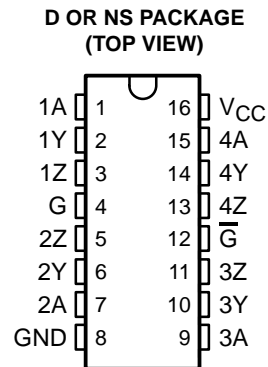


# AM26LV31C, AM26LV31I LOW-VOLTAGE HIGH-SPEED QUADRUPLE DIFFERENTIAL LINE DRIVERS

SLLS201F – MAY 1995 – REVISED APRIL 2002

- 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 . . .  $\pm 30$  mA
- Controlled Rise and Fall Times . . . 3 ns Typ
- Differential Output Voltage With 100- $\Omega$  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 a 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

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



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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

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## AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGES
	SMALL OUTLINE (D, NS)
0°C to 70°C	AM26LV31CD
	AM26LV31CNSR
-45°C to 85°C	AM26LV31INSR

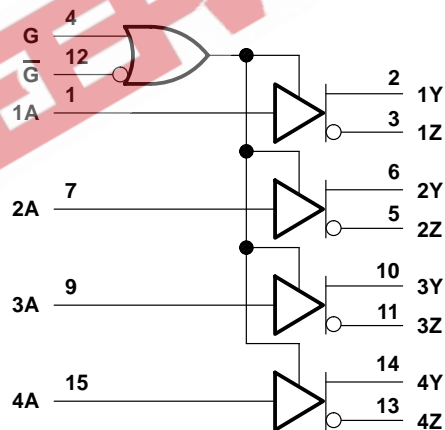
The D package also is available taped and reeled. Add the suffix R to device type (e.g., AM26LV31CDR). The NS package is only available taped and reeled.

## FUNCTION TABLE

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

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

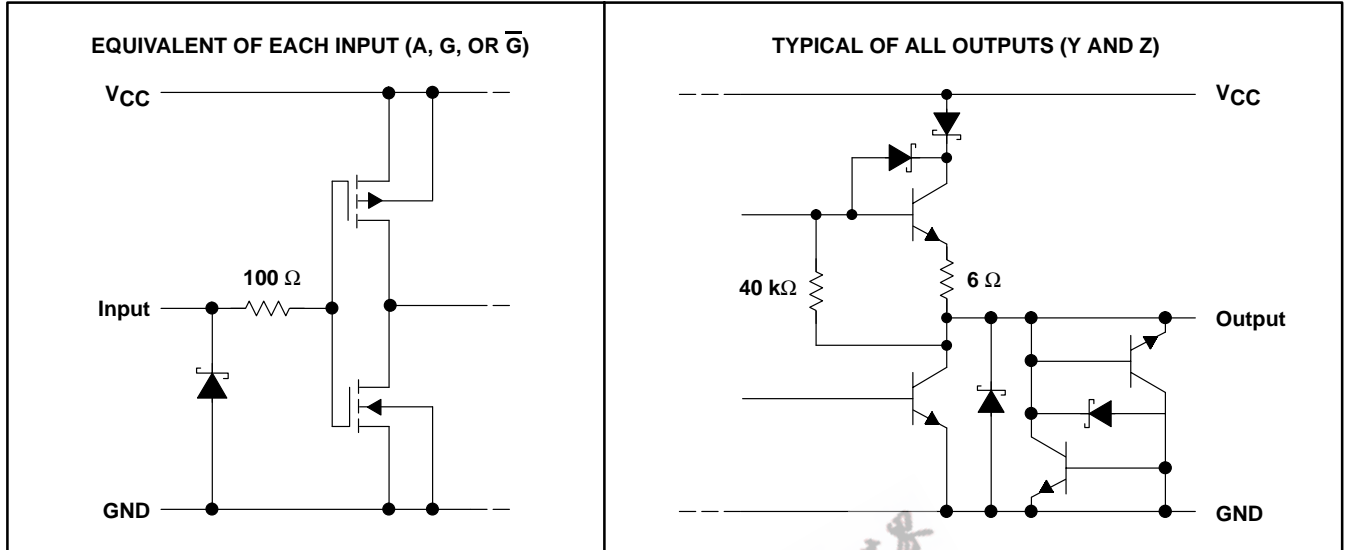
## logic diagram (positive logic)



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

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**schematic (each driver)**



All resistor values are nominal.

