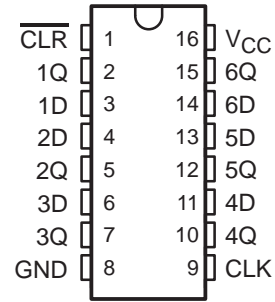


# SN74F174A HEX D-TYPE FLIP-FLOP WITH CLEAR

SDFS029B – D2932, MARCH 1987 – REVISED OCTOBER 1993

- Contains Six Flip-Flops With Single-Rail Outputs
- Buffered Clock and Direct Clear Inputs
- Applications Include:
  - Buffer/Storage Registers
  - Shift Registers
  - Pattern Generators
- Fully Buffered Outputs for Maximum Isolation From External Disturbances
- Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs

D OR N PACKAGE  
(TOP VIEW)



## description

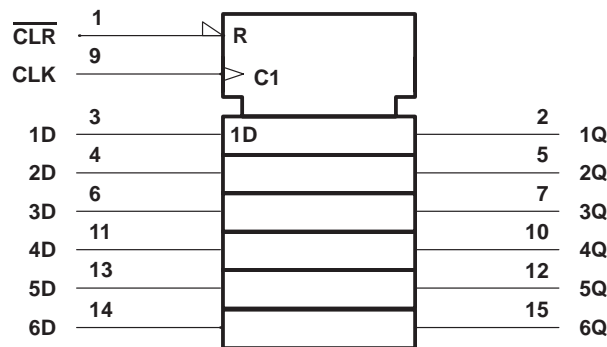
This monolithic, positive-edge-triggered flip-flop utilizes TTL circuitry to implement D-type flip-flop logic with a direct clear (CLR) input. Information at the data (D) inputs meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock (CLK) input is at either the high or low level, the D-input signal has no effect at the output.

The SN74F174A is characterized for operation from 0°C to 70°C.

FUNCTION TABLE  
(each flip-flop)

| INPUTS |     |   | OUTPUT         |
|--------|-----|---|----------------|
| CLR    | CLK | D | Q              |
| H      | L   | X | Q <sub>0</sub> |
| H      | ↑   | H | H              |
| H      | ↑   | L | L              |
| L      | X   | X | L              |

## logic symbol†

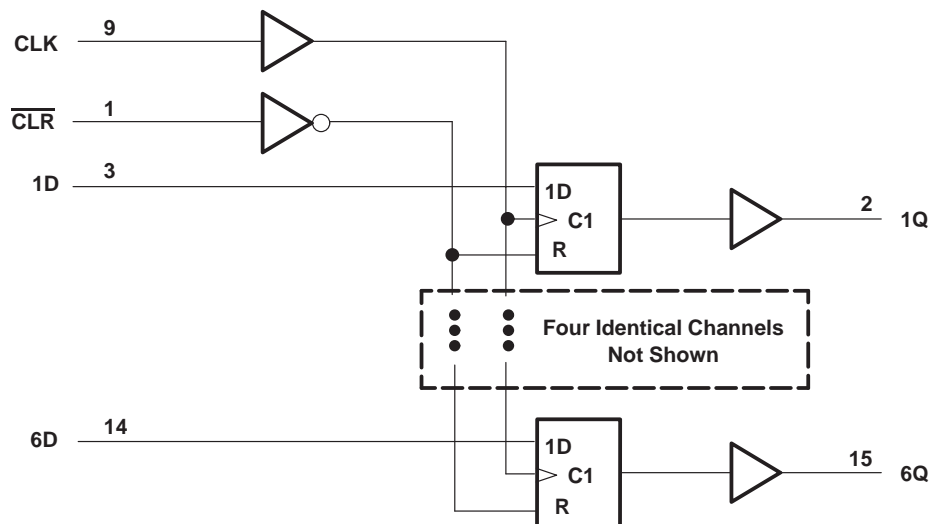


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

# SN74F174A HEX D-TYPE FLIP-FLOP WITH CLEAR

SDFS029B – D2932, MARCH 1987 – REVISED OCTOBER 1993

## logic diagram (positive logic)



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

|   |                    |
|---|--------------------|
| Supply voltage range, $V_{CC}$ .....                  | -0.5 V to 7 V      |
| Input voltage range, $V_I$ (see Note 1) .....         | -1.2 V to 7 V      |
| Input current range .....                             | -30 mA to 5 mA     |
| Voltage applied to any output in the high state ..... | -0.5 V to $V_{CC}$ |
| Current into any output in the low state .....        | 40 mA              |
| Operating free-air temperature range .....            | 0°C to 70°C        |
| Storage temperature range .....                       | -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.

