WÜRTH ELEKTRONIK

MORE POWERFUL THAN EVER – THE NEW SLIM.flex TECHNOLOGY

Webinar

Michael Kress

October 13th 2020

AGENDA

1. Basics
2. Design rules
3. Build up
4. Applications
5. SLIM.flex = robust

Michael Kress
Head of Product and Process Development

SLIM.flex BASICS

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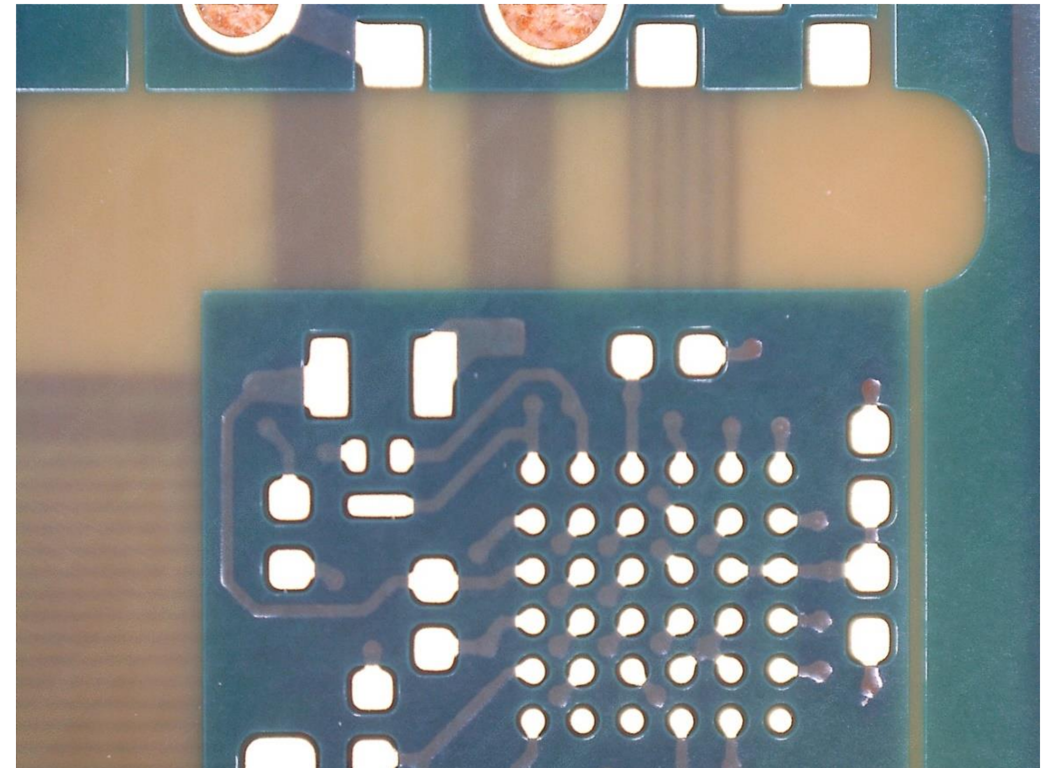
Flex / Rigid-flex buildup possibilities

- 4F – 4 layer flex: 0.23mm thick
- 6F – 6 layer flex: 0.30mm thick
- 8F – 8 layer flex: 0.38mm thick

Benefits

- Suitable for BGA Pitch 0.3mm
- Solderable several times leadfree
- Very robust and reliable
- Very flexible flex areas possible
- Possible with all common solder surfaces



SLIM.flex BASICS

more than you expect

Design rules
SLIM.flex

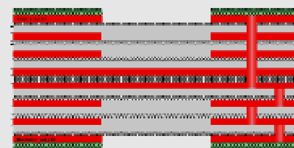
Application in accordance with IPC 2223 Use A: Flex-to-install

No UL marking (all materials are UL listed)

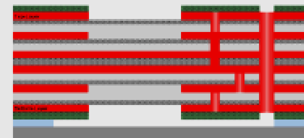
These design rules apply to:

Flexible circuit boards with 3 to 8 copper layers on flexible polyimide material, optionally with glued mechanical stiffener or solder carrier.

