Devices thru Material Innovation

NEC/TOKIN

FLEX SUPPRESSOR®

Noise suppression sheet

Vol.16

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●All specifications in this catalog and production status of products are subject to change without notice. Prior to the purchase, please contact NEC TOKIN for updated product data.
●Please request for a specification sheet for detailed product data prior to the purchase.
●Before using the product in this catalog, please read "Precautions" and other safety precautions listed in the printed version catalog.

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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.

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FLEX SUPPRESSOR®

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.

Features

- Usable in quasi microwave ranges → Can be used in highspeed clocks (Up to 10GHz).
- Thin, flexible material → Can be used in portable equipment.
- Virtually no limitation in where it can be used → Less time required for installation.
- Can be manufactured in a variety of shapes/sizes → Usable in a wide variety of applications.
- Resonance suppression → Controls the high frequency current and suppresses unwanted electromagnetic resonance by creating impedance.
- Electromagnetic wave suppression → Suppresses the electromagnetic wave intruding the sheet by the magnetic loss of its composition.

Applications

- Radiation noise suppression in all kinds of electronic equipment.
- Quasi microwave range interference prevention inside and in between electronics.
- Mobile communications equipment, wireless equipment (BS,CS tuners), office automation equipment (personal computers,TFT LCDs,etc.), communication terminals in audio/video equipment, digital exchanges, etc.

Main Benefits

- In open space → Act as EMI suppressor to radiated noise waves.
- Affixing on boards and cables → Attenuation of noise current in the signal line.
- Suppress the radiation noise from cables that are acting as an antenna for noise frequency band.

Intellectual Property Right

- FLEX SUPPRESSOR® is a registered trademark of NEC TOKIN.
- The FLEX SUPPRESSOR® hold patent number 3528427 and other intellectual property regarding its structure, manufacturing process and usages.

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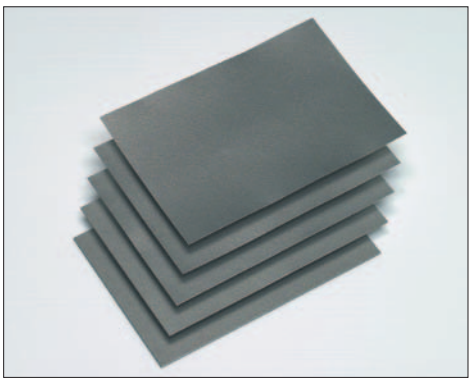
FLEX SUPPRESSOR® HALOGEN FREE

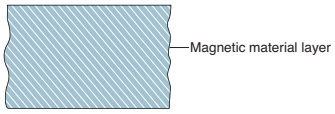
Halogen free type



Outline

- Lowered impact to the environment. Halogen free.
- EFF type has highest level permeability (μ130) in the market among halogen free type with flame retardant. It can deliver the same performance with a thinner profile and is ideal for EMI shield for small size devices.
- EFA type has acquired flame retardant (UL 94V-0 certified), and is free of red phosphorus and halogens.
- EFG type is ideal for high-frequency regulation compliance and spurious suppression in wireless applications because it has excellent attenuation characteristics for Wi-Fi bandwidths or higher.

Structural Diagram



Specifications *1

Features		Standard specifications	High magnetic permeability type	Extra high magnetic permeability type	Flame retardant type, Red phosphorus free type	High frequency specifications
Type		EFR	EFX	EFF	NEW EFA	NEW EFG
Effective Frequency		Up to 10GHz				
Operating temperature	(˚C)	-40 to +105				
Thickness	(mm)	0.05, 0.1, 0.2, 0.3, 0.5, 1.0	0.05, 0.1, 0.2, 0.3, 0.5	0.1, 0.2, 0.3	0.05, 0.1,(0.2,0.3)*3	0.05, 0.1, 0.2, 0.3
Standard Dimensions	(mm)	240 × 240			240 × 240 / Roll acceptable	240 × 240
Specific gravity *2		2.8 (typ.)	3.2 (typ.)	3.6 (typ.)	3.1 (typ.)	3.0 (typ.)
Tensile strength	(Mpa)	3.6 (min.)	6.8 (min.)	6.9 (min.)	6.8 (min.)	3.5 (min.)
Surface resistance	(Ω)	1.0×10^6 (min.)	1.0×10^5 (min.)	1.0×10^5 (min.)	1.0×10^6 (min.)	1.0×10^5 (min.)
Thermal conductivity	(W/m K)	0.22	0.22 (typ.)	0.4 (typ.)	1.3 (typ.)	0.22 (typ.)
Approved standard		UL94 V-0	—	UL94 V-0		UL94 V-1
		UL File No.E176124	—	UL File No.E176124		
Environment	RoHS	Compliant				
	Others	Halogen free, PVC free, Lead free	Red phosphorus free, Halogen free, PVC free, Lead free	Halogen free, PVC free, Lead free	Red phosphorus free, Halogen free, PVC free, Lead free	Halogen free, PVC free, Lead free
Relative magnetic permeability	(at.1MHz)	60 (typ.)	100 (typ.)	130 (typ.)	60 (typ.)	20 (typ.)
Remarks		μ60 high permeability. Various thickness. Flame retardant (UL94 V-0 certified)	μ100 high permeability. Various thickness.	Industry's highest magnetic permeability of μ130 with halogen free composition. Flame retardant (UL94 V-0 certified)	μ60 high permeability. Red phosphorus free. Flame retardant (UL94 V-0 certified)	Excellent suppression of high-frequency noise in Wi-Fi and higher bandwidths.

