Flex Suppressor®

EF Series

Electronic Components
KEMET
CHARGED.

Overview

The EF Series Flex Suppressor® is an effective suppressor for high frequency noise generated from electronic devices. The flexible sheet is a polymer base blended with micron sized magnetic powders dispersed into the material. The EF Series are effective for resonance and wave suppression, and can be cut into virtually any shape.

Applications

- Radiation noise suppression for electronic equipment
- Quasi-microwave range interference prevention inside and in between electronics
- Mobile communications equipment, wireless equipment (Wi-Fi, Bluetooth), office automation equipment (personal computers, TFT LCD's etc.), communication terminals in audio/video equipment, digital exchanges, etc.
- ESD (electro static discharge) countermeasure

Benefits

- Usable in quasi-microwave ranges
- Can be used in high-speed clocks (Up to 10 GHz)
- Thin, flexible material used in portable equipment
- Virtually no limitation in where it can be used
- Less time required for installation
- 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

Part Number System

EFR	(01)-	240x240	T08	00
Series Type	Thickness	Standard Dimensions (mm)	Tape 1 Type Adhesive Tape Thickness	Tape 2 Type
EFR EFX EFF EFA EFH EFG	(003)- = 0.03 mm (005)- = 0.05 mm (007)- =0.07 mm (01)- = 0.1 mm (02)- = 0.2 mm (03)- = 0.3 mm (05)- = 0.5 mm (10)- = 1.0 mm	240 x 240	T08 = 0.03 mm T15 = 0.14 mm T22 = 0.05 mm T29 = 0.01 mm Blank = No adhesive tape	00 = Without PET tape Blank = Without Tape 1 Type

Specifications

Features		Standard Specifications	High Magnetic Permeability Type	Extra High Magnetic Permeability Type	Flame Retardant Type, Red Phosphorus Free Type	High Frequency	High Temp. Reflow
Type		EFR	EFX	EFF	EFA	EFG	EFH
Effective Frequency		Up to 10 GHz					
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	0.07/0.1/0.2/0.3	0.03/0.05/0.1/(0.2/0.3)[2]	0.05/0.1/0.2/0.3	0.05/0.1
Standard Dimensions (mm)		240 x 240			240 x 240 (roll on request)	240 x 240	
Specific Gravity[1]		2.8 typical	3.2 typical	3.6 typical	3.1 typical	3.0 typical	3.1 typical
Tensile Strength (Mpa)		3.6 minimum	6.8 minimum	6.9 minimum	6.8 minimum	3.5 minimum	6.8 minimum
Surface Resistance (Ω)		1.0 x 10^6 minimum	1.0 x 10^5 minimum	1.0 x 10^5 minimum	1.0 x 10^6 minimum	1.0 x 10^5 minimum	1.0 x 10^6 minimum
Thermal Conductivity (W/m K)		0.22	0.22	0.4	1.3	0.22	1.3
Approved Standard		UL94 V-0	UL94 HB	UL94 V-0		UL94 V-1	UL94 V-0
		UL File No. E176124					UL File No. E176124
Environment	RoHS	Compliant					
	Halogen	Free					
	PVC	Free					
	Lead	Free					
	Red Phosphorus	—	Free	—	Free	—	Free
Relative Magnetic Permeability (at 3 MHz)		60 typical	100 typical	130 typical	60 typical	20 typical	60 typical
Remarks		µ60 high permeability Various thickness Flame retardant (UL 94 V-0 certified)	µ100 high permeability Various thickness	Industry's highest magnetic permeability of µ130 with halogen free composition. Flame retardant (UL 94 V-0 certified)	µ60 high permeability. Red phosphorus free Flame retardant (UL 94 V-0 certified)	Excellent suppression of high frequency noise in Wi-Fi and higher bandwidths.	Can be mounted before reflowing

Above specifications are for the Flex Suppressor® alone (adhesives and etc. not included)

[1] Value in 23°C atmosphere

[2] Sheets with 0.2 mm and 0.3 mm thickness are lamination of 0.1 mm sheets.

