

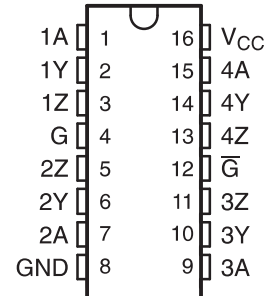
## FEATURES

- **Controlled Baseline**
  - One Assembly
  - One Test Site
  - One Fabrication Site
- **Extended Temperature Performance of –55°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree <sup>(1)</sup>**
- **Meets or Exceeds the Requirements of TIA/EIA-422-B and ITU Recommendation V.11**
- **Low Power,  $I_{CC} = 100 \mu\text{A}$  Typ**
- **Operates From a Single 5 V Supply**
- **High Speed,  $t_{PLH} = t_{PHL} = 7 \text{ ns}$  Typ**
- **Low Pulse Distortion,  $t_{sk(p)} = 0.5 \text{ ns}$  Typ**

(1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

- **High Output Impedance in Power-Off Conditions**
- **Improved Replacement for AM26LS31**

AM26C31... D PACKAGE



## DESCRIPTION/ORDERING INFORMATION

The AM26C31 is a differential line driver with complementary outputs, designed to meet the requirements of TIA/EIA -422-B and ITU (formerly CCITT). The 3-state outputs have high-current capability for driving balanced lines, such as twisted-pair or parallel-wire transmission lines, and they provide the high-impedance state in the power-off condition. The enable functions are common to all four drivers and offer the choice of an active-high (G) or active-low ( $\bar{G}$ ) enable input. BiCMOS circuitry reduces power consumption without sacrificing speed.

The AM26C31 is characterized for operation over extended temperature range of –55°C to 125°C.

### ORDERING INFORMATION<sup>(1)</sup>

| T <sub>A</sub> | PACKAGE <sup>(2)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------------------|--------------|-----------------------|------------------|
| –55°C to 125°C | SOIC – D               | Reel of 2500 | AM26C31MDREP          | 26C31EP          |

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

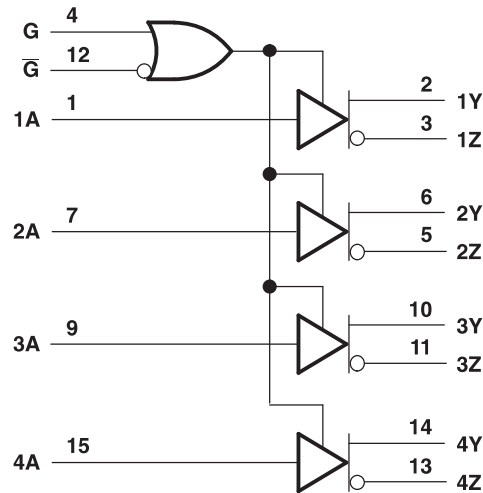


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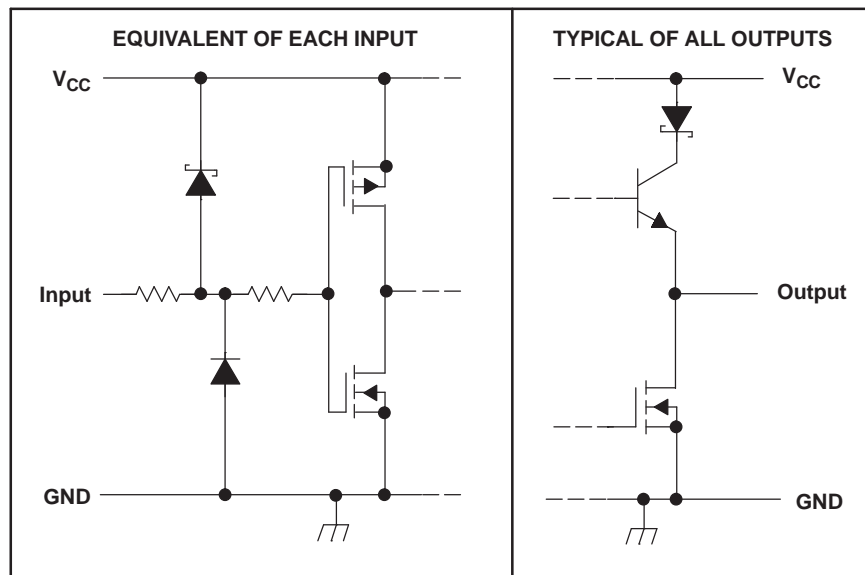
**FUNCTION TABLE**  
 (each driver)

| INPUT<br>A | ENABLES |           | OUTPUT |   |
|------------|---------|-----------|--------|---|
|            | 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 |

