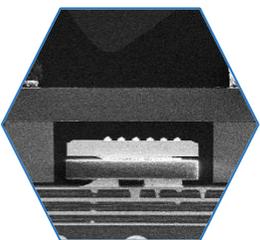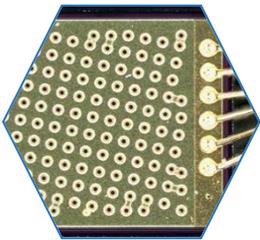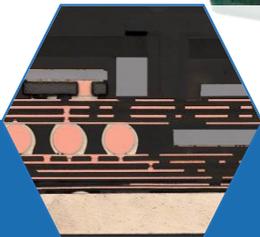# STMicroelectronics Proximity Sensor and Flood Illuminator

New time-of-flight and illumination device from the Apple iPhone 12.

Title:
STMicroelectronics Proximity Sensor and Flood Illuminator

Pages: 180

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June 2021

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PDF & Excel file

Reference:
SPR21576

This full reverse costing study has been conducted to provide insights into technology data, the manufacturing cost and selling price of the STMicroelectronics Proximity Sensor and Flood Illuminator in the Apple iPhone 12.

Located in the front above the main speaker, the proximity sensor and flood illuminator use optical Land Grid Array (LGA) packaging. The device is a custom version for Apple, coming after STMicroelectronics also released a custom proximity sensor for the iPhone X. While being 15% smaller than the previous version overall, the new version's flood illuminator is twice as large. The sensor is still based on FlightSense™ technology.

The flood illuminator has a larger Vertical Cavity Surface Emitting Laser (VCSEL) die and VCSEL driver die. The diffuser is more sophisticated with a complexity close to a diffractive optical element.

To reduce the package size with larger components, STMicroelectronics has developed a 3D package with two stacked Printed Circuit Boards (PCBs). The 3D package manages the heat dissipation of the flood VCSEL thanks to a ceramic substrate, solder balls and PCB design.

This report analyzes the complete microsystem from the VCSEL illuminator of the proximity sensor manufactured by Trumpf to the VCSEL of the flood illuminator manufactured by Lumentum. It also analyzes the two integrated circuits with VCSEL driver from Texas Instruments and the Single Photon Avalanche Diode (SPAD) developed by STMicroelectronics.

It includes analyses of the package, the diffuser and the filters with optical and Scanning Electron Microscopy pictures and Energy Dispersive X-ray analyses of the main semiconductor components. The report also includes a complete cost analysis and price estimation of the device based on a detailed description of the package, the Time-of-Flight detector, and the two VCSELs.

The report features also a complete technology comparison with the proximity sensor from the Apple iPhone X.

The report features also a complete technology comparison with the proximity sensor from the Apple iPhone X.

The report features also a complete technology comparison with the proximity sensor from the Apple iPhone X.

COMPLETE TEARDOWN WITH

- Explanation of device operation
- Detailed optical and SEM photos
- Precise measurements
- Materials analysis
- Manufacturing process flow
- Supply chain evaluation
- Comparison between proximity sensor of iPhone 12 and iPhone X
- Manufacturing cost analysis
- Estimated sales price

IC — LED — RF — MEMS — **IMAGING** — PACKAGING — SYSTEM — POWER - DISPLAY

TABLE OF CONTENTS

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Sylvain Hallereau is Principal Technology & Cost Analyst at System Plus Consulting. Sylvain produces reverse engineering & costing reports while also contributing to custom projects, especially focused on solid-state lighting components, sensors, biotechnology devices, and ICs. He holds a master's degree in Microelectronics from the University of Nantes (France).

Léo VATANT works as a microelectronic laboratory analyst at System Plus Consulting. He is graduated from the University of Limoges where he obtained a Master degree in material science majoring Ceramics. He previously worked on different subject among which solar cells and tellurite glasses for optical fibre application."

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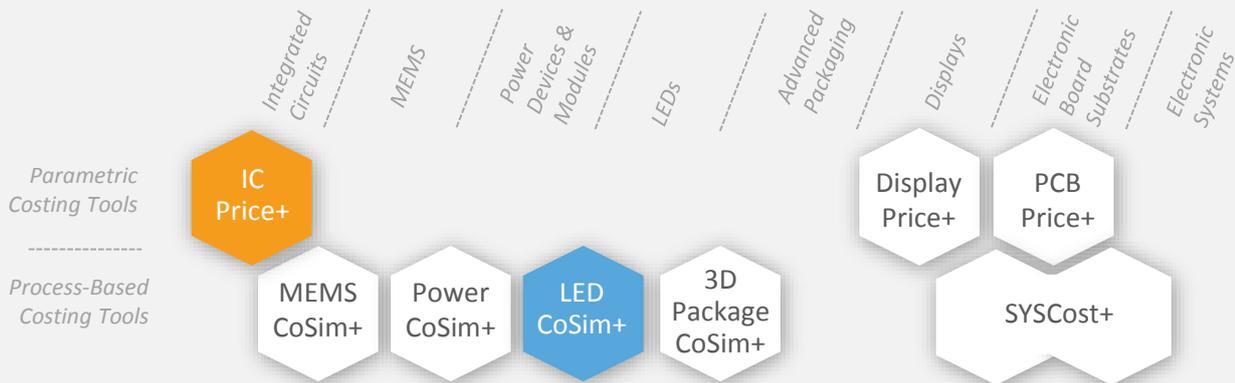April 2021

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Our analysis is performed with our costing tools LED CoSim+ and IC Price+.

System Plus Consulting offers powerful costing tools to evaluate any process or device, the production cost and selling price, from single chip to complex structures. All these tools are on sale under corporate license.

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The process-based costing tool is used to evaluate the manufacturing cost per wafer using your own inputs or using the predefined parameters included in the tool. It is possible to enter any LED process flow.

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Reverse Costing® is the process of disassembling a device (or a system) in order to identify its technology and calculate its manufacturing cost, using in-house models and tools.

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