Characteristics of Contact Discharge using 6GHz Current Probe

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Abstract: Magnetic heads and semiconductor devices have been found to be sensitive to electrostatic discharge (ESD). It has been reported that magnetic heads have suffered magnetic damage from ESD current on the order of 10 mA having pulse widths on the order of nanoseconds. However, the discharge current has been measured using 1-2GHz current probes. Therefore, the measured current-waveforms tended the rise-time to be longer and the peak-value to be lower than the real current-waveforms. In this paper, high-frequency responded current-probe was newly developed and used to measure the discharge-current.

Fig. 1 shows the comparison of frequency responses of the prototype P-72 probe and Tektronix ct-6 probe. The cut-off frequencies are approximately 6GHz and 1.5GHz respectively. Fig. 2 shows the current-waveforms varied depending on the cut-off frequencies of 2GHz to 6GHz used the-P-72 probe, when discharging from the 4pF capacitor applied 30V. The rise-times, picked up from 20% to 80%, were shortened from 148 pico-sec at 2GHz to 58 pico-sec at 6GHz. Therefore, it was understood that the P-72 probe was effective to measure fast rise-time such as the discharge from small capacitors. Fig. 3 shows typical waveforms discharged from 4pF applied 10V to 70V. The peak values increased from 30mA to 300mA as the voltage increased. The pulse widths were less than one nano-sec. Fig. 4 shows the rise-time vs. applied voltage. At more than 30V the rise-times were shorter than 60 pico-sec. As the voltage decreased from 20V to 10V, the rise-times were longed to 140 pico-sec. Therefore, the rise-time of the discharge current was influenced by the applied voltage.