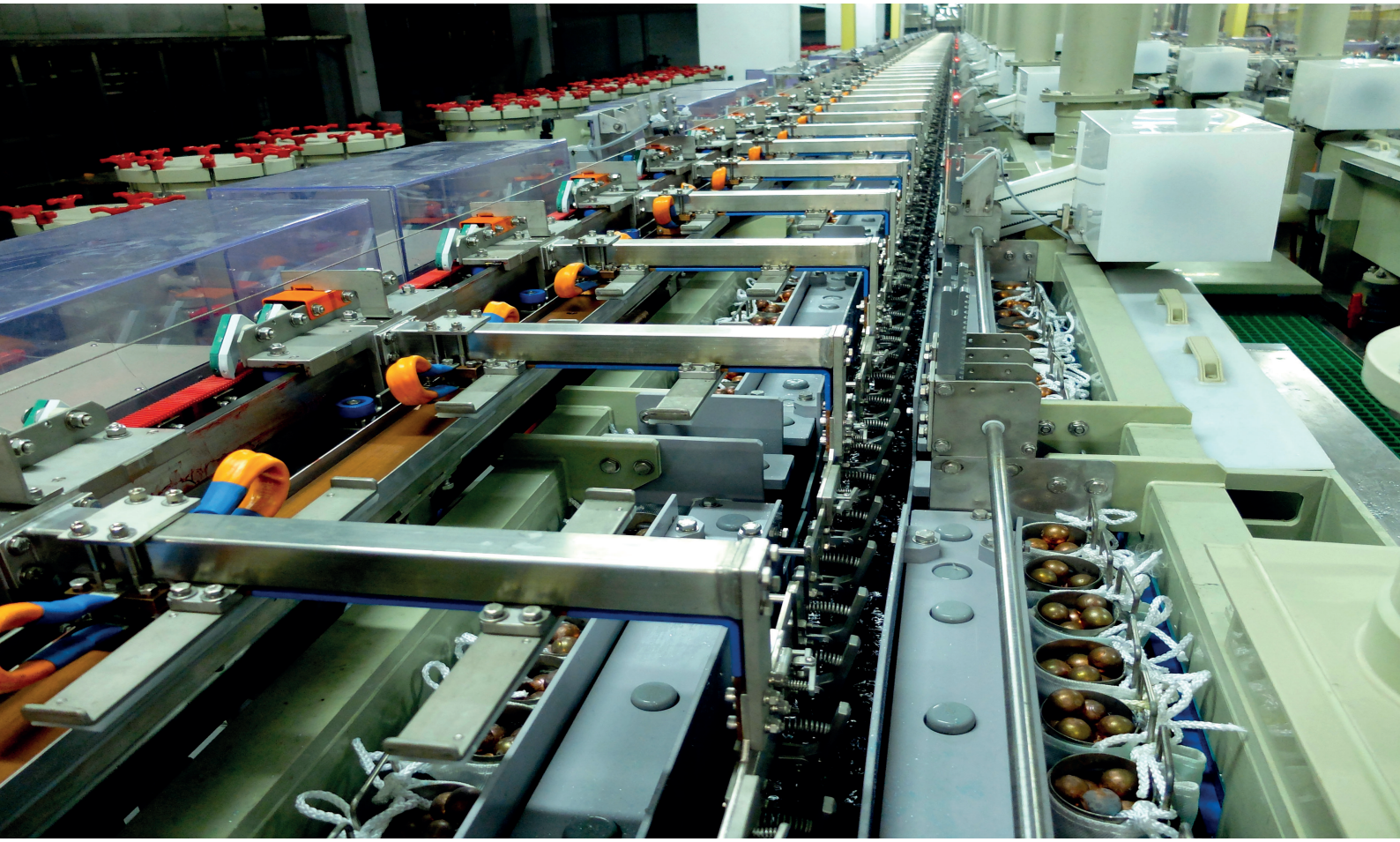
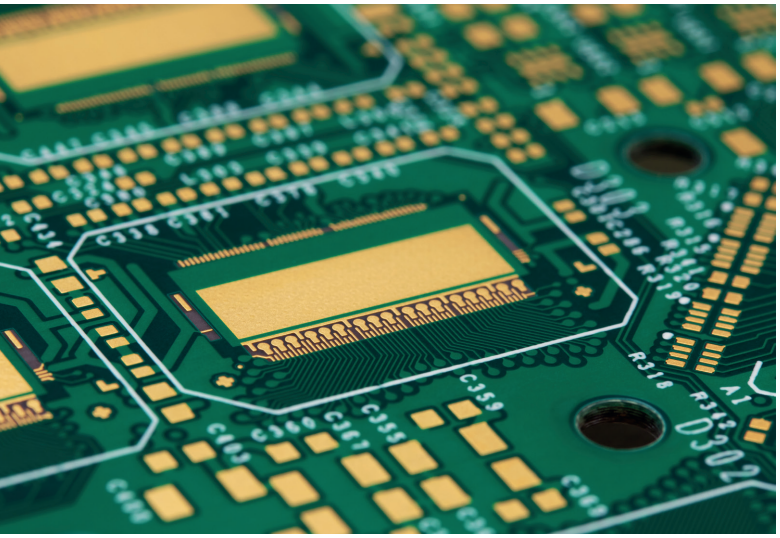
