LOW-VOLTAGE HIGH-SPEED QUADRUPLE DIFFERENTIAL LINE DRIVER WITH ±15-kV IEC ESD PROTECTION

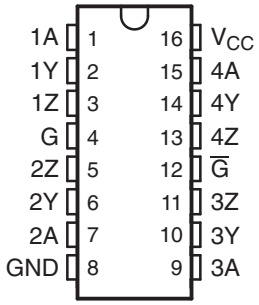
FEATURES

- Meets or Exceeds Standards TIA/EIA-422-B and ITU Recommendation V.11
- Operates From a Single 3.3-V Power Supply
- ESD Protection for RS422 Bus Pins
  - ±15-kV Human-Body Model (HBM)
  - ±8-kV IEC61000-4-2, Contact Discharge
  - ±15-kV IEC61000-4-2, Air-Gap Discharge
- Switching Rates up to 32 MHz
- Propagation Delay Time . . . 8 ns Typ
- Pulse Skew Time . . . 500 ps Typ
- High Output-Drive Current . . . ±30 mA
- Controlled Rise and Fall Times . . . 5 ns Typ
- Differential Output Voltage With 100-Ω Load . . . 2.6 V Typ
- Accepts 5-V Logic Inputs With 3.3-V Supply
- I_{off} Supports Partial-Power-Down Mode Operation
- Driver Output Short-Protection Circuit
- Glitch-Free Power-Up/Power-Down Protection

SUPPORTS DEFENSE, AEROSPACE, AND MEDICAL APPLICATIONS

- Controlled Baseline
- One Assembly/Test Site
- One Fabrication Site
- Available in Extended (–55°C/105°C) Temperature Range(1)
- Extended Product Life Cycle
- Extended Product-Change Notification
- Product Traceability

D PACKAGE
(TOP VIEW)



(1) Additional temperature ranges are available – contact factory

DESCRIPTION/ORDERING INFORMATION

The AM26LV31E is a quadruple differential line driver with 3-state outputs. This driver has ±15-kV ESD (HBM and IEC61000-4-2, Air-Gap Discharge) and ±8-kV ESD (IEC61000-4-2, Contact Discharge) protection. This device is designed to meet TIA/EIA-422-B and ITU Recommendation V.11 drivers with reduced supply voltage.

The device is optimized for balanced-bus transmission at switching rates up to 32 MHz. The outputs have high current capability for driving balanced lines, such as twisted-pair transmission lines, and provide a high impedance in the power-off condition.

The AM26LV31ES is characterized for operation from –55°C to 105°C.

ORDERING INFORMATION

T_A	PACKAGE(1)(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–55°C to 105°C	SOIC – D	Tape and reel	AM26LV31ESDREP	A26LV31ESP

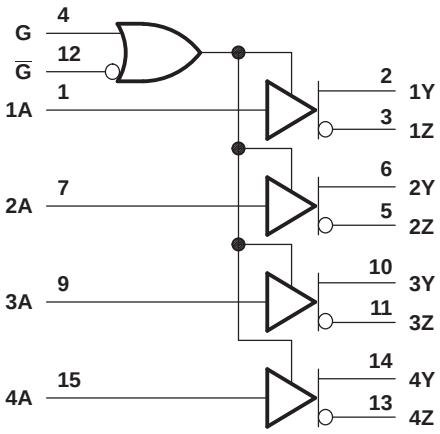
(1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

FUNCTION TABLE(1)

