

# SN54F02, SN74F02 QUADRUPLE 2-INPUT POSITIVE-NOR GATES

SDFS036A – MARCH 1987 – REVISED OCTOBER 1993

- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

## description

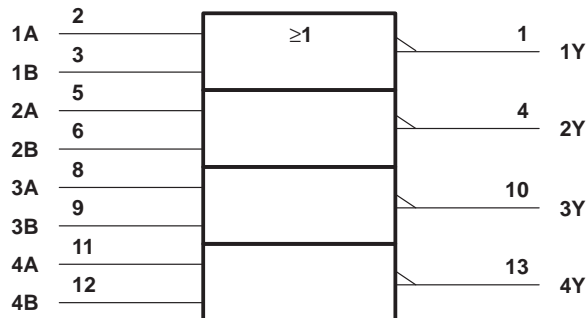
These devices contain four independent 2-input NOR gates. They perform the Boolean functions  $Y = A + B$  or  $Y = \overline{A} \cdot \overline{B}$  in positive logic.

The SN54F02 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74F02 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE  
(each gate)

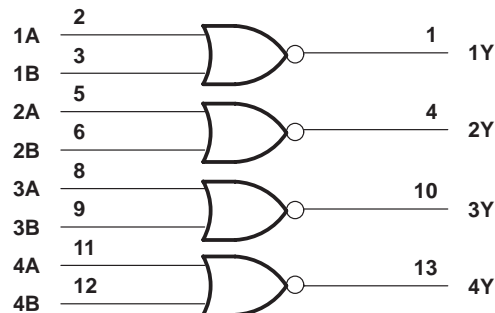
INPUTS		OUTPUT
A	B	Y
H	X	L
X	H	L
L	L	H

## logic symbol†



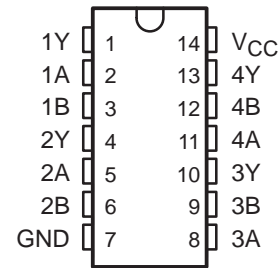
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)

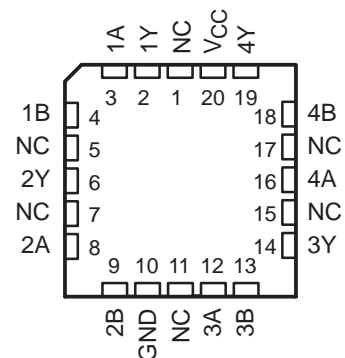


Pin numbers shown are for the D, J, and N packages.

SN54F02 ... J PACKAGE  
SN74F02 ... D OR N PACKAGE  
(TOP VIEW)



SN54F02 ... FK PACKAGE  
(TOP VIEW)



NC – No internal connection

# SN54F02, SN74F02

## QUADRUPLE 2-INPUT POSITIVE-NOR GATES

SDFS036A – MARCH 1987 – REVISED OCTOBER 1993

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

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	–1.2 V to 7 V
Input current range	–30 mA to 5 mA
Voltage range applied to any output in the high state	–0.5 V to $V_{CC}$
Current into any output in the low state	40 mA
Operating free-air temperature range: SN54F02	–55°C to 125°C
SN74F02	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.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

### recommended operating conditions

		SN54F02			SN74F02			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
$I_{IK}$	Input clamp current			–18			–18	mA
$I_{OH}$	High-level output current			–1			–1	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		SN54F02			SN74F02			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,	$I_{OH} = -1$ mA	2.5	3.4		2.5	3.4		V
	$V_{CC} = 4.75$ V,	$I_{OH} = -1$ mA				2.7			
$V_{OL}$	$V_{CC} = 4.5$ V,	$I_{OL} = 20$ mA	0.3	0.5		0.3	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,	$V_I = 0.5$ V		–0.6			–0.6		mA
$I_{OS}§$	$V_{CC} = 5.5$ V,	$V_O = 0$	–60		–150	–60		–150	mA
$I_{CCH}$	$V_{CC} = 5.5$ V,	$V_I = 0$	3.7	5.6		3.7	5.6		mA
$I_{CCL}$	$V_{CC} = 5.5$ V,	See Note 2	8.7	13		8.7	13		mA

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

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

NOTE 2:  $I_{CCL}$  is measured with one input at 4.5 V and all others grounded.



# SN54F02, SN74F02

## QUADRUPLE 2-INPUT POSITIVE-NOR GATES

SDFS036A – MARCH 1987 – REVISED OCTOBER 1993

### switching characteristics (see Note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = 25°C			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
			‘F02			SN54F02		SN74F02		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	1.7	4	5.5	1.7	7.5	1.7	6.5	ns
t <sub>PHL</sub>			1	2.8	4.3	1	6.5	1	5.3	

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

NOTE 3: Load circuits and waveforms are shown in Section 1.

