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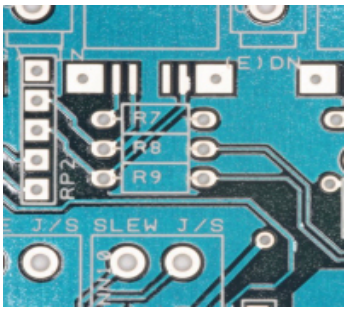

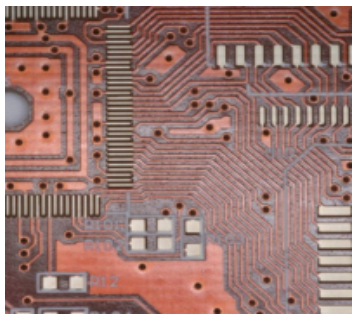

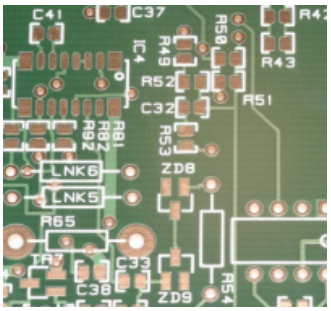

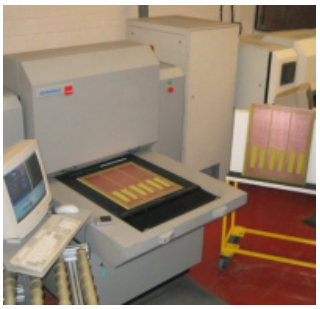

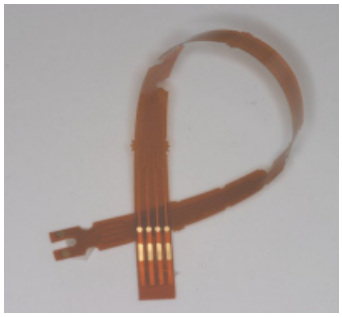

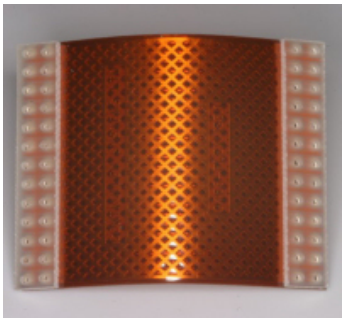

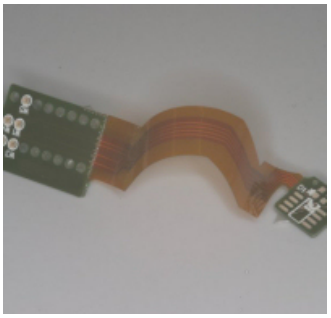

M1035 IECQ-CECC

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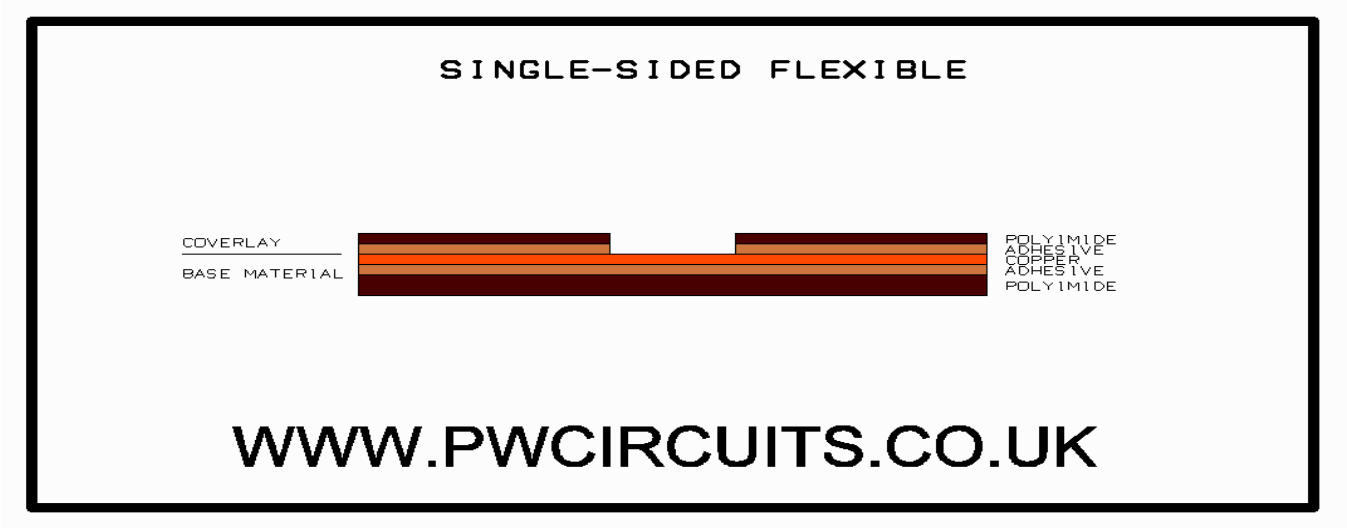
Flexible & Flexi–Rigid PCB's

