WÜRTH ELEKTRONIK

DIGITAL STANDARD STACKUPS – WE ARE SPEAKING YOUR LANGUAGE

AGENDA

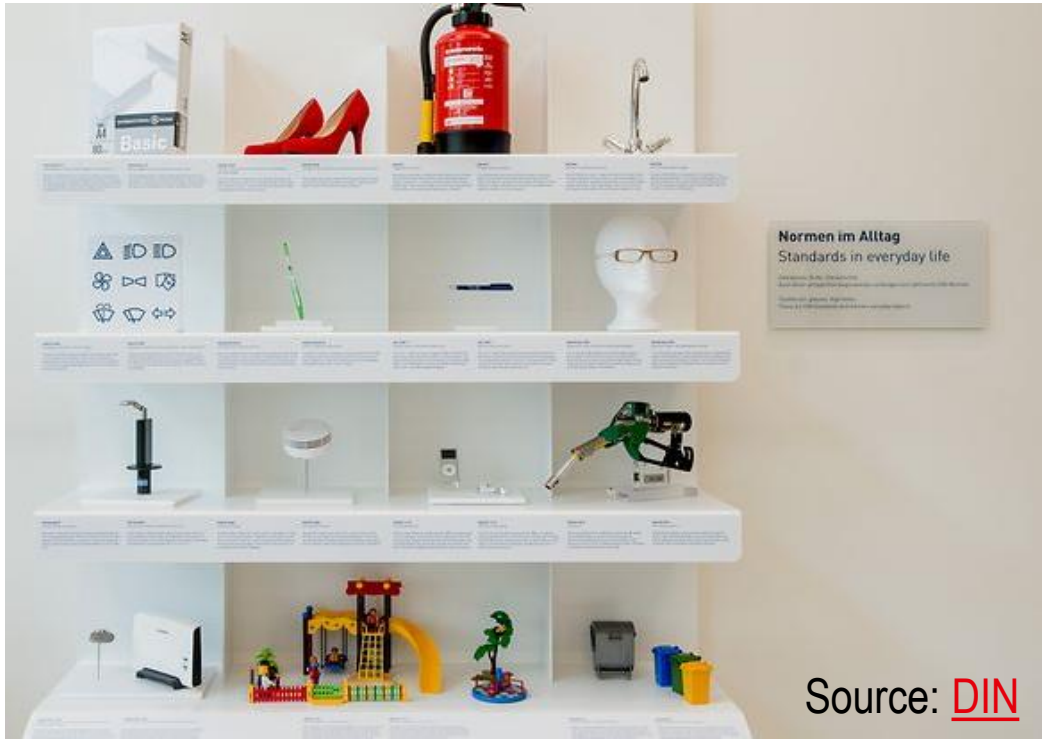
1. The power of standards
2. The new way: Relearn to find a suitable stackup
3. Digital standard stackups
4. Demonstration of stackup import process in AD20
5. Modifications and project specific stackups
6. Summary and outlook

Andreas Schilpp
Technical Marketing

THE POWER OF STANDARDS

Standards in everyday life

- **Standard: Something that is regarded as exemplary, model-like, and by which others are guided; guideline, standard, norm. [Duden]**



Source: DIN

- **Standards at work: IPC, UL etc.**

- **Materials, stackups, design rules from your PCB manufacturers, typically as pdf**

→ Unfortunately, there are only a few standards for this

PDF

Source: Adobe

THE POWER OF STANDARDS

Digital PCB standards

- **We use standards all the time, but when it comes to designing PCBs, we let the variety of options tempt us into daily, misunderstood creativity - this is dangerous and expensive!**
- **Paper is a thing of the past – PCB standards for EDA tools from your Printed Circuit Board producer are here!**
- **Standards at work are**
  - the basis for quality and
  - efficiency and
  - reliability by using proven stackups with proven manufacturability and, last but not least,
  - cost-optimized.
- **And in digital form they are unbeatable in terms of**
  - error prevention and
  - productivity increase

THE POWER OF STANDARDS

PCB Design Flow – stackup related items

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MCAD

Mechanical Design

- Checking of all interfaces
  - Mechanical
  - Electrical
- Modular system
  - Homogeneous
  - Heterogeneous
- Shape and mechanical layout
- Installation concept, foldings
  - Bend radii
  - IPC use A / use B
- Fastening points
- DXF output

Physical Design

Material and Stackup

- Materal selection
  - Operating conditions
  - Functional surface
- Components, esp. critical ones
- Thickness
  - Bending radius ratio
- Number of copper layers
  - Flex areas (signals, planes)
  - Rigid areas
- Via technology (PTH, µVia, BV)
- Functional surface
- Impedance matching

EDA Layout

Layout

- Outline, DXF import
- Board planning mode
- Layer stack manager
- Via types
- Impedance profiles
- Prelim. component placement
  - Only on rigid parts
- Routing
  - traces, planes
- Design rules

