

CD4007UB Types

CMOS Dual Complementary Pair Plus Inverter

High-Voltage Types (20-Volt Rating)

■ CD4007UB types are comprised of three n-channel and three p-channel enhancement-type MOS transistors. The transistor elements are accessible through the package terminals to provide a convenient means for constructing the various typical circuits as shown in Fig. 2.

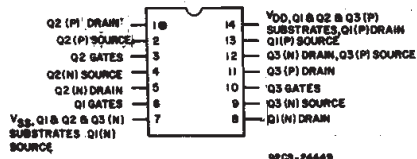
More complex functions are possible using multiple packages. Numbers shown in parentheses indicate terminals that are connected together to form the various configurations listed.

The CD4007UB 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).

Applications:

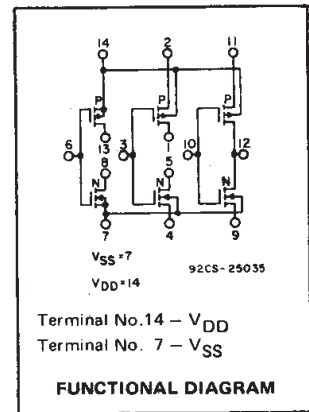
- Extremely high-input impedance amplifiers
- Shapers
- Inverters
- Threshold detector
- Linear amplifiers
- Crystal oscillators

TERMINAL DIAGRAM Top View



Features:

- Standardized symmetrical output characteristics
- Medium Speed Operation – t_{PHL} , $t_{PLH} = 30$ ns (typ.) at 10 V
- 100% tested for quiescent current at 20 V
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"
- Maximum input current of $1 \mu\text{A}$ at 18 V over full package-temperature range; 100 nA at 18 V and 25°C



RECOMMENDED OPERATING CONDITIONS

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

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

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES ($^\circ\text{C}$)							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	–	
	13,5	0,15	15	-4,2	-4	-2,8	-2,4	-3,4	-6,8	–	
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	–	5	4				4	–	–	V
	1	–	10	8				8	–	–	
	1,5	–	15	12,5				12,5	–	–	
Input Current I_{IN} Max.		0,18	18	$\pm 0,1$	$\pm 0,1$	± 1	± 1	–	$\pm 10^{-5}$	$\pm 0,1$	μA

CD4007UB Types

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})

Voltages referenced to V_{SS} Terminal -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS

..... -0.5V to V_{DD} +0.5V

DC INPUT CURRENT, ANY ONE INPUT

..... ±10mA

POWER DISSIPATION PER PACKAGE (P_D):

For T_A = -55°C to +100°C 500mW

For T_A = +100°C to +125°C Derate Linearly at 12mW/°C to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW

OPERATING-TEMPERATURE RANGE (T_A)

..... -55°C to +125°C

STORAGE TEMPERATURE RANGE (T_{stg})

..... -65°C to +150°C

LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max +265°C

DYNAMIC ELECTRICAL CHARACTERISTICS at T_A = 25°C; Input t_r, t_f = 20 ns, C_L = 50 pF, R_L = 200 KΩ

CHARACTERISTIC	CONDITIONS	LIMITS		UNITS	
		V _{DD} Volts	Typ.		Max.
Propagation Delay Time:	t _{PHL} , t _{PLH}	5	55	110	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

