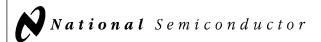
D4017BM/CD4017BC D4022BM/CD4022BC



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

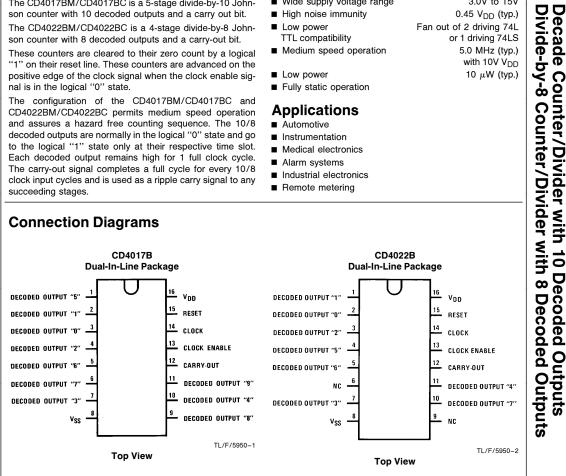
- Wide supply voltage range
- High noise immunity
- Low power
- TTL compatibility
- Medium speed operation
- Low power
- Fully static operation

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 μW (typ.)

Applications

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

Connection Diagrams



Order Number CD4017B or CD4022B

Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

DC Supply Voltage (V_{DD}) $-0.5 \text{ V}_{DC} \text{ to } +18 \text{ V}_{DC}$ Input Voltage (V_{IN}) $-0.5 \text{ V}_{DC} \text{ to } \text{ V}_{DD} +0.5 \text{ V}_{DC}$

Storage Temperature (Ts) $-65^{\circ}\text{C to } +150^{\circ}\text{C}$

Power Dissipation (PD)

Dual-In-Line 700 mW Small Outline 500 mW

Lead Temperature (T_L) (Soldering, 10 seconds)

260°C

Recommended Operating

Conditions (Note 2)

DC Supply Voltage (V_{DD}) $+3 \text{ V}_{DC} \text{ to } +15 \text{ V}_{DC}$ Input Voltage (V_{IN}) $0 \text{ to } \text{V}_{DD} \text{ V}_{DC}$

Operating Temperature Range (T_A)

DC Electrical Characteristics CD4017BM, CD4022BM (Note 2)

Symbol	Parameter	Conditions	−55°C			+ 25 °			+ 125°C	
Cymbol	rarameter	Conditions	Min	Max	Min	Тур	Max	Min	Max	Units
I _{DD}	Quiescent Device Current	$V_{DD} = 5V, V_{IN} = V_{DD} \text{ or } V_{SS}$ $V_{DD} = 10V, V_{IN} = V_{DD} \text{ or } V_{SS}$ $V_{DD} = 15V, V_{IN} = V_{DD} \text{ or } V_{SS}$		5 10 20		0.3 0.5 1.0	5 10 20		150 300 600	μΑ μΑ μΑ
V _{OL}	Low Level Output Voltage	$ I_O < 1.0 \mu A$ $V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V V
V _{OH}	High Level Output Voltage	$ I_O < 1.0 \mu A$ $V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.95		V V V
V _{IL}	Low Level Input Voltage	$ \begin{vmatrix} I_O < 1.0 \ \mu A \\ V_{DD} = 5V, V_O = 0.5V \text{ or } 4.5V \\ V_{DD} = 10V, V_O = 1.0V \text{ or } 9.0V \\ V_{DD} = 15V, V_O = 1.5V \text{ or } 13.5V \\ \end{vmatrix} $		1.5 3.0 4.0			1.5 3.0 4.0		1.5 3.0 4.0	V V
V _{IH}	High Level Input Voltage		3.5 7.0 11.0		3.5 7.0 11.0			3.5 7.0 11.0		V V V
l _{OL}	Low Level Output Current (Note 3)	$V_{DD} = 5V, V_{O} = 0.4V$ $V_{DD} = 10V, V_{O} = 0.5V$ $V_{DD} = 15V, V_{O} = 1.5V$	0.64 1.6 4.2		0.51 1.3 3.4	0.88 2.25 8.8		0.36 0.9 2.4		mA mA mA
I _{OH}	High Level Output Current (Note 3)	$V_{DD} = 5V, V_{O} = 4.6V$ $V_{DD} = 10V, V_{O} = 9.5V$ $V_{DD} = 15V, V_{O} = 13.5V$	-0.25 -0.62 -1.8		-0.2 -0.5 -1.5	-0.36 -0.9 -3.5		-0.14 -0.35 -1.1		mA mA mA
I _{IN}	Input Current	$V_{DD} = 15V, V_{IN} = 0V$ $V_{DD} = 15V, V_{IN} = 15V$		-0.1 0.1		-10 ⁻⁵	-0.1 0.1		-1.0 1.0	μA μA

