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## MrRobot: an automated ASIC testing rig

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This work presents an automated solution for testing medium scale ASIC productions. Small scale prototype ASIC production are tested by hand in order to validate ASIC designs, and big scale ASIC productions are validated using industrial methods either checking directly the wafer or using specific instrumentation. Scientific experiments usually require producing thousands of ASICs that do not fall in any of these categories. In order to solve this problem, we have developed a testing rig to automate this procedure. Medium scale ASIC productions can be tested without having to do so manually and avoiding the cost of industrial testing solutions.

### Summary

This work presents an automated solution for testing medium scale ASIC productions (1k-100k ASICs). Small scale prototype ASIC production are tested by hand in order to validate the ASIC design, and big scale ASIC productions are validated using industrial methods either checking directly the wafer or using specific instrumentation. Scientific experiments usually require producing thousands of ASICs that do not fall in any of these categories. This number of ASICs take too long to test by hand and using industrial testing methods is financially not possible. In order to solve this problem, we have developed a testing rig to automate this procedure for any ASIC, and to minimize human related errors. Medium scale ASIC productions can be tested without having to place the ASIC manually in the board and avoiding the cost of industrial testing solutions. To test the ASICs the testing rig picks the ASICs from trays, places them in the testing boards, runs the tests and places the ASIC back in the source tray if the test result is good or in the reject tray otherwise. In order to do so, the trays are placed in a 3-axis cartesian robot. The robot can pick up the ASIC using a vacuum pump placed at the end of the robot arm. To finely pin-point the chip location, the robot arm has a high-resolution camera. Using computer-vision algorithms the robot can locate the chip with a precision of 0.05mm.

To place the ASIC in the testing board, the testing socket has to be an open-top socket. This type of socket open when they are pressed down, and clamp and auto-align the ASIC when released. The robot arm can press down the socket prior to lowering the chip into position and releasing them. The testing board is ASIC dependent, but the testing rig is not. It can be configured for any ASIC as long as the testing board uses an open-top socket. Multiple chips can be tested simultaneously to reduce overall testing time if the testing board allows it. In that case, the robot will fill up all the testing sockets prior to starting the test and afterwards it will place each ASIC in the proper tray depending if the ASIC has passed the test or if it has failed.

The available test surface has enough space to place 14 ASIC trays. The total number of units that can be placed at the same time depend on the size of the ASIC. As an example, for QFN64 packages (9x9mm) each tray holds 260 units, so a total of 3640 units can be placed at the same time. Once a batch of chips have been tested, the trays can be replaced, and the test can continue.

This testing rig has already been successfully used to test three different ASICs totaling more than twenty thousand units.

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