

# CD4000B, CD4001B, CD4002B, CD4025B Types

## CMOS NOR Gates

High-Voltage Types (20-Volt Rating)

- Dual 3 Input plus Inverter – CD4000B
- Quad 2 Input – CD4001B
- Dual 4 Input – CD4002B
- Triple 3 Input – CD4025B

RCA-CD4000B, 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.

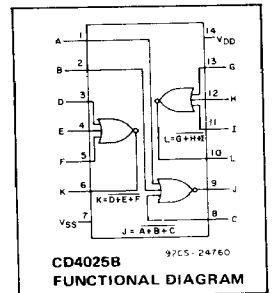
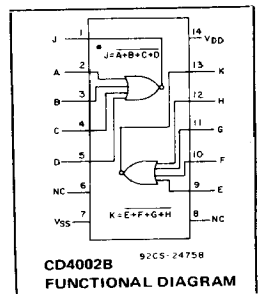
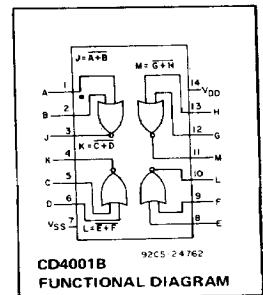
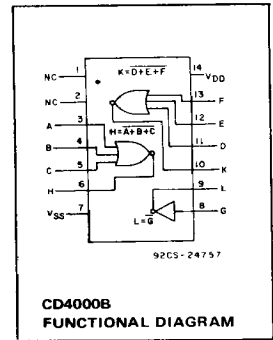
The CD4000B, CD4001B, CD4002B, and CD4025B types are supplied in 14-lead hermetic dual-in-line ceramic packages (D and F suffixes), 14-lead dual-in-line plastic packages (E suffix), 14-lead ceramic flat packages (K suffix), and in chip form (H suffix).

### Features:

- Propagation delay time = 60 ns (typ.) at  $C_L = 50$  pF,  $V_{DD} = 10$  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  $\mu$ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (over full package temperature range):

1 V at  $V_{DD} = 5$  V  
 2 V at  $V_{DD} = 10$  V  
 2.5 V at  $V_{DD} = 15$  V

- Meets all requirements of JEDEC Tentative Standard No. 13A, "Standard Specifications for Description of "B" Series CMOS Devices"



### STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
				Values at -55, +25, +125 Apply to D,F,K,H Packages Values at -40, +25, +85 Apply to E Package							
	V <sub>O</sub> (V)	V <sub>IN</sub> (V)	V <sub>DD</sub> (V)	+25							
-55				-40	+85	+125	Min.	Typ.	Max.		
Quiescent Device Current, I <sub>DD</sub> Max.	-	0.5	5	0.25	0.25	7.5	7.5	-	0.01	0.25	$\mu$ 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 <sub>OL</sub> 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		
	4.6	0.5	5	-0.64	-0.61	-0.42	-0.36	-0.51	1		
Output High (Source) Current, I <sub>OH</sub> Min.	2.5	0.5	5	2	1.8	1.3	1.15	1.6	3.2		mA
	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		
	4.6	0.5	5	-0.64	-0.61	-0.42	-0.36	-0.51	1		
Output Voltage: Low-Level, V <sub>OL</sub> 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 <sub>OH</sub> 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 <sub>IL</sub> 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 <sub>IH</sub> Min.	0.5	-	5			3.5		3.5	-	-	V
	1	-	10			7		7	-	-	
	1.5	-	15			11		11	-	-	
Input Current I <sub>IN</sub> Max.		0.18	18	+0.1	+0.1	+1	$\pm 1$	-	+10 <sup>5</sup>	+0.1	$\mu$ A

# CD4000B, 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)	-0.5 to +20 V
INPUT VOLTAGE RANGE, ALL INPUTS	-0.5 to $V_{DD}$ + 0.5 V
DC INPUT CURRENT, ANY ONE INPUT	$\pm 10$ mA
POWER DISSIPATION PER PACKAGE ( $P_D$ )	500 mW
For $T_A$ = 40 to +60°C (PACKAGE TYPE E)	500 mW
For $T_A$ = +60 to +85°C (PACKAGE TYPE E)	Derate Linearly at 12 mW/°C to 200 mW
For $T_A$ = -55 to +100°C (PACKAGE TYPES D, F, K)	500 mW
For $T_A$ = +100 to +125°C (PACKAGE TYPES D, F, K)	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 ( $T_A$ )	
PACKAGE TYPES D, F, K, H	-55 to +125°C
PACKAGE TYPE E	-40 to +85°C
STORAGE TEMPERATURE RANGE ( $T_{stg}$ )	-65 to +150°C
LEAD TEMPERATURE (DURING SOLDERING) At distance 1/16" (1.32 mm) from case for 10 s max.	+265°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, $t_{PHL}, t_{PLH}$	Any Input	5	125	250	ns
		10	60	120	
		15	45	90	
Transition Time, $t_{THL}, t_{TLH}$	Any Input	5	100	200	ns
		10	50	100	
		15	40	80	
Input Capacitance, $C_{IN}$	Any Input	5	7.5	pF	

