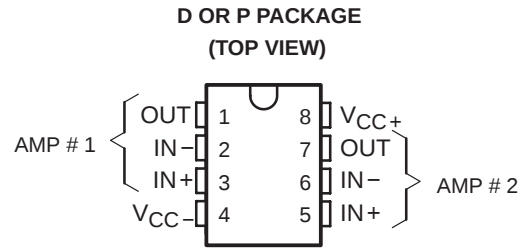


# RC4559

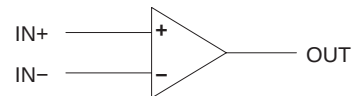
## DUAL HIGH-PERFORMANCE OPERATIONAL AMPLIFIER

SLOS074 – D2785, OCTOBER 1983 — REVISED JUNE 1988

- **Matched Gain and Offset Between Amplifiers**
- **Unity-Gain Bandwidth . . . 3 MHz Min**
- **Slew Rate . . . 1.5 V/ns Min**
- **Low Equivalent Input Noise Voltage**  
2  $\mu$ V/Hz Max (20 Hz to 20 kHz)
- **No Frequency Compensation Required**
- **No Latch Up**
- **Wide Common-Mode Voltage Range**
- **Low Power Consumption**
- **Designed to be Interchangeable with Raytheon RC4559**



**symbol (each amplifier)**



### AVAILABLE OPTIONS

| SYMBOLIZATION |                   | OPERATING<br>TEMPERATURE<br>RANGE | $V_{IO}$ max<br>at 25°C |
|---------------|-------------------|-----------------------------------|-------------------------|
| DEVICE        | PACKAGE<br>SUFFIX |                                   |                         |
| RC4559        | D, P              | -0°C to 70°C                      | 6 mV                    |

The D packages are available taped and reeled. Add the suffix R to the device type when ordering. (i.e., RC4559DR)

### description

The RC4559 is a dual high-performance operational amplifier. The high common-mode input voltage and the absence of latch-up make this amplifier ideal for low-noise signal applications such as audio preamplifiers and signal conditioners. This amplifier features a guaranteed dynamic performance and output drive capability that far exceeds that of the general-purpose type amplifiers.

The RC4559 is characterized for operation from 0°C to 70°C.

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

|                                                                                  |                |
|----------------------------------------------------------------------------------|----------------|
| Supply voltage $V_{CC+}$ (see Note 1)                                            | 18 V           |
| Supply voltage $V_{CC-}$ (see Note 1)                                            | -18 V          |
| Differential input voltage (see Note 2)                                          | $\pm 30$ V     |
| Input voltage (any input, see Notes 1 and 3)                                     | $\pm 15$ V     |
| Duration of output short-circuit to ground, one amplifier at a time (see Note 4) | unlimited      |
| Continuous total dissipation                                                     | 500 mW         |
| Operating free-air temperature range                                             | 0°C to 70°C    |
| Storage temperature range                                                        | -65°C to 125°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds                     | 260°C          |

- NOTES: 1. All voltage values, unless otherwise noted, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .
2. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
4. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

# RC4559

## DUAL HIGH-PERFORMANCE OPERATIONAL AMPLIFIER

electrical characteristics at specified free-air temperature,  $V_{CC+} = 15\text{ V}$ ,  $V_{CC-} = -15\text{ V}$

