

AM26LS31 Quadruple Differential Line Driver

1 Features

- Meets or exceeds the requirements of ANSI TIA/EIA-422-B and ITU
- Operates from a single 5V supply
- TTL-Compatible
- Complementary outputs
- High output impedance in power-off conditions
- Complementary output-enable inputs
- Available MIL-PRF-38535-qualified options (M): All parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

2 Applications

- Motor encoders
- Field transmitters: pressure sensors and temperature sensors
- Military and avionics imaging
- Temperature sensors or controllers using modbus

3 Description

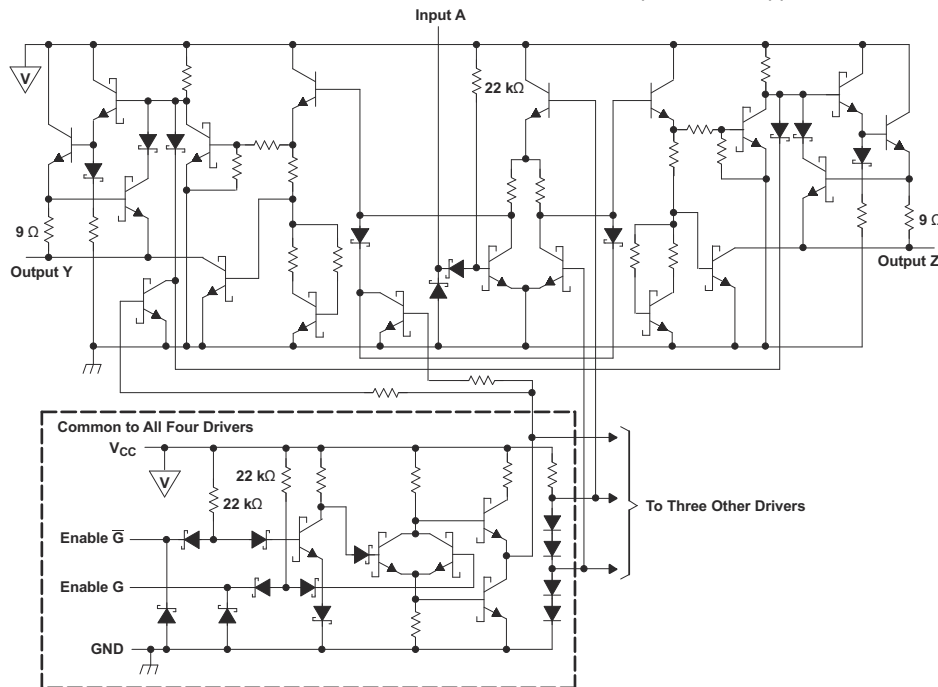
The AM26LS31CN-E family of devices is a quadruple complementary-output line driver designed to meet the requirements of ANSI TIA/EIA-422-B and ITU (formerly CCITT) Recommendation V.11. The 3-state outputs have high-current capability for driving balanced lines such as twisted-pair or parallel-wire transmission lines, and are in the high-impedance state in the power-off condition. The enable function is common to all four drivers and offers the choice of an active-high or active-low enable (G , \bar{G}) input. Low-power Schottky circuitry reduces power consumption without sacrificing speed.

Package Information

| PART NUMBER | PACKAGE ⁽¹⁾ | PACKAGE SIZE ⁽²⁾ |
|--------------|------------------------|-----------------------------|
| AM26LS31MFK | LCCC (20) | 8.89mm × 8.89mm |
| AM26LS31MJ | CDIP (16) | 19.6mm × 6.92mm |
| AM26LS31MW | CFP (16) | 10.3mm × 6.73mm |
| AM26LS31CD | SOIC (16) | 9.9mm × 3.91mm |
| AM26LS31CDB | SSOP (16) | 6.2mm × 5.3mm |
| AM26LS31CN-E | PDIP (16) | 19.3mm × 6.35mm |
| AM26LS31xNS | SO (16) | 10.3mm × 5.3mm |

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

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



All resistor values are nominal.

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Schematic (Each Driver)

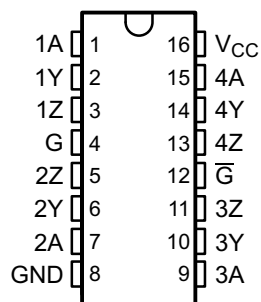


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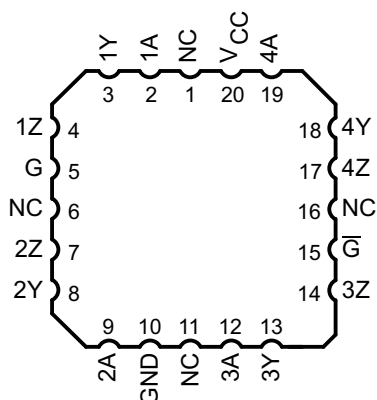
4 Pin Configuration and Functions



**Figure 4-1. D (SOIC), DB (SSOP), N (PDIP) , NS (SO), J (CDIP), or W (CFP) Packages
(Top View)**

Table 4-1. Pin Functions

| PIN | | I/O | DESCRIPTION |
|----------------|-----|-----|---|
| NAME | NO. | | |
| 1A | 1 | I | Logic Data Input to RS422 Driver number 1 |
| 1Y | 2 | O | RS-422 Data Line (Driver 1) |
| 1Z | 3 | O | RS-422 Data Line (Driver 1) |
| G | 4 | I | Driver Enable (active high) |
| \overline{G} | 12 | I | Driver Enable (active Low) |
| 2A | 7 | I | Logic Data Input to RS422 Driver number 2 |
| 2Y | 6 | O | RS-422 Data Line (Driver 2) |
| 2Z | 5 | O | RS-422 Data Line (Driver 2) |
| 3A | 9 | I | Logic Data Input to RS422 Driver number 3 |
| 3Y | 10 | O | RS-422 Data Line (Driver 3) |
| 3Z | 11 | O | RS-422 Data Line (Driver 3) |
| 4A | 15 | I | Logic Data Input to RS422 Driver number 4 |
| 4Y | 14 | O | RS-422 Data Line (Driver 4) |
| 4Z | 13 | O | RS-422 Data Line (Driver 4) |
| VCC | 16 | – | Power Input. Connect to 5V Power Source. |
| GND | 8 | – | Device Ground Pin |



**Figure 4-2. FK (LCCC) 20-Pin Package
(Top View)**

Table 4-2. Pin Functions

| PIN | | I/O | DESCRIPTION |
|------|-----|-----|---|
| NAME | NO. | | |
| 1A | 1 | I | Logic Data Input to RS422 Driver number 1 |
| 1Y | 2 | O | RS-422 Data Line (Driver 1) |
| 1Z | 3 | O | RS-422 Data Line (Driver 1) |
| G | 4 | I | Driver Enable (active high) |
| Ḡ | 12 | I | Driver Enable (active Low) |
| 2A | 7 | I | Logic Data Input to RS422 Driver number 2 |
| 2Y | 6 | O | RS-422 Data Line (Driver 2) |
| 2Z | 5 | O | RS-422 Data Line (Driver 2) |
| 3A | 9 | I | Logic Data Input to RS422 Driver number 3 |
| 3Y | 10 | O | RS-422 Data Line (Driver 3) |
| 3Z | 11 | O | RS-422 Data Line (Driver 3) |
| 4A | 15 | I | Logic Data Input to RS422 Driver number 4 |
| 4Y | 14 | O | RS-422 Data Line (Driver 4) |
| 4Z | 13 | O | RS-422 Data Line (Driver 4) |
| VCC | 8 | I | Power Input. Connect to 5V Power Source. |
| GND | 16 | I | Device Ground Pin |

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | MIN | MAX | UNIT |
|------------------|--|-----------|-----|------|
| V _{CC} | Supply voltage ⁽²⁾ | | 7 | V |
| V _I | Input voltage | | 7 | V |
| | Output off-state voltage | | 5.5 | V |
| | Lead temperature 1,6 mm (1/16 in) from case for 10 s | | 260 | °C |
| | Lead temperature 1,6 mm (1/16 in) from case for 60 s | J package | 300 | °C |
| T _{stg} | Storage temperature | –65 | 150 | °C |

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

5.2 ESD Ratings

| | | VALUE | UNIT |
|--------------------|-------------------------|--|-------|
| V _(ESD) | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾ | ±2000 |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾ | ±1000 |

- (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 | AM26LS31C | 4.75 | 5 | 5.25 | V |
| | | AM26LS31M | 4.5 | 5 | 5.5 | |
| V _{IH} | High-level input voltage | 2 | | | | V |
| V _{IL} | Low-level input voltage | 0.8 | | | | V |
| I _{OH} | High-level output current | −20 | | | | mA |
| I _{OL} | Low-level output current | 20 | | | | mA |
| T _A | Operating free-air temperature | AM26LS31C | 0 | 70 | | °C |
| | | AM26LS31I | −40 | 85 | | |
| | | AM26LS31M | −55 | 125 | | |

5.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | AM26LS31x | | | | UNIT |
|-------------------------------|---|-----------|-----------|----------|---------|------|
| | | D (SOIC) | DB (SSOP) | N (PDIP) | NS (SO) | |
| | | 16 PINS | 16 PINS | 16 PINS | 16 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance ⁽²⁾ | 84.6 | 82 | 60.6 | 88.5 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 43.5 | – | 48.1 | 46.2 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 43.2 | – | 40.6 | 50.7 | °C/W |
| ψ _{JT} | Junction-to-top characterization parameter | 10.4 | – | 27.5 | 13.5 | °C/W |
| ψ _{JB} | Junction-to-board characterization parameter | 42.8 | – | 40.3 | 50.3 | °C/W |

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.
- (2) The package thermal impedance is calculated in accordance with JESD 51-7.