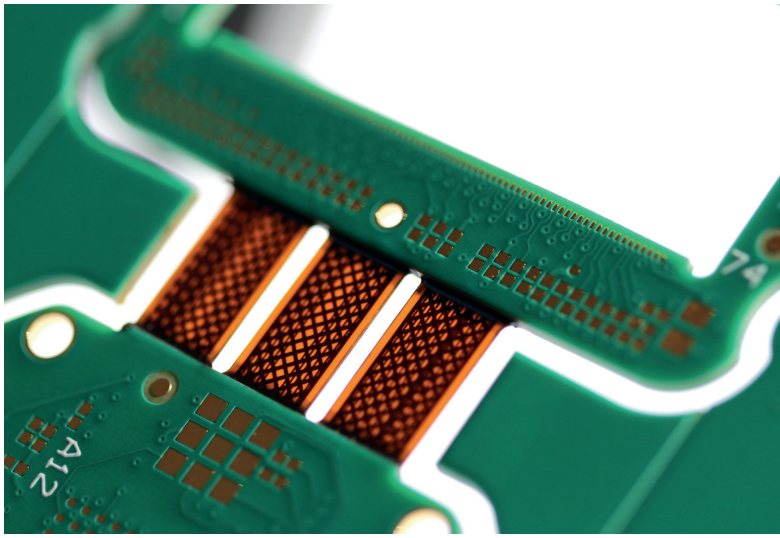
eurotronics

