

# CDx4AC574, CDx4ACT574 Octal D-Type Flip-Flop, 3-State Positive-Edge-Triggered

## 1 Features

- SCR-latchup-resistant CMOS process and circuit design
- Speed of bipolar FAST\*/AS/S with significantly reduced power consumption
- Balanced propagation delays
- AC types feature 1.5V to 5.5V *operation and balanced noise immunity at 30% of the supply*
- $\pm 24\text{mA}$  output drive current
  - Fanout to 15 FAST\* ICs
  - Drives 50ohm transmission lines

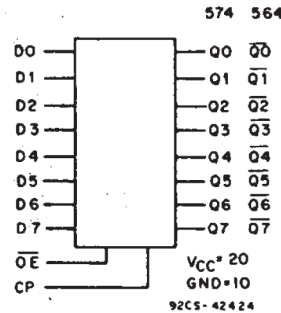
## 2 Description

The CDx4AC574 and the CDx4ACT574 octal D-type, 3-state, positive-edge-triggered flip-flops use the RCA ADVANCED CMOS technology.

### Device Information

| PART NUMBER   | PACKAGE <sup>(1)</sup> | PACKAGE SIZE <sup>(2)</sup> | BODY SIZE <sup>(3)</sup> |
|---------------|------------------------|-----------------------------|--------------------------|
| CDx4AC/ACT574 | DW (SOIC, 20)          | 12.80mm × 10.3mm            | 12.80mm × 7.50mm         |
|               | N (PDIP, 20)           | 24.33mm × 9.4mm             | 24.33mm × 6.35mm         |

- (1) For all available packages, see [Section 10](#).
- (2) The package size (length × width) is a nominal value and includes pins, where applicable.
- (3) The body size (length × width) is a nominal value and does not include pins.



Functional Block Diagram

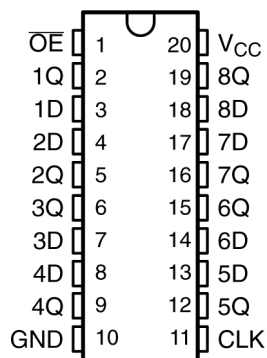
\*FAST is a Registered Trademark of Fairchild Semiconductor Corp.



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## 3 Pin Configuration and Functions



**Figure 3-1. CDx4AC/ACT574 DW Package, 20-Pin SOIC; N Package, 20-Pin PDIP (Top View)**

**Table 3-1. Pin Functions**

| PIN             |     | TYPE | DESCRIPTION       |
|-----------------|-----|------|-------------------|
| NAME            | NO. |      |                   |
| OE              | 1   | I    | Active low enable |
| 1Q              | 2   | O    | Data output       |
| 1D              | 3   | I    | Data input        |
| 2D              | 4   | I    | Data input        |
| 2Q              | 5   | O    | Data output       |
| 3Q              | 6   | O    | Data output       |
| 3D              | 7   | I    | Data input        |
| 4D              | 8   | I    | Data input        |
| 4Q              | 9   | O    | Data output       |
| GND             | 10  | -    | Ground pin        |
| CLK             | 11  | I    | Clock pin         |
| 5Q              | 12  | O    | Data output       |
| 5D              | 13  | I    | Data input        |
| 6D              | 14  | I    | Data input        |
| 6Q              | 15  | O    | Data output       |
| 7Q              | 16  | O    | Data output       |
| 7D              | 17  | I    | Data input        |
| 8D              | 18  | I    | Data input        |
| 8Q              | 19  | O    | Data output       |
| V <sub>CC</sub> | 20  | -    | Power pin         |

## 4 Specifications

### 4.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                  |                                                                          |                                                                       | MIN  | MAX  | UNIT              |
|------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------|------|------|-------------------|
| V <sub>CC</sub>  | Supply-voltage                                                           |                                                                       | -0.5 | 6    | V                 |
| I <sub>IK</sub>  | Input diode current                                                      | (V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V) |      | ±20  | mA                |
| I <sub>OK</sub>  | Output diode current                                                     | (V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V) |      | ±50  | mA                |
| I <sub>O</sub>   | Output source or sink current per output pin                             | (V <sub>O</sub> > -0.5 V or V <sub>O</sub> < V <sub>CC</sub> ± 0.5 V) |      | ±50  | mA                |
|                  | V <sub>CC</sub> or ground current (I <sub>CC</sub> or I <sub>GND</sub> ) |                                                                       |      | ±100 | mA <sup>(2)</sup> |
| T <sub>stg</sub> | Storage temperature                                                      |                                                                       | -65  | +150 | °C                |

- (1) 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.
- (2) For up to 4 outputs per device; add ± 25 mA for each additional output.

### 4.2 ESD Ratings

|                    |                         |                                                                             | VALUE | UNIT |
|--------------------|-------------------------|-----------------------------------------------------------------------------|-------|------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup> | ±2000 | V    |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

### 4.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

| CHARACTERISTIC                  |                                                                             | MIN | MAX             | UNIT |
|---------------------------------|-----------------------------------------------------------------------------|-----|-----------------|------|
| V <sub>CC</sub> <sup>(2)</sup>  | Supply-voltage range: (For T <sub>A</sub> = full package-temperature range) |     |                 |      |
|                                 | AC types                                                                    | 1.5 | 5.5             | V    |
|                                 | ACT types                                                                   | 4.5 | 5.5             | V    |
| V <sub>I</sub> , V <sub>O</sub> | Input or output voltage                                                     | 0   | V <sub>CC</sub> | V    |
| T <sub>A</sub>                  | Operating temperature                                                       | -55 | + 125           | °C   |
| dt/dv                           | Input rise and fall slew rate                                               |     |                 |      |
|                                 | at 1.5 V to 3 V (AC types)                                                  | 0   | 50              | ns/V |
|                                 | at 3.6 V to 5.5 V (AC types)                                                | 0   | 20              | ns/V |
|                                 | at 4.5 V to 5.5 V (ACT types)                                               | 0   | 10              | ns/V |

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report: [Implications of Slow or Floating CMOS Inputs](#).
- (2) Unless otherwise specified, all voltages are referenced to ground.

