

CD4011UB Types

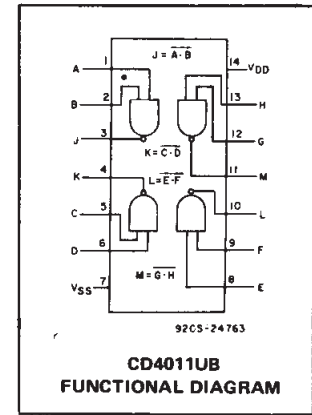
CMOS Quad 2-Input NAND Gate High-Voltage Types (20-Volt Rating)

■ CD4011UB quad 2-input NAND gate provides the system designer with direct implementation of the NAND function and supplements the existing family of CMOS gates.

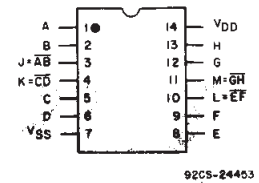
The CD4011UB types are supplied in 14-lead hermetic dual-in-line ceramic packages (F3A suffix), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline packages (M, MT, M96, and NSR suffixes), and 14-lead thin shrink small-outline packages (PW and PWR suffixes).

Features:

- Propagation delay time = 30 ns (typ.) at $C_L = 50$ pF, $V_{DD} = 10$ V
- Standardized symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1 μ A at 18 V over full package temperature range; 100 nA at 18 V and 25°C
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"



TERMINAL ASSIGNMENT



**TOP VIEW
CD4011UB**

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})	.....	-0.5V to +20V
Voltages referenced to V_{SS} Terminal	.....
INPUT VOLTAGE RANGE, ALL INPUTS	.....	-0.5V to $V_{DD} + 0.5$ V
DC INPUT CURRENT, ANY ONE INPUT	± 10 mA
POWER DISSIPATION PER PACKAGE (P_D):	.....
For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$	.....	500 mW
For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$	.....	Derate Linearly at 12 mW/°C to 200 mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR	.....
FOR $T_A =$ FULL PACKAGE-TEMPERATURE RANGE (All Package Types)	.....	100 mW
OPERATING-TEMPERATURE RANGE (T_A)	.....	-55°C to $+125^\circ\text{C}$
STORAGE TEMPERATURE RANGE (T_{stg})	.....	-65°C to $+150^\circ\text{C}$
LEAD TEMPERATURE (DURING SOLDERING):	.....
At distance $1/16 \pm 1/32$ inch (1.59 ± 0.79 mm) from case for 10s max	.....	$+265^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges.

CHARACTERISTIC	MIN.	MAX.	UNITS
Supply Voltage Range (For $T_A =$ Full Package Temperature Range)	3	18	V

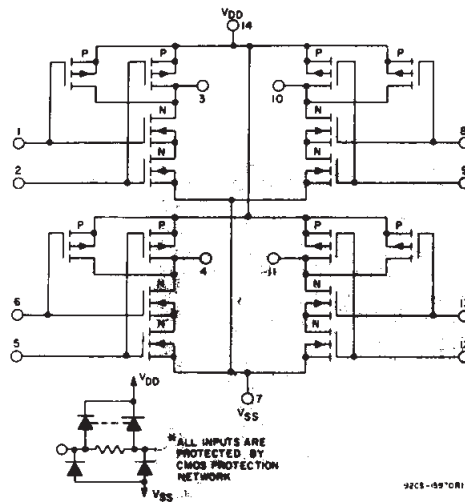


Fig. 1 - Schematic diagram for type CD4011UB.

