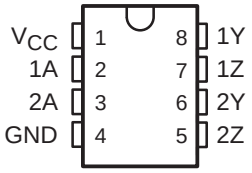
- **Meets or Exceeds the Requirements of ANSI Standard EIA/TIA-422-B and ITU Recommendation V.11**
- **Designed to Operate at 20 Mbaud or Higher**
- **TTL-and CMOS-Input Compatibility**
- **Single 5-V Supply Operation**
- **Output Short-Circuit Protection**
- **Improved Replacement for the μA9638**

**D OR P PACKAGE**
**(TOP VIEW)**




## description

The SN75ALS191 is a dual, high-speed, differential line driver designed to meet ANSI Standard EIA/TIA-422-B and ITU Recommendation V.11. The inputs are TTL- and CMOS-compatible and have input clamp diodes. Schottky-diode-clamped transistors minimize propagation delay time. This device operates from a single 5-V power supply and is supplied in eight-pin packages.

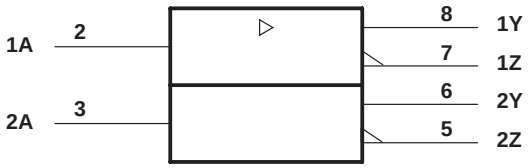
The SN75ALS191 is characterized for operation from 0°C to 70°C.

**FUNCTION TABLE**
**(each driver)**

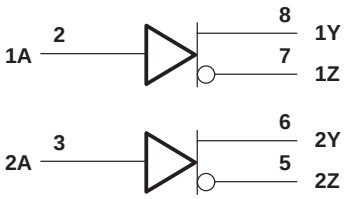
| INPUTS A | OUTPUTS Y | OUTPUTS Z |
|---|---|---|
| H | H | L |
| L | L | H |

H = high level, L = low level,
Z = high impedance

## logic symbol†

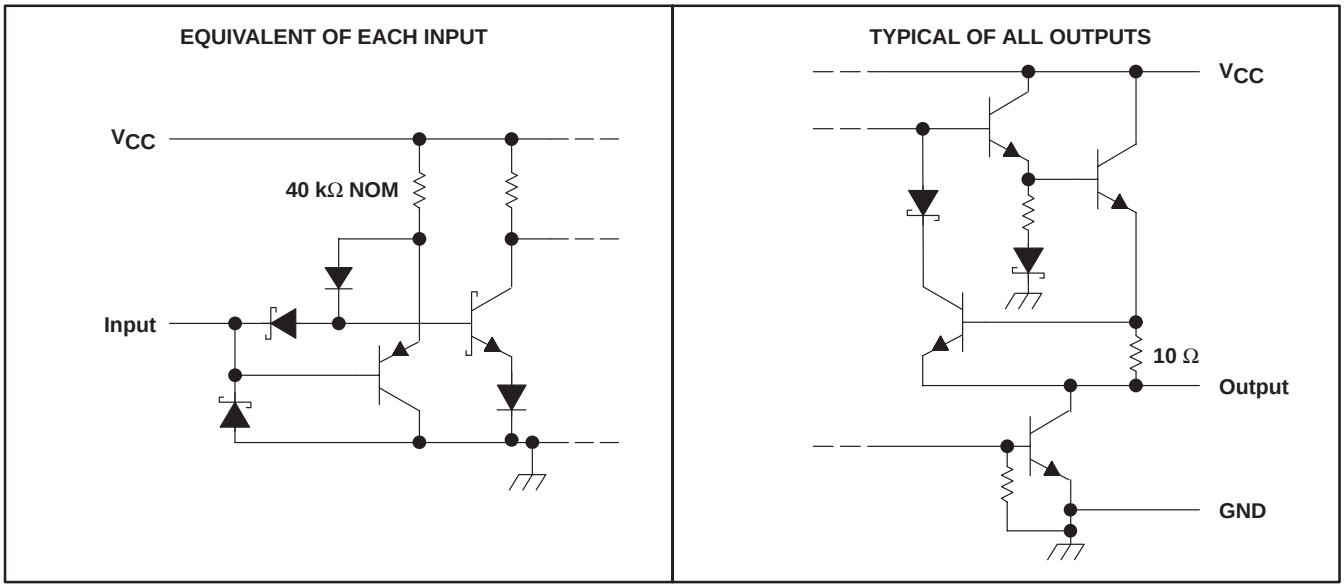



## logic diagram (positive logic)




† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## schematics of inputs and outputs




