

## CD4094BC

### 8-Bit Shift Register/Latch with 3-STATE Outputs

#### General Description

The CD4094BC consists of an 8-bit shift register and a 3-STATE 8-bit latch. Data is shifted serially through the shift register on the positive transition of the clock. The output of the last stage ( $Q_8$ ) can be used to cascade several devices. Data on the  $Q_8$  output is transferred to a second output,  $Q'_8$ , on the following negative clock edge.

The output of each stage of the shift register feeds a latch, which latches data on the negative edge of the STROBE input. When STROBE is HIGH, data propagates through the latch to 3-STATE output gates. These gates are enabled when OUTPUT ENABLE is taken HIGH.

#### Features

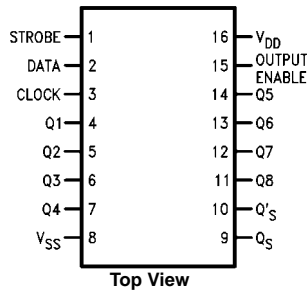
- Wide supply voltage range: 3.0V to 18V
- High noise immunity:  $0.45 V_{DD}$  (typ.)
- Low power TTL compatibility:  
Fan out of 2 driving 74L or 1 driving 74LS
- 3-STATE outputs

#### Ordering Code:

Order Number	Package Number	Package Description
CD4094BCWM	M16B	16-Lead Small Outline Intergrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
CD4094BCN	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 Diagram

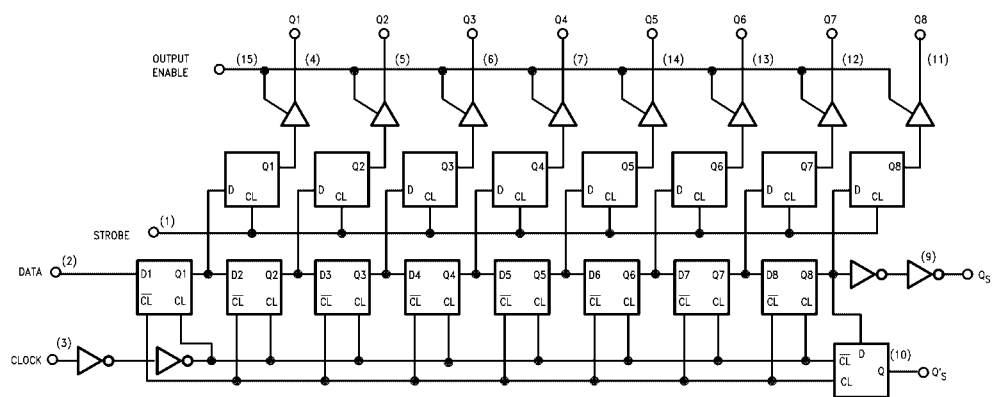


#### Truth Table

Clock	Output Enable	Strobe	Data	Parallel Outputs		Serial Outputs	
				$Q_1$	$Q_N$	$Q_8$ (Note 1)	$Q'_8$
—	0	X	X	Hi-Z	Hi-Z	Q7	No Change
—	0	X	X	Hi-Z	Hi-Z	No Change	Q7
—	1	0	X	No Change	No Change	Q7	No Change
—	1	1	0	0	$Q_{N-1}$	Q7	No Change
—	1	1	1	1	$Q_{N-1}$	Q7	No Change
—	1	1	1	No Change	No Change	No Change	Q7

X = Don't Care  
— = HIGH-to-LOW  
— = LOW-to-HIGH

**Note 1:** At the positive clock edge, information in the 7th shift register stage is transferred to  $Q_8$  and  $Q'_8$ .



**Absolute Maximum Ratings**(Note 2)

(Note 3)

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 3)

DC Supply Voltage ( $V_{DD}$ )	+3.0 to +15 $V_{DC}$
Input Voltage ( $V_{IN}$ )	0 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)

