Supplementary Information for

Hard-Switching Reliability Studies of 1200 V Vertical GaN PiN Diodes

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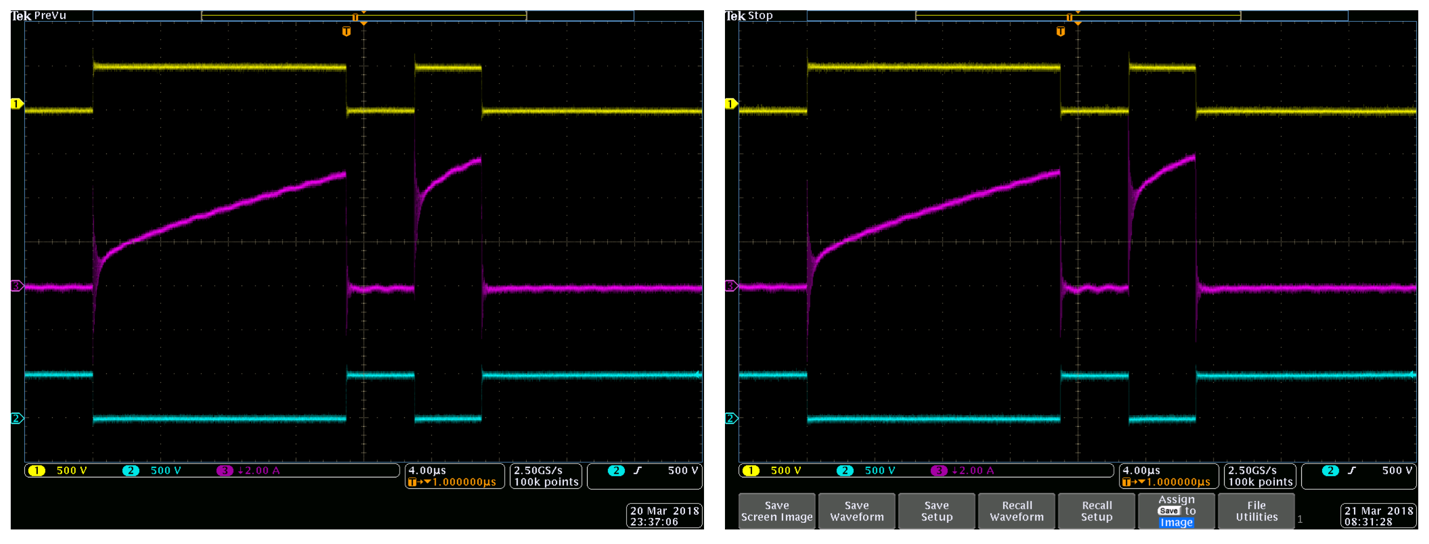
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**Vertical GaN PiN Diode Structure**



**Figure S1.** Illustration of a vertical GaN PiN diode, showing the different regions of the device and the contact metals.

