

## 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

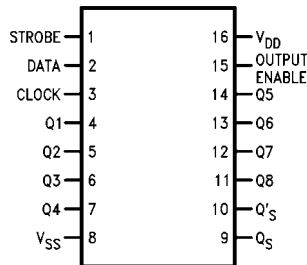
### Ordering Code:

Order Number	Package Number	Package Description
CD4094BCWMM	M16B	16-Lead Small Outline Integrated 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

Pin Assignments for DIP and SOIC



Top View

### Truth Table

Clock	Output Enable	Strobe	Data	Parallel Outputs		Serial Outputs	
				Q1	Q <sub>N</sub>	Q <sub>S</sub> (Note 1)	Q' <sub>Σ</sub>
⎯	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 <sub>N</sub> -1	Q7	No Change
⎯	1	1	1	1	Q <sub>N</sub> -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 Q8 and Q<sub>S</sub>.



### 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 ( $T_A$ )	-40°C to +85°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	-40°C		+25°C			+85°C		Units	
			Min	Max	Min	Typ	Max	Min	Max		
$I_{DD}$	Quiescent Device Current	$V_{DD} = 5.0V$		20			20		150	$\mu A$	
		$V_{DD} = 10V$		40			40		300	$\mu A$	
		$V_{DD} = 15V$		80			80		600	$\mu A$	
$V_{OL}$	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
		$V_{DD} = 15V$		0.05		0	0.05		0.05	V	
$V_{OH}$	HIGH Level Output Voltage	$V_{DD} = 5.0V$	4.95		4.95	5.0		4.95		V	
		$V_{DD} = 10V$	9.95		9.95	10.0		9.95		V	
		$V_{DD} = 15V$	14.95		14.95	15.0		14.95		V	
$V_{IL}$	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	
		$V_{DD} = 15V, V_O = 1.5V$ or 13.5V		4.0			4.0		4.0	V	
$V_{IH}$	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	
		$V_{DD} = 15V, V_O = 1.5V$ or 13.5V	11.0		11.0			11.0		V	
$I_{OL}$	LOW Level Output Current (Note 4)	$V_{DD} = 5.0V, V_O = 0.4V$	0.52		0.44	0.88		0.36		mA	
		$V_{DD} = 10V, V_O = 0.5V$	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 Current (Note 4)	$V_{DD} = 5.0V, V_O = 4.6V$	-0.52		-0.44	0.88		-0.36		mA	
		$V_{DD} = 10V, V_O = 9.5V$	-1.3		-1.1	2.25		-0.9		mA	
		$V_{DD} = 15V, V_O = 13.5V$	-3.6		-3.0	8.8		-2.4		mA	
$I_{IN}$	Input Current	$V_{DD} = 15V, V_{IN} = 0V$		-0.3			-0.3		-1.0	$\mu A$	
		$V_{DD} = 15V, V_{IN} = 15V$		0.3			0.3		1.0	$\mu A$	
$I_{OZ}$	3-STATE Output Leakage Current	$V_{DD} = 15V, V_{IN} = 0V$ or 15V		1			1		10	$\mu A$	

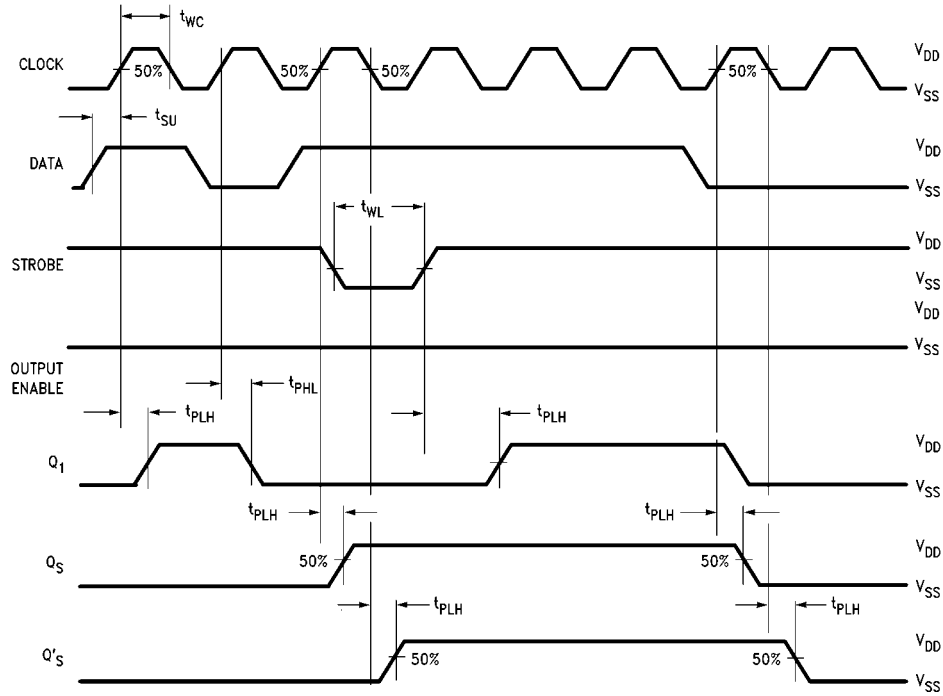
**Note 4:**  $I_{OH}$  and  $I_{OL}$  are tested one output at a time.