| PARAMETER       |                                                              | TEST CONDITIONS <sup>†</sup>                                                           | $T_A$ <sup>‡</sup> | MIN  | TYP | MAX | UNIT            |
|-----------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------|------|-----|-----|-----------------|
| $V_{IO}$        | Input offset voltage                                         | $V_O = 0$                                                                              | 25°C               |      | 2   | 6   | mV              |
|                 |                                                              |                                                                                        | Full Range         |      |     | 7.5 |                 |
| $I_{IO}$        | Input offset current                                         | $V_O = 0$                                                                              | 25°C               |      | 5   | 100 | nA              |
|                 |                                                              |                                                                                        | Full range         |      |     | 200 |                 |
| $I_{IB}$        | Input bias current                                           | $V_O = 0$                                                                              | 25°C               |      | 40  | 250 | nA              |
|                 |                                                              |                                                                                        | Full range         |      |     | 500 |                 |
| $V_I$           | Input voltage range                                          |                                                                                        | 25°C               | ±12  | ±13 |     | V               |
| $V_{OM}$        | Maximum peak output voltage swing                            | $R_L \geq 3\text{ k}\Omega$                                                            | 25°C               | ±12  | ±13 |     | V               |
|                 |                                                              | $R_L = 600\text{ }\Omega$                                                              | 25°C               | ±9.5 | ±10 |     |                 |
|                 |                                                              | $R_L \geq 2\text{ k}\Omega$                                                            | Full range         | ±10  |     |     |                 |
| $V_I$           | Input voltage range                                          | $V_O = \pm 10\text{ V}$ ,<br>$R_L = 2\text{ k}\Omega$                                  | 25°C               | 20   | 300 |     | V/mV            |
|                 |                                                              |                                                                                        | Full range         | 15   |     |     |                 |
| $B_{OM}$        | Maximum output-swing bandwidth                               | $V_{OPP} = 20\text{ V}$ ,<br>$R_L = 2\text{ k}\Omega$                                  | 25°C               | 24   | 32  |     | kHz             |
| $B_1$           | Unity-gain bandwidth                                         |                                                                                        | 25°C               | 3    | 4   |     | MHz             |
| $r_i$           | Input resistance                                             |                                                                                        | 25°C               | 0.3  | 1   |     | M $\Omega$      |
| CMRR            | Common-mode rejection ratio                                  | $V_O = 0$                                                                              | 25°C               | 80   | 100 |     | dB              |
| $k_{SVS}$       | Supply voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ ) | $V_O = 0$                                                                              | 25°C               |      | 10  | 75  | $\mu\text{V/V}$ |
| $V_n$           | Equivalent input noise voltage (closed loop)                 | $A_{VD} = 100$ ,<br>$R_S = 1\text{ k}\Omega$ ,<br>$f = 20\text{ Hz to } 20\text{ kHz}$ | 25°C               |      | 1.4 | 2   | $\mu\text{V}$   |
| $I_n$           | Equivalent input noise current                               | $f = 20\text{ Hz to } 20\text{ kHz}$                                                   | 25°C               |      | 25  |     | pA              |
| $I_{CC}$        | Supply current (both amplifiers)                             | No load, No signal                                                                     | 25°C               |      | 3.3 | 5.6 | mA              |
|                 |                                                              |                                                                                        | 0°C                |      | 4   | 6.6 |                 |
|                 |                                                              |                                                                                        | 70°C               |      | 3   | 5   |                 |
| $V_{O1}/V_{O2}$ | Crosstalk attenuation                                        | $A_{VD} = 100$ ,<br>$R_S = 1\text{ k}\Omega$ ,<br>$f = 10\text{ kHz}$                  | 25°C               |      | 90  |     | dB              |

<sup>†</sup> All characteristics are specified under open-loop operation, unless otherwise noted.

<sup>‡</sup> Full range operating free-air temperature range is 0°C to 70°C.

matching characteristics at  $V_{CC+} = 15\text{ V}$ ,  $V_{CC-} = -15\text{ V}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER |                                                 | TEST CONDITIONS                                    | MIN | TYP  | MAX | UNIT |
|-----------|-------------------------------------------------|----------------------------------------------------|-----|------|-----|------|
| $V_{IO}$  | Input offset voltage                            | $V_O = 0$                                          |     | ±0.2 |     | mV   |
| $I_{IO}$  | Input offset current                            | $V_O = 0$                                          |     | ±7.5 |     | nA   |
| $I_{IB}$  | Input bias current                              | $V_O = 0$                                          |     | ±15  |     | nA   |
| $A_{VD}$  | Large-signal differential voltage amplification | $V_O = \pm 10\text{ V}$ , $R_L = 2\text{ k}\Omega$ |     | ±1   |     | dB   |

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

| PARAMETER |                         | TEST CONDITIONS                                                         | MIN | TYP | MAX | UNIT             |
|-----------|-------------------------|-------------------------------------------------------------------------|-----|-----|-----|------------------|
| $t_r$     | Rise time               | $V_I = 20\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ |     | 80  |     | $\mu\text{s}$    |
|           | Overshoot               |                                                                         |     | 18% |     |                  |
| SR        | Slew rate at unity gain | $V_I = 10\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ | 1.5 | 2   |     | V/ $\mu\text{s}$ |



**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| RC4559D          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| RC4559DE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| RC4559DG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| RC4559DR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| RC4559DRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| RC4559DRG4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| RC4559P          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| RC4559PE4        | 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.

