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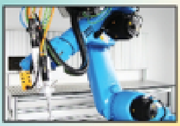

ViscoTec releases dispenser for complex materials of varying viscosities. EM products begin on...

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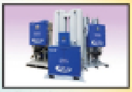
Components and Distribution



South-Tek slashes cost of nitrogen use; ICAPE speaks out on new global business landscape; Micro Harmonics and Cornell use MMW to study virus evolution. Special features begin on...

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New Products

Würth Elektronik subsidiary IQD expands portfolio of rubidium atomic clock oscillators. New products begin on....

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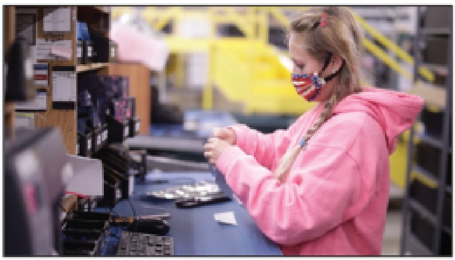
When the Chips are Down: Managing the Semiconductor Shortage

By David Stein, VP — Global Supplier Management, Digi-Key Electronics

THIEF RIVER FALLS, MN — Over the past six months, demand for semiconductors has exploded. Driven in large part by the automotive and consumer electronics industries, this massive spike in demand has snarled supply chains and caused a shortage of semiconductors.



Digi-Key offers nearly 12 million products, with 2.6 million immediately available.

This situation actually began 18 to 24 months ago, when a large amount of design activity began to take place across a broad spectrum of industries, with applications for vehicles, personal electronics, automation, and 5G devices.

Much of this activity was derailed by the coronavirus pandemic, which shifted design and support to the medical industry in early 2020. Now, many companies are resuming previous 2019 projects, as well as starting new ones, creating an even higher demand for semiconductors.

This uptick in demand, combined with lower inventory levels at suppliers and distributors, has caused various shortages and lengthening of supplier product lead times to record highs. At the same time, a lack of shipping containers in Asia, along with logistical challenges, social distancing and quarantine measures continue to disrupt activities in the region.

In addition, the supply chains of raw materials such as manganese, antimony, tungsten, and ferrovanadium have been affected by supply problems and increased freight costs since November.

Lastly, in Europe and the U.S., ports can no longer keep up with unloading containers. With increased COVID-19 health and safety measures in place, ports are operating with reduced staff. Many container ships are anchored for several days, unable to dock. The recent blockage of the Suez Canal further exacerbated these backups, which then resonated throughout global trade.

Shortage and Squeeze

This shortage has broad implications for the in-

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New Techniques for Flexible Printed Electronics

AARHUS, DENMARK — The next generation of electronics is taking the shape of non-rigid, flexible, and customizable circuitry, easily integrated into many different objects. Direct-write printing technology is a popular approach to creating these new electronics, through the use of functional inks. These nanomaterial inks can be tailored to add specific functionalities when used on various flexible substrates, such as textiles or plastics.

The technology, known as printed electronics (PE) has been around for decades, but has recently gained traction due to advances in ink materials, process technology and design methods. In a recent research paper from Aarhus University, published in the journal *Advanced Materials*, professor Shweta Agarwala and her team offer a comprehensive review of the current state of the technology.

PE is already being used in many applications. It is an attractive method to impart electrical functionality to nearly any surface and it has the advantage of being relatively inexpensive

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UMC Plans $36 Billion Semi Fab Expansion

HSINCHU, TAIWAN — United Microelectronics Corporation (UMC) has announced plans to expand capacity at its 300 mm Fab 12A Phase 6 (P6) in Tainan Science Park, Taiwan. The expansion, developed through a collaboration with several of its largest customers, is scheduled to begin in 2023 with an estimated cost of NT$100 billion ($36 billion USD).

The plans come as automakers and a growing range of other sectors have been unable to se-

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Using Millimeter Wave Technology to Prevent Future Viral Outbreaks

By Dr. Dave Rizzo

The next breakthrough in the fight against deadly viral outbreaks may be just a higher frequency away. While millimeter wave (MMW) devices are more commonly associated with military applications, remote sensing, security screening, and next-generation telecommunications, it is now being used to gain new insight into the mechanics of viral transfer.

Curt Dunnam, director of operations at the ACERT National Biomedical Center at Cornell University, works with a research team that understands the vital urgency to perfect biomedical research devices that operate at the higher end of the MMW spectrum.

Initially limited by the physics of waveguide technology, Dunnam and co-workers overcame this barrier through advanced componentry and quasi-optical techniques that can now enlist millimeter-wave technology in the search for treatments for COVID-19 and similar viruses.

ACERT's investigation into constituents of the coronavirus is part of a collaboration with other university teams that has been deemed critical to the coronavirus research effort.

Spectrometer setup at Cornell University.

"Our research is significantly involved in SARS-CoV-2 spike-protein studies," says Dunnam. "A new generation of high-field, high-frequency electron spin resonance spectrometers hold the future promise of more closely analyzing fusion peptide structure and function in the current coronavirus as well as other similar viral proteins."