CD4011UB Types

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)					+25			
				-55	-40	+85	+125	Min.	Typ.	Max.	
Quiescent Device Current, I _{DD} Max.	-	0,5	5	0.25	0.25	7.5	7.5	-	0.01	0.25	μA
	-	0,10	10	0.5	0.5	15	15	-	0.01	0.5	
	-	0,15	15	1	1	30	30	-	0.01	1	
	-	0,20	20	5	5	150	150	-	0.02	5	
Output Low (Sink) Current I _{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	-	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	-	
	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	-	
Output High (Source) Current, I _{OH} Min.	4.6	0,5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	-	mA
	2.5	0,5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2	-	
	9.5	0,10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	-	
Output Voltage: Low-Level, V _{OL} Max.	-	0,5	5	0.05				-	0	0.05	V
	-	0,10	10	0.05				-	0	0.05	
	-	0,15	15	0.05				-	0	0.05	
Output Voltage: High-Level, V _{OH} Min.	-	0,5	5	4.95				4.95	5	-	V
	-	0,10	10	9.95				9.95	10	-	
	-	0,15	15	14.95				14.95	15	-	
Input Low Voltage, V _{IL} Max.	4.5	-	5	1				-	-	1	V
	9	-	10	2				-	-	2	
	13.5	-	15	2.5				-	-	2.5	
Input High Voltage, V _{IH} Min.	0.5,4.5	-	5	4				4	-	-	V
	1,9	-	10	8				8	-	-	
	1.5,13.5	-	15	12.5				12.5	-	-	
Input Current I _{IN} Max.		0,18	18	±0.1	±0.1	±1	±1	-	±10 ⁻⁵	±0.1	μA

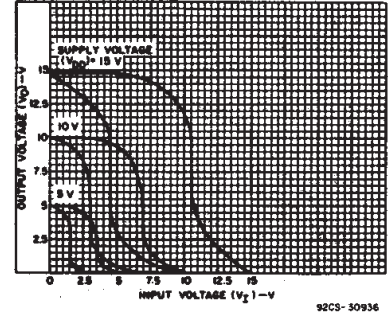


Fig. 2 - Minimum and maximum voltage transfer characteristics.

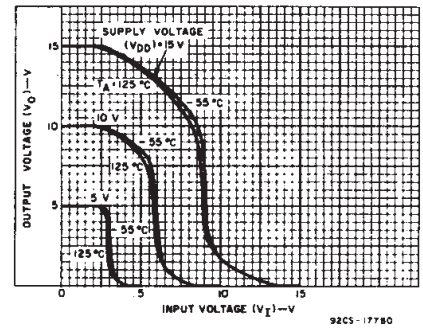


Fig. 3 - Typical voltage transfer characteristics as a function of temperature.

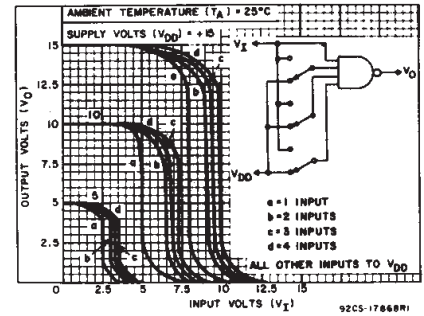


Fig. 4 - Typical multiple input switching transfer characteristics for CD4012UB.

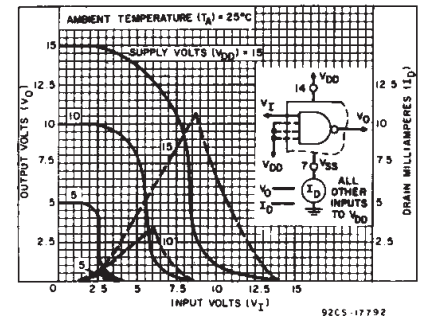


Fig. 5 - Typical current and voltage transfer characteristics.

DYNAMIC ELECTRICAL CHARACTERISTICS

At $T_A = 25^\circ\text{C}$, Input $t_p, t_f = 20\text{ ns}$, and $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS	
		V _{DD} VOLTS	TYP.		MAX
Propagation Delay Time, t_{PHL}, t_{PLH}		5	60	120	ns
		10	30	60	
		15	25	50	
Transition Time, t_{THL}, t_{TLH}		5	100	200	ns
		10	50	100	
		15	40	80	
Input Capacitance, C _{IN}	Any Input		10	15	pF

CD4011UB Types

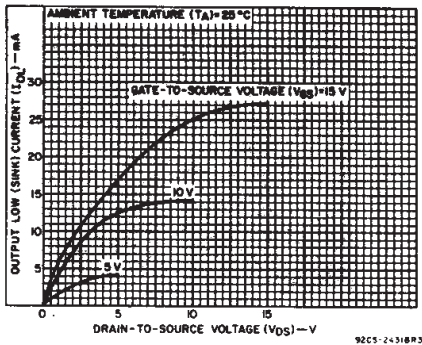


Fig. 6 - Typical output low (sink) current characteristics.

