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## NTE4070B and NTE4070BT Integrated Circuit CMOS, Quad Exclusive OR Gate

**Description:**

The NTE4070B (14-Lead DIP) and NTE4070BT (SOIC-14) are quad exclusive OR gates constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. These complementary MOS logic gates find primary use where low power dissipation and/or high noise immunity is desired.

**Features:**

- Quiescent Current = 0.5nA Typ/Pkg at 5 Vdc
- Noise Immunity = 45% of V<sub>DD</sub> (Typ)
- Supply Voltage Range = 3Vdc to 18Vdc
- All Outputs Buffered
- Capable of Driving Two Low-Power TTL Loads, One Low-Power Schottky TTL Load or Two HTL Loads Over the Rated Temperature Range
- Double Diode Protection on All Inputs

**Absolute Maximum Ratings:** (Voltages Referenced to V<sub>SS</sub>, Note 1)

DC Supply Voltage, V <sub>DD</sub> .....	-0.5 to +18.0V
Input Voltage (All Inputs), V <sub>in</sub> .....	-0.5 to V <sub>DD</sub> + 0.5V
DC Current Drain (Per Pin), I .....	10mA
Operating Temperature Range, T <sub>sA</sub> .....	-55 to +125°C
Storage Temperature Range, T <sub>stg</sub> .....	-65 to +150°C
Lead Temperature (8-Seconds Soldering), T <sub>L</sub> .....	260°C

Note 1. These devices contain circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V<sub>in</sub> and V<sub>out</sub> be constrained to the range V<sub>SS</sub> ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>DD</sub>.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V<sub>SS</sub> or V<sub>DD</sub>).

**Electrical Characteristics:** (Voltages referenced to  $V_{SS}$ , Note 2)

Parameter	Symbol	$V_{DD}$ Vdc	-55°C		+25°C			+125°C		Unit
			Min	Max	Min	Typ	Max	Min	Max	
Output Voltage "0" Level $V_{in} = V_{DD}$ or 0  "1" Level $V_{in} = 0$ or $V_{DD}$	$V_{OL}$	5.0	-	0.05	-	0	0.05	-	0.05	Vdc
		10	-	0.05	-	0	0.05	-	0.05	Vdc
		15	-	0.05	-	0	0.05	-	0.05	Vdc
	$V_{OH}$	5.0	4.95	-	4.95	5.0	-	4.95	-	Vdc
		10	9.95	-	9.95	10	-	9.95	-	Vdc
		15	14.95	-	14.95	15	-	14.95	-	Vdc
Input Voltage "0" Level ( $V_O = 4.5$ or $0.5$ Vdc) ( $V_O = 9.0$ or $1.0$ Vdc) ( $V_O = 13.5$ or $1.5$ Vdc)  "1" Level ( $V_O = 0.5$ or $4.5$ Vdc) ( $V_O = 1.0$ or $9.0$ Vdc) ( $V_O = 1.5$ or $13.5$ Vdc)	$V_{IL}$	5.0	-	1.5	-	2.25	1.5	-	1.5	Vdc
		10	-	3.0	-	4.50	3.0	-	3.0	Vdc
		15	-	4.0	-	6.75	4.0	-	4.0	Vdc
	$V_{IH}$	5.0	3.5	-	3.5	2.75	-	3.5	-	Vdc
		10	7.0	-	7.0	5.50	-	7.0	-	Vdc
		15	11.0	-	11.0	8.25	-	11.0	-	Vdc
Output Drive Current Source ( $V_{OH} = 2.5$ Vdc) ( $V_{OH} = 4.6$ Vdc) ( $V_{OH} = 9.5$ Vdc) ( $V_{OH} = 13.5$ Vdc)  Sink ( $V_{OL} = 0.4$ Vdc) ( $V_{OL} = 0.5$ Vdc) ( $V_{OL} = 1.5$ Vdc)	$I_{OH}$	5.0	-3.0	-	-2.4	-4.2	-	-1.7	-	mAdc
		5.0	-0.64	-	-0.51	-0.88	-	-0.36	-	mAdc
		10	-1.6	-	-1.3	-2.25	-	-0.9	-	mAdc
		15	-4.2	-	-3.4	-8.8	-	-2.4	-	mAdc
	$I_{OL}$	5.0	0.64	-	0.51	0.88	-	0.36	-	mAdc
		10	1.6	-	1.3	2.25	-	0.9	-	mAdc
		15	4.2	-	3.4	8.8	-	2.4	-	mAdc
Input Current	$I_{in}$	15	-	±0.1	-	±0.00001	±0.1	-	±0.1	μAdc
Input Capacitance ( $V_{IN} = 0$ )	$C_{in}$	-	-	-	-	5.0	7.5	-	-	pF
Quiescent Current (Per Package)	$I_{DD}$	5.0	-	0.25	-	0.0005	0.25	-	7.5	μAdc
		10	-	0.5	-	0.0010	0.5	-	15	μAdc
		15	-	1.0	-	0.0015	1.0	-	30	μAdc
Total Supply Current (Dynamic plus Quiescent, Per Package, $C_L = 50$ pF on all outputs, all buffers switching, Note 3, Note 4)	$I_T$	5.0	$I_T = (0.3\mu A/kHz) f + I_{DD}$							μAdc
		10	$I_T = (0.6\mu A/kHz) f + I_{DD}$							μAdc
		15	$I_T = (0.8\mu A/kHz) f + I_{DD}$							μAdc

