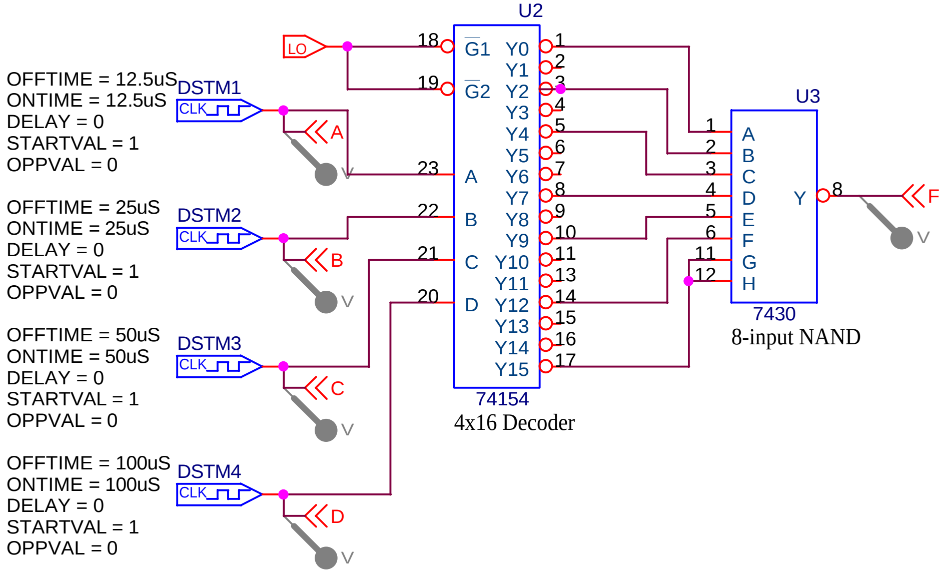
EGR 270
Fundamentals of Computer Engineering
File:4x16Decoder.opj

Implementing a Sum of Products expression using a 4 x 16 Decoder

Purpose: Use a 4 x 16 decoder to implement the function f(D,C,B,A) = Sum(0,2,4,7,9,12,15)

Note that the 16 output lines are active-LOW. Since a NAND gate is equivalent to a negative-input OR, the output of the NAND produces a Sum of the (essentially active-HIGH) decoder outputs.

Analysis: Graphing all 16 possible inputs will require a TRANSIENT analysis with a final time of 16(12.5us) = 200 us



Notes:

1) The 74154 and 7430 devices are found in the EVAL library.

2) The inputs to the circuit are generated using part DigClock from the SOURCE library. The frequency of each clock (or the length of the ONTIME and OFFTIME) are unimportant. The important point is that the period of B is twice the period of A, the period of C is twice the period of B, etc., in order to generate the 16 input combinations in counting order.

3) The LO input to the active-LOW enables on the 74154 are generated using the part $D_LO from the SOURCE library. The easiest way to insert this part is to click on the GND toolbar.

4) OFFPAGE symbols (using the <<C toolbar) were used to label the inputs, A, B, C, and D, and the output, F.

5) The binary count of the input was displayed on the graph using a BUS. This was done after simulation by selecting ADD - TRACE and then typing in {D,C,B,A};COUNT;D. This means that the signals D,C,B,A are used to form the binary count, the bus was named COUNT, and the count was displayed in Decimal format (D). Use B for binary format, O for octal, and H or X for hexadecimal.