**LOGIC DIAGRAM (POSITIVE LOGIC)**



**SCHEMATICS OF INPUTS AND OUTPUTS**



**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

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

|                         |   | MIN  | MAX            | UNIT |
|-------------------------|---|------|----------------|------|
| $V_{CC}$                | Supply voltage range <sup>(2)</sup>         | -0.5 | 7              | V    |
| $V_I$                   | Input voltage range                         | -0.5 | $V_{CC} + 0.5$ | V    |
| $V_{ID}$                | Differential input voltage range            | -14  | 14             | V    |
| $V_O$                   | Output voltage range                        | -0.5 | 7              | V    |
| $I_{IK}$ or<br>$I_{OK}$ | Input or output clamp current               |      | ±20            | mA   |
| $I_O$                   | Output current                              |      | ±150           | mA   |
|                         | $V_{CC}$ current                            |      | 200            | mA   |
|                         | GND current                                 |      | -200           | mA   |
| $\theta_{JA}$           | Package thermal impedance <sup>(3)(4)</sup> |      | 73             | °C/W |
| $T_J$                   | Operating virtual junction temperature      |      | 150            | °C   |
| $T_{stg}$               | Storage temperature range                   | -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 the network ground terminal.
- (3) Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

**RECOMMENDED OPERATING CONDITIONS**

|          |                                | MIN | NOM | MAX | UNIT |
|----------|--------------------------------|-----|-----|-----|------|
| $V_{CC}$ | Supply voltage                 | 4.5 | 5   | 5.5 | V    |
| $V_{ID}$ | Differential input voltage     |     | ±7  |     | V    |
| $V_{IH}$ | 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 | -55 |     | 125 | °C   |

## ELECTRICAL CHARACTERISTICS

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

| PARAMETER           |   | TEST CONDITIONS   | MIN | TYP <sup>(1)</sup> | MAX         | UNIT     |
|---------------------|---|---|-----|--------------------|-------------|----------|
| V <sub>OH</sub>     | High-level output voltage   | I <sub>O</sub> = -20 mA   | 2.2 | 3.4                |             | V        |
| V <sub>OL</sub>     | Low-level output voltage  | I <sub>O</sub> = 20 mA  |     | 0.2                | 0.4         | V        |
| V <sub>OD</sub>     | Differential output voltage magnitude                             | R <sub>L</sub> = 100 Ω, See Figure 1  | 2   | 3.1                |             | V        |
| Δ V <sub>OD</sub>   | Change in magnitude of differential output voltage <sup>(2)</sup> | R <sub>L</sub> = 100 Ω, See Figure 1  |     |                    | ±0.4        | V        |
| V <sub>OC</sub>     | Common-mode output voltage  | R <sub>L</sub> = 100 Ω, See Figure 1  |     |                    | 3           | V        |
| Δ V <sub>OC</sub>   | Change in magnitude of common-mode output voltage <sup>(2)</sup>  | R <sub>L</sub> = 100 Ω, See Figure 1  |     |                    | ±0.4        | V        |
| I <sub>I</sub>      | Input current   | V <sub>I</sub> = V <sub>CC</sub> or GND   |     |                    | ±1          | μA       |
| I <sub>O(off)</sub> | Driver output current with power off                              | V <sub>CC</sub> = 0<br>V <sub>O</sub> = 6 V<br>V <sub>O</sub> = -0.25 V   |     |                    | 100<br>-100 | μA       |
| I <sub>OS</sub>     | Driver output short-circuit current                               | V <sub>O</sub> = 0  |     |                    | -170        | mA       |
| I <sub>OZ</sub>     | High-impedance off-state output current                           | V <sub>O</sub> = 2.5 V<br>V <sub>O</sub> = 0.5 V  |     |                    | 20<br>-20   | μA       |
| I <sub>CC</sub>     | Quiescent supply current  | I <sub>O</sub> = 0, V <sub>I</sub> = 0 V or 5 V<br>I <sub>O</sub> = 0, V <sub>I</sub> = 2.4 V or 0.5 V <sup>(3)</sup> |     |                    | 100<br>3.2  | μA<br>mA |
| C <sub>I</sub>      | Input capacitance   |   |     | 6                  |             | pF       |

