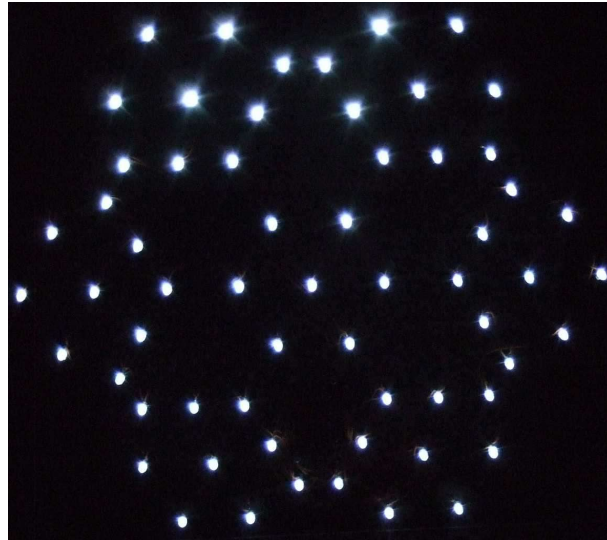


Christmas LED Snowflake Project

Version 1.1 (01/12/2008)



The snowflake is a follow-on from my Christmas star project from a few years ago. This year I decided to make a display using only white LEDs, shaped like a snowflake crystal.

The display size is similar to the star but uses a different microcontroller, a PIC18F1330. It is an 18 pin chip with good features, and is my current favourite general purpose microcontroller.

This design does not have any push-buttons for setting the turn on/off times etc., although I it can be connected it to my Christmas star serial data output which then controls the on/off times.

Making the Snowflake

The display is made with clear 2mm thick Polycarbonate/Acrylic plastic sheet (The type found in DIY stores).
(You could use a thin sheet of wood instead if you want.)
Cut a piece 40 x 37 cm (16" x 14.5") for the snowflake to easily fit on it.

Cutting the sheet

Leave any protective film on the sheet.

Score it with a good quality, heavy duty "Stanley" type retractable DIY knife and metal straight edge, **Take great care not to cut your fingers!**

Repeat the scoring several times to make sure that the plastic is weakened enough.

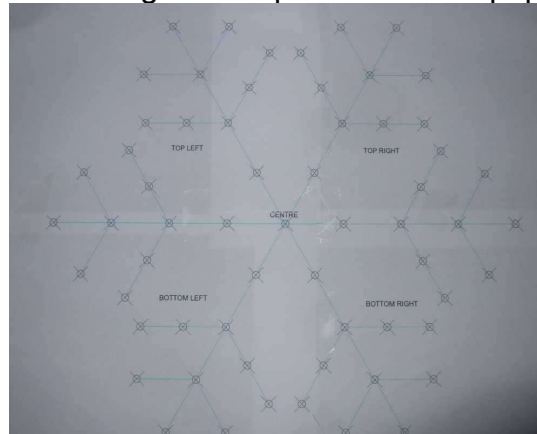
When sufficiently scored, it should be possible to snap the sheet cleanly by placing the scored line aligned with the edge of of your workbench. Bend the rest of the sheet down, forcing it to break along the score.

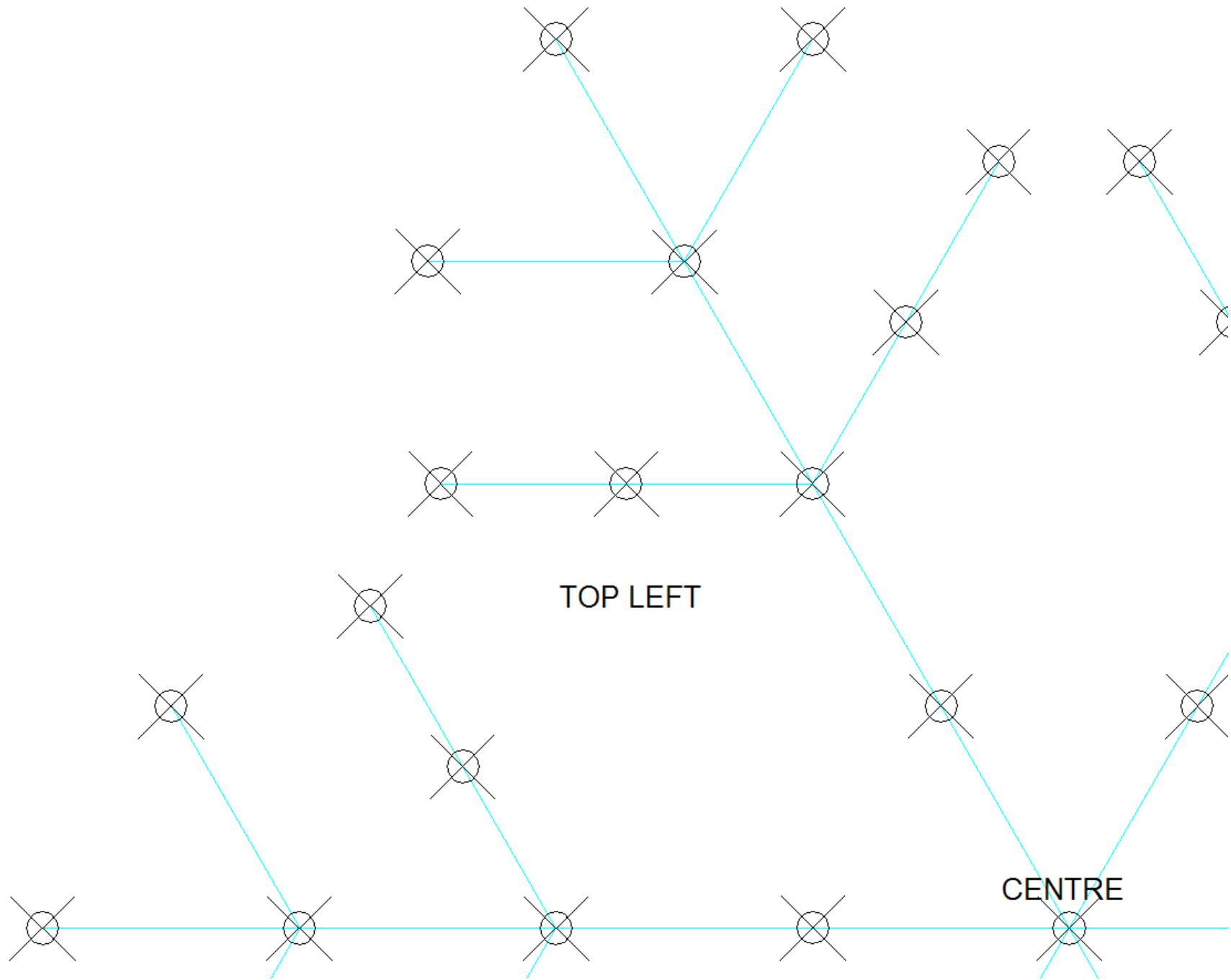
Or it can be sawn using a jigsaw at very low speed with a fine toothed blade intended for plastic or metal cutting.

