Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

### description

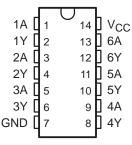
These devices contain six independent hex inverters. They perform the Boolean function  $Y = \overline{A}$ .

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.

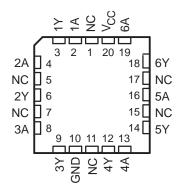
FUNCTION TABLE (each inverter)

INPUT A	OUTPUT Y
Н	L
L	Н

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



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



NC - No internal connection

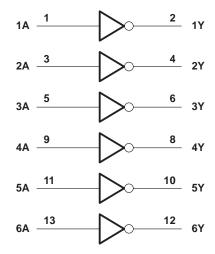
### logic symbol†

	1		2	437
1A	3	1	4	1Y
2A	5		6	2Y
3A	9		8	3Y
4A	11		10	4Y
5A 6A	13	<b></b>	12	5Y 6Y
θA				01

<sup>†</sup> 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)



### SN54ALS04B, SN54AS04, SN74ALS04B, SN74AS04 HEX INVERTERS

SDAS063B - APRIL 1982 - REVISED DECEMBER 1994

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

Supply voltage, V <sub>CC</sub>	7 \
Input voltage, V <sub>I</sub>	7 V
Operating free-air temperature range, TA: SN54ALS04B	-55°C to 125°C
SN74ALS04B	0°C to 70°C
Storage temperature range	-65°C to 150°C

### recommended operating conditions

		SN54ALS04B			SN	UNIT				
		MIN	NOM	MAX	MIN	NOM	MAX	UNII		
Vcc	Supply voltage	4.5	5	5.5	4.5	5	5.5	V		
$V_{IH}$	High-level input voltage	2			2			V		
\/	Low lovel input veltage			0.8‡			0.8	V		
VIL	Low-level input voltage			0.7§				V		
IOH	High-level output current			-0.4			-0.4	mA		
I <sub>OL</sub>	Low-level output current			4			8	mA		
T <sub>A</sub>	Operating free-air temperature	-55		125	0		70	°C		

<sup>‡</sup> Applies over -55°C to 70°C temperature range

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

PARAMETER	TEST C	TEST CONDITIONS		4ALS0	4B	SN74ALS04B			UNIT
PARAMETER	1531 (1	TEST CONDITIONS			MAX	MIN	TYP¶	MAX	UNII
VIK	V <sub>CC</sub> = 4.5 V,	I <sub>I</sub> = -18 mA			-1.2			-1.2	V
Voн	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$	$I_{OH} = -0.4 \text{ mA}$	V <sub>CC</sub> -2			V <sub>CC</sub> -2	2		V
VOL	V <sub>CC</sub> = 4.5 V	I <sub>OL</sub> = 4 mA		0.25	0.4		0.25	0.4	V
VOL		$I_{OL} = 8 \text{ mA}$					0.35	0.5	٧
lį	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 7 V			0.1			0.1	mA
lН	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 2.7 V			20			20	μΑ
I <sub>IL</sub>	$V_{CC} = 5.5 \text{ V},$	V <sub>I</sub> = 0.4 V			-0.1			-0.1	mA
IO <sup>#</sup>	$V_{CC} = 5.5 \text{ V},$	V <sub>O</sub> = 2.25 V	-20		-112	-30		-112	mA
<sup>I</sup> ссн	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 0		0.65	1.1		0.65	1.1	mA
ICCL	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 4.5 V		2.9	4.4		2.9	4.2	mA

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



<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.

<sup>§</sup> Applies over 70°C to 125°C temperature range

<sup>#</sup>The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, IOS.

### switching characteristics (see Figure 1)

PARAMETER	RAMETER FROM TO (OUTPUT)		C <sub>L</sub> R <sub>L</sub> T <sub>A</sub>	$V_{CC} = 4.5 \text{ V to } 5$ $C_L = 50 \text{ pF},$ $R_L = 500 \Omega,$ $T_A = \text{MIN to MA}$			UNIT
			SN54AI	LS04B	SN74AI	LS04B	
			MIN	MAX	MIN	MAX	
<sup>t</sup> PLH	А	V	3	17	3	11	ns
t <sub>PHL</sub>	ζ	1	2	13	2	8	115

<sup>†</sup> 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 <sub>CC</sub>	
Input voltage, V <sub>I</sub>	
Operating free-air temperature range, T <sub>A</sub> : SN54AS04	–55°C to 125°C
SN74AS04	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

		SN54AS04			S	UNIT		
		MIN	NOM	MAX	MIN	NOM	MAX	UNII
VCC	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
VIH	High-level input voltage	2			2			V
V <sub>IL</sub>	Low-level input voltage			0.8			0.8	V
ІОН	High-level output current			-2			-2	mA
loL	Low-level output current			20			20	mA
TA	Operating free-air temperature	-55		125	0		70	°C

