Products the world can trust

Comprehensive PCB compliance, performance and reliability testing solutions

Empowering Trust™

Testing services for printed circuit boards (PCBs)

UL serves manufacturers across the entire PCB supply chain:

Industrial laminates

- Rigid
- Ultrathin
- Flexible
- High-density interconnect
- Metal-based
- Metal-clad laminates

Coatings and solder masks

- Solder resist
- Conformal coating
- Films
- Liquids
- Photoimageable
- UV curable

PCBs

- Single-layer
- Multilayer
- Hybrid
- Flexible
- Flex-rigid
- Metal-based

Assemblies

- Traceability program

Optimized market access

UL offers a full range of testing and certification services to UL Standards and many other international, national and regional requirements, including American Society for Testing and Materials (ASTM), Association Connecting Electronics Industries (IPC) and International Electrotechnical Commission (IEC).

In each targeted market, UL can help you gain the confidence you need to succeed. The scope of our services include:

Precertification services

Consulting
Planning
Project optimization
Quotation

Safety testing and certification

PCB compliance
Laminate and coating compliance
Production board testing
Assembly traceability

Performance and reliability testing

Reflow simulation
Thermal cycling and thermal stress
Failure analysis
Interconnect stress testing (IST)
Signal integrity testing
Conductive anodic filament growth (CAF)
Coating testing — conformal coating and solder mask

Overall testing capability

Advanced analytical
Chemical
Electrical
Environmental
Flammability
Mechanical and physical
Coatings

Early communication with a UL engineer

Certification project scope reviewed by a UL engineer

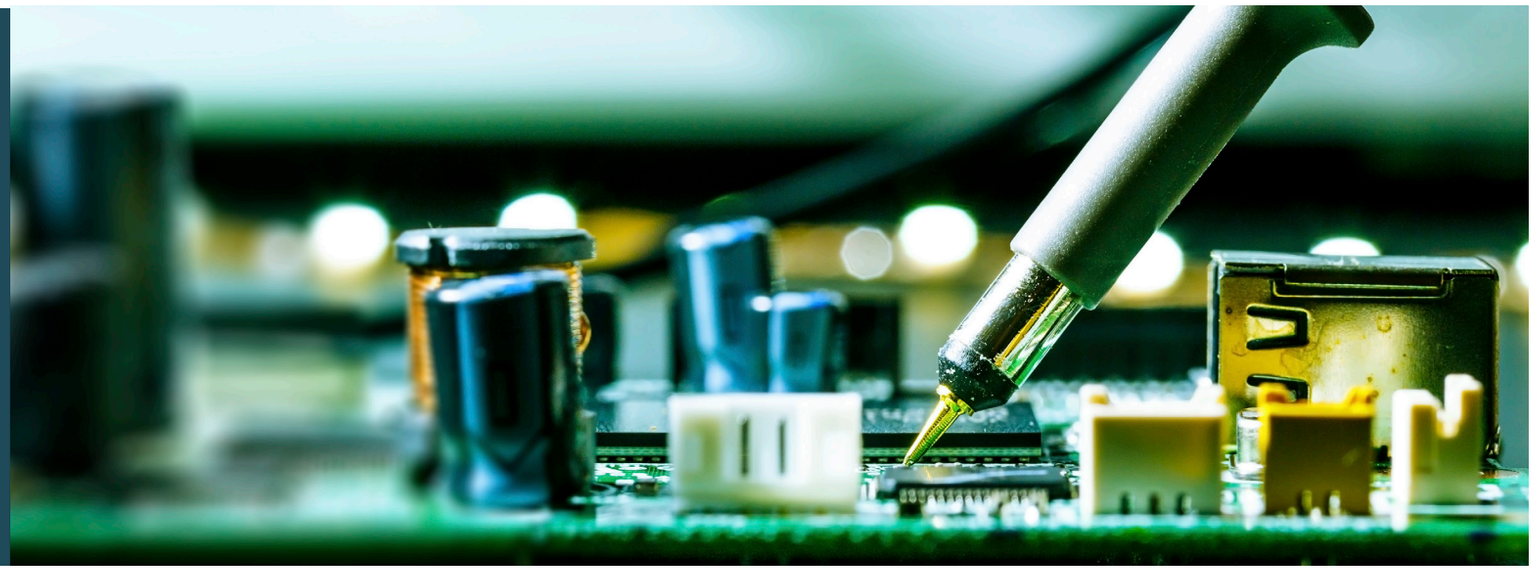
Detailed list of project documentation and requirements

