Guidelines for Handling PolyStrata® Components

This document is intended to provide guidelines on how to handle, store, and assemble PolyStrata® components. PolyStrata® parts are high performance components that can be handled and assembled using standard microelectronics industry methods.

Part Finish

- PolyStrata® components are constructed from high purity electroplated copper, but various surface finishes can be applied.
- Bare Copper (BCU): No surface finish applied. Compatible with solder surface mount processes.
- Direct Immersion Gold (DIG). Minimum of 100nm of immersion gold will be applied. Compatible with solder and epoxy surface mount processes, and with gold wire bonding.

General Handling and Storage

Polystrata® components are not ESD sensitive.

Handling

- PolyStrata® components are solid state RF devices of copper construction utilizing air as a dielectric. As such most sensitive RF cavities and surfaces are on the interior of the component surrounded by a robust copper ground shell. This makes the components robust to handling as scratches or other surface defects on the exterior of the part will not affect part performance.
- Care should be taken to avoid bending/deforming parts, as a ductile material, copper parts will deform under excessive force, which may detune interior structures.
- While every effort is made to design parts to minimize exposure of sensitive features to potential handling damage, some designs and interconnect strategies necessitate these features at the extents of the part.
- Handling with vacuum pick tool is recommended. The top of components will contain topology and openings that could cause vacuum pick up to fail. Specific areas will be provided to facilitate vacuum pick-up. Limit placement force to <400grams.

Storage

- Inhibiting corrosion is the primary objective of storage conditions.
- DIG finished parts should not be exposed to sulfur or chloride containing items/substances. Do not store with desiccants in same bag as this can lead to tarnish. If desiccant is used, bag & seal parts first then use secondary bag with desiccant.

In-Process Storage

- BCU finished parts should be handled as MSL5 parts per J-STD-033.
- DIG finished parts should be handled as MSL2a parts per J-STD-033.
- Note: No baking is required when these are exposed to environments outside the permitted levels. Instead, a cleaning step may be required. See Cleaning section below.
- Please see assembly process notes below to understand concerns related to corrosion for each scenario.

Long Term Storage

- PolyStrata® parts have no risk of popcorning or delamination as no plastic molding or lamination is used in its construction. As such parts are rated as MSL1.
- PolyStrata® components are solid-state RF devices, as such long-term storage should comply with JEDEC JEP160 guidance for devices with sensitivity to oxygen.

FOD Sensitivity

PolyStrata® parts have 250-500um openings to interior RF cavities. A potential failure mechanism is that a conductive or non-conductive particle gets stuck inside the RF structure and detunes or shorts the device. Typical cleanliness and FOD control procedures are sufficient to ensure good functionality until part is enclosed in a dust proof enclosure.

Assembly Processes

It is recommended, but not required, to use N_2 or inert gas environment during elevated temperature processes like epoxy cures or solder reflow.

Solder Reflow

- PolyStrata® components are compatible with all solder reflow profiles described in J-STD-020.
- DIG finished components are protected from corrosion that may interfere with solder reflow. These parts have passed MSL1 testing.
- BCU finished components will form copper oxides on surfaces over time when exposed to air. This could interfere with successful solder operations. If proper storage precautions are followed as described above, the typical fluxing action during reflow is enough to clean and prepare the surface for good solder

wetting. These oxides are visible and turn the copper surface purple. If this is observed a spray or dip clean with acetic acid followed by an isopropyl rinse and a thorough drying can be used to remove the oxide.

- Note: As the entire component body is metal, solder will wick across these surfaces. This does not indicate a failure but should be minimized. Components intended for solder reflow are specifically designed for this process and include dielectric features to manage solder starvation of joints as well as recommended solder stencil patterns and assume a stencil thickness of 2mils, unless stated otherwise.
- No-Clean flux is recommended due to the potential for FOD ingress into the RF cavities during cleaning.

Epoxy

- BCU finished parts are not recommended for silver filled electrically conductive epoxy attach processes. This is due to in compatibility with the copper surface of most available epoxies.
- DIG finished parts are preferred for silver filled electrically conductive epoxies.

Die Attach

- Recommend use of Silver Sintered Nano Particle paste for die attach of bare die to PolyStrata® components. Consult material vendor to ensure compatibility with surface finishes.

Wire Bonding

- DIG finished parts are compatible with gold ribbon, wire and ball bonding processes. Recommend Argon Plasma cleaning immediately prior to wire bonding. Do not use oxygen plasma. Ensure parts are sufficiently secured during bonding on heated stage. Consider part shape and bottom surface geometry when planning securing method.
- Parts will remain wire bondable after multiple thermal excursions through solder reflow (6min @ 260C), or in ambient environment, with bond strengths above MIL-STD-883 pull test requirements. (Argon plasma clean was used prior to bonding).

Cleaning

- PolyStrata® parts are compatible with a wide range of solvents such as isopropyl, acetic acid, hydrofluoric acid, and various flux cleaners.
- Wash temperatures up to 70C is acceptable.
- Recommend a final isopropyl rinse and dry bake in nitrogen environment to ensure no remaining chemistry or moisture internal to part after cleaning process.
- Ultrasonic cleaning may cause fatigue in the small, suspended structure internal to parts and lead permanent damage to RF structures. (Device sensitivity can be determined on a per part basis through FEA)
- Special attention to FOD concerns described earlier should be made during cleaning. The presence of excessive loose conductive or non-conductive particles (~50um-250um size), in the solutions or on the devices being cleaned, could result in FOD ingress into the interior of the PolyStrata® part, becoming stuck. This could detune or cause a short in the part.

Typical Environmental Test Results

Test	Method	Parameters	Result
Moisture Sensitivity	IPC / J-STD-020E, MSL1	168 hrs., 85C/85RH, 3x solder reflow	PASS
Accelerated Life	JESD22-A118B	130°C, 85% RH, 96 hrs.	PASS
Thermal Cycling	JESD22-A104E, Cond. B	-55°C to 125°C, 700 cycles	PASS
Mechanical Shock	JESD22-B104C, Cond. B	1500g, 0.5 ms, 6 orientations, 5 shocks/orientation, 30 shocks total	PASS
Vibration	JESD22-B103B.01, Cond. 1	20G, 20 - 2000 Hz, 4 sweeps/axis, 4 min./sweep	PASS