

6-inch VCSEL Wafer Foundry Economics

David Cheskis, Ph.D., dcheskis@anadigics.com

ANADIGICS, Inc., 141 Mt. Bethel Road, Warren, NJ 07059 USA

GaAs-based VCSELs have revolutionized data communications systems by providing a low cost, high volume manufacturing platform that provides the speed and performance needed for these applications. The emerging trend of using GaAs-based VCSELs as near infrared illumination sources to replace LEDs is enabling a wider range of sensing, gesture recognition, biometrics and free-space optics applications. New products are being adopted in a variety of markets, including entertainment, mobile computer and automotive.

VCSELs have inherently better performance than LEDs. However, the key to VCSELs successfully displacing LEDs is to be able to manufacture them with the same scale, quality and cost structure. Existing 3-inch and 4-inch VCSEL manufacturing facilities have enough capacity for data communications and specialty applications, but don't have the ability to efficiently scale to meet the demands of these new large volume end applications.

To meet the needs of these new applications, VCSEL manufacturing capabilities need to scale in a manner similar to the transition of GaAs RF products when substrates increased from 3-inch to 4-inch and then to 6-inch diameters. Manufacturing VCSELs on 6-inch substrates provides several advantages over the industry's existing capabilities. In addition to the 2x to 4x increase in gross area per wafer, the larger substrate becomes more economical as the die size increases for arrays of VCSEL emitters. Additionally, the advanced wafer fabrication capabilities in a 6-inch facility provide improved yields, better repeatability, and lower costs – all of which enable different business models to emerge for an industry in the early stages.

ANADIGICS has experience in these fundamental process technology advancements -- launching the compound semiconductor's first 6-inch GaAs fab in 1999. We now have successfully demonstrated a 6-inch GaAs VCSEL fabrication process, enabling VCSEL device manufacturers to scale their products in support of aggressive volume and costs requirements of new applications. This paper will discuss the economics of the 6-inch GaAs foundry and how it enables the VCSEL to become a cost-effective alternative to LEDs for a myriad of new applications across a wide array of markets.