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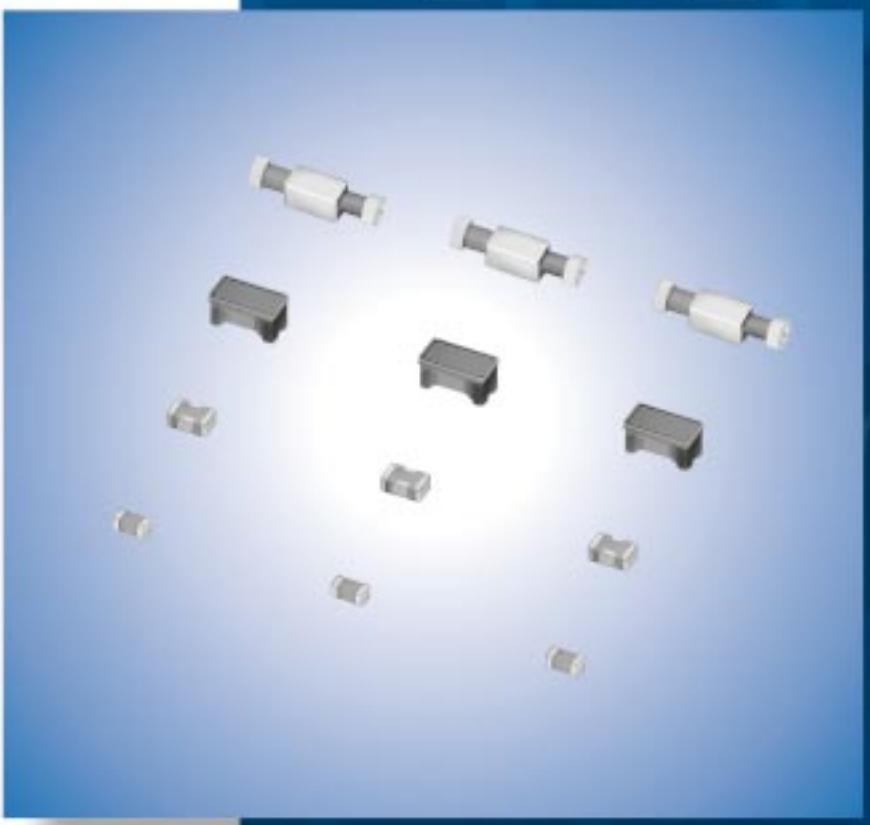
On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive



muRata Innovator in Electronics

Murata
Manufacturing Co., Ltd.

Cat.No.C50E

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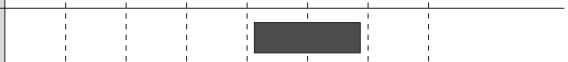
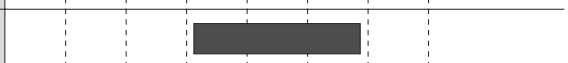
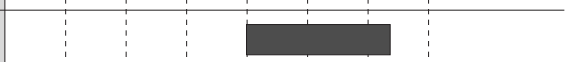
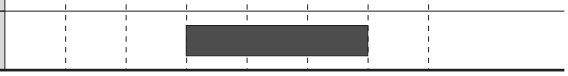
Products Guide/Effective Frequency Range

Product Guide

Type		Series	Dimensions (mm)	Dimensions EIA Code	Effective Frequency Range (10kHz 100kHz 1MHz 10MHz 100MHz 1GHz 10GHz)
Inductor Type	Standard	**BLM18A**	1.6 × 0.8	0603	
	For High Speed Signals	**BLM18B**	1.6 × 0.8	0603	
	For High Current	**BLM18P**	1.6 × 0.8	0603	
Capacitor Type	Standard Type	**NFM21H**	2.0 × 1.25	0805	
	T Filter for High Current	**NFE61H**	6.8 × 1.6	2706	
Chip Common Mode Choke Coils		**DLW31S**	3.2 × 1.6	1206	

On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive

Chip Ferrite Beads Part Numbering

Chip Ferrite Beads for Automotive

(Part Number)

BL	M	18	AG	102	S	H	1	D
❶	❷	❸	❹	❺	❻	❼	❽	❾

❶Product ID

Product ID	
BL	Chip Ferrite Beads

❷Type

Code	Type
M	Monolithic Type

❸Dimensions (L×W)

Code	Dimensions (L×W)	EIA
18	1.6×0.8mm	0603

❹Characteristics/Applications

Code *1	Characteristics/Applications	Series
AG	for General Use	**BLM18**
BA	for High-speed Signal Lines	
BB		
BD		
PG	for Power Supplies	

*1 Frequency characteristics vary with each code.

❺Impedance

Expressed by three figures. The unit is in ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two figures.

❻Performance

Expressed by a letter.

Ex.)

Code	Performance
S/T	Sn Plating

❼Category

Code	Category
H	For Automotive

❽Number of Circuits

Code	Number of Circuits
1	1 Circuit

❾Packaging

Code	Packaging	Series
B	Bulk	**BLM18**
J	Paper Taping (ø330mm Reel)	
D	Paper Taping (ø180mm Reel)	
C	Bulk Case	

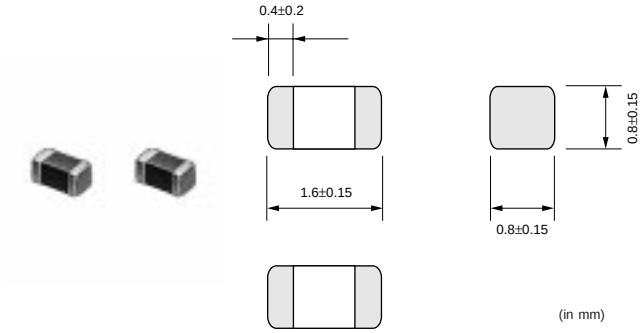
On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive

Chip Ferrite Beads BLM18 Series

BLM18A Series

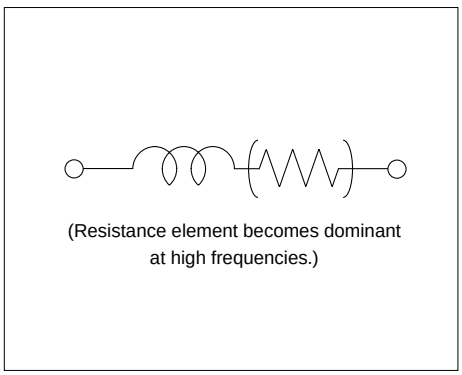
■ Features

The chip ferrite beads BLM series is designed to function nearly as a resistor at noise frequencies, which greatly reduces the possibility of resonance and leaves signal wave forms undistorted.
The BLM series is effective in circuits without stable ground lines because the BLM series does not need a connection to ground.
The nickel barrier structure of the external electrodes provides excellent solder heat resistance.
BLM_A series generates an impedance from the relatively low frequencies. Therefore BLM_A series is effective in noise suppression in a wide frequency range (30MHz to several hundred MHz).

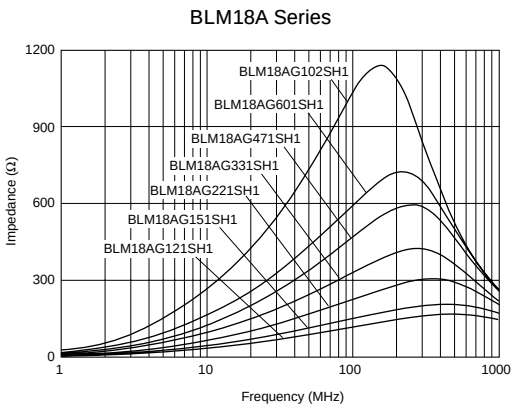


Part Number	Impedance (at 100MHz/20°C) (ohm)	Rated Current (mA)	DC Resistance (max.) (ohm)	Operating Temperature Range (°C)
BLM18AG121SH1	120 ±25%	200	0.20	-55 to +125
BLM18AG151SH1	150 ±25%	200	0.25	-55 to +125
BLM18AG221SH1	220 ±25%	200	0.30	-55 to +125
BLM18AG331SH1	330 ±25%	200	0.45	-55 to +125
BLM18AG471SH1	470 ±25%	200	0.50	-55 to +125
BLM18AG601SH1	600 ±25%	200	0.50	-55 to +125
BLM18AG102SH1	1000 ±25%	100	0.70	-55 to +125

■ Equivalent Circuit



■ Impedance-Frequency (Typical)



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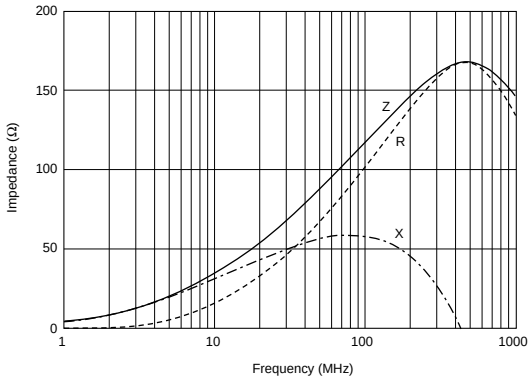
■ Impedance-Frequency Characteristics

BLM18AG121SH1



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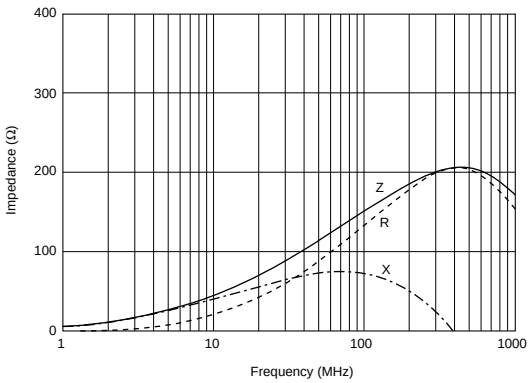

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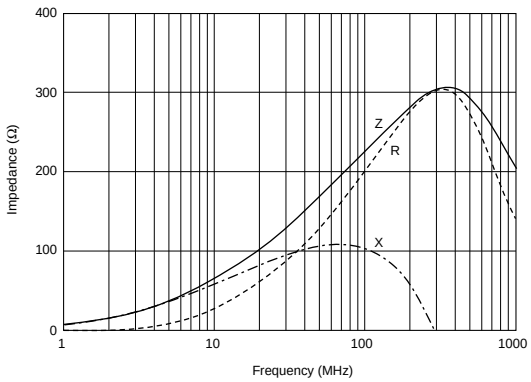
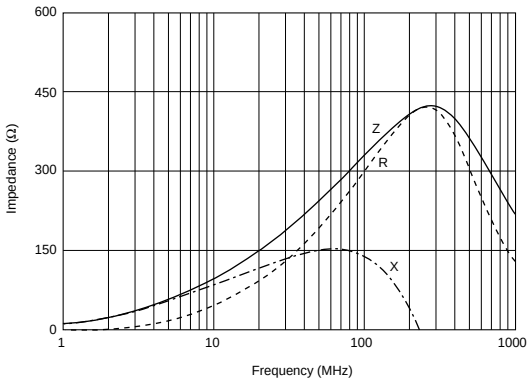


BLM18AG331SH1



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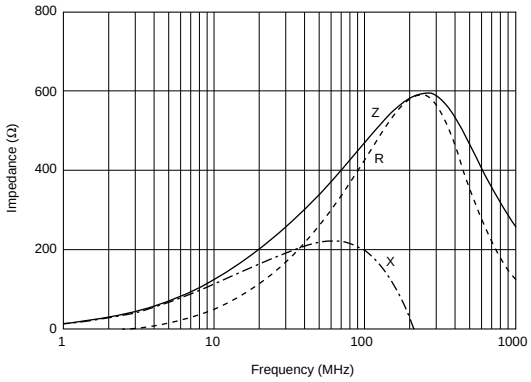

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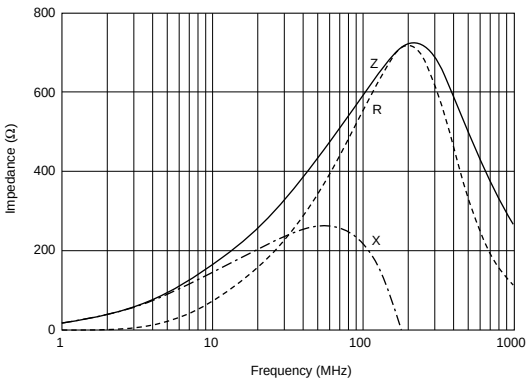
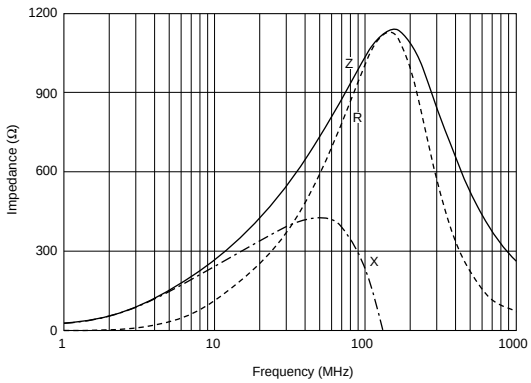


BLM18AG102SH1



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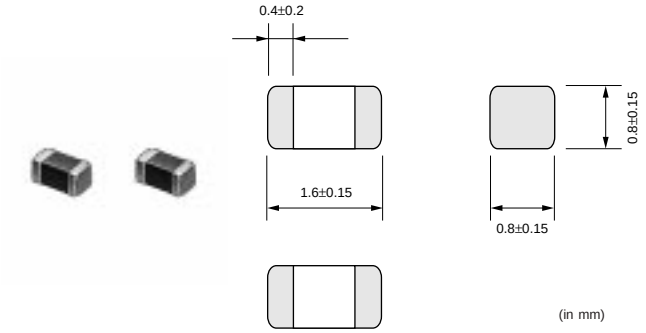
BLM18B Series

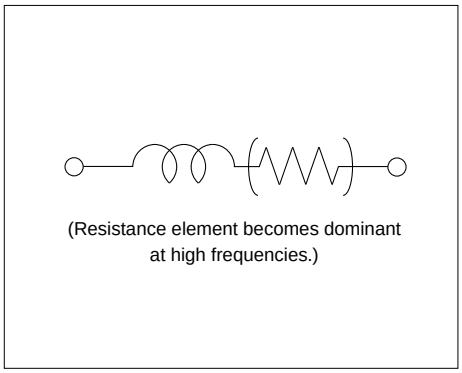
■ Features

The chip ferrite beads BLM series is designed to function nearly as a resistor at noise frequencies, which greatly reduces the possibility of resonance and leaves signal wave forms undistorted.
The BLM series is effective in circuits without stable ground lines because the BLM series does not need a connection to ground.
The nickel barrier structure of the external electrodes provides excellent solder heat resistance.
The BLM_B series can minimize attenuation of the signal waveform due to its sharp impedance characteristics. Various impedances are available to match signal frequency.