Table 1 – Ratings & Part Number Reference

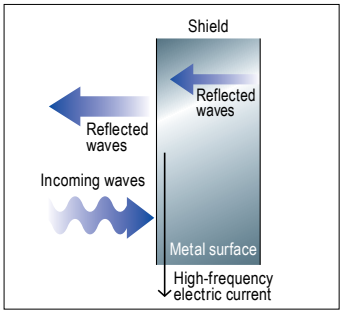
Part Number	Series	Thickness (mm)	Tape Thickness (mm)	Relative Magnetic Permeability @ 3 MHz	Specific Gravity (typical)	Tensile Strength (Mpa minimum)	Surface Resistance (Ω minimum)	Thermal Conductivity (W/m K)
EFR(005)-240x240T0800	EFR	0.05	0.03	60	2.8	3.6	1.0 x 10^6	0.22
EFR(01)-240x240T0800	EFR	0.1	0.03	60	2.8	3.6	1.0 x 10^6	0.22
EFR(02)-240x240	EFR	0.2	--	60	2.8	3.6	1.0 x 10^6	0.22
EFR(02)-240x240T0800	EFR	0.2	0.03	60	2.8	3.6	1.0 x 10^6	0.22
EFR(03)-240x240	EFR	0.3	--	60	2.8	3.6	1.0 x 10^6	0.22
EFR(03)-240x240T0800	EFR	0.3	0.03	60	2.8	3.6	1.0 x 10^6	0.22
EFR(05)-240x240	EFR	0.5	--	60	2.8	3.6	1.0 x 10^6	0.22
EFR(05)-240x240T1500	EFR	0.5	0.14	60	2.8	3.6	1.0 x 10^6	0.22
EFR(10)-240x240	EFR	1	--	60	2.8	3.6	1.0 x 10^6	0.22
EFR(10)-240x240T1500	EFR	1	0.14	60	2.8	3.6	1.0 x 10^6	0.22
EFX(005)-240x240T0800	EFX	0.05	0.03	100	3.2	6.8	1.0 x 10^5	0.22
EFX(01)-240x240T0800	EFX	0.1	0.03	100	3.2	6.8	1.0 x 10^5	0.22
EFX(02)-240x240	EFX	0.2	--	100	3.2	6.8	1.0 x 10^5	0.22
EFX(02)-240x240T0800	EFX	0.2	0.03	100	3.2	6.8	1.0 x 10^5	0.22
EFX(03)-240x240	EFX	0.3	--	100	3.2	6.8	1.0 x 10^5	0.22
EFX(03)-240x240T0800	EFX	0.3	0.03	100	3.2	6.8	1.0 x 10^5	0.22
EFX(05)-240x240	EFX	0.5	--	100	3.2	6.8	1.0 x 10^5	0.22
EFX(05)-240x240T1500	EFX	0.5	0.14	100	3.2	6.8	1.0 x 10^5	0.22
EFF(007)-240x240T0800	EFF	0.07	0.03	130	3.6	6.9	1.0 x 10^5	0.4
EFF(01)-240x240T0800	EFF	0.1	0.03	130	3.6	6.9	1.0 x 10^5	0.4
EFF(02)-240x240	EFF	0.2	--	130	3.6	6.9	1.0 x 10^5	0.4
EFF(02)-240x240T0800	EFF	0.2	0.03	130	3.6	6.9	1.0 x 10^5	0.4
EFF(03)-240x240	EFF	0.3	--	130	3.6	6.9	1.0 x 10^5	0.4
EFF(03)-240x240T0800	EFF	0.3	0.03	130	3.6	6.9	1.0 x 10^5	0.4
EFA(003)-240x240T0800	EFA	0.03	0.03	60	3.1	6.8	1.0 x 10^6	1.3
EFA(005)-240x240T0800	EFA	0.05	0.03	60	3.1	6.8	1.0 x 10^6	1.3
EFA(01)-240x240T0800	EFA	0.1	0.03	60	3.1	6.8	1.0 x 10^6	1.3
EFA(02)-240x240	EFA	0.2	--	60	3.1	6.8	1.0 x 10^6	1.3
EFA(02)-240x240T0800	EFA	0.2	0.03	60	3.1	6.8	1.0 x 10^6	1.3
EFA(03)-240x240	EFA	0.3	--	60	3.1	6.8	1.0 x 10^6	1.3
EFA(03)-240x240T0800	EFA	0.3	0.03	60	3.1	6.8	1.0 x 10^6	1.3
EFG(005)-240x240T0800	EFG	0.05	0.03	20	3	3.5	1.0 x 10^5	0.22
EFG(01)-240x240T0800	EFG	0.1	0.03	20	3	3.5	1.0 x 10^5	0.22
EFG(02)-240x240	EFG	0.2	--	20	3	3.5	1.0 x 10^5	0.22
EFG(02)-240x240T0800	EFG	0.2	0.03	20	3	3.5	1.0 x 10^5	0.22
EFG(03)-240x240	EFG	0.3	--	20	3	3.5	1.0 x 10^5	0.22
EFG(03)-240x240T0800	EFG	0.3	0.03	20	3	3.5	1.0 x 10^5	0.22
EFH(005)-240x240T2200	EFH	0.05	0.05	60	3.1	6.8	1.0 x 10^6	1.3
EFH(01)-240x240T2200	EFH	0.1	0.05	60	3.1	6.8	1.0 x 10^6	1.3

Shielding

Shielding materials

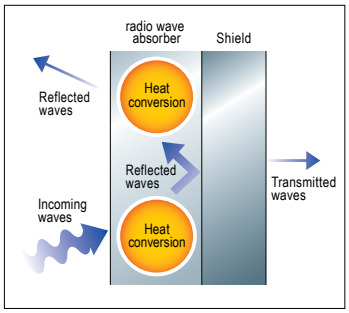
(metal, electrically conductive material)

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.



