

## DS26F31M Quad High Speed Differential Line Drivers

Check for Samples: [DS26F31M](#)

### FEATURES

- **Military Temperature Range**
- **Output Skew—2.0 ns Typical**
- **Input to Output Delay—10 ns**
- **Operation from Single +5.0V Supply**
- **16-lead CDIP Package**
- **Outputs Won't Load Line When  $V_{CC} = 0V$**
- **Output Short Circuit Protection**
- **Meets the Requirements of EIA Standard RS-422**
- **High Output Drive Capability for 100Ω Terminated Transmission Lines**

### DESCRIPTION

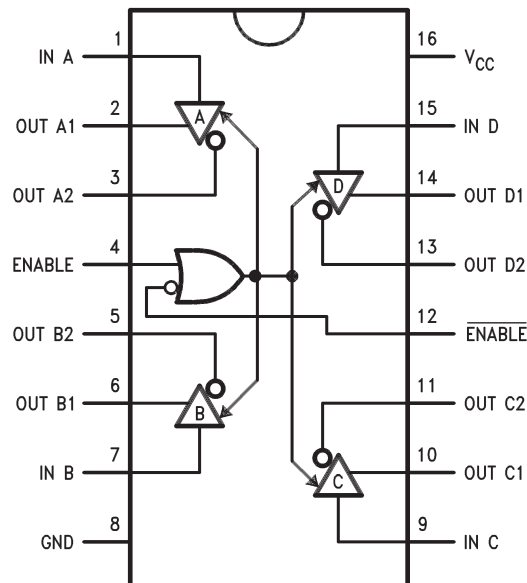
The DS26F31 is a quad differential line driver designed for digital data transmission over balanced lines. The DS26F31 meets all the requirements of EIA Standard RS-422 and Federal Standard 1020. It is designed to provide unipolar differential drive to twisted-pair or parallel-wire transmission lines.

The DS26F31 offers improved performance due to the use of state-of-the-art L-FAST bipolar technology. The L-FAST technology allows for higher speeds and lower currents by utilizing extremely short gate delay times. Thus, the DS26F31 features lower power, extended temperature range, and improved specifications.

The circuit provides an enable and disable function common to all four drivers. The DS26F31M features tri-state outputs and logical OR-ed complementary enable inputs. The inputs are all LS compatible and are all one unit load.

The DS26F31M offers optimum performance when used with the DS26F32 Quad Differential Line Receiver.

### Connection and Logic Diagrams



For Complete Military Product Specifications, refer to the appropriate SMD or MDS.

**Figure 1. 16-Lead CDIP Package (Top View)**  
**See Package Numbers NAJ0020A, NFE0016A, or NAD0016A**



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.

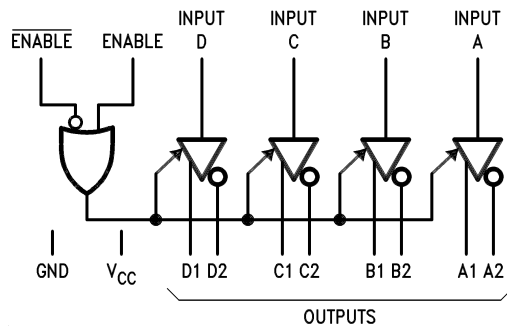


Figure 2. Logic Symbol

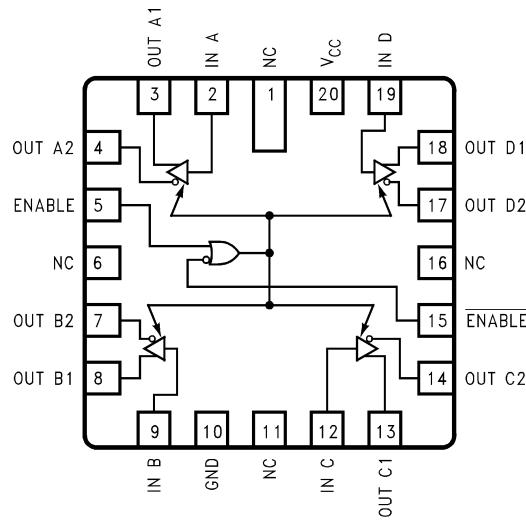


Figure 3. 20-Lead LCCC (NAJ0020A)



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### Absolute Maximum Ratings<sup>(1)(2)</sup>

Storage Temperature Range CDIP	-65°C to +175°C	
Lead Temperature CDIP (Soldering, 60 sec.)	300°C	
Maximum Power <sup>(3)</sup> Dissipation at 25°C	Cavity Package	1500 mW
Supply Voltage	7.0V	
Input Voltage	7.0V	
Output Voltage	5.5V	

- (1) Absolute Maximum Ratings are those values beyond which the safety of the device cannot be ensured. They are not meant to imply that the devices should be operated at these limits. The [Electrical Characteristics](#) provide conditions for actual device operation.
- (2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
- (3) Derate cavity package 10 mW/°C above 25°C.

