

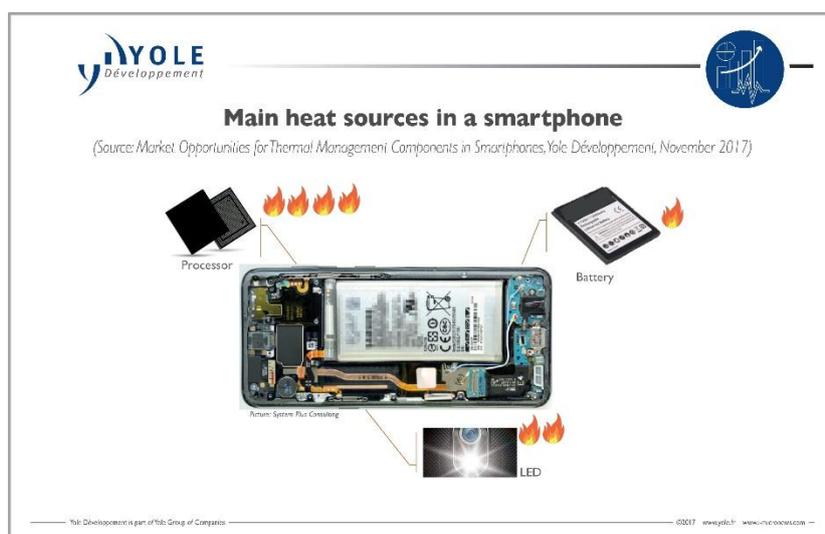


FOR IMMEDIATE RELEASE:

Smartphones: a significant challenge for thermal management companies

Extracted from: Market Opportunities for Thermal Management Components in Smartphones report, Yole Développement | Thermal Management In Smartphones: Technology Comparison report, System Plus Consulting – November 2017

LYON, France – November 30, 2017: Many thermal management technologies have been developed and tested to support new requirements and follow industries evolution. Therefore the market for thermal management solutions is today clearly in expansion. Amongst the numerous industries, the growing smartphone market, expected to reach almost 2.1 billion smartphones annually by 2022, represents a great opportunity. Indeed thermal management solutions enable better performance and longer lifetime as well as comfort and safety for the end-users. The thermal management components for smartphone applications is showing more than 26% CAGR¹ between 2016 and 2022. The components involved include packaging, PCB², heat pipe/vapor chamber, thermal sheet, smartphone back cover etc. Many companies are today deeply involved in the development of innovative thermal management solutions and would like to ensure their business expansion in this field. Beyond the interest for smartphones, thermal management solutions could also be applied in other electronic devices: power electronics and automotive components are part of them. That is why lot of companies are keeping a close eye on this topic and lot of questions are pending...



¹ CAGR : Compound Annual Growth Rate

² PCB : Printed Circuit Board

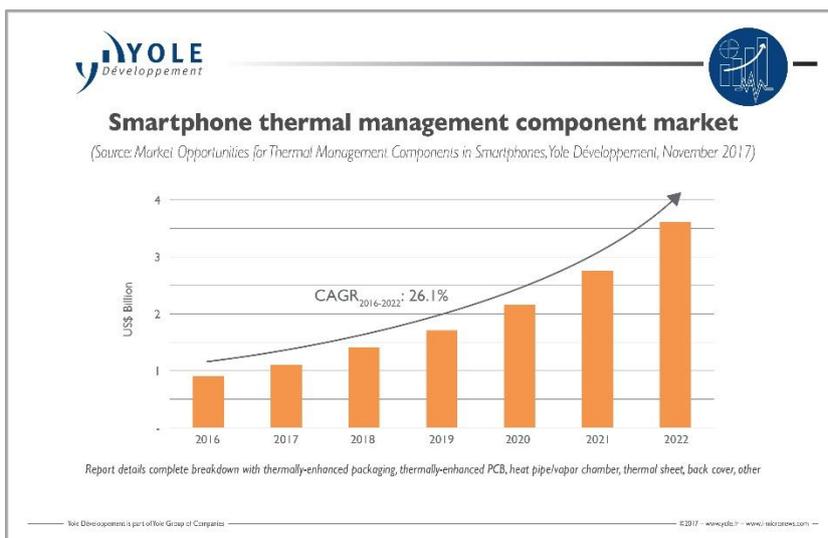
Yole Group of Companies including [System Plus Consulting](#) and [Yole Développement \(Yole\)](#) is conducting extensive researches to answer to the market questionings. The group proposes today two dedicated reports: [Market Opportunities for Thermal Management Components in Smartphones report](#) from Yole and [Thermal Management In Smartphones: Technology Comparison report](#) from System Plus Consulting.