### 4.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                        | CDx4AC/ACT574 |          | UNIT |
|-------------------------------|----------------------------------------|---------------|----------|------|
|                               |                                        | DW (SOIC)     | N (PDIP) |      |
|                               |                                        | 20 PINS       | 20 PINS  |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance | 101.2         | 50       | °C/W |

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

## 4.5 Static Electrical Characteristics: AC Series

| CHARACTERISTICS |                               | TEST CONDITIONS                                                               |                     | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |      |            |      |             |      | UNIT |
|-----------------|-------------------------------|-------------------------------------------------------------------------------|---------------------|---------------------|--------------------------------------------|------|------------|------|-------------|------|------|
|                 |                               |                                                                               |                     |                     | +25                                        |      | -40 to +85 |      | -55 to +125 |      |      |
|                 |                               | V <sub>I</sub> (V)                                                            | I <sub>O</sub> (mA) |                     | MIN                                        | MAX  | MIN        | MAX  | MIN         | MAX  |      |
| V <sub>IH</sub> | High-Level Input Voltage      |                                                                               |                     | 1.5                 | 1.2                                        | —    | 1.2        | —    | 1.2         |      | V    |
|                 |                               |                                                                               |                     | 3                   | 2.1                                        | —    | 2.1        | —    | 2.1         | —    |      |
|                 |                               |                                                                               |                     | 5.5                 | 3.85                                       | —    | 3.85       | —    | 3.85        | —    |      |
| V <sub>IL</sub> | Low-Level Input Voltage       |                                                                               |                     | 1.5                 | —                                          | 0.3  | —          | 0.3  | —           | 0.3  | V    |
|                 |                               |                                                                               |                     | 3                   | —                                          | 0.9  | —          | 0.9  | —           | 0.9  |      |
|                 |                               |                                                                               |                     | 5.5                 | —                                          | 1.65 | —          | 1.65 | —           | 1.65 |      |
| V <sub>OH</sub> | High-Level Output Voltage     | V <sub>IH</sub> or V <sub>IL</sub><br>(1), (2)                                | -0.05               | 1.5                 | 1.4                                        | —    | 1.4        | —    | 1.4         |      | V    |
|                 |                               |                                                                               | -0.05               | 3                   | 2.9                                        | —    | 2.9        | —    | 2.9         | —    |      |
|                 |                               |                                                                               | -0.05               | 4.5                 | 4.4                                        | —    | 4.4        | —    | 4.4         | —    |      |
|                 |                               |                                                                               | -4                  | 3                   | 2.58                                       | —    | 2.48       | —    | 2.4         | —    |      |
|                 |                               |                                                                               | -24                 | 4.5                 | 3.94                                       | —    | 3.8        | —    | 3.7         | —    |      |
|                 |                               |                                                                               | -75                 | 5.5                 | —                                          | —    | 3.85       | —    | —           | —    |      |
|                 |                               |                                                                               | -50                 | 5.5                 | —                                          | —    | —          | —    | 3.85        | —    |      |
| V <sub>OL</sub> | Low-Level Output Voltage      | V <sub>IH</sub> or V <sub>IL</sub><br>(1), (2)                                | 0.05                | 1.5                 | —                                          | 0.1  | —          | 0.1  | —           | 0.1  | V    |
|                 |                               |                                                                               | 0.05                | 3                   | —                                          | 0.1  | —          | 0.1  | —           | 0.1  |      |
|                 |                               |                                                                               | 0.05                | 4.5                 | —                                          | 0.1  | —          | 0.1  | —           | 0.1  |      |
|                 |                               |                                                                               | 12                  | 3                   | —                                          | 0.36 | —          | 0.44 | —           | 0.5  |      |
|                 |                               |                                                                               | 24                  | 4.5                 | —                                          | 0.36 | —          | 0.44 | —           | 0.5  |      |
|                 |                               |                                                                               | 75                  | 5.5                 | —                                          | —    | —          | 1.65 | —           | —    |      |
|                 |                               |                                                                               | 50                  | 5.5                 | —                                          | —    | —          | —    | —           | 1.65 |      |
| I <sub>I</sub>  | Input Leakage Current         | V <sub>CC</sub> or GND                                                        |                     | 5.5                 | —                                          | ±0.1 | —          | ±1   | —           | ±1   | μA   |
| I <sub>OZ</sub> | 3-State Leakage Current       | V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                     | 5.5                 | —                                          | ±0.5 | —          | ±5   | —           | ±10  | μA   |
| I <sub>CC</sub> | Quiescent Supply Current, MSI | V <sub>CC</sub> or GND                                                        | 0                   | 5.5                 | —                                          | 8    | —          | 80   | —           | 160  | μA   |

(1) Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

(2) Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C. 75 ohms at +125°C.