*1 Above specifications are for FLEX SUPPRESSOR® alone. (adhesives and etc. not included) *2 Value in 23˚C atmosphere.
*3 Sheets with 0.2mm and 0.3mm thickness are lamination of 0.1mm sheets.

Classification *4

EFR (01) – 20 × 20 T08 00 S

- S: precut type *5
- 00: Tape 2 type (With PET tape ··· 00: without PET tape)
- T08: Tape 1 type (Adhesive tape thickness ··· T08: 0.03mm, T15: 0.14mm, T36: 0.01mm)
- 20 × 20: Size (mm)
- (01): Thickness (005: 0.05mm, 01: 0.1mm, 02: 0.2mm, 03: 0.3mm, 05: 0.5mm)
- EFR: Type

*4 Please contact local sales representative for detailed specification.
*5 FLEX SUPPRESSOR® and adhesive layer are being cut into designeted form but the release paper below is left uncut for handling convenience.

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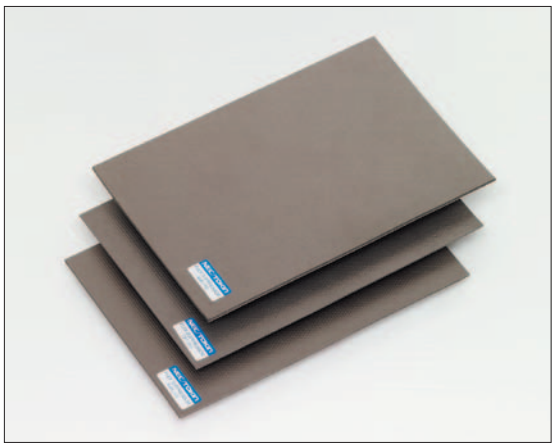
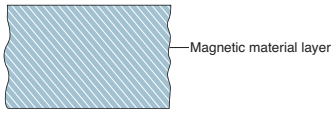
FLEX SUPPRESSOR®



Outline

● Type FK2, FK3 realizes high magnetic permeability characteristics (μ100).
Its five fold magnetic permeability to the standard K4E type means that a thinner piece can achieve the same result, and therefore it is suitable for EMI prevention applications in small devices.

Structural Diagram



Specifications *1

Features		Standard specifications	High magnetic permeability type	High magnetic permeability type
Type		K4E	FK2	NEW FK3
Effective Frequency		Up to 10GHz		
Operating temperature	(°C)	-25 to +85		
Thickness	(mm)	0.3, 0.5, 1.0	0.5	0.05, 0.1, (0.2,0.3) *3
Standard Dimensions	(mm)	500 × 160	240 × 240	240 × 240 / Roll acceptable
Specific gravity *2		3.0 (typ.)	3.1 (typ.)	
Tensile strength	(Mpa)	3.4 (min.)	4.0 (min.)	
Surface resistance	(Ω)	1.0×10^6 (min.)		
Thermal conductivity	(W/m K)	0.22 (typ.)	0.35 (typ.)	
Approved standard		UL94 V-1	UL94 V-0	
		UL File No.E176124		
Environment	RoHS	Compliant		
	Others	PVC Free, Lead Free		
Relative magnetic permeability (at.1MHz)		20 (typ.)	100 (typ.)	
Remarks		Standard model	μ100 high permeability	

*1 Above specifications are for FLEX SUPPRESSOR® alone. (adhesives and etc. not included) *2 Value in 23°C atmosphere.
*3 Sheets with 0.2mm and 0.3mm thickness are lamination of 0.1mm sheets.

