



DIGITAL PCB STANDARDS – MATERIAL DATABASE

**DIGITAL
STANDARDS**

AI

01010101 0101 010101 0101

0101

01010101 0101 010101 0101



AGENDA



- 1 My objectives for today's webinar
- 2 The Würth Elektronik materials database for AltiumDesigner20
- 3 Demonstration of Material Library import process in AD20
- 4 The description makes the difference
- 5 Minimum copper layer thicknesses of the finished PCB according to IPC
- 6 Summary and outlook



Andreas Schilpp
Technical Marketing





MY OBJECTIVES FOR TODAY'S WEBINAR

1. Each participant knows

1. how the WE CircuitBoardTechnology material database for AD20 is structured and what data content is included
2. how to load and use an Altium Material Library
3. where the WE CircuitBoardTechnology material database can be requested.

2. Each participant will be given a recipe for determining the minimum copper layer thicknesses permitted by IPC according to the information in the WE CircuitBoardTechnology material database or in the WE standard layerstacks.



DIGITAL PCB STANDARDS – MATERIAL DATABASE

Introduction

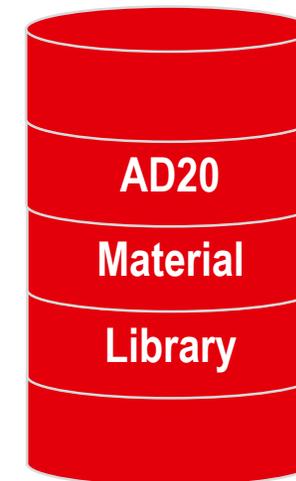


Within Altium Designer20 there is the capability to create layer stackups for PCB designs suitable for production. This is possible utilizing the Layerstack Manager in combination with the Material Library within a PCB job.

Request the files with the link in the red box!

Terms and Conditions

All information and files disclosed is provided “as is” and without any warranty whatsoever, whether express, statutory or implied, as to its accuracy, completeness or performance. Any user has the duty and responsibility to perform due diligence reviews of the provided content. The duplication, processing, distribution and any kind of exploitation outside the limits of copyright law require the written consent of Würth Elektronik. Changes and errors excepted.



Request files here

DIGITAL PCB STANDARDS – MATERIAL DATABASE

Introduction



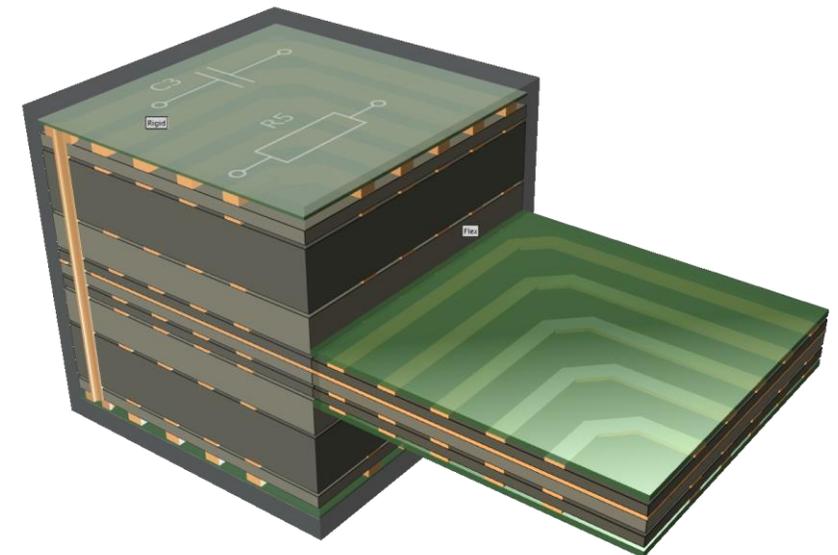
- This Material Library is the basis of our standard layer stackups, see also our [webinar from 2.2.2021](#)



Download BASIC
stackups here



Download HDI
stackups here



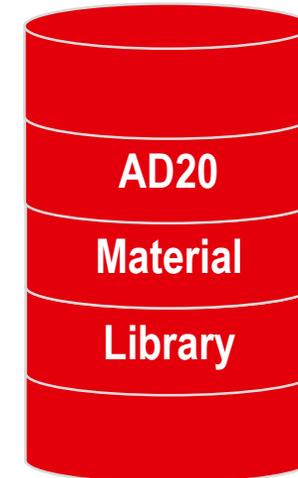
Download RIGID.flex
stackups here

DIGITAL PCB STANDARDS – MATERIAL DATABASE

Benefit

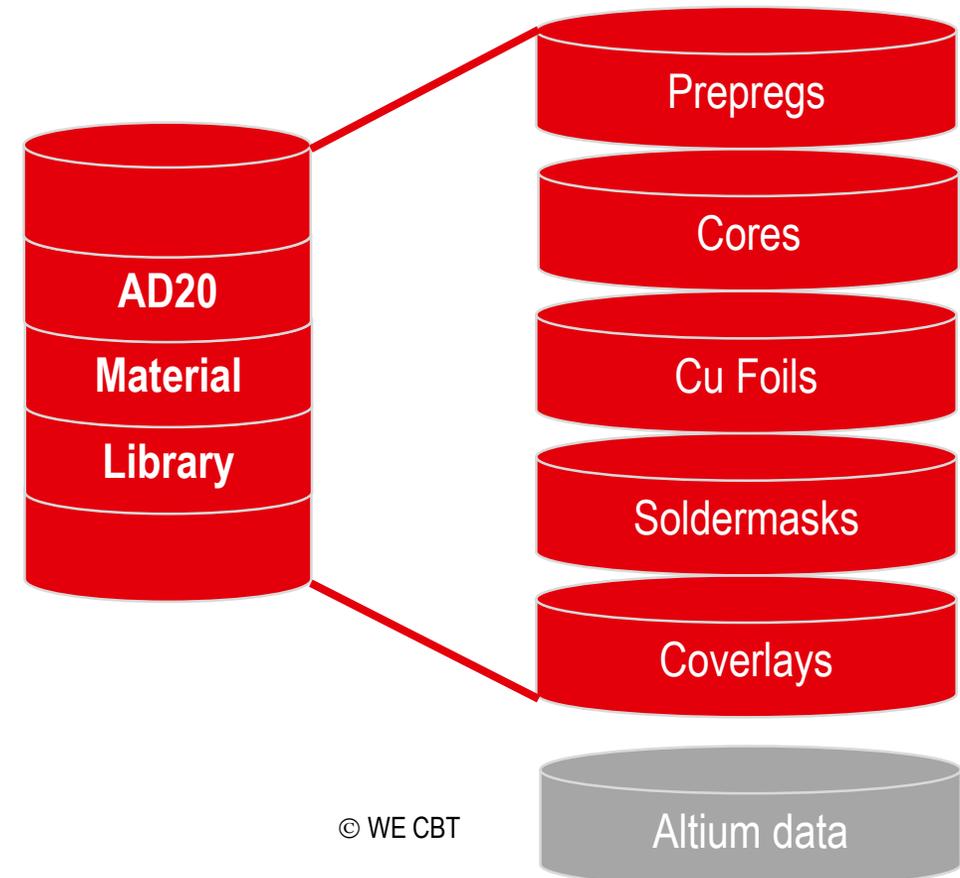
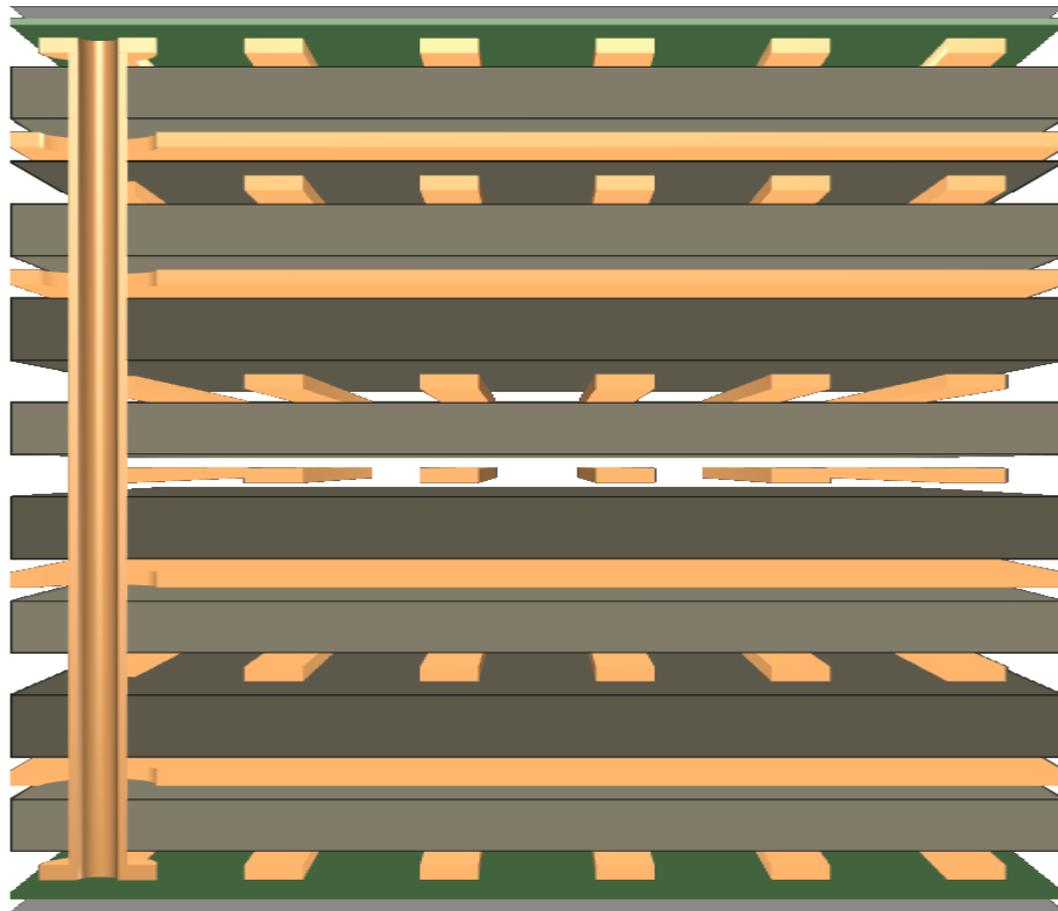