Precertification services

Paving the way for future compliance

UL's precertification reviews are designed to shorten the path to certification. Through an advanced technical consultation with a UL engineer, we'll help make sure you fully understand the sample requirements and test program ahead of time, thus avoiding potential costly delays. Precertification reviews are also eligible for a 100 percent credit toward certification costs.*

*The credit is only applicable for the Scope of Services and test program agreed upon in the associated precertification project. The credit is valid for a maximum of 120 days after the completion of the precertification project (may be less based on country-specific business laws and practices). Additional terms may apply.



Benefits

Accelerated time to market

We make sure that you understand the test program and its requirements, enabling you to avoid obstacles and proactively build in efficiencies that accelerate certification. In addition, precertification identification of potential noncompliance issues allows you to correct them before they occur.

Decreased costs

We minimize the possibility of expensive rework or redesign delays resulting from improper sample submissions and test failures.

Increased peace of mind

We keep you informed and up to date throughout the entire process, so you can feel confident that your product and your business needs are well cared for.

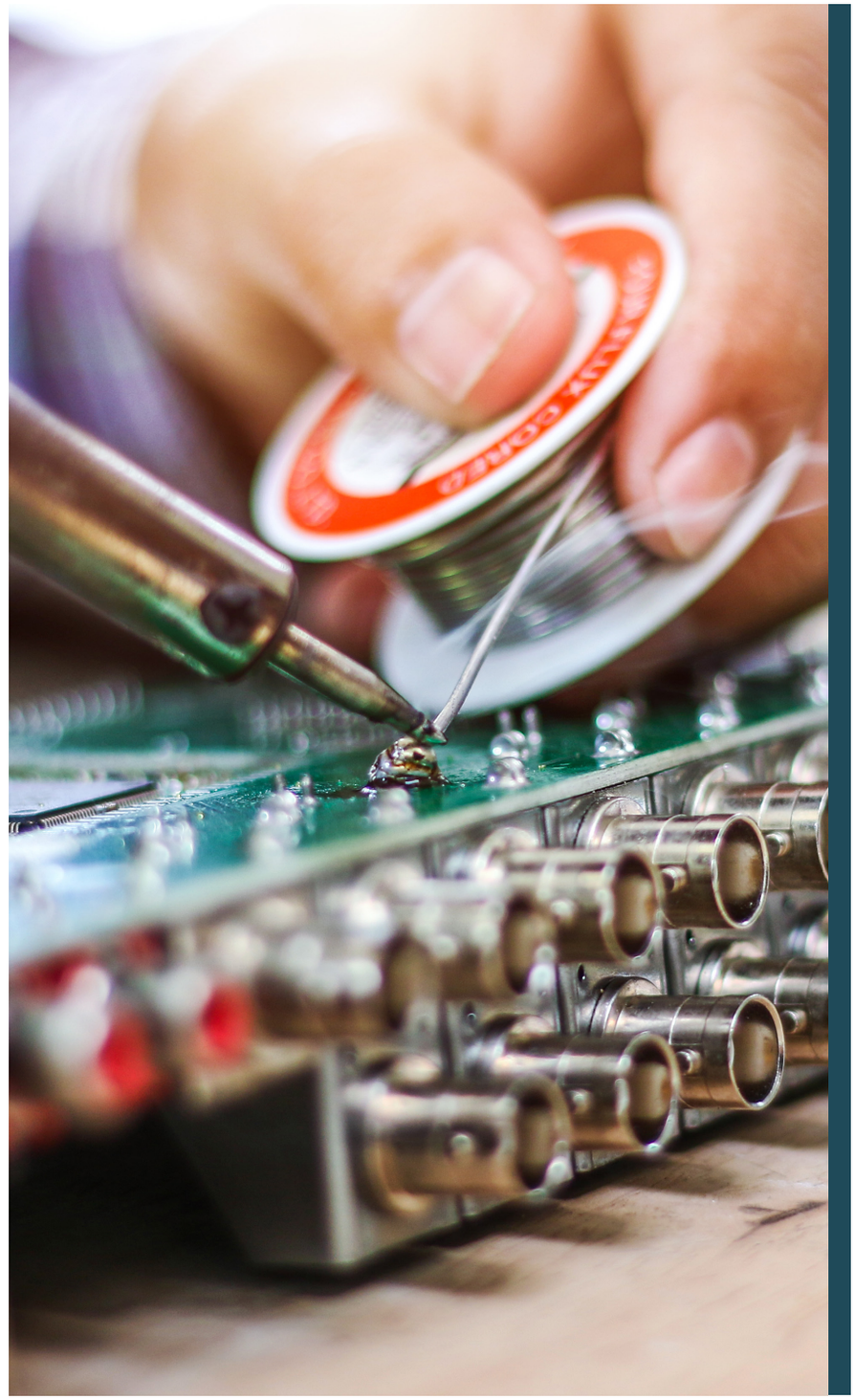
Safety testing and certification

Setting the benchmark

UL is the only organization that issues PCB safety Standards. You can make use of our technical expertise in safety testing and certification services; this process can help achieve regulatory compliance as well as communicate to customers that your product has been tested to the benchmark of product safety.

UL's extensive relationships across the entire PCB supply chain have manufacturers turning to us when they are looking for reliable components from trustworthy sources. Your customers will also value how UL assists them to eliminate duplicate testing of the finished end products when they contain UL Recognized components.

All testing can be conducted in UL-accredited laboratories or in your own qualified facilities.



UL Standards for PCBs

For UL recognition of PCB safety, the following Standards apply:

- UL 796 Printed Wiring Boards – for standard rigid, metal-based and HDI PCBs
- UL 796F Flexible Materials Interconnect Constructions – for flexible and flex-rigid PCBs
- UL 746E Polymeric Materials – for industrial laminates and materials used in PCBs
