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Application Note for the Mounting and Soldering of Surface Mount Chips

This application note identifies the recommended and proper techniques for conduction cooling and acceptable RF performance for surface mount chips.

INTITIAL CONCERNS

Proper soldering techniques are essential if a surface mount chip is to achieve the expected power dissipation and RF performance. The chip must be provided with adequate conductive cooling. This will prevent excessive chip temperatures that could lead to early device failure. These devices normally mount to a circuit board and the inductance seen to "ground" is introduced by any vias in the ground plane. In order to minimize this effect and lower the thermal resistance between the device and the ground plane, we recommend the following:

1) Create the maximum amount of thermally conductive vias around/under the device.
2) Use heavy copper cladding on the PC board to aid as a thermal heat spreader.

TYPE OF SOLDERS

We suggest the use of the solders shown below when installing Res-Net surface mount chips. The listing also shows the preferred plating for the thermal heat spreader surface.

SOLDER TYPE	LIQUIDOUS TEMPERATURE (degrees C)	PLATING TYPE
Sn63	183 eutectic	Nickel, Silver
Sn96	221 eutectic	Nickel, Silver
80Au/20Sn	280 eutectic	Gold over Nickel

MOUNTING

Res-Net recommends that the mounting pads be 0.010" to 0.020" larger than the device size. This oversize should be symmetrical around the body of the chip.

PREPARATION FOR HAND SOLDERING

1. Clean parts with Isopropyl alcohol.
2. Apply a small amount of RMA flux (MIL-F-14256) within the areas to be soldered.
3. Sn63 is usually recommended for soldering. You may use a perform, solder paste, or solder wire. When performs are used, the size should be 0.005" to 0.010" larger than the pad size. Try to maintain a maximum long term temperature of 200 C for this solder.
4. The flux must be removed upon completion of soldering. Ultrasonic bath or vapor degreaser is an acceptable alternative to hand cleaning. Use a flux solvent as recommended by the flux manufacturer.

AUTOMATED SOLDERING

Direct exposure to thermal shock heating can cause reliability problems when the rate of rise in temperature is too rapid due to the inability of mechanical stress to be spread throughout the component.

Different soldering techniques create impact temperature "rates of rise" based on the heat transfer mechanisms that are used. Wave soldering uses liquid solder as the heat transfer mechanism. This is the highest heat transfer method and is the hardest soldering method to use without shocking the surface mount component.

Vapor phase reflow (VPR) uses the latent heat of vaporization from the condensing vapor as the heat transfer method.

WAVE SOLDERING

This is the most critical process. The maximum temperature should be 232 C +/-2 C for 63/37 solder. The preheat temperature should be about 140 C and the temperature rate of rise should be limited to 4 Deg C/second. The total wave dwell time should not exceed 10 seconds with a 5-7 second optimum time for adequate soldering. The higher the preheat or smaller difference between preheat and solder wave should be the goal to achieve.

