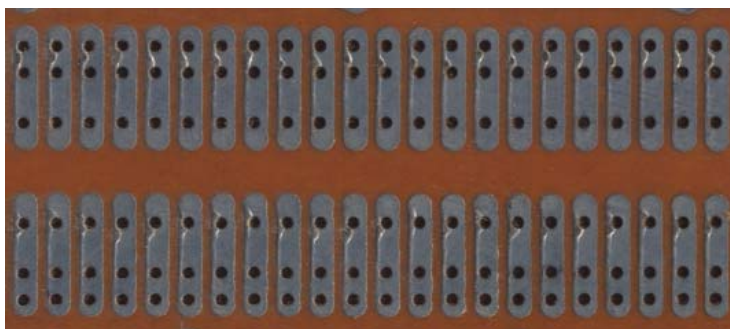


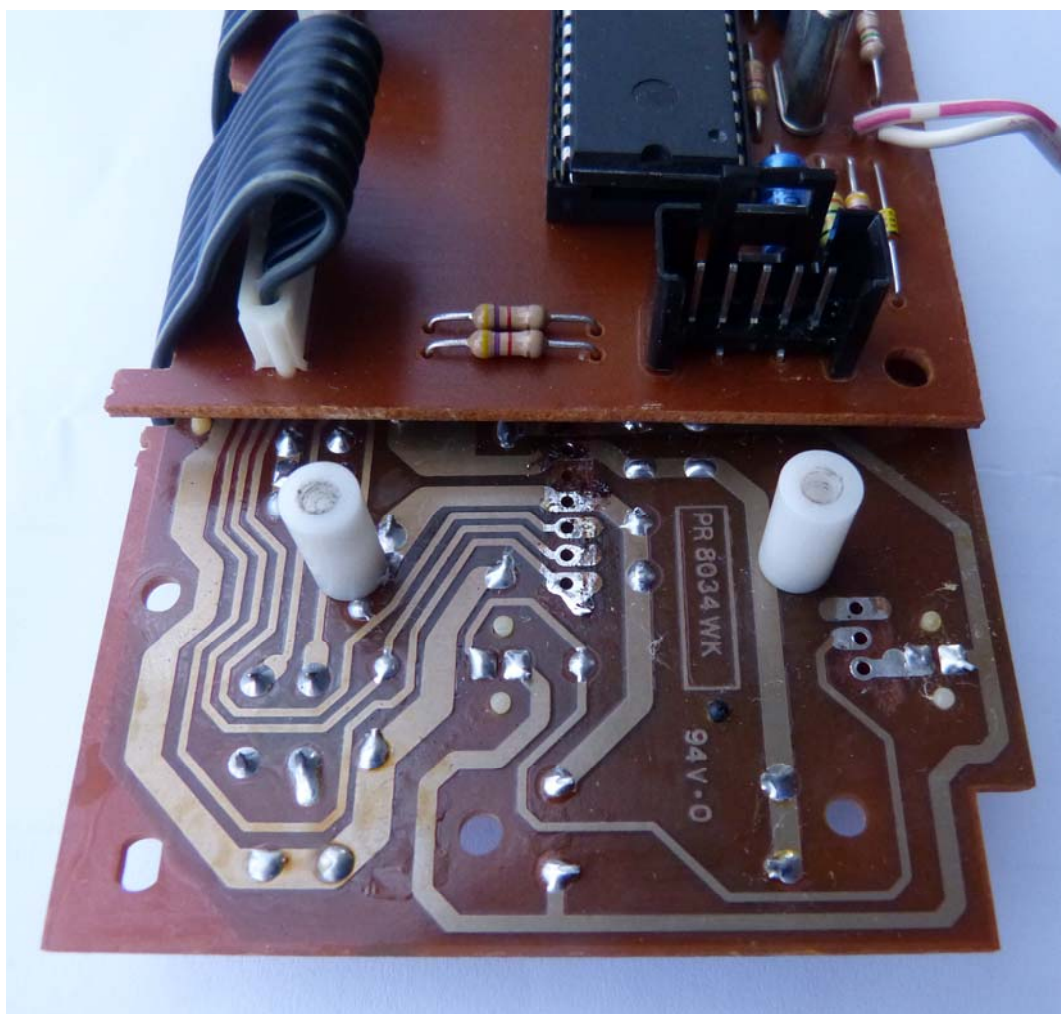
Repairing the Display Driver in a Philips CD160 CD Player (Part 2)

