

Rework from Micro to Macro

The rework universe – Factors influencing the ideal solder connection of PCB and component.

The Universe of Component Repair

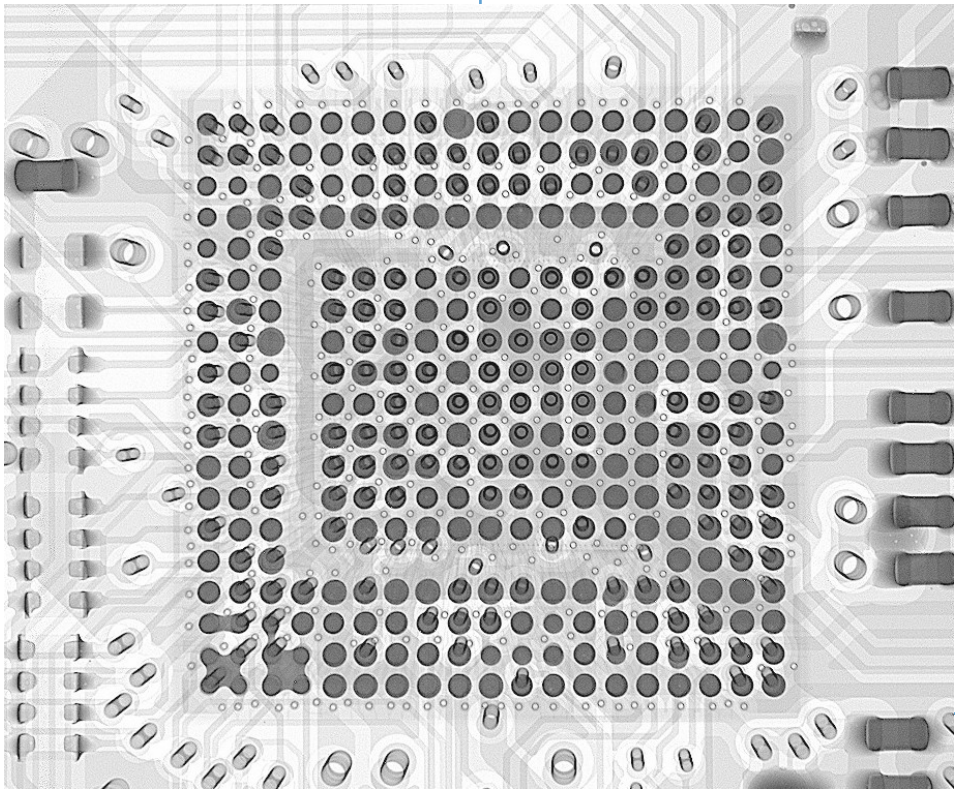
Author
Jörg Nolte
Product Manager Tools,
Rework and Inspection
Ersa GmbH

published in
productronic 10/2018
in Germany

In modern electronics production, the degree of perfection is edging ever closer to optimum. The race is on to reach the zero-defect limit, not least due to high-precision machines and processes. Even so, faults in production and (early)

failures of electronic components can never be completely ruled out. Repairs and reworking remain necessary and they too have to be executed with the highest possible degree of precision and quality.



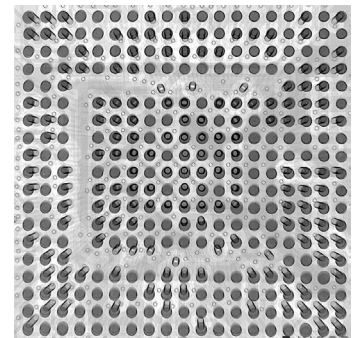


X-ray of a BGA with bridging and enlarged balls of solder

As in every other universe, the component manufacturing and repair universe has its own fixed stars and numerous other "heavenly bodies". The mutual effects of different parameters can become endlessly complex. The far-reaching interaction is not immediately evident to every observer. A central luminary is the connecting of component and PCB. Various influencing factors orbit around it, some of which are shown in Illus. 01.

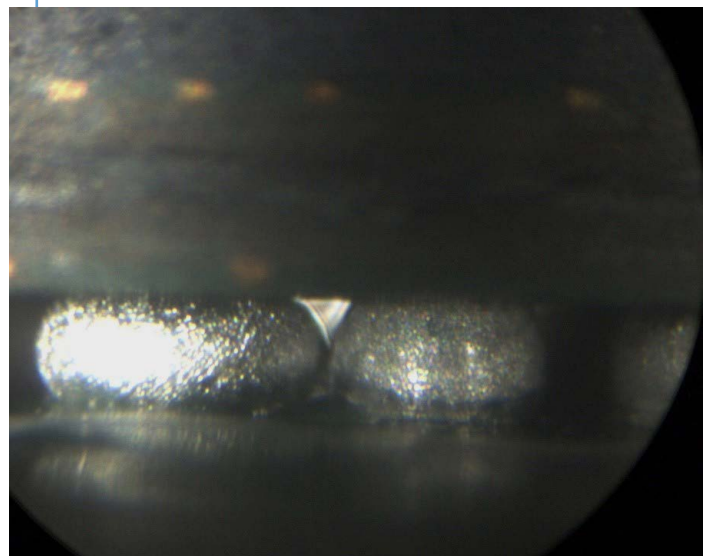
In addition to the printing, placement and soldering processes also encountered in electronics manufacturing, additional specific influencing factors apply to repairs – CB design and placement, for example, are relevant for dimensioning and the desoldering and soldering profiles. The board must emerge from every subsequent repair process undamaged and without distortion. The environmental conditions to which a component is exposed in the field result in an individual aging pattern. Components of this kind may have to be desiccated before repair to minimise residual moisture. If an incorrect component has been placed or a component incorrectly placed, replacement is absolutely necessary.

