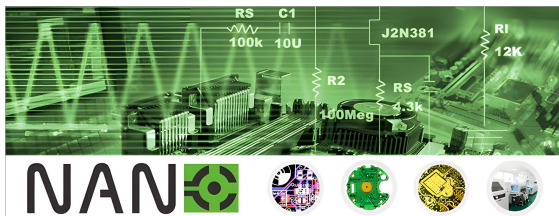


**ELECTRONICS  
DESIGN AND MANUFACTURING  
SERIES**

**PCB STACK-UP  
PLANNING**

## Nanotech Elektronik is an EMS company with a wide range of services

- PCB Services
- SMT and THT assembly
- Electronic components
- BOM Services
- Prototypes
- Turnkey manufacturing



### Our technological capabilities in the scope of assembly

| Production and assembly of printed circuit boards |  |
|---|--|
| Minimum order quantity                            | from 1 piece upwards   |
| Maximum PCB size (X x Y)                          | automatic SMT assembly - 610 mm x 510 mm;<br>THT assembly - no restrictions  |
| Minimum PCB Size (X x Y)                          | automatic SMT assembly - 50 mm x 50 mm;<br>THT assembly - no restrictions  |
| SMD components assembly                           |  |
| Component size range                              | from 0,4 mm x 0,2 mm (01005) to 45 mm x 100 mm   |
| Component height (max)                            | 15 mm  |
| Types of components                               | Chips: 01005, 0201, 0402, 0603, 0805, 1206, 1210, 1812, 2010, 2225, 2512   |
|   | IC: PLCC18-PLCC84, LCC20-LCC84, SO, HSOP, SOJ18-SOJ44, MSOP8-MSOP10, SSOP8-SSOP64, HSOP20-HSOP44, TSSOP8-TSSOP80, TSOP28-TSOP56, TQFP32-TQFP176, LQFP32-LQFP256, QFP44-QFP304, CSP40-CSP56 (0,5), BGA46-BGA100 (0,75-0,8), LBGA48-LBGA280 (0,75-0,8), BGA81-BGA324 (1,0) up to LBGA1936 (1,0), BGA208 (1,27) up to LBGA1225 (1,27), BGA169 (1,5) up to LBGA400, CBGA121 - CBGA1089 |
| Assembly accuracy (X, Y)                          | 50µm for chips 01005, 0201, 0402   |
|   | 75µm for chips > 0402, SOIC  |
|   | 30µm for QFPs  |

Product quality is assured by a multi-level control system at every stage of the production cycle. The manufactured product will fully comply with the provided technical requirements and standards of the international association of electronics manufacturers (Institute of Printed Circuits - IPC).

## Contents

1. **The advantages of multilayer PCB**
2. **What determines the cost of PCB**
3. **Recommended stack-ups**
  - 3.1 4-layer stackups
  - 3.2 6-layer stackups
  - 3.3 8-layer stackups
  - 3.4 10-layer stackups
  - 3.5 12-layer stackups
  - 3.6 14-layer stackups
  - 3.7 16-layer stackups
4. **Via holes plugging**
5. **Copper thickness in multilayer PCB**
6. **PCB fabrication capabilities**

## Contacts

Feel free to contact us if you have further questions. You will always obtain comprehensive information both in the scope of designing and producing printed circuit boards, as well as practical information specifying the product manufacture and delivery time. We are always happy to share our knowledge and experience, in addition to taking care of the highest quality the projects implemented by us, which can be confirmed by the line-up of our clients in the EU and worldwide.

We are always willing to prepare a detailed cost estimate for the production of printed circuit boards, purchase of electronic components, assembly works consisting in mounting components on PCBs and other additional works. Owing to this, you will be able to find out about the production cost of both the first prototype batch and the cost of serial production after sending us the technical documentation of the project.

You can also contact us by phone at **+48 338 338 338** or write to the following e-mail address: **office@nanotech-elektronik.com** (we communicate in English, German and Polish).

Sincerely,  
The Team of Nanotech Elektronik.

## 1. The advantages of multilayer PCBs

Sometimes PCB layout designers believe that the use of multilayer PCBs is solely due to the high density of connections, and that additional layers are introduced when connection routing cannot be made on fewer layers.

However, in addition to this obvious fact that the number of routing layers depends on the number and density of connections, there are many other situations where the use of additional layers is not only recommended but often necessary, even in cases where the PCB can be designed with fewer layers or even as a double-sided PCB.

First of all, an important criterion for selecting the number of layers for routing is the electrical properties of the conductors of the PCBs at higher frequencies. Today, more and more electronic designs include high-speed data transmission lines. Therefore, a conductor on a PCB isn't solely an electrical connection, but rather a transmission line with a specific impedance value. At the same time, to ensure the integrity (absence of distortion and reflections) of high-frequency digital signals, we need to control the exact impedance value so that it corresponds to the calculations "by design".

Impedance control mainly is possible in multilayer printed circuits, with internal reference (ground/power) planes, ensuring efficient isolation of the return currents.

Sometimes designers try to calculate the impedance on a two-sided printed circuit board, but, unfortunately, in practice it is not possible to achieve the required accuracy of 5% - 10% due to the spread of laminate parameters and the impossibility to adjust the distance between the signal layer and the reference plane.

Another important advantage of multilayer printed circuit boards is their resistance to electromagnetic interference, as well as their ability to reduce the level of their own electromagnetic radiation.

A properly designed layer stack-up allows not only to ensure optimal wave characteristics of the transmission lines on the PCB, but also to shield the signal paths most sensitive to interference, reduce the level of intrinsic noise, minimize parasitic energy losses and, thus, ensure optimal thermal operation of the electronic device.

It is possible to improve the stability of an electronic device and increase performance by changing from a double-sided printed circuit board to a four-layer printed circuit board, adding internal copper planes for power and grounding. Sometimes, in order to successfully certify a device to more stricter requirements for electromagnetic compatibility, it is enough to optimize the printed circuit board without significant changes in the circuit.

On the other hand, an increase in the number of layers of a multilayer printed circuit board leads to a higher cost, and also requires certain technological capabilities from the manufacturer. However, if you understand what factors and how increase the cost of a multilayer printed circuit board, you can design its layout in the most optimal way and achieve the desired solution at an affordable price.

In the next chapter, we will explain these factors and how they affect the cost of manufacturing printed circuit boards.

## **2. What determines the cost of PCB**

Generally multilayer printed circuit board consist of one or more cores (a thin glass-epoxy laminate with two layers of copper), several layers of prepregs and outer layers of copper in the form of copper foil. The prepregs are used to glue all the layers together.

It can be said that the cost of a printed circuit board depends on the number of cores - the more cores, the more expensive it is to manufacture a printed circuit board.

Depending on how the interlayer connections are designed, the PCB may contain metallized holes, or vias - through vias, blind and buried. In our previous issue "Guide to Printed Circuit Boards" we have already explained that usually metallized holes can be made mechanically only between layers of copper within the same core or between copper layers within the stack of several cores glued together using prepregs.

Making a stack of cores includes drilling cycles and subsequent metallization. And the number of such cycles is also one of the main price criteria affecting the cost of a multilayer printed circuit board.

Thus, we can formulate a rule: for the same number of layers, a PCB with fewer cores number and, correspondingly, fewer drilling and metallization cycles will be cheaper.

In the case of PCB with high connection density, several additional signal layers are usually used. This is especially common when using BGAs with a large number of pads. To route signals away from the BGA pads, designers use vias between the pads of the BGA chip and additional 2, 3 or 4 layers for signal routing.

Therefore, printed circuit boards with high-density BGAs usually utilize more layers and are mostly more expensive.

A good solution in such a situation could be the HDI printed circuit board technology, which allows to reduce the number of signal layers using micro-vias and vias in the pad (Via-in-pad).

Sometimes, the use of more expensive HDI technology can lead to a cheaper printed circuit board by using fewer layers than if the same printed circuit board was implemented using traditional technology.

Unfortunately, there is no well defined price dependence on the number of layers in multilayer printed circuit boards and HDI printed circuit boards, so we recommend to ask the manufacturer for a price quote for each approach at the early stages of layout design.

If you want to learn more about the design of HDI structures (build-ups), we recommend checking out our guide “High Density Interconnect Printed Circuits”, which can be downloaded from our website.

### **3. Recommended stack-ups**

In order to properly design a multilayer printed circuit board, the construction of the layer stack-up must be carefully considered. Layer stack-up planning depends, on the one hand, on the technological capabilities of manufacturer and, on the other hand, on the requirements for the electrical properties of the PCB.

You need to remember that a multilayer PCB consists of a combination of cores, prepregs and copper foil layers. Below you can find some of the materials that

our suppliers have in stock and we recommend to use these materials in your designs when ordering PCB from us:

### Materials used for the multilayer PCB fabrication

|                                  |                  |
|----------------------------------|------------------|
| <i>Standard copper thickness</i> | 9 $\mu\text{m}$  |
|                                  | 18 $\mu\text{m}$ |
|                                  | 35 $\mu\text{m}$ |
|                                  | 50 $\mu\text{m}$ |
|                                  | 70 $\mu\text{m}$ |

|                                   |                 |
|-----------------------------------|-----------------|
| <i>Standard prepreg thickness</i> | 1080 (0,075 mm) |
|                                   | 2116 (0,105 mm) |
|                                   | 7628 (0,185 mm) |
|                                   | 7628 (0,216 mm) |

|                                |              |
|--------------------------------|--------------|
| <i>Standard core thickness</i> | 0,1 mm       |
|                                | 0,13 mm      |
|                                | 0,21 mm      |
|                                | 0,25 mm      |
|                                | 0,36 mm      |
|                                | 0,51 mm      |
|                                | 0,71 mm      |
|                                | 1,0 mm       |
|                                | 1,2 mm       |
|                                | 1,6 mm       |
|                                | 2,0 mm       |
|                                | 2,4 (2,5) mm |
|                                | 3,2 mm       |

Below, you can find a list of the most common variants of PCB layer stack-ups. The most cost-effective variants we marked with the stamp "Recommended".

