

## CMOS 8-Input NOR/OR Gate

High-Voltage Types (20-Volt Rating)

■ CD4078B NOR/OR Gate provides the system designer with direct implementation of the positive-logic 8-input NOR and OR functions and supplements the existing family of CMOS gates.

The CD4078B types are supplied in 14-lead dual-in-line ceramic packages (D and F suffixes), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline package (NSR suffix), and in chip form (H suffix).

### DC SUPPLY-VOLTAGE RANGE, ( $V_{DD}$ )

Voltages referenced to  $V_{SS}$  Terminal) ..... -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to  $V_{DD}$  + 0.5V

DC INPUT CURRENT, ANY ONE INPUT .....  $\pm 10$  nA

### POWER DISSIPATION PER PACKAGE ( $P_D$ ):

For  $T_A = -55^\circ\text{C}$  to  $+100^\circ\text{C}$  ..... 500mW

For  $T_A = +100^\circ\text{C}$  to  $+125^\circ\text{C}$  ..... Derate Linearity at 12mW/ $^\circ\text{C}$  to 200mW

### DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR  $T_A = \text{FULL PACKAGE-TEMPERATURE RANGE (All Package Types)}$  ..... 100mW

OPERATING-TEMPERATURE RANGE ( $T_A$ ) .....  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$

STORAGE TEMPERATURE RANGE ( $T_{stg}$ ) .....  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$

### LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16  $\pm$  1/32 inch (1.59  $\pm$  0.79mm) from case for 10s max .....  $+265^\circ\text{C}$

### Features:

- Medium-Speed Operation:  
 $t_{PHL}$ ,  $t_{PLH} = 75$  ns (typ.) at  $V_{DD} = 10$  V
- Buffered inputs and output
- 5-V, 10-V, and 15-V parametric ratings
- Standardized symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1  $\mu\text{A}$  at 18 V over full package-temperature range:  
100 nA at 18 V and  $25^\circ\text{C}$
- Noise margin (over full package-temperature range):  
1 V at  $V_{DD} = 5$  V  
2 V at  $V_{DD} = 10$  V 2.5 V at  $V_{DD} = 15$  V
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

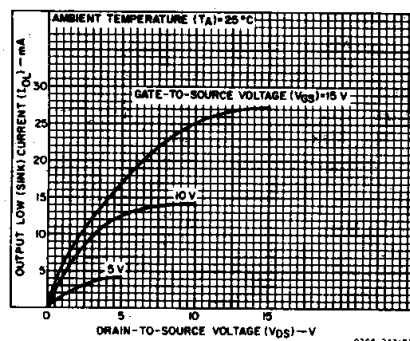
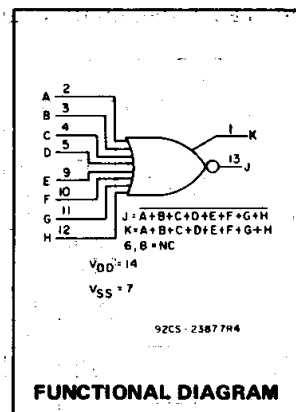


Fig. 2 – Typical output low (sink) current characteristics.

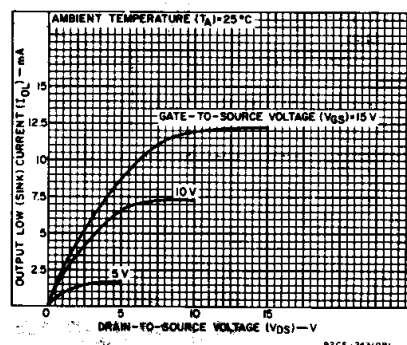


Fig. 3 – Minimum output low (sink) current characteristics.

### RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	Min.	Max.	Units
Supply-Voltage Range (For $T_A$ Full Package Temperature Range)	3	18	V

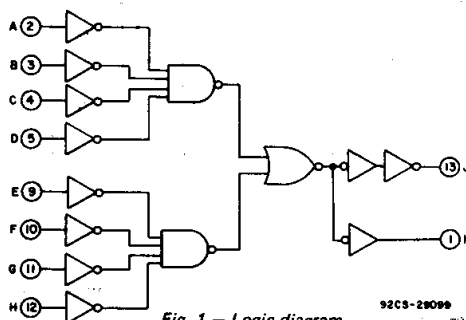


Fig. 1 – Logic diagram.

### DYNAMIC ELECTRICAL CHARACTERISTICS

At  $T_A = 25^\circ\text{C}$ ; Input  $t_r$ ,  $t_f = 20$  ns,  $C_L = 50$  pF,  $R_L = 200$  k $\Omega$

CHARACTERISTIC	TEST CONDITIONS	LIMITS		UNITS	
		V <sub>DD</sub> VOLTS	TYP. MAX.		
Propagation Delay Time, t <sub>PHL</sub> , t <sub>PLH</sub>		5	150	300	ns
		10	75	150	
		15	55	110	
Transition Time, t <sub>THL</sub> , t <sub>TLH</sub>		5	100	200	ns
		10	50	100	
		15	40	80	
Input Capacitance, C <sub>IN</sub>	Any Input		5	7.5	pF

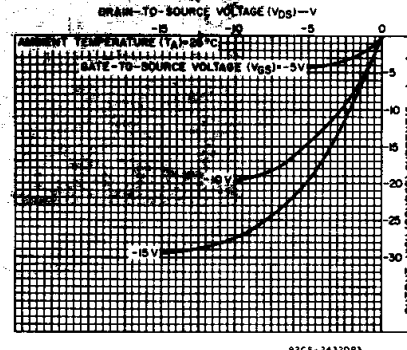


Fig. 4 – Typical output high (source) current characteristics.

# CD4078B Types

## STATIC ELECTRICAL CHARACTERISTICS

CHARACTER- ISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V <sub>O</sub> (V)	V <sub>IN</sub> (V)	V <sub>DD</sub> (V)					+25			
				-55	-40	+85	+125	Min.	Typ.	Max.	
Quiescent Device Current, I <sub>DD</sub> Max.	—	0.5	5	0.25	0.25	7.5	7.5	—	0.01	0.25	μA
	—	0.10	10	0.5	0.5	15	15	—	0.01	0.5	
	—	0.15	15	1	1	30	30	—	0.01	1	
	—	0.20	20	5	5	150	150	—	0.02	5	
Output Low (Sink) Current I <sub>OL</sub> Min.	0.4	0.5	5	0.64	0.61	0.42	0.36	0.51	1		mA
	0.5	0.10	10	1.6	1.5	1.1	0.9	1.3	2.6		
	1.5	0.15	15	4.2	4	2.8	2.4	3.4	6.8		
Output High (Source) Current, I <sub>OH</sub> Min.	4.6	0.5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1		mA
	2.5	0.5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2		
	9.5	0.10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6		
	13.5	0.15	15	-4.2	-4	-2.8	-2.4	-3.4	-6.8		
Output Voltage: Low Level, V <sub>OL</sub> Max.	—	0.5	5	0.05					0	0.05	V
	—	0.10	10	0.05					0	0.05	
	—	0.15	15	0.05					0	0.05	
Output Voltage: High Level, V <sub>OH</sub> Min.	—	0.5	5	4.95				4.95	5		V
	—	0.10	10	9.95				9.95	10		
	—	0.15	15	14.95				14.95	15		
Input Low Voltage, V <sub>IL</sub> Max.	0.5,4.5	—	5	1.5				—	—	1.5	V
	1.9	—	10	3				—	—	3	
	1.5,13.5	—	15	4				—	—	4	
Input High Voltage, V <sub>IH</sub> Min.	0.5,4.5	—	5	3.5				3.5	—	—	V
	1.9	—	10	7				7	—	—	
	1.5,13.5	—	15	11				11	—	—	
Input Current I <sub>IN</sub> Max.		0.18	18	±0.1	±0.1	±1	±1	—	±10 <sup>-5</sup>	±0.1	μA

