

Suggested stackup 6ML

6ML BOARD - 1.60MM		6ML BOARD - 2.00MM		6ML BOARD - 2.40MM	
Contents	Thickness (mm)	Contents	Thickness (mm)	Contents	Thickness (mm)
Solder mask	0.02	Solder mask	0.02	Solder mask	0.02
0,5oz + plating	0.035	0,5oz + plating	0.035	0,5oz + plating	0.035
PP	0.12	PP	0.27	PP	0.24
	0.035		0.035		0.035
CCL 0,43 1oz/1oz	0.43	CCL 0,7 1oz/1oz	0.43	CCL 0,85 1oz/1oz	0.73
	0.035		0.035		0.035
PP	0.24	PP	0.38	PP	0.24
	0.035		0.035		0.035
CCL 0,43 1oz/1oz	0.43	CCL 0,7 1oz/1oz	0.43	CCL 0,85 1oz/1oz	0.73
	0.035		0.035		0.035
PP	0.12	PP	0.27	PP	0.24
0,5oz + plating	0.035	0,5oz + plating	0.035	0,5oz + plating	0.035
Solder mask	0.02	Solder mask	0.02	Solder mask	0.02
Total	1.59	Total	2	Total	2.375

We do not provide PP types as it depends on your design, presence of copper surface and each factory has its own strategy on which types or combinations to use in stackups.

Suggested stackup 8ML

8ML BOARD - 1.60MM		8ML BOARD - 2.00MM		8ML BOARD - 2.40MM	
Contents	Thickness (mm)	Contents	Thickness (mm)	Contents	Thickness (mm)
Solder mask	0.02	Solder mask	0.02	Solder mask	0.02
0,5oz + plating	0.035	0,5oz + plating	0.035	0,5oz + plating	0.035
PP	0.08	PP	0.12	PP	0.200
	0.035		0.035		0.035
CCL 0,27 1oz/1oz	0.13	CCL 0,43 1oz/1oz	0.33	CCL 0,5 1oz/1oz	0.53
	0.035		0.035		0.035
PP	0.38	PP	0.24	PP	0.24
	0.035		0.035		0.035
CCL 0,27 1oz/1oz	0.13	CCL 0,43 1oz/1oz	0.33	CCL 0,5 1oz/1oz	0.430
	0.035		0.035		0.035
PP	0.38	PP	0.24	PP	0.200
	0.035		0.035		0.035
CCL 0,27 1oz/1oz	0.13	CCL 0,43 1oz/1oz	0.33	CCL 0,5 1oz/1oz	0.53
	0.035		0.035		0.035
PP	0.08	PP	0.12	PP	0.08
0,5oz + plating	0.035	0,5oz + plating	0.035	0,5oz + plating	0.035
Solder mask	0.02	Solder mask	0.02	Solder mask	0.02
Total	1.575	Total	2	Total	2.495

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Suggested stackup 10ML

10ML BOARD - 1.60MM		10ML BOARD - 2.00MM		10ML BOARD - 2.40MM	
Contents	Thickness (mm)	Contents	Thickness (mm)	Contents	Thickness (mm)
Solder mask	0.02	Solder mask	0.02	Solder mask	0.02
0,5oz + plating	0.035	0,5oz + plating	0.035	0,5oz + plating	0.035
PP	0.15	PP	0.15	PP	0.12
	0.035		0.035		0.035
CCL 0,22 1oz/1oz	0.13	CCL 0,27 1oz/1oz	0.23	CCL 0,43 1oz/1oz	0.33
	0.035		0.035		0.035
PP	0.16	PP	0.16	PP	0.24
	0.035		0.035		0.035
CCL 0,22 1oz/1oz	0.13	CCL 0,27 1oz/1oz	0.23	CCL 0,43 1oz/1oz	0.33
	0.035		0.035		0.035
PP	0.16	PP	0.16	PP	0.16
	0.035		0.035		0.035
CCL 0,22 1oz/1oz	0.13	CCL 0,27 1oz/1oz	0.23	CCL 0,43 1oz/1oz	0.33
	0.035		0.035		0.035
PP	0.16	PP	0.16	PP	0.24
	0.035		0.035		0.035
CCL 0,22 1oz/1oz	0.13	CCL 0,27 1oz/1oz	0.23	CCL 0,43 1oz/1oz	0.33
	0.035		0.035		0.035
PP	0.15	PP	0.15	PP	0.12
0,5oz + plating	0.035	0,5oz + plating	0.035	0,5oz + plating	0.035
Solder mask	0.02	Solder mask	0.02	Solder mask	0.02
Total	1.635	Total	2.035	Total	2.535

We do not provide PP types as it depends on your design, presence of copper surface and each factory has its own strategy on which types or combinations to use in stackups.

