

Commercialization of GaN Based Field Effect Transistors

Shawn R. Gibb, **Daniel S. Green**, Brook Hosse, David E. Grider and Joseph A. Smart

RF Micro Devices – Infrastructure Product Group
10420-A Harris Oaks Blvd
Charlotte, NC 28269

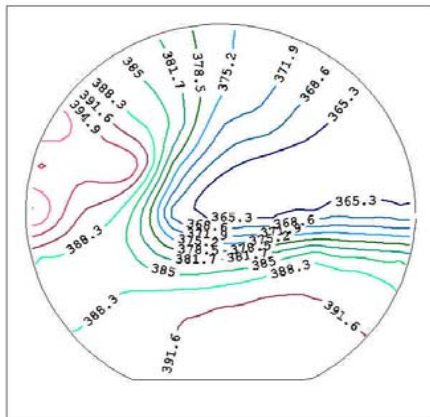
- Tailored Nucleation process to be independent of substrate surfaces or manufacturer.
- Ability to use multiple vendors substrates simplifies supply chain.
- Four GaN HEMT on SiC Wafers Grown in Same Epi Growth Run.
 - Multiple substrate vendors (both 6H [*Vendors 2-3*] and 4H [*Vendor 1*]) represented.
 - Wafer to Wafer Uniformity of 3%

Statistical Summary	
Number of Test Points	69
Average Value	382.0
Maximum Value	404.7
Minimum Value	361.1
Sample Spread(%)	11.42
Std Dev Value	11.9
Sample Std Dev(%)	3.11

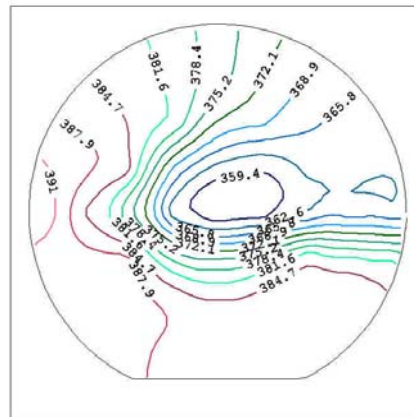
Statistical Summary	
Number of Test Points	69
Average Value	378.5
Maximum Value	395.6
Minimum Value	354.7
Sample Spread(%)	10.81
Std Dev Value	10.8
Sample Std Dev(%)	2.86

Statistical Summary	
Number of Test Points	69
Average Value	372.5
Maximum Value	404.3
Minimum Value	347.2
Sample Spread(%)	15.33
Std Dev Value	13.5
Sample Std Dev(%)	3.62

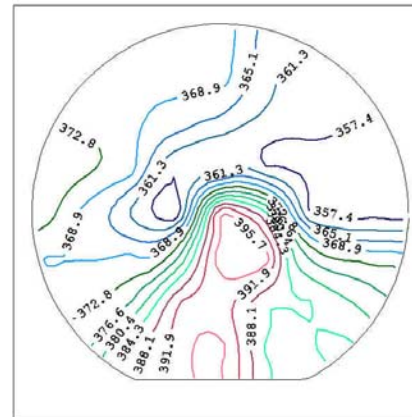
Statistical Summary	
Number of Test Points	69
Average Value	373.6
Maximum Value	386.4
Minimum Value	353.9
Sample Spread(%)	8.7
Std Dev Value	9.0
Sample Std Dev(%)	2.41



