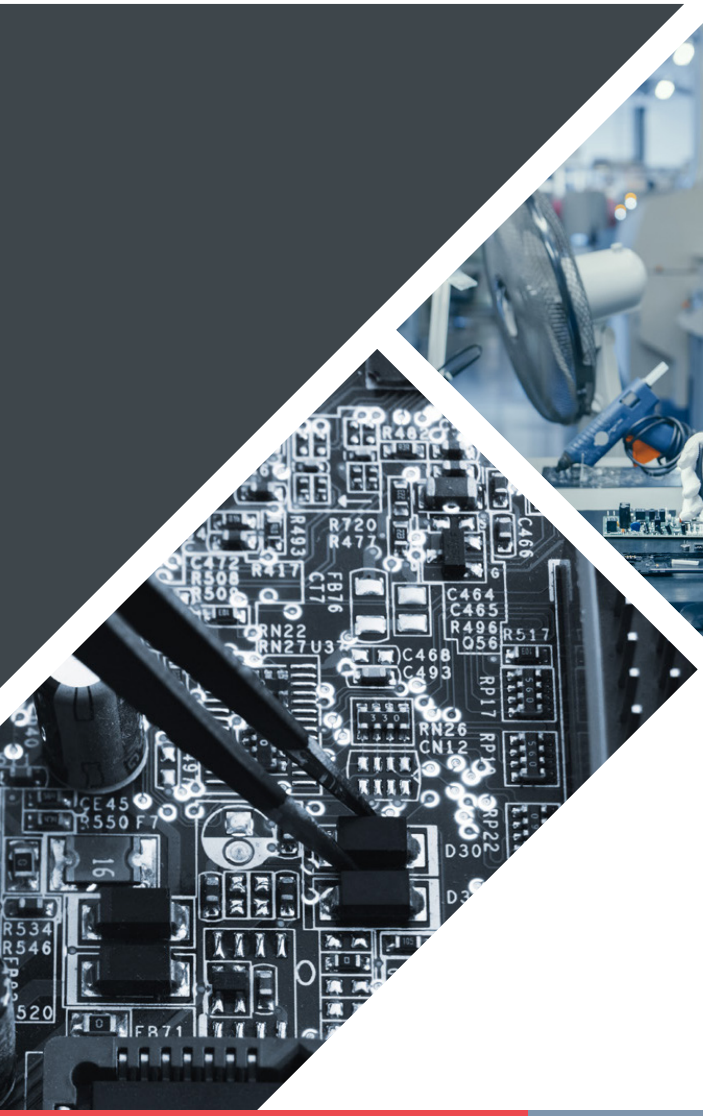
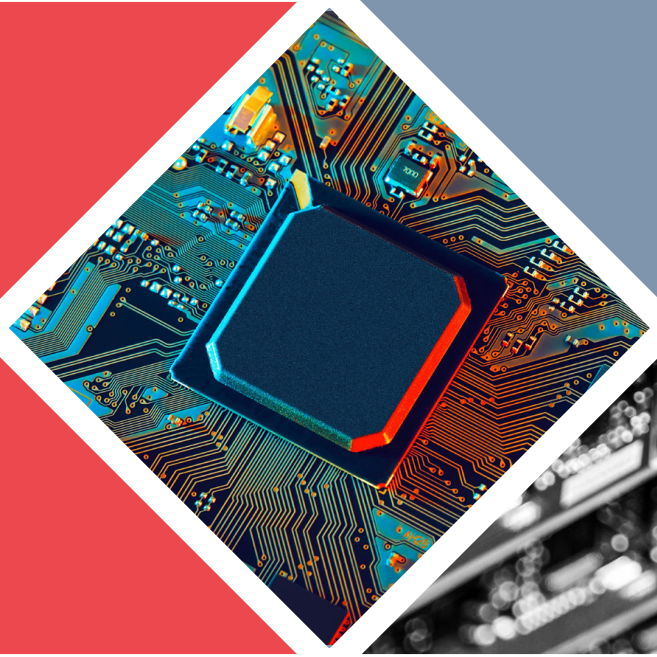
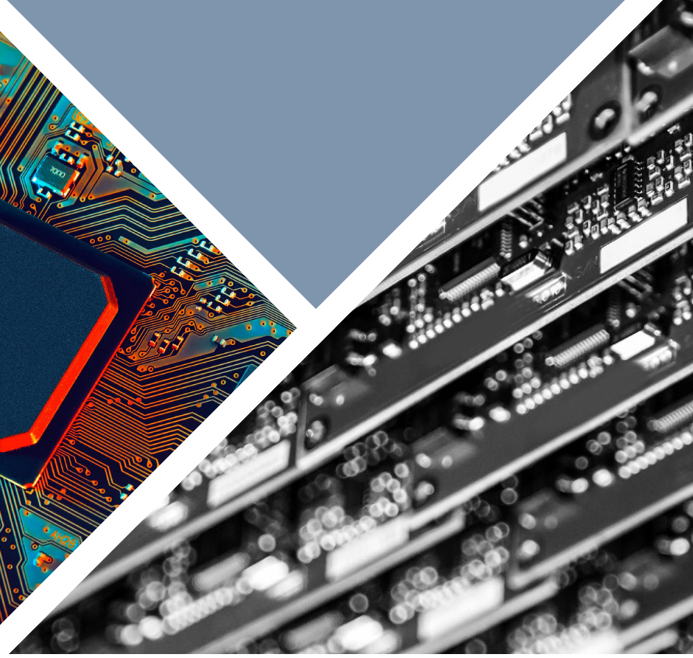
MACROFAB CAPABILITIES