- **Enables more control to the PCB designer as a plug-in solution**
 - Provides material options you may need
 - Shows the impact of what you are doing respectively changing
 - Helps to decide if adjustments have to be made in the stackup or in the trace routing to meet impedance requirements
 - See real dimensional properties in Altium 3D view, i.e. core thickness
- **Secures accurate material selection and dk / df values**
 - Manufacturability of final stackup is more likely
 - Altium Draftsman uses material data of the library also for documentation
 - 3D field solver integrated in AltiumDesigner (Simberian) is able to correctly calculate impedance values based on accurate material data
- **The WE Material Library is a perfect match for WE capabilities**



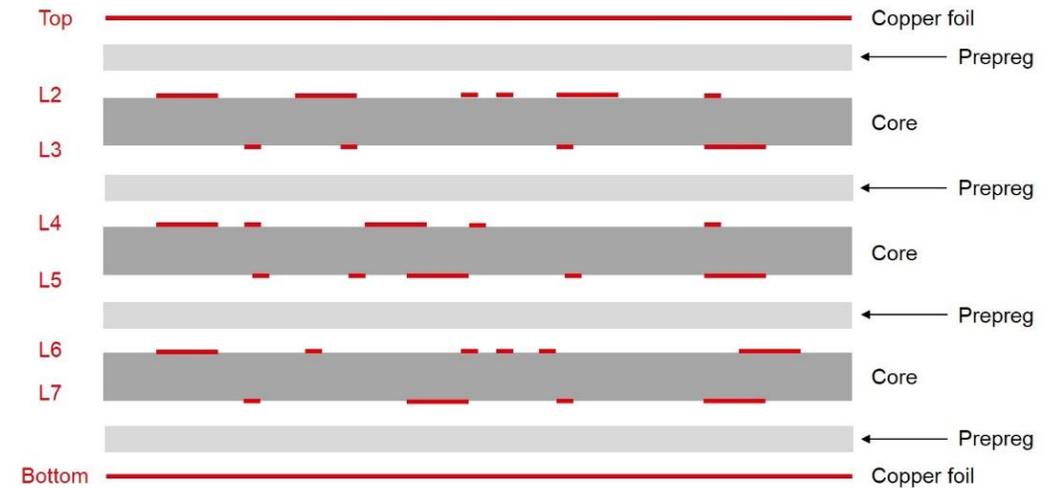
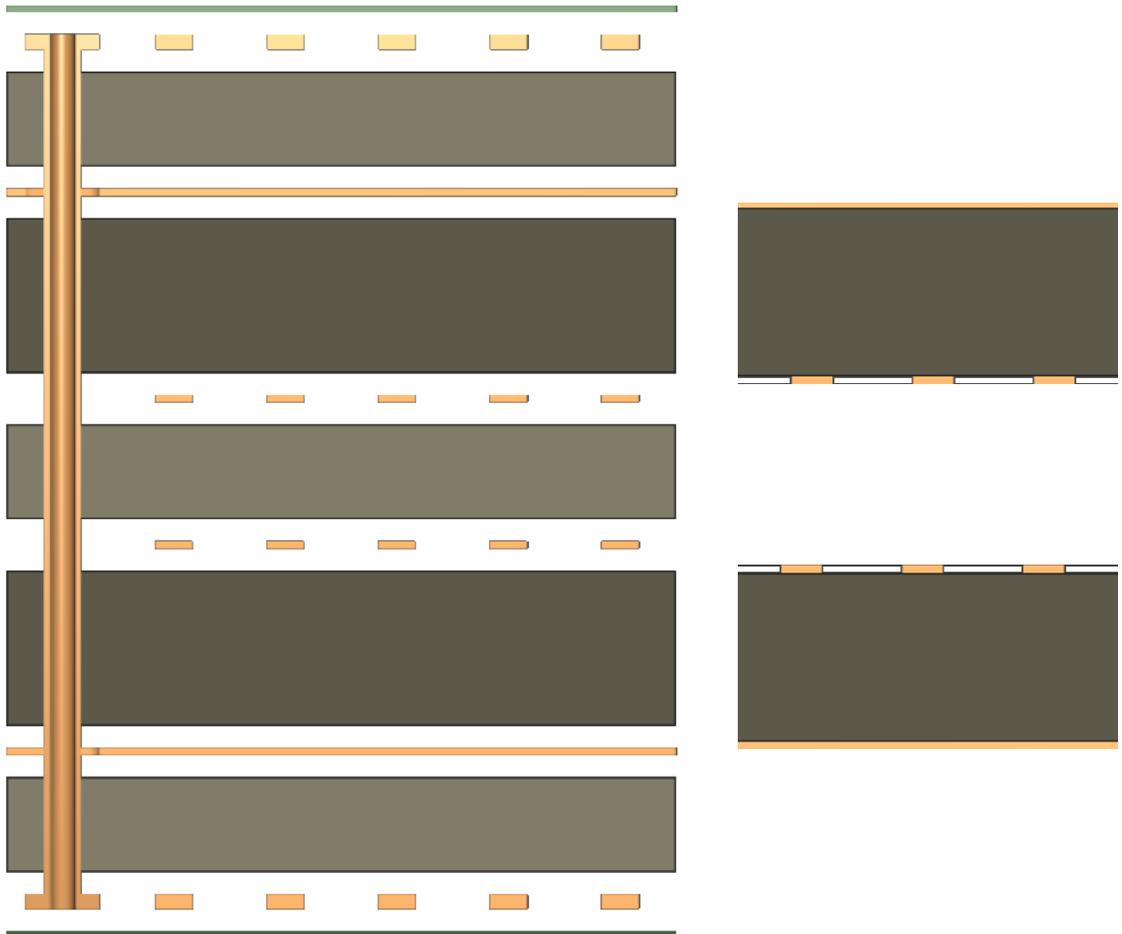
DIGITAL PCB STANDARDS – MATERIAL DATABASE

