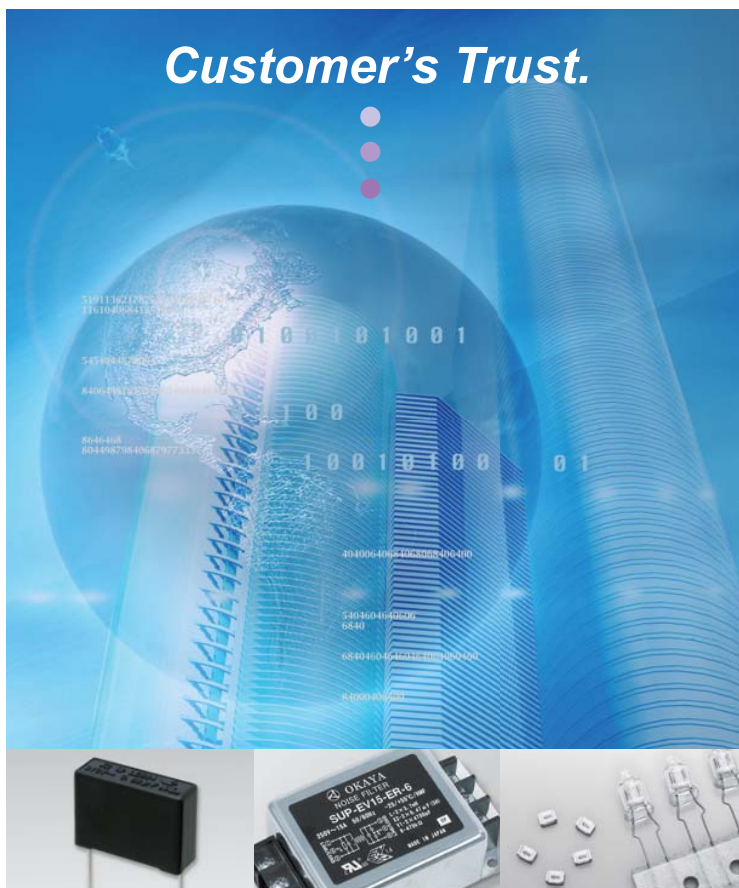


NOISE SUPPRESSING COMPONENTS



OKAYA

Customer's Trust.



<http://www.okayaelec.co.jp>

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NOISE SUPPRESSION CAPACITORS



NOISE SUPPRESSION CAPACITORS



The information provided in this catalog, as well as any additional data supplied by Okaya or Okaya representatives, is for general use only to assist the buyer in making its own independent decision as to the suitability of the products for the buyer's intended use and application.

Except for any limited warranties contained in Okaya Terms and Conditions, OKAYA DISCLAIMS WITH RESPECT TO THEIR GOODS AND DATA AND INFORMATION RELATED TO THEM, ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE.

The specifications contained in this catalog are subject to change without notice.

For improvement, specifications are subject to change without prior notice.

When components are used for special applications requiring high reliability (life maintenance equipment, atomic energy, airplanes, artificial satellites, etc.), contact us beforehand. Also make sure to evaluate and verify the components in a state that they are mounted on actual equipment.

SAFETY STANDARDS

Okaya noise suppression capacitors have been recognized by the following safety standards organizations:

Organization (Country)	Applicable Standard	
	Household Appliances	Office Appliances and others
IEC	PUB 65	PUB 950
UL (U.S.A)	UL60384-14 (capacitor)	UL1283 (filter)
cUL (C.S.A)	CSA E60384-14	C22.2 No.8
CSA (Canada)	CSA E60384-14	C22.2 No.8
VDE (Germany)	IEC/EN 60384-14	IEC/EN 60384-14
ENEC ALL EUROPIAN COUNTRIES	IEC/EN 60384-14	IEC/EN 60384-14
SEV (Switzerland)	IEC/EN 60384-14	IEC/EN 60384-14
BS (Great Britian)	IEC/EN 60384-14	IEC/EN 60384-14
SEMKO (Sweden)	IEC/EN 60384-14	IEC/EN 60384-14
DEMKO (Denmark)	IEC/EN 60384-14	IEC/EN 60384-14
NEMKO (Norway)	IEC/EN 60384-14	IEC/EN 60384-14
FIMKO (Finland)	IEC/EN 60384-14	IEC/EN 60384-14
ÖVE (Austria)	-----	IEC/EN 60384-14
IMQ (Italy)	-----	IEC/EN 60384-14

- Electrical apparatus are classified roughly into two categories, i.e., (a) household appliances and (b) office appliances including office automation (OA) and others.
- The standards for noise suppression capacitors to be used in the household appliances are more strict than those in the office appliances and others.
- The products enumerated in the following pages (with a few exceptions) have been approved under standards applicable to the household appliances, so that you may use them for almost all applications.
In order to avoid any accidents in machine applications which may experience unexpected abnormal surge voltage, or which are subjected to continuous 24-hour use, it is necessary to build in an extra measure of reliability. Here, the strict test conditions conducted by the above-mentioned safety standards organizations can be considered as one of the criteria from a reliability point of view.
- The product should be selected on the basis of a thorough consideration of such safety standards according to its application.



NOISE SUPPRESSION CAPACITORS



OUTLINE OF CAPACITOR CLASS RATINGS

Capacitors are classified by the IEC into two categories (these designations are used by most European countries).

Class Y: Capacitors used in applications where damage to the capacitor may involve danger of electrical shock.

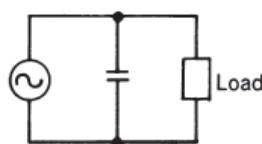
Class X: Capacitors used in applications where damage to the capacitor will not lead to the danger of electrical shock.

These X and Y Classifications are further divided into subcategories as shown in the tables.
(Ref. IEC60384-14, 2nd edition, 1993)

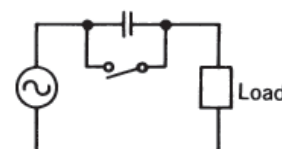
Subclass	Peak Voltage	IEC 664 Category	Application
X1	>2,500V <4,000V	III	Hi-pulse
X2	<2,500V	II	General
X3	<1,200V	I	General

Subclass	Type Insulation	Voltage Range	Peak Voltage
Y1	Double	<500V	8,000V
Y2	Basic	>150V <300V	5,000V
Y3	Basic	>150V <150V	None
Y4	Basic	<250V	2,500V

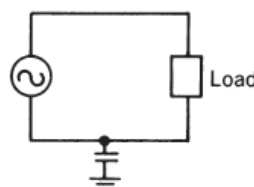
In addition, in North America, Designations of Across-the-Line capacitors, Antenna couplings, and Line bypass capacitors refer to the following applications:



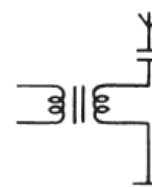
Class X: Across-the-line



Class X: Across-the-line



Class Y: Line bypass



Class Y: Antenna coupling

Okaya characterizes all capacitors using the standard test procedures outlined in JIS C 5102, 5150, 5151. These test parameters are confirmed by a Q.A. audit and are published as guaranteed specifications shown as "dielectric withstanding voltage".

Okaya performs 100% screen testing of all capacitors during the production process. These tests are subject to changes due to improvements in test equipment and procedures and are published for reference only.



NOISE SUPPRESSION CAPACITORS



FEATURES

The design and manufacture of OKAYA AC capacitors incorporates many features which make them superior in noise suppression applications.

Both single and double wound construction of the metallized polyester and polypropylene films insure long term reliability.

Many series are oil impregnated to prevent annoying buzz and hum. This also provides additional protection against "Corona" by eliminating air gaps.

The electrical connection to the metallized film is made via a special multi-element solder which provides excellent surge current withstand capability and a decrease in Dissipation Factor.

The special metallizing method is effective in lowering the level of dv/dt at the boundary between the margin section and the active section, thus improving voltage characteristics and Corona characteristics.

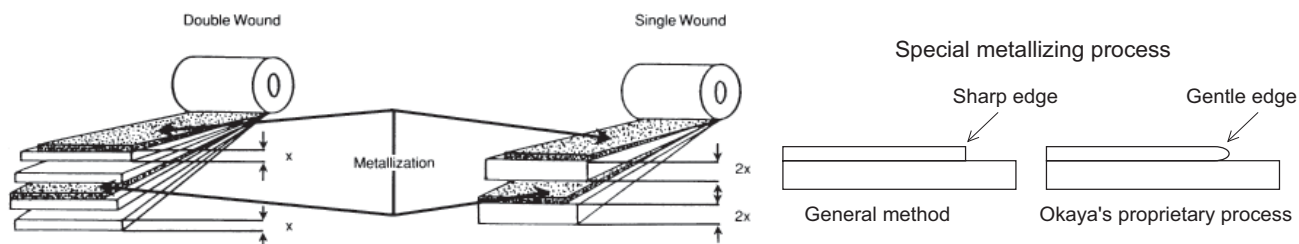
OKAYA's proprietary potting process prevents the outer case of the capacitor from exploding when exposed to "killer surges". Some competitive devices are designated "suitable for use with special enclosure only" by certain safety approval agencies.

OKAYA's AC capacitors employ a case made of FR-PBT (Polybutylene Terephthalate) which is impervious to most cleaning processes. The case and potting material are both rated UL94 Flame Class V-0.

OKAYA has one of the highest dv/dt ratings of any capacitor in its class. In many cases 1.5 to 4 times higher than competitive devices.

The capacitors in the general purpose series have been improved specially in AC voltage withstand characteristics by the Okaya's proprietary process for metallizing dielectric, resulting in smaller size and enhanced safety.

WINDING MELTED



Important point: This gentle edge performs a function of dispersing the level of dv/dt , thus improving voltage characteristics and Corona characteristics.

Part No.	dv/dt at 390Vdc (V/ μ sec)
RE103	400
RE153	400
RE223	400
RE333	400
RE473	200
RE683	200
RE104	200
RE154	200
RE224	200
RE334	100
RE474	100
RE684	100
RE105	100
RE155	100
RE225	100

Part No.	dv/dt at 390Vdc (V/ μ sec)
LE103	400
LE153	400
LE223	400
LE333	400
LE473	150
LE683	150
LE104	150
LE154	150
LE224	150
LE334	150
LE474	100
LE684	100
LE105	100
LE155	100
LE225	100
LE335	70

Part No.	dv/dt at 390Vdc (V/ μ sec)
LE104-MX	150
LE154-MX	150
LE224-MX	150
LE334-MX	150
LE474-MX	100
LE684-MX	100
LE105-MX	100
LE155-MX	70
LE225-MX	70

Part No.	dv/dt at 390Vdc (V/ μ sec)
LE155-K	100
LE225-K	100
LE335-K	100
LE475-K	100
LE685-K	70
LE106-K	70

Part No.	dv/dt at 390Vdc (V/ μ sec)
LE155-K-M	100
LE225-K-M	100
LE335-K-M	70
LE475-K-M	70
LE685-K-M	70
LE106-K-M	70



OKAYA Spark Quenchers have the following characteristics which make it possible to easily use them in a wide range of applications.

- 1) The Overload capacity is large.
- 2) They are not polarized; thus can be used in both AC and DC circuits.
- 3) They have a favorable effect on surge voltage and accompanying oscillations caused by contact chatter.
- 4) They are effective against spurious potentials having magnitudes below circuit voltage.
- 5) They offer a high degree of protection for semiconductor devices, and as thyristors and SCRs.
- 6) They improve the dv/dt ratio.

OUTLINE OF CAPACITOR CLASS RATINGS

Capacitors are classified by the IEC into the following categories (these designations are used by most European countries) :

Class Y: Capacitors used in applications where damage to the capacitor may involve the danger of electrical shock.

Class X: Capacitors used in applications where damage to the capacitor will not lead to the danger of electrical shock.

European Safety Agencies subdivide Class X into X1, X2 and X3 classifications. The test criteria for these subclasses is shown in the table.

Subclass	Peak Voltage on Service	Peak Voltage Test 1.2/50 sec.
X1	>2,500V ≤4,000V	4,000V
X2	≤2,500V	2,500V
X3	≤1,200V	None

RC COMBINATION TABLE

μF	10	27	33	47	50	68	100	120	150	160	200	220	470	500
0.01	XE XEB			XE XEB				XE XEB RE				XE XEB	XE XEB	
0.033	XE XEB AU			XE XEB AU				XE XEB AU RE				XE XEB	XE XEB	
0.1	XE XEB AU			XE XEB AU		CRH		XE XEB AU RE			CRE	XE XEB	XE XEB	
0.2	XE XEB			XE XEB				XE XEB RE				XE XEB		
0.22														
0.3	XE XEB					CRE 3CRE		XE XEB	CRE			XE XEB		
0.33			CRH 3CRH	CRH XE XEB										
0.47		CRH 3CRH												
0.5	XE XEB			XE	CRE 3CRE 6CRE									
1.0	XE XEB													



NOISE SUPPRESSION CAPACITORS

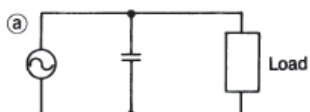


APPLICATION EXAMPLES

Electrical noise, which effects the correct operation of electrical equipment, can originate from sources both external and internal to the product. For example, high frequency noise can be generated by the rotation of a brush motor. As a counter measure to such noise, a capacitor can be introduced into the noise prevention circuitry to lower the circuit impedance. It is necessary to use a capacitor with excellent, high-frequency characteristics. This is why metallized polyester film is used by OKAYA as the capacitor dielectric in all AC noise suppression capacitors.

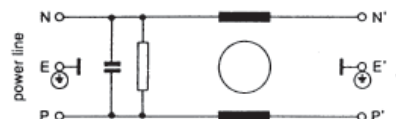
Examples of Uses:

- a) Effective as countermeasure for low-energy noise produced by high frequencies in DC motor brushes. Applications include power tools using multi-pole brush motors, vacuum cleaners, mixers, etc.



- b) Here, a common coil is used to compose a filter circuit as a means of improving attenuation and expanding band range.

Applications include a wide variety of office appliances, switching power units, etc.



- c) This shows countermeasures against common mode noise taken in addition to the measures shown in b).



*NOTE: For applications of the type shown in b) and c), see the Noise Filter section.

RATED CURRENT

The following is used to calculate the current for a supply voltage. Values for 250Vac, 50/60Hz are shown in the table (Precautions should be taken with regard to voltage fluctuation and permissible deviation of electrostatic capacitance when calculating maximum values).

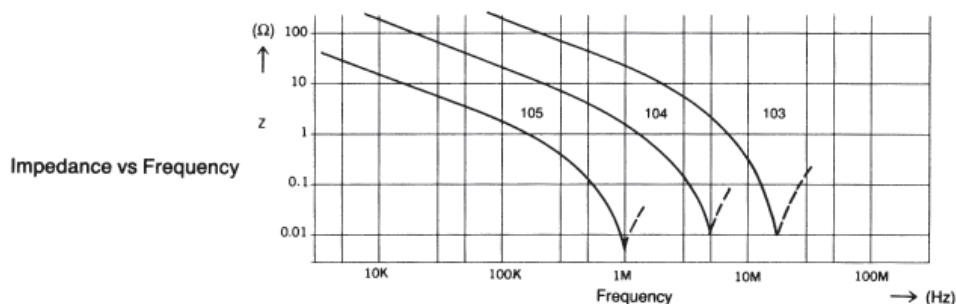
$$I = 2 \pi f C E \text{ (A)}$$

I : Current Amps (A)
f : Operating frequency (Hz)
C : Electrostatic capacitance Farads (F)
E : Supply voltage AC (V)

Unit: mA

Frequency \ Capacitance μF	0.001	0.0015	0.0022	0.0033	0.0047	0.0068	0.01	0.015	0.022	0.033
50Hz	0.1	0.1	0.2	0.3	0.4	0.5	0.8	1.18	1.73	2.59
60Hz	0.1	0.1	0.2	0.3	0.4	0.6	0.9	1.41	2.07	3.11

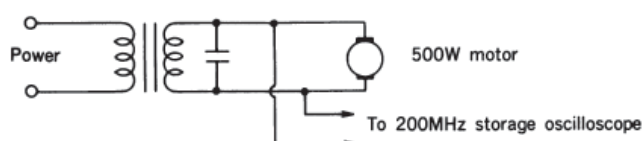
Frequency \ Capacitance μF	0.047	0.068	0.1	0.15	0.22	0.33	0.47	0.68	1.0
50Hz	3.69	5.34	7.85	11.8	17.3	25.9	36.9	53.4	78.5
60Hz	4.43	6.41	9.42	14.1	20.7	31.1	44.3	64.1	94.2



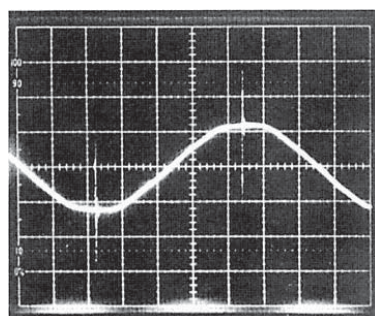


EXAMPLES OF NOISE SUPPRESSION EFFECTS

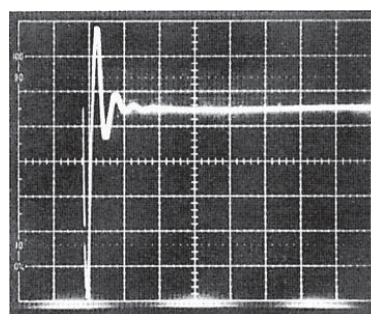
Noise suppression capacitors are most widely applied as countermeasures to noise occurring in inverters, switching power units, brush motors, and to the full range of Office Automation equipment.



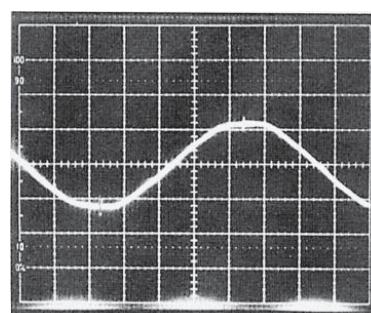
These illustrations show examples of the noise suppression effects produced with a 500W class brush motor used on a commercial 120V line. The load is driven through an isolation transformer.



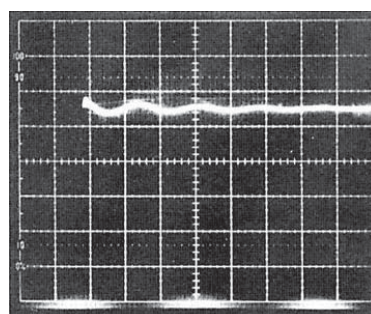
A) This illustration shows the line waveform without any noise countermeasures. A damped oscillation wave of about 800Vp-p is visible at the instant of positive and negative peak.



B) This illustration shows an observation of the noise component alone. (Time axis 10µsec/div.)



C) This illustration shows the results of noise countermeasures taken by inserting an XE474 (0.47µF) capacitor in the line. A minute amount of noise appears to remain in the sine curve, but it is not considered significant.



D) This illustration shows the same isolation of the noise at a time axis of 10µsec/div. By the insertion of the electrostatic capacitance of 0.47µF, the period of damping oscillation has become longer, but the peak voltage is well damped, thus producing excellent results.

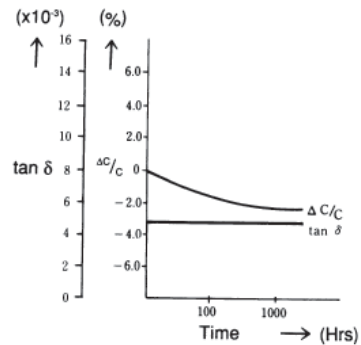


NOISE SUPPRESSION CAPACITORS

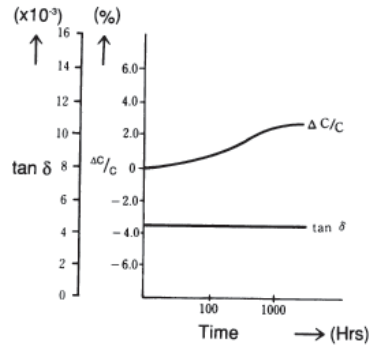


PERFORMANCE CHARACTERISTICS

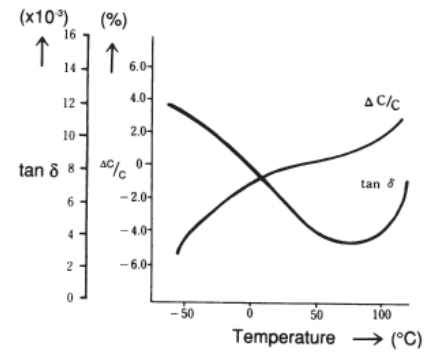
Endurance (XE-Z type)



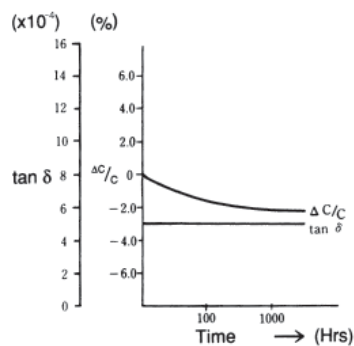
Damp Heat Endurance (XE-Z type)



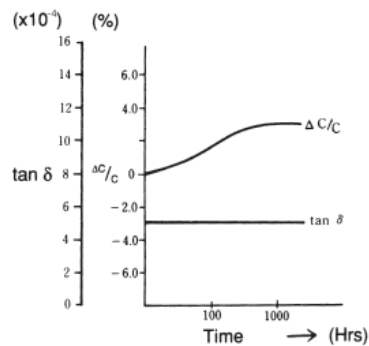
Temperature Characteristics (XE-Z type)



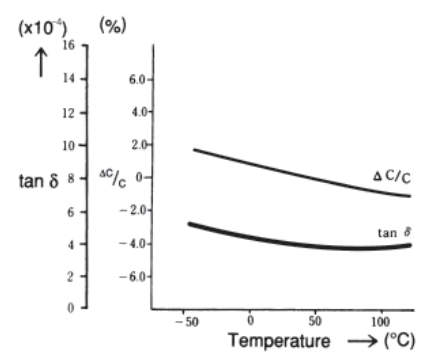
Endurance (LE type)



Damp Heat Endurance (LE type)



Temperature Characteristics (LE type)



TEST CONDITIONS

Temperature Endurance:
At maximum rated temperature and
at 125% of rated voltage.
The voltage is increased to
1,000Vac for 0.1 second.

Damp Heat Endurance:
 $\sqrt{2} \times WV$

Temperature Characteristics:
-50°C to +100°C
100% Rated Voltage



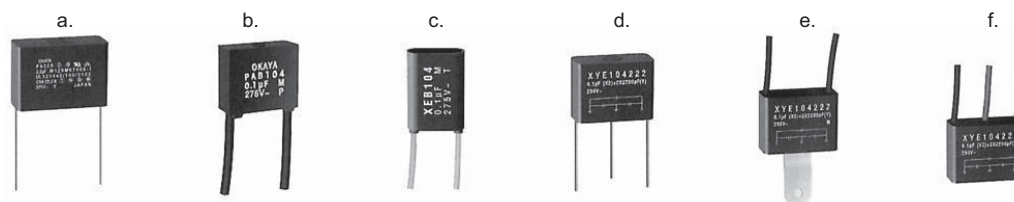
NOISE SUPPRESSION CAPACITORS



FORM

Rated Voltage	Safety Standard	Lead Type	Forms	Model	Page
310Vac*		Bare Wire	a	LE-MX Series	12
275Vac*		Bare Wire	a	LE Series	13
300Vac*		Bare Wire	a	LE-K, LE-K-M Series	14
275Vac*		Bare Wire	a	RE-L Series	15
275Vac*		Bare Wire	a	PA-L Series	16
300Vac		Bare Wire	a	VEA Series	17
500Vac		Bare Wire	a	XH Series	18
275Vac*		Flex Wire	b	REB Series	19
250Vac*		Flex Wire	c	XEB Series	20
275Vac*		Bare Wire	a	XE-Z Series	21
300Vac*		Bare Wire	a	YF Series	22
250Vac		Bare Wire	a	YE Series	23
250Vac		Bare Wire	d	XYE-AN Series	24~25
250Vac		Flex Wire, Earth Terminal	e	XYE-BE Series	
250Vac		Flex Wire	f	XYE-BN Series	
440Vac	-	Flex Wire	-	3XYG Series	26
310Vac	-	Bare Wire	a	EPC Series	27

* UL and cUL, CSA = 250Vac



APPLICATIONS

AC Motors
DC Motors
Brush Motors
Grinders
Motor Controls
Mixers
Dryers

Machine Tools
Washers
Power Supplies
Automotive
Lighting
Frequency Controls

Contact Protection
Industrial Controls
Robotics
NC Controls
CNC Controls
Antenna Coupling

AC Line Suppression
Vacuum Cleaners
Tumblers
Electric Switching
Power Snubbers
Mechanical Switching

DESIGN CAUTIONS

- 1) When protecting switching contacts, always include a resistor in series with the noise suppression capacitors. See Spark Quencher section for products specifically designed for such applications.
- 2) In high speed circuits, the addition of a noise suppression capacitor may slow the response time of the circuit. For best response characteristics, do not use a larger capacitor than is absolutely necessary to suppress the noise level.
- 3) Noise suppression capacitors are most effective when located close to the offending noise source. Excessive lead length may cause abnormal oscillation and decrease the energy absorption capability of the capacitor.
- 4) When noise suppression capacitors are connected across power lines, care must be taken that the resulting in-rush current does not cause the fuse or circuit breaker to open. Special consideration must be given to both the capacitor value and the breaker ratings.
- 5) OKAYA noise suppression capacitors are specifically designed for standard line frequencies and should not be used in circuits where normal operation will exceed 70Hz.
- 6) To prevent permanent damage to noise suppression capacitors, they should not be allowed to self-heat more than 5 degrees centigrade above ambient.
- 7) These products do absorb normal line surges. However they are not intended to absorb high-energy surges such as induced lightning. See Transient Voltage Suppressor section for products specifically designed for such applications.



Features

- Rated voltage 310Vac.
- Class X2 series.
- Operating temperature up to 110°C.
- Smallest size of LE series.

Applications

- Designed mainly for suppressing noise occurring in power line of electrical appliances.

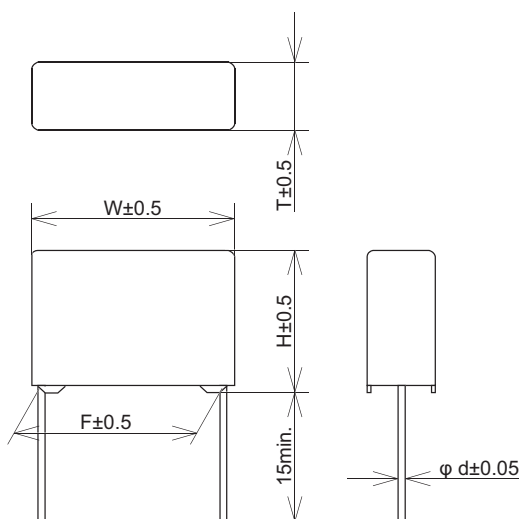


Safety Standard	File No.
UL :UL60384-14	E47474
cUL :CSA E60384-14	E47474
ENEC :IEC/EN60384-14	SE/0142-1

The "ENEC" mark is a common European product certification mark based on testing to harmonized European safety standard. The mark with #14 stands for SEMKO.

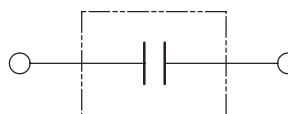


Dimensions



Unit: mm

Circuit



Model numbering system

L	E				-	M	X
Series name	Capacitance					Supported mark	

Electrical Specifications

Rated Voltage **310Vac**

Safety Standard	Class	Model Number	Capacitance μF±10%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance
				W	H	T	F	d			
  	X2	LE104-MX	0.1	17.0	11.0	5.0	15.0	0.6	C≤1μF 0.003max. (f=10kHz) C≥1.5μF 0.002max. (f=1kHz)	Line to Line 1,000Vac 50/60Hz 60sec or 1,870Vdc 60sec Line to Case 2,100Vac 50/60Hz 60sec	Line to Line C≤0.33μF 15,000MΩmin. C≥0.47μF 5,000Ω•Fmin. Line to Case 100,000MΩmin. (at 100Vdc)
		LE154-MX	0.15		12.0	6.0					
		LE224-MX	0.22		14.0	6.5					
		LE334-MX	0.33	17.5	16.5	7.5	22.5				
		LE474-MX	0.47	7.0							
		LE684-MX	0.68	18.0	8.5						
		LE105-MX	1.0	21.0	10.0	27.5	0.8				
		LE155-MX	1.5	22.5	13.0						
		LE225-MX	2.2	25.5	15.5						

Operating Temperature: -55~+110°C

Features

- Metalized polypropylene film capacitor.
- Rated voltage 275Vac.
- Compact size.
- IEC/EN 60384-14 class X2.

Applications

- Designed mainly for suppressing noise occurring in power line of electrical appliances.

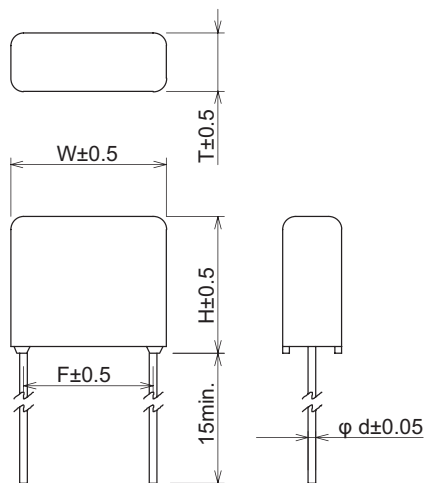


Safety Standard		File No.
UL	:UL60384-14	E47474
cUL	:CSA E60384-14	E47474
ENEC	:IEC/EN60384-14	SE/0142-1

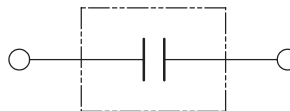
The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #14 stands for SEMKO.



• Dimensions



• Circuit



• Model numbering system

L	E			
Series name		Capacitance		

Electrical Specifications

Rated Voltage **275Vac**

Safety Standard	Class	Model Number	Capacitance μF±10%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance		
				W	H	T	F	d					
c  US	X2	LE103	0.01	12.0	10.5	4.5	10.0	0.6	C≤1μF 0.003max. (f=10kHz) C>1μF 0.002max. (f=1kHz)	Line to Line C≤2.2μF 1,250Vac 50/60Hz 60sec C=3.3μF 1,000Vac 50/60Hz 60sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 103~334 15,000MΩmin. 474~225 5,000Ω•Fmin. Line to Case 100,000MΩmin (at 100Vdc)		
		LE153	0.015			5.5							
		LE223	0.022										
		LE333	0.033									17.0	11.0
		LE473	0.047										
		LE683	0.068										
		LE104	0.1	11.5	5.5								
		LE154	0.15			6.5							
		LE224	0.22				8.0						
		LE334	0.33	17.5	17.5			9.5				22.5	0.8
		LE474	0.47	25.5		19.5							
		LE684	0.68		22.0		12.0						
		LE105	1.0					30.5				24.5	
		LE155	1.5	18.0									
		LE225	2.2		28.0								
		LE335	3.3	30.0		27.5							

Operating Temperature: -55~+100°C



LE-K, LE-K-M SERIES NOISE SUPPRESSION CAPACITOR



Features

- Rated voltage 300Vac, Class X2 series.
- Tolerance of Capacitance $\pm 10\%$ (LE-K), $\pm 20\%$ (LE-K-M).
- High Capacitance 1.5 ~ 10 μ F.



Safety Standard		File No.
UL	:UL60384-14	E47474
cUL	:CSA E60384-14	E47474
ENEC	:IEC/EN60384-14	SE/0142-1

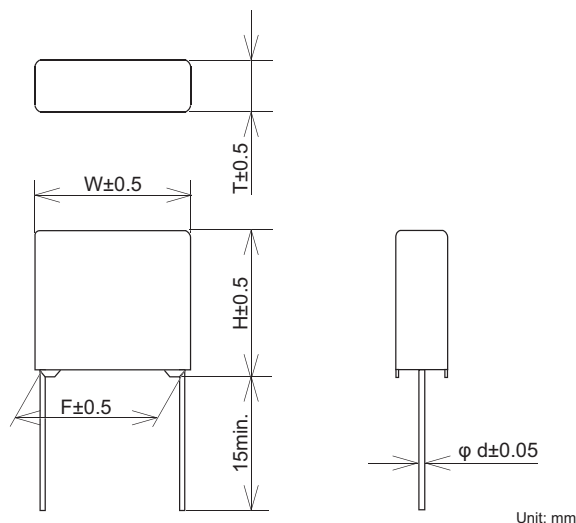
The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #14 stands for SEMKO.



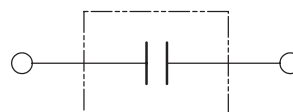
Applications

- Designed mainly for suppressing noise occurring in power line of electrical appliances.

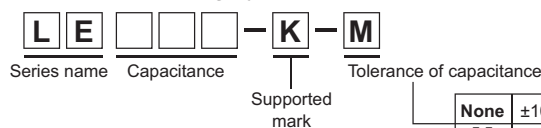
Dimensions



Circuit



Model numbering system



Electrical Specifications

Rated Voltage **300Vac**

Safety Standard	Class	Model Number	Capacitance μF±10%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance
				W	H	T	F	d			
	X2	LE155-K	1.5	25.5	28.0	16.0	22.5	0.8	0.002max. (f=1kHz)	Line to Line C≤3.3μF 1,250Vac 50/60Hz 60sec C≥4.7μF 1,770Vdc 60sec Line to Case 2,100Vac 50/60Hz 60sec	Line to Line 5,000Ω•Fmin. (at 100Vdc) Line to Case 100,000MΩmin (at 100Vdc)
		LE225-K	2.2		32.0	20.5					
		LE335-K	3.3	31.0	35.5	21.5	27.5				
		LE475-K	4.7		40.0	26.0					
		LE685-K	6.8	39.0	27.0	35.0	1.0				
		LE106-K	10.0	46.5	43.5	31.0		42.5			

Safety Standard	Class	Model Number	Capacitance μF±20%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance
				W	H	T	F	d			
	X2	LE155-K-M	1.5	30.5	24.5	15.0	27.5	0.8	0.002max. (f=1kHz)	Line to Line C≤3.3μF 1,250Vac 50/60Hz 60sec C≥4.7μF 1,770Vdc 60sec Line to Case 2,100Vac 50/60Hz 60sec	Line to Line 5,000Ω•Fmin. Line to Case 100,000Ωmin (at 100Vdc)
		LE225-K-M	2.2		28.0	18.0					
		LE335-K-M	3.3	38.0	31.0	21.0	35.0				
		LE475-K-M	4.7								
		LE685-K-M	6.8	41.0	38.0	23.0	37.5	1.0			
		LE106-K-M	10.0		43.0	28.0					

Operating Temperature: -55~+100°C

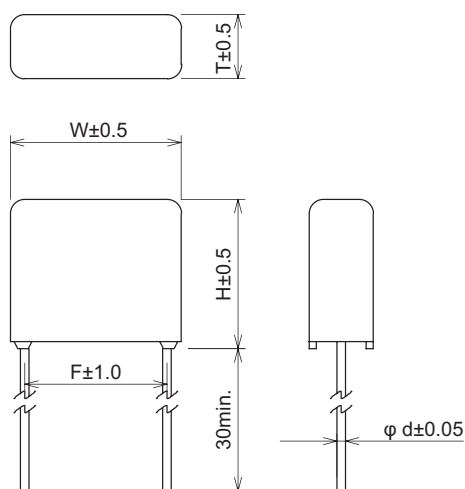
Features

- Rated voltage 275Vac.
- IEC/EN 60384-14 class X2.

Applications

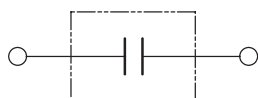
- Designed mainly for suppressing noise occurring in power line of electrical appliances.

• Dimensions



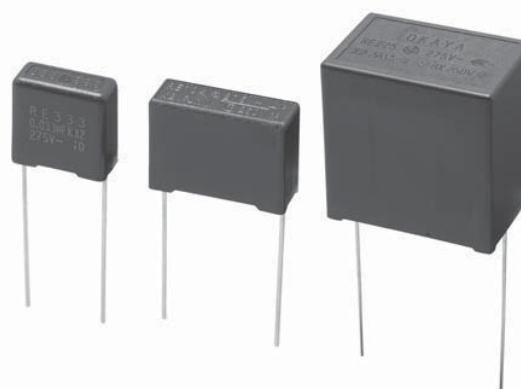
Unit: mm

• Circuit

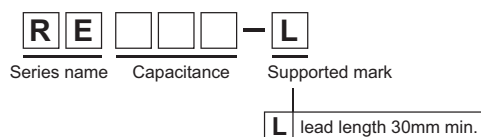


Safety Standard	File No.
UL :UL-60384-14	E47474
cUL :CSA E60384-14	E47474
CSA :CSA E60384-14, C22.2 No.8	LR37404, LR104926
VDE :IEC/EN 60384-14	094750X
SEMKO :IEC/EN 60384-14	1303400, 916932
NEMKO :IEC/EN 60384-14	P08208949, P10211810
DEMKO :IEC/EN 60384-14	144191-01, 315279-01
FIMKO :IEC/EN 60384-14	FI 24150A2, FI 25644
Electrosuisse :IEC/EN 60384-14	13.0339, 13.0068
ENEC :IEC/EN 60384-14	40028657

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #10 stands for VDE.



• Model numbering system



Electrical Specifications

Rated Voltage **275Vac (CSA: 250V)**

Safety Standard	Class	Model Number	Capacitance μF±10%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance		
				W	H	T	F	d					
cULUS SR DE S N D FI S 10	X2	RE103-L	0.01	12.0	10.5	4.5	10.0	0.6	C≤1μF 0.003max. (f=10kHz)	Line to Line 1,250Vac 50/60Hz 60sec	Line to Line 103~334 15,000MΩmin. 474~225 5,000Ω•Fmin.		
		RE153-L	0.015										
		RE223-L	0.022										
		RE333-L	0.033	11.5	5.5								
		RE473-L	0.047										
		RE683-L	0.068										
		RE104-L	0.1	17.0	11.0	5.0	15.0						
		RE154-L	0.15										
		RE224-L	0.22										
		RE334-L	0.33	25.5	17.5	8.0	22.5		C>1μF 0.002max. (f=1kHz)	Line to Case 2,000Vac 50/60Hz 60sec	Line to Case 100,000MΩmin. (at 100Vdc)		
		RE474-L	0.47										
		RE684-L	0.68										
		RE105-L	1.0	30.5	21.0	10.5	27.5	0.8					
		RE155-L	1.5										
		RE225-L	2.2										

Operating Temperature: -55~+100°C

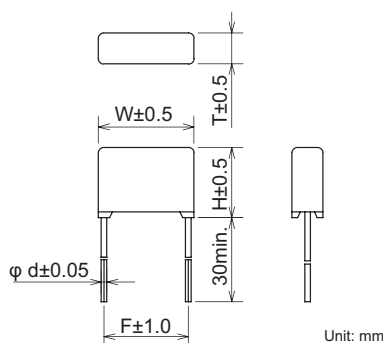
Features

- Rated voltage 275Vac.
- IEC/EN 60384-14 class X2.

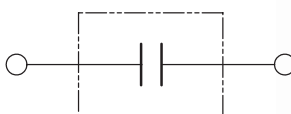
Applications

- Designed mainly for suppressing noise occurring in power line of electrical appliances.

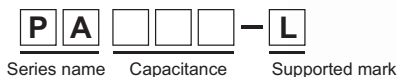
• Dimensions



• Circuit



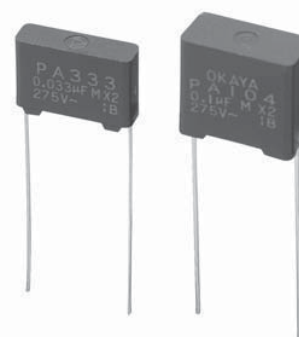
• Model numbering system



L lead length 30mm min.



Safety Standard	File No.
UL :UL-60384-14	E47474
cUL :CSA E60384-14	E47474
CSA :CSA E60384-14, C22.2 No.8	LR37404, LR104926
VDE :IEC/EN 60384-14	40018318, 40017808
SEMKO :IEC/EN 60384-14	917611, 1111621
NEMKO :IEC/EN 60384-14	P08209479, P06206040
DEMKO :IEC/EN 60384-14	315316-01, D-00242
FIMKO :IEC/EN 60384-14	FI25733, FI27268
Electrosuisse:IEC/EN 60384-14	12.0939, 12.0937



Electrical Specifications

Rated Voltage **275Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance												
				W	H	T	F	d															
cUL[®]US SR[®]      	X2	PA103-L	0.01	17.0	12.0	5.0	15.0	0.6	0.01max. (at 1kHz)	Line to Line 1,250Vac 50/60Hz 60sec	Line to Line 103~334 15,000MΩmin. 474~225 5,000Q•Fmin												
		PA123-L	0.012																				
		PA153-L	0.015																				
		PA183-L	0.018																				
		PA223-L	0.022																				
		PA273-L	0.027																				
		PA333-L	0.033																				
		PA393-L	0.039		12.5	5.5		0.8															
		PA473-L	0.047																				
		PA563-L	0.056																				
		PA683-L	0.068		13.5	6.5																	
		PA823-L	0.082																				
		PA104-L	0.1		15.0	8.0																	
		PA124-L	0.12	25.0		6.5	22.5																
		PA154-L	0.15																				
		PA184-L	0.18	17.5	8.0																		
		PA224-L	0.22																				
		PA274-L	0.27	30.0	17.0	8.5	27.5	1.0				Line to Case 2,000Vac 50/60Hz 60sec	Line to Case 100,000MΩmin. (at 500Vdc)										
		PA334-L	0.33	25.0	19.5	10.0	22.5																
		PA394-L	0.39	30.0	22.0	11.0	27.5																
		PA474-L	0.47																				
		PA564-L	0.56		24.5	13.5																	
		PA684-L	0.68																				
PA824-L	0.82	30.5	28.0	16.0	37.5																		
PA105-L	1.0																						
PA125-L	1.2	41.0		15.5																			
PA155-L	1.5																						
PA185-L	1.8	32.5	17.5																				
PA225-L	2.2																						

Operating Temperature: -40~+100°C

Features

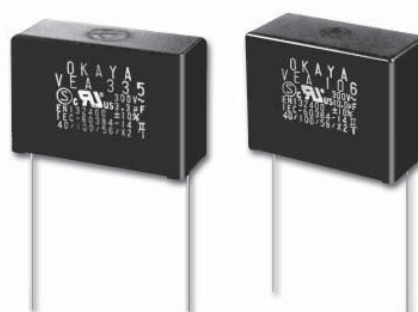
- Single and three phase application.
- High Capacitance 1.0 ~ 10 μ F.

Applications

- Suppressing noise occurring in large power systems, such as 3 phase 500Vac inverters, and welding machines.

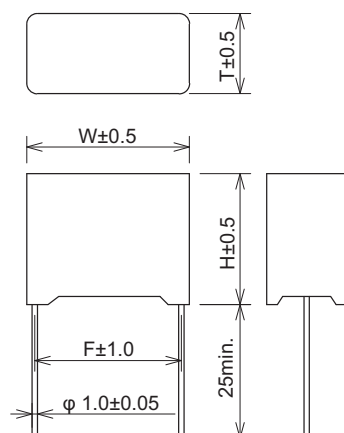


Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2 No.8	
SEMKO	:IEC/EN 60384-14	712459

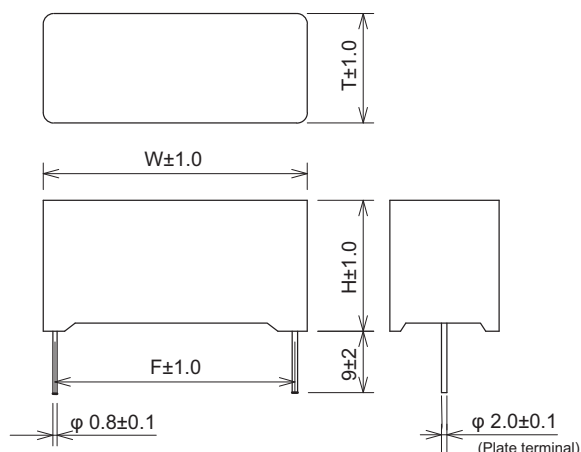


• Dimensions

Type: a

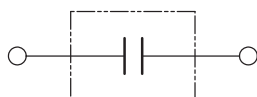


Type: b

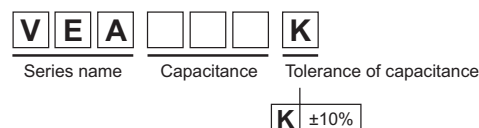


Unit: mm

• Circuit



• Model numbering system



Electrical Specifications

Rated Voltage **300Vac**

Safety Standard	Class	Model Number	Capacitance μF±10%	Dimensions				Type	Dissipation Factor	Test Voltage	Insulation Resistance
				W	H	T	F				
 	X2	VEA105K	1.0	30.5	24.5	15.0	27.5	a	0.001max. (at 1kHz)	Line to Line 1,450Vdc 60sec. or 1,000Vac 60sec.	Line to Line 5,000Ω•Fmin.
		VEA155K	1.5	41.0	28.0	15.5	37.5				
		VEA225K	2.2		32.5	17.5					
		VEA305K	3.0	49.5	33.0	20.5	45.0	b	0.002max. (at 1kHz)	Line to Case 2,100Vac 50/60Hz 60sec.	Line to Case 30,000MΩmin. (at 500Vdc)
		VEA335K	3.3								
		VEA475K	4.7	59.5	35.5	21.5	55.0				
		VEA685K	6.8								
		VEA106K	10.0								

Operating Temperature: -40~+100°C

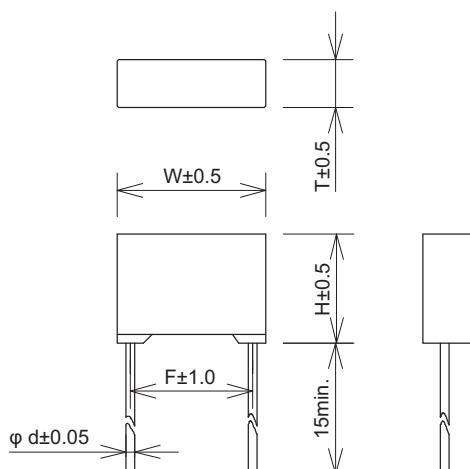
Features

- 500Vac rated capacitor designed for use in high voltage system.

Applications

- Suppressing noise occurring in large power systems, such as 3 phase 500Vac inverters, and welding machines.

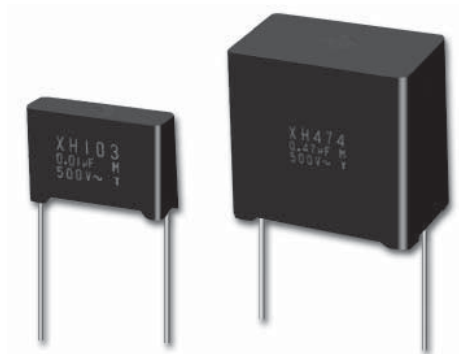
Dimensions



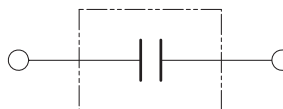
Unit: mm



Safety Standard		File No.
UL	:UL60384-14	E47474
cUL	:CSA E60384-14	E47474
TÜV	:IEC/EN 60384-14	J9650619



Circuit



Model numbering system

X	H			
Series name		Capacitance		

Electrical Specifications

Rated Voltage **500Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Dimensions					Dissipation Factor	Test Voltage		Insulation Resistance					
				W	H	T	F	d									
		XH102	0.001	17.0	12.5	5.5	15.0	0.8	0.01max. (at 1kHz)	Line to Line 2,200Vac 50/60Hz 60sec	Line to Case 2,200Vac 50/60Hz 60sec	Line to Line 15,000MΩmin. (at 500Vdc)	Line to Case 100,000MΩmin. (at 500Vdc)				
		XH152	0.0015														
		XH222	0.0022														
		XH332	0.0033		13.5	6.5											
		XH472	0.0047														
		XH682	0.0068											15.0	8.0		
 	X2	XH103	0.01	25.0	16.0	6.5	22.5			0.01max. (at 1kHz)				Line to Line 2,000Vac 50/60Hz 60sec	Line to Case 2,200Vac 50/60Hz 60sec	Line to Line 15,000MΩmin. (at 500Vdc)	Line to Case 100,000MΩmin. (at 500Vdc)
		XH153	0.015														
		XH223	0.022														
		XH333	0.033														
		XH473	0.047														
		XH683	0.068														
		XH104	0.1	30.0	24.5	13.5	27.5										
		XH154	0.15														
		XH224	0.22														
		XH334	0.33	31.0	28.0	16.0		27.5									
XH474	0.47	36.0	33.5						22.0		32.5						

Operating Temperature: -40~+100°C

Features

- X2 class capacitor RE series with insulated flexible wire leads.
- Two types of wire (single wire type & multiple wire type).
- UL, CSA (cUL), IEC/EN 60384-14 (class X2).



Safety Standard		File No.
UL	:UL60384-14	E236227
cUL	:CSA E60384-14	
ENEC	:IEC/EN 60384-14	SE/0142-28

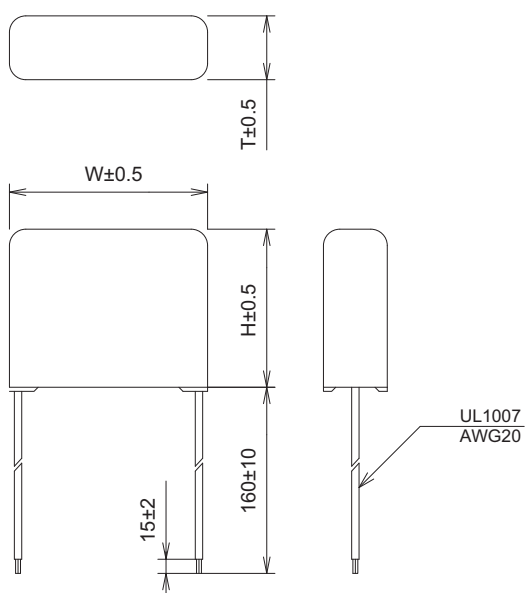
The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #14 stands for SEMKO.



Applications

- Industrial machinery, Electric appliances and Lighting.

