

CD4011B, CD4012B, CD4023B Types

CMOS NAND GATES

High-Voltage Types (20-Volt Rating)

Quad 2 Input – CD4011B

Dual 4 Input – CD4012B

Triple 3 Input – CD4023B

■ CD4011B, CD4012B, and CD4023B NAND gates provide the system designer with direct implementation of the NAND function and supplement the existing family of CMOS gates. All inputs and outputs are buffered.

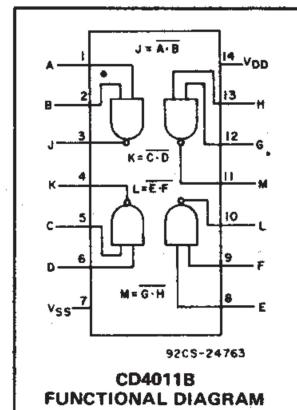
The CD4011B, CD4012B, and CD4023B types are supplied in 14-lead hermetic dual-in-line ceramic packages (F3A suffix), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline packages (M, MT, M96, and NSR suffixes), and 14-lead thin shrink small-outline packages (PWR suffix). The CD4011B and CD4023B types also are supplied in 14-lead thin shrink small-outline packages (PW suffix).

Features:

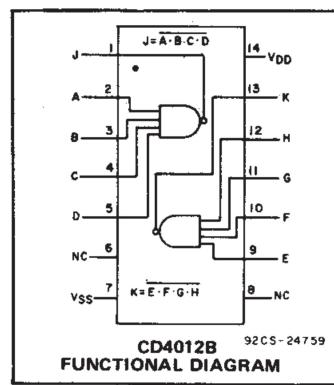
- Propagation delay time = 60 ns (typ.) at $C_L = 50 \text{ pF}$, $V_{DD} = 10 \text{ V}$
- Buffered inputs and outputs
- Standardized symmetrical output characteristics
- Maximum input current of $1 \mu\text{A}$ at 18 V over full package temperature range; 100nA at 18 V and 25°C
- 100% tested for quiescent current at 20 V
- 5-V, 10-V, and 15-V parametric ratings
- 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"



**CD4011B
FUNCTIONAL DIAGRAM**



**CD4012B
FUNCTIONAL DIAGRAM**

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 $V_{DD} + 0.5\text{V}$

DC INPUT CURRENT, ANY ONE INPUT $\pm 10\text{mA}$

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 Linearity at $12\text{mW}/^\circ\text{C}$ 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°C to +125°C

STORAGE TEMPERATURE RANGE (T_{stg}) -65°C to +150°C

LEAD TEMPERATURE (DURING SOLDERING):

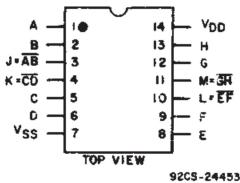
At distance $1/16 \pm 1/32$ inch ($1.59 \pm 0.79\text{mm}$) from case for 10s max +265°C

RECOMMENDED OPERATING CONDITIONS

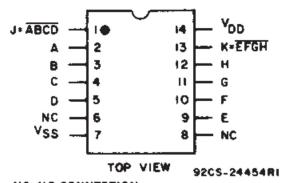
For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

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

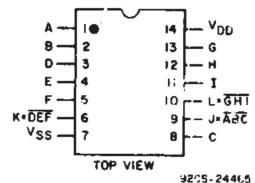
TERMINAL ASSIGNMENTS



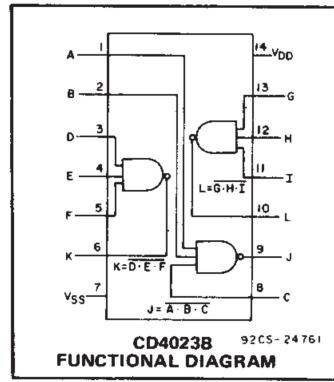
CD4011B



CD4012B



CD4023B



**CD4023B
FUNCTIONAL DIAGRAM**

CD4011B, CD4012B, CD4023B Types

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
				+25				Min.	Typ.	Max.	
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	-40	+85	+125				
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	1.5				-	-	1.5	V
	9	-	10	3				-	-	3	
	13.5	-	15	4				-	-	4	
Input High Voltage, V _{IH} Min.	0.5, 4.5	-	5	3.5				3.5	-	-	V
	1.9	-	10	7				7	-	-	
	1.5, 13.5	-	15	11				11	-	-	
Input Current I _{IN} Max.		0,18	18	±0.1	±0.1	±1	±1	-	±10 ⁻⁵	±0.1	μA

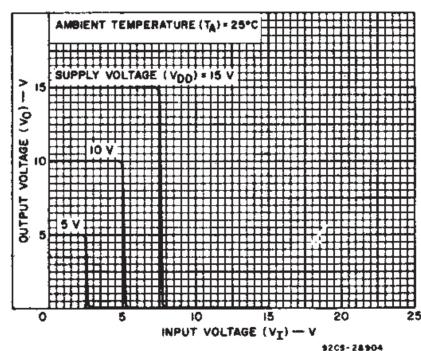


Fig.1 — Typical voltage transfer characteristics.