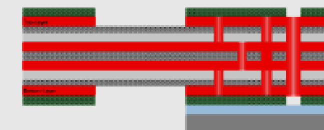
Examples:



SLIM.**flex** 8F
Standard: only microvias used



SLIM.**flex** 6F
Option: solder carrier, PTH



SLIM.**flex** 4F-Ri
Options: Stiffener, PTH

Nomenclature: F = Flex, Ri = Rigid (starr)

SLIM.flex DESIGN RULES

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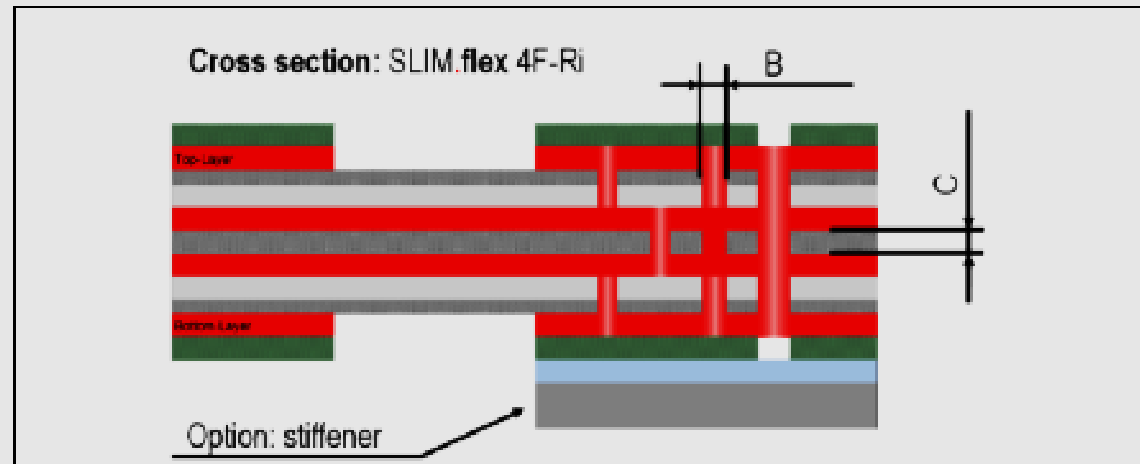


Symbol	Description	Technical Standard	Advanced requirements
	Line widths and spacing	75µm/75µm, only Microvias	75µm/100µm with PTH
	Minimum pad diameter for microvia	225µm	200µm
	Minimum pad diameter for PTH		450 µm
B	Finished Hole diameter lasered microvia	70µm	70 µm
-	Distance copper to outline	≥ 300µm	≥ 100µm (Lasercut)
-	Number x of copper layers (xF)	3-8	
C	Thickness of flexible material polyimide	50µm	75 / 100µm
-	Thickness of cold-bonded stiffener made of FR4 material	0,1 – 0,5mm	0,5 – 0,8mm
-	Thickness of cold-bonded solder carrier made of FR4 material	0,80mm	
-	Thickness of glue for stiffener	50 µm	

