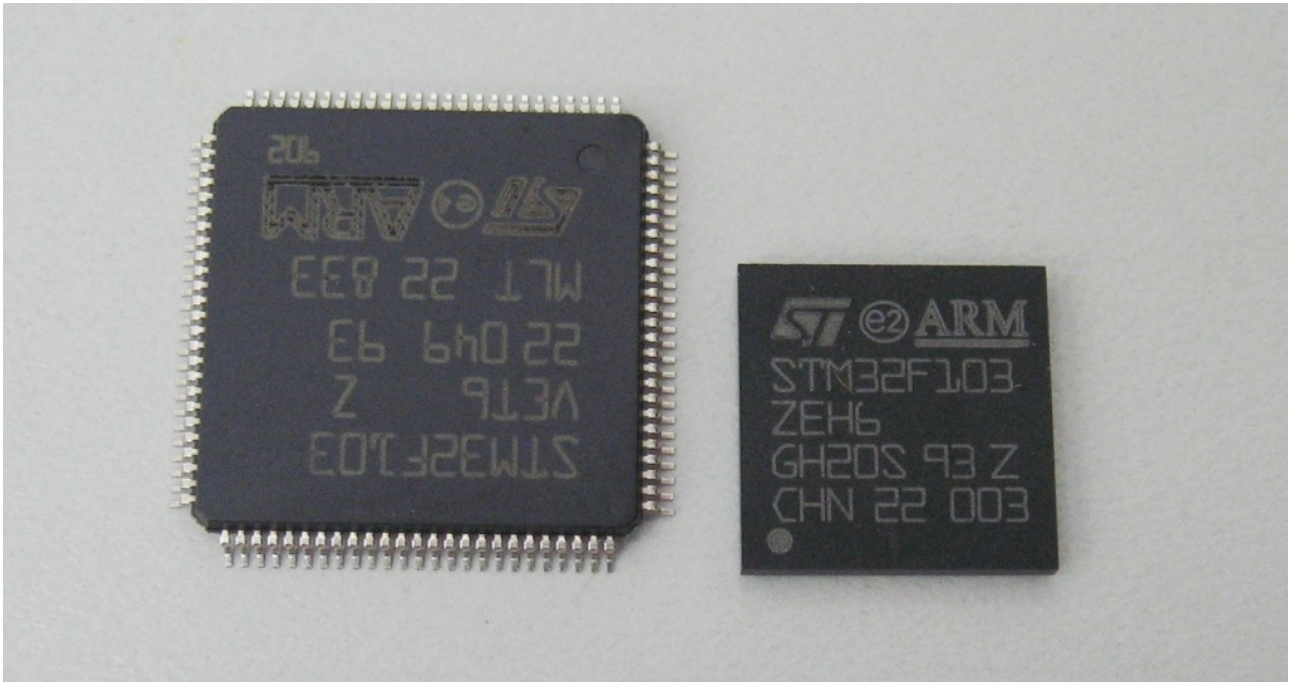


USE BGA DEVICES IN YOUR PROJECTS

BGA components are significantly smaller and can hold a greater number of pins than components with external pins. They are taking place in high-density and high volume applications. In the next figure, we have a ARM microprocessor model STM32F103 in fine pitch traditional and in BGA package.

As we can see, the fine pitch occupied area is more or less twice. If we consider the PCB pin area area too, the occupied area becomes higher.



In the last years, a lot of BGA ICs have been developed. Not only microcontrollers or programmable gate array. Today we can find almost all the main analog functions like operational amplifiers, comparators, timers, AD and DA converters, radio frequency circuits and so on.

This ultra-miniaturized components availability, allows the designer to develop complex circuits in very reduced PCB areas.

Unfortunately, this option is not often exercised because there are many impediments in the use of BGA. We can say that the culture of BGA is not yet widespread.

BGA mounting is not difficult, at least it is not more difficult than Fine Pitch component assembly. But there are a number of assumptions in order to reliably assemble BGA, these assumptions concern in a part, the project phase, so you have to take it into account during the design and largely concern the PCB mounting methods and equipment used in production.

Below is a decalogue of points to keep in mind if you want to begin to use this technology.

1. The Balls (BGA pins) must have a precise diameter, usually suggested by the manufacturer. This diameter must to be agreed with the company that will assemble the device; in that way, other elements present in the circuit will be take into account.
2. The PCB master must be designed bearing in mind the rules of the circuits with high density of interconnections. You must verify that the choosen PCB manufacturer is compliant with these rules. An example over all: many high-density BGA pin require blind, laser made holse, a technology that not all the PCB producer have.
3. Circuit test: is always a good idea to insert test pads for the PCB traks hidden in PCB intermediate layers and ending on BGA balls.
4. The serigraphic sheet will be realized with laser technology (best aspect of the hollows where the tin cream will enter), especially for devices with high density of balls, for example with a pitch of 0.8 to 1 mm and 0.3 mm of the Ball diameter.
5. The tin cream will be suitable for BGA (more fluid than normal SMD creams) and shall be composed of microspheres of tin, with a diameter smaller than the regular SMD creams.

6. The serigraphic sheet thickness will take into account of all the element present on the circuit. Usually BGA devices needs sheets with a lower thickness than normal. When the sheet must be of higher thickness due to other components in circuit, we must work on the sheet hollow and pcb ball diameter to correctly dose the tin cream.
7. The temperature soldering profile is very important. It must take into account all the circuit elements, the bigger one, with a higher thermal mass, and the little ones that could be very little BGA devices. If the profile is not enough warm, we will experience a bad soldering of massive components; otherwise, with a too high temperature profile, we will damage the little components. With a too short pre-heating phase the tin cream flux components will not be correctly activated; with a too long phase conversely, the activation will take place before the soldering phase.
8. Rework: the correct thermal profile setup could need 3 or 4 devices. These boards and the one discarded during production, must be reworked with a dedicated machine that can relocate the BGA and fine pitch ICs not correctly mounted. Otherwise all the defective circuits will be lost.
9. Inspection: ordinary optical inspection system don't work with BGAs because the balls ar all under the IC. It is then needed an optical inspection system with a 90°; side view. It must be emphasized that the welding of the BGA is very reliable and once adjusted the welding process, a random inspection is only needed. For our experience an X-ray analysis is not needed if you have a good vision system.
10. Mechanical robustness: the mechanical strength of a BGA is proportional to its size, then doubling the area wil double the resistance. The maximum bending of the PCB must be verified, because the BGA balls has no elasticity, like the ceramic capacitors on the card. Other elements of fragility can sometimes be the pads of the PCB, which in front of a side pull or push of the BGA IC, could be detached from the rest of the circuit. If the circuit is to be molded (Macromelt or similar), you may think about protection of BGA components with resin or glue.

Redox has developed all the necessary mounting technologies to support the customer and to succeed in the migration to BGA from the first prototype.

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