

Examples of Countermeasures for Static Electricity

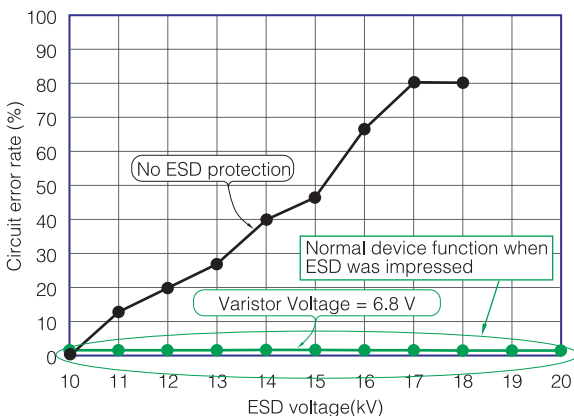
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1 Examples of Countermeasures for Keypad Line Static Electricity

This will explain examples of countermeasures for static electricity on mobile phone keypad lines.

A mobile phone was set to camera mode, and ESD was impressed to the keypad. Next, the number of device malfunctions was counted and the malfunction percentage was calculated. Figure 1 shows the malfunction percentage of the device when a chip varistor was used for the keypad line and for when no ESD protective device was used. When no ESD protection was used, the malfunction percentage increased according to the increase in the ESD charge voltage. A malfunction phenomenon occurred where the LCD turned OFF. When a chip varistor was used, no malfunction occurred even when the ESD charge voltage was increased. This shows that chip varistors can be used to effectively reduce ESD from keypad lines.

Figure 1 Test Results



with a voltage of 6.8 V was used, no malfunctions occurred at ESD charge voltages of 10 kV or less. Next, the cause of this result will be explained using an ESD clamp waveform when a single chip varistor was used as shown in Figure 3. Figure 3 shows that the ESD clamp voltage of the 6.8 V type varistor was lower than the 8 V type varistor. It is believed that the reason why the 6.8 V type varistors could reduce the malfunction percentage was because of the reduction of the influence on the later steps of the IC / circuit. As mentioned previously, the key when selecting a countermeasure is considering the tendency where items with a low varistor voltage have better efficiency as ESD clamps. This is a good example for showing the effectiveness of items with a low varistor voltage for circuits that need to be protected.

Figure 2 Test Results

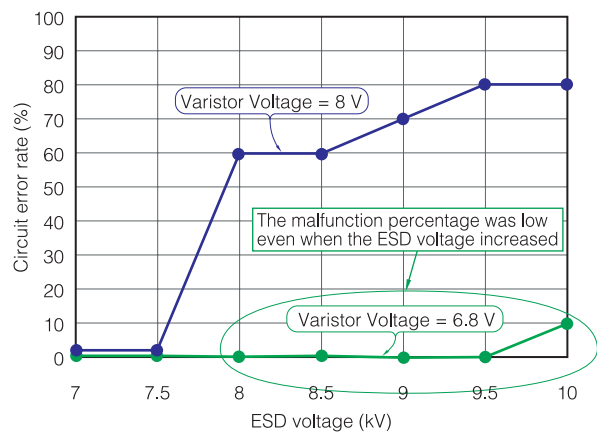
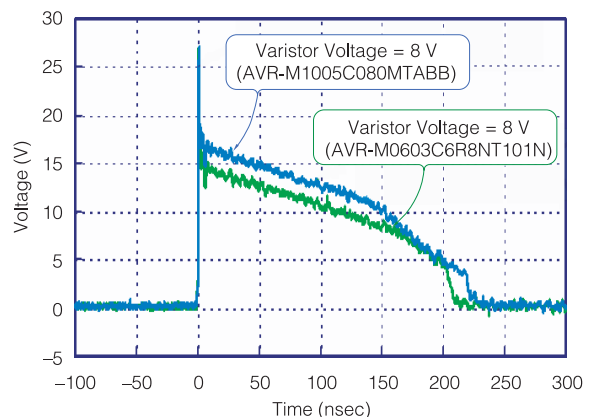


Figure 3 Measurement Results



2 Examples of Countermeasures for Headphone Line Static Electricity

This will explain countermeasures for static electricity on digital AV player headphone lines.

ESD was impressed to headphones while audio was being played. Next, the number of device malfunctions was counted and the malfunction percentage was calculated. Figure 2 shows the malfunction percentage of the device for when a varistor with a voltage of 8 V was used for the headphone line and for when a varistor with a voltage of 6.8 V was used. When the varistor with a voltage of 8V was used, the malfunction percentage of the device increased according to the increase in the ESD charge voltage. On the other hand, when a varistor

3 | Examples of Countermeasures Using Damping Resistors

Another countermeasure for protecting circuits from ESD is using damping resistors. Figure 4 shows the ESD clamp waveform according to the damping resistance. A series of damping resistors was used on a line, and it showed better ESD clamp characteristics than when only a chip varistor was used. Damping resistors may affect normal circuit operation. However, damping resistors are effective as ESD countermeasures.

Figure 4 Measured Waveform (ESD Voltage = 2 kV)

