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Signal Tracking Automation of LEVCON Air Data Controller

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***Abstract*— In this paper, we present the simulation technique of troubleshooting a complex PCB. The simulation is carried out for SIM board which is a module present in LADC (Levcon Air Data Computer) which is being used in LCA's (Light Compact Aircraft).SIM is a multilayered complex PCB , troubleshooting such PCB is time consuming and lot of man power is required. By using the files generated during the manufacturing process of a PCB a software code is developed using the tool Visual Basics. The front end design includes a scanned picture of a SIM PCB and lists which shows the complete test cases, signal flow, signal name, and components which are under the particular selected test case. This paper also presents the expected voltage values of the components being selected. This analysis will reduce time required for trouble shooting process, cost and man power involved. This technique can be implemented for any general PCB.**

***Index Terms*— Printed Circuit Board, Front End Design, LADC, Visual Basics.**

I. INTRODUCTION

Printed circuit boards (PCB) appear to be a very attractive solution for testing high-speed integrated circuits(IC)[1].Every electronic product is constructed with one or more printed-circuit boards. The PCB's hold the ICs and other components and implement the interconnections between them. Performance of the wire-bond technology degrades at higher frequencies due to the excess inductance introduced by the bond wires [2][3][4].The technique of flip-bonding a bare die directly on-to a PCB is known as flip-chip on board (FCOB) technology, which is very attractive because of its good performance at higher frequencies of operation and the large pad count it supports [2][5].PCB's are created in abundance for computers, portable electronics and entertainment equipment. They are also made for test equipment, space craft and manufacturing.

After the manufacturing process of PCB before it is sent to the customer or used in the application it must be tested for its proper working. In conventional in-circuit test fixture fails [3] for high speed circuits. If any one test case fails then the board is said to be failed. Troubleshooting of complex PCB boards is a difficult task.

The LADC (Levcon Analog Air Data Computer) is a quadruplex air data computer and important hardware configuration of the Light Combat Aircraft (LCA) air data system .It consists of four modules namely Digital Module (DM), Servo Interface Module(SIM), Digital Interface Module(DIM), Power Interface Module (PIM) .The SIM takes care of analog interface and the corresponding signal conditioning required in LADC system.

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II. SYSTEM OVERVIEW

In recent times, testing fields has seen major advantages. However Modern days PCB's are complex multilayered and contain Microprocessors, RAMs, ROM, Ball Grid Arrays, Field-Programmable Gate Array and UN-identified integrated circuits. Designers need to mind the essential documentation, design steps and strategies, and final checks whenever a PCB test case fails. After correcting all the faults in the PCB it is very much necessary to verify the timing analysis and reliability of the circuit. This task is filled with loopholes and is very tedious and time consuming. A process is developed which reduces time. The previous method in practice was using analog inputs which are fed to pin heads directly. With the help of the software developed for the process of troubleshooting is adopting by automation which includes generation of test cases which generates voltage parameters.

III. OBJECTIVES OF THE WORK

- When there is a test case failed, then the troubleshooting engineer must study the entire schematics.
- Identify the single or multiple test cases that have failed and try to trace their path in the schematic.
- Identify that particular netlist, and find its voltage value by using the probes.
- If it is working then identify the proceeding one causing the fault.
- To carry out this process even for a single test case many files has to be referred.
- The another tedious work during this manual troubleshooting for engineer is that he has to find the components in the PCB.
- This is time consuming process as every component will not be named on the PCB and the PCB will also have a large number on elements mounted on it.
- This type of troubleshooting also requires a lot of man power.

The paper deals with method which helps to overcome all the above mentioned problems involved in manual troubleshooting of a PCB by atomizing and developing a front end design and providing the application to the costumer.

IV. ORGANIZATION OF THE WORK

Following Block diagram depicts the steps involved in troubleshooting process.

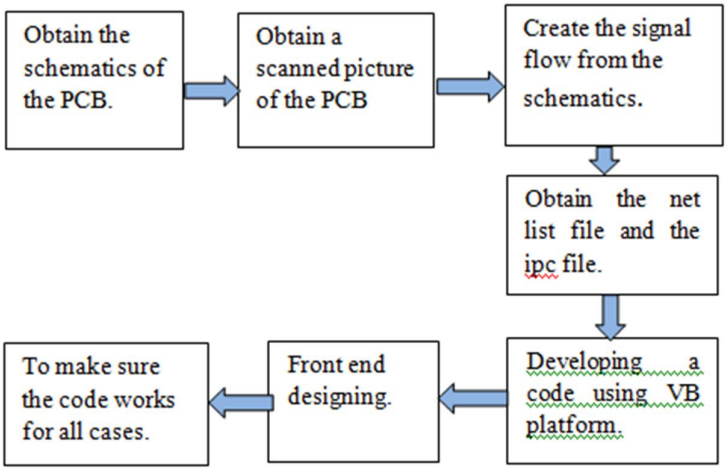

Figure1. Block Diagram Depicts The Procedure Involved In Troubleshooting Of A PCB

After the manufacturing process of PCB before it is sent to the customer or used in the application it must be tested for its proper working. This testing process is carried out by ATE (Automated Testing Equipment). ATE gives only the test results. It will not depict the failed components.

