

# SN54HC4002, SN74HC4002 DUAL 4-INPUT POSITIVE-NOR GATES

SCLS157

D2684, DECEMBER 1982—REVISED SEPTEMBER 1987

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

## description

These devices contain two independent 4-input positive NOR gates. They perform the Boolean functions:

$$Y = A + B + C + D \text{ or } Y = \overline{A} \cdot \overline{B} \cdot \overline{C} \cdot \overline{D}$$

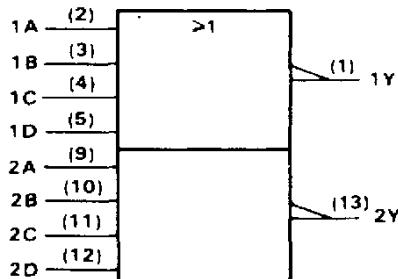
in positive logic.

The SN54HC4002 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74HC4002 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

## FUNCTION TABLE

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

## logic symbol†

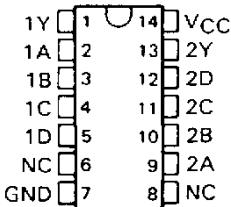


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

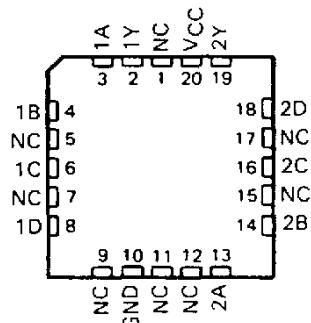
Pin numbers shown are for D, J, and N packages.

SN54HC4002 . . . J PACKAGE  
SN74HC4002 . . . D OR N PACKAGE

(TOP VIEW)

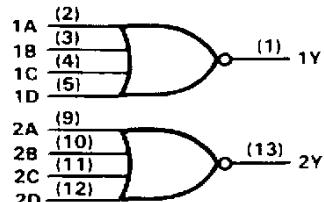


SN54HC4002 . . . FK PACKAGE  
(TOP VIEW)



NC—No internal connection

## logic diagram (positive logic)



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INSTRUMENTS

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# SN54HC4002, SN74HC4002 DUAL 4-INPUT POSITIVE-NOR GATES

## absolute maximum ratings over operating free-air temperature range<sup>†</sup>

Supply voltage range, V <sub>CC</sub> . . . . .	-0.5 V to 7 V		
Input clamp current, I <sub>IK</sub> (V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>CC</sub> ) . . . . .	±20 mA		
Output clamp current, I <sub>OK</sub> (V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> ) . . . . .	±20 mA		
Continuous output current, I <sub>O</sub> (V <sub>O</sub> = 0 to V <sub>CC</sub> ) . . . . .	±25 mA		
Continuous current through V <sub>CC</sub> or GND pins . . . . .	±50 mA		
Lead temperature 1.6 mm (1/16 in) from case for 60 s: FK or J package . . . . .	300°C		
Lead temperature 1.6 mm (1/16 in) from case for 10 s: D or N package . . . . .	260°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

		SN54HC4002			SN74HC4002			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	2	5	6	2	5	6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V V <sub>CC</sub> = 4.5 V V <sub>CC</sub> = 6 V	1.5 3.15 4.2		1.5 3.15 4.2			V
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V V <sub>CC</sub> = 4.5 V V <sub>CC</sub> = 6 V	0 0 0	0.3 0.9 1.2	0 0 0	0.3 0.9 1.2		V
V <sub>I</sub>	Input voltage		0	V <sub>CC</sub>	0	V <sub>CC</sub>		V
V <sub>O</sub>	Output voltage		0	V <sub>CC</sub>	0	V <sub>CC</sub>		V
t <sub>t</sub>	Input transition (rise and fall) times	V <sub>CC</sub> = 2 V V <sub>CC</sub> = 4.5 V V <sub>CC</sub> = 6 V	0 0 0	1000 500 400	0 0 0	1000 500 400		ns
T <sub>A</sub>	Operating free-air temperature		-55	125	-40	85		°C

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC4002		SN74HC4002		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -20 $\mu$ A	2 V 4.5 V 6 V	1.9 4.4 5.9	1.998 4.499 5.999		1.9 4.4 5.9		1.9 4.4 5.9		V
	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -4 mA	4.5 V	3.98	4.30		3.7		3.84		
	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -5.2 mA	6 V	5.48	5.80		5.2		5.34		
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 20 $\mu$ A	2 V 4.5 V 6 V	0.002 0.001 0.001	0.1 0.1 0.1		0.1 0.1 0.1		0.1 0.1 0.1		V
	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 4 mA	4.5 V	0.17	0.26		0.4		0.33		
	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 5.2 mA	6 V	0.15	0.26		0.4		0.33		
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0	6 V		±0.1	±100		±1000		±1000	nA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0	6 V			2		40		20	$\mu$ A
C <sub>i</sub>		2 to 6 V		3	10		10		10	pF

