

CDx4ACT151 8-Line to 1-Line Data Selectors/Multiplexers

1 Features

- Inputs are TTL-voltage compatible
- 8-line to 1-line multiplexers can perform as:
 - Boolean function generators
 - Parallel-to-serial converters
 - Data source selectors
- Speed of bipolar F, AS, and S, with significantly reduced power consumption
- Balanced propagation delays
- $\pm 24\text{mA}$ output drive current
 - Fanout to 15 F devices
- SCR-latchup-resistant CMOS process and circuit design
- Exceeds 2kV ESD protection per MIL-STD-883, method 3015

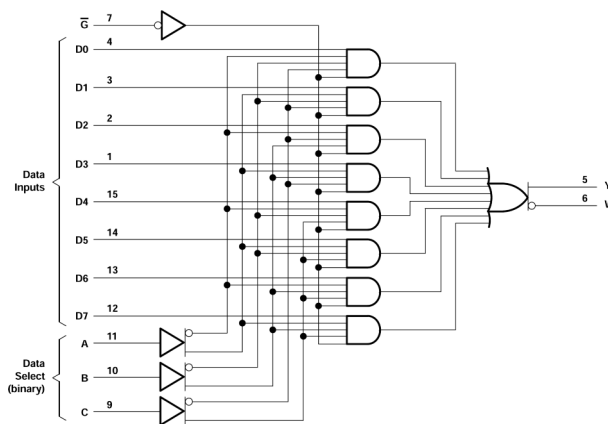
2 Description

These data selectors/multiplexers provide full binary decoding to select one of eight data sources. The strobe (\bar{G}) input must be at a low logic level to enable the inputs. A high level at the strobe terminal forces the W output high and the Y output low.

Device Information

| PART NUMBER | PACKAGE ⁽¹⁾ | PACKAGE SIZE ⁽²⁾ | BODY SIZE ⁽³⁾ |
|-------------|------------------------|-----------------------------|--------------------------|
| CDx4ACT151 | D (SOIC, 16) | 8.65mm × 6mm | 8.65mm × 3.9mm |
| | J (CDIP, 16) | 19.55mm × 7.9mm | 19.55 mm × 6.7mm |

- (1) For more information, see [Mechanical, Packaging, and Orderable Information](#).
- (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.



Logic Diagram (Positive Logic)



Table of Contents

| | | | |
|--|---|--|----|
| 1 Features | 1 | 6.2 Device Functional Modes..... | 9 |
| 2 Description | 1 | 7 Application and Implementation | 10 |
| 3 Pin Configuration and Functions | 3 | 7.1 Power Supply Recommendations..... | 10 |
| 4 Specifications | 4 | 7.2 Layout..... | 10 |
| 4.1 Absolute Maximum Ratings..... | 4 | 8 Device and Documentation Support | 11 |
| 4.2 ESD Ratings..... | 4 | 8.1 Documentation Support..... | 11 |
| 4.3 Recommended Operating Conditions..... | 4 | 8.2 Receiving Notification of Documentation Updates... | 11 |
| 4.4 Thermal Information..... | 4 | 8.3 Support Resources..... | 11 |
| 4.5 Electrical Characteristics..... | 5 | 8.4 Trademarks..... | 11 |
| 4.6 Switching Characteristics..... | 5 | 8.5 Electrostatic Discharge Caution..... | 11 |
| 4.7 Operating Characteristics..... | 6 | 8.6 Glossary..... | 11 |
| 5 Parameter Measurement Information | 7 | 9 Revision History | 11 |
| 6 Detailed Description | 9 | 10 Mechanical, Packaging, and Orderable Information | 11 |
| 6.1 Functional Block Diagram..... | 9 | | |

3 Pin Configuration and Functions

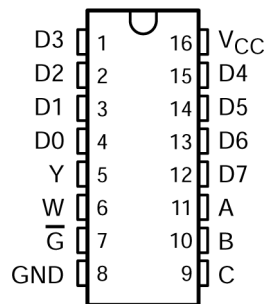


Figure 3-1. CD54ACT151 J Package; CD74ACT151 D or N Package; 16-Pin CDIP, SOIC, or PDIP (Top View)

Pin Functions

| PIN | | I/O ⁽¹⁾ | DESCRIPTION |
|-----|-----------------|--------------------|---------------------------|
| NO. | NAME | | |
| 1 | D3 | I | Data input 3 |
| 2 | D2 | I | Data input 2 |
| 3 | D1 | I | Data input 1 |
| 4 | D0 | I | Data input 0 |
| 5 | Y | O | Data output |
| 6 | W | O | Data output, inverted |
| 7 | \bar{G} | I | Output strobe, active low |
| 8 | GND | — | Ground |
| 9 | C | I | Address select C |
| 10 | B | I | Address select B |
| 11 | A | I | Address select A |
| 12 | D7 | I | Data input 7 |
| 13 | D6 | I | Data input 6 |
| 14 | D5 | I | Data input 5 |
| 15 | D4 | I | Data input 4 |
| 16 | V _{CC} | — | Positive supply |

(1) Signal Types: I = Input, O = Output, I/O = Input or Output.

