Toshiba’s amorphous magnetic Noise Suppressors are essentially small saturable cores. The square-shaped magnetic hysteresis of these devices is key to their noise suppression ability. They are most effective at suppressing the noise associated with the reverse recovery of diodes.

Toshiba offers two types of devices, which have been specifically designed for noise suppression: **AMOBEADS**® and **SPIKE KILLER™**. **AMOBEADS** are smaller than **SPIKE KILLERs** and have been designed for a single turn. They are simply slipped over the lead of a diode and require no additional circuit board space (also available in a surface mount configuration). **SPIKE KILLERs** are used when **AMOBEADS** are insufficient to handle the noise in a particular circuit. They are typically wire wrapped as an inductor. For even larger noise problems, Toshiba’s saturable cores can be used as **SPIKE KILLERs**.

To better understand the mechanism by which these devices suppress noise, consider a switching diode, with current as shown in **Figure 1**, in series with a saturable reactor (i.e. wire wrapped saturable core).

**Figure 1:**
Current Through a Switching Diode

**Figure 2:**
Magnetic Behavior of a Saturable Core

**Figure 2** shows the magnetic hysteresis curve the reactor would follow. The Magnetic Field, H, is proportional to the current flowing in the reactor while the slope of the hysteresis curve is proportional to the inductance of the reactor at the corresponding value of current. When the diode is conducting (Region I in **Figure 1**), current flows in one direction through the reactor. This situation corresponds to the nearly horizontal region in **Figure 2**. The slope of the curve in this region is small, therefore a very low inductance is put in series with the diode while it is conducting.

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Advantages of Amorphous Noise Suppressors

• Low Noise: When placed in series with a diode, they more effectively suppress noise-causing transient current change.
• Low Loss: There is low hysteresis loss and almost no resistive loss through the components.
• Diode Protection: The products suppress current and voltage spikes within the circuit, protecting the diode.
• Space Savings: AMOBEADS can be mounted directly onto the leads of diodes and require no additional circuit board space. (Also available in a surface mount configuration).

Now suppose the current changes sign (Region II in Figure 1). Only after the current crosses zero will the magnetization be on the inclined portion of Figure 2. This region of the curve has a large slope and so a high inductance is put in series with the diode. The presence of the saturable reactor thus impedes further changes in current. The result is shown in Figure 3.

The current is changed from a severe reverse recovery to a so-called “soft recovery” (i.e. reduced in magnitude and spread out over time). In this way the di/dt is drastically reduced. There is now less coupling with parasitics in the circuit that would have otherwise created noise. By decreasing the di/dt associated with the reverse recovery in diodes, the saturable reactor suppresses this kind of noise. Unlike Ferrite Beads, which are designed to absorb noise after it is created, Amorphous Magnetic Noise Suppressors eliminate the cause of the noise. Where Ferrite Beads are purposely made lossy, Amorphous Noise Suppressors are engineered to have very low loss.

It should be noted that because of the mechanism discussed above, Amorphous Noise Suppressors are only effective at suppressing noise associated with “zero-crossing” current (i.e. current which changes sign). They are not effective at suppressing noise about a DC current.