



GR551x Reliability Test Report

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Preface

Purpose

This document introduces GR551x reliability qualification results, providing users with product reliability performance and reference standard, including device level and package level reliability test results.

Audience

This document is intended for:

- GR551x user
- GR551x developer
- Bluetooth product engineer
- Bluetooth system designer

Release Notes

This document is the second release of *GR551x Reliability Test Report*, corresponding to GR551x SoC series.

Revision History

| Version | Date | Description |
|---------|------------|--|
| 1.0 | 2020-02-19 | Initial release |
| 1.1 | 2023-04-20 | <ul style="list-style-type: none">• Updated a test point (1000h) to the HTOL test and the test passed.• Updated a test point (1000 h) to the HTST test and the test passed. |

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1 Overview

The Goodix GR551x family is a single-mode, low-power Bluetooth 5.1 System-on-Chip (SoC). This report aims to provide a detailed description of the methods used to verify that the product under test meets Goodix stringent quality and reliability requirements. Each test is described and the results are presented. The evaluations done for this qualification are included in the following sections.

2 Reliability Test Items and Results

2.1 Electrostatic Discharge: Human Body Model (HBM)

Table 2-1 Human body model test requirements

| | |
|--------------------|------------------------------|
| Reference Standard | ESDA/JEDEC JS-001-2017 |
| Test Parameter | I-V curve / Function test |
| Model | Human Body Model |
| Test Conditions | RP=1.5 k Ω , C=100 pF |
| Sample Size | 3 ea. per mode |
| Criteria | Pass / Fail = 0 / 1 |

Table 2-2 Test results

| HBM Sensitivity | Class | All Pin Combination |
|-----------------|-------|---|
| +/-2000 V | 2 | Power to power (+/-) IO to power (+/-) IO to IO (+/-) |

2.2 Electrostatic Discharge: Charged Device Model (CDM)

Table 2-3 Charged device model test requirements

| | |
|--------------------|---------------------------|
| Reference Standard | ESDA/JEDEC JS-002-2014 |
| Test Parameter | I-V curve / Function test |
| Model | Charged Device Model |
| Test Conditions | RP=0 Ω , C=0 pF |
| Sample Size | 3 ea. per mode |
| Criteria | Pass / Fail = 0 / 1 |

Table 2-4 Test results

| CDM Sensitivity | Class | Pin Combination |
|-----------------|-------|--------------------------------|
| +/-500 V | C2a | All pin (+/-) to common ground |

2.3 Latch Up (LU)

Table 2-5 Latch up test requirements

| | |
|--------------------|---------------------------|
| Reference Standard | JESD-78D |
| Test Parameter | I-V curve / Function test |

| | |
|-----------------|----------------------------------|
| Model | Current / Voltage trigger |
| Test Conditions | +/-200 mA trigger / over voltage |
| Sample Size | 3 ea. per mode |
| Criteria | Pass / Fail = 0 / 1 |

Table 2-6 Test results

| Test Result | Class |
|-------------------|-------|
| I trigger | I |
| Over voltage test | |

2.4 High Temperature Operating Life Test (HTOL)

Table 2-7 High temperature operating life test requirements

| | |
|--------------------|---|
| Reference Standard | JESD22-A108D |
| Test Parameter | Function test |
| Model | Arrhenius model for temperature acceleration factor and voltage $AF = \exp [\beta * (V_{stress} - V_{op})] * \exp \left[\frac{E_a}{K} \left(\frac{1}{T_{op}} - \frac{1}{T_{stress}} \right) \right]$ |
| Test Conditions | 125°C, 1000 hrs., VCCmax |
| Sample Size | 77 |
| Criteria | Pass / Fail = 0 / 1 |

Table 2-8 Test results

| Time Point | 168 hrs. | 500 hrs. | 1000 hrs. |
|------------|----------|----------|-----------|
| Result | Pass | Pass | Pass |

2.5 Pre-Conditioning (Pre-Con)

Table 2-9 Pre-conditioning test requirements

| | |
|--------------------|---------------------------------------|
| Reference Standard | JESD22-A113F |
| Test Parameter | Function test / Appearance inspection |
| Model | None |
| Test Conditions | 3x reflow, 30°C/60% RH, 192 hrs. |
| Sample Size | 308 |
| Criteria | Pass / Fail = 0 / 1 |

Table 2-10 Test results

| | |
|------------|--------------|
| Time Point | Pre-con over |
| Result | Pass |

2.6 Temperature Cycling Test (TCT)

Table 2-11 Temperature cycling test requirements

| | |
|--------------------|---------------------------------------|
| Reference Standard | JESD22-A104E |
| Test Parameter | Function test / Appearance inspection |
| Model | None |
| Test Conditions | -65°C to 150°C, 500 cycles |
| Sample Size | 77 |
| Criteria | Pass / Fail=0 / 1 |

Table 2-12 Test results

| | |
|------------|------------|
| Time Point | 500 cycles |
| Result | Pass |

2.7 Highly Accelerated Temperature and Humidity Stress Test (HAST)

Table 2-13 Highly accelerated temperature and humidity stress test requirements

| | |
|--------------------|---------------------------------------|
| Reference Standard | JESD22-A110D |
| Test Parameter | Function test / Appearance inspection |
| Model | None |
| Test Conditions | Vccmax, 130°C, 85% RH, 96 hrs |
| Sample Size | 77 |
| Criteria | Pass / Fail=0 / 1 |

Table 2-14 Test results

| | |
|------------|---------|
| Time Point | 96 hrs. |
| Result | Pass |

2.8 High Temperature Storage Test (HTST)

Table 2-15 High temperature storage test requirements

| | |
|--------------------|---------------|
| Reference Standard | JESD22-A103C |
| Test Parameter | Function test |

| | |
|------------------------|-------------------|
| Model | None |
| Test Conditions | 150°C, 1000 hrs. |
| Sample Size | 77 |
| Criteria | Pass / Fail=0 / 1 |

Table 2-16 Test results

| | |
|-------------------|-----------|
| Time Point | 1000 hrs. |
| Result | Pass |

2.9 Unbiased Highly Accelerated Temperature and Humidity Stress Test (UHASt)

Table 2-17 Unbiased highly accelerated temperature and humidity stress test requirements

| | |
|---------------------------|---------------------------------------|
| Reference Standard | JESD22-A118 |
| Test Parameter | Function test / Appearance inspection |
| Model | None |
| Test Conditions | 130°C, 85% RH, 96 hrs |
| Sample Size | 77 |
| Criteria | Pass / Fail=0 / 1 |

Table 2-18 Test results

| | |
|-------------------|--------|
| Time Point | 96 hrs |
| Result | Pass |