

# AM26LV31 Low-Voltage High-Speed Quadruple Differential Line Drivers

## 1 Features

- Switching rates up to 32MHz
- Operate from a single 3.3V supply
- Propagation delay time: 8ns typical
- Pulse skew time: 500ps typical
- High output-drive current:  $\pm 30$  mA
- Controlled rise and fall times: 3ns typical
- Differential output voltage with 100 $\Omega$  load: 1.5V typical
- Ultra-low power dissipation
  - DC, 0.3mW maximum
  - 32MHz All channels (no load), 385mW typical
- Accept 5V logic inputs with 3.3V supply
- Low-voltage pin-to-pin compatible replacement for AM26C31, AM26LS31, MB571
- High output impedance in power-off condition
- Driver output short-protection circuit
- Package options include plastic small-outline (D, NS) packages

## 2 Applications

- Motor control: [brushless DC](#) and [brushed DC](#)
- [Field transmitters](#): temperature sensors and pressure sensors
- [Temperature sensors](#) or controllers using Modbus

## 3 Description

The AM26LV31C and AM26LV31I are BiCMOS quadruple differential line drivers with 3-state outputs. They are designed to be similar to TIA/EIA-422-B and ITU Recommendation V.11 drivers with reduced supply-voltage range.

The devices are optimized for balanced-bus transmission at switching rates up to 32MHz. The outputs have very high current capability for driving balanced lines such as twisted-pair transmission lines and provide a high impedance in the power-off condition. The enable function is common to all four drivers and offers the choice of active-high or active-low enable inputs. The AM26LV31C and AM26LV31I are designed using Texas Instruments proprietary LinIMPACT-C60™ technology, facilitating ultra-low power consumption without sacrificing speed. These devices offer optimum performance when used with the AM26LV32 quadruple line receivers.

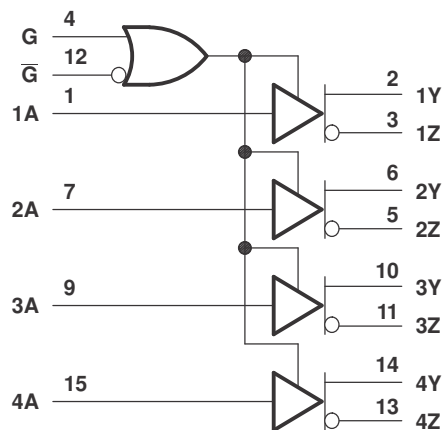
The AM26LV31C is characterized for operation from 0°C to 70°C. The AM26LV31I is characterized for operation from –45°C to 85°C.

### Package Information

| PART NUMBER | PACKAGE <sup>(1)</sup> | PACKAGE SIZE <sup>(2)</sup> |
|-------------|------------------------|-----------------------------|
| AM26LV31C   | SOIC (D) 16            | 9.9mm x 6mm                 |
| AM26LV31I   | SOIC (D) 16            | 9.9mm x 6mm                 |
|             | SO (NS) 16             | 10.2mm x 7.8mm              |

(1) For more information, see [Section 11](#).

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



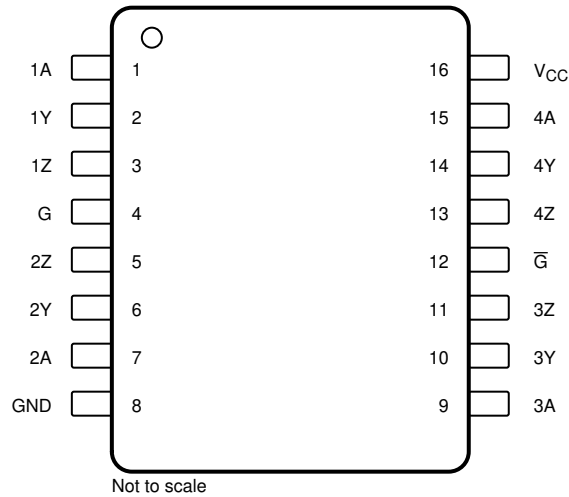
Logic Diagram (Positive Logic)



## Table of Contents

|  |    |  |    |
|--|----|--|----|
| <b>1 Features</b> .....                          | 1  | 7.4 Device Functional Modes.....                                 | 11 |
| <b>2 Applications</b> .....                      | 1  | <b>8 Application and Implementation</b> .....                    | 12 |
| <b>3 Description</b> .....                       | 1  | 8.1 Application Information.....                                 | 12 |
| <b>4 Pin Configuration and Functions</b> .....   | 3  | 8.2 Typical Application.....                                     | 12 |
| <b>5 Specifications</b> .....                    | 4  | 8.3 Power Supply Recommendations.....                            | 13 |
| 5.1 Absolute Maximum Ratings.....                | 4  | 8.4 Layout.....  | 13 |
| 5.2 ESD Ratings.....                             | 4  | <b>9 Device and Documentation Support</b> .....                  | 15 |
| 5.3 Recommended Operating Conditions.....        | 4  | 9.1 Device Support.....  | 15 |
| 5.4 Thermal Information.....                     | 4  | 9.2 Receiving Notification of Documentation Updates....          | 15 |
| 5.5 Electrical Characteristics.....              | 5  | 9.3 Support Resources.....                                       | 15 |
| 5.6 Switching Characteristics.....               | 5  | 9.4 Trademarks.....  | 15 |
| 5.7 Typical Characteristics.....                 | 6  | 9.5 Electrostatic Discharge Caution.....                         | 15 |
| <b>6 Parameter Measurement Information</b> ..... | 7  | 9.6 Glossary.....  | 15 |
| <b>7 Detailed Description</b> .....              | 10 | <b>10 Revision History</b> .....                                 | 15 |
| 7.1 Overview.....                                | 10 | <b>11 Mechanical, Packaging, and Orderable Information</b> ..... | 16 |
| 7.2 Functional Block Diagram.....                | 10 |  |    |
| 7.3 Feature Description.....                     | 10 |  |    |