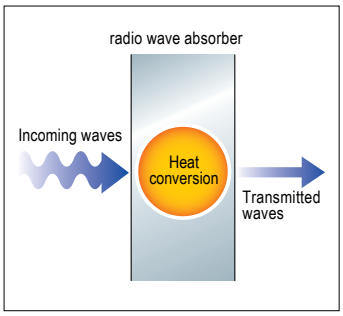
Shielding material + radio wave absorber

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.



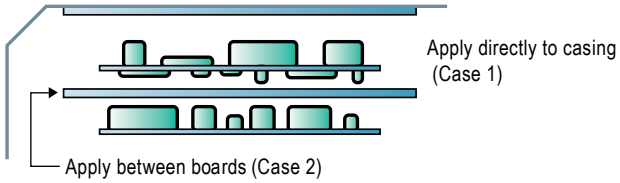
Reference: Other absorbing and reflecting examples

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

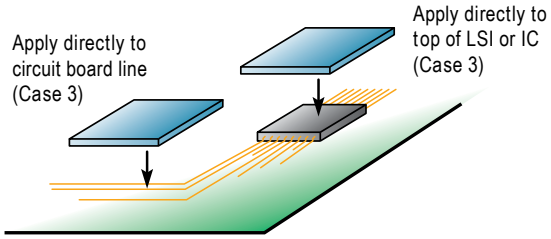
Applications

Case 1 – To suppress noise reflected by casing

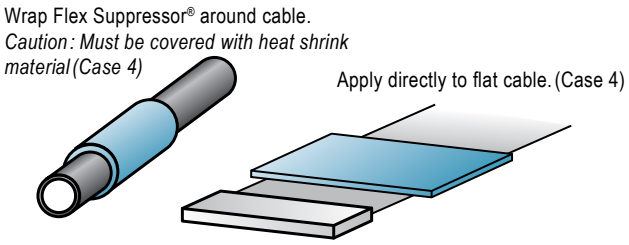
Case 2 – To suppress cross talk between substrates



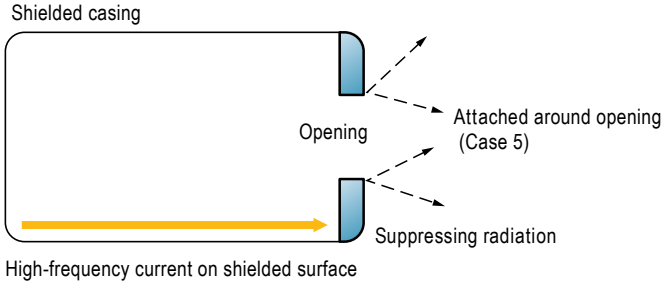
Case 3 – To suppress radiation noises from LSI and IC



Case 4 – To suppress noise from cables



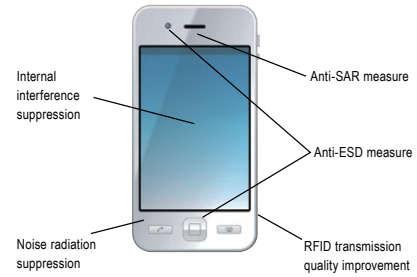
Case 5 – To suppress noise radiation (reflected noise) from the opening of shield, casing, etc.



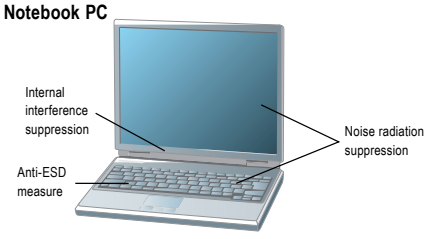
Applications cont'd

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 chassis	Near antenna Around touch panel
Digital Camera	On CCD module FPD, image processing LSI, and Memory slot	On the board	—	On the board and FPC On metal parts such as chassis	—
Notebook PC	On CPU and GPU On cables inside LCD panel On I/O e.g. PCMCA and memory slot	On wireless LAN module	On loop antenna and metal parts near antenna – Communication distance improvement	On CPU and GPU On metal parts such as chassis	—
DVD/BD	On LSI and FPC near optical pickup On MPEG chip	On the board and on FPC	—	On metal parts such as chassis	—
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 chassis	—
RFID/RW	—	—	On loop antenna, and metal parts near antenna – Communication distance improvement	—	—
Optical Reception Module	—	On the interior of the chassis 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	—	—	—	—