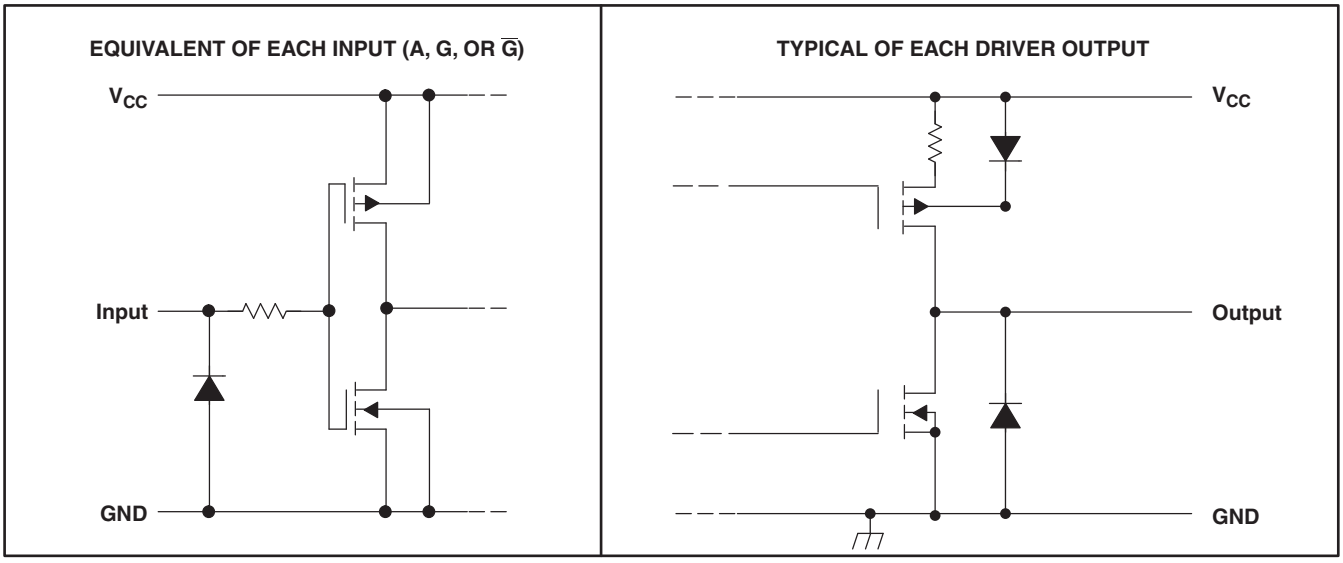
INPUT A	ENABLES		OUTPUTS	
	G	$\overline{G}$	Y	Z
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Z	Z

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

LOGIC DIAGRAM



SCHEMATIC



ABSOLUTE MAXIMUM RATINGS(1)

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range(2)		–0.5	6	V
V_I	Input voltage range		–0.5	6	V
V_O	Output voltage range		–0.5	6	V
I_{IK}	Input clamp current	$V_I < 0$		–20	mA
I_{OK}	Output clamp current	$V_O < 0$		–20	mA
I_O	Continuous output current			±150	mA
	Continuous current through V_{CC} or GND			±200	mA
T_J	Operating virtual junction temperature			150	°C
θ_{JA}	Package thermal impedance(3)(4)			73	°C/W
T_A	Operating free-air temperature range		–55	105	°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 input voltage are with respect to the network GND.
(3) Maximum power dissipation is a function of $T_{J(max)}$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} – T_A)/\theta_{JA}$. Selecting the maximum 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	3	3.3	3.6	V
V_I	Input voltage	0		5.5	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	–55		105	°C

ELECTRICAL CHARACTERISTICS

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

PARAMETER		TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
V_{OH}	High-level output voltage	V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = –20 mA	2.4	3		V
V_{OL}	Low-level output voltage	V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = 20 mA		0.2	0.4	V
$\|V_{OD1}\|$	Differential output voltage	I_O = 0 mA	2		4	V
$\|V_{OD2}\|$	Differential output voltage	R_L = 100 Ω (see Figure 1)(2)	2	2.6		V
$\Delta\|V_{OD}\|$	Change in magnitude of differential output voltage	R_L = 100 Ω (see Figure 1)(2)			±0.4	V
V_{OC}	Common-mode output voltage	R_L = 100 Ω (see Figure 1)(2)		1.5	2	V
$\Delta\|V_{OC}\|$	Change in magnitude of common-mode output voltage	R_L = 100 Ω (see Figure 1)(2)			±0.4	V
$I_{O(OFF)}$	Output current with power off	V_{CC} = 0, V_O = –0.25 V or 5.5 V			±127	µA
I_{OZ}	High-impedance state output current	V_O = –0.25 V or 5.5 V, G = 0.8 V or $\overline{G}$ = 2 V			±127	µA
I_I	Input current	V_{CC} = 0 or 3.6 V, V_I = 0 or 5.5 V			±10	µA
I_{OS}	Short-circuit output current	V_O = V_{CC} or GND(3)	–30		–150	mA
I_{CC}	Supply current (total package)	V_I = V_{CC} or GND, No load, enable			100	µA
C_{pd}	Power dissipation capacitance	No load(4)		160		pF

(1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
(2) Refer to TIA-EIA-422-B for exact conditions.
(3) Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.
(4) C_{pd} determines the no-load dynamic current consumption: $I_S = C_{pd} \times V_{CC} \times f + I_{CC}$

