Abstracts

Design of embedded high Q-inductors in MCM-L technology

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Although discrete surface mount passive components (resistors, capacitors and inductors) have been popular in mixed signal designs, the development of integrated passive components suitable for integration with printed wiring boards is relatively recent. This integration is imperative since in some mixed signal designs, off-chip passive components take up more real estate on the boards than the analog and digital signal processing units. This paper shows the possibility of fabricating a large number of MCM's with high wiring density and integrated passives using standard PWB technology. However, the presence of inherent lossy materials in standard PWB technology reduces the Q factor of embedded passives in the more traditional components such as spiral inductors. In this paper, the embedded passives were modeled using coupled line parameters obtained using quasi-TEM approximations. This modeling approach provides advantages and greater insight over the more traditional methods for modeling embedded passives. Based on this modeling approach, a systematic method to improve the quality (Q) factors of the integrated inductors is also presented based on a layout optimization scheme. By departing from the traditional spiral inductors, a max Q-factor of 103 was obtained for an 11 nH inductor at 2.2 GHz with a resonant frequency of 3.6 GHz. Several other inductors have been obtained with Q-factors ranging from 23-38 for inductors ranging from 28 nH to 20 nH respectively. The authors believe that this is the first paper showing such high Q-factors for embedded passives in organic technology.

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