STMicroelectronics’ Near Infrared Camera Sensor in the Apple iPhone X

The first NIR camera sensor with multiple innovations based on imager-silicon-on-insulator substrate from SOITEC, supplied and produced by STMicroelectronics for the Apple True Depth Module

Ahead of all its competitors, Apple has started using 3D sensing. For the iPhone’s 10th anniversary, it integrated this new functionality, under the name of ‘True Depth sensing’. Rather than scene sensing, like competitors such as Lenovo, the 3D Time of Flight system provided by STMicroelectronics and ams enables face recognition and targets security applications. Working along with a dot projector, the near infrared (NIR) camera sensor allows high-precision depth sensing. This NIR camera sensor is the first to feature Imager-Substrate On Insulator (SOI) technology provided by SOITEC, allowing higher quantum efficiency with very low noise.

Located in the iPhone X’s front, around the main speaker, the True Depth system is packaged in one metal enclosure. The system features a dot projector, a red/green/blue camera and a NIR camera sensor. The latter device, provided by STMicroelectronics, is a NIR camera sensor based on an Imager-SOI substrate, involving multiple innovations.

The SOI substrate allows high quantum efficiency and reduces noises from the substrate. Combined with STMicroelectronics’ knowledge of NIR sensing technology, the sensor die has very small pixels, less than 4 µm long, and high resolution of almost two megapixels, thanks to STMicroelectronics’ new technology node, reaching below 140 nm on SOI. This allows the sensor to precisely detect faces to unlock the smartphone in a very short response time. The use of deep trenches coupled with SOI substrates provides high dynamic range pixels. This camera assembly uses stud bumping to connect the sensor die in flip-chip configuration, along with an optical module comprising four lenses.

This report analyzes the complete NIR camera sensor, including a full analysis of the module and the sensor die, along with a cost analysis and a price estimate for the device. It also includes a physical and technical comparison with other NIR image sensors for 3D sensing, such as those from Infineon, pmd and Tower Semiconductor for consumer applications, Melexis for automotive, and Texas Instruments for industrial applications.
ANA LYSIS PERFORMED WITH OUR COSTING TOOLS MEMS COSIM+ AND IC PRICE+

System Plus Consulting offers powerful costing tools to evaluate the production cost and selling price from single chip to complex structures.

MEMS CoSim+
Cost simulation tool to evaluate the cost of any MEMS process or device.

IC Price+
The tool performs the necessary cost simulation of any Integrated Circuit: ASICs, microcontrollers, DSP, memories, smartpower, and more.
RELATED REPORTS

 Lenovo Phab2Pro 3D Time of Flight (ToF) Camera Google Tango Ready
 World’s first 3D tri-camera bundle including Infineon/pmd REAL3TM ToF image sensor integrated into a consumer smartphone.

 STMicroelectronics Time of Flight Proximity Sensor in the Apple iPhone 7 Plus
 A look inside the Single Photon Avalanche Diode (SPAD) from STMicroelectronics entering the high-end Apple handset.

 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.

ANNUAL SUBSCRIPTION OFFER

Each year System Plus Consulting releases a comprehensive collection of new reverse engineering & costing analyses in various domains.

You can choose to buy over 12 months a set of 3, 4, 5, 7, 10 or 15 Reverse Costing® reports.

Up to 47% discount!

More than 60 reports released each year on the following topics (considered for 2017):

- **MEMS & Sensors:**
  - Accelerometer - Compass - Display / Optics - Environment - Fingerprint - Gyroscope - IMU/Combo - Light - Microphone - Oscillator - Pressure sensor
- **Power:**
  - GaN - IGBT - MOSFET - Si Diode - SiC
- **Systems:**
  - Automotive - Consumer - Energy - Medical - Telecom
- **Imaging:**
  - Infrared - Visible
- **Integrated Circuits & RF:**
  - Integrated Circuit (IC) - RF IC
- **LEDs:**
  - LED Lamp - UV LED - White/blue LED
- **Packaging:**
  - 3D Packaging - Embedded - SIP - WLP
Please process my order for “STMicroelectronics NIR Camera Sensor” Reverse Costing Report

Ref.: SP17378

- Full Reverse Costing report: EUR 3,490*
- Annual Subscription (including this report as the first of the year):
  - 3 reports: EUR 8,400*
  - 5 reports: EUR 12,500*
  - 7 reports: EUR 16,000*
  - 10 reports: EUR 21,000*
  - 15 reports: EUR 27,500*

*For price in dollars please use the day’s exchange rate  
*All reports are delivered electronically in pdf format  
*For French customer, add 20% for VAT  
*Our prices are subject to change. Please check our new releases and price changes on www.systemplus.fr. The present document is valid 6 months after its publishing date: December 2017

