National Semiconductor

June 1996

CD4015BM/CD4015BC Dual 4-Bit Static Shift Register

General Description

The CD4015BM/CD4015BC contains two identical, 4-stage, serial-input/parallel-output registers with independent "Data", "Clock," and "Reset" inputs. The logic level present at the input of each stage is transferred to the output of that stage at each positive-going clock transition. A logic high on the "Reset" input resets all four stages covered by that input. All inputs are protected from static discharge by a series resistor and diode clamps to V_{DD} and V_{SS}.

Features

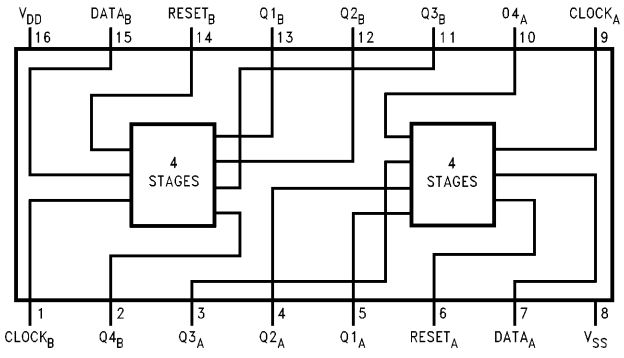
■ Wide supply voltage range	3.0V to 18V
■ High noise immunity	0.45 V_{DD} (typ.)
■ Low power TTL compatibility	Fan out of 2 driving 74L or 1 driving 74LS
■ Medium speed operation	8 MHz (typ.) clock rate
■ Fully static design	@$V_{DD} - V_{SS} = 10V$

Applications

- Serial-input/parallel-output data queueing
- Serial to parallel data conversion
- General purpose register

Connection Diagram and Truth Table

Dual-In-Line Package



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CL▲	D	R	Q_1	Q_n	
⌐	0	0	0	Q_{n-1}	
⌐	1	0	1	Q_{n-1}	
⌐	X	0	Q_1	Q_n	(No change)
X	X	1	0	0	

▲ Level change

X = Don't care case

Order Number CD4015B

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.

DC 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

DC Supply Voltage (V_{DD})	$+3$ to $+15$ V_{DC}
Input Voltage (V_{IN})	0 to V_{DD} V_{DC}
Operating Temperature Range (T_A)	
CD4015BM	$-55°C$ to $+125°C$
CD4015BC	$-40°C$ to $+85°C$

DC Electrical Characteristics CD4015BM (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		0.005	5		150	μA
		$V_{DD} = 10V$, $V_{IN} = V_{DD}$ or V_{SS}		10		0.010	10		300	μA
		$V_{DD} = 15V$, $V_{IN} = V_{DD}$ or V_{SS}		20		0.015	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		2.25	1.5		1.5	V
		$V_{DD} = 10V$, $V_O = 1.0V$ or $9.0V$		3.0		4.50	3.0		3.0	V
		$V_{DD} = 15V$, $V_O = 1.5V$ or $13.5V$		4.0		6.75	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	2.75		3.5		V
		$V_{DD} = 10V$, $V_O = 1.0V$ or $9.0V$	7.0		7.0	5.50		7.0		V
		$V_{DD} = 15V$, $V_O = 1.5V$ or $13.5V$	11.0		11.0	8.25		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	2.25		0.9		mA
		$V_{DD} = 15V$, $V_O = 1.5V$	4.2		3.4	8.8		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	-2.25		-0.9		mA
		$V_{DD} = 15V$, $V_O = 13.5V$	-4.2		-3.4	-8.8		-2.4		mA
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	μA

Note 1: "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 2: $V_{SS} = 0V$ unless otherwise specified.