## 4 Pin Configuration and Functions



**Figure 4-1. D or NS Package, SOIC 16 Pins  
(Top View)**

**Table 4-1. Pin Functions**

| PIN |                 | I/O | DESCRIPTION              |
|-----|-----------------|-----|--------------------------|
| NO. | NAME            |     |                          |
| 1   | 1A              | I   | Driver 1 input           |
| 2   | 1Y              | O   | Driver 1 output          |
| 3   | 1Z              | O   | Driver 1 inverted output |
| 4   | G               | I   | Active high enable       |
| 5   | 2Z              | O   | Driver 2 inverted output |
| 6   | 2Y              | O   | Driver 2 output          |
| 7   | 2A              | I   | Driver 2 input           |
| 8   | GND             | —   | Ground pin               |
| 9   | 3A              | I   | Driver 3 input           |
| 10  | 3Y              | O   | Driver 3 output          |
| 11  | 3Z              | O   | Driver 3 inverted output |
| 12  | $\bar{G}$       | I   | Active low enable        |
| 13  | 4Z              | O   | Driver 4 inverted output |
| 14  | 4Y              | O   | Driver 4 output          |
| 15  | 4A              | I   | Driver 4 input           |
| 16  | V <sub>CC</sub> | —   | Power pin                |

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|   | MIN  | MAX | UNIT |
|---|------|-----|------|
| Supply voltage range, $V_{CC}$ <sup>(2)</sup> | -0.3 | 6   | V    |
| Input voltage range, $V_I$                    | -0.3 | 6   | V    |
| Output voltage range, $V_O$                   | -0.3 | 6   | V    |
| Storage temperature, $T_{stg}$                | -65  | 150 | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values are with respect to GND.

### 5.2 ESD Ratings

|                                     |  | VALUE | UNIT |
|-------------------------------------|--|-------|------|
| $V_{(ESD)}$ Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | ±3000 | V    |
|                                     | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | ±250  |      |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 5.3 Recommended Operating Conditions

|          |                                | MIN       | NOM | MAX | UNIT |
|----------|--------------------------------|-----------|-----|-----|------|
| $V_{CC}$ | Supply voltage                 | 3         | 3.3 | 3.6 | V    |
| $V_{IH}$ | High-level input voltage       | 2         |     |     | V    |
| $V_{IL}$ | Low-level input voltage        |           |     | 0.8 | V    |
| $I_{OH}$ | High-level output current      |           |     | -30 | mA   |
| $I_{OL}$ | Low-level output current       |           |     | 30  | mA   |
| $T_A$    | Operating free-air temperature | AM26LV31C | 0   | 70  | °C   |
|          |                                | AM26LV31I | -45 | 85  | °C   |

### 5.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |  | D (SOIC) | NS (SO) | UNIT |
|-------------------------------|--|----------|---------|------|
|                               |  | 16 PINS  | 16 PINS |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | 84.6     | 88.5    | °C/W |
| $R_{\theta JC(top)}$          | Junction-to-case (top) thermal resistance    | 43.5     | 46.2    | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 43.2     | 50.7    | °C/W |
| $\psi_{JT}$                   | Junction-to-top characterization parameter   | 10.4     | 13.5    | °C/W |
| $\psi_{JB}$                   | Junction-to-board characterization parameter | 42.8     | 50.3    | °C/W |
| $R_{\theta JC(bot)}$          | Junction-to-case (bottom) thermal resistance | n/a      | n/a     | °C/W |

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 5.5 Electrical Characteristics

over recommended operating supply-voltage and free-air temperature ranges (unless otherwise noted)

| PARAMETER          |  | TEST CONDITIONS   | MIN  | TYP <sup>(1)</sup> | MAX  | UNIT |
|--------------------|--|---|------|--------------------|------|------|
| V <sub>IK</sub>    | Input clamp voltage  | I <sub>I</sub> = 18mA                                     |      |                    | -1.5 | V    |
| V <sub>OH</sub>    | High-level output voltage  | V <sub>IH</sub> = 2V, I <sub>OH</sub> = -12mA             | 1.85 | 2.3                |      | V    |
| V <sub>OL</sub>    | Low-level output voltage   | V <sub>IL</sub> = 0.8V, I <sub>OH</sub> = 12mA            |      | 0.8                | 1.05 | V    |
| V <sub>OD</sub>    | Differential output voltage <sup>(2)</sup>                       | R <sub>L</sub> = 100Ω                                     | 0.95 | 1.5                |      | V    |
| V <sub>OC</sub>    | Common-mode output voltage                                       |   | 1.3  | 1.55               | 1.9  | V    |
| Δ V <sub>Ocl</sub> | Change in magnitude of common-mode output voltage <sup>(2)</sup> |   |      |                    | ±0.2 | V    |
| I <sub>O</sub>     | Output current with power off                                    | V <sub>O</sub> = -0.25V or 6V, V <sub>CC</sub> = 0        |      |                    | ±100 | μA   |
| I <sub>OZ</sub>    | Off-state (high-impedance state) output current                  | V <sub>O</sub> = -0.25V or 6V, G = 0.8V or $\bar{G}$ = 2V |      |                    | ±100 | μA   |
| I <sub>H</sub>     | High-level input current   | V <sub>CC</sub> = 0 or 3V, V <sub>I</sub> = 5.5V          |      |                    | 10   | μA   |
| I <sub>L</sub>     | Low-level input current  | V <sub>CC</sub> = 3.6V, V <sub>I</sub> = 0                |      |                    | -10  | μA   |
| I <sub>OS</sub>    | Short-circuit output current                                     | V <sub>CC</sub> = 3.6V, V <sub>O</sub> = 0                |      |                    | -200 | mA   |
| I <sub>CC</sub>    | Supply current (all drivers)                                     | V <sub>I</sub> = V <sub>CC</sub> or GND, No load          |      |                    | 100  | μA   |
| C <sub>pd</sub>    | Power-dissipation capacitance (all drivers) <sup>(3)</sup>       | No load   |      | 160                |      | pF   |

(1) All typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = 25°C.

