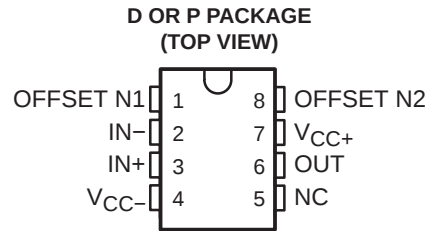


- Low Noise
- No External Components Required
- Replace Chopper Amplifiers at a Lower Cost
- Wide Input-Voltage Range  
... 0 to  $\pm 14$  V Typ
- Wide Supply-Voltage Range  
...  $\pm 3$  V to  $\pm 18$  V



NC – No internal connection

## description/ordering information

These devices offer low offset and long-term stability by means of a low-noise, chopperless, bipolar-input-transistor amplifier circuit. For most applications, external components are not required for offset nulling and frequency compensation. The true differential input, with a wide input-voltage range and outstanding common-mode rejection, provides maximum flexibility and performance in high-noise environments and in noninverting applications. Low bias currents and extremely high input impedances are maintained over the entire temperature range. The OP07 is unsurpassed for low-noise, high-accuracy amplification of very-low-level signals.

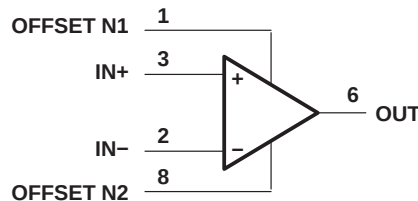
These devices are characterized for operation from 0°C to 70°C.

## ORDERING INFORMATION

| $T_A$       | PACKAGE <sup>†</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|-------------|----------------------|--------------|-----------------------|------------------|
| 0°C to 70°C | PDIP (P)             | Tube of 50   | OP07CP                | OP07CP           |
|             |                      | Tube of 50   | OP07DP                | OP07DP           |
|             | SOIC (D)             | Tube of 75   | OP07CD                | OP07C            |
|             |                      | Reel of 2500 | OP07CDR               |                  |
|             |                      | Tube of 75   | OP07DD                | OP07D            |
|             |                      | Reel of 2500 | OP07DDR               |                  |

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

## symbol



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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**

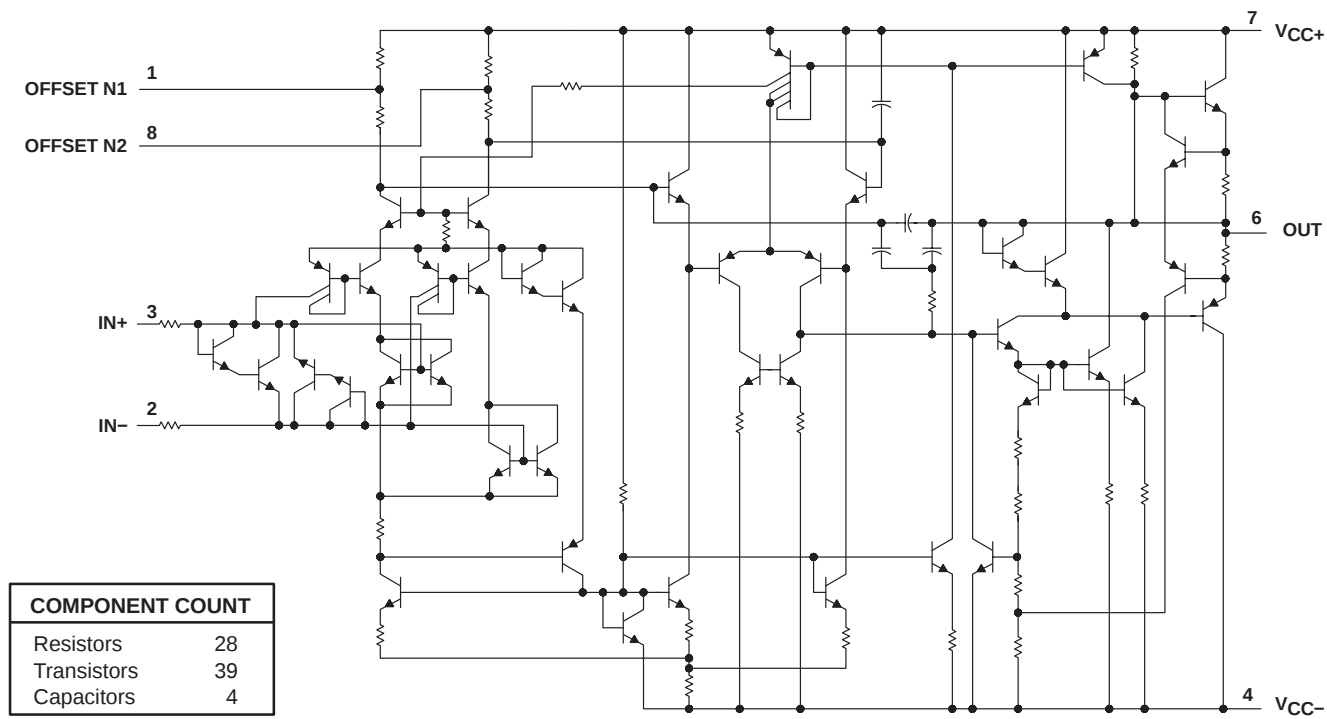
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OP07C, OP07D  
PRECISION OPERATIONAL AMPLIFIERS

