

CASE STUDY

DNA ANALYSIS CHIP

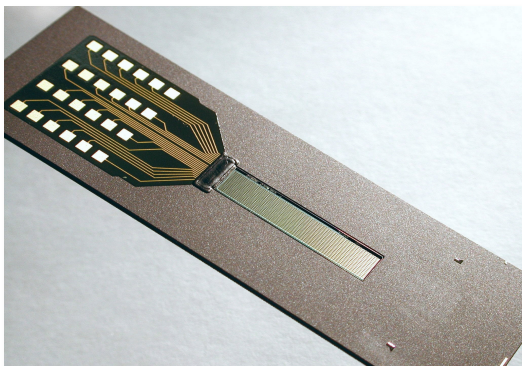
Design and manufacture the package, assembly and test processes for one of the first silicon-based DNA analysis chips.



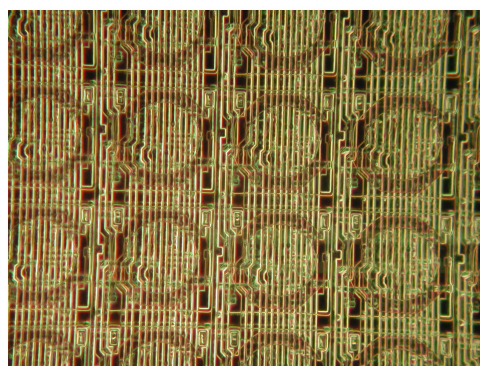
BACKGROUND: Most pathogens have related strains that are not harmful to humans. It is vital to be able to quickly, and inexpensively distinguish between harmful and non-harmful versions of these micro-organisms in a clinical setting. DNA analysis chips have made this process substantially easier and less expensive.

PROJECT DETAILS: While there are many methods for analyzing DNA using microchip technology today, in the late 1990's there were few options. In 2001, the customer however, developed a chip with 12,000 individual sites for growing nucleotides and they needed assistance in bring the device to production. Each individually addressable site on the chip was coated with a special film that facilitated the growth of different nucleotides, each with as many as 150 base pairs. Upon exposing the hybridized chip to the sample of unknown RNA, the sites where the nucleotides joined was

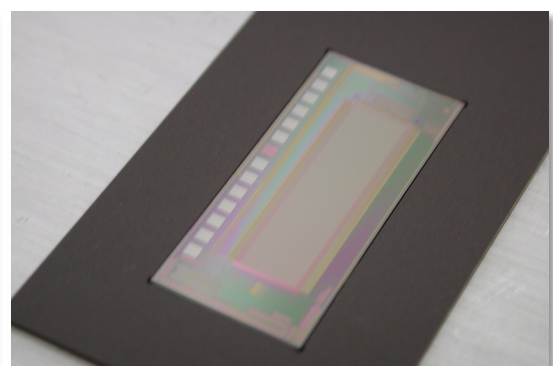
detectable using a UV fluorescence imaging technique. The packaging of these DNA analysis chips was subject to many constraints. The package needed to be in the shape of a microscope slide, and due to the variety of fluids used in the device, a special die attach material had to be developed so that the chip was not contaminated by chemicals leached from the assembly. It was determined that conventional dicing water inhibited the complete hybridization of the reaction sites thus a custom water formulation was developed. Dimensional control was critical to not only minimize cavitation and bubble formation while eliminating dead space, but it was also essential to ensure the fluorescent readout was accurate. Since the bond pads on the chip were platinum, special platinum wirebonding process had to be developed. The package had to evolve not only with advances in the instrumentation, but also with subsequent revisions of the DNA chip itself.



The 12k DNA Analysis chip



Closeup of the reaction sites where base-pairs are grown



The 90k chip that eliminated wirebonds

RESULT: The device was successfully brought to market in early 2002 and it played a critical role in the analysis and containment of the SARS outbreak from China in November 2002. Subsequent version of the device had up to 90,000 analysis sites. All told, 7 variations of the package were developed with the last two being manufactured at the 1000's per month rate. A complex end of line testing was also developed and implemented along with custom final device packaging.