SYC SEMICONDUCTORES Y COMPONENTES

26LS32-SMD

# 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 have an input sensitivity of 500 mV over the input voltage range of ±15V.

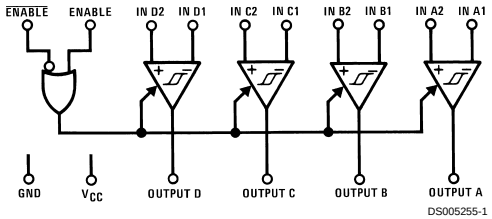
The DS26LS32A differ in function from the popular DS26LS32 and DS26LS33 in that input pull-up and pull-down resistors are included which prevent output oscillation on unused channels.

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 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
- ±0.2V sensitivity over the input voltage range on the DS26LS32 and DS26LS32A, ±0.5V sensitivity on the DS26LS33
- 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
- Operation from a single 5V supply
- TRI-STATE outputs, with choice of complementary output enables for receiving directly onto a data bus

## Logic Diagram

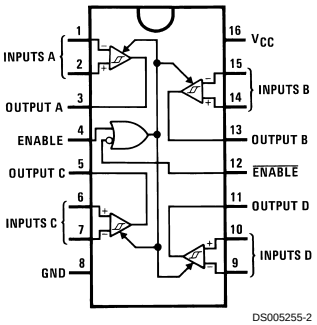



DS005255-1

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## Connection Diagram

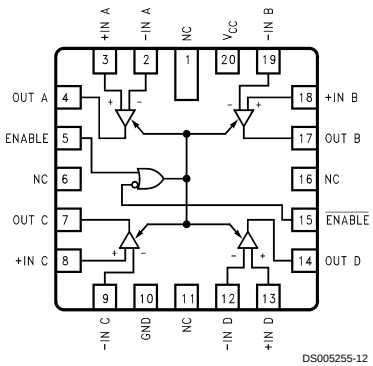
**Dual-In-Line Package**




DS005255-2

**Top View**
**Order Number DS26LS32CM, DS26LS32CN, DS26LS32ACM, DS26LS32ACN, DS26LS33ACM or DS26LS33ACN**
**See NS Package Number M16A or N16E**
**For Complete Military Product Specifications, refer to the appropriate SMD or MDS.**
**Order Number DS26LS32MJ/883, DS26LS32MW/883, DS26LS32ME/883, DS26LS33MW/883**
**See NS Package Number E20A, J16A or W16A**

**20-Lead Ceramic Leadless Chip Carrier**




DS005255-12

## Truth Table

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

Hi-Z = TRI-STATE®
Note: Input conditions may be any combination not defined for ENABLE and $\overline{\text{ENABLE}}$ .

## Absolute Maximum Ratings (Note 3)

**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 (Note 1) at 25˚C | |
| Cavity Package | 1433 mW |
| Molded Dip Package | 1362 mW |
| SO Package DS26LS32 | 1002 mW |
| DS26LS32A | 1051 mW |
| 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 DS26LS32AC (COML) | 4.75 | 5.25 | V |
| Temperature, ($T_A$) | | | |
| DS26LS32M, DS26LS33M (MIL) | −55 | +125 | ˚C |
| DS26LS32C DS26LS32AC (COML) | 0 | +70 | ˚C |

**Note 1:** Derate cavity package 9.6 mW/˚C above 25˚C; derate molded DIP package 10.9 mW/˚C above 25˚C.

**Note 2:** Derate SO Package 8.01 mW/˚C for DS26LS32
8.41 mW/˚C for DS26LS32A

## Electrical Characteristics (Notes 4, 5, 6)

over the operating temperature range unless otherwise specified

| 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 µA | 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 3:** "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 4:** 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 5:** All typical values are $V_{CC}$ = 5V, $T_A$ = 25˚C.