Classification *4

K4E (03) – 20 × 20 T08 00 S

- S: precut type *5
- 00: Tape 2 type (With PET tape ···00: without PET tape)
- T08: Tape 1 type (Adhesive tape thickness ···T08: 0.03mm, T15: 0.14mm, T36: 0.01mm,)
- 20 × 20: Size (mm)
- (03): Thickness (03: 0.3mm, 05: 0.5mm, 10: 1.0mm)
- K4E: Type

*4 Please contact local sales representative for detailed specification.
*5 FLEX SUPPRESSOR® and adhesive layer are being cut into designeted form but the release paper below is left uncut for handling convenience.

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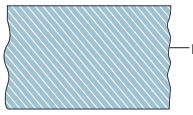
FLEX SUPPRESSOR®
High Thermal Conductivity Type

HALOGEN FREE

Outline *1

- With 10times greater thermal conductivity, compared to conventional K4E type, this model can cunteract to the noise and the heat at the same time.
- Heat resistant up to 130C. Flame resistant.
- Halogen free.

Structural Diagram



Specifications *1

Features		Standard specifications
Type		**HF2**
Effective Frequency		Up to 10GHz
Operating temperature	(℃)	-40 to +130
Thickness	(mm)	0.3, 0.5, 1.0
Standard Dimensions	(mm)	400 × 160
Specific gravity *2		4.9 (typ.)
Tensile strength	(Mpa)	1.5 (min.)
Surface resistance	(Ω)	1.0×10^{6} (min.)
Thermal conductivity	(W/m K)	2.0 (typ.)
Approved standard		UL94 V-0
		UL File No.E176124
Environment	RoHS	Compliant
	Others	Halogen free, PVC Free, Lead Free
Remarks		Thermal conductivity improved model.

*1 Above specifications are for FLEX SUPPRESSOR® alone. (adhesives and etc. not included) *2 Value in 23℃ atmosphere.

Classification *3

HF2 (05) – 20 × 20 T36 00 S

- S: precut type *4
- 00: Tape 2 type (With PET tape ···00: without PET tape)
- T36: Tape 1 type (Adhesive tape thickness ···T36: 0.01mm)
- 20 × 20: Size(mm)
- (05): Thickness(03: 0.3mm, 05: 0.5mm, 10: 1.0mm)
- HF2: Type

*3 Please contact local sales representative for detailed specification.
*4 FLEX SUPPRESSOR® and adhesive layer are being cut into designeted form but the release paper below is left uncut for handling convenience.

Thermal resistance (℃/W) *5

Sheet size	Specification		
	HF2 (03)	HF2 (05)	HF2 (10)
10mm × 10mm	1.50	2.50	5.00
20mm × 20mm	0.38	0.63	1.25
30mm × 30mm	0.17	0.28	0.56

*5 Above values are calculated from the formula below.
Formala $R = \frac{L}{A} \times \frac{1}{\lambda}$
R:Thermal resistance(℃/W) λ:Thermal conductivity(W/m·K)
L:Specimen's thickness(m) A:Specimen's area(m^2)

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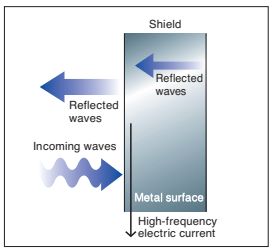
Shielding

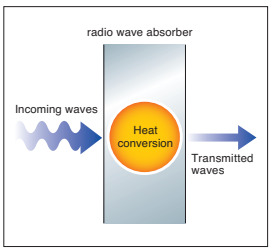
●Shielding materials
(metal, electrically conductive material)

- 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.



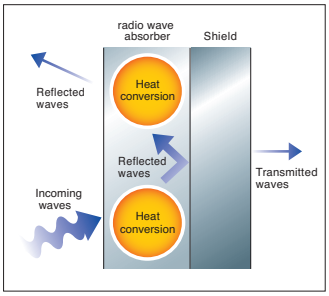
●Radio wave absorbers

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



●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.



