Apple iPhone X – Infrared Dot Projector

The world’s most advanced dot projector for 3D sensing
with four innovative parts:
Its package; a dedicated VCSEL; a folded optic; and the active DOE

Apple has made a great technology choice with its 3D facial identification for the iPhone X. The new technology is presented as being 20 times more accurate than the older fingerprint approach with a one-in-a million probability of a random person unlocking your iPhone.

The underlying 3D imaging technology is called “Structured light” and uses a set of projected “dots” unto the face of the user. Biometric face authentication allows the screen to be unlocked very fast, and eliminates the need for finger use, entering passwords or patterns.

The IR Dot Projector is the structured light emitter of the 3D camera system called “True Depth” by Apple, that recognises users.

This report is focused on the illumination module which includes 4 innovative sub-parts:
• Its packaging exploits a novel thermal management approach with ceramic substrate inserted
• Its NIR vertical cavity surface emitting laser (VCSEL) diode with a dedicated light emission profile driven by a Broadcom integrated circuit
• A folded optical path using wafer level optic
• Its active diffractive optical element (DOE)

The report provides a complete process reverse engineering of the complex module with a detailed analysis of the supply chain.

This report describes the full system’s technology and manufacturing process, including the package, VCSEL, electronics, the folded optic and the DOE. It estimates the manufacturing cost and price for the Dot Projector and compares it with other 3D sensors, such as Intel’s Real Sense, and the sensor pmd provides Lenovo.
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