Component miniaturization poses many challenges for global printed-circuit-board (PCB) rework, especially with tiny 0201 and 01005 chips. While a number of solutions have been developed for removing these small chips from PCBs, replacing them is no simple matter. Firms are often faced with retaining these tiny chips, especially the miniature 01005 chips, because of the difficulty and expense of replacing them. But the PCBs on which the tiny chips are mounted are too costly to discard so, ideally, a practical means of replacing these small chips and reworking these PCBs would serve the industry well.

Two main challenges await those faced with reworking PCBs populated with these miniature chip components and attempting to remove the chips. Typically, operators work with a soldering iron fitted with an extremely small soldering tip, trying to access the solder holding the chip. This approach can introduce the effects of thermal shock. The soldering iron is typically set at +360°C.

Unfortunately, chip components are usually specified for a maximum temperature of +260°C with a temperature rise of 6°C/second. When using a soldering iron and tip set at +360°C, the heat from the tip is transferred to the component in about 3 to 6 seconds for an effective temperature rise of 60°C/second or well in excess of the component specification. Capacitors tend to suffer from such a rapid temperature rise more than resistors, but precision laser-trimmed resistors can be temperature sensitive and be degraded by such a rapid and excessive thermal gradient.

These temperature limits and specifications are followed in circuit assembly lines, as used in convection reflow ovens during initial circuit-assembly processes. Similarly, they should be followed in any PCB rework processes if a circuit’s components are expected to maintain their reliability and performance levels.

Another main challenge facing those trying to rework PCBs with miniature chip components is to achieve the correct solder volume to meet IPC standards, notably when solder should not remain on the top of a chip connection. Unfortunately, this can result from the use of conventional soldering tips. Fortunately, a novel approach to soldering has been developed to enable operators to rework PCBs with such miniature components while still maintaining performance, reliability, and repeatability when replacing these small components. The approach is supported by a tool kit, the Solder Ball Placement Kit from Metcal, that includes all the tools needed to rework small chip components.

**Solder Ball Kits**

The kit is based on the use of solder balls that can be dispensed into flux with special tools capable of picking up a single solder ball and placing it on a pad next to a component to be mounted. Components are precisely placed under microscopic view and the use of solder balls enables a high degree of control and repeatability.

Once components and solder balls have been properly placed, hot air is applied to reflow the solder to the component part to be mounted; the gel flux maintains the component and solder balls in place until the reflow process. A hot air tool with low airflow rate, such as the model HCT2-120 Hot Air Pencil from Metcal, is recommended for this reflow process to...
minimize the deleterious effects of thermal shock on the PCB.

Each Solder Ball Placement Kit includes the tools required for placing individual solder balls where needed. The kit also contains four different sizes of solder balls, 2000 of each, for use with four different component sizes: 01005, 0201, 0402, and 0603 components.

When replacement solder balls are needed, a similar arrangement of 2000 each of the four sizes of solder balls is available in a tin under a different model number. The versatile Solder Ball Placement Kit features a glue scraper for reworking PCBs with glued components, such as found in cellular telephones and portable computer products. The kit even includes a sharpening stone to maintain a sharp edge on the glue scraper.

The Solder Ball Placement Kit is currently available from authorized Metcal distributors as well as from the company’s website. More information about the kit can be obtained from the firm’s website.

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