DC Electrical Characteristics CD4017BC, CD4022BC (Note 2)

Symbol	Parameter	Conditions	−40°C		+ 25 °			+ 85°C		Units
	I didilicter		Min	Max	Min	Тур	Max	Min	Max	Onits
I _{DD}	Quiescent Device Current	$V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$		20 40 80		0.5 1.0 5.0	20 40 80		150 300 600	μΑ μΑ μΑ
V _{OL}	Low Level Output Voltage	$ I_{O} < 1.0 \mu A$ $V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V V
V _{OH}	High Level Output Voltage	$ I_{O} < 1.0 \mu A$ $V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.95		V V

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: I_{OL} and I_{OH} are tested one output at a time.

DC Electrical Characteristics CD4017BC, CD4022BC (Note 2) (Continued)

Symbol	Parameter	Conditions	−40°C		+ 25 °			+ 85°C		Units
	raiametei	Conditions	Min	Max	Min	Тур	Max	Min	Max	Office
V _{IL}	Low Level Input Voltage	$\begin{array}{l} I_O < 1.0 \; \mu A \\ V_{DD} = 5 \text{V}, V_O = 0.5 \text{V or } 4.5 \text{V} \\ V_{DD} = 10 \text{V}, V_O = 1.0 \text{V or } 9.0 \text{V} \\ V_{DD} = 15 \text{V}, V_O = 1.5 \text{V or } 13.5 \text{V} \end{array}$		1.5 3.0 4.0			1.5 3.0 4.0		1.5 3.0 4.0	>>>
V _{IH}	High Level Input Voltage	$ \begin{array}{l} I_O < 1.0 \; \mu A \\ V_{DD} = 5 \text{V}, V_O = 0.5 \text{V or } 4.5 \text{V} \\ V_{DD} = 10 \text{V}, V_O = 1.0 \text{V or } 9.0 \text{V} \\ V_{DD} = 15 \text{V}, V_O = 1.5 \text{V or } 13.5 \text{V} \end{array} $	3.5 7.0 11.0		3.5 7.0 11.0			3.5 7.0 11.0		>>>
l _{OL}	Low Level Output Current (Note 3)	$V_{DD} = 5V, V_{O} = 0.4V$ $V_{DD} = 10V, V_{O} = 0.5V$ $V_{DD} = 15V, V_{O} = 1.5V$	0.52 1.3 3.6		0.44 1.1 3.0	0.88 2.25 8.8		0.36 0.9 2.4		mA mA mA
I _{OH}	High Level Output Current (Note 3)	$V_{DD} = 5V, V_{O} = 4.6V$ $V_{DD} = 10V, V_{O} = 9.5V$ $V_{DD} = 15V, V_{O} = 13.5V$	-0.2 -0.5 -1.4		-0.16 -0.4 -1.2	-0.36 -0.9 -3.5		-0.12 -0.3 -1.0		mA mA mA
I _{IN}	Input Current	$V_{DD} = 15V, V_{IN} = 0V$ $V_{DD} = 15V, V_{IN} = 15V$		-0.3 0.3		-10^{-5} 10^{-5}	-0.3 0.3		-1.0 1.0	μA 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: $V_{SS} = ov$ unless otherwise specified.

