Capacitive Fingerprint Sensors

Technology and Patent Infringement Risk Analysis

Component A
iPhone 5S

Component B
Ascend Mate 7

Component C
Galaxy S5

Component D
Galaxy S6
• Headquartered in Sophia Antipolis, France, **Knowmade** is a Technology Intelligence and IP Strategy consulting company. We provide patent search, patent analysis, patent valuation, IP landscape, scientific literature landscape, technology scouting, technology transfer and technology tracking. Our service offer consists of custom studies, on-demand tracking, analysis reports and strategy consulting. Knowmade combines information search services, scientific expertise, powerful analytics and visualization tools, and proprietary methodologies for analyzing patents and scientific information. With a solid focus on Microelectronics, Compound Semiconductors, LED, MEMS, Nanotechnology and Biotechnology, **Knowmade** supports research laboratories, industrial companies and investors in their business development.

• Headquartered in Nantes, France, **System Plus Consulting** is specialized in technology and cost analysis of electronic components and systems in the fields of Integrated Circuits, Power Devices and Modules, MEMS & Sensors, LED, Image Sensors, Packaging including wafer level, Electronic Boards and Systems. The company offers custom reverse costing analyses, standard reverse costing reports and costing tools. These analyses are used by Purchasing Departments to measure their suppliers’ cost structure, R&D Departments to confirm technological choices depending on their impact on costs, and Benchmarking/Marketing Departments to monitor the products on the market.

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>p04</td>
</tr>
<tr>
<td>Scope of the Study</td>
<td>p05</td>
</tr>
<tr>
<td>Rationales for Choice</td>
<td>p06</td>
</tr>
<tr>
<td>Key Features of the Report</td>
<td>p07</td>
</tr>
<tr>
<td>Objectives of the Report</td>
<td>p08</td>
</tr>
<tr>
<td>Terminology for Patent Analysis</td>
<td>p09</td>
</tr>
<tr>
<td>Methodology</td>
<td>p11</td>
</tr>
<tr>
<td>Patent Search Strategy</td>
<td>p13</td>
</tr>
<tr>
<td><strong>Companies Presentation</strong></td>
<td>p14</td>
</tr>
<tr>
<td>AuthenTec</td>
<td>p15</td>
</tr>
<tr>
<td>Apple</td>
<td>p16</td>
</tr>
<tr>
<td>Fingerprint Cards</td>
<td>p17</td>
</tr>
<tr>
<td>Validity &amp; Synaptics</td>
<td>p18</td>
</tr>
<tr>
<td><strong>Products Presentation</strong></td>
<td>p19</td>
</tr>
<tr>
<td>Fingerprint Sensor Supply Chain</td>
<td>p20</td>
</tr>
<tr>
<td>TMDR92 – iPhone 5S</td>
<td>p21</td>
</tr>
<tr>
<td>FPC1020 – Ascend Mate 7</td>
<td>p22</td>
</tr>
<tr>
<td>VAL004A8-T – Galaxy S5</td>
<td>p23</td>
</tr>
<tr>
<td>B1202A0-01 – Galaxy S6</td>
<td>p24</td>
</tr>
<tr>
<td><strong>Executive Summary</strong></td>
<td>p25</td>
</tr>
<tr>
<td><strong>Tear Down</strong></td>
<td>p30</td>
</tr>
<tr>
<td>Physical Analysis Methodology</td>
<td>p31</td>
</tr>
<tr>
<td>Fingerprint Sensor Characteristics</td>
<td>p32</td>
</tr>
<tr>
<td>Packaging</td>
<td>p33</td>
</tr>
<tr>
<td>Sensing Area</td>
<td>p35</td>
</tr>
<tr>
<td>Technology Comparison</td>
<td>p36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patent Analysis</strong></td>
<td>p37</td>
</tr>
<tr>
<td>Patent Infringement Risk Potential</td>
<td>p38</td>
</tr>
<tr>
<td>IP Portfolio</td>
<td>p39</td>
</tr>
<tr>
<td>TMDR92 – Apple iPhone 5S</td>
<td>p40</td>
</tr>
<tr>
<td>Patent Identification</td>
<td></td>
</tr>
<tr>
<td>Patent Infringement Risk</td>
<td></td>
</tr>
<tr>
<td>Conclusions</td>
<td></td>
</tr>
<tr>
<td>FPC1020 - Huawei Ascend Mate 7</td>
<td>p52</td>
</tr>
<tr>
<td>Patent Identification</td>
<td></td>
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<td>Patent Infringement Risk</td>
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<td>Conclusions</td>
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<tr>
<td>VAL004A8-T - Samsung Galaxy S5</td>
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<td>p92</td>
</tr>
<tr>
<td>Patent Identification</td>
<td></td>
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<tr>
<td>Patent Infringement Risk</td>
<td></td>
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<tr>
<td>Conclusions</td>
<td></td>
</tr>
<tr>
<td><strong>Conclusions</strong></td>
<td>p111</td>
</tr>
<tr>
<td><strong>Related Reports</strong></td>
<td>p114</td>
</tr>
</tbody>
</table>
INTRODUCTION
Scope of the Study

