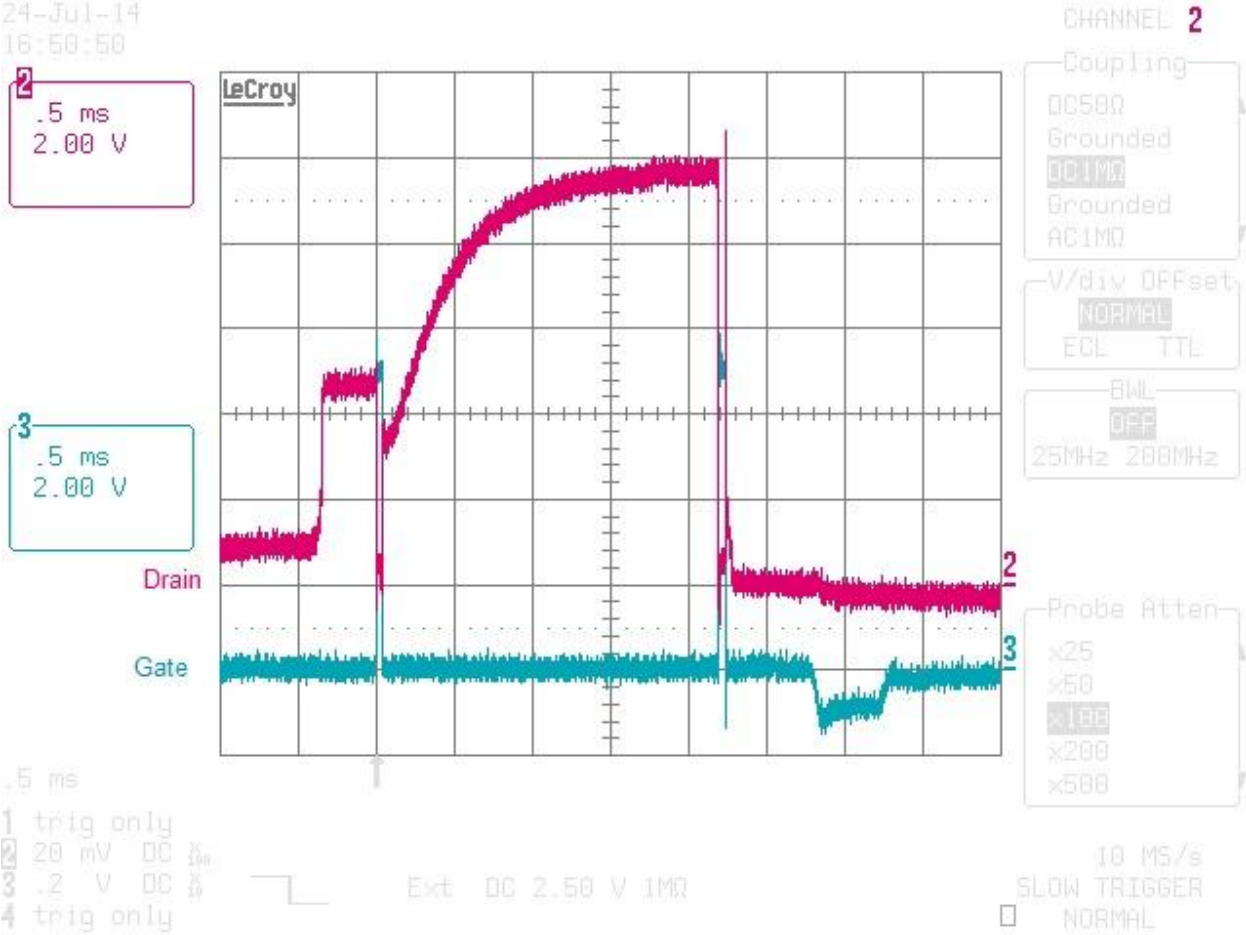


Dynamic RDS(on) Testing on FTI-1000

The waveform below shows a simple Dynamic RDSOn test. The test is done with a Vstress of 10V and a stress time of only 2 ms to allow the scope to show the waveforms clearly. Normal the stress would be much greater. The pictures are taken on an enhancement mode device.