The market & technology report from Yole is a comprehensive overview of the smartphone thermal management solutions, covering hardware and software. It details the technical trends and strategies to deal with thermal issues. Market forecasts, players' landscape including all key thermal management components are analyzed in this new report.

In parallel, System Plus Consulting performed a comparative technology review. This analysis provides insights focused on the assembling structure as well as an overview of the thermal

management technologies of 10 flagship smartphones from leading suppliers including Apple, Samsung, Huawei, LG and Xiaomi.

How can smartphones deal with growing heat management challenges? What are the current solutions? Who are involved in this industry? Yole and System Plus Consulting analysts offer you today a snapshot of this promising industry.



“The importance of thermal management in smartphones is due to the growing number of smartphone functionalities and raised customer requirements for processing speed, leading to increased heat dissipation,” explains **Dr Milan Rosina, Senior Analyst for Energy Conversion and Emerging Materials at Yole**. And he adds: *“Additional components needed to ensure new smartphone functions desired by customers, including wireless charging, high-resolution cameras, 3D gaming, security, authentication, and high-speed streaming, also result in denser component integration, making thermal management even more difficult.”*

Actually, smartphones contain several components that generate heat, and components whose performance and lifetime is negatively impacted by heat.



Excessive heating of some components, such as lithium ion batteries, has to be carefully handled for safety reasons.

The processor is the most important and hottest component in a smartphone. “To improve low power and high efficiency processors, companies including Apple and Samsung decreased their technology node up to 10 nm,” explains **Elena Barbarini, Senior Cost**

Engineer at System Plus Consulting. “This approach obliged the companies to improve heat dissipation; increasing die thickness and thus introducing innovative packaging solutions”.

Amongst the other heat-generating components in a smartphone, Yole’s analysts mention image sensors, light sources and batteries.

Suitable thermal management solutions are now sought to avoid hot spots in smartphone and keep the component temperature at acceptable levels. The enclosure temperature, or skin temperature, must be also kept relatively low to avoid users feeling uncomfortable when using the smartphone.

So what are today’s solutions? Smartphones pose a significant challenge to the implementation of traditional cooling schemes, such as heat sinks and fans, due to form factor limitations and the specific way the device is used by customers.

According to Yole’s analysts, there are different approaches for thermal management, based both on hardware and software solutions. Software thermal management (STM) has several advantages. It enables additional design flexibility and an optimal reaction to a given thermal event and can be improved by a software update in existing products. Contrary to hardware solutions, such as heat pipes, STM does not take additional space in smartphone.

The optimal way to deal with heat in smartphones would be to reduce heat generation, by using higher performance chips. Significant improvements have been made in chip manufacturing, with the 10 nm node introduced in 2016, and chip architectures, including multiple core architectures, with “high-power” and “low-power” cores, associated with appropriate software control. However, in the future, processor improvements might be not fast enough to follow rapidly elevating customer requirements for smartphone functionality and performance.

So other thermal management solutions will increasingly be needed. Similar trends were observed in the past, when thermal transfer sheet performance was not sufficient to dissipate heat from poorly thermally designed processors, leading to heat pipes being introduced into the first smartphones from NEC and Sony. Today, the Samsung Galaxy S8, LG G5, Google Pixel 2 XL are just a few examples of smartphones relying on heat pipes to improve their thermal management.

Alternatively, vapor chambers might perform better than heat pipes in the near future. Ultrathin vapor chambers are already under development by several players, such as Furukawa Electric, TaiSol, AVC and Delta, but still face difficult technology challenges.

As always, the smartphones industry is still an attractive market due to the large volumes. In addition, the very specific technical needs of this industry also enable strong technology differentiation. This dynamic context is offering numerous business opportunities for both established and new players to enter this market.