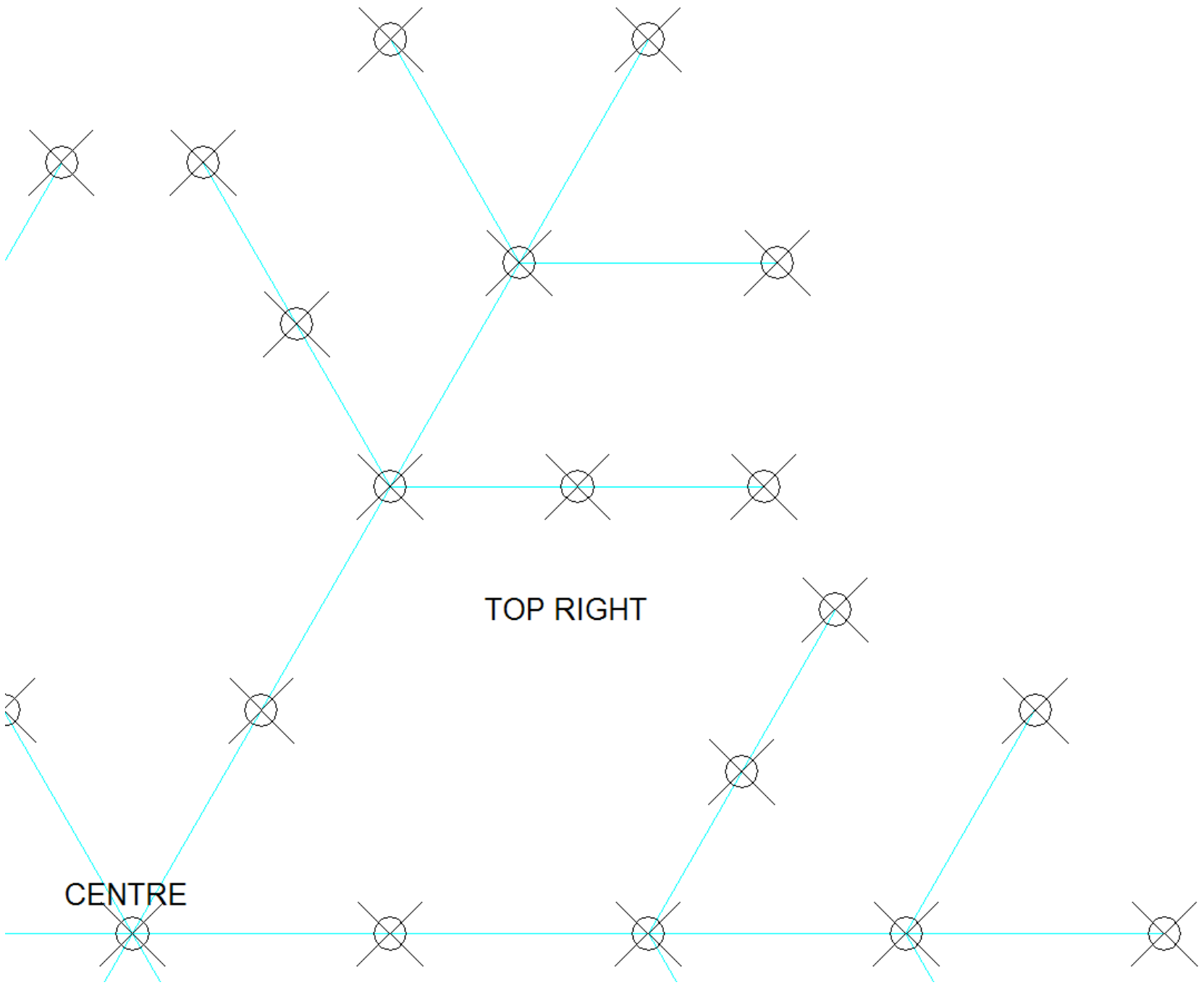
Now print the templates on the next four pages – make sure they print at the correct size by setting the Adobe Reader print option for "Page Scaling to None" or "100%".

