

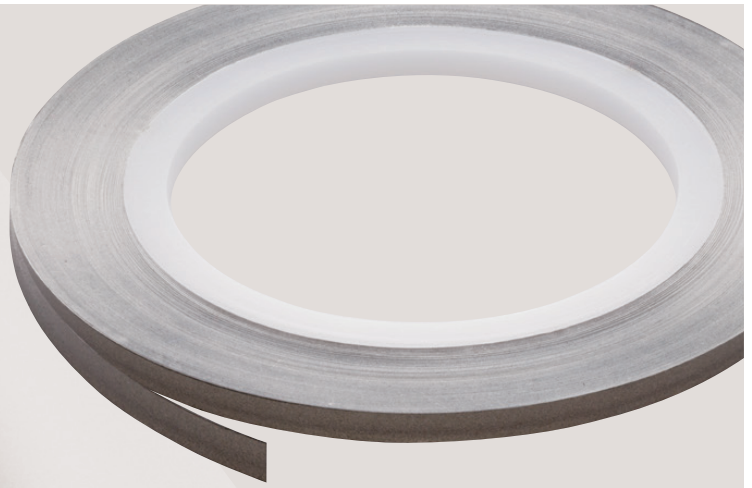
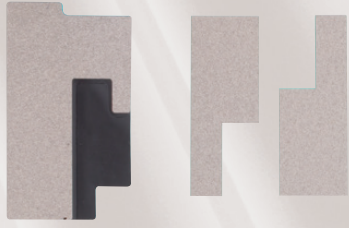
*vol.19*

# **FLEX SUPPRESSOR**®

Noise suppression sheet



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## **FLEX SUPPRESSOR®**

An EMI suppressor sheet that insures clean electromagnetic environments.

The secret of FLEX SUPPRESSOR® an EMI suppressor-lies in its structure, where ultra-thin magnetic metal foils on the micron order overlap each other in the same direction. Because of this unique configuration, FLEX SUPPRESSOR® can suppress noise at a level surpassing that of ferrite-based devices.

FLEX SUPPRESSOR® absorbs harmful noises and converts them into heat to create clean electromagnetic environments.



FLEX SUPPRESSOR is a registered trademark of TOKIN.  
The FLEX SUPPRESSOR® hold patent number 3641796 and other intellectual property regarding its structure, manufacturing process and usages.

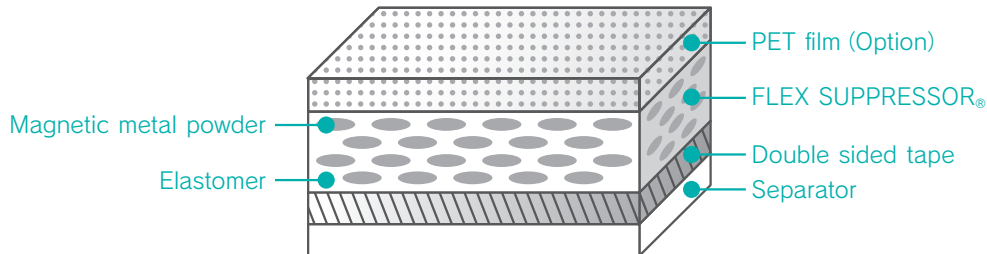


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## Outline

FLEX SUPPRESSOR® is a composite magnetic body in the form of sheet made by blending and dispersing micron sized magnetic material powders in a polymer base, and a sheet type noise suppressor effectively suppressing high frequency noise generated from electronic devices.

## Structure



## Specifications

- High Permeability type
- UL94 V-0 Flame Retardant type
- GHz band High Performance type

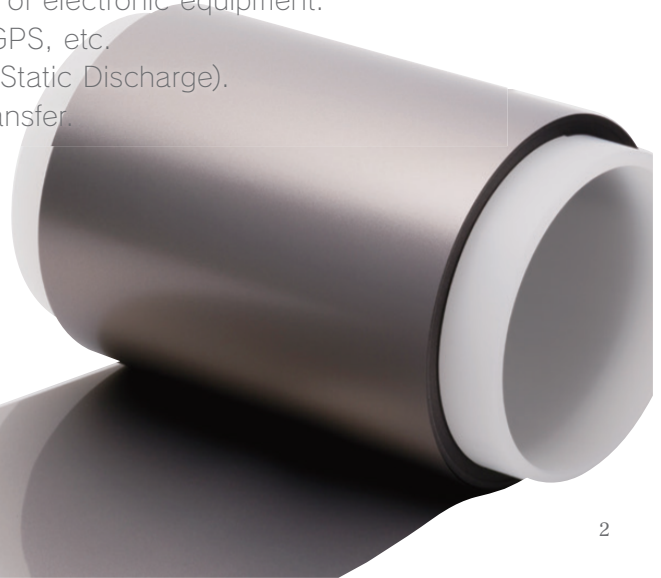
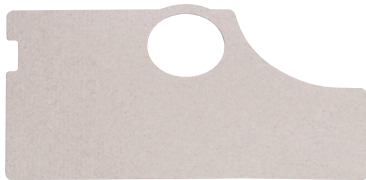
## Features

- High permeability achieves high noise suppression effect even if it is thin.
- Flexible sheet type noise suppressor.
- It can suppress noise just put on only.
- Easy to process a shape.
- Best suits for thin devices with the limitation of the space.
- Usable in a wide range from MHz band to GHz band.



## Applications


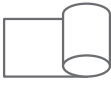
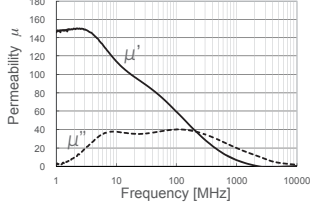
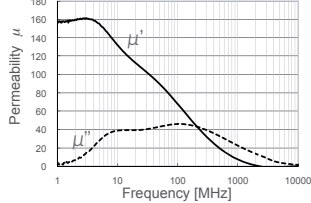
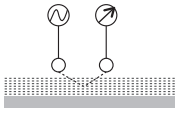
- Radiation noise suppression in all kinds of electronic equipment.
- Measures for the desense LTE, Wi-Fi, GPS, etc.
- Malfunction prevention of ESD (Electro Static Discharge).
- Magnetic material for Wireless power transfer.



