RIGID.FLEX WITH FLEXIBLE SOLDERMASK OR COVERLAY?

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

AGENDA

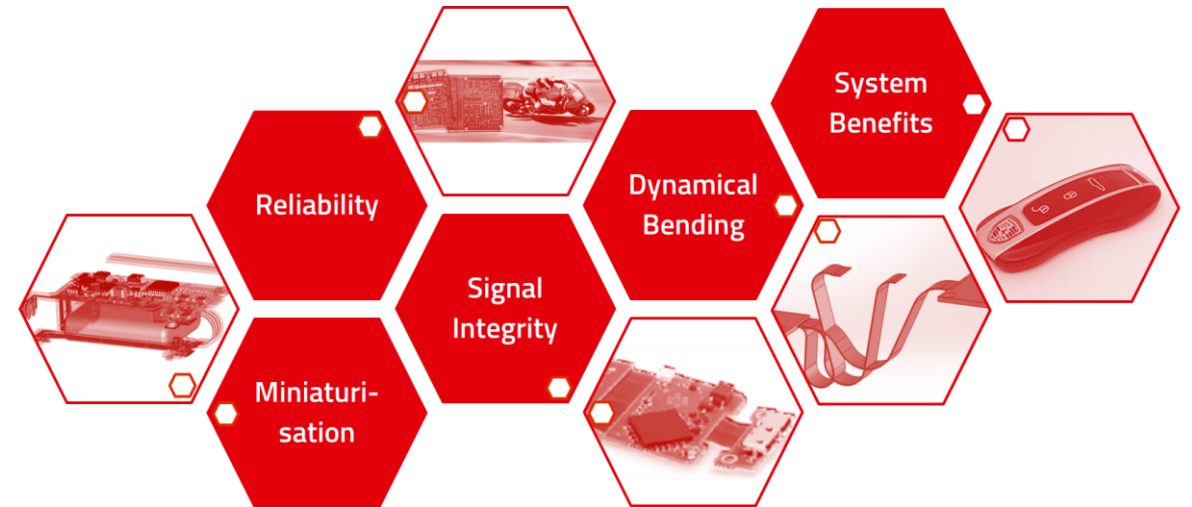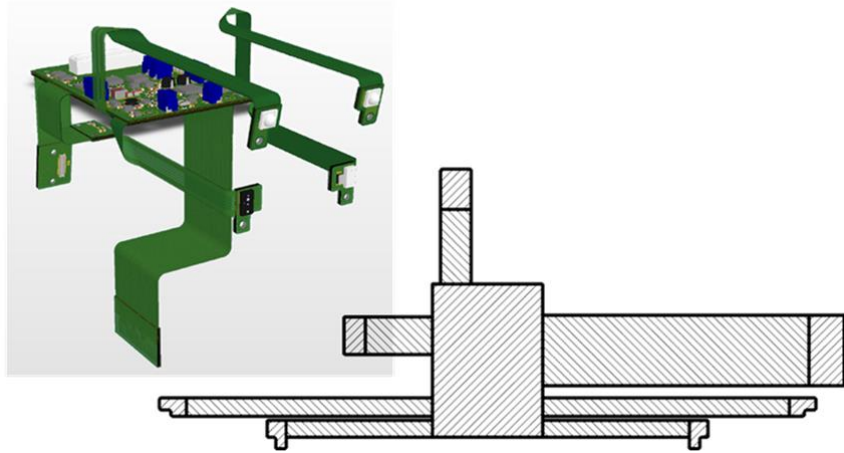RIGID.flex with flexible soldermask or coverlay?

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Technical Project Management

# INTRODUCTION

Why using Flexible Circuits?

A variety of possible materials and material combinations exist for flexible circuits.
This webinar provides an overview of flexible covercoats and coverlays and their
usage with RIDIG.flex.

