



Arm Based Logic Analyzer

Sonam M. Tiple*, Swetansha Chauhan, Aishwarya Sharma, Prof. V. P. Mulik, Prof. A. P. Yadav
Department of E&TC, SPPU, BVCOEW, Pune, Maharashtra, India

Abstract—Logic Analyzer is an electronic instrument that captures data from digital circuit and displays them. Advantage over the oscilloscope Logic Analyzer can display many signal at a time. It has advanced triggering capabilities, and is useful when a user needs to see the timing relationships between many signals in a digital system. Logic analyzer is a revamp version of oscilloscopes. It represents a data in a same way as a scope does, the X axis is time and the Y axis is voltage amplitude. But, rather than providing high voltage resolution or time-interval accuracy like a scope. Response of logic analyzer is in the same way as your logic circuit does when signal crosses a single threshold in your system. It recognizes the signal to be either low or high.

The main objective is to design powerful lab equipment with benefits of efficient, low power, reliable, portable and low cost for verifying and debugging the operation of digital designs. Embedded systems based on ARM provide a solution to meet the testability and flexibility request with low cost. Logic analyzers provide advantage for looking at time relationships or data on a bus. Device under test is connected to the system by USB connector and with the help of software like Visual Basic (VB) we can display the results of LA on PC.

Keywords—ARM, Logic Analyzer, Triggering, USB, VB

I. INTRODUCTION

A logic analyzer is an electronic instrument that captures and displays multiple signals from a digital system or digital circuit. A logic analyzer may convert the captured data into timing diagrams, protocol decodes, state machinetraces, assembly language, or may correlate assembly with source-level software. Logic Analyzers have advanced triggering capabilities, it helps user to see the timing relationships between many signals in a digital system.

Logic analyzers are specially used to check or test complex digital or logic circuits. They appeared shortly after the first microprocessors were used because to fault find these circuits required the instrument to have access to a large number of lines, more than could be seen using a conventional oscilloscope. Since then the need for logic analyzers has grown, especially as the complexity of circuits has continued to grow.

Oscilloscope is similar as logic analyzer as it can perform many of the functions of logic analyzer, but the analyzer is more suitable for operating in a digital environment because it can display relative timing of a large number of signals. Essentially logic analyzer enables traces of logic signals to be seen in such a way that the operation of several lines in a digital circuit can be monitored and investigated.

The selection criteria of logic analyzer will depend upon the cost budget and the actual requirements. Particularly creating a cost effective analyzers are PC logic analyzers. Digital system performance demands have steadily increased, driving microprocessor and I/O buses to higher operating rates. The performance of Logic analyzer has increased in speed, width, and memory depth to meet the need of today's system designers debugging multiple, gigabyte-transfer-rate buses. And also the important feature of today's analyzers is that, they are able to capture multiple time-correlated snapshots of traffic on the buses that make up a system.

