

# SMD/BLOCK Type EMI Suppression Filters

# EMIFIL<sup>®</sup>



*Innovator  
in Electronics*

**Murata  
Manufacturing Co., Ltd.**

⚠Note • Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.  
• This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please review our product specifications or consult the approval sheet for product specifications before ordering.

C31E.pdf  
Mar.28,2011

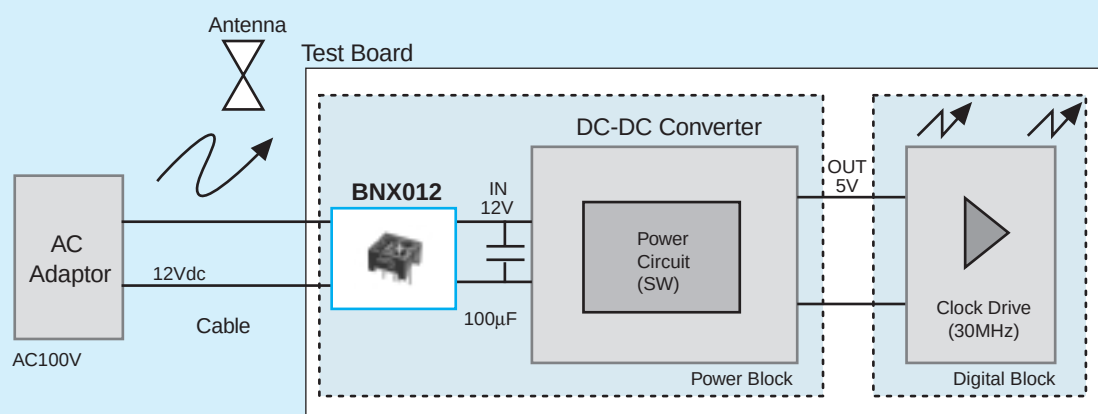


## Block Type EMIFIL®

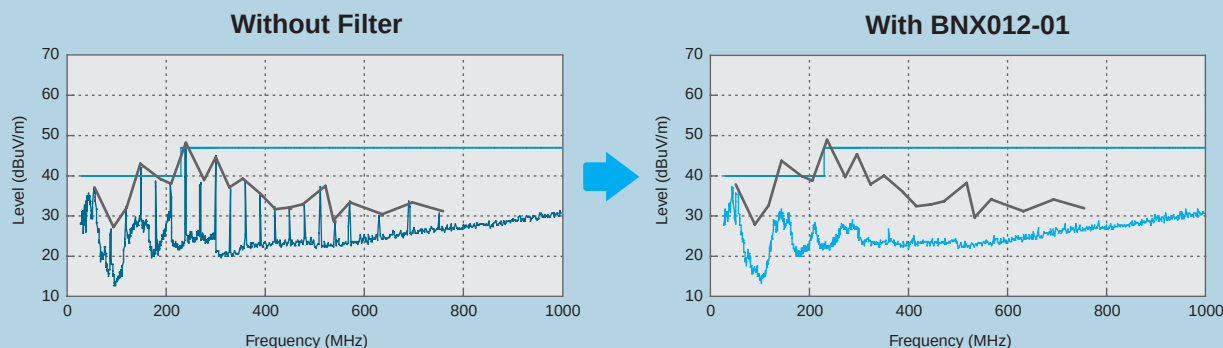
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| Type                                                  | Part Number | Thickness (mm) | Rated Voltage | Effective Frequency Range | Rated Current | $K_{it}$ | $\geq 3A$ | Flow | $R_{eFlow}$ |
|-------------------------------------------------------|-------------|----------------|---------------|---------------------------|---------------|----------|-----------|------|-------------|
| SMD Type for Power Lines <sup>p191</sup>              | BNX022-01   | 3.1            | 50Vdc         | 1MHz to 1GHz:35dB min.    | 10A           | $K_{it}$ | $\geq 3A$ |      | $R_{eFlow}$ |
|                                                       | BNX023-01   | 3.1            | 100Vdc        | 1MHz to 1GHz:35dB min.    | 15A           | $K_{it}$ | $\geq 3A$ |      | $R_{eFlow}$ |
|                                                       | BNX024H01   | 3.5            | 50Vdc         | 100kHz to 1GHz:35dB min.  | 15A           | $K_{it}$ | $\geq 3A$ |      | $R_{eFlow}$ |
|                                                       | BNX025H01   | 3.5            | 25Vdc         | 50kHz to 1GHz:35dB min.   | 15A           | $K_{it}$ | $\geq 3A$ |      | $R_{eFlow}$ |
| Lead Type for Power Lines <sup>p193</sup>             | BNX002-01   | 18.0           | 50Vdc         | 1MHz to 1GHz:40dB min.    | 10A           | $K_{it}$ | $\geq 3A$ | Flow |             |
|                                                       | BNX003-01   | 18.0           | 150Vdc        | 5MHz to 1GHz:40dB min.    | 10A           | $K_{it}$ | $\geq 3A$ | Flow |             |
|                                                       | BNX005-01   | 18.5           | 50Vdc         | 1MHz to 1GHz:40dB min.    | 15A           | $K_{it}$ | $\geq 3A$ | Flow |             |
| Lead Type Low Profile for Power Lines <sup>p194</sup> | BNX012-01   | 8.0            | 50Vdc         | 1MHz to 1GHz:40dB min.    | 15A           | $K_{it}$ | $\geq 3A$ | Flow |             |
|                                                       | BNX016-01   | 8.0            | 25Vdc         | 100kHz to 1GHz:40dB min.  | 15A           | $K_{it}$ | $\geq 3A$ | Flow |             |

