

Panasonic

INDUSTRY

2021

EMC Components
ESD Components

Products Catalog



2021.5



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- The switchover date for compliance with the RoHS Directive/REACH Regulations varies depending on the part number or series of our products.
- When you use the inventory of our products for which it is unclear whether those products are compliant with the RoHS Directive/REACH Regulation, please select "Sales Inquiry" in the website inquiry form and contact us.

We do not take any responsibility for the use of our products outside the scope of the specifications, descriptions, guidelines and precautions described in this online catalog.

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Common mode Noise Filters

Type: **EXCX4CZ**



Features

- Small and thin (L 0.65 mm×W 0.50 mm×H 0.30 mm)
- High-common mode attenuation at 2.4GHz, Suitable for noise suppression at Wi-Fi band
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

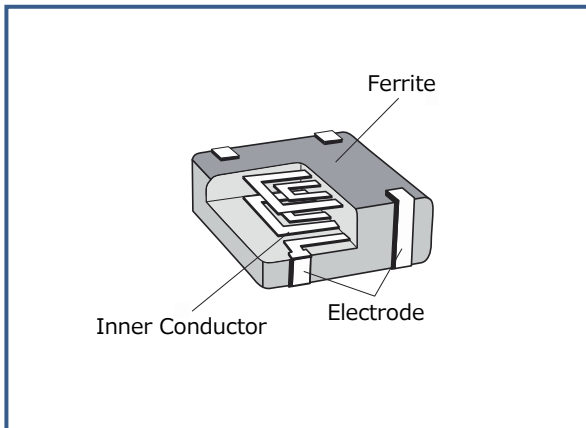
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Suppresses noise radiation to Wi-Fi Equipment

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	X	4	C	Z	2	0	0	X	
Product Code		Size		Number of Terminals	Type	Characteristics	Nominal Impedance		Form		Suffix
Noise Filter		Code	Dimensions(mm)	4 Terminals	C Coupled type	Wide band width, high attenuation	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.		Code	Packing	
		X	0.65×0.50×0.30 (L)×(W)×(H)						X	Pressed Carrier Taping 2 mm pitch, 10,000 pcs	

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXCX4CZ (0202)	0.50 ±0.05	0.65 ±0.05	0.30 ±0.05	0.12 ±0.10	0.40 ±0.10	0.15 ±0.10	0.28

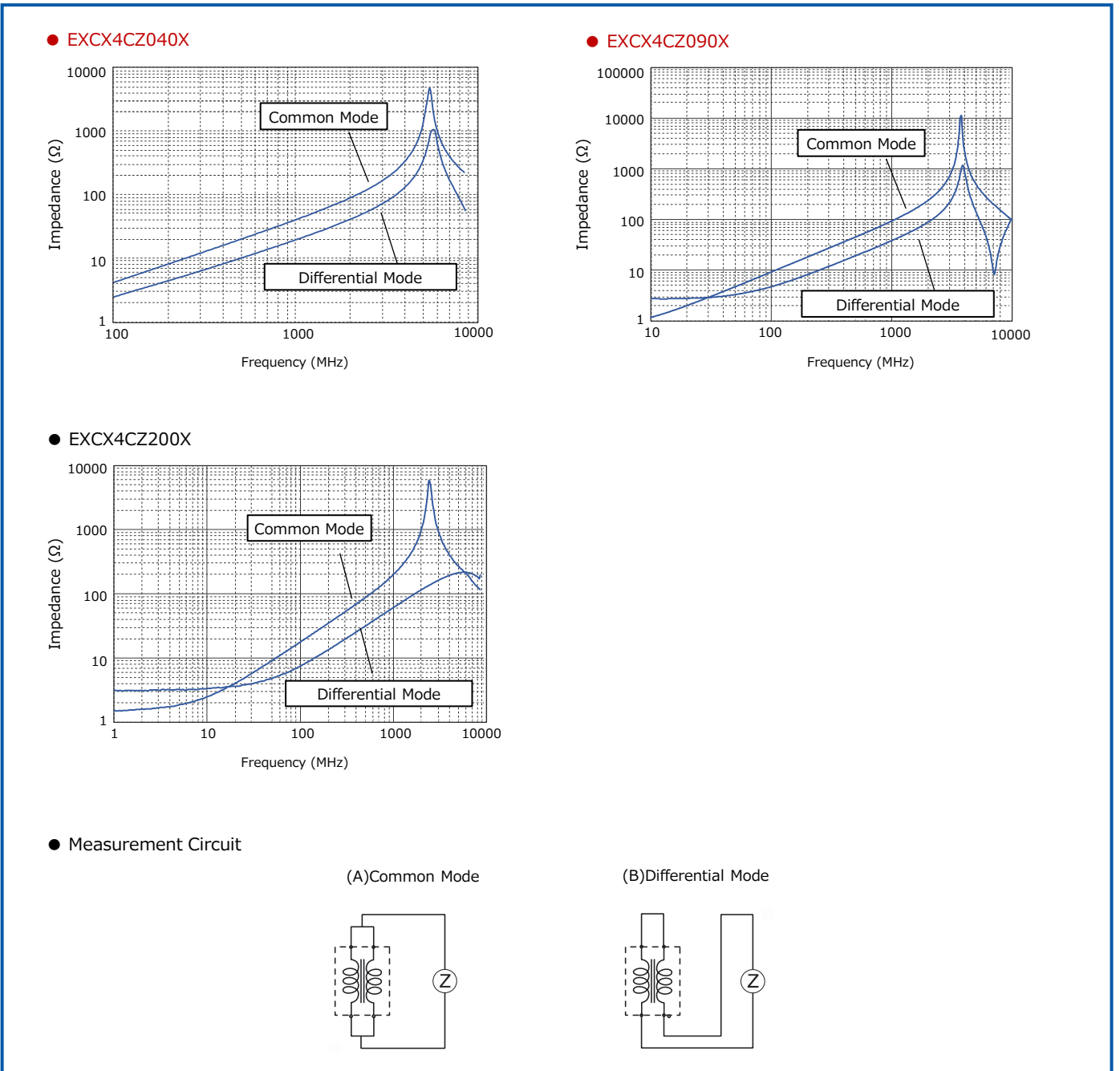
Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Ratings				
Part Number	Impedance (Ω) at 100 MHz	Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode			
NEW EXCX4CZ040X	4 Ω \pm 2 Ω	5	100	1.0 \pm 30 %
NEW EXCX4CZ090X	9 Ω \pm 3 Ω	5	100	1.9 \pm 30 %
EXCX4CZ200X	20 Ω \pm 30 %	5	100	3.0 \pm 30 %

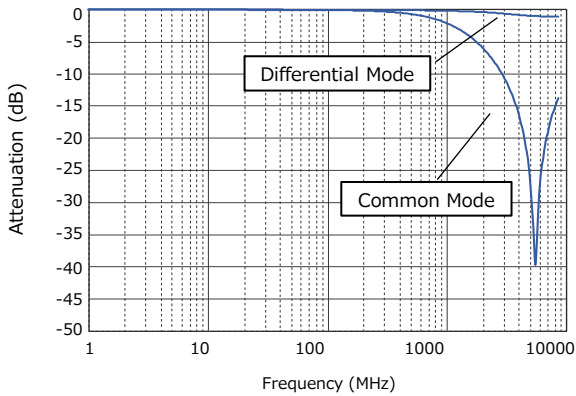
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

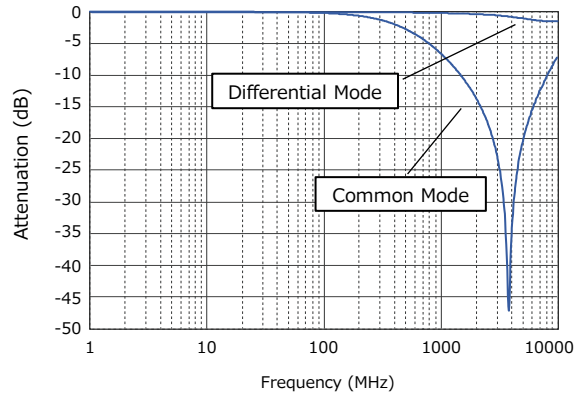


Attenuation Characteristics (Typical)

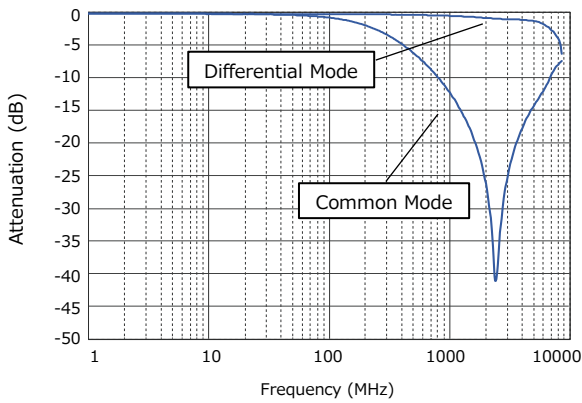
● EXCX4CZ040X



● EXCX4CZ090X



● EXCX4CZ200X



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXCX4CH**



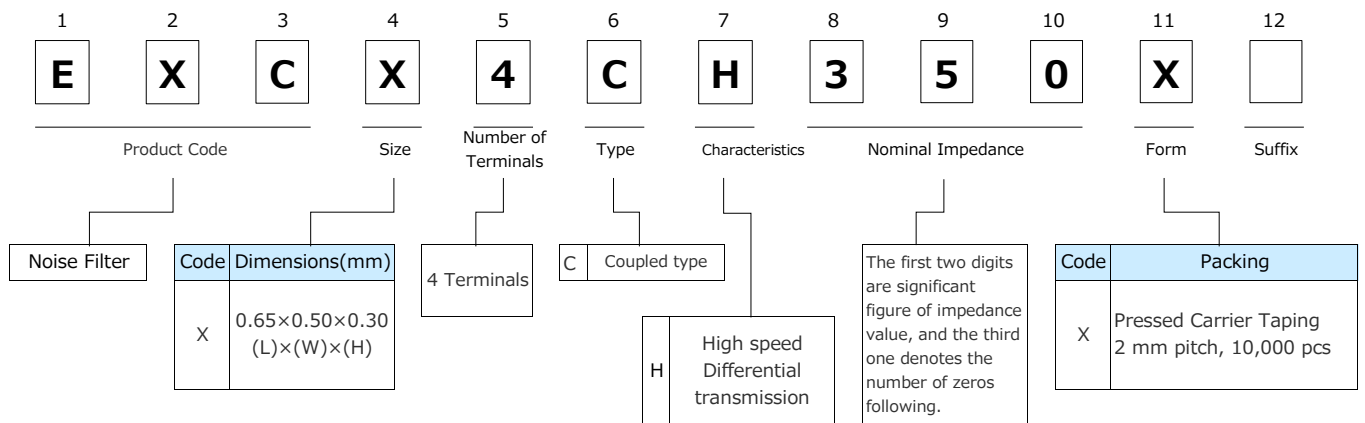
Features

- Small and thin (L 0.65 mm×W 0.50 mm×H 0.30 mm)
- High common mode attenuation in high-speed differential transmission lines, Cut-off frequency is more than 8.5 GHz, and an influence to differential transmission signal quality is little
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

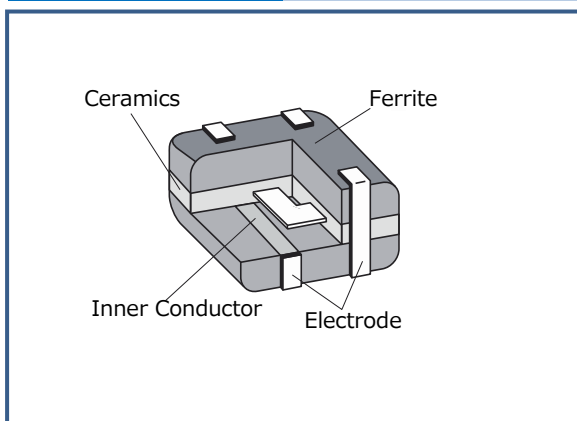
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as USB, LVDS and HDMI

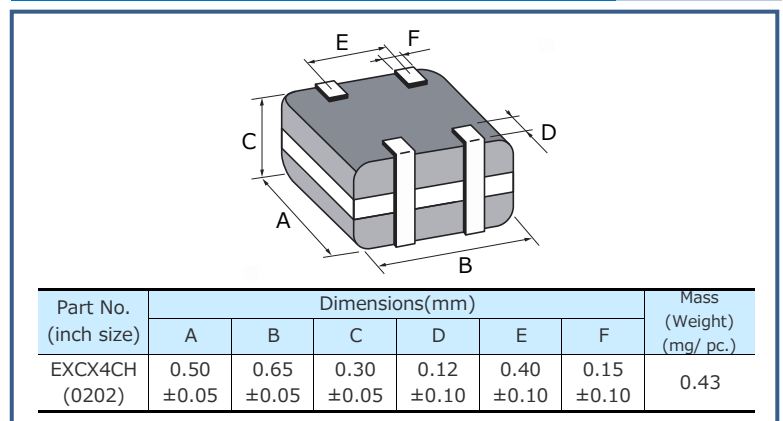
Explanation of Part Numbers



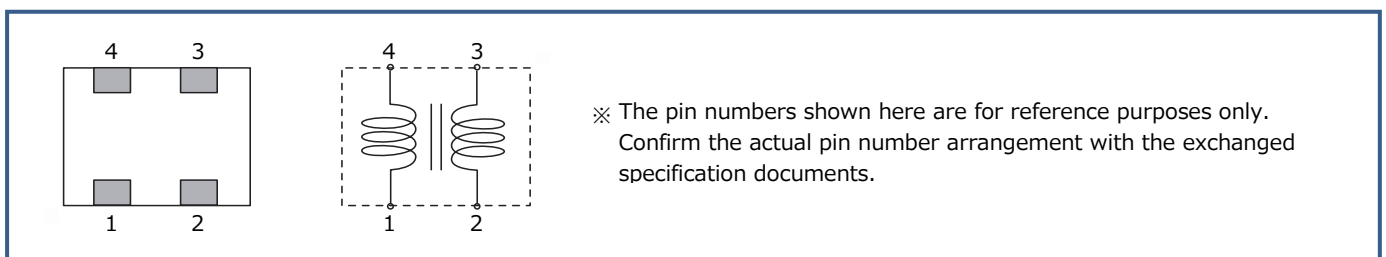
Construction



Dimensions in mm (not to scale)



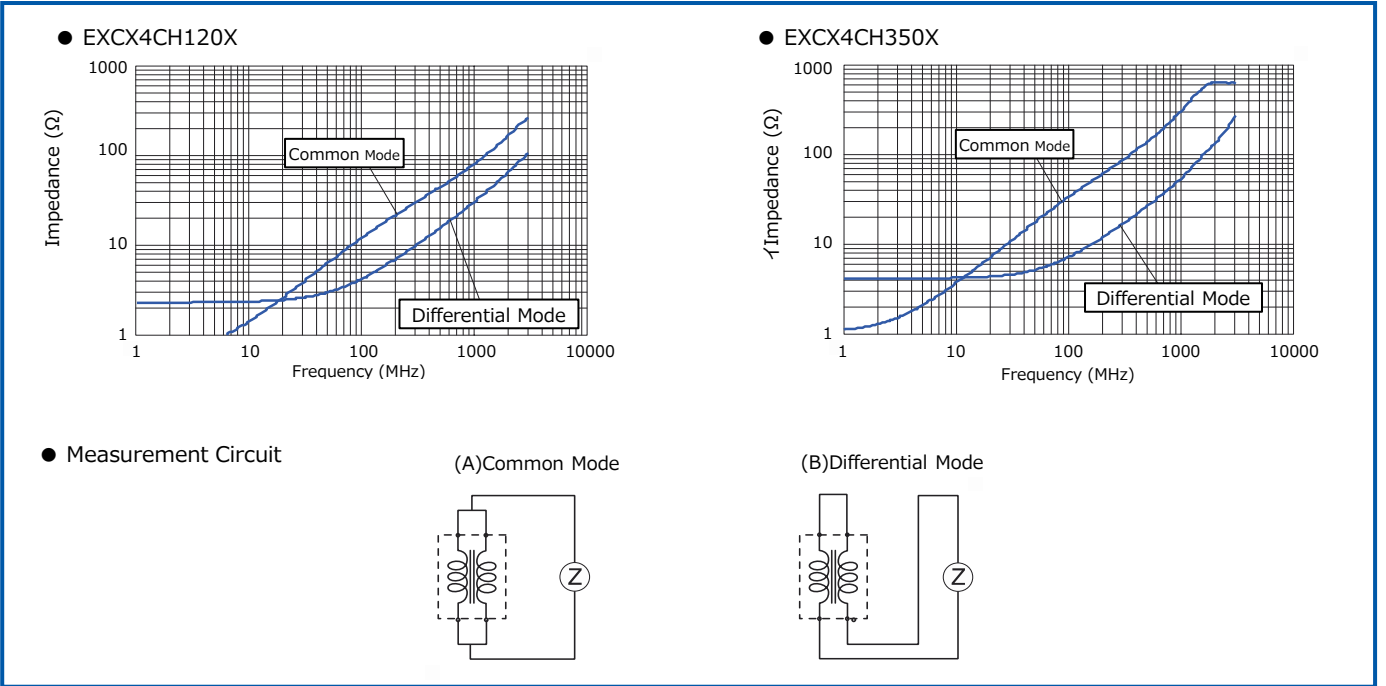
Circuit Configuration (No Polarity)



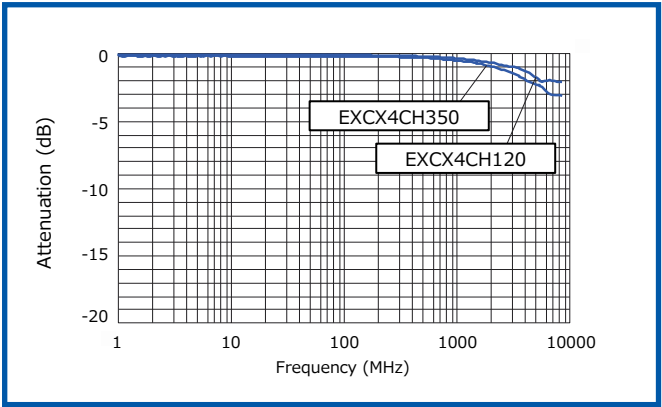
Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode				
EXCX4CH120X	12 Ω \pm 5 Ω		5	100	2.0
EXCX4CH350X	35 Ω \pm 30 %		5	100	2.7

● Category Temperature Range -40 °C to +85 °C

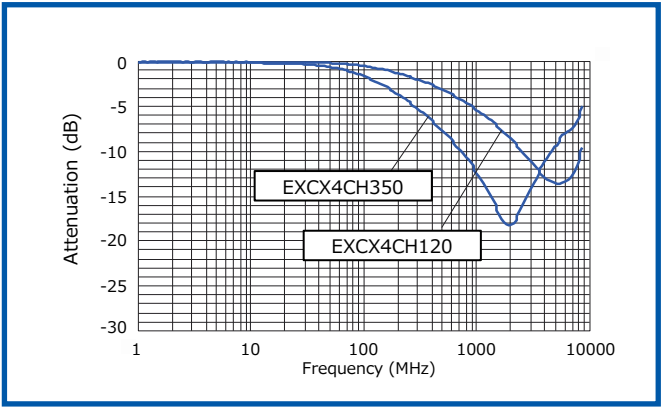
Impedance Characteristics (Typical)



Insertion Loss (Typical)



Common mode Attenuation Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXCX4CE**



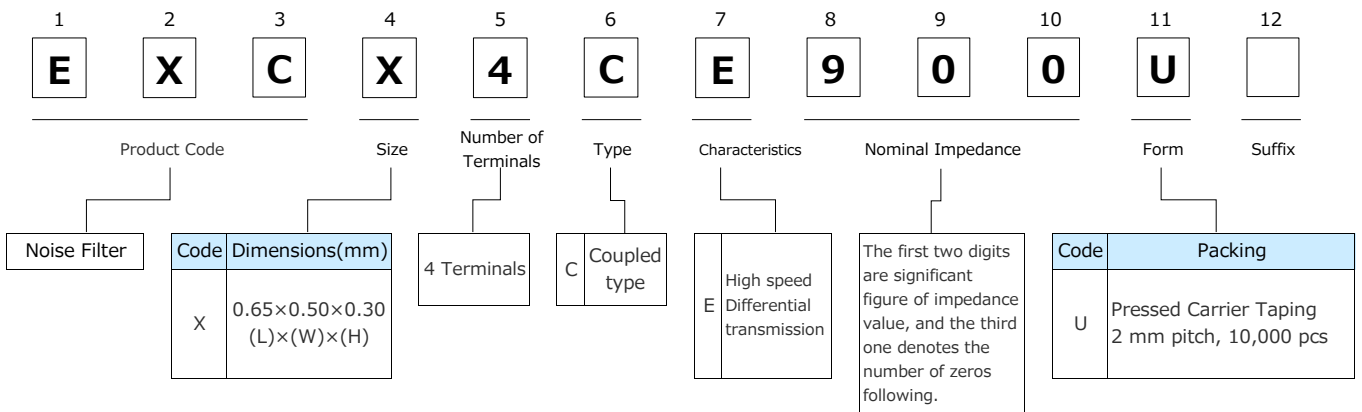
Features

- Small and thin (L 0.65 mm×W 0.50 mm×H 0.30 mm)
- Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

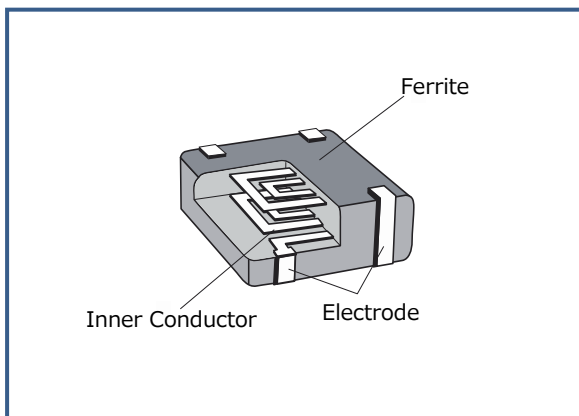
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

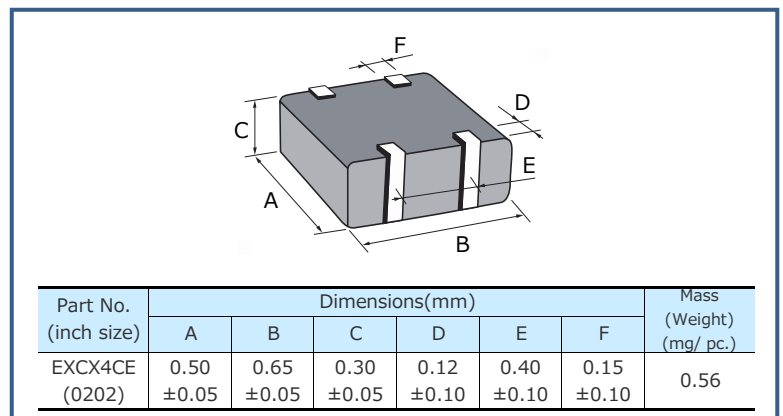
Explanation of Part Numbers



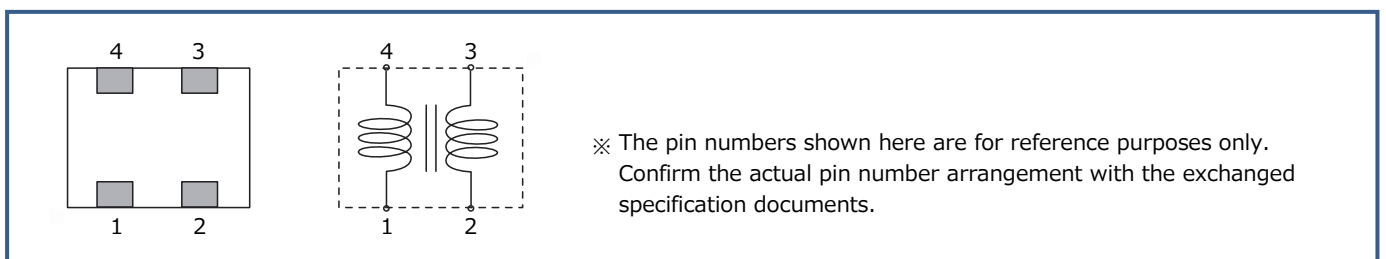
Construction



Dimensions in mm (not to scale)



Circuit Configuration (No Polarity)

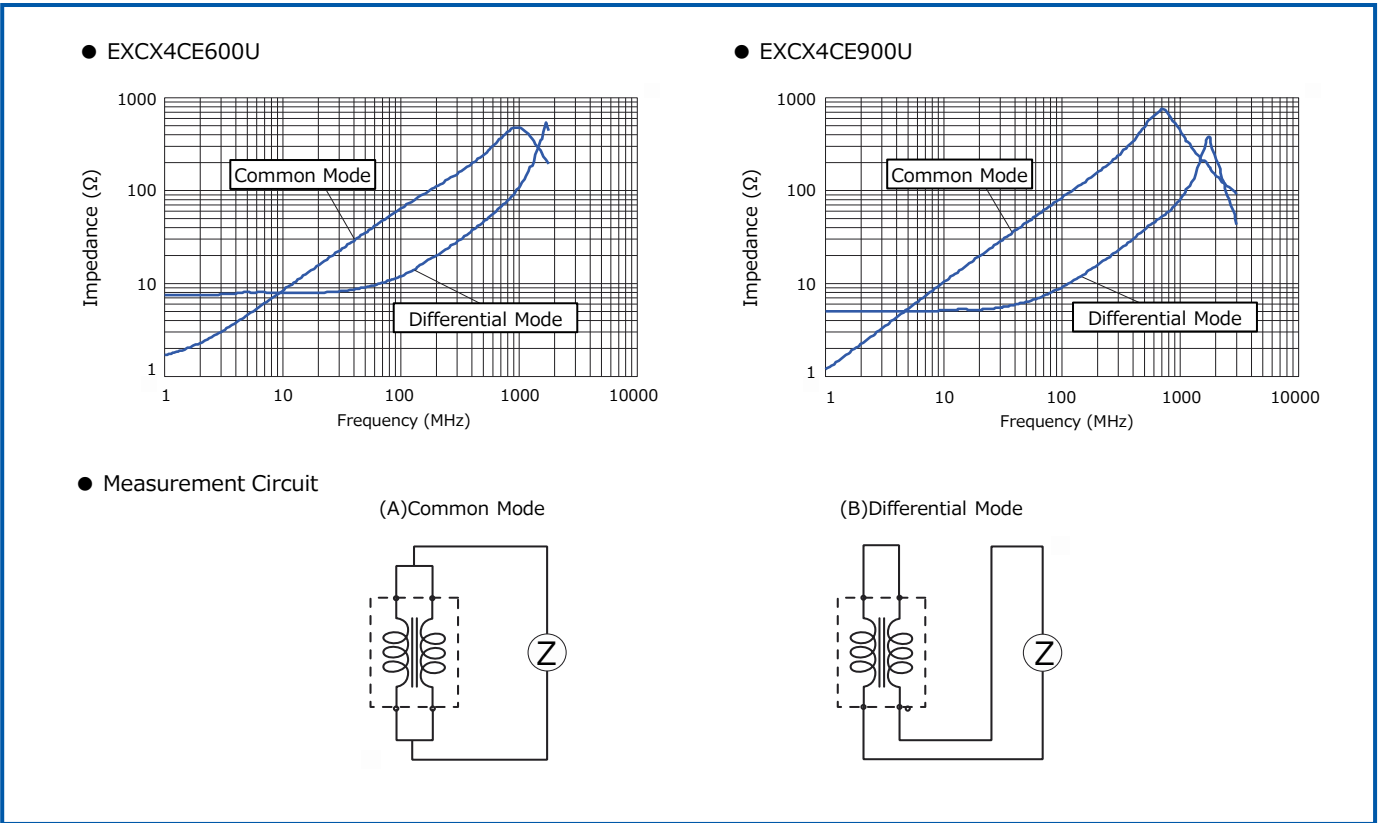


Ratings

Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXCX4CE600U	60 Ω ±20 %	18 Ω max.	5	100	2.4±30 %
EXCX4CE900U	90 Ω ±20 %	20 Ω max.	5	100	3.0±30 %

● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files



Common mode Noise Filters

Type: **EXCX4CT**



This series is not a recommended product.
Not recommended for new design.

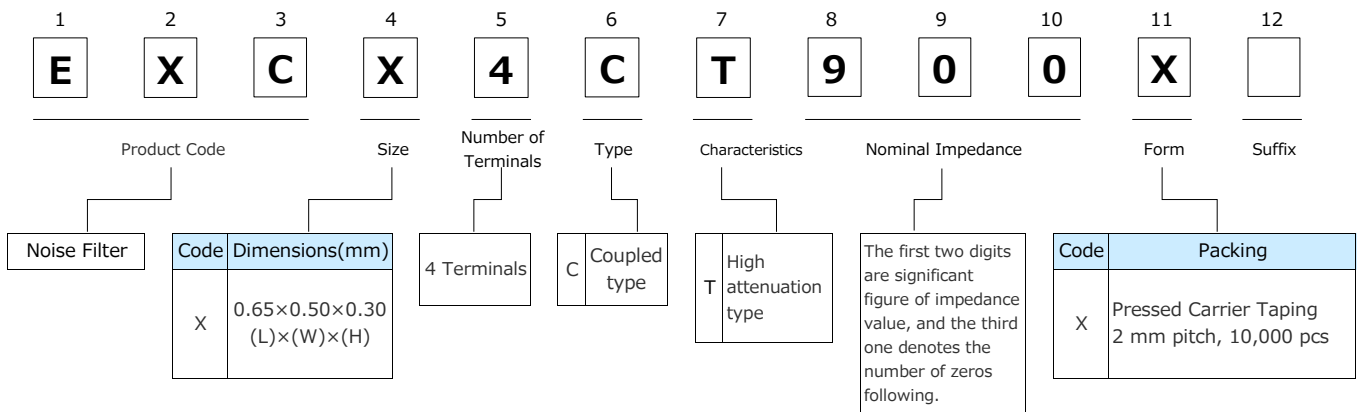
Features

- Small and thin (L 0.65 mm×W 0.50 mm×H 0.30 mm)
- High attenuation at common-mode for noise suppression of harmonic signal components and cellular frequency
- Cut-off frequency is more than 3 GHz, the insertion loss is low in differential transmission line
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

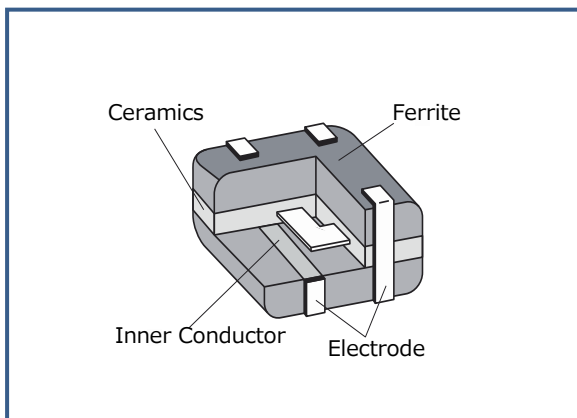
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

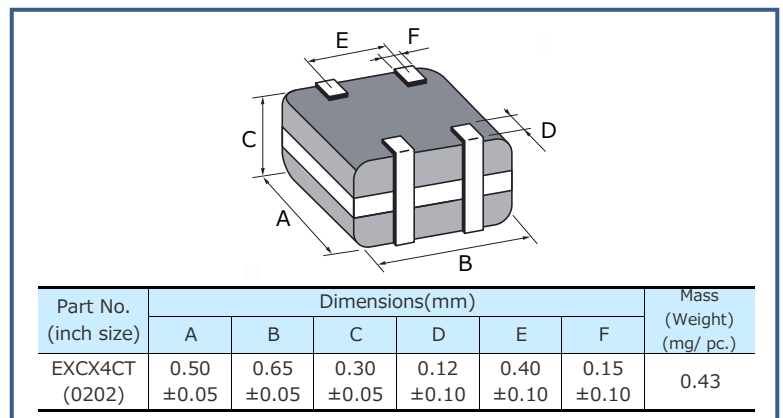
Explanation of Part Numbers



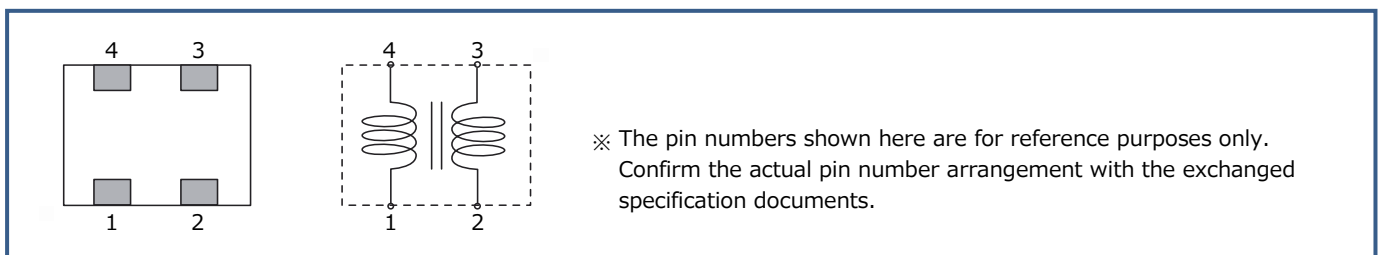
Construction



Dimensions in mm (not to scale)



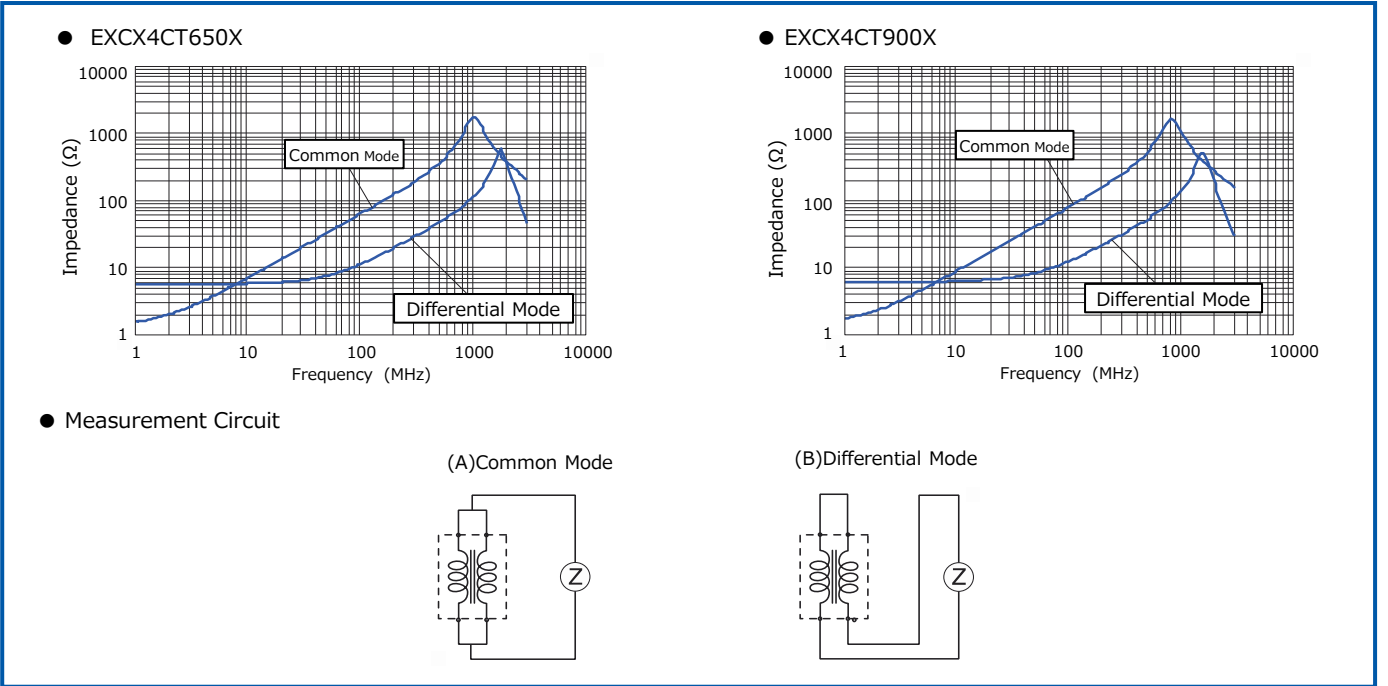
Circuit Configuration (No Polarity)



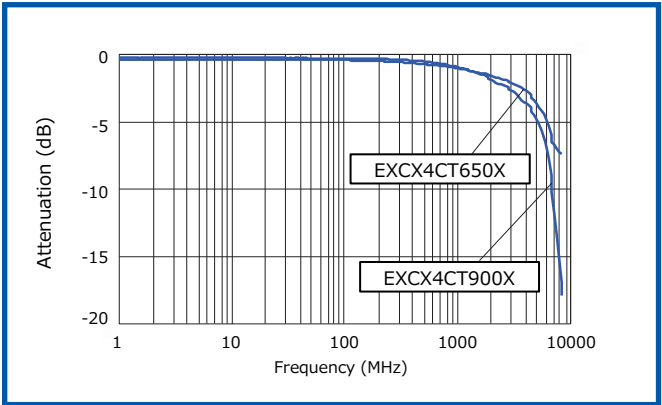
Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode				
EXCX4CT650X	65 $\Omega \pm 20\%$		10	100	2.7 $\Omega \pm 30\%$
EXCX4CT900X	90 $\Omega \pm 20\%$		10	100	3.0 $\Omega \pm 30\%$

● Category Temperature Range $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

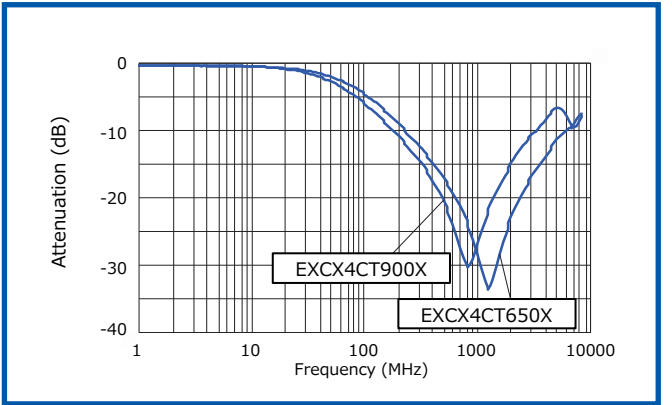
Impedance Characteristics (Typical)



Insertion Loss (Typical)



Common mode Attenuation Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC14CH**



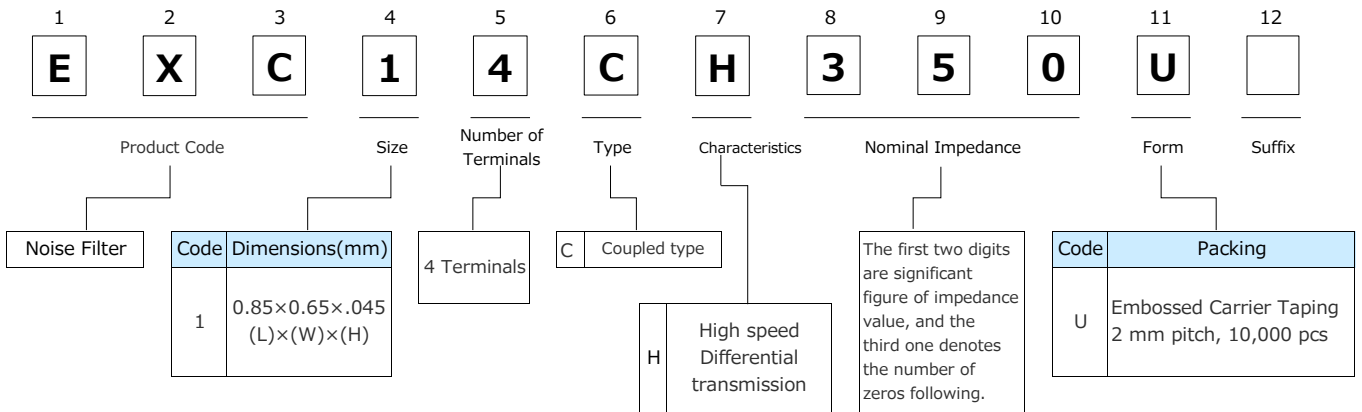
Features

- Small and thin (L 0.85 mm×W 0.65 mm×H 0.45 mm)
- High common mode attenuation in high-speed differential transmission lines, Cut-off frequency is more than 8.5 GHz, and an influence to differential transmission signal quality is little
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

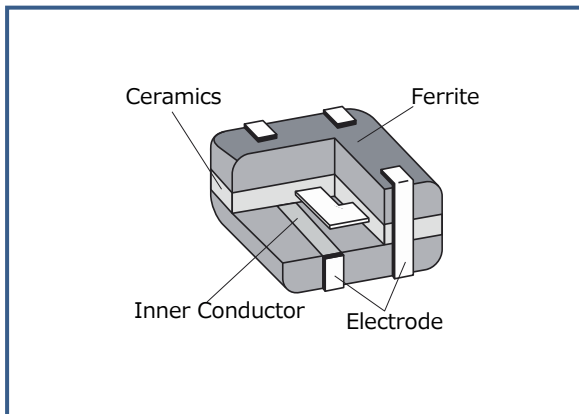
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as USB, LVDS and HDMI

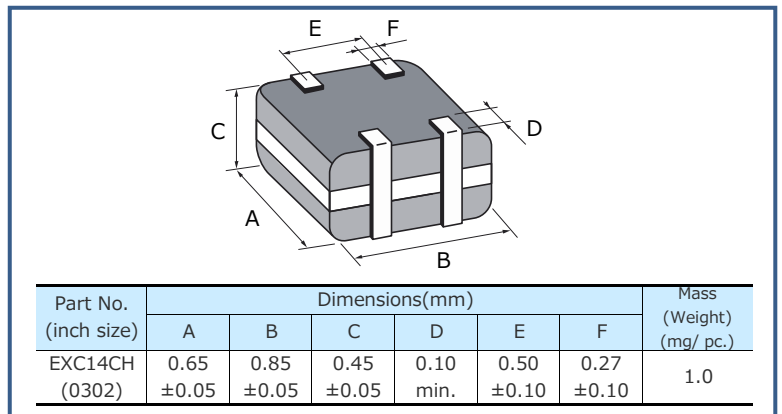
Explanation of Part Numbers



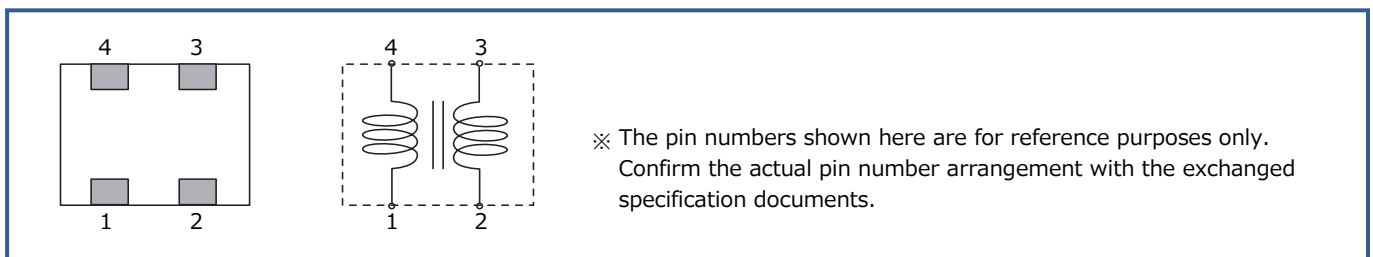
Construction



Dimensions in mm (not to scale)



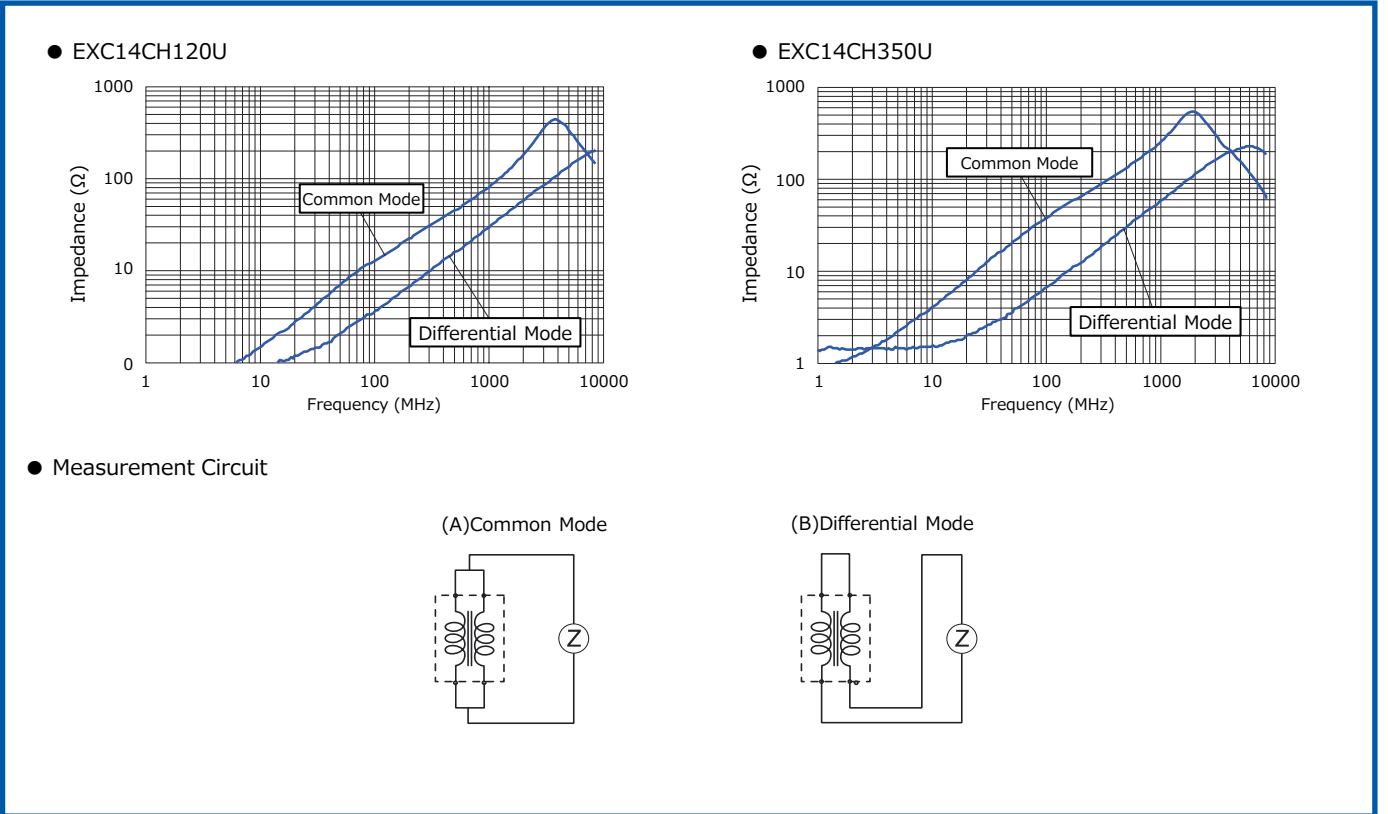
Circuit Configuration (No Polarity)