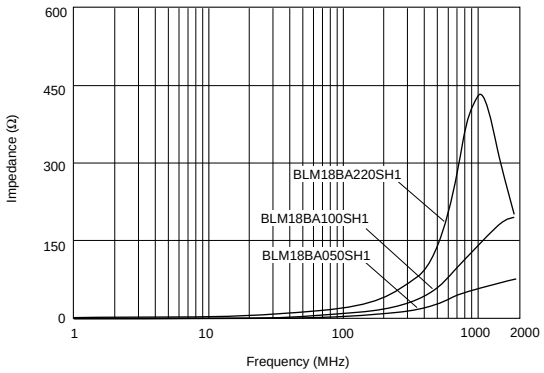
Part Number	Impedance (at 100MHz/20°C) (ohm)	Rated Current (mA)	DC Resistance (max.) (ohm)	Operating Temperature Range (°C)
BLM18BA050SH1	5 ±25%	500	0.20	-55 to +125
BLM18BB050SH1	5 ±25%	700	0.10	-55 to +125
BLM18BA100SH1	10 ±25%	500	0.25	-55 to +125
BLM18BB100SH1	10 ±25%	500	0.15	-55 to +125
BLM18BA220SH1	22 ±25%	500	0.35	-55 to +125
BLM18BB220SH1	22 ±25%	500	0.25	-55 to +125
BLM18BA470SH1	47 ±25%	300	0.55	-55 to +125
BLM18BB470SH1	47 ±25%	500	0.30	-55 to +125
BLM18BB600SH1	60 ±25%	200	0.35	-55 to +125
BLM18BA750SH1	75 ±25%	300	0.70	-55 to +125
BLM18BB750SH1	75 ±25%	200	0.35	-55 to +125
BLM18BA121SH1	120 ±25%	200	0.90	-55 to +125
BLM18BB121SH1	120 ±25%	200	0.50	-55 to +125
BLM18BD121SH1	120 ±25%	200	0.40	-55 to +125
BLM18BB141SH1	140 ±25%	200	0.55	-55 to +125
BLM18BB151SH1	150 ±25%	200	0.55	-55 to +125
BLM18BD151SH1	150 ±25%	200	0.40	-55 to +125
BLM18BB221SH1	220 ±25%	200	0.65	-55 to +125
BLM18BD221SH1	220 ±25%	200	0.45	-55 to +125
BLM18BB331SH1	330 ±25%	200	0.75	-55 to +125
BLM18BD331SH1	330 ±25%	200	0.50	-55 to +125
BLM18BD421SH1	420 ±25%	200	0.55	-55 to +125
BLM18BB471SH1	470 ±25%	50	1.00	-55 to +125
BLM18BD471SH1	470 ±25%	200	0.55	-55 to +125
BLM18BD601SH1	600 ±25%	200	0.65	-55 to +125
BLM18BD102SH1	1000 ±25%	100	0.85	-55 to +125
BLM18BD152SH1	1500 ±25%	50	1.20	-55 to +125
BLM18BD182SH1	1800 ±25%	50	1.50	-55 to +125
BLM18BD222SH1	2200 ±25%	50	1.50	-55 to +125
BLM18BD252SH1	2500 ±25%	50	1.50	-55 to +125

■ Equivalent Circuit

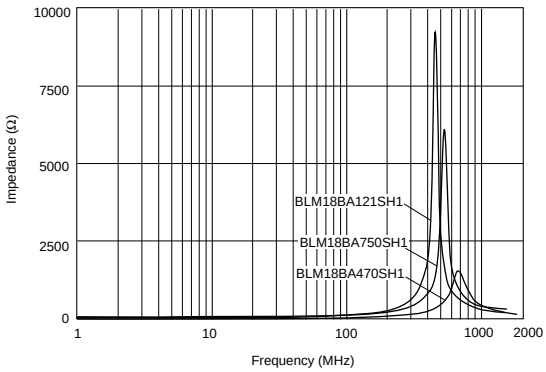


■ Impedance-Frequency (Typical)

BLM18BA Series



BLM18BA Series



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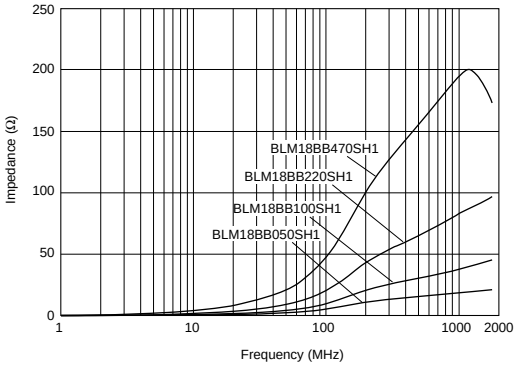
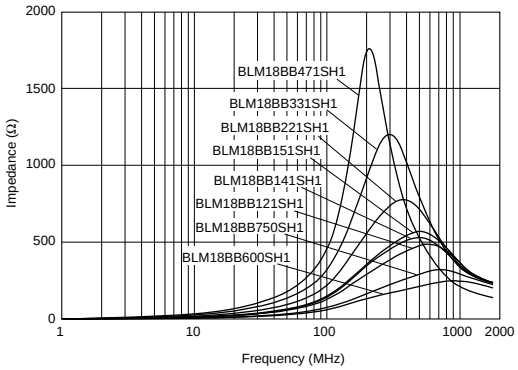
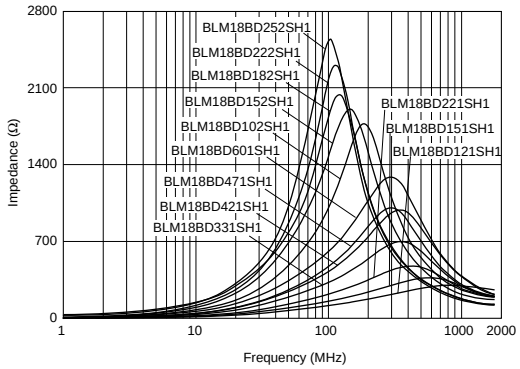


BLM18BB Series



BLM18BD Series



■ Impedance-Frequency Characteristics

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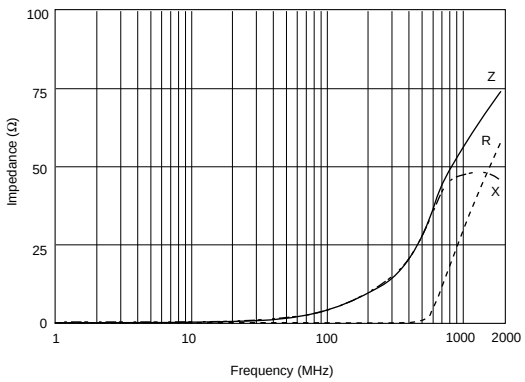

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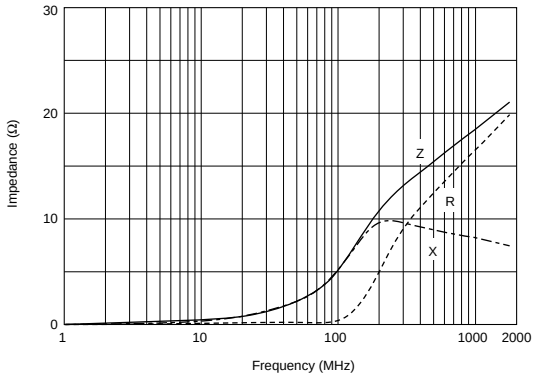

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■ Impedance-Frequency Characteristics

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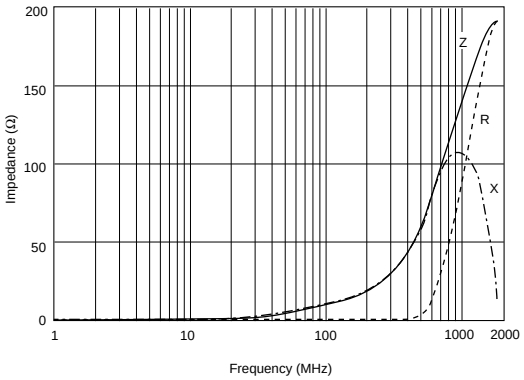

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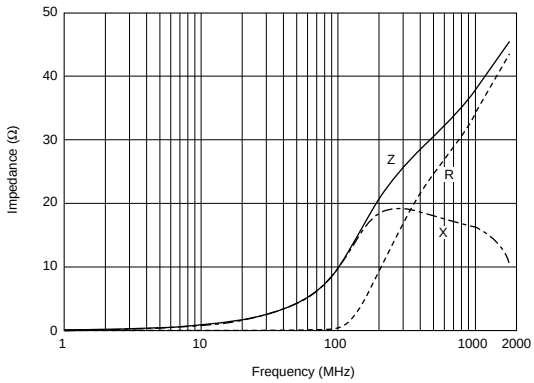

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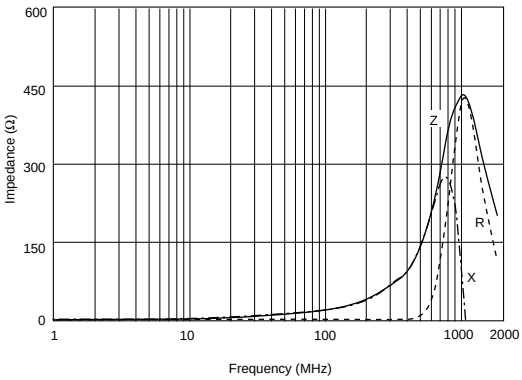

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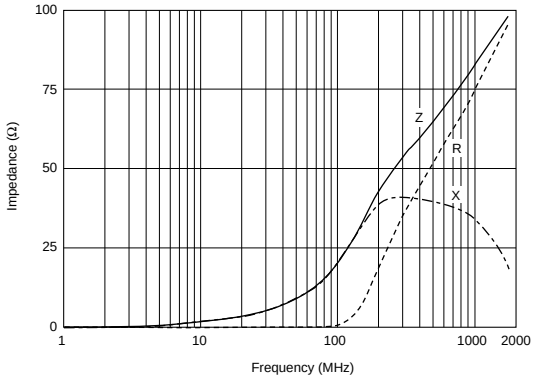

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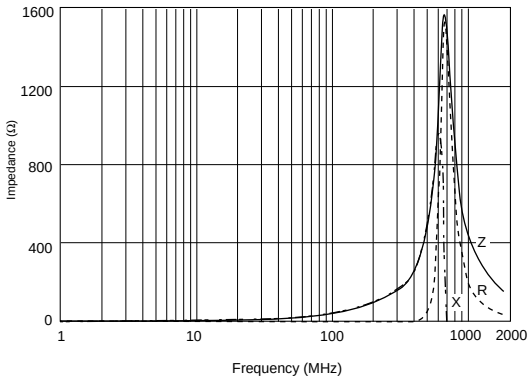

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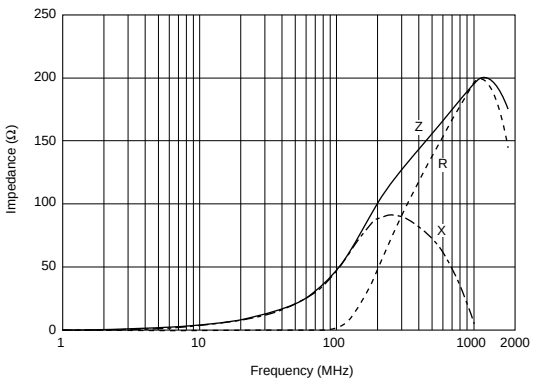

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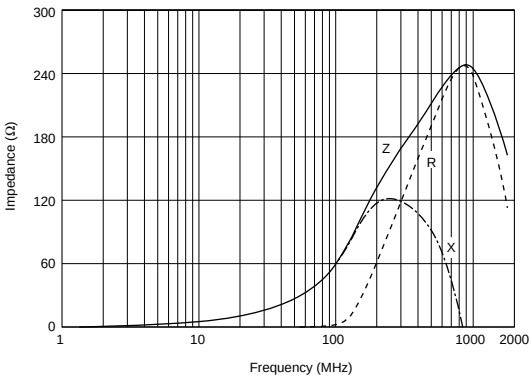

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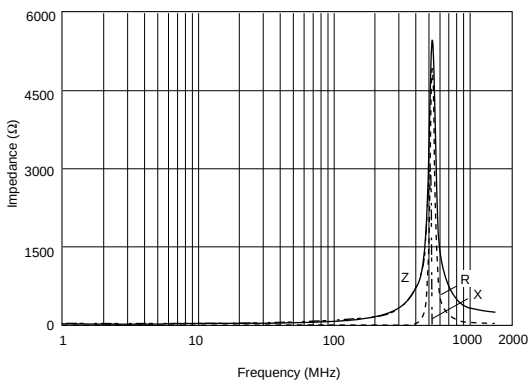

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■ Impedance-Frequency Characteristics

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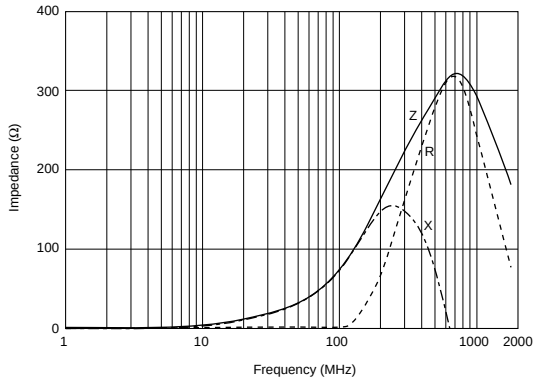

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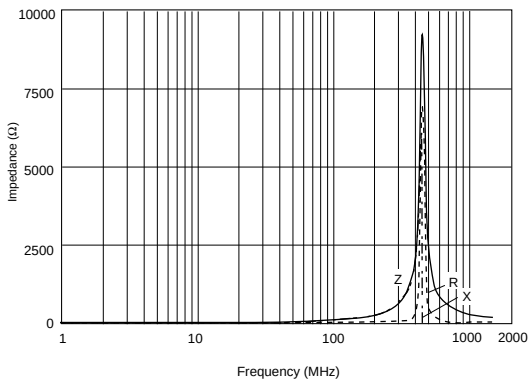

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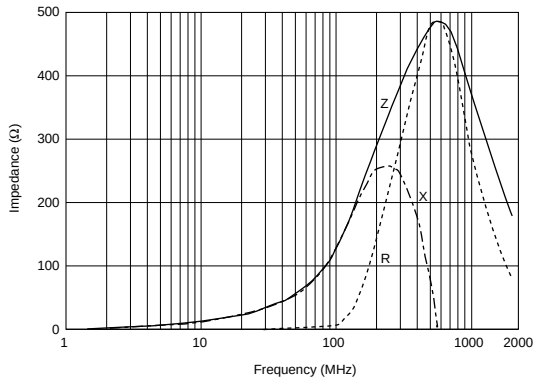

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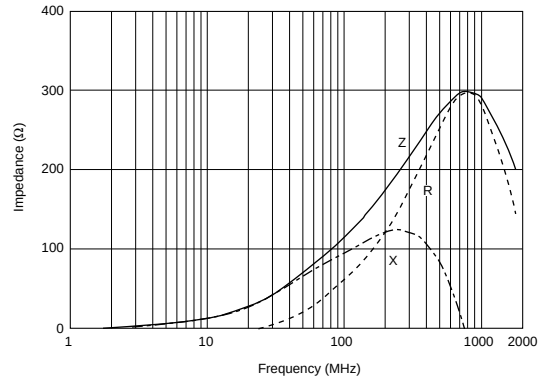

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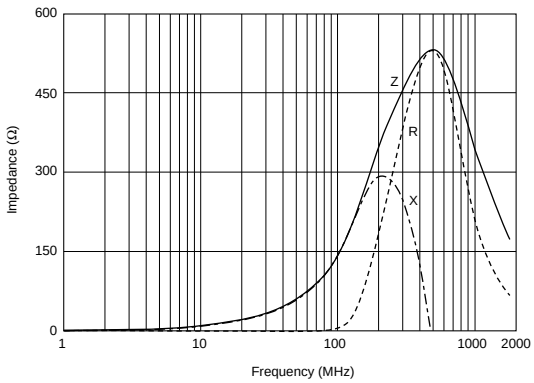

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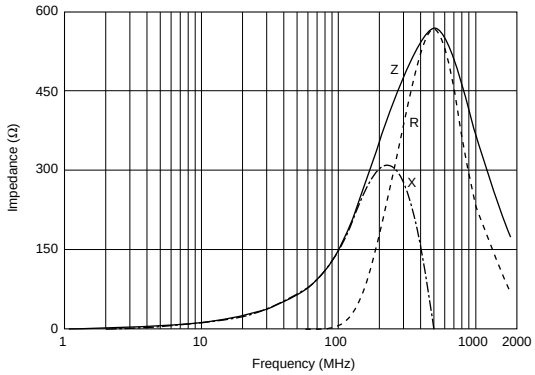
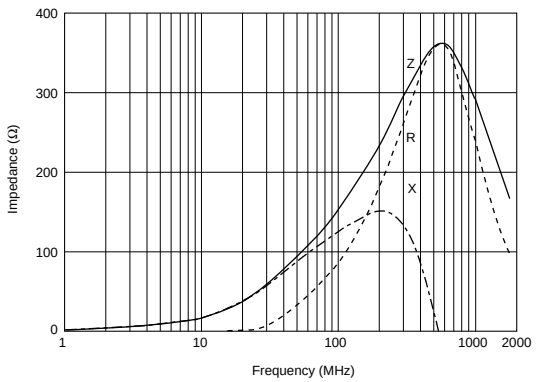