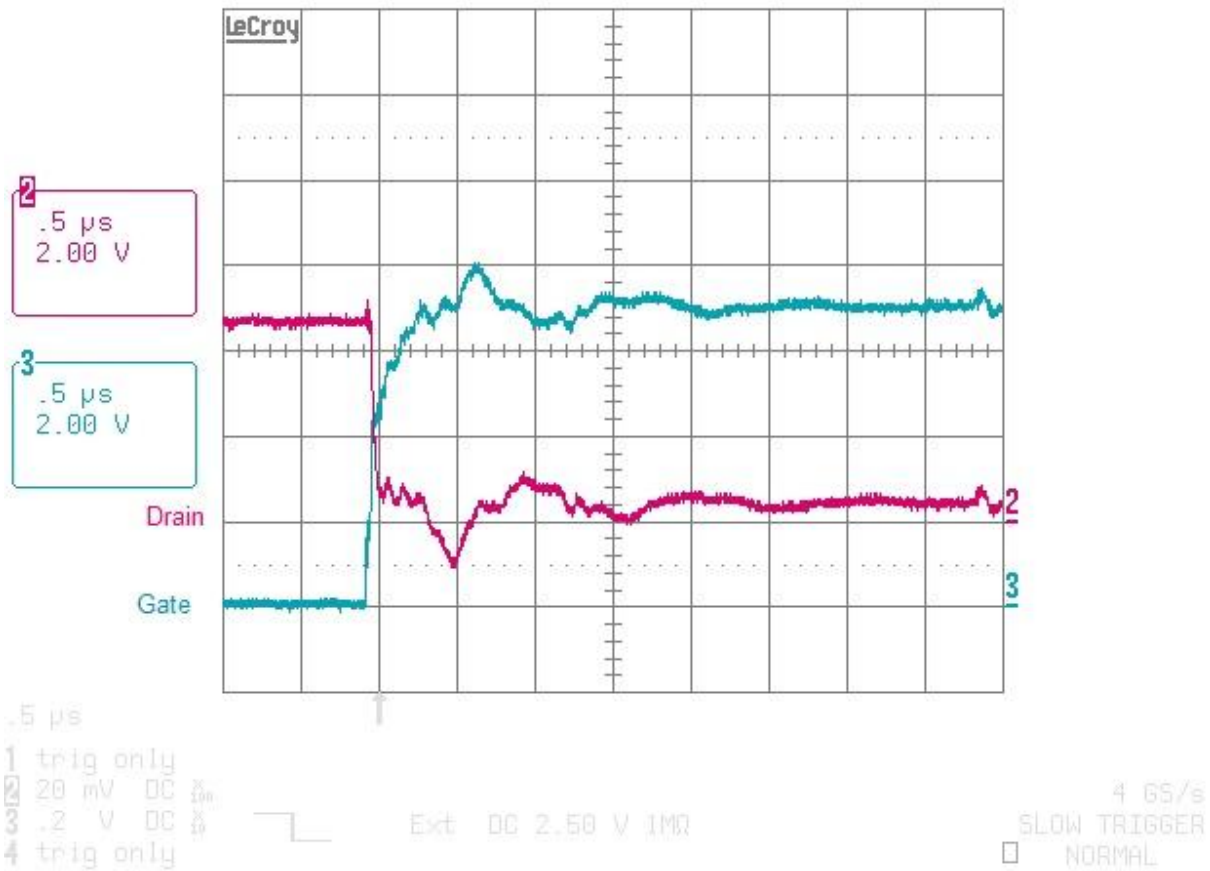


As can be seen, initially the drain voltage goes to 5V with the DUT off. Next the gate is pulsed on to measure the initial RDS. For the RDS measurement, the drain voltage is approximately 0.6V with an ID of 5A for an RDS of around 0.12 ohms.

