



Figure 8. Maximum whisker length as a function of time at 85°C/85%RH and soldering method

DISCUSSION

With no other obvious factors contributing to whisker growth the results confirm that corrosion induced by high temperature and humidity can induce whisker growth. It can be hypothesised that the driver for the whisker growth is the compressive stresses generated by the increase in volume that occurs as the solder is converted to corrosion products.

It is generally considered that a whisker of 50µm represents a reliability risk since it has the potential to short typical circuitry. Under the conditions of this test whiskers of that length did develop in less than 1000h at 60°C/90%RH and 85°C/85%RH.

However, even at 95%RH a temperature of 40°C was not sufficient to generate whiskers of a length that could be considered a reliability risk.

The relationship between soldering method and whisker growth is presumably related to the extent to which the residue of the fluxing system used can contribute the ions that drive the corrosion process in the humid condition. There does not appear to be any obvious way in which the susceptibility of the solder itself could be affected by the method by which it is applied to the substrate as in all cases it solidifies unconstrained from the molten state.

The fact that most whisker growth occurs at the sides of the traces is presumably related to the fact that most of the flux residue ends up being concentrated in that area.

CONCLUSIONS

Under conditions of 60°C/90%RH and 85°C/85%RH corrosion that appears to be related to the character of the residues used in the soldering process can cause SAC305 solder to produce whiskers long enough to compromise circuit reliability. Where circuitry vulnerable to failure by shorts caused by whiskers is likely to be exposed to such conditions consideration should be given to effective removal of flux residues or the selection of fluxes with residues that do not support the sort of corrosion that seems to drive whisker growth.

FUTURE WORK

Given the apparent relationship between flux residue and whisker growth under conditions of heat and humidity the possibility of formulating effective fluxes that have residues that do not promote whisker-inducing corrosion is being investigated.