SLIM.flex Build up

- Available as a PDF-document

Rigid

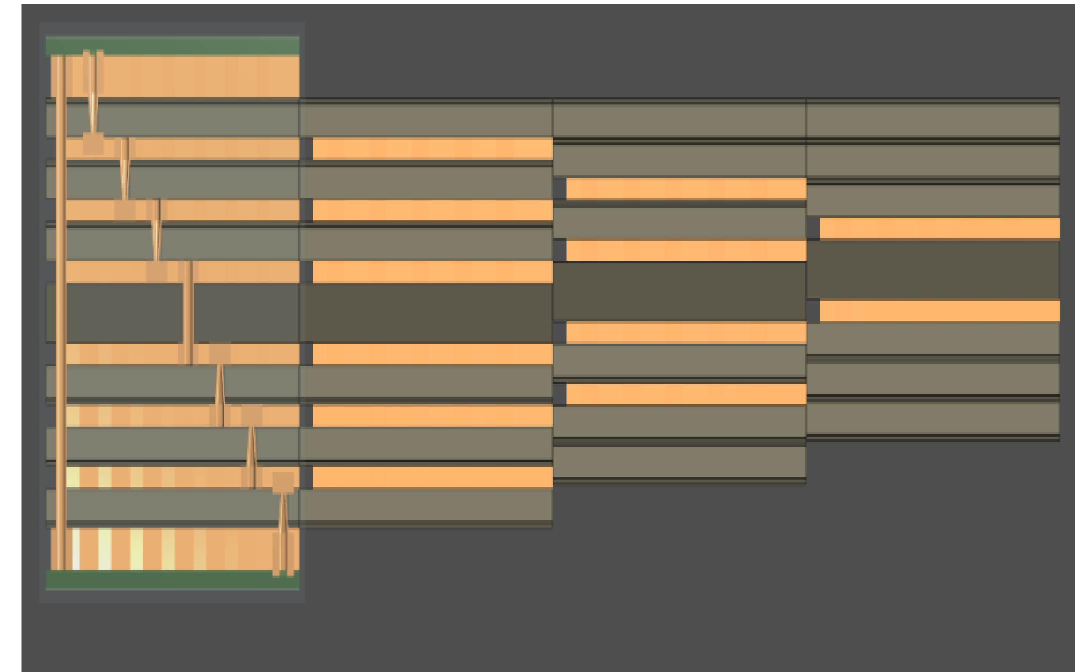
#	Layer	Thickness	Description	Dk	Df	Note
	Top Solder	0.015mm	Soldermask JIS-C-5012/IPC-SM840	4,3	0,05	flexibel, photosensitive
1	Top Side	0.035mm	ED Copper + plating			
		0.005mm	Flexible core IPC-4204/11	3,4	0,003	Flex Polyimide adhesiveless
		0.028mm	Bonding film IPC-4204/2 (part of)	3	0,019	Flexible Adhesive (Epoxy)
2	Inner Layer 1	0.018mm	ED Copper + plating			
		0.005mm	Flexible core IPC-4204/11	3,4	0,003	Flex Polyimide adhesiveless
		0.028mm	Bonding film IPC-4204/2 (part of)	3	0,019	Flexible Adhesive (Epoxy)
3	Inner Layer 2	0.018mm	ED Copper + plating			
		0.005mm	Flexible core IPC-4204/11	3,4	0,003	Flex Polyimide adhesiveless
		0.028mm	Bonding film IPC-4204/2 (part of)	3	0,019	Flexible Adhesive (Epoxy)
4	Inner Layer 3	0.018mm	ED Copper + plating			
		0.050mm	Flexible core IPC-4204/11	3,4	0,002	Flex Polyimide adhesiveless
5	Inner Layer 4	0.018mm	ED Copper + plating			
		0.028mm	Bonding film IPC-4204/2 (part of)	3	0,019	Flexible Adhesive (Epoxy)
		0.005mm	Flexible core IPC-4204/11	3,4	0,003	Flex Polyimide adhesiveless
6	Inner Layer 5	0.018mm	ED Copper + plating			
		0.028mm	Bonding film IPC-4204/2 (part of)	3	0,019	Flexible Adhesive (Epoxy)
		0.005mm	Flexible core IPC-4204/11	3,4	0,003	Flex Polyimide adhesiveless
7	Inner Layer 6	0.018mm	ED Copper + plating			
		0.028mm	Bonding film IPC-4204/2 (part of)	3	0,019	Flexible Adhesive (Epoxy)
		0.005mm	Flexible core IPC-4204/11	3,4	0,003	Flex Polyimide adhesiveless
8	Bottom Side	0.035mm	ED Copper + plating			
	Bottom Solder	0.015mm	Soldermask JIS-C-5012/IPC-SM840	4,3	0,05	flexibel, photosensitive

Total thickness: 0.456mm

Flex

notes:	FLEX8_8F_0,46_12				WÜRTH ELEKTRONIK
Final copper thickness according to IPC-6012	PCB Thickness Tolerance: rigid ± 10% / flex ± 0,05mm				
	customer		created		
IPC 2223 use A "Flex to install"	pcb name		approved		
	engineer		format	A4, landscape	
Please regard to our sectional design rules: ► www.we-online.com	date				
	Template Revision: 07/2020 by Andreas Schilpp / Michael Kress / Werner Öchslen				

