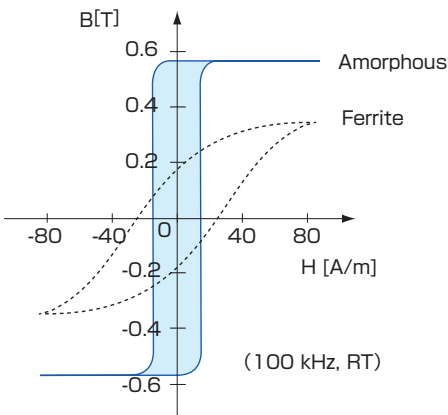
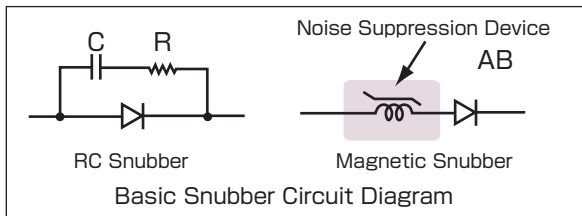


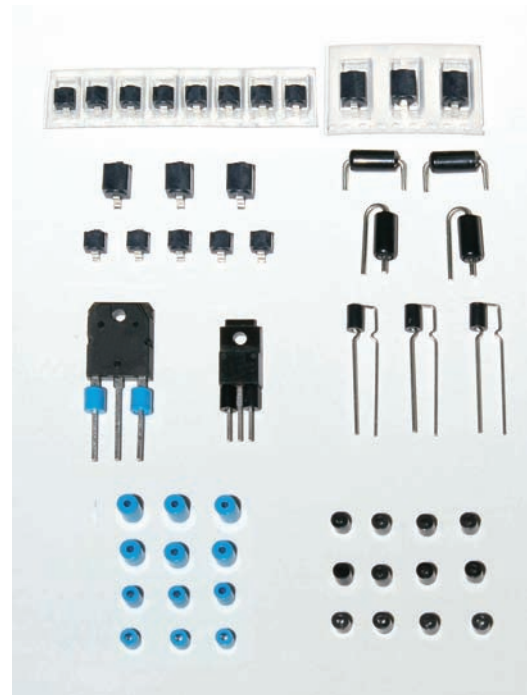
## 2.Noise Suppression Devices AMOBEADS®

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.

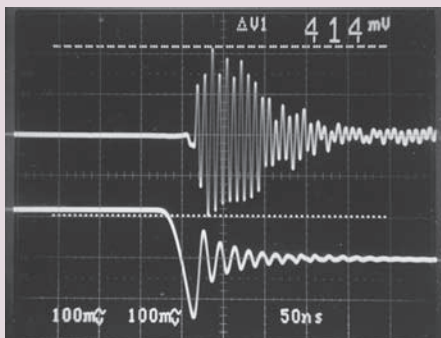


B-H Curve (typical)

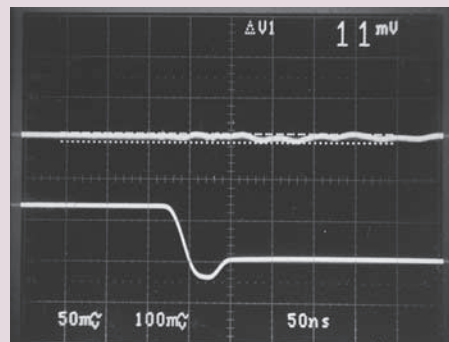


### Example for Noise Suppressing Effect (Chopper Converter)

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®

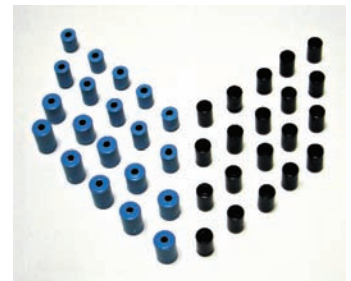
#### W series

Type No.	Finished Dimensions [mm]			Core Size [mm]*1			Total Flux*2 $\phi c[\mu Wb]$ min	AL value*3 L[ $\mu H$ ] 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.

