MOSFET Safe Operating Area FTI-1000 Application

Using the SOA or HP module, the Safe Operating Area test applies a given power to the MOSFET device under test (DUT) for a given pulse width. A passing device will absorb the programed power for the pulse duration, followed by a final VDS measurement. Should a device breakdown, or otherwise fail during the Pulse, an over current detection will halt the test immediately and report the failure.

PARAMETERS

GateResistor: The resistance in series with the DUT gate, used for device stability during the test

GateStepV: The Vgs amplitude increase/decrease the system will adjust (per measurement cycle) to regulate Drain current

Load_Current: The amplitude of the drain current during the test pulse.

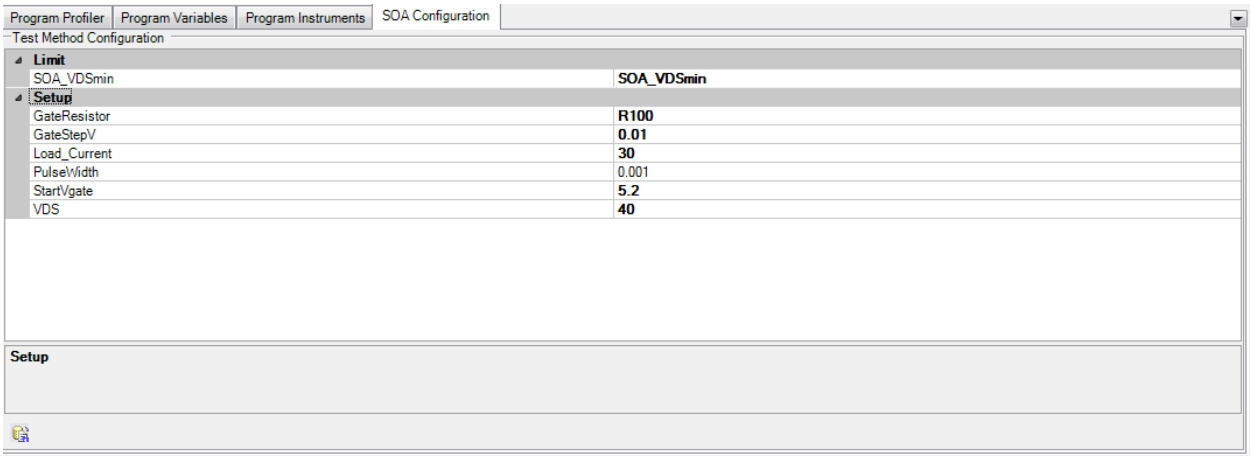
PulseWidth: The duration of time the power is applied during the test

StartVgate: The initial Vgs from which the system regulates to achieve the programmed drain current. Set this parameter to “0” to automatically find the Vgs at the test current.

VDS: The voltage across the DUT, from Drain to Source, during the test

LIMITS

SOA_VDSmin: The minimum VDS measured at the end of the test, used to determine a passing or failing device



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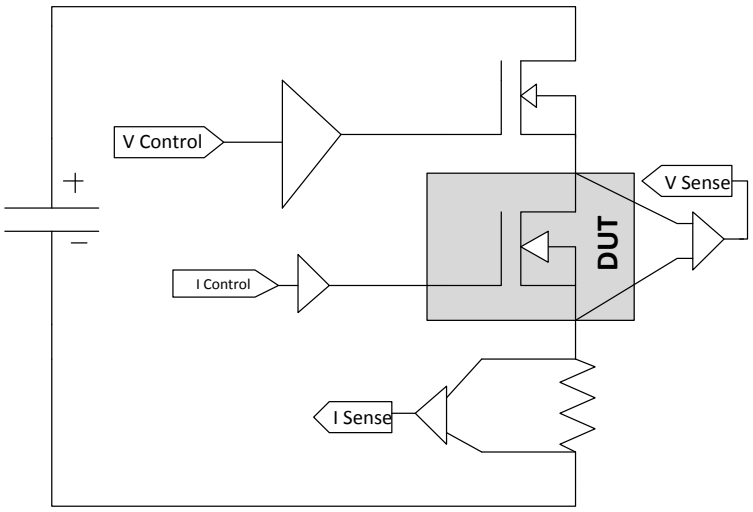
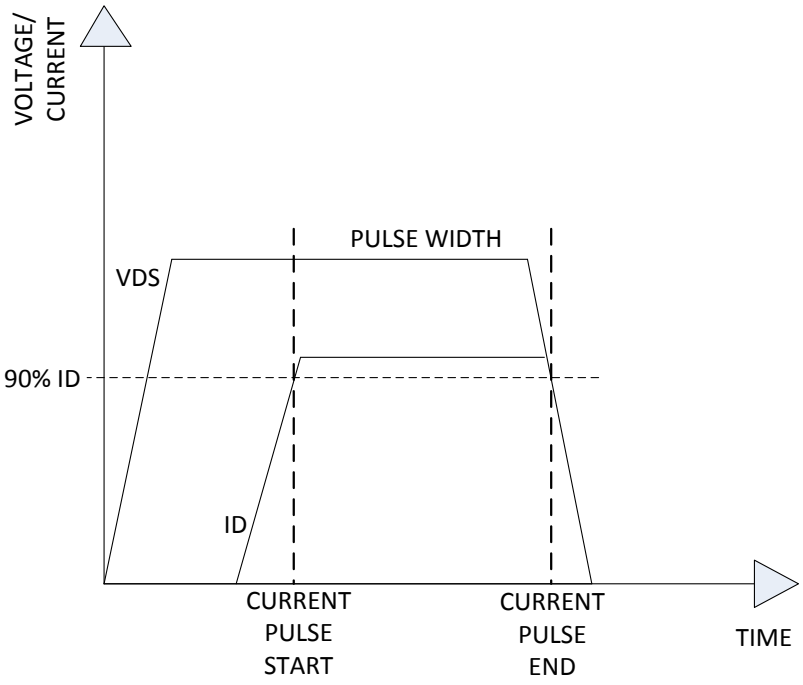
TEST CONFIGURATION AND PROFILE