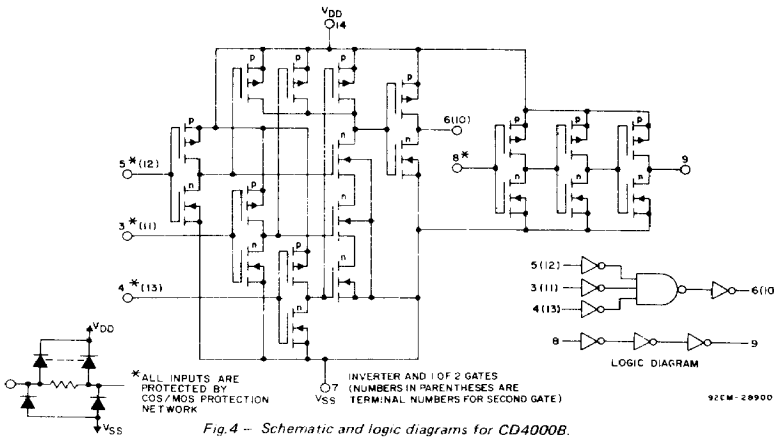


Fig. 4 - Schematic and logic diagrams for CD4000B.

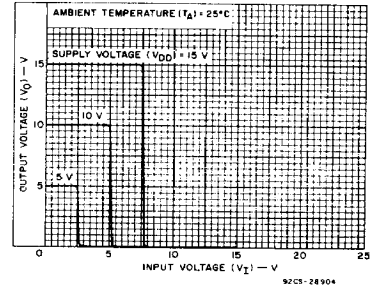


Fig. 1 - Typical voltage transfer characteristics.

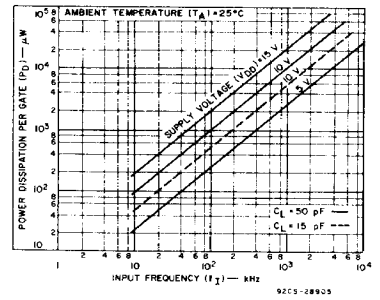


Fig. 2 - Typical power dissipation vs. frequency.

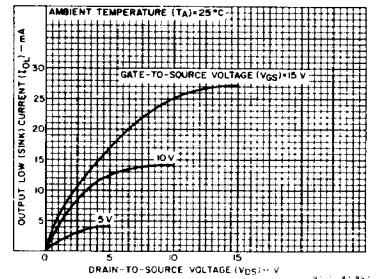


Fig. 3 - Typical output low (sink) current characteristics.

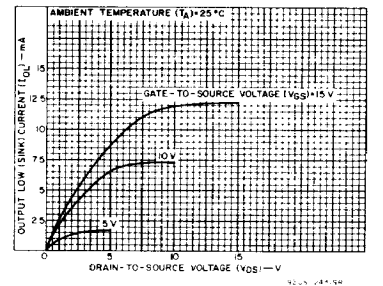


Fig. 5 - Minimum output low (sink) current characteristics.

# CD4000B, CD4001B, CD4002B, CD4025B Types

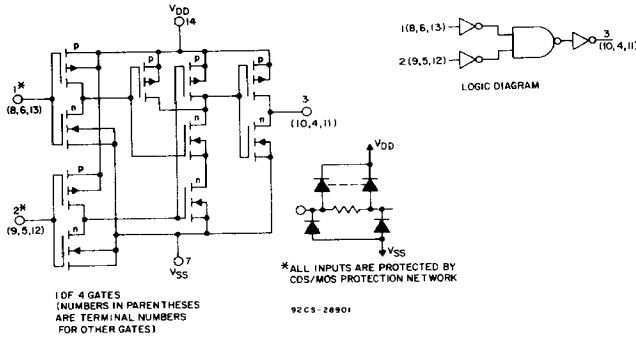


Fig.6 - Schematic and logic diagrams for CD4001B.

