

ESD Association Technical Report

*For the Protection of Electrostatic
Discharge Susceptible Items*

*Transmission Line Pulse
Round Robin*

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Transmission Line Pulse
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FOREWORD

This document was prepared by the ESD Association Working Group 5.5, Transmission Line Pulse. It is intended to provide data on the repeatability and reproducibility limits of the methods of SP5.5.1 TLP Standard Practice.

Recommendations from the ASTM E691 were incorporated in this round robin study. Those being: 5 test labs participated in data collection, test samples used were homogenous and identical, first set of identical structures tested to failure, a second set of structures were passed from lab to lab, all data was collected and analyzed to determine the reproducibility of the TLP test method.

This technical report round robin is intended to support the repeatability of the TLP standard practice method in order that it may be elevated to a standard test method.

The round robin subcommittee had the following active members:

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TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE	1
1.1. PURPOSE.....	1
1.2. TEST SITES	1
1.3. TEST STRUCTURES	1
1.4. OBJECTIVE	2
2.0 REFERENCES.....	2
3.0 DEFINITIONS	2
4.0 PROCEDURE	3
4.1 STRUCTURES TESTED TO FAILURE – DIODE STACKS	3
4.2 STRUCTURES NOT TESTED TO FAILURE – SOLZ STANDARD.....	3
5.0 RESULTS	3
5.1 DIODE STACKS	3
5.2 SHORT OPEN LOAD ZENER	4
5.3 OTHER STRUCTURES	6
6.0 DISCUSSION.....	7
6.1 TLP MEASUREMENTS	7
6.2 TEST STRUCTURE SELECTION FOR TLP.....	7
7.0 CONCLUSIONS.....	8
8.0 ACKNOWLEDGEMENTS.....	8

TABLES

TABLE 5.1.1: TEST PARAMETER PER SITE.....	3
TABLE 5.1.2: DIODE STACK FAILURE DATA	4
TABLE 5.1.3: DIODE STACK ON-STATE DATA.....	4
TABLE 5.2.1: SOLZ SUMMARY DATA.....	5
TABLE 5.2.2: SOLZ ZENER DATA.....	6

FIGURES

FIGURE 1: 3 SERIES FORWARD, 3 SERIES REVERS GAAS DIODES	1
FIGURE 2: BONDING DIAGRAM FOR DIODE STACKS	2
FIGURE 3: I-V DATA AND LEAKAGE DATA FOR RF21994420 DIODE STACK	10
FIGURE 4: I-V DATA AND LEAKAGE DATA FOR RF21994426 DIODE STACK	10
FIGURE 5: I-V DATA AND LEAKAGE DATA FOR DIODE STACKS, ONE OPERATOR.....	11
FIGURE 6: I-V DATA AND LEAKAGE DATA FOR DIODE STACK, REPEATABILITY ON ONE SYSTEM, ONE OPERATOR.....	11
FIGURE 7: OPEN, 2 NANOSECOND RISE TIME, I-V PLOT	12
FIGURE 8: OPEN, 10 NANOSECOND RISE TIME, I-V PLOT	12
FIGURE 9: SHORT, 2 NANOSECOND RISE TIME, I-V PLOT	13
FIGURE 10: SHORT, 10 NANOSECOND RISE TIME, I-V PLOT	13
FIGURE 11: 5 OHM LOAD, 2 NANOSECOND RISE TIME, I-V PLOT	14
FIGURE 12: 5 OHM LOAD, 10 NANOSECOND RISE TIME, I-V PLOT	14
FIGURE 13: ZENER DIODE, 2 NANOSECOND RISE TIME, I-V PLOT	15
FIGURE 14: ZENER DIODE, 10 NANOSECOND RISE TIME, I-V PLOT	15
FIGURE 15: PINS 12 - 11, TEST SITE 1, SLIGHT OR NO OSCILLATIONS	16
FIGURE 16: PINS 12 - 11, TEST SITE 2, DEVICE OSCILLATION.....	16
FIGURE 17: PINS 8 - 7, COLLECTOR – EMITTER BREAKDOWN.....	17
FIGURE 18: PINS 8 – 7, COLLECTOR – EMITTER BREAKDOWN, BUT NOT REPEATABLE I-V PLOT.....	17
FIGURE 19: PINS 8 – 7, COLLECTOR – EMITTER OSCILLATION, NO BREAKDOWN OBSERVED	18
FIGURE 20: OSCILLATION EXAMPLE	18