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

Supply voltage range, $V_{CC}$ (see Note 1)	.....	-0.3 V to 6 V
Input voltage range, $V_I$	.....	-0.3 V to 6 V
Output voltage range, $V_O$	.....	-0.3 V to 6 V
Package thermal impedance, $\theta_{JA}$ (see Note 2): D package	.....	73°C/W
NS package	.....	64°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	.....	260°C
Storage temperature range, $T_{stg}$	.....	-65°C to 150°C

† 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.

NOTES: 1. All voltage values are with respect to GND.

2. 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	°C
		AM26LV31I	-45	85	

# AM26LV31C, AM26LV31I

## LOW-VOLTAGE HIGH-SPEED

### QUADRUPLE DIFFERENTIAL LINE DRIVERS

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

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

† All typical values are at V<sub>CC</sub> = 3.3 V and T<sub>A</sub> = 25°C.

‡ 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.

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

### switching characteristics, V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub> Propagation delay time, low- to high-level output	See Figure 2	4	8	12	ns
t <sub>PHL</sub> Propagation delay time, high- to low-level output		4	8	12	ns
t <sub>t</sub> Transition time (t <sub>r</sub> or t <sub>f</sub> )			3		ns
SR Slew rate, single-ended output voltage	See Note 3 and Figure 2		0.3	1	V/ns
t <sub>PZH</sub> Output-enable time to high level	See Figure 3		10	20	ns
t <sub>PZL</sub> Output-enable time to low level	See Figure 4		10	20	ns
t <sub>PHZ</sub> Output-disable time from high level	See Figure 3		10	20	ns
t <sub>PLZ</sub> Output-disable time from low level	See Figure 4		10	20	ns
t <sub>sk(p)</sub> Pulse skew	f = 32 MHz, See Note 4		0.5	1.5	ns
t <sub>sk(o)</sub> Skew limit	f = 32 MHz			1.5	ns
t <sub>sk(lim)</sub> Skew limit (device to device)	f = 32 MHz, See Note 5			3	ns

NOTES: 3. Slew rate is defined by:

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

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

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

PARAMETER MEASUREMENT INFORMATION

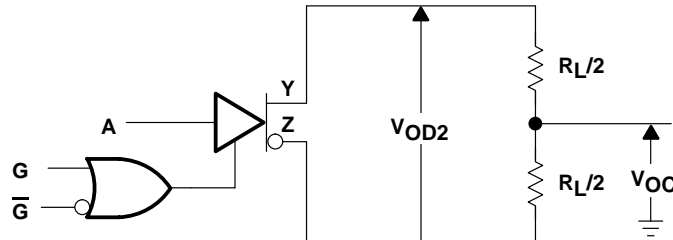
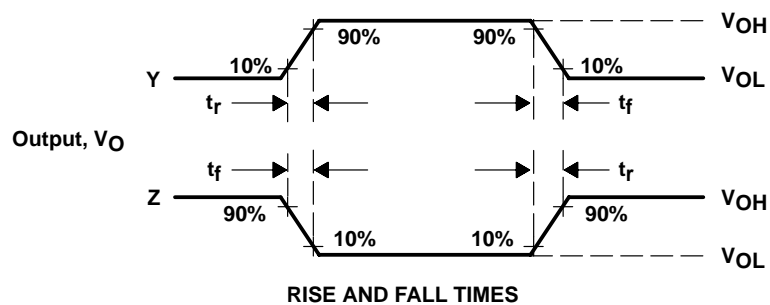
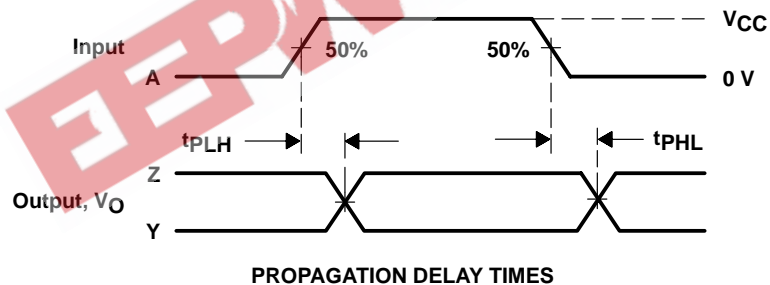
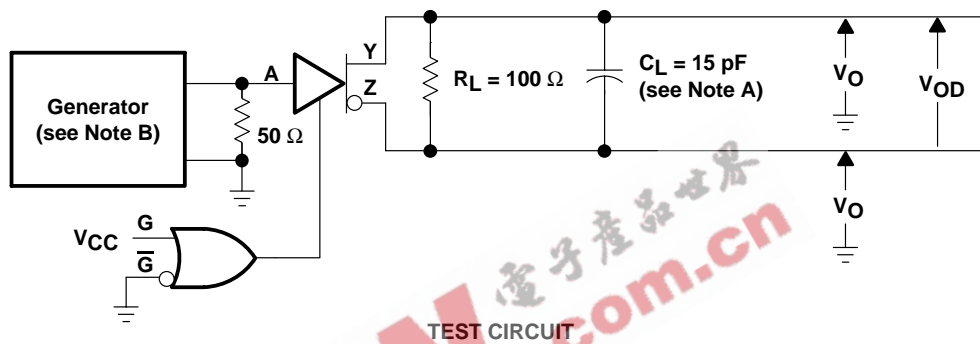


Figure 1. Differential and Common-Mode Output Voltages



NOTES: A.  $C_L$  includes probe and jig capacitance.

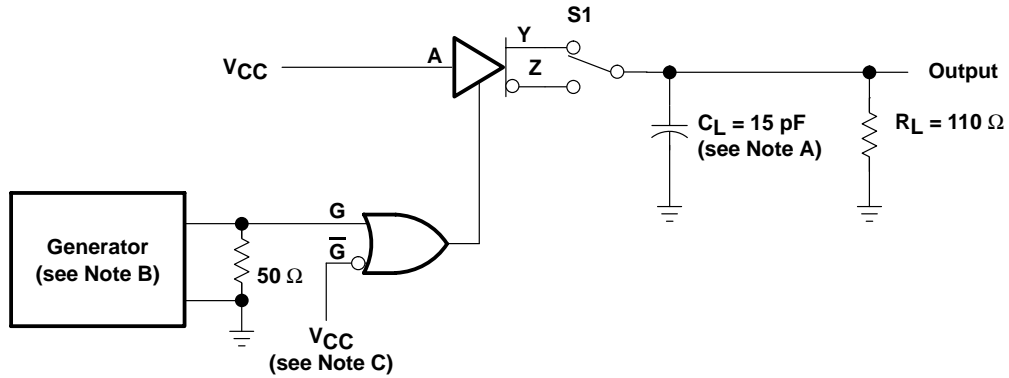
B. The input pulse is supplied by a generator having the following characteristics: PRR = 32 MHz,  $Z_O \approx 50 \Omega$ , 50% duty cycle,  $t_r$  and  $t_f \leq 2$  ns.

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

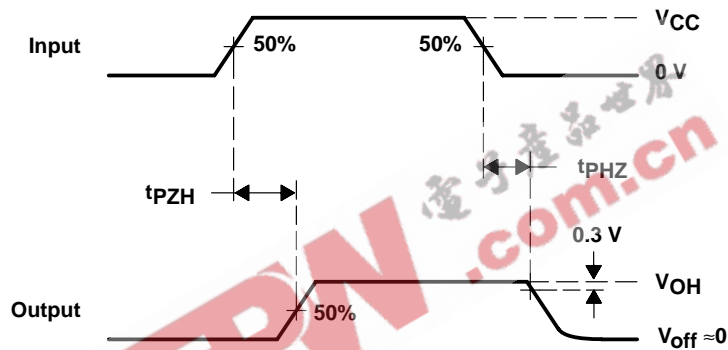
**AM26LV31C, AM26LV31I**  
**LOW-VOLTAGE HIGH-SPEED**  
**QUADRUPLE DIFFERENTIAL LINE DRIVERS**