4 Specifications

4.1 Absolute Maximum Ratings

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

| | | MIN | MAX | UNIT |
|---|---------------------------|---|------|-----------|
| V _{CC} | Supply voltage | -0.5 | 6 | V |
| I _{IK} ⁽²⁾ | Input clamp current | (V _I < 0 V or V _I > V _{CC}) | | ±20 mA |
| I _{OK} ⁽²⁾ | Output clamp current | (V _O < 0 V or V _O > V _{CC}) | | ±50 mA |
| I _O | Continuous output current | (V _O > 0 V or V _O < V _{CC}) | | ±50 mA |
| Continuous current through V _{CC} or GND | | | ±100 | mA |
| T _{stg} | Storage temperature range | -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) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

4.2 ESD Ratings

| | | | VALUE | UNIT |
|--------------------|-------------------------|---|-------|------|
| V _(ESD) | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾ | ±2000 | V |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible with the necessary precautions.

4.3 Recommended Operating Conditions

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

| | | T _A = 25°C | | -55°C to 125°C | | -40°C to 85°C | | UNIT |
|-----------------|------------------------------------|-----------------------|-----------------|----------------|-----------------|---------------|-----------------|------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| V _{CC} | Supply voltage | 4.5 | 5.5 | 4.5 | 5.5 | 4.5 | 5.5 | V |
| V _{IH} | High-level input voltage | 2 | | 2 | | 2 | | V |
| V _{IL} | Low-level input voltage | | 0.8 | | 0.8 | | 0.8 | V |
| V _I | Input voltage | 0 | V _{CC} | 0 | V _{CC} | 0 | V _{CC} | V |
| V _O | Output voltage | 0 | V _{CC} | 0 | V _{CC} | 0 | V _{CC} | V |
| I _{OH} | High-level output current | | -24 | | -24 | | -24 | mA |
| I _{OL} | Low-level output current | | 24 | | 24 | | 24 | mA |
| Δt/Δv | Input transition rise or fall rate | | 10 | | 10 | | 10 | ns/V |

- (1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

4.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | CD74ACT151 | UNIT |
|-------------------------------|--|------------|------|
| | | D (SOIC) | |
| | | 16 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance | 119.9 | °C/W |

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

4.5 Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS | | V _{CC} | T _A = 25°C | | -55°C to 125°C | | -40°C to 85°C | | UNIT |
|---------------------------------|---|---|-----------------|-----------------------|------|----------------|------|---------------|-----|------|
| | | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| V _{OH} | V _I = V _{IH} or V _{IL} | I _{OH} = -50 μA | 4.5 V | 4.4 | | 4.4 | | 4.4 | V | |
| | | I _{OH} = -24 mA | 4.5 V | 3.94 | | 3.7 | | 3.8 | | |
| | | I _{OH} = -50 mA ⁽¹⁾ | 5.5 V | | | 3.85 | | | | |
| | | I _{OH} = -75 mA ⁽¹⁾ | 5.5 V | | | | | 3.85 | | |
| V _{OL} | V _I = V _{IH} or V _{IL} | I _{OL} = 50 μA | 4.5 V | | 0.1 | | 0.1 | 0.1 | V | |
| | | I _{OL} = 24 mA | 4.5 V | | 0.36 | | 0.5 | 0.44 | | |
| | | I _{OL} = 50 mA ⁽¹⁾ | 5.5 V | | | | 1.65 | | | |
| | | I _{OL} = 75 mA ⁽¹⁾ | 5.5 V | | | | | 1.65 | | |
| I _I | V _I = V _{CC} or GND | | 5.5 V | | ±0.1 | | ±1 | ±1 | μA | |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | | 5.5 V | | 8 | | 160 | 80 | μA | |
| ΔI _{CC} ⁽²⁾ | V _I = V _{CC} - 2.1 V | | 4.5 V to 5.5 V | | 2.4 | | 3 | 2.8 | mA | |
| C _i | | | | | 10 | | 10 | 10 | pF | |

