# CDx4HCT74 Dual D-Type Positive-Edge-Triggered Flip-Flops With Clear and Preset

## 1 Features

- LSTTL input logic compatible
  - $V_{IL(max)}$ = 0.8 V, $V_{IH(min)}$ = 2 V
- CMOS input logic compatible
  - $I_I \leq 1$ µA at $V_{OL}$, $V_{OH}$
- Buffered inputs
- 4.5 V to 5.5 V operation
- Wide operating temperature range: -55°C to +125°C
- Supports fanout up to 10 LSTTL loads
- Significant power reduction compared to LSTTL logic ICs

## 2 Applications

- Convert a momentary switch to a toggle switch
- Divide a clock signal by 2 or 4

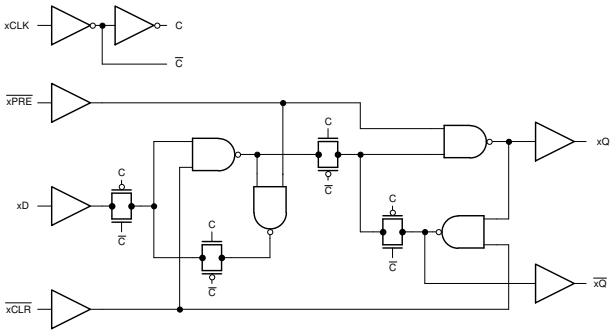
## 3 Description

The CDx4HCT74-Q1 devices contain two independent D-type positive-edge-triggered flip-flops with asynchronous preset and clear pins for each.

**Device Information**(1)

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| CD74HCT74M | SOIC (14) | 8.70 mm × 3.90 mm |
| CD74HCT74E | PDIP (14) | 19.30 mm × 6.40 mm |
| CD54HCT74F | CDIP (14) | 21.30 mm × 7.60 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.




**Functional block diagram**

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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## 4 Revision History

| DATE | REVISION | NOTES |
|---|---|---|
| June 2020 | * | Initial release. Moved the HCT devices from the SCHS124 to a standalone data sheet. |


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# 5 Pin Configuration and Functions

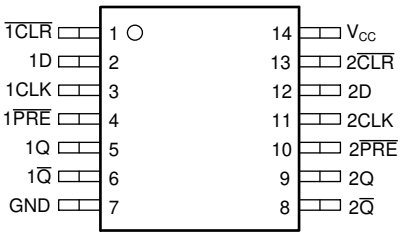


**Figure 5-1. D, N, or J Package 14-Pin SOIC, PDIP, or CDIP Top View**

## Pin Functions

| PIN | | I/O | DESCRIPTION |
|---|---|---|---|
| NAME | NO. | | |
| 1 $\overline{CLR}$ | 1 | Input | Channel 1, Clear Input, Active Low |
| 1D | 2 | Input | Channel 1, Data Input |
| 1CLK | 3 | Input | Channel 1, Positive edge triggered clock input |
| 1 $\overline{PRE}$ | 4 | Input | Channel 1, Preset Input, Active Low |
| 1Q | 5 | Output | Channel 1, Output |
| 1 $\overline{Q}$ | 6 | Output | Channel 1, Inverted Output |
| GND | 7 | — | Ground |
| 2 $\overline{Q}$ | 8 | Output | Channel 2, Inverted Output |
| 2Q | 9 | Output | Channel 2, Output |
| 2 $\overline{PRE}$ | 10 | Input | Channel 2, Preset Input, Active Low |
| 2CLK | 11 | Input | Channel 2, Positive edge triggered clock input |
| 2D | 12 | Input | Channel 2, Data Input |
| 2 $\overline{CLR}$ | 13 | Input | Channel 2, Clear Input, Active Low |
| $V_{CC}$ | 14 | — | Positive Supply |

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# 6 Specifications

## 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | –0.5 | 7 | V |
| $I_{IK}$ | Input clamp current(2) | $V_I < –0.5$ V or $V_I > V_{CC} + 0.5$ V | | ±20 | mA |
| $I_{OK}$ | Output clamp current(2) | $V_O < –0.5$ V or $V_O > V_{CC} + 0.5$ V | | ±20 | mA |
| $I_O$ | Continuous output current | $V_O > –0.5$ V or $V_O < V_{CC} + 0.5$ V | | ±25 | mA |
| | Continuous current through $V_{CC}$ or GND | | | ±50 | mA |
| $T_J$ | Junction temperature(3) | Hermetic Package or Die | | 175 | °C |
| | | Plastic Package | | 150 | °C |
| | Lead temperature (soldering 10s) | SOIC - lead tips only | | 300 | °C |
| $T_{stg}$ | Storage temperature | | –65 | 150 | °C |

(1) Stresses beyond those listed under *Absolute Maximum Rating* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
(3) Guaranteed by design.

## 6.2 Recommended Operating Conditions

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

| | | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 4.5 | | 5.5 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | 2 | | | V |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 4.5 V to 5.5 V | | | 0.8 | V |
| $V_I$ | Input voltage | | 0 | | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | | $V_{CC}$ | V |
| $t_t$ | Input transition time | $V_{CC}$ = 4.5 V | | | 500 | ns |
| | | $V_{CC}$ = 5.5 V | | | 400 | |
| $T_A$ | Operating free-air temperature | | –55 | | 125 | °C |

## 6.3 Thermal Information

| THERMAL METRIC(1) | | CD74HCT74 | | UNIT |
|---|---|---|---|---|
| | | N (PDIP) | D (SOIC) | |
| | | 14 PINS | 14 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 62.3 | 88.1 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 50.0 | 47.5 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 42.0 | 43.8 | °C/W |
| $\Psi_{JT}$ | Junction-to-top characterization parameter | 29.6 | 13.7 | °C/W |
| $\Psi_{JB}$ | Junction-to-board characterization parameter | 41.8 | 43.5 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | N/A | °C/W |

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report.


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## 6.4 Electrical Characteristics

over operating free-air temperature range; typical values measured at $T_A$ = 25°C (unless otherwise noted).

| PARAMETER | | TEST CONDITIONS | | $V_{CC}$ | Operating free-air temperature ($T_A$) | | | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 25°C | | | –40°C to 85°C | | | –55°C to 125°C | | | |
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{OH}$ | High-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –20 µA | 4.5 V | 4.4 | | | 4.4 | | | 4.4 | | | V |
| | | | $I_{OH}$ = –4 mA | 4.5 V | 3.98 | | | 3.84 | | | 3.7 | | | |
| $V_{OL}$ | Low-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 µA | 4.5 V | | | 0.1 | | | 0.1 | | | 0.1 | V |
| | | | $I_{OL}$ = 4 mA | 4.5 V | | | 0.26 | | | 0.33 | | | 0.4 | |
| $I_I$ | Input leakage current | $V_I$ = $V_{CC}$ and GND | $I_O$ = 0 | 5.5 V | | | ±0.1 | | | ±1 | | | ±1 | µA |
| $I_{CC}$ | Supply current | $V_I$ = $V_{CC}$ or GND | $I_O$ = 0 | 5.5 V | | | 4 | | | 40 | | | 80 | µA |
| $\Delta I_{CC}$ (1) | Additional Quiescent Device Current Per Input Pin. | $V_I$ = $V_{CC}$ – 2.1 | | 4.5 V to 5.5 V | | 100 | 360 | | | 450 | | | 490 | µA |
| $C_i$ | Input capacitance | | | 5 V | | | 10 | | | 10 | | | 10 | pF |

(1) For dual-supply systems theoretical worst case ($V_I$ = 2.4 V, $V_{CC}$ = 5.5 V) specification is 1.8 mA.

