

CDx4ACT04 Hex Inverters

1 Features

- Inputs are TTL-voltage compatible
- 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

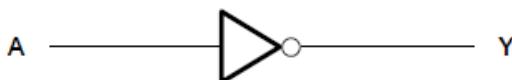
2 Description

The 'ACT04 devices contain six independent inverters. The devices perform the Boolean function $Y = \bar{A}$.

Device Information

PART NUMBER	PACKAGE ⁽¹⁾	PACKAGE SIZE ⁽²⁾	BODY SIZE ⁽³⁾
CD54ACT04	J (CDIP, 14)	19.55mm x 7.9mm	19.55mm x 6.7mm
CD74ACT04	D (SOIC, 14)	8.65mm x 6mm	8.65mm x 3.9mm
	N (PDIP, 14)	19.3mm x 9.4mm	19.3mm x 6.35mm

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



Logic Diagram, Each Inverter (Positive Logic)



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3 Pin Configuration and Functions

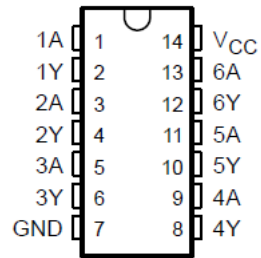


Figure 3-1. CD54ACT04 J Package, 14-Pin CDIP; CD74ACT04 N or D Package, 14-Pin PDIP or SOIC (Top View)

Table 3-1. Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
1A	1	Input	Channel 1, Input A
1Y	2	Output	Channel 1, Output Y
2A	3	Input	Channel 2, Input A
2Y	4	Output	Channel 2, Output Y
3A	5	Input	Channel 3, Input A
3Y	6	Output	Channel 3, Output Y
GND	7	—	Ground
4Y	8	Output	Channel 4, Output Y
4A	9	Input	Channel 4, Input A
5Y	10	Output	Channel 5, Output Y
5A	11	Input	Channel 5, Input A
6Y	12	Output	Channel 6, Output Y
6A	13	Input	Channel 6, Input A
V _{CC}	14	—	Positive Supply

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}	Input clamp current	(V _I < 0 or V _I > V _{CC}) ⁽²⁾		±20 mA
I _{OK}	Output clamp current	(V _O < 0 or V _O > V _{CC}) ⁽²⁾		±50 mA
I _O	Continuous output current	(V _O = 0 to V _{CC})		±50 mA
Continuous current through V _{CC} or GND				±100 mA
T _{stg}	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, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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 Recommended Operating Conditions

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

		T _A = 25°C		- 40°C to 85°C		- 55°C to 125°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.

4.3 Thermal Information

THERMAL METRIC ⁽¹⁾		CD74ACT04		UNIT
		N (PDIP)	D (SOIC)	
		14 PINS	14 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	80	89.9	°C/W

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

4.4 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS		V _{CC}	TA = 25°C		– 40°C to 85°C		–55°C TO 125°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		3.8		3.7		
		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		0.44		0.5	
		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		± 0.1		± 0.1	µA
I _{CC}	V _I = V _{CC} or GND I _O = 0		5.5 V		4		40		80	µA
ΔI _{CC}	V _I = V _{CC} – 2.1 V		4.5 V to 5.5 V		2.4		2.8		3	mA
C _i					10		10		10	pF

Table 4-1. Act Input Load Table

INPUT	UNIT LOAD
A	0.18

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

4.5 Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	– 40°C TO 85°C		–55°C TO 125°C		UNIT
			MIN	MAX	MIN	MAX	
t _{PLH}	A	Y	2.4	8.5	2.3	9.3	ns
t _{PHL}			2.4	8.5	2.3	9.3	