Documentation

Fabrication Data

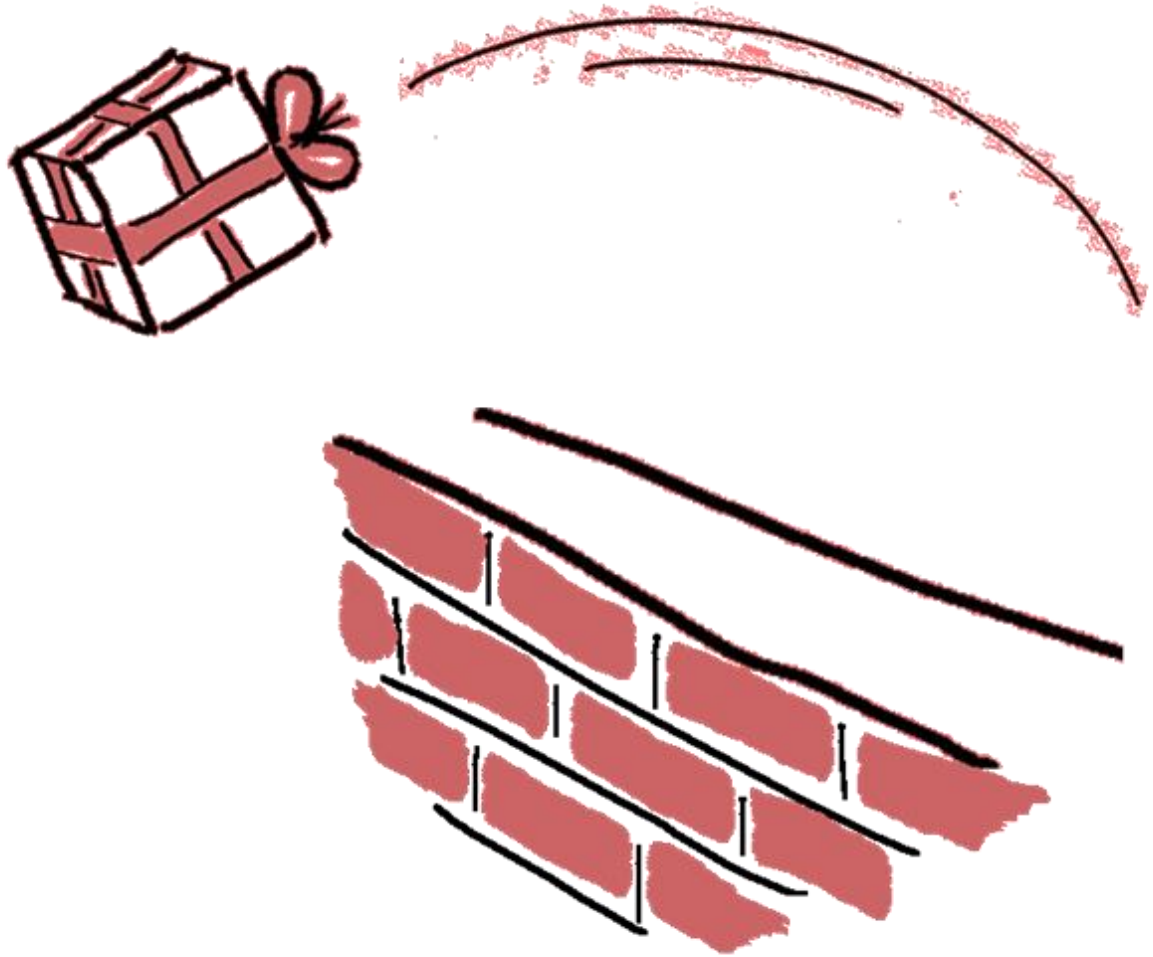
- Materal and stackup
  - Operating conditions
  - Functional surface
- Delivery array
- Gerbers
- i.e. AD20 Draftsman

RELEARN TO FIND A SUITABLE STACKUP

The old way

- Copy and paste of specifications, materials and stackups from old projects
- Finish the complete layout process
- Try to find a PCB manufacturer who makes the boards, at least in prototype volume
- And what about the series? Yield? Reliability? Cost?

The more complex the technology, the less this one-way street works



RELEARN TO FIND A SUITABLE STACKUP

Cooperate With Your PCB Manufacturer

- First, specify your load profile and material requirements
- Check whether you could use standard stackups wherever possible
- Then talk to your PCB manufacturer and start a project if needed

→ use standards

→ use digital standards

This is the new and better way to efficiently develop quality in every new project. The times when standards had to be transferred from paper or copied from old projects are over.

DIGITAL STANDARD STACKUPS

Remarks and explanations

- **Nomenclature of file names**

Examples:

	Technology	Total Layer Count	Construction	True Overall Thickness	Nominal Copper Thickness inner Layers
BASIC6_ML6_2,07_17	BASIC	6	ML6	2,07mm	17
FLEX6_2F-4Ri_1,03_17	FLEX	6	2F-4Ri	1,03mm	17
HDI6_1-4b-1_1,36_35	HDI	6	1-4b-1	1,36mm	35

- **Structure and contents of the tables**
  - Nominal thickness: For your orientation
  - Different Constructions
  - File names

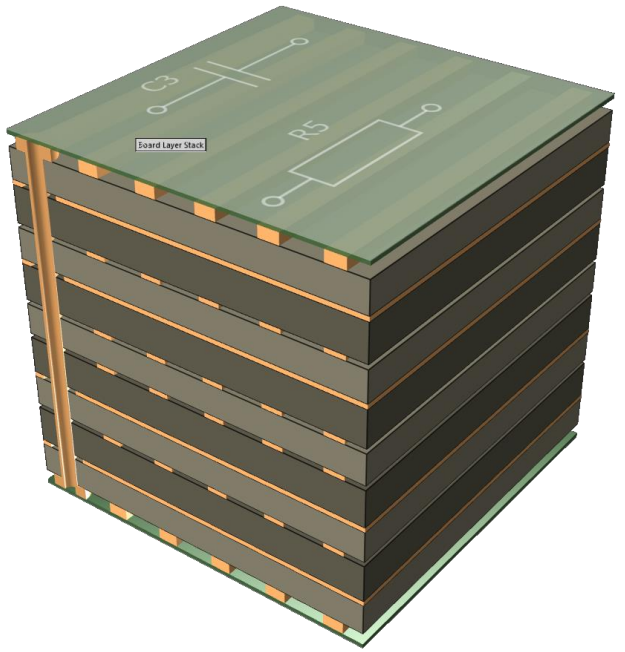
Layer	Nominal thickness*	17 µ copper	35 µ copper
4	1,00 mm	BASIC4_ML4_1,00_17	BASIC4_ML4_1,04_35
	1,55 mm	BASIC4_ML4_1,60_17	BASIC4_ML4_1,64_35
	2,00 mm	BASIC4_ML4_2,14_17	BASIC4_ML4_2,18_35
	2,40 mm	BASIC4_ML4_2,44_17	BASIC4_ML4_2,48_35
	1,[illegible] mm	[illegible] 0,96 [illegible]	[illegible]