BLM18BD151SH1



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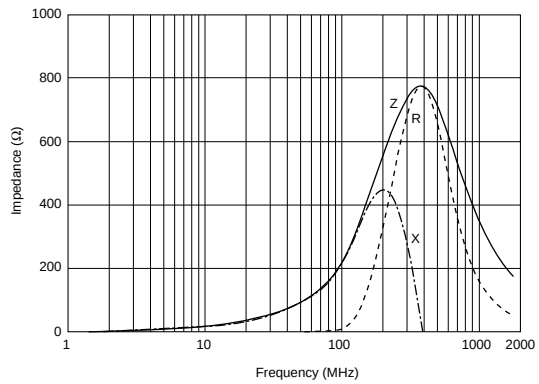

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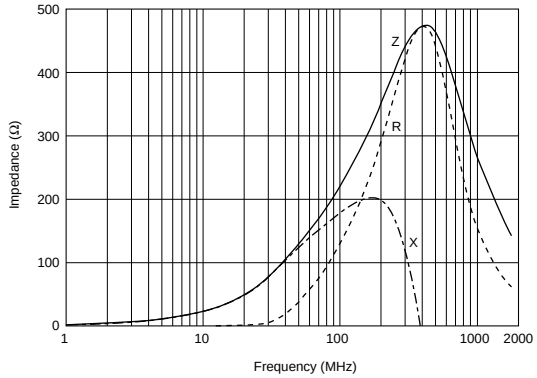
■ Impedance-Frequency Characteristics

BLM18BD221SH1



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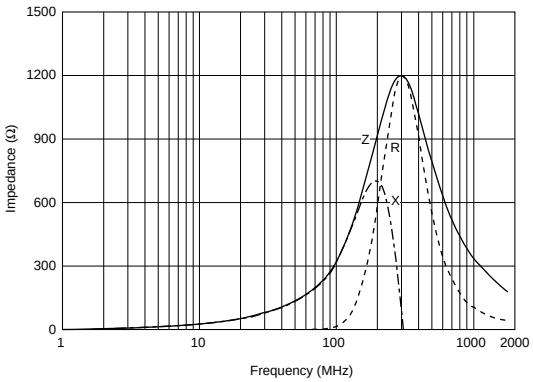

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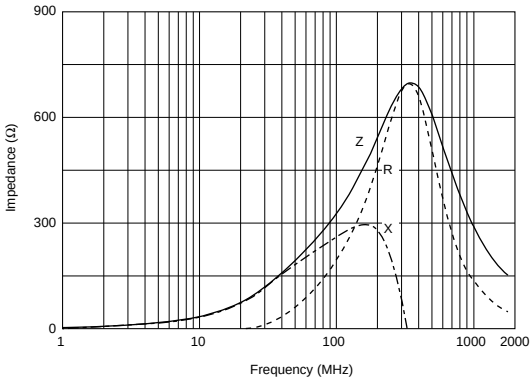

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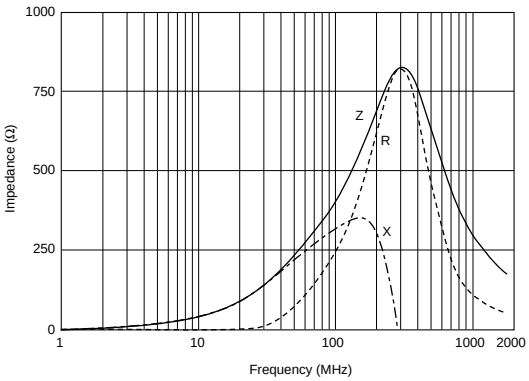

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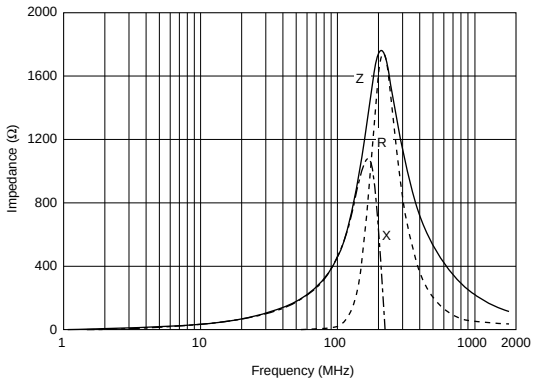

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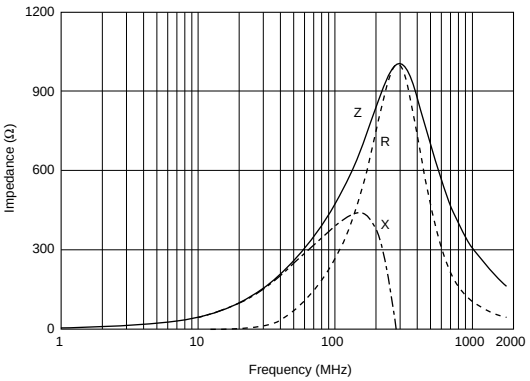

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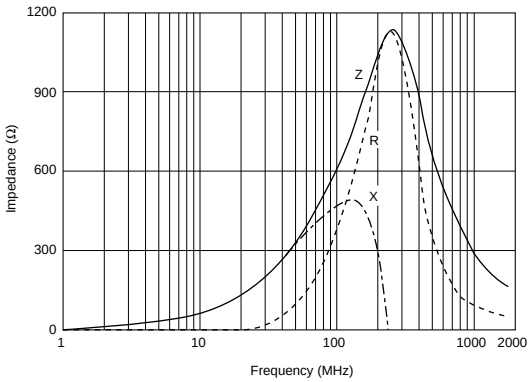
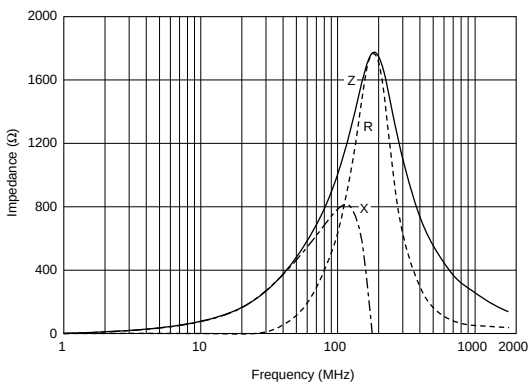


BLM18BD102SH1



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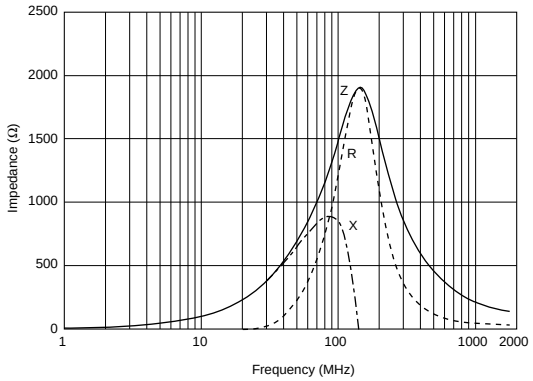
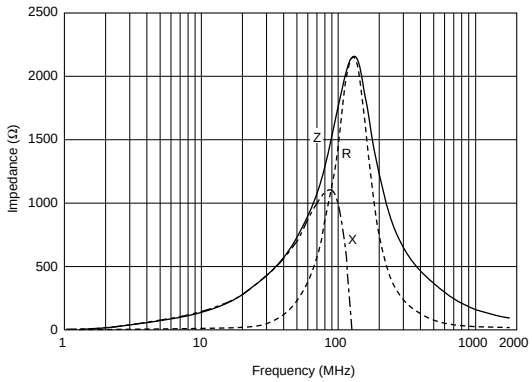
■ Impedance-Frequency Characteristics

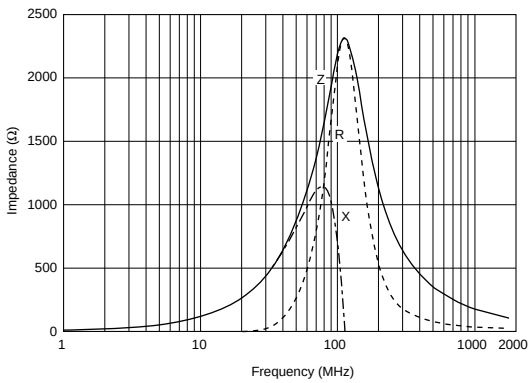
BLM18BD152SH1



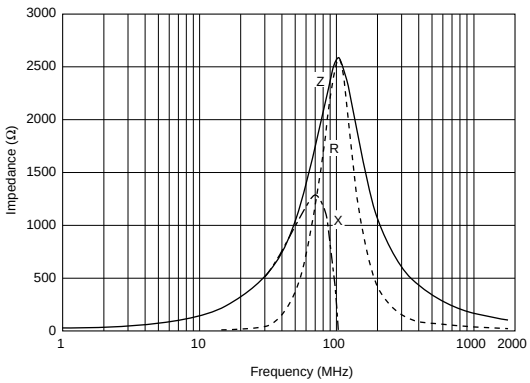
BLM18BD182SH1



BLM18BD222SH1



BLM18BD252SH1

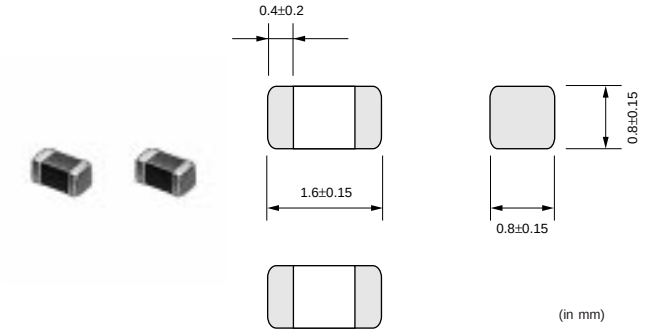


1

BLM18P Series

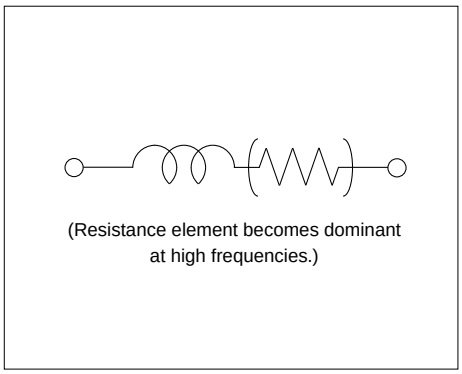
■ Features

The chip ferrite beads BLM series is designed to function nearly as a resistor at noise frequencies, which greatly reduces the possibility of resonance and leaves signal wave forms undistorted.
The BLM series is effective in circuits without stable ground lines because the BLM series does not need a connection to ground.
The nickel barrier structure of the external electrodes provides excellent solder heat resistance.
The BLM_P series can be used in high current circuits due to its low DC resistance.



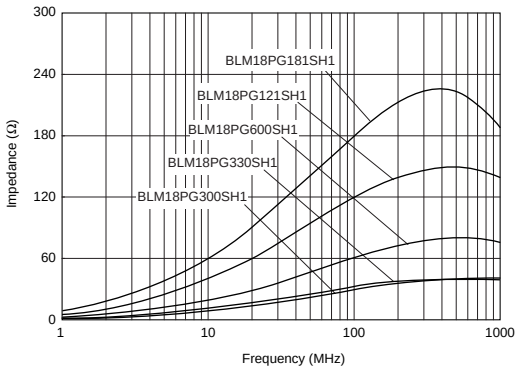
Part Number	Impedance (at 100MHz/20°C) (ohm)	Rated Current (mA)	DC Resistance (max.) (ohm)	Operating Temperature Range (°C)
BLM18PG300SH1	30 (Typ.)	1000	0.05	-55 to +125
BLM18PG330SH1	33 ±25%	3000	0.025	-55 to +125
BLM18PG600SH1	60 (Typ.)	500	0.10	-55 to +125
BLM18PG121SH1	120 ±25%	2000	0.05	-55 to +125
BLM18PG181SH1	180 ±25%	1500	0.09	-55 to +125

■ Equivalent Circuit



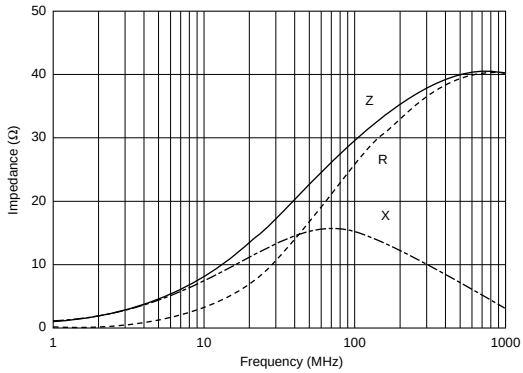
■ Impedance-Frequency (Typical)

BLM18P Series

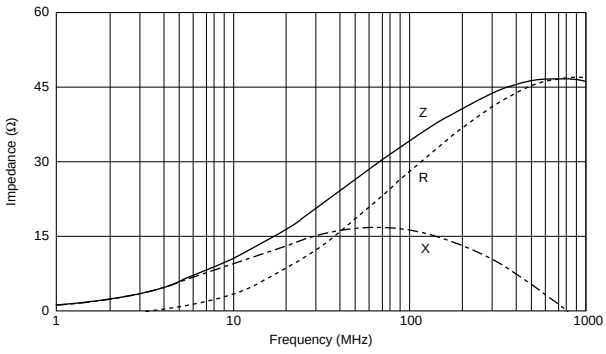


■ Impedance-Frequency Characteristics

BLM18PG300SH1



BLM18PG330SH1



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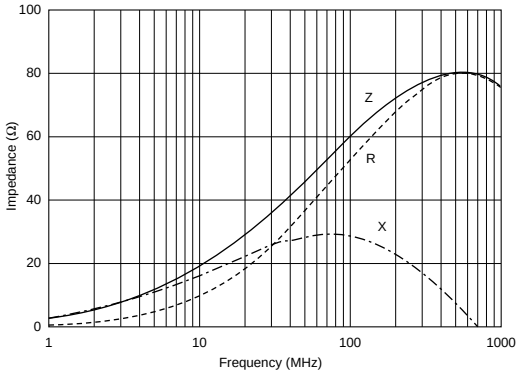
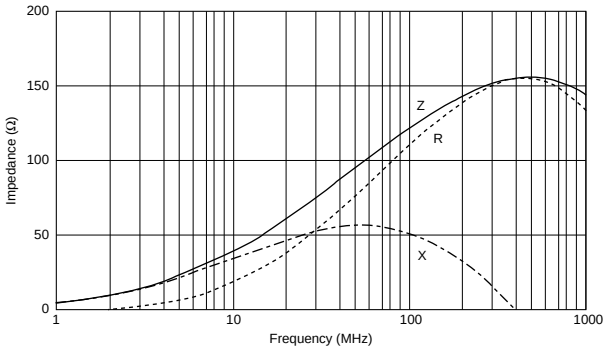
■ Impedance-Frequency Characteristics

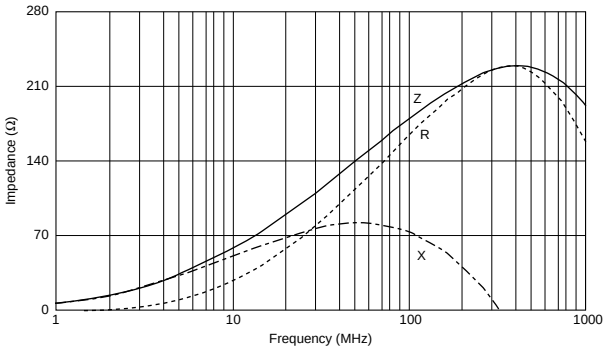
BLM18PG600SH1



BLM18PG121SH1



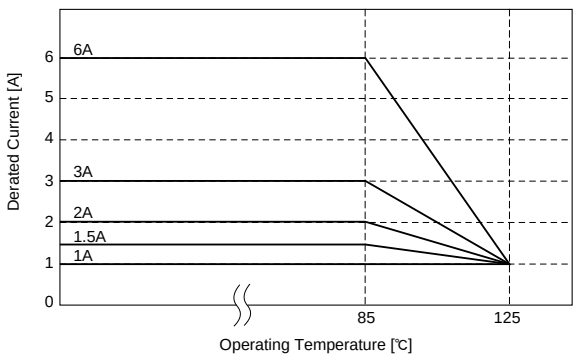
BLM18PG181SH1



■ Notice (Rating)

In operating temperatures exceeding +85℃, derating of current is necessary for chip Ferrite Beads for which rated current is 1500mA or over. Please apply the derating curve shown in chart according to the operating temperature.