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">5962-9757801Q2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9757801Q2A SNJ54F 02FK
<a href="#">5962-9757801QCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801QC A SNJ54F02J
<a href="#">5962-9757801QDA</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801QD A SNJ54F02W
<a href="#">JM38510/33301B2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301B2A
JM38510/33301B2A.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301B2A
<a href="#">JM38510/33301BCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301BCA
JM38510/33301BCA.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301BCA
<a href="#">JM38510/33301BDA</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301BDA
JM38510/33301BDA.A	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301BDA
<a href="#">M38510/33301B2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301B2A
<a href="#">M38510/33301BCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301BCA
<a href="#">M38510/33301BDA</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 33301BDA
<a href="#">SN54F02J</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54F02J
SN54F02J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54F02J
<a href="#">SN74F02D</a>	Obsolete	Production	SOIC (D)   14	-	-	Call TI	Call TI	0 to 70	F02
<a href="#">SN74F02DR</a>	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	F02
SN74F02DR.A	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	F02

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN74F02DRG4	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	F02
<a href="#">SN74F02N</a>	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74F02N
SN74F02N.A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74F02N
<a href="#">SN74F02NSR</a>	Active	Production	SOP (NS)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74F02
SN74F02NSR.A	Active	Production	SOP (NS)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74F02
<a href="#">SNJ54F02FK</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801Q2A SNJ54F02FK
SNJ54F02FK.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801Q2A SNJ54F02FK
<a href="#">SNJ54F02J</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801QC A SNJ54F02J
SNJ54F02J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801QC A SNJ54F02J
<a href="#">SNJ54F02W</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801QD A SNJ54F02W
SNJ54F02W.A	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9757801QD A SNJ54F02W

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts 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.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**OTHER QUALIFIED VERSIONS OF SN54F02, SN74F02 :**

- Catalog : [SN74F02](#)
- Military : [SN54F02](#)

NOTE: Qualified Version Definitions:

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

## 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
SN74F02DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74F02NSR	SOP	NS	14	2000	330.0	16.4	8.1	10.4	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)
SN74F02DR	SOIC	D	14	2500	353.0	353.0	32.0
SN74F02NSR	SOP	NS	14	2000	353.0	353.0	32.0



**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-9757801Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-9757801QDA	W	CFP	14	25	506.98	26.16	6220	NA
JM38510/33301B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
JM38510/33301B2A.A	FK	LCCC	20	55	506.98	12.06	2030	NA
JM38510/33301BDA	W	CFP	14	25	506.98	26.16	6220	NA
JM38510/33301BDA.A	W	CFP	14	25	506.98	26.16	6220	NA
M38510/33301B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
M38510/33301BDA	W	CFP	14	25	506.98	26.16	6220	NA
SN74F02N	N	PDIP	14	25	506	13.97	11230	4.32
SN74F02N.A	N	PDIP	14	25	506	13.97	11230	4.32
SNJ54F02FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54F02FK.A	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54F02W	W	CFP	14	25	506.98	26.16	6220	NA
SNJ54F02W.A	W	CFP	14	25	506.98	26.16	6220	NA

**D0014A****PACKAGE OUTLINE****SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

**NOTES:**

1. All linear dimensions are in millimeters. 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. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.



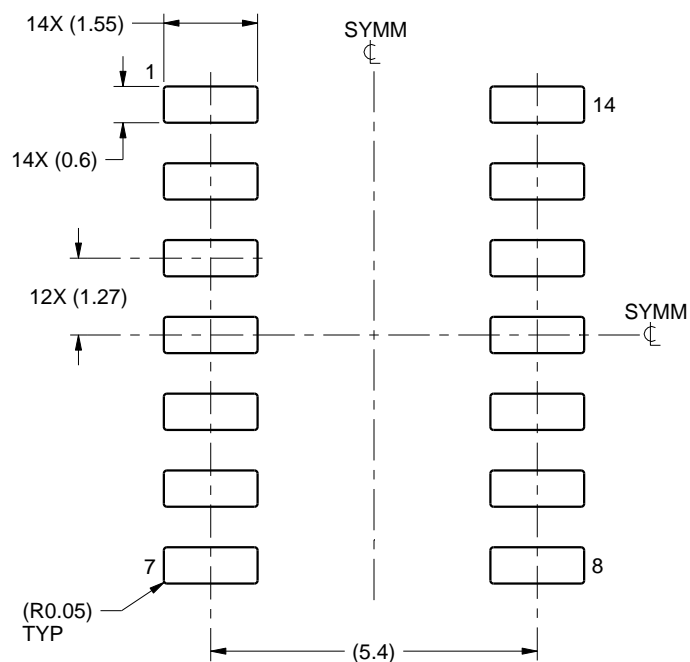
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# EXAMPLE BOARD LAYOUT