- UL 746F Polymeric Materials – for flexible dielectric film materials
- UL 94 – for flammability of plastic materials

UL Standards related to PCBs

Certification is driven by end-product requirements. The actual PCB ratings required are dependent on the end-product application and how the PCB will be employed. Always check with the end-product manufacturer to determine what ratings they require. Many end-product standards, such as the following, require UL Recognized PCBs:

- UL 60950 – Information technology equipment
- UL 60065 – Audio and video equipment
- UL 62368 – ITE and audio/video equipment
- UL 60601 – Medical equipment
- UL 60335 – Appliances
- UL 61010 – Industrial control equipment
- UL 8750 – LED equipment

UL Recognized = enhanced market acceptance

PCB components and materials that are recognized by UL are known to have undergone the industry's most stringent safety testing and follow-up program. UL Recognized components are listed in UL's Online Certifications Directory, UL.com/database and the UL iQ™ database iq.UL.com/pwb. These allow your customers to search and identify the components and materials they need to complete their subassemblies or end products.

QUICK-TURN CERTIFICATION
for rush orders

UL also offers Quick-Turn Certification of production boards to UL 796. This service allows for faster time to market by testing actual production boards instead of requiring specialized samples that first need to be created. The service is limited to the tested build of materials, construction stack-up and trace layout.

Performance and reliability testing

Empowering the PCB industry

Advances in today's electronic applications depend upon sophisticated PCB technology. If it doesn't work, the whole product will be compromised. Increase your customers' confidence by demonstrating the PCB is not only compliant to regulatory safety requirements but also tested to perform reliably.

Our performance testing and certification programs apply to a comprehensive range of PCB components and materials. Every program can be customized to match the PCB application and meet your business needs.

Thermal and environmental conditioning

Thermal and environmental conditioning accelerates degradation of the PCB to determine material and structural integrity via microsection analysis and destructive and nondestructive testing.

Interconnect stress testing (IST)

IST speeds up temperature cycling to detect susceptibility to early failure, and thereby increases product reliability. It is 12 times faster than in an air-to-air thermal oven, creating the opportunity for greater testing output.

