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NTE4093B and NTE4093BT
Integrated Circuit
CMOS, Quad 2–Input NAND Schmitt Trigger

Description:

The NTE4093B (14–Lead DIP) and NTE4093BT (SOIC–14) Schmitt Triggers are constructed with MOS P–channel and N–channel enhancement mode devices in a single monolithic structure. These devices find primary use where low power dissipation and/or high noise immunity is desired. The NTE4093B/BT may be used in place of th NTE4011B/BT quad 2–input NAND gate for enhanced noise immunity or to “square up” slowly changing waveforms.

Features:

- Quiescent Current = 0.5nA Typ/Pkg at 5 Vdc
- Supply Voltage Range = 3Vdc to 18Vdc
- 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_{SS}, Note 1)

DC Supply Voltage, V_{DD} . . . . . –0.5 to +18.0V
Input Voltage (All Inputs), V_{in} . . . . . –0.5 to V_{DD} + 0.5V
DC Current Drain (Per Pin), I 10mA
Operating Temperature Range, T_A . . . . . –55 to +125°C
Storage Temperature Range, T_{stg} . . . . . –65 to +150°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 is is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \le (V_{in}$ or $V_{out}) \le V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).

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_{OL}	5.0	–	0.05	–	0	0.05	–	0.05	Vdc
V_{in} = V_{DD} or 0		10	–	0.05	–	0	0.05	–	0.05	Vdc
		15	–	0.05	–	0	0.05	–	0.05	Vdc
“1” Level	V_{OH}	5.0	4.95	–	4.95	5.0	–	4.95	–	Vdc
V_{in} = 0 or V_{DD}		10	9.95	–	9.95	10	–	9.95	–	Vdc
		15	14.95	–	14.95	15	–	14.95	–	Vdc
Input Voltage “0” Level	V_{IL}									
(V_O = 4.5 or 0.5Vdc)		5.0	–	1.5	–	–	1.5	–	1.5	Vdc
(V_O = 9.0 or 1.0Vdc)		10	–	3.0	–	–	3.0	–	3.0	Vdc
(V_O = 13.5 or 1.5Vdc)		15	–	4.0	–	–	4.0	–	4.0	Vdc
“1” Level	V_{IH}									
(V_O = 0.5 or 4.5Vdc)		5.0	3.5	–	3.5	–	–	3.5	–	Vdc
(V_O = 1.0 or 9.0Vdc)		10	7.0	–	7.0	–	–	7.0	–	Vdc
(V_O = 1.5 or 13.5Vdc)		15	11.0	–	11.0	–	–	11.0	–	Vdc
Output Drive Current Source	I_{OH}									
(V_{OH} = 2.5Vdc)		5.0	–3.0	–	–2.4	–4.2	–	–1.7	–	mAdc
(V_{OH} = 4.6Vdc)		5.0	–0.64	–	–0.51	–0.88	–	–0.36	–	mAdc
(V_{OH} = 9.5Vdc)		10	–1.6	–	–1.3	–2.25	–	–0.9	–	mAdc
(V_{OH} = 13.5Vdc)		15	–4.2	–	–3.4	–8.8	–	–2.4	–	mAdc
Sink	I_{OL}									
(V_{OL} = 0.4Vdc)		5.0	0.64	–	0.51	0.88	–	0.36	–	mAdc
(V_{OL} = 0.5Vdc)		10	1.6	–	1.3	2.25	–	0.9	–	mAdc
(V_{OL} = 1.5Vdc)		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 = 50pF on all outputs, all buffers switching, Note 3, Note 4)	I_T	5.0	I_T = (1.2µA/kHz) f + I_{DD}							µAdc
		10	I_T = (2.4µA/kHz) f + I_{DD}							µAdc
		15	I_T = (3.6µA/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:

$$I_T(C_L) = I_T(50pF) + 4 \times 10^{-3}(C_L - 50)\, V_{DD} f$$

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

Electrical Characteristics (Cont'd): (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	
Hysteresis Voltage (Pin2, Pin5, Pin9. Pin12 held high, Note 5)	V_H	5.0	0.20	0.42	0.17	0.26	0.39	0.13	0.39	Vdc
		10	–	0.5	–	0.0010	0.5	–	15	Vdc
		15	–	1.0	–	0.0015	1.0	–	30	Vdc
Threshold Voltage Positive−Going (Pin2, Pin5, Pin9. Pin12 held high)	V_{IL}	5.0	1.90	4.15	1.80	2.70	4.05	1.70	4.05	Vdc
		10	3.05	6.75	2.95	4.43	6.65	2.85	6.65	Vdc
		15	4.12	9.15	4.02	6.03	9.05	3.92	9.05	Vdc
Negative−Going	V_{IH}	5.0	1.63	3.76	1.63	2.44	3.66	1.53	3.66	Vdc
		10	2.70	6.18	2.70	4.05	6.08	2.60	6.08	Vdc
		15	3.69	8.40	3.69	5.53	8.30	3.70	8.30	Vdc

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 5. $V_H = V_{T+} - V_{T-}$ (But maximum variation of V_H is specified as less than V_{T+}max − V_{T-}min).

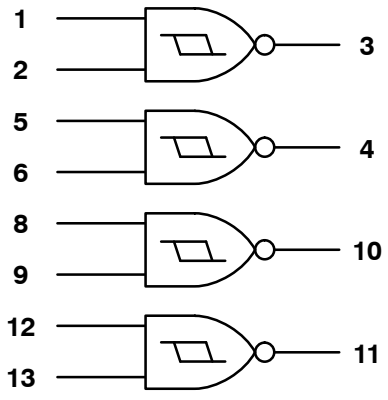
Switching Characteristics: (C_L = 50pF, T_A = +25°C, Note 2)

Parameter	Symbol	V_{DD} Vdc	Min	Typ	Max	Unit
Output Rise and Fall Times	t_{TLH}, t_{THL}	5.0	–	100	200	ns
		10	–	50	100	ns
		15	–	40	80	ns
Propagation Delay Time	t_{PLH}. t_{PHL}	5.0	–	125	250	ns
		10	–	50	100	ns
		15	–	40	80	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.