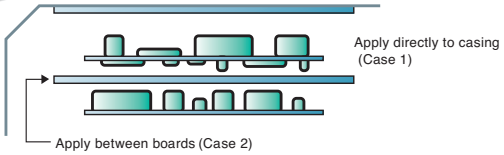
Reference : Other absorbing and reflecting examples

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

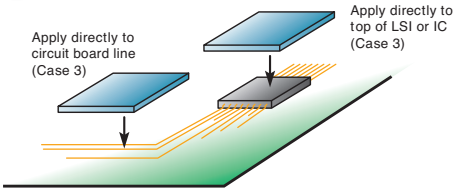
Applications

Case1 To suppress noise reflected by casing

Case2 To suppress cross talk between substrates



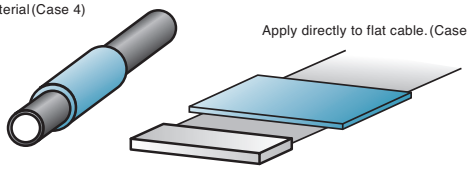
Case3 To suppress radiation noises from LSI and IC



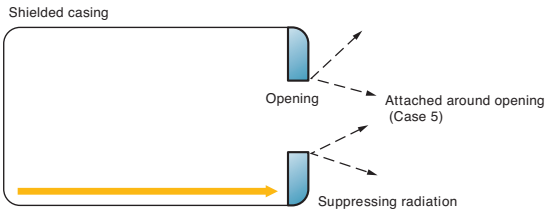
Insulation process should be performed when there is contact to conductive material

Case4 To suppress noise from cables

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

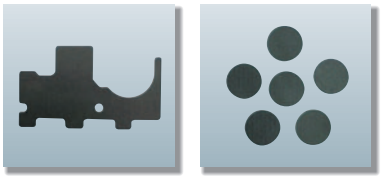


Case5 To suppress noise radiation (reflected noise) from the opening of shield, casing, etc

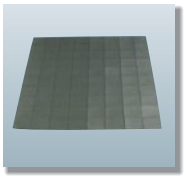


Typical shapes

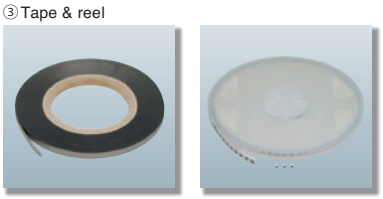
① With holes, cut-out shapes, circular shapes



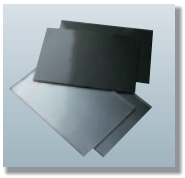
② Precut



③ Tape & reel



④ With aluminum or PET sheet



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Noise suppressor FLEX SUPPRESSOR® Applications

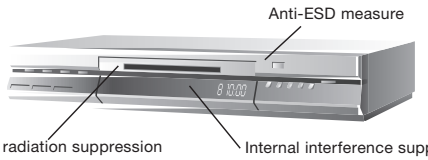
Devices	Noise radiation suppression	Internal interference suppression	RFID transmission quality improvement	Anti-ESD measure	Anti-SAR measure
Mobile phone	・On main CPU	・On FPC and LSI for LCD module and camera module ・On main CPU → reception improvement	・On loop antenna → Communication distance improvement	・On FPC and LSI of LCD module and camera module ・On metal parts such as chasis	・Near antenna ・Around touch panel
DSC/DVC	・On CCD module FPD, image processing LSI, and Memory slot	・On the board	—	・On the board and FPC ・On metal parts such as chasis	—
Notebook PC	・On CPU and GPU ・On cables inside LCD panel ・On I/O e.g. PCMCA and memory slot	・On the TV tuner → beat noise countermeasure ・On wireless LAN module	・On loop antenna and metal parts near antenna → Communication distance improvement	・On CPU and GPU ・On metal parts such as chasis	—
DVD/BD	・On LSI and FPC near optical pickup ・On MPEG chip	・On the board and on FPC	—	・On metal parts such as chasis	—
Car audio & visual	・On LSI, flexible board	・On GPS receiver and TV tuner ・On LSI for LCD→Radio reception improvement	—	・On metal parts such as chasis	—
RFID/RW	—	—	・On loop antenna, and metal parts near antenna → Communication distance improvement	—	—
Optical reception module	—	・On the interior of the chasis and on LSI → error rate improvement	—	—	—
Wireless LAN	—	・On Cable and co-axial cable→Reception improvement	—	—	—
Scanner	・On scanner head board and FPC	—	—	—	—
HDD	・On I/F cable	—	—	—	—

Applications (Image)