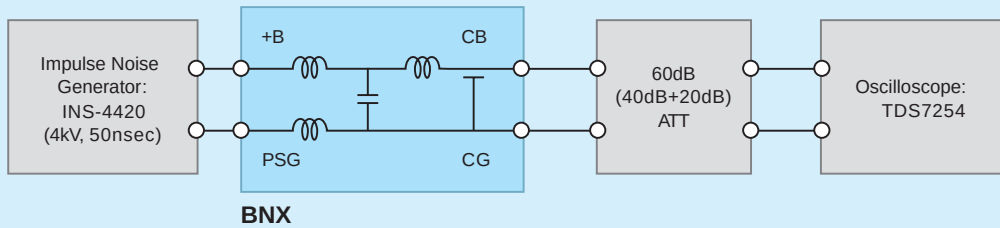
## Noise Suppression of Radiation Noise from Power Line Cable



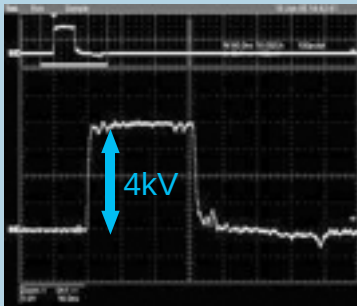
### Test Result



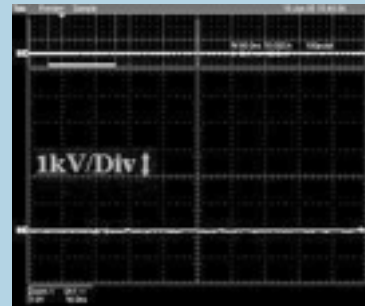
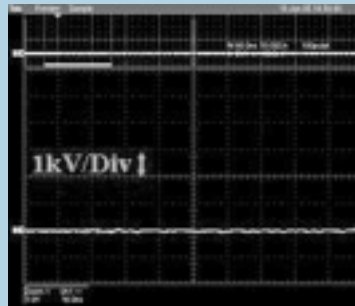
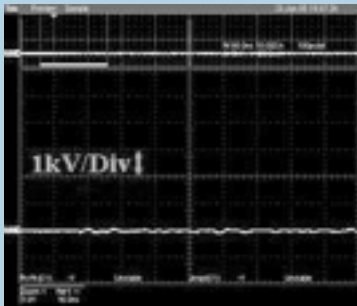
## Impulse Noise Countermeasure



### Without Filter

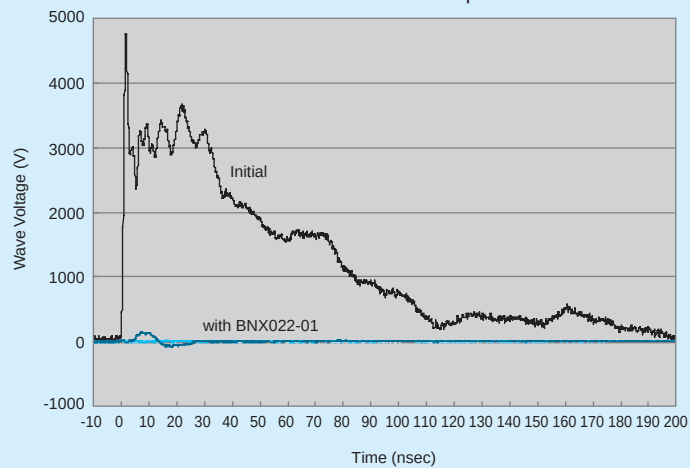


### With Filter

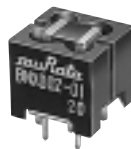


## ESD Countermeasure

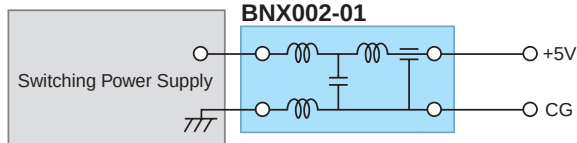
### ESD Waveform Comparison



## Suppression of Ripple Noise of DC Side in the Switching Power Supply



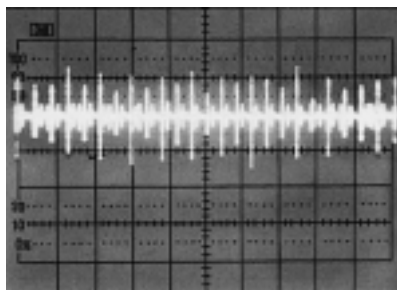
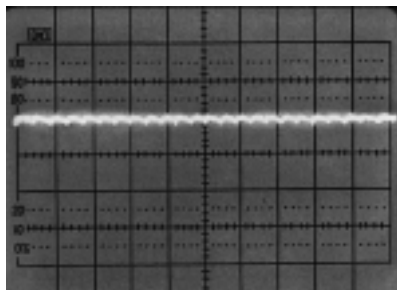
Test Circuit



Type of Filter

EMI Suppression Effect / Description

Without Filter

+5.0V→  
50μs/div  
0.2V/divThere is high frequency noise  
of 0.5V maximum.When BNX002-01  
is used+5.0V→  
50μs/div  
0.2V/div

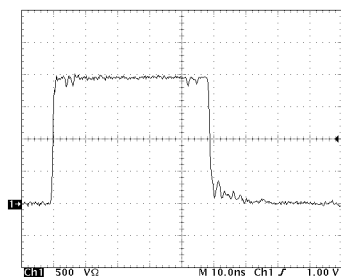
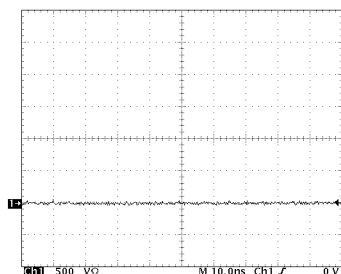
BNX002-01 can suppress most of noise.

## Example of Impulse Noise Suppression

Type of Filter

EMI Suppression Effect

Without Filter

Impulse Noise  
2000V/50nsY-axis: 500V/div  
X-axis: 10ns/secWhen BNX002  
is usedY-axis: 500V/div  
X-axis: 10ns/sec

# BNX02□ Series

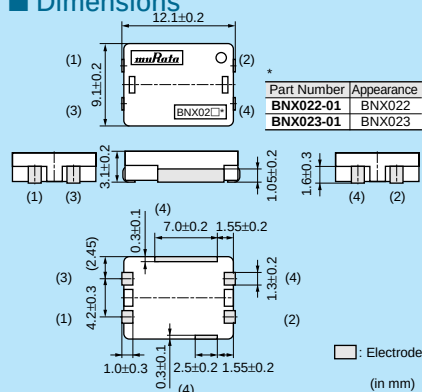


SMD package of block type EMIFIL®.