- (1) Test one output at a time, not exceeding 1-second duration. Measurement is made by forcing indicated current and measuring voltage to minimize power dissipation. Test verifies a minimum 50-Ω transmission-line drive capability at 85°C and 75-Ω transmission-line drive capability at 125°C.
- (2) Additional quiescent supply current per input pin, TTL inputs high, 1 unit load

Table 4-1. Act Input Load Table

| INPUT | UNIT LOAD ⁽¹⁾ |
|------------|--------------------------|
| D | 1 |
| \bar{G} | 1 |
| A, B, or C | 1 |

- (1) Unit Load is ΔI_{CC} limit specified in electrical characteristics table (e.g., 2.4 mA at 25°C).

4.6 Switching Characteristics

over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V, C_L = 50 pF (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | -55°C to 125°C | | -40°C to 85°C | | UNIT |
|------------------|--------------|-------------|----------------|------|---------------|------|------|
| | | | MIN | MAX | MIN | MAX | |
| t _{PLH} | D | Y | 3.9 | 15.5 | 4 | 14.1 | ns |
| t _{PHL} | | | 3.9 | 15.5 | 4 | 14.1 | |
| t _{PLH} | D | W | 4.2 | 16.9 | 4.4 | 15.4 | ns |
| t _{PHL} | | | 4.2 | 16.9 | 4.4 | 15.4 | |
| t _{PLH} | A, B, or C | Y | 5.1 | 20.2 | 5.2 | 18.4 | ns |
| t _{PHL} | | | 5.1 | 20.2 | 5.2 | 18.4 | |
| t _{PLH} | A, B, or C | W | 5.4 | 21.6 | 5.6 | 19.6 | ns |
| t _{PHL} | | | 5.4 | 21.6 | 5.6 | 19.6 | |
| t _{PLH} | \bar{G} | Y | 3 | 12.1 | 3.1 | 11 | ns |
| t _{PHL} | | | 3 | 12.1 | 3.1 | 11 | |

CD54ACT151, CD74ACT151

SCHS338A – MARCH 2003 – REVISED AUGUST 2024

over recommended operating free-air temperature range, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$, $C_L = 50\text{ pF}$ (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

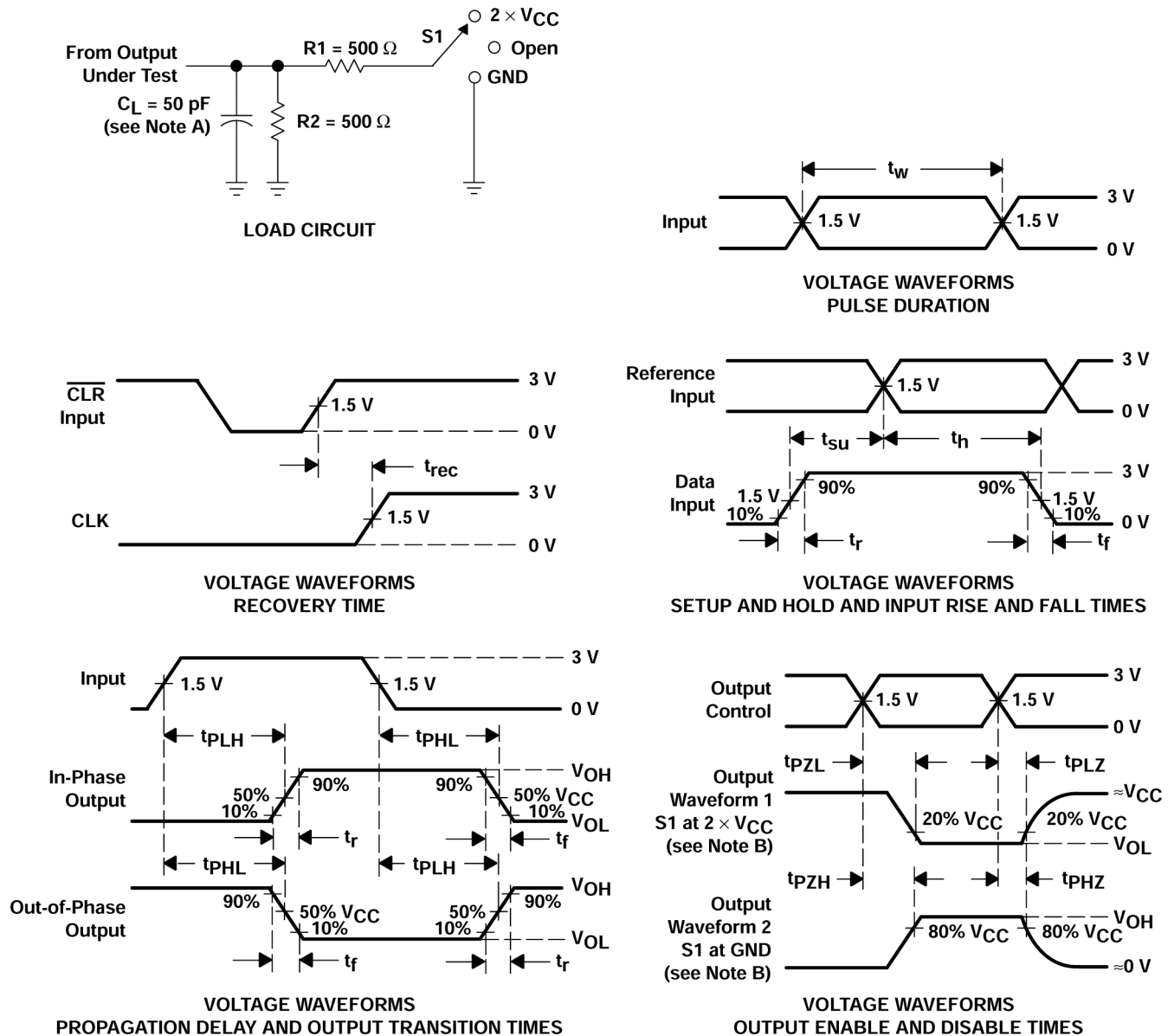
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | -55°C to 125°C | | -40°C to 85°C | | UNIT |
|-----------|--------------|-------------|----------------|------|---------------|------|------|
| | | | MIN | MAX | MIN | MAX | |
| t_{PLH} | \bar{G} | W | 3.4 | 13.5 | 3.5 | 12.3 | ns |
| t_{PHL} | | | 3.4 | 13.5 | 3.5 | 12.3 | |

