October 1987
Revised March 2002

CD40192BC • CD40193BC
Synchronous 4-Bit Up/Down Decade Counter •
Synchronous 4-Bit Up/Down Binary Counter

General Description

The CD40192BC and CD40193BC up/down counters are monolithic complementary MOS (CMOS) integrated circuits. The CD40192BC is a BCD counter, while the CD40193BC is a binary counter.

Counting up and counting down is performed by two count inputs, one being held HIGH while the other is clocked. The outputs change on the positive-going transition of this clock.

These counters feature preset inputs that are enabled when load is a logical "0" and a clear which forces all outputs to "0" when it is at logical "1". The counters also have carry and borrow outputs so that they can be cascaded using no external circuitry.

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

Features

■ Wide supply voltage range: 3V to 15V
■ High noise immunity: 0.45 V_{DD} (typ.)
■ Low power TTL compatibility: Fan out of 2 driving 74L or 1 driving 74LS
■ Carry and borrow outputs for easy expansion to N-bit by cascading
■ Asynchronous clear
■ Equivalent to: MM74C192 and MM74C193

Ordering Code:

Order Number	Package Number	Package Description
CD40192BCN	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
CD40193BCM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD40193BCN	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 suffix letter "X" to the ordering code.

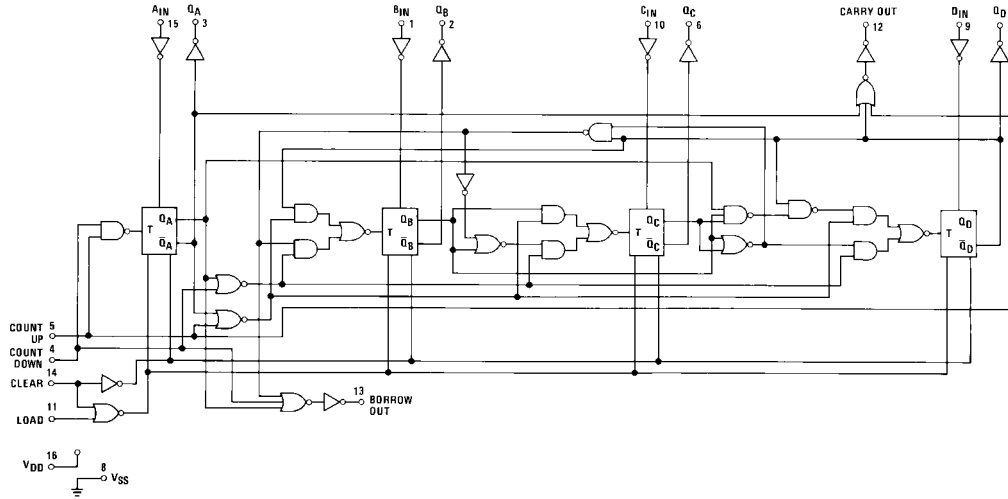## Connection Diagram

Pin Assignments for DIP and SOIC

Top View
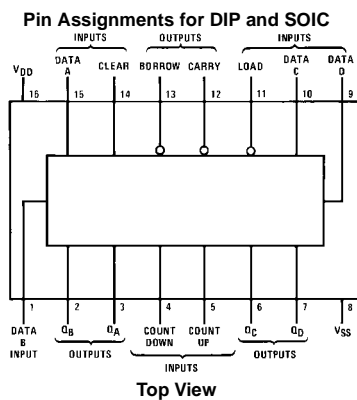
Cascading Packages
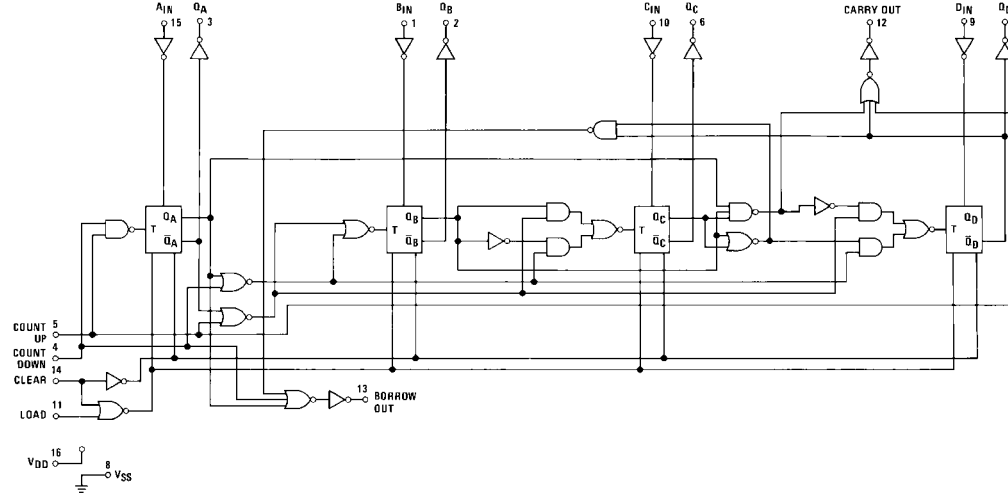
CD40192BC • CD40193BC
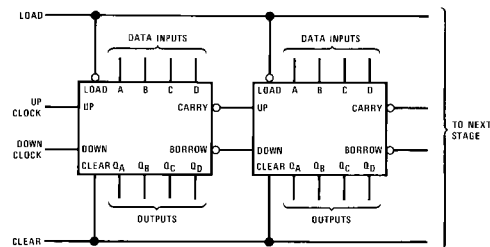
Block Diagrams