5.5 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| PARAMETER | TEST CONDITIONS | MIN | TYP ⁽²⁾ | MAX | UNIT |
|--|--|-----|--------------------|-------|---------------|
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}, I_I = -18\text{mA}$ | | | -1.5 | V |
| V_{OH} High-level output voltage | $V_{CC} = \text{MIN}, I_{OH} = -20\text{mA}$ | 2.5 | | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, I_{OL} = 20\text{mA}$ | | | 0.5 | V |
| I_{OZ} Off-state (high-impedance-state) output current | $V_{CC} = \text{MIN}, V_O = 0.5\text{V}$ | | | -20 | μA |
| | $V_{CC} = \text{MIN}, V_O = 2.5\text{V}$ | | | 20 | |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 7\text{V}$ | | | 0.1 | mA |
| I_{IH} High-level input current | $V_{CC} = \text{MAX}, V_I = 2.7\text{V}$ | | | 20 | μA |
| I_{IL} Low-level input current | $V_{CC} = \text{MAX}, V_I = 0.4\text{V}$ | | | -0.36 | mA |
| I_{OS} Short-circuit output current ⁽³⁾ | $V_{CC} = \text{MAX}$ | -30 | | -150 | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX}$, all outputs disabled | | 32 | 80 | mA |

(1) For C-suffix devices, V_{CC} min = 4.75V and V_{CC} max = 5.25V. For M-suffix devices, V_{CC} min = 4.5V and V_{CC} max = 5.5V.

(2) All typical values are at $V_{CC} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.

(3) Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

5.6 Switching Characteristics – AM26LS31

$T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$ (see Figure 6-1)

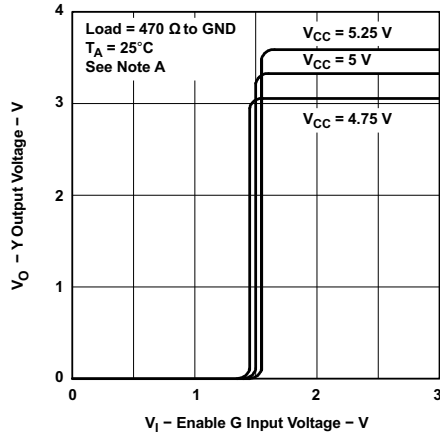
| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|--|-----|-----|-----|------|
| t_{PLH} Propagation delay time, low- to high-level output | $C_L = 30\text{pF}$, S1 and S2 open | | 14 | 20 | ns |
| t_{PHL} Propagation delay time, high- to low-level output | | | 14 | 20 | |
| t_{PZH} Output enable time to high level | $C_L = 30\text{pF}$ | | 25 | 40 | ns |
| t_{PZL} Output enable time to low level | | | 37 | 45 | |
| t_{PHZ} Output disable time from high level | $C_L = 10\text{pF}$, S1 and S2 closed | | 21 | 30 | ns |
| t_{PLZ} Output disable time from low level | | | 23 | 35 | |
| t_{SKEW} Output-to-output skew | $C_L = 30\text{pF}$, S1 and S2 open | | 1 | 6 | ns |

5.7 Switching Characteristics – AM26LS31M

$T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$ (see Figure 6-1)

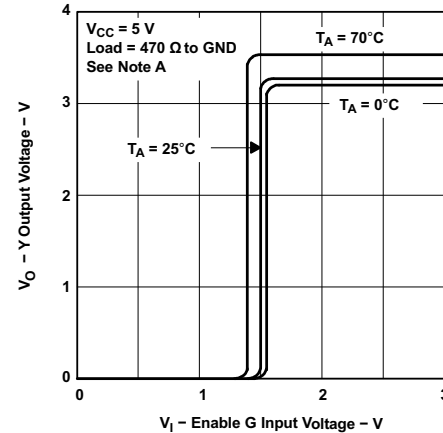
| PARAMETER | TEST CONDITIONS | MIN | MAX | UNIT |
|---|--|-----|-----|------|
| t_{PLH} Propagation delay time, low- to high-level output | $C_L = 30\text{pF}$, S1 and S2 open | | 30 | ns |
| t_{PHL} Propagation delay time, high- to low-level output | | | 30 | |
| t_{PZH} Output enable time to high level | $C_L = 30\text{pF}$ | | 60 | ns |
| t_{PZL} Output enable time to low level | | | 68 | |
| t_{PHZ} Output disable time from high level | $C_L = 10\text{pF}$, S1 and S2 closed | | 45 | ns |
| t_{PLZ} Output disable time from low level | | | 53 | |
| t_{SKEW} Output-to-output skew | $C_L = 30\text{pF}$, S1 and S2 open | | 9 | ns |

5.8 Typical Characteristics



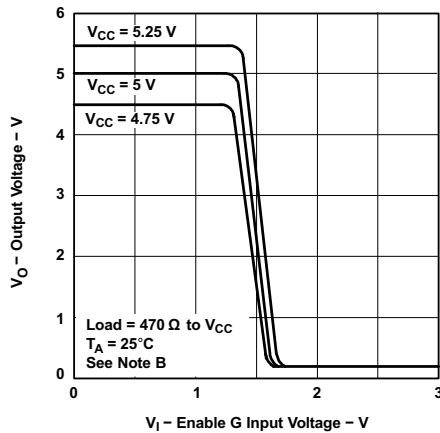
A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

Figure 5-1. Output Voltage vs Enable G Input Voltage



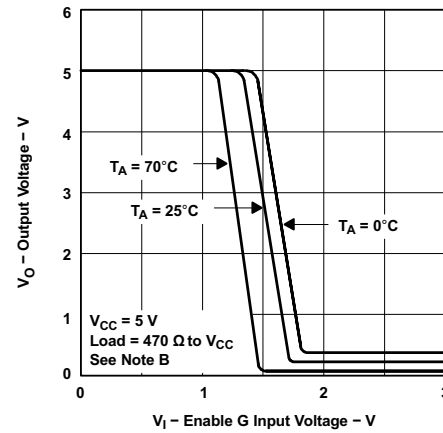
A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

Figure 5-2. Output Voltage vs Enable G Input Voltage



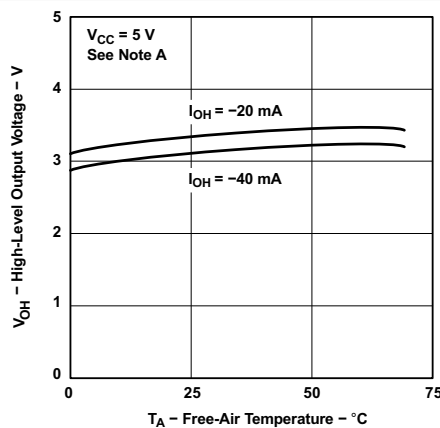
B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

Figure 5-3. Output Voltage vs Enable G Input Voltage



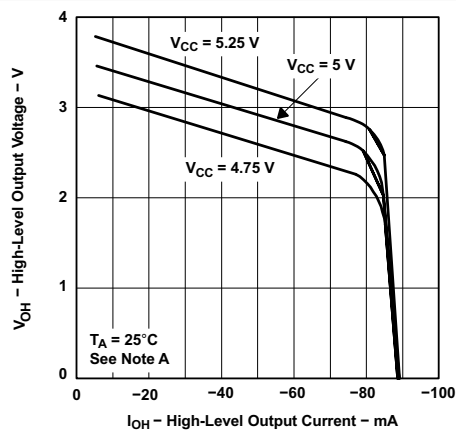
B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

