National Semiconductor

February 1988

CD4014BM/CD4014BC 8-Stage Static Shift Register

General Description

The CD4014BM/CD4014BC 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 input is in the logical "1" state, data is jammed into each stage of the register synchronously with the positive transition of the clock.

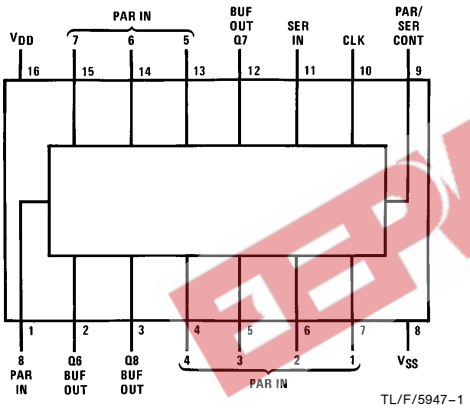
All inputs are protected against static discharge with diodes to V_{DD} and V_{SS}.

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

Connection Diagram

Dual-In-Line Package



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Top View

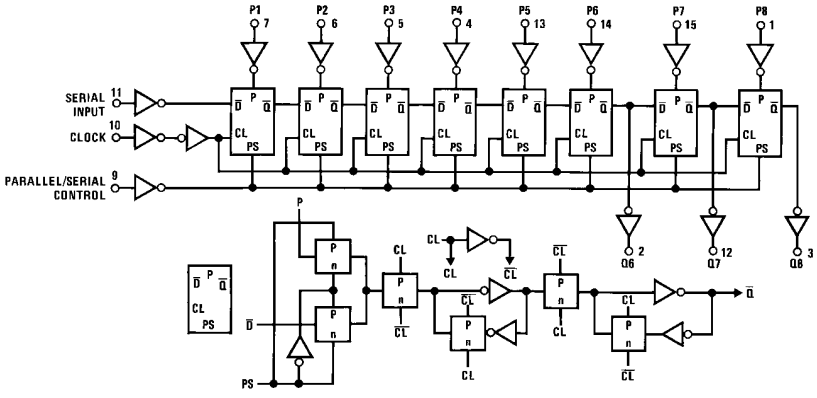
Truth Table

CL*	Serial Input	Parallel/ Serial Control	PI 1	PI n	Q1 (Internal)	Q_n	
⌐	X	1	0	0	0	0	
⌐	X	1	1	0	1	0	
⌐	X	1	0	1	0	1	
⌐	X	1	1	1	1	1	
⌐	0	0	X	X	0	Q_{n-1}	
⌐	1	0	X	X	1	Q_{n-1}	
⌙	X	X	X	X	Q1	Q_n	No Change

*Level change
X = Don't care case

Order Number CD4014B

Logic Diagram



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  RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{DD})	−0.5V to +18V
Input Voltage (V_{IN})	−0.5 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 2)

Supply Voltage (V_{DD})	3.0V to 15V
Input Voltage (V_{IN})	0 to V_{DD}
Operating Temperature Range (T_A)	
CD4014BM	−55°C to +125°C
CD4014BC	−40°C to +85°C

DC Electrical Characteristics CD4014BM (Note 2)

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}		5		0.1	5		150	μA
		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	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert$ < 1 μA		0.05		0	0.05		0.05	V
		V_{DD} = 10V, $\lvert I_O \rvert$ < 1 μA		0.05		0	0.05		0.05	V
		V_{DD} = 15V, $\lvert I_O \rvert$ < 1 μA		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert$ < 1 μA	4.95		4.95	5		4.95		V
		V_{DD} = 10V, $\lvert I_O \rvert$ < 1 μA	9.95		9.95	10		9.95		V
		V_{DD} = 15V, $\lvert I_O \rvert$ < 1 μA	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2	1.5		1.5	V
		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
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	3		3.5		V
		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		V
I_{OL}	Low Level Output Current (Note 3)	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	2.2		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	4.2		3.4	8		2.4		mA
I_{OH}	High Level Output Current (Note 3)	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	−2.2		−0.9		mA
		V_{DD} = 15V, V_O = 13.5V	−4.2		−3.4	−8		−2.4		mA
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.10		-10^{-5}	−0.10		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.10		10^{-5}	0.10		1.0	μA

DC Electrical Characteristics CD4014BC (Note 2)

