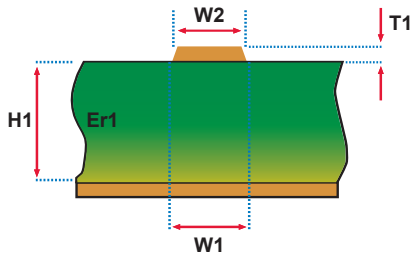
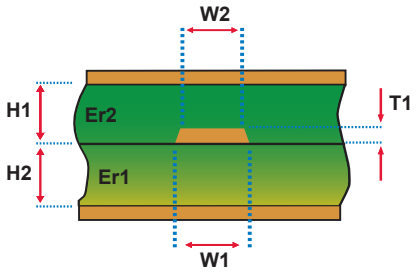
Flex & Rigid-Flex Controlled Impedance Design

Common Impedance Configurations

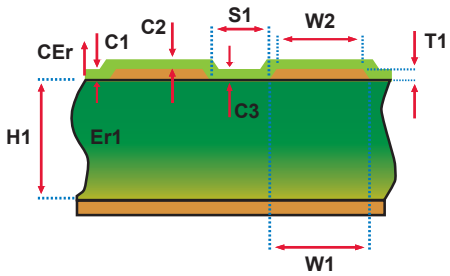
Surface Microstrip



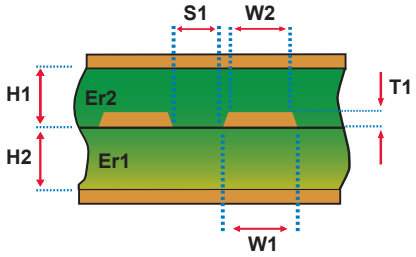
Offset Stripline



Edged-Coupled Coated Mircostrip



Edge-Coupled Offset Stripline



Common Configurations

Most common configurations are the 2-layer surface micro strip and the 3-layer stripline. These apply to both single ended and edge coupled differential pair circuitry.

Rigid-Flex Design Consideration

Typically requires the impedance configuration in the flex layers to change from a surface micro-strip in the flex area(s) to a stripline once the circuitry enters the rigid areas. Dependent upon the presence of additional ground/power planes within the rigid sections.

May require thicker flex layer construction to meet impedance values.

Common Configurations

Less common impedance configurations such as offset stripline and co-planar are possible but not typically used in flex designs.

Often result in increased flex thickness which negatively impacts the flexibility, bend capability and bend reliability of the flex sections.

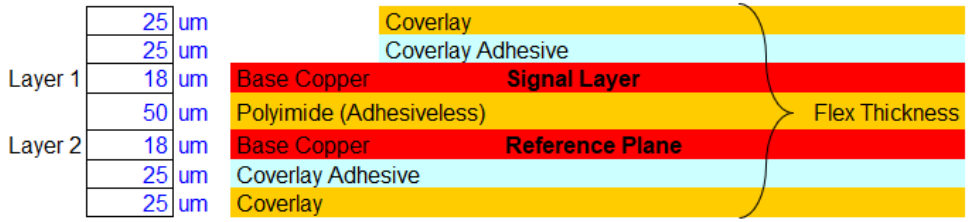
PRO TIP

The surface micro-strip is the preferred configuration, if two-sided shielding is not required. Allows for thinner flex construction, improved flexibility/bend capability and reduced part cost.

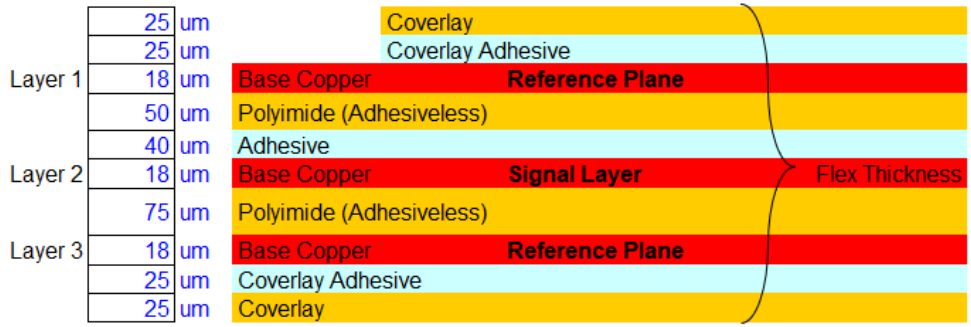
Flex & Rigid-Flex Controlled Impedance Design

Impedance Controlled Material Stackups

2 Layer Surface Micro-Strip



3 Layer Embedded Stripline



PRO TIP

For higher current circuits, investigate increased trace width(s) with ½ oz copper before increasing copper thickness to allow for thinnest flex construction.

Controlled Impedance vs Bend Capability

Controlled impedance designs require thicker than standard flex cores to achieve impedance values. Results in a thicker flex construction which reduces bend capabilities. The surface micro-strip configuration allows for the thinnest possible construction with the highest degree of flexibility and bend capability. Stripline configuration allows for two sided shielding but significantly increases flex thickness, reduces bend capabilities and increases part cost.

Preferred Copper Thickness

½ oz copper allows for thinner traces/flex cores and reduced part cost.

Trace Line Width and Spacing

Common 100 ohm differential pair configuration:

- ½ Copper
- 0.004” trace with 0.006” spacing

Common 50 ohm single ended configuration:

- ½ Copper
- 0.004” Trace

Flex & Rigid-Flex Controlled Impedance Design

Polyimide Material Properties

Polyimide					
Dielectric Constant	1 MHz	IPC-TM-650 2.5.5.3	3.2	3.2	3.2
Dissipation Factor	1 MHz	IPC-TM-650 2.5.5.3	0.002	0.002	0.002
Dielectric Strength	kV/mil	ASTM-D-149	7	7	7

Polyimide / Teflon Hybrid		
Property	**Pyralux® TK 187518R**	**Pyralux® TK 185018R**
Dielectric Constant 10 GHz	2.5	2.8
Dissipation Factor 10 GHz	0.002	0.003

Benefits of Polyimide

Polyimide flex materials are well suited for controlled impedance designs. Low DK value, homogenous material construction and tightly controlled thicknesses allow for good impedance results and design performance.

Material Types – Adhesiveless & Adhesive Based

Both adhesive based and adhesiveless polyimide flex core materials can be used for impedance-controlled designs. Adhesiveless materials are preferred for higher speed applications due to more consistent results.

Advanced Materials

Advanced materials, Teflon and Teflon/Polyimide hybrid, available for very high-speed designs. Not supported by all manufacturers and significantly more expensive than polyimide.

PRO TIP

Standard adhesiveless polyimide meets the requirements of most controlled impedance designs while minimizing costs.