## 6.5 Timing Requirements

over operating free-air temperature range; typical values measured at TA = 25°C (unless otherwise noted).

| | | | $V_{CC}$ | Operating free-air temperature ($T_A$) | | | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 25°C | | | –40°C to 85°C | | | –55°C to 125°C | | | |
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $t_{su}$ | Setup time | D to CLK | 4.5 V | 12 | | | 15 | | | 18 | | | ns |
| $t_h$ | Hold time | | 4.5 V | 3 | | | 3 | | | 3 | | | ns |
| $t_{rem}$ | Removal time | $\overline{CLR}$, $\overline{PRE}$, to CLK | 4.5 V | 6 | | | 8 | | | 9 | | | ns |
| $t_w$ | Pulse width | $\overline{CLR}$, $\overline{PRE}$ | 4.5 V | 16 | | | 20 | | | 24 | | | ns |
| | | CLK | 4.5 V | 18 | | | 23 | | | 27 | | | |
| $f_{max}$ | CLK frequency | | 4.5 V | 25 | | | 20 | | | 16 | | | MHz |

## 6.6 Switching Characteristics

over operating free-air temperature range; typical values measured at TA = 25°C (unless otherwise noted).

| PARAMETER | | FROM | TO | TEST CONDITIONS | $V_{CC}$ | Operating free-air temperature ($T_A$) | | | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 25°C | | | –40°C to 85°C | | | –55°C to 125°C | | | |
| | | | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $t_{pd}$ | Propagation delay | CLK | Q, $\overline{Q}$ | $C_L$ = 50 pF | 4.5 V | | | 35 | | | 44 | | | 53 | ns |
| | | $\overline{CLR}$, $\overline{PRE}$ | Q, $\overline{Q}$ | $C_L$ = 50 pF | 4.5 V | | | 40 | | | 50 | | | 60 | |
| $t_t$ | Transition-time | | Y | $C_L$ = 50 pF | 4.5 V | | | 15 | | | 19 | | | 22 | ns |
| $f_{max}$ | CLK Frequency | | | $C_L$ = 15 pF | 5 V | | 50 | | | | | | | | |

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## 6.7 Operating Characteristics

over operating free-air temperature range; typical values measured at $T_A$ = 25°C (unless otherwise noted).

| PARAMETER | | TEST CONDITIONS | $V_{CC}$ | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance per gate | No load | 5 V | | 30 | | pF |

## 6.8 Typical Characteristics

$T_A$ = 25°C

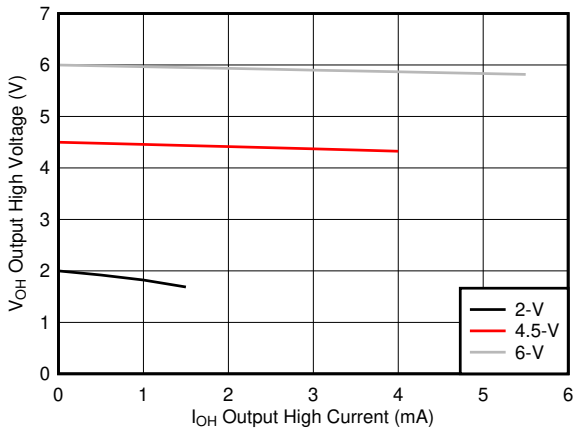


**Figure 6-1. Typical output voltage in the high state ($V_{OH}$)**

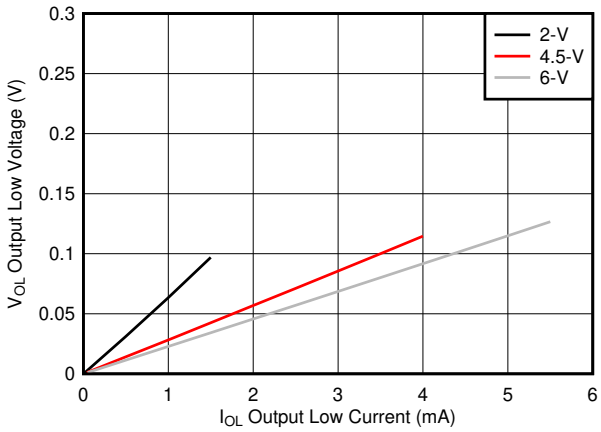


**Figure 6-2. Typical output voltage in the low state ($V_{OL}$)**


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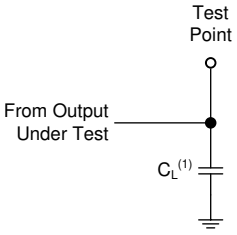
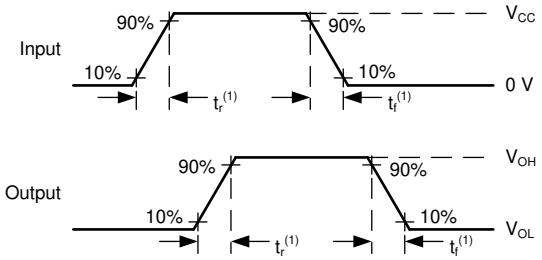
## 7 Parameter Measurement Information

- Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O$ = 50 Ω, $t_t$ < 6 ns.
- The outputs are measured one at a time, with one input transition per measurement.




A. $C_L$ = 50 pF and includes probe and jig capacitance.

**Figure 7-1. Load Circuit**




A. $t_t$ is the greater of $t_r$ and $t_f$.

**Figure 7-2. Voltage Waveforms Transition Times**

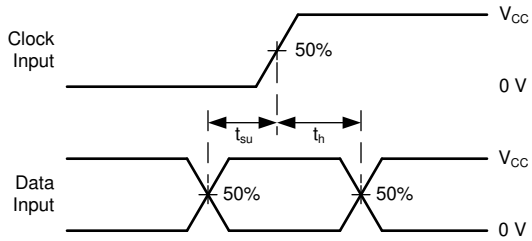



**Figure 7-3. Voltage Waveforms Setup and Hold Times**

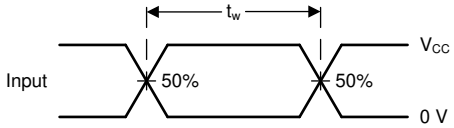
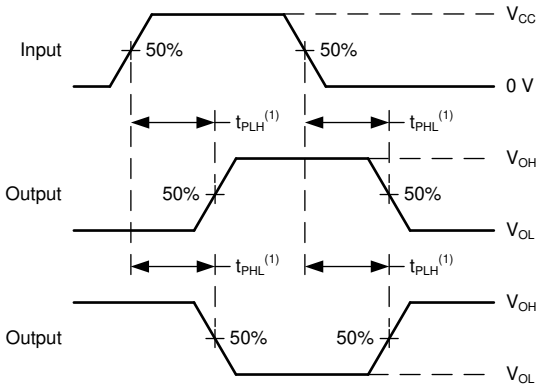



