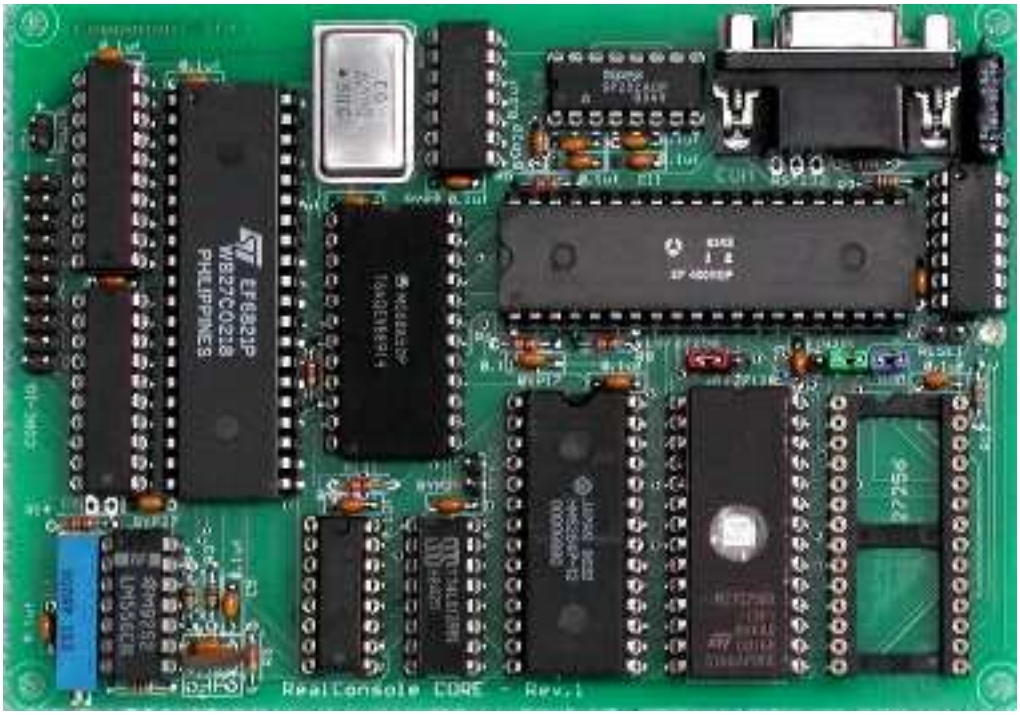
Building the "FlipChip Tester"

1. Assembly of the Core Board

You will need a fine low-wattage soldering iron and a Voltmeter.
Take your time to solder the components on the Core Board. Better to spend a few more minutes now working accurately, rather than searching for that little solder excess that causes a short circuit.
Soldering the components in order from smallest height to higher has the advantage that the board lays stable on your desk while soldering. Therefore the following soldering order is proposed.

1. Solder all resistors except the trim pot.
   Make sure that the resistors with the different values are in their correct position.
   Check the electrical diagram and follow the traces on the Core Board if you have any doubt.
   Use the Ohm range of the Voltmeter if you are not sure interpreting the colour codes.
2. Solder the IC sockets that are supplied in the kit. ***Notice the orientation of the sockets.***
   If you prefer to use sockets for all ICs you can solder these sockets too, but *do not solder* the two sockets for the 74LS245's yet. It is a little easier to solder the CORE_IO header before the two sockets for the 74LS245's are soldered.
3. Solder the bypass capacitors.
4. Solder the trim pot, and the male headers JP1, JP4, CORE-IO, and EP-1.
5. Solder the two sockets for the 74LS245's, if you want to use sockets for them. See step 2.
6. Solder the LED. ***Notice the correct polarity!***
   The cathode is near the IC #18, 74LS132. The anode is near the resistor. The shorter lead of the LED is (normally) the cathode, the longer lead is the anode. If you are not sure about the cathode and anode pin, use a power supply and a series resistor to limit the current. The pin that connects to the (+) of the power supply is the anode when the LED is on.
7. Solder the electrolytic polarized capacitor. ***Notice the correct polarity!***
8. Solder all other capacitors.
9. Solder the ICs on the Core Board for which you do not use an IC socket, including the two 74LS245's if you did not use sockets for them.
   - ***Take care that you install the ICs in the correct orientation!***
     The choice is up to you to use IC sockets for all ICs or for just a few.
     The kit only supplies sockets for the most important ICs.
10. Solder the Crystal Oscillator. ***Notice the location of pin #1.*** The dot on the metal casing indicates pin #1, the corner of the casing at pin #1 is sharp, the 3 other corners are round.
11. Solder the DE-9 serial port connector *or* the 3-pin RS-232 header, depending on which you will use to connect the Core Board to the COM port or terminal.
12. Put all the ICs in the sockets.
    Install the EPROM in position IC23. Leave IC29 (at the corner of the Core Board) empty.
    - ***Take care that you put the ICs in the correct orientation!***
13. Connect a jumper at the position "HI/27128" on the header EP-1 near the EPROM IC23.
14. Admire your work ☺, and do a visual inspection with a bright light.
    The Core Board is finished.
    - ✓ Are all ICs installed with pin 1 at the correct side?
    - ✓ Have the LED and the polarised capacitor the correct orientation?
    - ✓ No small droplets of solder near the soldering joints?