(2) Δ|V<sub>OD</sub>| and Δ|V<sub>Ocl</sub>| are the changes in magnitude of V<sub>OD</sub> and V<sub>OC</sub>, respectively, that occur when the input is changed from a high level to a low level.

(3) C<sub>pd</sub> determines the no-load dynamic current consumption. I<sub>S</sub> = C<sub>pd</sub> × V<sub>CC</sub> × f + I<sub>CC</sub>

## 5.6 Switching Characteristics

| PARAMETER            |   | TEST CONDITIONS                        | MIN | TYP <sup>(1)</sup> | MAX | UNIT |
|----------------------|---|--|-----|--------------------|-----|------|
| t <sub>PLH</sub>     | Propagation delay time, low- to high-level output   | See Figure 6-2                         | 4   | 8                  | 20  | ns   |
| t <sub>PHL</sub>     | Propagation delay time, high- to low-level output   |  | 4   | 8                  | 20  | ns   |
| t <sub>t</sub>       | Transition time (t <sub>r</sub> or t <sub>f</sub> ) |  |     | 3                  |     | ns   |
| SR                   | Slew rate, single-ended output voltage              | See Note <sup>(2)</sup> and Figure 6-2 |     | 0.3                | 1   | V/ns |
| t <sub>PZH</sub>     | Output-enable time to high level                    | See Figure 6-3                         |     | 10                 | 20  | ns   |
| t <sub>PZL</sub>     | Output-enable time to low level                     | See Figure 6-4                         |     | 10                 | 20  | ns   |
| t <sub>PHZ</sub>     | Output-disable time from high level                 | See Figure 6-3                         |     | 10                 | 20  | ns   |
| t <sub>PLZ</sub>     | Output-disable time from low level                  | See Figure 6-4                         |     | 10                 | 20  | ns   |
| t <sub>sk(p)</sub>   | Pulse skew  | f = 32MHz, See Note <sup>(3)</sup>     |     | 0.5                | 3   | ns   |
| t <sub>sk(o)</sub>   | Skew limit  | f = 32MHz                              |     |                    | 3   | ns   |
| t <sub>sk(lim)</sub> | Skew limit (device to device)                       | f = 32 MHz, See Note <sup>(4)</sup>    |     |                    | 3   | ns   |

(1) All typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = 25°C

(2) Slew rate is defined by Equation 1

(3) Pulse skew is defined as the |t<sub>PLH</sub> - t<sub>PHL</sub>| of each channel of the same device.

(4) Skew limit (device to device) is the maximum difference in propagation delay times between any two channels of any two devices.

$$SR = \frac{90\% (V_{OH} - V_{OL}) - 10\% (V_{OH} - V_{OL})}{t_f}, \text{ the differential slew rate of } V_{CC} \text{ is } 2 \times SR. \quad (1)$$

