

Flexible Substrates

Fabrication of Flexible High Density Multi-Layer Substrates

Fast Facts

1. Arbitrary shape, foldable, stackable
2. Multiple internal routing layers with high density wiring (4 routing layers shown so far)
3. Typical total thickness 20 - 60 μm

There are variety of electronic systems which need flexible substrates for components as well as next level system interconnection purposes. Based on the corresponding application scenario the flexible substrates have to support different complexities regarding a number of routing layers, intra-layer routing density and type of interconnect metallization. Fraunhofer IZM offers versatile processes for the manufacturing of high density multi-layer flex substrates. The fabrication approach features the capabilities of Fraunhofer IZMs well established wafer level redistribution technology which is applied on rigid temporary carrier wafers.

High density wiring structures are generated in semi-additive technology using seed layer deposition by PVD, mask aligner technology for pattern definition as well as electro-chemical deposition of metals and wet-chemical differential etching. Typical copper is used as wiring metallization with up to 5 μm track height and line pitches below 15 μm .

Inter dielectric layers with micro vias are fabricated by spin coating, lithographic structuring

and cure of photo sensitive polyimide precursors. A multi-layer build up is obtained by sequential alternated processing of polyimide and metal layers. With the current technology flexible substrates with up to four internal metal routing layers were fabricated so far. The proposed technology also allows the realization of electrical through contacts through the flex substrates. With that option interconnections from the bottom to the top side of the flex substrates are possible.

As further feature custom specific pad metallizations like Cu, CuSn, Au, NiAu, AuSn or AgSn can be fabricated to accommodate the flex substrate to the desired assembly and interconnection processes such as soldering, wire bonding or thermo compression bonding using conductive adhesives. Based on standard redistribution technology additional features like integrated passive components such as inductors, capacitors and resistors can be implemented into the multi-layer wiring structure of the flex substrates.

After the processing of the multi-layer build up is fully finished it will be detached from the temporary carrier wafer using a special designed high speed de-bonding process. During that process, an interface layer between the carrier wafer and the bottom layer of the flex substrate is opened so that the flex multi-layer can be peeled off. By using the described technology fully custom specific foldable or stackable flexible multi-layer substrates with arbitrary shapes and forms as well as chemical and high temperature stability can be manufactured.



Flexible Multi-Layer Substrate with High Density Copper Wiring

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