

Design Rules

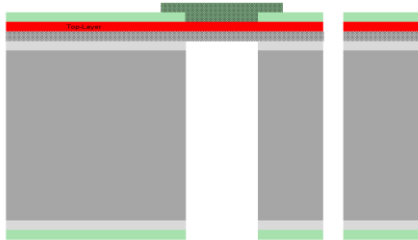
RIGID.flex 1F-xRi

These design rules apply to:

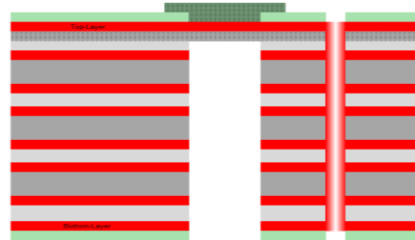
RIGID.flex PCBs with one copper layer on flexible polyimide material, externally located.

Application in accordance with IPC 2223 Use A: Flex-to-install, UL marking according UL94 and UL796F possible.

Examples:



1F-ORi: 1 copper layer

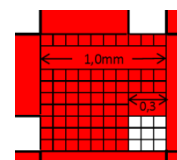


1F-7Ri: 8 copper layers with PTH

Nomenclature: Ri = Rigid, F = Flex

Basic instructions

- Please comply with general standards, such as IPC or IEC
- Please refer to the valuable hints and tips in our RIGID.flex Design Guide at www.we-online.com/flex.
- Please refer to our BASIC Design Rules for rules on conductor widths, spacings, via and pad sizes as well as solder mask at www.we-online.com/basic.
- Filling of PTHs (plated through holes):
Do not use open holes in solder pads! Keep at least 400µm distance from solder pads to holes to be plugged on both sides (Via plugging, IPC-4761 type III). For vias according to IPC-4761 type VII (filled and capped) please consult us for allowed design rules (conductor spacing)!
- Lift-off areas - attention: NO copper layout below the flex and NO vias permitted in these areas!
- Flexible and rigid-flexible circuit boards must be dried before they are assembled. Further information about this is available at www.we-online.com/dryingprocess.
- Copper removal is required in ground or reference layers for drying.
 - Recommendation: Copper openings 0.3mm per 1mm length of copper.
- Flex-to-install bending radius: Installation Use A in accordance with IPC-2223 up to 90° bending angle:
 - 1 copper layer: 10 x total thickness (IPC-2223 section 5.2.3.3)
 - For use in more demanding conditions, please contact us.
- We will be happy to create the optimal delivery panel for you (best price!).



Design Rules

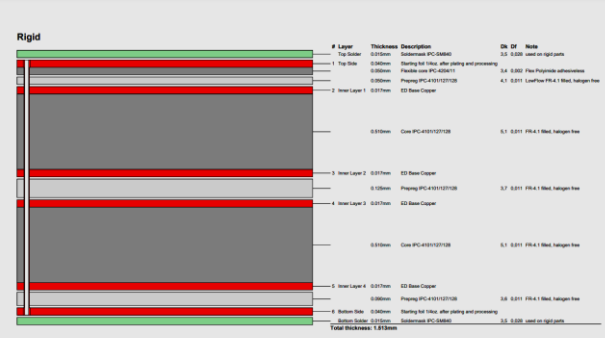
RIGID.flex 1F-xRi

Material specifications

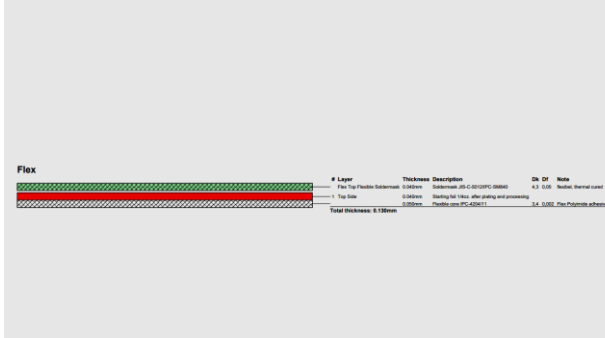
Material	Standard	Spec. sheet	Description	Application
Flexible base material	IPC-4202	11	Polyimide adhesive less	Standard
	IPC-4202	2	Polyimide with glue	Not recommended for microvia and hand-soldering
	JPCA-BM03			
Rigid material (cores, prepregs)	IPC-4101	128	FR4.1 Tg 150°C, filled; low-halogen, low CTE(z)	Standard for RIGID.flex
LowFlow Prepreg	IPC-4101	128	FR4.1 Tg 150°C	Standard
Soldermask	IPC-SM840		green, photosensitive	Standard lacquer in the rigid areas
Flexible solder mask	JIS C 5012/ IPC-SM840		green	Partially in the flex area or over the entire area of the flex side
Coverlay	IPC-4203	1 / 2	Polyimide coverlay film, acrylic or epoxy glue	Optional in place of flex solder mask (surcharge)

Standard Stackups

The standard stackups you will find under www.we-online.com/flex.