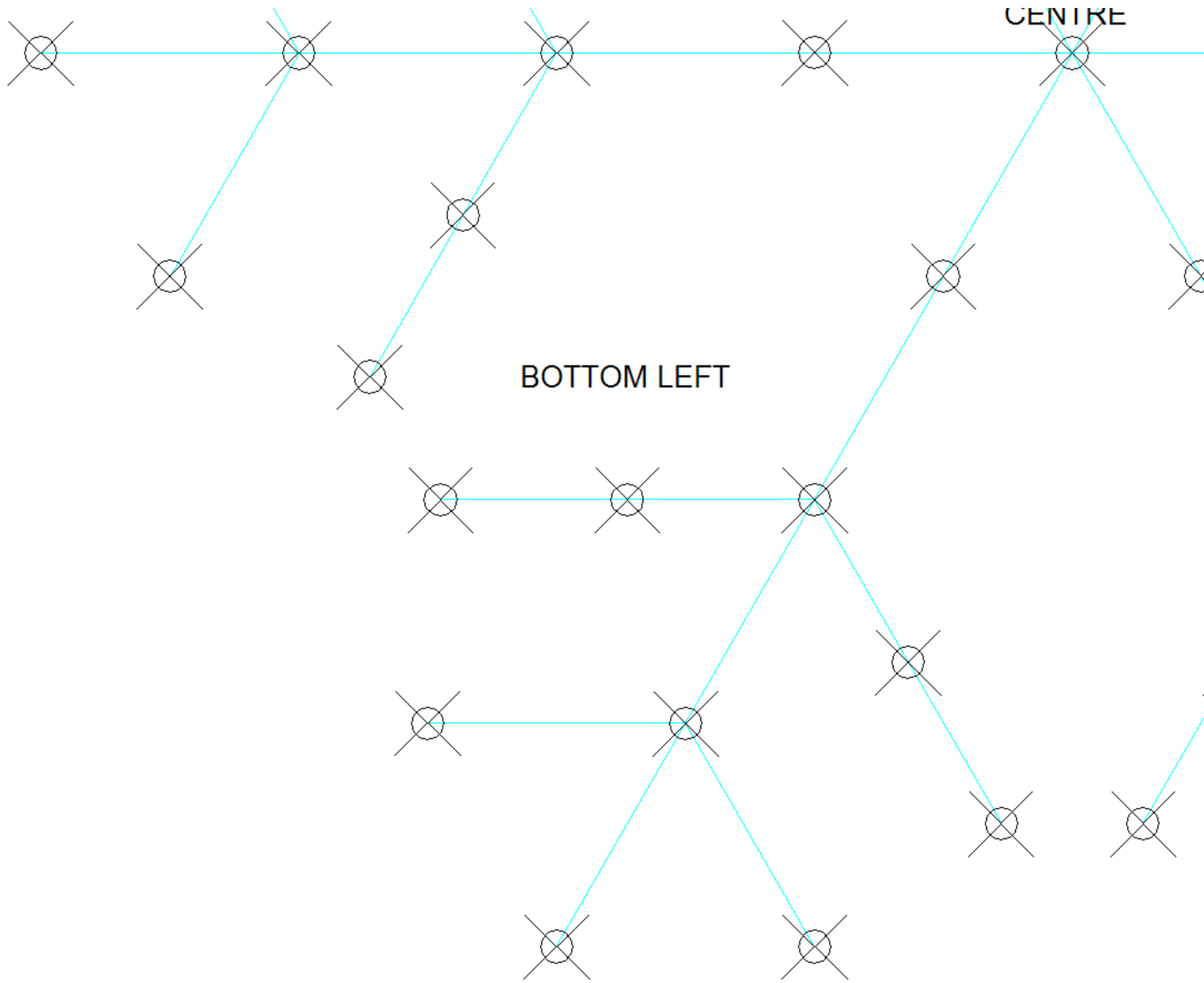
Trim excess paper at the overlapping sides (still leaving a small overlap) then join sheets with clear tape. (Hold the sheets to the light to get best alignment of the overlapped edges before finally taping them)