Signal integrity testing

Signal integrity testing (SIT) determines the amount of signal propagation caused by the characteristics of the materials, conductors and accompanying structures on the PCB. Losses in the signal will result in frequency-dependent attenuation.

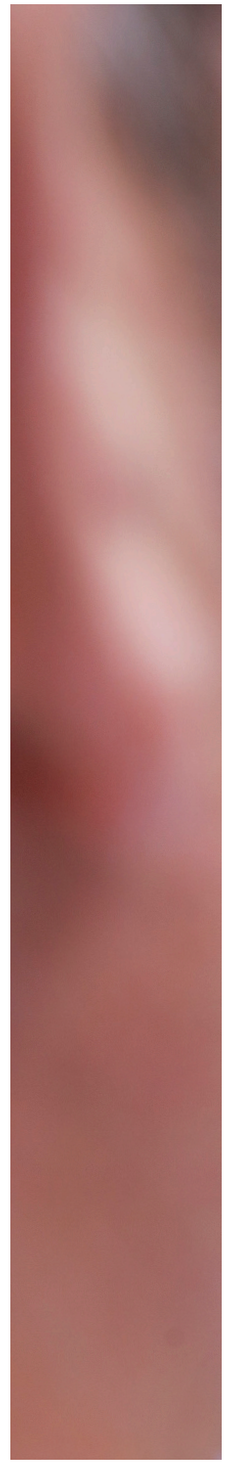
Conductive anodic filament (CAF) growth

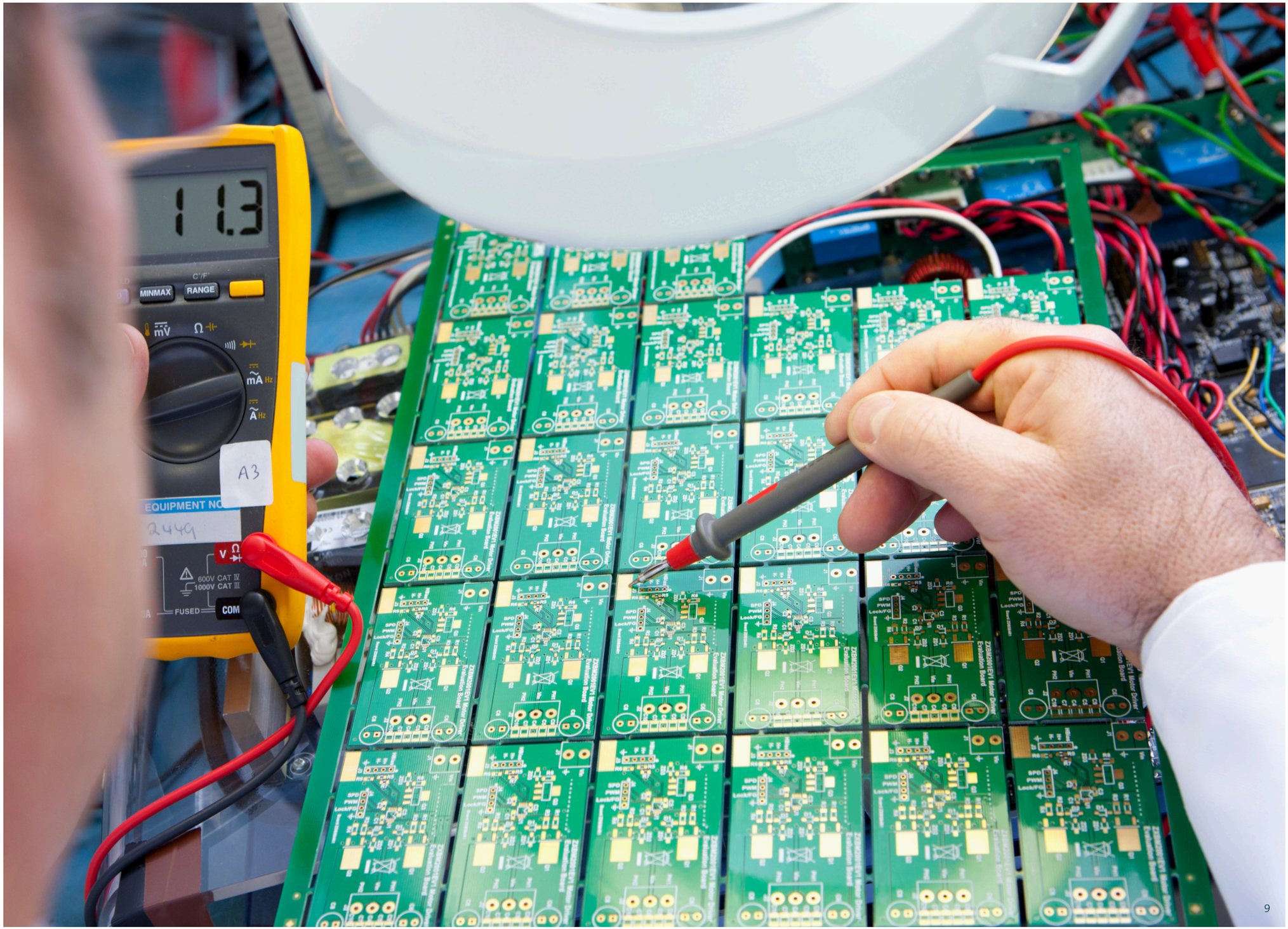
The need for CAF testing is ever increasing with overall product sizes and conductor spacings being reduced. CAF failure involves the growth or "electrochemical migration" of copper in a PCB. This unintentional growth typically bridges two oppositely biased copper conductors resulting in a short circuit. Catching and correcting this potential failure can substantially lengthen product lifespans.

