

## RF integrated magnetic thin film noise suppressor on coplanar transmission line

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RF electromagnetic noise emission on electronic devices and transmission line can be attenuated by the loss generation of the ferromagnetic resonance (FMR) and the eddy current loss of magnetic thin films without external magnetic fields. In order to suppress the RF electromagnetic noise on coplanar transmission line, we have investigated the RF noise suppression using soft magnetic films [1]. Actually, we demonstrated the RF integrated noise suppressor using CoNbZr magnetic films, whose performances are compared with that of non-integrated type which was processed on a separate wafer with magnetic film and the coplanar line itself. The coplanar transmission line with characteristic impedance of  $50 \Omega$  is designed with  $50 \mu\text{m}$  width of signal line and  $3 \mu\text{m}$  thickness on 7059 corning glass (permittivity,  $\epsilon_r = 5.84$ ) substrate. As shown in Fig. 1, this structure is composed of magnetic film/polyimide/Cu transmission line/seed layer (Cu/Ti)/glass substrate. The transmission lines are deposited by Cu electroplating. The Cu/Ti ( $1000/100 \text{ \AA}$ ) seed layers and the amorphous CoNbZr magnetic films are deposited by rf sputtering. To open the contact pad, the polyimide was etched by Reactive ion etching with  $\text{O}_2$  gas. The electric performance is measured with two ground-signal-ground pin (GSG) type wafer probes using HP 8720D network analyzer from 0.1 to 20 GHz. In Fig. 2, the magnitude of transmission signal for the integrated noise suppressor (B, C) using CoNbZr films is great attenuated from  $-6 \text{ dB(A)}$  to  $-30 \text{ dB(B)}$ ,  $-57 \text{ dB(C)}$  at dip point frequency due to ferromagnetic resonance in comparison with that of the non-integrated type (A). Therefore, these enhancements are good applicable to micro-EMI (electron magnetic interference) fields for RF electronic devices and transmission line.

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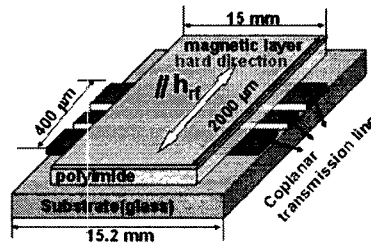


Fig. 1 A schematic of the integrated RF noise suppressor

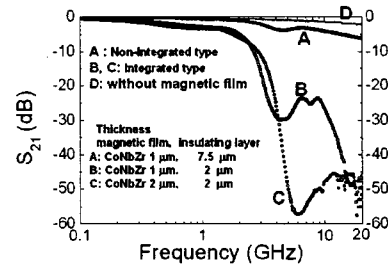


Fig. 2 Signal attenuation ( $S_{21}$ ) of the RF integrated noise suppressor with CoNbZr film in comparison with that of non-integrated type

### References

- [1] Ki Hyeon Kim, Hideaki Nagura, Shigehiro Ohnuma, Masahiro Yamaguchi, Ken-Ichi Arai, J. Appl. Phys., 93(10), 8002(2003)