PIONEER CIRCUITS, INC.

STANDARD MATERIAL STACK UPS

FLEX & RIGID FLEX CIRCUIT MATERIAL INFORMATION

MATERIALS OVERVIEW

Flex and/or rigid flex printed circuit boards typically contain copper, polyimide film and an adhesive material which are all laminated or bonded together through heat and pressure. The copper that is used comes in the form of foil for greater flexibility. Polyimide film is the non-conductive layer that surrounds the copper – it is flexible, but extremely reliable, so it is able to withstand the heat and pressure of the lamination process as well as the environment of the final end-use application. Finally, the adhesive layer is used to bond the layers together. Although acrylic is typically used as the adhesive, it may pose manufacturing problems for certain designs including squeezing into copper areas to cause electrical problems, and moisture out gassing to cause delamination or debonding. Because of this, non-acrylic and adhesiveless options are available as well. Your manufacturer will be able to advise you on the best form of bonding to use for your stack up as well as other material suggestions to avoid problems.

Using the correct materials and thickness of materials is crucial during the lamination process. **An incorrect stack up could cause defects, delamination and in some cases, can even cause the part to explode.** Your manufacturer will have different choices for materials as well as thickness, and can recommend the best options for your design. Be sure to work with your manufacturer early on in the design process to make sure your materials and stack up are ready for lamination.

The following stack ups are the typical constructions using Dupont based materials before cover-coat lamination. There are 4 different types of flex circuits (IPC-6013). Type 1 is a simple, single-sided flex circuit. Type 2 is a double-sided flex circuit. Type 3 is a multiple layer or all flex circuit, and Type 4 is a rigid flex circuit, the most complex stack up. All of these configurations are shown with cover coat on both sides of the stack up of materials.

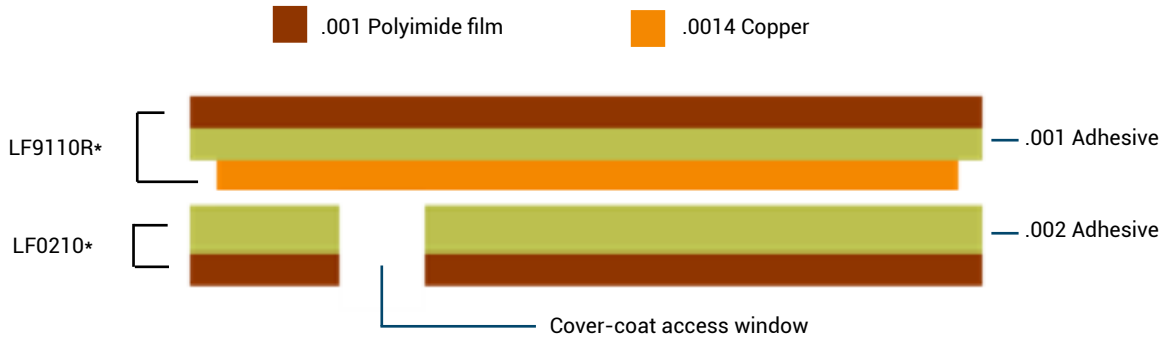
QUALITY MATTERS

Pioneer Circuits uses the highest quality materials from Hitachi, Isola, Arlon and Dupont that are specified for IPC-4101 products to MIL-S-13949 criteria.

