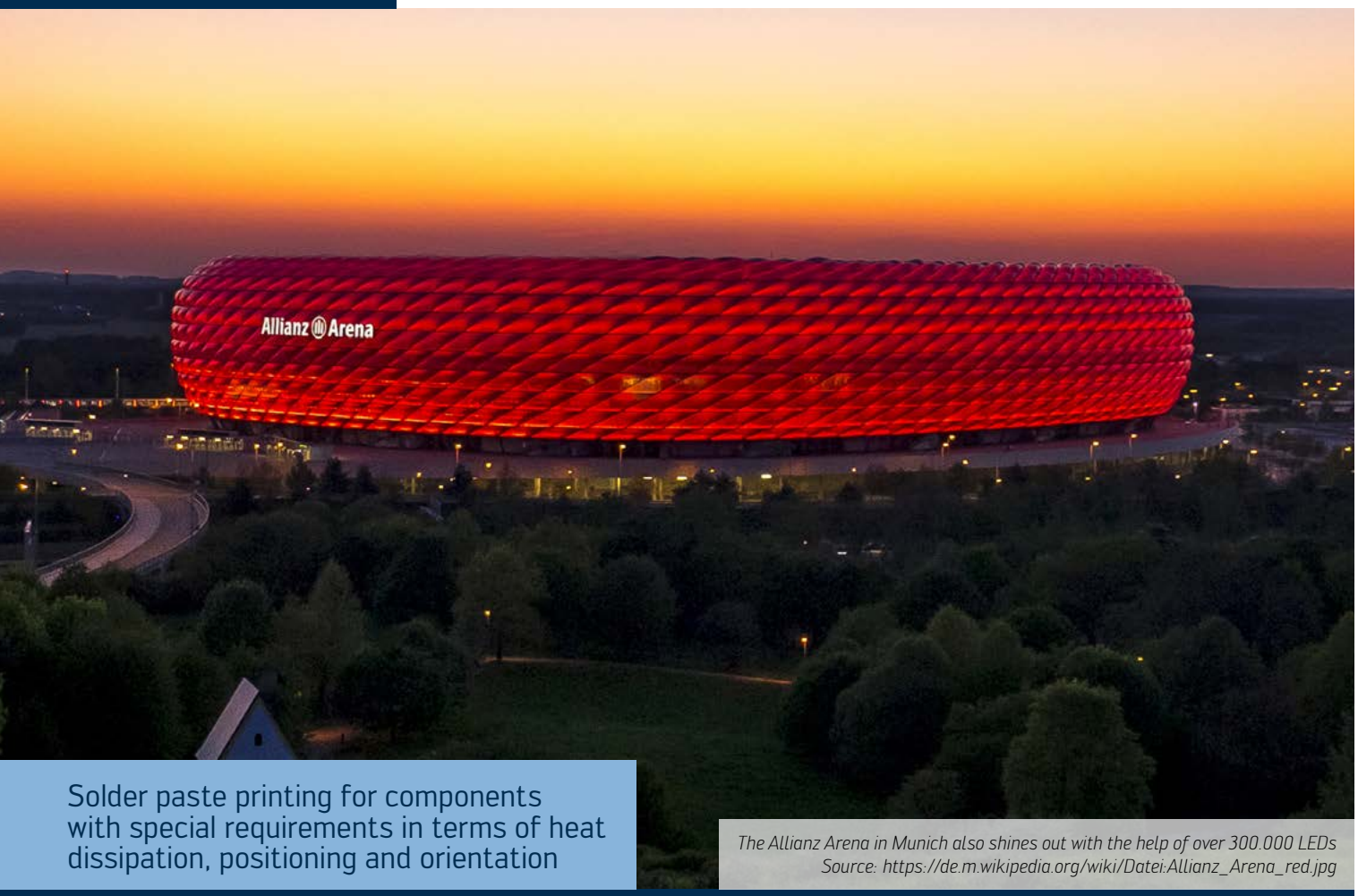
Technical article



The Allianz Arena in Munich also shines out with the help of over 300.000 LEDs
Source: https://de.m.wikipedia.org/wiki/Datei:Allianz_Arena_red.jpg