**500 V**

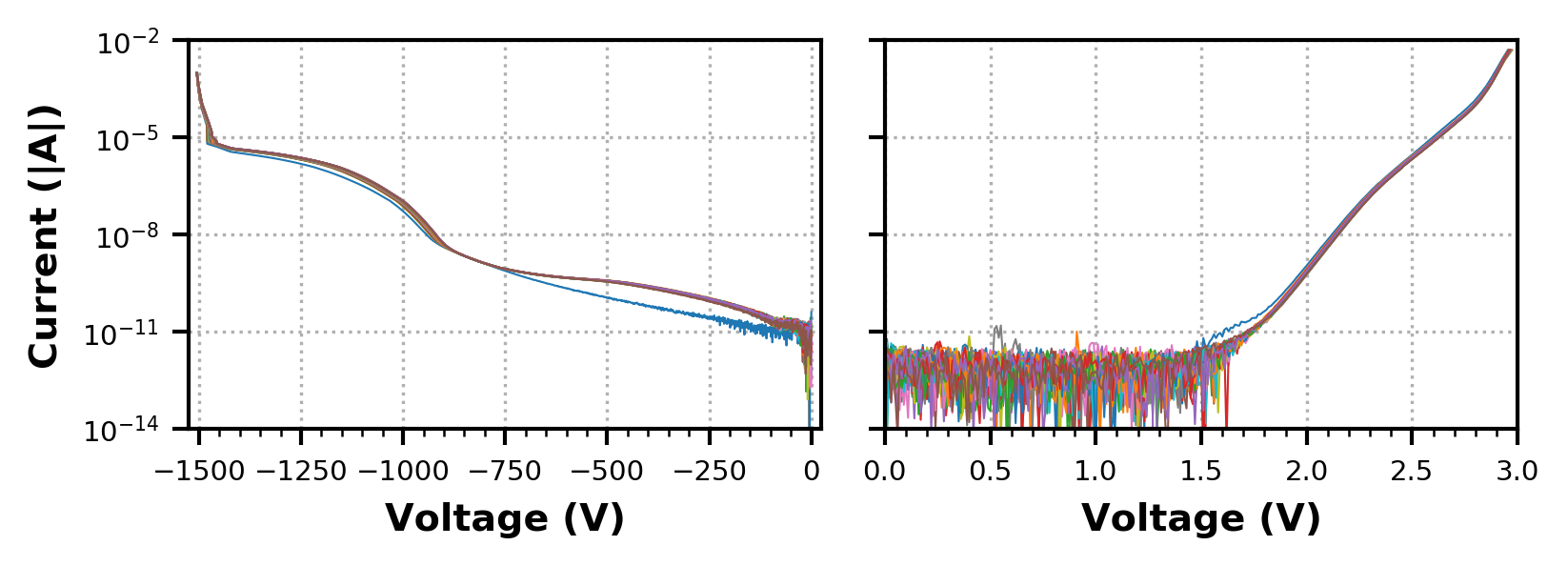


(a) (b)



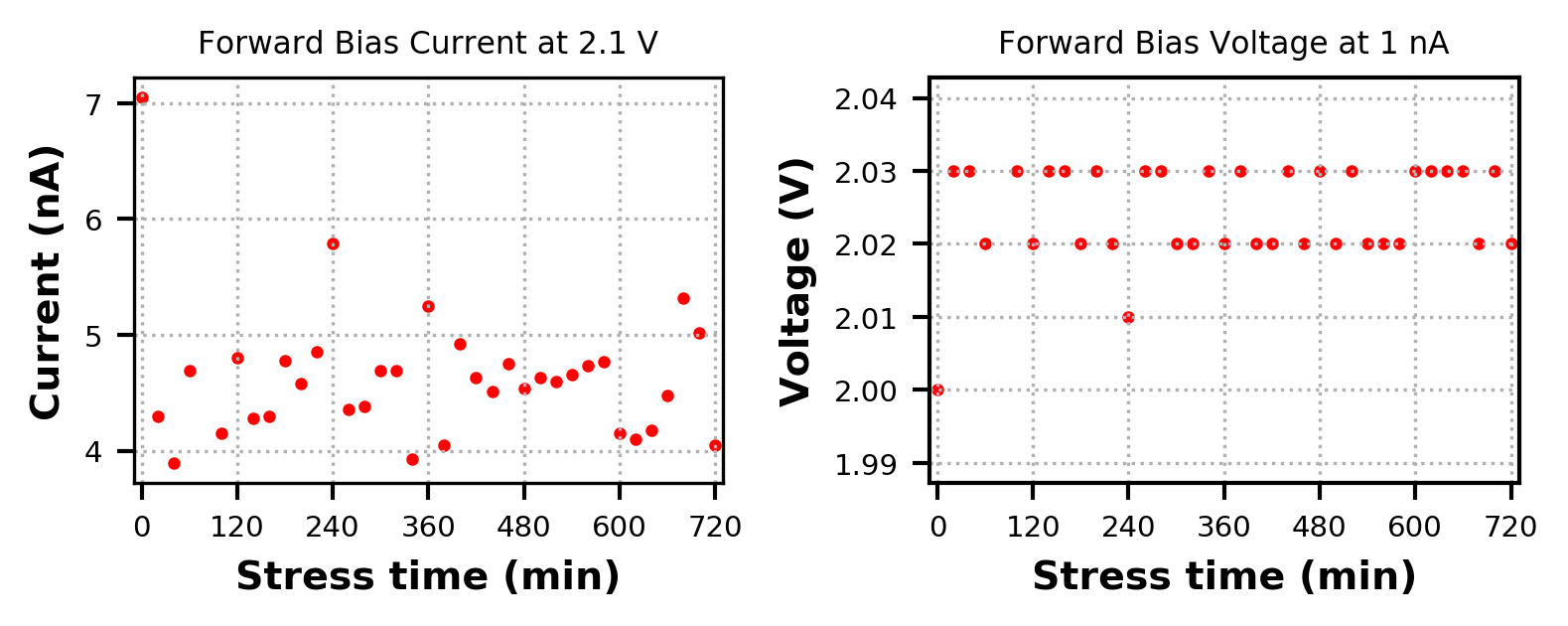
(c) (d)