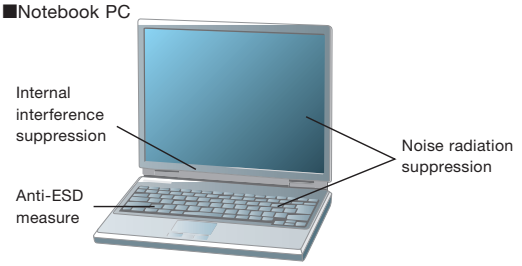
■Mobile phone

■Digital still camera

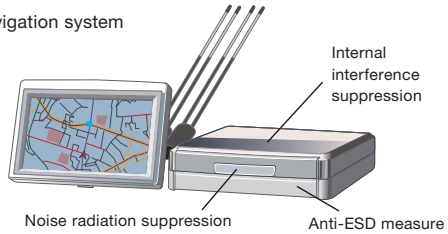
■DVD recorder



■Notebook PC



■Car navigation system



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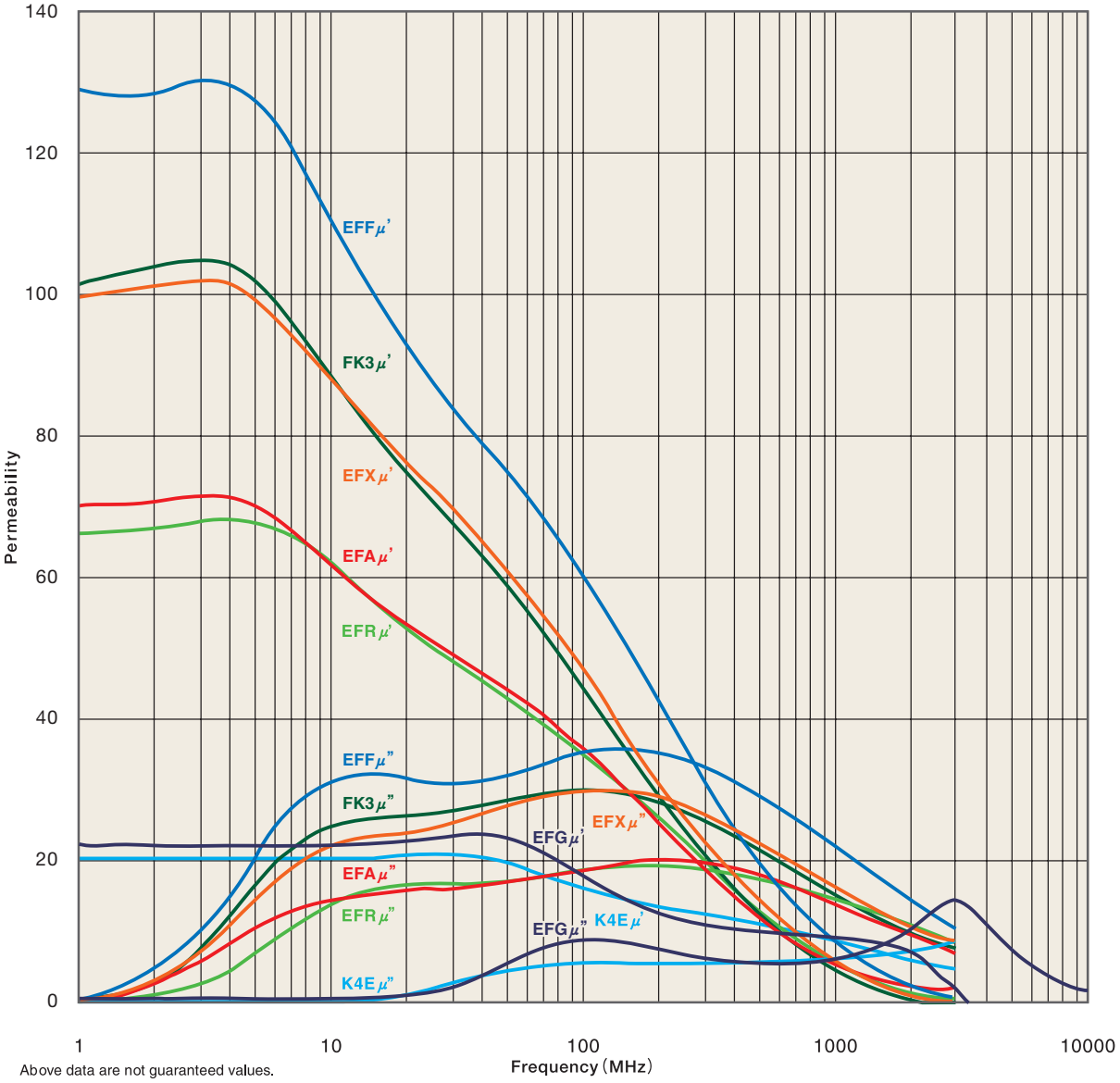
Characteristic Example 1 : Permeability characteristics