SLOS099E – OCTOBER 1983 – REVISED MAY 2004

schematic



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                                         |                |
|-------------------------------------------------------------------------|----------------|
| Supply voltage: $V_{CC+}$ (see Note 1)                                  | 22 V           |
| $V_{CC-}$ (see Note 1)                                                  | -22 V          |
| Differential input voltage (see Note 2)                                 | $\pm 30$ V     |
| Input voltage, $V_I$ (either input, see Note 3)                         | $\pm 22$ V     |
| Duration of output short circuit (see Note 4)                           | Unlimited      |
| Package thermal impedance, $\theta_{JA}$ (see Notes 5 and 6): D package | 97°C/W         |
| P package                                                               | 85°C/W         |
| Operating virtual junction temperature, $T_J$                           | 150°C          |
| 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 |

<sup>†</sup> 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, unless otherwise noted, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .
  2. Differential voltages are at  $IN+$  with respect to  $IN-$ .
  3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
  4. The output may be shorted to ground or to either power supply.
  5. 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  $P_D = (T_J(max) - T_A)/\theta_{JA}$ . Selecting the maximum of 150°C can affect reliability.
  6. The package thermal impedance is calculated in accordance with JESD 51-7.

# OP07C, OP07D PRECISION OPERATIONAL AMPLIFIERS

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## recommended operating conditions

|             |                                |                        | MIN     | MAX      | UNIT |
|-------------|--------------------------------|------------------------|---------|----------|------|
| $V_{CC\pm}$ | Supply voltage                 |                        | $\pm 3$ | $\pm 18$ | V    |
| $V_{IC}$    | Common-mode input voltage      | $V_{CC\pm} = \pm 15$ V | -13     | 13       | V    |
| $T_A$       | Operating free-air temperature |                        | 0       | 70       | °C   |



# OP07C, OP97D PRECISION OPERATIONAL AMPLIFIERS

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electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15\text{ V}$  (unless otherwise noted)