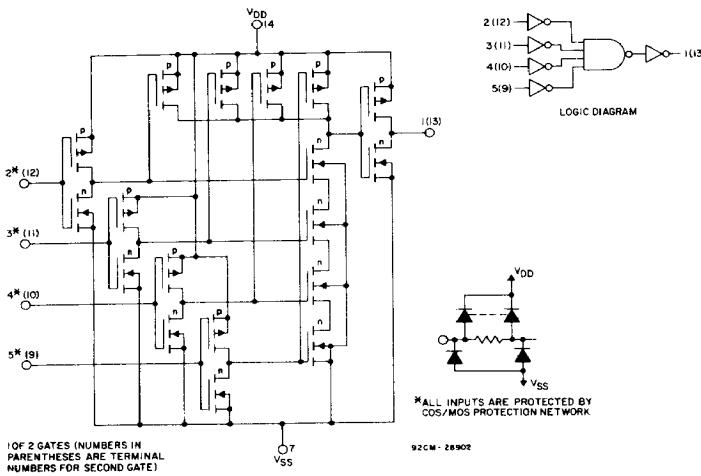


Fig.7 - Schematic and logic diagrams for CD4002B.

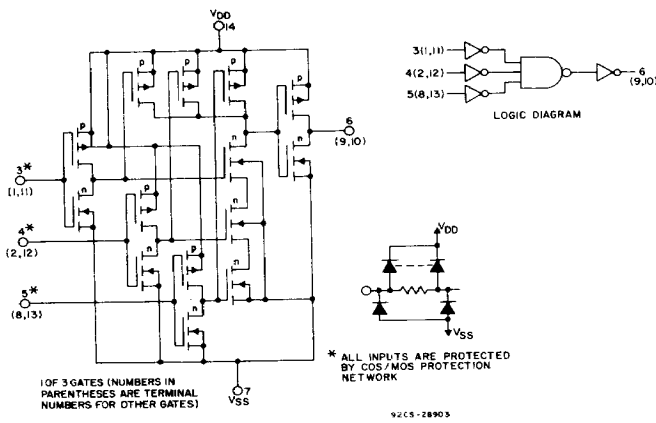


Fig.8 - Schematic and logic diagrams for CD4025B.

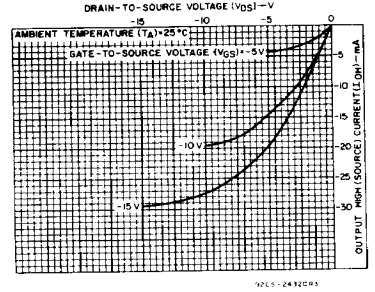


Fig.9 - Typical output high (source) current characteristics.

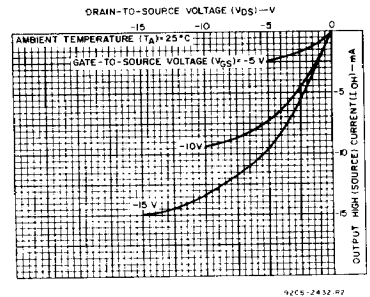


Fig.10 - Minimum output high (source) current characteristics.

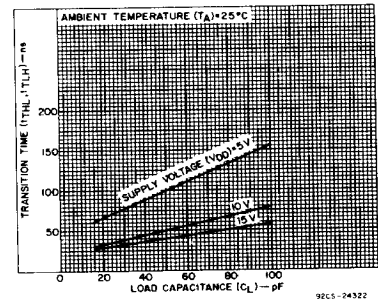


Fig.11 - Typical transition time vs. load capacitance.

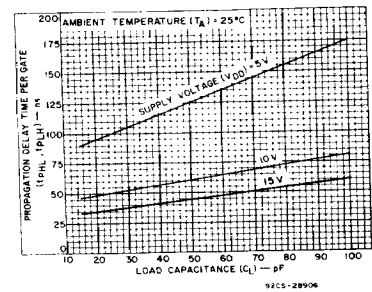


Fig.12 - Typical propagation delay time vs. load capacitance.

# CD4000B, CD4001B, CD4002B, CD4025B Types

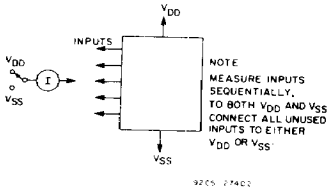


Fig. 13 - Input leakage current test circuit.