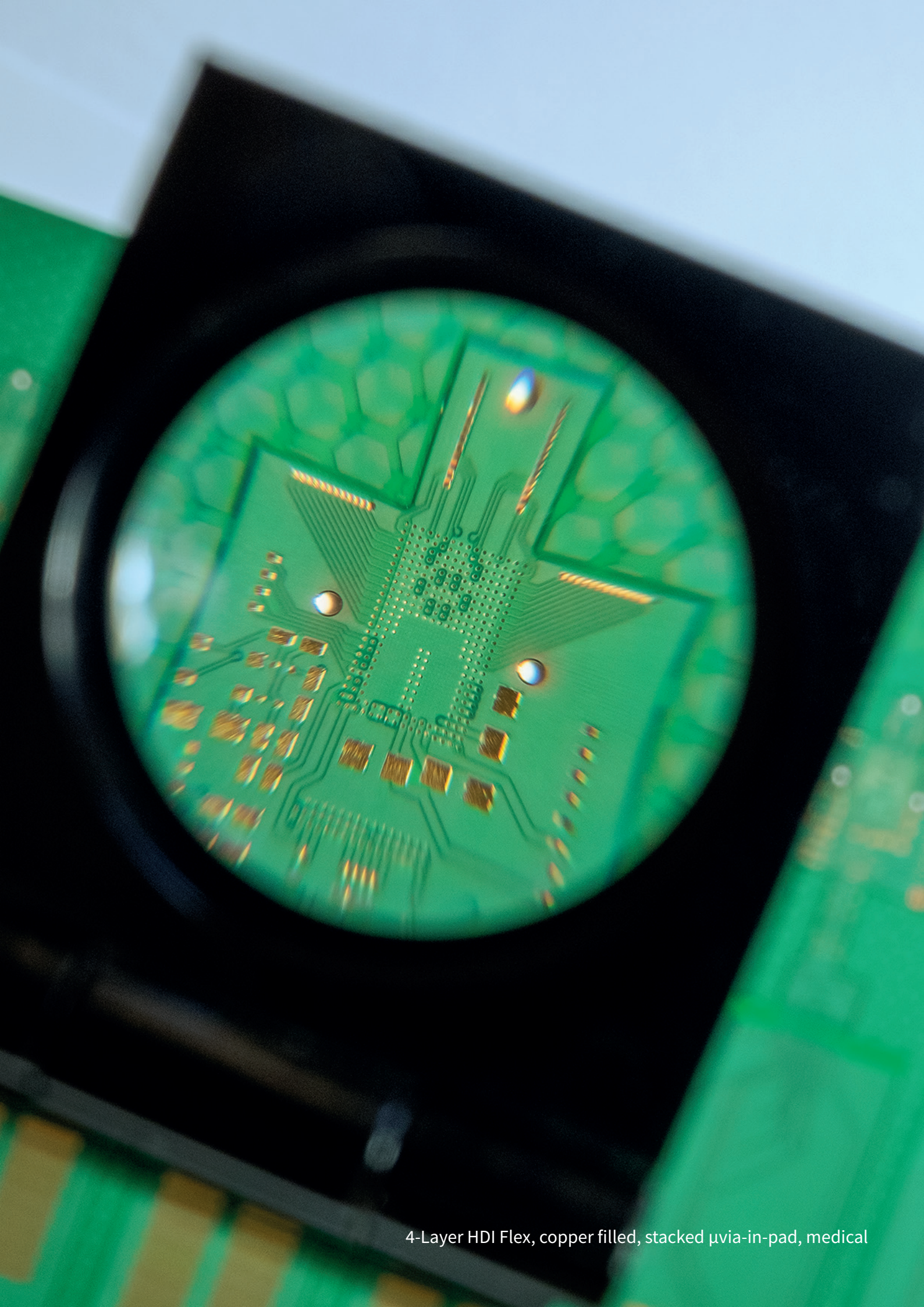
# Design Manual

**PCB** rigid, flex & rigid-flex









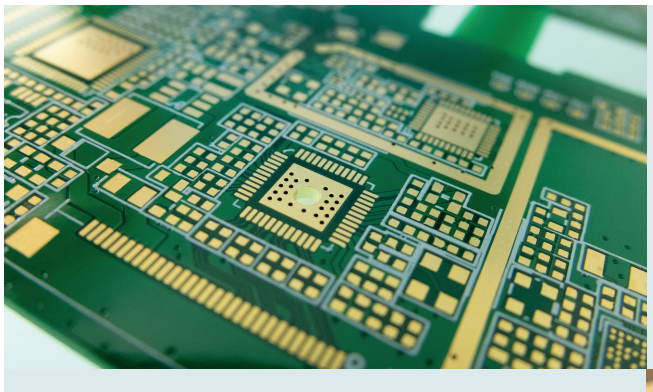
4-Layer HDI Flex, copper filled, stacked µvia-in-pad, medical

# Design rules

## PCB rigid, flex & rigid-flex

Eurotronics delivers highly advanced printed circuit board technologies to the unique requirements of each customer. Besides standard (HDI) printed circuit board technologies, Eurotronics adapts to the ongoing market trend towards miniaturization: ever thinner and ever more highly integrated printed circuit boards. We offer advanced capabilities ranging from ultra-fine line production with copper filled stacked micro via's to the processing of ultra-thin base materials and the manufacture of complex rigid-flex substrates incorporating bookbinder and window technology.