COVERLAY AND COVERCOAT

Basic functions

- Encapsulation of conductors to protect against corrosion and oxidation
- Protection against environmental influences
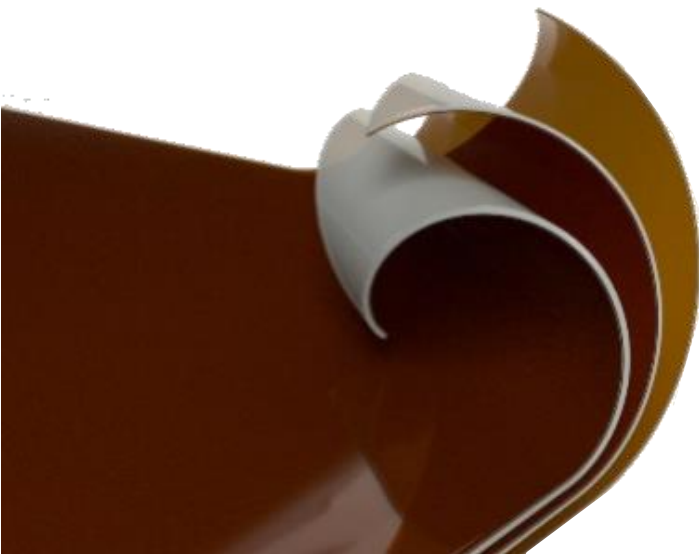- Bendabilty
  - Flex to Install
  - Dynamical bending
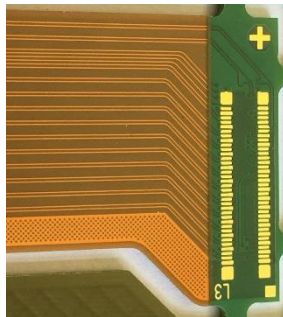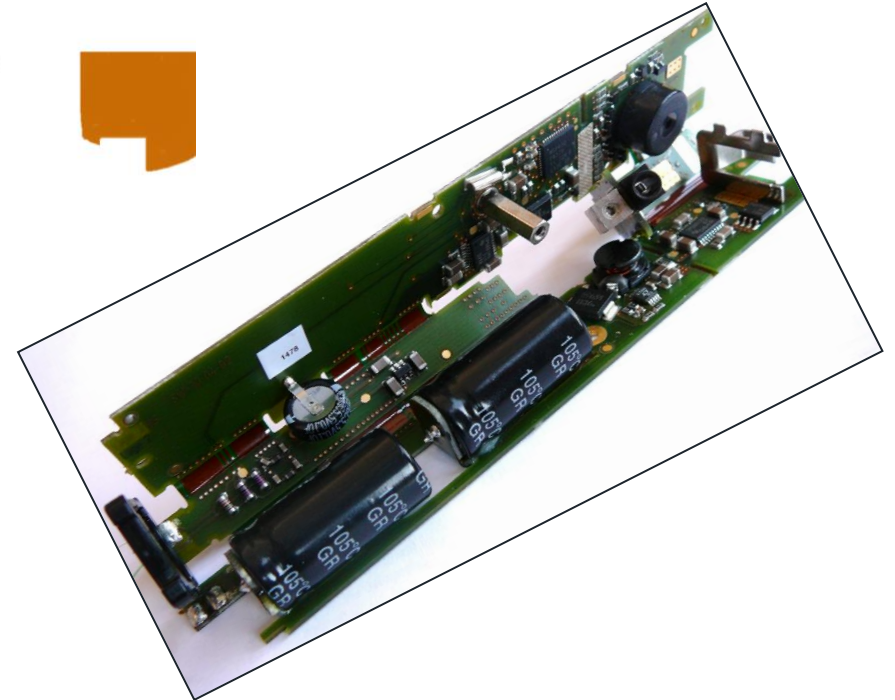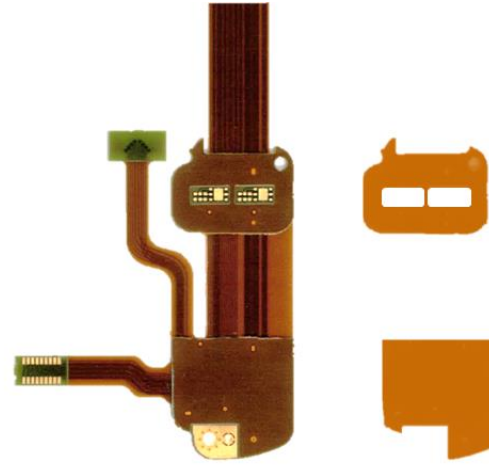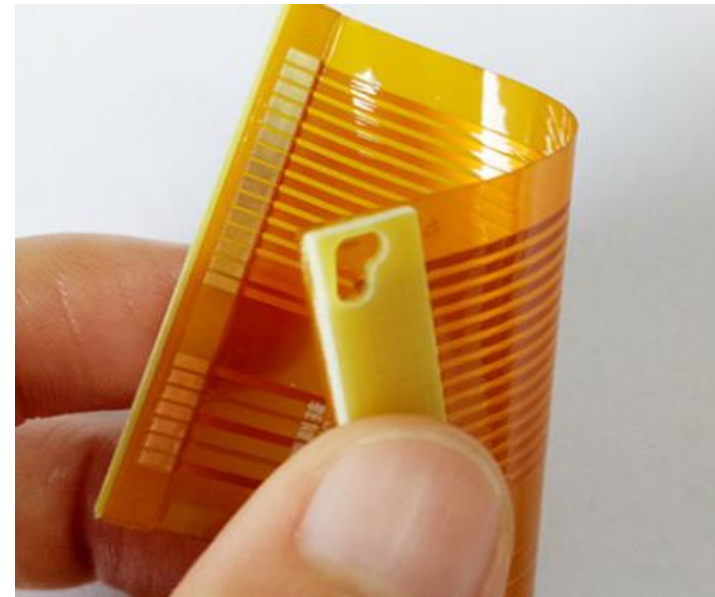
COVERLAY

Intro

What is Coverlay?

- Composite of polyimide and adhesive
- Polyimide: 12.5 µm, 25 µm or 50 µm
- Adhesive thickness: 25 µm, 35 µm or 50 µm (acrylic/epoxy)
- Protection of conductors on inner and outer layer

What are its characteristics?

