

October 1987 Revised April 2002

# **CD4024BC**

# 7-Stage Ripple Carry Binary Counter

## **General Description**

The CD4024BC is a 7-stage ripple-carry binary counter. Buffered outputs are externally available from stages 1 through 7. The counter is reset to its logical "0" stage by a logical "1" on the reset input. The counter is advanced one count on the negative transition of each clock pulse.

#### **Features**

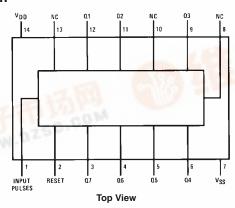
- Wide supply voltage range: 3.0V to 15V
- High noise immunity: 0.45 V<sub>DD</sub> (typ.)
- Low power TTL compatibility: Fan out of 2 driving 74L or 1 driving 74LS
- High speed: 12 MHz (typ.) input pulse rate V<sub>DD</sub> - V<sub>SS</sub> = 10V
- Fully static operation

# **Ordering Code:**

Order Number	Package Number	Package Description
CD4024BCM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD4024BCN	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

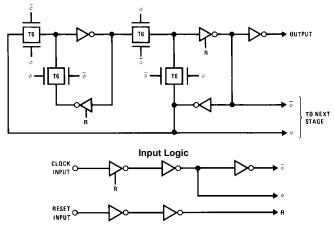
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

# **Connection Diagram**



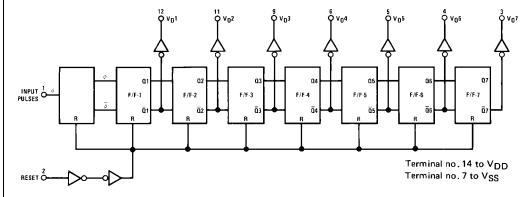


# **Logic Diagrams**



Flip-flop logic (1 of 7 identical stages).

# **Block Diagram**



## **Absolute Maximum Ratings**(Note 1)

(Note 2)

DC Supply Voltage ( $V_{\rm DD}$ ) -0.5 to +18  $V_{DC}$ Input Voltage (V<sub>IN</sub>) -0.5 to  $V_{DD}$  +0.5  $V_{DC}$ 

Storage Temperature Range (T<sub>S</sub>)  $-65^{\circ}C$  to  $+150^{\circ}C$ 

Power Dissipation (P<sub>D</sub>)

Dual-In-Line 700 mW Small Outline 500 mW

Lead Temperature

(Soldering, 10 seconds) (T<sub>L</sub>)

# **Recommended Operating** Conditions (Note 1)

DC Supply Voltage (V<sub>DD</sub>) +3 to +15  $V_{DC}$ Input Voltage (V<sub>IN</sub>) 0 to  $\mathrm{V}_\mathrm{DD}\,\mathrm{V}_\mathrm{DC}$ Operating Temperature Range (T<sub>A</sub>) -55°C to +125°C

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 table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

Note 2:  $V_{SS} = 0V$  unless otherwise specified.

## DC Electrical Characteristics (Note 2)

Symbol	Parameter	Conditions	–55°C		+25°C			+125°C		Units
	Farameter	Conditions	Min	Max	Min	Тур	Max	Min	Max	Ullits
I <sub>DD</sub> Quieso	Quiescent Device Current	$V_{DD} = 5V$		5		0.3	5		150	
		$V_{DD} = 10V$		10		0.5	10		300	μΑ
		$V_{DD} = 15V$		20		0.7	20		600	
V <sub>OL</sub>	LOW Level Output Voltage	I <sub>O</sub>  <1 μA								
		$V_{DD} = 5V$		0.05		0	0.05		0.05	
		$V_{DD} = 10V$		0.05		0	0.05		0.05	V
		$V_{DD} = 15V$		0.05		0	0.05		0.05	
V <sub>OH</sub>	HIGH Level Output Voltage	I <sub>O</sub>  <1 μA								
		$V_{DD} = 5V$	4.95		4.95	5		4.95		
		$V_{DD} = 10V$	9.95		9.95	10		9.95		V
		$V_{DD} = 15V$	14.95		14.95	15		14.95		
V <sub>IL</sub>	LOW Level Input Voltage	I <sub>O</sub>  <1 μA								
		$V_{DD} = 5V, V_{O} = 0.5V \text{ or } 4.5V$		1.5		2	1.5		1.5	
		$V_{DD} = 10V, V_{O} = 1.0V \text{ or } 9.0V$		3.0		4	3.0		3.0	V
		$V_{DD} = 15V$ , $V_{O} = 1.5V$ or $13.5V$		4.0		6	4.0		4.0	
V <sub>IH</sub>	HIGH Level Input Voltage	I <sub>O</sub>  <1 μA								
		$V_{DD} = 5V, V_{O} = 0.5V \text{ or } 4.5V$	3.5		3.5	3		3.5		
		$V_{DD} = 10V, V_{O} = 1.0V \text{ or } 9.0V$	7.0		7.0	6		7.0		V
		$V_{DD} = 15V$ , $V_{O} = 1.5V$ or $13.5V$	11.0		11.0	9		11.0		
I <sub>OL</sub>	LOW Level Output Current	$V_{DD} = 5V, V_{O} = 0.4V$	0.64		0.51	0.88		0.36		
	(Note 3)	$V_{DD} = 10V, \ V_{O} = 0.5V$	1.6		1.3	2.25		0.9		mA
		$V_{DD} = 15V, V_{O} = 1.5V$	4.2		3.4	8.8		2.4		
I <sub>OH</sub>	HIGH Level Output Current	$V_{DD} = 5V, V_{O} = 4.6V$	-0.64		-0.51	-0.88		-0.36		
	(Note 3)	$V_{DD} = 10V, V_{O} = 9.5V$	-1.6		-1.3	-2.25		-0.9		mA
		$V_{DD} = 15V, V_{O} = 13.5V$	-4.2		-3.4	-8.8		-2.4		
I <sub>IN</sub>	Input Current	$V_{DD} = 15V, V_{IN} = 0V$		-0.1		-10 <sup>-5</sup>	-0.1		-1.0	μА
		$V_{DD} = 15V, \ V_{IN} = 15V$		0.1		10 <sup>-5</sup>	0.1		1.0	μΑ