Figure 5-4. Output Voltage vs Enable G Input Voltage



A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

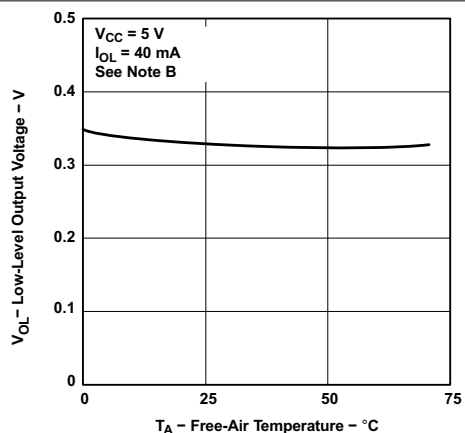
Figure 5-5. High-Level Output Voltage vs Free-Air Temperature



A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

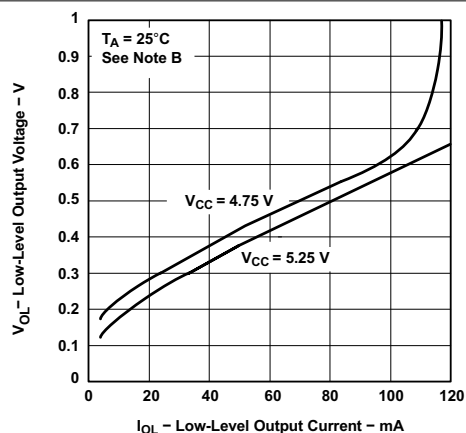
Figure 5-6. High-Level Output Voltage vs High-Level Output Current

5.8 Typical Characteristics (continued)



B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

Figure 5-7. Low-Level Output Voltage vs Free-Air Temperature



B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

Figure 5-8. Low-Level Output Voltage vs Low-Level Output Current

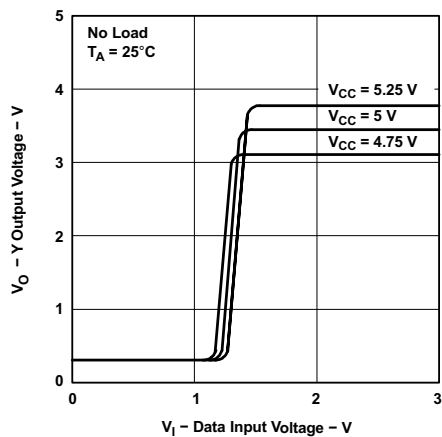


Figure 5-9. Y Output Voltage vs Data Input Voltage

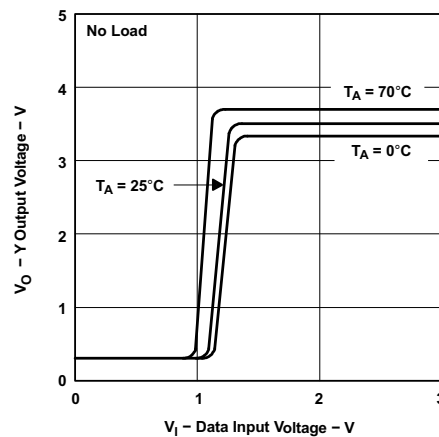
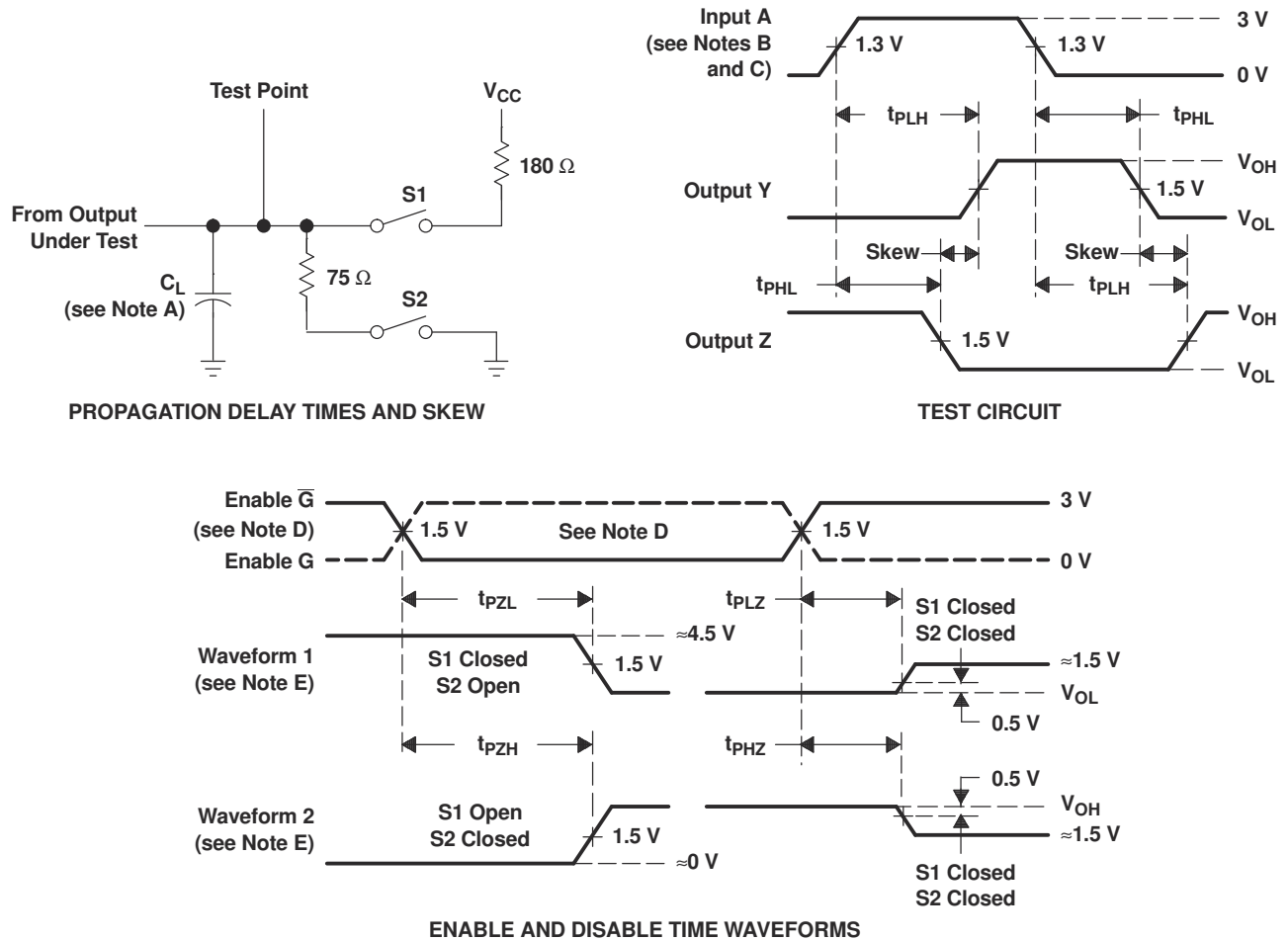


Figure 5-10. Y Output Voltage vs Data Input Voltage

6 Parameter Measurement Information



- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O ≈ 50 Ω, t_r ≤ 15 ns, t_f ≤ 6 ns.
 - C. When measuring propagation delay times and skew, switches S1 and S2 are open.
 - D. Each enable is tested separately.
 - E. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.

Figure 6-1. Test Circuit and Voltage Waveforms

7 Detailed Description

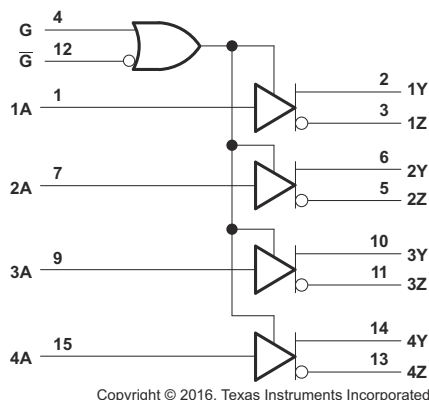
7.1 Overview

The AM26LS31x CN-E differential bus transmitter is a monolithic integrated circuit designed for unidirectional data communication on transmission lines. It is designed for balanced transmission lines and meets ANSI Standard EIA/TIA-422-B and ITU Recommendation V.11.

The AM26LS31x CN-E has a four 3-state differential line drivers that operate from a single 5V power supply. The driver also integrates active-high and active-low enables for precise device control.

The driver is designed to handle loads of a minimum of $\pm 30\text{mA}$ of sink or source current. The driver features positive- and negative-current limiting for protection from line fault conditions.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Complementary Output-Enable Inputs

The AM26LS31x can be configured using the G and \overline{G} logic inputs to control transmitter outputs. Setting either G to a logic HIGH or \overline{G} to a logic LOW enables the transmitter outputs. If G is set to logic LOW and \overline{G} is set to logic HIGH, the transmitter outputs are disabled. See [Table 7-1](#) for a complete truth table.

7.3.2 High Output Impedance in Power-Off Conditions

When the AM26LS31x transmitter outputs are disabled using G and \overline{G} , the outputs are set to a high impedance state.