Note 3: $I_{\mbox{\scriptsize OL}}$ and $I_{\mbox{\scriptsize OH}}$ are tested one output at a time.

AC Electrical Characteristics*

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

Symbol	Parameter	Conditions	Min	Тур	Max	Units
LOCK OPERA	ATION					•
t _{PHL} , t _{PLH}	Propagation Delay Time Carry Out Line	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V		415 160 130	800 320 250	ns ns ns
	Carry Out Line	$ \begin{array}{c} V_{DD} = 5V \\ V_{DD} = 10V \\ V_{DD} = 15V \end{array} \right\} C_L = 15 \ pF $		240 85 70	480 170 140	ns ns ns
	Decode Out Lines	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V		500 200 160	1000 400 320	ns ns ns
t _{TLH} , t _{THL}	Transition Time Carry Out and Decode Out Lines t _{TLH}	$V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$		200 100 80	360 180 130	ns ns ns
	t _{THL}	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V		100 50 40	200 100 80	ns ns ns
f _{CL}	Maximum Clock Frequency	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V	1.0 2.5 3.0	2 5 6		MHz MHz MHz
t _{WL} , t _{WH}	Minimum Clock Pulse Width	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V		125 45 35	250 90 70	ns ns ns
t _{rCL} , t _{fCL}	Clock Rise and Fall Time	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V			20 15 5	μs μs μs
t _{SU}	Minimum Clock Inhibit Data Setup Time	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V		120 40 32	240 80 65	ns ns ns
C _{IN}	Average Input Capacitance			5	7.5	pF

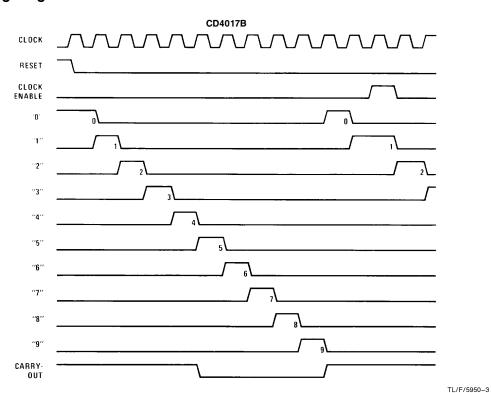
AC Electrical Characteristics*

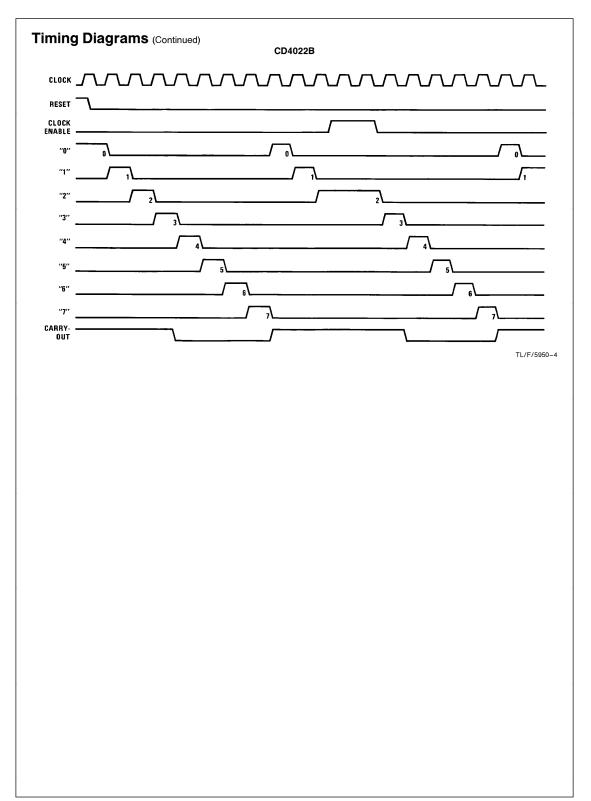
 T_A = 25°C, C_L = 50 pF, R_L = 200k, t_{rCL} and t_{fCL} = 20 ns, unless otherwise specified