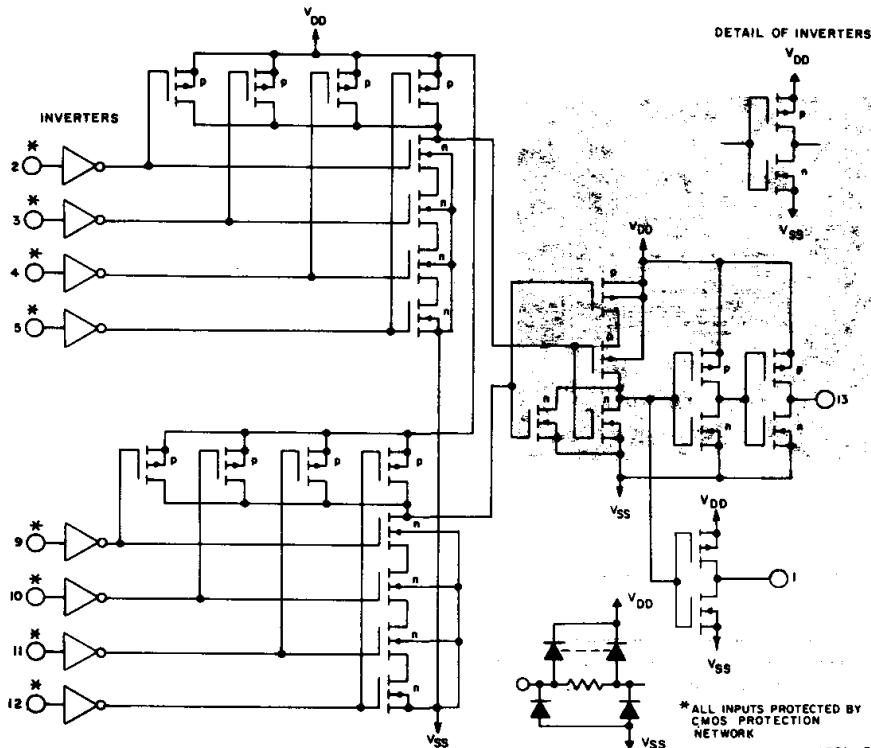


Fig. 8 — Schematic diagram.

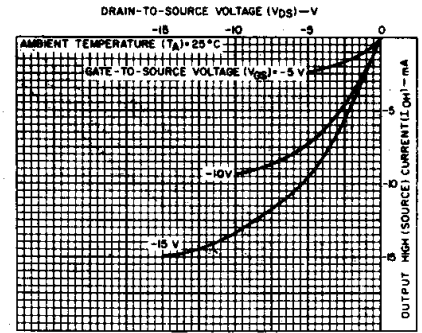


Fig. 5 — Minimum output high (source) current characteristics.

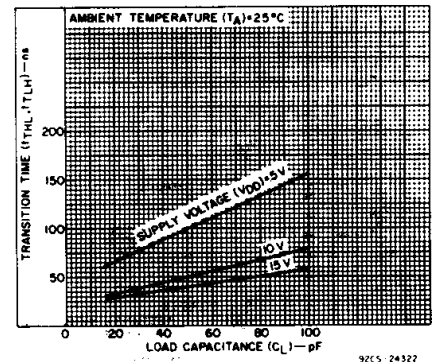


Fig. 6 — Typical transition time as a function of load capacitance.

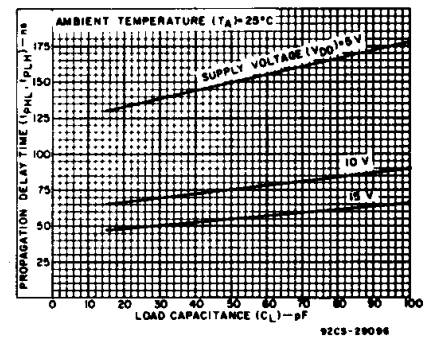


Fig. 7 — Typical propagation delay time as a function of load capacitance.