**Figure 7-4. Voltage Waveforms Pulse Width**




A. The maximum between $t_{PLH}$ and $t_{PHL}$ is used for $t_{pd}$.

**Figure 7-5. Voltage Waveforms Propagation Delays**

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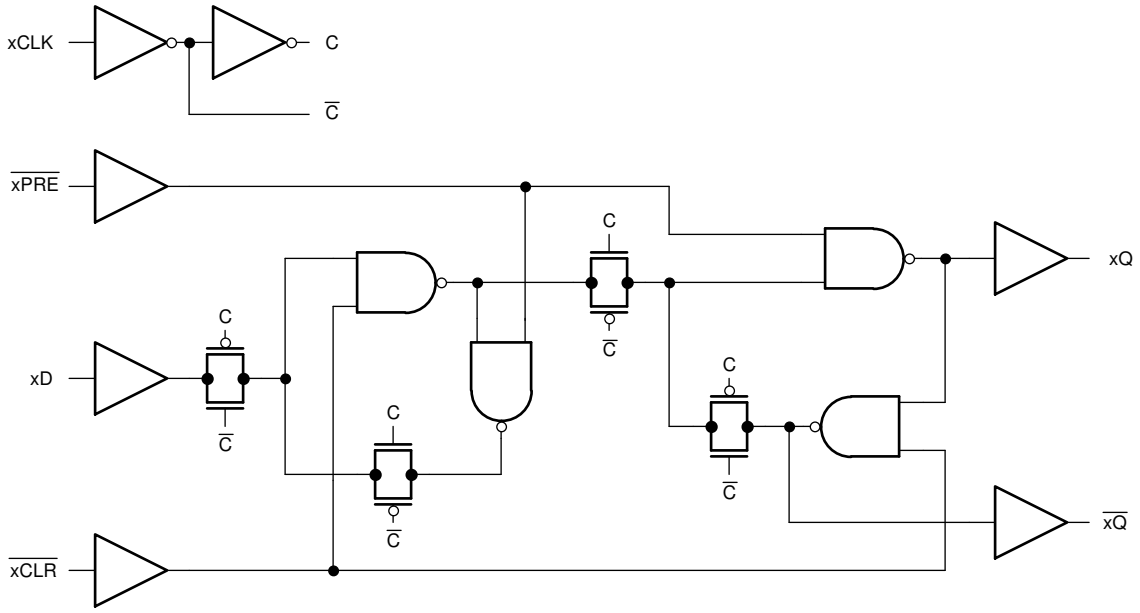
# 8 Detailed Description

## 8.1 Overview

The CDx4HCT74-Q1 devices contain two independent D-type positive-edge-triggered flip-flops with asynchronous preset and clear pins for each.

## 8.2 Functional Block Diagram




## 8.3 Feature Description

### 8.3.1 Balanced CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The drive capability of this device may create fast edges into light loads so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. It is important for the output power of the device to be limited to avoid damage due to over-current. The electrical and thermal limits defined in the *Section 6.1* must be followed at all times.

The CD74HCT74 can drive a load with a total capacitance less than or equal to the maximum load listed in the *Section 6.6* connected to a high-impedance CMOS input while still meeting all of the datasheet specifications. Larger capacitive loads can be applied, however it is not recommended to exceed the provided load value. If larger capacitive loads are required, it is recommended to add a series resistor between the output and the capacitor to limit output current to the values given in the *Section 6.1*.

### 8.3.2 TTL-Compatible CMOS Inputs

TTL-Compatible CMOS inputs are high impedance and are typically modeled as a resistor from the input to ground in parallel with the input capacitance given in the *Section 6.4*. The worst case resistance is calculated with the maximum input voltage, given in the *Section 6.1*, and the maximum input leakage current, given in the *Section 6.4*, using ohm's law (R = V ÷ I).

Signals applied to the inputs need to have fast edge rates, as defined by Δt/Δv in the *Section 6.2* to avoid excessive current consumption and oscillations. If a slow or noisy input signal is required, a device with a Schmitt-trigger input should be used to condition the input signal prior to the TTL-compatible CMOS input.

TTL-Compatible CMOS inputs have a lower threshold voltage than standard CMOS inputs to allow for compatibility with older bipolar logic devices. See the *Section 6.2* for the valid input voltages for the CD74HCT74.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### 8.3.3 Clamp Diode Structure

The inputs and outputs to this device have both positive and negative clamping diodes as depicted in Figure 8-1.

**CAUTION**

Voltages beyond the values specified in the Section 6.1 table can cause damage to the device. The recommended input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

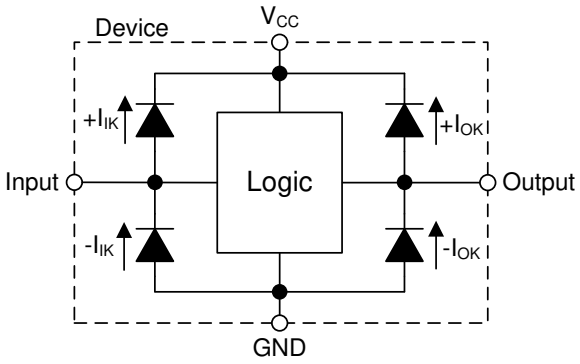


**Figure 8-1. Electrical Placement of Clamping Diodes for Each Input and Output**

## 8.4 Device Functional Modes

**Table 8-1. Function Table**

| INPUTS | | | | OUTPUTS | |
|---|---|---|---|---|---|
| $\overline{PRE}$ | $\overline{CLR}$ | CLK | D | Q | $\overline{Q}$ |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H(1) | H(1) |
| H | H | ↑ | H | H | L |
| H | H | ↑ | L | L | H |
| H | H | L | X | $Q_0$ | $\overline{Q}_0$ |

(1) This configuration is nonstable; that is, it does not persist when $\overline{PRE}$ or $\overline{CLR}$ returns to its inactive (high) level.

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# 9 Application and Implementation

**Note**

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

## 9.1 Application Information

Toggle switches are typically large, mechanically complex and relatively expensive. It is desirable to use a momentary switch instead because they are small, mechanically simple and low cost. Some systems require a toggle switch's functionality but are space or cost constrained and must use a momentary switch instead.

If the data input (D) of the D-type flip-flop is tied to the inverted output ( $\overline{Q}$), then each clock pulse will cause the value at the output (Q) to toggle. The momentary switch can be debounced and connected through a Schmitt-trigger buffer to the clock input (CLK) to toggle the output.

This application also utilizes a power-on reset circuit to ensure that the output always starts in the LOW state when power is applied.

