Setting a New Standard for Power Semiconductors Tests and Measurements

Continued improvements in the performance of power semiconductors drives demand for corresponding improvements in testing technology. LEMSYS has developed a solution specifically dedicated to fast medium power semiconductor devices. With the new PRO-AC test equipment, both manufacturers and users have now access to a performant and economical solution for dynamic parameter measurement.

Christian Rod and Pierre Goumaz, LEMSYS SA, Geneva, Switzerland

In a world where energy becomes more and more valuable, efficient power electronics devices are bound to increase their market share. The necessary increase in the production capability implies a specific and adapted solution for testing these new and efficient devices, characterized by fast commutations and a high sensitivity to parasitic elements, such as inductance. In order to provide the market with such an adapted solution, LEMSYS has designed the new PRO-AC test equipment.

Suited for device qualification and production

The new test equipment is shown in

Figure 1: **Lemsys new Pro-AC power semiconductor test equipment**

different devices and packages. Regarding the inner conception, it follows the goal of maximum simplicity. The repetitive and modular design leads to maintenance down-times as low as possible, increasing as much the production capability and decreasing the need for spare parts stock.

The mechanical adaptor is included in a specifically designed test frame that comprises a heating system for tests at devices rated temperature. This test frame can be used in a semi-automatic way (the user start the test sequence through the graphical user interface) or in a full-automatic way (the test sequence is started by the closure of the device-under-test drawer). Depending on the application, the choice between these two

Figure 2: **Main control software GUI for test edition**

Figure 3: **Display of real-time statistics in the main control software**

modes can be done easily through a dedicated user interface directly on the test frame.

The graphical user interface of the in-house developed control software (Figure 2) has been conceived to limit to its minimum the time required by the edition of a test sequence. It includes a lot of useful functionalities such as the possibility to run a test equipment auto-diagnostic, the possibility to save both plot images and measurement points in case of a failed test for analysis and reporting purposes and the real time statistics (Figure 3) allowing the user to easily keep an eye on the production quality.

Suited for power GaN tests

Fast switching devices require a test equipment with dynamic parasitic values (inductance and capacitance) as low as possible. The PRO-AC has been designed with the primary goal to provide the lowest parasitic inductance. Indeed, measurements taken directly on the device under test, and therefore including both the test equipment and the adaptor, show a value as low as 37.12 nH, as can be observed on Figure 4.

Such a low parasitic inductance value enables the PRO-AC to perform tests on very sensitive devices, such as the GaN transistor GS66508P, in conditions that create damaging oscillations if performed on other testers.

All common switching values, such as turn-on delay, rise-time or switching losses can be measured through different tests using standard single and double-pulse waveforms. Figure 5 illustrates a turn-on test at the PRO-AC rated voltage and current, respectively 1500 V and 600 A.

Figure 6 illustrates the turn-on behavior of a C3M0065090D SiC device measured on the new

PRO-AC. It can be seen the fast switching capability of the test equipment since the measured rise-time corresponds to the typical value indicated by the manufacturer datasheet, confirming the adequacy of the PRO-AC with the test of wide-bandgap devices.

Integration of static tests

The last key advantage of the new PRO-AC is its ability to be easily upgraded to a full AC and DC test system. It includes all the standard static tests, such as leakage current and breakdown voltage up to 3 kV, on-resistance and/or forward voltage drop up to 2000 A and gate leakage current measurements down to only a few nanoamps. Thus this test equipment is well suited for both production and qualification tests. Such an upgrade can be done without the need to upgrade

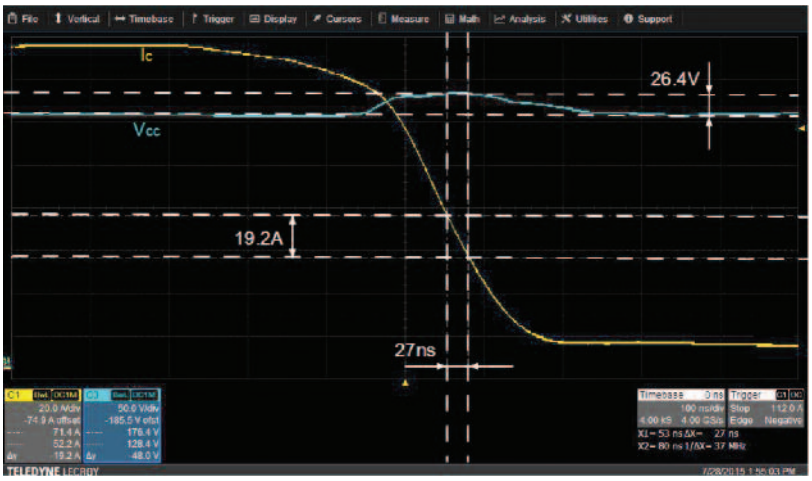

Figure 4: **Effect of the parasitic inductance on the DC-link voltage during a turn-off**

Figure 5: **1500 V/600 A double pulse waveform on a FZ1200R33KF2 IGBT module**

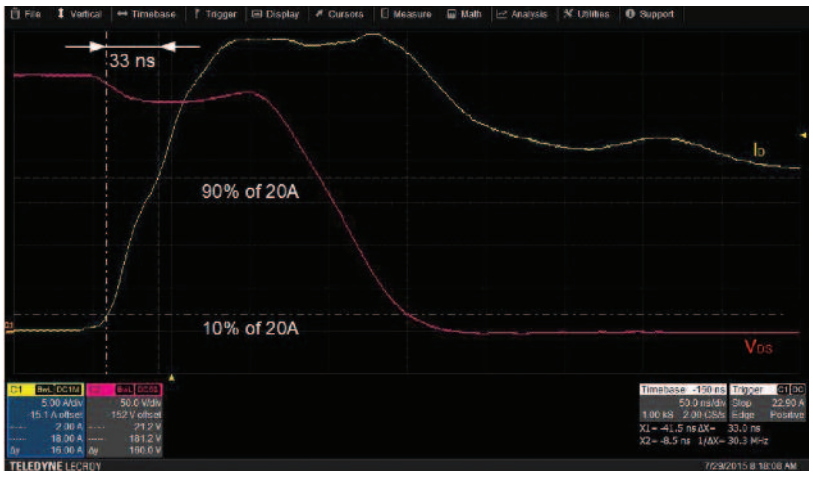

Figure 6: **Turn-on behavior of a SiC device (C3M0065090D)**

the adaptors, since they are fully compatible with LEMSYS full range of testers.

Conclusion

Developed with the goal to gather both high technical performances and the simplest possible use, the PRO AC-DC product family will integrate a production line as easily as a qualification laboratory. According to the previously presented results, users can expect lowest stray inductance, a solution specifically designed for the new devices generation, simple usage regarding both the graphical user interface and the change of mechanical adaptor, and options including all the standard static tests.