Back in 2016, LeEco, a former smartphone design company in China, was the first to integrate an ultrasonic sensor as a biometric fingerprint authentication device. This first integration was under a metal cover at the back of the screen. But the most interesting feature of such a sensor is its possible integration under the display without any additional components. With the integration in the latest Galaxy S10 series from Samsung, Qualcomm has proven that the biometric ultrasonic fingerprint under display is now ready for very high volume production and could compete with capacitive or optical sensors.

Either with the Exynos or the Qualcomm Chipset, the Samsung Galaxy S10 series is the first to feature the Ultrasonic Fingerprint Sensor directly under its display. The sensor is located on the front of the device directly glued onto the organic light emitting diode (OLED) material.

This report focuses on analyzing the ultrasonic sensor and its integration with the display. The sensor is manufactured using Low-Temperature Polycrystalline Silicon (LTPS) technology on a glass substrate. Using ferroelectric polymer, the sensor generates and processes ultrasonic waves on the substrate. The component also includes an acoustic horn structure in order to focus the ultrasonic waves.

Since the last version of the device, Qualcomm has made several changes at the thin-film transistor (TFT) level, reusing some mask layers. Also, the Qualcomm Biometric Integrated Circuit (QBIC) has evolved in terms of circuit and power handling, integrating more high voltage circuits and more on-chip memory.

This complete analysis of the Ultrasonic Fingerprint Module includes analyses of the sensor die and the Application Specific Integration Circuits (ASICs), along with a cost analysis and price estimation for the module. It also includes a physical and technical comparison with the previous version of the sensor in the LeEco LeMax Pro and with the Synaptics’ FS9500 optical fingerprint sensor. Finally, a cost comparison is included with the Synaptics sensor.

**COMPLETE TEARDOWN WITH**

- Detailed photos
- Precise measurements
- Materials analysis
- Manufacturing process flow
- Supply chain evaluation
- Manufacturing cost analysis
- Selling price estimation
- Comparison with previous version of the fingerprint sensor in the Le Max Pro from LeEco
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