NIC COMPONENTS CORP.

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MLCC - Ceramic Chip Capacitors / Failure Mode Study

Potential Failure Causes, Accelerators, Behavior

Cause	Sources	Indications	Behavior	Remedy
Electrical Overstress; AC current or Pulse current	Poor design choice or inappropriate component selection	▪ Self heating (I^2ESR), ▪ Increased leakage current ▪ Discoloration over time ▪ In severe cases melting of solder alloy and component displacement,	Decreased IR (increased LC) typically leading to short or open condition	Alternate lower loss dielectric MLCC or film capacitor
Electrical Overstress; Voltage	Poor design choice or inappropriate component selection	▪ Micro-cracking within ceramic ▪ Dielectric puncture ▪ External flashover	Decreased IR (increased LC) typically leading to short or open condition	Higher voltage rated component or alternate capacitor type
Mechanical Stress	▪ Component test or tape operations ▪ Component placement ▪ Centering jaws ▪ Post reflow PCB Flexure or Shock ▪ PCB depanelization ▪ Impact damage to PCB	▪ Damage to MLCC body ▪ Cracking observed in ceramic	Immediate or latent IR failure; increasing LC or erratic LC leading to short	▪ Machine set-up, maintenance and operator training ▪ Placement pressure ▪ PCB Routing ▪ Flexible soft terminal MLCCs
Thermal Stress	▪ Hand Soldering ▪ PCB Rework ▪ Wave – flow soldering ▪ Forced cooling – quenching ▪ Subsequent PCB soldering processes	▪ Cracking observed in ceramic ▪ Leaching of terminal metallization	Immediate or latent IR failure; increasing LC or erratic LC leading to short	▪ Training and control ▪ Reduce heating – cooling rates
Intrinsic Defect	▪ Contamination in ceramic ▪ Improper pressing or sintering	▪ High porosity or voids in ceramic ▪ Knit-line voiding or cracking ▪ Firing cracks	▪ Immediate or latent LC; increasing LC leading to short ▪ Early HALT test failure	Material control and clean room particle control Pressing and Sintering controls
Ionic or metal conduction	PC residues, flux residues, water type, saponifier, assembly aids, sealers or coatings & external sources	Electrochemical migration (dendrite growth) or corrosion	Decreased IR (increased LC) over time and operating temp & RH	IQC, alternate materials, cleaning upgrade and alternate sealers

ISO 9001:2008 REGISTERED