Our partner production facility is perfectly equipped to build highly integrated (HDI) multi-layer rigid and complex flexible circuit boards, suitable for microelectronics, COB, COF, flip chip and wire bond applications.
In order to achieve optimal quality results, we advise to the follow the applicable design rules and the designated IPC standards. This technical information only represents our basic capabilities. Together with our engineers we will evaluate our customer's layout designs to work out the best possible solution.

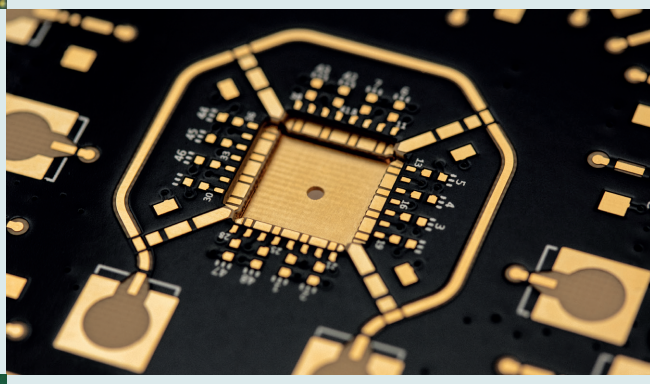


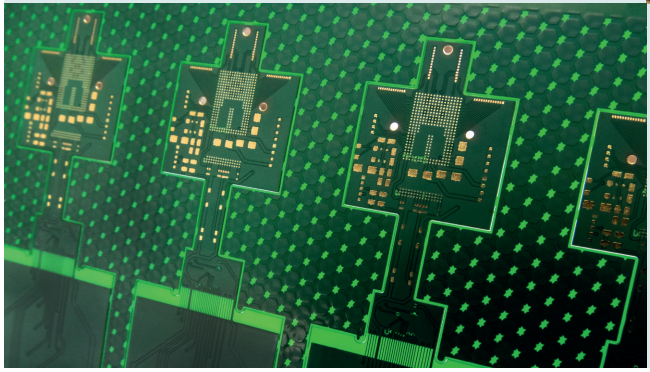
### Standard

To be able to achieve the highest level of production yields and product reliability, the design values mentioned in the standard category should be followed whenever possible for layout designs.

### Advanced

To achieve design values in this category, special materials, processes and equipments might be needed. If the design values of this category are intended to be used, Eurotronics strongly recommends consulting its engineering team during the early design phase (Design for Manufacturing).



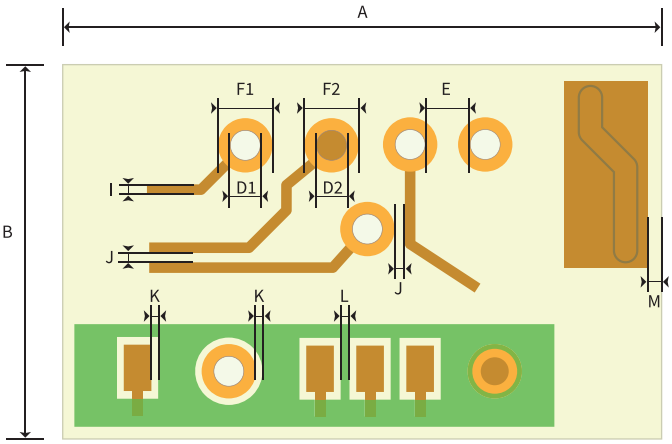


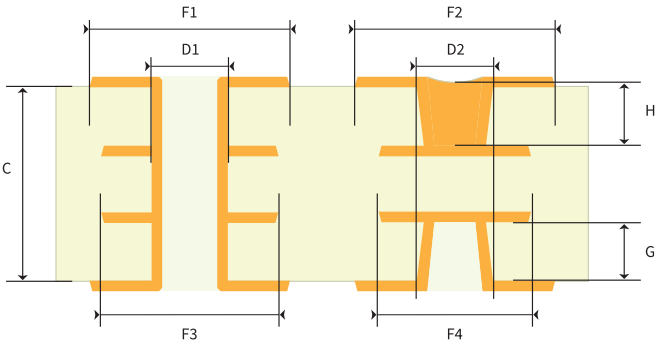
### Leading Edge

Eurotronics' engineering teams are looking forward to support your most challenging projects. Design values that go beyond the ones mentioned in the categories "standard" and "advanced" are considered to have leading edge status. PCB's designed using values of this category will require high level attention of our engineering teams.