**SN54HC4002, SN74HC4002  
DUAL 4-INPUT POSITIVE-NOR GATES**

**switching characteristics over recommended operating free-air temperature range (unless otherwise noted),  $C_L = 50 \text{ pF}$  (see Note 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC4002		SN74HC4002		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A thru D	Y	2 V	44	110		165		140		ns
			4.5 V		12	22		33		28	
			6 V		11	19		28		24	
t <sub>t</sub>		Y	2 V	38	75		110		95		ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	
C <sub>pd</sub>	Power dissipation capacitance per gate			No load, T <sub>A</sub> = 25°C			25 pF typ				

Note 1: Load circuits and voltage 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)
84044012A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	84044012A SNJ54HC 4002FK
8404401CA	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8404401CA SNJ54HC4002J
JM38510/65104BCA	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 65104BCA
JM38510/65104BCA.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 65104BCA
M38510/65104BCA	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 65104BCA
SN54HC4002J	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54HC4002J
SN54HC4002J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54HC4002J
SNJ54HC4002FK	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	84044012A SNJ54HC 4002FK
SNJ54HC4002FK.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	84044012A SNJ54HC 4002FK
SNJ54HC4002J	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8404401CA SNJ54HC4002J
SNJ54HC4002J.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8404401CA SNJ54HC4002J

<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.

**(4) 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.

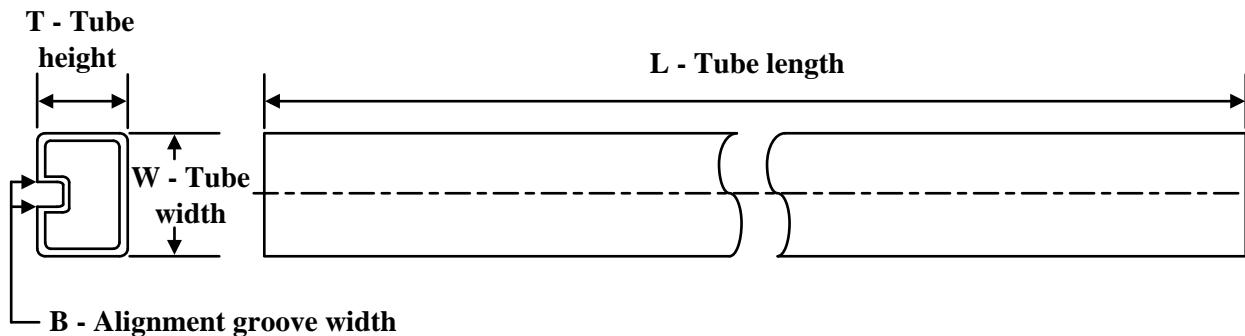
**(5) MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

**(6) 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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**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
84044012A	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54HC4002FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54HC4002FK.A	FK	LCCC	20	55	506.98	12.06	2030	NA