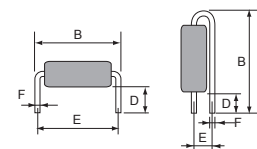


W series      DY series

### AMOBeads® with lead

#### Bulk type

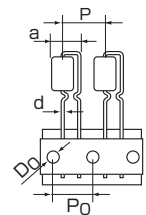
Type No.	Finished Dimensions [mm]				Current*4 [A]	Total flux*2 $\phi c[\mu Wb]$	AL Value*3 L[ $\mu H$ ]	Insulating Cover	Packing Unit
	B	D	E	F					
LB4X2X8F	16.0max	4.2±0.5	14.0±1.0	$\phi 1.25 \pm 0.1$	(8.0)	4.8 min	16.0 min	PBT case Black	1,000 [pcs/box]
LB4X2X8U	20.0max	4.0±0.5	5.0±1.0	$\phi 1.25 \pm 0.1$					



LB4X2X8F      LB4X2X8U

#### Radial tapping

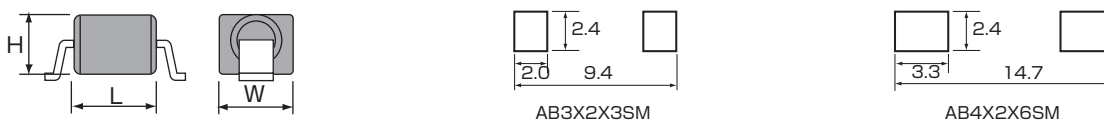
Type No.	P [mm]	Po [mm]	Do [mm]	a [mm]	d [mm]	Current*4 I [A]	Total Flux*7 $\phi c[\mu Wb]$	Packing Unit
LB2.8X4.5U	12.7	12.7	$\phi 4.0$	9.0max	$\phi 0.8$	(5)	0.9min	3,000 [pcs/box]



### SMD Type AMOBeads®

Type No.	Finished Dimensions [mm]			Lead width x thickness	I <sub>o</sub> *4 [A]	Total Flux*2 $\phi c[\mu Wb]$	AL value*3 L[ $\mu H$ ]	Insulating Cover	Packing Unit [pcs/reel]
	width	length	height						
AB3X2X3SM	5.0±0.3	5.0±0.3	4.0±0.3	(1.8x0.35)	(6.0)	0.9 min	3.0	LCP case	2,000
AB4X2X6SM	6.0±0.3	8.0±0.3	5.0±0.3	(1.8x0.52)	(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 L<sub>1</sub> at 1kHz, 100mA(sine wave), R.T.

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

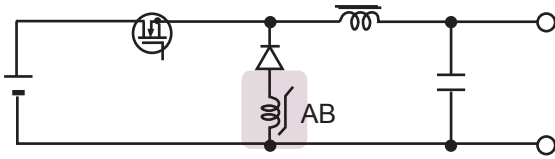
☆"AMOBeads®" sample kits are available. Please ask sales department.

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

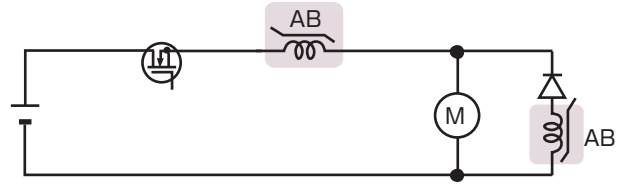
☆"AMOBeads®" and "SPIKE KILLER®" : Registered in U.S.A., France, Germany, U.K., Japan.

# Examples of Applied Circuits and their Characteristics

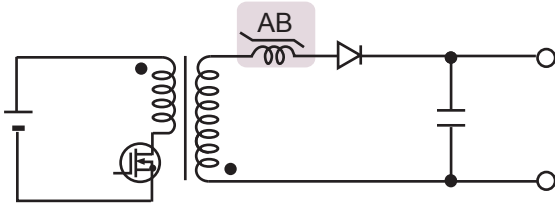
## Application of Amorphous Noise Suppression Devices