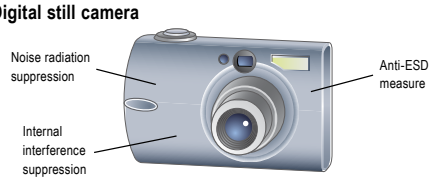
Mobile phone



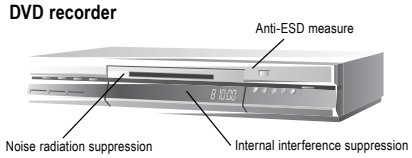
Notebook PC



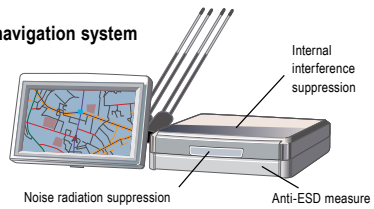
Digital still camera



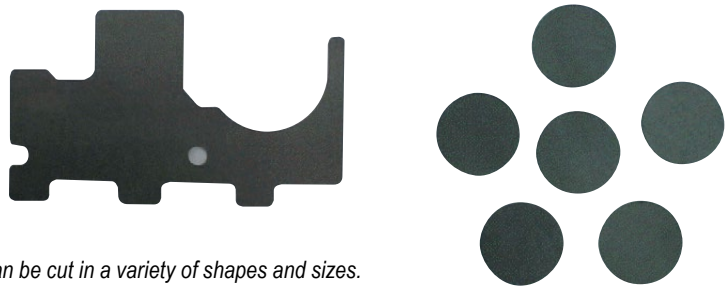
DVD recorder



Car navigation system

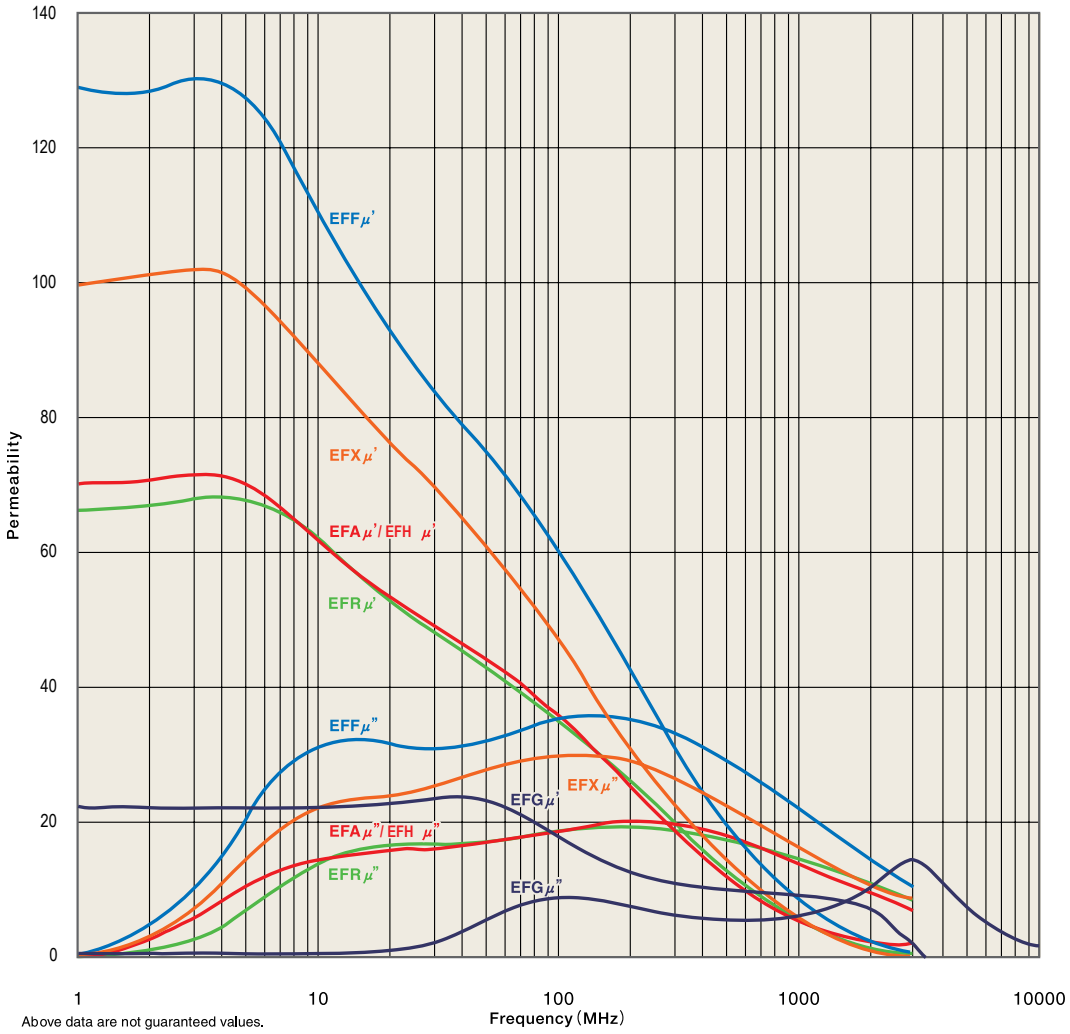


Examples of Shapes



Can be cut in a variety of shapes and sizes.