SWITCHING CHARACTERISTICS

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

PARAMETER		TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
t_{PHL}	Propagation delay time, high- to low-level output	See Figure 2	4	8	12	ns
t_{PLH}	Propagation delay time, low- to high-level output		3.5	8	12	ns
t_t	Transition time (t_r or t_f)	See Figure 2		5	10	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	See Figure 2(2)(3)		0.5	3	ns
$t_{sk(o)}$	Skew limit (pin to pin)				1.5	ns
$t_{sk(lim)}$	Skew limit (device to device)				3	ns
$f_{(max)}$	Maximum operating frequency	See Figure 2		32		MHz

(1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
(2) Pulse skew is defined as the $|t_{PLH} - t_{PHL}|$ of each channel of the same device.
(3) Skew limit (device to device) is the maximum difference in propagation delay times between any two channels of any two devices.

ESD PROTECTION

PARAMETER	TEST CONDITIONS	TYP	UNIT
Driver output	HBM	±15	kV
	IEC61000-4-2, Air-Gap Discharge	±15	
	IEC61000-4-2, Contact Discharge	±8	

PARAMETER MEASUREMENT INFORMATION

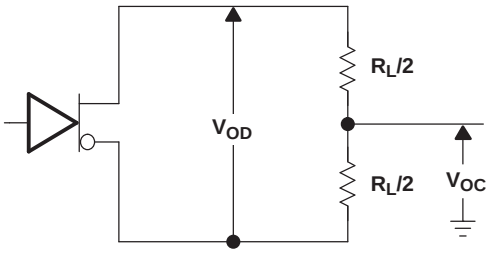
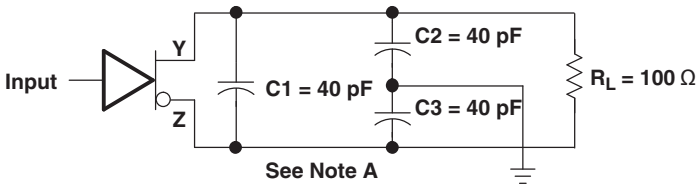
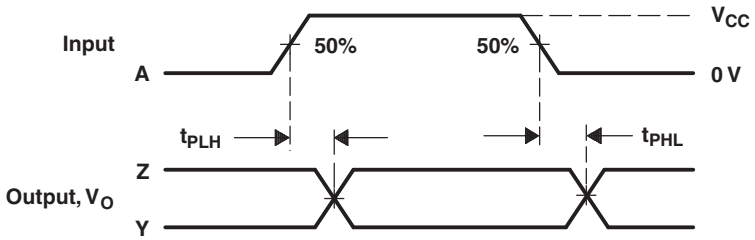
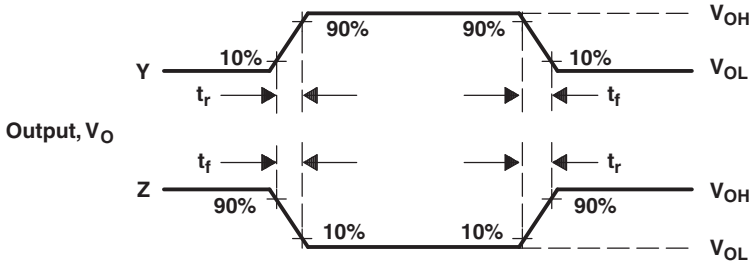