4.6 Operating Characteristics

V_{CC} = 5 V, T_A = 25°C

PARAMETER	TYP	UNIT
C _{pd} Power dissipation capacitance	105	pF

5 Parameter Measurement Information

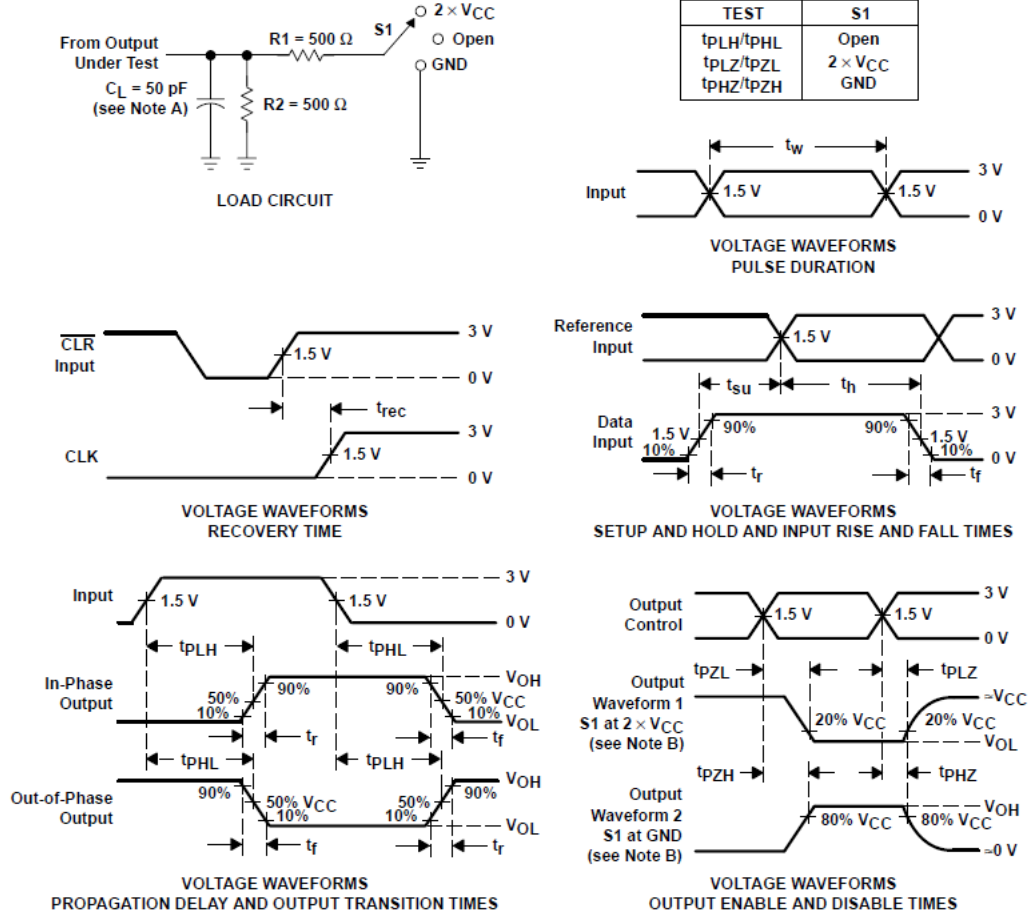


Figure 5-1.

- A. C_L includes probe and jig capacitance.
- B. 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.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 3 \text{ ns}$, $t_f \leq 3 \text{ ns}$.
- D. The outputs are measured one at a time, with one input transition per measurement.
- E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- F. t_{PZL} and t_{PZH} are the same as t_{en} .
- G. t_{PHL} and t_{PLH} are the same as t_{pd} .
- H. All parameters and waveforms are not applicable to all devices.

6 Detailed Description

6.1 Functional Block Diagram



Figure 6-1. Logic Diagram, Each Inverter (Positive Logic)

6.2 Device Functional Modes

Table 6-1. Function Table (Each Inverter)

INPUT	OUTPUT
A	Y
H	L
L	H

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 MIN and MAX supply voltage rating located in the [Section 4.2](#) 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 float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when 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 in [Layout Example](#) are 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 makes more sense or is more convenient. It is 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 I/Os so they also cannot float when disabled.

7.2.2 Layout Example

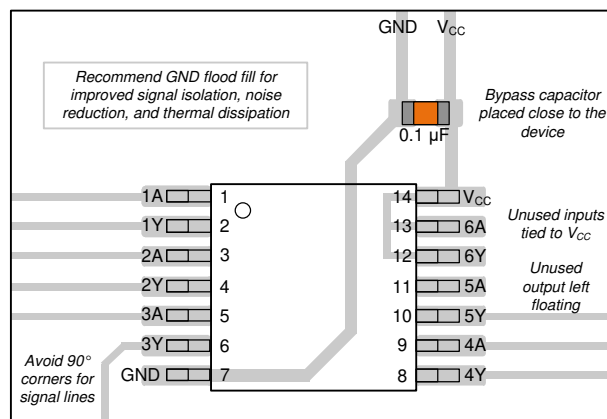


Figure 7-1. Layout Diagram

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
CD54ACT04	Click here	Click here	Click here	Click here	Click here
CD74ACT04	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.

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

Changes from Revision C (May 2023) to Revision D (August 2024) Page

- Added package size to *Device Information* table..... 1
- Updated RθJA values: D = 86 to 89.9, all values in °C/W.....4
- Changed packages from E and M to N and D4

Changes from Revision B (June 2002) to Revision C (May 2023) Page

- Added *Package Information* table, *Pin Functions* table, and *Thermal Information* table..... 1

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
CD54ACT04F3A	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	CD54ACT04F3A	Samples
CD74ACT04E	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD74ACT04E	Samples
CD74ACT04M	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-55 to 125	ACT04M	
CD74ACT04M96	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	ACT04M	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 CD54ACT04, CD74ACT04 :

- Catalog : [CD74ACT04](#)
- Military : [CD54ACT04](#)

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
CD74ACT04M96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD74ACT04M96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD74ACT04M96	SOIC	D	14	2500	330.0	12.4	3.75	3.75	1.15	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74ACT04M96	SOIC	D	14	2500	356.0	356.0	35.0
CD74ACT04M96	SOIC	D	14	2500	353.0	353.0	32.0
CD74ACT04M96	SOIC	D	14	2500	340.5	336.1	32.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD74ACT04E	N	PDIP	14	25	506	13.97	11230	4.32
CD74ACT04E	N	PDIP	14	25	506	13.97	11230	4.32

D0014A



PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

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.

EXAMPLE BOARD LAYOUT

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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.

J 14

GENERIC PACKAGE VIEW
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

J0014A



PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

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 hermetically 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



4214771/A 05/2017

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

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

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