7.3.3 Complementary Outputs

The AM26LS31x is the driver half of a pair of devices, with the AM26LS32 being the complementary receiver. TI recommends using these devices together for optimal performance, but any RS-422 compliant receive must ensure proper RS-422 communication and logic level translation.

7.4 Device Functional Modes

Table 7-1 lists the functional modes of the AM26LS31CN-E.

**Table 7-1. Function Table⁽¹⁾
(Each Driver)**

| INPUT 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)

8 Application and Implementation

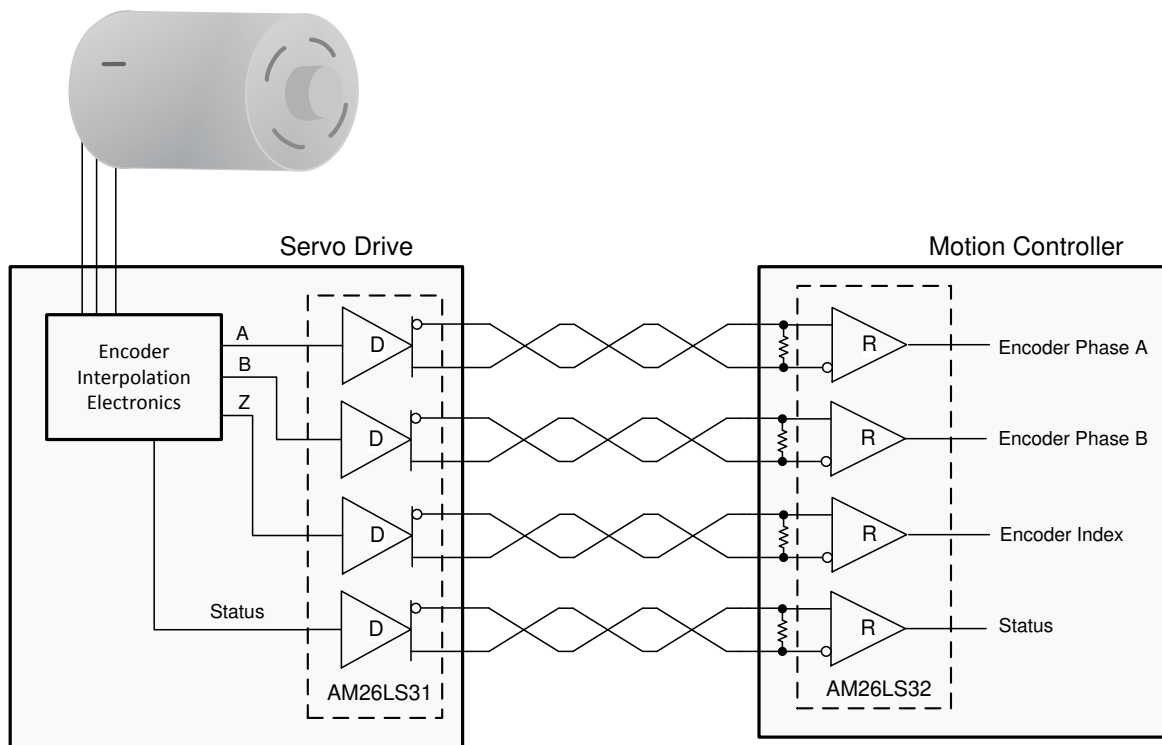
Note

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 that comply with RS-422 or RS-485, proper cable termination is essential for highly reliable applications with reduced reflections in the transmission line. Because RS-422 allows only one driver on the bus, if termination is used, it is placed only at the end of the cable near the last receiver. In general, RS-485 requires termination at both ends of the cable. 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. Laboratory waveforms for each termination technique (except multipoint termination) illustrate the usefulness and robustness of RS-422 (and, indirectly, RS-485). Similar results can be obtained if 485-compliant devices and termination techniques are used. For laboratory experiments, 100 feet of 100Ω, 24-AWG, twisted-pair cable (Bertek) was used. A single driver and receiver, TI AM26LS31CN-E and AM26LS32C, respectively, were tested at room temperature with a 5V supply voltage. Two plots per termination technique are shown. In each plot, the top waveform is the driver input and the bottom waveform is the receiver output. To show voltage waveforms related to transmission-line reflections, the first plot shows output waveforms from the driver at the start of the cable; the second plot shows input waveforms to the receiver at the far end of the cable.

8.2 Typical Application



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Figure 8-1. Encoder Application

8.2.1 Design Requirements

This example requires the following:

- 5V power source
- RS-485 bus operating at 10Mbps or less
- Connector that makes sure the correct polarity for port pins

8.2.2 Detailed Design Procedure

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 200mV on the A-B port, if the drive is in high impedance state (see [Fail-safe in RS-485 data buses](#)).

8.2.3 Application Curve

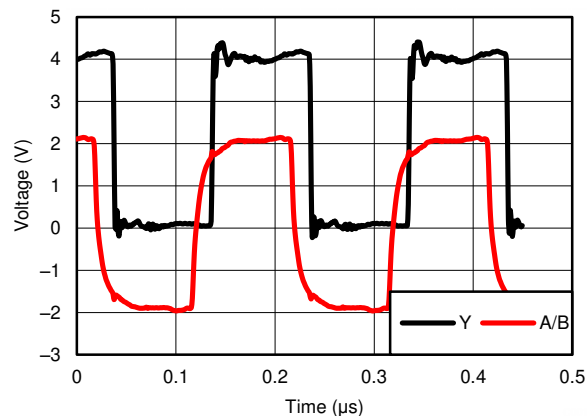


Figure 8-2. Differential 120-Ω Terminated Output Waveforms (Cat 5E Cable)

8.3 Power Supply Recommendations

Place a 0.1μF 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 often propagate into analog circuitry through the power supply of the circuit. Bypass capacitors are used to reduce the coupled noise by providing low impedance power sources local to the analog circuitry.
 - Connect low-ESR, 0.1μF ceramic bypass capacitors between each supply pin and ground, placed as close to the device as possible. A single bypass capacitor from V+ to ground is applicable for single-supply applications.
- 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.
- Place the external components as close to the device as possible. Keeping RF and RG close to the inverting input minimizes parasitic capacitance.
- Keep the length of input traces as short as possible. Always remember that the input traces are the most sensitive part of the circuit.

8.4.2 Layout Example

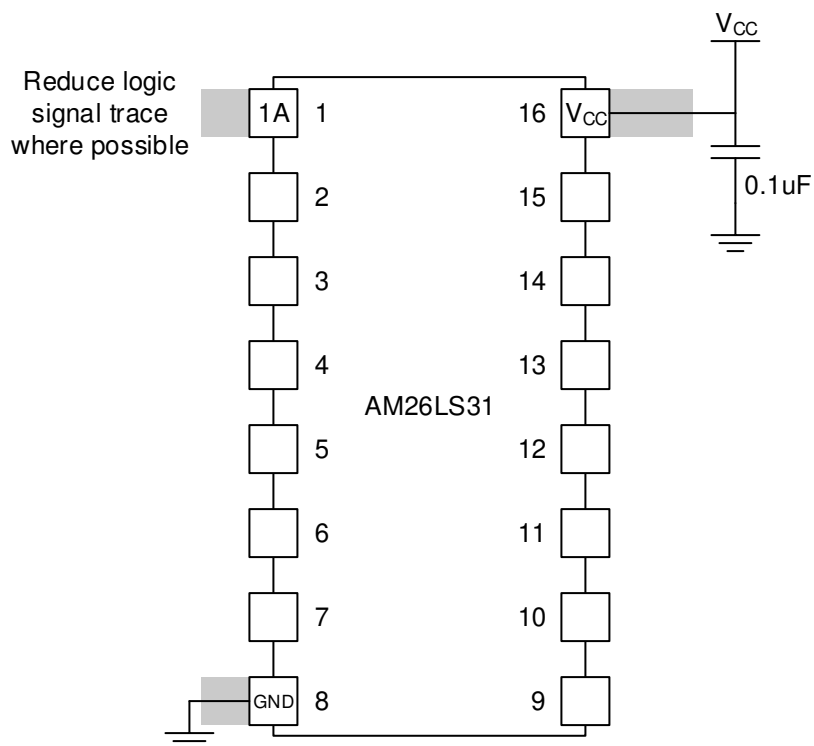


Figure 8-3. Layout Recommendation

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

[Failsafe in RS-485 data buses](#) (SLYT080)

9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](#). Click on *Notifications* 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.

