STMicroelectronics was the first company to provide Single Photon Avalanche Diode (SPAD) technology for proximity sensing. Back in 2016, Apple started to implement this technology for its high-end iPhone 7 Plus. At this time, the phone-making Original Equipment Manufacturers (OEMs) were looking for highly sensitive proximity sensors requiring low photon incidence to work. Several companies have followed this path and have developed their own SPAD technology. This year, ams started mass production of its proximity sensors based on SPAD technology and offer the solution to several customers. The very first customer is Huawei, with ams supplying a custom proximity sensor in the Huawei Mate 20 Pro. Following this, ams is expected to gain increasing market share with several design wins in other OEMs’ flagships this year.

In the Huawei Mate 20 Pro, the front optical hub is packaged in one metal enclosure featuring several cameras and sensors. The complete system features a red/green/blue (RGB) camera module, an ambient light sensor, a near-infrared (NIR) global shutter (GS) camera module, a flood illuminator, a proximity sensor and a dot projector.

This report focusses on analyzing the proximity sensor. Located in the front around the main speaker, the proximity sensor is contained in a Land Grid Array (LGA) package. The device is probably a custom version of the new TMF8701 component made specifically for Huawei, and is the first on the market from ams. The component includes a SPAD detector featuring a 15 µm-wide SPAD, with 128 pixel resolution, and a single Vertical Cavity Surface Emitting Laser (VCSEL). The structure uses innovative optical LGA packaging with polymer lenses produced using a transfer molding process.

This complete analysis of the proximity sensor includes detailed analyses of the SPAD detector and the VCSEL, along with a cost analysis and price estimation for the module. It also includes a physical and technical comparison with the custom proximity sensor from STMicroelectronics in the Apple iPhone 8 and iPhone X.
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