The Right Tool For The Job

Ron Leckie May, 2012

There's an old saying that, "if you're pushing in a thumb tack you don't need a sledge hammer." This applies to many businesses and most certainly to the semiconductor industry with its high capital intensity. If you are running very high volume production, you need tools that deliver performance with high throughput. However, in situations where volumes are lower but the product mix is considerably more varied, then different tools are required.

Quik-Pak, located in San Diego, California, specializes in providing on-shore IC Packaging and Assembly services to meet the needs of prototype and pre-production builds for their customers. They can take finished wafers and put them through all of the "back-end" steps including back-grind, saw, dicing, die bond, wire-bond or flip chip, etc to rapidly deliver packaged prototypes – in many cases as fast as same day turn-around. To achieve that for a wide-ranging set of customers requires both a toolset and a staff that have the right capabilities with a high degree of flexibility.

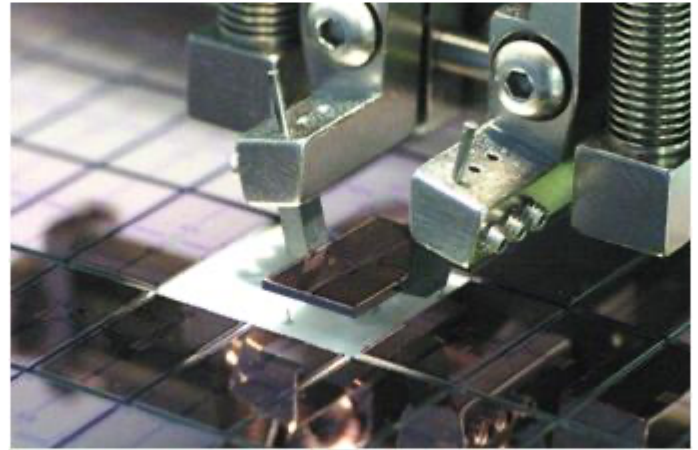
The Royce MP-300 in Quik-Pak's production line

For example, when the wafer is thinned and sawed, the next step is to pick out the die for assembly. This is where the requirements can vary significantly with die sizes ranging from as small as 8 mils square up to as much as an inch square. Of course, few die are in fact square and, at the extreme end of aspect ratio variability, Quik-Pak has handled die as narrow as 10 mils by 3/8 inch long. They also package MEMS and optoelectronics devices that add other die handling challenges. To pick and sort this wide variety of die from wafers, Quik-Pak uses the "right tool" which is an MP-300 die sorter from Royce Instruments, headquartered in Napa, California. The MP-300 is a very flexible pick-and-place tool that can be quickly configured to handle die from a wide range of sizes and types.

After many months of detailed design work, prototype wafers often come straight from their 6-week journey through the wafer foundry and, as can be imagined, there is a lot of pressure to have them tested and validated against the design. To debug new silicon with a new test program, chipmakers often elect to not even test the wafers, but they simply ask for a representative sample of die from the center of the wafer to be assembled into packages that can be handled and tested more practically. To add to the complexity of the task, many prototype wafers are manufactured in what is frequently termed "multi-project wafers" with multiple different designs stepped into the one wafer. The pick and place task is then challenged to pick out the right die for the right package. The MP-300 can be quickly loaded with a wafer map that will direct the pick-up tool to the appropriate locations. If a readable wafer map is not readily available, the tool's software enables the operator to quickly generate a machine sort map that can be effectively used in low-volume applications. Once the map is created, die sorting is then automatic.

The MP-300 has a variety of pick-up options that can be fitted to suit the task at hand. For conventional semiconductor die, the vacuum pick-up is generally used, but there are instances where the die surface cannot be touched, such as with MEMS, bumped or certain GaAs devices. For these, Royce offers a non-

surface contact tool that works in conjunction with an optimized die eject head which allows for complete control in raising the selected die up for pick-up. Finally, the selected die can be placed on a variety of output media depending on the end customer's specifications. These include such options as waffle packs, Gel-Pak™, film frames, JEDEC trays, substrates and even back on grip rings (expander hoops) when the customer wants to rebuild the dice back in the layout of the original wafer.



The Royce non-surface contact pick-up tool.

Similarly, at later stages in the assembly process, Quik-Pak uses the Royce 650 universal bond tester, which can test a wide range of bonds including regular wire bond pull strength, bond shear, BGA ball shear, die shear, etc. Once again, a versatile and quickly configurable system enables the operation to respond quickly to demand for different package types.

These flexible configurations on the MP-300 die sorter and Royce 650 bond tester, coupled with the fast set-up times, make them the "right tools" for operations such as Quik-Pak and in laboratories where there is a wide diversity of tasks to be handled – all urgently, of course.