## 4-layer stackups

|                                      |       | Required board thickness: 0,5 +/- 0,1 mm |          |                |                |        |
|--------------------------------------|-------|--|----------|----------------|----------------|--------|
|                                      | Layer | Thickness, um                            | Material |                |                |        |
| Nr. 1                                | SMT   |  | 20       | Solder mask    |                |        |
|                                      | TOP   | 1  |          | 18-25          | Copper Plating |        |
|                                      |       |  |          | 18             | Copper Foil    |        |
|                                      | INT 1 | 2  |          | 105            | Prepreg        | 1x2116 |
|                                      |       |  |          | 35             | Copper         |        |
|                                      |       |  |          | 130            | Core           |        |
|                                      | INT 2 | 3  |          | 35             | Copper         |        |
|                                      |       |  |          | 105            | Prepreg        | 1x2116 |
| BOTTOM                               | 4     |  | 18       | Copper Foil    |                |        |
|                                      |       |  | 18-25    | Copper Plating |                |        |
| SMB                                  |       |  | 20       | Solder mask    |                |        |
| Approximate board thickness: 0.46 mm |       |  |          |                |                |        |

|                                      |       | Required board thickness: 0,8 +/- 0,1 mm |          |                |                |        |
|--------------------------------------|-------|--|----------|----------------|----------------|--------|
|                                      | Layer | Thickness, um                            | Material |                |                |        |
| Nr. 2                                | SMT   |  | 20       | Solder mask    |                |        |
|                                      | TOP   | 1  |          | 18-25          | Copper Plating |        |
|                                      |       |  |          | 18             | Copper Foil    |        |
|                                      | INT 1 | 2  |          | 75             | Prepreg        | 1x1080 |
|                                      |       |  |          | 105            | Prepreg        | 1x2116 |
|                                      |       |  |          | 35             | Copper         |        |
|                                      |       |  |          | 250            | Core           |        |
|                                      | INT 2 | 3  |          | 35             | Copper         |        |
|                                      |       |  | 105      | Prepreg        | 1x2116         |        |
| BOTTOM                               | 4     |  | 75       | Prepreg        | 1x1080         |        |
|                                      |       |  | 18       | Copper Foil    |                |        |
| SMB                                  |       |  | 18-25    | Copper Plating |                |        |
|                                      |       |  | 20       | Solder mask    |                |        |
| Approximate board thickness: 0.71 mm |       |  |          |                |                |        |

|        |       | Required board thickness: 1,0 +/- 0,1 mm |  |               |                |         |
|--------|-------|--|--|---------------|----------------|---------|
|        | Layer |  |  | Thickness, um | Material       |         |
| Nr. 3  | SMT   |  |  | 20            | Solder mask    |         |
|        | TOP   | 1  |  | 18-25         | Copper Plating |         |
|        |       |  |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  |  | 2x1080        | 150            | Prepreg |
|        |       |  |  |               | 35             | Copper  |
|        |       |  |  |               | 510            | Core    |
|        | INT 2 | 3  |  |               | 35             | Copper  |
|        |       |  |  | 2x1080        | 150            | Prepreg |
| BOTTOM | 4     |  |  | 18            | Copper Foil    |         |
|        |       |  |  | 18-25         | Copper Plating |         |
| SMB    |       |  |  | 20            | Solder mask    |         |

Approximate board thickness: 0.89 mm

|       |        | Required board thickness: 1,6 +/- 0,15 mm |  |               |                |             |
|-------|--------|---|--|---------------|----------------|-------------|
|       | Layer  |   |  | Thickness, um | Material       |             |
| Nr. 4 | SMT    |   |  | 20            | Solder mask    |             |
|       | TOP    | 1   |  | 18-25         | Copper Plating |             |
|       |        |   |  |               | 18             | Copper Foil |
|       | INT 1  | 2   |  | 1x1080        | 75             | Prepreg     |
|       |        |   |  | 1x7628        | 185            | Prepreg     |
|       |        |   |  |               | 35             | Copper      |
|       |        |   |  |               | 1000           | Core        |
|       | INT 2  | 3   |  |               | 35             | Copper      |
|       |        |   |  | 1x7628        | 185            | Prepreg     |
|       | BOTTOM | 4   |  | 1x1080        | 75             | Prepreg     |
|       |        |   |  | 18            | Copper Foil    |             |
|       |        |   |  | 18-25         | Copper Plating |             |
| SMB   |        |   |  | 20            | Solder mask    |             |

Approximate board thickness: 1.54 mm

|        |       | Required board thickness: 2,0 +/- 0,2 mm |       |                |                |         |
|--------|-------|--|-------|----------------|----------------|---------|
|        | Layer |  |       | Thickness, um  | Material       |         |
| Nr. 5  | SMT   |  |       | 20             | Solder mask    |         |
|        | TOP   | 1  |       | 18-25          | Copper Plating |         |
|        |       |  |       | 18             | Copper Foil    |         |
|        | INT 1 | 2  |       | 2x1080         | 150            | Prepreg |
|        |       |  |       | 35             | Copper         |         |
|        |       |  |       |                | 1600           | Core    |
|        | INT 2 | 3  |       | 2x1080         | 35             | Copper  |
|        |       |  |       | 150            | Prepreg        |         |
| BOTTOM | 4     |  |       | 18             | Copper Foil    |         |
|        |       |  | 18-25 | Copper Plating |                |         |
| SMB    |       |  |       | 20             | Solder mask    |         |

Approximate board thickness: 1.92 mm

|       |        | Required board thickness: 2,5 +/- 0,2 mm |       |                |                |         |
|-------|--------|--|-------|----------------|----------------|---------|
|       | Layer  |  |       | Thickness, um  | Material       |         |
| Nr. 6 | SMT    |  |       | 20             | Solder mask    |         |
|       | TOP    | 1  |       | 18-25          | Copper Plating |         |
|       |        |  |       | 18             | Copper Foil    |         |
|       | INT 1  | 2  |       | 1x1080         | 75             | Prepreg |
|       |        |  |       | 1x2116         | 105            | Prepreg |
|       |        |  |       | 35             | Copper         |         |
|       |        |  |       |                | 2000           | Core    |
|       | INT 2  | 3  |       |                | 35             | Copper  |
|       |        |  |       | 1x2116         | 105            | Prepreg |
|       | BOTTOM | 4  |       | 1x1080         | 75             | Prepreg |
|       |        |  | 18    | Copper Foil    |                |         |
|       |        |  | 18-25 | Copper Plating |                |         |
| SMB   |        |  |       | 20             | Solder mask    |         |

Approximate board thickness: 2.41 mm

|        |        | Required board thickness: 3,0 +/- 0,2 mm |        |                |                |
|--------|--------|--|--------|----------------|----------------|
|        | Layer  |  |        | Thickness, um  | Material       |
| Nr. 7  | SMT    |  |        | 20             | Solder mask    |
|        | TOP    | 1  |        | 18-25          | Copper Plating |
|        |        |  |        | 18             | Copper Foil    |
|        | INT 1  | 2  | 1x1080 | 75             | Prepreg        |
|        |        |  | 1x7628 | 185            | Prepreg        |
|        |        |  |        | 35             | Copper         |
|        |        |  |        | 2400           | Core           |
|        | INT 2  | 3  |        | 35             | Copper         |
|        |        |  |        | 185            | Prepreg        |
|        | BOTTOM | 4  | 1x7628 | 185            | Prepreg        |
| 1x1080 |        |  | 75     | Prepreg        |                |
|        |        |  | 18     | Copper Foil    |                |
| SMB    |        |  | 18-25  | Copper Plating |                |
|        |        |  | 20     | Solder mask    |                |

Approximate board thickness: 2,95 mm

### 4-layer PCB stack-up (recommended)

|       |        | Required board thickness: 1,6 +/- 0,1 mm |        |                |                |
|-------|--------|--|--------|----------------|----------------|
|       | Layer  |  |        | Thickness, um  | Material       |
| Nr. 8 | SMT    |  |        | 20             | Solder mask    |
|       | TOP    | 1  |        | 18-25          | Copper Plating |
|       |        |  |        | 18             | Copper Foil    |
|       | INT 1  | 2  | 1x2116 | 105            | Prepreg        |
|       |        |  |        | 35             | Copper         |
|       |        |  |        | 1100           | Core           |
|       | INT 2  | 3  |        | 35             | Copper         |
|       |        |  |        | 105            | Prepreg        |
|       | BOTTOM | 4  | 1x2116 | 105            | Prepreg        |
|       |        |  |        | 18             | Copper Foil    |
|       |        |  | 18-25  | Copper Plating |                |
| SMB   |        |  | 20     | Solder mask    |                |

Approximate board thickness: 1,5 mm

## 6-layer stackups

|        |       | Required board thickness: 0,7 +/- 0,1 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 1  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 1x2116        | 105            | Prepreg |
|        |       |  | 18            | Copper         |         |
|        | INT 2 | 3  |               | 130            | Core    |
|        |       |  | 18            | Copper         |         |
|        | INT 3 | 4  | 1x2116        | 105            | Prepreg |
|        |       |  | 18            | Copper         |         |
|        | INT 4 | 5  |               | 130            | Core    |
| 18     |       |  | Copper        |                |         |
| BOTTOM | 6     | 1x2116                                   | 105           | Prepreg        |         |
|        |       | 18                                       | Copper Foil   |                |         |
| SMB    |       | 20                                       | Solder mask   |                |         |

