FAIRCHILD SEMICONDUCTOR™

October 1987
Revised January 1999

CD4017BC • CD4022BC
Decade Counter/Divider with 10 Decoded Outputs • Divide-by-8 Counter/Divider with 8 Decoded Outputs

General Description

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

The 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 CD4017BC and 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: 3.0V to 15V
- High noise immunity: 0.45 V_{DD} (typ.)
- Low power Fan out of 2 driving 74L
  TTL compatibility: or 1 driving 74LS
- Medium speed operation: 5.0 MHz (typ.)
  with 10V V_{DD}
- Low power: 10 μW (typ.)
- Fully static operation

Applications

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

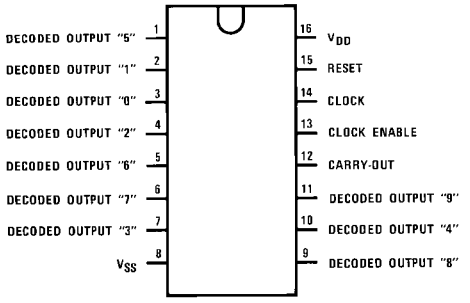
Ordering Code:

Order Number	Package Number	Package Description
CD4017BCM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD4017BCSJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
CD4017BCN	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
CD4022BCM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD4022BCN	N16E	16-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.

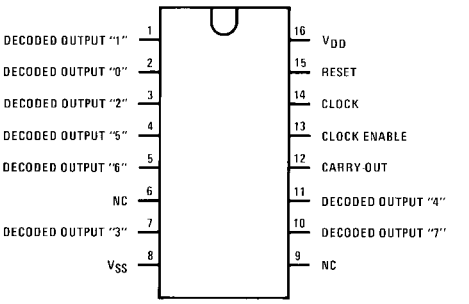
Connection Diagrams

Pin Assignments for DIP, SOIC and SOP
CD4017B



Top View

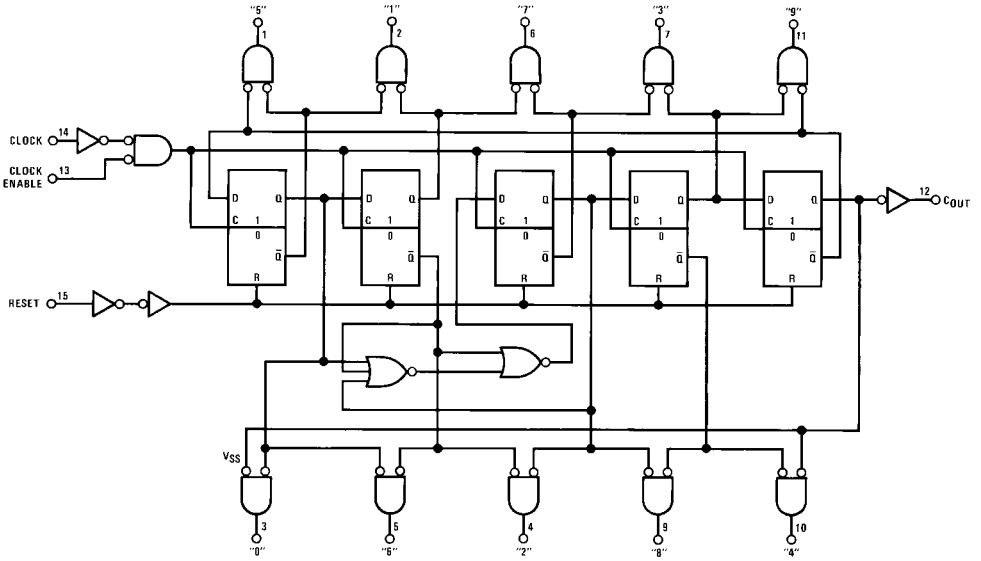
Pin Assignments for DIP and SOIC
CD4022B



