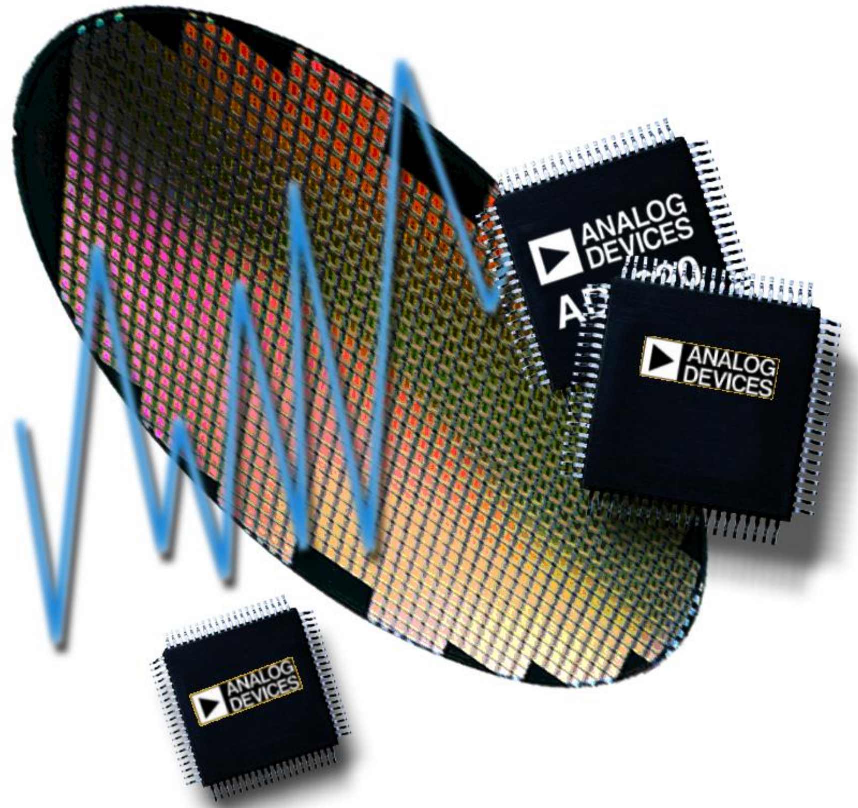


# Reliability Report

**Report Title:** ADRF5547 ESD Improvement Qualification

**Report Number:** 19198

**Revision:** A

**Date:** 14 March 2022

## Summary

This report documents the successful completion of the reliability qualification requirements for the release of the ADRF5547 ESD improved product in a 40-LFCSP package. The ADRF5547 is a two channel 5G RF Front End MCM.

### Table 1: ADRF5547 Product Characteristics

#### Die/Fab

| Die Id | Die 1 | Die 2 | Die 3 | Die 4 |
|---|---|---|---|---|
| Die Size (mm) | 2.11 x 1.89 | 1.27 x 1.07 | 2.11 x 1.89 | 1.27 x 1.07 |
| Wafer Fabrication Process | 0.18µm CMOS | 0.25µm GaAs pHEMT | 0.18µm CMOS | 0.25µm GaAs pHEMT |

#### Package/Assembly

| Package | 40-LFCSP |
|---|---|
| Body Size (mm) | 6.00 x 6.00 x 0.95 |
| Molding Compound | Epoxy |
| Die Attach | Conductive Epoxy |
| Moisture Sensitivity Level | 3 |
| Maximum Peak Reflow Temperature (°C) | 260 |

## Description / Results of Tests Performed

Tables 2 through 4 provide a description of the qualification tests conducted and the associated test results for products manufactured on the same technologies as described in Table 1. All devices were electrically tested before and after each stress. Any device that did not meet all electrical data sheet limits following stressing would be considered a valid (stress-attributable) failure unless there was conclusive evidence to indicate otherwise.

### Table 2: LFCSP Package Qualification Test Results

| Test Name | Specification | Conditions | Device | Lot # | Sample Size | Qty. Failures |
|---|---|---|---|---|---|---|
| High Temperature Storage Life (HTSL) | JESD22-A103 | 150°C 1000 Hours | ADRF5545 | Q14706.6 | 45 | 0 |
| Highly Accelerated Temperature and Humidity Stress Test (HAST) [1] | JESD22-A110 | 130°C/85%RH 33.3 psia Biased 96 Hours | ADRF5545 | Q14706.14 | 45 | 0 |
| | | | | Q14706.17 | 45 | 0 |
| | | | | Q14706.8 | 45 | 0 |
| Solder Heat Resistance (SHR) [1] | J-STD-020 | MSL-3 | ADRF5547 | Q14850.1 | 30 | 0 |
| | | | | Q16393.3 | 30 | 0 |
| Temperature Cycling (TCT) [1] | JESD22-A104 | -65°C/+150°C 1000 Cycles | ADRF5545 | Q14706.11 | 45 | 0 |
| | | | | Q14706.19 | 45 | 0 |
| | | | | Q14706.2 | 45 | 0 |
| Unbiased HAST (UHAST) [1] | JESD22-A118 | 130°C/85%RH 33.3 psia 96 Hours | ADRF5545 | Q14706.13 | 45 | 0 |
| | | | | Q14706.16 | 45 | 0 |
| | | | | Q14706.21 | 45 | 0 |

[1] These samples were subjected to preconditioning (per J-STD-020 Level 3) prior to the start of the stress test. Level 3 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