    This is how your Core Board looks after these steps:



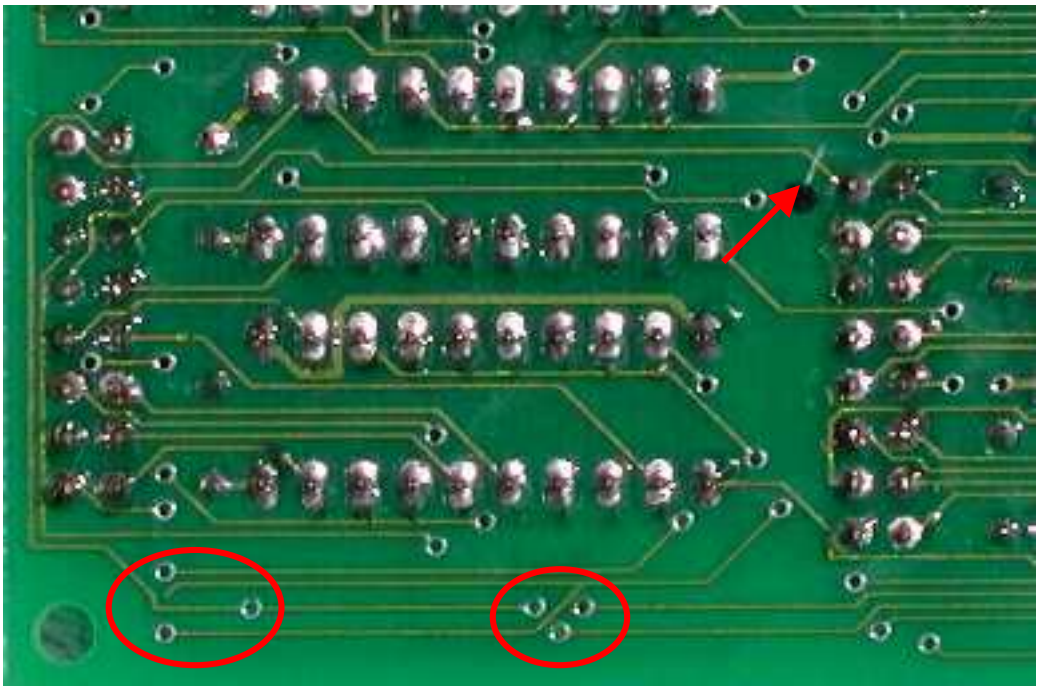
15. Connect a momentary switch (contacts normally open) to JP1, RESET.
16. Make sure the +5V power supply is turned off.
    Connect the +5 V. power supply to JP4. ****** Notice the correct polarity! ******
    Turn on the power supply, and press the RESET button for a short moment.
    - ✓ Check: after a few seconds, the LED must blink at a rate of one time per second.
17. Connect a serial cable to the RS-232 COM-port of your PC (or terminal) and connect the other end to the DE-9 connector or the 3-pin RS-232 header next to the DE-9 connector.
    Make sure the COM port or the terminal has the following settings:
    - ♦ Baudrate 9600 Baud, 8 data bits, no parity, Xon/Xoff disabled, no hardware handshake.
18. Put a jumper on the 2-pin header called DEBUG.
    Press and release the RESET button, then remove the jumper from the DEBUG header.
    The monitor identification message should appear on the terminal if the baudrate is OK.
    [The Core Board starts the Tester application if the DEBUG pins are open. The Tester application does not print a start-up message. The Core Board starts its monitor program if the DEBUG pins are connected just after reset or power-up. However, the Core Board will stall the execution (and the print of the start-up message) of the monitor until the DEBUG pins are open again.]
    Adjust the trim pot R11 a little if the text output is garbage. The frequency at the pin #5 of IC27 must be 153.6 kHz (if you have a frequency counter).
    When you do not see any text at all on the terminal, try the reversal of the TxD and RxD pin.
    When you use the RS-232 header it is easily corrected by just turning the connector 180°.
19. Turn off the power supply.
    Congratulations! You have a working Core Board on your desk.

2. Assembly of the I/O Board

I/O Board modification.

The I/O Board has one trace that should not be there. The new I/O Boards will have that trace cut, but the earlier delivered I/O Boards do not have that trace cut. Check that the trace is cut.