(1) All typical values are at V<sub>CC</sub> = 5 V and T<sub>A</sub> = 25°C.

(2) Δ|V<sub>OD</sub>| and Δ|V<sub>OC</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) This parameter is measured per input. All other inputs are at 0 V or 5 V.

## SWITCHING CHARACTERISTICS

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

| PARAMETER                               |  | TEST CONDITIONS            | MIN | TYP <sup>(1)</sup> | MAX | UNIT |
|---|--|----------------------------|-----|--------------------|-----|------|
| t <sub>PLH</sub>                        | Propagation delay time, low- to high-level output          | S1 is open, See Figure 2   |     | 7                  | 12  | ns   |
| t <sub>PHL</sub>                        | Propagation delay time, high- to low-level output          | S1 is open, See Figure 2   |     | 6.5                | 12  | ns   |
| t <sub>sk(p)</sub>                      | Pulse skew time ( t <sub>PLH</sub> - t <sub>PHL</sub>  )   | S1 is open, See Figure 2   |     | 0.5                | 4   | ns   |
| t <sub>r(OD)</sub> , t <sub>f(OD)</sub> | Differential output rise and fall times                    | S1 is open, See Figure 3   |     | 5                  | 12  | ns   |
| t <sub>PZH</sub>                        | Output enable time to high level                           | S1 is closed, See Figure 4 |     | 10                 | 19  | ns   |
| t <sub>PZL</sub>                        | Output enable time to low level                            | S1 is closed, See Figure 4 |     | 10                 | 19  | ns   |
| t <sub>PHZ</sub>                        | Output disable time from high level                        | S1 is closed, See Figure 4 |     | 7                  | 16  | ns   |
| t <sub>PLZ</sub>                        | Output disable time from low level                         | S1 is closed, See Figure 4 |     | 7                  | 16  | ns   |
| C <sub>pd</sub>                         | Power dissipation capacitance (each driver) <sup>(2)</sup> | S1 is open, See Figure 2   |     | 100                |     | pF   |

(1) All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

(2) C<sub>pd</sub> is used to estimate the switching losses according to P<sub>D</sub> = C<sub>pd</sub> × V<sub>CC</sub><sup>2</sup> × f, where f is the switching frequency.

PARAMETER MEASUREMENT INFORMATION

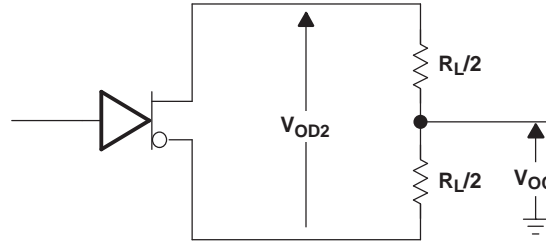
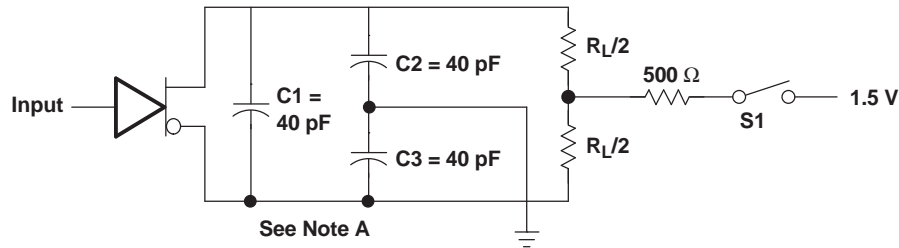
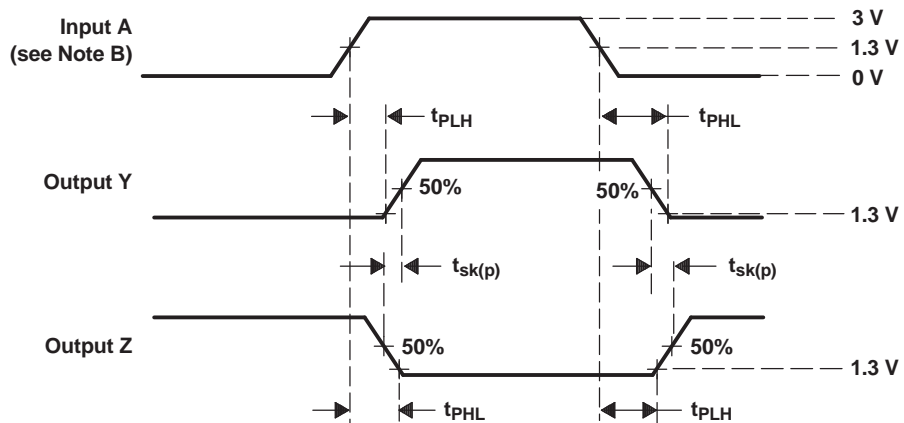