Conformal coating and solder mask testing

Conformal coatings are applied to electronic circuits to provide a barrier to moisture and contamination and to provide electrical insulation. UL offers a full suite of coating testing services, including:

- UL 746E evaluations
- IPC-CC-830: Qualification and performance testing of electrical insulating compounds for printed circuit assemblies
- IPC-SM-840: Qualification and performance specification of permanent solder mask and flexible cover materials
- IEC-60664-3: Insulation coordination for equipment within low-voltage systems, via the use of coatings to achieve insulation coordination of printed board performance and assemblies.

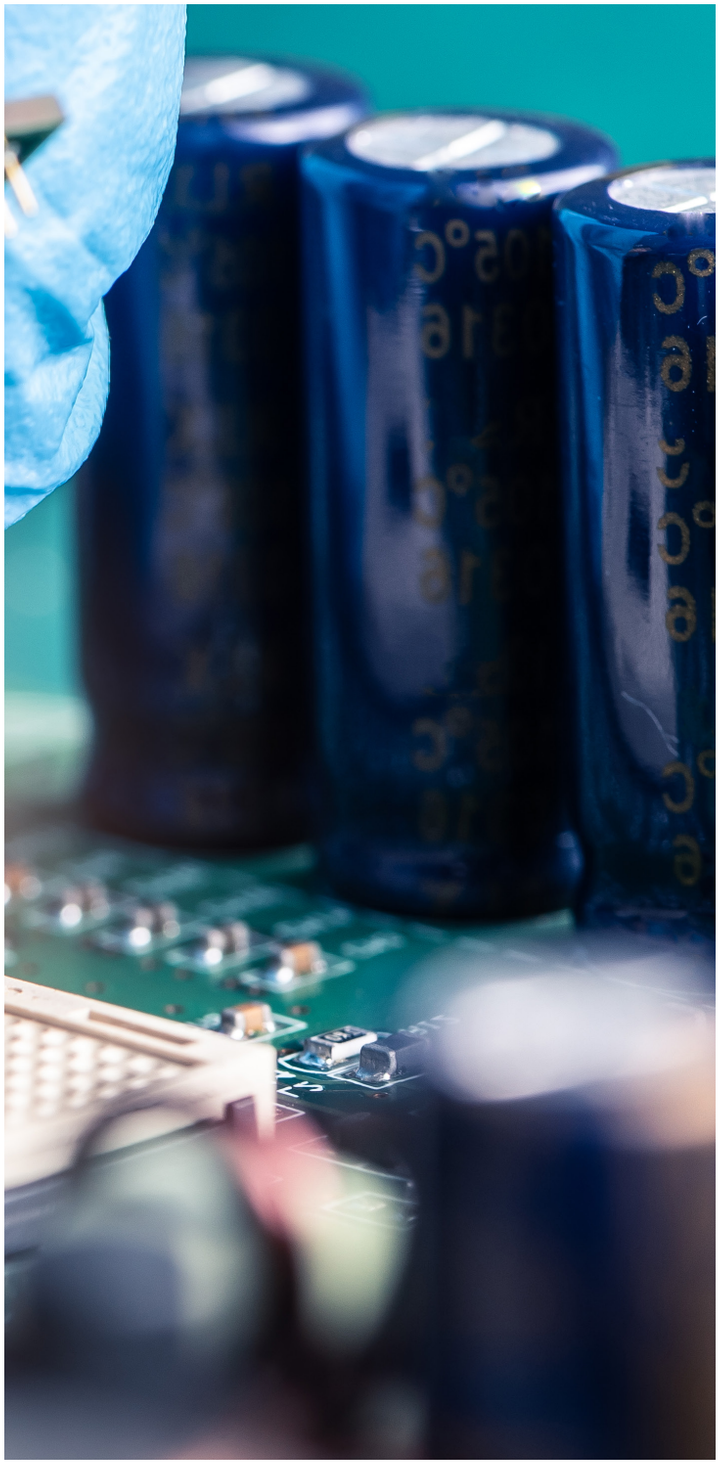



11.3
MINMAX
RANGE
A3
600V CAT IV
1000V CAT III
FUSED
COM

Overview of safety, performance and reliability testing

Explore our range of testing services. The following list includes commonly requested tests, such as flammability, ignition, long-term thermal aging and microsectioning analysis. We also perform many other tests that aren‘t listed. Please contact us about custom testing and designing a test plan to fit your unique needs.

