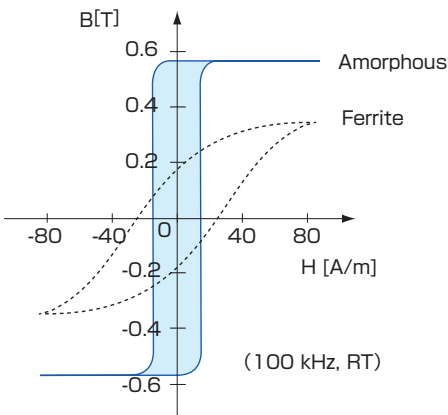
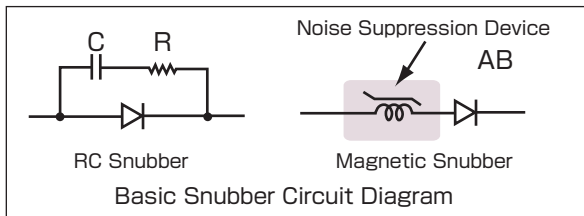


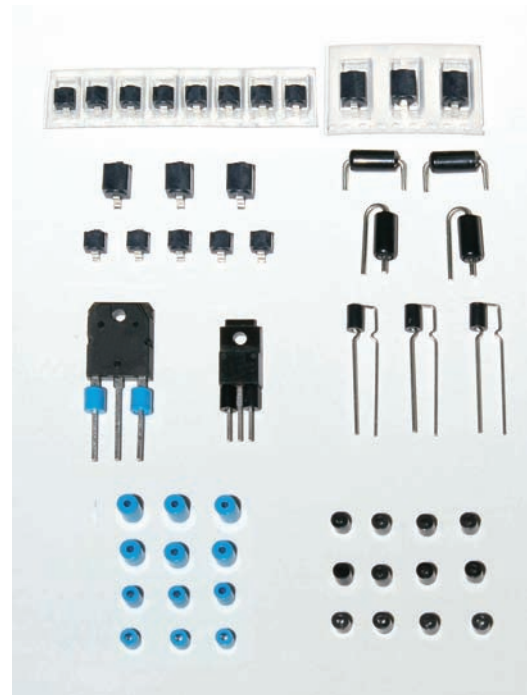
2.Noise Suppression Devices AMOBEADS®

An amorphous noise suppression device is unique and completely different from conventional noise filters. Conventional noise prevention products focus on somehow minimizing the noise after it's been created, by typically trying to absorb the noise, and so their effectiveness in noise reduction is directly influenced by frequency of the circuit. Amorphous noise suppressing devices, on the other hand, focus on the source of the noise and work to prevent or minimize the noise before it has a chance to develop. The source of the electronic circuit noise is the rapid change of current or voltage, and the effectiveness of the amorphous cores in eliminating this noise is independent of frequency.

An amorphous noise suppression device is a product that takes full advantage of the unique magnetic characteristics of the cobalt based amorphous alloy. Toshiba Materials offers two noise suppression devices, "AMOBEADS®" and "SPIKE KILLERS®". AMOBEADS® deliver excellent noise suppression results and are convenient to use by simply being slipped over the leads of the semiconductor device. "AMOBEADS®" are also available with a lead thru and in a surface mount configuration. "SPIKE KILLERS®", which are larger in size than "AMOBEADS®", most often are wire wound and are effective in eliminating or minimizing higher noise levels.

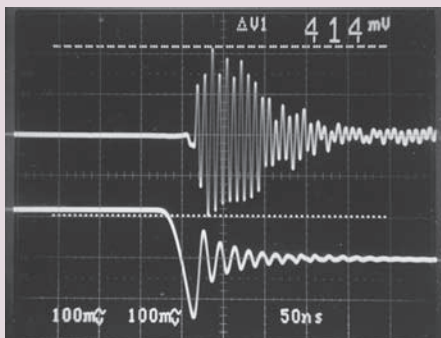


B-H Curve (typical)

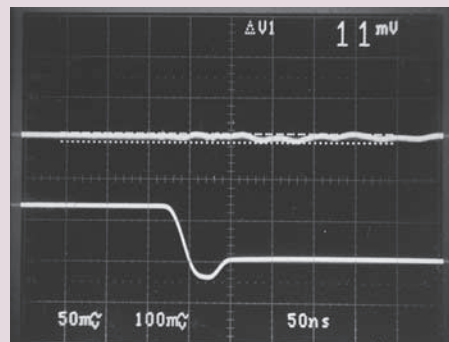


Example for Noise Suppressing Effect (Chopper Converter)

With an excellent saturable characteristic, "AMOBEADS®" suppress the reverse recovery current of the diode and decrease the noise that is occurring. When the current for diode reverses and tries to go into the recovery condition, the "AMOBEADS®" displays a large inductance and oppose the generation of the recovery current. In this instance, a soft recovery is possible for core material with a smaller coercive force.