# FLEX SUPPRESSOR®

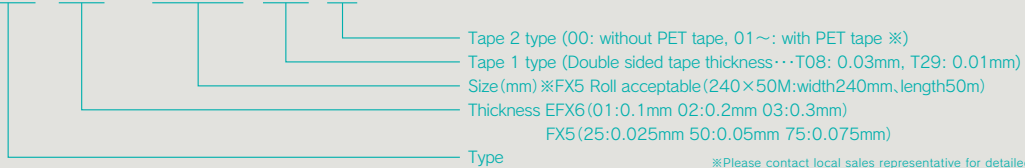


## High Permeability type

Type	FX5 <span style="border: 1px solid black; border-radius: 10px; padding: 2px;">Red phosphorus free</span>	EFX6 <span style="border: 1px solid black; border-radius: 10px; padding: 2px;">Red phosphorus free</span>
Effective frequency	Up to 10GHz	
Operating temperature	-40 to +105°C	
Thickness	0.025mm   0.05mm   0.075mm	0.1mm   0.2mm   0.3mm
Standard dimensions	240mm×240mm 	240mm×50m 
Permeability at 3MHz	150 typ. 	160 typ. 
Decoupling characteristics at 700MHz	 Attenuation(dB) vs Thickness (mm): 0.025mm: 1.0, 0.05mm: 2.0, 0.075mm: 3.0	Attenuation(dB) vs Thickness (mm): 0.1mm: 4.5, 0.2mm: 9.0, 0.3mm: 13.5
Specific gravity	3.3 typ.	
Surface resistivity	$1.0 \times 10^6 \Omega/\square$ typ.	
Approved standard	UL94 HB   UL File No. E176124	
Environment	RoHS compliant, Halogen free/PVC free/Lead free/Red phosphorus free	
Reflowing (260°C)	Please use double sided tape with reflowing	

### FX5/EFX6 classification ※

**EFX6 (01) - 240X240 T08 00**

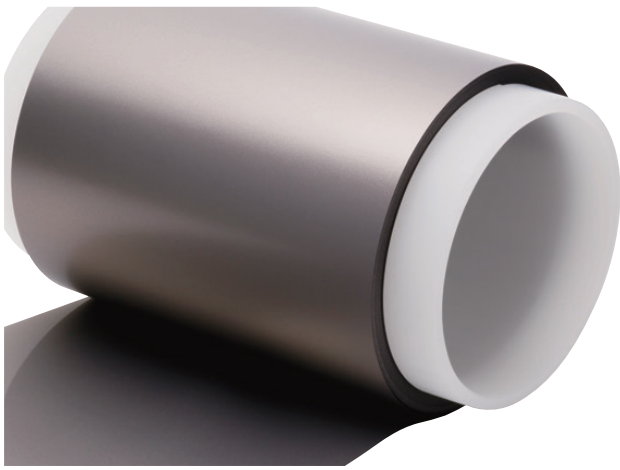


※Please contact local sales representative for detailed specification.



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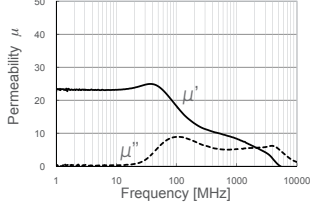
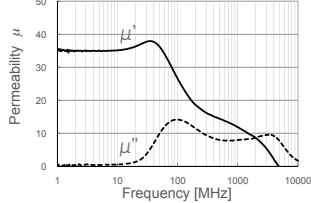
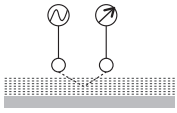
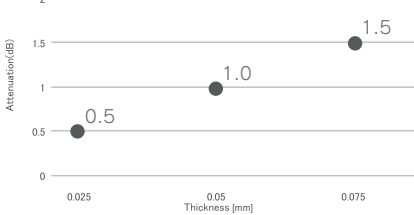
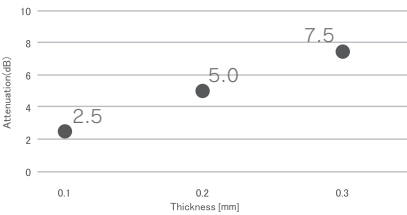




# FLEX SUPPRESSOR®

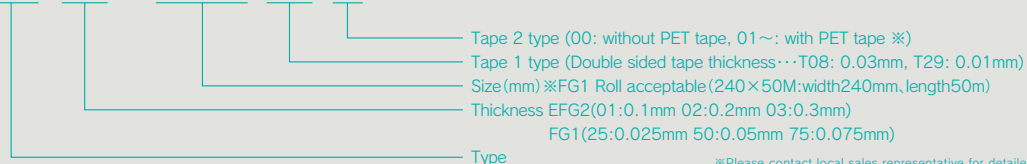
## GHz band High Performance type

Wi-Fi, GPS, LTE-A

Type	FG1 <span style="border: 1px solid black; border-radius: 10px; padding: 2px;">Red phosphorus free</span>	EFG2 <span style="border: 1px solid black; border-radius: 10px; padding: 2px;">Red phosphorus free</span>	
Effective frequency	1GHz to 10GHz		
Operating temperature	-40 to +105°C		
Thickness	0.025mm   0.05mm   0.075mm	0.1mm   0.2mm   0.3mm	
Standard dimensions	240mm×240mm 	240mm×50mm 	
Permeability at 3MHz	25 typ. 	35 typ. 	
Decoupling characteristics at 2.4GHz	 FLEX SUPPRESSOR Metal		
Specific gravity	3.1 typ.		
Surface resistivity	$1.0 \times 10^6 \Omega/\square$ typ.		
Approved standard	UL94 HB   UL File No. E176124		
Environment	RoHS compliant, Halogen free/PVC free/Lead free/Red phosphorus free		
Reflowing (260°C)	Please use double sided tape with reflowing		

### FG1/EFG2 classification \*

**EFG2 (01) - 240X240 T08 00**



※Please contact local sales representative for detailed specification.





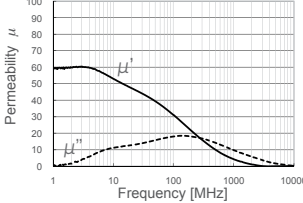
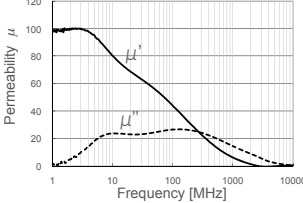
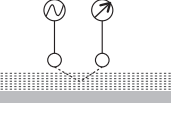
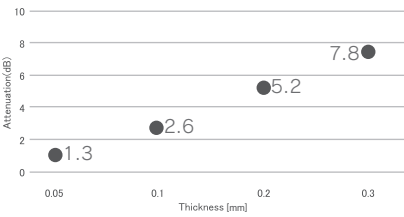
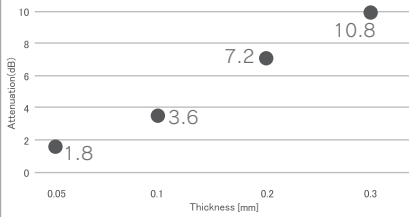