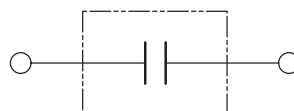
Dimensions



Unit: mm



Circuit



Model numbering system

R	E	B			
Series name			Capacitance		

Electrical Specifications

Rated Voltage **275Vac**

Safety Standard	Class	Model Number	Capacitance $\mu\text{F} \pm 10\%$	Dimensions			Dissipation Factor	Test Voltage	Insulation Resistance
				W	H	T			
	X2	REB473	0.047	17.0	12.5	5.5	0.003max. (at 10kHz)	Line to Line 1,250Vac 50/60Hz 60sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Line $C \leq 0.33 \mu\text{F}$ 15,000M Ω min. (at 100Vdc) Line to Case $C = 0.47 \mu\text{F}$ 5,000 $\Omega \cdot \text{F}$ min. (at 100Vdc)
		REB683	0.068		13.5	6.5			
		REB104	0.1		15.0	8.0			
		REB154	0.15	20.0	17.5	8.5			
		REB224	0.22		18.0	8.0			
		REB334	0.33		19.5	9.5			
		REB474	0.47	32.0	21.5	10.5			
		REB684	0.68		23.5	12.5			
		REB105	1.0						

Operating Temperature: -40~+100°C

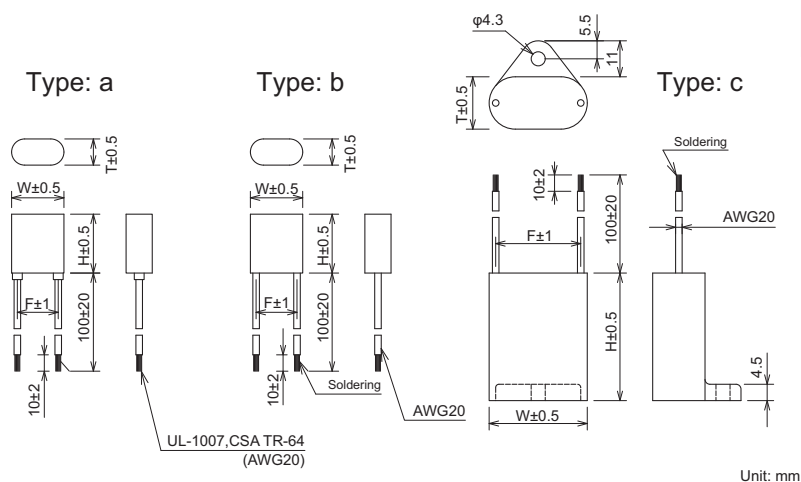
Features

- Long insulated flexible wire leads.
- Large devices have isolated external mounting tab.
- Electrical capabilities equivalent to XE series.

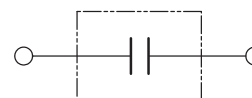
Applications

- Designed mainly for suppressing noise occurring in power line of electrical appliances.

Dimensions



Circuit



Model numbering system



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Class	Model Number	Capacitance $\mu\text{F}\pm 20\%$	Type	Dimensions				Dissipation Factor	Test Voltage		Insulation Resistance	
					W	H	T	F					
c  us	Y2	XEB102	0.001	a	16.0	18.0	8.0	12.5	0.01max. (at 1kHz)	Line to Line 2,000Vac 50/60Hz 60sec	Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 15,000M Ω min. (at 500Vdc)	Line to Case 100,000M Ω min. (at 500Vdc)
		XEB152	0.0015										
		XEB222	0.0022										
		XEB332	0.0033										
		XEB472	0.0047										
	XEB682	0.0068	b	18.0	21.5	8.5	15.0						
	X2	XEB103	0.01	a	16.0	18.0	8.0	12.5		Line to Line 1,250Vac 50/60Hz 60sec			
		XEB153	0.015										
		XEB223	0.022										
		XEB333	0.033										
		XEB473	0.047										
		XEB683	0.068	b	19.0	25.0	8.5	15.0					
		XEB104	0.1										
		XEB154	0.15										
		XEB224	0.22										
XEB334		0.33											
XEB474	0.47	c	30.0	39.0	16.0	26.0							
XEB684	0.68												
XEB105	1.0												

Operating Temperature: -40~+85°C



XE-Z SERIES

NOISE SUPPRESSION CAPACITOR



Features

- Best performance series in most popular configurations.
- Dielectric withstand voltage twice safety agency requirement.
- High dv/dt, surge resistance and I/R ratings.
- IEC/EN 60384-14 class X1.

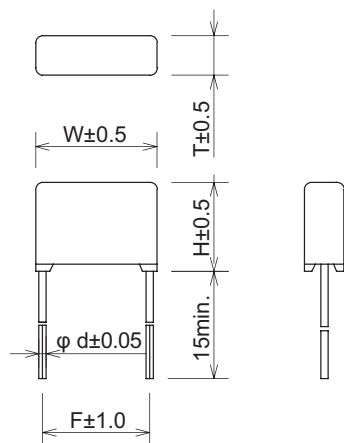
Applications

- Designed mainly for suppressing noise occurring in power line of electrical appliances.

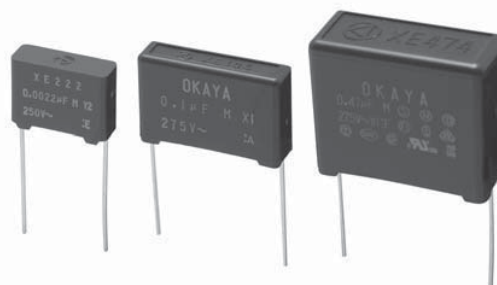


Safety Standard		File No.
UL	:UL60384-14	E47474
cUL	:CSA E60384-14	E47474
CSA	:CSA E60384-14	LR37404, LR104926
VDE	:IEC/EN 60384-14	40021020
SEMKO	:IEC/EN 60384-14	1021983
NEMKO	:IEC/EN 60384-14	P10213515
DEMKO	:IEC/EN 60384-14	315532-01
FIMKO	:IEC/EN 60384-14	FI 26476
Electrosuisse	:IEC/EN 60384-14	12.0477
ÖVE	:IEC/EN 60384-14	20938-003-03
IMQ	:IEC/EN 60384-14	102~682 V4048
		102~105 V4047

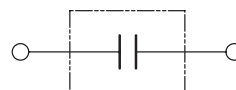
Dimensions



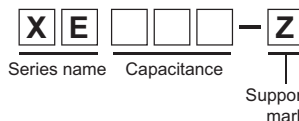
Unit: mm



Circuit



Model numbering system



Electrical Specifications

X1 (102~105) : 275Vac**Rated Voltage Y1 (102~682) : 250Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Dimensions					Dissipation Factor	Test Voltage		Insulation Resistance		
				W	H	T	F	d						
         	X1 and Y2*	XE102-Z	0.001	17.0	12.5	5.5	15.0	0.8	0.01max. (at 1kHz)	Line to Line 2,000Vac 50/60Hz 60sec	Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 15,000MΩmin. (at 500Vdc)	Line to Case 100,000MΩmin (at 500Vdc)	
		XE152-Z	0.0015											
		XE222-Z	0.0022											
		XE332-Z	0.0033											
		XE472-Z	0.0047											
		XE682-Z	0.0068											
	X1	XE103-Z	0.01	17.0	12.0	5.0	15.0	0.6		Line to Line 1,250Vac 50/60Hz 60sec				
		XE153-Z	0.015											
		XE223-Z	0.022											
		XE333-Z	0.033											
		XE473-Z	0.047	25.0	13.5	6.5	22.5	0.8						
		XE683-Z	0.068											
		XE104-Z	0.1											
		XE154-Z	0.15											
		XE224-Z	0.22	30.0	22.0	11.0	27.5	1.0						
		XE334-Z	0.33											
		XE474-Z	0.47											
		XE684-Z	0.68											
		XE105-Z	1.0	36.0	30.5	20.0	32.5							

Operating Temperature: -40~+100°C

*Rated voltage of Y2 is 250Vac.



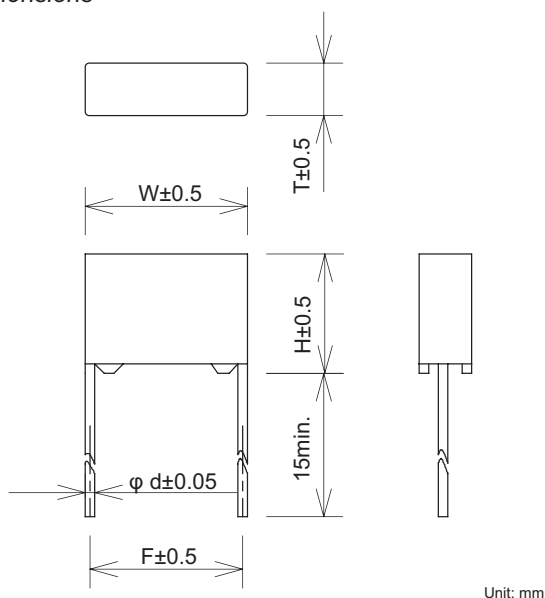
Features

- 30% smaller size of YE series.
- UL, cUL, IEC/EN 60384-14 class Y2.
- Good temperature characteristic compared to ceramic capacitor.

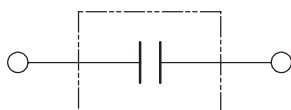
Applications

- Designed mainly for suppressing noise occurring in electric appliances and medical equipment.

Dimensions

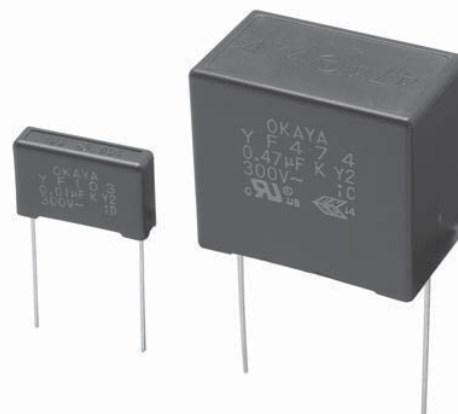


Circuit

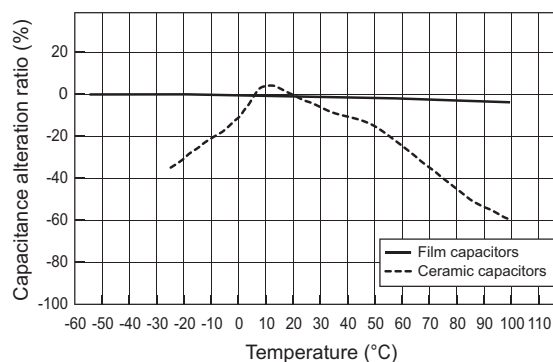


Safety Standard	File No.
UL :UL60384-14	E47474
cUL :CSA E60384-14	E47474
ENEC :IEC/EN60384-14	SE/0142-11

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #14 stands for SEMKO.



Temperature Characteristic



Model numbering system



Electrical Specifications

Rated Voltage **300Vac**

Safety Standard	Class	Model Number	Capacitance μF±10%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance
				W	H	T	F	d			
cUL [®] US	Y2	YF103	0.01	18.0	11.0	5.0	15.0	0.6	0.003max. (at 10kHz)	Line to Line 2,000Vac 50/60Hz 60sec	Line to Line C≤0.33μF 15,000MΩmin.
		YF153	0.015		11.5	6.0					
		YF223	0.022		12.5	7.0					
		YF333	0.033		14.0	8.0					
YF473		0.047	15.0		9.0						
E ¹⁴		YF683	0.068	26.0	15.5	7.5	22.5	0.8			
		YF104	0.1		17.5	11.0					
YF154		0.15	19.5		12.5						
S		YF224	0.22	31.0	20.5	13.5	27.5				
		YF334	0.33		24.0	16.0					
		YF474	0.47		27.0	18.5					

Operating Temperature: -55~+110°C

Features

- Y class rating up to 0.1 μ F not readily available elsewhere.
- IEC65 withstand voltage of 2,000Vac for severe applications.

Applications

- Designed mainly for suppressing noise occurring in applications.

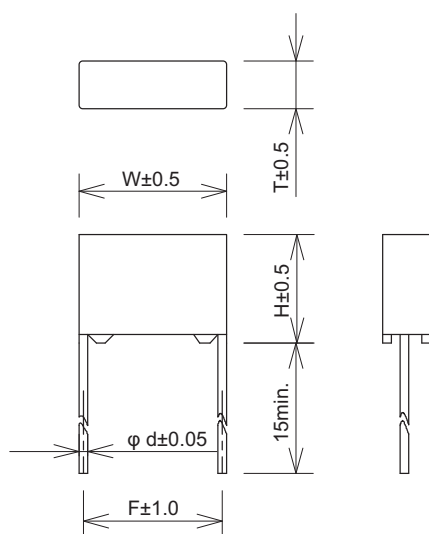


Safety Standard	File No.
UL :UL60384-14	E47474
cUL :CSA E60384-14	E47474
CSA :CSA E60384-14	LR37404
ENEC :IEC/EN 60384-14	40003928

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #10 stands for VDE.



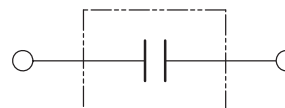
Dimensions



Unit: mm



Circuit



Model numbering system

Y	E			
Series name	Capacitance			

Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Dimensions					Dissipation Factor	Test Voltage	Insulation Resistance
				W	H	T	F	d			
   	Y2	YE102	0.001	13.0	10.0	4.0	11.0	0.6	0.01max. (at 1kHz)	Line to Line 2,000Vac 50/60Hz 60sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 30,000MΩmin Line to Case 100,000MΩmin (at 500Vdc)
		YE152	0.0015								
		YE222	0.0022								
		YE332	0.0033	17.0	12.0	5.0	15.0	0.8			
		YE472	0.0047								
		YE682	0.0068								
		YE103	0.01	25.0	12.5	5.5	22.5				
		YE153	0.015		13.5	6.5					
		YE223	0.022		15.0	8.0					
		YE333	0.033	30.0	16.0	6.5	27.5				
		YE473	0.047		17.5	8.0					
		YE683	0.068		19.5	10.0					
		YE104	0.1		22.0	11.0	27.5				

Operating Temperature: -40~+100°C

Features

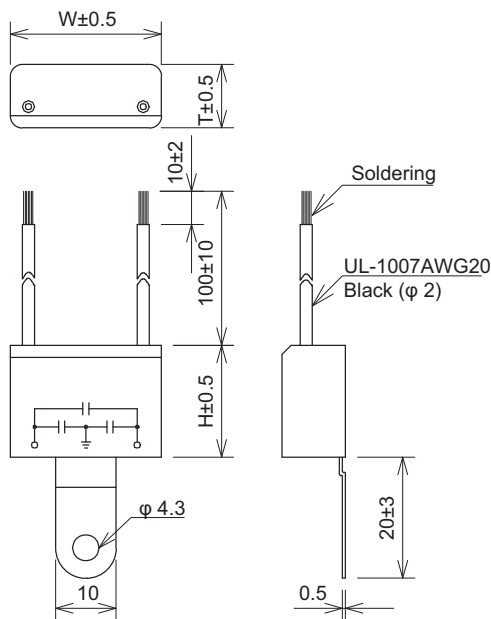
- Space saving PWB capacitor network has one X and two Y caps.
- Excellent common and normal mode capability in a wide capacitance selection.
- Flexible wire leads available with optional length.

Applications

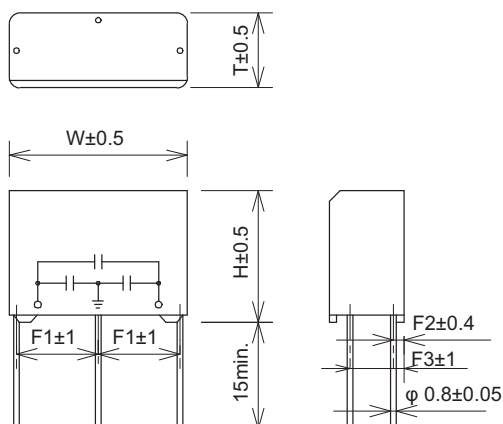
- Designed mainly for suppressing noise occurring in applications.

Dimensions

XYE-BE series

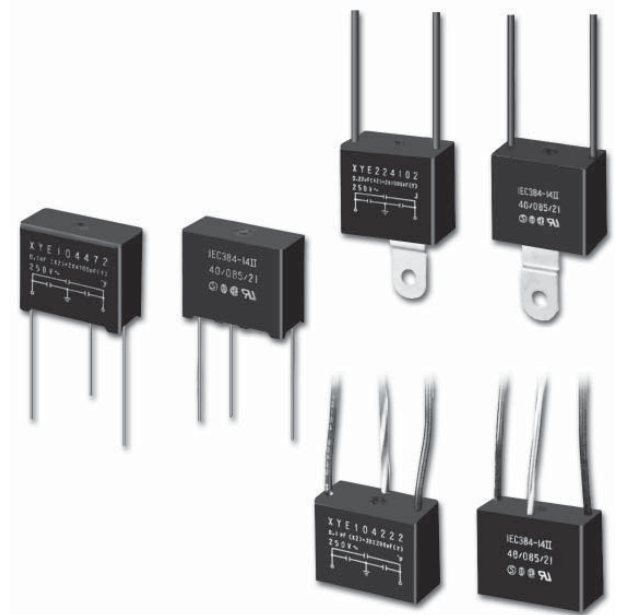


XYE-AN series

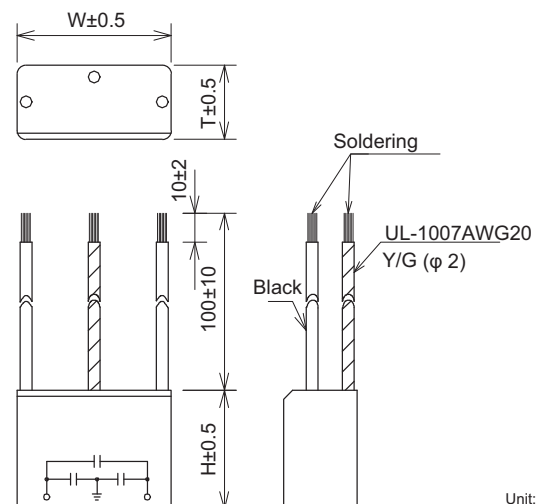


Safety Standard	File No.
UL :UL60384-14	E47474
cUL :CSA E60384-14	E47474
CSA :CSA E60384-14	LR37404
ENEC :IEC/EN60384-14	SE/0142-15

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #14 stands for SEMKO.



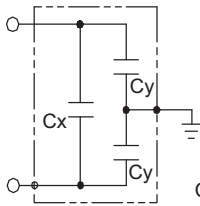
XYE-BN series



Unit: mm



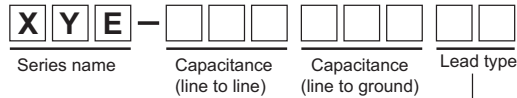
• Circuit



Cx: Line to Line (X capacitor)

Cy: Line to Ground (Y capacitor)

• Model numbering system



AN	Bare wire
BN	Flex PVC wire
BE	Flex PVC wire & metal terminal

Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Class	Model Number	Capacitance		Dimensions						Dissipation Factor	Test Voltage	Insulation Resistance
			Cx(μF±20%)	Cy(pF±20%)	W	H	T	F1	F2	F3			
UL[®] US SP[®] E14 S	X2 Y2	XYE-473472AN	0.047	4,700	25.0	18.5	10.5	11.5	1.5	6.1	0.01max at 1k ±100Hz	Line to Line 1,250Vac 50/60Hz 60sec	Line to Line Cx ≤0.33μF 15,000MΩmin. Cx =0.47μF 5,000Ω•Fmin.
		XYE-104102AN	0.1	1,000		20.0	12.0			7.1			
		XYE-104222AN		2,200									
		XYE-104332AN		3,300									
		XYE-104472AN		4,700									
		XYE-224102AN	0.22	1,000	22.5	14.5	8.6						
		XYE-224222AN		2,200									
		XYE-224332AN		3,300									
		XYE-224472AN		4,700									
		XYE-334222AN	0.33	2,200	30.0	26.0	19.0	13.5	1.8	9.7			
		XYE-334332AN		3,300									
		XYE-334472AN		4,700									
		XYE-474222AN	0.47	2,200									
		XYE-474332AN		3,300									
		XYE-474472AN	4,700										
		XYE-104102BN	0.1	1,000	26.0	20.0	12.5						
		XYE-104222BN		2,200									
		XYE-104332BN		3,300									
		XYE-104472BN		4,700									
		XYE-224102BN	0.22	1,000	23.0	15.0							
		XYE-224222BN		2,200									
		XYE-224332BN		3,300									
		XYE-224472BN		4,700									
		XYE-334222BN	0.33	2,200	31.0	27.5	18.5						
		XYE-334332BN		3,300									
		XYE-334472BN		4,700									
		XYE-474222BN	0.47	2,200									
		XYE-474332BN		3,300									
		XYE-474472BN	4,700										
		XYE-104102BE	0.1	1,000	26.0	20.0	12.5					-	-
		XYE-104222BE		2,200									
		XYE-104332BE		3,300									
		XYE-104472BE		4,700									
XYE-224102BE	0.22	1,000	23.0	15.0									
XYE-224222BE		2,200											
XYE-224332BE		3,300											
XYE-224472BE		4,700											
XYE-334222BE	0.33	2,200	31.0	27.5	18.5								
XYE-334332BE		3,300											
XYE-334472BE		4,700											
XYE-474222BE	0.47	2,200											
XYE-474332BE		3,300											
XYE-474472BE	4,700												

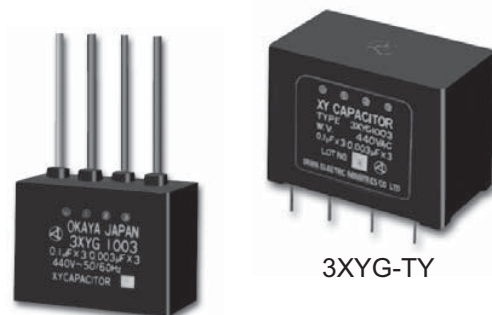
Operating temperature: -40~85°C

Features

- Three phase capacitor network.
- Two terminal style (bare wire or Insulated lead).

Applications

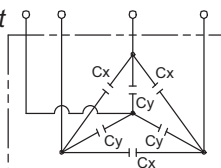
- Suppressing noise occurring in large power systems, such as 3 phase inverters.



3XYG

3XYG-TY

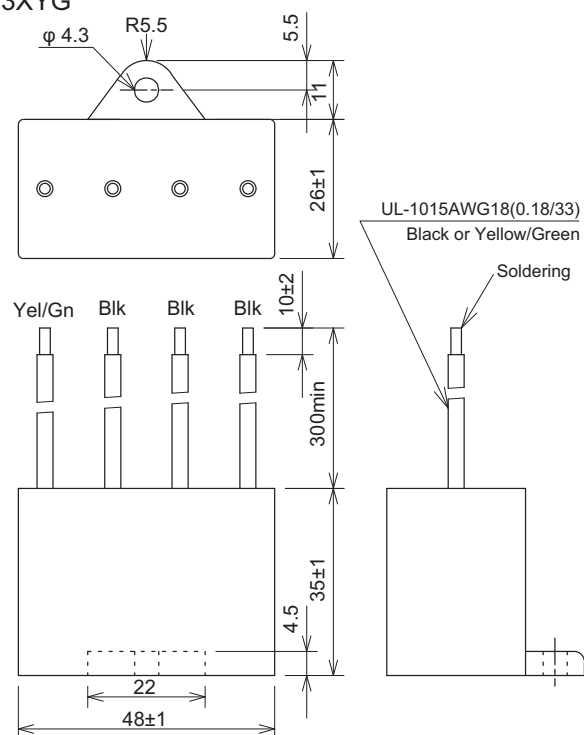
Circuit



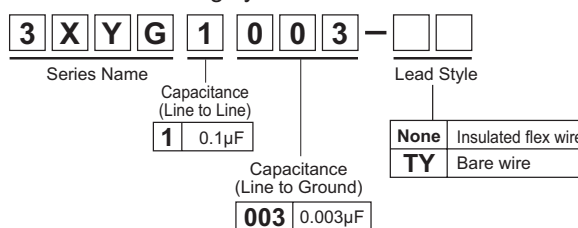
Cx: Line to Line (X capacitor)
Cy: Line to Ground (Y capacitor)

Dimensions

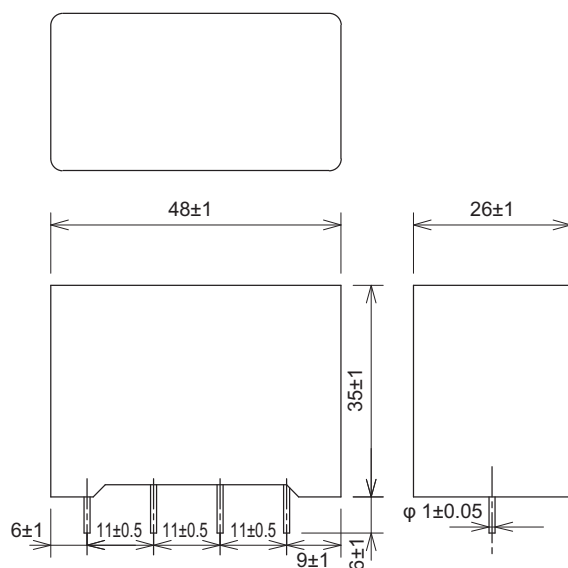
3XYG



Model numbering system



3XYG-TY



Unit: mm

Electrical Specifications

Rated Voltage **440Vac**

Model Number	Capacitance μF±20%	Dissipation Factor	Test Voltage	Insulation Resistance
3XYG1003 (Insulated lead)	X : 0.1μF Y : 0.003μF	X: 0.001 max. Y: 0.01 max. (at 1kHz)	Line to Line 2,000Vac 50/60Hz 60sec	Line to Line X: 10,000MΩ Y: 15,000MΩ (at 100Vdc)
3XYG1003-TY (Bare wire)			Terminal to Case 2,000Vac 50/60Hz 60sec	Terminal to Case 100,000MΩmin. (at 500Vdc)

Operating Temperature: -40~+85°C

Features

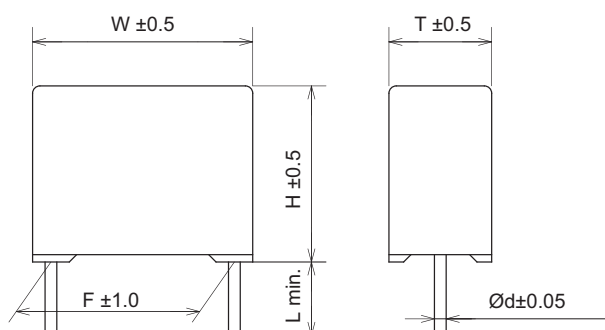
- Small-footprint
- Safety mechanism with segmented pattern
- JIS C 4908 compliance
- Metalized polyester film
- Non combustible plastic case

Applications

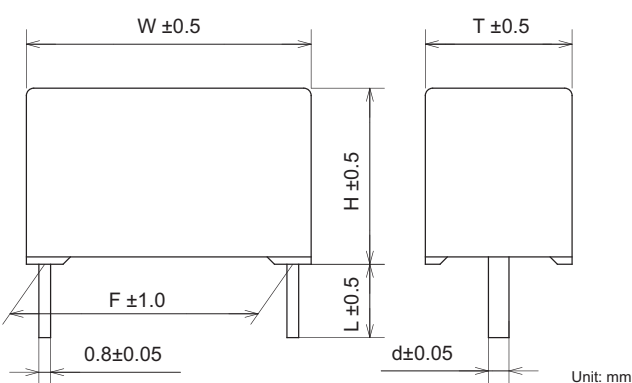
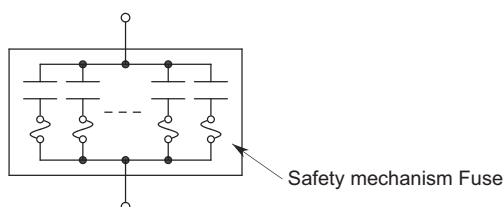
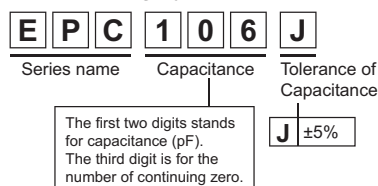
- Power conditioner, UPS, and waveform shaping circuit

• *Dimensions*

Type A (Lead wire)



Type B (Thick Lead wire)

• *Circuit*• *Model numbering system***Electrical Specifications**Rated Voltage **310Vac**

Rated Voltage	Model Number	Capacitance $\mu\text{F} \pm 5\%$	Dimensions (mm)							Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	d	L	Type			
310Vac	EPC105J	1.0	30.0	22.0	11.0	27.5	$\phi 1.0$	15	A	0.003max. (at 1kHz)	Line to Line 545Vac 50/60Hz 60sec.	Line to Line 7,500 ΩF (100Vdc)
	EPC155J	1.5	30.0	22.0	11.0	27.5	$\phi 1.0$	15	A			
	EPC225J	2.2	30.0	22.0	11.0	27.5	$\phi 1.0$	15	A			
	EPC335J	3.3	30.0	24.5	13.5	27.5	$\phi 1.0$	15	A			
	EPC475J	4.7	31.0	26.0	18.0	27.5	$\phi 1.0$	15	A			
	EPC685J	6.8	36.0	29.0	17.0	32.5	$\phi 1.0$	15	A		Terminal to Case 1,620Vac 50/60Hz 60sec.	Terminal to Case 30,000 $\text{M}\Omega$ min. (500Vdc)
	EPC106J	10.0	36.0	34.0	21.5	32.5	$\phi 1.0$	15	A			
	EPC156J	15.0	60.5	33.0	20.0	55.0	2*0.8	9	B			
	EPC226J	22.0	60.5	36.5	22.5	55.0	2*0.8	9	B			
	EPC336J	33.0	60.5	41.5	28.0	55.0	2*0.8	9	B			
	EPC476J	47.0	60.5	49.0	33.0	55.0	3*0.8	9	B			

Please inquire other capacitance.

Operating Temperature: -40~+105°C

OKAYA



PFC CAPACITORS

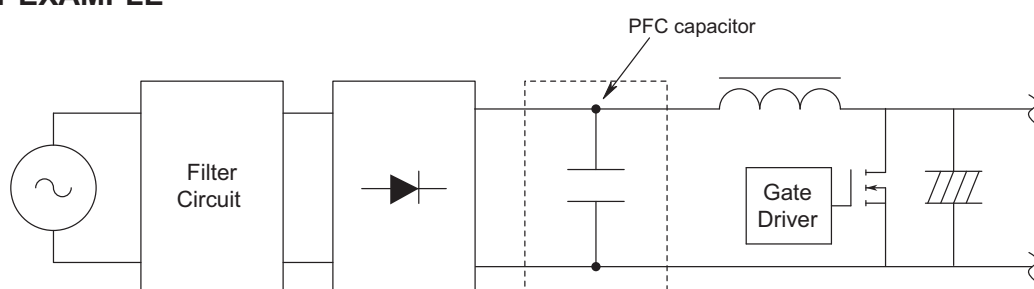


Recently, electric equipment and household electrical appliances have begun to utilize inverter technology to improve power efficiency. Therefore, many products generate a harmonic current. For suppressing the harmonic current, these products have an “Active filter circuit (*PFC circuit)”. Capacitors that are used in these circuits are called “Active-filter capacitors” or “PFC capacitors”.

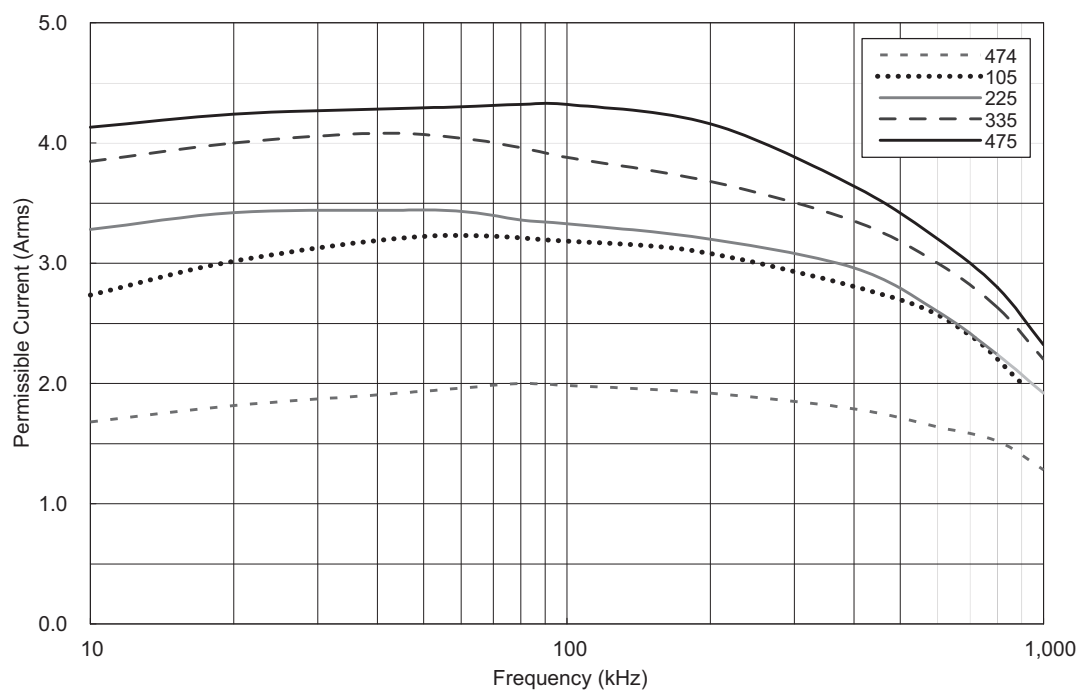
Resin-coated film capacitors are generally used for these circuits. Our film capacitors use a flame-retardant resin plastic case. Therefore, withstand voltage between line and ground is very high and safe. Also, the printed-wiring board mounting is stable.

*PFC: Power Factor Correction.

CIRCUIT EXAMPLE



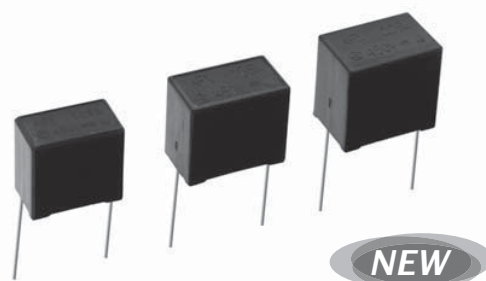
PERMISSIBLE CURRENT (type; AFC450V series)





Features

- Space-saving, high permissible current, low buzzing
- High reliability for proprietary-structure
- 2 kinds of lead pitch (10mm pitch•12.5mm pitch)
*0.01 μ F to 0.033 μ F
- Adopting for box type of casing,
 - High withstand voltage between line and case (2500Vac /1min)
 - Stable design for mounting on a board



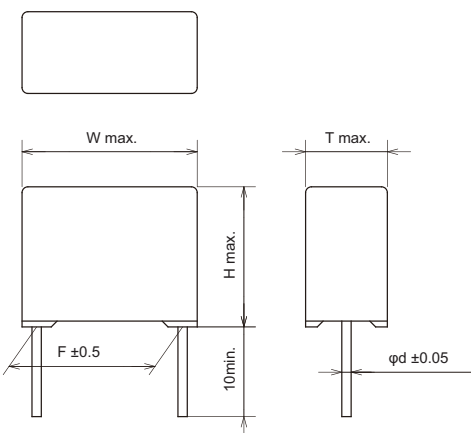
Applications

- PFC circuit of electrical equipment
- Flat-TV, PC, LED lighting etc.

• Circuit

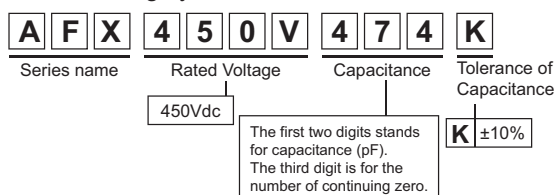


• Dimensions

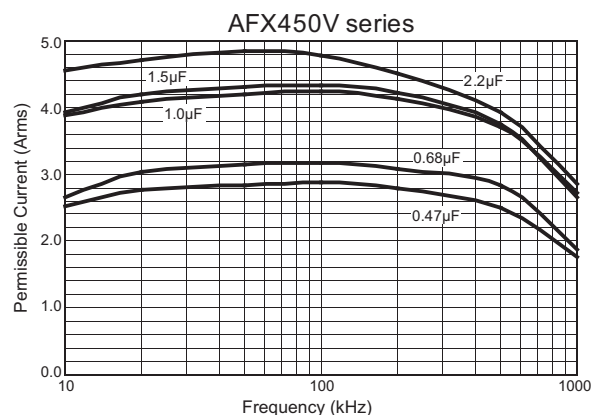


Unit: mm

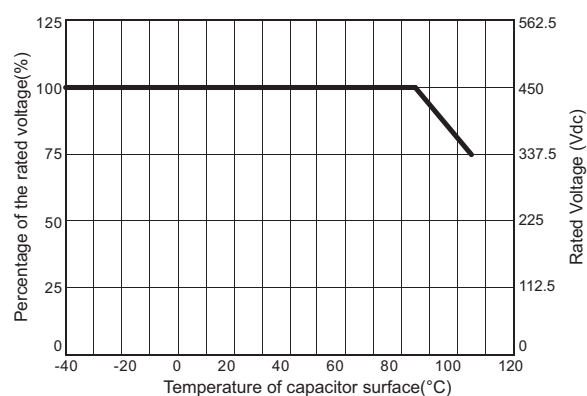
• Model numbering system



• Permissible current data



• Voltage derating by temperature



Electrical Specifications

Rated Voltage	Model Number	Capacitance μ F $\pm$ 10%	Dimensions (mm)					Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	ϕ d			
450Vdc	AFX450V474K	0.47	15.0	12.0	7.0	12.5	0.6	0.002max. (at 1kHz)	Rated Voltage $\times$ 1.5Vdc (60sec)	7,500 Ω •Fmin. (at 20°C, 100Vdc)
	AFX450V684K	0.68	15.0	13.5	8.5	12.5	0.6			
	AFX450V105K	1.0	15.5	14.5	9.5	12.5	0.8			
	AFX450V155K	1.5	17.5	15.5	10.5	15.0	0.8			
	AFX450V225K	2.2	17.5	17.0	12.5	15.0	0.8			

It is possible to use from more than 85°C to 105°C by derating of rated voltage.

Operating Temperature: -40~+105°C

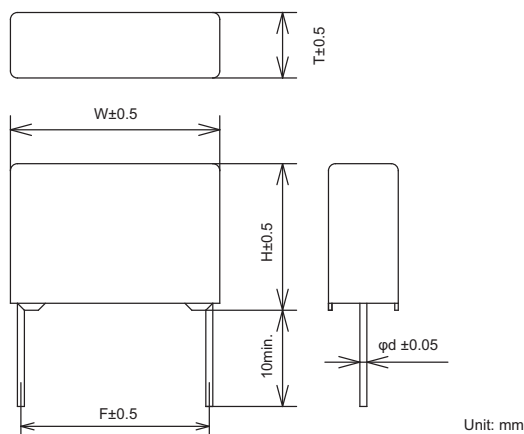
Features

- Smaller than AFC series.
- High withstand voltage (between line and case, 2500Vac - 60sec.)

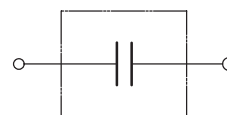
Applications

- Active filter circuit for electrical appliances. (PFC circuit)
- PFC circuit of electrical equipment
- Flat-TV, PC, LED lighting etc.

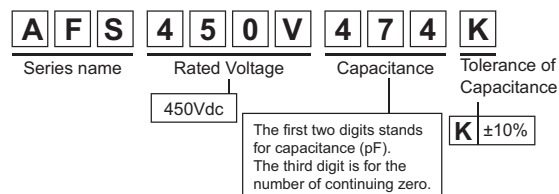
Dimensions



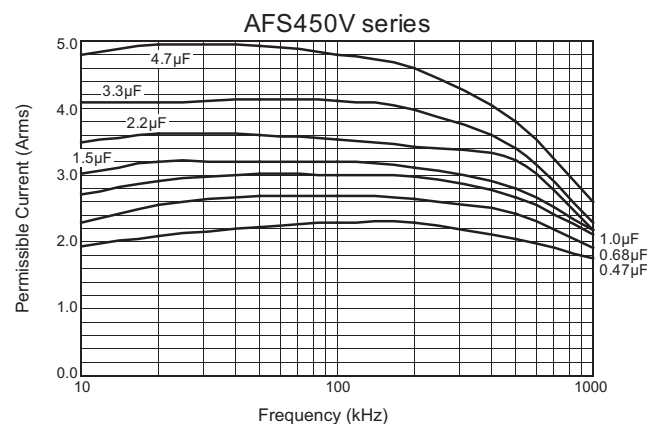
Circuit



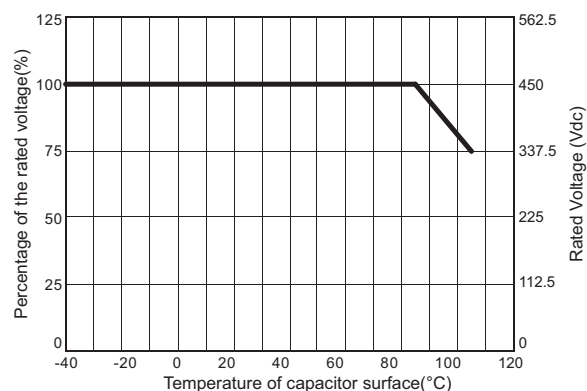
Model numbering system



Permissible current data



Voltage derating by temperature



Electrical Specifications

Rated Voltage	Model Number	Capacitance $\mu\text{F} \pm 10\%$	Dimensions (mm)					Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	ϕd			
450Vdc	AFS450V474K	0.47	17.5	13.5	5.5	15.0	0.8	0.002max. (at 1kHz)	Rated Voltage $\times 1.5\text{Vdc}$ (2~5sec)	7,500 $\Omega \cdot \text{Fmin.}$ (at 20°C 100Vdc)
	AFS450V684K	0.68	17.5	14.5	6.5	15.0	0.8			
	AFS450V105K	1.0	17.5	16.0	7.5	15.0	0.8			
	AFS450V155K	1.5	17.5	17.5	9.5	15.0	0.8			
	AFS450V225K	2.2	25.5	17.5	9.5	22.5	0.8			
	AFS450V335K	3.3	25.5	20.5	11.0	22.5	0.8			
	AFS450V475K	4.7	25.5	22.5	13.5	22.5	0.8			

It is possible to use from more than 85°C to 105°C by derating of rated voltage.

Operating Temperature: -40~+105°C



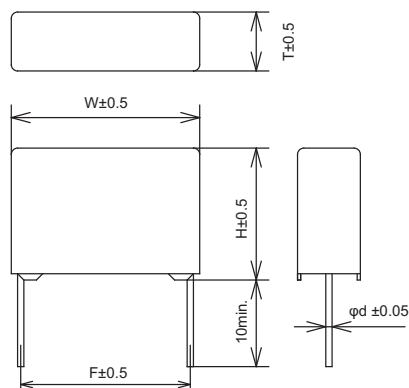
Features

- Low self-heating and low loss by using thin polypropylene film.
- High withstand voltage (between line and case) by the design of resin outer case.
- Stable design for mounting on a board.
- No derating voltage to maximum temperature.

Applications

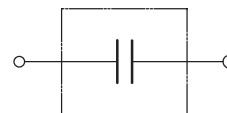
- Active filter circuit for electrical appliances. (PFC circuit)
- Flat screen television, PC display monitor, Audio-video equipment and home appliance.

Dimensions

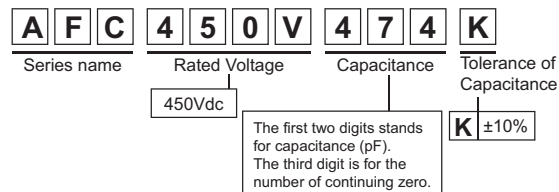


Unit: mm

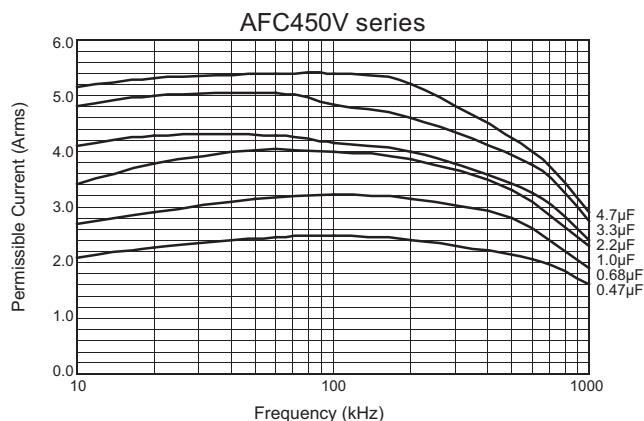
Circuit



Model numbering system



Permissible current data



Electrical Specifications

Rated Voltage	Model Number	Capacitance $\mu\text{F} \pm 10\%$	Dimensions (mm)					Dissipation Factor (at 1kHz)	Test Voltage $\times 1.75\text{Vdc}$ (2~5sec)	Insulation Resistance (at 20°C, 100Vdc)
			W	H	T	F	ϕd			
450Vdc	AFC450V474K	0.47	17.0	14.5	6.5	15.0	0.6	0.002max. (at 1kHz)	Rated Voltage $\times 1.75\text{Vdc}$ (2~5sec)	7,500 $\Omega \cdot \text{Fmin.}$ (at 20°C, 100Vdc)
	AFC450V684K	0.68	17.5	15.0	7.5	15.0	0.8			
	AFC450V105K	1.0	17.5	18.0	9.5	15.0	0.8			
	AFC450V225K	2.2	25.5	19.5	10.5	22.5	0.8			
	AFC450V335K	3.3	25.5	22.0	13.5	22.5	0.8			
	AFC450V475K	4.7	25.5	25.5	16.5	22.5	0.8			

Operating Temperature: -40~+105°C



Features

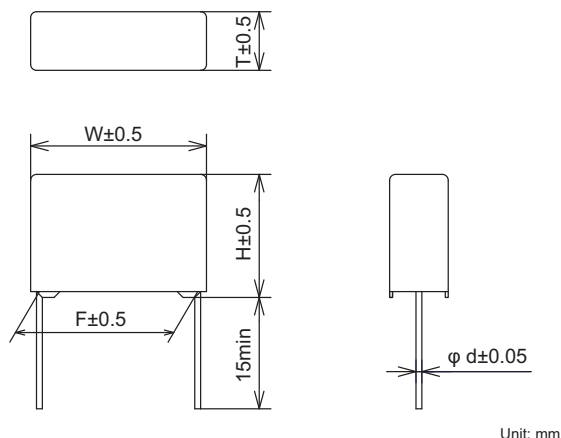
- 30% smaller size of HCE series.
- High withstand voltage (line to case) by resin case.

Applications

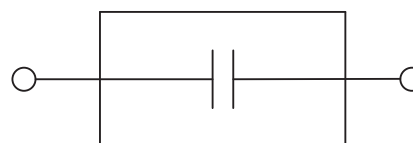
- Active filter circuit for electrical appliances. (PFC circuit)



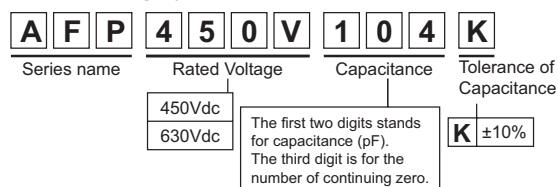
• Dimensions



• Circuit



• Model numbering system



Electrical Specifications

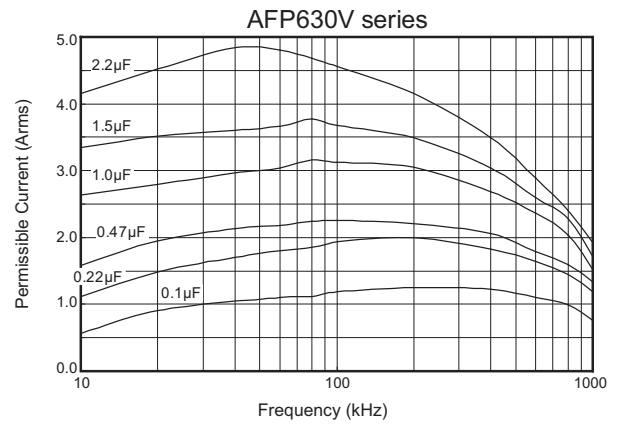
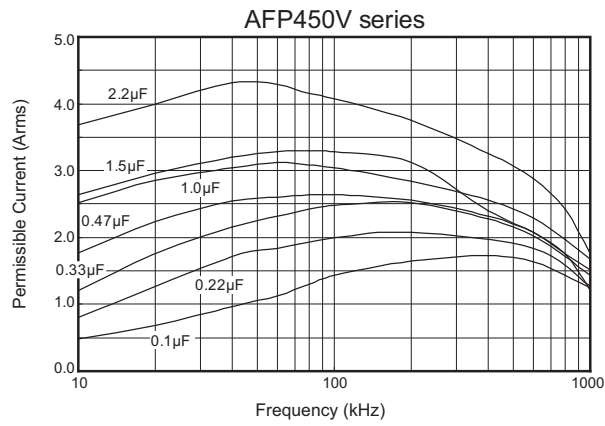
Rated Voltage	Model Number	Capacitance µF±10%	Dimensions (mm)					Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	φ d			
450Vdc	AFP450V104K	0.1	12.0	11.5	6.5	10.0	0.6	C≤1.0µF 0.001max. C>1.0µF 0.002max. (at 1kHz)	Rated Voltage ×1.75Vdc (2~5sec)	C≤0.33µF 50,000MΩmin. C>0.33µF 20,000Ω•Fmin. (at 20°C, 100Vdc)
	AFP450V154K	0.15	14.0	11.5	7.0	12.5	0.6			
	AFP450V224K	0.22	14.0	13.5	8.5	12.5	0.6			
	AFP450V334K	0.33	14.0	15.5	10.0	12.5	0.6			
	AFP450V474K	0.47	17.0	16.5	11.5	15.0	0.6			
	AFP450V684K	0.68	22.5	17.0	10.0	20.0	0.6			
	AFP450V105K	1.0	22.5	20.5	12.0	20.0	0.6			
	AFP450V155K	1.5	26.0	22.0	13.5	22.5	0.8			
630Vdc	AFP450V225K	2.2	26.0	25.0	17.0	22.5	0.8			
	AFP630V104K	0.1	17.0	12.0	6.0	15.0	0.6			
	AFP630V154K	0.15	17.0	15.0	8.0	15.0	0.6			
	AFP630V224K	0.22	17.0	16.0	9.0	15.0	0.6			
	AFP630V334K	0.33	25.5	17.5	8.0	22.5	0.8			
	AFP630V474K	0.47	25.5	19.0	9.5	22.5	0.8			
	AFP630V684K	0.68	30.5	21.0	10.5	27.5	0.8			
	AFP630V105K	1.0	30.5	23.0	12.5	27.5	0.8			
	AFP630V155K	1.5	30.5	27.5	17.0	27.5	0.8			
	AFP630V225K	2.2	30.5	30.5	20.5	27.5	0.8			

Operating Temperature: -55~+100°C



• *Permissible current data*

The representative capacity value's permissible current characteristics per rated voltage is shown below.
Please ask a sales representative for capacitance data not shown below.



