

## CD40174BC • CD40175BC Hex D-Type Flip-Flop • Quad D-Type Flip-Flop

### General Description

The CD40174BC consists of six positive-edge triggered D-type flip-flops; the true outputs from each flip-flop are externally available. The CD40175BC consists of four positive-edge triggered D-type flip-flops; both the true and complement outputs from each flip-flop are externally available.

All flip-flops are controlled by a common clock and a common clear. Information at the D inputs meeting the set-up time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. The clearing operation, enabled by a negative pulse at Clear input, clears all Q outputs to logical "0" and  $\bar{Q}$ s (CD40175BC only) to logical "1".

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

### Features

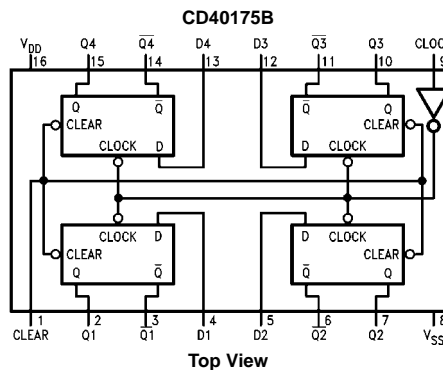
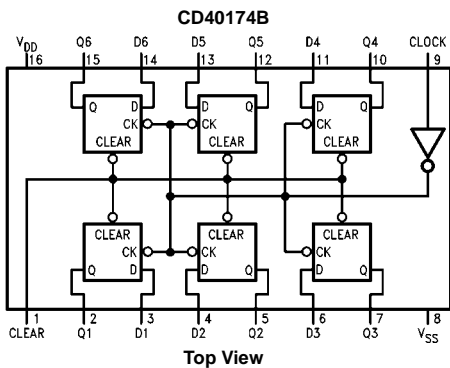
- Wide supply voltage range: 3V to 15V
- High noise immunity:  $0.45 V_{DD}$  (typ.)
- Low power TTL compatibility: fan out of 2 driving 74L or 1 driving 74 LS
- Equivalent to MC14174B, MC14175B
- Equivalent to MM74C174, MM74C175

### Ordering Code:

Order Number	Package Number	Package Description
CD40174BCM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD40174BCN	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
CD40175BCM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD40175BCN	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



## Truth Table

Inputs			Outputs	
Clear	Clock	D	Q	$\bar{Q}$ (Note 1)
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	H	X	NC	NC
H	L	X	NC	NC

H = HIGH Level

L = LOW Level

X = Irrelevant

↑ = Transition from LOW-to-HIGH level

NC = No change

**Note 1:**  $\bar{Q}$  for CD40175B only

### Absolute Maximum Ratings (Note 2)

(Note 3)

DC Supply Voltage ( $V_{DD}$ )	-0.5V to +18V
Input Voltage ( $V_{IN}$ )	-0.5V 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 3)

DC Supply Voltage ( $V_{DD}$ )	3V to 15 $V_{DC}$
Input Voltage ( $V_{IN}$ )	0V to $V_{DD} V_{DC}$
Operating Temperature Range ( $T_A$ )	-55°C to +125°C

**Note 2:** "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 tables of "Recommended Operating Conditions" and "Electrical Characteristics" provide conditions for actual device operation.

