Test Capabilities

Chandler Johann Schumacher Laboratory (JSL)
Services

isola®

JSL Analytical Services

Extensive evaluation of printed wiring boards & laminates

- In house testing
- Interpretation of third party testing
- Assistance with development and troubleshooting of analysis methods
- to be used at the customer's facility.

Standardized test methods appropriate

- ASTM
- IPC-TM-650
- UL

Results backed by

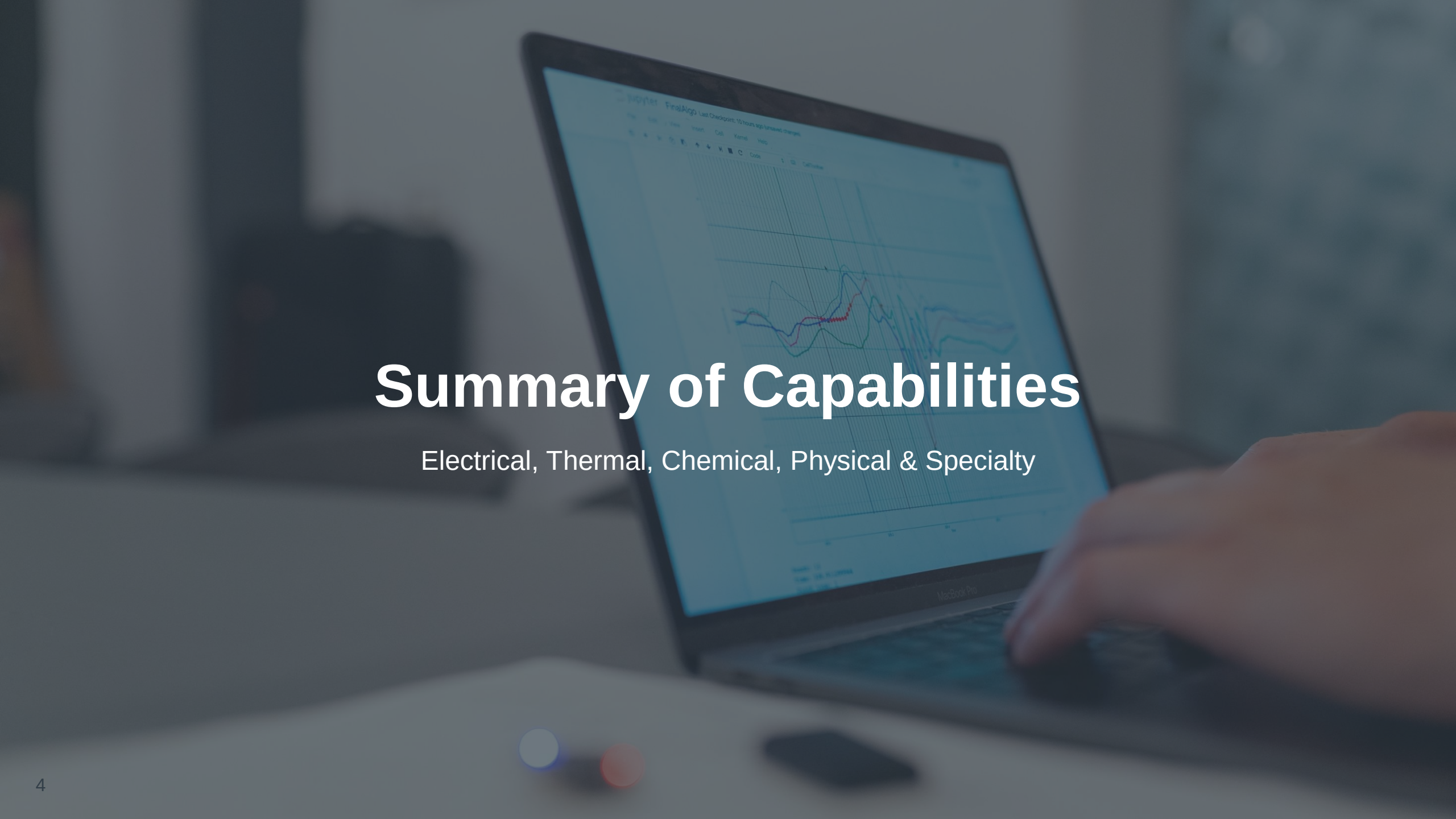
- Team of experts with over 150 years of combined industry experience
- Extensive review process which ensures quality and reliability of data

Analytical Services Laboratory

- Innovation
- Experience
- Reliability

Sample, Submission & Results

- **Sample Submission**
  - Samples must be submitted via Isola Technical Services Representative
  - Samples must be accompanied by Isola JSL a Lab Request Form (LRF)
  - Samples must be appropriately identified
  - Samples must meet the specific requirements for requested test as defined within this document
- **Results**
  - All results will be communicated by JSL to the Isola Technical Services Representative