- Available as flame retardant V-0
- Thermal conductivity   0.2 W m−1 K−1
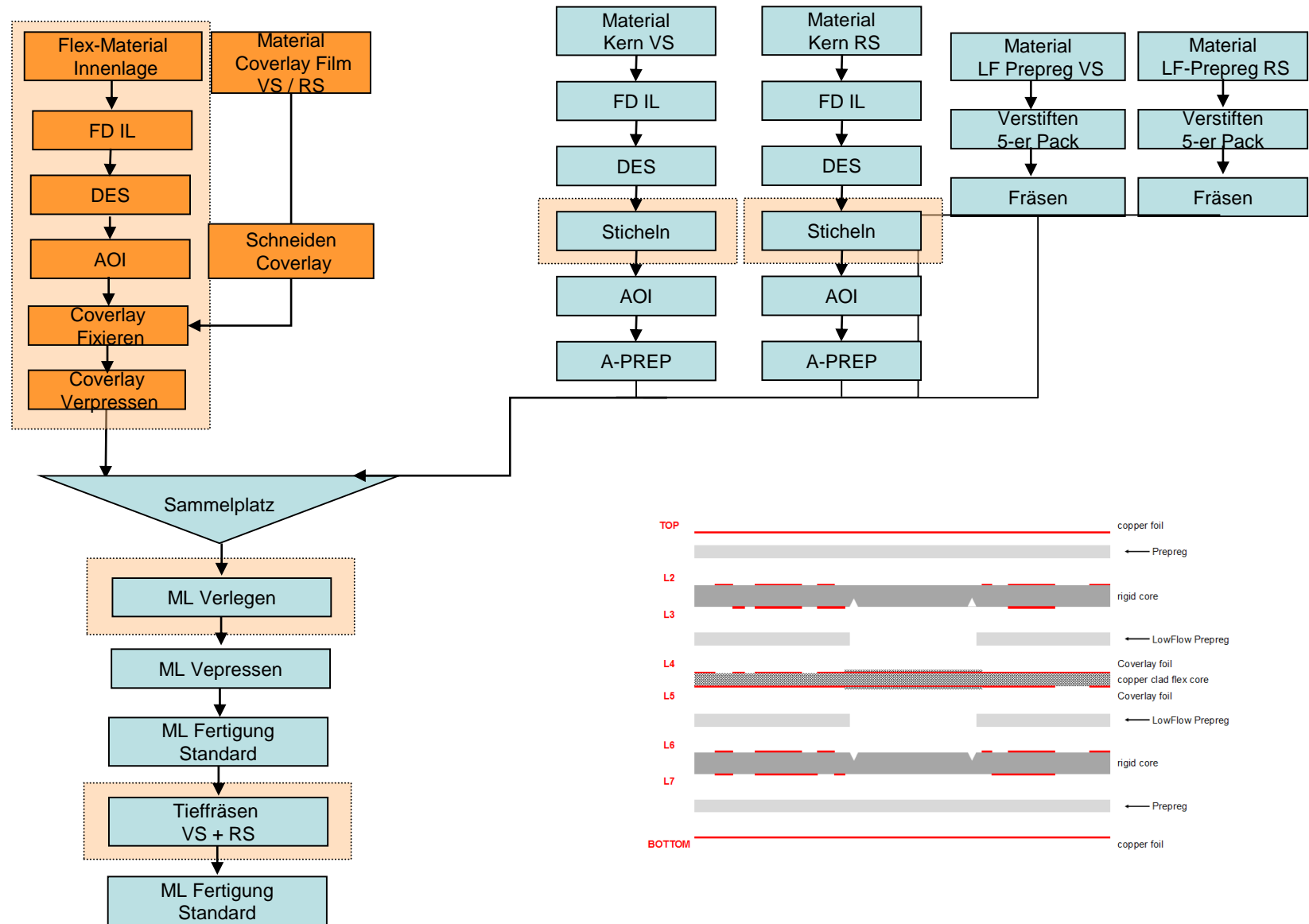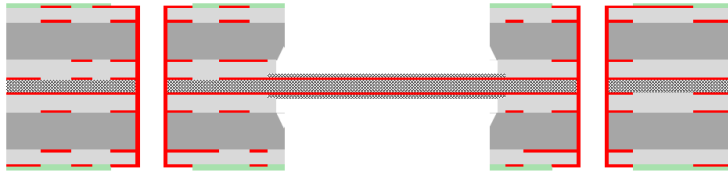- Dielectric strength ≥ 4 kV/mil
- Low outgassing

COVERLAY

Types and properties

	Coverlay
Application	Manual as Sheet Material in flex and rigid parts
Layer allocation	Innerlayer / Outerlayer
Positioning accuracy	+/- 150µm
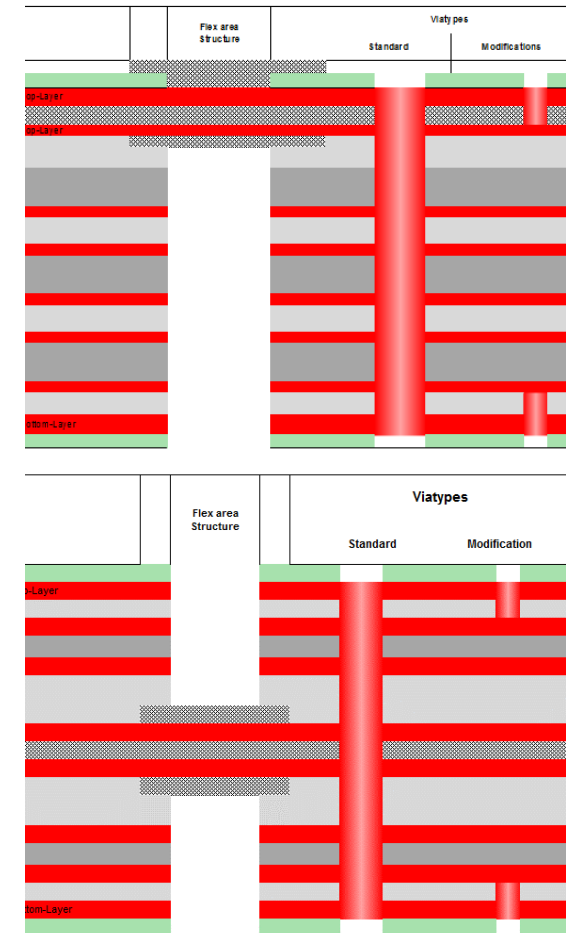
COVERLAY

Example Flexrigid xRi-2F-xRi

COVERLAY

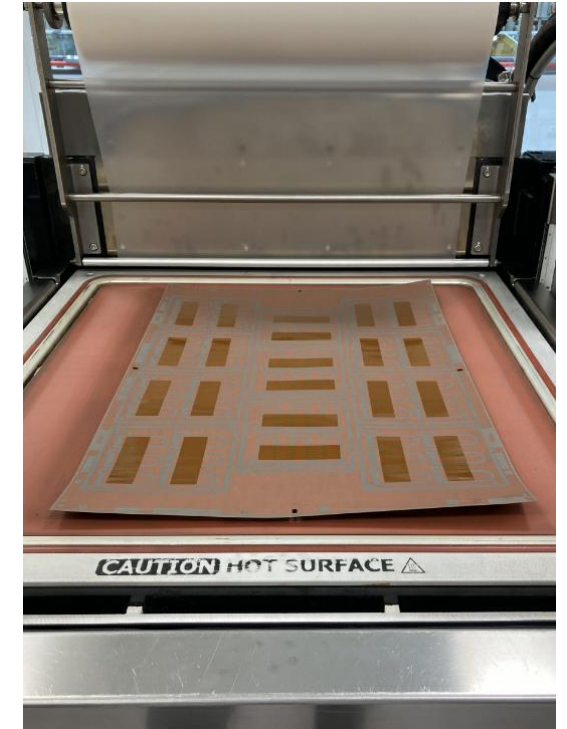Example flexinnerlayer xRi–2F–xRi

- cutting
- registration
- fixing
- pressing

COVERCOAT

Intro

What is Covercoat?