### Operating Range

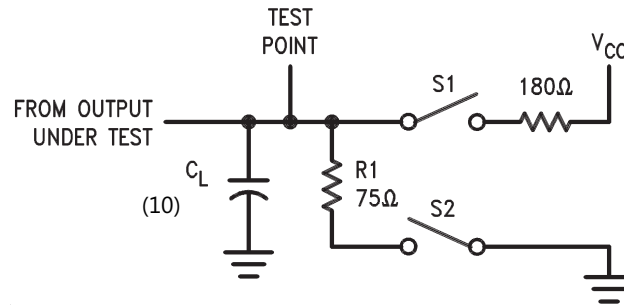
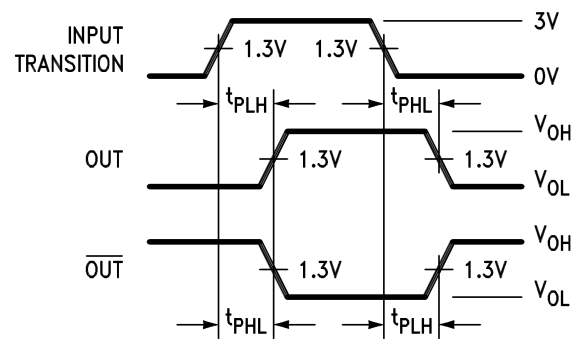
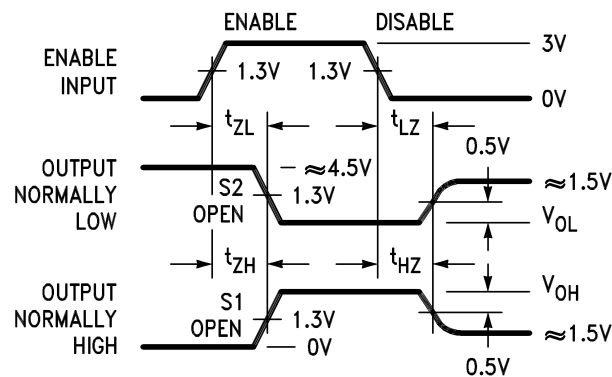
DS26F31M	Temperature	-55°C to +125°C
	Supply Voltage	4.5V to 5.5V