**Figure S2.** 500V stressed v-GaN PiN diode oscilloscope reading of diode voltage in yellow, diode current in magenta, and switch voltage in blue for the double-pulse traces (a) pre-stress and (b) post-stress, along with the stress pulse traces (c) pre-stress and (d) post-stress. The yellow trace is plotted on a scale of 500 V/div at an offset of +1500 V, the blue on a scale of 500 V/div at an offset of -2000 V, and the magenta parts (a, b) are on an inverted scale of 2 A/div at offset of -2A for parts while (c, d) are on an inverted scale of 1 A/div at offset of -1A.

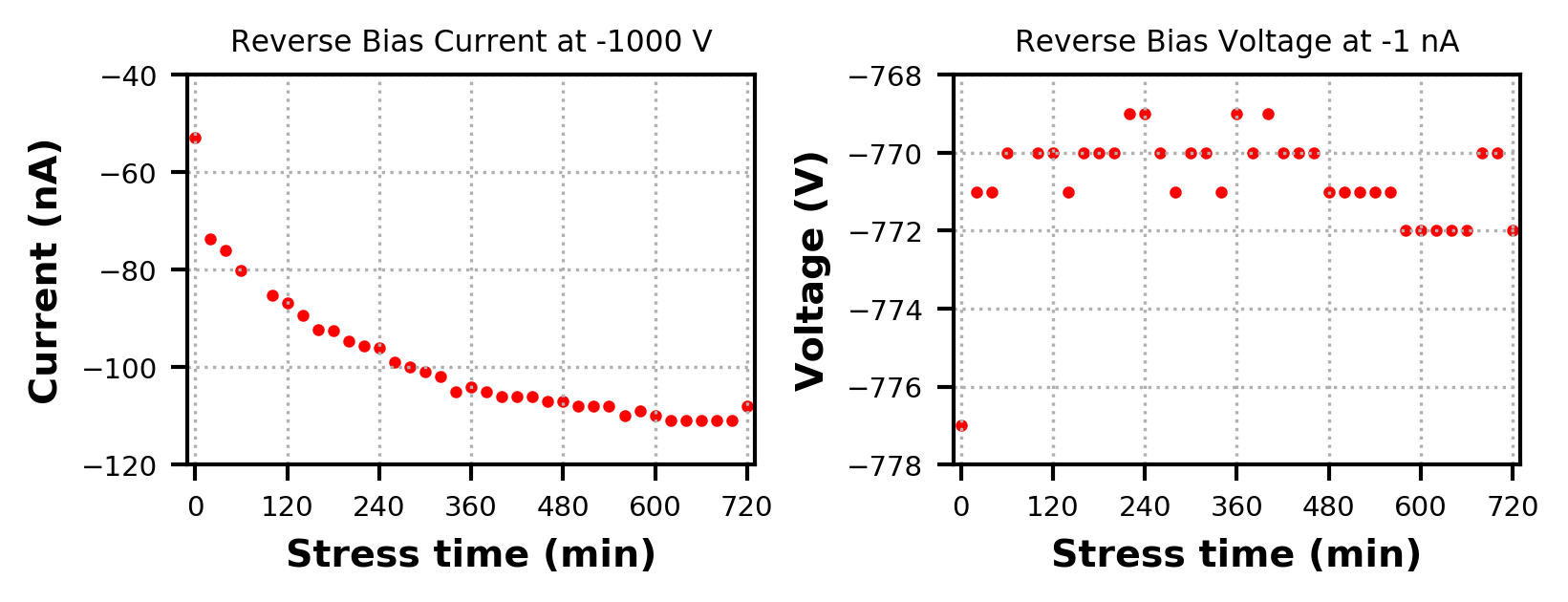


(a) (b)