[Derating]



1

Specifications and Test Methods

■ Test and Measurement Conditions

<Unless otherwise specified>
Temperature: Ordinary Temp. 15 to 35°C
Humidity: Ordinary Humidity 25 to 85%(RH)

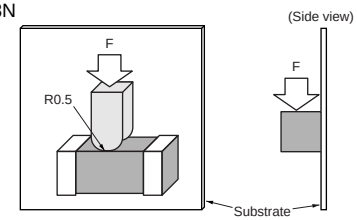
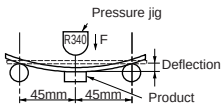
<In case of doubt>
Temperature: 20±2°C
Humidity: 60 to 70%(RH)
Atmospheric pressure: 86 to 106kPa

■ Specifications

1. Electrical Performance

No.	Item	Specifications	Test Methods
1	Impedance	Meet rating table above Impedance frequency Characteristics (Typical): see the appendix.	Measuring Equipment: Agilent 4291A or the equivalent Measuring Frequency: 100±1MHz Test Fixture: Agilent 16092A or the equivalent (for BLM18BA□□□SH1□ type: Agilent 16192A or the equivalent)
2	DC Resistance	Meet rating table above.	Measuring Equipment: Digital multi-meter

2. Mechanical Performance

No.	Item	Specifications	Test Methods
1	Appearance and Dimensions	Meet dimensions.	Visual Inspection and measured with Slide Calipers.
2	Solderability	The electrodes should be at least 95% covered with new solder coating.	Flux: Ethanol solution of rosin, 25wt% Pre-heating: 150±5°C, 60±5s Solder: (1) Sn/Pb=60/40 (2) Sn-3.0Ag-0.5Cu solder Solder Temperature: (1) 230±5°C (2) 240±5°C Immersion Time: (1) 4±1s (2) 3±1s Immersion and emersion rates: 25mm/s
3	Resistance to Soldering Heat	Meet Table 1.	Flux: Ethanol solution of rosin, 25wt% Pre-heating: 150±5°C, 60±5s Solder: Sn/Pb=60/40 or Sn-3.0Ag-0.5Cu solder Solder Temperature: 270±5°C Immersion Time: 10±0.5s Immersion and emersion rates: 25mm/s Then measured after exposure to room conditions for 48±4 hrs.
4	Bonding Strength		It should be soldered on the substrate. Applying Force (F): 6.8N Applying Time: 5±1s 
5	Bending Strength		It should be soldered on the glass-epoxy substrate. Subatrate: 100 x 40 x 1.6mm Deflection (n): 1.0mm (Glass-epoxy substrate) Speed of Applying Force: 0.5mm/s Keeping Time: 30s 
6	Vibration		It should be soldered on the substrate. Oscillation Frequency: 10 to 2000 to 10Hz for 20 min. Total Amplitude: 1.5mm or Acceleration amplitude 49m/s^2 whichever is smaller. Testing Time: A period of 2 hours in each of 3 mutually perpendicular directions. (Total 6 hrs.)

3. Environmental Performance

It should be soldered on the substrate.

No.	Item	Specifications	Test Methods
1	Humidity	Meet Table 1.	Temperature: 70±2°C Humidity: 90 to 95%(RH) Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for 48±4 hrs.
2	Heat Life		Temperature: 125±3°C (for BLM18PG330SH1/121SH1/181SH1: +85±3°C) Applying Current: Rated Current Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for 48±4 hrs.
3	Cold Resistance		Temperature: -55±2°C Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for 48±4 hrs.
4	Temperature Cycle		1 cycle: 1 step: -55°C (+0°C, -3°C) / 30±3 minutes. 2 step: Room Temperature / within 5 minutes. 3 step: +125°C (+3°C, -0°C) / 30±3 minutes. 4 step: Room Temperature / within 5 minutes. Total of 1000 cycles Then measured after exposure to room conditions for 48±4 hrs.

Table 1

Appearance	No damage
Impedance Change	within±30%
DC Resistance	Meet Table 2.

Table 2

Part Number	DC Resistance (ohm max.) Values After Testing	Part Number	DC Resistance (ohm max.) Values After Testing	Part Number	DC Resistance (ohm max.) Values After Testing
BLM18AG121SH1	0.30	**BLM18BB470SH1**	0.40	**BLM18BD421SH1**	0.65
BLM18AG151SH1	0.35	**BLM18BB600SH1**	0.45	**BLM18BB471SH1**	1.10
BLM18AG221SH1	0.40	**BLM18BA750SH1**	0.80	**BLM18BD471SH1**	0.65
BLM18AG331SH1	0.55	**BLM18BB750SH1**	0.45	**BLM18BD601SH1**	0.75
BLM18AG471SH1	0.60	**BLM18BA121SH1**	1.00	**BLM18BD102SH1**	0.95
BLM18AG601SH1	0.60	**BLM18BB121SH1**	0.60	**BLM18BD152SH1**	1.30
BLM18AG102SH1	0.80	**BLM18BD121SH1**	0.50	**BLM18BD182SH1**	1.60
BLM18BA050SH1	0.30	**BLM18BB141SH1**	0.65	**BLM18BD222SH1**	1.60
BLM18BB050SH1	0.20	**BLM18BB151SH1**	0.65	**BLM18BD252SH1**	1.60
BLM18BA100SH1	0.35	**BLM18BD151SH1**	0.50	**BLM18PG300SH1**	0.10
BLM18BB100SH1	0.25	**BLM18BB221SH1**	0.75	**BLM18PG330SH1**	0.05
BLM18BA220SH1	0.45	**BLM18BD221SH1**	0.55	**BLM18PG600SH1**	0.20
BLM18BB220SH1	0.35	**BLM18BB331SH1**	0.85	**BLM18PG121SH1**	0.10
BLM18BA470SH1	0.65	**BLM18BD331SH1**	0.60	**BLM18PG181SH1**	0.18

On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive

Chip EMIFIL® Part Numbering

Chip EMIFIL® Capacitor Type for Automotive

(Part Number) NF ❶ | M ❷ | 21 ❸ | HC ❹ | 102 ❺ | R ❻ | 1H ❼ | 3 ❽ | D ❾

❶Product ID

Product ID	
NF	Chip EMI Filters Capacitor Type

❷Structure

Code	Structure
M	Capacitor Type
E	Block, LC Combined Type

❸Dimensions (L×W)

Code	Dimensions (L×W)	EIA
21	2.0×1.25mm	0805
61	6.8×1.6mm	2606

❹Features

Code	Features
HC	For Automotive
HT	T Circuit for Heavy-duty

❺Capacitance

Expressed by three figures. The unit is in pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two figures.

❻Characteristics

Code	Capacitance Change (Temperature Characteristics)
C	±20%, ±22%
D	+20/-30%, +22/-33%
F	+30/-80%, +22/-82%
R	±15%
U	-750 ±120ppm/°C
Z	Other

❼Rated Voltage

Code	Rated Voltage
1H	50V
2A	100V

❽Electrode/Others

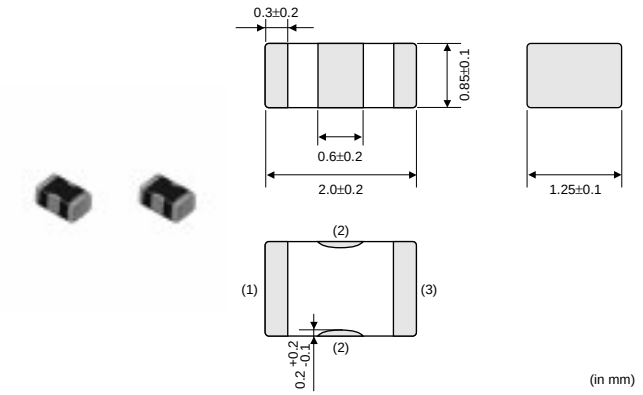
Code	Electrode
3	Sn Plating
9	Others

❾Packaging

Code	Packaging	Series
L	Plastic Taping (ø180mm Reel)	**NFE**
K	Plastic Taping (ø330mm Reel)	
B	Bulk	All series
D	Paper Taping (ø180mm Reel)	**NFM**

On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive

Chip EMIFIL® Capacitor Type NFM21H Series



The chip "EMIFIL" NFM21H series is a chip type three terminal EMI suppression filter. It can reduce residual inductance to an extremely low level making it excellent for noise suppression at high frequencies.

■ Features

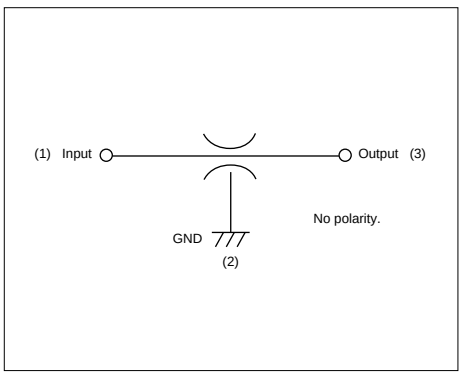
1. Wide operating temperature range. (-55 to +125 degree C)
2. Three terminal structure enables high performance in high frequency range.
3. Uses original electrode structure which realizes excellent solderability.
4. An electrostatic capacitance range of 22 to 22000pF enables suppression of noise at specific frequencies.

■ Applications

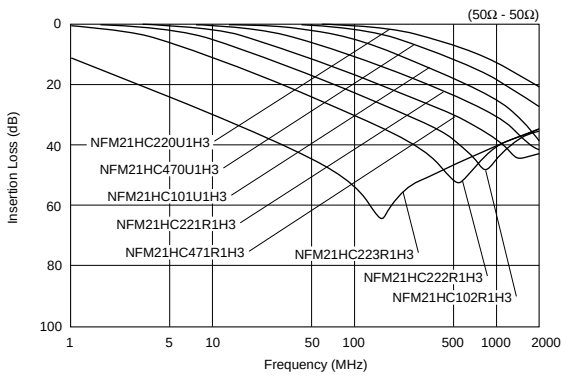
Severe EMI suppression and high impedance circuits such as digital circuits.

Part Number	Capacitance (pF)	Rated Voltage (Vdc)	Rated Current (mA)	Insulation Resistance (min.) (M ohm)	Operating Temperature Range (°C)
NFM21HC220U1H3	22 +20%,-20%	50	700	1000	-55 to +125
NFM21HC470U1H3	47 +20%,-20%	50	700	1000	-55 to +125
NFM21HC101U1H3	100 +20%,-20%	50	700	1000	-55 to +125
NFM21HC221R1H3	220 +20%,-20%	50	700	1000	-55 to +125
NFM21HC471R1H3	470 +20%,-20%	50	1000	1000	-55 to +125
NFM21HC102R1H3	1000 +20%,-20%	50	1000	1000	-55 to +125
NFM21HC222R1H3	2200 +20%,-20%	50	1000	1000	-55 to +125
NFM21HC223R1H3	22000 +20%,-20%	50	2000	1000	-55 to +125

■ Equivalent Circuit



■ Insertion Loss Characteristics (Typical)



Specifications and Test Methods

■ Test and Measurement Conditions

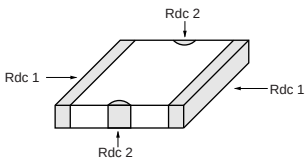
<Unless otherwise specified>
Temperature: Ordinary Temp. 15 to 35°C
Humidity: Ordinary Humidity 25 to 85%(RH)

<In case of doubt>
Temperature: 20±2°C
Humidity: 60 to 70%(RH)
Atmospheric pressure: 86 to 106kPa

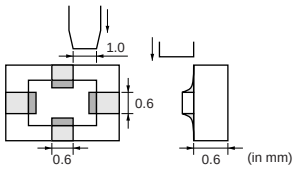
2

■ Specifications

1. Electrical Performance

No.	Item	Specifications	Test Methods
1	Capacitance (Cap.)	Meet rating table above.	Frequency 22 to 100pF: 1.0±0.1MHz 220 to 22000pF: 1.0±0.1kHz Voltage: 1±0.2Vrms
2	Insulation Resistance (I.R.)		Voltage: Rated Voltage Charging Time: 2 minutes max.
3	Withstanding Voltage	Products should not be damaged.	Test Voltage: 150Vdc Testing Time: 1 to 5s Charge/Discharge Current: 50mA max.
4	DC Resistance (Rdc 1, 2)	Meet rating table above.	Measured with 100mA max. Rdc 1: between signal terminals Rdc 2: between ground terminals 

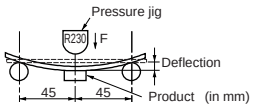
2. Mechanical Performance

No.	Item	Specifications	Test Methods
1	Appearance and Dimensions	Meet dimensions.	Visual Inspection and measured with Slide Calipers.
2	Solderability	Electrodes should be at least 90% covered with new solder coating.	Flux: Ethanol solution of rosin, 25wt% Pre-heat: 150±5°C, 60±5s Solder: (1) Sn/Pb = 60/40 (2) Sn-3.0Ag-0.5Cu solder Solder Temperature: (1) 230±5°C (2) 240±3°C Immersion Time: (1) 2±0.5s (2) 3±1s Immersion and emersion rates: 25mm/s
3	Resistance to soldering heat	Meet Table 1. Table 1 Appearance: No damage Cap. Change: within ± 7.5% I.R.: Meet rating table above. Rdc 1, 2: 22 to 2200pF: 0.5Ω max.; 22000pF: 0.05Ω max.	Flux: Ethanol solution of rosin, 25wt% Pre-heat: 150±5°C, 60±5s Solder: Sn/Pb = 60/40 or Sn-3.0Ag-0.5Cu solder Solder Temperature: 270±5°C Immersion Time: 10±1s Immersion and emersion rates: 25mm/s Initial values: About 220 to 22000pF, measured after Heat treatment [150°C ($\pm^{0}_{10}$°C), 1 hour] and exposure in the room condition for 48±4 hrs. Then measured after exposure to room conditions for Following hours. 22 to 100pF: 24±2 hrs. 220 to 22000pF: 48±4 hrs.
4	Bonding Strength	The electrodes should show no failure after testing.	It should be soldered on the glass-epoxy substrate. Applying Force (F): 17.6N Applying Time: 60s 

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specifications	Test Methods
5	Bending Strength	Meet Table 2. Table 2 Appearance: No damage Cap. Change: within ± 12.5% Rdc 1, 2: 22 to 2200pF: 0.5Ω max.; 22000pF: 0.05Ω max.	It should be soldered on the glass-epoxy substrate (t = 1.0mm). Deflection: 2mm Keeping Time: 30s 
6	Vibration	Meet Table 3. Table 3 Appearance: No damage Capacitance: Meet rating table above. Rdc 1, 2: 22 to 2200pF: 0.5Ω max.; 22000pF: 0.05Ω max.	It should be soldered on the glass-epoxy substrate. Oscillation Frequency: 10 to 55 to 10Hz for 1 min. Total Amplitude: 1.5mm Testing Time: A period of 2 hrs. in each of 3 mutually perpendicular directions. (Total 6 hrs.) Initial values: About 220 to 22000pF, measured after heat treatment [150°C (+0, -10°C), 1 hr.] and exposure to room conditions for 48±4 hrs.

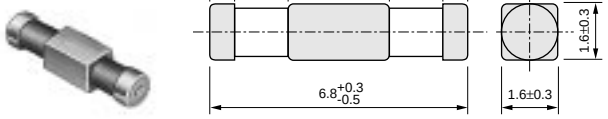
3. Environment Performance (It should be soldered on the glass-epoxy substrate.)