# GENERIC PACKAGE VIEW

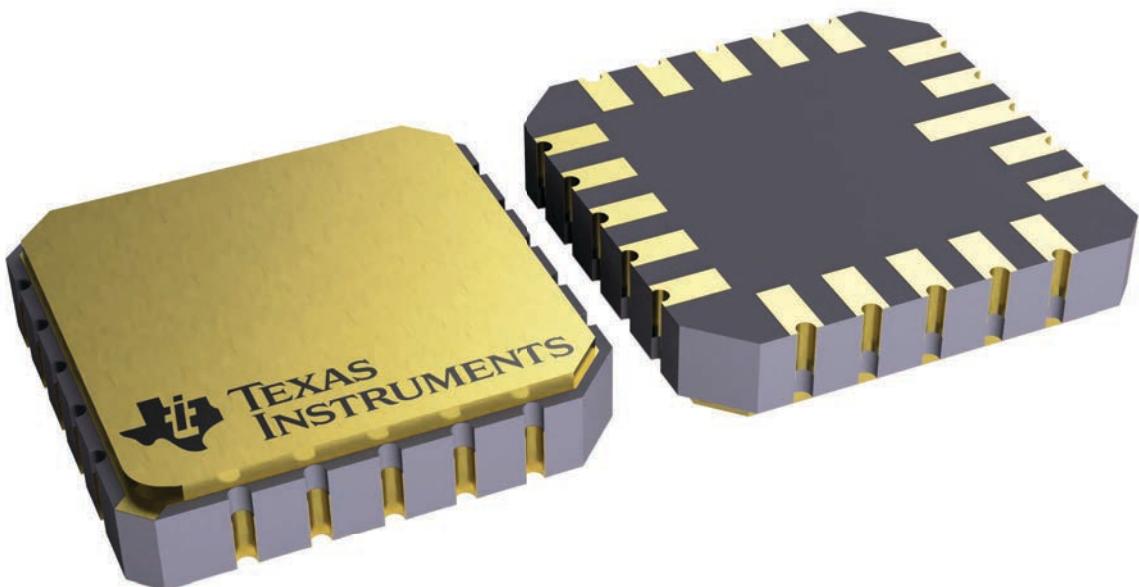
**FK 20**

**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.



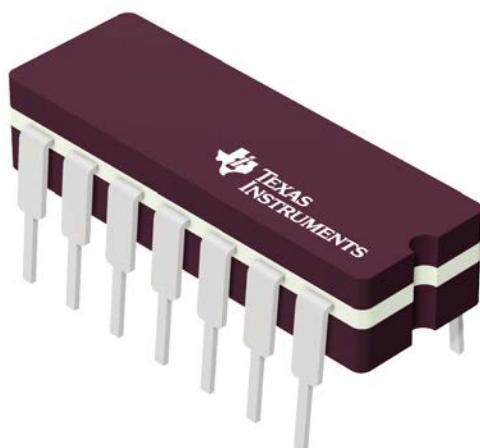
4229370VA\

# GENERIC PACKAGE VIEW

**J 14**

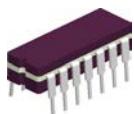
**CDIP - 5.08 mm max height**

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

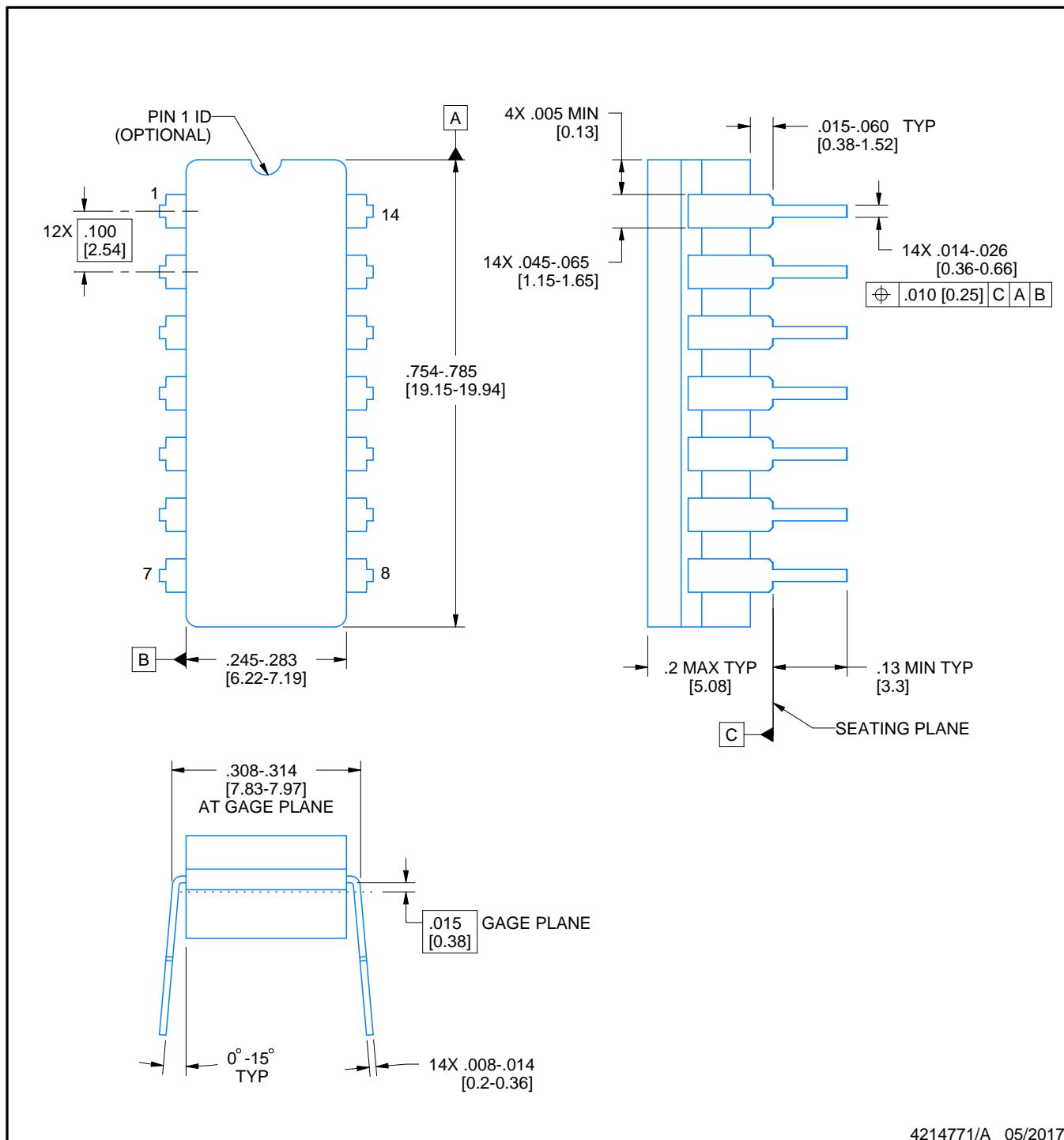


# PACKAGE OUTLINE

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



