Nemotek wafer-level camera

Wafer-Level cameras (WLCs) continue to gain in popularity, bolstered by the need for low-cost/small-size camera phones.

The reflow compatibilities of WLCs provide a big advantage over traditional camera modules, since they can partake in the same reflow soldering process used for assembling the other electronic components on a board.

Nemotek Technologie

Founded in 2008, Nemotek Technologie manufactures customized WLCs for portable applications. Nemotek provides design, manufacturing and testing services for WLCs, as well as for Wafer-Level Packaging (WLP) and Wafer-Level Optics (WLO).

Nemotek’s Wafer-Level Packaging and Wafer-Level Optics products use technologies licensed by Tessera. Nemotek operates a 12,000m² facility in Morocco, including a Class 10 clean room.

Wafer-level camera

The camera is a fixed-focus VGA module integrating a Wafer-Level Packaged CMOS Image Sensor and Wafer-Level Optics. The camera module is provided in a 3.7x3.3x2.4mm 21-pin package, compatible with reflow soldering.

The WLP CIS die and the WL-Optics die are integrated at the die-level using die attach.

Wafer-Level Packaging

The Wafer-Level Packaging is based on Tessera’s Shellcase® MVP solution. The Shellcase process was used in the previous Wafer-Level Camera we analyzed (the Omnivision OVM7692), but it employed a redistribution of the CIS pads to the back side through the edge of the die, using a “T-contact” (Tessera Shellcase RT process). This time, redistribution is realized using Through-Silicon Vias (TSVs) to connect the bond pads of the die and the BGA interface on the rear face of the package.

The TSV manufacturing process used is very different from the typical TSV process, since tapered holes are etched into the Silicon wafer, as opposed to high aspect ratio holes. Therefore, the holes are made with low-cost/high-throughput equipment, instead of expensive DRIE equipment. In the same fashion, the TSVs are insulated with a thick, low-cost polymer deposited by electrophoretic deposition process, instead of thin Silicon Oxide deposited by PECVD.

The lead used to connect the pads of the CIS with the solder balls consists of an aluminum/copper conductive layer and a nickel/phosphorus plating layer. The lead penetrates through the bond pad to form a circumferential edge contact. The CIS is protected by a glass carrier, sealed with an epoxy bonding process.

Wafer-level optics

The wafer-level optics is a single wafer element, reflow compatible, based on Tessera’s OptiML™ solution.

Two lenses made with a UV curable polymer are manufactured on a borosilicate glass wafer with a replication process. A plastic tool (likely
Polydimethylsiloxane (PDMS) silicone) molded into a master is used to imprint the polymer lenses. Each master can be used to make a large number of PDMS tools, and each PDMS tool can be used to imprint a large number of lenses.

The lenses are covered with a thin anti-reflective coating (ARC). The two sides of the glass wafer also hold an IR filter (consisting of layers of Titanium oxide sandwiched with layers of Silicon oxide) and an aperture made of Chromium layers.

**Cost structure**

The main benefit of working with Nemotek is that it is a "one-stop shop" which provides a complete solution, from optics to packaging, thus eliminating overhead related to multiple subcontractors.

On the downside, Nemotek uses optics and packaging technologies licensed by Tessera, and has to pay royalties for these.

To wrap things up, the complete Wafer-Level Camera assembly cost (without the CMOS Image Sensor) is close to 30 cents, which is very competitive compared to other previously-analyzed technologies from ST, Toshiba and Omnivision. The Wafer-Level Packaging of the CIS remains the main cost driver, with ~50%.

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