*These codes are Dupont Material Designation

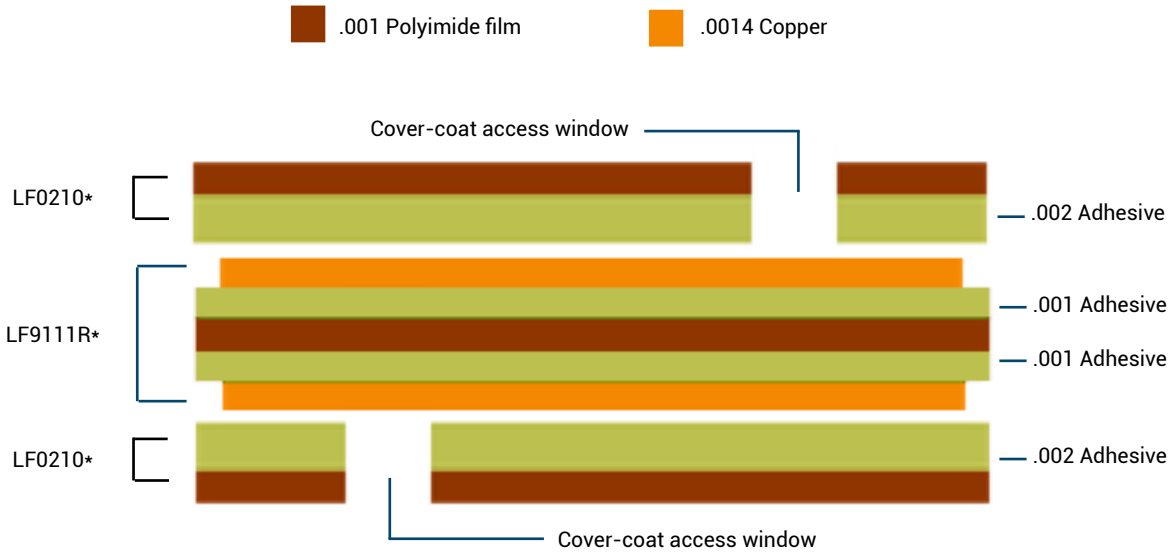
SINGLE-SIDED FLEX CIRCUIT: IPC-6013 TYPE 1

Single-layer, single-sided flex pcb's have 1 conductive layer of copper sandwiched using acrylic to bond the outer layers of polyimide film. This is the simplest form of a flex