# Design rules

## PCB rigid, flex & rigid-flex



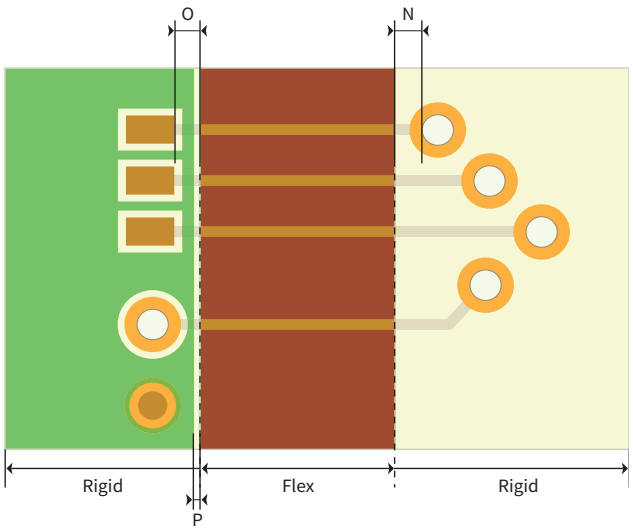



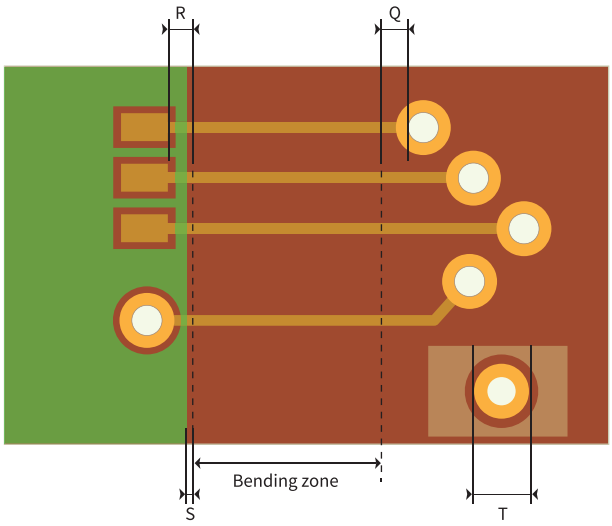

| Ref. | Design parameter | Unit | Standard | Advanced | Leading Edge |
|---|---|---|---|---|---|
| A,B | Maximum board size | mm | 630 x 620 (rigid), 570 x 417 (rigid-flex) 265 x 417 (flex) | | |
| | Maximum board thickness | mm | 5 | | |
| C | Minimum board thickness (substrate thickness without Cu) | µm | 25 | 12.5 | 12.5 |
| | Maximum layer count rigid PCB | - | 30, HDI: 6+N+6 | ELIC | |
| | Maximum layer count rigid-flex PCB | - | 10 + 4 flex | 14 + 6 flex | 20 + 8 flex |
| | Maximum layer count flex PCB | - | 6 | 8 | > 8 |
| D1 | Minimum through hole diameter (mechanically drilled) | µm | 150 ~ 250 | 100 | 75 |
| D2 | Minimum hole diameter (laser drilled, blind & through holes) | µm | 75 ~100 | 50 | 40 |
| E | Minimum distance hole - hole (mechanically drilled) | µm | 350 | 275 | 200 |
| (F1-D1)/2 | Minimum annular ring outer layer (mechanically drilled) | µm | 100 | 75 | 50 |
| (F2-D2)/2 | Minimum annular ring outer layer (laser drilled) | µm | 70 | 50 | 25 |
| (F3-D1)/2 | Minimum annular ring inner layer (mechanically drilled) | µm | 100 | 75 | 50 |
| (F4-D2)/2 | Minimum annular ring inner layer (laser drilled) | µm | 70 | 50 | 25 |
| C, D1 | Maximum aspect ratio through holes | D1:C | 1:10 | 1:12 | 1:16 |
| G, D2 | Maximum aspect ratio blind via's (base copper included) | D2:G | 1:0.8 | 1:0.9 | 1:1 |
| H | Copper filling ratio blind via's | % | 80 | 90 | >90 |
| I | Minimum line width (depending on copper thickness) | µm | 75 | 50 | <50 |
| J | Minimum spacing (depending on copper thickness) | µm | 75 | 50 | <50 |
| K | Minimum solder mask clearance to conductive pattern | µm | 95 | 75 | 60 |
| L | Minimum solder mask dam width | µm | 80 | 50 | 25 |
| M | Minimum distance conductive material to board outline (mechanical/laser) | µm | 150 / 100 | 100 / 60 | 75 / 30 |
| | Layer to layer registration | µm | +/- 50 | +/- 40 | +/- 30 |
| | Hole to hole registration (laser drilled) | µm | +/- 25 | +/- 20 | +/- 20 |
| | Hole to hole registration (mechanically drilled) | µm | +/- 50 | +/- 30 | +/- 25 |
| | Controlled impedance tolerance | % | +/- 10 | +/- 8 | +/- 5 |
| | Automatic optical inspection (AOI) | % | 100 | 100 | 100 |