- thin lacquer-like layer of unfilled polymers, polymer mixtures, epoxy, pigments, solvents
- Layer thickness: protection of conductors on outer layers

What are its characteristics?

- Available as flame retardant V-0
- Low coefficient of thermal expansion
- High surface adhesion
- Good thermal stability
- Very good resolution (photoimaged coatings)
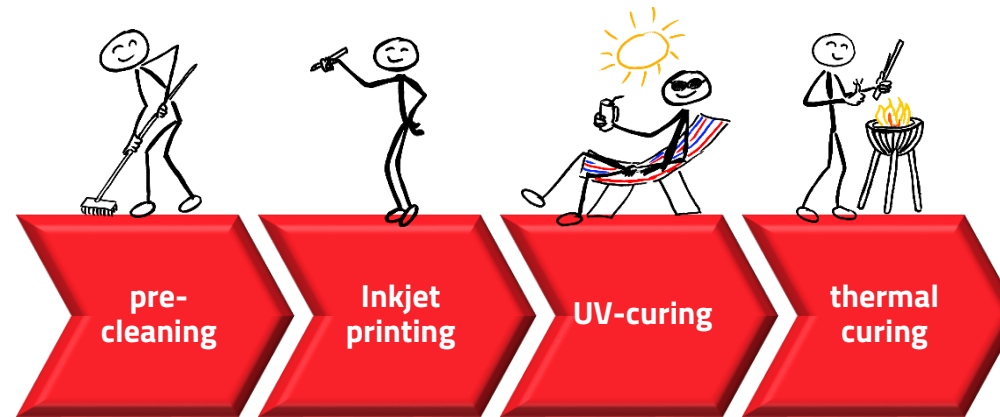- Cost-effective (non-photoimaged coatings)
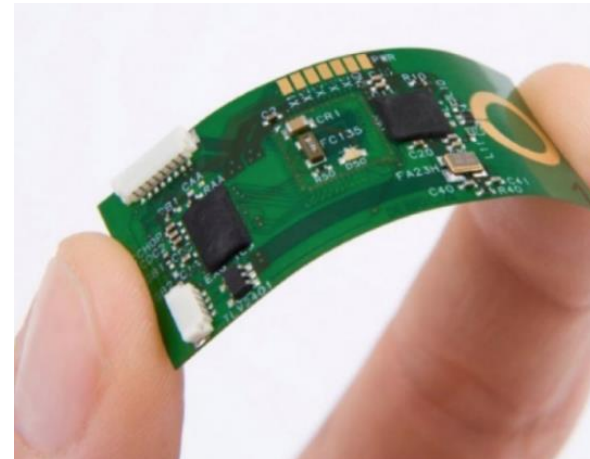
COVERCOAT

Types and properties

	Photoimaged Covercoat	Non-photoimaged Covercoat
Application	Screen printing / Spray	Screen printing / Inkjet
Layer allocation	Outer layer	Outer layer
Positioning accuracy	± 50 µm	± 200 µm

COVERCOAT

Application

by Inkjet:

| pre-cleaning | Inkjet printing | UV-curing | thermal curing |

by screen printing:

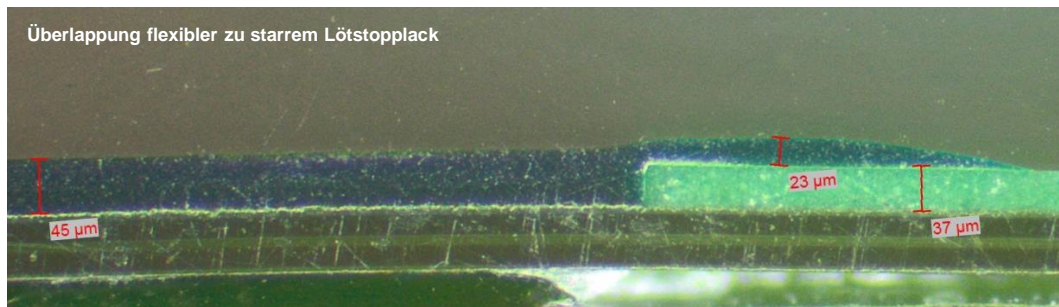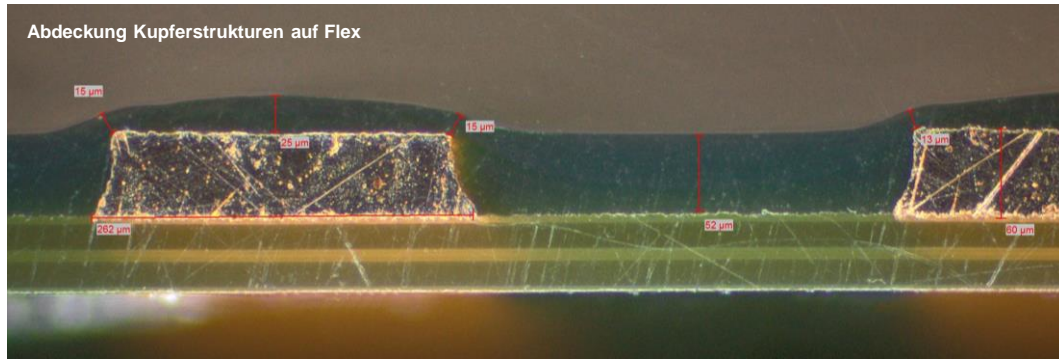| create screen | pre-cleaning | screen printing | thermal curing | screen washout |
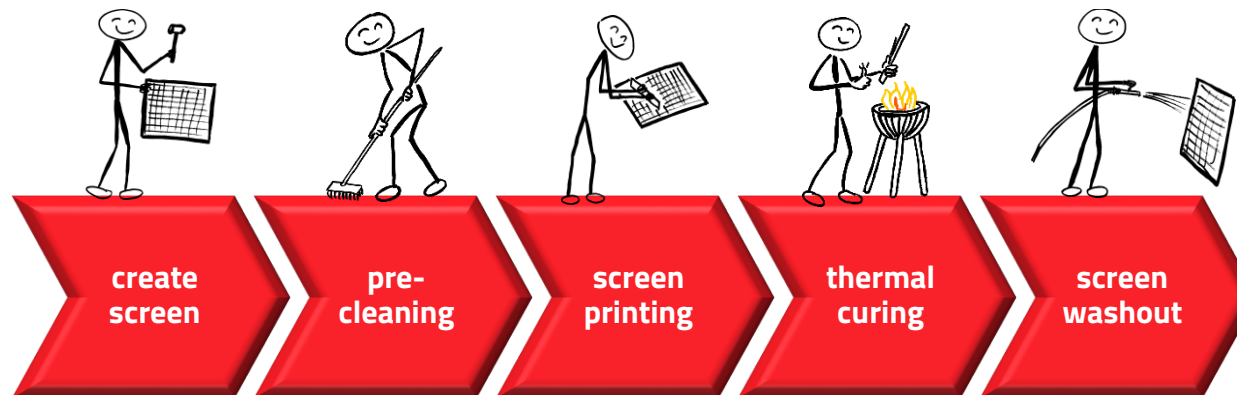
COVERCOAT

