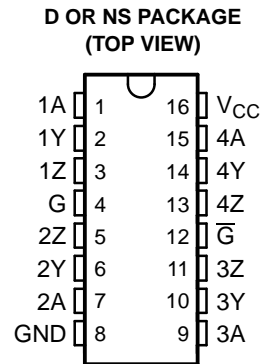


FEATURES

- Switching Rates up to 32 MHz
- Operate From a Single 3.3-V Supply
- Propagation Delay Time . . . 8 ns Typ
- Pulse Skew Time . . . 500 ps Typ
- High Output-Drive Current . . . ± 30 mA
- Controlled Rise and Fall Times . . . 3 ns Typ
- Differential Output Voltage With 100- Ω Load . . . 1.5 V Typ
- Ultra-Low Power Dissipation
 - dc, 0.3 mW Max
 - 32 MHz All Channels (No Load), 385 mW Typ
- Accept 5-V Logic Inputs With 3.3-V 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



DESCRIPTION/ORDERING INFORMATION

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 32 MHz. 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

ORDERING INFORMATION

T _A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	SOIC – D	Tape and reel	AM26LV31CD	AM26LV31C
			AM26LV31CDR	
	SOIC – NS	Tape and reel	AM26LV31CNS	26LV31
			AM26LV31CNSR	
–45°C to 85°C	SOIC – D	Tape and reel	AM26LV31ID	AM26LV31I
			AM26LV31IDR	
	SOIC – NS	Tape and reel	AM26LV31INS	26LV31I
			AM26LV31INSR	

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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

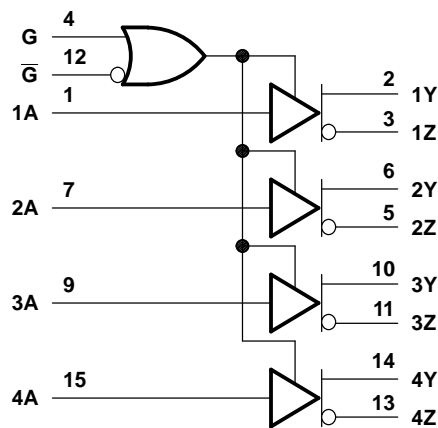
LinIMPACT-C60 is a trademark of Texas Instruments.

FUNCTION TABLE⁽¹⁾

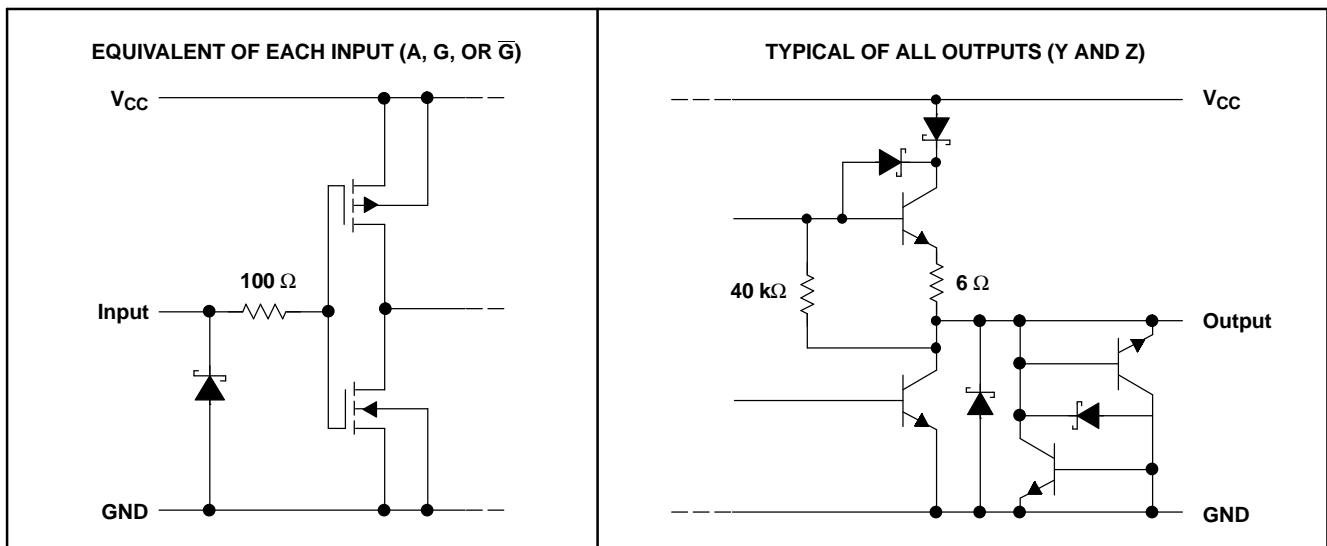
INPUT A	ENABLES		OUTPUTS	
	G	\bar{G}	Y	Z
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Z	Z

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

LOGIC DIAGRAM (POSITIVE LOGIC)



SCHEMATIC (EACH DRIVER)



All resistor values are nominal.

Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT
V _{CC}	Supply voltage range ⁽²⁾	-0.3	6	V
V _I	Input voltage range	-0.3	6	V
V _O	Output voltage range	-0.3	6	V
θ _{JA}	Package thermal impedance ⁽³⁾	D package		73
		NS package		64
	Lead temperature	1,6 mm (1/16 in) from case for 10 s		260
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 are with respect to GND.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

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
		AM26LV31I		-45	85

Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{IK}	Input clamp voltage I _I = 18 mA			-1.5	V
V _{OH}	High-level output voltage V _{IH} = 2 V, I _{OH} = -12 mA	1.85	2.3		V
V _{OL}	Low-level output voltage V _{IL} = 0.8 V, I _{OH} = 12 mA		0.8	1.05	V
V _{OD}	Differential output voltage ⁽²⁾	0.95	1.5		V
V _{OC}	Common-mode output voltage R _L = 100 Ω	1.3	1.55	1.8	V
Δ V _{OC}	Change in magnitude of common-mode output voltage ⁽²⁾			±0.2	V
I _O	Output current with power off V _O = -0.25 V or 6 V, V _{CC} = 0			±100	μA
I _{OZ}	Off-state (high-impedance state) output current V _O = -0.25 V or 6 V, G = 0.8 V or \bar{G} = 2 V			±100	μA
I _H	High-level input current V _{CC} = 0 or 3 V, V _I = 5.5 V			10	μA
I _L	Low-level input current V _{CC} = 3.6 V, V _I = 0			-10	μA
I _{OS}	Short-circuit output current V _{CC} = 3.6 V, V _O = 0			-200	mA
I _{CC}	Supply current (all drivers) V _I = V _{CC} or GND, No load			100	μA
C _{pd}	Power-dissipation capacitance (all drivers) ⁽³⁾ No load		160		pF

- (1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
- (2) Δ|V_{OD}| and Δ|V_{OC}| are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.
- (3) C_{pd} determines the no-load dynamic current consumption. I_S = C_{pd} × V_{CC} × f + I_{CC}

AM26LV31C, AM26LV31I LOW-VOLTAGE HIGH-SPEED QUADRUPLE DIFFERENTIAL LINE DRIVERS

SLLS201G–MAY 1995–REVISED MAY 2005

Switching Characteristics

$V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽¹⁾	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	See Figure 2	4	8	12	ns
t_{PHL}	Propagation delay time, high- to low-level output		4	8	12	ns
t_t	Transition time (t_r or t_f)			3		ns
SR	Slew rate, single-ended output voltage	See Note ⁽²⁾ and Figure 2		0.3	1	V/ns
t_{PZH}	Output-enable time to high level	See Figure 3		10	20	ns
t_{PZL}	Output-enable time to low level	See Figure 4		10	20	ns
t_{PHZ}	Output-disable time from high level	See Figure 3		10	20	ns
t_{PLZ}	Output-disable time from low level	See Figure 4		10	20	ns
$t_{sk(p)}$	Pulse skew	$f = 32\text{ MHz}$, See Note ⁽³⁾		0.5	1.5	ns
$t_{sk(o)}$	Skew limit	$f = 32\text{ MHz}$			1.5	ns
$t_{sk(lim)}$	Skew limit (device to device)	$f = 32\text{ MHz}$, See Note ⁽⁴⁾			3	ns

(1) All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

(2) Slew rate is defined by:

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

(3) Pulse skew is defined as the $|t_{PLH} - t_{PHL}|$ 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.