Recommended data file formats: Extended GERBER (RS-274X), ODB++, DXF, DWG.

# Design rules

## PCB rigid, flex & rigid-flex




| Ref. | Design parameter | Unit | Standard | Advanced | Leading edge |
|---|---|---|---|---|---|
| N | Distance holes to transition zone rigid-flex by routing / laser | mm | 1.0 / <1.0 | 0.4 / 0.3 | 0.2 / 0.1 |
| O | Distance Cu to transition zone rigid-flex by routing / laser | µm | 500 / 300 | 300 / 200 | 100 / 75 |
| P | Distance solder mask to transition zone rigid-flex | µm | 200 | 150 | 100 |
| Q | Distance via's to bending zone flex | µm | 400 | 300 | 100 |
| R | Distance conductive pads to bending zone flex | µm | 300 | 200 | 150 |
| S | Distance solder mask to bending zone flex | µm | 100 | 70 | 50 |
| T | Coverlay opening: pad size + | µm | + 250 | + 200 | + 150 |

### Adhesive & coverlay

For circuit boards with very small clearances, coverlay is only suitable to a limited extent. There is arisk that small webs are damaged during manufacturing. Several factors such as thickness, quantity and size of clearances play an important role. Therefor defining a minimum web widthis very difficult.

# Design rules

## PCB Cavity

| Design parameter | Standard | Advanced | Leading Edge |
|---|---|---|---|
| Depth routing tolerance | +/- 100 µm | +/- 50 µm | +/- 35µm |
| Contact depth milling tolerance | +/- 50 µm | +/-25 µm | +/-25 µm |
| Smallest milling cutter | 800 µm | 500 µm | 500 µm |

Multi-cavity layouts are possible, depending on the boards thickness and layer count.

