National Semiconductor

CD4001BM/CD4001BC Quad 2-Input NOR Buffered B Series Gate
CD4011BM/CD4011BC Quad 2-Input NAND Buffered B Series Gate

General Description

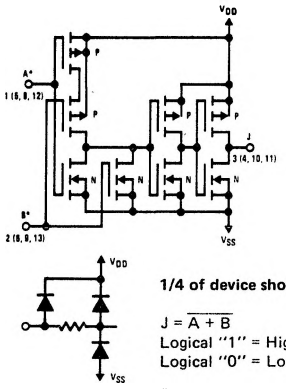
These quad gates are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. They have equal source and sink current capabilities and conform to standard B series output drive. The devices also have buffered outputs which improve transfer characteristics by providing very high gain.

All inputs are protected against static discharge with diodes to V_{DD} and V_{SS}.

Features

- Low power TTL compatibility — fan out of 2 driving 74L or 1 driving 74LS
- 5V—10V—15V parametric ratings
- Symmetrical output characteristics
- Maximum input leakage 1μA at 15V over full temperature range

Schematic and Connection Diagrams



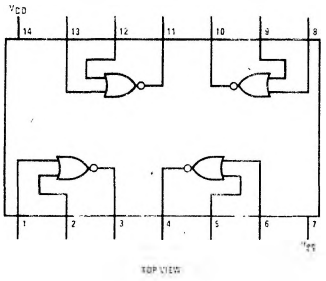
1/4 of device shown

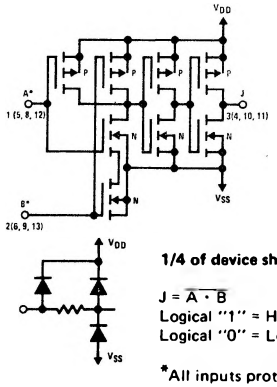
$J = \overline{A + B}$

Logical "1" = High
Logical "0" = Low

*All inputs protected by standard CMOS protection circuit.

CD4001BC/CD4001BM
Dual-In-Line and Flat Package





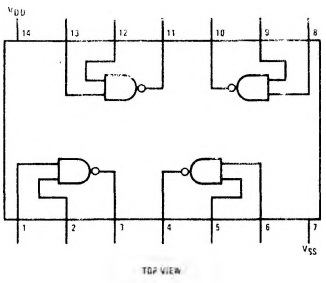
1/4 of device shown

$J = \overline{A \cdot B}$

Logical "1" = High
Logical "0" = Low

*All inputs protected by standard CMOS protection circuit.

CD4011BC/CD4011BM
Dual-In-Line and Flat Package



Absolute Maximum Ratings (Notes 1 and 2)

Voltage at Any Pin	−0.5V to V_{DD} + 0.5V
Package Dissipation	500 mW
V_{DD} Range	−0.5 V_{DC} to +18 V_{DC}
Storage Temperature	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	300°C

Operating Conditions

Operating V_{DD} Range	3 V_{DC} to 15 V_{DC}
Operating Temperature Range	
CD4001BM, CD4011BM	−55°C to +125°C
CD4001BC, CD4011BC	−40°C to +85°C

DC Electrical Characteristics CD4001BM, CD4011BM (Note 2)

PARAMETER		CONDITIONS	−55°C		+25°C			+125°C		UNITS
			MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD}	Quiescent Device Current	V_{DD} = 5V		0.25		0.004	0.25		7.5	μA
		V_{DD} = 10V		0.50		0.005	0.50		15	μA
		V_{DD} = 15V		1.0		0.006	1.0		30	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\mu A$		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\mu A$	4.95		4.95	5		4.95		V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\mu A$	9.95		9.95	10		9.95		V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\mu A$	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 4.5V		1.5		2	1.5		1.5	V
		V_{DD} = 10V, V_O = 9.0V		3.0		4	3.0		3.0	V
		V_{DD} = 15V, V_O = 13.5V		4.0		6	4.0		4.0	V
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V	3.5		3.5	3		3.5		V
		V_{DD} = 10V, V_O = 1.0V	7.0		7.0	6		7.0		V
		V_{DD} = 15V, V_O = 1.5V	11.0		11.0	9		11.0		V
I_{OL}	Low Level Output Current	V_{DD} = 5V, V_O = 0.4V	0.64		0.51	0.88		0.36		mA
		V_{DD} = 10V, V_O = 0.5V	1.6		1.3	2.25		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	4.2		3.4	8.8		2.4		mA
I_{OH}	High Level Output Current	V_{DD} = 5V, V_O = 4.6V	−0.64		−0.51	−0.88		−0.36		mA
		V_{DD} = 10V, V_O = 9.5V	−1.6		−1.3	−2.25		−0.9		mA
		V_{DD} = 15V, V_O = 13.5V	−4.2		−3.4	−8.8		−2.4		mA
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.10		-10^{-5}	−0.10		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.10		10^{-5}	0.10		1.0	μA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: All voltages measured with respect to V_{SS} unless otherwise specified.

