

LED

IC

MEMS

IMAGING

PACKAGING

SYSTEM

POWER

# STMicroelectronics HTS221 Humidity and Temperature Sensor

*High performances humidity sensor based on STMicroelectronics capacitive digital sensor in a tiny compact package*



The HTS221 humidity sensor is the first environmental sensor from STMicroelectronics which follows the trend of new open cavity combos. Assembled in a 6-pins LGA 2 x 2 x 0.9mm package; the HTS221 is a digital humidity and temperature sensor equipped with a sensor die and an ASIC. It has operating ranges of  $-40...+125^{\circ}\text{C}$ ,  $0...100\%$  relative humidity for 16bit output data for temperature and humidity.

**Title:** Humidity and Temperature Sensor

**Pages:** 121

**Date:** April 2015

**Format:** pdf + xls

**PRICE:**

Full report: EUR 2,990

Technology report: EUR 1,990

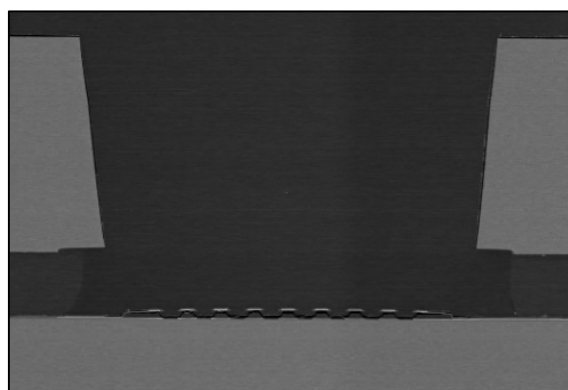
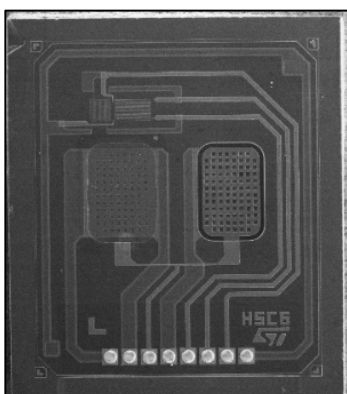
The relative humidity sensor uses a polymer dielectric planar capacitor digital measurement technology which allows a precise response in very compact size. The integrated heater allows a high ODR.

This device uses a new type of package built around an original holed cap developed by STMicroelectronics for mobile phones and for industrial application with a temperature range from  $-40^{\circ}\text{C}$  to  $+120^{\circ}\text{C}$ .

The report presents a deep technology and cost analysis of HTS221 with an exhaustive package analysis. It also includes a technology and production cost comparison with Bosch BME280 humidity and pressure sensor and with Sensirion SHTC1 humidity MEMS.

COMPLETE TEARDOWN WITH:

- Detailed Photos
- Precise Measurements
- Material Analysis
- Manufacturing Process Flow
- Supply Chain Evaluation
- Manufacturing Cost Analysis
- Selling Price Estimation
- Comparison of HTS221 vs. Bosch BME280 and Sensirion SHTC1



# TABLE OF CONTENTS

## Overview / Introduction

## Companies Profile

## Physical Analysis

- Physical Analysis Methodology
- Package
  - ✓ Package Views & Dimensions
  - ✓ Package Opening
  - ✓ Wire bonding Process
  - ✓ Package Cross-Section
- ASIC Die
  - ✓ View, Dimensions & Marking
  - ✓ ASIC Delayering
  - ✓ ASIC main blocks identification
  - ✓ ASIC Process
  - ✓ ASIC Die Cross-Section
- Pressure & Humidity Die
  - ✓ View, Dimensions & Marking
  - ✓ MEMS Humidity Sensing Area
  - ✓ Cap
  - ✓ MEMS Humidity Cross-Section
  - ✓ MEMS processes

## Comparison with Bosch BME280 and Sensirion SHTC1 pressure sensor

## Manufacturing Process Flow

- ASIC Front-End Process
- MEMS humidity Process Flow
- Wafer Fabrication Units
- Packaging Process Flow & Assembly Unit

## Cost Analysis

- Main steps of economic analysis
- Yields Hypotheses
- ASIC Front-End Cost
- ASIC Back-End 0 : Probe Test & Dicing
- ASIC Front-End Cost
- MEMS Humidity Wafer & Die Cost
- MEMS Humidity Front-End Cost
- MEMS Humidity Back-End 0 : Probe Test & Dicing
- Back-End : Packaging Cost
- Back-End : Packaging Cost per Process Steps
- Back-End : Final Test Cost
- BME280 Component Cost

## Price Estimation



**Author:**  
Sylvain Hallereau

Sylvain is in charge of costing analyses for IC, Power and MEMS. He has more than 10 years of experience in the MEMS manufacturing costs analysis and has studied a wide range of technologies.