This report provides a technology and patent infringement risk analysis of 4 capacitive fingerprint sensors designed by Company X, Company Y and Company Z and included in smartphones: Apple iPhone 5S, Huawei Ascend Mate7 and Samsung Galaxy S5 and S6.

Component A
(Company X)

Component B
(Company Y)

Component C
(Company Z)

Component B
(Company Z)

iPhone 5S

Ascend Mate 7

Galaxy S5

Galaxy S6

This report is focused on some aspects presenting similar features between the 4 selected products and revealed by the reverse engineering performed by System Plus Consulting. These product features are only related to the fingerprint sensor die, design and packaging. They are not related to the ASIC. They are not related to the electrical circuit of the sensing area nor the signal process as those features are not accessible by a tear down of the device.

Disclaimer: This report does not provide detailed claim charts and legal opinions regarding patent infringements. The risks of patent infringement highlighted in this report require more in-depth legal assessments to be confirmed.
INTRODUCTION
Rationales for Choice

Fingerprint sensors using capacitive technology represent a fast growing market, and it can be linked to the development of fingerprint scanners in smartphones and other electronic devices. The fingerprint sensor vendor Idex forecasts an increase of 360% of the number of fingerprint sensor units in mobile devices and of the fingerprint sensor market between 2014 and 2017 (Source: N+1 Singer, Idex, 2014).

Various devices (external fingerprint scanners, cars, phones, computers, keyboards and the like,...) integrating a capacitive fingerprint sensor have been available on the market since the late 90’s. However, those sensors lacked efficiency and were difficult to use.

But a new generation of capacitive fingerprint sensors has emerged in the last few years. More efficient and easy to use, less expansive, they have been incorporated in the last generations of smartphones of companies like Apple, Samsung or Huawei.

This market growth is supported by a new phase of IP development, revealed by an increase in the number of new patents related to capacitive fingerprint sensor published since 2012 (Source: Knowmade, 2015).

AuthenTec, now part of Apple, is the 1st provider of fingerprint sensors for smartphone manufacturers (Fujitsu, Motorola, Philips, Apple,...). In 2013, for the 1st time, Apple included a fingerprint sensor in one of its devices, the iPhone 5S, following the acquisition of AuthenTec. In the last couple of years, other manufacturers relied upon others fingerprint sensors companies. In particular, the smartphone world leader Samsung choose a technology developed by Synaptics (Validity) and began to incorporate fingerprint scanners in its Galaxy products, including the Galaxy S5, in 2014. Launched in 2015, Samsung’s Galaxy S6 also included such a fingerprint sensor but slightly different from the 1st generation. For its part Huawei choose the Swedish company Fingerprint Cards to equip its Ascend Mate 7 released in 2015.

The fingerprint sensors found in the Apple iPhone 5S (AuthenTec), Huawei Ascend Mate 7 (Fingerprint Cards) and Samsung Galaxy S5 and S6 (Synaptics) represent 3 different technological choices but sharing common characteristics. Moreover, AuthenTec, Fingerprint Cards and Synaptics are the main actors in capacitive fingerprint sensing solutions for electronic devices. Thus the comparison of each fingerprint sensor with the technology developed by the two other companies would provide a deeper insight in the capacitive fingerprint sensor domain.
INTRODUCTION

