

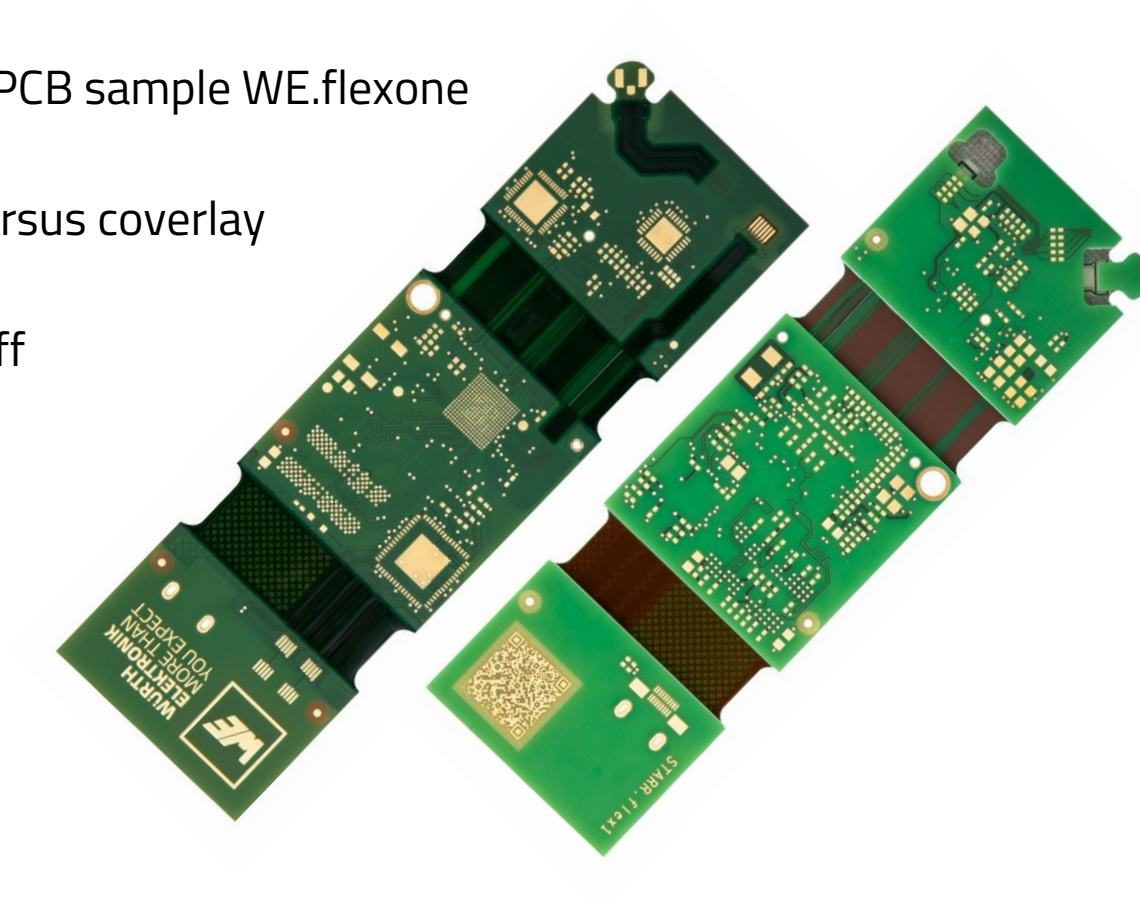


EXPERIENCE THE FLEXIBILITY!
PHYSICAL PCB SAMPLE WE.FLEXONE!

AGENDA

physical PCB sample WE.flexone

1. Presentation physical PCB sample WE.flexone
2. stackup
3. Flexible soldermask versus coverlay
4. Signal integrity
5. ZIF-contact and Lift-Off
6. Combination with HDI
7. QR-Code

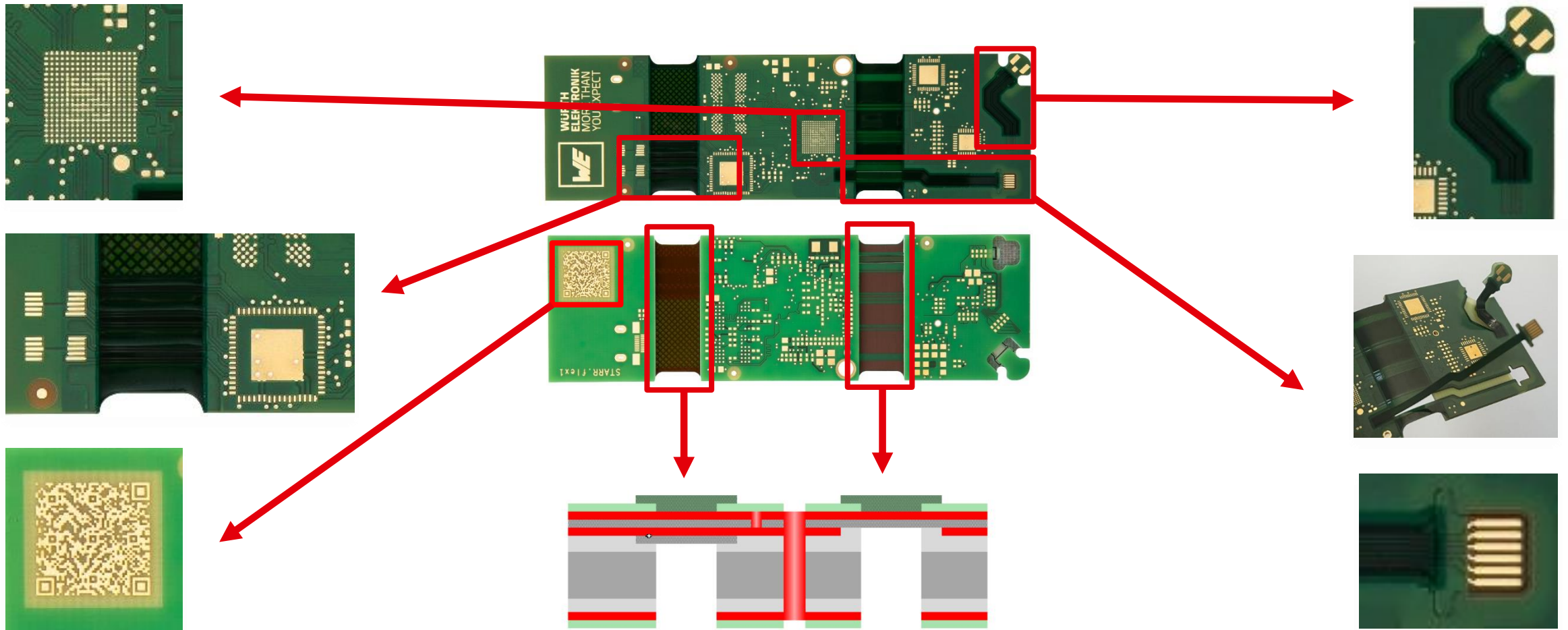


Werner Öchslen
Technical Project Management



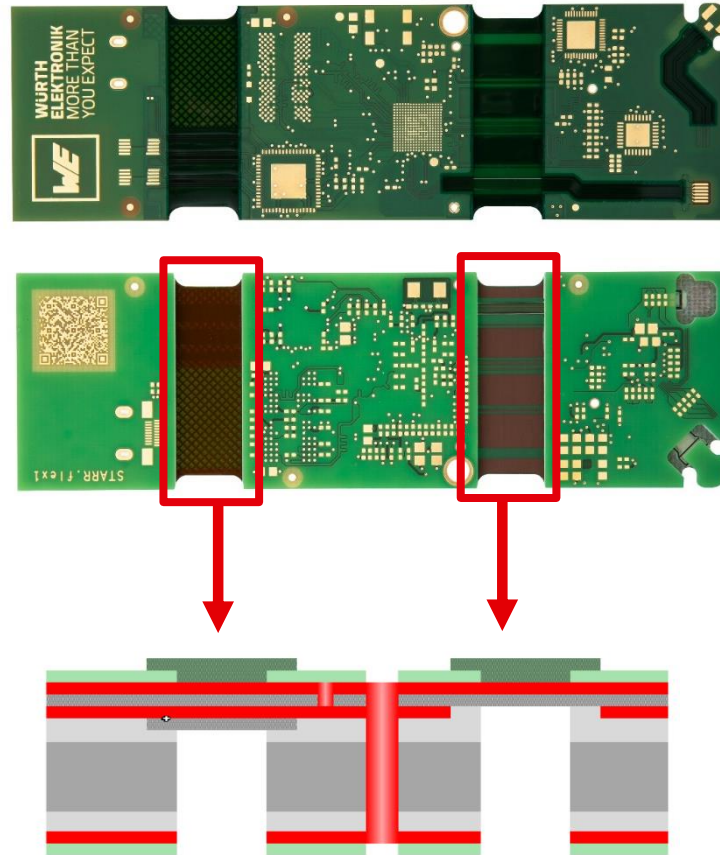
WE.FLEXONE

Introduction physical PCB sample



WE.FLEXONE

Stackup

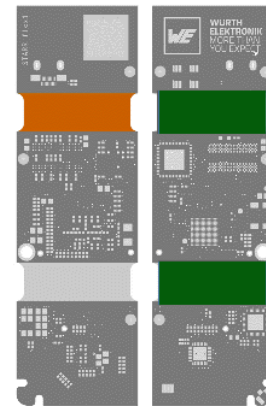
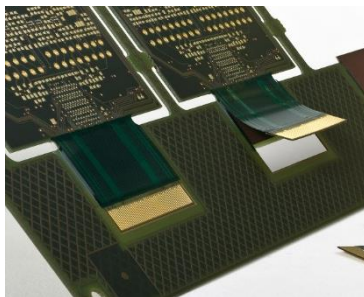
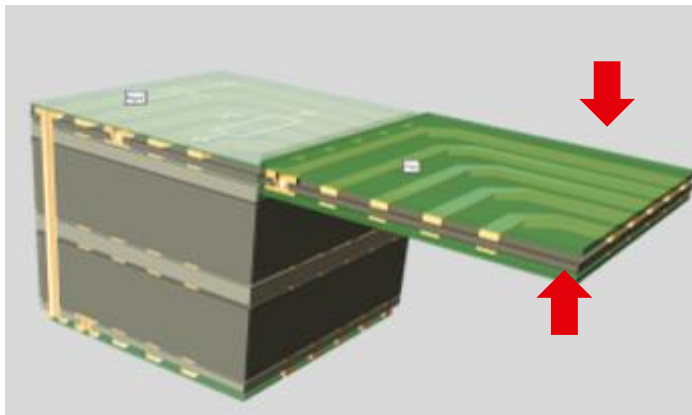


WE.FLEXONE

Stackup

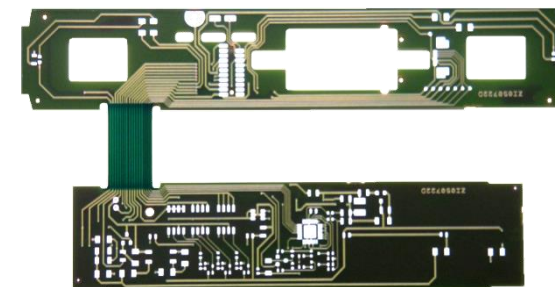
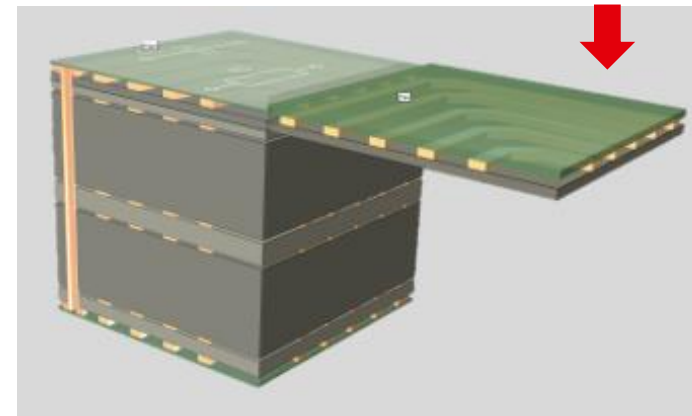
RIGID.flex 2F-xRi