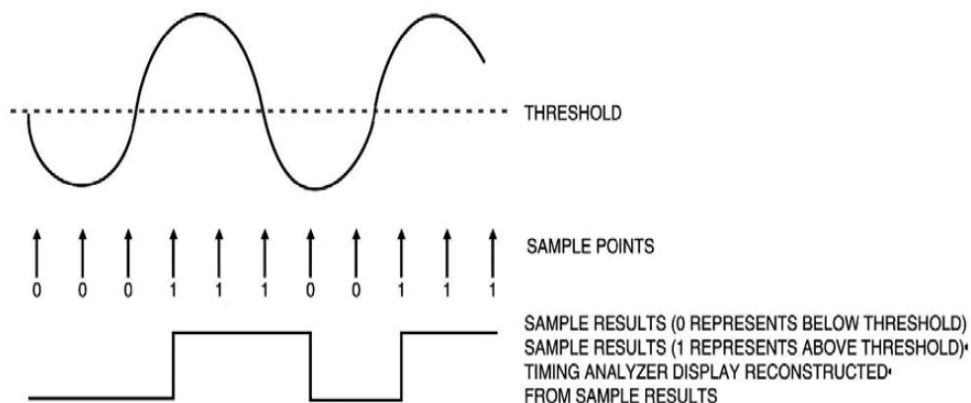


Fig 1: Timing Analyzer sample points

II. BLOCK DIAGRAM

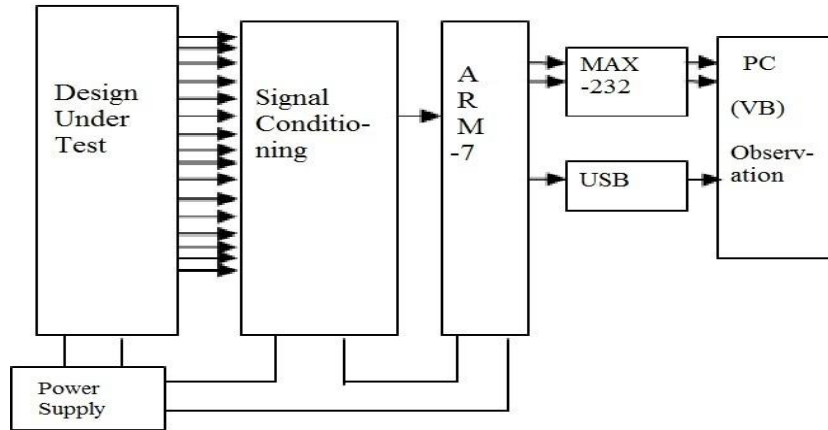


Fig 2: 16 channel Logic Analyzer

III. WORKING

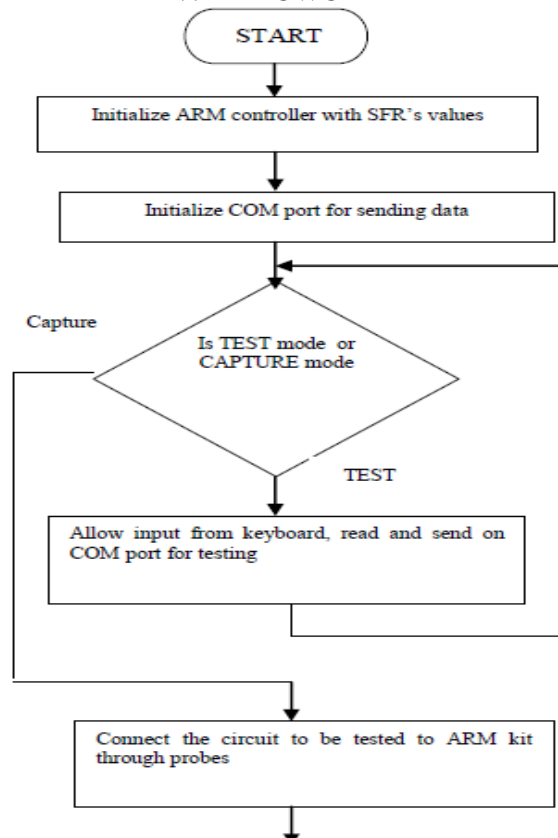
As one can observe the diagram, we can see that there is a Microcontroller, which is a part of the hardware, controlling the whole functional behavior. The Input/Output controller on microcontroller takes the Input from the ports via logical probes connected to the circuit being tested. The Microcontroller takes the Input from the Input/Output Controller and transfers the data to the USB 2.0 Host IC module situated on-board. The USB module will transfer the data to the device connected to it. The device should have the LogiScope application running which will take the input from the USB device module and display the output accordingly on the screen.

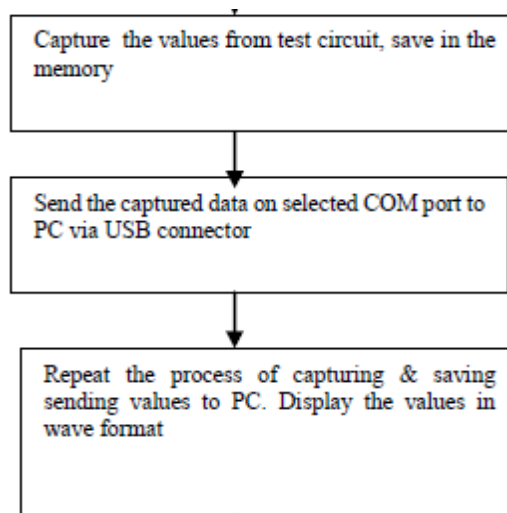
ARM7 is one of the widely used micro-controller family in embedded system application. A worldwide community of ARM partners and third-party vendors has developed among semiconductor and product design companies, including hardware engineers, system designers, and software developers.