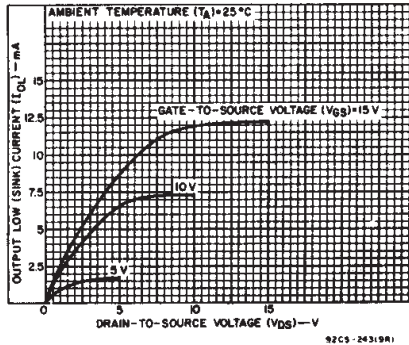


Fig. 7 - Minimum output low (sink) current characteristics.

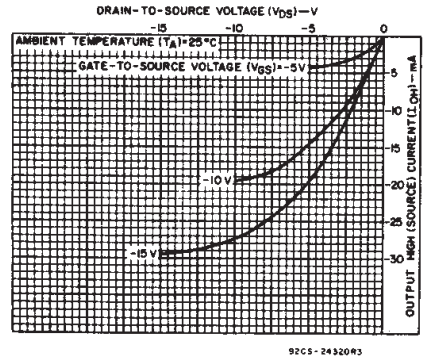


Fig. 8 - Typical output high (source) current characteristics.

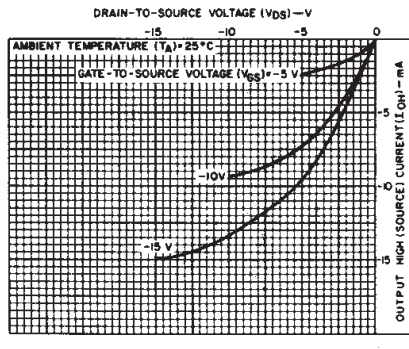


Fig. 9 - Minimum output high (source) current characteristics.

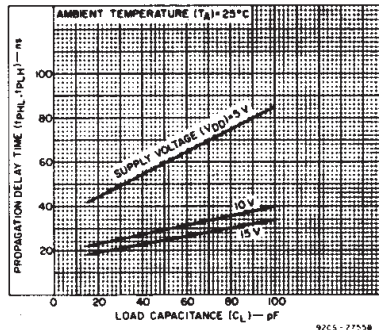


Fig. 10 - Typical propagation delay time vs. load capacitance.

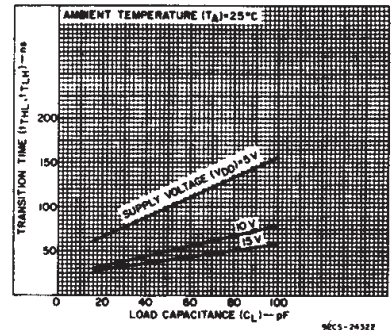


Fig. 11 - Typical transition time vs. load capacitance.

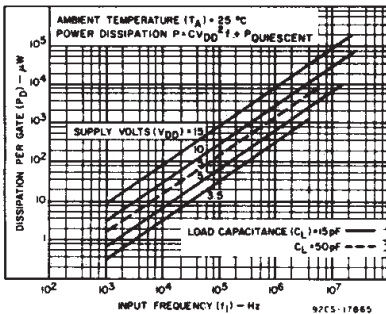


Fig. 12 - Typical power dissipation vs. frequency characteristics.

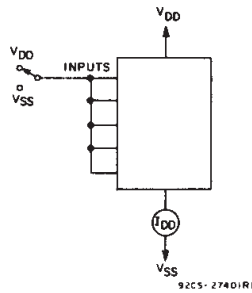


Fig. 13 - Quiescent device current test circuit.