Flexible PCB's are now being used in place of traditional FR4 in a large number of different applications, Benefits include solving interconnecting problems, reduction of weight, reduction of space and reduced assembly costs. Flexible applications can be dynamic flexing (designed for flexing or stress over a period of time at elevated temperatures) or flex & stay applications (designed for flexing once and being secured into place).

Types of Flexible & Flexi-Rigid PCB's

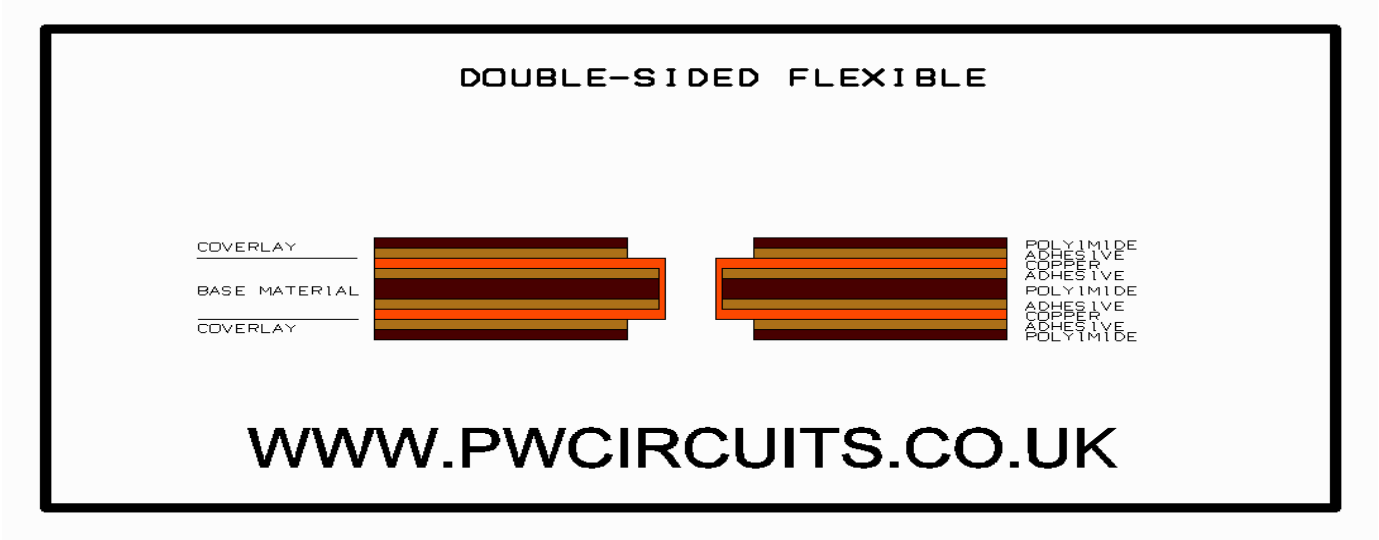
Single-sided flexible circuits are the simplest and there for cheapest, consisting of a single conductor layer on a flexible dielectric film (see figure 1) with the option of a coverlay or semi flexible liquid photo imagable solder resist (for some flex & stay applications). Parts of the flexible can be made more rigid by the use of additional stiffeners.