- Flexible soldermask on the outer layer (Standard)
- Coverlay on the inner layer (Standard)
- Coverlay on the outer layer (Option)



RIGID.flex 1F-xRi

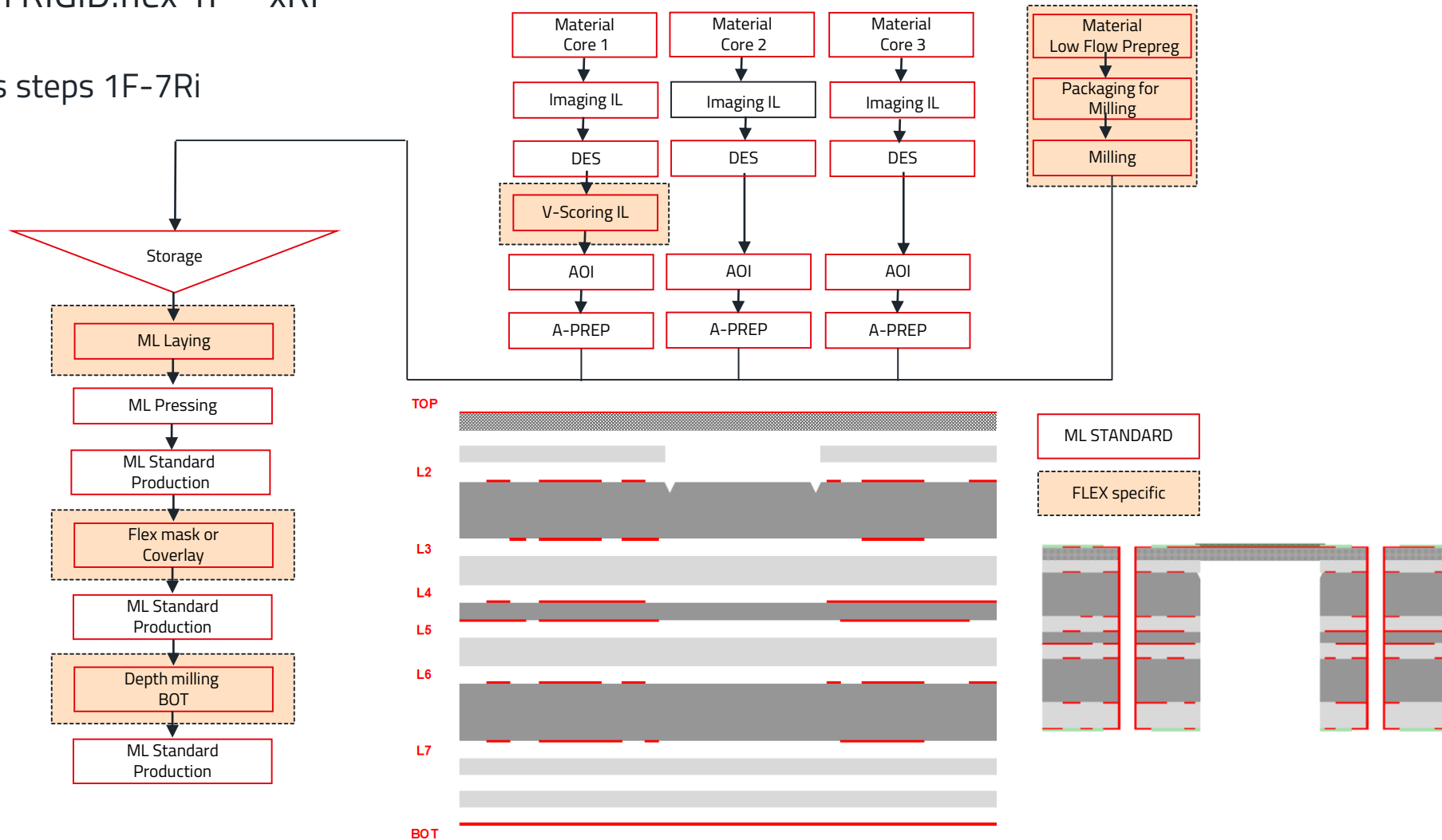
- Flexible soldermask on the outer layer (Standard)
- Coverlay on the outer layer (Option)



WE.FLEXONE

Production RIGID.flex 1F – xRi

- Process steps 1F-7Ri



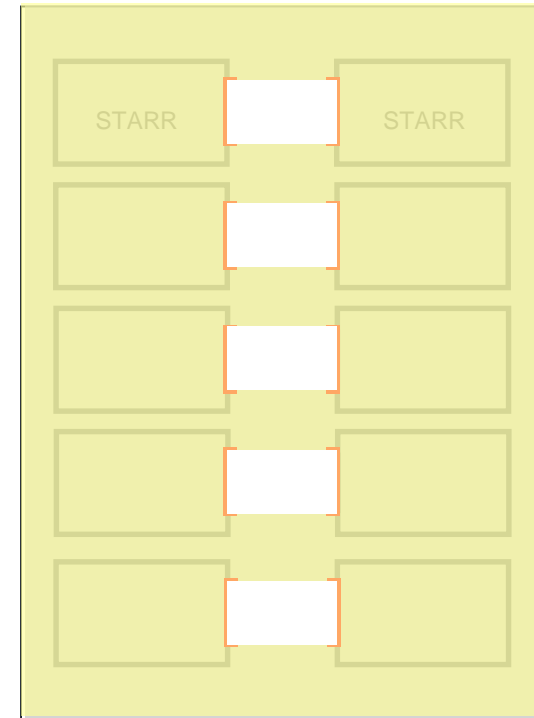
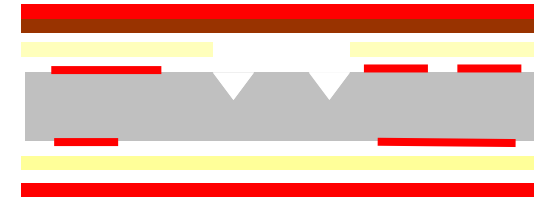
WE.FLEXONE

Production RIGID.flex 1F – xRi

- Stackup 1F-7Ri



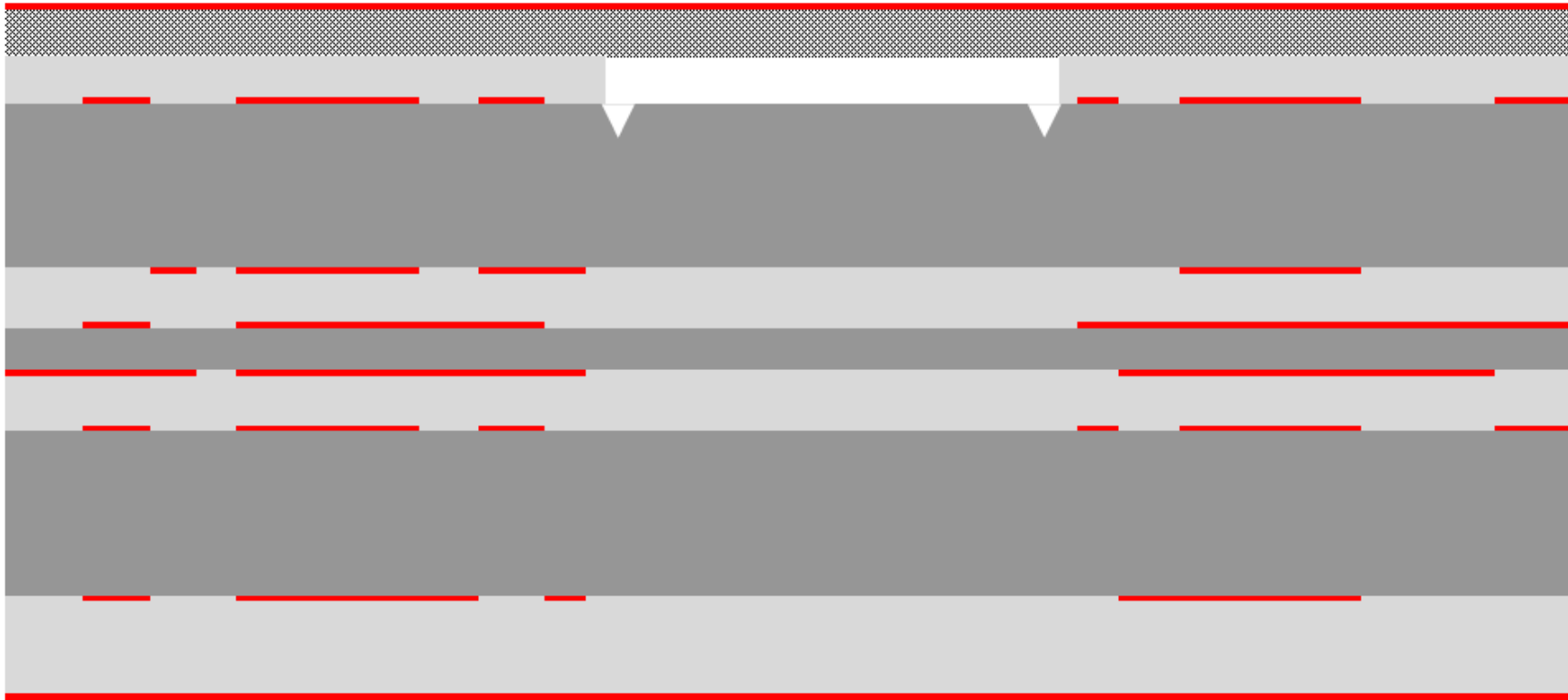
Polyimide + Copper
LowFlow Prepreg
Core
Prepreg
Copper