## 4.6 Static Electrical Characteristics: ACT Series

| CHARACTERISTICS |                           | TEST CONDITIONS                                |                     | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |     |            |     |             |     | UNIT |
|-----------------|---------------------------|------------------------------------------------|---------------------|---------------------|--------------------------------------------|-----|------------|-----|-------------|-----|------|
|                 |                           |                                                |                     |                     | +25                                        |     | -40 to +85 |     | -55 to +125 |     |      |
|                 |                           | V <sub>I</sub> (V)                             | I <sub>O</sub> (mA) |                     | MIN                                        | MAX | MIN        | MAX | MIN         | MAX |      |
| V <sub>IH</sub> | High-Level Input Voltage  |                                                |                     | 4.5 to 5.5          | 2                                          | —   | 2          | —   | 2           | —   | V    |
| V <sub>IL</sub> | Low-Level Input Voltage   |                                                |                     | 4.5 to 5.5          | —                                          | 0.8 | —          | 0.8 | —           | 0.8 | V    |
| V <sub>OH</sub> | High-Level Output Voltage | V <sub>IH</sub> or V <sub>IL</sub><br>(1), (2) | -0.05               | 4.5                 | 4.4                                        | —   | 4.4        | —   | 4.4         | —   | V    |
|                 |                           |                                                | -24                 | 4.5                 | 3.94                                       | —   | 3.8        | —   | 3.7         | —   |      |
|                 |                           |                                                | -75                 | 5.5                 | —                                          | —   | 3.85       | —   | —           | —   |      |
|                 |                           |                                                | -50                 | 5.5                 | —                                          | —   | —          | —   | 3.85        | —   |      |

| CHARACTERISTICS  |                                                   | TEST CONDITIONS                                                               |                     | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |      |            |      |             |      | UNIT |
|------------------|---------------------------------------------------|-------------------------------------------------------------------------------|---------------------|---------------------|--------------------------------------------|------|------------|------|-------------|------|------|
|                  |                                                   |                                                                               |                     |                     | +25                                        |      | -40 to +85 |      | -55 to.+125 |      |      |
|                  |                                                   | V <sub>I</sub> (V)                                                            | I <sub>O</sub> (mA) |                     | MIN                                        | MAX  | MIN        | MAX  | MIN         | MAX  |      |
| V <sub>OL</sub>  | Low-Level Output Voltage                          | V <sub>IH</sub> or V <sub>IL</sub><br>(1), (2)                                | 0.05                | 4.5                 | —                                          | ±0.1 | —          | ±1   | —           | ±1   | V    |
|                  |                                                   |                                                                               | 24                  | 4.5                 | —                                          | 0.36 | —          | 0.44 | —           | 0.5  |      |
|                  |                                                   |                                                                               | 75                  | 5.5                 | —                                          | —    | —          | 1.65 | —           | —    |      |
|                  |                                                   |                                                                               | 50                  | 5.5                 | —                                          | —    | —          | —    | —           | 1.65 |      |
| I <sub>I</sub>   | Input Leakage Current                             | V <sub>CC</sub> or GND                                                        |                     | 5.5                 | —                                          | ±0.1 | —          | ±1   | —           | ±1   | μA   |
| I <sub>OZ</sub>  | 3-State Leakage Current                           | V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                     | 5.5                 | —                                          | ±0.5 | —          | ±5   | —           | ±10  | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current, MSI                     | V <sub>CC</sub> or GND                                                        | 0                   | 5.5                 | —                                          | 8    | —          | 80   | —           | 160  | μA   |
| ΔI <sub>CC</sub> | Additional Quiescent Supply Current per Input Pin | V <sub>CC</sub> -2.1                                                          |                     | 4.5 to 5.5          | —                                          | 2.4  | —          | 2.8  | —           | 3    | mA   |
|                  | TTL Inputs High                                   |                                                                               |                     |                     |                                            |      |            |      |             |      |      |
|                  | 1 Unit Load                                       |                                                                               |                     |                     |                                            |      |            |      |             |      |      |

(1) Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

(2) Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at + 125°C.

**Table 4-1. Act Input Loading Table**

| INPUT              | UNIT LOADS <sup>(1)</sup> |
|--------------------|---------------------------|
| D, $\overline{OE}$ | 0-7                       |
| CP                 | 1.17                      |

(1) Unit load is  $\Delta I_{CC}$  limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

#### 4.7 Prerequisite for Switching: AC Series

| SYMBOL           | CHARACTERISTICS          | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) -°C |     |             |     | UNIT |
|------------------|--------------------------|---------------------|-------------------------------------------|-----|-------------|-----|------|
|                  |                          |                     | -40 to +85                                |     | -55 to +125 |     |      |
|                  |                          |                     | MIN                                       | MAX | MIN         | MAX |      |
| t <sub>W</sub>   | Clock Pulse Width        | 1.5                 | 44                                        | —   | 50          | —   | ns   |
|                  |                          | 3.3 <sup>(1)</sup>  | 4.9                                       | —   | 5.6         | —   |      |
|                  |                          | 5 <sup>(2)</sup>    | 3.5                                       | —   | 4           | —   |      |
| t <sub>SU</sub>  | Setup Time Data to Clock | 1.5                 | 2                                         | —   | 2           | —   | ns   |
|                  |                          | 3.3                 | 2                                         | —   | 2           | —   |      |
|                  |                          | 5                   | 2                                         | —   | 2           | —   |      |
| t <sub>H</sub>   | Hold Time Data to Clock  | 1.5                 | 2                                         | —   | 2           | —   | ns   |
|                  |                          | 3.3                 | 2                                         | —   | 2           | —   |      |
|                  |                          | 5                   | 2                                         | —   | 2           | —   |      |
| f <sub>MAX</sub> | Maximum Clock Frequency  | 1.5                 | 11                                        | —   | 10          | —   | MHz  |
|                  |                          | 3.3                 | 101                                       | —   | 89          | —   |      |
|                  |                          | 5                   | 143                                       | —   | 125         | —   |      |