# Design rules

## PCB base materials

| Material type | Designation | Tg °C | Vendor | Remarks |
|---|---|---|---|---|
| Standard FR4 | S1000-H | 150 | Shengyi | Low CTE, CAF resistant, IPC-4101 Type Designation: /21, /98, /99,/101, /121, /124 |
| | TU-662 | 150 | TUC | |
| | NP-155FTL | 150 | NanYa | |
| High Tg FR4 | S1000-2M | 180 | Shengyi | Low CTE, CAF resistant, IPC-4101 Type Designation: /98, /99, /101, /121, /124, /126, /129 |
| | IT-180A | 175 | ITEQ | |
| | TU-768 | 180 | TUC | |
| | NP-175F | 175 | NanYa | |
| | 370HR | 180 | Isola | |
| | EM-827 | 175 | EMC | |
| High frequency | 4000 Series | 280 | Rogers | Ceramic filled high speed, low loss substrate |
| | I-Tera MT40 | 200 | Isola | High speed, low loss substrate |
| Thermal management | TC350 (Plus) | | Rogers | Thermal Conductivity (1.0 W/mK) and Dielectric Constant Stability across Wide Temperatures (-9 ppm/°C) |
| | 92ML | 160 | Rogers | |
| Ultra Low CTE | HL832NSF | 250-270 | Mitsubishi | CTEz: 17-22 ppm/°C |
| Polyimide film | ThinFlex-A, -G, -H, -K,... | - | ThinFlex | Adhesive-less FCCL, IPC-4104 Type Designation : /11 |
| | Pyralux AP/AC Series | - | Dupont | |
| | 2FP, 2LP Series | - | Taiflex | |
| | SF202 | - | Shengyi | |
| | NanPao F Series | - | Nan Pao | Acrylic adhesive type FCCL |
| Coverlay | ThinFlex-I, -M, -Q | - | ThinFlex | |
| | LF, FR | - | Dupont | |
| | FH, FHL | - | Taiflex | |
| | SF305C | - | Shengyi | |
| | NanPao L Series | - | Nan Pao | |
| Bonding adhesive | ThinFlex-KC | - | ThinFlex | |
| | LF, FR | - | Dupont | |
| | BT25 | - | Taiflex | |
| | NanPao D Series | - | Nan Pao | |

Above listed are commonly used base materials. Basically any type of material is available upon request.

Hybrid stack-up's and implant compatible materials are also available upon request.

We explicitly remark that printed circuit board production and assembly processes can change the physical and chemical properties of the base materials under influence of chemicals, high pressure and high temperatures. Therefore we are here to advise our customers in the best possible manner to ensure that the base materials used comply with the intended usage of the application.

