

# SN54ALS74A, SN54AS74A, SN74ALS74A, SN74AS74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SDAS143C – APRIL 1982 – REVISED AUGUST 1995

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

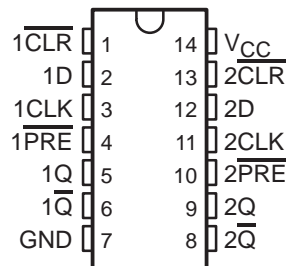
TYPE	TYPICAL MAXIMUM CLOCK FREQUENCY ( $C_L = 50$ pF) (MHz)	TYPICAL POWER DISSIPATION PER FLIP-FLOP (mW)
'ALS74A	50	6
'AS74A	134	26

## description

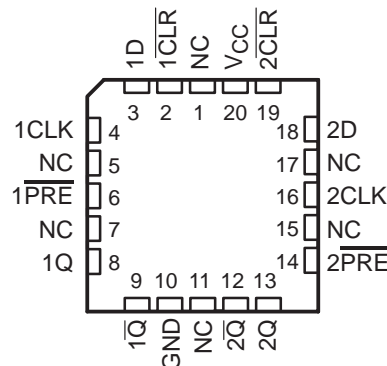
These devices contain two independent positive-edge-triggered D-type flip-flops. A low level at the preset (PRE) or clear (CLR) inputs sets or resets the outputs regardless of the levels of the other inputs. When PRE and CLR are inactive (high), data at the data (D) input meeting the setup-time requirements are transferred to the outputs on the positive-going edge of the clock (CLK) pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of CLK. Following the hold-time interval, data at the D input can be changed without affecting the levels at the outputs.

The SN54ALS74A and SN54AS74A are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS74A and SN74AS74A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS74A, SN54AS74A . . . J PACKAGE  
SN74ALS74A, SN74AS74A . . . D OR N PACKAGE  
(TOP VIEW)



SN54ALS74A, SN54AS74A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

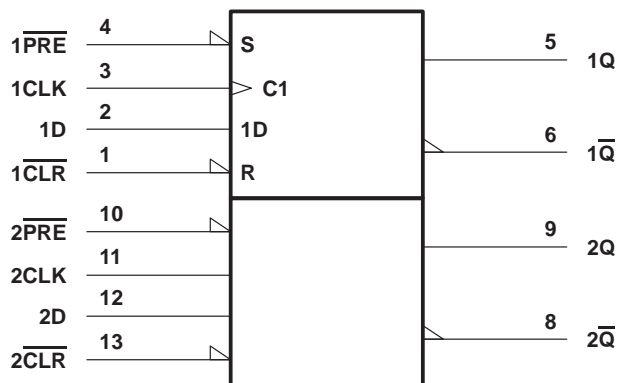
INPUTS				OUTPUTS	
PRE	CLR	CLK	D	Q	Q-bar
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H <sup>†</sup>	H <sup>†</sup>
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q <sub>0</sub>	Q <sub>0</sub> -bar

<sup>†</sup>The output levels in this configuration are not specified to meet the minimum levels for  $V_{OH}$  if the lows at PRE and CLR are near  $V_{IL}$  maximum. Furthermore, this configuration is nonstable; that is, it does not persist when PRE or CLR returns to its inactive (high) level.

