

Wide Band Gap and Power Devices

Jason Osheroff

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NEPP ETW WBG & Power Devices Session Agenda

10 min	**“Wide Band Gap and Power Devices Radiation Updates”** Jason Osheroff, NASA GSFC
25 min	**“Understanding Single-Event Effects in Silicon Carbide High Voltage Power Devices for Lunar Exploration”** Arthur Witulski, Vanderbilt University
20 min	**“Joint SAE/JEDEC GaN Power Device Working Group”** Rod de Leon, Boeing
25 min	**“Collaborative Evaluation of GaN FET Reliability”** Christopher Tiu, NASA GSFC, Toren Hobbs/Carol Putman, NASA MSFC Kristen Boomer, NASA GRC/Ahmad Hammoud, NASA GRC/HX5



Wide Band Gap and Power Devices Radiation Updates

Jason Osheroff

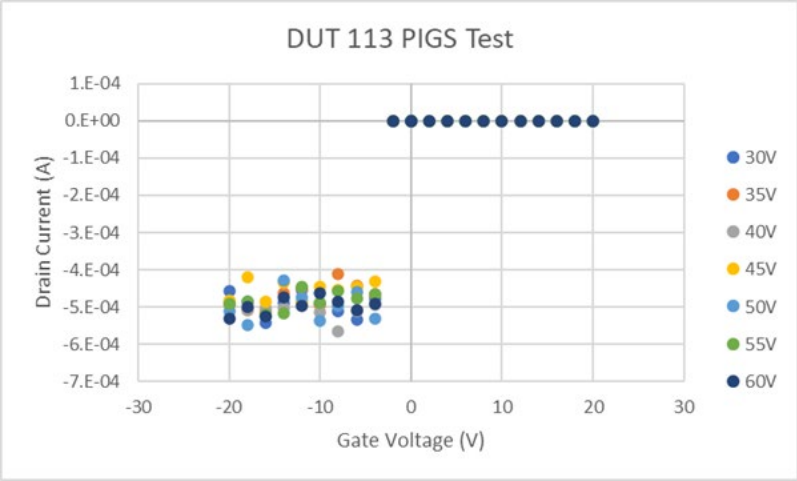
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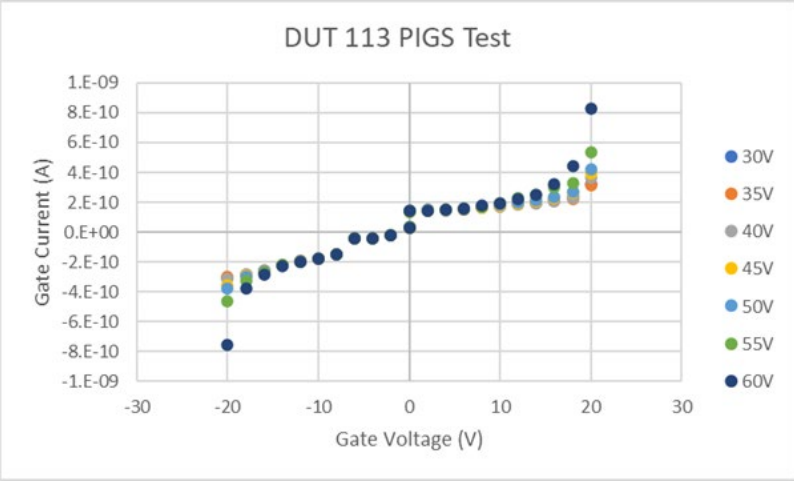
SSDI SFL22P06S.5 p-Type 60V Power MOSFET

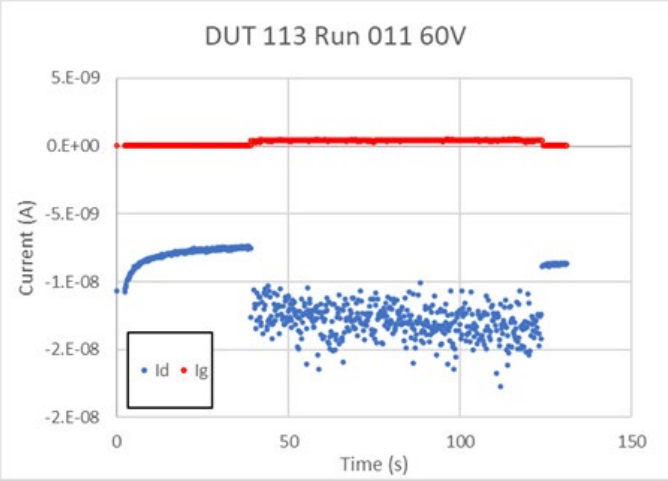
- DUT 111
  - Failed during the PIGS test after 60V
- DUT 113
  - Passed full rated voltage
- DUT 112 & 114
  - Damaged during set up