- Also available digitally for AltiumDesigner20



AGENDA

1 Basics

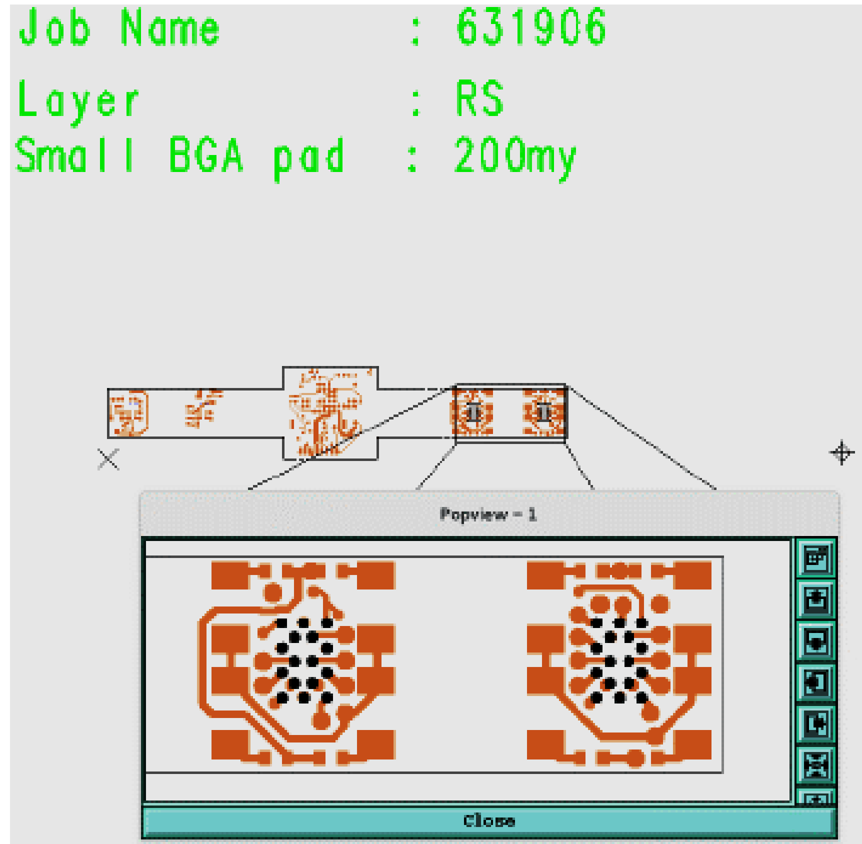
2 Designrues

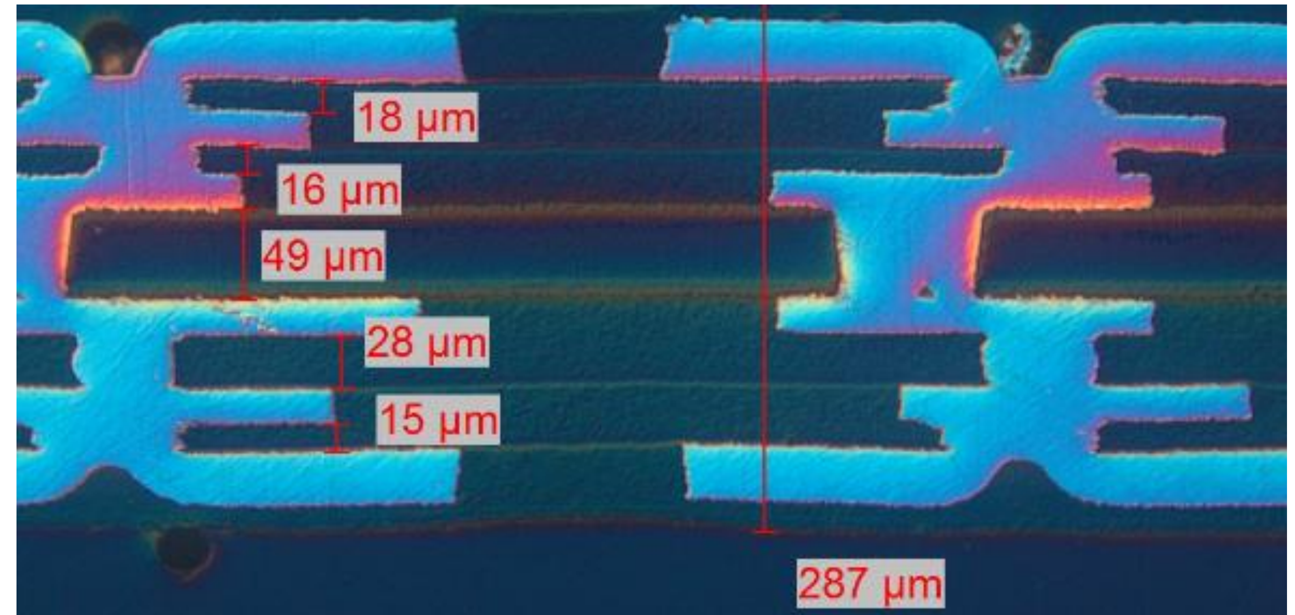
3 Build up

4 **Applications**

5 SLIM.flex = robust

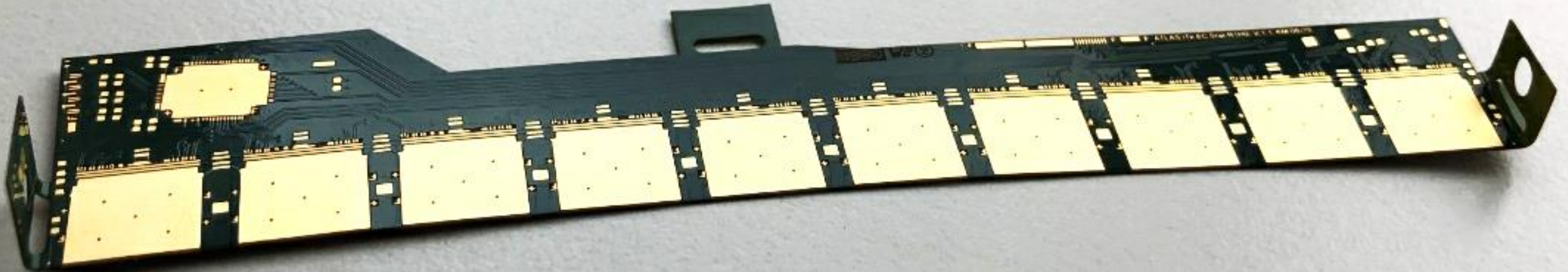
SLIM.flex APPLICATIONS





SLIM.flex APPLICATIONS

Particle sensor in the LHC, Cern



Highlights

- Build up 4-layer HDI 1-2b-1, 0,25mm thick
- HDI-Design for FlipChip technology
- Bare chip assembly with wire bonding
- Impedance specified build up
- 75µm fineline layout