From the connector OUT7-8 pin #2 connects to IC7 pin #2. That is a trace on the solder side of the I/O Board, which runs near pin #1 and BYP7. Leave that trace alone. There is also a trace that runs from IC5 pin #2 over to OUT5-6 pin #2, also on the solder side. That trace is also good. There is also a long trace that goes from OUT7-8 pin #2, all the way over to IC5 pin #2. That trace must be cut. The best location to cut that trace is near OUT7-8 pin #2, which is indicated in the picture just above the black dot, and the red arrow. The two ellipses help to locate the shown corner of the I/O Board.



The I/O board only contains ICs, pin headers, bypass capacitors and one electrolytic polarised capacitor. If you want to put the ICs in sockets you must buy the sockets, as these are not included in the kit. The advice is to use sockets for the ICs, as an error on the Tester could damage them.

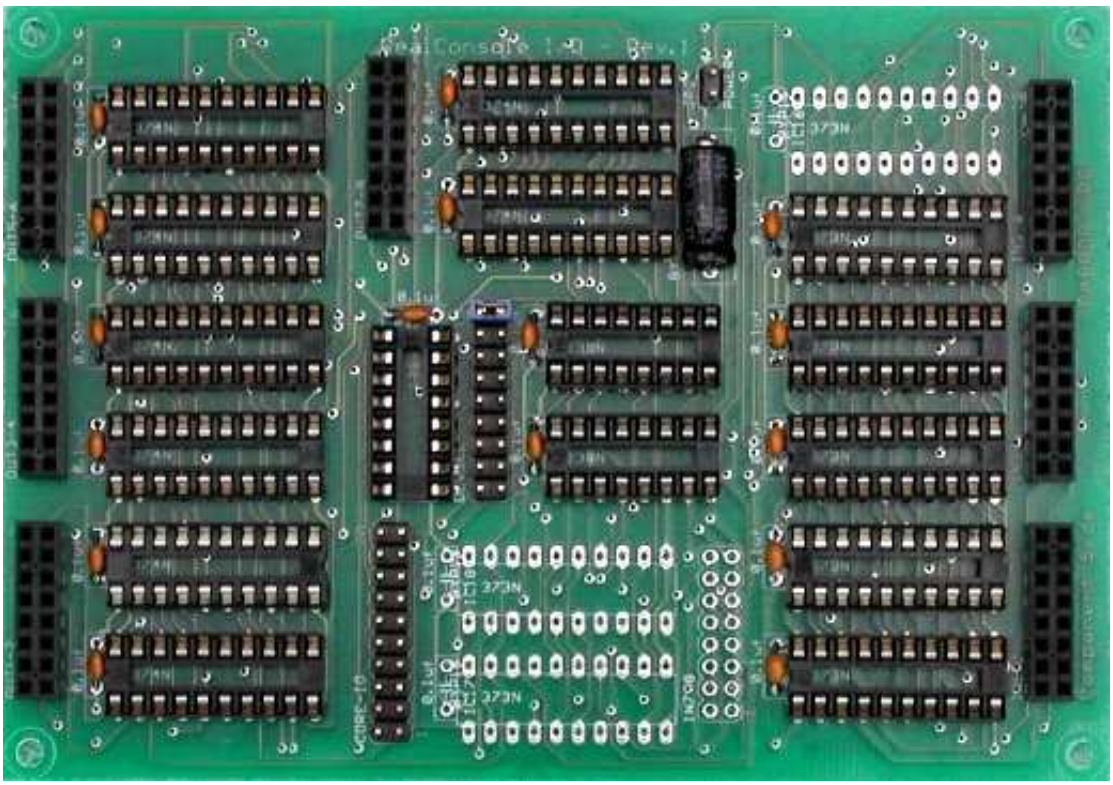
The proposed soldering order is as follows.

1. If you use sockets, first solder the sockets for the ICs. Do ***not*** solder the ICs themselves. It is strongly recommended to use sockets for the 74LS373 input latches, because their pins have a direct connection to the contact fingers of the FlipChip to be tested. The FlipChip can have a fault that could damage the input latches. The 73LS374 output latches do not have a direct connection to the FlipChip to be tested as the output latches are buffered on the Tester Board by the 74LS125's.
2. Solder the CORE-IO header.
3. Decide how you will arrange the position of the Core Board and the I/O board(s). Make the flat cable to connect the Core Board and the I/O Board(s). Connect the Core and I/O Board(s) with the flat cable and apply the +5V power to the Core Board through JP4.
   ****** Notice the correct polarity! ******
   - ✓ Check. Connect the (-) connector of the Voltmeter to the pin #10 of any octal latch. Set the Voltmeter to a DC Voltage setting higher than 5V (for example 20V). Connect the (+) connection of the Voltmeter to pin #20 of any octal latch. The meter must indicate a positive 5 V. In that case you know that the flat cable is OK.

