

# DS26LS31C/DS26LS31M Quad High Speed Differential Line Driver

### **General Description**

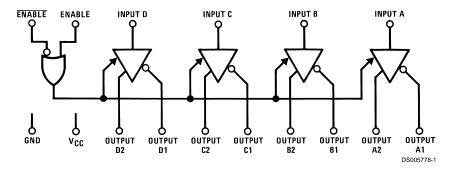
The DS26LS31 is a quad differential line driver designed for digital data transmission over balanced lines. The DS26LS31 meets all the requirements of EIA Standard RS-422 and Federal Standard 1020. It is designed to provide unipolar differential drive to twisted-pair or parallel-wire transmission lines.

The circuit provides an enable and disable function common to all four drivers. The DS26LS31 features TRI-STATE ® outputs and logically ANDed complementary outputs. The inputs are all LS compatible and are all one unit load.

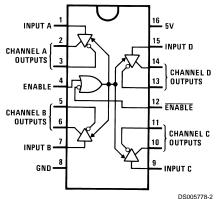
#### **Features**

- Output skew 2.0 ns typical
- Input to output delay 10 ns typical
- Operation from single 5V supply
- Outputs won't load line when V<sub>CC</sub> = 0V
- Four line drivers in one package for maximum package density
- Output short-circuit protection
- Complementary outputs
- Meets the requirements of EIA Standard RS-422
- Pin compatible with AM26LS31
- Available in military and commercial temperature range

## **Logic and Connection Diagrams**



#### **Dual-In-Line Package**



#### **Top View**

Order Number DS26LS31CM, or DS26LS31CN
See NS Package M16A or N16E
For Complete Military Product Specifications,
refer to the appropriate SMD or MDS.
Order Number DS26LS31MJ/883, DS26LS31ME/883 or DS26LS31MW/883
See NS Package E20A, J16A or W16A

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Supply Voltage

#### **Absolute Maximum Ratings** (Note 2)

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

Input Voltage	7V
Output Voltage	5.5V
Output Voltage (Power OFF)	-0.25 to 6V
Maximum Power Dissipation (Note 1) at 25°C	
Cavity Package	1509 mW

Molded DIP Package 1476 mW SO Package 1051 mW

# **Operating Conditions**

	Min	Max	Units
Supply Voltage, V <sub>CC</sub>			
DS26LS31M	4.5	5.5	V
DS26LS31	4.75	5.25	V
Temperature, T <sub>A</sub>			
DS26LS31M	-55	+125	°C
DS26LS31	0	+70	°C

Note 1: Derate cavity package 10.1 mW/°C above 25°C; derate molded DIP package 11.9 mW/°C above 25°C; derate SO package 8.41 mW/°C above 25°C.

#### Electrical Characteristics (Notes 3, 4, 5)

Symbol	Parameter	Conditions	Min	Тур	Max	Units
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -20 mA	2.5			V
V <sub>OL</sub>	Output Low Voltage	I <sub>OL</sub> = 20 mA			0.5	V
V <sub>IH</sub>	Input High Voltage		2.0			V
V <sub>IL</sub>	Input Low Voltage				0.8	V
I <sub>IL</sub>	Input Low Current	V <sub>IN</sub> = 0.4V		-40	-200	μA
I <sub>IH</sub>	Input High Current	V <sub>IN</sub> = 2.7V			20	μA
I <sub>I</sub>	Input Reverse Current	V <sub>IN</sub> = 7V			0.1	mA
Io	TRI-STATE Output Current	V <sub>O</sub> = 2.5V			20	μA
		V <sub>O</sub> = 0.5V			-20	μA
V <sub>CL</sub>	Input Clamp Voltage	I <sub>IN</sub> = -18 mA			-1.5	V
I <sub>sc</sub>	Output Short-Circuit Current		-30		-150	mA
I <sub>cc</sub>	Power Supply Current	All Outputs Disabled		35	60	mA
		or Active				