Parameter	Condition	MIN	MAX	Units
Gate Threshold Voltage (V_{GSth})	$V_{DS} = V_{GS}$, I_D = -250µA	-1.0	-2.5	V
Zero Gate Voltage Drain Current (I_{DSS})	V_{DS} = -60 V, V_{GS} = 0 V	-0.015	-1.0	µA
Drain-Source Breakdown Voltage (BV_{DSS})	V_{GS} = 0 V, I_D = -250µA	-60		V
Gate-Source Leakage Current (I_{GSS})	V_{GS} = +/- 10 V, V_{DS} = 0 V		+/-100	nA
Static Drain-Source Resistance (R_{DS_on})	V_{GS} = -5 V, I_D = -22 A		0.089	Ω

DUT #	20V	25V	30V	35V	40V	45V	50V	55V	60V
111	✓	-	✓	-	✓	-	✓	-	✗
113	-	-	✓	✓	✓	✓	✓	✓	✓



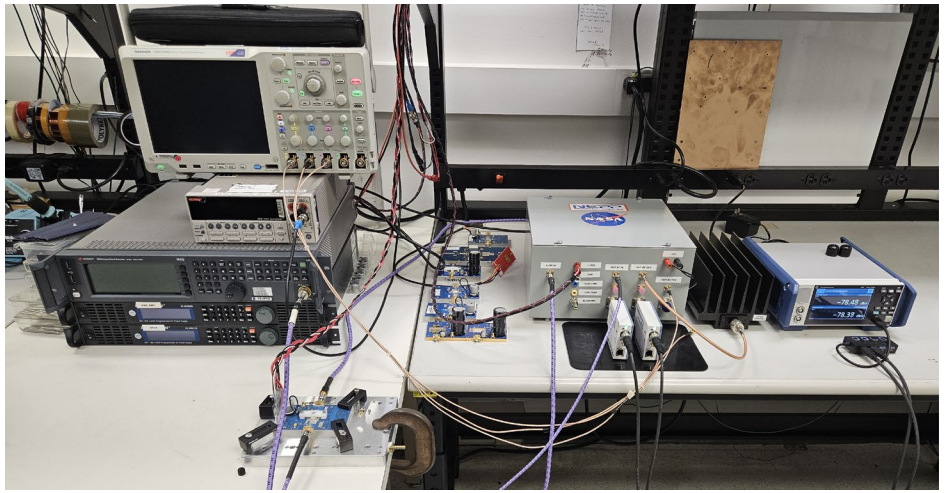


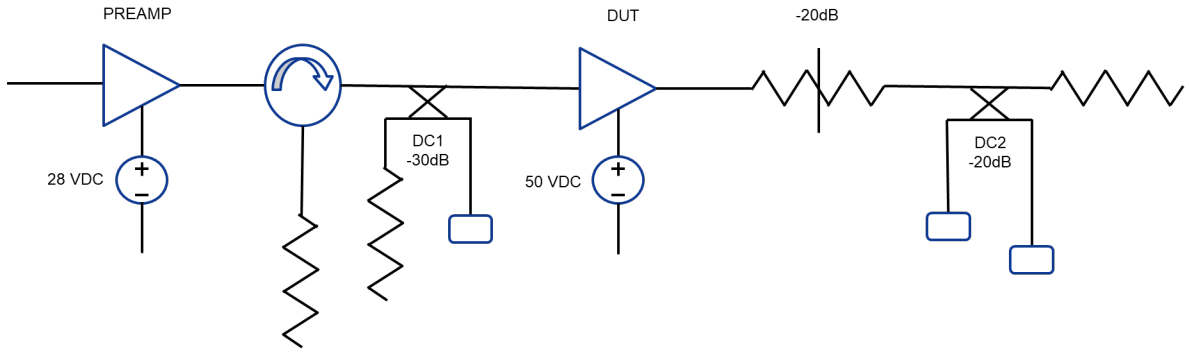


New NEPP RF Test Bench

- 2-4 & 4-6 GHz setups
- RF Input capability: <-20 dBm to 50 dBm
- RF Output: up to 500 W (57dBm)
- Drain Voltage: up to 80V
- Output options
  - Power meter
  - High Speed Oscilloscope
- Remote LabVIEW control by: Alyson Topper