Summary of Capabilities

Electrical, Thermal, Chemical, Physical & Specialty

Electrical

Electrical

- Dielectric Constant/Dissipation Factor (DK/DF)
  - Bereskin Method
  - IPC Method
  - HP Method
  - SPP
  - Set2Dil
- Arc Resistance
- Dielectric Breakdown
- Electric Strength
- Surface and Volume

Electrical

Dielectric Constant/Dissipation Factor (DK/DF)

- Dielectric Constant (DK): Measure of the energy storing capacity of a resin system resulting from polarization when an electric field is applied
- Dissipation Factor (DF): Measure of the loss rate of a resin system as it pertains to microwave energy
- DK/DF results reported reflect resin and glass and are therefore dependent on resin content of the sample

Bereskin Method

- Frequency Range 50Mhz – 13.5 Ghz
- Uses a resonating strip-line with fields in the Z-axis direction
- Measures DK and DF using Peak Max (DK) and -/+3db (DF)
- Designed by Dr. Alexander Bereskin and used by Chandler
- ASL under licensing agreement.

Sample Requirements

- Two (2) Unclad laminates: 4.0” x 1.25 “
- 0.020 “ – 0.080” Thick
- Free from all internal/external copper
- External copper can be etched at the JSL

Test Standards: Isola defined method.

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Electrical

Dielectric Constant/Dissipation Factor (DK/DF)

- Dielectric Constant (DK): Measure of the energy storing capacity of a resin system resulting from polarization when an electric field is applied
- Dissipation Factor (DF): Measure of the loss rate of a resin system as it pertains to microwave energy
- DK/DF results reported reflect resin and glass and are therefore dependent on resin content of the sample

Sample Requirements

- Two (2) laminate samples required; 1 Large, 1 Small
  - (Large) 2.7” x 1.9” x 0.060”
  - (Small) 2.7” x 1.8” x 0.060”
  - Up to 6 thin laminates may be stacked to meet thickness requirements +/- 0.003”
- Free from all internal/external copper
- External copper can be etched at the JSL

IPC Method

- Frequency Range 10 Mhz – 40.0 Ghz
- Uses a resonating strip-line with fields in the Z-axis direction
- Industry standard developed by Robert Trout for IPC

Test Standards: IPC TM-650 Method 2.5.5.5

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Electrical

Dielectric Constant/Dissipation Factor (DK/DF)

- Dielectric Constant (DK): Measure of the energy storing capacity of a resin system resulting from polarization when an electric field is applied
- Dissipation Factor (DF): Measure of the loss rate of a resin system as it pertains to microwave energy
- DK/DF results reported reflect resin and glass and are therefore dependent on resin content of the sample

Hewlett Packard (HP)

- Frequency . Range: 1.0 Mhz – 1.8 Ghz
- Measures Z-axis capacitance using parallel plates for DK and DF determination.

Sample Requirements

- One (1) unclad laminate 2.0” x 2.0”
- Minimum Thickness: .008”
- No Maximum Thickness
- Free from all internal/external copper
- External copper can be etched at the ASL

Test Standards: IPC TM-650 Method 2.5.5.9

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Electrical

Dielectric Constant/Dissipation Factor (DK/DF)

- Determines rigid insulating material's ability to resist breakdown parallel to laminations
- Increasingly higher than normal voltage is applied to electrical components to determine the voltage where the insulation breaks down

Sample Requirements

- Printed wiring board manufactured to test specification

Sample Conditioning

- Condition A –As Received
- Condition D48/50 –After immersion in 50°C water for 48 hours followed by D0.5/23 – immersion in 23°C water for 0.5 hour

Test Standards: IPC TM-650 Method 2.5.6

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Electrical

Dielectric Constant/Dissipation Factor (DK/DF)

- Determines rigid insulating material's ability to resist breakdown parallel to laminations
- Increasingly higher than normal voltage is applied to electrical components to determine the voltage where the insulation breaks down.

Hewlett Packard (HP)

- Condition A –As Received
- Condition D48/50 –After immersion in 50°C water for 48 hours followed by D0.5/23 – immersion in 23°C water for 0.5 hour

Sample Requirements

- Four (4) Unclad laminates: 2.0" x 3.0 "
- Thickness greater than 0.0199"
- Free from all internal/external copper
- External copper can be etched at the JSL

Test Standards: IPC TM-650 Method 2.5.5.9

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Electrical

Electrical Strength

- Measures the electrical strength of a material as an insulator
- Defined as the maximum voltage required to produce a dielectric breakdown through the material
- Expressed as Volts per unit thickness.

Sample Requirements

- Three (3) Unclad laminates: 3.5” x 3.5 “
- Thickness less than 0.020”
- Free from all internal/external copper
- External copper can be etched at the JSL

Sample Conditioning

- Condition D48/50 –After immersion in 50°C water for 48 hours followed by D0.5/23 – immersion in 23°C water for 0.5 hour

Test Standards: IPC TM-650 Method 2.5.6.2

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Electrical

Electrical Strength

- Measures the electrical strength of a material as an insulator
- Defined as the maximum voltage required to produce a dielectric breakdown through the material
- Expressed as Volts per unit thickness.