ANNEXES

ANNEX A: GAAS WAFER STATISTICS	9
ANNEX B: DIODE STACK I-V AND LEAKAGE PLOTS.....	10
ANNEX C: SOLZ I-V PLOTS	12
ANNEX D: BARE HBT DEVICES SHOWING OSCILLATION PROBLEMS	16

1.0 PURPOSE AND SCOPE

1.1. Purpose

The purpose of this document is to detail round robin results in order to establish the repeatability and reproducibility of the ESDA 5.5 Transmission Line Pulse (TLP) standard practice. The results shown here are for 100 nanosecond pulse lengths and should not be confused with very fast transmission line pulse (VF-TLP). Work done here follows the recommendations found in the ASTM E691.

1.2. Test Sites

Five test laboratories were used in this round robin. They are listed at the beginning of this document. Each site had access to a TLP system. Those systems were from three different manufactures.

Of the three different systems used, all were charge line TLP pulse generated. Their main TLP mode was time domain reflect – overlap (TDR-O), in a 50-ohm system. The systems were two terminal, single pulse and single ground probe. And finally, all systems had both voltage and current probes.

1.3. Test Structures

There were three sets of test structures used. The motivation for this selection is due to the very nature of the test. The TLP test is to measure the I-V characteristics, measure leakage and to determine failure level information similar to the Human Body Model (HBM), test of a particular structure. These I-V and leakage characteristics are very valuable parameters to the design engineer and TLP test systems can measure these data points. (Note: Leakage characteristics are the collection of leakage measurements at a predefined direct current (DC) voltage where one measurement is taken after each TLP pulse is applied.) In order to be compliant with the recommendations in ASTM E691, additional tests were made to make the round robin data analysis more comprehensive. It was decided to select a second structure in which all test sites would measure that same structure but not take it to destruction. An initial set of test structures proved unsuitable for meaningful TLP measurements and are discussed in Section 0.

1.3.1 Diode Stacks

The first test structure was a diode stack. This diode stack consisted of three series forward and three series reverse Gallium Arsenide (GaAs) diodes. These diode stacks were mounted in dual in-line package (DIP) carriers for TLP testing. They were furnished by RF Micro Devices. All structures came from the same lot and wafer. Statistics of the wafer's basic diffusion and bipolar transistor properties are found in Annex A. This data will show that the device characteristics remain the same across the wafer.

Each site was given ten diode stacks to test. All sites received structures from different sites on the wafer since all structures were to be tested to failure. Figure 1 shows the design layout and circuit schematic of the diodes that were tested. Figure 2 shows the DIP carrier bonding diagram.

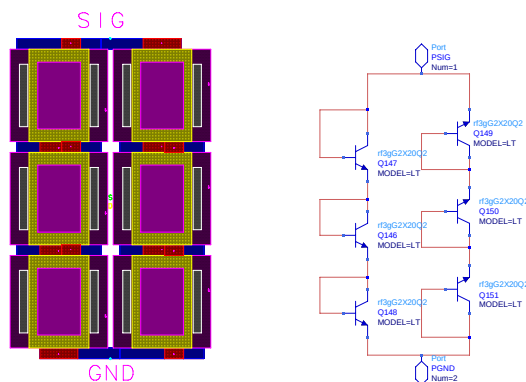


Figure 1: Three Series Forward, Three Series Reverse GaAs Diodes

