

Diode Production Test Using the Agilent B2900A Series of SMUs

Technical Overview

Agilent B2901/02/11/12A Precision Source/Measure Unit

Agilent B2901A Precision SMU, 1ch, 100 fA resolution, 210 V, 3A DC/10.5 A pulse

Agilent B2902A Precision SMU, 2ch, 100 fA resolution, 210 V, 3A DC/10.5 A pulse

Agilent B2911A Precision SMU, 1ch, 10 fA resolution, 210 V, 3A DC/10.5 A pulse

Agilent B2912A Precision SMU, 2ch, 10 fA resolution, 210 V, 3A DC/10.5 A pulse

Introduction

To ensure compliance with manufacturing specifications, single-point pass/fail DC testing must be performed on packaged diodes. Because these tests are also used to identify and remove defective devices before shipment, their reliability is important to guarantee product quality. In addition, it is also essential to perform the tests quickly to keep the production throughput high.

Agilent B2901/02/11/12A Precision Source/Measure Unit meets all of these requirements, making it the best solution for diode production test. It is a compact and cost-effective bench-top Source/Measure Unit (SMU) with the capability to

source and measure both voltage and current. They cover currents from 10 fA to 3 A (DC)/10.5 A (pulse) and voltages from 100 nV to 210 V. In addition to these comprehensive measurement capabilities, the B2900A Series of SMUs possesses high throughput that reduces test times. The B2900A Series of SMUs also has many features that make it well-adapted for production test, such as pass/fail binning, a digital I/O interface for handler control, and code compatibility with standard single and dual channel SMU products.

This technical overview shows how to use the B2900A Series of SMUs for production test. A simple diode test example will be shown for a forward voltage test (V_f).



Easy production test system configuration

Figure 1 shows a conceptual diagram of a system based on the B2900A Series of SMUs for production diode test. The widely available banana style terminals of the B2900A Series of SMUs greatly simplify the test system configuration. As will be discussed later, in most production testing measurement results are compared with pre-defined limits and pass/fail judgments are made. Output signals from the GPIO port of the B2900A Series of SMUs can be used to communicate with the component handler to sort devices based on the pass/fail criteria.

Program memory improves throughput

Fast test times are essential to maximize throughput and maintain high levels of factory productivity. Besides possessing fast intrinsic measurement speed, the B2900A Series of SMUs has a program memory function that can be used to improve production test throughput. Program memory allows you to store long strings of SCPI command lines once into the volatile memory of the B2900A Series of SMUs and then recall those strings multiple times while the program is executing using a single SCPI command. By storing the command strings in memory, the time that would have been spent sending those same commands over a communication bus is eliminated.

For tests that utilize lots of repeated code (such as subroutines), program memory can dramatically reduce test times. Of course, programs can be saved to or loaded from any attached USB flash memory device (please see Figure 2).

The B2900A Series of SMUs also has a data buffer on each SMU channel that can hold up to 100,000 data points. This enables you to transfer all the data in the buffer at once after a series of measurements have completed instead of having to transfer data after every measurement. One way to use this to improve throughput would be to have the B2900A Series of SMUs send measurement data to a PC while a component handler places a new device on a DUT interface.