(1) 3.3 V; min. is @ 3 V

(2) 5 V; min. is @ 4.5 V

## 4.8 Switching Characteristics: AC Series

$t_f = 3 \text{ ns}$ ,  $C_L = 50 \text{ pF}$

| SYMBOL                            | CHARACTERISTICS                                                     | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) -°C |      |             |      | UNIT |
|-----------------------------------|---------------------------------------------------------------------|---------------------|-------------------------------------------|------|-------------|------|------|
|                                   |                                                                     |                     | -40 to +85                                |      | -55 to +125 |      |      |
|                                   |                                                                     |                     | MIN                                       | MAX  | MIN         | MAX  |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delays: Clock to Q AC574                                | 1.5                 | —                                         | 123  | —           | 135  | ns   |
|                                   |                                                                     | 3.3 <sup>(1)</sup>  | 4                                         | 13.7 | 3.8         | 15.1 |      |
|                                   |                                                                     | 5 <sup>(2)</sup>    | 2.9                                       | 9.8  | 2.7         | 10.8 |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Clock to $\overline{Q}$ AC564                                       | 1.5                 | —                                         | 128  | —           | 141  | ns   |
|                                   |                                                                     | 3.3                 | 4.1                                       | 14.4 | 4           | 15.8 |      |
|                                   |                                                                     | 5                   | 2.9                                       | 10.3 | 2.8         | 11.3 |      |
| t <sub>PZL</sub> t <sub>PZH</sub> | Output Enable to Q, $\overline{O}$                                  | 1.5                 | —                                         | 165  | —           | 181  | ns   |
|                                   |                                                                     | 3.3                 | 5.6                                       | 19.2 | 5.5         | 21.8 |      |
|                                   |                                                                     | 5                   | 3.7                                       | 13.2 | 3.6         | 14.5 |      |
| t <sub>PLZ</sub> t <sub>PHZ</sub> | Output Disable to Q, $\overline{Q}$                                 | 1.5                 | —                                         | 165  | —           | 181  | ns   |
|                                   |                                                                     | 3.3                 | 4.7                                       | 16.5 | 4.5         | 18.1 |      |
|                                   |                                                                     | 5                   | 3.7                                       | 13.2 | 3.6         | 14.5 |      |
| C <sub>PD</sub> <sup>(3)</sup>    | Power Dissipation Capacitance                                       | —                   | 67 Typ.                                   |      | 67 Typ.     |      | pF   |
| V <sub>OHV</sub>                  | Min. (Valley) V <sub>OH</sub>                                       |                     | 4 Typ. @25°C                              |      |             |      | V    |
|                                   | During Switching of Other Outputs (Output Under Test Not Switching) | 5                   |                                           |      |             |      |      |
|                                   |                                                                     |                     |                                           |      |             |      |      |
| V <sub>OLP</sub>                  | Max. (Peak) V <sub>OL</sub>                                         |                     | 1 Typ. @25°C                              |      |             |      | V    |
|                                   | During Switching of Other Outputs (Output Under Test Not Switching) | 5                   |                                           |      |             |      |      |
|                                   |                                                                     |                     |                                           |      |             |      |      |
| C <sub>I</sub>                    | Input Capacitance                                                   | —                   | —                                         | 10   | —           | 10   | pF   |
| C <sub>O</sub>                    | 3-State Output Capacitance                                          | —                   | —                                         | 15   | —           | 15   | pF   |

(1) 3.3 V: min. is @ 3.6 V

(2) 5 V: min. is @ 5.5 V

(3)  $C_{PD}$  is used to determine the dynamic power consumption, per flip flop.

## 4.9 Prerequisite for Switching: ACT Series

| SYMBOL           | CHARACTERISTICS          | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) -°C |     |            |     | UNIT |
|------------------|--------------------------|---------------------|-------------------------------------------|-----|------------|-----|------|
|                  |                          |                     | -40 to +85                                |     | -55 to+125 |     |      |
|                  |                          |                     | MIN                                       | MAX | MIN        | MAX |      |
| t <sub>W</sub>   | Clock Pulse Width        | 5 <sup>(1)</sup>    | 3.9                                       | —   | 4.5        | —   | ns   |
| t <sub>SU</sub>  | Setup Time Data to Clock | 5                   | 2                                         | —   | 2          | —   | ns   |
| t <sub>H</sub>   | Hold Time Data to Clock  | 5                   | 2.6                                       | —   | 3          | —   | ns   |
| f <sub>MAX</sub> | Maximum Clock Frequency  | 5                   | 125                                       | —   | 110        | —   | MHz  |

