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STATEMENT OF WORK

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Solution Sources Programming, Inc.

STATEMENT OF WORK

1. INTRODUCTION

1.1 Scope

This statement of work, hereafter referred to as the SOW, covers the In-circuit test programs, hereafter referred to as ICT, supplied by Solution Sources Programming, Inc., hereafter referred to as SSP.

1.2 General

The details of the SOW reflect SSP's goals for an ICT program, ideally identifying a high percentage of in-circuit detectable faults. (Please note: an ICT program is designed to catch manufacturing faults. Functional fault coverage cannot be guaranteed.) The development and successful implementation of a quality ICT program is affected by many items. Some of these items are under the control of the programmer, while others are the result of design. The design can have a considerable impact on the test coverage, both positively and negatively. The goals listed in SSP's SOW may not be attainable due to component configuration, the effect of adjacent components, tester limitations, fixturing constraints, and a host of other testability issues. In such cases certain devices may be untestable or a different testing approach may be required. A list of all untestable and/or limited tested devices will be supplied to the Customer at the completion of the program.

2. IN-CIRCUIT DEVELOPMENT QUOTATION

A detailed quote will be provided once all the items required are received. If no Statement of Work and/or required lead-time by the Customer is supplied, SSP will provide a standard non-expedited quote in 48 hours using a fixture vendor from SSP's Approved Vendor List.

2.1 Items required for a quote

- a) Schematics
- b) Assembly and Fabrication Drawings
- c) Netlist or Net Count
- d) Bill of Materials
- e) Customer's Statement of Work (if special requirements are requested)
- f) Targeted System and Configuration

2.2 Explanation of the Quote

The SSP quote consists of two pages. Page one has two main sections, one of which includes the breakdown of the Base Program and Fixture and another section which lists the Options and their extra costs. The Base Program and Fixture cost is the price for a program and fixture that adheres to SSP's SOW. The Options portion of the quote includes an Expedite option if a quicker than normal lead time is requested, Installation cost outside of the Bay Area, and a few other common test options that are requested. The options which are chosen will be added to the Base Program and Fixture total. The second page of the quote shows a Test Matrix which illustrates the devices which will be requiring a Setup, Vectorless (i.e., Testjet or Opens Express), Logic, and Boundary Scan tests which are part of the Base program cost.

2.3 Descriptions of the Test Methods used in the Test Matrix

Setup Test: SSP will reserve all the tester resources necessary to write a functional test in the future and the I/O pins will be defined according to the device specification.

Vectorless Test: A test will be developed using Testjet or Opens Express dependant on the platform requested.

Logic Test: A logic test as described in the Device Testing Details which is located later in section 3.1 will be developed.

STATEMENT OF WORK (Continued)

2.3 Descriptions of the Test Methods used in the Test Matrix (Continued)

Boundary Scan Test: A Boundary Scan test will be developed using a .BSDL file (must be IEEE 1149.1 compliant) provided by either the Customer or the designer of the device. The accuracy of the Boundary Scan test is dependent upon the accuracy of the .BSDL file. The Boundary Scan test is testing for manufacturing defects and not functionality. SSP recommends vectorless testing on such devices as a back up in the event the .BSDL file does not work.

3. SSP'S STANDARD AND OPTIONAL TESTS THAT ARE AVAILABLE

The standard tests mentioned in this section are the tests that SSP will provide with a normal program in which there is no Customer supplied Statement of Work. The optional test section will list some of the enhanced test options available at additional costs that SSP can provide.

3.1 Standard Developed Test

Continuity: All testable combinations will be tested. Switches and jumpers will be tested for the open position.

Opens: Opens are NOT directly detected by in-circuit testing because each network only has one probe on it. However an open trace will usually cause tested devices to fail which will ultimately lead to identifying the open trace.

Diodes: Diodes will be tested for a forward voltage drop.

Passive Components: Components will be tested according to standard tester calculations effected by component tolerance, measurement error, system residuals, and fixture residuals. Certain components with the following values will be tested as stated below:

- **Resistors:** Parts less than 100 ohms usually require wide test limits. Parts that are less than 10 ohms will be tested as closed jumpers.
- **Capacitors:** Parts less than 200p usually require wide test limits.
- **Inductors:** Parts less than 50u will be tested for continuity only.
- **Transformers:** Parts will be tested for continuity only.
- **Unstuffed Parts:** All unstuffed parts will be tested using an absence test to confirm they are not installed.