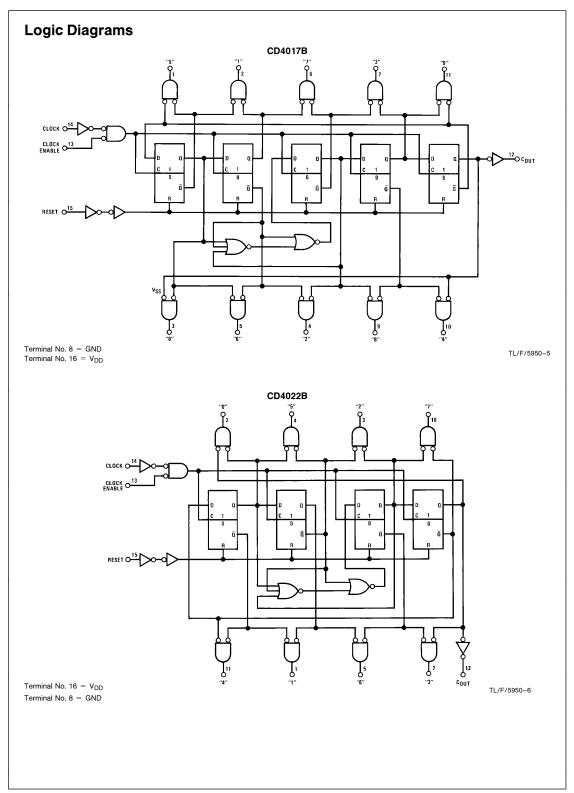
Symbol	Parameter	Conditions	Min	Тур	Max	Units
RESET OPERAT	TION		•			
[†] PHL, tPLH	Propagation Delay Time Carry Out Line	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V		415 160 130	800 320 250	ns ns ns
	Carry Out Line	$ \begin{array}{c} V_{DD} = 5V \\ V_{DD} = 10V \\ V_{DD} = 15V \end{array} \right\} C_L = 15 \ pF $		240 85 70	480 170 140	ns ns ns
	Decode Out Lines	$V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$		500 200 160	1000 400 320	ns ns ns
t _W	Minimum Reset Pulse Width	$V_{DD} = 5V \\ V_{DD} = 10V \\ V_{DD} = 15V$		200 70 55	400 140 110	ns ns ns
^t REM	Minimum Reset Removal Time	V _{DD} = 5V V _{DD} = 10V V _{DD} = 15V		75 30 25	150 60 50	ns ns ns

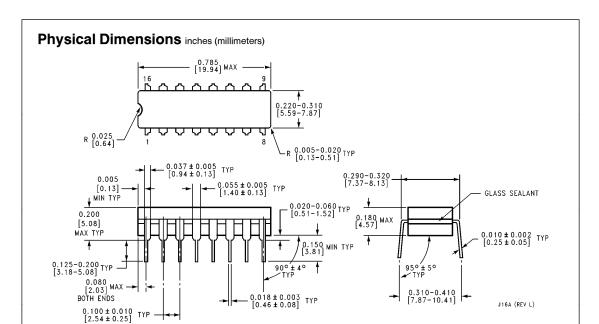
^{*}AC Parameters are guaranteed by DC correlated testing.

Timing Diagrams



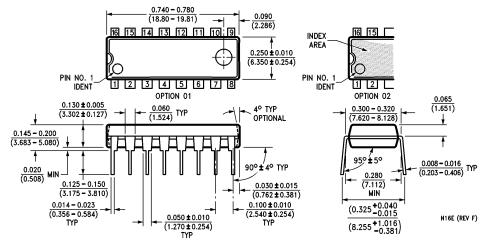






Ceramic Dual-In-Line Package (J) Order Number CD4017BMJ, CD4017BCJ, CD4022BMJ, CD4022BCJ NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N) Order Number CD4017BMN, CD4017BCN, CD4022BMN, CD4022BCN NS Package Number N16E

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