## Table 3: 0.18µm CMOS Fab Qualification Test Results

| Test Name | Specification | Conditions | Device | Lot # | Sample Size | Qty. Failures |
|---|---|---|---|---|---|---|
| Early Life Failure Rate (ELFR) | AEC-Q100-008 | $T_A$=125°C 48 Hours | HMC8038WLP4CE | Q12190.EL1 | 667 | 0 |
| | | | | Q12190.EL2 | 667 | 0 |
| | | | | Q12190.EL3 | 667 | 0 |
| High Temperature Operating Life (HTOL) | JESD22-A108 | 135°<Tj<150°C 2000 Hours | HMC8038WLP4CE | Q12190.HO1 | 77 | 0 |
| | | | | Q12190.HO2 | 77 | 0 |
| | | | | Q12190.HO3 | 77 | 0 |
| | | 150°C<Tj<175°C Biased 1000 Hours | HMC1119LP4ME | Q11569.13 | 77 | 0 |
| | | | | Q11569.8 | 77 | 0 |
| | | | HMC305SLP4E | Q12015.11 | 77 | 0 |
| | | | | Q12015.14 | 77 | 0 |
| | | | | Q12015.8 | 77 | 0 |
| | | | HMC7992LP3DE | Q12018.11 | 77 | 0 |
| | | | ADRF5545 | Q14706.1 | 45 | 0 |
| | | | | Q14706.3 | 45 | 0 |
| | | | | Q14706.9 | 45 | 0 |
| High Temperature Storage Life (HTSL) | JESD22-A103 | 150°C 1000 Hours | ADRF5130 | Q12145.6 | 77 | 0 |
| | | | ADRF5160 | Q12144.11 | 77 | 0 |
| | | | | Q12144.5 | 77 | 0 |
| | | | | Q12144.8 | 77 | 0 |
| | | | HMC1119LP4ME | Q11569.7 | 77 | 0 |
| | | | HMC7992LP3DE | Q12018.3 | 77 | 0 |
| Highly Accelerated Temperature and Humidity Stress Test (HAST) [1] | JESD22-A110 | 130°C/85%RH 33.3 psia Biased 96 Hours | HMC1119LP4ME | Q11569.11 | 77 | 0 |
| | | | HMC305SLP4E | Q12015.13 | 77 | 0 |
| | | | | Q12015.9 | 77 | 0 |
| | | | HMC540SLP3E | Q12017.7 | 77 | 0 |
| | | | | Q12017.9 | 77 | 0 |
| | | | HMC7992LP3DE | Q12018.1 | 77 | 0 |
| | | | | Q12018.10 | 77 | 0 |
| | | | HMC8038LP4CE | Q11991.10 | 77 | 0 |
| | | | | Q11991.9 | 77 | 0 |
| | | | ADRF5545 | Q14706.14 | 45 | 0 |
| | | | | Q14706.17 | 45 | 0 |
| | | | | Q14706.8 | 45 | 0 |
| Low Temperature Operating Life (LTOL) [1] | JESD22-A108 | -40°C Biased 1000 Hours | ADRF5020 | Q12227.3 | 77 | 0 |
| | | | ADRF5022 | Q12229.4 | 77 | 0 |
| | | | ADRF5041 | Q12234.4 | 77 | 0 |

[1] These samples were subjected to preconditioning (per J-STD-020 Level 3) prior to the start of the stress test. Level 3 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

## Table 4: 0.25um GaAs PHEMT Fab Qualification Test Results

| Test Name | Specification | Conditions | Device | Lot # | Sample Size | Qty. Failures |
|---|---|---|---|---|---|---|
| High Temperature Operating Life (HTOL) | JESD22-A108 | 150°C<Tj<175°C Biased 1000 Hours | ADRF5545 | Q14706.1 | 45 | 0 |
| | | | | Q14706.3 | 45 | 0 |
| | | | | Q14706.9 | 45 | 0 |
| Highly Accelerated Temperature and Humidity Stress Test (HAST) [1] | JESD22-A110 | 130°C/85%RH 33.3 psia Biased 96 Hours | ADRF5545 | Q14706.14 | 45 | 0 |
| | | | | Q14706.17 | 45 | 0 |
| | | | | Q14706.8 | 45 | 0 |
| | | | ADRF5539 | Q14520.1 | 77 | 0 |
| | | | | Q14520.6 | 77 | 0 |
| | | | ADRF5540 | Q14515.2 | 77 | 0 |

[1] These samples were subjected to preconditioning (per J-STD-020 Level 3) prior to the start of the stress test. Level 3 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

Samples of the many devices manufactured with these package and process technologies are continuously undergoing reliability evaluation as part of the ADI Reliability Monitor Program. Additional qualification data is available on Analog Devices' web site.

## ESD Test Results

The results of Human Body Model (HBM) and Field-Induced Charged Device Model (FICDM) ESD testing are summarized in Table 5. ADI measures ESD results using stringent test procedures based on the specifications listed. Any comparison with another supplier's results should ensure that the same ESD test procedures have been used. For further details, please see the EOS/ESD chapter of the ADI Reliability Handbook (available via the 'Quality and Reliability' link on Analog Devices' web site).

**Table 5: ADRF5547 ESD Test Results**

| ESD Model | Package | ESD Test Spec | RC Network | Highest Pass Level | First Fail Level | Class |
|---|---|---|---|---|---|---|
| FICDM | 40-LFCSP | JS-002 | 1Ω, Cpkg | ±500V | ±750V | C2a |
| HBM | 40-LFCSP | JS-001 | 1.5kΩ, 100pF | ±1000V | ±1250V | 1C |

## Latch-Up Test Results

The ADRF5547 is built on dielectrically isolated wafer fabrication processes that are not susceptible to the latch-up phenomenon.

## Approvals

Reliability Engineer: Adam Shaw

## Additional Information

Data sheets and other additional information are available on Analog Devices' web site