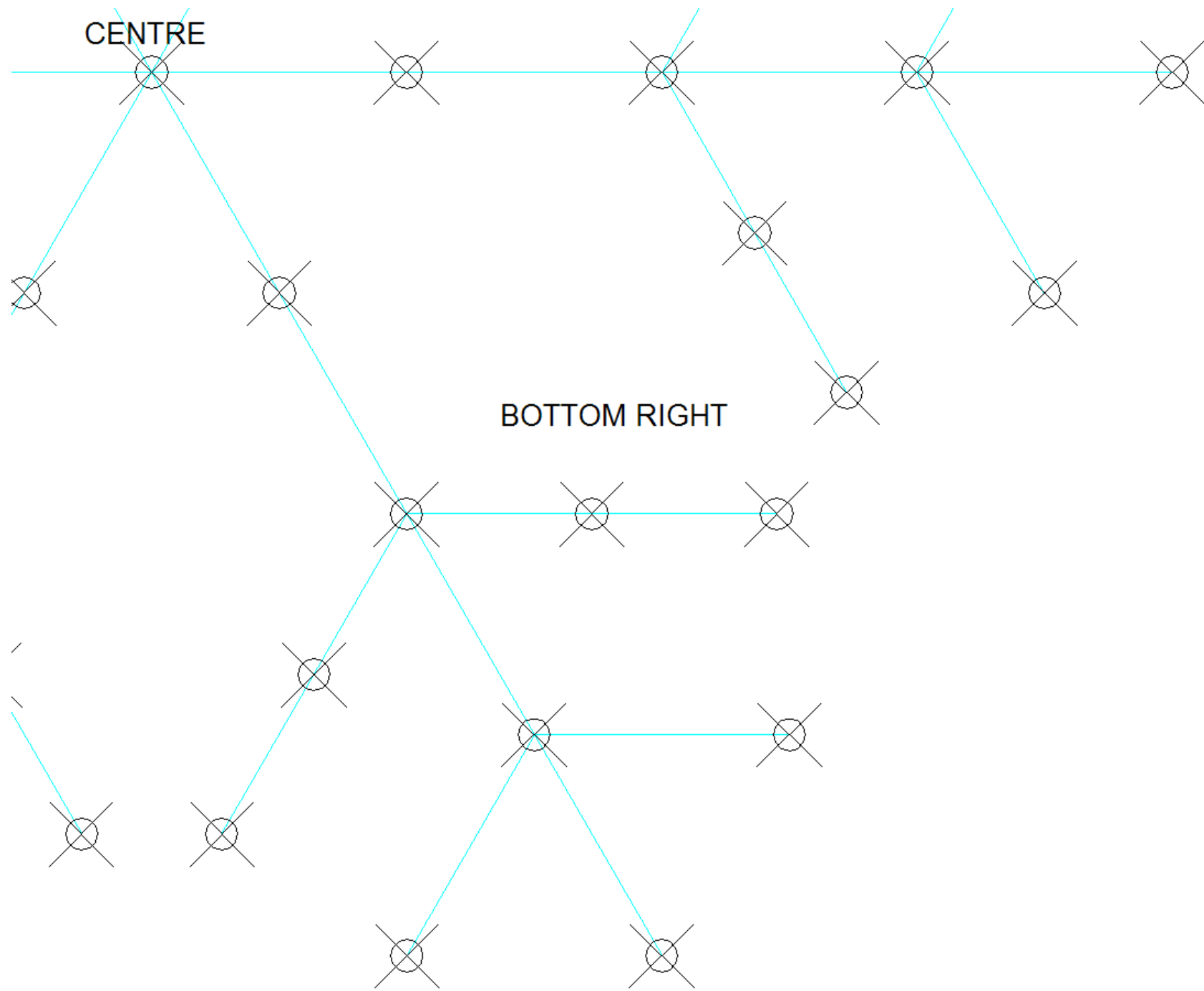
When all four sheets are taped together, trim around the outside then tape it centrally onto the plastic sheet.
It helps if you first mark the centre points of each edge of the plastic and the paper.











Drilling the LED holes

Use a sharp point to mark the plastic sheet for the centre of each hole.

Drill each hole slowly with a 5mm metal drill bit.

(Test the drill hole size first on some scrap material so that the LEDs are a firm fit in the holes).

You can also now drill two holes in the top corners of the sheet to attach string for hanging it in a window.

Using the PCB as a template, mark and drill four 3.5 mm mounting holes for it in the space below the centre LED.

Fit all LEDs with the flat side (short lead) towards the top of the sheet.

If any are a loose fit, apply a drop of general purpose clear adhesive to the side of the led before pushing it into the hole.

Wiring the LED Anodes and Cathodes

The diagrams on the next two pages show colour coded guides to wiring the LED anode and cathode connections.

A cathode connection is the shorter lead adjacent to the flat side of each led.

Using thin, single strand insulated wire. Make the connections by carefully stripping just enough insulation to wrap the wire around each led lead without cutting the wire.