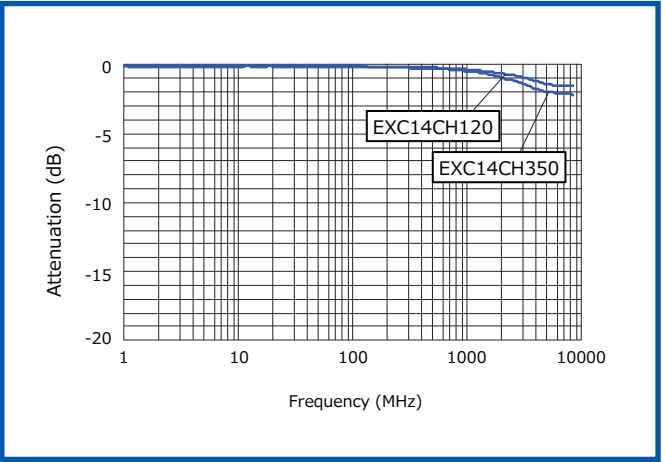
Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC14CH120U	12 Ω ±25 %	10 Ω max.	5	100	1.0
EXC14CH350U	35 Ω ±30 %	15 Ω max.	5	100	1.5

● Category Temperature Range -40 °C to +85 °C

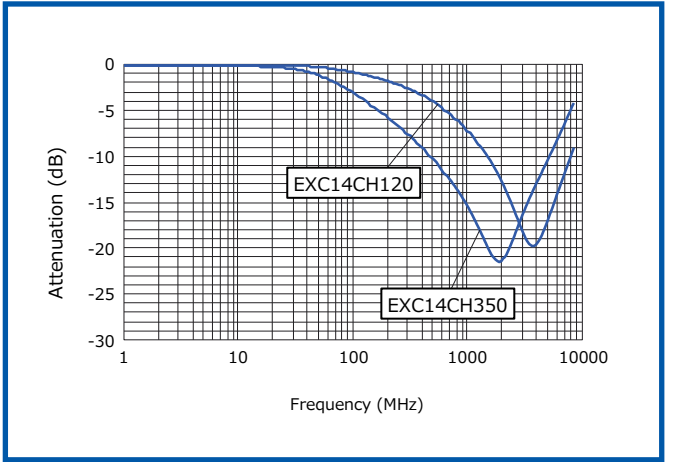
Impedance Characteristics (Typical)



Insertion Loss (Typical)



Common mode Attenuation Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC14CG/EXC14CE**



Features

- Small and thin (L 0.85 mm×W 0.65 mm×H 0.45 mm)
- Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- Low DC resistance and low insertion loss
- High-Q value and high impedance of GHz zone : EXC14CG type
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

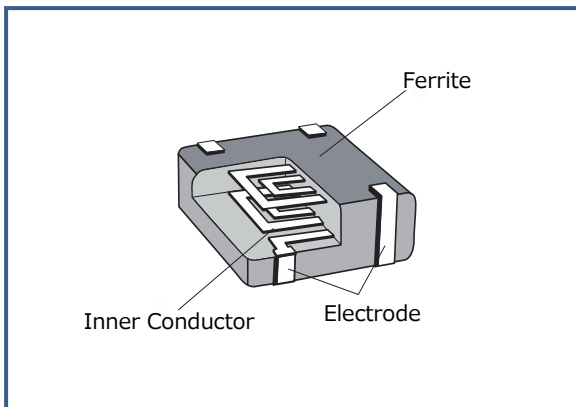
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as USB, LVDS and MHL

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	1	4	C	E	9	0	0	U	
Product Code			Size	Number of Terminals	Type	Characteristics	Nominal Impedance			Form	Suffix
Noise Filter	Code		Dimensions(mm)	4 Terminals	C Coupled type	E High speed Differential transmission G High-Q type	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.			Code	Packing
	1	0.85×0.65×.045 (L)×(W)×(H)								U	Embossed Carrier Taping 2 mm pitch, 10,000 pcs

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC14CE	0.65	0.85	0.45	0.10	0.50	0.27	1.4
EXC14CG (0302)	±0.05	±0.05	±0.05	min.	±0.10	±0.10	

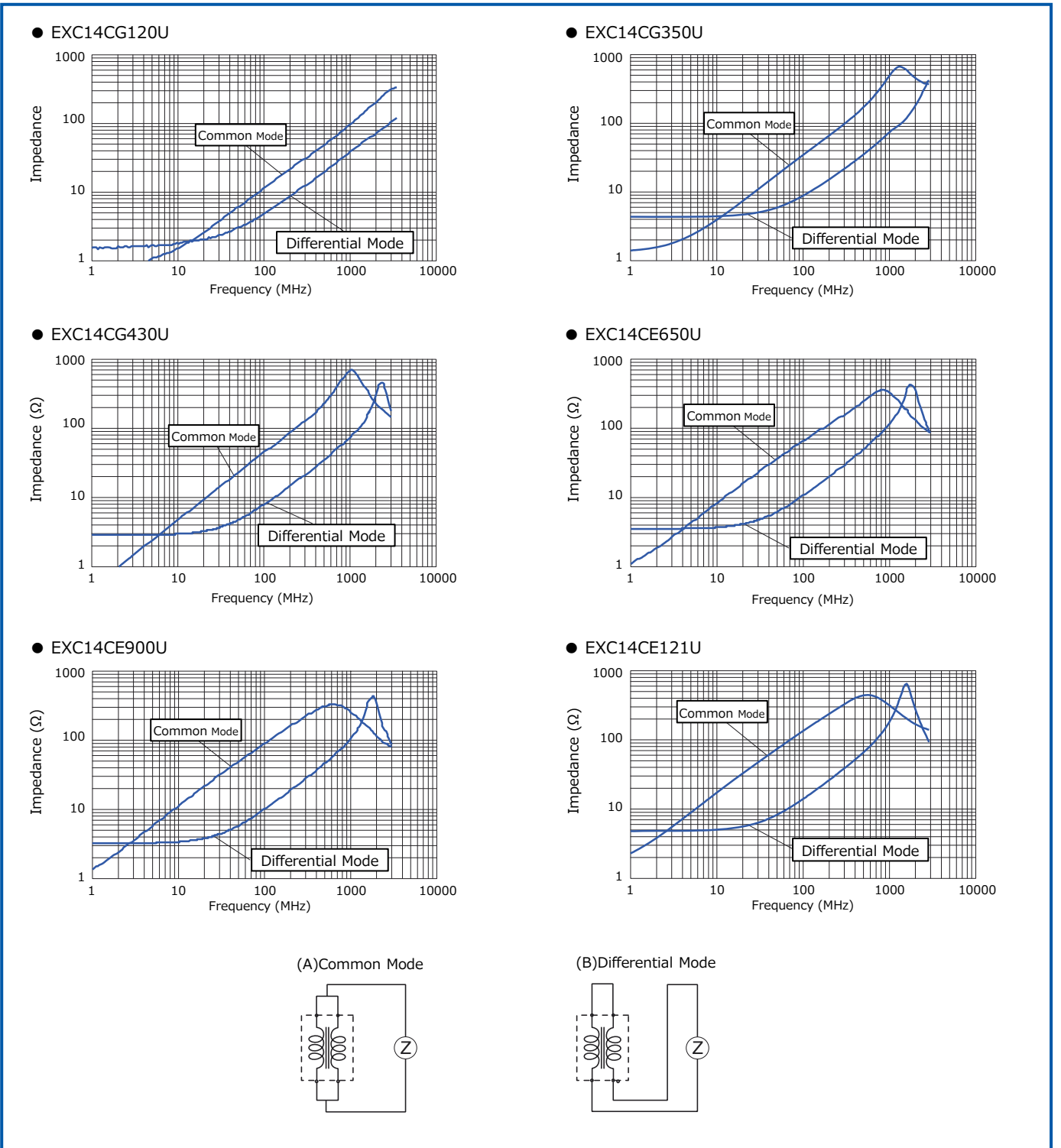
Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC14CG120U	12 Ω ±30 %	10 Ω max.	5	130	2.0
EXC14CG350U	35 Ω ±30 %	15 Ω max.	5	100	2.0
EXC14CG430U	43 Ω ±25 %	15 Ω max.	5	100	2.7
EXC14CE650U	65 Ω ±20 %	20 Ω max.	5	130	2.5
EXC14CE900U	90 Ω ±20 %	20 Ω max.	5 </td <td>130</td> <td>2.5</td>	130	2.5
EXC14CE121U	120 Ω ±20 %	20 Ω max.	5	100	3.8

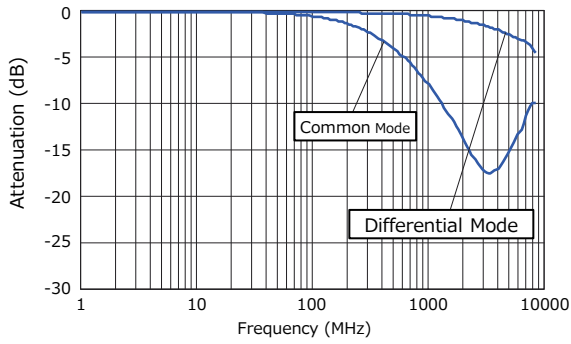
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

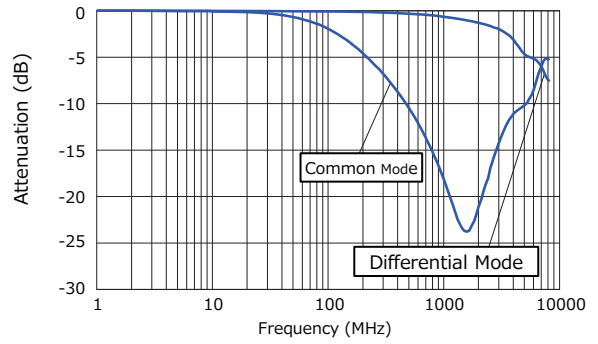


Attenuation Characteristics (Typical)

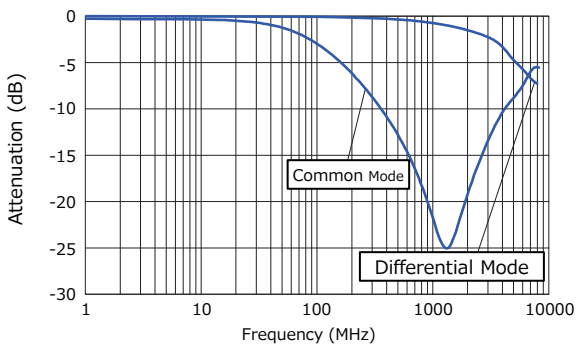
● EXC14CG120U



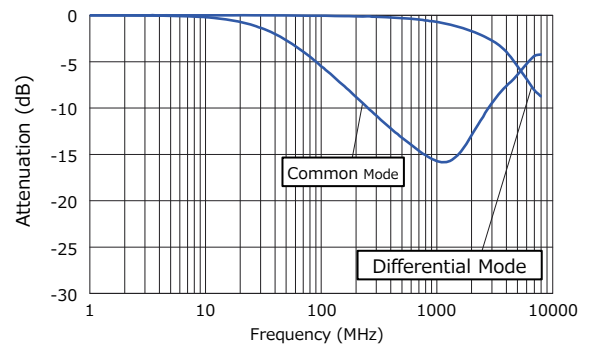
● EXC14CG350U



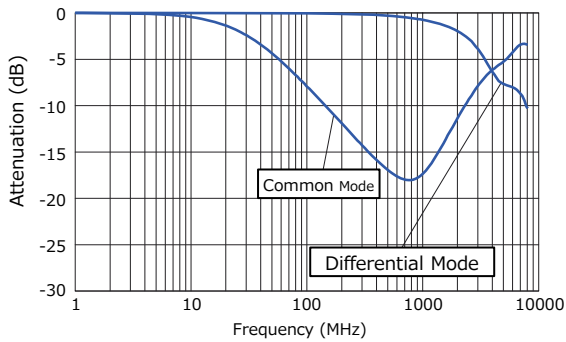
● EXC14CG430U



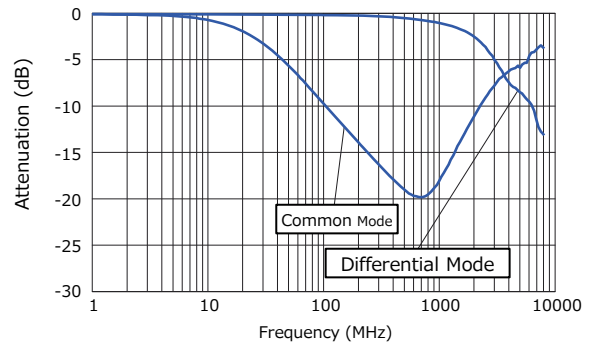
● EXC14CE650U



● EXC14CE900U



● EXC14CE121U



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC14CT**



Features

- Small and thin(L 0.85 mm×W 0.65 mm×H 0.45 mm)
- High attenuation at common-mode for noise suppression of harmonic signal components and cellular frequency
- High cut-off frequency and capability of coping with high-speed signals (USB and HDMI)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

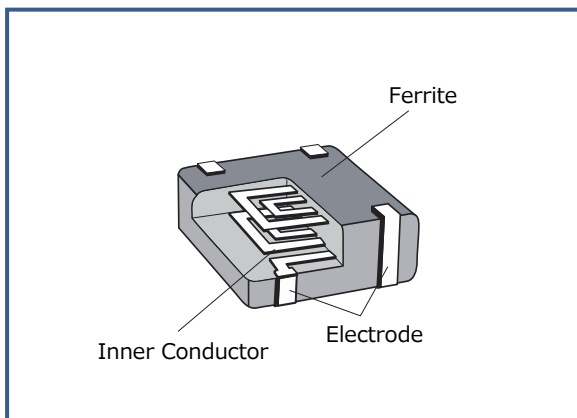
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	1	4	C	T	9	0	0	U	
Product Code			Size	Number of Terminals	Type	Characteristics	Nominal Impedance			Form	Suffix
Noise Filter	Code	Dimensions(mm)	4 Terminals	C	Coupled type	High attenuation type	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.			Code	Packing
	1	0.85×0.65×.045 (L)×(W)×(H)								U	Embossed Carrier Taping 2 mm pitch, 10,000 pcs

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC14CT (0302)	0.65 ±0.05	0.85 ±0.05	0.45 ±0.05	0.10 min.	0.50 ±0.10	0.27 ±0.10	1.0

Circuit Configuration (No Polarity)

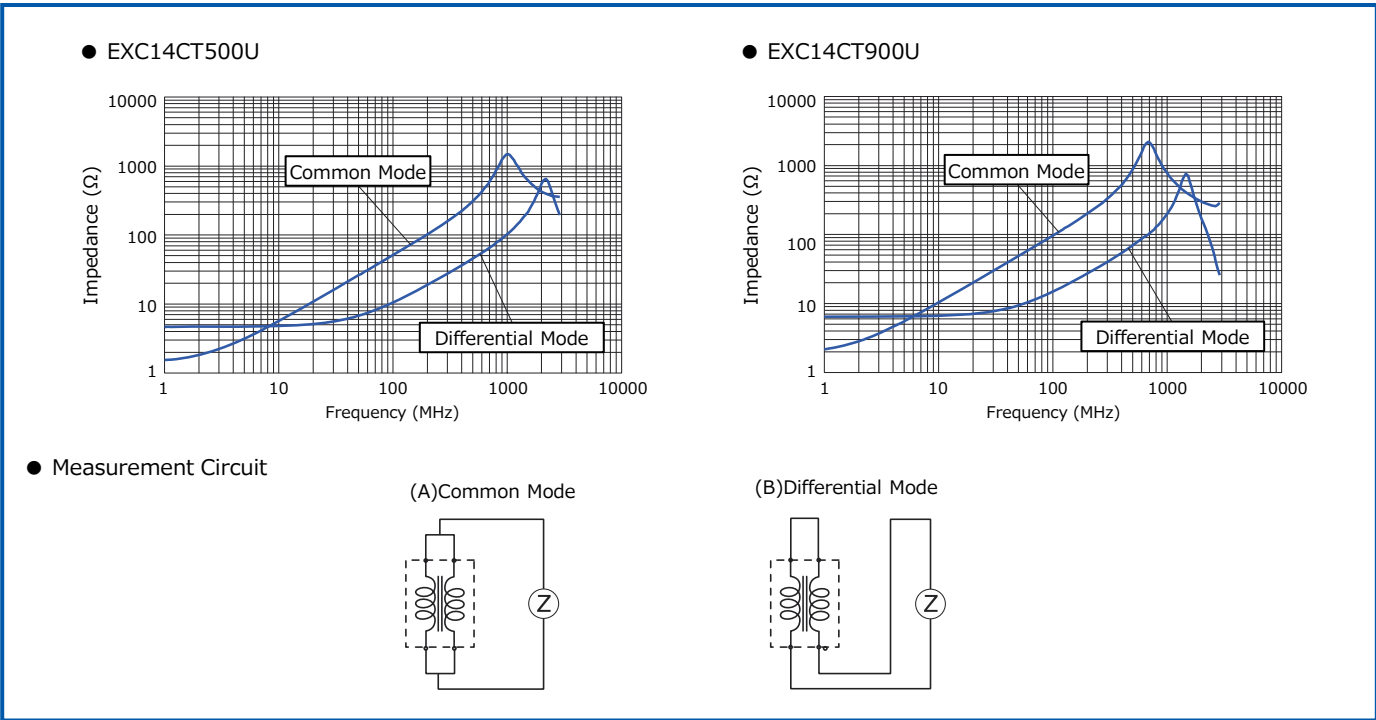
※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Ratings

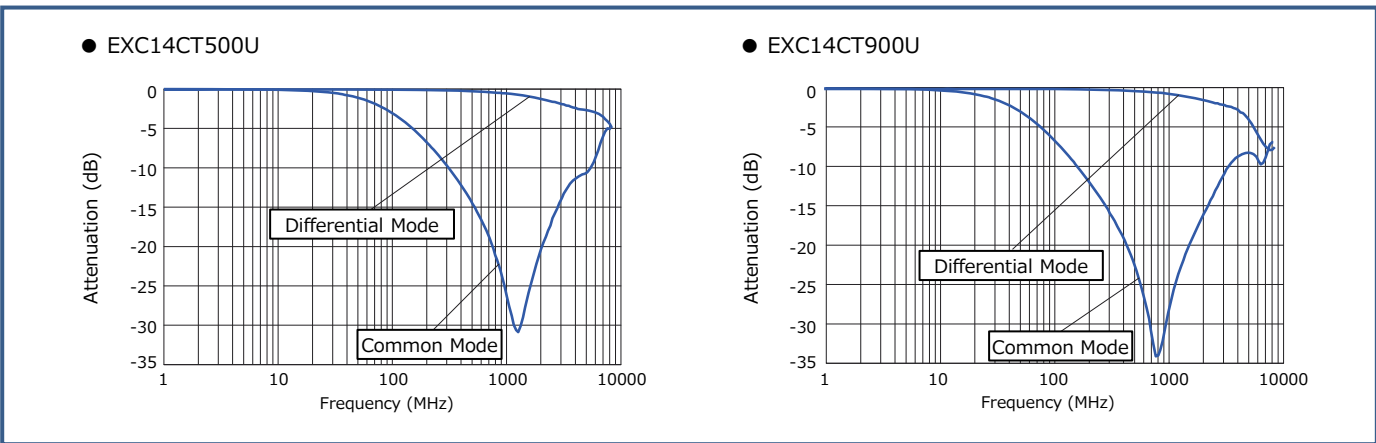
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC14CT500U	50 Ω ±25 %	17 Ω max.	5	100	2.3 Ω ±30 %
EXC14CT900U	90 Ω ±20 %	20 Ω max.	5	100	3.3 Ω ±30 %

● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)



Attenuation Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC14CX**



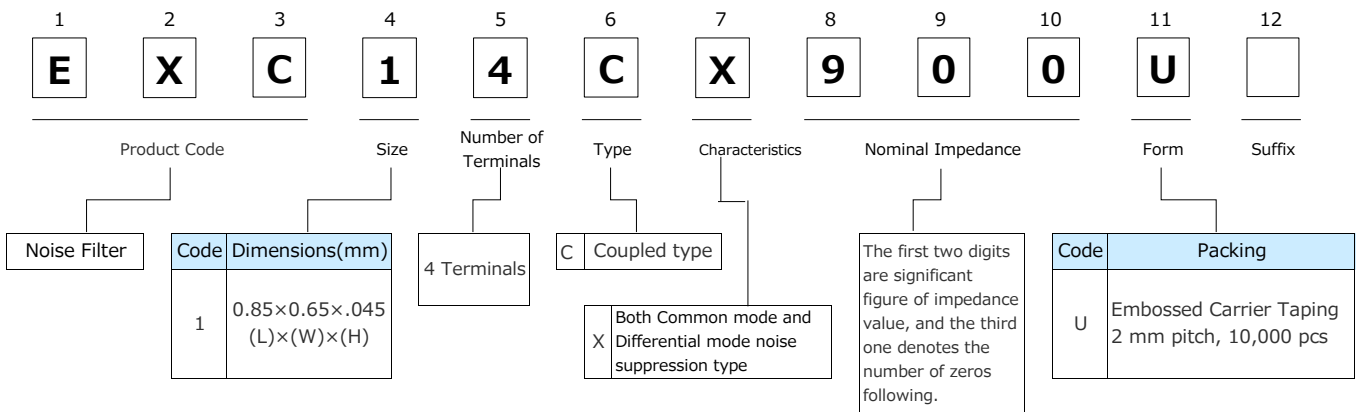
Features

- Small and thin (L 0.85 mm×W 0.65 mm×H 0.45 mm)
- Effective noise suppression of smartphones by eliminating common mode noises and removing differential signal components
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

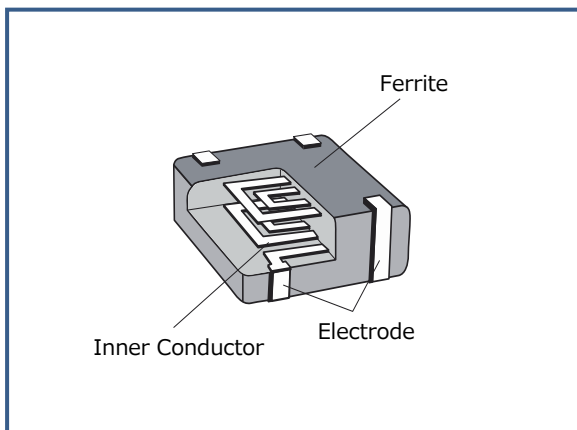
Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

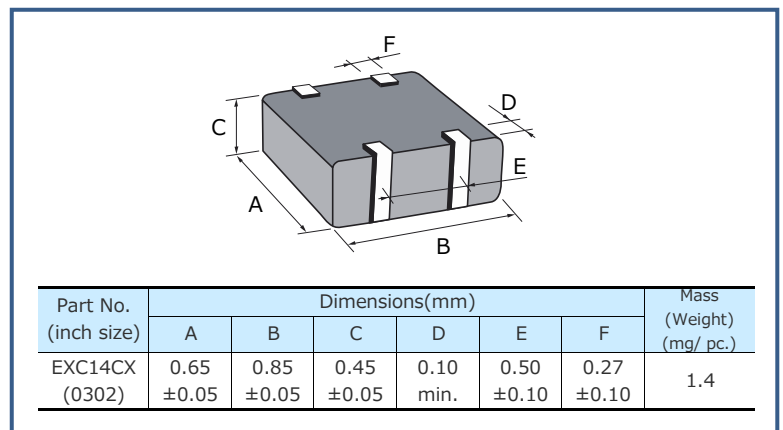
Explanation of Part Numbers



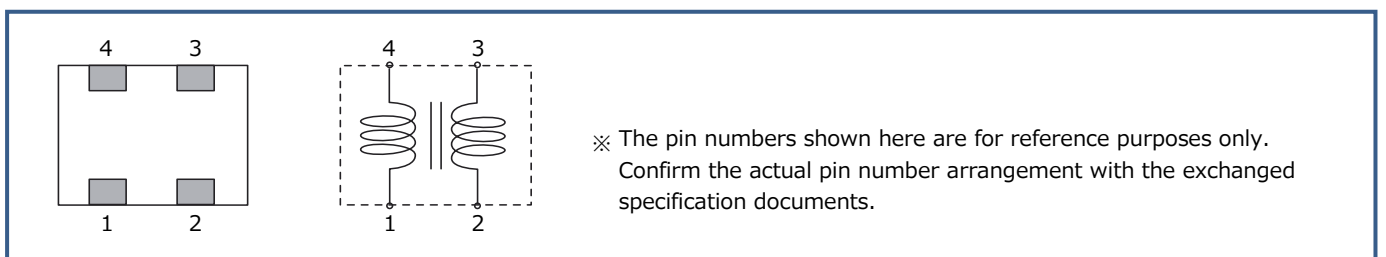
Construction



Dimensions in mm (not to scale)



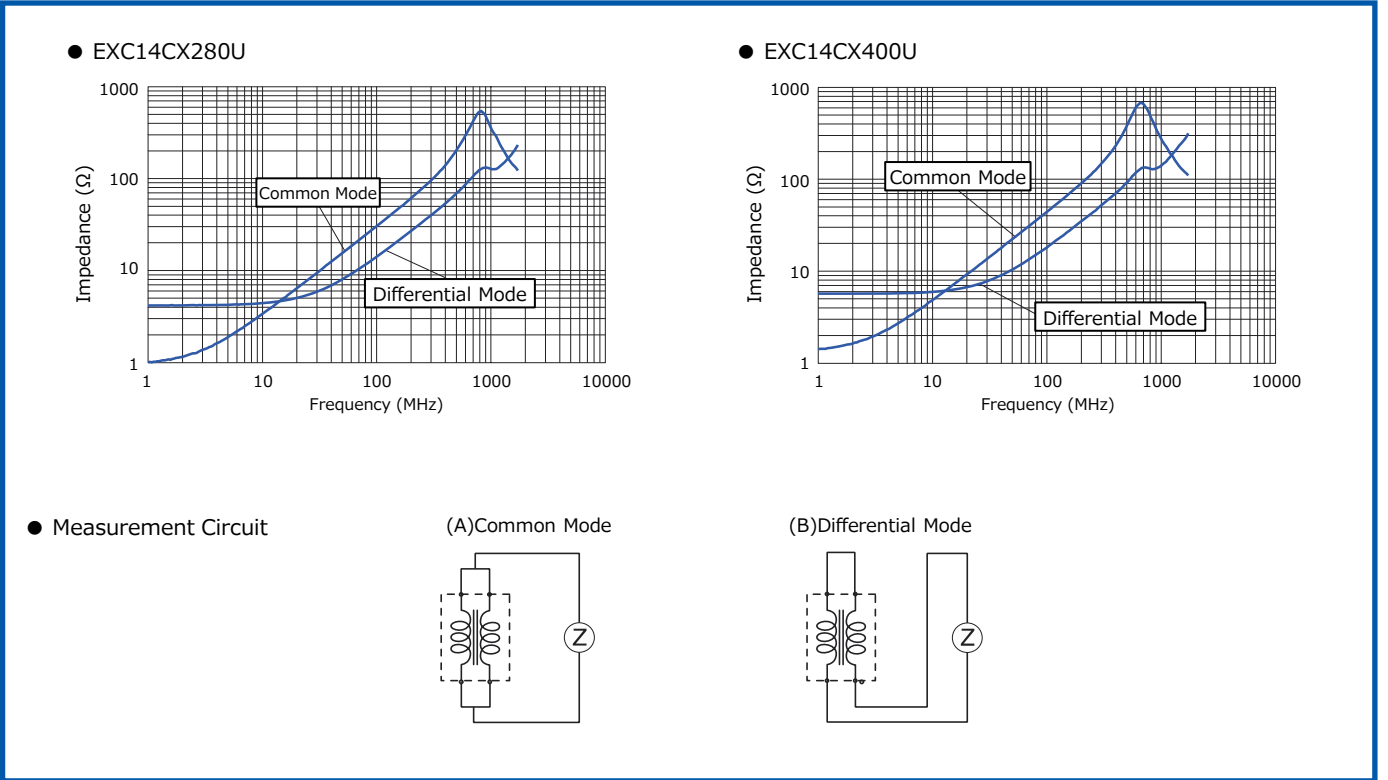
Circuit Configuration (No Polarity)



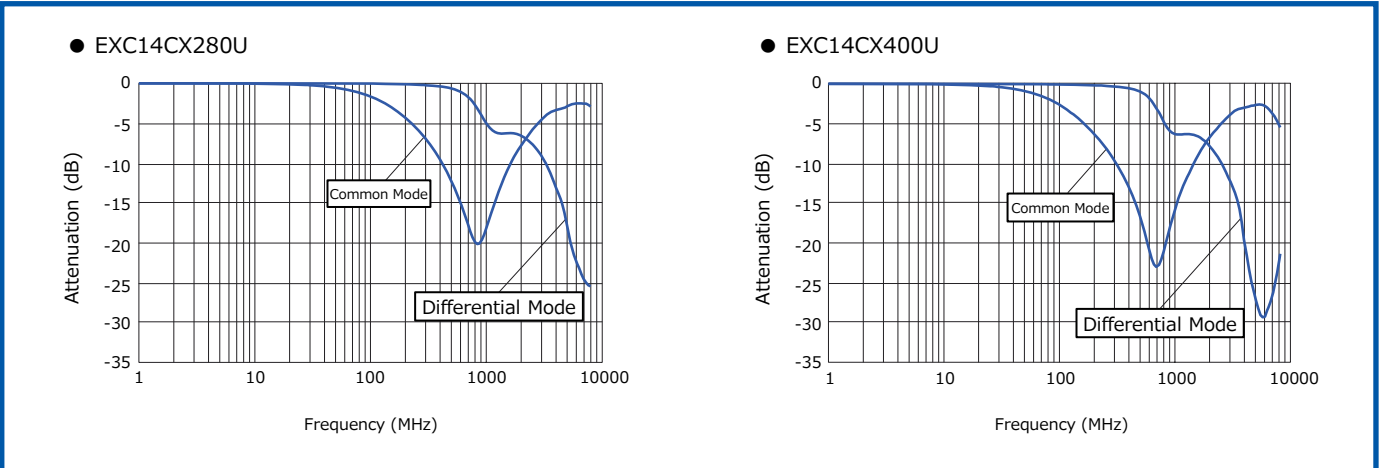
Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC14CX280U	28 Ω ±25 %	25 Ω max.	5	100	3.0
EXC14CX400U	40 Ω ±25 %	30 Ω max.	5	100	4.0

● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)



Attenuation Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC16CT**



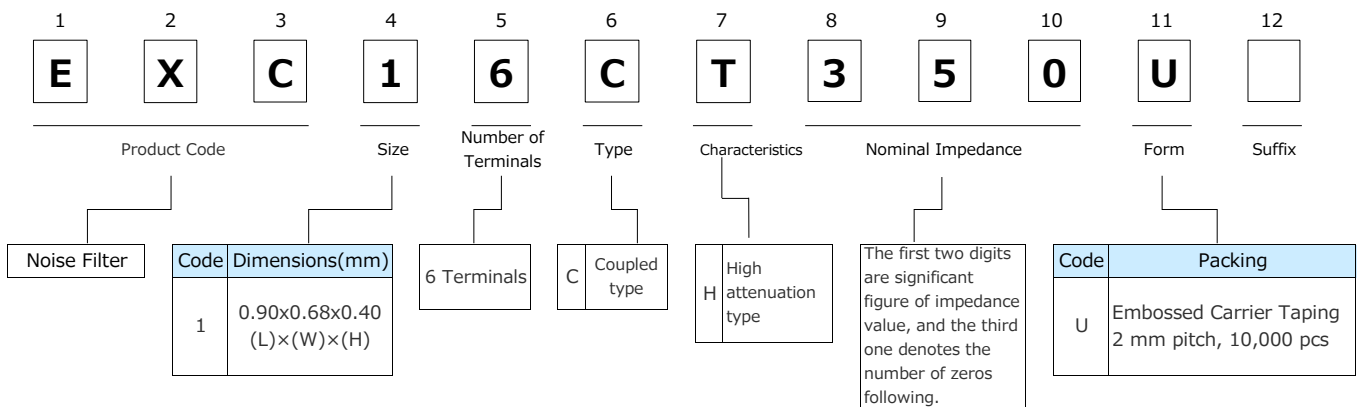
Features

- Corresponding to new high-speed differential interface (MIPI C-PHY)
Corresponding to 3-line transmission, transmission rate up to 2.5 Gbps
- Unique plating fine coil process and ceramic multilayer process enable compact size
(L 0.90 × W 0.68 × H 0.40 mm)
around 40% reduction of mounting area (comparing with MIPI D-PHY)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

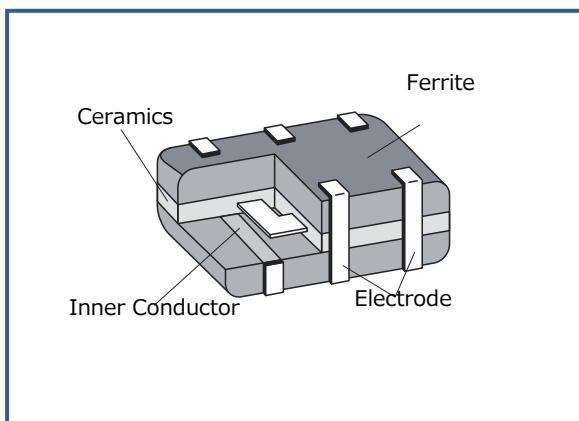
Recommended Applications

- High resolution camera and display equipped mobile devices (Smartphones, Tablet PCs and wearable)
- Noise suppression of high-speed differential data lines such as MIPI C-PHY

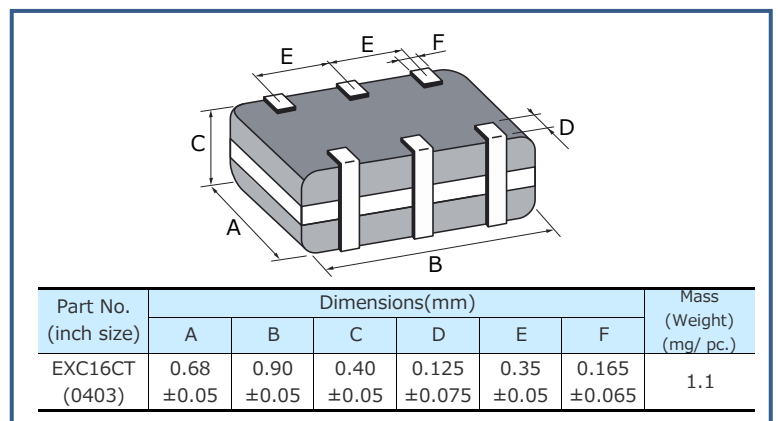
Explanation of Part Numbers



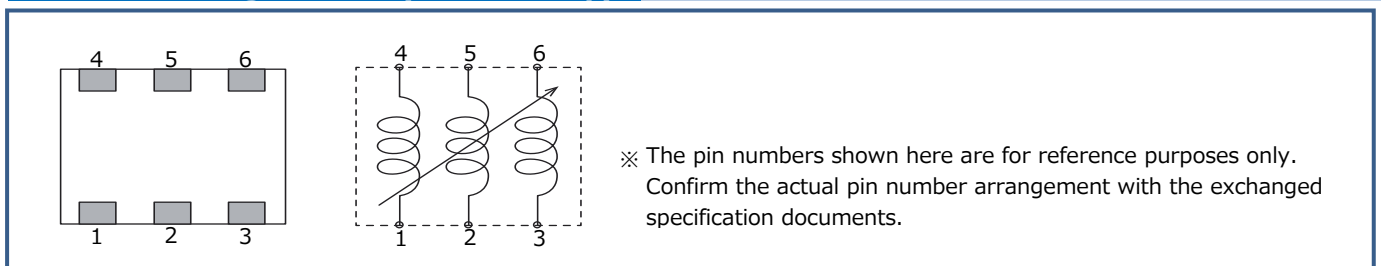
Construction



Dimensions in mm (not to scale)



Circuit Configuration (No Polarity)

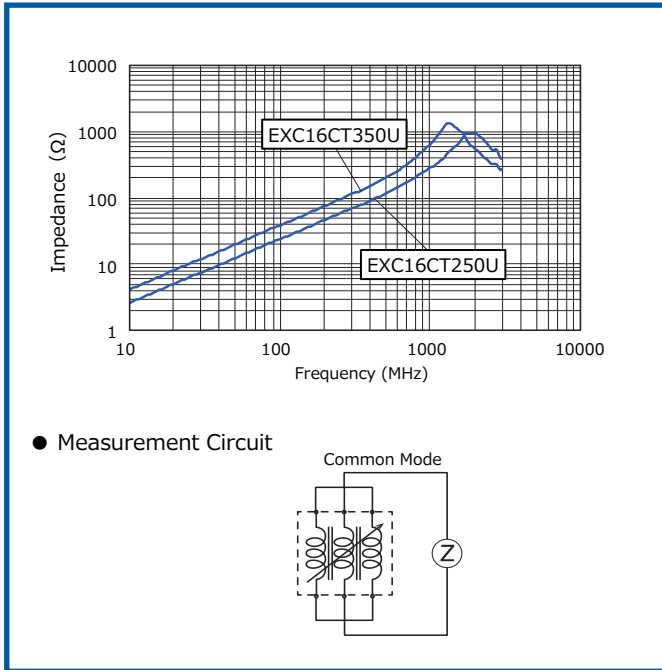


Ratings

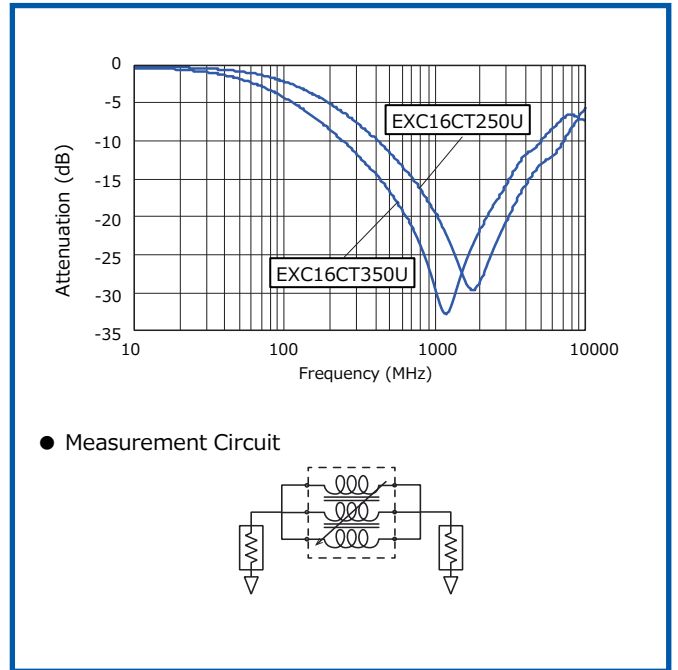
Part Number	Impedance (Ω) at 100 MHz	Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode			
EXC16CT250U	25 $\Omega \pm 25\%$	5	100	3.0
EXC16CT350U	35 $\Omega \pm 30\%$	5	100	4.0

● Category Temperature Range $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

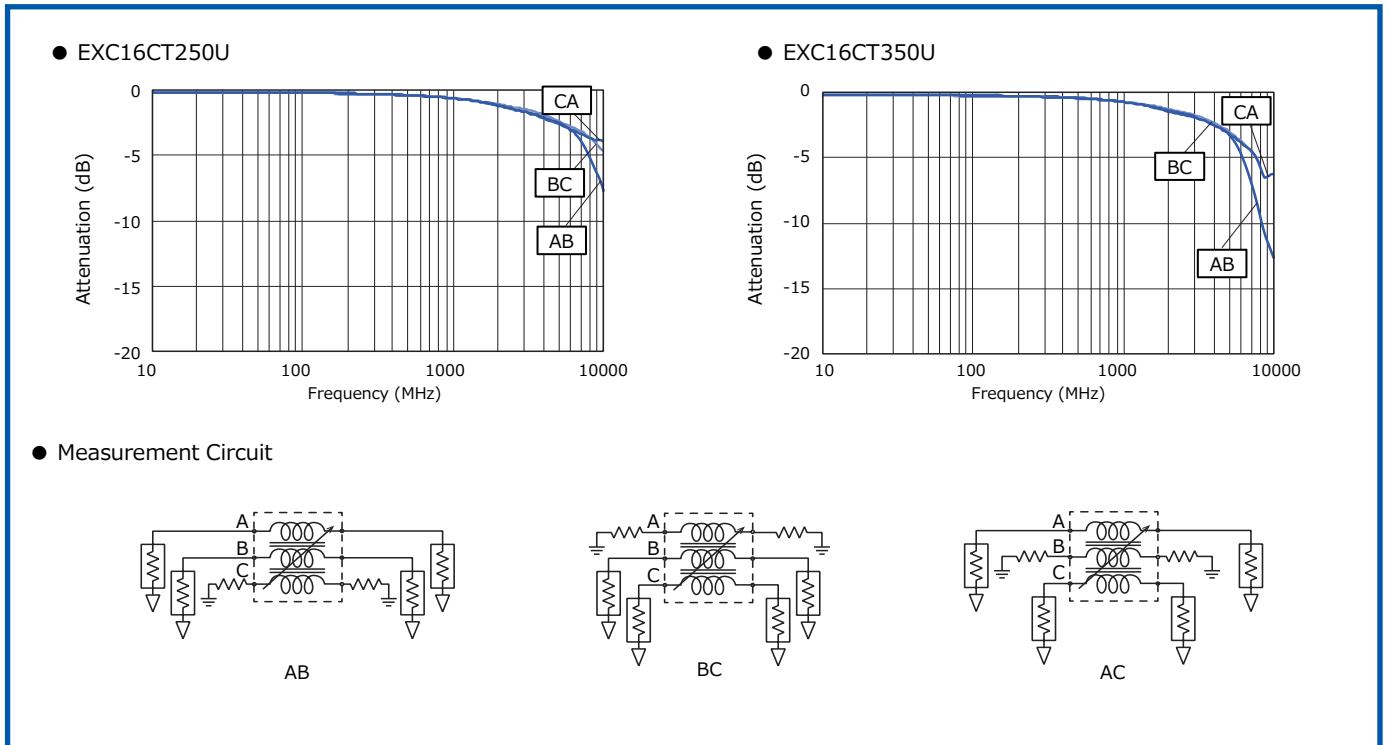
Common mode Impedance Characteristics (Typical)



Common mode Attenuation Characteristics (Typical)



Differential Insertion Loss (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC24CH**



Features

- Small and thin type, built-in filter circuit (L 1.25 mm×W 1.00 mm×H 0.50 mm)
- Suppression of high frequency noise with little influence of waveform rounding on signal transmission, achieved by setting high cut-off frequency between 6 and 10 GHz
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

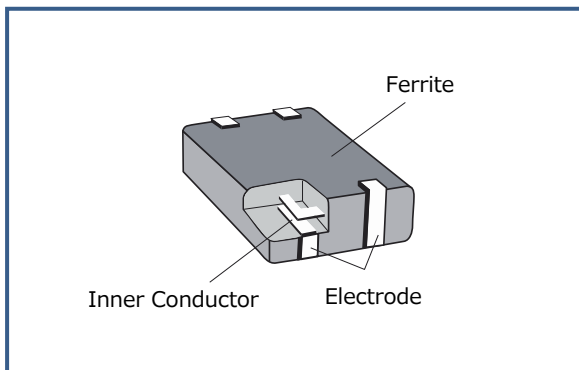
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as USB 3.0, HDMI and Display Port

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	2	4	C	H	9	0	0	U	
Product Code		Size		Number of Terminals	Type	Characteristics	Nominal Impedance			Form	Suffix
Noise Filter	Code	Dimensions(mm)		4 Terminals	C Coupled type	H High speed Differential transmission (for Gbps)	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.			Code	Packing
	2	1.25×1.00×0.50 (L)×(W)×(H)								U	Embossed Carrier Taping 4 mm pitch, 5,000 pcs

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC24CH (0504)	1.25 ±0.15	1.00 ±0.15	0.50 ±0.10	0.20 ±0.15	0.55 ±0.10	0.30 ±0.10	3

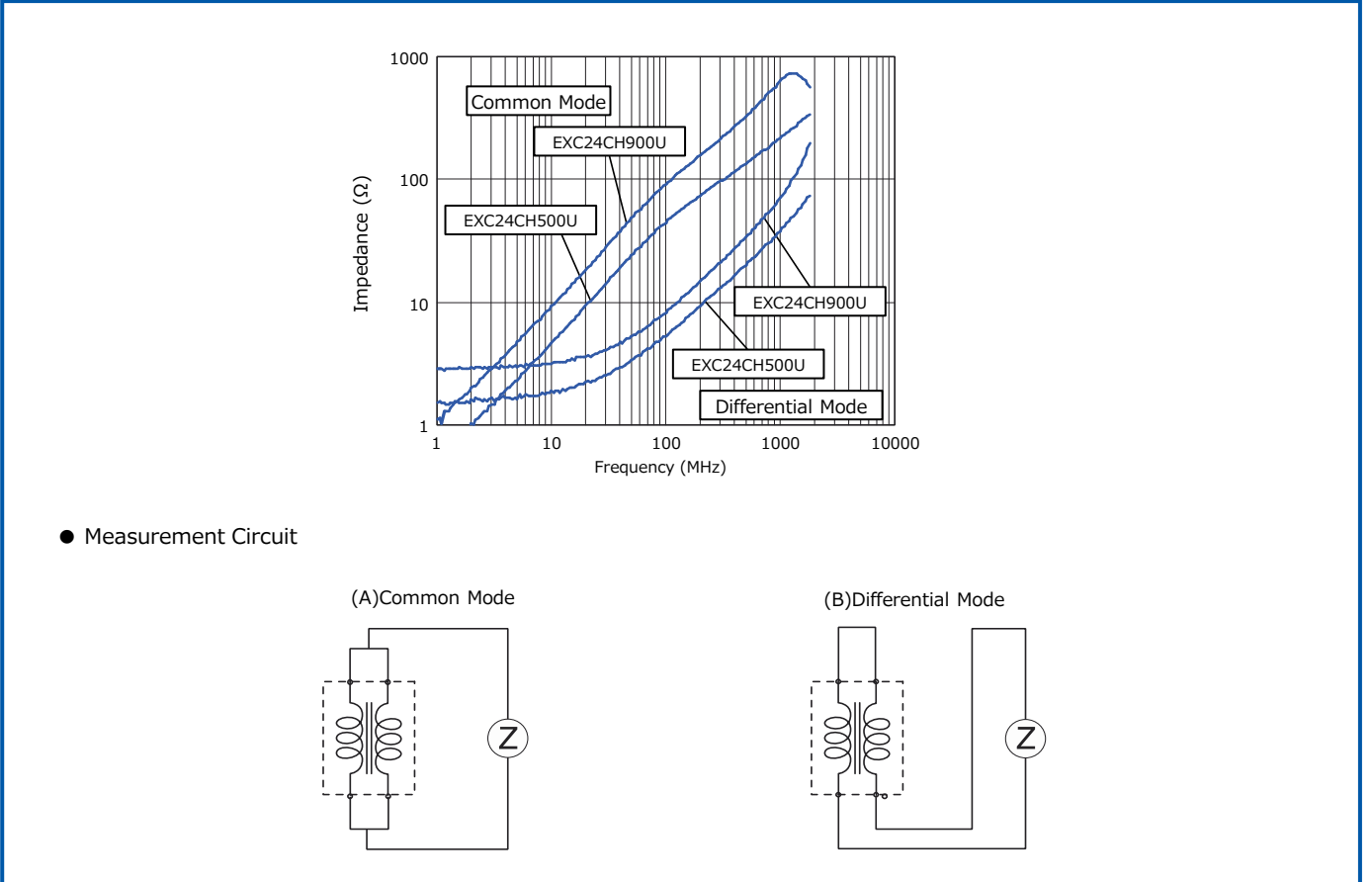
Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Ratings						
Part Number	Impedance (Ω) at 100 MHz		Cutoff Frequency (GHz)	Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode				
EXC24CH500U	50 Ω ±25 %	13 Ω max.	10 Typ.	5	160	1.5
EXC24CH900U	90 Ω ±20 %	15 Ω max.	6 Typ.	5	130	2.5