Hewlett Packard (HP)

- Condition D48/50 –After immersion in 50°C water for 48 hours followed by D0.5/23 – immersion in 23°C water for 0.5 hour

Sample Requirements

- Laminate thickness of less than 0.51 mm [0.020 “]:
- Three (3) samples
- 50.8 ± 1.6 mm x 50.8 ± 1.6mm
- 2.0” ± 0.062” x 2.0” ± 1/16”
- Laminate thickness of 0.51 mm [0.020“] or greater.
- Three (3) samples
- 101.6 ± 3.2 mm x 101.6 ± 3.2 mm
- 4.0” ± 0.062” x 4.0’ ± 1/8”

Test Standards: IPC TM-650 Method 2.5.6.2

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Electrical

Surface and Volume Resistivity

- Determine surface and volume resistivity of metallic-clad or unclad laminates under conditions of specified humidity and temperature and at elevated temperatures.
- Samples are etched leaving copper circles to which leads are soldered for connection to the resistivity meter.

Sample Requirements

- Laminate thickness of less than 0.51 mm [0.020 “]:
- Three (3) samples
- 50.8 ± 1.6 mm x 50.8 ± 1.6mm
- 2.0” ± 0.062” x 2.0” ± 1/16”
- Laminate thickness of 0.51 mm [0.020“] or greater.
- Three (3) samples
- 101.6 ± 3.2 mm x 101.6 ± 3.2 mm
- 4.0” ± 0.062” x 4.0’ ± 1/8”

Sample Conditioning

- Condition A –As Received
- Condition F– Per IPC Standard
- Condition C96/35/90 – After conditioning at 35°C/90% Relative Humidity for 96 hours
- Condition E24/XXX –After conditioning at XXX°C for 24 hours where XXX is defined by material slash sheet

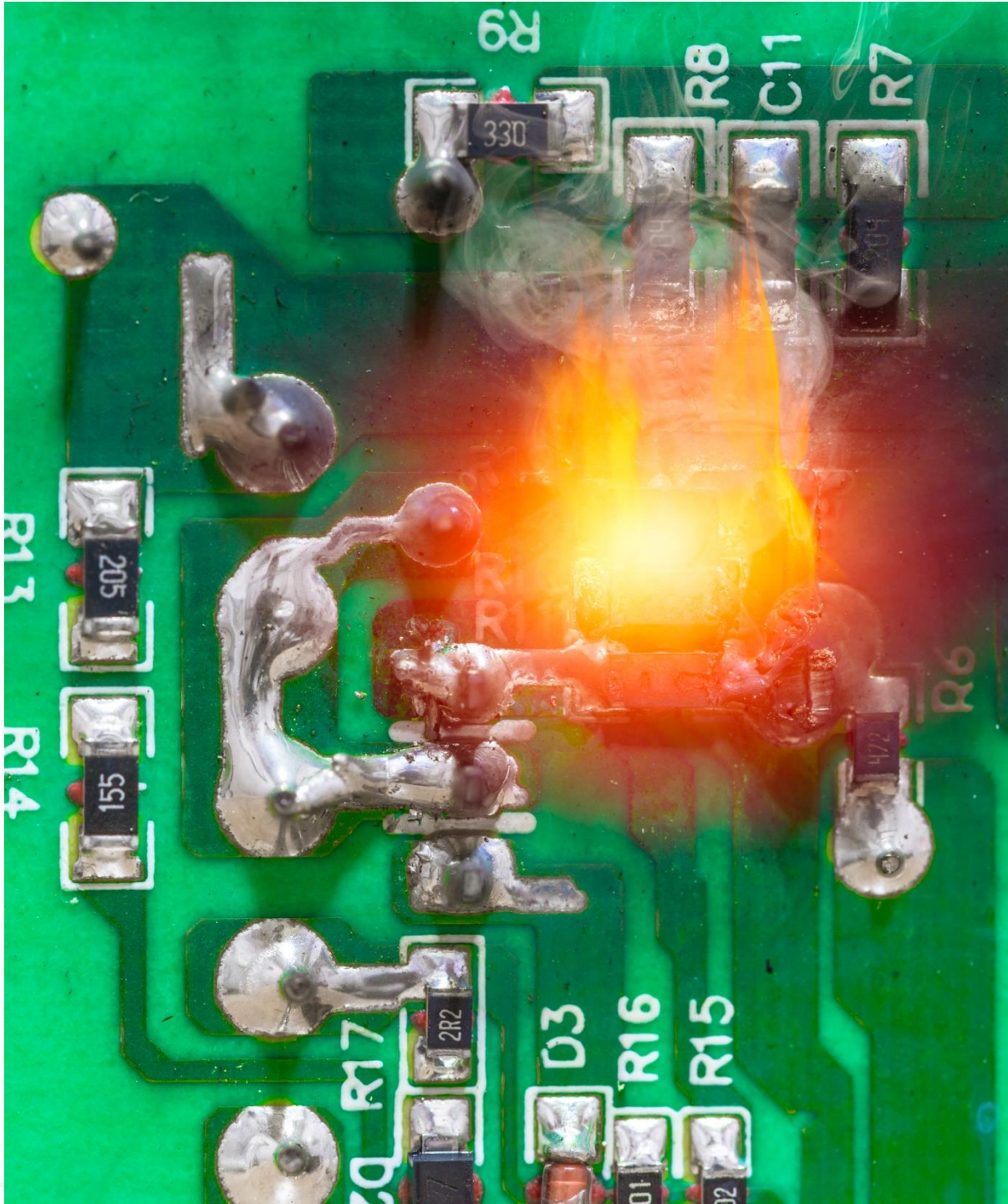
Test Standards: IPC TM-650 Method 2.5.17.1