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

Supply voltage, $V_{CC}$ (see Note 1) . . . . . 7 V
Input voltage, $V_I$ . . . . . 7 V
Continuous total dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, $T_A$ . . . . . 0°C to 70°C
Storage temperature range, $T_{stg}$ . . . . . – 65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°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 except differential output voltage ($V_{OD}$) are with respect to network ground terminal.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \le 25°C$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25°C$ | $T_A = 70°C$ POWER RATING |
|---|---|---|---|
| D | 725 mW | 5.8 mW/°C | 464 mW |
| P | 1000 mW | 8.0 mW/°C | 640 mW |

## recommended operating conditions

| | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|
| Supply voltage, $V_{CC}$ | 4.75 | 5 | 5.25 | V |
| High-level input voltage, $V_{IH}$ | 2 | | | V |
| Low-level input voltage, $V_{IL}$ | | | 0.8 | V |
| High-level output current, $I_{OH}$ | | | – 50 | mA |
| Low-level output current, $I_{OL}$ | | | 50 | mA |
| Operating free-air temperature, $T_A$ | 0 | | 70 | °C |

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

| PARAMETER | | TEST CONDITIONS | | | MIN | TYP† | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{IK}$ | Input clamp voltage | $V_{CC}$ = 4.75 V, | $I_I$ = –18 mA | | | –1 | –1.2 | V |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = 4.75 V, $V_{IL}$ = 0.8 V | $V_{IH}$ = 2 V, | $I_{OH}$ = – 10 mA | 2.5 | 3.3 | | V |
| | | | | $I_{OH}$ = – 40 mA | 2 | | | |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = 4.75 V, $I_{OL}$ = 40 mA | $V_{IH}$ = 2 V, | $V_{IL}$ = 0.8 V, | | | 0.5 | V |
| $\|V_{OD1}\|$ | Differential output voltage | $V_{CC}$ = 5.25 V, | $I_O$ = 0 | | | | 2 $V_{OD2}$ | V |
| $\|V_{OD2}\|$ | Differential output voltage | $V_{CC}$ = 4.75 V to 5.25 V, See Figure 1 | | $R_L$ = 100 Ω, | 2 | | | V |
| $\Delta\|V_{OD}\|$ | Change in magnitude of differential output voltage‡ | | | | | | ± 0.4 | V |
| $V_{OC}$ | Common-mode output voltage§ | | | | | | 3 | V |
| $\Delta\|V_{OC}\|$ | Change in magnitude of common-mode output voltage‡ | | | | | | ± 0.4 | V |
| $I_O$ | Output current with power off | $V_{CC}$ = 0 | | $V_O$ = 6 V | | 0.1 | 100 | µA |
| | | | | $V_O$ = – 0.25 V | | –0.1 | –100 | |
| | | | | $V_O$ = – 0.25 V to 6 V | | | ±100 | |
| $I_I$ | Input current | $V_{CC}$ = 5.25 V, | $V_I$ = 5.5 V | | | | 50 | µA |
| $I_{IH}$ | High-level input current | $V_{CC}$ = 5.25 V, | $V_I$ = 2.7 V | | | | 25 | µA |
| $I_{IL}$ | Low-level input current | $V_{CC}$ = 5.25 V, | $V_I$ = 0.5 V | | | | 200 | µA |
| $I_{OS}$ | Short-circuit output current¶ | $V_{CC}$ = 5.25 V, | $V_O$ = 0 | | –50 | | –150 | mA |
| $I_{CC}$ | Supply current (all drivers) | $V_{CC}$ = 5.25 V, | No load, | All inputs at 0 V | | 32 | 40 | mA |