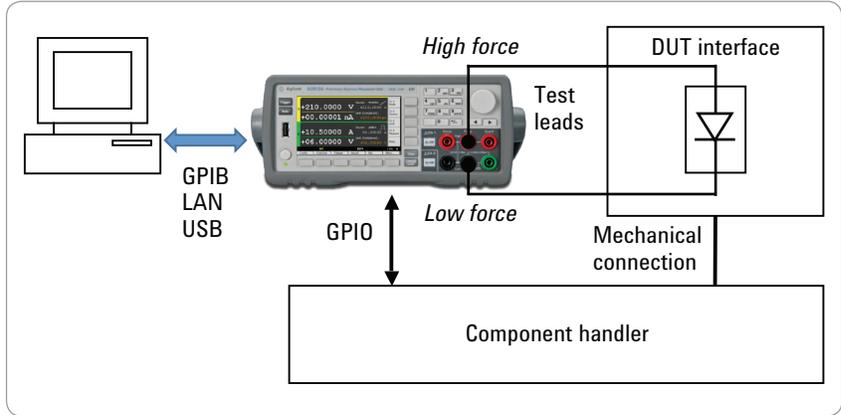


Figure 1. Example test system configuration using the B2900A Series of SMUs

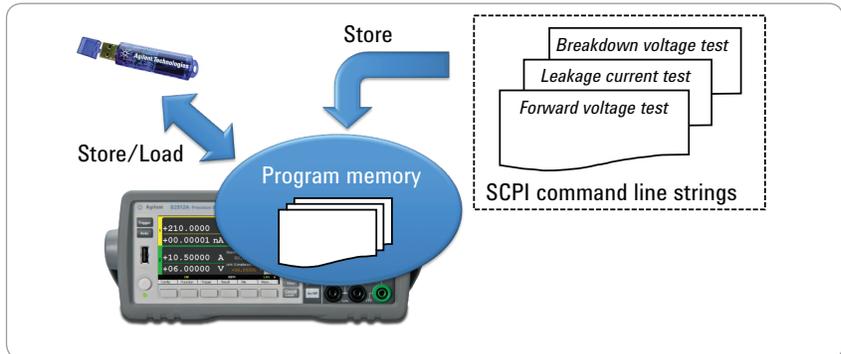


Figure 2. Program memory allows strings of SCPI commands to be stored for later execution

Multiple pass/fail judgment modes

In production test, a limit test function is generally used to eliminate defective devices through a pass/fail judgment based on pre-defined limits. Recognizing that there are a variety of pass/fail limit scenarios, the B2900A Series of SMUs supports two modes: Compliance mode and Limit mode (up to 12 binning limits possible).

Compliance mode utilizes the intrinsic compliance feature of the B2900A Series of SMUs that allows a limit to be placed on voltage or current output to prevent device damage. When the SMU's output reaches the limit value during a measurement it is in compliance status. If Compliance mode is enabled, then the test fails when the SMU reaches compliance status. One possible use of this feature is to determine the polarity of diodes (please see Figure 3).

Limit mode is usually used to determine if a device parameter is within specified low and high limits. When Limit mode is enabled the B2900A Series of SMUs makes a Pass/Fail judgment based on whether or not the measured value is within specified low and high limits (please see Figure 4). A typical use of this mode is to perform grading and sorting. For example, using two binning limits in Limit mode it is possible to sort devices into five classes (please see Figure 5).

After performing pass/fail testing with these modes, you can view the results on the wide QVGA LCD display of the B2900A Series of SMUs. In addition, you can program the B2900A Series of SMUs to output specified Pass/Fail bit patterns through the GPIO port to other equipment such as handlers for component binning.

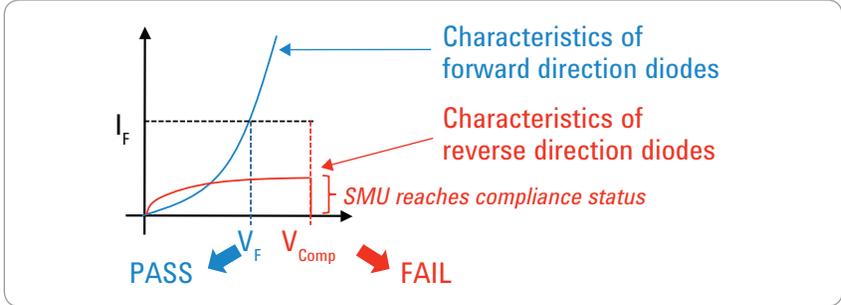


Figure 3. Example showing how the Compliance mode's pass/fail test capability can be used to determine diode polarity