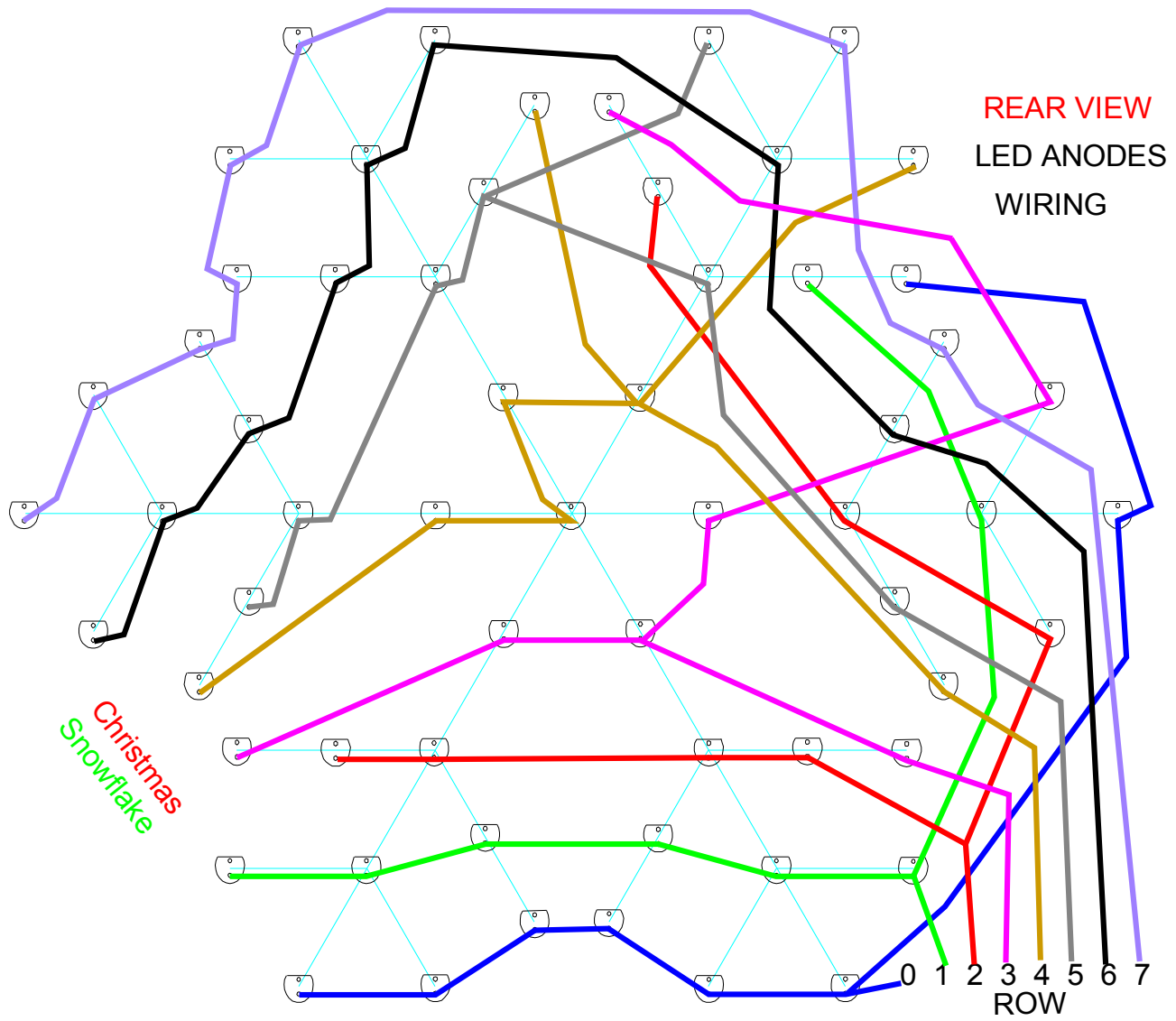
Leave plenty of wire free for connecting each wire to the pcb which is intended to fit in the space under the centre led.

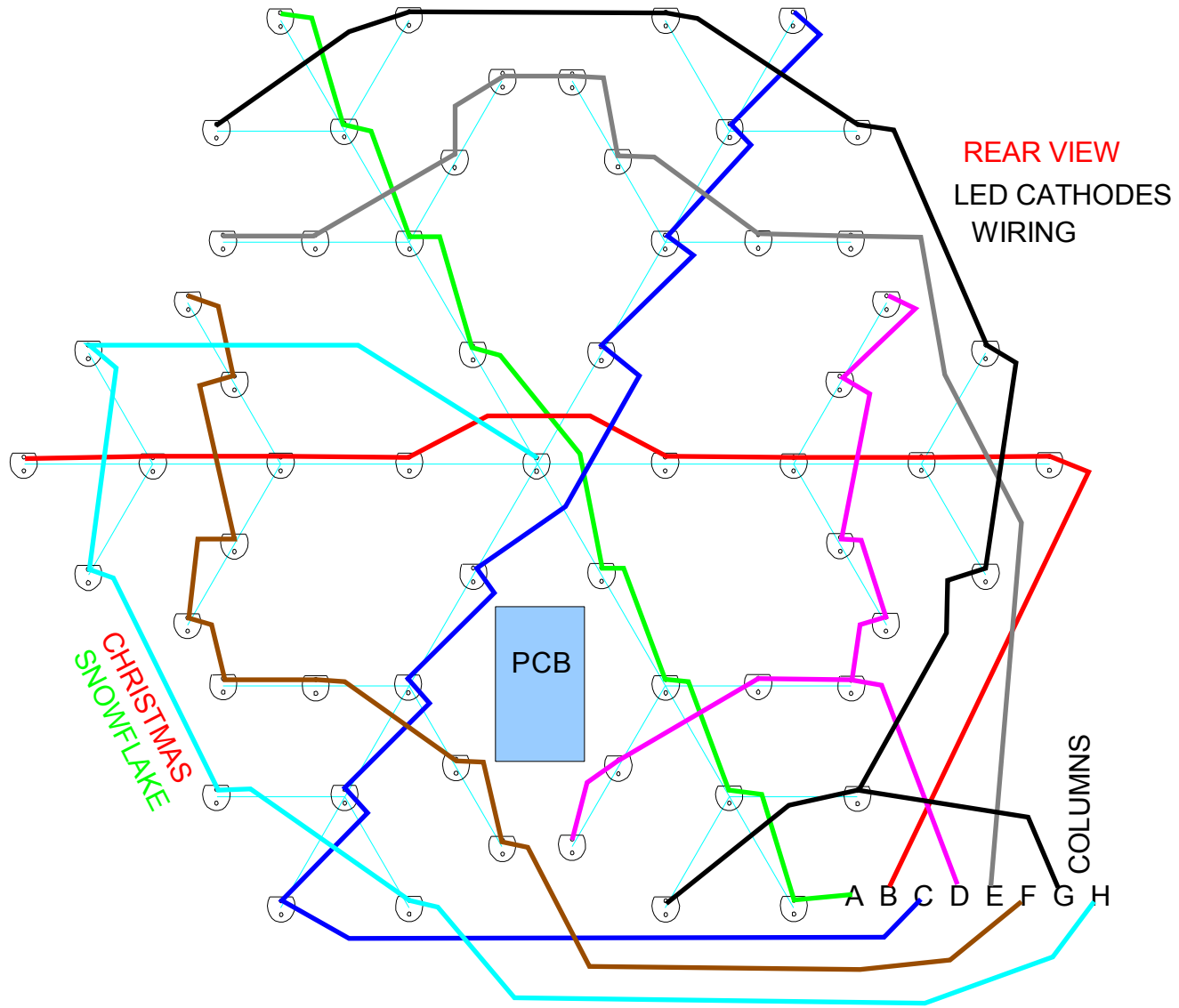
Do not solder the leads closer than about 5mm from each LED and trim the surplus lead length after making a connection.