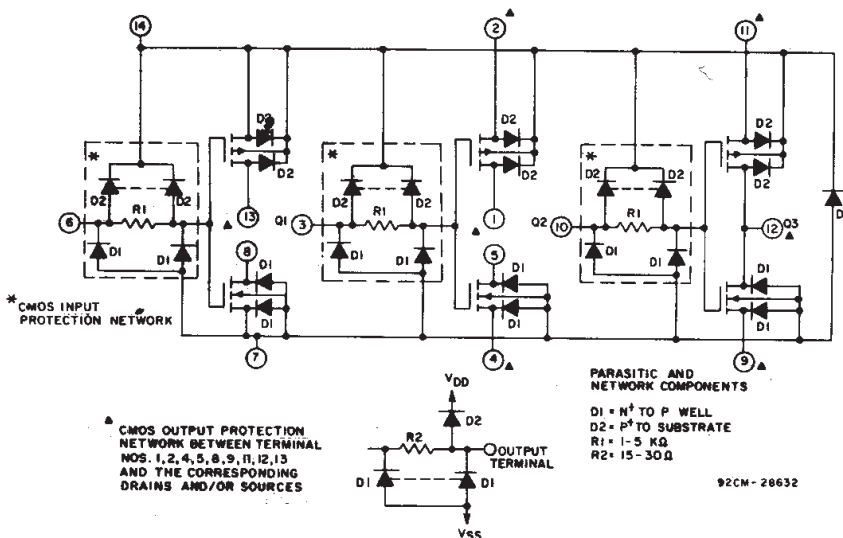
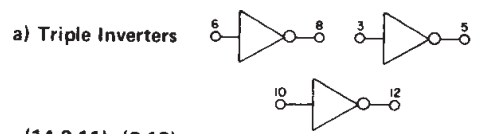
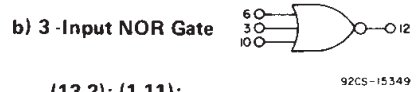


Fig. 1 — Detailed schematic diagram of CD4007UB showing input, output, and parasitic diodes.



(14,2,11); (8,13);
(1,5); (7,4,9)

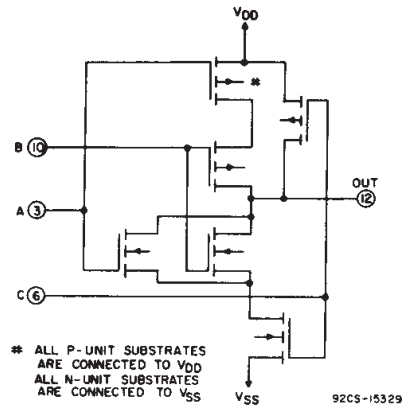


(13,2); (1,11);
(12,5,8); (7,4,9)



(1,12,13); (2,14,11);
(4,8); (5,9)

d) Tree (Relay) Logic



(13,12,5); (4,9,8);
(14,2); (1,11)

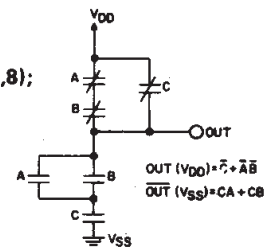
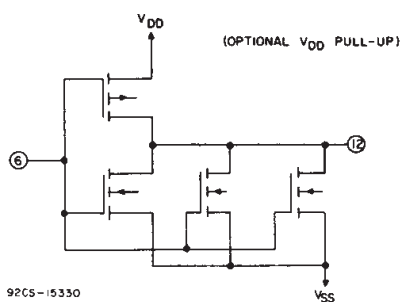


Fig. 2 — Sample CMOS logic circuit arrangements using type CD4007UB.

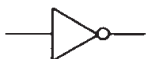
3
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CD4007UB Types

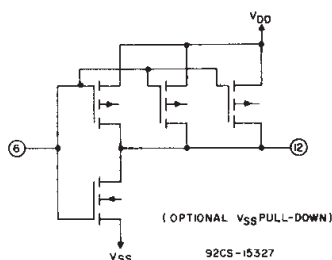
e) High Sink-Current Driver



(6,3,10); (8.5, 12);
(11,14); (7,4,9)



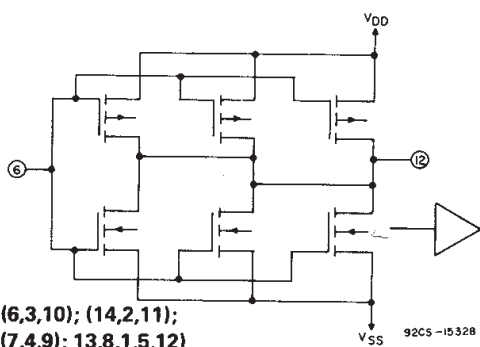
f) High Source-Current Driver



(6,3,10); (13,1,12);
(14,2,11); (7,9)

