

## CD4023M/CD4023C Triple 3-Input NAND Gate CD4025M/CD4025C Triple 3-Input NOR Gate

### General Description

These triple gates are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. All inputs are protected against static discharge with diodes to  $V_{DD}$  and  $V_{SS}$ .

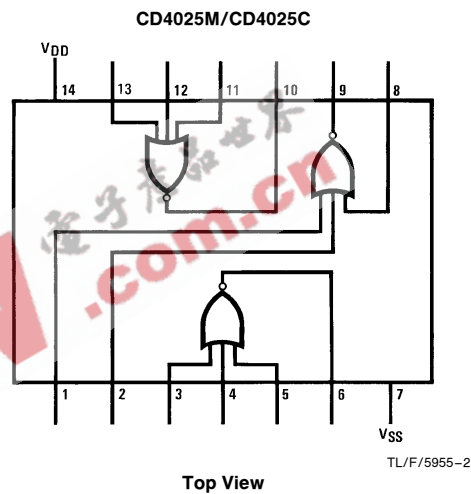
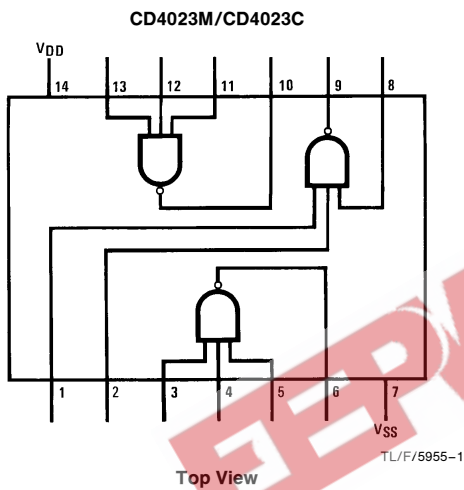
### Features

- Wide supply voltage range
- High noise immunity
- 5V–10V parametric ratings
- Low power

3.0V to 15V  
0.45  $V_{DD}$  (typ.)

### Connection Diagrams

#### Dual-In-Line Packages



Order Number CD4023 or CD4025

### Absolute Maximum Ratings (Note 1)

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

Voltage at Any Pin  $V_{SS} -$  to  $V_{DD} + 0.3V$   
 Operating Temperature Range  
 CD4023M, CD4025M  $-55^{\circ}C$  to  $+125^{\circ}C$   
 CD4023C, CD4025C  $-40^{\circ}C$  to  $+85^{\circ}C$

Storage Temperature Range  $-65^{\circ}C$  to  $+150^{\circ}C$   
 Power Dissipation ( $P_D$ )  
 Dual-In-Line 700 mW  
 Small Outline 500 mW  
 Operating  $V_{DD}$  Range  $V_{SS} + 3.0V$  to  $V_{SS} + 15V$   
 Lead Temperature  
 (Soldering, 10 seconds)  $260^{\circ}C$