| PARAMETER                                                              | TEST CONDITIONS†                                                                            | TA          | OP07C |            |            | OP07D |            |            | UNIT                         |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------|-------|------------|------------|-------|------------|------------|------------------------------|
|                                                                        |                                                                                             |             | MIN   | TYP        | MAX        | MIN   | TYP        | MAX        |                              |
| $V_{IO}$ Input offset voltage                                          | $V_O = 0$ , $R_S = 50\ \Omega$                                                              | 25°C        |       | 60         | 150        |       | 60         | 150        | $\mu\text{V}$                |
|                                                                        |                                                                                             | 0°C to 70°C |       | 85         | 250        |       | 85         | 250        |                              |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage         | $V_O = 0$ , $R_S = 50\ \Omega$                                                              | 0°C to 70°C |       | 0.5        | 1.8        |       | 0.7        | 2.5        | $\mu\text{V}/^\circ\text{C}$ |
|                                                                        | See Note 6                                                                                  |             |       | 0.4        |            |       | 0.5        |            | $\mu\text{V}/\text{mV}$      |
|                                                                        | $R_S = 20\ \text{k}\Omega$ , See Figure 1                                                   | 25°C        |       | $\pm 4$    |            |       | $\pm 4$    |            | mV                           |
| $I_{IO}$ Input offset current                                          |                                                                                             | 25°C        |       | 0.8        | 6          |       | 0.8        | 6          | nA                           |
|                                                                        |                                                                                             | 0°C to 70°C |       | 1.6        | 8          |       | 1.6        | 8          |                              |
| $\alpha_{IIO}$ Temperature coefficient of input offset current         |                                                                                             | 0°C to 70°C |       | 12         | 50         |       | 12         | 50         | pA/°C                        |
| $I_{IB}$ Input bias current                                            |                                                                                             | 25°C        |       | $\pm 1.8$  | $\pm 7$    |       | $\pm 2$    | $\pm 12$   | nA                           |
|                                                                        |                                                                                             | 0°C to 70°C |       | $\pm 2.2$  | $\pm 9$    |       | $\pm 3$    | $\pm 14$   |                              |
| $\alpha_{IIB}$ Temperature coefficient of input bias current           |                                                                                             | 0°C to 70°C |       | 18         | 50         |       | 18         | 50         | pA/°C                        |
| $V_{ICR}$ Common-mode input voltage range                              |                                                                                             | 25°C        |       | $\pm 13$   | $\pm 14$   |       | $\pm 13$   | $\pm 14$   | V                            |
|                                                                        |                                                                                             | 0°C to 70°C |       | $\pm 13$   | $\pm 13.5$ |       | $\pm 13$   | $\pm 13.5$ |                              |
| $V_{OM}$ Peak output voltage                                           | $R_L \geq 10\ \text{k}\Omega$                                                               | 25°C        |       | $\pm 12$   | $\pm 13$   |       | $\pm 12$   | $\pm 13$   | V                            |
|                                                                        | $R_L \geq 2\ \text{k}\Omega$                                                                |             |       | $\pm 11.5$ | $\pm 12.8$ |       | $\pm 11.5$ | $\pm 12.8$ |                              |
|                                                                        | $R_L \geq 1\ \text{k}\Omega$                                                                |             |       | $\pm 12$   |            |       | $\pm 12$   |            |                              |
|                                                                        | $R_L \geq 2\ \text{k}\Omega$                                                                | 0°C to 70°C |       | $\pm 11$   | $\pm 12.6$ |       | $\pm 11$   | $\pm 12.6$ |                              |
| $A_{VD}$ Large-signal differential voltage amplification               | $V_{CC\pm} = \pm 3\text{ V}$ , $V_O = \pm 0.5\text{ V}$ ,<br>$R_L \geq 500\ \text{k}\Omega$ | 25°C        |       | 100        | 400        |       | 400        |            | V/mV                         |
|                                                                        |                                                                                             | 25°C        |       | 120        | 400        |       | 120        | 400        |                              |
|                                                                        | $V_O = \pm 10\text{ V}$ , $R_L = 2\ \text{k}\Omega$                                         | 0°C to 70°C |       | 100        | 400        |       | 100        | 400        |                              |
| $B_1$ Unity-gain bandwidth                                             |                                                                                             | 25°C        |       | 0.4        | 0.6        |       | 0.4        | 0.6        | MHz                          |
| $r_i$ Input resistance                                                 |                                                                                             | 25°C        |       | 8          | 33         |       | 7          | 31         | M $\Omega$                   |
| $CMRR$ Common-mode rejection ratio                                     | $V_{IC} = \pm 13\text{ V}$ , $R_S = 50\ \Omega$                                             | 25°C        |       | 100        | 120        |       | 94         | 110        | dB                           |
|                                                                        |                                                                                             | 0°C to 70°C |       | 97         | 120        |       | 94         | 106        |                              |
| $k_{SVS}$ Supply-voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ ) | $V_{CC\pm} = \pm 3\text{ V}$ to $\pm 18\text{ V}$ ,<br>$R_S = 50\ \Omega$                   | 25°C        |       | 7          | 32         |       | 7          | 32         | $\mu\text{V}/\text{V}$       |
|                                                                        |                                                                                             | 0°C to 70°C |       | 10         | 51         |       | 10         | 51         |                              |
| $P_D$ Power dissipation                                                | $V_O = 0$ , No load                                                                         | 25°C        |       | 80         | 150        |       | 80         | 150        | mW                           |
|                                                                        | $V_{CC\pm} = \pm 3\text{ V}$ , $V_O = 0$ ,<br>No load                                       |             |       | 4          | 8          |       | 4          | 8          |                              |