PARAMETER MEASUREMENT INFORMATION

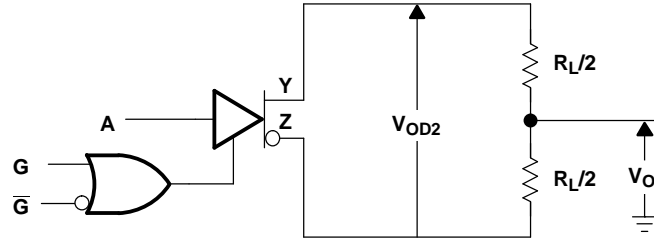
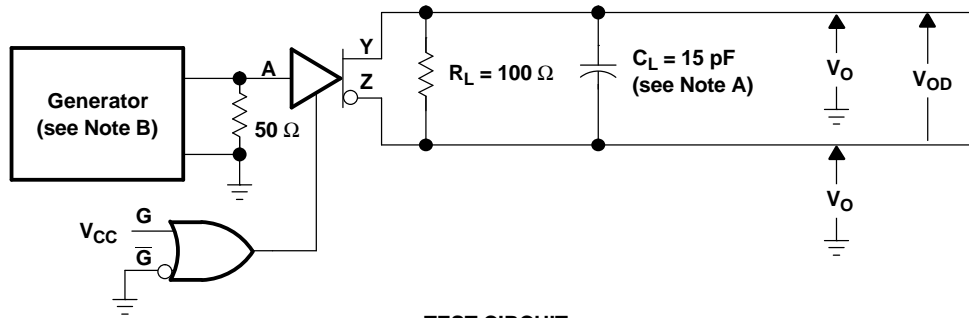
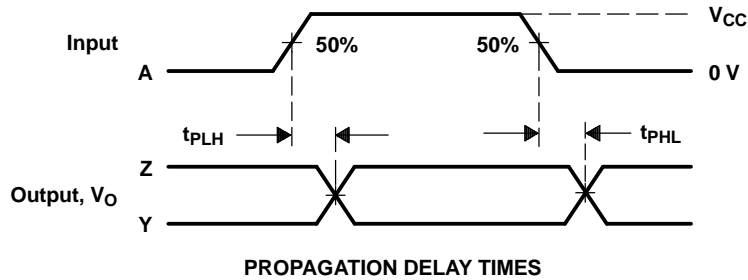


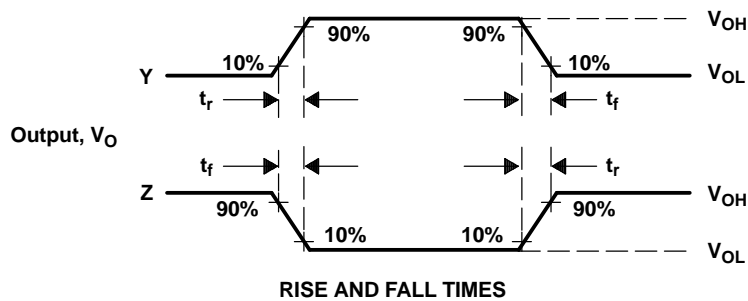
Figure 1. Differential and Common-Mode Output Voltages



TEST CIRCUIT



PROPAGATION DELAY TIMES

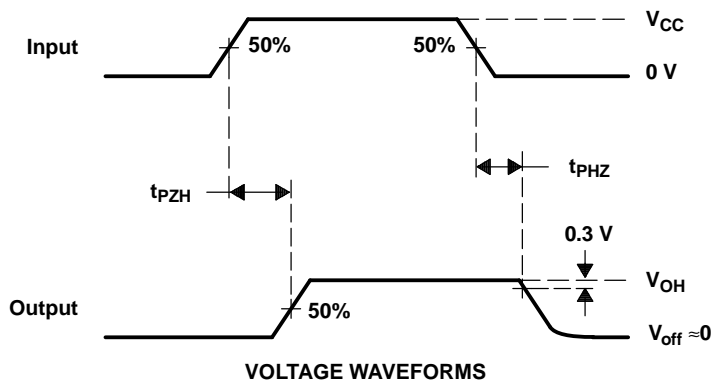
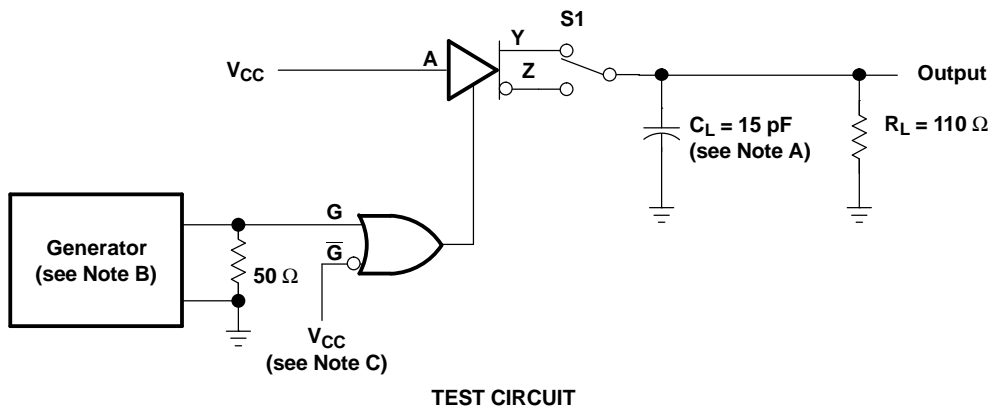


RISE AND FALL TIMES

- NOTES: A. C_L includes probe and jig capacitance.
B. The input pulse is supplied by a generator having the following characteristics: PRR = 32 MHz, $Z_O \approx 50 \Omega$, 50% duty cycle, t_r and $t_f \leq 2$ ns.