Individual components are rarely replaced after reballing. A different situation applies in relation to the cold soldering of a BGA, or microfissures which can occur over time as a result of high thermal load on the component. In this case, the existing component can remain in place. A defined resoldering process reinstates the function of the component. Several service providers base their business model on this procedure.



X-ray of the BGA following the repair – no bridges, no anomalies in the cross-section dimensions.

ERSASCOPE photo of a BGA connection with excessively large cross-section dimensions

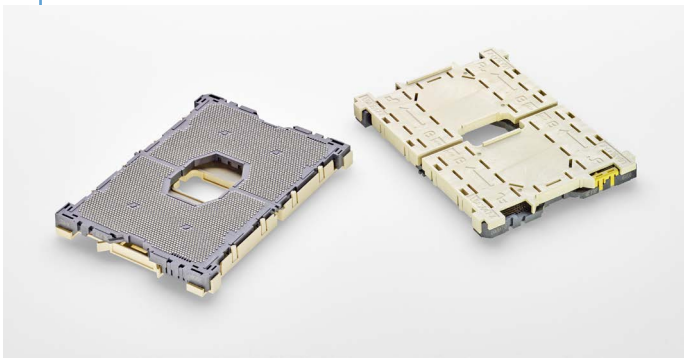


THE APPLICATIONS – ENDLESS EXPANSES

In classic repair applications such as ball grid arrays, it is often the failure of components in the consumer area, resulting from thermal damage, which necessitates the use of rework systems. But production problems are also possible: Bridging or soldering connection size anomalies in a BGA can be caused by incorrectly-dimensioned soldering paste application, as shown in the example (Illus. 02 to 04).

Once the BGA has been unsoldered and a new component installed, an X-ray clearly shows that repairs can actually deliver results superior to those in the original manufacturing process. Given the diversity of components in use today, the spectrum of repair tasks is an almost unimaginable field. In actual practice, processing extends from size 0201 chip components to SMD frame connectors with a length of 120 mm or two-part land grid array sockets (model LGA 3647).

Two-part land grid array socket LGA 3647; source: TE Connectivity

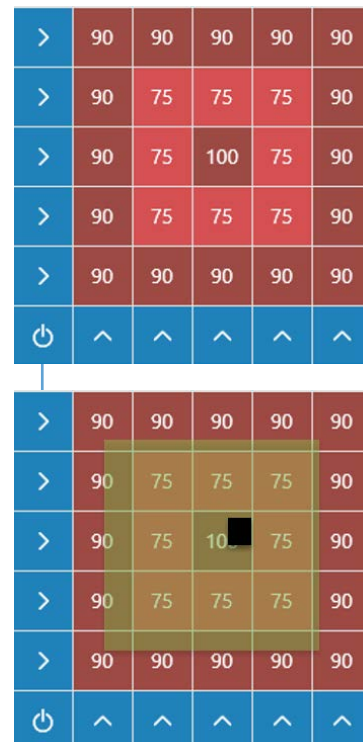


In the case of "bottom terminated components" (BTC) the trend to finer connection structures continues in the BGA and MLF configurations. In addition to these frequently-encountered component forms, there are also customer-specific "systems on board" which have to be removed as a unit from a larger supporting structure. For this task, in particular, even and complete warming of the component – including from above – is decisive. Processing therefore calls for systems which can be easily adapted to the respective application. Successful repairs should be possible with just a little expertise or