Figure 1



Double sided flexible circuits consist of two copper layers with a dielectric layer in between (see figure 2) normally connected with plated through holes, with the option of coverlay's or semi flexible liquid photo imagable solder resist (for some flex & stay applications). Parts of the flexible can be made more rigid by the use of additional stiffeners.

Figure 2



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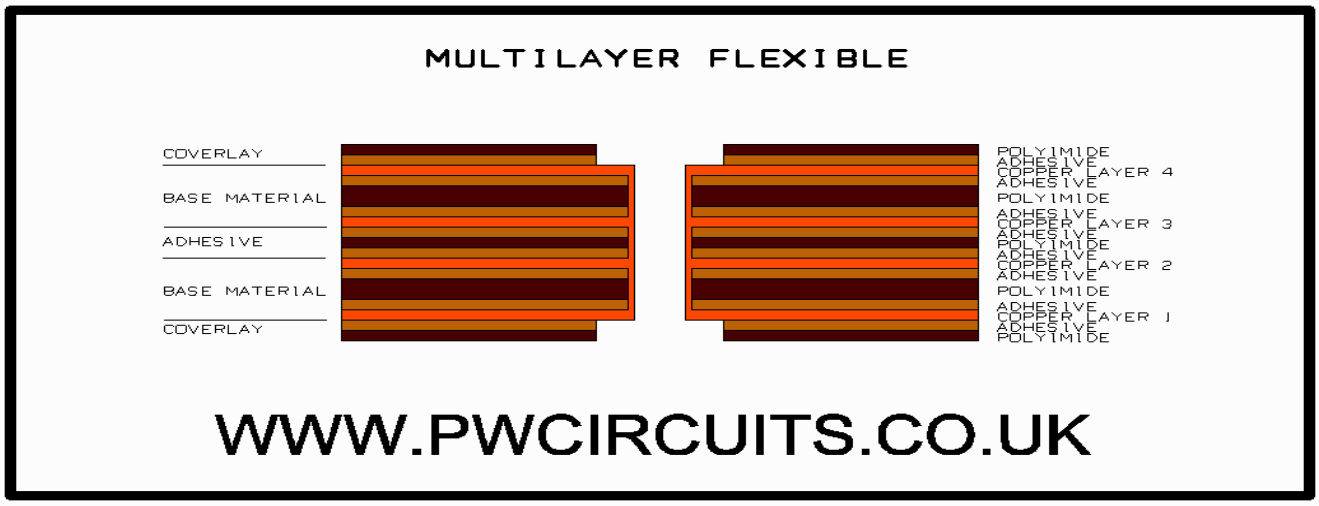
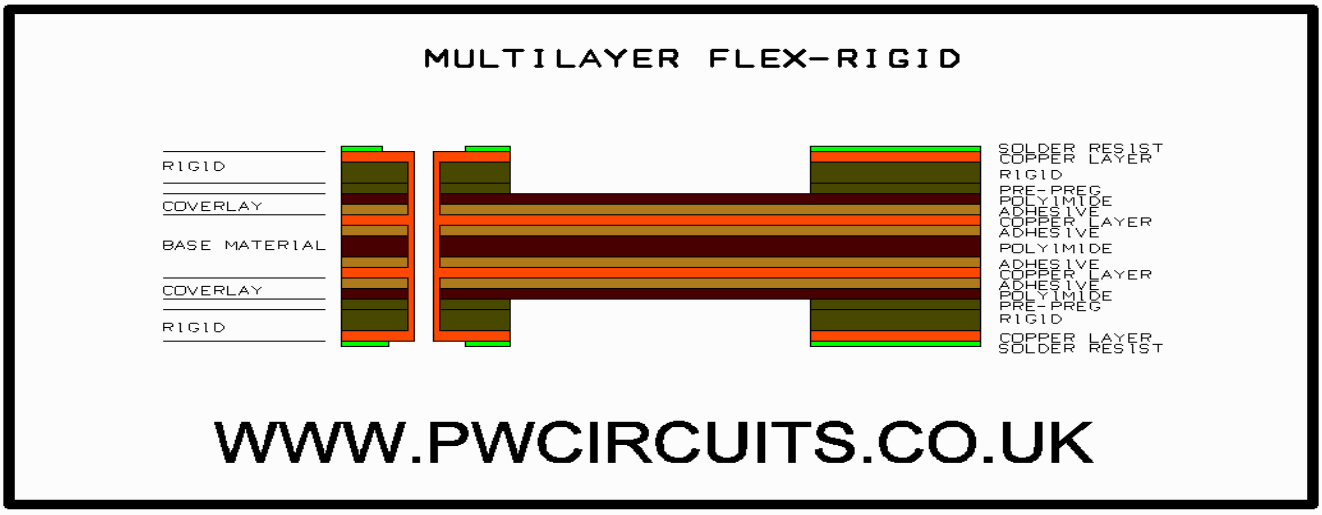
Multilayer flexible circuits consist of three or more copper layers with a dielectric layer in between (see figure 3) normally connected with plated through holes, with the option of coverlay's or semi flexible liquid photo imagable solder resist (for some flex & stay applications). Parts of the flexible can be made more rigid by the use of additional stiffeners.