Without Countermeasure



With AMOBEADS®
(AB4×2×8W)

Standard Specifications

AMOBeads®

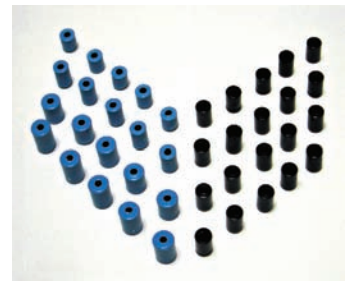
W series

| Type No. | Finished Dimensions [mm] | | | Core Size [mm]*1 | | | Total Flux*2 $\phi c[\mu Wb]$ min | AL value*3 L[μH] min | Insulating Cover | Packing Unit |
|------------|--------------------------|-----------|----------|------------------|-------|------|--------------------------------------|--------------------------------|------------------|--------------------|
| | O.D. max | I. D. min | H.T. max | O.D. | I. D. | H.T. | | | | |
| AB3X2X3W | 4.0 | 1.5 | 4.5 | 3.0 | 2.0 | 3.0 | 0.9 | 3.0 | PBT case Blue | 2,000 [pcs/box] |
| AB3X2X4.5W | 4.0 | 1.5 | 6.0 | 3.0 | 2.0 | 4.5 | 1.3 | 5.0 | | |
| AB3X2X6W | 4.0 | 1.5 | 7.5 | 3.0 | 2.0 | 6.0 | 1.8 | 7.0 | | |
| AB4X2X4.5W | 5.0 | 1.5 | 6.0 | 4.0 | 2.0 | 4.5 | 2.7 | 9.0 | | |
| AB4X2X6W | 5.0 | 1.5 | 7.5 | 4.0 | 2.0 | 6.0 | 3.6 | 12.0 | | |
| AB4X2X8W | 5.0 | 1.5 | 9.5 | 4.0 | 2.0 | 8.0 | 4.8 | 16.0 | | |

DY series (low price) (Recommend for big demand, 10,000pcs/lot)

| Type No. | Finished Dimensions [mm] | | Total Flux*7 $\phi c[\mu Wb]$ | Insulating Cover | Packing Unit [pcs/bag] |
|-------------|--------------------------|---------|----------------------------------|------------------|---------------------------|
| | O.D. | H.T. | | | |
| AB2.8X4.5DY | 4.0±0.2 | 5.7±0.3 | 0.9min | PBT Black | 10,000 |
| AB3X2X3DY | 4.0±0.2 | 4.2±0.3 | 0.9min | PBT Black | 10,000 |
| AB3X2X4.5DY | 4.0±0.2 | 5.7±0.3 | 1.3min | PBT Gray | 10,000 |
| AB4X2X4.5DY | 5.0±0.2 | 5.7±0.3 | 2.7min | PBT Black | 5,000 |
| AB4X2X6DY | 5.0±0.2 | 7.2±0.3 | 3.6min | PBT Black | 5,000 |

*Inner diameter can pass through a 1.2X0.7mm lead.

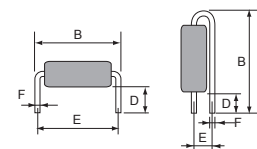


W series DY series

AMOBeads® with lead

Bulk type

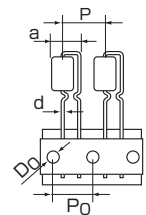
| Type No. | Finished Dimensions [mm] | | | | Current [A] | Total flux $\phi c[\mu Wb]$ | AL Value L[μH] | Insulating Cover | Packing Unit |
|----------|--------------------------|---------|----------|---------------------|----------------|--------------------------------|--------------------------|-------------------|--------------------|
| | B | D | E | F | | | | | |
| LB4X2X8F | 16.0max | 4.2±0.5 | 14.0±1.0 | $\phi 1.25 \pm 0.1$ | (8.0) | 4.8 min | 16.0 min | PBT case Black | 1,000 [pcs/box] |
| LB4X2X8U | 20.0max | 4.0±0.5 | 5.0±1.0 | $\phi 1.25 \pm 0.1$ | | | | | |