DIGITAL STANDARD STACKUPS

BASIC

Layer	Nominal thickness*	17 µ copper	35 µ copper
4	1,00 mm	BASIC4_ML4_1,00_17	BASIC4_ML4_1,04_35
	1,55 mm	BASIC4_ML4_1,60_17	BASIC4_ML4_1,64_35
	2,00 mm	BASIC4_ML4_2,14_17	BASIC4_ML4_2,18_35
	2,40 mm	BASIC4_ML4_2,44_17	BASIC4_ML4_2,48_35
6	1,00 mm	BASIC6_ML6_0,96_17	BASIC6_ML6_1,04_35
	1,55 mm	BASIC6_ML6_1,57_17	BASIC6_ML6_1,64_35
	2,00 mm	BASIC6_ML6_2,07_17	BASIC6_ML6_2,06_35
	2,40 mm	BASIC6_ML6_2,32_17	BASIC6_ML6_2,39_35
8	1,00 mm	BASIC8_ML8_1,02_17	-
	1,55 mm	BASIC8_ML8_1,55_17	BASIC8_ML8_1,66_35
	2,00 mm	BASIC8_ML8_1,95_17	BASIC8_ML8_2,06_35
	2,40 mm	BASIC8_ML8_2,33_17	BASIC8_ML8_2,44_35
10	1,00 mm	-	-
	1,55 mm	BASIC10_ML10_1,48_17	BASIC10_ML10_1,63_35
	2,00 mm	BASIC10_ML10_1,96_17	BASIC10_ML10_2,10_35
	2,40 mm	BASIC10_ML10_2,36_17	BASIC10_ML10_2,30_35

** the actual total thickness can be seen from the file name*

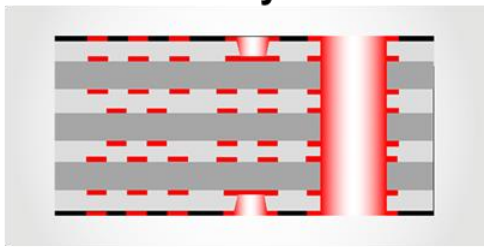


Download BASIC stackups here

DIGITAL STANDARD STACKUPS

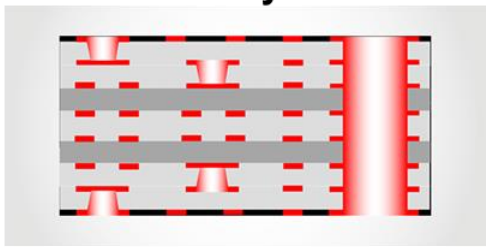
Structure of the HDI table

1 Microvia-Layer



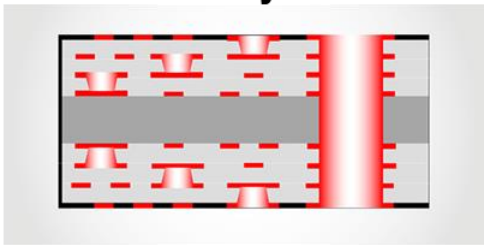
& PTH

2 Microvia-Layers



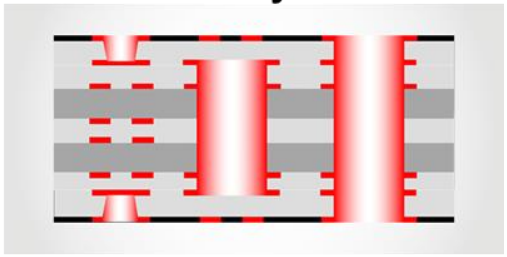
& PTH

3 Microvia-Layers



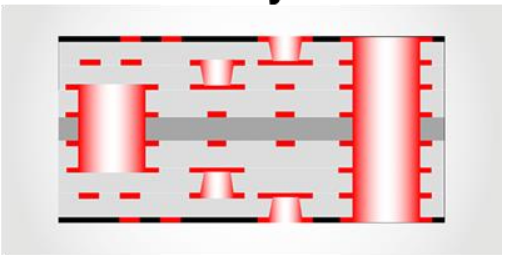
& PTH

1 Microvia-Layer



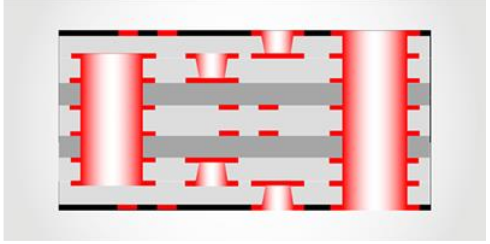
& PTH & Buried Via

2 Microvia-Layers



& PTH & Buried Via

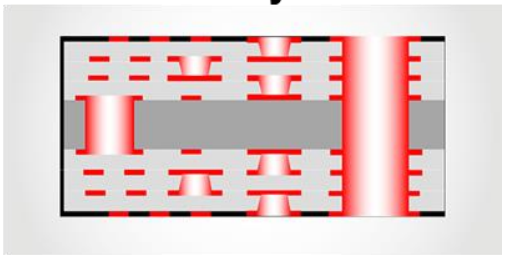
2 Microvia-Layers



& PTH & Buried Via

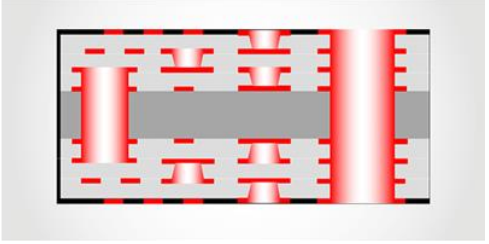
Buried Via starts on inner Microvia layer

3 Microvia-Layers



& PTH & Buried Via

3 Microvia-Layers



& PTH & Buried Via

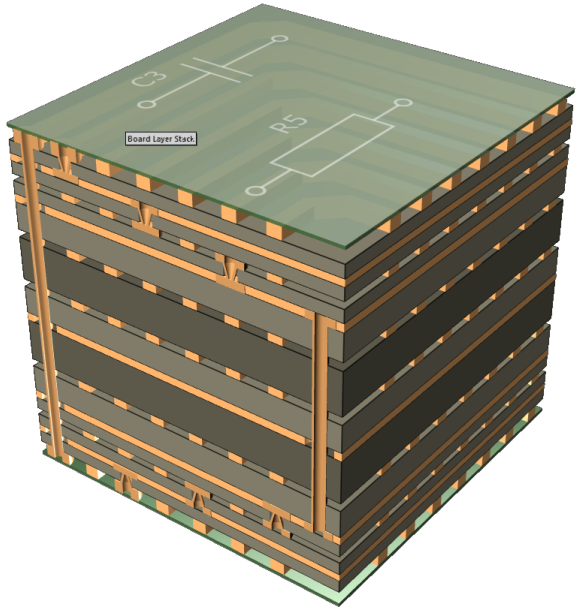
Buried Via starts on inner Microvia layer

DIGITAL STANDARD STACKUPS

HDI, inner layer foil 1oz.

