MSL RAD Front-End-Electronics
TFlex Rigid-Flex layout

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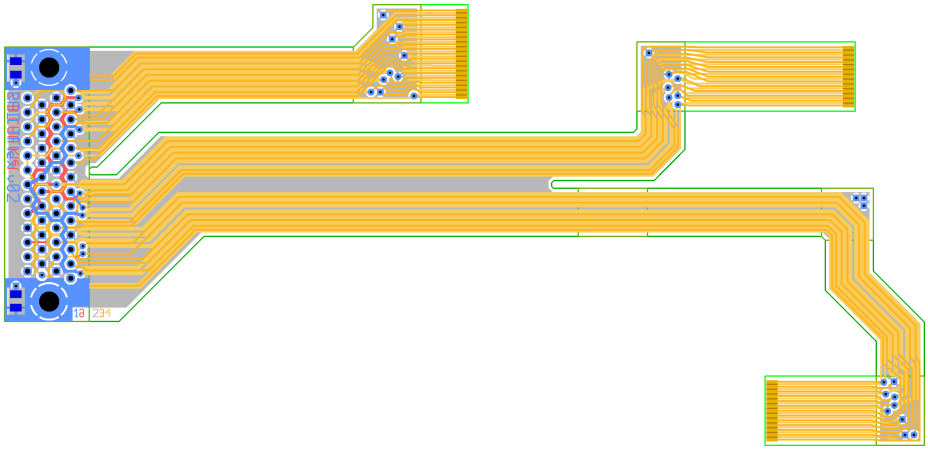


The TFlex rigid-flex board provides the electric connection from the Rad Sensor Head interface connetor (MDM 51) to the RADA, RADBC, and RADF boards of the front end electronics. The RADA and RADBC board connections are made with Omnetics Dualobe connectors, 25-pin duckbill type. The RADF board connection is made with Omnetics Dualobe connector, 37-pin duckbill type.

1 Fabrication

The board shall be made according to IPC 6013 class III standards, verified and documented.

1.1 Material

The base materials are polyimide and polyimide glass. The copper thickness on all layers is 17 μm. Surface finish on rigid areas shall be HAL Pb/Sn.

Surface finish on the *Inner Flex* for the Omnetics connectors shall be chem. Nickel/Gold.

1.2 Design Rules

The minimum trace width is 0.25 mm (10 mil), clearance 0.15 mm (6 mil), the clearance on top surfaces to copper carrying −70 V detector bias shall be 0.3 mm (12 mil).

A copper-copper clearance of 0.25 mm (10 mil) is maintained on most the layout.

The minimum via hole diameter is 0.3 mm (12 mil), with annular rings of 0.25 mm (10 mil) width.

The edge clearance of inner copper traces and pads is 0.5 mm (20 mil) minimum. The chassis ground on the rigid top layer runs to the edge.

1.3 Layers

The design has six copper layers.

The two innermost layers (3 and 4) are on both sides of a flexible Capton strip *(Inner Flex)*. These layers are exposed at three flexible branches towards the Omnetics connectors. The copper traces shall be covered by a Capton film. The total thickness at the Omnetics connector end shall not exceed 0.25 mm.

Where the *Inner Flex* layers are not exposed, they are sandwiched between two further flexible Capton strips *(Outer Flex)*, with copper planes on the outside surfaces (layers 2 and 5). The copper area shall be covered by a Capton film. The total thickness shall not exceed 0.55 mm.

On the *Rigid* areas of the TFlex, the flexible layers shall be sandwiched between polyimide glass, with copper layers (1 and 6) on the outside surfaces. The total thickness of the rigid areas shall not exceed 1.3 mm.

All vias and component through-holes are located in the *Rigid* areas. The solder pads for the duckbill type Omnetics connectors are on the *Inner Flex* layers.

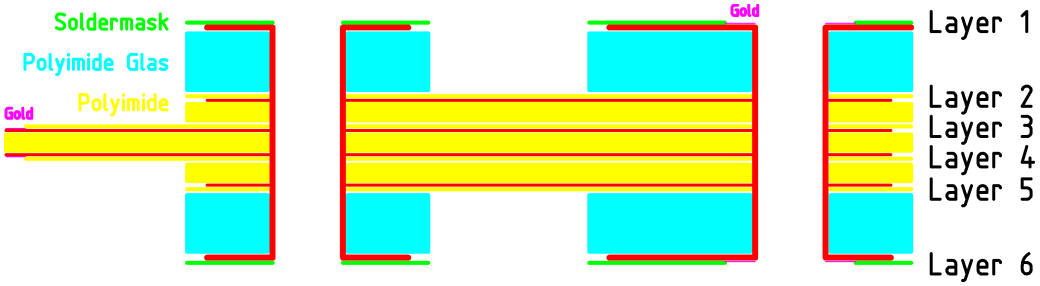


Figure 1: TFlex layer stack.