Approximate board thickness: 0,68 mm

|        |       | Required board thickness: 0,8 +/- 0,1 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 2  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 1x2116        | 105            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        | INT 2 | 3  |               | 130            | Core    |
|        |       |  | 35            | Copper         |         |
|        | INT 3 | 4  | 1x2116        | 105            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        | INT 4 | 5  |               | 130            | Core    |
| 35     |       |  | Copper        |                |         |
| BOTTOM | 6     | 1x2116                                   | 105           | Prepreg        |         |
|        |       | 18                                       | Copper Foil   |                |         |
| SMB    |       | 20                                       | Solder mask   |                |         |

Approximate board thickness: 0,75 mm

|       |        | Required board thickness: 1,0 +/- 0,1 mm |        |                |                |
|-------|--------|--|--------|----------------|----------------|
|       | Layer  |  |        | Thickness, um  | Material       |
| Nr. 3 | SMT    |  |        | 20             | Solder mask    |
|       | TOP    | 1  |        | 18-25          | Copper Plating |
|       |        |  |        | 18             | Copper Foil    |
|       | INT 1  | 2  | 2x1080 | 150            | Prepreg        |
|       |        |  |        | 35             | Copper         |
|       |        |  |        | 210            | Core           |
|       | INT 2  | 3  |        | 35             | Copper         |
|       | INT 3  | 4  | 1x2116 | 105            | Prepreg        |
|       |        |  |        | 35             | Copper         |
|       |        |  |        | 210            | Core           |
|       | INT 4  | 5  |        | 35             | Copper         |
|       | BOTTOM | 6  | 2x1080 | 150            | Prepreg        |
|       |        |  | 18     | Copper Foil    |                |
| SMB   |        |  | 18-25  | Copper Plating |                |
|       |        |  | 20     | Solder mask    |                |

Approximate board thickness: 0.96 mm

|        |       | Required board thickness: 1,6 +/- 0,1 mm |        |                |                |
|--------|-------|--|--------|----------------|----------------|
|        | Layer |  |        | Thickness, um  | Material       |
| Nr. 4  | SMT   |  |        | 20             | Solder mask    |
|        | TOP   | 1  |        | 18-25          | Copper Plating |
|        |       |  |        | 18             | Copper Foil    |
|        | INT 1 | 2  | 1x1080 | 75             | Prepreg        |
|        |       |  | 1x7628 | 185            | Prepreg        |
|        |       |  |        | 35             | Copper         |
|        |       |  |        | 360            | Core           |
|        | INT 2 | 3  |        | 35             | Copper         |
|        | INT 3 | 4  | 1x7628 | 185            | Prepreg        |
|        |       |  |        | 35             | Copper         |
|        |       |  |        | 360            | Core           |
|        | INT 4 | 5  |        | 35             | Copper         |
| BOTTOM | 6     | 1x7628                                   | 185    | Prepreg        |                |
|        |       | 1x1080                                   | 75     | Prepreg        |                |
| SMB    |       |  | 18     | Copper Foil    |                |
|        |       |  | 18-25  | Copper Plating |                |
|        |       |  | 20     | Solder mask    |                |

Approximate board thickness: 1.56 mm

|        |       | Required board thickness: 2,0 +/- 0,2 mm |        | Thickness, um | Material       |         |
|--------|-------|--|--------|---------------|----------------|---------|
|        | Layer |  |        |               |                |         |
| Nr. 5  | SMT   |  |        | 20            | Solder mask    |         |
|        | TOP   | 1  |        | 18-25         | Copper Plating |         |
|        |       |  |        | 18            | Copper Foil    |         |
|        | INT 1 | 2  |        | 1x1080        | 75             | Prepreg |
|        |       |  |        | 1x7628        | 185            | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 510            | Core    |
|        | INT 2 | 3  |        |               | 35             | Copper  |
|        |       |  |        | 1x7628        | 185            | Prepreg |
|        | INT 3 | 4  |        | 1x1080        | 75             | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 510            | Core    |
|        | INT 4 | 5  |        |               | 35             | Copper  |
|        |       |  |        | 1x7628        | 185            | Prepreg |
| BOTTOM | 6     |  | 1x1080 | 75            | Prepreg        |         |
|        |       |  |        | 18            | Copper Foil    |         |
| SMB    |       |  |        | 18-25         | Copper Plating |         |
|        |       |  |        | 20            | Solder mask    |         |

Approximate board thickness: 1,92 mm

|        |       | Required board thickness: 2,4 +/- 0,2 mm |        | Thickness, um | Material       |         |
|--------|-------|--|--------|---------------|----------------|---------|
|        | Layer |  |        |               |                |         |
| Nr. 6  | SMT   |  |        | 20            | Solder mask    |         |
|        | TOP   | 1  |        | 18-25         | Copper Plating |         |
|        |       |  |        | 18            | Copper Foil    |         |
|        | INT 1 | 2  |        | 1x1080        | 75             | Prepreg |
|        |       |  |        | 1x7628        | 185            | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 710            | Core    |
|        | INT 2 | 3  |        |               | 35             | Copper  |
|        |       |  |        | 1x7628        | 185            | Prepreg |
|        | INT 3 | 4  |        | 1x1080        | 75             | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 710            | Core    |
|        | INT 4 | 5  |        |               | 35             | Copper  |
|        |       |  |        | 1x7628        | 185            | Prepreg |
| BOTTOM | 6     |  | 1x1080 | 75            | Prepreg        |         |
|        |       |  |        | 18            | Copper Foil    |         |
| SMB    |       |  |        | 18-25         | Copper Plating |         |
|        |       |  |        | 20            | Solder mask    |         |

Approximate board thickness: 2,32 mm

|       |        | Required board thickness: 3,0 +/- 0,2 mm |        | Thickness, um  | Material       |
|-------|--------|--|--------|----------------|----------------|
|       | Layer  |  |        |                |                |
| Nr. 7 | SMT    |  |        | 20             | Solder mask    |
|       | TOP    | 1  |        | 18-25          | Copper Plating |
|       |        |  |        | 18             | Copper Foil    |
|       | INT 1  | 2  | 1x1080 | 75             | Prepreg        |
|       |        |  | 1x2116 | 105            | Prepreg        |
|       |        |  |        | 35             | Copper         |
|       |        |  |        | 1100           | Core           |
|       | INT 2  | 3  |        | 35             | Copper         |
|       | INT 3  | 4  | 1x2116 | 105            | Prepreg        |
|       |        |  |        | 35             | Copper         |
|       |        |  |        | 1100           | Core           |
|       | INT 4  | 5  |        | 35             | Copper         |
|       | BOTTOM | 6  | 1x2116 | 105            | Prepreg        |
|       |        |  | 1x1080 | 75             | Prepreg        |
|       |        |  | 18     | Copper Foil    |                |
| SMB   |        |  | 18-25  | Copper Plating |                |
|       |        |  | 20     | Solder mask    |                |

Approximate board thickness: 2,9 mm

### 6-layer PCB stack-up (recommended)

|       |        | Required board thickness: 1,6 +/- 0,15 mm |        | Thickness, um | Material       |
|-------|--------|---|--------|---------------|----------------|
|       | Layer  |   |        |               |                |
| Nr. 8 | SMT    |   |        | 20            | Solder mask    |
|       | TOP    | 1   |        | 18-25         | Copper Plating |
|       |        |   |        | 18            | Copper Foil    |
|       | INT 1  | 2   | 1x7628 | 185           | Prepreg        |
|       |        |   |        | 35            | Copper         |
|       |        |   |        | 400           | Core           |
|       | INT 2  | 3   |        | 35            | Copper         |
|       | INT 3  | 4   | 2x2116 | 210           | Prepreg        |
|       |        |   |        | 35            | Copper         |
|       |        |   |        | 400           | Core           |
|       | INT 4  | 5   |        | 35            | Copper         |
|       | BOTTOM | 6   | 1x7628 | 185           | Prepreg        |
|       |        |   |        | 18            | Copper Foil    |
|       |        |   |        | 18-25         | Copper Plating |
| SMB   |        |   | 20     | Solder mask   |                |

Approximate board thickness: 1,55 mm

|       |        | Required board thickness: 1,6 +/- 0,15 mm |                |                |         |
|-------|--------|---|----------------|----------------|---------|
|       | Layer  |   | Thickness, um  | Material       |         |
| Nr. 9 | SMT    |   | 20             | Solder mask    |         |
|       | TOP    | 1   | 18-25          | Copper Plating |         |
|       |        |   | 18             | Copper Foil    |         |
|       | INT 1  | 2   | 1x2116         | 105            | Prepreg |
|       |        |   | 35             | Copper         |         |
|       |        |   |                | 500            | Core    |
|       | INT 2  | 3   | 35             | Copper         |         |
|       | INT 3  | 4   | 1x7628         | 185            | Prepreg |
|       |        |   | 35             | Copper         |         |
|       |        |   |                | 500            | Core    |
|       | INT 4  | 5   | 35             | Copper         |         |
|       | BOTTOM | 6   | 1x2116         | 105            | Prepreg |
| 18    |        |   | Copper Foil    |                |         |
| SMB   |        | 18-25                                     | Copper Plating |                |         |
|       |        | 20  | Solder mask    |                |         |