Symbol	Parameter	Conditions	55°C		+25°C			+125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
$I_{DD}$	Quiescent Device Current	$V_{DD} = 5.0V$		5.0			5.0		150	$\mu A$
		$V_{DD} = 10V$		10			10		300	
		$V_{DD} = 15V$		20			20		600	
$V_{OL}$	LOW Level Output Voltage	$V_{DD} = 5.0V$		0.05		0	0.05		0.05	V
		$V_{DD} = 10V$ $ I_O  \leq 1.0 \mu A$		0.05		0	0.05		0.05	
		$V_{DD} = 15V$		0.05		0	0.05		0.05	
$V_{OH}$	HIGH Level Output Voltage	$V_{DD} = 5.0V$	4.95		4.95	5.0		4.95		V
		$V_{DD} = 10V$ $ I_O  \leq 1 \mu A$	9.95		9.95	10.0		9.95		
		$V_{DD} = 15V$	14.95		14.95	15.0		14.95		
$V_{IL}$	LOW Level Input Voltage	$V_{DD} = 5.0V, V_O = 0.5V$ 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	
		$V_{DD} = 15V, V_O = 1.5V$ or $13.5V$		4.0			4.0		4.0	
$V_{IH}$	HIGH Level Input Voltage	$V_{DD} = 5.0V, V_O = 0.5V$ 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		
		$V_{DD} = 15V, V_O = 1.5V$ or $13.5V$	11.0		11.0			11.0		
$I_{OL}$	LOW Level Output Current (Note 4)	$V_{DD} = 5.0V, V_O = 0.4V$	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 (Note 4)	$V_{DD} = 5.0V, V_O = 4.6V$	−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			−0.1		−1.0	$\mu A$
		$V_{DD} = 15V, V_{IN} = 15V$		0.1			0.1		1.0	
$I_{OZ}$	3-STATE Output Leakage Current	$V_{DD} = 15V, V_{IN} = 0V$ or $15V$		0.3			±0.3		±9	$\mu A$

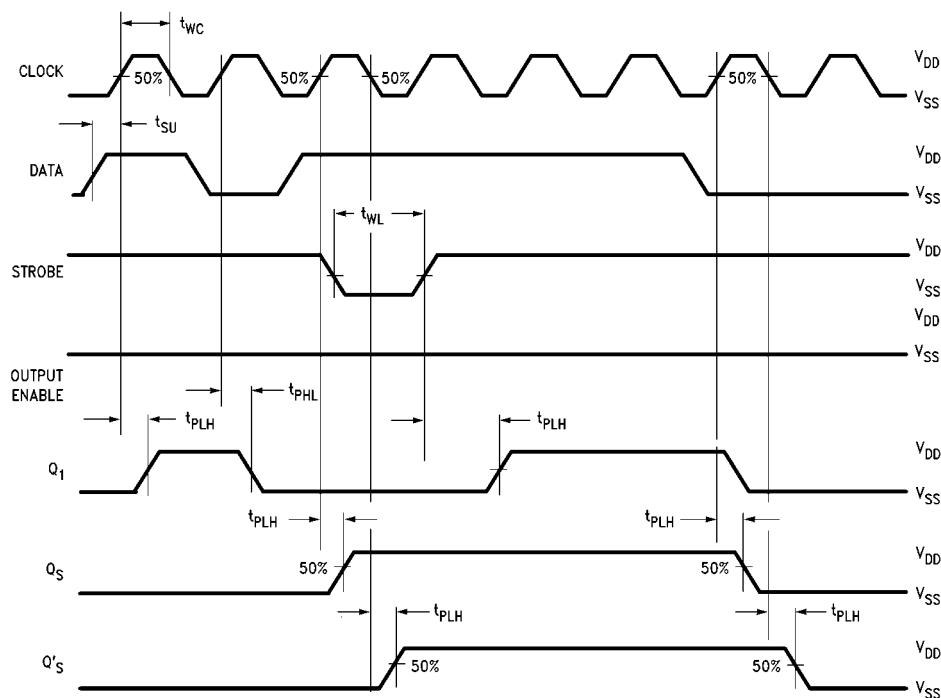
**Note 4:**  $I_{OH}$  and  $I_{OL}$  are tested one output at a time.