### DC Electrical Characteristics CD4023M, CD4025M

Symbol	Parameter	Conditions	Limits						Units	
			$-55^{\circ}C$		$+25^{\circ}C$			$+125^{\circ}C$		
			Min	Max	Min	Typ	Max	Min		Max
$I_L$	Quiescent Device Current	$V_{DD} = 5.0V$ $V_{DD} = 10V$		0.05		0.001	0.05		3.0	$\mu A$
				0.1		0.001	0.1		6.0	$\mu A$
$P_D$	Quiescent Device Dissipation/Package	$V_{DD} = 5.0V$ $V_{DD} = 10V$		0.25		0.005	0.25		15	$\mu W$
				1.0		0.01	1.0		60	$\mu W$
$V_{OL}$	Output Voltage Low Level	$V_{DD} = 5.0V, V_I = V_{DD}, I_O = 0A$ $V_{DD} = 10V, V_I = V_{DD}, I_O = 0A$		0.05		0	0.05		0.05	V
				0.05		0	0.05		0.05	V
$V_{OH}$	Output Voltage High Level	$V_{DD} = 5.0V, V_I = V_{SS}, I_O = 0A$ $V_{DD} = 10V, V_I = V_{SS}, I_O = 0A$	4.95		4.95	5.0		4.95		V
			9.95		9.95	10		9.95		V
$V_{NL}$	Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 3.6V, I_O = 0A$ $V_{DD} = 10V, V_O = 7.2V, I_O = 0A$	1.5		1.5	2.25		1.4		V
			3.0		3.0	4.5		2.9		V
$V_{NH}$	Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 0.95V, I_O = 0A$ $V_{DD} = 10V, V_O = 2.9V, I_O = 0A$	1.4		1.5	2.25		1.5		V
			2.9		3.0	4.5		3.0		V
$I_{DN}$	Output Drive Current N-Channel (4025) (Note 2)	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$ $V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	0.5		0.40	1.0		0.28		mA
			1.1		0.9	2.5		0.65		mA
$I_{DP}$	Output Drive Current P-Channel (4025) (Note 2)	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$ $V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-0.62		-0.5	-2.0		-0.35		mA
			-0.62		-0.5	-1.0		-0.35		mA
$I_{DN}$	Output Drive Current N-Channel (4023) (Note 2)	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$ $V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	0.31		0.25	0.5		0.175		mA
			0.63		0.5	0.6		0.35		mA
$I_{DP}$	Output Drive Current P-Channel (4023) (Note 2)	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$ $V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-0.31		-0.25	-0.5		-0.175		mA
			-0.75		-0.6	-1.2		-0.4		mA
$I_I$	Input Current				10				pA	

**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:**  $I_{DN}$  and  $I_{DP}$  are tested one output at a time.

DC Electrical Characteristics CD4023C, CD4025C										
Symbol	Parameter	Conditions	Limits						Units	
			- 40°C		+ 25°C			+ 85°C		
			Min	Max	Min	Typ	Max	Min		Max
I <sub>L</sub>	Quiescent Device Current	V <sub>DD</sub> = 5.0V		0.05		0.005	0.5		15	μA
		V <sub>DD</sub> = 10V		5.0		0.005	5.0		30	μA
P <sub>D</sub>	Quiescent Device Dissipation/Package	V <sub>DD</sub> = 5.0V		2.5		0.025	2.5		75	μW
		V <sub>DD</sub> = 10V		50		0.05	50		300	μW
V <sub>OL</sub>	Output Voltage Low Level	V <sub>DD</sub> = 5.0V, V <sub>I</sub> = V <sub>DD</sub> , I <sub>O</sub> = 0A		0.01		0	0.01		0.05	V
		V <sub>DD</sub> = 10V, V <sub>I</sub> = V <sub>DD</sub> , I <sub>O</sub> = 0A		0.01		0	0.01		0.05	V
V <sub>OH</sub>	Output Voltage High Level	V <sub>DD</sub> = 5.0V, V <sub>I</sub> = V <sub>SS</sub> , I <sub>O</sub> = 0A	4.99		4.99	5.0		4.95		V
		V <sub>DD</sub> = 10V, V <sub>I</sub> = V <sub>SS</sub> , I <sub>O</sub> = 0A	9.99		9.99	10		9.95		V
I <sub>I</sub>	Input Current				10					pA
V <sub>NL</sub>	Noise Immunity (All Inputs)	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 3.6V, I <sub>O</sub> = 0A	1.5		1.5	2.25		1.4		V
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 7.2V, I <sub>O</sub> = 0A	3.0		3.0	4.5		2.9		V
V <sub>NH</sub>	Noise Immunity (All Inputs)	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 0.95V, I <sub>O</sub> = 0A	1.4		1.5	2.25		1.5		V
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 2.9V, I <sub>O</sub> = 0A	2.9		3.0	4.5		3.0		V
I <sub>DN</sub>	Output Drive Current N-Channel (4025) (Note 2)	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 0.4V, V <sub>I</sub> = V <sub>DD</sub>	0.35		0.3	1.0		0.24		mA
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 0.5V, V <sub>I</sub> = V <sub>DD</sub>	0.72		0.6	2.5		0.48		mA
I <sub>DP</sub>	Output Drive Current P-Channel (4025) (Note 2)	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 2.5V, V <sub>I</sub> = V <sub>SS</sub>	-0.35		-0.3	-2.0		-0.24		mA
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.5V, V <sub>I</sub> = V <sub>SS</sub>	-0.3		-0.25	-1.0		-0.2		mA
I <sub>DN</sub>	Output Drive Current N-Channel (4023) (Note 2)	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 0.4V, V <sub>I</sub> = V <sub>DD</sub>	0.145		0.12	0.5		0.095		mA
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 0.5V, V <sub>I</sub> = V <sub>DD</sub>	0.3		0.25	0.6		0.2		mA
I <sub>DP</sub>	Output Drive Current P-Channel (4023) (Note 2)	V <sub>DD</sub> = 5.0V, V <sub>O</sub> = 2.5V, V <sub>I</sub> = V <sub>SS</sub>	-0.145		-0.12	-0.5		-0.095		mA
		V <sub>DD</sub> = 10V, V <sub>O</sub> = 9.5V, V <sub>I</sub> = V <sub>SS</sub>	-0.35		-0.3	-1.2		-0.24		mA
I <sub>I</sub>	Input Current				10					pA