Benefits

- Eliminating of the acrylic improves the detectin and measurement of the collision reaction
- Small thickness with very low tolerances is advantageous for the assembly of the flipchip components

SLIM.flex APPLICATIONS

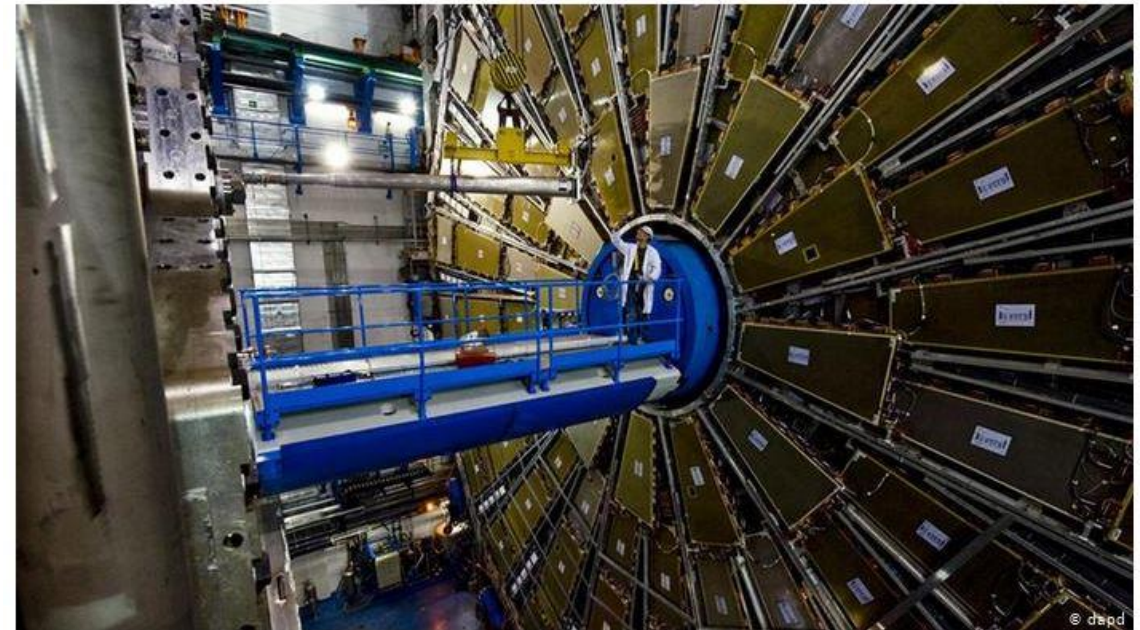
Particle sensor in the LHC, Cern

Progess for research

- **Build-up SLIM.flex 4F, thickness 0,25mm**
- **Impedance matched**
  - **Zdiff = 100Ω on inner layers**
  - **Zdiff = 110Ω on outer layers**
  - **Zo = 50Ω on inner layers**
- **75µm fineline layout**
- **Components: FC soldered, bare chips wirebonded**

Benefits

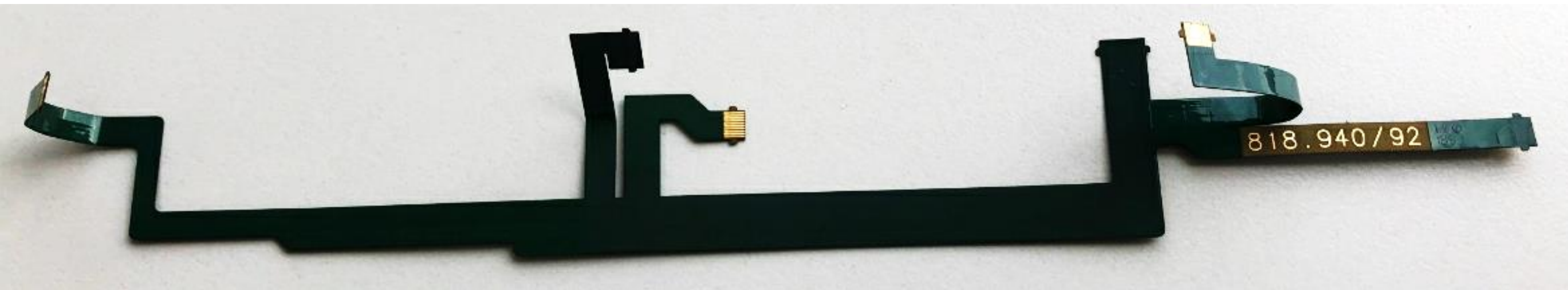
- **Elimination of acrylic improves detection and measurement of collision reactions**
- **Small thickness with very low tolerances is advantageous for the assambly of the FC components**
- **Larger process window in the soldering process**