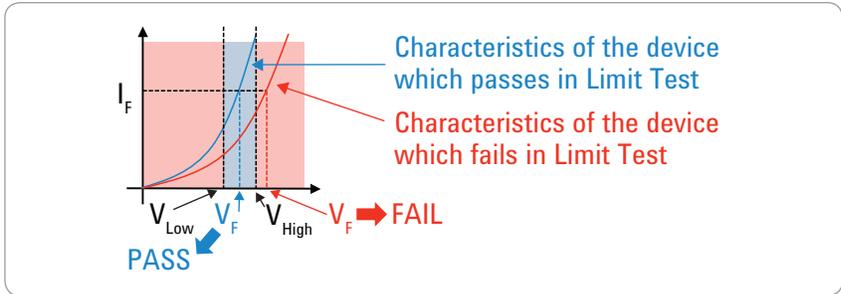


Figure 4. Example showing how the Limit mode's pass/fail test capability can be applied to a diode forward voltage test

| | Measurement parameter | | | | |
|-------------|-----------------------|------|-------|-------|------|
| | Low1 | Low2 | High2 | High1 | |
| | A | B | C | D | E |
| Limit 1 | FAIL | PASS | PASS | PASS | FAIL |
| Limit 2 | FAIL | FAIL | PASS | FAIL | FAIL |
| Bit pattern | 100 | 010 | 000 | 001 | 011 |

If a device fails the Limit 1 tests, it will be sorted into bins A or E.
 For devices that pass the Limit 1 tests, the Limit 2 tests will be performed.
 If a device then fails the Limit 2 tests, it will be sorted into bins B or D.
 Devices that pass all of these tests will be sorted into bin C.

Figure 5. Example showing how to sort devices into five classes using two limit tests

Production diode test flow example

Figure 6 shows a simplified flow for production diode testing. Before beginning the actual testing, it is good practice to store repeated operations into the program memory of the B2900A Series of SMUs (such as the forward voltage test in this example). After this test pre-loading has been performed and the stored program has been run, the B2900A Series of SMUs waits for a Start of Test (SOT) trigger from the component handler. Once the diode is in-place, the handler sends an SOT trigger signal to the B2900A Series of SMUs to inform it that testing can begin. The B2900A Series of SMUs first makes a measurement using the program stored in program memory and displays the Pass/Fail testing result. Then, the B2900A Series sends a specified Pass/Fail bit pattern and an End of Test (EOT) signal to the component handler and stores the test data to the PC. This procedure is then repeated until all of the devices have been tested.

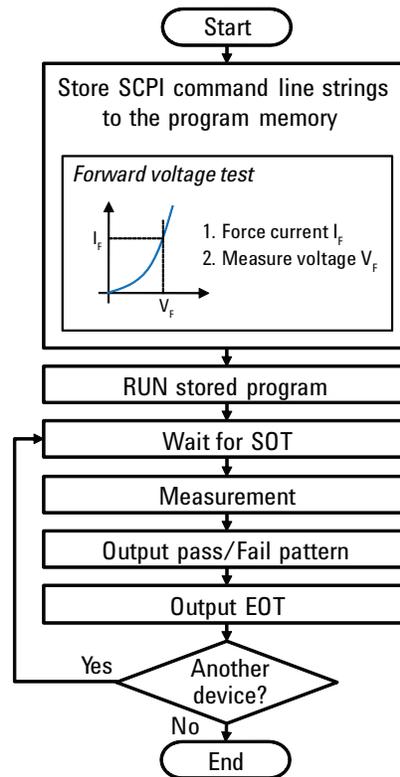


Figure 6. Diode production test flow example using the B2900A Series of SMUs

Summary

The Agilent B2901/02/11/12A Precision Source/Measure Unit is the best solution for the production testing of diodes and other devices. The B2900A Series of SMUs possesses high throughput, which greatly reduces test times. In addition, the program memory function of the B2900A Series of SMUs allows the test throughput to be improved even more. The B2900A Series of SMUs also provides useful features for production test such as pass/fail decision-making, a digital I/O interface for handler control, and program compatibility with standard single and dual channel SMU products.

The B2900A Series of SMUs is equipped with popular banana style terminals that make it easy to connect to other instruments in a production test system. Both SCPI commands and IVI-COM drivers are available for the B2900A Series of SMUs for remote control using the GPIB, USB or LAN communication protocols.

Its wide current and voltage measurement ranges (from 10 fA/100 nV to 10.5 A/210 V) provide superior measurement performance and allow you to test devices more accurately and easily than ever before.

For more detailed information on the various models of the B2900A Series of SMUs, please refer to the data sheet of the B2900A Series of SMUs (5990-7009EN)



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