

SN54ALS04B, SN54AS04, SN74ALS04B, SN74AS04 HEX INVERTERS

SDAS063B – APRIL 1982 – REVISED DECEMBER 1994

- 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 hex inverters. They perform the Boolean function $Y = \bar{A}$.

The SN54ALS04B and SN54AS04 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS04B and SN74AS04 are characterized for operation from 0°C to 70°C .

FUNCTION TABLE
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

SN54ALS04B, SN54AS04 . . . J PACKAGE
SN74ALS04B, SN74AS04 . . . D OR N PACKAGE
(TOP VIEW)

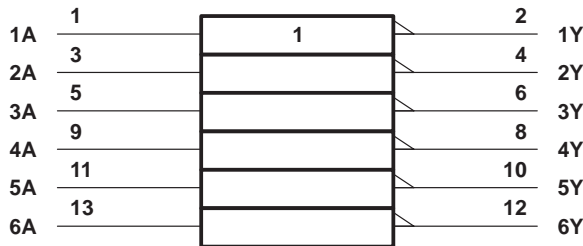


SN54ALS04B, SN54AS04 . . . FK PACKAGE
(TOP VIEW)



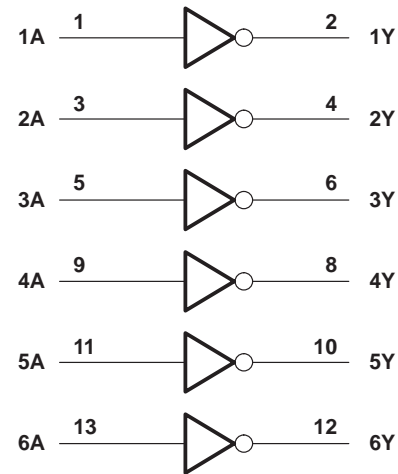
NC – No internal connection

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)



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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 : SN54ALS04B	-55°C to 125°C
SN74ALS04B	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

		SN54ALS04B			SN74ALS04B			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
				0.7§				
I_{OH}	High-level output current			-0.4			-0.4	mA
I_{OL}	Low-level output current			4			8	mA
T_A	Operating free-air temperature	-55		125	0		70	°C

‡ Applies over -55°C to 70°C temperature range

§ Applies over 70°C to 125°C temperature range

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

PARAMETER	TEST CONDITIONS	SN54ALS04B			SN74ALS04B			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 $5.5 V$, $I_{OH} = -0.4 mA$	$V_{CC} - 2$			$V_{CC} - 2$			V
V_{OL}	$V_{CC} = 4.5 V$		0.25	0.4		0.25	0.4	V
		$I_{OL} = 4 mA$				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}	$V_{CC} = 5.5 V$, $V_I = 0.4 V$			-0.1			-0.1	mA
$I_{O}^{\#}$	$V_{CC} = 5.5 V$, $V_O = 2.25 V$	-20		-112	-30		-112	mA
I_{CCH}	$V_{CC} = 5.5 V$, $V_I = 0$		0.65	1.1		0.65	1.1	mA
I_{CCL}	$V_{CC} = 5.5 V$, $V_I = 4.5 V$		2.9	4.4		2.9	4.2	mA

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

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



SN54ALS04B, SN54AS04, SN74ALS04B, SN74AS04 HEX INVERTERS

SDAS063B – APRIL 1982 – REVISED DECEMBER 1994

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R _L = 500 Ω, T _A = MIN to MAX†				UNIT
			SN54ALS04B		SN74ALS04B		
			MIN	MAX	MIN	MAX	
t _{PLH}	A	Y	3	17	3	11	ns
t _{PHL}			2	13	2	8	

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

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 : SN54AS04	-55°C to 125°C
SN74AS04	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

	SN54AS04			SN74AS04			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			-2			-2	mA
I _{OL} Low-level output current			20			20	mA
T _A Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS	SN54AS04			SN74AS04			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 _{OL}	V _{CC} = 4.5 V, I _{OL} = 20 mA	0.35	0.5		0.35	0.5		V
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 ¶	V _{CC} = 5.5 V, V _O = 2.25 V	-30		-112	-30		-112	mA
I _{CCH}	V _{CC} = 5.5 V, V _I = 0		3	4.8		3	4.8	mA
I _{CCL}	V _{CC} = 5.5 V, V _I = 4.5 V		14	26.3		14	26.3	mA

§ All typical values are at V_{CC} = 5 V, T_A = 25°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}.



