Technical paper TP1101

Wave soldering of Cellergy supercapacitors

Abstract:

Many supercapacitors for pulse applications are usually approved for manual soldering only. Cellergy's R&D department performed experiments in order to evaluate the use of Wave Soldering as an additional method of soldering Cellergy's supercapacitors to printed circuit boards (PCB's). Experiments were successful and using Wave Soldering is approved for our through-hole (round leads) products.

Introduction:

Wave Soldering of Cellergy supercapacitors (SCs) to PCB's was tested for through-hole printed circuit assemblies only. The challenge of wave soldering for supercapacitors with aqueous electrolyte as well as organic electrolyte is the high ambient temperature in the wave soldering bath and preheating oven. Electrical performance of the SCs was measured before and after the Wave Soldering.

Wave soldering is a large-scale soldering process by which electronic components are soldered to a PCB to form an electronic assembly. The process is much faster, thus can lower the cost of assembly and can create a higher quality product than manual soldering of components. The name is derived from the use of waves of molten solder to attach metal components to the PCB.

The process uses a tank (or bath) to hold a quantity of molten solder; the components are inserted into the PCB and the loaded PCB is passed across a pumped wave or waterfall of solder. The solder wets the exposed metallic leads protruding from the bottom of the PCB, creating a reliable mechanical and electrical connection.

Wave soldering is largely used where SMT is not suitable (e.g. large power devices and high pin count connectors), or where simple through-hole technology prevails (certain major appliances).

A typical wave soldering temperature profile is shown in Fig. 1.

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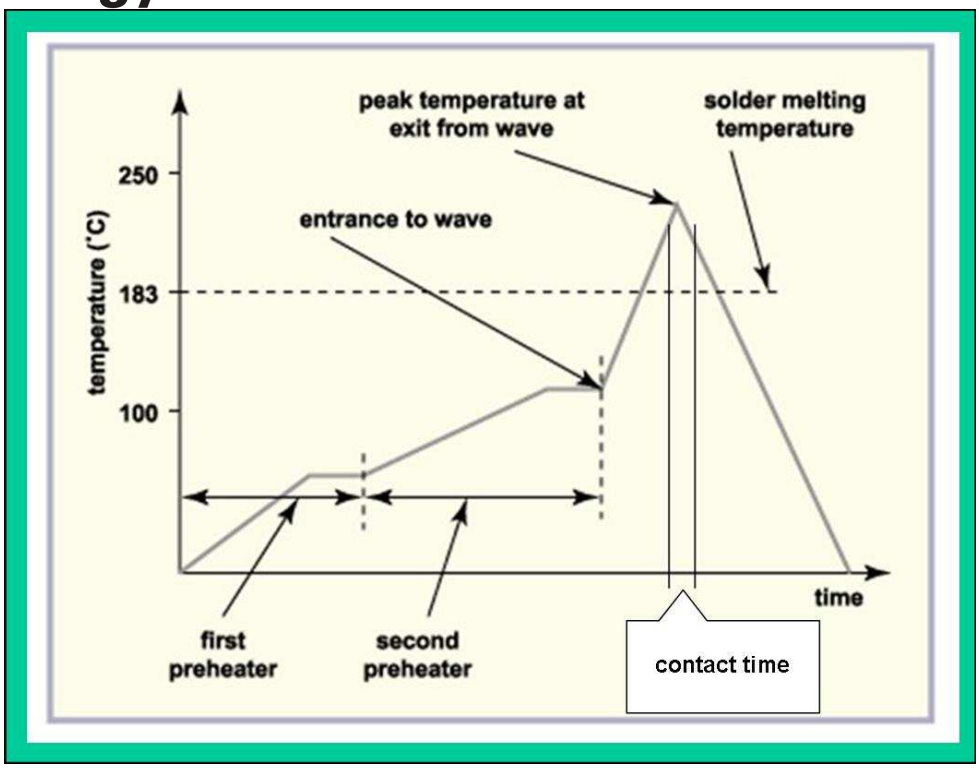

Fig. 1: Typical wave soldering temperature profile for Sn-Pb system

Experimental:

We performed 2 experiments with two types of Wave Soldering Machines:

1) For SnPb solder

Tool type: Electrovert, Ultrapak 600C
Flux type: RMA
Solder type: Sn63

Solder Profile parameters:

	Pre Heating(PH) Zone(Z)1	PH Z2	PH Z3	PH Z4	Soldering Pot
Temperature (C)	310	290	240	180	245

Conveyer Speed: 1.1 m/sec

2) For RoHS (Lead Free) solder

Tool type: Vitronics Soltec Deltawave
Flux type: Syntactic N.clean
Solder type: SN100

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Solder Profile parameters:

	Pre Heating(PH) Zone(Z)1	PH Z2	PH Z3 (Upper lamp)	Soldering Pot
Temperature (C)	250	139	25%	260

Conveyer Speed: 1.1 m/sec

The Supercapacitor's parameters: Capacitance, ESR and Leakage Current were measured before and after wave soldering processes.

Conclusions:

1) After Wave Soldering process Cellergy supercapacitors stay in Spec, with marginal change and no visual appearance damage.
2) Cellergy's through-hole supercapacitors **are approved for wave soldering**.
3) The manufacturer should follow wave soldering machine parameters, which are similar to those detailed above, or otherwise consult with the equipment manufacturer.

Recommendations:

The recommendations are depending of the flux type a customer will use or needs to use. Cellergy recommends the following Wave Soldering setting for its through-hole supercapacitors:

Profile feature	**Sn-Pb system**	**Pb-free (RoHS) system**
Solder melting point	183C	217C to 227C
Peak temperature	235C	260C
Contact (Dwell) time in the solder (includes Chip Wave and Maine Wave)	1.5 – 3.5 sec (2.5 - 3 seconds most common)	1.5 – 3.5 sec (2.5 - 3 seconds most common)
Topside Preheat Temperature	75C -100C	105C – 120C
Bottom side Preheat Temperature	about 35C higher than topside	about 35C higher than topside
Maximum Ramp-up rate of topside (to avoid component damage)	2C/sec	2C/sec
Conveyor speed	0.9 – 1.8 m/min	0.9 – 1.8 m/min
Solder pot temperature	240C – 250C	255C – 265C
Ramp-down rate	4C/sec max.	4C/sec max.

Notes:

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1. The wave soldering temperature profile is also depending on the flux and alloy type as well as tool type.
2. The conveyer speed should be adjusted per the solder equipment manufacturer's recommendations in order to insure the appropriate contact time in the wave.
3. Use of this recommended solder profile should optimize terminal solder wetting.
4. The PC board should be permitted to air-cool at room ambient conditions following exposure to the soldering environment. Forced air-cooling is not recommended.
5. These are general guidelines, which have proven to yield excellent results; however, depending upon your equipment, components, and circuit boards, your optimal settings may be different. In order to optimize your process, it is recommended to perform a designed experiment, optimizing the most important variables (amount of flux applied, conveyor speed, topside preheat temperature, solder pot temperature and board orientation).
6. All information given without liability. Our components are designed to the above shown conditions. Nevertheless, an individual validation of the soldering behavior in the customer's application is necessary.
7. For further technical support, do not hesitate to contact us.

Acknowledgments

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