D0014A

SOIC - 1.75 mm max height

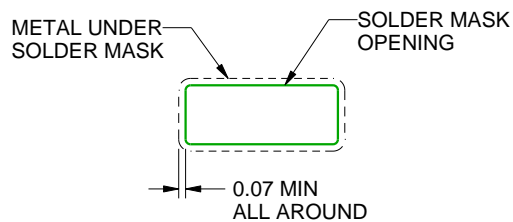
SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
SCALE:8X



NON SOLDER MASK  
DEFINED



SOLDER MASK  
DEFINED

SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

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

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

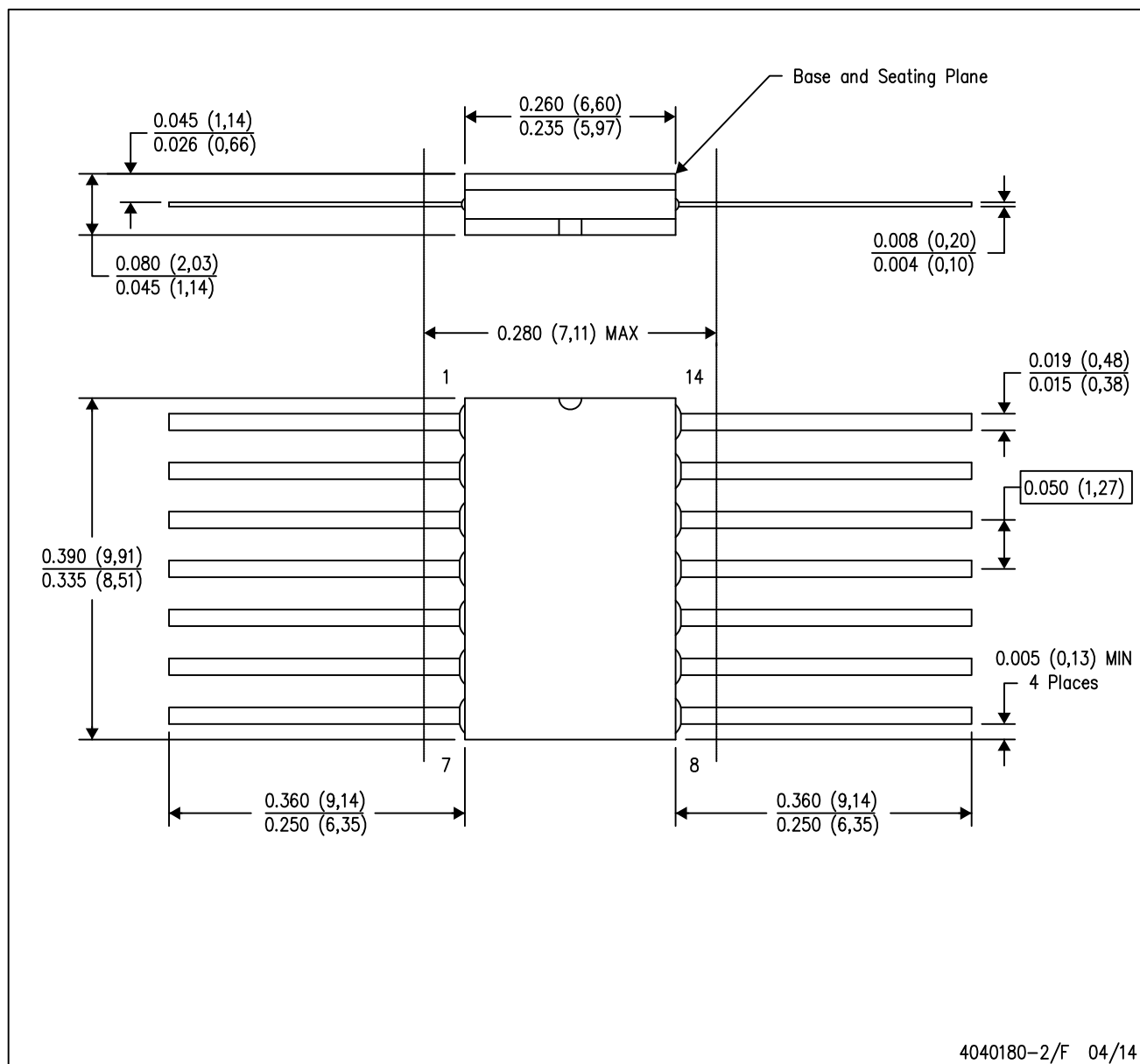
14-PINS SHOWN



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

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



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

## 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

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
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



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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