DC Electrical Characteristics CD4001BC, CD4011BC (Note 2)

PARAMETER		CONDITIONS	−40°C		+25°C			+85°C		UNITS
			MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD}	Quiescent Device Current	V_{DD} = 5V		1		0.004	1		7.5	μA
		V_{DD} = 10V		2		0.005	2		15	μA
		V_{DD} = 15V		4		0.006	4		30	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\mu A$		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\mu A$	4.95		4.95	5		4.95		V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\mu A$	9.95		9.95	10		9.95		V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\mu A$	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 4.5V		1.5		2	1.5		1.5	V
		V_{DD} = 10V, V_O = 9.0V		3.0		4	3.0		3.0	V
		V_{DD} = 15V, V_O = 13.5V		4.0		6	4.0		4.0	V
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V	3.5		3.5	3		3.5		V
		V_{DD} = 10V, V_O = 1.0V	7.0		7.0	6		7.0		V
		V_{DD} = 15V, V_O = 1.5V	11.0		11.0	9		11.0		V
I_{OL}	Low Level Output Current	V_{DD} = 5V, V_O = 0.4V	0.52		0.44	0.88		0.36		mA
		V_{DD} = 10V, V_O = 0.5V	1.3		1.1	2.25		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	3.6		3.0	8.8		2.4		mA
I_{OH}	High Level Output Current	V_{DD} = 5V, V_O = 4.6V	−0.52		−0.44	−0.88		−0.36		mA
		V_{DD} = 10V, V_O = 9.5V	−1.3		−1.1	−2.25		−0.9		mA
		V_{DD} = 15V, V_O = 13.5V	−3.6		−3.0	−8.8		−2.4		mA
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.30		-10^{-5}	−0.30		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.30		10^{-5}	0.30		1.0	μA

AC Electrical Characteristics CD4001BC, CD4001BM

T_A = 25°C, Input t_r; t_f = 20 ns. C_L = 50 pF, R_L = 200k. Typical temperature coefficient is 0.3%/°C.

PARAMETER		CONDITIONS	TYP	MAX	UNITS
t_{PHL}	Propagation Delay Time, High-to-Low Level	V_{DD} = 5V	120	250	ns
		V_{DD} = 10V	50	100	ns
		V_{DD} = 15V	35	70	ns
t_{PLH}	Propagation Delay Time, Low-to-High Level	V_{DD} = 5V	110	250	ns
		V_{DD} = 10V	50	100	ns
		V_{DD} = 15V	35	70	ns
t_{THL}, t_{TLH}	Transition Time	V_{DD} = 5V	90	200	ns
		V_{DD} = 10V	50	100	ns
		V_{DD} = 15V	40	80	ns
C_{IN}	Average Input Capacitance	Any Input	5	7.5	pF
C_{PD}	Power Dissipation Capacity	Any Gate	14		pF

AC Electrical Characteristics CD4011BC, CD4011BM

T_A = 25°C, Input t_r; t_f = 20 ns. C_L = 50 pF, R_L = 200k. Typical Temperature Coefficient is 0.3%/°C.

PARAMETER		CONDITIONS	TYP	MAX	UNITS
t_{PHL}	Propagation Delay, High-to-Low Level	V_{DD} = 5V	120	250	ns
		V_{DD} = 10V	50	100	ns
		V_{DD} = 15V	35	70	ns
t_{PLH}	Propagation Delay, Low-to-High Level	V_{DD} = 5V	85	250	ns
		V_{DD} = 10V	40	100	ns
		V_{DD} = 15V	30	70	ns
t_{THL}, t_{TLH}	Transition Time	V_{DD} = 5V	90	200	ns
		V_{DD} = 10V	50	100	ns
		V_{DD} = 15V	40	80	ns
C_{IN}	Average Input Capacitance	Any Input	5	7.5	pF
C_{PD}	Power Dissipation Capacity	Any Gate	14		pF