Attaching the MM5450 decoder/driver

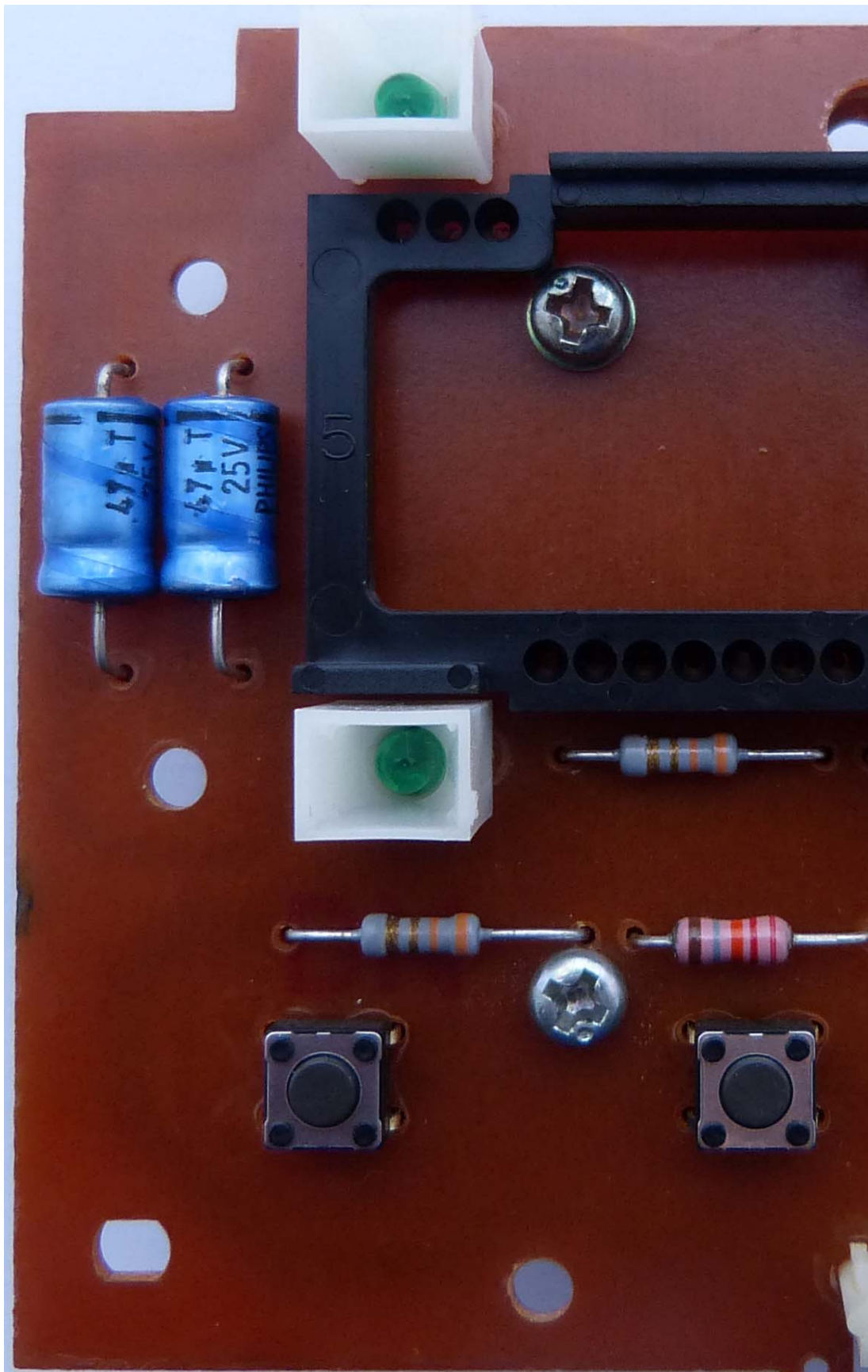
Some means of mounting the new IC needs to be found. For the repair described here, a piece of perforated board with 22 pairs of pads was used. Alternatively, a suitable PCB could be fabricated, or a piece of square-pad perforated board could be used. The new board can be mounted on spacers behind the display board, but suitable positions for these are quite restricted, due to the placement of the PCB tracks. The following photographs show the method used for this repair.