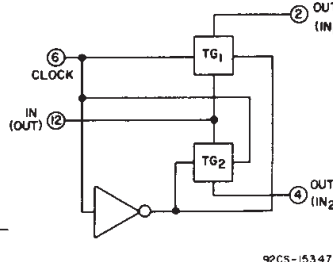


g) High Sink - and Source-Current Driver



(6,3,10); (14,2,11);
(7,4,9); (13,8,1,5,12)

h) Dual Bi-Directional Transmission Gating



(1,5,12); (2,9);
(11,4); (8,13,10);
(6,3)

Fig. 2 - Sample CMOS logic circuit arrangements using type CD4007UB (Cont'd).

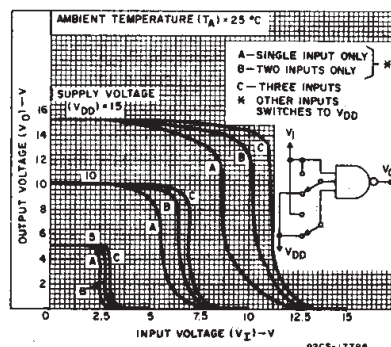


Fig. 3 - Typical voltage-transfer characteristics for NAND gate.

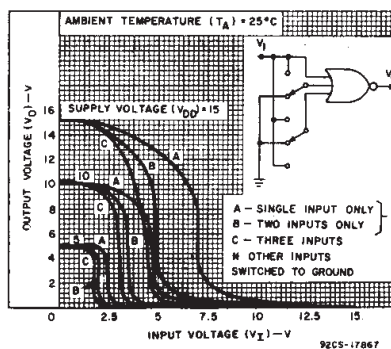


Fig. 4 - Typical voltage-transfer characteristics for NOR gate.

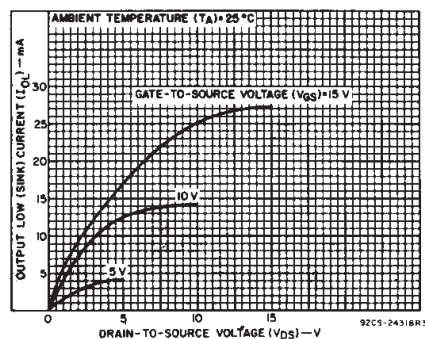


Fig. 5 - Typical output low (sink) current characteristics.

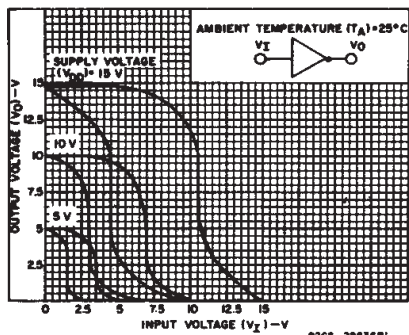


Fig. 6 - Minimum and maximum voltage-transfer characteristics for inverter.

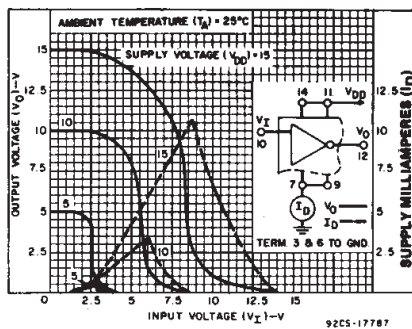


Fig. 7 - Typical current and voltage-transfer characteristics for inverter.

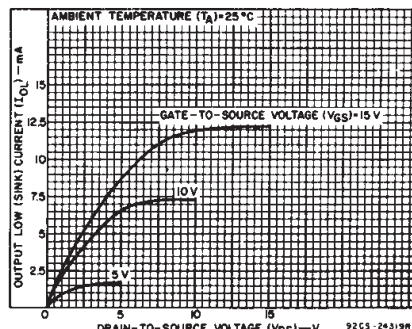


Fig. 8 - Minimum output low (sink) current characteristics.