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Thermal

Thermal

- Glass Transition Temperature (Tg)
- Delta Tg by DSC & DMA
- Coefficient of Thermal Expansion (CTE)
- Time to Delamination
- Decomposition Temperature (Td)
- Weight Loss by TGA



Thermal

Differential Scanning Calorimeter (DSC)

- Measures the flow of heat into or out of a sample relative to a reference while heating the sample with a linear temperature ramp

Sample Requirements

- Multilayer laminates –2” x 2”
- Rigid Board laminates or PWB’s – optimal size 2” x 2”
- Minimum size –3mm x 3mm if sample has been cut to a good clean edge
- 10mm x 10mm if ASL must remove any rough edges
- Samples should be clad if possible

Glass Transition Temperature (Tg)

- Measure of the softening point of the amorphous molecules within the sample as indicated by the temperature at half height of the step change in heat flow
- Ramp rate of 20°C/min

Delta Tg

- Measure of the softening point of the amorphous molecules within the sample as indicated by the temperature at half height of the step change in heat flow
- Ramp rate of 20°C/min

Test Standards IPC TM-650 Method 2.4.25

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Thermal

Dynamic Mechanical Analysis (DMA)

- Detects changes in the storage modulus, loss modulus and tan delta of a material while heating the sample with a linear temperature ramp

Sample Requirements

- Laminates and Printed Wiring Boards –minimum sizes
  - 2.5 – 3.5 mm thick : 5 mm wide x 60 mm long
  - 1.5 – 2.5 mm thick : 9 mm wide x 45 mm long
  - 0.25 – 1.5 mm thick : 11 mm wide x 35 mm long
- No Copper in sample if possible
- No Holes
- No Solder
- If samples are minimum size, edges must be clean and smooth

Glass Transition Temperature (Tg)

- Measure of the softening point of the amorphous molecules within the sample as indicated by the temperature at the onset of the change in CTE
- Ramp rate of 10°C/min

Delta Tg

- Comparison of the Tg measured during the first heat of the sample to the
- Tg when the sample is reheated. Depending upon the grade, the sample
- may be held at an isothermal temperature above the Tg
- Frequently considered a measure of the cure of the material
- Ramp rate of 3°C/min

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Thermal

Thermomechanical Analysis(TMA)

- Measures finite changes in the height of the sample related to the sample temperature

Sample Requirements

- Laminates and Printed Wiring Boards –minimum sizes
  - 2.5 – 3.5 mm thick : 5 mm wide x 60 mm long
  - 1.5 – 2.5 mm thick : 9 mm wide x 45 mm long
  - 0.25 – 1.5 mm thick : 11 mm wide x 35 mm long
- No Copper in sample if possible
- No Holes
- No Solder
- If samples are minimum size, edges must be clean and smooth

Glass Transition Temperature (Tg)

- Measure of the softening point of the amorphous molecules within the sample as indicated by the temperature of the peak in the tan delta
- Ramp rate of 3°C/min

Delta Tg

- Comparison of the Tg measured during the first heat of the sample to the Tg when the sample is reheated. Depending upon the grade, the sample may be held at an isothermal temperature above the Tg
- Frequently considered a measure of the cure of the material
- Ramp rate of 3°C/min

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Thermal

Thermomechanical Analysis(TMA)

- Measures finite changes in the height of the sample related to the sample temperature

Sample Requirements

- Rigid Board & Multilayer Laminates or PWB's – optimal size 2" x 2"
  - Minimum size –8mm x 8mm if sample has been cut to a good clean edge
  - 15mm x 15mm if JSL must remove any rough edges
- Laminate samples must be clad
- PWB Samples
  - No Holes, No Solder