OKAYA



HIGH PULSE CAPACITORS



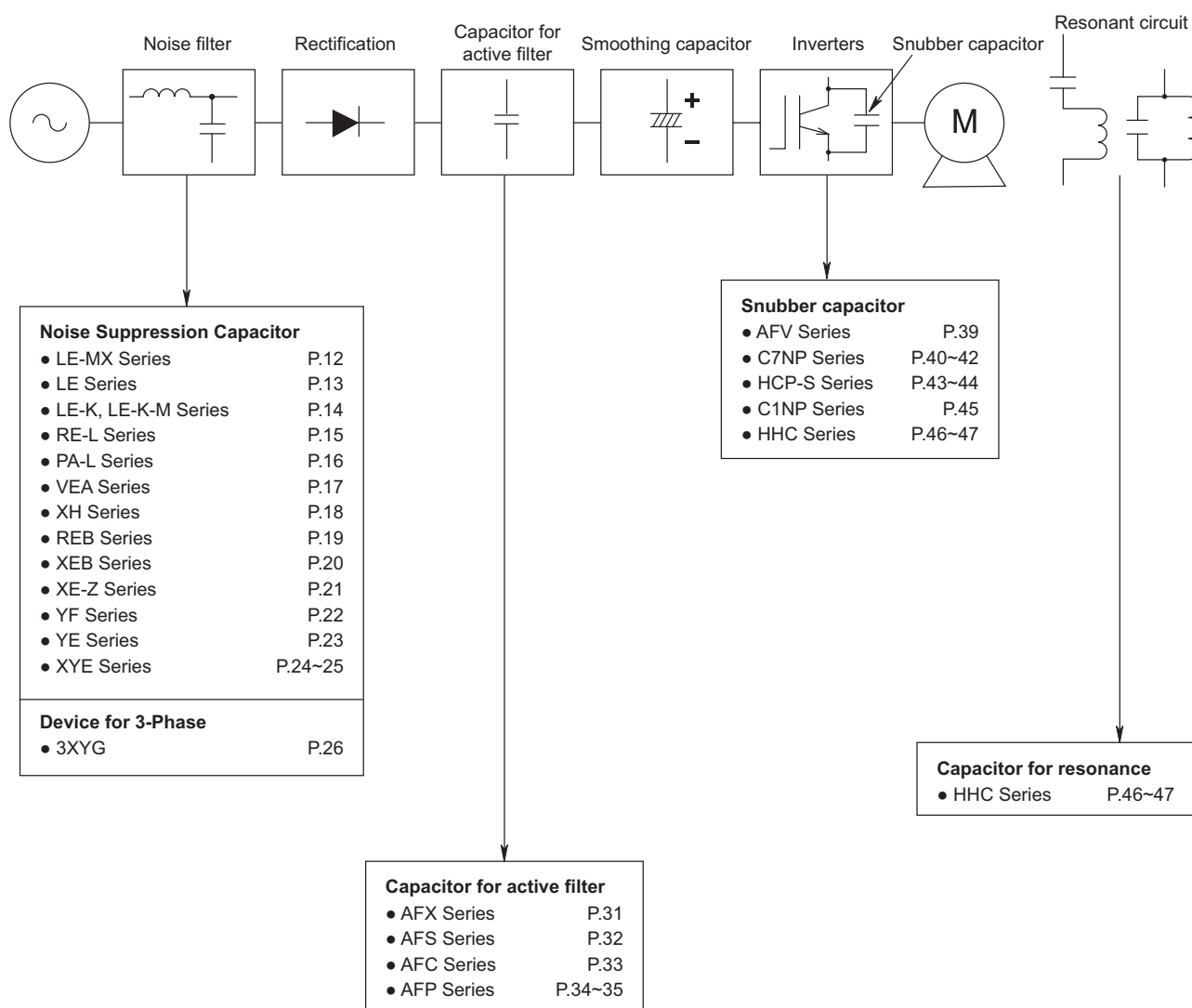
HIGH PULSE CAPACITORS



WHAT IS HIGH PULSE CAPACITOR?

- Designed for power semiconductor.
- Reduces the excessive voltage caused by the turning on time and off of power semiconductor and lowers the value of dv/dt .
- Made up of non-inductive Metallized Polypropylene Film that provides excellent anti-pulse characteristics and low insertion loss, which are generally regarded as important features necessary for the capacitor. The metallized polypropylene capacitor is specially characterized by its high insulation resistance and low dissipation that permit low insertion loss from low frequency to high frequency, low heating and better endurance to surges, providing excellent electrical characteristics required for high frequency circuit and high voltage circuit.

POWER ELECTRONICS APPLICATIONS



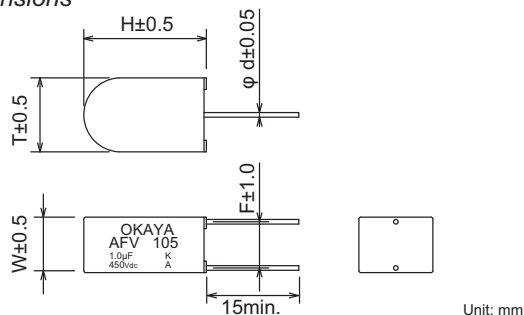
Features

- For use in active filters and snubbers for electronic circuit.
- Featured metallized polypropylene films to increase electric current withstand capability.
- 50% better dielectric withstand than the HCP series and 3~5 times better than the HCE series.
- The resin case is designed to consume a smaller footprint due to the reduced length and width.
- The case top features a radius which allows for ventilated effects.

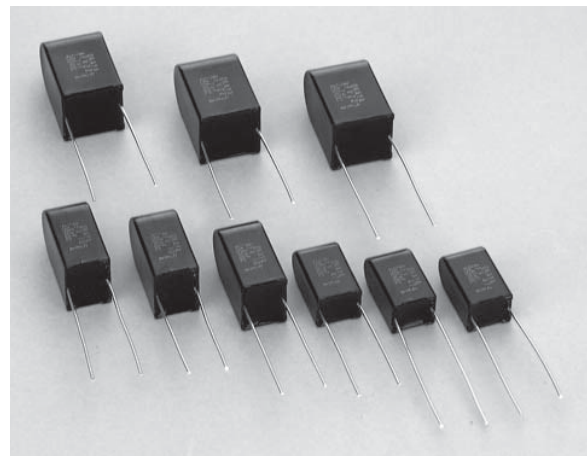
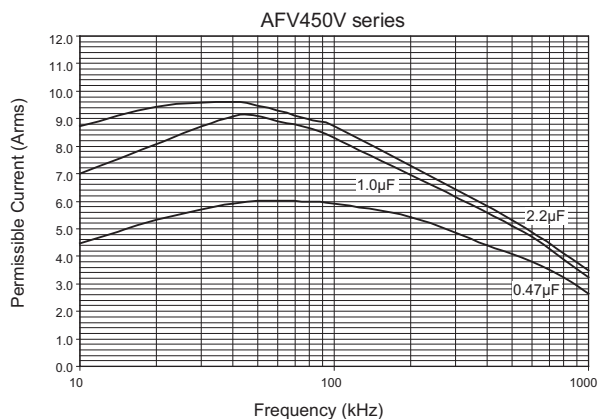
Applications

- TV, PC Display monitor, Electric Appliances (75~500W) and all electric equipment using switching power supplies or semiconductors requiring snubber circuit.

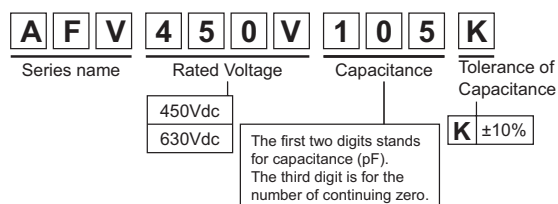
Dimensions



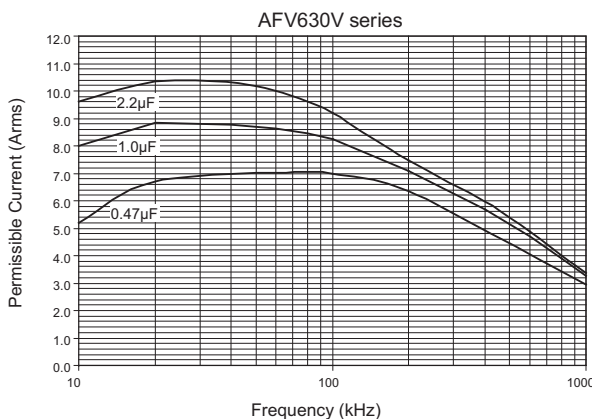
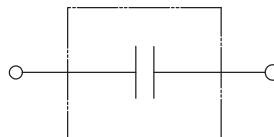
Permissible current data



Model numbering system



Circuit



Electrical Specifications

Rated Voltage	Model Number	Capacitance μF±10%	Dimensions (mm)					Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	d			
450Vdc	AFV450V474K	0.47	12.0	21.0	10.5	10.0	0.8	0.001max. (at 1kHz)	Rated Voltage ×1.75Vdc (2~5sec)	20,000MΩ min. (at 20°C, 100Vdc)
	AFV450V105K	1.0	12.0	26.5	16.0	10.0	1.0			
	AFV450V225K	2.2	17.0	27.5	17.0	15.0	1.0			
630Vdc	AFV630V474K	0.47	12.0	26.5	16.0	10.0	1.0			
	AFV630V105K	1.0	17.0	27.5	17.0	15.0	1.0			
	AFV630V225K	2.2	20.0	36.0	26.0	17.5	1.0			

It is possible to use from more than 85°C to 105°C by derating of rated voltage.

Operating Temperature: -40~+85°C

Features

- High insulation resistance (more than 50,000MΩ at less than 0.33μF).
- Low dissipation factor (less than 0.001 at 1kHz).
- High surge withstand voltage and high current withstand capability.

Applications

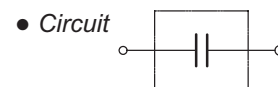
- High frequent circuit, resonant circuit in high voltage, snubber circuit, protection of semiconductors, ultra-high impedance circuit and long time constant circuit.



type: a



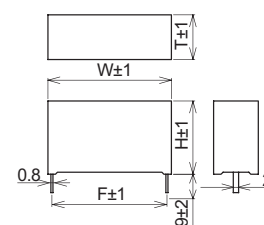
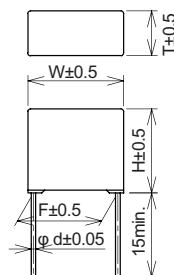
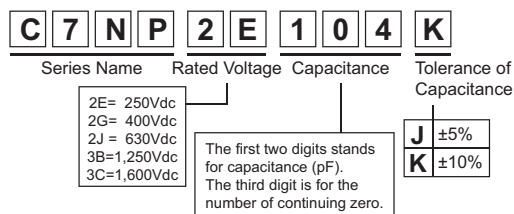
type: b



• Dimensions

type: b

• Model numbering system



Unit: mm

Electrical Specifications

Rated Voltage	Model Number	Capacitance μF	Dimensions (mm)						Dissipation factor	Test voltage	Insulation resistance
			W	H	T	F	φ d	Type			
2E (250Vdc)	C7NP2E104□	0.1	17.0	13.5	6.5	15.0	0.8	a	0.001max. (at 1kHz)	Rated Voltage x 1.75Vdc (2~5sec)	C≤0.33μF 50,000MΩmin. (at 20°C, 100Vdc) C>0.33μF 20,000Ω•Fmin. (at 20°C, 100Vdc)
	C7NP2E154□	0.15	17.0	13.5	6.5	15.0	0.8	a			
	C7NP2E224□	0.22	17.0	15.0	8.0	15.0	0.8	a			
	C7NP2E334□	0.33	25.0	16.0	6.5	22.5	0.8	a			
	C7NP2E474□	0.47	25.0	17.5	8.0	22.5	0.8	a			
	C7NP2E684□	0.68	25.0	19.5	10.0	22.5	0.8	a			
	C7NP2E105□	1.0	30.0	22.0	11.0	27.5	0.8	a			
	C7NP2E155□	1.5	30.0	24.5	13.5	27.5	0.8	a			
	C7NP2E225□	2.2	30.5	28.0	16.0	27.5	1.0	a			
	C7NP2E335□	3.3	41.0	28.0	15.5	37.5	1.0	a			
	C7NP2E475□	4.7	41.0	28.0	15.5	37.5	1.0	a			
	C7NP2E685□	6.8	41.0	32.5	17.5	37.5	1.0	a			
	C7NP2E106□	10	59.5	35.0	21.5	55.0	-	b			
2G (400Vdc)	C7NP2E156□	15	59.5	43.5	30.5	55.0	-	b			
	C7NP2E226□	22	59.5	43.5	30.5	55.0	-	b			
	C7NP2G473□	0.047	17.0	13.5	6.5	15.0	0.8	a			
	C7NP2G683□	0.068	17.0	13.5	6.5	15.0	0.8	a			
	C7NP2G104□	0.1	17.0	15.0	8.0	15.0	0.8	a			
	C7NP2G154□	0.15	25.0	16.0	6.5	22.5	0.8	a			
	C7NP2G224□	0.22	25.0	17.5	8.0	22.5	0.8	a			
	C7NP2G334□	0.33	25.0	19.5	10.0	22.5	0.8	a			
	C7NP2G474□	0.47	30.0	22.0	11.0	27.5	0.8	a			
	C7NP2G684□	0.68	30.0	24.5	13.5	27.5	0.8	a			
	C7NP2G105□	1.0	30.0	24.5	13.5	27.5	0.8	a			
	C7NP2G155□	1.5	41.0	28.0	15.5	37.5	1.0	a			
	C7NP2G225□	2.2	41.0	28.0	17.5	37.5	1.0	a			
	C7NP2G335□	3.3	49.5	33.0	20.5	45.0	-	b			
	C7NP2G475□	4.7	59.5	35.5	21.5	55.0	-	b			
	C7NP2G685□	6.8	59.5	43.5	30.5	55.0	-	b			
	C7NP2G106□	10	59.5	43.5	30.5	55.0	-	b			

□:J=Tolerance of Capacitance ±5%, K=Tolerance of Capacitance ±10%

Operating Temperature: -40~+85°C



Electrical Specifications

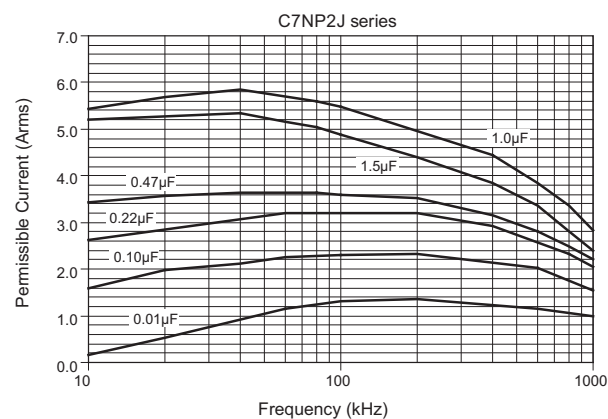
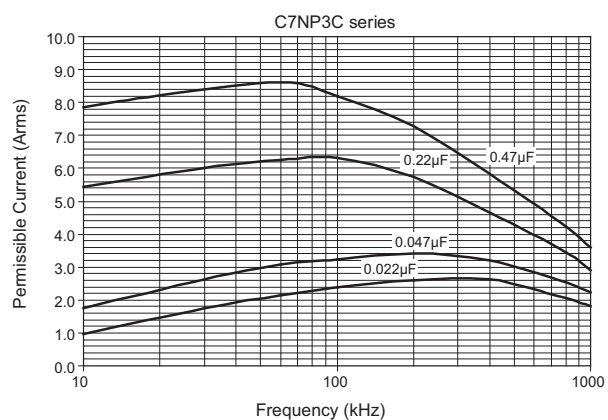
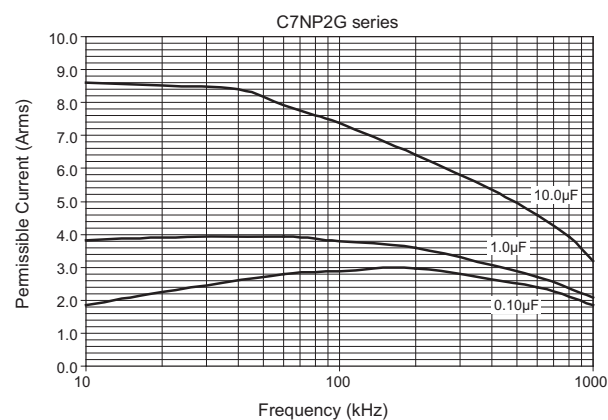
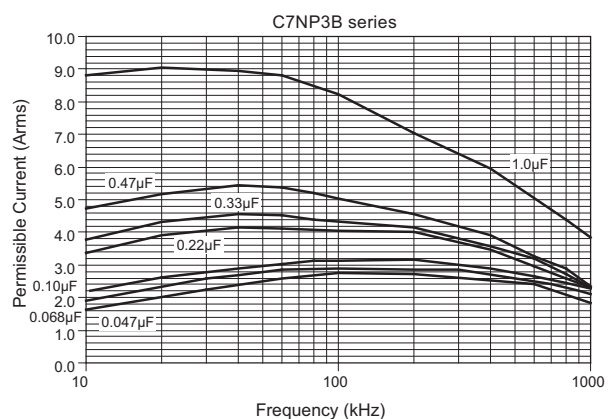
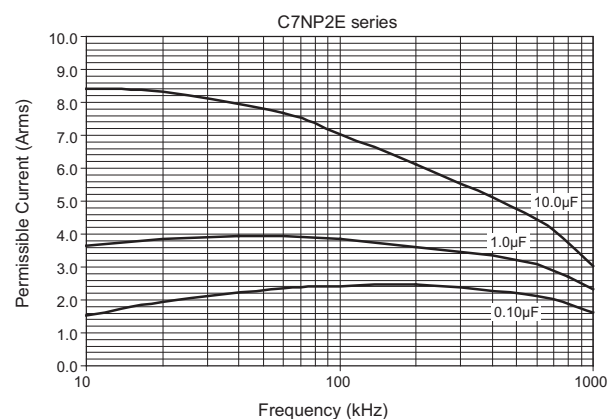
Rated Voltage	Model Number	Capacitance μF	Dimensions (mm)						Dissipation factor	Test voltage	Insulation resistance
			W	H	T	F	φ d	Type			
2J (630Vdc)	C7NP2J103□	0.01	17.0	13.5	6.5	15.0	0.8	a	0.001max. (at 1kHz)	Rated Voltage ×1.75Vdc (2~5sec)	C≤0.33μF 50,000MΩmin. (at 20°C, 100Vdc) C>0.33μF 20,000Ω•Fmin. (at 20°C, 100Vdc)
	C7NP2J153□	0.015	17.0	13.5	6.5	15.0	0.8	a			
	C7NP2J223□	0.022	17.0	13.5	6.5	15.0	0.8	a			
	C7NP2J333□	0.033	17.0	13.5	6.5	15.0	0.8	a			
	C7NP2J473□	0.047	17.0	13.5	6.5	15.0	0.8	a			
	C7NP2J683□	0.068	17.0	15.0	8.0	15.0	0.8	a			
	C7NP2J104□	0.1	25.0	16.0	6.5	22.5	0.8	a			
	C7NP2J154□	0.15	25.0	17.5	8.0	22.5	0.8	a			
	C7NP2J224□	0.22	25.0	19.5	10.0	22.5	0.8	a			
	C7NP2J334□	0.33	30.0	22.0	11.0	27.5	0.8	a			
	C7NP2J474□	0.47	30.0	22.0	11.0	27.5	0.8	a			
	C7NP2J684□	0.68	30.0	24.5	13.5	27.5	0.8	a			
	C7NP2J105□	1.0	30.5	28.0	16.0	27.5	1.0	a			
	C7NP2J155□	1.5	41.0	28.0	15.5	37.5	1.0	a			
	C7NP2J225□	2.2	49.5	33.0	20.5	45.0	-	b			
	C7NP2J335□	3.3	59.5	35.5	21.5	55.0	-	b			
	C7NP2J475□	4.7	59.5	43.5	30.5	55.0	-	b			
	C7NP2J685□	6.8	59.5	43.5	30.5	55.0	-	b			
3B (1250Vdc)	C7NP3B472□	0.0047	17.0	13.5	6.5	15.0	0.8	a			
	C7NP3B682□	0.0068	17.0	15.0	8.0	15.0	0.8	a			
	C7NP3B103□	0.01	25.0	16.0	6.5	22.5	0.8	a			
	C7NP3B153□	0.015	25.0	16.0	6.5	22.5	0.8	a			
	C7NP3B223□	0.022	25.0	17.5	8.0	22.5	0.8	a			
	C7NP3B333□	0.033	25.0	19.5	10.0	22.5	0.8	a			
	C7NP3B473□	0.047	25.0	19.5	10.0	22.5	0.8	a			
	C7NP3B683□	0.068	30.0	22.0	11.0	27.5	0.8	a			
	C7NP3B104□	0.1	30.0	24.5	13.5	27.5	0.8	a			
	C7NP3B154□	0.15	30.5	28.0	16.0	27.5	1.0	a			
	C7NP3B224□	0.22	41.0	28.0	15.5	37.5	1.0	a			
	C7NP3B334□	0.33	41.0	28.0	15.5	37.5	1.0	a			
	C7NP3B474□	0.47	41.0	32.5	17.5	37.5	1.0	a			
	C7NP3B684□	0.68	59.5	35.5	21.5	55.0	-	b			
	C7NP3B105□	1.0	59.5	43.5	30.5	55.0	-	b			
3C (1600Vdc)	C7NP3C102□	0.0001	17.0	13.5	6.5	15.0	0.8	a			
	C7NP3C152□	0.0015	17.0	13.5	6.5	15.0	0.8	a			
	C7NP3C222□	0.0022	17.0	15.0	8.0	15.0	0.8	a			
	C7NP3C332□	0.0033	25.0	16.0	6.5	22.5	0.8	a			
	C7NP3C472□	0.0047	25.0	16.0	6.5	22.5	0.8	a			
	C7NP3C682□	0.0068	25.0	17.5	8.0	22.5	0.8	a			
	C7NP3C103□	0.01	25.0	17.5	8.0	22.5	0.8	a			
	C7NP3C153□	0.015	25.0	19.5	10.0	22.5	0.8	a			
	C7NP3C223□	0.022	30.0	22.5	11.0	27.5	0.8	a			
	C7NP3C333□	0.033	30.0	24.5	13.5	27.5	0.8	a			
	C7NP3C473□	0.047	30.0	24.5	13.5	27.5	0.8	a			

□:J=Tolerance of Capacitance ±5%, K=Tolerance of Capacitance ±10%

Operating Temperature: -40~+85°C

• *Permissible current data*

The representative capacity value's permissible current characteristics per rated voltage is shown below.
Please ask a sales representative for capacitance data not shown below.

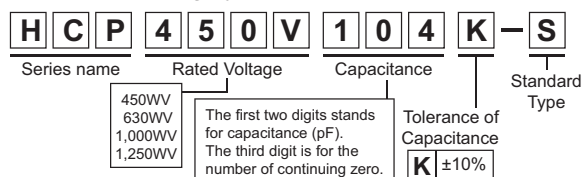


Features

- Compact size and resin case.
- Improved safety and suppressing self-heating.

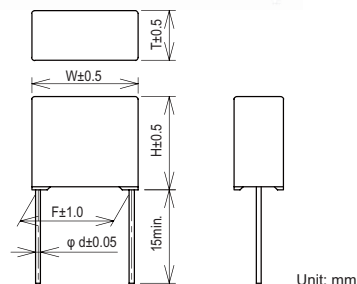
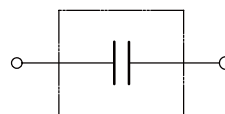
Applications

- High frequency circuit, high voltage resonant circuit, snubber circuit and protection of semiconductors such as IGBT, IPM and MOSFET.
- Model numbering system



• Dimensions

• Circuit



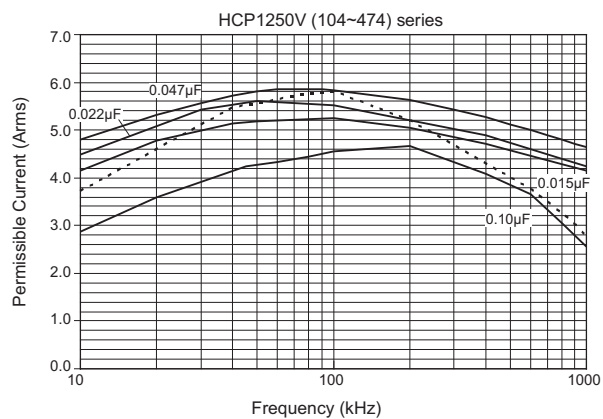
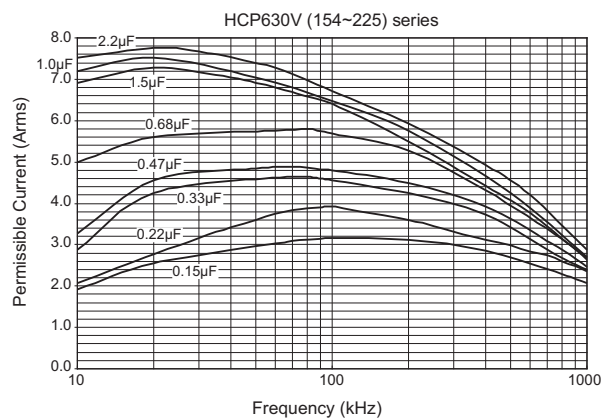
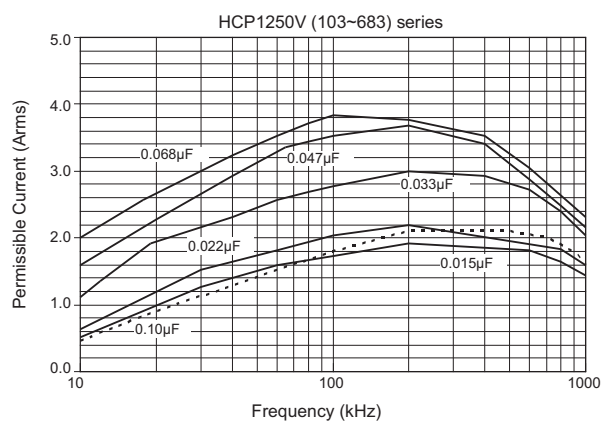
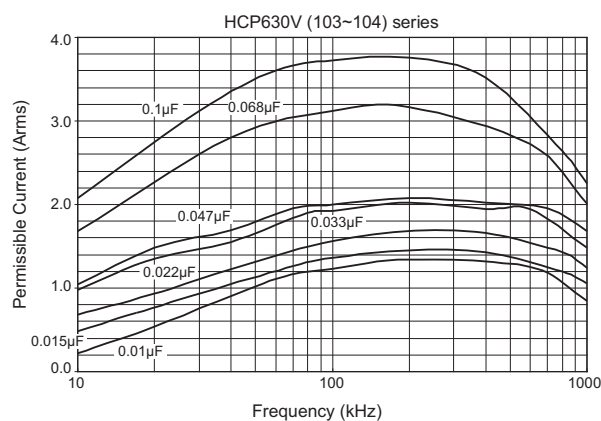
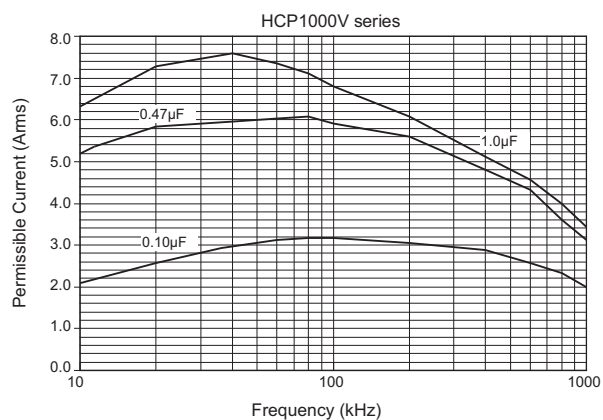
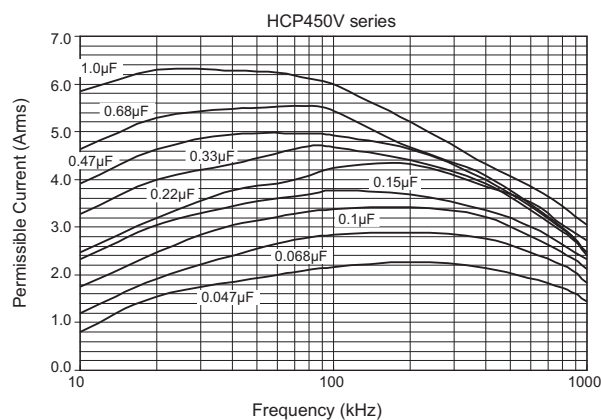
Electrical Specifications

Rated Voltage	Model Number	Capacitance $\mu F \pm 10\%$	Dimensions (mm)					Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	ϕd			
450Vdc	HCP450V473K-S	0.047	17.0	12.0	5.0	15.0	0.6	0.001max. (at 1k $\pm$ 100Hz)	Rated Voltage $\times 1.75V_{dc}$ (2~5sec)	$C \leq 0.33\mu F$ 50,000M Ω min. (at 20°C, 100Vdc) $C > 0.33\mu F$ 20,000 $\Omega \cdot F$ min. (at 20°C, 100Vdc)
	HCP450V683K-S	0.068	17.0	12.5	5.5	15.0	0.8			
	HCP450V104K-S	0.1	17.0	13.5	6.5	15.0	0.8			
	HCP450V154K-S	0.15	17.0	15.0	8.0	15.0	0.8			
	HCP450V224K-S	0.22	25.0	16.0	6.5	22.5	0.8			
	HCP450V334K-S	0.33	25.0	17.5	8.0	22.5	0.8			
	HCP450V474K-S	0.47	30.0	22.0	11.0	27.5	0.8			
	HCP450V684K-S	0.68	30.0	22.0	11.0	27.5	0.8			
	HCP450V105K-S	1.0	30.0	24.5	13.5	27.5	0.8			
630Vdc	HCP630V103K-S	0.01	17.0	12.0	5.0	15.0	0.6			
	HCP630V153K-S	0.015	17.0	12.0	5.0	15.0	0.6			
	HCP630V223K-S	0.022	17.0	12.0	5.0	15.0	0.6			
	HCP630V333K-S	0.033	17.0	12.0	5.0	15.0	0.6			
	HCP630V473K-S	0.047	17.0	12.5	5.5	15.0	0.8			
	HCP630V683K-S	0.068	17.0	13.5	6.5	15.0	0.8			
	HCP630V104K-S	0.1	17.0	15.0	8.0	15.0	0.8			
	HCP630V154K-S	0.15	25.0	17.5	8.0	22.5	0.8			
	HCP630V224K-S	0.22	25.0	17.5	8.0	22.5	0.8			
	HCP630V334K-S	0.33	25.0	19.5	10.0	22.5	0.8			
	HCP630V474K-S	0.47	30.0	22.0	11.0	27.5	0.8			
	HCP630V684K-S	0.68	30.0	24.5	13.5	27.5	0.8			
	HCP630V105K-S	1.0	30.5	28.0	16.0	27.5	1.0			
1000Vdc	HCP1000V104K-S	0.1	25.0	17.5	8.0	22.5	0.8			
	HCP1000V474K-S	0.47	30.5	28.0	16.0	27.5	1.0			
	HCP1000V105K-S	1.0	41.0	32.5	17.5	37.5	1.0			
	HCP1250V103K-S	0.01	17.0	15.0	8.0	15.0	0.8			
1250Vdc	HCP1250V153K-S	0.015	25.0	16.0	6.5	22.5	0.8			
	HCP1250V223K-S	0.022	25.0	16.0	6.5	22.5	0.8			
	HCP1250V333K-S	0.033	25.0	17.5	8.0	22.5	0.8			
	HCP1250V473K-S	0.047	25.0	19.5	10.0	22.5	0.8			
	HCP1250V683K-S	0.068	30.0	22.0	11.0	27.5	0.8			
	HCP1250V104K-S	0.1	30.0	24.5	13.5	27.5	0.8			
	HCP1250V154K-S	0.15	30.5	28.0	16.0	27.5	1.0			
	HCP1250V224K-S	0.22	41.0	28.0	15.5	37.5	1.0			
	HCP1250V334K-S	0.33	41.0	28.0	15.5	37.5	1.0			
	HCP1250V474K-S	0.47	41.0	32.5	17.5	37.5	1.0			

It is possible to use from more than 85°C to 105°C by derating of rated voltage.

Operating Temperature: -40~+85°C

● Permissible current data



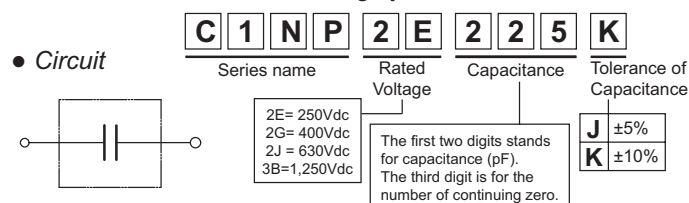
Features

- High performance.
- High capacitance.
- High surge withstand voltage and high current withstand capability.

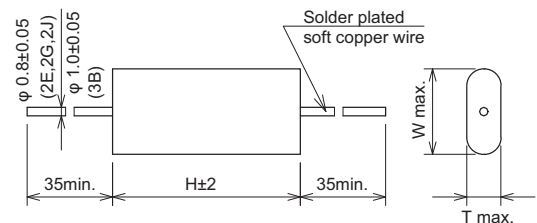
Applications

- High frequency circuit, High voltage resonant circuit, Snubber circuit and Protection of semiconductors.

- Model numbering system



• Dimensions



Unit: mm

Electrical Specifications

Rated Voltage	Model Number	Capacitance μF	Dimensions (mm)				Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	φ d			
2E (250Vdc)	C1NP2E225□	2.2	20.0	44.0	8.0	0.8	0.001max. (at 1kHz)	Rated Voltage ×1.75Vdc (2~5sec)	20,000Ω•Fmin. (at 20°C, 100Vdc)
	C1NP2E275□	2.7	21.5	44.0	9.0	0.8			
	C1NP2E335□	3.3	22.0	44.0	10.5	0.8			
	C1NP2E395□	3.9	23.5	44.0	11.5	0.8			
	C1NP2E475□	4.7	25.0	44.0	13.0	0.8			
	C1NP2E565□	5.6	27.0	44.0	14.5	0.8			
	C1NP2E685□	6.8	28.5	44.0	16.5	0.8			
	C1NP2E825□	8.2	33.5	44.0	17.5	0.8			
	C1NP2E106□	10	34.5	44.0	19.5	0.8			
2G (400Vdc)	C1NP2E126□	12	37.0	44.0	22.0	0.8			
	C1NP2G125□	1.2	20.5	44.0	9.0	0.8			
	C1NP2G155□	1.5	22.0	44.0	10.5	0.8			
	C1NP2G185□	1.8	23.5	44.0	11.5	0.8			
	C1NP2G225□	2.2	25.0	44.0	13.0	0.8			
	C1NP2G275□	2.7	26.5	44.0	14.5	0.8			
	C1NP2G335□	3.3	28.5	44.0	16.5	0.8			
2J (630Vdc)	C1NP2G395□	3.9	32.0	44.0	17.5	0.8			
	C1NP2G475□	4.7	34.5	44.0	19.0	0.8			
	C1NP2J824□	0.82	20.5	44.0	9.5	0.8			
	C1NP2J105□	1.0	21.5	44.0	10.0	0.8			
	C1NP2J125□	1.2	23.0	44.0	11.5	0.8			
	C1NP2J155□	1.5	24.5	44.0	13.0	0.8			
	C1NP2J185□	1.8	26.5	44.0	14.5	0.8			
3B (1250Vdc)	C1NP2J225□	2.2	28.0	44.0	16.0	0.8			
	C1NP2J275□	2.7	30.5	44.0	17.5	0.8			
	C1NP2J335□	3.3	35.0	44.0	20.0	0.8			
	C1NP3B105□	1.0	30.0	60.0	20.5	1.0			
	C1NP3B125□	1.2	32.5	60.0	23.0	1.0			
	C1NP3B155□	1.5	35.5	60.0	26.0	1.0			
	C1NP3B185□	1.8	38.5	60.0	29.0	1.0			
	C1NP3B225□	2.2	38.0	70.0	28.5	1.0			
	C1NP3B275□	2.7	41.5	70.0	32.0	1.0			
	C1NP3B335□	3.3	45.5	70.0	36.0	1.0			
	C1NP3B395□	3.9	49.0	70.0	39.5	1.0			
	C1NP3B475□	4.7	53.0	70.0	44.0	1.0			

□:J=Tolerance of Capacitance ±5%, K=Tolerance of Capacitance ±10%

Operating Temperature: -40~+85°C

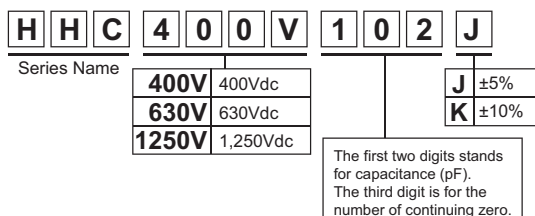
Features

- Compact size and resin case.
- Best for high frequency and high current.

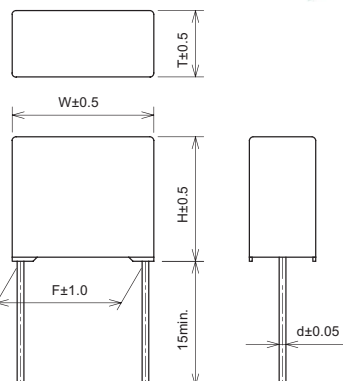
Applications

- High frequency circuit, High voltage resonant circuit, Snubber circuit and Protection of semiconductors such as IGBT, IPM and MOSFET.

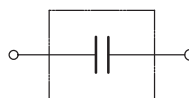
- Model numbering system



• Dimensions



• Circuit



Electrical Specifications

Rated Voltage	Model Number	Capacitance μF	Dimensions (mm)					Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	φ d			
400Vdc	HHC400V333□	0.033	17.0	12.0	5.0	15.0	0.8	0.001max. (at 1kHz)	Rated Voltage ×1.75Vdc (2~5sec)	50,000MΩmin. (at 20°C, 100Vdc)
	HHC400V393□	0.039	17.0	13.5	6.5	15.0	0.8			
	HHC400V473□	0.047	17.0	13.5	6.5	15.0	0.8			
	HHC400V563□	0.056	17.0	15.0	8.0	15.0	0.8			
	HHC400V683□	0.068	17.0	15.0	8.0	15.0	0.8			
	HHC400V823□	0.082	25.0	16.0	6.5	22.5	0.8			
	HHC400V104□	0.1	25.0	16.0	6.5	22.5	0.8			
	HHC400V124□	0.12	25.0	17.5	8.0	22.5	0.8			
	HHC400V154□	0.15	25.0	17.5	8.0	22.5	0.8			
	HHC400V184□	0.18	25.0	19.5	10.0	22.5	0.8			
630Vdc	HHC630V224□	0.22	25.0	19.5	10.0	22.5	0.8			
	HHC630V103□	0.01	17.0	12.0	5.0	15.0	0.8			
	HHC630V123□	0.012	17.0	12.5	5.5	15.0	0.8			
	HHC630V153□	0.015	17.0	12.5	5.5	15.0	0.8			
	HHC630V183□	0.018	17.0	12.5	5.5	15.0	0.8			
	HHC630V223□	0.022	17.0	12.5	5.5	15.0	0.8			
	HHC630V273□	0.027	17.0	13.5	6.5	15.0	0.8			
	HHC630V333□	0.033	17.0	15.0	8.0	15.0	0.8			
	HHC630V393□	0.039	17.0	15.0	8.0	15.0	0.8			
	HHC630V473□	0.047	17.0	15.0	8.0	15.0	0.8			
	HHC630V563□	0.056	25.0	16.0	6.5	22.5	0.8			
	HHC630V683□	0.068	25.0	16.0	6.5	22.5	0.8			
	HHC630V823□	0.082	25.0	17.5	8.0	22.5	0.8			
	HHC630V104□	0.1	25.0	17.5	8.0	22.5	0.8			
	HHC630V124□	0.12	25.0	19.5	10.0	22.5	0.8			
1250Vdc	HHC1250V154□	0.15	25.0	19.5	10.0	22.5	0.8			
	HHC1250V184□	0.18	25.0	19.5	10.0	22.5	0.8			
	HHC1250V224□	0.22	25.0	19.5	10.0	22.5	0.8			
	HHC1250V102□	0.001	17.0	12.0	5.0	15.0	0.8			
	HHC1250V122□	0.0012	17.0	12.0	5.0	15.0	0.8			
	HHC1250V152□	0.0015	17.0	12.0	5.0	15.0	0.8			
	HHC1250V182□	0.0018	17.0	12.0	5.0	15.0	0.8			
	HHC1250V222□	0.0022	17.0	12.0	5.0	15.0	0.8			
	HHC1250V272□	0.0027	17.0	12.5	5.5	15.0	0.8			
	HHC1250V332□	0.0033	17.0	12.5	5.5	15.0	0.8			

□:J=Tolerance of Capacitance ±5%, K=Tolerance of Capacitance ±10%

Operating Temperature: -40~+105°C

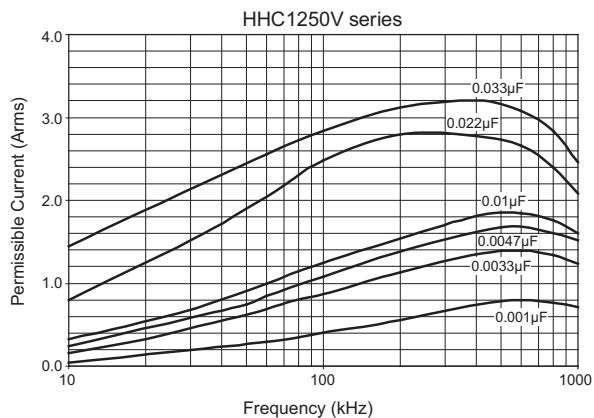
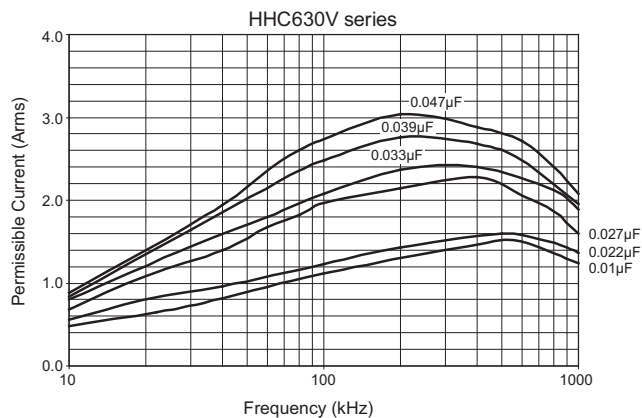
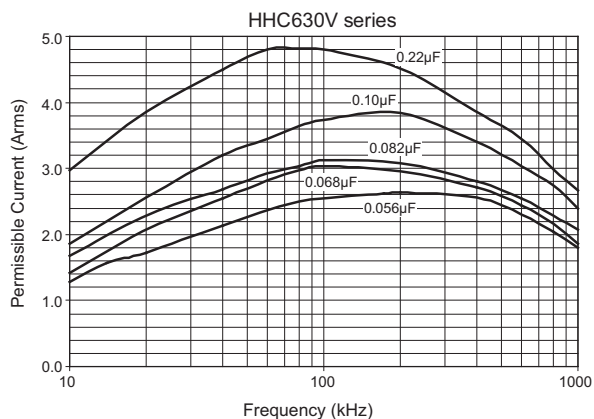
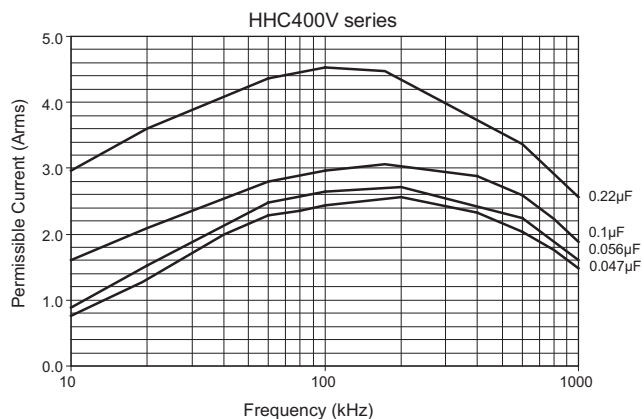
Electrical Specifications

Rated Voltage	Model Number	Capacitance μF	Dimensions (mm)					Dissipation Factor	Test Voltage	Insulation Resistance
			W	H	T	F	ϕd			
1250Vdc	HHC1250V392□	0.0039	17.0	12.5	5.5	15.0	0.8	0.001max. (at 1kHz)	Rated Voltage $\times 1.75\text{Vdc}$ (2~5sec)	50,000M Ω min. (at 20°C, 100Vdc)
	HHC1250V472□	0.0047	17.0	12.5	5.5	15.0	0.8			
	HHC1250V562□	0.0056	17.0	13.5	6.5	15.0	0.8			
	HHC1250V682□	0.0068	17.0	13.5	6.5	15.0	0.8			
	HHC1250V822□	0.0082	17.0	15.0	8.0	15.0	0.8			
	HHC1250V103□	0.01	17.0	15.0	8.0	15.0	0.8			
	HHC1250V123□	0.012	25.0	16.0	6.5	22.5	0.8			
	HHC1250V153□	0.015	25.0	16.0	6.5	22.5	0.8			
	HHC1250V183□	0.018	25.0	17.5	8.0	22.5	0.8			
	HHC1250V223□	0.022	25.0	17.5	8.0	22.5	0.8			
	HHC1250V273□	0.027	25.0	19.5	10.0	22.5	0.8			
	HHC1250V333□	0.033	25.0	19.5	10.0	22.5	0.8			

□:J=Tolerance of Capacitance $\pm 5\%$, K=Tolerance of Capacitance $\pm 10\%$ Operating Temperature: $-40 \sim +105^\circ\text{C}$

● Permissible current data

The representative capacity value's permissible current characteristics per rated voltage is shown below.
Please ask a sales representative for capacitance data not shown below.



OKAYA

SPARK QUENCHING R-C NETWORKS



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The specifications contained in this catalog are subject to change without notice.

For improvement, specifications are subject to change without prior notice.

When components are used for special applications requiring high reliability (life maintenance equipment, atomic energy, airplanes, artificial satellites, etc.) , contact us beforehand. Also make sure to evaluate and verify the components in a state that they are mounted on actual equipment.

SAFETY STANDARDS

Okaya spark quenchers have been recognized by the following safety standards organizations:

Organization (Country)	Applicable Standard	
	Household Appliances	Office Appliances and others
IEC	PUB 65	PUB 950
UL (U.S.A)	UL60384-14 (capacitor)	UL1283 (filter)
cUL (C.S.A)	CSA E60384-14	CSA E60384-14
CSA (Canada)	CSA E60384-14	CSA E60384-14
VDE (Germany)	IEC/EN 60384-14	IEC/EN 60384-14
ENEC ALL EUROPIAN COUNTRIES	IEC/EN 60384-14	IEC/EN 60384-14
SEV (Switzerland)	IEC/EN 60384-14	IEC/EN 60384-14
BS (Great Britain)	IEC/EN 60384-14	IEC/EN 60384-14
SEMKO (Sweden)	IEC/EN 60384-14	IEC/EN 60384-14
DEMKO (Denmark)	IEC/EN 60384-14	IEC/EN 60384-14
NEMKO (Norway)	IEC/EN 60384-14	IEC/EN 60384-14
FIMKO (Finland)	IEC/EN 60384-14	IEC/EN 60384-14
ÖVE (Austria)	-----	IEC/EN 60384-14
IMQ (Italy)	-----	IEC/EN 60384-14

- Electrical apparatus are classified roughly into two categories, i.e., (a)household appliances and (b) office appliances including office automation (OA) and others.
- The standards for noise suppression capacitors to be used in the household appliances are more strict than those in the office appliances and others.
- The products enumerated in the following pages (with a few exceptions) have been approved under standards applicable to the household appliances, so that you may use them for almost all applications.
- In order to avoid any accidents in machine applications which may experience unexpected abnormal surge voltage, or which are subjected to continuous 24-hour use, it is necessary to build in an extra measure of reliability. Here, the strict test conditions conducted by the above-mentioned safety standards organizations can be considered as one of the criteria from a reliability point of view.



SPARK QUENCHERS INTRODUCTION RC NETWORKS

Recent developments in electronic equipment have shown the following trends:

- Increasing demands for numerical control machines, robotics and technically advanced appliances are requiring progressive electronic technologies.
- When employing integrated circuit and microcomputer technology, today's equipment is required to perform multifunction in limited size.
- The denser the installation of components, the more the components must be miniaturized and of lighter weight.
- As a result, the following problems arise:
 - 1) Functional limits of magnetic relays and switches have narrowed due to increasing contact amperage.
 - 2) Miniaturization of electronic components has reduced their dielectric strength.
 - 3) Circuit noise has increased as a result of the coexistence of signal and power lines.
 - 4) Safety standards for electronic equipment and components have become increasingly restrictive.

Some key factors affecting circuit performance are:

- 1) Arcing between relay and switch contacts result in wear and binding.
- 2) Contact arcing, results in high frequency noise and abnormal high voltages.
- 3) The generation of back electromotive force (EMF) is due to the self-inductance of inductive loads.
- 4) The occurrence of high frequency noise is the result of contact chatter in magnetic relays and switches.

Back EMF, due to self-inductance, affects Silicon Control Rectifiers (SCRs) and Solid-state Relays (SSRs) and can result in the breakdown of other semi-conductor devices. Power line surges must also be carefully considered. Either may be a contributing factor in equipment malfunctions, failures and in extreme cases fire and/or electrical shock.

To illustrate these factors, consider that relay contact chatter is capable of inducing oscillations of several KiloHertz, contact arcing frequencies of several Megahertz and amplitudes 10 to 20 times normal circuit voltages. Voltage surges from external sources may approach thousands of volts.

To protect electronic equipment against costly failures or malfunctions, Okaya has developed advanced components to suppress contact arcing and filter unwanted electrical noise.

DETERMINING RC VALUE

In general, the RC determining formula is regarded as quite complex, but since the RC combination has the decisive effect of integrating the rapid changes of the waveform to a smoothed average, the determination of RC values by complex formulas becomes unnecessary.

It is possible to select a suitable OKAYA Spark Quencher using the chart or the formulas shown below. Keep in mind that there is no one exact value of Spark Quencher which will satisfy all applications. The chart and formula are guide-lines to give the user a starting point from which to work. The final selection must be evaluated in the application to determine its acceptability.

		LOAD CURRENT - AMPERES										
		0.05	0.1	0.2	0.3	0.5	1.0	2.0	3.0	5.0		
Source Voltage	125Vac or 125Vdc	0.01	0.01	0.01	0.01	0.022	0.1	0.3	0.5	1.0	MFD + OHMs	R+C Values
		+	+	+	+	+	+	+	+	+		
		470	470	220	120	120	47	47	47	10		
	250Vac or 250Vdc	0.01	0.01	0.01	0.01	0.022	0.1	0.3	0.5	1.0	MFD + OHMs	
		+	+	+	+	+	+	+	+	+		
		470	470	470	470	120	120	120	47	47		

$$C = \frac{I^2}{10}$$

$$R = \frac{V}{10 (1 + \frac{50}{V}) I}$$

C = Capacitance in MFD
I = Load Current in Amps
R = Resistance in Ohms
V = Source Voltage

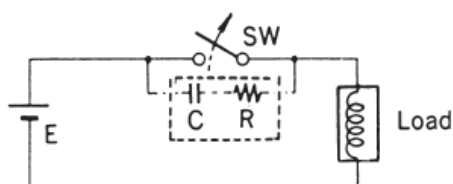


Spark Quenchers are easily selectable electronic components designed to prevent or substantially minimize the occurrence of arcing and noise generation in relay and switch contacts.

