

# Assignment 1 - VHDL Synthesis

*In this assignment you'll write a VHDL circuit description and synthesize it into a schematic.*

## Question 1

Attached is the first page of the data sheet for a 74LS151 8-to-1 multiplexer IC.

Write a VHDL entity statement for this device. Use the same signal names (e.g. B, W, etc) as used in the data sheet. Use the `bit` type for the select and strobe inputs and the `bit_vector` type with indices 0 to 7 for the 'D' inputs. Ignore Vcc and ground inputs. Use your initials plus the digits 151 as the entity name (e.g. if your name is Doug Mah, your entity statement would begin "entity DM151 is ...").

Write an architecture that models the behaviour of the device. You can assume positive true logic (0 = L, 1 = H). Don't worry if your description ends up looking rather long-winded.

Include comments giving at least the purpose of the circuit ("8 to 1 multiplexer"), your name, the course and the date.

Look up the instructions on using Design Compiler available on the course Web page. Synthesize your design using Synopsys Design Compiler and plot a schematic of the result. Since this is a combinational circuit your design should not have any flip-flops.

Hand in a listing of your VHDL code and the schematic generated.

# 54LS151/DM54LS151/DM74LS151 Data Selector/Multiplexer

## General Description

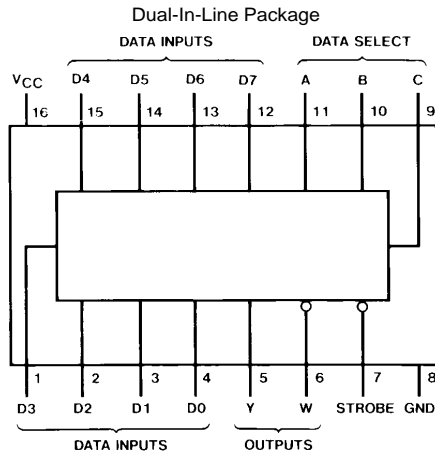
This data selector/multiplexer contains full on-chip decoding to select the desired data source. The 'LS151 selects one-of-eight data sources. The 'LS151 has a strobe input which must be at a low logic level to enable these devices. A high level at the strobe forces the W output high, and the Y output low.

The 'LS151 features complementary W and Y outputs.

## Features

- ✓ Select one-of-eight data lines
- ✓ Performs parallel-to-serial conversion
- ✓ Permits multiplexing from N lines to one line
- ✓ Also for use as Boolean function generator
- ✓ Typical average propagation delay time data input to W output 12.5 ns
- ✓ Typical power dissipation 30 mW
- ✓ Alternate Military/Aerospace device (54LS151) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

## Connection Diagram



TL/F/6392 -1

Order Number 54LS151DMQB,54LS151FMQB,54LS151LMQB,  
DM54LS151J,DM54LS151W,DM74LS151Mor DM74LS151N  
See NS Package Number E20A, J16A, M16A, N16E or W16A

## Truth Table

Inputs				Outputs	
Select			Strobe S	YW	
C	B	A		Y	W
X	X	X	H	L	H
L	L	L	L	D0	$\overline{D0}$
L	L	H	L	D1	$\overline{D1}$
L	H	L	L	D2	$\overline{D2}$
L	H	H	L	D3	$\overline{D3}$
H	L	L	L	D4	$\overline{D4}$
H	L	H	L	D5	$\overline{D5}$
H	H	L	L	D6	$\overline{D6}$
H	H	H	L	D7	$\overline{D7}$

H = High Level, L = Low Level, X = Don't Care  
D0, D1...D7 = the level of the respective D input