Key Features of the Report

- This report provides a deep insight on technology data and manufacturing processes (teardown analysis) of Component A, Component B, Component C and Component D components, and comparative studies of product features.
- It provides patents related to the target product features and held by Apple, Fingerprint Cards and Synaptics.
- It provides discussions on the potential patent infringement risks by comparing relevant patent claim elements to the target product features and manufacturing processes.
- This report also provides an extensive Excel database with all patents analyzed in this study (26 patent families including more than 100 patents). This database allows multi-criteria searches:
  - Patent publication number
  - Hyperlinks to the original documents
  - Priority date
  - Title
  - Abstract
  - Patent Assignees
  - Legal status of the patent

Disclaimer: This report does not provide any insight analyses or counsel regarding legal aspects or the validity of any individual patent. Knowmade and System Plus Consulting are research firms that provide technical analysis and opinions. The research, technical analysis and/or work contained herein is not a legal opinion and should not be construed as such.
INTRODUCTION
Objectives of the Report

• Provide an overview of technology data and manufacturing process of Component A, Component B, Component C and Component D components supplied by Apple (AuthenTec), Fingerprint Cards, Validity and Synaptics.

• Find the technical and manufacturing process similarities and differences of Component A, Component B, Component C and Component D components.

• Identify key patents held by Apple (AuthenTec), Fingerprint Cards and Synaptics (Validity), and related to the target product features and manufacturing processes.

• Find the link between patented technological solutions and marketed products.

• Identify the potential infringing parties, and help to find evidence of use.

• Identify potential risks of patent infringement, and identify the patents which require a more in depth legal assessment.
INTRODUCTION

Methodology

Teardown Analysis
- Package is analyzed and measured.
- The dies are extracted in order to get overall data: dimensions, main blocks, pad number and pin out, die marking.
- Setup of the manufacturing process.

Comparative Study
- The similarities and differences of target of products are identified (product features and manufacturing processes).
- A set of product features and manufacturing processes is selected regarding their interest in terms of IP study.

Patent Search
- Patents are extracted from Questel-Orbit worldwide patent database by using keyword-based queries.
- The selection of relevant patents is done manually by expert review of the subject-matter of inventions.
- The patents are manually categorized regarding the selected product features.

Infringement Risks
- The links between the patented technologies and the target product features are established.
- The potential infringing parties of the target product are identified, and the potential risks of patent infringements are discussed.
INTRODUCTION

Methodology

• The data were extracted from the FamPat worldwide database (Questel-ORBIT) which provides 90+ million patent documents from 95 offices.

• The patents search was performed in September 2015, hence patents published after this date will not be available in this report.

• The patent selection was done manually.

Number of selected patent families for capacitive fingerprint sensor technologies IP Investigation:

26 over a number of returned results > 900

• The statistical analysis was performed with Questel Orbit IP Business Intelligence software.

• The patents were manually categorized using keyword analysis of patent title, abstract and claims, in conjunction with expert review of the subject-matter of inventions.

• The patents were organized according to FamPat’s family rules (variation of EPO strict family): A Patent Family comprises patents linked by exactly same priority numbers (strict family), plus comparison of priority and application numbers, specific rules by country and information gathered from other sources (national files, legal status ...).

Disclaimer: KnowMade is a research firm that provides technical analysis and technical opinions. The research, technical analysis and/or work contained herein is not a legal opinion and should not be construed as such.
# INTRODUCTION

## Patent Search Strategy

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- + Truncation replacing any number of characters
- ? Truncation replacing zero or one character
- # Truncation replacing one character
- _ Truncation for word that may have a space (ex: semiconductor, semi conductor)
- OR Finds references containing at least one of the words
- AND Finds references containing all words
- S Finds references containing the terms in the same sentence
- nD Finds references containing adjacent terms, regardless of the order, and may be separated by a maximum of n words
- nW Finds references containing adjacent terms, in the order specified, and may be separated by a maximum of n words
- ( ) Parentheses are necessary to combine different operators
- /TI/OTI Search in Title
- /BI Search in Title and Abstract
- /CLMS Search in Claims
- /DESC/ODES Search in Description
- /PA.FLD Search in Patent Assignees
- /IC Search in International Patent Classification (IPC)
The **Component A** fingerprint sensor from **Company A** is integrated in the home button if the **Apple iPhone 5S**. The iPhone 5S was launched in 2013. The sensor features a square shape with a resolution of xx pixels and pixel density of xx ppi. It uses a capacitive touch technology. The sensor array is composed of XXX capacitor plates mounted on a XXX substrate and covered by a protective XXX. The sensor die is XXX to a XXX substrate.
This report is focused on some aspects presenting similar features between the 4 selected products and revealed by the reverse engineering performed by System Plus Consulting. These product features are only related to the fingerprint sensor die, design and packaging. They are not related to the ASIC.