Approximate board thickness: 1,57 mm

### 8-layer stackups

|        |       | Required board thickness: 1,0 +/- 0,1 mm |                |                |         |
|--------|-------|--|----------------|----------------|---------|
|        | Layer |  | Thickness, um  | Material       |         |
| Nr. 1  | SMT   |  | 20             | Solder mask    |         |
|        | TOP   | 1  | 18-25          | Copper Plating |         |
|        |       |  | 18             | Copper Foil    |         |
|        | INT 1 | 2  | 1x2116         | 105            | Prepreg |
|        |       |  | 18             | Copper         |         |
|        |       |  |                | 130            | Core    |
|        | INT 2 | 3  | 18             | Copper         |         |
|        | INT 3 | 4  | 1x2116         | 105            | Prepreg |
|        |       |  | 18             | Copper         |         |
|        |       |  |                | 130            | Core    |
|        | INT 4 | 5  | 18             | Copper         |         |
|        | INT 5 | 6  | 1x2116         | 105            | Prepreg |
| 18     |       |  | Copper         |                |         |
|        |       |  | 130            | Core           |         |
| INT 6  | 7     | 18                                       | Copper         |                |         |
| BOTTOM | 8     | 1x2116                                   | 105            | Prepreg        |         |
|        |       | 18                                       | Copper Foil    |                |         |
| SMB    |       | 18-25                                    | Copper Plating |                |         |
|        |       | 20                                       | Solder mask    |                |         |

Approximate board thickness: 0,96 mm

|        |       | Required board thickness: 1,6 +/- 0,15 mm |        |               |                |         |
|--------|-------|---|--------|---------------|----------------|---------|
|        | Layer |   |        | Thickness, um | Material       |         |
| Nr. 2  | SMT   |   |        | 20            | Solder mask    |         |
|        | TOP   | 1   |        | 18-25         | Copper Plating |         |
|        |       |   |        | 18            | Copper Foil    |         |
|        | INT 1 | 2   |        | 2x1080        | 150            | Prepreg |
|        |       |   |        |               | 35             | Copper  |
|        |       |   |        |               | 250            | Core    |
|        | INT 2 | 3   |        |               | 35             | Copper  |
|        | INT 3 | 4   |        | 1x7628        | 185            | Prepreg |
|        |       |   |        |               | 35             | Copper  |
|        |       |   |        |               | 210            | Core    |
|        | INT 4 | 5   |        |               | 35             | Copper  |
|        | INT 5 | 6   |        | 1x7628        | 185            | Prepreg |
|        |       |   |        |               | 35             | Copper  |
|        |       |   |        |               | 250            | Core    |
| INT 6  | 7     |   |        | 35            | Copper         |         |
| BOTTOM | 8     |   | 2x1080 | 150           | Prepreg        |         |
|        |       |   |        | 18            | Copper Foil    |         |
| SMB    |       |   |        | 18-25         | Copper Plating |         |
|        |       |   |        | 20            | Solder mask    |         |

Approximate board thickness: 1.56 mm

|        |       | Required board thickness: 2,0 +/- 0,2 mm |        |               |                |         |
|--------|-------|--|--------|---------------|----------------|---------|
|        | Layer |  |        | Thickness, um | Material       |         |
| Nr. 3  | SMT   |  |        | 20            | Solder mask    |         |
|        | TOP   | 1  |        | 18-25         | Copper Plating |         |
|        |       |  |        | 18            | Copper Foil    |         |
|        | INT 1 | 2  |        | 1x1080        | 75             | Prepreg |
|        |       |  |        | 1x2116        | 105            | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 360            | Core    |
|        | INT 2 | 3  |        |               | 35             | Copper  |
|        | INT 3 | 4  |        | 2x1080        | 150            | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 360            | Core    |
|        | INT 4 | 5  |        |               | 35             | Copper  |
|        | INT 5 | 6  |        | 2x1080        | 150            | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        | 360           | Core           |         |
| INT 6  | 7     |  |        | 35            | Copper         |         |
| BOTTOM | 8     |  | 1x2116 | 105           | Prepreg        |         |
|        |       |  | 1x1080 | 75            | Prepreg        |         |
| SMB    |       |  |        | 18            | Copper Foil    |         |
|        |       |  |        | 18-25         | Copper Plating |         |
|        |       |  |        | 20            | Solder mask    |         |

Approximate board thickness: 1.92 mm

|        |       | Required board thickness: 2,4 +/- 0,2 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 4  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 2x1080        | 150            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  |               | 510            | Core    |
|        | INT 2 | 3  |               | 35             | Copper  |
|        | INT 3 | 4  | 1x7628        | 185            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  |               | 510            | Core    |
|        | INT 4 | 5  |               | 35             | Copper  |
|        | INT 5 | 6  | 1x7628        | 185            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  |               | 510            | Core    |
| INT 6  | 7     |  | 35            | Copper         |         |
| BOTTOM | 8     | 2x1080                                   | 150           | Prepreg        |         |
|        |       | 18                                       | Copper Foil   |                |         |
| SMB    |       |  | 18-25         | Copper Plating |         |
|        |       |  | 20            | Solder mask    |         |

Approximate board thickness: 2,37 mm

|        |       | Required board thickness: 3,0 +/- 0,2 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 5  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 2x1080        | 150            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  |               | 710            | Core    |
|        | INT 2 | 3  |               | 35             | Copper  |
|        | INT 3 | 4  | 1x7628        | 185            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  |               | 710            | Core    |
|        | INT 4 | 5  |               | 35             | Copper  |
|        | INT 5 | 6  | 1x7628        | 185            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  |               | 710            | Core    |
| INT 6  | 7     |  | 35            | Copper         |         |
| BOTTOM | 8     | 2x1080                                   | 150           | Prepreg        |         |
|        |       | 18                                       | Copper Foil   |                |         |
| SMB    |       |  | 18-25         | Copper Plating |         |
|        |       |  | 20            | Solder mask    |         |

Approximate board thickness: 2,98 mm

## 10-layer stackups

|        |       | Required board thickness: 1,3 +/- 0,15 mm |                |                |
|--------|-------|---|----------------|----------------|
|        | Layer |   | Thickness, um  | Material       |
| Nr. 1  | SMT   |   | 20             | Solder mask    |
|        | TOP   |   | 18-25          | Copper Plating |
|        |       |   | 18             | Copper Foil    |
|        | INT 1 |   | 105            | Prepreg        |
|        |       |   | 18             | Copper         |
|        |       |   | 130            | Core           |
|        | INT 2 |   | 18             | Copper         |
|        |       |   | 105            | Prepreg        |
|        | INT 3 |   | 18             | Copper         |
|        |       |   | 130            | Core           |
| INT 4  |       | 18  | Copper         |                |
|        |       | 105                                       | Prepreg        |                |
| INT 5  |       | 18  | Copper         |                |
|        |       | 130                                       | Core           |                |
| INT 6  |       | 18  | Copper         |                |
|        |       | 105                                       | Prepreg        |                |
| INT 7  |       | 18  | Copper         |                |
|        |       | 130                                       | Core           |                |
| INT 8  |       | 18  | Copper         |                |
|        |       | 105                                       | Prepreg        |                |
| BOTTOM |       | 18  | Copper Foil    |                |
|        |       | 18-25                                     | Copper Plating |                |
| SMB    |       | 20  | Solder mask    |                |

Approximate board thickness: 1,24 mm

|        |       | Required board thickness: 1,6 +/- 0,15 mm |               |                |         |
|--------|-------|---|---------------|----------------|---------|
|        | Layer |   | Thickness, um | Material       |         |
| Nr. 2  | SMT   |   | 20            | Solder mask    |         |
|        | TOP   | 1   | 18-25         | Copper Plating |         |
|        |       |   | 18            | Copper Foil    |         |
|        | INT 1 | 2   | 2x1080        | 150            | Prepreg |
|        |       |   |               | 35             | Copper  |
|        |       |   |               | 130            | Core    |
|        | INT 2 | 3   |               | 35             | Copper  |
|        | INT 3 | 4   | 1x2116        | 105            | Prepreg |
|        |       |   |               | 35             | Copper  |
|        |       |   |               | 210            | Core    |
|        | INT 4 | 5   |               | 35             | Copper  |
|        | INT 5 | 6   | 1x2116        | 105            | Prepreg |
|        |       |   |               | 35             | Copper  |
|        |       |   |               | 210            | Core    |
| INT 6  | 7     |   | 35            | Copper         |         |
| INT 7  | 8     | 1x2116                                    | 105           | Prepreg        |         |
|        |       |   | 35            | Copper         |         |
|        |       |   | 130           | Core           |         |
| INT 8  | 9     |   | 35            | Copper         |         |
| BOTTOM | 10    | 2x1080                                    | 150           | Prepreg        |         |
|        |       |   | 18            | Copper Foil    |         |
| SMB    |       |   | 18-25         | Copper Plating |         |
|        |       |   | 20            | Solder mask    |         |