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

DADAMETED	TEST C	TEST CONDITIONS		SN54AS04			SN74AS04		
PARAMETER	IESI C	TEST CONDITIONS			MAX	MIN	TYP§	MAX	UNIT
VIK	$V_{CC} = 4.5 \text{ V},$	$I_{I} = -18 \text{ mA}$			-1.2			-1.2	V
Voн	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$	$I_{OH} = -2 \text{ mA}$	V <sub>CC</sub> -2	2		V <sub>CC</sub> -2	2		V
$V_{OL}$	$V_{CC} = 4.5 \text{ V},$	$I_{OL} = 20 \text{ mA}$		0.35	0.5		0.35	0.5	V
ΙĮ	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 7 V			0.1			0.1	mA
lιΗ	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 2.7 V			20			20	μΑ
I <sub>ΙL</sub>	$V_{CC} = 5.5 \text{ V},$	$V_{I} = 0.4 \ V$			-0.5			-0.5	mA
ΙΟ <sup>¶</sup>	$V_{CC} = 5.5 \text{ V},$	$V_0 = 2.25 \text{ V}$	-30		-112	-30		-112	mA
Іссн	$V_{CC} = 5.5 \text{ V},$	V <sub>I</sub> = 0		3	4.8		3	4.8	mA
<sup>I</sup> CCL	$V_{CC} = 5.5 V,$	V <sub>I</sub> = 4.5 V		14	26.3		14	26.3	mA

<sup>§</sup> All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.



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

# SN54ALS04B, SN54AS04, SN74ALS04B, SN74AS04 HEX INVERTERS

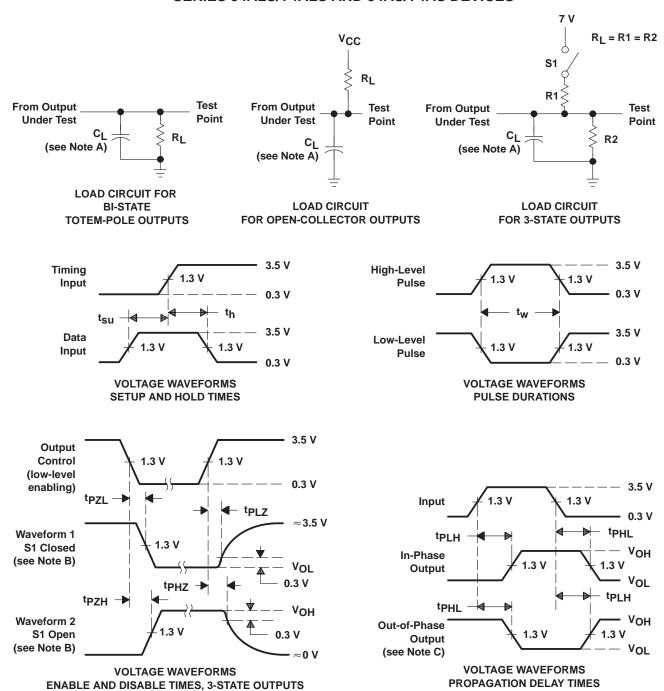
SDAS063B - APRIL 1982 - REVISED DECEMBER 1994

### switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>C</sub> C <sub>L</sub> R <sub>L</sub> T <sub>A</sub>	UNIT			
			MIN	MAX	SN74/ MIN	MAX	1 1
t <sub>PLH</sub>	٨	V	1	6	1	5	20
<sup>t</sup> PHL	A	ſ	1	4.5	1	4	ns

 $<sup>^\</sup>dagger$  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,  $t_{\Gamma}$  =  $t_{f}$  = 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	e Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp (3)
5962-86843012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-8684301DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
JM38510/37006B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/37006BCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54ALS04BJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54AS04J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN74ALS04BD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BDBLE	OBSOLETE	SSOP	DB	14		TBD	Call TI	Call TI
SN74ALS04BDBR	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BDBRE4	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BDE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BDRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS04BN3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74ALS04BNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS04BNSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS04BNSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS04D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS04DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS04DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS04DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS04N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS04NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS04NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS04NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM



#### PACKAGE OPTION ADDENDUM

18-Jul-2006

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SNJ54ALS04BFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54ALS04BJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54ALS04BW	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ54AS04FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54AS04J	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type

(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 <a href="http://www.ti.com/productcontent">http://www.ti.com/productcontent</a> 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.

