

## CD4002BM/CD4002BC Dual 4-Input NOR Gate CD4012BM/CD4012BC Dual 4-Input NAND Gate

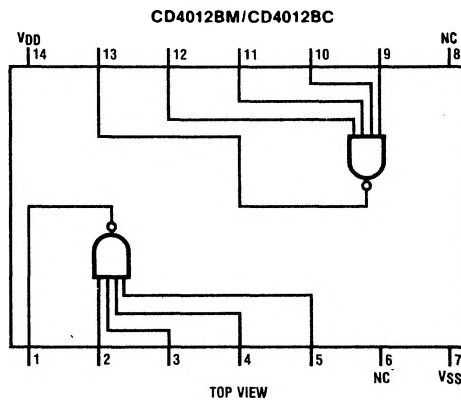
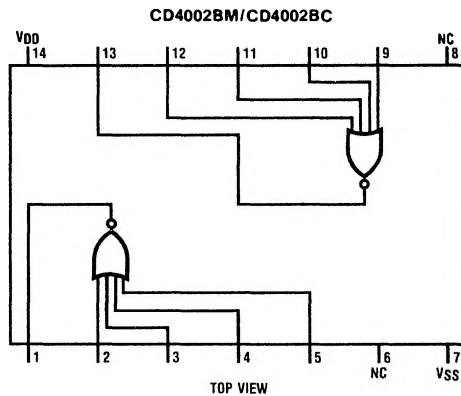
### General Description

These dual gates are monolithic complementary MOS (CMOS) integrated circuits constructed with N-and P-channel enhancement mode transistors. They have equal source and sink current capabilities and conform to standard B series output drive. The devices also have buffered outputs which improve transfer characteristics by providing very high gain. All inputs are protected against static discharge with diodes to  $V_{DD}$  and  $V_{SS}$ .

### Features

- Wide supply voltage range 3.0V to 15V
- High noise immunity 0.45  $V_{DD}$  (typ.)
- Low power TTL compatibility fanout of 2 driving 74L or 1 driving 74LS
- 5V-10V-15V parametric ratings
- Symmetrical output characteristics
- Maximum input leakage 1  $\mu$ A at 15V over full temperature range

### Connection Diagram



### Absolute Maximum Ratings (Notes 1 and 2)

V <sub>DD</sub> Supply Voltage	-0.5V to +18V
V <sub>IN</sub> Input Voltage	-0.5 to V <sub>DD</sub> 0.5V
T <sub>S</sub> Storage Temperature Range	-65°C to +150°C
P <sub>D</sub> Package Dissipation	500mW
T <sub>L</sub> Lead Temperature (soldering, 10 seconds)	300°C

### Recommended Operating Conditions (Note 2)

V <sub>DD</sub> Supply Voltage	3.0 to 15V
V <sub>IN</sub> Input Voltage	0V to V <sub>DD</sub> V
T <sub>A</sub> Operating Temperature Range	
CD4002BM, CD4012BM	-55°C to +125°C
CD4002BC, CD4012BC	-40°C to +85°C

### DC Electrical Characteristics (Note 2) — CD4002BM, CD4012BM

Parameter	Conditions	-55°C		25°C			125°C		Units
		Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
I <sub>DD</sub> Quiescent Device Current	V <sub>DD</sub> = 5.0V		0.25		0.004	0.25		7.5	μA
	V <sub>DD</sub> = 10V		0.5		0.005	0.5		15	μA
	V <sub>DD</sub> = 15V		1.0		0.006	1.0		30	μA
V <sub>OL</sub> Low Level Output Voltage	V <sub>DD</sub> = 5.0V		0.05		0	0.05		0.05	V
	V <sub>DD</sub> = 10V		0.05		0	0.05		0.05	V
	V <sub>DD</sub> = 15V		0.05		0	0.05		0.05	V
V <sub>OH</sub> High Level Output Voltage	V <sub>DD</sub> = 5.0V	4.95		4.95	5.0		4.95		V
	V <sub>DD</sub> = 10V	9.95		9.95	10		9.95		V
	V <sub>DD</sub> = 15V	14.95		14.95	15		14.95		V
V <sub>IL</sub> Low Level Input Voltage	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 0.5V or 4.5V		1.5		2.25	1.5		1.5	V
	V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
	V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V		4.0		6.75	4.0		4.0	V
V <sub>IH</sub> High Level Input Voltage	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 0.5V or 4.5V	3.5		3.5	2.75		3.5		V
	V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
	V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V	11.0		11.0	8.25		11.0		V
I <sub>OL</sub> Low Level Output Current	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 0.4V	0.64		0.51	0.88		0.36		mA
	V <sub>DD</sub> = 10V, V <sub>O</sub> = 0.5V	1.6		1.3	2.2		0.90		mA
	V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V	4.2		3.4	8.0		2.4		mA
I <sub>OH</sub> High Level Output Current	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 4.6V	-0.64		-0.51	-0.88		-0.36		mA
	V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.5V	-1.6		-1.3	-2.2		-0.90		mA
	V <sub>DD</sub> = 15V, V <sub>O</sub> = 13.5V	-4.2		-3.4	-8.0		-2.4		mA
I <sub>IN</sub> Input Current	V <sub>DD</sub> = 15V, V <sub>IN</sub> = 0V		-0.10		-10 <sup>-5</sup>	-0.10		-1.0	μA
	V <sub>DD</sub> = 15V, V <sub>IN</sub> = 15V		0.10		10 <sup>5</sup>	0.10		1.0	μA