Solder paste printing for components with special requirements in terms of heat dissipation, positioning and orientation

Attaching LEDs correctly in solder paste printing

Since their invention in 1962, light emitting diodes, in brief LEDs, have found their way into every area of our lives. They illuminate our path as headlights on motor vehicles; they keep us informed as indicator lamps; their luminance warns us of danger and they show us the world on huge displays. Today, with their high level of efficiency, they have displaced many other lamps.

kurtz ersa

LED with gull-wing connectors Source: https://de.m.wikipedia.org/wiki/Datei:Luxeon_K2_LED..jpg

INFORMATION ON THE PRODUCT

But, as Goethe himself penned for his character Götz von Berlichingen: "Where the light is brightest, the shadows are deepest." This statement still applies today, and particularly for the LED. They shed their light for us only with the right connection to the assembly. This is where warming plays a major role. The miniaturization of the LED leads to high power density in small areas. This requires high-quality solder joints to ensure the desired heat dissipation. The aim here is a low solder gap and very few voids (defects in the solder connection). Because even the most efficient LED transforms over half of the infed energy into heat which has to be conducted away to prevent damage to the LED. By comparison, the bulbs common before the advent of the LED transformed 95 % of the infed energy into heat.

Many LED types require a precise solder volume for their electrical connection. The casing forms in today's LEDs largely dispense with wired connections. Pads on the underside of the LED constitute the connection points to the assembly. This leads to minimal dimensions and lower manufacturing costs. But it also means soldering connections requiring a strictly-defined volume in order to achieve the planned parameters. With volume fluctuations, glue joints change their solder height, instead of increasing the solder meniscus without altering the clearance, as is the case, for example, with a gull-wing connection. This means that volume fluctuations in printing lead to tipping of the LEDs or even open solder joints, when the solder volumes excessively lift the LED on a pad.

This is why it makes sense to fully view the assembly situation:

What pad sizes are desirable in order to be able to print evenly?

How do I design the solder stop masks so that the pad sizes show only minor tolerances?

Can I keep the board even in the area of the LED so that the printing process remains constant?

How do I dissipate heat from the LED without causing problems in the soldering process?

What solder volumes make sense for the different pad dimensions?

How can the printing result be verified?

Applications in which high-performance LEDs are used, such as vehicle headlights or street lighting, present particular challenges in terms of reliable processing. The VERSAPRINT 2 stencil printer with integrated 3D-SPI offers the ideal conditions.

The VERSAPRINT 2 ULTRA³ stencil printer with integrated 3D inspection

In the area of layouts, LED manufacturers provide very clear stipulations. Recommendations are rarer, however, when it comes to process management. In general, it makes sense to monitor the printed volume for a solder joint by means of 3D inspection. Here, with the VERSAPRINT2 ULTRA³, Ersa offers a stencil printer featuring an integrated 3D line scanning camera which is able to carry out a 3D assessment of the printing result directly. The integration into the printer permits meaningful functions which could not be provided by downstream solder paste inspection systems: For example, in an automatic cycle, the unprinted board can be measured for its zero height reference, to automatically counterbalance batch fluctuations in the volume measurement.
Reprinting to rectify inadequate printing results can be carried out by the operator directly following inspection.