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CAPABILITIES OVERVIEW

WORLD-CLASS PCBA PRODUCTION CAPABILITIES, BUILT IN NORTH AMERICA

ISO 9001:2015 · IATF 16949:2016 · AS9100D CERTIFIED ISO 9001 · ISO 13485:2016 · ITAR REGISTERED

Macrofab capabilities include fine-pitch BGA, HDI, and QFN assembly. See below for an overview of our fabrication and assembly specifications. MacroFab's manufacturing cloud offers up to IPC class 3 production and ISO9001:2015, ISO/IATF 16949, AS9100, and ISO13485 certifications. Our plantform automatically converts your information from Eagle, Altium, PADS, KiCAD, DipTrace, OrCAD and Allegro, and offers complete workspace integration with Altimade.

PCB Fabrication

- 2-36 layers
- Blind, buried, micro-drilled vias
- High-Density Interconnect (HDI)
- Controlled impedance
- Castellations
- Flip-chip capable
- Encapsulating (Epoxy potting)

PCB and Product Assembly

- Through-hole, SMD, hybrid, modules
- Full product box build assemblies
- Double-sided assembly by default
- Conformal coating
- Cable and wire harness
- Minimal component size 01005
- IPC-A-610 Class 2 and 3

Engineering Services

- PCB design review
- DRC and DFM
- File conversion and management

Testing and Validation

- Component programming and flashing
- Functional testing
- In-Circuit testing (ICT)
- Burn-in
- Flying probe
- RF spectrum testing

Component Sourcing

- Real-time stock visibility
- Integrated component suppliers
- Turnkey component sourcing
- Customer supplied inventory support
- Consignment support
- Alternative sourcing
- Component lifecycle management