pcb. Below, we have a typical construction using Dupont base materials (LF9110R*) with cover-coat for an acrylic-based polyimide film copper clad. Our illustration represents the stack up before the lamination process.



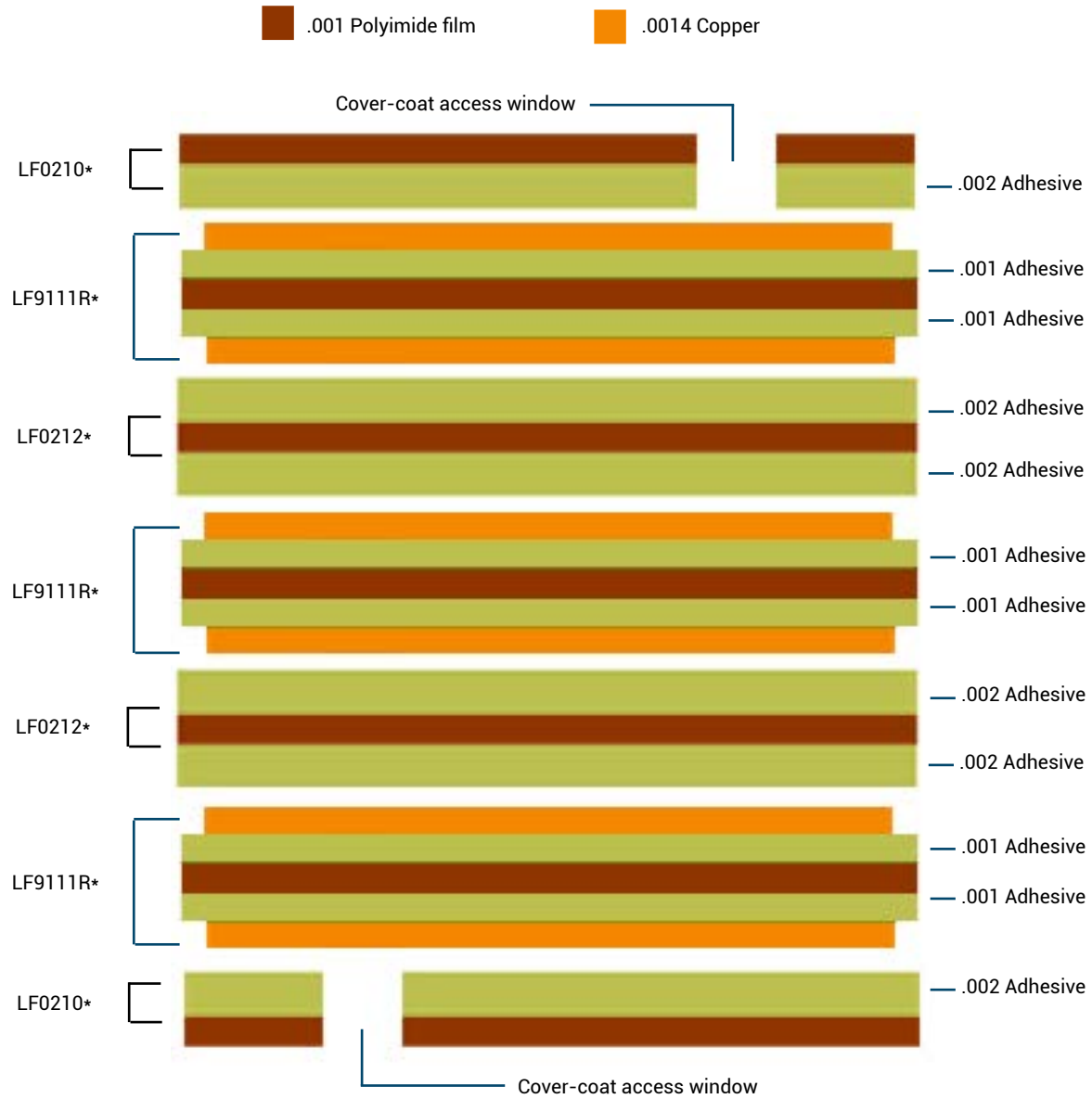
DOUBLE-SIDED FLEX CIRCUIT: IPC-6013 TYPE 2