Approximate board thickness: 1,58 mm

|        |       | Required board thickness: 2,0 +/- 0,2 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 3  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 2x1080        | 150            | Prepreg |
|        |       |  |               | 35             | Copper  |
|        |       |  |               | 210            | Core    |
|        | INT 2 | 3  |               | 35             | Copper  |
|        | INT 3 | 4  | 1x7628        | 185            | Prepreg |
|        |       |  |               | 35             | Copper  |
|        |       |  |               | 210            | Core    |
|        | INT 4 | 5  |               | 35             | Copper  |
|        | INT 5 | 6  | 1x7628        | 185            | Prepreg |
|        |       |  |               | 35             | Copper  |
|        |       |  |               | 210            | Core    |
|        | INT 6 | 7  |               | 35             | Copper  |
|        | INT 7 | 8  | 1x7628        | 185            | Prepreg |
|        |       |  |               | 35             | Copper  |
|        |       |  |               | 210            | Core    |
|        | INT 8 | 9  |               | 35             | Copper  |
| BOTTOM | 10    | 2x1080                                   | 150           | Prepreg        |         |
|        |       |  | 18            | Copper Foil    |         |
| SMB    |       |  | 18-25         | Copper Plating |         |
|        |       |  | 20            | Solder mask    |         |

Approximate board thickness: 1,94 mm

|        |       | Required board thickness: 2,4 +/- 0,2 mm |        |                |                |
|--------|-------|--|--------|----------------|----------------|
|        | Layer |  |        | Thickness, um  | Material       |
| Nr. 4  | SMT   |  |        | 20             | Solder mask    |
|        | TOP   | 1  |        | 18-25          | Copper Plating |
|        |       |  |        | 18             | Copper Foil    |
|        | INT 1 | 2  | 1x1080 | 75             | Prepreg        |
|        |       |  | 1x7628 | 185            | Prepreg        |
|        |       |  |        | 35             | Copper         |
|        |       |  |        | 250            | Core           |
|        | INT 2 | 3  |        | 35             | Copper         |
|        | INT 3 | 4  | 1x7628 | 185            | Prepreg        |
|        |       |  |        | 35             | Copper         |
|        |       |  | 250    | Core           |                |
| INT 4  | 5     |  | 35     | Copper         |                |
| INT 5  | 6     | 1x7628                                   | 185    | Prepreg        |                |
|        |       |  | 35     | Copper         |                |
|        |       |  | 250    | Core           |                |
| INT 6  | 7     |  | 35     | Copper         |                |
| INT 7  | 8     | 1x7628                                   | 185    | Prepreg        |                |
|        |       |  | 35     | Copper         |                |
|        |       |  | 250    | Core           |                |
| INT 8  | 9     |  | 35     | Copper         |                |
| BOTTOM | 10    | 1x7628                                   | 185    | Prepreg        |                |
|        |       | 1x1080                                   | 75     | Prepreg        |                |
|        |       |  | 18     | Copper Foil    |                |
| SMB    |       |  | 18-25  | Copper Plating |                |
|        |       |  | 20     | Solder mask    |                |

Approximate board thickness: 2,32 mm

|        |       | Required board thickness: 3,0 +/- 0,2 mm |                |                |         |
|--------|-------|--|----------------|----------------|---------|
|        | Layer |  | Thickness, um  | Material       |         |
| Nr. 5  | SMT   |  | 20             | Solder mask    |         |
|        | TOP   | 1  | 18-25          | Copper Plating |         |
|        |       |  | 18             | Copper Foil    |         |
|        |       |  | 1x1080         | 75             | Prepreg |
|        |       |  | 1x7628         | 185            | Prepreg |
|        | INT 1 | 2  | 35             | Copper         |         |
|        |       |  | 360            | Core           |         |
|        | INT 2 | 3  | 35             | Copper         |         |
|        |       |  | 1x7628         | 185            | Prepreg |
|        | INT 3 | 4  | 35             | Copper         |         |
|        |       |  | 360            | Core           |         |
|        | INT 4 | 5  | 35             | Copper         |         |
|        |       |  | 2x7628         | 370            | Prepreg |
|        | INT 5 | 6  | 35             | Copper         |         |
|        |       |  | 360            | Core           |         |
|        | INT 6 | 7  | 35             | Copper         |         |
|        |       |  | 1x7628         | 185            | Prepreg |
|        | INT 7 | 8  | 35             | Copper         |         |
|        |       |  | 360            | Core           |         |
|        | INT 8 | 9  | 35             | Copper         |         |
|        |       | 1x7628                                   | 185            | Prepreg        |         |
|        |       | 1x1080                                   | 75             | Prepreg        |         |
| BOTTOM | 10    | 18                                       | Copper Foil    |                |         |
|        |       | 18-25                                    | Copper Plating |                |         |
| SMB    |       | 20                                       | Solder mask    |                |         |

Approximate board thickness: 2.93 mm

## 12-layer stackups

|        |       | Required board thickness: 1,6 +/- 0,15 mm |                |                |         |
|--------|-------|---|----------------|----------------|---------|
|        | Layer |   | Thickness, um  | Material       |         |
| Nr. 1  | SMT   |   | 20             | Solder mask    |         |
|        | TOP   | 1   | 18-25          | Copper Plating |         |
|        |       |   | 18             | Copper Foil    |         |
|        | INT 1 | 2   | 1x2116         | 105            | Prepreg |
|        |       |   | 35             | Copper         |         |
|        |       |   | 130            | Core           |         |
|        | INT 2 | 3   |                | 35             | Copper  |
|        |       |   | 1x2116         | 105            | Prepreg |
|        | INT 3 | 4   |                | 35             | Copper  |
|        |       |   | 130            | Core           |         |
|        | INT 4 | 5   |                | 35             | Copper  |
|        |       |   | 1x2116         | 105            | Prepreg |
| INT 5  | 6     |   | 35             | Copper         |         |
|        |       | 130                                       | Core           |                |         |
| INT 6  | 7     |   | 35             | Copper         |         |
|        |       | 1x2116                                    | 105            | Prepreg        |         |
| INT 7  | 8     |   | 35             | Copper         |         |
|        |       | 130                                       | Core           |                |         |
| INT 8  | 9     |   | 35             | Copper         |         |
|        |       | 1x2116                                    | 105            | Prepreg        |         |
| INT 9  | 10    |   | 35             | Copper         |         |
|        |       | 130                                       | Core           |                |         |
| INT 10 | 11    |   | 35             | Copper         |         |
|        |       | 1x2116                                    | 105            | Prepreg        |         |
| BOTTOM | 12    |   | 18             | Copper Foil    |         |
|        |       | 18-25                                     | Copper Plating |                |         |
| SMB    |       |   | 20             | Solder mask    |         |

Approximate board thickness: 1.65 mm

|        |       | Required board thickness: 2,0 +/- 0,2 mm |        |               |                |         |
|--------|-------|--|--------|---------------|----------------|---------|
|        | Layer |  |        | Thickness, um | Material       |         |
| Nr. 2  | SMT   |  |        | 20            | Solder mask    |         |
|        | TOP   | 1  |        | 18-25         | Copper Plating |         |
|        |       |  |        | 18            | Copper Foil    |         |
|        | INT 1 | 2  |        | 2x1080        | 150            | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 130            | Core    |
|        | INT 2 | 3  |        |               | 35             | Copper  |
|        | INT 3 | 4  |        | 1x2116        | 105            | Prepreg |
|        |       |  |        |               | 35             | Copper  |
|        |       |  |        |               | 210            | Core    |
|        | INT 4 | 5  |        |               | 35             | Copper  |
|        | INT 5 | 6  |        | 1x2116        | 105            | Prepreg |
|        |       |  |        | 35            | Copper         |         |
|        |       |  |        | 210           | Core           |         |
| INT 6  | 7     |  |        | 35            | Copper         |         |
| INT 7  | 8     |  | 1x2116 | 105           | Prepreg        |         |
|        |       |  |        | 35            | Copper         |         |
|        |       |  |        | 210           | Core           |         |
| INT 8  | 9     |  |        | 35            | Copper         |         |
| INT 9  | 10    |  | 1x2116 | 105           | Prepreg        |         |
|        |       |  |        | 35            | Copper         |         |
|        |       |  |        | 130           | Core           |         |
| INT 10 | 11    |  |        | 35            | Copper         |         |
| BOTTOM | 12    |  | 2x1080 | 150           | Prepreg        |         |
|        |       |  |        | 18            | Copper Foil    |         |
|        |       |  |        | 18-25         | Copper Plating |         |
| SMB    |       |  |        | 20            | Solder mask    |         |

Approximate board thickness: 1,94 mm

|        |       | Required board thickness: 2,4 +/- 0,2 mm |        |                |                |
|--------|-------|--|--------|----------------|----------------|
|        | Layer |  |        | Thickness, um  | Material       |
| Nr. 3  | SMT   |  |        | 20             | Solder mask    |
|        | TOP   | 1  |        | 18-25          | Copper Plating |
|        |       |  |        | 18             | Copper Foil    |
|        |       |  | 1x1080 | 75             | Prepreg        |
|        |       |  | 1x2116 | 105            | Prepreg        |
|        | INT 1 | 2  |        | 35             | Copper         |
|        |       |  |        | 210            | Core           |
|        | INT 2 | 3  |        | 35             | Copper         |
|        |       |  | 1x7628 | 185            | Prepreg        |
|        | INT 3 | 4  |        | 35             | Copper         |
|        |       |  |        | 210            | Core           |
|        | INT 4 | 5  |        | 35             | Copper         |
|        |       | 1x2116                                   | 105    | Prepreg        |                |
| INT 5  | 6     |  | 35     | Copper         |                |
|        |       |  | 210    | Core           |                |
| INT 6  | 7     |  | 35     | Copper         |                |
|        |       | 1x2116                                   | 105    | Prepreg        |                |
| INT 7  | 8     |  | 35     | Copper         |                |
|        |       |  | 210    | Core           |                |
| INT 8  | 9     |  | 35     | Copper         |                |
|        |       | 1x7628                                   | 185    | Prepreg        |                |
| INT 9  | 10    |  | 35     | Copper         |                |
|        |       |  | 210    | Core           |                |
| INT 10 | 11    |  | 35     | Copper         |                |
|        |       | 1x2116                                   | 105    | Prepreg        |                |
|        |       | 1x1080                                   | 75     | Prepreg        |                |
| BOTTOM | 12    |  | 18     | Copper Foil    |                |
|        |       |  | 18-25  | Copper Plating |                |
| SMB    |       |  | 20     | Solder mask    |                |