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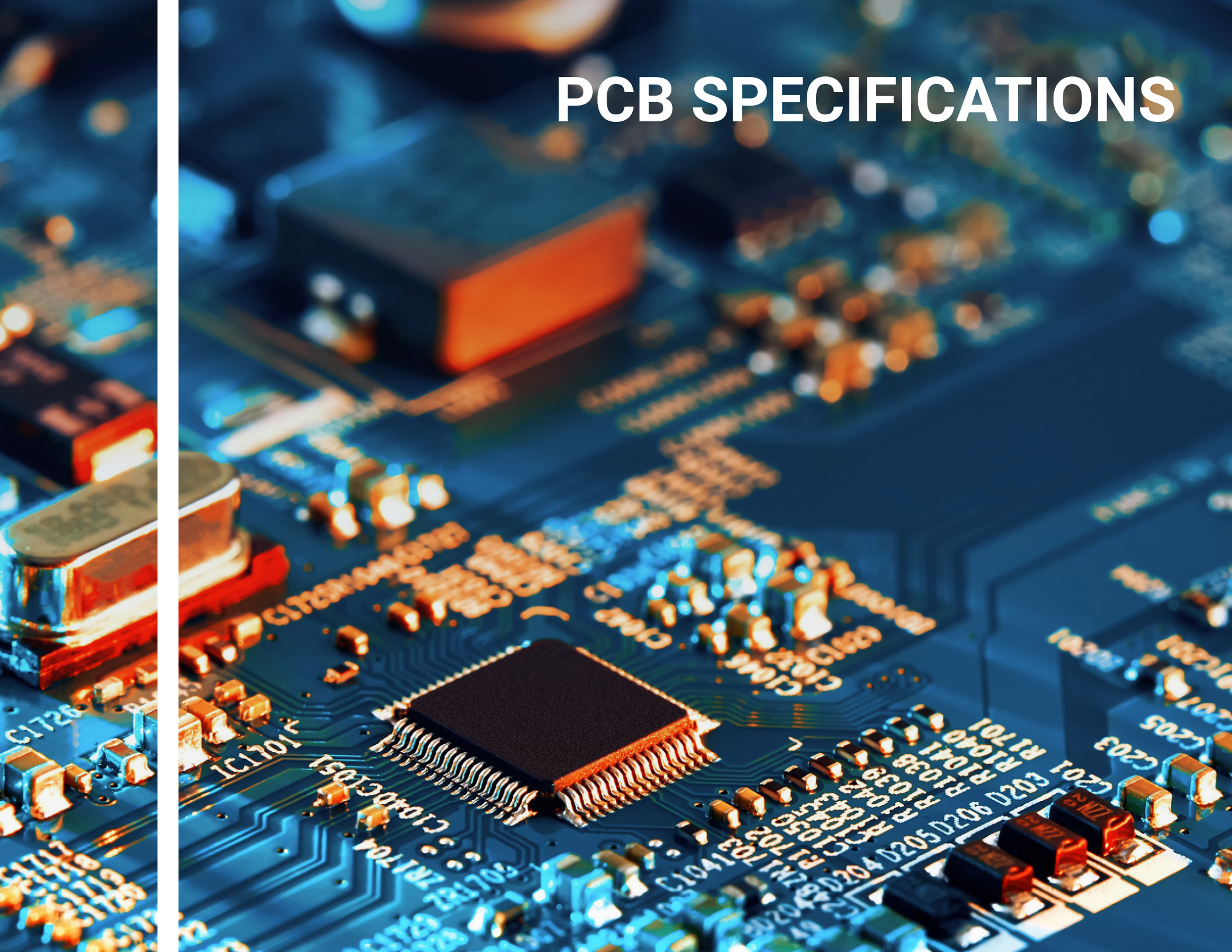
PCB SPECIFICATIONS



PCB SPECIFICATIONS

CAPABILITIES

Layer Count and Stackups

- 2-36 Layers
- Default and custom stackups available

Surface Finish

- ENIG (standard)
- ENIPIG
- Lead-free HASL
- EHG

Materials

- FR4-TG1785 (standard)
- Rogers 4003C
- Rogers 4350B
- Rogers 4450B
- Aluminum
- Other materials possible - contact for details

Copper Weight

- ½ oz (18µm)
- 1 oz (35µm)
- 2 oz(70µm)
- Other weights possible - contact for details

Soldermask and Silkscreen Colors

- All standard colors
- Custom colors available on request

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PCB SPECIFICATIONS

CAPABILITIES

Fabrication Processes

- Plated slots
- Impedance control
- Hard gold
- Edge fingers
- Beveled edges
- Blind, buried, micro-drilled, back-drilled vias
- Via in Pad - Epoxy filled and capped vias
- Castellations