**Note 3:**  $V_{SS} = 0V$  unless otherwise specified.

### DC Electrical Characteristics (Note 3)

CD40174BC/CD40175BC

Symbol	Parameter	Conditions	-55°C		+25°C			+125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
$I_{DD}$	Quiescent Device Current	$V_{DD} = 5V, V_{IN} = V_{DD}$ or $V_{SS}$		1.0			1.0		30	$\mu A$
		$V_{DD} = 10V, V_{IN} = V_{DD}$ or $V_{SS}$		2.0			2.0		60	
		$V_{DD} = 15V, V_{IN} = V_{DD}$ or $V_{SS}$		4.0			4.0		120	
$V_{OL}$	LOW Level Output Voltage	$V_{DD} = 5V$		0.05			0.05		0.05	V
		$V_{DD} = 10V$	$ I_O  < 1 \mu A$	0.05			0.05		0.05	
		$V_{DD} = 15V$		0.05			0.05		0.05	
$V_{OH}$	HIGH Level Output Voltage	$V_{DD} = 5V$	4.95		4.95	5		4.95		V
		$V_{DD} = 10V$	9.95		9.95	10		9.95		
		$V_{DD} = 15V$	14.95		14.95	15		14.95		
$V_{IL}$	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	
		$V_{DD} = 15V, V_O = 1.5V$ or 13.5V		4.0			4.0		4.0	
$V_{IH}$	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		
		$V_{DD} = 15V, V_O = 1.5V$ or 13.5V	11.0		11.0			11.0		
$I_{OL}$	LOW Level Output Current <small>(Note 4)</small>	$V_{DD} = 5V, V_O = 0.4V$	0.64		0.51	0.88		0.36		mA
		$V_{DD} = 10V, V_O = 0.5V$	1.6		1.3	2.25		0.9		
		$V_{DD} = 15V, V_O = 1.5V$	4.2		3.4	8.8		2.4		
$I_{OH}$	HIGH Level Output Current <small>(Note 4)</small>	$V_{DD} = 5V, V_O = 4.6V$	-0.64		-0.51	-0.88		-0.36		mA
		$V_{DD} = 10V, V_O = 9.5V$	-1.6		-1.3	-2.25		-0.9		
		$V_{DD} = 15V, V_O = 13.5V$	-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	$\mu A$
		$V_{DD} = 15V, V_{IN} = 15V$		-0.1		$10^{-5}$	-0.1		1.0	

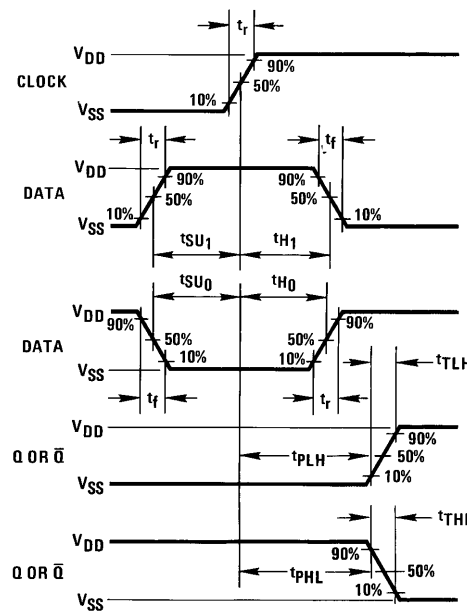
**Note 4:**  $I_{OH}$  and  $I_{OL}$  are tested one output at a time.

**AC Electrical Characteristics** (Note 5)T<sub>A</sub> = 25°C, C<sub>L</sub> = 50 pF, R<sub>L</sub> = 200k and t<sub>r</sub> = t<sub>f</sub> = 20 ns, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Time to a Logical "0" or Logical "1" from Clock to Q or $\bar{Q}$ (CD40175 Only)	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		190 75 60	300 110 90	ns
t <sub>PHL</sub>	Propagation Delay Time to a Logical "0" from Clear to Q	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		180 70 60	300 110 90	ns
t <sub>PLH</sub>	Propagation Delay Time to a Logical "1" from Clear to $\bar{Q}$ (CD40175 Only)	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		230 90 75	400 150 120	ns
t <sub>SU</sub>	Time Prior to Clock Pulse that Data must be Present	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		45 15 13	100 40 35	ns
t <sub>H</sub>	Time after Clock Pulse that Data Must be Held	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		-11 -4 -3	0 0 0	ns
t <sub>THL</sub> , t <sub>TLH</sub>	Transition Time	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		100 50 40	200 100 80	ns
t <sub>WH</sub> , t <sub>WL</sub>	Minimum Clock Pulse Width	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		130 45 40	250 100 80	ns
t <sub>WL</sub>	Minimum Clear Pulse Width	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V		120 45 40	250 100 80	ns
t <sub>RCL</sub>	Maximum Clock Rise Time	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V	15 5.0 5.0			μs
t <sub>CL</sub>	Maximum Clock Fall Time	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V	15 5.0 5.0	50 50 50		μs
f <sub>CL</sub>	Maximum Clock Frequency	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V	2.0 5.0 6.0	3.5 10 12		MHz
C <sub>IN</sub>	Input Capacitance	Clear Input Other Input		10 5.0	15 7.5	pF
C <sub>PD</sub>	Power Dissipation	Per Package (Note 6)		130		pF