## 9.2 Typical Application

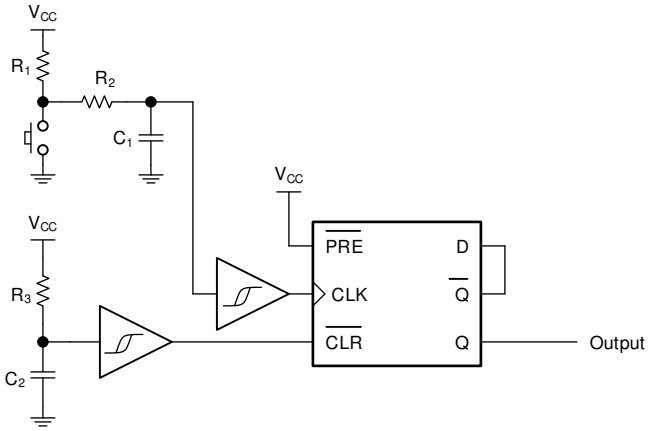


**Figure 9-1. Typical application schematic**

### 9.2.1 Design Requirements

#### *9.2.1.1 Power Considerations*

Ensure the desired supply voltage is within the range specified in the *Section 6.2*. The supply voltage sets the device's electrical characteristics as described in the *Section 6.4*.

The supply must be capable of sourcing current equal to the total current to be sourced by all outputs of the CD74HCT74 plus the maximum supply current, $I_{CC}$, listed in the *Section 6.4*. The logic device can only source or sink as much current as it is provided at the supply and ground pins, respectively. Be sure not to exceed the maximum total current through GND or $V_{CC}$ listed in the *Section 6.1*.

Total power consumption can be calculated using the information provided in CMOS Power Consumption and $C_{pd}$ Calculation.

Thermal increase can be calculated using the information provided in Thermal Characteristics of Standard Linear and Logic (SLL) Packages and Devices.


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**CAUTION**

The maximum junction temperature, $T_J$(max) listed in the *Section 6.1*, is an *additional limitation* to prevent damage to the device. Do not violate any values listed in the *Section 6.1*. These limits are provided to prevent damage to the device.

#### *9.2.1.2 Input Considerations*

Unused inputs must be terminated to either $V_{CC}$ or ground. These can be directly terminated if the input is completely unused, or they can be connected with a pull-up or pull-down resistor if the input is to be used sometimes, but not always. A pull-up resistor is used for a default state of HIGH, and a pull-down resistor is used for a default state of LOW. The resistor size is limited by drive current of the controller, leakage current into the CD74HCT74, as specified in the *Section 6.4*, and the desired input transition rate. A 10-kΩ resistor value is often used due to these factors.

Refer to the *Section 8.3* for additional information regarding the inputs for this device.

#### *9.2.1.3 Output Considerations*

The positive supply voltage is used to produce the output HIGH voltage. Drawing current from the output will decrease the output voltage as specified by the $V_{OH}$ specification in the *Section 6.4*. Similarly, the ground voltage is used to produce the output LOW voltage. Sinking current into the output will increase the output voltage as specified by the $V_{OL}$ specification in the *Section 6.4*.

Unused outputs can be left floating. Do not connect outputs directly to $V_{CC}$ or ground.

Refer to *Section 8.3* for additional information regarding the outputs for this device.

#### *9.2.1.4 Timing Considerations*

The CD74HCT74 is a clocked device. As such, it requires special timing considerations to ensure normal operation.

Primary timing factors to consider:

- Maximum clock frequency: the maximum operating clock frequency defined in *Section 6.5* is the maximum frequency at which the device is guaranteed to function. This value refers specifically to the triggering waveform, measuring from one trigger level to the next.
- Pulse duration: ensure that the triggering event duration is larger than the minimum pulse duration, as defined in the *Section 6.5*.
- Setup time: ensure that the data has changed at least one setup time prior to the triggering event, as defined in the *Section 6.5*.
- Hold time: ensure that the data remains in the desired state at least one hold time after the triggering event, as defined in the *Section 6.5*.

### 9.2.2 Detailed Design Procedure

1. Add a decoupling capacitor from $V_{CC}$ to GND. The capacitor needs to be placed physically close to the device and electrically close to both the $V_{CC}$ and GND pins. An example layout is shown in the *Section 11*.
2. Ensure the capacitive load at the output is ≤ 70 pF. This is not a hard limit, however it will ensure optimal performance. This can be accomplished by providing short, appropriately sized traces from the CD74HCT74 to the receiving device.
3. Ensure the resistive load at the output is larger than ($V_{CC}$ / $I_O$(max)) Ω. This will ensure that the maximum output current from the *Section 6.1* is not violated. Most CMOS inputs have a resistive load measured in megaohms; much larger than the minimum calculated above.
4. Thermal issues are rarely a concern for logic gates, however the power consumption and thermal increase can be calculated using the steps provided in the application report, CMOS Power Consumption and Cpd Calculation

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### 9.2.3 Application Curves

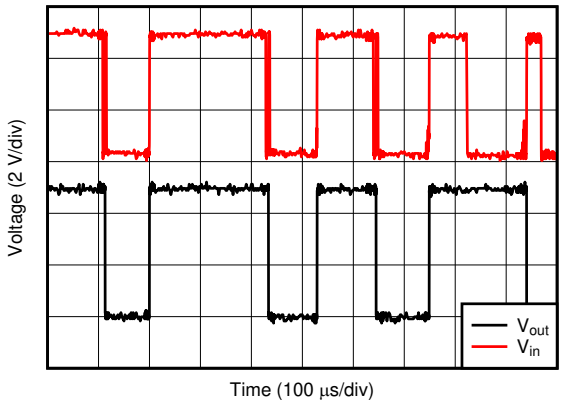


**Figure 9-2. Waveform for non-debounced switch.**

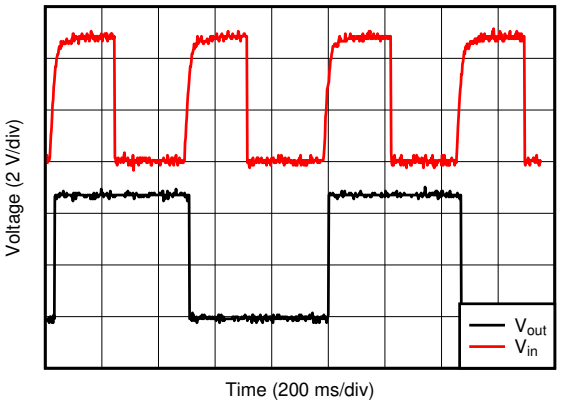


**Figure 9-3. Waveform for debounced switch.**


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## 10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Section 6.2*. Each $V_{CC}$ terminal should have a bypass capacitor to prevent power disturbance. A 0.1-µF capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1-µF and 1-µF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in *Figure 11-1*.

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# 11 Layout

## 11.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or $V_{CC}$, whichever makes more sense for the logic function or is more convenient.

