

## 6 Inch GaAs Fab Conversion Cost Effectiveness Evaluation Process

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### Abstract

Wafer fabs are capital-intensive, this make it very hard for decision-makers to decide if, when and how converting their fab to manufacture 6" wafers will be financially wise. In recent years we have studied the various aspects driving semiconductor companies, to increase wafer size. We have found the primary factor for the big silicon players was significant increase in product demand while technological hurdles and corporate culture prevented a just in time die shrinking and/or a rapid introduction of operational improvements. The result - a growing need to increase the wafer area as another fast track measure to increase capacity and productivity, thus rapidly meeting market demands while decreasing unit cost.

For the III – V industry things are a bit different. The technological advance enables III – V companies to rapidly decrease feature size, then reacting faster to market needs. III – V fabs typically run multiple products with lower wafer yields using one toolset. Above all, the projected revenue generated by GaAs lcs (including FETs, MMICs, and digital devices) in 2005 is approx. \$10B a year, and total wafer capacity will be less than 3 million wafers per year. Therefore, contrary to the silicon industry, the economy of scale is still far from being real. However, there are a number of arguments for increasing wafer size in the III – V industry. The inability to decrease feature size or the need to rapidly reduce wafer and unit cost in a low demand environment for instance. The market availability for 4" production tools and support systems is diminishing etc. We believe that exercising caution when attempting to decide if a 6" conversion is a wise measure and as important as when to convert. Measuring 6" conversion cost effectiveness with an all-inclusive modeling tool is essential for any III – V Company out there.

MAX I.E.G. has developed a three steps approach to quantify the cost effectiveness of converting a 4" fab to a 6" one, putting an emphasis on a data driven process, and complex decision making process simplification.

- **First step**, segmenting current and future products into 6" Manufacturability feasibility. The viable products and processes are then analyzed further to identify preliminary strategic, technological and operational gaps between market demands and existing manufacturing capabilities.
- **Second step**, using a Total Cost of Operations (TCO) model, through which we are able to quantify the total capital cost needed for the conversion, total floor space size and cost implications, and total staffing cost for direct/non-direct workforce. Our model will 'spit out' the cost of goods sold (COGS) over a desired horizon and the investment cost for each of the products modeled. We then can compare COGS for the two alternatives and assess the real financial implications.
- **Final step**, a detailed ROI/TCO comparison process between the 6" line alternative and an operationally improved 4" line. This will enable us to determine if a 6" conversion is business wise, what will be the optimized point in time to convert using the market analysis process, and what will be the best way to do it. As an immediate result of implementing this process we are able to simplify the road to the answer, decrease decision making time, and save a great deal of cost!

The long-term benefit of using this process is realized if the conversion will happen or not. If we go for a conversion we have all the modeling infrastructure for the conversion completed, and if the decision is to abandon the conversion then the potential growth for the existing 4" line is through already road mapped improvements, and the understanding of what kind of market scenarios will justify converting in the future is based on facts and not marketing schemes.