Board used for the new decoder/driver IC



Spacers were used to support the new board. The holes for these must avoid any tracks on the display board. Use insulated spacers or metal ones with insulating washers.

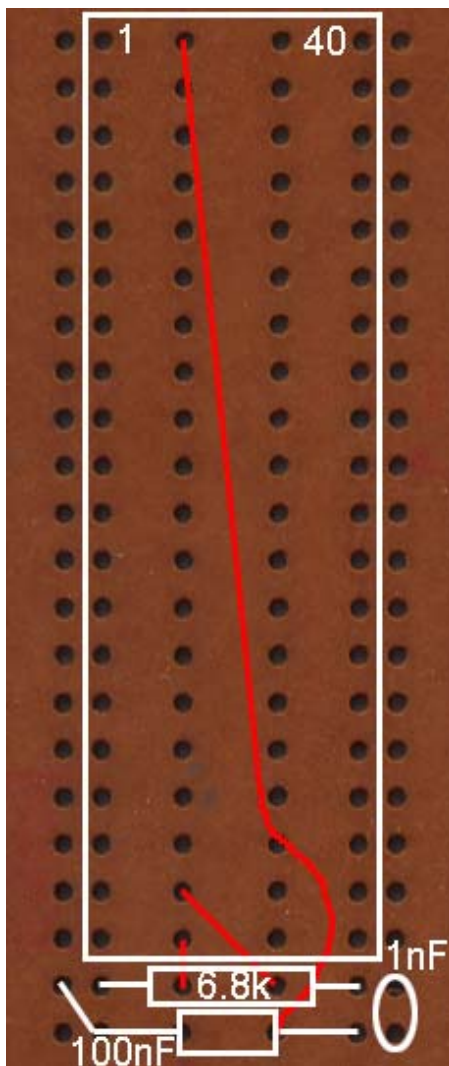


Location of the spacer fixing screws: they must be fitted before the module is soldered back in. The bottom screw is almost touching the resistor, but it doesn't matter, since insulated spacers have been used.

The new board must be positioned so that when the front panel is re-fitted, it clears the flange at the bottom of the case and the flange towards the CD tray. Also, there should be a suitable gap between the board and the control board to accommodate the wiring to that side of the MM5450. It was found that the IC is best mounted with pin 1 (i.e. with the notch in the package) at the bottom.

