Wirebonding to PolyStrata
Application Note

1. Overview

PolyStrata components are commonly used in high-frequency and millimeter-wave assemblies where low-loss, broadband interconnects and compact three-dimensional structures are required. As these components are integrated onto target substrates and modules, reliable and repeatable wirebond transitions become a critical part of overall system performance. This application note provides guidance for assembly processes and expected post-attach performance when wirebonding to standard PolyStrata RF launches.

1.1. Available Models and Usage

The following models are available by request to assist with design:

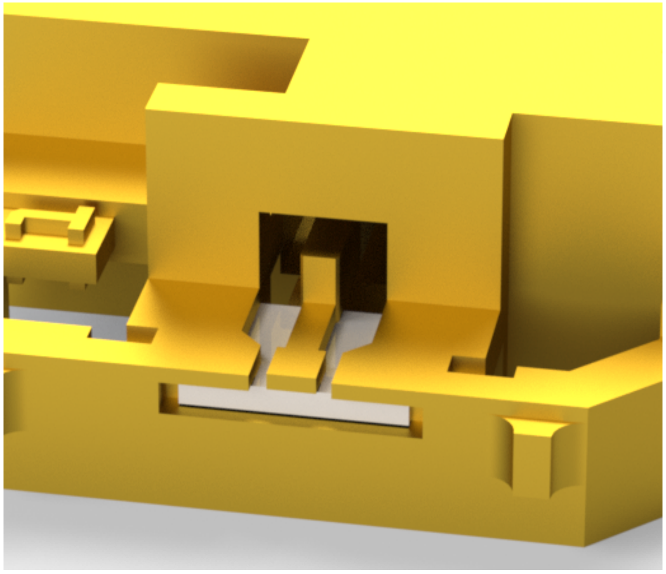
HFSS Models
- HFSS 3D-component of the PolyStrata launch for direct import
- Allows for simulating bond wires and target substrate

Recommended Wirebond Model
- Similar to the HFSS model above, but with example bonds and substrates included
- Includes example loop geometry and substrate designs for RO4350B, RT5880, and Alumina materials.

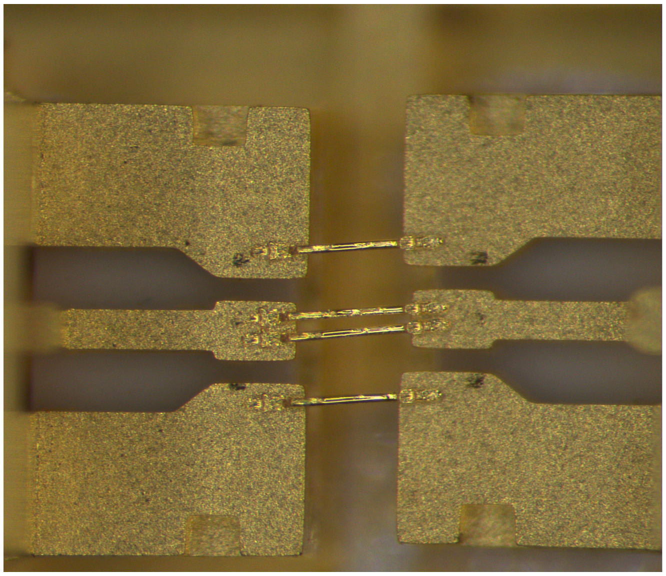
Mechanical Model
- 3D STEP model of the full PolyStrata part
- Used for mechanical form, fit, and function analysis in full system

Figure 1: Wirebond Launch Geometry

(a) 3D Render of GSG Launch



(b) Top View - Bonded



2. Wirebond Attach Process

This section outlines the recommended assembly practices for attaching wirebonds to PolyStrata components. Although the PolyStrata bond pads themselves are fabricated with gold surfaces optimized for ultrasonic bonding, proper surface preparation and controlled bonding parameters on the customer side are essential for achieving consistent mechanical strength and RF performance.

2.1. Overview of Wirebond Attach Process

1. Argon plasma cleaning of both the PolyStrata and target component's wirebond interface
2. Mechanical alignment and optical verification of alignment
3. Gold wirebond attach
4. Post-bond inspection, including optical inspection, pull tests, and electrical verification.

2.2. Surface Preparation and Cleaning

Gold to gold wirebonding is sensitive to:
- Organic films from fingerprints, flux residue, etc.
- Oxide films on bond surface
- Moisture residue
- Particulates or other foreign debris

Even though PolyStrata gold surfaces do not oxidize appreciably, foreign materials can inhibit weld formation and dramatically reduce bond pull strength. To mitigate this, argon plasma treatment is the preferred method for removing light organic contamination without chemically altering the PolyStrata surface.

Argon Plasma Clean Steps

The below table outlines the recommended "recipe" for cleaning PolyStrata components prior to bonding.

Cleaning Steps					
Step Num.	**Base Pressure (mT)**	**RF Power (W)**	**Argon (sccm)**	**Oxygen (sccm)**	**Time (s)**
1	225	400	0	210	240
2	60	300	25	0	90
3	60	200	25	0	600

2.3. Bonding Method Recommendations

PolyStrata components are fully compatible with standard gold wedge or gold ball bonding methods. However, wedge is highly recommended due to better control of the wire loop parameters and its effect on RF performance.