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# FLEX SUPPRESSOR®



## UL94 V-0 Flame Retardant type

Type	EFA <span style="border: 1px solid black; border-radius: 10px; padding: 2px;">Red phosphorus free</span>	FF1 <span style="border: 1px solid black; border-radius: 10px; padding: 2px;">AEC-Q200</span>
Effective frequency	Up to 10GHz	
Operating temperature	-40 to +105°C	
Thickness	0.05mm   0.1mm   0.2mm   0.3mm	0.05mm   0.1mm   0.2mm   0.3mm
Standard dimensions	240mm×240mm  240mm×50m(0.05mm,0.1mm) 240mm×30m(0.2mm) 240mm×20m(0.3mm) 	240mm×240mm  240mm×50m(0.05mm,0.1mm) 240mm×30m(0.2mm) 240mm×20m(0.3mm) 
Permeability at 3MHz	60 typ. 	100 typ. 
Decoupling characteristics at 700MHz	 	
Specific gravity	3.1 typ.	
Surface resistivity	$1.0 \times 10^6 \Omega/\square$ typ.	
Approved standard	UL94 V-0 UL File No. E176124	
Environment	RoHS compliant, Halogen free/PVC free/Lead free	
Reflowing (260°C)	Please use double sided tape with reflowing	

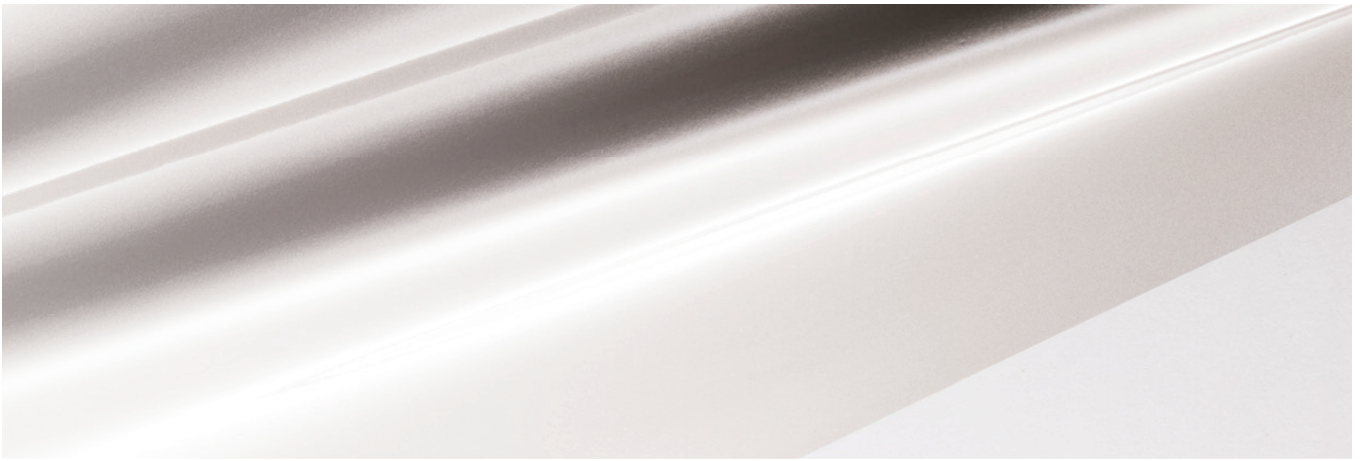
### EFA/FF1/EFF4 classification ※

<b>EFA</b>	<b>(01)</b>	<b>-</b>	<b>20X20</b>	<b>T08</b>	<b>00</b>	
						Tape 2 type (00: without PET tape, 01~: with PET tape ※) Tape 1 type (Double sided tape thickness···T08: 0.03mm, T29: 0.01mm) Size (mm) ※EFA,FF1 Roll acceptable (width 240mm, length: 0.05/0.1mm 50m 0.2mm/30m 0.3mm/20m) Thickness EFA(005:0.05mm 01:0.1mm 02:0.2mm 03:0.3mm) FF1 (50:0.05mm 100:0.1mm 200:0.2mm 300:0.3mm) EFF4(01:0.1mm 02:0.2mm 03:0.3mm 05:0.5mm)
						Type

※Please contact local sales representative for detailed specification.



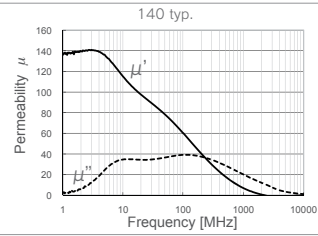
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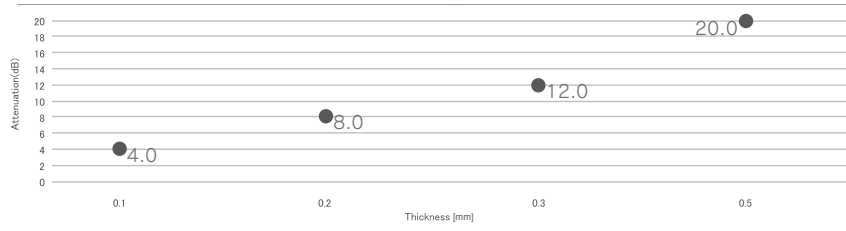
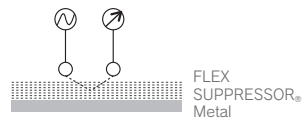
Type	EFF4 <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">AEC-Q200</span>			
Effective frequency	Up to 10GHz			
Operating temperature	-40 to +105°C			
Thickness	0.1mm	0.2mm	0.3mm	0.5mm
Standard dimensions	240mm×240mm			



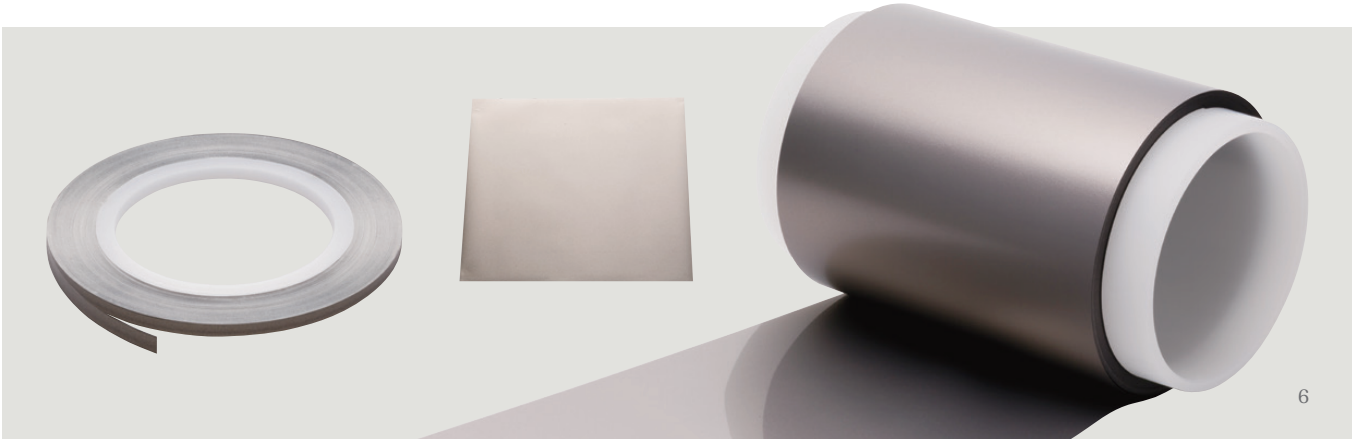
Permeability at 3MHz



Decoupling characteristics at 700MHz



Specific gravity	3.7 typ.
Surface resistivity	$1.0 \times 10^6 \Omega/\square$ typ.
Approved standard	UL94 V-0 UL File No. E176124
Environment	RoHS compliant, Halogen free/PVC free/Lead free
Reflowing (260°C)	Please use double sided tape with reflowing

