

# **Reflow Soldering of Lead-less LTCC Products**

**AN-40-004**

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## 1.0 Introduction

Mini-Circuits has developed products having a lead-less LTCC (Low Temperature Co-fired Ceramic) substrate that serves as the base of the unit. Examples of such products are the SBTC series of power splitters and the DBTC series of directional couplers.

Metallized pads on the bottom surface, typically deposited with palladium-silver, form the electrical connections and mechanical mounting points. The absence of leads makes possible the ultimate in packing density for a given component size. As with other kinds of surface mount components, lead-less LTCC is mounted on a user's motherboard via stencil printing of solder paste followed by reflow. An optimum choice of solder formulation and a well-controlled reflow process are required to ensure proper wetting of both the LTCC component pads and the motherboard metallization. Adequate wetting is essential for reliable connections.

## 2.0 Solders suitable for lead-less LTCC

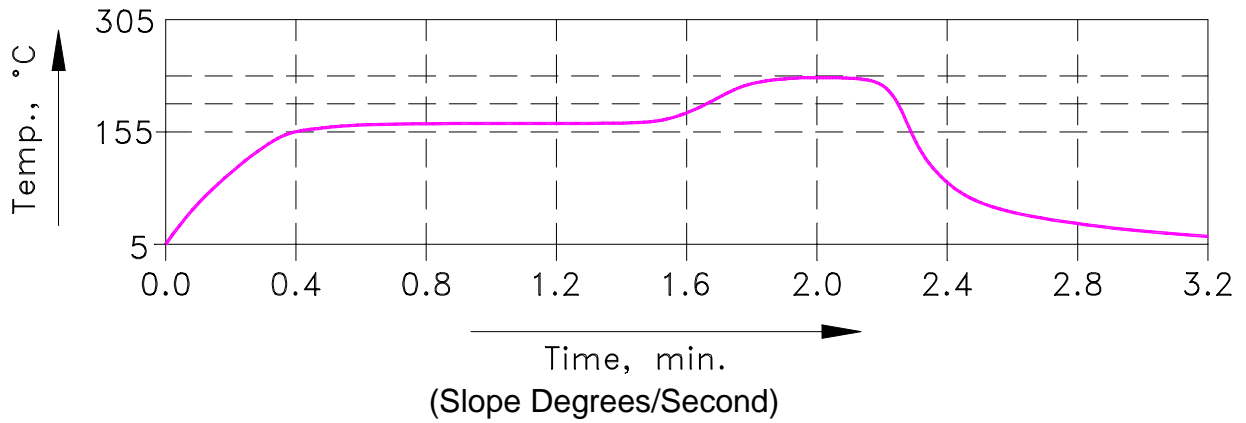
Both tin-lead eutectic (Sn/Pb 63/37%) and silver-bearing solder (Sn/Pb/Ag 62/36/2%) have been used successfully with lead-less LTCC. The solder paste must be formulated especially for stencil printing. A well chosen solder paste will not require raising the peak temperature, relative to what is needed for other kinds of components, in order to obtain good wetting.

Examples of solder pastes that have been used successfully without providing an inert atmosphere in the conveyor oven are Kester Part No. 57-3201-4813 (Easy Profile 256, Sn/Pb) and EFD Inc. type 6-SN62-575 (Sn/Pb/Ag). These materials contain "no-clean" flux. Solder pastes containing water-soluble flux are generally more active in removing oxidation from surfaces to be soldered.

## 3.0 Reflow ovens and temperature profiles

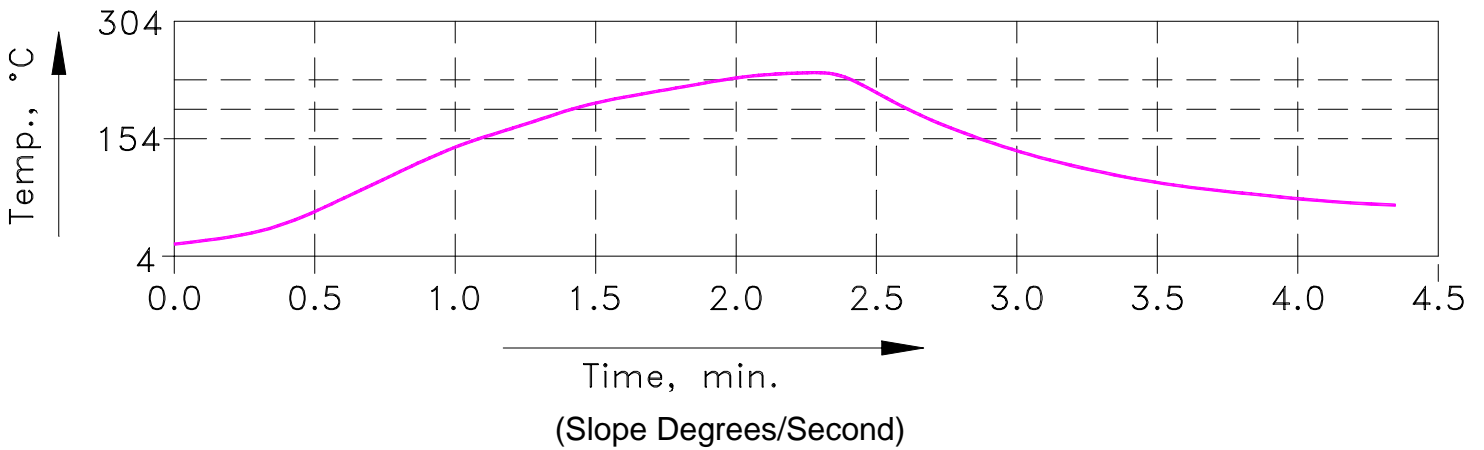
The importance of control of the temperature profile in the reflow process must be emphasized. The optimum profile depends upon the type of solder paste to be used to mount the lead-less LTCC component to the motherboard. The temperature profile recommended by the solder manufacturer for the particular solder paste should be followed as closely as possible.

Figure 1 illustrates the profile used with Kester 57-3201-4813 (Sn/Pb), and Figure 2 the profile used with EFD 6-SN62-575 (Sn/Pb/Ag). In each case the conveyor oven is a Sikama unit having 6 zones (4 heating zones in the middle, and 2 cooling zones at input and output). The pre-heat time above 150°C, up to when solder-melt temperature is reached, is critical for proper activation of the flux contained in the solder paste.



	Peak Degrees C	Min	Max Rising Slope	Total Time Above 150	Total Time Above 183	Total Time Above 220
1	226.1	26.4	7.64	109.14	31.90	14.26

**Fig. 1 – Reflow Profile used for Kester 57-3201-4813 Sn/Pb solder paste**



	Peak Degrees C	Min	Max Rising Slope	Max Falling Slope	Total Time Above 150	Total Time Above 179	Total Time Above 216
1 Built In TC	223.6	27.8	2.55	-2.77	64.90	46.98	18.67

**Fig. 2 – Reflow Profile used for EFD 6-SN62-575 Sn/Pb/Ag solder paste**