WE.FLEXONE

Production RIGID.flex 1F – xRi

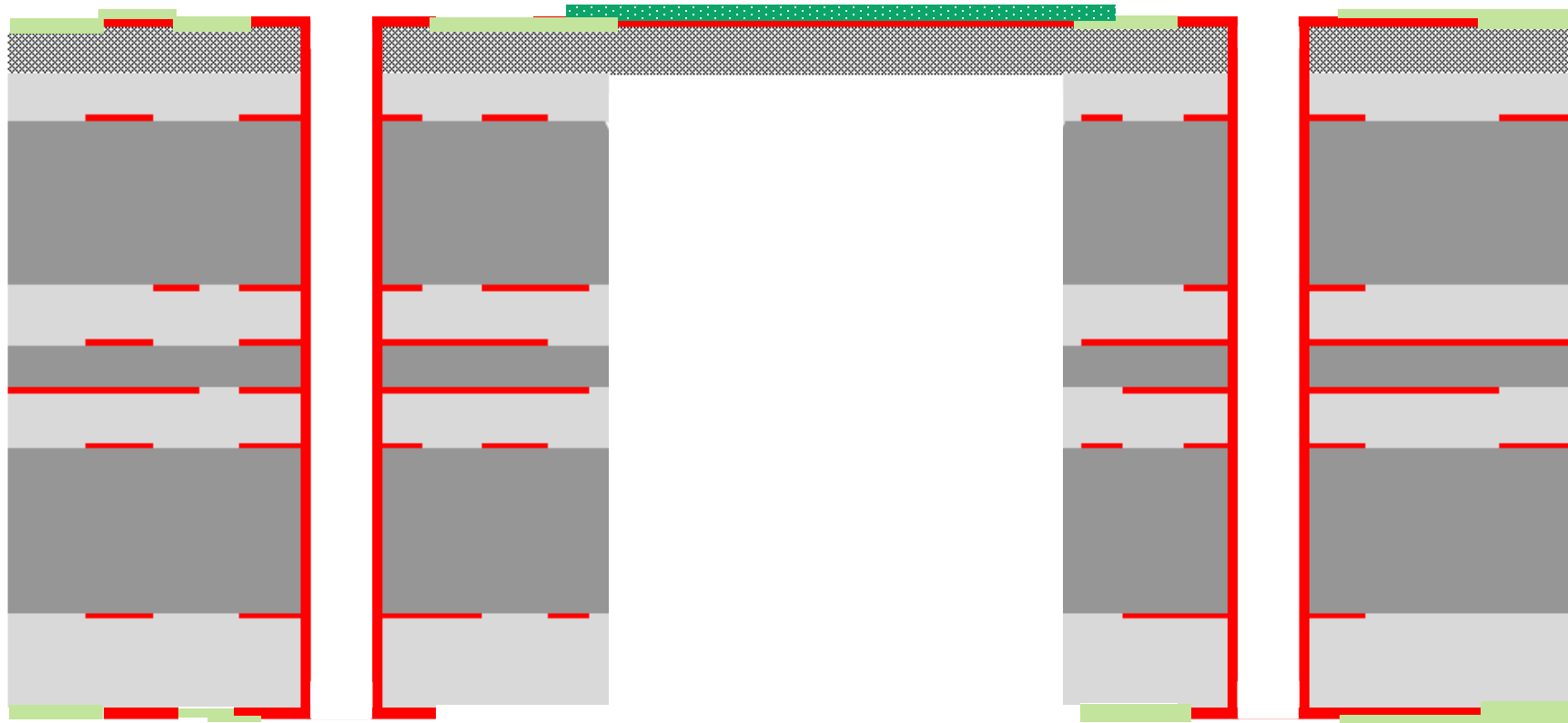
- Stackup 1F-7Ri



WE.FLEXONE

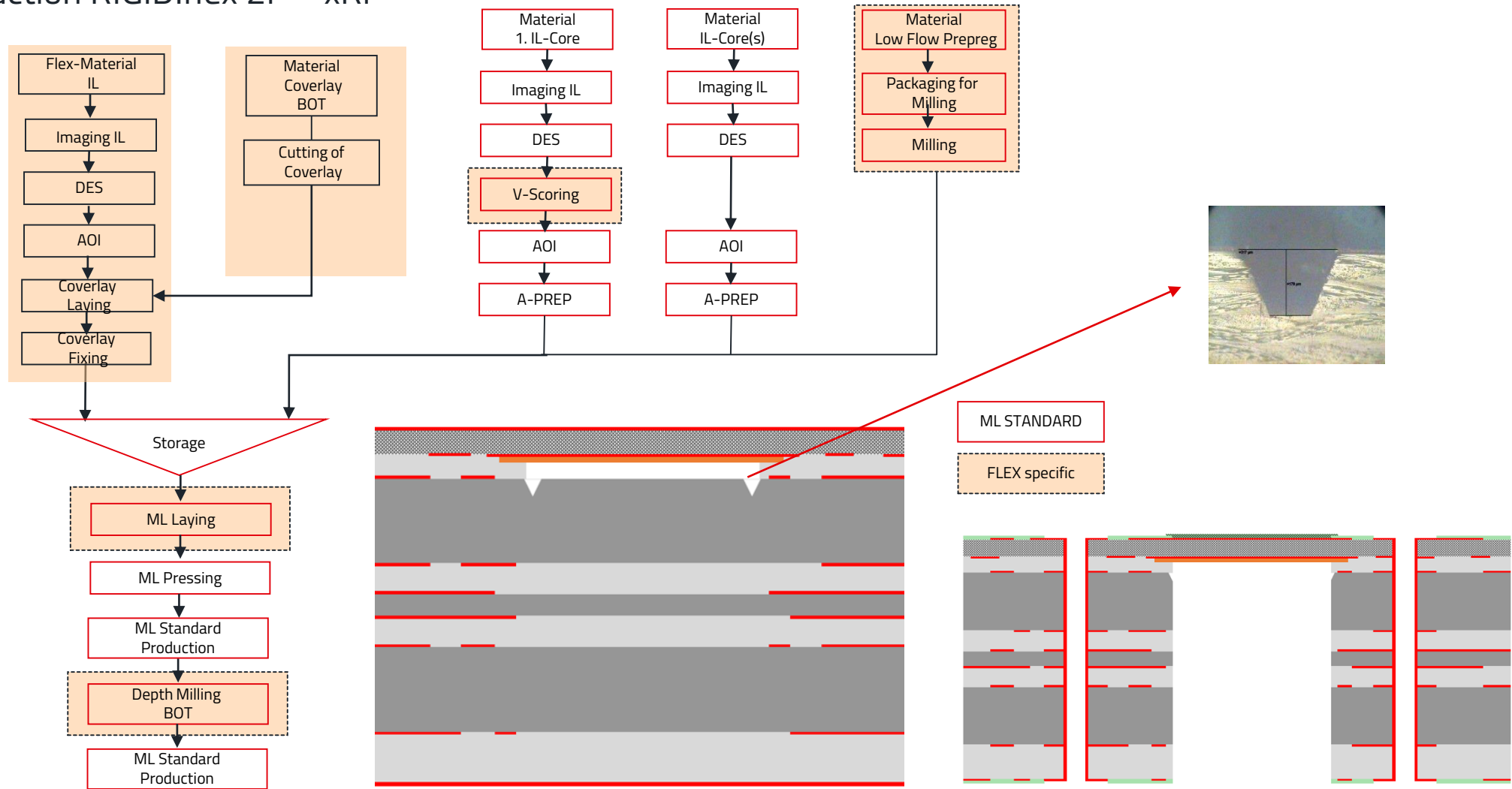
Production RIGID.flex 1F – xRi

- Stackup 1F-7Ri



WE.FLEXONE

Production RIGID.flex 2F – xRi

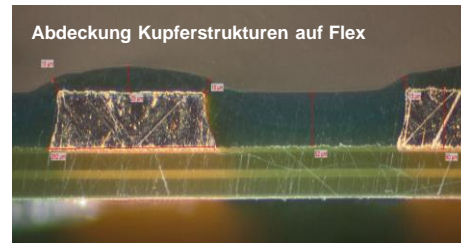
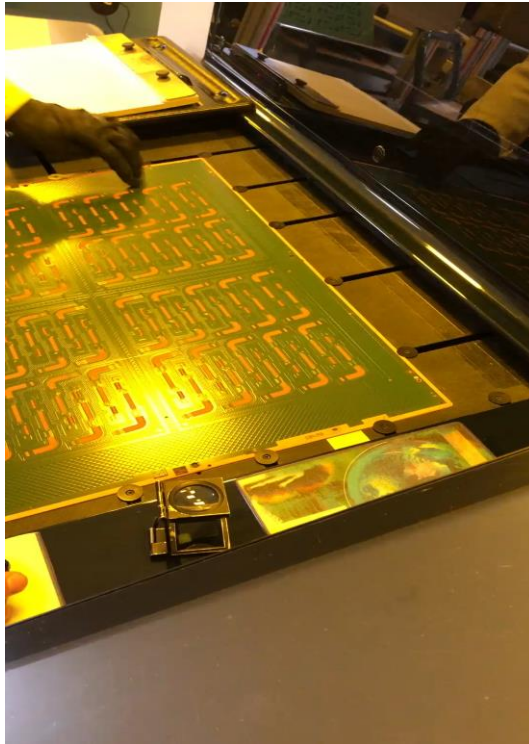


WE.FLEXONE

Flexible soldermask versus Coverlay

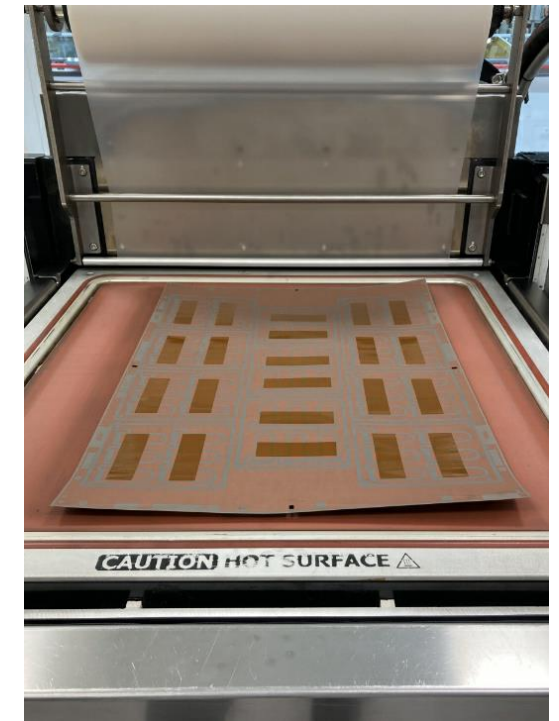
FLEXIBLE SOLDERMASK

- Automated application using inkjet
- Partially in the flexible area



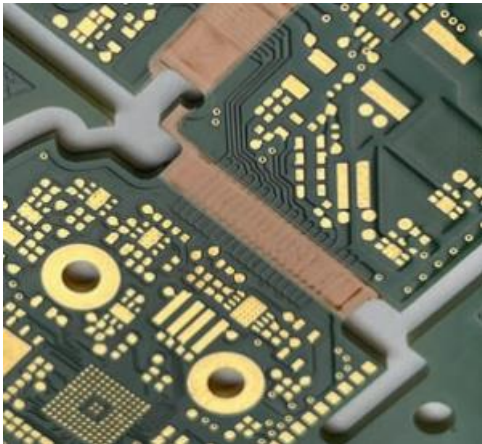
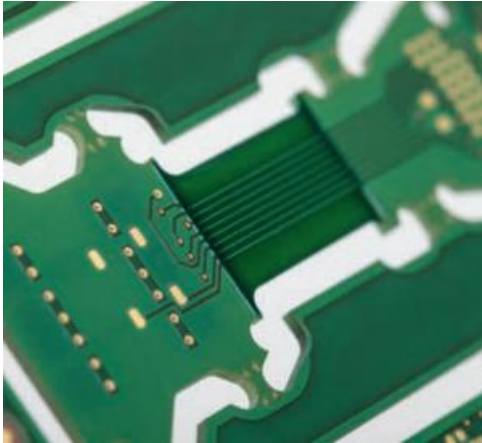
COVERLAY