### Copper Claddings and Foils

Electro Deposited (ED): 5, 9, 12, 18 and 35µm

Rolled Annealed (RA): 18 and 35µm

Other thicknesses are available upon request

# Design rules
## PCB surface finishes

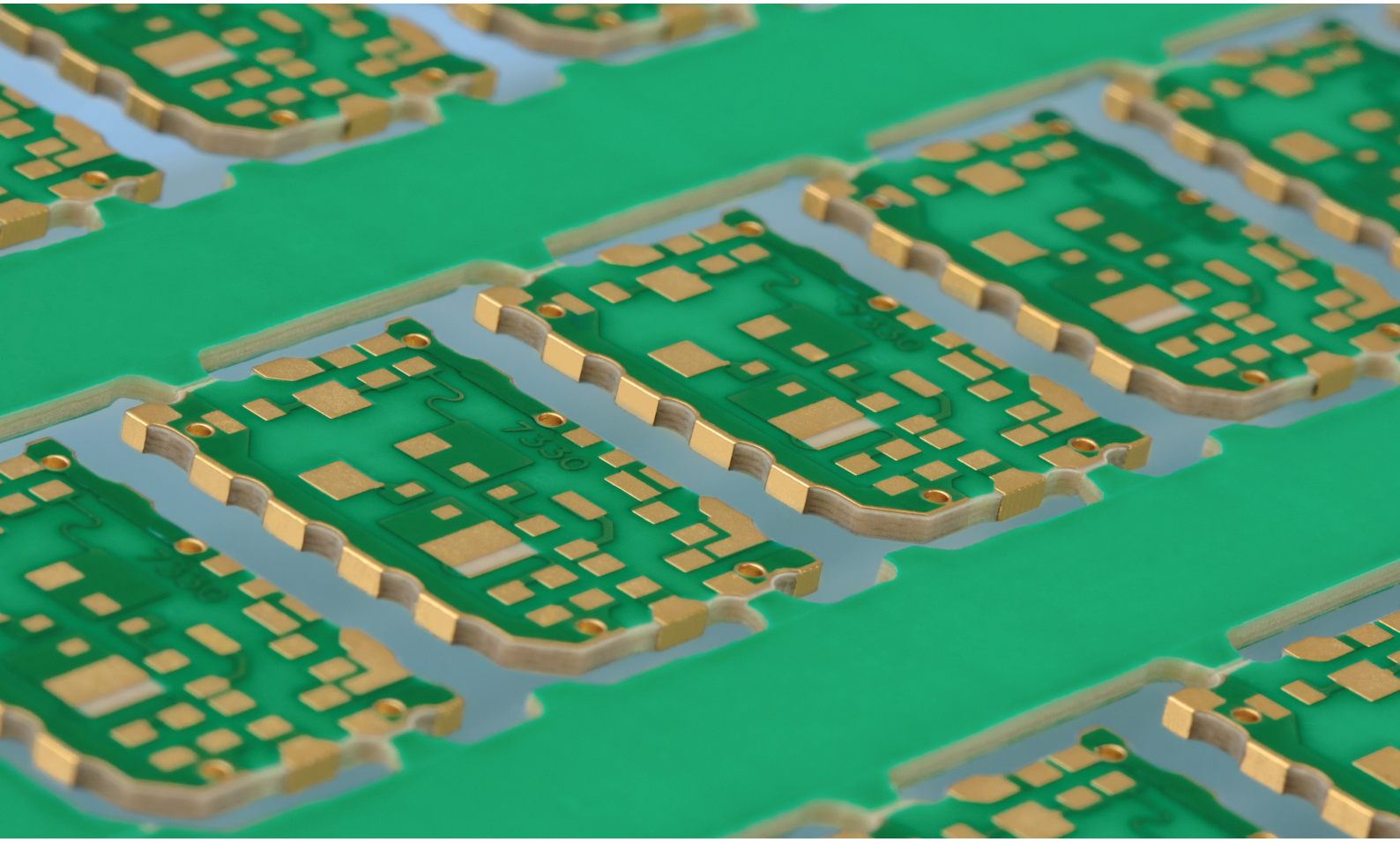
| Surface finish type | Thickness (µm) | Recommended shelf life | Soldering | Al-wire bonding | Au-wire bonding | Contacts/ connectors |
|---|---|---|---|---|---|---|
| ENIG (NiAu) | Ni: 3 ~ 6<br>Au: 0.05 minimum | 1 year | ++ | ++ | - | + |
| ENEPIG (NiPdAu) | Ni: 3 ~ 6<br>Pd: 0.05 ~ 0.15<br>Au: 0.05 minimum | 1 year<br>(for Au-wire bonding we recommend a shelf life of 6 months) | ++ | ++ | ++ | + |
| Electroplated Ni / soft Au | According to customer requirement | 6 months | ++ | ++ | - | + |
| Electroplated Ni / hard Au | According to customer requirement | 1 year | ++ | ++ | ++ | ++ |
| Immersion Tin (Sn) | 1.2 maximum | 6 months | ++ | - | - | - |
| Immersion Silver (Ag) | 0.15 ~ 0.45 | 6 months | ++ | - | - | - |
| HASL lead free | 0.2 - 0.3 - 0.5 | 1 year | ++ | - | - | - |
| OSP (ENTEK HT plus) | 1 ~ 30 | 1 year | ++ | - | - | - |

# Design rules
## PCB quality assurance

Eurotronics attaches great value to quality just to ensure that only PCB's that meet your quality requirements are delivered. That's why Eurotronics has build up a long term strategic partnership with one of the finest printed circuit board production facilities in Taiwan, China, Germany and Switzerland to make sure high quality printed circuit board technologies are guaranteed with respect for human rights and the strictest environmental demands.

The quality management system is guaranteed by a fully integrated ERP system and well maintained calibration processes. Every single PCB is inspected according to latest applicable IPC A-600 class 2 and pursuant to customer specifications.
At explicit request we can even guarantee IPC Class 3 or produce according to AS9100.

| Quality overview |
|---|
| Design for Manufacturing (DfM) |
| Verified, validated and reproducible production processes managed by a fully integrated ERP system. |
| ISO 9001 certified quality management systems. |
| ISO 14001 certified environmental quality systems. |
| ISO 45001 occupational health & safety systems. |
| UL, RoHs, REACH & EICC-GeSi certified quality management systems. |
| Inspection & electrical testing according to IPC-A600 class 2, class 3 or specific customer specifications. |
| Interconnect stress test (IPC specified thermal cycle test). |

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