FAIRCHILD SEMICONDUCTOR™

October 1987
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CD4021BC
8-Stage Static Shift Register

General Description

The 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 outputs 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

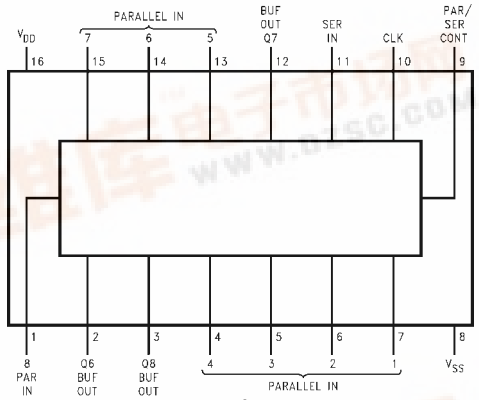
- Wide supply voltage range: 3.0V to 15V
- High noise immunity: 0.45 V_{DD} (typ.)
- Low power TTL compatibility:
  Fan out of 2 driving 74L or 1 driving 74LS
- 5V–10V–15V parametric ratings
- Symmetrical output characteristics
- Maximum input leakage 1 µA at 15V over full temperature range

Ordering Code:

Order Number	Order Code	Package Description
CD4021BCM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD4021BCN	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



Top View

Truth Table

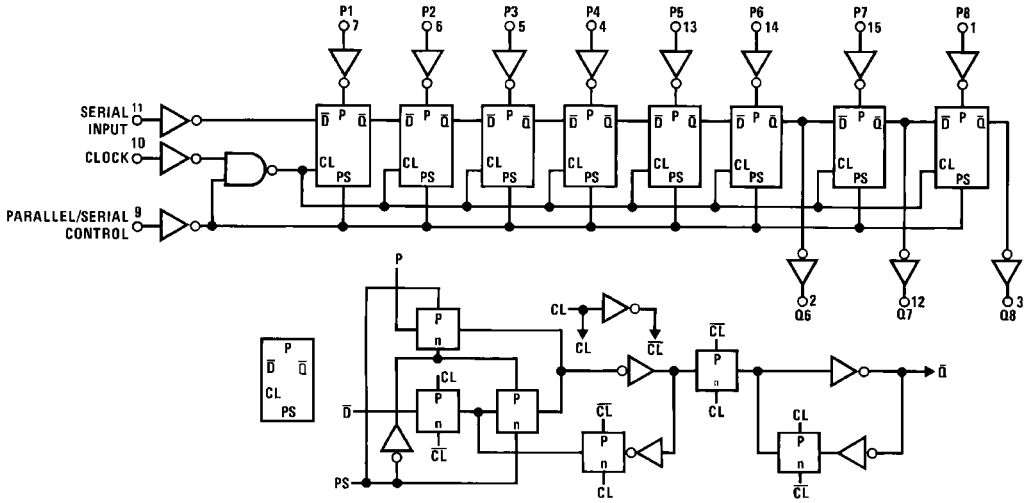
C_L (Note 1)	Serial Input	Parallel/ Serial Control	PI 1	PI n	Q1 (Internal)	Q_n (Note 2)
X	X	1	0	0	0	0
X	X	1	0	1	0	1
X	X	1	1	0	1	0
X	X	1	1	1	1	1
⌐	0	0	X	X	0	Q_{n-1}
⌐	1	0	X	X	1	Q_{n-1}
¬	X	0	X	X	Q1	Q_n

X = Don't care case

Note 1: Level change

Note 2: No change

Logic Diagram



Absolute Maximum Ratings (Note 3)

(Note 4)

Supply Voltage (V_{DD})	−0.5V to +18V
Input Voltage (V_{IN})	−0.5V to V_{DD} +0.5V
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 4)

Supply Voltage (V_{DD})	3V to 15V
Input Voltage (V_{IN})	0 to V_{DD}
Operating Temperature Range (T_A)	
CD4021BCN	−55°C to +125°C

Note 3: "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 4: V_{SS} = 0V unless otherwise specified.