- ✓ Remark. You need one I/O Board if you only want to test single-height FlipChips. If you also want to test double-height FlipChips, you must install a second I/O Board, and the flat cable from the Core Board must connect to both I/O Boards.
  See also “Construction for double-height FCs” and “Configuration of the I/O Board”.
- ✓ Turn the power supply off, and disconnect the flat cable from the I/O Board.

4. Solder the bypass capacitors.
5. Solder the electrolytic polarised capacitor. ***Notice the correct polarity!***
6. Solder the 3 decoder ICs, or install the decoder ICs in their sockets.
   Notice the orientation of the sockets or the ICs.
7. Solder the header JP1 and the header JP2.
8. Solder the 4 headers for the output ports.
9. Solder *three* headers for the input ports IN1-2, IN3-4, and IN5-6 for I/O Board #0. Solder *two* headers for the input ports IN1-2, and IN3-4 for I/O Board #1. The input port IN5 is only used on the I/O Board #0 for the Tester State register. The Tester does not use IN7-8. See the “Construction for single-height FCs” for the two possible connection options available.

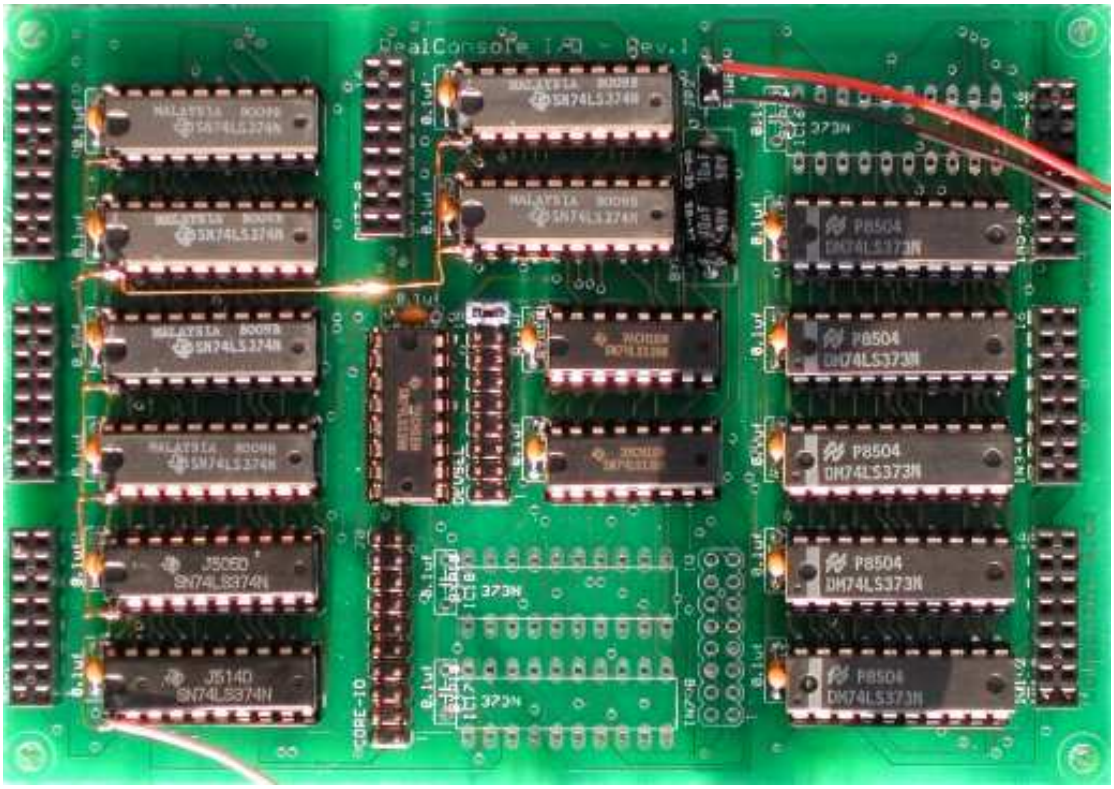
   This is how your I/O Board #0 component side looks after these steps, using the female headers. Note the three not-installed input latches, the 16-pin header for IN7-8 and the blue jumper in JP1 set for I/O Board #0.