### 5.7 Typical Characteristics

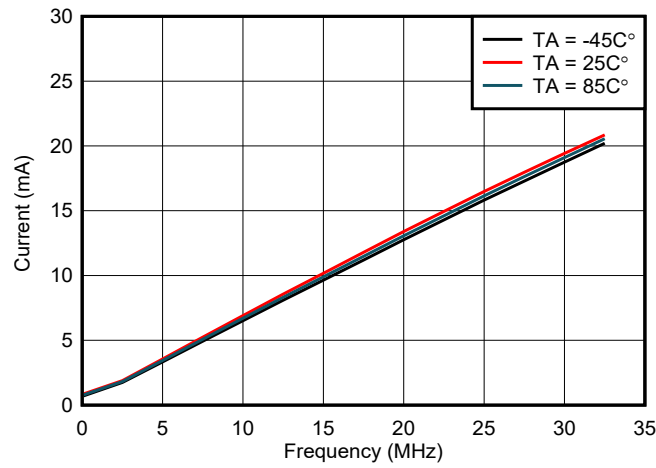


Figure 5-1. Current vs Frequency

## 6 Parameter Measurement Information

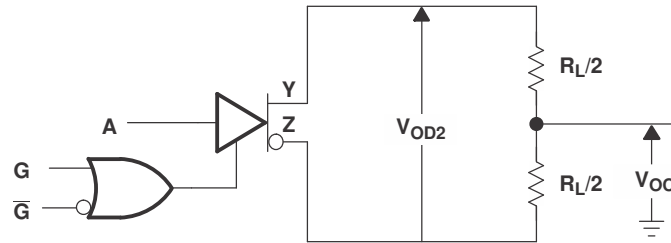
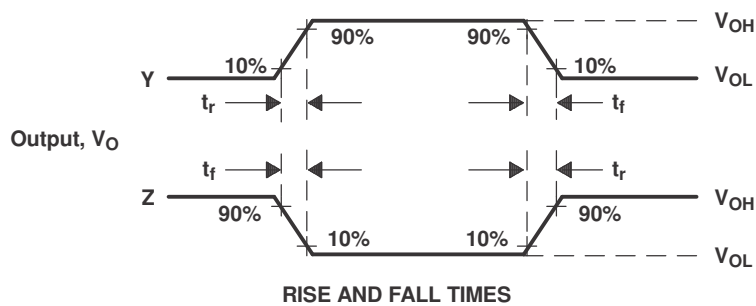
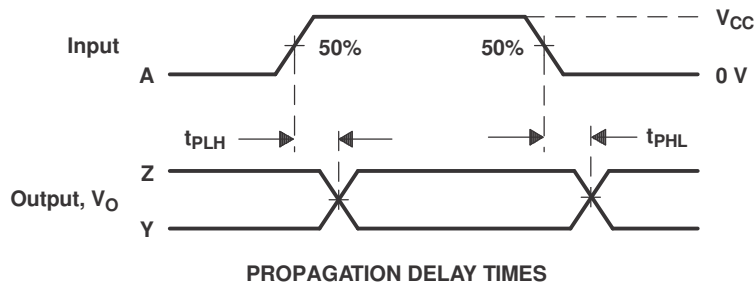
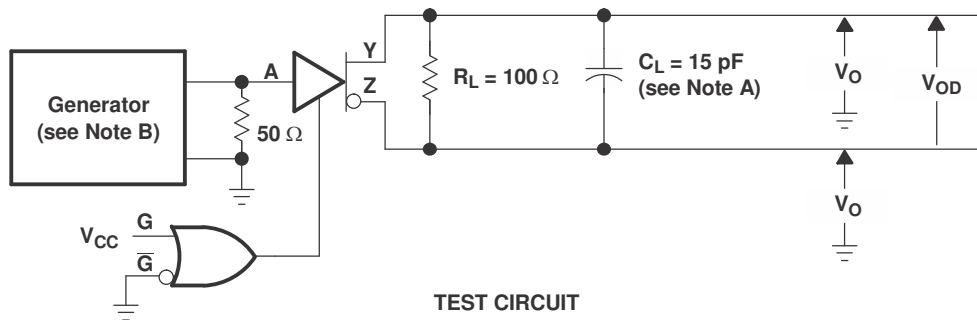
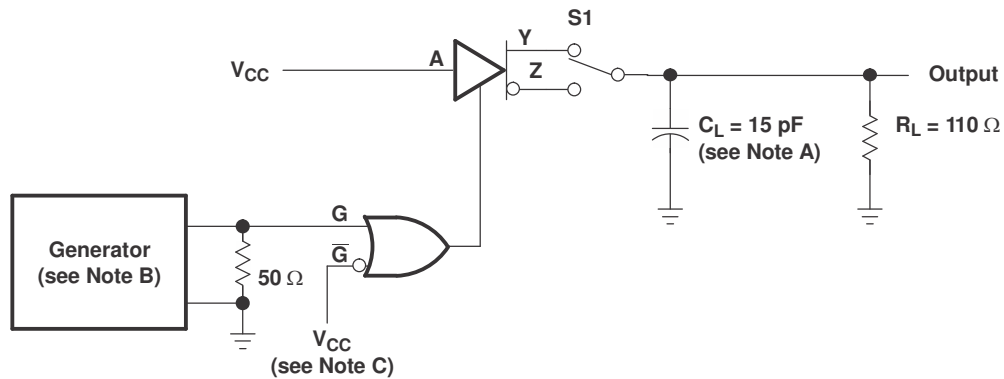


Figure 6-1. Differential and Common-Mode Output Voltages

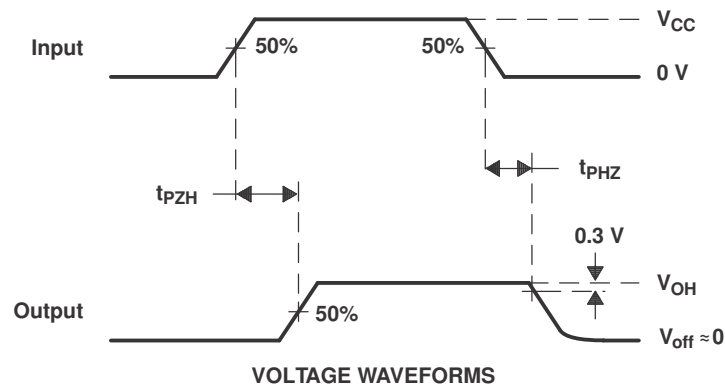


- A.  $C_L$  includes probe and jig capacitance.
- B. The input pulse is supplied by a generator having the following characteristics: PRR = 10MHz,  $Z_O = 50\Omega$ , 50%v duty cycle,  $t_r$  and  $t_f \leq 10\text{ns}$ .

Figure 6-2. Test Circuit and Voltage Waveforms,  $t_{PHL}$  and  $t_{PLH}$



TEST CIRCUIT

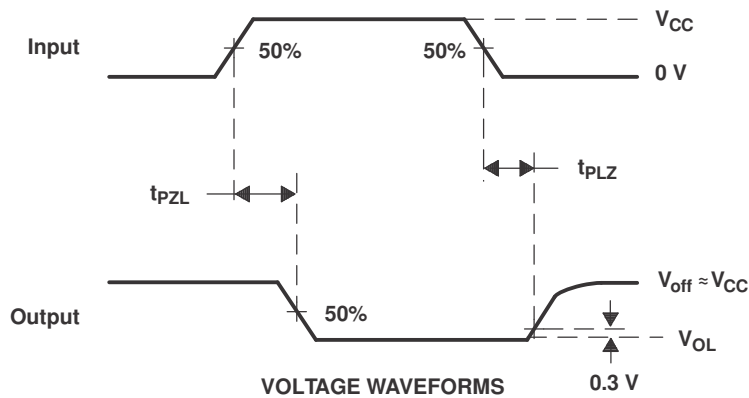
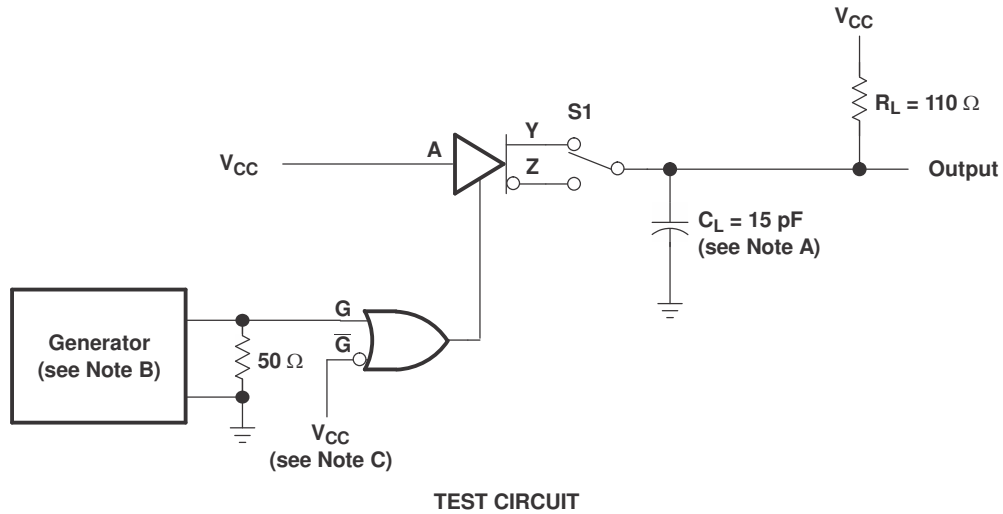