(**TIP:** Hold each LED lead while trimming to prevent it flying off.)

Use small pieces of PVC tape or sticky labels to mark each Row/Column wire to make it easier to identify when connecting to the PCB.

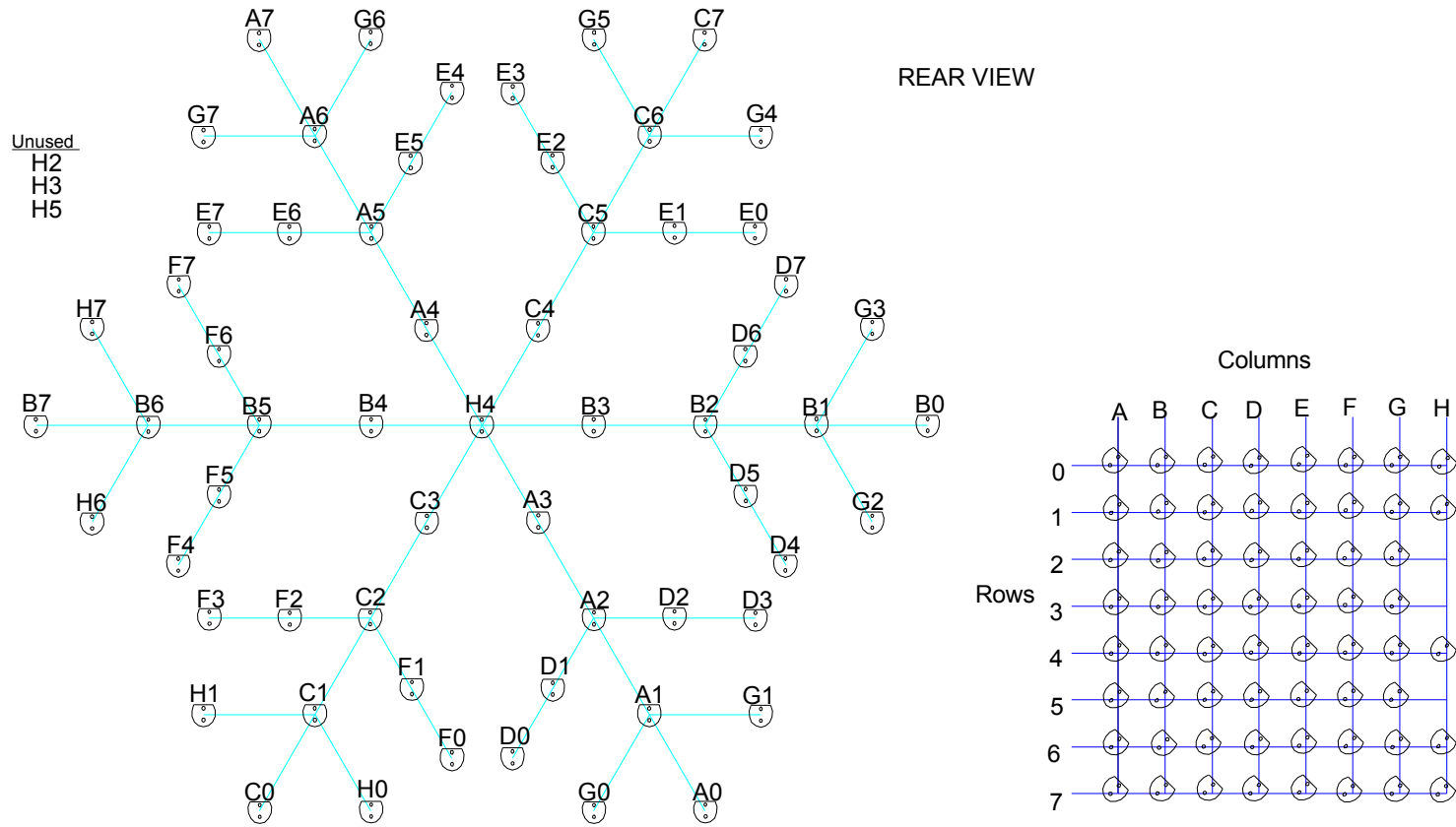
The trimmed LED leads are quite sharp – you may want to cover them over later using another similar sized plastic sheet.