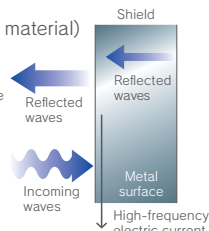


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# Shielding

## Shielding materials (metal, electrically conductive material)

- While transmitted waves can be minimized, most of the incoming waves are reflected, causing internal interference.
- High-frequency electric current occurs on the metal surfaces and reflected noise occurs at the shielding joints, metal openings, and other parts when the grounding is poor.

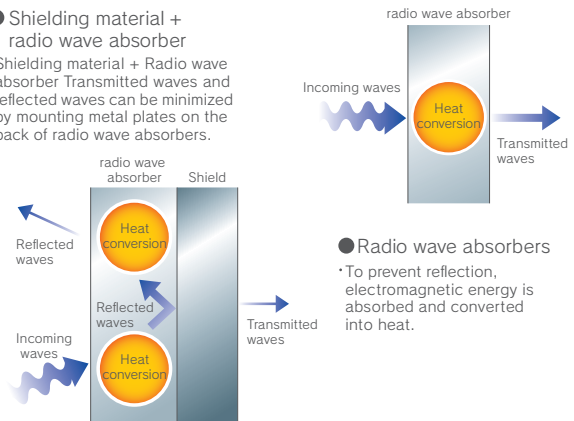


Reference : Other absorbing and reflecting examples

	Absorbing	Reflecting
Radio waves	Radio waves absorbers	Metals
Light	Black objects	White objects, Mirrors
Sound	Absorbers, Felt	Solid bodies (Concrete, etc.)

## Shielding material + radio wave absorber

- Shielding material + Radio wave absorber Transmitted waves and reflected waves can be minimized by mounting metal plates on the back of radio wave absorbers.

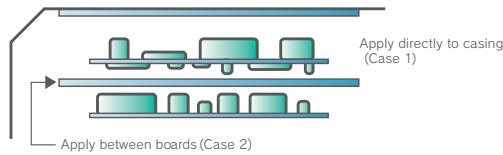


- Radio wave absorbers
- To prevent reflection, electromagnetic energy is absorbed and converted into heat.

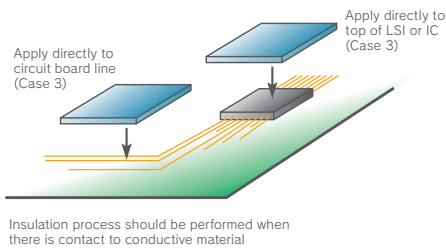
# Applications

**Case1** To suppress noise reflected by casing

**Case2** To suppress cross talk between substrates

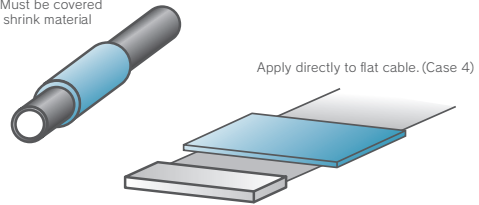


**Case3** To suppress radiation noises from LSI and IC

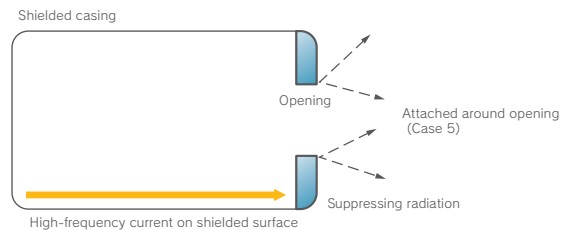


**Case4** To suppress noise from cables

Wrap FLEX SUPPRESSOR® around cable.  
Caution: Must be covered with heat shrink material (Case 4)



**Case5** To suppress noise radiation (reflected noise) from the opening of shield, casing, etc

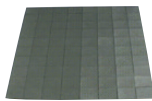


# Typical shapes

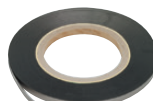
1 With holes, cut-out shapes, circular shapes



2 Precut



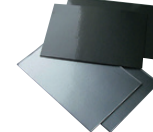
3 Reel



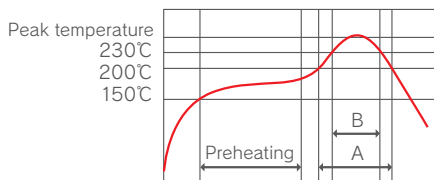
4 Roll



5 With aluminum or PET sheet



# Recommended reflow profile



Peak temperature	260°C
Preheating	150~180°C 90sec max.
A	200°C or more, 60sec max.
B	230°C or more, 40sec max.
Number of times	2 times max.



