

Remote Supplement for Digital Lab

Handy things found in multisim:

Probe_red: a nice indicator you can stick on any wire to show its logic state

Interactive_digital_constant: a handy source when you want to play with an input.

Logic analyzer: displays plot of logic state for up to 16 inputs vs time.

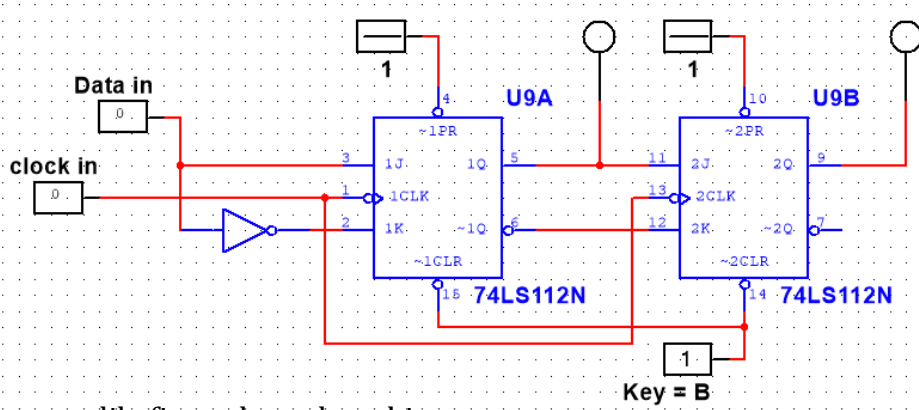
Word generator: can generate arbitrary sequences of up to 36-bit words.

Has a learning curve. Probably all you need now is the Digital_clock source.

1. Easy to do with interactive constants on all the inputs and indicators on the outputs. don't forget to turn the simulation switch on to try it (and off to change the circuit.)

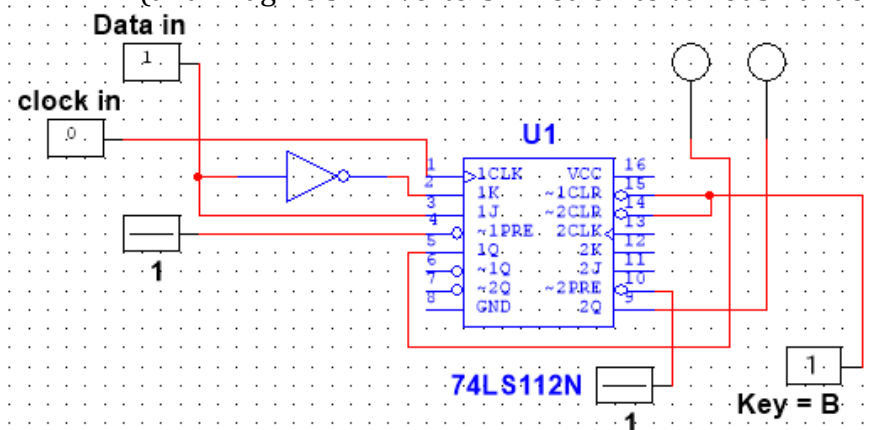
Under "TTL", use the 74LS series components, not 74LS_IC. the difference is the 74LS representation of the IC breaks up multi-component ICs (like the 74LS04, that has six inverters in one package) into separate instances. It is a very standard practice when drawing schematics that you put each instance wherever it makes sense in the signal flow in the schematic.

I think most people would agree that this:



is more readily figured out than this:

(and imagine six inverters wired off to various random locations)



The reference designations (U9A, etc.) keep track of the physical location of the instance. You don't really need the As and Bs, since the pin numbers tell you which unit it is.

2. You can show the clock input and four outputs on a logic analyzer.

3. You should look at a couple of the outputs on an oscilloscope. If you were doing this for real, you'd see very non-square transitions that never get near zero or five volts, but the digital simulation in Multisim is an add-on that is not nearly as realistic as their analog simulation.

4. For the monostable, you should actually wire up the circuit and test it. Multisim seems not to have the 74LS221, so use the 74123N (from "Mixed") instead. You'll need to search for a data sheet for this (Texas Instruments has one) and compare it with the 221. It has identical pinouts and similar operation. One difference you will notice is that the pulse width dependence on RC is different, so you'll need to **recalculate** the values you got for the prelab. The other difference is that the 123 is "retriggerable", while the 221 is not. **Explain the difference.**

5. Use the 74HC164N_4V from the CMOS menu. the _xV is just the supply voltage used to operate the chip (you noticed you didn't have to connect a power supply to your digital components — it just assumes one connected to the proper pins. This is always 5.0 V for TTL, but the CMOS will run off anything from 0–6 volts. You can check it out any way you like. If you connect a logic analyzer to the outputs, and use a digital clock set to ~100 Hz for the clock, the simulation will actually run at about 1 Hz, which is a nice rate for manually inputting the data and watching the pattern you get. Be sure to hook up the clock to the logic analyzer's external clock input, and to put your input data line onto one of the analyzer inputs as well.

6. They don't have the 74LS283. You can use the CMOS version: 74HC283N_4V, which has the same pinout. You can use one of the Dig_Hex_Displays under "indicators" to display the 4-bit inputs and outputs in a nice readable form. Throw in a Probe lamp for the carry out.

7. I couldn't find a magnitude comparator, so you can skip this part. (Extra credit if you can.)