(1) 5 V: min. is @ 4.5 V

## 4.10 Switching Characteristics: ACT Series

$t_r, t_f = 3 \text{ ns}$ ,  $C_L = 50 \text{ pF}$

| SYMBOL                            | CHARACTERISTICS                       | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) -°C |      |             |      | UNITS |
|-----------------------------------|---------------------------------------|---------------------|-------------------------------------------|------|-------------|------|-------|
|                                   |                                       |                     | -40 to +85                                |      | -55 to +125 |      |       |
|                                   |                                       |                     | MIN                                       | MAX  | MIN         | MAX  |       |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delays: Clock to Q ACT574 | 5 <sup>(1)</sup>    | 2.9                                       | 10.2 | 2.8         | 11.2 | ns    |
| t <sub>PLH</sub> t <sub>PHL</sub> | Clock to $\overline{Q}$ ACT564        | 5                   | 3                                         | 10.6 | 2.9         | 11.7 | ns    |

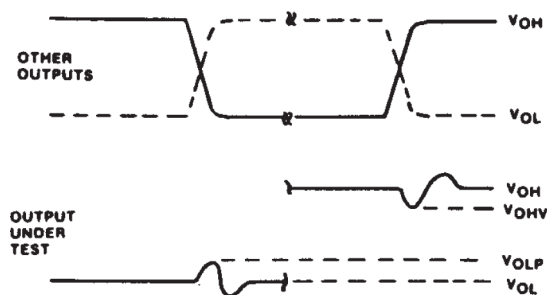
$t_r, t_f = 3 \text{ ns}, C_L = 50 \text{ pF}$ 

| SYMBOL                                                              | CHARACTERISTICS                                                                                   | V <sub>CC</sub> (V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) -°C |      |             |      | UNITS |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------|------|-------------|------|-------|
|                                                                     |                                                                                                   |                     | -40 to +85                                |      | -55 to +125 |      |       |
|                                                                     |                                                                                                   |                     | MIN                                       | MAX  | MIN         | MAX  |       |
| t <sub>PLZ</sub> t <sub>PHZ</sub> t <sub>PZL</sub> t <sub>PZH</sub> | Output Enable and Disable to Q ACT574                                                             | 5                   | 3.7                                       | 13.2 | 3.6         | 14.5 | ns    |
| t <sub>PLZ</sub> t <sub>PHZ</sub> t <sub>PZL</sub> t <sub>PZH</sub> | Output Enable and Disable to $\overline{Q}$ ACT564                                                | 5                   | 3.7                                       | 13.2 | 3.6         | 14.5 | ns    |
| C <sub>PD</sub> <sup>(2)</sup>                                      | Power Dissipation Capacitance                                                                     | —                   | 67 Typ.                                   |      | 67 Typ.     |      | pF    |
| V <sub>OHV</sub>                                                    | Min. (Valley) V <sub>OH</sub> During Switching of Other Outputs (Output Under Test Not Switching) | 5                   | 4 Typ. @25°C                              |      |             |      | V     |
| V <sub>OLP</sub>                                                    | Max. (Peak) V <sub>OL</sub> During Switching of Other Outputs (Output Under Test Not Switching)   | 5                   | 1 Typ. @ 25°C                             |      |             |      | V     |
| C <sub>I</sub>                                                      | Input Capacitance                                                                                 | —                   | —                                         | 10   | —           | 10   | pF    |
| C <sub>O</sub>                                                      | 3-State Output Capacitance                                                                        | —                   | —                                         | 15   | —           | 15   | pF    |

(1) 5 V: min. is @ 5.5 V

(2)  $C_{PD}$  is used to determine the dynamic power consumption, per flip flop.

## 5 Parameter Measurement Information



- $V_{OHV}$  AND  $V_{OLP}$  are measured with respect to a ground REFERENCE NEAR THE OUTPUT UNDER TEST.
- INPUT PULSES HAVE THE FOLLOWING CHARACTERISTICS:  $PRR \leq 1$  MHz,  $t_r = 3$  ns,  $t_f = 3$  ns, SKEW 1 ns.
- R.F. FIXTURE WITH 700-MHz DESIGN RULES REQUIRED. IC SHOULD BE SOLDERED INTO TEST BOARD AND BYPASSED WITH  $0.1 \mu F$  CAPACITOR. SCOPE AND PROBES REQUIRE 700-MHz BANDWIDTH.
- 92CS-42406

Figure 5-1. Simultaneous Switching Transient Waveforms.

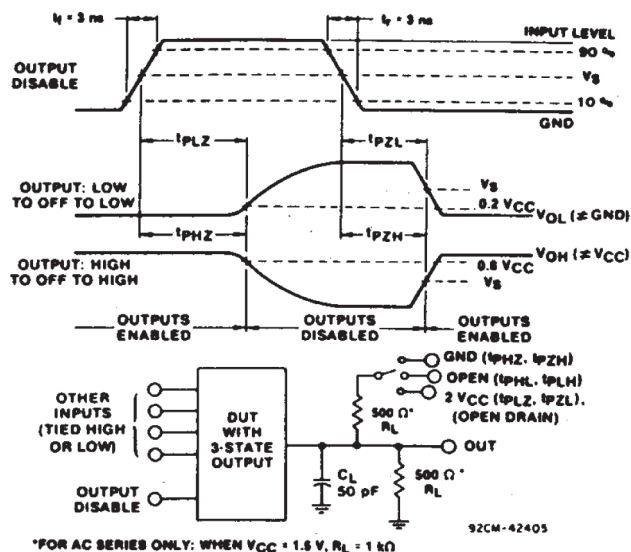


Figure 5-2. Three-state Propagation Delay Waveforms and Test Circuit.