CD40192BC Synchronous 4-Bit Up/Down Decade Counter

CD40193BC Synchronous 4-Bit Up/Down Binary Counter

Absolute Maximum Ratings(Note 1)

(Note 2)

DC Supply Voltage (V$_{DD}$)	−0.5 to +18 V$_{DC}$
Input Voltage (V$_{IN}$)	−0.5 to V$_{DD}$ +0.5 V$_{DC}$
Storage Temperature Range (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 to 15 V$_{DC}$
Input Voltage (V$_{IN}$)	0 to V$_{DD}$ V$_{DC}$
Operating Temperature Range (T$_A$)	
CD40192BC, CD40193BC	−55°C to +125°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 "Recommended Operating Conditions" and Electrical Characteristics tables provide conditions for actual device operation.

Note 2: V$_{SS}$ = 0V unless otherwise specified.

DC Electrical Characteristics (Note 3)

Symbol	Parameter	Conditions	−55°C Min	−55°C Max	+25°C Min	+25°C Typ	+25°C Max	+125°C Min	+125°C Max	Units
I$_{DD}$	Quiescent Device	V$_{DD}$ = 5V, V$_{IN}$ = V$_{DD}$or V$_{SS}$		5			5		150	
	Current	V$_{DD}$ = 10V, V$_{IN}$ = V$_{DD}$ or V$_{SS}$		10			10		300	μA
		V$_{DD}$ = 15V, V$_{IN}$ = V$_{DD}$ or V$_{SS}$		20			20		600	
V$_{OL}$	LOW Level	V$_{DD}$ = 5V		0.05			0.05		0.05	
	Output Voltage	V$_{DD}$ = 10V		0.05			0.05		0.05	V
		V$_{DD}$ = 15V		0.05			0.05		0.05	
V$_{OH}$	HIGH Level	V$_{DD}$ = 5V	4.95		4.95			4.95		
	Output Voltage	V$_{DD}$ = 10V	9.95		9.95			9.95		V
		V$_{DD}$ = 15V	14.95		14.95			14.95		
V$_{IL}$	LOW Level	V$_{DD}$ = 5V, V$_O$ = 0.5V or 4.5V		1.5			1.5		1.5	
	Input Voltage	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$_{IH}$	HIGH Level	V$_{DD}$ = 5V, V$_O$ = 0.5V or 4.5V	3.5		3.5			3.5		
	Input Voltage	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		
I$_{OL}$	LOW Level Output	V$_{DD}$ = 5V, V$_O$ = 0.4V	0.64		0.51	0.88		0.36		
	Current (Note 4)	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		
I$_{OH}$	HIGH Level Output	V$_{DD}$ = 5V, V$_O$ = 4.6V	−0.64		−0.51	−0.88		−0.36		
	Current (Note 4)	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		
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	

Note 3: AC Parameters are guaranteed by DC correlated testing.

Note 4: I$_{OH}$ and I$_{OL}$ are tested one output at a time.

AC Electrical Characteristics (Note 3)

$T_A = 25°C$, $C_L = 50$ pF, $R_L = 200$ kΩ, input $t_r = t_f = 20$ ns, unless otherwise specified.

| Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL} or t_{PLH}	Propagation Delay Time from Count Up or Count Down to Q	$V_{DD} = 5V$		250	400	
		$V_{DD} = 10V$		100	160	ns
		$V_{DD} = 15V$		80	130	
t_{PHL} or t_{PLH}	Propagation Delay Time from Count Up to Carry	$V_{DD} = 5V$		120	200	
		$V_{DD} = 10V$		50	80	ns
		$V_{DD} = 15V$		40	65	
t_{PHL} or t_{PLH}	Propagation Delay Time from Count Down to Borrow	$V_{DD} = 5V$		120	200	
		$V_{DD} = 10V$		50	80	ns
		$V_{DD} = 15V$		40	65	
t_{SU}	Time Prior to Load That Data Must Be Present	$V_{DD} = 5V$		100	160	
		$V_{DD} = 10V$		30	50	ns
		$V_{DD} = 15V$		25	40	
t_{PHL}	Propagation Delay Time from Clear to Q	$V_{DD} = 5V$		130	220	
		$V_{DD} = 10V$		60	100	ns
		$V_{DD} = 15V$		50	80	
t_{PLH} or t_{PHL}	Propagation Delay Time from Load to Q	$V_{DD} = 5V$		300	480	
		$V_{DD} = 10V$		120	190	ns
		$V_{DD} = 15V$		95	150	
t_{TLH} or t_{THL}	Output Transition Time	$V_{DD} = 5V$		100	200	
		$V_{DD} = 10V$		50	100	ns
		$V_{DD} = 15V$		40	80	
f_{CL}	Maximum Count Frequency	$V_{DD} = 5V$	2.5	4		
		$V_{DD} = 10V$	6	10		MHz
		$V_{DD} = 15V$	7.5	12.5		
t_{rCL} or t_{fCL}	Maximum Count Rise or Fall Time	$V_{DD} = 5V$	15			
		$V_{DD} = 10V$	5			µs
		$V_{DD} = 15V$	1			
t_{WH}, t_{WL}	Minimum Count Pulse Width	$V_{DD} = 5V$		120	200	
		$V_{DD} = 10V$		35	80	ns
		$V_{DD} = 15V$		28	65	
t_{WH}	Minimum Clear Pulse Width	$V_{DD} = 5V$		300	480	
		$V_{DD} = 10V$		120	190	ns
		$V_{DD} = 15V$		95	150	
t_{WL}	Minimum Load Pulse Width	$V_{DD} = 5V$		100	160	
		$V_{DD} = 10V$		40	65	ns
		$V_{DD} = 15V$		32	55	
C_{IN}	Average Input Capacitance	Load and Data Inputs (A,B,C,D)		5	7.5	pF
		Count Up, Count Down and Clear		10	15	
C_{PD}	Power Dissipation Capacity	(Note 5)		100		pF

Note 5: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation, see Family Characteristics application note, AN-90.

Timing Diagrams
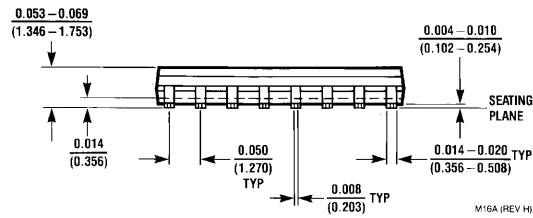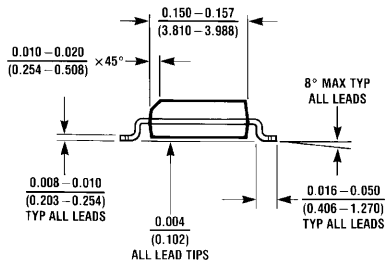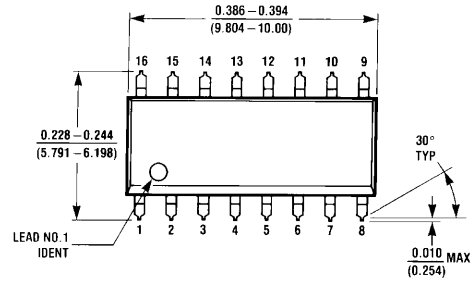
CD40192BC
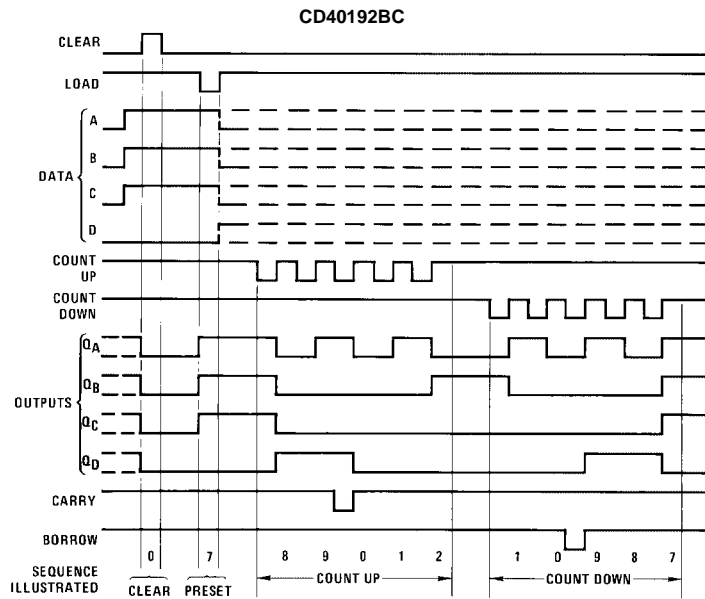
Sequence:
1. Clear outputs to zero.
2. Load (preset) to BCD seven.
3. Count up to eight, nine, carry, zero, one and two.
4. Count down to one, zero, borrow, nine, eight and seven.