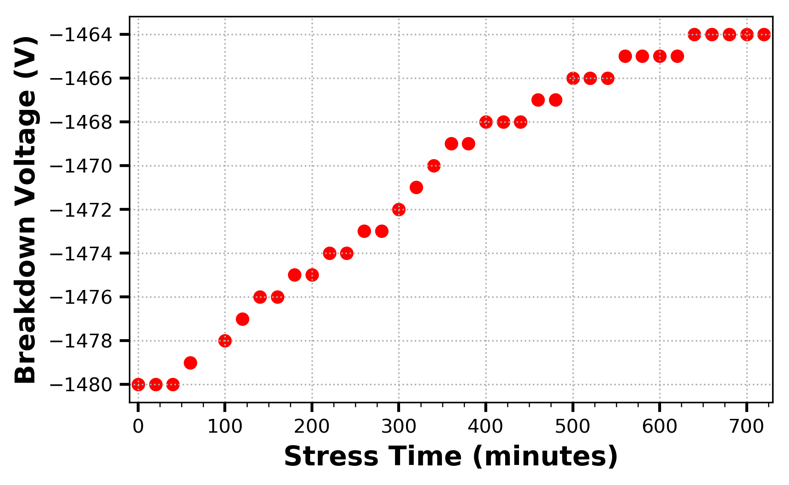
**Figure S3.** Cumulative(a)reverse and (b) forward I-Vs over the full duration for the v-GaN stressed at 500 V.



(a) (b)



(c) (d)



(e)

**Figure S4.** Forward bias (a) leakage current at 2.1 V and (b) voltage variability at 1 nA,reverse bias (c) leakage current at -1000 V and (d) voltage variability at-1 nA, and(e)breakdown voltage vs. stress time for the v-GaN stressed at 500 V.

**750 V**

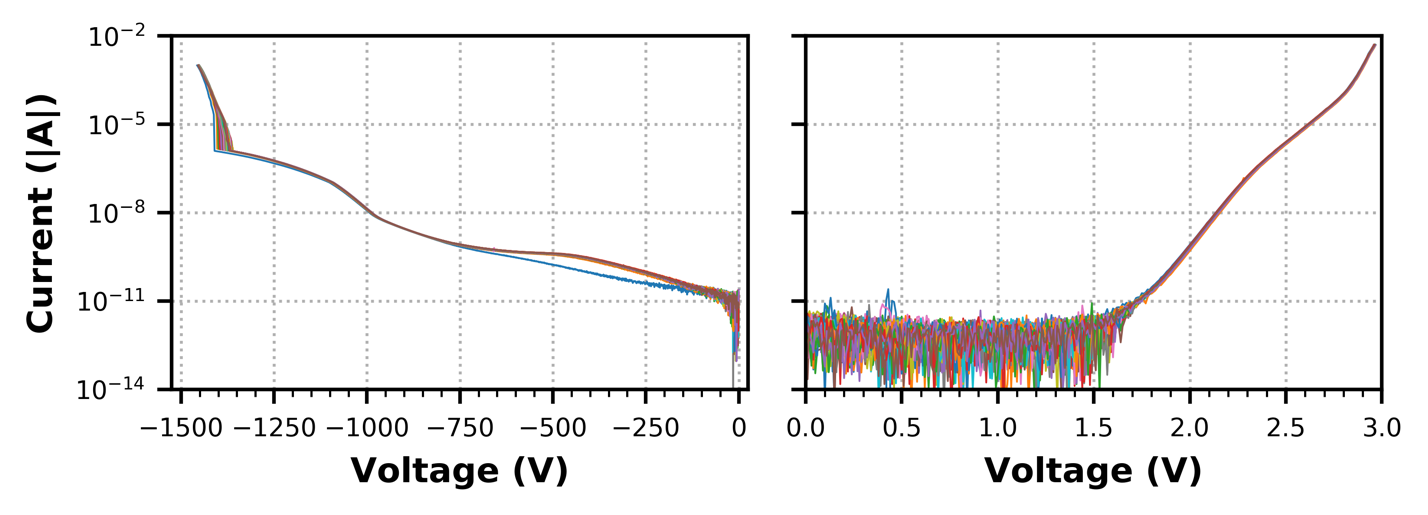
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(a) (b)