7V

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

Symbol	Parameter	Conditions	Min	Тур	Max	Units
t <sub>PLH</sub>	Input to Output	C <sub>L</sub> = 30 pF		10	15	ns
t <sub>PHL</sub>	Input to Output	C <sub>L</sub> = 30 pF		10	15	ns
Skew	Output to Output	C <sub>L</sub> = 30 pF		2.0	6.0	ns
t <sub>LZ</sub>	Enable to Output	C <sub>L</sub> = 10 pF, S2 Open		15	35	ns
t <sub>HZ</sub>	Enable to Output	C <sub>L</sub> = 10 pF, S1 Open		15	25	ns
t <sub>ZL</sub>	Enable to Output	C <sub>L</sub> = 30 pF, S2 Open		20	30	ns
t <sub>zH</sub>	Enable to Output	C <sub>L</sub> = 30 pF, S1 Open		20	30	ns

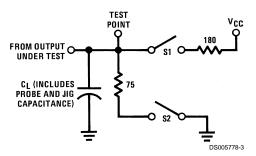
Note 2: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

Note 3: Unless otherwise specified min/max limits apply across the -55°C to +125°C temperature range for the DS726LS31M and across the 0°C to +70°C range for the DS26LS31. All typicals are given for V  $_{CC}$  = 5V and  $T_{A}$  = 25  $^{\circ}C.$ 

Note 4: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to ground unless otherwise specified.

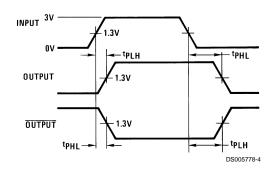
Note 5: Only one output at a time should be shorted.

# **AC Test Circuit and Switching Time Waveforms**



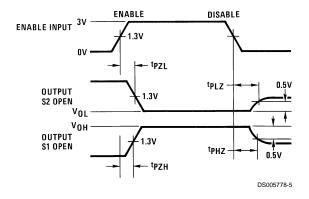
S1 and S2 of load circuit are closed except where shown.

FIGURE 1. AC Test Circuit



f = 1 MHz,  $t_r \le 15$  ns,  $t_f \le 6$  ns

FIGURE 2. Propagation Delays



 $f = 1 \text{ MHz}, t_r \le 15 \text{ ns}, t_f \le 6 \text{ ns}$ 

FIGURE 3. Enable and Disable Times

# **Typical Applications**

Two-Wire Balanced System, RS-422

ENABLE O

DATA O

1/4 DS26LS32

DATA OUTPUT

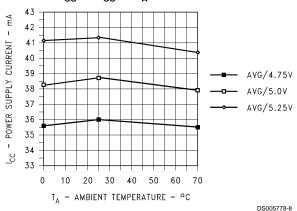
DS005778-6

 $\textbf{Note 6:} \ \ \mathsf{R}_{\mathsf{T}} \ \mathsf{is \ optional \ although \ highly \ recommended \ to \ reduce \ reflection}.$ 

# **Typical Performance Characteristics**

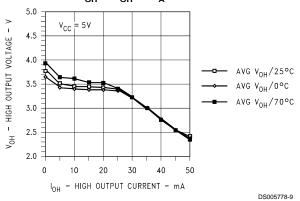
# DS26LS31CN Unloaded I<sub>C</sub> vs Frequency vs T<sub>A</sub> THE STATE OF THE STATE

