

# CD4001B, CD4002B, CD4025B Types

## CMOS NOR Gates

High-Voltage Types (20-Volt Rating)

Quad 2 Input – CD4001B  
Dual 4 Input – CD4002B  
Triple 3 Input – CD4025B

■ CD4001B, CD4002B, and CD4025B NOR gates provide the system designer with direct implementation of the NOR function and supplement the existing family of CMOS gates. All inputs and outputs are buffered.

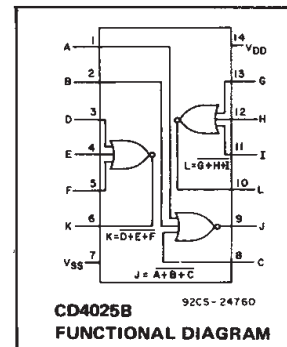
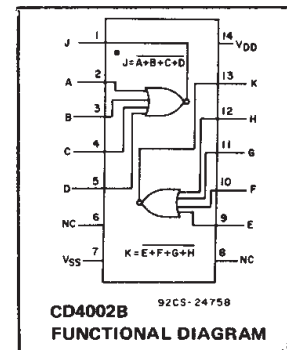
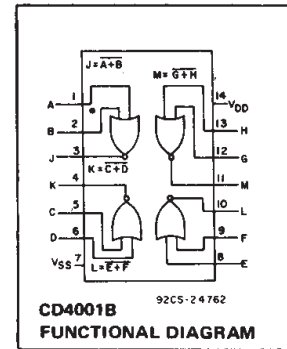
The CD4001B, CD4002B, and CD4025B types are supplied in 14-lead hermetic dual-in-line ceramic packages (F3A suffix), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline packages (M, MT, M96, and NSR suffixes), and 14-lead thin shrink small-outline packages (PW and PWR suffixes).

### Features:

- Propagation delay time = 60 ns (typ.) at  $C_L = 50 \text{ pF}$ ,  $V_{DD} = 10 \text{ V}$
- Buffered inputs and outputs
- Standardized symmetrical output characteristics
- 100% tested for maximum quiescent current at 20 V
- 5-V, 10-V, and 15-V parametric ratings
- Maximum input current of  $1 \mu\text{A}$  at 18 V over full package-temperature range;  $100 \text{ nA}$  at 18 V and  $25^\circ\text{C}$
- Noise margin (over full package temperature range):
  - 1 V at  $V_{DD} = 5 \text{ V}$
  - 2 V at  $V_{DD} = 10 \text{ V}$
  - 2.5 V at  $V_{DD} = 15 \text{ V}$
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of "B" Series CMOS Devices"

### STATIC ELECTRICAL CHARACTERISTICS

CHARACTER- ISTIC	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, $I_{DD} \text{ Max.}$	–	0,5	5	0,25	0,25	7,5	7,5	–	0,01	0,25	$\mu\text{A}$
	–	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 $I_{OL} \text{ Min.}$	0,4	0,5	5	0,64	0,61	0,42	0,36	0,51	1	–	$\text{mA}$
	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	–	
	–	0,20	20	5	5	150	150	–	0,02	5	
Output High (Source) Current, $I_{OH} \text{ Min.}$	4,6	0,5	5	-0,64	-0,61	-0,42	-0,36	-0,51	-1	–	$\text{mA}$
	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, $V_{OL} \text{ Max.}$	–	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, $V_{OH} \text{ Min.}$	–	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, $V_{IL} \text{ Max.}$	0,5,4,5	–	5	1,5				–	–	1,5	V
	1,9	–	10	3				–	–	3	
	1,5,13,5	–	15	4				–	–	4	
Input High Voltage, $V_{IH} \text{ Min.}$	0,5	–	5	3,5				3,5	–	–	V
	1	–	10	7				7	–	–	
	1,5	–	15	11				11	–	–	
Input Current $I_{IN} \text{ Max.}$		0,18	18	$\pm 0,1$	$\pm 0,1$	$\pm 1$	$\pm 1$	–	$\pm 10^{-5}$	$\pm 0,1$	$\mu\text{A}$



3  
COMMERCIAL CMOS  
HIGH VOLTAGE ICs

# CD4001B, CD4002B, CD4025B Types

## 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

## 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

.....  $\pm 10$ mA

### POWER DISSIPATION PER PACKAGE ( $P_D$ ):

For  $T_A = -55^\circ\text{C}$  to  $+100^\circ\text{C}$  ..... 500mW

For  $T_A = +100^\circ\text{C}$  to  $+125^\circ\text{C}$  ..... Derate Linearly at 12mW/ $^\circ\text{C}$  to 200mW

### DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR  $T_A = \text{FULL PACKAGE-TEMPERATURE RANGE (All Package Types)}$  ..... 100mW

### OPERATING-TEMPERATURE RANGE ( $T_A$ )

.....  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$

### STORAGE TEMPERATURE RANGE ( $T_{stg}$ )

.....  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$

### LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16  $\pm$  1/32 inch (1.59  $\pm$  0.79mm) from case for 10s max .....  $+265^\circ\text{C}$

## DYNAMIC ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	TEST CONDITIONS	ALL TYPES LIMITS		UNITS	
		$V_{DD}$ VOLTS	TYP.		MAX.
Propagation Delay Time, $t_{PHL}, t_{PLH}$		5	125	250	ns
		10	60	120	
		15	45	90	
Transition Time, $t_{THL}, t_{TLH}$		5	100	200	ns
		10	50	100	
		15	40	80	
Input Capacitance, $C_{IN}$	Any Input		5	7.5	pF

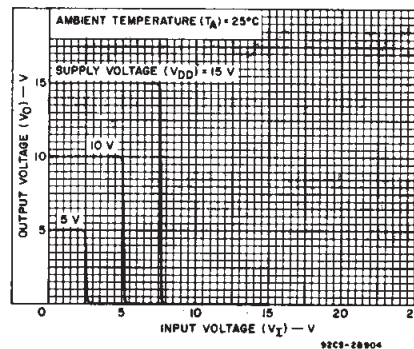


Fig. 1 - Typical voltage transfer characteristics.

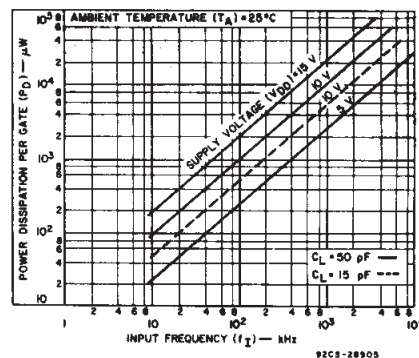


Fig. 2 - Typical power dissipation vs. frequency.

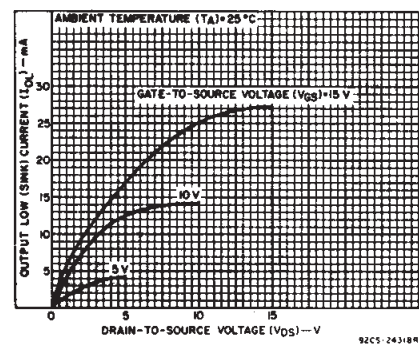


Fig. 3 - Typical output low (sink) current characteristics.

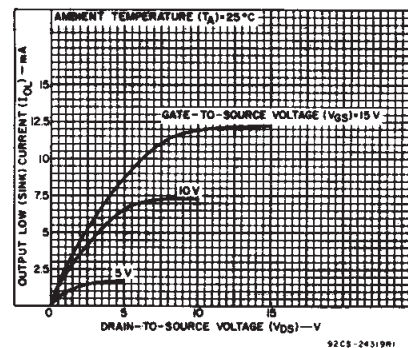


Fig. 4 - Minimum output low (sink) current characteristics.

**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>
7704403CA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
89263AKB3T	OBSOLETE	CFP	WR	16		TBD	Call TI	Call TI
CD4001BE	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD4001BF	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
CD4001BF3A	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
CD4001BM	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4001BM96	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4001BMT	ACTIVE	SOIC	D	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4001BNSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4001BPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4001BPWE4	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4001BPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4001BPWRE4	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4002BE	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD4002BF	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
CD4002BF3A	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
CD4002BM	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4002BM96	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4002BMT	ACTIVE	SOIC	D	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4002BNSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4002BPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4002BPWE4	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4002BPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4002BPWRE4	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4025BE	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD4025BF	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
CD4025BF3A	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
CD4025BM	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-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>
CD4025BM96	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4025BMT	ACTIVE	SOIC	D	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4025BNSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4025BPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4025BPWE4	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4025BPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4025BPWRE4	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
JM38510/05252BCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
JM38510/05254BCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC

<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) 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.

**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.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.