NOTE 1: The input-voltage ratings may be exceeded provided the input-current ratings are observed.

## recommended operating conditions

|          |                                | MIN | NOM | MAX | UNIT |
|----------|--------------------------------|-----|-----|-----|------|
| $V_{CC}$ | Supply voltage                 | 4.5 | 5   | 5.5 | V    |
| $V_{IH}$ | High-level input voltage       | 2   |     |     | V    |
| $V_{IL}$ | Low-level input voltage        |     |     | 0.8 | V    |
| $I_{IK}$ | Input clamp current            |     |     | -18 | mA   |
| $I_{OH}$ | High-level output current      |     |     | -1  | mA   |
| $I_{OL}$ | Low-level output current       |     |     | 20  | mA   |
| $T_A$    | Operating free-air temperature | 0   |     | 70  | °C   |

# SN74F174A HEX D-TYPE FLIP-FLOP WITH CLEAR

SDFS029B – D2932, MARCH 1987 – REVISED OCTOBER 1993

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

| PARAMETER | TEST CONDITIONS                                    | MIN | TYP† | MAX  | UNIT          |
|-----------|--|-----|------|------|---------------|
| $V_{IK}$  | $V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$    |     |      | -1.2 | V             |
| $V_{OH}$  | $V_{CC} = 4.5\text{ V}$ , $I_{OH} = -1\text{ mA}$  | 2.5 | 3.4  |      | V             |
|           | $V_{CC} = 4.75\text{ V}$ , $I_{OH} = -1\text{ mA}$ | 2.7 |      |      |               |
| $V_{OL}$  | $V_{CC} = 4.5\text{ V}$ , $I_{OL} = 20\text{ mA}$  |     | 0.3  | 0.5  | V             |
| $I_I$     | $V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$       |     |      | 0.1  | mA            |
| $I_{IH}$  | $V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$     |     |      | 20   | $\mu\text{A}$ |
| $I_{IL}$  | $V_{CC} = 5.5\text{ V}$ , $V_I = 0.5\text{ V}$     |     |      | -0.6 | mA            |
| $I_{OS}‡$ | $V_{CC} = 5.5\text{ V}$ , $V_O = 0$                | -60 |      | -150 | mA            |
| $I_{CCH}$ | $V_{CC} = 5.5\text{ V}$ , See Note 2               |     | 30   | 45   | mA            |
| $I_{CCL}$ | $V_{CC} = 5.5\text{ V}$ , See Note 3               |     | 39   | 55   | mA            |

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

- NOTES: 2.  $I_{CCH}$  is measured with all outputs open, all data inputs and enable input at 4.5 V, and the clock input at 4.5 V after being momentarily grounded.
3.  $I_{CCL}$  is measured with all outputs open, all data inputs and enable input at 0 V, and the clock input at 4.5 V after being momentarily grounded.

## timing requirements

|                    |  | $V_{CC} = 5\text{ V}$ ,<br>$T_A = 25^\circ\text{C}$ |     | $V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ ,<br>$T_A = \text{MIN to MAX}§$ |     | UNIT |
|--------------------|--|---|-----|--|-----|------|
|                    |  | MIN   | MAX | MIN  | MAX |      |
| $f_{\text{clock}}$ | Clock frequency                        | 0   | 100 | 0  | 80  | MHz  |
| $t_w$              | Pulse duration                         | CLK high  | 4   | 4  |     | ns   |
|                    |  | CLK low   | 6   | 6  |     |      |
|                    |  | $\overline{\text{CLR}}$ low                         | 5   | 5  |     |      |
| $t_{\text{su}}$    | Setup time before $\text{CLK}\uparrow$ | Data high or low                                    | 4.5 | 4.5  |     | ns   |
|                    |  | $\overline{\text{CLR}}$ high¶                       | 5   | 5  |     |      |
| $t_h$              | Hold time after $\text{CLK}\uparrow$   | Data high or low                                    | 0.5 | 1  |     | ns   |

§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

¶ Inactive-state setup time is also referred to as recovery time.

