Thermal Compression Bonding Process with Low CTE No-flow Underfill* and Copper Pillar Bump*

*** Advanpack Solutions (APS) Pte Ltd Proprietary**

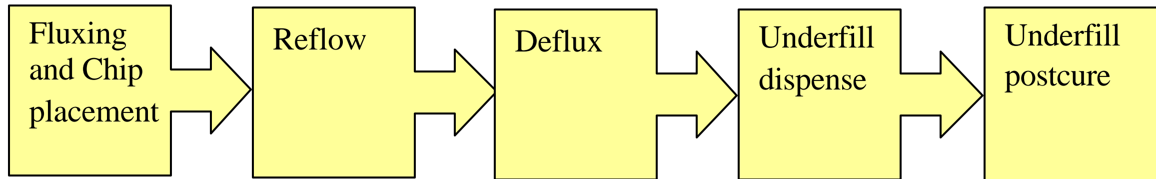

Fig. 1 Conventional Underfill Process

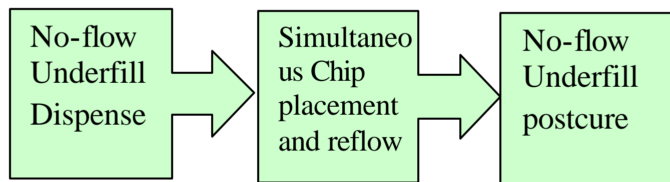

Fig. 2 Thermal Compression Bonding process with No flow Underfill

As depicted in Fig 1, the Conventional Underfill (CUF) Process has more process steps as compared to the Thermal Compression Bonding with No-flow Underfill (TCB-NFU) Process in Fig. 2. As such, the CUF process has lower production efficiency and requires higher capital investments and floor space. Furthermore, the effectiveness and efficiency of this process is highly dependent on the die size and the bump pitch of the package and gap between die and substrate.

The TCB-NFU process was invented to eliminate the limitations faced by the CUF process, while not having to compromise the yield and reliability of the well-established CUF process, reflow oven is eliminated to free up production space.

In the TCB-NFU process, a low CTE (silica-filled) NFU is pre-dispensed onto the substrate. A Copper pillar (with reflowable solder cap) bumped die is then picked and aligned to the substrate bond pads. Heat and mechanical force is applied to the die. During this process, heat is applied to melt the solder caps on the pillar bumps, mechanical force is applied to push the silica fillers away from the joint area and finally,

the fluxing component in the NFU, removes the oxide from the solder and bond pad. In the event, solder joints are being formed. Typical process time require for joint formation is 5secs. The package is then sent for postcure to cure the NFU. Typical postcure time is about 30 ~ 60mins.

Using the above method described, consistently high yield and void-free packages are achieved. The TCB-NFU process has been successfully demonstrated on packages with die sizes up to 22mm x 22mm and >5000 I/O with both Sn/Pb eutectic and lead-free bump metallurgies.

APS has developed a proprietary NFU material (P-Bond ™ LR-9000 series) specifically recommended for use with the TCB process. This material has unique properties, such as, excellent high temperature stability and exceptional fluxing strength. In addition, it is also engineered with superior mechanical properties to ensure good package reliability. This material is compatible with both Sn/Pb eutectic and lead-free bump metallurgies.

APS has also developed the proprietary Copper Pillar Bump. It is highly recommended for use with the TCB-NFU process as it guarantees consistently high yield and high bump standoff, which is un-matched by the conventional solder bumps.

The above integrated technologies is deemed an ideal solution for high pin count device in flip chip BGA package for graphic, routers, CPU and chipset applications.

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