VOLTAGE WAVEFORMS

- A.  $C_L$  includes probe and jig capacitance.
- B. The input pulse is supplied by a generator having the following characteristics: PRR = 1MHz,  $Z_O = 50 \Omega$ , 50%v duty cycle,  $t_r$  and  $t_f$  (10% to 90%)  $\leq 2\text{ns}$ .
- C. To test the active-low enable  $\overline{G}$ , ground G and apply an inverted waveform to  $\overline{G}$ .

Figure 6-3. Test Circuit and Voltage Waveforms,  $t_{PZH}$  and  $t_{PHZ}$





- A.  $C_L$  includes probe and jig capacitance.
- B. The input pulse is supplied by a generator having the following characteristics: PRR = 1MHz,  $Z_O = 50\Omega$ , 50%v duty cycle,  $t_r$  and  $t_f$  (10% to 90%)  $\leq 2$ ns.
- C. To test the active-low enable  $\bar{G}$ , ground G and apply an inverted waveform to  $\bar{G}$ .

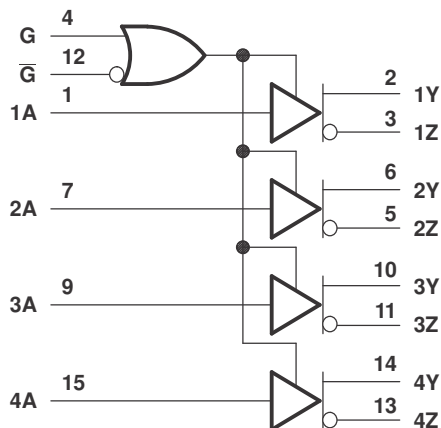
**Figure 6-4. Test Circuit and Voltage Waveforms,  $t_{pZL}$  and  $t_{PLZ}$**

## 7 Detailed Description

### 7.1 Overview

The AM26LV31C and AM26LV31I are BiCMOS quadruple differential line drivers with 3-state outputs. The devices are designed to be similar to TIA/EIA-422-B and ITU Recommendation V.11 drivers with a single 3.3-V power supply. The drivers also integrate active-high and active-low enables for precise device control.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 Active high and active low

The devices can be configured using the G and G logic inputs to select transmitter output. A logic high on the G pin or a logic low on the G pin enables the device to operate. These pins are simply a way to configure the logic to match that of the receiving or transmitting controller or microprocessor.

#### 7.3.2 Operates from a 3.3-V Supply with up to 5-V Logic

While the transmitters operate from a single 3.3-V rail, the logic can operate off the same rail or another 5-V rail, making designs much more flexible to communicate to controllers.

#### 7.3.3 High Speed Transmission

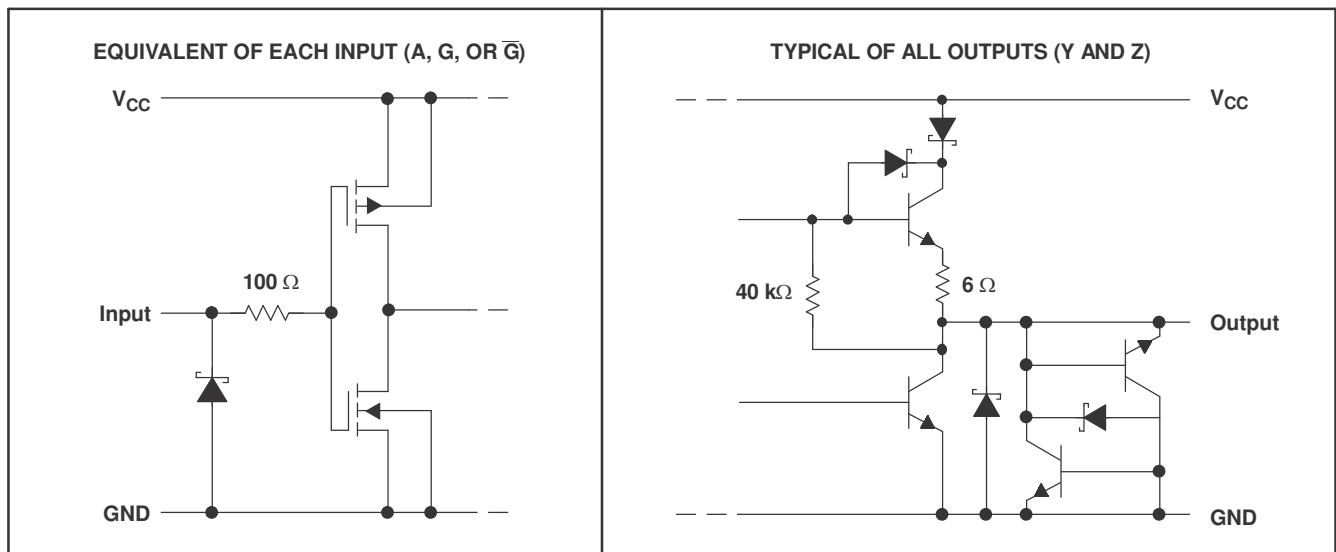
The AM26LV31C and AM26LV31I are optimized for balanced-bus transmission at switching rates up to 32 MHz. The devices are designed using Texas Instruments proprietary LinIMPACT-C60™ technology, facilitating ultra-low power consumption without sacrificing speed.

