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Menlo Micro, Corning Demonstrate World's First Through Glass Via (TGV) Package for MEMS Switch Applications

Brings Significant Benefits in Size, Cost and Performance

PHILADELPHIA, June 12, 2018 – A new era of high-performance RF and power switching products has begun. Corning Incorporated and Menlo Micro, the company responsible for re-inventing one of the most fundamental building blocks of electronic systems – the electronic switch – today announced a major milestone in the development of Menlo's revolutionary Digital-Micro-Switch (DMS) technology platform. The two companies have demonstrated the successful integration of Through Glass Via (TGV) packaging technology, enabling the expansion of Menlo's high-performance RF and power products to ultra-small wafer scale packaging.

TGV allows Menlo to shrink the size of its products by more than 60 percent compared to traditional wire-bond packaging technologies, making it particularly well-suited for applications where increased channel density and reduction of size, weight, power, and cost are critical. Menlo Micro will demonstrate this technology at the IEEE MTT International Microwave Symposium this week in Philadelphia.

In addition to the significant size reduction, TGV brings major benefits in performance to Menlo's DMS products. By eliminating wire bonds and replacing them with short, well-controlled metallized vias, Menlo is now able to reduce package parasitics by more than 75 percent. This allows support for increasingly higher frequencies, which are becoming more and more

important in advanced wireless communications systems, test instrumentation, and numerous aerospace and defense applications. Additionally, the unique properties of glass versus legacy substrate materials like silicon enable lower RF losses and higher linearity, which translates into lower power consumption and higher overall efficiency.

"The initial decision we made to develop our DMS technology as a metal-to-metal contact switch on a glass substrate was critical to ensure performance," said Chris Keimel, CTO at Menlo Micro. "Our switch is extremely broadband – able to operate from DC to beyond 50GHz – but packaging has always been a limitation. By moving to TGV we have eliminated the unnecessary interconnects that had been limiting performance. More importantly, as our partner and investor, Corning delivered a high-performance via in glass, and our hermeticity and reliability requirements are also achieved. This will allow us to push our product roadmap into new markets. We are substantially increasing performance and reducing overall size and cost to levels that will be truly transformative to many applications."

Using proprietary materials, designs and wafer-level processing techniques, Menlo's DMS technology has demonstrated reliability in real-life applications (typically exceeding 10 billion switching operations with a roadmap to exceed 20 billion), all while handling hundreds of volts and tens of amps of current. Menlo was launched in December 2016 with funding from GE, Paladin Capital, Microsemi, and Corning. Menlo has been focused on building its infrastructure and investing in the expansion of its manufacturing base, resulting in a broader portfolio of products and increased fabrication capacity to meet customer demands.

"We are very excited to see our relationship with Menlo continue to grow with the adoption of TGV technology," said Corning Precision Glass Solutions Division Vice President David Velasquez. "Together, we have demonstrated the ability to make hundreds of thousands of vias in glass wafers. We've also developed a proprietary via design and process to provide hermetic, copper interconnects that enable high reliability and reduced package size. This marks a major step toward the mass-production readiness of TGV."

Menlo's unique approach to solving problems through advanced material science allows it to offer unprecedented power handling (kilowatts) in a micromechanical device with superior electrical performance, size, cost, and reliability as compared to both traditional electromechanical relays and solid-state devices. Using TGV packaging, Menlo is developing

RF products covering bandwidths from DC-18GHz, with the capability and roadmap to extend beyond 50GHz. The DMS platform enables dozens of high value applications for RF and AC/DC products, covering such diverse markets as battery management, home automation, electric vehicles, military and professional radios, wireless base stations and IoT.

About Corning Incorporated

Corning is one of the world's leading innovators in materials science, with a 166-year track record of life-changing inventions. Corning applies its unparalleled expertise in glass science, ceramics science, and optical physics along with its deep manufacturing and engineering capabilities to develop category-defining products that transform industries and enhance people's lives. Corning succeeds through sustained investment in RD&E, a unique combination of material and process innovation, and deep, trust-based relationships with customers who are global leaders in their industries.

Corning's capabilities are versatile and synergistic, which allow the company to evolve to meet changing market needs, while also helping our customers capture new opportunities in dynamic industries. Today, Corning's markets include optical communications, mobile consumer electronics, display technology, automotive, and life sciences vessels. Corning's industry-leading products include damage-resistant cover glass for mobile devices; precision glass for advanced displays; optical fiber, wireless technologies, and connectivity solutions for state-of-the-art communications networks; trusted products to accelerate drug discovery and delivery; and clean-air technologies for cars and trucks.

About Menlo Micro

Headquartered in Irvine, California, Menlo Micro is reimagining one of the most fundamental building blocks of electronic systems – the electronic switch. The company's Digital-Micro-Switch platform is a game changer for those who design electronic systems, serving multiple industries including next generation 5G mobile networks, industrial IoT markets, battery management, home automation, electronic vehicles and medical instrumentation. Menlo Micro is backed by GE Ventures, with investments from Corning Incorporated, Microsemi Corporation, and Paladin Capital Group. For more information, visit www.menlomicro.com and @menlomicro on Twitter.

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