## switching characteristics (see Note 4)

| PARAMETER        | FROM (INPUT)            | TO (OUTPUT) | $V_{CC} = 5\text{ V}$ ,<br>$C_L = 50\text{ pF}$ ,<br>$R_L = 500\ \Omega$ ,<br>$T_A = 25^\circ\text{C}$ |     |     | $V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ ,<br>$C_L = 50\text{ pF}$ ,<br>$R_L = 500\ \Omega$ ,<br>$T_A = \text{MIN to MAX}§$ |     | UNIT |
|------------------|-------------------------|-------------|--|-----|-----|---|-----|------|
|                  |                         |             | MIN  | TYP | MAX | MIN   | MAX |      |
| $f_{\text{max}}$ |                         |             | 100  | 140 |     | 80  |     | MHz  |
| $t_{\text{PLH}}$ | CLK                     | Any Q       | 2.7  | 4.5 | 8   | 2.7   | 9   | ns   |
| $t_{\text{PHL}}$ |                         |             | 3.4  | 4.2 | 10  | 3.3   | 11  |      |
| $t_{\text{PHL}}$ | $\overline{\text{CLR}}$ | Any Q       | 4.2  | 6.3 | 14  | 4.2   | 15  | ns   |

NOTE 4: Load circuits and waveforms are shown in Section 1.



**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|-----------------------------|
| SN74F174AD       | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74F174ADE4     | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74F174ADG4     | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74F174ADR      | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74F174ADRE4    | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74F174ADRG4    | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| SN74F174AN       | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU            | N / A for Pkg Type           |                             |
| SN74F174ANE4     | ACTIVE                | PDIP         | N               | 16   | 25          | 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.

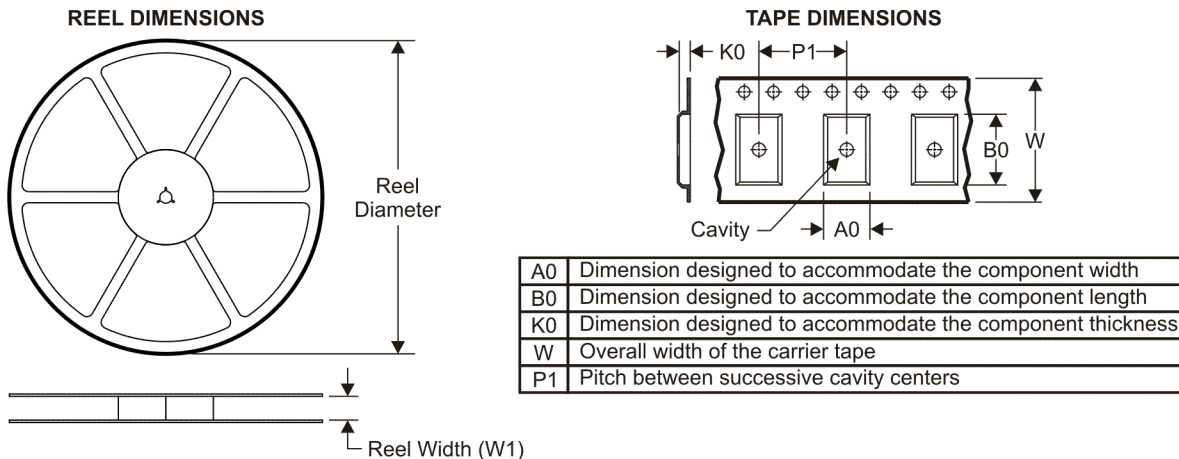
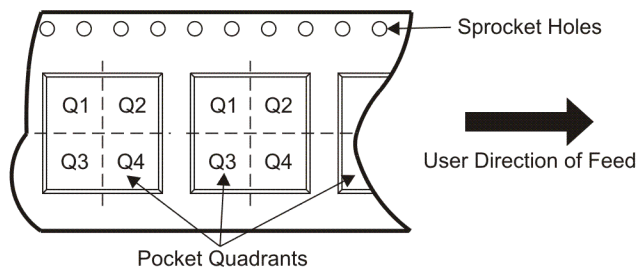
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74F174ADR | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |

TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74F174ADR | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

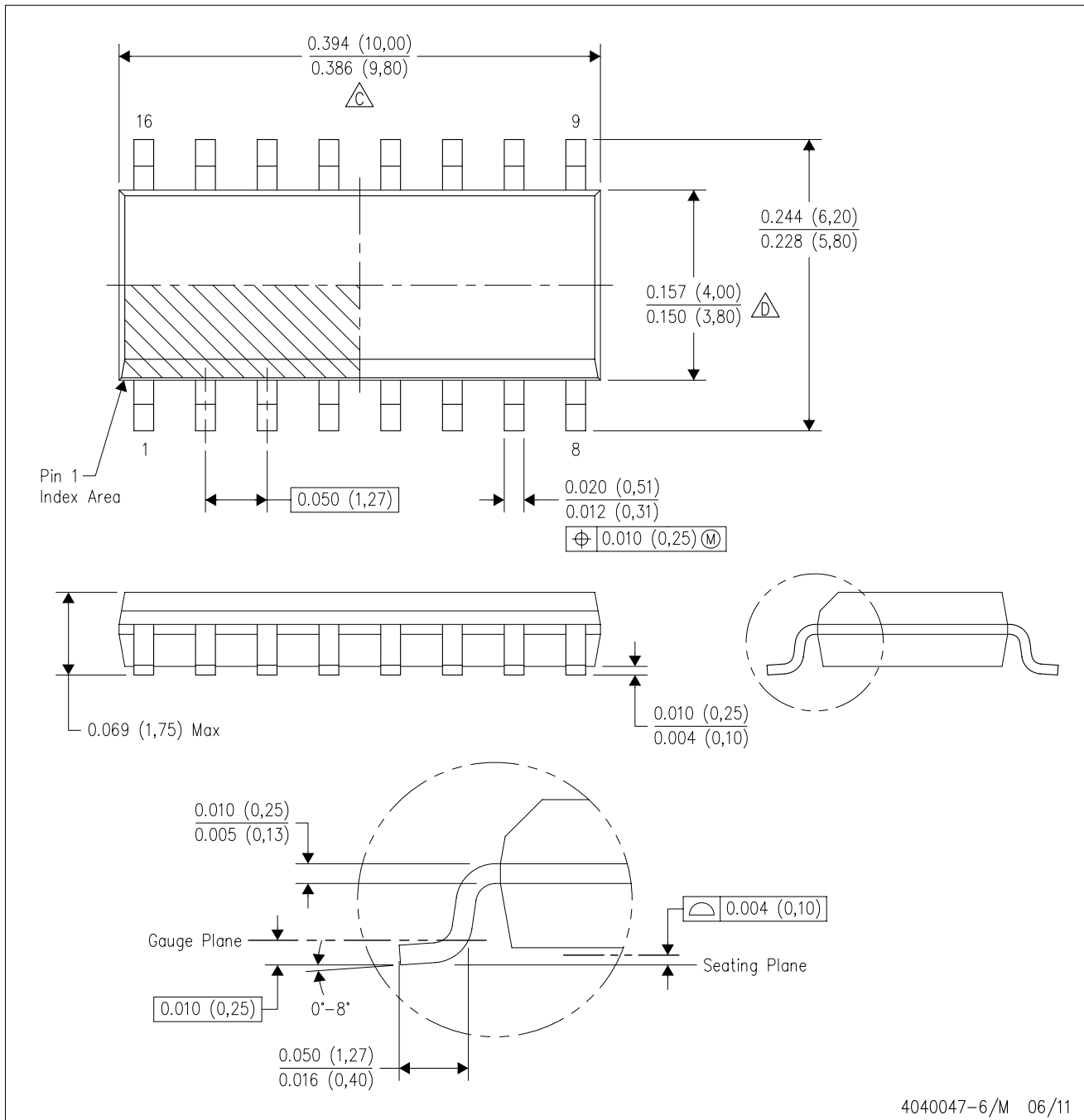
16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G16)

