Vitronics Soltec

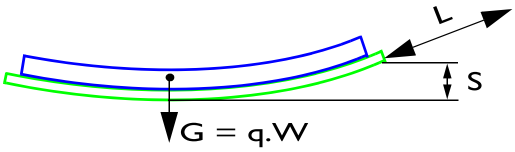
Information Sheet 023

By G. Schouten

Board sagging due to board weight

Due to the weight of the board with components the board will sag.
This sagging will increase due to the decrease of the modules of elasticity in flexure E, with increasing temperatures. The given formulas are valid for solid boards. If a board has large holes or is a pre-cut multi-format board the sagging will be far more than calculated for a solid board.

Legend



W = board width

q = component load/width

G = board weight

L = board length

S = sagging

Figure 1: Model of a solid board with an equally divided component load

Calculations

For a solid board we can use the general formula $S = \frac{5.q.W^4}{384.E.I}$

E = modulus of elasticity in flexure (kg/cm^2)
I = moment of inertia (cm^4)

If the board material is FR4 glass epoxy the factor E at a temperature exceeding 180 °C is: E ≈ 60.000 kg/cm.

For a common board thickness of 0.16 cm the general formula can be transformed to: $S \cong 7.10^{-4} . \frac{G.W^3}{L} \ (cm)$

Note: Sagging will be considerably reduced when the board is supported on all four sides. If sagging is still too much, extra means of supporting have to be used, to ensure a well controlled soldering operation and/or to prevent solder flooding the board.