

By G. Schouten

The allowable permanent mechanical load for solderjoints on PCBs

Introduction

The allowable permanent mechanical load on joints soldered on PCBs is compared to the initial solder strength relatively low. The reason for that is that the solder is sensitive for creep and fatigue loads, due to the low melting point of the solder alloy.

If a metal is used at a temperature range that is larger than 0.4 times its melting point (in K) the metal will creep when exposed over a certain mechanical load.

With lead-free soft-solder alloys the 0.4 times melting point will give a temperature of about 200K which is far below the ambient temperature at which the solderjoints will normally function.

This means that for the permanent load at a solderjoint one must calculate with the creep strength.

Allowable load per joint

The creep strength of a solderjoint is related to the time that a permanent load is present and to the joint temperature.

For equipment that should last for 30 years this means that the permanent load per joint should be $< 0.2\text{N}$ in case of joints at PTHs.

For non PTH-joints, e.g. joints on single sided boards, this permanent load should be $< 0.1\text{N}$

In case of temperature changes also fatigue loads due to differences in thermal expansion of the materials involved will reduce the joint reliability over time.

The recommended permanent load in that case should be $< 0.07\text{N}$ per joint.

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