Stackup parameters

INTERNAL COPPER THICKNESS AFTER PROCESSING

BASE FOIL	MIN. AFTER PROCES - SING
18 µm (1/2 oz)	11.4 µm
35 µm (1 oz)	24.9 µm
70 µm (2 oz)	55.7 µm
105 µm (3 oz)	86.6 µm
140 µm (4 oz)	117.5 µm

EXTERNAL COPPER THICKNESS AFTER PLATING

BASE FOIL	MIN. CLASS 2	MIN. CLASS 3
12 µm (3/8 oz)	29.3 µm	34.3 µm
18 µm (1/2 oz)	33.4 µm	38.4 µm
35 µm (1 oz)	47.9 µm	52.9 µm
70 µm (2 oz)	78.7 µm	83.7 µm
105 µm (3 oz)	108.6 µm	113.6 µm
140 µm (4 oz)	139.5 µm	144.5 µm

COMMON PREPREG PROPERTIES

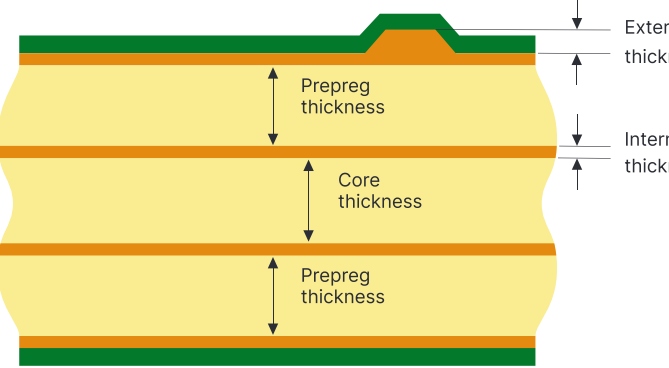
TYPE	THICKNESS (MM)	RESIN (%)
106	0.05	65
1080	0.08	65
2116	0.12	55
7628	0.19	46

COMMON MATERIAL LIST

Medium Tg	Shengyi S1000-H
	ITEQ IT-158
High Tg	Shengyi S1000-2M
	ITEQ IT-180A

COMMON CORE THICKNESS

Thickness (mm)
0.1 1/1
0.2 1/1
0.3 1/1
0.4 1/1
0.5 1/1
0.6 1/1
0.8 1/1
1.0 1/1
1.2 1/1
1.3 1/1
1.5 1/1
1.9 1/1



Design tips - Stackup

- Make sure the stackup is symmetric.
- Normally suggested stackups are a foil build. Special core build is possible (for example with Rogers), but not common.
- Standard thickness tolerance of +/-10% is for board >1mm. Standard thickness tolerance of +/-0,1mm is for 1mm board. Thickness tolerance for board ≤1mm shall be approved by NCAB.
- Minimum dielectric thickness will be 90µm according to IPC if FAB drawing doesn't specify anything and there aren't Micro vias.
- Keep in mind to use maximum 3 sheets of prepreg to bond layers together.
- The stackup used in production might be a bit different to the specified one, but an EQ will be send to confirm it. This happens due to the copper distribution, materials on stocks, ... etc.
- For thicker copper foils needs thicker dielectric between layers.
- Foil thickness value after processing is not the same as base foil, see tables above.
- Differences in the % of resin for same prepreg type will have impact on different thickness of the prepreg.
- If you require microvias in your product, keep in mind Aspect ratio (recommended (0,8:1)and advanced (1:1)) when you choose the right prepreg.
- If you require special materials, thickness tolerance or stackups, contact your local NCAB office.