Top View

Logic Diagrams

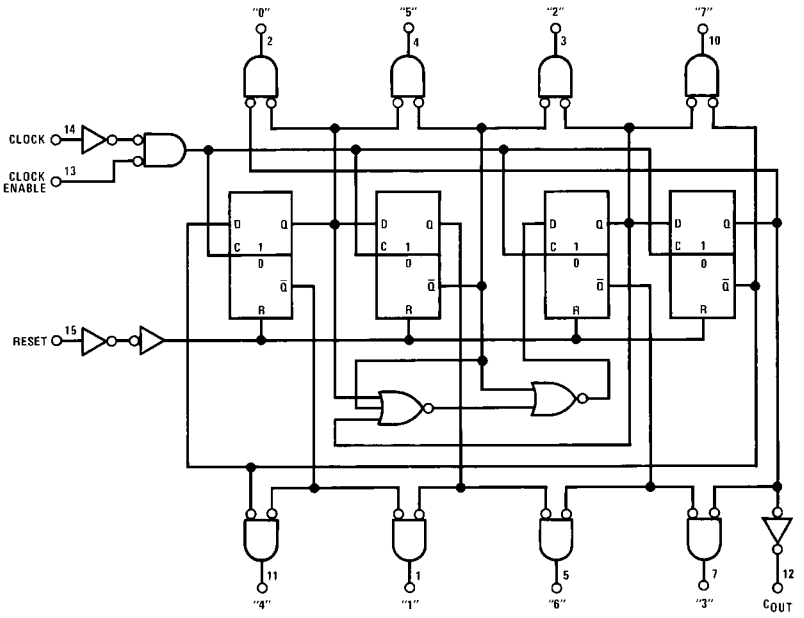
CD4017B



Terminal No. 8 = GND

Terminal No. 16 = V_{DD}

CD4022B



Terminal No. 16 = V_{DD}

Terminal No. 8 = GND

Absolute Maximum Ratings(Note 1)

(Note 2)

DC Supply Voltage (V_{DD})	−0.5 V_{DC} to +18 V_{DC}
Input Voltage (V_{IN})	−0.5 V_{DC} to V_{DD} +0.5 V_{DC}
Storage Temperature (T_S)	−65°C to +150°C
Power Dissipation (P_D)	
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 V_{DC} to +15 V_{DC}
Input Voltage (V_{IN})	0 to V_{DD} V_{DC}
Operating Temperature Range (T_A)	−40°C to +85°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	−40°C		+25°			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device	V_{DD} = 5V		20		0.5	20		150	µA
	Current	V_{DD} = 10V		40		1.0	40		300	µA
		V_{DD} = 15V		80		5.0	80		600	µA
V_{OL}	LOW Level	$\|I_O\|$ < 1.0 µA								
	Output Voltage	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	$\|I_O\|$ < 1.0 µA								
	Output Voltage	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	$\|I_O\|$ < 1.0 µA								
	Input Voltage	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	$\|I_O\|$ < 1.0 µA								
	Input Voltage	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	V_{DD} = 5V, V_O = 0.4V	0.52		0.44	0.88		0.36		mA
	Current (Note 3)	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	V_{DD} = 5V, V_O = 4.6V	−0.2		−0.16	−0.36		−0.12		mA
	Current (Note 3)	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 3: I_{OL} and I_{OH} are tested one output at a time.

AC Electrical Characteristics (Note 4)

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

Symbol	Parameter	Conditions		Min	Typ	Max	Units
CLOCK 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
	Carry Out Line	$V_{DD} = 5V$			240	480	ns
		$V_{DD} = 10V$	$C_L = 15$ pF		85	170	ns
		$V_{DD} = 15V$			70	140	ns
	Decode Out Lines	$V_{DD} = 5V$			500	1000	ns
		$V_{DD} = 10V$			200	400	ns
		$V_{DD} = 15V$			160	320	ns
t_{TLH}, t_{THL}	Transition Time Carry Out and Decode Out Lines						
	t_{TLH}	$V_{DD} = 5V$			200	360	ns
		$V_{DD} = 10V$			100	180	ns
		$V_{DD} = 15V$			80	130	ns
	t_{THL}	$V_{DD} = 5V$			100	200	ns
		$V_{DD} = 10V$			50	100	ns
		$V_{DD} = 15V$			40	80	ns
f_{CL}	Maximum Clock Frequency	$V_{DD} = 5V$	Measured with	1.0	2		MHz
		$V_{DD} = 10V$	Respect to Carry	2.5	5		MHz
		$V_{DD} = 15V$	Output Line	3.0	6		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 Setup 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

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

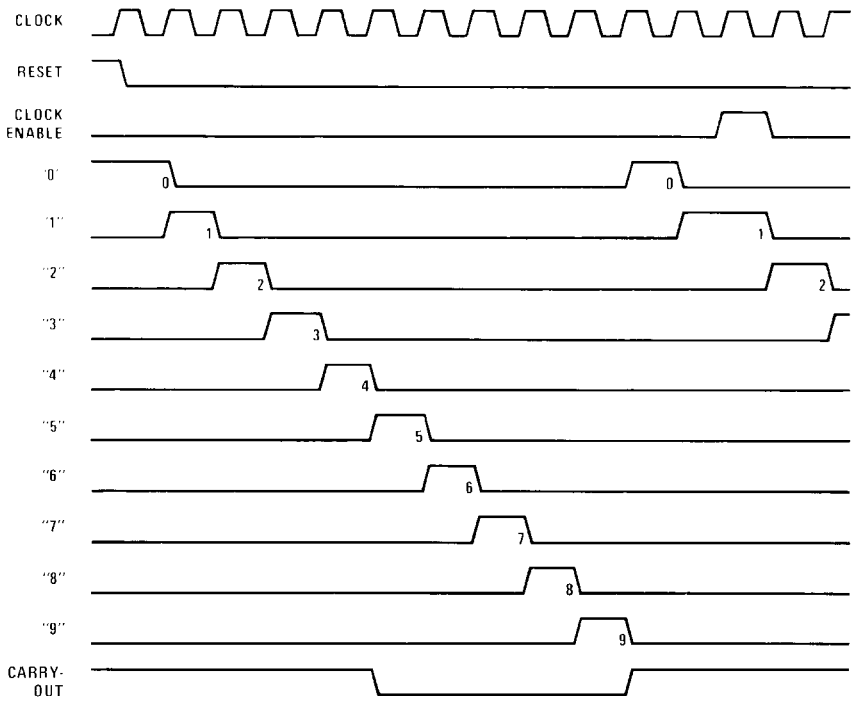
AC Electrical Characteristics (Note 4)