Figure 1. Differential and Common-Mode Output Voltages



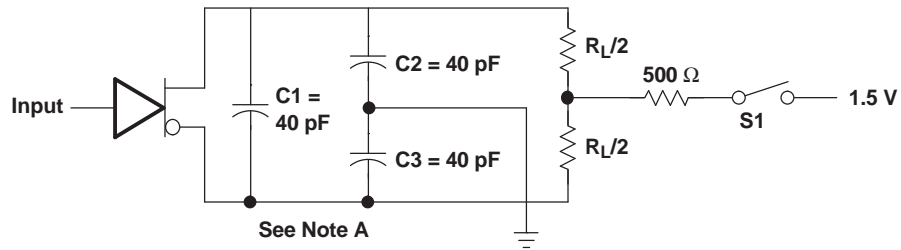
TEST CIRCUIT



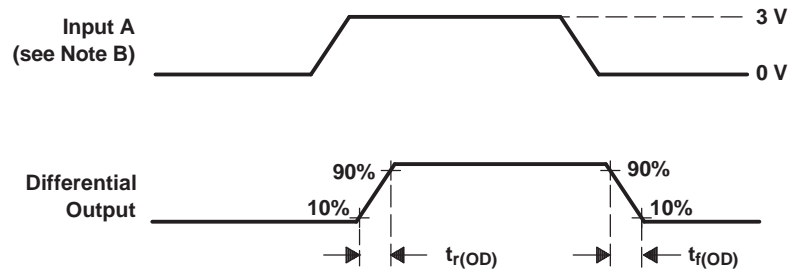
- A.  $C_1$ ,  $C_2$ , and  $C_3$  include probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ , duty cycle  $\leq 50\%$ , and  $t_r, t_f \leq 6 \text{ ns}$ .

Figure 2. Propagation Delay Time and Skew Waveforms and Test Circuit

PARAMETER MEASUREMENT INFORMATION (continued)



