

CD4017BM/CD4017BC Decade Counter/Divider with 10 Decoded Outputs **CD4022BM/CD4022BC Divide-by-8 Counter/Divider with 8 Decoded Outputs**

General Description

The CD4017BM/CD4017BC is a 5-stage divide-by-10 Johnson counter with 10 decoded outputs and a carry out bit.

The CD4022BM/CD4022BC is a 4-stage divide-by-8 Johnson counter with 8 decoded outputs and a carry-out bit.

These counters are cleared to their zero count by a logical "1" on their reset line. These counters are advanced on the positive edge of the clock signal when the clock enable signal is in the logical "0" state.

The configuration of the CD4017BM/CD4017BC and CD4022BM/CD4022BC permits medium speed operation and assures a hazard free counting sequence. The 10/8 decoded outputs are normally in the logical "0" state and go to the logical "1" state only at their respective time slot. Each decoded output remains high for 1 full clock cycle. The carry-out signal completes a full cycle for every 10/8 clock input cycles and is used as a ripple carry signal to any succeeding stages.

Features

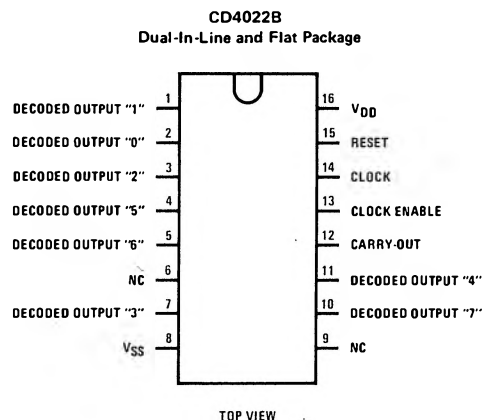
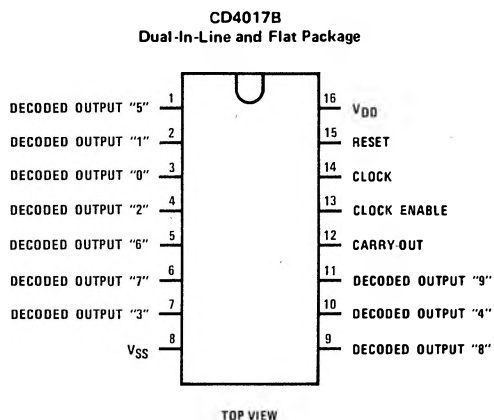
- Wide supply voltage range
- High noise immunity
- Low power TTL compatibility
- Medium speed operation
- Low power
- Fully static operation

3.0V to 15V
0.45 V_{DD} (typ.)
fan out of 2
driving 74L
or 1 driving
74LS
5.0 MHz (typ.)
with 10V V_{DD}
10 μ W (typ.)

Applications

- Automotive
- Instrumentation
- Medical electronics
- Alarm systems
- Industrial electronics
- Remote metering

Connection Diagrams



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
CD4017BM, CD4022BM	
CD4017BC, CD4022BC	-40°C to +85°C

DC Electrical Characteristics CD4017BM, CD4022BM (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		1.0	20		600	μA
V_{OL} Low Level Output Voltage	$ I_O < 1.0\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 < 1.0\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 < 1.0\mu A$								
	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V		1.5			1.5		1.5	V
	$V_{DD} = 10V, V_O = 1.0V$ or 9.0V		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	$ I_O < 1.0\mu A$								
	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V	3.5		3.5			3.5		V
	$V_{DD} = 10V, V_O = 1.0V$ or 9.0V	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	$V_{DD} = 5V, V_O = 4.6V$	-0.25		-0.2	-0.36		-0.14		mA
	$V_{DD} = 10V, V_O = 9.5V$	-0.62		-0.5	-0.9		-0.35		mA
	$V_{DD} = 15V, V_O = 13.5V$	-1.8		-1.5	-3.5		-1.1		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 CD4017BC, CD4022BC (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		0.5	20		150	μA
	$V_{DD} = 10V$		40		1.0	40		300	μA
	$V_{DD} = 15V$		80		5.0	80		600	μA
V_{OL} Low Level Output Voltage	$ I_O < 1.0\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 < 1.0\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.) 4017BC, 4022BC (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 _O < 1.0μA								
	V _{DD} = 5V, V _O = 0.5V or 4.5V		1.5			1.5		1.5	V
	V _{DD} = 10V, V _O = 1.0V or 9.0V		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	I _O < 1.0μA								
	V _{DD} = 5V, V _O = 0.5V or 4.5V	3.5		3.5			3.5		V
	V _{DD} = 10V, V _O = 1.0V or 9.0V	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	-0.2		-0.16	-0.36		-0.12		mA
	V _{DD} = 10V, V _O = 9.5V	-0.5		-0.4	-0.9		-0.3		mA
	V _{DD} = 15V, V _O = 13.5V	-1.4		-1.2	-3.5		-1.0		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

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.