**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.

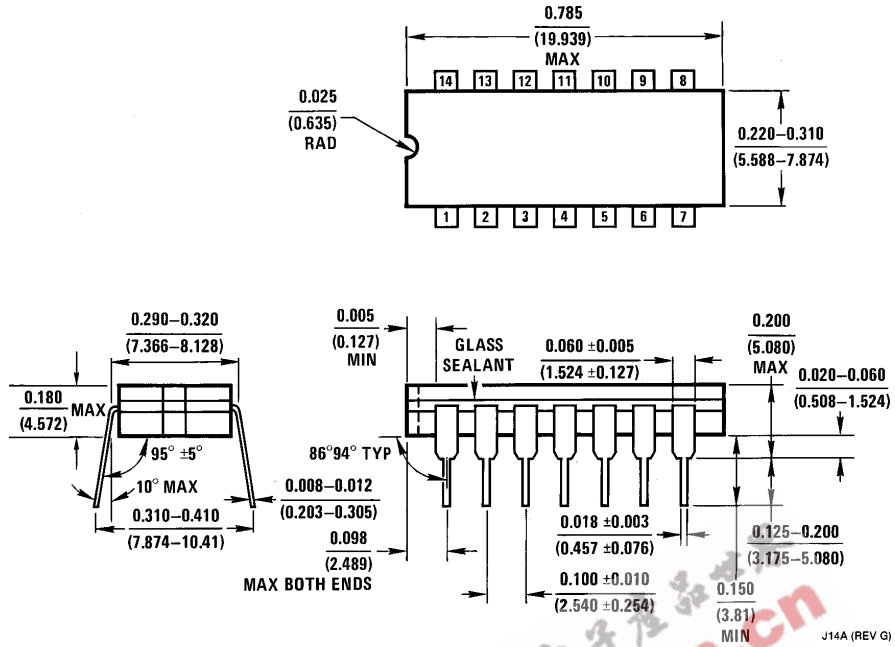
**Note 2:** I<sub>DN</sub> and I<sub>DP</sub> are tested one output at a time.