Fuses: Fuses will be tested for continuity only.

Jumpers: Jumpers will be removed from the board before test and the board will be tested for absence. Jumpers will not be replaced.

LEDS: LEDS will be tested for a forward voltage drop. This test can't be performed if there is an internal series resistor.

Thermistors: Thermistors will be tested for nominal resistance with a minimum tolerance of 25%.

Transistors: Transistors will be tested for two diode voltage drops.

Zener Diodes: Zener diodes will be tested for the zener voltage. The testable range will be based on the tester instrumentation.

Op Amps: Op amps will be tested by providing a small differential voltage on the inputs and testing the outputs for the appropriate voltage swings.

Opto Isolators: Opto Isolators will be tested using a powered analog test.

STATEMENT OF WORK (Continued)

3.1 Standard Developed Test (Continued)

Oscillators: Oscillators will be tested using the frequency measuring capability on the testers.

Pals: Pals will be tested for stuck-at-faults using vectors generated by Acugen.

Rams/Roms: Rams/Roms will be tested using a "Cyclic Redundancy Check" hereafter referred to as CRC test which is created by reading a part on a known good assembly and using that learned CRC to test production assemblies.

Digital IC's: IC's will be tested for stuck at faults, typically detecting most pin faults.

LSI/Custom IC's: If a library model is available, the device will be tested to the extent possible by the model and "Device Under Test" hereafter referred to as DUT circuitry. If no library model is available, then device will be tested using vectorless techniques (i.e., Test Jet or Opens Express).

3.2 Optional Developed Tests

Flash Programming: A test can be developed to program Customer-supplied information in the form of a Motorola S-Records file or an Intel Hex file format then programmed into a Flash Prom device already loaded on the assembly.

Mac Address/Customer supplied programming of Serial EEproms: A test can be developed to program a Mac Address and/or Customer-supplied information into an EEprom loaded on the assembly. This Mac Address information can either come from a Mac Address label or SSP can use a predefined Address range and control the addresses using a file. The other various Customer-supplied information must be provided in a written specification to SSP.

ISP Programming: A test can be developed to program and verify ISP devices loaded on the assembly which include Altera, Lattice and Xilinx devices.

A/D Converters and D/A Converters: Tests for High, Low and Midrange values can be performed.

Frequency testing outside tester's measurement capabilities: For testers with limited or insufficient frequency measurement capabilities, hardware can be added in the fixture to allow frequency measurements in excess of 100MHz as an option.

Customer supplied Models: Customer may request SSP to spend up to a pre-determined amount of time to debug and/or enhance Customer-supplied models and/or tests. Due to the number of variables involved in this process, there is no warranty or guarantee of the results.

Switches/Jumpers: Switches can be tested in both the open and closed position. Jumpers can be tested for presence or absence. Please note that having jumpers on the board at test time usually reduces the fault coverage and may adversely effect some tests.

LED's: A visual test can also be performed.

STATEMENT OF WORK (Continued)

4. DOCUMENTATION REQUIRED TO COMPLETE A PROGRAM AND FIXTURE

4.1 Non Customer Specific Documentation required for all Programs

- a) Bill of Materials
- b) Gerber Files
- c) Schematics
- d) Assembly Drawings
- e) Fabrication Drawings
- f) Tester Configuration and Type
- g) Bare Board (Optional)
- h) Golden Loaded Board
- i) Customer's Statement of Work (if special requirements are requested)

4.2 Cad Files

Cad Files which include Component, Pin #, X and Y Coordinate, Side of Board, including Testpoints are requested on all programs we develop. SSP has experience with many of the Cad layout systems used in the industry and will request specific files from each and also list them below. If requested files or files with the above information cannot be provided, SSP can reverse engineer the Gerber files and/or digitize film to reproduce the information typically in a Cad file for an additional cost.