Approximate board thickness: 2,32 mm

|        |       | Required board thickness: 3,0 +/- 0,2 mm |               |                |                |  |
|--------|-------|--|---------------|----------------|----------------|--|
|        | Layer |  | Thickness, um | Material       |                |  |
| Nr. 4  | SMT   |  | 20            | Solder mask    |                |  |
|        | TOP   | 1  |               | 18-25          | Copper Plating |  |
|        |       |  |               | 18             | Copper         |  |
|        |       |  | 1x1080        | 75             | Prepreg        |  |
|        |       |  | 1x2116        | 105            | Prepreg        |  |
|        | INT 1 | 2  |               | 35             | Copper         |  |
|        |       |  |               | 360            | Core           |  |
|        | INT 2 | 3  |               | 35             | Copper         |  |
|        |       |  | 1x2116        | 105            | Prepreg        |  |
|        | INT 3 | 4  |               | 35             | Copper         |  |
|        |       |  |               | 360            | Core           |  |
|        | INT 4 | 5  |               | 35             | Copper         |  |
|        |       | 1x2116                                   | 105           | Prepreg        |                |  |
| INT 5  | 6     |  | 35            | Copper         |                |  |
|        |       |  | 360           | Core           |                |  |
| INT 6  | 7     |  | 35            | Copper         |                |  |
|        |       | 1x2116                                   | 105           | Prepreg        |                |  |
| INT 7  | 8     |  | 35            | Copper         |                |  |
|        |       |  | 360           | Core           |                |  |
| INT 8  | 9     |  | 35            | Copper         |                |  |
|        |       | 1x2116                                   | 105           | Prepreg        |                |  |
| INT 9  | 10    |  | 35            | Copper         |                |  |
|        |       |  | 360           | Core           |                |  |
| INT 10 | 11    |  | 35            | Copper         |                |  |
|        |       | 1x2116                                   | 105           | Prepreg        |                |  |
|        |       | 1x1080                                   | 75            | Prepreg        |                |  |
| BOTTOM | 12    |  | 18-25         | Copper Plating |                |  |
|        |       |  | 18            | Copper         |                |  |
| SMB    |       |  | 20            | Solder mask    |                |  |

Approximate board thickness: 2,94 mm

## 14-layer stackups

|        |       | Required board thickness: 2,0 +/- 0,2 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 1  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 1x2116        | 105            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  | 130           | Core           |         |
|        | INT 2 | 3  |               | 35             | Copper  |
|        |       |  | 1x2116        | 105            | Prepreg |
|        | INT 3 | 4  |               | 35             | Copper  |
|        |       |  | 130           | Core           |         |
|        | INT 4 | 5  |               | 35             | Copper  |
|        |       |  | 1x2116        | 105            | Prepreg |
|        | INT 5 | 6  |               | 35             | Copper  |
|        |       |  | 130           | Core           |         |
| INT 6  | 7     |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| INT 7  | 8     |  | 35            | Copper         |         |
|        |       | 130                                      | Core          |                |         |
| INT 8  | 9     |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| INT 9  | 10    |  | 35            | Copper         |         |
|        |       | 130                                      | Core          |                |         |
| INT10  | 11    |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| INT11  | 12    |  | 35            | Copper         |         |
|        |       | 130                                      | Core          |                |         |
| INT 12 | 13    |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| BOTTOM | 14    |  | 18            | Copper Foil    |         |
|        |       |  | 18-25         | Copper Plating |         |
| SMB    |       |  | 20            | Solder mask    |         |

Approximate board thickness: 1,95 mm

|        |       | Required board thickness: 2,5 +/- 0,2 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 2  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 2x1080        | 150            | Prepreg |
|        |       |  |               | 35             | Copper  |
|        |       |  |               | 210            | Core    |
|        | INT 2 | 3  |               | 35             | Copper  |
|        | INT 3 | 4  | 1x2116        | 105            | Prepreg |
|        |       |  |               | 35             | Copper  |
|        |       |  |               | 210            | Core    |
|        | INT 4 | 5  |               | 35             | Copper  |
|        | INT 5 | 6  | 1x2116        | 105            | Prepreg |
|        |       |  |               | 35             | Copper  |
|        |       |  |               | 210            | Core    |
| INT 6  | 7     |  | 35            | Copper         |         |
| INT 7  | 8     | 1x2116                                   | 105           | Prepreg        |         |
|        |       |  | 35            | Copper         |         |
|        |       |  | 210           | Core           |         |
| INT 8  | 9     |  | 35            | Copper         |         |
| INT 9  | 10    | 1x2116                                   | 105           | Prepreg        |         |
|        |       |  | 35            | Copper         |         |
|        |       |  | 210           | Core           |         |
| INT10  | 11    |  | 35            | Copper         |         |
| INT11  | 12    | 1x2116                                   | 105           | Prepreg        |         |
|        |       |  | 35            | Copper         |         |
|        |       |  | 210           | Core           |         |
| INT 12 | 13    |  | 35            | Copper         |         |
| BOTTOM | 14    | 2x1080                                   | 150           | Prepreg        |         |
|        |       |  | 18            | Copper Foil    |         |
| SMB    |       |  | 18-25         | Copper Plating |         |
|        |       |  | 20            | Solder mask    |         |

Approximate board thickness: 2,48 mm

|        |       | Required board thickness: 3,0 +/- 0,2 mm |               |                |                |  |
|--------|-------|--|---------------|----------------|----------------|--|
|        | Layer |  | Thickness, um | Material       |                |  |
| Nr. 3  | SMT   |  | 20            | Solder mask    |                |  |
|        | TOP   | 1  |               | 18-25          | Copper Plating |  |
|        |       |  |               | 18             | Copper Foil    |  |
|        | INT 1 | 2  | 1x1080        | 75             | Prepreg        |  |
|        |       |  | 1x7628        | 185            | Prepreg        |  |
|        |       |  |               | 35             | Copper         |  |
|        |       |  |               | 210            | Core           |  |
|        | INT 2 | 3  |               | 35             | Copper         |  |
|        | INT 3 | 4  | 1x7628        | 185            | Prepreg        |  |
|        |       |  |               | 35             | Copper         |  |
|        |       |  |               | 210            | Core           |  |
|        | INT 4 | 5  |               | 35             | Copper         |  |
|        | INT 5 | 6  | 1x7628        | 185            | Prepreg        |  |
|        |       |  |               | 35             | Copper         |  |
|        |       |  | 210           | Core           |                |  |
| INT 6  | 7     |  | 35            | Copper         |                |  |
| INT 7  | 8     | 1x7628                                   | 185           | Prepreg        |                |  |
|        |       |  | 35            | Copper         |                |  |
|        |       |  | 210           | Core           |                |  |
| INT 8  | 9     |  | 35            | Copper         |                |  |
| INT 9  | 10    | 1x7628                                   | 185           | Prepreg        |                |  |
|        |       |  | 35            | Copper         |                |  |
|        |       |  | 210           | Core           |                |  |
| INT10  | 11    |  | 35            | Copper         |                |  |
| INT11  | 12    | 1x7628                                   | 185           | Prepreg        |                |  |
|        |       |  | 35            | Copper         |                |  |
|        |       |  | 210           | Core           |                |  |
| INT 12 | 13    |  | 35            | Copper         |                |  |
| BOTTOM | 14    | 1x7628                                   | 185           | Prepreg        |                |  |
|        |       | 1x1080                                   | 75            | Prepreg        |                |  |
|        |       |  | 18            | Copper Foil    |                |  |
| SMB    |       |  | 18-25         | Copper Plating |                |  |
|        |       |  | 20            | Solder mask    |                |  |

Approximate board thickness: 3,0 mm

## 16-layer stackups

|        |       | Required board thickness: 2,2 +/- 0,2 mm |               |                |         |
|--------|-------|--|---------------|----------------|---------|
|        | Layer |  | Thickness, um | Material       |         |
| Nr. 1  | SMT   |  | 20            | Solder mask    |         |
|        | TOP   | 1  | 18-25         | Copper Plating |         |
|        |       |  | 18            | Copper Foil    |         |
|        | INT 1 | 2  | 1x2116        | 105            | Prepreg |
|        |       |  | 35            | Copper         |         |
|        |       |  | 130           | Core           |         |
|        | INT 2 | 3  |               | 35             | Copper  |
|        |       |  | 1x2116        | 105            | Prepreg |
|        | INT 3 | 4  |               | 35             | Copper  |
|        |       |  | 130           | Core           |         |
|        | INT 4 | 5  |               | 35             | Copper  |
|        |       |  | 1x2116        | 105            | Prepreg |
|        | INT 5 | 6  |               | 35             | Copper  |
|        |       |  | 130           | Core           |         |
|        | INT 6 | 7  |               | 35             | Copper  |
|        |       |  | 1x2116        | 105            | Prepreg |
| INT 7  | 8     |  | 35            | Copper         |         |
|        |       | 130                                      | Core          |                |         |
| INT 8  | 9     |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| INT 9  | 10    |  | 35            | Copper         |         |
|        |       | 130                                      | Core          |                |         |
| INT10  | 11    |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| INT11  | 12    |  | 35            | Copper         |         |
|        |       | 130                                      | Core          |                |         |
| INT13  | 13    |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| INT14  | 14    |  | 35            | Copper         |         |
|        |       | 130                                      | Core          |                |         |
| INT 15 | 15    |  | 35            | Copper         |         |
|        |       | 1x2116                                   | 105           | Prepreg        |         |
| BOTTOM | 16    |  | 18            | Copper Foil    |         |
| SMB    |       |  | 18-25         | Copper Plating |         |
|        |       |  | 20            | Solder mask    |         |