VAPOR PHASE REFLOW SOLDERING

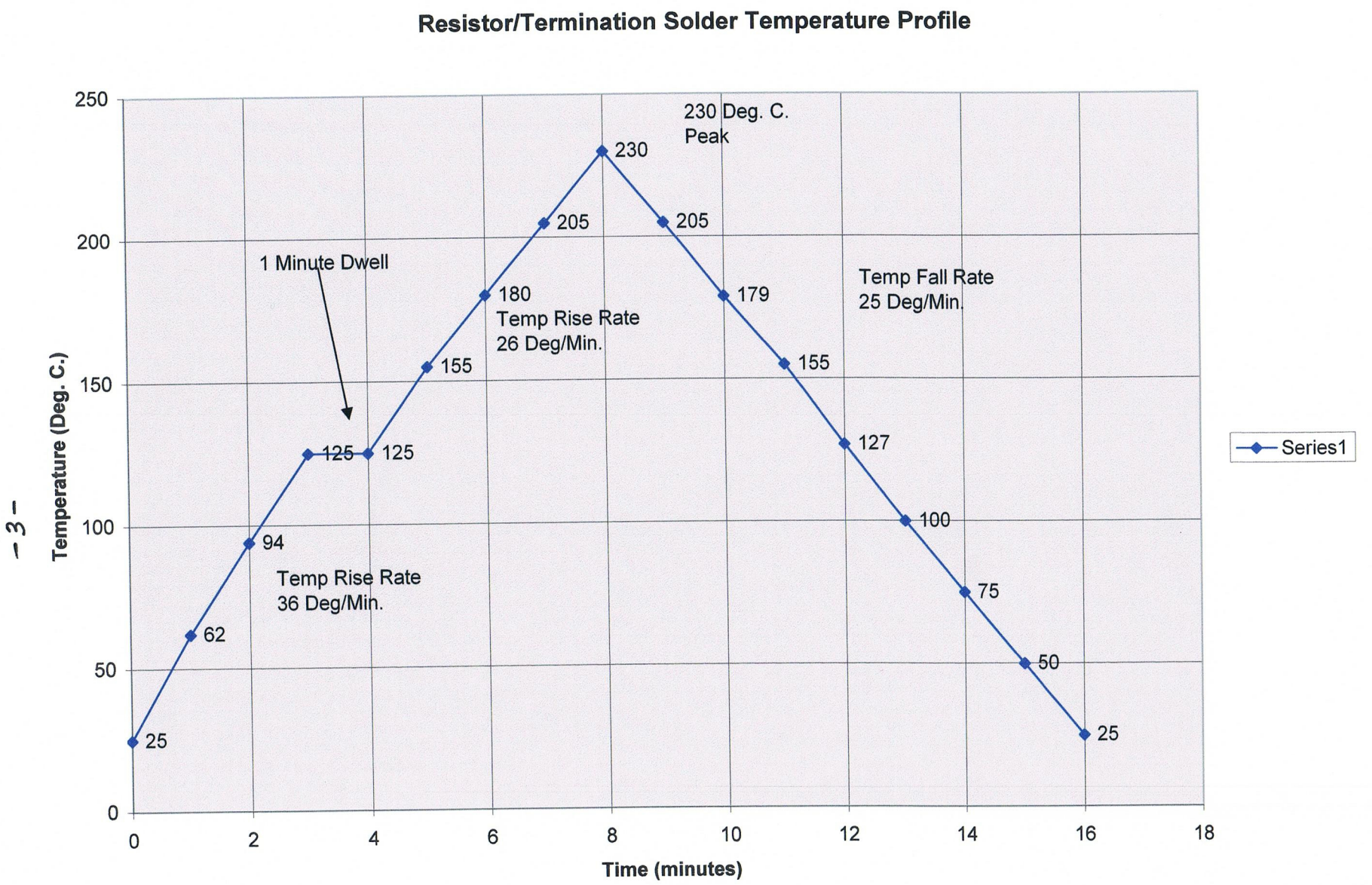
A preheat of 100 C is recommended for this method. This will improve soldering and minimize solder balls and splatter. Dwell time in the saturated vapor zone should be limited to one (1) minute maximum. Temperature rate of rise should be limited to <50 Deg C/second.

HOT BELT REFLOW AND IR REFLOW

The maximum rate of rise should be less than 4 Deg C/second. A rate of 1-2 Deg C/second is typical. Here, the 63/37 eutectic solder is preferred so that solder migration and termination leaching is minimized. The ideal conditions for this type of soldering are to use 215-219 Deg. C. peak temperature with 45-60 seconds above the melting point of the solder.

Page three (3) of this application note shows the preferred resistor/termination solder temperature profile for Res-Net components.

Proper selection of processes, as shown above, and PC board design will ultimately yield a final robust and reliable product.


Resistor/Termination Solder Temperature Profile
Temperature (Deg. C.)
Time (minutes)
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
25
62
94
125
125
155
180
205
230
205
179
155
127
100
75
50
25
230 Deg. C.
Peak
1 Minute Dwell
Temp Rise Rate
26 Deg/Min.
Temp Rise Rate
36 Deg/Min.
Temp Fall Rate
25 Deg/Min.
Series1

ELECTRO TECHNIK

RES-NET MICROWAVE

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- Wound Film Capacitors and Electronic Filters

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- RF/Microwave Resistors, Attenuators, Terminations

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www.tepro-vamistor.com

- Wirewound and Metal Film Resistors

Vamistor
P.O. Box 1260, Clearwater, FL 33757
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- Carbon Film and RL 42 Resistors

Magnetics Products

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- Power Transformers and Power Inductors

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