Spark Quenchers consist of specially designed capacitors and resistors connected in series. Spark discharges and induced noise are absorbed over a wide range by the accumulation characteristic and impedance of the capacitor, while the RC time constant delays and averages surge voltage and oscillations.

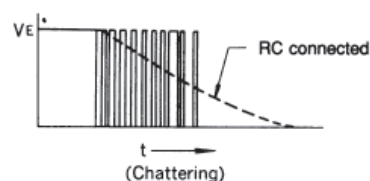
EFFECT OF SPARK QUENCHER

Arc suppression



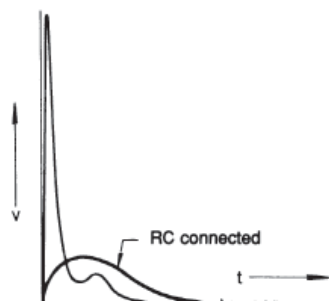
At the moment of switch opening, the RC combination absorbs and suppresses the energy of the arc by letting it bypass the switch.

Damping oscillation



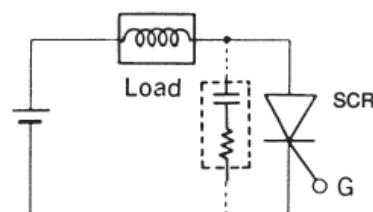
The RC combination absorbs the high frequency oscillations caused by mechanical vibrations such as relay contact chattering. Similarly the oscillations created by arcing are also averaged and suppressed by the RC combination regardless of their origin.

Back electromotive force suppression



With back electromotive force due to self-inductance, the surge voltage peak is suppressed by conducting it through the RC circuit on the low impedance side. The peak is absorbed by the capacitance of RC. The wave-form is averaged and smoothed by the time constant of the RC; thus generated noise is eliminated or substantially minimized.

Dv/dt suppression



The RC combination allows the dv/dt of the "on" and "off" operation of thyristors or similar devices to decrease; thus surge voltages are suppressed and semi-conductor elements are protected.

Even in the case of zero crossing circuits, such as AC circuits, protection is necessary since harmonic noise occurs when there is a gap between phases or current and voltage of the load circuit.



OKAYA Spark Quenchers have the following characteristics which make it possible to easily use them in a wide range of applications.

- 1) The Overload capacity is large.
- 2) They are not polarized; thus can be used in both AC and DC circuits.
- 3) They have a favorable effect on surge voltage and accompanying oscillations caused by contact chatter.
- 4) They are effective against spurious potentials having magnitudes below circuit voltage.
- 5) They offer a high degree of protection for semiconductor devices, and as thyristors and SCRs.
- 6) They improve the dv/dt ratio.

OUTLINE OF CAPACITOR CLASS RATINGS

Capacitors are classified by the IEC into the following categories (these designations are used by most European countries) :

Class Y: Capacitors used in applications where damage to the capacitor may involve the danger of electrical shock.

Class X: Capacitors used in applications where damage to the capacitor will not lead to the danger of electrical shock.

European Safety Agencies subdivide Class X into X1, X2 and X3 classifications. The test criteria for these subclasses is shown in the table.

Subclass	Peak Voltage on Service	Peak Voltage Test 1.2/50 sec.
X1	>2,500V ≤4,000V	4,000V
X2	≤2,500V	2,500V
X3	≤1,200V	None

RC COMBINATION TABLE

μF	10	27	33	47	50	68	100	120	150	160	200	220	470	500
0.01	XE XEB			XE XEB				XE XEB RE				XE XEB	XE XEB	
0.033	XE XEB AU			XE XEB AU				XE XEB AU RE				XE XEB	XE XEB	
0.1	XE XEB AU			XE XEB AU		CRH		XE XEB AU RE			CRE	XE XEB	XE XEB	
0.2	XE XEB			XE XEB				XE XEB RE				XE XEB		
0.22														
0.3	XE XEB					CRE 3CRE		XE XEB	CRE			XE XEB		
0.33			CRH 3CRH	CRH XE XEB										
0.47		CRH 3CRH												
0.5	XE XEB			XE	CRE 3CRE 6CRE									
1.0	XE XEB													



GENERAL CONSTRUCTION

Spark Quenchers must have the capacity to store surge voltages and current energy, and afford protection against inductively induced potentials. The dielectric material of the OKAYA capacitors, used in Spark Quenchers, affords a very high degree of voltage withstand strength. All resistors are non-inductive solid slug type to insure a high degree of protection against pulse potentials. To provide additional protection for equipment and users, especially when these components are used in AC applications, all OKAYA Spark Quenchers are packaged in cases which meet UL-94 Flame Class V-O.

SAFETY STANDARDS

Safety standards for capacitors used in conjunction with AC power sources have recently been adopted by many world wide standards agencies.

OKAYA Spark Quenchers are fully tested to these standards (see Chart). As well, Okaya is able to offer some products with 500 Vac ratings.

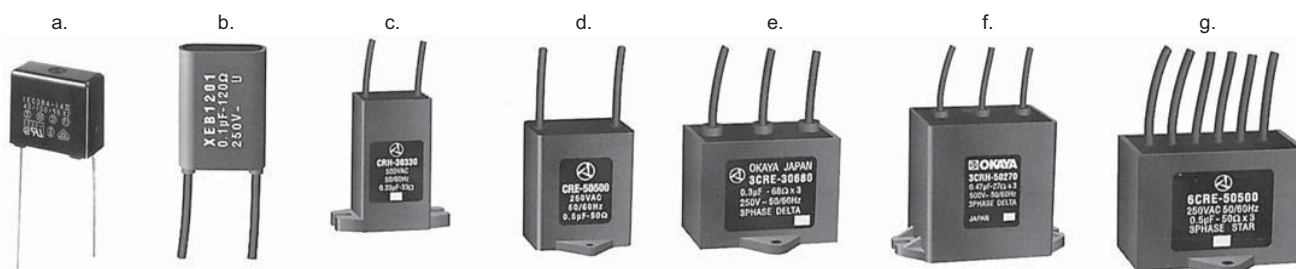
APPLICATIONS

- A) Protection for contacts and from noise during switching operations of equipment such as radio, TV, copiers, mixers, coffee grinders, dryers, tool machine equipment, etc.
- B) Protection of electronic instruments during operation of relays, solenoids, motors, etc.
- C) Electrical noise protection of semiconductor devices during control of triacs, thyristors, motors, welders, illumination equipment, etc.

FORM

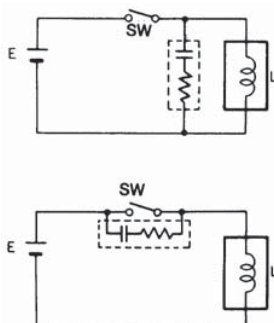
Line Voltage	Safety Standard	Lead Type	Forms	Model	Page
250Vac		Bare wire	a	AU series	60
250Vac		Bare wire	a	TA series	60
275Vac*		Bare wire	a	RE series	61
250Vac		Bare wire	a	XE series	62
250Vac		Flex PVC wire	b	XEB series	63
250Vac		Flex PVC wire	d	CRE series	64
250Vac	(30680 : not approved)	Flex PVC wire	e	3CRE series (3 phase delta connection)	64
250Vac		Flex PVC wire	g	6CRE series (3 individual circuits)	64
500Vac		Flex PVC wire	c	CRH series	65
500Vac		Flex PVC wire	f	3CRH series (3 phase delta connection)	65

* UL and CSA = 250Vac

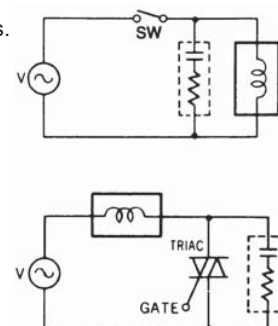


APPLICATIONS

Standard example in DC circuits.



Standard example in AC circuits.



For phase control circuits employing SCR or TRIAC, etc.

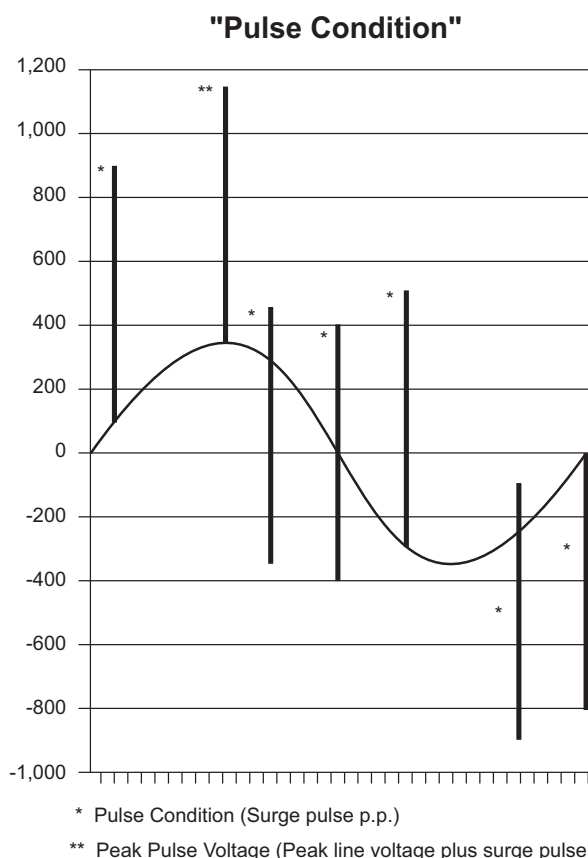


DESIGN CAUTIONS

- 1) Using OKAYA Spark Quenchers will help prevent abnormal operation due to electrical noise and/or surge pulses. It is not recommended that these devices be used in circuits with frequencies greater than 70 Hz. When used in 3-phase, full wave rectified applications, care must be taken to insure that the Spark Quencher does not self heat by more than 5 degrees centigrade or permanent damage to the Spark Quencher may occur.
- 2) When protecting contacts feeding small circuit loads, it is recommended that the Spark Quencher be placed in parallel with the load, rather than the contacts, for the most effective application.
- 3) In high speed circuits, the addition of a Spark Quencher may slow the response time of the circuit. For best response characteristics, do not use a larger Spark Quencher than is absolutely necessary to suppress the noise level.
- 4) Spark Quenchers should be connected as close as possible to the noise source. Excessive lead length may allow abnormal oscillation and/or decrease energy absorption capacity.
- 5) When a thyristor, triac or inverter circuit is to be protected by a Spark Quencher, care must be taken that high harmonic currents do not cause over heating of the Spark Quencher resistor. If heating occurs, we suggest the employment of a Spark Quencher with a lower resistance. The Spark Quencher must not self heat by more than 5 degrees centigrade. In inverter applications, it is recommended that an OKAYA noise suppression capacitor be used across the power lines, instead of the Spark Quencher.
- 6) While it may appear effective to protect contacts with a capacitor only, the capacitor discharge current will cause accumulative damage to the contacts when they close. The proper technique is to apply a Spark Quencher across either the contacts or the load.
- 7) Regarding the pulse condition (superimposed pulse condition), value of () shows the condition of rated voltage. Please be careful not to raise the temperature rise when use in the phase control circuit.
- 8) Peak to peak value of pulse condition shows the maximum pulse voltage that is able to apply between terminals of spark quencher with superimposed line voltage. It must not exceed the peak pulse voltage when add the line voltage.

EXPRESSION OF RATED VOLTAGE

The rated voltage of OKAYA Spark Quenchers is expressed by the steady-state (line) voltage rating. They can, however, withstand much higher voltages from power surges. In this catalog, the maximum voltage (including the line voltage) that the Spark Quenchers can withstand is expressed as the "Peak Pulse Voltage". For example, the XE series is rated 250Vac RMS (350Vac Peak) maximum line voltage, but can withstand surge voltages up to 1,200Vac (including Peak line voltage). "Pulse Condition" means the maximum voltage that can be input between terminals of the Spark Quencher (excluding line voltage) during operation. For example, when the XE series is used in a 250Vac RMS (350Vac Peak) line voltage application, it can withstand surge voltages up to 800Vac (P-P) above the Peak line voltage. The following drawing shows examples of both "Peak Pulse Voltage" and "Pulse Condition" for clarification.



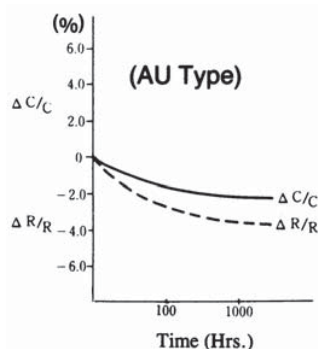


SPARK QUENCHERS

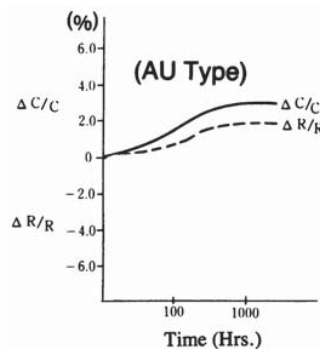


PERFORMANCE CHARACTERISTICS

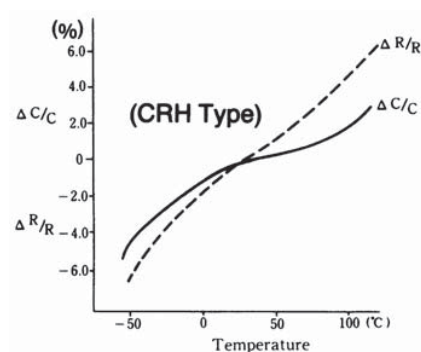
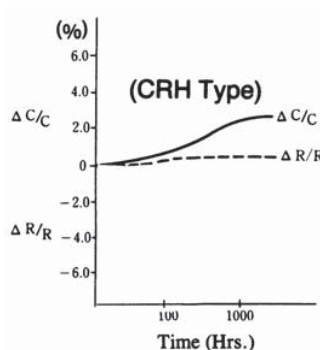
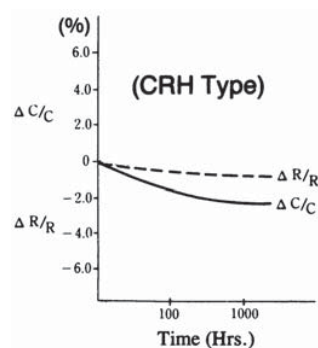
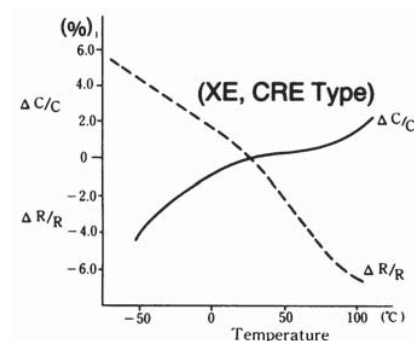
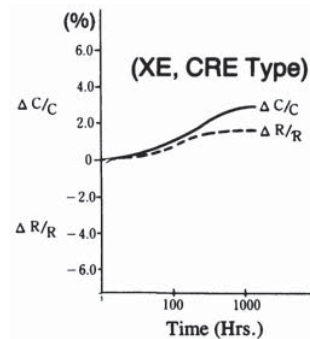
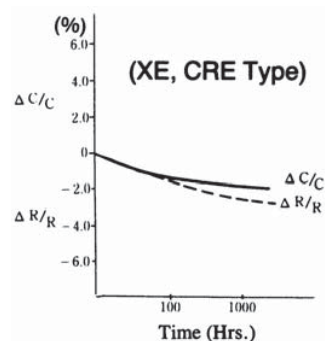
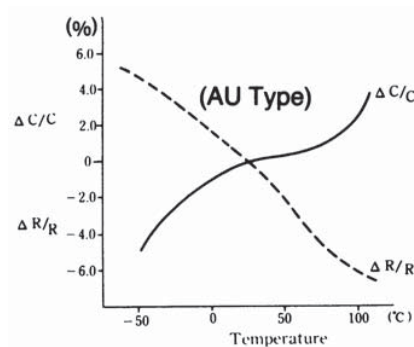
Temperature Endurance



Damp Heat Endurance



Temperature Characteristics



TEST CONDITIONS

Temperature Endurance:

While operating at maximum rated temperature and at 125% of rated voltage, input the table voltages four times per hour for 0.1 second.

Model	Applied voltage
AU, CRE	880 Vac
XE	1,000 Vac
CRH	1,500 Vac

Damp Heat Endurance:

60 $^{\circ}C$, 90~95% RH
100% Rated Voltage

Temperature Characteristics:

-50 $^{\circ}C$ to ~100 $^{\circ}C$
100% Rated Voltage



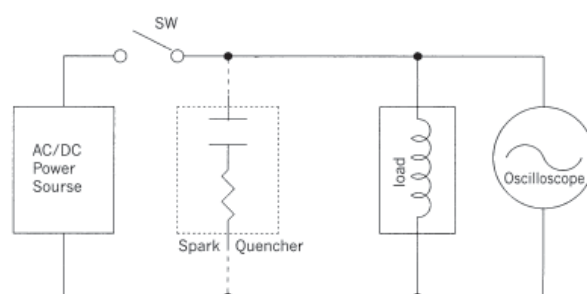
EXAMPLES OF ABSORPTION OF NOISE

The following illustrations show examples of the operation of a variety of commonly used magnetic relays and contactors with and without a Spark Quencher. The ability of the Spark Quencher to integrate peak power surges and suppress high frequency oscillations is visibly demonstrated.

Without a Spark Quencher in the circuit, surge voltage becomes 10 to 30 times larger than the normal circuit voltage and the noise frequency approaches 10 MHz. Spark Quenchers effectively absorb high frequency oscillations induced by contact chattering and attenuate peak surge voltages.

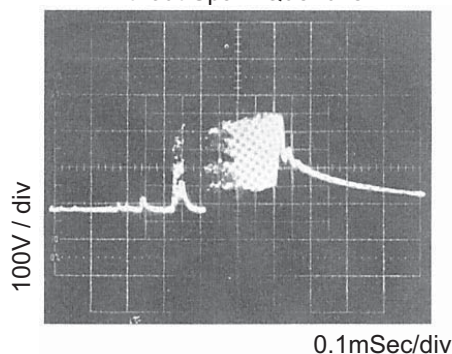
In general, inductive load circuit malfunctions occur as a result of component dielectric breakdown induced by excessive peak potential, or unnecessary radiation accompanied by occurrences of high frequency oscillations due to rapid changes of voltage. Spark Quenchers are effective in preventing both types of electrical noise.

In the following illustrations of noise waves, note that the time base is quite small compared with the normal 50/60 Hz line (16-20 msec).

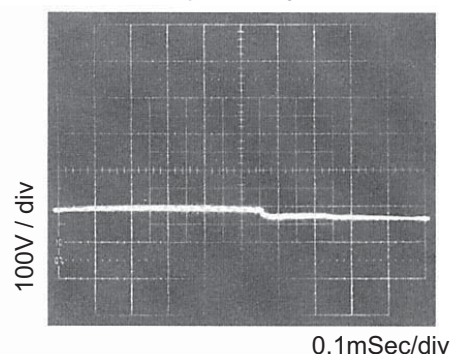


Example 1. Magnetic relay closed in 12Vdc circuit.

Without Spark Quencher

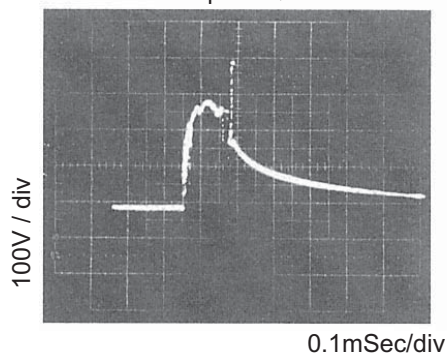


With XE-1201

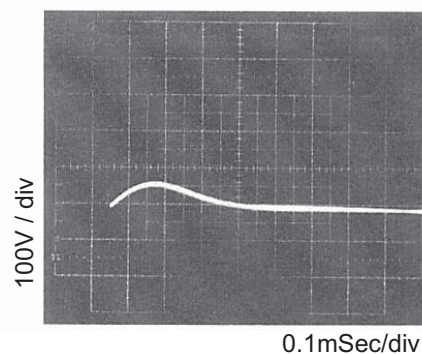


Example 2. Magnetic relay opened in 12Vdc circuit.

Without Spark Quencher



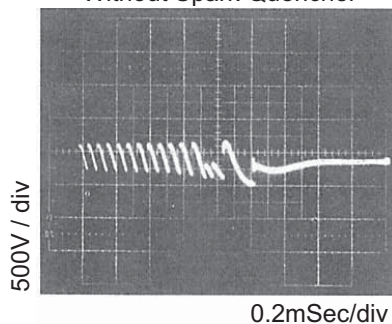
With XE-1201



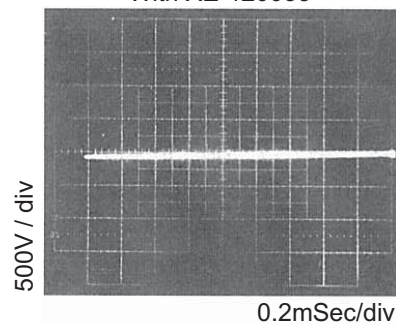


Example 3. Magnetic relay opened in 120Vac circuit.

Without Spark Quencher

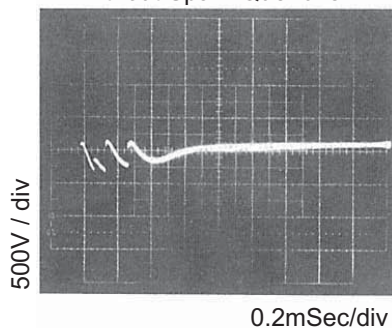


With XE-120033

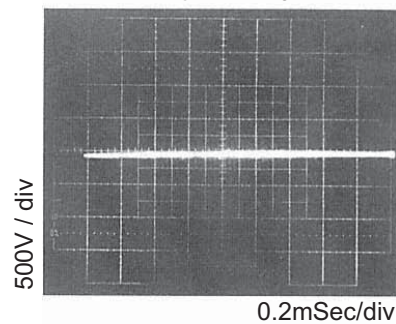


Example 4. Large magnetic relay opened in 120Vac circuit.

Without Spark Quencher

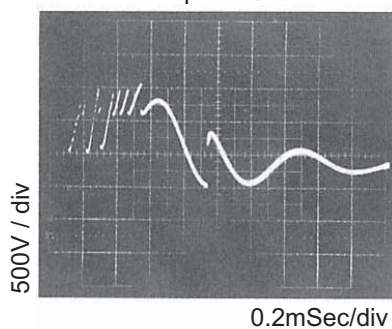


With XE-1202

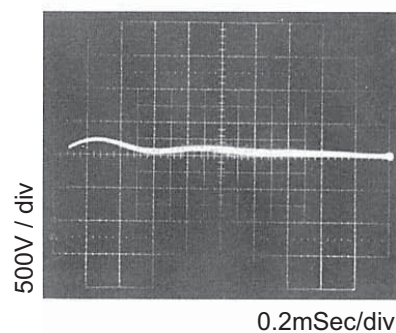


Example 5. Magnetic contactor opened in 240Vac circuit.

Without Spark Quencher

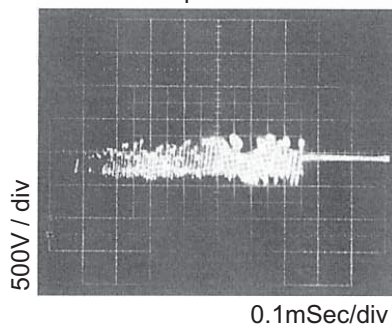


With XE-1202

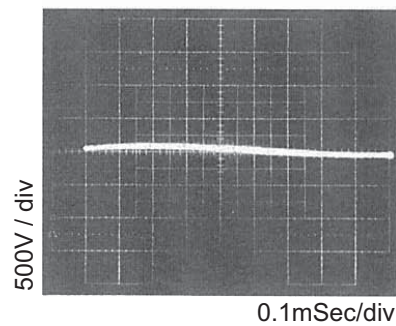


Example 6. Rotary solenoid opened in 120Vac circuit.

Without Spark Quencher



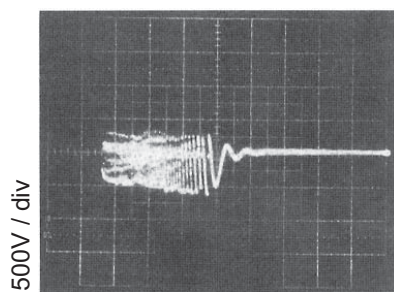
With XE-1201





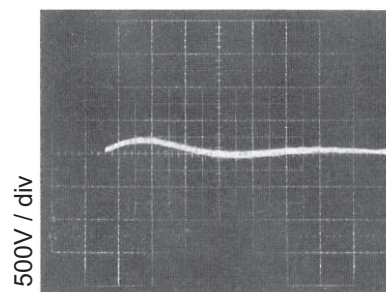
Example 7. Motor timer opened in 120Vac circuit.

Without Spark Quencher



0.2mSec/div

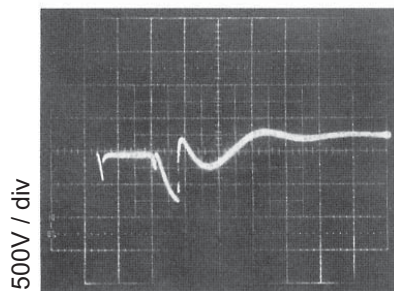
With AU-1201



0.2mSec/div

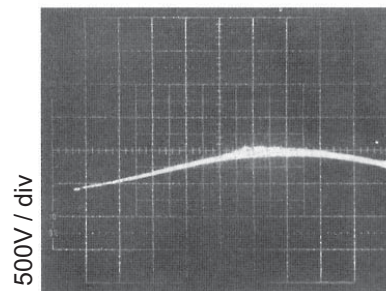
Example 8. Induction motor opened in 240Vac circuit.

Without Spark Quencher



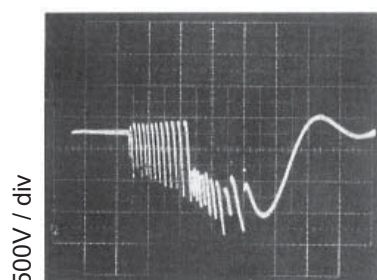
0.2mSec/div

With XE-1201



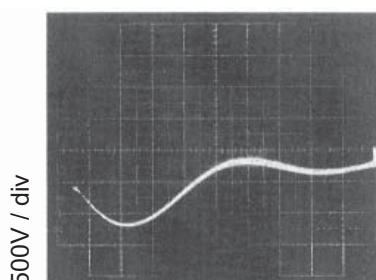
0.2mSec/div

Without Spark Quencher



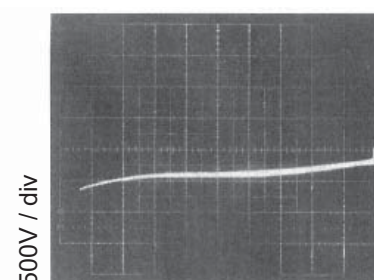
0.2mSec/div

With XE-120033



0.2mSec/div

With XE-1202



0.2mSec/div

Two of the illustrations in example 8 are the result of the switch opening without Spark Quencher protection. The variation in the wave forms is due to the difference in the AC voltage at the instant of circuit opening.

Three of the noise-graph illustrations are the result of the switch opening with Spark Quencher protection. Noise that occurs at the time of load disconnect is absorbed by the LRC loop. Proportionally as the capacitor becomes larger, the noise prevention becomes more effective.



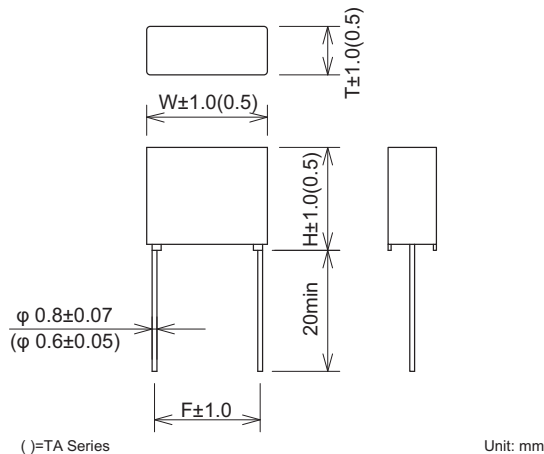
Features

- Compact size.
- AC or DC applications.

Applications

- Suppressing mechanical switching surge occurring Automatic machines and Office appliances.

Dimensions



Model numbering system

Series Name	Resistance	Capacitance
AU	010 10Ω	033 0.033μF
TA	047 47Ω	1 0.1μF
	120 120Ω	

• AU Series



Safety Standard	File No.
UL :UL60384-14	E47474
cUL :CSA E60384-14	E47474
CSA :CSA E60384-14	LR37404, LR104926
ENEC-VDE :IEC/EN 60384-14	40007824

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard. The mark with #10 stands for VDE.

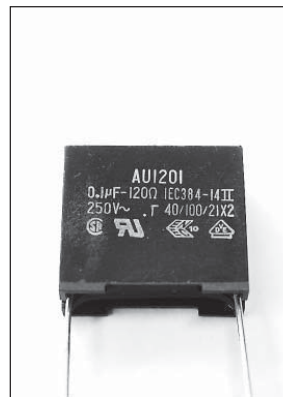


• TA Series



Safety Standard	File No.
UL :UL60384-14	E47474
cUL :CSA E60384-14	E47474
CSA :CSA E60384-14	LR37404
VDE :IEC/EN 60384-1	126004

• AU Series



• TA Series



• Circuit



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Resistance Ω±30%	Dimensions				Pulse condition (max.)				Peak Pulse Voltage	Test Voltage	Insulation Resistance
					W	H	T	F	Peak to peak	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)			
   	X2	AU120033	0.033	120(1/2W)	20.0	17.0	8.0	17.5	700V	20msec.	120(60)Hz	3(0.8)	700V	Line to Line 1,250Vac 50/60Hz 2~5sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 15,000MΩ min. Line to Case 100,000MΩ min. (at 100Vdc)
		AU1201	0.1							50msec.					
		AU047033	0.033	47(1/2W)						20msec.		6(1.5)			
		AU0471	0.1							50msec.					
		AU010033	0.033	10/(1/2W)						20msec.		10(2.5)			
		AU0101	0.1							50msec.					
  	X2	TA120033	0.033	120(1/4W)	18.0	12.0	5.0	16.0		20msec.		3(0.8)	800V	Line to Line 2,000Vdc or 1,080Vac Line to Case 2,000Vac	

Operating Temperature: -40~+100°C
(TA Series= -40~+85°C)



Features

- Various safety approval.
- Compact size.
- AC or DC applications.
- Good peak pulse withstand capability.

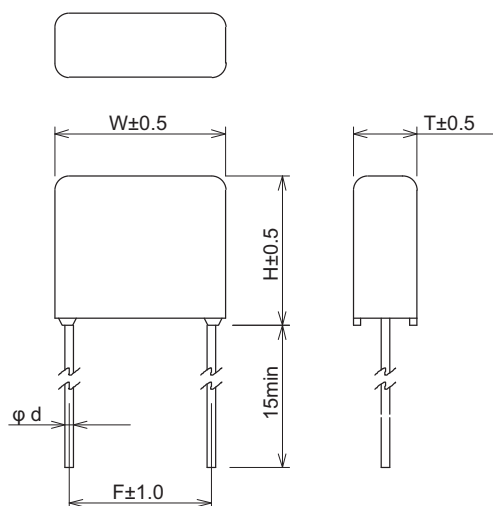
Applications

- Suppressing mechanical switching surge occurring Automatic machines and Office appliances.

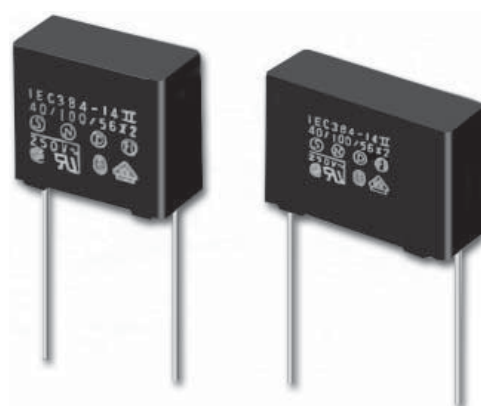


Safety Standard		File No.
UL	:UL60384-14	E47474
cUL	:CSA E60384-14	E47474
CSA	:CSA E60384-14	LR37404, LR104926
VDE	:IEC/EN 60384-14	40024027
SEMKO	:IEC/EN 60384-14	1218214
NEMKO	:IEC/EN 60384-14	P07208382
DEMKO	:IEC/EN 60384-14	D-02403
FIMKO	:IEC/EN 60384-14	FI 27865
Electrosuisse	:IEC/EN 60384-14	13.0823

• Dimensions



Unit: mm



• Model numbering system

R	E	1	2	0			
Series Name		Resistance		Capacitance			

01	0.01μF
033	0.033μF
1	0.1μF
2	0.2μF

• Circuit



Electrical Specifications

Rated Voltage **275Vac (UL, CSA: 250V)**

Safety Standard	Class	Model Number	Capacitance μF±20%	Resistance Ω±30%	Dimensions					Pulse condition (max.)				Peak Pulse Voltage	Test Voltage	Insulation Resistance			
					W	H	T	F	d	Peak to peak	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)						
	X2	RE12001	0.01	120(1/4W)	16.0	13.5	6.0	14.0	0.6±0.05	800V	50msec	120Hz	1.5	1,200V max.	Line to Line 1,000Vac 50/60Hz 60sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 15,000MΩmin (at 100Vdc) Line to Case 100,000MΩmin (at 100Vdc)			
		RE120033	0.033										1.0						
		RE1201	0.1	120(1/2W)	17.0	15.5	8.0	15.0	0.8±0.07				0.45						
		RE1202	0.2		24.5	17.0	8.5	22.5					0.15						

Operating Temperature: -40~+100°C



Features

- Wide variations of constant.

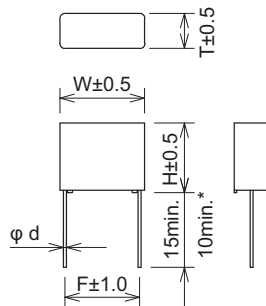
Applications

- Suppressing mechanical switching surge occurring Automatic machines and Office appliances.



Safety Standard		File No.
UL	:UL60384-14	E47474
cUL	:CSA E60384-14	E47474
CSA	:CSA E60384-14	LR37404
VDE	:IEC/EN 60384-14	40021694
Electrosuisse	:IEC/EN 60384-14	13.0340
SEMKO	:IEC/EN 60384-14	1214750
NEMKO	:IEC/EN 60384-14	P07207757
FIMKO	:IEC/EN 60384-14	FI 27517
DEMKO	:IEC/EN 60384-14	D-01387

Dimensions



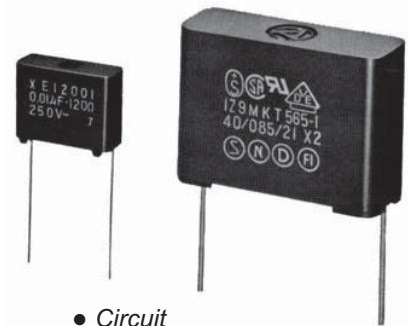
*XE0103~XE01010

Unit: mm

Model numbering system

Series Name	Resistance	Capacitance
X	E	
010	10Ω	01 0.01μF
047	47Ω	033 0.033μF
120	120Ω	1 0.1μF
220	220Ω	2 0.2μF
470	470Ω	3 0.3μF
		5 0.5μF
		10 1.0μF

The combination of Resistance and Capacitance is shown in following chart.



Circuit



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Resistance Ω±30%	Dimensions					Pulse condition (max.)				Peak Pulse Voltage	Test Voltage	Insulation Resistance
					W	H	T	F	d	Peak to peak	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)			
	X2	XE01001	0.01	10 (1/4W)	17.0	14.0	7.0	15.0	0.6±0.05	800V	50 msec	120Hz	4.5	1,200V max.	Line to Line 1,250Vac 50/60Hz 60sec	Line to Line 15,000MΩ min. (500Vdc) except XE0105 0475, 01010 5,000MΩ min. (500Vdc)
		XE04701		47 (1/4W)									3.0			
		XE12001		120 (1/4W)									1.5			
		XE22001		220 (1/4W)									0.8			
		XE47001		470 (1/4W)									0.45			
		XE010033	0.033	10 (1/4W)	17.5	15.0	8.0	0.8±0.07	3.0							
		XE047033		47 (1/4W)					2.0							
		XE120033		120 (1/4W)					1.0							
		XE220033		220 (1/4W)					0.5							
		XE470033		470 (1/4W)					0.25							
		XE0101	0.1	10 (1/2W)	23.5	17.5	8.5	20.0	0.8±0.07				1.5			
		XE0471		47 (1/2W)									1.0			
		XE1201		120 (1/2W)									0.45			
		XE2201		220 (1/2W)									0.2			
		XE4701		470 (1/2W)									0.1			
		XE0102	0.2	10 (1/2W)	30.0	20.0	11.0	27.5	1.0±0.10				0.5			
		XE0472		47 (1/2W)									0.3			
		XE1202		120 (1/2W)									0.15			
		XE2202		220 (1/2W)									0.08			
		XE0103		10 (1W)									0.2			
		XE0473	0.3	47 (1W)	40.0	28.0	16.0	36.5	1.0±0.10				0.1			
		XE1203		120 (1W)									0.05			
		XE2203		220 (1W)									0.02			
		XE0105		10 (1W)									0.18			
		XE0475		47 (1W)									0.05			
		XE01010	1.0	10 (1W)	47.0	33.5	22.0	43.5					0.15			

Operating Temperature: -40~+100°C



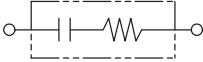
Features

- Rated voltage 250Vac, compact size.

Applications

- Suppressing mechanical occurring switching surge Automatic machines and Office appliances.

Circuit

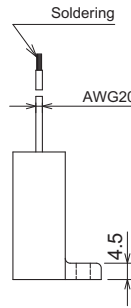
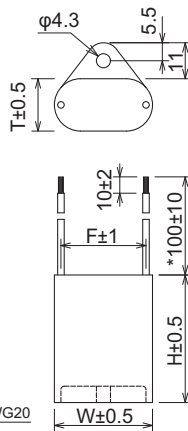
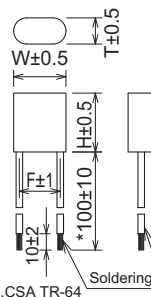
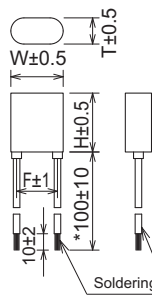


Dimensions

Type: a

Type: b

Type: c



*200±20, 300±30 available

Unit: mm



Model numbering system

Series Name	Resistance	Capacitance
X	010 10Ω	01 0.01μF
E	047 47Ω	033 0.033μF
B	120 120Ω	1 0.1μF
	220 220Ω	2 0.2μF
	470 470Ω	3 0.3μF
		5 0.5μF
		10 1.0μF

The combination of Resistance and Capacitance is shown in following chart.

Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Resistance Ω±30%	Type	Dimensions				Pulse condition (max.)				Peak Pulse Voltage	Test Voltage	Insulation Resistance
						W	H	T	F	Peak to peak	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)			
       	X2	XEB01001	0.01	10(1/4W)	a	16.0	18.0	8.0	12.5	800V	50msec	120Hz	4.5	1,200V max.	Line to Line 1,250Vac 50/60Hz 60sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 15×10³MΩ min. except: XEB0105 0475,01010 5,000MΩ min. (500Vdc) Line to Case 1×10⁵MΩ min. (500Vdc)
		XEB04701		47(1/4W)									3.0			
		XEB12001		120(1/4W)									1.5			
		XEB22001		220(1/4W)									0.8			
		XEB47001		470(1/4W)									0.45			
		XEB010033	0.033	10(1/4W)									3.0			
		XEB047033		47(1/4W)									2.0			
		XEB120033		120(1/4W)									1.0			
		XEB220033		220(1/4W)									0.5			
		XEB470033		470(1/4W)									0.25			
		XEB0101	0.1	10(1/2W)	b	21.5	28.0	11.0	17.0				1.5			
		XEB0471		47(1/2W)									1.0			
		XEB1201		120(1/2W)									0.45			
		XEB2201		220(1/2W)									0.2			
		XEB4701		470(1/2W)									0.1			
		XEB0102	0.2	10(1/2W)									0.5			
		XEB0472		47(1/2W)									0.3			
		XEB1202		120(1/2W)									0.15			
		XEB2202		220(1/2W)									0.08			
		XEB0103	0.3	10(1 W)	c	30.0	39.0	16.0	26.0				0.2			
		XEB0473		47(1 W)									0.1			
		XEB1203		120(1 W)									0.05			
		XEB2203		220(1 W)									0.02			
		XEB0105	0.5	10(1 W)									0.18			
		XEB0475		47(1 W)									0.05			
		XEB01010		10(1 W)									0.15			

Operating Temperature: -40~+100°C



CRE, 3CRE, 6CRE SERIES

SPARK QUENCHER

OKAYA

Features

- Broad use in industrial applications.
- External mounting tab.
- 1/2 watt non-inductive, high pulse resistor.
- Three phase delta connection (3 CRE). Three phase three line (6 CRE).

Applications

- Automatic machines and industrial machinery.

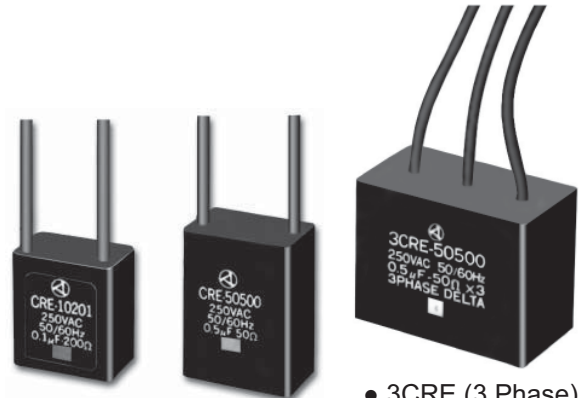
Model numbering system

Supported number	Series name	Capacitance	Resistance
None	1 Phase	10 0.1μF	201 200Ω
3	3 Phase	20 0.2μF	151 150Ω
6	3 Phase 3 Line	30 0.3μF	680 68Ω
		50 0.5μF	500 50Ω

The combination of Resistance and Capacitance is shown in following chart.



Safety Standard	File No.
UL :UL60384-14	E47474
VDE :IEC/EN 60384-14	128527

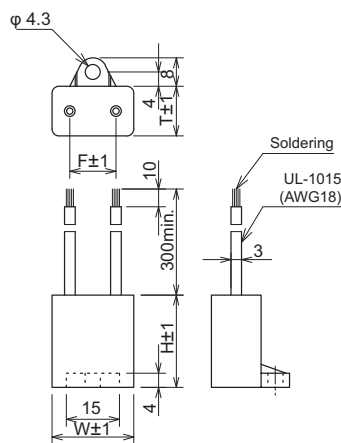


• CRE Series

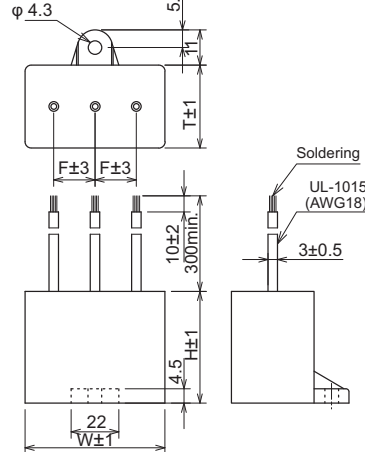
• 3CRE (3 Phase)
• 6CRE (3 Phase)

Dimensions

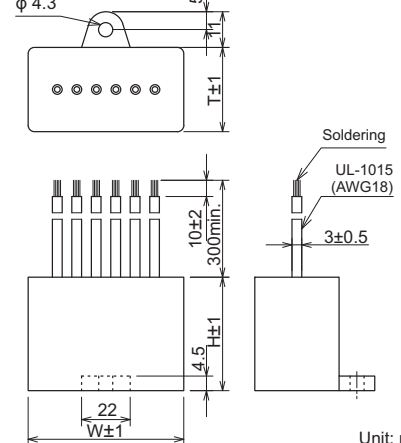
CRE



3CRE

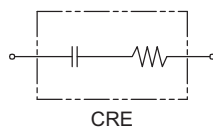


6CRE

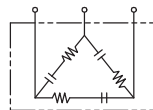


Unit: mm

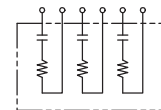
Circuit



CRE



3CRE



6CRE

Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Class	Model Number	Capacitance μF±20%	Resistance Ω±30%	Dimensions				Pulse condition (max.)				Peak Pulse Voltage	Test Voltage	Insulation Resistance	
					W	H	T	F	Peak to peak	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency(Hz)				
 	X2	CRE-10201	0.1	200(1/2W)	23	26	14	13	700V	50msec.	360Hz.	0.45	800V max.	Line to Line 625Vac 50/60Hz 60sec	Line to Line 10,000MΩ min.	
		CRE-20151	0.2	150(1/2W)	23	26	14	13		70msec.		0.15				
		CRE-30680	0.3	68(1/2W)	25	32	16	15				0.1				
		CRE-50500	0.5	50(1/2W)	25	32	16	15				0.07				
		3CRE-30680*	0.3/1 phase	68 (1/2W) /1 phase	44	35	26	-				0.1		Line to Case 2,000Vac 50/60Hz 60sec	Line to Case 100,000MΩmin. (at 500Vdc)	
		3CRE-50500	0.5	50(1/2W)	44	35	26	-				0.07				
		6CRE-50500	/1 phase	/1 phase	48											

* 3CRE-30680 is not UL approved.

Operating Temperature: -40~+85°C



Features

- 500Vac rating for application in high voltage phase control.
- Flexible wire leads with external mounting tab.
- 6 and 10 watt non-inductive, high pulse resistor.

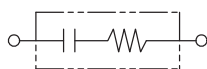
Applications

- 500Vac line Automatic machines and Office appliances.



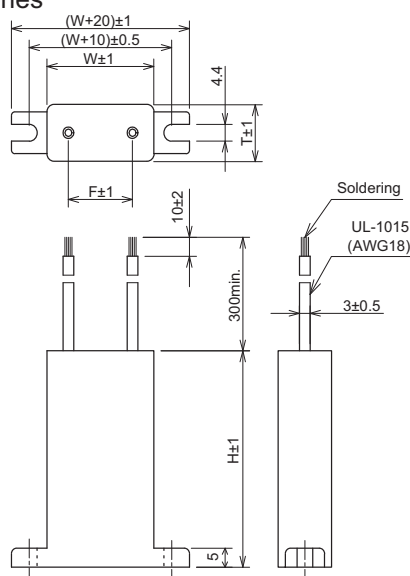
• CRH Series

• Circuit



• Dimensions

CRH Series



Safety Standard	File No.
UL :UL60384-14	E47474

• Model numbering system

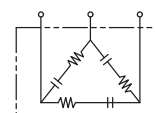
Supported number	Series Name	Capacitance	Resistance
None	1 Phase	10 0.1μF	270 27Ω
3	3 Phase	20 0.22μF	330 33Ω
		30 0.33μF	470 47Ω
		50 0.47μF	680 68Ω

The combination of Resistance and Capacitance is shown in following chart.

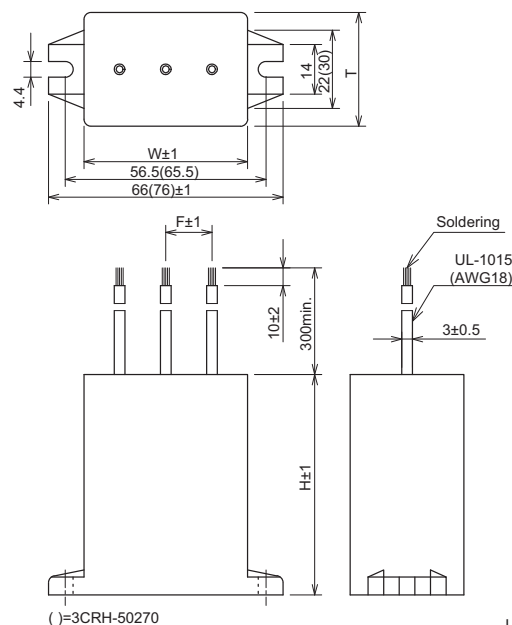


• 3CRH Series (3 Phase)

• Circuit



3CRH Series (3 Phase)



Unit: mm

Electrical Specifications

Rated Voltage **500Vac**

Safety Standard	Model Number	Capacitance μF±20%	Resistance Ω±30%	Dimensions				Pulse condition (max.)				Peak Pulse Voltage	Test Voltage	Insulation Resistance											
				W	H	T	F	Peak to peak	Pulse width	Repetitive frequency	Pulse width (sec) x Frequency (Hz)														
	CRH-10680	0.1	68(6W)	30	57	15	18	1,000V	50msec.	720Hz	1.0	1,500V	Line to Line 1,250Vac 50/60Hz 60sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Line 10,000MΩmin Line to Case 100,000MΩmin (at 500Vdc)											
	CRH-20470	0.22	47(6W)			20	28		70msec.		0.3														
	CRH-30330	0.33	33(6W)						100msec.		0.2														
	CRH-50270	0.47	27(10W)	40	62	32	13																		
	3CRH-30330	0.33/1 phase	33 (6W)/1 phase	46																					
	3CRH-50270	0.47/1 phase	27(10W)/1 phase	56											40	18									

Operating Temperature: -40~+70°C

AC POWER LINE NOISE FILTERS



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The specifications contained in this catalog are subject to change without notice.

For improvement, specifications are subject to change without prior notice.

When components are used for special applications requiring high reliability (life maintenance equipment, atomic energy, airplanes, artificial satellites, etc.), contact us beforehand. Also make sure to evaluate and verify the components in a state that they are mounted on actual equipment.