**Step 1**
- Package is analyzed and measured

**Step 2**
- The dies are extracted in order to get overall data: dimensions, main blocks, pad number and pin out, die marking

**Step 3**
- Setup of the manufacturing process
TEAR DOWN

Packaging

Component A
Company X
- Capacitive window
- Stainless steel ring
- Markings for alignment to adjacent PCB
- Stainless steel plate

Component B
Company Y
- LCD package and encapsulation materials
- Aluminum ring
- Markings on ring
- Markings for alignment to components and transition to a PCB with solder pastes
- Protection materials

Component C
Company Z
- Metal inner sensor, aluminum ring
-markings on bond pads and for alignment to the PCB
- Airfoil, solder pastes on PCB
- Protection film, plate

Component D
Company Z
- Metal inner sensor, aluminum ring
- Markings on bond pads and for alignment to the PCB
- Airfoil, solder pastes on protection film, PCB
- Stainless plate
In this technology and patent infringement risk analysis, we have chosen the 3 following levels for characterizing the potential risk of patent infringement.

- **Unlikely infringement**: The product features being investigated do not reproduce any elements of the patent’s claims

- **Likely infringement**: The product features being investigated reproduced at least partly one element of the patent’s claims

- **Highly likely infringement**: The product features being investigated reproduced at least one element of the patent’s claims
PATENT ANALYSIS
Component A – Patent Identification

IDENTIFIED PATENT FAMILIES

- iPhone 5S home button assembly
- iPhone 5S home button – cross section

Patent pending in the USA

An environmental

The button assembly 500 includes...
PATENT ANALYSIS
Component A – Patent Infringement Risk

Component A Features

Company X

The sensing elements are covered with a layer of

The sensing surface is covered with an

Intellectual Property Rights

Company Y

Pending application: WO 2015/123456
Title: Method of
Scope of the main claim:
A fingerprint sensing device comprising:

Fig. 2b

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**PATENT ANALYSIS**

Component A – Patent Infringement Risk

---

**Component A Features**  
*Company X*

- The fingerprint sensor is included in the product design.
- The sensor is placed in a specific position.
- The sensor comprises:...

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**Highly Likely Infringement**

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**Intellectual Property Rights**  
*Company Z*

- Granted patent: US...
- Pending applications: GB, DE, FR, IT, KR, MX, TW...
- Title: Fingerprint sensor
- Scope of the main claim:
  - An electronic device user interface comprising:...

- Scope of dependent claims:
  - claims 3 and 4: flexible circuit
  - claim 6:...
  - claim 7:...
  - claim 8:...
  - claim 10:...
CONCLUSIONS

SUMMARY OF PATENT INFRINGEMENT RISK

The fingerprint sensor Component A shows a high risk of infringement regarding 3 patents owned by Company Z and a medium risk of infringement regarding 1 patent belonging to Company Y.

The sensor Component B has a risk of infringement towards 4 patents owned by Company X and a medium risk for a patent of Company Z.

Both sensors Component C & D show a risk of infringement regarding 3 patents belonging to Company X portfolio.

The infringement risk levels are:

- Highly likely
- Likely

Device and Fingerprint Sensor

Component A

Component B

Components C & D

Intellectual Property Rights

Company X

Company Y

Company Z

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EXCEL DATABASE
Containing all the patents analyzed in the report

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26 patent families composed of more than 100 patents.
This database allows multi-criteria searches and includes patent publication number, hyperlinks to the original documents, priority date, title, abstract, patent assignees, legal status for each member of the patent family.
ORDER FORM

Capacitive Fingerprint Sensors - November 2015
Technology and Patent Infringement Risk Analysis
TMDR92 (AuthenTec-Apple), FPC1020 (Fingerprint Cards), VAL004A8-T (Synaptics) and B1202A0-01 (Synaptics)

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Credit Card Number: _______ _______ _______ _______
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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.

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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.

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The transport costs and risks are fully borne 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).

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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?

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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.

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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.

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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.