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Recommended Operating Conditions" and "Electrical Characteristics" provide conditions for actual device operation.

**Note 2:** V<sub>SS</sub> = 0V unless otherwise specified.

## DC Electrical Characteristics (Note 2) — CD4002BC, CD4012BC

Parameter	Conditions	-40°C		25°C			85°C		Units
		Min.	Max.	Min.	Typ.	Max.	Min.	Max.	
$I_{DD}$ Quiescent Device Current	$V_{DD} = 5.0V$		1.0		0.004	1.0		7.5	$\mu A$
	$V_{DD} = 10V$		2.0		0.005	2.0		15	$\mu A$
	$V_{DD} = 15V$		4.0		0.006	4.0		30	$\mu A$
$V_{OL}$ Low Level Output Voltage	$V_{DD} = 5.0V$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V$		0.05		0	0.05		0.05	V
	$V_{DD} = 15V$		0.05		0	0.05		0.05	V
$V_{OH}$ High Level Output Voltage	$V_{DD} = 5.0V$	4.95		4.95	5.0		4.95		V
	$V_{DD} = 10V$	9.95		9.95	10		9.95		V
	$V_{DD} = 15V$	14.95		14.95	15		14.95		V
$V_{IL}$ Low Level Input Voltage	$V_{DD} = 5V, V_O = 0.5V$ or $4.5V$		1.5		2.25	1.5		1.5	V
	$V_{DD} = 10V, V_O = 1.0V$ or $9.0V$		3.0		4.50	3.0		3.0	V
	$V_{DD} = 15V, V_O = 1.5V$ or $13.5V$		4.0		6.75	4.0		4.0	V
$V_{IH}$ High Level Input Voltage	$V_{DD} = 5.0V, V_O = 0.5V$ or $4.5V$	3.5		3.5	2.75		3.5		V
	$V_{DD} = 10V, V_O = 1.0V$ or $9.0V$	7.0		7.0	5.50		7.0		V
	$V_{DD} = 15V, V_O = 1.5V$ or $13.5V$	11		11	8.25		11		V
$I_{OL}$ Low Level Output Current	$V_{DD} = 5.0V, V_O = 0.4V$	0.52		0.44	0.88		0.36		mA
	$V_{DD} = 10V, V_O = 0.5V$	1.3		1.1	2.2		0.90		mA
	$V_{DD} = 15V, V_O = 1.5V$	3.6		3.0	8.0		2.4		mA
$I_{OH}$ High Level Output Current	$V_{DD} = 5.0V, V_O = 4.6V$	-0.52		-0.44	-0.88		-0.36		mA
	$V_{DD} = 10V, V_O = 9.5V$	-1.3		-1.1	-2.2		-0.90		mA
	$V_{DD} = 15V, V_O = 13.5V$	-3.6		-3.0	-8.0		-2.4		mA
$I_{IN}$ Input Current	$V_{DD} = 15V, V_{IN} = 0V$		-0.3		$-10^{-5}$	-0.3		-1.0	$\mu A$
	$V_{DD} = 15V, V_{IN} = 15V$		0.3		$10^{-5}$	0.3		1.0	$\mu A$

## AC Electrical Characteristics $T_A = 25^\circ C, C_L = 50pF$ , unless otherwise noted.

Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{PHL}$ Propagation Delay, High to Low Level	$V_{DD} = 5.0V$		125	250	ns
	$V_{DD} = 10V$		60	100	ns
	$V_{DD} = 15V$		45	70	ns
$t_{PLH}$ Propagation Delay, Low to High Level	$V_{DD} = 5.0V$		125	250	ns
	$V_{DD} = 10V$		60	100	ns
	$V_{DD} = 15V$		45	70	ns
$t_{THL}, t_{TLH}$ Transition Time	$V_{DD} = 5.0V$		100	200	ns
	$V_{DD} = 10V$		50	100	ns
	$V_{DD} = 15V$		40	80	ns
$C_{IN}$ Average Input Capacitance (Note 3)	Any Input		5.0	7.5	pF
$C_{PD}$ Power Dissipation Capacity (Note 4)	Any Gate		20		pF

**Note 3:** Capacitance is guaranteed by periodic testing.

**Note 4:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics, Application Note AN-90.