



CD4029BM/CD4029BC Presettable Binary/Decade Up/Down Counter

General Description

The CD4029BM/CD4029BC is a presettable up/down counter which counts in either binary or decade mode depending on the voltage level applied at binary/decade input. When binary/decade is at logical "1," the counter counts in binary, otherwise it counts in decade. Similarly, the counter counts up when the up/down input is at logical "1" and vice versa.

A logical "1" preset enable signal allows information at the "jam" inputs to preset the counter to any state asynchronously with the clock. The counter is advanced one count at the positive-going edge of the clock if the carry in and preset enable inputs are at logical "0." Advancement is inhibited when either or both of these two inputs is at logical "1." The carry out signal is normally at logical "1" state and goes to logical "0" state when the counter reaches its maximum count in

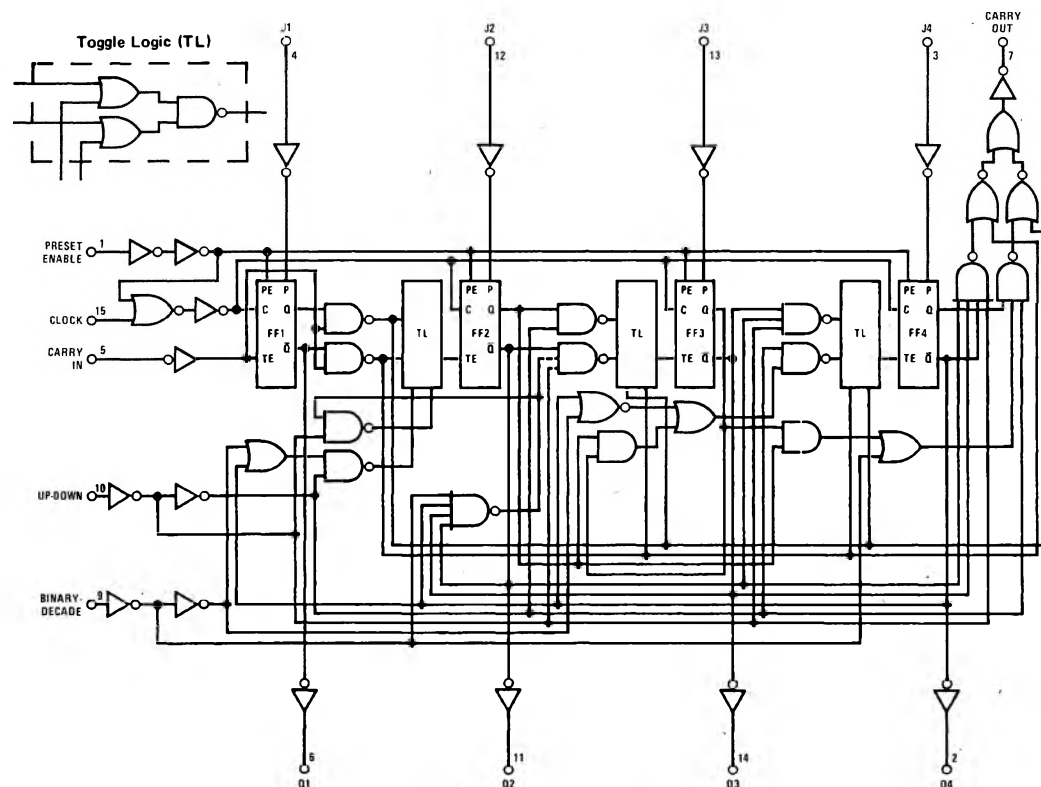
the "up" mode or the minimum count in the "down" mode provided the carry input is at logical "0" state.

All inputs are protected against static discharge by diode clamps to both V_{DD} and V_{SS} .

Features

- Wide supply voltage range 3V to 15V
- High noise immunity 0.45 V_{DD} (typ.)
- Low power fan out of 2
TTL compatibility driving 74L
or 1 driving 74LS
- Parallel jam inputs
- Binary or BCD decade up/down counting

Logic 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
CD4029BM	-40°C to +85°C
CD4029BC	

