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Improved Leadframe Configuration for Warpage Resolution

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I. Overview

A quad flat no-leads (QFN) package in semiconductor manufacturing industry is composed of different direct materials namely leadframe, wire, silicon die, adhesive, and molding compound. One of these materials significantly affect the behavior of the package, particularly the leadframe on warpage issue shown in Fig. 1.

Fig. 1. Leadframe warpage.

One major factor for warpage is the mismatch on the coefficient of thermal expansion (CTE) values of the materials, especially when the leadframe strip is subjected to heat. Fig. 2 shows the assembly manufacturing processes that involve heat during the process.

Fig. 2. Assembly process flow where heat is involved.

II. Problem Identification

Highlighted in Fig. 3 is the actual leadframe strip warpage, which is considered as a major issue in assembly manufacturing. The QFN leadframe strip design comes with 2 maps configuration and this leadframe is subjected to heat at die attach process.

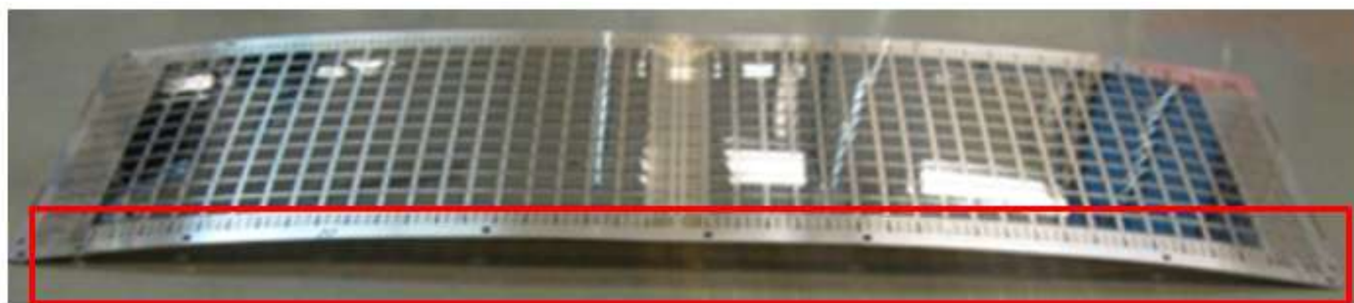

Fig. 3. Leadframe strip warpage after die attach process.

This warpage issue can eventually affect the succeeding processes like wirebond, mold and post-mold cure (PMC), resulting to high risk of crumpled leadframe during input and output loading in the machine.

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III. SEMICONDUCTOR PROCESS SOLUTION

An improved solution in die attach process is done through augmenting the QFN leadframe configuration from 2 maps to 4 maps as depicted in Fig. 4.

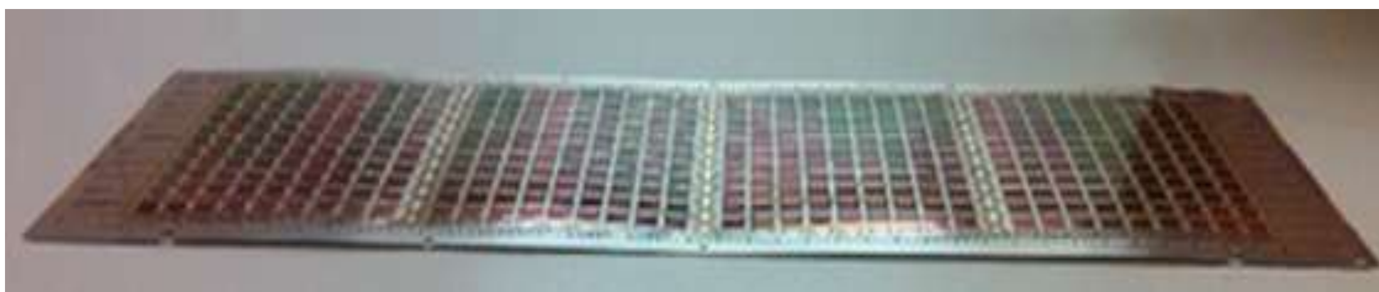

Fig. 4. Leadframe strip with 4 maps configuration.

With the improved leadframe design, occurrence of warpage could be mitigated. Robust process could be realized especially the succeeding process stations with heat involved. The improved leadframe configuration could also improve the reliability of the package and could serve as an error proofing design to control crumpled strips.

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