Potential Future Work

RF GaN work with Aerospace

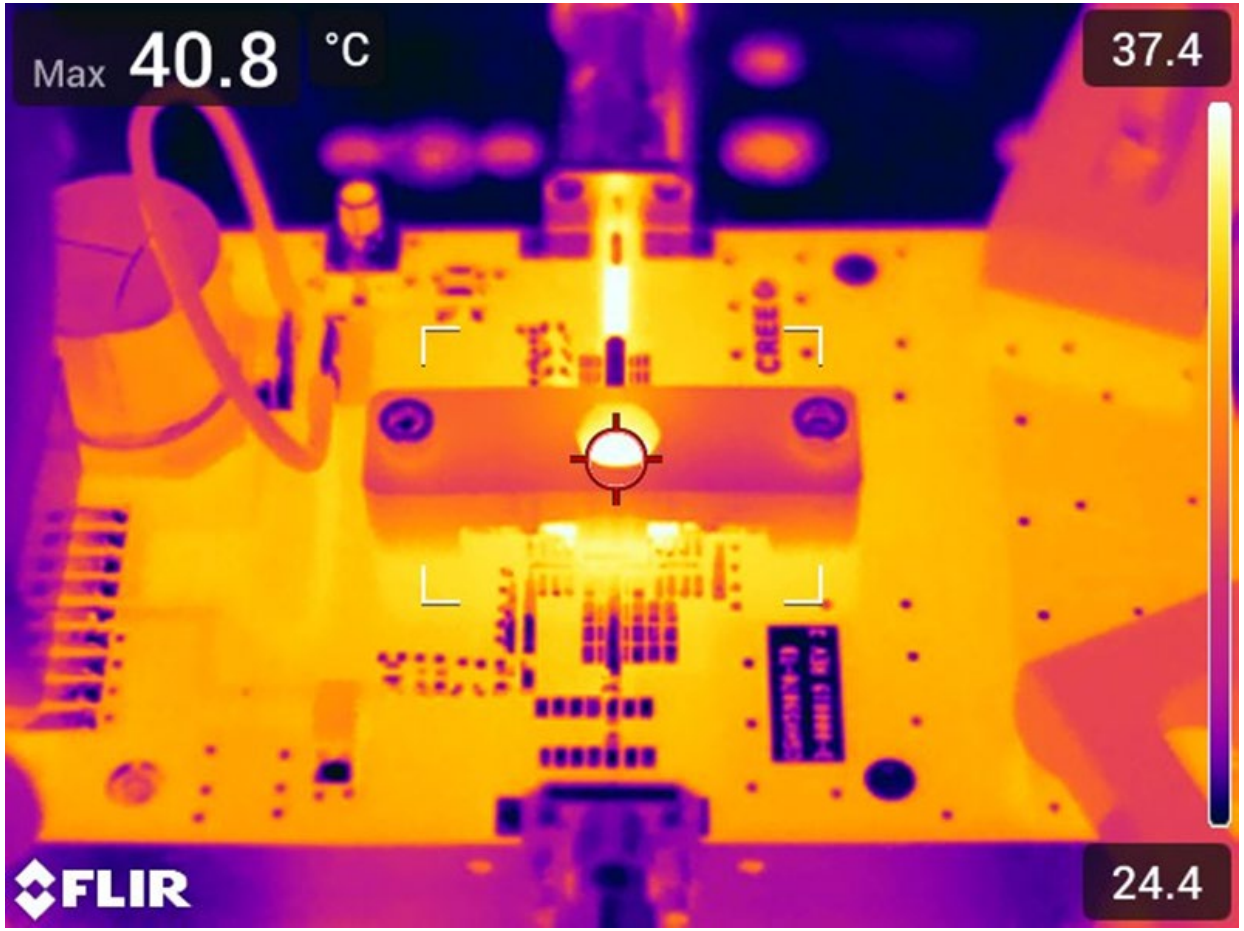
- Unable to get beamtime in May
- Aiming for July at TAMU/MSU pending funding
- 2 independent set ups for both RF and DC mode operation
- 28V and 50V parts

CLAWS Proposal with NC State

- High Permittivity Dielectrics on GaN HEMTS
- RF and DC devices

TID Testing of GaOx with AFRL

- Devices enroute



WBG Community Updates

- RADECS 2023 Short Course on SEE in WBG Devices
- JEDEC
  - First GaN HEMT Slash sheets
  - Focus has shifted towards GaN due to demand
  - John Hutson (Lipscomb) laid out path for SiC standards
- SRHEC – Test and Evaluation Working Group
  - nSEE subgroup-expanding testing availability for neutrons
- SBIR Topic Z1.06 and Z1.05 merged this past call
  - Good submission rates for Phase I & II
- VU LuSTR Project successfully wrapped up this year
  - See talk from Art Witulski

Questions?



Feel free to reach out to me at:
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