Development of high-density capacitor embedded interposer

It contributes to realizing miniaturization and reducing power consumption of a high performance electronic information device.

We have developed a new chip capacitor embedded interposer using a narrow gap chip parts mounting technology. This interposer is expected to reduce power distribution network (PDN) impedance. To investigate the efficacy of the interposer, we have fabricated other various types of capacitor embedded interposer test element group (TEG), such as a general chip capacitor embedded organic interposer, a thin film capacitor on a silicon interposer using the same design. We evaluated PDN impedances of decoupling capacitor embedded interposers for a 3-D integrated LSI system by using a developed ultralow impedance evaluation system. As a result, the chip capacitor embedded interposer shows a low PDN impedance that could be evaluated at the frequency range of up to 10 GHz. This indicates that the developed interposer shows a comparable level of PDN impedance as the thin film capacitor embedded silicon interposer.

Katsuya KIKUCHI

Nanoelectronics Research Institute

k-kikuchi@aist.go.jp

AIST TODAY Vol.14 No.4 p.14 (2014)

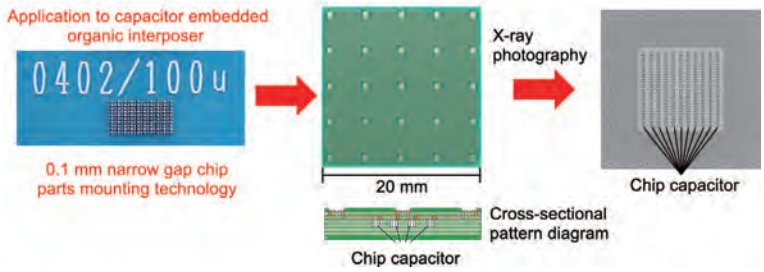


Figure decoupling capacitor embedded interposers using narrow gap chip parts mounting technology

Development of highly sensitive spin torque diode

Accelerating the applications of spintronics devices to IC tags or car radars

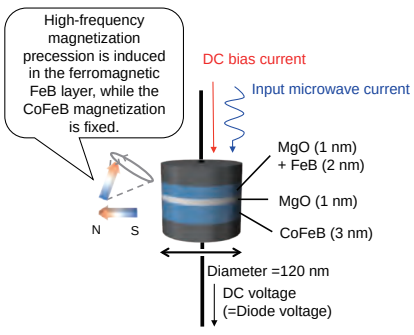
We have developed highly sensitive spin torque diode using a nonlinear effect. In 2005, we invented a spin torque diode by combining the large magnetoresistance effect of magnetic tunnel junctions (MTJs) and high-frequency spin precession induced by input microwave current. Because of the small spin precession, the diode sensitivity was much smaller than that of conventional semiconductor diodes. In this study, we adopted a new layer structure of MgO tunnel barrier/FeB free layer/MgO capping layers into MTJs. By manipulating the magnetic potential of the FeB layer we obtained the nonlinear effect in the MTJ. Due to the nonlinearity, spin precession was amplified greatly and the detection sensitivity of the microwave current became about three times higher than that of the semiconductor diodes. Because of the high sensitivity, small size, high frequency agility and tunability, the spin toque diode will be applied to high-frequency electronics such as communication devices, IC tags and car radars.

Hitoshi KUBOTA

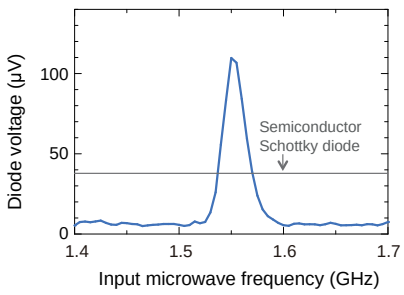
Spintronics Research Center

hit-kubota@aist.go.jp

AIST TODAY Vol.14 No.4 p.15 (2014)



A schematic illustration of spin torque diode



Spin torque diode spectrum

Power of the input microwave was fixed at 0.01 μW (microwave current of 4.8 μA) and DC bias current was fixed at -0.3 mA. Peak frequency corresponds to the ferromagnetic resonance frequency of the FeB layer.