Structure and content



DIGITAL PCB STANDARDS – MATERIAL DATABASE

Comparison EDA stackup versus real life



DEMONSTRATION

Video: Material Library import into AD20 – step by step



The screenshot displays the Altium Designer 20 software interface during a material library import demonstration. The main window shows the Layer Stack Manager, which lists the following layers from top to bottom:

#	Name	Material	Type	Weight	Thickness	Dk	Df
	Top Overlay		Overlay				
	Top Solder	Solder Resist	Solder Mask		0.01mm	3.5	
1	Top Layer		Signal	1oz	0.035mm		
	Dielectric 1	FR-4					
2	Bottom Layer		Signal				
	Bottom Solder	Solder					
	Bottom Overlay						

The Select Material dialog box is open, showing a list of materials with the following columns: #, Manufacturer, Name, Thickness, Weight, Process, and Source. The list includes materials from Würth Elektronik (WE) such as WE-WL-0006, WE-WL-0005, WE-WL-0004, WE-WL-0003, WE-WL-0002, WE-WL-0001, WE-RA-0003, WE-RA-0002, WE-RA-0001, WE-ED-0016, WE-ED-0015, WE-ED-0014, WE-ED-0013, WE-ED-0012, WE-ED-0011, WE-ED-0010, WE-ED-0009, WE-ED-0008, WE-ED-0007, WE-ED-0006, WE-ED-0005, WE-ED-0004, and WE-ED-0003.

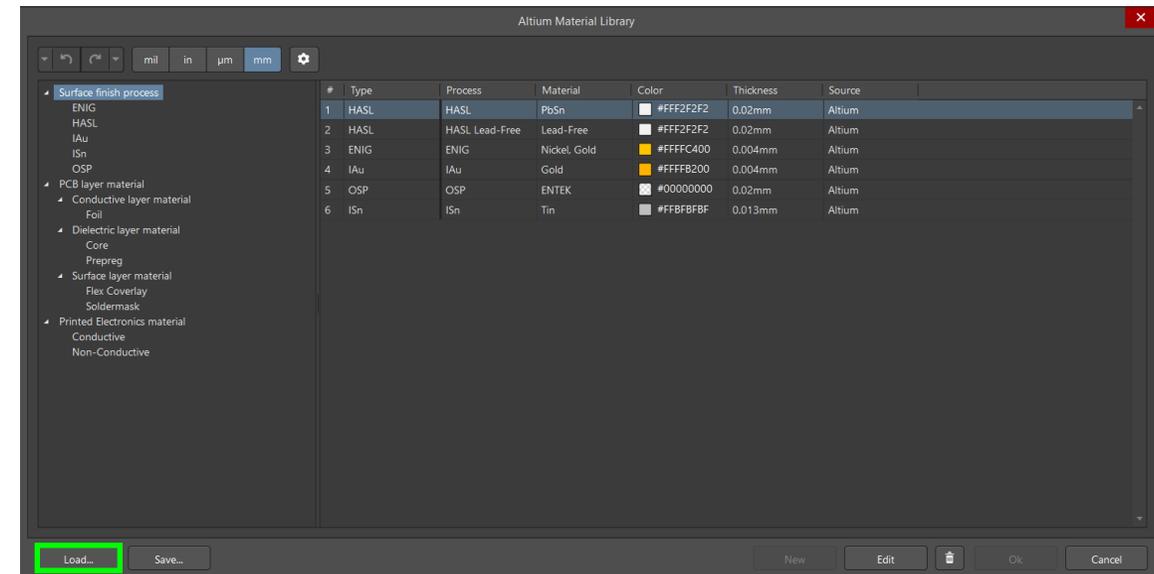
The video player interface at the bottom shows a man speaking in a video call window, indicating that this is a video demonstration.

DIGITAL PCB STANDARDS – MATERIAL DATABASE

Quick Installation Guide in AD20



- Start AD20, **O**pen or Create a **N**ew PCB – PCB Editor
- Access the PCB Layer Stack Manager:
Design > Layer Stack Manager
- Open the Altium Material Library: **T**ools **M**aterial Library
- To install the WE Material Library, click the **Load...** button
- Choose XML-File
„WE-AD20-Material-Library_V2.12.xml“ and OPEN – loading is performed.
- Activate columns „Description“ and „Note“ in the Setting Menu!
- DONE!**



#	Manufacturer	Thickness	Constructions	Description	Resin	Frequency	Dk	Df	GlassTransTemp	Source	Name
1	WE	0.005mm	1x0.2mil	Flexible core IPC-4204/11	100%	1GHz	3.4	0.003	220°C	User	WE-PI-0100
2	WE	0.0125mm	1x0.5mil	Flexible core IPC-4204/11	100%	1GHz	3.4	0.003	220°C	User	WE-PI-0101
3	WE	0.025mm	1x1mil	Flexible core IPC-4204/11	100%	1GHz	3.4	0.003	220°C	User	WE-PI-0102
4	WE	0.05mm	2x2mil	Flexible core IPC-4204/11	100%	1GHz	3.4	0.002	220°C	User	WE-PI-0103
5	WE	0.05mm	1x1037	Core IPC-4101/40/42	74%	1GHz	4.2	0.01	250°C	User	WE-CO-0080
6	WE	0.06mm	1x1078	Core IPC-4101/40/42	65%	1GHz	4.3	0.01	250°C	User	WE-CO-0081
7	WE	0.06mm	1x1080	Core IPC-4101/127/128	58%	1GHz	4.2	0.011	150°C	User	WE-CO-0040
8	WE	0.06mm	1 x 106	Core IPC-4101/21	72.8%	1MHz	3.2	0.02	135°C	User	WE-CO-0001
9	WE	0.075mm	2x1.5mil	Flexible core IPC-4204/11	100%	1GHz	3.4	0.002	220°C	User	WE-PI-0104