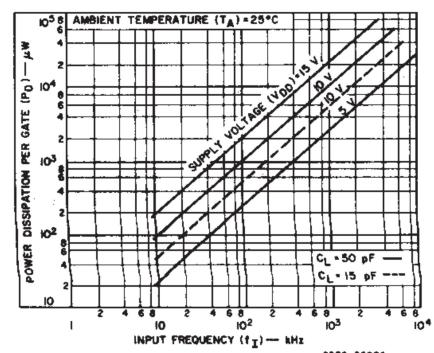


Fig.2 — Typical power dissipation characteristics.

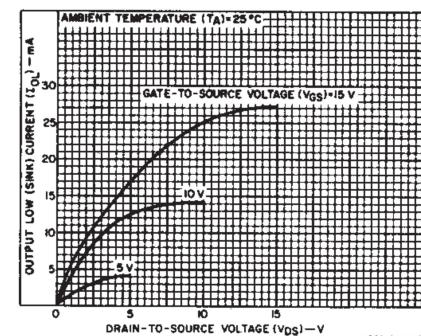


Fig.3 — Typical output low (sink) current characteristics.

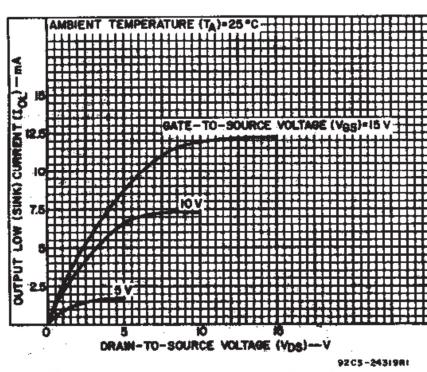


Fig.4 — Minimum output low (sink) current characteristics.

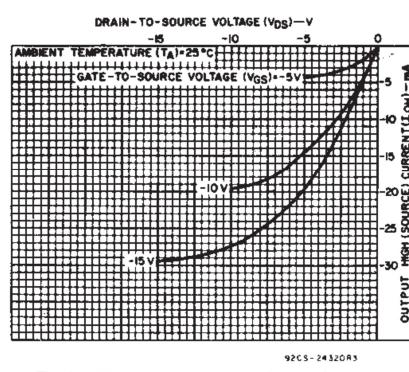


Fig.5 — Typical output high (source) current characteristics.

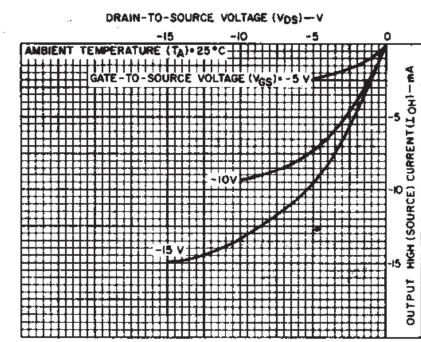
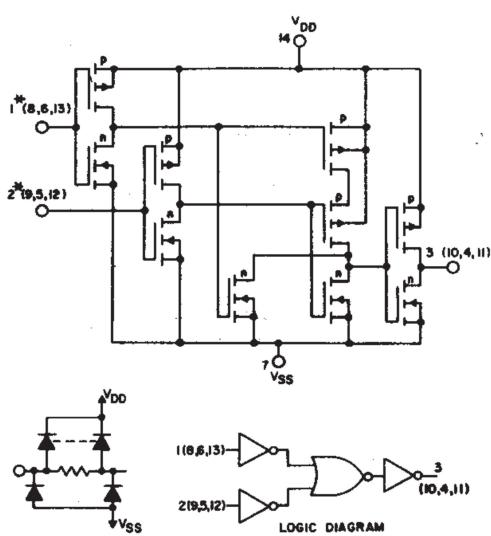


Fig.6 — Minimum output high (source) current characteristics.