Ctech.UL.com/pcb



Advanced analytical techniques

- Atomic absorption spectroscopy (AAS)
- Ash content
- Differential scanning calorimetry (DSC), glass transition temperature
- Dynamic X-ray (2D or 3D X-ray)
- Dynamic mechanical analysis (DMA)
- Energy dispersive X-ray spectroscopy (EDS)
- Extractions
- Failure analysis (F/A)
- Fourier transform infrared spectroscopy (FTIR)
- Gas chromatography/mass spectroscopy (GC/MS)
- Gel content
- Ignition loss
- Inductively coupled plasma spectroscopy/optical emission spectroscopy (ICP/OES)
- Ion chromatography (IC)
- Microwave digestion
- Scanning electron microscopy (SEM)
- Thermogravimetric analysis (TGA)
- Thermomechanical analysis (TMA)
- X-ray (live-time, nondestructive inspection of package)
- X-ray fluorescence (XRF)

Chemical testing

- Alloy composition
- Bisphenol-A content
- Chemical resistance/solder resistance
- Density/specific gravity
- Flammability
- Hazardous substance analysis
- Heavy metals/lead content
- Ion chromatography (IC)
- Organotin content
- pH
- Phthalate content
- Restriction of hazardous substances (RoHS)
- Solder paste - slump test
- Spitting of flux-cored wire solder
- Viscosity