Biochemistry and Electromagnetics

NMR and MRI devices have long been the gold standard for determining molecular structure and diagnosing soft tissue abnormalities such as tumors. Similar, but more advanced, microwave base electron-spin resonance (ESR) technology has enabled medical researchers to identify a chink in the coronavirus armor.

In a recent paper, Susan Daniel and Gary Whittaker of Cornell University describe that the coronavirus uses a spike protein — specifi-

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cally a fusion peptide — to infect host cells. This fusion process does not evolve and change as quickly as other parts of the protein, so if it can be nullified, potentially broadly-acting antiviral strategies can be developed.

The researchers needed a way to observe the microscopic process of the spike protein's shape shifting during fusion. "We have unique facilities for doing such confirmation dynamics of proteins," says Dunnam. "We send out very short, well-defined pulses, but at millimeter wavelengths. The induced electron spin resonance signals exhibit an intrinsically high SNR and bandwidth, resulting in several orders of magnitude improvement in speed and resolution over NMR methods."

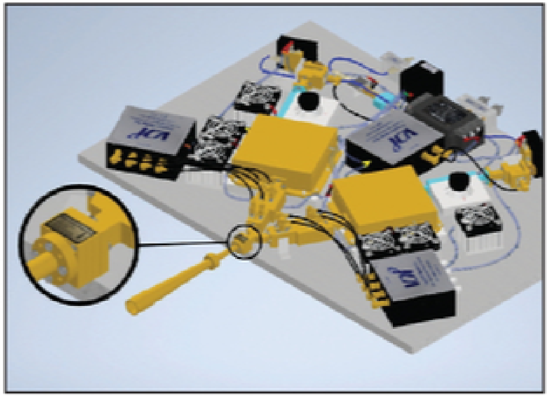
Virginia Diodes, Inc. (VDI) built the world's highest-power solid-state coherent 240 GHz source that puts out 500 mW for Cornell's ACERT center. "Increased power enables a very short pulse that provides increased spectral coverage of the sample," adds Dunnam. "However, at half a watt we can't afford to give up anything through insertion loss, hence we require an extremely efficient isolator."

Expanding MMW R&D

VDI referred Dunnam to MMW technology specialist Micro Harmonics for the production of an isolator that operates at such high frequencies with low insertion loss. Ultimately, the company delivered a component with only 1.2 dB of insertion loss at 240 GHz.

Under a two-phased NASA contract, Micro Harmonics developed a line of advanced isolators for applications that span frequencies from 50 to 330 GHz. The incredibly low insertion loss is achieved by reducing the length of an internal ferrite rod as much as possible. The design saturates the ferrite with an unusually strong magnetic bias field, which enables the incident signal to rotate the required 45° in the shortened rod.

Dunnam goes on to point out other engineering challenges faced at such high frequencies. The relatively increased power enables a very short pulse that provides increased spectral coverage of the protein sample. But after the last transmitted pulse in this application, full receiver sensitivity to the reflected decaying electron spin signal is required within 10 nanoseconds.



CAD drawing of Cornell's spectrometer.

"Any kind of ringing in the system that is due to reflections can increase 'dead time' and obscure results, so all the impedance mismatches and spurious signals in the system must be less than 0.1%," states Dunnam. "Additionally, the solid-state source multiplier conversion efficiency and stability can be adversely impacted by out-of-phase signals being reflected back. Low port reflection in the isolator helps keep all that in check."

The source could be destroyed by too much reflected energy, and since it was expensive to fabricate, it needed to be protected.

Lastly, the issue of heat absorption must be addressed even at sub-watt transmitter power levels. Power in the reverse signal is absorbed within the isolator, creating heat. Historically, high heat was not an issue as there was very little power available from solid-state sources at MMW frequencies, but as Dunnam points out, 500 mW at 240 GHz is, relatively speaking, a lot.

In his research center's application of studying viral proteins, wavelengths are short and components are necessarily small and fragile.

To overcome the problem of high heat loads, the Micro Harmonics isolators selected by Dunnam incorporate diamond heatsinks into their design. Diamond is the ultimate

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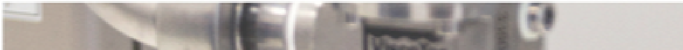

Integrating ERP with BPM Programmers Using an API

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that also contains the APS workflow instructions) that is stored on the customer's server.

- **Barcode Pressure Plate.** Scan the barcode for the correct pressure plate for the sockets.
- **Barcode Parts.** Scan the received parts to ensure that they match the job.
- **Barcode Quantity.** Scan the correct batch quantity that is to be programmed.

available to assist anyone developing an API or provide developers with the framework to develop it themselves.

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Using Millimeter Wave Technology to Prevent Future Viral Outbreaks

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thermal conductor, approaching 2,200 W/m-K, more than five times greater than copper. Diamond effectively channels heat from the resistive layer in the isolator to the metal waveguide block, lowering operating temperatures.

By pushing the limits of MMW technology, engineers are laying the groundwork for the next wave of medical advancement that will help fight against future outbreaks and pandemics.

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