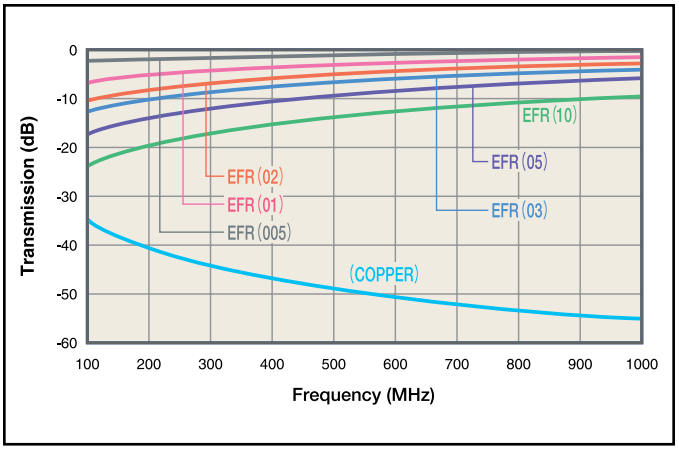
Permeable Characteristics



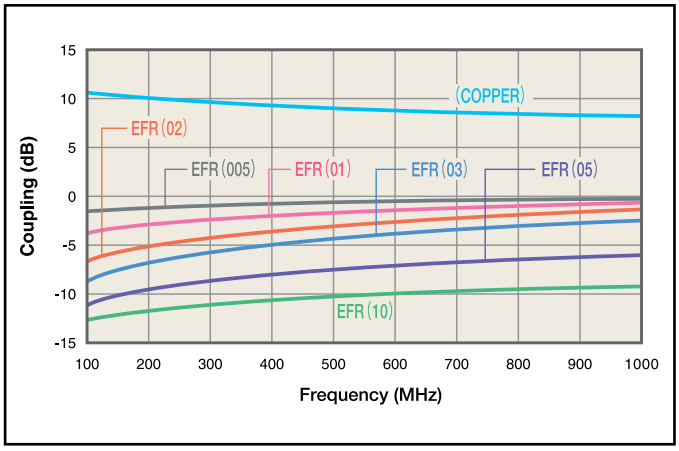
Above data are not guaranteed values.