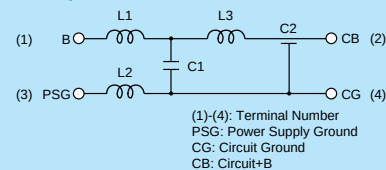
BNX022/BNX023



## Dimensions



## Equivalent Circuit



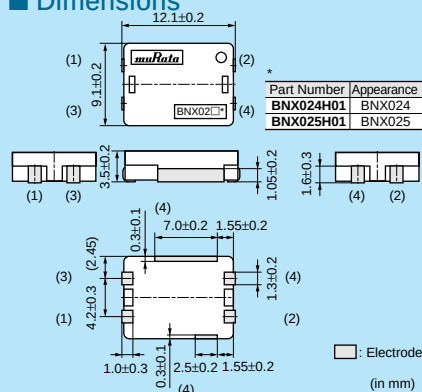
## Packaging

| Code | Packaging                | Minimum Quantity |
|------|--------------------------|------------------|
| L    | 180mm Reel Embossed Tape | 400              |
| K    | 330mm Reel Embossed Tape | 1500             |
| B    | Bulk(Bag)                | 100              |

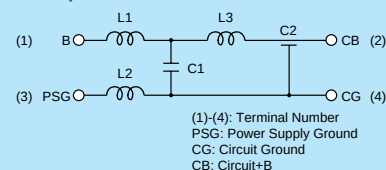
BNX024H/BNX025H



## Dimensions



## Equivalent Circuit



## Packaging

| Code | Packaging                | Minimum Quantity |
|------|--------------------------|------------------|
| L    | 180mm Reel Embossed Tape | 400              |
| K    | 330mm Reel Embossed Tape | 1500             |
| B    | Bulk(Bag)                | 100              |

Refer to pages from p.197 to p.200 for mounting information.

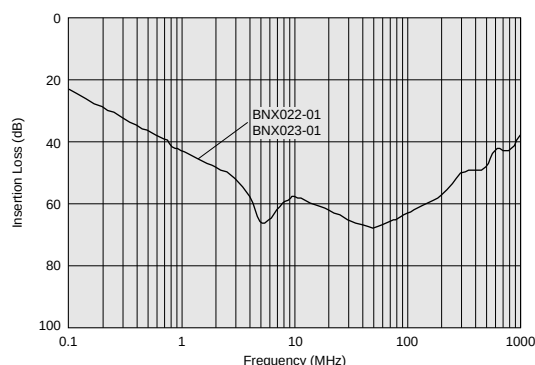
## Rated Value (□: packaging code)

| Part Number | Rated Voltage | Withstand Voltage | Rated Current | Insulation Resistance (min.) | Insertion Loss (20 to 25 degrees C line impedance=50 ohm) |         |
|-------------|---------------|-------------------|---------------|------------------------------|-----------------------------------------------------------|---------|
| BNX022-01□  | 50Vdc         | 125Vdc            | 10A           | 500M ohm                     | 1MHz to 1GHz:35dB min.                                    | Kit ≥3A |
| BNX023-01□  | 100Vdc        | 250Vdc            | 15A           | 500M ohm                     | 1MHz to 1GHz:35dB min.                                    | Kit ≥3A |
| BNX024H01□  | 50Vdc         | 125Vdc            | 15A           | 100M ohm                     | 100kHz to 1GHz:35dB min.                                  | Kit ≥3A |
| BNX025H01□  | 25Vdc         | 62.5Vdc           | 15A           | 50M ohm                      | 50kHz to 1GHz:35dB min.                                   | Kit ≥3A |

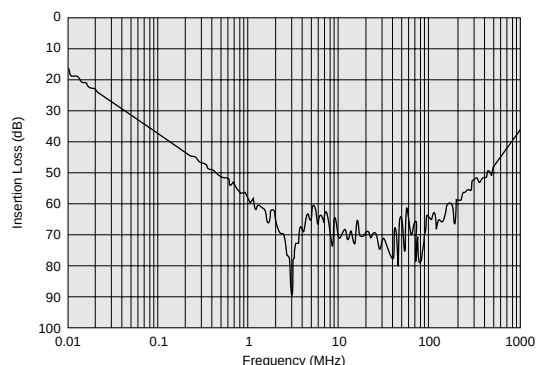
Operating Temperature Range: -40°C to +125°C (BNX022/BNX023), -55°C to +125°C (BNX024H/BNX025H)

## Insertion Loss Characteristics

BNX022/023



BNX024H01

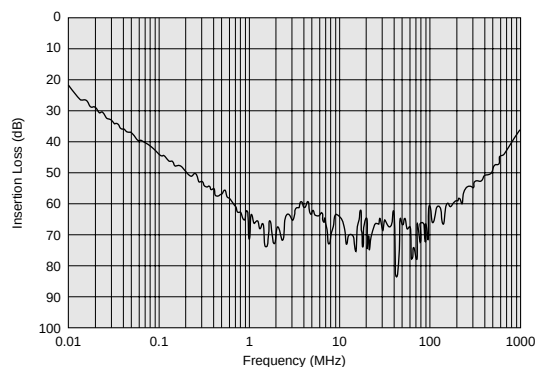


Continued on the following page. ↗

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## ■ Insertion Loss Characteristics

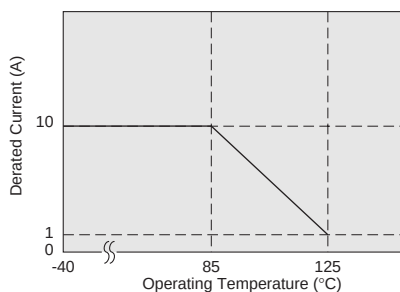
### BNX025H01



## ■ Notice (Rating)

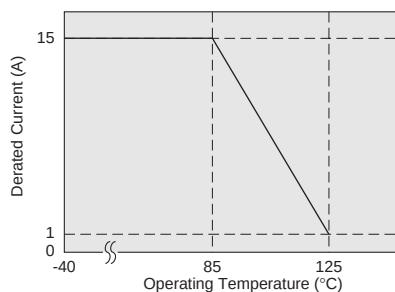
In operating temperatures exceeding +85°C, derating of current is necessary for BNX022 series. Please apply the derating curve shown in chart according to the operating temperature.

