

## Design Rules

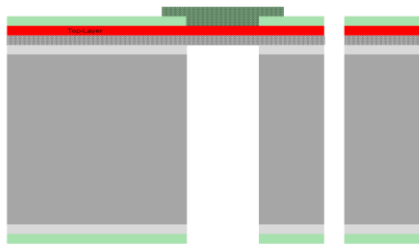
### Flex-rigid 1F – xRi

Application in accordance with IPC 2223 Use A: Flex-to-install  
UL labelling in accordance with UL94 and UL796 possible

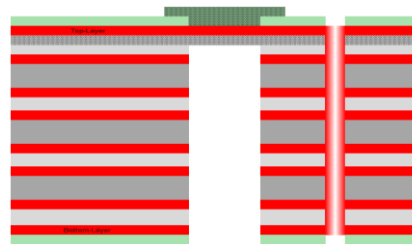


These design rules apply to:

**flex-rigid circuit boards with 1 copper layer on flexible polyimide material, externally located.**



Example: 1 copper layer: 1F-0Ri

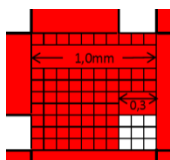


Example: 8 copper layers: 1F-7Ri

Nomenclature: F = flexible, Ri = rigid

#### Basic information

- Please comply with general standards, such as IPC or IEC
- Please note the useful information and tips in the WE Flex-Rigid Design Guide \*
- Please see the WE Basic Design Guide for rules for line widths, spacing, via and pad sizes, solder mask\*
- Filling of plated through holes (PTH):  
Never use open vias in solder areas! For PTH plugging (IPC Type III) always keep a clearance of 400µm to solder areas on both sides! In case of IPC Type VII (filled and capped) please ask for possible design rules (in special: line space parameters).
- **Lift-off** areas - attention: NO copper layout below the flex and NO vias permitted!
- Flex-rigid circuit boards must be dried before they are assembled and soldered. Further information about this can be found on our Internet pages. \*
- For the drying, copper openings in ground / reference layers and in large copper areas on flex material are needed. Recommendation:



→ Copper openings: 0.3 mm per 1 mm length of copper (up to 70µm Cu thickness):

- Flex-to-install bending radius: Assembly bending requirement according to IPC-2223:
  - 1 copper layer: Bending radius at least 10 x total thickness (IPC-2223, Section 5.2.4.2)
  - For use in more demanding conditions, please contact us
- We will be happy to create the optimal delivery panel for you (best price!)

\* All mentioned documents can be found online at: [www.we-online.com/flex](http://www.we-online.com/flex)

# Design Rules Flex-rigid 1F – xRi

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UL labelling in accordance with UL94 and UL796 possible



Material	Standard	Spec. Sheet	Description	Application
flexible base material	IPC-4204	11	Polyimide adhesive-less	Standard
	IPC-4204	2	Polyimide with glue	Not recommended for microvia and hand-soldering
	JPCA-BM03		Polyimide with glue	
Rigid material	IPC4101	128	FR4 Tg 150°C, filled; low-halogen	Standard
LowFlow Prepreg	IPC-4101	128	Epoxy Prepreg Tg150°C	Standard
Soldermask	IPC-SM840		green, photosensitive	Standard lacquer in the rigid areas
Flexible soldermask	JIS C 5012/ IPC-SM840		green	Partially in the flex area or over the entire area of flex side
Coverlay	IPC-4203	1 / 2	Polyimide coverlay film, acrylic or epoxy glue	Optional covering of flexible area in place of flexible lacquer (surcharge)

## Layer stack-up

Standard stack-up drawings see [www.we-online.com/flex](http://www.we-online.com/flex)



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#### Standard design

1. Flexible layer out of Polyimide 50 µm adhesiveless, PCB total thickness 0.8 mm to 1.55 mm
2. Copper layer thickness inner layers 18 µm, 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
6. Smallest milling diameter 1.6 mm
7. Solderable surface ENIG
8. Packaged in ESD shrink wrap