# Layer	Thickness	Description	Dr	Df	Note
1 Top Side	0.035mm	Substrate IPC-4202	0.2	0.008	used on rigid parts
2 Inner Layer 1	0.035mm	Prepreg IPC-4101/12128	0.4	0.002	Flex Polyimide adhesives
3 Inner Layer 2	0.035mm	Prepreg IPC-4101/12128	0.4	0.002	Flex Polyimide adhesives
4 Core	0.508mm	Core IPC-4101/12128	0.1	0.011	FR4.1 Med. halogen free
5 Inner Layer 3	0.035mm	Prepreg IPC-4101/12128	0.4	0.002	Flex Polyimide adhesives
6 Inner Layer 4	0.035mm	Prepreg IPC-4101/12128	0.4	0.002	Flex Polyimide adhesives
7 Bottom Side	0.035mm	Substrate IPC-4202	0.2	0.008	used on rigid parts
Total thickness: 1.015mm					



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1 Top Side	0.035mm	Substrate IPC-4202	0.2	0.008	used on rigid parts
2 Core	0.508mm	Core IPC-4101/12128	0.1	0.011	FR4.1 Med. halogen free
3 Inner Layer	0.035mm	Prepreg IPC-4101/12128	0.4	0.002	Flex Polyimide adhesives
4 Bottom Side	0.035mm	Substrate IPC-4202	0.2	0.008	used on rigid parts
Total thickness: 0.138mm					

Combination with microvia technique and buried via technique is possible:

See WE HDI Microvia Design Guide.

- **Flex side:** Microvias through dielectric 100µm thick. Always specify microvia-in-solder pad with copperfilling (filling ratio ≥70%)!
- **Rigid side:** Microvias can also be designed with 60µm dielectric by consultation.
- **Buried vias** after consultation by modification of the stackup (additional costs due to additional multilayer process).

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Standard design

1. Flexible layer out of Polyimide 50µm adhesive less, PCB total thickness 0.8mm to 1.55mm
2. Copper layer thickness inner layers 18µm, outer layers 12µm + plated copper
3. Low-Flow Prepreg between flexible and rigid material
4. Flexible soldermask green on flex side, not flex side or optional all rigid areas with standard green solder resist epoxy
5. Standard PTH (Plated Through Holes)
6. Smallest milling diameter 1.6 mm
7. Solderable surface ENIG
8. Packaged in ESD shrink wrap

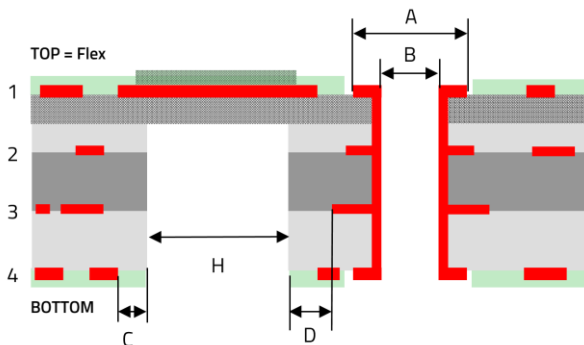
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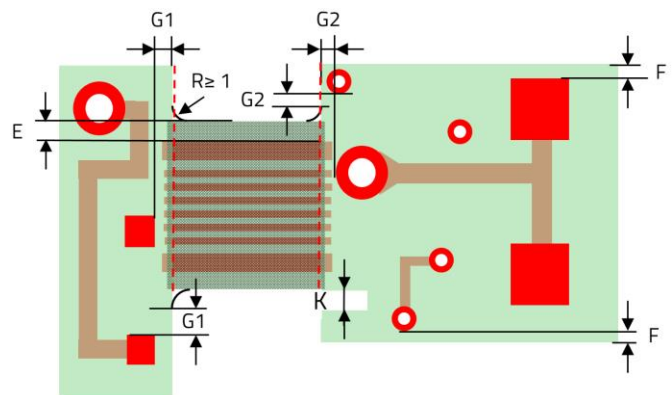


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Stackup 1F-3Ri



Top view



Symbol	Description	Technical Standard	Advanced requirements
	Line widths and spacings	see WE BASIC Design Rules!	
A	Minimum via pad diameter →For all Pad-connections Teardrops are recommended!	see WE BASIC Design Rules!	
B	Final diameter of PTH	see WE BASIC Design Rules!	
C	Spacing, Cu – outer layer to flex-rigid transition (bottom)	≥300µm	
D	Spacing, Cu – inner layer to flex-rigid transition	≥800µm	
E	Distance of conductor to the flexible contour	≥300µm	
F	Spacing, exposed Cu – outside of flex-rigid transition	≥300µm	
G1	Flexible lacquer: Spacing, exposed Cu to flex-rigid transition (top)	≥800µm	≥400µm
G2	Flexible lacquer: Spacing, drillpad to flex-rigid transition (top)	≥1000µm	≥800µm
G1 + G2	Coverlay: Spacing to flex-rigid transition, exposed Cu (top) and drillpad	≥1500µm	≥1000µm
G1 + G2	Coverlay with UL marking : Spacing to flex-rigid transition for exposed Cu (top) and for drillpad	≥2000µm	≥1500µm
H	Length of the flex area	≥5mm	≥2.5mm
K	Minimum recess width directly at the flex area	1.6mm	1.0mm
„K”	Outline manufacturing of flex area: No scoring permitted!		
„ZIF”	ZIF contacts thickness tolerance (material of stiffener)	± 0.05mm (FR4)	± 0.03mm (PI) special stackup
-	Combination with microvia and buried via technique is possible	see HDI Microvia Design Guide!	

Further specifications available on request, please contact us: flex@we-online.com