LB4X2X8F LB4X2X8U

Radial tapping

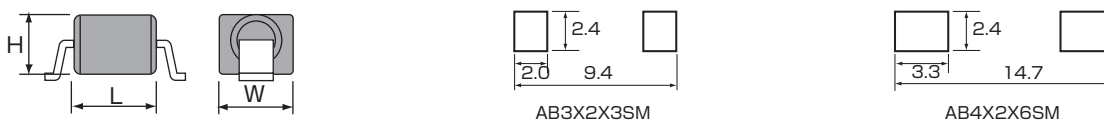
| Type No. | P [mm] | Po [mm] | Do [mm] | a [mm] | d [mm] | Current*4 I [A] | Total Flux*7 $\phi c[\mu Wb]$ | Packing Unit |
|------------|--------|---------|------------|--------|------------|--------------------|----------------------------------|--------------------|
| LB2.8X4.5U | 12.7 | 12.7 | $\phi 4.0$ | 9.0max | $\phi 0.8$ | (5) | 0.9min | 3,000 [pcs/box] |



SMD Type AMOBeads®

| Type No. | Finished Dimensions [mm] | | | Lead width x thickness | I _o *4 [A] | Total Flux*2 $\phi c[\mu Wb]$ | AL value*3 L[μH] | Insulating Cover | Packing Unit [pcs/reel] |
|-----------|--------------------------|---------|---------|------------------------|--------------------------|----------------------------------|----------------------------|------------------|----------------------------|
| | width | length | height | | | | | | |
| AB3X2X3SM | 5.0±0.3 | 5.0±0.3 | 4.0±0.3 | (1.8×0.35) | (6.0) | 0.9 min | 3.0 | LCP case | 2,000 |
| AB4X2X6SM | 6.0±0.3 | 8.0±0.3 | 5.0±0.3 | (1.8×0.52) | (9.0) | 3.6 min | 12.0 | Black | 1,000 |

Recommended Land Pattern (mm)



*1 Reference Value *2 Minimum Guarantee on Measuring Condition : 50kHz, 80A/m(sine wave), R.T.

*3 Measuring Condition:50kHz, 1V, 1turn, R.T.

*4 Typical Value, using a cross section of lead

*5 Measuring Condition:100kHz, 80A/m(sine wave), R.T. *6 Tolerance ±0.2[mm]

*7 Converted from Inductance Value L₁ at 1kHz, 100mA(sine wave), R.T.

$$\phi c(\mu Wb) = 0.282 \times L_1(\mu H)$$

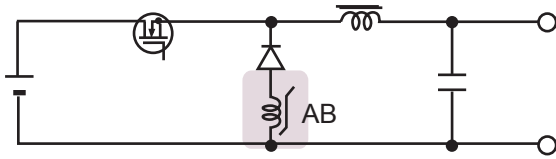
☆"AMOBeads®" sample kits are available. Please ask sales department.

☆"AMOBeads®" and "SPIKE KILLER®" : Registered trademarks of TOSHIBA MATERIALS Co., Ltd.

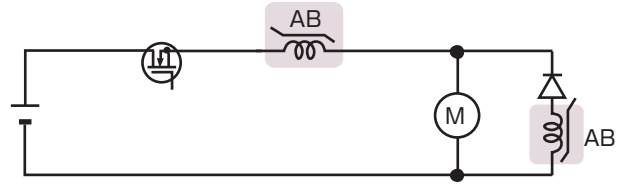
☆"AMOBeads®" and "SPIKE KILLER®" : Registered in U.S.A., France, Germany, U.K., Japan.

Examples of Applied Circuits and their Characteristics

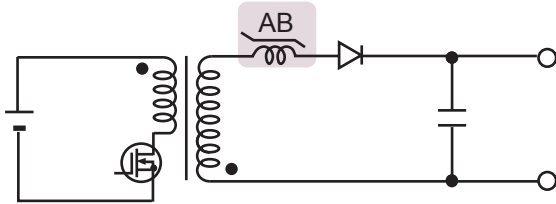
Application of Amorphous Noise Suppression Devices



