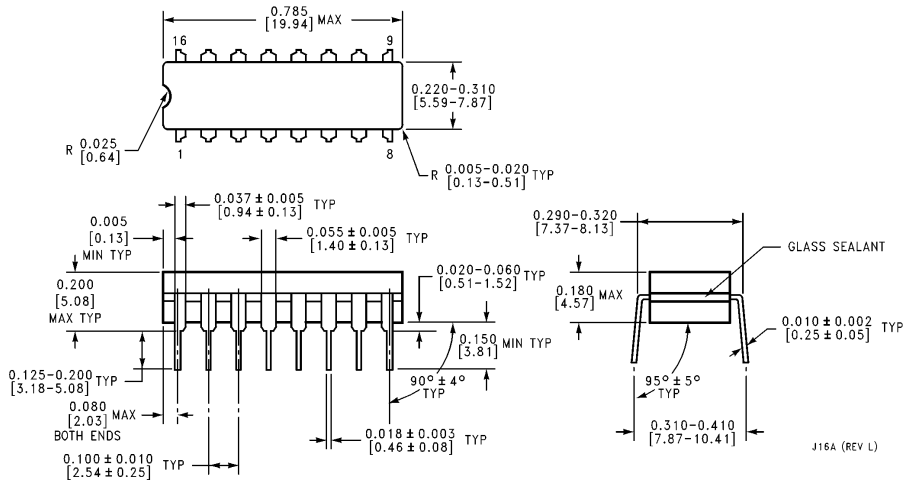
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Single Wire with Driver Ground Reference—RS-423



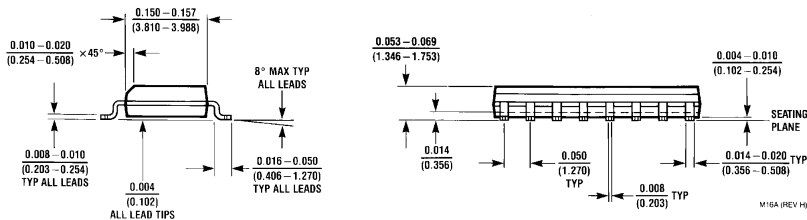
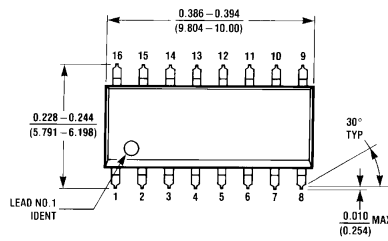
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Physical Dimensions inches (millimeters)



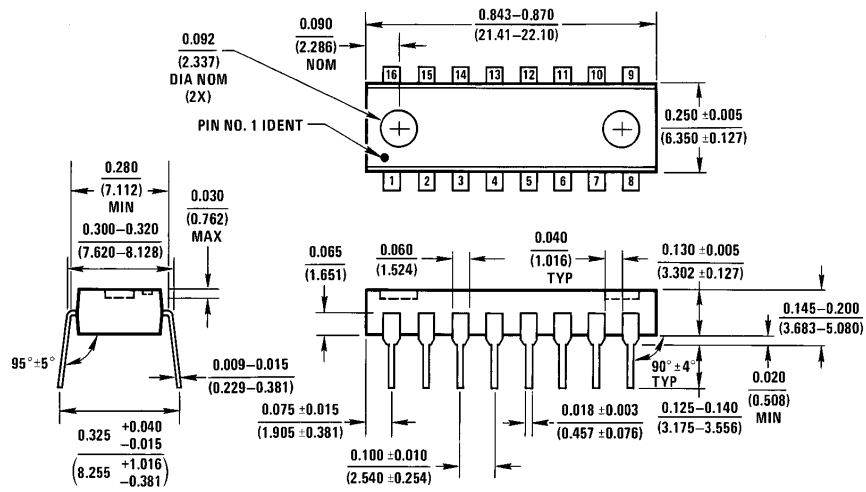
Ceramic Dual-In-Line Package (J)

Order Number DS26LS32MJ, DS26LS33MJ, DS26LS32MJ/883 or DS26LS33MJ/883
NS Package Number J16A



Small Outline Package (M)
Order Number DS26LS32CM or DS26LS32ACM
NS Package Number M16A

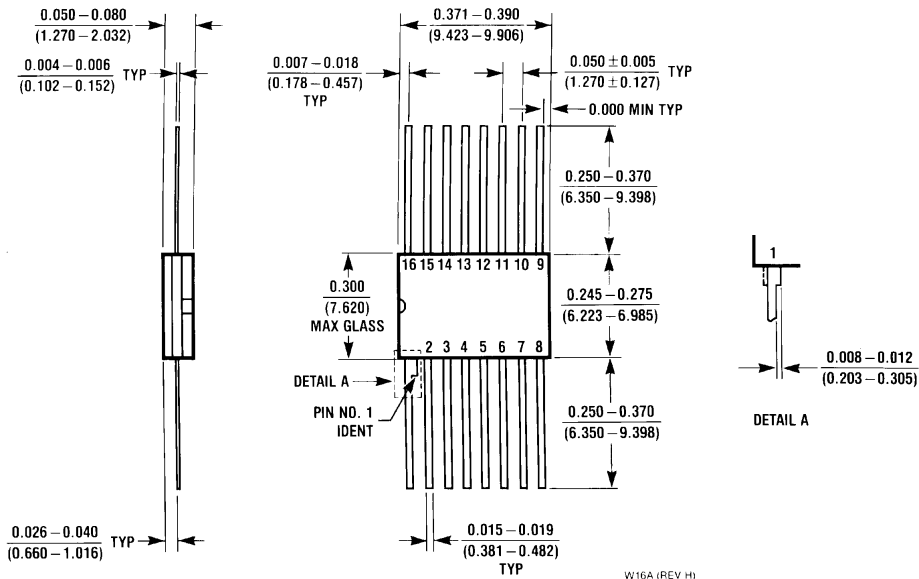
Physical Dimensions inches (millimeters) (Continued)



N16A (REV E)

Molded Dual-In-Line Package (N)
Order Number DS26LS32CN, DS26LS32ACN, DS26LS33CN or DS26LS33ACN
NS Package Number N16A

Physical Dimensions inches (millimeters) (Continued)



16 Lead Ceramic Flatpak (W)
Order Number DS26LS32MW/883 or DS26LS33MW/883
NS Package Number W16A

W16A (REV H)

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