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

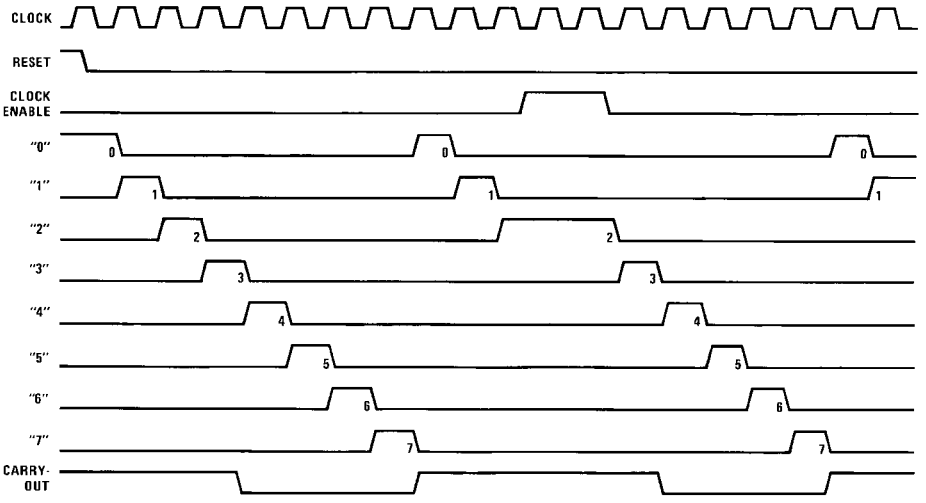
Symbol	Parameter	Conditions		Min	Typ	Max	Units
RESET OPERATION							
t_{PHL}, t_{PLH}	Propagation Delay Time						
	Carry Out Line	$V_{DD} = 5V$			415	800	ns
		$V_{DD} = 10V$			160	320	ns
		$V_{DD} = 15V$			130	250	ns
	Carry Out Line	$V_{DD} = 5V$			240	480	ns
		$V_{DD} = 10V$	$C_L = 15$ pF		85	170	ns
		$V_{DD} = 15V$			70	140	ns
	Decode Out Lines	$V_{DD} = 5V$			500	1000	ns
		$V_{DD} = 10V$			200	400	ns
		$V_{DD} = 15V$			160	320	ns
t_W	Minimum Reset	$V_{DD} = 5V$			200	400	ns
	Pulse Width	$V_{DD} = 10V$			70	140	ns
		$V_{DD} = 15V$			55	110	ns
t_{REM}	Minimum Reset	$V_{DD} = 5V$			75	150	ns
	Removal Time	$V_{DD} = 10V$			30	60	ns
		$V_{DD} = 15V$			25	50	ns