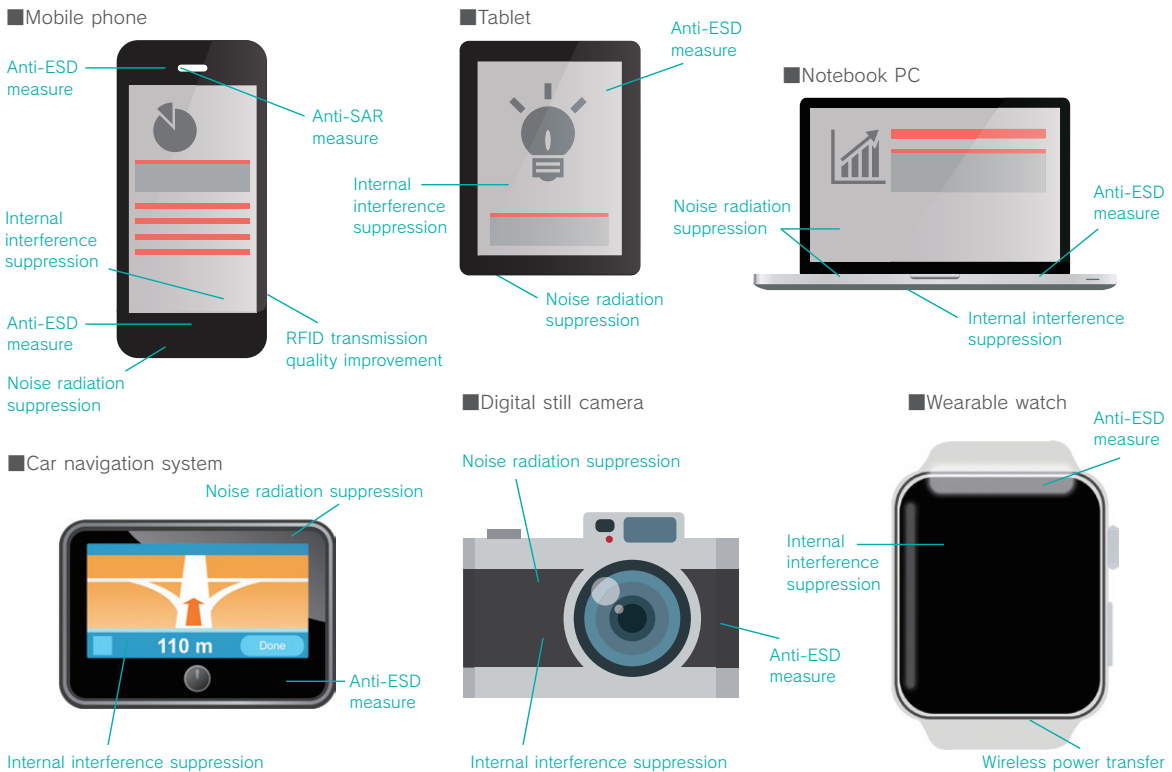
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# Noise suppressor FLEX SUPPRESSOR® Applications

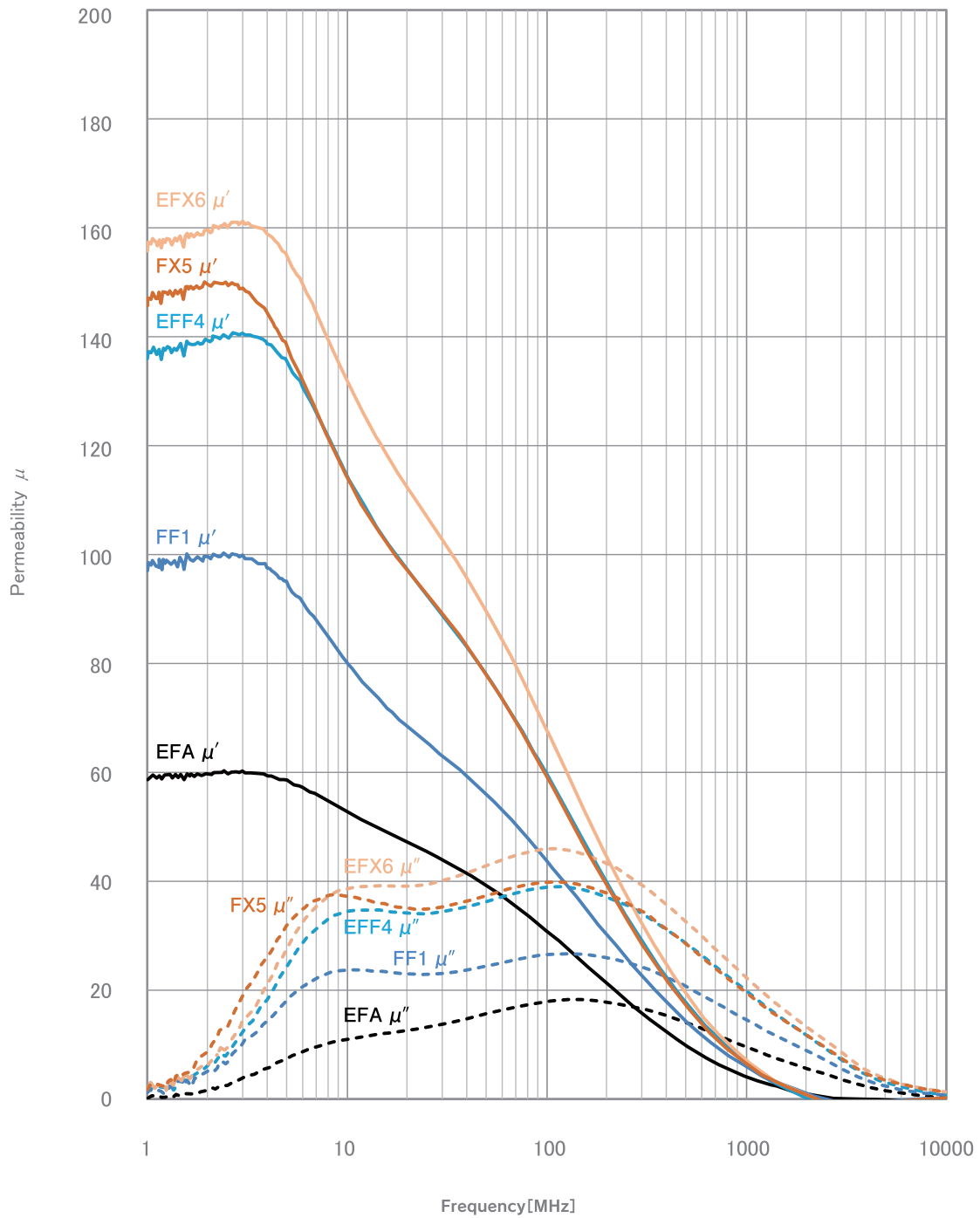
Devices	Noise radiation suppression	Internal interference suppression	RFID transmission quality improvement	Anti-ESD measure	Anti-SAR measure
Mobile phone	●On main CPU	●On FPC and LSI for LCD module and camera module ●On main CPU→ Reception improvement	●On loop antenna→ Communication distance improvement	●On FPC and LSI for LCD module and camera module ●On metal parts such as chassis	●On near antenna and chassis
DSC/DVC	●On CCD module FPD, image processing LSI, and memory slot	●On the board	●On loop antenna→ Communication distance improvement	●On the board and FPC ●On metal parts such as chassis	_____
Notebook PC/ Tablet	●On CPU and GPU ●On cables inside LCD panel	●On memory and SSD ●On wireless LAN and LTE module	●On loop antenna and metal parts near antenna→ Communication distance improvement	●On CPU and GPU ●On metal parts such as chassis	_____
Car infotainment	●On LCD and FPC ●On control box	●On GPS receiver and TV tuner ●On LSI for LCD→ Radio reception improvement	_____	●On metal parts such as chassis	_____
NFC tag	_____	_____	●On loop antenna, and metal parts near antenna→ Communication distance improvement	_____	_____
Base station, Optical transceiver module	_____	●On the interior of the chassis and on LSI→ Error rate improvement	_____	_____	_____
Wireless LAN (Wi-Fi), etc.	_____	●On cable and co-axial cable→ Reception improvement	_____	_____	_____