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	−55°C		+25°C			+125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device	V_{DD} = 5V, V_{IN} = V_{DD} or V_{SS}		5		0.1	5		150	
	Current	V_{DD} = 10V, V_{IN} = V_{DD} or V_{SS}		10		0.2	10		300	µA
		V_{DD} = 15V, V_{IN} = V_{DD} or V_{SS}		20		0.3	20		600	
V_{OL}	LOW Level	V_{DD} = 5V		0.05		0	0.05		0.05	
	Output Voltage	V_{DD} = 10V $\quad \lvert I_O \rvert < 1$ µA		0.05		0	0.05		0.05	V
		V_{DD} = 15V		0.05		0	0.05		0.05	
V_{OH}	HIGH Level	V_{DD} = 5V	4.95		4.95	5		4.95		
	Output Voltage	V_{DD} = 10V $\quad \lvert I_O \rvert < 1$ µA	9.95		9.95	10		9.95		V
		V_{DD} = 15V	14.95		14.95	15		14.95		
V_{IL}	LOW Level	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2	1.5		1.5	
	Input Voltage	V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4	3.0		3.0	V
		V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6	4.0		4.0	
V_{IH}	HIGH Level	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	3		3.5		
	Input Voltage	V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	6		7.0		V
		V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	9		11.0		
I_{OL}	LOW Level Output	V_{DD} = 5V, V_O = 0.4V	0.64		0.51	0.88		0.36		
	Current (Note 5)	V_{DD} = 10V, V_O = 0.5V	1.6		1.3	2.2		0.90		mA
		V_{DD} = 15V, V_O = 1.5V	4.2		3.4	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 5)	V_{DD} = 10V, V_O = 9.5V	−1.6		−1.3	−2.2		−0.90		mA
		V_{DD} = 15V, V_O = 13.5V	−4.2		−3.4	−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 5: I_{OH} and I_{OL} are tested one output at a time.

AC Electrical Characteristics (Note 6)

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

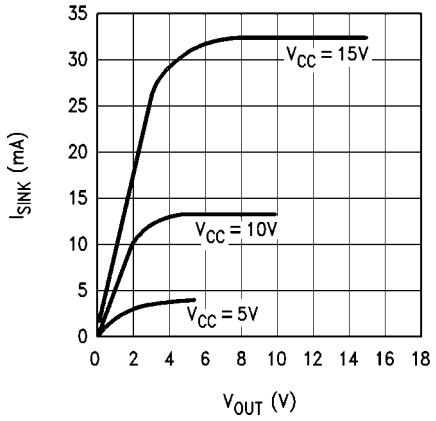
Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PLH}, t_{PHL}	Propagation Delay Time	$V_{DD} = 5V$		240	350	
		$V_{DD} = 10V$		100	175	ns
		$V_{DD} = 15V$		70	140	
t_{THL}, t_{TLH}	Transition Time	$V_{DD} = 5V$		100	200	
		$V_{DD} = 10V$		50	100	ns
		$V_{DD} = 15V$		40	80	
f_{CL}	Maximum Clock	$V_{DD} = 5V$	2.5	3.5		
	Input Frequency	$V_{DD} = 10V$	5	10		MHz
		$V_{DD} = 15V$	8	16		
t_W	Minimum Clock	$V_{DD} = 5V$		100	200	
	Pulse Width	$V_{DD} = 10V$		50	100	ns
		$V_{DD} = 15V$		40	80	
t_rCL, t_fCL	Clock Rise and	$V_{DD} = 5V$			15	
	Fall Time (Note 6)	$V_{DD} = 10V$			15	µs
		$V_{DD} = 15V$			15	
t_s	Minimum Set-Up Time					
	Serial Input	$V_{DD} = 5V$		60	120	
	$t_H \geq 200$ ns	$V_{DD} = 10V$		40	80	ns
	(Ref. to CL)	$V_{DD} = 15V$		30	60	
	Parallel Inputs	$V_{DD} = 5V$		25	50	
	$t_H \geq 200$ ns	$V_{DD} = 10V$		15	30	ns
	(Ref. to P/S)	$V_{DD} = 15V$		10	20	
t_H	Minimum Hold Time	$V_{DD} = 5V$			0	
	Serial In, Parallel In, $t_s \geq 400$ ns	$V_{DD} = 10V$			10	ns
	Parallel/Serial Control	$V_{DD} = 15V$			15	
t_{WH}	Minimum P/S	$V_{DD} = 5V$		150	250	
	Pulse Width	$V_{DD} = 10V$		75	125	ns
		$V_{DD} = 15V$		50	100	
t_{REM}	Minimum P/S Removal	$V_{DD} = 5V$		100	200	
	Time (Ref. to CL)	$V_{DD} = 10V$		50	100	ns
		$V_{DD} = 15V$		40	80	
C_I	Average Input Capacitance	Any Input		5	7.5	pF
C_{PD}	Power Dissipation			100		pF
	Capacitance (Note 8)					

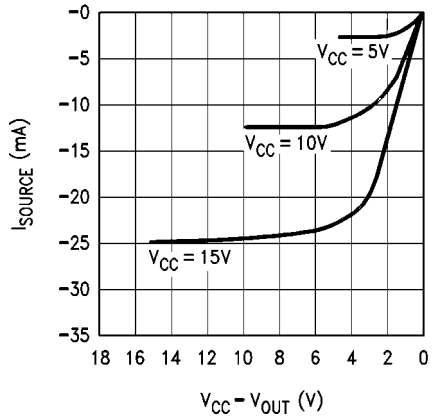
Note 6: AC Parameters are guaranteed by DC correlated testing.