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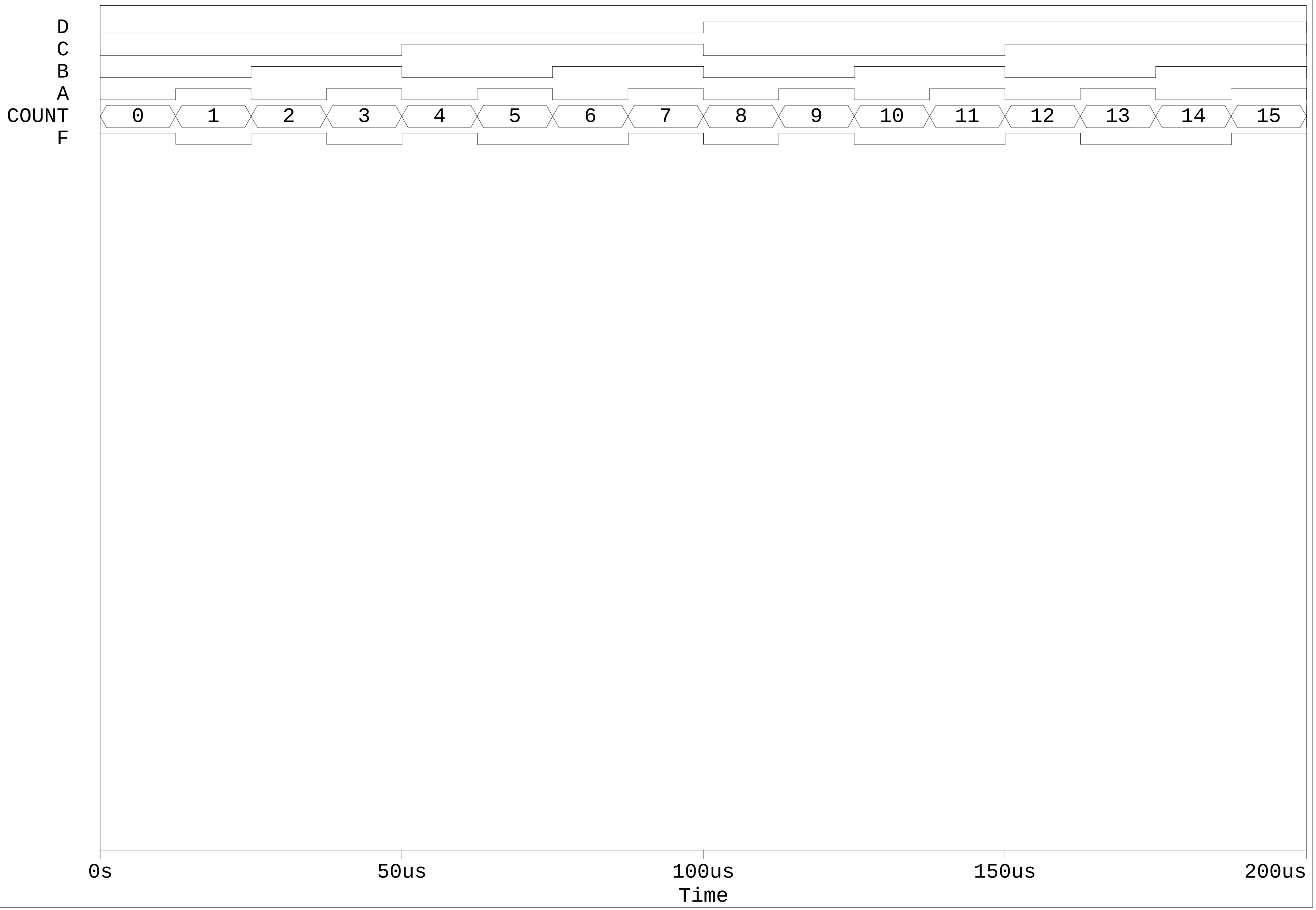
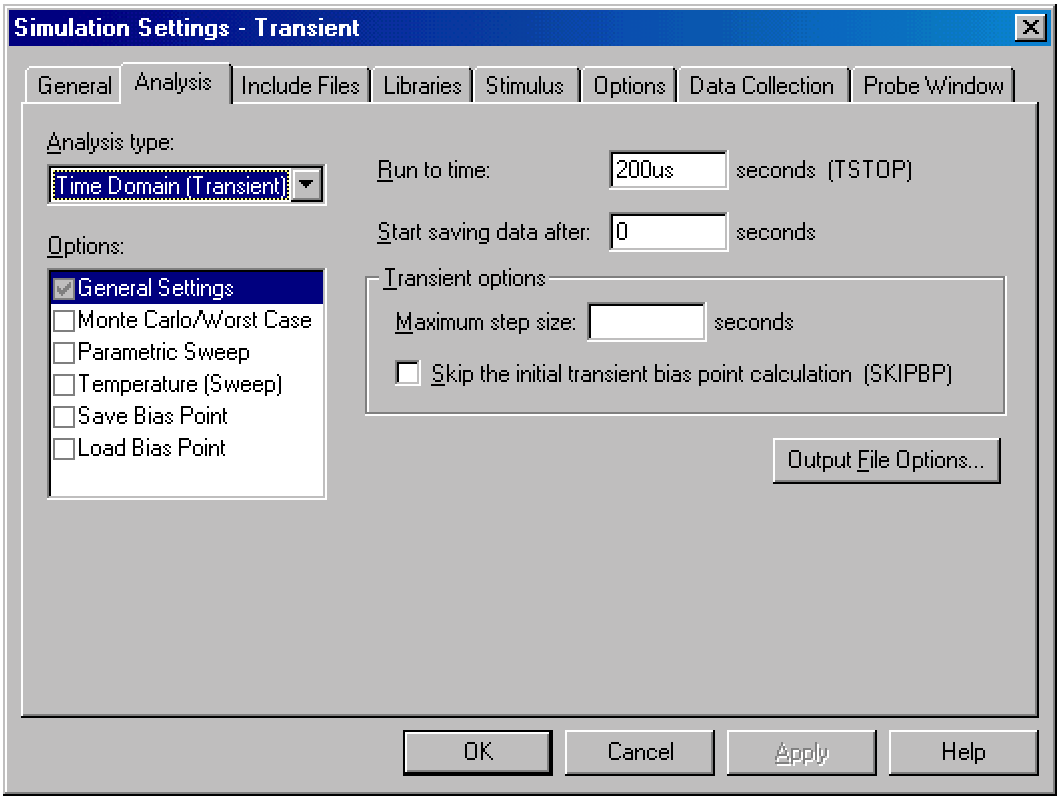
Date: Thursday, February 17 | Sheet 1 of 1