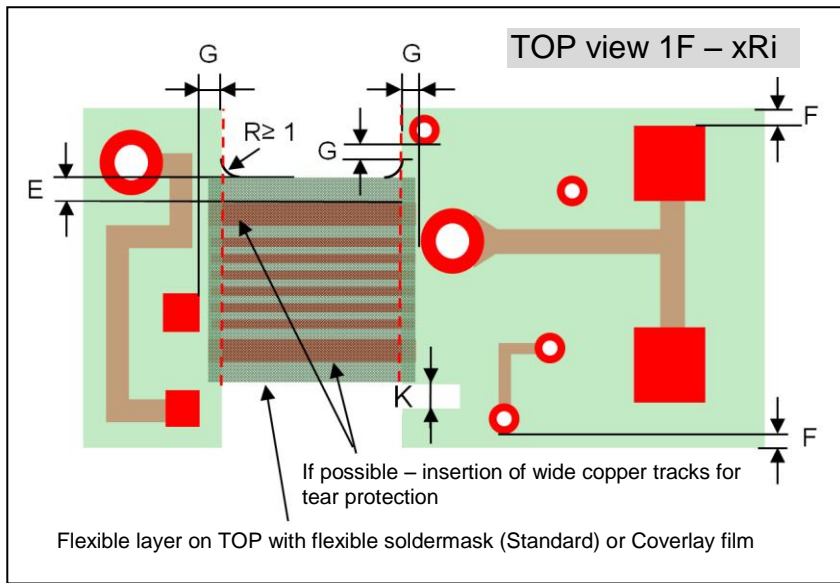
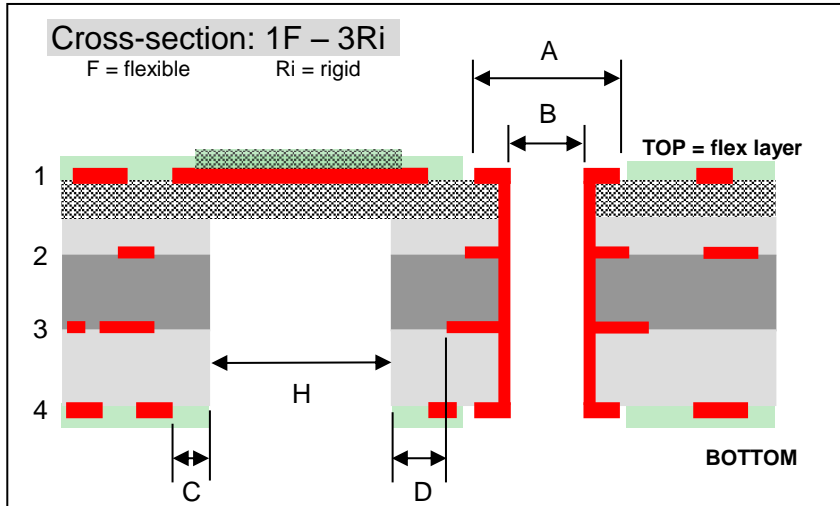
#### Combination with microvia technique and buried via technique possible:

see WE HDI Design Guide for microvias through dielectric 100µm thick. Microvia-in-solder pad always specify with copper filling (filling rate  $\geq 70\%$ )!

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UL<sup>®</sup> US

Symbol	Description	Technical standard	Advanced requirements
	Line widths and spacings	see WE Basic Design Guide!	
A	Minimum via pad diameter →→ teardrops recommended ←←	see WE Basic Design Guide!	
B	Final diameter of continuous vias	see WE Basic Design Guide!	
C	Spacing, Cu – outer layer to flex-rigid transition coupling (bottom)	≥ 300 µm	
D	Spacing, Cu – inner layer to flex-rigid transition coupling	≥ 800 µm	
E	Distance of conductor to the flexible contour	≥ 300 µm	
F	Spacing, exposed Cu – outside of flex-rigid transition coupling	≥ 300 µm	
G	Flexible lacquer: Spacing, exposed Cu to flex-rigid transition coupling (top)	≥ 1000 µm	≥ 800 µm
G	PI coverlay: Spacing, exposed Cu to flex-rigid transition coupling (top)	≥ 1500 µm	≥ 1000 µm
G	PI coverlay <b>with UL Listing</b> : Spacing exposed Cu to flex-rigid transition (top)	≥ 2000 µm	≥ 1500 µm
H	Length of the flex area	≥ 5mm	≥ 2.5 mm
K	Minimum recess width directly at the flex area	1.6 mm	1.0 mm
“K”	<b>Outline manufacturing of flex area: No scoring permitted!</b>		
“ZIF”	<b>ZIF contacts thickness tolerance</b>		± 0.05 mm

→ Enhanced specifications on request – please. Contact us at: [flex@we-online.de](mailto:flex@we-online.de)