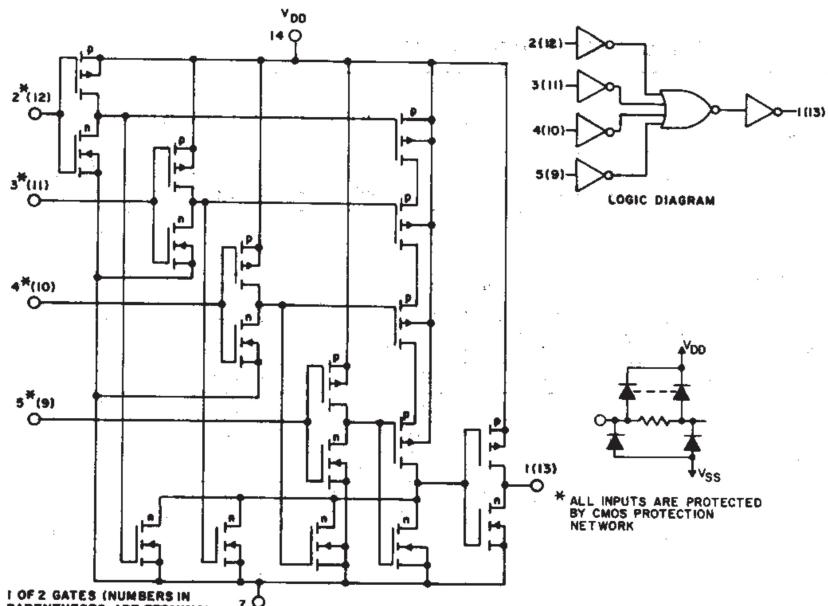
CD4011B, CD4012B, CD4023B Types



* ALL INPUTS ARE PROTECTED BY CMOS PROTECTION NETWORK

1 OF 4 GATES (NUMBERS IN PARENTHESES ARE TERMINAL NUMBERS FOR OTHER GATES)

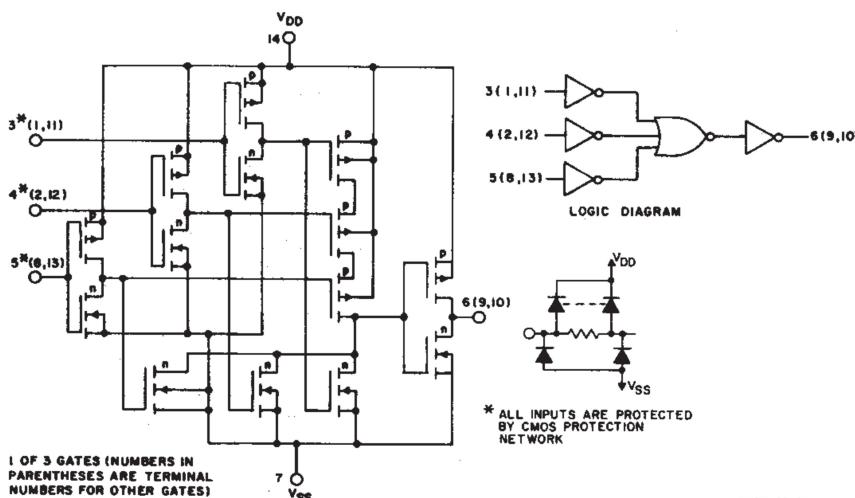
Fig.7 – Schematic and logic diagrams for CD4011B.



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* ALL INPUTS ARE PROTECTED BY CMOS PROTECTION NETWORK

Fig.8 – Schematic and logic diagrams for CD4012B.



1 OF 3 GATES (NUMBERS IN PARENTHESES ARE TERMINAL NUMBERS FOR OTHER GATES)

Fig.9 – Schematic and logic diagrams for CD4023B.

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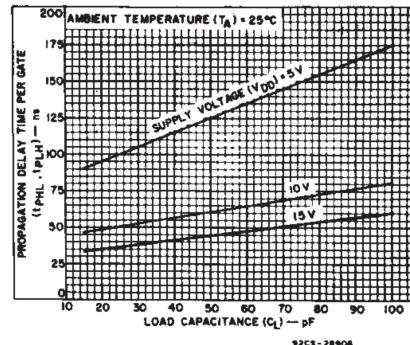


Fig.10 – Typical propagation delay time per gate as a function of load capacitance.

