

Reliability assessment and mechanical characterization of Cu and Au ball bonds in BGA package

Abstract

Extended reliability and mechanical characterisation of Au and Pd-coated Cu (Cu) ball bonds are useful technical information for Au and Cu wire deployment in semiconductor device packaging. This paper discusses the influence of wire type on the package reliability and mechanical performance after several component reliability stress tests. Failure analysis has been conducted to identify the associated failure mechanisms of Au and Cu ball bonds after reliability tests. Wire pull strength and ball bond shear (with its break modes) of both wire types are investigated after unbiased highly accelerated temperature and humidity stress test (UHAST), temperature cycling (TC) and high temperature storage life test (HTSL) at various aging temperatures. Reliability Weibull plots have been plotted for each reliability stresses. Obviously Au ball bond is found with longer time-to-failure in Unbiased HAST stress compare to Cu ball bonds. Cu wire exhibits equivalent package and or better reliability margin compare to Au ball bonds in TC and HTSL tests. Failure mechanisms of UHAST and HTSL have been proposed and its mean-time-to failure (t_{50}), characteristics life ($t_{63.2}$, η) and shape parameter (β) have been discussed in this paper.

Keywords

Component reliability; Reliability assessments; Mechanical characterizations; High temperature storage lives