

## 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  $V_{SS}$ .

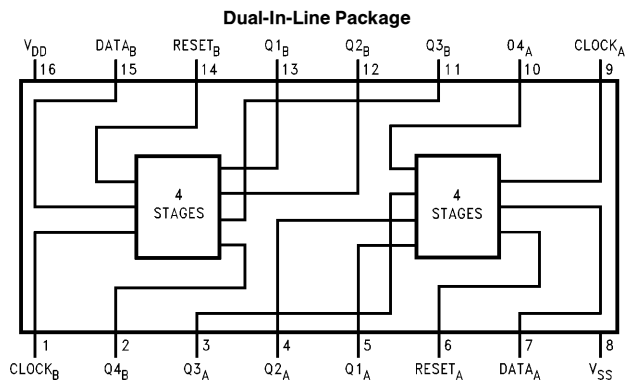
### Features

- 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 @  $V_{DD} - V_{SS} = 10V$
- Fully static design




### Applications

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

### Connection Diagram and Truth Table



TL/F/5948-1

CL <sup>▲</sup>	D	R	Q <sub>1</sub>	Q <sub>n</sub>
	0	0	0	Q <sub>n-1</sub>
	1	0	1	Q <sub>n-1</sub>
	X	0	Q <sub>1</sub>	Q <sub>n</sub>
X	X	1	0	0

(No change)

▲ 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	$\mu A$
		$V_{DD} = 10V, V_{IN} = V_{DD}$ or $V_{SS}$		10		0.010	10		300	$\mu A$
		$V_{DD} = 15V, V_{IN} = V_{DD}$ or $V_{SS}$		20		0.015	20		600	$\mu A$
$V_{OL}$	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)	$V_{DD} = 5V, V_O = 0.4V$	0.64		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	$\mu A$
		$V_{DD} = 15V, V_{IN} = 15V$		0.1		$10^{-5}$	0.1		1.0	$\mu A$

**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 <sub>DD</sub>	Quiescent Device Current	V <sub>DD</sub> = 5V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub>		20		0.005	20		150	μA
		V <sub>DD</sub> = 10V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub>		40		0.010	40		300	μA
		V <sub>DD</sub> = 15V, V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub>		80		0.015	80		600	μA
V <sub>OL</sub>	Low Level Output Voltage	V <sub>DD</sub> = 5V		0.05		0	0.05		0.05	V
		V <sub>DD</sub> = 10V		0.05		0	0.05		0.05	V
		V <sub>DD</sub> = 15V		0.05		0	0.05		0.05	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>DD</sub> = 5V	4.95		4.95	5		4.95		V
		V <sub>DD</sub> = 10V	9.95		9.95	10		9.95		V
		V <sub>DD</sub> = 15V	14.95		14.95	15		14.95		V
V <sub>IL</sub>	Low Level Input Voltage	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.5V or 4.5V		1.5		2.25	1.5		1.5	V
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
		V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V		4.0		6.75	4.0		4.0	V
V <sub>IH</sub>	High Level Input Voltage	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.5V or 4.5V	3.5		3.5	2.75		3.5		V
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
		V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V or 13.5V	11.0		11.0	8.25		11.0		V
I <sub>OL</sub>	Low Level Output Current (Note 3)	V <sub>DD</sub> = 5V, V <sub>O</sub> = 0.4V	0.52		0.44	0.88		0.36		mA
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 0.5V	1.3		1.1	2.25		0.9		mA
		V <sub>DD</sub> = 15V, V <sub>O</sub> = 1.5V	3.6		3.0	8.8		2.4		mA
I <sub>OH</sub>	High Level Output Current (Note 3)	V <sub>DD</sub> = 5V, V <sub>O</sub> = 4.6V	-0.52		-0.44	-0.88		-0.36		mA
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.5V	-1.3		-1.1	-2.25		-0.9		mA
		V <sub>DD</sub> = 15V, V <sub>O</sub> = 13.5V	-3.6		-3.0	-8.8		-2.4		mA
I <sub>IN</sub>	Input Current	V <sub>DD</sub> = 15V, V <sub>IN</sub> = 0V		-0.3		-10 <sup>-5</sup>	-0.3		-1.0	μA
		V <sub>DD</sub> = 15V, V <sub>IN</sub> = 15V		0.3		10 <sup>-5</sup>	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<sub>SS</sub> = 0V unless otherwise specified.