The SOA test is configured per the below diagram, and is programed to produce the below profile waveform.

SOA Test Configuration



SOA Test Profile



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INITIAL RUN CONFIGURATION

The SOA test, based on the above configuration, regulates the Drain current by incrementing the gate voltage. This increment however is of a fixed value, set by the *GateStepV* passed parameter. Due to this fixed value, the gate voltage must first be set to the appropriate value so the programmed current is reached.

Manual initial gate voltage setting:

To assign the initial gate voltage manually, enter the expected *StartVgate* (Vgs) needed to regulate the programmed *Load_Current* (ID). After running the test, the peak current will be displayed at which point fine adjustments to the initial Vgs may need to be made due to current over shoot, or under shoot.

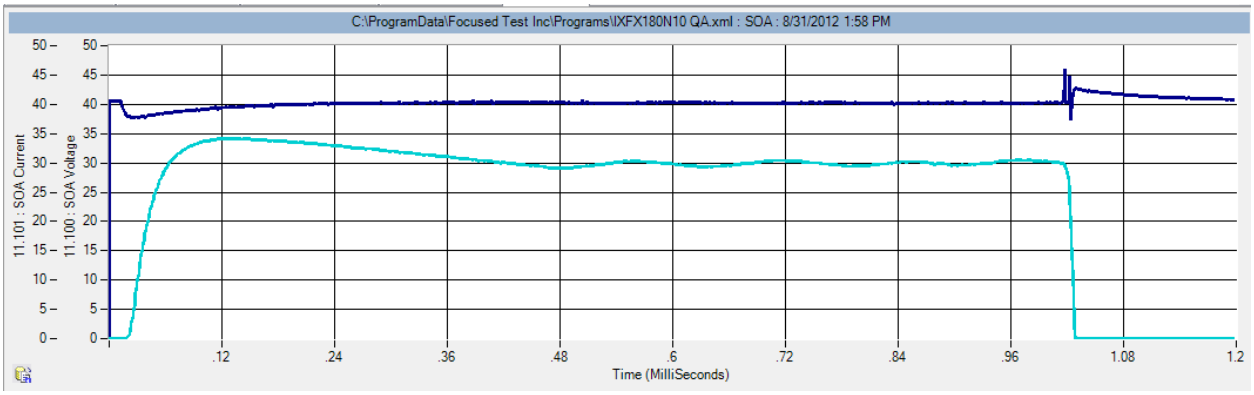
One can also use the scope tool to graphically determine if the *StartVgate* needs adjustment.

Automatic initial gate voltage setting:

By setting the *StartVgate* (Vgs) parameter to "0", the automatic Vgs search function is activated. This function will automatically find an appropriate Vgs for the programmed ID.

Note: Due to certain device characteristics, the automatic initial Vgs search function may display a found Vgs that under regulates a large programmed ID. In this case, use a small percentage greater *StartVgate*, and verify using the scope tool.

EXAMPLE WAVEFORMS



Current over shoot. Decrease of *StartVgate* will correct the current waveform.

