Creating Drill Templates using METAPOST

(and a Snowman too)

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Overview

For prototyping, paper templates provide a quick and accurate way to perform drilling, routing or cutting operations. The METAPOST picture-drawing language provides an easy way to create these templates. METAPOST implements a picture-drawing language similar to Knuth's METAFONT except that the output is PostScript.

Heatsink Drill Template

The drill template in figure 2 is used to drill and tap holes for mounting five Lumiled Luxeon Star LEDs on a heatsink.

Lines 14-30 define a function that draws an LED outline and two mounting holes. To draw the outline a square path is created and then drawn by shifting the lower-left corner to the appropriate coordinates.

Lines 32-41 define a function to draw a mounting hole outline with crosshairs. A path is defined for each of the crosshair lines. The mounting hole outline and crosshairs are drawn with a line thickness of 1pt.

Lines 44-64 draw the heatsink template. The point z0 is used to offset the template drawing on the output page.

Lines 52-55 output a top and bottom outline. p1 is the path containing the bottom outline. To get the top outline p1 is reflected about the horizontal centerline of the heatsink.
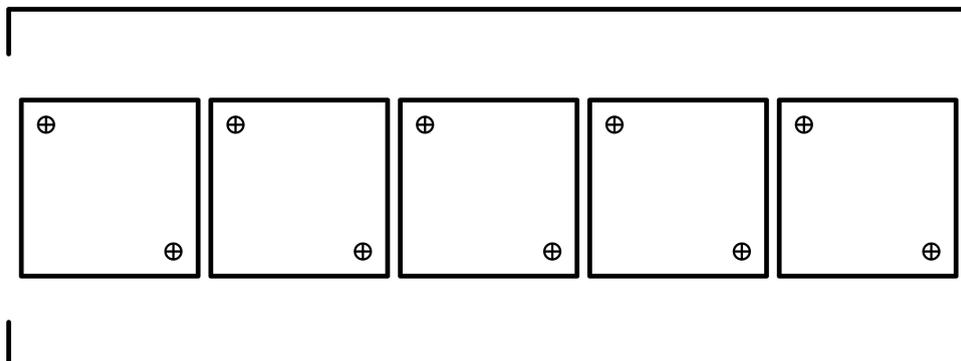
Lines 59-62 equally space the LEDs across the heatsink.