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9.4 Trademarks

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.

| Changes from Revision L (October 2018) to Revision M (March 2024) | Page |
|---|-------------------|
| • Changed the Device Information table to the <i>Package Information</i> table..... | 1 |
| • Changed the <i>Thermal Information</i> table..... | 5 |

| Changes from Revision K (July 2016) to Revision L (October 2018) | Page |
|---|-------------------|
| • Changed VCC pin number From: 8 To: 16 in the <i>Pin Functions</i> table | 3 |
| • Changed GND pin number From: 16 To: 8 in the <i>Pin Functions</i> table | 3 |

| Changes from Revision J (January 2014) to Revision K (February 2014) | Page |
|--|-------------|
| <ul style="list-style-type: none"> Added <i>Applications</i> section, the <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..... Split up <i>Switching Characteristics</i> table into two tables specified for each part..... | 1 6 |

| Changes from Revision I (February 2006) to Revision J (January 2014) | Page |
|---|-----------------|
| <ul style="list-style-type: none"> Updated document to new TI data sheet format - no specification changes..... Deleted <i>Ordering Information</i> table..... Updated Features..... | 1 1 1 |

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 part number | Status (1) | Material type (2) | Package Pins | Package qty Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---|
| 5962-7802301M2A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962- 7802301M2A AM26LS31 MFKB |
| 5962-7802301MEA | Active | Production | CDIP (J) 16 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-7802301ME A AM26LS31MJB |
| 5962-7802301MFA | Active | Production | CFP (W) 16 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-7802301MF A AM26LS31MWB |
| 5962-7802301Q2A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | - | 5962- 7802301Q2A AM26LS31M |
| 5962-7802301Q2A.A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962- 7802301Q2A AM26LS31M |
| AM26LS31CD | Obsolete | Production | SOIC (D) 16 | - | - | Call TI | Call TI | 0 to 70 | AM26LS31C |
| AM26LS31CDBR | Active | Production | SSOP (DB) 16 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | SA31C |
| AM26LS31CDBR.A | Active | Production | SSOP (DB) 16 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | SA31C |
| AM26LS31CDR | Active | Production | SOIC (D) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | AM26LS31C |
| AM26LS31CDR.A | Active | Production | SOIC (D) 16 | 2500 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | AM26LS31C |
| AM26LS31CN | Active | Production | PDIP (N) 16 | 25 TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | AM26LS31CN |
| AM26LS31CN.A | Active | Production | PDIP (N) 16 | 25 TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | AM26LS31CN |
| AM26LS31CNSR | Active | Production | SOP (NS) 16 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 26LS31 |
| AM26LS31CNSR.A | Active | Production | SOP (NS) 16 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 26LS31 |
| AM26LS31INSR | Active | Production | SOP (NS) 16 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 26LS31 |
| AM26LS31INSR.A | Active | Production | SOP (NS) 16 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 26LS31 |
| AM26LS31MFKB | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962- 7802301M2A AM26LS31 MFKB |

| Orderable part number | Status (1) | Material type (2) | Package Pins | Package qty Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|-----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|-------------------------------------|
| AM26LS31MFKB.A | Active | Production | LCCC (FK) 20 | 55 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-7802301M2A AM26LS31 MFKB |
| AM26LS31MJB | Active | Production | CDIP (J) 16 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-7802301ME A AM26LS31MJB |
| AM26LS31MJB.A | Active | Production | CDIP (J) 16 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-7802301ME A AM26LS31MJB |
| AM26LS31MWB | Active | Production | CFP (W) 16 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-7802301MF A AM26LS31MWB |
| AM26LS31MWB.A | Active | Production | CFP (W) 16 | 25 TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-7802301MF A AM26LS31MWB |

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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OTHER QUALIFIED VERSIONS OF AM26LS31, AM26LS31M :

- Catalog : [AM26LS31](#)
- Military : [AM26LS31M](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION



*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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| AM26LS31CDBR | SSOP | DB | 16 | 2000 | 330.0 | 16.4 | 8.35 | 6.6 | 2.4 | 12.0 | 16.0 | Q1 |
| AM26LS31CDR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| AM26LS31CDR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| AM26LS31CNSR | SOP | NS | 16 | 2000 | 330.0 | 16.4 | 8.1 | 10.4 | 2.5 | 12.0 | 16.0 | Q1 |
| AM26LS31INSR | SOP | NS | 16 | 2000 | 330.0 | 16.4 | 8.1 | 10.4 | 2.5 | 12.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

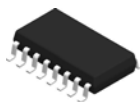
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| AM26LS31CDBR | SSOP | DB | 16 | 2000 | 353.0 | 353.0 | 32.0 |
| AM26LS31CDR | SOIC | D | 16 | 2500 | 353.0 | 353.0 | 32.0 |
| AM26LS31CDR | SOIC | D | 16 | 2500 | 340.5 | 336.1 | 32.0 |
| AM26LS31CNSR | SOP | NS | 16 | 2000 | 353.0 | 353.0 | 32.0 |
| AM26LS31INSR | SOP | NS | 16 | 2000 | 353.0 | 353.0 | 32.0 |

TUBE



*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-7802301M2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-7802301MFA | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |
| 5962-7802301Q2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-7802301Q2A.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| AM26LS31CN | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| AM26LS31CN.A | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| AM26LS31MFKB | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| AM26LS31MFKB.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| AM26LS31MWB | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |
| AM26LS31MWB.A | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |

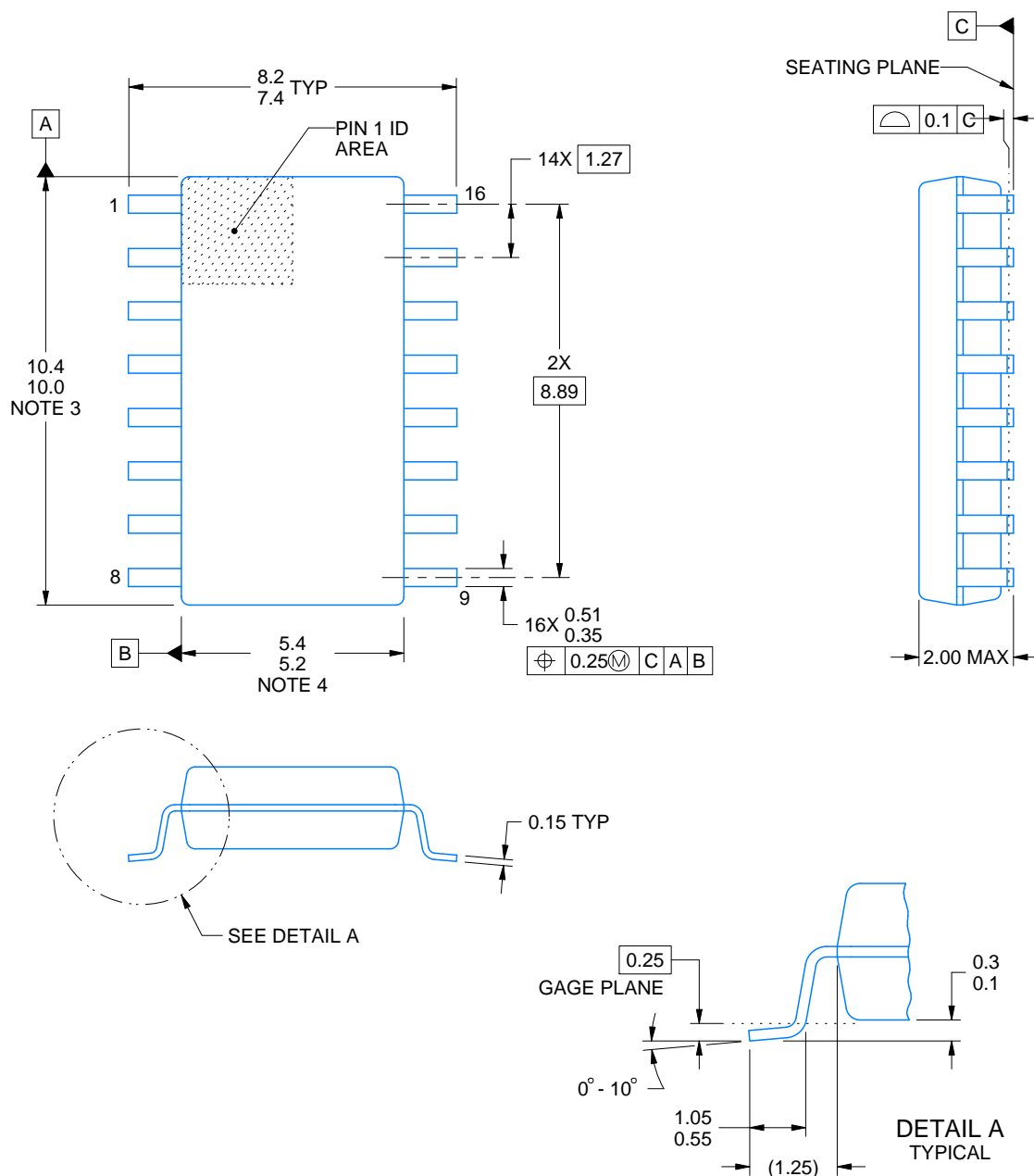


PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

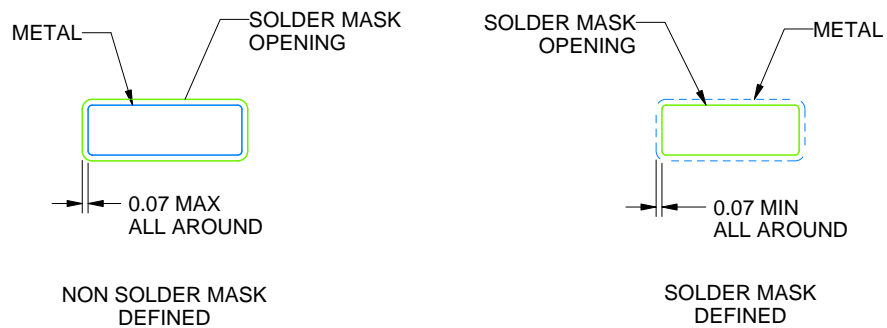
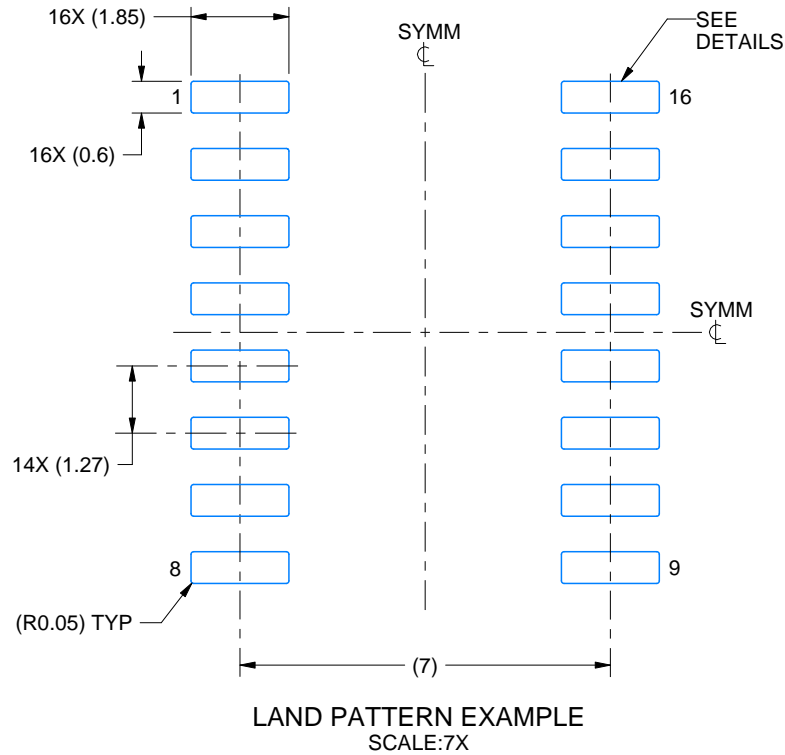
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

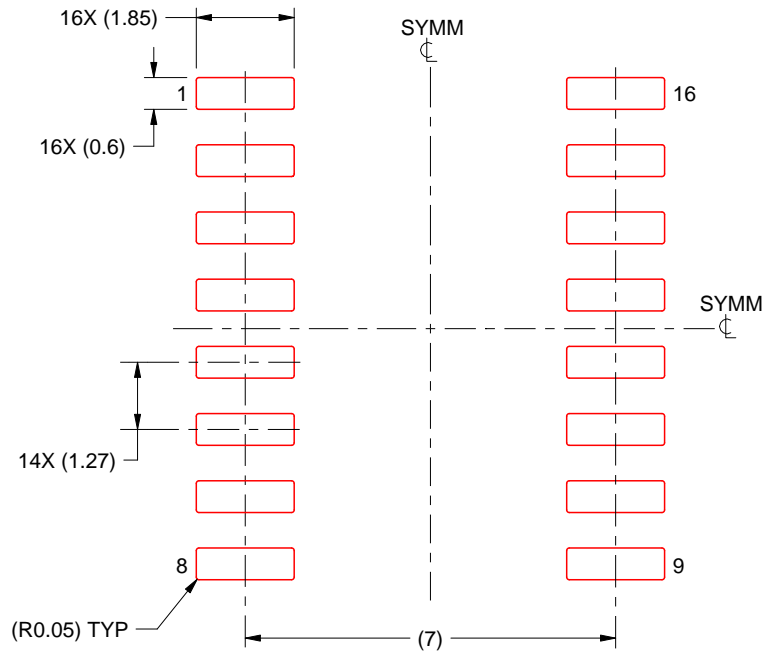
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



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

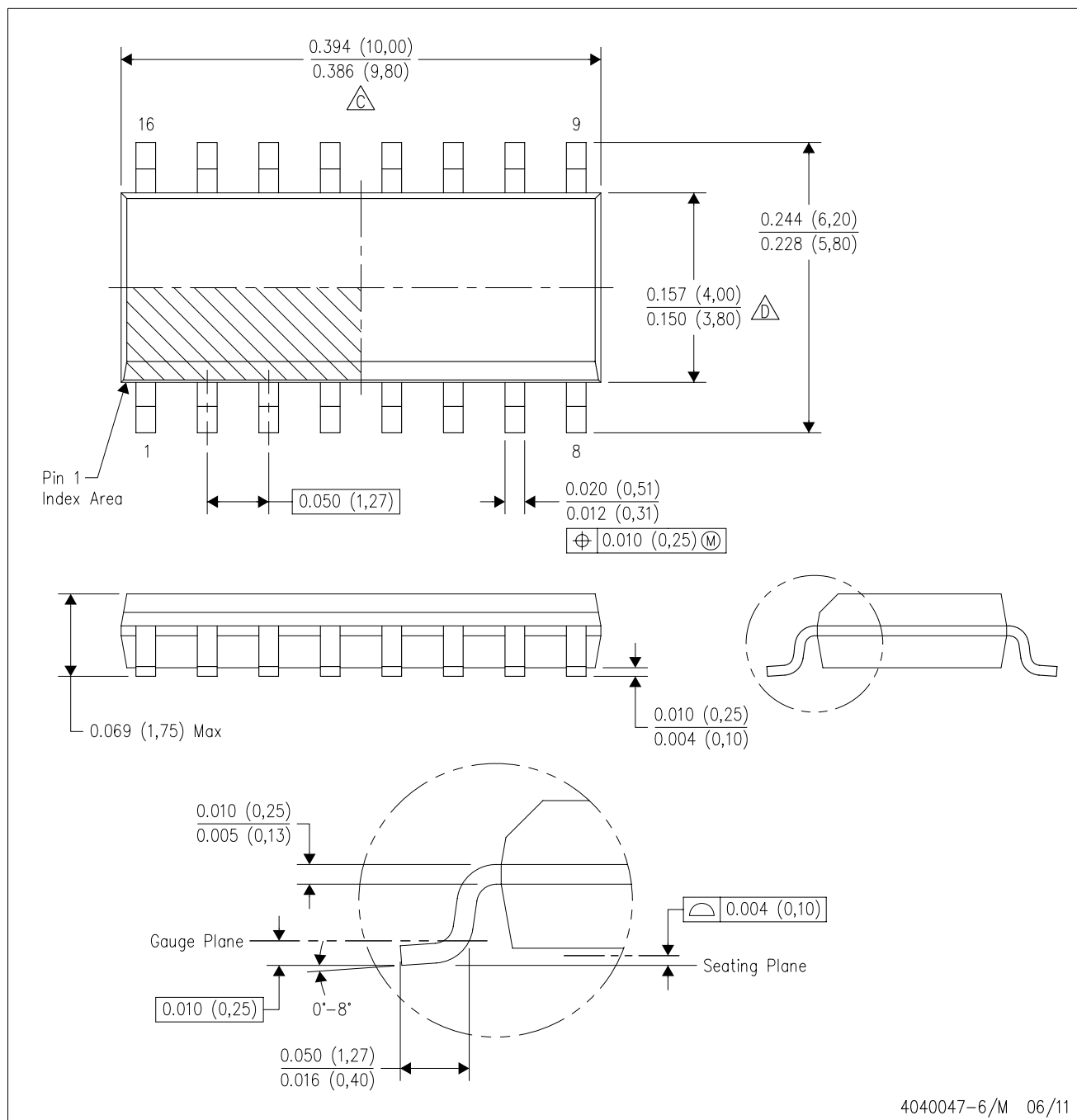
4220735/A 12/2021

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.