Time to Delamination

- Measure of the time at which separation of the internal layers of a sample occurs at a temperature of interest.
- Indication of the materials ability to withstand processing temperatures
- Can be measured at any critical temperature
  - T-260
  - T-288
  - T-300
  - T-XXX

Test Standards: IPC TM-650 Method 2.424.1

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Thermal

Thermogravimetric Analysis (TGA)

- Utilizes a microbalance to measure finite changes in weight as a sample is heated at a controlled rate

Sample Requirements

- Rigid Board & Multilayer Laminates or PWB's – optimal size 2" x 2"
  - Minimum size –2mm x 2mm if sample has been cut to a good clean edge
  - 15mm x 15mm if JSL must remove any rough edges
- Laminate samples must free from all external and internal copper
  - External copper can be etched at JSL
- PWB Samples
  - No Holes, No Solder, Minimal internal copper

Decomposition Temperature (Td)

- The temperatures at which a sample loses 2% and 5% of its initial weight while heated at the method defined ramp rate
- Test Standard: IPC TM-650 Method 2.4.24.6 – 10°C/Minute
- Test Standard: UL 746A Section 45 – 20°C/Minute

Weight Loss

- The percent of weight lost when a sample is held isothermally a defined temperature for a defined time

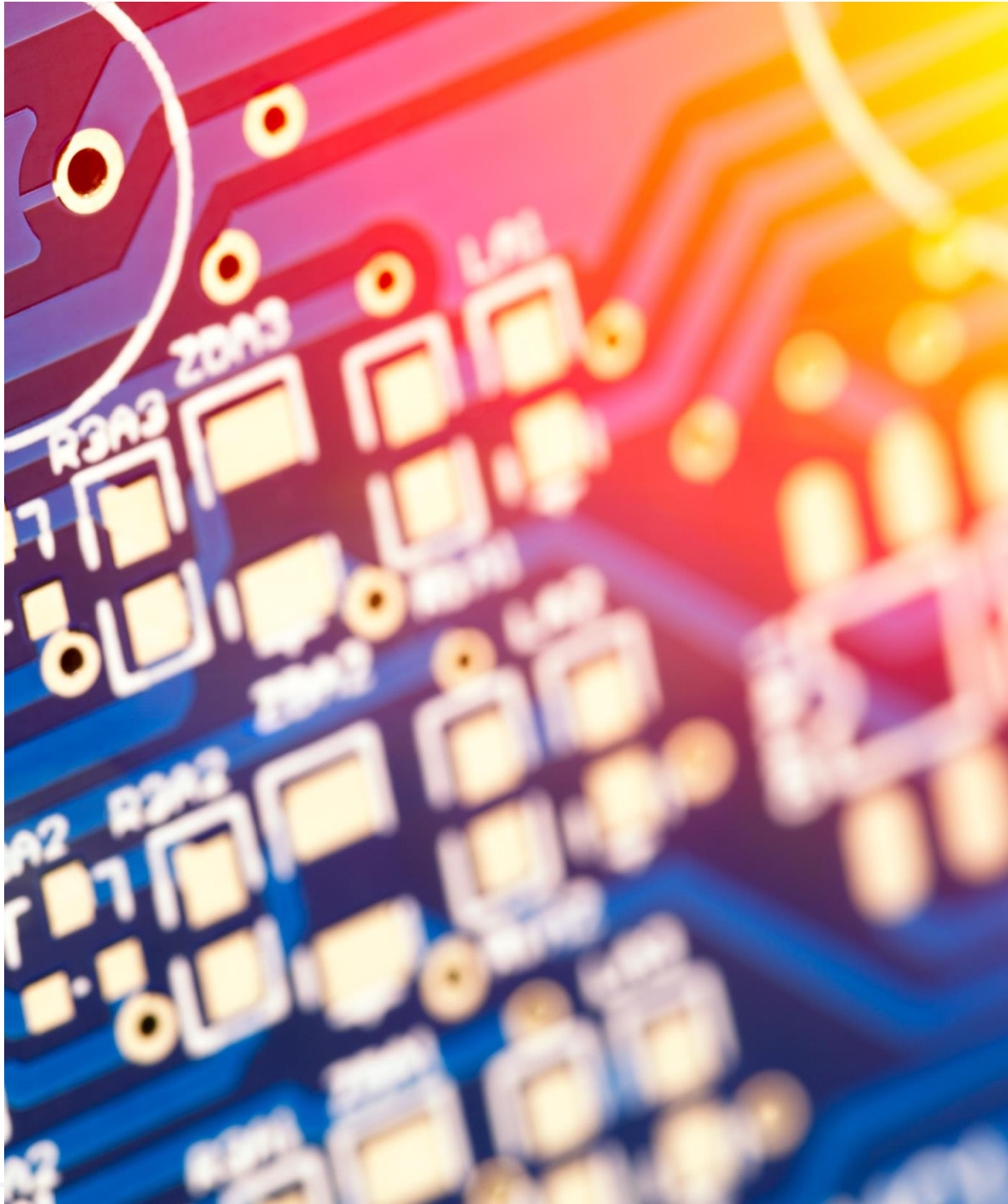
The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Chemical