LECTURE

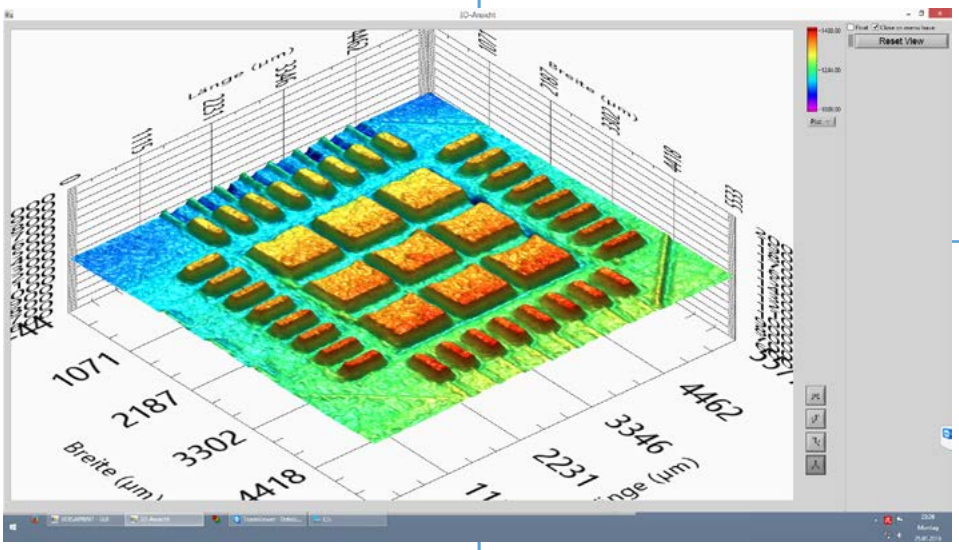
The lecture deals with how current LED types can be printed and with the risks existing for the printing process. Examples show how the volume of a typical glue joint can be calculated and the calculated volumes ideally printed onto the pads of the board. Because only an ideally designed printing process permits error-free and reliable connection of the LED to the assembly. Furthermore, the lecture goes into the possibilities offered by the VERSAPRINT 2 ULTRA³'s integrated 3D inspection, which optimizes implementation and monitoring of the printing process.

SPEAKER

Harald Grumm completed his studies of Precision and Electronic Instrument Engineering at the University of Applied Sciences in Berlin. Since 1996, he has been working in precision engineering and surface mounting, with main focus on stencil and screen printing. In the course of his work as Stencil Printing Project Manager at Ersa GmbH, he has defined the new generation of VERSAPRINT stencil printers, spoken at training courses on stencil printing and been involved on various publications in the area of stencil printing and component part assembly.

COMPANY PROFILE

For decades, Ersa has been a proven partner in the field of soldering technology. The product spectrum extends far beyond pure soldering: hand soldering irons, repair stations, stencil printers, reflow, selective and wave soldering systems, as well as process automation, offer the quality-conscious customer solutions for the challenges his products present today, and those to be



Example of a 3D visualization of the printing result with VERSAPRINT 2.

faced in the future. Plant and process training courses round off the extensive range of services in the program. The worldwide network of subsidiaries and commercial partners ensures the international availability of products and services.

STATEMENT

Electronics are an integral element of most areas of our lives. The smart phone accompanies us everywhere and shapes our everyday professional and private life; motor vehicles are beginning to drive autonomously and LEDs are an essential component in communication between electronics and humans.

Cost-efficient and reliable production of electronic assemblies is a key technology for the future. LEDs in particular, are experiencing a breakneck development in the power spectrum. High light output with minimum dimensions and low consumption ensure their continued use in modern assemblies. But this very combination of optics and surface mounting assembly techniques has its pitfalls. As a rule, the spatial arrangement on the assembly is of little significance for the electronic functions but is of major importance for the optical aspects. If the LED becomes skewed or tilted, the illumination or the angle of radiation changes. Therefore, when LEDs are being processed, special care is necessary in the design of the soldering procedure. The main focus is on the design of the solder joint – beginning with pad layout and on to the definition and verification of the printed solder paste volume and the finished joint.

Modern machine engineering offers many possibilities for monitoring and supporting manufacturing processes. But when it comes to planning the printing, your expertise is what counts. Give consideration to components with high risk potential in the lead-up to production so that the solution is, quite literally, a shining example. ■

Ersa GmbH
Leonhard-Karl-Str. 24
97877 Wertheim
Phone: +49 9342 800-0
info@ersa.de
www.ersa.com

Kurtz Ersa, Inc.
usa@kurtzersa.com

Kurtz Ersa Mexico
info-kmx@kurtzersa.com

Kurtz Ersa Asia Ltd.
asia@kurtzersa.com

Ersa Shanghai
info-esh@kurtzersa.com

Kurtz Ersa Vietnam Company Limited
info-kev@kurtzersa.com

Ersa France
info-efr@kurtzersa.com