Electrical Characteristics

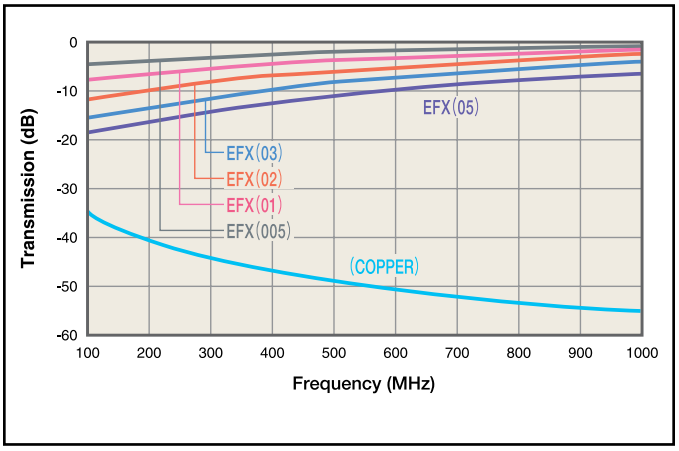
EFR – Attenuation of transmission noise



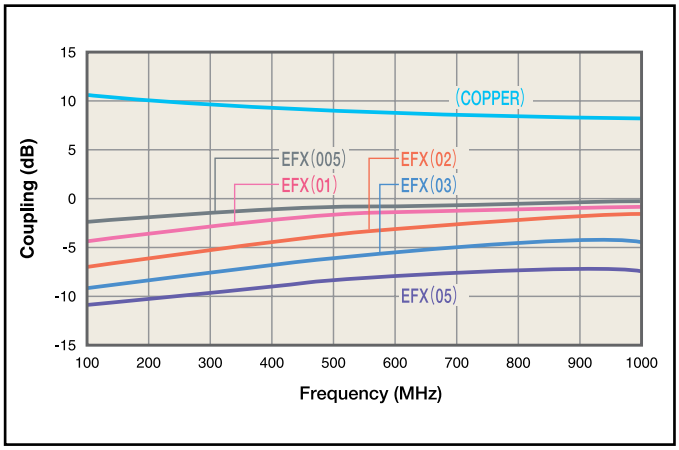
EFR – Attenuation of coupling noise



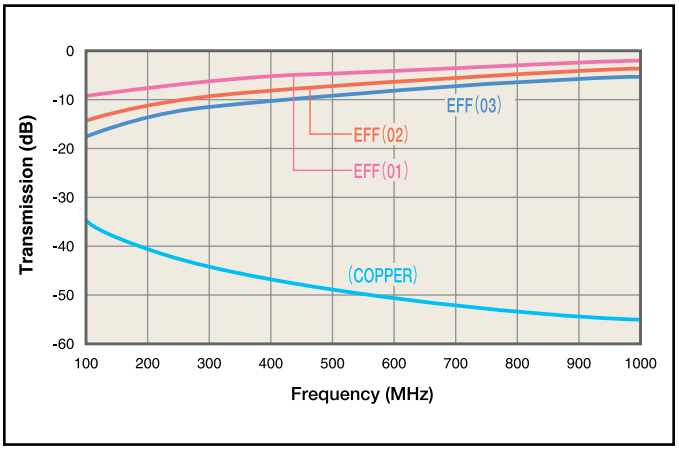
EFX – Attenuation of transmission noise



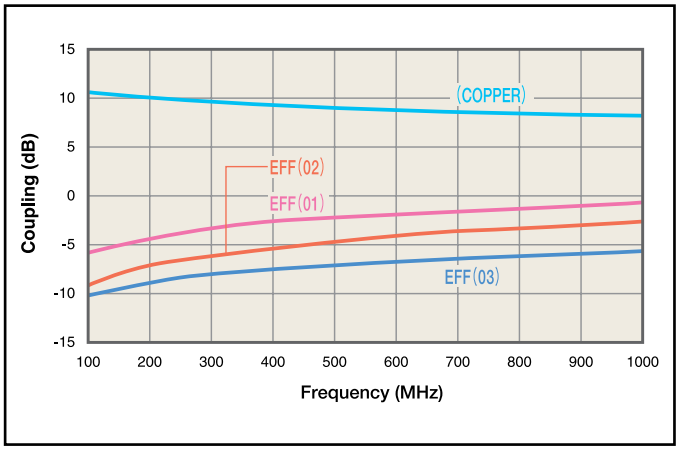
EFX – Attenuation of coupling noise



EFF – Attenuation of transmission noise



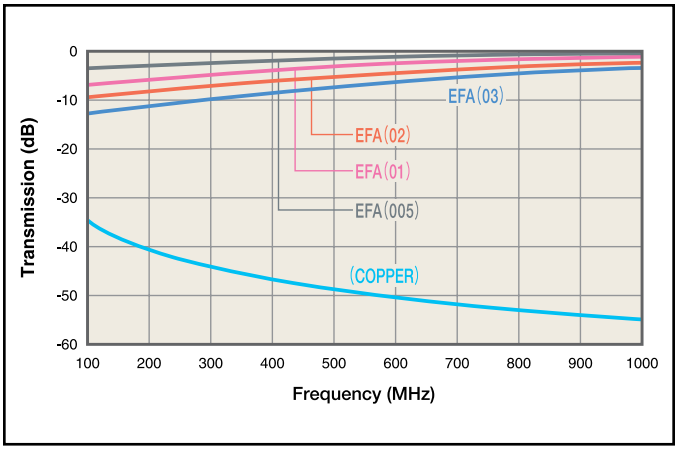
EFF – Attenuation of coupling noise



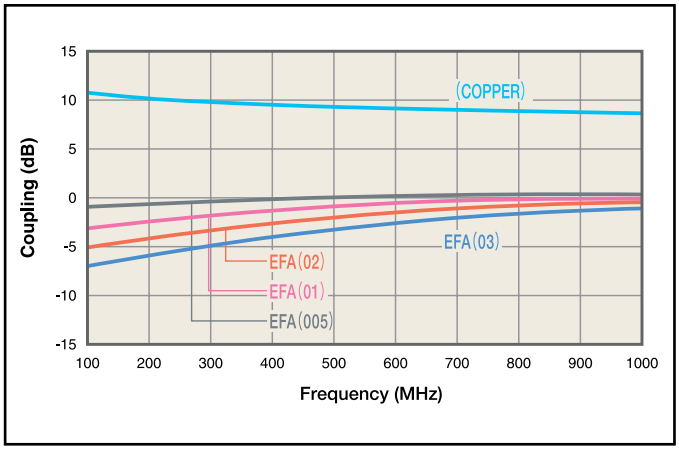
Above data are not guaranteed values.

