

## Camera Phone Modules Look to a New Design

Jacky Perdrigeat, Nemotek Technologies, [www.nemotektechnologies.com](http://www.nemotektechnologies.com)  
*Camera modules in mobile phone handsets available in the last few years now shifting focus to new technologies and designs to meet increased demand*



The first commercial mobile phone in North America with a built-in camera to capture photographs or video was developed in 2002. As mobile phone usage increases and cameras gain ubiquity in mobile phones, demand for such functionality continues to increase, with significantly strong growth in emerging countries. Consumers in these regions are demanding camera technology in their mobile phone handsets, although a high megapixel resolution is not required. According to market forecasts, VGA up to 3MP resolution will still represent 40 to 50 percent of the camera market by 2012, and 80 percent of mobile phones sold around the world will have at least one camera.

One new method now available to answer the demand for camera modules in mobile phones is wafer-level camera (WLC), which is associated to hybrid wafer-level lens. WLC is one of the technologies that responds to a reflowable process for camera modules and will drastically improve mobile phone manufacturing.

The WLC offers three main technical advantages:

- Highly reliable performance
- Drastic miniaturization versus conventional cameras (up to 50 percent)
- Cost reduction when volume will be achieved

For these benefits to be realized, thousands of lenses are built simultaneously and directly on the wafer, dramatically reducing the size and cost of additional materials. The lens wafers are then aligned and bonded at the wafer level using WaferStack technology and the bonded lens wafers are then diced to individual, integrated optical elements that can be mounted onto a packaged image sensor. The accuracy of the wafer stack process eliminates the need for costly manual focusing resulting in substantial cost savings.

To fully reap the benefits of WLCs, the mobile phone assembly board process is in

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line with the full surface mounted technology (SMT) method, contrary to other existing methods. Today, the majority of camera modules embedded in mobile phones are assembled using CMOS sensors with plastic lenses within a holder. This method makes it impossible to reflow the camera modules as a part of the regular reflow process used for other ICs contained in mobile phone motherboards. Due to the technology limitations, a separate assembly other than SMT must be performed for the camera modules to be assembled effectively.

### Market Structure for WLCs

The camera module manufacturers are either the CMOS sensor makers, independent camera module makers within the Electronic Manufacturer Services (EMS) or the lens manufacturers developing part of the module. Moving forward, the sensor makers will focus more on their core activity: CMOS sensors. This means along with the impact of the current international conditions, potential investment has been reduced in camera module assembly capacity. The camera module makers and the EMS will not immediately invest in new technology since they are already equipped with standard camera module assembly techniques. Additionally, the lens manufacturers are only producing lenses compatible with reflow process but don't provide the total camera product itself.

Consequently, the providers that are able to offer a complete and fully reflowable camera such as WLCs are presently limited because they must have wafer level technology to reduce the supply chain and lead time. As such, those suppliers that can offer the benefits associated with WLCs will be much in demand as partners. To be a supplier requires having the competencies in semiconductor technique, optical design, as well as the ability to have manufacturing and expertise in the camera system, which is something far from obvious. Looking at each step of the process from design to manufacturing for a wafer level camera also requires skills in lithography, thin film deposition, metal coating, plating, micromilling, wafers stacking, hybrid dicing, electrical and image testing.

Pressure is on the mobile phone manufacturers to focus on finding new technologies for camera modules that are fully compatible with the SMT board assembly process to improve productivity for supply chain reduction and to improve the cost of ownership. With the need for further cost reduction, the option of deploying wafer level cameras is still small compared to the actual potential, but that is changing. The conventional module makers are trying to keep control of the actual supply chain and are investigating in the possibility of providing wafer level cameras by buying separate elements from different wafer level camera part manufacturers.

Although the new suppliers are able to produce wafer-level camera or parts, they still need to be recognized by the market. Sensor manufacturers are also determining how to deliver wafer-level cameras, not by investing themselves, but by buying module parts or complete wafer-level cameras. The supply chain for wafer-level cameras is still in its early stages being adopted by the industry, and thus will take the usual time for the supply to fulfill the demand. However, now that there is a technology alternative that can provide a more streamlined and cost-effective process, the market will begin to take notice as high volumes of camera phones are being shipped.

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**Source URL (retrieved on 09/17/2014 - 4:49pm):**

<http://www.ecnmag.com/articles/2010/08/camera-phone-modules-look-new-design>