Double-sided flex pcb's have 2 conductive layers of copper with a polyimide layer in the middle and sandwiched using acrylic to bond the outer layers of cover-coat. Below, we have a typical construction using Dupont base (LF9111R*) materials with cover-coat for an acrylic-based polyimide film copper clad. Our illustration represents the stack up before the lamination process.



ALL-FLEX CIRCUIT (MULTI-LAYER): IPC-6013 TYPE 3

Multilayer flex pcb's have 3 or more conductive layers of copper with polyimide layers in the middle, sandwiched using acrylic to bond the outers of layer cover-coat. The more layers a flex pcb has, the more complex it becomes, so make sure to work with your manufacturer to address any potential problems. Below, we have a typical 6-layer construction using Dupont-base (LF-9111R*) materials with cover-coat for an acrylic-based polyimide film copper clad. Our illustration represents the stack up before the lamination process.



**The thickness of this adhesive is the manufacturer's choice

CAUTION:

All-acrylic bonded constructions have end-use application limitations

Plated-through holes should be kept below .025 in diameter

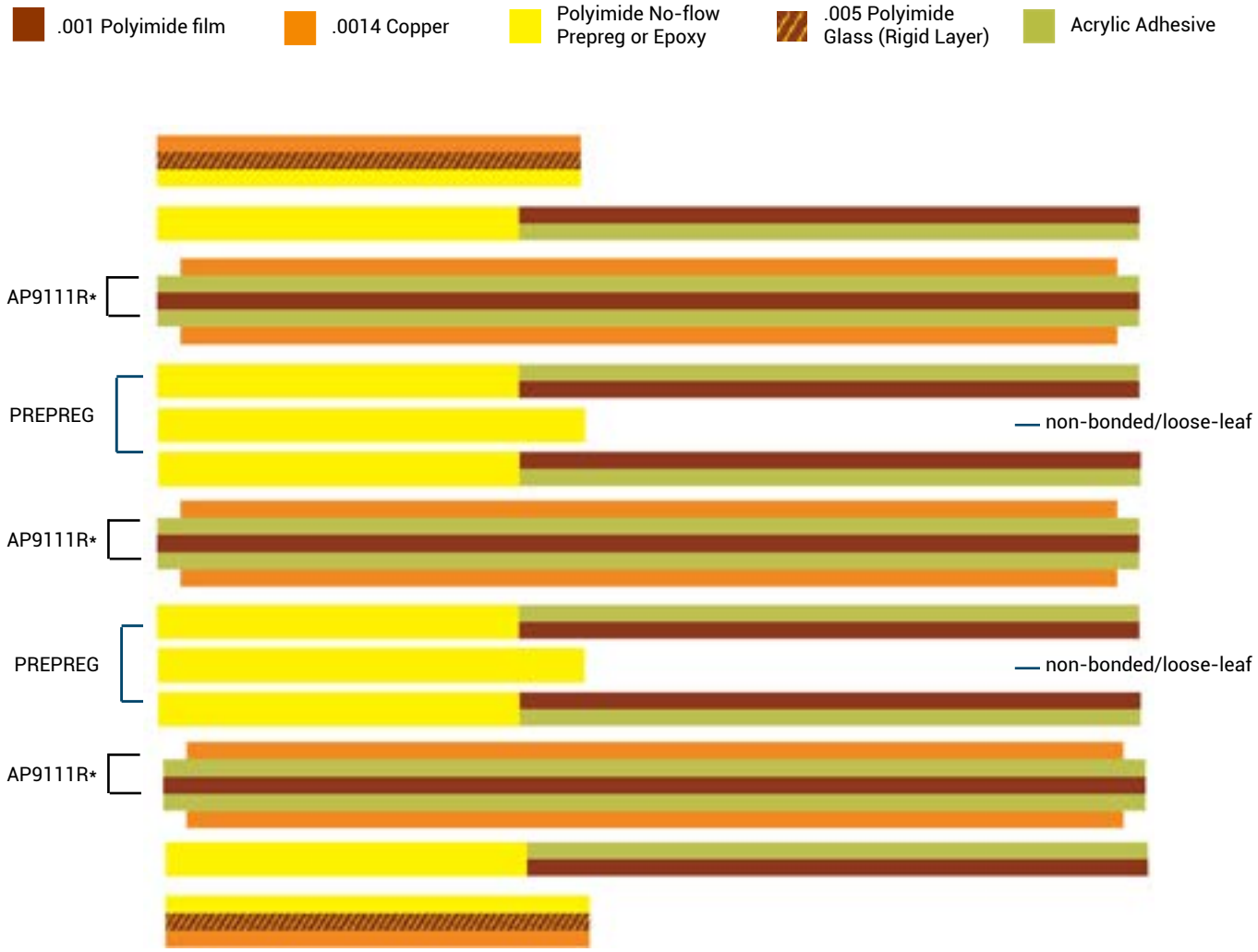
Layer count should not exceed 8 layers

For more information, please contact Pioneer Circuits' Applications Engineering and/or plan to attend our no charge Technical Training Seminar.

RIGID FLEX CIRCUIT: IPC-6013 TYPE 4

Rigid flex pcb's have both flex and rigid sections as the name suggests. The stack up is much more complicated and uses another type of bonding material along with the acrylic adhesive. Below, we have a typical loose-leaf construction using Dupont base (AP9111R*) materials and polyimide or Epoxy no flow pre-preg as the rigid section bonding material. Our illustration represents the stack up before the lamination process.***

WITH ACRYLIC ADHESIVE



***Minimum: .0035 dielectric

EXTREME CAUTION:

Acrylic constructions are not recommended for high-reliabiilty applications

Plated-through holes should be kept below .025

Layer count should not exceed 8 layers

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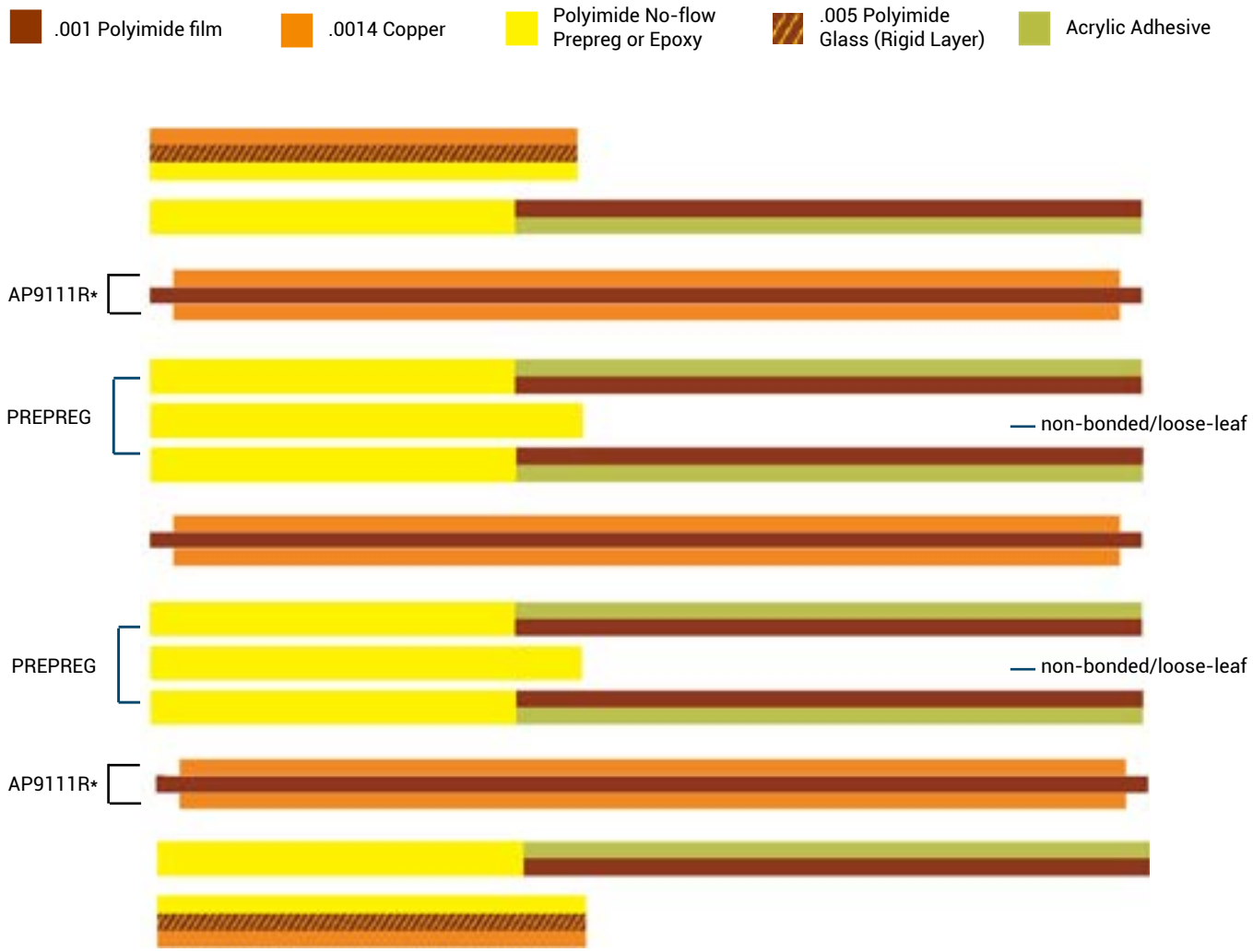
When selecting a manufacturer, it is good to choose one who has adhesiveless options for bonding. Because typical acrylic adhesives may pose manufacturing problems for certain designs including squeezing into copper areas to cause electrical problems, and moisture out gassing to cause delamination or debonding, non-acrylic and adhesiveless options should be available as well. Our illustration represents an adhesiveless rigid-flex stack up before the lamination process.***

WITH ADHESIVELESS BONDING



***Minimum: .0035 dielectric

PREFERED CONSTRUCTION:

Used in high-reliability end-use applications

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