Not Photosensitive Covercoat

- Application by Inkjet
- Only in flexible area
- Distance to pads: 200 µm

Abdeckung Kupferstrukturen auf Flex

Überlappung flexibler zu starrem Lötstopplack
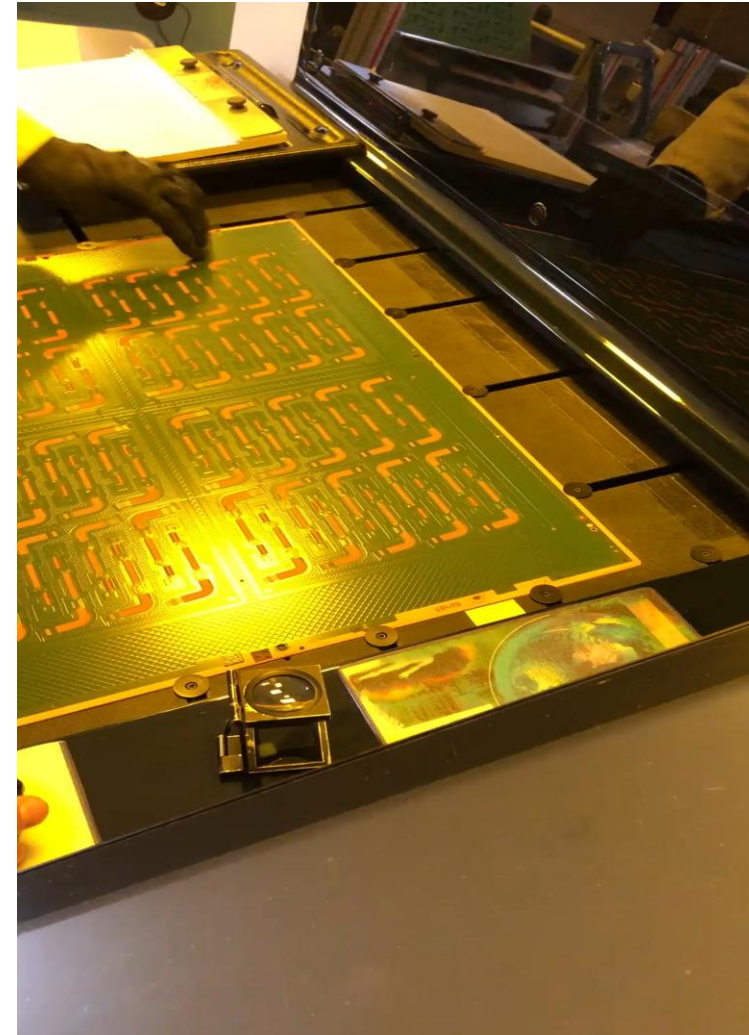
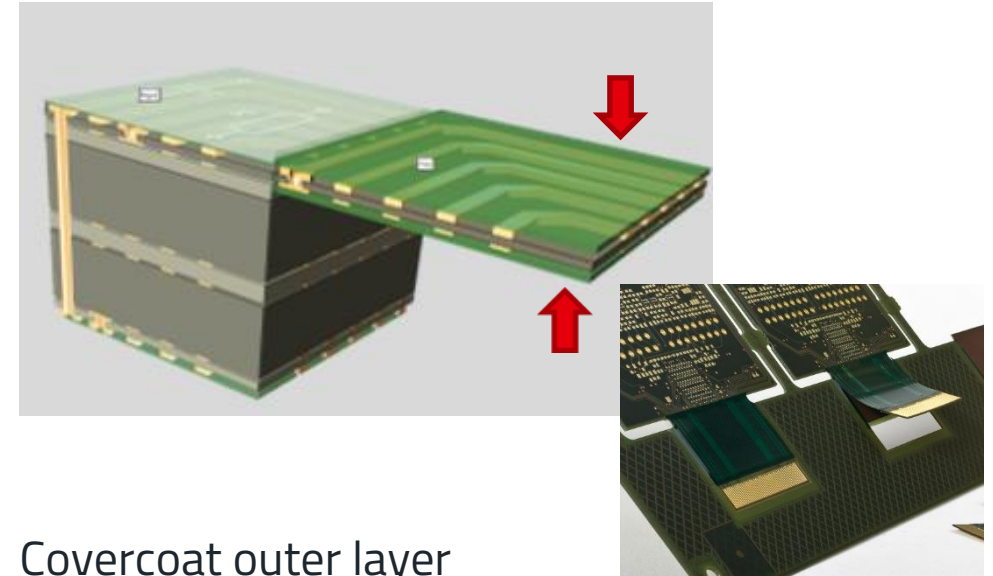# APPLICATION IN THE WE PORTFOLIO "FLEX SOLUTIONS