## 11.2 Layout Example

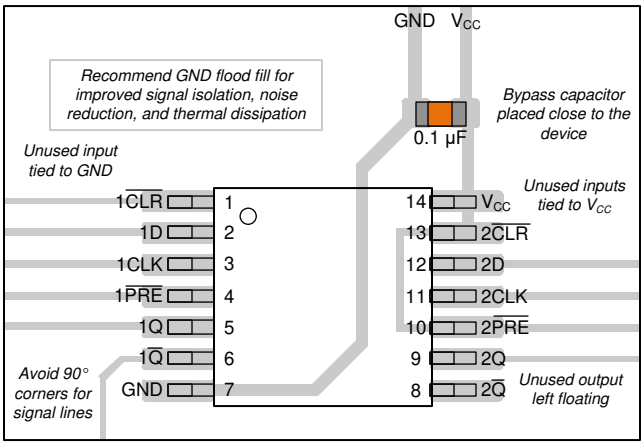


**Figure 11-1. Example layout for the CD74HCT74**


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# 12 Device and Documentation Support

## 12.1 Documentation Support

### 12.1.1 Related Documentation

For related documentation see the following:

- HCMOS Design Considerations
- CMOS Power Consumption and CPD Calculation
- Designing with Logic

## 12.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

## 12.3 Trademarks

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All trademarks are the property of their respective owners.

## 12.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 12.5 Glossary

| | |
|---|---|
| TI Glossary | This glossary lists and explains terms, acronyms, and definitions. |

# 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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## PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| 5962-8685301CA | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-8685301CA CD54HCT74F3A |
| CD54HCT74F | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | CD54HCT74F |
| CD54HCT74F.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | CD54HCT74F |
| CD54HCT74F3A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-8685301CA CD54HCT74F3A |
| CD54HCT74F3A.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-8685301CA CD54HCT74F3A |
| CD74HCT74E | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -55 to 125 | CD74HCT74E |
| CD74HCT74E.A | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -55 to 125 | CD74HCT74E |
| CD74HCT74M | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | -55 to 125 | HCT74M |
| CD74HCT74M96 | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU \| SN | Level-1-260C-UNLIM | -55 to 125 | HCT74M |
| CD74HCT74M96.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HCT74M |
| CD74HCT74M96G4 | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HCT74M |
| CD74HCT74M96G4.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HCT74M |
| CD74HCT74MT | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | -55 to 125 | HCT74M |

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**OTHER QUALIFIED VERSIONS OF CD54HCT74, CD74HCT74 :**

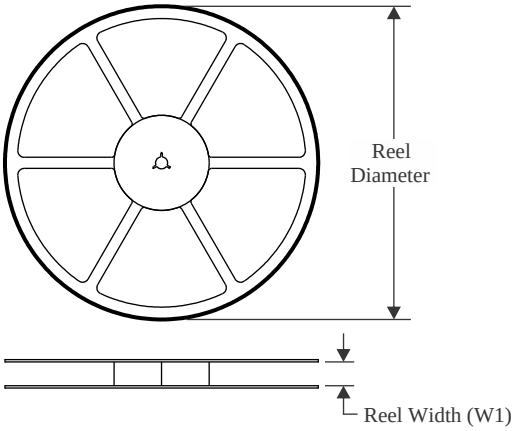
- Catalog : CD74HCT74
- Military : CD54HCT74

NOTE: Qualified Version Definitions:

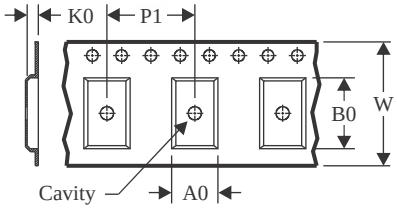
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

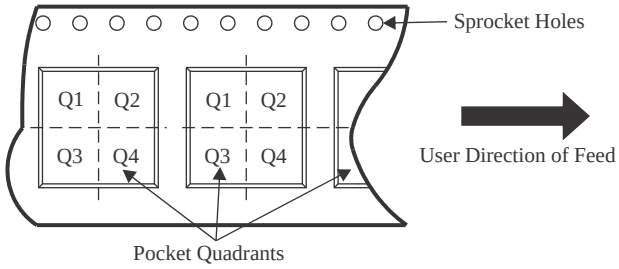



**TAPE DIMENSIONS**




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

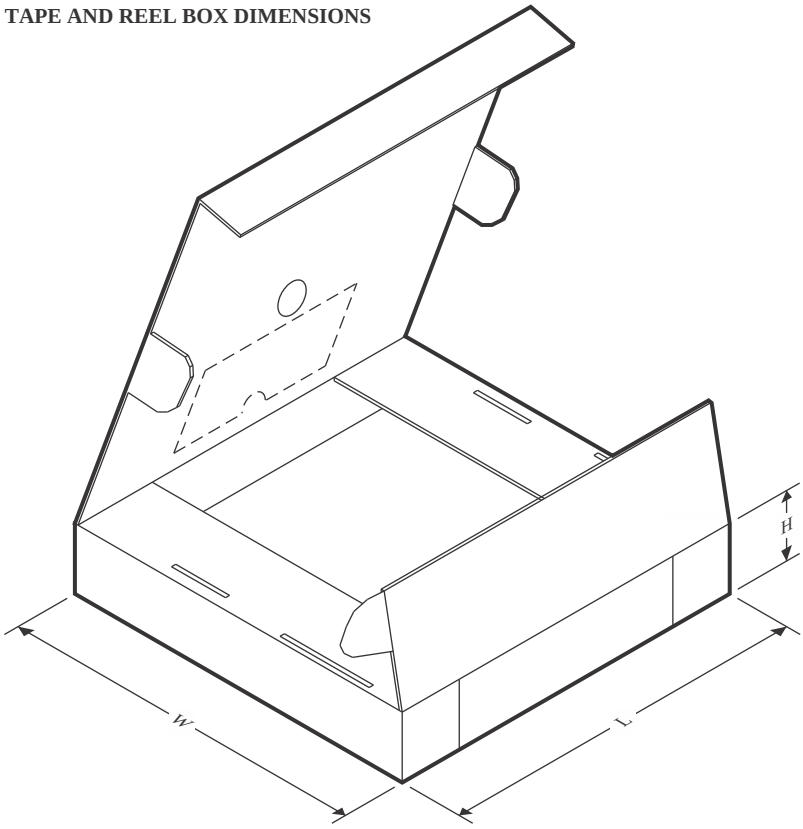
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CD74HCT74M96 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.6 | 9.3 | 2.1 | 8.0 | 16.0 | Q1 |
| CD74HCT74M96 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| CD74HCT74M96G4 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| CD74HCT74M96G4 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |

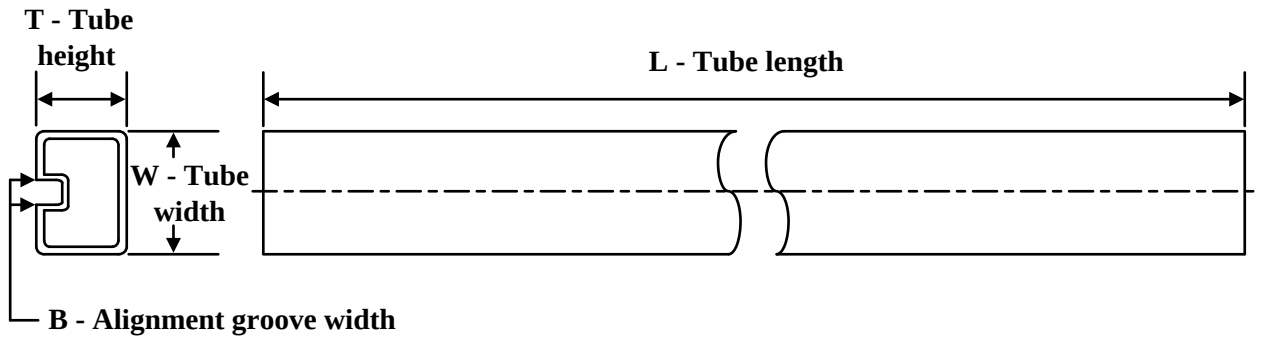
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

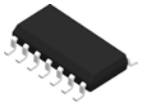
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| CD74HCT74M96 | SOIC | D | 14 | 2500 | 366.0 | 364.0 | 50.0 |
| CD74HCT74M96 | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| CD74HCT74M96G4 | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| CD74HCT74M96G4 | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |

## TUBE




*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|---|---|---|---|---|---|---|---|---|
| CD74HCT74E | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD74HCT74E | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD74HCT74E.A | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| CD74HCT74E.A | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |

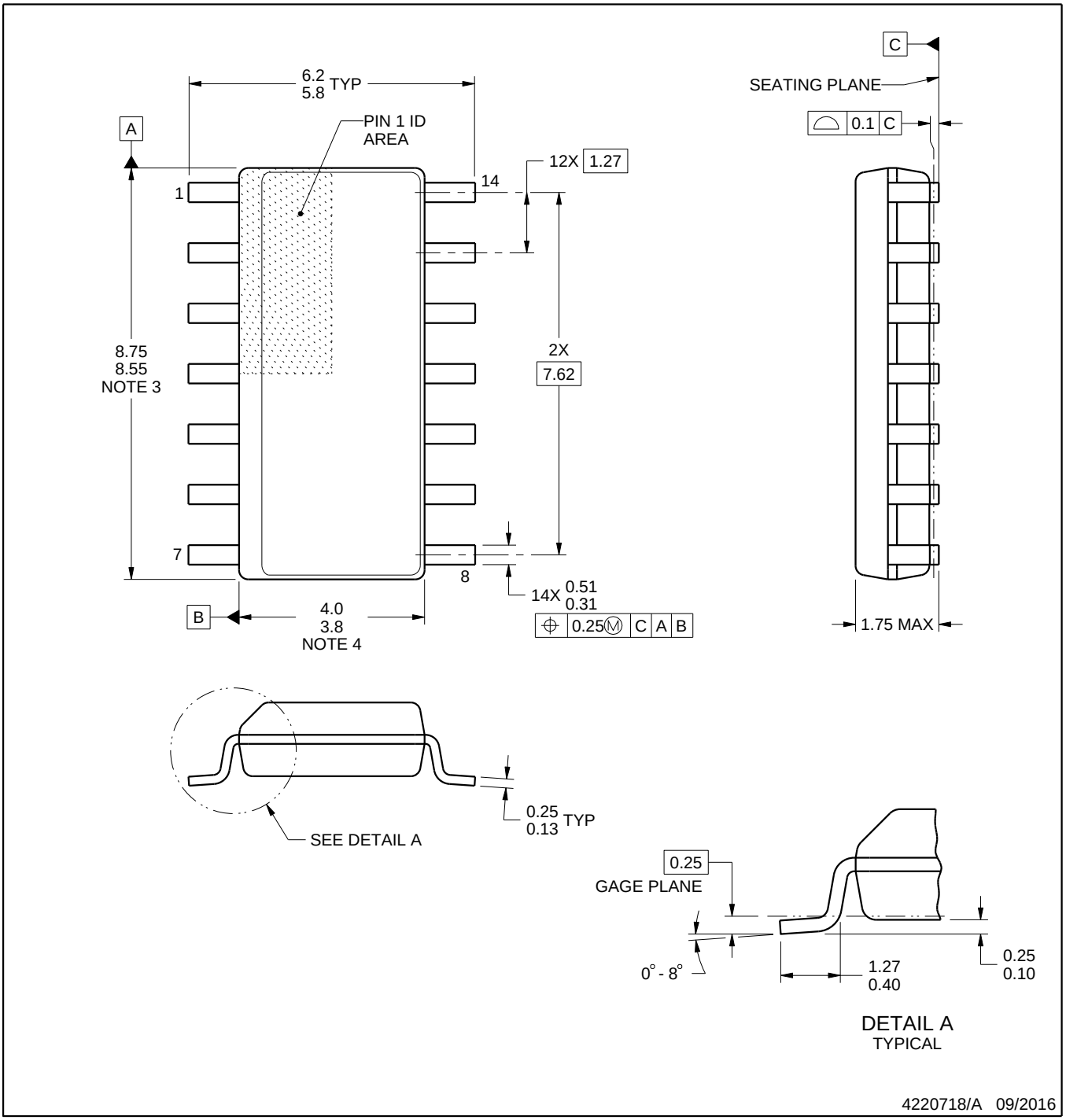


# PACKAGE OUTLINE

## D0014A

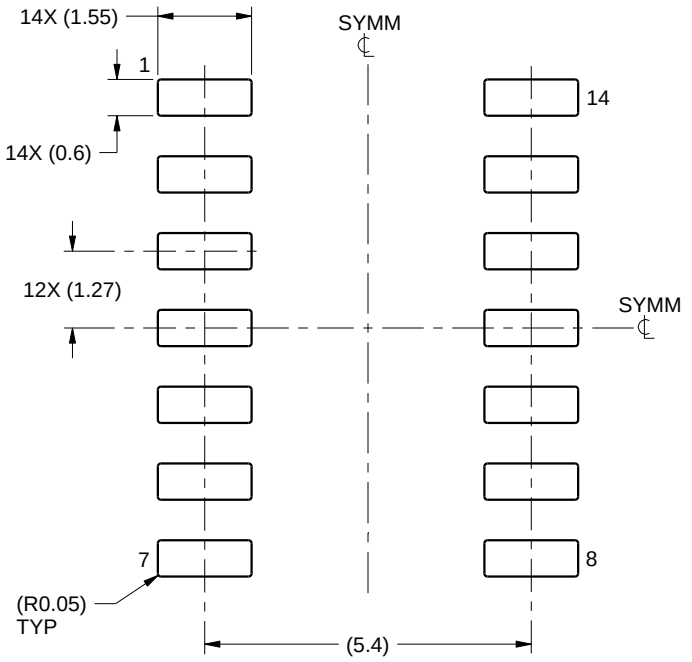
## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

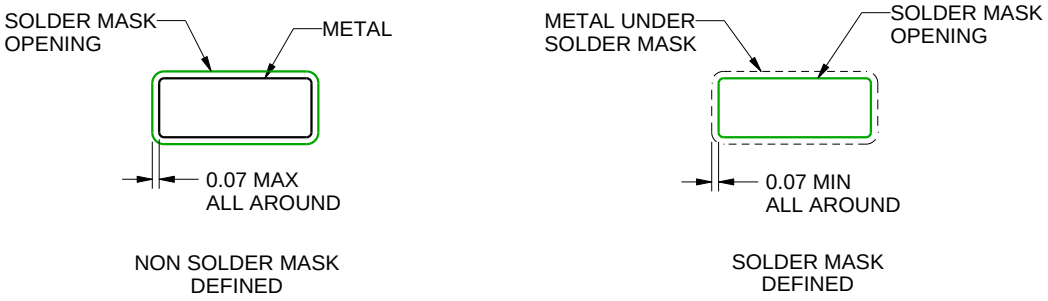



NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.