35µm copper

Layer	Nominal thickness*	1 Microvia layer and PTH	2 Microvia layer and PTH	3 Microvia layer and PTH	1 Microvia layer, PTH and Buried Via	2 Microvia layer, PTH and Buried Via	3 Microvia layer, PTH and Buried Via	2 Microvia layer, PTH and Buried Via. Buried Via starts on inner Microvia layer	3 Microvia layer, PTH and Buried Via. Buried Via starts on inner Microvia layer
4	0,80 mm	HDI4_1-2-1_0,94_35	-	-	HDI4_1-2b-1_0,94_35	-	-	-	-
	1,00 mm	HDI4_1-2-1_1,04_35	-	-	HDI4_1-2b-1_1,04_35	-	-	-	-
	1,20 mm	HDI4_1-2-1_1,26_35	-	-	HDI4_1-2b-1_1,26_35	-	-	-	-
	1,55 mm	HDI4_1-2-1_1,53_35	-	-	HDI4_1-2b-1_1,53_35	-	-	-	-
6	0,80 mm	HDI6_1-4-1_0,93_35	HDI6_2-2-2_0,93_35	-	HDI6_1-4b-1_0,90_35	-	-	-	-
	1,00 mm	HDI6_1-4-1_1,13_35	-	-	-	-	-	-	-
	1,20 mm	HDI6_1-4-1_1,35_35	HDI6_2-2-2_1,23_35	-	HDI6_1-4b-1_1,36_35	HDI6_2-2b-2_1,13_35	-	HDI6_2-2(4b)-2_1,14_35	-
	1,55 mm	HDI6_1-4-1_1,55_35	HDI6_2-2-2_1,45_35	-	HDI6_1-4b-1_1,58_35	HDI6_2-2b-2_1,45_35	-	HDI6_2-2(4b)-2_1,46_35	-
	2,00 mm	HDI6_1-4-1_1,75_35	HDI6_2-2-2_1,72_35	-	HDI6_1-4b-1_1,76_35	-	-	HDI6_2-2(4b)-2_1,72_35	-
8	0,80 mm	-	-	-	-	-	-	-	-
	1,00 mm	HDI8_1-6-1_1,02_35	HDI8_2-4-2_1,12_35	-	HDI8_1-6b-1_1,05_35	HDI8_2-4b-2_1,09_35	-	-	-
	1,20 mm	HDI8_1-6-1_1,32_35	-	-	HDI8_1-6b-1_1,35_35	-	-	HDI8_2-4(6b)-2_1,13_35	-
	1,55 mm	HDI8_1-6-1_1,62_35	HDI8_2-4-2_1,54_35	HDI8_3-2-3_1,64_35	HDI8_1-6b-1_1,55_35	HDI8_2-4b-2_1,55_35	HDI8_3-2b-3_1,64_35	HDI8_2-4(6b)-2_1,54_35	HDI8_3-2(4b)-3_1,64_35
	2,00 mm	HDI8_1-6-1_1,72_35	-	-	HDI8_1-6b-1_1,75_35	-	-	HDI8_2-4(6b)-2_1,74_35	-
10	0,80 mm	-	-	-	-	-	-	-	-
	1,00 mm	HDI10_1-8-1_1,32_35	-	-	-	-	-	-	-
	1,20 mm	HDI10_1-8-1_1,52_35	HDI10_2-6-2_1,21_35	-	HDI10_1-8b-1_1,34_35	-	-	HDI10_2-6(8b)-2_1,37_35	-
	1,55 mm	HDI10_1-8-1_1,72_35	HDI10_2-6-2_1,36_35	HDI10_3-4-3_1,63_35	HDI10_1-8b_1_1,63_35	HDI10_2-6b-2_1,64_35	HDI10_3-4b-3_1,54_35	HDI10_2-6(8b)-2_1,66_35	HDI10_3-4(6b)-3_1,64_35
	2,00 mm	-	HDI10_2-6-2_1,66_35	-	-	-	-	-	-
12	0,80 mm	-	-	-	-	-	-	-	-
	1,00 mm	-	-	-	-	-	-	-	-
	1,20 mm	-	-	-	-	-	-	-	-
	1,55 mm	HDI12_1-10-1_1,61_35	HDI12_2-8-2_1,50_35	-	HDI12_1-10b-1_1,63_35	-	HDI12_3-6b-3_1,63_35	HDI12_2-8(10b)-2_1,50_35	-
	2,00 mm	HDI12_1-10-1_1,86_35	HDI12_2-8-2_1,70_35	HDI12_3-6-3_1,70_35	-	HDI12_2-8b-2_1,70_35	-	HDI12_2-8(10b)-2_1,70_35	HDI12_3-6(8b)-3_1,70_35