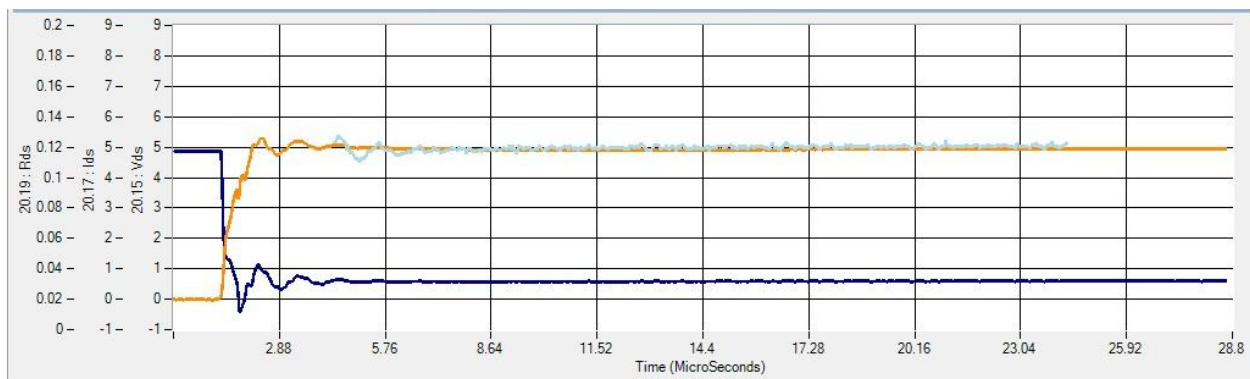
Next the DUT is shut off, and a stress voltage is applied (through a 50K resistor). At the end of the stress time, the DUT is turned on again, the 5A drain current applied and the RDS measured a second time.

The next picture shows a zoomed in view of the initial RDSon measurement. The gate is driven to 7V, and the Drain settles to about 0.6V.

24-Jul-14
16:47:42



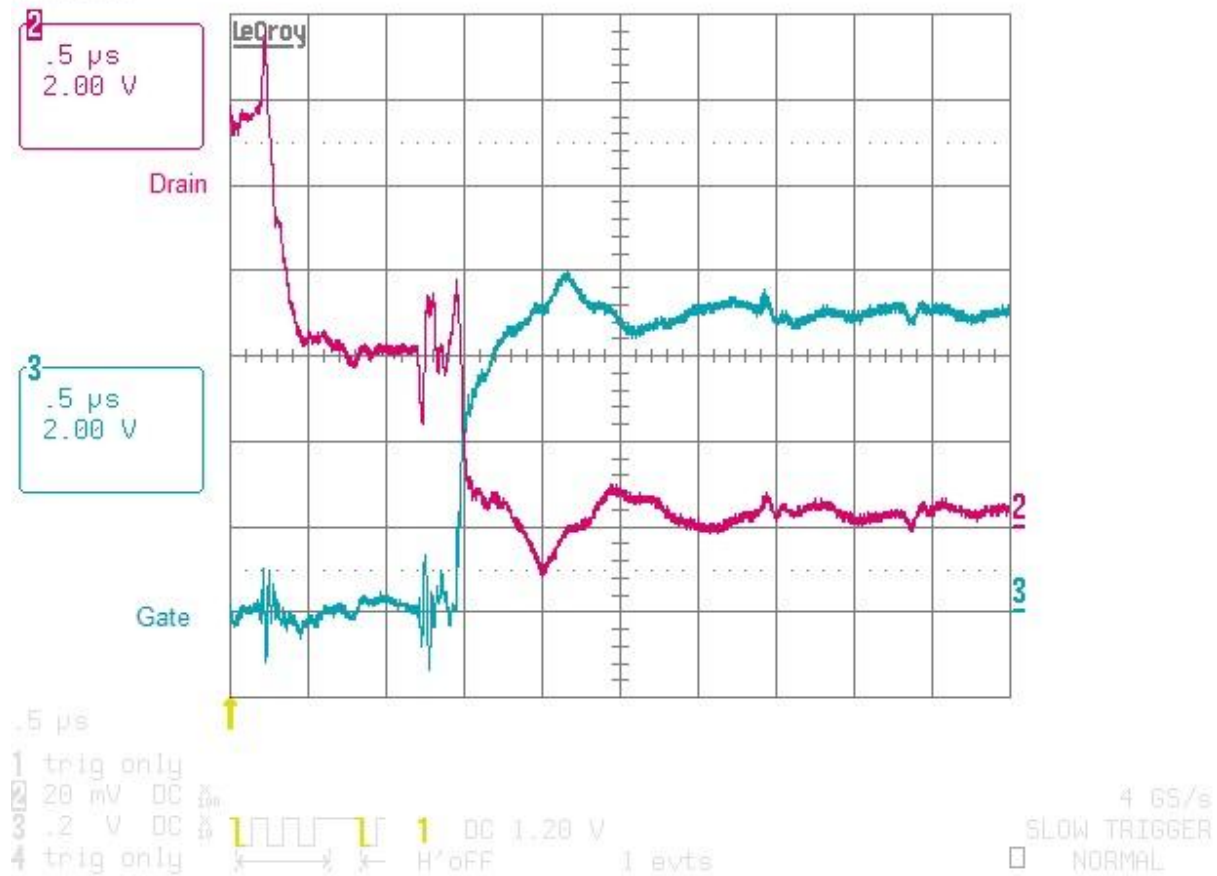
This same picture is available on the FTI-1000 tester, using the tester “scope display” of the digitized current and voltage waveform.