● Category Temperature Range -40 °C to +85 °C

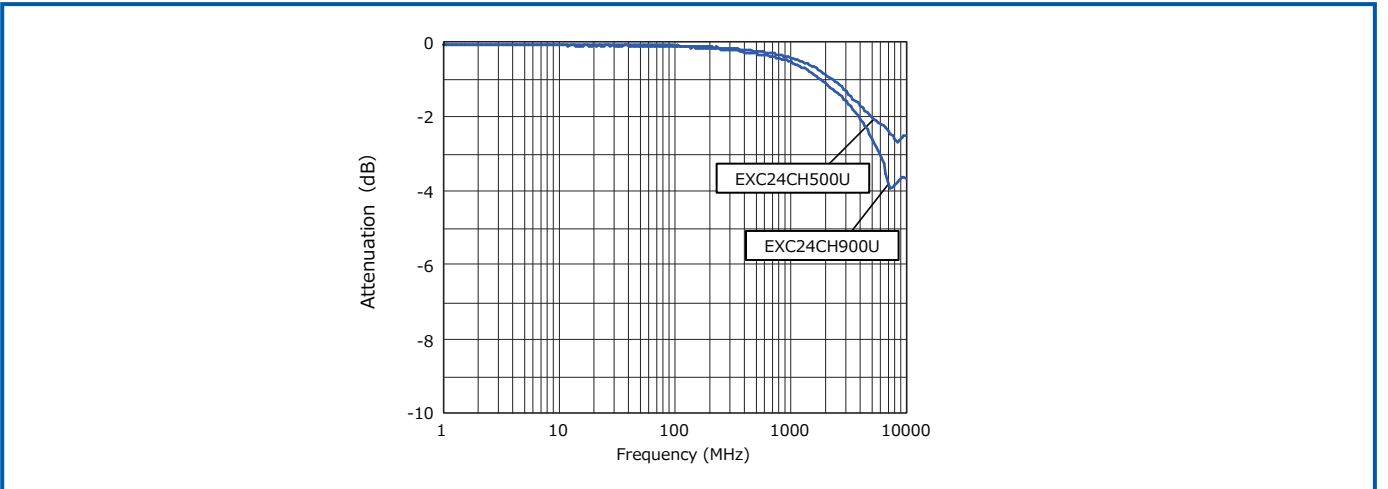
Impedance Characteristics (Typical)



● Measurement Circuit



Insertion Loss (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC24CG**



Features

- Elimination of radiation noises from high-speed differential transmissions
- Prevention of reflection of transmission signals and noise radiation by controlling TDR characteristic impedance as 100 Ω
- Satisfaction of eye pattern standards of HDMI waveforms with capability to improve waveform fluctuations of skew and overshoot
- Simple multilayer structure, excellent mass productivity and high reliability
- Small and thin (L 1.25 mm×W 1.00 mm×H 0.50 mm)
- RoHS compliant

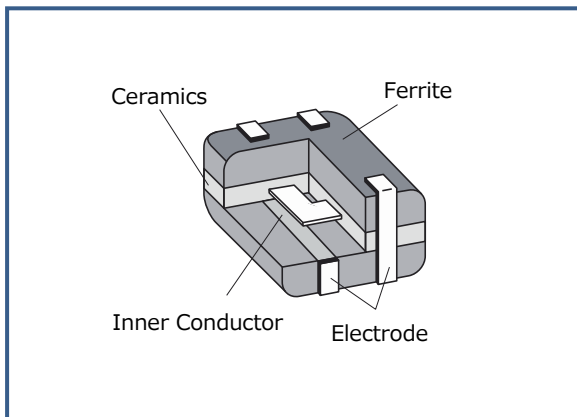
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as HDMI, SATA and LAN

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	2	4	C	G	9	0	0	U	
Product Code		Size		Number of Terminals	Type	Characteristics	Nominal Impedance			Form	Suffix
Noise Filter		Code	Dimensions(mm)	4 Terminals	C Coupled type	G High speed Differential transmission (for Gbps)	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.			Code	Packing
		2	1.25×1.00×0.50 (L)×(W)×(H)							U	Embossed Carrier Taping 4 mm pitch, 5,000 pcs

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC24CG (0504)	1.25 ±0.15	1.00 ±0.15	0.50 ±0.10	0.20 ±0.15	0.55 ±0.10	0.30 ±0.10	3

Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC24CG240U	24 Ω ±25 %	15 Ω max.	5	160	1.5
EXC24CG360U	36 Ω ±25 %	15 Ω max.	5	130	1.7
EXC24CG900U	90 Ω ±25 %	20 Ω max.	5	100	3.0

● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

● EXC24CG240U

● EXC24CG360U

● EXC24CG900U

● Measurement Circuit

(A) Common Mode

(B) Differential Mode

■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC24CE/EXC24CF**



Features

- Elimination of radiation noises from high-speed differential transmissions
- Strong multilayer structure, excellent reflow resistance and high mounting reliability
- Magnetic shield type with no leakage
- High-Q impedance : EXC24CF
- Small and thin (L 1.25 mm×W 1.00 mm×H 0.50 mm)
- RoHS compliant

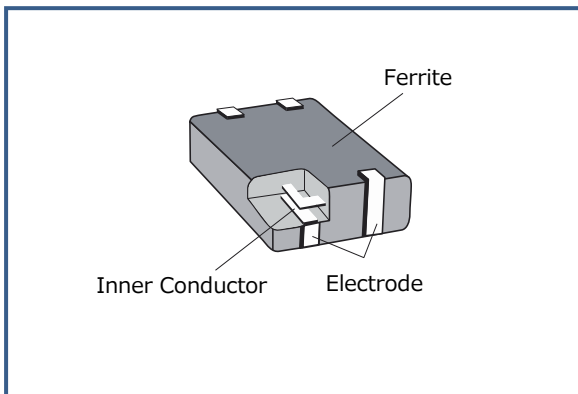
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as USB 2.0 and LVDS

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	2	4	C	E	9	0	0	U	
Product Code		Size		Number of Terminals	Type	Characteristics	Nominal Impedance		Form		Suffix
Noise Filter	Code	Dimensions(mm)		4 Terminals	C Coupled type	E High speed Differential transmission (for Mbps) F High speed Differential transmission (for Mbps) High-Q type	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.		Code	Packing	
	2	1.25×1.00×0.50 (L)×(W)×(H)							U	Embossed Carrier Taping 4 mm pitch, 5,000 pcs	

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC24CE	1.25	1.00	0.50	0.20	0.55	0.30	3
EXC24CF (0504)	±0.15	±0.15	±0.10	±0.15	±0.10	±0.10	

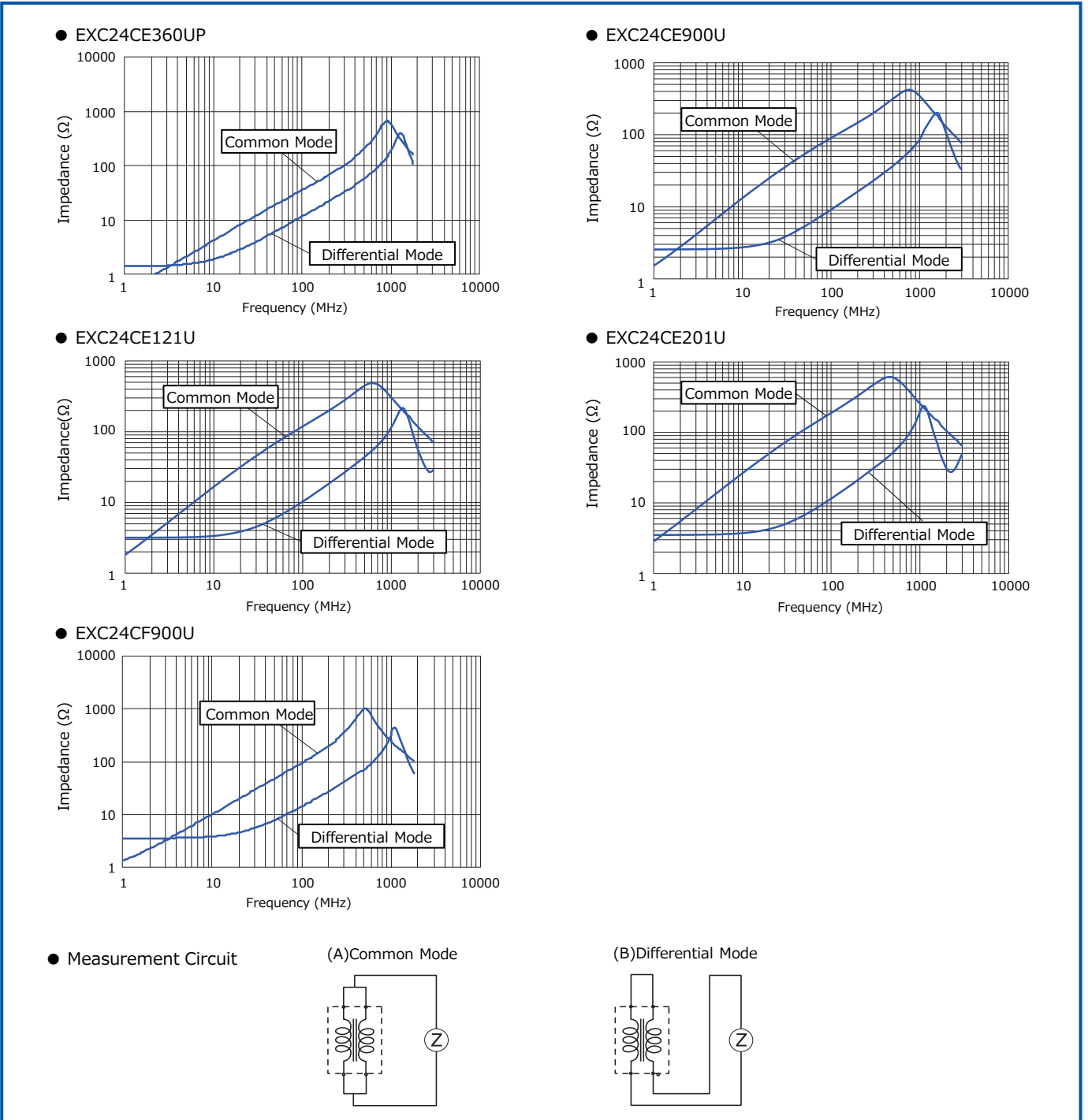
Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC24CE360UP	36 Ω ±25 %	20 Ω max.	5	200	1.0
EXC24CE900U	90 Ω ±25 %	15 Ω max.	5	160	1.75
EXC24CE121U	120 Ω ±25 %	18 Ω max.	5	140	2.2
EXC24CE201U	200 Ω ±25 %	20 Ω max.	5	130	2.7
EXC24CF900U	90 Ω ±25 %	20 Ω max.	5	130	2.5

● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters

Type: **EXC34CG/CE**



Features

- Thin type, built-in filter circuit (L 2.0 mm×W 1.25 mm×H 0.50 mm)
- Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

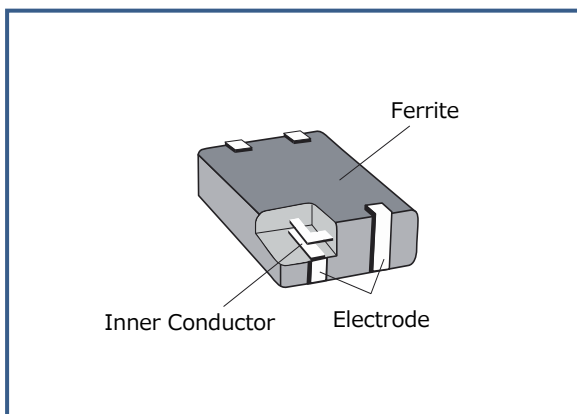
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers)
- Noise suppression of high-speed differential data lines such as USB2.0, LVDS, HDMI and LAN

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	3	4	C	G	9	0	0	U	
Product Code		Size	Number of Terminals	Type	Characteristics	Nominal Impedance			Form	Suffix	
Noise Filter	Code	Dimensions(mm)	4 Terminals	C Coupled type	E High speed Differential transmission (for Mbps) G High speed Differential transmission (for Gbps)	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.			Code	Packing	
	3	2.00×1.25×0.50 (L)×(W)×(H)							U	Embossed Carrier Taping 4 mm pitch, 5,000 pcs	

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC34C (0805)	2.00 ±0.15	1.25 ±0.15	0.50 ±0.10	0.30 ±0.20	0.80 ±0.10	0.30 ±0.15	5

Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

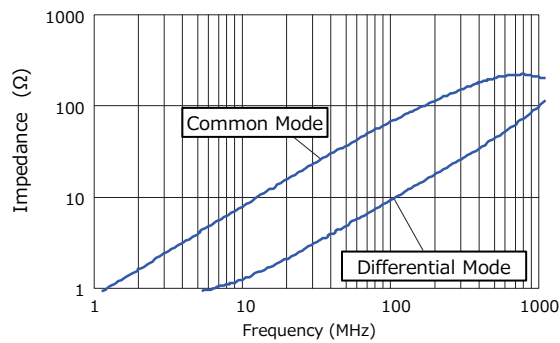
Ratings

Part Number	Impedance (Ω) at 100 MHz	Rated Current (mA) DC	Rated Voltage (V) DC	Insulation Resistance (M Ω)min.	Withstand Voltage (V) DC	DC Resistance (Ω)max.
	Common Mode					
EXC34CE670U	67 Ω ±25 %	250	5	10 M Ω	125	0.8
EXC34CE900U	90 Ω ±25 %	250	5	10 M Ω	125	0.8
EXC34CE121U	120 Ω ±25 %	200	5	10 M Ω	125	1.0
EXC34CE201U	200 Ω ±25 %	200	5	10 M Ω	125	1.0
EXC34CG900U	90 Ω ±25 %	100	5	10 M Ω	125	3.0

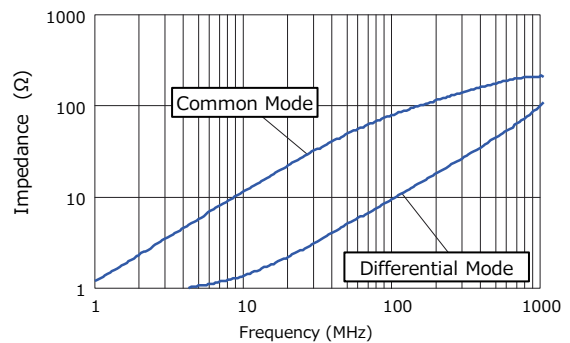
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

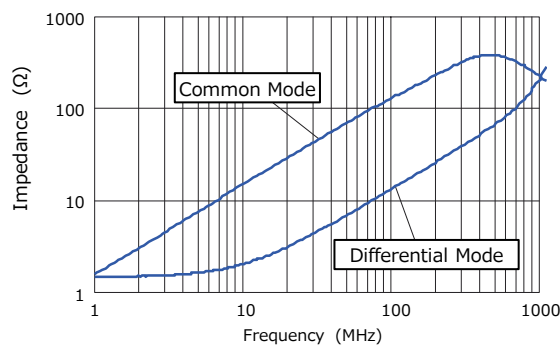
● EXC34CE670U



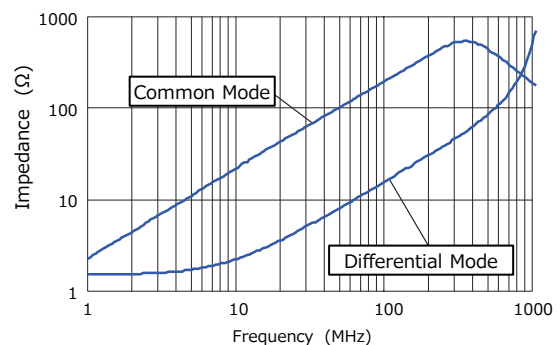
● EXC34CE900U



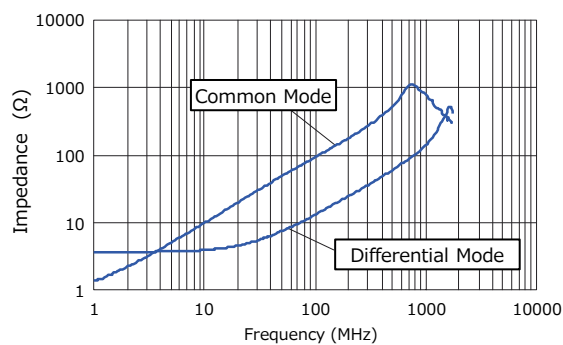
● EXC34CE121U



● EXC34CE201U

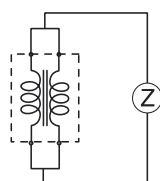


● EXC34CG900U

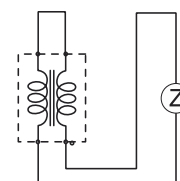


● Measurement Circuit

(A) Common Mode



(B) Differential Mode



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters Array

Type: **EXC18CG/EXC18CE**



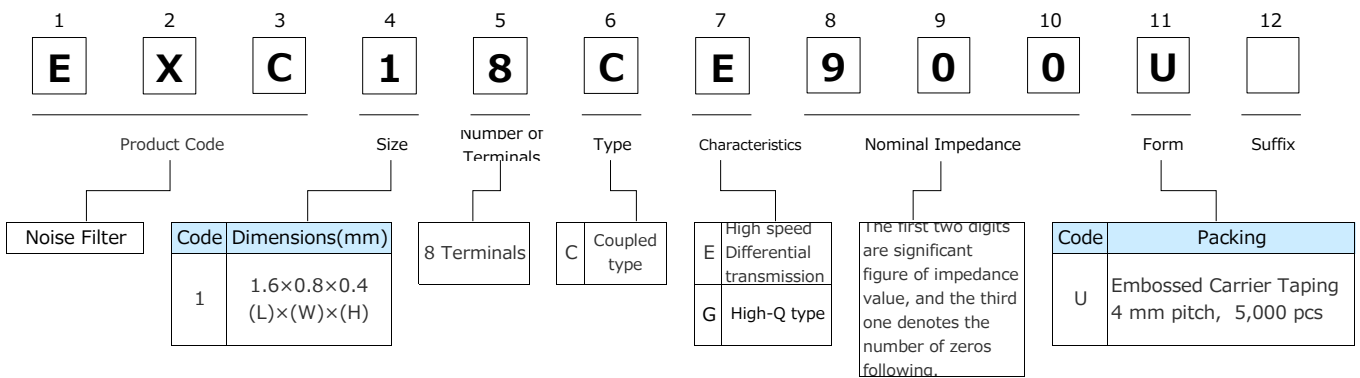
Features

- Small and thin type, two built-in filter circuit (L 1.6 mm ×W 0.8 mm×H 0.4 mm)
- Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- Low DC resistance and low insertion loss
- High-Q value and high impedance of GHz zone : EXC18CG type
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

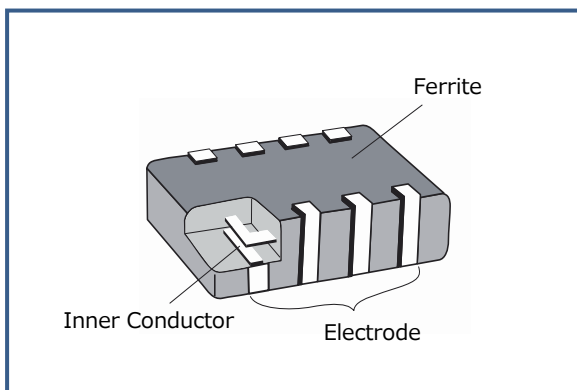
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers)
- Noise suppression of high-speed differential data lines such as USB2.0, LVDS, HDMI and LAN

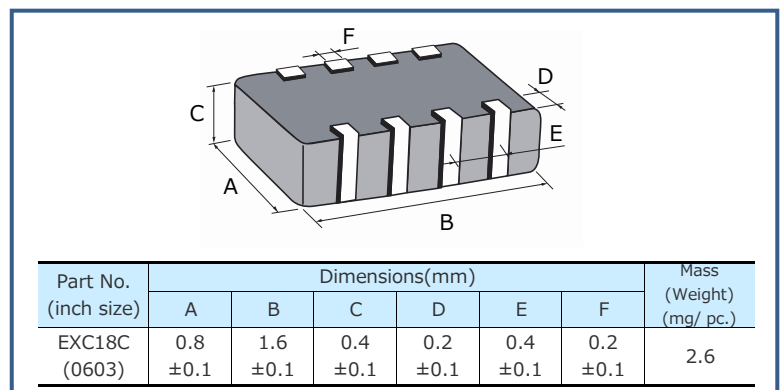
Explanation of Part Numbers



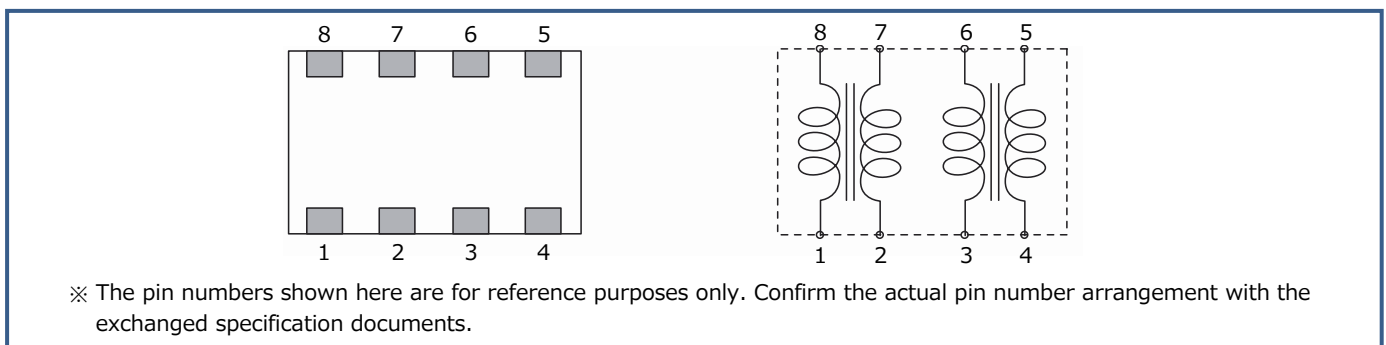
Construction



Dimensions in mm (not to scale)



Circuit Configuration (No Polarity)



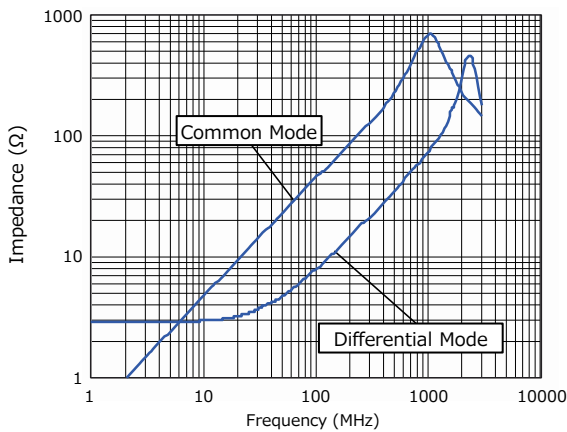
Ratings

Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC18CG430U	43 Ω ±25 %	15 Ω max.	5	100	2.7
EXC18CE650U	65 Ω ±20 %	18 Ω max.	5	140	1.8
EXC18CE900U	90 Ω ±20 %	20 Ω max.	5	130	2.0
EXC18CE201U	200 Ω ±20 %	22 Ω max.	5	100	3.5

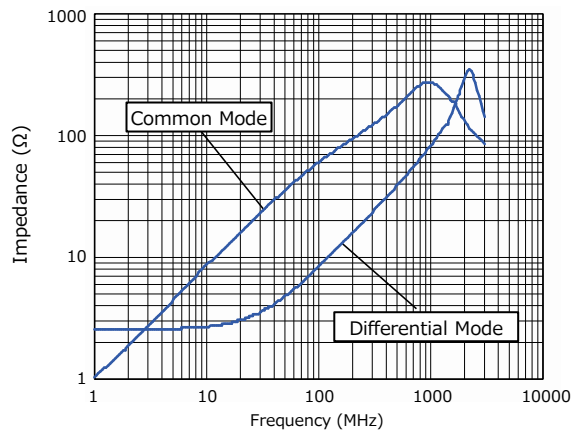
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

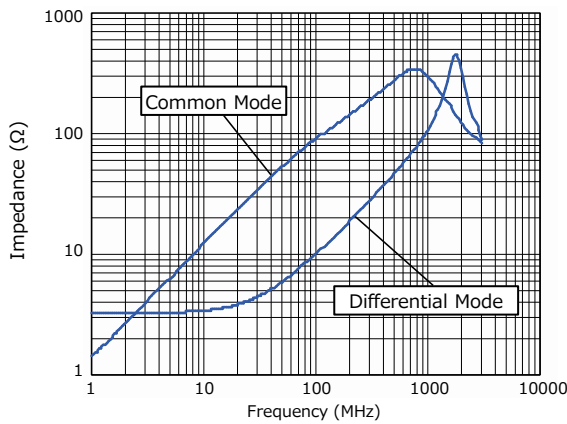
● EXC18CG430U



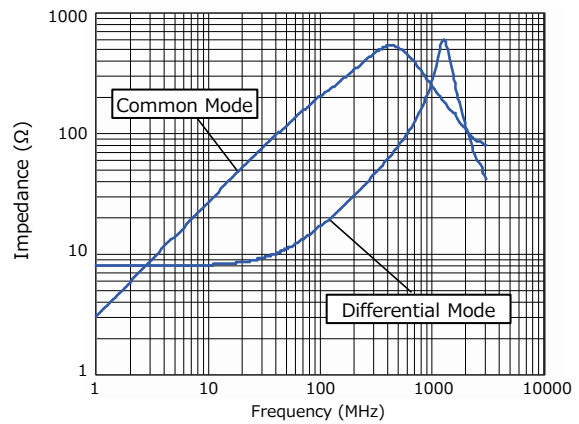
● EXC18CE650U



● EXC18CE900U

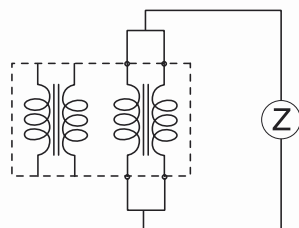


● EXC18CE201U

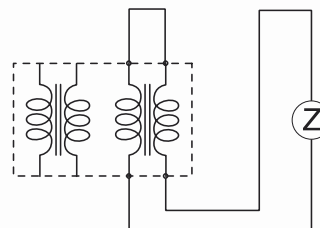


● Measurement Circuit

(A) Common Mode



(B) Differential Mode



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters Array

Type: **EXC28CH**



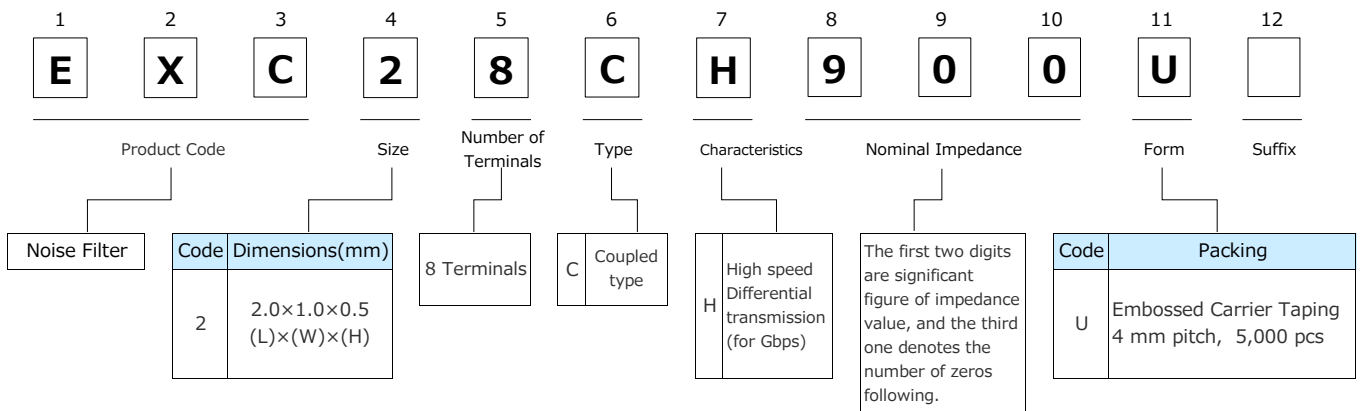
Features

- Small and thin type, two built-in filter circuit (L 2.0 mm×W 1.0 mm×H 0.5 mm)
- Suppression of high frequency noise with little influence of waveform rounding on signal transmission, achieved by setting high cut-off frequency between 6 and 10 GHz
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

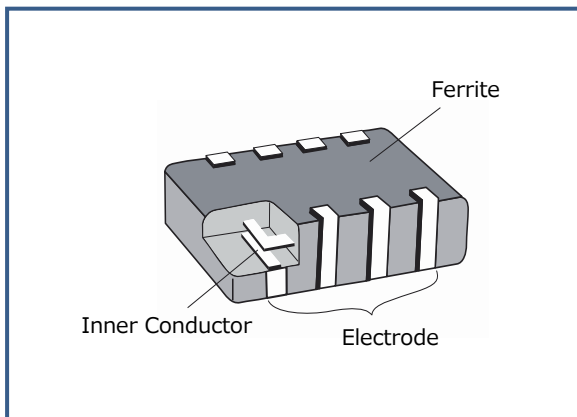
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers)
- Noise suppression of high-speed differential data lines such as USB3.0, LVDS, HDMI and LAN

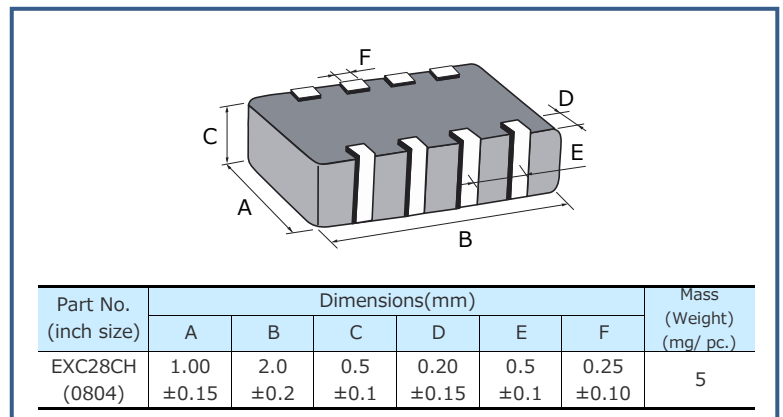
Explanation of Part Numbers



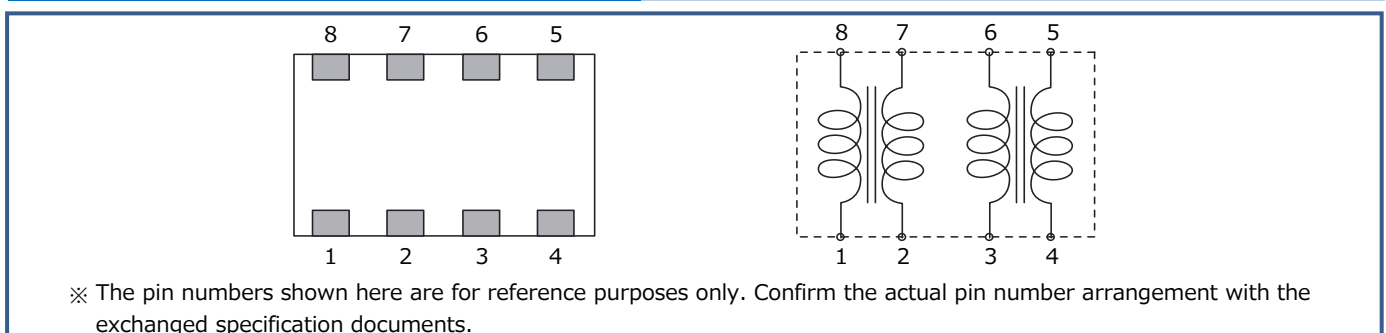
Construction



Dimensions in mm (not to scale)



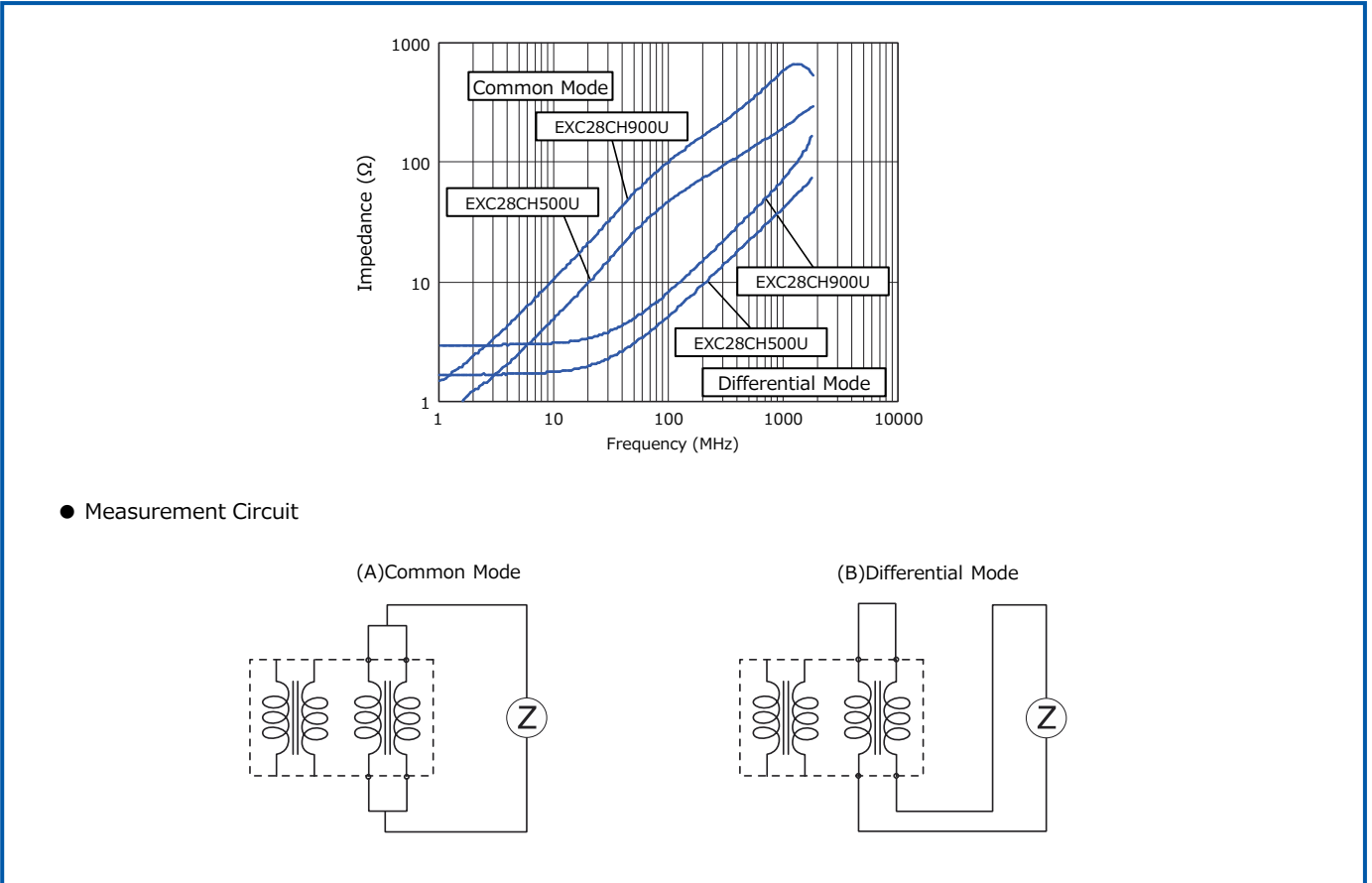
Circuit Configuration (No Polarity)



Ratings						
Part Number	Impedance (Ω) at 100 MHz		Cutoff Frequency (GHz)	Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode				
EXC28CH500U	50 Ω ±25 %	13 Ω max.	10 Typ.	5	160	1.5
EXC28CH900U	90 Ω ±20 %	15 Ω max.	6 Typ.	5	130	2.5

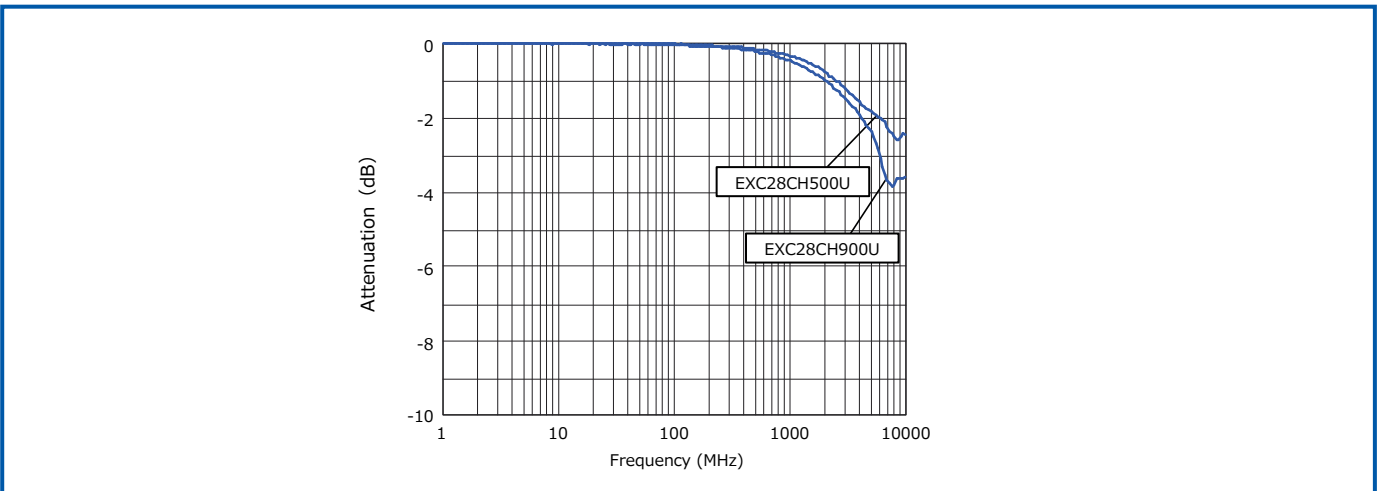
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)



● Measurement Circuit

Insertion Loss (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters Array

Type: **EXC28CG**



Features

- Small and thin type, two built-in filter circuit (L 2.0 mm×W 1.0 mm×H 0.5 mm)
- Prevention of weakening of transmission signals by controlling signal pass band as 3 GHz or above
- Prevention of reflection of transmission signals and noise radiation by controlling TDR characteristic impedance as 100 Ω
- Satisfaction of eye pattern standards of HDMI waveforms with capability to improve waveform fluctuations of Jitter and phase shift etc
- Elimination of radiation noises from high-speed differential transmissions
- Magnetic shield type with no leakage
- RoHS compliant

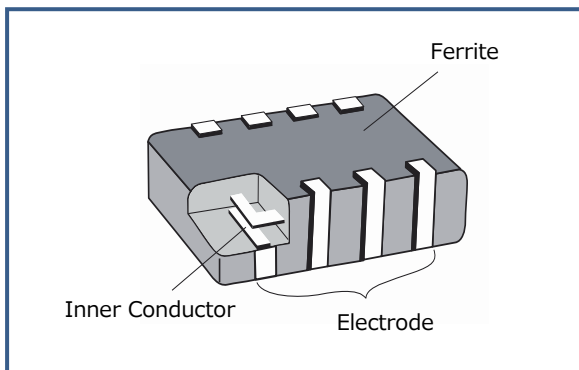
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as HDMI, SATA and LAN

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	2	8	C	G	9	0	0	U	
Product Code		Size		Number of Terminals	Type	Characteristics	Nominal Impedance		Form		Suffix
Noise Filter	Code	Dimensions(mm)		8 Terminals	C Coupled type	G High speed Differential transmission (for Gbps)	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.		Code	Packing	
	2	2.0×1.0×0.5 (L)×(W)×(H)							U	Embossed Carrier Taping 4 mm pitch, 5,000 pcs	

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC28CG (0804)	1.00±0.15	2.0±0.2	0.5±0.1	0.20±0.15	0.5±0.1	0.25±0.10	5

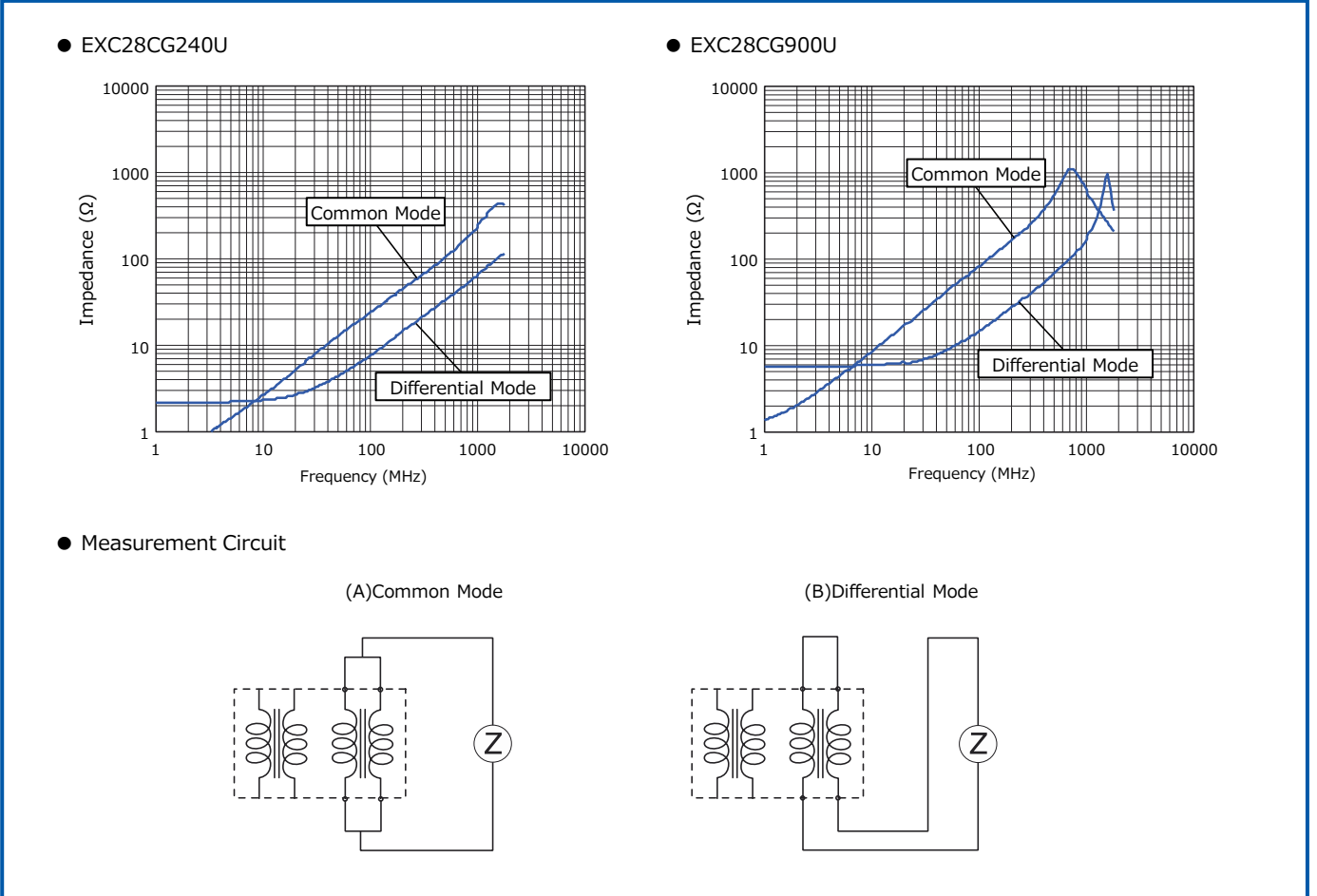
Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC28CG240U	24 Ω \pm 25 %	15 Ω max.	5	160	1.5
EXC28CG900U	90 Ω \pm 25 %	17 Ω max.	5	130	3.0

● Category Temperature Range -40°C to $+85^{\circ}\text{C}$

Impedance Characteristics (Typical)



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters Array

Type: **EXC28CE**



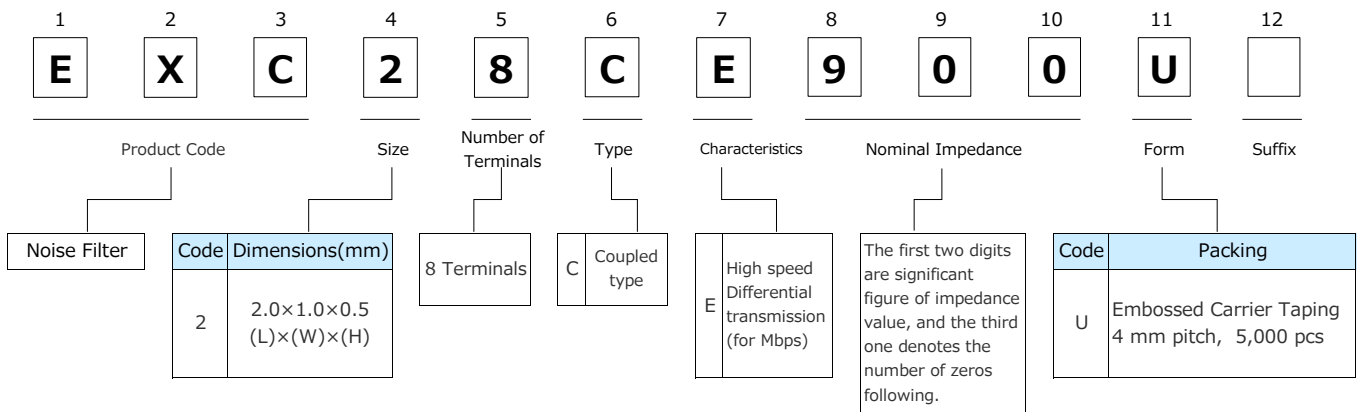
Features

- Small and thin type, two built-in filter circuit (L 2.0 mm×W 1.0 mm×H 0.5 mm)
- Elimination of radiation noises from high-speed differential transmissions
- Magnetic shield type with no leakage
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

