



# CD4021BM/CD4021BC 8-Stage Static Shift Register

## General Description

The CD4021BM/CD4021BC is an 8-stage parallel input/serial output shift register. A parallel/serial control input enables individual JAM inputs to each of 8 stages. Q output are available from the sixth, seventh, and eighth stages. All outputs have equal source and sink current capabilities and conform to standard "B" series output drive.

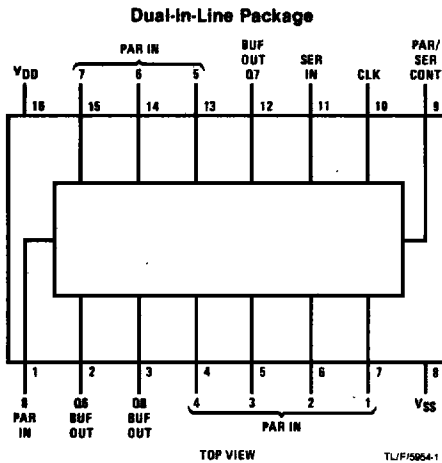
When the parallel/serial control input is in the logical "0" state, data is serially shifted into the register synchronously with the positive transition of the clock. When the parallel/serial control is in the logical "1" state, data is jammed into each stage of the register asynchronously with the clock.

All inputs are protected against static discharge with diodes to  $V_{DD}$  and  $V_{SS}$ .

## Features

- Wide supply voltage range: 3.0V to 15V
- High noise immunity:  $0.45 V_{DD}$  (typ.)
- Low power TTL compatibility fan out of 2 driving 74L or 1 driving 74LS
- 5V-10V-15V parametric ratings
- Symmetrical output characteristics
- Maximum input leakage  $1 \mu A$  at 15V over full temperature range

## Connection Diagram



## Truth Table

CL*	Serial Input	Parallel/Serial Control	PI 1	PI n	Q1 (Internal)	Qn
X	X	1	0	0	0	0
X	X	1	0	1	0	1
X	X	1	1	0	1	0
X	X	1	1	1	1	1
—	0	0	X	X	0	$Q_{n-1}$
—	1	0	X	X	1	$Q_{n-1}$
—	X	0	X	X	$Q_1$	$Q_n$

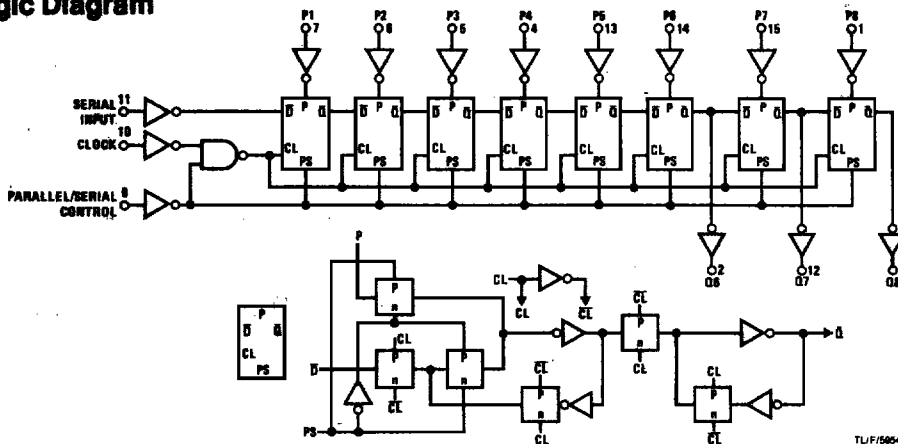
No Change

\* Level change  
 X = Don't care case

Order Number CD4021BMJ or CD4021BCJ  
 See NS Package J16A

Order Number CD4021BMN or CD4021BCN  
 See NS Package N16E

## Logic Diagram



### Absolute Maximum Ratings (Notes 1 & 2)

V <sub>DD</sub> Supply Voltage	-0.5 to +18V
V <sub>IN</sub> Input Voltage	-0.5 to V <sub>DD</sub> + 0.5V
T <sub>S</sub> Storage Temperature Range	-65°C to +150°C
P <sub>D</sub> Package Dissipation	500 mW
T <sub>L</sub> Lead Temperature (Soldering, 10 seconds)	260°C