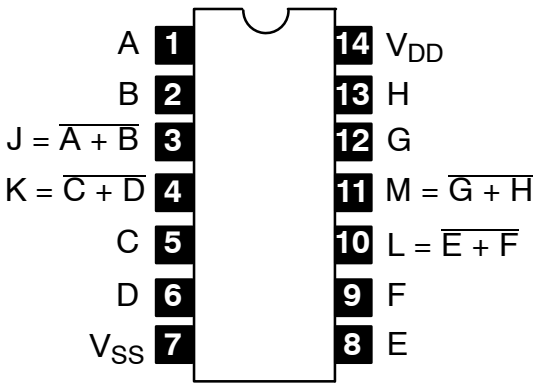
Note 3. The formulas given are for the typical characteristics only at +25°C.

Logic Diagram

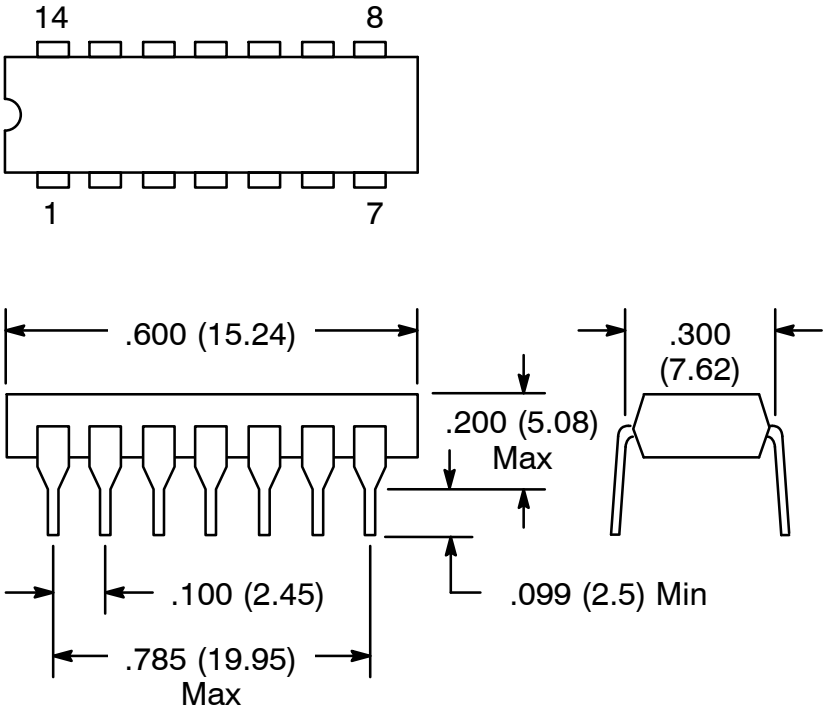


V_{DD} = Pin14
V_{SS} = Pin7

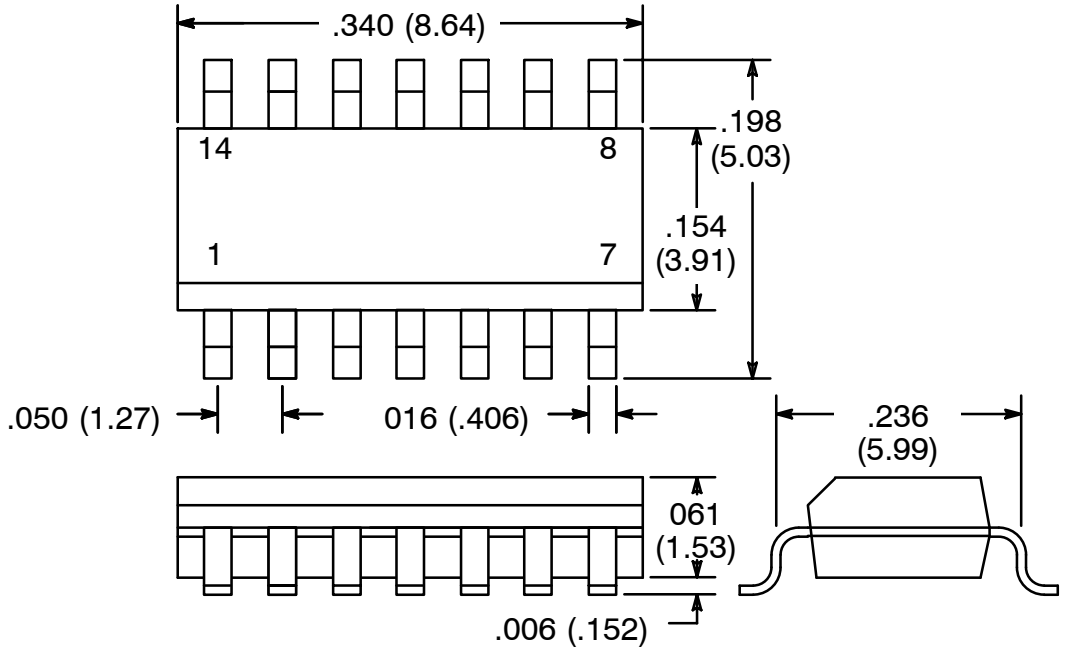
Pin Connection Diagram



NTE4093B



NTE4093BT



NOTE: Pin1 on Beveled Edge