Derating



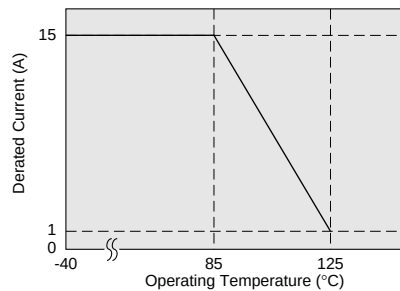
In operating temperatures exceeding +85°C, derating of current is necessary for BNX023 series. Please apply the derating curve shown in chart according to the operating temperature.

Derating



In operating temperatures exceeding +85°C, derating of current is necessary for BNX024H/025H series. Please apply the derating curve shown in chart according to the operating temperature.

Derating



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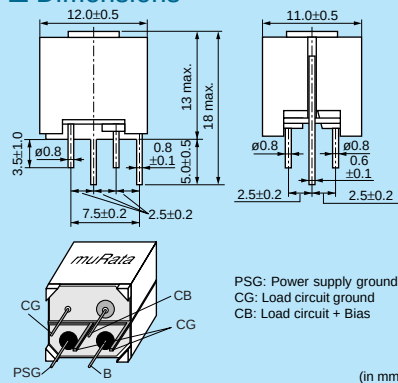


**Large insertion loss from several hundred kHz to several GHz.**

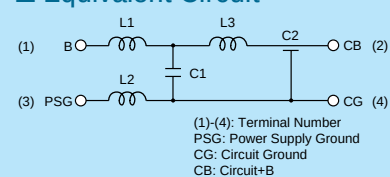
BNX002/BNX003



## ■ Dimensions



### ■ Equivalent Circuit



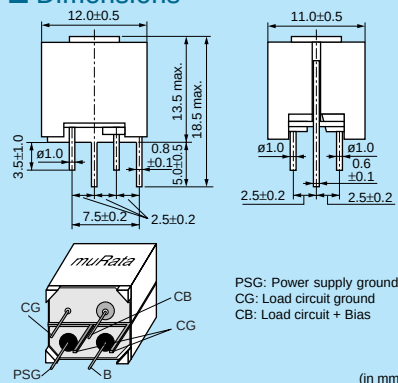
## ■ Packaging

| Code | Packaging | Minimum Quantity |
|------|-----------|------------------|
| -    | Box       | 100              |

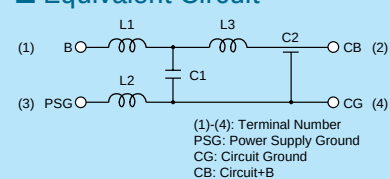
BNX005



## ■ Dimensions



### ■ Equivalent Circuit



## ■ Packaging

| Code | Packaging | Minimum Quantity |
|------|-----------|------------------|
| -    | Box       | 100              |

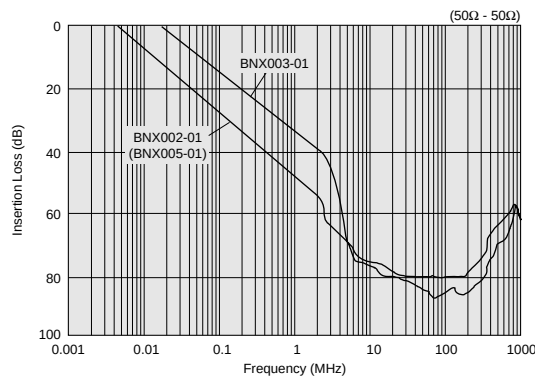
Refer to pages from p.197 to p.200 for mounting information.

■ Rated Value

| Part Number      | Rated Voltage | Withstand Voltage | Rated Current | Insulation Resistance<br>(min.) | Insertion Loss<br>(20 to 25 degrees C line impedance=50 ohm) |                                                                                                  |
|------------------|---------------|-------------------|---------------|---------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <b>BNX002-01</b> | 50Vdc         | 125Vdc            | 10A           | 100M ohm                        | 1MHz to 1GHz:40dB min.                                       |  <b>≥3A</b> |
| <b>BNX003-01</b> | 150Vdc        | 375Vdc            | 10A           | 100M ohm                        | 5MHz to 1GHz:40dB min.                                       |  <b>≥3A</b> |
| <b>BNX005-01</b> | 50Vdc         | 125Vdc            | 15A           | 100M ohm                        | 1MHz to 1GHz:40dB min.                                       |  <b>≥3A</b> |

Operating Temperature Range: -30°C to +85°C

### ■ Insertion Loss Characteristics



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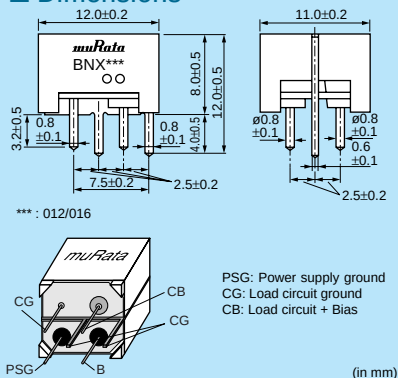
## BNX01□ Series



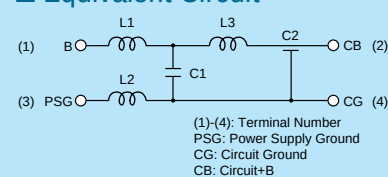
Low profile version of BNX series.



