Dynamic Rdson Test: Key Requirements

- Fast, Single Shot Measurement for good Repeatability
- Test is required to detect areas of wafer with highest trapping
- Tester must tolerate bad DUT to avoid Probe Card failures
- Fast Switching Time from OFF to ON State (need <1µs)
- Fast Sampling to see Transients and Settling Time (need >20 MS/s)
- $V_{ds}$ Stress Voltage needs:
  - Controlled Rise Time (no Overshoot)
  - Current must be Limited
  - Accurate Monitoring of Voltage and Leakage Current
- <1µs Measurement Delay after End $V_{stress}$ and Start 2nd Rdson
  - Minimize Stray Capacitance and Inductance
Dynamic Rdson Test Circuit
GaN Dynamic Rdson Test Method

1\textsuperscript{st} Rdson measure

Stress Voltage
7ms, 20V

2\textsuperscript{nd} Rdson measure

VDS  VGS
GaN Dynamic Rdson Test Method

E-Mode Device

1st Rdson measure

Stress Voltage

2ms, 10V

2nd Rdson measure
GaN Dynamic Rdson Test Method

Stress Voltage
2.5ms, 15V

1st Rdson measure

D-Mode Device

2nd Rdson measure

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GaN Drdson Before Stress

- Time (usec)
  - Vds Initial
  - Ids Initial
  - Rds Initial

- VDS (V) IDs (A)
  - -2 to 8
  - -1 to 5
  - -1 to 0

- Resistance (ohms)
  - 0 to 0.16
  - 0 to 0.1
  - 0 to 0.02
GaN DRdson after Stress: 500V for 5ms

Rdson after Stress
Rdson before Stress
GaN DRdson after Stress: 500V for 5s

Rdson after stress

Rdson before Stress
FTI 1000 with Dynamic RDson Test Station
FAQ’s

- Can Hard Switching be used?
  - Yes – add inductance in series with current sensor.

- Need to measure $\text{DR}\text{dson}$ immediately after Stress to emulate real-life conditions
  - Agreed, but the worst case needs to be measured in a few $\mu$s after stress, which is effectively the same measurement as Dynamic Rdson.

- Why test 100% of devices in production test?
  - Trapping varies across the wafer, and so there is no other way to know if a specific die has higher Rdson

- What are minimum practical test times?
  - Measure time 10 $\mu$s (5 $\mu$s settling, 5 $\mu$s averaging), Stress Time 50 – 100 msec for wafer sort.
  - It is possible to test faster, maybe as low as 1 $\mu$s settling and < 10 msec stress, for packaged part test.