† All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise noted.

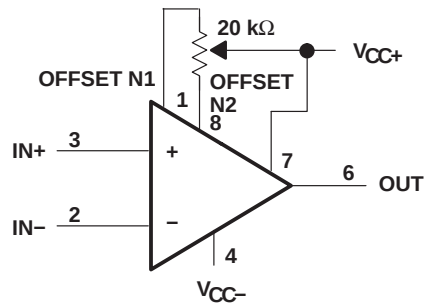
NOTE 7: Since long-term drift cannot be measured on the individual devices prior to shipment, this specification is not intended to be a warranty. It is an engineering estimate of the averaged trend line of drift versus time over extended periods after the first 30 days of operation.

operating characteristics,  $V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER                                               | TEST CONDITIONS <sup>†</sup>        | OP07C | OP07D | UNIT                         |
|---------------------------------------------------------|-------------------------------------|-------|-------|------------------------------|
|                                                         |                                     | TYP   | TYP   |                              |
| $V_n$ Equivalent input noise voltage                    | $f = 10\text{ Hz}$                  | 10.5  | 10.5  | $\text{nV}/\sqrt{\text{Hz}}$ |
|                                                         | $f = 100\text{ Hz}$                 | 10.2  | 10.3  |                              |
|                                                         | $f = 1\text{ kHz}$                  | 9.8   | 9.8   |                              |
| $V_{N(PP)}$ Peak-to-peak equivalent input noise voltage | $f = 0.1\text{ Hz to }10\text{ Hz}$ | 0.38  | 0.38  | $\mu\text{V}$                |
| $I_n$ Equivalent input noise current                    | $f = 10\text{ Hz}$                  | 0.35  | 0.35  | $\text{pA}/\sqrt{\text{Hz}}$ |
|                                                         | $f = 100\text{ Hz}$                 | 0.15  | 0.15  |                              |
|                                                         | $f = 1\text{ kHz}$                  | 0.13  | 0.13  |                              |
| $I_{N(PP)}$ Peak-to-peak equivalent input noise current | $f = 0.1\text{ Hz to }10\text{ Hz}$ | 15    | 15    | $\text{pA}$                  |
| SR      Slew rate                                       | $R_L \geq 2\text{ k}\Omega$         | 0.3   | 0.3   | $\text{V}/\mu\text{s}$       |

<sup>†</sup> All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise noted.

