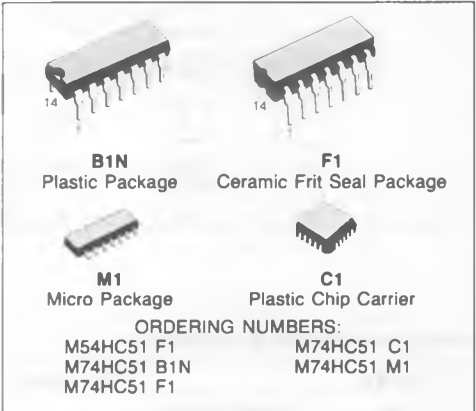
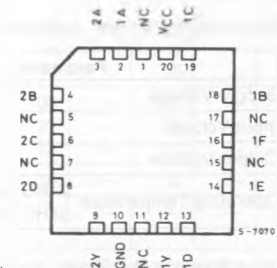
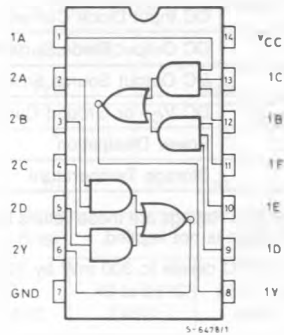


DUAL 2 WIDE-2 INPUT AND/OR INVERT GATE

- HIGH SPEED
 $t_{PD} = 10 \text{ ns (TYP.) at } V_{CC} = 5 \text{ V}$
- 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 54/74LS51



PIN CONNECTIONS (top view)

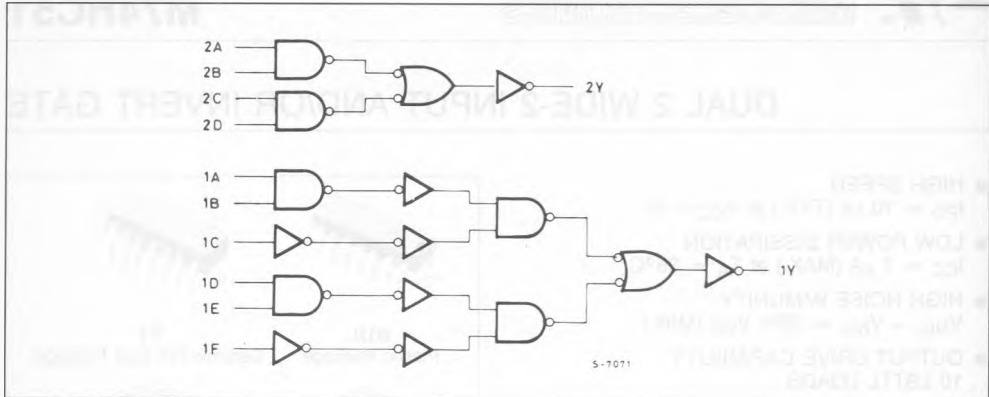


NC =
 No Internal
 Connection

DESCRIPTION

The M54/74HC51 is a high speed CMOS DUAL 2 WIDE-2 INPUT AND/OR INVERT GATE fabricated in silicon gate CMOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption. It contains a 2-WIDE 2-INPUT AND-OR-INVERT GATE and a 2-WIDE 3-INPUT AND-OR-INVERT GATE. The internal circuit is composed of 3 stages (2-INPUT) or 5 stages (3-INPUT) 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.

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 | Value | 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 | $^{\circ}C$ | |
| | | - 40 to 85 - 55 to 125 | | |
| t_r, t_f | Input Rise and Fall Time | V_{CC} { 2 V 4.5V 6 V | 0 to 1000 0 to 500 0 to 400 | 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 | | | 1.5 | — | — | 1.5 | — | 1.5 | — | V | | |
| | | 4.5 | | | 3.15 | — | — | 3.15 | — | 3.15 | — | | | |
| | | 6.0 | | | 4.2 | — | — | 4.2 | — | 4.2 | — | | | |
| V _{IL} | 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 _{OH} | High Level Output Voltage | 2.0 | | V _I I _O | 1.9 | 2.0 | — | 1.9 | — | 1.9 | — | V | | |
| | | 4.5 | | | V _{IH} | - 20 μA | 4.4 | 4.5 | — | 4.4 | — | | 4.4 | — |
| | | 6.0 | | | or | | 5.9 | 6.0 | — | 5.9 | — | | 5.9 | — |
| | | 4.5 | | | V _{IL} | - 4.0 mA | 4.18 | 4.31 | — | 4.13 | — | | 4.10 | — |
| 6.0 | | - 5.2 mA | 5.68 | 5.8 | — | 5.63 | — | 5.60 | — | | | | | |
| V _{OL} | Low Level Output Voltage | 2.0 | | V _{IH} or V _{IL} | — | 0 | 0.1 | — | 0.1 | — | 0.1 | V | | |
| | | 4.5 | | | 20 μA | — | 0 | 0.1 | — | 0.1 | — | | 0.1 | |
| | | 6.0 | | | | — | 0 | 0.1 | — | 0.1 | — | | 0.1 | |
| | | 4.5 | | | 4.0 mA | — | 0.17 | 0.26 | — | 0.33 | — | | 0.40 | |
| 6.0 | 5.2 mA | — | 0.18 | 0.26 | — | 0.33 | — | 0.40 | | | | | | |
| I _I | Input Leakage Current | 6.0 | | V _I = V _{CC} or GND | — | — | ± 0.1 | — | ± 1 | — | ± 1 | μA | | |
| 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)

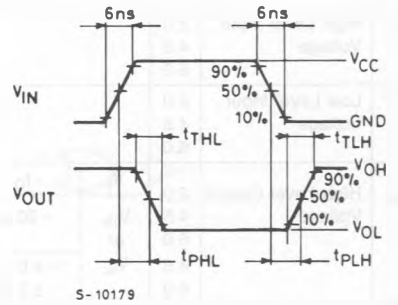
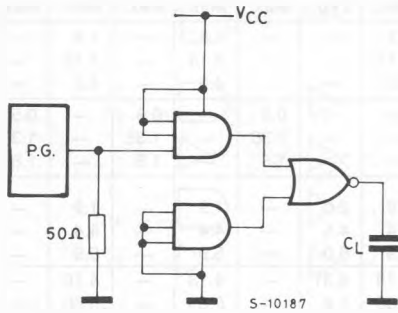
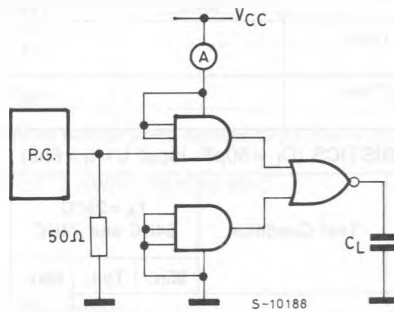
| Symbol | Parameter | 54HC and 74HC | | | Unit |
|--------------------------------------|------------------------|---------------|------|------|------|
| | | Min. | Typ. | Max. | |
| t _{TLH} t _{THL} | Output Transition Time | | 4 | 8 | ns |
| t _{PLH} t _{PHL} | Propagation Delay Time | | 10 | 18 | 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 | 105 | — | 130 | — | 155 | ns |
| | | 4.5 | | | — | 13 | 21 | — | 26 | — | 33 | |
| | | 6.0 | | | — | 11 | 18 | — | 22 | — | 28 | |
| C _{IN} | Input Capacitance | | | | — | 5 | 10 | — | 10 | — | 10 | pF |
| C _{PD} (*) | Power Dissipation Capacitance | | | | — | 33 | — | — | — | — | — | 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.)

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