### 7.4 Device Functional Modes

Table 7-1. Function Table<sup>(1)</sup>

| INPUT<br>A | ENABLES |           |  | OUTPUTS |   |
|------------|---------|-----------|--|---------|---|
|            | G       | $\bar{G}$ |  | Y       | Z |
| H          | H       | X         |  | H       | L |
| L          | H       | X         |  | L       | H |
| H          | X       | L         |  | H       | L |
| L          | X       | L         |  | L       | H |
| X          | L       | H         |  | Z       | Z |

(1) H = high level, L = low level, X = irrelevant, Z = high impedance (off)



|| resistor values are nominal.

Figure 7-1. Schematic (Each Driver)

## 8 Application and Implementation

### Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

### 8.1 Application Information

When designing a system that uses drivers, receivers, and transceivers, proper cable termination is essential for highly reliable applications with reduced reflections in the transmission line. If termination is used, it can be placed at the end of the cable near the last receiver. Factors to consider when determining the type of termination usually are performance requirements of the application and the ever-present factor, cost. The different types of termination techniques discussed are unterminated lines, parallel termination, AC termination, and multipoint termination. For laboratory experiments, 100 feet of 100- $\Omega$ , 24-AWG, twisted-pair cable (Bertek) was used. A single driver and receiver, TI AM26LV31C and AM26LV32C, respectively, were tested at room temperature with a 3.3-V supply voltage. The first plot shows output waveforms from the driver at the start of the cable (A/B); the second plot shows input waveforms to the receiver at the far end of the cable (Y).

### 8.2 Typical Application

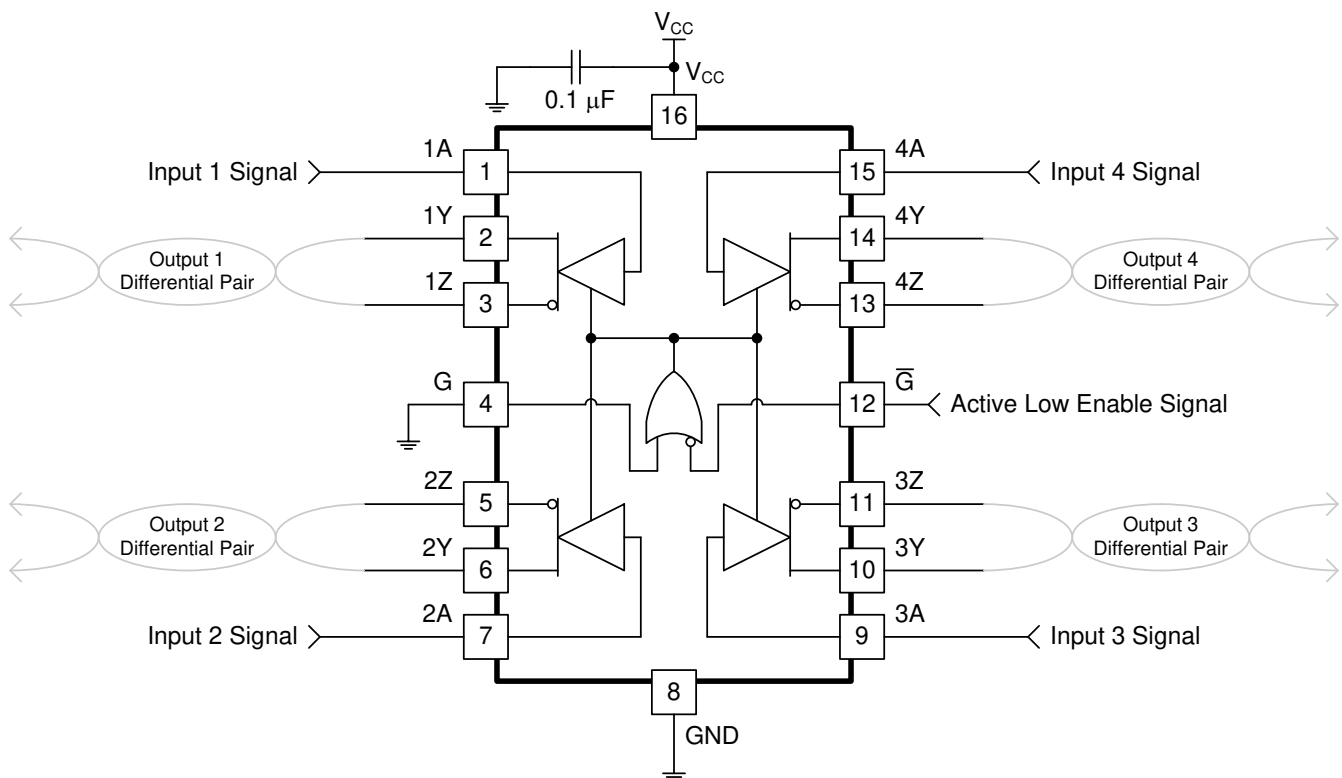


Figure 8-1. Differential Terminated Configuration With All Channels and Active Low Enable Used

### 8.2.1 Design Requirements

Resistor and capacitor (if used) termination values are shown for each laboratory experiment, but vary from system to system. For example, the termination resistor,  $R_T$ , must be within 20% of the characteristic impedance,  $Z_0$ , of the cable and can vary from about 80  $\Omega$  to 120  $\Omega$ .