Via Fill Options

- Soldermask tented
- Non-conductive epoxy
- Conductive epoxy
- Copper

Board Area

- Max dimensions: 14.9" x 14.9" (378.46mm x 378.46mm)
- Minimum billable area: 1 square inch (25.4mm²)
- Larger boards possible - contact for details

Board Thickness

- 0.062" (1.6mm) standard
- 0.008"-0.248" (0.2mm-6.3mm) custom
- PCB thickness increments at 0.0004" (0.1016mm)

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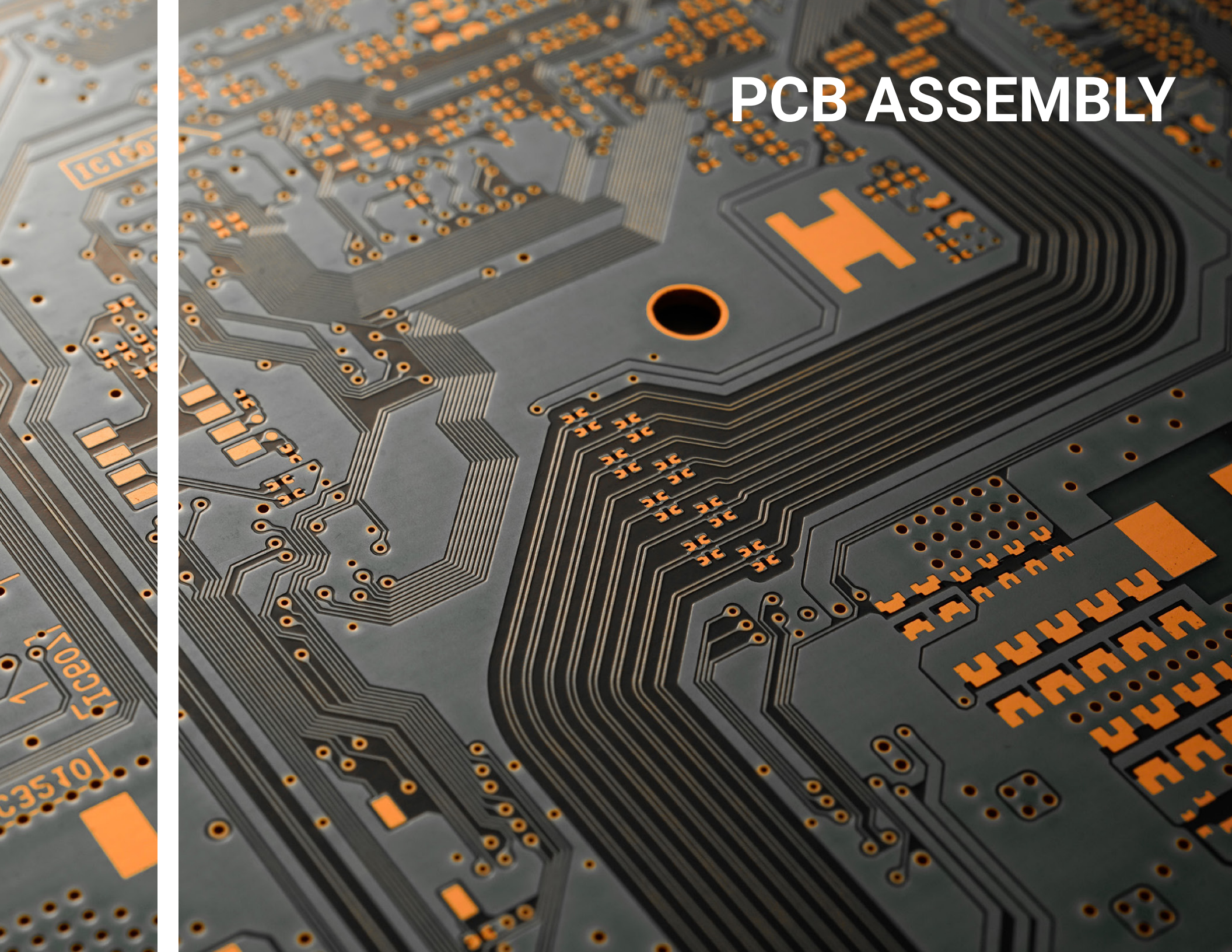
PCB ASSEMBLY