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**PARAMETER MEASUREMENT INFORMATION**



**TEST CIRCUIT**

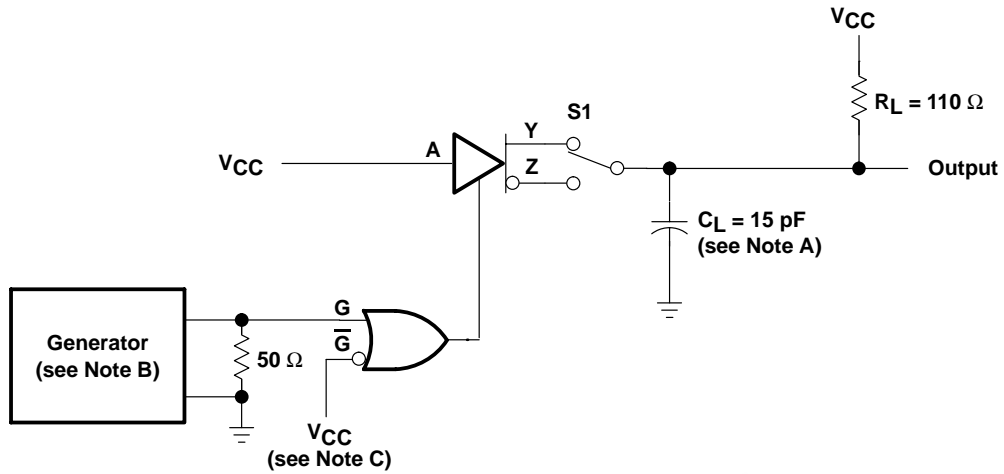


**VOLTAGE WAVEFORMS**

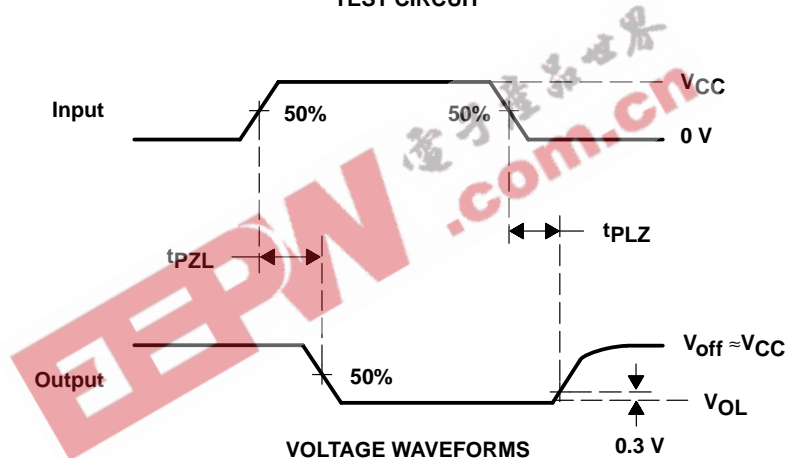
- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz,  $Z_O = 50 \Omega$ , 50% duty cycle,  $t_r$  and  $t_f$  (10% to 90%)  $\leq 2$  ns.  
 C. To test the active-low enable  $\bar{G}$ , ground G and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

**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%)  $\leq 2$  ns.  
 C. To test the active-low enable  $\bar{G}$ , ground G and apply an inverted waveform to  $\bar{G}$ .

