

# 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

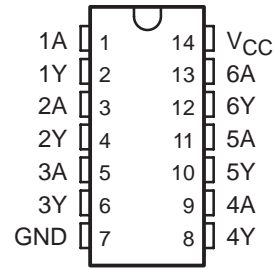
These devices contain six independent inverting drivers. They perform the Boolean function  $Y = \bar{A}$ .

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  $70^{\circ}\text{C}$ .

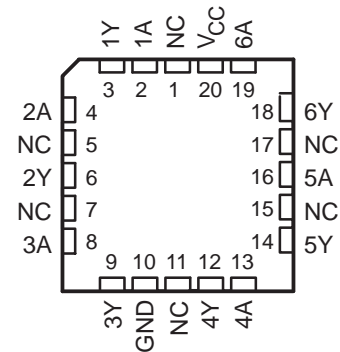
FUNCTION TABLE  
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

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

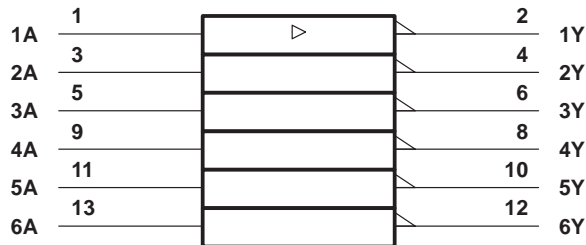


SN54AS1004A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

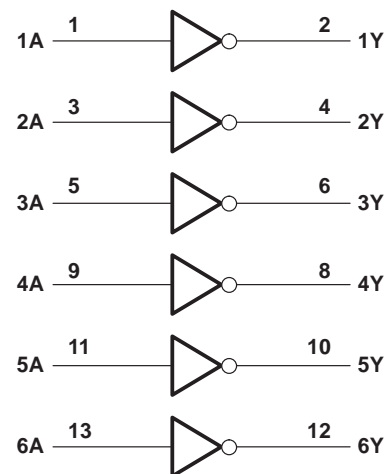
## logic symbol†



† 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)



# SN54AS1004A, SN74ALS1004, SN74AS1004A

## HEX INVERTING DRIVERS

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

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

<sup>†</sup> 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 <sup>‡</sup>	MAX	
$V_{IK}$	$V_{CC} = 4.5$ V, $I_I = -18$ mA			–1.5	V
$V_{OH}$	$V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -0.4$ mA	$V_{CC} - 2$			V
	$V_{CC} = 4.5$ V, $I_{OH} = -3$ mA	2.4	3.2		
	$V_{CC} = 4.5$ V, $I_{OH} = -15$ mA	2			
$V_{OL}$	$V_{CC} = 4.5$ V, $I_{OL} = 12$ mA		0.25	0.4	V
	$V_{CC} = 4.5$ V, $I_{OL} = 24$ mA		0.35	0.5	
$I_I$	$V_{CC} = 5.5$ V, $V_I = 7$ V			0.1	mA
$I_{IH}$	$V_{CC} = 5.5$ V, $V_I = 2.7$ V			20	μA
$I_{IL}$	$V_{CC} = 5.5$ V, $V_I = 0.4$ V			–0.1	mA
$I_{O}^{\S}$	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	–30		–112	mA
$I_{CCH}$	$V_{CC} = 5.5$ V, $V_I = 0$		0.84	3	mA
$I_{CCL}$	$V_{CC} = 5.5$ V, $V_I = 4.5$ V		7	12	mA

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

<sup>\S</sup> 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)	VCC = 4.5 V to 5.5 V, CL = 50 pF, RL = 500 Ω, TA = MIN to MAX††		UNIT
			SN74ALS1004		
			MIN	MAX	
tPLH	A	Y	1	7	ns
tPHL			1	6	

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



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

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

<sup>†</sup> 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<sup>‡</sup>

		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

<sup>‡</sup> 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 <sup>§</sup>	MAX	MIN	TYP <sup>§</sup>	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		
		$I_{OH} = -40$ mA	2						
		$I_{OH} = -48$ mA				2			
$V_{OL}$	$V_{CC} = 4.5$ V	$I_{OL} = 40$ mA		0.25	0.5				V
		$I_{OL} = 48$ mA				0.35	0.5		
$I_I$	$V_{CC} = 5.5$ 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

