

DUAL 4-INPUT AND GATE

- **HIGH SPEED**
 $t_{PD} = 11 \text{ ns (TYP.) at } V_{CC} = 5\text{V}$
- **LOW POWER DISSIPATION**
 $I_{CC} = 1 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- **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**
 $V_{CC} \text{ (OPR)} = 2\text{V to } 6\text{V}$
- **PIN AND FUNCTION COMPATIBLE**
 WITH 54/74LS21

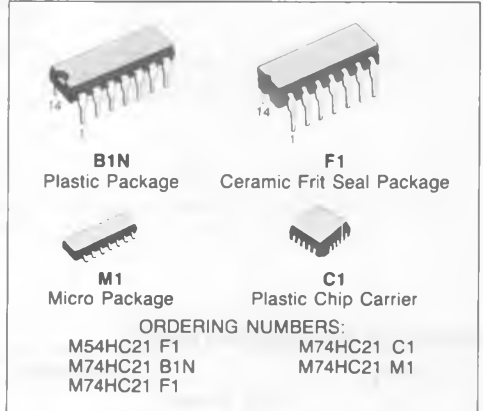
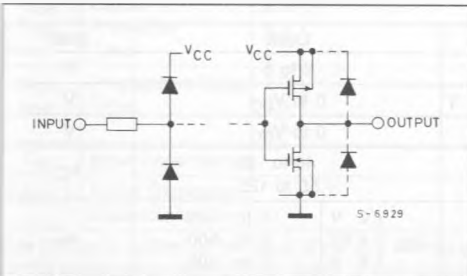
DESCRIPTION

The M54/74HC21 is a high speed CMOS DUAL 4-INPUT AND GATE fabricated in silicon gate C²MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

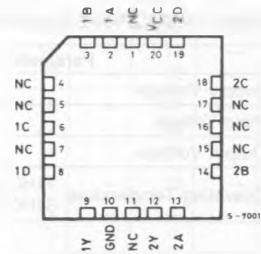
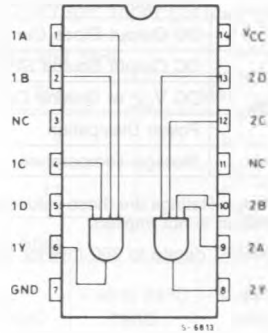
The internal circuit is composed of 3 stages including buffered output, which gives high noise immunity and a stable output.

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

INPUT AND OUTPUT EQUIVALENT CIRCUIT

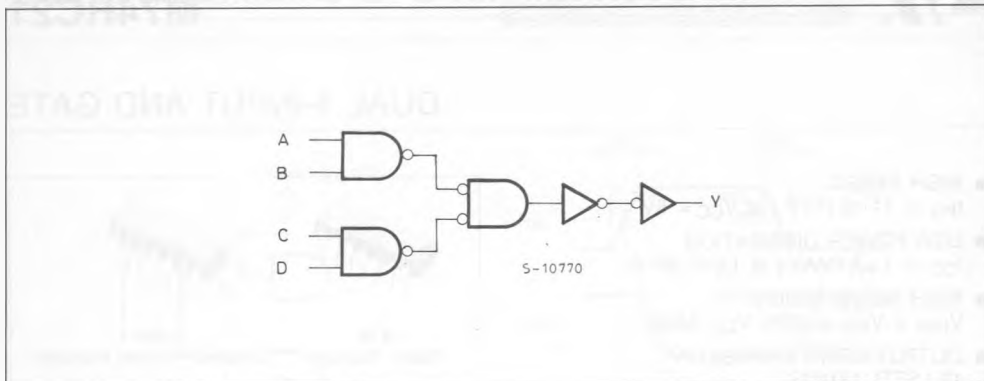


PIN CONNECTIONS (top view)



NC =
No Internal
Connection

LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------------------|--|-------------------------|-------------|
| V_{CC} | Supply Voltage | - 0.5 to 7 | V |
| V_I | DC Input Voltage | - 0.5 to $V_{CC} + 0.5$ | V |
| V_O | DC Output Voltage | - 0.5 to $V_{CC} + 0.5$ | V |
| I_{IK} | DC Input Diode Current | ± 20 | mA |
| I_{OK} | DC Output Diode Current | ± 20 | mA |
| I_O | DC Output Source Sink Current Per Output Pin | ± 25 | mA |
| I_{CC} or I_{GND} | DC V_{CC} or Ground Current | ± 50 | mA |
| P_D | Power Dissipation | 500 (*) | mW |
| T_{stg} | Storage Temperature | - 65 to 150 | $^{\circ}C$ |

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

(*) 500 mW: $\cong 65^{\circ}C$ derate to 300 mW by 10 mW/ $^{\circ}C$: $65^{\circ}C$ to $85^{\circ}C$

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Limit | Unit |
|------------|---|---|-------------|
| V_{CC} | Supply Voltage | 2 to 6 | V |
| V_I | Input Voltage | 0 to V_{CC} | V |
| V_O | Output Voltage | 0 to V_{CC} | V |
| T_A | Operating Temperature 74HC Series 54HC Series | - 40 to 85 - 55 to 125 | $^{\circ}C$ |
| t_r, t_f | Input Rise and Fall Time | $V_{CC} \begin{cases} 2 \text{ V} & 0 \text{ to } 1000 \\ 4.5 \text{ V} & 0 \text{ to } 500 \\ 6 \text{ V} & 0 \text{ to } 400 \end{cases}$ | ns |