## ■ Dimensions



## ■ Equivalent Circuit



## ■ Packaging

| Code | Packaging | Minimum Quantity |
|------|-----------|------------------|
| -    | Box       | 150              |

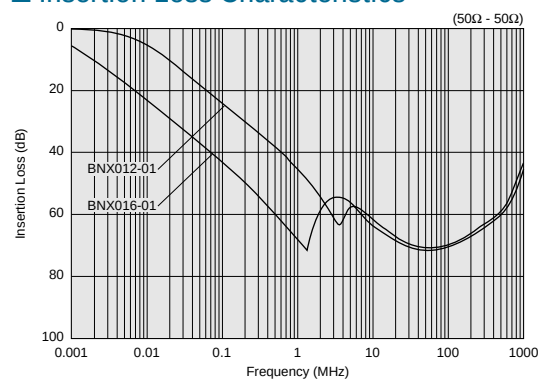
Refer to pages from p.197 to p.200 for mounting information.

## ■ Rated Value

| Part Number | Rated Voltage | Withstand Voltage | Rated Current | Insulation Resistance (min.) | Insertion Loss (20 to 25 degrees C line impedance=50 ohm) |               |
|-------------|---------------|-------------------|---------------|------------------------------|-----------------------------------------------------------|---------------|
| BNX012-01   | 50Vdc         | 125Vdc            | 15A           | 500M ohm                     | 1MHz to 1GHz:40dB min.                                    | Kit $\geq 3A$ |
| BNX016-01   | 25Vdc         | 62.5Vdc           | 15A           | 50M ohm                      | 100kHz to 1GHz:40dB min.                                  | Kit $\geq 3A$ |

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

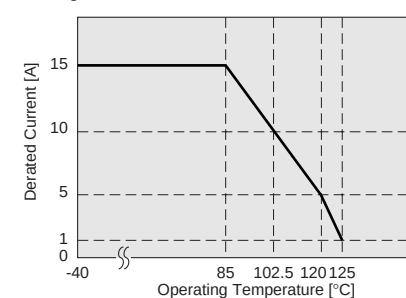
## ■ Insertion Loss Characteristics



## ■ Notice (Rating)

In operating temperatures exceeding +85°C, derating of current is necessary for BNX01□ series. Please apply the derating curve shown in chart according to the operating temperature.

## Derating



## ● Connecting ± power line

In case of using ± power line, please connect to each terminal as shown.

| Power Supply (BNX Input) | BNX    | Circuit (BNX Output)  |
|--------------------------|--------|-----------------------|
| Power Supply +Bias -     | B CB   | - Load Circuit +Bias  |
| Power Supply Ground -    | PSG CG | - Load Circuit Ground |
| Power Supply -Bias -     | B CB   | - Load Circuit -Bias  |
| Power Supply Ground -    | PSG CG | - Load Circuit Ground |

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## ⚠ Caution

## ● Rating

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

## Notice

## ● Storage and Operating Conditions

## &lt;Operating Environment&gt;

Do not use products in a chemical atmosphere such as chlorine gas, acid or sulfide gas.

Do not use products in the environment close to the organic solvent.

## &lt;Storage and Handling Requirements&gt;

## 1. Storage Period

BNX series should be used within 12 months.

Solderability should be checked if this period is exceeded.

## 2. Storage Conditions

(1) Storage temperature: -10 to +40°C

Relative humidity: 15 to 85%

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 (Soldering and Mounting)

## 1. Cleaning

Do not clean BNX series (SMD Type).

Before cleaning, please contact Murata engineering.

## 2. Soldering

Reliability decreases with improper soldering methods.

Please solder by the standard soldering conditions shown in mounting information.

## 3. Other

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, 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.

## ● Handling

## 1. Resin Coating

Using resin for coating/molding products may affect the products performance.

So please pay careful attention in selecting resin.

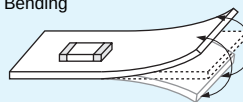
Prior to use, please make the reliability evaluation with the product mounted in your application set.

## 2. Handling of a Substrate (for BNX02□)

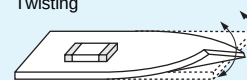
After mounting products on a substrate, do not apply any stress to the product caused by bending or twisting to the substrate when cropping the substrate, inserting and removing a connector from the substrate or tightening screw to the substrate.

Excessive mechanical stress may cause cracking in the Product.

Bending



Twisting



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## ⚠ Caution

## ● Rating

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

## Notice

## ● Storage and Operating Conditions

## &lt;Operating Environment&gt;

1. Do not use products in a chemical atmosphere such as chlorine gas, acid or sulfide gas.
2. Do not use products near water, oil or organic solvents.

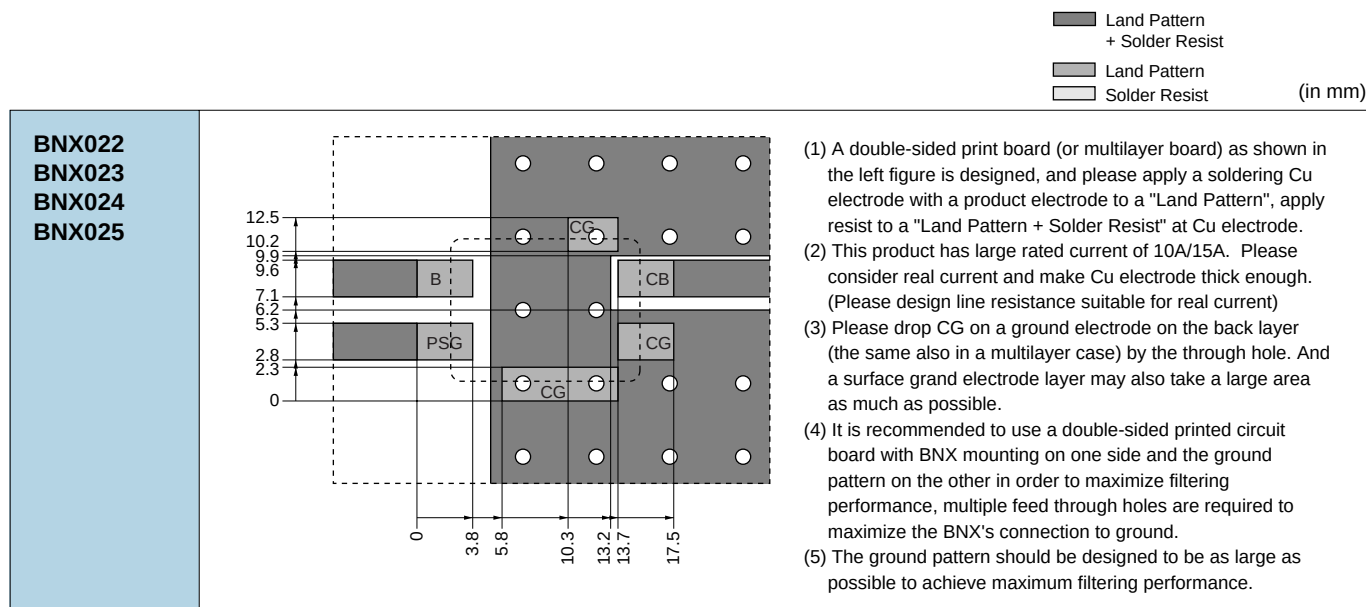
## &lt;Storage and Handling Requirements&gt;