Note 2. Data labeled "Typ" is not to be used for design purposes but is intended as an indication of the device's potential performance.

Note 3. The formulas given are for the typical characteristics only at +25°C.

Note 4. To calculate total supply current at loads other than 50pF:

$$I_T(C_L) = I_T(50pF) + 1 \times 10^{-3}(C_L - 50) V_{DD}f$$

where:  $I_T$  is in μA (per package),  $C_L$  in pF,  $V_{DD}$  in volts and  $f$  in kHz is input frequency.

Note 3. The formulas given are for the typical characteristics only at +25°C.

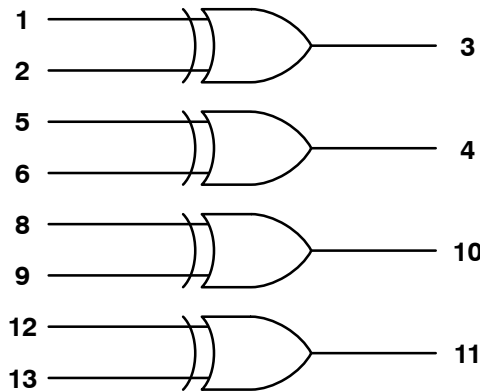
**Switching Characteristics:** ( $C_L = 50\text{pF}$ ,  $T_A = +25^\circ\text{C}$ , Note 2)

Parameter	Symbol	$V_{DD}$ Vdc	Min	Typ	Max	Unit
Output Rise and Fall Times $t_{TLH}, t_{THL} = (1.35\text{ns/pf}) C_L + 33\text{ns}$ $t_{TLH}, t_{THL} = (0.60\text{ns/pf}) C_L + 20\text{ns}$ $t_{TLH}, t_{THL} = (0.40\text{ns/pf}) C_L + 20\text{ns}$	$t_{TLH}, t_{THL}$	5.0	-	100	200	ns
		10	-	50	100	ns
		15	-	40	80	ns
Propagation Delay Time $t_{PLH}, t_{PHL} = (0.90\text{ns/pf}) C_L + 115\text{ns}$ $t_{PLH}, t_{PHL} = (0.36\text{ns/pf}) C_L + 47\text{ns}$ $t_{PLH}, t_{PHL} = (0.26\text{ns/pf}) C_L + 37\text{ns}$	$t_{PLH}, t_{PHL}$	5.0	-	175	350	ns
		10	-	75	150	ns
		15	-	50	100	ns

Note 2. Data labeled “Typ” is not to be used for design purposes but is intended as an indication of the device’s potential performance.

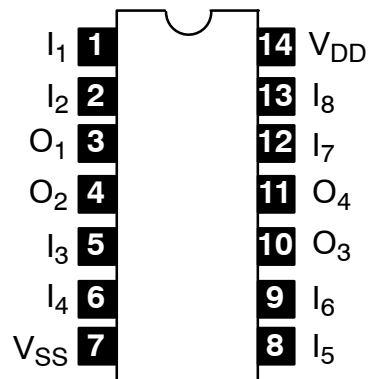
Note 3. The formulas given are for the typical characteristics only at +25°C.

