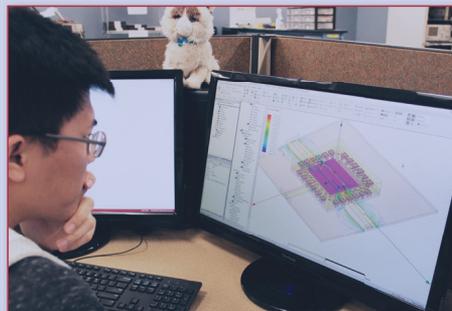


FAB S and LAB S

Focusing on the Technology, Marki Microwave Reinvents the Mixer



Say “mixers” and industry veterans will likely say “Marki Microwave.” Founder Ferenc Marki spent his career designing mixers, beginning at Watkins Johnson in 1971, then starting his own company 20 years later. Now led by son Christopher, Marki Microwave has expanded its product portfolio and adopted MMIC technology, yet still nurtures the highly skilled assembly capabilities that differentiate the company’s flagship mixers.

The MT3 mixer family is a good example of the marriage of hybrid and MMIC technologies. The original hybrid T3 (short for “two tone terminator”) is a triple balanced mixer with hand-wound baluns, achieving multi-octave frequency coverage on the RF, LO and IF ports. A nearly ideal commutating mixer, the design optimizes intermodulation performance, with the input third-order intercept (IIP3) at least 10 dB—as high as 20 dB in some cases—above the LO drive level. Maintaining this performance, the MMIC version retains the hand-wound IF balun, while using planar circuits for the RF and LO baluns. Operationally, the MMIC design significantly boosts manufacturing capacity, reducing the backlog on the highly skilled assembly operators. In an industry driven to automate to reduce cost and increase volume, Marki takes a thoughtful approach, preserving its highly skilled assembly capability where it differentiates the performance of its products.

Marki’s differentiation begins with design: a strong engineering team and a commitment to simulation. Since recruiting engineers mid-career is nearly impossible, given the cost of housing in the Bay Area, Marki has an active college intern program, drawing from top universities in California and around the country, such as Georgia Tech and the University of Illinois. For the engineering team, first-pass design success is the expectation, which is not unreasonable if the models are carefully constructed,

particularly for EM simulation. Often, any discrepancy between measured data and simulation is traced to the measurement.

Except for circuit fabrication, Marki’s manufacturing capabilities include all the processes required to build and test products internally. A hybrid line has highly skilled operators who hand wind cores and do precision soldering, a capability not available from outside contract manufacturers. Process steps that can be automated, such as epoxy and solder paste dispensing, resistor/capacitor placement and lid attachment, are performed with automatic manufacturing equipment wherever possible. The microelectronics lab assembles chip-and-wire circuits on GaAs, alumina, sapphire and Rogers substrates using ultrasonic wedge bonding. The deep-recess bonders have the capability to reach into packages and make short bonds, important for millimeter wave performance. Because Marki’s products do not dissipate significant power, die are attached to the substrate or package with epoxy using automated pick and place equipment. Marki’s test capabilities are also comprehensive, supporting both development and production and measuring from DC to 67 GHz.

GaAs foundries supply the passive circuits used in Marki’s products, as well as fabricating several PHEMT distributed amplifiers designed by Marki and offered as catalog products. The designs were optimized to drive Marki mixers and achieve optimum linearity.

While the company name may be synonymous with mixers, this second-generation Marki is expanding beyond that legacy, adding amplifiers and passive products, strengthening millimeter wave capabilities and responding to market needs. As a company video states, “We focus on the technology, whatever it takes to make the best products with the biggest impact.”

www.markimicrowave.com