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

DC Electrical Characteristics CD4015BC (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}		20		0.005	20		150	μA
		V_{DD} = 10V, V_{IN} = V_{DD} or V_{SS}		40		0.010	40		300	μA
		V_{DD} = 15V, V_{IN} = V_{DD} or V_{SS}		80		0.015	80		600	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V		0.05		0	0.05		0.05	V
		V_{DD} = 10V		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} = 5V	4.95		4.95	5		4.95		V
		V_{DD} = 10V	9.95		9.95	10		9.95		V
		V_{DD} = 15V	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		2.25	1.5		1.5	V
		V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
		V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6.75	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	2.75		3.5		V
		V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
		V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	8.25		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	2.25		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 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	−2.25		−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		-10^{-5}	−0.3		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.3		10^{-5}	0.3		1.0	μA

Note 1: "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 2: V_{SS} = 0V unless otherwise specified.

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

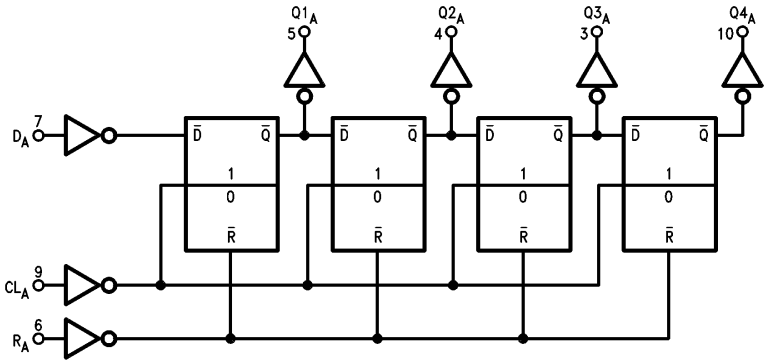
AC Electrical Characteristics*

$T_A = 25°C$, $C_L = 50$ pF, $R_L = 200k$, $t_r = t_f = 20$ ns, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CLOCK OPERATION						
t_{PHL}, t_{PLH}	Propagation Delay Time	$V_{DD} = 5V$		230	350	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
t_{WL}, t_{WM}	Minimum Clock Pulse-Width	$V_{DD} = 5V$		160	250	ns
		$V_{DD} = 10V$		60	110	ns
		$V_{DD} = 15V$		50	85	ns
t_{rCL}, t_{fCL}	Clock Rise and Fall Time	$V_{DD} = 5V$			15	μs
		$V_{DD} = 10V$			15	μs
		$V_{DD} = 15V$			15	μs
t_{SU}	Minimum Data Set-Up Time	$V_{DD} = 5V$		50	100	μs
		$V_{DD} = 10V$		20	40	μs
		$V_{DD} = 15V$		15	30	μs
f_{CL}	Maximum Clock Frequency	$V_{DD} = 5V$	2	3.5		MHz
		$V_{DD} = 10V$	4.5	8		MHz
		$V_{DD} = 15V$	6	11		MHz
C_{IN}	Input Capacitance	Clock Input		7.5	10	pF
		Other Inputs		5	7.5	pF
RESET OPERATION						
$t_{PHL(R)}$	Propagation Delay Time	$V_{DD} = 5V$		200	400	ns
		$V_{DD} = 10V$		100	200	ns
		$V_{DD} = 15V$		80	160	ns
$t_{WH(R)}$	Minimum Reset Pulse Width	$V_{DD} = 5V$		135	250	ns
		$V_{DD} = 10V$		40	80	ns
		$V_{DD} = 15V$		30	60	ns

*AC Parameters are guaranteed by DC correlated testing.

Logic Diagrams



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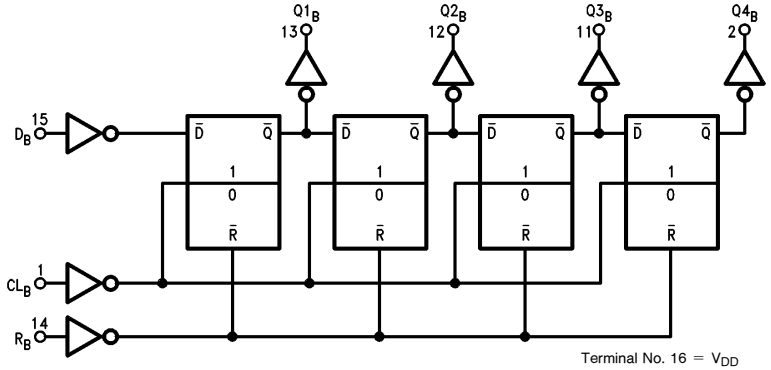
Logic Diagrams (Continued)