Model Number	Rated Voltage (Vac)	Rated Current																								Safety Standard	Terminal*	Case	Page
		1	2	3	4	5	6	8	10	15	20	30	40	50	60	70	75	80	100	150	200	250	300						
SUP□-EX□	250					○			○	○	○	○													UL,cUL,SEMKO	SWB	Resin	72~73	
SUP□-EY□	250					○			○	○	○	○													UL,cUL,SEMKO	SWB	Resin	74~75	
SUP-ET□-ER-0	250					○		○	○	○															UL,cUL,SEMKO	F	Metal	76~77	
SUP-E□H	250	○	○	○																					CSA,SEMKO	PVC	Metal	78	
	250					○			○	○	○														UL,CSA,SEMKO	F, SW, SR	Metal	78	
SUP-E□H-EP	250	○	○	○																					CSA,SEMKO	PVC	Metal	79	
	250					○			○	○	○														UL,CSA,SEMKO	SW	Metal	79	
SUP-G□H-EPR	250					○			○	○	○														UL,CSA,SEMKO	F, SW, SR	Metal	80	
SUP-P□H-EPR	250					○		○	○	○	○	○													UL,CSA,SEMKO	F, SW, SR	Metal	81	
SUP-P□H-E1PR /-R	250					○		○	○	○	○	○													UL,CSA,SEMKO	F, SW, SR	Metal	82	
SUP-E□-ER-6	250					○			○	○	○	○													UL,cUL,TÜV	SWB	Metal	83	
SUP-E□-ER-6	250					○			○	○	○	○													UL,cUL,TÜV	SWB	Metal	84	
SUP-E□-ER-6	250					○			○	○	○	○													UL,cUL,TÜV	SWB	Metal	85	
SUP-E□-ER-6	250					○			○	○	○	○													UL,cUL,TÜV	SWB	Metal	86	
SUP-E□-ER-6	250					○			○	○	○	○													UL,cUL,SEMKO	SWB	Metal	87	
SUP-E□-ER-6	250					○			○	○	○	○													UL,cUL,SEMKO	SWB	Metal	88	
SUP-J□H-ER	250					○			○	○	○	○													CSA,SEMKO	SW	Metal	89	
SUP-MH-ER-4	250												○		○				○	○		○	○		UL	SW	Metal	90	
3SUP□-BE-6~30	250						○		○		○	○													UL,cUL,SEMKO	SWB	Resin	91~92	
3SUP□-BE-50, 60	250													○	○										UL,cUL,SEMKO	SWB	Resin	95	
3SUP□-BH-6~30	500						○		○		○	○													UL,cUL,SEMKO	SWB	Resin	93~94	
3SUP□-BH-50, 60	500													○	○										UL,cUL,SEMKO	SWB	Resin	96	
3SUP□-AE□	250													○			○		○	○	○	○	○		UL,cUL,SEMKO	SWB	Metal	97	
3SUP□-AH□	500													○			○		○	○	○	○	○		UL,cUL,SEMKO	SWB	Metal	98	
3SUP-H□-ER-6	500					○			○	○		○		○			○		○	○	○	○			UL,TÜV	SWB	Metal	99	
SUP-B□R-E	250		○		○		○																		UL	Lead	Plastic	100	
SUP-C□G-E	250			○			○																		-	Lead	Plastic	100	
RZR-N	-																								-	-	-	101	
SUP-K□H-ERB	125/250								○	○	○	○													-	SW	Metal	102	

*Terminal: PVC=Flex PVC Terminal, F=Faston® Terminal, SW=Screw Terminal, SR=Solder Terminal, SWB= Screw Terminal Block



INTRODUCTION

Recent years have witnessed tremendous advances in electronics. In the field of computers and related equipment, legal restrictions regarding safety and noise generation have grown more strict with each passing year. In most cases, electronic devices exported must now conform to the noise regulations of the target country in order for them to be given market approval.

The following is an introductory description of the ways in which noise is generated and the various noise regulations currently enforced throughout the world.

NOISE GENERATION AND TRANSMISSION

The noise generated by electronic devices consists of two kinds. **Radiated noise** is transmitted directly into the air from an electronic device, taking the form of an electric wave that interferes with other electronic devices. In contrast **Conductive noise** interferes with other components and devices by being transmitted along power lines and the wiring of electronic circuits. These two kinds of noise can be briefly explained in the context of an electronic device by means of the following diagram (Figure 1).

A) Electronic device

1. Conductive noise from electric power line.
2. Conductive noise along the signal lines connecting electronic devices.
3. Radiated noise transmitted from an electronic device which interferes with another device.
4. Radiated noise picked up and generated by the power line which acts as an antenna.
5. Radiated noise picked up and generated by the signal lines which act as an antenna.
6. Noise produced from a source within the electronic device.
7. Noise entering from the ground line..

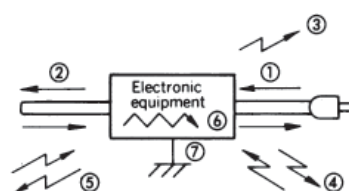


Figure 1

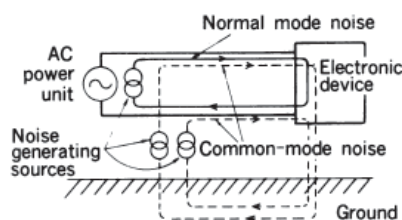


Figure 2

As shown in Figure 2, conductive noise can also be divided into two types, normal mode noise involving symmetrical noise components oscillating between lines (L1-L2) and common mode noise involving asymmetrical noise components transmitted between a line and ground (L1-E, L2- E).

OPERATING PRINCIPLES OF NOISE FILTERS

A key counter measure taken against noise is the use of noise filters. The operating principles of these devices are described in the following:

Viewed from the perspective of the circuit network, the noise filter is a kind of low range or low pass filter. It is designed to pass only frequencies lower than the cut off frequency of the filter, while attenuating or blocking all ranges higher than the cut off frequency.

As shown in Figure 3, the filter operates according to a principle whereby inductance connected directly in series with the line has virtually no effect on the noise current at low frequencies, but at high frequencies it demonstrates a high interruptive effect with respect to the noise current.

Also, a capacitor connected in parallel with the line is used as a side path to return high frequency back to the power line. The result is that normal mode noise passes through the capacitor and is shunted back to the other line. In the case of common mode noise, the result is that the noise passes through the midpoint of the two capacitors to ground.

The use of special materials such as amorphous alloys and toroidal cores gives the Okaya noise filters excellent insertion loss characteristics and high voltage pulse attenuation capability.

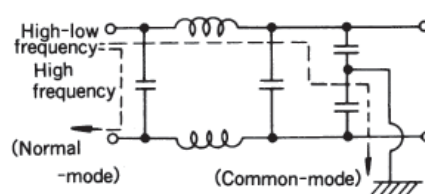


Figure 3

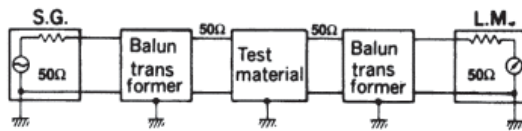


EVALUATION METHODS OF NOISE FILTER CHARACTERISTICS

1. Static Characteristics

With a measuring impedance of 50 ohms, the amount of attenuation (insertion loss) is determined by using a level meter to measure the voltage before and after insertion of a noise filter into the test circuit. Using this method, both normal mode and common mode attenuation can be measured.

Measuring Circuit

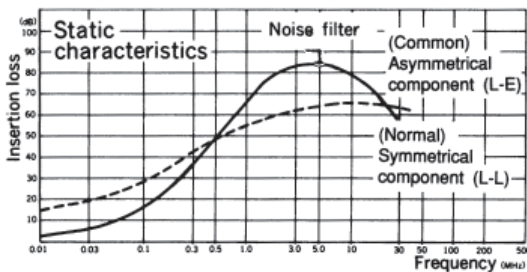


$$\text{Attenuation} = 20 \log_{10} (V_2 / V_1) \text{ [dB]}$$

V1 Level when test material is inserted

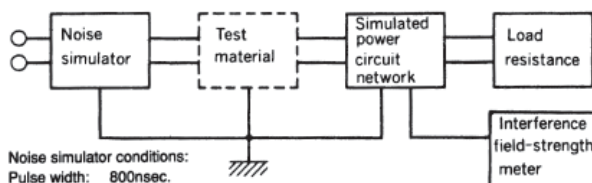
V2 Level when test material is not inserted

Test material: Noise filter.



2. Dynamic Characteristics

In order to achieve measurement results as near as possible to actual application conditions, the following method is used: With a noise simulator as the noise generating source, a rated current is allowed to flow through the test device and a simulated power circuit network. The amount of normal mode and common mode attenuation is measured.



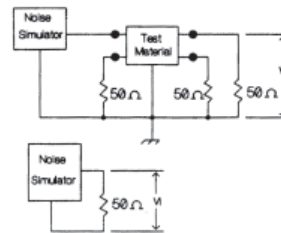
Noise simulator conditions:
Pulse width: 800nsec.
Frequency: 60Hz
Polarity: (+)
Test Material: Noise filter

3. Pulse Attenuation Characteristics

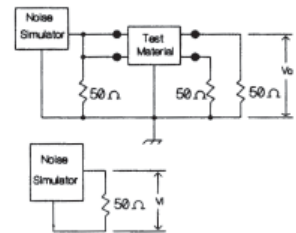
The following method is used to measure the noise margin for the external noise in an electronic device: a noise simulator is connected and the input/output voltages are measured. The formula noted below is then used to calculate the amount of attenuation in the form of the pulse absorption effect produced. In general, the noise condition used to test malfunctions is a high voltage pulse of 50nsec. to 1μsec at 1,000V to 2,000V in amplitude.

$$\text{Attenuation} = 20 \log_{10} (V_o / V_i) \text{ [dB]}$$

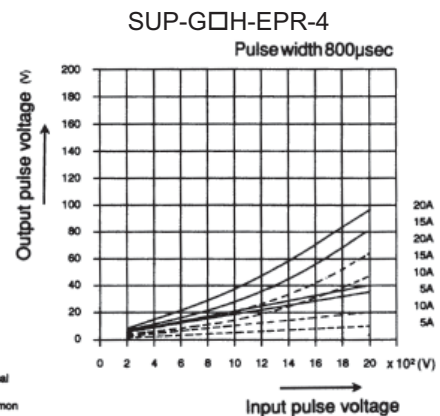
Normal Mode



Common Mode



TVSS characteristics





APPLICATION PRECAUTIONS

The following points should be kept in mind with regard to the installation of noise filters.

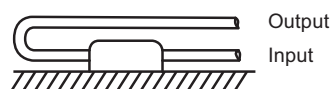
1. When mounting on the noise producing side, they should be mounted as close as possible to the source of the noise with noise electrical or mechanical contact between the input and output side of the filter.

(Example) When the input/output lines are bundled together or arranged parallel with each other, high frequency noise components induced on the input side, results in the production of noise current on the output side.

Separation of input/output lines (good example)



Bundling or parallel arrangement of input/output lines (poor example)



2. When the device is directly installed on the equipment exposed to interference, it is important to mount the noise filter as close as possible to the machines power unit or input wiring. If a power line is allowed to enter the case of the equipment without passing through the noise filter, noise current can be radiated throughout the inside of the equipment enclosure, affecting the internal electronics.
3. Precautions should be taken to insure that the ground line for the noise filter has a lower impedance than that of the noise current. If this is not done, the noise prevention effect will be lost. Also, ground lines should be as short as possible. The use of long ground lines will result in substantial reduction of the noise prevention effects (particularly in the high frequency ranges above several MHz.).
4. Whenever possible, the outer case of the noise filter should be mounted directly to the outer case of the electronic equipment. When this is not possible, a short grounding line should be used to link the outer case of the filter and the equipment.

Features

- Terminal preventing losing screw
- Two types of inductance coil are available: F means Ferrite H means High μ
- The capacitance of Y cap is selectable
- DIN rail type is option

Applications

- Medical devices, Information processing devices, Office appliances, and Various control systems



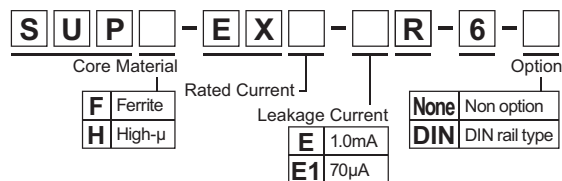
- DIN rail type (option)



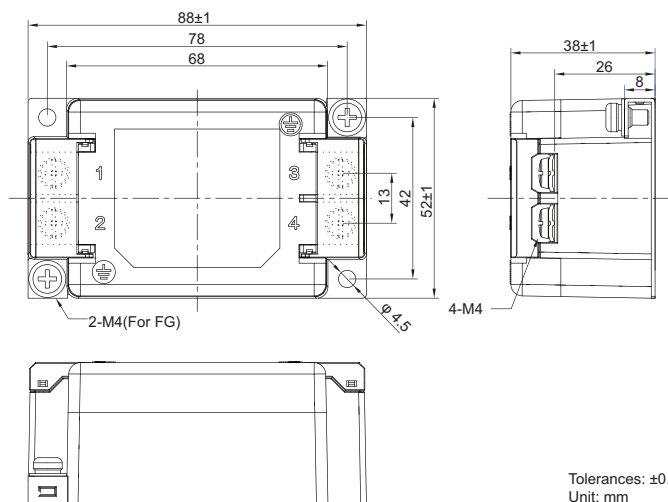
Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMKO :EN60939	SE/0142-31

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

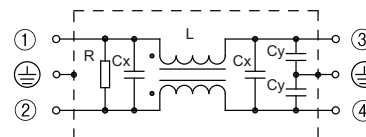
- Model numbering system



- Dimensions



- Circuit



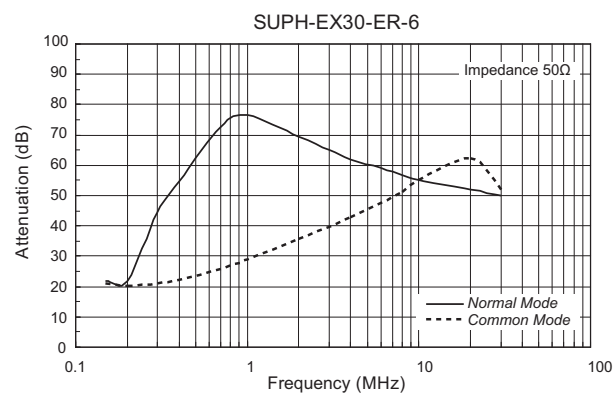
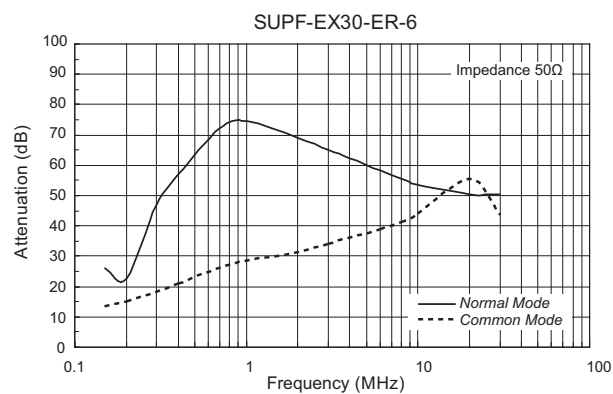
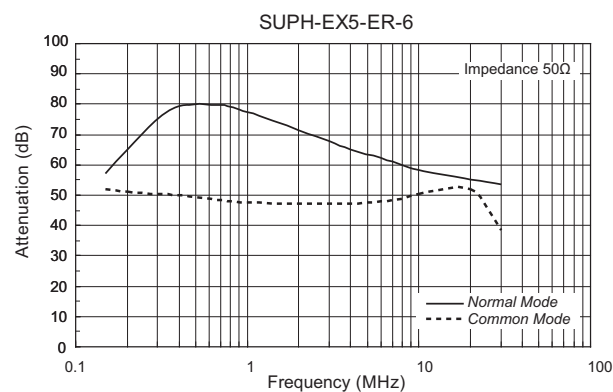
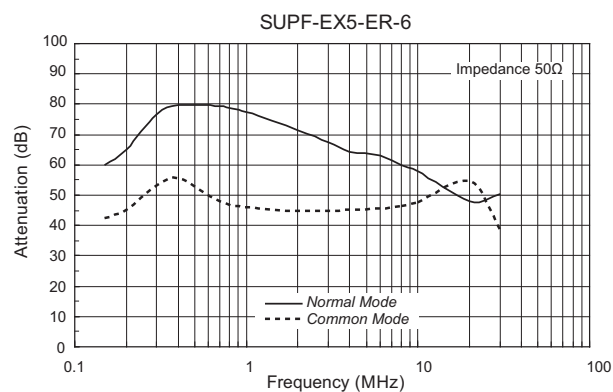
Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(g)
	SUP□-EX5-ER-6	5	Line to Line 1,000Vac 50/60Hz 60sec	Line to Ground 300M Ω min (at 500Vdc)	1.0mA (at 250Vac, 60Hz)	1.0Vac	45K	-25 ~ +55 (100°C with Temp. rise)	210
	SUP□-EX10-ER-6	10							
	SUP□-EX15-ER-6	15							
	SUP□-EX20-ER-6	20							
	SUP□-EX30-ER-6	30	Line to Ground 3,000Vac 50/60Hz 60sec		70 μ A (at 250Vac, 60Hz)				
	SUP□-EX5-E1R-6	5							
	SUP□-EX10-E1R-6	10							
	SUP□-EX15-E1R-6	15							
	SUP□-EX20-E1R-6	20							
	SUP□-EX30-E1R-6	30							

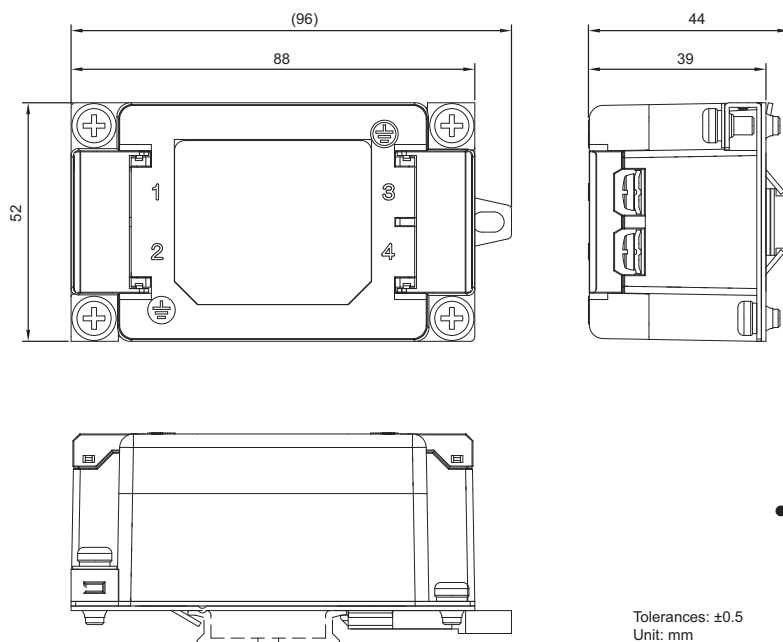
□ = F: Ferrite, H: High- μ

• Static characteristics



• Dimensions

DIN rail type (option)



Tolerances: ± 0.5
Unit: mm

• Note when installing EMI filter on DIN rail

Even though the ground connects correctly through the DIN rail, may not get noise attenuation. Be sure to connect the FG ground of EMI filter to the ground directory.

Features

- IEC60601 compliance (250Vac Line)
- Terminal preventing loosening screw
- Two type of inductance coil is available: F means Ferrite H means High μ
- The capacitance of Y cap is selectable
- DIN rail type is option

Applications

- Medical devices, Information processing devices, Office appliances, and Various control systems



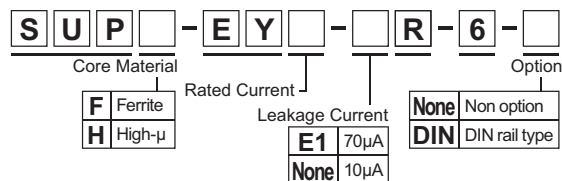
- DIN rail type (option)



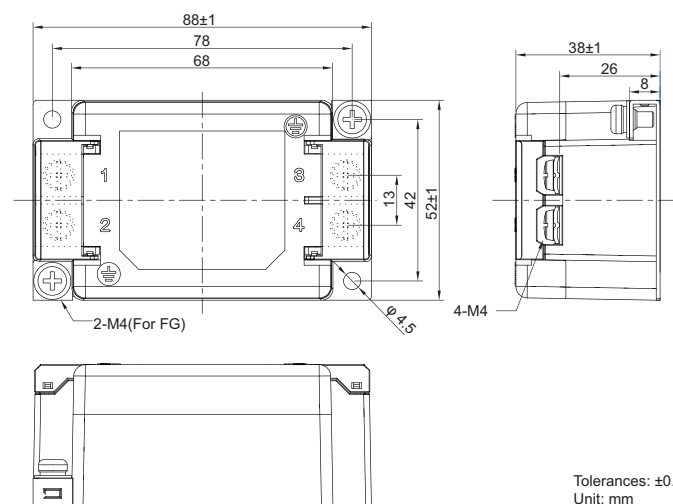
Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMCO :EN60939	SE/0142-31

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

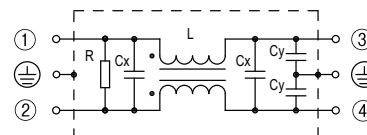
Model numbering system



Dimensions



Circuit



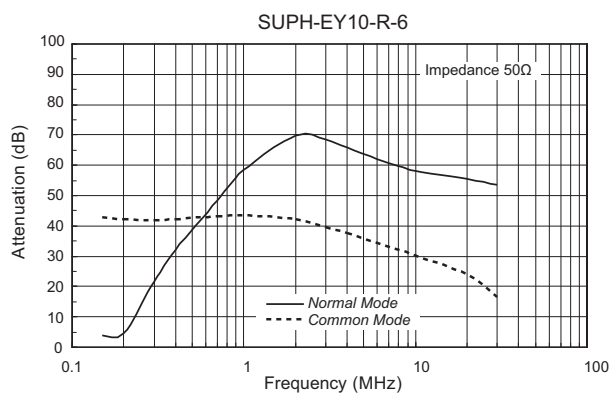
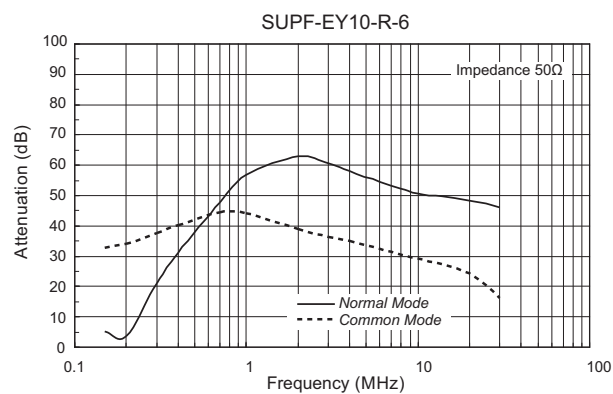
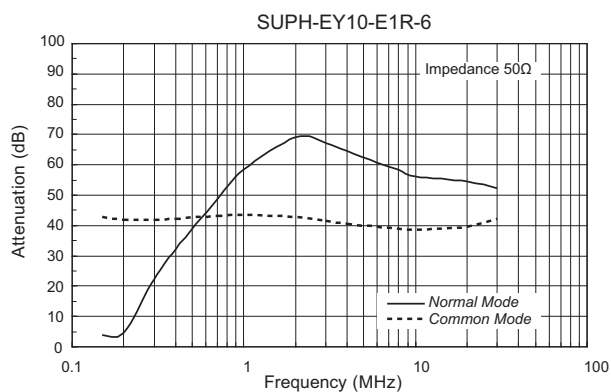
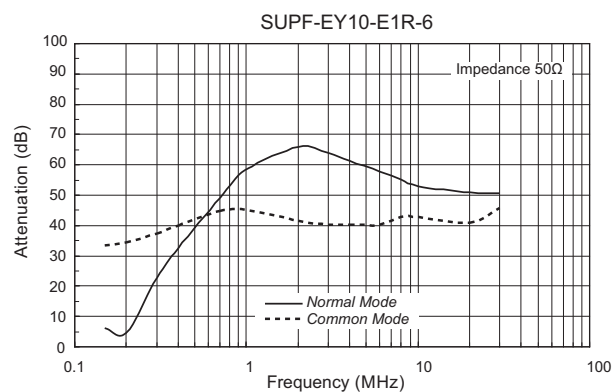
Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(g)
 	SUP□-EY5-E1R-6	5	Line to Line 1,500Vac 50/60Hz 60sec	Line to Ground 300M Ω min (at 500Vdc)	70 μ A (at 250Vac, 60Hz)	1.0Vac	45K	-25 ~ +55 (100°C with Temp. rise)	210
	SUP□-EY10-E1R-6	10							
	SUP□-EY15-E1R-6	15							
	SUP□-EY20-E1R-6	20							
	SUP□-EY30-E1R-6	30	Line to Ground 4,000Vac 50/60Hz 60sec		10 μ A (at 250Vac, 60Hz)				
	SUP□-EY5-R-6	5							
	SUP□-EY10-R-6	10							
	SUP□-EY15-R-6	15							
	SUP□-EY20-R-6	20							
	SUP□-EY30-R-6	30							

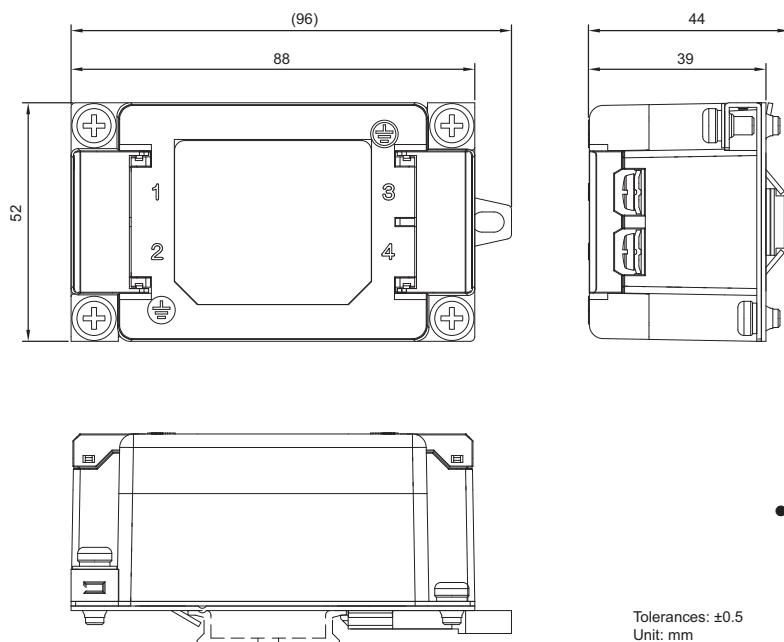
□ = F: Ferrite, H: High- μ

• Static characteristics



• Dimensions

DIN rail type (option)



• Note when installing EMI filter on DIN rail

Even though the ground connects correctly through the DIN rail, may not get noise attenuation. Be sure to connect the FG ground of EMI filter to the ground directory.



SUP-ET SERIES

NOISE FILTER



Features

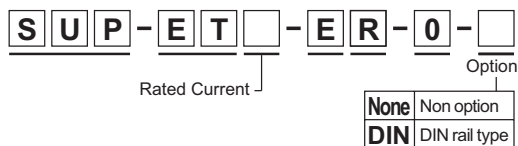
- Wiring with Faston terminal
- High attenuation by using a ferrite core with broad frequency characteristic
- Wide rating up (5, 8, 10, 15, 20 Ampere)
- Bleeder resistor for electric shock protection
- DIN rail type is option

Applications

- Information processing machines, Copiers, Fax machines, and Various control systems



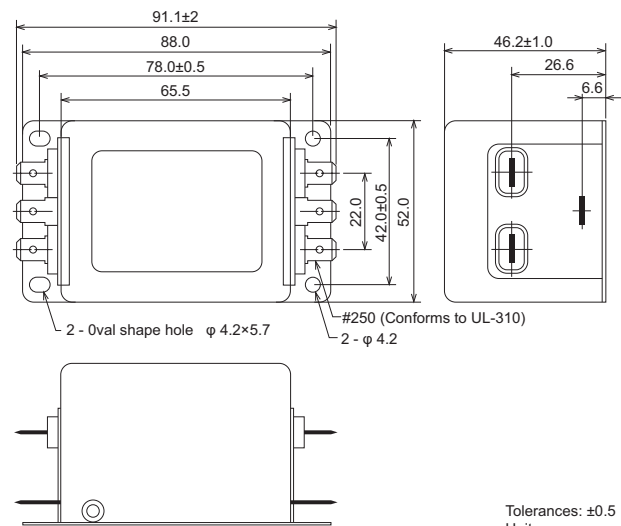
- Model numbering system



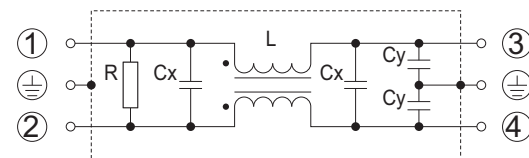
Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMKO :EN60939	SE/0142-2

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

- Dimensions (5 ~ 20A)



- Circuit



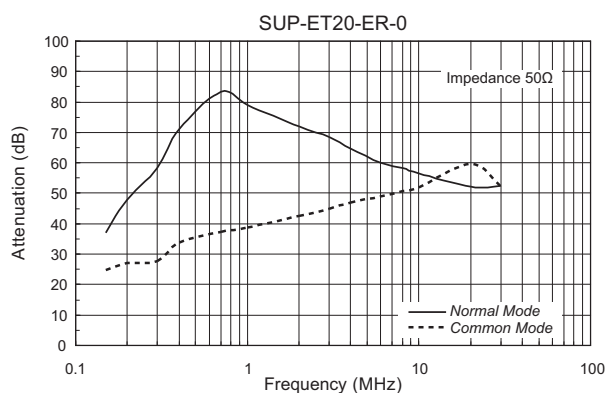
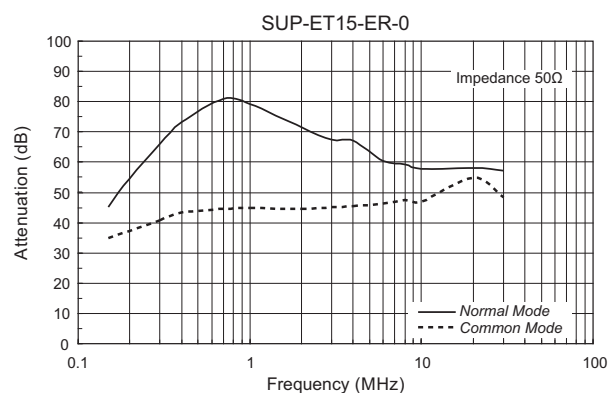
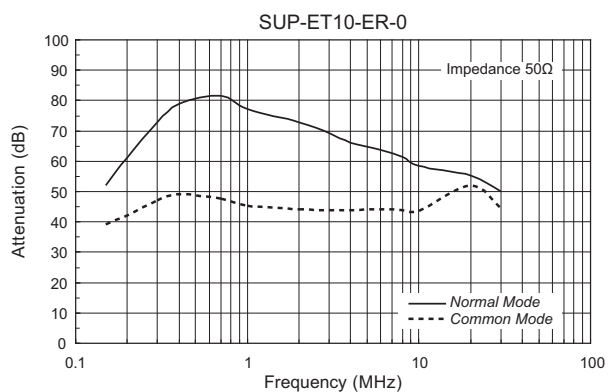
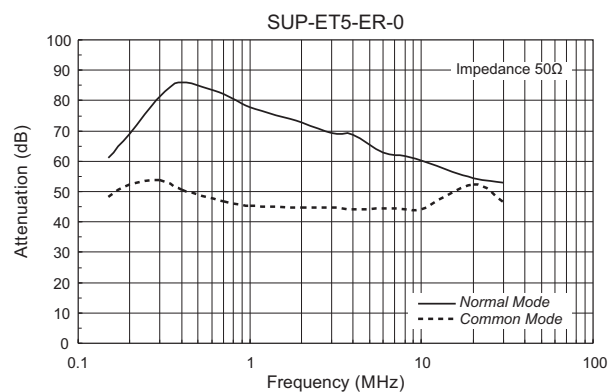
Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-ET5-ER-0	5	Line to Case 1,500Vac 50/60Hz 60sec	Line to Case 100MΩmin (at 500Vdc)	0.6mA (at 250Vac 60Hz)	1.0Vac	45K	-25 ~ +55 (100°C with Temp. rise)	0.2 ~ 20	0.15 ~ 20	250
	SUP-ET8-ER-0	8								0.2 ~ 20	
	SUP-ET10-ER-0	10								0.5 ~ 20	
	SUP-ET15-ER-0	15								2.0 ~ 20	
	SUP-ET20-ER-0	20								2.0 ~ 20	

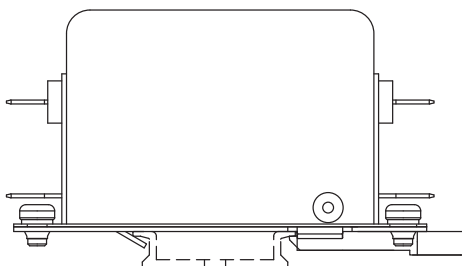
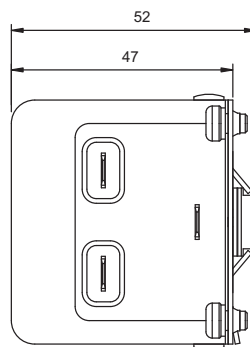
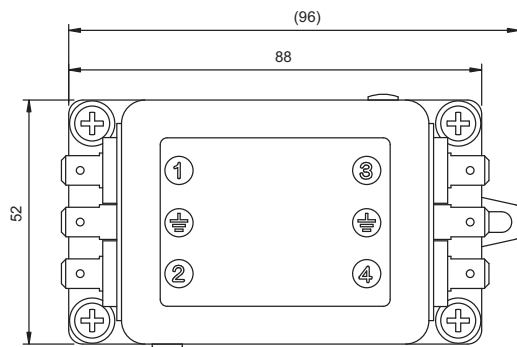
Guaranteed attenuation is more than 40dB in normal mode and more than 30dB in common mode.

• Static characteristics



• Dimensions

DIN rail type (option)



Tolerances: ± 0.5
Unit: mm

• Note when installing EMI filter on DIN rail

Even though the ground connects correctly through the DIN rail, may not get noise attenuation. Be sure to connect the FG ground of EMI filter to the ground directory.



SUP-EH SERIES

NOISE FILTERS



Features

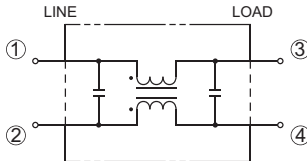
- Leak current lower than 10 μ A (250Vac, 60Hz),
The best for medical equipment.
- High performance magnetics for pulse absorption.
- High insertion loss characteristics.

Applications

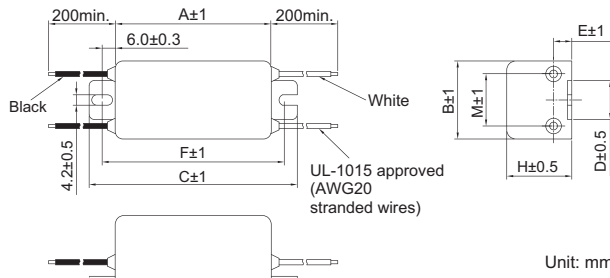
- Medical equipments, Printers, Copiers, Office appliances, Measuring devices and Control systems.

SUP-E□H Series (PVC wire)
(1~3A)

Circuit



Dimensions



Model Number	A	B	C	D	E	F	H	M
SUP-E1H	60	30	80	15	7.0	70	25	20
SUP-E2H		40		20				25
SUP-E3H								

Electrical Specifications

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-E1H	1	Line to Line 1,100Vac 50/60Hz 60sec	Line to Line 3,000M Ω min	10 μ A (at 250Vac 60Hz)	1.0Vac	30K	-25 ~ +55 (85°C with Temp.rise)	0.7 ~ 30	-	100
	SUP-E2H	2								-	
	SUP-E3H	3								-	
	SUP-E5H($\frac{0}{2}$)	5	Line to Case 2,240Vac 50/60Hz 60sec	Line to Case 6,000M Ω min (at 500Vdc)			35K	-25 ~ +50 (85°C with Temp. rise)	0.8 ~ 20	-	270
	SUP-E10H($\frac{0}{2}$)	10							1.0 ~ 30	-	
	SUP-E15H($\frac{0}{2}$)	15							1.5 ~ 30	-	
	SUP-E20H($\frac{0}{2}$)	20								-	

Guaranteed attenuation is more than 40dB.



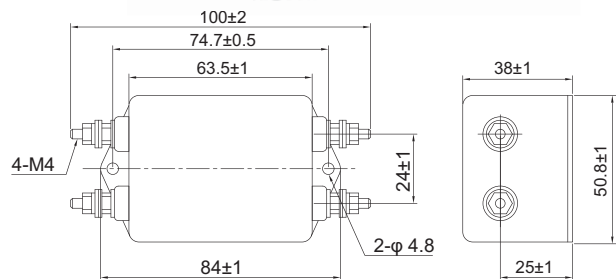
Safety Standard	File No.
UL :UL1283 / UL544	E78644
CSA :C22.2, No.8-M1986	LR60681
SEMKO :EN60939	SE/0142-13 SE/0142-14

UL-544 is the standard of medical equipments.
The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

SUP-E□H Series (Screw) - 0 (Faston® terminal)
(5~15A, 20A) - 2 (Solder terminal)

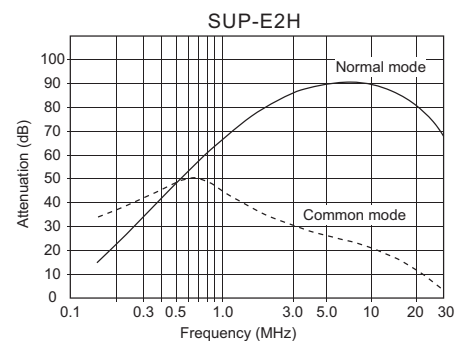


Dimensions



Unit: mm

Static characteristics

Rated Voltage **250Vac**

Features

- High performance magnetics for pulse absorption (20dB attenuation at 1,000V pulse).
- High insertion loss characteristics.

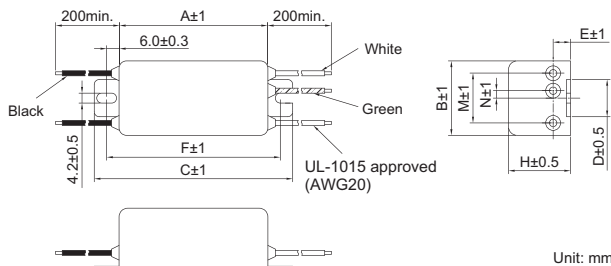
Applications

- PCs, Copiers, Printers, Office appliances, Measuring devices and Control systems.

SUP-E□H-EP Series (PVC wire) (1~3A)

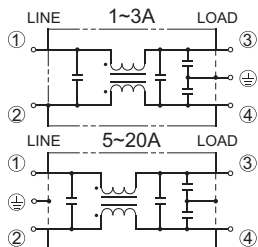


• Dimensions

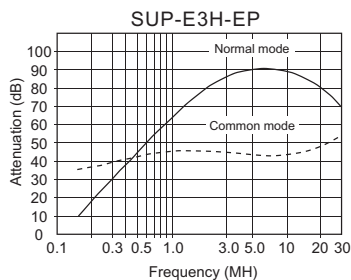


Model Number	A	B	C	D	E	F	H	M	N
SUP-E1H-EP	60	30	80	15	7.0	70	25	20	3
SUP-E2H-EP									
SUP-E3H-EP		40		20				25	4

• Circuit



• Static characteristics



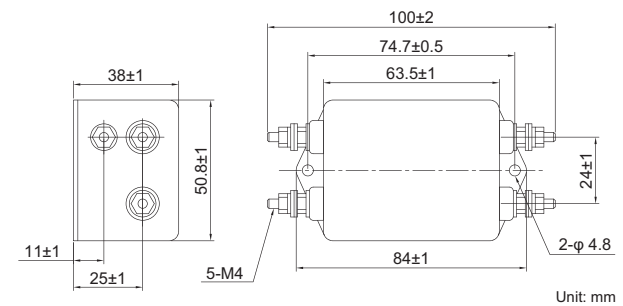
Safety Standard	File No.
UL :UL1283	E78644
CSA :C22.2, No.8-M1986	LR60681
SEMKO :EN60939	SE/0142-13 SE/0142-14

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

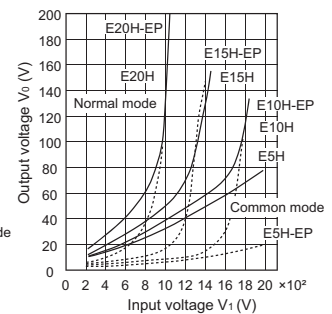
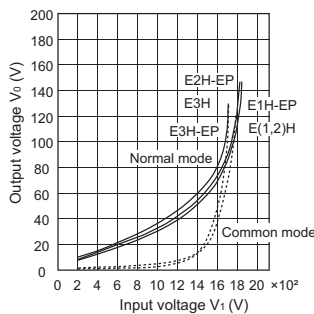
SUP-E□H-EP Series (Screw terminal) (5~15A, 20A)



• Dimensions



• TVSS Characteristics Pulse width 800nsec



Electrical Specifications

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ. (g)
									Normal Mode (MHz)	Common Mode (MHz)	
 	SUP-E1H-EP	1	Line to Line 1,100Vac 50/60Hz 60sec	Line to Line 3,000MΩmin	0.6mA (at 250Vac 60Hz)	1.0Vac	30K	-25 ~ +55 (85°C with Temp. rise)	0.7 ~ 30	0.7 ~ 30	105
	SUP-E2H-EP	2									
	SUP-E3H-EP	3									135
 	SUP-E5H-EP	5	Line to Case 2,240Vac 50/60Hz 60sec	Line to Case 6,000MΩmin (at 500Vdc)			35K	-25 ~ +50 (85°C with Temp. rise)	0.8 ~ 30	1.5 ~ 30	270
	SUP-E10H-EP	10									
	SUP-E15H-EP	15									
	SUP-E20H-EP	20									

Guaranteed attenuation is more than 40dB in normal mode, more than 40dB at 1~3A and more than 35dB at 5~20A in common mode.

Features

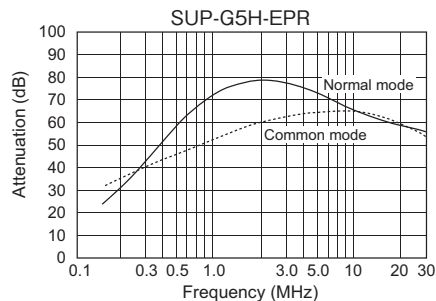
- Amorphous alloy core material (20dB attenuation of 2,000V).
- Three terminal styles (Faston®, solder and screw).
- Bleeder resistor for electric shock protection.

Applications

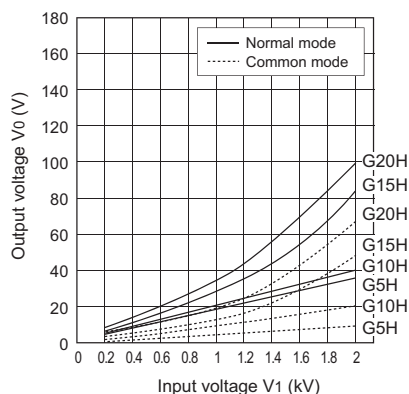
- PCs, Copiers, Office appliances, Measuring devices and Control systems.



Static characteristics



TVSS characteristics



Electrical Specifications

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-G5H-EPR(2)	5	L to L 1,000Vac 50/60Hz 60sec	Line to Case 6,000MΩmin (at 500Vdc)	0.6mA (at 250Vac 60Hz)	1.0Vac	30K	-25 ~ +55*	0.4 ~ 30	0.7 ~ 30	270
	SUP-G10H-EPR(2)	10	Line to Case 2,000Vac						0.5 ~ 30	0.8 ~ 30	
	SUP-G15H-EPR(2)	15	50/60Hz 60sec				35K	-25 ~ +50 (85°C with Temp. rise)	0.6 ~ 30	0.7 ~ 30	640
	SUP-G20H-EPR(2)	20							0.6 ~ 30	0.7 ~ 30	

Guaranteed attenuation is more than 30dB.
*85°C with Temp. rise.

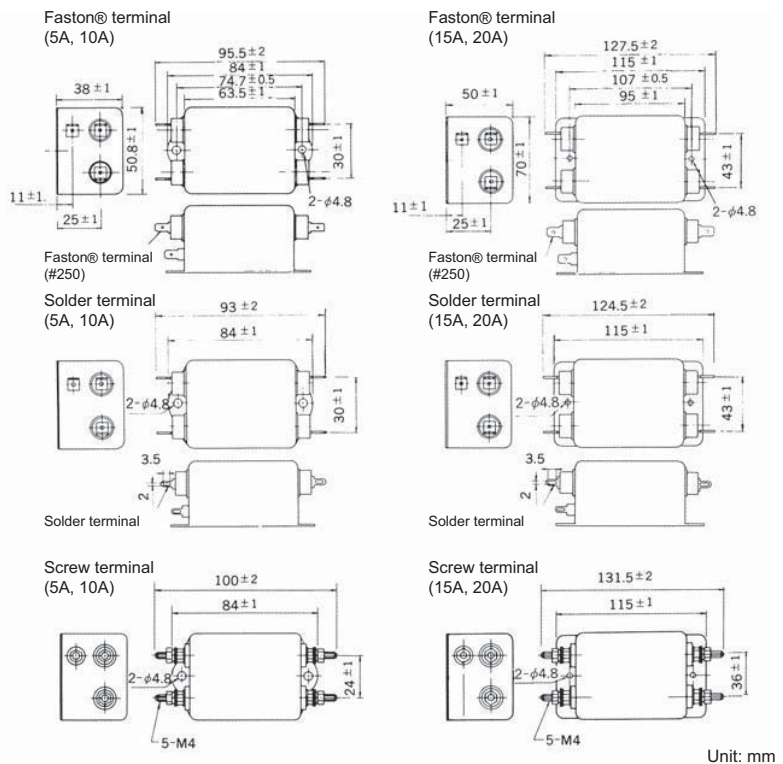


Safety Standard	File No.
UL :UL1283	E78644
CSA :C22.2, No.8-M1986	LR60681
SEMKO :EN60939	SE/0142-23

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

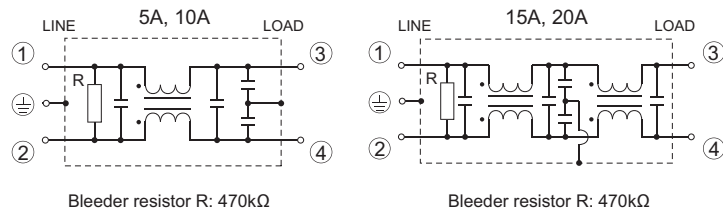
- SUP-G□H-EPR Series (Faston® terminal)
- SUP-G□H-EPR-2 Series (Solder terminal)
- SUP-G□H-EPR-4 Series (Screw terminal)

Dimensions



Unit: mm

Circuit



Bleeder resistor R: 470kΩ

Bleeder resistor R: 470kΩ

Features

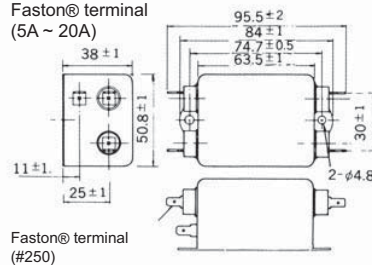
- Low range high attenuation effects by super high μ material (20~30dB at 10,000Hz). Excellent pulse absorption (more than 25dB attenuation with 1,500V pulse).
- Three terminal styles (Faston®, solder and screw).
- Bleeder resistor for electric shock protection.

Applications

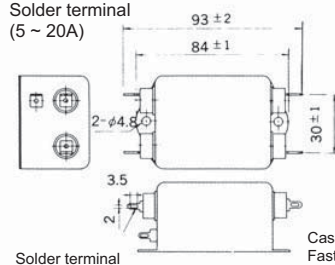
- Information processing devices (for Europe), Office appliances and Various control systems.
- SUP-P□H-EPR-0 Series (Faston® terminal)
- SUP-P□H-EPR-2 Series (Solder terminal)
- SUP-P□H-EPR-4 Series (Screw terminal)

Dimensions

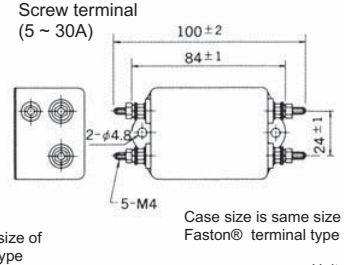
Faston® terminal
(5A ~ 20A)



Solder terminal
(5 ~ 20A)

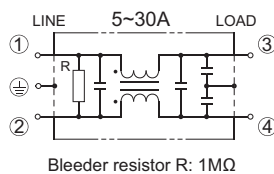


Screw terminal
(5 ~ 30A)

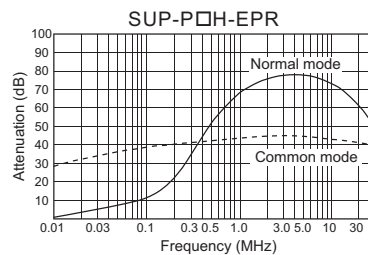


Unit: mm

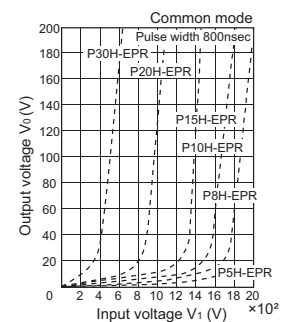
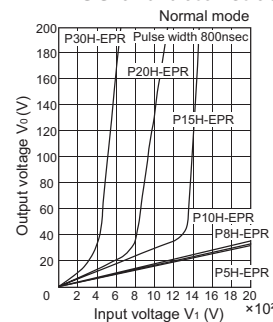
Circuit



Static characteristics



TVSS characteristics



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-P5H-EPR(- $\frac{0}{-4}$)	5	Line to Line 1,000Vac 50/60Hz 60sec	Line to Case 6,000MQmin (at 500Vdc)	0.6mA (at 250Vac 60Hz)	1.0Vac	35K	-25~ +50 (85°C with Temp. rise)	0.5 ~ 30	0.2 ~ 30	275
	SUP-P8H-EPR(- $\frac{0}{-4}$)	8							0.6 ~ 30	0.3 ~ 30	
	SUP-P10H-EPR(- $\frac{0}{-4}$)	10							0.7 ~ 30	0.4 ~ 20	
	SUP-P15H-EPR(- $\frac{0}{-4}$)	15							0.9 ~ 30	0.7 ~ 30	
	SUP-P20H-EPR(- $\frac{0}{-4}$)	20							1.5 ~ 30	3.0 ~ 30	
	*SUP-P30H-EPR-4	30							3.0 ~ 30	5.0 ~ 30	

Guaranteed attenuation is more than 40dB in normal mode and more than 35dB in common mode.

*only screw terminal type



SUP-PH-E1PR / -R SERIES

NOISE FILTERS



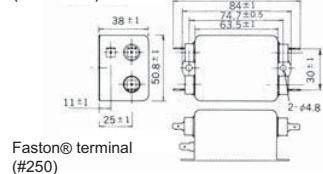
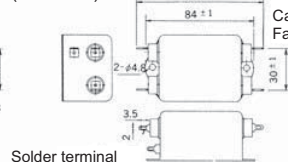
Features

- Low range high attenuation effects by super high μ material (20~30dB at 10,000Hz). Excellent pulse absorption (more than 25dB attenuation with 1,500V pulse).
- Two types of leakage current
 - less than 70 μ A
 - less than 10 μ A (applies to medical equipment)
- Three terminal styles (Faston®, solder and screw).
- Bleeder resistor for electric shock protection.

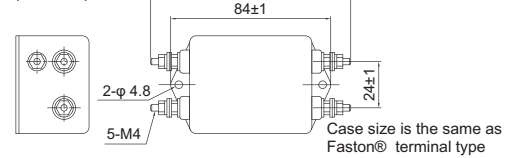
Applications

- Information processing devices (for Europe), Medical equipment, office appliances and various control systems.