# SN54ALS74A, SN54AS74A, SN74ALS74A, SN74AS74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

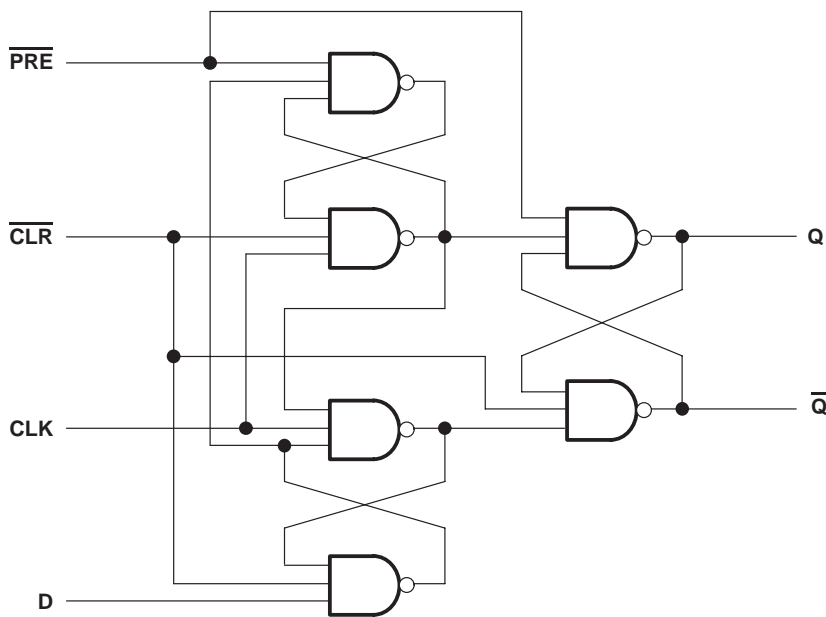
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## logic symbol†



† 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)



## 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, $T_A$ : SN54ALS74A	-55°C to 125°C
SN74ALS74A	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.

# SN54ALS74A, SN54AS74A, SN74ALS74A, SN74AS74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

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## recommended operating conditions

		SN54ALS74A			SN74ALS74A			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			0.7			0.8	V
$I_{OH}$	High-level output current			-0.4			-0.4	mA
$I_{OL}$	Low-level output current			4			8	mA
$f_{clock}$	Clock frequency	0		25	0		34	MHz
$t_w$	Pulse duration	$\overline{PRE}$ or $\overline{CLR}$ low		15	15		ns	
		CLK high		17.5	14.5			
		CLK low		17.5	14.5			
$t_{su}$	Setup time before CLK $\uparrow$	Data		16	15		ns	
		$\overline{PRE}$ or $\overline{CLR}$ inactive		10	10			
$t_h$	Hold time after CLK $\uparrow$	Data		2	0		ns	
$T_A$	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS		SN54ALS74A		SN74ALS74A		UNIT
				MIN	TYP $\dagger$	MAX	MIN	
$V_{IK}$		$V_{CC} = 4.5\text{ V}$ ,	$I_I = -18\text{ mA}$		-1.5		-1.5	V
$V_{OH}$		$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ ,	$I_{OH} = -2\text{ mA}$	$V_{CC}-2$		$V_{CC}-2$		V
$V_{OL}$		$V_{CC} = 4.5\text{ V}$	$I_{OL} = 4\text{ mA}$	0.25	0.4	0.25	0.4	V
			$I_{OL} = 8\text{ mA}$			0.35	0.5	
$I_I$	CLK or D	$V_{CC} = 4.5\text{ V}$ ,	$V_I = 7\text{ V}$		0.1		0.1	mA
	$\overline{PRE}$ or $\overline{CLR}$				0.2		0.2	
$I_{IH}$	CLK or D	$V_{CC} = 4.5\text{ V}$ ,	$V_I = 2.7\text{ V}$		20		20	$\mu\text{A}$
	$\overline{PRE}$ or $\overline{CLR}$				40		40	
$I_{IL}$	CLK or D	$V_{CC} = 4.5\text{ V}$ ,	$V_I = 0.4\text{ V}$		-0.2		-0.2	mA
	$\overline{PRE}$ or $\overline{CLR}$				-0.4		-0.4	
$I_{O\ddagger}$		$V_{CC} = 5.5\text{ V}$ ,	$V_O = 2.25\text{ V}$	-20	-112	-30	-112	mA
$I_{CC}$		$V_{CC} = 5.5\text{ V}$ ,	See Note 1	2.4	4	2.4	4	mA

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

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

NOTE 1:  $I_{CC}$  is measured with D, CLK, and  $\overline{PRE}$  grounded, then with D, CLK, and  $\overline{CLR}$  grounded.