Figure 1. Test Circuit, V_{OD} and V_{OC}





PROPAGATION DELAY TIMES

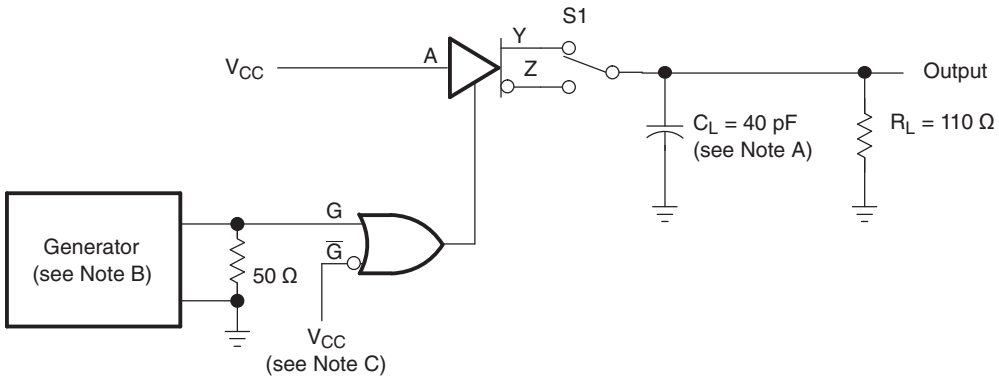


RISE AND FALL TIMES

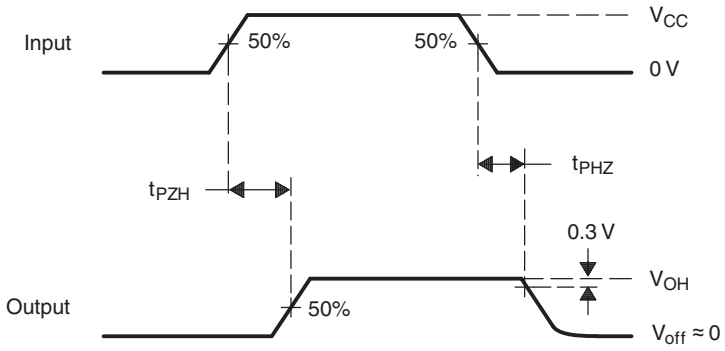
NOTES: A. C_L includes probe and jig capacitance.
B. The input pulse is supplied by a generator having the following characteristics: PRR = 32 MHz, 50% duty cycle, t_r and t_f ≤ 2 ns.

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

PARAMETER MEASUREMENT INFORMATION (continued)



TEST CIRCUIT



VOLTAGE WAVEFORMS

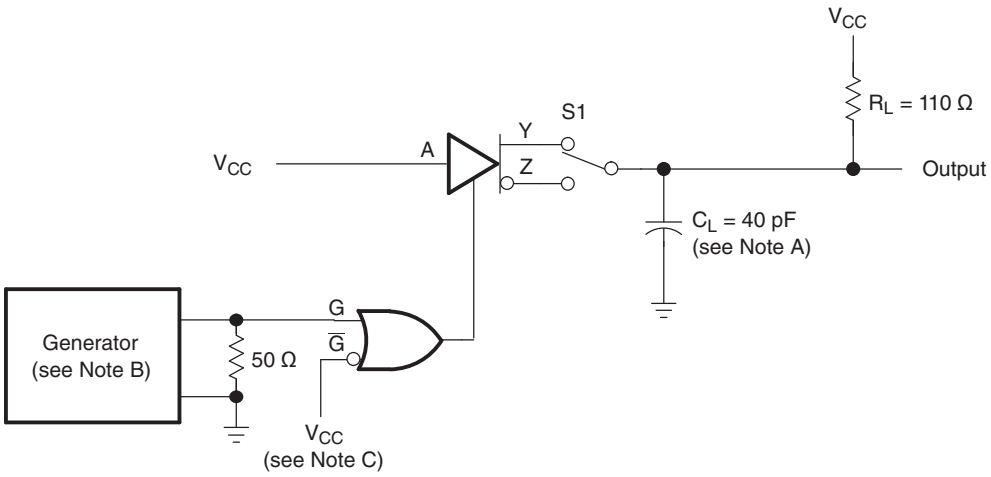
A. C_L includes probe and jig capacitance.

B. The input pulse is supplied by a generator having the following characteristics: PRR = 10 MHz, duty cycle = 50%, $t_r = t_f \leq 2$ns.

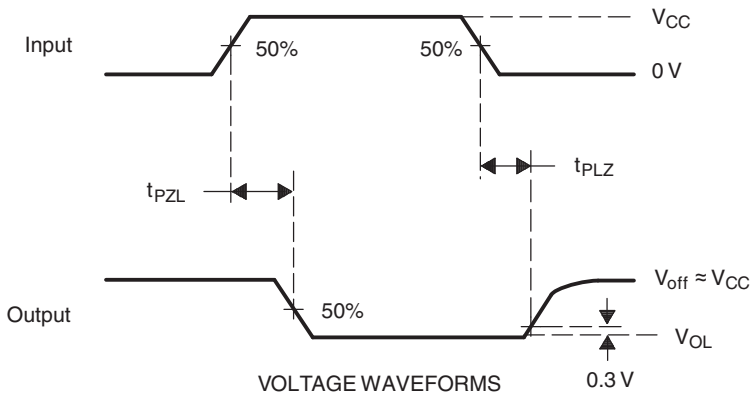
C. To test the active-low enable $\overline{G}$, ground G and apply an inverted waveform $\overline{G}$.

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

PARAMETER MEASUREMENT INFORMATION (continued)



TEST CIRCUIT



VOLTAGE WAVEFORMS

A. C_L includes probe and jig capacitance.

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C. To test the active-low enable $\overline{G}$, ground G and apply an inverted waveform $\overline{G}$.

