National Semiconductor

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DM74S09 Quad 2-Input AND Gates with Open-Collector Outputs

General Description

This device contains four independent gates each of which performs the logic AND function. The open-collector outputs require an external pull-up resistor for proper logical operation.

Pull-Up Resistor Equations

$$R_{MAX} = \frac{V_{CC}\,(Min) - V_{OH}}{N_1\,(I_{OH}) + N_2\,(I_{IH})}$$

$$R_{MIN} = \frac{V_{CC}\,(Max) - V_{OL}}{I_{OL} - N_3\,(I_{IL})}$$

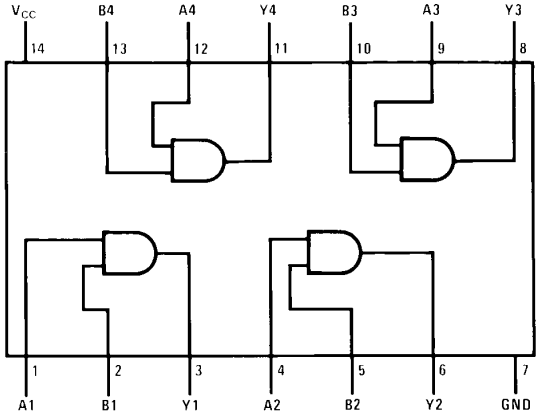
Where: $N_1\,(I_{OH})$ = total maximum output high current for all outputs tied to pull-up resistor

$N_2\,(I_{IH})$ = total maximum input high current for all inputs tied to pull-up resistor

$N_3\,(I_{IL})$ = total maximum input low current for all inputs tied to pull-up resistor

Connection Diagram

Dual-In-Line Package



TL/F/6465–1

Order Number DM74S09N
See NS Package Number N14A

Function Table

Y = AB

Inputs		Output
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

H = High Logic Level

L = Low Logic Level

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Absolute Maximum Ratings (Note)

Supply Voltage	7V
Input Voltage	5.5V
Output Voltage	7V
Operating Free Air Temperature Range	
DM74S	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: *The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.*

Recommended Operating Conditions

Symbol	Parameter	DM74S09			Units
		Min	Nom	Max	
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			V
V_{IL}	Low Level Input Voltage			0.8	V
V_{OH}	High Level Output Voltage			5.5	V
I_{OL}	Low Level Output Current			20	mA
T_A	Free Air Operating Temperature	0		70	°C