Figure 3



Flex-Rigid circuits consist of a mixture of flexible copper conductor layers on dielectric film & rigid copper material (see figure 4) normally connected with plated through holes. Coverlay's are applied to the flexible copper conductor layer & liquid photo imagable solder resist applied to the rigid areas.

Figure 4



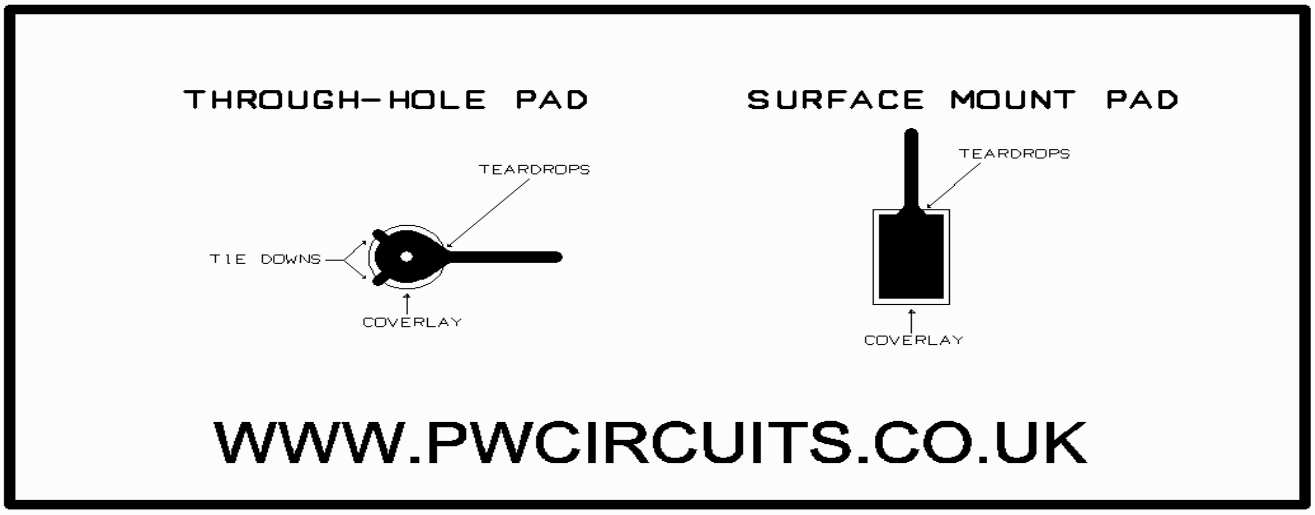
PW Circuits guidelines & material specifications

Tie downs & Teardrops

Through holes in flexible circuits should have tie downs. Tie downs are extra copper areas attached to the pad that are captured by the coverlay to anchor the copper pad to prevent delaminating between the copper and the base material (see figure 5). The adhesion of the copper on flexible material is lower than that of standard rigid material. Extra care must be taken when soldering flexible circuits.

Teardrops are the gradual transition from copper track to copper pad (see figure 5) this should be added to both through hole pads and surface mount pads to reduce stress points, this helps eliminate braking during flexing.