Der Teilchenbeschleuniger LHC ist der größte der Welt

SLIM.flex APPLICATIONS

HighTech Wiring harness



Highlights

- Cable construction ultra flat
- Build-up 6 Layer thickness 0.30mm
- Shielding for inner layers
- ZIF-contacts with locking hook

Benefits

- Alternative to cabel constructions
- Less space needed for many connections
- Super fast installation thanks to the precurved shape

AGENDA

1 Basics

2 Designrues

3 Build up

4 Applications

5 **SLIM.flex = robust**

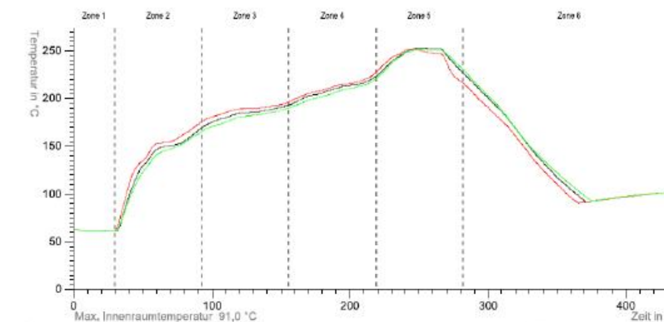
SLIM.**flex = VERY ROBUST**

Qualification (Extract)

- **Reflow testing**
  - Drying before reflow process
  - 6 times reflow process with a peak temperature of 260°C

Reflow

TESTS:
- Resistance to Soldering Heat acc. AEC-Q200 / MIL-Std 202 Method 210
- Solderability acc. AEC-Q200 / J-Std 002
- 5-times Reflow WE internal Standard



FACTS:
- Full Computer Controlled
- 4 heating zones with hot air circulation

- Zone 1:	Preheat Zone
- Zone 2:	Preheat Zone
- Zone 3:	Stabilization Zone
- Zone 4:	Soldering Zone
- Zone 5:	Cooling Zone