# SN54ALS74A, SN54AS74A, SN74ALS74A, SN74AS74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

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## 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
			SN54ALS74A		SN74ALS74A		
			MIN	MAX	MIN	MAX	
$f_{\text{max}}$			25		34		MHz
$t_{\text{PLH}}$	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\overline{\text{Q}}$	3	18	3	13	ns
$t_{\text{PHL}}$			5	17	5	15	
$t_{\text{PLH}}$	CLK	Q or Q	5	23	5	16	ns
$t_{\text{PHL}}$			5	20	5	18	

<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)<sup>‡</sup>

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Operating free-air temperature range, $T_A$ : SN54AS74A	-55°C to 125°C
SN74AS74A	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

		SN54AS74A			SN74AS74A			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
$f_{\text{clock}}^*$	Clock frequency	0		90	0		105	MHz
$t_w^*$	Pulse duration	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low		4		4		ns
		CLK high		4		4		
		CLK low		5.5		5.5		
$t_{\text{su}}^*$	Setup time before CLK $\uparrow$	Data		4.5		4.5	ns	
		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ inactive		2		2		
$t_h^*$	Hold time after CLK $\uparrow$	Data		0		0	ns	
$T_A$	Operating free-air temperature	-55		125	0		70	°C

\* On products compliant to MIL-STD-883C, Class B, this parameter is based on characterization data but is not production tested.



# SN54ALS74A, SN54AS74A, SN74ALS74A, SN74AS74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

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

PARAMETER	TEST CONDITIONS	SN54AS74A		SN74AS74A		UNIT	
		MIN	TYP†	MAX	MIN		TYP†
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			-1.2		-1.2	V
$V_{OH}$	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $I_{OH} = -2\text{ mA}$	$V_{CC}-2$		$V_{CC}-2$			V
$V_{OL}$	$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 20\text{ mA}$	0.25	0.5	0.25	0.5		V
$I_I$	$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$		0.1		0.1		mA
$I_{IH}$	CLK or D	$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$		20	20		$\mu\text{A}$
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$			40	40		
$I_{IL}$	CLK or D	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$		-0.5	-0.5		mA
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$			-1.8	-1.8		
$I_{O\ddagger}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$	-30	-112	-30	-112		mA
$I_{CC}$	$V_{CC} = 5.5\text{ V}$ , See Note 1	10.5	16	10.5	16		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,  $I_{OS}$ .

NOTE 1:  $I_{CC}$  is measured with D, CLK, and  $\overline{\text{PRE}}$  grounded, then with D, CLK, and  $\overline{\text{CLR}}$  grounded.

## switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_L = 500\ \Omega$ , $T_A = \text{MIN to MAX}\S$				UNIT
			SN54AS74A		SN74AS74A		
			MIN	MAX	MIN	MAX	
$f_{\text{max}}^*$			90		105	MHz	
$t_{\text{PLH}}$	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\overline{Q}$	2	9	2	7.5	ns
$t_{\text{PHL}}$			2.5	11.5	2.5	10.5	
$t_{\text{PLH}}$	CLK	Q or Q	2.5	10	3	8	ns
$t_{\text{PHL}}$			3.5	10.5	3	9	

\* On products compliant to MIL-STD-833, Class B, this parameter is based on characterization data but is not production tested.

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

# SN54ALS74A, SN54AS74A, SN74ALS74A, SN74AS74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

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## 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>
5962-9862701Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9862701QCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
84011012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
8401101CA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
8401101DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
JM38510/37101B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/37101BCA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54ALS74AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN54AS74AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN74ALS74AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS74ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS74ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS74ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS74ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS74ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS74AJ	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI
SN74ALS74AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS74AN3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74ALS74ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS74ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS74ANSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS74AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS74ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS74ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS74ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS74AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS74ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS74ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS74ANSRE4	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>
SNJ54ALS74AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54ALS74AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54ALS74AW	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
SNJ54AS74AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54AS74AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	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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# 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:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



4040180-2/D 07/03

- 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

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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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