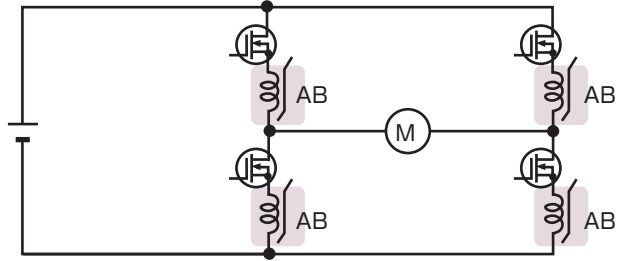
Chopper Converter



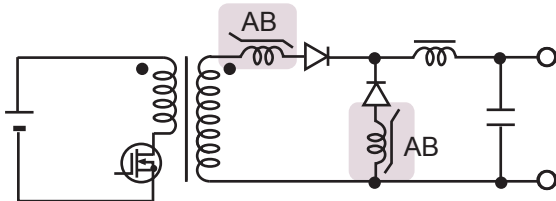
Control Circuit for Motor



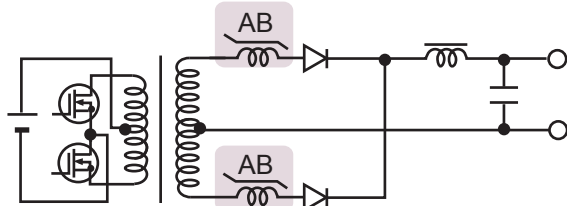
Flyback Converter



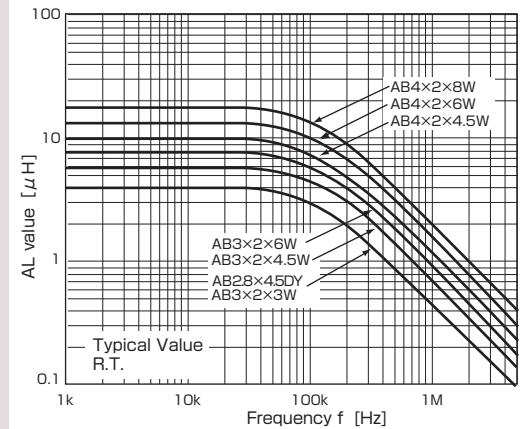
Motor Driving Circuit



Forward Converter

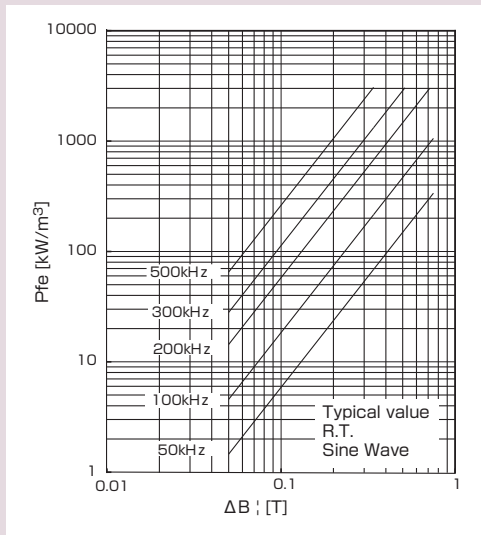


Push-pull Converter

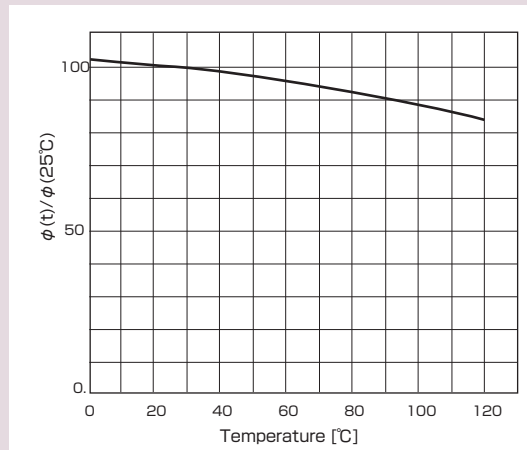


Frequency Characteristics of Inductance

Characteristics (Typical value)



Coreloss Characteristic [AMOBeads®]



Flux(ϕ) Decline Ratio vs. Temperature

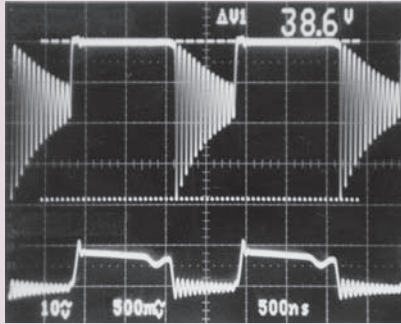
Effects of Noise Suppression by AMOBEADS[®]

Spike Voltage Suppression

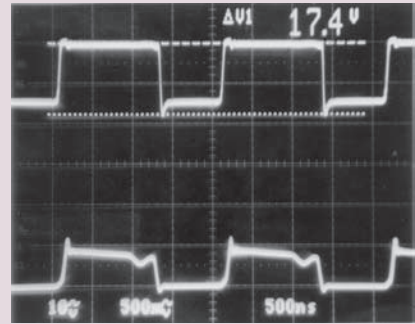
Spike voltage can be reduced and ringing phenomena can also be prevented by AMOBEADS. Also Schottky barrier diode (SBD) can be protected from over voltage.