**AC Electrical Characteristics** (Note 5)T<sub>A</sub> = 25°C, C<sub>L</sub> = 50 pF

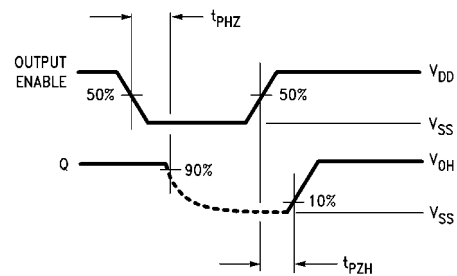
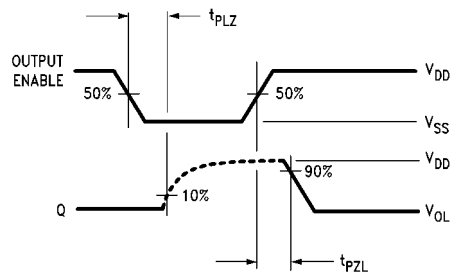
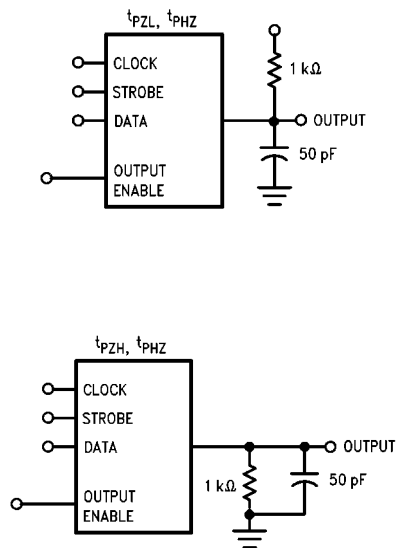
Symbol	Parameter	Conditions	Min	Typ	Max	Units
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Clock to Q <sub>S</sub>	V <sub>DD</sub> = 5.0V		300	600	ns
		V <sub>DD</sub> = 10V		125	250	ns
		V <sub>DD</sub> = 15V		95	190	ns
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Clock to Q' <sub>Σ</sub>	V <sub>DD</sub> = 5.0V		230	460	ns
		V <sub>DD</sub> = 10V		110	220	ns
		V <sub>DD</sub> = 15V		75	150	ns
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Clock to Parallel Out	V <sub>DD</sub> = 5.0V		420	840	ns
		V <sub>DD</sub> = 10V		195	390	ns
		V <sub>DD</sub> = 15V		135	270	ns
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Strobe to Parallel Out	V <sub>DD</sub> = 5.0V		290	580	ns
		V <sub>DD</sub> = 10V		145	290	ns
		V <sub>DD</sub> = 15V		100	200	ns
t <sub>PHZ</sub>	Propagation Delay HIGH Level to HIGH Impedance	V <sub>DD</sub> = 5.0V		140	280	ns
		V <sub>DD</sub> = 10V		75	150	ns
		V <sub>DD</sub> = 15V		55	110	ns
t <sub>PLZ</sub>	Propagation Delay LOW Level to HIGH Impedance	V <sub>DD</sub> = 5.0V		140	280	ns
		V <sub>DD</sub> = 10V		75	150	ns
		V <sub>DD</sub> = 15V		55	110	ns
t <sub>PZH</sub>	Propagation Delay HIGH Impedance to HIGH Level	V <sub>DD</sub> = 5.0V		140	280	ns
		V <sub>DD</sub> = 10V		75	150	ns
		V <sub>DD</sub> = 15V		55	110	ns
t <sub>PZL</sub>	Propagation Delay HIGH Impedance to LOW Level	V <sub>DD</sub> = 5.0V		140	280	ns
		V <sub>DD</sub> = 10V		75	150	ns
		V <sub>DD</sub> = 15V		55	110	ns
t <sub>THL</sub> , t <sub>TLH</sub>	Transition Time	V <sub>DD</sub> = 5.0V		100	200	ns
		V <sub>DD</sub> = 10V		50	100	ns
		V <sub>DD</sub> = 15V		40	80	ns
t <sub>SU</sub>	Set-Up Time Data to Clock	V <sub>DD</sub> = 5.0V	80	40		ns
		V <sub>DD</sub> = 10V	40	20		ns
		V <sub>DD</sub> = 15V	20	10		ns
t <sub>r</sub> , t <sub>f</sub>	Maximum Clock Rise and Fall Time	V <sub>DD</sub> = 5.0V	1			ms
		V <sub>DD</sub> = 10V	1			ms
		V <sub>DD</sub> = 15V	1			ms
t <sub>PC</sub>	Minimum Clock Pulse Width	V <sub>DD</sub> = 5.0V	200	100		ns
		V <sub>DD</sub> = 10V	100	50		ns
		V <sub>DD</sub> = 15V	83	40		ns
t <sub>PS</sub>	Minimum Strobe Pulse Width	V <sub>DD</sub> = 5.0V	200	100		ns
		V <sub>DD</sub> = 10V	80	40		ns
		V <sub>DD</sub> = 15V	70	35		ns
f <sub>max</sub>	Maximum Clock Frequency	V <sub>DD</sub> = 5.0V	1.5	3.0		MHz
		V <sub>DD</sub> = 10V	3.0	6.0		MHz
		V <sub>DD</sub> = 15V	4.0	8.0		MHz
C <sub>IN</sub>	Input Capacitance	Any Input		5.0	7.5	pF