Figure 4. Test Circuit and Voltage Waveforms, t_{PZL} and t_{PLZ}

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)
AM26LV31ESDREP	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 105	A26LV31ESP
AM26LV31ESDREP.A	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 105	A26LV31ESP
V62/09603-01XE	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 105	A26LV31ESP

(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.

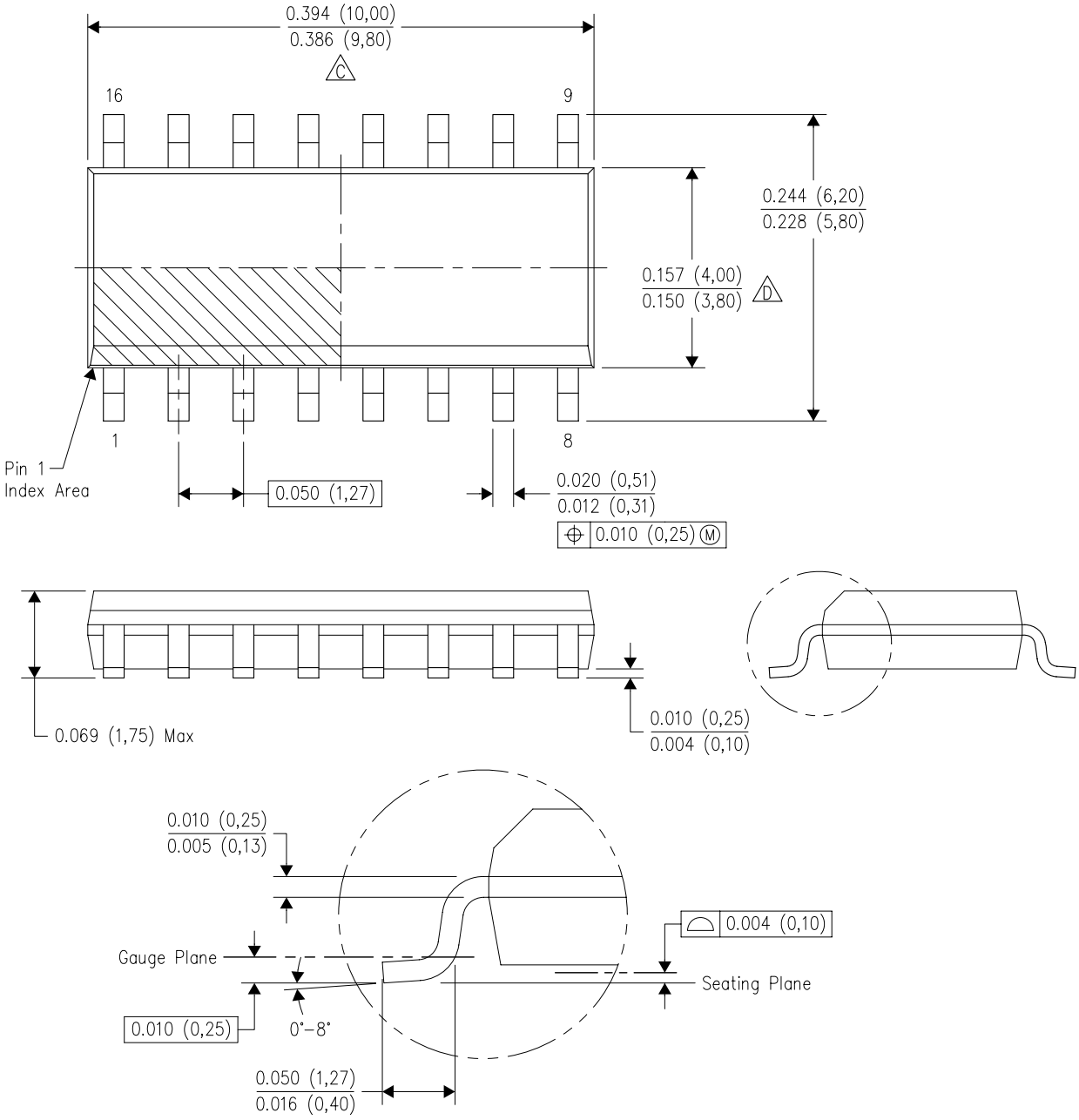
OTHER QUALIFIED VERSIONS OF AM26LV31E-EP :

- Catalog : AM26LV31E

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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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