DIGITAL PCB STANDARDS – MATERIAL DATABASE

Deleting user content

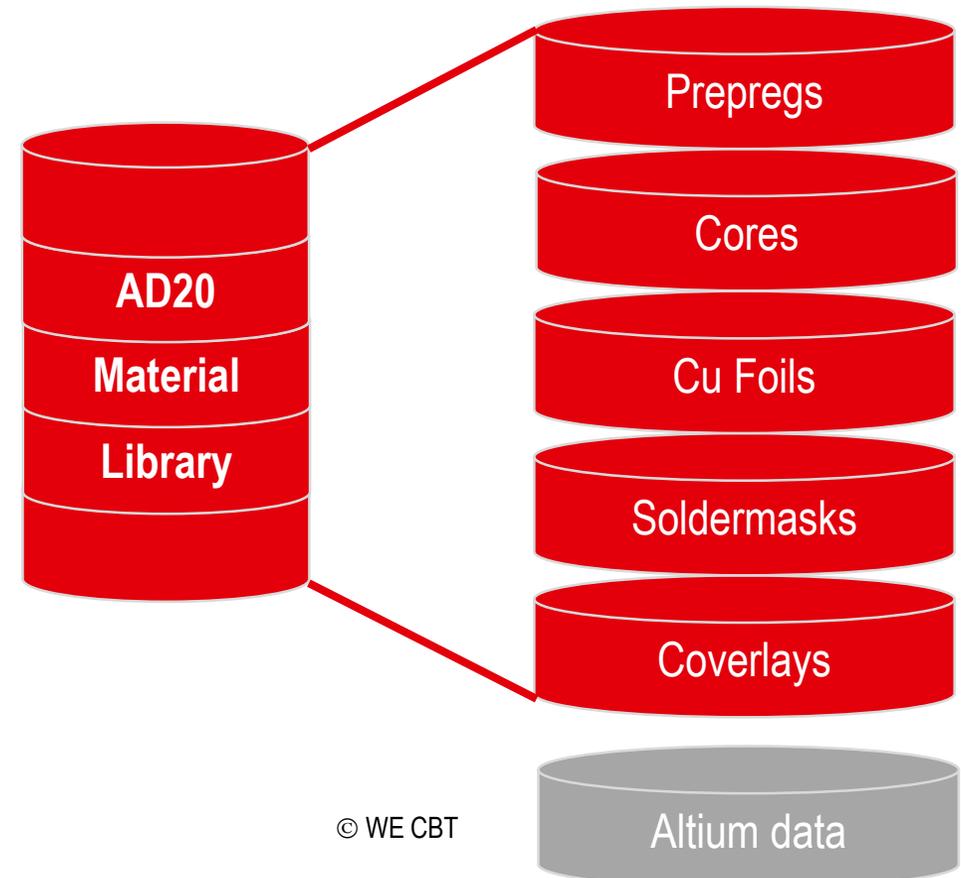


- **CLEAN-LIB.xml comes with the Würth Elektronik Circuit Board Technology material library.**

The file "CLEAN-LIB.xml" can be used to delete user entries of the material database, i.e. Würth Elektronik Circuit Board Technology material library.

The Altium entries cannot currently be deleted.

- **Just follow the Quick Installation Guide and Load the CLEAN-LIB.xml file.**





AGENDA

- 1 My objectives for today's webinar
- 2 The Würth Elektronik materials database for AltiumDesigner20
- 3 Demonstration of Material Library import process in AD20
- 4 The description makes the difference**
- 5 Minimum copper layer thicknesses of the finished PCB according to IPC
- 6 Summary and outlook

DIGITAL PCB STANDARDS – MATERIAL DATABASE

The description makes the difference



■ Example: RIGID.flex layerstack 3Ri-4F-3Ri

#	Name	Thickness	Description	Note	Dk	Df	GlassTransTemp	#	Name	Thickness	Description	Note	Dk
	Top Overlay								Top Overlay				
	Top Solder	0.015mm	Soldermask IPC-SM840	used on rigid parts	3.5	0.028	100°C		Top Solder	0.015mm	Soldermask IPC-SM840	used on rigid parts	3.5
	Flex Top Coverlay	0.03mm	PI Coverlay IPC-4203/1	Polyimide + bonding film (Acr...	3.6	0.02	60°C		Flex Top Coverlay	0.03mm	PI Coverlay IPC-4203/1	Polyimide + bonding film (Acr...	3.6
1	Top Side	0.03mm	Starting foil 1/4oz. after plating and processing					1	Top Side	0.03mm	Starting foil 1/4oz. after plating and processing		
	Dielectric 1	0.065mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.5	0.011	150°C		Dielectric 1	0.065mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.5
2	Inner Layer 1	0.017mm	ED Base Copper					2	Inner Layer 1	0.017mm	ED Base Copper		
	Core 1	0.1mm	Core IPC-4101/127/128	FR-4.1 filled, halogen free	3.8	0.011	150°C		Core 1	0.1mm	Core IPC-4101/127/128	FR-4.1 filled, halogen free	3.8
3	Inner Layer 2	0.017mm	ED Base Copper					3	Inner Layer 2	0.017mm	ED Base Copper		
	Dielectric 2	0.174mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.7	0.011	150°C		Dielectric 2	0.174mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.7
4	Inner Layer 3	0.017mm	ED Base Copper					4	Inner Layer 3	0.017mm	ED Base Copper		
	Polyimide 1	0.05mm	Flexible core IPC-4204/11	Flex Polyimide adhesiveless	3.4	0.002	220°C		Polyimide 1	0.05mm	Flexible core IPC-4204/11	Flex Polyimide adhesiveless	3.4
5	Inner Layer 4	0.017mm	ED Base Copper					5	Inner Layer 4	0.017mm	ED Base Copper		
	Dielectric 3	0.06mm	IPC-4101/127/128 + IPC-4203/1	MIX layer Prepreg + Bondply	3.2	0.011	150°C		Dielectric 3	0.06mm	IPC-4101/127/128 + IPC-4203/1	MIX layer Prepreg + Bondply	3.2
6	Inner Layer 5	0.017mm	ED Base Copper					6	Inner Layer 5	0.017mm	ED Base Copper		
	Polyimide 2	0.05mm	Flexible core IPC-4204/11	Flex Polyimide adhesiveless	3.4	0.002	220°C		Polyimide 2	0.05mm	Flexible core IPC-4204/11	Flex Polyimide adhesiveless	3.4
7	Inner Layer 6	0.017mm	ED Base Copper					7	Inner Layer 6	0.017mm	ED Base Copper		
	Dielectric 4	0.174mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.7	0.011	150°C		Dielectric 4	0.174mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.7
8	Inner Layer 7	0.017mm	ED Base Copper					8	Inner Layer 7	0.017mm	ED Base Copper		
	Core 2	0.1mm	Core IPC-4101/127/128	FR-4.1 filled, halogen free	3.8	0.011	150°C		Core 2	0.1mm	Core IPC-4101/127/128	FR-4.1 filled, halogen free	3.8
9	Inner Layer 8	0.017mm	ED Base Copper					9	Inner Layer 8	0.017mm	ED Base Copper		
	Dielectric 5	0.065mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.5	0.011	150°C		Dielectric 5	0.065mm	Prepreg IPC-4101/127/128	FR-4.1 filled, halogen free	3.5
10	Bottom Side	0.03mm	Starting foil 1/4oz. after plating and processing					10	Bottom Side	0.03mm	Starting foil 1/4oz. after plating and processing		
	Flex Bottom Cov...	0.03mm	PI Coverlay IPC-4203/1	Polyimide + bonding film (Acr...	3.6	0.02	60°C		Flex Bottom Cov...	0.03mm	PI Coverlay IPC-4203/1	Polyimide + bonding film (Acr...	3.6
	Bottom Solder	0.015mm	Soldermask IPC-SM840	used on rigid parts	3.5	0.028	100°C		Bottom Solder	0.015mm	Soldermask IPC-SM840	used on rigid parts	3.5
	Bottom Overlay								Bottom Overlay				