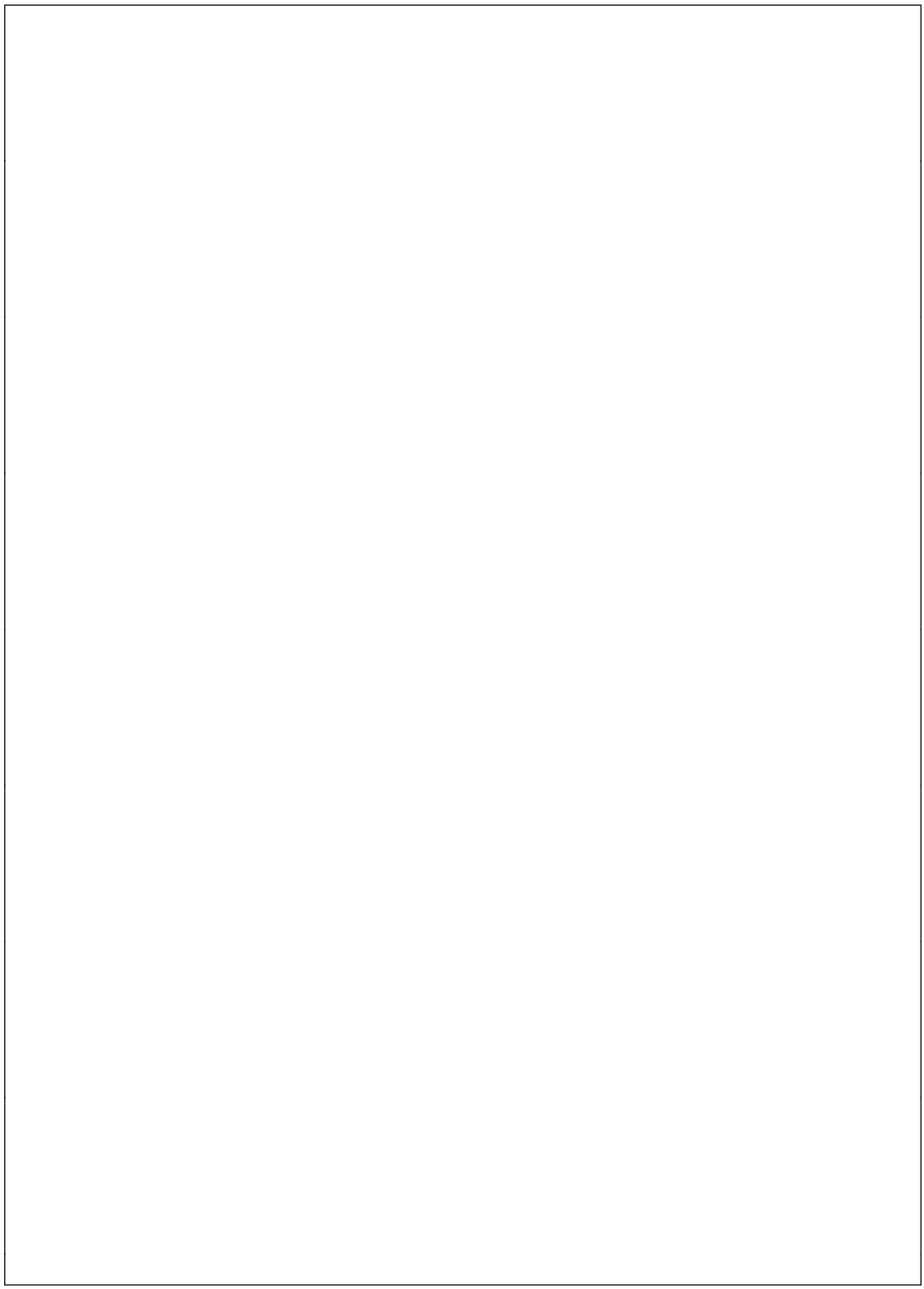
Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA			−1.2	V
I_{CEX}	High Level Output Current	V_{CC} = Min, V_O = 5.5V V_{IH} = Min			250	μA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max V_{IL} = Max			0.5	V
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 5.5V			1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V			50	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.5V			−2	mA
I_{CCH}	Supply Current with Outputs High	V_{CC} = Max		18	32	mA
I_{CCL}	Supply Current with Outputs Low	V_{CC} = Max		32	57	mA

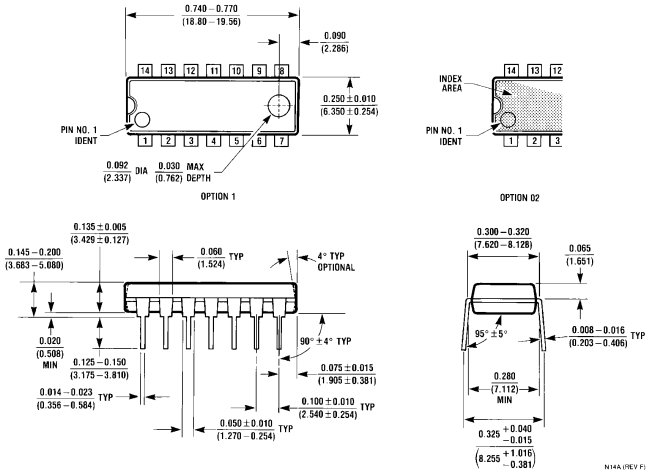
Switching Characteristics at V_{CC} = 5V and T_A = 25°C (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	R_L = 280Ω				Units
		C_L = 15 pF		C_L = 50 pF		
		Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time Low to High Level Output	3	10	4	18	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	3	10	4	18	ns

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.



Physical Dimensions inches (millimeters)



14-Lead Molded Dual-In-Line Package (N)
Order Number DM74S09N
NS Package Number N14A

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