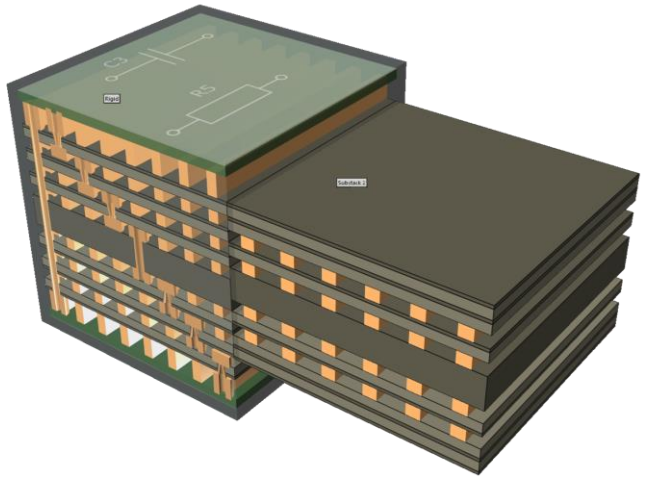
Download HDI stackups here

DIGITAL STANDARD STACKUPS

SLIM.flex

Layer	Nominal thickness*	Stackup
4	0,25 mm	FLEX4_4F_0,25_12
6	0,35 mm	FLEX6_6F_0,35_12
8	0,46 mm	FLEX8_8F_0,46_12

** the actual total thickness can be seen from the file name*

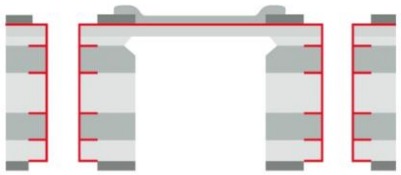


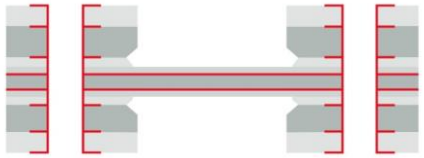
Download SLIM.flex stackups here

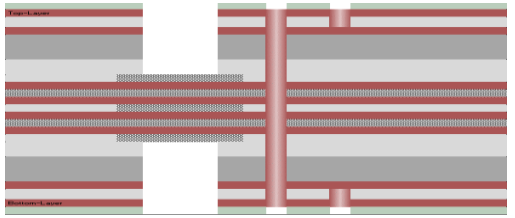
DIGITAL STANDARD STACKUPS

Structure of the RIGID.**flex** table

1F-xRi (Starrflex)	xRi-2F-xRi (Flex-rigid)	2F-xRi (Flex-rigid)	xRi-4F-xRi (Flex-rigid)





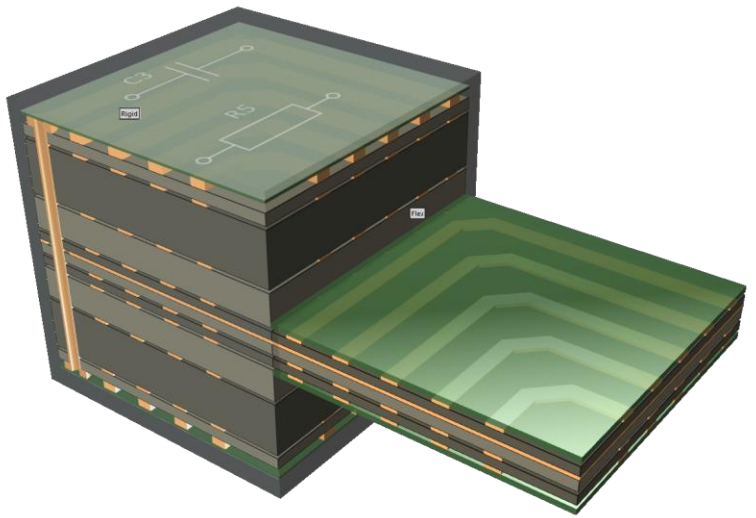


- Standard nomenclature for RIGID.flex stackups: *x* **Ri –** *y* **F –** *z* **Ri**
  - F = Flex, Ri = Rigid
  - *x, y, z* ….the figure correlates to the number of copper layers
  - The total number of layers is calculated by the sum of the copper layers on the rigid and flexible material (x+y+z).
  - If x, y or z is missing, this shows a stiffener without copper, e.g.. Ri: Stiffener for PURE.flex.