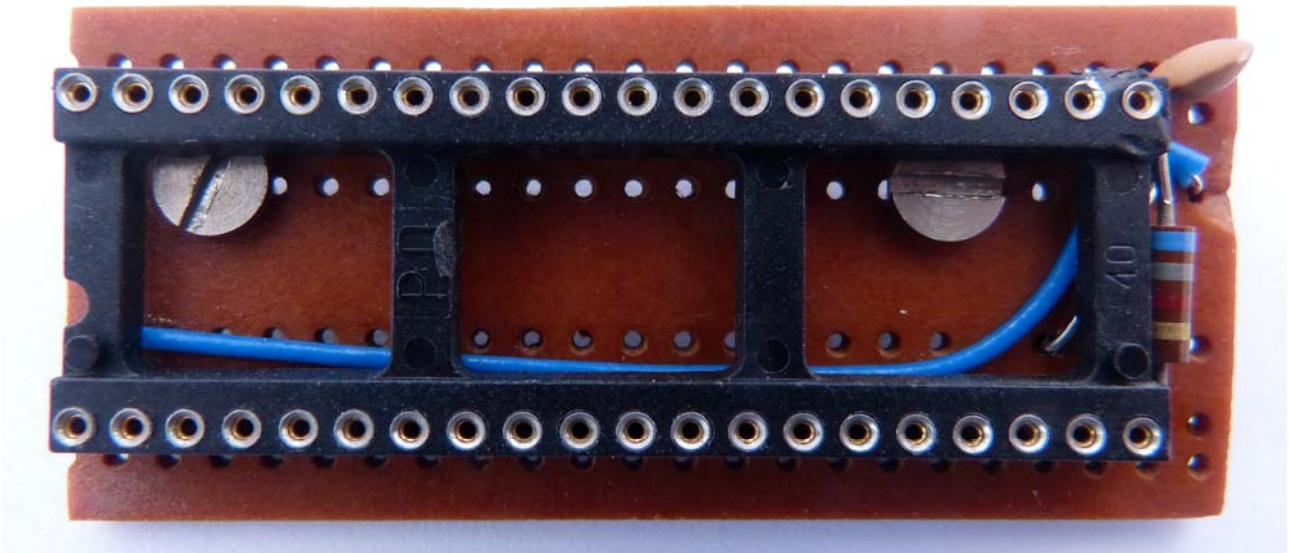
When suitable support spacers for the new board have been fixed in position, pass the wires from the display module through the hole. Reseat the module in its plastic frame and solder the module in position. Since wires will also be attached to some of the pads on the display board later, it is recommended that only stand-off pins 7 & 10 are soldered at this stage.

The MM5450 has the capability of adjusting the display brightness, by means of a reference current through a resistor connected between the positive supply (V_{DD}) and pin 19. Provision has been made on the new board for this component, along with a small capacitor (1nF) between pin 19 and ground. A 100nF transient-suppression capacitor is also fitted to the board. Variations between individual ICs may require experimenting with the resistance value, but in the CD160 being repaired here, 6.8k Ω resulted in a current of about 7mA through each segment, which was quite bright enough.

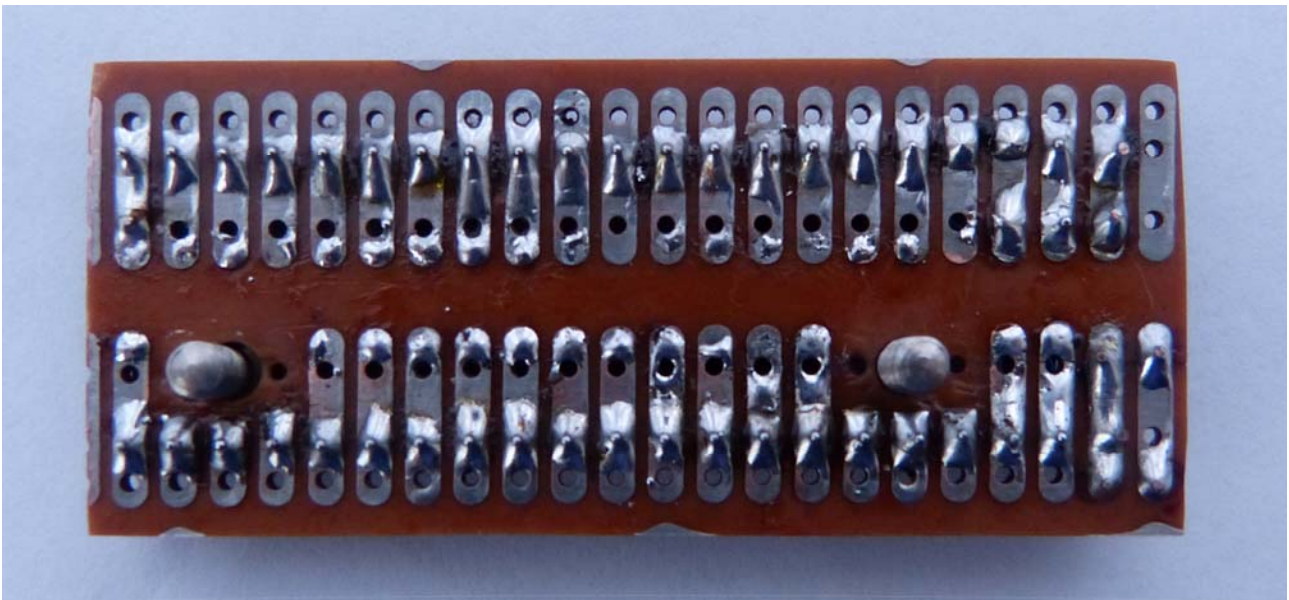


Suggested layout and wiring (red lines) of the MM5450 circuit board. Screw holes need to be drilled for attachment to the support spacers