4.7 Operating Characteristics

 $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | | TYP | UNIT |
|-----------|-------------------------------|-----|------|
| C_{pd} | Power dissipation capacitance | 120 | pF |

5 Parameter Measurement Information



- C_L includes probe and test-fixture capacitance.
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$. Phase relationships between waveforms are arbitrary.
- For clock inputs, f_{max} is measured with the input duty cycle at 50%.
- The outputs are measured one at a time with one input transition per measurement.
- t_{PLH} and t_{PHL} are the same as t_{pd} .
- t_{PZL} and t_{PZH} are the same as t_{en} .
- t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- All parameters and waveforms are not applicable to all devices.

Figure 5-1. Load Circuit and Voltage Waveforms

| TEST | S1 |
|-------------------|------|
| t_{PLH}/t_{PHL} | Open |

| TEST | S1 |
|-------------------|-------------------|
| t_{PLZ}/t_{PZL} | $2 \times V_{CC}$ |
| t_{PHZ}/t_{PZH} | GND |

6 Detailed Description

6.1 Functional Block Diagram

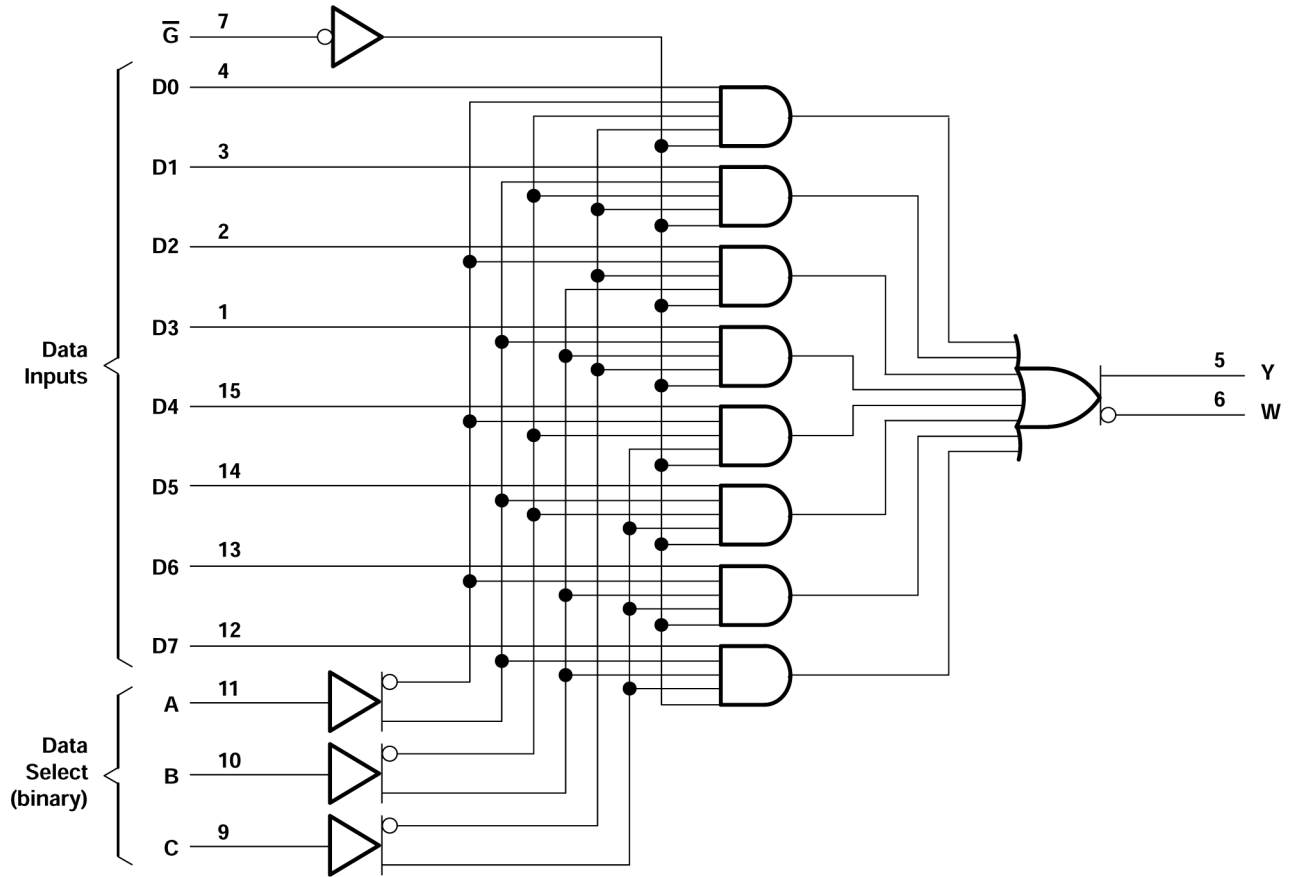


Figure 6-1. Logic Diagram (Positive Logic)

6.2 Device Functional Modes

Table 6-1. Function Table

| SELECT | | | STROBE \bar{G} | OUTPUTS | |
|--------|---|---|------------------|---------|------------|
| C | B | A | | Y | W |
| X | X | X | H | L | H |
| L | L | L | L | D0 | $\bar{D}0$ |
| L | L | H | L | D1 | $\bar{D}1$ |
| L | H | L | L | D2 | $\bar{D}2$ |
| L | H | H | L | D3 | $\bar{D}3$ |
| H | L | L | L | D4 | $\bar{D}4$ |
| H | L | H | L | D5 | $\bar{D}5$ |
| H | H | L | L | D6 | $\bar{D}6$ |
| H | H | H | L | D7 | $\bar{D}7$ |

7 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.

7.1 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the [Section 4.1](#) table.

Each V_{CC} pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 μF is recommended. If there are multiple V_{CC} pins, 0.01 μF or 0.022 μF is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 μF and 1 μF are commonly used in parallel. The bypass capacitor should be installed as close to the power pin 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 3 of the 4 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 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 must 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 makes more sense or is more convenient. It is generally acceptable to float outputs 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 IOs, so they cannot float when disabled.

8 Device and Documentation Support

8.1 Documentation Support

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 |
|------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| CD54ACT151 | Click here | Click here | Click here | Click here | Click here |
| CD74ACT151 | Click here | Click here | Click here | Click here | Click here |

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.

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8.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
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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 * (March 2003) to Revision A (August 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> , Application and Implementation section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section | 1 |
| • Updated RθJA values: D = 73 to 119.9, 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 Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| CD54ACT151F3A | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | CD54ACT151F3A | Samples |
| CD74ACT151M96 | ACTIVE | SOIC | D | 16 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | ACT151M | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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OTHER QUALIFIED VERSIONS OF CD54ACT151, CD74ACT151 :

- Catalog : [CD74ACT151](#)
- Military : [CD54ACT151](#)

NOTE: Qualified Version Definitions:

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

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74ACT151M96 | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74ACT151M96 | SOIC | D | 16 | 2500 | 353.0 | 353.0 | 32.0 |

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

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