PCB ASSEMBLY

CAPABILITIES

Solder Types

- RoHS/lead-free solder only
- SAC305 for surface mount
- SN100 only for through-hole

Flux Types

- SMT: no-clean
- Through-hole: no-clean or water wash

Assembly Supported

- Single-sided or double-sided
- Through-hole (PTH)
- SMD
- BGA
- LGA
- SoP
- Modules and Daughterboard

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PCB ASSEMBLY

CAPABILITIES

Mechanical Component Limits

- Chip components, ex: resistors/ capacitors
  - 01005 10 mil x 05 mil (0.25mm x 0.0125mm)
- Leaded packages, ex: SOIC/QFP/TSOP
  - 11.8 mil (0.3mm) Lead Pitch
- Leadless packages, ex: QFN, TQFN
  - 11.8 mil (0.3mm) Lead Pitch
- Under package leads, ex: BGA, ex: BGA/FBGA/ LGA
  - 15.7 mil (0.4mm) Ball Pitch

Depanelization

- V-score and linear blade
- Mouse bites
- Fully routed

Machines and Processes

- Solder paste screen printers
- Solder paste jet printers
- SMT pick and place machines
- Convection reflow ovens
- Automatic optical inspection
- PCB automatic board washers
- Selective and wave through hole soldering
- X-Ray inspection

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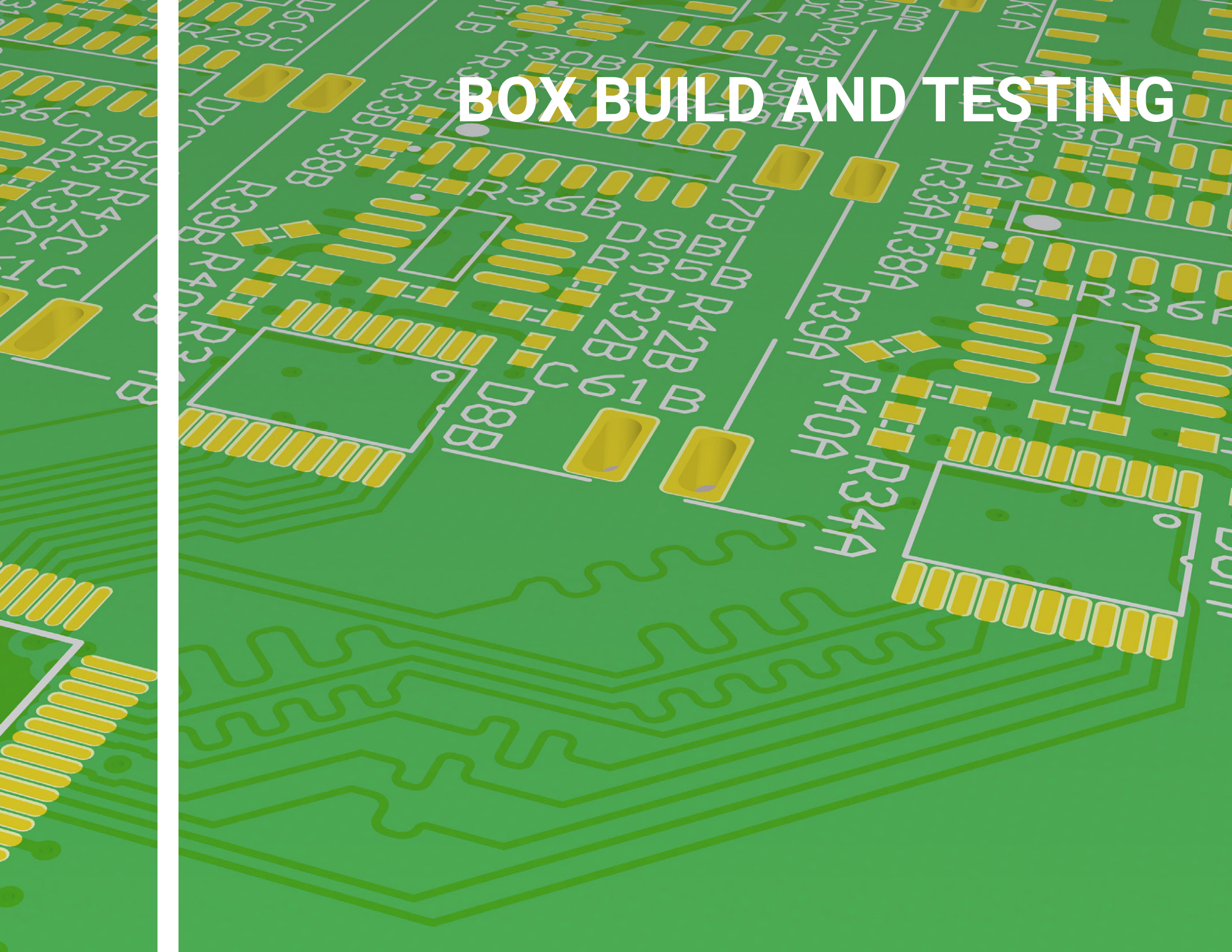
BOX BUILD AND TESTING