260°C

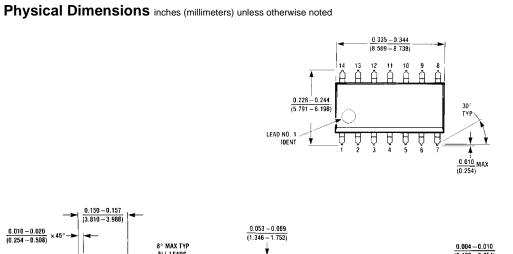
Note 3: I<sub>OH</sub> and I<sub>OL</sub> are tested one output at a time.

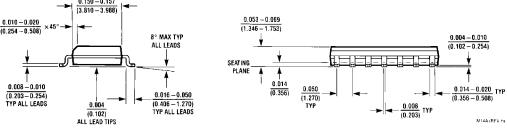
**AC Electrical Characteristics** (Note 4)  $T_A = 25^{\circ}C$ ,  $C_L = 50$  pF,  $R_L = 200$  k,  $t_r$  and  $t_f = 20$  ns unless otherwise specified

Symbol	Parameter	Conditions	Min	Тур	Max	Units
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Time	V <sub>DD</sub> = 5V		185	350	
	to Q1 Output	V <sub>DD</sub> = 10V		85	125	ns
		V <sub>DD</sub> = 15V		70	100	
t <sub>THL</sub> , t <sub>TLH</sub>	Transition Time	V <sub>DD</sub> = 5V		100	200	
		V <sub>DD</sub> = 10V		50	100	ns
		V <sub>DD</sub> = 15V		40	80	
t <sub>WL</sub> , t <sub>WH</sub>	Minimum Input Pulse Width	$V_{DD} = 5V$		75	200	
		V <sub>DD</sub> = 10V		40	110	ns
		V <sub>DD</sub> = 15V		35	90	
t <sub>RCL</sub> , t <sub>FCL</sub>	Input Rise and Fall Time	$V_{DD} = 5V$			15	
		V <sub>DD</sub> = 10V			10	μs
		V <sub>DD</sub> = 15V			8	
f <sub>CL</sub>	Maximum Input Pulse Frequency	$V_{DD} = 5V$	1.5	5		
		V <sub>DD</sub> = 10V	4	12		MHz
		V <sub>DD</sub> = 15V	5	15		
t <sub>PHL</sub>	Reset Propagation Delay Time	$V_{DD} = 5V$		185	350	
		V <sub>DD</sub> = 10V		85	125	ns
		V <sub>DD</sub> = 15V		70	100	
t <sub>WH</sub>	Reset Minimum Pulse Width	$V_{DD} = 5V$		185	350	
		V <sub>DD</sub> = 10V		85	125	ns
		$V_{DD} = 15V$		70	100	
C <sub>IN</sub>	Input Capacitance (Note 5)	Any Input		5	7.5	pF

Note 4: AC Parameters are guaranteed by DC correlated testing.

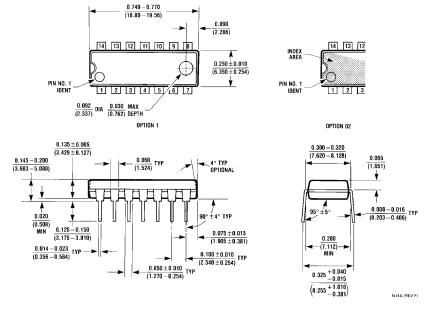
Note 5: Capacitance is guaranteed by periodic testing.





14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M14A

### Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N14A

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