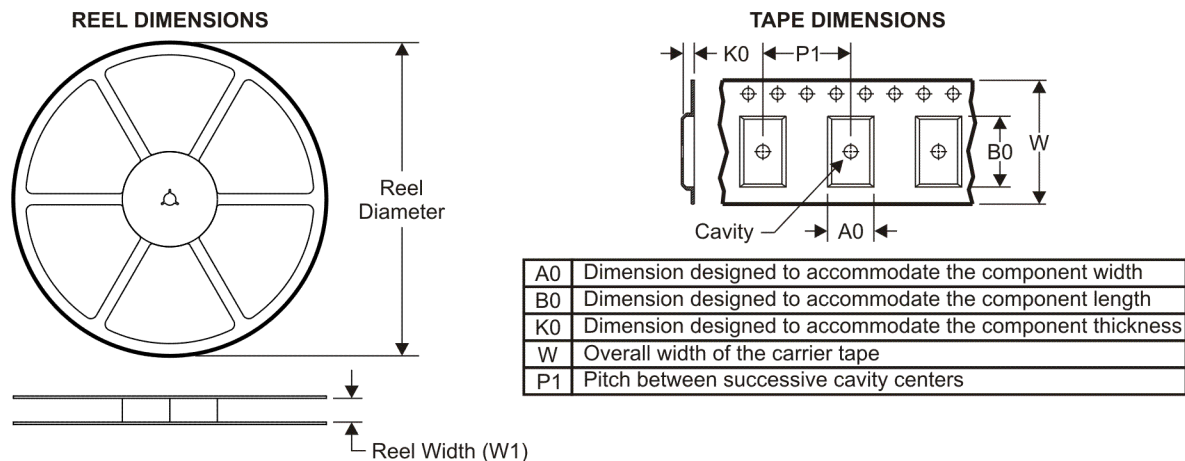
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

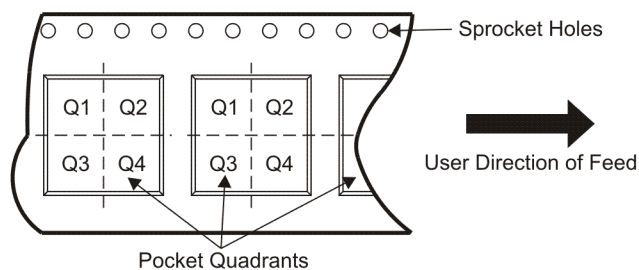
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## TAPE AND REEL INFORMATION



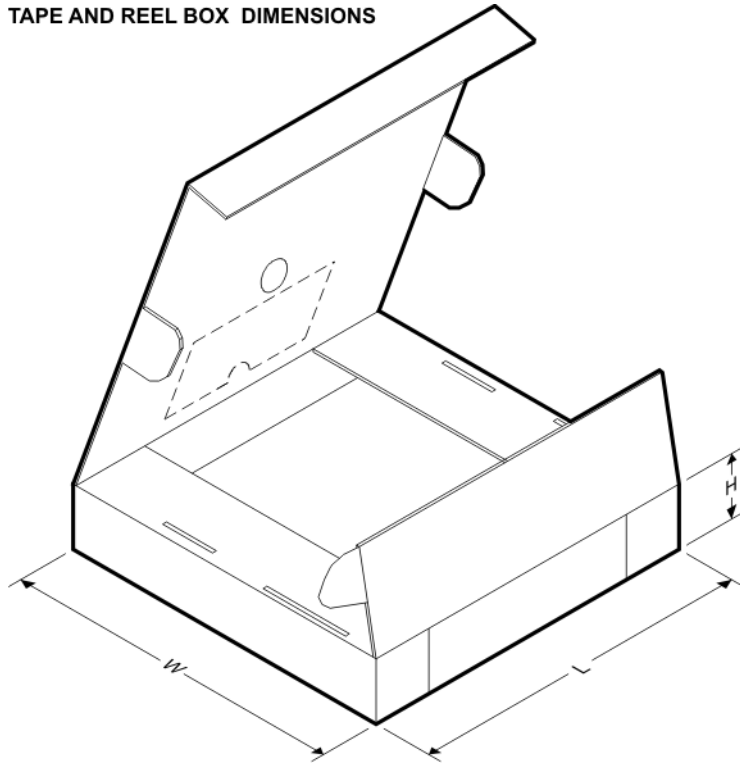
### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*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 |
|----------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| RC4559DR | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