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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
CLOCKED OPERATION					
t _{PHL} , t _{PLH} Propagation Delay Time: Carry Out Line	V _{DD} = 5V		415	800	ns
	V _{DD} = 10V		160	320	ns
	V _{DD} = 15V		130	250	ns
	V _{DD} = 5V		240	480	ns
	V _{DD} = 10V		85	170	ns
	V _{DD} = 15V		70	140	ns
	V _{DD} = 5V		500	1000	ns
	V _{DD} = 10V		200	400	ns
	V _{DD} = 15V		160	320	ns
	V _{DD} = 5V		200	360	ns
	V _{DD} = 10V		100	180	ns
	V _{DD} = 15V		80	130	ns
t _{TLH} , t _{THL} Transition Time Carry Out and Decode Out Lines	V _{DD} = 5V		100	200	ns
	V _{DD} = 10V		50	100	ns
	V _{DD} = 15V		40	80	ns
	V _{DD} = 5V		125	250	ns
	V _{DD} = 10V		45	90	ns
	V _{DD} = 15V		35	70	ns
	V _{DD} = 5V			20	μs
	V _{DD} = 10V			15	μs
	V _{DD} = 15V			5	μs
	V _{DD} = 5V		120	240	ns
	V _{DD} = 10V		40	80	ns
	V _{DD} = 15V		32	65	ns
f _{CL} Maximum Clock Frequency	V _{DD} = 5V } Measured with V _{DD} = 10V } Respect to Carry V _{DD} = 15V } Output Line	2.0 5.0 6.7	2 5 6		MHz MHz MHz
t _{WL} , t _{WH} Minimum Clock Pulse Width	V _{DD} = 5V		125	250	ns
	V _{DD} = 10V		45	90	ns
	V _{DD} = 15V		35	70	ns
t _{rCL} , t _{fCL} Clock Rise and Fall Time	V _{DD} = 5V			20	μs
	V _{DD} = 10V			15	μs
	V _{DD} = 15V			5	μs
t _{SU} Minimum Clock Inhibit Data Set-Up Time	V _{DD} = 5V		120	240	ns
	V _{DD} = 10V		40	80	ns
	V _{DD} = 15V		32	65	ns
C _{IN} Average Input Capacitance			5	7.5	pF

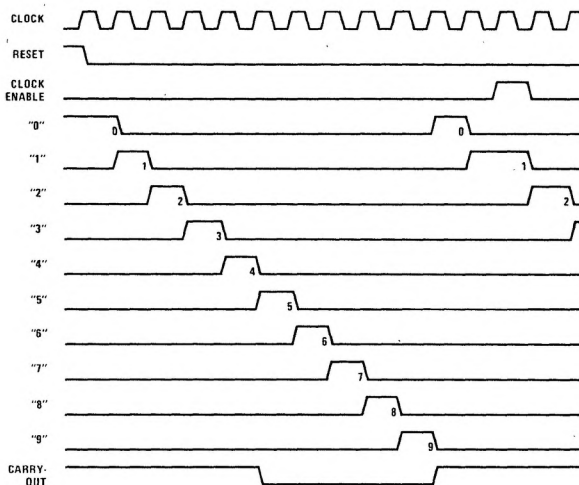
AC Electrical Characteristics (Cont'd.)

$T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$, t_{rCL} and $t_{fCL} = 20\text{ ns}$, unless otherwise specified.

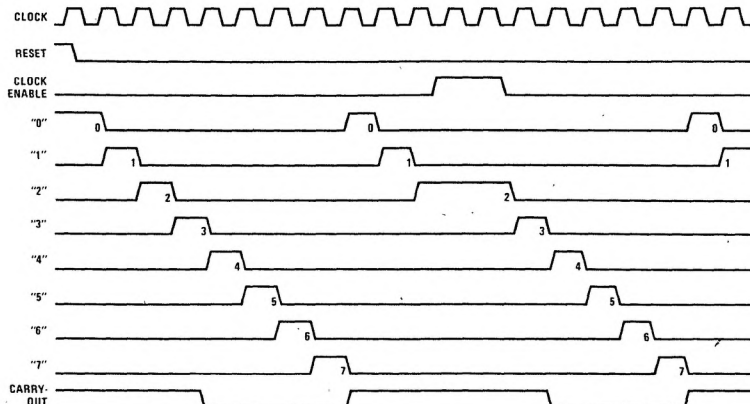
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
RESET OPERATION					
t_{PHL}	Propagation Delay Time: Carry Out Line	$V_{DD} = 5\text{V}$	415	800	ns
		$V_{DD} = 10\text{V}$	160	320	ns
		$V_{DD} = 15\text{V}$	130	250	ns
	Carry Out Line	$V_{DD} = 5\text{V}$	240	480	ns
		$V_{DD} = 10\text{V}$	85	170	ns
		$V_{DD} = 15\text{V}$	70	140	ns
	Decode Out Lines	$V_{DD} = 5\text{V}$	500	1000	ns
		$V_{DD} = 10\text{V}$	200	400	ns
		$V_{DD} = 15\text{V}$	160	320	ns
t_{WH}	Minimum Reset Pulse Width	$V_{DD} = 5\text{V}$	200	400	ns
		$V_{DD} = 10\text{V}$	70	140	ns
		$V_{DD} = 15\text{V}$	55	110	ns
t_{REM}	Minimum Reset Removal Time	$V_{DD} = 5\text{V}$	75	150	ns
		$V_{DD} = 10\text{V}$	30	60	ns
		$V_{DD} = 15\text{V}$	25	50	ns

Timing Diagrams

CD4017B



CD4022B



Logic Diagrams