SHIP TO
Name (Mr/Ms/Dr/Pr):
Job Title:
Company:
Address:
City: State:
Postcode/Zip:
Country:
VAT ID Number for EU members:
Tel:
Email:
Date:
Signature:

PAYMENT
DELIVERY on receipt of payment: 

By credit card:
Number: __ __ __ __ | __ __ __ __ | __ __ __ __ | __ __ __ __ |
Expiration date: | __ | __ | / | __ | __ | Card Verification Value: __ __ __ |

By bank transfer:
HSBC - CAE - Le Terminal - 2 rue du Charron - 44800 St Herblain France
BIC code: CCFRFRPP

In EUR
Bank code: 30056 - Branch code: 00955 - Account: 09550003234
IBAN: FR76 3005 6009 5509 5500 0323 439

In USD
Bank code: 30056 - Branch code: 00955 - Account: 09550003247
IBAN: FR76 3005 6009 5509 5500 0324 797

Return order by:
FAX: +33 2 53 55 10 59
MAIL: SYSTEM PLUS CONSULTING
21 rue La Nouë Bras de Fer
44200 Nantes – France

Contact:
EMAIL: sales@systemplus.fr
TEL: +33 2 40 18 09 16

BILLING CONTACT
First Name: __________________________
Last Name: __________________________
Email: ______________________________
Phone: ______________________________

ABOUT SYSTEM PLUS CONSULUTING
System Plus Consulting is specialized in the cost analysis of electronics from semiconductor devices to electronic systems. A complete range of services and costing tools to provide in-depth production cost studies and to estimate the objective selling price of a product is available.

Our services:
TECHNOLOGY ANALYSIS - COSTING SERVICES - COSTING TOOLS - TRAININGS
www.systemplus.fr - sales@systemplus.fr
1. INTRODUCTION
The present terms and conditions apply to the offers, sales and deliveries of services managed by System Plus Consulting except in the case of a particular written agreement.
Buyer must note that placing an order means an agreement without any restriction with these terms and conditions.

2. PRICES
Prices of the purchased services are those which are in force on the date the order is placed. Prices are in Euros and worked out without taxes. Consequently, the taxes and possible added costs agreed when the order is placed will be charged on these initial prices.
System Plus Consulting may change its prices whenever the company thinks it necessary. However, the company commits itself in invoicing at the prices in force on the date the order is placed.

3. REBATES and DISCOUNTS
The quoted prices already include the rebates and discounts that System Plus Consulting could have granted according to the number of orders placed by the Buyer, or other specific conditions. No discount is granted in case of early payment.

4. TERMS OF PAYMENT
System Plus Consulting delivered services are to be paid within 30 days end of month by bank transfer except in the case of a particular written agreement.
If the payment does not reach System Plus Consulting on the deadline, the Buyer has to pay System Plus Consulting a penalty for late payment the amount of which is three times the legal interest rate. The legal interest rate is the current one on the delivery date. This penalty is worked out on the unpaid invoice amount, starting from the invoice deadline. This penalty is sent without previous notice.
When payment terms are over 30 days end of month, the Buyer has to pay a deposit which amount is 10% of the total invoice amount when placing his order.

5. OWNERSHIP
System Plus Consulting remains sole owner of the delivered services until total payment of the invoice.

6. DELIVERIES
The delivery schedule on the purchase order is given for information only and cannot be strictly guaranteed. Consequently any reasonable delay in the delivery of services will not allow the buyer to claim for damages or to cancel the order.

7. ENTRUSTED GOODS SHIPMENT
The transport costs and risks are fully born by the Buyer. Should the customer wish to ensure the goods against lost or damage on the base of their real value, he must imperatively point it out to System Plus Consulting when the shipment takes place. Without any specific requirement, insurance terms for the return of goods will be the carrier current ones (reimbursement based on good weight instead of the real value).

8. FORCE MAJEURE
System Plus Consulting responsibility will not be involved in non execution or late delivery of one of its duties described in the current terms and conditions if these are the result of a force majeure case. Therefore, the force majeure includes all external event unpredictable and irresistible as defined by the article 1148 of the French Code Civil?

9. CONFIDENTIALITY
As a rule, all information handed by customers to System Plus Consulting are considered as strictly confidential.
A non-disclosure agreement can be signed on demand.

10. RESPONSABILITY LIMITATION
The Buyer is responsible for the use and interpretations he makes of the reports delivered by System Plus Consulting. Consequently, System Plus Consulting responsibility can in no case be called into question for any direct or indirect damage, financial or otherwise, that may result from the use of the results of our analysis or results obtained using one of our costing tools.

11. APPLICABLE LAW
Any dispute that may arise about the interpretation or execution of the current terms and conditions shall be resolved applying the French law.
It the dispute cannot be settled out-of-court, the competent Court will be the Tribunal de Commerce de Nantes.