DC Electrical Characteristics CD4029BM (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			5	5	150	μA
	$V_{DD} = 10V$		10			10		300	μA
	$V_{DD} = 15V$		20			20		600	μA
V_{OL} Low Level Output Voltage	$ I_{O1} < 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_{OH} High Level Output Voltage	$ I_{O1} < 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_{IL} Low Level Input Voltage	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V		1.5			1.5		1.5	V
	$V_{DD} = 10V, V_O = 1V$ or 9V		3.0			3.0		3.0	V
	$V_{DD} = 15V, V_O = 1.5V$ or 13.5V		4.0			4.0		4.0	V
V_{IH} High Level Input Voltage	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V	3.5		3.5			3.5		V
	$V_{DD} = 10V, V_O = 1V$ or 9V	7.0		7.0			7.0		V
	$V_{DD} = 15V, V_O = 1.5V$ or 13.5V	11.0		11.0			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	$V_{DD} = 15V, V_{IN} = 0V$		-0.1		-10^{-5}	-0.1		-1.0	μA
	$V_{DD} = 15V, V_{IN} = 15V$		0.1		10^{-5}	0.1		1.0	μA

DC Electrical Characteristics CD4029BC (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			20		150	μA
	$V_{DD} = 10V$		40			40		300	μA
	$V_{DD} = 15V$		80			80		600	μA
V_{OL} Low Level Output Voltage	$ I_{O1} < 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_{OH} High Level Output Voltage	$ I_{O1} < 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_{IL} Low Level Input Voltage	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V		1.5			1.5		1.5	V
	$V_{DD} = 10V, V_O = 1V$ or 9V		3.0			3.0		3.0	V
	$V_{DD} = 15V, V_O = 1.5V$ or 13.5V		4.0			4.0		4.0	V
V_{IH} High Level Input Voltage	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V	3.5		3.5			3.5		V
	$V_{DD} = 10V, V_O = 1V$ or 9V	7.0		7.0			7.0		V
	$V_{DD} = 15V, V_O = 1.5V$ or 13.5V	11.0		11.0			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	$V_{DD} = 15V, V_{IN} = 0V$		-0.1		-10^{-5}	-0.1		-1.0	μA
	$V_{DD} = 15V, V_{IN} = 15V$		0.1		10^{-5}	0.1		1.0	μA

DC Electrical Characteristics (Cont'd.) CD4029BC (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
V _{IL} Low Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V		1.5			1.5		1.5	V
	V _{DD} = 10V, V _O = 1V or 9V		3.0			3.0		3.0	V
	V _{DD} = 15V, V _O = 1.5V or 13.5V		4.0			4.0		4.0	V
V _{IH} High Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V	3.5		3.5			3.5		V
	V _{DD} = 10V, V _O = 1V or 9V	7.0		7.0			7.0		V
	V _{DD} = 15V, V _O = 1.5V or 13.5V	11.0		11.0			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		-0.3		-10 ⁻⁵	-0.3		-1.0	μA
	V _{DD} = 15V, V _{IN} = 15V		0.3		10 ⁻⁵	0.3		1.0	μA

AC Electrical Characteristics T_A = 25°C, C_L = 50 pF, R_L = 200 k, Input t_{rCL} = t_{fCL} = 20 ns, unless otherwise specified

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
CLOCKED OPERATION					
t _{PHL} or t _{PLH} Propagation Delay Time to Q Outputs	V _{DD} = 5V		200	400	ns
	V _{DD} = 10V		85	170	ns
	V _{DD} = 15V		70	140	ns
t _{PHL} or t _{PLH} Propagation Delay Time to Carry Output	V _{DD} = 5V		320	640	ns
	V _{DD} = 10V		135	270	ns
	V _{DD} = 15V		110	220	ns
t _{PHL} or t _{PLH} Propagation Delay Time to Carry Output	V _{DD} = 5V, C _L = 15 pF		285	570	ns
	V _{DD} = 10V, C _L = 15 pF		120	240	ns
	V _{DD} = 15V, C _L = 15 pF		95	190	ns
t _{THL} or t _{TLH} Transition Time/Q or Carry Output	V _{DD} = 5V		100	200	ns
	V _{DD} = 10V		50	100	ns
	V _{DD} = 15V		40	80	ns
t _{WH} or t _{WL} Minimum Clock Pulse Width	V _{DD} = 5V		160	320	ns
	V _{DD} = 10V		70	135	ns
	V _{DD} = 15V		55	110	ns
t _{rCL} or t _{fCL} Maximum Clock Rise and Fall Time	V _{DD} = 5V	15			μs
	V _{DD} = 10V	10			μs
	V _{DD} = 15V	5			μs
t _{SU} Minimum Set-Up Time	V _{DD} = 5V		180	360	ns
	V _{DD} = 10V		70	140	ns
	V _{DD} = 15V		55	110	ns
f _{CL} Maximum Clock Frequency	V _{DD} = 5V	1.5	3.1		MHz
	V _{DD} = 10V	3.7	7.4		MHz
	V _{DD} = 15V	4.5	9		MHz
C _{IN} Average Input Capacitance	Any Input		5	7.5	pF
CPD Power Dissipation Capacitance	Per Package, (Note 3)		65		pF
PRESET ENABLE OPERATION					
t _{PHL} or t _{PLH} Propagation Delay Time to Q Output	V _{DD} = 5V		285	570	ns
	V _{DD} = 10V		115	230	ns
	V _{DD} = 15V		95	195	ns