Frequency : 500kHz
Output Voltage - Current : 5V-20A

Without Countermeasure



AMOBEADS "AB4×2×4.5W"

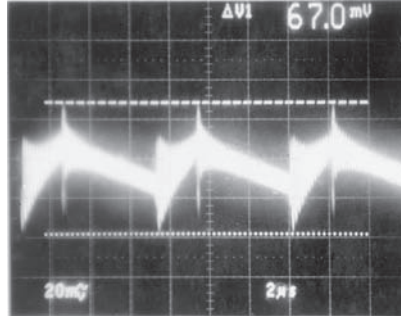


Output Noise Reduction

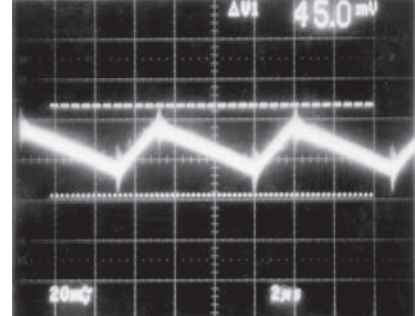
When the ferrite is replaced by AMOBEADS at the secondary output diode (FRD) of the forward converter circuit, the output noise can be tremendously reduced, not only the noise peak level but also the amplitude range.

Frequency : 150kHz
Output Voltage - Current : 15V-10A

RC Snubber +Ferrite Beads



AMOBEADS "AB4×2×4.5W"

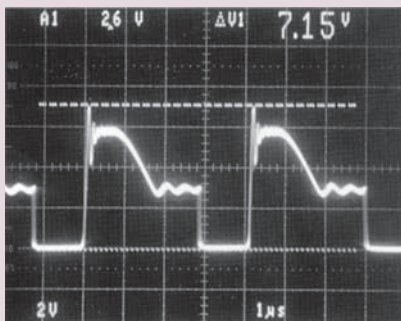


Primary Surge Voltage

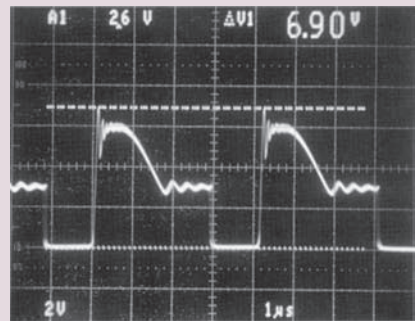
When the ferrite is replaced by AMOBEADS at the secondary output diode (SBD) of the forward converter circuit, the output noise and harmful influence to the primary stage can be reduced. These effects are based on the inclination of the actual BH curves between amorphous and ferrite materials.

Frequency : 250kHz
Output Voltage - Current : 5V-15A

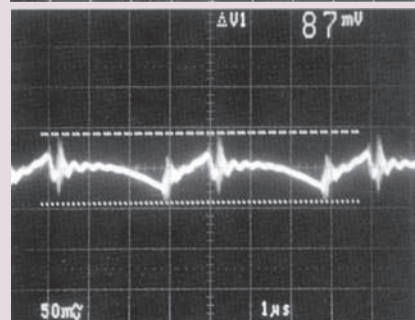
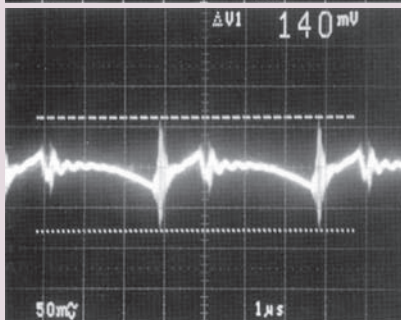
Ferrite Beads 4×2×4



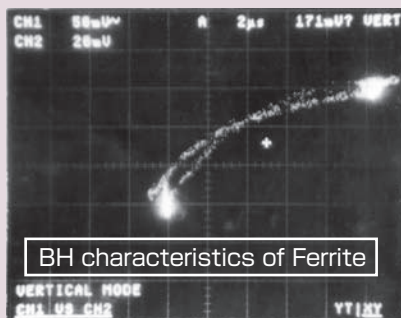
AMOBEADS "AB4×2×4.5W"



Output Noise



Actual BH Curve



B
↑
H
→