In this waveform, the dark blue trace is the VDS, the orange trace is the ID and the gray trace is the computed RDS. For this waveform, the tester was programmed to wait 3 usec after the initial turn on, and the measure for 20 usec. The RDS is then computed at each sample and averaged across the 20 usec for an RDS_{ON} of 120 mOhm.

The next waveform shows the removal of the stress voltage and the post-stress (final) RDSon measurement.

24-Jul-14
17:02:07

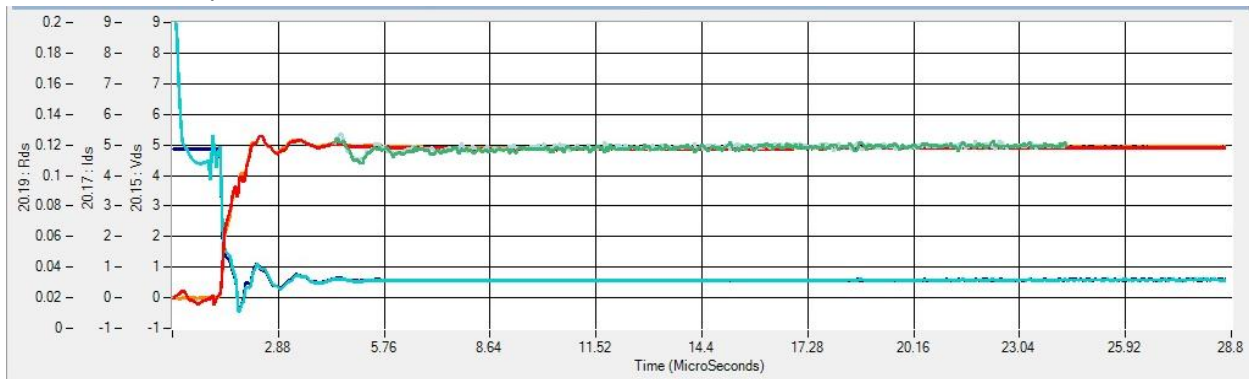


A silicon FET is used to discharge the Stress voltage for 1 usec, bringing the VDS down to approximately 5V, so that the DUT is in almost identical conditions to the initial RDS reading. The DUT is turned on and the final RDS measured.



The above waveform shows the tester display of the post stress RDS measurement. Here the VDS is light blue, the ID is read and the computed RDS is green.