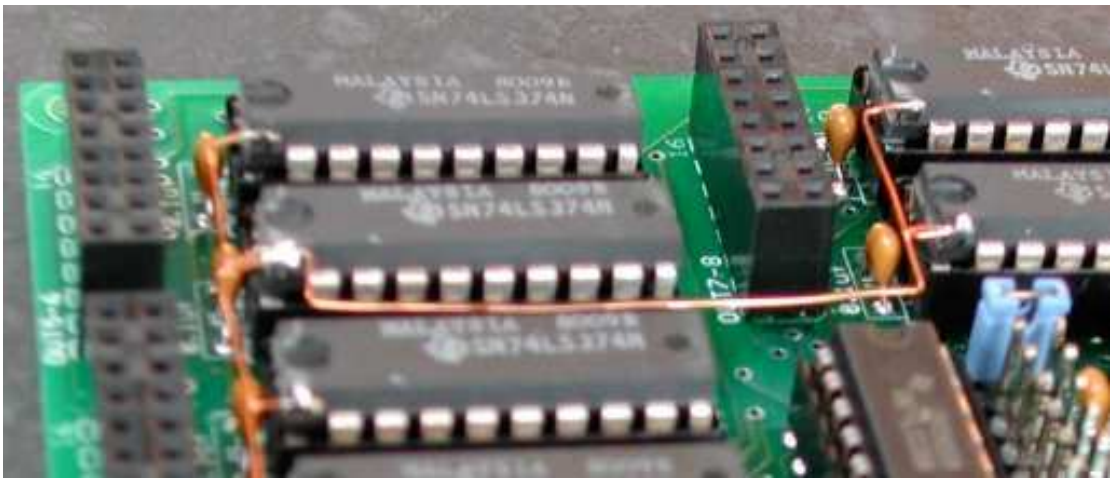
10. Prepare the octal latches. The I/O Board package contains eight 74LS374 ICs for the output latches and eight 74LS373 ICs for the input latches. You need only 5 input latches on the I/O Board #0, and only 4 input latches on the I/O Board #1.
    - Bend pin #1 of eight 74LS374 135°, so that this pin points slanted “up in the air”.
      Pin #1 may not make any contact with the I/O Board.
11. If you do not use sockets for the octal latches, solder the input and output latches that are needed for the Tester on the I/O Board. The eight latches that have pin #1 bent upward are the output latches. ***Make sure that you install the ICs in the correct orientation!***

12. If you used sockets, install the octal latches. The eight latches that have pin #1 bent upward are the output latches. ***Make sure that you install the ICs in the correct orientation!***
13. Connect the bent upward pin #1 of the eight output latches to each other with a short wire. To prevent a short circuit condition, slide a suitable length of insulation over the wire between each soldered pin #1, or used lacquered wire from an old transformer coil.

    This is how your I/O Board looks after you completed all the described steps. I soldered a black and a red wire to the power supply connector pins, and a pink wire to the common #1 pins of the 74LS374 output latches. These three wires go to the Tester Board.



And here is a detail picture of the upper left corner of the picture above.



3. Assembly of the Tester Board

The Tester board contains ICs, pin headers, bypass capacitors, SIL resistor packs, one electrolytic polarised capacitor, and 4 DIP switch packages. Plan to put the ICs in sockets! The advice is to use sockets for the ICs, as an error on the Tester or module under test (MUT) could damage them. Also, the DIP switches may be used often, so it is wise to put the DIP switches on sockets too, or use external switches through JP1, JP2, JP3, and JP4.

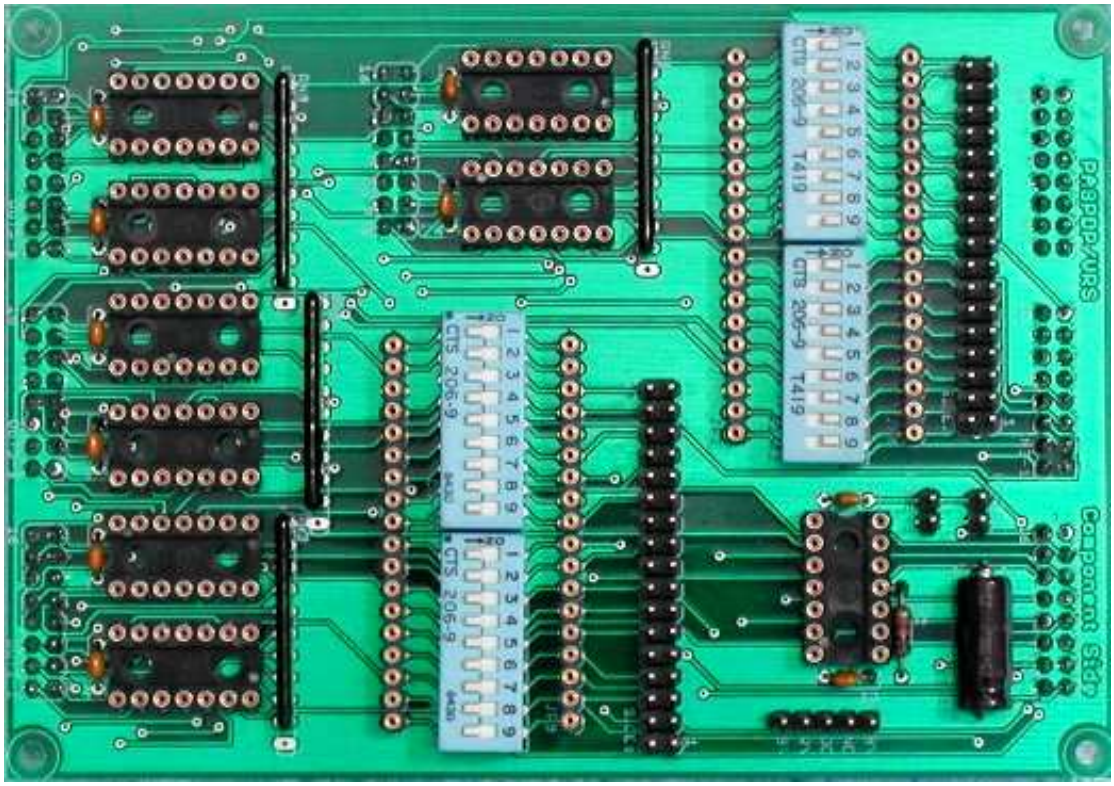
Attention.