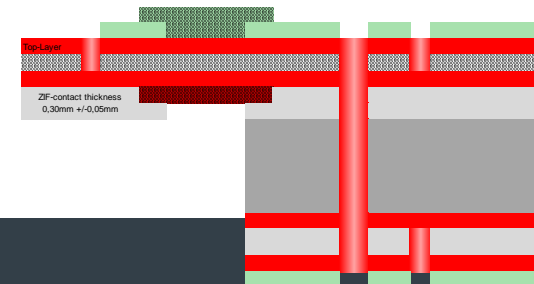Selection notes
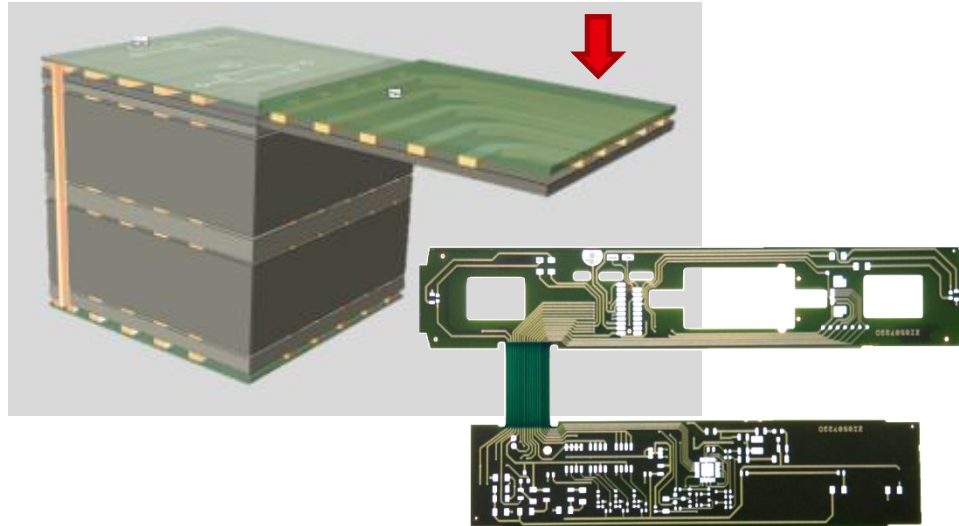
RIGID.**flex 1F-xRi**

Covercoat outer layer
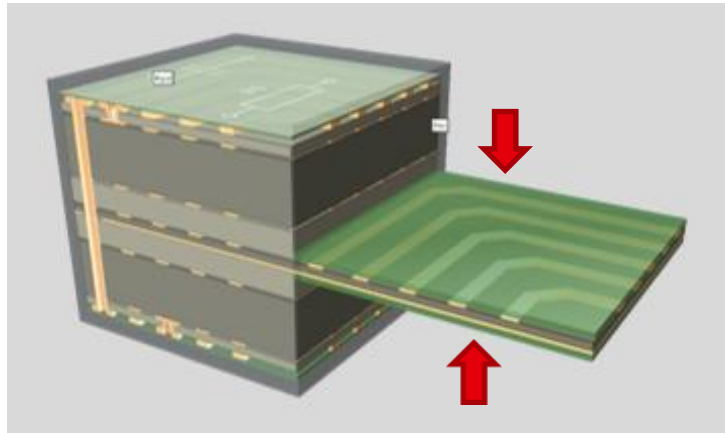Coverlay outer layer

RIGID.**flex 2F-xRi**

Covercoat outer layer
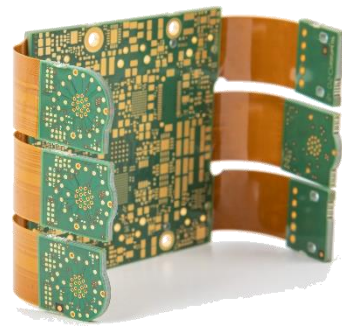Coverlay inner + outer layer

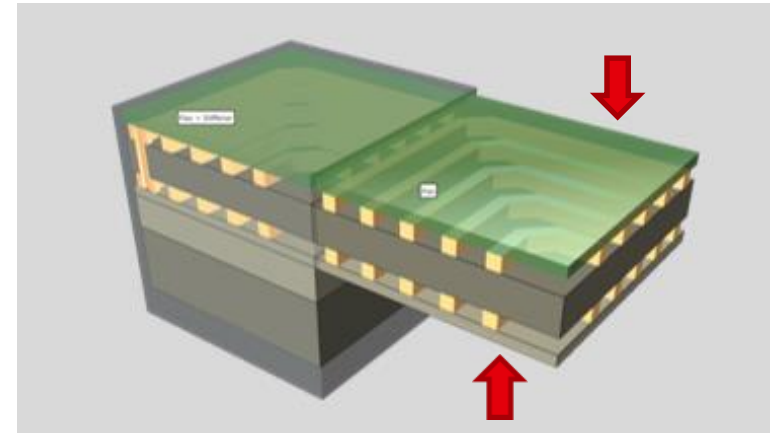# APPLICATION IN THE WE PORTFOLIO "FLEX SOLUTIONS
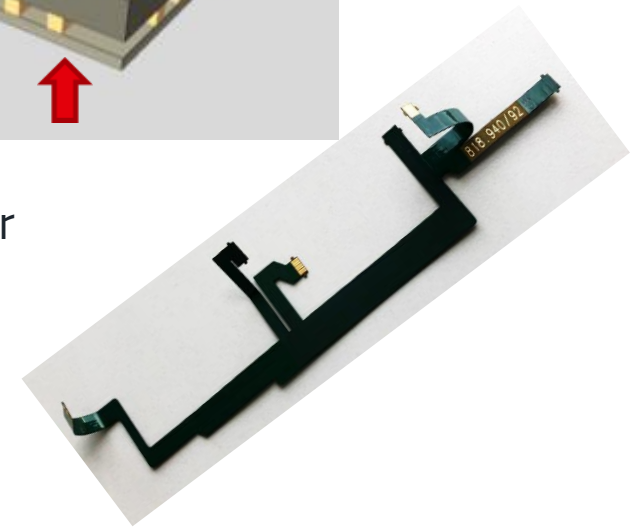
Selection notes