This example requires the following:

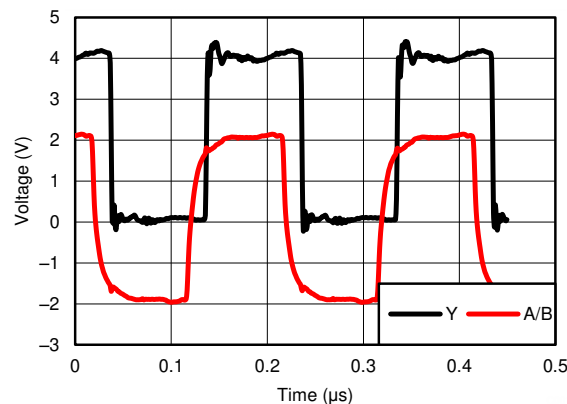
- 3.3-V power source
- RS-485 bus operating at 32 MHz or less
- Connector that ensures the correct polarity for port pins

### 8.2.2 Detailed Design Procedure

Ensure values in Absolute Maximum Ratings are not exceeded. Supply voltage,  $V_{IH}$ , and  $V_{IL}$  must comply with Recommended Operating Conditions.

Place the device close to bus connector to keep traces (stub) short to prevent adding reflections to the bus line. If desired, add external fail-safe biasing to ensure 200 mV on the A-B port, if the drive is in high impedance state (see Failsafe in RS-485 data buses).

### 8.2.3 Application Curves



**Figure 8-2. Differential 120- $\Omega$  Terminated Output Waveforms (Cat 5E Cable)**

## 8.3 Power Supply Recommendations

Place a 0.1- $\mu\text{F}$  bypass capacitors close to the power-supply pins to reduce errors coupling in from noisy or high impedance power supplies.

## 8.4 Layout

### 8.4.1 Layout Guidelines

For best operational performance of the device, use good PCB layout practices, including:

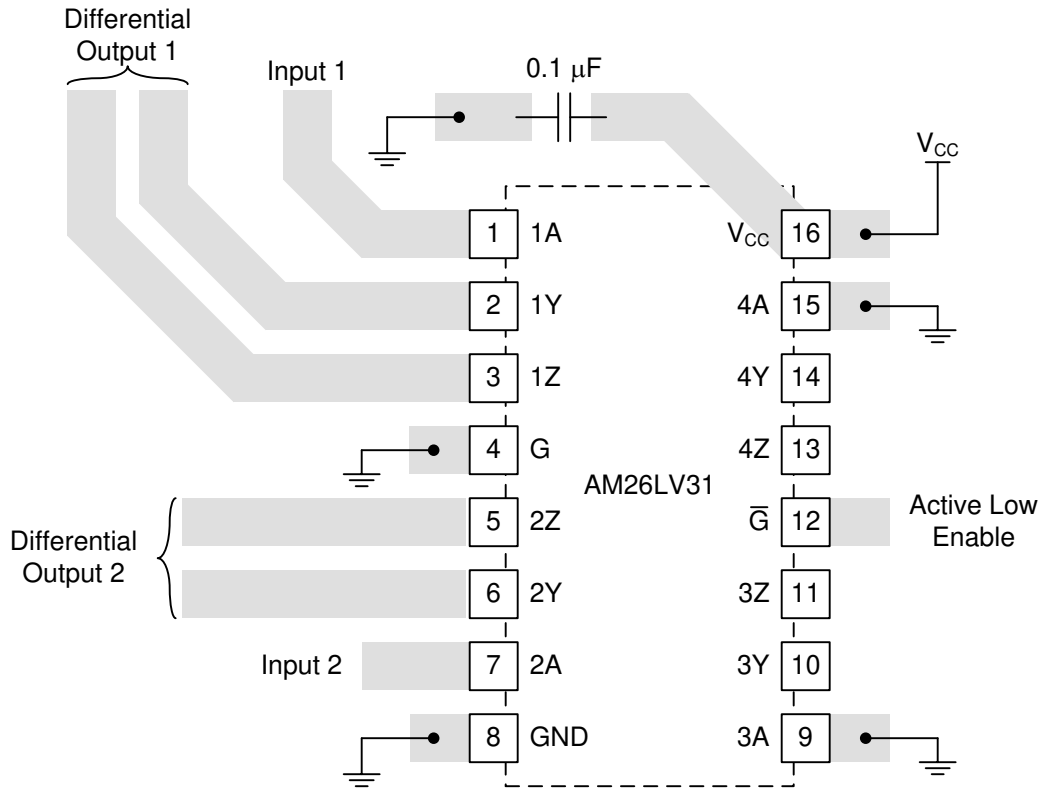
- Noise can propagate into analog circuitry through the power pins of the circuit as a whole, as well as the operational amplifier. Bypass capacitors are used to reduce the coupled noise by providing low impedance power sources local to the analog circuitry. Connect low-ESR, 0.1- $\mu\text{F}$  ceramic bypass capacitors between supply pin and ground, placed as close to the device as possible.
- Separate grounding for analog and digital portions of circuitry is one of the simplest and most effective methods of noise suppression. One or more layers on multilayer PCBs are usually devoted to ground planes. A ground plane helps distribute heat and reduces EMI noise pickup. Make sure to physically separate digital and analog grounds, paying attention to the flow of the ground current.
- To reduce parasitic coupling, run the input traces as far away from the supply or output traces as possible. If it is not possible to keep them separate, it is much better to cross the sensitive trace perpendicular as opposed to in parallel with the noisy trace.

**AM26LV31**

SLLS2011 – MAY 1995 – REVISED APRIL 2024

- Keep the length of input traces as short as possible. Always remember that the input traces are the most sensitive part of the circuit.
- Consider a driven, low-impedance guard ring around the critical traces. A guard ring can significantly reduce leakage currents from nearby traces that are at different potentials.

**8.4.2 Layout Example**



**Figure 8-3. Trace Layout on PCB and Recommendations**

## 9 Device and Documentation Support

### 9.1 Device Support

#### 9.1.1 Development Support

### 9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 9.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 9.4 Trademarks

LinIMPACT-C60™ is a trademark of Texas Instruments.