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

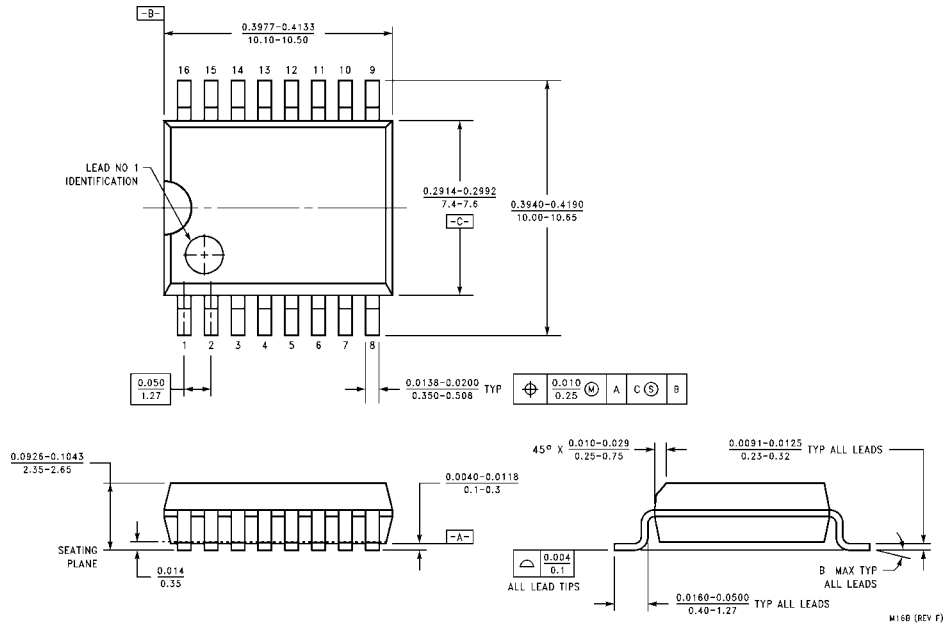
Timing Diagram



Test Circuits and Timing Diagrams for 3-STATE

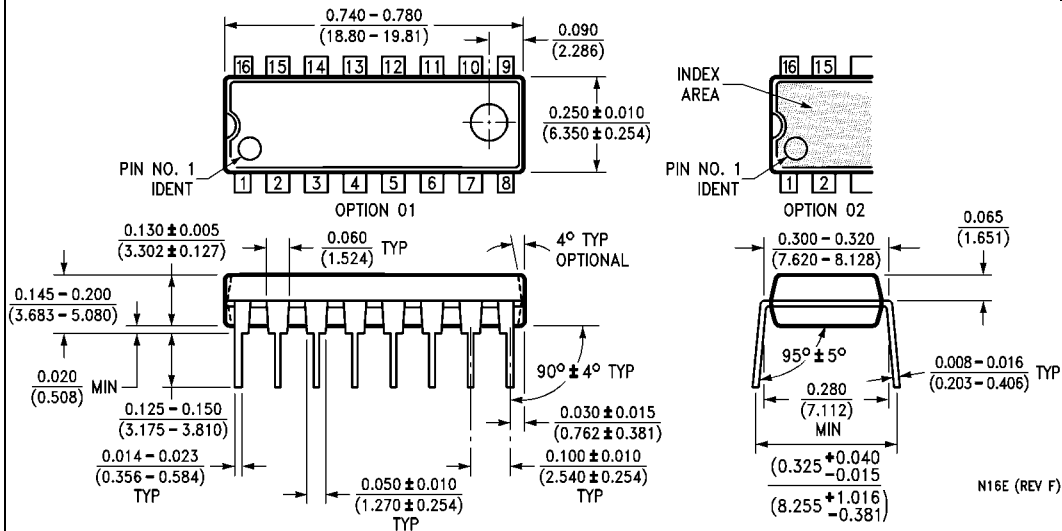


**Physical Dimensions** inches (millimeters) unless otherwise noted



**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide M16B**

**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**

N16E (REV F)

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