The circuit board needs holes drilled in it for attachment to the support spacers. 6BA or M2.5-M3 screws are a suitable size. A 40-pin DIL socket will need to be soldered to the board, but if the socket overlaps the holes, the screws will have to be inserted before the socket. Also, it will probably be necessary to file down the heads of the screws to enable them to fit under the socket. The following photograph illustrates this. Don't fit the IC at this stage.



The 40-pin DIL socket in place. The 100nF capacitor hasn't been fitted yet.



Underside of the board. Removing the copper around the screw holes is advisable

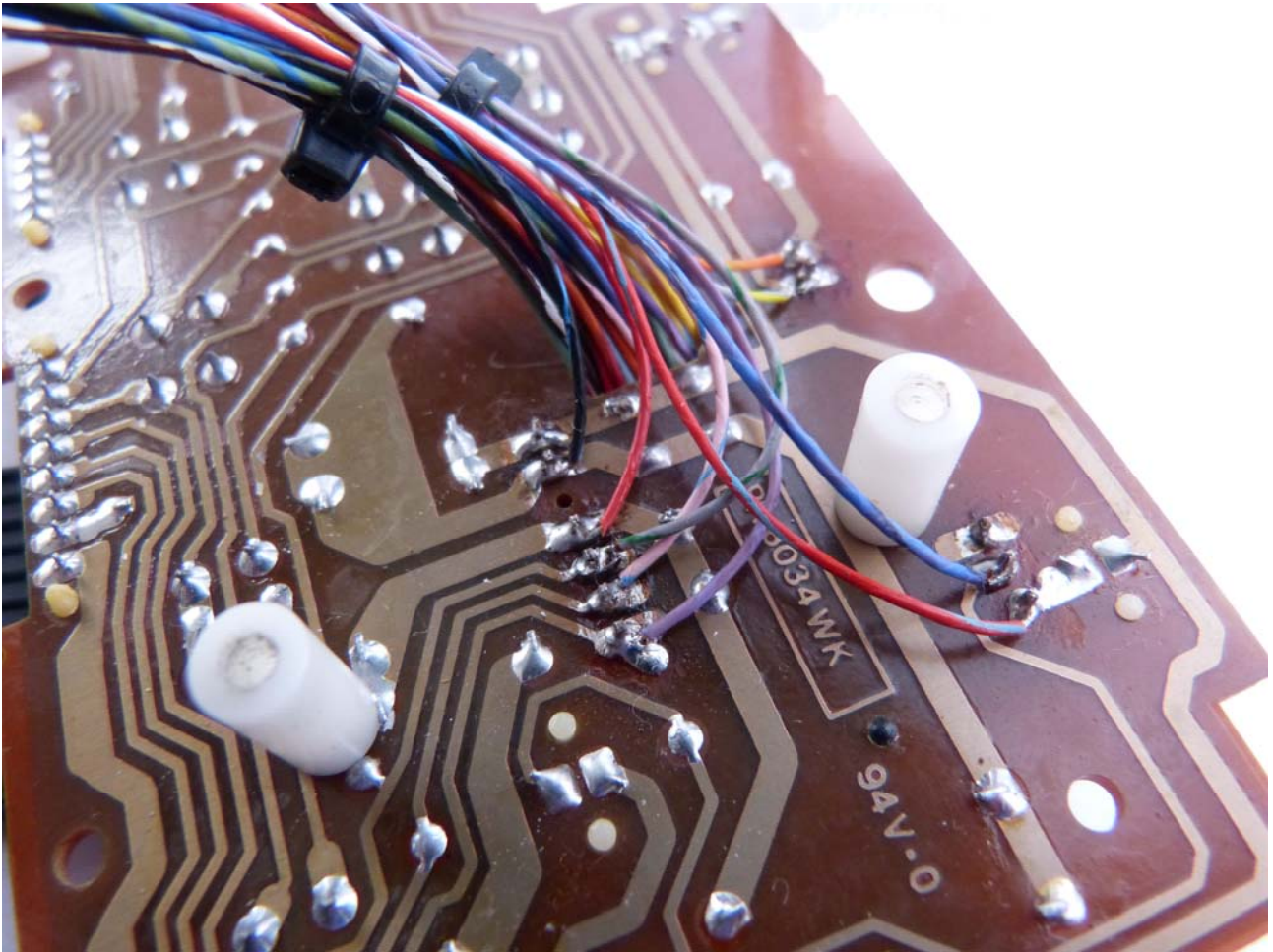
Connecting the board to the display

Before wiring the board, the operation of the status LEDs (TRACK, TIME, PAUSE and REPEAT) should be checked. The procedure is the same as when checking the display LEDs: that is, using a power source and a resistor. The anodes of the status LEDs are connected to stand-off 7, as are those of the display LEDs. The status LED cathodes are routed to the following stand-off pads:-

LED	PAD
TIME	8
TRACK	9
REPEAT	11
PAUSE	12

If any LEDs are non-operational, now is the time to replace them.

Wires need to be soldered to several of the stand-off pads (1-4, 6, 8, 9, 11 and 12), to run alongside the bundle of wires coming from the display, as illustrated in the following photograph.