AC Electrical Characteristics (Cont'd.) $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, $t_{rCL} = t_{fCL} = 20\text{ ns}$, unless otherwise specified

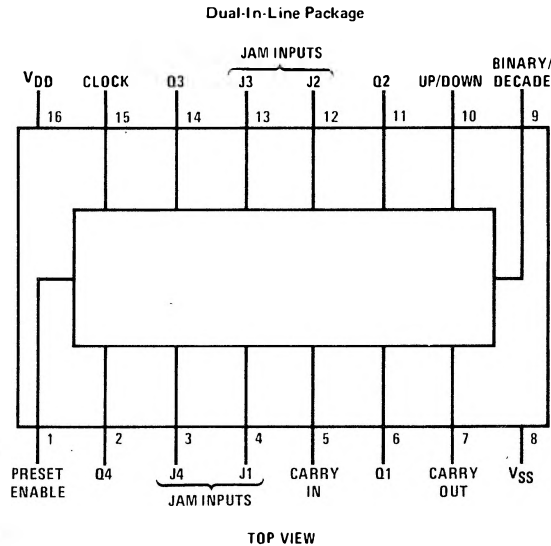
PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
PRESET ENABLE OPERATION (con't)						
tPHL or tPLH	Propagation Delay Time to Carry Output	VDD = 5V		400	800	ns
		VDD = 10V		165	330	ns
		VDD = 15V		135	260	ns
tWH	Minimum Preset Enable Pulse Width	VDD = 5V		80	160	ns
		VDD = 10V		30	60	ns
		VDD = 15V		25	50	ns
tREM	Minimum Preset Enable Removal Time	VDD = 5V		150	300	ns
		VDD = 10V		60	120	ns
		VDD = 15V		50	100	ns
CARRY INPUT OPERATION						
tPHL or tPLH	Propagation Delay Time to Carry Output	VDD = 5V		265	530	ns
		VDD = 10V		110	220	ns
		VDD = 15V		90	180	ns
tPHL, tPLH	Propagation Delay Time to Carry Output	VDD = 5V, CL = 15 pF		200	400	ns
		VDD = 10V, CL = 15 pF		85	170	ns
		VDD = 15V, CL = 15 pF		70	140	ns