**Author (Lab):**  
Yvon Le Goff

Yvon is the laboratory manager. He has deep knowledge in chemical & physical technical analyses. He previously worked for 25 years in Atmel Nantes Laboratory and analyses MEMS since more than 8 years.

# ANALYSIS PERFORMED WITH OUR COSTING TOOLS MEMS COSIM+ AND IC PRICE+

	Process-Based Costing Tools	Parametric Costing Tools
Integrated Circuits		IC Price+
MEMS	MEMS CoSim+	MEMS Price+
Power Devices & Modules	Power CoSim+	Power Price+
LEDs	LED CoSim+	
Advanced Packaging	3D-Package CoSim+	
Electronic Boards Substrates		PCB Price+
Electronic Systems	SYScost+	
Displays		Display Price+

## MEMS Cosim+

Cost simulation tool to evaluate the cost of any MEMS process or device:

**From single chip to complex structures.**

MEMS CoSim+ is a process-based costing tool used to evaluate the manufacturing cost per wafer using your own inputs or using the pre-defined parameters included in the tool.

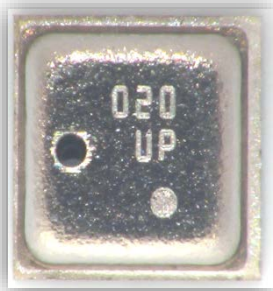
It is possible to enter any MEMS process flow.

## RELATED REPORTS

### Bosch Sensortec BME280

Integrated Environmental Sensor

High performances pressure and humidity sensor based on Bosch APSM process and innovative resistive measurement technology in a single compact package



Pages: 122  
Date: February 2015  
Full report: EUR 2,990\*

### Sensirion SHTC1

Humidity and Temperature Sensor

Humidity and temperature sensor made from a tiny die using Sensirion's CMOSens® process. This sensor is targeting portable devices



Pages: 89  
Date: July 2013  
Full report: EUR 2,990\*

### Bosch SMI130

6-Axis Automotive MEMS IMU

Bosch's first 6-Axis IMU for Automotive Application Combines 3-Axis Gyroscope and 3-Axis Accelerometer



Pages: 175  
Date: March 2015  
Full report: EUR 2,990\*

## 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 45% discount!**



More than 40 reports released each year on the following topics (considered for 2015):

- MEMS & Sensors (20 reports):
  - Gyros/Accelerometers/IMU
  - Oscillators/RF switches
  - Pressure sensors/Microphones
- Power Electronics & Systems (10 reports):
  - GaN and SiC devices
  - Inverters & modules
- Imaging & LEDs (5 reports):
  - Camera modules
  - Infrared sensors & cameras
  - LEDs
- Advanced Packaging (5 reports):
  - WLP
  - TSV
  - Embedded Devices...

Performed by

# ORDER FORM

Please process my order for "STMicroelectronics HTS221" Reverse Costing Report

Ref.: SP15209

- Full Reverse Costing report: EUR 2,990\*
- Technology Analysis\*\* report: EUR 1,990\*
- Annual Subscription (including this report as the first of the year):
  - 3 reports EUR 8 400\*
  - 4 reports EUR 11 000\*
  - 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](http://www.systemplus.fr). The present document is valid 6 months after its publishing date: April 2015

\*\* Technology Analysis report contains only Physical Analysis & Manufacturing Process Flow

## 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](mailto:sales@systemplus.fr)  
TEL: +33 2 40 18 09 16

## BILLING CONTACT

Name: .....  
Email:.....  
Phone:.....

## ABOUT SYSTEM PLUS CONSULTING

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:

**COSTING SERVICES - COSTING TOOLS - TRAININGS**

[www.systemplus.fr](http://www.systemplus.fr) - [sales@systemplus.fr](mailto:sales@systemplus.fr)

# TERMS AND CONDITIONS OF SALES

## 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.

If the dispute cannot be settled out-of-court, the competent Court will be the Tribunal de Commerce de Nantes.