BOX BUILD AND TESTING

CAPABILITIES

Conformal Coating

- Spray and dipping processes
- UV tracer and coverage checks
- Materials: Acrylic, Silicone, Polyurethane

Component Programming

- Pre-assembly bulk flashing
- In-Circuit programming
- All major microcontroller programming supported

Full Product Assemply

- Labels and serialization
- Epoxy encasement
- Enclosure assembly
- Packaging and documentation
- Direct drop shipping

Testing and Validation

- Full functional
- In-Circuit Testing (ICT)
- Burn-in cycles
- Flying probe
- RF spectrum testing

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DESIGN RULES (DRC)

DESIGN RULES (DRC)

CAPABILITIES

Design Minimums

- Trace width - 3 mil (0.0762mm)
- Spacing - 3 mil (0.0762mm)
- Annular ring - 3 mil (0.0762mm)
- Clearance - Copper to edge of Board - 3 mil (0.0762mm)

Design Minimums

- Drill size - 4 mil (0.1016mm)
- NPTH drill to drill - 6 mil (0.1524mm)
- PTH drill to drill - 19.69 mil (0.5mm)
- Paste aperture - 6 mil (0.1524mm)
- Paste clearance - 6 mil (0.1524mm)

Design Minimums

- Silkscreen size - 5 mil (0.127mm)
- Silkscreen text height - 32 mil (0.8mm)
- Soldermask dam - 3.93 mil (0.1mm)
- External route radius - 39.37 mil (1.0mm)
- Internal route radius - 31.49 mil (0.8mm)

Tolerances

- Board thickness tolerance:
  - T < 1.0mm: ±15%
  - 1.0 > T<1.6mm: ±10%
  - T>1.6mm: ±10%
- PCB board edge
  - ± 6 mil (0.15mm)
- NPTH drill hole size
  - ± 2 mil (0.05mm)
- PTH drill hole size
  - ± 3.15 mil (0.08mm)