### Electrical Characteristics<sup>(1)(2)</sup>

over operating range, unless otherwise specified

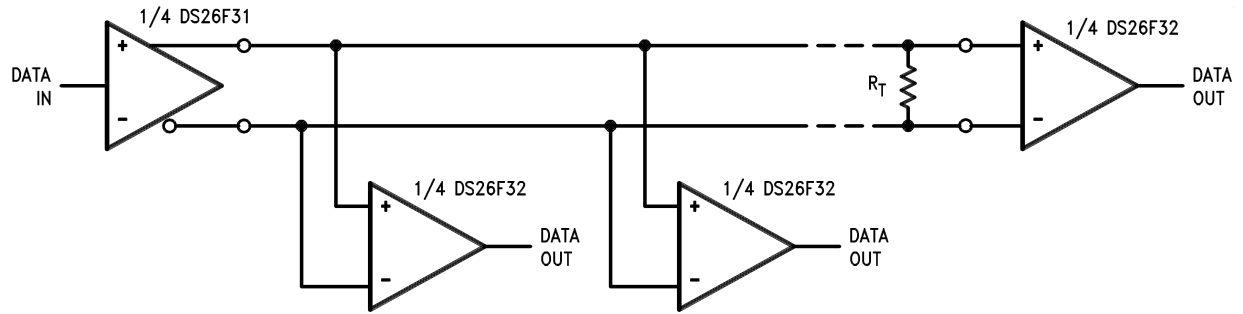
Symbol	Parameter	Conditions	Min	Typ	Max	Units
V <sub>OH</sub>	Output Voltage HIGH	V <sub>CC</sub> = Min, I <sub>OH</sub> = -20 mA	2.5	3.2		V
V <sub>OL</sub>	Output Voltage LOW	V <sub>CC</sub> = Min, I <sub>OL</sub> = 20 mA		0.32	0.5	V
V <sub>IH</sub>	Input Voltage HIGH	V <sub>CC</sub> = Min	2.0			V
V <sub>IL</sub>	Input Voltage LOW	V <sub>CC</sub> = Max			0.8	V
I <sub>IL</sub>	Input Current LOW	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V		-0.10	-0.20	mA
I <sub>IH</sub>	Input Current HIGH	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V		0.5	20	μA
I <sub>IR</sub>	Input Reverse Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 7.0V		0.001	0.1	mA
I <sub>OZ</sub>	Off State (High Impedance) Output Current	V <sub>CC</sub> = Max V <sub>O</sub> = 2.5V V <sub>O</sub> = 0.5V		0.5 0.5	20 -20	μA
V <sub>IC</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = -18 mA		-0.8	-1.5	V
I <sub>OS</sub>	Output Short Circuit	V <sub>CC</sub> = Max <sup>(3)</sup>	-30	-60	-150	mA
I <sub>CCX</sub>	Supply Current	V <sub>CC</sub> = Max, All Outputs Disabled			50	mA
I <sub>CC</sub>		V <sub>CC</sub> = Max, All Outputs Enabled			40	mA
t <sub>PLH</sub>	Input to Output	V <sub>CC</sub> = 5.0V, T <sub>A</sub> = 25°C, Load = <sup>(4)</sup> <sup>(5)</sup>		10	15	ns
t <sub>PHL</sub>	Input to Output	V <sub>CC</sub> = 5.0V, T <sub>A</sub> = 25°C, Load = <sup>(4)</sup>		10	15	ns
SKEW	Output to Output	V <sub>CC</sub> = 5.0V, T <sub>A</sub> = 25°C, Load = <sup>(4)</sup> <sup>(5)</sup>		2.0	4.5	ns
t <sub>LZ</sub>	Enable to Output	V <sub>CC</sub> = 5.0V, T <sub>A</sub> = 25°C, C <sub>L</sub> = 10 pF		23	32	ns
t <sub>HZ</sub>	Enable to Output	V <sub>CC</sub> = 5.0V, T <sub>A</sub> = 25°C, C <sub>L</sub> = 10 pF		15	25	ns
t <sub>ZL</sub>	Enable to Output	V <sub>CC</sub> = 5.0V, T <sub>A</sub> = 25°C, Load = <sup>(4)</sup>		20	30	ns
t <sub>ZH</sub>	Enable to Output	V <sub>CC</sub> = 5.0V, T <sub>A</sub> = 25°C, Load = <sup>(4)</sup>		23	32	ns

- (1) Unless otherwise specified min/max limits apply across the -55°C to +125°C temperature range for the DS26F31M and across the 0°C to +70°C range for the DS26F31C. All typicals are given for V<sub>CC</sub> = 5V and T<sub>A</sub> = 25°C.
- (2) All currents into the device pins are positive; all currents out of the device pins are negative. All voltages are referenced to ground unless otherwise specified.
- (3) Only one output at a time should be shorted.
- (4) C<sub>L</sub> = 30 pF, V<sub>I</sub> = 1.3V to V<sub>O</sub> = 1.3V, V<sub>PULSE</sub> = 0V to +3V (See AC Load Test Circuit for tri-state Outputs).
- (5) Skew is defined as the difference in propagation delays between complementary outputs at the 50% point.

**TEST CIRCUIT AND TIMING WAVEFORMS<sup>(6)(7)(8)(9)</sup>**

**Figure 4. AC Load Test Circuit for Tri-State Outputs<sup>(10)</sup>**

**Figure 5. Propagation Delay<sup>(11)(10)</sup>**

**Figure 6. Enable and Disable Times<sup>(10)(12)</sup>**

- (6) Diagram shown for Enable Low. Switches S1 and S2 open.
- (7) S1 and S2 of Load Circuit are closed except where shown.
- (8) Pulse Generator for all Pulses: Rate  $\leq 1.0$  MHz,  $Z_O = 50\Omega$ ,  $t_r \leq 6.0$  ns,  $t_f \leq 6.0$  ns.
- (9)  $C_L$  includes probe and jig capacitance.
- (10) All currents into the device pins are positive; all currents out of the device pins are negative. All voltages are referenced to ground unless otherwise specified.
- (11) Absolute Maximum Ratings are those values beyond which the safety of the device cannot be ensured. They are not meant to imply that the devices should be operated at these limits. The [Electrical Characteristics](#) provide conditions for actual device operation.
- (12) Unless otherwise specified min/max limits apply across the  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$  temperature range for the DS26F31M and across the  $0^\circ\text{C}$  to  $+70^\circ\text{C}$  range for the DS26F31C. All typicals are given for  $V_{CC} = 5\text{V}$  and  $T_A = 25^\circ\text{C}$ .

**TYPICAL APPLICATION**



**Figure 7. Typical Application**

## REVISION HISTORY

Changes from Revision B (April 2013) to Revision C	Page
• Changed layout of National Data Sheet to TI format .....	<a href="#">5</a>

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)