CD4007UB Types

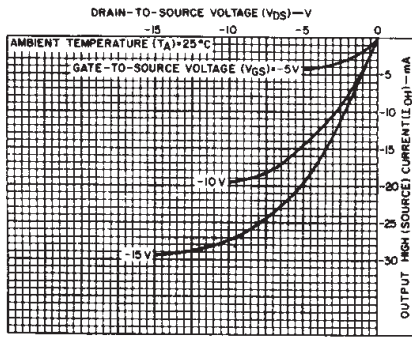


Fig. 9 - Typical output high (source) current characteristics.

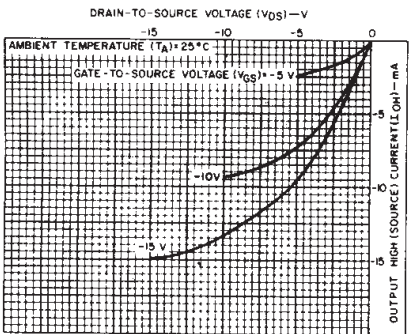


Fig. 10 - Minimum output high (source) current characteristics.

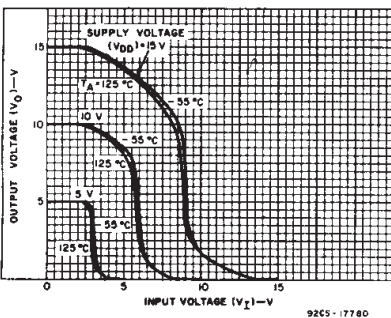


Fig. 11 - Typical voltage-transfer characteristics as a function of temperature.

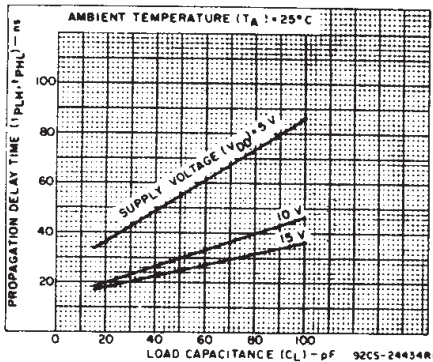


Fig. 12 - Typical propagation delay time vs. load capacitance.

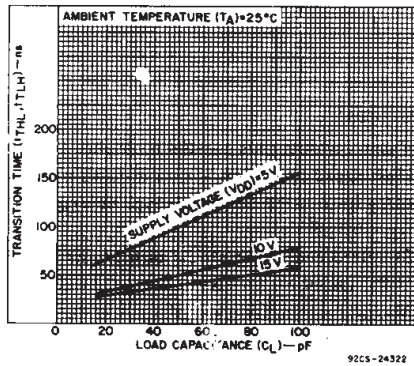


Fig. 13 - Typical transition time vs. load capacitance.

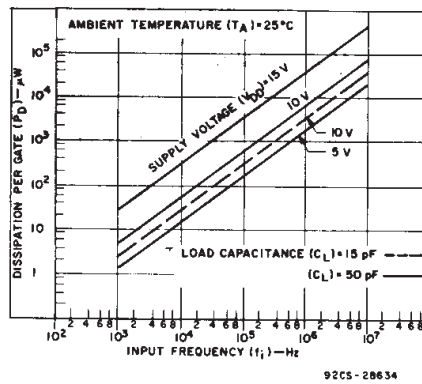


Fig. 14 - Typical dissipation vs. frequency characteristics.

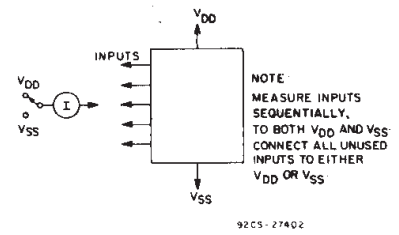


Fig. 15 - Input current test circuit.

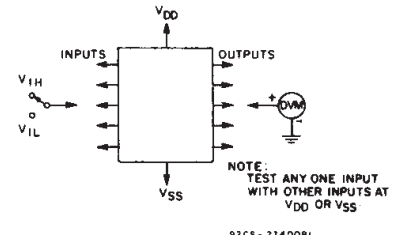


Fig. 16 - Input voltage test circuit.