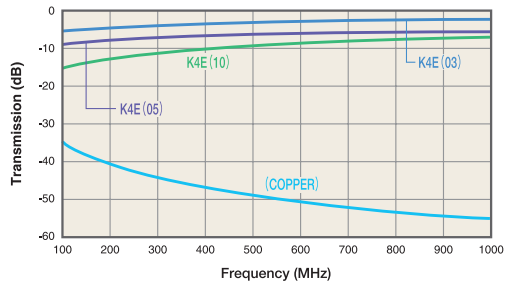
Above data are not guaranteed values.

Characteristic Example 2 : Radio noise attenuation characteristics in the vicinity of FLEX SUPPRESSOR®

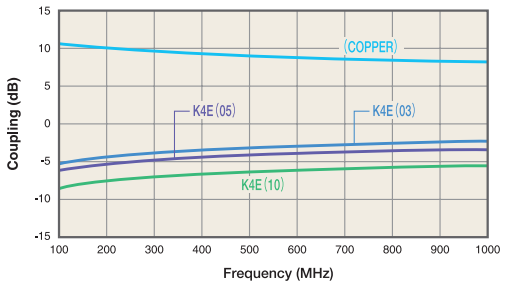
Attenuation level of transmission noise and coupling noise measured by micro loop antenna.