- Manual fixation + pressing
- Partially in the flexible area



WE.FLEXONE

Flexible soldermask versus coverlay



COMPARISON OF SELECTED PROPERTIES

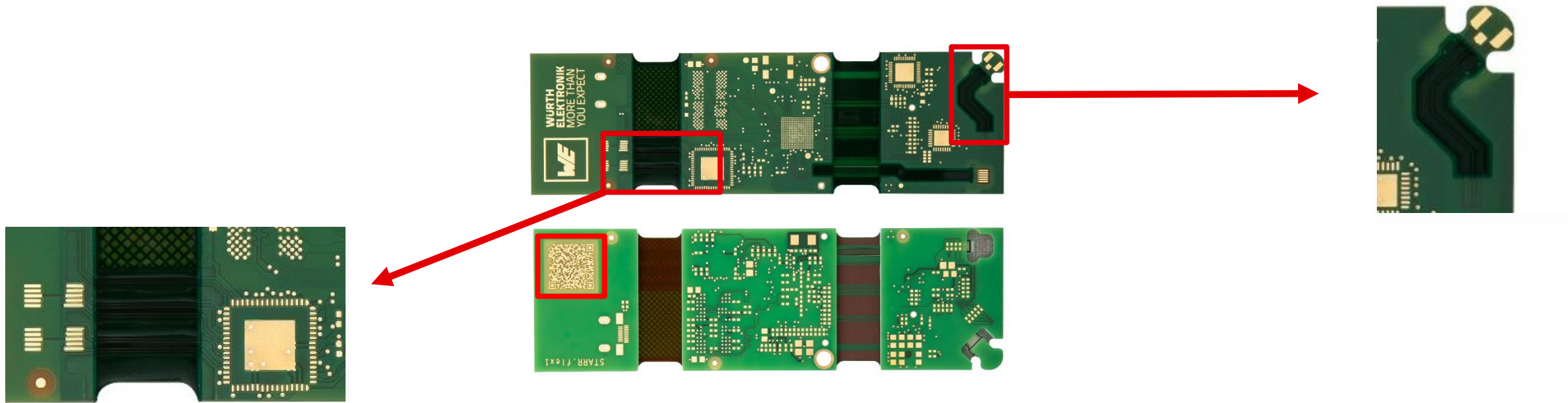
	Flexible soldermask	Coverlay
Colour	Green	Amber / brown
Composition	Mixture of binder, solvent and pigments	Composite film of polyimide film and adhesive layer
Registration	Automatic, optical	mechanical
Application	Liquid by inkjet or screen printing	Manual application, vacuum lamination
Structuring	Partial application, photo process	Cutting, lasering
Design	Very variable, small individual areas possible	Small individual areas must be connected in the PCB and/or in the delivery array
Dynamic bending application	No	Yes
Applicable to inner layers	No	Yes
Applicable to outer layers	Yes	Yes
Maximum copper thickness	up to 70 µm	up to 70 µm
Minimum distance vias and pads to rigid-flex intersection	Smaller, see Design Rules parameter "G"	Larger, see Design Rules parameter "G"
Use in vacuum	Limited	Very good
Mechanical robustness	Lacquer with pencil hardness $\geq 3H$	Resistant film
Dielectric strength	Approx. 150 V at 5 µm thickness	Approx. 3500 V/mil (1 mil = 25.4 µm)
Tenting of microvias	Limited	Yes
UL Listing	Yes	Yes
Effort and cost	Low effort, inexpensive	High effort, more expensive

More Information: Webinar „RIGID.flex with flexible soldermask or coverlay?“

<https://www.we-online.com/webinarrigidflex>

WE.FLEXONE

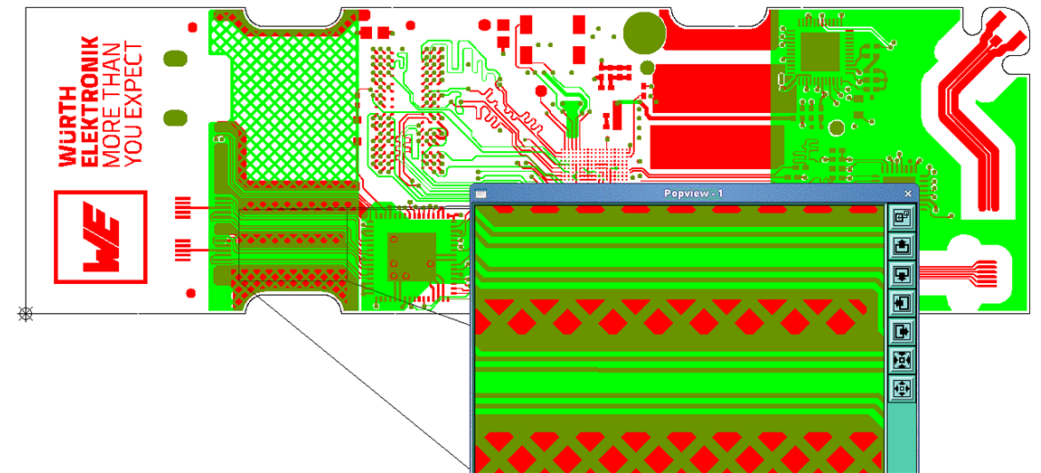
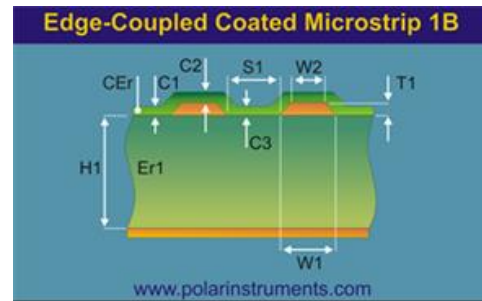
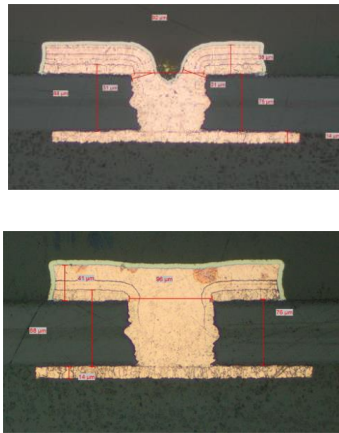
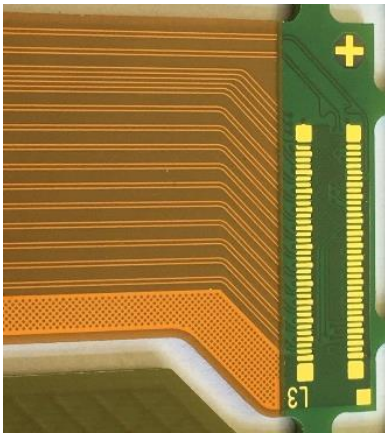
Signal integrity



WE.FLEXONE

Signal integrity

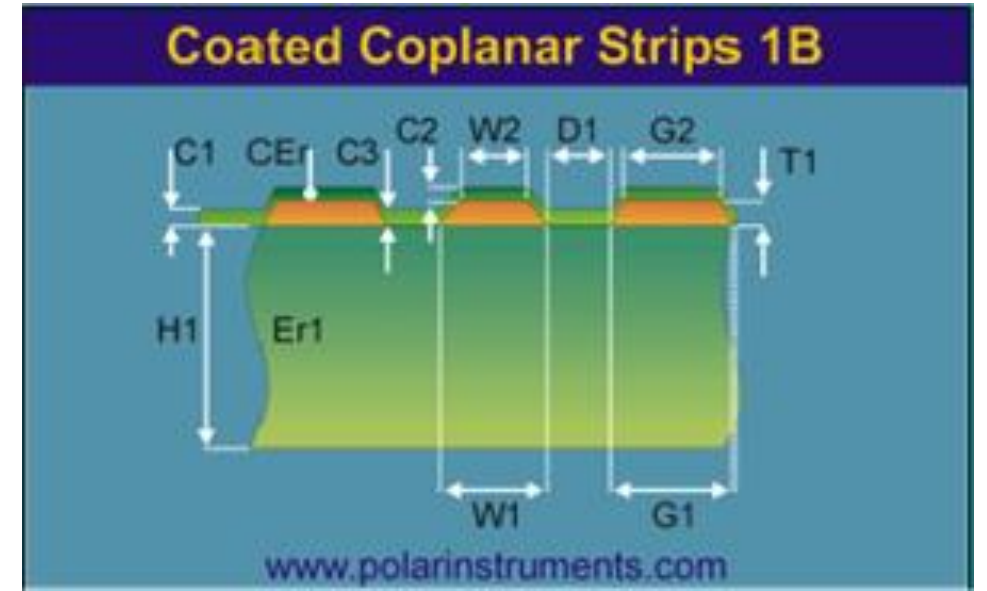
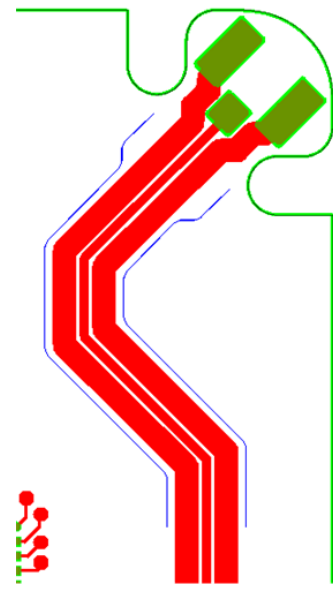
- Impedance defined traces
- 2F-xRi technology
 - 1:1 transmission of the signals
 - No jumps in impedance due to vias
 - Contacting of reference layer possible via microvias
 - Optionally signal routing also possible on L2
- Compromise for an undisturbed return path
 - 100% copper under the conductor pair
 - The remaining areas are hatched for drying and flexibility



WE.FLEXONE

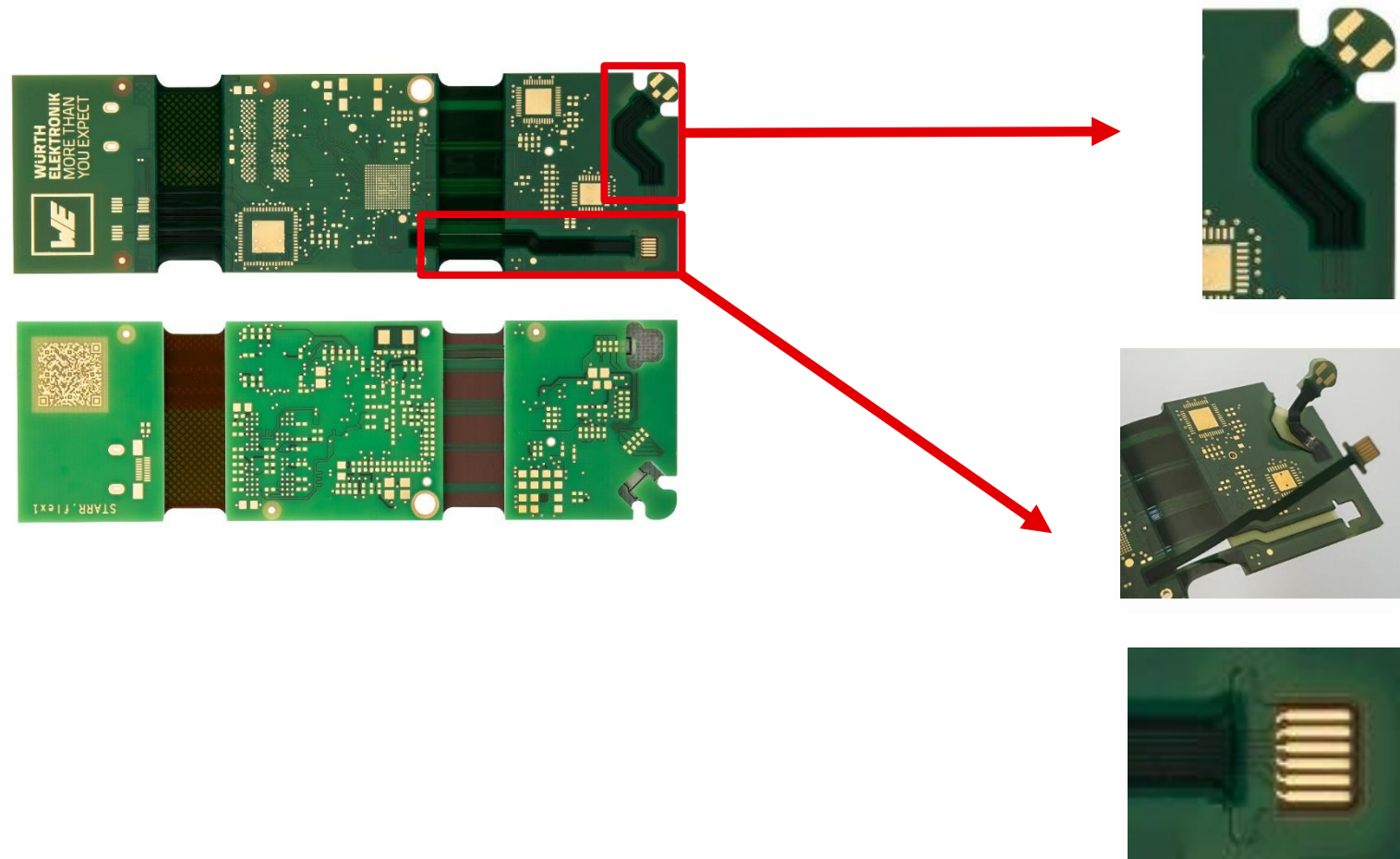
Signal integrity

- Impedance defined traces
- 1F-xRi technology
 - 1:1 transmission of the signals
 - No jumps in impedance due to vias