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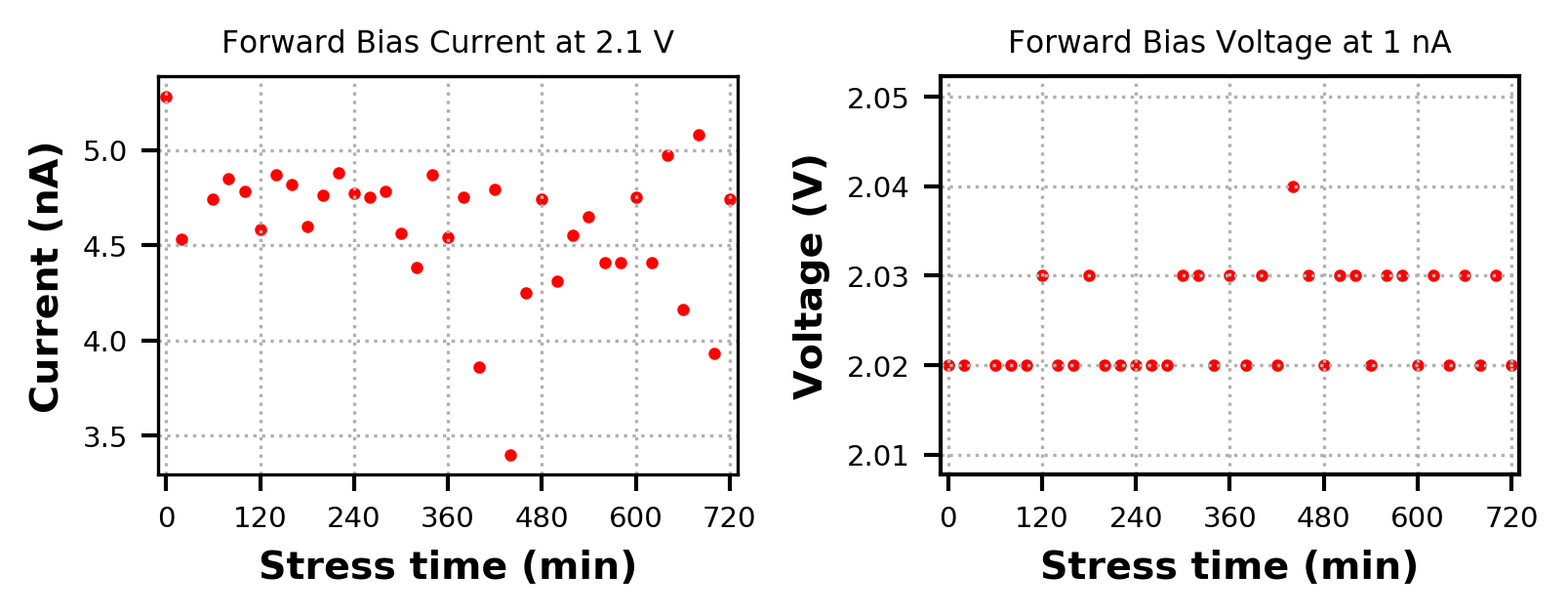
(c) (d)

**Figure S5.** 750 V stressed v-GaN PiN diode oscilloscope waveforms of diode voltage in yellow, diode current in magenta, and switch voltage in blue for the double-pulse traces (a) pre-stress and (b) post-stress, along with the stress pulse traces (c) pre-stress and (d) post-stress. The yellow trace is plotted on a scale of 500 V/div at an offset of +1500 V, the blue on a scale of 500 V/div at an offset of -2000 V, and the magenta parts (a, b) are on an inverted scale of 5 A/div at offset of -5A for parts while (c, d) are on an inverted scale of 1 A/div at offset of -1A.