**Note 6:** Only one output at a time should be shorted.

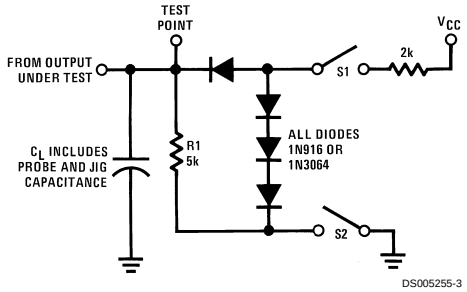
## Switching Characteristics

$V_{CC}$ = 5V, $T_A$ = 25˚C

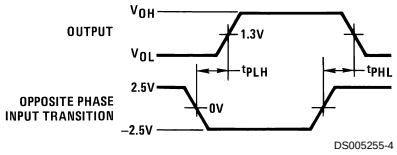
| Symbol | Parameter | Conditions | DS26LS32/DS26LS33 | | | DS26LS32A/DS26LS33A | | | Units |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $t_{PLH}$ | Input to Output | $C_L$ = 15 pF | | 17 | 25 | | 23 | 35 | ns |
| $t_{PHL}$ | | | | 17 | 25 | | 23 | 35 |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

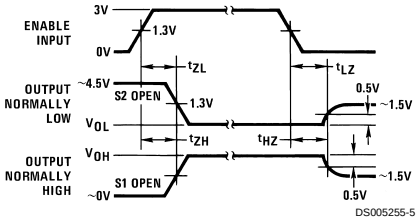
**Load Test Circuit for TRI-STATE® Outputs**




**Propagation Delay** (Notes 7, 9)




**Enable and Disable Times** (Notes 8, 9)



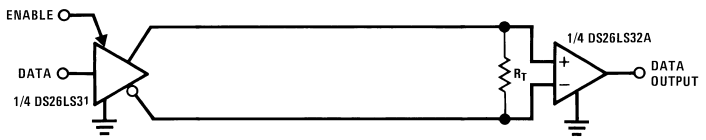

**Note 7:** Diagram shown for $\overline{\text{ENABLE}}$ low.

**Note 8:** S1 and S2 of load circuit are closed except where shown.

**Note 9:** Pulse generator for all pulses: Rate = 1.0 MHz; $Z_O$ = 50Ω; $t_r \leq 6$ ns; $t_f \leq 6.0$ ns.

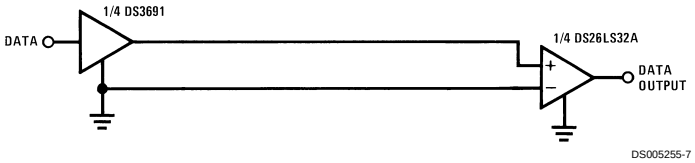
## Typical Applications

**Two-Wire Balanced Interface — RS-422**



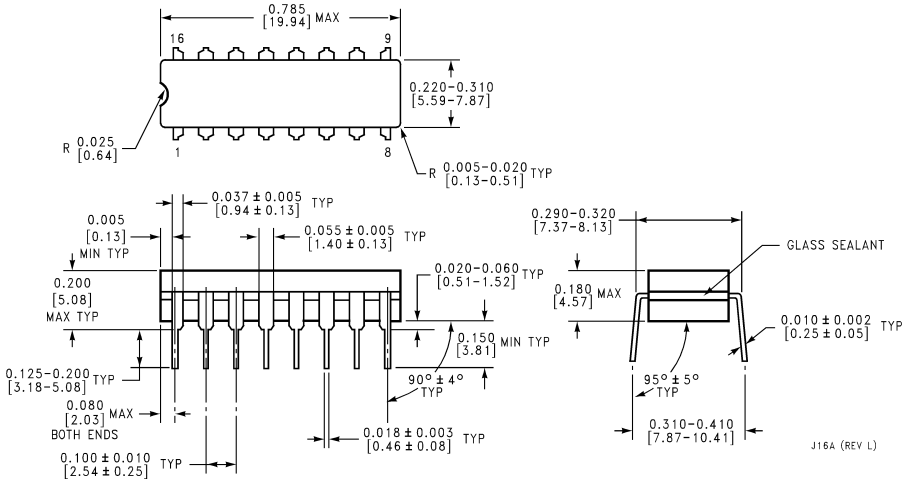
## Typical Applications (Continued)