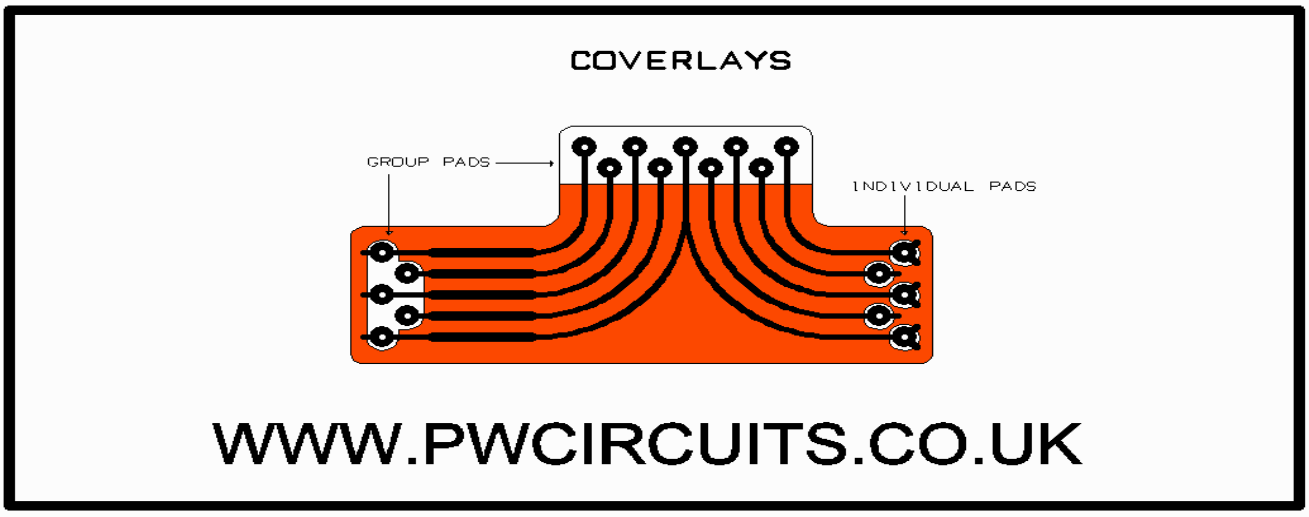
Figure 5



Coverlay Options

Coverlay is a flexible material applied to the outside layers of a flexible to insulate the copper this is normally a polyimide or polyester material. The coverlay is produced with a drilling or routing process which gives limitations to the shapes of openings, the simplest and most cost effective way is to have individual pad if space allows, a minimum of 0.008" distance is required between individual pads. The option of grouping pads is available if space is limited (figure 6). The coverlay pad should be a minimum of 0.010" larger than the copper pad. Coverlay around surface mount pads can be routed but a radius will remain from the size of the router or a laser cut process can be used to reduce the radius. Semi flexible liquid photo imagable solder resist (for some flex & stay applications) can be applied instead of a coverlay this enables any shape to be used with a minimum of 0.004" distance between individual pads.