WE.FLEXONE

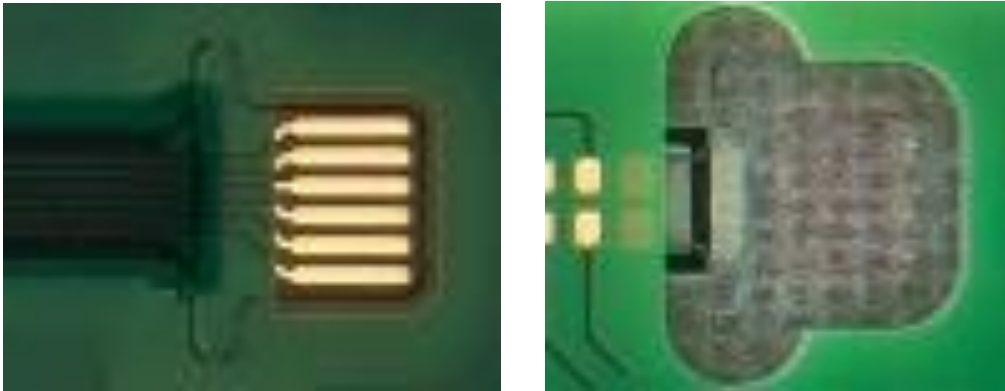
ZIF-contact + Lift-Off



WE.FLEXONE

ZIF-contact

- **ZIF** = **Z**ero **I**nsertion **F**orce



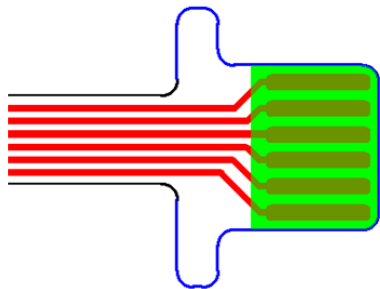
- Detachable and cost-effective connection solution
- Modular system structure
- Low construction heights
- Connection via
 - ribbon cable (FFC)
 - customized Flex / Rigid-Flex Printed Circuit Board (FPC)

ZIF-INTERFACE =

ZIF-connector

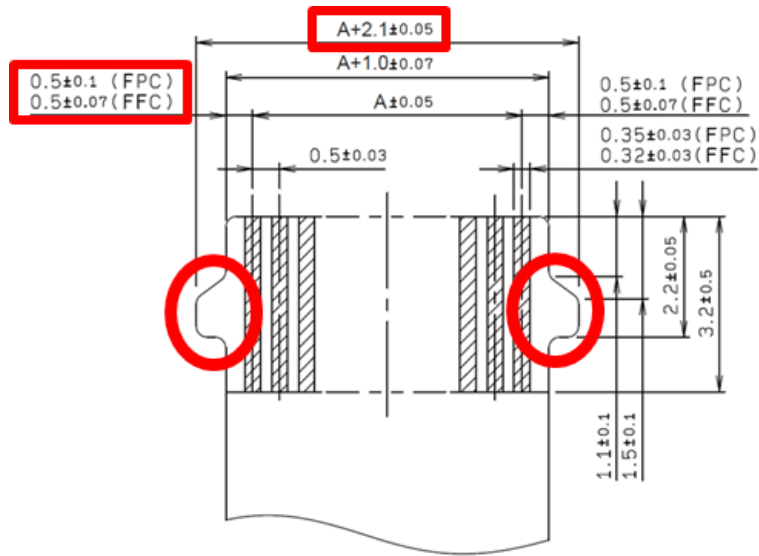
+

FPC ZIF-contact



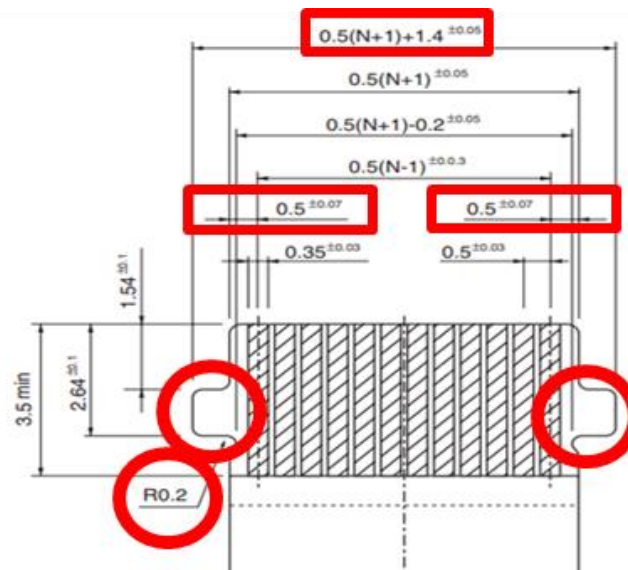
WE.FLEXONE

ZIF-contacts: Similarities



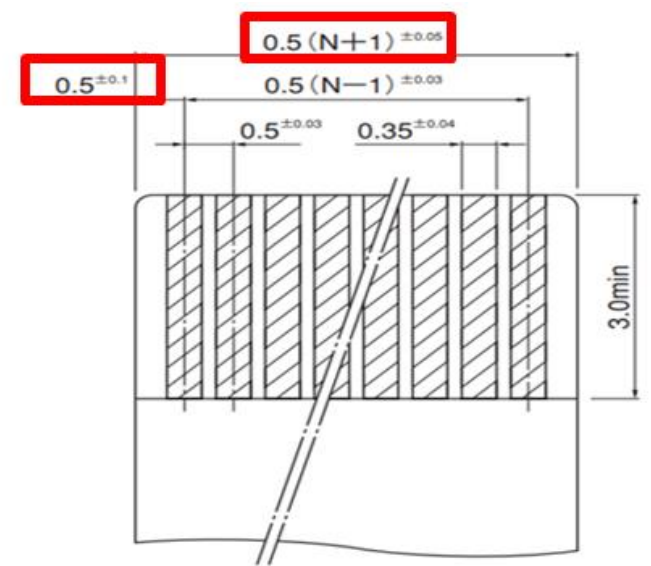
Similarities

- Small contour tolerances
- Small tolerances contacts to the contour
- Small radii at the interlocks



Consequences for the production

- Tolerances and radii not possible via milling process
- Contour processing generally by laser cutting

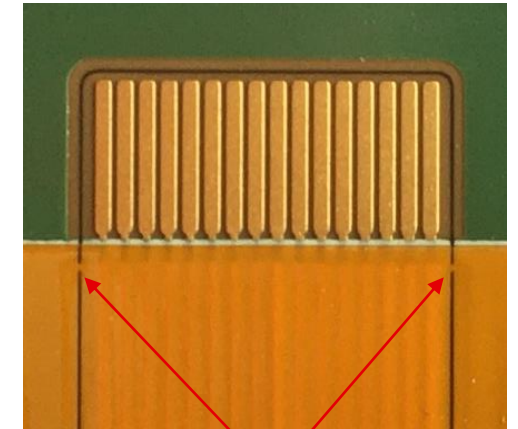
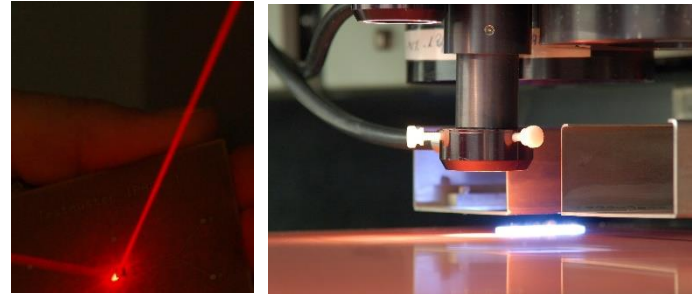


WE.FLEXONE

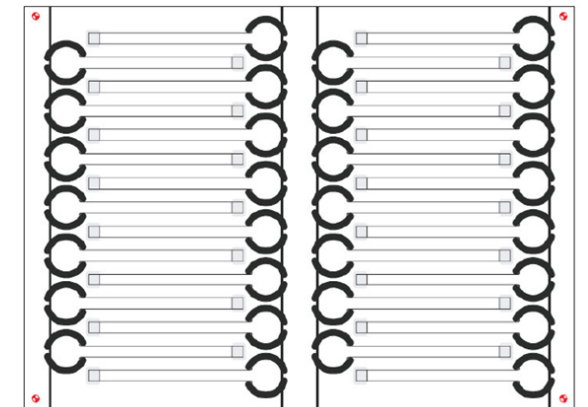
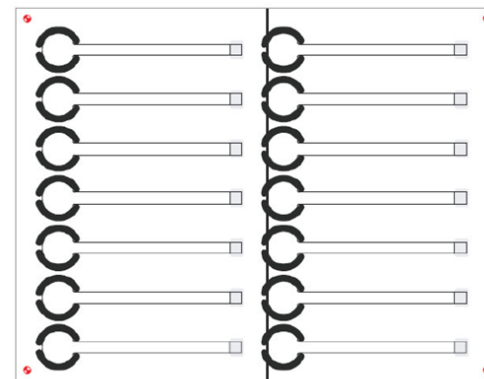
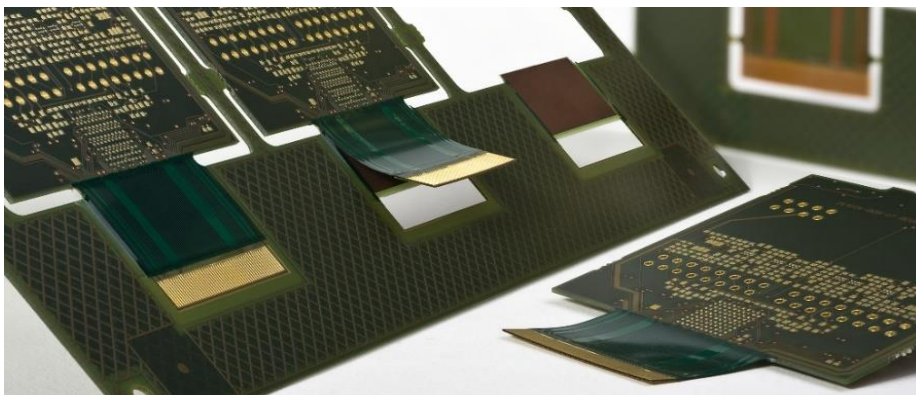
ZIF-contacts

Lasercutting of the ZIF-contact and flex area

- Registration of the laser via the conductive pattern
- Connection via laser micro bridges in the delivery panels
- "simpler" de-paneling process
- Delivery panel becomes more stable (FR4 remains unglued under the flexible area)
- Optimized delivery panel design with smaller distances possible