Approximate board thickness: 2,18 mm

|        |       | Required board thickness: 2,5 +/- 0,2 mm |               |                |                |
|--------|-------|--|---------------|----------------|----------------|
|        | Layer |  | Thickness, um | Material       |                |
| Nr. 2  | SMT   |  | 20            | Solder mask    |                |
|        | TOP   | 1  |               | 18-25          | Copper Plating |
|        |       |  |               | 18             | Copper Foil    |
|        | INT 1 | 2  | 1x1080        | 75             | Prepreg        |
|        |       |  | 1x7628        | 185            | Prepreg        |
|        |       |  |               | 35             | Copper         |
|        |       |  |               | 130            | Core           |
|        | INT 2 | 3  |               | 35             | Copper         |
|        | INT 3 | 4  | 1x2116        | 105            | Prepreg        |
|        |       |  |               | 35             | Copper         |
|        |       |  |               | 130            | Core           |
|        | INT 4 | 5  |               | 35             | Copper         |
|        | INT 5 | 6  | 1x2116        | 105            | Prepreg        |
|        |       |  |               | 35             | Copper         |
|        |       |  |               | 130            | Core           |
|        | INT 6 | 7  |               | 35             | Copper         |
| INT 7  | 8     | 1x2116                                   | 105           | Prepreg        |                |
|        |       |  | 35            | Copper         |                |
|        |       |  | 130           | Core           |                |
| INT 8  | 9     |  | 35            | Copper         |                |
| INT 9  | 10    | 1x2116                                   | 105           | Prepreg        |                |
|        |       |  | 35            | Copper         |                |
|        |       |  | 130           | Core           |                |
| INT10  | 11    |  | 35            | Copper         |                |
| INT11  | 12    | 1x2116                                   | 105           | Prepreg        |                |
|        |       |  | 35            | Copper         |                |
|        |       |  | 130           | Core           |                |
| INT13  | 13    |  | 35            | Copper         |                |
| INT14  | 14    | 1x2116                                   | 105           | Prepreg        |                |
|        |       |  | 35            | Copper         |                |
|        |       |  | 130           | Core           |                |
| INT 15 | 15    |  | 35            | Copper         |                |
| BOTTOM | 16    | 1x7628                                   | 185           | Prepreg        |                |
|        |       | 1x1080                                   | 75            | Prepreg        |                |
|        |       |  | 18            | Copper Foil    |                |
| SMB    |       |  | 18-25         | Copper Plating |                |
|        |       |  | 20            | Solder mask    |                |

Approximate board thickness: 2,48 mm

|        |       | Required board thickness: 3,0 +/- 0,2 mm |        |                |                |
|--------|-------|--|--------|----------------|----------------|
|        | Layer |  |        | Thickness, um  | Material       |
| Nr. 3  | SMT   |  |        | 20             | Solder mask    |
|        | TOP   | 1  |        | 18-25          | Copper Plating |
|        |       |  |        | 18             | Copper Foil    |
|        | INT 1 | 2  | 1x1080 | 75             | Prepreg        |
|        |       |  | 1x2116 | 105            | Prepreg        |
|        |       |  |        | 35             | Copper         |
|        |       |  |        | 210            | Core           |
|        | INT 2 | 3  |        | 35             | Copper         |
|        | INT 3 | 4  | 1x2116 | 105            | Prepreg        |
|        |       |  |        | 35             | Copper         |
|        |       |  |        | 210            | Core           |
|        | INT 4 | 5  |        | 35             | Copper         |
|        | INT 5 | 6  | 1x2116 | 105            | Prepreg        |
|        |       |  |        | 35             | Copper         |
|        |       |  |        | 210            | Core           |
|        | INT 6 | 7  |        | 35             | Copper         |
| INT 7  | 8     | 1x2116                                   | 105    | Prepreg        |                |
|        |       |  | 35     | Copper         |                |
|        |       |  | 210    | Core           |                |
| INT 8  | 9     |  | 35     | Copper         |                |
| INT 9  | 10    | 1x2116                                   | 105    | Prepreg        |                |
|        |       |  | 35     | Copper         |                |
|        |       |  | 210    | Core           |                |
| INT10  | 11    |  | 35     | Copper         |                |
| INT11  | 12    | 1x2116                                   | 105    | Prepreg        |                |
|        |       |  | 35     | Copper         |                |
|        |       |  | 210    | Core           |                |
| INT13  | 13    |  | 35     | Copper         |                |
| INT14  | 14    | 1x2116                                   | 105    | Prepreg        |                |
|        |       |  | 35     | Copper         |                |
|        |       |  | 210    | Core           |                |
| INT 15 | 15    |  | 35     | Copper         |                |
| BOTTOM | 16    | 1x2116                                   | 105    | Prepreg        |                |
|        |       | 1x1080                                   | 75     | Prepreg        |                |
|        |       |  | 18     | Copper Foil    |                |
|        |       |  | 18-25  | Copper Plating |                |
| SMB    |       |  | 20     | Solder mask    |                |

Approximate board thickness: 2,95 mm

#### 4. Via holes plugging

On a printed circuit board, the metallized holes, intended for assembling of through-hole components, always remain open from under the solder mask. But if we are talking about the vias, it is important to determine the method of their manufacture - whether they will be opened from under the mask or will be covered with a solder mask (tenting) or they will be filled with the appropriate material (plugged).

Usually there are several possible approaches: leaving the vias open under the mask, tenting vias, filling the vias with mask or non-conductive resin (mask plugged via), filling the vias with conductive paste or copper (plated via). All methods have advantages and disadvantages.

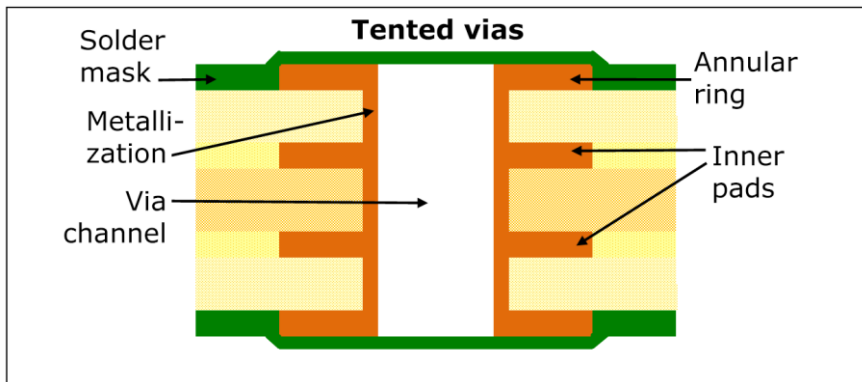
The most expensive option is to fill the vias with conductive materials or copper. The main disadvantage of this method is that such vias have an expansion coefficient different from laminate, which creates a risk of defects. Therefore, this technology is used only if strict requirements are imposed on the thermal conductivity of the vias interconnections.

Below there is a description of the technologies used.

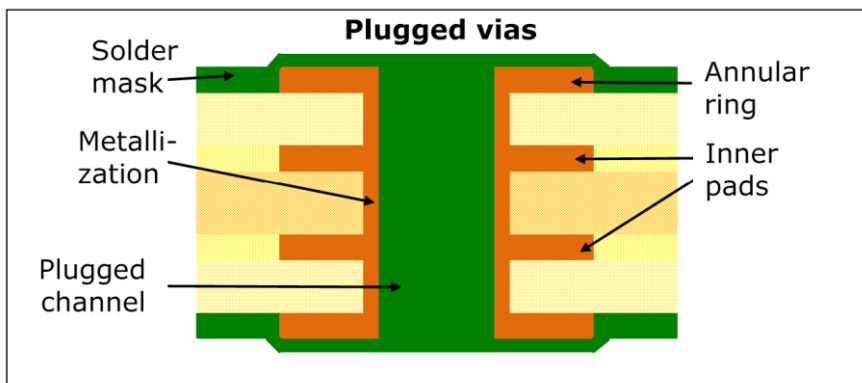
**Tenting vias.** This is the cheapest and simplest technology. According to this method, the via hole and the copper ring (annular ring) are covered by solder mask. When using this method, the hole channel is not filled. Vias with a diameter of 0,3 mm and less will certainly be covered, while vias with a diameter of 0,4 - 0,6 mm may also be covered, but with less probability. All holes above these diameters are most likely to have leaks and will only be partially concealed.

The main purpose of covering the vias with a solder mask is to prevent short circuits between the vias pads and other conductive elements.

Please note that vias must be covered with a solder mask on both sides of the PCB, otherwise there is a risk of contamination of the hole channel with chemical residues.