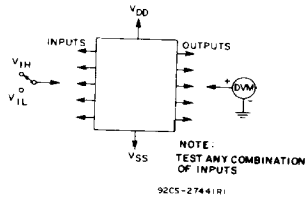


Fig. 14 - Input-voltage test circuit.

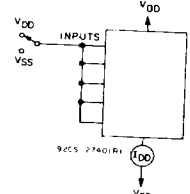
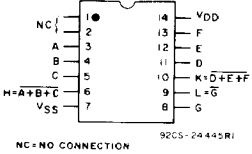
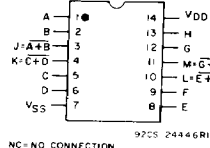


Fig. 15 - Quiescent-device current test circuit.

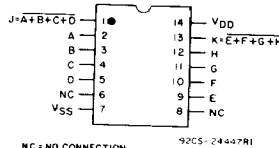
## TERMINAL ASSIGNMENTS (TOP VIEW)



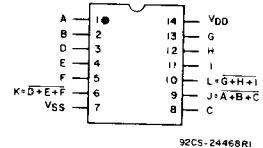
CD4000B



CD4001B

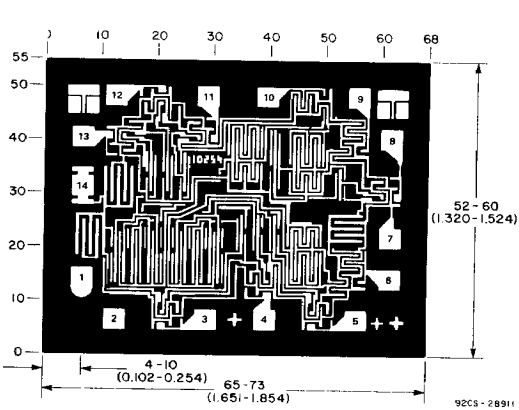


CD4002B

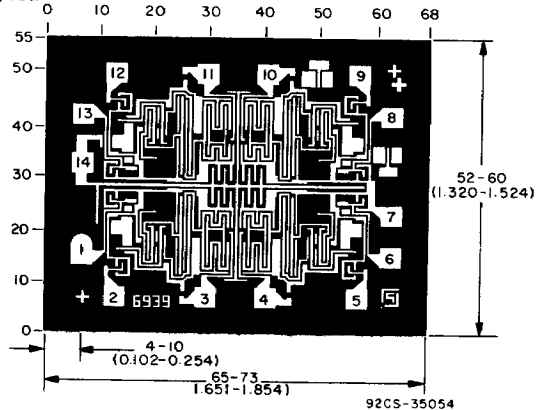


CD4025B

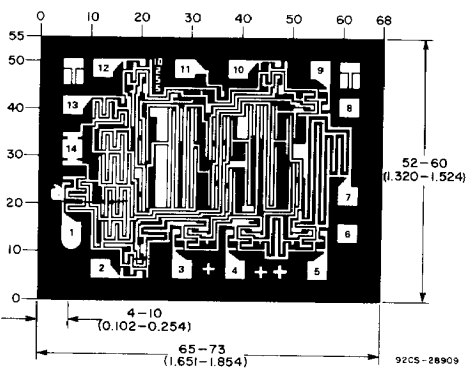
## CHIP PHOTOGRAPHS Dimensions and Pad Layouts



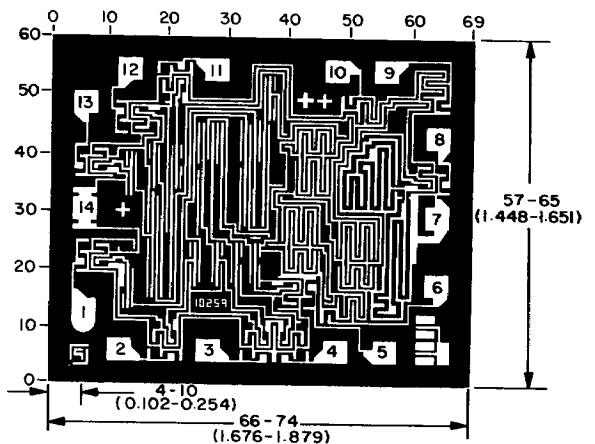
CD4000B



CD4001B



CD4002B



CD4025B