



CD4024BM/CD4024BC 7-Stage Ripple Carry Binary Counter

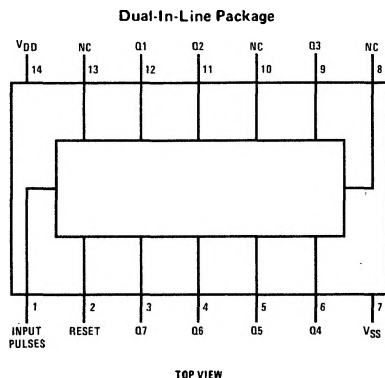
General Description

The CD4024BM/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.

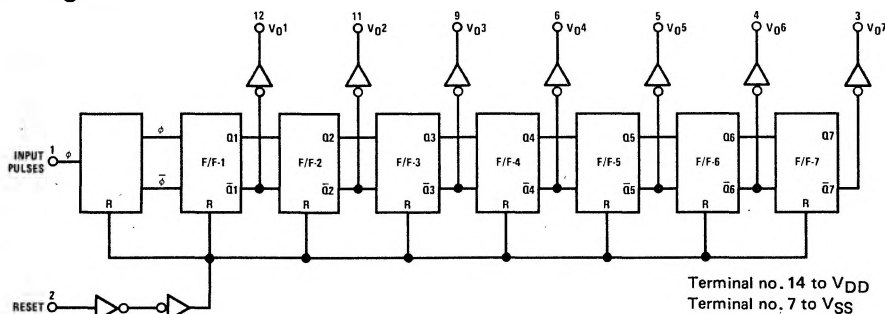
Features

- Wide supply voltage range 3.0V to 15V
- High noise immunity 0.45 V_{DD} (typ.)
- Low power TTL compatibility fan out of 2 driving 74L or 1 driving 74LS
- High speed 12 MHz (typ.)
- input pulse rate $V_{DD} - V_{SS} = 10V$
- Fully static operation

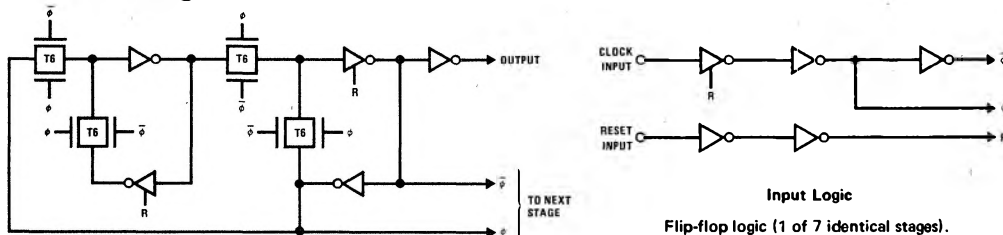
Connection Diagram



Logic Diagram



Schematic Diagram



Absolute Maximum Ratings

(Notes 1 and 2)

V_{DD} dc Supply Voltage	-0.5 to +18 V_{DC}
V_{IN} Input Voltage	-0.5 to V_{DD} +0.5 V_{DC}
T_S Storage Temperature Range	-65°C to +150°C
P_D Package Dissipation	500 mW
T_L Lead Temperature (Soldering, 10 seconds)	300°C

Recommended Operating Conditions

(Note 2)

V_{DD} dc Supply Voltage	+3 to +15 V_{DC}
V_{IN} Input Voltage	0 to V_{DD} V_{DC}
T_A Operating Temperature Range	-55°C to +125°C
CD4024BM	-40°C to +85°C
CD4024BC	

DC Electrical Characteristics CD4024BM (Note 2)