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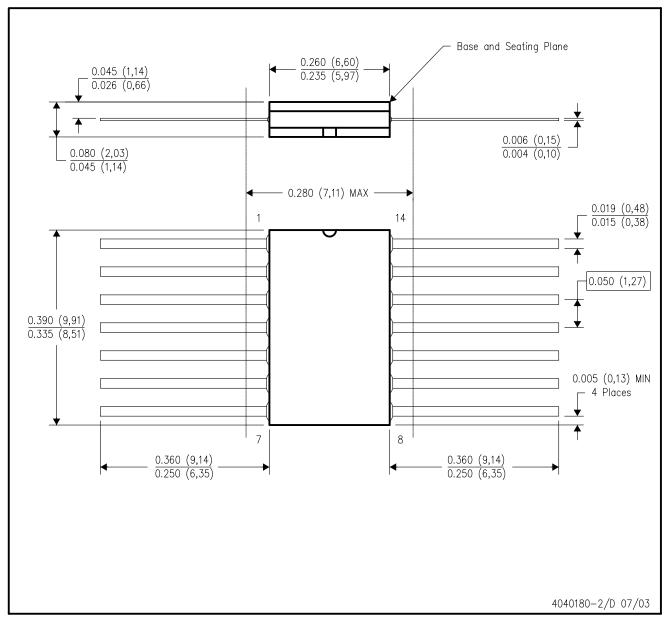
#### 14 LEADS SHOWN



- 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



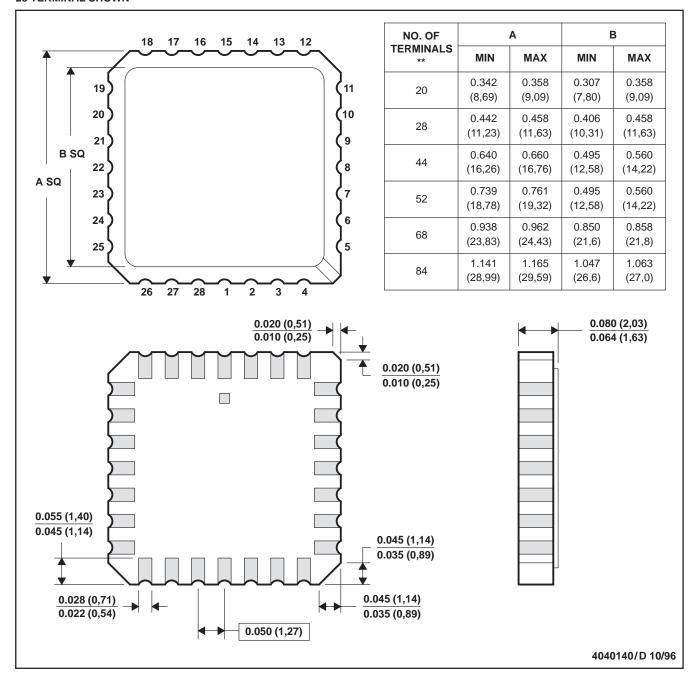
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB



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

#### **28 TERMINAL SHOWN**

#### **LEADLESS CERAMIC CHIP CARRIER**



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 metal lid.
- D. The terminals are gold plated.
- E. Falls within JEDEC MS-004



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

### PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

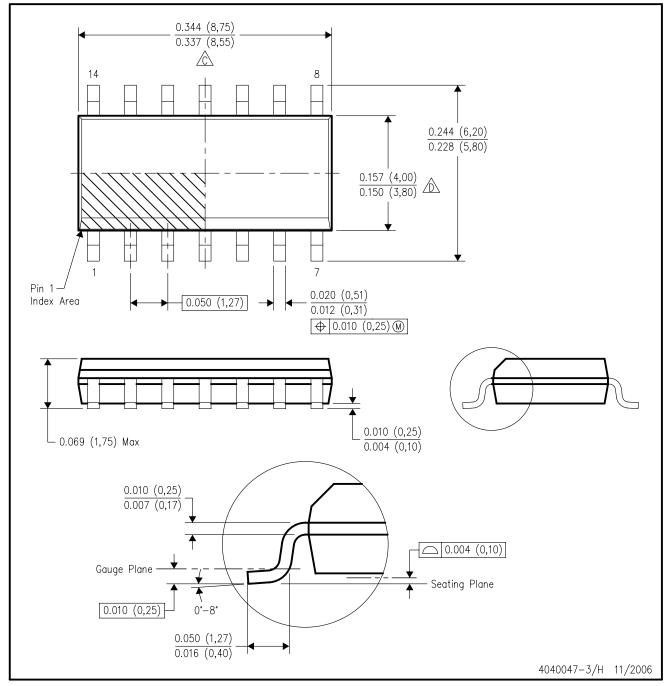


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.



### D (R-PDSO-G14)

### PLASTIC SMALL-OUTLINE PACKAGE



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



### **MECHANICAL DATA**

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

### 14-PINS SHOWN

### PLASTIC SMALL-OUTLINE PACKAGE



- 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.



### DB (R-PDSO-G\*\*)

### PLASTIC SMALL-OUTLINE

#### **28 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.

D. Falls within JEDEC MO-150

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Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
Low Power Wireless	www.ti.com/lpw	Telephony	www.ti.com/telephony
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