RIGID**.flex xRi-2F-xRi**

PURE**.flex**

Coverlay inner layer

Covercoat outer layer
Coverlay outer layer

BENCHMARK FLEXMASK OR COVERLAY?

Costs / technical

	Advantage	Disadvantage
Flexmask not photosensitiv	costs Small flexareas possible	Only partiell (2 coatingsystems necessary)
Flexmask photosensitiv	cost (1 coatingsystem) Small flexareas possible	no thick copper possible (only in prototypeplant used)
Coverlay	Different thicknesses Isolation Dynamical bending abrasion resistance „you always get the same in the market"	Position accurency Cost – manual workload

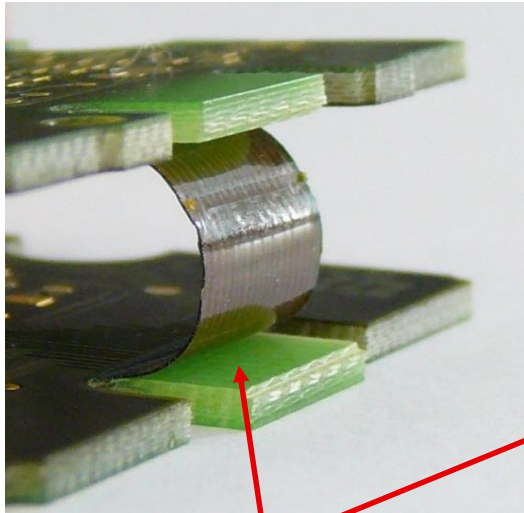# BENCHMARK FLEXMASK OR COVERLAY?

Tipps and Tricks

USING ARRAYS

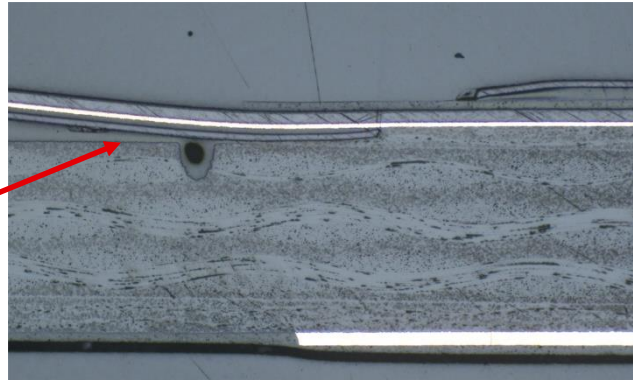- Less workload
- Better registration
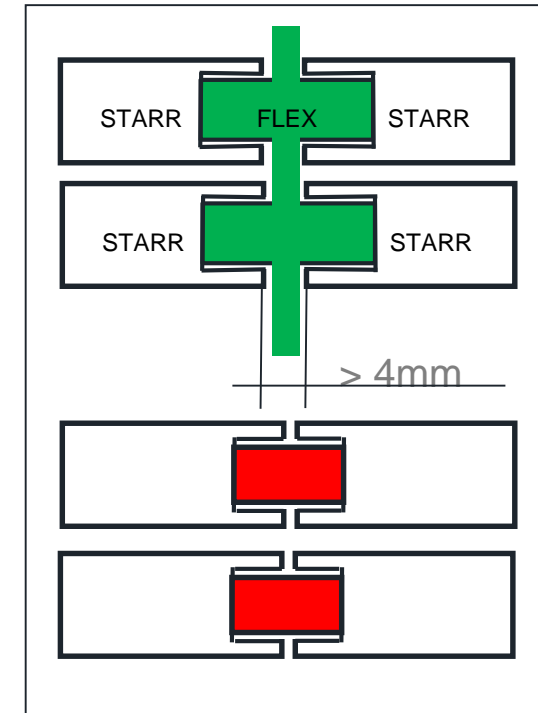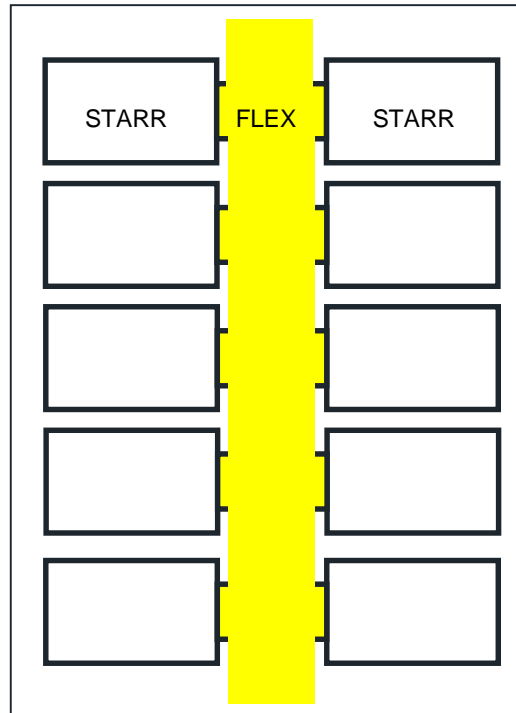
BENCHMARK FLEXMASK OR COVERLAY?