TABLE: 1

Input signal	Input V/g	Output signal	Expected o/pV/g min(v)	Expected o/p V/g max(v)	Measured o/p(v)	Result
-10Vref	10.00	AD_SIG_OUT(+4.88Vreff)	4.78	5.00	10.00	**F**
-10Vref	-10.00	AD_SIG_OUT(-4.88Vreff)	-5.00	-4.78	-4.89	**P**
+2.5vref_TAT	2.50	+2.5	2.46	2.53	2.49	**P**

The below figure shows the output sample from an ATE machine. Here we are considering a particular test case which has failed.
Table1.Here Vref Generation test is failed. The output signalAD_SIG_OUT (+4.88vref) is responsible for the failure.
Since the measured output voltage is not equal to the expected voltage, the test case AD_SIG_OUT (+4.88Vref) is failed.so in order to track the signal and identify the faulty components the following design flow is implemented.

V. DESIGN FLOW

1. Extracting the complete IPC, NET list, voltage files through coding to front end design.
2. Obtaining the scanned image of the PCB and developing a code for plotting on it.
3. Developing a code to extract signal names, signal flow and Pins and via's from IPC and Net list files respectively.
4. Plotting and displaying the expected voltage level of the components is done simultaneously.

VI. FRONT END DESIGN

The design consists of a scanned picture of a particular PCB, test cases followed by signal names, signal flow, pins and via's. Verification process is shown in steps in the fig, 2,3,4,5.

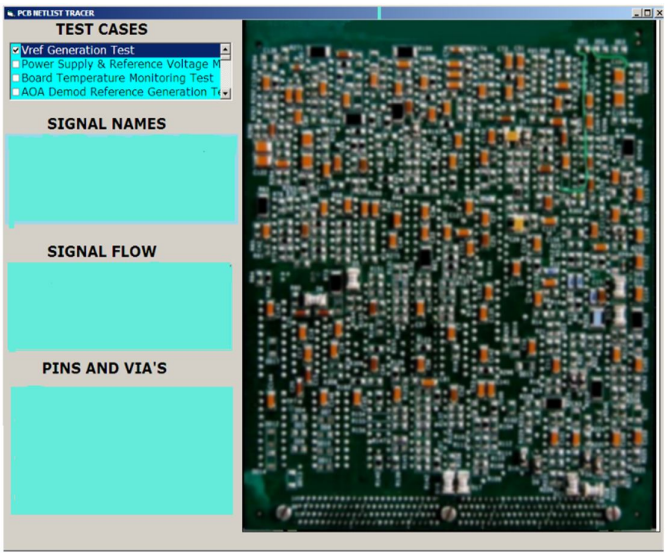

Figure2.From The Test Results Obtained From ATE, The Failed Test Case (Vref Generation Test) Is Selected As Shown

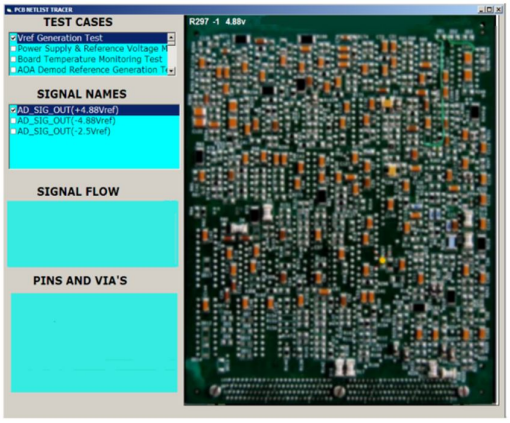

Figure3. The Signal Names Of The Particular Test Cases Are Being Displayed.

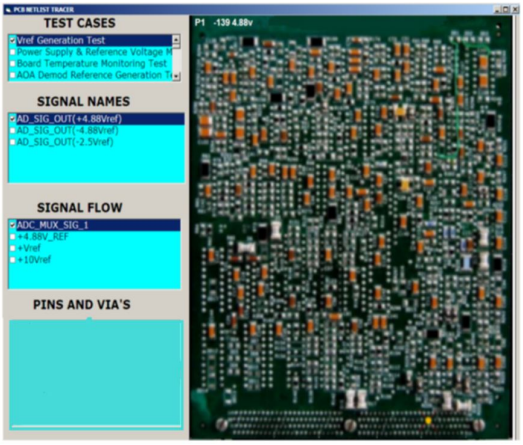

Figure4. The Signal Flow Of The Particular Signal Name Is Being Depicted.

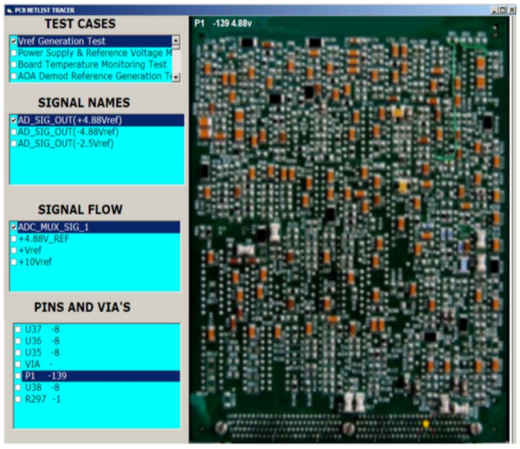

Figure5. The Pins And Vias Of The Failed Test Case Are Being Listed And The Selected Component Is Being Plotted On The PCB As Highlighted By The Circle.

VII. CONCLUSION

Using the programming platform Visual Basics, the proposed method is better than manual method as it overcomes the difficulty in analysis of various files related to that particular PCB,reducing the time taken by the person in searching the components ,providing accuracy in finding the faulty components for the user, displaying the respective components and voltage values required for further analysis, and one need not have complete knowledge about the PCB ,thus making it user friendly.

VIII. ACKNOWLEDGMENT

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