

GD54/74LS09

QUADRUPLE 2-INPUT POSITIVE AND GATES WITH OPEN-COLLECTOR OUTPUTS

Description

This device contains four independent 2-input AND gates. It performs the Boolean functions $Y=A \cdot B$ or $Y=\overline{A+B}$ in positive logic. The open-collector outputs require pull up resistor to perform correctly. Open collector devices are often used to generate higher V_{OH} levels.

Function Table (each gate)

INPUTS		OUTPUT
A	B	Y
H	H	H
L	X	L
X	L	L

Pull-Up Resistor Equations

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

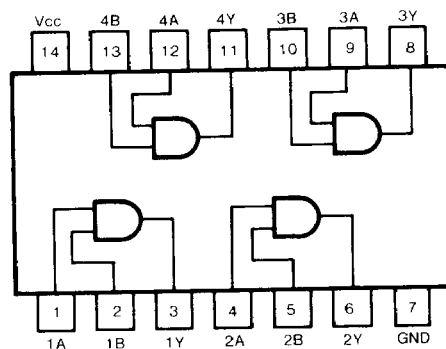
$$R_{MIN} = \frac{V_{CC}(\text{Max}) - V_{OL}}{I_{OL} - N_3(I_{IL})}$$

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

Absolute Maximum Ratings

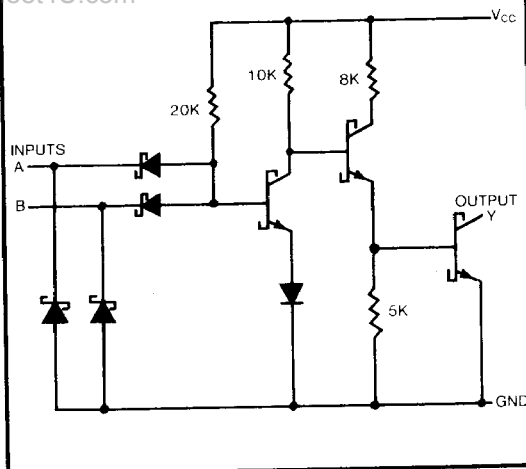
- Supply voltage, V_{CC} 7V
- Input voltage 7V
- output voltage 7V
- Operating free-air temperature range 54LS -55°C to 125°C
- 74LS 0°C to 70°C
- Storage temperature range -65°C to 150°C

Pin Configuration



Suffix-Blank: Plastic Dual In Line Package
 Suffix-J : Ceramic Dual In Line Package

Circuit Schematic (each gate)



Recommended Operating Conditions

SYMBOL	PARAMETER		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	54	4.5	5	5.5	V
		74	4.75	5	5.25	
V_{OH}	High-level output voltage	54,74			5.5	V
I_{OL}	Low-level output current	54			4	mA
		74			8	
T_A	Operating free-air temperature	54	-55		125	°C
		74	0		70	

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

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP (Note 1)	MAX	UNIT
V_{IH}	High-level input voltage			2		V
V_{IL}	Low-level input voltage		54		0.7	V
			74		0.8	
V_{IK}	Input clamp voltage	$V_{CC} = \text{Min.}, I_I = -18\text{mA}$			-1.5	V
I_{OH}	High-level output current	$V_{CC} = \text{Min.}, V_{IH} = \text{Min.}, V_{OH} = \text{Max.}$			100	μA
V_{OL}	Low-level output voltage	$V_{CC} = \text{Min.}, I_{OL} = 4\text{mA}, V_{IL} = \text{Max.}$	54,74	0.25	0.4	V
		$I_{OL} = 8\text{mA}$	74	0.35	0.5	
I_I	Input current at maximum input voltage	$V_{CC} = \text{Max.}, V_I = 7\text{V}$			0.1	mA
I_{IH}	High-level input current	$V_{CC} = \text{Max.}, V_I = 2.7\text{V}$			20	μA
I_{IL}	Low-level input current	$V_{CC} = \text{Max.}, V_I = 0.4\text{V}$			-0.4	mA
I_{CCH}	Supply current	Total with outputs high	$V_{CC} = \text{Max.}$	2.4	4.8	mA
I_{CCL}		Total with outputs low	$V_{CC} = \text{Max.}$	4.4	8.8	mA

Note 1: All typical values are at $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$.

Switching Characteristics, $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$

SYMBOL	PARAMETER	TEST CONDITION#	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	$C_L = 15\text{pF}, R_L = 2\text{k}\Omega$		20	35	ns
t_{PHL}	Propagation delay time, high-to-low-level output			17	35	ns

#For load circuit and voltage waveforms, see page 3-11.