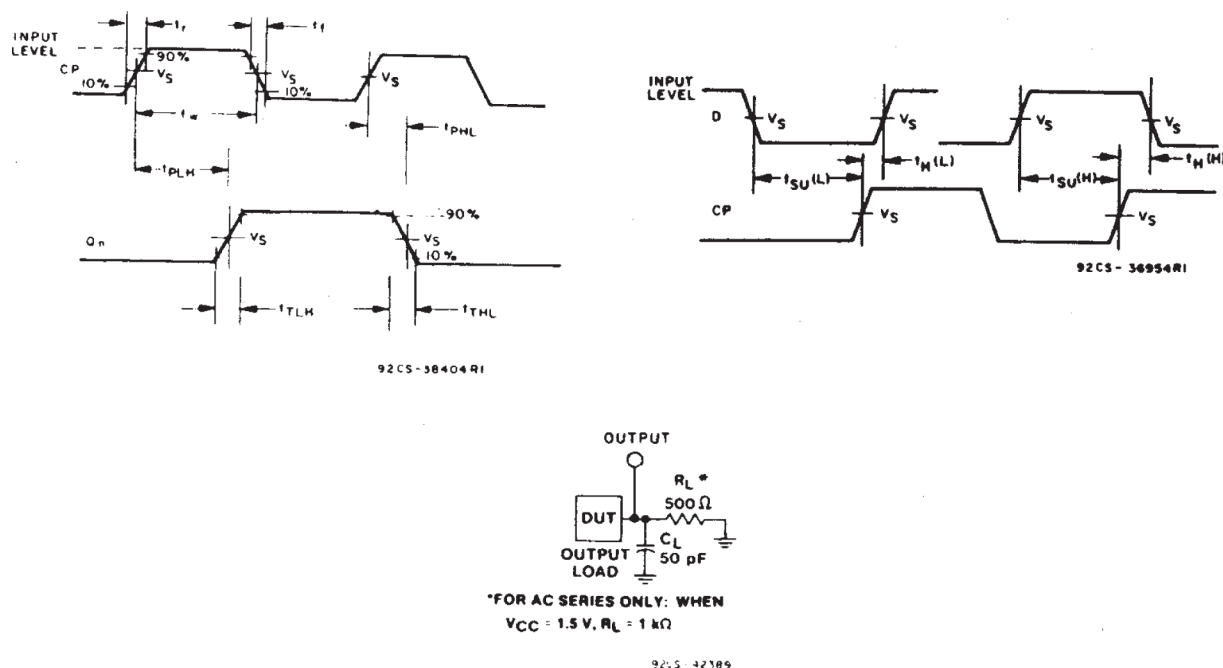


Figure 5-3. Propagation Delays Times and Test Circuit.

|                                 | CD54/74AC    | CD54/74ACT   |
|---------------------------------|--------------|--------------|
| Input Level                     | $V_{CC}$     | 3 V          |
| Input Switching Voltage, $V_S$  | $0.5 V_{CC}$ | 1.5 V        |
| Output Switching Voltage, $V_S$ | $0.5 V_{CC}$ | $0.5 V_{CC}$ |

## 6 Detailed Description

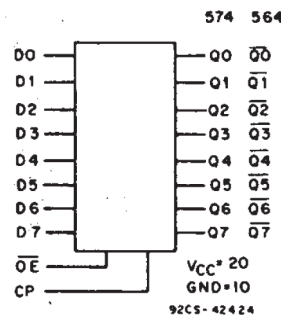
### 6.1 Overview

The CD54/74AC574 and the CD54/74ACT574 octal D-type, 3-state, positive-edge-triggered flip-flops use the RCA ADVANCED CMOS technology. The eight flip-flops enter data into their registers on the LOW-to-HIGH transition of the clock (CP). The Output Enable ( $\overline{OE}$ ) controls the 3-state outputs and is independent of the register operation. When the Output Enable ( $\overline{OE}$ ) is HIGH, the outputs are in the high-impedance state. The CD54/74AC/ACT574 share the same pin configurations, and the CD54/74AC/ACT574 has non-inverted outputs.

The CD74AC/ACT574 are supplied in 20-lead dual-in-line plastic packages (E suffix) and in 20-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over the following temperature ranges: Commercial (0 to 70°C); Industrial (-40 to +85°C); and Extended Industrial/Military (-55 to +125°C).

The CD54AC/ACT574, available in chip form (H suffix), are operable over the -55 to +125°C temperature range.

### 6.2 Functional Block Diagram



### 6.3 Device Functional Modes

**Table 6-1. Truth Table**

| Output Enable | Latch Enable | Data | AC/ACT373 Output |
|---------------|--------------|------|------------------|
| L             | H            | H    | H                |
| L             | H            | L    | L                |
| L             | L            | I    | L                |
| L             | L            | h    | H                |
| H             | X            | X    | Z                |

## 7 Application and Implementation

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### 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.

---

### 7.1 Power Supply Recommendations

The power supply can be any voltage between the min and max supply voltage rating located in [Section 4.3](#).

Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends 0.1  $\mu\text{F}$  and if there are multiple  $V_{CC}$  terminals, then TI recommends .01  $\mu\text{F}$  or .022  $\mu\text{F}$  for each power terminal. It is okay to parallel multiple bypass capacitors to reject different frequencies of noise. A 0.1  $\mu\text{F}$  and 1  $\mu\text{F}$  are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

### 7.2 Layout

#### 7.2.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever float. 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 or only three of the four buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified below are the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or  $V_{CC}$  whichever make more sense or is more convenient. Floating outputs is generally acceptable, unless the part is a transceiver. If the transceiver has an output enable pin it will disable the outputs section of the part when asserted. This will not disable the input section of the I.O's so they also cannot float when disabled.

## 8 Device and Documentation Support

### 8.1 Documentation Support (Analog)

#### 8.1.1 Related Documentation

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 8-1. Related Links**

| PARTS      | PRODUCT FOLDER             | SAMPLE & BUY               | TECHNICAL DOCUMENTS        | TOOLS & SOFTWARE           | SUPPORT & COMMUNITY        |
|------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| CD54AC574  | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| CD74AC574  | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| CD54ACT574 | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| CD74ACT574 | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |

### 8.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](#). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 8.3 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](#).

### 8.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 8.5 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.

### 8.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision * (December 1998) to Revision A (May 2024)                                                                                                                                                                                                                                                                            | Page |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| • Added <i>Device Information</i> table, <i>Pin Functions</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section ..... | 1    |
| • Updated RθJA values: DW = 40 to 101.2, all values in °C/W .....                                                                                                                                                                                                                                                                           | 4    |

## 10 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.

## PACKAGING INFORMATION

| Orderable part number         | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">CD54AC574F3A</a>  | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54AC574F3A        |
| CD54AC574F3A.A                | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54AC574F3A        |
| <a href="#">CD54ACT574F3A</a> | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54ACT574F3A       |
| CD54ACT574F3A.A               | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54ACT574F3A       |
| <a href="#">CD74AC574E</a>    | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74AC574E          |
| CD74AC574E.A                  | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74AC574E          |
| <a href="#">CD74AC574M</a>    | Obsolete      | Production           | SOIC (DW)   20 | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | AC574M              |
| <a href="#">CD74AC574M96</a>  | Active        | Production           | SOIC (DW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | AC574M              |
| CD74AC574M96.A                | Active        | Production           | SOIC (DW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | AC574M              |
| CD74AC574M96G4                | Active        | Production           | SOIC (DW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | AC574M              |
| <a href="#">CD74ACT574E</a>   | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74ACT574E         |
| CD74ACT574E.A                 | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74ACT574E         |
| <a href="#">CD74ACT574M</a>   | Obsolete      | Production           | SOIC (DW)   20 | -                     | -           | Call TI                              | Call TI                           | -55 to 125   | ACT574M             |
| <a href="#">CD74ACT574M96</a> | Active        | Production           | SOIC (DW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | ACT574M             |
| CD74ACT574M96.A               | Active        | Production           | SOIC (DW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | ACT574M             |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **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.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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 CD54AC574, CD54ACT574, CD74AC574, CD74ACT574 :**

- Catalog : [CD74AC574](#), [CD74ACT574](#)
- Military : [CD54AC574](#), [CD54ACT574](#)

NOTE: Qualified Version Definitions:

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

## TAPE AND REEL INFORMATION



\*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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74AC574M96  | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.9    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |
| CD74AC574M96  | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |
| CD74ACT574M96 | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74AC574M96  | SOIC         | DW              | 20   | 2000 | 356.0       | 356.0      | 45.0        |
| CD74AC574M96  | SOIC         | DW              | 20   | 2000 | 356.0       | 356.0      | 45.0        |
| CD74ACT574M96 | SOIC         | DW              | 20   | 2000 | 356.0       | 356.0      | 45.0        |

**TUBE**


\*All dimensions are nominal

| Device        | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD74AC574E    | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74AC574E.A  | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74ACT574E   | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74ACT574E.A | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |

J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



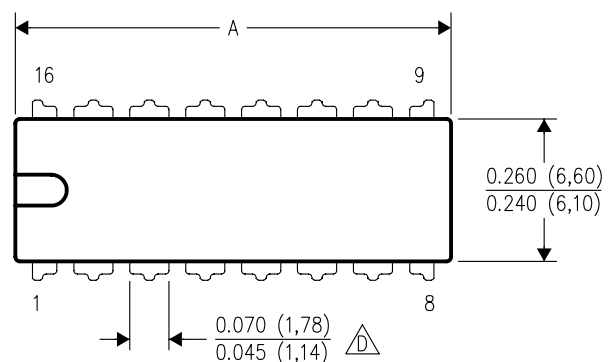
4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