## Applications (Image)



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## Permeability characteristics (EFA,FF1,EFF4,FX5,EFX6)

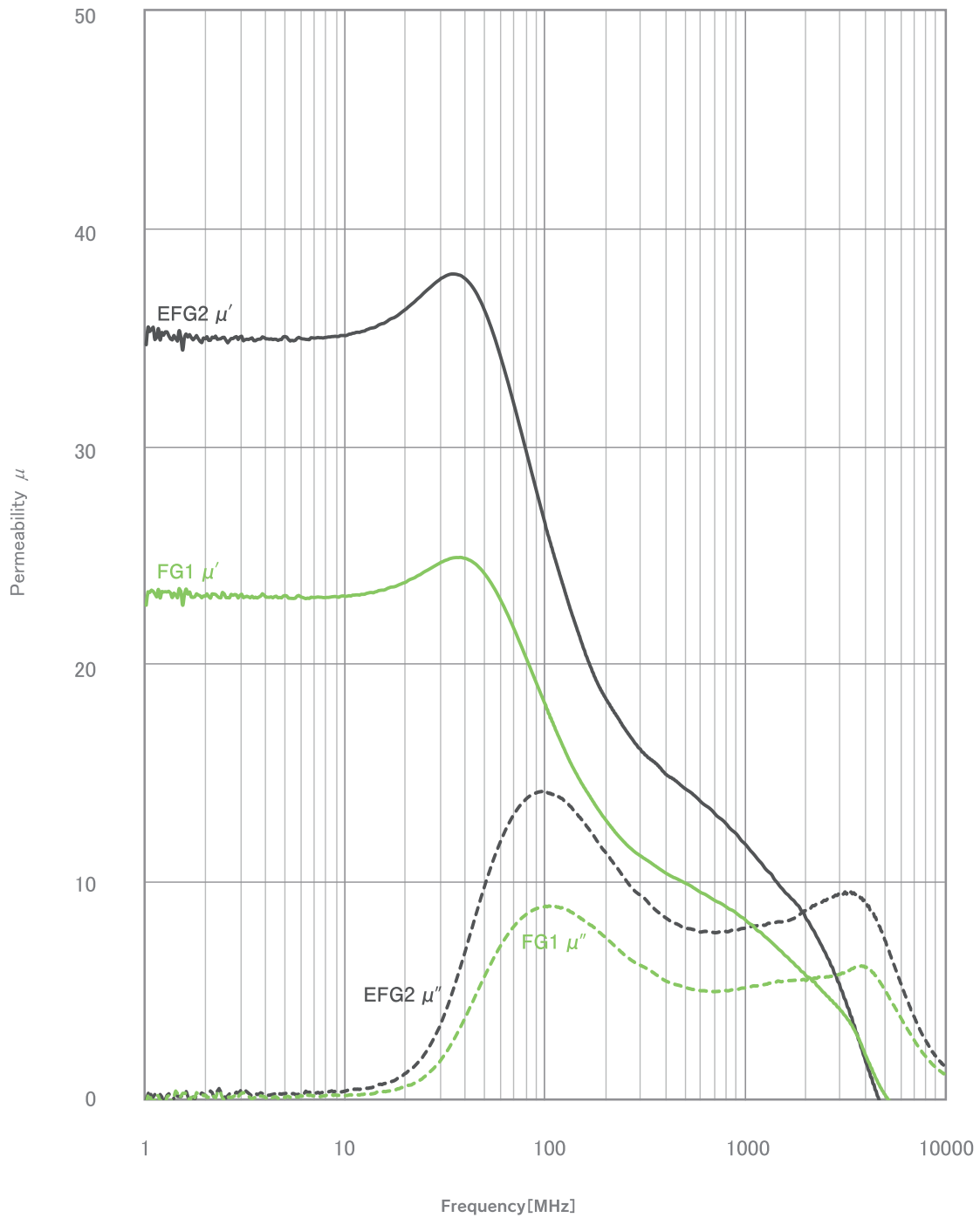


※Above data are not guaranteed values.



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## Permeability characteristics (FG1,EFG2)



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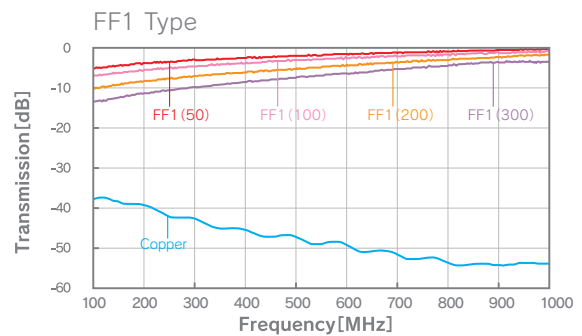
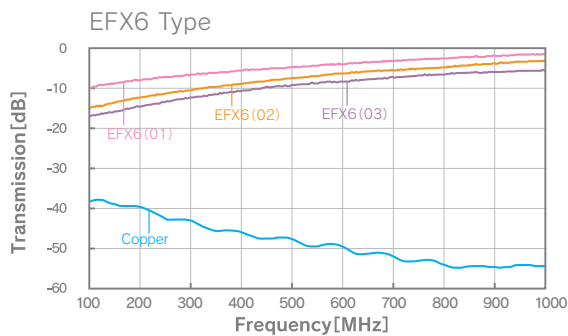
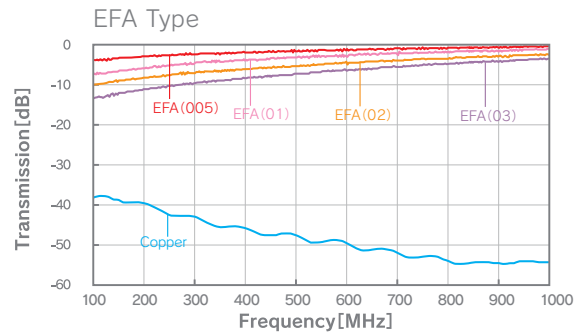
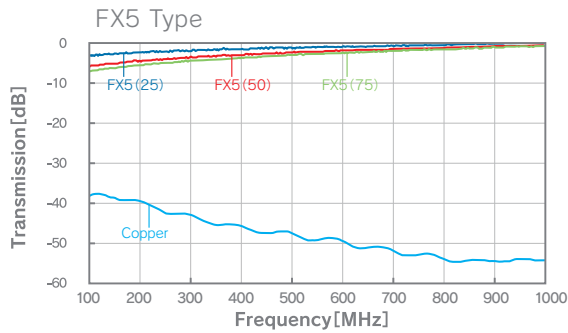