Only Tester Board #0 needs an IC (and socket) for IC9, 74LS10. The other Tester Board does not install IC9 and the associated parts, R1 (1k) and C1 (0.1 µF). R1 and C1 in the schematic diagram are called R2 and C2 on the Tester Board.

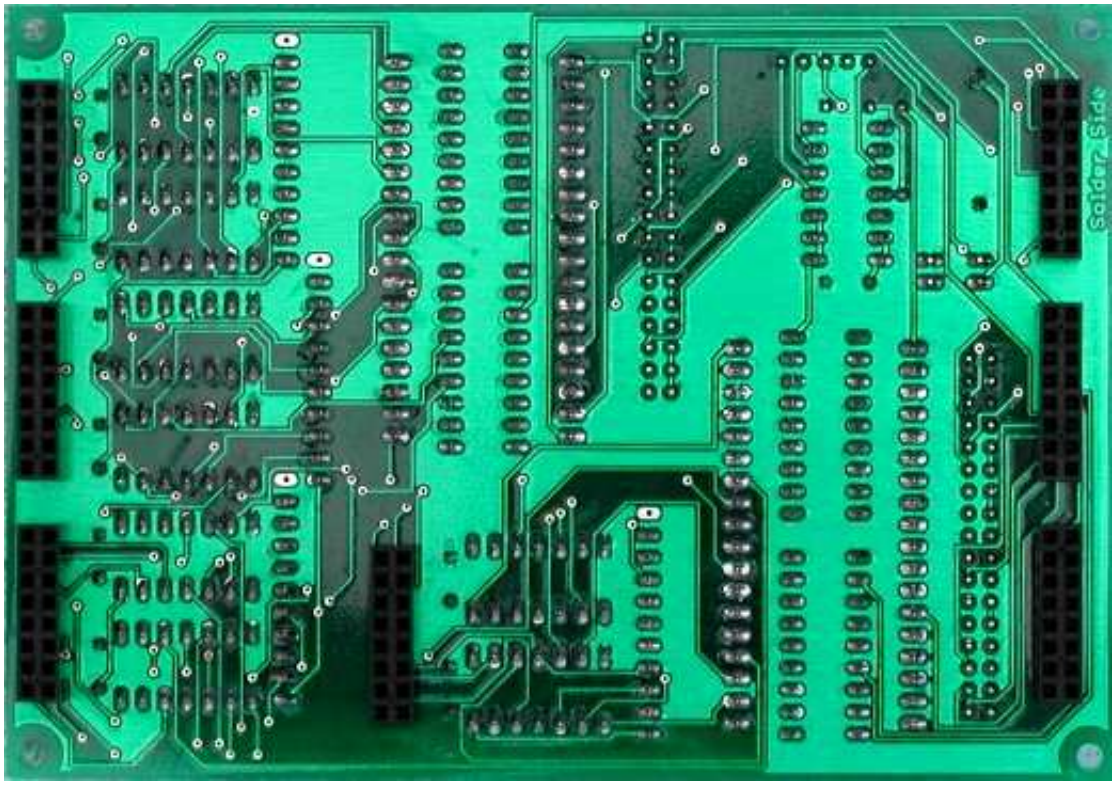
Make sure you are looking at the component side of the Tester Board!
The proposed soldering order is as follows.