1. Storage Period  
BNX Series should be used within 12 months.  
Solderability should be checked if this period is exceeded.
2. Storage Conditions  
(1) Storage temperature: -10 to +40°C  
Relative humidity: 15 to 85%  
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 (Soldering and Mounting)

1. Cleaning  
Failure and degradation of a product are caused by the cleaning method. When you clean in 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.
3. Other  
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.

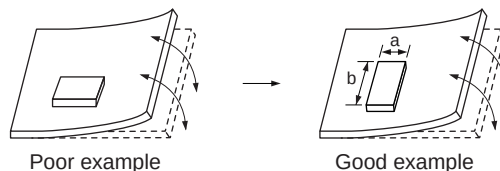
### 1. Standard Land Pattern Dimensions



#### ● PCB Warping (for BNX02□)

PCB should be designed so that products are not subjected to the mechanical stress caused by warping the board.

Products should be located in the sideways direction (Length:  $a < b$ ) to the mechanical stress.



### 2. Solder Paste Printing and Adhesive Application

When reflow soldering the block type EMIFIL®, 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.

Standard land dimensions should be used for resist and copper foil patterns.

| Series                                                           | Solder Paste Printing                                      | Adhesive Application |
|------------------------------------------------------------------|------------------------------------------------------------|----------------------|
| <b>BNX022</b><br><b>BNX023</b><br><b>BNX024</b><br><b>BNX025</b> | <p>●Guideline of solder paste thickness:<br/>150-200μm</p> |                      |

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**3. Standard Soldering Conditions****(1) Soldering Methods**

Use reflow soldering methods only.

Use standard soldering conditions when soldering block type EMIFIL® SMD type.

In cases where several different parts are soldered, each having different soldering conditions, use those conditions requiring the least heat and minimum time.

Solder: Use Sn-3.0Ag-0.5Cu solder. Use of Sn-Zn based solder will deteriorate performance of products.

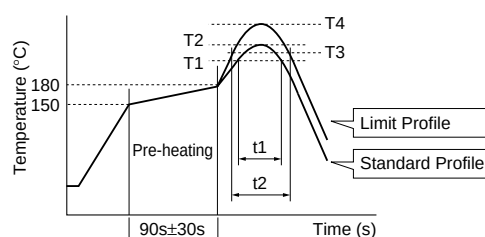
Flux:

- Use Rosin-based flux.  
In case of using RA type solder, products should be cleaned completely with no residual flux.
- Do not use strong acidic flux (with chlorine content exceeding 0.20wt%)
- Do not use water-soluble flux.

For additional mounting methods, please contact Murata.

**(2) Soldering Profile**

- Reflow Soldering Profile  
(Sn-3.0Ag-0.5Cu solder)



| 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) |                       |                 |
| <b>BNX022/023/024/025</b> | 220°C min.       | 30 to 60s  | 250±3°C               | 2 times max.    | 230°C min.    | 60s max.   | 260°C/10s             | 2 times max.    |

**(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: 100W max.

Temperature of soldering iron tip / Soldering time / Times:  
450°C max. / 5s max. / 1 time

Do not allow the tip of the soldering iron to directly contact the chip.

For additional methods of reworking with a soldering iron, please contact Murata engineering.

**4. Cleaning**

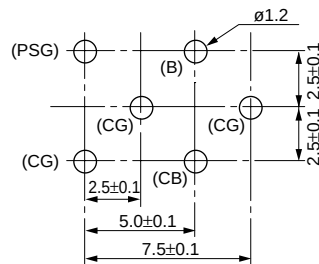
Do not clean BNX022/023/024/025 series. In case of cleaning, please contact Murata engineering.

### 1. Mounting Hole

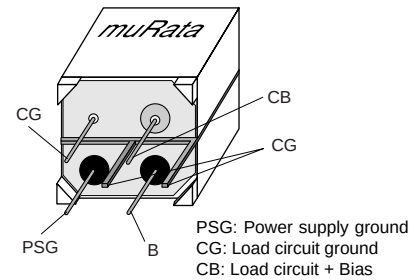
■ Mounting holes should be designed as specified below.

BNX00□/01□

Component Side



Terminal Layout (Bottom figure)



### 2. Using the Block Type EMIFIL® (Lead Type) Effectively

#### (1) How to use effectively

This product effectively prevents undesired radiation and external noise from going out / entering the circuit by grounding the high frequency components which cause noise problems. Therefore, grounding conditions may affect the performance of the filter and attention should be paid to the following for effective use.