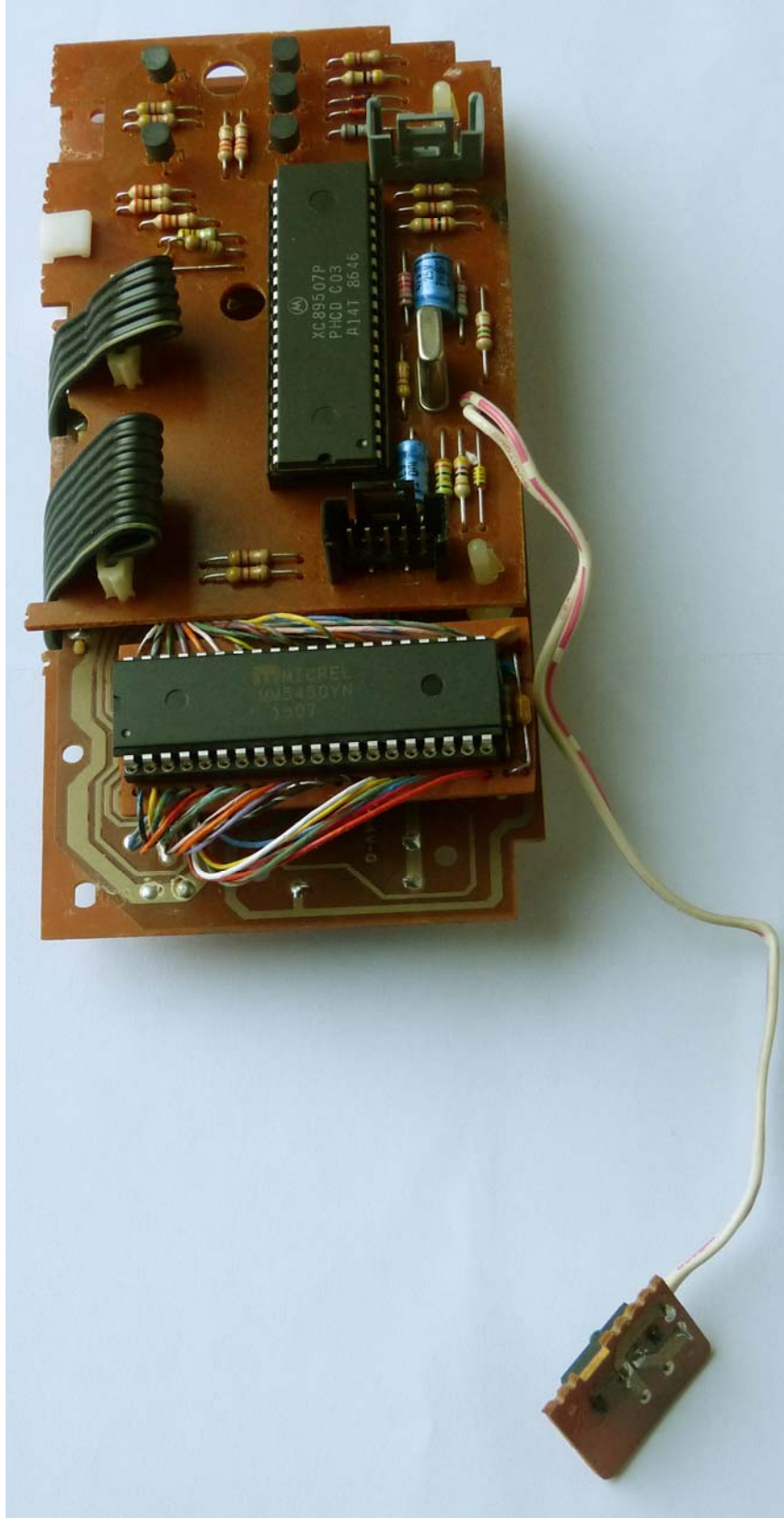
Connections to the stand-off pads

Separate the wires into two bundles, according to which side of the MM5450 they will be connected. The following table shows which wire will be connected to which pin.