Layer order		**Gerber file**
Top Soldermask	50 μm	`v02-16.frontmask.gbr`
Top Copper Layer 1	17 μm	`v02-16.group0.gbr`
Rigid Base	275 μm	`v02-16.group6.gbr`
Cover	50 μm	
Copper Plane Layer 2	17 μm	`v02-16.group1.gbr`
Outer Flex Base	50 μm	`v02-16.group7.gbr`
Adhesive	50 μm	
Top Flex Mask	50 μm	`v02-34.frontmask.gbr`
Copper Layer 3	17 μm	`v02-34.group2.gbr`
Inner Flex Base	50 μm	`v02-16.group8.gbr`
Copper Layer 4	17 μm	`v02-34.group3.gbr`
Bottom Flex Mask	50 μm	`v02-34.backmask.gbr`
Adhesive	50 μm	
Outer Flex Base	50 μm	`v02-16.group7.gbr`
Copper Plane Layer 5	17 μm	`v02-16.group4.gbr`
Cover	50 μm	
Rigid Base	275 μm	`v02-16.group6.gbr`
Bottom Copper Layer 6	17 μm	`v02-16.group5.gbr`
Bottom Soldermask	50 μm	`v02-16.backmask.gbr`

2 Design

Figs. 3 through 5 show all the bends and twists that this board needs to do to go into the RAD sensor.

Rigid Base:	Polyimide-Glass-(GIJ)
No-Flow Pregreg	Polyimide-Glass-(GIJ)
Coverlay	25 micron Poliyimide, 25 micron Acrylic-Adhesive
Flex Base	50 micron Polyimide, adhesiveless
Adhesive	Acrylic Adhesive
Finish	electroless Sn, incl. Omnetics connector
Soldermask	Probimer 65
tickness tolerance	+/ 10%
Fabrication	IPC-60132, Class III

Möller (TL)
Brockstedt Gmbh

Figure 2: TFlex materials.