- Transport system speed : 0.05 – 0.8 m/min

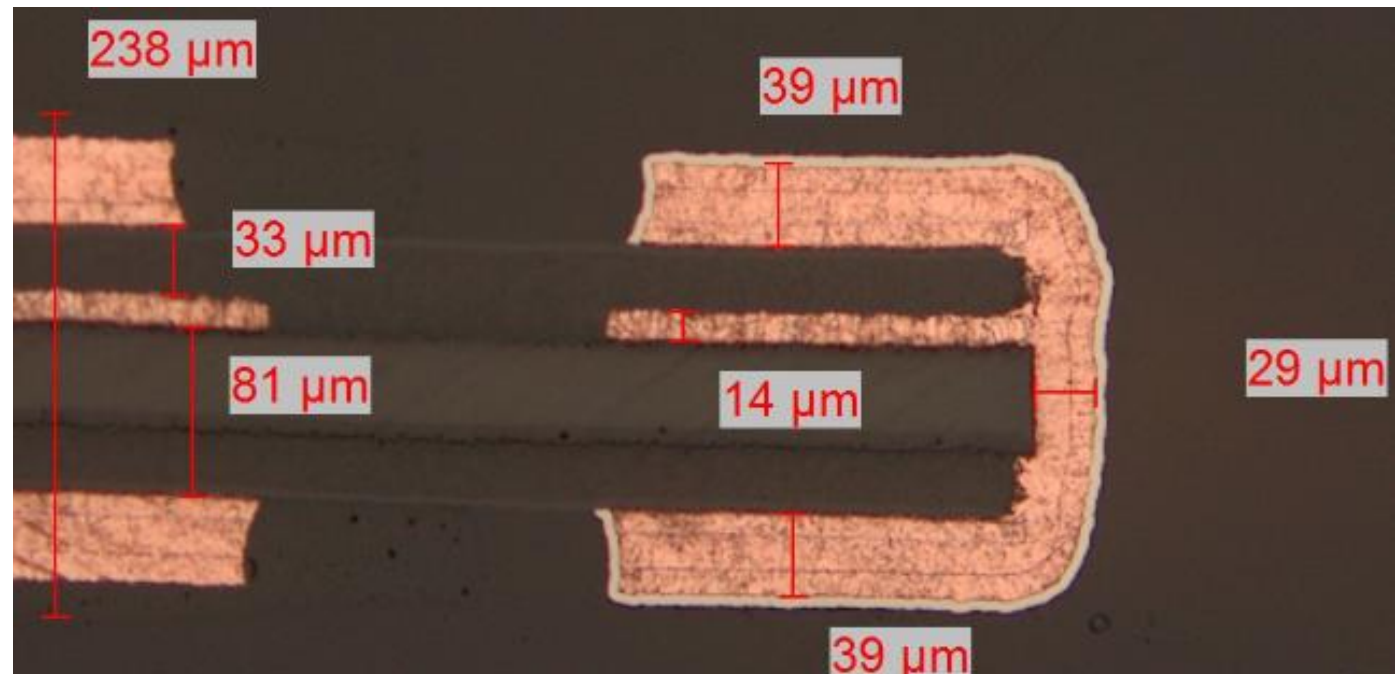
more than you expect

SLIM.flex = VERY ROBUST

Qualification (Extract)

- **Reflow testing**
  - Drying before reflow process
  - 10 times reflow process with a peak temperature of 260°C

⇨ **NO defects**



SLIM.flex = VERY ROBUST

Qualification (Extract)

- **Thermal shock test (-55°C / + 125°C)**
  - Drying before soldering process
  - 6 times reflow prozess with a peak temperatur of 245°C

Temperature Test System VT7012-S2

TESTS:

- High Temperature Exposure acc. AEC-Q200 / MIL-Std 202 Method 108
- Thermal Shock acc. AEC-Q200 / JESD22 Method JA-104

FACTS:

- Cabinet volume of 120 l
- Dimensions: W470 x H410 x D650 mm
- Max. temperature change rate 11 K/min
- 2 chambers
- Cold chamber   ->Temperature range -80°C to +70°C
- Warm chamber -> Temperature range -50°C to +220°C

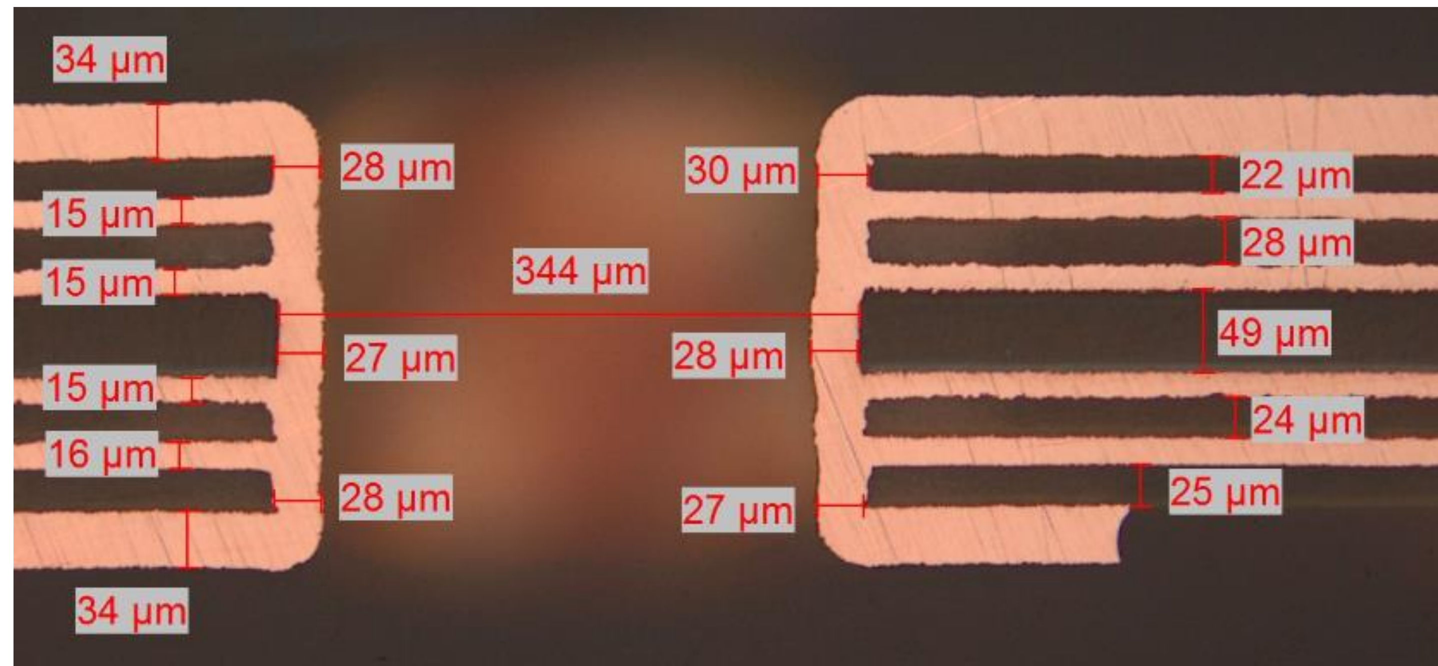
more than you expect

SLIM.flex = VERY ROBUST

Qualification (Extract)