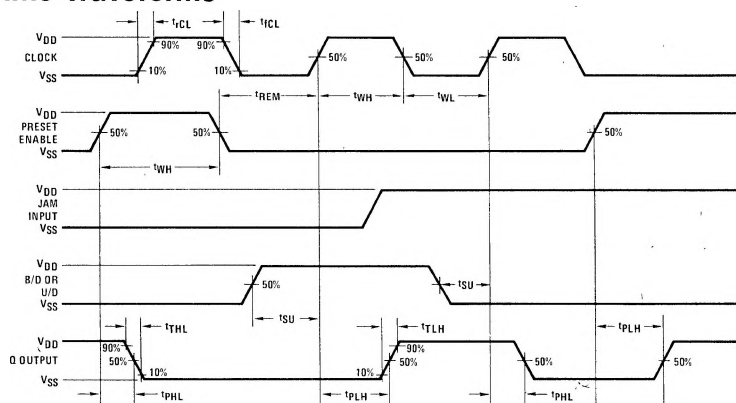
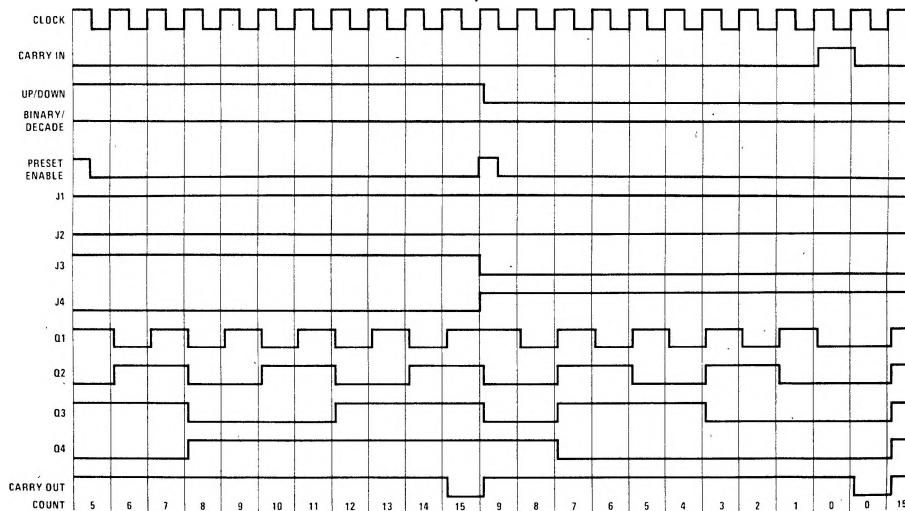
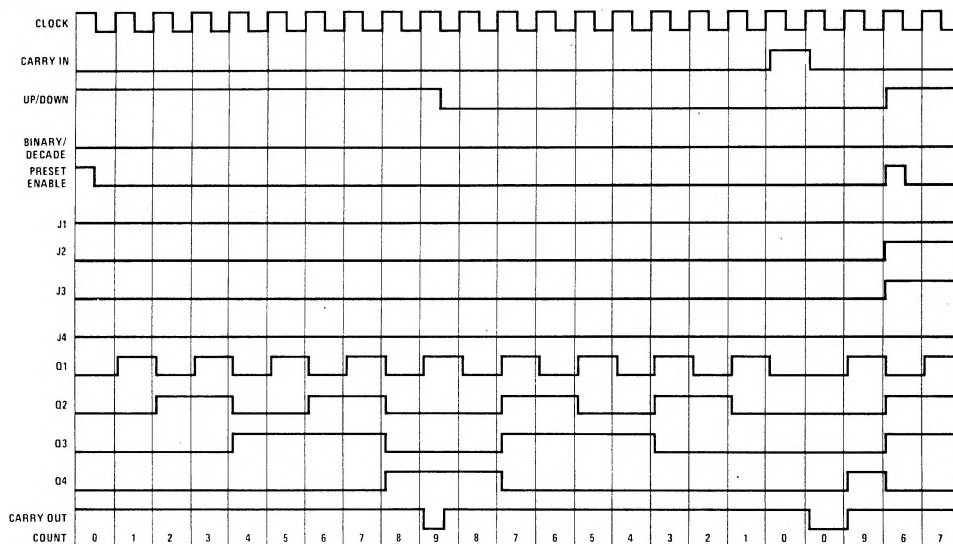
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual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

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

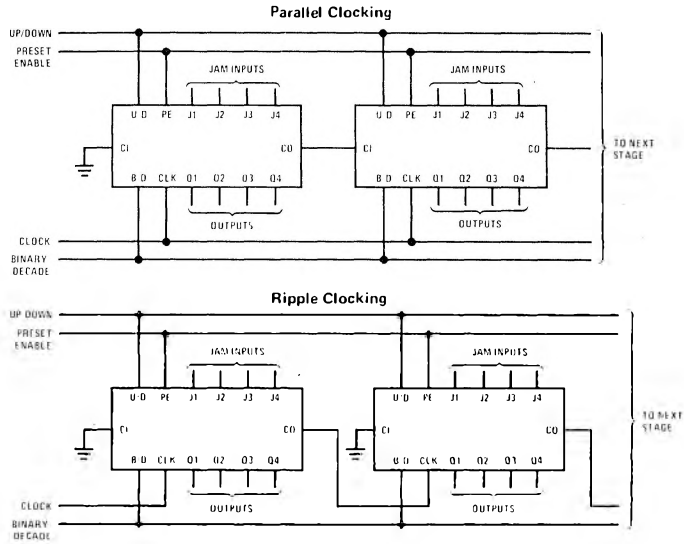
Note 3: C_{PD} determines the no load ac power consumption of any CMOS device. For complete explanation, see 54C/74C Family Characteristics application note, AN-90.

Connection Diagram





Cascading Packages



Carry out lines at the 2nd or later stages may have a negative-going spike due to differential internal delays. These spikes do not affect counter operation, but if the carry out is used to trigger external circuitry the carry out should be gated with the clock.