Tolerance of impedance control

TYPE OF IMPEDANCE	COMMON REQUESTED VALUE	TOLERANCE OF IMPEDANCE CONTROL		
		GENERAL	MODERATE	ADVANCED*
Single / Single Coplanar	40 Ω / 50 Ω / 75 Ω	± 10 %	± 8 %	± 5 %
Differential / Differential Coplanar	90 Ω / 100 Ω / 120 Ω	± 10 %	± 8 %	± 5 %

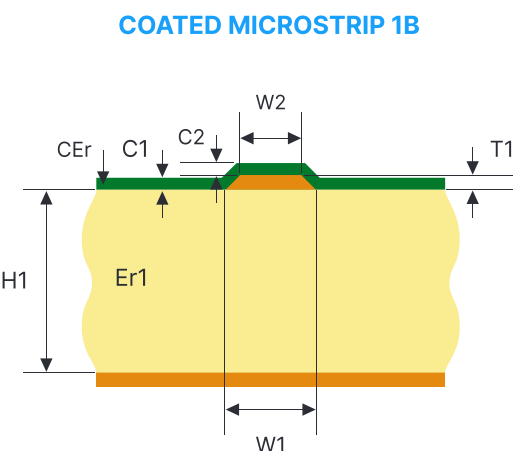
Relationship between parameters and impedance value

PARAMETERS MODIFICATION		EFFECT ON IMPEDANCE VALUE	
PARAMETERS	INCREASE ↑ / REDUCE ↓	IMPACTS ON IMPEDANCE	IMPEDANCE VALUE INCREASE ↑ / REDUCE ↓
H (dielectric thickness)	↑	Big	↑
W (trace width)	↑	Big	↓
S (trace space)	↑	Big	↓
T (copper thickness)	↑	Low	↓
C (solder mask thickness)	↑	Low	↓

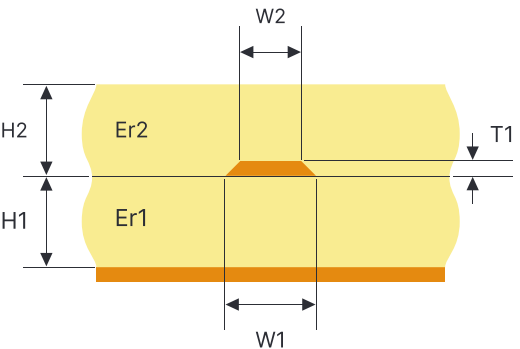
This table show impacts on impedance value if some parameters will be modified.