Environmental testing

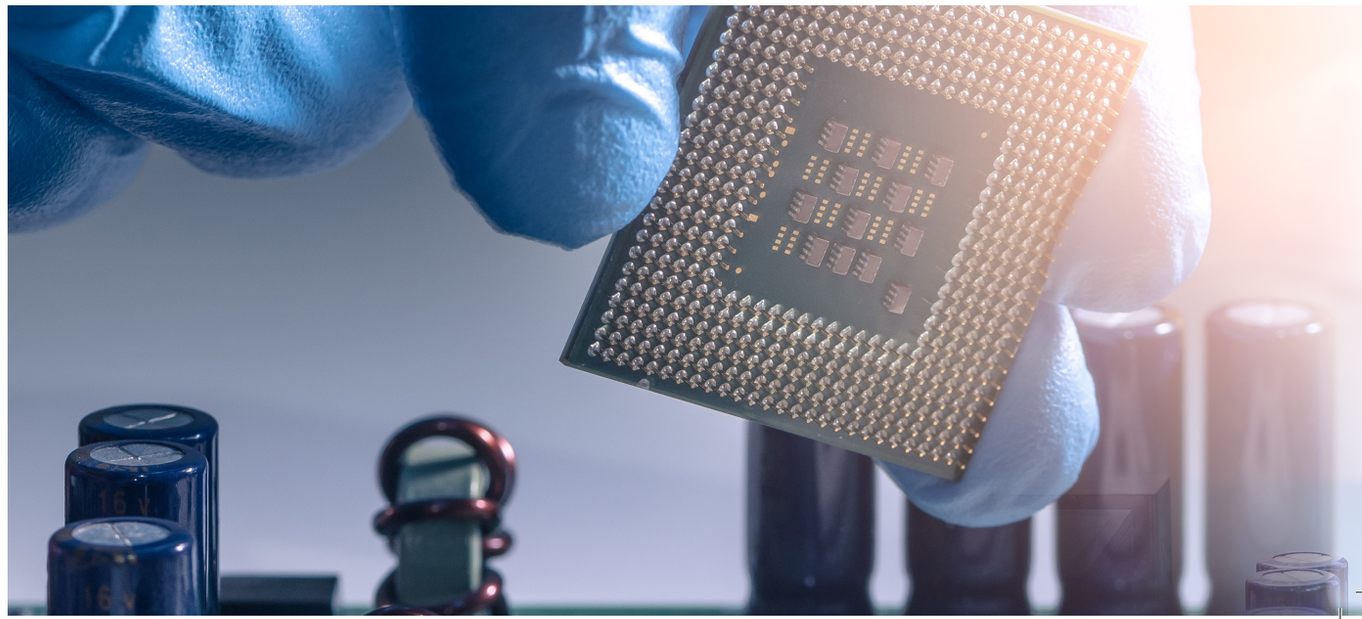
Accelerated aging
Altitude
Autoclave (pressure vessel)
Conductive anodic filament (CAF)
Chemical resistance
Cold impact
Corrosion resistance
Drop/impact
Drop resistance
Electromigration/electrochemical migration (ECM)
Flammability
Fluid resistance
Fungus resistance
Humidity (cycling or steady state)
Hydrolytic stability
Immersion
Interconnect stress test
Ingress protection (IP)
Moisture and insulation resistance (MIR)
Moisture absorption
Moisture resistance
Oxygen index
Salt spray/fog
Solvent resistance
Temperature/humidity
Thermal aging
Thermal cycling
Thermal shock
Thermal stress
Time to delamination
UV exposure
Vicat softening point
Water spray
Water vapor transmission/water absorption
Weathering

Flammability testing

Burning rate ASTM D 229, sections 61-66 (method I/vertical)
Burning rate ASTM D 635 (horizontal)
Burning rate FAA 25.853b5 (horizontal)
Burning rate FMVSS 302 (49CFR571) (horizontal)
Burning rate ISO 3795 (horizontal)
Burning rate UL 94 HB (horizontal)
Burning rate UL 94 HBF (horizontal)
Burning rate UL 94 5V (vertical)
Burning rate UL 94 V (vertical)
Burning rate UL 94 VTM (vertical)
Flammability, small component, UL 1694
Oxygen index ASTM D 2863 (Procedure A/Test Method A)