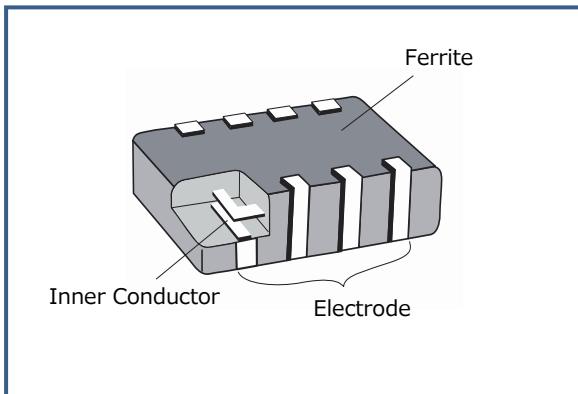
Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as USB2.0 and LVDS

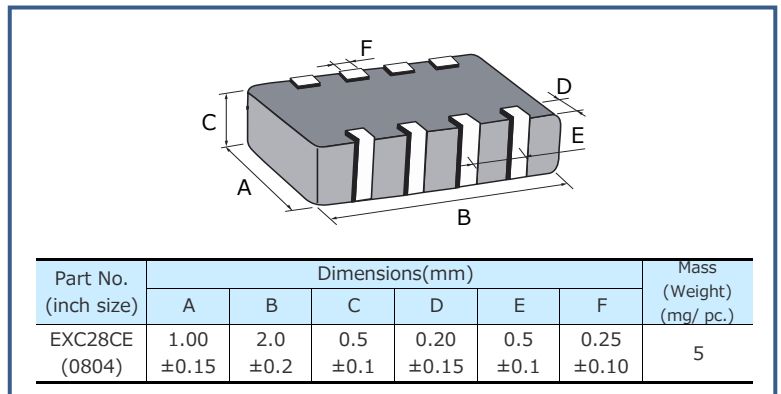
Explanation of Part Numbers



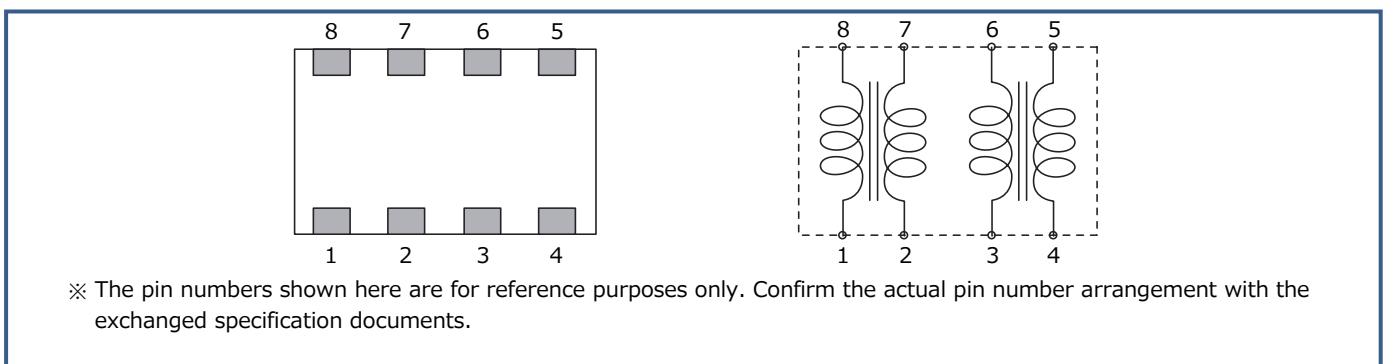
Construction



Dimensions in mm (not to scale)



Circuit Configuration (No Polarity)



Ratings					
Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC28CE900U	90 Ω ±25 %	15 Ω max.	5	160	1.5
EXC28CE121U	120 Ω ±25 %	18 Ω max.	5	140	2.0
EXC28CE201U	200 Ω ±25 %	20 Ω max.	5	130	2.5

● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

● EXC28CE900U

● EXC28CE121U

● EXC28CE201U

● Measurement Circuit

(A) Common Mode

(B) Differential Mode

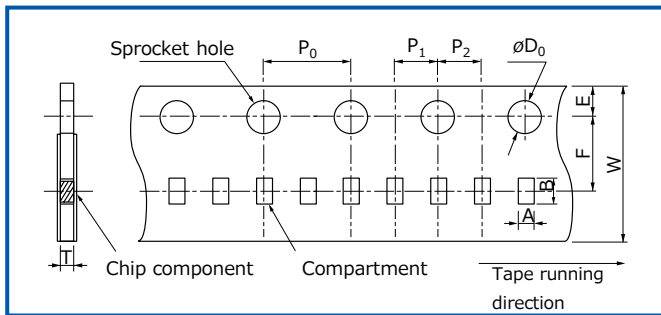
■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Packaging Methods (Taping)

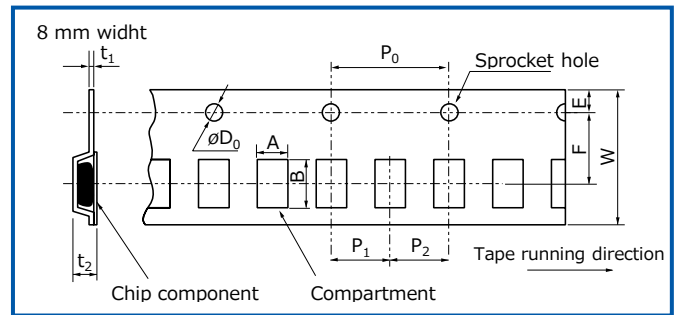
● Standard Quantity

Part Number	Size (inch)	Type	Kind of Taping	Pitch (P ₁)	Quantity
EXCX4C	0202	Single	Pressed Carrier Taping	2 mm	10,000 pcs / reel
EXC14C	0302			2 mm	10,000 pcs / reel
EXC16C	0403		Embossed Carrier Taping	4 mm	5,000 pcs / reel
EXC24C	0504				
EXC34C	0805	Array	Embossed Carrier Taping	4 mm	5,000 pcs / reel
EXC18C	0603				
EXC28C	0804				

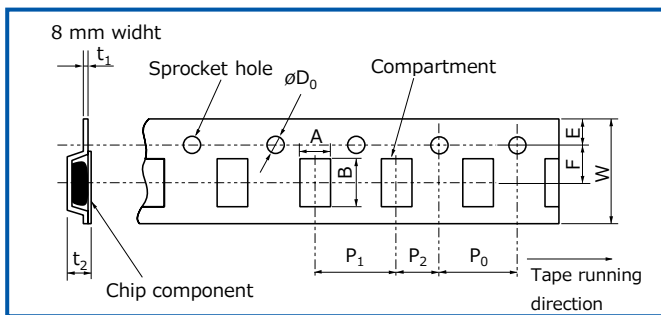
● Pressed Carrier Taping
EXCX4C



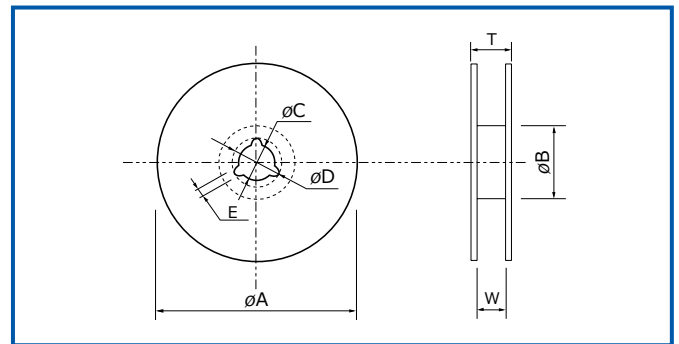
● Embossed Carrier Taping
EXC14C, 16C



● Embossed Carrier Taping
EXC18C, 24C, 28C, 34C



● Taping Reel



● Pressed Carrier Taping

Part Number	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	T
EXCX4C	0.60±0.10	0.80±0.10	8.0±0.2	3.50±0.05	1.75±0.10	2.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.35 typ.

● Embossed Carrier Taping

Part Number	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
EXC14C	0.75±0.10	0.95±0.10	8.0±0.2	3.50±0.05	1.75±0.10	2.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.25±0.05	0.85±0.15
EXC16C	0.77±0.10	0.99±0.10									0.80±0.15
EXC18C	1.00±0.10	1.80±0.10	8.0±0.2	3.5±0.1	1.75±0.10	4.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.25±0.05	0.80±0.05
EXC24C	1.20±0.15	1.45±0.15									
EXC28C	1.20±0.15	2.25±0.15									
EXC34C	1.50±0.20	2.30±0.20									0.90±0.15

● Taping Reel

Standard Reel Dimensions

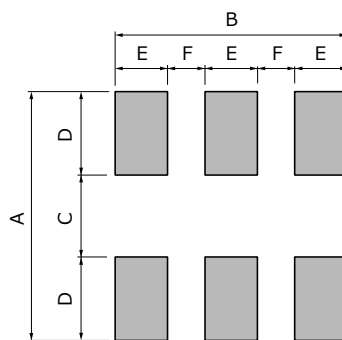
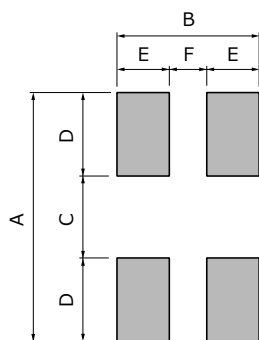
Part Number	øA	øB	øC	øD	E	W	T
EXCX4C	180.0±3.0	60.0±1.0	13.0±0.2	21.0±0.8	2.0±0.5	9.0±0.3	11.4±1.0
EXC14C			13.0±0.5				11.4±1.5
EXC16C							
EXC18C							
EXC24C							
EXC28C							
EXC34C							

Recommended Land Pattern Design

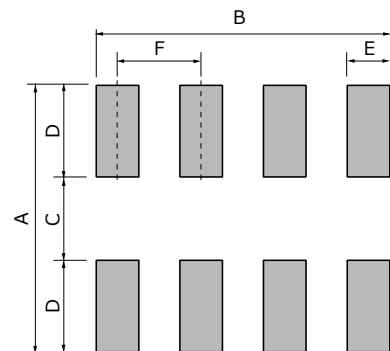
● Single

EXCX4C, 14C, 24C, 34C

EXC16C



● Array



Part Number	Dimensions (mm)					
	A	B	C	D	E	F
EXCX4C	0.80 to 0.90	0.60 to 0.75	0.20 to 0.30	0.30	0.20 to 0.25	0.20 to 0.25
EXC14C	0.80 to 1.00	0.80	0.30	0.25 to 0.35	0.30	0.20
EXC24C	1.60 to 2.00	0.95	0.70	0.45 to 0.65	0.35	0.25
EXC34C	2.60	1.20	1.10	0.75	0.40	0.40
EXC16C	0.99	0.85	0.33	0.33	0.15	0.20

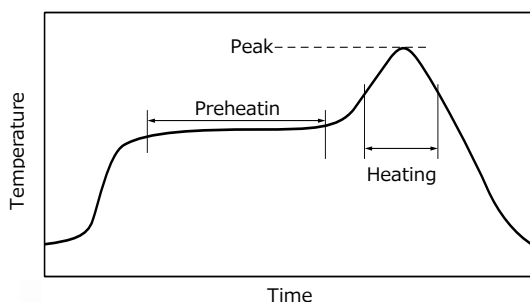
Part Number	Dimensions (mm)					
	A	B	C	D	E	F
EXC18C	1.4	1.4	0.4	0.5	0.2	0.4
EXC28C	1.4	1.75	0.4	0.5	0.25	0.5

Recommended Soldering Conditions

Recommendations and precautions are described below

● **Recommended soldering conditions for reflow**

- Reflow soldering shall be performed a maximum of two times.
- Please contact us for additional information when used in conditions other than those specified.
- Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.



For soldering (Example : Sn-37Pb)

	Temperature	Time
Preheating	140 °C to 160 °C	60 s to 120 s
Main heating	Above 200 °C	30 s to 40 s
Peak	235 ± 10 °C	max. 10 s

For lead-free soldering (Example :Sn-3Ag-0.5Cu)

	Temperature	Time
Preheating	150 °C to 170 °C	60 s to 120 s
Main heating	Above 230 °C	30 s to 40 s
Peak	max. 260 °C	max. 10 s

● **Flow soldering**

- We do not recommend flow soldering, because flow soldering may cause bridges between the electrodes.

《Repair with hand soldering》

- Preheat with a blast of hot air or similar method. Use a soldering iron with a tip temperature of 350 °C or less. Solder each electrode for 3 seconds or less.
- Never touch this product with the tip of a soldering iron.

Common mode Noise Filters with ESD Suppressor

Type: **EXC14CS**



This series is not a recommended product.
Not recommended for new design.

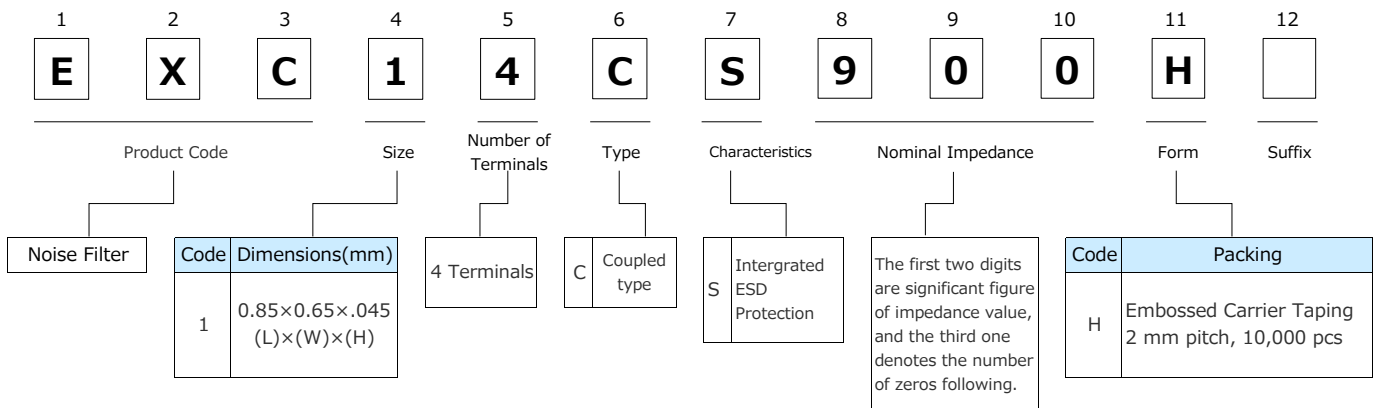
Features

- Provides EMI Filtering and ESD Protection (L 0.85 mm×W 0.65 mm×H 0.45mm)
- ESD and noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- High Common mode attenuation in the range between 700 MHz and 1000 MHz (RF band)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

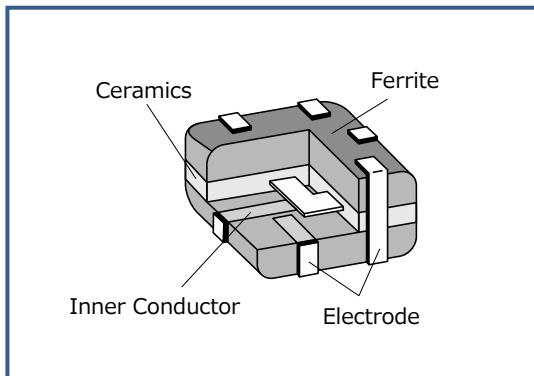
Recommended Applications

- Smartphones, Tablet PCs and DSC
- ESD and noise suppression of high-speed differential data lines such as MIPI and USB

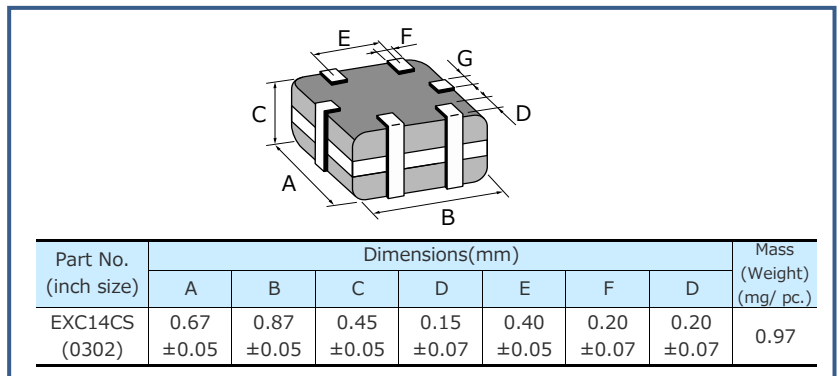
Explanation of Part Numbers



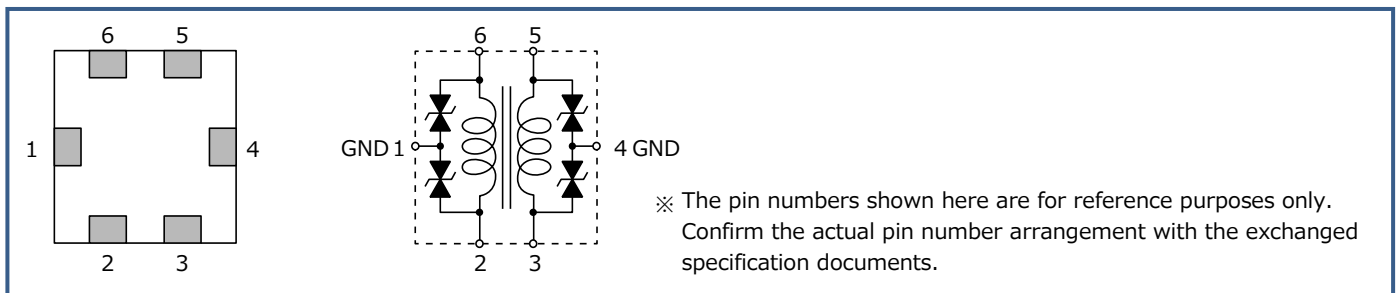
Construction



Dimensions in mm (not to scale)



Circuit Configuration (No Polarity)



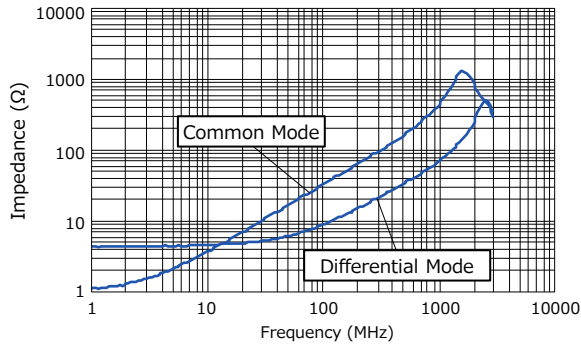
Ratings

Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC14CS350H	35 Ω ±30 %	15 Ω max.	5	100	2.0±30 %
EXC14CS900H	90 Ω ±20 %	20 Ω max.	5	100	3.3±30 %

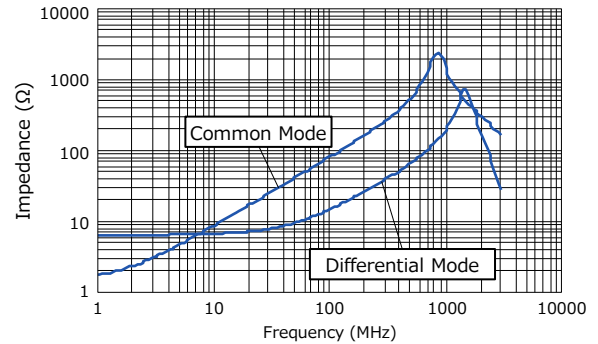
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

● EXC14CS350H

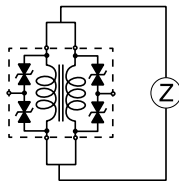


● EXC14CS900H

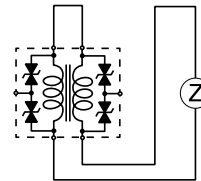


● Measurement Circuit

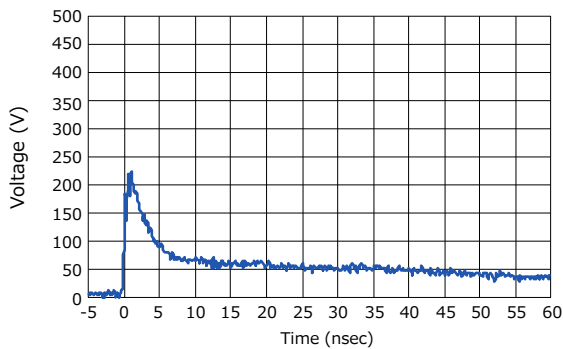
(A) Common Mode



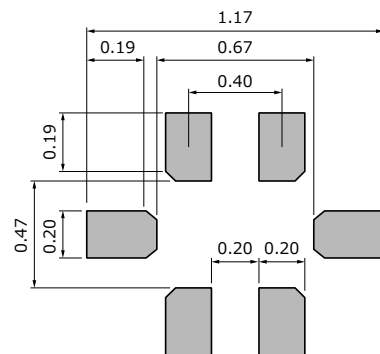
(B) Differential Mode



ESD Suppression Characteristics (Typ. : IEC6100-4-2, 8 kV contact discharge)



Recommended Land Pattern Design in mm (not to scale)



■ As for Packaging Methods, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters with ESD Suppressor

Type: **EXC24CS**



This series is not a recommended product.
Not recommended for new design.

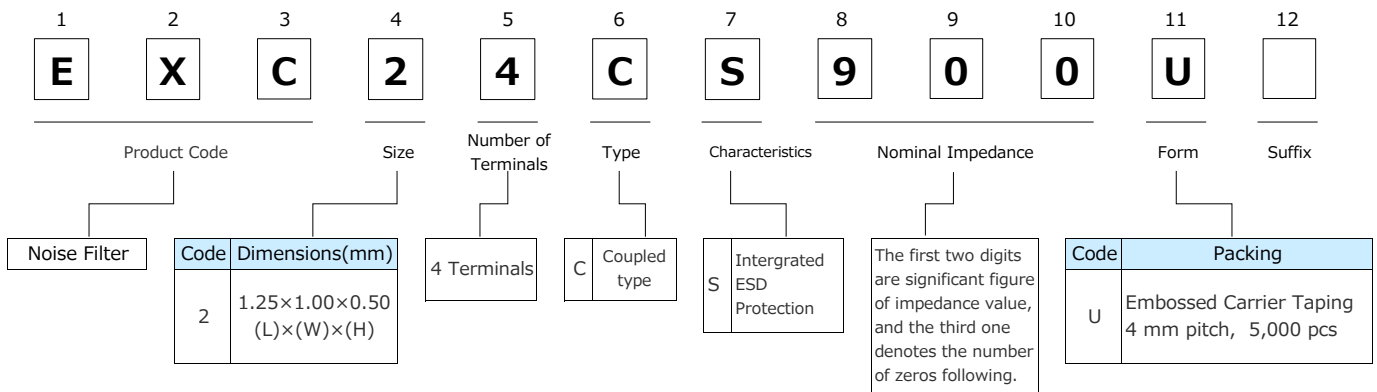
Features

- Provides EMI Filtering and ESD Protection (L 1.25 mm×W 1.00 mm×H 0.50 mm)
- ESD and noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- High Common mode attenuation in the range between 700 MHz and 1000 MHz (RF band)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

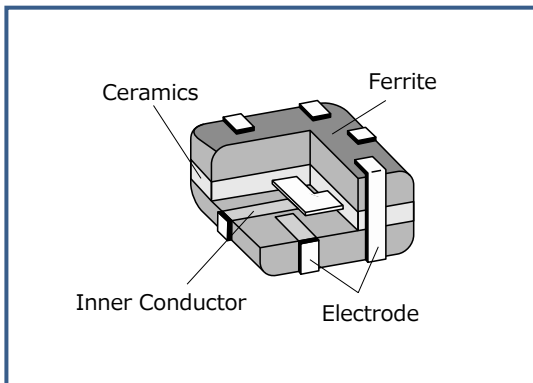
Recommended Applications

- Smartphones, Tablet PCs and DSC
- ESD and noise suppression of high-speed differential data lines such as MIPI and USB

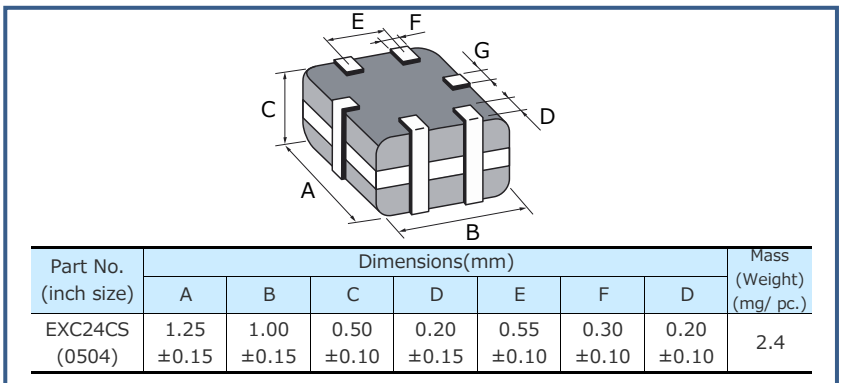
Explanation of Part Numbers



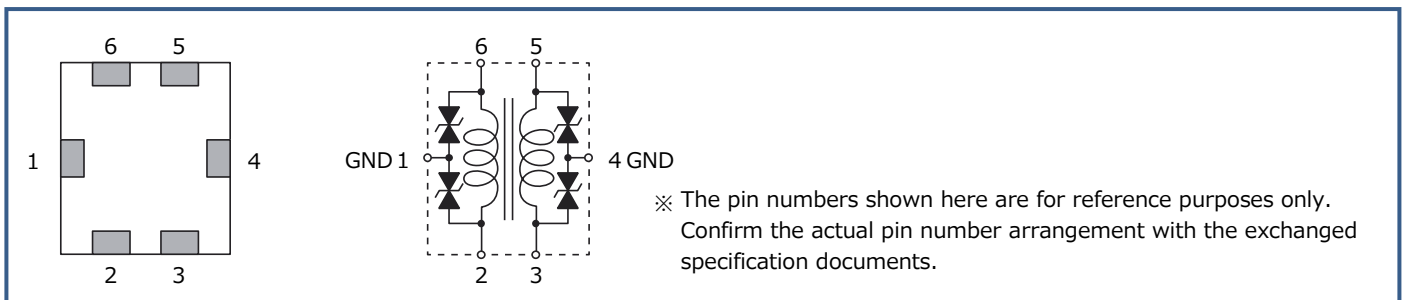
Construction



Dimensions in mm (not to scale)



Circuit Configuration (No Polarity)



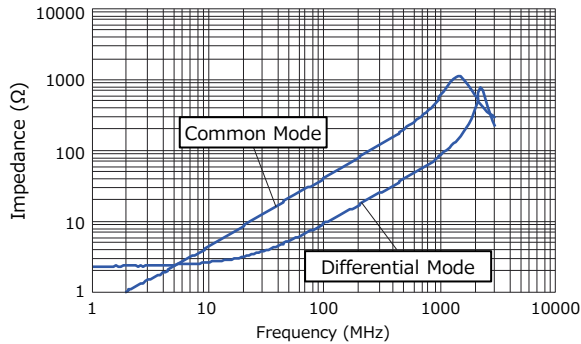
Ratings

Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Common Mode	Differential Mode			
EXC24CS350U	35 Ω ±30 %	15 Ω max.	5	100	2.0
EXC24CS900U	90 Ω ±20 %	20 Ω max.	5	100	3.0

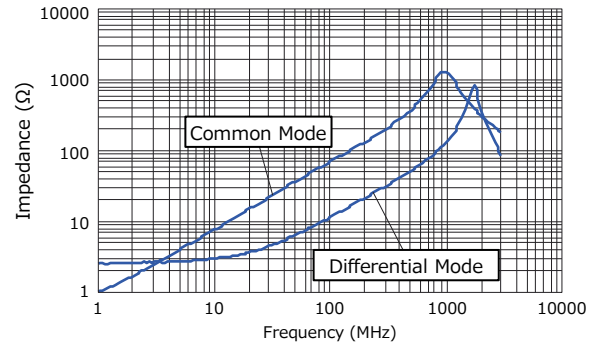
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

● EXC24CS350U

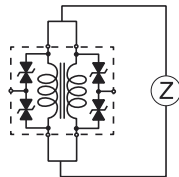


● EXC24CS900U

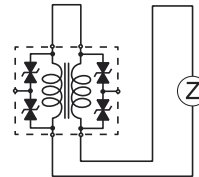


● Measurement Circuit

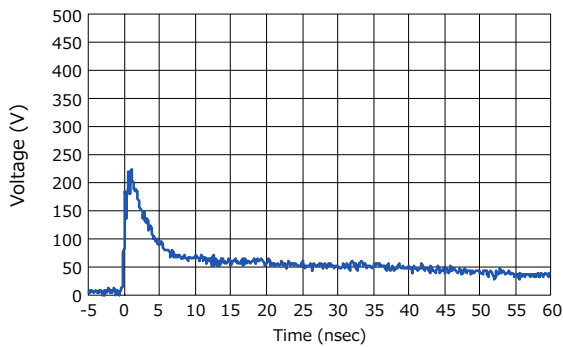
(A) Common Mode



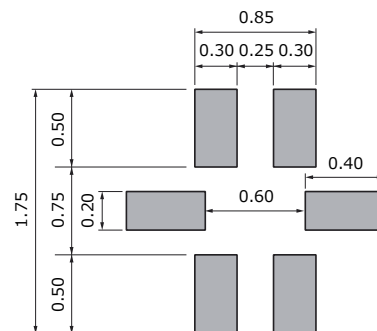
(B) Differential Mode



ESD Suppression Characteristics (Typ. : IEC6100-4-2, 8 kV contact discharge)



Recommended Land Pattern Design in mm (not to scale)



■ As for Packaging Methods, Soldering Conditions and Safety Precautions, Please see Data Files

Common mode Noise Filters Array with ESD Suppressor

Type: EXC18CS



This series is not a recommended product.
Not recommended for new design.

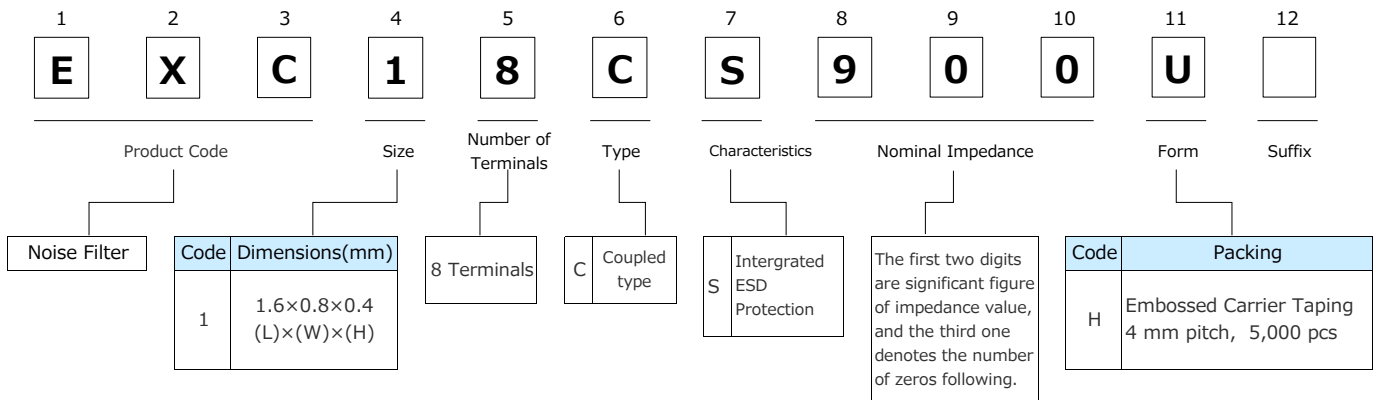
Features

- Provides EMI Filtering and ESD Protection (L 1.6 mm ×W 0.8 mm×H 0.4 mm)
- ESD and noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- High Common mode attenuation in the range between 700 MHz and 1000 MHz (RF band)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

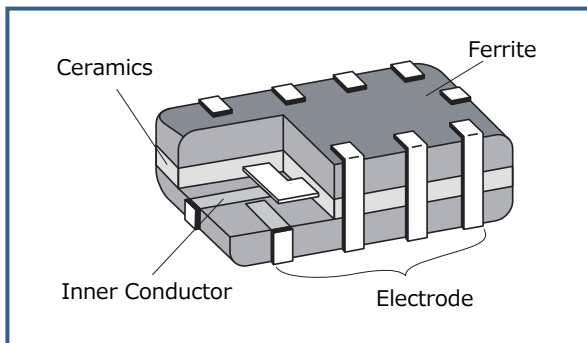
Recommended Applications

- Smartphones, Tablet PCs and DSC
- ESD and noise suppression of high-speed differential data lines such as MIPI and USB

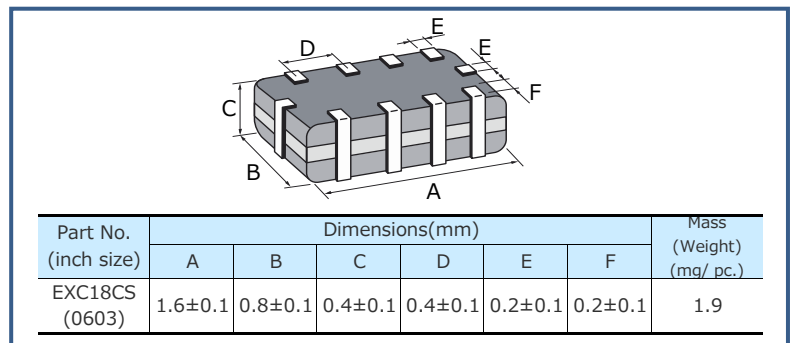
Explanation of Part Numbers



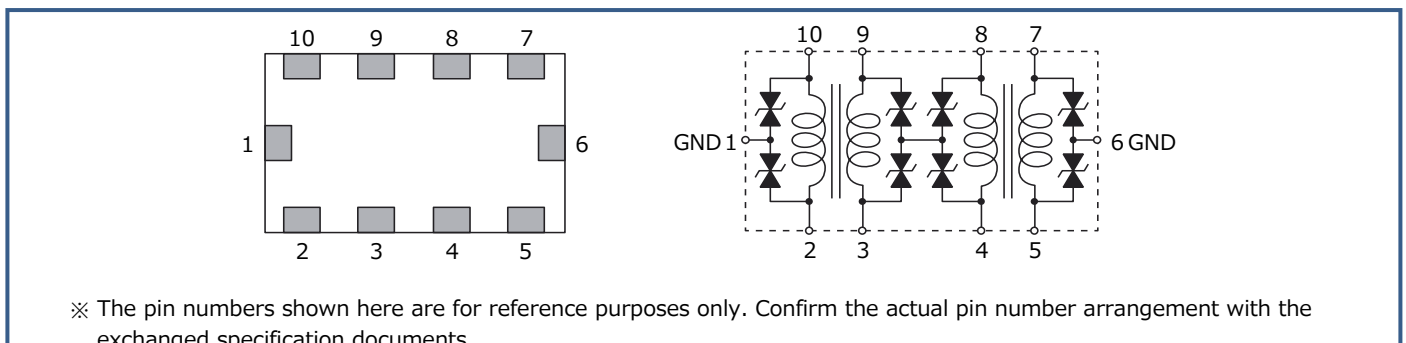
Construction



Dimensions in mm (not to scale)



Circuit Configuration (No Polarity)



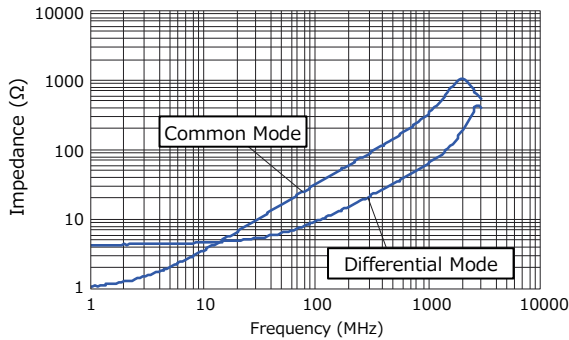
Ratings

Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)
	Common Mode	Differential Mode			
EXC18CS350U	35 Ω ±30 %	15 Ω max.	5	100	1.8±30 %
EXC18CS900U	90 Ω ±20 %	20 Ω max.	5	100	3.0±30 %

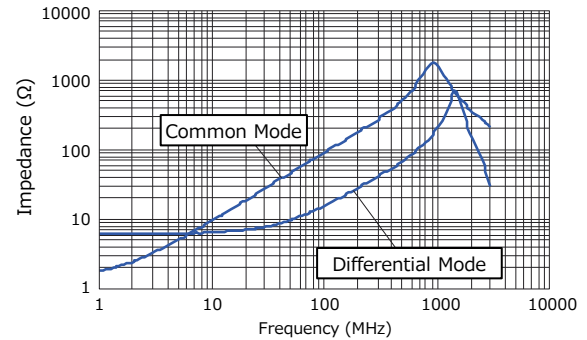
● Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

● EXC18CS350U

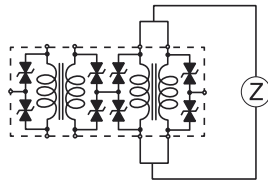


● EXC18CS900U

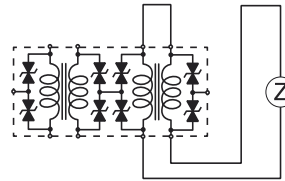


● Measurement Circuit

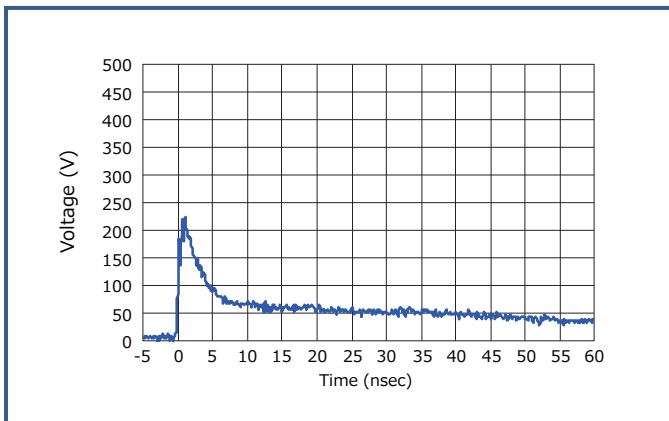
(A) Common Mode



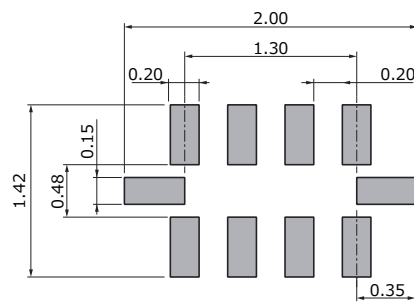
(B) Differential Mode



ESD Suppression Characteristics (Typ. : IEC6100-4-2, 8 kV contact discharge)



Recommended Land Pattern Design in mm (not to scale)



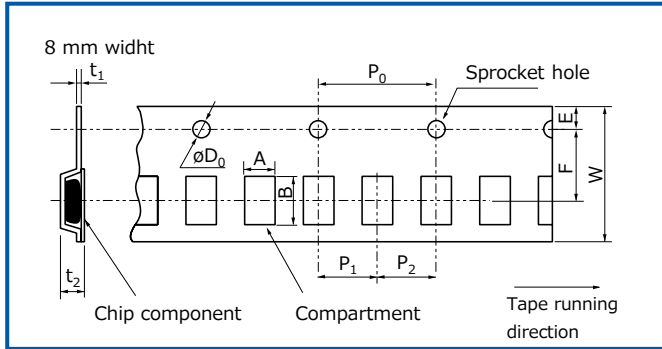
■ As for Packaging Methods, Soldering Conditions and Safety Precautions, Please see Data Files

Packaging Methods (Taping)

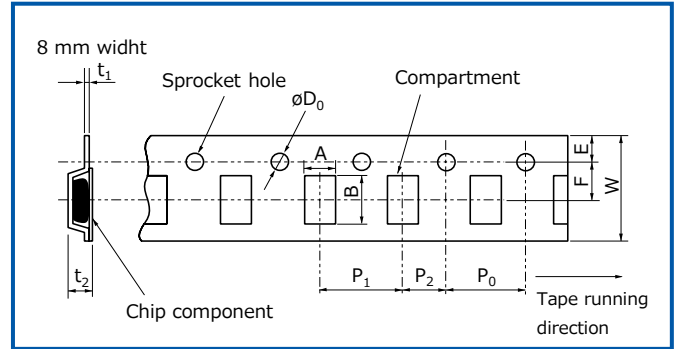
● Standard Quantity

Part Number	Size (inch)	Type	Kind of Taping	Pitch (P ₁)	Quantity
EXC14CS	0302	Single	Embossed Carrier Taping	2 mm	10,000 pcs / reel
EXC24CS	0504			4 mm	5,000 pcs / reel
EXC18CS	0603	Array			

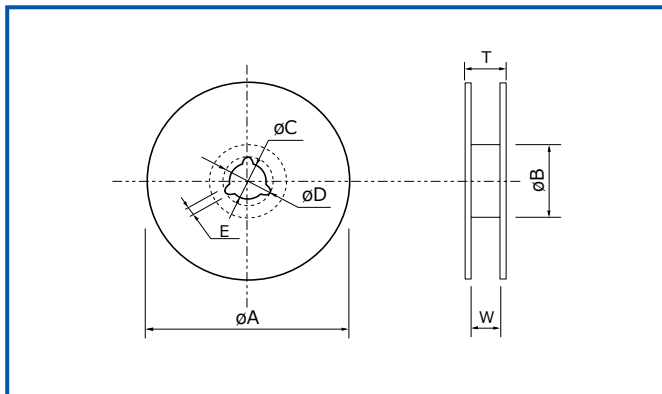
● Embossed Carrier Taping
EXC14CS



● Embossed Carrier Taping
EXC18CS, EXC24CS



● Taping Reel



● Embossed Carrier Taping

(mm)

Part Number	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
EXC14CS	0.75±0.10	0.95±0.10	8.0±0.2	3.50±0.05	1.75±0.10	2.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.25±0.05	0.85±0.15
EXC18CS	1.00±0.10	1.80±0.10	8.0±0.2	3.5±0.1	1.75±0.10	4.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.25±0.05	0.50±0.05
EXC24CS	1.20±0.15	1.45±0.15									0.90±0.15

● Taping Reel

Standard Reel Dimensions

(mm)

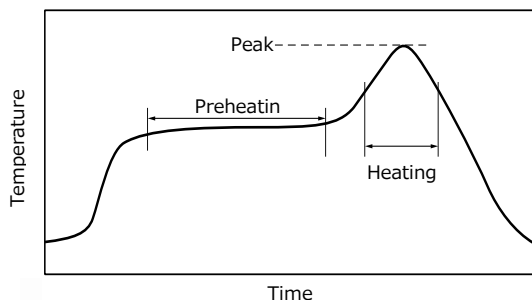
Part Number	øA	øB	øC	øD	E	W	T
EXC14CS EXC18CS EXC24CS	180.0±3.0	60.0±1.0	13.0±0.5	21.0±0.8	2.0±0.5	9.0±0.3	11.4±1.5

Recommended Soldering Conditions

Recommendations and precautions are described below

● **Recommended soldering conditions for reflow**

- Reflow soldering shall be performed a maximum of two times.
- Please contact us for additional information when used in conditions other than those specified.
- Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.



For soldering (Example : Sn-37Pb)

	Temperature	Time
Preheating	140 °C to 160 °C	60 s to 120 s
Main heating	Above 200 °C	30 s to 40 s
Peak	235 ± 10 °C	max. 10 s

For lead-free soldering (Example :Sn-3Ag-0.5Cu)

	Temperature	Time
Preheating	150 °C to 170 °C	60 s to 120 s
Main heating	Above 230 °C	30 s to 40 s
Peak	max. 260 °C	max. 10 s

● **Flow soldering**

- We do not recommend flow soldering, because flow soldering may cause bridges between the electrodes.

《Repair with hand soldering》

- Preheat with a blast of hot air or similar method. Use a soldering iron with a tip temperature of 350 °C or less. Solder each electrode for 3 seconds or less.
- Never touch this product with the tip of a soldering iron.

Replacement list for "Not recommended for new design"

* If you are using any of the following models on the deleted list, please substitute them with the suggested alternative model as soon as possible.

