FOUNDRIES

Optical step halves MMIC costs

Borrowing a technique used widely in silicon CMOS fabs, TriQuint is now offering a volume GaAs process that halves the cost of millimeter-wave PHEMT production for commercial applications such as automotive radar and satellite communications.

The TQP13-N process, which has been offered in a limited form for the past few months but has now progressed to a full-volume roll-out, produces GaAs PHEMTs with a 130 nm gate on a 6 inch wafer line.

Crucially, TriQuint uses standard optical lithography to define the 130 nm PHEMT gate region – a process step that until now has always demanded the use of electron-beam lithography.

Mike Peters, director of marketing for TriQuint's commercial foundry business in Hillsboro, Oregon, says that because standard I-line lithography equipment and photoresists are used, there is a direct cost saving of between 40 and 50% compared with the previous electron-beam process.

The key to fabricating the tiny gate features that are able to produce frequencies of up to 95 GHz is a concept known as "sidewall spacers", something that has been widely applied in CMOS processing to shrink gate sizes. In TriQuint's process the gate lengths initially defined using I-line equipment are actually quite large.

However, after a dielectric is deposited onto the wafer and then removed selectively using a plasma etch system, dielectric spacers are left along the sidewall of the original gate opening, effectively yielding a much smaller feature size.

Once the 130 nm gate opening has been defined, a gate-reinforcement metallization step forms the upper portion of the gate, producing a T-shaped gate contact that is very short and has a very low resistance.

Having developed these steps to a point where the overall process is completely stable and mature enough for high-volume use, TriQuint is already seeing a strong pull from lead customers who are keen to exploit the step-change in manufacturing costs.

Peters told *Compound Semiconductor* that the process was ideally suited to low-noise, medium-power applications in the millimeter-wave spectrum, for example automotive radar and receiver components used in satellite communications.

With customers and TriQuint's own business groups now able to manufacture these kinds of component at a much lower cost, Peters is expecting to see lots of commercial products containing the PHEMT die appear in the second half of 2008.

However, for high-power millimeter-wave applications – required by the military – the more expensive electron-beam process remains the best option, Peters explains.

"The optical process will not meet all of the needs for millimeter-wave functions," he said. "It is optimized for low-noise, lower-power, higher-volume applications."

The marketing director adds that customer interest is already very strong and that this market pull was a key factor in TriQuint's full release of the process.

Adaptive cruise control (ACC) for cars looks likely to be one of the biggest volume drivers for TriQuint. Figures from the market research firm Gartner suggest that this technology has only a 1% penetration at the moment. By 2015, however, it expects that more than half of the approximately 50 million new cars manufactured each year will use ACC or some other form of auto radar.

Receiver components for satellite television systems fitted to larger, luxury vehicles could also be a major driver for the PHEMT process, says market analyst Sandeep Kar from Frost & Sullivan.

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