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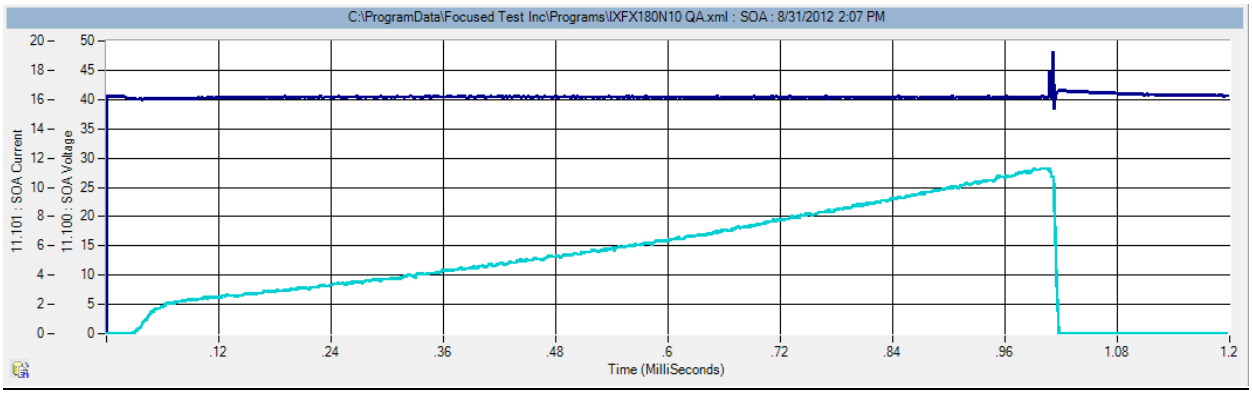
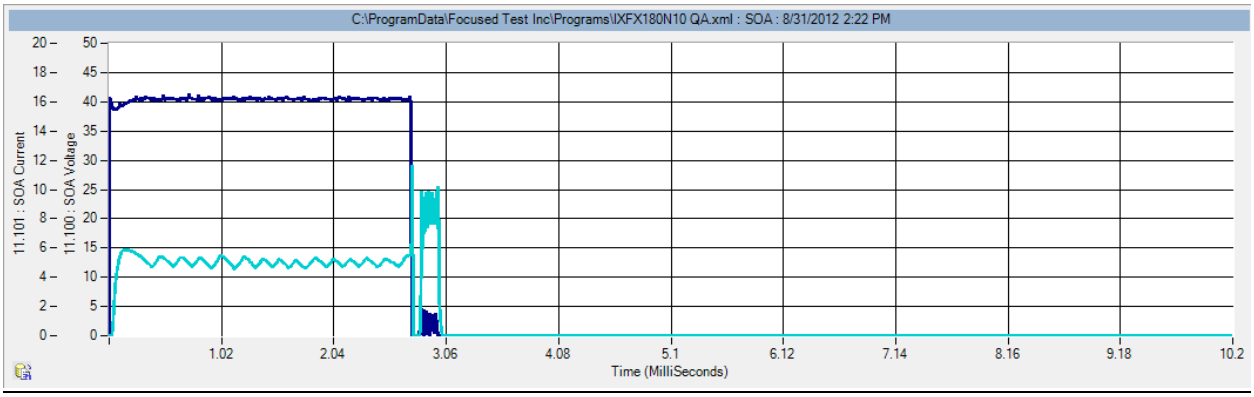
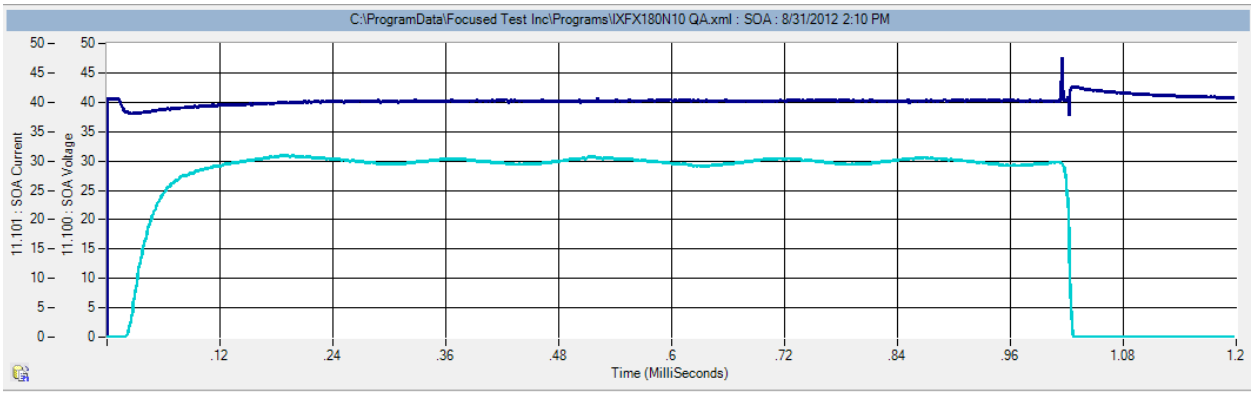


Current under shoot. Increase of *StartVgate* will correct the current waveform.



DUT failure waveform.



Corrected SOA test waveform.

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TEST FAILURE DETECTION

The SOA test will detect 3 failure modes of a tested MOSFET, minimum pulse width, minimum ID, and minimum VDS. This information is calculated from the array of data, measured during the test.

Minimum pulse width: The beginning of the SOA pulse is flagged once the current reaches 90% of the programmed value. Likewise, the end of the SOA pulse is flagged once the current falls below 90% of the programmed value. The difference between these two points multiplied by the sampling rate calculates the pulse width. If this calculated pulse width is less than the programmed value, an error message, and suggested troubleshooting steps will be logged to the user.

Minimum ID: Should the current during the test pulse not reach the programmed value, and error message, and suggested troubleshooting steps will be logged to the user.

Minimum VDS: If the minimum current is reached, and the start and end of pulse are found, the average VDS value is calculated from the pulse data. If this average VDS does not reach the programmed voltage minimum value, an error message will be logged to the user.