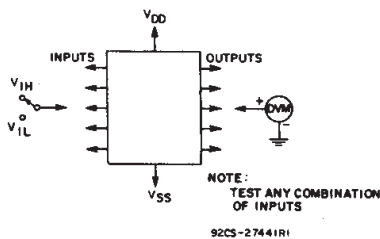


Fig. 14 - Input voltage test circuit.

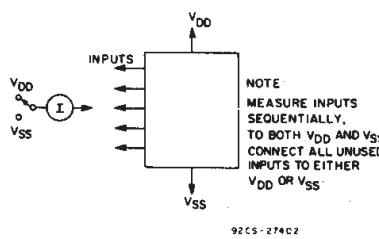
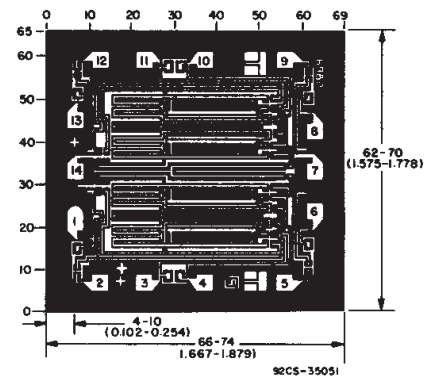


Fig. 15 - Input current test circuit.

Chip Dimensions and Pad Layout



CD4011UBH

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

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
CD4011UBE	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD4011UBE	Samples
CD4011UBEE4	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD4011UBE	Samples
CD4011UBF	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	CD4011UBF	Samples
CD4011UBM	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-55 to 125	CD4011UBM	
CD4011UBM96	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4011UBM	Samples
CD4011UBMT	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-55 to 125	CD4011UBM	
CD4011UBNSR	ACTIVE	SOP	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4011UB	Samples
CD4011UBPWR	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM011UB	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.

OBSOLETE: 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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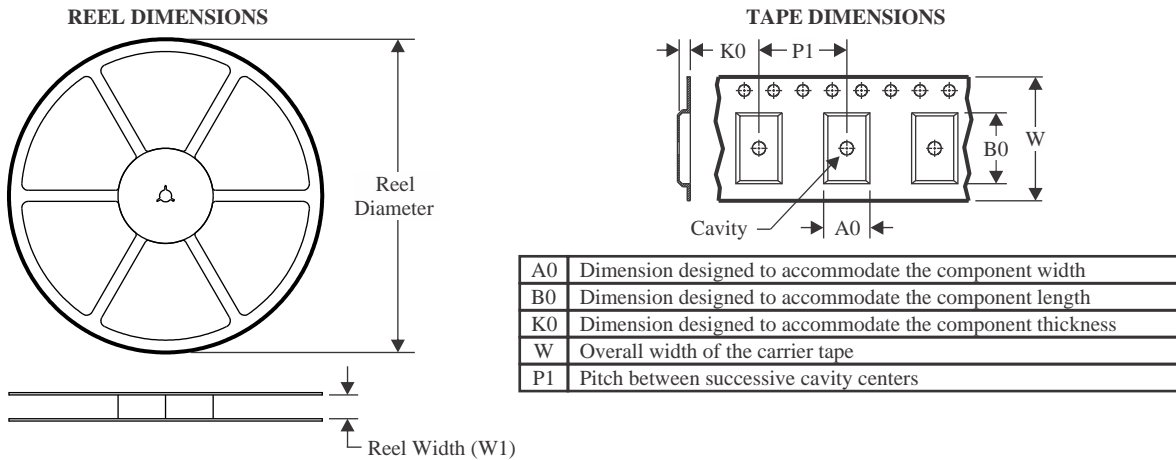
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OTHER QUALIFIED VERSIONS OF CD4011UB, CD4011UB-MIL :

- Catalog : [CD4011UB](#)
- Military : [CD4011UB-MIL](#)