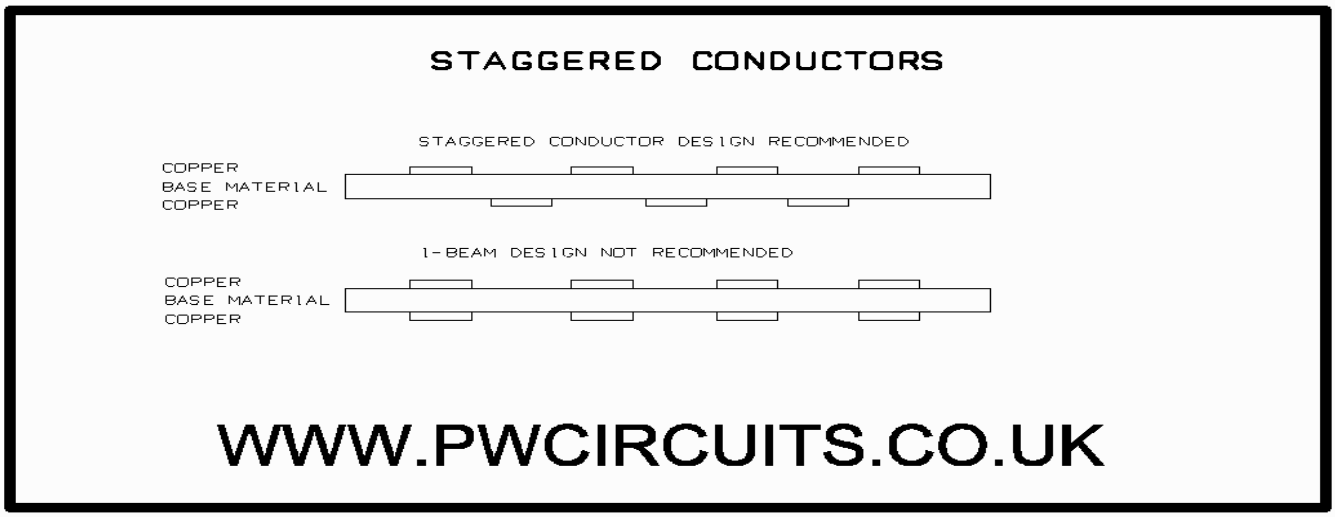
Figure 6



Staggered conductors

Staggering conductors (copper tracks) is recommended (see figure 7) as this maintains the maximum flexibility of the circuits, I beam designs occur when conductors on both layers lie directly on top of each other increase the stiffness of the circuits fold areas not recommended.

Figure 7



Fold Lines & Bend Radius

Fold lines can be added to your design by using tick marks which can be added to either the copper layers or silkscreen layers (figure 8). These ticks aid in bending your flexible in a specific position. The bend radius of your flexible should be approximately 10 times the over all material thickness including copper & a gap of at least 0.050" away from any plated through holes. Tracks should be radiused to help alleviate breaking during folding and bending, the tracks width should not change in the bend areas (figure 9).