Electrical Characteristics cont'd

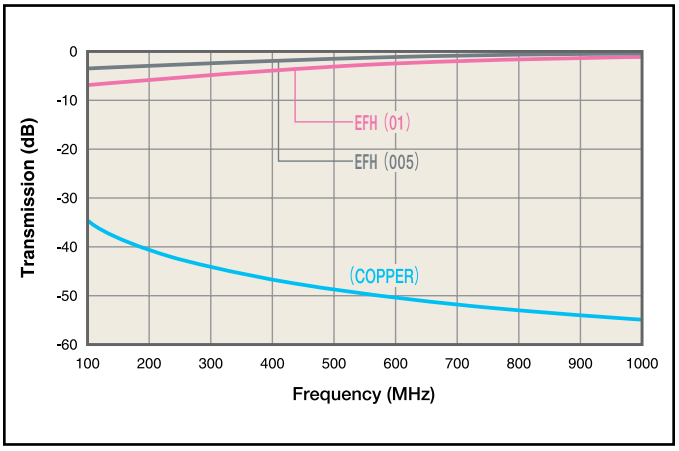
EFA – Attenuation of transmission noise



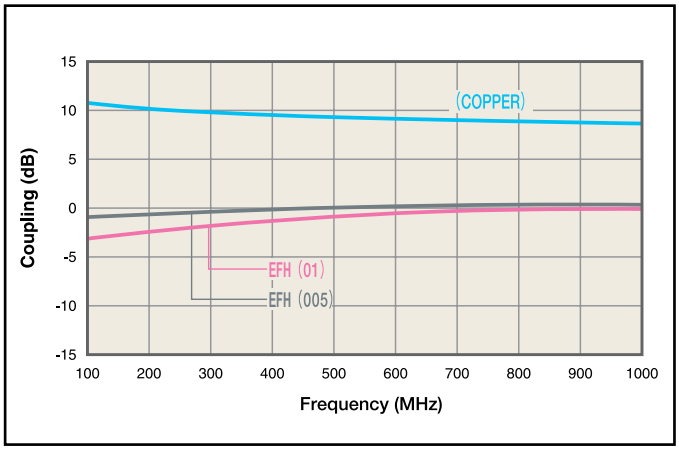
EFA – Attenuation of coupling noise



EFH – Attenuation of transmission noise



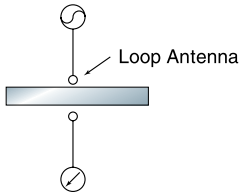
EFH – Attenuation of coupling noise



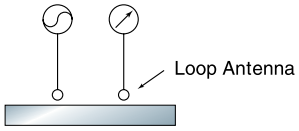
Above data are not guaranteed values.

