

## Substrate effects in monolithic RF transformers on silicon

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The effect of substrate RF losses on the characteristics of silicon-based integrated transformers is studied experimentally by using a substrate transfer technique. The maximum available gain is used to evaluate the quality of transformers similarly to that of active devices. The silicon substrate has a pronounced effect on the quality factor and mutual resistive coupling factor of the primary and secondary coils, thereby degrading the maximum available gain of the transformer. A highly structured patterned ground shield is shown to improve the maximum available gain of a transformer at high frequencies, while at low frequencies, it has little effect on the maximum available gain and even degrades the quality factors of the transformer coils. It is shown that the low-frequency degradation of the coil quality factors relates to local eddy currents in the patterned metal shield.

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