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

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
AM26LV31CD	ACTIVE	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
AM26LV31CDR	ACTIVE	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
AM26LV31CNSLE	OBSOLETE	SO	NS	16		None	Call TI	Call TI
AM26LV31CNSR	ACTIVE	SO	NS	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
AM26LV31INSR	ACTIVE	SO	NS	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

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

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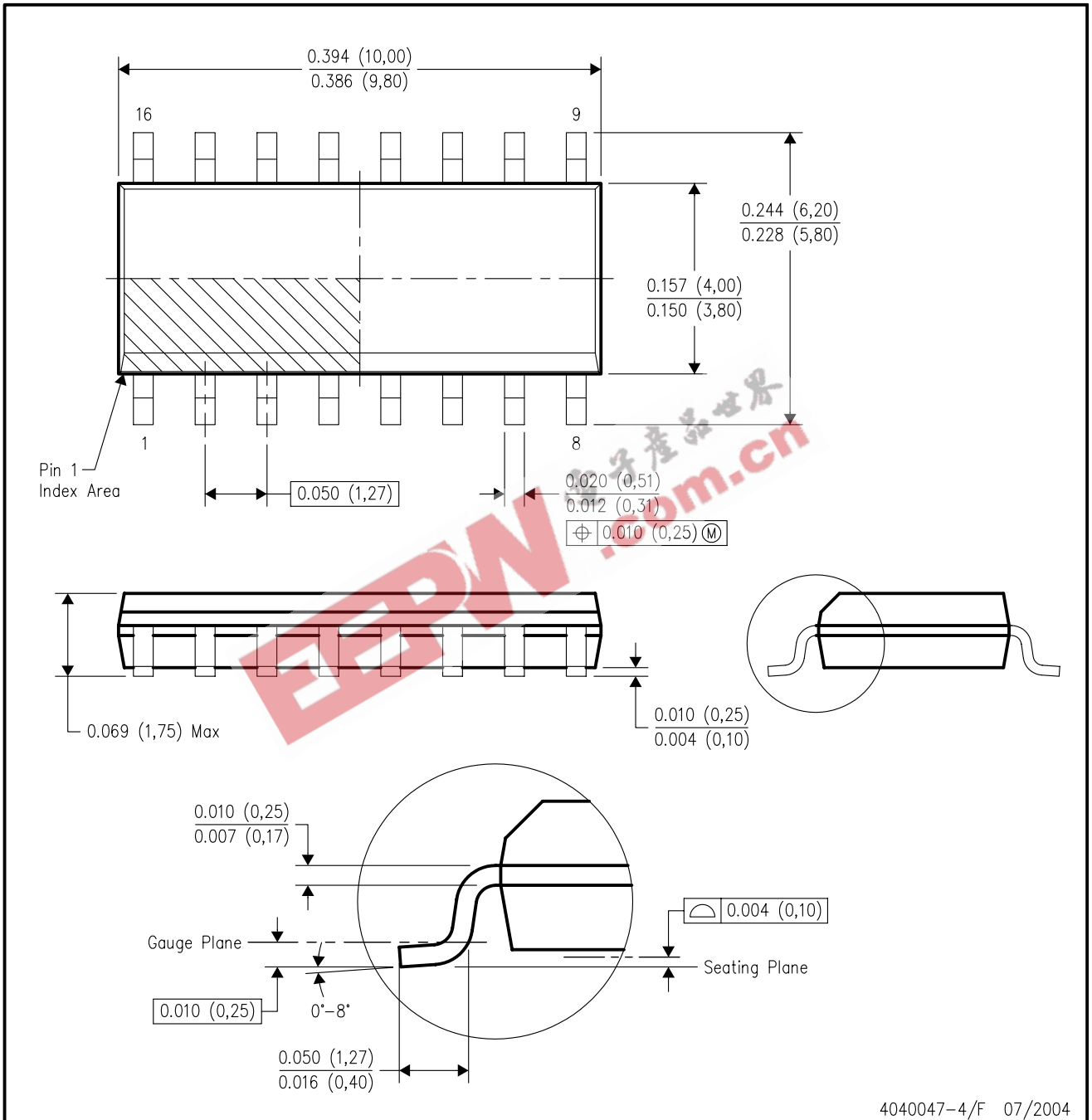
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# MECHANICAL DATA