Measuring Method of Electrical Characteristics

Attenuation of transmission noise

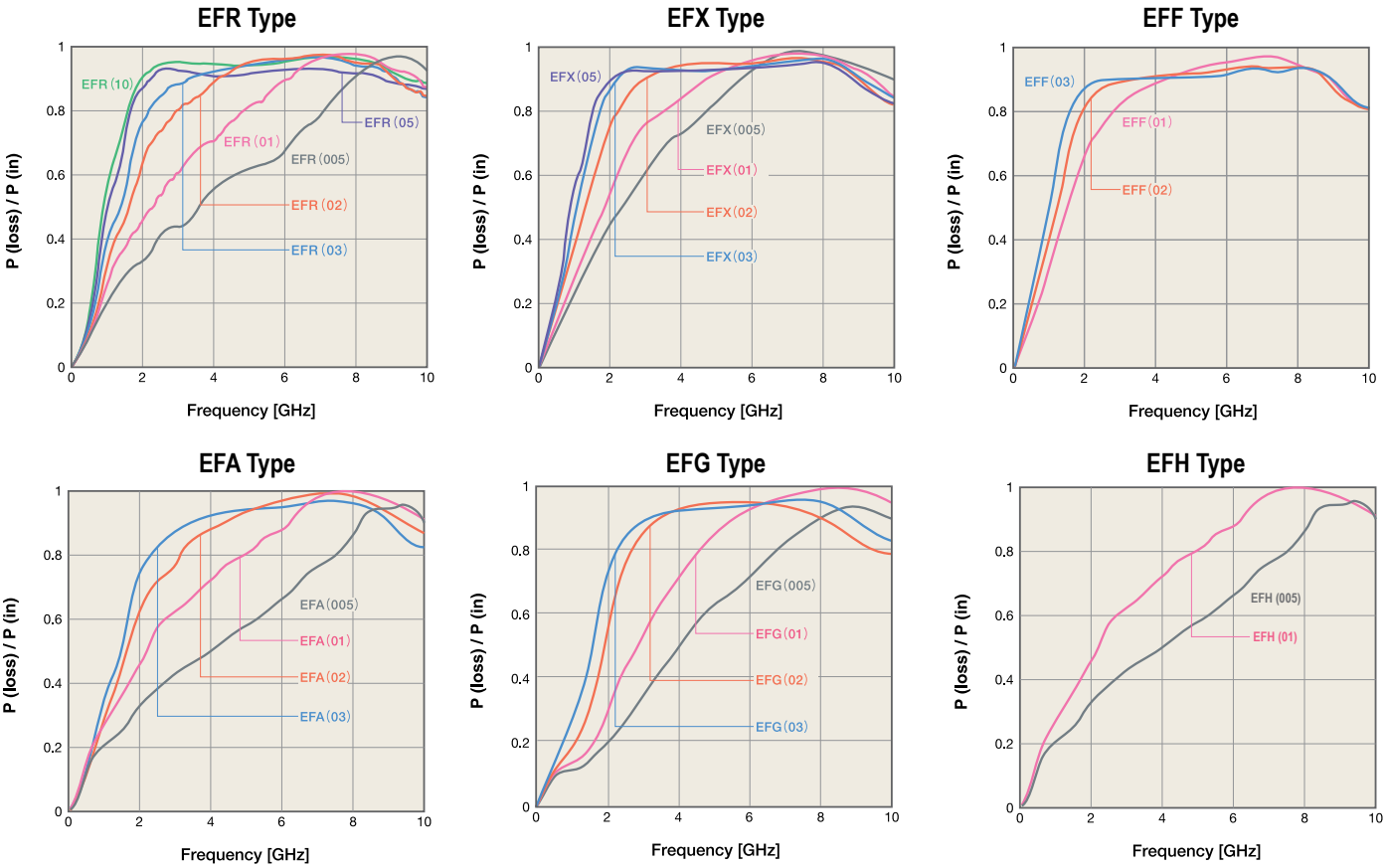


Attenuation of coupling noise



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 a Flex Suppressor® attached.



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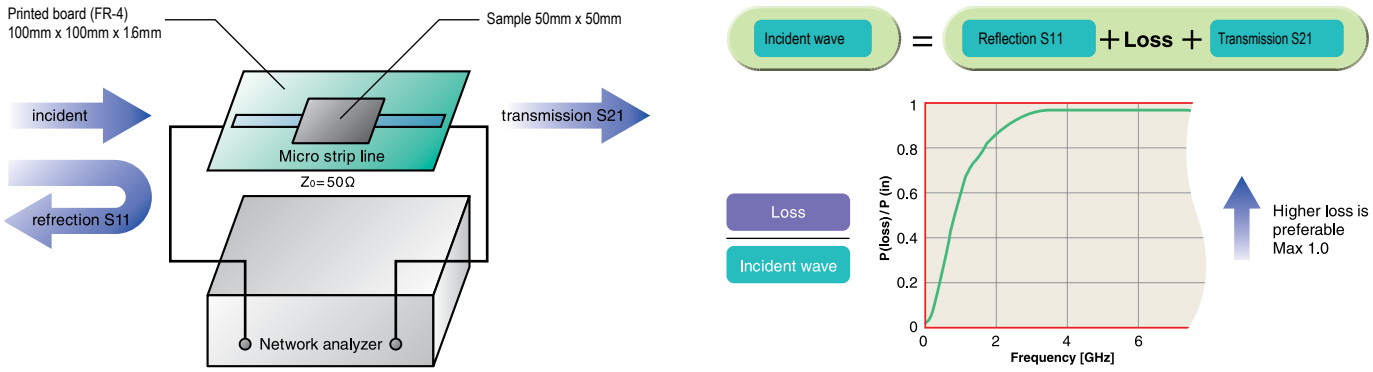
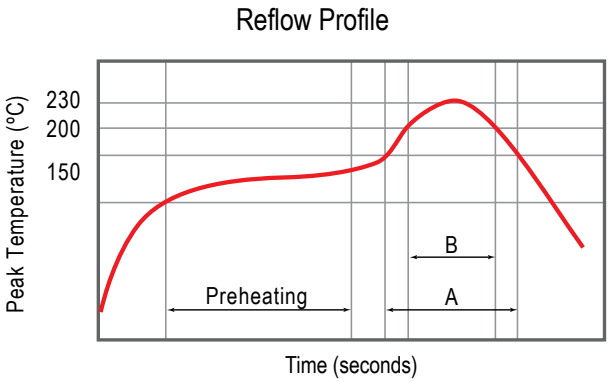
Measuring Method of Transmission Noise Attenuation Characteristics



Soldering Process



Peak Temperature	+260°C
Preheating	150 – 180°C 90 seconds maximum
A	200°C or more, 60 seconds maximum
B	230°C or more, 40 seconds maximum
Number of Times	2 times maximum

Handling Precautions

Avoid high-temperature, humidity and direct sunlight. Storage environment should be below 40ºC 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 the 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 cutting of the sheet is performed by the customer. 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.

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

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