**Note 3:** I<sub>OH</sub> and I<sub>OL</sub> are tested one output at a time.

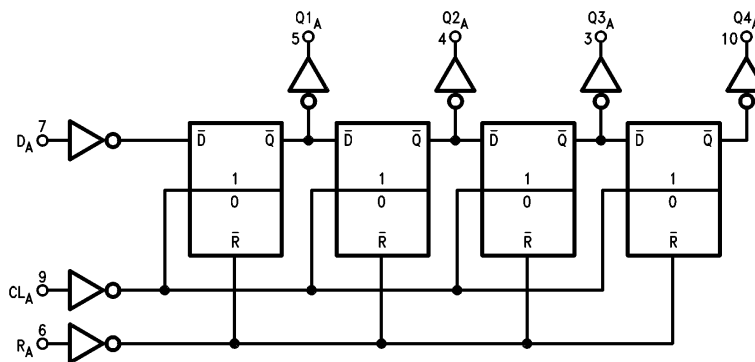
## AC Electrical Characteristics\*

$T_A = 25^\circ\text{C}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ k}$ ,  $t_r = t_f = 20\text{ ns}$ , unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>CLOCK OPERATION</b>						
$t_{\text{PHL}}, t_{\text{PLH}}$	Propagation Delay Time	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$		230 80 60	350 160 120	ns ns ns
$t_{\text{THL}}, t_{\text{TLH}}$	Transition Time	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$		100 50 40	200 100 80	ns ns ns
$t_{\text{WL}}, t_{\text{WM}}$	Minimum Clock Pulse-Width	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$		160 60 50	250 110 85	ns ns ns
$t_{\text{rCL}}, t_{\text{fCL}}$	Clock Rise and Fall Time	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$			15 15 15	$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$t_{\text{SU}}$	Minimum Data Set-Up Time	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$		50 20 15	100 40 30	$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$f_{\text{CL}}$	Maximum Clock Frequency	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$	2 4.5 6	3.5 8 11		MHz MHz MHz
$C_{\text{IN}}$	Input Capacitance	Clock Input Other Inputs		7.5 5	10 7.5	pF pF
<b>RESET OPERATION</b>						
$t_{\text{PHL(R)}}$	Propagation Delay Time	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$		200 100 80	400 200 160	ns ns ns
$t_{\text{WH(R)}}$	Minimum Reset Pulse Width	$V_{\text{DD}} = 5\text{V}$ $V_{\text{DD}} = 10\text{V}$ $V_{\text{DD}} = 15\text{V}$		135 40 30	250 80 60	ns ns ns

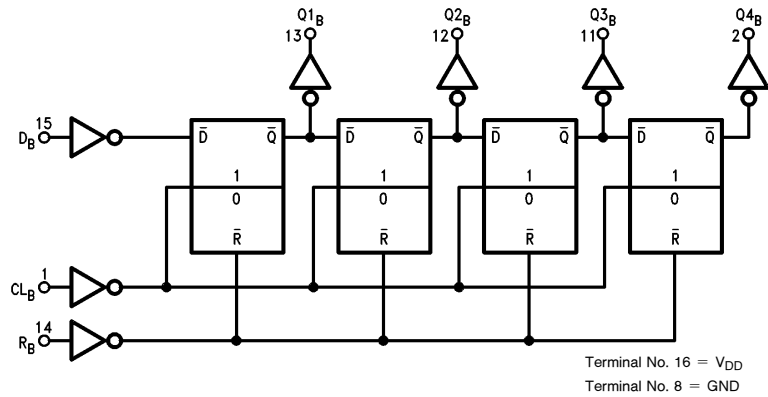
\*AC Parameters are guaranteed by DC correlated testing.