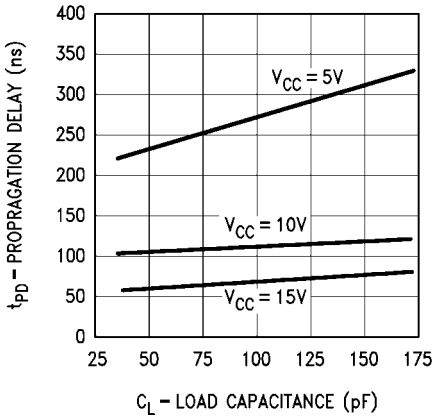
Note 7: If more than one unit is cascaded t_rCL should be made less than or equal to the fixed propagation delay of the output of the driving stage for the estimated capacitive load.

Note 8: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation, see 74C family characteristics application note AN-90.

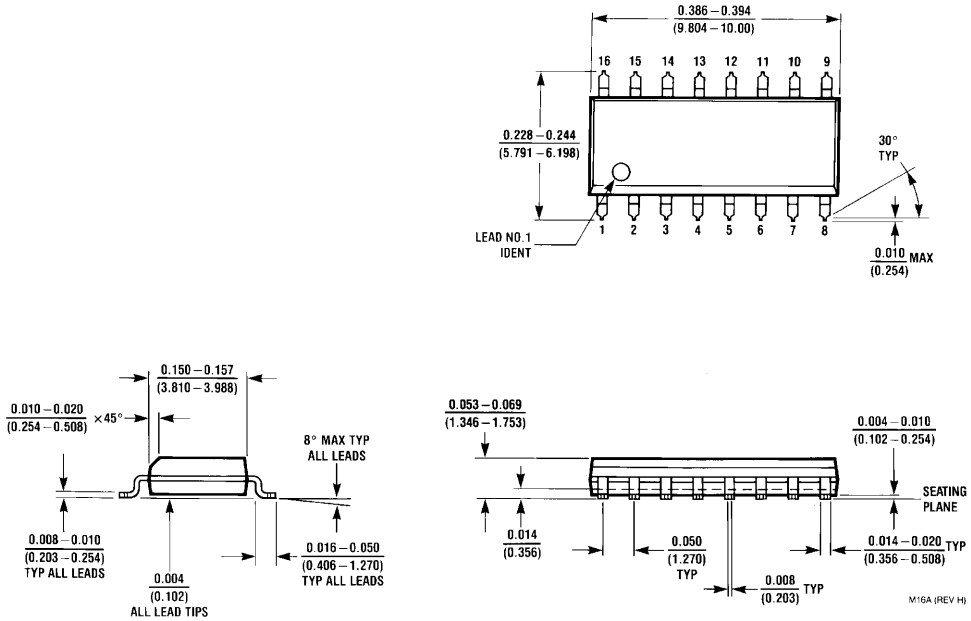
Typical Performance Characteristics





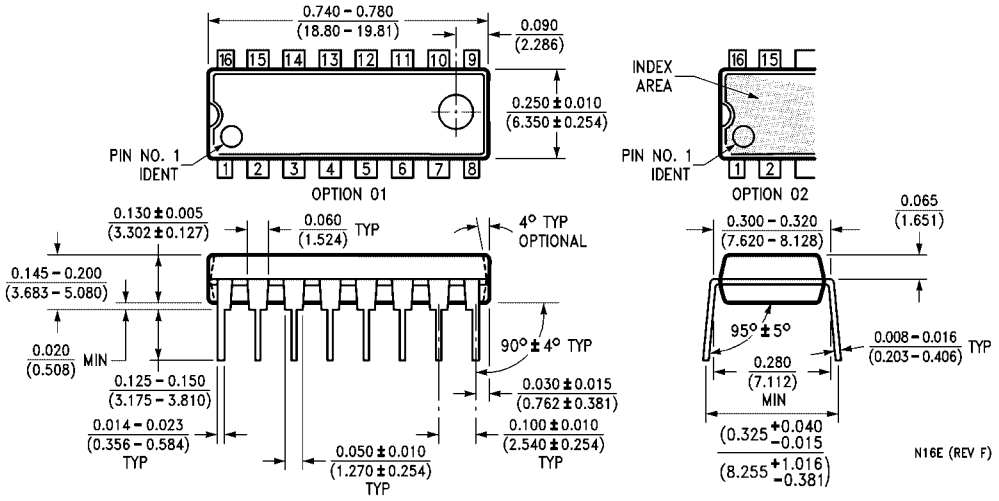


Physical Dimensions inches (millimeters) unless otherwise noted



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