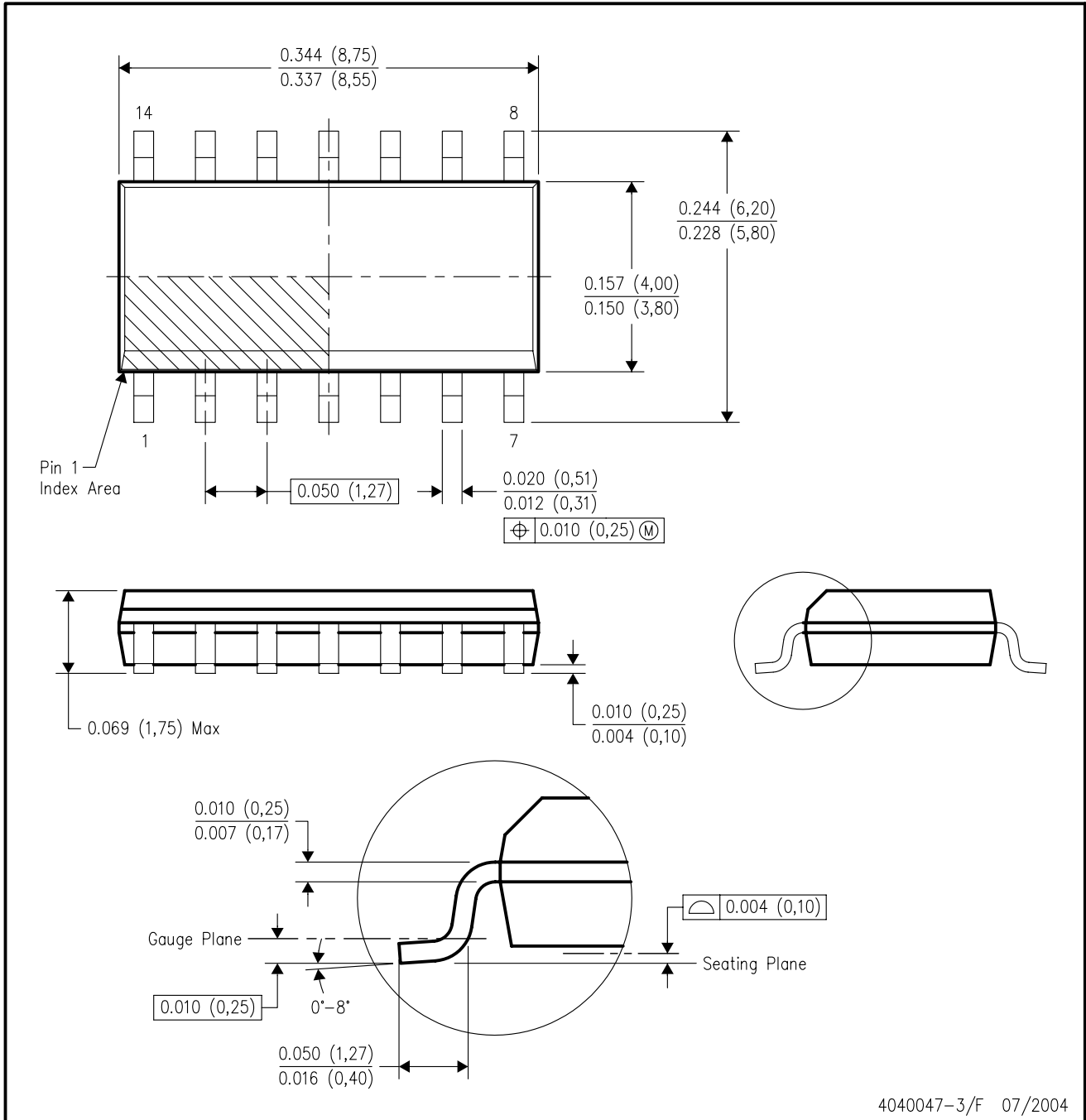
16 PINS SHOWN



- 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.

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.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-012 variation AB.

# 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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Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265