**Single Wire with Driver Ground Reference — RS-423**

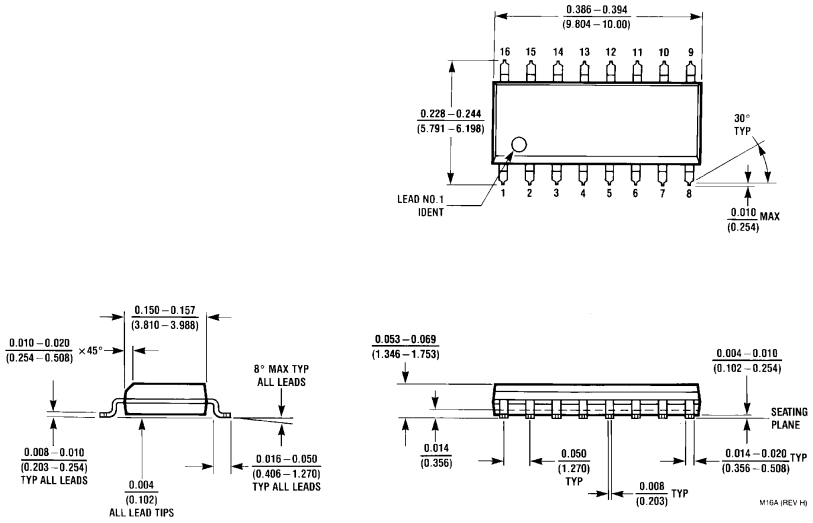



DS005255-7

## Physical Dimensions inches (millimeters) unless otherwise noted

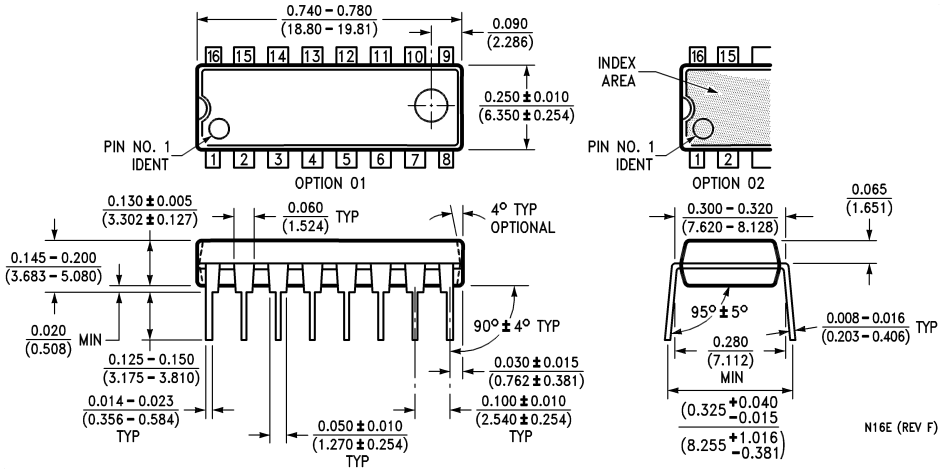



**Ceramic Dual-In-Line Package (J)**
**Order Number DS26LS32MJ/883 or DS26LS33MJ/883**
**NS Package Number J16A**

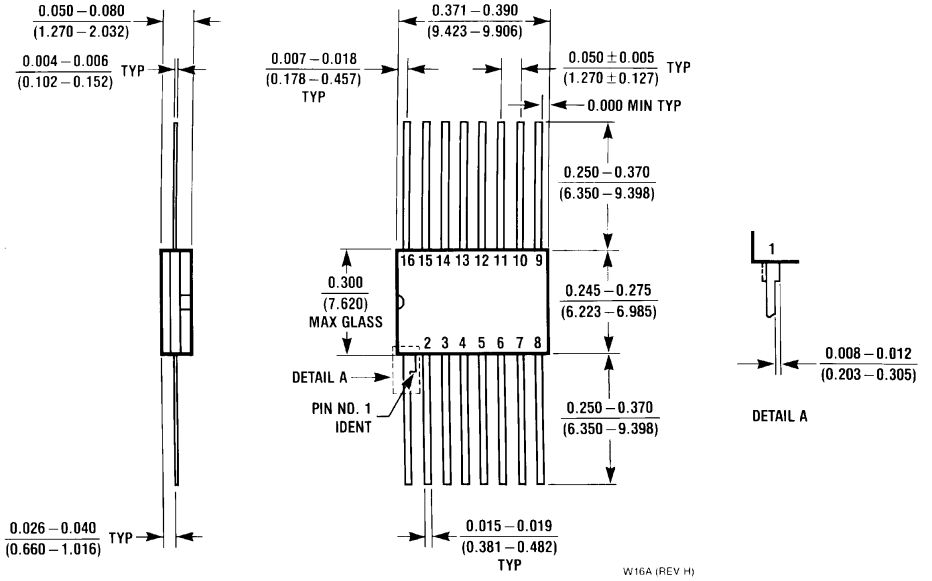



**Small Outline Package (M)**
**Order Number DS26LS32CM or DS26LS32ACM**