DIGITAL PCB STANDARDS – MATERIAL DATABASE

The description makes the difference, i.e. cores



- Example: RIGID.flex layerstack 3Ri-4F-3Ri – „Construction“ showing the used weaves (fabric)

#	Name	Material	Type	Weight	Thickness	Dk	Df	Description	Manufacturer	Copper Orient...	Constructions	Resin	Frequency	GlassTransTemp
	Top Overlay		Overlay											
	Top Solder	WE-SM-0001	Solder Mask		0.015mm	3.5	0.028	Soldermask IPC-SM840	WE				1GHz	100°C
	Flex Top Coverlay	WE-CL-0001	Bottom Coverlay		0.03mm	3.5	0.02	PI Coverlay IPC-4203/1	WE				1MHz	80°C
1	Top Side	WE-ED-0018	Signal	1oz	0.04mm			Starting foil 1/4oz. after plating and processing	WE	Above				
	Dielectric 1	WE-PP-0034	Prepreg		0.065mm	3.5	0.011	Prepreg IPC-4101/127/128	WE		1080	58%	1GHz	150°C
2	Inner Layer 1	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Above				
	Core 1	WE-CO-0046	Core		0.3mm	4.5	0.011	Core IPC-4101/127/128	WE		2x1501	43.5%	1GHz	150°C
3	Inner Layer 2	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Below				
	Dielectric 2	WE-PP-0036	Prepreg		0.18mm	3.9	0.011	Prepreg IPC-4101/127/128	WE		3x1080	58%	1GHz	150°C
4	Inner Layer 3	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Above				
	Polyimide 1	WE-PI-0103	Core											
5	Inner Layer 4	WE-ED-0003	Plane											
	Dielectric 3	WE-PP-0001	Prepreg											
6	Inner Layer 5	WE-ED-0003	Signal											
	Polyimide 2	WE-PI-0103	Core											
7	Inner Layer 6	WE-ED-0003	Signal											
	Dielectric 4	WE-PP-0036	Prepreg											
8	Inner Layer 7	WE-ED-0003	Signal											
	Core 2	WE-CO-0046	Core											
9	Inner Layer 8	WE-ED-0003	Signal											
	Dielectric 5	WE-PP-0034	Prepreg											
10	Bottom Side	WE-ED-0018	Signal											
	Flex Bottom Coverlay	WE-CL-0001	Bottom Coverlay											
	Bottom Solder	WE-SM-0001	Solder Mask											
	Bottom Overlay	WE-SM-0001	Overlay											

#	Manufacturer	Name	Thickness	Constructions	Resin	Frequency	Dk	Df	GlassTransTemp	Source	Description
73	WE	WE-CO-0045	0.25mm	2x1504	43%	1GHz	4.3	0.011	150°C	User	Core IPC-4101/1...
74	WE	WE-CO-0046	0.3mm	2x1501	43.5%	1GHz	4.5	0.011	150°C	User	Core IPC-4101/1...
75	WE	WE-CO-0047	0.36mm	2x7628	42%	1GHz	4.7	0.011	150°C	User	Core IPC-4101/1...
76	WE	WE-CO-0048	0.41mm	2x7628	48%	1GHz	4.8	0.011	150°C	User	Core IPC-4101/1...
77	WE	WE-CO-0049	0.46mm	1*7628M + 1*21...	43%	1GHz	4.8	0.011	150°C	User	Core IPC-4101/1...
78	WE	WE-CO-0050	0.51mm	1*7628M + 1*21...	47%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...
79	WE	WE-CO-0051	0.56mm	3*7628M	42%	1GHz	5	0.011	150°C	User	Core IPC-4101/1...
80	WE	WE-CO-0052	0.61mm	3*7628M	48%	1GHz	5	0.011	150°C	User	Core IPC-4101/1...
81	WE	WE-CO-0053	0.71mm	4*7628M	42%	1GHz	5	0.011	150°C	User	Core IPC-4101/1...
82	WE	WE-CO-0054	0.76mm	4*7628M	46.7%	1GHz	5	0.011	150°C	User	Core IPC-4101/1...
83	WE	WE-CO-0055	0.8mm	4*7628M	46.7%	1GHz	5	0.011	150°C	User	Core IPC-4101/1...
84	WE	WE-CO-0056	0.93mm	5*7628M	46.7%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...
85	WE	WE-CO-0057	1.08mm	6*7628M	44%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...
86	WE	WE-CO-0058	1.2mm	6*7628M	46.7%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...
87	WE	WE-CO-0059	1.4mm	7*7628M	46.7%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...
88	WE	WE-CO-0060	1.55mm	8*7628M	45%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...
89	WE	WE-CO-0061	2mm	12*7628M	44%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...
90	WE	WE-CO-0062	2.4mm	14*7628M	42%	1GHz	5.1	0.011	150°C	User	Core IPC-4101/1...



DIGITAL PCB STANDARDS – MATERIAL DATABASE

The description makes the difference, i.e. coverlay / bondply



■ Example: RIGID.flex layerstack 3Ri-4F-3Ri

Flex

+ Add Modify Delete

Features

#	Name	Material	Type	Weight	Thickness	Dk	Df	Description	Manufacturer	Copper Orient...	Constructions	Resin	Frequency	GlassTransTemp
	Top Overlay		Overlay											
	Top Solder	WE-SM-0001	Solder Mask		0.015mm	3.5	0.028	Soldermask IPC-SM840	WE				1GHz	100°C
✓	Flex Top Coverlay	WE-CL-0001	Bikini Coverlay		0.03mm	3.6	0.02	PI Coverlay IPC-4203/1	WE				1MHz	60°C
1	Top Side	WE-ED-0018	Signal	1oz	0.04mm			Starting foil 14oz. after plating and processing	WE	Above				
2	Dielectric 1	WE-PP-0034	Prepreg		0.065mm	3.5	0.011	Prepreg IPC-4101/127/128	WE		1080	58%	1GHz	150°C
3	Inner Layer 1	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Above				
	Core 1	WE-CO-0046	Core		0.3mm	4.5	0.011	Core IPC-4101/127/128	WE		2x1501	43.5%	1GHz	150°C
3	Inner Layer 2	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Below				
	Dielectric 2	WE-PP-0036	Prepreg		0.18mm	3.9	0.011	Prepreg IPC-4101/127/128	WE		3x1080	58%	1GHz	150°C
✓	Inner Layer 3	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Above				
✓	Polyimide 1	WE-PI-0103	Core		0.05mm	3.4	0.002	Flexible core IPC-4204/11	WE		2x2mil	100%	1GHz	220°C
✓	Inner Layer 4	WE-ED-0003	Plane	1/2oz	0.017mm			ED Base Copper	WE	Below				
✓	Dielectric 3	WE-PB-0001	Prepreg		0.06mm	3.2	0.011	IPC-4101/127/128 + IPC-4203/1	WE		1x1080 + LF0111	62%	1MHz	150°C
✓	Inner Layer 5	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Above				
✓	Polyimide 2	WE-PI-0103	Core		0.05mm	3.4	0.002	Flexible core IPC-4204/11	WE		2x2mil	100%	1GHz	220°C
✓	Inner Layer 6	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Below				
	Dielectric 4	WE-PP-0036	Prepreg											
	Inner Layer 7	WE-ED-0003	Signal											
	Core 2	WE-CO-0046	Core											
	Inner Layer 8	WE-ED-0003	Signal											
	Dielectric 5	WE-PP-0034	Prepreg											
	Bottom Side	WE-ED-0018	Signal											
✓	Flex Bottom Cover...	WE-CL-0001	Bikini Coverlay											
	Bottom Solder	WE-SM-0001	Solder Mask											
	Bottom Overlay		Overlay											