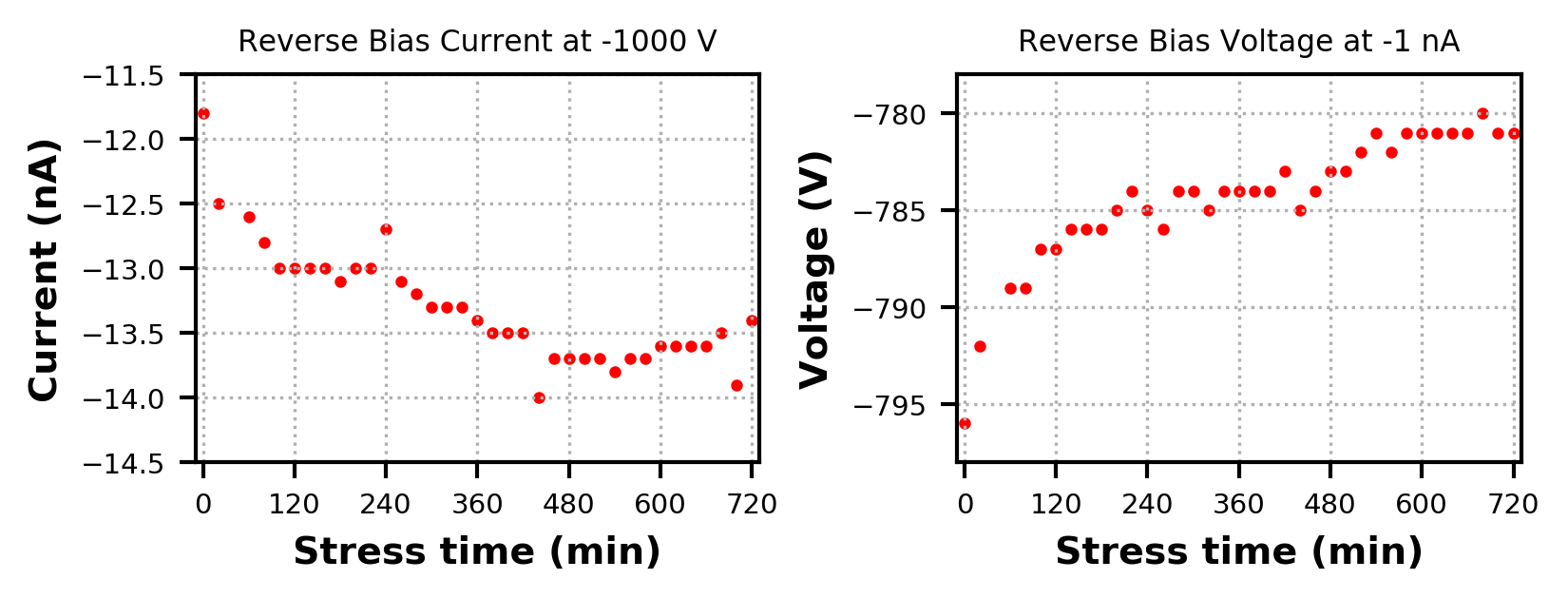
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(a) (b)

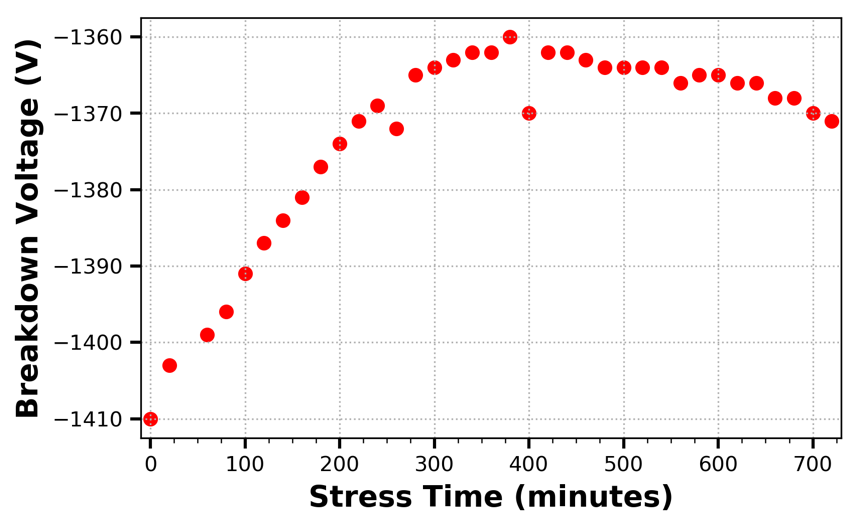
**Figure S6.** Cumulative(a)reverse and (b) forward I-Vs over the full stress duration for the v-GaN stressed at 750 V.

