

# SN54AS1004A, SN74ALS1004, SN74AS1004A HEX INVERTING DRIVERS

SDAS074B – APRIL 1982 – REVISED JANUARY 1995

- 'AS1004A Offer High Capacitive-Drive Capability
- Driver Version of 'ALS04B and 'AS04
- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

## description

These devices contain six independent inverting drivers. They perform the Boolean function  $Y = \bar{A}$ .

The SN54AS1004A is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS1004 and SN74AS1004A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**FUNCTION TABLE**  
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

**SN54AS1004A ... J PACKAGE**  
**SN74ALS1004, SN74AS1004A ... D OR N PACKAGE**  
(TOP VIEW)

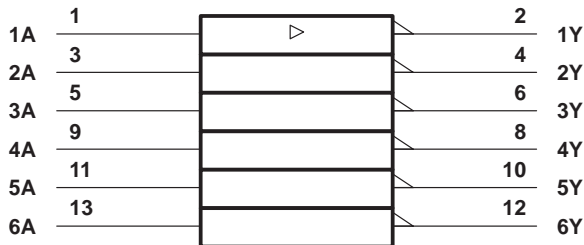


**SN54AS1004A ... FK PACKAGE**  
(TOP VIEW)



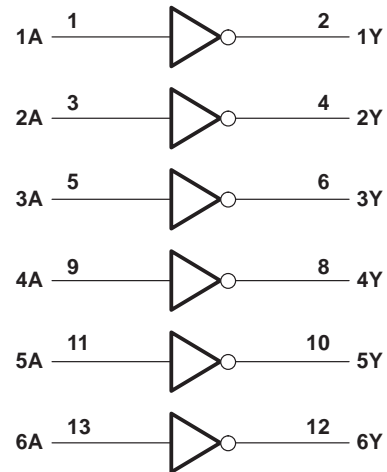
NC – No internal connection

## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the D, J, and N packages.

## logic diagram (positive logic)



PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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# SN54AS1004A, SN74ALS1004, SN74AS1004A HEX INVERTING DRIVERS

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

Supply voltage, $V_{CC}$ .....	7 V
Input voltage, $V_I$ .....	7 V
Operating free-air temperature range, $T_A$ : SN74ALS1004 .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## recommended operating conditions

		SN74ALS1004			UNIT
		MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{OH}$	High-level output current			-15	mA
$I_{OL}$	Low-level output current			24	mA
$T_A$	Operating free-air temperature	0		70	°C

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

PARAMETER	TEST CONDITIONS	SN74ALS1004			UNIT
		MIN	TYP‡	MAX	
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			-1.5	V
$V_{OH}$	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ , $I_{OH} = -0.4\text{ mA}$	$V_{CC} - 2$			V
	$V_{CC} = 4.5\text{ V}$	$I_{OH} = -3\text{ mA}$	2.4	3.2	
		$I_{OH} = -15\text{ mA}$	2		
$V_{OL}$	$V_{CC} = 4.5\text{ V}$	$I_{OL} = 12\text{ mA}$	0.25	0.4	V
		$I_{OL} = 24\text{ mA}$	0.35	0.5	
$I_I$	$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$			0.1	mA
$I_{IH}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$			20	μA
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$			-0.1	mA
$I_{O}^{\S}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$	-30		-112	mA
$I_{CCH}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0$		0.84	3	mA
$I_{CCL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 4.5\text{ V}$		7	12	mA

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

§ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

## switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_L = 500\ \Omega$ , $T_A = \text{MIN to MAX}^{\dagger\dagger}$		UNIT
			SN74ALS1004		
			MIN	MAX	
$t_{PLH}$	A	Y	1	7	ns
$t_{PHL}$			1	6	

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



# SN54AS1004A, SN74ALS1004, SN74AS1004A HEX INVERTING DRIVERS

SDAS074B – APRIL 1982 – REVISED JANUARY 1995

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

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Operating free-air temperature range, $T_A$ : SN54AS1004A	-55°C to 125°C
SN74AS1004A	0°C to 70°C
Storage temperature range	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## recommended operating conditions‡

		SN54AS1004A			SN74AS1004A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.8			0.8	V
$I_{OH}$	High-level output current			-40			-48	mA
$I_{OL}$	Low-level output current			40			48	mA
$T_A$	Operating free-air temperature	-55		125	0		70	°C

‡ These high sink- or source-current devices are not recommended for use above 40 MHz.