SN54ALS04B, SN54AS04, SN74ALS04B, SN74AS04 HEX INVERTERS

SDAS063B – APRIL 1982 – REVISED DECEMBER 1994

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
			SN54AS04		SN74AS04		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	1	6	1	5	ns
t_{PHL}			1	4.5	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 (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
5962-86843012A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-86843012A SNJ54ALS04BFK	Samples
5962-8684301DA	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8684301DA SNJ54ALS04BW	Samples
JM38510/37006B2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 37006B2A	Samples
JM38510/37006BCA	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 37006BCA	Samples
M38510/37006B2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 37006B2A	Samples
M38510/37006BCA	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510/ 37006BCA	Samples
SN54ALS04BJ	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54ALS04BJ	Samples
SN54AS04J	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54AS04J	Samples
SN74ALS04BDBR	ACTIVE	SSOP	DB	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	G04B	Samples
SN74ALS04BDR	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS04B	Samples
SN74ALS04BDRG4	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS04B	Samples
SN74ALS04BN	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS04BN	Samples
SN74ALS04BNSR	ACTIVE	SO	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS04B	Samples
SN74ALS04BNSRE4	ACTIVE	SO	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS04B	Samples
SN74AS04DR	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	AS04	Samples
SN74AS04N	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74AS04N	Samples
SN74AS04NSR	ACTIVE	SO	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74AS04	Samples

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
SNJ54ALS04BFK	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 86843012A SNJ54ALS 04BFK	Samples
SNJ54ALS04BJ	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54ALS04BJ	Samples
SNJ54ALS04BW	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8684301DA SNJ54ALS04BW	Samples
SNJ54AS04FK	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54AS 04FK	Samples
SNJ54AS04J	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54AS04J	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.

OBSELETE: 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 SN54ALS04B, SN54AS04, SN74ALS04B, SN74AS04 :

- Catalog : [SN74ALS04B](#), [SN74AS04](#)
- Military : [SN54ALS04B](#), [SN54AS04](#)

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
SN74ALS04BDBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74ALS04BDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74ALS04BDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74ALS04BNSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74AS04DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74AS04NSR	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)
SN74ALS04BDBR	SSOP	DB	14	2000	356.0	356.0	35.0
SN74ALS04BDR	SOIC	D	14	2500	356.0	356.0	35.0
SN74ALS04BDR	SOIC	D	14	2500	340.5	336.1	32.0
SN74ALS04BNSR	SO	NS	14	2000	356.0	356.0	35.0
SN74AS04DR	SOIC	D	14	2500	356.0	356.0	35.0
SN74AS04NSR	SO	NS	14	2000	356.0	356.0	35.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-86843012A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8684301DA	W	CFP	14	25	506.98	26.16	6220	NA
JM38510/37006B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
M38510/37006B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
SN54AS04J	J	CDIP	14	25	506.98	15.24	13440	NA
SN74ALS04BN	N	PDIP	14	25	506	13.97	11230	4.32
SN74ALS04BN	N	PDIP	14	25	506	13.97	11230	4.32
SN74AS04N	N	PDIP	14	25	506	13.97	11230	4.32
SN74AS04N	N	PDIP	14	25	506	13.97	11230	4.32
SNJ54ALS04BFK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54ALS04BW	W	CFP	14	25	506.98	26.16	6220	NA
SNJ54AS04FK	FK	LCCC	20	55	506.98	12.06	2030	NA

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

DB0014A



PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

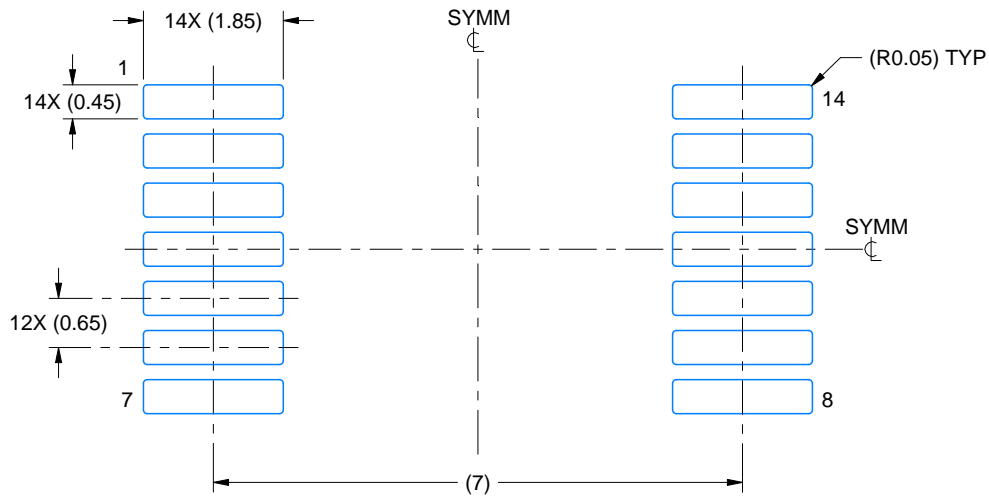
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220762/A 05/2024

NOTES: (continued)

- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220762/A 05/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

GENERIC PACKAGE VIEW

FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4229370VA\

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

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.
 -  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.
 -  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



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. 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.
 - E. 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.

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.

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