Tipps and Tricks

■ FLEX LiftOff

Bending with flexmask in the inner radius

■ Polyimide looks outside for insulation

FLEX LiftOff

■ Bending begins in the rigid area

LITERATURE

Design Guide Flex Solutions

In our Design Guide you will find an overview of all variants of our flex solutions. In addition, our specialists have summarized valuable design tips for you here. This will help you bring your application to success reliably and safely.

- New issue: September 2023
- New contents
  - Combination HDI & RIGID.flex
  - Signal integrity with RIGID.flex
    - Basic properties
    - Impedance defined stackups
    - Impedance measurement
  - Comparison flexible soldermask versus Coverlay
  - Coverlay as insulation foil
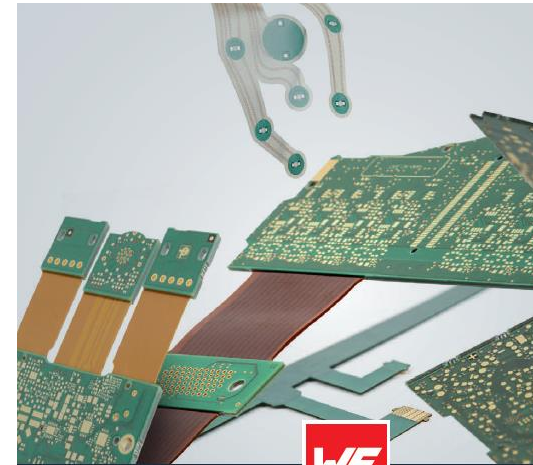
FLEX SOLUTIONS
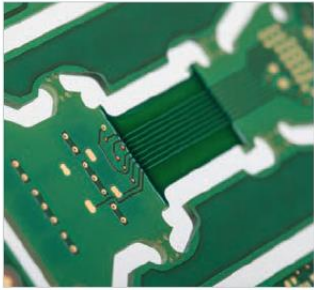DESIGN GUIDE

EN

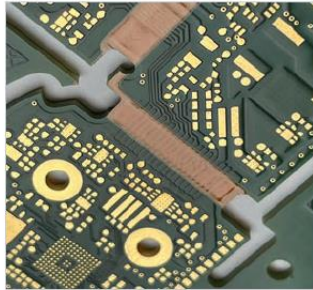**WÜRTH ELEKTRONIK** MORE THAN YOU EXPECT

LITERATURE

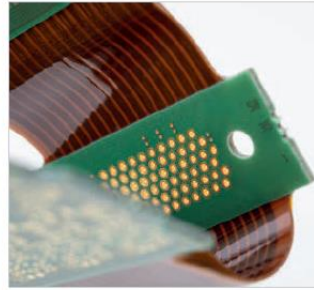## Design Guide Flex Solution - Excerpt

EXAMPLES

Flex outside: left flex solder resist

Center coverlay

Right: Flex inside with Coverlay

FLEXIBLE SOLDER RESIST OR COVERCOAT

Flex soldermask is a varnish, i.e. a mixture of binder, solvent and pigments. In contrast to solder resist for rigid printed circuit boards, flex resist remains flexible after curing, ideally resistant to folding. Flex varnish is applied by inkjet or screen printing.

COVERLAY OR COVER FILM

Coverlay is a composite film consisting of polyimide film and adhesive layer. Polyimide film thickness standard 25 µm, adhesive thickness matching the copper layer thickness. Other polyimide film thicknesses optional. Cutting or laser, manual registration and tacking, pressing in vacuum press.

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 ≥ 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

WHEN CAN I CHOOSE BETWEEN FLEXIBLE SOLDERMASK AND COVERLAY?

The choice is only possible for the variants with 1F–xRi and 2F–xRi outer flex layers - and even then only for the outer layer. With Stackup 2F–xRi, copper layer 2 is always protected with a Coverlay, as are all copper layers with inner flex layers.
With PURE.flex, it is also possible to choose between flex coating and overlay.
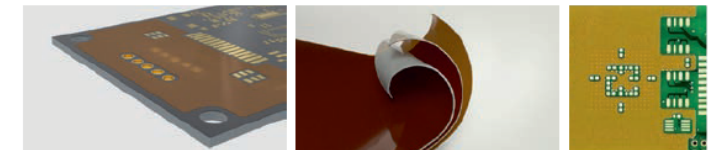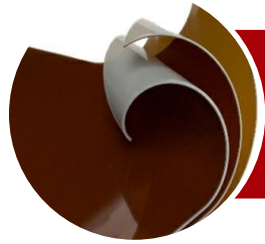
! Are you looking for a special solution?
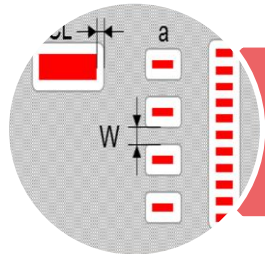Talk to our FLEXperts!

COVERLAY AS INSULATION FOIL

Coverlay foil can be used as a protective and insulating foil, both on the rigid areas of a STARR.flex PCB and on rigid BASIC or HDI PCBs.
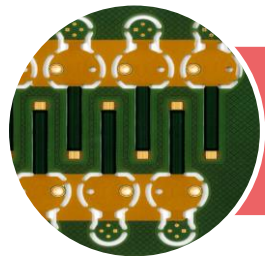
SUMMARY

Design guide with advantages and disadvantages

(technical and commercial)

Decision Flexmask or Coverlay

(WE Standard: Flexmask)

Selection of design parameters in the design rules

THANK YOU VERY MUCH FOR YOUR ATTENTION

You have the choice: RIGID.flex with flexible soldermask or coverlay?