Laser micro bridges



WE.FLEXONE

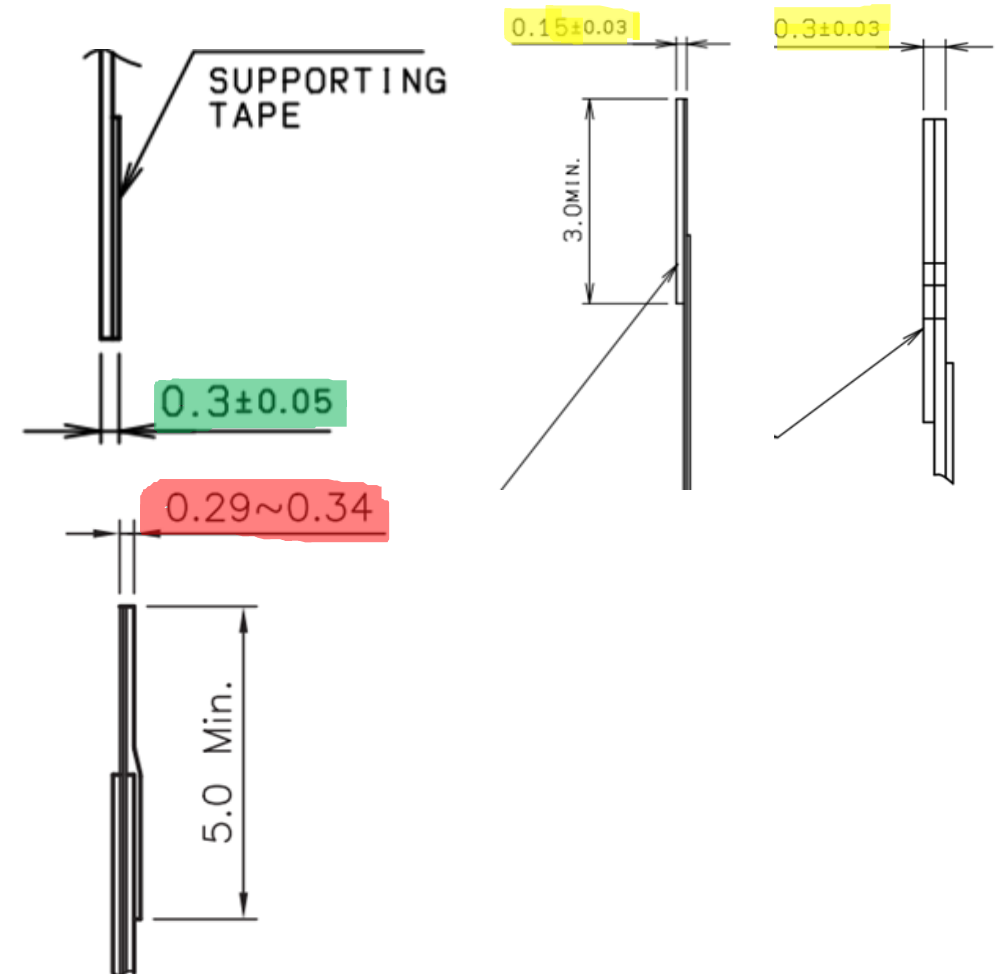
Differences in ZIF contacts

Thickness tolerance

- Standard tolerance ± 0.05 mm
- Advanced requirements ± 0.03 mm
- Smaller tolerances for PCB production not possible
 - FFC tolerance $0.29\text{--}0.34$ mm just not producible

Consequences for the production

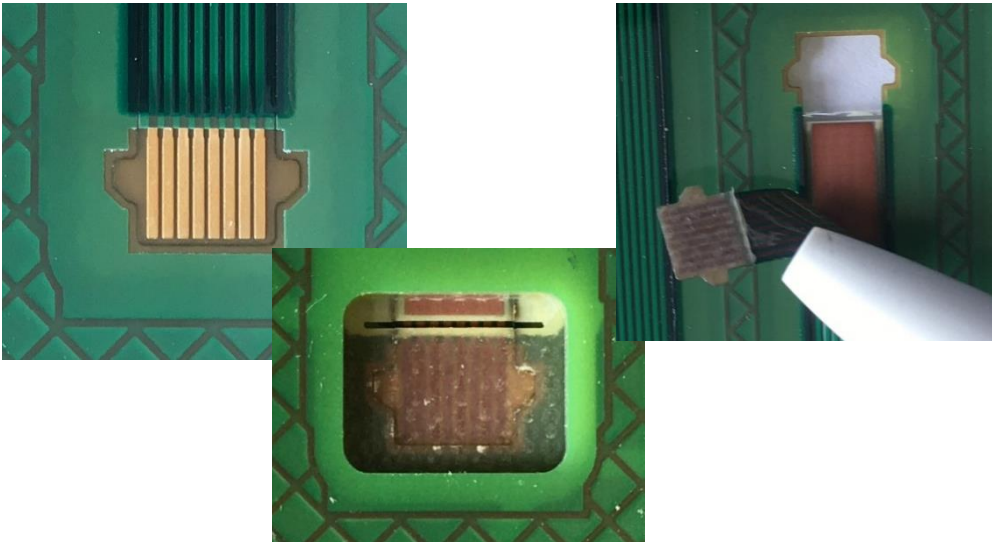
- Standard: FR4 stiffener via depth milling (± 0.05 mm tolerance)
- Advanced: Polyimide stiffener (± 0.03 mm tolerance)



WE.FLEXONE

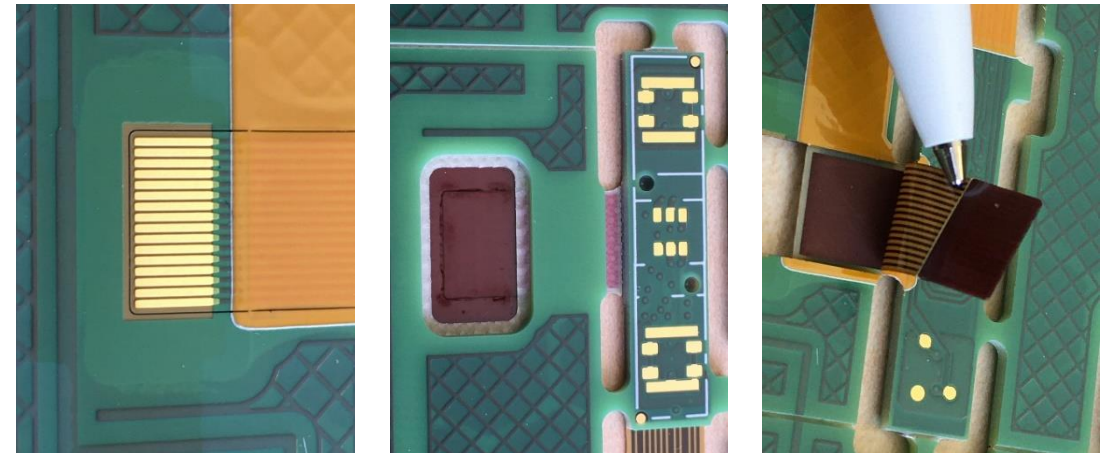
ZIF-contacts

Standard: FR4-Stiffener



- Recommended standard
- Via automated depth milling process
- Thickness tolerance +/- 0.05 mm

Option: Polyimide-Stiffener



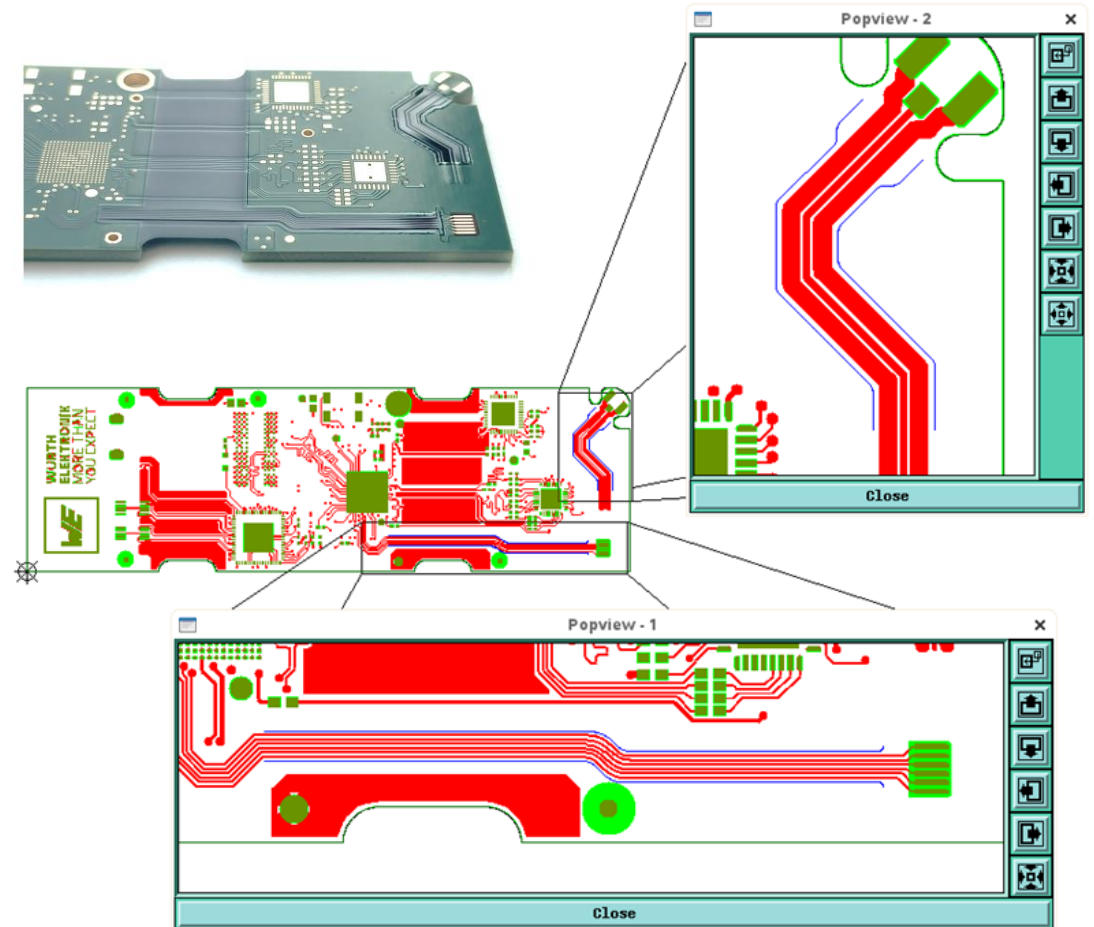
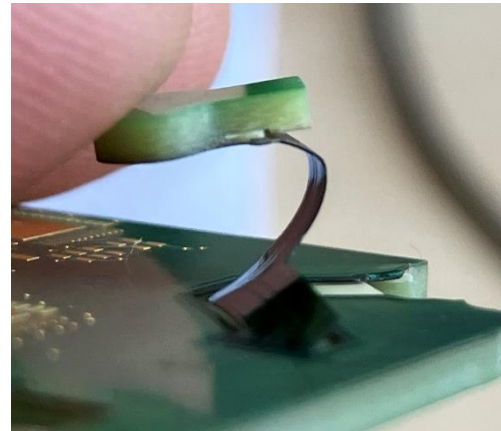
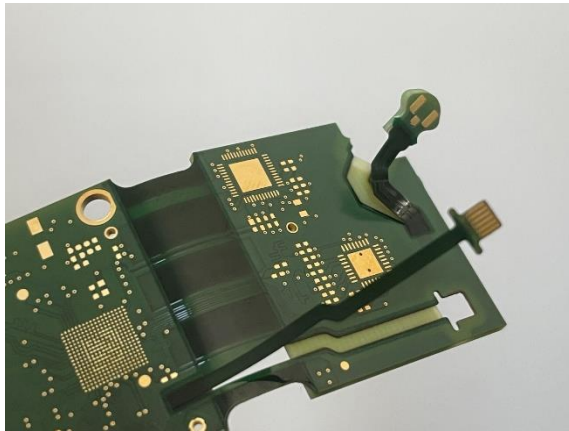
- More effort + higher costs
- Polyimide stiffeners must be inserted manually
- Thickness tolerance +/- 0.03 mm

WE.FLEXONE

Lift-Off

- Flex will be released of unglued FR4 material
- Other layers can be used for routing & assembly