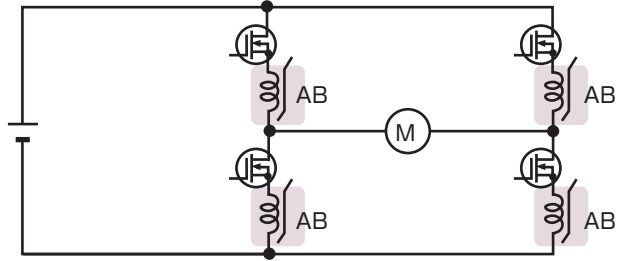
Chopper Converter



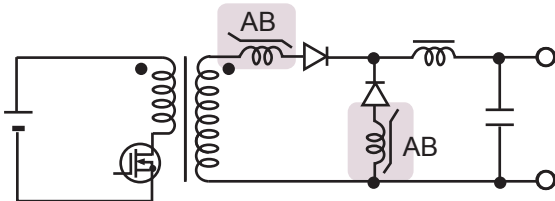
Control Circuit for Motor



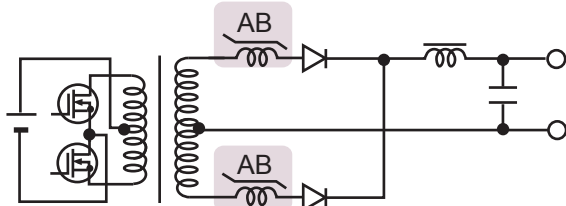
Flyback Converter



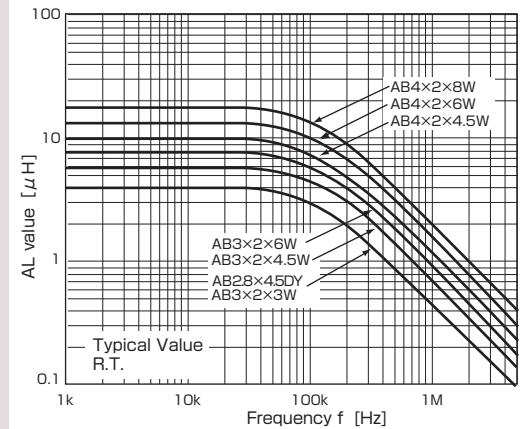
Motor Driving Circuit



Forward Converter

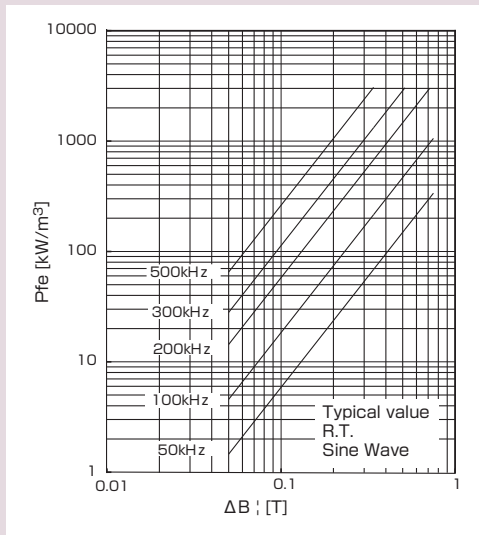


Push-pull Converter

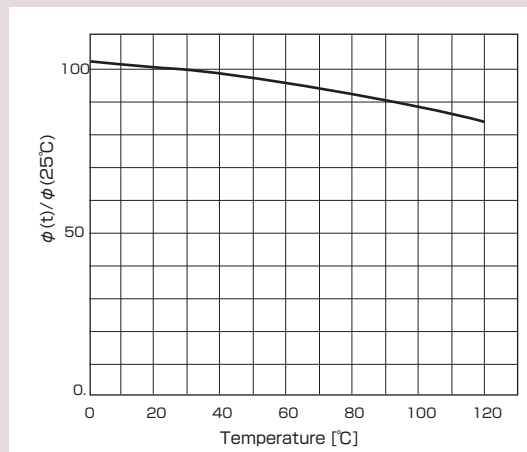


Frequency Characteristics of Inductance

## Characteristics (Typical value)



Coreloss Characteristic [AMOBEADS®]



Flux ( $\phi$ ) Decline Ratio vs. Temperature

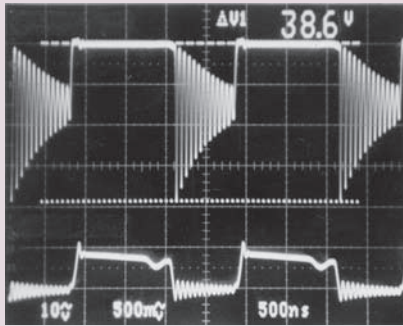
# Effects of Noise Suppression by AMOBEADS<sup>®</sup>