Select Material

mil in μm mm

#	Manufacturer	Name	Thickness	Color	Dielectric Stren...	Volume Resistiv...	Frequency	Dk	Df	Source	Description
6	WE	WE-CL-0001	0.03mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Coverlay IPC-4203/1
7	WE	WE-CL-0002	0.04mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Coverlay IPC-4203/1
8	WE	WE-CL-0003	0.04mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Coverlay IPC-4203/1
9	WE	WE-CL-0004	0.06mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Coverlay IPC-4203/1
10	WE	WE-CL-0005	0.04mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Coverlay IPC-4203/1
11	WE	WE-CL-0006	0.06mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Coverlay IPC-4203/1
12	WE	WE-CL-0007	0.04mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Coverlay IPC-4203/2
13	WE	WE-BP-0001	0.045mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Bondply IPC-4203/1
14	WE	WE-BP-0002	0.07mm	#FFFF9900	240kV/mm	1E19Ω-cm	1MHz	3.6	0.02	User	PI Bondply IPC-4203/1

OK Cancel

DIGITAL PCB STANDARDS – MATERIAL DATABASE

The description makes the difference, i.e. prepreg



- Example: RIGID.flex layerstack 3Ri-4F-3Ri – „Construction“ showing the used weaves (fabric)

#	Name	Material	Type	Weight	Thickness	Dk	Df	Description	Manufacturer	Copper Orient...	Constructions	Resin	Frequency	GlassTransTemp
	Top Overlay		Overlay											
	Top Solder	WE-SM-0001	Solder Mask		0.015mm	3.5	0.028	Soldermask IPC-SM840	WE				1GHz	100°C
	Flex Top Coverlay	WE-CL-0001	Etch Coverlay		0.03mm	3.6	0.02	PI Coverlay IPC-4203/1	WE				1MHz	60°C
1	Top Side	WE-ED-0018	Signal	1oz	0.04mm			Starting foil 1/4oz. after plating and processing	WE	Above				
	Dielectric 1	WE-PP-0034	Prepreg		0.065mm	3.5	0.011	Prepreg IPC-4101/127/128	WE		1080	58%	1GHz	150°C
2	Inner Layer 1	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Above				
	Core 1	WE-CO-0046	Core		0.3mm	4.5	0.011	Core IPC-4101/127/128	WE		2x1501	43.5%	1GHz	150°C
3	Inner Layer 2	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Below				
	Dielectric 2	WE-PP-0036	Prepreg		0.18mm	3.9	0.011	Prepreg IPC-4101/127/128	WE		3x1080	58%	1GHz	150°C
4	Inner Layer 3	WE-ED-0003	Signal	1/2oz	0.017mm			ED Base Copper	WE	Above				
	Polyimide 1	WE-PI-0103	Core		0.05mm	3.4	0.002	Flexible core IPC-4204/11	WE		2x2mil	100%	1GHz	220°C
5	Inner Layer 4	WE-ED-0003	Plane	1/2oz	0.017mm			ED Base Copper	WE	Below				
	Dielectric 3	WE-PB-0001	Prepreg											
6	Inner Layer 5	WE-ED-0003	Signal											
	Polyimide 2	WE-PI-0103	Core											
7	Inner Layer 6	WE-ED-0003	Signal											
	Dielectric 4	WE-PP-0036	Prepreg											
8	Inner Layer 7	WE-ED-0003	Signal											
	Core 2	WE-CO-0046	Core											
9	Inner Layer 8	WE-ED-0003	Signal											
	Dielectric 5	WE-PP-0034	Prepreg											
10	Bottom Side	WE-ED-0018	Signal											
	Flex Bottom Coverlay	WE-CL-0001	Etch Coverlay											
	Bottom Solder	WE-SM-0001	Solder Mask											
	Bottom Overlay		Overlay											

Select Material											
#	Manufacturer	Name	Thickness	Constructions	Resin	Frequency	Dk	Df	GlassTransTemp	Source	Description
41	WE	WE-PP-0033	0.1mm	2x106Lowflow	73%	1GHz	4.4	0.011	150°C	User	Prepreg IPC-4101/127/128
42	WE	WE-PP-0034	0.065mm	1080	58%	1GHz	3.5	0.011	150°C	User	Prepreg IPC-4101/127/128
43	WE	WE-PP-0035	0.125mm	2x1080	58%	1GHz	3.7	0.011	150°C	User	Prepreg IPC-4101/127/128
44	WE	WE-PP-0036	0.18mm	3x1080	58%	1GHz	3.9	0.011	150°C	User	Prepreg IPC-4101/127/128
45	WE	WE-PP-0037	0.08mm	1080Lowflow	63%	1GHz	3.8	0.011	150°C	User	Prepreg IPC-4101/127/128
46	WE	WE-PP-0038	0.15mm	2x1080Lowflow	63%	1GHz	4.1	0.011	150°C	User	Prepreg IPC-4101/127/128
47	WE	WE-PP-0039	0.087mm	2113	56%	1GHz	3.6	0.011	150°C	User	Prepreg IPC-4101/127/128
48	WE	WE-PP-0040	0.174mm	2x2113	56%	1GHz	4	0.011	150°C	User	Prepreg IPC-4101/127/128
49	WE	WE-PP-0041	0.255mm	3x2113	56%	1GHz	4	0.011	150°C	User	Prepreg IPC-4101/127/128
50	WE	WE-PP-0042	0.105mm	2116	46%	1GHz	3.8	0.011	150°C	User	Prepreg IPC-4101/127/128
51	WE	WE-PP-0043	0.22mm	2x2116	46%	1GHz	4.3	0.011	150°C	User	Prepreg IPC-4101/127/128
52	WE	WE-PP-0044	0.32mm	3x2116	46%	1GHz	4.4	0.011	150°C	User	Prepreg IPC-4101/127/128
53	WE	WE-PP-0045	0.18mm	7628	46.7%	1GHz	4.2	0.011	150°C	User	Prepreg IPC-4101/127/128
54	WE	WE-PP-0046	0.37mm	2x7628	46.7%	1GHz	4.6	0.011	150°C	User	Prepreg IPC-4101/127/128

DIGITAL PCB STANDARDS – MATERIAL DATABASE

The description makes the difference: Copper foils



- **Filtering options**
 - Source (Altium / user)
 - Columns showing: Description!
 - Column order
- **The oz. values are inaccurate due to rounding!**

Select Material

mil in μ m mm ⚙

#	Manufacturer	Name	Thickness	Weight	Process	Source	Description
1	WE	WE-ED-0016	0.018mm	1/2oz	Plated base foil	User	Plated HDI inner layer after plating and processi...
2	WE	WE-ED-0017	0.02mm	1/2oz	Plated base foil	User	Starting foil 1/4oz. after plating and processing
3	WE	WE-ED-0008	0.03mm	1oz	Plated base foil	User	Starting foil 1/4oz. after plating and processing
4	WE	WE-ED-0009	0.035mm	1oz	Plated base foil	User	Starting foil 1/2oz. after plating and processing
5	WE	WE-ED-0018	0.04mm	1oz	Plated base foil	User	Starting foil 1/4oz. after plating and processing
6	WE	WE-ED-0010	0.045mm	1oz	Plated base foil	User	Starting foil 1/2oz. after plating and processing
7	WE	WE-ED-0014	0.05mm	1oz	Plated base foil	User	Starting foil 1/2oz. after plating and processing
8	WE	WE-ED-0015	0.055mm	1oz	Plated base foil	User	Starting foil 1/2oz. after plating and processing
9	WE	WE-ED-0011	0.07mm	2oz	Plated base foil	User	Starting foil 1oz. after plating and processing
10	WE	WE-ED-0012	0.105mm	3oz	Plated base foil	User	Starting foil 2oz. after plating and processing
11	WE	WE-ED-0013	0.15mm	3oz	Plated base foil	User	Starting foil 3oz. after plating and processing