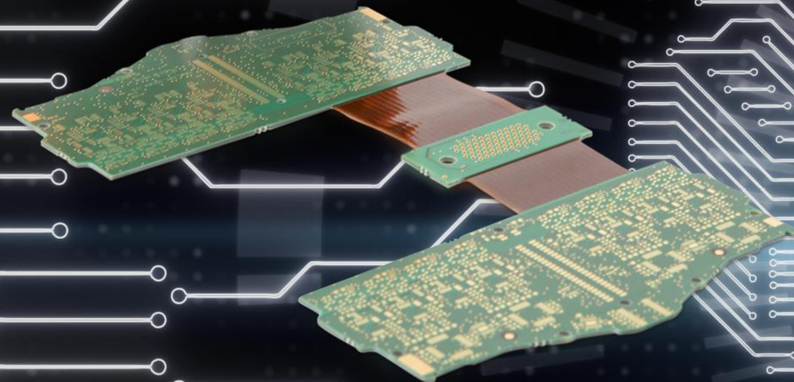
- **Thermal shock test (-55°C / + 125°C)**
  - Drying before soldering process
  - 5 times reflow prozess with a peak temperatur of 245°C

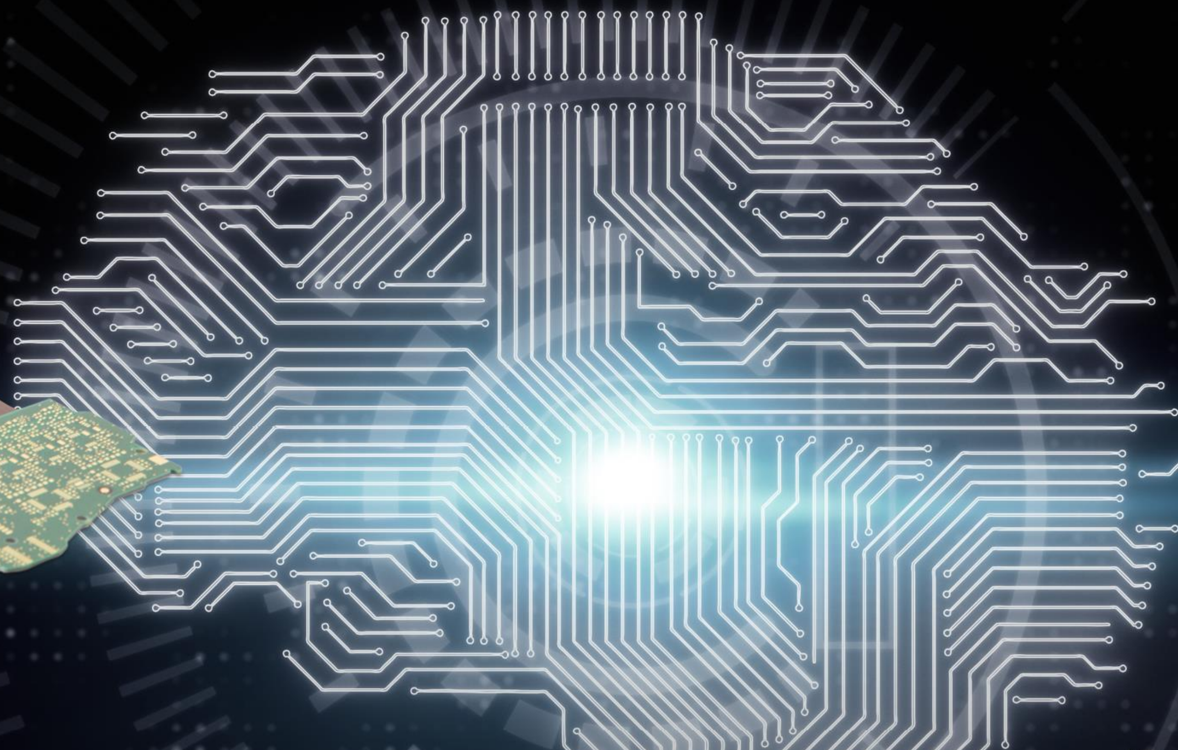
➔500 testcycles without defects



SUMMARY

- **Suitable for**
  - BGA Pitch 0.35mm with soldermask
  - BGA Pitch 0.30mm with soldermask excempted in a block
- **Fine line layout on all layers**
- **Microvias between all layers possible**
  - Microvias filled with copper
- **Excellent thermal stability**
  - Risk of delamination in the soldering process is reduced significantly
  - Capable of multiple reflows (10 times JEDEC reflow tested without failures)





THANK YOU FOR YOUR ATTENTION!

Questions?