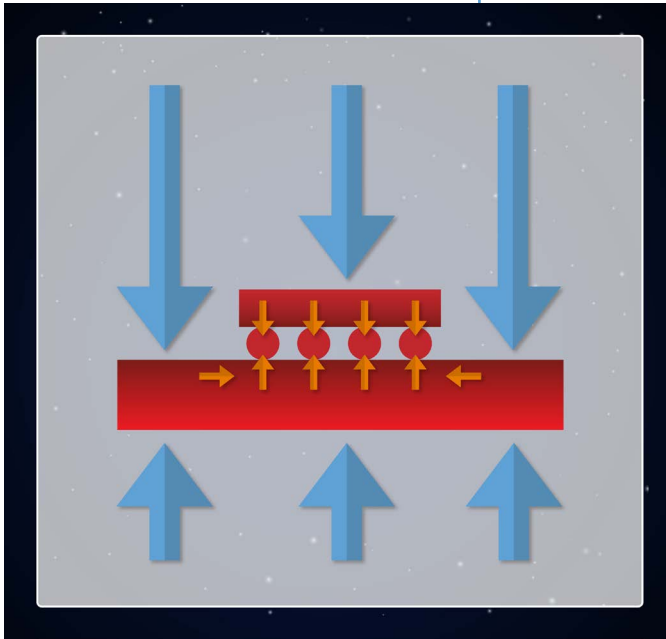
special parts. Increasingly, rework systems are being used in prototype construction, as system upgrades and in forensic technology.

SYSTEMATIC TECHNOLOGY

As Europe's leading manufacturer of soldering systems, Ersa had dedicated itself to optimising manufacturing processing together with the customers. When it comes to repairs, the focus is on controlling the influencing parameters and thus optimising the reliability of the component. Ersa therefore relies on homogenous and controlled warming of the component. Sensor-monitored temperature regulation in the target component is just as important as the combined hybrid heating technology consisting of infrared rays and convection support. The fitted boards are heated as gently as possible. Individually-interchanged heating zones cater to the respective heat requirement and can be dosed as required. In this way, it is possible, with the IR Matrix Heizung™, to preheat boards of up to 625 x 625 mm almost distortion-free. With this technology, each one of the 25 heating elements can be individually set during the entire soldering process.



Matrix heating of the HR 600 XL with 25 individually-adjustable heating elements and a "hot spot" under the target component.



○ *Ideal heating of a BGA component during repair with the smallest temperature differences.*

Not only is the heating process during soldering controlled fully automatically, the placement of almost all types of SMD components is also, in part, fully automatic. Image processing algorithms assume the recognition of component connections and landing site and calculate the ideal position. Wetted with fluxing agent or already printed with the correct soldering paste volume, the target component is then set in place by means of high-precision positioning axes. The influencing parameters originating in the placement, paste application and soldering processes are thus clearly shown. In order to minimise user errors, modern rework stations support the user in the other production steps. Rework systems can now also be integrated into the existing customer MES (manufacturing execution system) structure. It is possible to receive tasks from an MES system. These are processed with the identification of component and user. Afterwards, the repair is reported back to the MES, together with the associated process data. This means that, in terms of data, the repair is no longer a "black hole".

As the above example shows, the ER-SASCOPE inspection solution remains indispensable in repairs. Soldering faults in concealed solder joints are assessed and documented with the ER-SASCOPE. Similarly, every repair department requires ergonomic and

high-performance soldering tools. The ESD-safe i-CON NANO is the entry-level station in the Ersa portfolio of professional hand-soldering systems. It extends to the multichannel i-CON VARIO 4. This station makes four simultaneously-usable soldering tools available. Desoldering tweezers and a hot air soldering iron support the processing of fine SMD components. The X-TOOL VARIO desoldering iron, for example, permits desoldering of the still-susceptible electrolyte capacitor in THT designs on older boards. And the i-TOOL is the universal soldering tool for a wide range of soldering tasks. In the context of BGA repair, gentle removal of residual solder using special soldering tips for this tool has proven its worth.

Closely connected to the soldering stations and rework systems is the Ersa solder fume extraction unit. For the health and safety of staff, it is important that harmful, respirable flux fumes are extracted and filtered. This also protects the devices themselves and the components being processed from acidic substances. In addition to the components, the repair activity naturally centres on the people involved. For the staff and the success of their work, qualified training is decisive. The knowledge of process parameter, auxiliary agents and influencing factors in the rework universe is indispensable. In the context of the soldering technology electronics training association (AVLE), Ersa offers corresponding training courses from hand soldering to reworking and beyond.

Ersa HR 200

Ersa HR 550

Ersa HR 600/2

Ersa HR 600 XL

kurtz ersa

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

The Ersa Hybrid Rework systems: HR 200, HR 550 and HR 600/2 as well as the HR 600 XL –perfectly coordinated solutions for efficient reworking from micro to macro.

INDIVIDUAL AND UNIVERSAL

Depending on the application, the volume of work, user preferences and available budget, the spectrum of rework systems is a broad one. With the HR 200, Ersa offers the gentle hybrid heating technology at entry level. With this appliance, control ensues solely through the user and the processable component size is limited to 30 x 30 mm.

A wide range of components and the full scope of rework functions are offered by the HR 550 and HR 600/2 systems.

With the HR 550, component alignment is manual while, as described, the HR 600/2 operates automatically. The HR 600 XL was devised for very large components and an extended performance spectrum. In the coming years, this platform will be further expanded, both with new hardware components and in terms of software, to offer new functions. Ersa will thus continue to live up to the standard it sets itself of meeting individual customer wishes with universal solutions. ■