### Recommended Operating Conditions (Note 2)

V <sub>DD</sub> Supply Voltage	3 to 15V
V <sub>IN</sub> Input Voltage	0 to V <sub>DD</sub>
T <sub>A</sub> Operating Temperature Range	-55°C to +125°C
CD4021BM	-40°C to +85°C
CD4012BC	

### DC Electrical Characteristics (Note 2) — CD4021BM

SYM	Parameter	Conditions	-55°C		25°C			125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I <sub>DD</sub>	Quiescent Device Current	V <sub>DD</sub> = 5V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub> V <sub>DD</sub> = 10V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub> V <sub>DD</sub> = 15V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub>		5 10 20		0.1 0.2 0.3	5 10 20		150 300 600	μA μA μA
V <sub>OL</sub>	Low Level Output Voltage	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V  I <sub>O</sub>   < 1 μA		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V V V
V <sub>OH</sub>	High Level Output Voltage	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V  I <sub>O</sub>   < 1 μA	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.95		V V V
V <sub>IL</sub>	Low Level Input Voltage	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.5V or 4.5V V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V		1.5 3.0 4.0		2 4 6	1.5 3.0 4.0		1.5 3.0 4.0	V V V
V <sub>IH</sub>	High Level Input Voltage	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.5V or 4.5V V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V	3.5 7.0 11.0		3.5 7.0 11.0	3 6 9		3.5 7.0 11.0		V V V
I <sub>OL</sub>	Low Level Output Current (Note 3)	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.4V V <sub>DD</sub> = 10V, V <sub>O</sub> = 0.5V V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V	0.64 1.6 4.2		0.51 1.3 3.4	0.88 2.2 8		0.36 0.90 2.4		mA mA mA
I <sub>OH</sub>	High Level Output Current (Note 3)	V <sub>DD</sub> = 5V, V <sub>O</sub> = 4.6V V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.5V V <sub>DD</sub> = 15V, V <sub>O</sub> = 13.5V	-0.64 -1.6 -4.2		-0.51 -1.3 -3.4	-0.88 -2.2 -8		-0.36 -0.90 -2.4		mA mA mA
I <sub>IN</sub>	Input Current	V <sub>DD</sub> = 15V, V <sub>IN</sub> = 0V V <sub>DD</sub> = 15V, V <sub>IN</sub> = 15V		-0.10 0.10		-10 <sup>-5</sup> 10 <sup>-5</sup>	-0.10 0.10		-1.0 1.0	μA μA

### DC Electrical Characteristics (Note 2) — CD4021BC

SYM	Parameter	Conditions	-40°C		25°C			85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I <sub>DD</sub>	Quiescent Device Current	V <sub>DD</sub> = 5V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub> V <sub>DD</sub> = 10V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub> V <sub>DD</sub> = 15V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub>		20 40 80		0.1 0.2 0.3	20 40 80		150 300 600	μA μA μA
V <sub>OL</sub>	Low Level Output Voltage	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V  I <sub>O</sub>   < 1 μA		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V V V
V <sub>OH</sub>	High Level Output Voltage	V <sub>DD</sub> = 5V V <sub>DD</sub> = 10V V <sub>DD</sub> = 15V  I <sub>O</sub>   < 1 μA	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.95		V V V
V <sub>IL</sub>	Low Level Input Voltage	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.5V or 4.5V V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V		1.5 3.0 4.0		2 4 6	1.5 3.0 4.0		1.5 3.0 4.0	V V V
V <sub>IH</sub>	High Level Input Voltage	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.5V or 4.5V V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V	3.5 7.0 11.0		3.5 7.0 11.0	3 6 9		3.5 7.0 11.0		V V V
I <sub>OL</sub>	Low Level Output Current (Note 3)	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.4V V <sub>DD</sub> = 10V, V <sub>O</sub> = 0.5V V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V	0.52 1.3 3.6		0.44 1.1 3.0	0.88 2.2 8		0.36 0.90 2.4		mA mA mA
I <sub>OH</sub>	High Level Output Current (Note 3)	V <sub>DD</sub> = 5V, V <sub>O</sub> = 4.6V V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.5V V <sub>DD</sub> = 15V, V <sub>O</sub> = 13.5V	-0.52 -1.3 -3.6		-0.44 -1.1 -3.0	-0.88 -2.2 -8		-0.36 -0.90 -2.4		mA mA mA
I <sub>IN</sub>	Input Current	V <sub>DD</sub> = 15V, V <sub>IN</sub> = 0V V <sub>DD</sub> = 15V, V <sub>IN</sub> = 15V		-0.3 0.3		-10 <sup>-5</sup> 10 <sup>-5</sup>	-0.3 0.3		-1.0 1.0	μA μA