• Dimensions

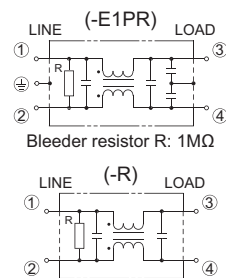
Faston® terminal
(5A ~ 20A)Faston® terminal
(#250)Solder terminal
(5A ~ 20A)

Solder terminal

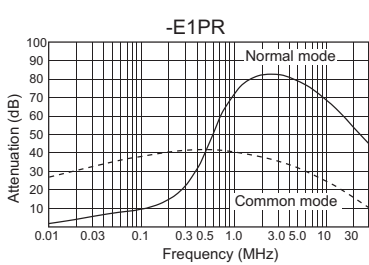
Case size is the same as
Faston® terminal typeScrew terminal
(5 ~ 30A)Case size is the same as
Faston® terminal type

Unit: mm

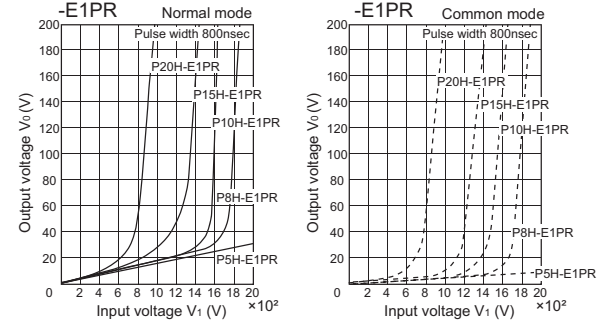
• Circuit



• Static characteristics



• TVSS characteristics



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
UL®	SUP-P5H-E1PR($\frac{3}{4}$)	5	Line to Line 1,000Vac 50/60Hz 60sec	Line to Case 6,000MΩmin (at 500Vdc)	70μA (at 250Vac 60Hz)	1.0Vac	35K	-25~ +50 (85°C with Temp. rise)	0.5 ~ 20	0.05 ~ 20	275
	SUP-P8H-E1PR($\frac{3}{4}$)	8							0.6 ~ 30	0.09 ~ 30	
	SUP-P10H-E1PR($\frac{3}{4}$)	10							0.7 ~ 30	0.1 ~ 30	
SUP-P15H-E1PR($\frac{3}{4}$)	15	1.0 ~ 30									
CSA	SUP-P20H-E1PR($\frac{3}{4}$)	20							1.5 ~ 30	3.0 ~ 30	
	*SUP-P30H-E1PR-4	30							3.0 ~ 30	4.0 ~ 30	
SEMCO	SUP-P5H-R($\frac{3}{4}$)	5	Line to Case 2,000Vac 50/60Hz 60sec		10μA (at 250Vac 60Hz)				0.5 ~ 20	-	
	SUP-P8H-R($\frac{3}{4}$)	8							0.6 ~ 30	-	
	SUP-P10H-R($\frac{3}{4}$)	10							0.7 ~ 30	-	
E14	SUP-P15H-R($\frac{3}{4}$)	15							1.0 ~ 30	-	
	SUP-P20H-R($\frac{3}{4}$)	20							1.5 ~ 30	-	
	*SUP-P30H-R-4	30							3.0 ~ 30	-	

Guaranteed attenuation is more than 40dB in normal mode and more than 35dB in common mode for SUP-PH-E1PR series.
(more than 25dB at 15A and more than 20dB at 20A, 30A)

*only screw terminal type

Features

- Uses wiring-easy terminal block.
- General purpose model made with ferrite core.
- Bleeder resistor for electric shock protection.

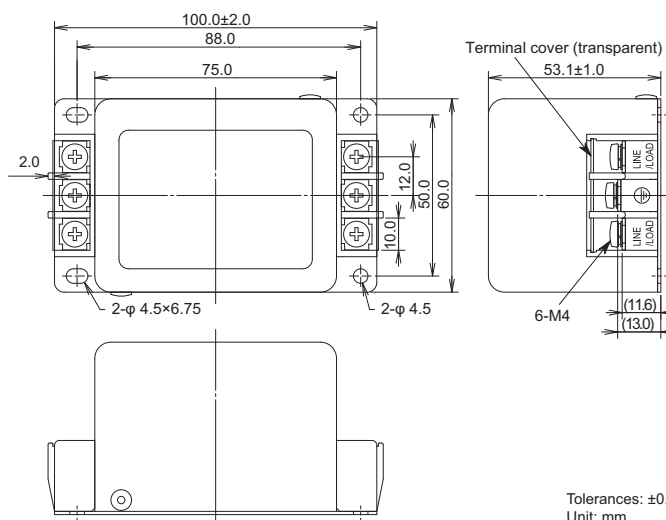
Applications

- Thyristor-applied systems, Fax machines, Game machines, Various control systems and etc.



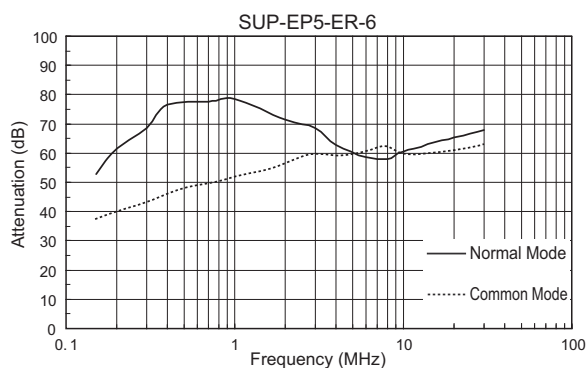
Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2, No.8-M1986	
TÜV	:EN60939	R2-50006831

- *Dimensions (5~30A)*

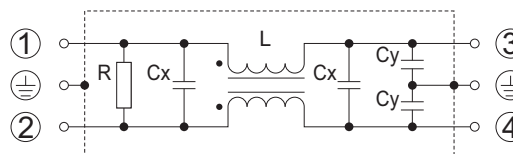


Tolerances: ± 0.5
Unit: mm

- *Static characteristics*



- *Circuit (5 ~ 30A)*



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current (max.)	Voltage Drop (max.)	Temperature Rise (max.)	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
 UL	SUP-EP5-ER-6	5	Line to Case 2,500Vac 50/60Hz 60sec	Line to Case 100MΩmin (at 500Vdc)	1mA (at 250Vac 60Hz)	1.0Vac	45K	-25 ~ +50 (100°C with Temp. rise)	0.15 ~ 30	0.3 ~ 20	450
	SUP-EP10-ER-6	10							0.4 ~ 20		
	SUP-EP15-ER-6	15							0.7 ~ 20		
	SUP-EP20-ER-6	20							2.0 ~ 30		
	 EPCOS	SUP-EP30-ER-6							30	6.0 ~ 30	

Guaranteed attenuation is more than 35dB in normal mode and more than 30dB in common mode.
Available leakage current 70μA max.(250Vac, 60Hz) type for medical equipments and low leakage current equipments.

Features

- Uses wiring-easy terminal block.
- The super high μ core allows high attenuation.
- Bleeder resistor for electric shock protection.

Applications

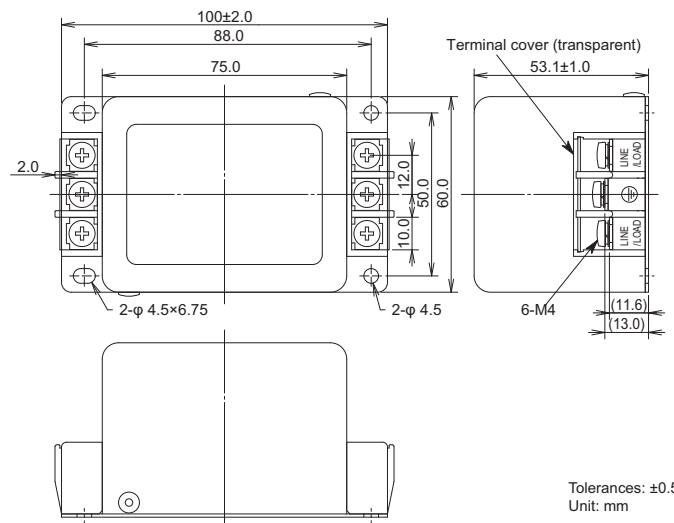
- Information processing devices, Office appliances, Various control systems and etc.



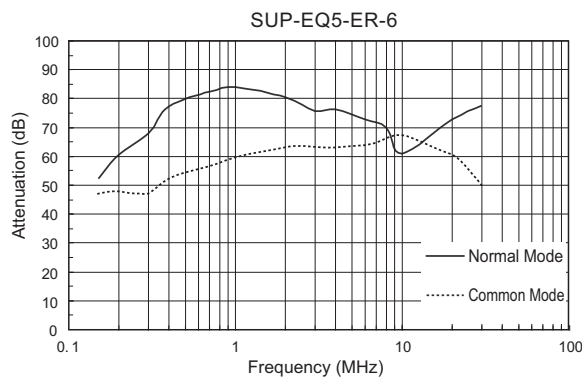
Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2, No.8-M1986	
TÜV	:EN60939	R2-50006839



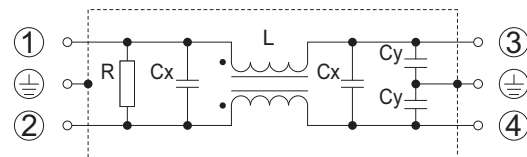
• Dimensions (5~30A)



• Static characteristics



• Circuit (5~30A)



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-EQ5-ER-6	5	Line to Case 2,500Vac 50/60Hz 60sec	Line to Case 100MΩmin (at 500Vdc)	1mA (at 250Vac 60Hz)	1.0Vac	45K	-25 ~ +55 (100°C with Temp. rise)	0.15 ~ 30	0.15 ~ 20	450
	SUP-EQ10-ER-6	10							0.2 ~ 30	0.6 ~ 20	
	SUP-EQ15-ER-6	15							0.4 ~ 30	1.0 ~ 30	
	SUP-EQ20-ER-6	20									
	SUP-EQ30-ER-6	30									

Guaranteed attenuation is more than 30dB in normal mode and common mode.
Available leakage current 70μA max.(250Vac, 60Hz) type for medical equipments and low leakage current equipments.

Features

- Uses wiring-easy terminal block.
- High attenuation over a broad band range by two-stage ferrite core circuit construction.
- Wide range lineup (5 to 30A).
- Bleeder resistor for electric shock protection.

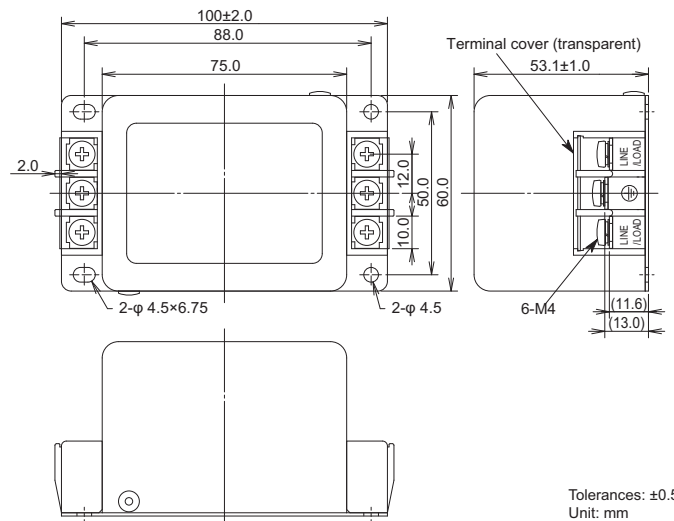
Applications

- Information processing devices, Office appliances, Various control systems and etc.

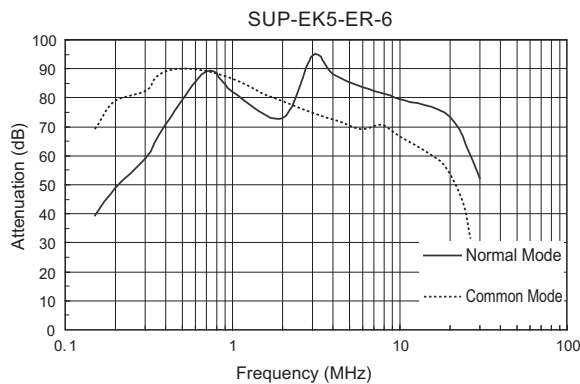


Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2, No.8-M1986	
TÜV	:EN60939	R2-50006837

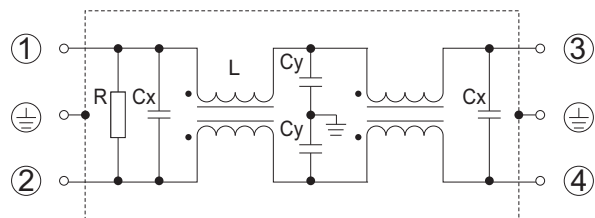
• Dimensions (5~30A)



• Static characteristics



• Circuit (5 ~ 30A)



Electrical Specifications

Rated Voltage 250Vac

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-EK5-ER-6	5	Line to Case 2,500Vac 50/60Hz 60sec	Line to Case 100MΩmin (at 500Vdc)	1mA (at 250Vac 60Hz)	1.0Vac	45K	-25 ~ +50 (100°C with Temp. rise)	0.4 ~ 20	0.15 ~ 10	500
	SUP-EK10-ER-6	10							0.5 ~ 30	0.2 ~ 10	
	SUP-EK15-ER-6	15							0.4 ~ 10		
	SUP-EK20-ER-6	20							*0.6 ~ 30	*2.0 ~ 30	
	SUP-EK30-ER-6	30									

Guaranteed attenuation is more than 40dB in normal and common mode. (*more than 35dB)
Available leakage current 70μA max.(250Vac, 60Hz) type for medical equipments and low leakage current equipments.

Features

- Uses wiring-easy terminal block.
- The two stage super high μ core allows high attenuation over a broad band range.
- Wide range lineup (5 to 30A).
- Bleeder resistor for electric shock protection.

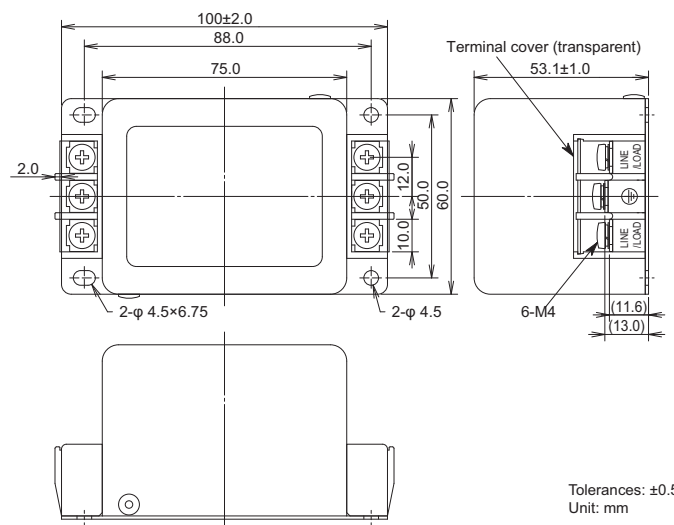
Applications

- Information processing devices, Office appliances, Various control systems and etc.

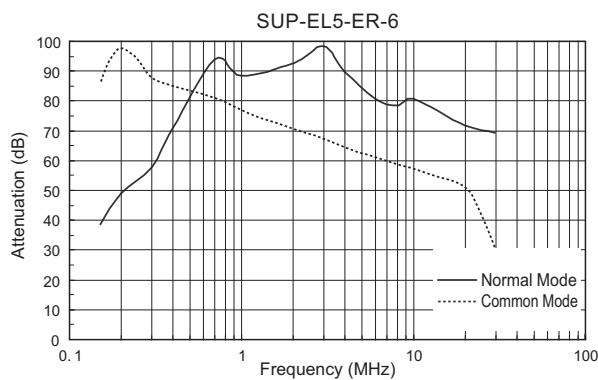


Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2, No.8-M1986	
TÜV	:EN60939	R2-50006835

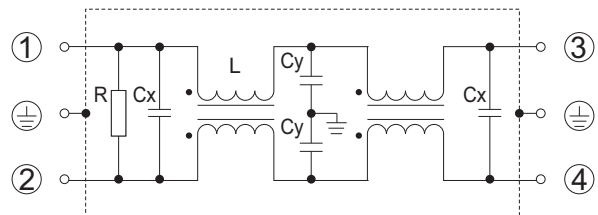
• Dimensions (5~30A)



• Static characteristics



• Circuit (5~30A)



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-EL5-ER-6	5	Line to Case 2,500Vac 50/60Hz 60sec	Line to Case 100MΩmin (at 500Vdc)	1mA (at 250Vac 60Hz)	1.0Vac	45K	-25 ~ +55 (100°C with Temp. rise)	0.4 ~ 30	0.15 ~ 10	500
	SUP-EL10-ER-6	10							0.6 ~ 30	0.3 ~ 10	
	SUP-EL15-ER-6	15							0.7 ~ 30	0.4 ~ 10	
	SUP-EL20-ER-6	20							*1.0 ~ 30	*1.0 ~ 20	
	SUP-EL30-ER-6	30									

Guaranteed attenuation is more than 40dB in normal mode and common mode. (*more than 35dB)
Available leakage current 70μA max.(250Vac, 60Hz) type for medical equipments and low leakage current equipments.

Features

- Uses wiring-easy terminal block.
- General purpose model made with ferrite core.
- Wide range lineup (5 to 30A).
- Bleeder resistor for electric shock protection.

Applications

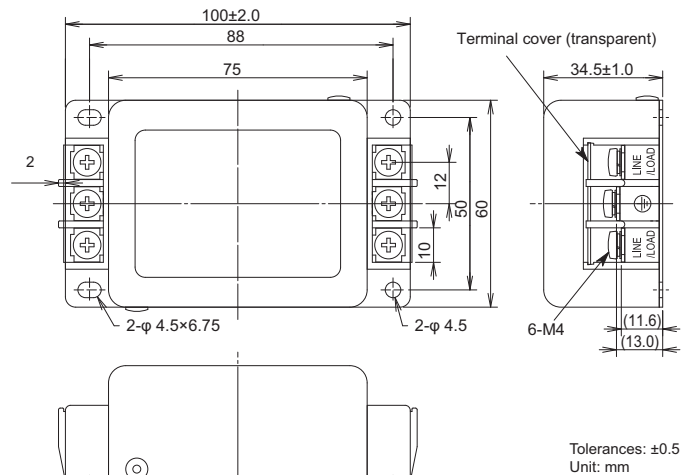
- Information processing devices, Office appliances, and Various control systems (elevators).



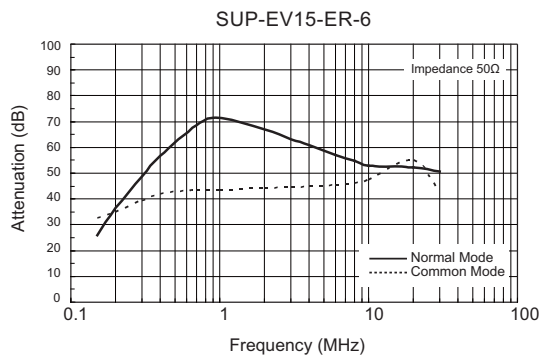
Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2, No.8-M1986	
SEMKO	:EN60939	SE/0142-12

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

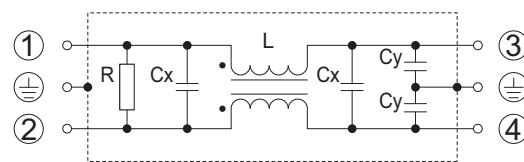
• Dimensions (5~30A)



• Static characteristics



• Circuit (5 ~ 30A)



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-EV5-ER-6	5	Line to Case 2,500Vac 50/60Hz 60sec	Line to Case 100MΩmin (at 500Vdc)	1mA (at 250Vac 60Hz)	1.0Vac	45K	-25 ~ +50 (100°C with Temp. rise)	0.3 ~ 20	0.15 ~ 20	300
	SUP-EV10-ER-6	10								0.2 ~ 20	
	SUP-EV15-ER-6	15								0.5 ~ 20	
	SUP-EV20-ER-6	20							0.6 ~ 20	*1.0 ~ 20	
	SUP-EV30-ER-6	30									

Guaranteed attenuation is more than 35dB in normal and 25dB (*more than 20dB) in common mode.
Available leakage current 70μA max.(250Vac, 60Hz) type for medical equipments and low leakage current equipments.



Features

- Uses wiring-easy terminal block.
- The super high μ core allows high attenuation.
- Wide range lineup (5 to 30A).
- Bleeder resistor for electric shock protection.

Applications

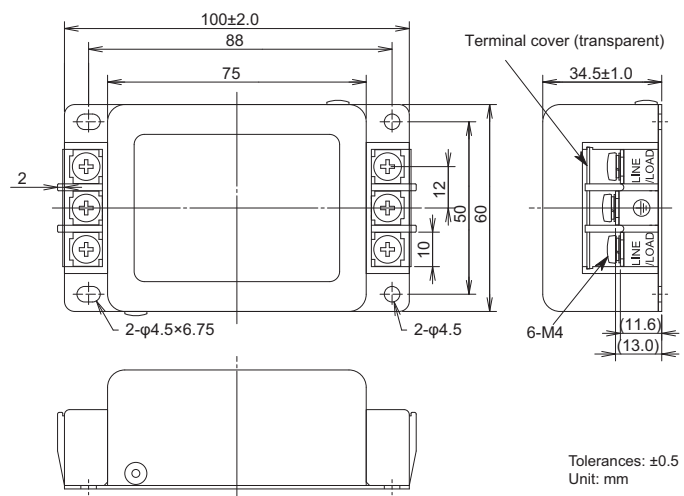
- Information processing devices, Office appliances, and Various control systems (elevators).



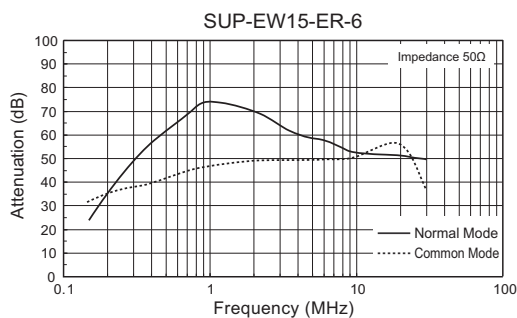
Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2, No.8-M1986	
SEMKO	:EN60939	SE/0142-12

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

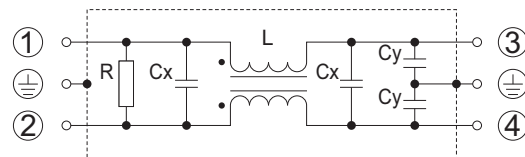
• Dimensions (5~30A)



• Static characteristics



• Circuit (5~30A)



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-EW5-ER-6	5	Line to Case 2,500Vac 50/60Hz 60sec	Line to Case 100MΩmin (at 500Vdc)	1mA (at 250Vac 60Hz)	1.0Vac	45K	-25 ~ +55 (100°C with Temp. rise)	0.3 ~ 20	0.15 ~ 20	300
	SUP-EW10-ER-6	10								*0.15 ~ 20	
	SUP-EW15-ER-6	15								*0.7 ~ 20	
	SUP-EW20-ER-6	20							0.5 ~ 20	*2.0 ~ 20	
	SUP-EW30-ER-6	30							0.6 ~ 20	*2.0 ~ 20	

Guaranteed attenuation is more than 35dB in normal and 25dB in common mode. (*more than 20dB)
Available leakage current 70μA max. (250Vac, 60Hz) type for medical equipments and low leakage current equipments.

Features

- Common and normal mode attenuation to 30MHz.
- Leak current lower than 1.0mA (250Vac, 60Hz).
- Bleeder resistor for electric shock protection.

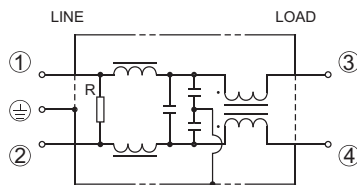
Applications

- Copiers, Fax machines, Office appliances, Measuring devices, Control systems.

- SUP-J□H-ER-4 Series (Screw terminal)

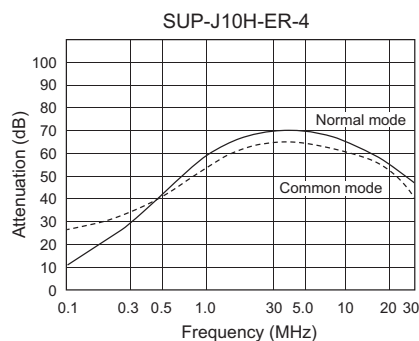


Circuit



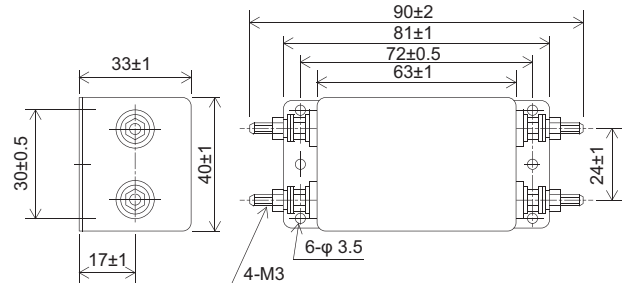
Bleeder resistor R: 1M Ω (J5H, J10H, J15H)
470k Ω (J20H, J30H)

Static characteristics

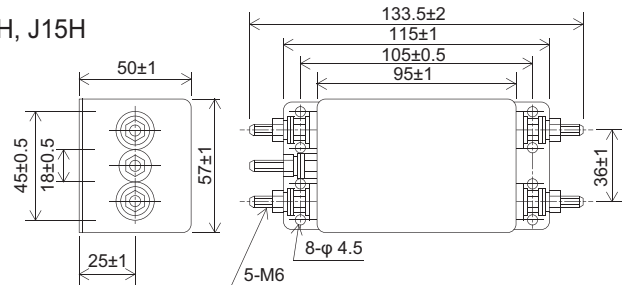


Dimensions

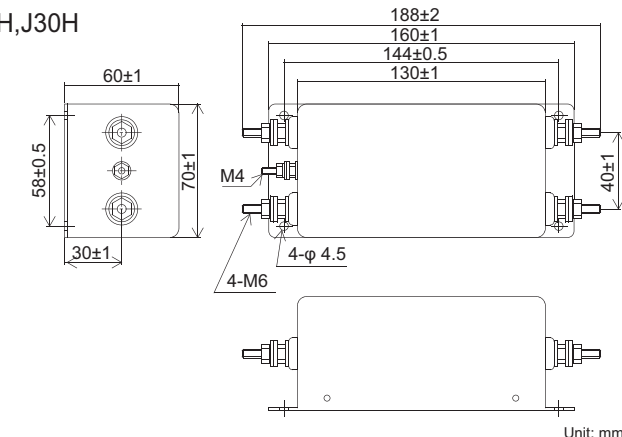
J5H



J10H, J15H



J20H, J30H



Unit: mm

Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-J5H-ER-4	5	Line to Line 1,000Vac 50/60Hz 60sec Line to Case 2,000Vac 50/60Hz 60sec	Line to Case 6,000M Ω min. (at 500Vdc)	1.0mA (at 250Vac 60Hz)	1.5Vac	30K	-25 ~ +55 (85°C with Temp. rise)	0.5 ~ 30	0.5 ~ 20	230
	SUP-J10H-ER-4	10							0.6 ~ 30		600
	SUP-J15H-ER-4	15							1.0 ~ 30		620
	SUP-J20H-ER-4	20							0.5 ~ 30		1,270
	SUP-J30H-ER-4	30							0.7 ~ 30		

Guaranteed attenuation is more than 30dB.

Features

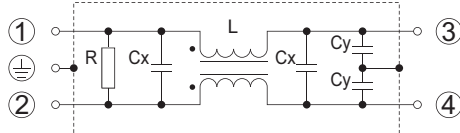
- Single phase filter.
- The adoption of super high μ core material ensures high attenuation.
- Leak current lower than 0.6mA (250Vac, 60Hz).

Applications

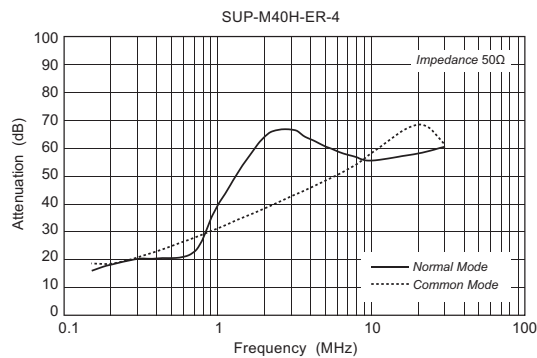
- PCs, Printers, UPS, Office appliances, Measuring devices, and Control systems.



Circuit

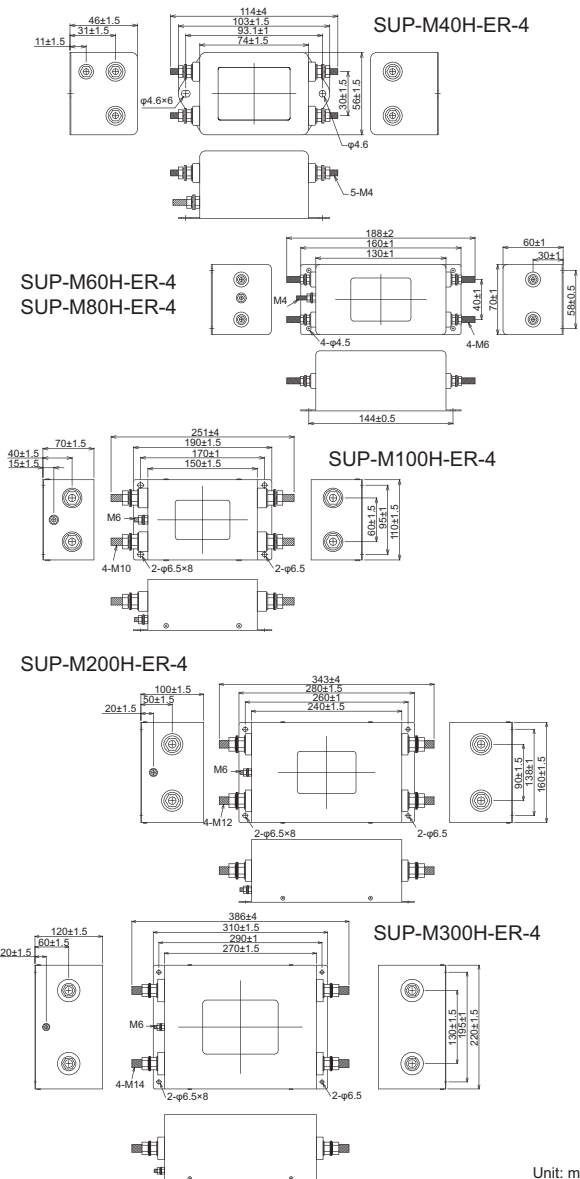


Static characteristics



Safety Standard	File No.
UL : UL1283	E78644

Dimensions



Unit: mm

Electrical Specifications

Rated Voltage **250Vac**

Safety Agency	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(kg)
									Normal Mode (MHz)	Common Mode (MHz)	
	SUP-M40H-ER-4	40	Line to Line 1,000Vac 50/60Hz 60sec Line to Ground 2,000Vac 50/60Hz 60sec	Line to Ground 6,000MΩmin (at 500Vdc)	0.6mA (at 250Vac 60Hz)	Less than 1.0Vac	35K	-25 ~ +50	*1 1.0 ~ 30	*4 2.0 ~ 30	0.4
	SUP-M60H-ER-4	60							*2 0.6 ~ 30	*5 2.0 ~ 30	0.9
	SUP-M80H-ER-4	80							*2 0.6 ~ 30	*5 2.0 ~ 30	1.0
	SUP-M100H-ER-4	100							*3 0.4 ~ 30	*5 2.0 ~ 30	2.0
	SUP-M200H-ER-4	200							*3 0.4 ~ 30	*5 2.0 ~ 30	7.2
	SUP-M300H-ER-4	300							*3 0.4 ~ 30	*5 2.0 ~ 30	12.0

Guaranteed attenuation of *1 is 30dB, *2 is 35dB, *3 is 40dB, *4 is 25dB and *5 is more than 20dB.



3SUP□-BE(6~30) SERIES

NOISE FILTERS



Features

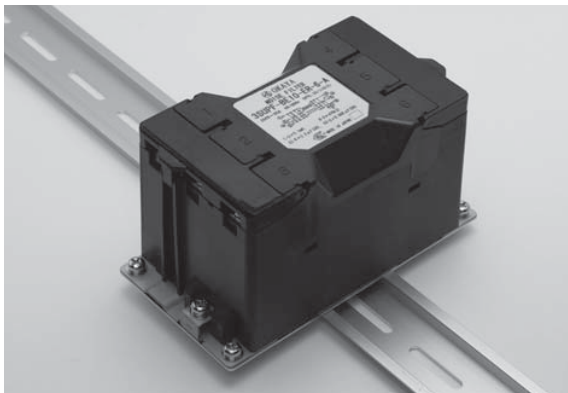
- Terminal preventing losing screw
- Two type of inductance coil is available: F means Ferrite, H means High μ
- DIN rail type is option

Applications

- Inverter power supplies, UPS, NC controlled machineries



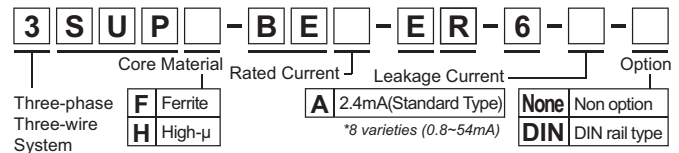
- DIN rail type (option)



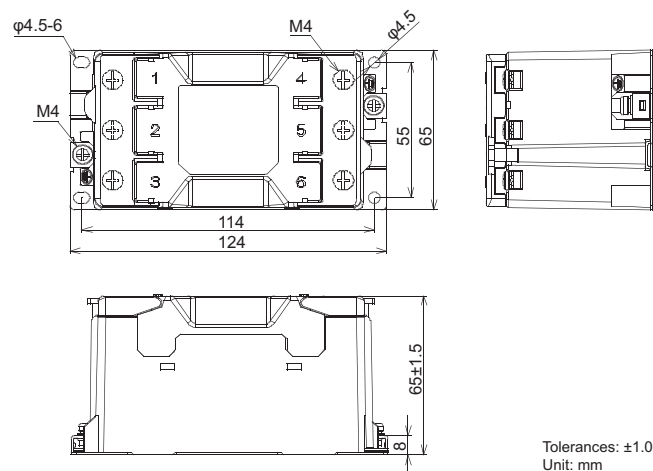
Safety Standard		File No.
UL	:UL1283	E78644
cUL	:C22.2, No.8-M1986	
SEMKO	:EN60939	SE/0142-32

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

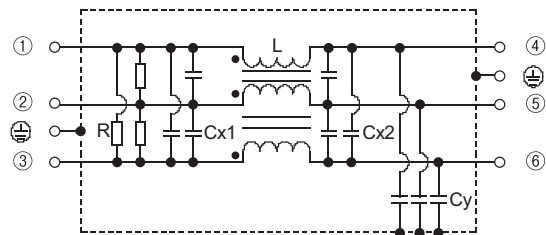
- Model numbering system



- Dimensions



- Circuit



Electrical Specifications

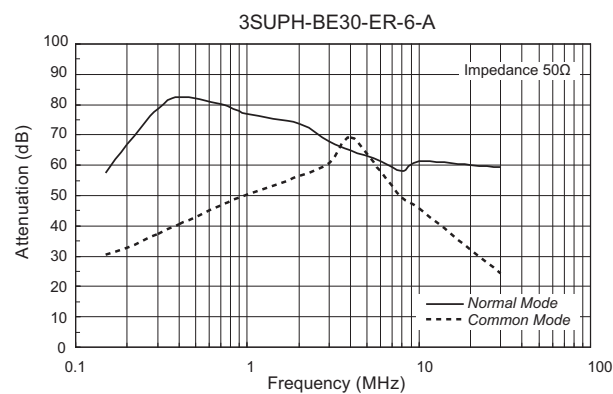
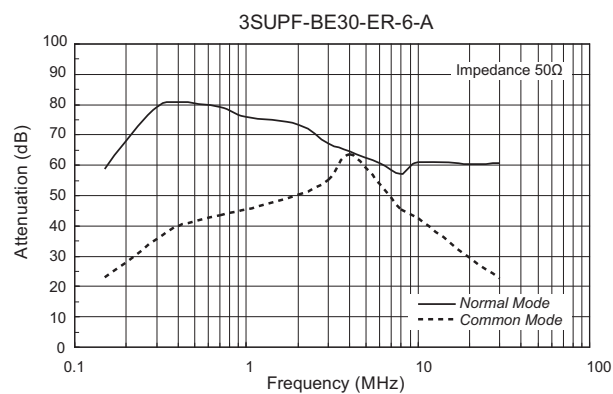
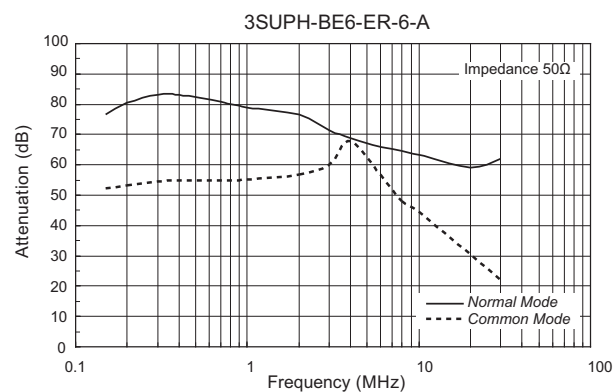
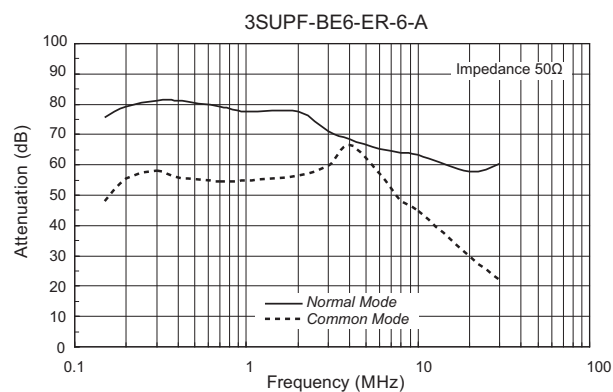
Rated Voltage **250Vac**

Safety Standard	Model Number*1	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current *2 max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(g)
	3SUP□-BE6-ER-6-A	6	Line to Case 2,000Vac 50/60Hz 60sec	Line to case 6,000MΩmin (at 500Vdc)	2.4mA (at 250Vac 60Hz)	1.0Vac	60K	-25 ~ +50 (Derating of current from 50 to 85°C)	490
	3SUP□-BE10-ER-6-A	10							510
	3SUP□-BE20-ER-6-A	20							530
	3SUP□-BE30-ER-6-A	30							540

□ = F: Ferrite, H: High- μ

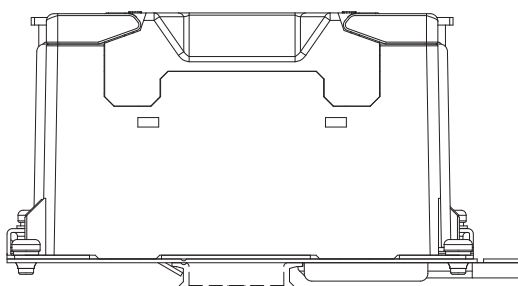
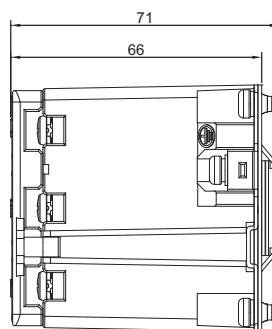
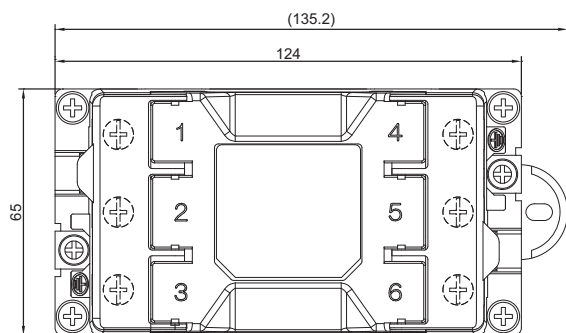
*1 Standard type *2 Leakage current of Standard type

• Static characteristics



• Dimensions

DIN rail type (option)



Tolerances: ±0.5
Unit: mm

• Note when installing EMI filter on DIN rail

Even though the ground connects correctly through the DIN rail, may not get noise attenuation. Be sure to connect the FG ground of EMI filter to the ground directory.

3SUP□-BE(50, 60) SERIES

NOISE FILTERS



Features

- Three phase filter delta (250Vac).
- The capacitance of Y capacitor is selectable.

Applications

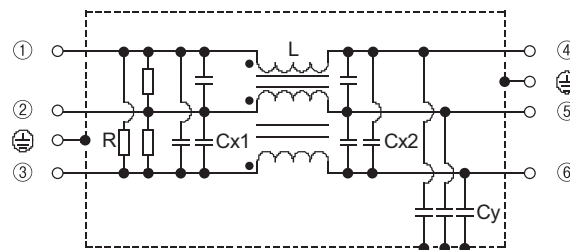
- Inverter power supplies, UPS, NC controlled machineries.



Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMKO :EN60939	SE/0142-33

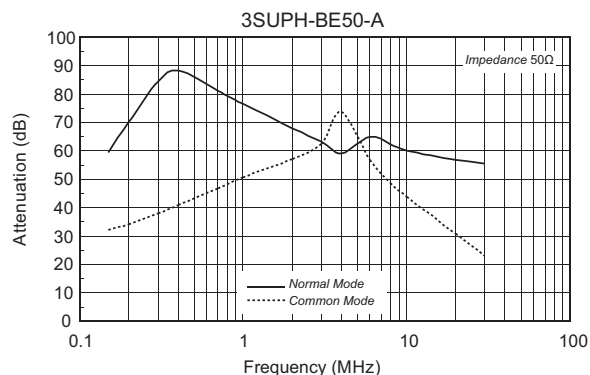
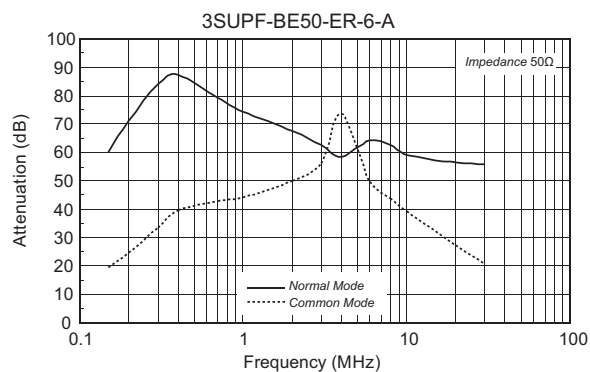
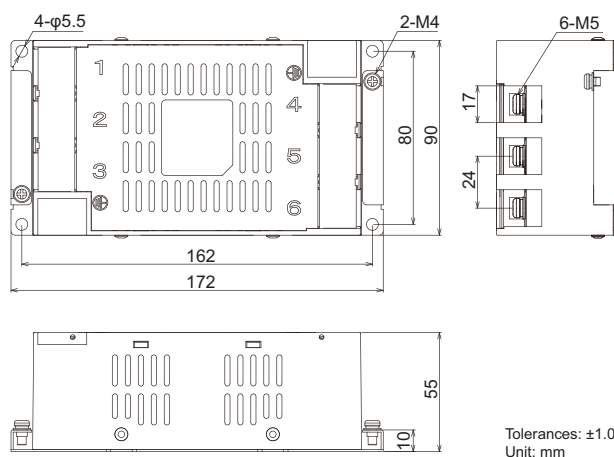
The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

Circuit



Static characteristics

Dimensions



Electrical Specifications

Rated Voltage **250Vac**

Safety Standard	Model Number*1	Rated Current (A)	Test Voltage *2	Insulation Resistance	Leakage Current *3 max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(g)
	3SUP□-BE50-ER-6-A	50	Line to Case 2,000Vac 50/60Hz 60sec	Line to case 6,000MΩmin (at 500Vdc)	2.5mA (at 250Vac 60Hz)	1.0Vac	60K	-25 ~ +50 (Derating of current from 50 to 85°C)	1,000
	3SUP□-BE60-ER-6-A	60							

□ = F: Ferrite, H: High-μ

*1 Standard type *2 Leakage current of Standard type *3 Leakage current of standard type

3SUP□-BH(6~30) SERIES

NOISE FILTERS



Features

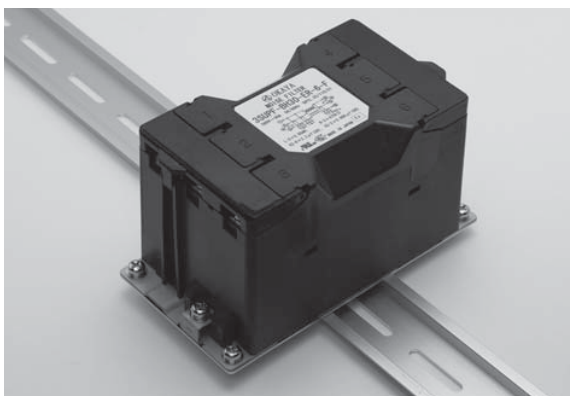
- Terminal preventing losing screw
- Three-phase three-wire system (Rated Voltage 500Vac)
- Two type of inductance coil is available: F means Ferrite, H means High μ
- DIN rail type is option

Applications

- Inverter power supplies, UPS, NC controlled machineries



- DIN rail type (option)



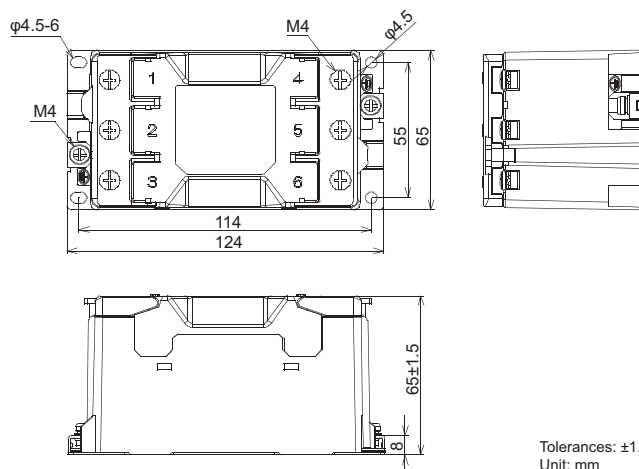
Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMKO :EN60939	SE/0142-32

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

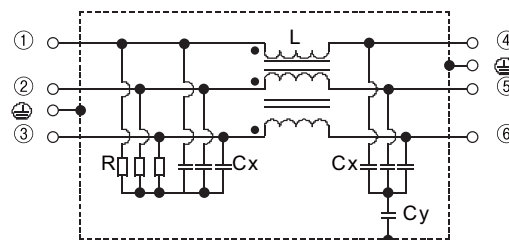
- Model numbering system

3	S	U	P	□	-	B	H	□	-	E	R	-	6	-	□	-	□
Three-phase Three-wire System				Core Material				Rated Current				Leakage Current					Option
				F Ferrite H High- μ				F 5.5mA(Standard Type) *7 varieties (0.8~37mA)							None Non option DIN DIN rail type		

- Dimensions



- Circuit



Electrical Specifications

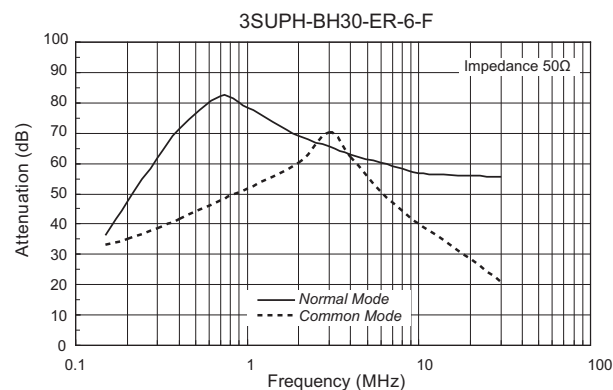
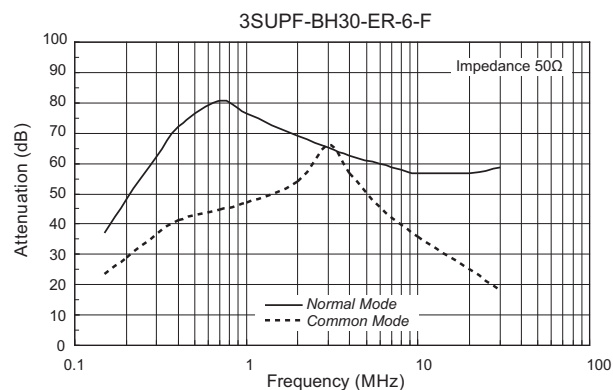
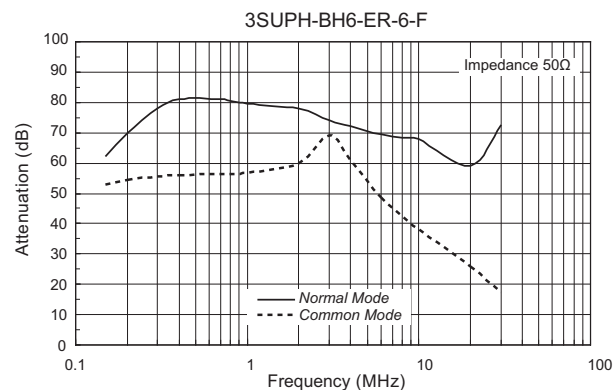
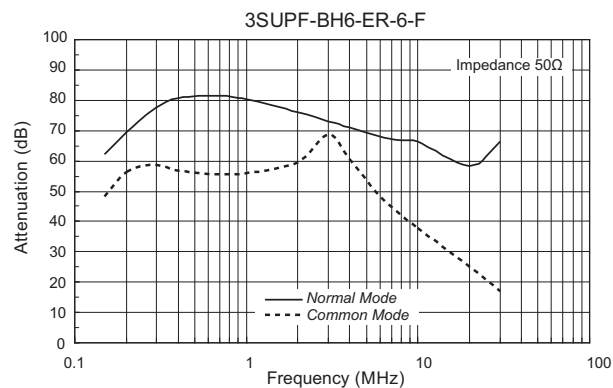
Rated Voltage **500Vac**

Safety Standard	Model Number*1	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current *2 max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(g)
	3SUP□-BH6-ER-6-F	6	Line to Case 2,000Vac 50/60Hz 60sec	Line to case 6,000M Ω min (at 500Vdc)	5.5mA (at 500Vac 60Hz)	1.0Vac	60K	-25 ~ +50 (Derating of current from 50 to 85°C)	490
	3SUP□-BH10-ER-6-F	10							510
	3SUP□-BH20-ER-6-F	20							530
	3SUP□-BH30-ER-6-F	30							540

□= F: Ferrite, H: High- μ

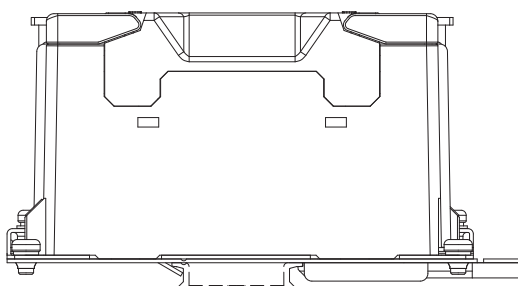
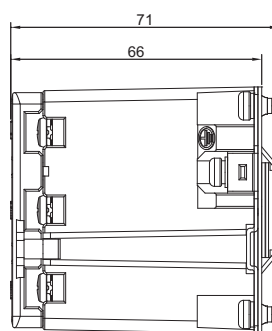
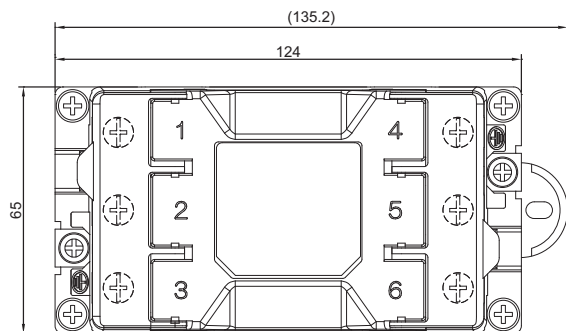
*1 Standard type *2 Leakage current of Standard type

• Static characteristics



• Dimensions

DIN rail type (option)



Tolerances: ±0.5
Unit: mm

• Note when installing EMI filter on DIN rail

Even though the ground connects correctly through the DIN rail, may not get noise attenuation. Be sure to connect the FG ground of EMI filter to the ground directory.

