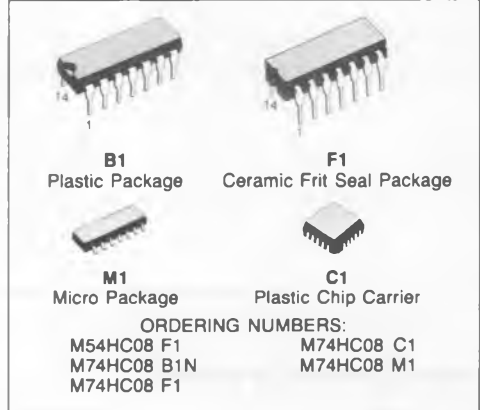


## QUAD 2-INPUT AND GATE

- **HIGH SPEED**  
 $t_{PD} = 7 \text{ ns (TYP.)}$  at  $V_{CC} = 5V$
- **LOW POWER DISSIPATION**  
 $I_{CC} = 1 \mu A \text{ (MAX.)}$  at  $T_A = 25^\circ C$
- **HIGH NOISE IMMUNITY**  
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**  
 10 LSTTL LOADS
- **SYMMETRICAL OUTPUT IMPEDANCE**  
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- **BALANCED PROPAGATION DELAYS**  
 $t_{PLH} = t_{PHL}$
- **WIDE OPERATING VOLTAGE RANGE**  
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- **PIN AND FUNCTION COMPATIBLE**  
 WITH 54/74LS08



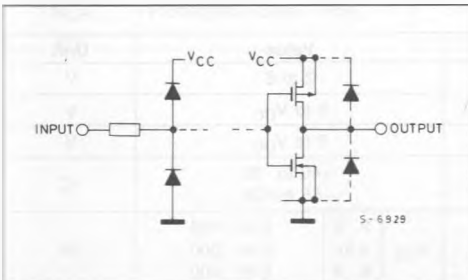
### DESCRIPTION

The M54/74HC08 is a high speed CMOS QUAD 2-INPUT AND GATE fabricated in silicon gate C<sup>2</sup>MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

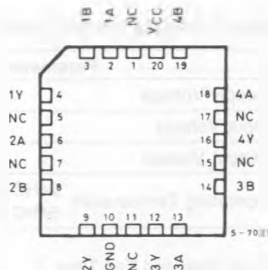
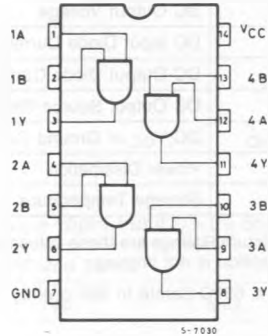
The internal circuit is composed of 2 stages including buffer output, which gives high noise immunity and stable output.

All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### INPUT AND OUTPUT EQUIVALENT CIRCUIT

