Test Plan Document
[ASMD Multiplier]

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Introduction

Purpose:

The purpose of this test plan outline is to provide insight into the testing approach and procedures for validating the ASMD Multiplier hardware design and board.

Scope:

The Skywater technology being used is the 130 nanometer semiconductor. This semiconductor. A semiconductor is a material that has an electrical conductivity value falling between that of a conductor. Some applications of the Skywalker 130 specifically could be used in Analog and mixed-signal integrated circuits, microcontrollers, microprocessors, and “IOT” devices. To test the Skywater chip we will use a JTAG demo board which is fully populated. A development board is designed to demonstrate and facilitate the testing and programming capabilities of the Joint Test Action Group (JTAG) interface. JTAG is a standardized interface used for debugging and programming integrated circuits, including microcontrollers and FPGAs.

Test Objectives:

Hardware Test Objectives:

- Verify the functionality and performance of the hardware components.
- Ensure that the hardware meets the specified design requirements.
- Detect and report any defects or issues.

Software Test Objectives:

- Verify the ability to connect to the JTAG to be used to test the multiplier.
- Ensure the interface testing phase is complete to verify the exchange of data between the chip and external components.
- Detect and report and defects or issues.

Test Environment:

Hardware Setup:

The test environment will be conducted in an environment that replicates the same environment where the final product would be used. The test board being used would be a XJDemo board or JTAG board. This will be used instead of using boundary scan on the chip, because the wires on the test board are routed to an ftdi chip only and there are no alternate wires to run them through a multiplexer.

Test Data:

To test the skywalker130 there are multiple routes that could be taken to achieve this such as; scan pattern tests, functional test patterns, and analog test patterns.

Test Strategy:

Testing Strategy:

To begin the overall testing process one must first simulate the specifications and verify the functionality of the design. During this step we will utilize automation tools to help assist the design, implementation, and verification of the semiconductor. Once the chip is fabricated a wafer probe test will be performed to check for any functional defects. The chip will then be delivered and will undergo functional testing next. Here the chip will be tested to make sure the chip performs the intended functions given in the design. Since we are only dealing with a basic ASMD multiplier there is no need to for speed or power consumption.

Test Levels:

Unit testing is the process of testing individual components of the semiconductor. To do so you must go in through each flip flop or gate and test the functionality of each one. When

testing each component you are isolating that specific component to ensure results are only coming from that component.

After unit testing Integrated testing should be implemented to ensure all components can work together as one. This type of testing combines function blocks within the semiconductor testing one and adding another component, thus eventually creating one system that performs the intended functions.

System testing is to test out the system as a whole to ensure all components can cooperatively work together. System testing is a broad testing step because there are many aspects to account for when testing the IC as a whole. One must test the compatibility, test the performance of the chip, test the chip in its specific environment it would be used in. You can integrate the system and connect the semiconductor to other components such as, connecting the ic to the computer to see the compatibility with other devices.

Test Types:

- Functional Testing
- Interface Testing
- Compatibility Testing
- Performance Testing
- Security Testing
- Reliability Testing
- System Integration

Test Schedule:

Key Milestones for Testing:

- Completion of design verification
- Unit testing for each component
- Completion of Integration testing
- Verification of functionality
- Completion of performance testing
- Completion of reliability testing

Test Cases:

Test cases can be applied in different stages when testing the semiconductor. There are test cases for almost each type of test for example; design verification, integration test cases, functional test cases, etc. Test cases give an engineer a place to start when beginning that specific stage in the test strategy. Testing specific semiconductors ultimately still depends on the

certain specifications intended for the chip. For example a test case in the unit testing process would be to ensure all the logic gates meet the specifications needed.

Test Procedures:

1. Test Setup - Setting the environment and obtaining all the necessary tools needed to test all components of the ASMD Multiplier.
2. Functional Testing - Test the functionality of the chip, ensure all components are operating, test and record outputs to ensure they meet the correct output. For the ASMD multiplier you can put in multiple equations to observe the outputs. You would also want to test negative and positive numbers as well as 0. Also test the boundaries of the multiplier, testing the smallest and largest positive and negative numbers.
3. Test all operations with signed and unsigned numbers and observe the output for any defects.
4. Next test that 0 multiplied by any number will result in 0. This is to ensure that the multiplier is picking up on the identity of the number.
5. Observe the power consumption, measure clock frequencies and operational speed.
6. Ensure the Skywater is able to connect to external components. Connect the semiconductor to a JTAG to be able to test the functionality of the chip and the ability to be integrated.
7. Test the ASMD multiplier's ability to detect errors. Purposely input incorrect values into the multiplier to see if the multiplier will respond correctly with an error.
8. Measure the time it takes to complete multiple different equations and record the results.

Test Pass/ Fail Criteria:

Pass Criteria:

- The ASMD multiplier should produce correct answers for a broad variety of equations/input values.
- Multiplier should be able to account for the boundaries. (highest and lowest representable numbers)
- The semiconductor cooperates with overflow and underflow conditions.
- The multiplier detects and reports errors.

Fail Criteria:

- Incorrect outputs for any multiplication equations.
- Incorrect outputs for very large or small numbers.
- Incorrect results when 0 is in the equation.
- Incorrect sign or value when multiplying.
- Failure to report errors when error occurs.

The ASMD multiplier should be able to add, subtract, multiply, and divide. The ASMD multiplier breaks down the multiplication process into separate stages, making it a sequential multiplier. If the ASMD chip can perform the actions above it meets the exit criteria.