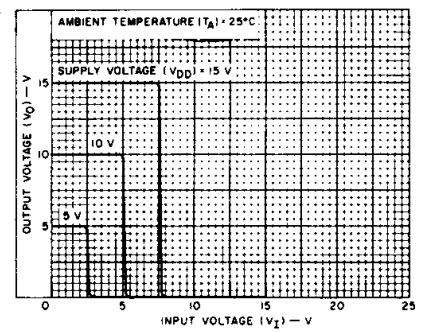


Fig. 9 — Typical voltage transfer characteristics (NOR output).

## CD4078B Types

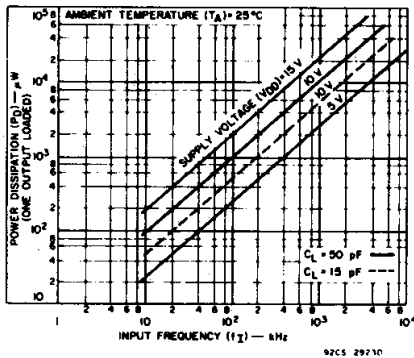


Fig. 10 - Typical dynamic power dissipation as a function of frequency.

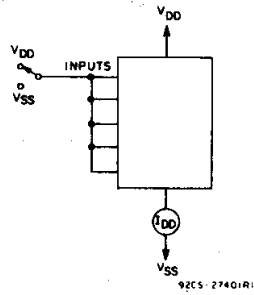


Fig. 11 - Quiescent-device-current test circuit.

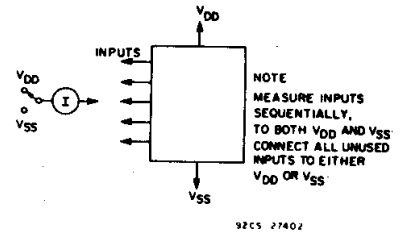


Fig. 12 - Input current test circuit.

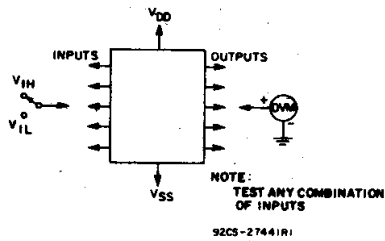


Fig. 13 - Input-voltage test circuit.

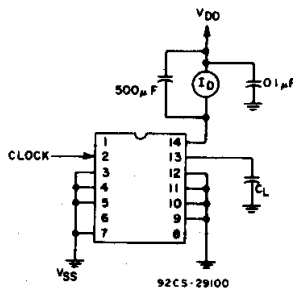
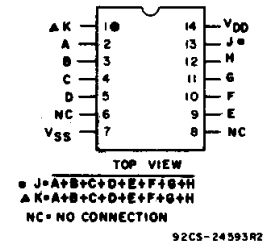
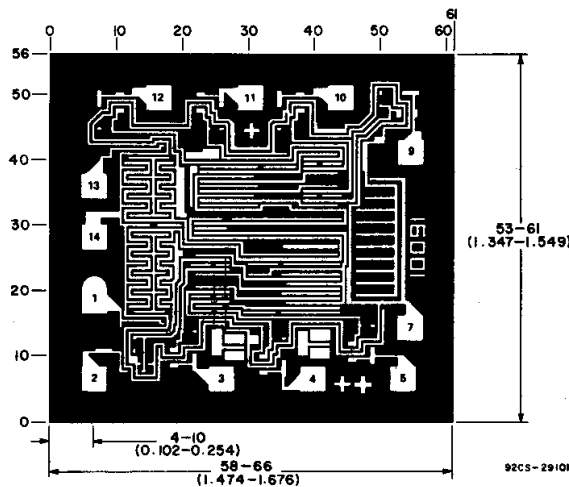


Fig. 14 - Dynamic power dissipation test circuit.



TERMINAL ASSIGNMENT



Dimensions and pad layout for CD4078BH.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils ( $10^{-3}$  inch).

## **IMPORTANT NOTICE**

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265