Figure 1: Heatsink Template for Mounting Five Luxeon Star/C LEDs

Listing 1: Heatsink Template

```metapost
1   L = 25mm;        % length of Luxeon/C (x direction)
2   W = 25mm;        % width of Luxeon/C  (y direction)
3
4   % 4-40 thread requires a drill size of #43 (0.089)
5   % for soft metals
6
7   d = 0.089in;          % diameter of drill bit
8   offset=3.5mm;         % distance from the edge of the Luxeon/C to the mounting hole
9   HS_length=5.34375in;  % length of the heatsink (5 11/32")
10  HS_width=2in;         % width of the heatsink
11
12  % (x, y) is the lower-left corner of the LED
13
14  def draw_led(expr x, y) =
15    save p;
16    path p[];
17    p1 = (0,0)--(0,L)--(L,L)--(L,0)--cycle; % body of the Luxeon/C
18
19    % draw the Luxeon/C body with line thickness of 2pt
20
21    pickup pencircle scaled 2pt;
22    draw p1 shifted (x,y);
23
24    % draw the mounting holes, upper left and lower right, and
25    % crosshairs with a line thickness of 1pt.
26
27    draw_mounting_hole(x+offset,y+W-offset); % upper left
28    draw_mounting_hole(x+L-offset,y+offset); % lower right
29
30  enddef;
31
32  def draw_mounting_hole(expr x,y) =
33    save p;
34    path p[];
35    p1 = (-d/2,0)--(d/2,0); % horizontal line across the drill hole diameter
36    p2 = (0,-d/2)--(0,d/2); % vertical line across the drill hole diameter
37    pickup pencircle scaled 1pt;
38    draw fullcircle scaled d shifted (x,y);
39    draw p1  shifted (x,y);
40    draw p2  shifted (x,y);
41  enddef;
42
43
44  beginfig(1);
45    path p[];
46
47    z0 = (1in,1in); % offset for the laserjet
48
49    % Draw an outline to aid in positioning the template on the
50    % heatsink.
51
52    pickup pencircle scaled 2pt;
53    p1 = (0,0.25in) -- (0,0) -- (HS_length,0) -- (HS_length,0.25in);
54    draw p1 shifted z0; % bottom outline
55    draw p1 reflectedabout ((0,1in),(1in,1in)) shifted z0; % top outline
56
57    % Place five LEDs, equally spaced, on the heatsink.
58
59    spacing = (HS_length - 5L)/6;
60    for i=1 upto 5:
61      draw_led(i*spacing + (i-1)*L + x0, HS_width/2 - W/2 + y0);
62    endfor
63
64  endfig;
65
66
67
68
69  end.
```
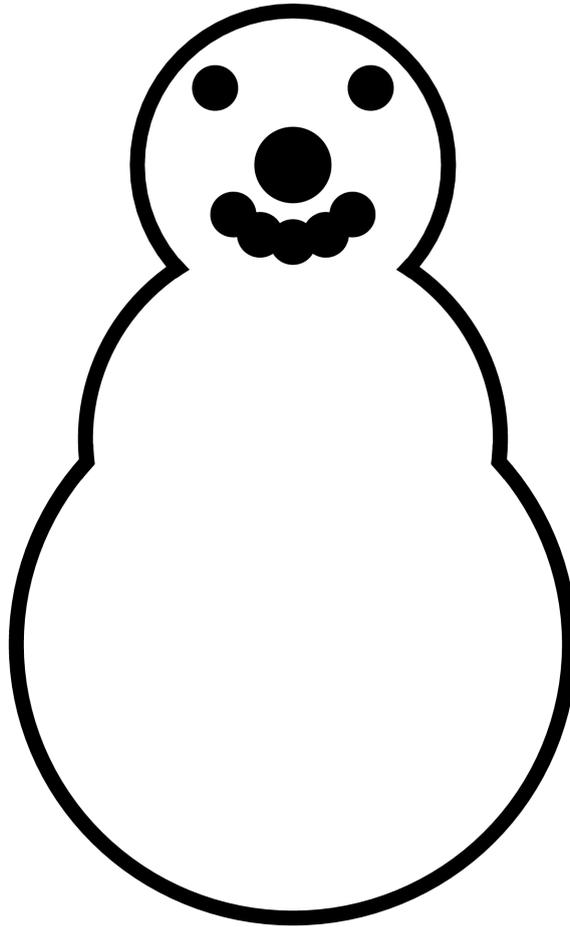
2

Snowman

Figure 2: Snowman

Listing 2: Snowman

```
1  penwidth = 4pt;
2  pageoffset = 0.5in; % margin for the laserjet
3
4  def draw_snowman(expr w) =
5    save a, b, c;
6
7    pickup pencircle scaled penwidth;
8
9    % circle centers
10
11   z0 = (w/2+pageoffset,w/2+pageoffset); % bottom circle
12   z1 = (x0,1.375w-w/2+pageoffset);      % middle circle
13   z2 = (x0,1.875w-w/2+pageoffset);      % top circle
14
15   % circle diameters
16
17   a = w;         % bottom circle
18   b = 3w/4;      % middle circle
19   c = 0.5625w;   % top circle
20
21   % draw the circles and then erase the inner lines
```

```
22
23    draw fullcircle scaled a shifted z0;
24    draw fullcircle scaled b shifted z1;
25    draw fullcircle scaled c shifted z2;
26
27    unfilldraw fullcircle scaled (a - 2penwidth) shifted z0;
28    unfilldraw fullcircle scaled (b - 2penwidth) shifted z1;
29    unfilldraw fullcircle scaled (c - 2penwidth) shifted z2;
30
31    % eyes
32
33    for i=-1 step 2 until 1:
34      filldraw fullcircle scaled 0.1c shifted (x2 + (3/16)*i*x2, y2 + c/4);
35    endfor;
36
37    % nose
38
39    filldraw fullcircle scaled 0.2c shifted z2;
40
41    % mouth
42
43    path c[];
44    c[0] = fullcircle scaled 0.1c shifted (x2, y2-c/4); % 7.85
45    for i=50 step -25 until -50:
46      filldraw  c[0] rotatedaround(z2, i);
47    endfor;
48
49
50  enddef;
51
52  beginfig(1); draw_snowman(2in); endfig;
53
54  end.
```

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References

Hobby, J. D. (1992). *A User's Manual for MetaPost* (Tech. Rep. No. no. 162).
Knuth, D. E. (1986). *The METAFONTbook* (Vol. C). Reading, MA, USA: Addison-Wesley.

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