**Logic Diagram**

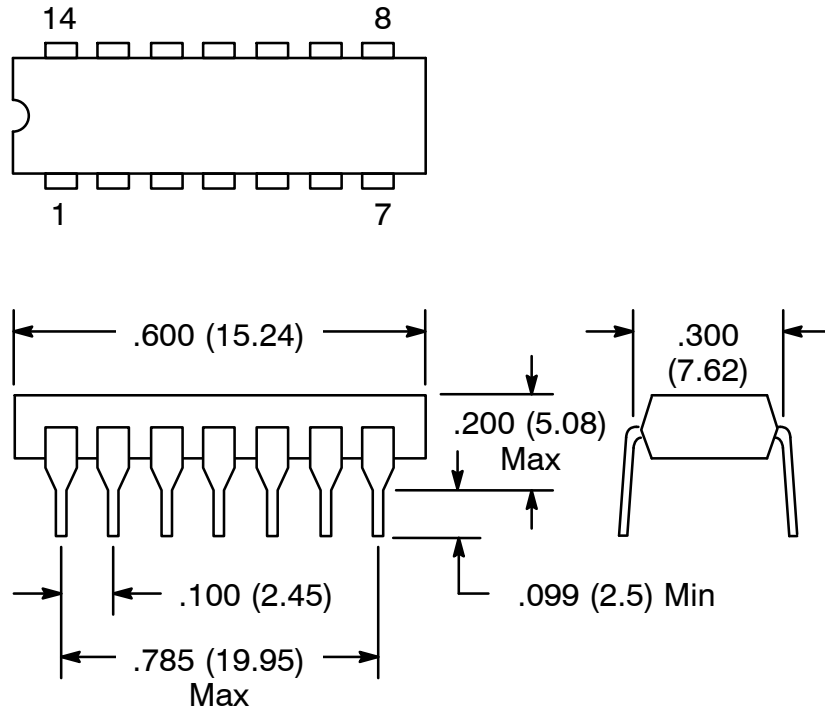


$V_{DD} = \text{Pin14}$   
 $V_{SS} = \text{Pin7}$

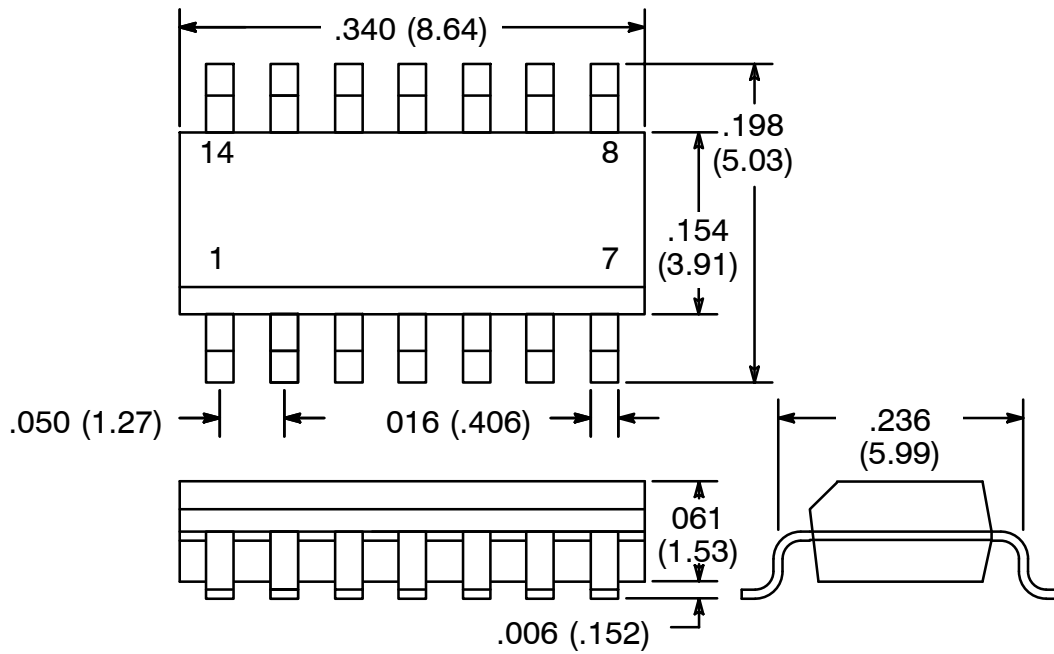
**Pin Connection Diagram**



### NTE4070B



### NTE4070BT



NOTE: Pin1 on Beveled Edge