† All typical values are at $V_{CC}$ = 5 V and $T_A$ = 25°C.
‡ $|V_{OD}|$ and $|V_{OC}|$ 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.
§ In ANSI Standard EIA/TIA-422-B, $V_{OC}$, which is the average of the two output voltages with respect to ground, is called output offset voltage, $V_{OS}$.
¶ Only one output at a time should be shorted, and duration of the short circuit should not exceed one second.

## switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 5 V

| PARAMETER | | TEST CONDITIONS | MIN | TYP# | MAX | UNIT |
|---|---|---|---|---|---|---|
| $t_{d(OD)}$ | Differential-output delay time | $C_L$ = 15 pF, $R_L$ = 100 Ω, See Figure 2 | | 3.5 | 7 | ns |
| $t_{t(OD)}$ | Differential-output transition time | | | 3.5 | 7 | ns |
| | Skew | | | 1.5 | 4 | ns |

# Typical values are at $T_A$ = 25°C.

## PARAMETER MEASUREMENT INFORMATION

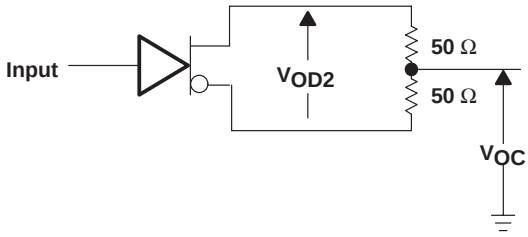
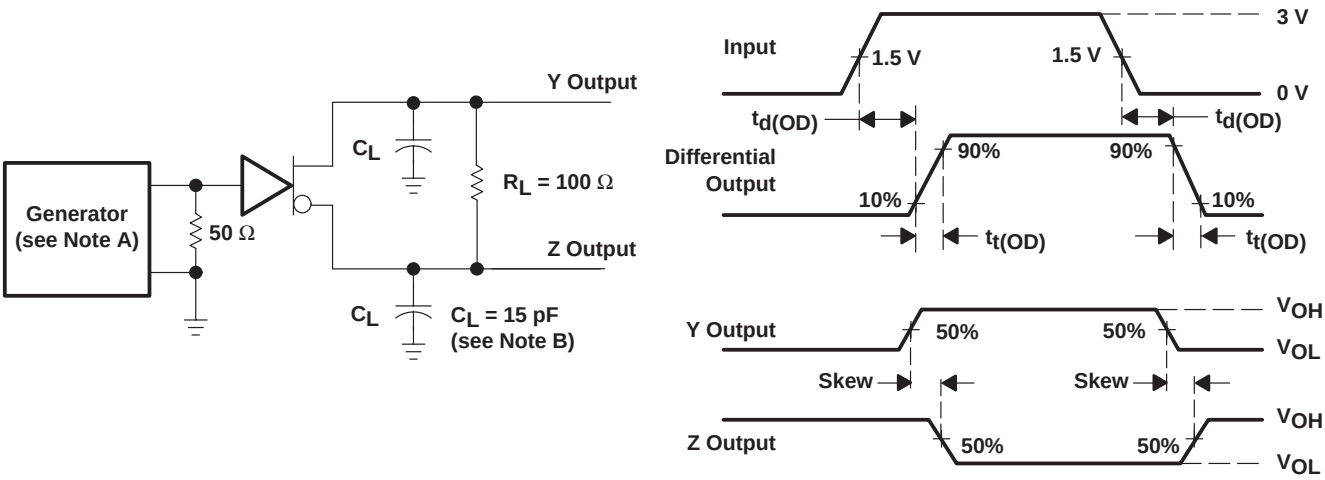



**Figure 1. Differential and Common-Mode Output Voltages**




**TEST CIRCUIT** **VOLTAGE WAVEFORMS**

NOTES: A. The input pulse generator has the following characteristics: $Z_O$ = 50 Ω, PRR ≤ 500 kHz, $t_w$ = 100 ns, $t_r$ = ≤ 5 ns.
B. $C_L$ includes probe and jig capacitance.