TYPE / K4E

● Attenuation of transmission noise

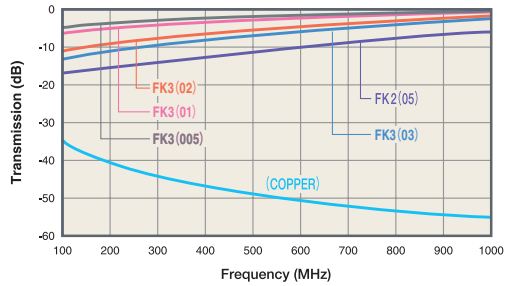


● Attenuation of coupling noise

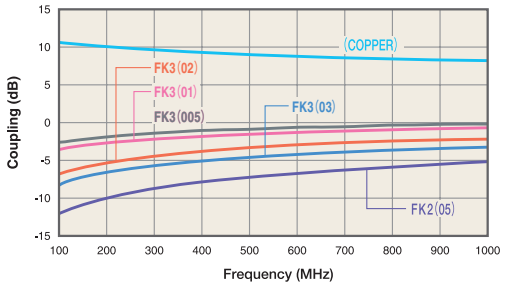


TYPE / FK2、FK3

● Attenuation of transmission noise

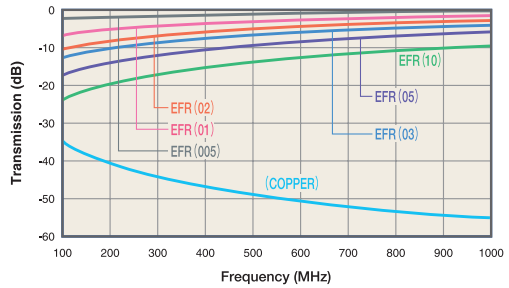


● Attenuation of coupling noise

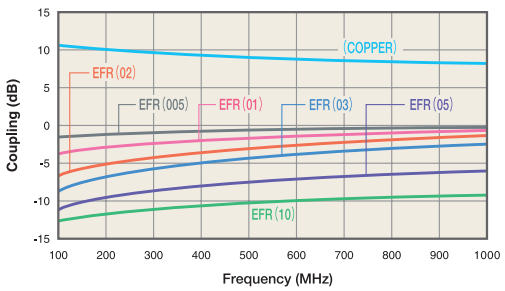


TYPE / EFR

● Attenuation of transmission noise

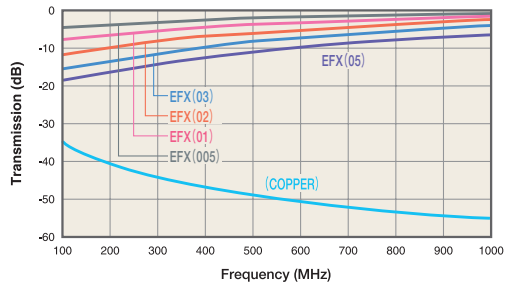


● Attenuation of coupling noise

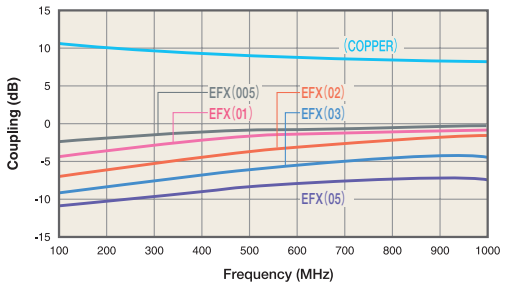


TYPE / EFX

● Attenuation of transmission noise

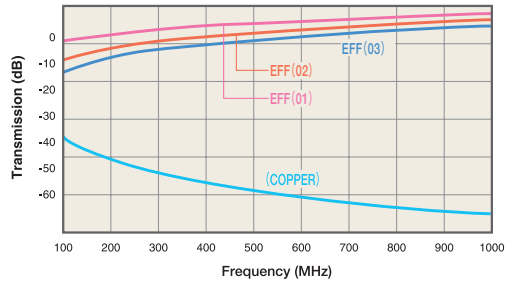


● Attenuation of coupling noise

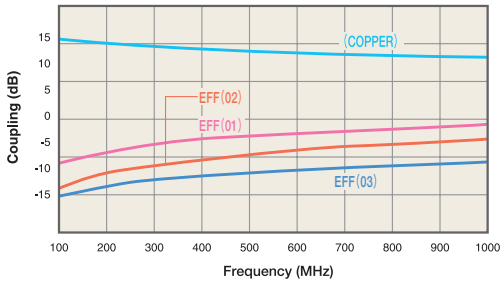


TYPE / EFF

● Attenuation of transmission noise

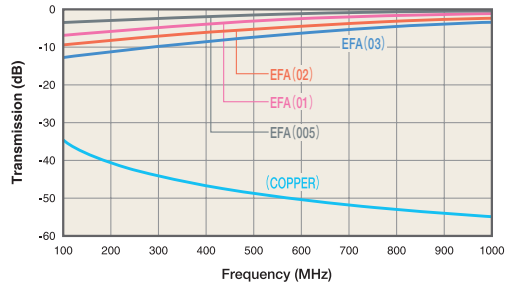


● Attenuation of coupling noise

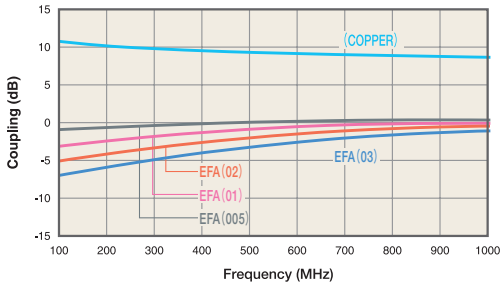


TYPE / EFA

● Attenuation of transmission noise



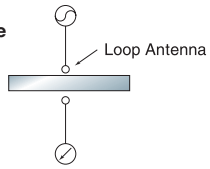
● Attenuation of coupling noise



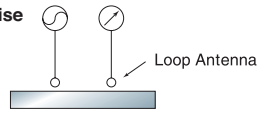
Above data are not guaranteed values.

In-house measuring method of Characteristic Example 2

●Attenuation of transmission noise



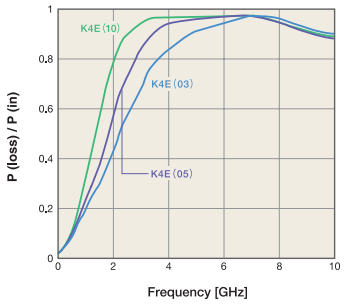
●Attenuation of coupling noise



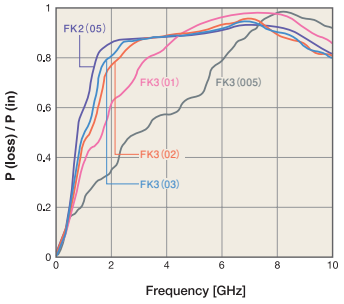
Characteristic Example 3 : Transmission noise attenuation characteristics