Non-recommended part number				Replacement part number							
Common mode Noise Filters with ESD Suppressor				Common mode Noise Filters				ESD Suppressor			Combination Pattern
Part Number	Inch size	ESD protection element	Impedance (Common Mode)	Part Number	Inch size	Impedance (Common Mode)	Number of pieces	Part Number	Inch size	Number of pieces	
EXC14CS350U	0302	2 line	35 Ω	EXC14CH350U	0302	35 Ω	1	EZAEG1N50AC	0201	2	①
				EXC14CH350U	0302	35 Ω	1	EZAEG2N50AX	0402	2	②
EXC14CS900U	0302		90 Ω	EXC14CE900U	0302	90 Ω	1	EZAEG1N50AC	0201	2	① ^{*1}
				EXC14CE900U	0302	90 Ω	1	EZAEG2N50AX	0402	2	② ^{*1}
			EXC24CH900U	0504	90 Ω	1	EZAEG1N50AC	0201	2	③	
			EXC24CH900U	0504	90 Ω	1	EZAEG2N50AX	0402	2	④	
EXC24CS350U	0504		35 Ω	EXC24CH500U	0504	50 Ω	1	EZAEG1N50AC	0201	2	①
				EXC24CH500U	0504	50 Ω	1	EZAEG2N50AX	0402	2	②
		EXC24CE360UP		0504	36 Ω	1	EZAEG1N50AC	0201	2	③ ^{*1}	
		EXC24CE360UP		0504	36 Ω	1	EZAEG2N50AX	0402	2	④ ^{*1}	
EXC24CS900U	0504	90 Ω	EXC24CH900U	0504	90 Ω	1	EZAEG1N50AC	0201	2	①	
			EXC24CH900U	0504	90 Ω	1	EZAEG2N50AX	0402	2	②	
EXC18CS350U	0603	4 line	35 Ω	EXC14CH350U	0302	35 Ω	2	EZAEG1N50AC	0201	4	① ^{*2}
				EXC14CH350U	0302	35 Ω	2	EZAEG2N50AX	0402	4	② ^{*2}
EXC18CS900U	0603		90 Ω	EXC18CE900U	0603	90 Ω	1	EZAEG1N50AC	0201	4	① ^{*1}
				EXC18CE900U	0603	90 Ω	1	EZAEG2N50AX	0402	4	② ^{*1}
				EXC24CH900U	0504	90 Ω	2	EZAEG1N50AC	0201	4	③ ^{*2}
				EXC24CH900U	0504	90 Ω	2	EZAEG2N50AX	0402	4	④ ^{*2}

*1: USB2.0, LVDS(<1Gbps) only

*2: No replacement part number for Array products

2 mode Noise Filters

Type: **EXC14CP**



Features

- Small size and low-profile : 0302 inch size (L 0.85 mm×W 0.65 mm×H 0.45 mm)
- Burst/radiation noise filtering for audio circuits
- The optimally magnetic-coupled ferrite beads allow for the filtering of both common and normal mode noises
- The strong multi-layer structure provides high resistance to reflow soldering heat and a high mounting reliability
- Lead, halogen, and antimony free
- RoHS compliant

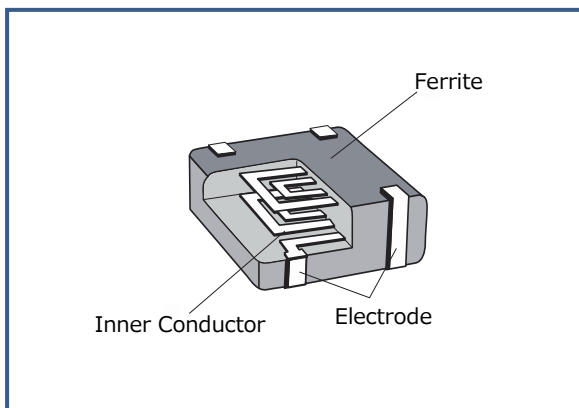
Recommended Applications

- Smart phones, Tablet PCs, DSC and Portable Music Player
- Noise suppression of burst noise of Receiver/Microphone and D-class power amplifier

Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
E	X	C	1	4	C	P	2	2	1	U	
Product Code		Size		Number of Terminals	Type	Characteristics	Nominal Impedance			Form	Suffix
Noise Filter	Code	Dimensions(mm)		4 Terminals	C Coupled type	P Low DCR Type	The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.			Code	Packing
	1	0.85×0.65×.045 (L)×(W)×(H)								U	Embossed Carrier Taping 2 mm pitch, 10,000 pcs

Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC14CP (0302)	0.65 ±0.05	0.85 ±0.05	0.45 ±0.05	0.10 min.	0.50 ±0.10	0.27 ±0.10	1.2

Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

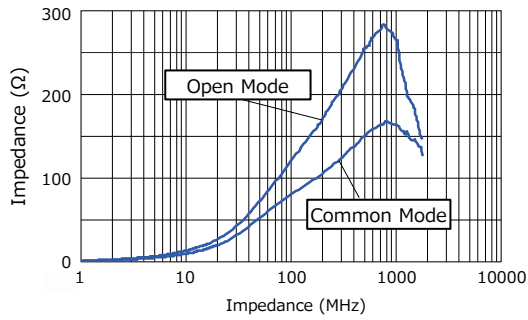
Ratings

Part Number	Impedance (Ω) at 100 MHz		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	Open mode	Common mode			
EXC14CP121U	120 $\Omega \pm 30\%$	75 $\Omega \pm 25\%$	5	300	0.5
EXC14CP221U	220 $\Omega \pm 30\%$	140 $\Omega \pm 25\%$		200	0.7

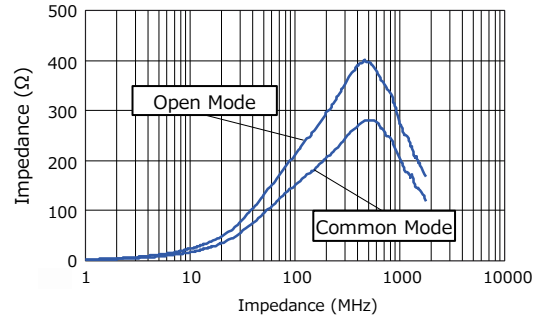
● Category Temperature Range $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

Impedance Characteristics (Typical)

● EXC14CP121U

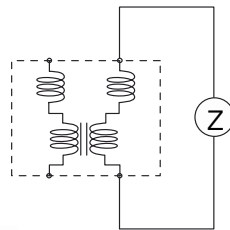


● EXC14CP221U

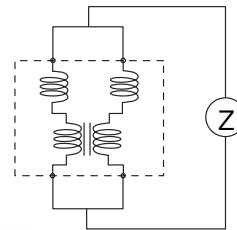


● Measurement Circuit

(A) Open Mode



(B) Common Mode



■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

2 mode Noise Filters

Type: **EXC24CB/CP**

Type: **EXC24CN**



Features

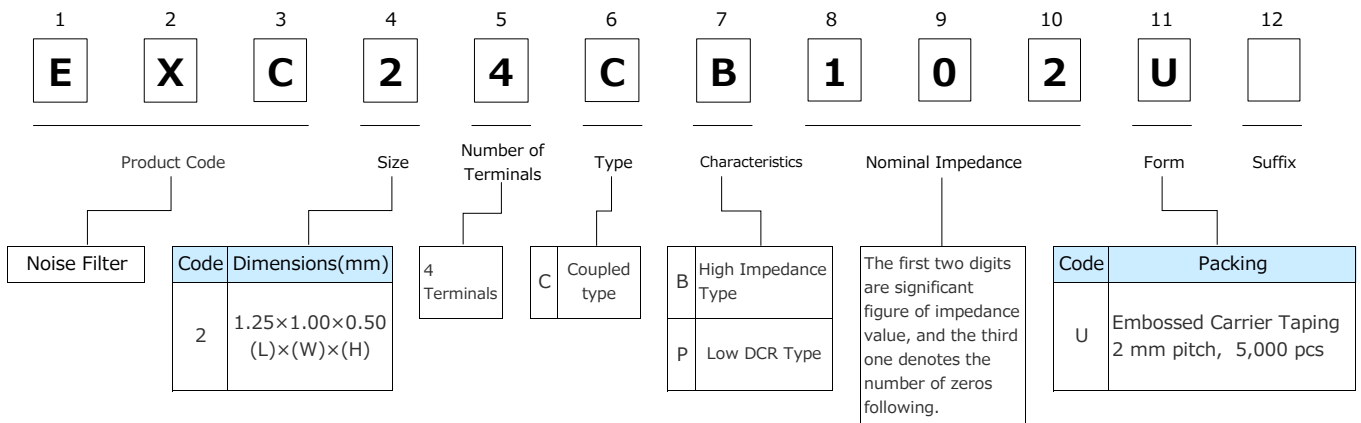
- Burst/radiation noise filtering for audio circuits
- The optimally magnetic-coupled ferrite beads allow for the filtering of both common and normal mode noises
- The strong multi-layer structure provides high resistance to reflow soldering heat and a high mounting reliability
- Magnetic shield type
- High Impedance : 220 to 1 kΩ (EXC24CB type)
- Low Resistance Value : 0.4 Ω max. (EXC24CP type)
- High Impedance : 600 Ω, Low Resistance Value : 0.9 Ω max. (EXC24CN type)
- RoHS compliant

Recommended Applications

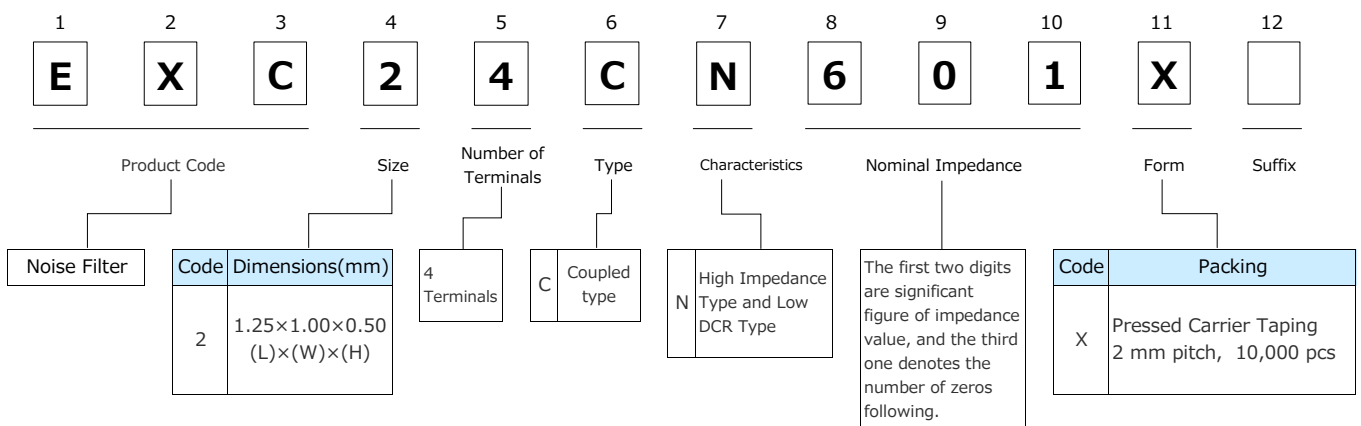
- Smart phones, Tablet PCs, DSC and Portable Music Player
- Noise suppression of burst noise of Receiver/Microphone and D-class power amplifier

Explanation of Part Numbers

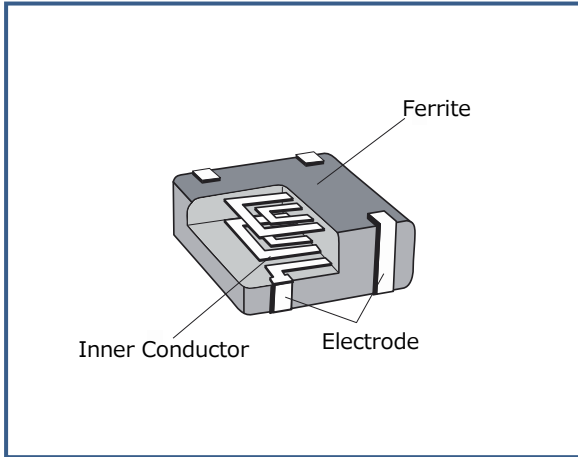
● EXC24CB/CP Type



● EXC24CN Type



Construction



Dimensions in mm (not to scale)

Part No. (inch size)	Dimensions(mm)						Mass (Weight) (mg/ pc.)
	A	B	C	D	E	F	
EXC24C (0504)	1.00 ±0.15	1.25 ±0.15	0.50 ±0.10	0.20 ±0.15	0.65 ±0.10	0.35 ±0.10	3

Circuit Configuration (No Polarity)

※ The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Ratings

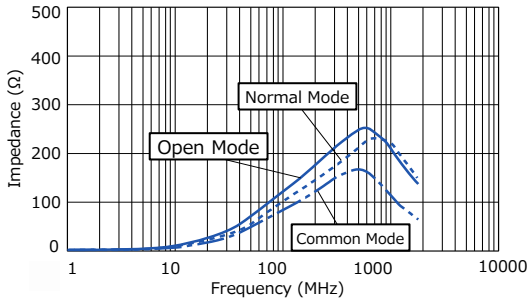
Part Number	Impedance (Open mode)		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	(Ω) at 100 MHz	Tolerance (%)			
EXC24CP121U	120	±25	5	500	0.3
EXC24CP221U	220			350	0.4
EXC24CB221U	220			100	0.7
EXC24CB102U	1000			50	1.5

Part Number	Impedance (Common mode)		Rated Voltage (V) DC	Rated Current (mA) DC	DC Resistance (Ω)max.
	(Ω) at 100 MHz	Tolerance (%)			
EXC24CN601X	600	±25	5	200	0.9

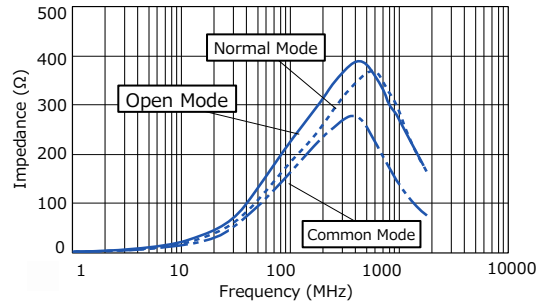
●Category Temperature Range -40 °C to +85 °C

Impedance Characteristics (Typical)

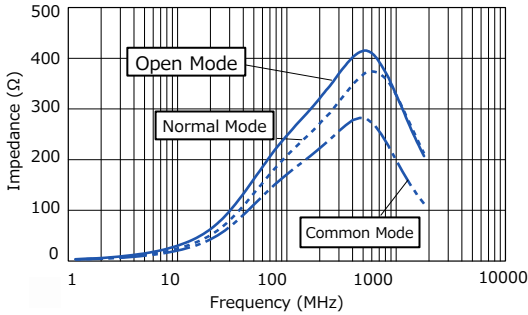
● EXC24CP121U



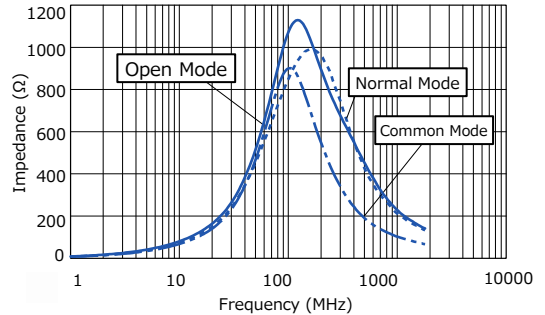
● EXC24CP221U



● EXC24CB221U

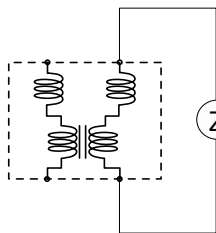


● EXC24CB102U

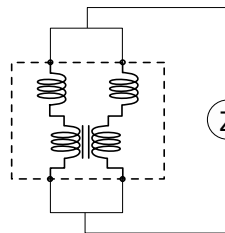


● Measurement Circuit

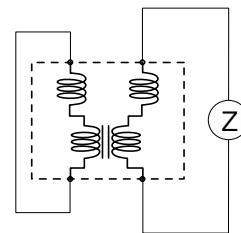
(A) Open Mode



(B) Common Mode

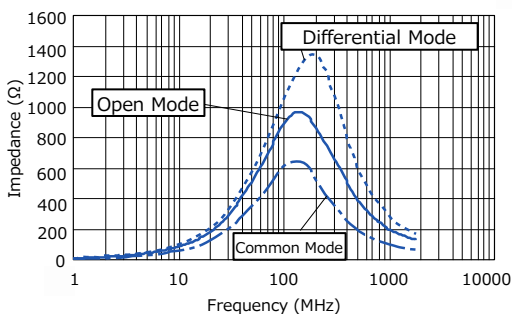


(C) Normal Mode



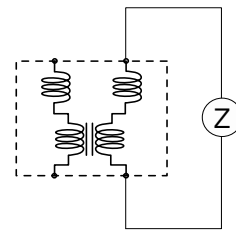
Impedance Characteristics (Typical)

● EXC24CN601X

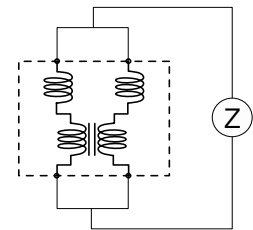


● Measurement Circuit

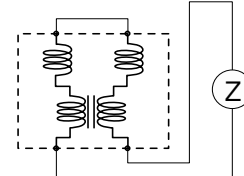
(A) Open Mode



(B) Common Mode



(C) Differential Mode



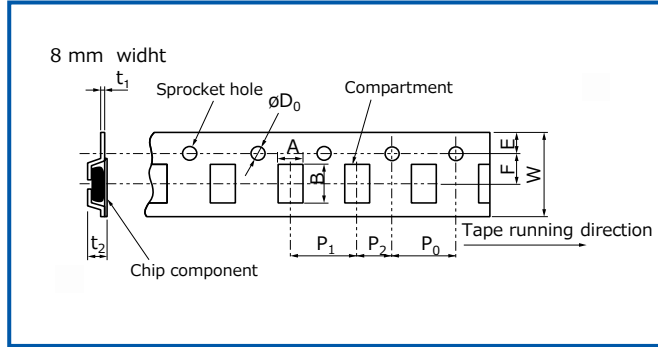
■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Packaging Methods (Taping)

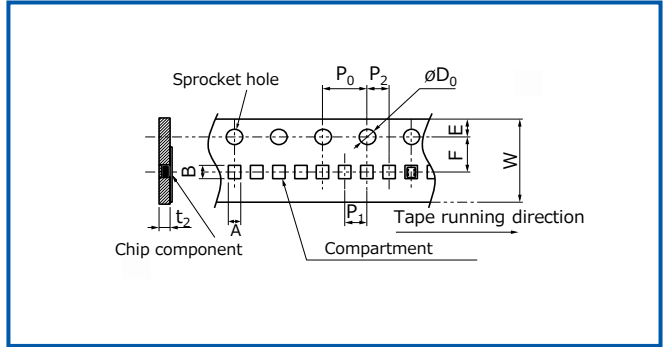
● Standard Quantity

Part Number	Size (inch)	Kind of Taping	Pitch(P ₁)	Quantity
EXC14CP□□□U	0302	Embossed Carrier Taping	2 mm	10,000 pcs/ reel
EXC24CP/CB□□□U	0504		4 mm	5,000 pcs/ reel
EXC24CN□□□X	0504	Pressed Carrier Taping	2 mm	10,000 pcs/ reel

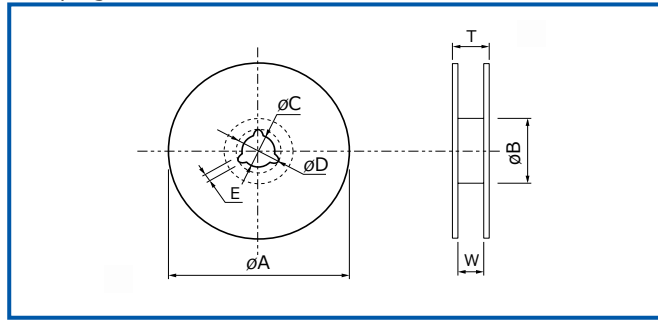
● Embossed Carrier Taping



● Pressed Carrier Taping



● Taping Reel



● Embossed Carrier Dimensions (mm)

Part Number	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
EXC14CP	0.75±0.10	0.95±0.10	8.0±0.2	3.50±0.05	1.75±0.10	2.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.25±0.05	0.85±0.15
EXC24CP/CB	1.20±0.15	1.45±0.15	8.0±0.2	3.50±0.10	1.75±0.10	4.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.25±0.05	0.90±0.15

● Pressed Carrier Dimensions (mm)

Part Number	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₂
EXC24CN	1.14±0.10	1.38±0.15	8.0±0.2	3.5±0.1	1.75±0.10	2.0±0.1	2.0±0.1	4.0±0.1	1.5 ^{+0.1} ₀	0.68±0.10

● Standard Reel Dimensions (mm)

Part Number	øA	øB	øC	øD	E	W	T
EXC14C/EXC24C	180.0±3.0	60.0±1.0	13.0±0.5	21.0±0.8	2.0±0.5	9.0±0.3	11.4±1.5

Recommended Land Pattern Design

The diagram shows two rectangular pads. Dimension A is the total height of the pads. Dimension B is the total width between the inner edges of the pads. Dimension C is the distance between the top edges of the pads. Dimension D is the height of each pad. Dimension E is the distance from the center of each pad to the nearest edge. Dimension F is the distance between the centers of the two pads.

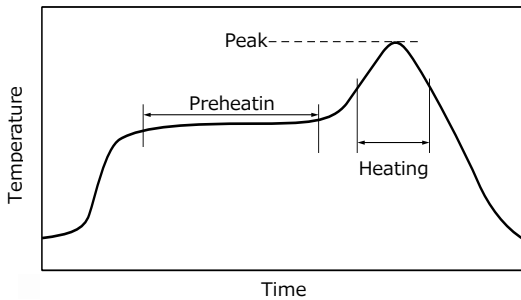
Part Number	Dimensions (mm)					
	A	B	C	D	E	F
EXC14CP	0.80 to 1.00	0.80	0.30	0.25 to 0.35	0.30	0.20
EXC24CP EXC24CB EXC24CN	1.50 to 1.90	1.10	0.50	0.50 to 0.70	0.40	0.30

Recommended Soldering Conditions

Recommendations and precautions are described below

● **Recommended soldering conditions for reflow**

- Reflow soldering shall be performed a maximum of two times.
- Please contact us for additional information when used in conditions other than those specified.
- Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.



● **Flow soldering**

- We do not recommend flow soldering, because flow soldering may cause bridges between the electrodes.

For soldering (Example : Sn-37Pb)

	Temperature	Time
Preheating	140 °C to 160 °C	60 s to 120 s
Main heating	Above 200 °C	30 s to 40 s
Peak	235 ± 10 °C	max. 10 s

For lead-free soldering (Example :Sn-3Ag-0.5Cu)

	Temperature	Time
Preheating	150 °C to 170 °C	60 s to 120 s
Main heating	Above 230 °C	30 s to 40 s
Peak	max. 260 °C	max. 10 s

《Repair with hand soldering》

- Preheat with a blast of hot air or similar method. Use a soldering iron with a tip temperature of 350 °C or less. Solder each electrode for 3 seconds or less.
- Never touch this product with the tip of a soldering iron.

Performance		
Test Item	Performance Requirements	Test Conditions Resistance
Resistance	Within Specified Tolerance	25 °C
Overload	–	Rated Voltage
Resistance to Soldering Heat	±30 % (Impedance Change)	260 °C, 10 s
Rapid Change of Temperature	±30 % (Impedance Change)	–40 °C (30 min.) / +85 °C (30 min.), 200 cycles
High Temperature Exposure	±30 % (Impedance Change)	85 °C , 500 h
Damp Heat, Steady State	±30 % (Impedance Change)	60 °C, 95 %RH, 500 h
Load Life in Humidity	±30 % (Impedance Change)	60 °C, 95 %RH, Rated Current, 500 h

Safety Precautions

(Common mode Noise Filters/Array, Common mode Noise Filters/Array with ESD Suppressor, 2 mode Noise Filters)

- When using our products, no matter what sort of equipment they might be used for, be sure to make a written agreement on the specifications with us in advance. The design and specifications in this catalog are subject to change without prior notice.
- Do not use the products beyond the specifications described in this catalog.
- This catalog explains the quality and performance of the products as individual components. Before use, check and evaluate their operations when installed in your products under the actual conditions for use.
- Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other significant damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/gas equipment, rotating equipment, and disaster/crime prevention equipment.
- * Systems equipped with a protection circuit and a protection device.
- * Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault.
- * Systems equipped with an arresting the spread of fire or preventing glitch.

(1) Precautions for use

- These products are designed and manufactured for general and standard use in general electronic equipment. (e.g. AV equipment, home electric appliances, office equipment, information and communication equipment) For applications in which special quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury (such as for aircraft and aerospace equipment, traffic and transport equipment, combustion equipment, medical equipment, accident prevention and anti-theft devices, and safety equipment), please be sure to consult with our sales representative in advance and to exchange product specifications which conform to such applications.
- These products are not intended for use in the following special conditions. Before using the products, carefully check the effects on their quality and performance, and determine whether or not they can be used.
 1. In liquid, such as water, oil, chemicals, or organic solvent.
 2. In direct sunlight, outdoors, or in dust.
 3. In salty air or air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO_x.
 4. Electric Static Discharge (ESD) Environment.

These components are sensitive to static electricity and can be damaged under static shock (ESD). Please take measures to avoid any of these environments.
Smaller components are more sensitive to ESD environment.
 5. Electromagnetic and Radioactive Environment.

Avoid any environment where strong electromagnetic waves and radiation exist.
 6. In an environment where these products cause dew condensation.
 7. Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin or other materials.
- These products generate Joule heat when energized. Carefully position these products so that their heat will not affect the other components.
- Carefully position these products so that their temperatures will not exceed the category temperature range due to the effects of neighboring heat-generating components. Do not mount or place heat-generating components or inflammables, such as vinyl-coated wires, near these products.
- Note that non-cleaning solder, halogen-based highly active flux, or water-soluble flux may deteriorate the performance or reliability of the products.
- Carefully select a flux cleaning agent for use after soldering. An unsuitable agent may deteriorate the performance or reliability. In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues. Otherwise, the insulation performance may be deteriorated.
- Do not apply flux to these products after soldering. The activity of flux may be a cause of failures in these products.
- Refer to the recommended soldering conditions and set the soldering condition. High peak temperature or long heating time may impair the performance or the reliability of these products.

- Recommended soldering condition is for the guideline for ensuring the basic characteristics of the products, not for the stable soldering conditions. Conditions for proper soldering should be set up according to individual conditions.
- Do not reuse any products after removal from mounting boards.
- Do not drop these products. If these products are dropped, do not use them. Such products may have received mechanical or electrical damage.
- If any doubt or concern to the safety on these products arise, make sure to inform us immediately and conduct technical examinations at your side.

(2) Precautions for storage

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of -5 °C to +40 °C and a relative humidity of 15 % to 75 %.

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO_x.
2. In direct sunlight.

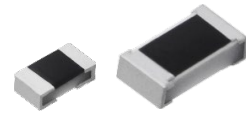
(3) Precaution specific to this product

1. Use rosin-based flux or halogen-free flux.
2. For cleaning, use an alcohol-based cleaning agent. Before using any other type, consult with our sales person in advance.
3. Mounting of the suppressors with excessive or insufficient wetting amount of solder may affect the connection reliability or the performance of the suppressors. Carefully check the effects and apply a proper amount of solder for use.
4. Do not apply shock to Filters or pinch them with a hard tool (e.g. pliers and tweezers). Otherwise, their bodies may be chipped, affecting their performance. Excessive mechanical stress may damage the filters. Handle with care.
7. Avoid excessive bending of printed circuit boards in order to protect the suppressors from abnormal stress.
8. Do not immerse the suppressors in solvent for a long time. Before using solvent, carefully check the effects of immersion.
9. Do not apply excessive tension to the terminals.

<Package markings>

Package markings include the product number, quantity, and country of origin. In principle, the country of origin should be indicated in English.

EZAEG type
EZAEG 2A, 3A series



- Don't use these products in the engine room.
- Don't use these products in any driving applications or any other critical functions that may affect passenger's safety. (e.g. Power train, ABS, Engine ECU, Air bag, and so on.)
- Don't use these products in applications related to the autonomous driving equipment with system level 3 or higher.

Features

- ESD protection of high-speed data lines
- Low capacitance [1005 (0402) size : 0.05 pF, 1608 (0603) size : 0.10 pF]
- Good ESD suppression characteristics
- Good ESD withstanding
- RoHS compliant

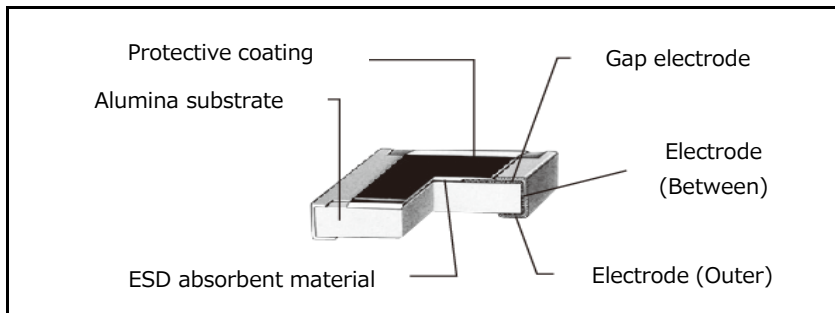
Recommended applications

- Smart phones, Mobile phones, RF Modules, NFC and GPS
- ESD suppression of high-speed differential data line such as Antena circuit, HDMI, SATA, USB, Display Port

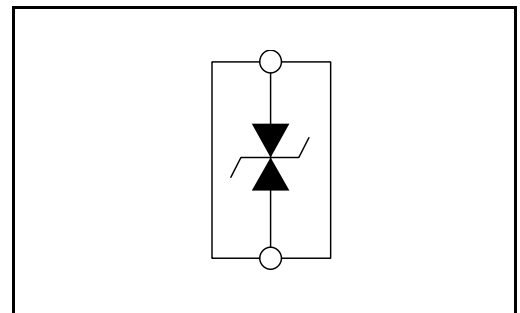
Explanation of part numbers

1	2	3	4	5	6	7	8	9	10	11	
E	Z	A	E	G	2	A	5	0	A	X	
Product code	Size		Design specification		Peak voltage		Special feature		Packing methods		
ESD Suppressor	Code	Size mm (inch)	Code	Design specification	Code	Voltage	Code	Feature	Code	Packaging	Part No.
	2	1005 (0402)	A	Rated voltage 30 V	50	500 V	A	Standard	X	Pressed carrier taping 2 mm pitch, 10,000 pcs	EZAEG2A
	3	1608 (0603)							V	Punched carrier taping 4 mm pitch, 5,000 pcs	EZAEG3A

Construction



Circuit configuration



Dimensions (not to scale)

Part No. (inch size)	Dimensions					Mass (Weight) (g/1000 pcs)
	L	W	a	b	T	
EZAEG2A (0402)	1.00±0.10	0.50±0.05	0.20±0.10	0.25±0.10	0.38±0.05	0.6
EZAEG3A (0603)	1.60±0.15	0.80±0.15	0.30±0.20	0.30±0.20	0.50±0.10	2.2

Unit : mm

Ratings

Part number	Capacitance*1	Rated voltage	Category temperature range
EZAEG2A50AX	0.05+0.05/-0.04 pF	30 V max.	-55 °C to +125 °C
EZAEG3A50AV	0.10+0.10/-0.08 pF		

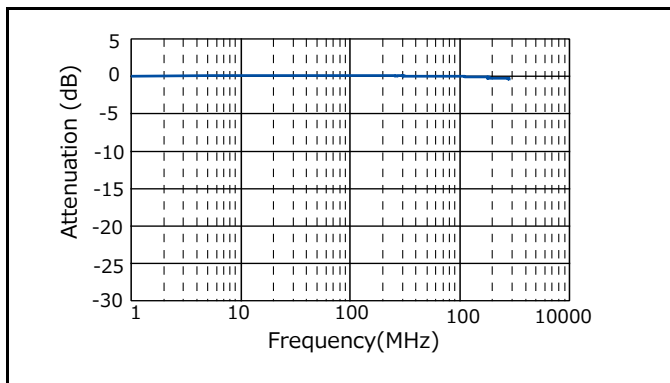
*1: Capacitance = The capacitance value shall be measured under the conditions specified below.

Frequency : 1 MHz ± 10 %, Voltage : 1 Vrms ± 0.2 Vrms, Temperature : 25 °C ± 2 °C

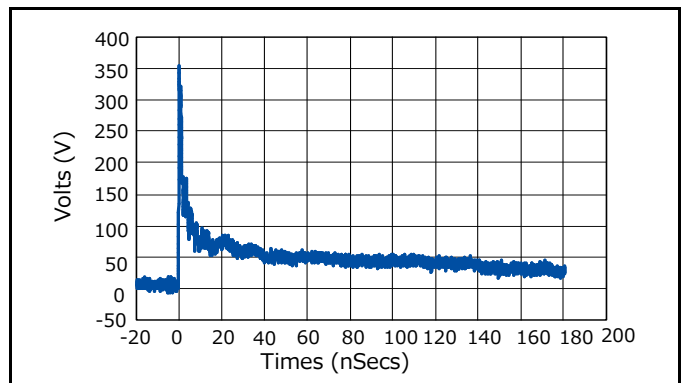
Performance

Test item	Performance requirements	Test conditions
Peak voltage	500 V max.	IEC61000-4-2, contact discharge 8 kV, Peak voltage value
Clamping voltage	100 V max.	IEC61000-4-2, contact discharge 8 kV, voltage at 30 ns after initiation of pulse
Leakage current	1 µA max.	Current at rated voltage (DC 30 V)
ESD withstanding	Leakage current 10 µA max.	IEC61000-4-2, contact discharge 8 kV, +/- 10 times
Rapid change of temperature		-55 °C (30 min.) / +125 °C (30 min.), 100 cycles
Load life in humidity		60 °C, 90 % to 95 %RH, Rated voltage, 1000 h
Endurance at 85 °C		85 °C, Rated voltage, 1000 h
Resistance to soldering heat		270 °C, 10 s

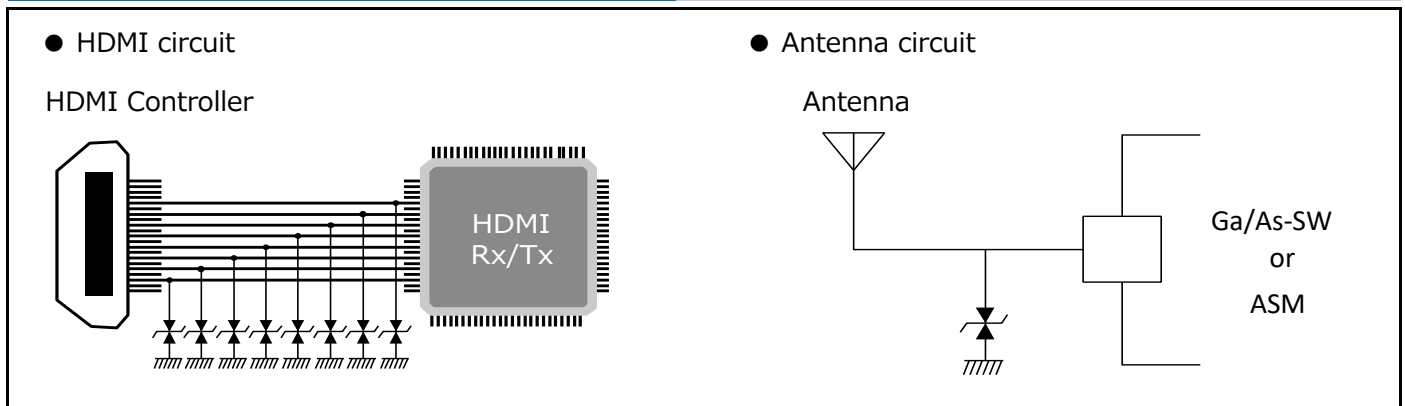
Frequency characteristics



ESD Suppression voltage waveform



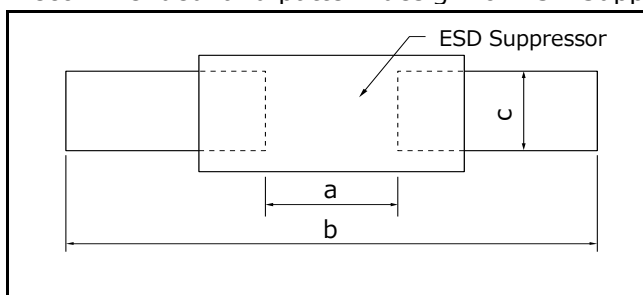
Typical circuits requiring protection



Recommended land pattern

Recommended land pattern design for ESD Suppressor is shown below.

Unit : mm

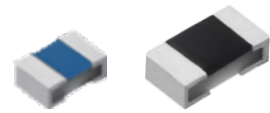


Part number	Dimensions		
	a	b	c
EZAEG2A	0.5 to 0.6	1.4 to 1.6	0.4 to 0.6
EZAEG3A	0.7 to 0.9	2.0 to 2.2	0.8 to 1.0

■ As for packaging methods, soldering conditions and safety Precautions, please see data files.

EZAEG type

EZAEG 1N, 2N series



- Don't use these products in the engine room.
- Don't use these products in any driving applications or any other critical functions that may affect passenger's safety. (e.g. Power train, ABS, Engine ECU, Air bag, and so on.)
- Don't use these products in applications related to the autonomous driving equipment with system level 3 or higher.

Features

- Good ESD withstanding (IEC61000-4-2 15 kV contact/air Discharge)
- ESD protection of high-speed data lines
- Low capacitance [0603 (0201) size : 0.04 pF, 1005(0402) size : 0.05 pF]
- Good ESD suppression characteristics
- RoHS compliant

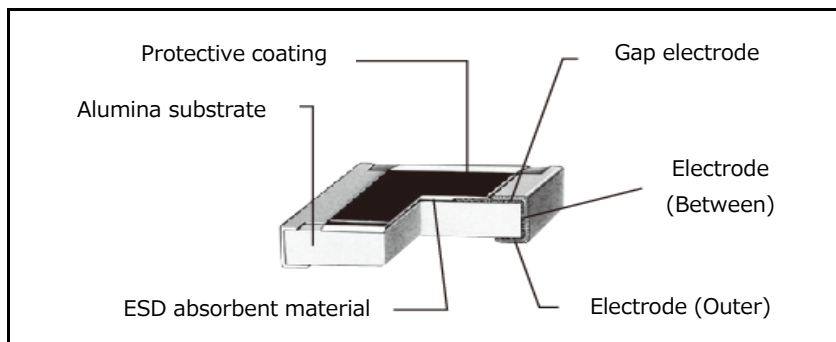
Recommended applications

- Smart phones, Mobile phones, RF Modules, NFC and GPS
- ESD suppression of high-speed differential data line such as Antena circuit, HDMI, SATA, USB, Display Port

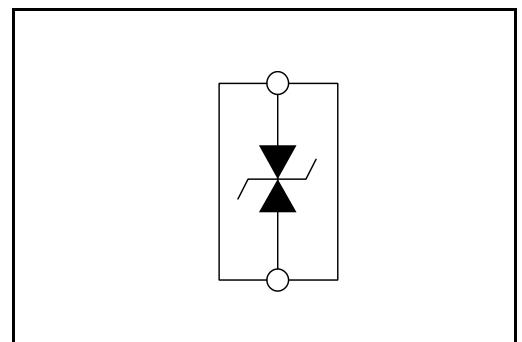
Explanation of part numbers

1	2	3	4	5	6	7	8	9	10	11	
E	Z	A	E	G	2	N	5	0	A	X	
Product code	Size		Design specification		Peak voltage		Special Feature		Packing methods		
ESD Suppressor	Code	Size mm (inch)	Code	Design specification	Code	Voltage	Code	Feature	Code	Packaging	Part No.
	1	0603 (0201)	N	ESD withstanding 15 kV, Rated voltage 30 V	50	500 V	A	Standard	C	Pressed carrier taping 2 mm pitch, 15,000 pcs	EZAEG1N
	2	1005 (0402)			X	Pressed carrier taping 2 mm pitch, 10,000 pcs	EZAEG2N				

Construction



Circuit configuration



Dimensions (not to scale)

Part No. (inch size)	Dimensions					Mass (Weight) (g/1000 pcs)
	L	W	a	b	T	
EZAEG1N (0201)	0.60±0.03	0.30±0.03	0.15±0.10	0.15±0.10	0.23±0.03	0.12
EZAEG2N (0402)	1.00±0.10	0.50±0.05	0.20±0.10	0.27±0.10	0.38±0.05	0.60

Unit : mm

Ratings

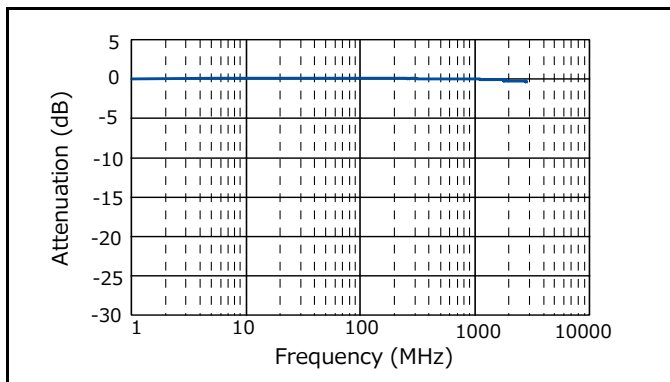
Part number	Capacitance*1	Rated voltage	Category temperature range
EZAEG1N50AC	0.04+0.04/-0.03 pF	30 V max.	-55 °C to +125 °C
EZAEG2N50AX	0.05+0.05/-0.04 pF		

*1: Capacitance = The capacitance value shall be measured under the conditions specified below.
 Frequency : 1 MHz ± 10 %, Voltage : 1 Vrms ± 0.2 Vrms, Temperature : 25 °C ± 2 °C

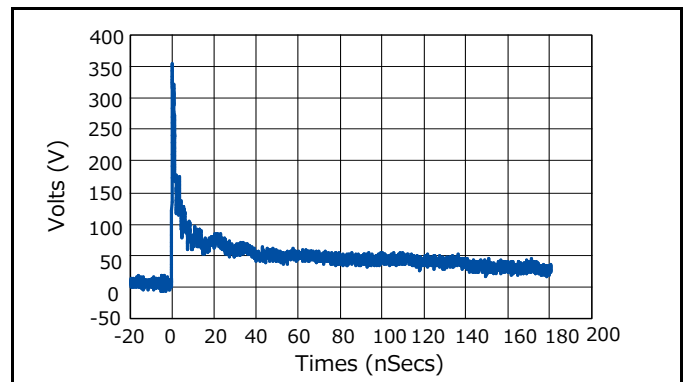
Performance

Test item	Performance requirements	Test conditions
Peak voltage	500 V max.	IEC61000-4-2, contact discharge 8 kV, Peak voltage value
Clamping voltage	100 V max.	IEC61000-4-2, contact discharge 8 kV, voltage at 30 ns after initiation of pulse
Leakage current	1 µA max.	Current at rated voltage (DC 30 V)
ESD withstanding	Leakage current 10 µA max.	IEC61000-4-2, contact discharge 15 kV or air discharge 15 kV, +/- 50 times
Rapid change of temperature		-55 °C (30 min.) / +125 °C (30 min.), 100 cycles
Load life in humidity		60 °C, 90 % to 95 %RH, Rated voltage, 1000 h
Endurance at 85 °C		85 °C, Rated voltage, 1000 h
Resistance to soldering heat		270 °C, 10 s

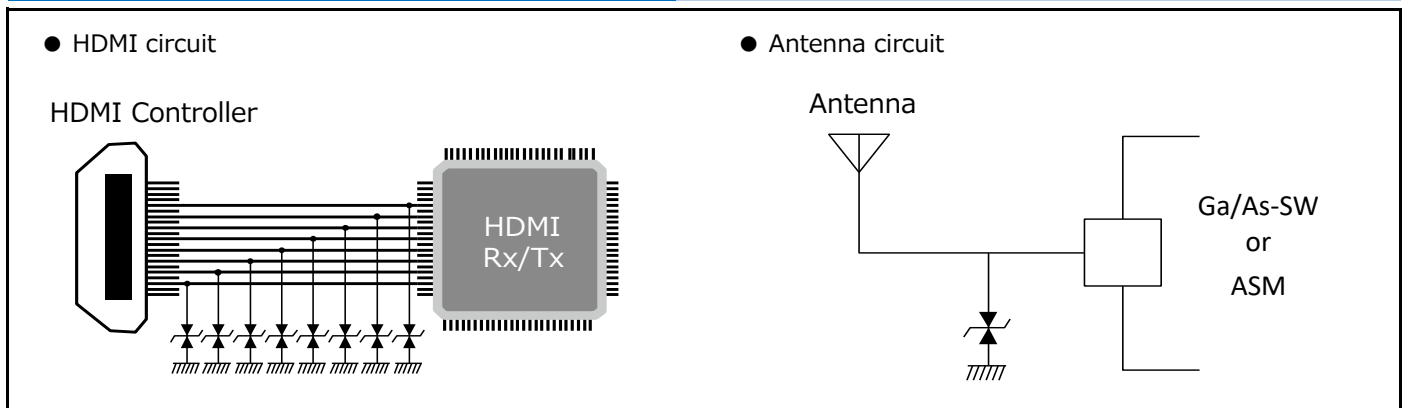
Frequency characteristics



ESD Suppression voltage waveform

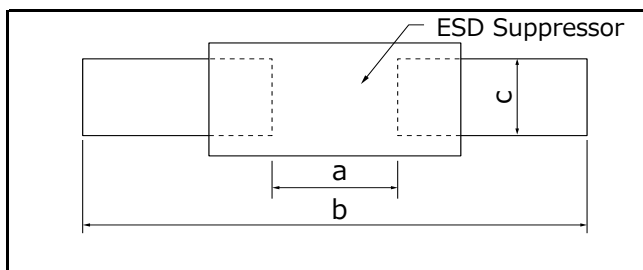


Typical circuits requiring protection



Recommended land pattern

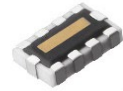
Recommended land pattern design for ESD Suppressor is shown below.



Unit : mm

Part number	Dimensions		
	a	b	c
EZAEG1N	0.3 to 0.4	0.8 to 0.9	0.25 to 0.35
EZAEG2N	0.5 to 0.6	1.4 to 1.6	0.40 to 0.60

■ As for packaging methods, soldering conditions and safety precautions, please see data files.



EZAEGCA type

- Don't use these products in the engine room.
- Don't use these products in any driving applications or any other critical functions that may affect passenger's safety. (e.g. Power train, ABS, Engine ECU, Air bag, and so on.)
- Don't use these products in applications related to the autonomous driving equipment with system level 3 or higher.

Features

- 4 ESD suppressors in one package
- ESD protection of high-speed data lines
- Low capacitance (0.25 pF)
- Good ESD suppression characteristics
- Good ESD withstanding
- RoHS compliant

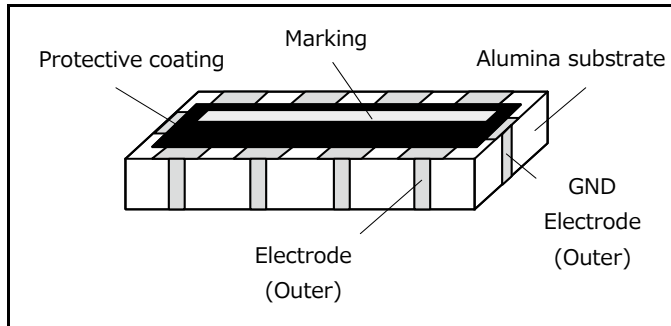
Recommended applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD)
- ESD suppression of high-speed differential data line such as USB3.0, HDMI, Display Port

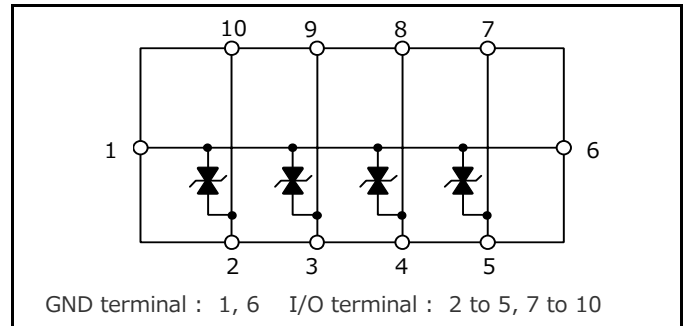
Explanation of part numbers

1	2	3	4	5	6	7	8	9	10	11	
E	Z	A	E	G	C	A	5	0	A	V	
Product code		Size		Design specification		Peak voltage		Special feature		Packing methods	
ESD Suppressor		Code	Size mm (inch)	Code	Design specification	Code	Voltage	Code	Feature	Code	Packaging
		C	2012 (0805) 4 Line use	A	Rated voltage 15 V	50	500 V	A	Standard	V	Punched carrier taping 4 mm pitch, 5,000 pcs

Construction



Circuit configuration



Dimensions (not to scale)

Part No. (inch size)	Dimensions								Mass (Weight) (g/1000 pcs)
	L	W	a	b	c	d	e	T	
EZAEGCA50AV (0805)	2.0±0.1	1.25±0.10	(0.5)	0.30±0.15	0.25±0.15	0.20±0.15	0.35±0.15	0.50±0.10	4

Unit : mm
() Reference

Ratings

Part number	Capacitance* ¹	Rated voltage* ²	Rated current* ³	Category temperature range
EZAEGCA50AV	0.25+0.05/-0.10 pF	15 V max.	100 mA max.	-55 °C to +125 °C

*1: Capacitance = The capacitance value shall be measured under the conditions specified below.