No.	Item	Specifications	Test Methods
1	Humidity	Meet Table 4. Table 4 Appearance: No damage Cap. Change: within ± 12.5% I.R.: Meet rating table above. Rdc 1, 2: 22 to 2200pF: 0.5Ω max.; 22000pF: 0.05Ω max.	Temperature: 70±2°C Humidity: 90 to 95%(RH) Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for following hours. 22 to 100pF: 24±2 hrs. 220 to 22000pF: 48±4 hrs.
2	Heat Life		Temperature: 125±3°C Test Voltage: Rated Voltage x 200% Applying Current: 50mA max. Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for following hours. 22 to100pF: 24±2 hrs. 220 to 22000pF: 48±4 hrs. Initial values: About 220 to 22000pF, measured after heat treatment [150°C (+0, -10°C), 1 hour] and exposure to room conditions for 48±4 hrs.
3	Cold Resistance		Temperature: -55 ± 2°C Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for following hours. 22 to 100pF: 24±2 hrs. 220 to 22000pF: 48±4 hrs.
4	Temperature Cycling	Meet Table 5. Table 5 Appearance: No damage Cap. Change: within ± 7.5% I.R.: Meet rating table above. Rdc 1, 2: 22 to 2200pF: 0.5Ω max.; 22000pF: 0.05Ω max.	1 Cycle 1 step: -55^{+0}_{-3}°C / 30 ±3 minutes 2 step: Room Temperature / within 5 minutes. 3 step: -125^{+3}_{-0}°C / 30 ±3 minutes 4 step: Room Temperature / within 5 minutes. Total of 1000 cycles Then measured after exposure to room conditions for following hours. 22 to 100pF: 24±2 hrs. 220 to 22000pF: 48±4 hrs. Initial values: About 220 to 22000pF, measured after heat treatment [150°C (+0, -10°C), 1 hr.] and exposure to room conditions for 48±4 hrs.

On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive

Chip EMIFIL® LC Combined Type for Large Current NFE61H Series

The T-type chip EMI Filter NFE61H series consists of a feedthrough capacitor and ferrite beads.



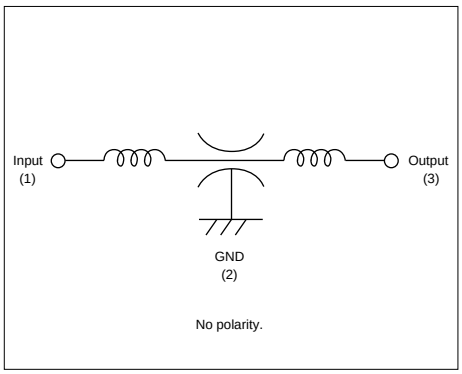
(in mm)

■ Features

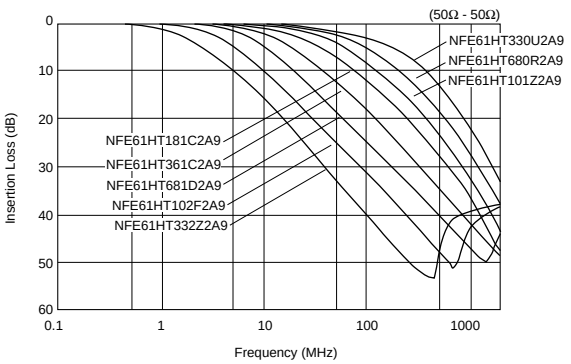
1. Its large rated current of 2A and low voltage drop due to small DC resistance are suitable for DC power line use.
2. The feedthrough capacitor realizes excellent high frequency characteristics.
3. The structure incorporates built-in ferrite beads which minimize resonance with surrounding circuits.
4. 33 to 3300pF lineups can be used signal lines.

Part Number	Capacitance (pF)	Rated Voltage (Vdc)	Rated Current (A)	Insulation Resistance (min.) (M ohm)	Operating Temperature Range (°C)
NFE61HT330U2A9	33 +30%,-30%	100	2	1000	-55 to +125
NFE61HT680R2A9	68 +30%,-30%	100	2	1000	-55 to +125
NFE61HT101Z2A9	100 +30%,-30%	100	2	1000	-55 to +125
NFE61HT181C2A9	180 +30%,-30%	100	2	1000	-55 to +125
NFE61HT361C2A9	360 +20%,-20%	100	2	1000	-55 to +125
NFE61HT681D2A9	680 +30%,-30%	100	2	1000	-55 to +125
NFE61HT102F2A9	1000 +80%,-20%	100	2	1000	-55 to +125
NFE61HT332Z2A9	3300 +80%,-20%	100	2	1000	-55 to +125

■ Equivalent Circuit



■ Insertion Loss Characteristics (Typical)



Specifications and Test Methods

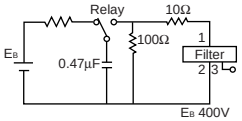
■ Test and Measurement Conditions

<Unless otherwise specified>
Temperature: Ordinary Temp. 15 to 35°C
Humidity: Ordinary Humidity 25 to 85%(RH)

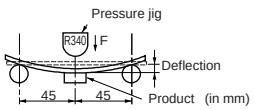
<In case of doubt>
Temperature: 20±2°C
Humidity: 60 to 70%(RH)
Atmospheric pressure: 86 to 106kPa

■ Specifications

1. Electrical Performance

No.	Item	Specifications	Test Methods
1	Capacitance (Cap.)	Meet rating table above.	Table 1 Capacitance: 33, 68, 100 (pF) — Voltage: 1 to 5Vrms — Frequency: 1MHz±10% Capacitance: 180, 360, 680, 1000, 3300 (pF) — Voltage: 1±0.2Vrms — Frequency: 1kHz±10%
2	Insulation Resistance (I.R.)	Meet rating table above.	Voltage: 100Vdc Charging Time: 60±5s
3	Withstanding Voltage	Products should not be damaged.	Test Voltage: 250Vdc Testing Time: 1 to 5s Charge/Discharge current: 10mA max.
4	Resistance to Surge Voltage	Meet Table 2. Table 2 Appearance: No damage Cap. Change: 33, 68, 100, 180, 360, 680 (pF): within±15% Cap. Change: 1000, 3300 (pF): within±30% I.R.: Meet rating table above. Withstanding Voltage: No damage	Attenuating transient voltage of exponential function should be applied to products in the following conditions:  Peak Voltage: 400V Force Period: 1s The number of Surges: 10^5

2. Mechanical Performance

No.	Item	Specifications	Test Methods
1	Appearance and Dimensions	Meet dimensions.	Visual Inspection and measured with Slide Calipers
2	Solderability	The electrodes should be at least 75% covered with new solder coating.	Flux: Ethanol solution of rosin, 25wt% Pre-heat: 150±5°C, 60±5s Solder: (1) Sn/Pb = 60/40 (2) Sn-3.0Ag-0.5Cu solder Solder Temperature: (1) 230±5°C (2) 240±3°C Immersion Time: (1) 4±1s (2) 3±1s Immersion and emersion rates: 25mm/s
3	Resistance to soldering heat	Meet Table 2.	Flux: Ethanol solution of rosin, 25wt% Pre-heat: 150±5°C, 60±5s Solder: Sn/Pb = 60/40 or Sn-3.0Ag-0.5Cu solder Solder Temperature: 270±5°C (for NFE61HT332Z2A9□: 250±5°C) Immersion Time: 10±1s Immersion and emersion rates: 25mm/s
4	Bending Strength	Meet Table 3. Table 3 Appearance: No damage Cap. Change: 33, 68, 100, 180, 360, 680 (pF): within±15% Cap. Change: 1000, 3300 (pF): within±30%	It should be soldered on the paper-phenol substrate. (t=1.6mm)  Deflection: 3mm Keeping Time: 30s
5	Vibration	Meet Table 2.	Oscillation Frequency: 10 to 2000 to 10Hz for 20 min. Total Amplitude: 1.5mm or Acceleration amplitude 49m/s^2 whichever is smaller Testing Time: A period of 2 hours in each of 3 mutually perpendicular directions. (Total 6 hrs.)

Specifications and Test Methods

3. Environment Performance (It should be soldered on the substrate.)

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Methods</th></tr>
<tr><td>1</td><td>Humidity</td><td rowspan="3">Meet Table 4.
Table 4
<table><tr><td>Appearance</td><td colspan="2">No damage</td></tr><tr><td rowspan="2">Cap. Change</td><td>33, 68, 100, 180, 360, 680 (pF)</td><td>within±15%</td></tr><tr><td>1000, 4700 (pF)</td><td>within±30%</td></tr><tr><td>I.R.</td><td colspan="2">100MΩ min.</td></tr><tr><td>Withstanding Voltage</td><td colspan="2">No damage</td></tr></table></td><td>Temperature: 85±2°C
Humidity: 85%(RH)
Time: 1000 hrs. (+48 hrs., -0 hr.)
Then measured after exposure to room conditions for 4 to 48 hrs.</td></tr>
<tr><td>2</td><td>Heat Life</td><td>Temperature: 125±2°C
Test Voltage:
33, 68, 100, 180, 360, 680 (pF): Rated Voltage x 200%
1000, 3300 (pF): Rated Voltage x 150%
Time: 1000 hrs. (+48 hrs., -0 hr.)
Then measured after exposure to room conditions for 4 to 48 hrs.</td></tr>
<tr><td>3</td><td>Cold Resistance</td><td>Temperature: -55±2°C
Time: 500 hrs. (+24hrs., -0 hr.)
Then measured after exposure to room conditions for 4 to 48 hrs.</td></tr>
<tr><td>4</td><td>Temperature Cycling</td><td>Meet Table 2.</td><td>1 Cycle
1 step: -55°C (+0°C, -3°C) / 30±3 minutes.
2 step: Room Temperature / within 5 minutes.
3 step: +125°C (+3°C, -0°C) / 30±3 minutes.
4 step: Room Temperature / within 5 minutes.
Total of 500 cycles
Then measured after exposure to room conditions for 4 to 48 hrs.</td></tr>
</table>

On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive

Chip Common Mode Choke Coils Part Numbering

Chip Common Mode Choke Coils for Automotive

(Part Number)

DL	W	31	S	H	222	S	Q	2	L
❶	❷	❸	❹	❺	❻	❼	❽	❾	❿

❶Product ID

Product ID	
DL	Chip Common Mode Choke Coils

❷Structure

Code	Structure
W	Winding Type

❸Dimensions (L×W)

Code	Dimensions (L×W)	EIA
31	3.2×1.6mm	1206

❹Type

Code	Type
S	Magnetically Shielded One Circuit Type

❺Category

Code	Category
H	For Automotive

❻Impedance

Typical impedance at 100MHz is expressed by three figures. The unit is in ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two figures.

❼Circuit

Ex.)

Code	Circuit	Series
S	Standard Type	**DLW31S**

❽Features

Code	Features
Q	Expressed by a letter.

❾Number of Signal Lines

Code	Number of Signal Lines
2	Two Lines

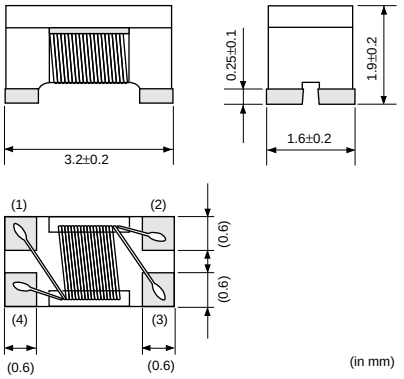
❿Packaging

Code	Packaging	Series
L	Plastic Taping (ø180mm Reel)	**DLW31S**
B	Bulk	

On-Board Type (DC) EMI Suppression Filters (EMIFIL®) for Automotive

Chip Common Mode Choke Coil DLW31S Series

The DLW31SH series is a high performance wound type chip common mode choke coil.



■ Features

1. DLW31SH is the small size. (3.2x1.6x1.9mm)
2. Suitable for noise suppression at car area networks like CAN (Controller Area Network) bus.
3. DLW31SH has high common mode impedance so it is suitable for noise suppression through wide frequency range.
4. Wide operating temperature range. (-40 to +125 degree C)

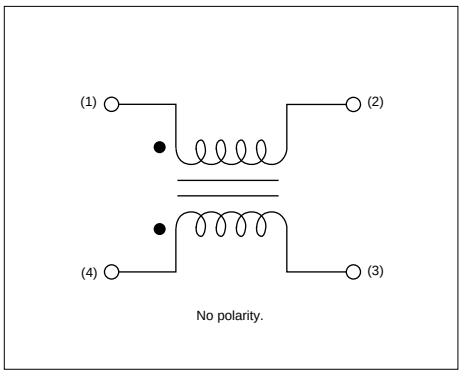
■ Applications

Noise suppression at car area networks like CAN bus or Car navigation system.

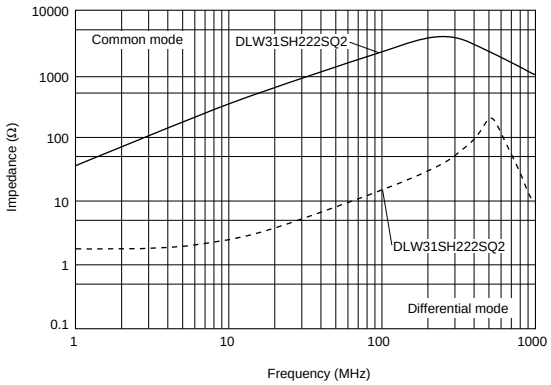
Part Number	Common Mode Impedance (at 100MHz, 20°C) (ohm)	Rated Current (mA)	Rated Voltage (Vdc)	Insulation Resistance (min.) (M ohm)	Withstand Voltage (Vdc)	DC Resistance (ohm)
DLW31SH222SQ2	2200 ±25%	80	32	10	80	1.6 ±20%

Operating Temperature Range : -40°C to 125°C

■ Equivalent Circuit



■ Impedance-Frequency Characteristics



Specifications and Test Methods

■ Test and Measurement Conditions

<Unless otherwise specified>
Temperature: Ordinary Temp. 15 to 35°C
Humidity: Ordinary Humidity 25 to 85%(RH)

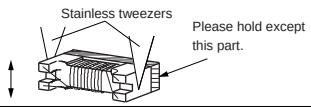
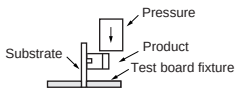
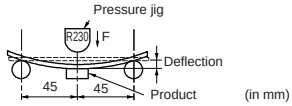
<In case of doubt>
Temperature: 20±2°C
Humidity: 60 to 70%(RH)
Atmospheric Pressure: 86 to 106kPa

■ Specifications

1. Electrical Performance

No.	Item	Specifications	Test Methods
1	Common Mode Impedance (Zc)	Meet rating table above.	Measuring Equipment: Agilent 4291A or the equivalent Measuring Frequency:100±1MHz Test Fixture: Agilent 16092A or equivalent
2	Insulation Resistance (I.R.)		Measuring voltage: Rated Voltage Charging time: 1 minute max.
3	Withstanding Voltage	Products should not be damaged.	Test Voltage: 2.5 times for Rated Voltage Tsting Time: 1 to 5s Charge/Discharge Current: 1mA max.
4	DC Resistance (Rdc)	Meet rating table above.	Measuring current: 10mA max. (In case of doubt in the above mentioned standard condition, measure by four terminal methods.)

2. Mechanical Performance

No.	Item	Specifications	Test Methods
1	Appearance and Dimensions	Meet dimensions.	Visual Inspection and measured with Slide Calipers
2	Solderability	The electrodes should be at least 90% covered with new solder coating.	The electrodes should be at least 90% covered with new solder coating. Flux: Ethanol solution of rosin, 25wt% includes activator equivalent to 0.06 to 0.10wt% chlorine Pre-heating: 150±5°C, 60±5s Solder: (1) Sn/Pb=60/40 (2) Sn-3.0Ag-0.5Cu solder Solder Temperature: (1) 230±5°C (2) 245±3°C Immersion Time: (1) 3±0.5s (2) 4±1s Immersion and emersion rates: 25mm/s 
3	Resistance to Soldering Heat	Meet Table 1.	Flux: Ethanol solution of rosin, 25wt% includes activator equipment to 0.06 to 0.10wt% chlorine Pre-heating: 150±5°C, 60±5s Solder: Sn/Pb=60/40 or Sn-3.0Ag-0.5Cu solder Solder Temperature: 260±5°C Immersion Time: 10±0.5s Immersion and emersion rates: 25mm/s Then measured after exposure in the room condition for 4 to 48 hrs.
4	Bonding Strength	No evidence of coming off substrate. Products should not be mechanically damaged.	It should be soldered on the substrate. Applying Force (F): 10N Applying Time: 5±1s 
5	Bending Strength	Meet Table 1.	It should be soldered on the Glass-epoxy substrate (t=1.0mm). Deflection (n): 2.0mm Keeping time: 5s Speed of Applying Force: 0.5mm/s 

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specifications	Test Methods
6	Vibration	Meet Table 1.	It should be soldered on the substrate. Oscillation Frequency: 10 to 2000 to 10Hz for 20 min. Total Amplitude 1.5mm or Acceleration amplitude 49m/s^2 whichever is smaller. Testing Time: A period of 4 hrs. in each of 3 mutually perpendicular directions. (Total 12 hrs.)