PARAMETER	CONDITIONS	-55°C		25°C			125°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD} Quiescent Device Current	$V_{DD} = 5V$		5		0.3	5		150	μA
	$V_{DD} = 10V$		10		0.5	10		300	μA
	$V_{DD} = 15V$		20		0.7	20		600	μA
V_{OL} Low Level Output Voltage	$ I_O < 1\mu A$								
	$V_{DD} = 5V$		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	$ I_O < 1\mu A$								
	$V_{DD} = 5V$	4.95		4.95	5		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	$ I_O < 1\mu A$								
	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V		1.5		2	1.5		1.5	V
	$V_{DD} = 10V, V_O = 1.0V$ 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
V_{IH} High Level Input Voltage	$ I_O < 1\mu A$								
	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V	3.5		3.5	3		3.5		V
	$V_{DD} = 10V, V_O = 1.0V$ 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		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

DC Electrical Characteristics CD4024BC (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD} Quiescent Device Current	$V_{DD} = 5V$		20		0.3	20		150	μA
	$V_{DD} = 10V$		40		0.5	40		300	μA
	$V_{DD} = 15V$		60		0.7	80		600	μA
V_{OL} Low Level Output Voltage	$ I_O < 1\mu A$								
	$V_{DD} = 5V$		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	$ I_O < 1\mu A$								
	$V_{DD} = 5V$	4.95		4.95	5		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

DC Electrical Characteristics (Cont'd.) CD4024BC (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
V_{IL} Low Level Input Voltage	$I_{IQ} < 1\mu A$								
	$V_{DD} = 5V, V_O = 0.5V \text{ or } 4.5V$		1.5		2	1.5		1.5	V
	$V_{DD} = 10V, V_O = 1.0V \text{ or } 9.0V$		3.0		4	3.0		3.0	V
	$V_{DD} = 15V, V_O = 1.5V \text{ or } 13.5V$		4.0		6	4.0		4.0	V
V_{IH} High Level Input Voltage	$I_{IQ} < 1\mu A$								
	$V_{DD} = 5V, V_O = 0.5V \text{ or } 4.5V$	3.5		3.5	3		3.5		V
	$V_{DD} = 10V, V_O = 1.0V \text{ or } 9.0V$	7.0		7.0	6		7.0		V
	$V_{DD} = 15V, V_O = 1.5V \text{ or } 13.5V$	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 $T_A = 25^\circ C$, $C_L = 50 \text{ pF}$, $R_L = 200 \text{ k}$, t_r and $t_f = 20 \text{ ns}$ unless otherwise specified.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t_{PHL}, t_{PLH} Propagation Delay Time (Note 3)	$V_{DD} = 5V$		185	350	ns
	$V_{DD} = 10V$		85	125	ns
	$V_{DD} = 15V$		70	100	ns
t_{THL}, t_{TLH} Transition Time	$V_{DD} = 5V$		100	200	ns
	$V_{DD} = 10V$		50	100	ns
	$V_{DD} = 15V$		40	80	ns
t_{WL}, t_{WH} Minimum Input Pulse Width	$V_{DD} = 5V$		75	200	ns
	$V_{DD} = 10V$		40	110	ns
	$V_{DD} = 15V$		35	90	ns
t_{RCL}, t_{FCL} Input Rise and Fall Time	$V_{DD} = 5V$			15	μs
	$V_{DD} = 10V$			10	μs
	$V_{DD} = 15V$			8	μs
f_{CL} Maximum Input Pulse Frequency	$V_{DD} = 5V$	1.5	5		MHz
	$V_{DD} = 10V$	4	12		MHz
	$V_{DD} = 15V$	5	15		MHz
t_{PHL} Reset Propagation Delay Time	$V_{DD} = 5V$		185	350	ns
	$V_{DD} = 10V$		85	125	ns
	$V_{DD} = 15V$		70	100	ns
t_{WH} Reset Minimum Pulse Width	$V_{DD} = 5V$		185	350	ns
	$V_{DD} = 10V$		85	125	ns
	$V_{DD} = 15V$		70	100	ns
C_{IN} Input Capacitance (Note 4)	Any Input		5	7.5	pF

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.

Note 3: To Q1 output.

Note 4: Capacitance is guaranteed by periodic testing.