Common Impedance Structures

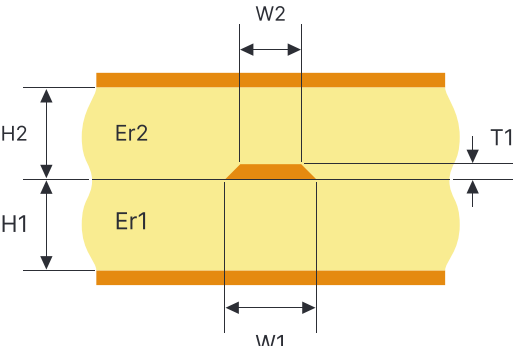
Single



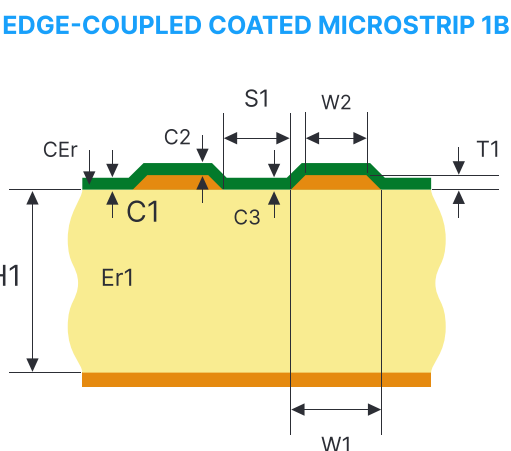
EMBEDDED MICROSTRIP 1B1A



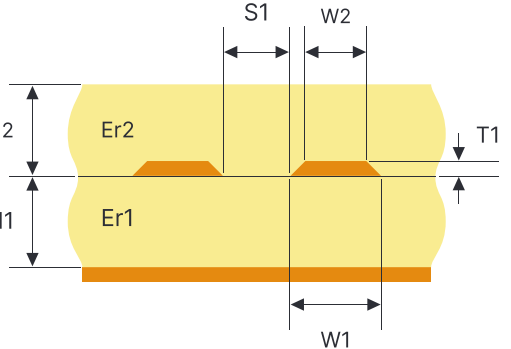
OFFSET STRIPLINE 1B1A



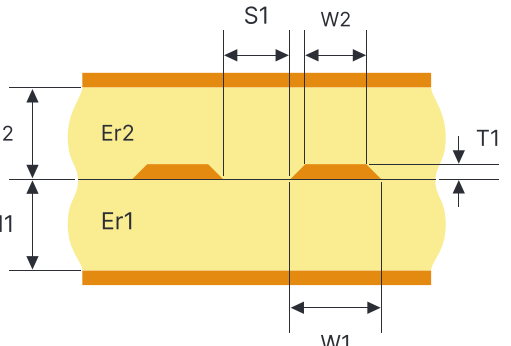
Differential



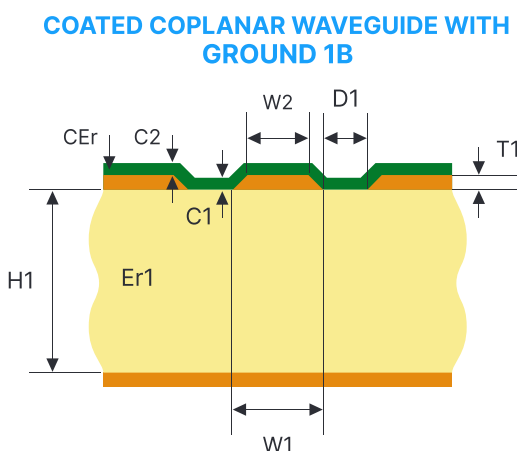
EDGE-COUPLED EMBEDDED MICROSTRIP 1B1A



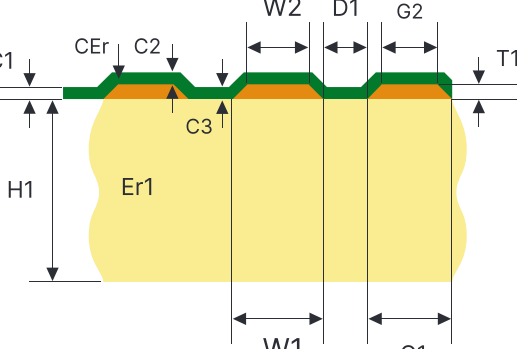
EDGE-COUPLED OFFSET STRIPLINE 1B1A



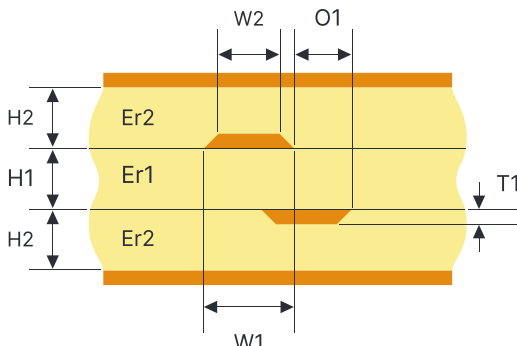
Single coplanar



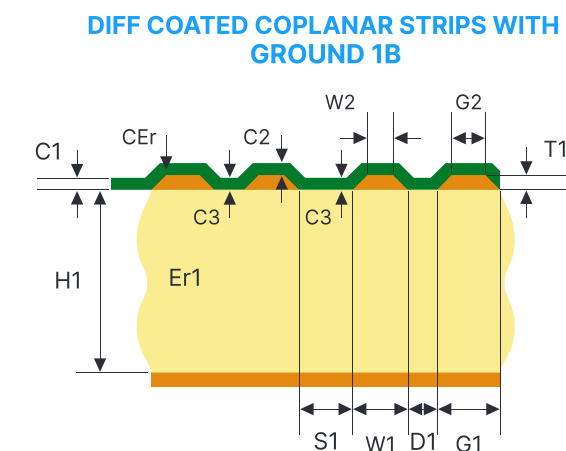
COATED COPLANAR STRIPS 1B



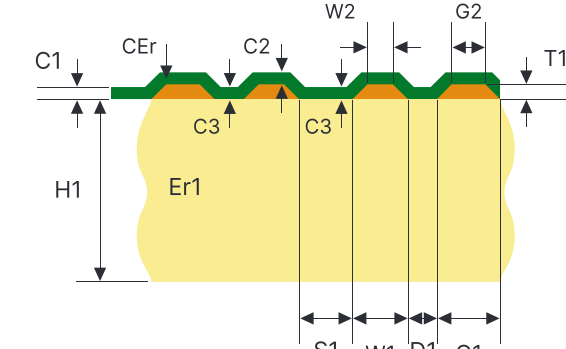
BROADSIDE-COUPLED STRIPLINE 2S



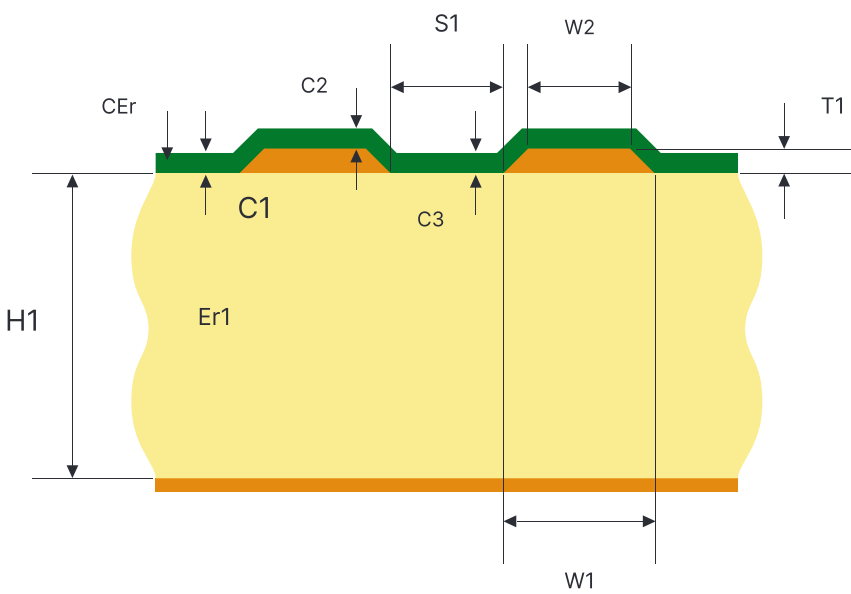
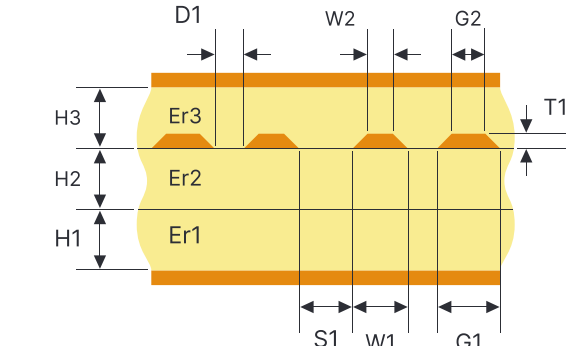
Differential coplanar



DIFF COATED COPLANAR STRIPS 1B



DIFF OFFSET COPLANAR STRIPS 2B1A



IMPEDANCE PARAMETERS NEEDED FOR CALCULATION

SYMBOL	FEATURE
H1,H2,H3..	Dielectric thickness between copper layers after pressing.
Er1	Dielectric constant of prepreg or core used between copper layers.
W1	The bottom width of impedance lines, which is the customer required impedance trace width.
W2	The top width of impedance lines.
S1	The space between two differential impedance traces.
T1	Finished copper thickness, which is different with our normal definition.
C1	Solder mask thickness on material.
C2	Solder mask thickness on copper.
C3	Solder mask thickness on material between traces (C1 = C3).
CEr	Dielectric constant of solder mask. Normally use 3.4 to calculate.

Design tips - Impedance

- Consider better type of material (medium, high or ultra-high speed) and flat glass style when signal speed is above 2 GHz and timing is critical.