# DS26LS31 I<sub>CC</sub> vs V<sub>CC</sub> vs T<sub>A</sub>

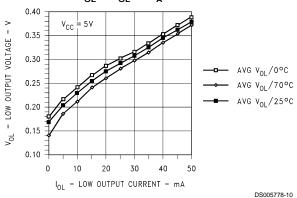


DS26LS31CN  $V_{OH}$  vs  $I_{OH}$  vs  $T_{A}$ 

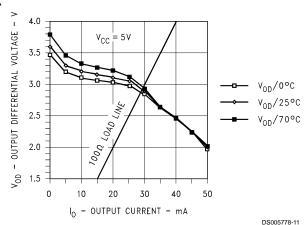
f - SWITCHING FREQUENCY - MHz



#### DS26LS31CN $V_{\rm OL}$ vs $I_{\rm OL}$ vs $T_{\rm A}$

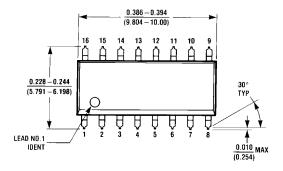


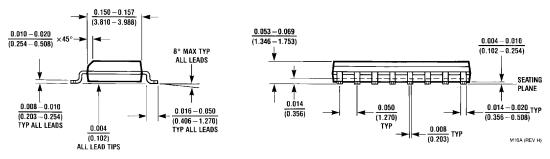
DS26LS31CN  $V_{\rm OD}$  vs  $I_{\rm O}$  vs  $T_{\rm A}$ 



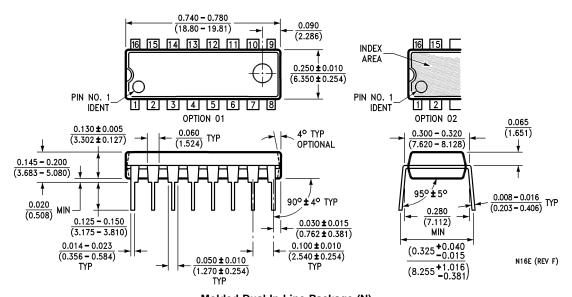
DS005778-7

## Physical Dimensions inches (millimeters) unless otherwise noted



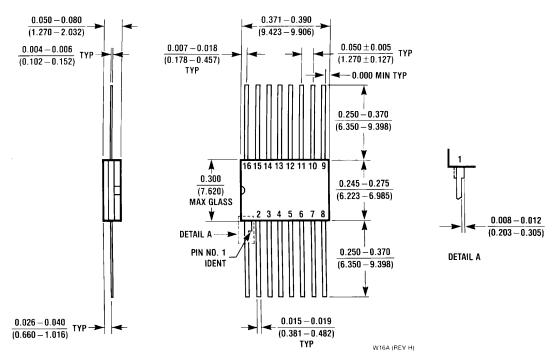


Small Outline Package (M) Order Number DS26LS31CM NS Package Number M16A

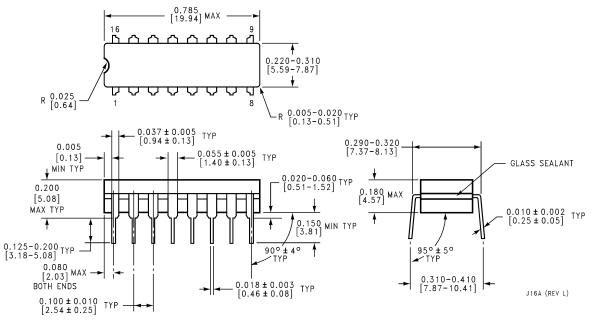


Molded Dual-In-Line Package (N) Order Number DS26LS31CN NS Package Number N16E

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

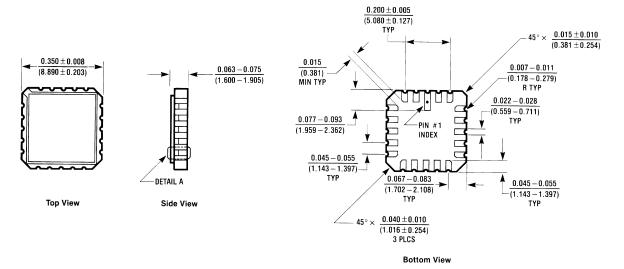


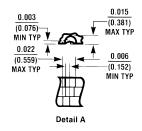
16 Lead Ceramic Flatpak (F)
Order Number DS26LS31MW/883
NS Package Number W16A



16 Lead Ceramic Dual-in-Line Package (J)
Order Number DS26LS31MJ/883
NS Package Number J16A

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





20 Lead Ceramic Leadless Chip Carrier (E)

O Lead Ceramic Leadless Chip Carrier (E)
Order Number DS26LS31MJE/883
NS Package Number E20A

#### LIFE SUPPORT POLICY

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- A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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E20A (REV D)