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

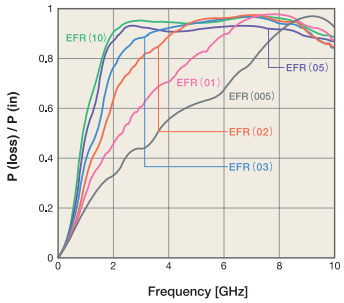
TYPE / K4E



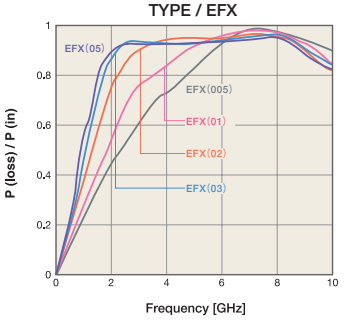
TYPE / FK2、FK3



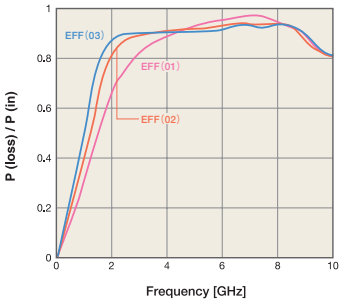
TYPE / EFR



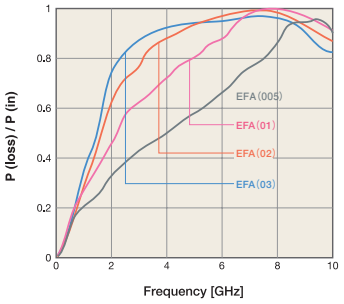
TYPE / EFX



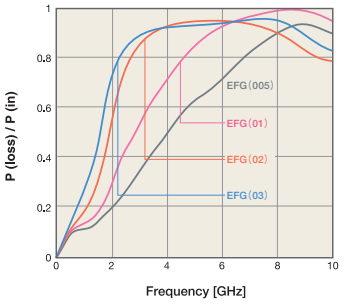
TYPE / EFF



TYPE / EFA

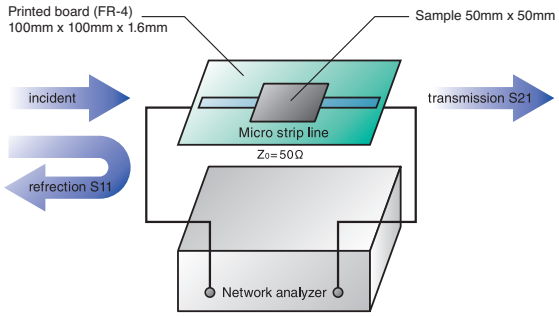


TYPE / EFG

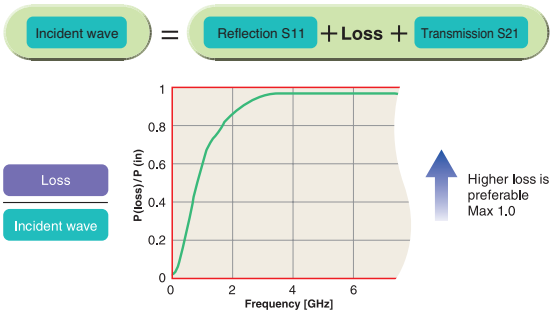


Above data are not guaranteed values.

In-house measuring method of Characteristic Example 3



Characteristic Example 3 : How to read the graph



Precautions

● Handling precautions

- Avoid high-temperature, humidity and direct sunlight. Storage environment should be below 40℃ 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® 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 NEC TOKIN sales representatives.
- Please be advised that the manufacturer accepts no responsibility for any infraction by users of the manufacturer's products on third party patents or industrial copyrights. The manufacturer is responsible only when such infractions are attributable to the structural design of the product and its manufacturing process.
- Should any of these products come under the category of strategic goods or services (according to Japan's foreign trade and foreign exchange regulations), the sender must obtain an export license from the Japanese Government before said products can be exported outside Japan.
- 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 NEC 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 NEC 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 sureto 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® does not contain substances listed below:

(1) Ozone depleting substance

- CFC (chlorofluorocarbon)
- Halon
- Carbon tetrachloride
- 1,1,1-Trichloroethane
- HCFC (hydrochlorofluorocarbon)
- HBFC (hydrobromfluorcarbon)
- 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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●All specifications in this catalog and production status of products are subject to change without notice. Prior to the purchase, please contact NEC TOKIN for updated product data.
●Please request for a specification sheet for detailed product data prior to the purchase.
●Before using the product in this catalog, please read "Precautions" and other safety precautions listed in the printed version catalog.

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