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## NOTES:

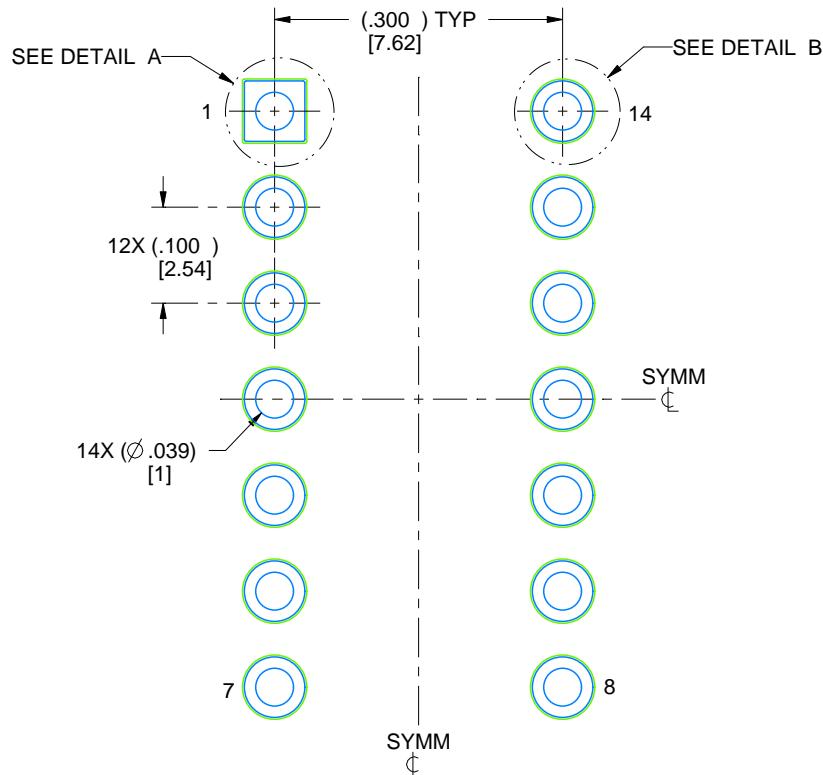
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with 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

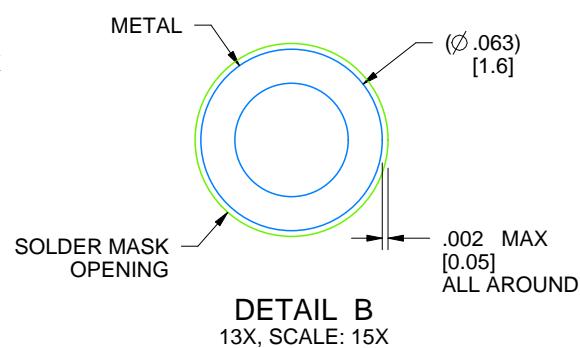
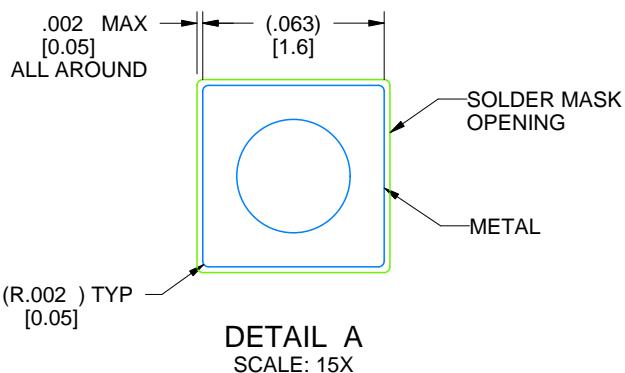
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE  
NON-SOLDER MASK DEFINED  
SCALE: 5X



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