**AC Electrical Characteristics**  $T_A = 25^\circ\text{C}$ , Input  $t_r, t_f = 20\text{ ns}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ k}\Omega$ 

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PLH}, t_{PHL}$	Propagation Delay Time	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		240 100 70	350 175 140	ns ns ns
$t_{THL}, t_{TLH}$	Transition Time	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		100 50 40	200 100 80	ns ns ns
$f_{CL}$	Maximum Clock Input Frequency	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$	2.5 5 8	3.5 10 16		MHz MHz MHz
$t_W$	Minimum Clock Pulse Width	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		100 50 40	200 100 80	ns ns ns
$t_{r,CL}, t_{f,CL}$	Clock Rise and Fall Time (Note 4)	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$			15 15 15	$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$t_s$	Minimum Set-up Time Serial Input $t_H \geq 200\text{ ns}$ (Ref. to CL)	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		60 40 30	120 80 60	ns ns ns
	Parallel Inputs $t_H \geq 200\text{ ns}$ (Ref. to P/S)	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		25 15 10	50 30 20	ns ns ns
$t_H$	Minimum Hold Time Serial In, Parallel In, $t_s \geq 400\text{ ns}$ Parallel/Serial Control	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$			0 10 15	ns ns ns
$t_{WH}$	Minimum P/S Pulse Width	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		150 75 50	250 125 100	ns ns ns
$t_{REM}$	Minimum P/S Removal Time (Ref. to CL)	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		100 50 40	200 100 80	ns ns ns
$C_I$	Average Input Capacitance	Any Input		5	7.5	pF
$C_{PD}$	Power Dissipation Capacitance (Note 5)			100		pF

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:**  $V_{SS} = 0\text{V}$  unless otherwise specified.

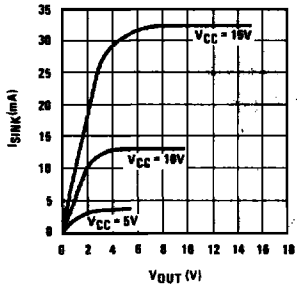
**Note 3:**  $I_{OH}$  and  $I_{OL}$  are tested one output at a time.

**Note 4:** If more than one unit is cascaded  $t_{r,CL}$  should be made less than or equal to the fixed propagation delay of the output of the driving stage for the estimated capacitive load.

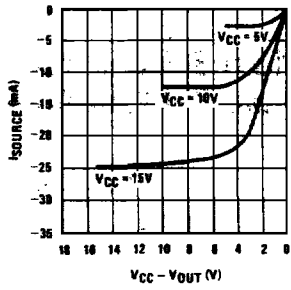
**Note 5:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation, see 54C/74C family characteristics application note AN-90.

# Typical Performance Characteristics

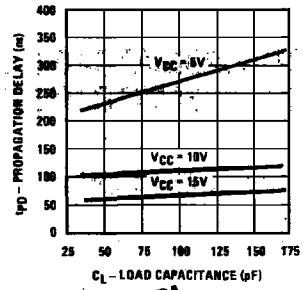
CD4021BM/CD4012BC



TL/F/5954-3



TL/F/5954-4



TL/F/5954-5

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