- Ensure a reliable lamination process and avoid risk of resin starvation by letting factory selecting number of prepregs, prepreg styles and resin content in the stackup.
- Keep in mind primary drivers of impedance signal losses:
  - Line length (line losses are directly proportional to line length, shorter line – less losses / longer line – greater losses)
  - Dielectric loss (can be reduced by appropriate material selection)
  - 3a Copper loss (cross-section area – stackup design)
  - 3b Copper loss due to surface roughness (can be reduced by material selection and/or stackup)
- When request tighter impedance tolerance (below +/- 10%) discuss with [www.pcbx.com](http://www.pcbx.com) contact what is possible for your design.
- When designing rigid-flex boards, please note that separate calculations need to be done for the rigid and flex part for the same signal.
- Thickness and dielectric constant of solder mask will be adjusted by manufacturer depend of their solder mask properties / printing method.
- Differences in the % of resin for same prepreg type will have impact on impedance.
- If you required support for impedance calculations, Please contact [www.pcbx.com](http://www.pcbx.com).

Checklist of necessary information for impedance calculations

- Type, value and tolerance of impedance control
- Width / Space of impedance traces
- Layers where the impedance traces are present and which layers are to be considered as references.
- Type of material and finish board thickness
- Reference stackup is needed
- Finish copper thickness on external/internal layers
- Special type of solder mask if needed
- Always ask for pcbx's stackup before you start routing design