Matrix Diagram

This diagram identifies each LED in the matrix – useful for locating any wiring errors or faults.

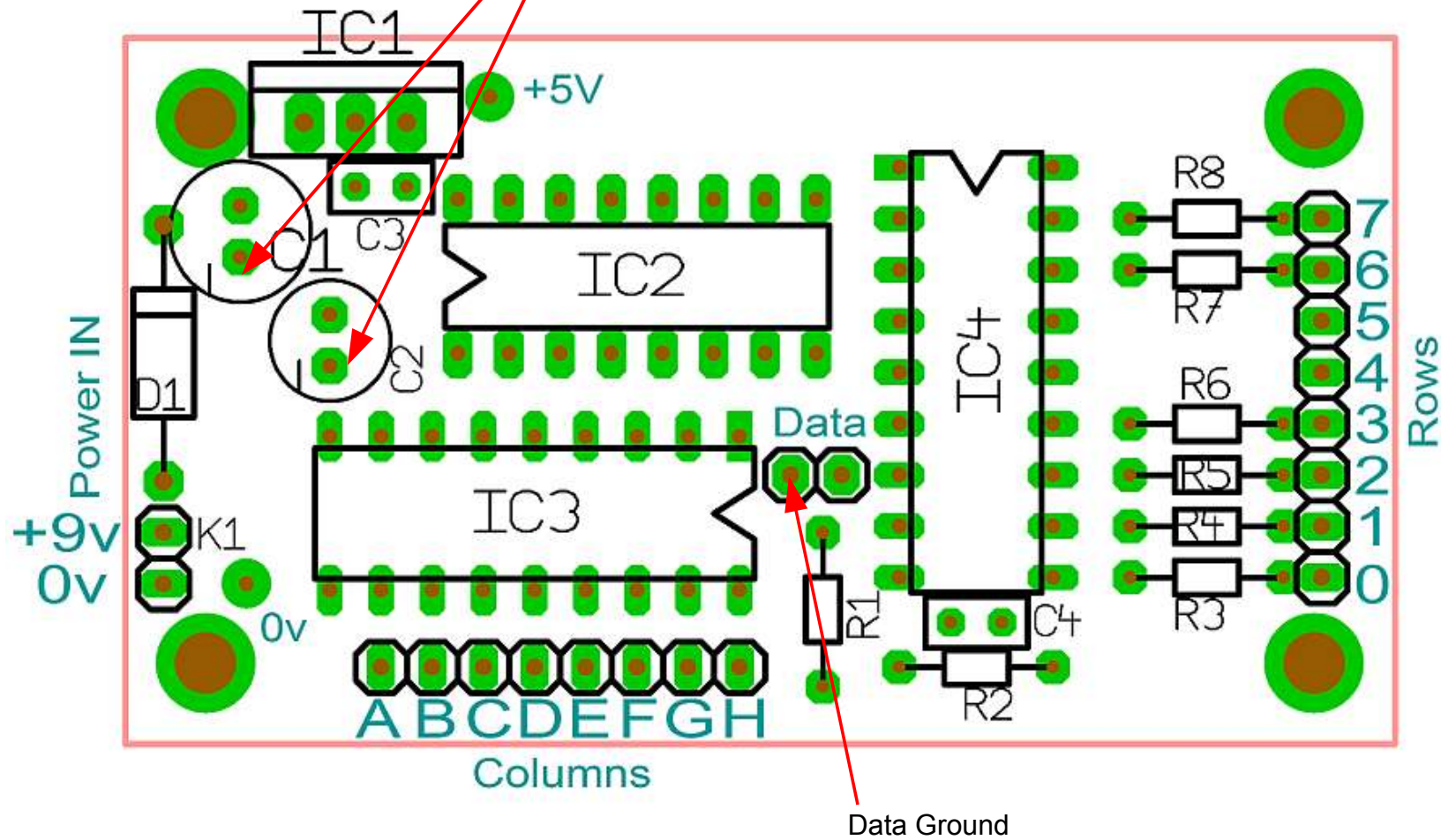


Component Layout (top view)