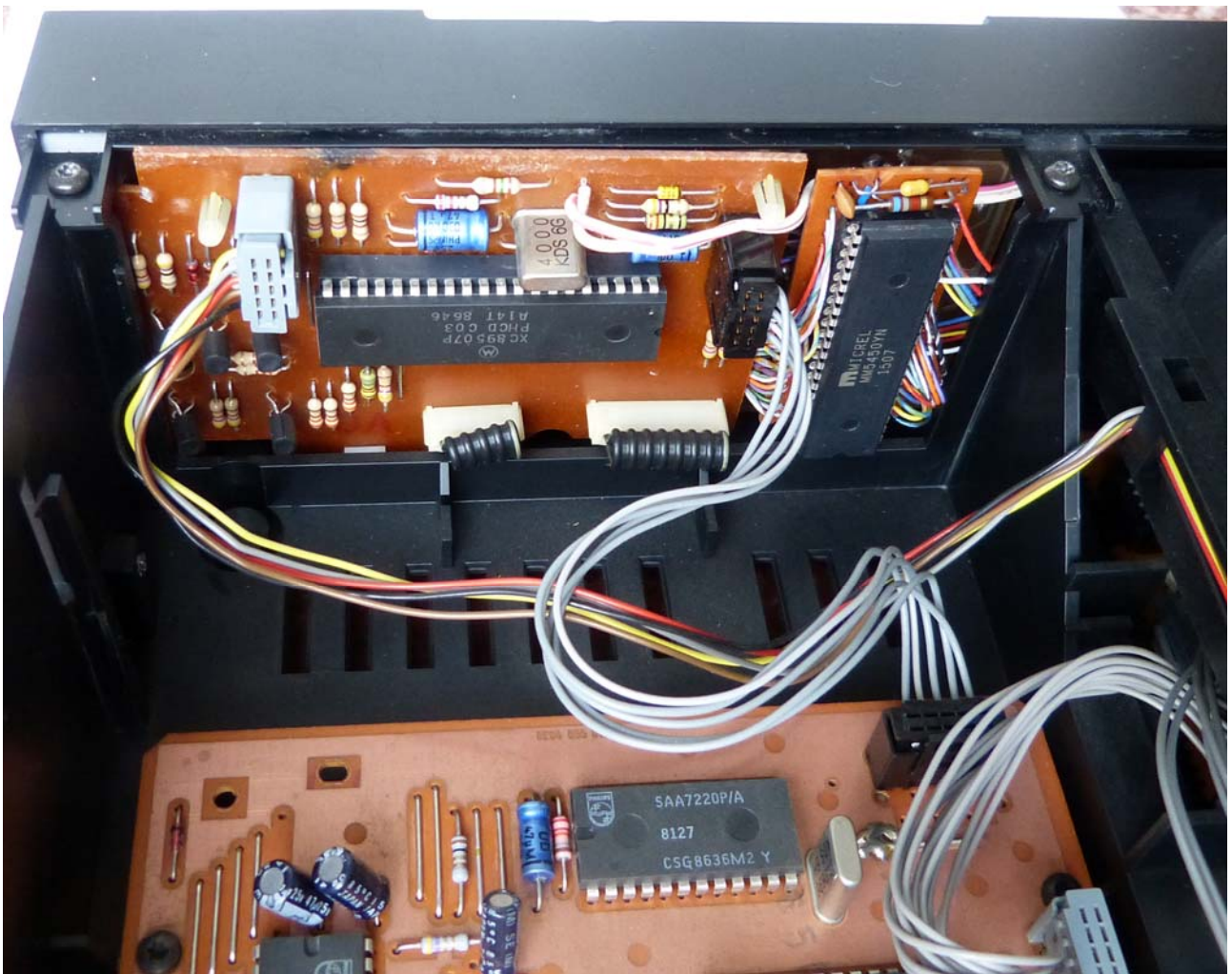
MM5450YN pin	Function	Wired to
1	V _{SS}	NSM4202A stand-off 6 (GND)
2	Output Bit 17	Segment 3a cathode
3	Output Bit 16	Colon cathode
4	Output Bit 15	Segment 2g cathode
5	Output Bit 14	Segment 2f cathode
6	Output Bit 13	Segment 2e cathode
7	Output Bit 12	Segment 2d cathode
8	Output Bit 11	Segment 2c cathode
9	Output Bit 10	Segment 2b cathode
10	Output Bit 9	Segment 2a cathode
11	Output Bit 8	Not used
12	Output Bit 7	Segment 1g cathode
13	Output Bit 6	Segment 1f cathode
14	Output Bit 5	Segment 1e cathode
15	Output Bit 4	Segment 1d cathode
16	Output Bit 3	Segment 1c cathode
17	Output Bit 2	Segment 1b cathode
18	Output Bit 1	Segment 1a cathode
19	Brightness Control	1nF capacitor to GND and 6.8k Ω resistor to V _{DD}
20	V _{DD}	NSM4202A stand-off 4 (+5V via a 3.3 Ω resistor)
21	Clock In	NSM4202A stand-off 3 (CLK)
22	Data In	NSM4202A stand-off 2 (DAT)
23	Data Enable (active LOW)	NSM4202A stand-off 1 (DE)
24	Output Bit 34	NSM4202A stand-off 8 (TIME LED)
25	Output Bit 33	NSM4202A stand-off 9 (TRACK LED)
26	Output Bit 32	NSM4202A stand-off 12 (PAUSE LED)
27	Output Bit 31	Segment 4g cathode
28	Output Bit 30	Segment 4f cathode
29	Output Bit 29	Segment 4e cathode
30	Output Bit 28	Segment 4d cathode
31	Output Bit 27	Segment 4c cathode
32	Output Bit 26	Segment 4b cathode
33	Output Bit 25	Segment 4a cathode
34	Output Bit 24	NSM4202A stand-off 11 (REPEAT LED)
35	Output Bit 23	Segment 3g cathode
36	Output Bit 22	Segment 3f cathode
37	Output Bit 21	Segment 3e cathode
38	Output Bit 20	Segment 3d cathode
39	Output Bit 19	Segment 3c cathode
40	Output Bit 18	Segment 3b cathode

The wires can now be cut to a suitable length to allow them to be soldered to the board, leaving enough slack to allow it to be easily manoeuvred into position on the spacers after soldering.

When the wiring is complete, mount the board on the spacers and fit the IC. Care should be taken to support the board from underneath as the device is pushed home. The completed assembly is shown below. Reassembly of the player is a reversal of the dismantling procedure.



Completed board assembly



The completed job

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2015