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

<sup>¶</sup> 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

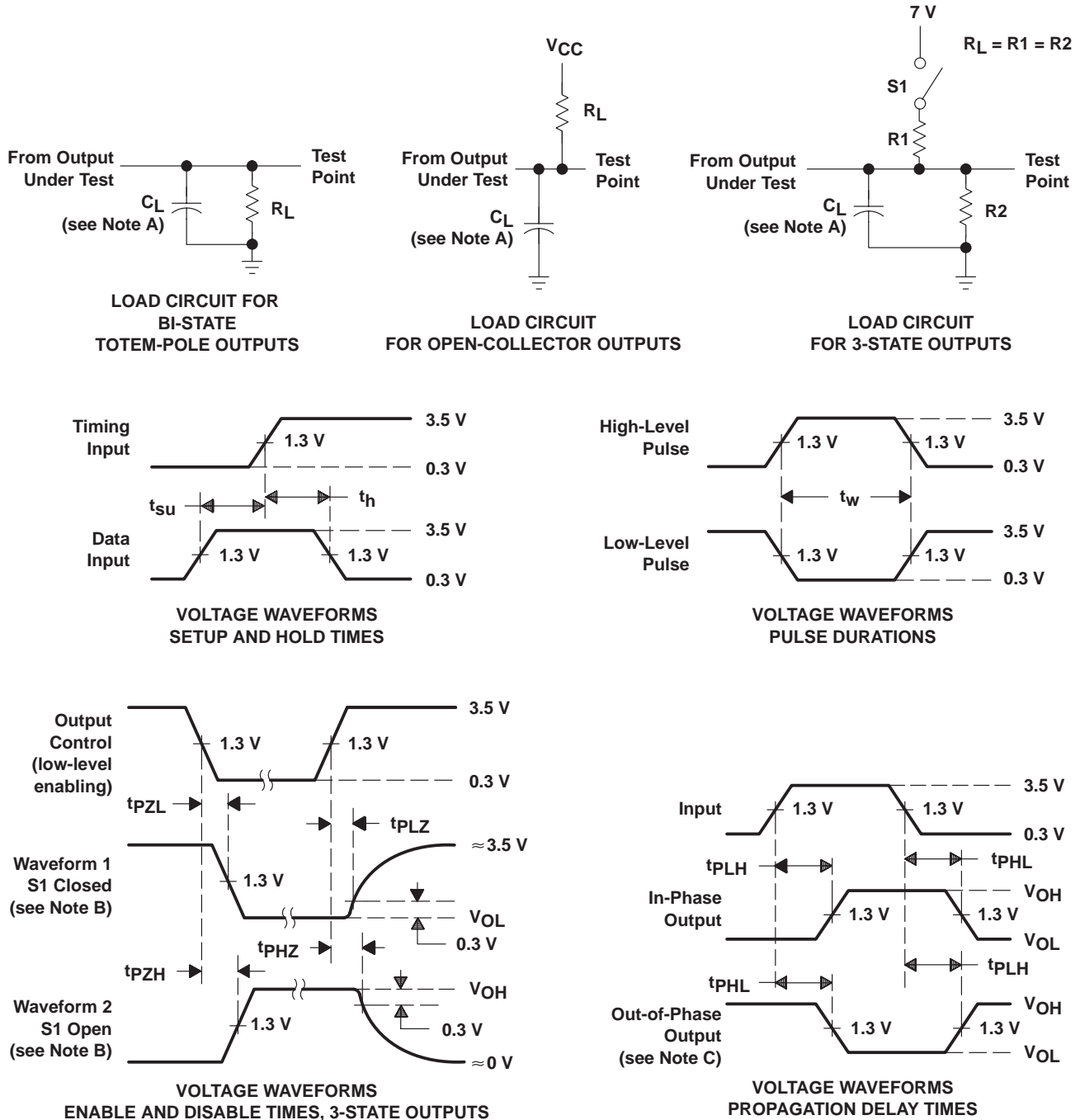
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switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX†				UNIT
			SN54AS1004A		SN74AS1004A		
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A	Y	1	5	1	4	ns
t <sub>PHL</sub>			1	5	1	4	

† 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 <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
5962-88729012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-8872901CA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
5962-8872901DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SN54AS1004AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN74ALS1004D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS1004NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS1004NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS1004NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS1004AN3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74AS1004ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS1004ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004ANSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS1004ANSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SNJ54AS1004AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54AS1004AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54AS1004AW	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

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

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**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
SN74ALS1004DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
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)
SN74ALS1004DR	SOIC	D	14	2500	346.0	346.0	33.0
SN74ALS1004NSR	SO	NS	14	2000	346.0	346.0	33.0
SN74AS1004ADR	SOIC	D	14	2500	346.0	346.0	33.0
SN74AS1004ANSR	SO	NS	14	2000	346.0	346.0	33.0

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

## LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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



PINS ** DIM	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-G14)

## PLASTIC SMALL-OUTLINE PACKAGE



## 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 .006 (0,15) per end.
- $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AB.

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 and JEDEC MO-092AB

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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



14/18 Pin Only  
20 Pin vendor option

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.

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