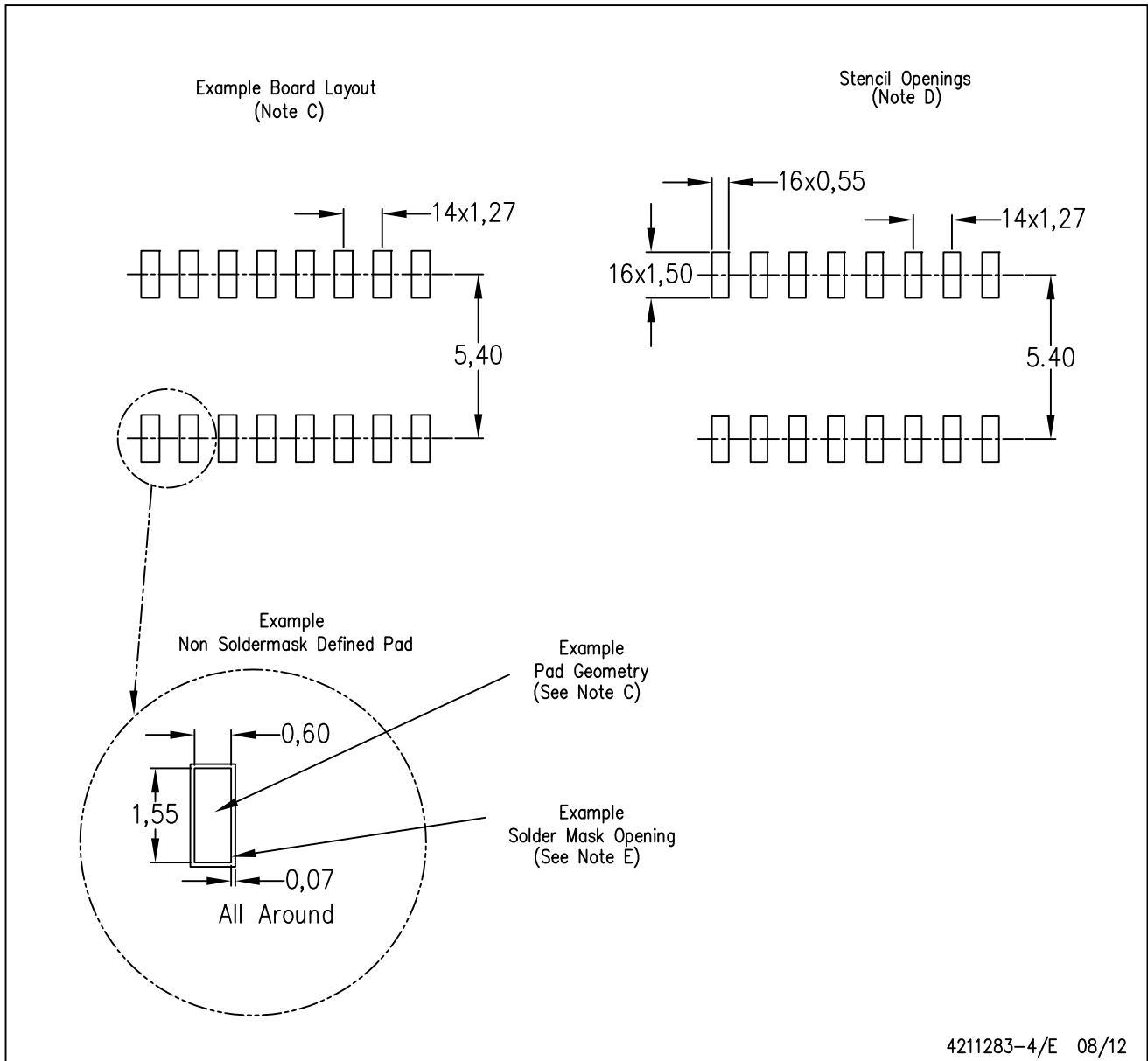
PLASTIC SMALL OUTLINE



- 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.

D (R-PDSO-G16)

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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