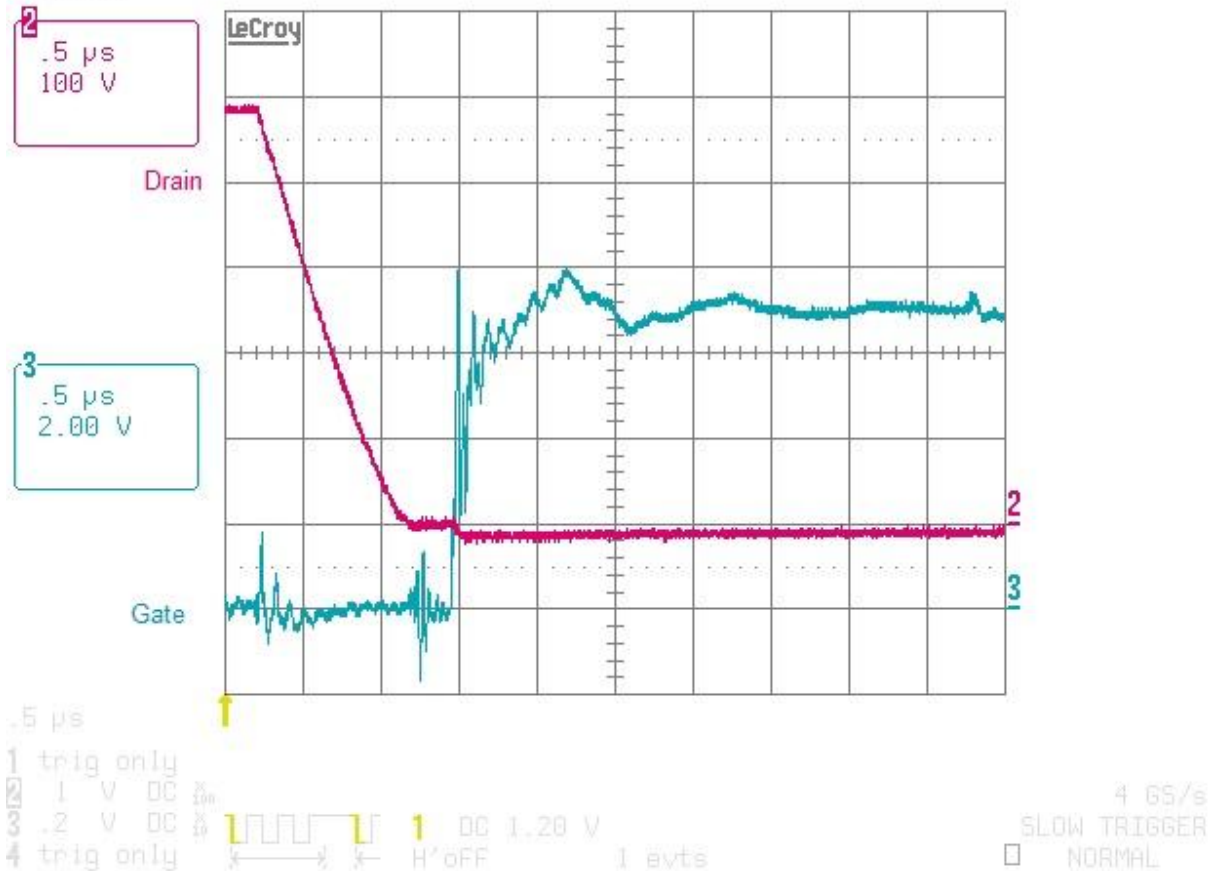
Normally on the tester, we will overlay both the before and after RDS readings, so that any differences can be seen easily.



In this case, with no significant stress, the before and after waveforms match almost perfectly.

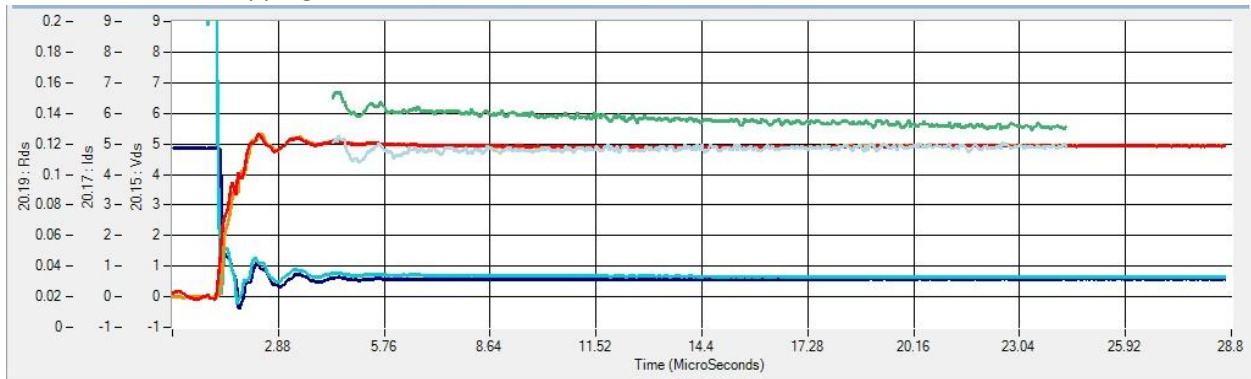
Now a real stress of 500V is applied for 5ms. The external oscilloscope shows the following:

24-Jul-14
17:14:39



The waveform from the tester shows the RDS shift. The initial RDSON is 117mOhm, and after the stress, the RDS increases to an average of 136mOhm. A shift of 17%. It is also interesting to note that the RDS is actually recovering during the 20 usec averaging. During the 20 usec, it goes from a starting value

over 140mOhm, dropping almost 20 mOhm in the 20 usec.



Finally, with a longer stress, the shift is much greater. In the waveform below, the DUT was stressed at 500V for 5 seconds. This was done only about 1 minutes after the previous test, and the device had almost recovered, starting with an initial RDS of 118 mOhm, ending with a post-stress RDSON of 174mOhm (47% increase).