Select Material

mil in μ m mm ⚙

#	Manufacturer	Name	Thickness	Weight	Process	Source	Description
1	WE	WE-ED-0001	0.009mm	1/4oz	Base foil	User	ED Base Copper
2	WE	WE-ED-0002	0.012mm	1/3oz	Base foil	User	ED Base Copper
3	WE	WE-RA-0001	0.017mm	1/2oz	Base foil	User	RA Base Copper
4	WE	WE-ED-0003	0.017mm	1/2oz	Base foil	User	ED Base Copper
5	WE	WE-RA-0002	0.035mm	1oz	Base foil	User	RA Base Copper
6	WE	WE-ED-0004	0.035mm	1oz	Base foil	User	ED Base Copper
7	WE	WE-RA-0003	0.07mm	2oz	Base foil	User	RA Base Copper
8	WE	WE-ED-0005	0.07mm	2oz	Base foil	User	ED Base Copper
9	WE	WE-ED-0006	0.105mm	3oz	Base foil	User	ED Base Copper
10	WE	WE-ED-0007	0.21mm	3oz	Base foil	User	ED Base Copper



AGENDA

- 1 My objectives for today's webinar
- 2 The Würth Elektronik materials database for AltiumDesigner20
- 3 Demonstration of Material Library import process in AD20
- 4 The description makes the difference
- 5 Minimum copper layer thicknesses of the finished PCB according to IPC**
- 6 Summary and outlook

DIGITAL PCB STANDARDS – MATERIAL DATABASE

Minimum copper foil thicknesses according to IPC specification



- **Inner layers → IPC designation „Internal Layer Foil Thickness after Processing“**
 - IPC-6012E Table 3-14 resp. IPC-6013D Table 3-18
 - Depending on Foil Starting Weight → see „**Thickness**“ of base copper
 - With consideration of the minus tolerances of the copper foil as delivered
 - Minus the process tolerance reduction

- **Outer layers → IPC designation „External Conductor Thickness after Plating&Processing“**
 - IPC-6012E Table 3-15 resp.. IPC-6013D Table 3-19
 - Depending on Foil Starting Weight → see „**Description**“ of plated base foil
 - With consideration of the minus tolerances of the copper foil as delivered
 - Plus average (IPC-6012) resp. minimum (IPC-6013) plating depending on IPC class and IPC type
 - Minus the process tolerance reduction



DIGITAL PCB STANDARDS – MATERIAL DATABASE

Example: Outer Layers ¼ oz. base copper (9µm)



- IPC-6012E Table 3-15 for rigid PCBs

March 2020

IPC-6012E

Table 3-15 External Conductor Thickness after Plating

Weight ^{1,4}	Absolute Cu Min. (IPC-4562 less 10% reduction) (µm) [µin] ⁵	Plus average plating for Class 1 and 2 (20 µm) [787 µin] ² FOR REFERENCE PURPOSES ONLY	Plus average plating for Class 3 (25 µm) [984 µin] ² FOR REFERENCE PURPOSES ONLY	Maximum Variable Processing Allowance Reduction ³ (µm) [µin] FOR REFERENCE PURPOSES ONLY	Minimum Surface Conductor Thickness after Processing (µm) [µin]	
					Class 1 & 2	Class 3
1/8 oz.	4.60 [181]	24.60 [967]	29.60 [1,165]	1.50 [59]	23.1 [909]	28.1 [1,106]
1/4 oz.	7.70 [303]	27.70 [1,091]	32.70 [1,287]	1.50 [59]	26.2 [1,031]	31.2 [1,228]
3/8 oz.	10.80 [425]	30.80 [1,213]	35.80 [1,409]	1.50 [59]	29.3 [1,154]	34.3 [1,350]
1/2 oz.	15.40 [606]	35.40 [1,394]	40.40 [1,591]	2.00 [79]	33.4 [1,315]	38.4 [1,512]
1 oz.	30.90 [1,217]	50.90 [2,004]	55.90 [2,201]	3.00 [118]	47.9 [1,886]	52.9 [2,083]
2 oz.	61.70 [2,429]	81.70 [3,217]	86.70 [3,413]	3.00 [118]	78.7 [3,098]	83.7 [3,295]
3 oz.	92.60 [3,646]	112.60 [4,433]	117.60 [4,630]	4.00 [157]	108.6 [4,276]	113.6 [4,472]
4 oz.	123.50 [4,862]	143.50 [5,650]	148.50 [5,846]	4.00 [157]	139.5 [5,492]	144.5 [5,689]

Note 1. Starting foil weight of design requirement per procurement documentation.

Note 2. Process allowance reduction does not allow for rework processes for weights below 1/2 oz. For 1/2 oz. and above, the process allowance reduction allows for one rework process.

Note 3. Reference: Average Cu Plating Thickness

Class 1 = 20 µm [787 µin] Class 2 = 20 µm [787 µin] Class 3 = 25 µm [984 µin]

Note 4. For copper foil above 4 oz., utilize the formula provided in 3.6.2.15.

Note 5. For foil weights not listed in Table 3-14, the finished copper foil thickness shall be calculated using the following algorithms. For microns (µm) use [(34.3 X Weight) X 0.9] and for [µin] microinches use [(1.35 X Weight) X 0.9] X 1000.

DIGITAL PCB STANDARDS – MATERIAL DATABASE

Example: Inner Layers ½ oz. base copper (17µm)



- IPC-6012E Table 3-14 for rigid PCBs

Table 3-14 Internal Layer Foil Thickness after Processing¹

Weight (µm) [oz./ft ²]	Absolute Cu Min. (IPC-4562 less 10% reduction) (µm) [µin] FOR REFERENCE PURPOSES ONLY ²	Maximum Variable Processing Allowance Reduction ³ (µm) [µin] FOR REFERENCE PURPOSES ONLY	Minimum Foil Thickness after Processing (µm) [µin]
5.10 [1/8 oz.]	4.60 [181]	1.50 [59]	3.1 [122]
8.50 [1/4 oz.]	7.70 [303]	1.50 [59]	6.2 [244]
12.00 [3/8 oz.]	10.80 [425]	1.50 [59]	9.3 [366]
17.10 [1/2 oz.]	15.40 [606]	4.00 [157]	11.4 [449]
34.30 [1 oz.]	30.90 [1,217]	6.00 [236]	24.9 [980]
68.60 [2 oz.]	61.70 [2,429]	6.00 [236]	55.7 [2,193]
102.90 [3 oz.]	92.60 [3,646]	6.00 [236]	86.6 [3,409]
137.20 [4 oz.]	123.50 [4,862]	6.00 [236]	117.5 [4,626]
Above 137.20 [4 oz.]	IPC-4562 value less 10% reduction	6.00 [236]	6 µm [236 µin] below minimum thickness of calculated 10% reduction of foil thickness in IPC-4562

Note 1. This table also applies to external, non-plated layers.