Wire Type

- Material: Gold (Au), thermosonic compatible
- Diameter: 25.4um round recommended

Bonding Method

Wedge bonding is highly preferred for PolyStrata components due to:

- Lower bond loop height
- Better control of wire shape
- Lower inductance

Ball bonding can be used, but degradation in return loss and repeatability of the RF match is expected.

Ultrasonic Bond Parameters

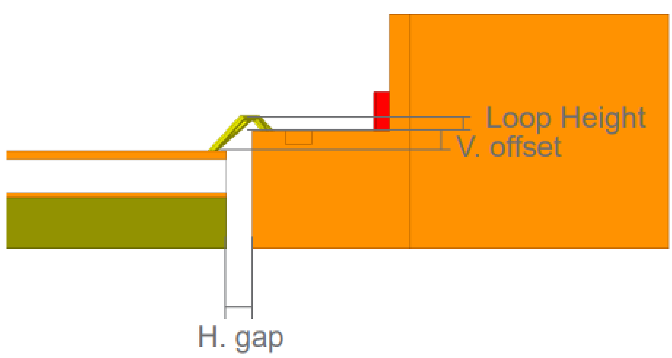
- Bond force: 20-40 grams
- Bond time: 10-20 ms
- Stage temperature: 100-150°C

Loop Control

Loop parameters for wirebonding include horizontal gap, vertical offset between surfaces, and loop height. Generally, these parameters should be kept as small as possible to ensure a wideband RF match. However, consideration must be made for manufacturability. The table below provides a reference for maximum tolerable loop parameters for a 20dB return loss (typ.) match to a 5mil alumina substrate.

Maximum Loop Parameters by Frequency			
Max. Frequency	**Horizontal Gap (um)**	**Vertical Offset (um)**	**Loop Height (um)**
85 GHz	≤50	≤100	≤50
67 GHz	≤75	≤100	≤50
50 GHz	≤75	≤100	≤75
40 GHz	≤100	≤100	≤75
30 GHz	≤125	≤100	≤125

Figure 2: Loop Parameter Definition



2.4. Avoiding Common Issues

Below is a list of list of common problems associated with improper wirebond assembly processes and recommended fixes.

Common Issues		
Issue	**Cause**	**Recommend Fix**
Weak pull strength	Organic contamination	Increase Ar plasma cleaning time and/or improve post clean handling controls
Poor heel geometry	Incorrect ultrasonic power	Tune US settings and verify tool condition
Wire sag	Excessive loop height or heat	Reduce loop height and decrease stage heating during bonding
Non-wet or ”skipped” bonds	Hard Ni layer on target substrate	Reduce Ni thickness (ENIG/ENIPIG < 5 um)
Lift-off under shock and vibration	Incorrect bond force	Slightly increase bond force within spec

3. Wirebond Pull Tests and Performance

This section summarizes the mechanical and environmental performance of wirebonds attached to PolyStrata components. To isolate the effects of assembly handling, substrate design, and the PolyStrata surface condition, testing was conducted in two stages:

1. Pre-bond testing: Components were first subjected to thermal and environmental stresses to assess surface stability prior to wirebond attachment.

2. Post-bond testing: Following the initial environmental exposure, wirebonds were placed using the recommended thermosonic gold bonding process. Pull strength measurements were recorded to establish baseline mechanical performance.

This staged approach provides a clear view of how PolyStrata surfaces, wirebond interface quality, and environmental stresses interact, and demonstrates the robustness of the wirebond attach process across the assembly lifecycle.

Wirebond Test Summary	
Number of Samples for Each Test	16 components with 20 pulls performed per component
Pull Strength Pass/Fail Criteria	>3gf
Pull Angle	90°
Wirebond Launch Angle	45° from component surface
Pull Hook PN	HT-002-04121
Pre-bond Test Result	All samples passed
Post-bond Test Result	All samples passed

3.1. Pre-bond Testing

For this test group, parts were subjected to environmental stress prior to the wirebonding process.

Pre-bond Test Matrix				
Description	**Step 1**	**Step 2**	**Step 3**	**Step 4**
1 year storage profile	85°C / 60% RH 168 hours	Plasma Clean	Wirebond	Pull Test
Epoxy curing cycle	175°C – 4 hours in ambient humidity	Plasma Clean	Wirebond	Pull Test
SMT Reflow Cycle	260°C – 6 minutes	Plasma Clean	Wirebond	Pull Test
All test combined (sequential)	All pre-bond tests	Plasma Clean	Wirebond	Pull Test

3.2. Post-bond Testing

This test group was subjected to environmental stresses *after* the wirebonding process.

Post-bond Test Matrix				
Description	**Step 1**	**Step 2**	**Step 3**	**Step 4**
Epoxy curing cycle	Plasma Clean	Wirebond	175°C – 4 hours in ambient humidity	Pull Test
SMT Reflow Cycle	Plasma Clean	Wirebond	260°C – 6 minutes	Pull Test
High-Temperature Stress	Plasma Clean	Wirebond	300°C – 1hr in N_2	Pull Test