- Design maximized grounding area in the P.C. board, and grounding pattern for all the grounding terminals of the product to be connected. (Please follow the specified recommendations.)
- Minimize the distance between ground of the P.C. board and the ground plate of the product. (Recommend using the through hole connection between grounding area both of component side and bottom side.)
- Insert the terminals into the holes on P.C. board completely.
- Don't connect PSG terminal with CG terminal directly. (See the item 1. Terminal Layout)

#### (2) Self-heating

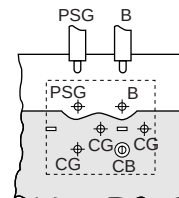
Though this product has a large rated current, localized selfheating may be caused depending on soldering conditions. To avoid this, attention should be paid to the following:

- Use P.C. board with our recommendation on hole diameter / land pattern dimensions, mentioned in the right hand drawing, especially for 4 terminals which pass current.
- Solder the terminals to the P.C. board with soldercover area at least 90%. Otherwise, excess self-heating at connection between terminals and P.C. board may lead to smoke and / or fire of the product even when operating at rated current.
- After installing this product in your product, please make sure the self-heating is within the rated current recommended.

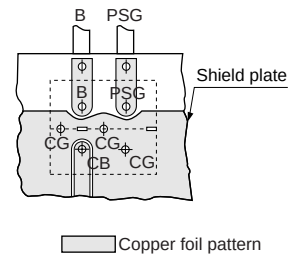
#### P. C. Board Patterns

Use a bilateral P.C. board. Insert the BNX into the P.C.board until the root of the terminal is secured, then solder.

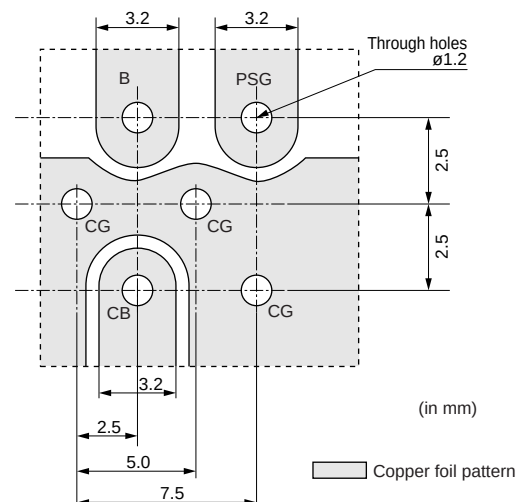
##### (1) Component Side View



##### (2) Bottom View



#### Recommended Land Pattern

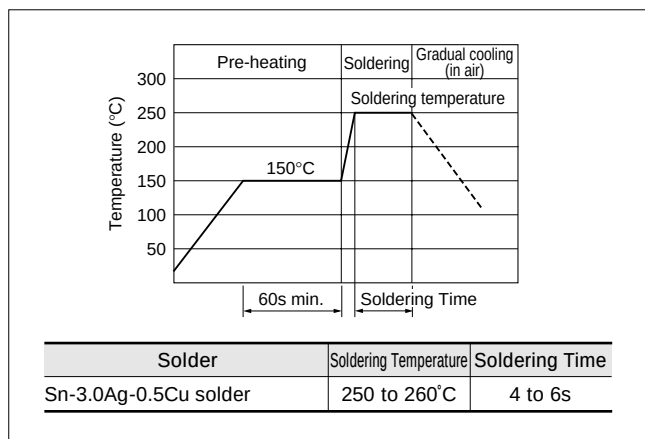


△Note • Please read rating and △CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

• This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please review our product specifications or consult the approval sheet for product specifications before ordering.

**3. Soldering**

- (1) Use Sn-3.0Ag-0.5Cu solder.
- (2) Use Rosin-based flux. Do not use strong acidic flux with halide content exceeding 0.2wt% (chlorine conversion value).
- (3) Products and the leads should not be subjected to any mechanical stress during the soldering process, or while subjected to the equivalent high temperatures.
- (4) Standard flow soldering profile

**4. Cleaning**

Clean the block Type EMIFIL® (Lead Type) in the following conditions.

- (1) Cleaning temperature should be limited to 60°C max. (40°C max for alcohol type cleaner).
- (2) Ultrasonic cleaning should comply with the following conditions, avoiding the resonance phenomenon at the mounted products and P.C.B.  
Power: 20W/liter max.  
Frequency: 28 to 40kHz  
Time: 5 min. max.
- (3) Cleaner
  - (a) Alcohol type cleaner  
Isopropyl alcohol (IPA)
  - (b) Aqueous agent  
Pine Alpha ST-100S

- (4) There should be no residual flux or residual cleaner left after cleaning.

In the case of using aqueous agent, products should be dried completely after rinsing with de-ionized water in order to remove the cleaner.

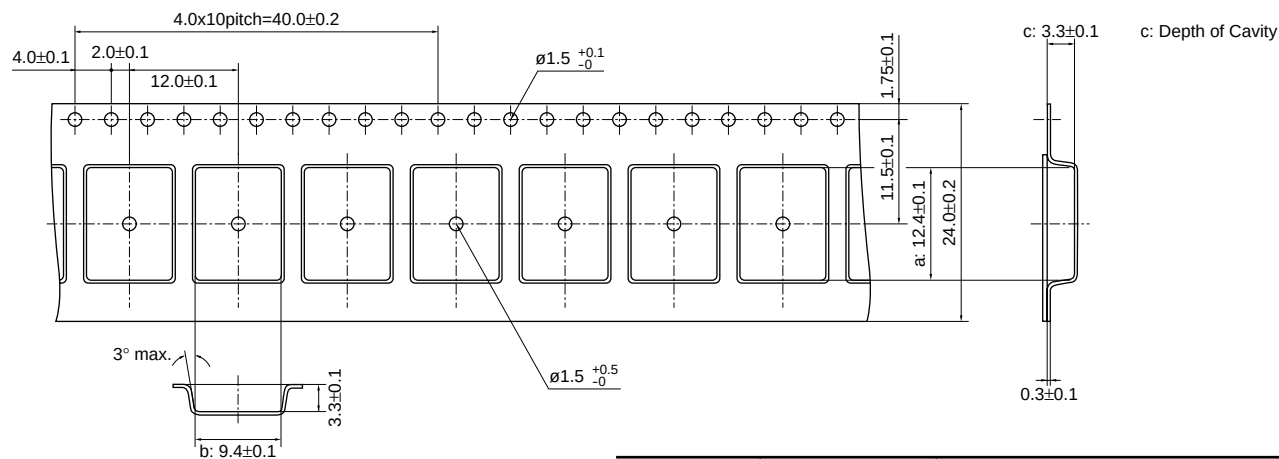
- (5) The surface of products may become dirty after cleaning, but there is no deterioration on mechanical, electrical characteristics and reliability.
- (6) Other cleaning: Please contact us.