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# Radio noise attenuation characteristics in the vicinity of FLEX SUPPRESSOR®

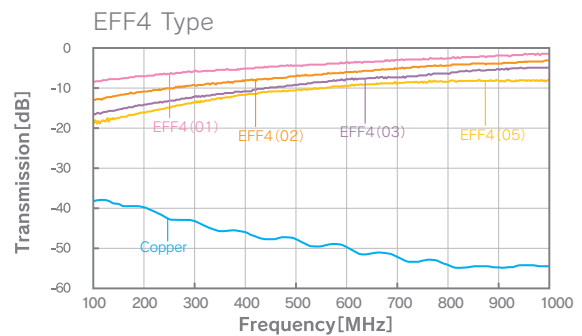
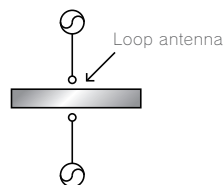
Attenuation level of transmission noise measured by micro loop antenna.

## Attenuation of transmission noise



## In-house measuring method of characteristics

Attenuation of transmission noise



※Above data are not guaranteed values.

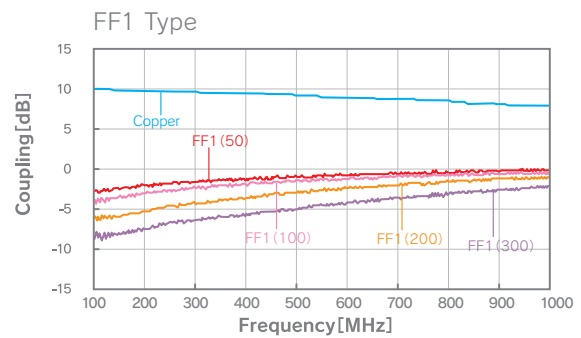
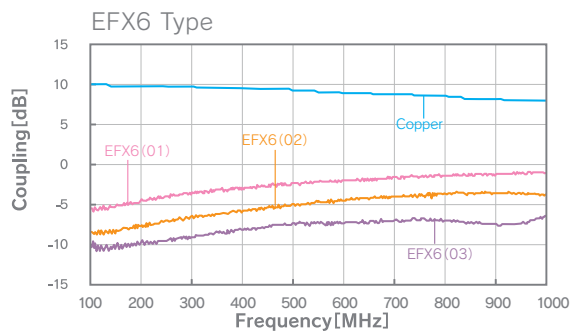
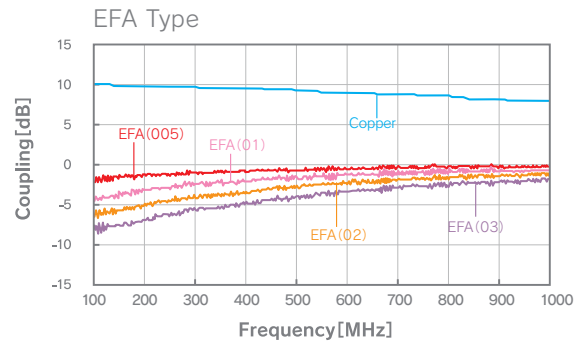
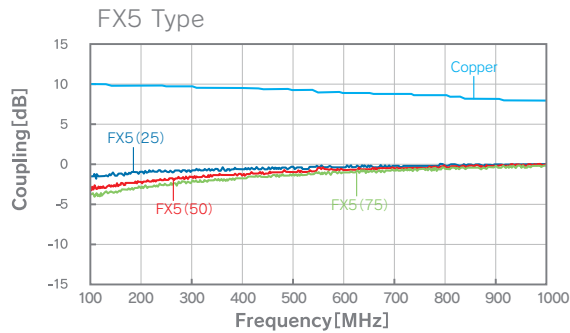


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# Radio noise attenuation characteristics in the vicinity of FLEX SUPPRESSOR®

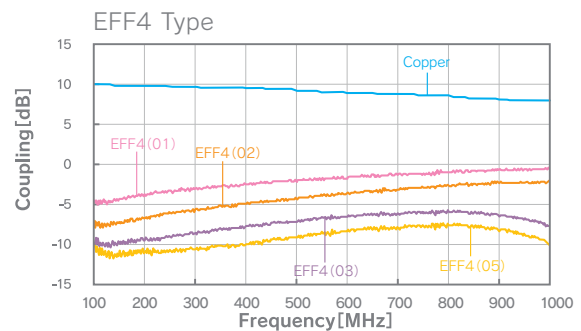
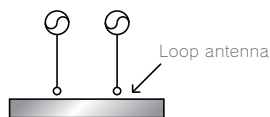
Attenuation level of coupling noise measured by micro loop antenna.

## Attenuation of coupling noise



## In-house measuring method of characteristics

Attenuation of coupling noise



※Above data are not guaranteed values.