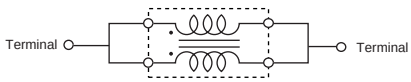
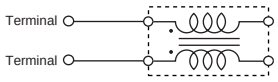
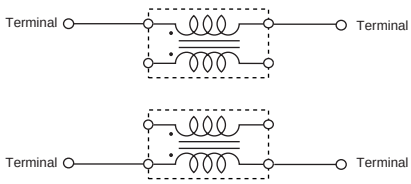
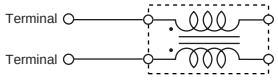
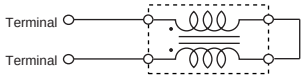
3. Environmental Performance (Products should be soldered on the substrate.)

No.	Item	Specifications	Test Methods
1	Humidity	Meet Table 1.	Temperature: 85±2°C Humidity: 85%(RH) Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for 4 to 48 hrs.
2	Heat Life		Temperature: 125±2°C Applying Voltage: Rated Current Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for 4 to 48 hrs.
3	Cold Resistance		Temperature: -40±2°C Time: 1000 hrs. (+48 hrs., -0 hr.) Then measured after exposure to room conditions for 4 to 48 hrs.
4	Temperature Cycle		1 Cycle Step 1 -40°C (+0°C, -3°C) / 30±3 minutes. Step 2 Room Temperature / within 5 minutes. Step 3 +125°C (+3°C, -0°C) / 30±3 minutes. Step 4 Room Temperature / within 5 minutes. Total of 1000 cycles Then measured after exposure to room conditions for 4 to 48 hrs.

Table 1

Appearance	No damage
Common Mode Impedance Change	within±20%
Insulation Resistance	10MΩ min.
Withstanding Voltage	No damage

4. Test Terminal (When measuring and supplying the voltage, the following terminal is applied.)

No.	Item	Terminal to be Tested
1	Common Mode Impedance (Measurement Terminal)	
2	Withstanding Voltage (Measurement Terminal)	
3	DC Resistance (Measurement Terminal)	
4	Insulation Resistance (Measurement Terminal)	
5	Heat Life (Supply Terminal)	

■ Measuring Method for Common Mode Impedance

Measured common mode impedance may include measurement error due to stray capacitance, residual inductance of test fixture.

To correct this error, the common mode impedance should be calculated as follows;

(1) Measure admittance of the fixture (opened), Go Bo.

(2) Measure impedance of the fixture (shorted), Rs Xs.

(3) Measure admittance of the specimen, Gm Bm.

(4) Calculate corrected impedance |Z| using the formula below.

$$|Z| = (Rx^2+Xx^2)^{1/2}$$

Where

$$Rx = \frac{Gm - Go}{(Gm-Go)^2 + (Bm-Bo)^2} - Rs$$

$$Xx = \frac{-(Bm - Bo)}{(Gm-Go)^2 + (Bm-Bo)^2} - Xs$$

⚠Caution/Notice

■ ⚠Caution (Rating)

Do not use products beyond the rated current and rated voltage as this may create excessive heat and deteriorate the insulation resistance.

■ ⚠Caution (Soldering and Mounting)

Please provide special attention when mounting chip "EMIFIL" (BLM_P) series in close proximity to other products that radiate heat.
The heat generated by other products may deteriorate the insulation resistance and cause excessive heat in this component.

■ Notice (Storage and Operating Condition)

< Operating Environment >
Do not use products in a chemical atmosphere such as chlorine gas, acid or sulfide gas.
< Storage and Handling requirements >
1. Storage Period
BLM series should be used within 6 months, the other series should be used within 12 months. Products to be used after this period should be checked for solderability.

2. Storage conditions
(1) Storage temperature : -10 to 40 degree C
Relative humidity : 30 to 70%
Avoid sudden changes in temperature and humidity.
(2) Do not store products in a chemical atmosphere such as chlorine gas, acid or sulfide gas.

■ Notice (Rating)

Noise suppression levels resulting from Murata's EMI suppression filters "EMIFIL" may vary, depending on the circuits and ICs used, type of noise, mounting pattern, lead wire length, mounting location, and other operating conditions. Be sure to check and confirm in advance the noise suppression effect of each filter, in actual circuits, etc. before applying the filter in a commercial-purpose equipment design.

■ Notice (Soldering and Mounting)

1. Washing
Failure and degradation of a product are caused by the washing method. When you wash on the conditions that are not in mounting information, please contact Murata engineering.
2. Soldering
Reliability decreases with improper soldering methods. Please solder by the standard soldering conditions shown in mounting information.

■ Notice (Handling)

Do not make any resin coating DLW31SH series.
Resin coating may cause a change in impedance value or open circuit of wire.

Soldering and Mounting

1. Standard Land Pattern Dimensions

NF□ series suppress noise by conducting the high-frequency noise element to ground. Therefore, to obtain maximum performance from these filters, the ground pattern should be made as large as possible during the PCB design stage. As shown in the right, one side of the PCB is used for chip mounting, and the other is used for grounding.

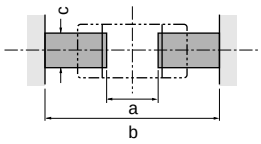
Small diameter feedthrough holes are then used to connect the grounds on each side of the PCB. This reduces the high-frequency impedance of the grounding and maximizes the filter's performance.

Land Pattern + Solder Resist
Land Pattern
Solder Resist
(in mm)

BLM18

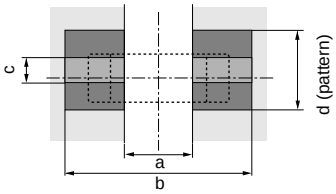
●Reflow and Flow

BLM Series (Except BLM□□P series)



Type	Soldering	a	b	c
BLM18 (except 18PG type)	Flow	0.7	2.2-2.6	0.7
	Reflow		1.8-2.0	

BLM□□P



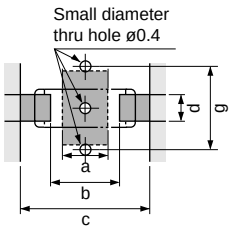
Type	Rated Current (A)	Soldering	a	b	c	Land pad thickness and dimension d		
						18μm	35μm	70μm
BLM18PG	0.5-1.5	Flow/ Reflow	0.7	Flow 2.2-2.6 Reflow 1.8-2.0	0.7	0.7	0.7	0.7
	2					1.2	0.7	0.7
	3					2.4	1.2	0.7

• Do not apply narrower pattern than listed above to BLM□□P. Narrow pattern can cause excessive heat or open circuit.

NFM21

● Reflow Soldering

Chip mounting side



Part Number	Size (mm)				
	a	b	c	d	g
NFM21H	0.6	1.4	2.6	0.8	2.3

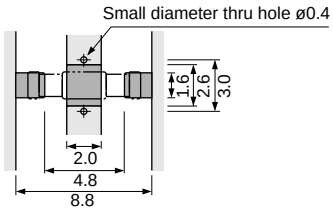
The chip EMI filter suppress noise by conducting the high-frequency noise to ground. Therefore, to get enough noise reduction, feed through holes which are connected to ground-plane should be arranged according to the figure to reinforce the ground-pattern.

• NFM21 is specially adapted for reflow soldering.

NFE61H

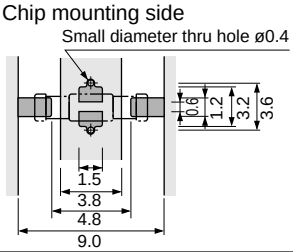
● Reflow Soldering

Chip mounting side



● Flow Soldering (Except NFE61HT332)

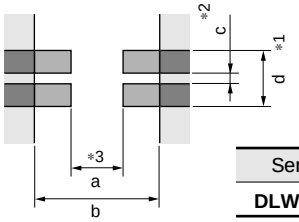
Chip mounting side



DLW31S

●Reflow Soldering

DLW31S



Series	a	b	c	d
DLW31S	1.6	3.7	0.4	1.6

∗ 1: If the pattern is made with wider than 1.6mm (DLW31S) it may result in components turning around, because melting speed is different. In the worst case, short circuit between lines may occur.

∗ 2: If the pattern is made with less than 0.4mm, in the worst case, short circuit between lines may occur due to spread of soldering paste or mount placing accuracy.

∗ 3: If the pattern is made with wider than 1.6mm (DLW31S), the bending strength will be reduced.

Do not use gild pattern; excess soldering heat may dissolve metal of a copper wire.

Continued on the following page.

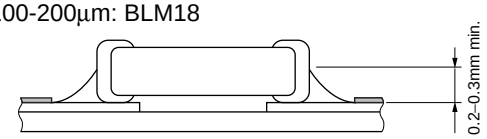
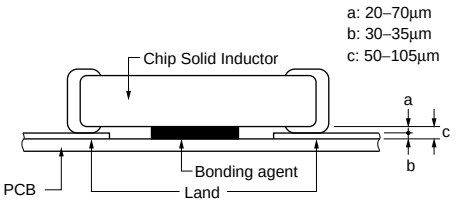
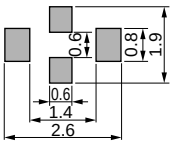
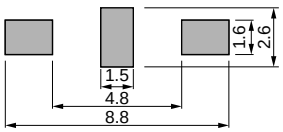
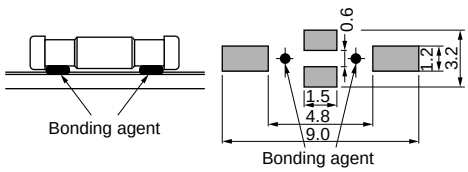
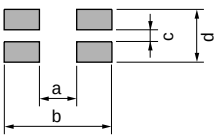
Soldering and Mounting

Continued from the preceding page.

2. Solder Paste Printing and Adhesive Application

When reflow soldering the chip EMI suppression filter, the printing must be conducted in accordance with the following cream solder printing conditions.
If too much solder is applied, the chip will be prone to damage by mechanical and thermal stress from the PCB and may crack. In contrast, if too little solder is applied, there is the potential that the termination strength will be insufficient, creating the potential for detachment.
Standard land dimensions should be used for resist and copper foil patterns.
When flow soldering the EMI suppression filter, apply the adhesive in accordance with the following conditions.
If too much adhesive is applied, then it may overflow into the land or termination areas and yield poor solderability. In contrast, if insufficient adhesive is applied, or if the adhesive is not sufficiently hardened, then the chip may become detached during flow soldering process.

(in mm)

<table>
<tr><th>Series</th><th>Solder Paste Printing</th><th>Adhesive Application</th></tr>
<tr><td>BLM</td><td>●Ensure that solder is applied smoothly to a minimum height of 0.2mm to 0.3mm at the end surface of the part.
●Coat the solder paste a thickness:
100-200µm: BLM18
 
</td><td>Coating amount is illustrated in the following diagram.
 
</td></tr>
<tr><td>NFM</td><td>●Use Sn/Pb=60/40 or Sn-3.0Ag-0.5Cu solder for pattern printing.
●Coat the solder paste a thickness:
100-150µm: NFM21
NFM21H
 
</td><td></td></tr>
<tr><td>NFE61H</td><td>●Use Sn/Pb=60/40 or Sn-3.0Ag-0.5Cu solder for pattern printing.
●Coat the solder paste a thickness: 150-200µm
 
</td><td>Apply 1.0mg of bonding agent at each chip.
 
</td></tr>
<tr><td>DLW</td><td>●Use Sn/Pb=60/40 or Sn-3.0Ag-0.5Cu solder for pattern printing.
●Coat the solder paste a thickness:
100-150µm: DLW31S
*Solderability is subjected to reflow condition and thermal conductivity. Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
DLW31S
 

<table>
<tr><th>Series</th><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>DLW31S</td><td>1.6</td><td>3.7</td><td>0.4</td><td>1.6</td></tr>
</table></td><td></td></tr>
</table>

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3. Standard Soldering Conditions

(1) Soldering Methods

Use flow and reflow soldering methods only.
Use standard soldering conditions when soldering chip EMI suppression filters.
In cases where several different parts are soldered, each having different soldering conditions, use those conditions requiring the least heat and minimum time.

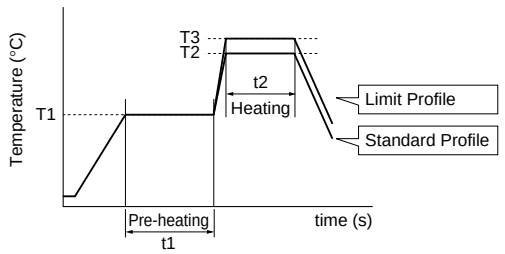
Solder : H60A H63A solder (JIS Z 3238)
In case of lead-free solder, use Sn-3.0Ag-0.5Cu solder

Flux :

- Use Rosin-based flux (when using RA type solder, clean products sufficiently to avoid residual flux.
- Do not use strong acidic flux (with chlorine content exceeding 0.20wt%)
- Do not use water-soluble flux.

(2) Soldering profile

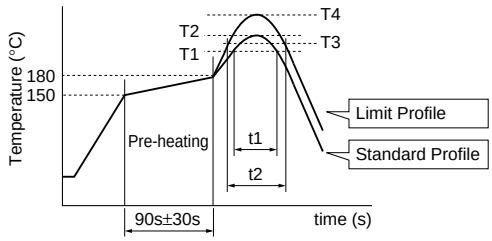
●Flow Soldering profile
(Eutectic solder, Sn-3.0Ag-0.5Cu solder)



Series	Pre-heating		Standard Profile			Limit Profile		
			Heating		Cycle of flow	Heating		Cycle of flow
	Temp. (T1)	Time. (t1)	Temp. (T2)	Time. (t2)		Temp. (T3)	Time. (t2)	
BLM NFE61H*	150°C	60s min.	250°C	4 to 6s	2 times	265 ±3°C	5s max.	2 times

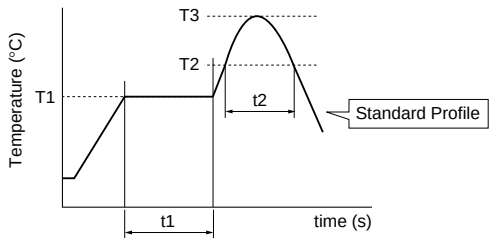
*Except NFE61HT332

●Reflow Soldering profile
①Soldering profile for Lead-free solder (Sn-3.0Ag-0.5Cu)



Series	Standard Profile				Limit Profile			
	Heating		Peak temperature (T2)	Cycle of reflow	Heating		Peak temperature (T4)	Cycle of reflow
	Temp. (T1)	Time. (t1)			Temp. (T3)	Time. (t2)		
BLM, NFE NFM, DLW	220°C min.	30 to 60s	245±3°C	2 times	230°C min.	60s max.	260°C/10s	2 times

②Soldering profile for Eutectic solder
(Limit profile: refer to ①)



Series	Pre-heating		Standard Profile			
			Heating		Peak temperature (T3)	Cycle of reflow
	Temp. (T1)	Time. (t1)	Temp. (T2)	Time. (t2)		
BLM, NFE NFM, DLW	150°C	60s min.	183°C min.	60s max.	230°C	2 times

Continued on the following page.

Soldering and Mounting

Continued from the preceding page.

