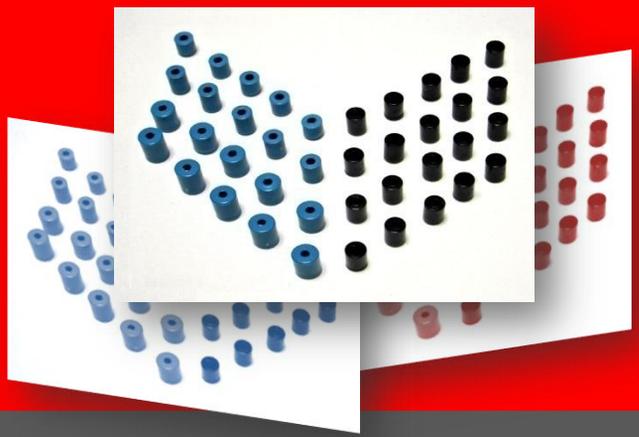


Amorphous Magnetic Noise Suppressors



How Do They Work?

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.

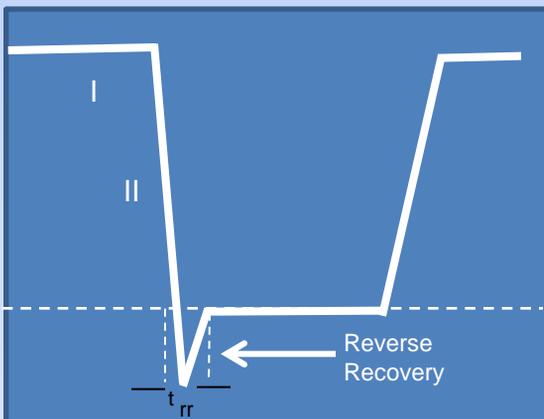


Figure 1:
Current Through a Switching Diode

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).

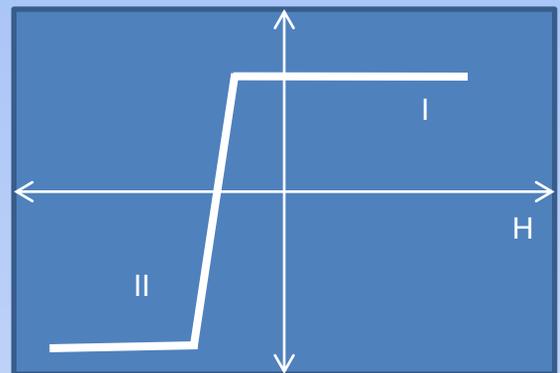


Figure 2:
Magnetic Behavior of a Saturable Core

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.

CONTACT INFORMATION

AMORPHOUS CORES

Advanced Materials Division
290 Donald Lynch Blvd.
Marlborough, MA 01752
amd@taec.toshiba.com
Tel: 508-303-5041
Fax: 508-481-8890

Dexter Magnetic Technologies
Tel: 800-775-3829
Fax: 877-221-5052
info@dextermag.com

BFI Optilas GmbH (In Europe)
Tel.: +49 (0) 60 74 40 98 - 0
Fax: +49 (0) 60 74 40 98 - 110
info@bfioptilas.com

WEBSITE

- www.suppressnoise.toshiba.com
- www.taec.toshiba.com

ROHS INFORMATION

- www.rohs.toshiba.com

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**.

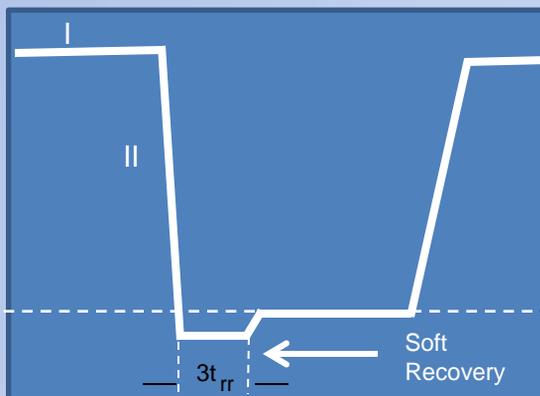


Figure 3:
Effect of
a Noise
Suppressor

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.

- AMOBEADS is a registered trademark and SPIKE KILLER is a trademark of Toshiba Corporation in the United States and certain other jurisdictions. All other trademarks are the property of their respective owners and may be registered in certain jurisdictions.
- The information contained herein is subject to change without notice.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situation in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc.
- The Toshiba products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These Toshiba products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (“Unintended Usage”). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc. Unintended usage of Toshiba products listed in this document shall be made at the customer’s own risk.
- The products described in this document may include products subject to foreign exchange and foreign trade laws.
- The products contained herein may also be controlled under the U.S. Export Administration Regulations and/or subject to the approval of the U.S. Department of Commerce or U.S. Department of State prior to export. Any export or re-export, directly or indirectly in contravention of any of the applicable export laws and regulations, is hereby prohibited.

TOSHIBA
Leading Innovation >>>