DIGITAL STANDARD STACKUPS

RIGID.flex

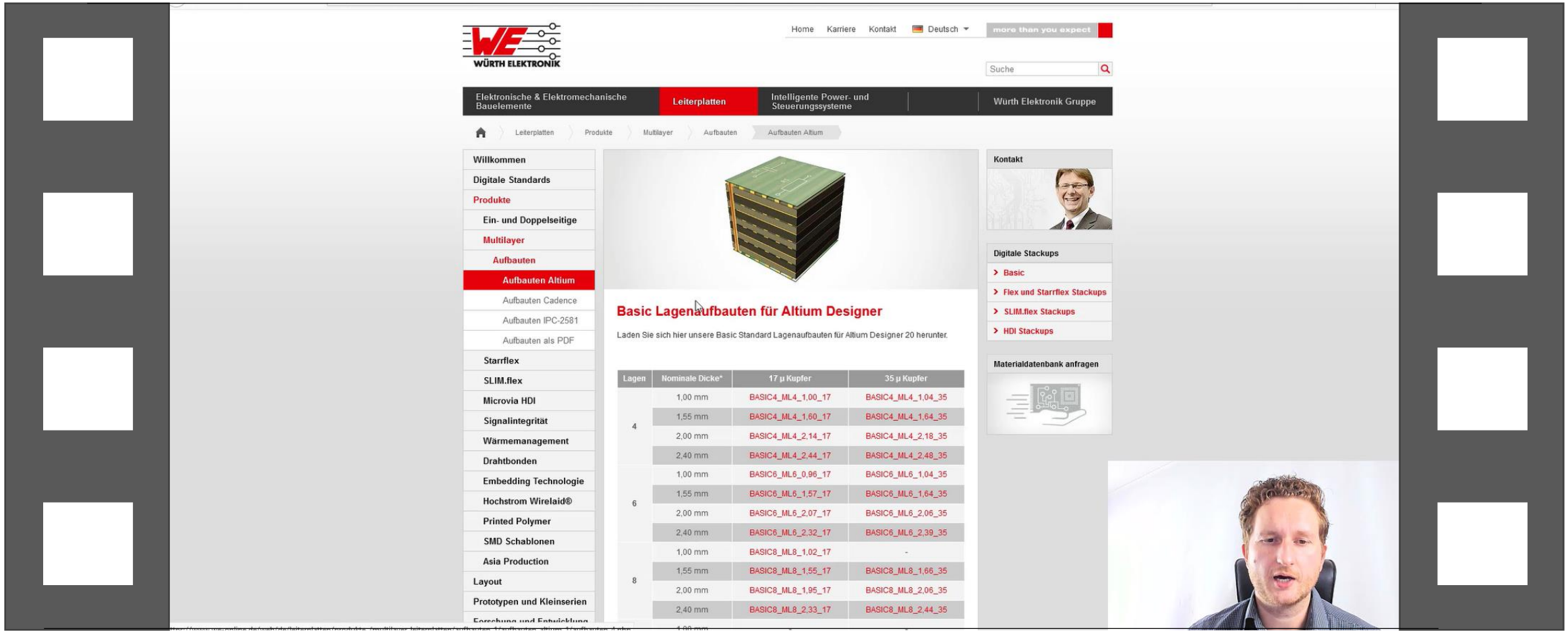
Layer	Nominal thickness*	1F-xRi (Starrflex)	xRi-2F-xRi (Flex-rigid)	2F-xRi (Flex-rigid)	xRi-4F-xRi (Flex-rigid)
2	0,80 mm	FLEX2_1F-1Ri_0,78_17	-	-	-
	1,00 mm	FLEX2_1F-1Ri_0,98_17	-	-	-
	1,55 mm	FLEX2_1F-1Ri_1,47_17	-	-	-
3	0,80 mm	-	-	FLEX3_2F_1Ri_0,86_17	-
	1,00 mm	-	-	FLEX3_2F_1Ri_0,96_17	-
	1,55 mm	-	-	FLEX3_2F_1Ri_1,55_17	-
4	0,80 mm	FLEX4_1F-3Ri_0,75_17	FLEX4_1Ri_2F_1Ri_0,77_17	FLEX4_2F_2Ri_0,78_17	-
	1,00 mm	FLEX4_1F-3Ri_0,95_17	FLEX4_1Ri_2F_1Ri_0,99_17	FLEX4_2F_2Ri_0,98_17	-
	1,55 mm	FLEX4_1F-3Ri_1,54_17	FLEX4_1Ri_2F_1Ri_1,51_17	FLEX4_2F_2Ri_1,57_17	-
6	1,00 mm	-	FLEX6_2Ri_2F_2Ri_1,02_17	FLEX6_2F_4Ri_1,03_17	FLEX6_1Ri_4F_1Ri_1,03_17
	1,55 mm	FLEX6_1F-5Ri_1,52_17	FLEX6_2Ri_2F_2Ri_1,55_17	FLEX6_2F_4Ri_1,55_17	FLEX6_1Ri_4F_1Ri_1,56_17
8	1,00 mm	-	FLEX8_3Ri_2F-3Ri_1,58_17	-	FLEX8_2Ri_4F_2Ri_1,06_17
	1,55 mm	FLEX8_1F-7Ri_1,56_17	FLEX8_3Ri_2F_3Ri_1,00_17	FLEX8_2F_6Ri_1,59_17	FLEX8_2Ri_4F_2Ri_1,59_17
10	1,00 mm	-	-	-	FLEX10_3Ri_4F_3Ri_1,09_17
	1,55 mm	-	-	-	FLEX10_3Ri_4F_3Ri_1,50_17



Download RIGID.flex stackups here

DEMONSTRATION

Video: Stackup import into AD2020 – step by step



DIGITAL STANDARD STACKUPS

- **Where you can get all this.**
  - Short-link:

    www.we-online.com/digital-stackups
  - QR-Code:

EDA Software	Basic	Flex-Rigid	Microvia HDI	SLIM.flex
Altium Designer	to the Stackups	to the Stackups	to the Stackups	to the Stackups
Cadence	to the Stackups	to the Stackups	coming soon	coming soon
IPC-2581 Format	to the Stackups	to the Stackups	coming soon	coming soon
PDF	to the Stackups	to the Stackups	to the Stackups	to the Stackups

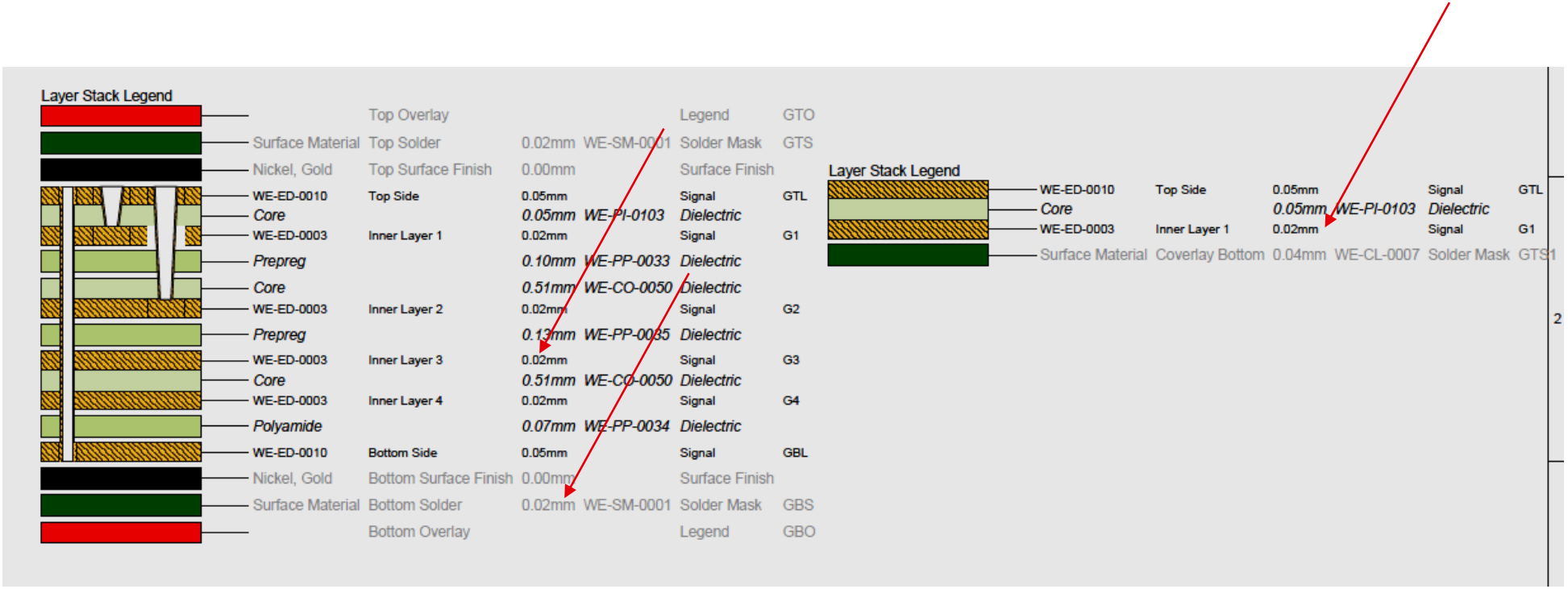
Digital stackups for other EDA tools are planned:

Mentor

EAGLE

MODIFICATIONS AND PROJECT SPECIFIC STACKUPS

- **Stackups can of course also be modified**
  - with regard to material, material thickness - ideally with a material database
  - with regard to viatechnology, e.g. microvias

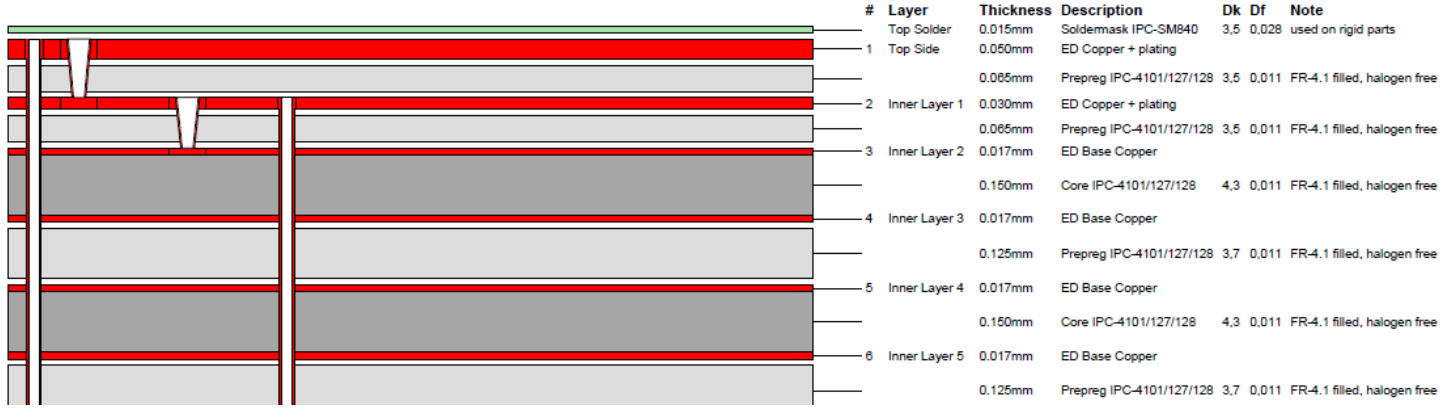


MODIFICATIONS AND PROJECT SPECIFIC STACKUPS

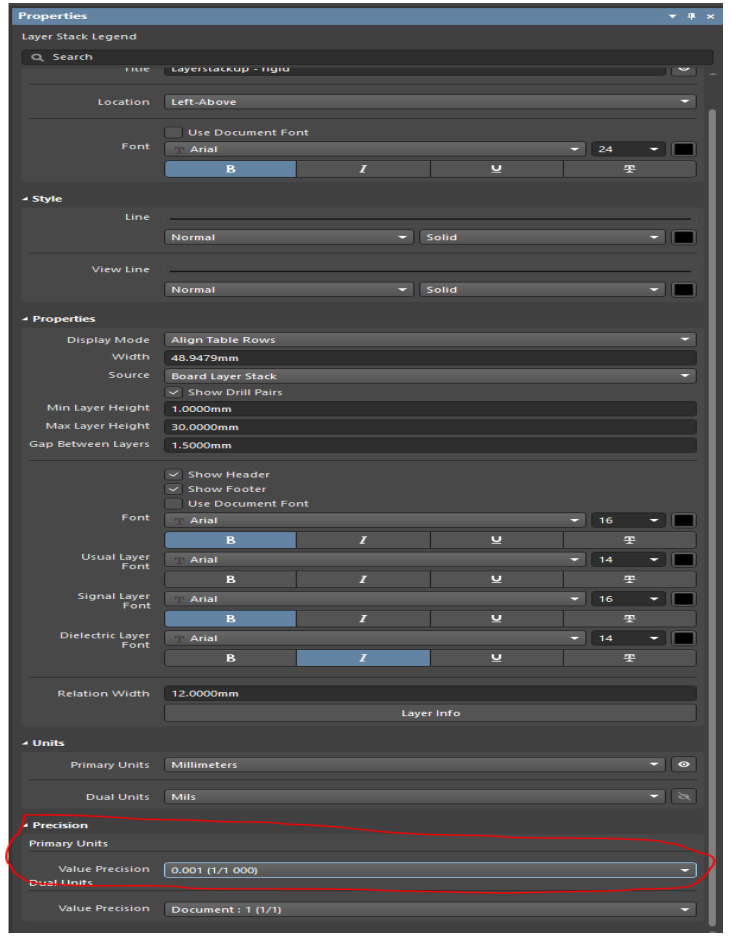
- **Basic recommendation:**

  Data output with 3 digits behind the decimal point!

