新型微小高Q值電感之分析、設計及模型建立

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摘要

本論文因應無線通訊射頻電路對高品質電感的需求，提出有別於傳統架構，極具創意之高Q值，小面積電感。當今 CMOS VLSI 0.18um technology 提供 6 層金屬和一層多晶矽，使得電感設計有更多發揮的空間，想要設計出Q值高，面積小之電感不再是夢想。Q值、L值及面積是電感之重要參數，一般由晶圓廠提供之電感 Q 值不高又佔面積，以 TSMC 0.18um 1P6M technology 為例提供的是方形電感，Q < 8，Area > 0.0467mm^2，UMC 0.18um 1P6M 提供的是圓形電感，Q < 19.41，Area > 0.06 mm^2。下線實作部分(tapeout)，TSMC 及 UMC 都有實作經驗，但以 UMC 為主，最後有做本案設計之電感與 UMC 電感之比較。另外，本文亦提供相當準確之電感模型，並與量測結果做比較，以利電路設計者參考使用。

Analysis, Design and Modeling of Novel Miniature High Quality Factor Inductors for 0.18um RF CMOS Technology

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Abstract

Several innovative RF CMOS on-chip inductor structures are proposed in this thesis. We take advantage of modern VLSI technology with multi-metal layers utilization, for example, TSMC 0.18um 1P6M process supports one polysilicon and six metal layers, where the metal consists of aluminum alloy. Rather than the typical inductors, our designing inductors that achieve much higher quality factor with smaller area at the equal inductance level can be easily integrated with other RF IC devices. The thesis also offers accurate inductor pi models that are comparable with the measurement results. These accurate inductor models can be applied to the broadband circuit design.

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I have done the best of my limited ability. I wish there is some contribution to the semiconductor industry and academia from my hard working effort.

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