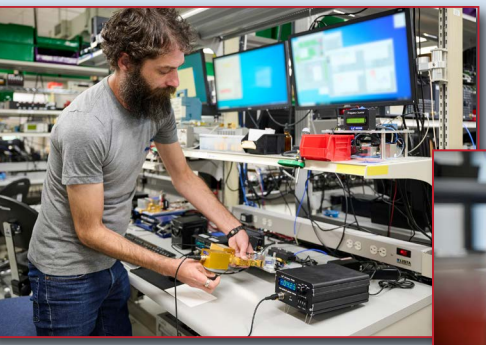
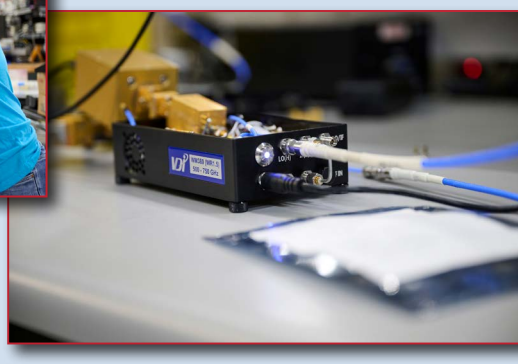
FABS and LABS

Virginia Diodes, Inc.: Making THz Spectrum Useful





Virginia Diodes, Inc. (VDI) was founded in 1996 by the current CEO, Dr. Thomas W. Crowe. Dr. Crowe earned his M.S.E.E. and Ph.D. from the University of Virginia (UVa), slightly more than a mile from the current VDI facility in Charlottesville, Va. While at UVa, his research centered on developing Schottky diode technology tailored for terahertz (THz) applications. In 1996, VDI was launched as a spin-off from the Terahertz Research Program at UVa.

VDI was formed to bring high frequency component innovations to a broader market and support further research in the area. From its inception in 1996 to 2001, VDI sold Schottky diodes for scientific applications, including radio astronomy and high frequency radar. By the early 2000s, VDI had expanded its product line to include mixers, detectors, multipliers and sources operating into the THz frequency range. By 2004, the company was selling transmitter and receiver modules for THz sub-systems. During this period, VDI moved into the current Charlottesville facility and developed capabilities to replace the UVa facilities.

Market applications are creating the need for products and systems at higher mmWave and THz frequency ranges. In response, VDI's product portfolio has expanded dramatically. The company still offers W-Band (75 to 110 GHz) and G-Band (110 to 300 GHz) diodes and a range of single-function components that include detectors, mixers, waveguide amplifiers and frequency multipliers. These component families now include banded offerings from 50 GHz to beyond the THz range. VDI is also integrating these functional capabilities into higher-level receiver and transmitter assemblies and modules that cover frequency bands from 50 GHz to approximately 3 THz. The company rounds out its high frequency portfolio with a family of passive components that include bandpass filters, waveguide sections, tapers, horn antennas and directional couplers that operate in millimeter and THz waveguide bands.

As frequencies increase, so do testing challenges. A standard solution is to add frequency extenders to lower frequency test equipment. These frequency extenders up-convert and down-convert signals to the appropriate frequencies for test. VDI is the gold standard for test and measurement capabilities at millimeter and THz frequency bands with a broad range of frequency extenders that operate from 26 GHz to 1.5 THz for VNAs and spectrum analyzers. The company also makes extension modules for signal generation, noise testing and portable spectrum analyzer applications. Depending on the applications, these extenders operate in bands from 50 GHz to the THz frequency range. In addition to its test and measurement portfolio, VDI has power meters, noise source modules and compact converters that operate in standard waveguide bands up to 500 GHz, with the power meter capable of measuring applications above 3 THz.

The addressable market applications have grown along with the product portfolio. VDI's earliest customers were in radio astronomy, atmospheric science and plasma diagnostics. Now, VDI low noise receivers operating to 900 GHz have flown on CubeSat platforms to study ice clouds and tropical storm evolution. VDI is developing high-power solid-state sources that use dynamic nuclear polarization to produce hundreds of milliwatts at 300 GHz and beyond for magnetic resonance signal applications. They are also involved in 6G and next-generation communications and automotive radar applications. VDI continues to support these and many other fields of research with targeted research and development to improve the sensitivity and power at frequencies up to 5 THz. What started as a university activity has grown into 30,000 sq. ft. across two locations that employs approximately 120 people who are all focused on making the THz spectrum useful.

www.vadiodes.com