



Reflow Soldering Conditions for VCO and Synthesizer Products



Introduction

This application note describes recommended practices for the successful assembly of M/A-COM VCO and synthesizer components using automated solder reflow techniques. Guidelines are included on how to achieve a proper solder connection without damage to the component.

Handling and Storage Precautions

These components are static sensitive so appropriate handling precautions should be observed. Exposure to static electricity or over voltage may cause defects in the product or degrade its reliability. Components should also be stored in such a way so as to avoid exposure to corrosive, salty or dusty atmospheres, high humidity, direct sunlight and strong electric fields.

Solder Screen Guidelines

A solder screen or stencil is required to screen the minimum amount of solder paste onto the pads of the footprint. This amount or thickness will directly affect the quality of the solder joint. The optimum thickness is 0.18 mm to 0.25 mm (0.007 inch to 0.010 inch). Silk screen techniques can control paste thickness well enough to keep it in the optimum range; the thickness being a function of the screen mesh, emulsion thickness and printer set up parameters. A stencil technique can also achieve similar results by using a stencil made of 0.2 mm (0.008 inch) thick brass or stainless steel. The stencil or screen opening should be the same size as the pads on the footprint (1:1 registration), excluding any solder resist mask areas.

Solder Selection

The solders recommended for use in reflow soldering are Sn63 (63% Sn, 37% Pb) and Sn62 (62% Sn, 36% Pb & 2% Ag), these are commonly used and have become recognized as industry standards. Sn63 and Sn62 are eutectic compounds with melting points of +183°C and +179°C respectively. These temperatures are high enough to ensure that no solder reflow is possible within the standard operating and storage temperature requirements of most printed circuit board equipment. They are also low enough to not cause damage to the internal devices of the VCO or synthesizer during proper solder reflow, as described in this application

note. When selecting solder paste, parameters such as flux type, particle size and metal content should also be considered. The solder paste should be carefully selected to suit all of the relevant process parameters being used.

Recommended Profile for Reflow Soldering

The melting point of whichever solder is used will usually be higher than the recommended maximum storage temperature of the VCO or synthesizer. Therefore, when the entire component is heated to the solder melting point temperature, failure to complete soldering within a short time could result in thermal failure. The most common solder reflow method is accomplished in a multi-zone Convection / I.R. belt furnace oven. A typical profile reflects the four distinct heating stages, or zones, of reflow soldering (pre-heat, soak, reflow and cooling) recommended in automated reflow processes to ensure the reliability and integrity of the finished solder joints. It is recommended that the following precautions are observed to minimize the thermal stress to which these components are subjected.

Always preheat the printed circuit board (failure to do so can cause excessive thermal shock and stress that can result in damage to the component.).

The change in temperature between the soak stage and the maximum solder temperature should be 60°C or less.

The temperature in the reflow stage should be limited to a maximum of +230°C.

Temperatures of +230°C may be sustained for up to 10 seconds.

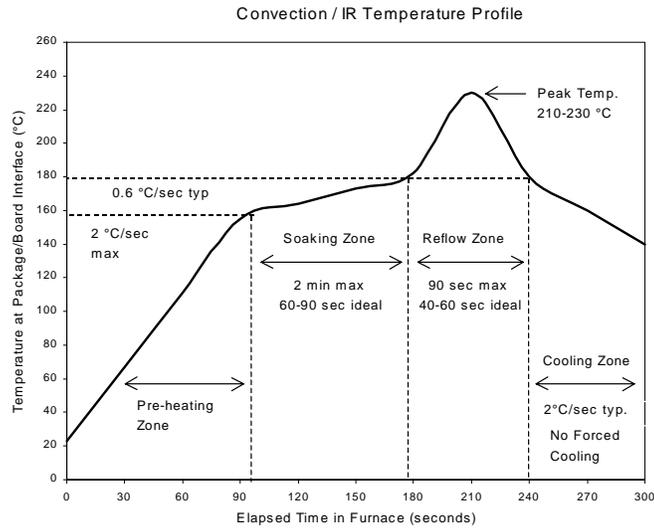
Temperatures greater than +220°C may be sustained for up to 30 seconds.

Temperatures greater than +180°C may be sustained for up to 90 seconds.

After soldering has been completed, the board should be allowed to cool gradually. The use of forced cooling will increase the temperature gradient and may result in latent failure due to mechanical stress.

Mechanical stress or shock should not be applied to the board during cooling.

Following these recommendations will ensure that no damage occurs during the soldering operation. A typical profile incorporating these guidelines that shows temperature versus time is shown below.



This profile will vary among soldering systems, however the maximum permitted levels must not be exceeded. The profile shows the actual temperature that might be experienced on the

surface of a board at, or near, a central solder joint. During this type of reflow soldering, the circuit board and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. This effect can cause the main body of a component to be up to 30°C cooler than adjacent solder joints. The temperature will also vary across the surface of the board depending on the component types, density and type of substrate used. It is therefore recommended that temperature recordings are taken with a calibrated thermocouple connected directly to one of the solder pads of the component on the printed circuit board. This application note details the recommended profile for a single reflow soldering process. It is strongly recommended that the VCOs and synthesizers are NOT put through a second reflow process as damage could occur to the components for which M/A-COM cannot be held responsible.

Circuit Board Cleaning

It is recommended that either a no clean solder which leaves little residue is used or that cleaning is achieved by dipping, boiling or vapor methods with isopropyl alcohol for up to 5 minutes duration. Aqueous or semi-aqueous cleaning methods are not recommended, please consult the factory before using these techniques.