LAND PATTERN EXAMPLE
SCALE:8X




SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

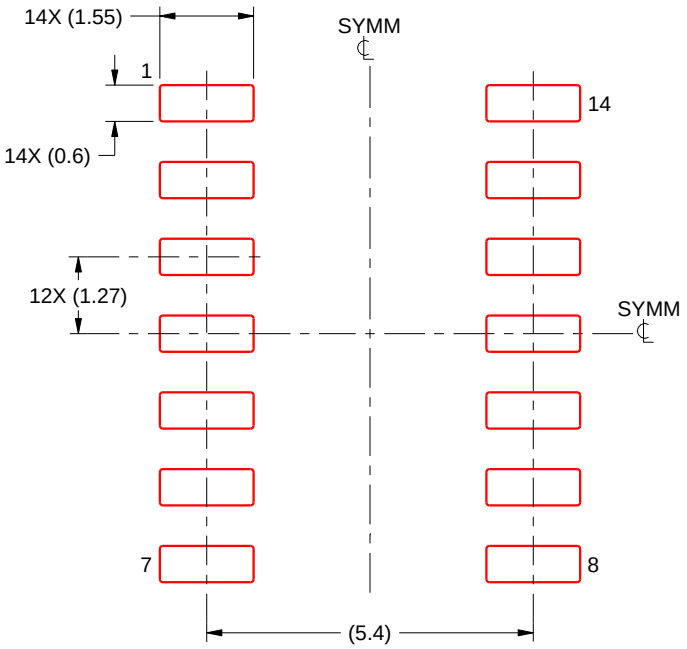
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

## D0014A

## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A 09/2016

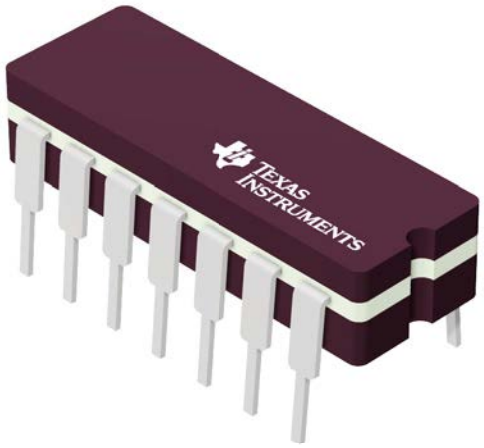
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# GENERIC PACKAGE VIEW

## J 14 CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE




Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

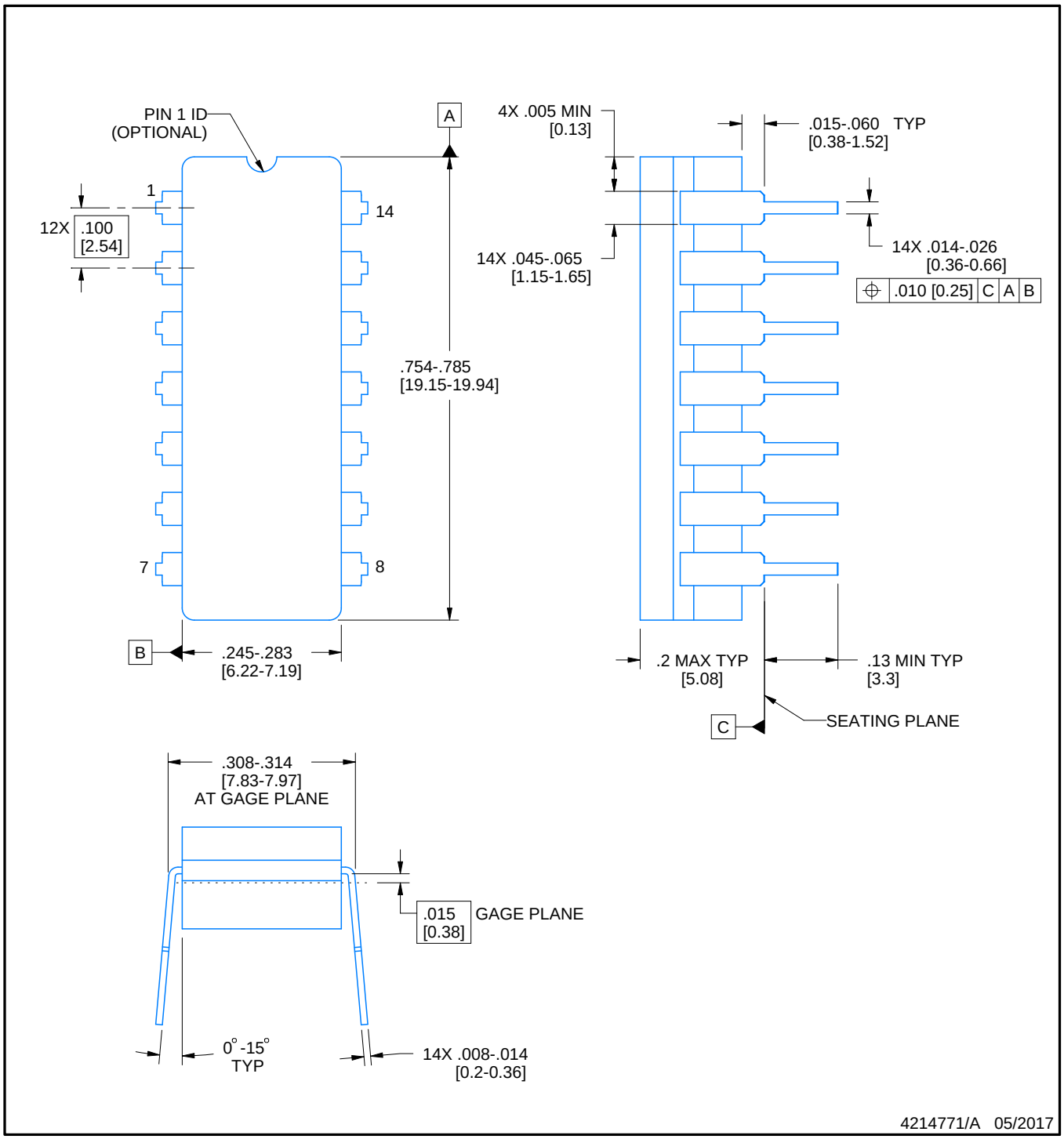
4040083-5/G

# PACKAGE OUTLINE

## J0014A

## CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE




NOTES:

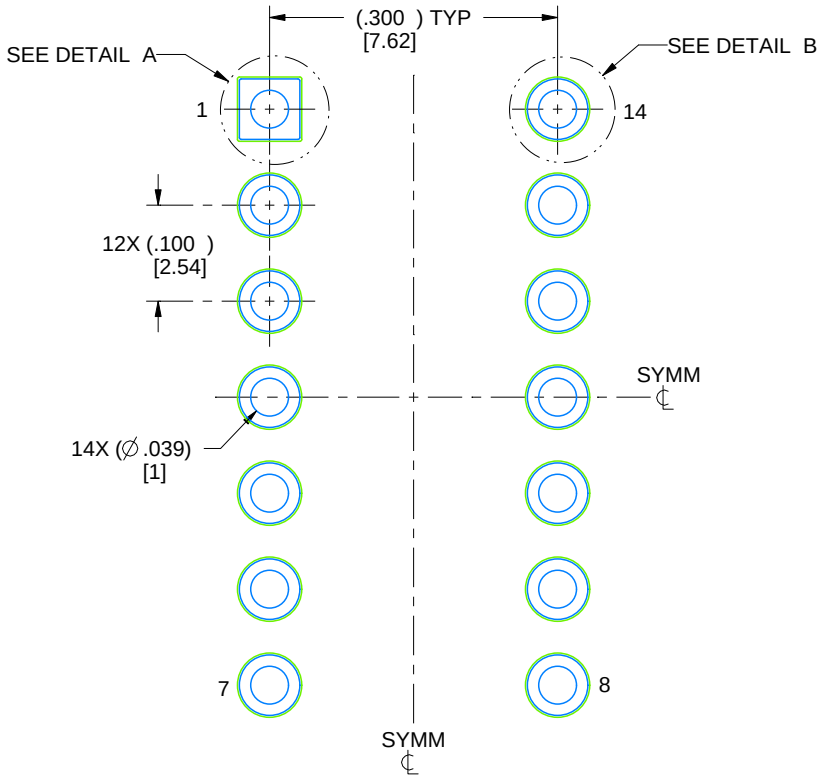
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermitically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

# EXAMPLE BOARD LAYOUT

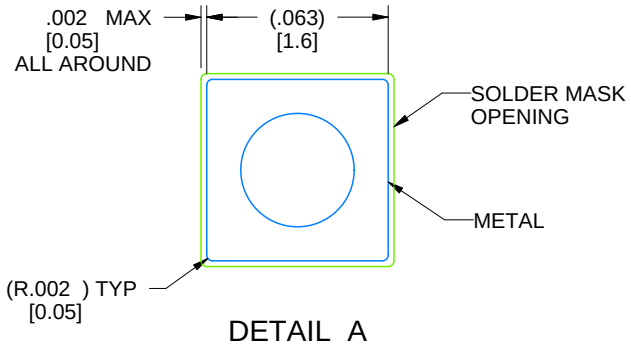
## J0014A

## CDIP - 5.08 mm max height

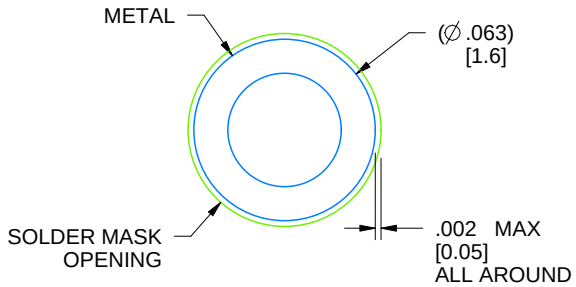
CERAMIC DUAL IN LINE PACKAGE




LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X




DETAIL A
SCALE: 15X



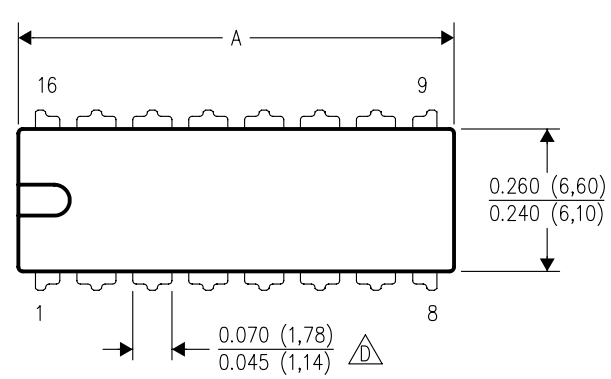

DETAIL B
13X, SCALE: 15X

4214771/A 05/2017

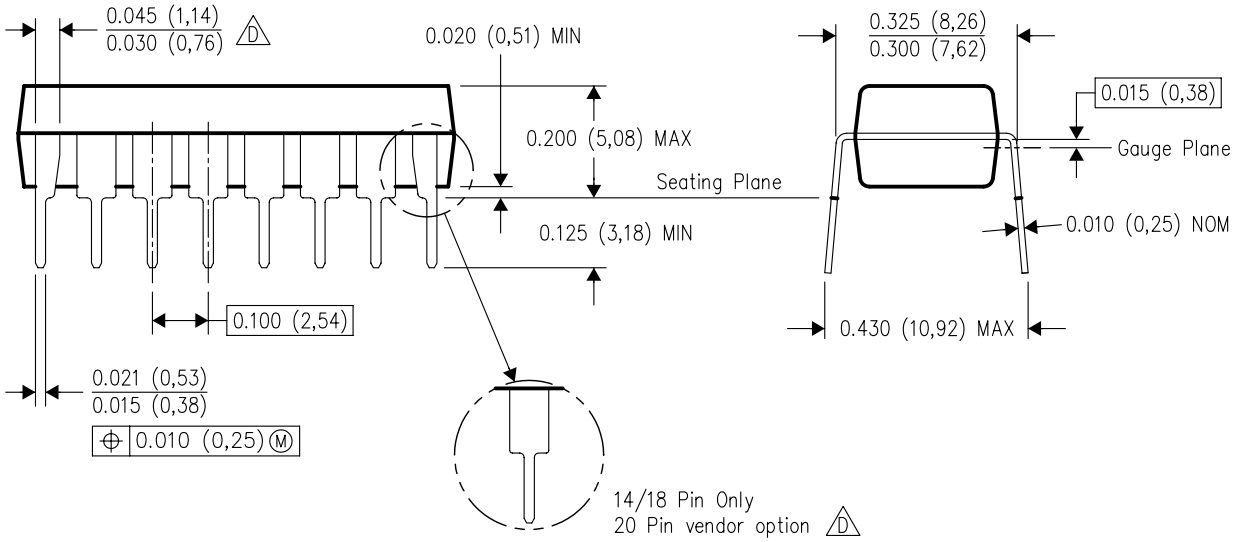
## N (R–PDIP–T**)

## PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN




| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS–001 VARIATION (C) | AA | BB | AC | AD |




4040049/E 12/2002

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

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