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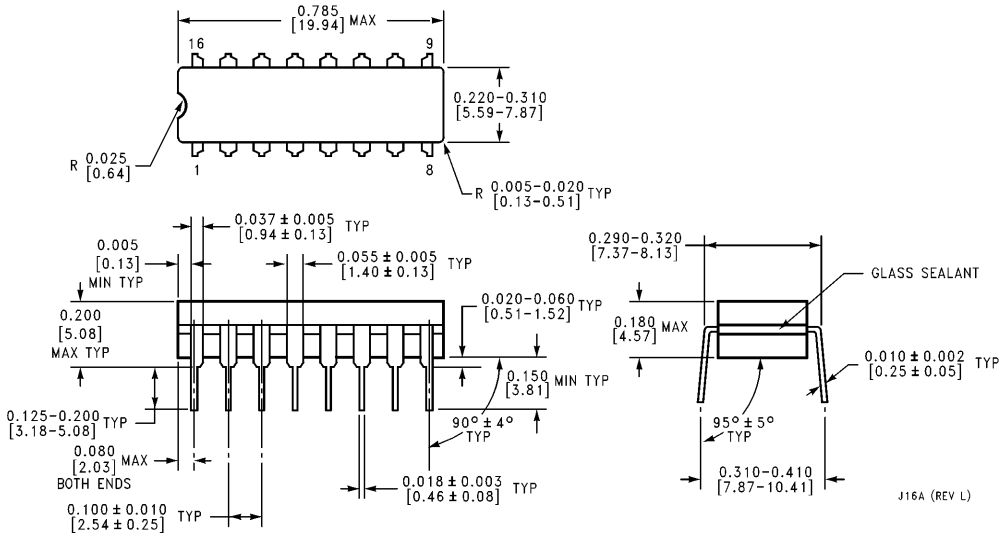
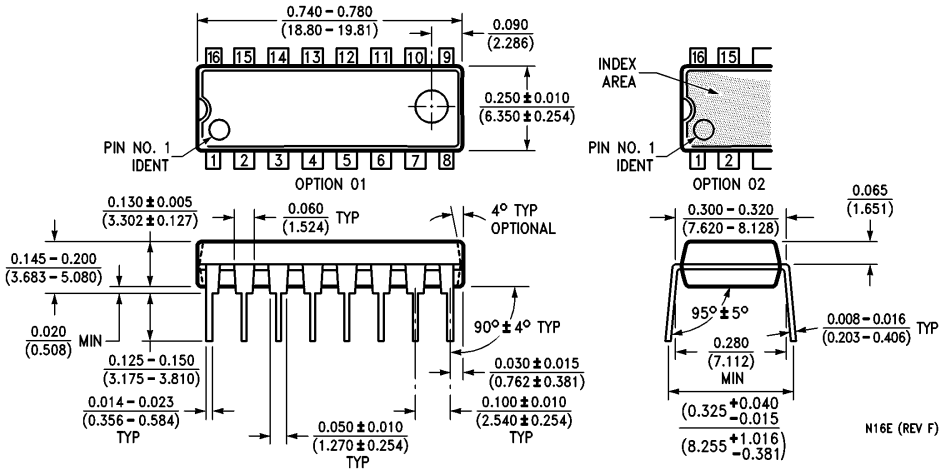
Physical Dimensions inches (millimeters) unless otherwise noted



Ceramic Dual-In-Line Package (J)
Order Number CD4015BMJ or CD4015BCJ
NS Package Number J16A

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



Molded Dual-In-Line Package (N)
Order Number CD4015BMN or CD4015BCN
NS Package Number N16E

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