- a) **Allegro/Cadence:** Symbol Pin Report, Testprep.log, and Component Placement Report are required. If a testability review is requested and/or the program is to be developed on a Genrad a .VAL file may be required which is a special extracted file from the Database that is used by Fabmaster.
- b) **Pads Perform 2000:** A .ASC file of the complete database is required.
- c) **PCAD:** A .PDF file of the complete database is required.
- d) **Mentor Graphics:** A Neutral file with all the board attributes is required.

4.3 Pal Files

SSP uses Acugen to develop vector tests for Pals. The software package requires specific files in order to run, some of which are listed below.

- a) **Standard Pals:** .JED file is required
- b) **AMD Mach Devices:** .JED File is required
- c) **Altera Devices:** .FIT and either .RPT or .EDO files are required.
- d) **Lattice Devices:** .SIM file is required.

4.4 Device Specification Requirements

A device specification for all Custom devices or on devices whose specs SSP cannot obtain from the Web will be required and must include Pin Number, Pin Name, Pin Description, and Pin Type.

4.5 .BSDL Files

A .BSDL file for Boundary Scan is required for all Custom devices that the Customer has identified as requiring Boundary Scan.

STATEMENT OF WORK (Continued)

5. FIXTURE SPECIFICATION

SSP selects its fixture suppliers based on an internal "Approved Vendor List" (AVL). Each fixture vendor has been approved to do a certain complexity of fixtures. Unless the Customer specifies a fixture vendor, SSP will use a fixture vendor from its AVL based on the complexity of the fixture required. The performance of the fixture may vary depending on the specific processes used in the Customer's no clean environment. Due to these variations in environments, SSP cannot guarantee or warranty contact performance of the fixture. SSP uses High Spring Force Steel Tipped Headless 3-Sided Chisel probes anticipating use in a no clean environment. These probes do not always work since there are many different no clean processes being used which SSP cannot take responsibility. This is a result of Customer/SSP having no control on the amount of remaining flux on the board. If a Customer has a special probe requirement, or if a higher than standard high spring force probe is required, then it must be specified at the outset and it also may result in additional costs. If probe styles selected by either the Customer/SSP do not perform satisfactorily, and a probe replacement is recommended or required, additional cost will be billed to the Customer for both probe and labor to replace for each occurrence.

6. DELIVERABLES FOR HP PROGRAMS

6.1 HP Files

SSP provides with a completed program all the files in the program directory. These files include all the Custom Libraries, Fixture Files, Documentation on Fixture Electronics and all the necessary files needed to run, sustain, or regenerate the test program.

6.2 Test Coverage and Quality Reports

SSP provides a test coverage report generated by HP (and then commented by SSP) that gives the Customer a clear picture of the test coverage and devices that aren't tested. SSP runs HP Board Grader. All the reports can be found in the "bdg_data" directory. SSP also provides additional unique reports located in the main board directory.

7. DELIVERABLES FOR GENRAD PROGRAMS

7.1 GenRad Files

SSP provides with a completed program all the files in the program directory. These files include all the Custom Libraries, Fixture Files, Documentation on Fixture Electronics and all the necessary files needed to run, sustain, or regenerate the test program.

7.2 Test Coverage and Quality Reports

SSP provides an accurate test coverage report generated by GenRad ALLFAULT (and then commented by SSP) that gives the Customer a clear picture of the test coverage and devices that aren't tested. All of the reports are in the main board directory.

STATEMENT OF WORK (Continued)

8. WARRANTY

8.1 Program

For a period of ninety (90) days following the date of acceptance of work, Customer to notify SSP in writing of any problem falling within the scope of this agreement. SSP shall make its best efforts to effect correction.

SSP makes no guarantee or warranty implied or expressed as to the merchantability or fitness of equipment or services provided or that they will cause Customer's product or service to work in a particular manner.

All programs generated by SSP will be archived for a period of one year from invoice of the main program. Customer/CM should maintain/create a backup when program is either installed or accepted. Customer will not be notified prior to destruction of Customer files after one year.

8.2 Fixture

SSP will pass on the warranty of its suppliers to the Customer.

10. EXTENDED WARRANTY

- **Available upon request.**