Chemical

- Samples must be submitted via Isola Technical Services Representative
- Samples must be accompanied by Isola JSL a Lab Request Form (LRF)
- Samples must be appropriately identified
- Samples must meet the specific requirements for requested test as defined within this document

Results: All results will be communicated by JSL to the Isola Technical Services Representative



Chemical

Water Absorption

- Evaluates the resistance of dielectric materials to water
- Results reported as the percent increase in weight

Sample Requirements

- Three (3) Laminate Samples: 4” x 4“
- Free from all internal/external copper
- External copper can be etched at the JSL

Sample Conditioning

- Condition D24/23 –After immersion in 23°C water for 24 hours

Test Standards: PC-TM-650 Method 2.6.2.1

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Chemical

Methylene Chloride Absorption

- Evaluates the resistance of dielectric materials to methylene chloride
- Results reported as the percent increase in weight

Sample Requirements

- Three (3) Laminate Samples: 4” x 4“
- Free from all internal/external copper
- External copper can be etched at the JSL

Sample Conditioning

- Condition D24/23 –After immersion in 23°C water for 24 hours

Test Standards: IPC TM-650 Method 2.3.4.2

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Chemical

Flammability

- Measures a material's ability to self-extinguish
- Materials tested to UL 94 for flammability V0

Sample Requirements

- Ten (10) Laminate Samples: 0.5" x 5.0"
- Free from all internal/external copper
- External copper can be etched at the JSL

Sample Conditioning

- Condition D24/23 –After immersion in 23°C water for 24 hours

Test Standards: IPC TM-650 Method 2.6.16

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Chemical

Pressure Cooker

- Rapid evaluation of the laminate glass to resin integrity
- Test can only be performed on 1/16” material

Sample Requirements

- Five (5) Laminate Samples: 4” x 4“ x 1/16”
- Free from all internal/external copper
- External copper can be etched at the JSL

Sample Conditioning

- Condition D24/23 –After immersion in 23°C water for 24 hours

Test Standards: UL 94

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Chemical

Solder Float

- Evaluates the time to delamination of copper clad materials when exposed to 288°C (550° F) solder

Sample Requirements

- Three (3) Clad Laminate Samples: 2” x 2”
- Free from all internal copper
- External copper must be intact

Sample Conditioning

- Condition D24/23 –After immersion in 23°C water for 24 hours

Test Standards: Isola defined test

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Chemical

Solderability

- Evaluates a sample's ability to accept solder components

Sample Requirements

- Two (2) Clad Laminate Samples: 3" x 5"
- Free from all internal copper
- External copper must be intact

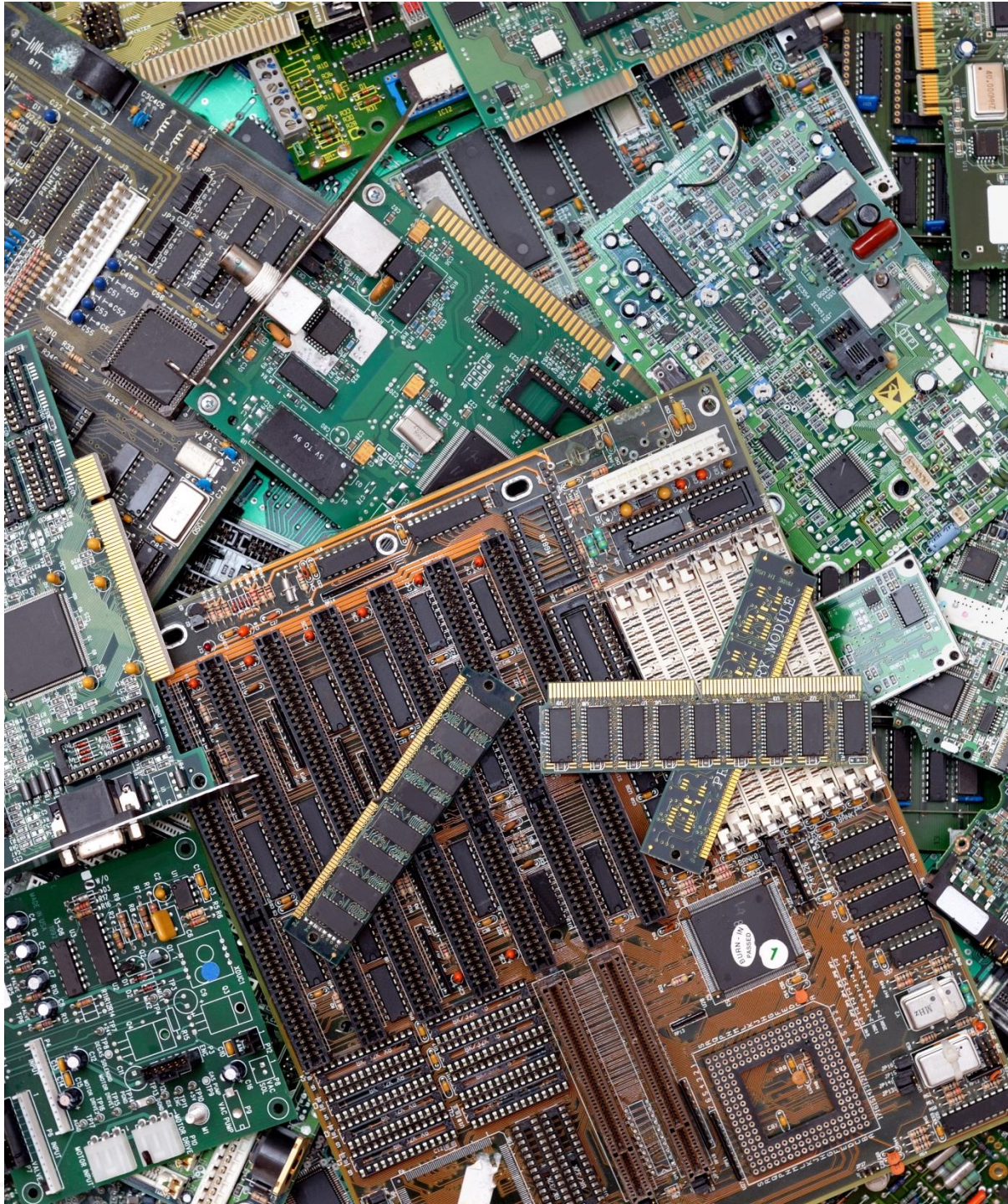
Test Standards: IPC-EIA/JEDEC J-STD-002B

