Device Characterization of Solar Inverters

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USING GALLIUM NITRIDE IN SOLAR INVERTERS
Motivations:
• Increase the efficiency of solar energy, known to be highly inefficient
• Decrease the overall cost
• Potentially more durable
• Website: making this information more useful in practice

Testing Needed:
• Static and dynamic characterization

My role in this:
• Assist with testing
• Technique for storing data

STATIC CHARACTERIZATION

Behavior while Fully On/ Fully Off:
• internal resistance of the device
  – conduction loss
• How much voltage can the device withstand before failure?
• At any particular voltage, how much current can the device carry?
• Curve Tracer

Figure 3 (left): a graph of the information received from the curve tracer
Figure 4 (right): graph of turn on energy losses

DYNAMIC CHARACTERIZATION

Behavior while Switching:
• Time during which voltage and current are changing as the device switches on and off.
• Power loss due to the overlap of voltage and current
• Oscillation present while switching: overshoot
  – Voltage going above the power rating during shut off

Figure 5 (left, top): Turn off waveform
Figure 6 (left, bottom): Example of oscillation while switching
Figure 7 (right): Dynamic Testing Set Up

RESULTS SO FAR
• Overshoot
• Faster switching → Loss
• Internal Resistance
• Ground Work for Database

Figure 8: Graph of internal resistance

STORING THE INFORMATION

Website
• Searching capability
• Uploading with progression
• Not repeating tests
• Widespread use

Figure 1 (above): Solar inverter
Figure 2 (right): Device used for testing

FUTURE RESEARCH

• Better database implementation
• Cost analysis
• GaN, Si, SiC comparisons

Figure 9: Switching loss