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

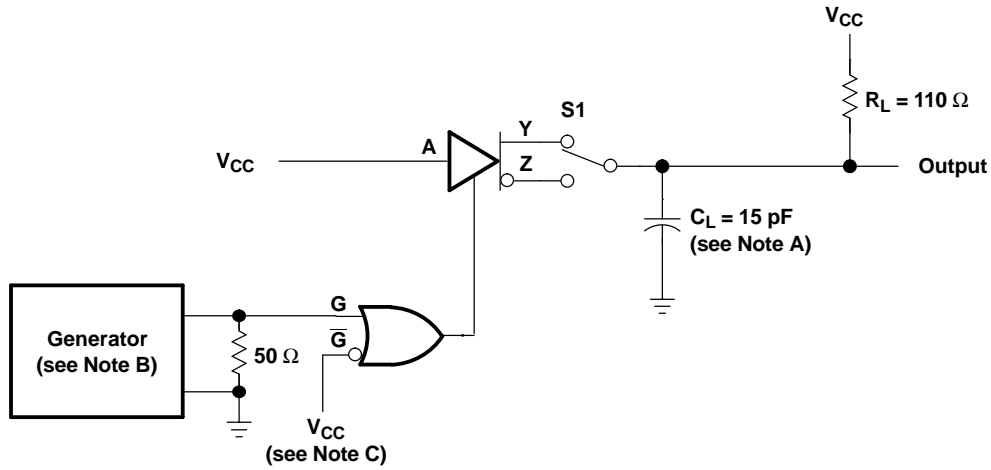
PARAMETER MEASUREMENT INFORMATION



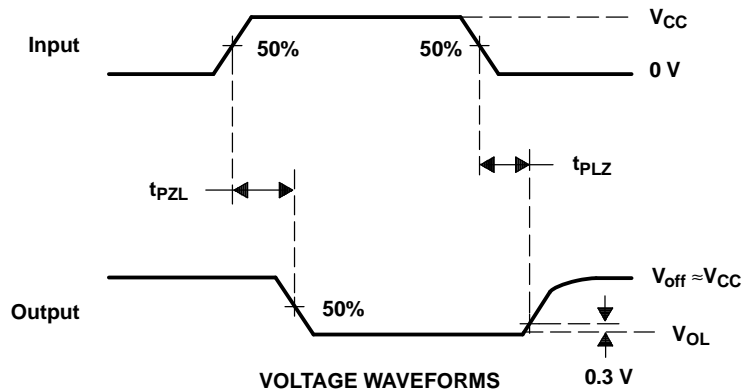
- NOTES: A. C_L includes probe and jig capacitance.
 B. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, $Z_O = 50 \Omega$, 50% duty cycle, t_r and t_f (10% to 90%) ≤ 2 ns.
 C. To test the active-low enable \overline{G} , ground G and apply an inverted waveform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

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

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

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

Figure 4. Test Circuit and Voltage Waveforms, t_{pZL} and t_{pLZ}

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
AM26LV31CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AM26LV31C	Samples
AM26LV31CDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AM26LV31C	Samples
AM26LV31CDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AM26LV31C	Samples
AM26LV31CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	0 to 70	AM26LV31C	Samples
AM26LV31CDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AM26LV31C	Samples
AM26LV31CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AM26LV31C	Samples
AM26LV31CNSLE	OBSOLETE	SO	NS	16		TBD	Call TI	Call TI	0 to 70		
AM26LV31CNSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	26LV31	Samples
AM26LV311D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-45 to 85	AM26LV311	Samples
AM26LV311DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-45 to 85	AM26LV311	Samples
AM26LV311DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-45 to 85	AM26LV311	Samples
AM26LV311NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU 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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

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	16.8	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
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	364.0	364.0	27.0
AM26LV31CDRG4	SOIC	D	16	2500	333.2	345.9	28.6
AM26LV31IDR	SOIC	D	16	2500	333.2	345.9	28.6
AM26LV31INSR	SO	NS	16	2000	367.0	367.0	38.0

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.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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.

IMPORTANT NOTICE

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

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

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

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

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

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

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

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

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

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

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

Products

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

Applications

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

TI E2E Community

e2e.ti.com