

# Electronic Package Design with Specialized Marker for Die Placement

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## I. BACKGROUND OF THE STUDY

- Substrate material plays a vital role in electronic packaging industry, as it represents a great portion of the cost and contributes to the overall package performance in terms of electrical and thermo-mechanical response
- Substrate-based packages in Fig. 1 have stack-up made of a dielectric core material, prepreg material, copper traces and vias for the input-output (I/O) signal connections, and protected with top and bottom solder resist material

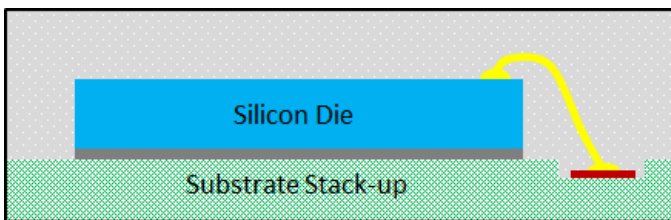


Fig. 1. Cross-sectional view of a substrate-based electronic package.

- Die placement is one critical characteristic requirement needed to meet during die attach process, with the only reference used during the process is the wiring diagram given in Fig. 2

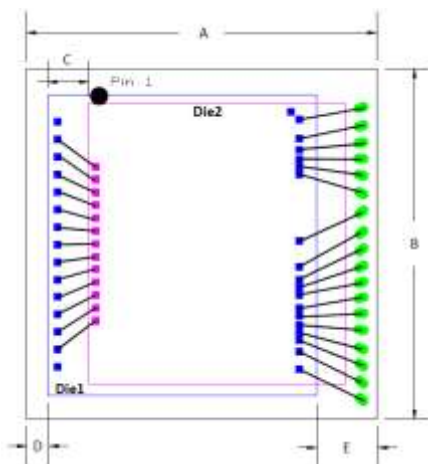


Fig. 2. Wiring diagram of an electronic package.

## II. PROBLEM IDENTIFICATION

- Misaligned die placement anomalies were encountered on a substrate-based electronic package, due to unclear reference procedure for die placement
- The issue of misaligned die placement is difficult to distinguish visually due to few micron difference as was encircled in Fig. 3.

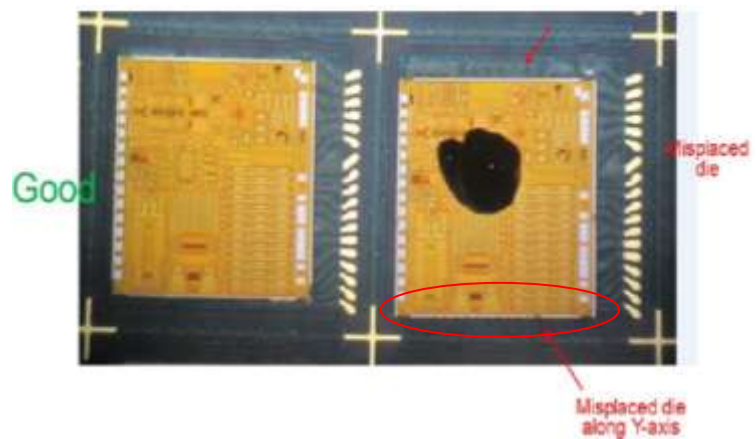


Fig. 3. Misaligned die placement.

- The issue would eventually result to exposed die upon package singulation of units in Fig. 4

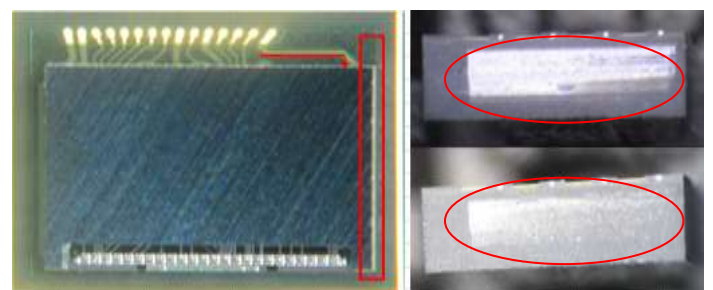


Fig. 4. Exposed die due to misaligned die placement.

### III. ELECTRONIC PACKAGE DESIGN SOLUTION

- The substrate-based electronic package is augmented and improved to have a specialized marker for die placement reference on the substrate die pad surface

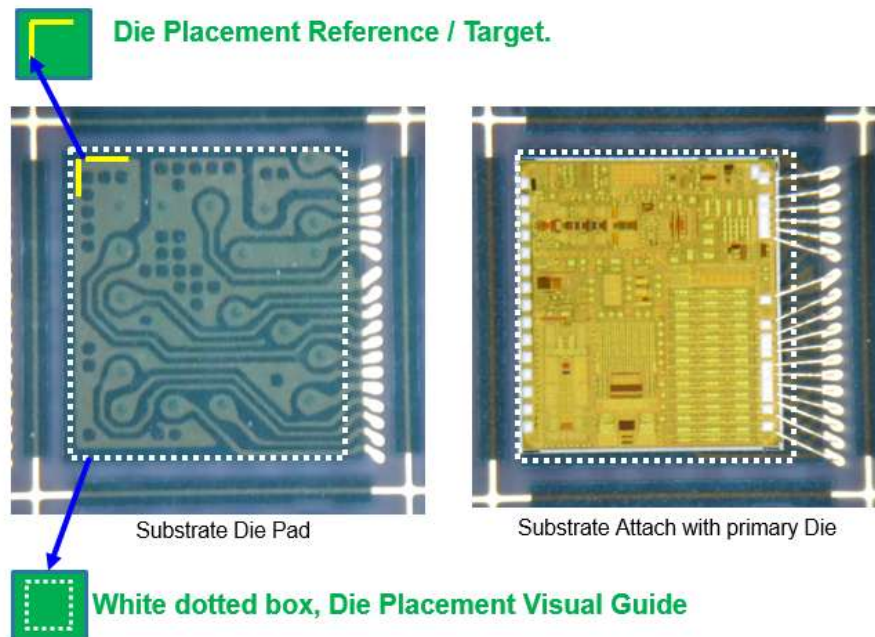


Fig. 5. Improved substrate-based electronic package with specialized marker as die placement reference.

- The solution includes silkscreen marking line by non-conductive ink that crosses over the traces without interference for better use of substrate die pad space, with the silkscreen layer being brighter, providing better contrast for faster hand assembly
- The specialized marker in yellow line in Fig. 5 serves as the reference and target die placement, based on the requirement during machine setup, with the silicon die must be at the center on the pad (white dotted box)
- In the case that the die is placed outside the white box lines, the machine must undergo repair or troubleshooting so that the placement would comply with the required measurement
- Outside the white dotted box is considered forbidden area for die placement, and production lots should be subjected to disposition once the die is placed on the forbidden area
- The improved design serves also as an error-proof control for the die placement, preventing it to progress into exposed die upon package singulation of units