DYNAMIC ELECTRICAL CHARACTERISTICS

At T_A = 25°C; Input t_r, t_f = 20 ns, C_L = 50 pF, R_L = 200 kΩ

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS	
		V _{DD} VOLTS	TYP.	MAX.	
Propagation Delay Time, t _{PHL} , t _{PLH}		5 10 15	125 60 45	250 120 90	ns
Transition Time, t _{THL} , t _{T LH}		5 10 15	100 50 40	200 100 80	ns
Input Capacitance, C _{IN}	Any Input		5	7.5	pF

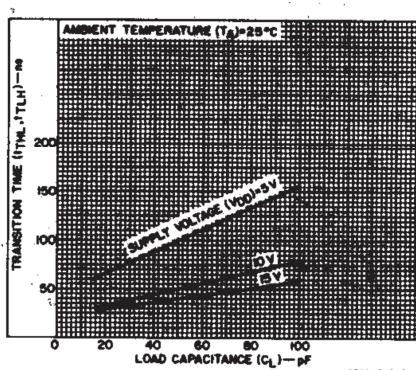


Fig.11 – Typical transition time as a function of load capacitance.

CD4011B, CD4012B, CD4023B Types

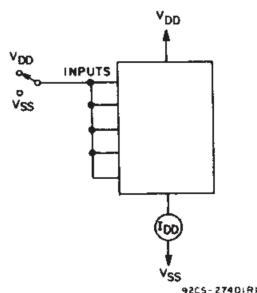


Fig. 12 – Quiescent-device-current test circuit.

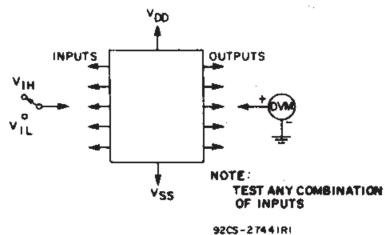


Fig. 13 – Input-voltage test circuit.

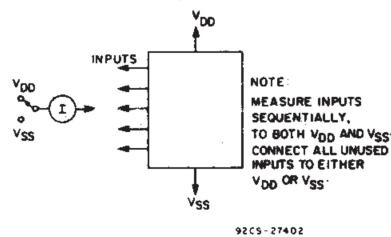
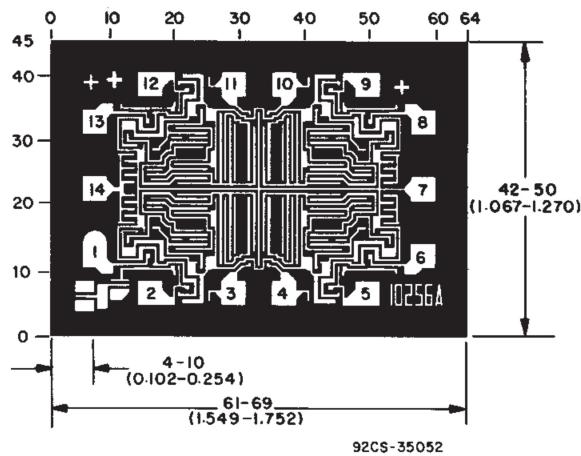
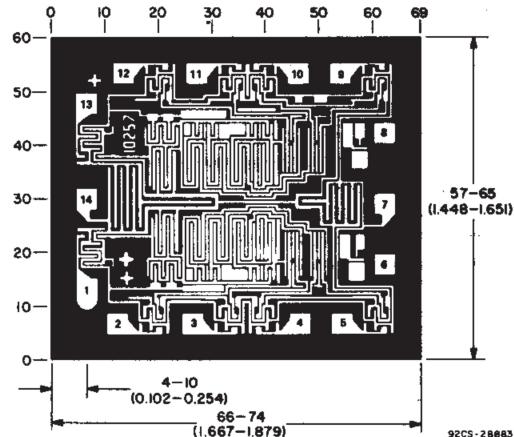


Fig. 14 – Input-current test circuit.

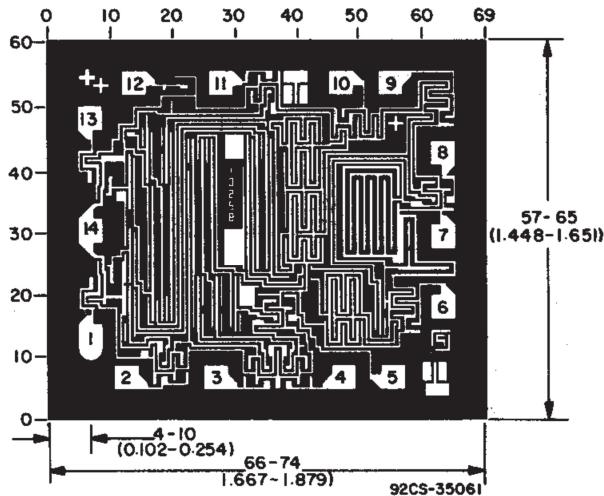
Chip Dimensions and Pad Layouts



CD4011BH



CD4012BH



CD4023BH

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