Timing Diagrams

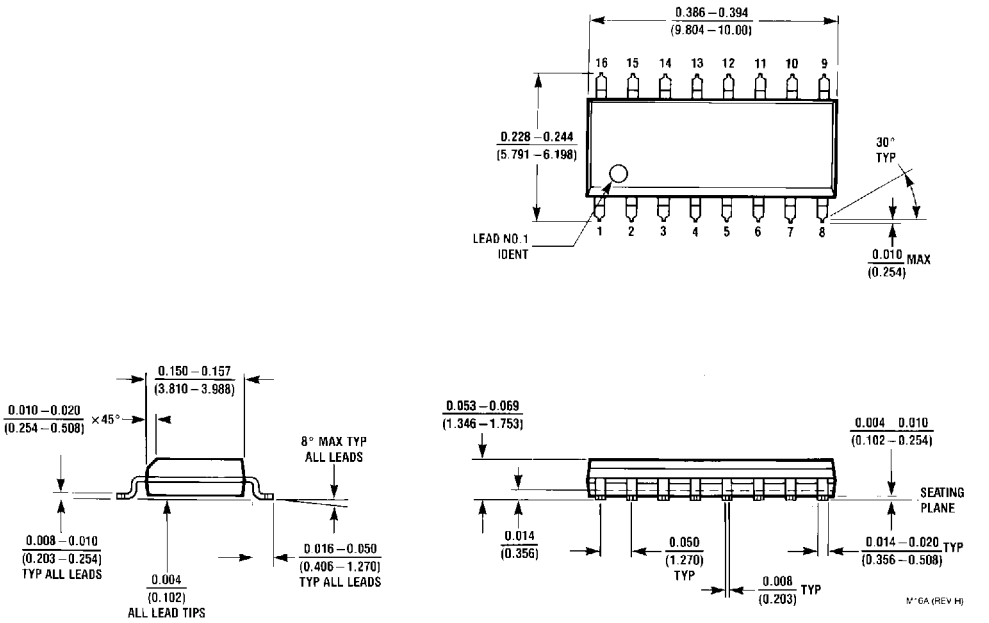
CD4017B



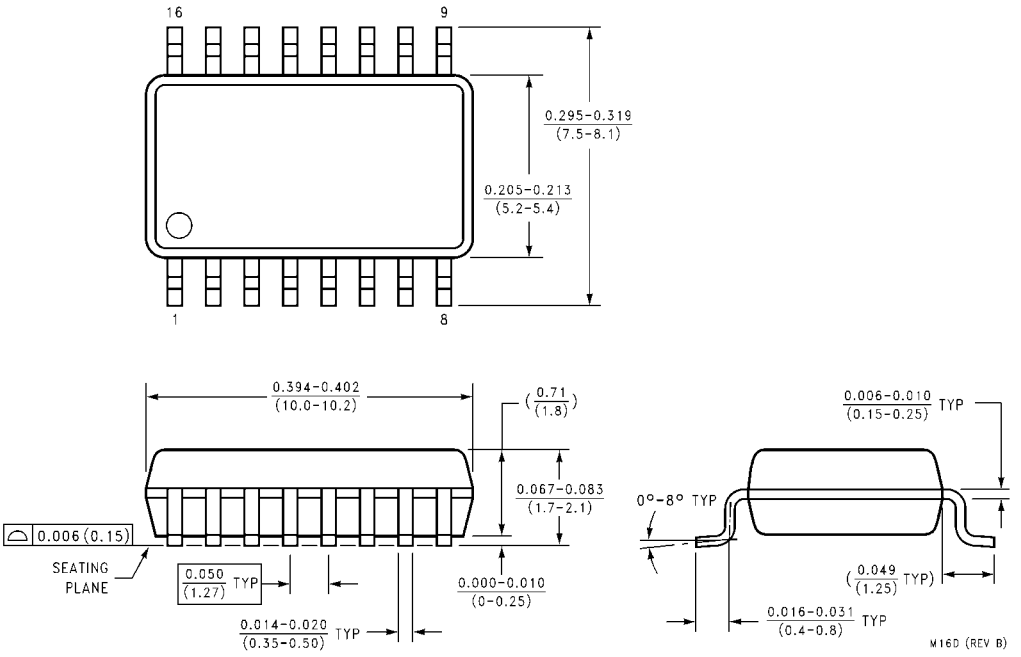
CD4022B



Physical Dimensions inches (millimeters) unless otherwise noted

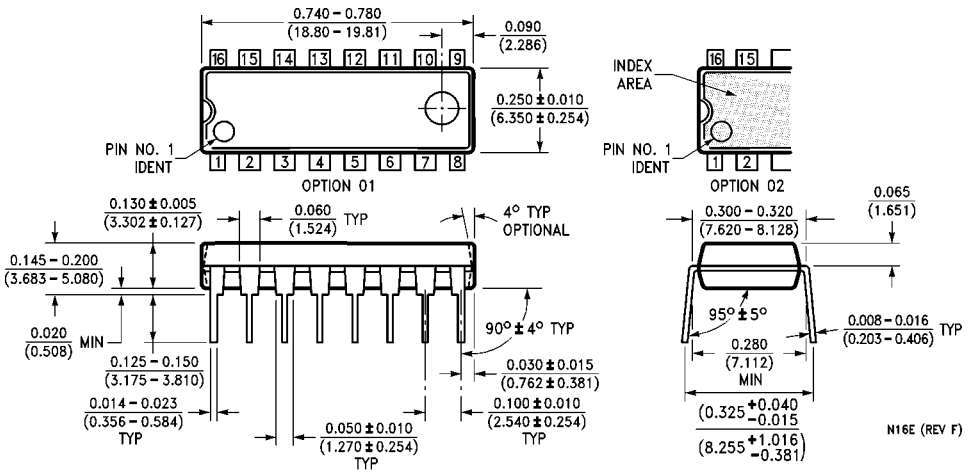


16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M16A



16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

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



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-1, 0.300" Wide
Package Number N16E

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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