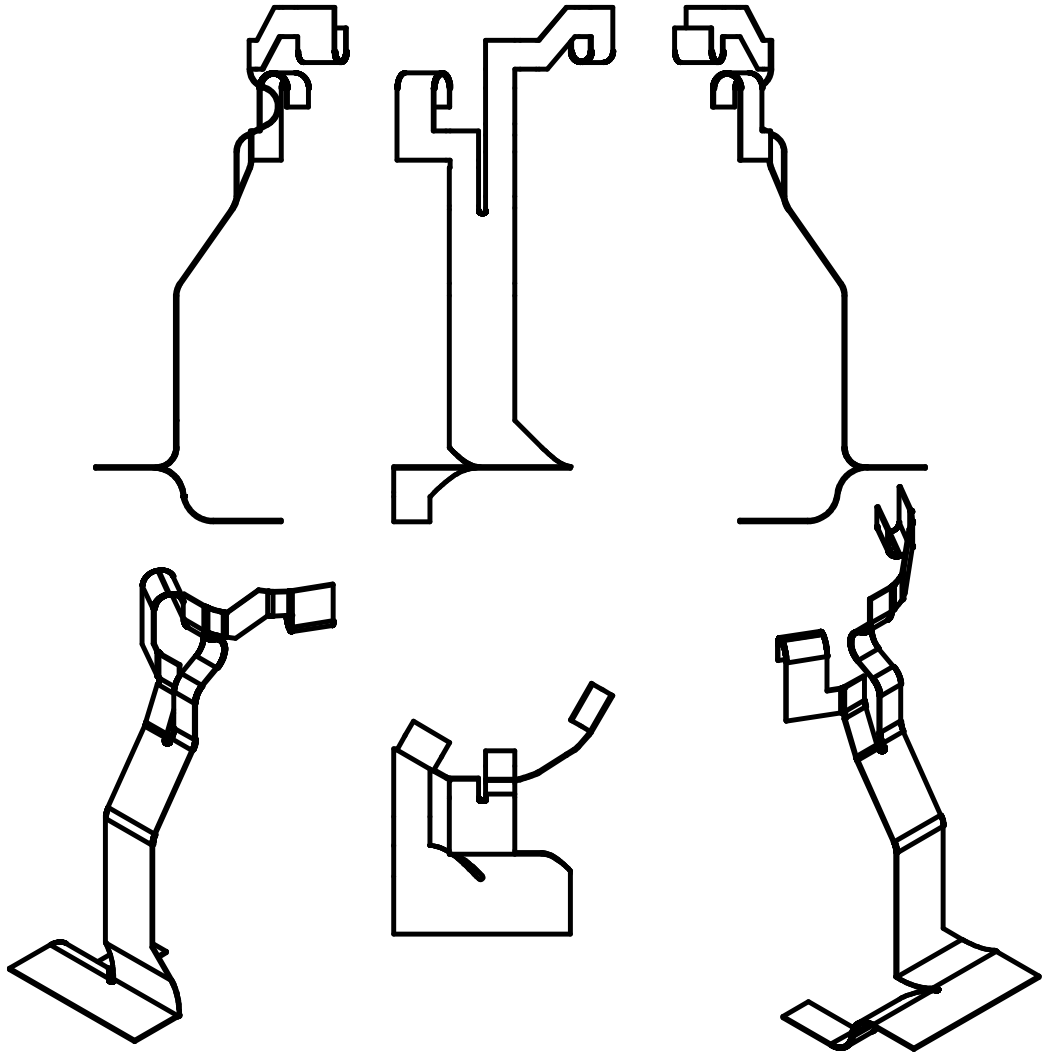


Figure 3: TFlex CAD views

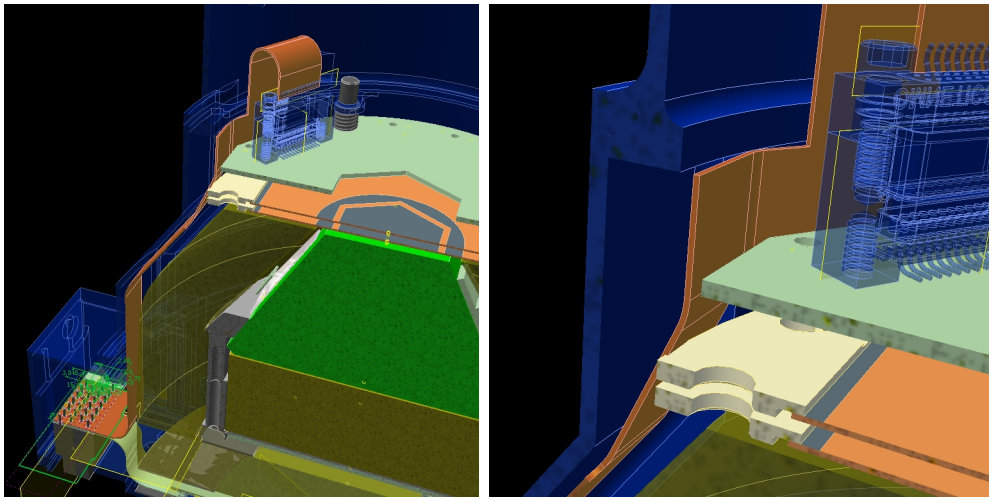


Figure 4: RADBC flex routing

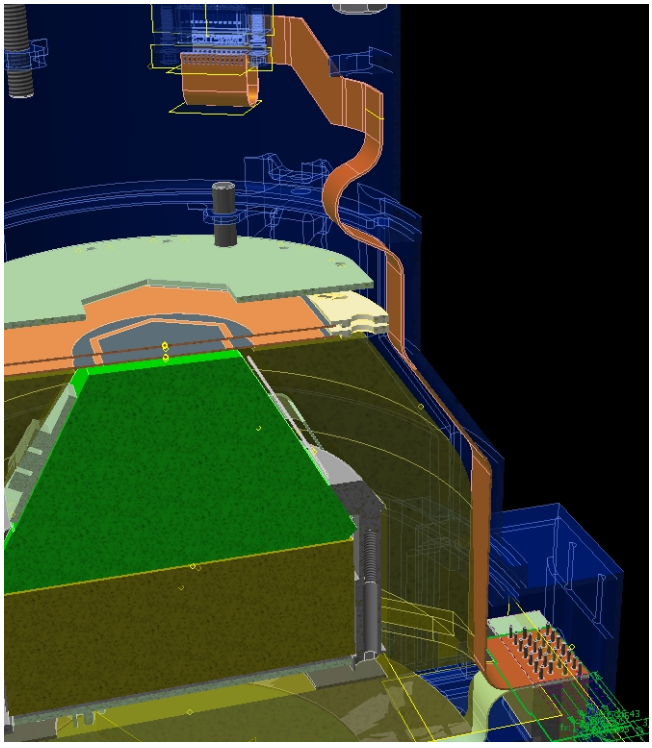


Figure 5: RADA flex routing

2.1 Tools

The design is done with GNU EDA tools. (`http://www.geda.seul.org/`) The layout tool is PCB version 20060822. GAF version is 20060824.