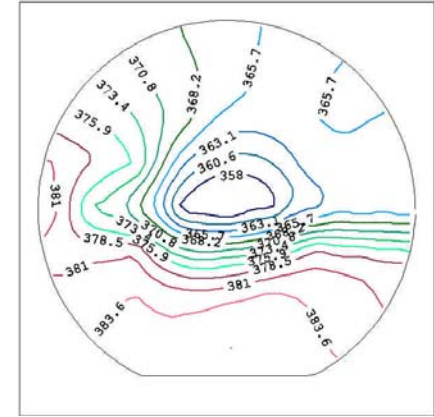
Vendor 1



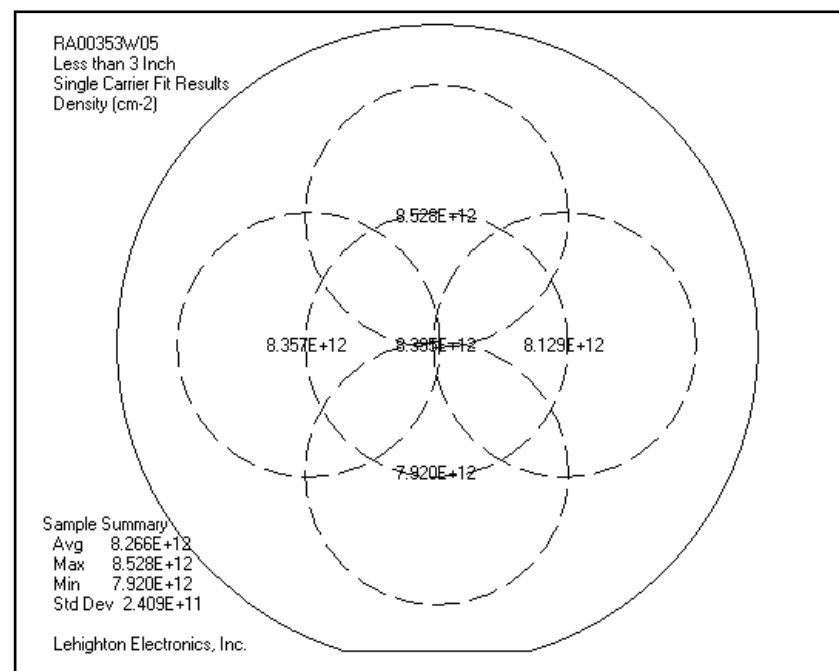
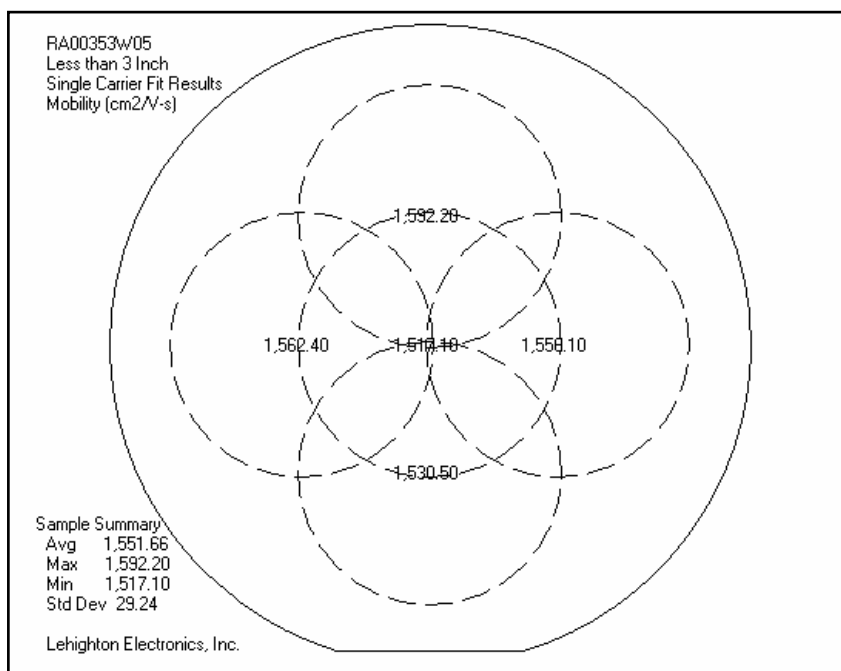
Vendor 3