### APPLICATION INFORMATION



**Figure 1. Input Offset-Voltage Null Circuit**

**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| OP-07DPSR        | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP-07DPSRE4      | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07CD           | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07CDE4         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07CDG4         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07CDR          | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07CDRE4        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07CDRG4        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07CP           | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| OP07CPE4         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| OP07DD           | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07DDE4         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07DDR          | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07DDRE4        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| OP07DP           | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| OP07DPE4         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |

<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 - 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)

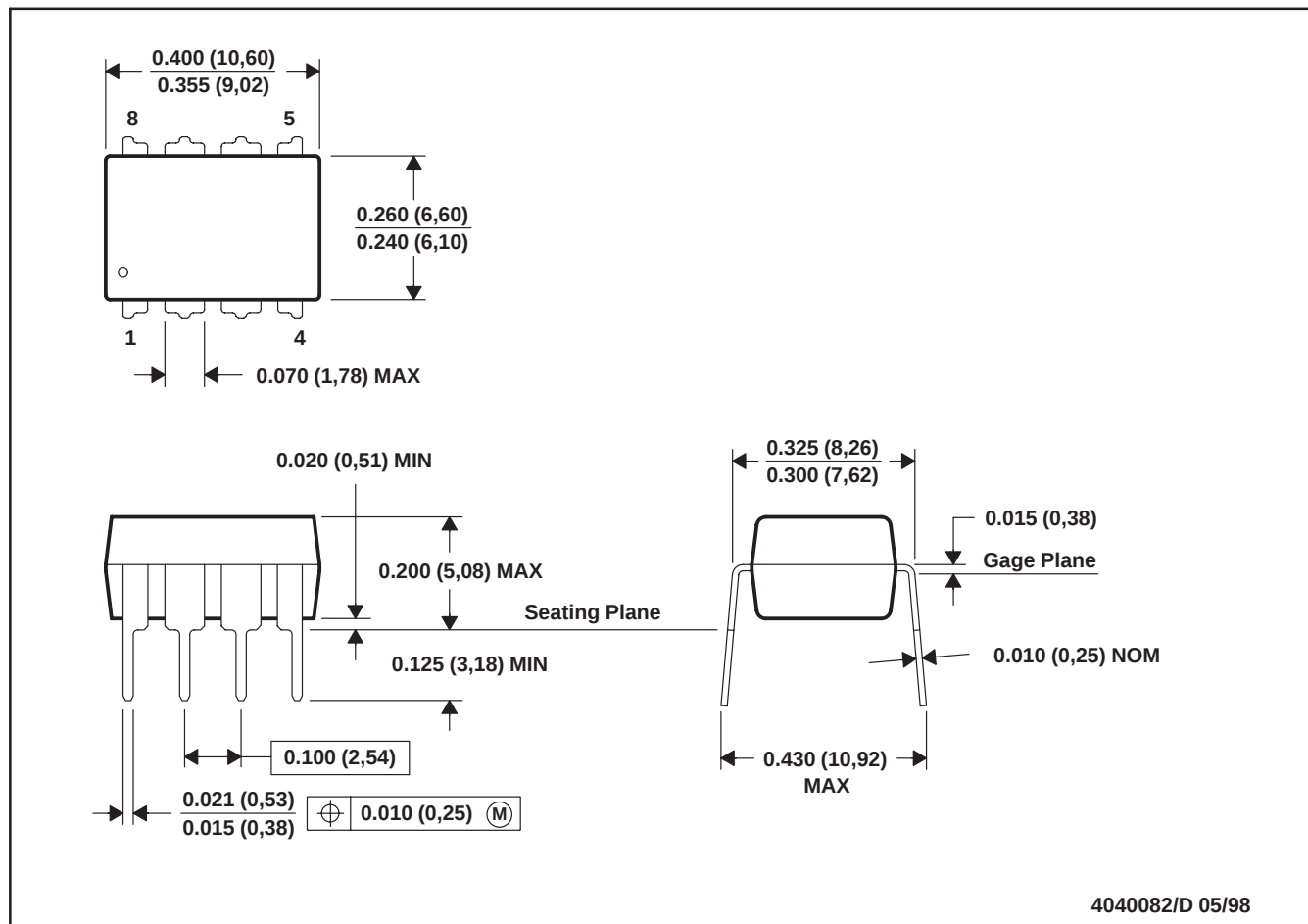
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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## P (R-PDIP-T8)