2.2 Schematics

Fig. 6 shows the schematics drawing of the TFlex board.

2.3 Layout

Fig. 7 shows a) the layout of the *Inner Flex* outline with copper layers, b) the *Outer Flex* layers, and c) the *Rigid* areas. Scale 1:1.

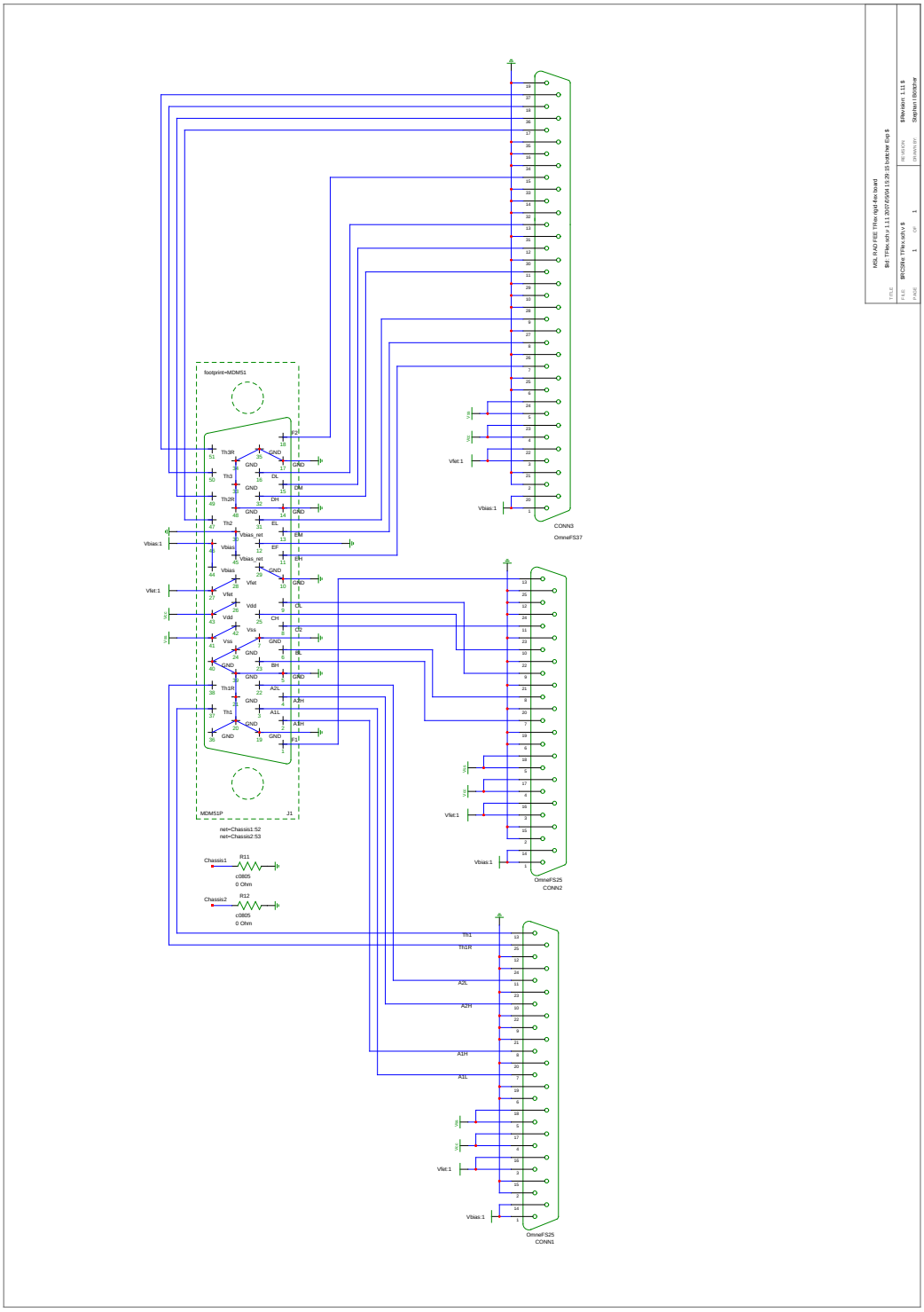
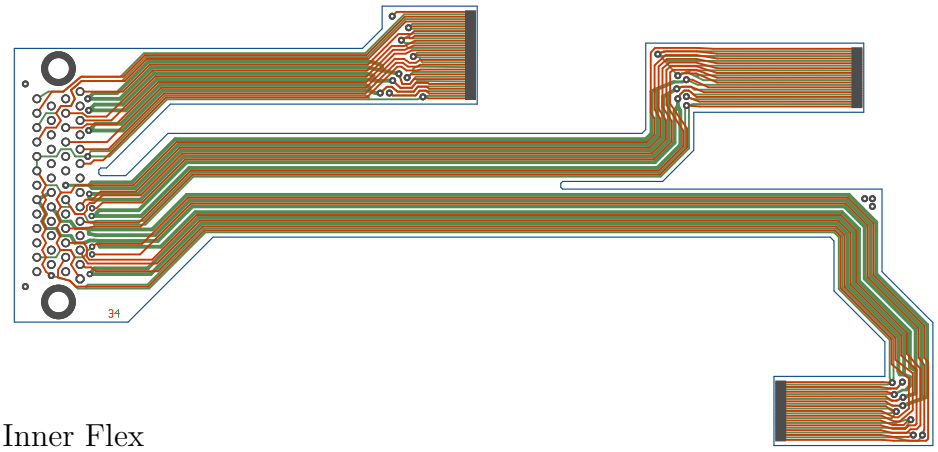
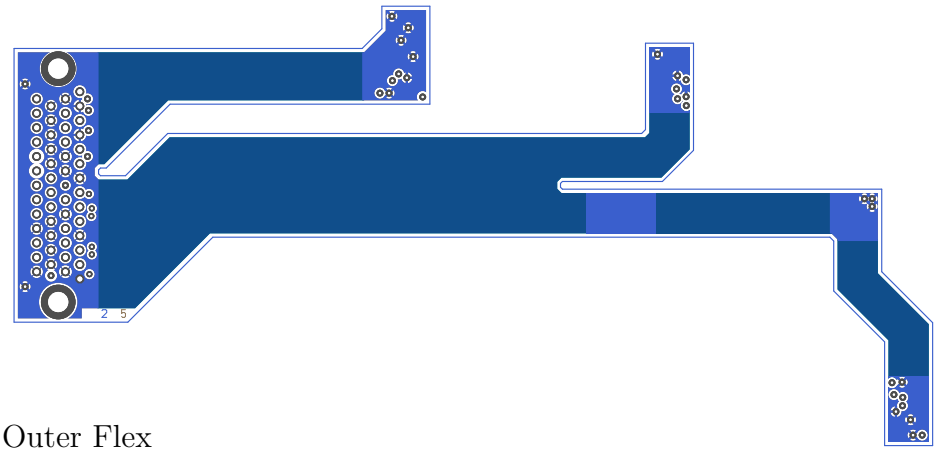