Vendor 1



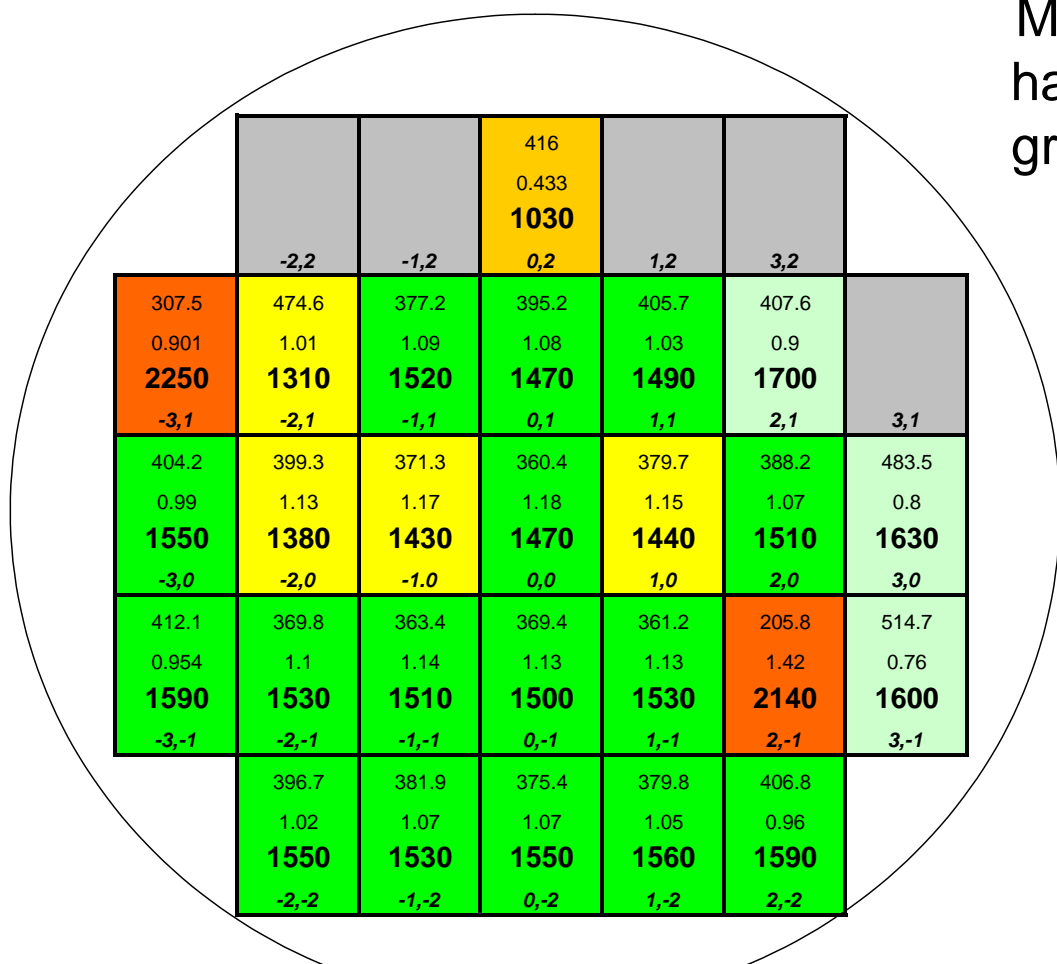
Vendor 2



Standard GaN HEMT Structure Grown at RFMD exhibits:

- Mobility data measured is quite uniform, $\sigma = 1.8\%$.
- Sheet charge density (n_s) measured is quite uniform, $\sigma = 2.9\%$.

Measurement Courtesy of Lehighton Electronics, Inc.



Mobilities as high as 2250 cm²/V·s have been measured on RFMD grown material:

- High mobility attributed to atomically abrupt AlGaIn/GaN interfaces.
- Average n_s of 1.1x10¹³ cm⁻².
- Average μ of 1550 cm²/V·s.
- 70% of sites measured have μ > 1450 cm²/V·s.
- High mobility regions to be sent out for independent third party evaluation.
- Shows good correlation with data measured externally at Leighton Electronics, Inc on Model 1600 Contactless Mobility System.