1. If you use sockets, first solder the sockets for the ICs and optionally for the DIP switch packages. Do *not* solder the ICs themselves. See also step 6. It is strongly recommended to use sockets for the 74LS125 buffers, because their pins have a direct connection to the contact fingers of the FlipChip to be tested. The FlipChip can have a fault that could damage the buffers. ***Notice the orientation of the sockets.***
2. Solder the bypass capacitors near each IC.
3. Solder R1 and C1 indicated with “R2” and “C2” on the Tester Board. Remember that you install these two components only on the Tester Board #0.
4. Solder the four SIL resistor packs. The dot on the package indicates the location of pin #1. The Tester Board has one more hole in the board for the SIL package. Make sure that the SIL package is soldered with the ‘DOT’ pin in the hole with the text “1” next to it.
5. Optionally, solder the SIL machine-tooled female pins JP1/JP3 and JP2/JP4 next to both sides of the DIP switch packages. Check that the two separate 9-pin SIL machine-tooled female pins fit nicely next to each other. If necessary, use a file to make the cut end “clean”. You can use one SIL machine-tooled female pins inserted into the two to be soldered to get them “in line”.
6. Solder the electrolytic polarised capacitor. The “+” is near the edge of the Tester Board. ***Notice the correct polarity!***
7. Solder the two 34-pin male headers, SIDE1 and SIDE2.
8. Solder the two 2-pin male headers for the power supply connections.
9. Solder the 5-pin male header.
10. Solder the four DIP switch packages. Remove the protective adhesive from the package before you solder the package on the board.
11. Solder the seven 16-pin headers that connect the Tester Board to the I/O Board.
    Decide how you will connect the Tester Board and the I/O Board and do one of the following. (See also “Construction for single-height FCs”).
    - Solder seven male 16-pin headers on the *component side* of the Tester Board #0, or six male 16-pin headers on the *component side* of the Tester Board #1.
      The Tester Board and the I/O Board connect with seven/six short flat cables.
    - Solder seven female 16-pin headers on the *solder side* of the Tester Board #0, or six female 16-pin headers on the *solder side* of the Tester Board #1.
      The Tester Board and the I/O Board connect with seven/six 16-pin male headers.
12. If you did not use sockets for the ICs, solder the ICs on the Tester Board. If you used sockets, install the ICs in the sockets. ***Take care that you install the ICs in the correct orientation!***

This is how your Tester Board #0 component side looks after these steps, using the female headers on the solder side. Note the position of the SIL resistor packages.

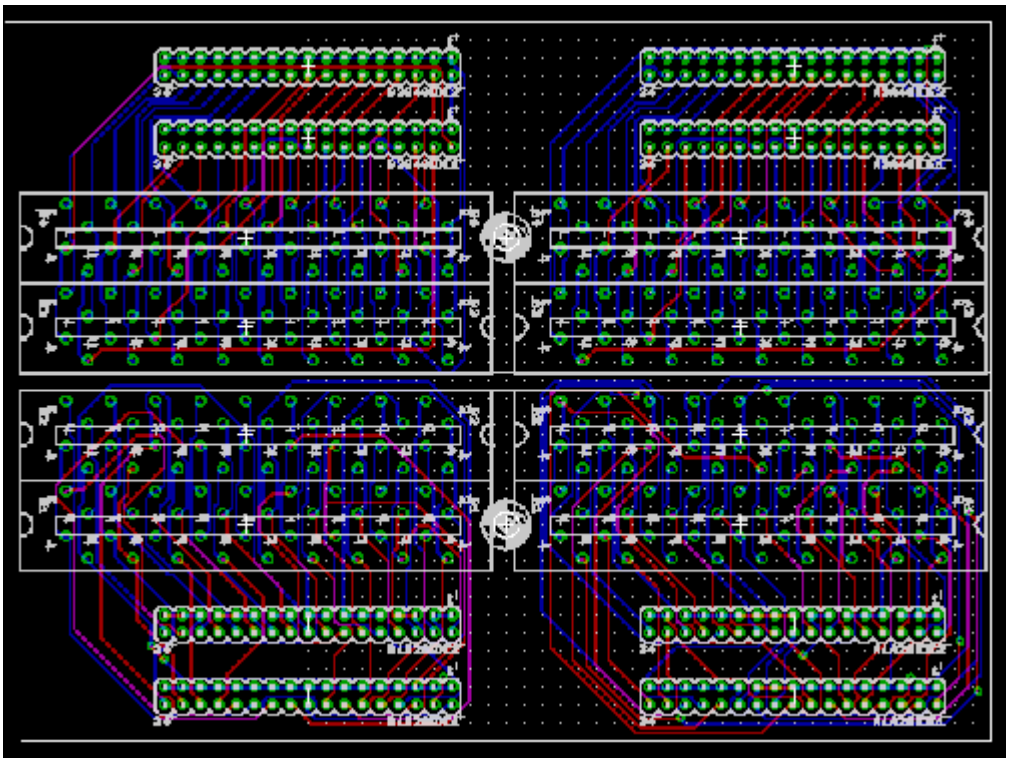


And here is the solder side of the Tester Board #0 with the female 16-pin headers.