**Figure 2. Test Circuit and Voltage Waveforms**

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) |
|---|---|---|---|---|---|---|---|---|
| SN75ALS191D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS191DE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS191DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS191DRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS191DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS191P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN75ALS191PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN75ALS191PSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS191PSRE4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

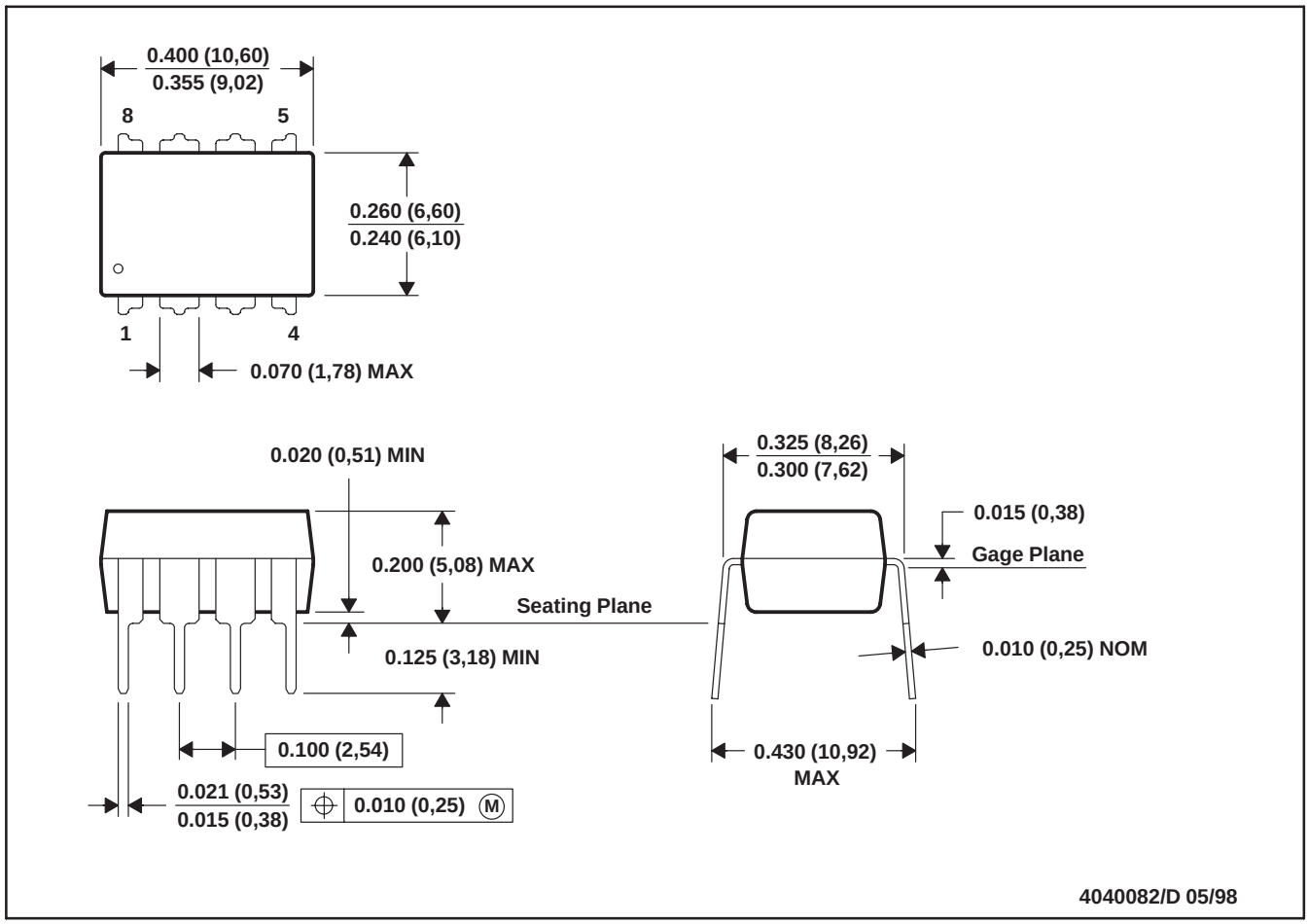
(1) The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing 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.