TEST CIRCUIT

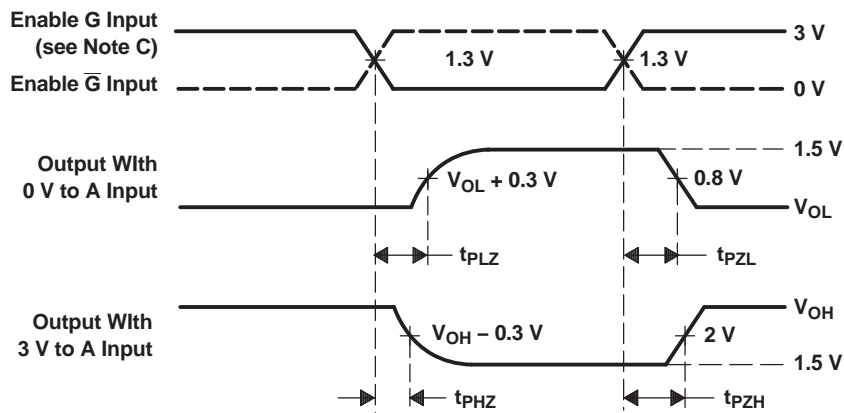
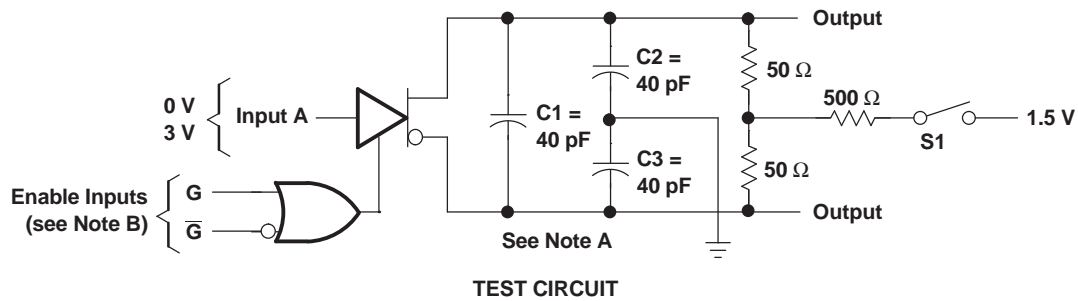


VOLTAGE WAVEFORMS

- A. C1, C2, and C3 include probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz, duty cycle  $\leq$  50%, and  $t_r, t_f \leq$  6 ns.

Figure 3. Differential Output Rise and Fall Time Waveforms and Test Circuit

PARAMETER MEASUREMENT INFORMATION (continued)



VOLTAGE WAVEFORMS

- A. C1, C2, and C3 include probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz, duty cycle  $\leq$  50%,  $t_r <$  6 ns, and  $t_f <$  6 ns.
- C. Each enable is tested separately.

Figure 4. Output Enable and Disable Time Waveforms and Test Circuit

### TYPICAL CHARACTERISTICS

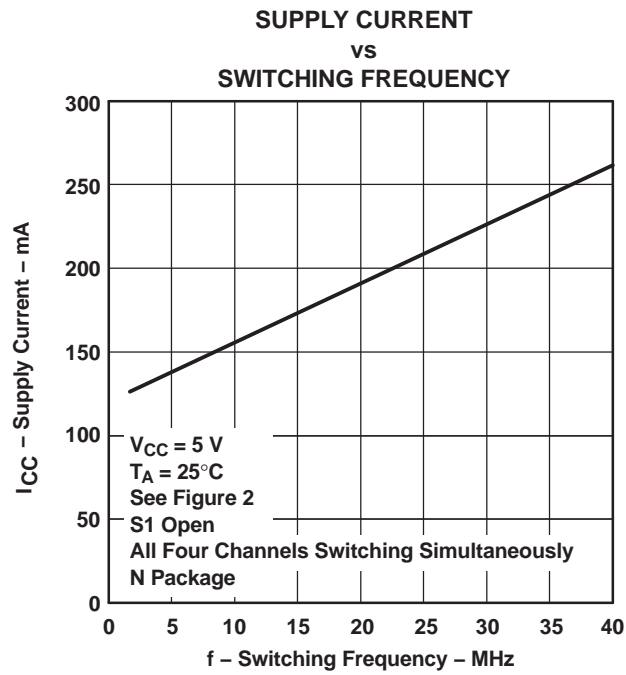


Figure 5.



**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                 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| AM26C31MDREP     | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green    | Call TI   NIPDAU                     | Level-1-260C-UNLIM   | -55 to 125   | 26C31EP                 | <a href="#">Samples</a> |
| V62/07647-01XE   | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | 26C31EP                 | <a href="#">Samples</a> |

(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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**OTHER QUALIFIED VERSIONS OF AM26C31-EP :**

- Catalog: [AM26C31](#)
- Military: [AM26C31M](#)

## NOTE: Qualified Version Definitions:

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

**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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| AM26C31MDREP | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| AM26C31MDREP | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 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) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| AM26C31MDREP | SOIC         | D               | 16   | 2500 | 346.0       | 346.0      | 33.0        |
| AM26C31MDREP | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |

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.

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