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 9.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 9.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| <b>Changes from Revision H (April 2018) to Revision I (April 2024)</b>        | <b>Page</b> |
|---|-------------|
| • Changed the Device information to the <i>Package Information</i> table..... | 1           |
| • Changed the <i>Thermal Information</i> table values.....                    | 4           |
| • Changed <a href="#">Figure 5-1</a> .....                                    | 6           |
| • Changed the Note B in <a href="#">Figure 6-2</a> .....                      | 7           |

| <b>Changes from Revision G (May 2005) to Revision H (April 2018)</b>  | <b>Page</b> |
|---|-------------|
| • Added <i>Device Information</i> table, <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section ..... | 1           |
| • Changed the $t_{PLH}$ and $t_{PHL}$ MAX value From: 12 ns To: 20 ns in the <i>Switching Characteristics</i> .....   | 5           |
| • Changed the $t_{sk(p)}$ and $t_{sk(o)}$ MAX value From: 1.5 ns To: 3 ns in the <i>Switching Characteristics</i> .....   | 5           |

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| AM26LV31IDR      | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -45 to 85    | AM26LV311               | Samples |
| AM26LV31INSR     | ACTIVE        | SO           | NS              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -45 to 85    | 26LV311                 | Samples |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| AM26LV31CDR   | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| AM26LV31CDRG4 | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| AM26LV31CNSR  | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| AM26LV31IDR   | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| AM26LV31INSR  | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| AM26LV31CDR   | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| AM26LV31CDRG4 | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| AM26LV31CNSR  | SO           | NS              | 16   | 2000 | 367.0       | 367.0      | 38.0        |
| AM26LV31IDR   | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| AM26LV31INSR  | SO           | NS              | 16   | 2000 | 356.0       | 356.0      | 35.0        |

**TUBE**


\*All dimensions are nominal

| Device       | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|--------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| AM26LV31CD   | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| AM26LV31CDE4 | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| AM26LV31CDG4 | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| AM26LV31ID   | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |

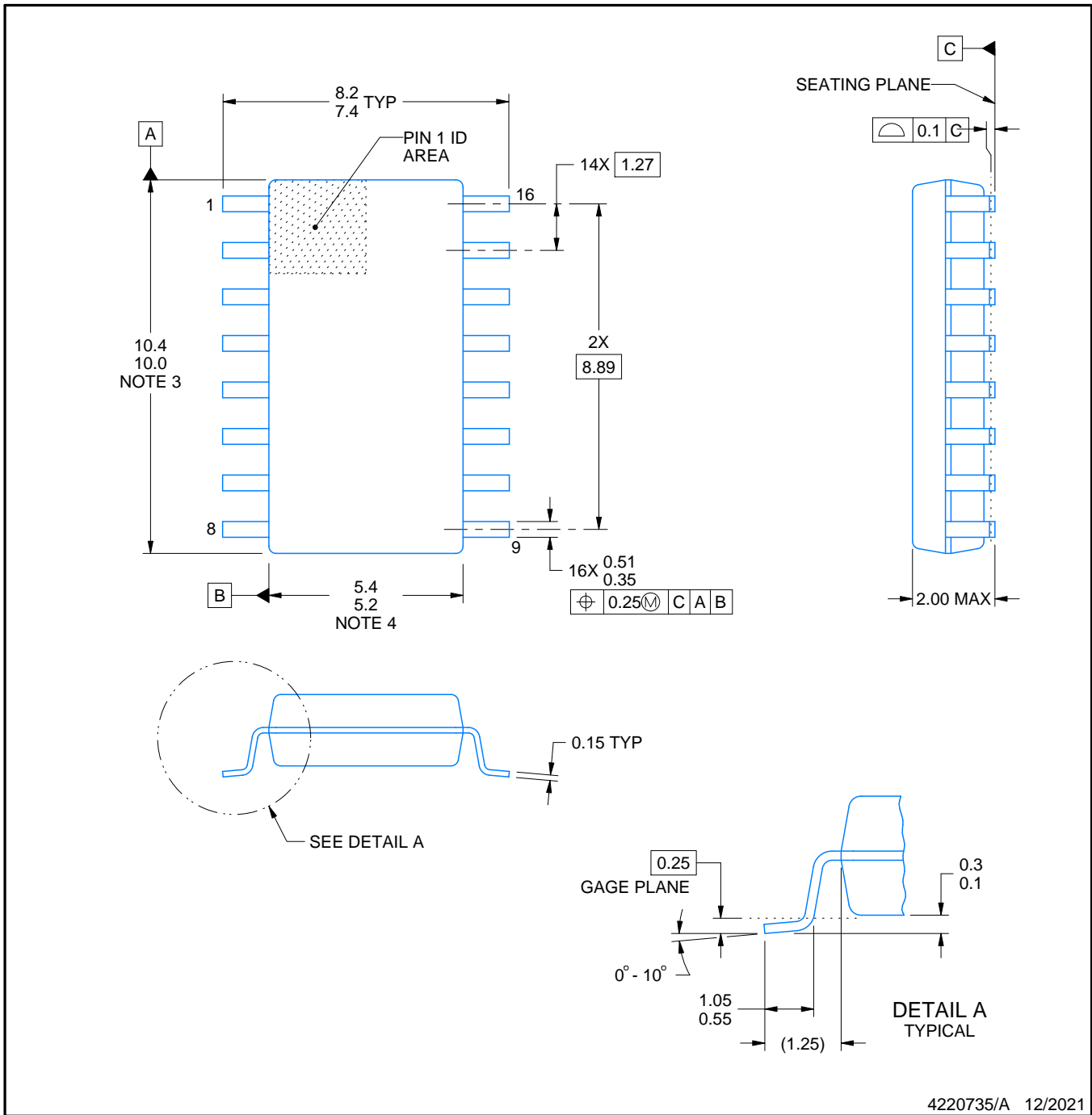


# PACKAGE OUTLINE

## NS0016A

### SOP - 2.00 mm max height

SOP



#### NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

# EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.



D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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