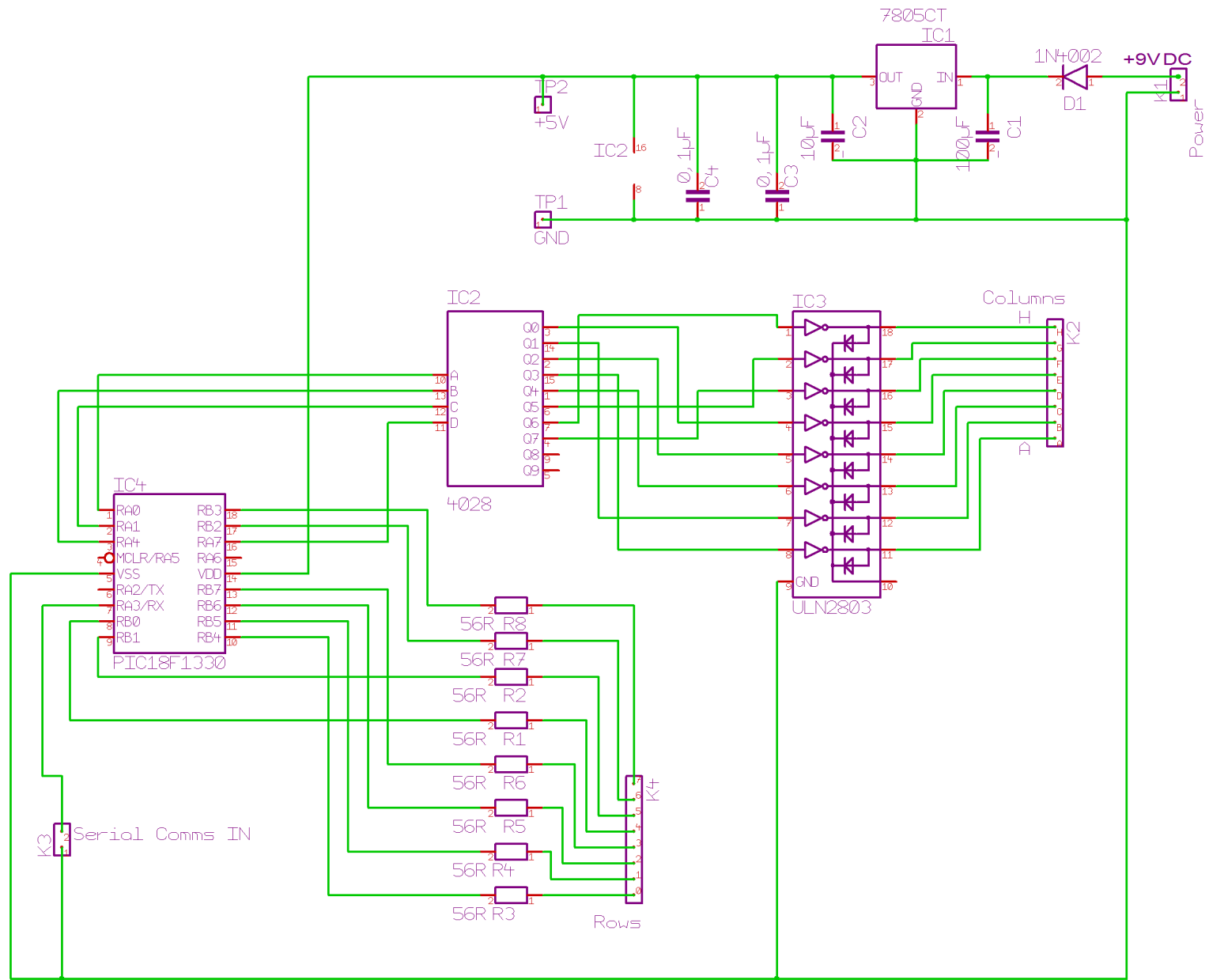
Note capacitors polarity for C1 & C2 (-ve side is marked)

Use a socket for the microcontroller chip IC4.

Double check the orientation of each chip as you fit it. (they all face in different directions to greatly simplify the pcb layout)



Circuit Diagram



Circuit Description

The snowflake is controlled by a PIC18F1330 microcontroller (ic4). It multiplexes the 8x8 LED array by sequential turning on one column at a time then sending 8 bits of data to the 8 LEDs in that column before moving on to the next.

This occurs much too fast for the eye to notice any flicker.

The microcontroller selects the column to turn-on via a logic chip (ic2), a 4028 BCD to Decimal decoder. This is needed in this design as the microcontroller does not have enough outputs to address the columns directly.

Only 8 outputs of the 4028 are used and these can be controlled using only 3 ports of the microcontroller (although a fourth port is actually used so that all of the columns can be turned-off when needed)

The 4028 drives a ULN2803 8 way transistor array. This chip has outputs easily capable of supplying enough current to light all 8 leds in each row.

The row leds are driven directly by the microcontroller via current limiting resistors as each output will only have to light one led in a column. Each microcontroller port can handle 25mA max . As the display is multiplexed, it is possible to get-away with higher peak currents by using smaller value resistors although I do not recommend it!

Power is provided via a 5 volts regulator ic1. The power consumption is quite low though and if you have already built one of my Christmas stars, you could just run a length of wire from it's 5 volts regulator output directly to the "TP2" 5 volts connection and not bother fitting ic1.

Testing

After fitting all components to the pcb except the microcontroller, visually inspect the board to check for solder splashes, dry joints etc. (also use a multimeter to check power supply tracks for shorts if you have one.)

Apply power and check the voltage between TP1 & TP2 is 5 volts if you have a meter.

If all OK, fit the microcontroller in it's socket and apply power.

All leds should light-up for a few seconds at power-on. If some do not light, turn-off the power and check their connections.

During the actual display, check the led patterns for symmetry and rectify any wiring mistakes by tracing led connections and comparing them to the anodes and cathodes wiring diagrams.

Parts List

Component	Value	Notes
C1	100 μ F	25v working electrolytic
C2	10 μ F	16 or 25v working electrolytic
C3	0,1 μ F	Small 50v type
C4	0,1 μ F	Small 50v type
D1	1N4002	Or 1N4001
IC1	7805CT	Standard 5V regulator
IC2	CD4028BE	Or equiv. (BCD to decimal decoder)
IC3	ULN2803	Or ULN2803A (Darlington Transistor array)
IC4	PIC18F1330-I/P	Microchip PIC microcontroller (use an IC socket)
R1	56R	All resistors are 0.25W carbon
R2	56R	
R3	56R	
R4	56R	
R5	56R	
R6	56R	
R7	56R	
R8	56R	
LEDS		

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