## 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

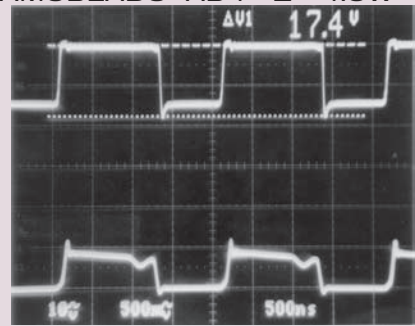
### Without Countermeasure



Diode Voltage  $V_D$   
10V/div

Diode Current  $I_D$   
5A/div

### AMOBEADS "AB4×2×4.5W"

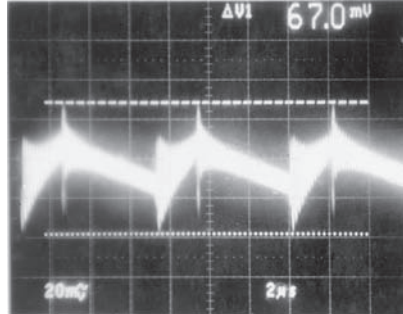


## Output Noise Reduction

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.

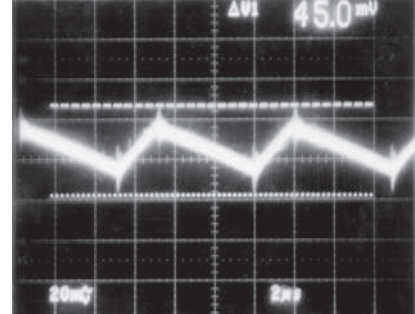
Frequency : 150kHz  
Output Voltage - Current : 15V-10A

### RC Snubber +Ferrite Beads



Output Noise  $V_N$   
20mV/div

### AMOBEADS "AB4×2×4.5W"

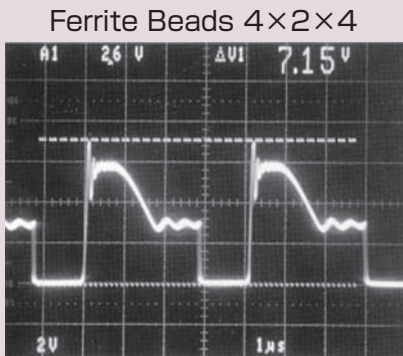


## Primary Surge Voltage

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

### Output Noise

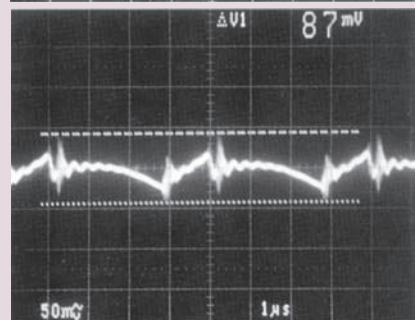
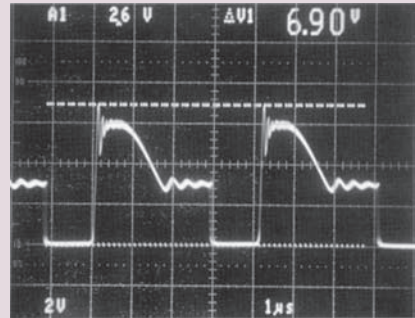


MOS-FET Drain-Source Voltage  $V_{DS}$   
200V/div

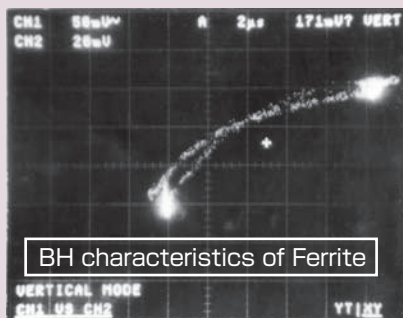


Output Noise  $V_N$   
50mV/div

### AMOBEADS "AB4×2×4.5W"

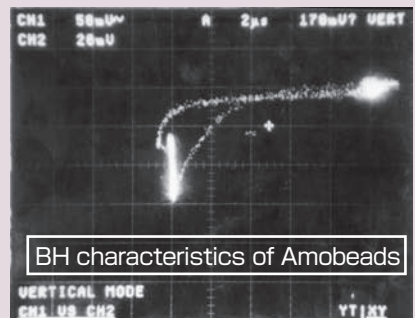


## Actual BH Curve



BH characteristics of Ferrite

B  
↑  
H  
→



BH characteristics of Amobeads

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## Toshiba:

[AB4X2X4.5W](#) [AB 3X2X3DY](#) [AB3X2X4.5W](#) [LB 2.8X4.5U](#) [AB4X2X8W](#) [LB4X2X8U](#) [AB4X2X6SM](#) [AB3X2X4.5DY](#)  
[AB3X2X6W](#) [AB3X2X3W](#) [AB 2.8X4.5DY](#)