(A) F(D,C,B,A) = Sum(0,2,4,7,9,12,15) implemented using a 4 x 16 decoder





Simulation Settings - Transient

Analysis type: Time Domain (Transient)

Options:

- ☑ General Settings
- □ Monte Carlo/Worst Case
- □ Parametric Sweep
- □ Temperature (Sweep)
- □ Save Bias Point
- □ Load Bias Point

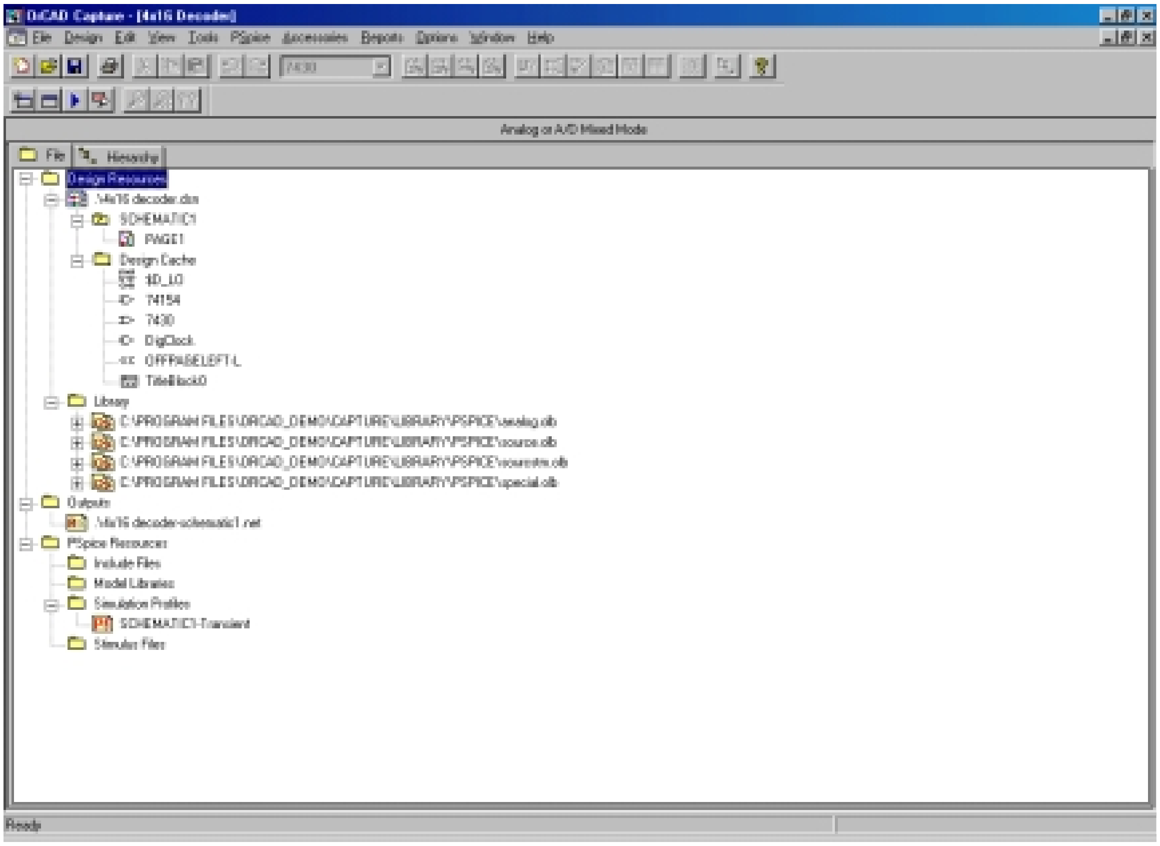
Run to time: 200us seconds (TSTOP)

Start saving data after: 0 seconds

Transient options

Maximum step size: seconds

□ Skip the initial transient bias point calculation (SKIPBP)



OrCAD Capture - [4x16 Decoder]

```
Design Resources
  .\4x16 decoder.dsn
    SCHEMATIC1
      PAGE1
    Design Cache
      $D_LO
      74154
      7430
      DigClock
      OFFPAGELEFT-L
      TitleBlock0
  Library
    C:\PROGRAM FILES\ORCAD_DEMO\CAPTURE\LIBRARY\PSPICE\analog.olb
    C:\PROGRAM FILES\ORCAD_DEMO\CAPTURE\LIBRARY\PSPICE\source.olb
    C:\PROGRAM FILES\ORCAD_DEMO\CAPTURE\LIBRARY\PSPICE\sourcstm.olb
    C:\PROGRAM FILES\ORCAD_DEMO\CAPTURE\LIBRARY\PSPICE\special.olb
Outputs
  .\4x16 decoder-schematic1.net
PSpice Resources
  Include Files
  Model Libraries
  Simulation Profiles
    SCHEMATIC1-Transient
  Stimulus Files
```