Frequency : 1 MHz ± 10 %, Voltage : 1 Vrms ± 0.2 Vrms, Temperature : 25 °C ± 2 °C

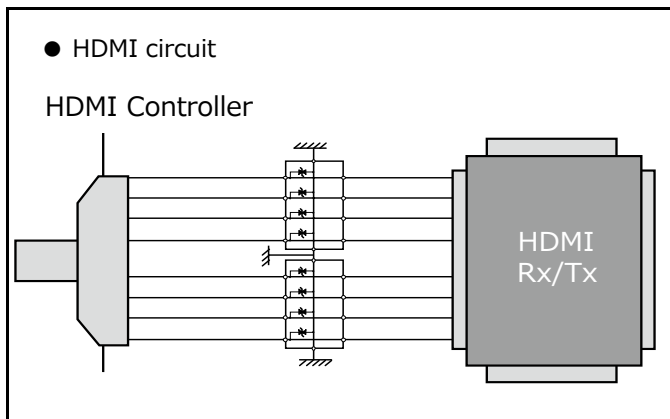
*2: Rated voltage between I/O terminal and GND.

*3: Rated current between input terminal and output terminal.

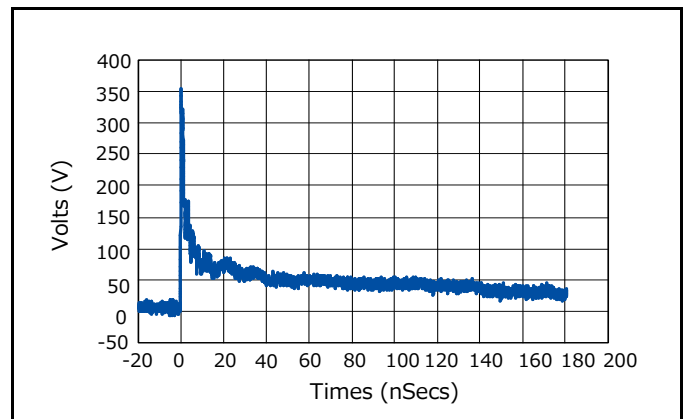
Performance

Test item	Performance requirements	Test conditions
Peak voltage	500 V max.	IEC61000-4-2, contact discharge 8 kV, Peak voltage value
Clamping voltage	100 V max.	IEC61000-4-2, contact discharge 8 kV, voltage at 30 ns after initiation of pulse
Leakage current	1 µA max.	Current at Rated voltage (DC 15 V)
ESD withstanding	Leakage current 10 µA max.	IEC61000-4-2, contact discharge 8 kV, +/- 10 times
Rapid change of temperature		-55 °C (30 min.) / +125 °C (30 min.), 100 cycles
Load life in humidity		60 °C, 90 % to 95 %RH, Rated voltage, 1000 h
Endurance at 85 °C		85 °C, Rated voltage, 1000 h
Resistance to soldering heat		270 °C, 10 s

Frequency characteristics

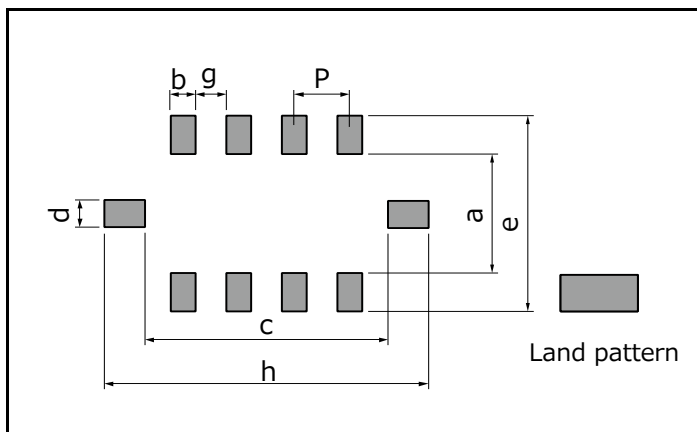


ESD Suppression voltage waveform



Recommended land pattern

Recommended land pattern design for ESD Suppressor Array is shown below.



Unit : mm

Dimensions			
a	b	c	d
0.75	0.25	1.70	0.35

Dimensions			
e	h	g	P
1.85	2.60	0.25	0.50

■ As for packaging methods, soldering conditions and safety Precautions, please see data files.

EZAEG type EZAEG 3W series



Features

- Excellent ESD withstanding(Conforms with automotive ESD standards (ISO10605, air discharge 25 kV)
- Low capacitance 1608 (0603) size : 0.10 pF
- High rated voltage (DC 50 V) contributes to reduce the risk of communication error
- AEC-Q200 compliant
- RoHS compliant

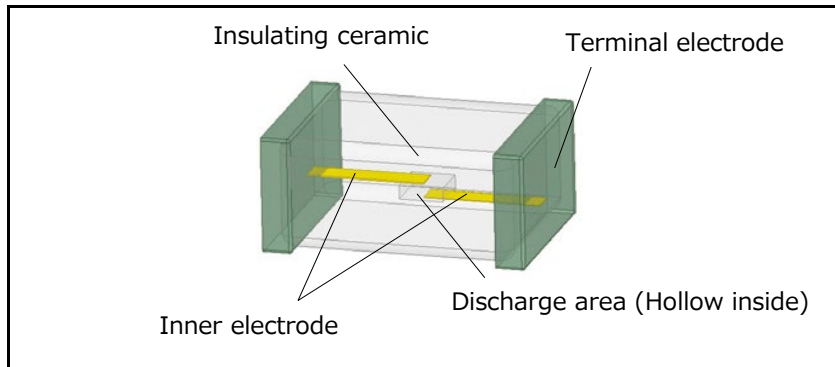
Recommended applications

- High speed data line for automotive (CAN, Ethernet, USB, LVDS)
- Automotive antenna
- Amusement equipment

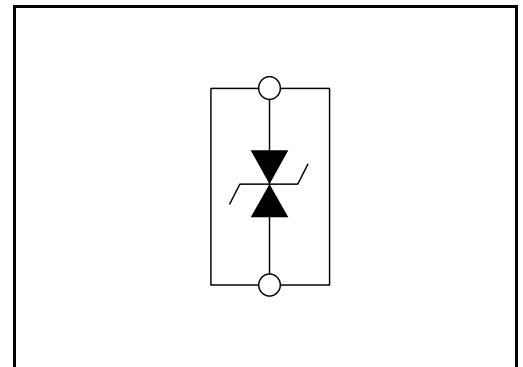
Explanation of part numbers

1	2	3	4	5	6	7	8	9	10	11		
E	Z	A	E	G	3	W	1	1	A	V		
Product code		Size		Design specification		Peak voltage		Special feature		Packing methods		
ESD Suppressor		Code	Size mm (inch)	Code	Design specification	Code	Voltage	Code	Feature	Code	Packaging	Part No.
		3	1608 (0603)	W	High with standing type Rated voltage 50 V	11	1000 V	A	Standard	V	Punched carrier taping 4 mm pitch, 4,000 pcs	EZAEG3W

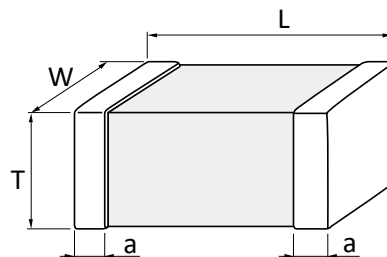
Construction



Circuit configuration



Dimensions (not to scale)



Part No. (inch size)	Dimensions				Mass (Weight) (g/1000 pcs)
	L	W	T	a	
EZAEG3W (0603)	1.60±0.15	0.80±0.15	0.80±0.15	0.30±0.20	3.8

Unit : mm

Ratings

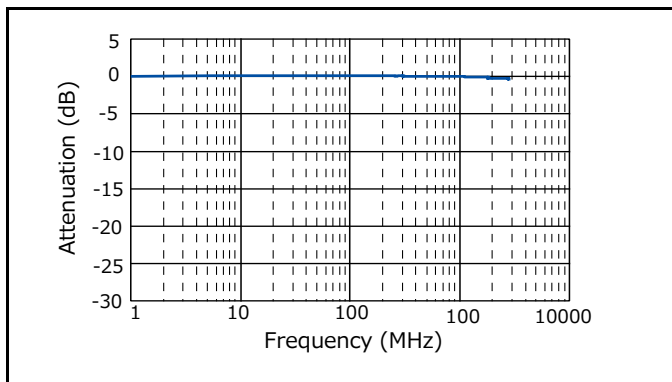
Part number	Capacitance*1	Rated voltage	Category temperature range
EZAEG3W11AV	0.10+0.10/-0.08 pF	50 V max.	-55 °C to +125 °C

*1: Capacitance = The capacitance value shall be measured under the conditions specified below.
 Frequency : 1 MHz ± 10 %, Voltage : 1 Vrms ± 0.2 Vrms, Temperature : 25 °C ± 2 °C

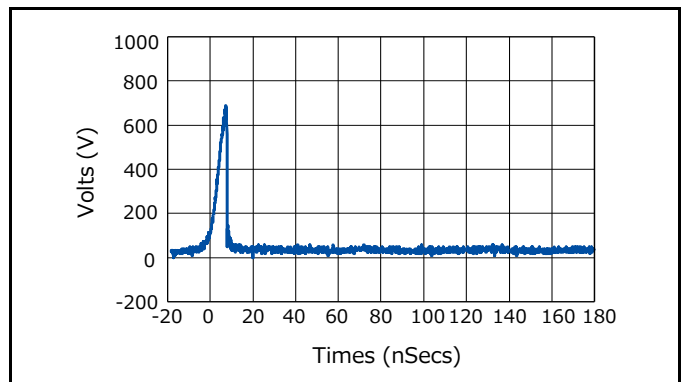
Performance

Test item	Performance requirements	Test conditions
Peak voltage	1000 V max.	ISO10605, air discharge 15 kV, Peak voltage value
Leakage current	1 µA max.	Current at Rated voltage (DC 50 V)
ESD withstanding	Leakage current 10 µA max.	ISO10605, air discharge 25 kV, +/- 50 times
Rapid change of temperature		-55 °C (30 min.) / +125 °C (30 min.), 100 cycles
Load life in humidity		85 °C, 85 %RH, Rated voltage, 1000 h
Endurance at 125 °C		125 °C, Rated voltage, 1000 h
Resistance to soldering Heat		270 °C, 10 s

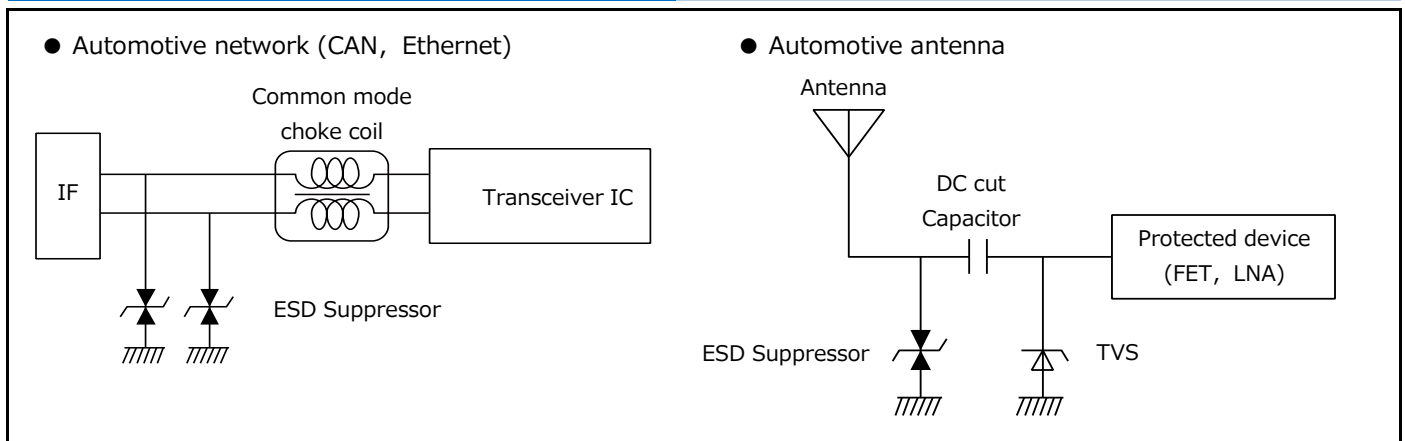
Frequency Characteristics



ESD Suppression voltage waveform

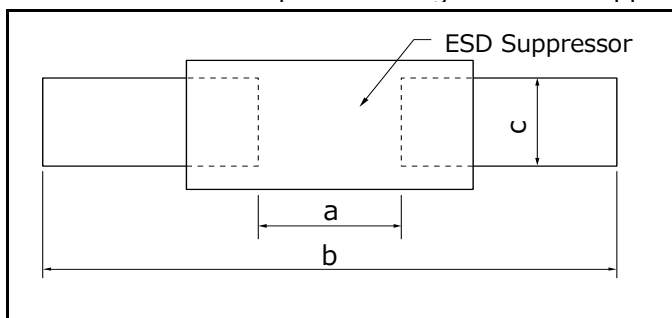


Typical circuits requiring protection



Recommended land pattern

Recommended land pattern design for ESD Suppressor is shown below.



Unit : mm

Part number	Dimensions		
	a	b	c
EZAEG3W	0.8 to 1.0	2.0 to 2.6	0.8 to 1.0

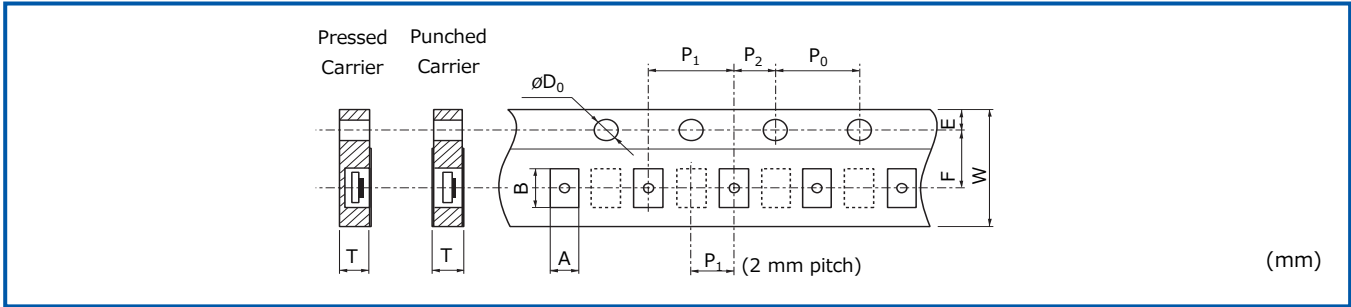
■ As for packaging methods, soldering conditions and safety precautions, please see data files.

Packaging Methods (Taping)

● Standard Quantity

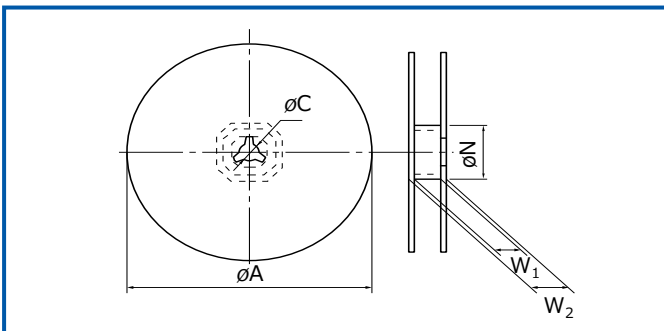
Part Number	Size (inch)	Type	Kind of Taping	Pitch (P ₁)	Quantity
EZAEG1N	0201	Single	Pressed Carrier Taping	2 mm	15,000 pcs / reel
EZAEG2A,2N	0402				10,000 pcs / reel
EZAEG3A	0603		Array	Punched Carrier Taping	4 mm
EZAEG3W	0603	4,000 pcs / reel			
EZAEGCA	0805	5,000 pcs / reel			

● Carrier Taping



Part Number	Size(inch)	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	T
EZAEG1N	0201	0.38±0.05	0.68±0.05	8.00±0.20	3.50±0.05	1.75±0.10	2.00±0.10	2.00±0.05	4.00±0.10	1.5 ^{+0.1} ₀	0.42±0.05
EZAEG2A,2N	0402	0.70±0.05	1.20±0.05				0.60±0.05				
EZAEG3A	0603	1.10±0.10	1.90±0.10	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.5 ^{+0.1} ₀	0.70±0.05
EZAEG3W	0603	0.91±0.10	1.82±0.10								1.08±0.10
EZAEGCA	0805	1.55±0.15	2.30±0.20				0.85±0.05				

● Taping Reel



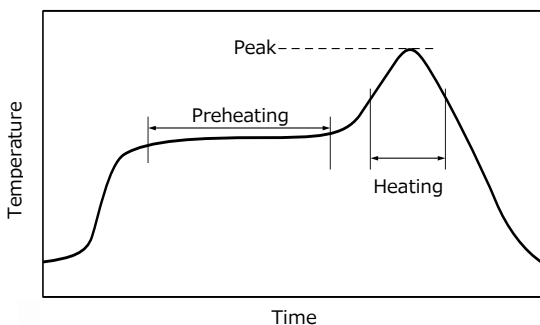
Dimensions(mm)		
øA	øN	øC
180.0 ⁰ _{-1.5}	60.0 ^{+1.0} ₀	13.0±0.2
Dimensions(mm)		
W ₁	W ₂	
9.0 ^{+1.0} ₀	11.4±1.0	

Recommended Soldering Conditions

Recommendations and precautions are described below

● Recommended soldering conditions for reflow

- Reflow soldering shall be performed a maximum of two times.
- Please contact us for additional information when used in conditions other than those specified.
- Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.



For soldering (Example : Sn/Pb)

	Temperature	Time
Preheating	140 °C to 160 °C	60 s to 120 s
Main heating	Above 200 °C	30 s to 40 s
Peak	235 ± 5 °C	max. 10 s

For lead-free soldering (Example : Sn/Ag/Cu)

	Temperature	Time
Preheating	150 °C to 180 °C	60 s to 120 s
Main heating	Above 230 °C	30 s to 40 s
Peak	max. 260 °C	max. 10 s

Safety Precautions (Common precautions for ESD Suppressor)

- When using our products, no matter what sort of equipment they might be used for, be sure to make a written agreement on the specifications with us in advance. The design and specifications in this catalog are subject to change without prior notice.
- Do not use the products beyond the specifications described in this catalog.
- This catalog explains the quality and performance of the products as individual components. Before use, check and evaluate their operations when installed in your products under the actual conditions for use.
- Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other significant damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/gas equipment, rotating equipment, and disaster/crime prevention equipment.
 - * Systems equipped with a protection circuit and a protection device.
 - * Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault.
 - * Systems equipped with an arresting the spread of fire or preventing glitch.

(1) Precautions for use

- It is prohibited to use these products for the following usage.
 - ① Usage in the engine room.
 - ② Usage in any driving applications or any other critical functions that affect passenger safety. (e.g. Power train, ABS, Engine ECU, Air bag, etc.)
 - ③ Usage in applications related to the autonomous driving equipment with system level 3 or higher.
 - ④ Usage for power supply circuits because this product is suitable for Gbps level high-speed differential signal circuits and GHz level high-frequency circuit.
 - ⑤ Usage in managed medical devices (classes 3 or 4) that may affect a serious impact on human life or health.
- These products are designed and manufactured for general and standard use in general electronic equipment. (e.g. AV equipment, home electric appliances, office equipment, information and communication equipment) For applications in which special quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury (such as for aircraft and aerospace equipment, traffic and transport equipment, combustion equipment, medical equipment, accident prevention and anti-theft devices, and safety equipment), please be sure to consult with our sales representative in advance and to exchange product specifications which conform to such applications.
- These products are not intended for use in the following special conditions. Before using the products, carefully check the effects on their quality and performance, and determine whether or not they can be used.
 - ① In liquid, such as water, oil, chemicals, or organic solvent.
 - ② In direct sunlight, outdoors, or in dust.
 - ③ In salty air or air with a high concentration of corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , or NO_x .
 - ④ Electromagnetic and Radioactive Environment.
Avoid any environment where strong electromagnetic waves and radiation exist.
 - ⑤ In an environment where these products cause dew condensation.
 - ⑥ Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin or other materials.
- These products generate Joule heat when energized. Carefully position these products so that their heat will not affect the other components.
- Carefully position these products so that their temperatures will not exceed the category temperature range due to the effects of neighboring heat-generating components. Do not mount or place heat-generating components or inflammables, such as vinyl-coated wires, near these products.
- Note that non-cleaning solder, halogen-based highly active flux, or water-soluble flux may deteriorate the performance or reliability of the products.
- Carefully select a flux cleaning agent for use after soldering. An unsuitable agent may deteriorate the performance or reliability. In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues. Otherwise, the insulation performance may be deteriorated.
- Do not apply flux to these products after soldering. The activity of flux may be a cause of failures in these products.

- Refer to the recommended soldering conditions and set the soldering condition. High peak temperature or long heating time may impair the performance or the reliability of these products.
- Recommended soldering condition is for the guideline for ensuring the basic characteristics of the products, not for the stable soldering conditions. Conditions for proper soldering should be set up according to individual conditions.
- Do not reuse any products after removal from mounting boards.
- Do not drop these products. If these products are dropped, do not use them. Such products may have received mechanical or electrical damage.
- If any doubt or concern to the safety on these products arise, make sure to inform us immediately and conduct technical examinations at your side.

(2) Precautions for storage

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of 5 °C to 35 °C and a relative humidity of 45 % to 85 %.

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

- ① In salty air or in air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO_x.
- ② In direct sunlight.

(3) Precaution specific to this product

- ① If a large electric surge (especially, one which is larger than an ESD) is expected to be applied, be sure to test and confirm proper ESD Suppressor (hereafter called the suppressors) functionality when mounted on your board. When the applied load is more than the allowable rated power under normal load conditions, it may impair performance and/or the reliability of the suppressors. Never exceed the rated power. If the product will be used under these special conditions, be sure to contact a Panasonic representative first.
- ② Do not use halogen-based or other high-activity flux. Otherwise, the residue may impair the suppressors' performance and/or reliability.
- ③ When soldering with a soldering iron, never touch the suppressors' bodies with the tip of the soldering iron. When using a soldering iron with a high temperature tip, finish soldering as quickly as possible (within three seconds at 350 °C max.).
- ④ Mounting of the suppressors with excessive or insufficient wetting amount of solder may affect the connection reliability or the performance of the suppressors. Carefully check the effects and apply a proper amount of solder for use.
- ⑤ When the suppressors' protective coatings are chipped, flawed, or removed, the characteristics of the suppressors may be impaired. Take special care not to apply mechanical shock during automatic mounting or cause damage during handling of the boards with the suppressors mounted
- ⑥ Do not apply shock to the suppressors or pinch them with a hard tool (e.g. pliers and tweezers). Otherwise, the suppressors' protective coatings and bodies may be chipped, affecting their performance.
- ⑦ Avoid excessive bending of printed circuit boards in order to protect the suppressors from abnormal stress.
- ⑧ Do not immerse the suppressors in solvent for a long time. Before using solvent, carefully check the effects of immersion.
- ⑨ Do not apply excessive tension to the terminals.

(4) AEC-Q200 Compliant (ESD Suppressor, High withstanding type)

The products are tested based on all or part of the test conditions and methods defined in AEC-Q200. Please consult with Panasonic for the details of the product specification and specific evaluation test results, etc., and please review and approve Panasonic's product specification before ordering.

<Package markings>

Package markings include the product number, quantity, and country of origin.

In principle, the country of origin should be indicated in English.

Multilayer Varistor (Automotive Grade)

Series: EZJZ-M, EZJP-M

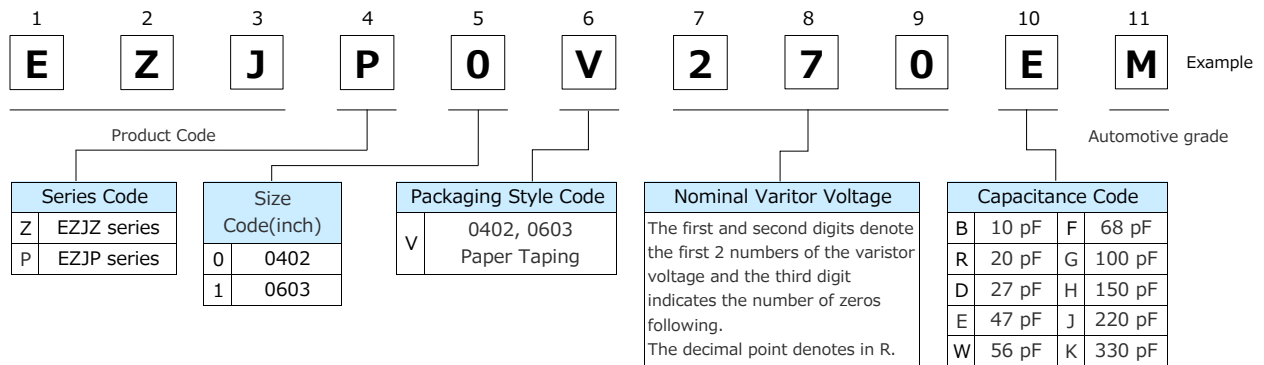


Features

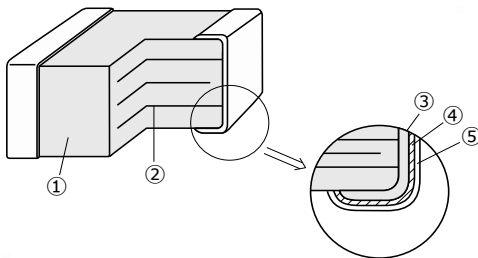
- Excellent ESD suppression due to original advanced material technology
- Having large electrostatic resistance meeting IEC61000-4-2, ISO10605
- Having no polarity (bipolar) facilitated replacing Zener Diodes. Capable of replacing 2 Zener Diodes and 1 Capacitor
- Lead-free plating terminal electrodes enabling great solderability
- Wide range of products is available by adopting multilayer structure, meeting various needs
- AEC-Q200 compliant
- RoHS compliant

■ As for Packaging Methods, Handling Precautions Please see Data Files

Explanation of Part Numbers

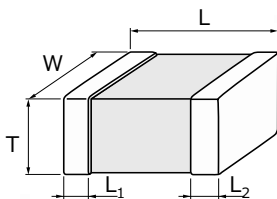


Construction



No.	Name	
①	Zinc oxide-based ceramics	
②	Internal electrode	
③	Terminal electrode	Substrate electrode
④		Intermediate electrode
⑤		External electrode

Dimensions in mm (not to scale)

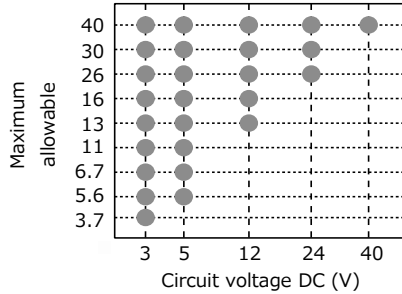


Size Code	Size(inch)	L	W	T	L ₁ , L ₂
0	0402	1.00±0.05	0.50±0.05	0.50±0.05	0.2±0.1
1	0603	1.6±0.1	0.8±0.1	0.8±0.1	0.3±0.2

Features

Wide variety of products is available by adopting multilayer construction, which achieved wide range of usage, such as application to DC voltage lines and signal lines.

- Varistor voltage : 12 to 100 V (at 1 mA)
- Capacitance : 10 to 220 pF max. (at 1 MHz)
- Circuit voltage



Recommended Applications

- Engine ECU
- Various body ECU
- Communication line, such as CAN, LIN
- Audio, Navigation
- LED Light
- Control SW

Ratings and Characteristics

Size (inch)	Part No.	Maximum allowable voltage DC (V)	Nominal varistor voltage at 1 mA (V)	Capacitance (pF)		Maximum peak current at 8/20 μs, 2 times (A)	Maximum ESD	
				at 1 MHz	at 1 kHz		IEC61000-4-2 150 pF/ 330 Ω	ISO10605 330 pF/ 2 kΩ
0402	NEW EZJP0V120JM	7.5	12	220 max.[150 typ.]	175 typ.	10	Contact discharge 8 kV	Contact discharge 25 kV
	EZJP0V180HM	11	18	150 max.[120 typ.]	140 typ.	10		
	EZJP0V220HM	13	22	150 max.[100 typ.]	116 typ.	10		
	EZJP0V270GM	18	27	100 max.[85 typ.]	100 typ.	10		
	EZJP0V270EM	18	27	47 max.[33 typ.]	37 typ.	4		
	EZJP0V270RM	18	27	20 max.[15 typ.]	16.5 typ.	2		
	EZJP0V270BM	18	27	10 max.[8 typ.]	10 typ.	—		
	EZJP0V330GM	25	33	100 max.[85 typ.]	100 typ.	10		
	EZJP0V420WM	30	42	56 max.[40 typ.]	45 typ.	6		
	EZJP0V650DM	40	65	27 max.[22 typ.]	33 typ.	2		
EZJP0V101BM	30	100	10 max.[8 typ.]	10 typ.	—			
0603	NEW EZJP1V120KM	7.5	12	330 max.[250 typ.]	290 typ.	20	Contact discharge 8 kV	Contact discharge 25 kV
	EZJP1V180JM	11	18	220 max.[180 typ.]	210 typ.	20		
	EZJP1V220JM	13	22	220 max.[160 typ.]	185 typ.	10		
	EZJP1V270GM	18	27	100 max.[85 typ.]	100 typ.	10		
	EZJP1V270EM	18	27	47 max.[33 typ.]	37 typ.	5		
	EZJP1V270RM	18	27	20 max.[15 typ.]	16.5 typ.	2		
	EZJP1V330GM	25	33	100 max.[85 typ.]	100 typ.	10		
	EZJP1V420FM	30	42	68 max.[55 typ.]	63 typ.	8		
	EZJP1V650DM	40	65	27 max.[22 typ.]	33 typ.	2		
	EZJZ1V180JM	11	18	220 max.[180 typ.]	210 typ.	20		
	EZJZ1V220JM	13	22	220 max.[160 typ.]	185 typ.	20		
	EZJZ1V270GM	16	27	100 max.[85 typ.]	100 typ.	20		
	EZJZ1V330GM	26	33	100 max.[85 typ.]	100 typ.	20		
	EZJZ1V420FM	30	42	68 max.[55 typ.]	63 typ.	15		
	EZJZ1V650DM	40	65	27 max.[22 typ.]	33 typ.	5		

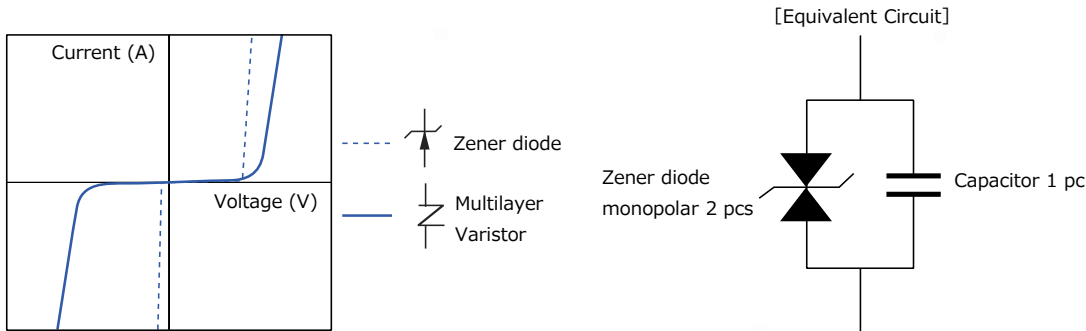
- Operating Temperature Range : EZJP serie -55 to 150 °C, EZJZ serie -55 to 125 °C

* Recommend soldering method : Reflow soldering

Maximum Allowable Voltage	Maximum DC Voltage that can be applied continuously within the operating temperature range
Varistor Voltage	Varistor starting voltage between terminals at DC 1 mA, also known as Breakdown voltage
Maximum Peak Current	Maximum current that can be withstood under the standard pulse 8/20 μs, 2 times based
Maximum ESD	Maximum voltage that can be withstood under ESD

Varistor Characteristics and Equivalent Circuit

A Multilayer Varistor does not have an electrical polarity like zener diodes and is equivalent to total 3 pcs of 2 zener diodes and 1 capacitor.

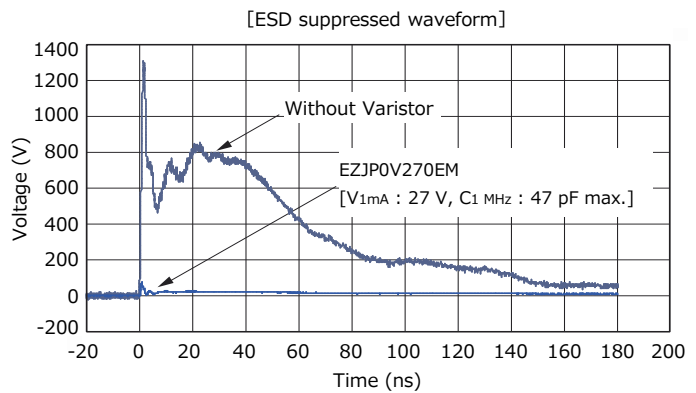
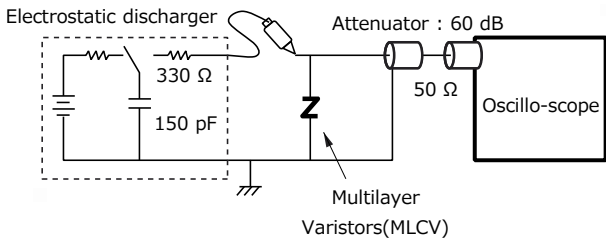


ESD Suppressive Effects

Typical effects of ESD suppression

Test conditions :

IEC61000-4-2* Level4 Contact discharge, 8 kV

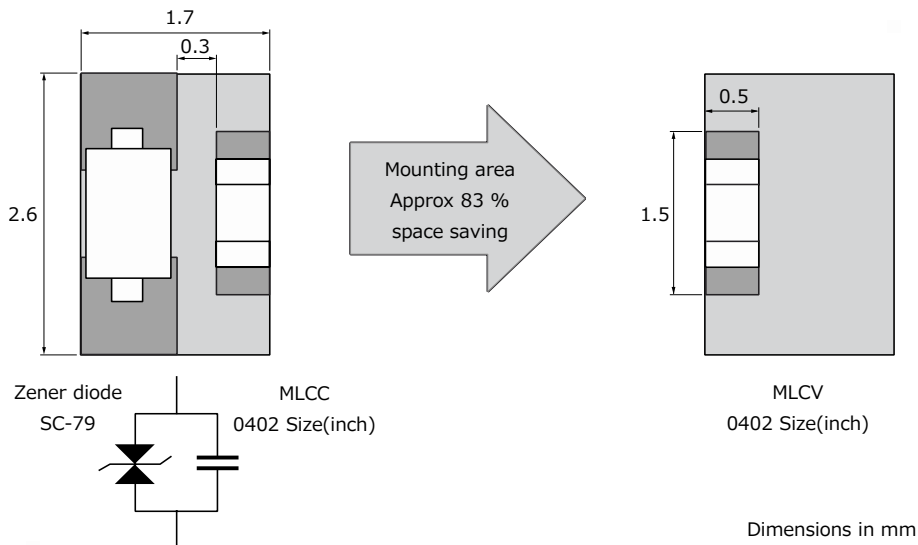


*IEC61000-4-2 ... International Standard of the ESD testing method (HBM) for electronic equipment ability to withstand ESD generated from a human body. It sets 4 levels of severity

Severity	Level 1	Level 2	Level 3	Level 4
Contact discharge	2 kV	4 kV	6 kV	8 kV
Air discharge	2 kV	4 kV	8 kV	15 kV

Replacement of Zener diode

Replacing "Zener diode and Capacitor" with Multilayer Varistor saves both the mounting area and number of components used.



Performance and Testing Methods

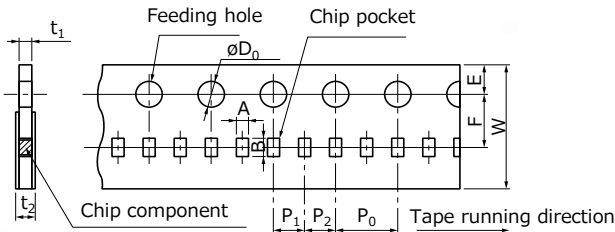
Characteristics	Specifications	Testing Method															
Standard test conditions		Electrical characteristics shall be measured under the following conditions. Temp. : 5 to 35 °C, Relative humidity : 85 % or less															
Varistor voltage	To meet the specified value.	The Varistor voltage is the voltage (V_C or V_{CmA}) between both end terminals of a Varistor when specified current (CmA) is applied to it. The measurement shall be made as quickly as possible to avoid heating effects.															
Maximum allowable voltage	To meet the specified value.	The maximum DC voltage that can be applied continuously to a varistor.															
Capacitance	To meet the specified value.	Capacitance shall be measured at the specified frequency, bias voltage 0 V, and measuring voltage 0.2 to 2.0 Vrms															
Maximum peak current	To meet the specified value.	The maximum current measured (Varistor voltage tolerance is within $\pm 10\%$) when a standard impulse current of 8/20 μ seconds is applied twice with an interval of 5 minutes.															
Maximum ESD	To meet the specified value.	The maximum ESD measured (while the varistor voltage is within blow ranges of its nominal value) when exposed to ESD 10 times (five times for each positive-negative polarity) based on IEC61000-4-2, ISO10605. EZJP□□□□□□M : within $\pm 10\%$, EZJZ□□□□□□M : within $\pm 30\%$															
Solder ability	To meet the specified value.	The part shall be immersed into a soldering bath under the conditions below. Solder : Sn-Ag-Cu Soldering flux : Ethanol solution of rosin (Concentration approx. 25 wt%) Soldering temp. : 230 \pm 5 °C Period : 4 \pm 1 s Soldering position : Immerse both terminal electrodes until they are completely into the soldering bath.															
Resistance to soldering heat	$\Delta V_C/V_C$: within $\pm 10\%$	After the immersion, leave the part for 24 \pm 2 hours under the standard condition, then evaluate its characteristics. Soldering conditions are specified below: Soldering conditions : 270 °C , 3 s / 260 °C , 10 s Soldering position : Immerse both terminal electrodes until they are completely into the soldering bath.															
Temperature cycling	$\Delta V_C/V_C$: within $\pm 10\%$	After repeating the cycles stated below for specified number of times, leave the part for 24 \pm 2 hours, then evaluate its characteristics. Cycle : 2000 cycles <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Period</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Max. Operating Temp.</td> <td>30\pm3 min</td> </tr> <tr> <td>2</td> <td>Ordinary temp.</td> <td>3 min max.</td> </tr> <tr> <td>3</td> <td>Min. Operating Temp.</td> <td>30\pm3 min</td> </tr> <tr> <td>4</td> <td>Ordinary temp.</td> <td>3 min max.</td> </tr> </tbody> </table>	Step	Temperature	Period	1	Max. Operating Temp.	30 \pm 3 min	2	Ordinary temp.	3 min max.	3	Min. Operating Temp.	30 \pm 3 min	4	Ordinary temp.	3 min max.
Step	Temperature	Period															
1	Max. Operating Temp.	30 \pm 3 min															
2	Ordinary temp.	3 min max.															
3	Min. Operating Temp.	30 \pm 3 min															
4	Ordinary temp.	3 min max.															
Vibration	$\Delta V_C/V_C$: within $\pm 10\%$	The varistor shall be soldered on the testing board shown. G force : 5 G Vibration frequency range : 10 to 2000 Hz Sweet time : 20 min. Sweet direction : 12 cycles for 3 courses perpendicular each other															
Mechanical Shock	$\Delta V_C/V_C$: within $\pm 10\%$	The varistor shall be soldered on the testing board shown. Shock-wave formation : Half sine , 11 ms G force : 50 G Sweet direction : 6 directions of X, Y, Z, for each three times															
Biased Humidity	$\Delta V_C/V_C$: within $\pm 10\%$	After conducting the test under the conditions specified below, leave the part 24 \pm 2 hours, then evaluate its characteristics. Temp. : 85 \pm 2 °C Humidity : 80 to 85 %RH Applied voltage : Maximum allowable voltage (Individually specified) Period : 2000+24/0 h															
High temperature exposure (dry heat)	$\Delta V_C/V_C$: within $\pm 10\%$	After conducting the test under the conditions specified below, leave the part 24 \pm 2 hours, then evaluate its characteristics. Temp. : Maximum operating temperature ± 3 °C (Individually specified) Applied voltage : Maximum allowable voltage (Individually specified) Period : 2000+24/0 h															

Packaging Methods (Taping)

● Standard Quantity

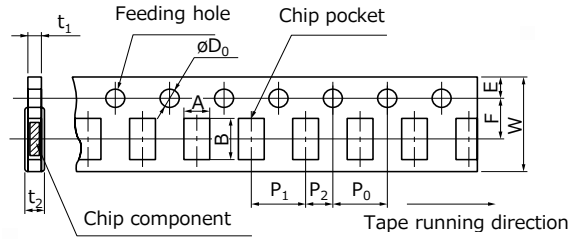
Series	Size Code (inch size)	Thickness (mm)	Kind of Taping	Pitch (mm)	Quantity (pcs/reel)
EZJZ, EZJP	0 (0402)	0.5	Punched Carrier Taping	2	10,000
	1(0603)	0.8		4	4,000

● 2 mm Pitch (Punched Carrier Taping) Size 0402



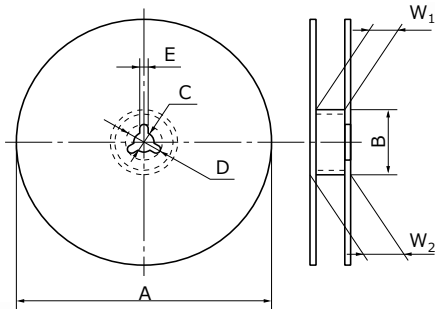
Symbol	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
Unit (mm)	0.62 ±0.05	1.12 ±0.05	8.0 ±0.2	3.50 ±0.05	1.75 ±0.10	2.00 ±0.05	2.00 ±0.05	4.0 ±0.1	1.5 ±0.1 0	0.7 max.	1.0 max.

● 4 mm Pitch (Punched Carrier Taping) Size 0603



Symbol	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
Unit (mm)	1.0 ±0.1	1.8 ±0.1	8.0 ±0.2	3.50 ±0.05	1.75 ±0.10	4.0 ±0.1	2.00 ±0.05	4.0 ±0.1	1.5 ±0.1 0	1.1 max.	1.4 max.

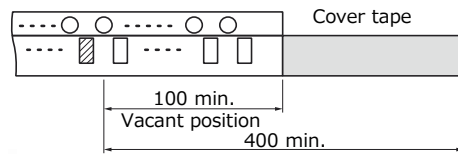
● Reel for Taping



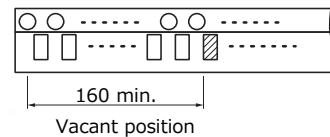
Symbol	A	B	C	D	E	W ₁	W ₂
Unit (mm)	ø180 ⁰ ₋₃	ø60.0 ^{+1.0} ₀	13.0±0.5	21.0±0.8	2.0±0.5	9.0 ^{+1.0} ₀	11.4±1.0

● Leader Part and Taped End

Leader part



Tape end



Unit (mm)

Multilayer Varistors,Chip Type (Automotive Grade)

Series: EZJZ-M, EZJP-M

Handling Precautions**[Precautions]**

- **Do not use the products beyond the descriptions in this product catalog.**
- **This product catalog guarantees the quality of the products as individual components. Before you use the products, please make sure to check and evaluate the products in the circumstance where they are installed in your product.**

 **Safety Precautions**

Multilayer Varistors(Automotive Grade) (hereafter referred to as “Varistors”) should be used for general purpose applications as countermeasures against ESD and noise found in vehicle electronics (Engine ECU and various body ECU, accessory equipment, etc.) equipment. When subjected to severe electrical, environmental, and/or mechanical stress beyond the specifications, as noted in the Ratings and Specified Conditions section, the Varistors’ performance may be degraded, or become failure mode, such as short circuit mode and open-circuit mode. If you use under the condition of short-circuit, heat generation of Varistors will occur by running large current due to application of voltage. There are possibilities of smoke emission, substrate burn-out, and, in the worst case, fire. For products which require high safety levels, please carefully consider how a single malfunction can affect your product. In order to ensure the safety in the case of a single malfunction, please design products with fail-safe, such as setting up protecting circuits, etc.

We are trying to improve the quality and the reliability, but the durability differs depending on the use environment and the use conditions. On use, be sure to confirm the actual product under the actual use conditions.

- For the following applications and conditions, please be sure to consult with our sales representative in advance and to exchange product specifications which conform to such applications.
 - When your application may have difficulty complying with the safety or handling precautions specified below.
 - High-quality and high-reliability required devices that have possibility of causing hazardous conditions, such as death or injury (regardless of directly or indirectly), due to failure or malfunction of the product.
 - ① Aircraft and Aerospace Equipment (artificial satellite, rocket, etc.)
 - ② Submarine Equipment (submarine repeating equipment, etc.)
 - ③ Transportation Equipment (airplanes, trains, ship, traffic signal controllers, etc.)
 - ④ Power Generation Control Equipment
(atomic power, hydroelectric power, thermal power plant control system, etc.)
 - ⑤ Medical Equipment (life-support equipment, pacemakers, dialysis controllers, etc.)
 - ⑥ Information Processing Equipment (large scale computer systems, etc.)
 - ⑦ Electric Heating Appliances, Combustion devices (gas fan heaters, oil fan heaters, etc.)
 - ⑧ Rotary Motion Equipment
 - ⑨ Security Systems
 - ⑩ And any similar types of equipment

 **Strict Observance****1. Confirmation of Rated Performance**

The Varistors shall be operated within the specified rating/performance.

Applications exceeding the specifications may cause deteriorated performance and/or breakdown, resulting in degradation and/or smoking or ignition of products. The following are strictly observed.

- (1) The Varistors shall not be operated beyond the specified operating temperature range.
- (2) The Varistors shall not be operated in excess of the specified maximum allowable voltage.
- (3) The Varistors shall not be operated in the circuits to which surge current and ESD that exceeds the specified maximum peak current and maximum ESD.
- (4) Never use for AC power supply circuits.

2. The Varistors shall not be mounted near flammables.

Operating Conditions and Circuit Design

1. Circuit Design

1.1 Operating Temperature and Storage Temperature

When operating a components-mounted circuit, please be sure to observe the "Operating Temperature Range", written in delivery specifications. Storage temperature of PCB after mounting Varistors, which is not operated, should be within the specified "Storage Temperature Range" in the delivery specifications. Please remember not to use the product under the condition that exceeds the specified maximum temperature.

1.2 Operating Voltage

The Varistors shall not be operated in excess of the "Maximum allowable voltage". If the Varistors are operated beyond the specified Maximum allowable voltage, it may cause short and/or damage due to thermal run away. The circuit that continuously applies high frequency and/or steep pulse voltage please examines the reliability of the Varistor even if it is used within a "Maximum allowable voltage". Also, it would be safer to check also the safety and reliability of your circuit.