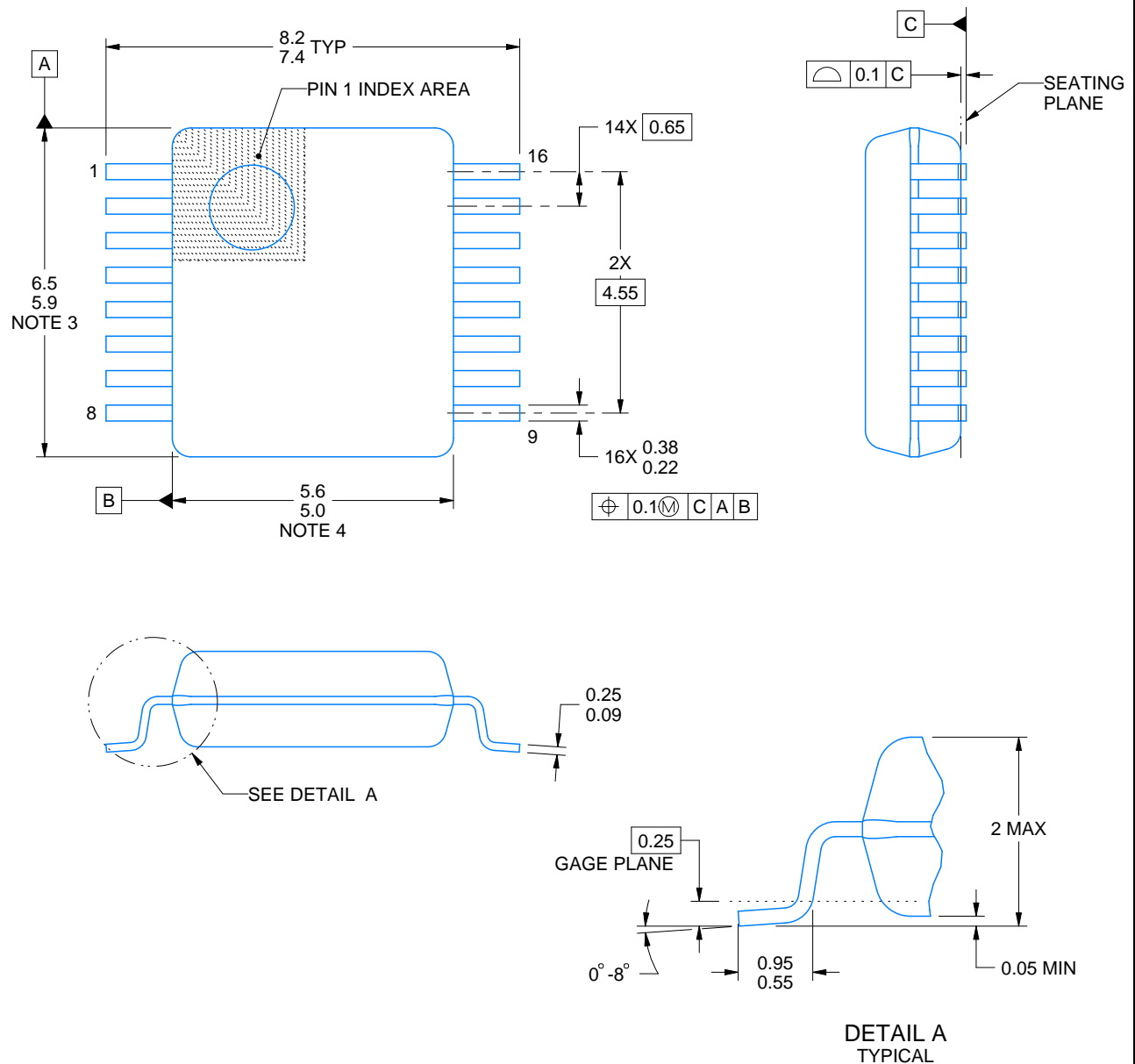
D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- $\triangle C$ 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.
- $\triangle D$ 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.



4220763/A 05/2022

NOTES:

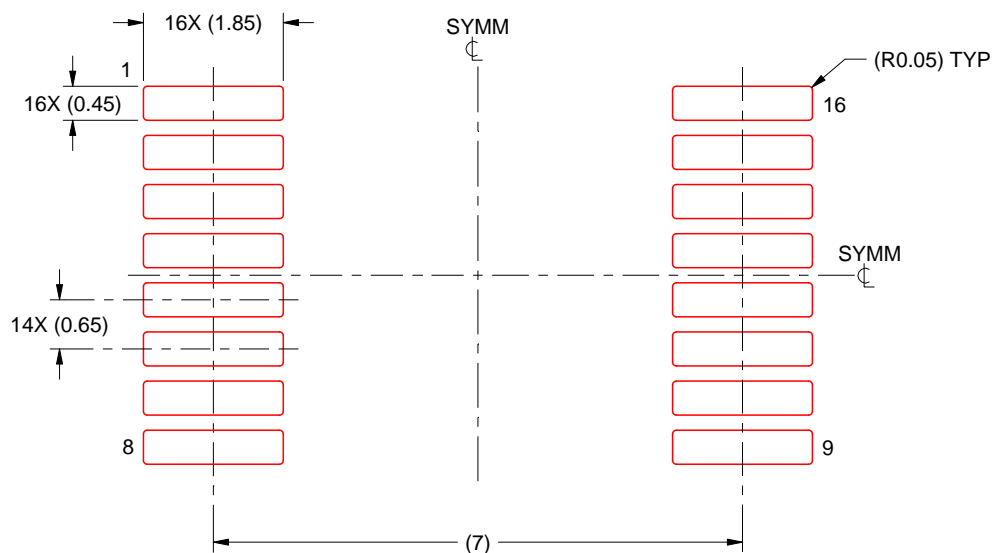
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

EXAMPLE STENCIL DESIGN

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

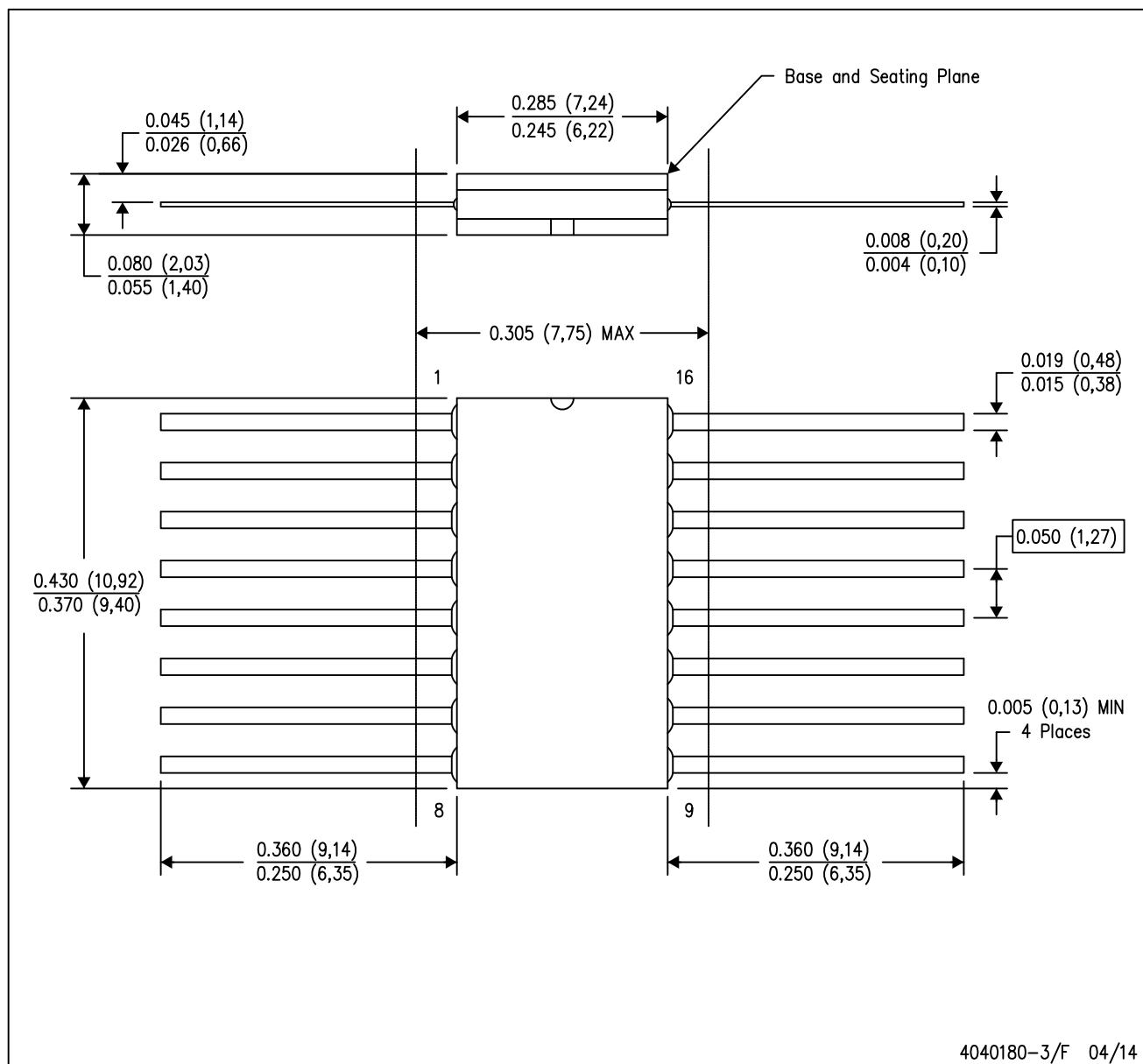
4220763/A 05/2022

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.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within MIL STD 1835 GDFP2-F16