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Physical

Physical

- Retain Resin
- Ash Content
- Flexural Strength
- Tensile Strength
- Dimensional Stability
- Peel Strength
- Construction



Physical

Retain Resin

- Percent of the total weight sample which is resin
- Measured by comparing the weight loss after a burn off at 550°C to the original weight as a percentage

Ash Content

- Percent of the total weight sample which is not resin
- Measured by comparing the weight remaining after a burn off at 550°C to the original weight as a percentage

Sample Requirements – Laminates

- One (1) Laminate Sample: 2” x 2”
- Free from all internal/external copper
- External copper can be etched at the JSL

Sample Requirements – Prepregs

- Thin samples with low resin content, ie 1080 or 106 glass styles
  - Five (5) 2” x 2” samples
- All other prepregs
  - One (1) 2” x 2” sample

Test Standard

- IPC TM-650 Method 2.3.16

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Physical

Retain Resin

- Percent of the total weight sample which is resin
- Measured by comparing the weight loss after a burn off at 550°C to the original weight as a percentage

Sample Requirements - Laminates

- One (1) Laminate Sample: 2” x 2”
- Free from all internal/external copper
- External copper can be etched at the JSL

Ash Content

- Percent of the total weight sample which is not resin
- Measured by comparing the weight remaining after a burn off at 550°C to the original weight as a percentage

Sample Requirements - Prepregs

- Thin samples with low resin content, ie 1080 or 106 glass styles
  - Five (5) 2” x 2” samples
- All other prepregs
  - One (1) 2” x 2” sample

Test Standards: IPC TM-650 Method 2.3.16

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Physical

Flexural Strength

- Determines the flexural strength of laminates by applying a specific load to a specific size and shaped specimen
- Results depend upon load force and sample size and shape
- Test can be completed at room or a defined elevated temperature

Sample Requirements

- Sample requirements vary
- Refer to Table I in IPC-TM-650 number 2.4.4

Sample Conditioning

- Condition D24/23 –After immersion in 23°C water for 24 hours

Test Standards: IPC-TM-650 2.4.4

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Physical

Dimensional Stability

- Determines the dimensional stability of glass reinforced, copper clad, thin laminates intended for use in multilayer printed wiring boards as they undergo etching and drying processes

Sample Requirements

- Three (3) Laminate Samples: 12” x 12”
- Any thickness
- Free from all internal copper
- External copper must be intact

Sample Conditioning

- Condition E4/105 – After conditioning at 105°C for 4 hours
- Condition E2/150 – After conditioning at 150°C for 2 hours

Test Standards: IPC TM-650 Method 2.4.39

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Physical

Peel Strength – At Elevated temperatures

- Measures the strength required to pull apart a bonded surface.
- Clad laminate samples are etched leaving strips of copper which are pulled from the laminate surface.
- Result is dependant on the sample thickness and speed of pulling force.
- Three test methods available:
  - At Elevated Temperature
  - At Process Solutions
  - After Thermal Stress