(3) Reworking with Solder Iron

The following conditions must be strictly followed when using a soldering iron.
Pre-heating: 150°C 60s min.
Soldering iron power output: 30W max.
Temperature of soldering iron tip / Soldering time:
280°C max./10s max. or 300°C max./3s max.*
*BLM: 350°C max./3s max.
Do not allow the tip of the soldering iron to directly contact the chip.
For additional methods of reworking with to soldering iron, please contact Murata engineering.

4. Cleaning

Following conditions should be observed when cleaning chip EMI filter.

(1) Cleaning Temperature: 60°C max. (40°C max. for alcohol type cleaner)

(2) Ultrasonic
Output: 20W/liter max.
Duration: 5 minutes max.
Frequency: 28 to 40kHz

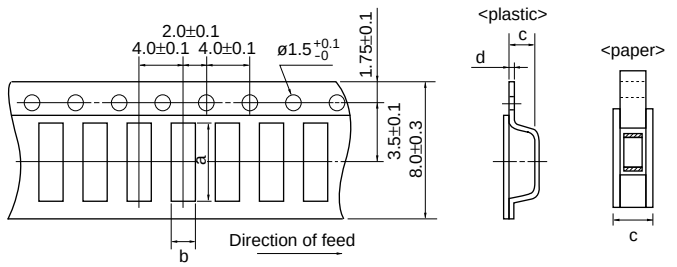
(3) Cleaning agent
The following list of cleaning agents have been tested on the individual components. Evaluation of final assembly should be completed prior to production.
Do not clean DLW31S series.
In case of cleaning, please contact Murata engineering.
(a) Alcohol cleaning agent
Isopropyl alcohol (IPA)
(b) Aqueous cleaning agent
Pine Alpha ST-100S

(4) Ensure that flux residue is completely removed.
Component should be thoroughly dried after aqueous agent has been removed with deionized water.

(5) Some products may become slightly whitened.
However, product performance or usage is not affected.
For additional cleaning methods, please contact Murata engineering.

Package

■ Minimum Quantity and Dimensions of 8mm Width Paper / Plastic Tape

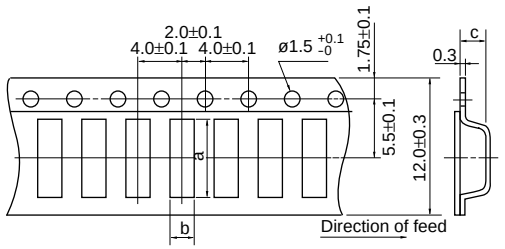


(in mm)

Part Number	Cavity Size (in mm)				Minimum Qty. (pcs.)				
					ø180mm reel		ø330mm reel		Bulk
	a	b	c	d	Paper Tape	Plastic Tape	Paper Tape	Plastic Tape	
BLM18	1.85	1.05	1.1 max.	-	4000	-	10000	-	1000
NFM21	2.3	1.55	1.1 max.	-	4000	-	-	-	500
DLW31S	3.6	2.0	2.1	0.3	-	2000	-	-	500

• Please contact us for BLM18 in bulk case.

■ Minimum Quantity and Dimensions of 12mm Width Plastic Tape



(in mm)

Part Number	Cavity Size			Minimum Qty. (pcs.)		
	a	b	c	ø180mm reel	ø330mm reel	Bulk
NFE61	7.2	1.9	1.75	2500	8000	500

Design Kits

●EKEMAUTOB

No.	Part Number	Quantity (pcs.)	Impedance typ. (at 100MHz, 20°C) (Ω)	Rated Current (mA)	DC Resistance (Ω) max.
1	**BLM18AG121SH1**	20	120 ±25%	200	0.20
2	**BLM18AG221SH1**	20	220 ±25%	200	0.30
3	**BLM18AG601SH1**	20	600 ±25%	200	0.50
4	**BLM18AG102SH1**	20	1000 ±25%	100	0.70
5	**BLM18BA050SH1**	20	5 ±25%	500	0.20
6	**BLM18BA100SH1**	20	10 ±25%	500	0.25
7	**BLM18BA470SH1**	20	47 ±25%	300	0.55
8	**BLM18BA750SH1**	20	75 ±25%	300	0.70
9	**BLM18BA121SH1**	20	120 ±25%	200	0.90
10	**BLM18BB050SH1**	20	5 ±25%	700	0.10
11	**BLM18BB100SH1**	20	10 ±25%	500	0.10
12	**BLM18BB470SH1**	20	47 ±25%	500	0.30
13	**BLM18BB750SH1**	20	75 ±25%	200	0.35
14	**BLM18BB121SH1**	20	120 ±25%	200	0.50
15	**BLM18BB221SH1**	20	220 ±25%	200	0.65
16	**BLM18BB471SH1**	20	470 ±25%	50	1.00
17	**BLM18BD121SH1**	20	120 ±25%	200	0.40
18	**BLM18BD221SH1**	20	220 ±25%	200	0.45
19	**BLM18BD471SH1**	20	470 ±25%	200	0.55
20	**BLM18BD601SH1**	20	600 ±25%	200	0.65
21	**BLM18BD102SH1**	20	1000 ±25%	100	0.85
22	**BLM18BD182SH1**	20	1800 ±25%	50	1.50
23	**BLM18BD252SH1**	20	2500 ±25%	50	1.50
24	**BLM18PG330SH1**	20	33 ±25%	3000	0.025
25	**BLM18PG121SH1**	20	120 ±25%	2000	0.05
26	**BLM18PG181SH1**	20	180 ±25%	1500	0.09

No.	Part Number	Quantity (pcs.)	Common Mode Impedance (at 100MHz, 20°C) (Ω)	Rated Voltage (Vdc)	Rated Current (mA)	Insulation Resistance (MΩ min.)
27	**DLW31SH222SQ2**	20	2200 ±25%	32	80	10

No.	Part Number	Quantity (pcs.)	Capacitance (pF)	Rated Voltage (Vdc)	Rated Current (mA)	Insulation Resistance (MΩ min.)
28	**NFM21HC220U1H3**	20	22 ±20%	50	700	1000
29	**NFM21HC470U1H3**	20	47 ±20%	50	700	1000
30	**NFM21HC101U1H3**	20	100 ±20%	50	700	1000
31	**NFM21HC221R1H3**	20	220 ±20%	50	700	1000
32	**NFM21HC471R1H3**	20	470 ±20%	50	1000	1000
33	**NFM21HC102R1H3**	20	1000 ±20%	50	1000	1000
34	**NFM21HC222R1H3**	20	2200 ±20%	50	1000	1000
35	**NFM21HC223R1H3**	20	22000 ±20%	50	2000	1000

Continued on the following page.

Design Kits

Continued from the preceding page.

No.	Part Number	Quantity (pcs.)	Capacitance (pF)	Rated Voltage (Vdc)	Rated Current (mA)	Insulation Resistance (MΩ min.)
36	**NFE61HT330U2A9**	20	33 ±30%	100	2000	1000
37	**NFE61HT680R2A9**	20	68 ±30%	100	2000	1000
38	**NFE61HT101Z2A9**	20	100 ±30%	100	2000	1000
39	**NFE61HT181C2A9**	20	180 ±30%	100	2000	1000
40	**NFE61HT361C2A9**	20	360 ±20%	100	2000	1000
41	**NFE61HT681D2A9**	20	680 ±30%	100	2000	1000
42	**NFE61HT102F2A9**	20	1000 +80%, -20%	100	2000	1000
43	**NFE61HT332Z2A9**	20	3300 +80%, -20%	100	2000	1000

Outlines of Major Noise Regulation Standards

1. EMI Regulations

Equipment \ Countries		Information Regulation	Japan	USA	Europe
Emission	Generic Standard	CISPR61000-6-3 (Residential, Commercial and Light Industry) IEC61000-6-4 (Industrial)			EN50081-1 (Residential, Commercial and Light Industry) EN50081-2 (Industrial)
	ITE : Information Technology Equipment Printer, Personal computer Word processor, Display	CISPR 22	VCCI ∗1	FCC Part 15 Subpart B	EN55022
	ISM equipment, Microwave	CISPR 11	∗1	FCC Part 18	EN55011
	Igniter (Automobile, Motorboat)	CISPR 12	JASO	FCC Part 15 Subpart B	Automotive Directive
	TV, Radio, Audio, VTR	CISPR 13	∗1	FCC Part 15 Subpart B	EN55013
	Household electrical equipment Portable tool	CISPR 14	∗1		EN55014
	Fluorescent Lamp, Luminary	CISPR 15	∗1		EN55015
	Transceiver	ITU-T	Radio Act ARIB (Voluntary Regulation)	FCC Part 15 Subpart C FCC Part 22	ETS300 Series
	(Reference) Power Supply Higher Harmonic	IEC61000-3	Industrial Voluntary Regulation		EN61000-3
Immunity	Basic Standard	IEC61000-4	In the process of Regulating at JIS		EN61000-4 Series
	Generic Standard	IEC61000-6-1 (Residential, Commercial and Light Industry) IEC61000-6-2 (Industrial)	In the process of Regulating at JIS		EN50082-1 (Residential, Commercial and Light Industry) EN50082-2 (Industrial)
	Industrial Process Measurement and Control Equipment		Industrial Voluntary Action		
	Radio, TV	CISPR 20			EN55020
	ITE : Information Technology Equipment	CISPR 24			EN55024

∗1 Electrical Appliance and Material Safety Law

There are EMI regulations in each country to meet EMI noise levels emitted from digital equipment.
In the countries which regulate EMI, equipment which does not satisfy regulations is not allowed to be sold.

Continued on the following page.

Outlines of Major Noise Regulation Standards

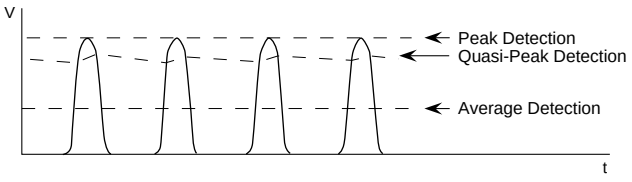
Continued from the preceding page.

2. Measurement Point and Noise Detection

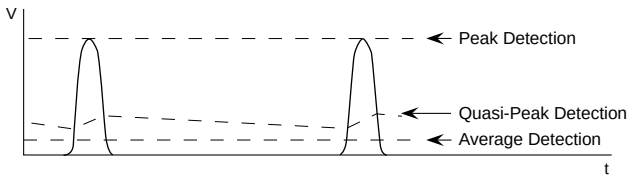
Regulation	Measuring Item	Polarization and Measuring Point	Frequency (Hz)	Detection	Measuring Devices
CISPR 22/ EN55022	Radiated Interference	Horizontal Pol. Vertical Pol.	30M to 1GHz	Quasi-Peak Detection	Antenna
	Main Interference Voltage	AC Main Ports	150k to 30MHz	Quasi-Peak Detection Mean Detection	Artificial Main Network
VCCI	Radiated Interference	Horizontal Pol. Vertical Pol.	30M to 1GHz	Quasi-Peak Detection	Dipole Antenna
	Main Interference Voltage	AC Main Ports	150k to 30MHz	Quasi-Peak Detection Mean Detection	Artificial Main Network
FCC Part 15	Radiated Interference	Horizontal Pol. Vertical Pol.	30M to 40GHz	Quasi-Peak Detection Mean Detection	Antenna
	Main Interference Voltage	AC Main Ports	150k to 30MHz	Quasi-Peak Detection	Artificial Main Network

Peak≧Quasi-Peak≧Average

(Qp)



Short Repetition Period



Long Repetition Period

3. Limits of CISPR 22/EN55022

(1) CISPR 22 recommends measurement at 10m distance. However, other distance is acceptable if the limitation is converted according to the following calculation. Limitation shown left is converted to limitation for 3m distance.

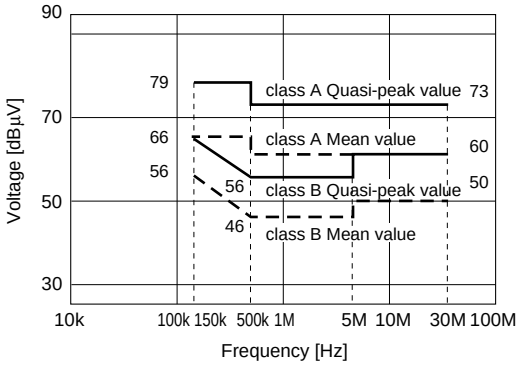
Conversion

Limitation for 10m Distance	→	Limitation for 3m Distance
R_{10} (dB μ V/m)		R_3 (dB μ V/m)
r_{10} (μ V/m)		r_3 (μ V/m)
$R_{10}=20 \log r_{10}$		$R_3=20 \log r_3$

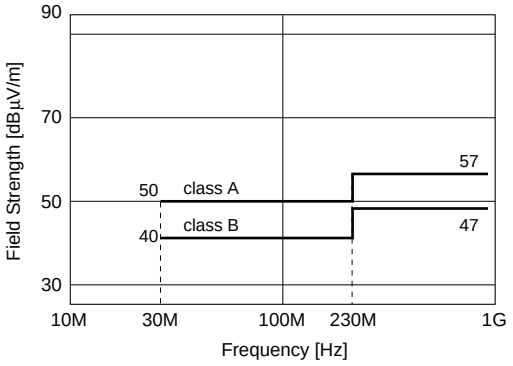
$$R_3=R_{10}+20\ (1-\log 3)$$

$$r_3 = \frac{10}{3}\ r_{10}$$

[Main Terminal Interference Voltage (Power Supply)]



[Radiated Interference]



On the border frequency, lower limit should be applied.

Class A Equipment: The equipment which is used in light industrial commercial areas.

Class B Equipment: The equipment which is used in residential areas.

Continued on the following page.

Outlines of Major Noise Regulation Standards

Continued from the preceding page.

(2) Scope of CISPR 22 Regulation

This regulation applies to information technology equipment (ITE) which are defined as:

(a) Equipment that receives data from external signal sources;

(b) Equipment that processes received data;

(c) Equipment that outputs data; and

(d) Equipment that has less than 600V rated voltage in power supply

[CISPR Regulations]

CISPR 10 Organization, Regulations and Procedures of CISPR
CISPR 11 Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment
CISPR 12 Vehicles, Motor Boats and Spark-Ignited Engine driven
CISPR 13 Sound and Television Receivers
CISPR 14 Household Electrical Appliances, Portable Tools and Similar Electrical Apparatus
CISPR 15 Fluorescent Lamps and Iuminaries
CISPR 16 Radio Interference Measuring Apparatus and Measurement Methods
CISPR 17 Passive Radio Interference Filters and Suppression Components
CISPR 18 Power Transmission Cables and High Voltage equipment
CISPR 19 Microwave Ovens for Frequencies above 1GHz
CISPR 20 Immunity of Sound and TV Broadcast Receivers and Associated Equipment
CISPR 21 Interference to Mobile Radio communications in the Presence of Impulsive Noise
CISPR 22 Information Technology Equipment
CISPR 23 Industrial Scientific and Medical (ISM) Equipment
CISPR 24 Immunity Regulation of Information Technology Equipment
CISPR 25 Receiver used on board vehicles, boats, and on devices

4. Limits of VCCI Voluntary Regulation

(1) VCCI recommends measurement at 10m distance; 3m or 30m distance measurements are also allowed.

(2) Scope of VCCI Voluntary Regulation

This regulation applies to information technology equipment (same as CISPR Pub.22), but the application is excluded on the following equipment:

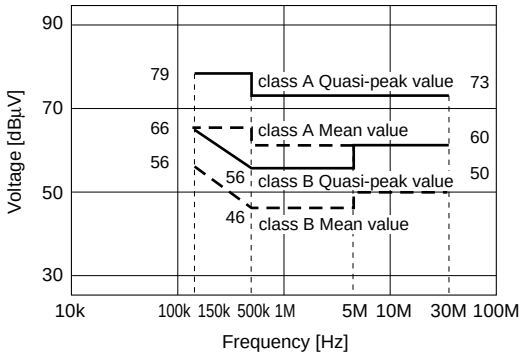
· Equipment for which other regulations already exist (e.g., household electrical appliances, radio and TV receivers)
· In station equipment principal purpose of which is electrical communication
· Industrial plant control system for which information processing is a secondary system function
· Industrial, commercial and medical testing and measuring systems for which data processing is a secondary system function
· Information equipment for which CISPR is conducting further deliberation

VCCI is the acronym of Voluntary Control Council for Interference by Data Processing Equipment and Electronic Office Machines.