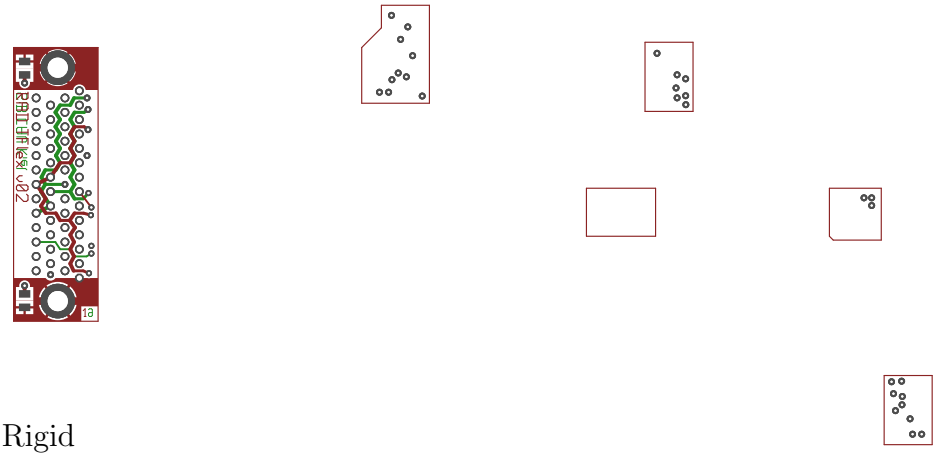
Figure 6: TFlex schematics: `TFlex.sch`



a) Inner Flex



b) Outer Flex



c) Rigid

Figure 7: Layout