DC SPECIFICATIONS

| Symbol | Parameter | V _{CC} | Test Condition | T _A = 25°C 54HC and 74HC | | | - 40 to 85°C 74HC | | - 55 to 125°C 54HC | | Unit | |
|-----------------|---------------------------|-------------------|--|--|-------------|--------------------|----------------------|--------------------|-----------------------|--------------------|------|----|
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | Max. | | |
| V _{IH} | High Level Input Voltage | 2.0 4.5 6.0 | | 1.5 3.15 4.2 | — — — | — — — | 1.5 3.15 4.2 | — — — | 1.5 3.15 4.2 | — — — | V | |
| V _{IL} | Low Level Input Voltage | 2.0 4.5 6.0 | | — — — | — — — | 0.5 1.35 1.8 | — — — | 0.5 1.35 1.8 | — — — | 0.5 1.35 1.8 | V | |
| V _{OH} | High Level Output Voltage | 2.0 | V _I | I _O - 20 μA | 1.9 | 2.0 | — | 1.9 | — | 1.9 | — | V |
| | | 4.5 | V _{IH} or V _{IL} | | 4.4 | 4.5 | — | 4.4 | — | 4.4 | — | |
| | | 6.0 | | | 5.9 | 6.0 | — | 5.9 | — | 5.9 | — | |
| V _{OL} | Low Level Output Voltage | 2.0 | V _{IH} or V _{IL} | 20 μA 4.0 mA 5.2 mA | — | 0 | 0.1 | — | 0.1 | — | 0.1 | V |
| | | 4.5 | | | — | 0 | 0.1 | — | 0.1 | — | 0.1 | |
| | | 6.0 | | | — | 0 | 0.1 | — | 0.1 | — | 0.1 | |
| I _I | Input Leakage Current | 6.0 | V _I = V _{CC} or GND | | — | — | ±0.1 | — | ±1 | — | ±1 | μA |
| | | 4.5 | | | | | | | | | | |
| | | 6.0 | | | | | | | | | | |
| I _{CC} | Quiescent Supply Current | 6.0 | V _I = V _{CC} or GND | | — | — | 1 | — | 10 | — | 20 | μA |

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 5V, T_A = 25°C, C_L = 15pF, Input t_r = t_f = 6ns)

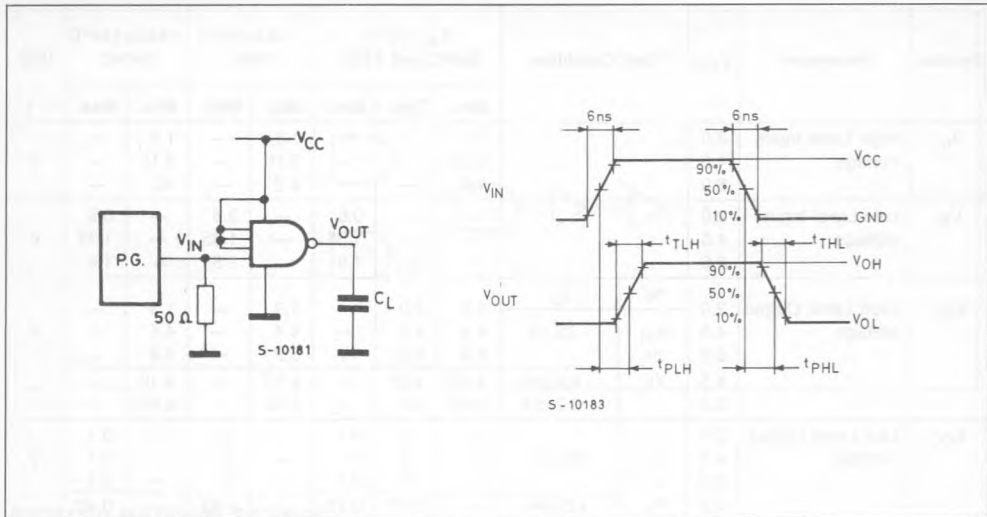
| Symbol | Parameter | 54HC and 74HC | | | Unit |
|--------------------------------------|------------------------|---------------|------|------|------|
| | | Min. | Typ. | Max. | |
| t _{TLH} t _{THL} | Output Transition Time | | 4 | 8 | ns |
| t _{PLH} t _{PHL} | Propagation Delay Time | | 11 | 18 | ns |

AC ELECTRICAL CHARACTERISTICS (C_L = 50pF, Input t_r = t_f = 6ns)

| Symbol | Parameter | V _{CC} | Test Condition | T _A = 25°C 54HC and 74HC | | | - 40 to 85°C 74HC | | - 55 to 125°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 | | — | 52 | 110 | — | 140 | — | 165 | ns |
| | | 4.5 | | — | 14 | 22 | — | 28 | — | 33 | |
| | | 6.0 | | — | 12 | 19 | — | 24 | — | 28 | |
| C _{IN} | Input Capacitance | | | — | 5 | 10 | — | 10 | — | 10 | pF |
| C _{PD} (*) | Power Dissipation Capacitance | | | — | 29 | — | — | — | — | — | 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. (Refer to Test Circuit)

SWITCHING CHARACTERISTICS TEST CIRCUIT



TEST CIRCUIT I_{CC} (Opr.)