**NS Package Number M16A**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

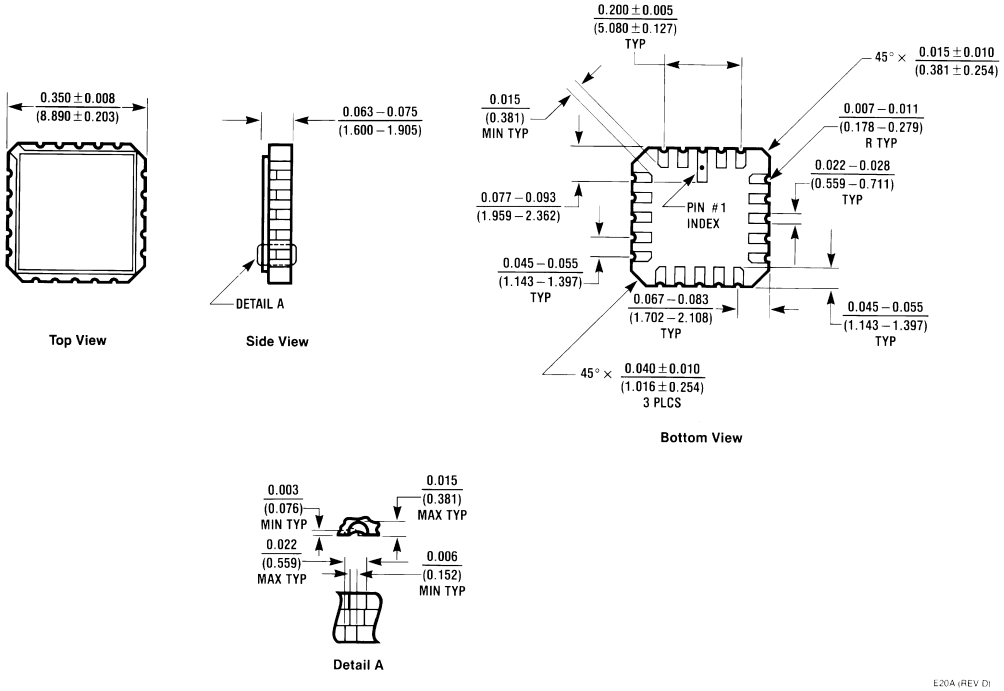



**Molded Dual-In-Line Package (N)**
**Order Number DS26LS32CN or DS26LS32ACN**
**NS Package Number N16E**




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

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)




**20 Lead Ceramic Leadless Chip Carrier (E)**
**Order Number DS26LS32ME/883**
**NS Package Number E20A**