## D (R-PDSO-G16)

## PLASTIC SMALL-OUTLINE PACKAGE



4040047-4/F 07/2004

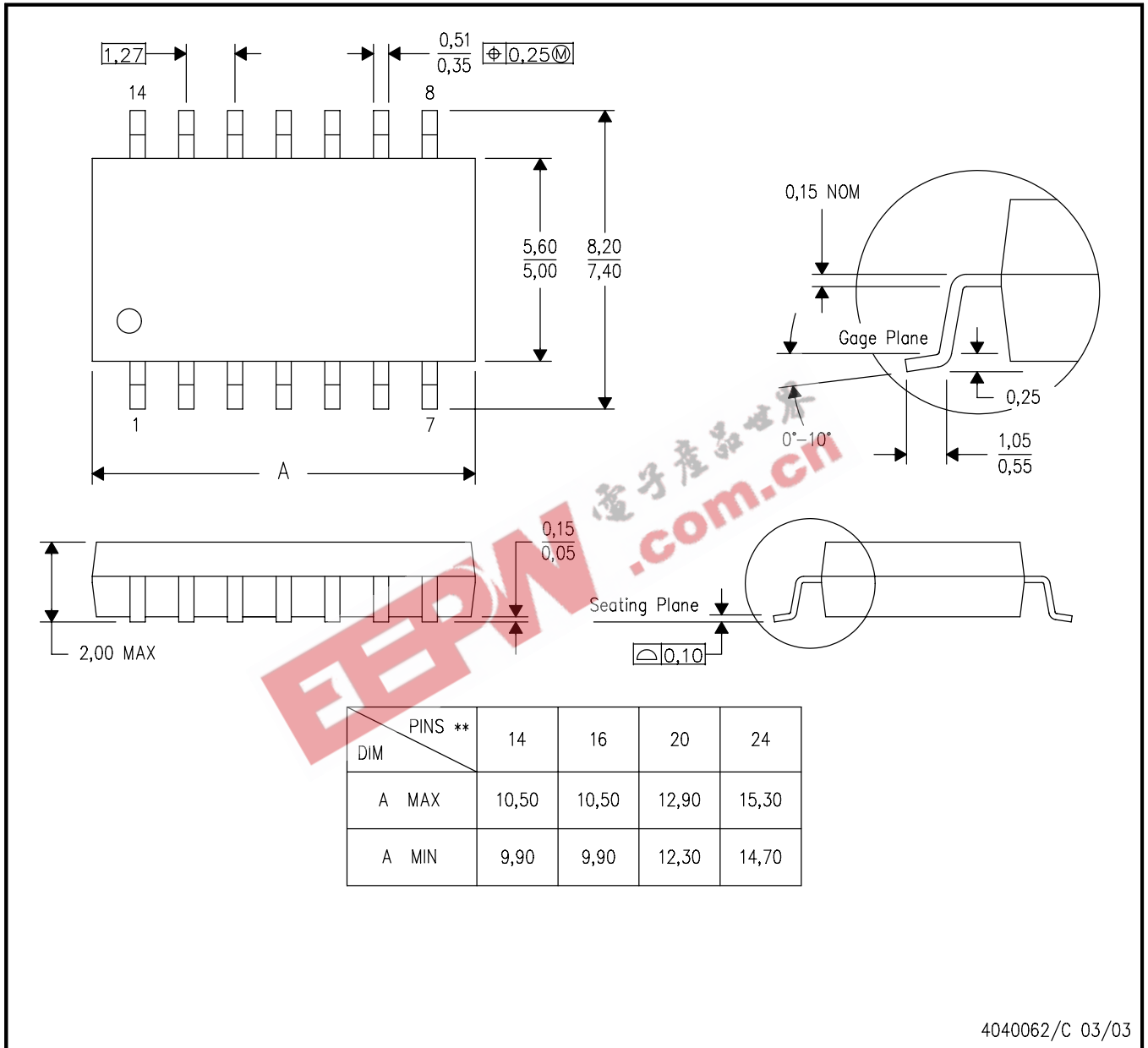
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0.15).
  - D. Falls within JEDEC MS-012 variation AC.

## MECHANICAL DATA

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

**PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**



4040062/C 03/03

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

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