## PLASTIC DUAL-IN-LINE

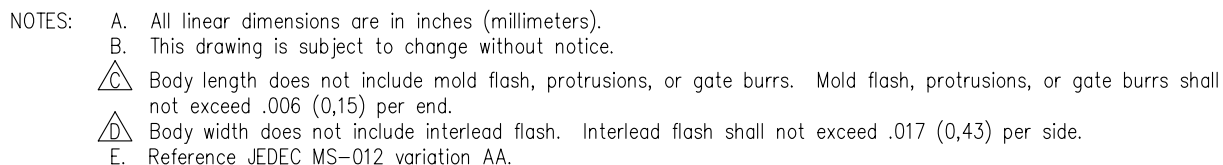


NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)



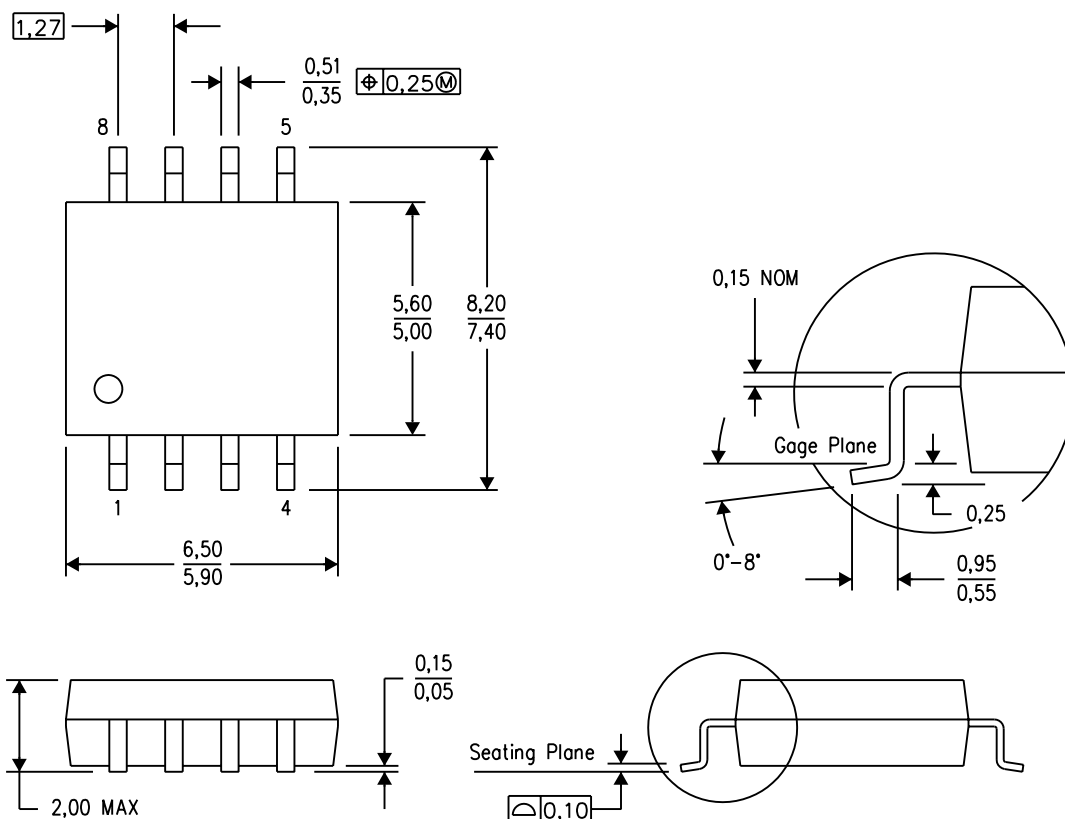
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# MECHANICAL DATA

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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