A detailed description of Yole Group of Companies reports is available on i-micronews.com, [battery & Energy Management reports section](#).

ABOUT THE REPORTS:**MARKET OPPORTUNITIES FOR THERMAL MANAGEMENT COMPONENTS IN SMARTPHONES**

How can smartphones deal with growing heat management challenges? - Produced by Yole Développement (Yole) part of Yole Group of Companies.

Companies cited in the report:

Amkor Technology, AT&S, Apple, ARM, ASUSTeK Computer, Inc. (ASUS), Auras, Asia Vital Components (AVC), Broadcom, CCI, Compeq Manufacturing, DECA Technologies, Furukawa Electric, Huawei, Coolpad, HiSilicon, Henkel, Huawei, HTC, Intel, Lenovo, LG, Mediatek, Microsoft, Nvidia Corp., Nanium, Nippon Mektron, NXP, Oppo, Qualcomm, Samsung, Samsung Electro-Mechanics Co, Ltd, Schoeller Electronics Systems... [Full list](#)

Author:

Dr. Milan Rosina is a Senior Analyst for Energy Conversion and Emerging Materials at Yole Développement. Before joining Yole, he worked as a Research Scientist and a Project Manager in the fields of photovoltaics, microelectronics, and LEDs. Dr. Rosina has more than 15 years of scientific and industrial experience with prominent research institutions, an equipment maker, and a utility company. His expertise includes new equipment and process development, due diligence, technology, and market surveys in the fields of renewable energy, energy storage, batteries, power electronics, thermal management and innovative materials and devices.

This report has been performed in collaboration with Mattin Grao Txapartegi and Jonathan Liao, both analysts part of the Power Electronics, Compound Semiconductor and Energy Management team at Yole Développement.

**THERMAL MANAGEMENT IN SMARTPHONES: TECHNOLOGY COMPARISON**

Comparative analysis of thermal management solution analysis of 10 flagship smartphones from Apple, Samsung, Huawei, LG and Xiaomi. - Produced by System Plus Consulting, part of Yole Group of Companies.

To complement Yole Développement's Thermal Management in Smartphones report, System Plus Consulting has conducted a comparative technology review to provide insights into the assembling structure and thermal management technology of 10 flagship smartphones from leading suppliers: Apple, Samsung, Huawei, LG and Xiaomi.

Authors:

- **Elena Barbarini** is in charge of costing analyses for MEMS, IC and Power Semiconductors. She has a deep knowledge of Electronics R&D and Manufacturing environment. Elena holds a Master in Nanotechnologies and a PhD in Power Electronics.
- **Yvon Le Goff** has joined System Plus Consulting in 2011, in order to setup the laboratory of System Plus Consulting. He previously worked during 25 years in Atmel Nantes Technological Analysis Laboratory as fab support in physical analysis, and 3 years at Hirex Engineering in Toulouse, in a DPA lab.

**ABOUT SYSTEM PLUS CONSULTING**

System Plus Consulting specializes in the cost analysis of electronics, from semiconductor devices to electronic systems. Created more than 20 years ago, System Plus Consulting has developed a complete range of services, costing tools and reports to deliver in-depth production cost studies and estimate the objective selling price of a product. System Plus Consulting engineers are experts in Integrated Circuits - Power Devices & Modules - MEMS & Sensors - Photonics – LED - Imaging – Display - Packaging - Electronic Boards & Systems.

Through hundreds of analyses performed each year, System Plus Consulting offers deep added-value reports to help its customers understand their production processes and determine production costs. Based on System Plus Consulting's results, manufacturers are able to compare their production costs to those of competitors. System Plus Consulting is a sister company of Yole Développement. More info on www.systemplus.fr.

**ABOUT YOLE DEVELOPPEMENT**

Founded in 1998, Yole Développement has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide covering MEMS and image sensors, Compound

Semiconductors, RF Electronics, Solid-state lighting, Displays, software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Nanomaterials, Power Electronics and Batteries & Energy Management. The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business. . For more information, visit www.yole.fr and follow Yole on [LinkedIn](#) and [Twitter](#).

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