Typical Performance Characteristics

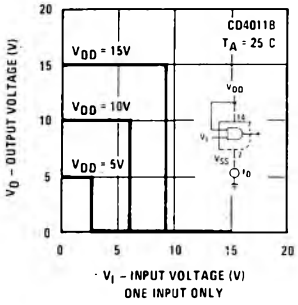


FIGURE 1. Typical Transfer Characteristics

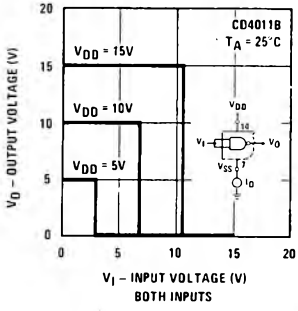


FIGURE 2. Typical Transfer Characteristics

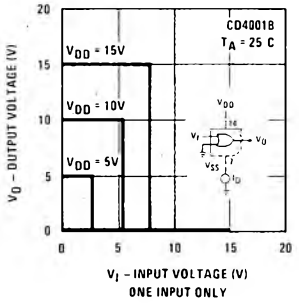


FIGURE 3. Typical Transfer Characteristics

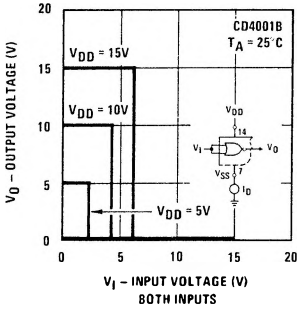


FIGURE 4. Typical Transfer Characteristics

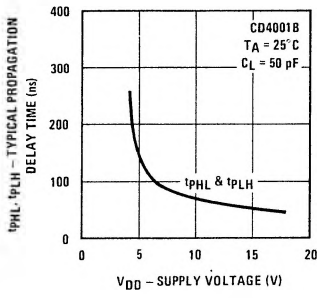


FIGURE 5

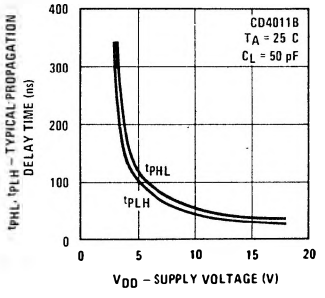


FIGURE 6

CD4001BM/CD4001BC, CD4011BM/CD4011BC

Typical Performance Characteristics (Cont'd.)

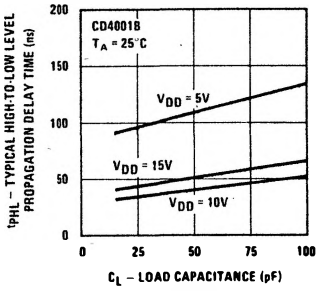


FIGURE 7

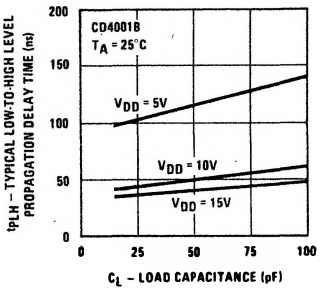


FIGURE 8

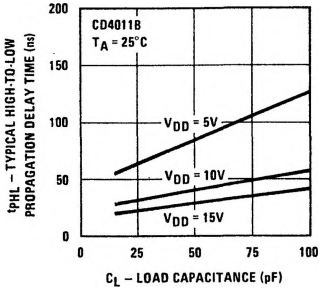


FIGURE 9

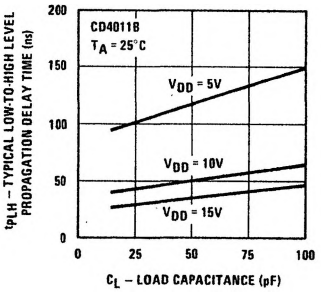


FIGURE 10

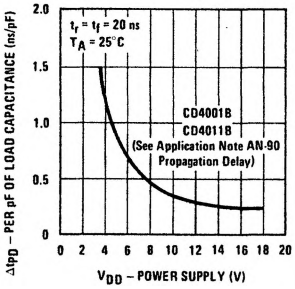


FIGURE 11

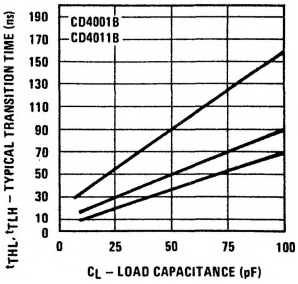


FIGURE 12

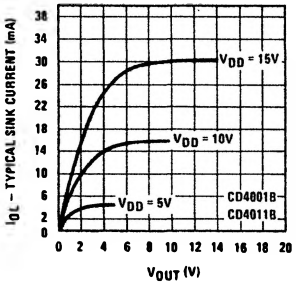


FIGURE 13

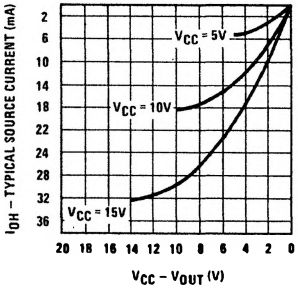


FIGURE 14