# TC74HC86P/F

TC74HC86P/F QUAD EXCLUSIVE OR GATE

The TC74HC86 is a high speed CMOS QUAD EXCLUSIVE OR GATE fabricated with silicon gate $C^2MOS$ technology.

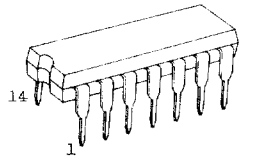
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

Input and output buffer are installed, which enables high noise immunity and stable output.

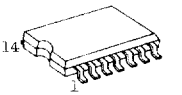
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed.....$t_{pd}$=13ns(Typ.) at $V_{CC}$=5V
- Low Power Dissipation.....$I_{CC}$=1$\mu$A(Max.) at Ta=25°C
- High Noise Immunity.....$V_{NIH}$=$V_{NIL}$=28% $V_{CC}$(Min.)
- Output Drive Capability.....10 LSTTL Loads
- Symmetrical Output Impedance..$|I_{OH}|$=$I_{OL}$=4mA(Min.)
- Balanced Propagation Delays...$t_{pLH} \fallingdotseq t_{pHL}$
- Wide Operating Voltage Range..$V_{CC(opr)}$=2V ~ 6V
- Pin and Function Compatible with 74LS86

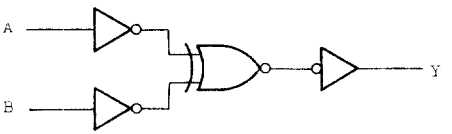



DIP14(3D14A-P)

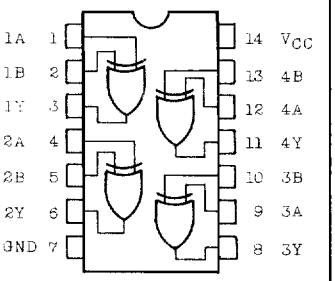



MFP14(F14GB-P)

LOGIC DIAGRAM (per Gate)




PIN ASSIGNMENT




(Top View)

## ABSOLUTE MAXIMUM RATINGS

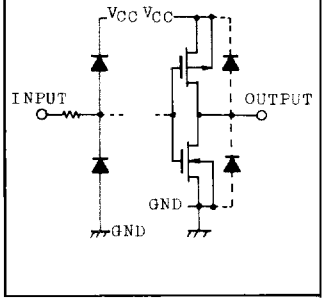
| PARAMETER | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Supply Voltage Range | $V_{CC}$ | -0.5 ∿ 7 | V |
| DC Input Voltage | $V_{IN}$ | -0.5 ∿ $V_{CC}$+0.5 | V |
| DC Output Voltage | $V_{OUT}$ | -0.5 ∿ $V_{CC}$+0.5 | V |
| Input Diode Current | $I_{IK}$ | ±20 | mA |
| Output Diode Current | $I_{OK}$ | ±20 | mA |
| DC Output Current | $I_{OUT}$ | ±25 | mA |
| DC $V_{CC}$/Ground Current | $I_{CC}$ | ±50 | mA |
| Power Dissipation | $P_D$ | 500(DIP)*/180(MFP) | mW |
| Storage Temperature | $T_{stg}$ | -65 ∿ 150 | °C |
| Lead Temperature 10sec | $T_L$ | 300 | °C |

* 500mW in the range of Ta=-40°C ~ 65°C. and from Ta=65°C up to 85°C derating factor of -10mW/°C shall be applied until 300mW.

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | LIMIT | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 2 ∿ 6 | V |
| Input Voltage | $V_{IN}$ | 0 ∿ $V_{CC}$ | V |
| Output Voltage | $V_{OUT}$ | 0 ∿ $V_{CC}$ | V |
| Operating Temperature | $T_{opr}$ | -40 ∿ 85 | °C |
| Input Rise and Fall Time | $t_r$, $t_f$ | 0 ∿ 1000($V_{CC}$=2.0V)<br>0 ∿ 500($V_{CC}$=4.5V)<br>0 ∿ 400($V_{CC}$=6.0V) | ns |

## INPUT and OUTPUT EQUIVALENT CIRCUIT




## DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | | | Ta=25°C | | | Ta=-40~85°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $V_{CC}$ | MIN. | TYP. | MAX. | MIN. | MAX. | |
| High-Level Input Voltage | $V_{IH}$ | | | 2.0 | 1.5 | - | - | 1.5 | - | V |
| | | | | 4.5 | 3.15 | - | - | 3.15 | - | |
| | | | | 6.0 | 4.2 | - | - | 4.2 | - | |
| Low-Level Input Voltage | $V_{IL}$ | | | 2.0 | - | - | 0.5 | - | 0.5 | V |
| | | | | 4.5 | - | - | 1.35 | - | 1.35 | |
| | | | | 6.0 | - | - | 1.8 | - | 1.8 | |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN}$= $V_{IH}$ or $V_{IL}$ | $I_{OH}$=-20μA | 2.0 | 1.9 | 2.0 | - | 1.9 | - | V |
| | | | | 4.5 | 4.4 | 4.5 | - | 4.4 | - | |
| | | | | 6.0 | 5.9 | 6.0 | - | 5.9 | - | |
| | | | $I_{OH}$=-4mA | 4.5 | 4.18 | 4.31 | - | 4.13 | - | |
| | | | $I_{OH}$=-5.2mA | 6.0 | 5.68 | 5.80 | - | 5.63 | - | |