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

PARAMETER	TEST CONDITIONS	SN54AS1004A			SN74AS1004A			UNIT
		MIN	TYP§	MAX	MIN	TYP§	MAX	
$V_{IK}$	$V_{CC} = 4.5$ V, $I_I = -18$ mA			-1.2			-1.2	V
$V_{OH}$	$V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -2$ mA	$V_{CC} - 2$			$V_{CC} - 2$			V
	$V_{CC} = 4.5$ V, $I_{OH} = -3$ mA	2.4	3.2		2.4	3.2		
	$V_{CC} = 4.5$ V, $I_{OH} = -40$ mA	2						
$V_{OL}$	$V_{CC} = 4.5$ V, $I_{OH} = -48$ mA				2			V
	$V_{CC} = 4.5$ V, $I_{OL} = 40$ mA	0.25			0.5			
	$V_{CC} = 4.5$ V, $I_{OL} = 48$ mA				0.35			
$I_I$	$V_{CC} = 5.5$ V, $V_I = 7$ V			0.1			0.1	mA
$I_{IH}$	$V_{CC} = 5.5$ V, $V_I = 2.7$ V			20			20	μA
$I_{IL}$	$V_{CC} = 5.5$ V, $V_I = 0.4$ V			-0.5			-0.5	mA
$I_{O}^{\parallel}$	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	-50		-200	-50		-200	mA
$I_{CCH}$	$V_{CC} = 5.5$ V, $V_I = 0$		3.5	5		3.5	5	mA
$I_{CCL}$	$V_{CC} = 5.5$ V, $V_I = 4.5$ V		16	27		16	27	mA

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

¶ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .



# SN54AS1004A, SN74ALS1004, SN74AS1004A HEX INVERTING DRIVERS

SDAS074B – APRIL 1982 – REVISED JANUARY 1995

## switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$ $C_L = 50 \text{ pF},$ $R_L = 500 \Omega,$ $T_A = \text{MIN to MAX}^\dagger$				UNIT
			SN54AS1004A		SN74AS1004A		
			MIN	MAX	MIN	MAX	
$t_{PLH}$	A	Y	1	5	1	4	ns
$t_{PHL}$			1	5	1	4	

<sup>†</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.



PARAMETER MEASUREMENT INFORMATION  
SERIES 54ALS/74ALS AND 54AS/74AS DEVICES





- NOTES: 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. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-88729012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 88729012A SNJ54AS 1004AFK	<a href="#">Samples</a>
5962-8872901CA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8872901CA SNJ54AS1004AJ	<a href="#">Samples</a>
5962-8872901DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8872901DA SNJ54AS1004AW	<a href="#">Samples</a>
SN54AS1004AJ	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54AS1004AJ	<a href="#">Samples</a>
SN74ALS1004D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS1004	<a href="#">Samples</a>
SN74ALS1004DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS1004	<a href="#">Samples</a>
SN74ALS1004N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS1004N	<a href="#">Samples</a>
SN74ALS1004NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS1004	<a href="#">Samples</a>
SN74AS1004AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AS1004A	<a href="#">Samples</a>
SN74AS1004ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AS1004A	<a href="#">Samples</a>
SN74AS1004ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AS1004A	<a href="#">Samples</a>
SN74AS1004ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	AS1004A	<a href="#">Samples</a>
SN74AS1004AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74AS1004AN	<a href="#">Samples</a>
SN74AS1004AN3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI	0 to 70		
SN74AS1004ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	74AS1004A	<a href="#">Samples</a>
SNJ54AS1004AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 88729012A SNJ54AS 1004AFK	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SNJ54AS1004AJ	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8872901CA SNJ54AS1004AJ	
SNJ54AS1004AW	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8872901DA SNJ54AS1004AW	

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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

(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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF SN54AS1004A, SN74AS1004A :**

- Catalog: [SN74AS1004A](#)
- Military: [SN54AS1004A](#)

## NOTE: Qualified Version Definitions:

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



**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


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

**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
SN74ALS1004NSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74AS1004ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74AS1004ANSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	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)
SN74ALS1004NSR	SO	NS	14	2000	367.0	367.0	38.0
SN74AS1004ADR	SOIC	D	14	2500	367.0	367.0	38.0
SN74AS1004ANSR	SO	NS	14	2000	367.0	367.0	38.0

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP1-F14

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  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.
  - $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211283-3/E 08/12

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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

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