

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialized Technologies, including Nanotechnology (8)

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THERMAL CONTROL OF AN ANTENNA POWER UNIT FOR RADIO FREQUENCY
APPLICATION

Abstract

One of the most important issues of the microelectronic research and design is the thermal control. The high level of integration of these components must take a thermal control design into account specially when this technology is coupled with the hybrid materials one. The high capability and the high efficiency of these elements is directly correlated to the thermal problem because as the power requested by the electronic devices increases also the internal temperature to be dissipated increases.

Actually the standards design rules, such as the MIL STD 833G, foresee many limits for these electronic components, some of them are related to the minimum and maximum operative temperatures and they must not be exceeded in order to preserve the functionality during the operative life.

In order to respect these design rules and to decrease the power dissipation by the Joule effect a new technological solution is proposed and studied in this paper. The idea is to have a thermal control by using thermal piping, by exploiting the pyroelectric effects of the material used for the packaging of the microelectronic devices. In particular the electronic components are installed on a surface of a pyroelectric material. This kind of material is able to convert the temperature, or a thermal flux, in an electrical charge spontaneously; that the charge is obtained it can be stored in a dedicated capacitor electrically attached to the surface.

The use of this kind of material is based on a constant thermal gradient to assure the flux of the electrical charge. In order to know the dynamic behavior of this device a thermo-elastic analysis is performed. In this paper the thermo-elastic analysis, the numerical solution of the non-stationary thermal problem and many different operative conditions are presented. The problem involves the study of a power unit, a HPA (High Power Amplifier), installed on a T/R (Transmission and Receive) module used in the RF (Radio Frequency) applications for a satellite antenna. It is possible to recognize the circuits printed on the support in the middle and the two power units placed at the left and right end of the component.