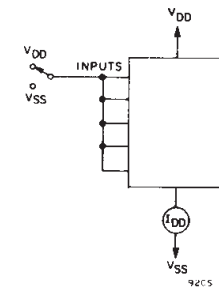
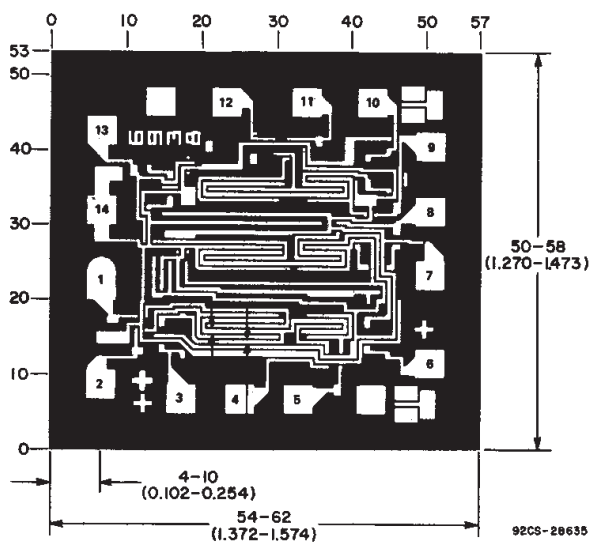


Fig. 17 - Quiescent device current test circuit.



DIMENSIONS AND PAD LAYOUT FOR CD4007UBH

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

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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)
CD4007UBE	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4007UBE
CD4007UBE.A	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4007UBE
CD4007UBEE4	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4007UBE
CD4007UBF	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4007UBF
CD4007UBF.A	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4007UBF
CD4007UBF3A	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4007UBF3A
CD4007UBF3A.A	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4007UBF3A
CD4007UBM	Obsolete	Production	SOIC (D) 14	-	-	Call TI	Call TI	-55 to 125	CD4007UBM
CD4007UBM96	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4007UBM
CD4007UBM96.A	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4007UBM
CD4007UBMT	Obsolete	Production	SOIC (D) 14	-	-	Call TI	Call TI	-55 to 125	CD4007UBM
CD4007UBNSR	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4007UB
CD4007UBNSR.A	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4007UB
CD4007UBPW	Obsolete	Production	TSSOP (PW) 14	-	-	Call TI	Call TI	-55 to 125	CM007UB
CD4007UBPWR	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM007UB
CD4007UBPWR.A	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM007UB

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

(2) **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.

(3) **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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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF CD4007UB, CD4007UB-MIL :

- Catalog : [CD4007UB](#)
- Military : [CD4007UB-MIL](#)

NOTE: Qualified Version Definitions:

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

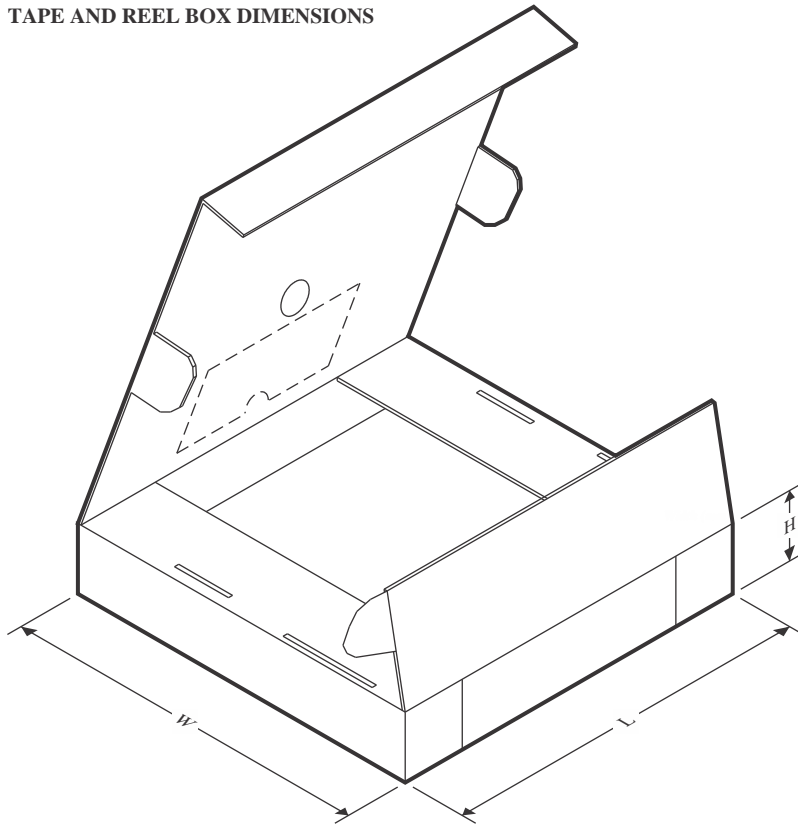
TAPE AND REEL INFORMATION

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
CD4007UBM96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD4007UBNSR	SOP	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
CD4007UBPWR	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)
CD4007UBM96	SOIC	D	14	2500	356.0	356.0	35.0
CD4007UBNSR	SOP	NS	14	2000	356.0	356.0	35.0
CD4007UBPWR	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)
CD4007UBE	N	PDIP	14	25	506	13.97	11230	4.32
CD4007UBE	N	PDIP	14	25	506	13.97	11230	4.32
CD4007UBE.A	N	PDIP	14	25	506	13.97	11230	4.32
CD4007UBE.A	N	PDIP	14	25	506	13.97	11230	4.32
CD4007UBEE4	N	PDIP	14	25	506	13.97	11230	4.32
CD4007UBEE4	N	PDIP	14	25	506	13.97	11230	4.32