The software will receive conditioned signals and display them in a user-friendly manner. It will provide several forms of triggering, cursors, zooming, etc. and standard window features. The PC is the user interface to the logic analyzer. The conditioned signals are received by the PC and the raw data is extracted from the USB packets.

RS-232 provides the serial communication between the microcontroller and the outside world such as display, PC or Mobile etc. So it is a media used to communicate between microcontroller and the PC. In our project the RS232 serves the function to transfer the edited notice (or data) from PC (VB software) to the microcontroller, for the further operation of the system.

IV. FLOWCHART





V. RESULT

This system can be built as 8 channels or 16 channels. In this scenario we have taken 16 channel layouts in which all 16 channels can act as input or an output mode depending on the setup. Initially all channels are set to logic high. When testing circuit is connected the value changes accordingly, i.e. Logic 0 or 1. Channel can be toggled, which can either be a Logic High or a Logic Low.

The graph is consisting of an X and Y axis. X axis displays a time and Y axis display values from 0 to 1.

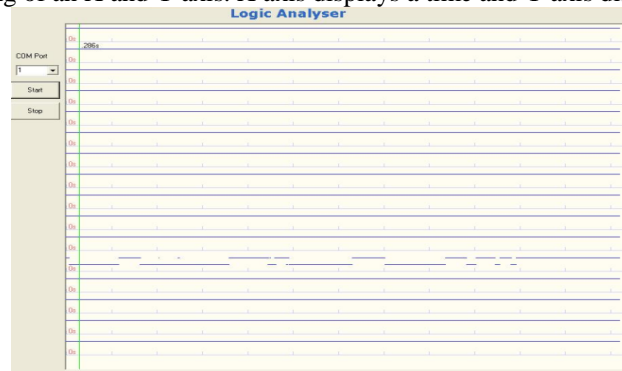


Fig 3: changes in Logic with respect to testing circuit.

VI. APPLICATION

- Laboratory Purpose
- Observe the waveforms to find out if there are burrs or interferes or if change in frequency
- Measure the timing of signals to find out conflicts or timing problems
- Logic analyzer can be used for error tracing or finding error bugs.

VII. CONCLUSION

This system works successfully for given circuit under test. It presents a new scenario to a flexible, portable, Low powered, cost effective logic analyzer. It is a powerful equipment of lab that can be used to debug and verify different digital systems with smaller size and less expensive.

REFERENCES

- [1] Zeng Weihua china university of Geosciences, Beijing,china,The design of digital multichannel analyzer based on FPGA,Asia Nuclear Prospects 2012 (ANUP2012) www.sciencedirect.com, Energy Procedia 39(2013)428-433,
- [2] Ramalingam.S.A,Fac of Electron.Technol,Abu Dhabi, GCC Conference and Exhibition 2013 7th IEEE,IEEE conference publication ,Design and implementation of hand Held Logic Analyzer, 10.1109/IEEEGCC.2013.6705738, www.ieeexplore.org
- [3] Varsha Karambelkar,Bharati Vidyapeeth Deemed University,Pune,Testing digital signals by low cost ARM based logic analyzer,International Journal of Engineering & advancedtechnology(IJEAT) ,ISSN:2249-8958,Volume-1,Issue-5,June2012
- [4] Mudit Kapoor, Neel Parikh, Vatsal Jhaven, Vivek Mehta,Pratik Sikka,dept of computer Engineering MPSTME,NMIMS,International Journal of Engg Technology and advanced engineering www.ijetae.com,ISSN2250-2459 , ISO9001:2008 Certificate journal,volume 4,issue 3,March 2014.
- [5] http://en.wikipedia.org/wiki/Logic_analyzer.