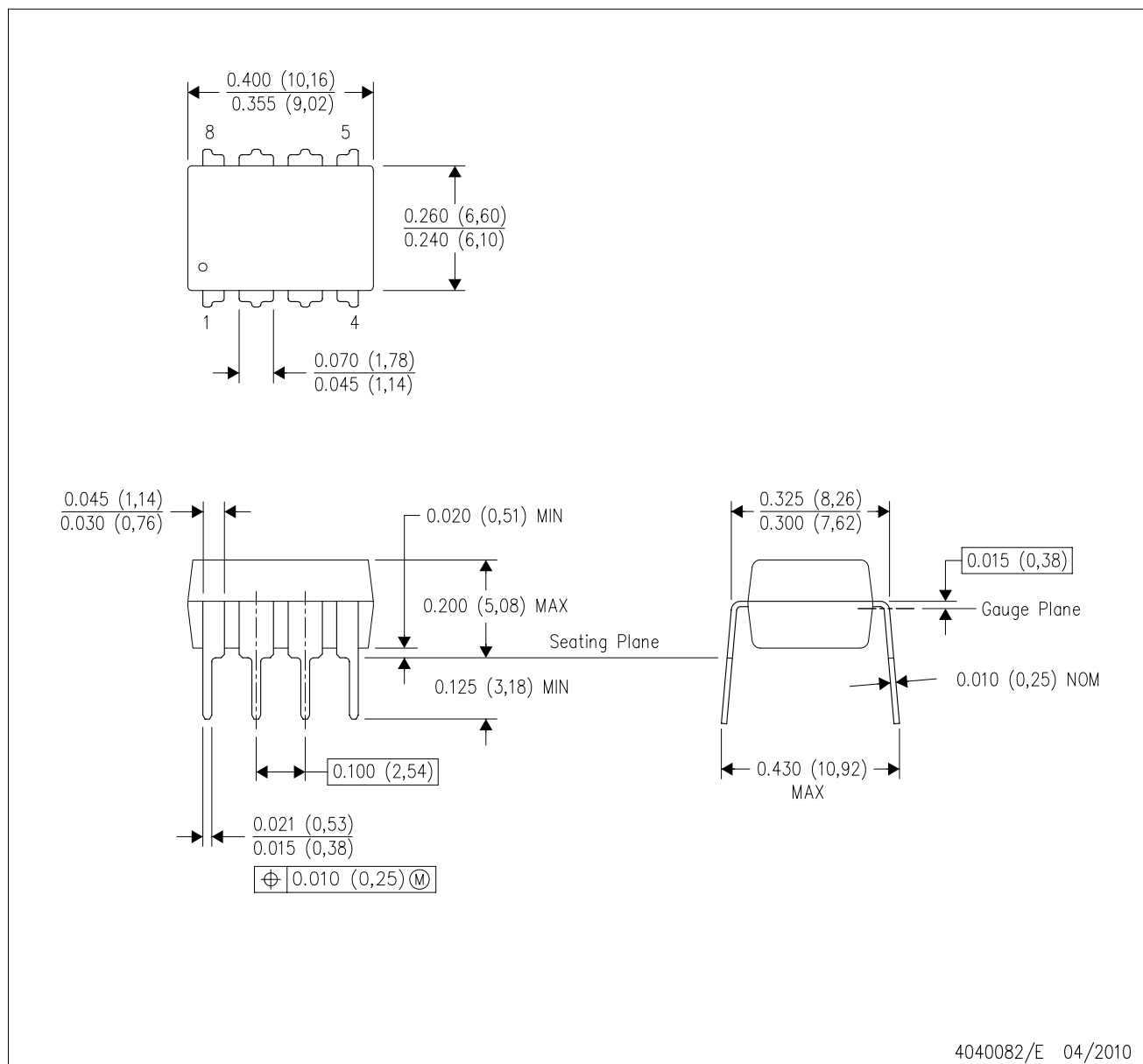


\*All dimensions are nominal

| Device   | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------|--------------|-----------------|------|------|-------------|------------|-------------|
| RC4559DR | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |

P (R-PDIP-T8)

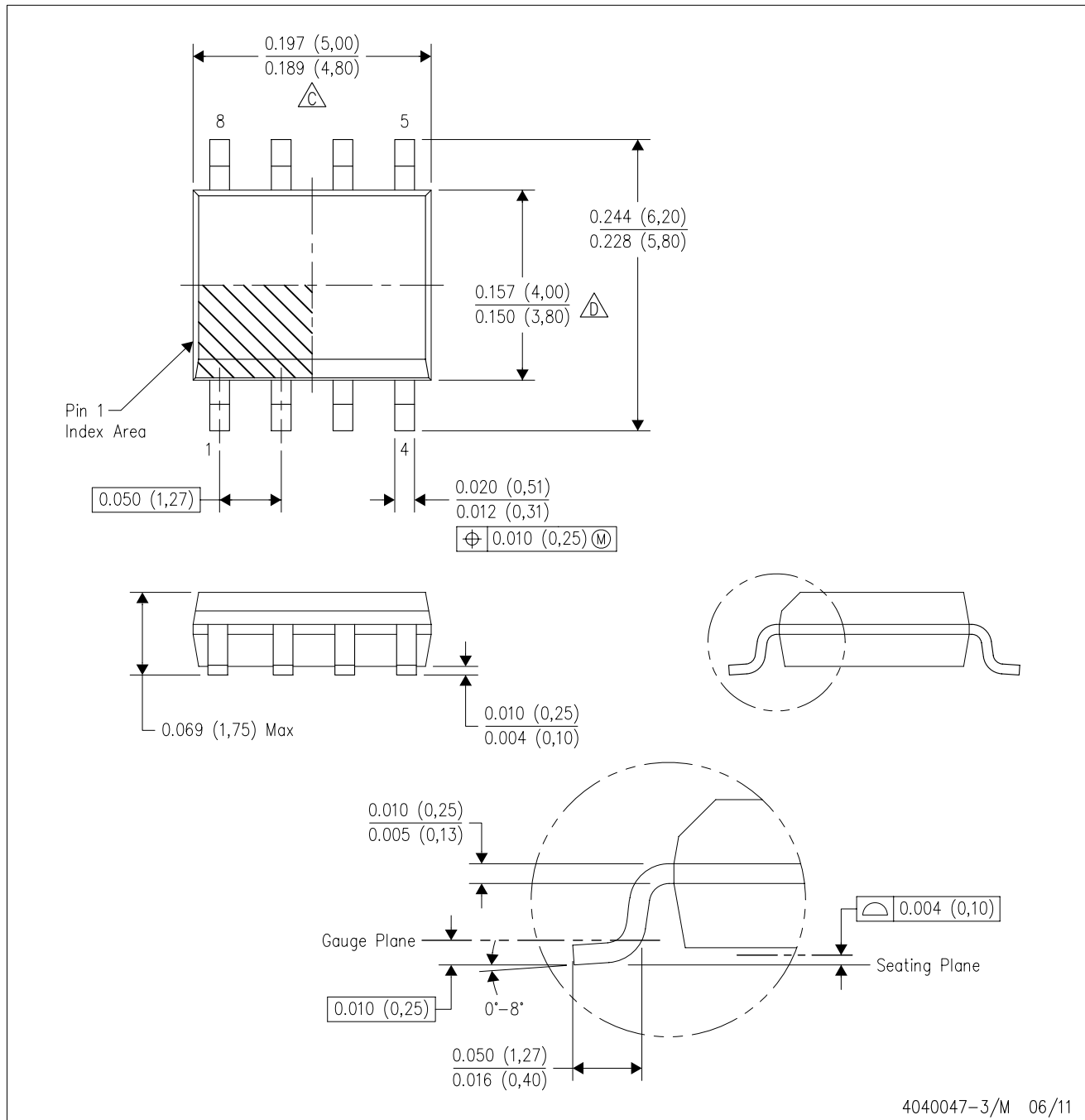
PLASTIC DUAL-IN-LINE PACKAGE



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

D (R-PDSO-G8)