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(a) (b)

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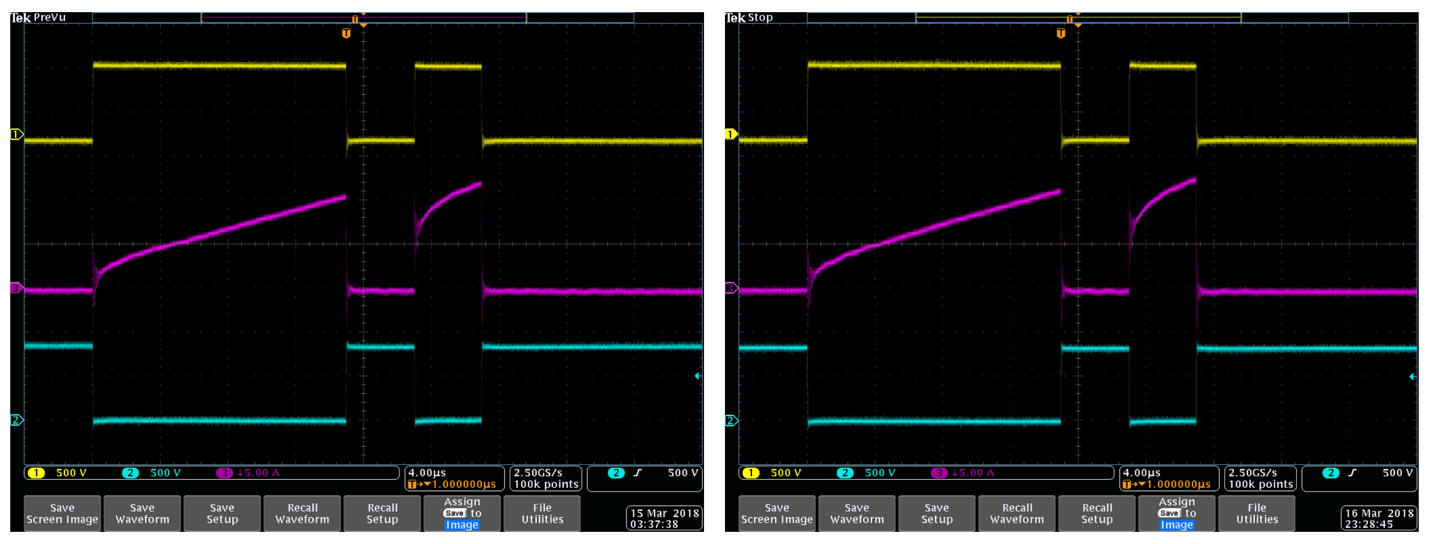
(c) (d)

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(e)

**Figure S7.** Forward bias (a) leakage current at 2.1 V and (b) voltage variation at 1 nA,reverse bias (c) leakage current at -1000 V and (d) voltage variation at-1 nA, and(e)breakdown voltage vs. stress time for the v-GaN stressed at 750 V.

**1000 V**



(a) (b)



(c) (d)

**Figure S8.** 1000V stressed v-GaN PiN diode oscilloscope captures of diode voltage in yellow, diode current in magenta, and switch voltage in blue for the double-pulse traces (a) pre-stress and (b) post- stress, along with stress pulse traces (c) pre-stress and (d) post- stress. The yellow trace is plotted on a scale of 500 V/div at an offset of +1500 V, the blue on a scale of 500 V/div at an offset of -2000 V, and the magenta parts (a, b) are on an inverted scale of 5 A/div at offset of -5A for parts while (c, d) are on an inverted scale of 2 A/div at offset of -2A.