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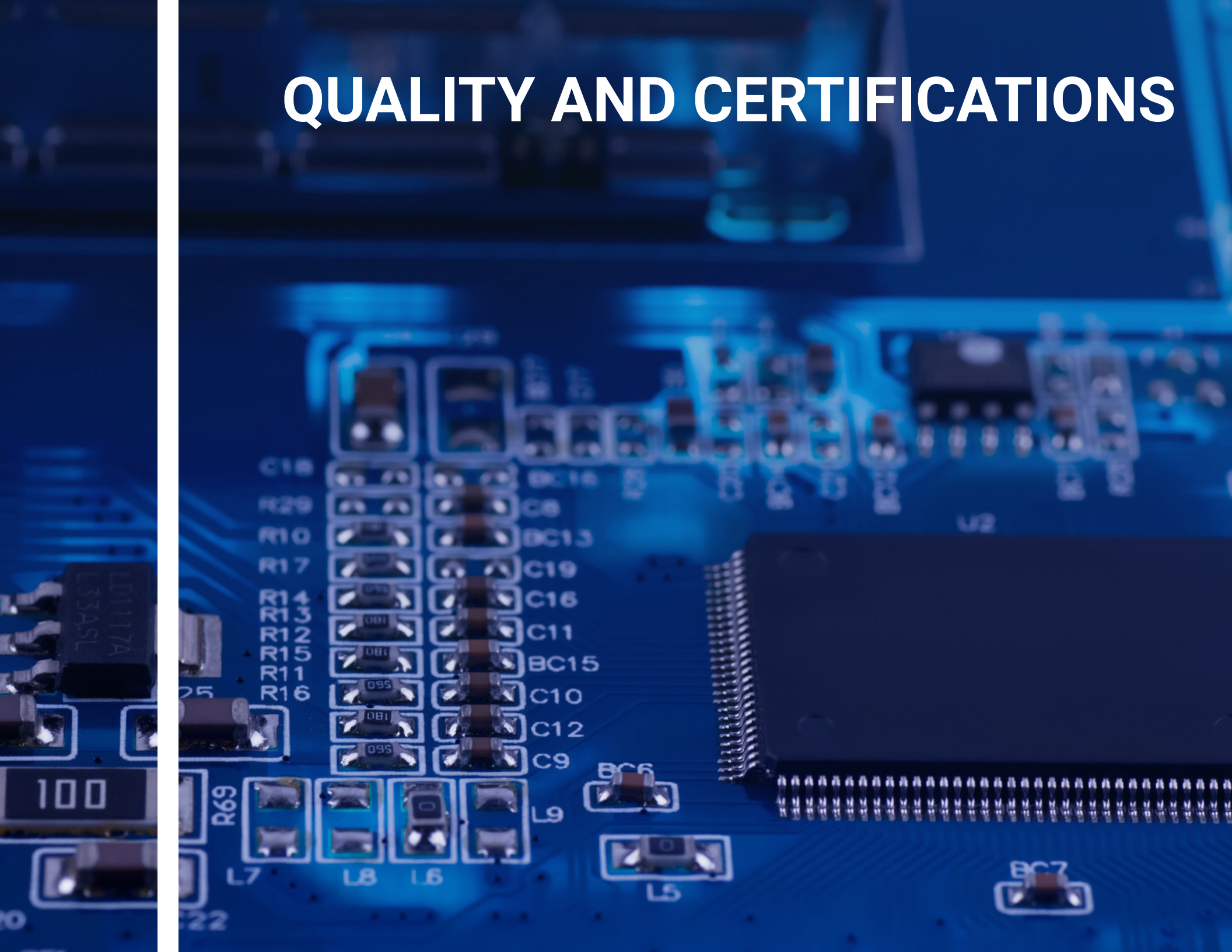
QUALITY AND CERTIFICATIONS



QUALITY AND CERTIFICATIONS

CAPABILITIES

MacroFab Manufacturing Guarantee

- Workmanship for one year after manufacturing
- Information and Intellectual Property is 100% confidential
- Transparent communication and order visibility
- Whatever it takes to get it right - for free

Inspection

- Visual inspection on all assemblies
- First Article Inspection Images for customer/ engineering review
- X-Ray for under-package leads (BGA and QFN) and engineering validation
- Automated optical inspection

MacroFab Facility Certifications

- ISO9001:2015
- IPC Class 2 and 3 production
- ITAR registered

Partner Facility Certifications

- AS9100D
- UL registered
- IPC Class 2 and 3 production
- ISO13485
- ISO/IATF 16949
- ISO9001
- ISO14001

IPC-A-610

- ESD safety procedures
- PCB Assemblies meet Class 2 with Class 3 available

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