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
CD4011UBM96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD4011UBNSR	SOP	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
CD4011UBPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4011UBM96	SOIC	D	14	2500	356.0	356.0	35.0
CD4011UBNSR	SOP	NS	14	2000	356.0	356.0	35.0
CD4011UBPWR	TSSOP	PW	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)
CD4011UBE	N	PDIP	14	25	506	13.97	11230	4.32
CD4011UBE	N	PDIP	14	25	506	13.97	11230	4.32
CD4011UBEE4	N	PDIP	14	25	506	13.97	11230	4.32
CD4011UBEE4	N	PDIP	14	25	506	13.97	11230	4.32

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.

EXAMPLE BOARD LAYOUT

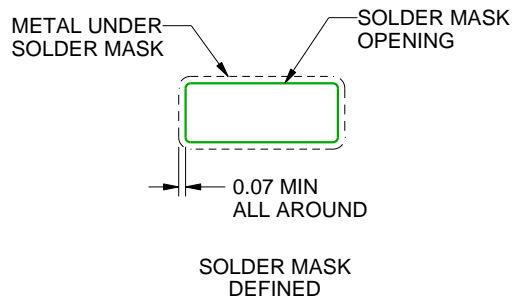
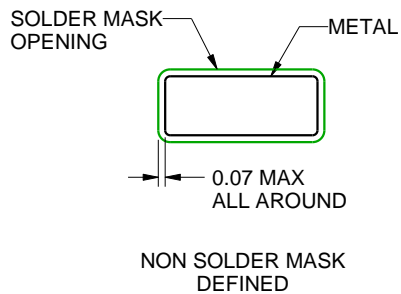
D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
SCALE:8X



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:
- 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.

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

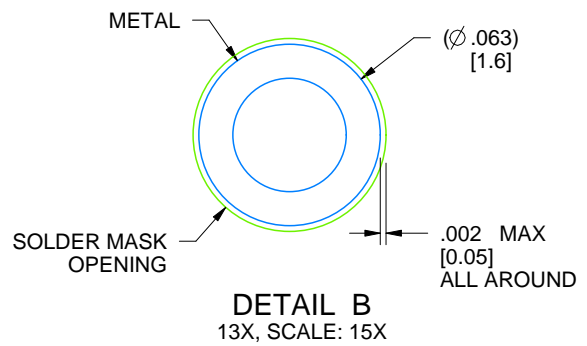
J0014A

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**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

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



4220202/B 12/2023

NOTES:

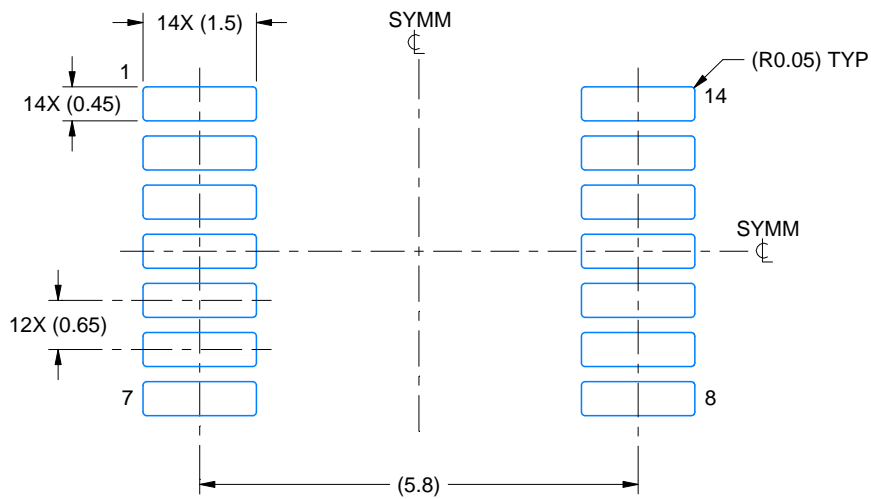
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220202/B 12/2023

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

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220202/B 12/2023

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.

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