At Process Solutions & After Thermal Stress

- Sample Requirements
  - Four (4) Laminate Samples: 2.5” x 2.5”
  - Any thickness
  - External copper must be intact, strips will be etched by JSL
- Test Standard
  - IPC TM-650 Method 2.4.13.1

At Elevated Temperature

- Sample Requirements
  - Four (4) Laminate Samples: 2.5” x 2.5”
  - Any thickness
  - External copper must be intact, strips will be etched by JSL
- Test Standard
  - IPC-TM-650 2.4.8

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Physical

Construction

- Determines thread count of woven glass fabric of prepreg and the number of glass fabric of laminates and printed wiring boards

Sample Requirements

- Laminate Samples: 2” x 2”
- Printed Wiring Board Samples: 2” x 2”
- Prepreg Samples: 2” x 2”

Number of Plies of Glass Fabric in Laminate and Printed Wiring Boards

- Resin is removed from sample by muffle furnace burn off at 550°C
- Layers of glass fiber are separated and counted

Determination of Tread Count

- Evaluation of glass under Ginger thread counter, or,
- Manual count of threads

Test Standards: IPC TM-650 Method 2.1.7

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Specialty

Specialty

- Profilometer
- FTIR
- Microsection
- Reflow
- Scanning Electron Microscope
- High Performance Liquid Chromatography
- Gel Permeation Chromatography

Specialty

Fourier Transform Infrared Spectroscopy (FTIR)

- Analyzes the change in a beam of infrared light which has been focused onto a sample
- Uses the amount of energy absorbed by or transmitted through a sample over a frequency range to produce an IR Spectrum
- Uses extensive libraries to identify or characterize organic materials and contaminants

Sample Requirements

- Raw Materials –Solid or Liquid Form ~1 gram
- Prepregs – 1” x 1”
- Printed Wiring Boards –1” x 1”
- Laminates – 1” x 1”
  - Samples can be etched at the JSL

Reporting Limitations

- FTIR Spectrum of standard materials will not be released

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Specialty

Microsection

- Evaluation of cross-sections of laminate and printed wiring board samples in a wide variety of configurations from surface to individual glass bundles
- Thread count of glass weave can be determined
- Microscope has magnification of 20 to 1000 X
- Potting of samples allows precision polishing and grinding
  - X – Axis
  - Y – Axis
  - Z – Axis
- Sample conditioning available
  - As received
  - Thermal Stressed
  - After reflow

Sample Limitation

- Samples for potting
  - Minimum: 0.5” x 0.5”
  - Maximum: 1.5” x 1”
- Z- Axis grind samples
  - Maximum: 6” x 6”

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Specialty

Reflow Oven

- Evaluation of the thermal integrity of circuit boards under repeated high heat conditions
- Same type of oven that is used in the industry to solder components to circuit boards
- Seven convection heating zones capable of running JEDEC reflow standards

Sample Requirements

- Printed Wiring Boards or laminates
  - Minimum: 2.0” x 2.0”
  - Maximum: 18” x 24”

Mimic customer profiles

- Lead or lead-free temperature profiles
- Accurate reproduction of profiles based on historical data of thermo-coupled boards
- Number of passes through oven defined by requestor

Evaluation of Samples

- Boards are visually inspected for delamination after every pass
- Cross-sections of failed or potential failed areas determine location of failure

Test Standards: IPC TM-650 Method 2.6.27

The above minimum sample requirements are enough to run a single test. Please be aware that issues can arise that require samples to be retested. It is always recommended that enough sample be submitted to allow for 2 to 3 tests if possible.

Specialty

Scanning Electron Microscopy (SEM)

- Evaluation of the thermal integrity of circuit boards under repeated high heat conditions
- Same type of oven that is used in the industry to solder components to circuit boards
- Seven convection heating zones capable of running JEDEC reflow standards

Energy Dispersive X-ray Spectroscopy (EDX)

- Identifies the elements on the scanned surface of the sample.
- Identifies the composition of the sample and inorganic contaminants

Sample Requirements

- Raw materials – Solid or powder form
- Prepregs
- Laminates – minimum size 1” x 1”
- Printed wiring boards – minimum size 1” x 1”

Specialty

High Performance Liquid Chromatography and Gel Permeation Chromatography (HPLC & GPC)

- HPLC: Separate the mixture of compounds to identify or quantify the individual component.
- GPC: Separate the mixture of compound to determine the molecular weight distribution or impurities.

Sample Requirements

- Sample in powder or liquid form around 1gram.

Sample Preparation & Conditioning

Sample Preparation

- Ability to accurately cut required test specimens from larger samples
  - Programmable Router
  - Diamond Saw
  - Dremel
  - Hand Shear
  - Drill Press
  - Belt Sander

Sample Conditioning

- Ability to meet test method conditioning requirements
  - 8 High Temperature Ovens
  - 3 Programmable Temperature and Humidity Chambers
  - Desiccators
  - Immersion in DI Water at Controlled Temperatures

Thank You

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