

Wireless Semiconductor Market Overview for 2006/2007

2006 was a significant year for microwave and millimeter-wave gallium arsenide (GaAs) semiconductors, particularly in the areas of packaging, integration and WiMAX.



Point-to-point radio and satellite communications systems at 14 to 50 GHz have traditionally used bare die devices with chip and wire construction to meet high linearity, high power and broad bandwidth requirements. But the continued growth in wireless communications has placed tremendous pressure on component manufacturers to provide standard QFN surface mount packaged products for large scale PCB assembly flow, in order to lower costs and ease handling and assembly for mass production.

In the past, packaging developments at these frequencies were done successfully by research groups using expensive custom designs. Such custom packages were tailored to take into account the thermal characteristic of the GaAs device, to minimize the losses and reflections of the input and output transitions. While these custom packages ensured good performance, they were expensive and did not lend themselves to high volume production applications.

A transformation from these expensive, custom packages to standard QFN surface mount packages, similar to what took place in RF front-ends used in the handset devices, is occurring for microwave and mmWave components. Recent technology developments show that mmWave components can be successfully housed in standard QFN packages. And circuit designers have been specifically designing microwave and mmWave products for packaging that include requirements such as ESD protection on-chip.

At Mimix, we've seen the microwave and mmWave engineering community transition their product designs from using bare die to standard, QFN packaged devices. While our customers were only evaluating these products last year, in 2006 we achieved design wins for many of these packaged parts from 14 to 50 GHz at industry-leading customers. In 2007, we expect these packaged products to go into high volume production, causing a fundamental market shift in revenue for high frequency devices from bare die to packaged products.

Integration As mentioned, the microwave and mmWave GaAs components market demonstrated strong growth in 2006. Specifically, digital microwave radio

for cellular backhaul provided a stable and growing market application for these components.

At the same time, Original Equipment Manufacturers (OEMs) started facing major price pressures and demands for higher performance digital radios to meet changing market needs. These demands have in turn created challenges for suppliers of mmWave GaAs components that will continue in 2007. As our company is seeing it, this trend is forcing design engineers to develop higher levels of product integration to meet these requirements.

There are a number of benefits of integration for mmWave components. Integration lowers costs and variability of transceivers by using fewer parts, a smaller footprint area and a simpler design. It also reduces the need for off-chip interstage matching between RF components, because this has all been done on-chip. Furthermore, this benefit is of particular importance to contract manufacturers that do not have the resources for complex microwave engineering.

The key to this technology is the integration of four functions or more into a single MMIC which provides increased performance and functionality, as well as lower costs. Mimix's 38-GHz receiver is a good example. It integrates four functions onto one chip: an LNA which provides the optimum noise figure; an image reject mixer with high linearity performance; an LO driver amplifier; and a frequency doubler for the LO input. The challenge facing design engineers is getting the balance just right when integrating amplifiers, mixers, and doublers together such that the optimum performance is achieved which is equivalent to or better than a discrete solution.

While Mimix has been a pioneer in this technological development and offered highly integrated devices for several years, we have definitely seen a shift this year. Where we originally had to convince customers on the value proposition of this design philosophy, these same customers are now purchasing large volumes of integrated devices. Furthermore, a convergence of market imperatives occurred this year where customers started purchasing not only highly integrated devices but those which are housed in standard QFN surface mount packages. At Mimix, we have seen the value proposition enhanced as our customers require only three to four packaged high frequency devices to complete an entire transceiver.

WiMAX. WiMAX continues to be a hot topic in the industry, and the complex data formats associated with WiMAX signals make it essential that products provide exceptional linearity at the highest data transmission format, and that they are adjustable when lower data formats are used. Products that accomplish this, along with on-chip bias circuitry, separate bias current adjustment, and standard QFN plastic package will succeed with customers by providing performance, flexibility and cost savings.

At Mimix, we've leveraged our systems background with our semiconductor expertise to offer WiMAX products in basic building blocks, as well as integrated modules. The thermally efficient and highly linear modules include multistage amplifiers, integrated power detectors and integrated attenuation — providing the best combination of price and performance.

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The WiMAX hype that began in 2004 evolved in 2006. WiMAX certified equipment has begun deployment, and more and more service operators have announced their roll-out plans. We saw real design slots at customers that have aggressive plans for products that are in production this year, leading us to believe that this market will ultimately live up to the initial hype. We expect additional real customers and competitors to emerge in 2007 and beyond, so Mimix has been working to establish our strategic position in this market and support the anticipated high volume requirements.

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