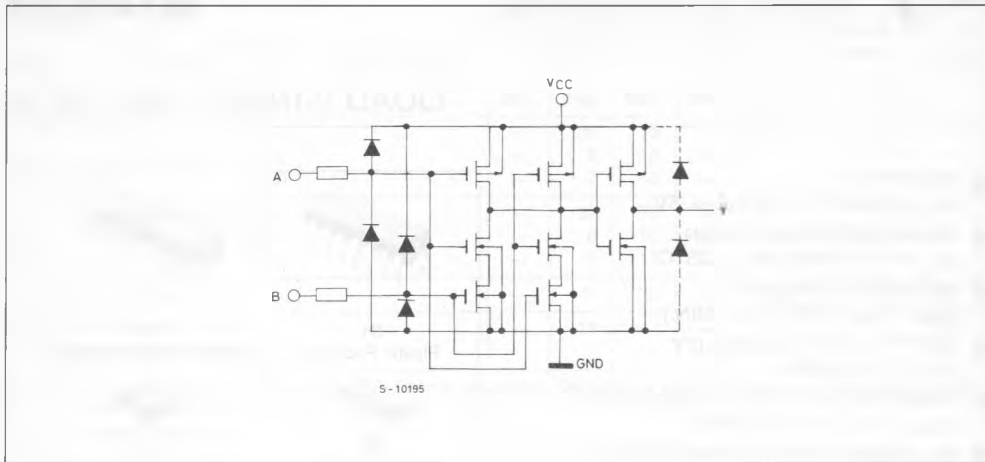


### PIN CONNECTIONS (top view)



NC =  
 No Internal  
 Connection

CIRCUIT SCHEMATIC (Per Gate)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	- 0.5 to 7	V
V <sub>I</sub>	DC Input Voltage	- 0.5 to V <sub>CC</sub> + 0.5	V
V <sub>O</sub>	DC Output Voltage	- 0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	± 20	mA
I <sub>OK</sub>	DC Output Diode Current	± 20	mA
I <sub>O</sub>	DC Output Source Sink Current Per Output Pin	± 25	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	± 50	mA
P <sub>D</sub>	Power Dissipation	500 (*)	mW
T <sub>stg</sub>	Storage Temperature	- 65 to 150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(\*) 500 mW: ≅ 65°C derate to 300 mW by 10 mW/°C: 65°C to 85°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit	
V <sub>CC</sub>	Supply Voltage	2 to 6	V	
V <sub>I</sub>	Input Voltage	0 to V <sub>CC</sub>	V	
V <sub>O</sub>	Output Voltage	0 to V <sub>CC</sub>	V	
T <sub>A</sub>	Operating Temperature	74HC Series 54HC Series	- 40 to 85 - 55 to 125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time	V <sub>CC</sub> { 2 V 4.5V 6 V	0 to 1000 0 to 500 0 to 400	ns

## DC SPECIFICATIONS

Symbol	Parameter	V <sub>CC</sub>	Test Condition		T <sub>A</sub> = 25°C 54HC and 74HC			- 40 to 85°C 74HC		- 55 to 125°C 54HC		Unit		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.			
V <sub>IH</sub>	High Level Input Voltage	2.0			1.5	—	—	1.5	—	1.5	—	V		
		4.5			3.15	—	—	3.15	—	3.15	—			
		6.0			4.2	—	—	4.2	—	4.2	—			
V <sub>IL</sub>	Low Level Input Voltage	2.0			—	—	0.5	—	0.5	—	0.5	V		
		4.5			—	—	1.35	—	1.35	—	1.35			
		6.0			—	—	1.8	—	1.8	—	1.8			
V <sub>OH</sub>	High Level Output Voltage	2.0	V <sub>I</sub>	I <sub>O</sub>	1.9	2.0	—	1.9	—	1.9	—	V		
		4.5			V <sub>IH</sub> or V <sub>IL</sub>	- 20 μA	4.4	4.5	—	4.4	—		4.4	—
		6.0					5.9	6.0	—	5.9	—		5.9	—
		4.5			- 4.0 mA - 5.2 mA	4.18	4.31	—	4.13	—	4.10		—	
6.0	5.68	5.8	—	5.63		—	5.60	—						
V <sub>OL</sub>	Low Level Output Voltage	2.0	V <sub>IH</sub> or V <sub>IL</sub>	20 μA	—	0.0	0.1	—	0.1	—	0.1	V		
		4.5			—	0.0	0.1	—	0.1	—	0.1			
		6.0			—	0.0	0.1	—	0.1	—	0.1			
		4.5			4.0 mA 5.2 mA	—	0.17	0.26	—	0.33	—		0.40	
6.0	—	0.18	0.26	—		0.33	—	0.40						
I <sub>I</sub>	Input Leakage Current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND		—	—	± 0.1	—	± 1.0	—	± 1.0	μA		
I <sub>CC</sub>	Quiescent Supply Current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND		—	—	1	—	10	—	20	μA		