- Connection via laser micro bridges in the delivery panels

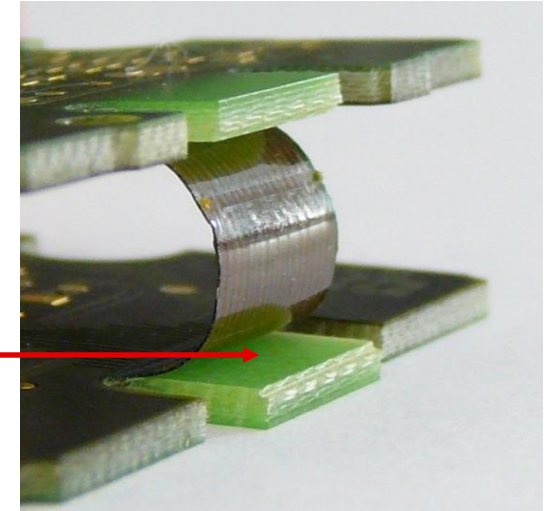


WE.FLEXONE

Lift-Off

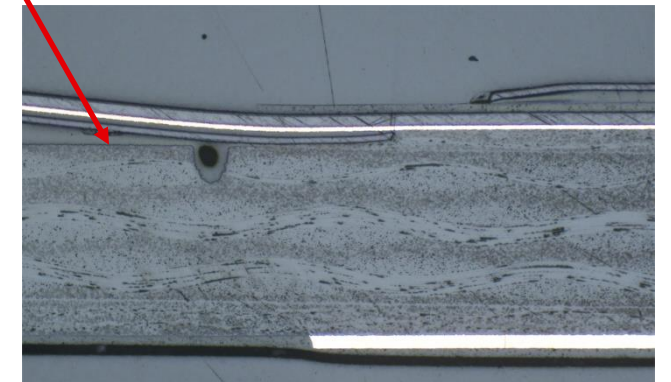
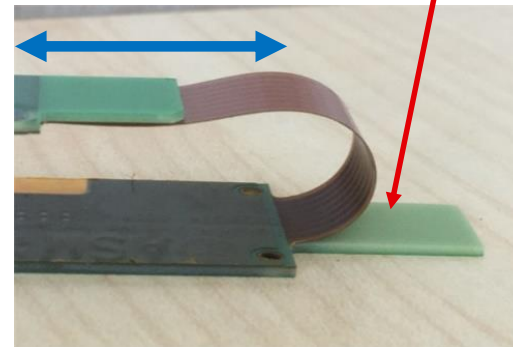
Rigidflex 2F(1F)-1Ri + Microvias									
PCB Thickness: 0,95 mm +/- 10%					Flex Thickness: 0,12 mm +/- 0,05mm				
Rigid area Structure	Flex area Thickness	Rigid area Thickness	Material description		LiftOff Area	Flex area Structure	LiftOff Area		Viatypes
Coverlay									
Soldermask		15							
L1		40	* Incl. Plating	Top-Layer					
	50	50	Polyimide						
L2	16	16							
Coverlay	50	95	2x 106 LowFlow						
		610	FR4 TG 150°						
		65	1x 1080						
L3		40	* Incl. Plating						
Soldermask		15							

Lift-Off



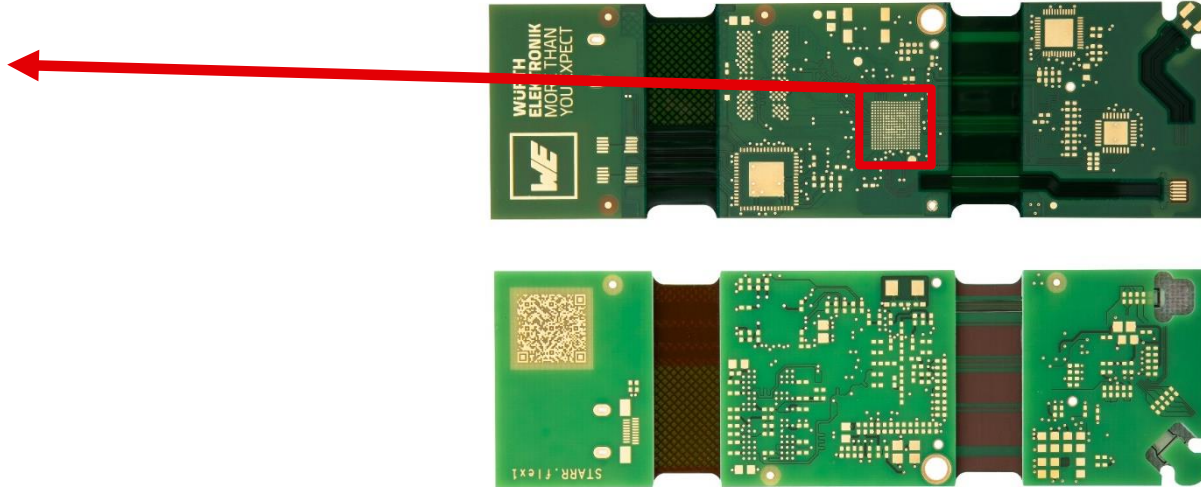
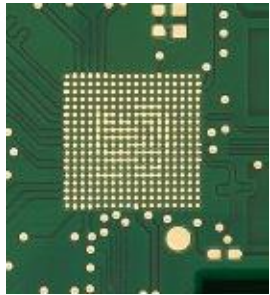
Stackup 2F(1F)-1Ri + Lift-Off

- Flex on L2 with RA copper
- No galvanic copper application on L2
- Covered with Coverlay
- Lift-Off for support with rolling movement



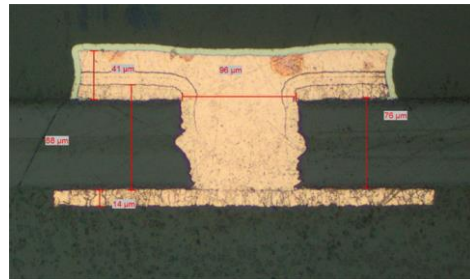
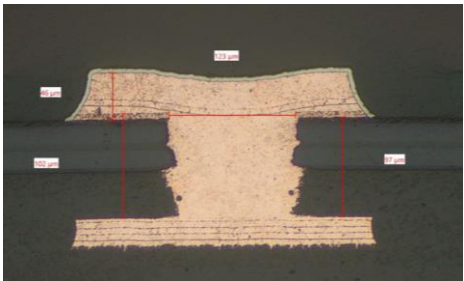
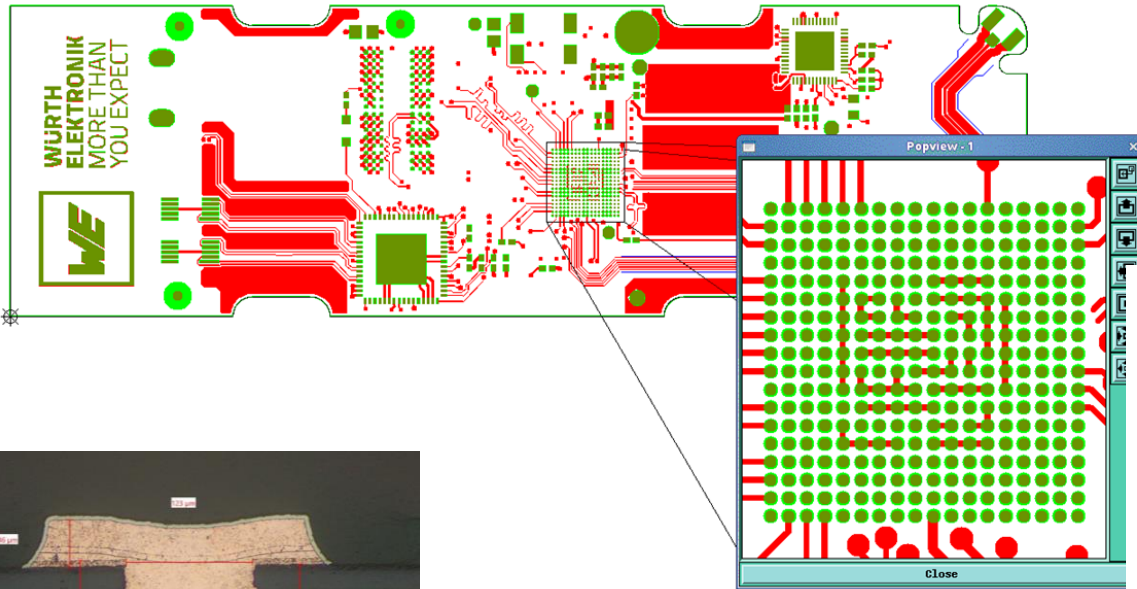
WE.FLEXONE

Combinations with HDI



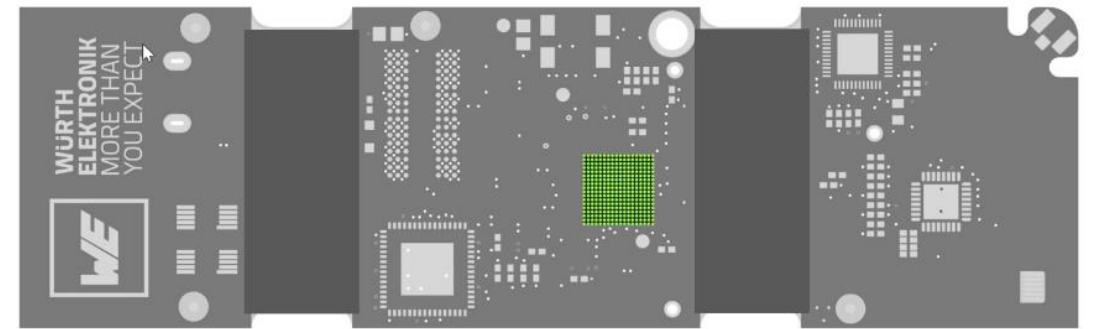
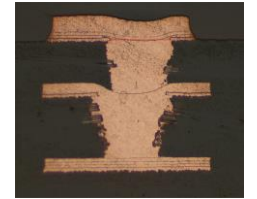
WE-FLEXONE

Combinations with HDI

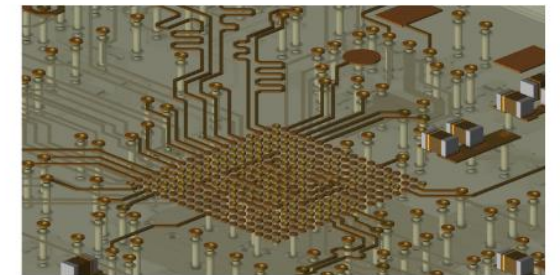
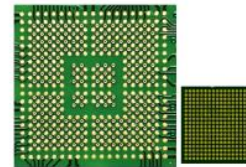


BGA-Pitch 0.40 mm

- Stacked microvias
- 250 µm microvia pads
- soldermask 40 µm clearance / 70 µm web