CD40193BC
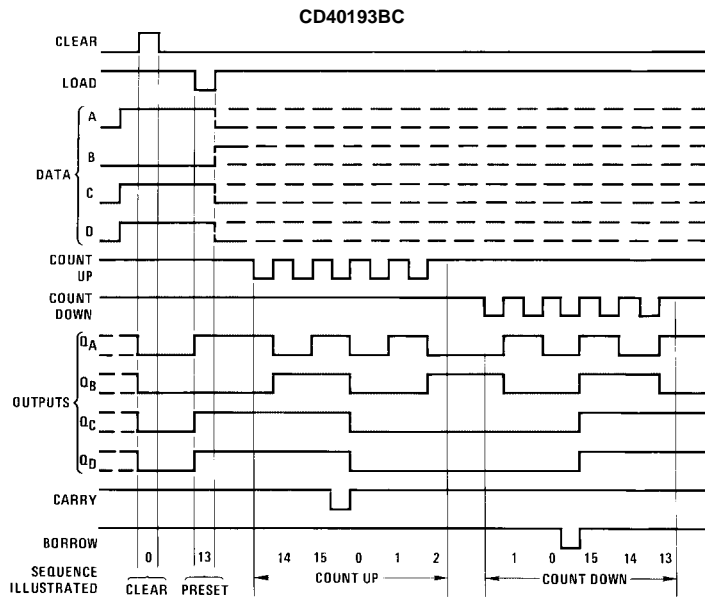
Sequence:
1. Clear outputs to zero.
2. Load (preset) to binary thirteen.
3. Count up to fourteen, fifteen, carry, zero, one and two.
4. Count down to one, zero, borrow, fifteen, fourteen and thirteen.

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Physical Dimensions inches (millimeters) unless otherwise noted

0.386 − 0.394
(9.804 − 10.00)

16 15 14 13 12 11 10 9

0.228 − 0.244
(5.791 − 6.198)

30°
TYP

LEAD NO.1
IDENT

1 2 3 4 5 6 7 8

0.010 MAX
(0.254)

0.150 − 0.157
(3.810 − 3.988)

0.010 − 0.020
(0.254 − 0.508) × 45°

8° MAX TYP
ALL LEADS

0.008 − 0.010
(0.203 − 0.254)
TYP ALL LEADS

0.004
(0.102)
ALL LEAD TIPS

0.016 − 0.050
(0.406 − 1.270)
TYP ALL LEADS

0.053 − 0.069
(1.346 − 1.753)

0.004 − 0.010
(0.102 − 0.254)

SEATING
PLANE

0.014
(0.356)

0.050
(1.270)
TYP

0.008 TYP
(0.203)

0.014 − 0.020 TYP
(0.356 − 0.508)

M16A (REV H)

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

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)
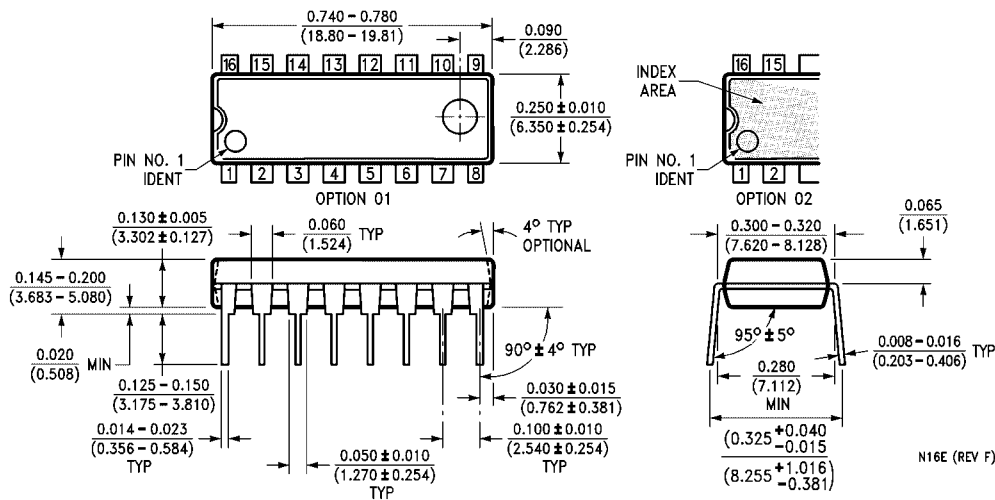
16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N16E

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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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