Symbol	Parameter	Conditions	−40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD} = 5V, V_{IN} = V_{DD} or V_{SS}		20		0.1	20		150	μA
		V_{DD} = 10V, V_{IN} = V_{DD} or V_{SS}		40		0.2	40		300	μA
		V_{DD} = 15V, V_{IN} = V_{DD} or V_{SS}		80		0.3	80		600	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert$ < 1 μA		0.05		0	0.05		0.05	V
		V_{DD} = 10V, $\lvert I_O \rvert$ < 1 μA		0.05		0	0.05		0.05	V
		V_{DD} = 15V, $\lvert I_O \rvert$ < 1 μA		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert$ < 1 μA	4.95		4.95	5		4.95		V
		V_{DD} = 10V, $\lvert I_O \rvert$ < 1 μA	9.95		9.95	10		9.95		V
		V_{DD} = 15V, $\lvert I_O \rvert$ < 1 μA	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2	1.5		1.5	V
		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
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	3		3.5		V
		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		V
I_{OL}	Low Level Output Current (Note 3)	V_{DD} = 5V, V_O = 0.4V	0.52		0.44	0.88		0.36		mA
		V_{DD} = 10V, V_O = 0.5V	1.3		1.1	2.2		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	3.6		3.0	8		2.4		mA

DC Electrical Characteristics CD4014BC (Note 2) (Continued)

Symbol	Parameter	Conditions	−40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{OH}	High Level Output Current (Note 3)	V_{DD} = 5V, V_O = 4.6V	−0.52		−0.44	−0.88		−0.36		mA
		V_{DD} = 10V, V_O = 9.5V	−1.3		−1.1	−2.2		−0.90		mA
		V_{DD} = 15V, V_O = 13.5V	−3.6		−3.0	−8		−2.4		mA
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.3		-10^{-5}	−0.3		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.3		10^{-5}	0.3		1.0	μA

AC Electrical Characteristics* 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_{PHL}, t_{PLH}	Propagation Delay Time	V_{DD} = 5V		200	320	ns
		V_{DD} = 10V		80	160	ns
		V_{DD} = 15V		60	120	ns
t_{THL}, t_{TLH}	Transition Time	V_{DD} = 5V		100	200	ns
		V_{DD} = 10V		50	100	ns
		V_{DD} = 15V		40	80	ns
f_{CL}	Maximum Clock Input Frequency	V_{DD} = 5V	2.8	4		MHz
		V_{DD} = 10V	6	12		MHz
		V_{DD} = 15V	8	16		MHz
t_W	Minimum Clock Pulse Width	V_{DD} = 5V		90	180	ns
		V_{DD} = 10V		40	80	ns
		V_{DD} = 15V		25	50	ns
t_{rCL}, t_{fCL}	Clock Rise and Fall Time (Note 4)	V_{DD} = 5V			15	μs
		V_{DD} = 10V			15	μs
		V_{DD} = 15V			15	μs
t_S	Minimum Set-Up Time (Note 6) Serial Input $t_H \geq$ 200 ns	V_{DD} = 5V		60	120	ns
		V_{DD} = 10V		40	80	ns
		V_{DD} = 15V		30	60	ns
	Parallel Inputs $t_H \geq$ 200 ns	V_{DD} = 5V		80	160	ns
		V_{DD} = 10V		40	80	ns
		V_{DD} = 15V		30	60	ns
	Parallel/Serial Control $t_H \geq$ 200 ns	V_{DD} = 5V		100	200	ns
		V_{DD} = 10V		50	100	ns
		V_{DD} = 15V		40	80	ns
t_H	Minimum Hold Time Serial In, Parallel In, $t_S \geq$ 400 ns Parallel/Serial Control	V_{DD} = 5V			0	ns
		V_{DD} = 10V			10	ns
		V_{DD} = 15V			15	ns
C_I	Average Input Capacitance (Note 5)	Any Input		5	7.5	pF
C_{PD}	Power Dissipation Capacitance (Note 5)			110		pF

*AC Parameters are guaranteed by DC correlated testing.

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} = 0V unless otherwise specified.

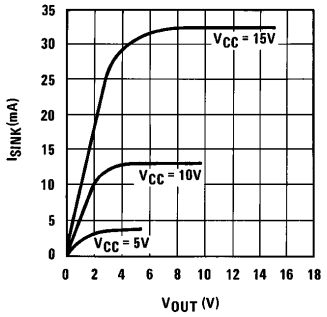
Note 3: I_{OL} and I_{OH} are tested one output at a time.

