X320994

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Department of Electrical Engineering

Experiment No._____Specifications of Certain Digital Devices

INTRODUCTION

All devices are designed to operate within certain parameter limits and specifications whether they be waterhoses, airplanes, logic gates, etc. A user of such "devices" will be aware of these limits and specifications either by choice (reading the instructions first) or by experience (which can be most frustrating!). The purpose of this experiment is to familiarize the student with the basic parameters of a commonly used digital logic family – 7400 TTL.

PRELIMINARY

P-1. Obtain the manufacturer's specifications for a 7400, 7404, and 7413 TTL devices.

7400 – Quad Two-input NAND Gate:

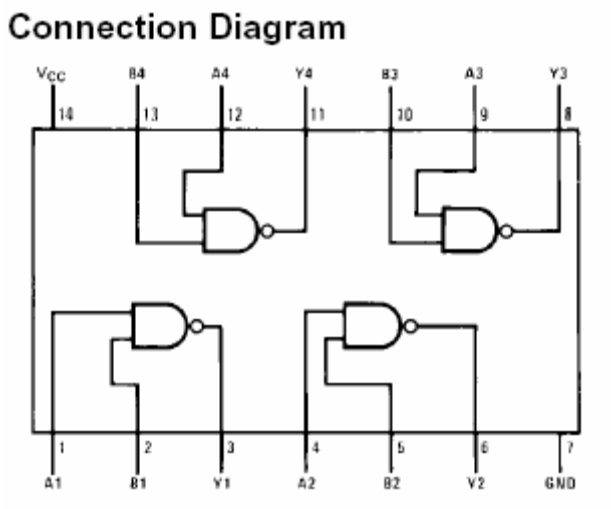
VCCmax = 5.25V (5V normal) TA (Range) = 0 – 70° C (25° normal)

Fanout: Input high/low – 40μA/ –1.6mA
Output high/low – –400μA/ 16mA

Propogation delay : tpLH = 22ns max
tpHL = 15ns max

Power supply current: VIN Grounded = 8mA
VIN Open = 22mA

PINOUT SKETCH FOR 7400 :



7404 – Hex Inverter:

VCCmax = 5.25V (5V normal) TA (Range) = 0 – 70° C (25° normal)

Fanout: Input high/low 40μA/ –1.6mA
Output high/low –400μA/ 16mA

Propogation delay :

tpLH = 22ns max

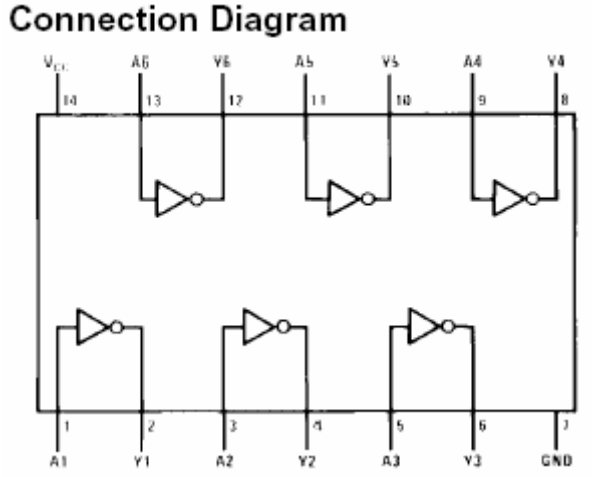
tpHL = 15ns max

Power supply current:

VIN Grounded = 12mA

VIN Open = 33mA

Pinout sketch:



7413 – Dual 4-Input Schmitt Trigger:

VCCmax = 5.25V (5V normal) TA (Range) = 0 – 70° C (25° normal)

Fanout: Input high/low 40μA/ –1.6mA
Output high/low –800μA/ 16mA

Propogation delay :

tpLH = 27ns max

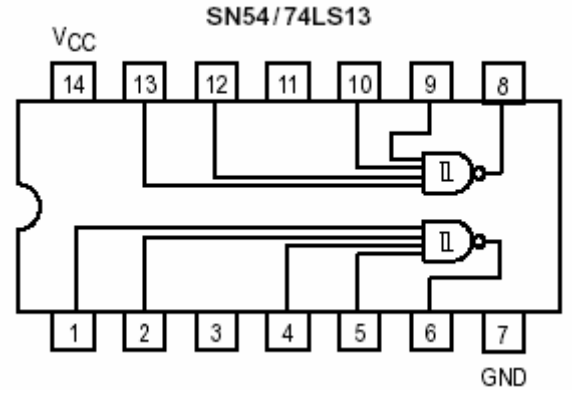
tpHL = 22ns max

Power supply current:

VIN Grounded = 23mA

VIN Open = 32mA

Pinout sketch:



PARAMETER	Min	Max	Units	Conditions
Positive-going Threshold Voltage				
Negative-going Threshold Voltage				
Hysteresis Voltage				
Input Current at Positive-going Threshold				
Input Current at Negative-going Threshold				

(INSTRUCTOR'S SIGNATURE_____DATE_____)

PROCEDURE

F-1. Under conditions of VCC = 5 volts and all outputs open, measure the current into the VCC terminal of a 7400, 7404, and 7413 TTL device for the conditions below.

a. All inputs are grounded
b. All inputs are at VCC

F-2. Cascade a chain of 7404 inverters to form a free-running oscillator (there must be an odd number). Measure the time period and calculate the average time for a 0 -> 1 -> 0 transition. Assuming the 0 -> 1 transition takes fifty percent longer than a 1 -> 0 transition, calculate both transition times.

F-3. With outputs unloaded, supply a slowly rising triangular wave (+5 -0 Volts, 0.1 Hertz) to one gate of a 7404 and to one gate of a 7413 and sketch Vout vs. Vin.

F-4. Apply 2.4 volts to the input of one of the above devices (minimum for a logic "1") and determine the current the output can "sink" before the output voltage becomes greater that 0.8 volts.

F-5. For the same device in F-4 above, apply 0.8 volts (maximum for a logic "0") and determine the current the output can "source" before the output voltage becomes less than 2.4 volts.

F-6. For the same device in F-4 above, determine how much current the input can "source" when it is at approximately 0.8 volts.

F-7. For the same device in F-4 above, determine how much current the input can "source" when it is at approximately 2.4 volts.

REPORT

R-1. Compare your data from F-1 and F-2 with the manufacturer's specifications.

R-2. Compare and discuss the results of F-3 as to the difference between the 7404 and the 7413.

R-3. Calculate the “fan-out” of the device tested in F-4 through F-7 above.