1.3 Self-heating

The surface temperature of the Varistors shall be under the specified Maximum Operating Temperature in the Specifications including the temperature rise caused by self-heating. Check the temperature rise of the Varistor in your circuit.

1.4 Environmental Restrictions

The Varistors does not take the use under the following special environments into consideration. Accordingly, the use in the following special environments, and such environmental conditions may affect the performance of the product; prior to use, verify the performance, reliability, etc. thoroughly.

- ① Use in liquids such as water, oil, chemical, and organic solvent.
- ② Use under direct sunlight, in outdoor or in dusty atmospheres.
- ③ Use in places full of corrosive gases such as sea breeze, Cl₂, H₂S, NH₃, SO₂, and NOx.
- ④ Use in environment with large static electricity or strong electromagnetic waves or strong radial ray.
- ⑤ Where the product is close to a heating component, or where an inflammable such as a polyvinyl chloride wire is arranged close to the product.
- ⑥ Where this product is sealed or coated with resin etc.
- ⑦ Where solvent, water, or water-soluble detergent is used in flux cleaning after soldering.
(Pay particular attention to water-soluble flux.)
- ⑧ Use in such a place where the product is wetted due to dew condensation.
- ⑨ Use the product in a contaminated state.
Ex.) Do not handle the product such as sticking sebum directly by touching the product after mounting printed circuit board.
- ⑩ Under severe conditions of vibration or impact beyond the specified conditions found in the Specifications.

2. Design of Printed Circuit Board

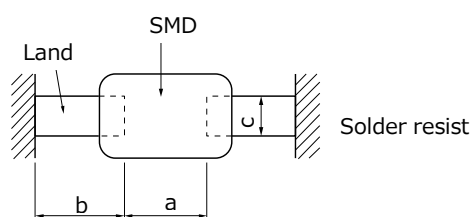
2.1 Selection of Printed Circuit Boards

There is a possibility of performance deterioration by heat shock (temperature cycles), which causes cracks, from alumina substrate. Please confirm that the substrate you use does not deteriorate the Varistors' quality.

2.2 Design of Land Pattern

- 1) Recommended land dimensions are shown below. Use the proper amount of solder in order to prevent cracking. Using too much solder places excessive stress on the Varistors.

Recommended Land Dimensions(Ex.)

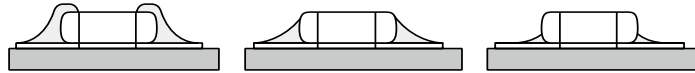


Size Code/EIA	Component dimensions			Unit (mm)		
	L	W	T	a	b	c
0(0402)	1.0	0.5	0.5	0.4 to 0.5	0.4 to 0.5	0.4 to 0.5
1(0603)	1.6	0.8	0.8	0.8 to 1.0	0.6 to 0.8	0.6 to 0.8

(2) The land size shall be designed to have equal space, on both right and left side. If the amount of solder on the right land is different from that of the left land, the component may be cracked by stress since the side with a larger amount of solder solidifies later during cooling.

Recommended Amount of Solder

(a) Excessive amount (b) Proper amount (c) Insufficient amount



2.3 Utilization of Solder Resist

(1) Solder resist shall be utilized to equalize the amounts of solder on both sides.

(2) Solder resist shall be used to divide the pattern for the following cases;

- Components are arranged closely.
- The Varistor is mounted near a component with lead wires.
- The Varistor is placed near a chassis.

See the table right.

Prohibited Applications and Recommended Applications

Item	Prohibited applications	Improved applications by pattern division
Mixed mounting with a component with lead wires	The lead wire of a Component With lead wires 	Solder resist
Arrangement near chassis	Chassis Solder(ground solder) Electrode pattern 	Solder resist
Retro-fitting of component with lead wires	A lead wire of Retrofitted component Soldering iron 	Solder resist
Lateral arrangement	Portion to be Excessively soldered Land 	Solder resist

2.4 Component Layout

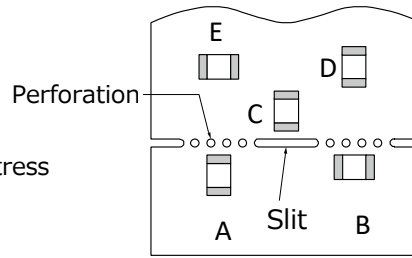
To prevent the crack of Varistors, place it on the position that could not easily be affected by the bending stress of substrate while going through procedures after mounting or handling.

(1) To minimize mechanical stress caused by the warp or bending of a PC board, please follow the recommended Varistors' layout below.

Prohibited layout	Recommended layout
	 Layout the Varistors sideways against the stressing direction.

- (2) The following layout is for your reference since mechanical stress near the dividing/breaking position of a PC board varies depending on the mounting position of the Varistors.

Magnitude of stress
 $A > B = C > D > E$



- (3) The magnitude of mechanical stress applied to the Varistors when dividing the circuit board in descending order is as follows: push back < slit < V-groove < perforation. Also take into account the layout of the Varistors and the dividing/breaking method.

2.5 Mounting Density and Spaces

Intervals between components should not be too narrow to prevent the influence from solder bridges and solder balls. The space between components should be carefully determined.

Precautions for Assembly

1. Storage

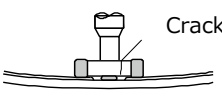
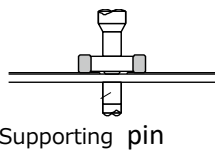
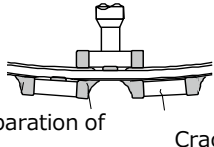
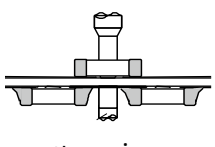
- (1) The Varistors shall be stored between 5 to 40 °C and 20 to 70 % RH, not under severe conditions of high temperature and humidity.
- (2) If stored in a place where humidity, dust, or corrosive gasses (hydrogen sulfide, sulfurous acid, hydrogen chloride and ammonia, etc.) are contained, the solderability of terminal electrodes will be deteriorated. In addition, storage in a place where the heat or direct sunlight exposure occurs will cause mounting problems due to deformation of tapes and reels and components and taping/reels sticking together.
- (3) Do not store components longer than 6 months. Check the solderability of products that have been stored for more than 6 months before use.

2. Adhesives for Mounting

- (1) The amount and viscosity of an adhesive for mounting shall be such that the adhesive will not flow off on the land during its curing.
- (2) If the amount of adhesive is insufficient for mounting, the Varistors may fall off after or during soldering.
- (3) Low-viscosity of the adhesive causes displacement of Varistors.
- (4) The heat-curing methods for adhesive are ultraviolet radiation, far-infrared radiation, and so on. In order to prevent the terminal electrodes of the Varistors from oxidizing, the curing shall be under the following conditions: 160 °C max., for 2 minutes max.
- (5) Insufficient curing may cause the Varistors to fall off after or during soldering. In addition, insulation resistance between terminal electrodes may deteriorate due to moisture absorption. In order to prevent these problems, please observe proper curing conditions.

3. Chip Mounting Consideration

- (1) When mounting the Varistors components on a PC board, the Varistor bodies shall be free from excessive impact loads such as mechanical impact or stress due to the positioning, pushing force and displacement of vacuum nozzles during mounting.
- (2) Maintenance and inspection of the Chip Mounter must be performed regularly.
- (3) If the bottom dead center of the vacuum nozzle is too low, the Varistor will crack from excessive force during mounting. Please refer to the following precautions and recommendations.
 - (a) Set and adjust the bottom dead center of the vacuum nozzles to the upper surface of the PC board after correcting the warp of the PC board.
 - (b) Set the pushing force of the vacuum nozzle during mounting to 1 to 3 N in static load.
 - (c) For double surface mounting, apply a supporting pin on the rear surface of the PC board to suppress the bending of the PC board in order to minimize the impact of the vacuum nozzles. Typical examples are shown in the table below secondary.
 - (d) Adjust the vacuum nozzles so that their bottom dead center during mounting is not too low.

Item	Prohibited mounting	Recommended mounting
Single surface mounting	 Crack	 Supporting pin The supporting pin does not necessarily have to be positioned
Double surface mounting	 Separation of Crack	 Supporting pin

- (4) The closing dimensions of the positioning chucks shall be controlled. Maintenance and replacement of positioning chucks shall be performed regularly to prevent chipping or cracking of the Varistors caused by mechanical impact during positioning due to worn positioning chucks.
- (5) Maximum stroke of the nozzle shall be adjusted so that the maximum bending of PC board does not exceed 0.5 mm at 90 mm span. The PC board shall be supported by an adequate number of supporting pins.

4. Selection of Soldering Flux

Soldering flux may seriously affect the performance of the Varistors. Please confirm enough whether the soldering flux have an influence on performance of the Varistors or not, before using.

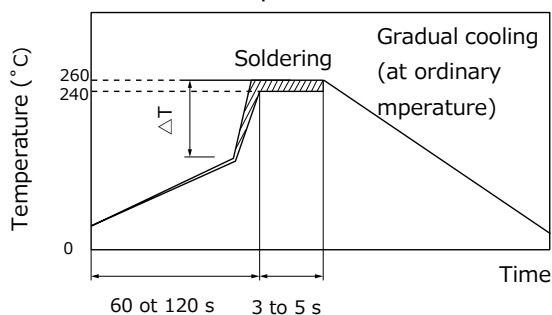
5. Soldering

5.1 Flow Soldering

When conducting flow soldering, stress from abrupt temperature change is applied to the Varistors, so the temperature, especially temperature of solder should be controlled very carefully. Varistors should not be subjected to abrupt temperature change because it causes occurrence of thermal cracks as a result of excessive thermal stress inside of the Varistors from flow soldering. You should be careful to temperature difference. Therefore it is essential that soldering process follow these recommended conditions.

- (1) Application of Soldering flux :
The soldering flux shall be applied to the mounted Varistors thinly and uniformly by foaming method.
- (2) Preheating : Conduct sufficient pre-heating, and make sure that the temperature difference between solder and Varistors' surface is 150 °C or less.
- (3) Immersion into Soldering bath :
The Varistors shall be immersed into a soldering bath of 240 to 260 °C for 3 to 5 seconds.
- (4) Gradual Cooling : After soldering, avoid rapid cooling (forced cooling) and conduct gradual cooling, so that thermal cracks do not occur.
- (5) Flux Cleaning : When the Varistors are immersed into a cleaning solvent, be sure that the surface temperatures of devices do not exceed 100 °C.
- (6) Performing flow soldering once under the conditions shown in the figure below
[Recommended profile of Flow soldering (Ex.)] will not cause any problems.
However, pay attention to the possible warp and bending of the PC board.

Recommended profile of Flow Soldering (Ex.)



<ΔT: Allowable temperature difference>

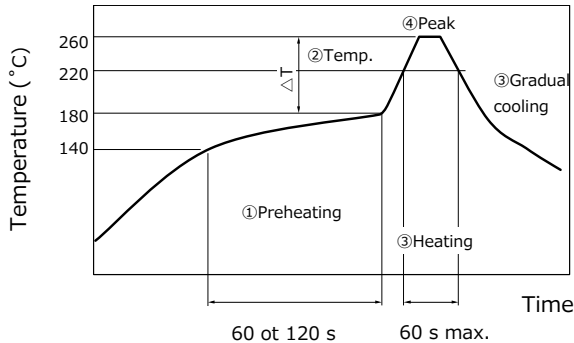
Size/EIA	Temp. Tol.
0603	T ≤ 150 °C

For products specified in individual specifications, avoid flow soldering.

5.2 Reflow Soldering

The reflow soldering temperature conditions are composed of temperature curves of Preheating, Temp. rise, Heating, Peak and Gradual cooling. Large temperature difference inside the Varistors caused by rapid heat application to the Varistors may lead to excessive thermal stresses, contributing to the thermal cracks. The Preheating temperature requires controlling with great care so that tombstone phenomenon may be prevented.

Recommended profile of Reflow Soldering (Ex.)



Item	Temperature	Period or Speed
① Preheating	140 to 180 °C	60 to 120 s
② Temp. rise	Preheating temp to Peak temp.	2 to 5 °C / s
③ Heating	220 °C min.	60 s max.
④ Peak	260 °C max.	10 s max.
⑤ Gradual cooling	Peak temp. to 140 °C	1 to 4 °C / s

Size/EIA	Temp. Tol.
0402, 0603	T \leq 150 °C

ΔT : Allowable temperature difference $\Delta T \leq 150$ °C

The rapid cooling (forced cooling) during Gradual cooling part should be avoided, because this may cause defects such as the thermal cracks, etc. When the Varistors are immersed into a cleaning solvent, make sure that the surface temperatures of the devices do not exceed 100 °C. Performing reflow soldering twice under the conditions shown in the figure above [Recommended profile of Flow soldering (Ex.)] will not cause any problems.

However, pay attention to the possible warp and bending of the PC board.

Recommended soldering condition is for the guideline for ensuring the basic characteristics of the components, not for the stable soldering conditions. Conditions for proper soldering should be set up according to individual conditions. The temperature of this product at the time of mounting changes depending on mounting conditions, therefore, please confirm that Product surface becomes the specified temperature when mounting it on the end product.

5.3 Hand Soldering

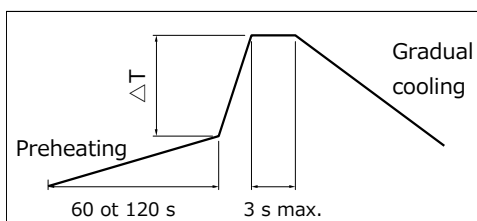
Hand soldering typically causes significant temperature change, which may induce excessive thermal stresses inside the Varistors, resulting in the thermal cracks, etc. In order to prevent any defects, the following should be observed.

- Control the temperature of the soldering tips with special care.
- Avoid the direct contact of soldering tips with the Varistors and/or terminal electrodes.
- Do not reuse dismantled Varistors.

(1) Condition 1 (with preheating)

- Soldering : Use thread solder (ϕ 1.0 mm or below) which contains flux with low chlorine, developed for precision electronic equipment.
- Preheating : Conduct sufficient preheating, and make sure that the temperature difference between solder and Varistors' surface is 150 °C or less.
- Temperature of Iron tip: 350 °C max.
(The required amount of solder shall be melted in advance on the soldering tip.)
- Gradual cooling : After soldering, the Varistors shall be cooled gradually at room temperature.

Recommended profile of Hand soldering (Ex.)



ΔT : Allowable temperature difference $\Delta T \leq 150$ °C

(2) Condition 2 (without preheating)

Hand soldering can be performed without preheating, by following the conditions below:

- (a) Soldering iron tip shall never directly touch the ceramic and terminal electrodes of the Varistors.
- (b) The lands are sufficiently preheated with a soldering iron tip before sliding the soldering iron tip to the terminal electrodes of the Varistors for soldering.

Conditions of Hand soldering without preheating

Item	Condition
Temperature of Iron tip	350 °C max.
Wattage	20 W max.
Shape of Iron tip	∅ 3 mm max.
Soldering time with a soldering iron	3 s max.

6. Post Soldering Cleaning

6.1 Cleaning solvent

Soldering flux residue may remain on the PC board if cleaned with an inappropriate solvent. This may deteriorate the performance of Varistors, especially insulation resistance.

6.2 Cleaning conditions

Inappropriate cleaning conditions such as insufficient cleaning or excessive cleaning may impair the electrical characteristics and reliability of the Varistors.

(1) Insufficient cleaning can lead to :

- (a) The halogen substance found in the residue of the soldering flux may cause the metal of terminal electrodes to corrode.
- (b) The halogen substance found in the residue of the soldering flux on the surface of the Varistors may change resistance values.
- (c) Water-soluble soldering flux may have more remarkable tendencies of (a) and (b) above compared to those of rosin soldering flux.

(2) Excessive cleaning can lead to :

- (a) When using ultrasonic cleaner, make sure that the output is not too large, so that the substrate will not resonate. The resonance causes the cracks in Varistors and/or solders, and deteriorates the strength of the terminal electrodes. Please follow these conditions for Ultrasonic cleaning:
 - Ultrasonic wave output : 20 W/L max.
 - Ultrasonic wave frequency : 40 kHz max.
 - Ultrasonic wave cleaning time : 5 min. max.

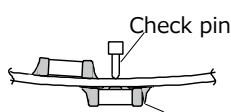
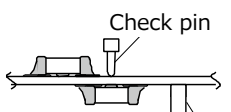
6.3 Contamination of Cleaning solvent

Cleaning with contaminated cleaning solvent may cause the same results as that of insufficient cleaning due to the high density of liberated halogen.

7. Inspection Process

The pressure from measuring terminal pins might bend the PCB when implementing circuit inspection after mounting Varistors on PCB, and as a result, cracking may occur.

- (1) Mounted PC boards shall be supported by an adequate number of supporting pins on the back with bend settings of 90 mm span 0.5 mm max.
- (2) Confirm that the measuring pins have the right tip shape, are equal in height, have the right pressure and are set in the correct positions. The following figures are for your reference to avoid bending the PC board.

Item	Prohibited mounting	Recommended mounting
Bending of PC board	 <p>Separated, Crack</p>	 <p>Supporting pin</p>

8. Protective Coating

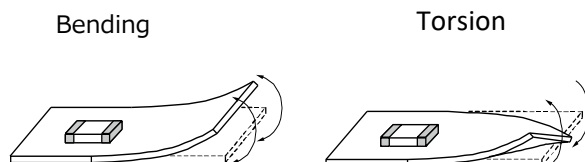
Make sure characteristics and reliability when using the resin coating or resin embedding for the purpose of improvement of humidity resistance or gas resistance, or fixing of parts because failures of a thermistors such as 1) ,2) and 3) may be occurred.

- (1) The solvent which contained in the resin permeate into the Varistors, and it may deteriorate the characteristic.

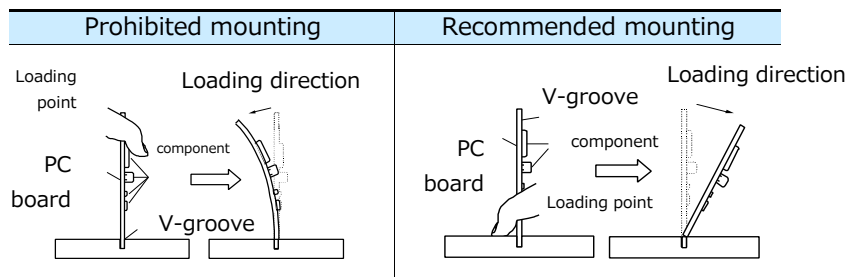
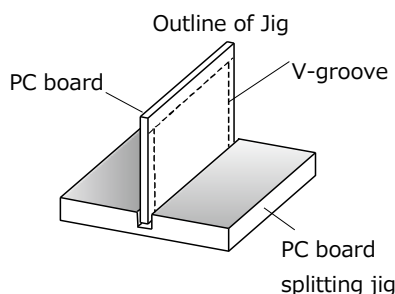
- (2) When hardening the resin, chemical reaction heat (curing heat generation) happen and it may occurs the infection to the Varistors.
- (3) The lead wire might be cut down and the soldering crack might be happen by expansion or contraction of resin hardening.

9. Dividing/Breaking of PC Boards

- (1) Please be careful not to stress the substrate with bending/twisting when dividing, after mounting components including Varistors. Abnormal and excessive mechanical stress such as bending or torsion shown below can cause cracking in the Varistors.

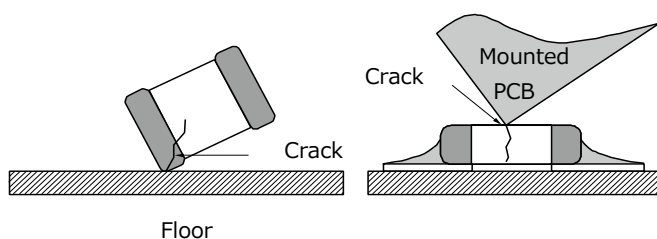


- (2) Dividing/Breaking of the PC boards shall be done carefully at moderate speed by using a jig or apparatus to prevent the Varistors on the boards from mechanical damage.
- (3) Examples of PCB dividing/breaking jigs: The outline of PC board breaking jig is shown below. When PC board are broken or divided, loading points should be close to the jig to minimize the extent of the bending. Also, planes with no parts mounted on should be used as plane of loading, in order to prevent tensile stress induced by the bending, which may cause cracks of the Varistors or other parts mounted on the PC boards.



10. Mechanical Impact

- (1) The Varistors shall be free from any excessive mechanical impact. The Varistor body is made of ceramics and may be damaged or cracked if dropped. Never use a Varistor which has been dropped; their quality may already be impaired, and in that case, failure rate will increase.
- (2) When handling PC boards with Varistors mounted on them, do not allow the Varistors to collide with another PC board. When mounted PC boards are handled or stored in a stacked state, the corner of a PC board might strike Varistors, and the impact of the strike may cause damage or cracking and can deteriorate the withstand voltage and insulation resistance of the Varistor.



- 11.** Do not reuse this product after removal from the mounting board.

Precautions for discarding

As to the disposal of the Varistors, check the method of disposal in each country or region where the modules are incorporated in your products to be used.

Other

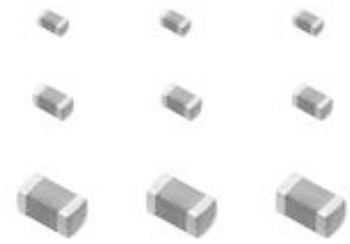
The various precautions described above are typical. For special mounting conditions, please contact us.

Applicable laws and regulations , others

1. This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.
2. This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) (DIRECTIVE 2011/65/EU and 2015/863/EU).
3. All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance.
4. If you need the notice by letter of "A preliminary judgement on the Laws of Japan foreign exchange and Foreign Trade Control", be sure to let us know.
5. These products are not dangerous goods on the transportation as identified by UN (United nations) numbers or UN classification.
6. The technical information in this catalog provides example of our products' typical operations and application circuit. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, Right or interest in our intellectual property.

AEC-Q200 Compliant

The products are tested based on all or part of the test conditions and methods defined in AEC-Q200. Please consult with Panasonic for the details of the product specification and specific evaluation test results, etc., and please review and approve Panasonic's product specification before ordering.



Multilayer Varistor for ESD pulse
[DC voltage lines/High speed signal lines]
Series: **EZJZ, EZJP**

Features

- Excellent ESD suppression due to original advanced material technology
- Having large electrostatic resistance meeting IEC61000-4-2, Level 4 standard
- Having no polarity (bipolar) facilitated replacing Zener Diodes. Capable of replacing 2 Zener Diodes and 1 Capacitor.
- Lead-free plating terminal electrodes enabling great solderability
- Wide range of products is available by adopting multilayer structure, meeting various needs
- Low capacitance versions for DC voltage lines of high speed busses
- Ultra low capacitance for high speed signal line
- Applicable to high-speed signal lines, such as interfaces (e.g. USB2.0, IEEE1394, HDMI, and so on), due to our original ultra-low capacitance technology.
- RoHS compliant

■ As for Packaging Methods, Handling Precautions Please see Data Files

Explanation of Part Numbers

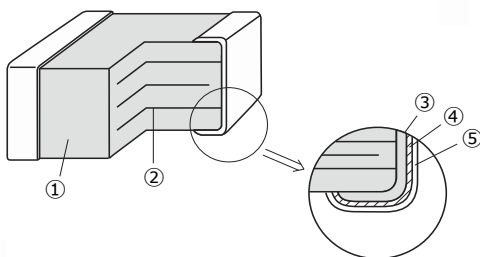
1	2	3	4	5	6	7	8	9	10	11	12	
E	Z	J	Z	0	V	2	7	0	E	A		Example
Product Code										Design Code		

Series Code	Packaging Style Code	Capacitance Code
Z EZJZ series P EZJP series	V 0402, 0603 Paper Taping	A 3 pF G 100 pF R 20 pF H 150 pF D 27 pF J 220 pF E 47 pF K 330 pF W 56 pF M 680 pF F 68 pF

Size Code(inch)	Nominal Varitor Voltage	Design Code
Z 0201 0 0402 1 0603	The first and second digits denote the first 2 numbers of the varistor voltage and the third digit indicates the number of zeros following. The decimal point denotes in R.	Nil Cap.Tolerance : max. B Cap.Tolerance : ±0.1 pF C Cap.Tolerance : ±0.25 pF D Cap.Tolerance : ±0.50 pF K Cap.Tolerance : ±10 % M Cap.Tolerance : ±20 %

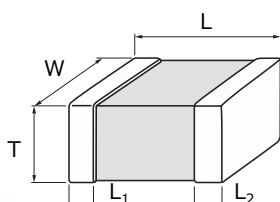
※ Below 3 pF, the 10 or 11th position of the P/N indicates the capacitance value as follows : 2.0 pF...20, 1.5 pF...15

Construction



No.	Name	
①	Semiconductive Ceramics	
②	Internal electrode	
③	Terminal electrode	
④		Substrate electrode
⑤		Intermediate electrode
	External electrode	

Dimensions in mm (not to scale)



Size Code	Size(inch)	L	W	T	L ₁ , L ₂
Z	0201	0.60±0.03	0.30±0.03	0.30±0.03	0.15±0.05
0	0402	1.00±0.05	0.50±0.05	0.50±0.05	0.2±0.1
1	0603	1.6±0.1	0.8±0.1	0.8±0.1	0.3±0.2

Multilayer Varistor, Low Capacitance Type [High speed signal lines]

Features

- Applicable to high-speed signal lines, such as interfaces (e.g. USB 2.0, IEEE1394, HDMI, and so on), due to our original material technology and multilayer technology.
- Capacitance : 0.8 to 2.1 pF typ.

Recommended Applications

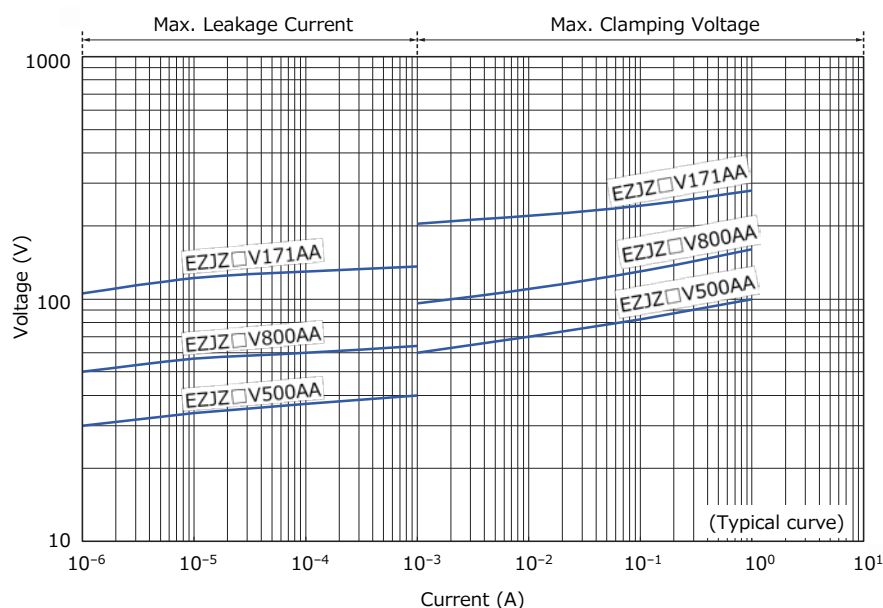
Mobile phone	Antenna circuit, External IF
DSC,DVC	USB2.0, IEEE1394
PC,PDA	USB2.0, IEEE1394, LAN1000BASE
TV,DVD	USB2.0, IEEE1394, HDMI
Game console	Controller, External IF

Ratings and Characteristics

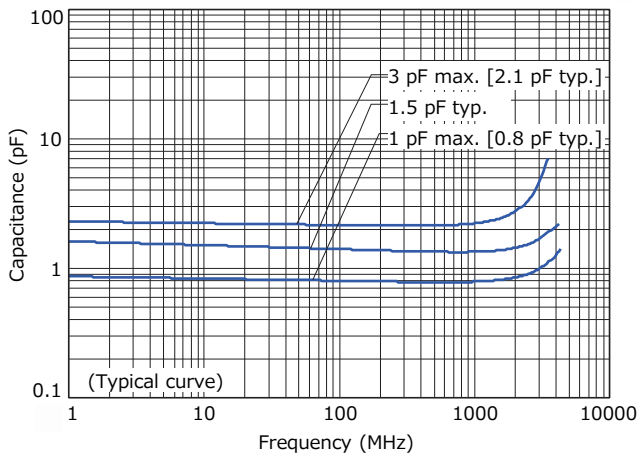
Size(inch)	Part No.	Maximum allowable voltage DC (V)	Nominal varistor voltage at 1 mA (V)	Capacitance at 1 MHz (pF)	Maximum ESD IEC61000-4-2
0402	EZJZ0V80010	10	80	1 max. [0.8 typ.]	Contact discharge : 8 kV
	EZJZ0V80015D	5	80	1.5±0.5	
	EZJZ0V500AA	5	50	3 max. [2.1 typ.]	
	EZJZ0V800AA	18	80	3 max. [2.1 typ.]	
	EZJZ0V171AA	18	170	3 max. [2.1 typ.]	
0603	EZJZ1V80010	10	80	1 max. [0.8 typ.]	
	EZJZ1V500AA	5	50	3 max. [2.1 typ.]	
	EZJZ1V800AA	18	80	3 max. [2.1 typ.]	
	EZJZ1V171AA	18	170	3 max. [2.1 typ.]	

- Operating Temperature Range : -40 to 85 °C
- * Recommend soldering method : Reflow soldering

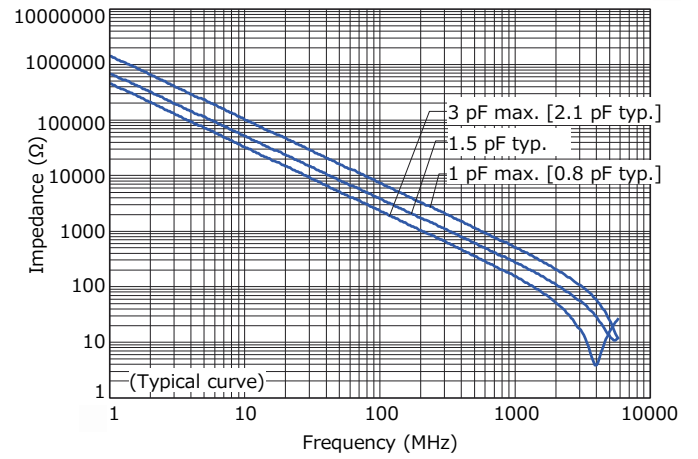
Voltage vs. Current



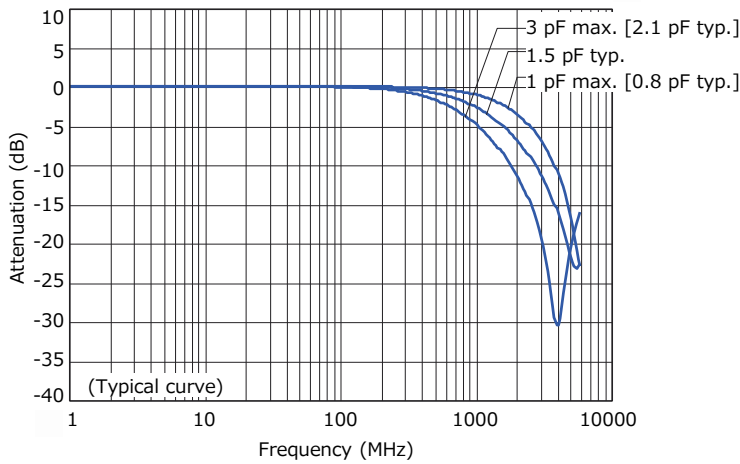
Capacitance vs. Frequency



Impedance vs. Frequency



Attenuation vs. Frequency



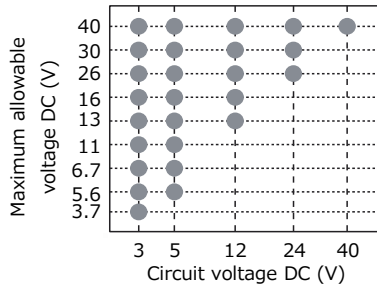
Multilayer Varistor, Low Voltage Type (Standard Type) [DC voltage lines/Low speed signal lines]

Features

Wide variety of products is available by adopting multilayer construction, which achieved wide range of usage, such as application to DC voltage lines and signal lines.

- Varistor voltage : 6.8 to 65 V (at 1 mA)
- Capacitance : 8.5 to 420 pF typ. (at 1 MHz)

● Circuit voltage



Recommended Applications

Mobile phone	SW, LCD, LED, Audio terminal, Battery pack, Memory card, External IF
DSC,DVC	SW, LCD, LED, USB
PC,PDA	SW, LCD, LED, USB
TV,DVD	Audio, Video terminal
Audio	Audio terminal, Microphone, Receiver
Game console	Controller, External IF

Ratings and Characteristics

Size (inch)	Part No.	Maximum allowable voltage DC (V)	Nominal varistor voltage at 1 mA (V)	Capacitance (pF)		Maximum peak current at 8/20 μs, 2 times (A)	Maximum ESD IEC61000-4-2
				at 1 MHz	at 1 kHz		
0201	EZJPZV6R8JA	3.7	6.8	220 max. [150 typ.]	175 typ.	5	Contact discharge :8 kV
	EZJPZV6R8GA	3.7	6.8	100 max. [85 typ.]	100 typ.	5	
	EZJPZV080GA	5.6	8	100 max. [85 typ.]	100 typ.	5	
	EZJPZV120GA	7.5	12	100 max. [85 typ.]	100 typ.	5	
	EZJPZV120DA	7.5	12	27 max. [22 typ.]	33 typ.	1	
	EZJPZV120RA	7.5	12	20 max. [15 typ.]	18 typ.	1	
	EZJPZV150RA	9	15	20 max. [15 typ.]	18 typ.	1	
	EZJPZV270RA	16	27	20 max. [15 typ.]	16.5 typ.	1	
0402	EZJPZV270BA	16	27	10 max. [8.5 typ.]	10 typ.	1	
	EZJP0V6R8MA	3.7	6.8	680 max. [420 typ.]	650 typ.	20	
	EZJP0V6R8GA	3.7	6.8	100 max. [85 typ.]	100 typ.	3	
	EZJP0V080MA	5.6	8	680 max. [420 typ.]	650 typ.	20	
	EZJP0V080KA	5.6	8	330 max. [290 typ.]	480 typ.	15	
	EZJP0V080GA	5.6	8	100 max. [65 typ.]	100 typ.	3	
	EZJP0V080DA	5.6	8	27 max. [22 typ.]	33 typ.	1	
	EZJP0V120JA	6.7	12	220 max. [150 typ.]	175 typ.	10	
	EZJZ0V180HA	11	18	150 max. [120 typ.]	140 typ.	10	
	EZJZ0V220HA	13	22	150 max. [100 typ.]	116 typ.	10	
	EZJP0V270EA	16	27	47 max. [33 typ.]	37 typ.	4	
	EZJP0V270RA	16	27	20 max. [15 typ.]	16.5 typ.	1	
0603	EZJZ0V420WA	30	42	56 max. [40 typ.]	45 typ.	10	
	EZJZ0V650DA	40	65	27 max. [22 typ.]	33 typ.	5	
	EZJP1V120KA	6.7	12	330 max. [250 typ.]	290 typ.	20	
	EZJZ1V180JA	11	18	220 max. [180 typ.]	210 typ.	20	
	EZJZ1V220JA	13	22	220 max. [160 typ.]	185 typ.	20	
	EZJZ1V270GA	16	27	100 max. [85 typ.]	100 typ.	20	
	EZJZ1V270EA	16	27	47 max. [33 typ.]	37 typ.	20	
	EZJZ1V270RA	16	27	20 max. [15 typ.]	16.5 typ.	3	
	EZJZ1V330GA	26	33	100 max. [85 typ.]	100 typ.	20	
	EZJZ1V420FA	30	42	68 max. [55 typ.]	63 typ.	15	
EZJZ1V650DA	40	65	27 max. [22 typ.]	33 typ.	5		

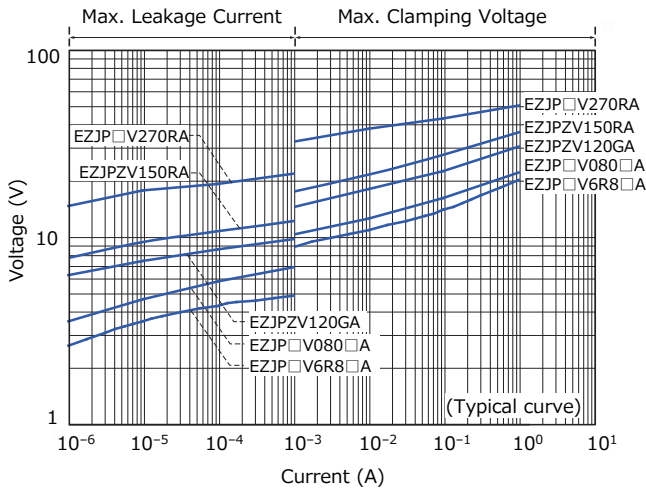
● Operating Temperature Range : -40 to 85 °C

* Recommend soldering method : Reflow soldering

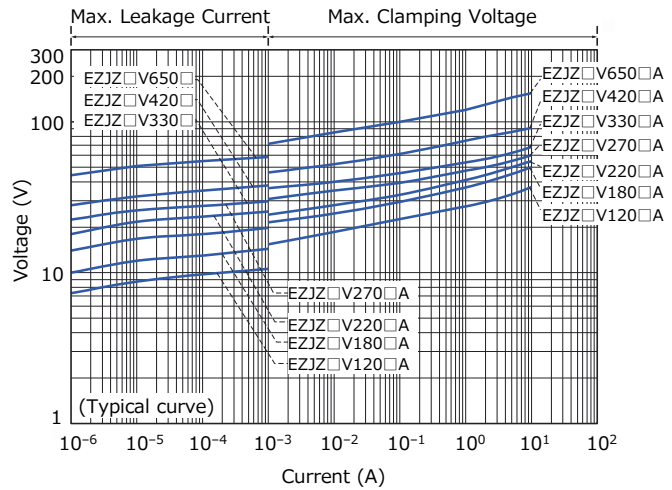
Maximum Allowable Voltage	Maximum DC Voltage that can be applied continuously within the operating temperature range
Varistor Voltage	Varistor starting voltage between terminals at DC 1 mA, also known as Breakdown voltage
Maximum Peak Current	Maximum current that can be withstood under the standard pulse 8/20 μs, 2 times based
Maximum ESD	Maximum voltage that can be withstood under ESD based on IEC61000-4-2, 10 times (5 times of each positive-negative polarity)

Voltage vs. Current

● EZJP Series

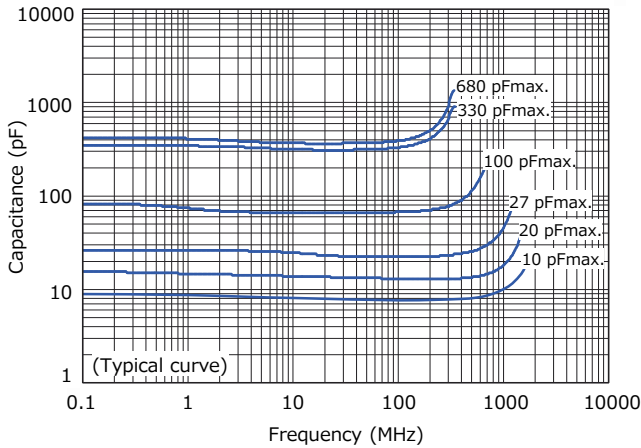


● EZJZ Series

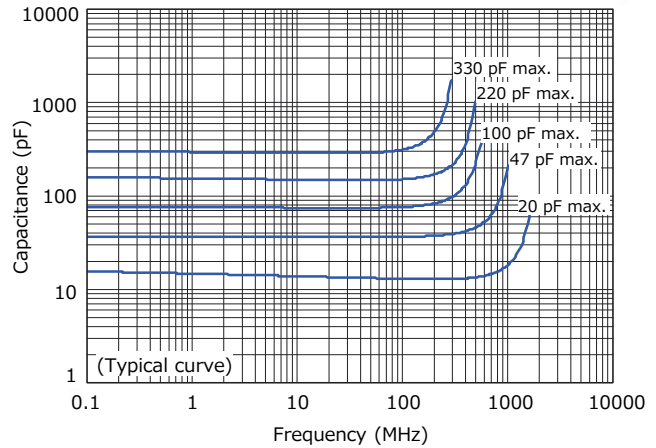


Capacitance vs. Frequency

● EZJP Series

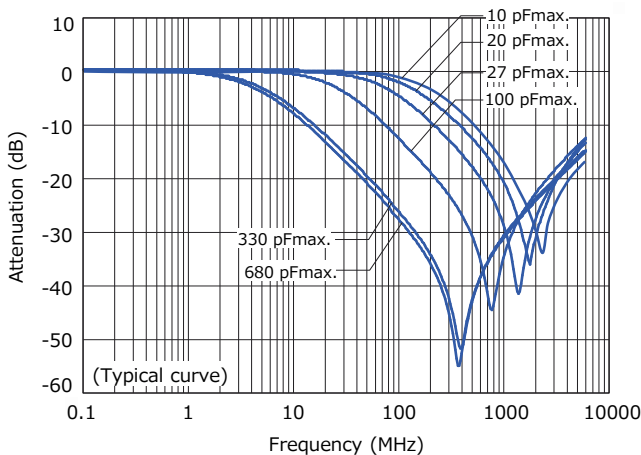


● EZJZ Series

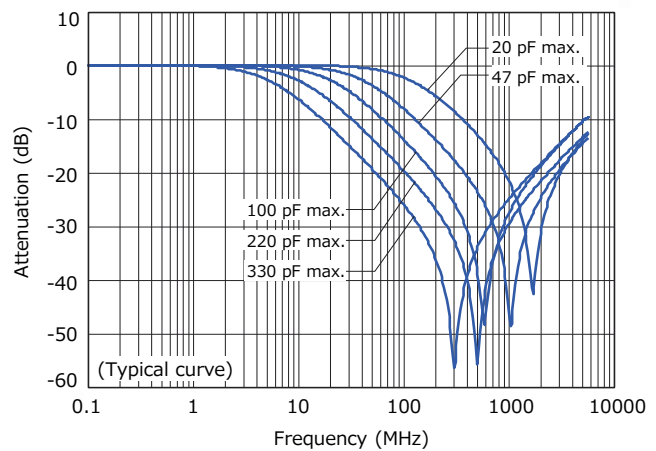


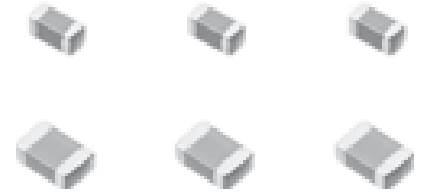
Attenuation vs. Frequency

● EZJP Series



● EZJZ Series





Multilayer Varistor for ESD pulse [DC voltage lines]

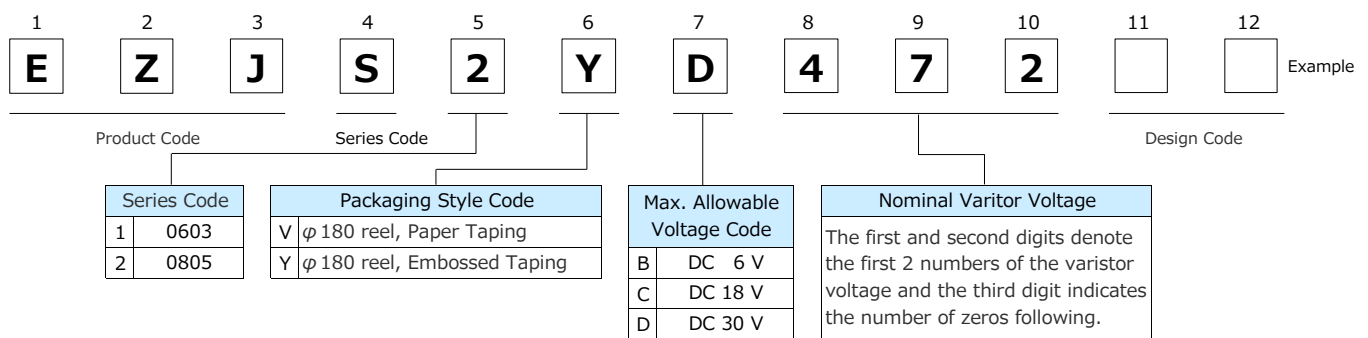
Series: **EZJS**

Features

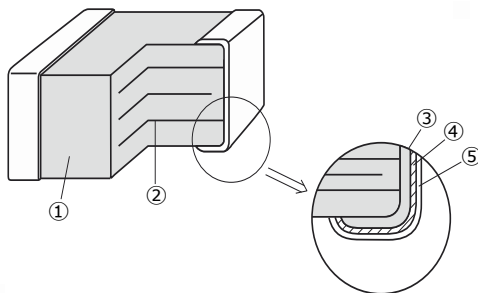
- Excellent ESD suppression due to original advanced material technology
- Having large electrostatic resistance meeting IEC61000-4-2, Special Level 30 kV standard
- Having no polarity (bipolar) facilitated replacing Zener Diodes. Capable of replacing 2 Zener Diodes and 1 Capacitor.
- Lead-free plating terminal electrodes enabling great solderability
- RoHS compliant

■ As for Packaging Methods, Handling Precautions Please see Data Files

Explanation of Part Numbers

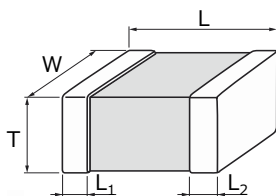


Construction



No.	Name	
①	Semiconductive Ceramics	
②	Internal electrode	
③	Terminal electrode	Substrate electrode
④		Intermediate electrode
⑤		External electrode

Dimensions in mm (not to scale)



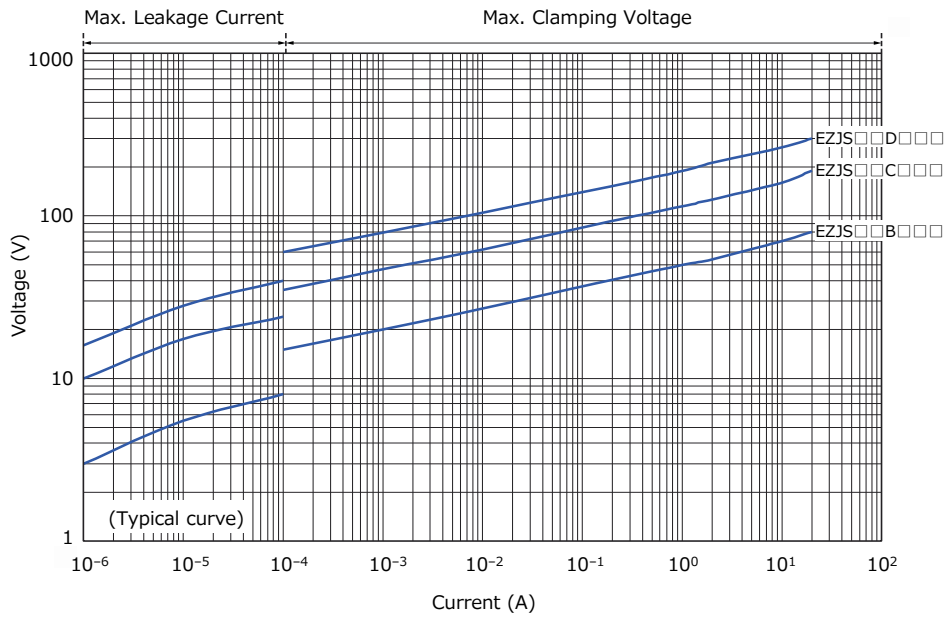
Size Code	Size(inch)	L	W	T	L ₁ , L ₂
1	0603	1.60±0.15	0.8±0.1	0.8±0.1	0.3±0.2
2	0805	2.0±0.2	1.25±0.20	0.8±0.2	0.50±0.25
				1.25±0.20	

Ratings and Characteristics

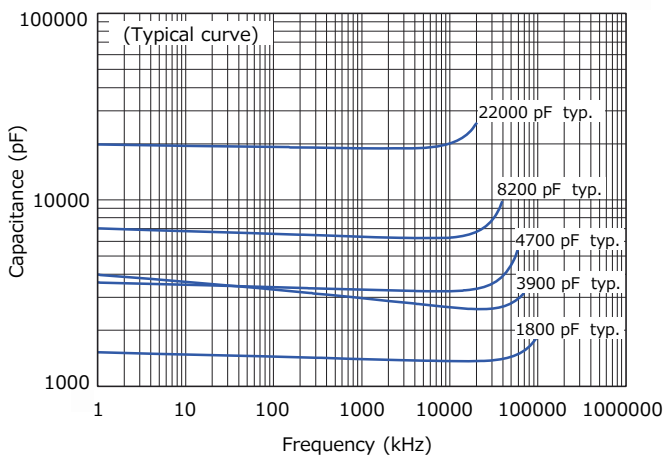
Size(inch)	Part No.	Maximum allowable voltage DC (V)	Nominal varistor voltage at 0.1 mA (V)	Capacitance at 1 kHz (pF)	Maximum ESD IEC61000-4-2
0603	EZJS1VB822	6	12	8200 typ.	Contact discharge : 30 kV
	EZJS1VC392	18	30	3900 typ.	
	EZJS1VD182	30	50	1800 typ.	
0805	EZJS2VB223	6	12	22000 typ.	
	EZJS2YC822	18	30	8200 typ.	
	EZJS2YD472	30	50	4700 typ.	