GENERIC PACKAGE VIEW

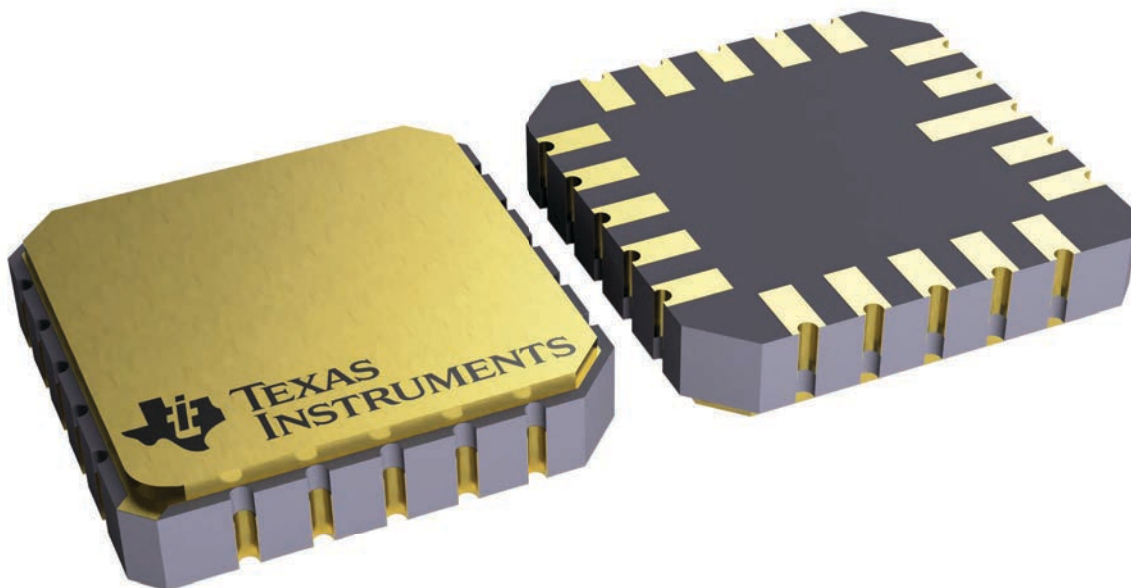
FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

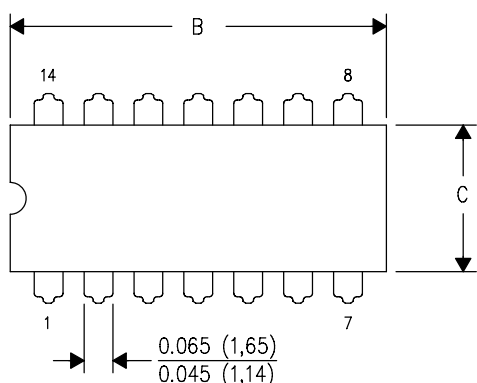


4229370VA\

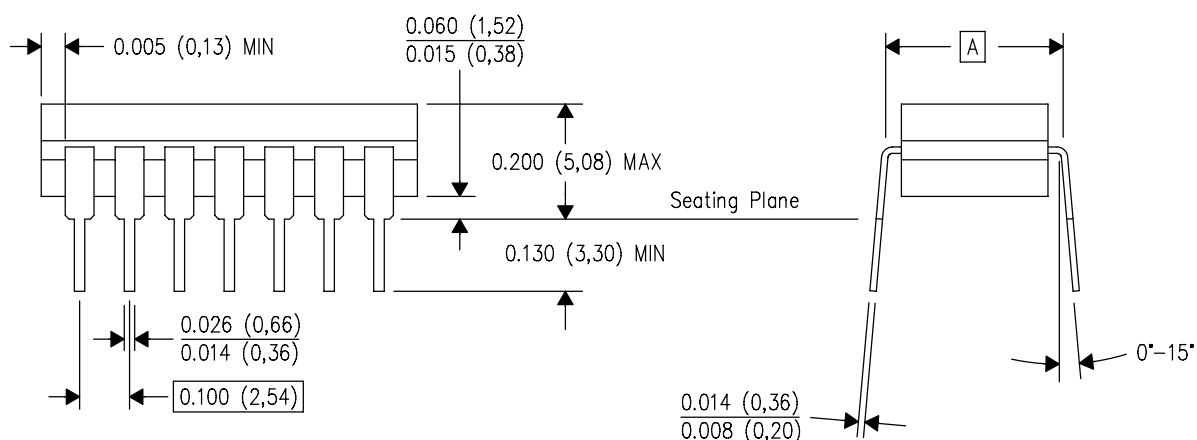
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| PINS ** DIM | 14 | 16 | 18 | 20 |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |



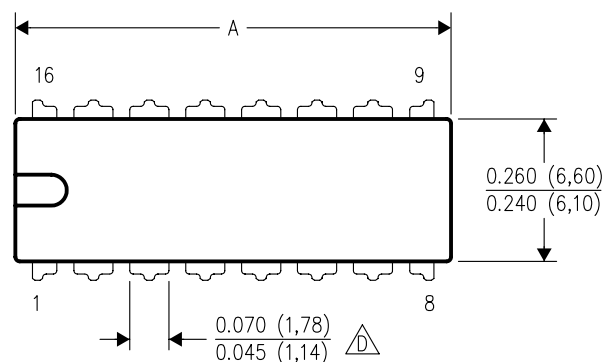
4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

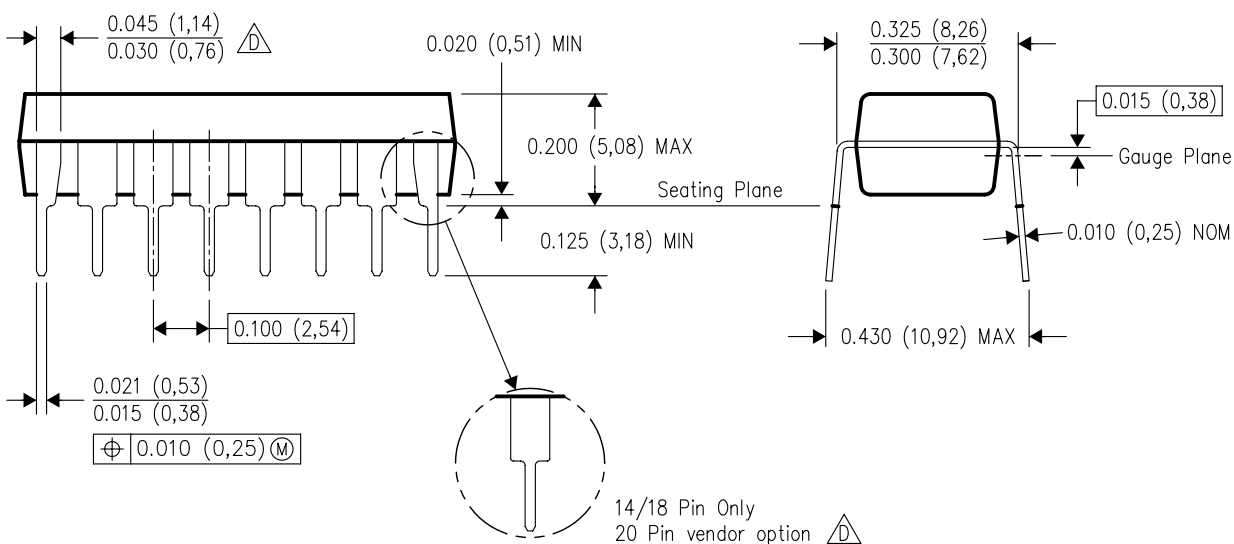
N (R-PDIP-T**)

16 PINS SHOWN



PLASTIC DUAL-IN-LINE PACKAGE



| PINS ** DIM | 14 | 16 | 18 | 20 |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS-001 VARIATION | AA | BB | AC | AD |



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 -  The 20 pin end lead shoulder width is a vendor option, either half or full width.

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