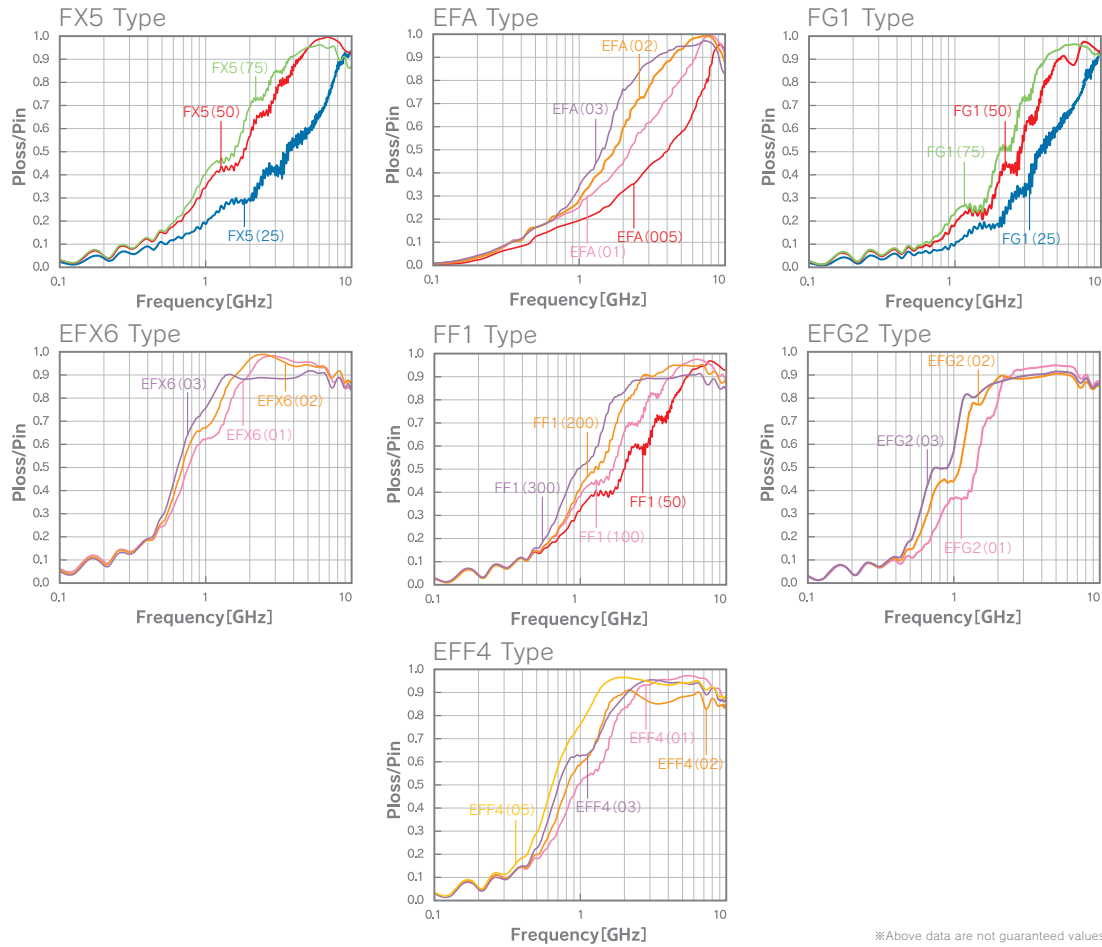


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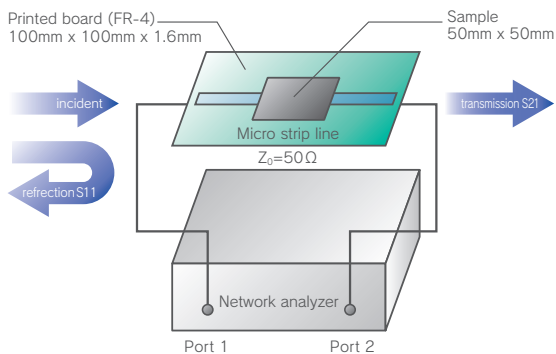


## Transmission noise attenuation characteristics

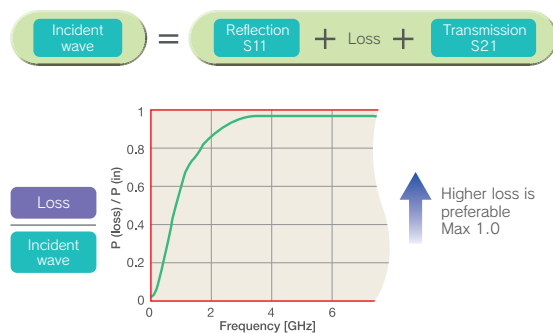
Shown in graphs below are values of transmission loss calculated from the transmission characteristics S11 and S21 measured on  $Z_0=50\Omega$  type MSL(Micro Strip Line) with FLEX SUPPRESSOR<sup>®</sup> attached.



## In-house measuring method of characteristics



## How to read the graph



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## Precautions

### ● Handling precautions

- Avoid high-temperature, humidity and direct sunlight. Storage environment should be below 40°C and below 70% relative humidity.
- The surface resistance value listed in this catalog is a reference value of the circuit parameter to indicate noise suppression. The value does not mean the product's insulation characteristics. The value may become lower if an excess pressure is applied to the product.
- Products in this catalog are not insulators. Please handle them as conductors. When in actual use, please be careful so that conductive material does not contact the surface or the edge of FLEX SUPPRESSOR<sup>®</sup> sheet. Insulation process should be performed when contact to conductive material is probable.
- Depending upon the processing procedure, powdery substance may drop out from sheet surface or edge if the cutting of the sheet is performed at the customer side. Please be careful as this powder may effect the component's performance depending on the location.
- Clean away any dust, oil or moisture from the surface of the installing area when attaching the sheet using adhesive tape.

### ● Handling of the products

- The manufacturer's warranty will not cover any disadvantage or damage caused by improper use of the products that deviates from the characteristics, specifications, or conditions for use described in this catalog.
- The products in this catalog are intended for use in ordinary electronic products. We withhold the selling of the products if any of them are to be used in special applications requiring extremely high reliability where product defects might pose a safety risk and human life.
- Though the manufacturer has taken all possible precautions to ensure the quality and reliability of its products, improper use of products may result in bodily injury, fire, or similar accident. If you have any questions regarding the use of the products in question, please consult your TOKIN sales representatives.
- Please be advised that the manufacturer accepts no responsibility for any infringement by users of the manufacturer's products on third party patents or industrial copyrights. The manufacturer is responsible only when such infringements are attributable to the structural design of the product and its manufacturing process.
- Export Control  
For customers outside Japan  
TOKIN products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.  
For customers in Japan  
For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.
- Please be advised that manufacturer accepts no responsibility for damages resulted from the misunderstanding of technical information shown in this catalog. Also, information shown in this catalog are subject to change without notice. Please contact local TOKIN sales representative for updated information.
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of TOKIN Corporation.

### ● Guarantee of characteristic value

- Descriptions in this catalog regarding product characteristics and quality are based solely on discrete components. When using these components, be sure to check the specifications with the component in question mounted on the products.
- The names of the products and the specifications in this catalog are subject to change without notice for the sake of improvement. The manufacturer also reserves the right to discontinue any of these products. At the time of delivery, please ask for specifications sheets to check the contents in order to use the products properly and safely.

## Information on environmentally influential substances

The FLEX SUPPRESSOR<sup>®</sup> does not contain substances listed below:

### (1) Ozone depleting substance

- CFC (chlorofluorocarbon)
- Halon
- Carbon tetrachloride
- 1,1,1-Trichloroethane
- HCFC (hydrochlorofluorocarbon)
- HBFC (hydrobromofluorocarbon)
- Methyl bromide

### (2) Substances regulated by RoHS order

- Lead and lead compound
- Mercury and mercury compound
- Cadmium and cadmium compound (content of plastics are below 5ppm)
- Hexavalent chromium and hexavalent chromium compound
- PBB (polybrominated biphenyl) and its kind
- PBDE (polybrominated diphenylether)

### (3) Other environmentally influential substances (examples)

- PCB (polychlorinated biphenyl)
- Polychlorinated naphthalene
- Hexachlorobenzene
- Organotin compounds (tributyl tin, triphenyl tin)
- Asbestos
- Azo compound
- Chlorinated paraffin and its kind (paraffin chloride, Chlorinated paraffin and chloroparaffin)
- Radioactive substance
- PVC

\*Please contact our sales person for details.



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