DC ELECTRICAL CHARACTERISTICS

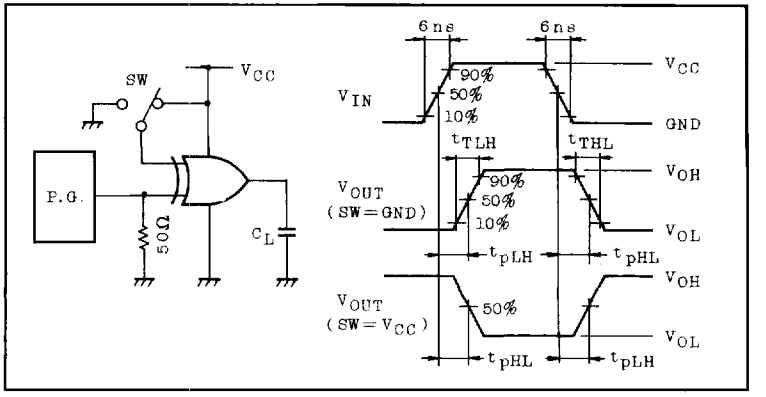
| PARAMETER | SYMBOL | TEST CONDITION | | $V_{CC}$ | Ta=25°C MIN. | Ta=25°C TYP. | Ta=25°C MAX. | Ta=-40~85°C MIN. | Ta=-40~85°C MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| Low-Level Output Voltage | $V_{OL}$ | $V_{IN}$= $V_{IH}$ or $V_{IL}$ | $I_{OL}$=20μA | 2.0 | - | 0.0 | 0.1 | - | 0.1 | V |
| | | | | 4.5 | - | 0.0 | 0.1 | - | 0.1 | |
| | | | | 6.0 | - | 0.0 | 0.1 | - | 0.1 | |
| | | | $I_{OL}$=4mA | 4.5 | - | 0.17 | 0.26 | - | 0.33 | |
| | | | $I_{OL}$=5.2mA | 6.0 | - | 0.18 | 0.26 | - | 0.33 | |
| Input Leakage Current | $I_{IN}$ | $V_{IN}$=$V_{CC}$ or GND | | 6.0 | - | - | ±0.1 | - | ±1.0 | μA |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN}$=$V_{CC}$ or GND | | 6.0 | - | - | 1.0 | - | 10.0 | |

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

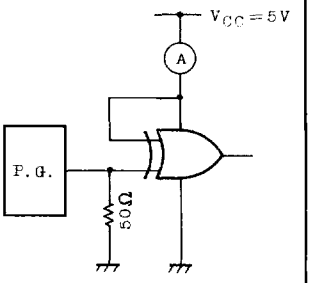
| PARAMETER | SYMBOL | TEST CONDITION | $V_{CC}$ | Ta=25°C MIN. | Ta=25°C TYP. | Ta=25°C MAX. | Ta=-40~85°C MIN. | Ta=-40~85°C MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Output Transition Time | $t_{TLH}$ $t_{THL}$ | | 2.0 | - | 30 | 75 | - | 95 | ns |
| | | | 4.5 | - | 8 | 15 | - | 19 | |
| | | | 6.0 | - | 7 | 13 | - | 16 | |
| Propagation Delay Time | $t_{pLH}$ $t_{pHL}$ | | 2.0 | - | 64 | 120 | - | 150 | ns |
| | | | 4.5 | - | 16 | 24 | - | 30 | |
| | | | 6.0 | - | 14 | 20 | - | 26 | |
| Input Capacitance | $C_{IN}$ | | | - | 5 | 10 | - | 10 | pF |
| Power Dissipation Capacitance | $C_{PD}$(1) | | | - | 34 | - | - | - | |

Note (1) $C_{PD}$ is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test circuit).
Average operating current can be obtained by the equation hereunder.
$I_{CC(opr)}=C_{PD}\cdot V_{CC}\cdot f_{IN}+I_{CC}/4$ (per Gate)

SWITCHING CHARACTERISTICS TEST CIRCUIT




$I_{CC}$(opr) TEST CIRCUIT




Input waveform is the same as that in case of switching characteristics test.