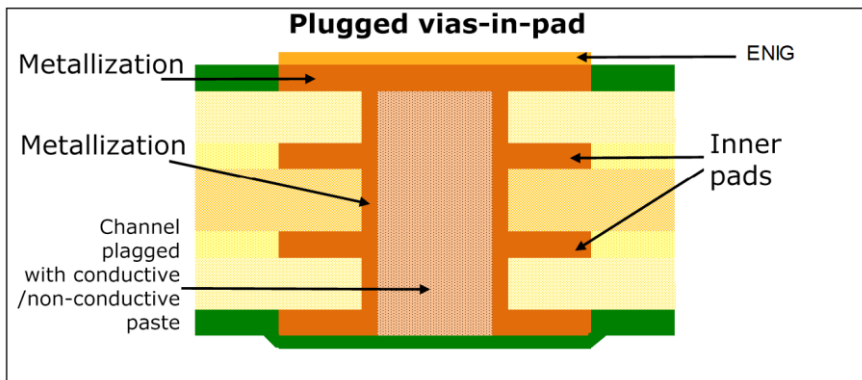


**Vias filled with solder mask or non-conductive resin (mask plugged via).** When using this technology, the vias are completely covered, and the holes are also plugged. This technology is very often used in BGA projects, where there is a risk of a short circuit during soldering between closely spaced vias and the BGA pads.

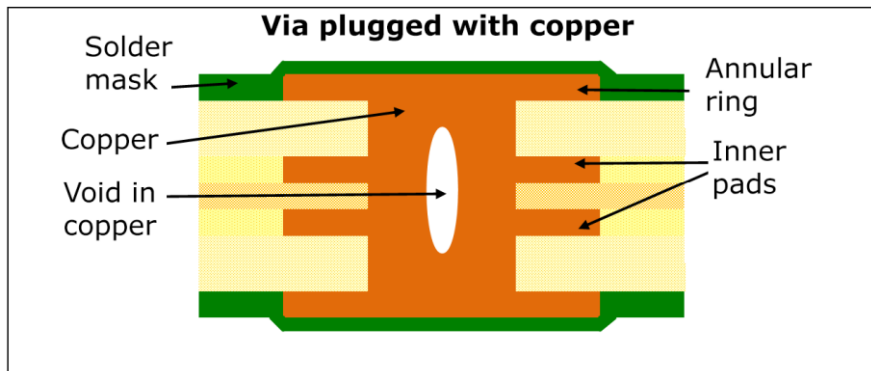


**Vias-In-Pad (Active Pads).** This technology is used in BGA designs with a small raster. The via holes are drilled directly in the solder pads of SMT components, which saves the PCB area and facilitates signal routing. The via holes are filled with conductive or non-conductive materials. After filling the holes, the surface of the vias is covered with copper, resulting in a good contact plane and facilitating the soldering of the most complex components.

The choice of conductive or non-conductive materials is based, on the one hand, on the requirements for heat dissipation and, on the other hand, on the maximum safety of interlayer connections, since non-conductive materials have a coefficient of thermal expansion more suitable for laminate than conductive materials. The difference in thermal coefficients leads to the risk of delamination in the case of excessively hot electronic components. The technology itself is not complicated.



**Vias Plugged with Copper.** The technology is based on via through holes plugged with copper, which improves their thermal and electrical conductivity. But the big disadvantage of this technology is the difficult-to-reach uniformity of the coating of through channels, which creates the risk of air voids that will outgas during soldering, compromising the uniformity of the soldering connections. In addition, the technology is more difficult to implement and, therefore, more expensive.



When ordering or requesting price quotes, we recommend to specify which technology is required, as they differ in price.

## 5. Copper thickness in multilayer PCB

Materials with a basic copper thickness of 18 or 35 microns are used for the inner layers of printed circuit boards. The thickness of copper does not change during the manufacture of the printed circuit board, since it is hidden internally during metallization of the stack of layers.

For the outer layers, materials with a copper thickness of 9...35 microns can be used. However, it must be borne in mind that during metallization, copper is applied to the holes, as well as to the entire surface of the panel, which increases the thickness of the outer layers by another 10 ... 25 microns. As a result, the final thickness of copper on the outer layers can reach 18...70 microns.

The choice of the outer copper foil thickness depends on the requirements for the width of the conductors and the spacings between the conductive elements on the printed circuit board.

Below there are the conductor/spacing restrictions on the PCB for different thicknesses of copper:

#### Outer layers

|                           |       |        |        |        |        |
|---------------------------|-------|--------|--------|--------|--------|
| Finished copper thickness | 35um  | 70um   | 105um  | 140um  | 210um  |
| Minimum trace width       | 0,1mm | 0,20mm | 0,23mm | 0,30mm | 0,60mm |
| Minimum clearance         | 0,1mm | 0,20mm | 0,24mm | 0,35mm | 0,70mm |

#### Inner layers

|                           |       |        |        |        |        |
|---------------------------|-------|--------|--------|--------|--------|
| Finished copper thickness | 35um  | 70um   | 105um  | 140um  | 210um  |
| Minimum trace width       | 0,1mm | 0,20mm | 0,27mm | 0,34mm | 0,60mm |
| Minimum clearance         | 0,1mm | 0,20mm | 0,30mm | 0,45mm | 0,85mm |

## 6. PCB fabrication capabilities

### Multilayer and HDI PCB

| Parameter   | Typical              | Advanced                |
|---|----------------------|-------------------------|
| Number of layers                                      | 4-16                 | 4-28                    |
| Minimum trace width, mm                               | 0,1                  | 0,075                   |
| Minimum spacing, mm                                   | 0,1 / 0,075          | 0,075 / 0,075           |
| Trace to board edge distance (outer/inner layers), mm | 0,5 / 0,5<br>(V-cut) | 0,25 / 0,4<br>(routing) |
| Minimum laser hole size, mm                           | 0,1                  | 0,075                   |
| Minimum drill hole size, mm                           | 0,2                  | 0,15                    |
| Minimum annular ring (outer/inner layers), mm         | 0,15 / 0,1           | 0,127 / 0,1             |
| Aspect ratio  | 1:8                  | 1:12                    |
| Via-in-Pad technology                                 | yes                  | yes                     |
| Buried (hidden) holes                                 | yes                  | yes                     |
| Blind holes   | yes                  | yes                     |

|   |      |      |
|---|------|------|
| Stacked and staggered microvias                 | yes  | yes  |
| Solder mask opening/ expansion, mm              | 0,05 | 0,05 |
| Solder bridge, mm                               | 0,1  | 0,1  |
| Minimum width of marking line (silkscreen), mm  | 0,15 | 0,15 |
| Minimum height of marking text (silkscreen), mm | 1    | 0,8  |

#### Flexible PCB

| Parameter   | Typical                | Advanced |
|---|------------------------|----------|
| Number of layers                                      | 1-2                    | 4        |
| Material  | Polyimide, PET         |          |
| Minimum trace width, mm                               | 0,15                   | 0,1      |
| Minimum spacing, mm                                   | 0,15                   | 0,1      |
| Trace to board edge distance, mm                      | 0,5                    | 0,25     |
| Minimum drill hole size, mm                           | 0,3                    | 0,2      |
| Coverlay opening/expansion, mm                        | 0,15                   | 0,15     |
| Possibility of manufacturing a stiffener for flex PCB | Yes (Polyimide or FR4) |          |

#### Rigid-flex PCB

| Parameter   | Typical           | Advanced             |
|---|-------------------|----------------------|
| Number of layers                                      | 4-16              | 4-28                 |
| Minimum trace width, mm                               | 0,1               | 0,075                |
| Minimum spacing, mm                                   | 0,1               | 0,075                |
| Trace to board edge distance (outer/inner layers), mm | 0,5 / 0,5 (V-cut) | 0,25 / 0,4 (routing) |
| Minimum drill hole size, mm                           | 0,25              | 0,2                  |
| Minimum annular ring (outer/inner layers), mm         | 0,15 / 1          | 0,127 / 0,1          |
| Via-in-Pad technology                                 | yes               | yes                  |
| Buried (hidden) holes (rigid part)                    | yes               | yes                  |
| Blind holes (rigid part)                              | yes               | yes                  |

|   |                                     |             |
|---|-------------------------------------|-------------|
| Solder mask (coverlay) opening/ expansion, mm         | 0,05 / 0,15                         | 0,05 / 0,15 |
| Solder bridge, mm                                     | 0,1 / 0,2                           | 0,1 / 0,2   |
| Minimum width of marking line (silkscreen), mm        | 0,15                                | 0,15        |
| Minimum height of marking text (silkscreen), mm       | 1                                   | 0,8         |
| Possibility of manufacturing a stiffener for flex PCB | Yes (Polyimide or FR4) <sup>2</sup> |             |

#### Aluminum core PCB

| Parameter  | Typical          | Advanced |
|--|------------------|----------|
| Number of layers   | 1-2              | 1-4      |
| Board Thickness, mm                                      | 0,5 – 3,2        |          |
| Copper thickness, $\mu\text{m}$                          | 35               |          |
| Dielectric thickness, $\mu\text{m}$                      | 50, 75, 100, 150 |          |
| Thermal conductivity, $\text{W}/(\text{m}\cdot\text{K})$ | 1-4              |          |
| Dielectric strength, kV                                  | 2-6              |          |
| Maximum size, mm   | 550,0 x 950,0    |          |
| Minimum trace width, mm                                  | 0,2              | 0,15     |
| Minimum spacing, mm                                      | 0,2              | 0,15     |
| Trace to board edge distance, mm                         | 0,5              | 0,25     |
| Minimum drill hole size, mm                              | 0,9              | 0,6      |
| Solder bridge, mm  | 0,1              | 0,05     |

#### Notes:

Standard copper via wall thickness is up to  $20\mu\text{m}$ .

Gold thickness for IG coating —  $0,05\text{-}0,11\mu\text{m}$ , for Hard Gold (Gold Fingers) —  $0,07\text{-}1,27\mu\text{m}$