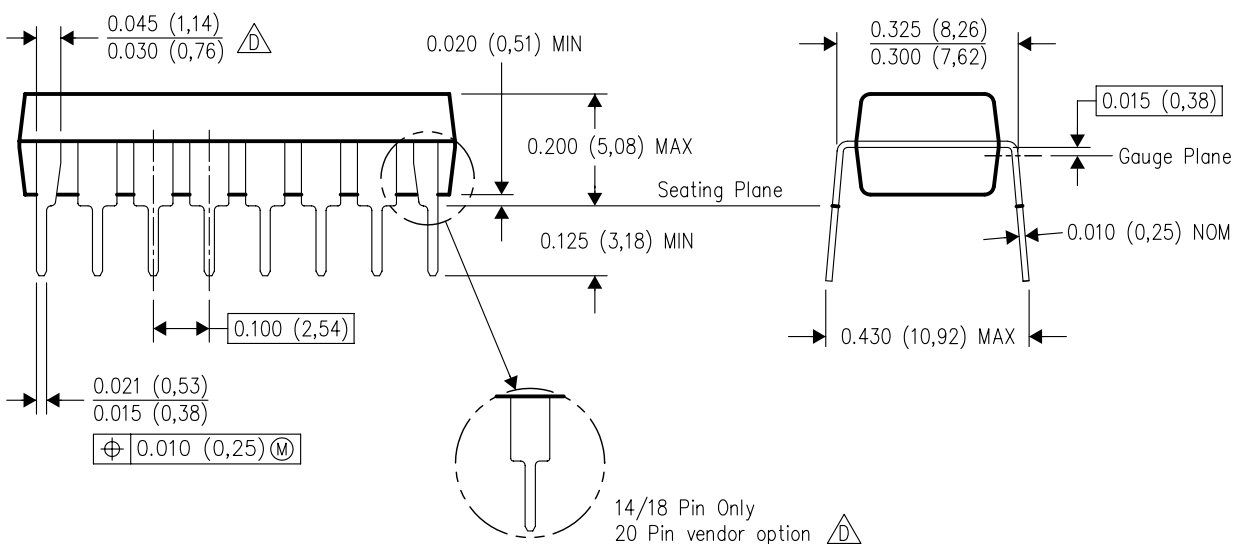
N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE

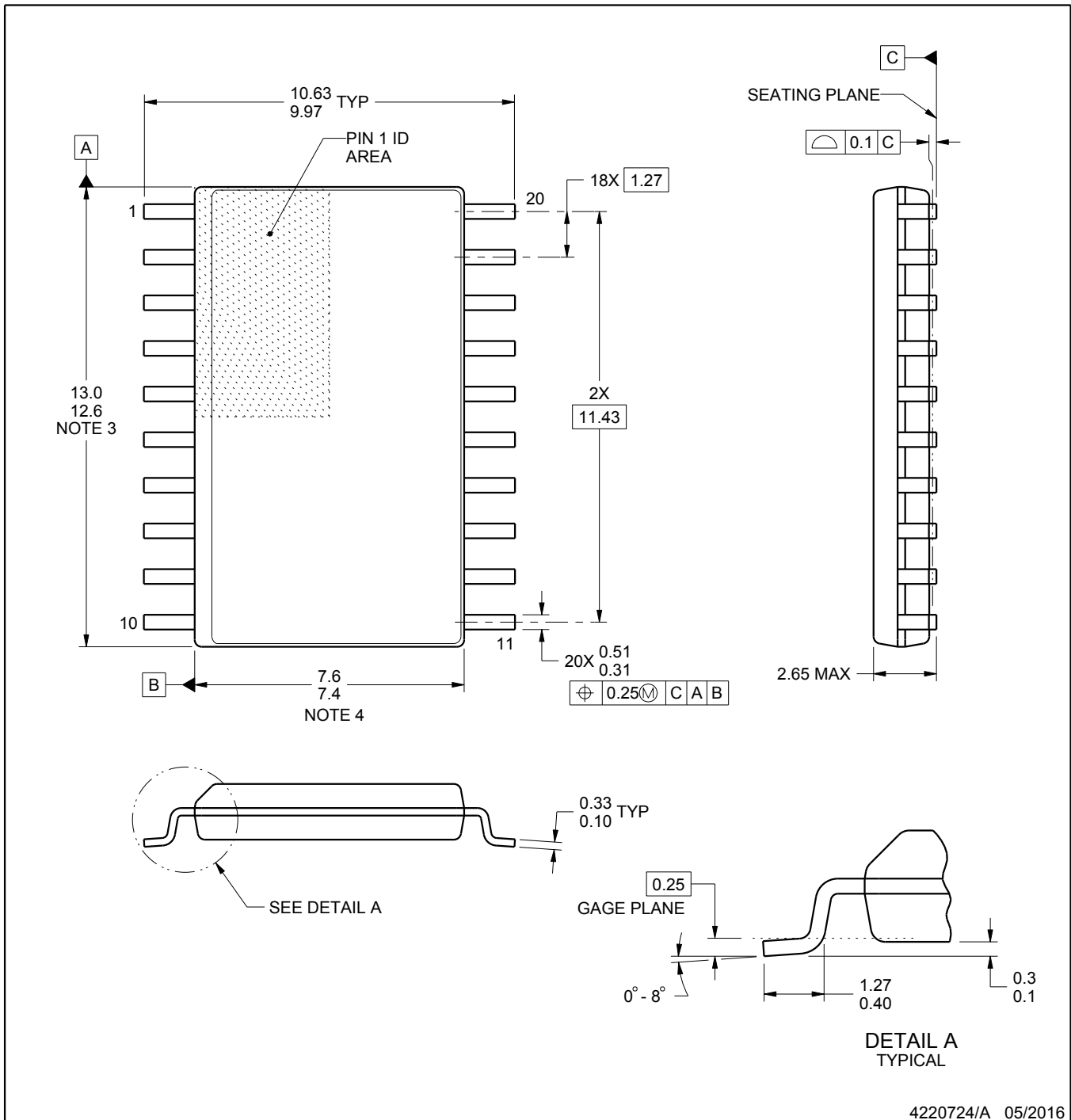


| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | 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.
  -  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.



## 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-013.

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

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

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

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.

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