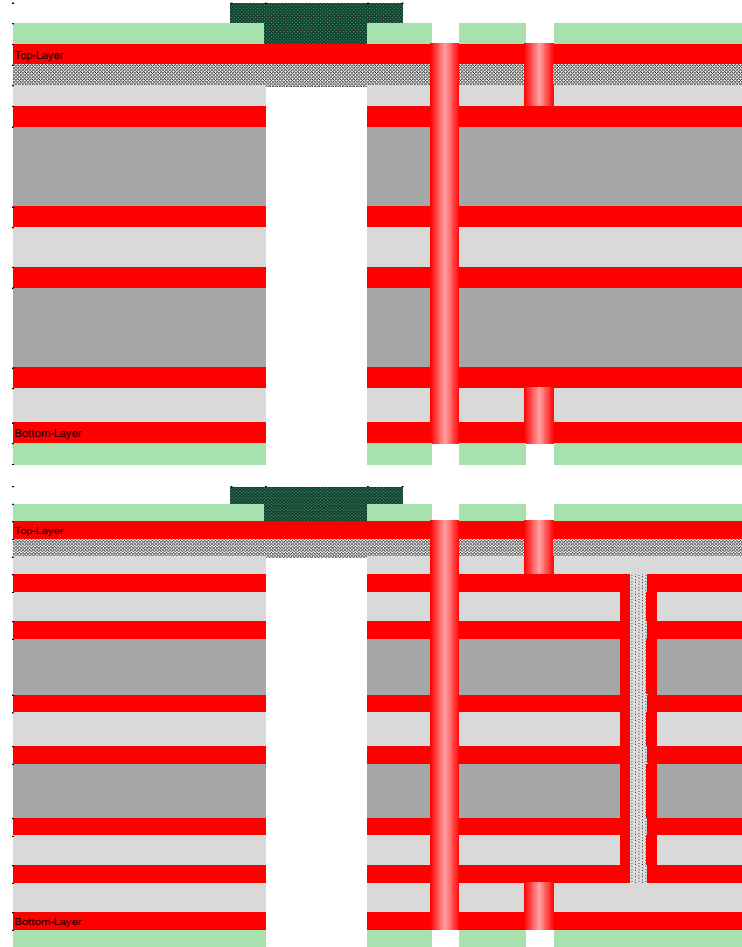
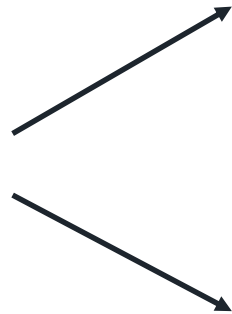
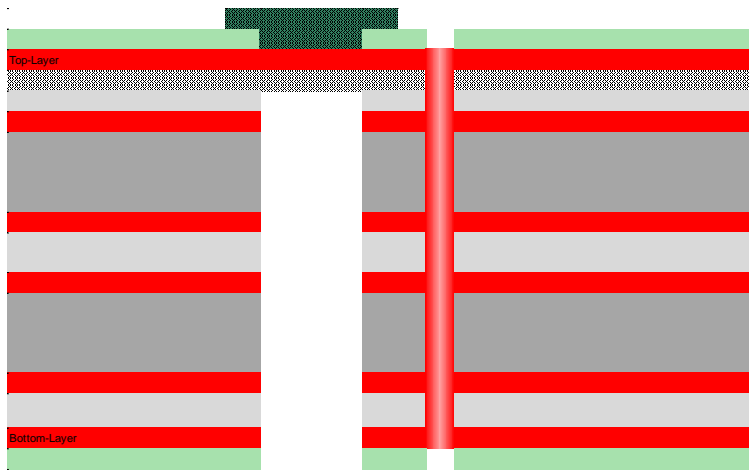
P 0.8 mm versus P 0.4 mm
PTH-dog bone versus microvia-in-pad



WE.FLEXONE

Combinations with HDI

1F-xRi stack



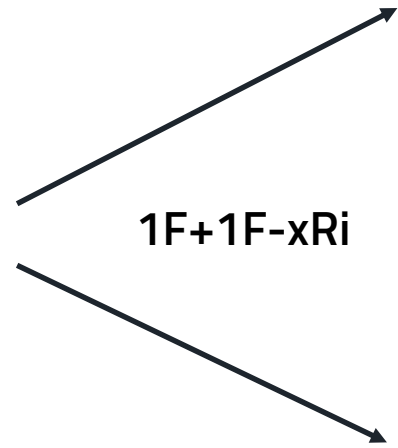
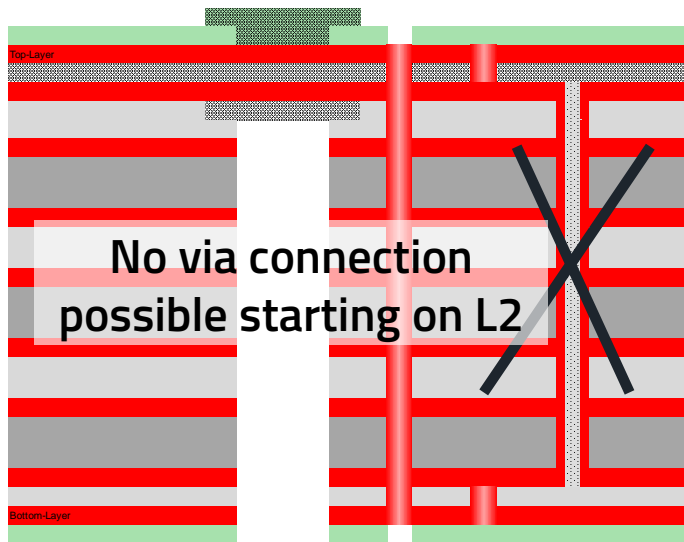
1F-5Ri +
HDI 1-4-1

1F-5Ri +
HDI 1-4b-1

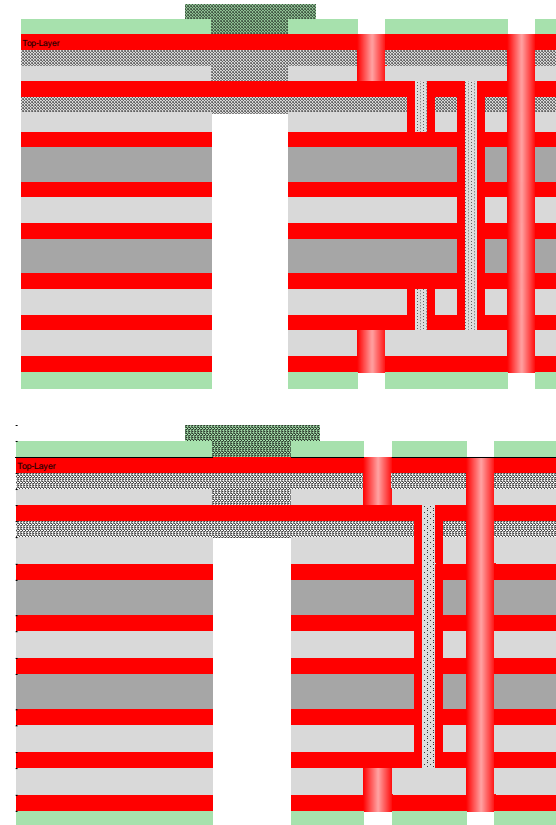
WE.FLEXONE

Combinations with HDI

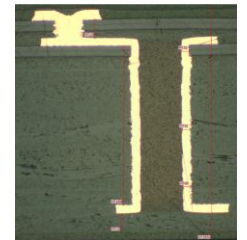
2F-xRi stack



1F+1F-xRi



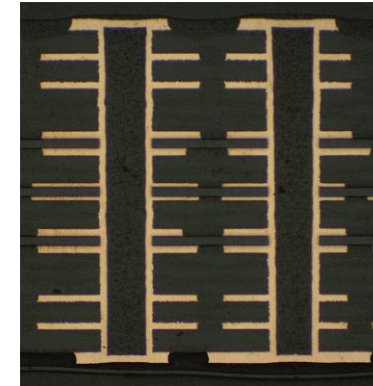
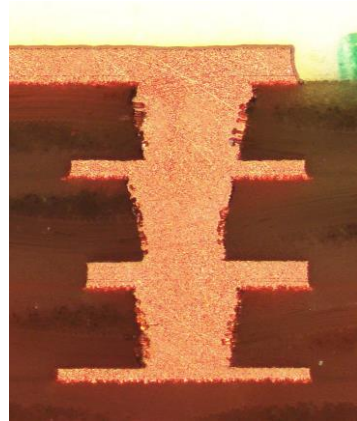
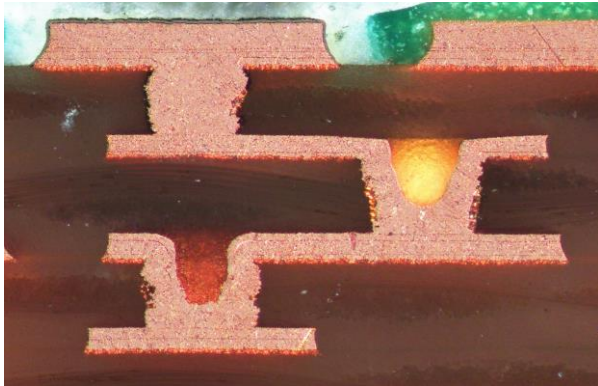
2F-6Ri +
HDI 2-4(6b)-2



2F-6Ri +
HDI 1-6b-1

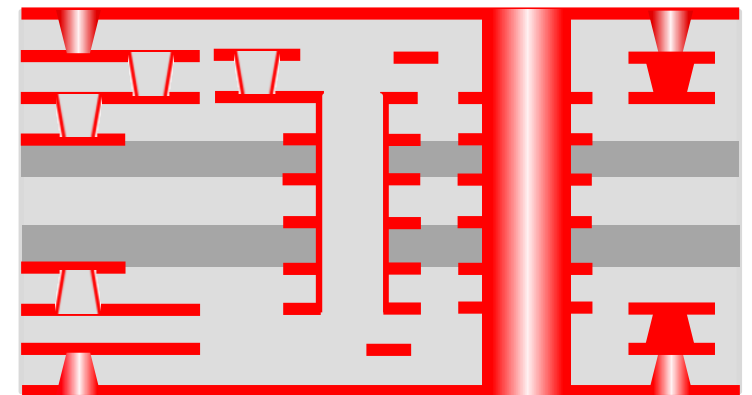
WE.FLEXONE

Combinations with HDI



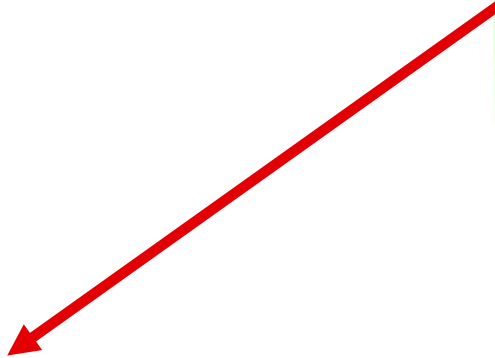
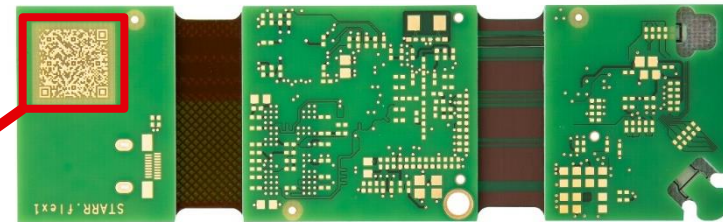
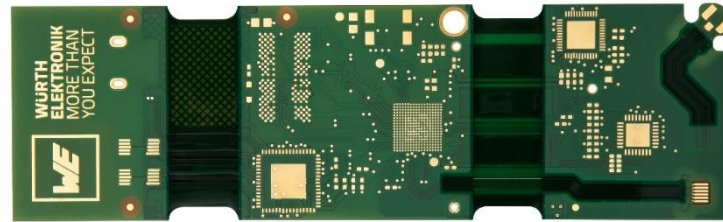
Generally, when combining different technologies or via combinations

- HDI design rules cannot be combined 1:1
- Early consultation between the partners enables potential multiplication!



WE.FLEXONE

QR-Code



WE.FLEXONE

QR-Code



LINK:
[RIGID.flex](#)
[physical sample](#)
[WE.flexone](#)

Code types and content				
Codes types	DMC	QR	Barcode	Text
Standard		ISO / IEC 18004	ISO / IEC 15420	
Picture			 <small>Wuerth Elektronik</small>	„WE“
Recommended minimum size	6 x 6 mm (square) 4 x 12 mm (rectangular)	8 x 8 mm		1 mm font size

Content can be numeric or alphanumeric characters.

Dynamic content:

- Numbering of production panel
- Numbering of delivery panel in production panel (nest number)
- Numbering single PCB in production panel (nest number)
- Serial number for delivery panel
- Serial number for single PCB

The codes are printed on the printed circuit board by inkjet printing in white colour.



**THANK YOU VERY
MUCH FOR YOUR
ATTENTION!**