## Logic Diagrams



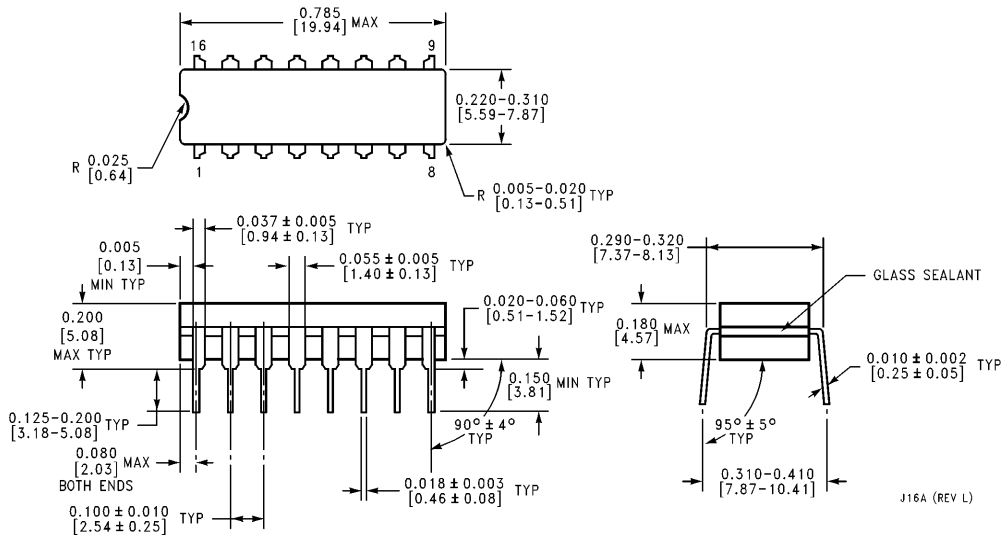
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**Logic Diagrams** (Continued)



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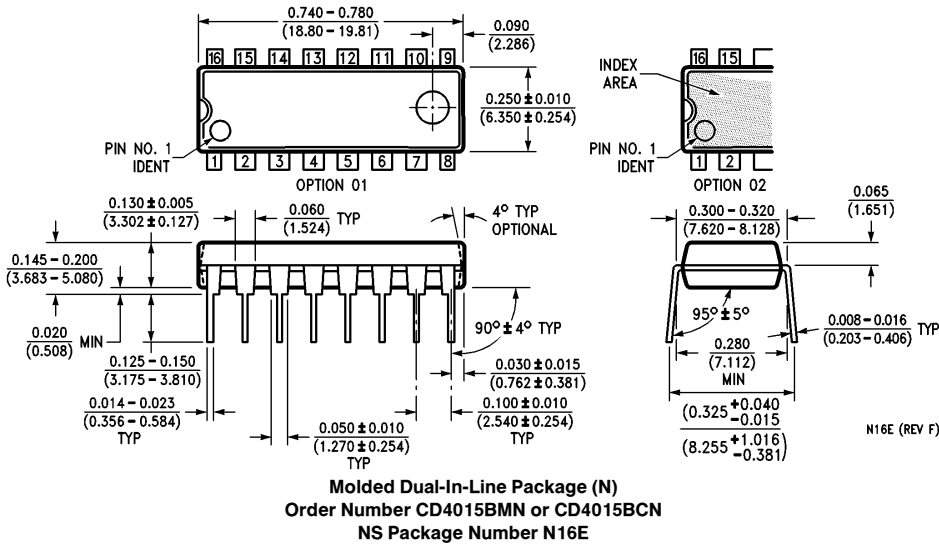
**Physical Dimensions** inches (millimeters) unless otherwise noted



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

J16A (REV L)


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



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