Figure 8

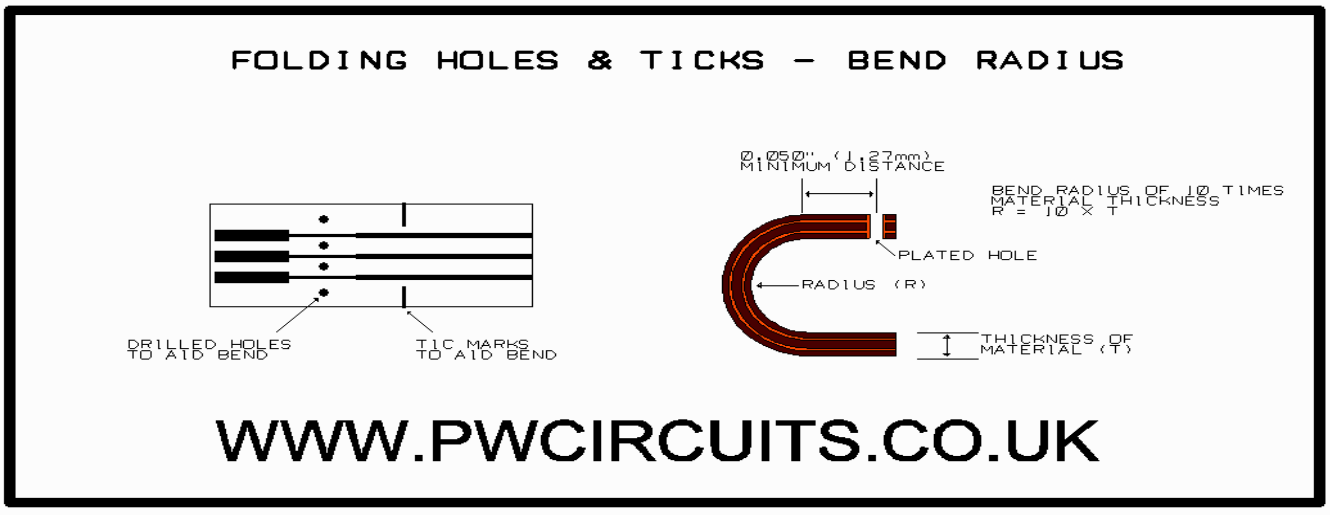
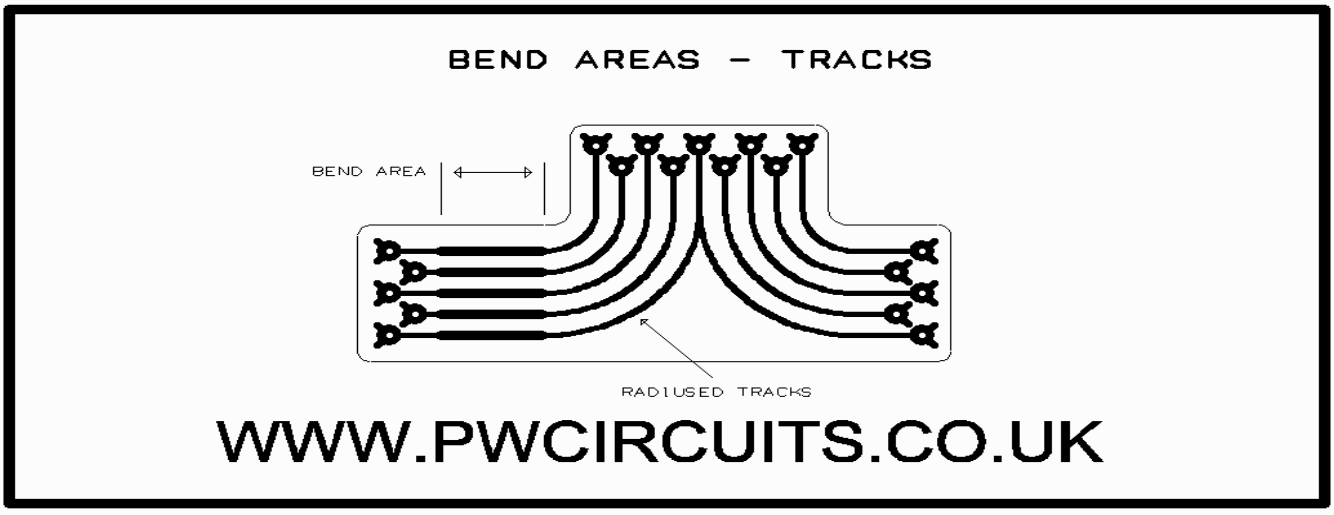