**AC Electrical Characteristics\***  $T_A = 25^\circ\text{C}$ ,  $C_L = 15\text{ pF}$ , and input rise and fall times = 20 ns. Typical temperature coefficient for all values of  $V_{DD} = 0.3\%/^\circ\text{C}$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>CD4025M</b>						
$t_{PHL}$	Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		35	50	ns
		$V_{DD} = 10\text{V}$		25	40	ns
$t_{PLH}$	Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		35	40	ns
		$V_{DD} = 10\text{V}$		25	70	ns
$t_{THL}$	Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		65	125	ns
		$V_{DD} = 10\text{V}$		35	70	ns
$t_{TLH}$	Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		65	175	ns
		$V_{DD} = 10\text{V}$		35	75	ns
$C_i$	Input Capacitance	Any Input		5.0		pF
<b>CD4025C</b>						
$t_{PHL}$	Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		35	80	ns
		$V_{DD} = 10\text{V}$		25	55	ns
$t_{PLH}$	Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		35	120	ns
		$V_{DD} = 10\text{V}$		25	65	ns
$t_{THL}$	Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		65	200	ns
		$V_{DD} = 10\text{V}$		35	115	ns
$t_{TLH}$	Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		65	300	ns
		$V_{DD} = 10\text{V}$		35	125	ns
$C_i$	Input Capacitance	Any Input		5.0		pF
<b>CD4023M</b>						
$t_{PHL}$	Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		50	75	ns
		$V_{DD} = 10\text{V}$		25	40	ns
$t_{PLH}$	Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		50	75	ns
		$V_{DD} = 10\text{V}$		25	40	ns
$t_{THL}$	Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		75	125	ns
		$V_{DD} = 10\text{V}$		50	75	ns
$t_{TLH}$	Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		75	100	ns
		$V_{DD} = 10\text{V}$		40	60	ns
$C_i$	Input Capacitance	Any Input		5.0		pF
<b>CD4023C</b>						
$t_{PHL}$	Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		50	100	ns
		$V_{DD} = 10\text{V}$		25	50	ns
$t_{PLH}$	Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		50	100	ns
		$V_{DD} = 10\text{V}$		25	50	ns
$t_{THL}$	Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		75	150	ns
		$V_{DD} = 10\text{V}$		50	100	ns
$t_{TLH}$	Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		75	125	ns
		$V_{DD} = 10\text{V}$		40	75	ns
$C_i$	Input Capacitance	Any Input		5.0		pF

\*AC Parameters are guaranteed by DC correlated testing.

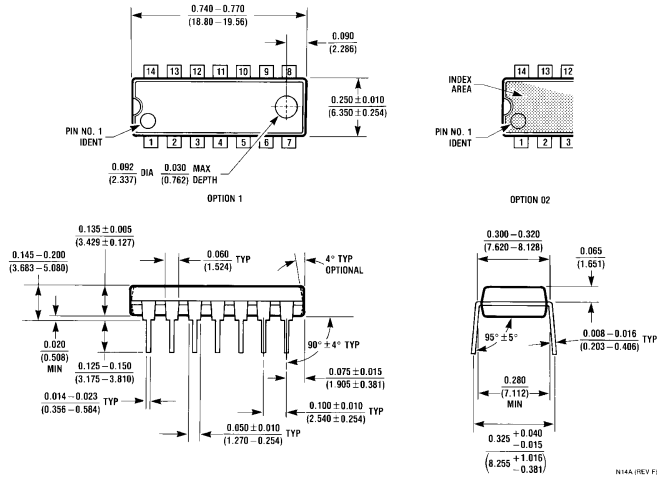
**Physical Dimensions** inches (millimeters)



Ceramic Dual-In-Line Package (J)  
 Order Number CD4023MJ, CD4023CJ, CD4025MJ or CD4025CJ  
 NS Package Number J14A

J14A (REV G)

**Physical Dimensions** inches (millimeters) (Continued)



**Molded Dual-In-Line Package (N)**  
 Order Number CD4023MN, CD4023CN, CD4025MN or CD4025CN  
 NS Package Number N14A



**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



**National Semiconductor Corporation**  
 1111 West Bardin Road  
 Arlington, TX 76017  
 Tel: 1(800) 272-9959  
 Fax: 1(800) 737-7018

**National Semiconductor Europe**  
 Fax: (+49) 0-180-530 85 86  
 Email: cnjwge@levm2.nsc.com  
 Deutsch Tel: (+49) 0-180-530 85 85  
 English Tel: (+49) 0-180-532 78 32  
 Français Tel: (+49) 0-180-532 93 58  
 Italiano Tel: (+49) 0-180-534 16 80

**National Semiconductor Hong Kong Ltd.**  
 13th Floor, Straight Block,  
 Ocean Centre, 5 Canton Rd.  
 Tsimshatsui, Kowloon  
 Hong Kong  
 Tel: (852) 2737-1600  
 Fax: (852) 2736-9960

**National Semiconductor Japan Ltd.**  
 Tel: 81-043-299-2309  
 Fax: 81-043-299-2408

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.