AC ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C, C<sub>L</sub> = 15pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t <sub>TLH</sub> t <sub>THL</sub>	Output Transition Time		4	8	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time		9	15	ns

AC ELECTRICAL CHARACTERISTICS ( $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$ )

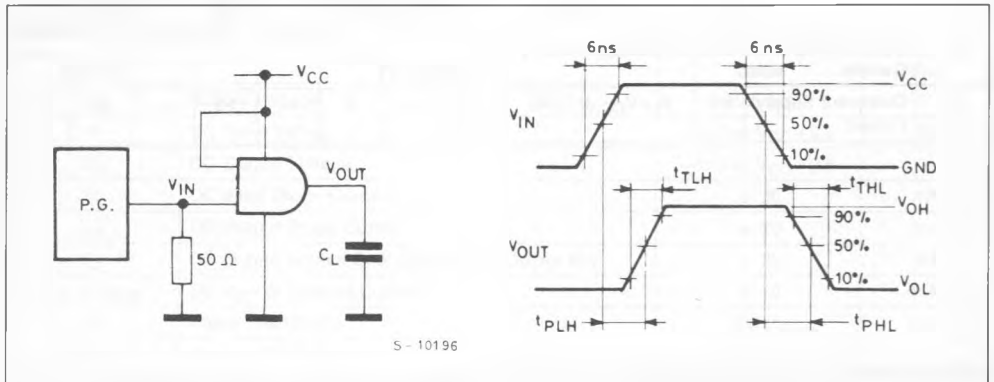
Symbol	Parameter	$V_{CC}$	Test Condition	$T_A = 25^\circ\text{C}$ 54HC and 74HC			$-40\text{ to }85^\circ\text{C}$ 74HC		$-55\text{ to }125^\circ\text{C}$ 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
$t_{TLH}$ $t_{THL}$	Output Transition Time	2.0		—	30	75	—	95		110	ns
		4.5		—	8	15	—	19		22	
		6.0		—	7	13	—	16		19	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	2.0		—	40	90	—	115		135	ns
		4.5		—	10	18	—	23		27	
		6.0		—	9	15	—	20		23	
$C_{IN}$	Input Capacitance			—	5	10	—	10		10	pF
$C_{PD} (*)$	Power Dissipation Capacitance			—	21	—	—	—			pF

Note (\*)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the following equation:

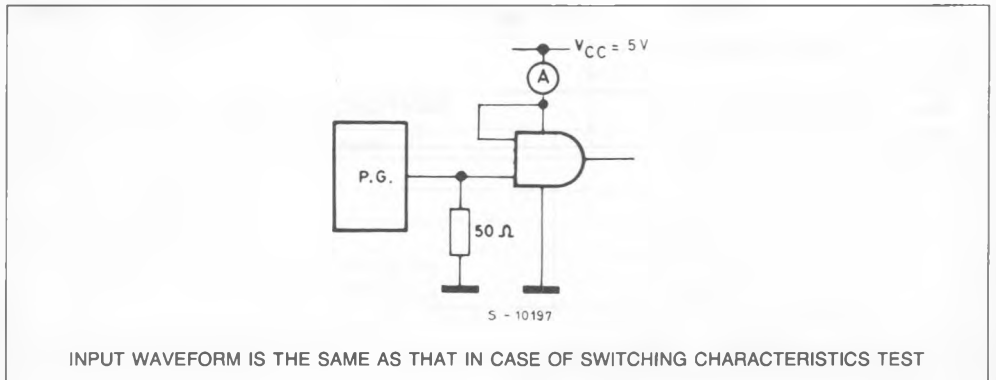
$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per Gate)}$$

SWITCHING CHARACTERISTICS TEST CIRCUIT



S - 10196

TEST CIRCUIT  $I_{CC}$  (Opr.)



S - 10197

INPUT WAVEFORM IS THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TEST