Note 4: 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 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.

Note 6: Setup times are measured with reference to clock and a fixed hold time (t_H) as specified.

Typical Performance Characteristics



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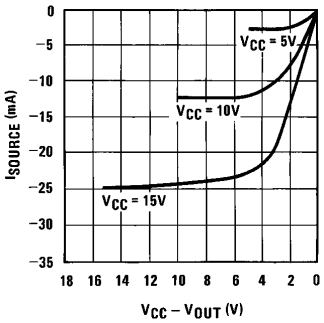

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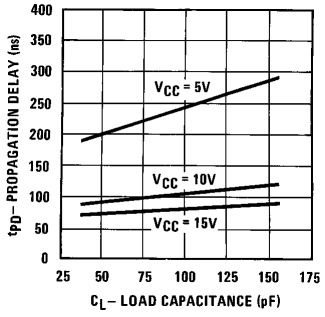

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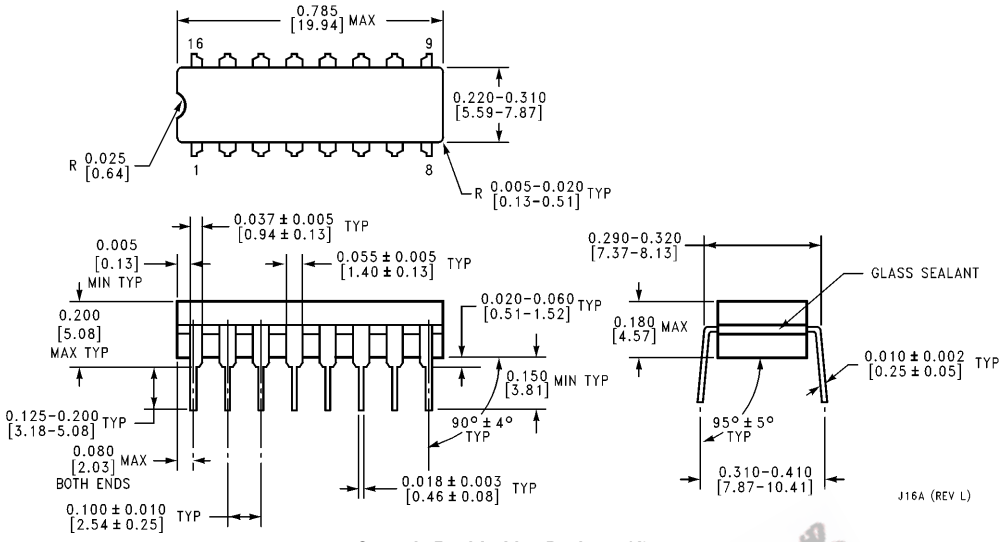
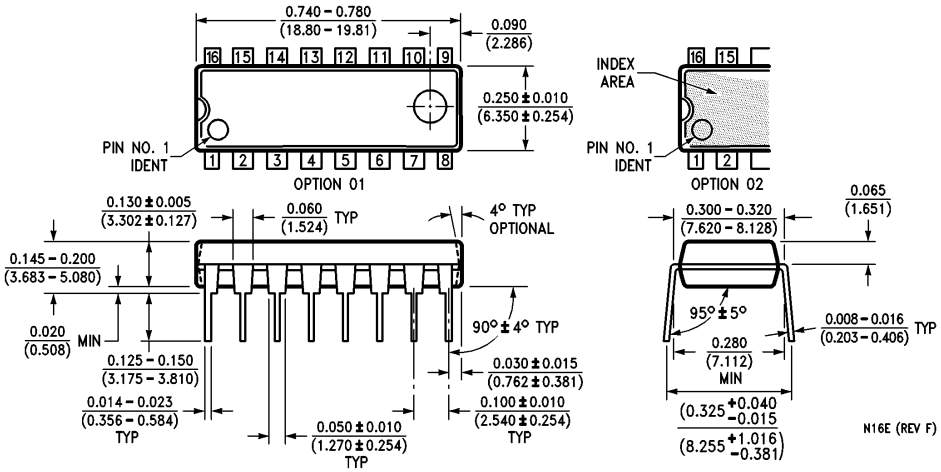
Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number CD4014BMJ or CD4014BCJ
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number CD4014BMN or CD4014BCN
NS Package Number N16E

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