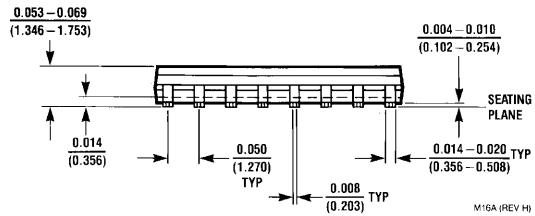
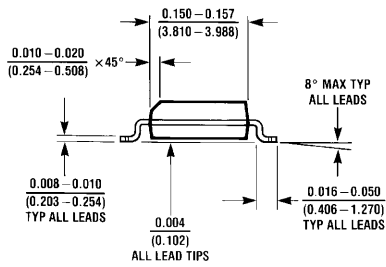
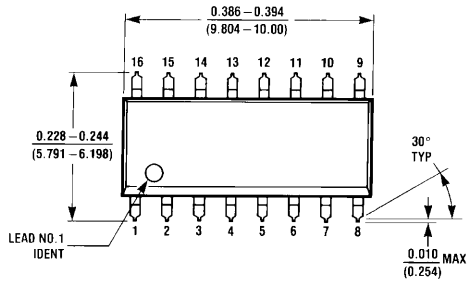
**Note 5:** AC Parameters are guaranteed by DC correlated testing.**Note 6:** C<sub>PD</sub> determines the no load AC power consumption of any CMOS device. For complete explanation, see 74C Family Characteristics application note, AN-90.

### Switching Time Waveforms



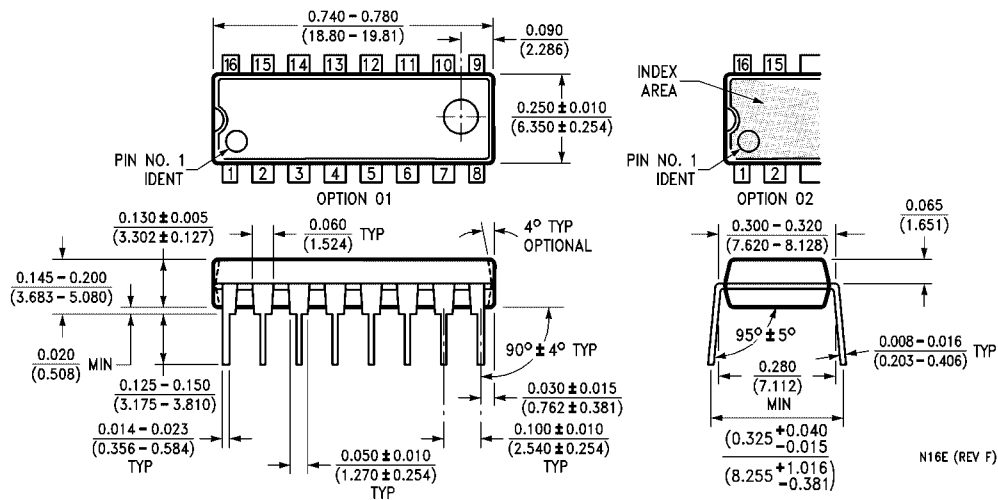
$t_r = t_f = 20 \text{ ns}$

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



**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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