- **In AD20:**
  - If you are in Draftsman, double-click on the stackup and then change the “Value Precision” in the Properties panel:



#	Layer	Thickness	Description	Dk	Df	Note
	Top Solder	0.015mm	Soldermask IPC-SM840	3,5	0,028	used on rigid parts
1	Top Side	0.050mm	ED Copper + plating			
		0.065mm	Prepreg IPC-4101/127/128	3,5	0,011	FR-4.1 filled, halogen free
2	Inner Layer 1	0.030mm	ED Copper + plating			
		0.065mm	Prepreg IPC-4101/127/128	3,5	0,011	FR-4.1 filled, halogen free
3	Inner Layer 2	0.017mm	ED Base Copper			
		0.150mm	Core IPC-4101/127/128	4,3	0,011	FR-4.1 filled, halogen free
4	Inner Layer 3	0.017mm	ED Base Copper			
		0.125mm	Prepreg IPC-4101/127/128	3,7	0,011	FR-4.1 filled, halogen free
5	Inner Layer 4	0.017mm	ED Base Copper			
		0.150mm	Core IPC-4101/127/128	4,3	0,011	FR-4.1 filled, halogen free
6	Inner Layer 5	0.017mm	ED Base Copper			
		0.125mm	Prepreg IPC-4101/127/128	3,7	0,011	FR-4.1 filled, halogen free



MODIFICATIONS AND PROJECT SPECIFIC STACKUPS

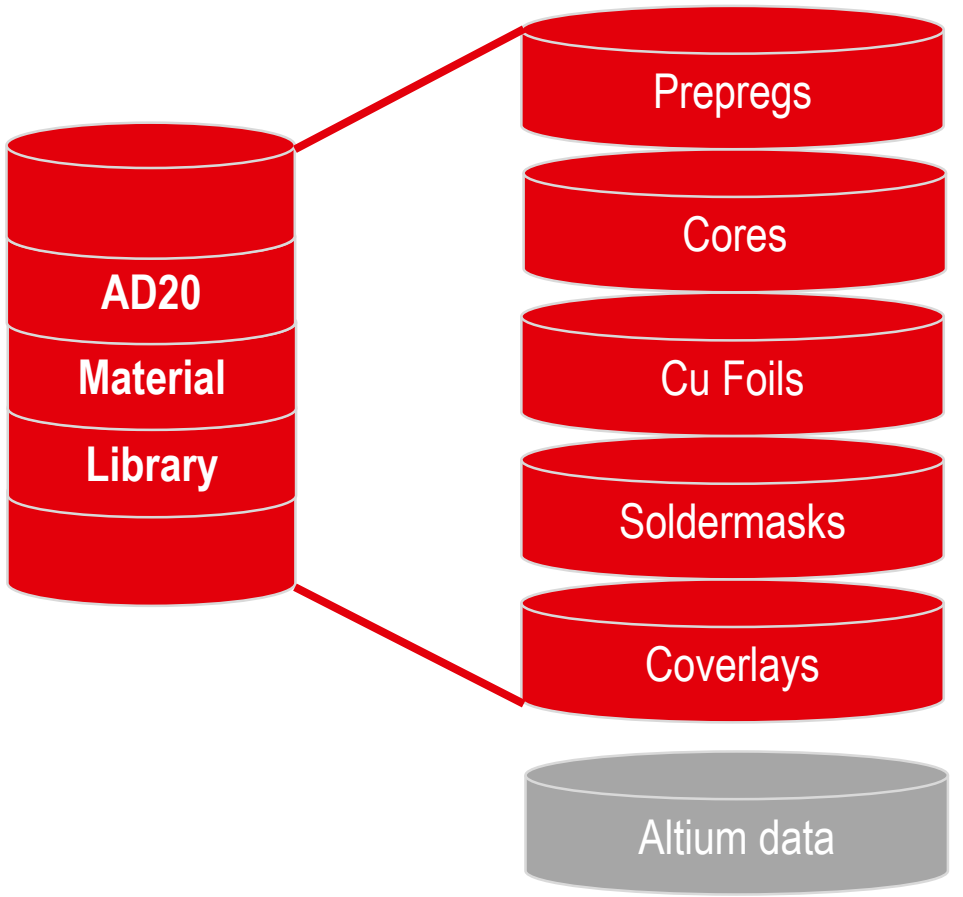
Material database in AD20

Possibilities opened up by using the material database

- **Material library**
  - For choosing available materials only
  - For having all material specs and dielectric values
  - For adding your functional surface using predefined Altium data

- **Current revision is 2.12 – published yesterday!**

- **We have decided to have our own webinar on this topic at short notice: 23 February 2021**



SUMMARY & OUTLOOK

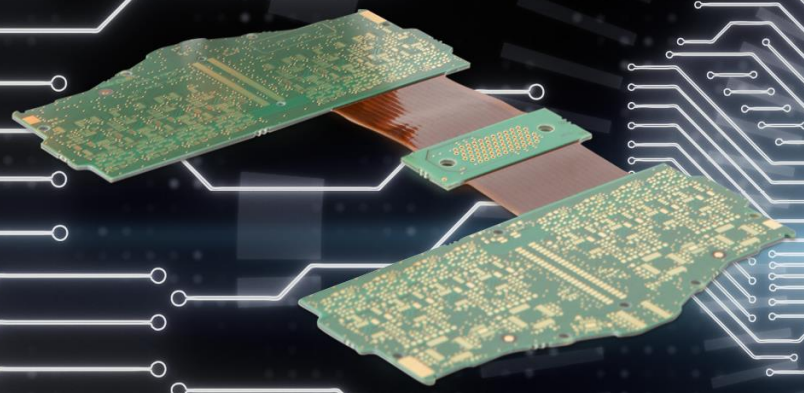
Digital Standards – Stackups

- **Digital standard stackups are available in proprietary data formats for several EDA tools**
- **More technologies and more EDA tools will follow**

- **Updating of all standards on the basis of the new MatLib revision 2.12: planned next week**
- **Offering rule sets for AltiumDesigner → Templates (stackup & rule set)**
  - First BASIC templates in Q3/2021
  - Advanced templates will follow
  - Other EDA tools will follow

- **Offers of collaboration for other EDA tools are very welcome. Please write in the question box or send me an email.**
- **Are you interested in our Circuit Board Technology webinars? Register for our newsletter here.**

WÜRTH ELEKTRONIK



WE SET THE PCB STANDARD

Digital stackups for your EDA tool and more…