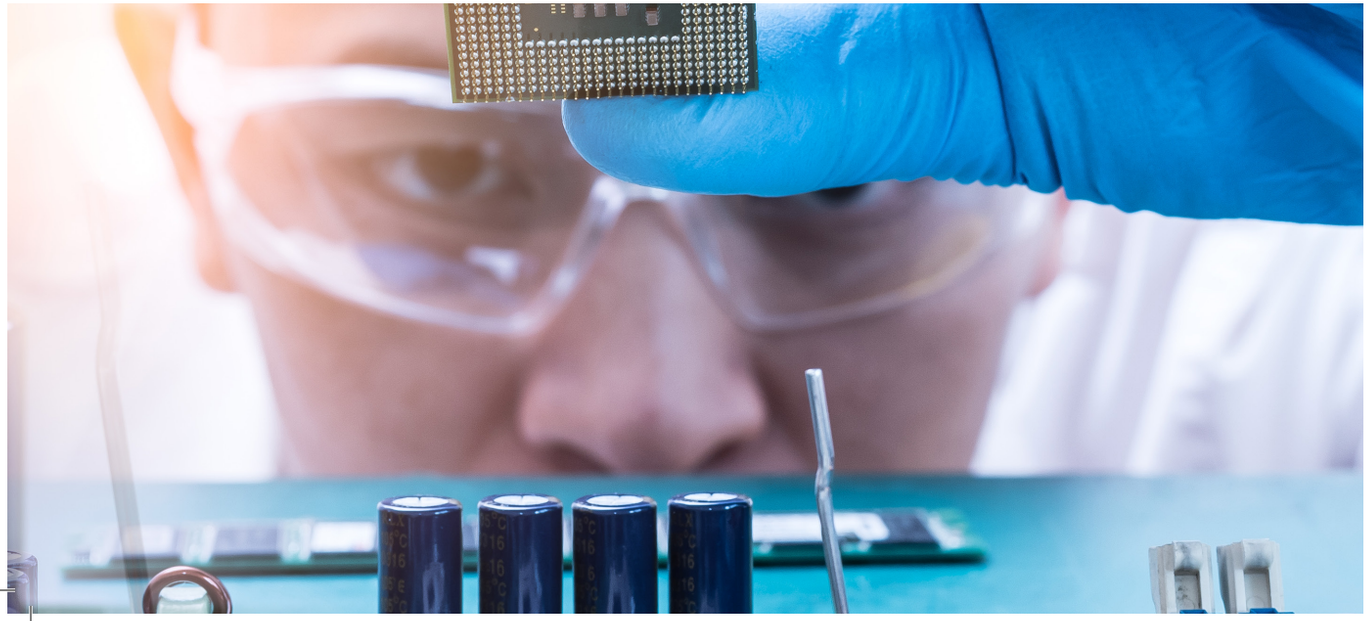
Electrical testing

Arc resistance
Capacitance
Comparative tracking index (CTI)
Conductive anodic filament growth (CAF)
Conductivity
Dielectric breakdown
Dielectric constant/permittivity
Dielectric strength
Dielectric withstanding voltage (DWV)
Dissipation factor/loss tangent
Electromigration/electrochemical migration (ECM)
High-current arc ignition (HAI)
High-voltage arc tracking
Hot-wire ignition
Inclined plane tracking
Interconnect stress test
Resistance
Signal integrity testing (SIT)/SET2DIL/TDR
Surface insulation resistance (SIR)/insulation resistance
Volume and surface resistivity



Mechanical and physical property testing

- Abrasion
- Adhesion
- Bend testing
- Bond strength
- Bow and twist
- Breaking strength
- Brittleness
- Coating thickness
- Coefficient of friction
- Coefficient of thermal expansion (CTE)
- Compression set
- Compression properties
- Compressive strength
- Cross-section analysis
- Cure
- Deflection under load
- Deformation temperature
- Dimensional stability
- Dynamic mechanical analysis (DMA)
- Elongation
- Flexural strength and modulus
- Glass transition temperature by thermal mechanical analysis (TMA)
- Hardness
- Impact strength
- Impact resistance
- Lap shear strength
- Mechanical cycling
- Mechanical strength
- Microsectioning
- Peel strength
- Plating thickness
- Rework simulation
- Shear properties
- Shear strength
- Softening point
- Specific gravity/density
- Tear resistance
- Tensile impact
- Tensile strength
- Tensile properties
- Tension and compression
- Young's Modulus



Coatings – conformal coating and solder masks

- Abrasion (Taber)
- Adhesion
- Appearance
- Coating thickness
- Cure time and temperature
- Dielectric strength
- Dielectric withstanding voltage (DWV)
- Electrochemical migration
- Flammability
- Flexibility
- Flourescence
- Fourier tansform infrared spectroscopy (FTIR)
- Fungus resistance
- Hardness
- Hydrolytic stability
- Insulation resistance
- Lap shear
- Moisture insulation resistance
- Peel strength
- Q-resonance
- Resistance to chemicals, solvents and cleaning agents
- Shelf life
- Tensile strength
- Thermal shock
- Thermal stress
- Viscosity
- Visual requirements

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