4. Assembly of the Connector Board

The Connector board only contains eight 34-pin headers and the connector block. First solder the 4 pin headers, or only 2 pin headers if you build the single-height configuration. The 4 pin headers at one long side of the Connector Board connect to the slots 1 and 2 of the connector block, and the 4 pin headers at the opposite long side of the Connector Board connect to the slots 3 and 4 of the connector block. You only need to solder the 2 or 4 pin headers at one side of the Connector Board. Remark. It is possible that the kit contains a cut-in-half Connector Board. In that case you will get the upper half or the lower half of the board as showed in the Eagle CAD drawing below.



Make sure that you put the pin headers at the component side of the Connector Board. The only text printed on the Connector Board is located near the pin headers.

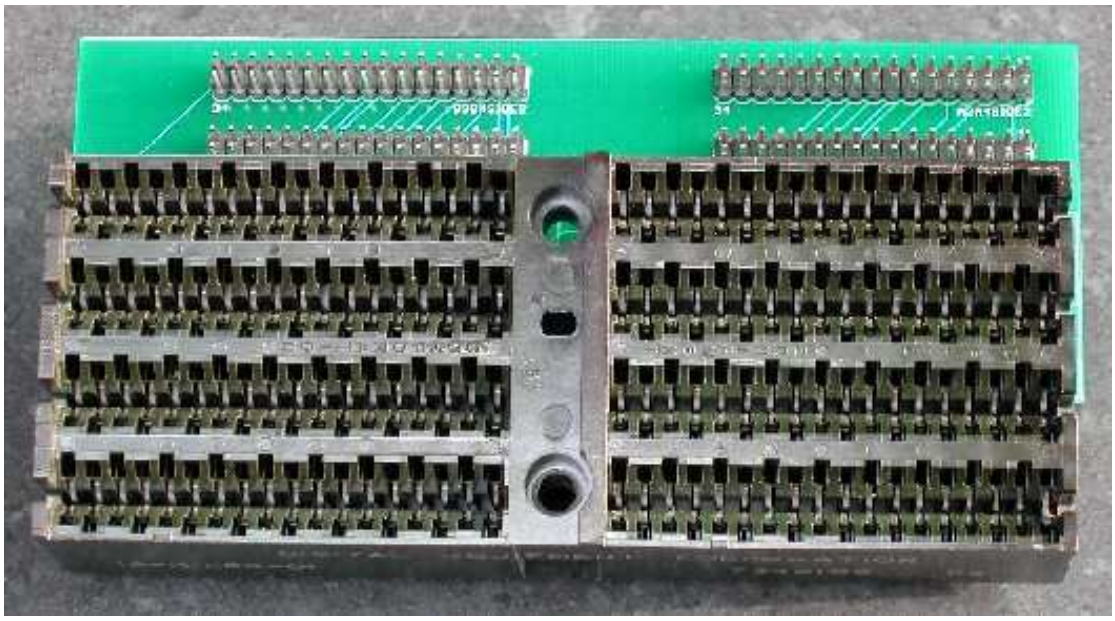
- A1A2SIDE1 and A1A2SIDE2 connects row A, slot 1 and slot 2 of the connector block
- A3A4SIDE1 and A3A4SIDE2 connects row A, slot 3 and slot 4 of the connector block
- B1B2SIDE1 and B1B2SIDE2 connects row B, slot 1 and slot 2 of the connector block
- B3B4SIDE1 and B3B4SIDE2 connects row B, slot 3 and slot 4 of the connector block

Take time for the correct installation of the connector block on the Connector Board!

1. Check that all the pins of the connector block are straight, and that they are “in-line” with each other. The holes in the Connector Board are a tight fit for the pins of the connector block so the connector block will only fit on the board if all pins are perfectly aligned.
2. You can install the connector block in the wrong way! Make sure that the cut form of the connector edge of double-height FlipChips aligns with the shape of the connector block.
3. If you have a cut-in-half Connector Board, 2 slots and 2 rows are not connected to the Connector Board. See the pictures for the correct position.

Tip. After you soldered the four (or two) 34-pin headers and put the connector block on the board, check the connection between a few contact fingers and the corresponding pins on the header with an Ohmmeter. Because of the tight fit of the connector block you will probably measure 0 Ohms between a contact finger and the correct header pin, but that is of course not guaranteed. For example, contact finger AA2 (A2 of row A) of the slots 3 and 4 connects to header A3A4SIDE2 pin #2, and contact finger AA1 of the slots 3 and 4 connects to header A3A4SIDE1 pin #10.

This picture shows the Connector block on “top” half of the Connector Board, the pin header that you can see at the right side is A3A4SIDE2.



This picture shows the alignment with a double-height FlipChip (a simple G7273 grant card).