**AC Electrical Characteristics** (Note 5) $T_A = 25^\circ\text{C}$ ,  $C_L = 50\text{ pF}$ 

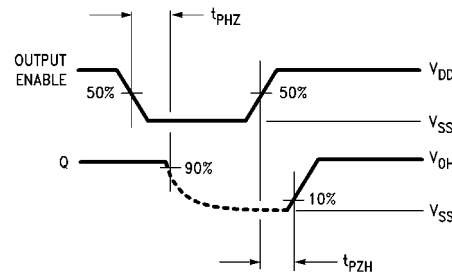
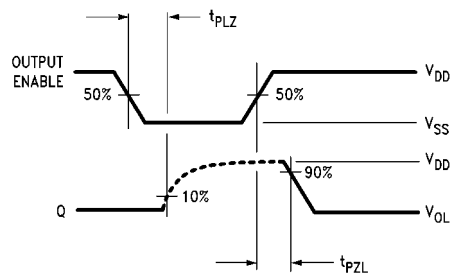
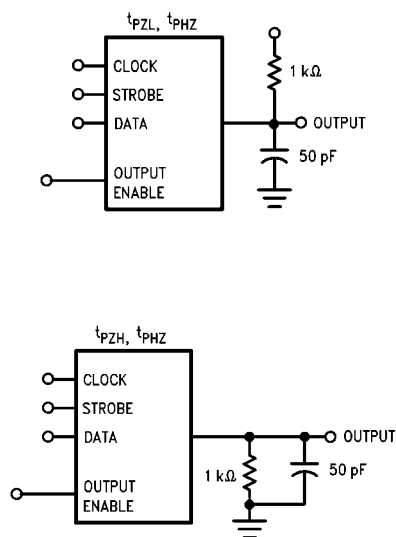
Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PHL}, t_{PLH}$	Propagation Delay Clock to $Q_S$	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		300 125 95	600 250 190	ns
$t_{PHL}, t_{PLH}$	Propagation Delay Clock to $Q'_S$	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		230 110 75	460 220 150	ns
$t_{PHL}, t_{PLH}$	Propagation Delay Clock to Parallel Out	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		420 195 135	840 390 270	ns
$t_{PHL}, t_{PLH}$	Propagation Delay Strobe to Parallel Out	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		290 145 100	580 290 200	ns
$t_{PHZ}$	Propagation Delay HIGH Level to HIGH Impedance	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		140 75 55	280 150 110	ns
$t_{PLZ}$	Propagation Delay LOW Level to HIGH Impedance	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		140 75 55	280 150 110	ns
$t_{PZH}$	Propagation Delay HIGH Impedance to HIGH Level	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		140 75 55	280 150 110	ns
$t_{PZL}$	Propagation Delay HIGH Impedance to LOW Level	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		140 75 55	280 150 110	ns
$t_{THL}, t_{TLH}$	Transition Time	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		100 50 40	200 100 80	ns
$t_{SU}$	Set-Up Time Data to Clock	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$	80 40 20	40 20 10		ns
$t_r, t_f$	Maximum Clock Rise and Fall Time	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$	1 1 1			ms
$t_{PC}$	Minimum Clock Pulse Width	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$	200 100 83	100 50 40		ns
$t_{PS}$	Minimum Strobe Pulse Width	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$	200 80 70	100 40 35		ns
$f_{max}$	Maximum Clock Frequency	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$	1.5 3.0 4.0	3.0 6.0 8.0		MHz
$C_{IN}$	Input Capacitance	Any Input		5.0	7.5	pF

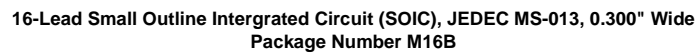
**Note 5:** AC Parameters are guaranteed by DC correlated testing.

## Timing Diagram

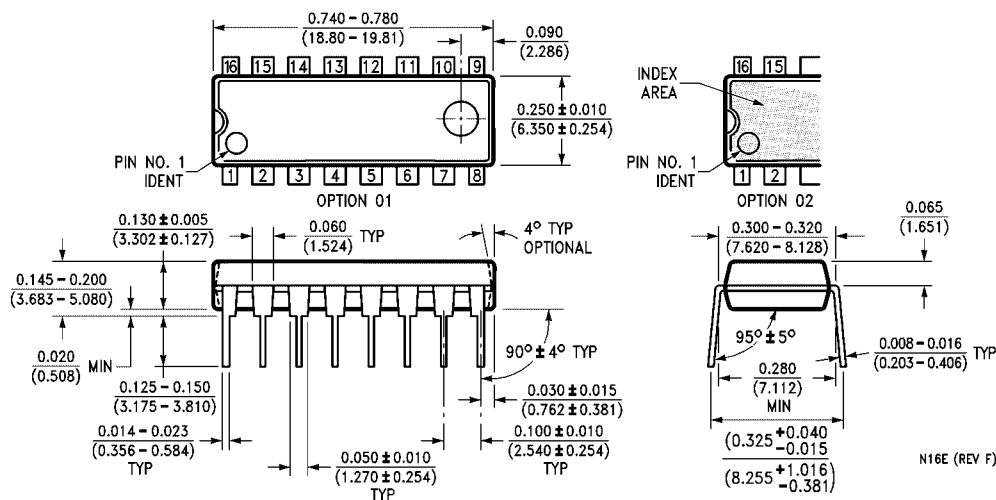


## Test Circuits and Timing Diagrams for 3-STATE





**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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