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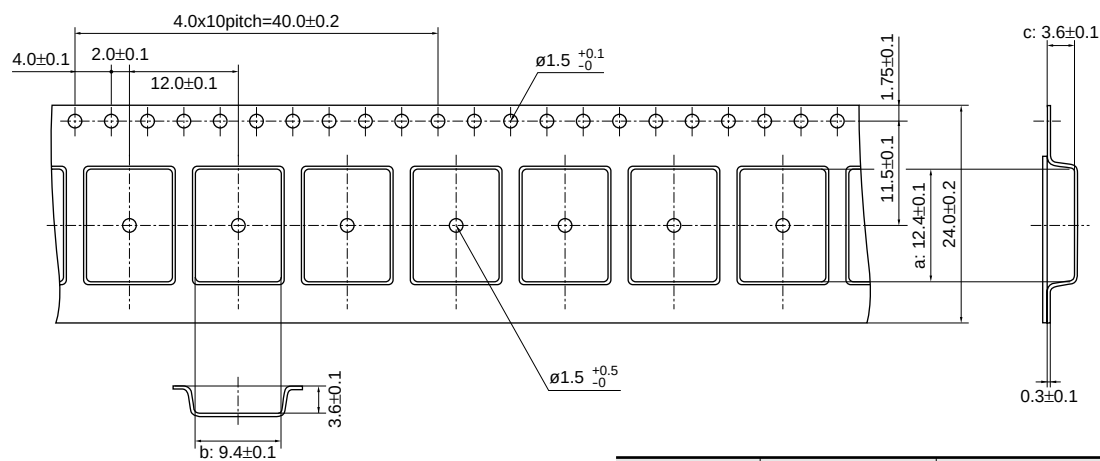


### ■ Minimum Quantity and Dimensions of 24mm Width Embossed Tape



Dimension of the cavity is measured at the bottom side.

| Part Number       | Cavity Size |     |     | Minimum Qty. (pcs.) |             |      |
|-------------------|-------------|-----|-----|---------------------|-------------|------|
|                   | a           | b   | c   | ø180mm Reel         | ø330mm Reel | Bulk |
| <b>BNX022/023</b> | 12.4        | 9.4 | 3.3 | 400                 | 1500        | 100  |



Dimension of the cavity is measured at the bottom side.

| Part Number       | Cavity Size |     |     | Minimum Qty. (pcs.) |             |      |
|-------------------|-------------|-----|-----|---------------------|-------------|------|
|                   | a           | b   | c   | ø180mm reel         | ø330mm reel | Bulk |
| <b>BNX024/025</b> | 12.4        | 9.4 | 3.6 | 400                 | 1500        | 100  |

(in mm)

"Minimum Quantity" means the number of units of each delivery or order. The quantity should be an integral multiple of the "Minimum Quantity".

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# BNX Block Type EMIFIL® Design Kits



## ●EKEPBNX0A

| No. | Part Number | Quantity (pcs.) | Insertion Loss             | Rated Voltage (Vdc) | Rated Current (A) |
|-----|-------------|-----------------|----------------------------|---------------------|-------------------|
| 1   | BNX002-01   | 1               | 1MHz to 1GHz : 40dB min.   | 50                  | 10                |
| 2   | BNX012-01   | 1               | 1MHz to 1GHz : 40dB min.   | 50                  | 15                |
| 3   | BNX016-01   | 1               | 100kHz to 1GHz : 40dB min. | 25                  | 15                |
| 4   | BNX012H01   | 1               | 1MHz to 1GHz : 40dB min.   | 50                  | 15                |
| 5   | BNX022-01   | 3               | 1MHz to 1GHz : 35dB min.   | 50                  | 10                |
| 6   | BNX023-01   | 3               | 1MHz to 1GHz : 35dB min.   | 100                 | 15                |
| 7   | BNX024H01   | 3               | 100kHz to 1GHz : 35dB min. | 50                  | 15                |
| 8   | BNX025H01   | 3               | 50kHz to 1GHz : 35dB min.  | 25                  | 15                |

## ●EKEPBLCKA

| No. | Part Number | Quantity (pcs.) | Insertion Loss              | Rated Voltage (Vdc) | Rated Current (A) |
|-----|-------------|-----------------|-----------------------------|---------------------|-------------------|
| 1   | BNX002-01   | 1               | 1MHz to 1GHz : 40dB min.    | 50                  | 10                |
| 2   | BNX003-01   | 1               | 5MHz to 1GHz : 40dB min.    | 150                 | 10                |
| 3   | BNX005-01   | 1               | 1MHz to 1GHz : 40dB min.    | 50                  | 15                |
| 4   | BNX012-01   | 1               | 1MHz to 1GHz : 40dB min.    | 50                  | 15                |
| 5   | BNX016-01   | 1               | 100kHz to 1GHz : 40dB min.  | 25                  | 15                |
| 6   | BNX012H01   | 1               | 1MHz to 1GHz : 40dB min.    | 50                  | 15                |
| 7   | BNP002-02   | 1               | 20MHz to 500MHz : 40dB min. | 50                  | 10                |
| 8   | BNX022-01   | 3               | 1MHz to 1GHz : 35dB min.    | 50                  | 10                |
| 9   | BNX023-01   | 3               | 1MHz to 1GHz : 35dB min.    | 100                 | 15                |
| 10  | BNX024H01   | 3               | 100kHz to 1GHz : 35dB min.  | 50                  | 15                |
| 11  | BNX025H01   | 3               | 50kHz to 1GHz : 35dB min.   | 25                  | 15                |

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