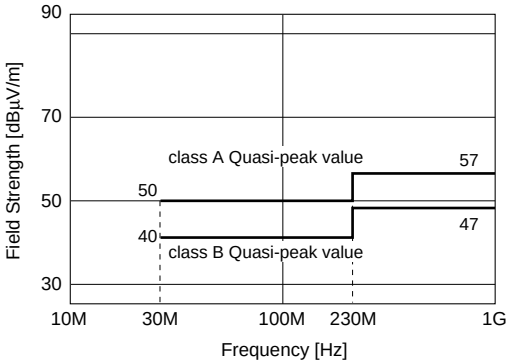
VCCI is organized by the following organizations:

· Japan Electronics and Information Technology Industries Association (JEITA)
· Japan Business Machine and Information System Industries Association (JBMIA)
· Communication and Information Network Association of Japan (CIAJ)

[Main Terminal Interference Voltage (Power Supply)]



[Radiated Interference]



On the border frequency, lower limit should be applied.

Class B ITE: Equipment that designed to be used at home.
Class A ITE: Equipment that does not meet interference limits of class B equipment, but satisfies interference limits of class A equipment.

Continued on the following page.

Outlines of Major Noise Regulation Standards

Continued from the preceding page.

5. Limits of FCC Part 15 Subpart B

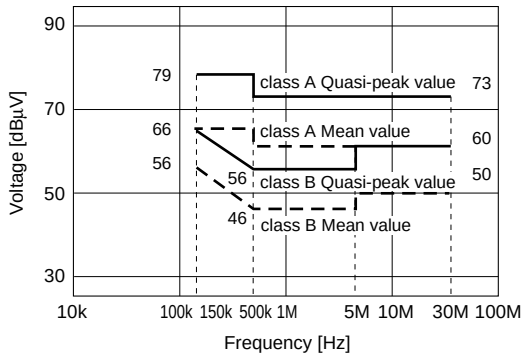
(1) Class A recommend to be measured with 10m distance. Class B recommend to be measured with 3m distance.

(2) The FCC Part 15 regulation controls radiated interference by establishing quasi-peak and mean value limits for fre-quencies ranging from 30MHz to 40GHz (or maximum frequency's fifth harmonic, whichever is lower). For AC main ports, the FCC Part 15 regulation controls main terminal interference voltage by establishing quasi-peak value limits for frequencies ranging from 450kHz to 30MHz.

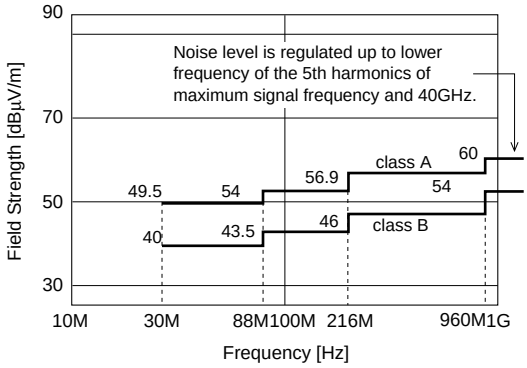
Measurement Frequency Range for Radiated Interference

Maximum Frequency the Equipment Internally Generates, Uses or Operates or Synchronizes (MHz)	Upper End of Measurement Frequency Range (MHz)
Less than 1.705	30
1.705 to 108	1000
108 to 500	2000
500 to 1000	5000
Over 1000	Maximum Frequency's Fifth Harmonic or 40GHz, Whichever is Lower

[Main Terminal Interference Voltage (Power Supply)]



[Radiated Interference]



On the border frequency, lower limit should be applied.

Class A Equipment: The digital equipment that is sold for commercial, industrial and office use.

Class B Equipment: The digital equipment that is sold to be used in residential areas.

(3)There is no regulation on power interference.

[FCC Regulations]

Part 1 Procedures
Part 2 Frequency Division and Radio Wave Treaty Issues and General Rules
Part 15 Radio Wave Equipment
- Intentionally electromagnetic radiation equipment
- Non-intentionally electromagnetic radiation equipment
- Incidentally electromagnetic radiation equipment

Part 18 Industrial, Scientific and Medical Equipment
Part 22 Public Mobile Wireless Operations
Part 68 Connecting Terminal Equipment to Telephone Circuit Network
Part 76 Cable Television

Continued on the following page.

Outlines of Major Noise Regulation Standards

Continued from the preceding page.

6. Immunity Regulations in Europe Union

All electric/electronic equipment cannot be sold in Europe without CE marking. To use CE marking, they must satisfy related EC directives such as EMC directives. For Information Technology Equipment, in EMC directive, emission regulations are integrated, and immunity regulations are applied. Although these immunity regulations are prepared by CENELEC, almost all contents are same as standards issued by IEC or CISPR.

All products which are sold in EU must satisfy EC directive which contains immunity regulation.

Principal EC Directive	
EMC Directive	89/336/EEC 92/31/EEC
Low-Voltage Electrical Products Directive	73/23/EEC
Machines Directive	89/392/EEC

7. Immunity Regulations in Japan

Equipment	Association
TV, Radio, Audio	JEITA (Japan Electronics and Information Technology)
ITE	
Office Machine	JBMIA (Japan Business Machine and Information System Industries Association)
Mi	CIAJ (Communication and Information Network Association of Japan) ARIB (Association of Radio Industries and Business)
Machine To Builders	JMTBA (Japan Machine Tool Builders' Association)
Industrial Measuring Control Equipment	JEMIMA (Japan Electric Measuring Instruments Manufacturers' Association)
Industrial Robot	JARA (Japan Robot Association)

The table on the right shows the preparation situation of JIS for EMC. At this moment, the immunity standards by JIS does not have a legal force like Electrical Application and Material Safety Law/VCCI.

Classification	Information Regulation	JIS
Terms	ISO60050-161 (IEV terms 161)	JIS C 0161
Basic Standard	IEC61000-4- 2	JIS C 1000-4-2
	IEC61000-4- 3	JIS C 1000-4-3
	IEC61000-4- 4	JIS C 1000-4-4
	IEC61000-4- 5	JIS C 1000-4-5
	IEC61000-4- 6	JIS C 1000-4-6
	IEC61000-4- 7	JIS C 1000-4-7
	IEC61000-4- 8	Under preparation
	IEC61000-4-11	
	IEC61000-4-14	
	IEC61000-4-17	
Generic Standard	IEC61000-6-1	
	IEC61000-6-2	

Noise Suppression Principles by DC EMIFIL®

1. Function of DC EMI Suppression Filters

DC EMI suppression filters absorb and eliminate high frequency noise which may produce electromagnetic interference in PC board circuits.

These filters are used in secondary circuits, and are small in size and light in weight, which further enhances their excellent noise suppression functions.

Chip and adhesive type filters can be mounted on PC boards automatically.

These filters are effective in the suppression of radiation noise in computers, peripheral equipment, and digital circuit application equipment (including various types of microcomputer application equipment), and function to suppress noise in audio/visual equipment, which uses digital memory chips and DSP.

These filters are also effective for improving the noise immunity of equipment used in noisy environments (such as electronic equipment for automobiles).

2. Noise Filter Suppression Principles

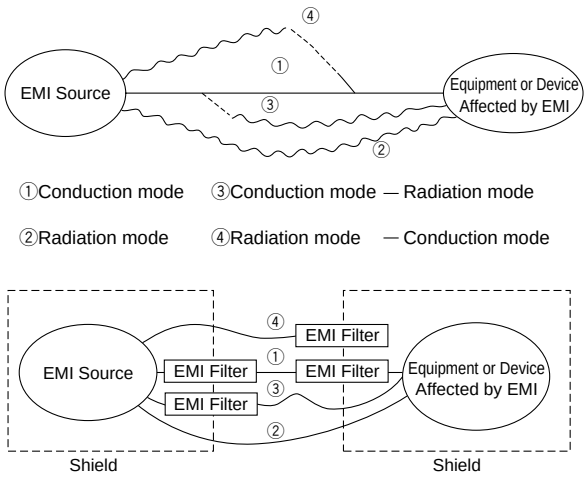
Generally, noise problems occur when the noise source and electronic equipment sensitive to the influence of noise are located in close proximity to one another.

In such situations, as shown in Figure at right, noise is conducted through a conductor, which produces an inductive field around the noise source.

To overcome such noise problems, it is preferable to reduce the amount of noise generated by the noise source or improve the noise resistance of adjacent equipment.

In order to satisfy equipment performance specifications and eliminate noise effectively at the same time, however, it is customary to reduce the amount of noise generated by the noise source, if it can't be eliminated altogether.

[EMI Propagation Mode and Model of Noise Filter Suppression]



3. Configuration of EMI Suppression Filters (DC)

DC EMI suppression filters are used to suppress noise produced by conductors. Noise radiation can be suppressed, if it is eliminated with a filter in advance.

Generally, such noise suppression is achieved with DC EMI suppression filters, according to the capacitive and inductive frequency characteristics of the respective conductors in the circuit.

Filters of this kind can be roughly divided into those:

(1) employing a capacitor,

(2) employing an inductor,

(3) employing a capacitor and inductor combination.

Continued on the following page.

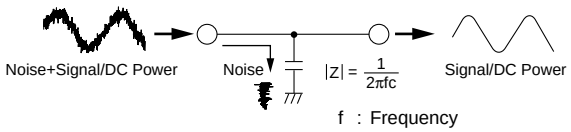
Noise Suppression Principles by DC EMIFIL®

Continued from the preceding page.

4. Capacitive Noise Suppression

When a capacitor is connected (bypass capacitor) to ground from a noisy signal line or power line, the circuit impedance decreases as the frequency increases. Since noise is a high frequency phenomenon, it flows to ground if a capacitor has been connected to ground, thereby making it possible to eliminate noise. (See Fig.)
EMI suppression filters employing a capacitor in this way are used to eliminate this type of noise.

[Capacitive Noise Suppression]



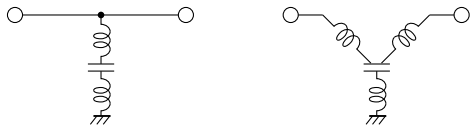
f : Frequency
c : Capacitance Value

5. High frequency Capacitor Characteristics Used for EMI Suppression Filters

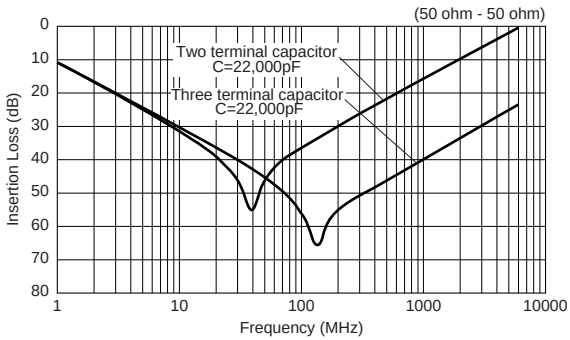
Even general-purpose capacitors can be used for noise suppression. However, since noise has an extremely high frequency range, general-purpose capacitors may not function as effective bypass capacitors, due to the large residual inductance built into the capacitor.
All the capacitors used in Murata's EMI suppression filters employ a three terminal structure or thru-type structure, which functions effectively even at high frequencies, thereby minimizing the influence of residual inductance. Consequently, an effective filter circuit can be formed even at frequencies exceeding 1GHz.
(Refer to Fig.)

[Equivalent circuit of general-purpose capacitor and three terminal capacitor in the high frequency area and comparison of insertion loss]

(a) Equivalent circuit of capacitors which is concerning ESL effect.



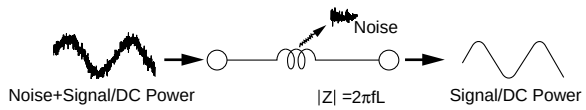
(b) Improvement of Insertion Loss Characteristics



6. Inductive Noise Suppression

When an inductor is inserted in series in a noise producing circuit (See Fig.), its impedance increases with frequency. In this configuration it is possible to attenuate and eliminate noise components (high frequency components). The Murata EMI suppression filter functions in this way.

[Inductive Noise Suppression]



f : Frequency
L : Capacitance Value

Continued on the following page.

Noise Suppression Principles by DC EMIFIL®

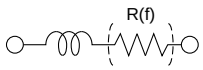
Continued from the preceding page.

7. Characteristics of Inductors Used in EMI Suppression Filters

General-purpose inductors also function to suppress noise when configured in series with a noise producing circuit. However, when general-purpose inductors are used, resonance may result in peripheral circuits, signal wave forms may become distorted, and satisfactory impedance may not be obtained at noise frequencies (due to insufficient high frequency impedance characteristics).

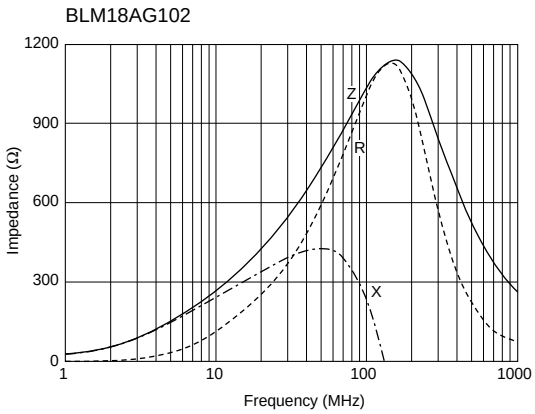
The inductors used for Murata's EMI suppression filters are designed to function nearly as a resistor at noise frequencies, which greatly reduces the possibility of resonance and leaves signal wave forms undistorted. And since sufficient impedance is obtained for frequencies ranging to hundreds of MHz, these specifically designed inductors operate effectively to suppress high-frequency noise. (See Fig.)

[Equivalent Circuit]



(Resistance element becomes dominant at high frequency.)

[Example of impedance frequency characteristics of inductor type EMIFIL®]



8. Capacitive-Inductive EMI Suppression Filters

If capacitive and inductive suppression characteristics are combined, it is possible to configure a much higher performance filter. In signal circuit applications where this combination is applied, noise suppression effects which have little influence on the signal wave form become possible.

This type of filter is also effective in the suppression of high-speed signal circuit noise. When used in DC power circuits, capacitive-inductive filters prevent resonance from occurring in peripheral circuits, thus making it possible to achieve significant noise suppression under normal service conditions.

9. Other EMI Suppression Filters

In addition to the capacitive-inductive filter, Murata also has a common mode choke coil, effective for common mode noise suppression.

Murata also has a range of built-in filter connectors which greatly reduce filter mounting space requirements.

Continued on the following page.

Noise Suppression Principles by DC EMIFIL®

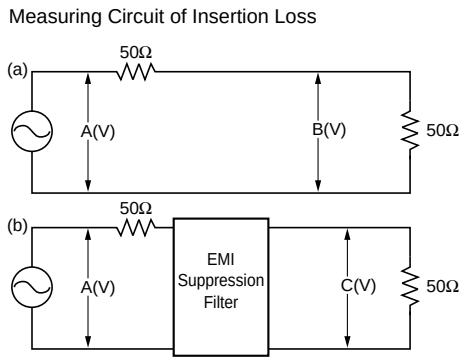
Continued from the preceding page.

10. Expressing EMI Suppression Filter Effects

EMI Suppression Filter effects are expressed in terms of the insertion loss measured in the circuit, normally specified in MIL-STD 220A. As shown in the 50Ω impedance circuit in the Figure at right, insertion loss is represented by the logarithmic ratio of the circuit output voltage with and without a filter in the circuit, which is multiplied by 20 and expressed in dB.

Therefore, an insertion loss of 20dB indicates an output voltage ratio (B/C) of 1/10, and an insertion loss of 40dB indicates an output voltage ratio (B/C) of 1/100.

[Measuring Circuit of Insertion Loss]



$$\text{Insertion Loss} = 20 \log \frac{B}{C} (\text{dB})$$

⚠Note:

1. Export Control
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   ③ Undersea equipment ④ Power plant equipment
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   ⑨ Data-processing equipment ⑩ Application of similar complexity and/or reliability requirements to the applications listed in the above
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