3SUP□-BH(50, 60) SERIES

NOISE FILTERS



Features

- Three phase filter delta (500Vac).
- The capacitance of Y capacitor is selectable.

Applications

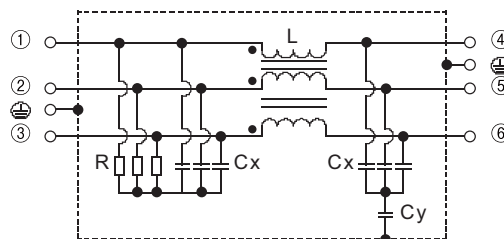
- Inverter power supplies, UPS, NC controlled machineries.



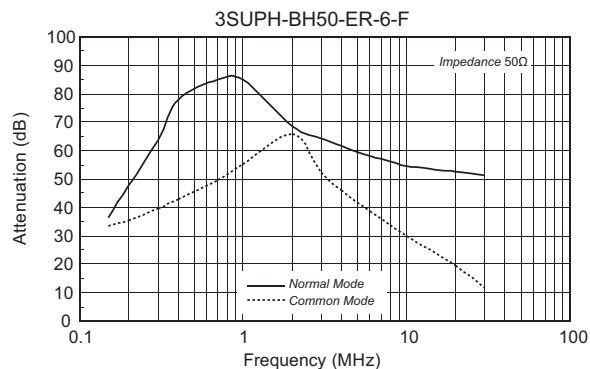
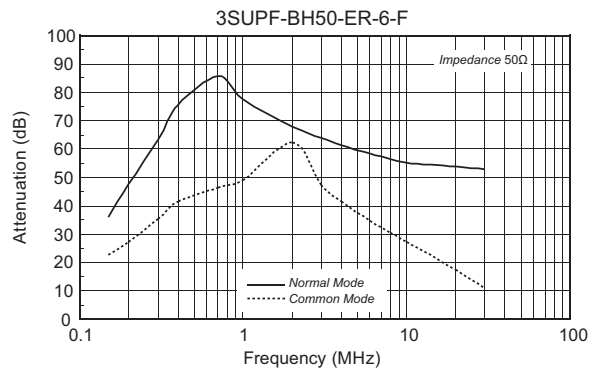
Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMKO :EN60939	SE/0142-33

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

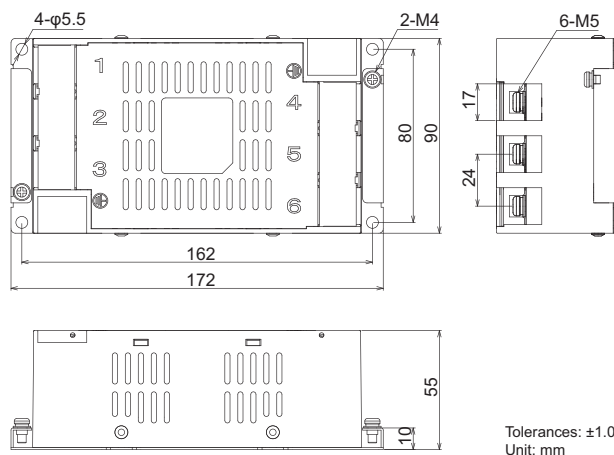
Circuit



Static characteristics



Dimensions



Electrical Specifications

Rated Voltage **500Vac**

Safety Standard	Model Number*1	Rated Current (A)	Test Voltage *2	Insulation Resistance	Leakage Current *3 max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(g)
	3SUP□-BH50-ER-6-F	50	Line to Case 3,000Vac 50/60Hz 60sec	Line to case 6,000MΩmin (at 500Vdc)	5.5mA (at 500Vac 60Hz)	1.0Vac	60K (Part of coil)	-25 ~ +50 (Derating of current from 50 to 85°C)	1,000
	3SUP□-BH60-ER-6-F	60							

□ = F: Ferrite, H: High-μ

*1 Standard type *1 Withstand voltage of standard type *3 Leakage current of standard type



Features

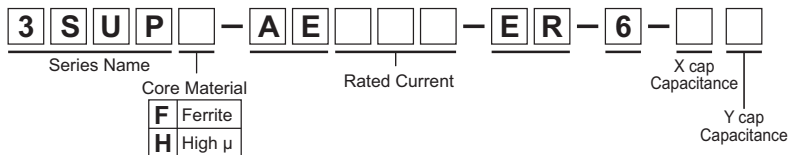
- Three phase filter delta (250Vac).
- 30% smaller size of former model.
- The capacitance of X and Y capacitor is selectable.

Applications

- Inverter power supplies, UPS, NC controlled machineries.

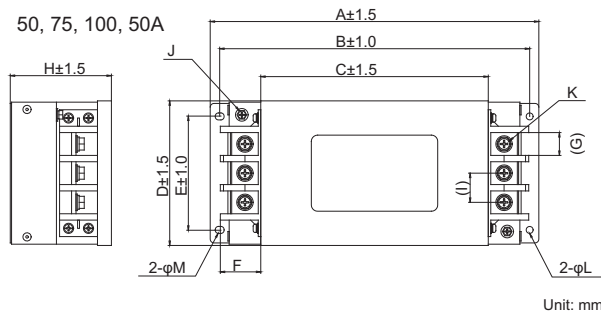


- Model numbering system



- Dimensions

50, 75, 100, 50A



Model Number	Dimensions (mm)												
	A	B	C	D	E	F	G	H	I	J	K	L	M
3SUP□-AE50	185	170	120	110	85	23	13	80	18	M4	M6	5.5	5.5x7
3SUP□-AE75	260	245	182	116	90	33	18	80	23	M4	M6	5.5	5.5x7
3SUP□-AE100	260	245	182	116	90	33	18	80	23	M4	M6	5.5	5.5x7
3SUP□-AE150	310	290	220	163	133	42	25	100	30	M6	M8	6.5	6.5x8

Electrical Specifications

Safety Standard	Model Number *1	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max. *2	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(kg)
	3SUP□-AE50-ER-6-OA	50	Line-Case 2,000Vac 50/60Hz 60sec	Line-Case 6,000MΩmin (at 500Vdc)	1.1mA (at 250Vac 60Hz)	1.0Vac	50K	-25 ~ +50 (100°C with Temp. rise)	2.0
	3SUP□-AE75-ER-6-OA	75							3.2
	3SUP□-AE100-ER-6-OA	100							7.0
	3SUP□-AE150-ER-6-OA	150							8.5
	3SUP□-AE200-ER-6-OA	200							10.0
	3SUP□-AE250-ER-6-OA	250							

*1 Standard type

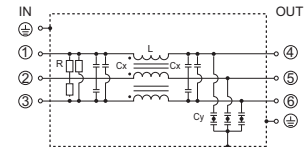
*2 Leakage current of Standard type



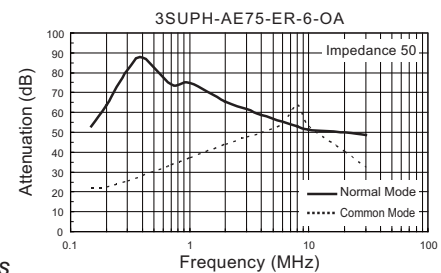
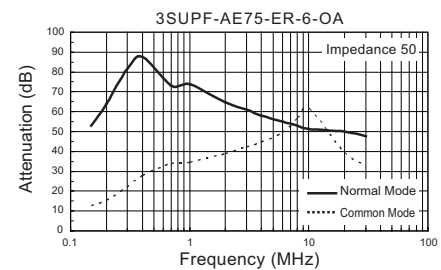
Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMKO :EN60939	SE/0142-7

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

- Circuit

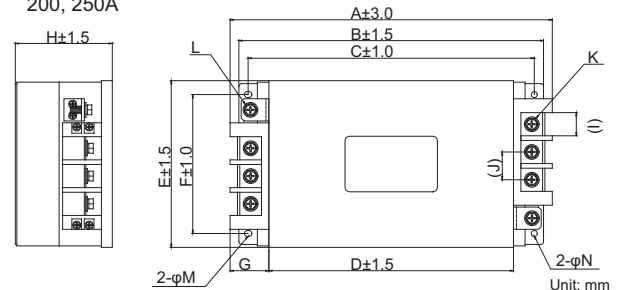


- Static characteristics



- Dimensions

200, 250A



Model Number	Dimensions (mm)													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3SUP□-AE200	349	330	310	265	180	150	42	105	25	30	30	M8	6.5x8	6.5
3SUP□-AE250	364	345	325	280	180	150	42	120	25	30	30	M8	6.5x8	6.5

Rated Voltage **250Vac**

Features

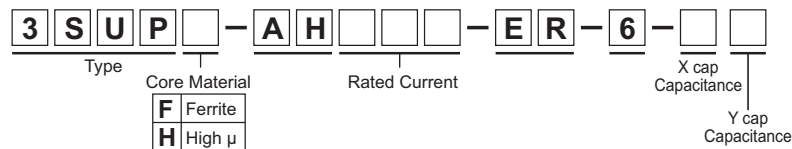
- Three phase filter delta (500Vac).
- 30% smaller size of former model.
- The capacitance of X and Y capacitor is selectable.

Applications

- Inverter power supplies, UPS, NC controlled machineries.

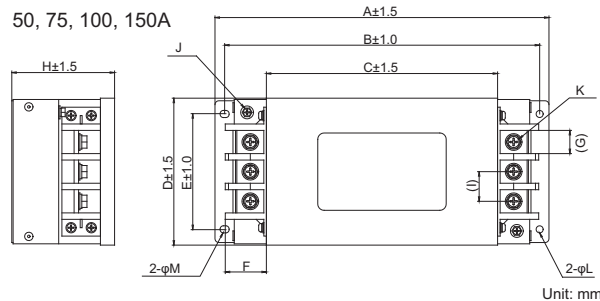


- Model numbering system



- Dimensions

50, 75, 100, 150A



Model Number	Dimensions(mm)												
	A	B	C	D	E	F	G	H	I	J	K	L	M
3SUP□-AH50	185	170	120	110	85	23	13	80	18	M4	M6	5.5	5.5x7
3SUP□-AH75	260	245	182	116	90	33	18	80	23	M4	M6	5.5	5.5x7
3SUP□-AH100	260	245	182	116	90	33	18	80	23	M4	M6	5.5	5.5x7
3SUP□-AH150	310	290	220	163	133	42	25	100	30	M6	M8	6.5	6.5x8

Electrical Specifications

Safety Standard	Model Number *1	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max. *2	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Weight typ.(kg)
	3SUP□-AH50-ER-6-OC	50	Line-Case 2,000Vac 50/60Hz 60sec	Line-Case 6,000MΩmin (at 500Vdc)	4.7mA (at 500Vac 60Hz)	1.0Vac	50K	-25 ~ +50 (100°C with Temp. rise)	2.0
	3SUP□-AH75-ER-6-OC	75							3.2
	3SUP□-AH100-ER-6-OC	100							7.0
	3SUP□-AH150-ER-6-OC	150							8.5
	3SUP□-AH200-ER-6-OC	200							10.0
	3SUP□-AH250-ER-6-OC	250							

*1 Standard type

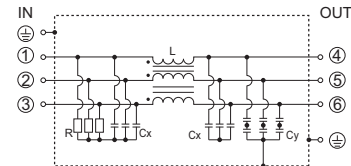
*2 Leakage current of Standard type



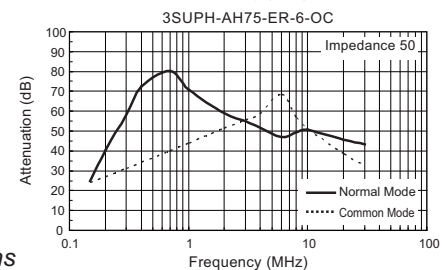
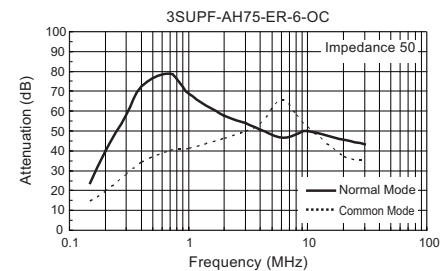
Safety Standard	File No.
UL :UL1283	E78644
cUL :C22.2, No.8-M1986	
SEMCO :EN60939	SE/0142-7

The "ENEC" mark is a common European product certification mark based on testing to harmonised European safety standard.

- Circuit

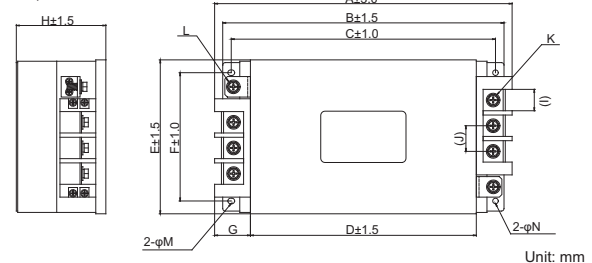


- Static characteristics



- Dimensions

200, 250A



Model Number	Dimensions(mm)												
	A	B	C	D	E	F	G	H	I	J	K	L	N
3SUP□-AH200	349	330	310	265	180	150	42	105	25	30	M8	M8	6.5x8
3SUP□-AH250	364	345	325	280	180	150	42	120	25	30	M8	M8	6.5x8

Rated Voltage **500Vac**

Features

- Three phase filter delta, high attenuation.
- EN55011 class A & B.
- Applies to CE marking (EN60939 approval by TÜV).

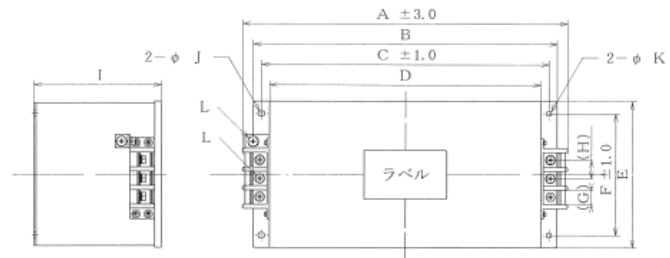
Applications

- Inverter power supplies, UPS, Servo-operated machinery.



Safety Standard		File No.
UL	:UL1283	E78644
TÜV	:EN60939	R50056176

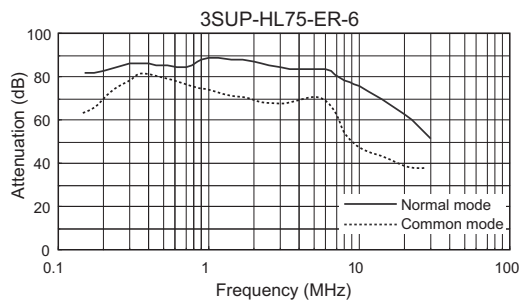
Dimensions



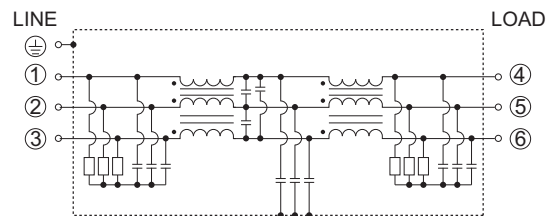
Unit: mm

Model Number	Dimensions(mm)											
	A	B	C	D	E	F	G	H	I	J	K	L
3SUP-HL5-ER-6	226	220	195	180	100	85	13	18	120	5.5×7	5.5	M4
3SUP-HL10-ER-6	226	220	195	180	100	85	13	18	120	5.5×7	5.5	M4
3SUP-HL15-ER-6	226	220	195	180	100	85	13	18	130	5.5×7	5.5	M4
3SUP-HL30-ER-6	246	230	215	200	100	85	13	18	140	5.5×7	5.5	M4
3SUP-HL50-ER-6	286	270	255	240	120	90	13	18	150	5.5×7	5.5	M6
3SUP-HL75-ER-6	396	370	350	330	170	140	18	23	155	6.5×8	6.5	M6
3SUP-HL100-ER-6	396	370	350	330	170	140	18	23	155	6.5×8	6.5	M6
3SUP-HL150-ER-6	484	440	420	400	200	170	25	30	200	6.5×8	6.5	M8
3SUP-HL200-ER-6	484	440	420	400	200	170	25	30	200	6.5×8	6.5	M8

Static characteristics



Circuit



Electrical Specifications

Rated Voltage **500Vac**

Safety Standard	Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ. (kg)
									Normal Mode (MHz)	Common Mode (MHz)	
	3SUP-HL5-ER-6	5	Line-Case 2,000Vac 50/60Hz 60sec	Line-Case 6,000MΩmin (at 500Vdc)	8.0mA (at 500Vac 60Hz)	1.5Vac	35K	-25 ~ +50 (85°C with Temp. rise)	*0.15 ~ 30	0.15 ~ 10	3.0
	3SUP-HL10-ER-6	10									3.3
	3SUP-HL15-ER-6	15									4.0
	3SUP-HL30-ER-6	30							0.15 ~ 30	*0.15 ~ 10	5.2
	3SUP-HL50-ER-6	50									6.5
	3SUP-HL75-ER-6	75									12.0
	3SUP-HL100-ER-6	100							0.15 ~ 30	0.15 ~ 10	12.5
	3SUP-HL150-ER-6	150									23.5
	3SUP-HL200-ER-6	200									24.5

Guaranteed attenuation is more than 30dB (*more than 40dB) in normal mode and more than 25dB (*more than 20dB) in common mode.

Features

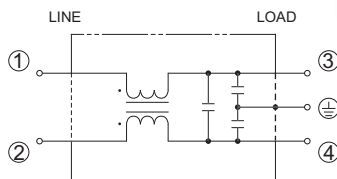
- High attenuation in MF and HF bands.
- PCB mounting with wire leads.
- Compact size.
- Case material rated UL94-VO.

Applications

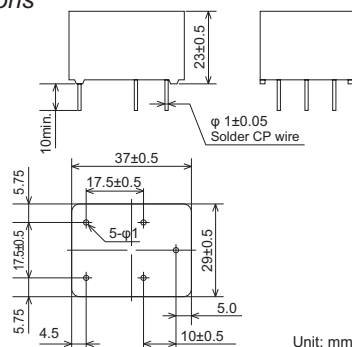
- Game machines and Control systems.

• SUP-B□R-E Series

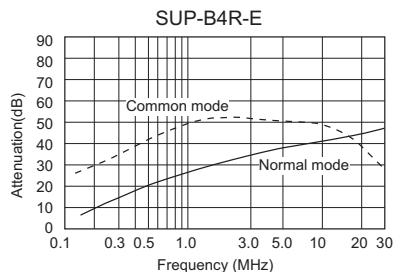
• Circuit



• Dimensions



• Static characteristics



Electrical Specifications

Model Number	Rated Current (A)	Test Voltage	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)
								Normal Mode (MHz)	Common Mode (MHz)	
SUP-B2R-E	2	Line to Line 1,000Vac 50/60Hz 60sec Line to Ground 1,500Vac 50/60Hz 60sec	Line to Line 1,000MQmin Line to Ground 1,000MQmin (at 500Vdc)	1.0mA (at 250Vac 60Hz)	1.0Vac	20K	-20 ~ +65 (85°C with Temp. rise)	0.9 ~ 10	0.4 ~ 10	41
SUP-B4R-E	4							1.5 ~ 10	0.7 ~ 10	
SUP-B6R-E	6				2.0 ~ 10	2.0 ~ 10	43			
SUP-C3G-E	3				2.0 ~ 30	1.0 ~ 10		23		
SUP-C6G-E	6				4.0 ~ 30	*1.5 ~ 20				

Guaranteed attenuation is more than 25dB in normal mode and more than 30dB in common mode. (*more than 25dB)



Features

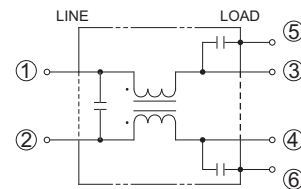
- High attenuation in MF and HF bands.
- PCB mounting with wire leads.
- Compact size.
- Case material rated UL94-VO.

Applications

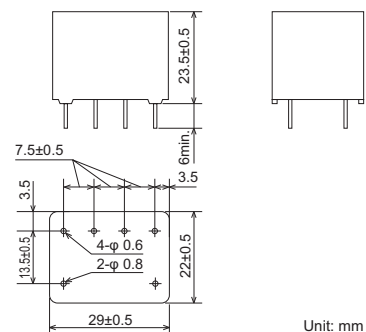
- Game machines and Control systems.

• SUP-C□G-E Series

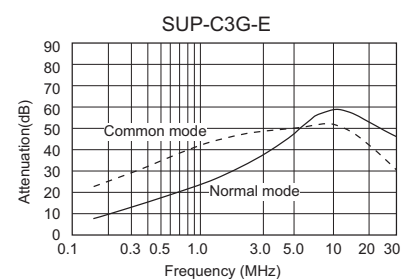
• Circuit



• Dimensions



• Static characteristics



Features

- Best for large current radiation noise.
- Easy installation.
- Multiple usage by parallel installation.
- Low conducted radiation noise by winding the primary or secondary power of leads.

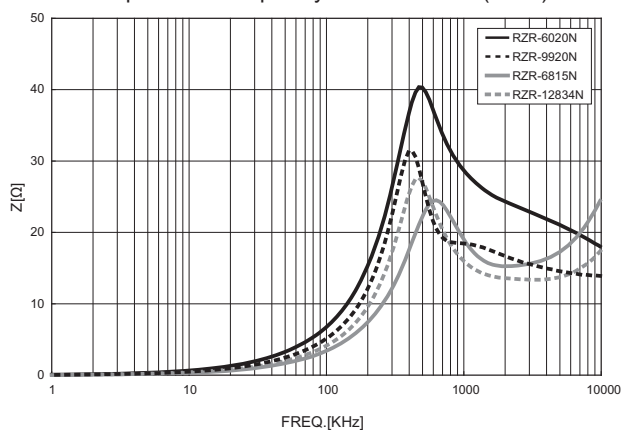
Applications

- NC machines, General inverters, UPS, and Industrial equipments.



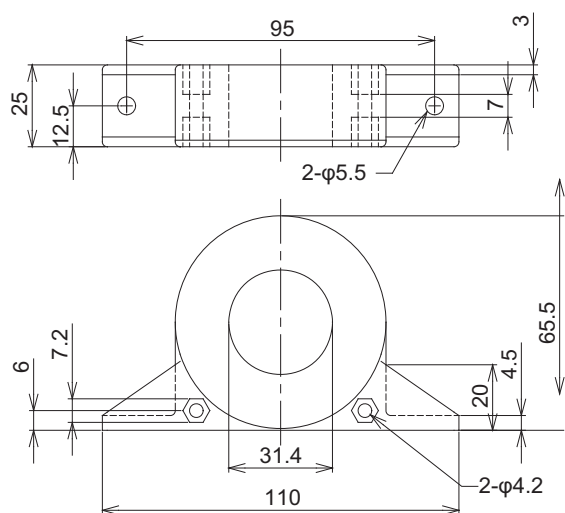
Characteristic Features

Impedance Frequency Characteristic (1turn)



Dimensions

RZR-6020N

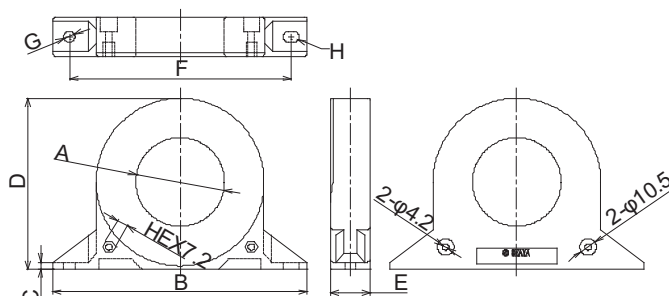


Weight typ. : 250g

RZR-6815N

RZR-9920N

RZR-12834N



Unit: mm

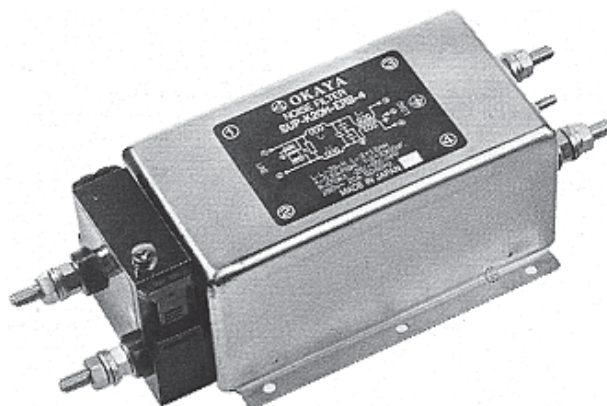
Model Number	Dimensions(mm)								Weight typ.(g)
	A	B	C	D	E	F	G	H	
RZR-6815N	40.0	130.0	4.5	74.0	20.0	110.0	φ6	φ6×9	220
RZR-9920N	56.0	160.0	4.5	108.0	25.0	140.0	φ7	φ7×10	570
RZR-12834N	95.5	190.0	5.0	139.0	39.0	160.0	φ7	φ7×10	1,010

Features

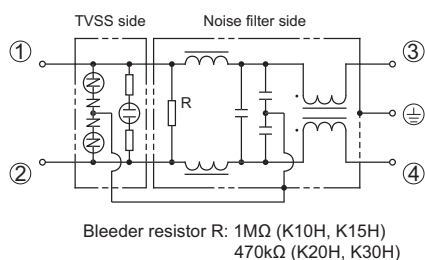
- Normal and common attenuation to 30MHz.
- VCCI, FCC, Part15.
- EMI/ RFI filter with transient voltage protection.
- TVS protection monitoring indicator.
- TVS protector is replaceable.

Applications

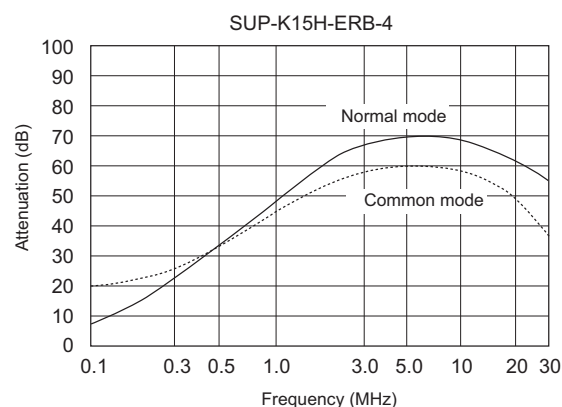
- Information processing systems, Control systems and NC machinery.



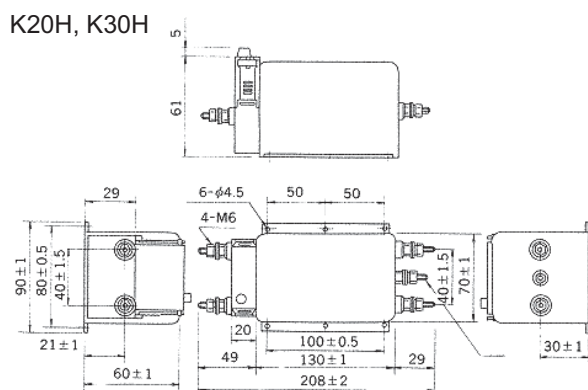
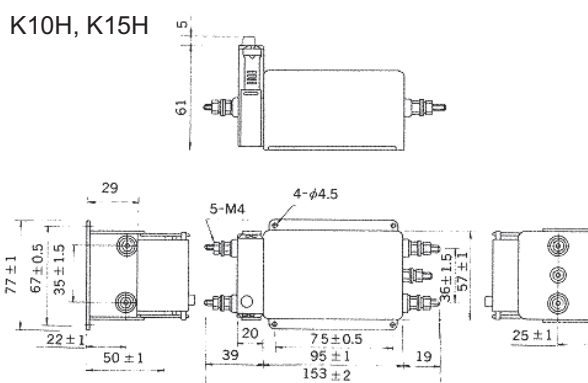
Circuit



Static characteristics



Dimensions



Unit: mm

Electrical Specifications

Model Number	Rated Voltage (Vac)	Rated Current (A)	Surge Voltage Withstand	Insulation Resistance	Leakage Current max.	Voltage Drop max.	Temperature Rise max.	Operating Temperature (°C)	Insertion losses		Weight typ.(g)			
									Normal Mode (MHz)	Common Mode (MHz)				
SUP-K10H-ERB-4P1	125	10	Line to Case 1.2/50μS 12kV	Line to Case 100MΩmin. (at 100Vdc)	0.5 mA (at 125Vac 60Hz)	1.5Vac	30K	-25 ~ +55 (85°C with Temp. rise)	0.6 ~ 30	0.5 ~ 20	660			
SUP-K15H-ERB-4P1		15							1.0~30	1.0~30	680			
SUP-K20H-ERB-4P1		20							0.5~30	0.9~30	1,500			
SUP-K30H-ERB-4P1		30							0.7~30	2.0~30				
SUP-K10H-ERB-4P2	250	10			1.0 mA (at 250Vac 60Hz)				0.6~30	0.5~30	660			
SUP-K15H-ERB-4P2		15							1.0~30	1.0~30	680			
SUP-K20H-ERB-4P2		20							0.5~30	0.9~30	1,500			
SUP-K30H-ERB-4P2		30							0.7~30	2.0~30				

Test Voltage: (Line to Line) 1,000Vac 50/60Hz 60sec
(Line to Ground) 2,000Vac 50/60Hz 60sec

Guaranteed attenuation is more than 30dB.

TRANSIENT VOLTAGE SURGE ABSORBERS (SURGE PROTECTIVE DEVICES)



SURGE PROTECTIVE DEVICES



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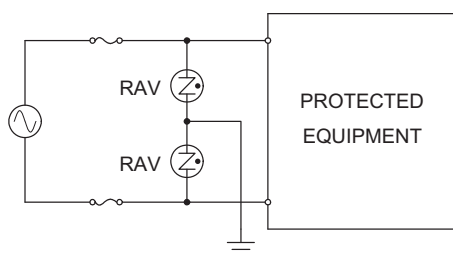
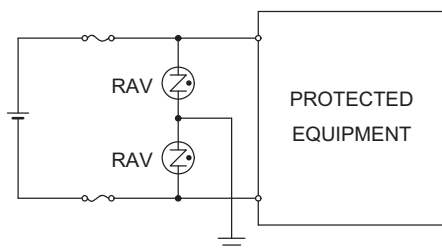
For improvement, specifications are subject to change without prior notice.

When components are used for special applications requiring high reliability (life maintenance equipment, atomic energy, airplanes, artificial satellites, etc.), contact us beforehand. Also make sure to evaluate and verify the components in a state that they are mounted on actual equipment.

Application		Model Series	Features	Impulse Discharge Current 8/20μs (A)	Page
AC Power Line Lightning Surge Single Phase	Single Phase	LV-Q	IEC61643-1 approval	5,000	106~107
		SV-Q	IEC61643-1 approval	5,000	110~111
		LVF-Q	IEC61643-1 approval	10,000	112~113
		RSPD-Q	IEC61643-1 approval	5,000	108~109
		R·C·M-BQZ-4, -5	Lightning surge	5,000	114~115
		R·A·V-BWZ-4, -5	Lightning surge	2,500	116~117
		R·A·V-BWZ-2A	Lightning surge	2,500	118~119
		R·A·M-BWZ,BXZ(LED)	Lightning surge	2,000	120
		R·A·M-152BQZ(LED)	Lightning surge	2,000	121
		R·A·M-LAS	Lightning surge	2,000	122
		R·A·V-LDEZ, BWZ-3C	Micro gap Gas discharge	1,000	123
		CTSPD	Lightning surge	9,000~	124
		R28-S	Ceramic gas arrester	20,000	125
		R28, R38	Ceramic gas arrester	10,000	126, 128
		R26, R36	Ceramic gas arrester	5,000	127, 129
		RHCA5039	SMD Gas discharge tube	2,000	134~135
		RA-MX-V7-Y/ Y(5)	Fast response Gas discharge tube w/taping	3,500	140~141
		RA-MX-V7-Y/ Y(SJQ)	Fast response Gas discharge tube w/taping	3,500	142~143
	RA-V7	Fast response Gas discharge tube	3,500	144~145	
	RA-C6	Fast response Gas discharge tube	2,000	146~147	
	Three Phase	LV-U	IEC61643-1 approval	5,000	106~107
		LVF-U	IEC61643-1 approval	5,000	110~111
		SV-U	IEC61643-1 approval	10,000	112~113
		RSPD-U	IEC61643-1 approval	5,000	108~109
		R·C·M-BUZ-4, -5	Lightning surge	5,000	114~115
		R·A·V-BXZ-4, -5	Lightning surge	2,500	116~117
		R·A·V-BXZ-2A, BYZ-2	Lightning surge	1,000~	118~119
		R·A·M-BUN-Z(LED)	Lightning surge	2,000	120
R·A·V-BWZ-3C		Lightning surge	2,400	123	
		R28-S	Ceramic gas arrester	20,000	125
Surge Protection for Network Line		R28, R38	Ceramic gas arrester	10,000	126, 128
		R26, R36	Ceramic gas arrester	5,000	127, 129
		R5K, R5K3	SMD Gas discharge tube	5,000	130~133
		RHCA3216, 4532	SMD Gas discharge tube	500~	136~139
		RA-C6	Fast response Gas discharge tube	2,000	146~147
		R·A·V-L-A	Fast response, high capacity surge protection	2,400	148~151
		R·A·V-LD	Fast response, high capacity surge protection	2,400	161
		ZP, CP, U, B, SA	Fast response Gas discharge tube w/taping	25.5~	152~155
		RLAN, RLAN2	Surge protector for Cat8e PoE1000BASE	5,000	164, 165
		RSP-LAN-B	Surge protector for LAN10/100BASE -T	-	157
		RSP-232	Surge protector for RS232, 9 pin	2,000	158
		RSP-TEL	Lightning surge protector for phone line	-	158
		RSP-485	Lightning surge protector for RS485/422	2,000	159
		RSD5-485	Lightning surge protector for RS485/422	5,000	160
		R·S·M-GL, GL-PT	Lightning surge protector for data line	1,000	162, 163
DC Power Line On-Off Surge		R·A·V-L-A	Fast response, high capacity surge protection	2,400	148~151
		R·A·V-LD	Fast response, high capacity surge protection	2,400	161
		ZP, CP, U, B, SA	Fast response Gas discharge tube w/taping	25.5~	152~155
		RSP-DC	Lightning surge protector for DC power circuit	128~	156
Electrostatic Surge		R·A·V-L-A	response, high capacity surge protection	2,400	148~151
		R·A·V-LD	Fast response, high capacity surge protection	2,400	161
		RHCA3216	SMD Gas discharge tube	500	136~137
		RA-C6	Fast response Gas discharge tube	2,000	146~147
		ZP, CP, U, B, SA	Fast response Gas discharge tube w/taping	25.5~	152~155
		RSP-232	Surge protector for RS(EIA)232	2,000	158

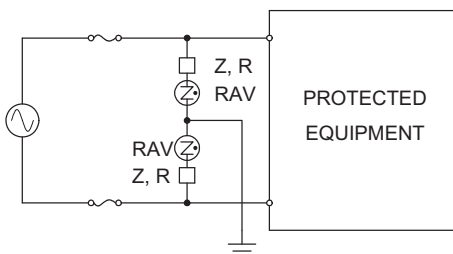
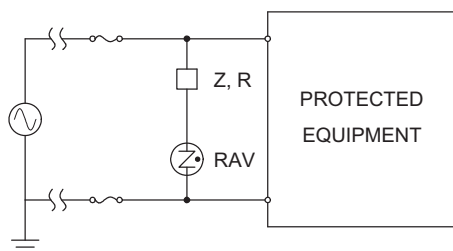
BASIC CIRCUIT TO PROTECT EQUIPMENT

- Input impedance is high



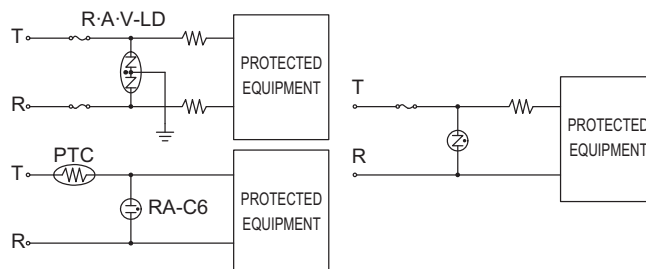
- Input impedance is low

The resistors (R) or MOV (Z) control continuous flow discharge and low value ones should be selected so as not to reduce the capacity of the surge protection device.

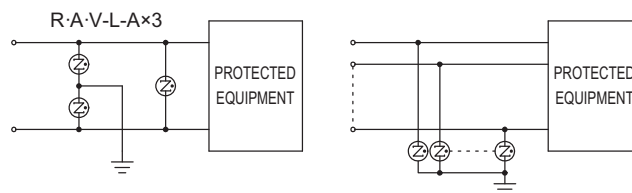


APPLICATION

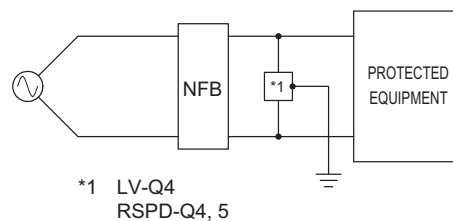
- Protecting telephone lines



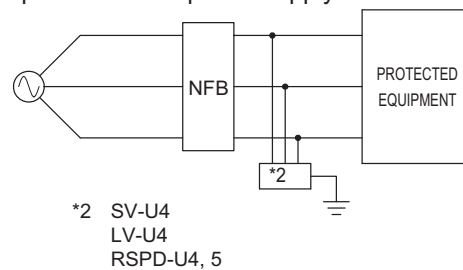
- Protecting telecommunications and signal lines



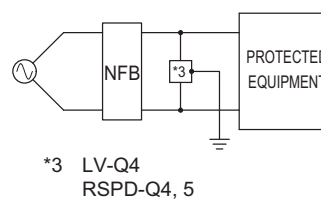
- Single phase power supply



- Three-phase inverter power supply



- Protecting power supply for vending machine





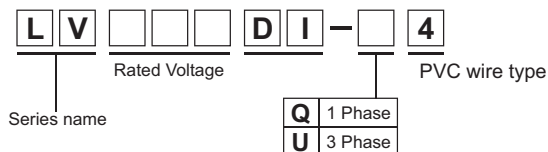
Features

- SPD with a fail safe function to prevent short-circuit (separation of circuit and element is visually confirmable)
- Compliance with IEC 61643-1 that meets the new JIS standards
- Against indirect lightning surge for single phase / three phase power supplies
- Quick response for surge
- Impulse current capacity 8/20 μ s-5,000A
- Impulse test category: Class II (Type II)
- Every circuit pathway consists of same components and offers the same voltage protection level.

Applications

- Tapping machine, NC machine, other machine tools
- Lithography equipment, Washing device, IC tester
- Injection molding machine, Winding machine, Surface mounter
- Vehicle air conditioner
- Servo amplifier
- Electric facility, Industrial equipment

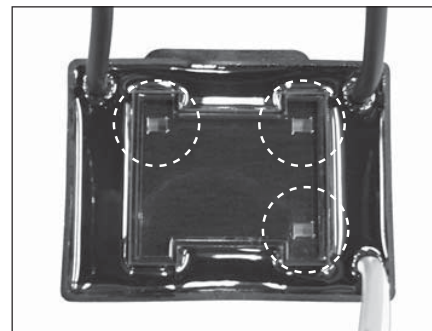
- Model numbering system



Safety Standard		File No.
UL	:UL1449 3rd.	E322107
cUL	:C22.2 No.8	
SEMKO	:IEC61643-1:2005 2nd :EN61643-11:2002 +A11	SE-57200 1400254



- Indicator of disconnecter status



Status

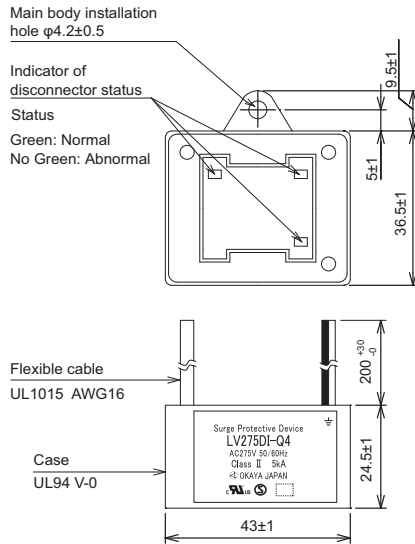
Green: Normal
No Green: Abnormal

Electrical Specifications

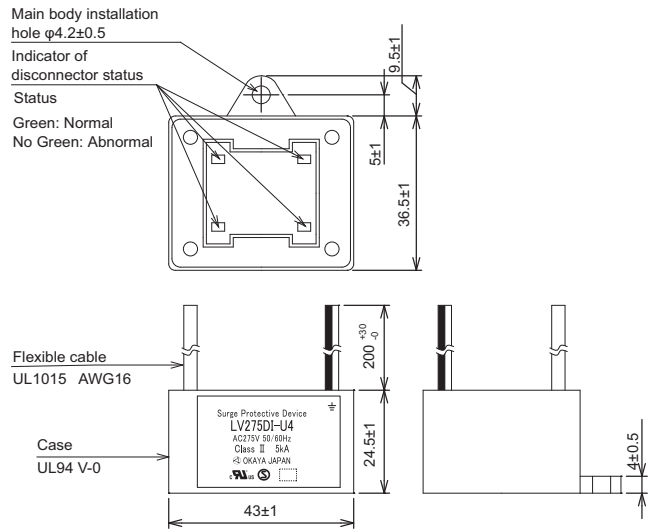
Safety Standard	Model Number	Rated Voltage 50/60Hz		DC Operating Voltage (V) ±25%	Voltage Protection Level (V)	Nominal Discharge Current 8/20µs (A)	Max. Discharge Current 8/20µs (A)	Impulse Life Test 8/20µs-1,000A
 	LV150DI-Q4	Single Phase	AC150V	450	1,200	2,500	5,000	Approx. 500 times
	LV275DI-Q4	Single Phase	AC275V	800	1,500			
	LV275DI-U4	Three Phase						
	LV480DI-Q4	Single Phase	AC480V	1,400	2,000			
	LV480DI-U4	Three Phase						
	LV550DI-U4	Three Phase	AC550V	1,600	2,500			

• Dimensions

LV-□□□DI-Q4 series (Single-Phase)



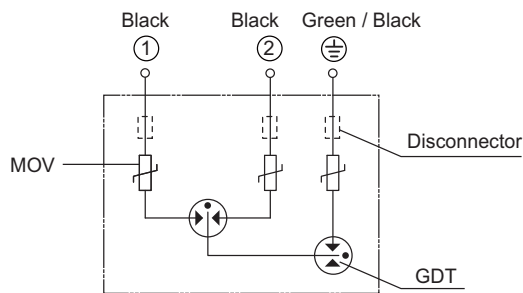
LV-□□□DI-U4 series (Three-Phase)



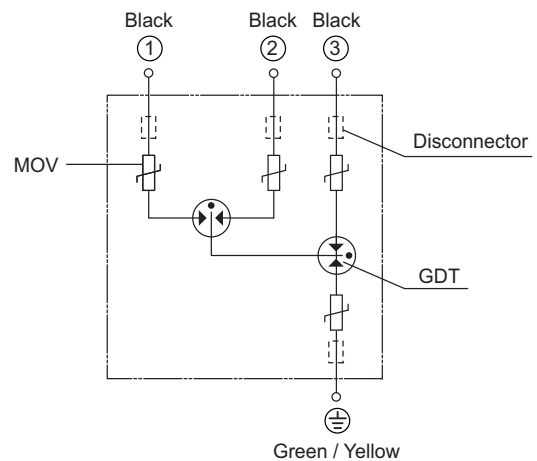
Unit: mm

• Circuit

LV□□□DI-Q4 series



LV□□□DI-U4 series



Flexible wires in black color can connect to each phase without any specific control.



Features

- Continual rated voltage AC150V-AC600V.
- IEC 61643-1 approval.
- Lightning surge protection for both single and three phase application.
- Fast response.
- Maximum peak surge current 8/20 μ s-5,000A.
- Every pathway consists of same elements.
Between line and line/between lines and ground can protect as the same level.
- Business equipment Compliant to IEC60950

Applications

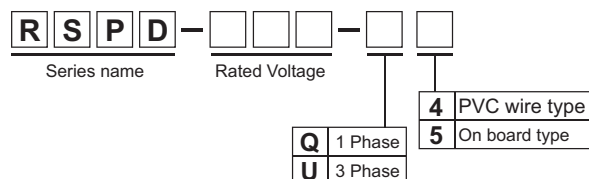
- Tapping machine, CNC turning machine, general machinery.



Safety Standard		File No.
UL	:UL1449 3rd.	E322107
cUL	:C22.2 No.8	
SEMCO	:IEC61643-1:1998+A1 :EN61643-11:2002+A11	SE-47338 1020655



Model numbering system



Electrical Specifications

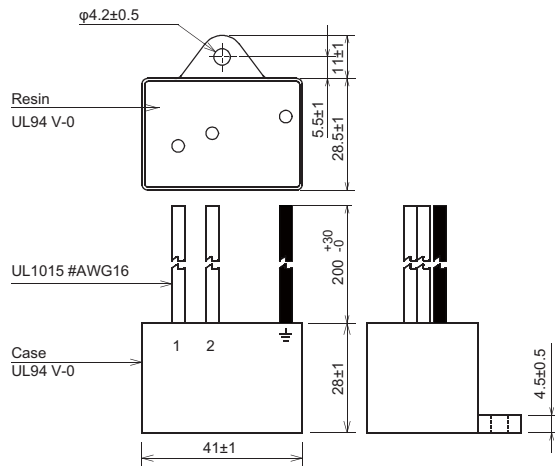
Safety Standard	Model Number*	Rated Voltage 50/60Hz		DC Operating Voltage (V)±25%	Voltage Protection Level (V)	Normal Discharge Current 8/20 μ s (A)	Max. Discharge Current 8/20 μ s (A)	Impulse life test 8/20 μ s-1,000A
	RSPD-150-Q□	Single Phase	AC150V	400	800	2,500	5,000	Approx. 300times
	RSPD-250-Q□	Single Phase	AC250V	700	1,300			
	RSPD-250-U□	Three Phase						
	RSPD-420-Q□	Single Phase	AC420V	1,100	1,500			
	RSPD-420-U□	Three Phase						
	RSPD-500-Q□	Single Phase	AC500V	1,300	2,000			
	RSPD-500-U□	Three Phase						
	RSPD-600-Q□	Single Phase	AC600V	1,500	2,500			
	RSPD-600-U□	Three Phase						

* □: PVC wire type=4, on board type=5

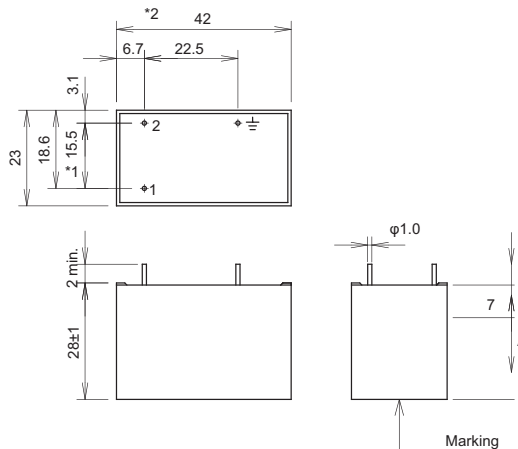
• Dimensions

RSPD-□□□-Q series (Single-Phase)

Wire terminal type (-4)

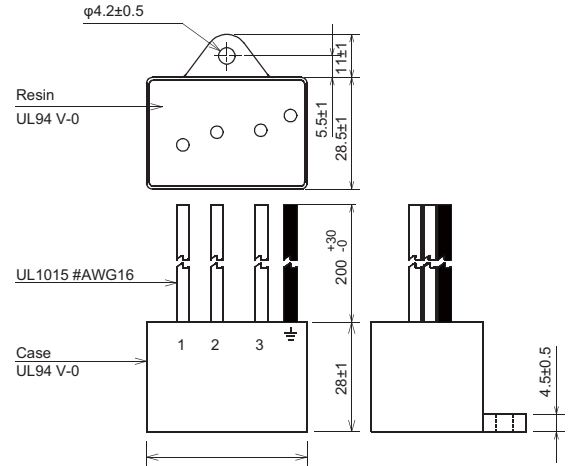


Solder lead type (-5)

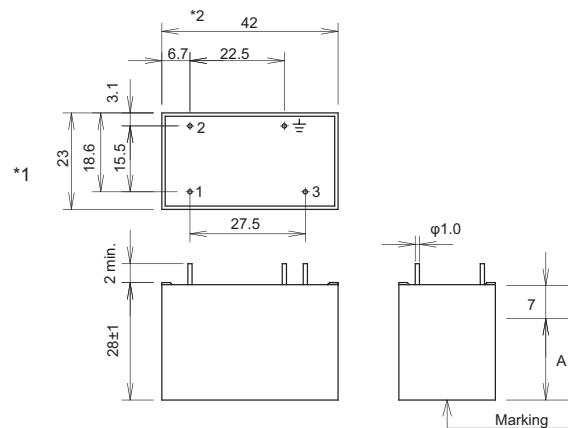


RSPD-□□□-U series (Three-Phase)

Wire terminal type (-4)



Solder lead type (-5)

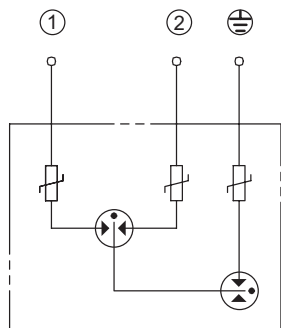


(A, *1, *2 Tolerance: ±0.5)

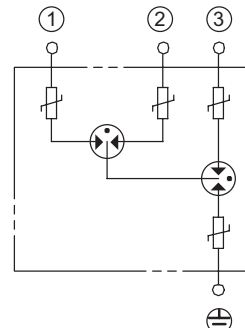
Unit: mm
Tolerance: ±1.0

• Circuit

RSPD-□□□-Q series



RSPD-□□□-U series



Flexible wires in black color can connect to each phase without any specific control.

Features

- SPD with a fail safe function to prevent short-circuit (separation of circuit and alarm contact for remote detection of separation).
- Compliance with IEC 61643-1 that meets the new JIS standards
- Against indirect lightning surge for three phase power supplies
- Quick response for surge
- Impulse current capacity: 8/20 μ s-5,000A
- Impulse test category: Class II (Type II)
- Every pathway consists of same elements.
Between line and line/between lines and ground can protect as the same level.