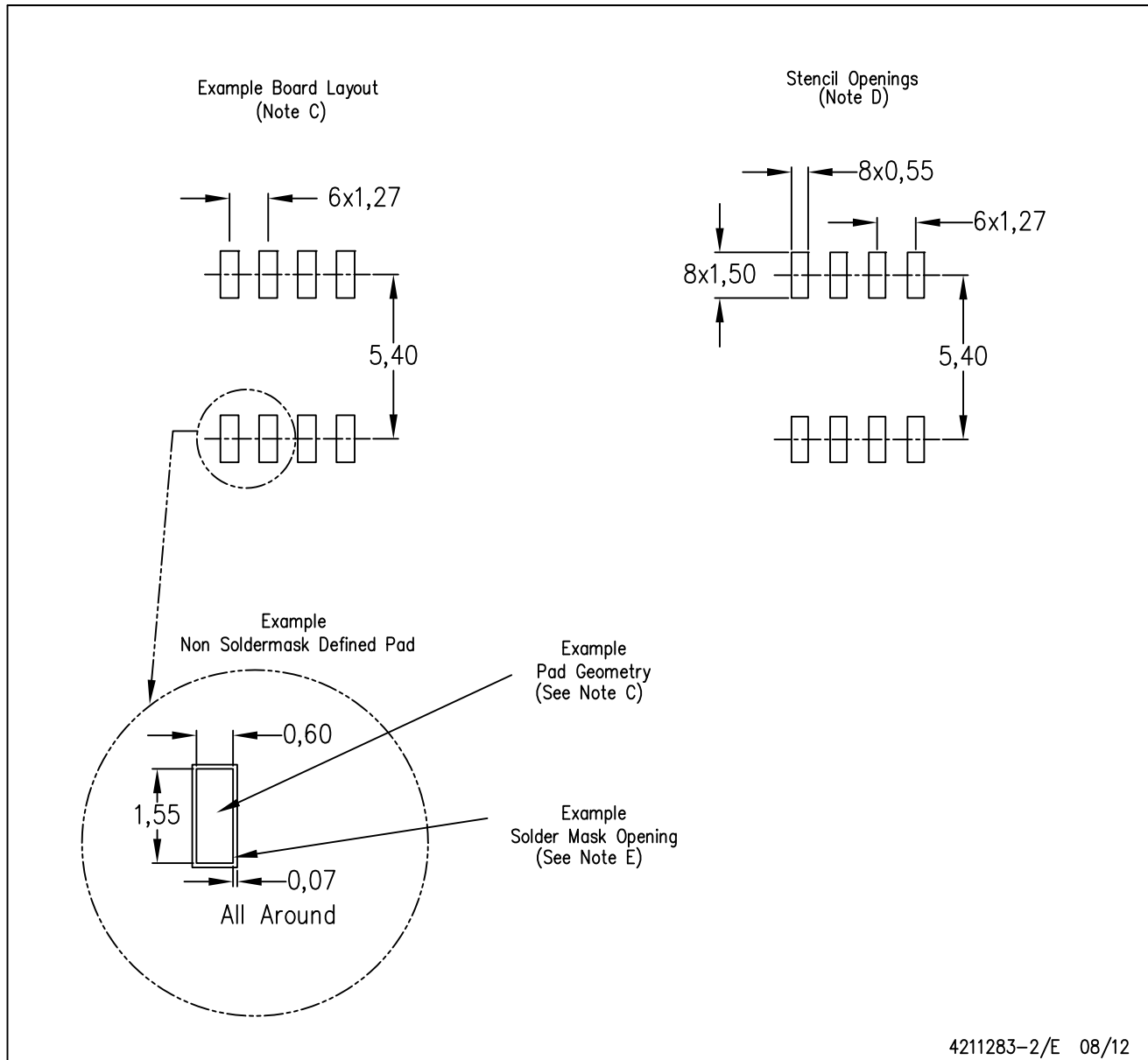
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  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.
  - $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

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.

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