Note 2. Process allowance reduction does not allow for rework processes for weights below 1/2 oz. For 1/2 oz. and above, the process allowance reduction allows for one rework process.

Note 3. For foil weights not listed in Table 3-13, the finished copper foil thickness **shall** be calculated using the following algorithms. For microns (µm) use [(34.3 X Weight) X 0.9] and for [µin] microinches use [(1.35 X Weight) X 0.9] X 1000.

DIGITAL PCB STANDARDS – MATERIAL DATABASE

Example: Outer Layers 1/4 oz. base copper (9µm)



■ IPC-6013D Table 3-19 for RIGID.flex (Type 4)

IPC-6013D

September 2017

Table 3-19 External Conductor Thickness after Plating^{1,2}

Weight ^{3,4}	Absolute Cu Min. (IPC-4562 less 10% reduction) (µm) [µin] ⁷ FOR REFERENCE PURPOSES ONLY	Plus minimum plating for Type 2 (10 µm) [394 µin] ⁵ FOR REFERENCE PURPOSES ONLY	Plus minimum plating for Type 3, 4 ≤ 1.5 mm [0.059 in] thickness (20 µm) [787 µin] ⁵ FOR REFERENCE PURPOSES ONLY	Plus minimum plating for Type 3, 4 > 1.5 mm [0.059 in] thickness (30 µm) [1181 µin] ⁵ FOR REFERENCE PURPOSES ONLY	Maximum Variable Processing Allowance Reduction ⁶ (µm) [µin] FOR REFERENCE PURPOSES ONLY	Minimum Surface Conductor Thickness after Processing (µm) [µin]		
						Type 2	Type 3, 4 ≤ 1.5 mm [0.059 in] thickness	Type 3, 4 > 1.5 mm [0.059 in] thickness
1/8 oz.	4.60 [181]	14.60 [575]	24.60 [967]	34.60 [1,362]	1.50 [59]	13.1 [516]	23.1 [909]	33.1 [1,303]
1/4 oz.	7.70 [303]	17.70 [697]	27.70 [1,091]	37.70 [1,484]	1.50 [59]	16.2 [638]	26.2 [1,031]	36.2 [1,425]
3/8 oz.	10.80 [425]	20.80 [819]	30.80 [1,213]	40.80 [1,606]	1.50 [59]	19.3 [760]	29.3 [1,154]	39.3 [1,559]
1/2 oz.	15.40 [606]	25.40 [1,000]	35.40 [1,394]	45.40 [1,787]	2.00 [79]	23.4 [921]	33.4 [1,315]	43.4 [1,709]
1 oz.	30.90 [1,217]	40.90 [1,610]	50.90 [2,004]	60.90 [2,398]	3.00 [118]	37.9 [1,491]	47.9 [1,886]	57.9 [2,280]
2 oz.	61.70 [2,429]	71.70 [2,823]	81.70 [3,217]	91.70 [3,610]	3.00 [118]	68.7 [2,705]	78.7 [3,098]	88.7 [3,492]
3 oz.	92.60 [3,646]	102.60 [4,039]	112.60 [4,433]	122.60 [4,827]	4.00 [157]	98.6 [3,882]	108.6 [4,276]	118.6 [4,669]
4 oz.	123.50 [4,862]	133.50 [5,236]	143.50 [5,650]	153.50 [6,043]	4.00 [157]	129.5 [5,098]	139.5 [5,492]	149.5 [5,886]

c. The minimum surface conductor thickness after processing values given in Table 3-19 are determined by the following equation:

Minimum Surface Conductor Thickness = a + b - c

Where:

a = Absolute copper foil minimum (IPC-4562 nominal less 10% reduction).

No finished foil thickness measurement is required for plated layers.

Some evidence of starting foil shall exist.

b = Minimum copper plating thickness (10 µm [394 µin] for Type 2; 20 µm [787 µin] for Type 3 and 4 ≤ 6 layers; 30 µm [1,181 µin] for Type 3 and 4 > 6 layers).

c = A maximum variable processing allowance reduction.

Note 1: The values in this table assume a single plating operation.

Note 2: When selective (button) plating is performed, refer to 3.6.2.16.

Note 3: Starting foil weight of design requirement per procurement documentation.

Note 4: For copper foil above 4 oz., utilize the formula provided in 3.6.2.16.

Note 5: Reference: Min. Cu Plating Thickness

Type 2 = (10 µm) [394 µin] Type 3 and 4 ≤ 1.5 mm [0.059 in] thickness = (20 µm) [787 µin]

Type 3 and 4 > 1.5 mm [0.059 in] thickness = (30 µm) [1,181 µin]

Note 6: Process allowance reduction does not allow for rework processes for weights below 1/2 oz. For 1/2 oz. and above, the process allowance reduction allows for one rework process.

Note 7: For foil weights not listed in Table 3-19, the absolute copper minimum shall be calculated using the following algorithms. For microns (µm) use [(34.3 X Weight) X 0.9] and for [µin] microinches use [(1.35 X Weight) X 0.9] X 1000.

SUMMARY & OUTLOOK

Digital Standards – material database

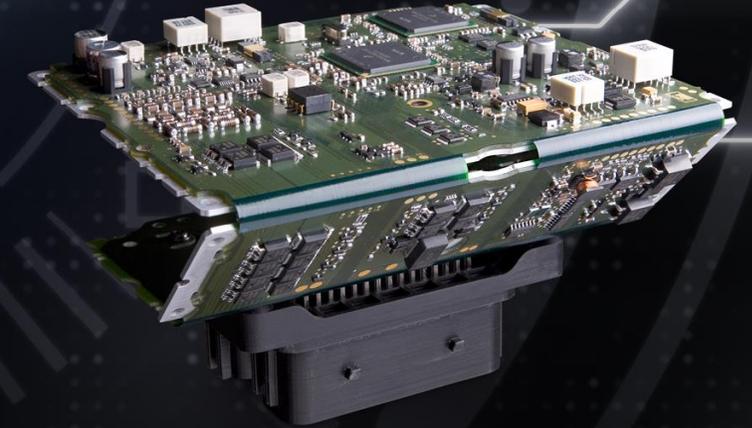
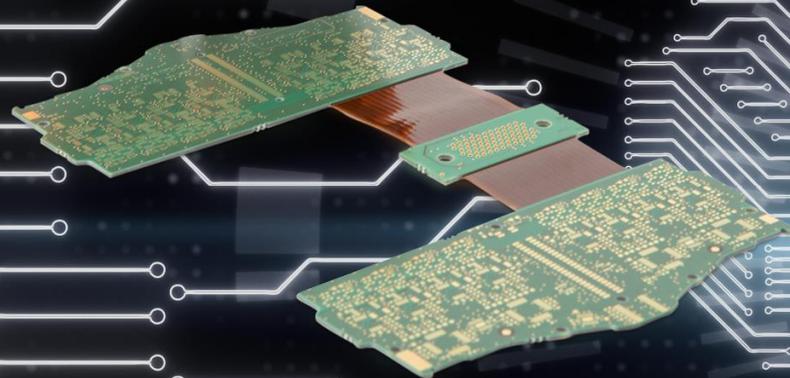


- Digital material database is available for AltiumDesigner20
- Material Library for more EDA tools will follow

- Updating of all standards on the basis of the new MatLib revision 2.12: Delayed, should com within next 2 weeks.
- 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](#).





WE SET THE PCB STANDARD
Digital stackups for your EDA tool and more...