- Operating Temperature Range : -40 to 85 °C
- * Avoid flow soldering.

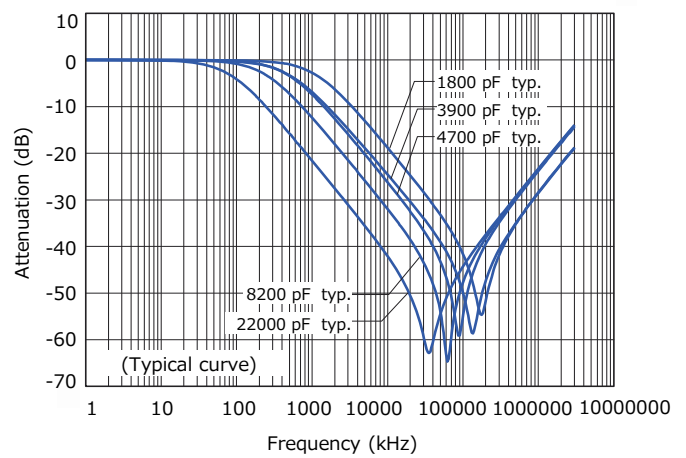
Voltage vs. Current



Capacitance vs. Frequency

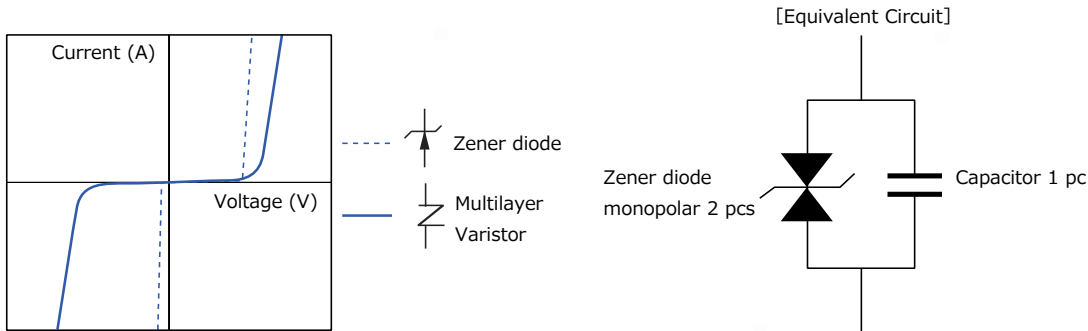


Attenuation vs. Frequency



Varistor Characteristics and Equivalent Circuit

A Multilayer Varistor does not have an electrical polarity like zener diodes and is equivalent to total 3 pcs of 2 zener diodes and 1 capacitor.

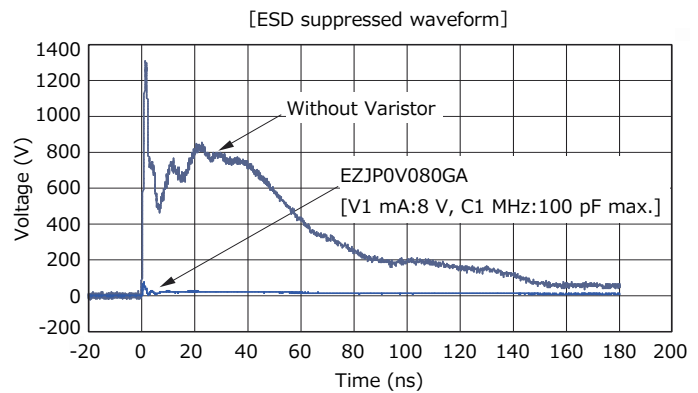
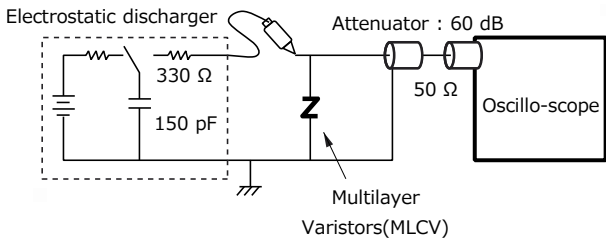


ESD Suppressive Effects

Typical effects of ESD suppression

Test conditions :

IEC61000-4-2* Level4 Contact discharge, 8 kV

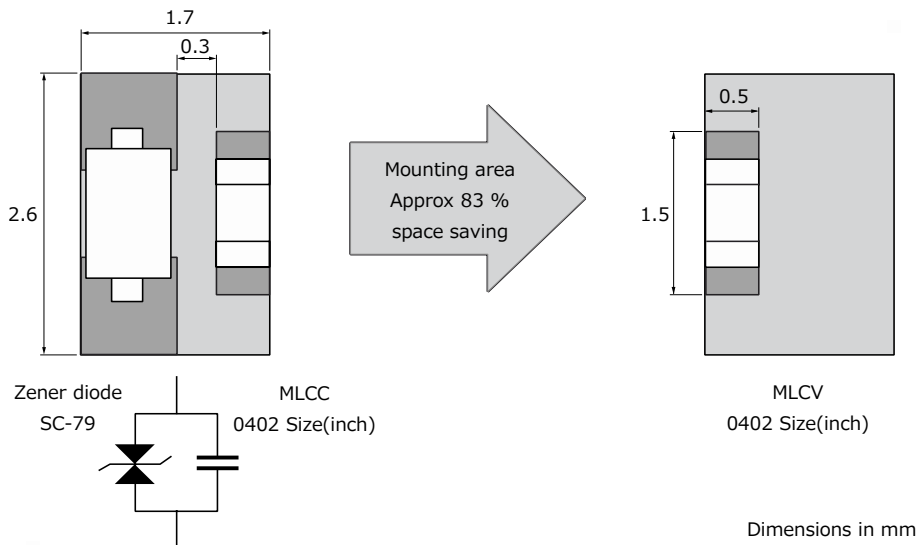


*IEC61000-4-2 ... International Standard of the ESD testing method (HBM) for electronic equipment ability to withstand ESD generated from a human body. It sets 4 levels of severity

Severity	Level 1	Level 2	Level 3	Level 4
Contact discharge	2 kV	4 kV	6 kV	8 kV
Air discharge	2 kV	4 kV	8 kV	15 kV

Replacement of Zener diode

Replacing "Zener diode and Capacitor" with Multilayer Varistor saves both the mounting area and number of components used.

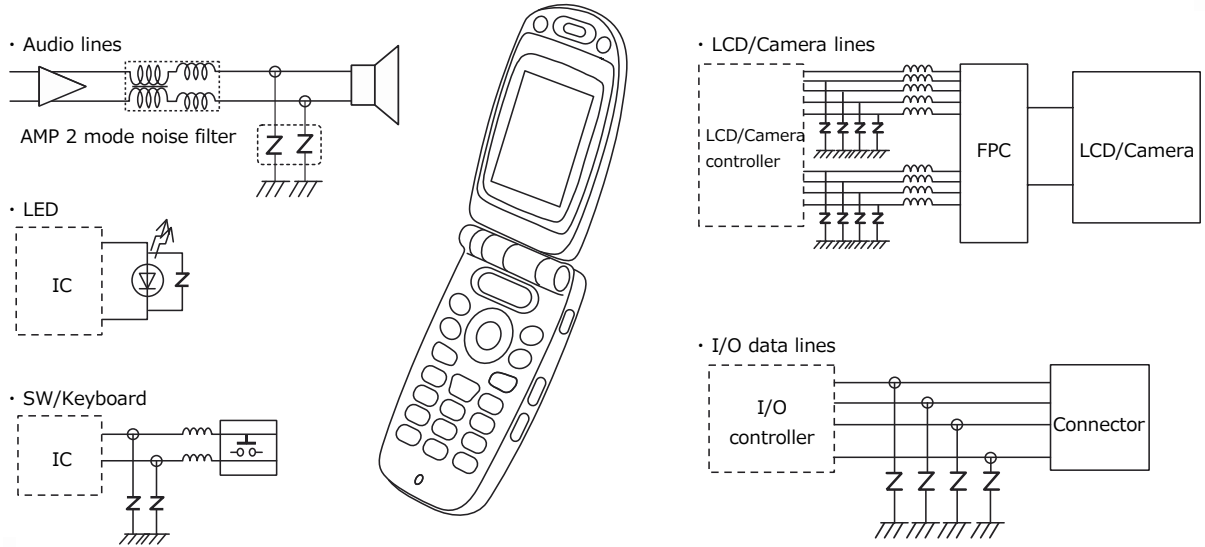


Recommended Applications

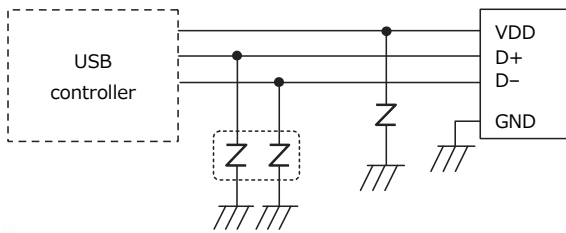
Applications	Series	Circuit			
		DC	1k	1M	1G (Hz)
Mobile phones, DSC, PC, PDA, HDD TV(PDP, LC etc.), DVD, DVC, Game consoles, Audio equipment	EZJZ, P Series	Ultra low capacitance (Cap. : 3 pF or less)	[Bar chart showing high performance from DC to GHz]		
		Low capacitance (Cap. : 20 to 680 pF)	[Bar chart showing performance from DC to tens of Hz]		
PWR, Photoelectric sensors, SSR, Motors, Pressure sensors, Proximity switches	EZJS Series	High capacitance (Cap. : 1800 to 22000 pF)	[Bar chart showing performance from DC to several kHz]		

Applications

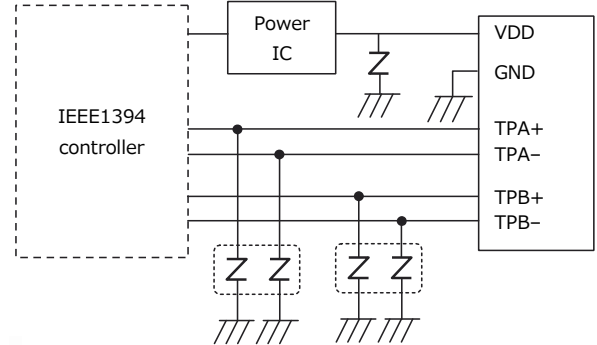
● Mobile Phone



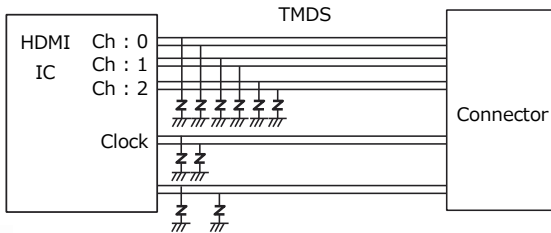
● USB1.1/2.0 lines



● IEEE1394 lines



● HDMI lines



Performance and Testing Methods

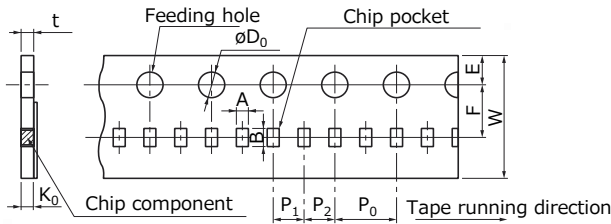
Characteristics	Specifications	Testing Method															
Standard test conditions		Electrical characteristics shall be measured under the following conditions. Temp. : 5 to 35 °C, Relative humidity : 85 % or less															
Varistor voltage	To meet the specified value.	The Varistor voltage is the voltage (V_{C_r} or $V_{C_{mA}}$) between both end terminals of a Varistor when specified current (C_{mA}) is applied to it. The measurement shall be made as quickly as possible to avoid heating effects.															
Maximum allowable voltage	To meet the specified value.	The maximum DC voltage that can be applied continuously to a varistor.															
Capacitance	To meet the specified value.	Capacitance shall be measured at the specified frequency, bias voltage 0 V, and measuring voltage 0.2 to 2.0 V _{rms}															
Maximum peak current	To meet the specified value.	The maximum current measured (Varistor voltage tolerance is within ±10 %) when a standard impulse current of 8/20 μ seconds is applied twice with an interval of 5 minutes.															
Maximum ESD	To meet the specified value.	The maximum ESD measured (while the varistor voltage is within ±30 % of its nominal value) when exposed to ESD 10 times (five times for each positive-negative polarity) based on IEC61000-4-2.															
Solder ability	To meet the specified value.	The part shall be immersed into a soldering bath under the conditions below. Solder : Sn-3.0Ag-0.5Cu Soldering flux : Ethanol solution of rosin (Concentration approx. 25 wt%) Soldering temp. : 230 ± 5 °C Period : 4 ± 1 s Soldering position : Immerse both terminal electrodes until they are completely into the soldering bath.															
Resistance to soldering heat	$\Delta V_c/V_c$: within ±10 %	After the immersion, leave the part for 24 ± 2 hours under the standard condition, then evaluate its characteristics. Soldering conditions are specified below: Soldering conditions : 270 °C , 3 s / 260 °C , 10 s Soldering position : Immerse both terminal electrodes until they are completely into the soldering bath.															
Temperature cycling	$\Delta V_c/V_c$: within ±10 %	After repeating the cycles stated below for specified number of times, leave the part for 24±2 hours, then evaluate its characteristics. Cycle : 5 cycles <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Period</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Max. Operating Temp.</td> <td>30±3 min</td> </tr> <tr> <td>2</td> <td>Ordinary temp.</td> <td>3 min max.</td> </tr> <tr> <td>3</td> <td>Min. Operating Temp.</td> <td>30±3 min</td> </tr> <tr> <td>4</td> <td>Ordinary temp.</td> <td>3 min max.</td> </tr> </tbody> </table>	Step	Temperature	Period	1	Max. Operating Temp.	30±3 min	2	Ordinary temp.	3 min max.	3	Min. Operating Temp.	30±3 min	4	Ordinary temp.	3 min max.
Step	Temperature	Period															
1	Max. Operating Temp.	30±3 min															
2	Ordinary temp.	3 min max.															
3	Min. Operating Temp.	30±3 min															
4	Ordinary temp.	3 min max.															
Biased Humidity	$\Delta V_c/V_c$: within ±10 %	After conducting the test under the conditions specified below, leave the part 24±2 hours, then evaluate its characteristics. Temp. : 40 ± 2 °C Humidity : 90 to 95 %RH Applied voltage : Maximum allowable voltage (Individually specified) Period : 500+24/0 h															
High temperature exposure (dry heat)	$\Delta V_c/V_c$: within ±10 %	After conducting the test under the conditions specified below, leave the part 24±2 hours, then evaluate its characteristics. Temp. : Maximum operating temperature ±3 °C (Individually specified) Applied voltage : Maximum allowable voltage (Individually specified) Period : 500+24/0 h															

Packaging Methods (Taping)

● Standard Quantity

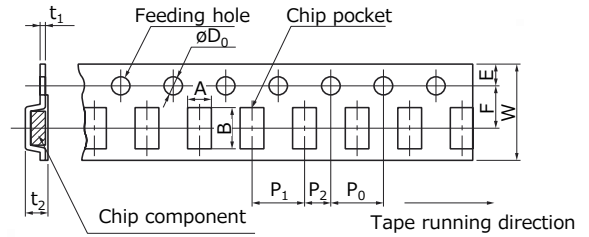
Series	Size Code (inch size)	Thickness (mm)	Kind of Taping	Pitch (mm)	Quantity (pcs/reel)
EZJZ, EZJP	Z(0201)	0.3	Pressed Carrier Taping	2	15,000
	0(0402)	0.5			10,000
	1(0603)	0.8	Punched Carrier Taping	4	4,000
EZJS	1(0603)	0.8			4,000
	2(0805)	0.8			5,000
		1.25	Embossed Carrier Taping		2,000

● 2 mm Pitch (Pressed Carrier Taping) Size 0201



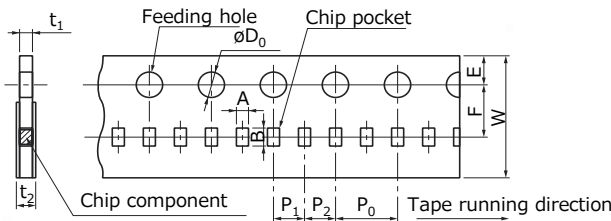
	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t	K ₀
Unit (mm)	0.36 ±0.03	0.66 ±0.03	8.0 ±0.2	3.50 ±0.05	1.75 ±0.10	2.00 ±0.05	2.00 ±0.05	4.0 ±0.1	1.5 +0.1 / 0	0.55 max	0.36 ±0.03

● 4 mm pitch (Embossed Carrier Taping) Size 0805



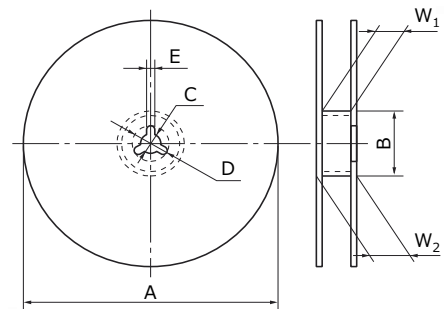
	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
Unit (mm)	1.55 ±0.20	2.35 ±0.20	8.0 ±0.2	3.50 ±0.05	1.75 ±0.10	4.0 ±0.1	2.00 ±0.05	4.0 ±0.1	1.5 +0.1 / 0	0.6 max	1.5 max

● 2 mm Pitch (Punched Carrier Taping) Size 0402



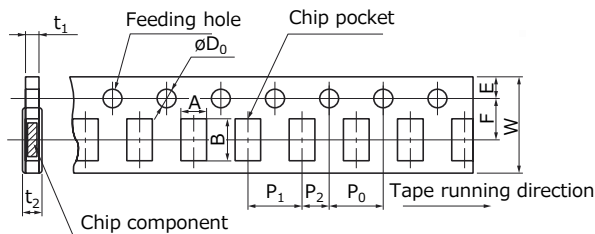
	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
Unit (mm)	0.62 ±0.05	1.12 ±0.05	8.0 ±0.2	3.50 ±0.05	1.75 ±0.10	2.00 ±0.05	2.00 ±0.05	4.0 ±0.1	1.5 +0.1 / 0	0.7 max	1.0 max

● Reel for Taping



	A	B	C	D	E	W ₁	W ₂
Unit (mm)	ø180 ⁰ / -3	ø60.0 ^{+1.0} / 0	13.0 ±0.5	21.0 ±0.8	2.0 ±0.5	9.0 ^{+1.0} / 0	11.4 ±1.0

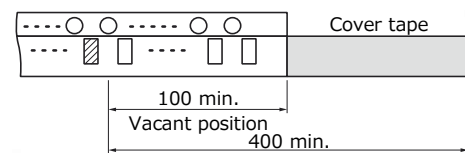
● 4 mm Pitch (Punched Carrier Taping) Size 0603, 0805, 0504/2 Array



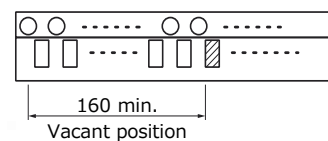
Size Code (inch size)	A	B	W	F	E	P ₁	P ₂	P ₀	øD ₀	t ₁	t ₂
1 (0603)	1.0 ±0.1	1.8 ±0.1									
S (0504 2 Array)	1.18 ±0.10	1.63 ±0.10	8.0 ±0.2	3.50 ±0.05	1.75 ±0.10	4.0 ±0.1	2.00 ±0.05	4.0 ±0.1	1.5 +0.1 / 0	1.1 max	1.4 max
2 (0805)	1.65 ±0.20	2.4 ±0.2									

● Leader Part and Taped End

Leader part



Tape end



Unit (mm)

Multilayer Varistors, Chip Type

Series: EZJZ, EZJP (For DC voltage lines, high speed signal lines)

Series: EZJS (For DC voltage lines)

Handling Precautions

[Precautions]

- **Do not use the products beyond the descriptions in this product catalog.**
- **This product catalog guarantees the quality of the products as individual components. Before you use the products, please make sure to check and evaluate the products in the circumstance where they are installed in your product.**

Safety Precautions

Multilayer Varistors (hereafter referred to as “Varistors”) should be used for general purpose applications as countermeasures against ESD and noise found in consumer electronics (audio/visual, home, office, information & communication) equipment. When subjected to severe electrical, environmental, and/or mechanical stress beyond the specifications, as noted in the Ratings and Specified Conditions section, the Varistors’ performance may be degraded, or become failure mode, such as short circuit mode and open-circuit mode.

If you use under the condition of short-circuit, heat generation of Varistors will occur by running large current due to application of voltage. There are possibilities of smoke emission, substrate burn-out, and, in the worst case, fire. For products which require high safety levels, please carefully consider how a single malfunction can affect your product. In order to ensure the safety in the case of a single malfunction, please design products with fail-safe, such as setting up protecting circuits, etc.

We are trying to improve the quality and the reliability, but the durability differs depending on the use environment and the use conditions. On use, be sure to confirm the actual product under the actual use conditions.

- For the following applications and conditions, please be sure to consult with our sales representative in advance and to exchange product specifications which conform to such applications.
 - When your application may have difficulty complying with the safety or handling precautions specified below.
 - High-quality and high-reliability required devices that have possibility of causing hazardous conditions, such as death or injury (regardless of directly or indirectly), due to failure or malfunction of the product.
 - ① Aircraft and Aerospace Equipment (artificial satellite, rocket, etc.)
 - ② Submarine Equipment (submarine repeating equipment, etc.)
 - ③ Transportation Equipment (motor vehicles, airplanes, trains, ship, traffic signal controllers, etc.)
 - ④ Power Generation Control Equipment
(atomic power, hydroelectric power, thermal power plant control system, etc.)
 - ⑤ Medical Equipment (life-support equipment, pacemakers, dialysis controllers, etc.)
 - ⑥ Information Processing Equipment (large scale computer systems, etc.)
 - ⑦ Electric Heating Appliances, Combustion devices (gas fan heaters, oil fan heaters, etc.)
 - ⑧ Rotary Motion Equipment
 - ⑨ Security Systems
 - ⑩ And any similar types of equipment

Strict Observance

1. Confirmation of Rated Performance

The Varistors shall be operated within the specified rating/performance.

Applications exceeding the specifications may cause deteriorated performance and/or breakdown, resulting in degradation and/or smoking or ignition of products. The following are strictly observed.

- (1) The Varistors shall not be operated beyond the specified operating temperature range.
- (2) The Varistors shall not be operated in excess of the specified maximum allowable voltage.
- (3) The Varistors shall not be operated in the circuits to which surge current and ESD that exceeds the specified maximum peak current and maximum ESD.
- (4) Never use for AC power supply circuits.

2. The Varistors shall not be mounted near flammables.

Operating Conditions and Circuit Design

1. Circuit Design

1.1 Operating Temperature and Storage Temperature

When operating a components-mounted circuit, please be sure to observe the "Operating Temperature Range", written in delivery specifications. Storage temperature of PCB after mounting Varistors, which is not operated, should be within the specified "Storage Temperature Range" in the delivery specifications. Please remember not to use the product under the condition that exceeds the specified maximum temperature.

1.2 Operating Voltage

The Varistors shall not be operated in excess of the "Maximum allowable voltage". If the Varistors are operated beyond the specified Maximum allowable voltage, it may cause short and/or damage due to thermal run away. The circuit that continuously applies high frequency and/or steep pulse voltage please examines the reliability of the Varistor even if it is used within a "Maximum allowable voltage". Also, it would be safer to check also the safety and reliability of your circuit.

1.3 Self-heating

The surface temperature of the Varistors shall be under the specified Maximum Operating Temperature in the Specifications including the temperature rise caused by self-heating. Check the temperature rise of the Varistor in your circuit.

1.4 Environmental Restrictions

The Varistors does not take the use under the following special environments into consideration. Accordingly, the use in the following special environments, and such environmental conditions may affect the performance of the product; prior to use, verify the performance, reliability, etc. thoroughly.

- ① Use in liquids such as water, oil, chemical, and organic solvent.
- ② Use under direct sunlight, in outdoor or in dusty atmospheres.
- ③ Use in places full of corrosive gases such as sea breeze, Cl₂, H₂S, NH₃, SO₂, and NOx.
- ④ Use in environment with large static electricity or strong electromagnetic waves or strong radial ray.
- ⑤ Where the product is close to a heating component, or where an inflammable such as a polyvinyl chloride wire is arranged close to the product.
- ⑥ Where this product is sealed or coated with resin etc.
- ⑦ Where solvent, water, or water-soluble detergent is used in flux cleaning after soldering.
(Pay particular attention to water-soluble flux.)
- ⑧ Use in such a place where the product is wetted due to dew condensation.
- ⑨ Use the product in a contaminated state.
Ex.) Do not handle the product such as sticking sebum directly by touching the product after mounting printed circuit board.
- ⑩ Under severe conditions of vibration or impact beyond the specified conditions found in the Specifications.

2. Design of Printed Circuit Board

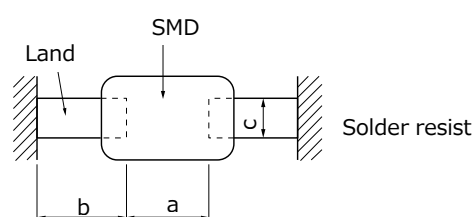
2.1 Selection of Printed Circuit Boards

There is a possibility of performance deterioration by heat shock (temperature cycles), which causes cracks, from alumina substrate. Please confirm that the substrate you use does not deteriorate the Varistors' quality.

2.2 Design of Land Pattern

- 1) Recommended land dimensions are shown below. Use the proper amount of solder in order to prevent cracking. Using too much solder places excessive stress on the Varistors.

Recommended Land Dimensions(Ex.)

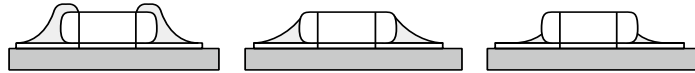


Size Code/EIA	Component dimensions			Unit (mm)		
	L	W	T	a	b	c
Z(0201)	0.6	0.3	0.3	0.2 to 0.3	0.25 to 0.30	0.2 to 0.3
0(0402)	1.0	0.5	0.5	0.4 to 0.5	0.4 to 0.5	0.4 to 0.5
1(0603)	1.6	0.8	0.8	0.8 to 1.0	0.6 to 0.8	0.6 to 0.8
2(0805)	2.0	1.25	0.8 to 1.25	0.8 to 1.2	0.8 to 1.0	0.8 to 1.0

(2) The land size shall be designed to have equal space, on both right and left side. If the amount of solder on the right land is different from that of the left land, the component may be cracked by stress since the side with a larger amount of solder solidifies later during cooling.

Recommended Amount of Solder

(a) Excessive amount (b) Proper amount (c) Insufficient amount



2.3 Utilization of Solder Resist

- (1) Solder resist shall be utilized to equalize the amounts of solder on both sides.
- (2) Solder resist shall be used to divide the pattern for the following cases;
 - Components are arranged closely.
 - The Varistor is mounted near a component with lead wires.
 - The Varistor is placed near a chassis.

See the table right.

Prohibited Applications and Recommended Applications

Item	Prohibited applications	Improved applications by pattern division
Mixed mounting with a component with lead wires	The lead wire of a Component With lead wires 	Solder resist
Arrangement near chassis	Chassis Solder(ground solder) Electrode pattern 	Solder resist
Retro-fitting of component with lead wires	A lead wire of Retrofitted component Soldering iron iron 	Solder resist
Lateral arrangement	Portion to be Excessively soldered Land 	Solder resist

2.4 Component Layout

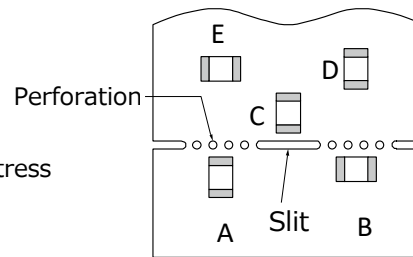
To prevent the crack of Varistors, place it on the position that could not easily be affected by the bending stress of substrate while going through procedures after mounting or handling.

- (1) To minimize mechanical stress caused by the warp or bending of a PC board, please follow the recommended Varistors' layout below.

Prohibited layout	Recommended layout
	 Layout the Varistors sideways against the stressing direction.

- (2) The following layout is for your reference since mechanical stress near the dividing/breaking position of a PC board varies depending on the mounting position of the Varistors.

Magnitude of stress
 $A > B = C > D > E$



- (3) The magnitude of mechanical stress applied to the Varistors when dividing the circuit board in descending order is as follows: push back < slit < V-groove < perforation. Also take into account the layout of the Varistors and the dividing/breaking method.

2.5 Mounting Density and Spaces

Intervals between components should not be too narrow to prevent the influence from solder bridges and solder balls. The space between components should be carefully determined.

Precautions for Assembly

1. Storage

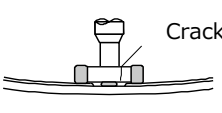
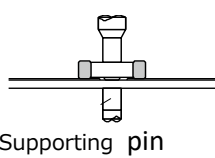
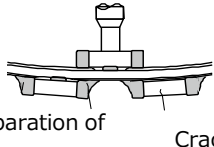
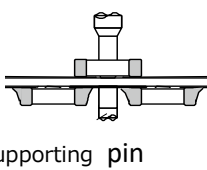
- (1) The Varistors shall be stored between 5 to 40 °C and 20 to 70 % RH, not under severe conditions of high temperature and humidity.
- (2) If stored in a place where humidity, dust, or corrosive gasses (hydrogen sulfide, sulfurous acid, hydrogen chloride and ammonia, etc.) are contained, the solderability of terminal electrodes will be deteriorated. In addition, storage in a place where the heat or direct sunlight exposure occurs will cause mounting problems due to deformation of tapes and reels and components and taping/reels sticking together.
- (3) Do not store components longer than 6 months. Check the solderability of products that have been stored for more than 6 months before use.

2. Adhesives for Mounting

- (1) The amount and viscosity of an adhesive for mounting shall be such that the adhesive will not flow off on the land during its curing.
- (2) If the amount of adhesive is insufficient for mounting, the Varistors may fall off after or during soldering.
- (3) Low-viscosity of the adhesive causes displacement of Varistors.
- (4) The heat-curing methods for adhesive are ultraviolet radiation, far-infrared radiation, and so on. In order to prevent the terminal electrodes of the Varistors from oxidizing, the curing shall be under the following conditions: 160 °C max., for 2 minutes max.
- (5) Insufficient curing may cause the Varistors to fall off after or during soldering. In addition, insulation resistance between terminal electrodes may deteriorate due to moisture absorption. In order to prevent these problems, please observe proper curing conditions.

3. Chip Mounting Consideration

- (1) When mounting the Varistors components on a PC board, the Varistor bodies shall be free from excessive impact loads such as mechanical impact or stress due to the positioning, pushing force and displacement of vacuum nozzles during mounting.
- (2) Maintenance and inspection of the Chip Mounter must be performed regularly.
- (3) If the bottom dead center of the vacuum nozzle is too low, the Varistor will crack from excessive force during mounting. Please refer to the following precautions and recommendations.
 - (a) Set and adjust the bottom dead center of the vacuum nozzles to the upper surface of the PC board after correcting the warp of the PC board.
 - (b) Set the pushing force of the vacuum nozzle during mounting to 1 to 3 N in static load.
 - (c) For double surface mounting, apply a supporting pin on the rear surface of the PC board to suppress the bending of the PC board in order to minimize the impact of the vacuum nozzles. Typical examples are shown in the table below secondary.
 - (d) Adjust the vacuum nozzles so that their bottom dead center during mounting is not too low.

Item	Prohibited mounting	Recommended mounting
Single surface mounting	 Crack	 Supporting pin The supporting pin does not necessarily have to be positioned
Double surface mounting	 Separation of Crack	 Supporting pin

- (4) The closing dimensions of the positioning chucks shall be controlled. Maintenance and replacement of positioning chucks shall be performed regularly to prevent chipping or cracking of the Varistors caused by mechanical impact during positioning due to worn positioning chucks.
- (5) Maximum stroke of the nozzle shall be adjusted so that the maximum bending of PC board does not exceed 0.5 mm at 90 mm span. The PC board shall be supported by an adequate number of supporting pins.

4. Selection of Soldering Flux

Soldering flux may seriously affect the performance of the Varistors. Please confirm enough whether the soldering flux have an influence on performance of the Varistors or not, before using.

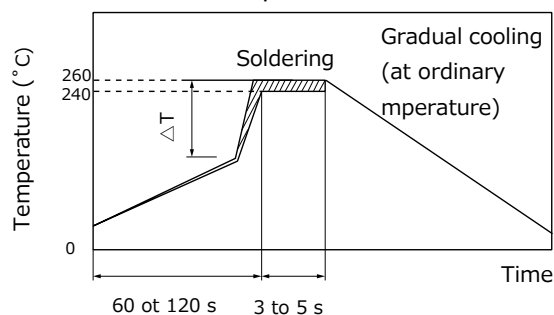
5. Soldering

5.1 Flow Soldering

When conducting flow soldering, stress from abrupt temperature change is applied to the Varistors, so the temperature, especially temperature of solder should be controlled very carefully. Varistors should not be subjected to abrupt temperature change because it causes occurrence of thermal cracks as a result of excessive thermal stress inside of the Varistors from flow soldering. You should be careful to temperature difference. Therefore it is essential that soldering process follow these recommended conditions.

- (1) Application of Soldering flux :
The soldering flux shall be applied to the mounted Varistors thinly and uniformly by foaming method.
- (2) Preheating : Conduct sufficient pre-heating, and make sure that the temperature difference between solder and Varistors' surface is 150 °C or less.
- (3) Immersion into Soldering bath :
The Varistors shall be immersed into a soldering bath of 240 to 260 °C for 3 to 5 seconds.
- (4) Gradual Cooling : After soldering, avoid rapid cooling (forced cooling) and conduct gradual cooling, so that thermal cracks do not occur.
- (5) Flux Cleaning : When the Varistors are immersed into a cleaning solvent, be sure that the surface temperatures of devices do not exceed 100 °C.
- (6) Performing flow soldering once under the conditions shown in the figure below
[Recommended profile of Flow soldering (Ex.)] will not cause any problems.
However, pay attention to the possible warp and bending of the PC board.

Recommended profile of Flow Soldering (Ex.)



<ΔT: Allowable temperature difference>

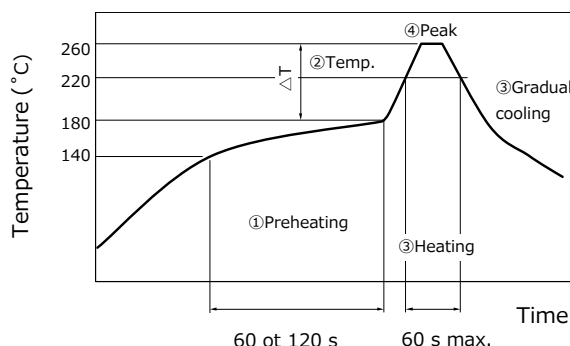
Size/EIA	Temp. Tol.
0603	T ≤ 150 °C

For products specified in individual specifications, avoid flow soldering.

5.2 Reflow Soldering

The reflow soldering temperature conditions are composed of temperature curves of Preheating, Temp. rise, Heating, Peak and Gradual cooling. Large temperature difference inside the Varistors caused by rapid heat application to the Varistors may lead to excessive thermal stresses, contributing to the thermal cracks. The Preheating temperature requires controlling with great care so that tombstone phenomenon may be prevented.

Recommended profile of Reflow Soldering (Ex.)



Item	Temperature	Period or Speed
① Preheating	140 to 180 °C	60 to 120 s
② Temp. rise	Preheating temp to Peak temp.	2 to 5 °C / s
③ Heating	220 °C min.	60 s max.
④ Peak	260 °C max.	10 s max.
⑤ Gradual cooling	Peak temp. to 140 °C	1 to 4 °C / s

Size/EIA	Temp. Tol.
0201 to 0805	T ≤ 150 °C

ΔT : Allowable temperature difference $\Delta T \leq 150$ °C

The rapid cooling (forced cooling) during Gradual cooling part should be avoided, because this may cause defects such as the thermal cracks, etc. When the Varistors are immersed into a cleaning solvent, make sure that the surface temperatures of the devices do not exceed 100 °C. Performing reflow soldering twice under the conditions shown in the figure above [Recommended profile of Flow soldering (Ex.)] will not cause any problems.

However, pay attention to the possible warp and bending of the PC board.

Recommended soldering condition is for the guideline for ensuring the basic characteristics of the components, not for the stable soldering conditions. Conditions for proper soldering should be set up according to individual conditions. The temperature of this product at the time of mounting changes depending on mounting conditions, therefore, please confirm that Product surface becomes the specified temperature when mounting it on the end product.

5.3 Hand Soldering

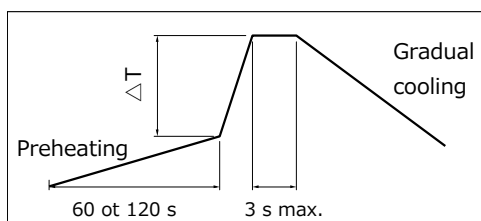
Hand soldering typically causes significant temperature change, which may induce excessive thermal stresses inside the Varistors, resulting in the thermal cracks, etc. In order to prevent any defects, the following should be observed.

- Control the temperature of the soldering tips with special care.
- Avoid the direct contact of soldering tips with the Varistors and/or terminal electrodes.
- Do not reuse dismantled Varistors.

(1) Condition 1 (with preheating)

- Soldering : Use thread solder ($\phi 1.0$ mm or below) which contains flux with low chlorine, developed for precision electronic equipment.
- Preheating : Conduct sufficient preheating, and make sure that the temperature difference between solder and Varistors' surface is 150 °C or less.
- Temperature of Iron tip: 300 °C max.
(The required amount of solder shall be melted in advance on the soldering tip.)
- Gradual cooling : After soldering, the Varistors shall be cooled gradually at room temperature.

Recommended profile of Hand soldering (Ex.)



ΔT : Allowable temperature difference $\Delta T \leq 150$ °C

(2) Condition 2 (without preheating)

Hand soldering can be performed without preheating, by following the conditions below:

- (a) Soldering iron tip shall never directly touch the ceramic and terminal electrodes of the Varistors.
- (b) The lands are sufficiently preheated with a soldering iron tip before sliding the soldering iron tip to the terminal electrodes of the Varistors for soldering.

Conditions of Hand soldering without preheating

Item	Condition
Temperature of Iron tip	270 °C max.
Wattage	20 W max.
Shape of Iron tip	∅ 3 mm max.
Soldering time with a soldering iron	3 s max.

6. Post Soldering Cleaning

6.1 Cleaning solvent

Soldering flux residue may remain on the PC board if cleaned with an inappropriate solvent. This may deteriorate the performance of Varistors, especially insulation resistance.

6.2 Cleaning conditions

Inappropriate cleaning conditions such as insufficient cleaning or excessive cleaning may impair the electrical characteristics and reliability of the Varistors.

(1) Insufficient cleaning can lead to :

- (a) The halogen substance found in the residue of the soldering flux may cause the metal of terminal electrodes to corrode.
- (b) The halogen substance found in the residue of the soldering flux on the surface of the Varistors may change resistance values.
- (c) Water-soluble soldering flux may have more remarkable tendencies of (a) and (b) above compared to those of rosin soldering flux.

(2) Excessive cleaning can lead to :

- (a) When using ultrasonic cleaner, make sure that the output is not too large, so that the substrate will not resonate. The resonance causes the cracks in Varistors and/or solders, and deteriorates the strength of the terminal electrodes. Please follow these conditions for Ultrasonic cleaning:
 - Ultrasonic wave output : 20 W/L max.
 - Ultrasonic wave frequency : 40 kHz max.
 - Ultrasonic wave cleaning time : 5 min. max.

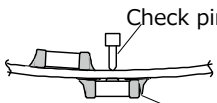
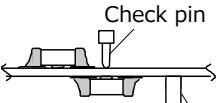
6.3 Contamination of Cleaning solvent

Cleaning with contaminated cleaning solvent may cause the same results as that of insufficient cleaning due to the high density of liberated halogen.

7. Inspection Process

The pressure from measuring terminal pins might bend the PCB when implementing circuit inspection after mounting Varistors on PCB, and as a result, cracking may occur.

- (1) Mounted PC boards shall be supported by an adequate number of supporting pins on the back with bend settings of 90 mm span 0.5 mm max.
- (2) Confirm that the measuring pins have the right tip shape, are equal in height, have the right pressure and are set in the correct positions. The following figures are for your reference to avoid bending the PC board.

Item	Prohibited mounting	Recommended mounting
Bending of PC board	 <p>Separated, Crack</p>	 <p>Supporting pin</p>

8. Protective Coating

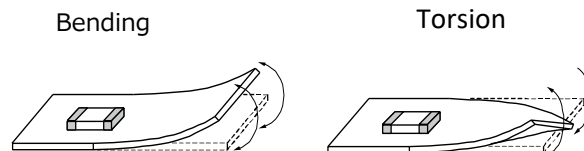
Make sure characteristics and reliability when using the resin coating or resin embedding for the purpose of improvement of humidity resistance or gas resistance, or fixing of parts because failures of a thermistors such as 1) ,2) and 3) may be occurred.

- (1) The solvent which contained in the resin permeate into the Varistors, and it may deteriorate the characteristic.

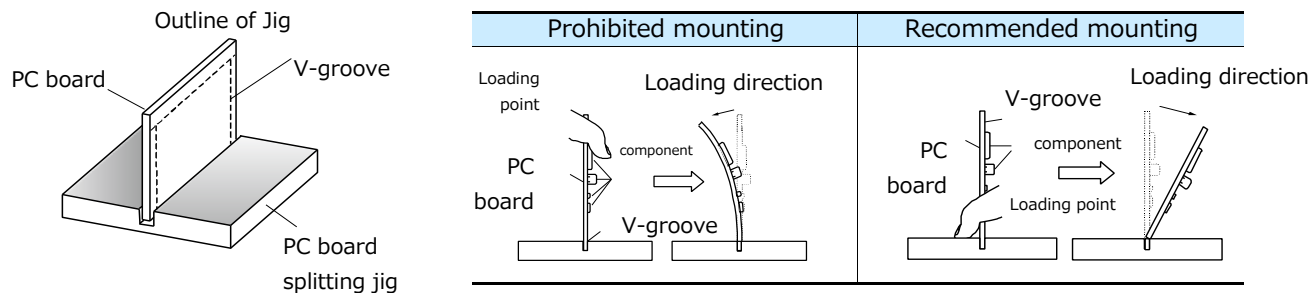
- (2) When hardening the resin, chemical reaction heat (curing heat generation) happen and it may occurs the infection to the Varistors.
- (3) The lead wire might be cut down and the soldering crack might be happen by expansion or contraction of resin hardening.

9. Dividing/Breaking of PC Boards

- (1) Please be careful not to stress the substrate with bending/twisting when dividing, after mounting components including Varistors. Abnormal and excessive mechanical stress such as bending or torsion shown below can cause cracking in the Varistors.

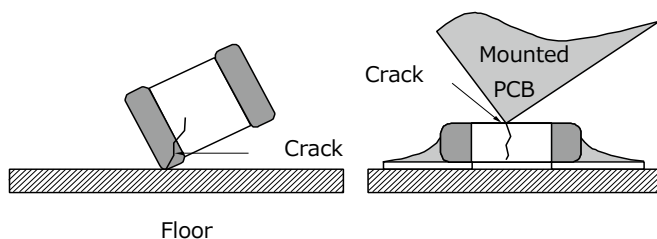


- (2) Dividing/Breaking of the PC boards shall be done carefully at moderate speed by using a jig or apparatus to prevent the Varistors on the boards from mechanical damage.
- (3) Examples of PCB dividing/breaking jigs: The outline of PC board breaking jig is shown below. When PC board are broken or divided, loading points should be close to the jig to minimize the extent of the bending. Also, planes with no parts mounted on should be used as plane of loading, in order to prevent tensile stress induced by the bending, which may cause cracks of the Varistors or other parts mounted on the PC boards.



10. Mechanical Impact

- (1) The Varistors shall be free from any excessive mechanical impact. The Varistor body is made of ceramics and may be damaged or cracked if dropped. Never use a Varistor which has been dropped; their quality may already be impaired, and in that case, failure rate will increase.
- (2) When handling PC boards with Varistors mounted on them, do not allow the Varistors to collide with another PC board. When mounted PC boards are handled or stored in a stacked state, the corner of a PC board might strike Varistors, and the impact of the strike may cause damage or cracking and can deteriorate the withstand voltage and insulation resistance of the Varistor.



11. Do not reuse this product after removal from the mounting board.

Precautions for discarding

As to the disposal of the Varistors, check the method of disposal in each country or region where the modules are incorporated in your products to be used.

Other

The various precautions described above are typical. For special mounting conditions, please contact us.

Applicable laws and regulations , others

1. This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.
2. This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) (DIRECTIVE 2011/65/EU and 2015/863/EU).
3. All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance.
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