Flip Chips

Application Overview:

Acoustic inspection of flip chips has become one of the dominant uses of acoustic microscopes. Ensuring adequate underfill flow or inspection for excess flux material is one of the more common applications. Many customers are experimenting with new methods of dispensing underfill or trying to qualify new materials. These firms have found utilizing acoustic inspection an essential tool during product development and failure analysis. Some of the larger volume flip chip manufacturers continue to use SAM technology in a lot qualification or process control role. Inspections can occur on board mounted or loose devices and semi or fully automated inspections are possible.

Package Types:

Flip chips, Flip-on-board, Flip-on-flex

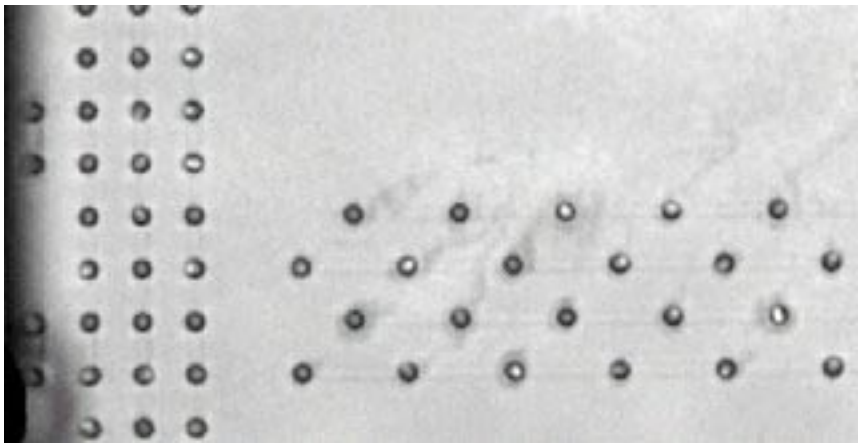
Inspection Standards:

- none -

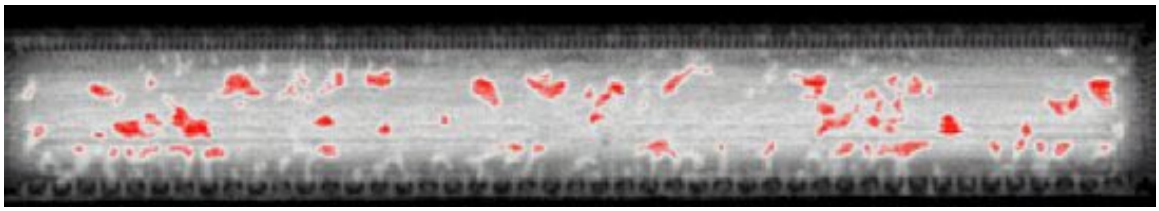
Failure Types Commonly Detected:

Underfill delamination
Underfill voiding
Underfill material characterization
Solder joint voiding
Solder joint delamination
Solder joint cracking
Die cracking
Filler particle density distribution

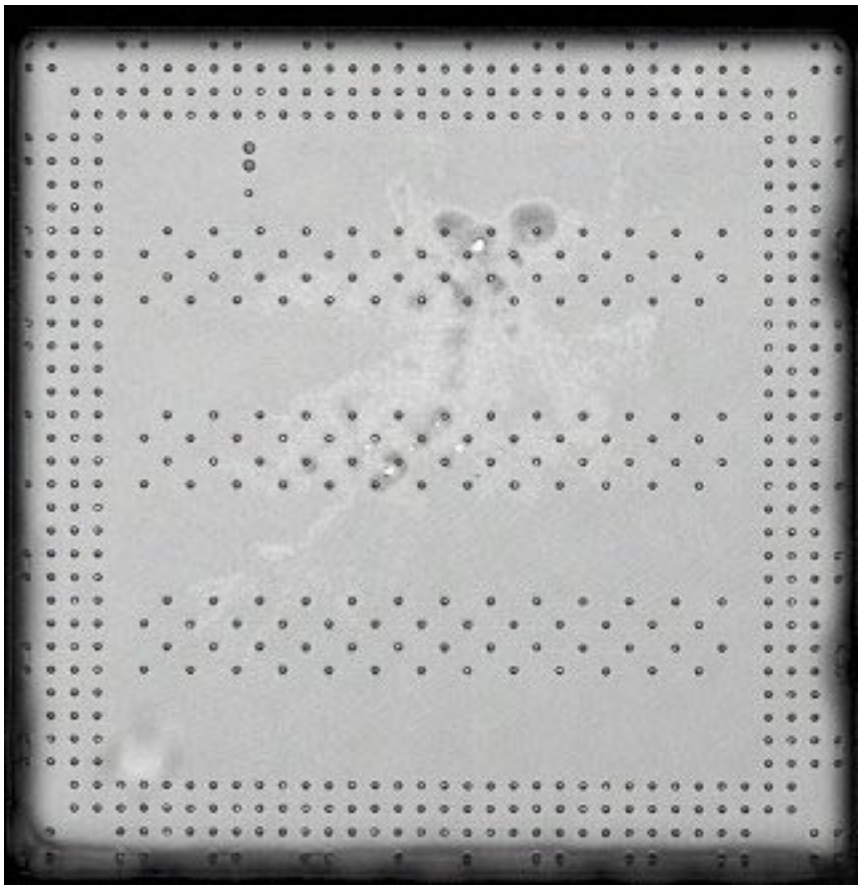
Images:



This is a pulse-echo (reflected) mode image of a section of a flip chip package. A UHF 5.9mm focal length transducer was used to create this image. This peak amplitude image displays information regarding the bond quality of the underfill and solder joint to die bond interfaceA white area in the center of a solder ball indicates a delaminated electrical interconnect. This disbonding was likely caused by the solder ball not properly wetting to the bond pad. The delamination may be so thin that the joint will pass electrical testing, but the joint will likely fail later in life. Delaminations as thin as 50 nanometers can be detected in flip chips by SAMs. The darker gray areas noted the location of varying underfill density. The density variation is due to the settling of the larger filler particles contained in the underfill material. These areas, commonly called "flow lines" because the pattern follows the dispensing direction of the underfill and can be considered a reliability concern due to the CTE mismatch they cause.



This is a pulse-echo (reflected) mode image of a flip chip bonded to a flex circuit. A UHF 5.9mm focal length transducer was used to create this image. This peak amplitude image displays information regarding the bond quality of the underfill to die and underfill to substrate interfaces. The read areas note the location where the underfill has separated from the die interface. These separations can expand upon stressing and compromise the structural integrity of the solder balls.



This is a pulse-echo (reflected) mode image of a flip chip package. A UHF 5.9mm focal length transducer was used to create this image. This peak amplitude image displays information regarding the bond quality of the underfill to die and underfill to substrate interfaces. Bright white areas represent disbonds between the underfill and die. A lack of underfill bonding near solder joints can cause the joint to be structurally unsound or cause electrical shorting between interconnects. Underfill delamination is frequently caused by an insufficient amount of underfill material or inadequate flow of that material underneath the chip or separation caused by part stress. Voids within the underfill are frequently caused by contaminates (like excess flux) or air pockets trapped during the flowing process.