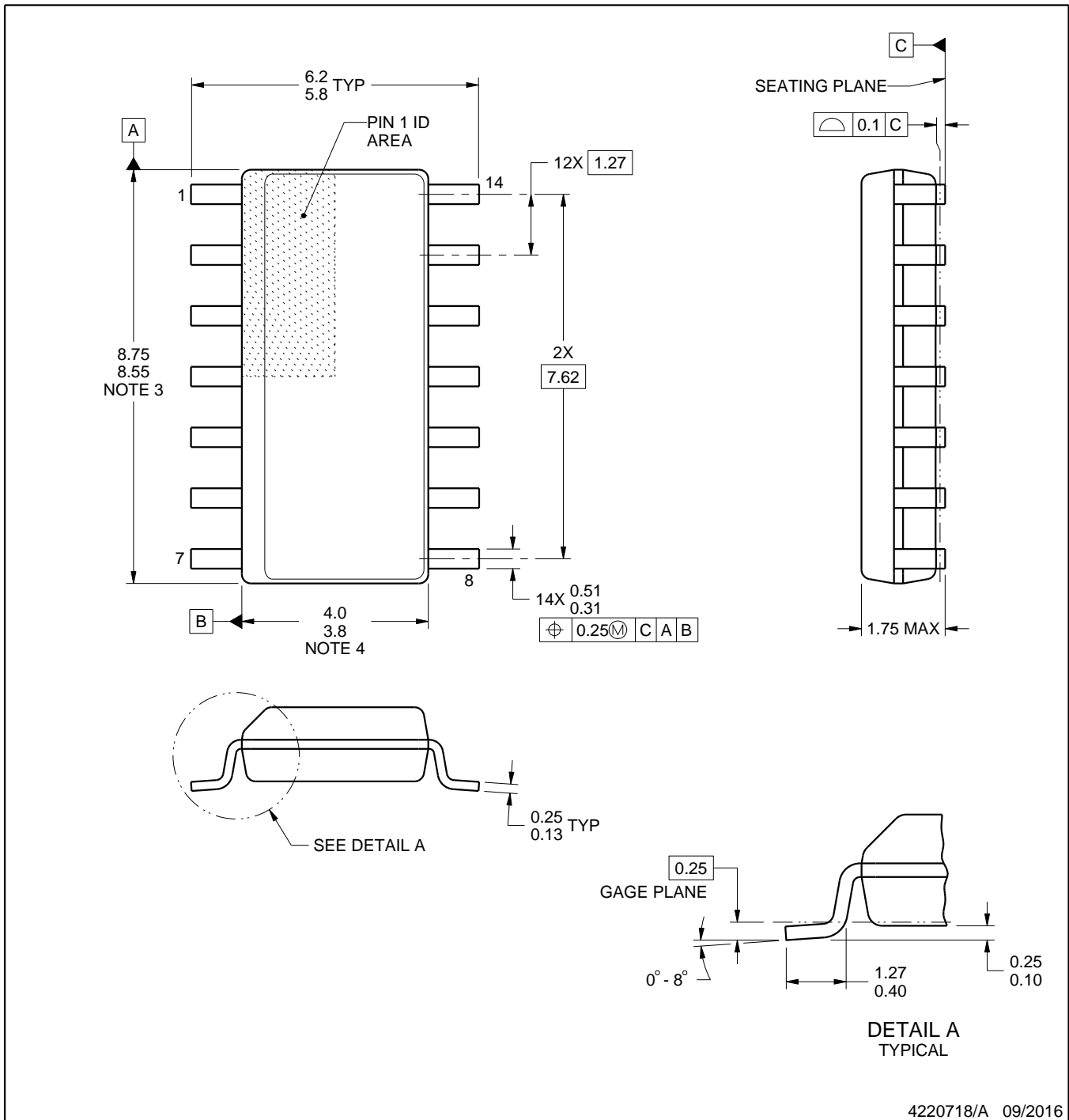
D0014A



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

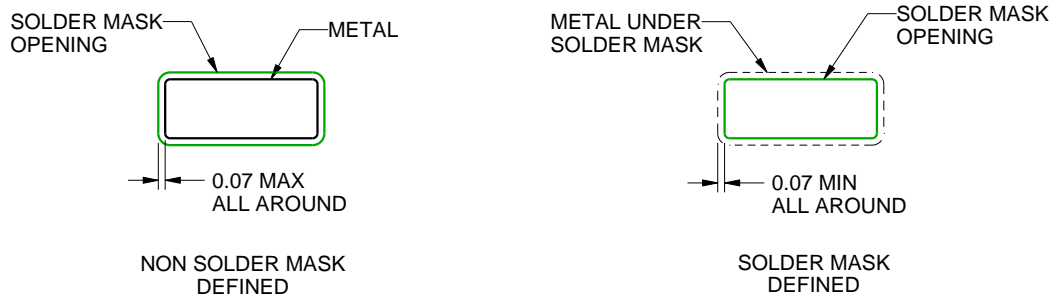
D0014A

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.

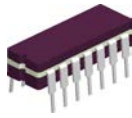
J 14

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



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N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



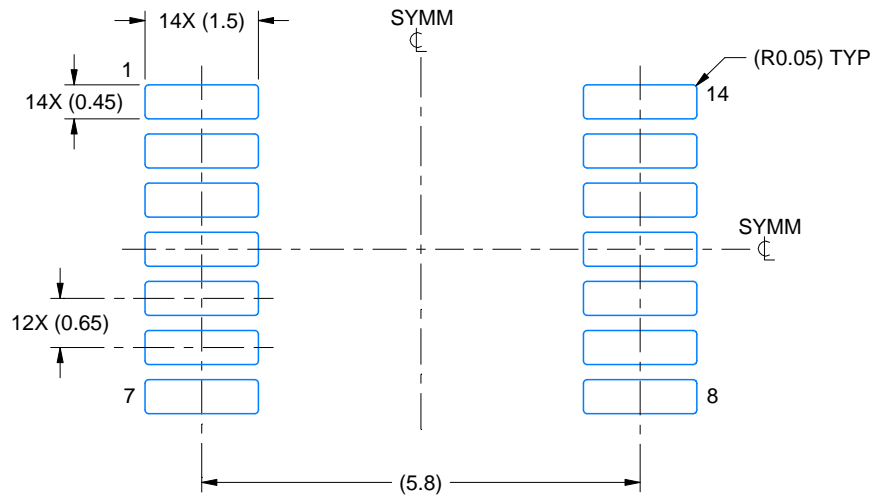
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

EXAMPLE BOARD LAYOUT

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



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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

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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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