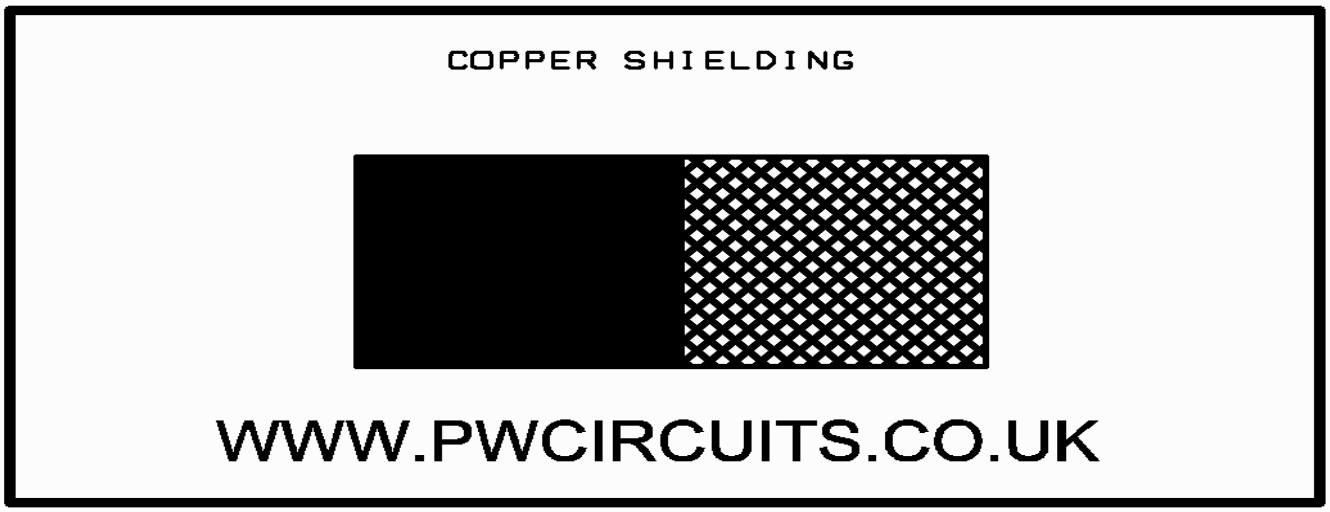
Figure 9



Copper Shielding

Solid copper shielding is the most common method but does increase the rigidity of the flexible and should be included in the thickness to bend radius calculation. Crosshatched copper shielding helps to retain the flexibility of the circuit (figure 10). Copper shielding can cover all or selective areas on one or both sides.

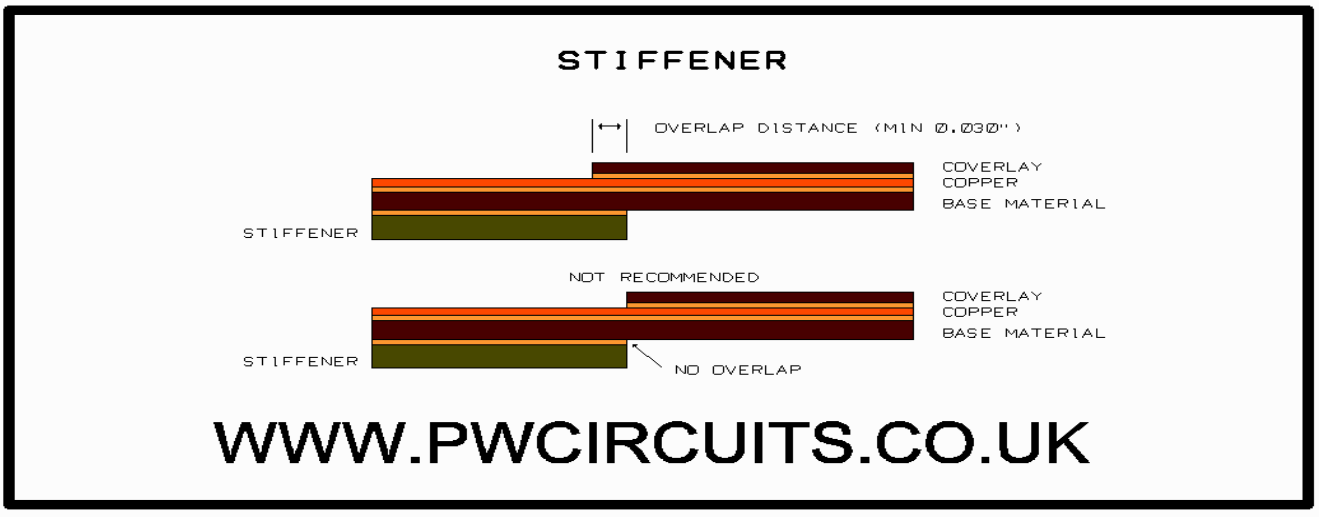
Figure 10



Stiffeners

Often application require support in areas where connectors or components are applied, most materials can be uses as a stiffener, the most common being FR4, polyimide or polyester with thickness from 0.050mm to 2.400mm. Stiffeners can be bonded using a high temperature pressure sensitive tape or a thermal setting adhesive. Holes in stiffeners should be 0.015" larger than the hole in the flexible to allow for registration. The position of the stiffener should overlap the coverlay by a minimum of 0.030" so there is no common ending, this will remove the potential for stress and cracking (figure 11)

Figure 11



Base Materials

The information below is standard for most base materials but for more information on flexible materials visit our links page for the material manufactures web sites. Base material copper thickness of 5, 9, 18, 35, 70 and 105 microns are available on one or both sides, base material polyimide thickness of 12, 25, 50, 75 and 125 microns are available standards are 25 & 50 microns. Coverlay polyimide thickness of 12, 25, 50, 75 and 125 microns are available standards are 25 & 50 microns with the adhesive thickness of 12, 25 and 50 microns. FR4 & polyimide Stiffeners from 0.050mm to 2.400mm or higher.