MPDI001A – JANUARY 1995 – REVISED JUNE 1999

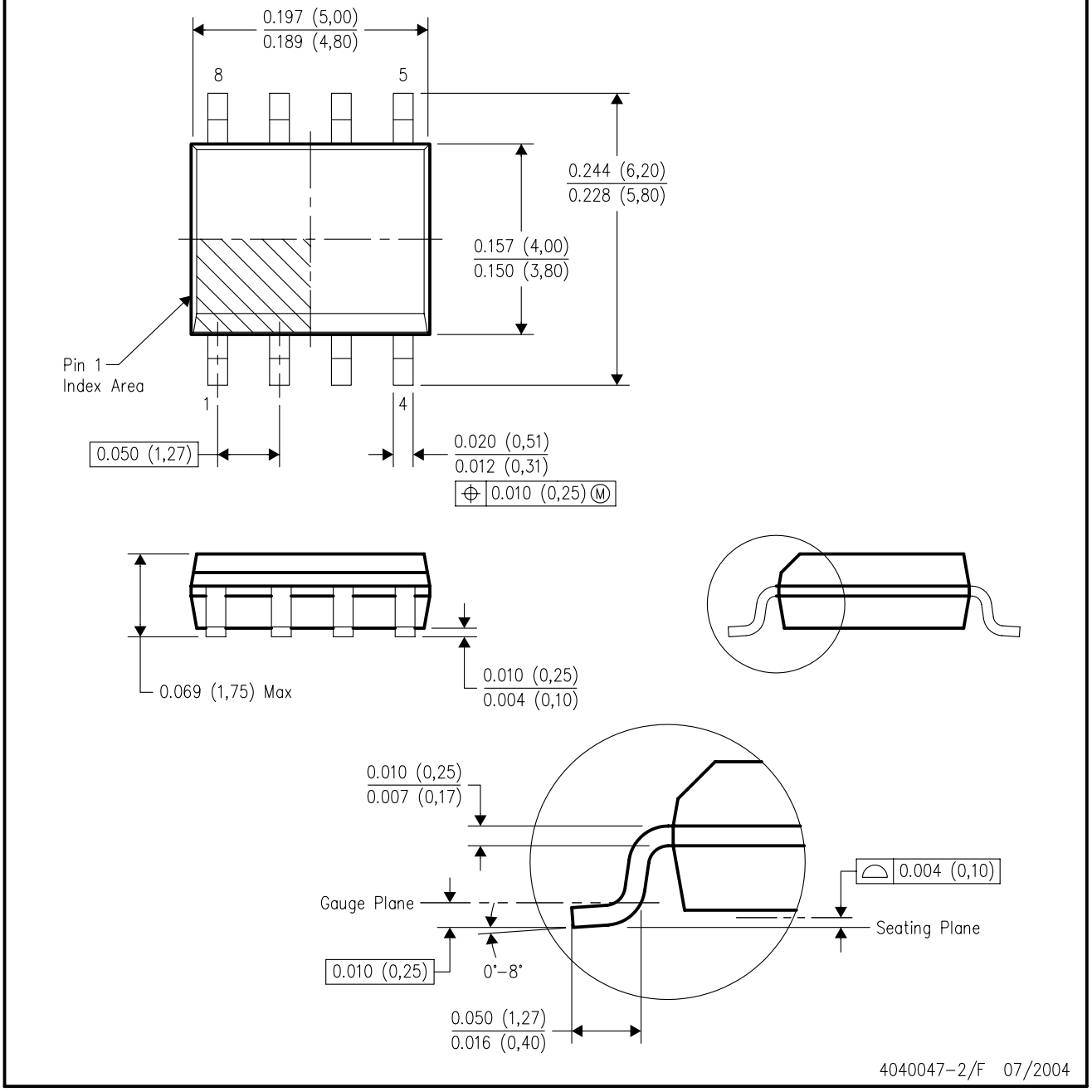
**P (R-PDIP-T8)** **PLASTIC DUAL-IN-LINE**




NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

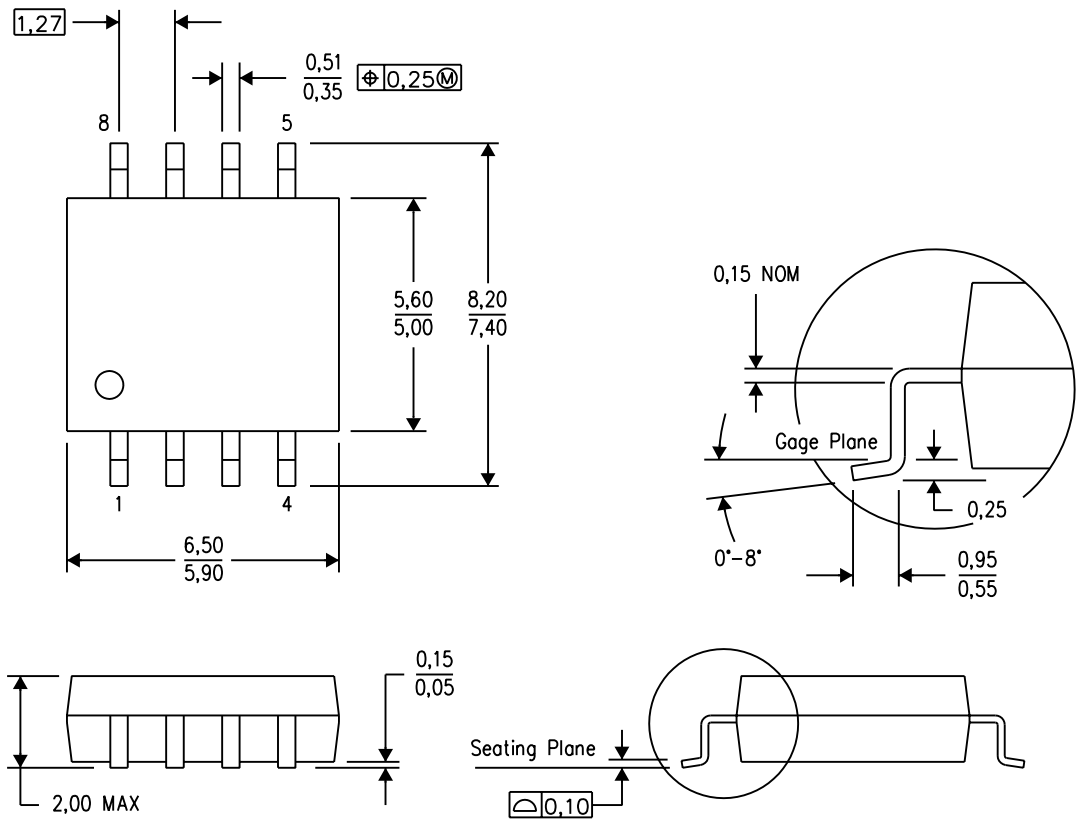
## D (R–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE




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 AA.

## MECHANICAL DATA

**PS (R-PDSO-G8)** **PLASTIC SMALL-OUTLINE PACKAGE**




4040063/C 03/03

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.

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Post Office Box 655303 Dallas, Texas 75265