Applications

- Power conditioner for solar photovoltaic system
- Electrical vehicle charger
- LED exterior illumination
- Tapping machine, NC machine, other machine tools
- Lithography equipment, Washing device, IC tester
- Injection molding machine, Winding machine, Surface mounter
- Vehicle air conditioner
- Servo amplifier
- Electric facility, Industrial equipment

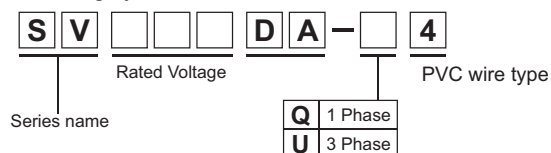


Safety Standard	File No.
UL :UL1449 * 3rd.	E322107
cUL :C22.2 No.8	
SEMKO :IEC61643-1:2005 2nd :EN61643-11:2002 +A11	SE-65070 1400256

* SCCR=5kA



- Model numbering system

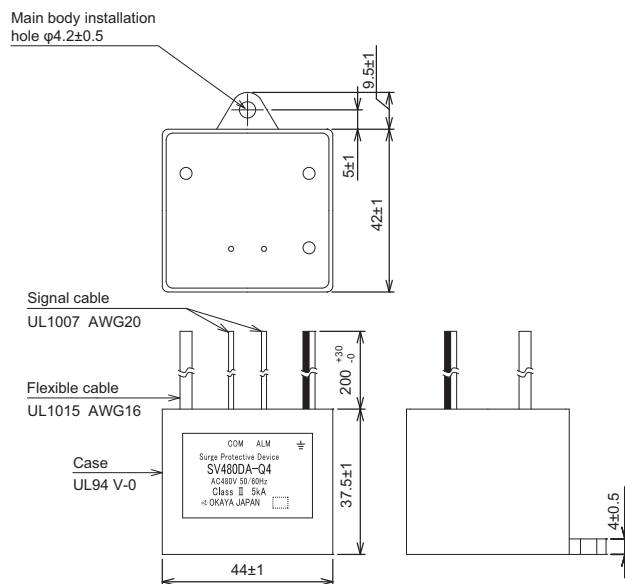


Electrical Specifications

Safety Standard	Model Number	Rated Voltage 50/60Hz		DC Operating Voltage (V)±25%	Voltage Protection Level (V)	Nominal Discharge Current 8/20μs (A)	Max. Discharge Current 8/20μs (A)	Impulse Life Test 8/20μs, 1,000A
—	SV150DA-Q4	Single Phase	AC150V	450	1,200	2,500	5,000	Approx. 500 times
	SV275DA-Q4	Single Phase	AC275V	800	1,500			
	SV275DA-U4	Three Phase						
—	SV480DA-Q4	Single Phase	AC480V	1,400	2,000			
	SV480DA-U4	Three Phase						
	SV550DA-U4	Three Phase	AC550V	1,600	2,500			

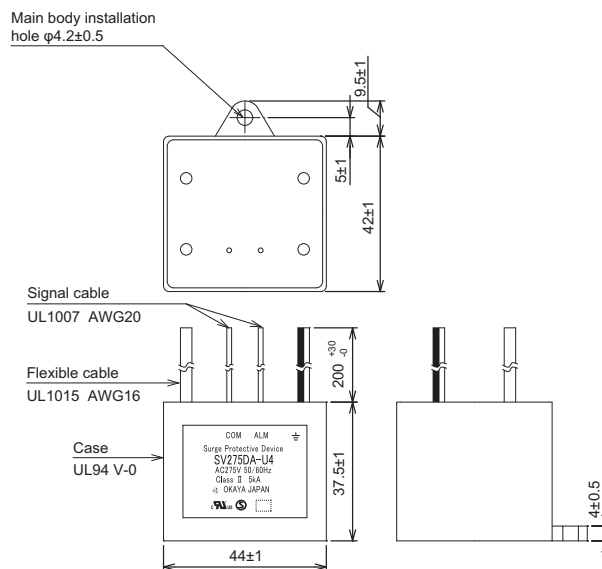
- *Dimensions*

SV-□□□DI-Q4 series (Single-Phase)



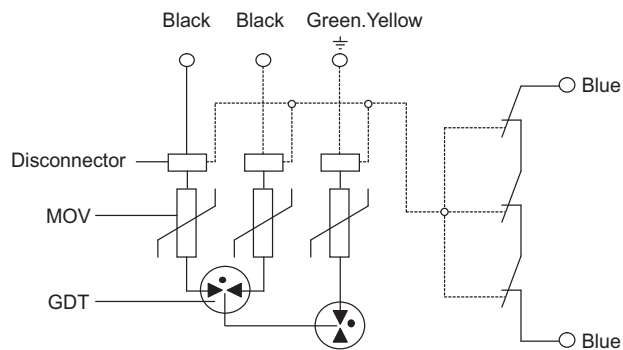
Unit: mm

SV-□□□DI-U4 series (Three-Phase)



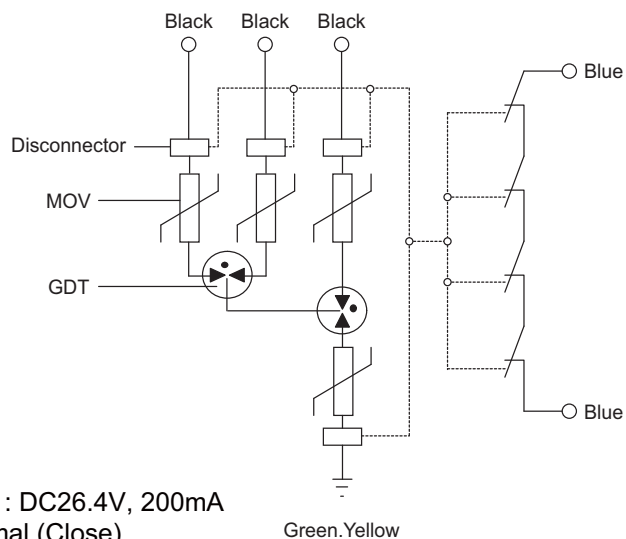
- *Circuit*

SV-□□□DI-Q4 series



Contact : Mechanical type
Maximum rating for contact circuit : DC26.4V, 200mA
Contact switching condition : Normal (Close)
Abnormal (Open)

SV-□□□DI-U4 series



Flexible wires in black color can connect to each phase without any specific control.

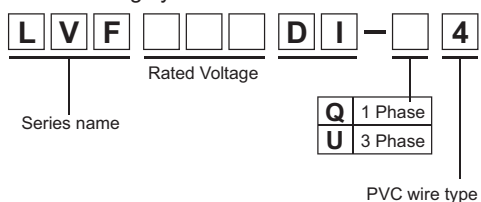
Features

- Compliant to the standard specification of the Ministry of Land, Infrastructure, Transport and Tourism
- SPD with a fail safe function to prevent short-circuit (separation of circuit and element is visually confirmable)
- Quick response for surge
- JIS5381-I : Nominal 8/20 μ s-5,000A
Max. 8/20 μ s-10,000A
- Impulse test category: Class II (Type II)
- Every pathway consists of same elements.
Between line and line/between lines and ground can protect as the same level.

Applications

- Road traffic and related equipment
- Power conditioner for solar photovoltaic system etc.

- Model numbering system



- Indicator of disconnecter status



Status

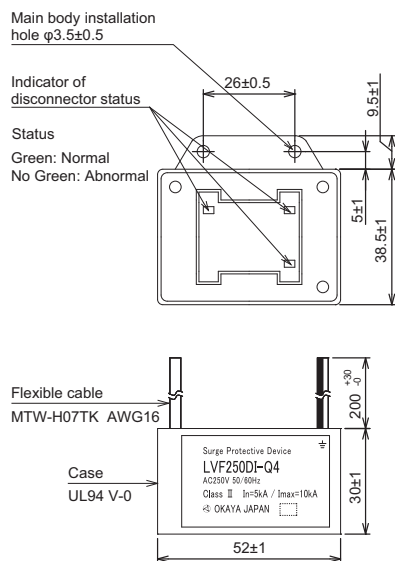
Green: Normal
No Green: Abnormal

Electrical Specifications

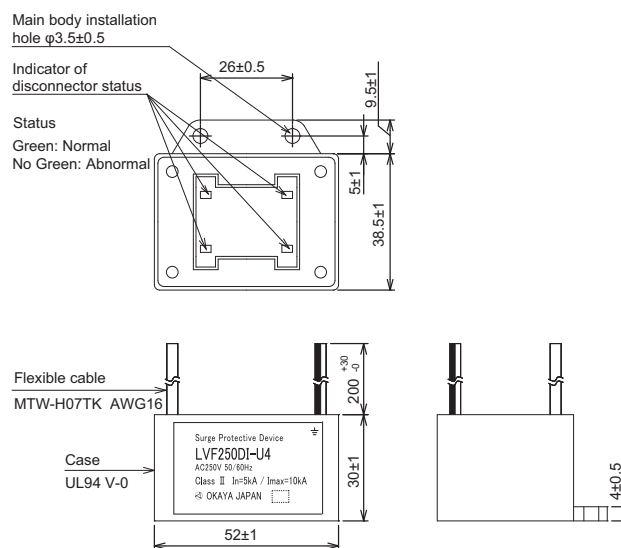
Model Number	Rated Voltage 50/60Hz		DC Operating Voltage (V) ±25%	Voltage Protection Level (V)	Nominal Discharge Current 8/20µs (A)	Max. Discharge Current 8/20µs (A)	Impulse Life Test 8/20µs-1,000A
LVF150DI-Q4	SinglePhase	AC150V	450	1,200	5,000	10,000	Approx. 500 times
LVF250DI-Q4	SinglePhase	AC250V	700	1,500			
LVF250DI-U4	ThreePhase						
LVF300DI-Q4	SinglePhase	AC300V	1,000	2,000			
LVF300DI-U4	ThreePhase						
LVF480DI-Q4	SinglePhase	AC480V	1,400	2,500			
LVF480DI-U4	ThreePhase						

• Dimensions

LVF-□□□□DI-Q4 series (Single-Phase)



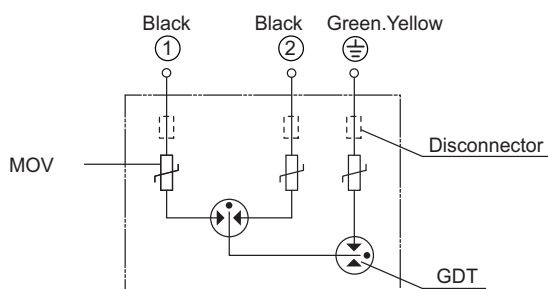
LVF-□□□□DI-U4 series (Three-Phase)



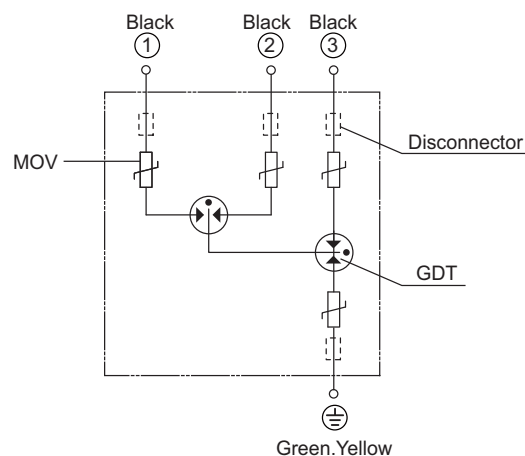
Unit: mm

• Circuit

LVF-□□□□DI-Q4 series



LVF-□□□□DI-U4 series



Flexible wires in black color can connect to each phase without any specific control.



R·C·M- BQZ-4, BQZ-5 BUZ-4, BUZ-5 SERIES SURGE PROTECTIVE DEVICES



Features

- Line to Line and Line to Ground combined protection.
- UL, CSA and CE safety approvals.
- Surge protection for both Single and Three-Phase applications.
- Compact size

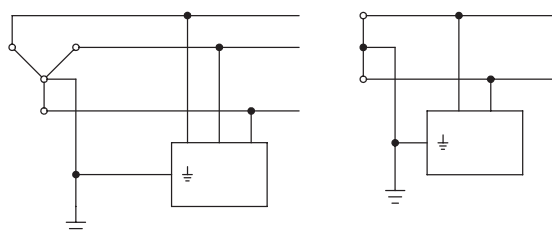
Applications

- Tapping machine, CNC turning machine, general machinery.

Rated Voltage

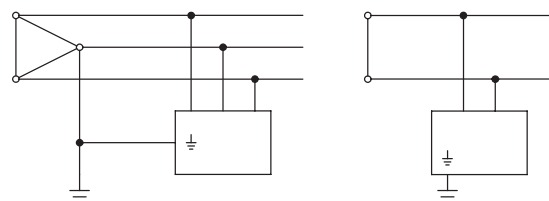
- Specification is different by delta connection and Y connection in Japan and overseas.
- Please use the RCM-BQZ and RCM-BUZ series at the rated voltage below.

- Y connection



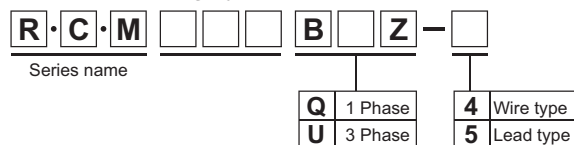
Y connection - 1 ϕ ~ AC430V(Line-Line) : R·C·M-781BQZ-4
 3 ϕ ~ AC430V(Line-Line) : R·C·M-781BUZ-4
 3 ϕ ~ AC500V : R·C·M-801BUZ-4

- Δ connection



Δ connection - 1 ϕ ~ AC250V : R·C·M-601BQZ-4
 3 ϕ ~ AC250V : R·C·M-601BUZ-4
 3 ϕ ~ AC290V : R·C·M-781BUZ-4

- Model numbering system



Electrical Specifications

Safety Standard	Model Number	Rated Voltage	Power Frequency Sparkover Voltage U_a (V) $\pm 20\%$	Nominal Discharge Current ins 8/20 μ s (A)	Max. Standard lightning Impulse Sparkover Voltage U_s 1.2/50 μ s (V)	Max. Sparkover Voltage at front of wave lighting Impulse U_{as} 10,000V/ μ s (V)	Max. Residual Voltage U_r 8/20 μ s-2500A (V)	Impulse Life Test 8/20 μ s 1,000A	Max. Impulse Discharge Current I_s 8/20 μ s (A)
 	R·C·M-601BQZ-□	1 Phase	AC250V	2,500	2,000	3,000	2,000	300 times	5,000
	R·C·M-601BUZ-□	3 Phase							
	R·C·M-781BQZ-□	3 Phase	AC430V						
	R·C·M-781BUZ-□	3 Phase	AC250/430V						
	R·C·M-801BUZ-□	3 Phase	AC290/500V		2,320	3,480	2,320		

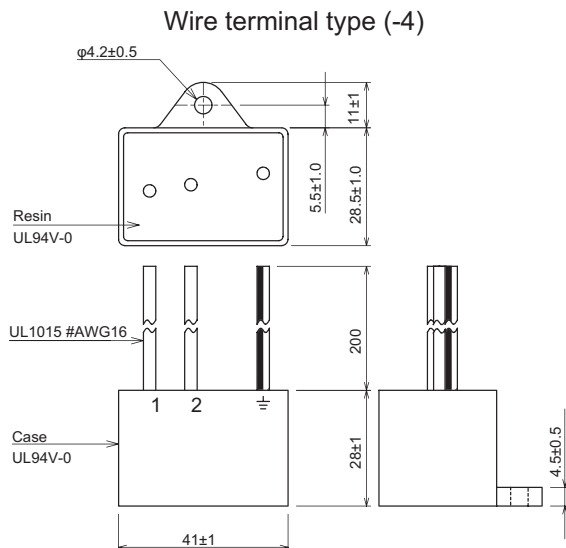
R·C·M-XXX-4: Wire type
 R·C·M-XXX-5: Lead type



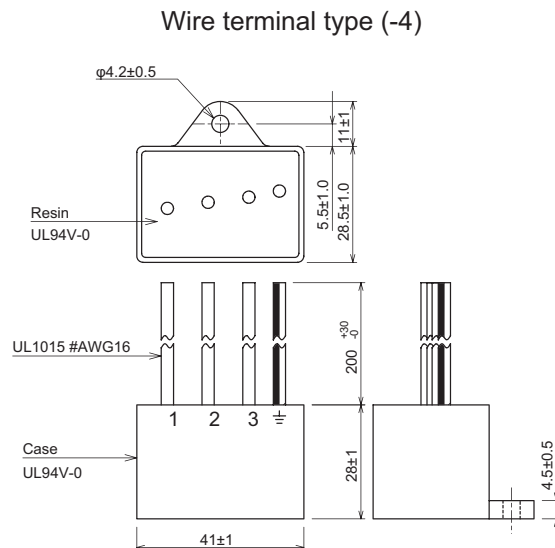
R-C-M- BQZ-4, BQZ-5 BUZ-4, BUZ-5 SERIES SURGE PROTECTIVE DEVICES

• Dimensions

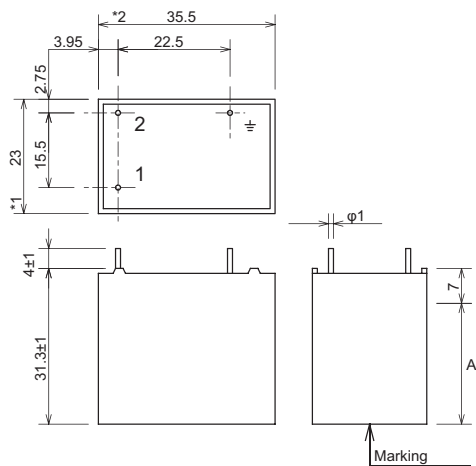
BQZ Series (Single-Phase)



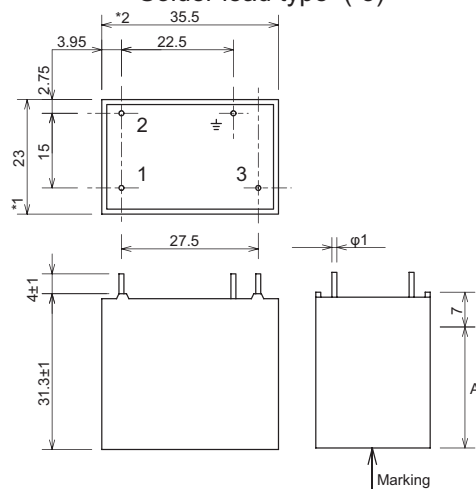
BUZ Series (Three-Phase)



Solder lead type (-5)



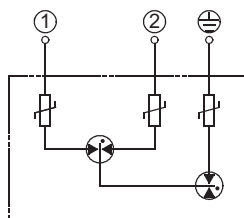
Solder lead type (-5)



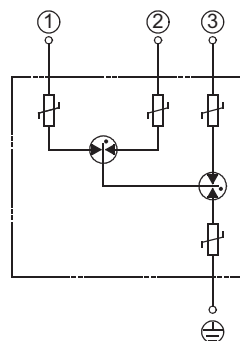
Unit: mm
(A, *1, *2 Tolerance: ±0.5)
Tolerance: ±1.0

• Circuit

BQZ series



BUZ series





Features

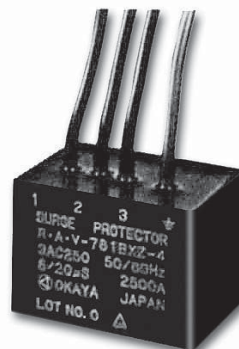
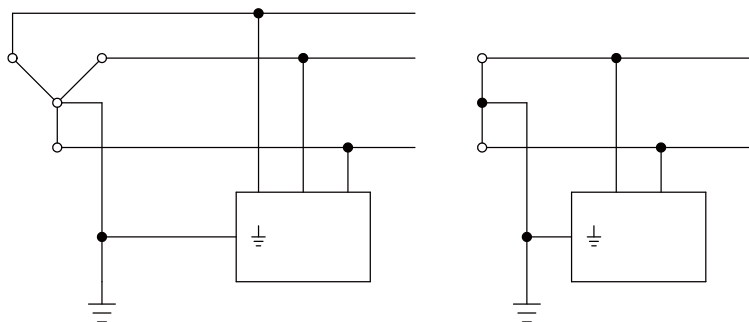
- These models are specifically designed for use in AC power line applications which may require European (CE) mark.
- They are designed for use in Single and Three-Phase applications for protection against “Common mode” noise transient surges.
- Three-Phase application include Delta and Y connections to AC500V.



Safety Standard		File No.
UL	:UL1449 3rd.	E322107
CSA	:C22.2 No.8	LR105073
TÜV	:EN60099-1	J9551051

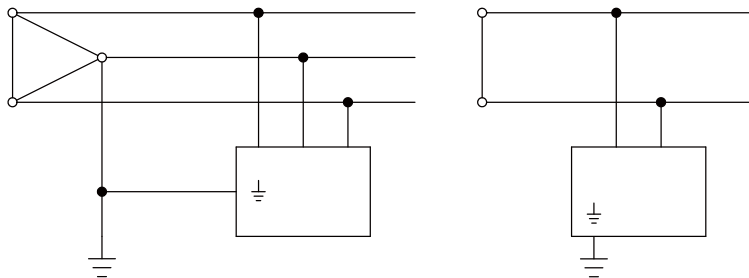
• Circuit

- Y connection



Y connection - 1 φ ~ AC500V : R·A·V-781BWZ-4
 3 φ ~ AC430V : R·A·V-781BXZ-4
 3 φ ~ AC500V : R·A·V-801BXZ-4

- Δ connection



Δ connection - 1 φ ~ AC250V : R·A·V-781BWZ-4
 3 φ ~ AC250V : R·A·V-781BXZ-4
 3 φ ~ AC250V : R·A·V-801BXZ-4

Electrical Specifications

Safety Standard	Model Number	Rated Voltage		Power Frequency Sparkover Voltage U_a (V) $\pm 20\%$	Nominal Discharge Current ins 8/20 μ s (A)	Max. Standard lightning Impulse Sparkover Voltage us 1.2/50 μ s (V)	Max. Sparkover Voltage at front of wave lighting Impulse usa 10,000V/ μ s (V)	Max. Residual Voltage ur 8/20 μ s-2,500A (V)
		Δ connection L-L, L- $\frac{1}{2}$	Y connection L-L, L- $\frac{1}{2}$					
  	R·A·V-781BWZ-4	AC250V	AC250/500V	700	2,500	2,000	3,000	2,000
	R·A·V-781BWZ-5							
	R·A·V-781BXZ-4		AC250/430V					
	R·A·V-781BXZ-5							
	R·A·V-801BXZ-4		AC290/500V	800		2,320	3,480	2,320
	R·A·V-801BXZ-5							

R·A·V-XXX-4: Wire type
 R·A·V-XXX-5: Lead type



R·A·V-BWZ-2A

This model is designed specifically for use in AC power line applications. This model uses specially treated discharge electrodes for greatly enhanced noise immunity test and surge life, making it optimum for the protection of single-phase power supply circuits.

R·A·V-BXZ-2A

This model is designed specifically for use in three-phase power circuit applications. Combining multiple PAVs with specially treated electrodes for greatly enhanced noise immunity test and surge life, this model is constructed in a unit-molded body.

R·A·V-BYZ-2

This model is designed specifically for use in three-phase power circuit applications. It is designed to protect against "normal mode" noise transient surges.

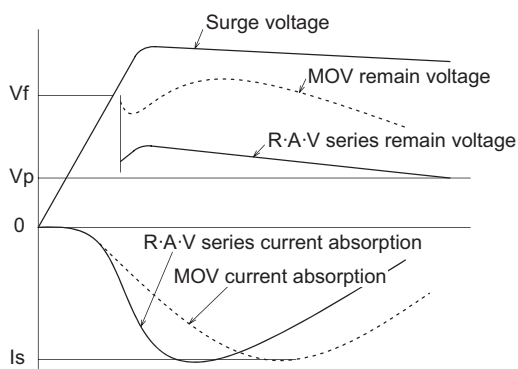
When used in conjunction with the RAV-BXZ-2A, it will furnish complete protection of equipment from both Normal and Common mode transient voltage surges.



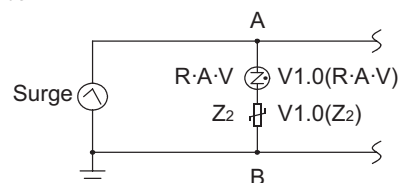
Safety Standard	File No.
UL :UL1449 3rd.	E322107
CSA :C22.2 No.8	LR105073



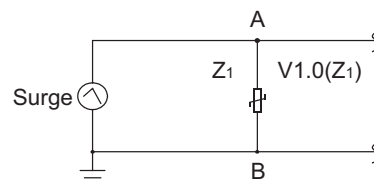
• Surge Absorption Capacitance Remain Voltage Comparison Chart



Surge Absorber

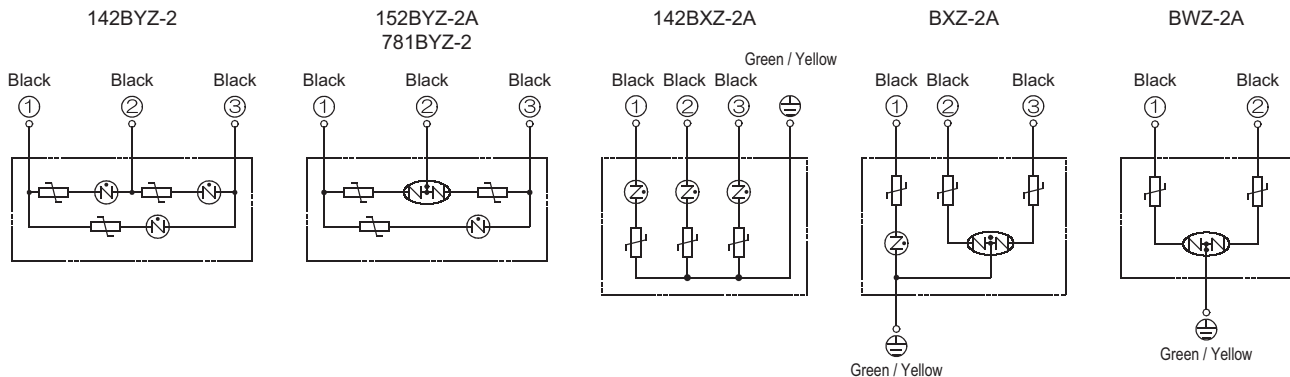


MOV

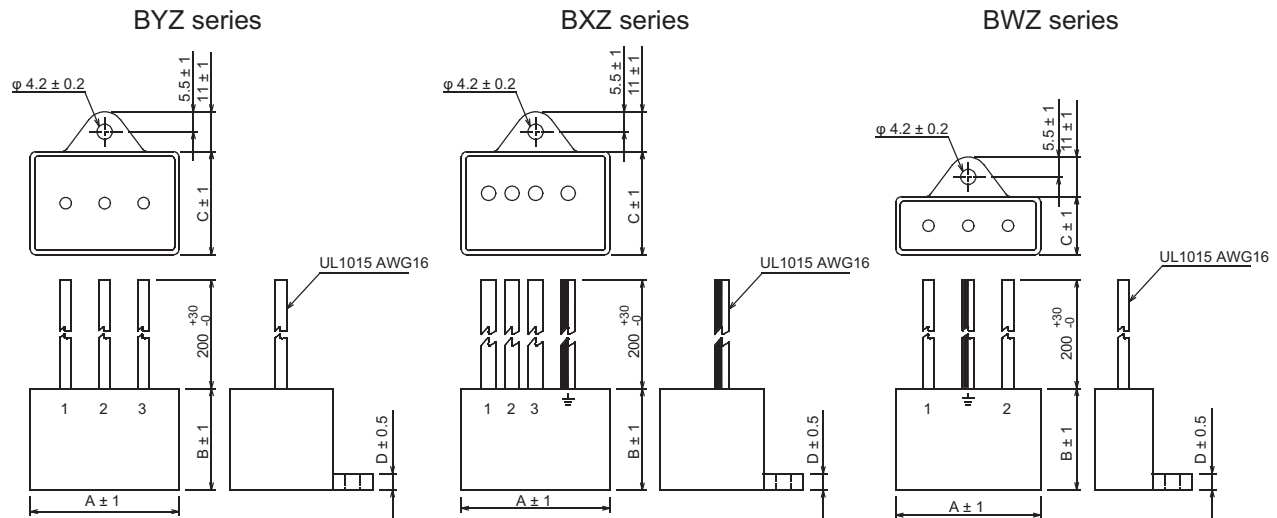


Vf: Breakdown voltage
Vp: Peak circuit voltage
 $V_p = V_{ac} \times \sqrt{2}$
Max. surge current
 $I_s: V1.0(R \cdot A \cdot V) + V1.0(Z_2) = V1.0(Z_1)$

● *Circuit*



● *Dimensions*



Unit: mm

Electrical Specifications

Safety Standard	Model Number	Line Voltage 50/60Hz		Max. Line Voltage (V)	Clamping Voltage (V) ±10%	Impulse Discharge Current 8/20μs (A)	Withstanding Impulse Voltage 1.2/50μs (V)	Capacitance (pF) *	Operating Temp. Range (°C)	Weight (g) Approx.	Dimensions (mm)			
											A	B	C	D
	R·A·V-401BWZ-2A	Single Phase	AC125V	145	403	2,500	20,000	100	-20 ~ +70	50	40	28	16	4.5
	R·A·V-781BWZ-2A	Single Phase	AC250V	300	783			50		60				
	R·A·V-781BXZ-2A	Three Phase	AC250V					75		100	41		28.5	
	R·A·V-781BYZ-2							50		140	59.9	43.5	30.6	5
—	R·A·V-142BXZ-2	Three Phase	AC400V	450	1,385	1,000	12,000	40		100	41	28	28.5	4.5
	R·A·V-142BYZ-2	Three Phase	AC460V	500	1,470	2,500	20,000	35						
	R·A·V-152BXZ-2A													
	R·A·V-152BYZ-2A	Three Phase	AC460V	500	1,470	2,500	20,000	35	100	41	28	28.5	4.5	

* Reference Value



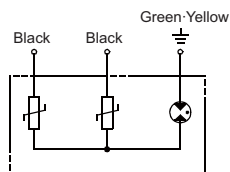
Features

- Compact size SPD
- Compliant to AC withstand voltage test
- Impulse discharge current 8/20μs-2kA
Common mode (1.2/50μs(R=12Ω)-15kV)
available.
- Compliance with safety standard (TÜV)
- External setting available for LED security light
and LED street light.

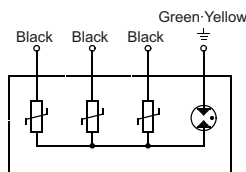
Applications

- LED security light, LED street light
- Industrial equipment required AC withstand
voltage test

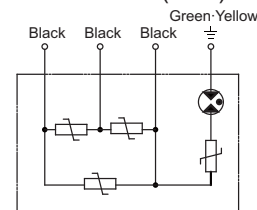
• Circuit R·A·M-BWZ(LED)



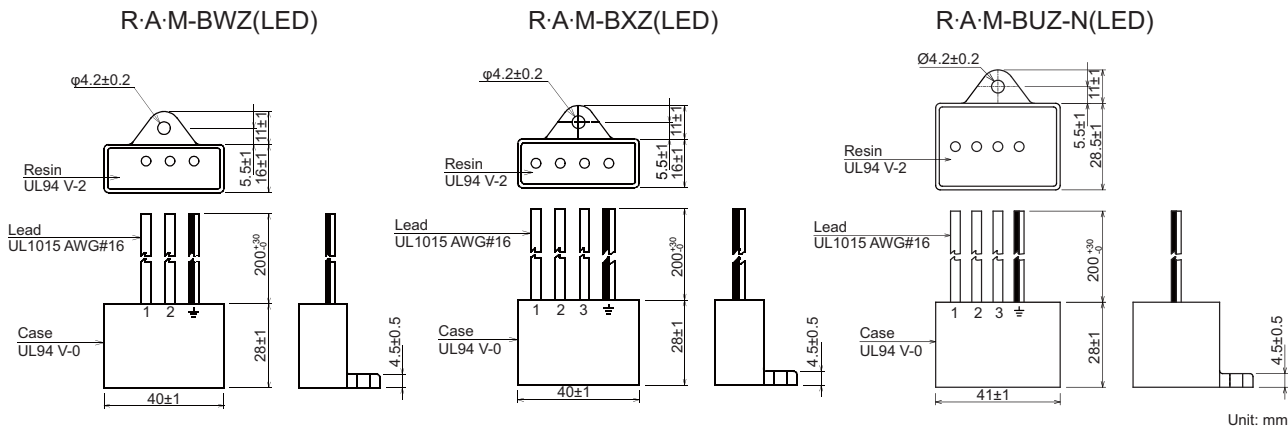
R·A·M-BXZ(LED)



R·A·M-BUZ-N(LED)



• Dimensions



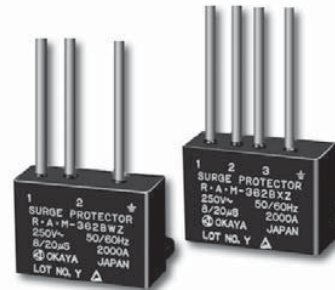
Electrical Specifications

Safety Standard	Model Number		Rated Voltage 50/60Hz (Vac)	Max. Line Voltage (Vac)	Varistor Voltage (V) ±10%	DC Breakdown Voltage Ez +30, -20% (V)	Impulse Discharge Current 8/20μs (A)	Insulation Resistance IR DC500V	Withstanding Voltage (Vac)	Operating Temp. Range (°C)	Weight (g) Approx.
—	R·A·M-242BWZ(LED)	1-2	125	140	540	—	2,000	>1,000	—	-20 ~ +70	40
		1,2- 1/2	—	—	—	2,400			—		
	R·A·M-302BWZ(LED)	1-2	250	300	940	—			—		
		1,2- 1/2	—	—	—	3,000			—		
	R·A·M-362BWZ(LED)	1-2	250	300	940	—			—		50
		1,2- 1/2	—	—	—	3,600			—		
	R·A·M-362BXZ(LED)	1-2-3-1	250	300	940	—			—		
		1,2,3 1/2	—	—	—	3,600			—		
—	R·A·M-302BUZ-N(LED)	1-2-3-1	250	300	470	—	2,000	>1,000	—	-20 ~ +70	62
		1,2,3- 1/2	—	—	—	3,000			—		
		1,2,3- 1/2	—	—	—	3,000			—		



Safety Standard	File No.
TÜV :IEC60384-14	J9650111

* If you need a product that is recognized by SEMKO, please contact to us.

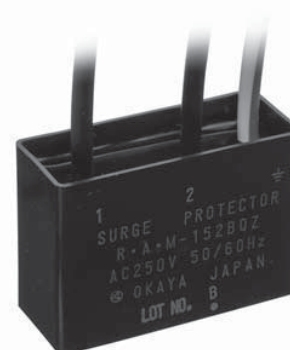


Features

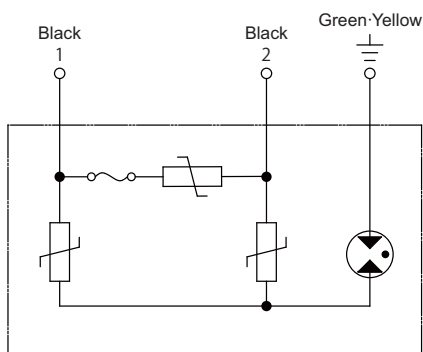
- Compact size SPD of rated AC250V available
- No use the fuse to between lines circuit because of SPD has a built-in separation mechanism
- Impulse discharge current 8/20 μ s-2kA
Common mode (1.2/50 μ s(R=12 Ω)-15kV) available.
- Compliance with safety standard (TÜV)
- External setting available for LED security light and LED street light.

Applications

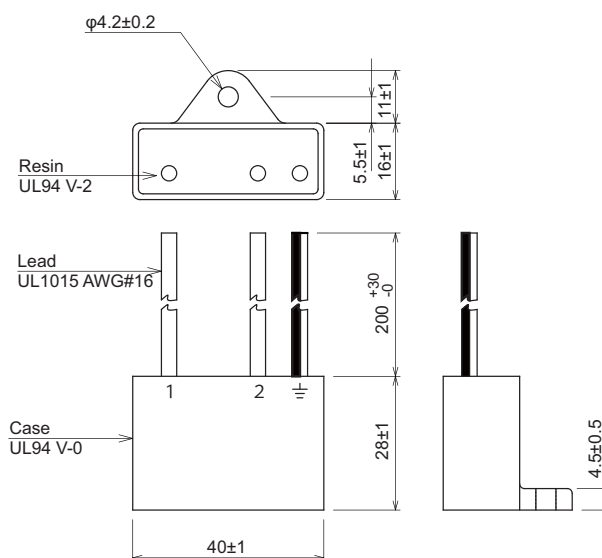
- LED security light, LED street light



Circuit



Dimensions



Unit: mm

Electrical Specifications

Safety Standard	Model Number	Rated Voltage 50/60Hz (Vac)	Max. Line Voltage (Vac)	Varistor Voltage (V) $\pm 10\%$	DC Breakdown Voltage Ez +30	Impulse Discharge Current 8/20 μ s (A)	Insulation Resistance IR DC500V	Withstand Voltage Test (Vac)	Operating Temp. Range (°C)	Weight (g) Approx.
-	R·A·M-152BQZ (LED)	1-2	250	300	470	-	2,000	>1,000	-	-40 ~ +70
		1,2- $\perp$	-	-	-	1,200				

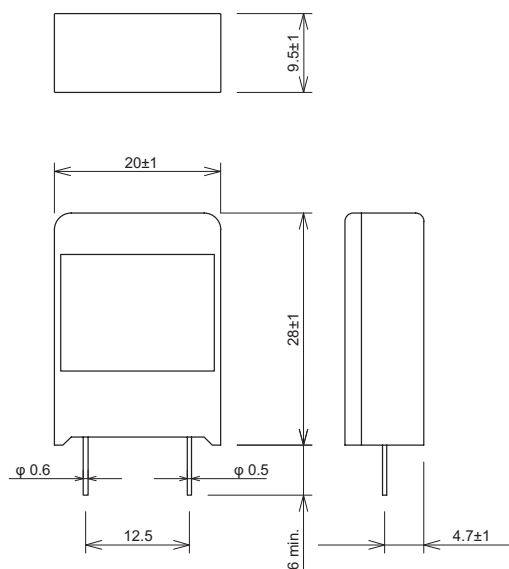
Features

- Fast response time.
- Bi-polar and it will fail open if surge withstand capability is exceeded.
- Small inter-terminal capacitance.
- High insulation resistance ($10^9\Omega$ min.).

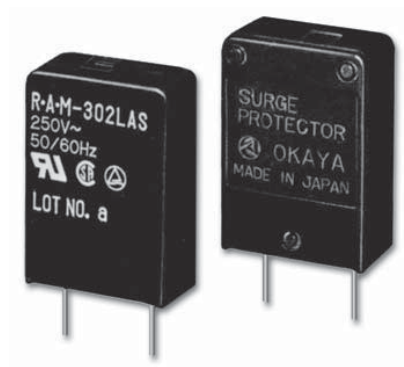


Safety Standard		File No.
UL	:UL1449 3rd.	E332107
CSA	:C22.2 No.8	LR105073
TÜV	:IEC60384-14	J9650111

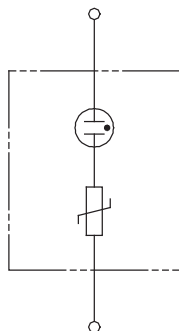
Dimensions



Unit: mm



Circuit



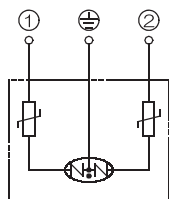
Electrical Specifications

Safety Standard			Model Number	Rated Voltage 50/60Hz (Vac)	Max. Line Voltage (Vac)	DC Breakdown Voltage Ez +30, -20%	Impulse Current Capacity 8/20μs(A)	Insulation Resistance IR (MΩmin.)	Withstanding Voltage	Capacitance 1MHz (pF)max.	Operating Temp. Range(°C)
UL	CSA	TÜV									
○	○	-	R·A·M-242LAS	125	140	2,400V	2,000	10,000 (DC500V)	1,000V/60s, 1,250V/3s	2.0	-20 ~ +80
○	○	○	R·A·M-302LAS	250	300	3,000V			1,500V/60s		
○	○	○	R·A·M-362LAS			3,600V			1,500V/60s, 1,800V/3s		

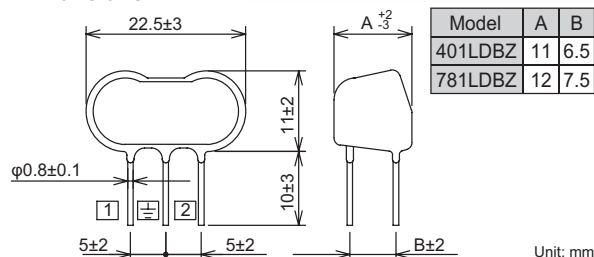
R·A·V-LDEZ

Designed specifically for use in AC power line applications. This model uses specially treated discharge electrodes for greatly enhanced noise immunity test and surge life making it optimum for the protection of single-phase power supply circuits.

• Circuit



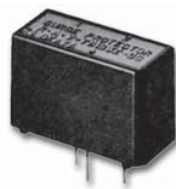
• Dimensions



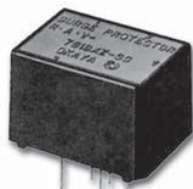
R·A·V-BWZ-3C, BXZ-3C

Use of surge protectors: Inverter, NC control systems, Welding machines and etc.

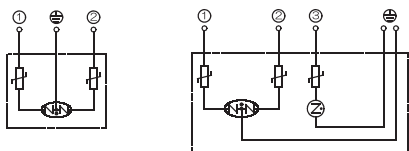
BWZ-3C series



BXZ-3C series



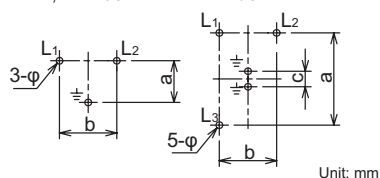
• Circuit



• Print circuit board hole dimensions

LDEZ, BWZ-3C

BXZ-3C



Model Number	Dimensions (mm)			
	a	b	c	φ
401LDEZ	6.5	10	-	1.2*
781LDEZ	7.5			
401BWZ-3C	6	2.8	16.6	1.2*
78BWZ-3C	6.9			
781BXZ-3C	16.6			

* Reference Value

Electrical Specifications

Safety Standard	Model Number	Line Voltage 50/60Hz		Max. Line Voltage (V)	Clamping Voltage (V) ±10%	Impulse Discharge Current 8/20μs (A)	Withstanding Impulse Voltage 1.2/50μs (V)	Capacitance (pF)*	Operating Temp. Range (°C)	Weight (g)*			
	R·A·V-401LDEZ	Single Phase	AC125V	145	403	1,000	12,000	100	-20 ~ +70	10			
	R·A·V-781LDEZ	Single Phase	AC250V	300	783			50					
	R·A·V-401BWZ-3C	Single Phase	AC125V	145	403	2,500	20,000	100		20			
	R·A·V-781BWZ-3C	Single Phase	AC250V	300	783			50			30		
	R·A·V-781BXZ-3C	Three Phase	AC250V										

* Reference Value

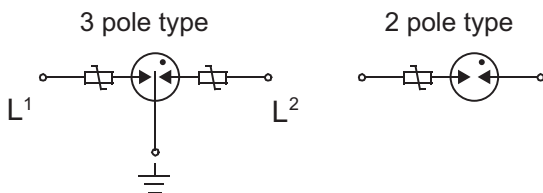
Features

- The RAV Surge Absorber is applicable for the protection of many types of electrical equipment.
- The RAV has the following features:
- 1) Large capacity surge protection.
 - 2) Fast response time.
 - 3) Good endurance to repetitive lightning.
 - 4) Small electrostatic capacity.
 - 5) No environmentally hazardous materials.

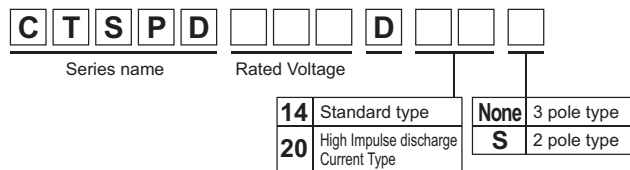
Applications

- Telephone, PBX, Wireless base station
- Optical transmission equipments
- CATV transmission equipments
- Fire alarm systems and Home security systems
- RoHS restriction complied

Circuit

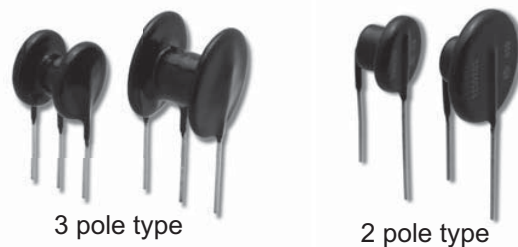


Model numbering system



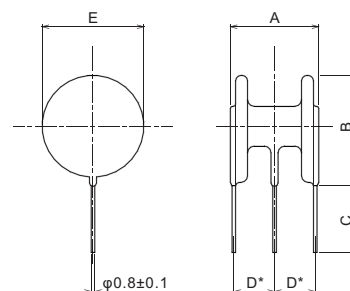
Electrical Specifications

Type	Model Number	Nominal Line Voltage 50/60Hz	Max. Line Voltage 50/60Hz	DC Operating Voltage 2,000V/s		Impulse Sparkover Voltage 10/200μs 3,000V		Residual Voltage 10/200μs 200A		Insulation Resistance DC100V	Capacitance 1MHz max. (pF)	Impulse Discharge Voltage 8/20μs 1 time (A)	Impulse Life Test 10/200μs 400A (times)
				Between L-E	Between L-L	Between L-E	Between L-L	Between L-E	Between L-L				
3 pole	CTSPD-125D14	AC125V	AC150V	>300V	>300V	<800V	<1,500V	<550V	<1,100V	>50MΩ	<3pF	9,000	1,000
	CTSPD-125D20											15,000	
	CTSPD-250D14	AC250V	AC300V	>500V	>500V	<1,300V	<2,000V	<1,000V	<1,600V			9,000	
	CTSPD-250D20											15,000	
2 pole	CTSPD-125D14S	AC125V	AC150V	>300V	-	<800V	-	<550V	-	>50MΩ	<3pF	4,500	1,000
	CTSPD-125D20S											7,500	
	CTSPD-250D14S	AC250V	AC300V	>500V	-	<1,300V	-	<1,000V	-			4,500	
	CTSPD-250D20S											7,500	

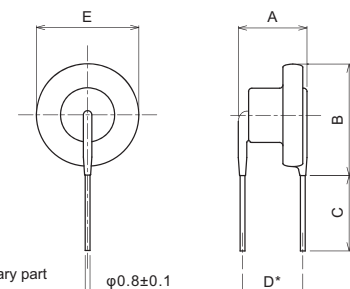


Dimensions

3 pole type



2 pole type



*Dimension of elementary part

φ0.8±0.1

Unit: mm

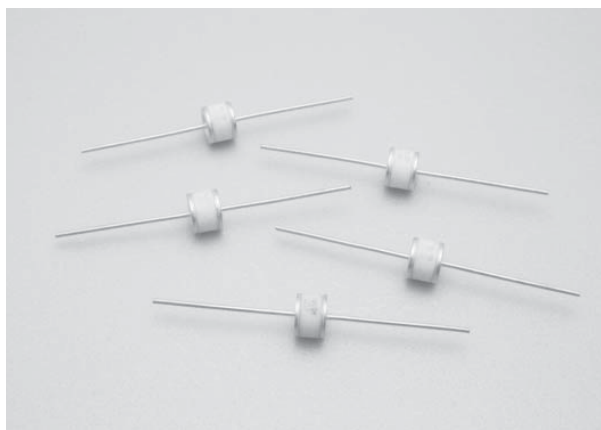
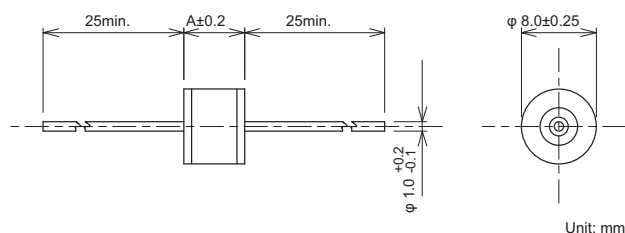
Features

- Quick response for surge
- High impulse current capacity
- It can withstand alternating current

Applications

- Telephone, PBX, Wireless base station, Optical transmission equipments, CATV transmission equipments, Fire alarm systems and Home security systems.

Dimensions



Model Number	A
R28-□□□-BHL	5.7
R28-□□□-BJL	6.05
R28-□□□-BKL	7.5

Electrical Specifications (Low Voltage Type)

(Conforms to ITU-T)

Model Number	DC Breakdown Voltage 100V/s~2,000V/s (V) ±20	Impulse Sparkover Voltage 100V/μs (V) max	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Impulse Life Test 10/1,000μs (A)300 times	Alternating Discharge Current 50Hz, 1s 10 times (A)	Impulse Discharge Current 8/20ms (A)
R28-900-BHL-S	90	450	10,000(DC50V)	1.5	100	10	20,000
R28-151-BHL-S	150	500					
R28-231-BHL-S	230	600	10,000 (DC100V)				
R28-251-BHL-S	250						
R28-301-BHL-S	300	650					
R28-351-BHL-S	350	750					
R28-401-BHL-S	400	800					
R28-471-BHL-S	470	900					
R28-601-BHL-S	600	1,300					

Electrical Specifications (High Voltage Type)

Model Number	DC Breakdown Voltage 500V/s (V)±20	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Withstanding Voltage	Impulse Life Test 8/20μs (A)300A times	Impulse Discharge Current 8/20μs (A)
R28-801-BHL-S	800	10,000(DC250V)	1.5	-	1000	20,000
R28-102-BHL-S	1,000	10,000(DC500V)		-		
R28-152-BHL-S	1,500			-		
R28-242-BJL-S	2,400			AC1,250V 3s		
R28-302-BKL-S	3,000			AC1,500V 60s		
R28-362-BKL-S	3,600			AC1,800V 3s		
R28-402-BKL-S	4,000			AC2,000V 60s		
R28-452-BKL-S	4,500	10,000(DC1000V)				

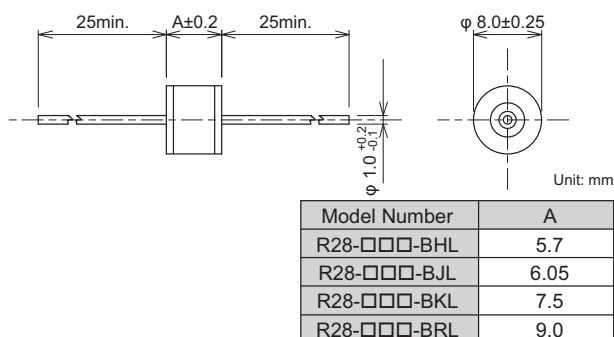
Features

- Quick response for surge.
- High impulse current capacity.
- It can withstand alternating current.
- Excellent insulation resistance and small capacitance.
- Recommendation of ITU-T conformity.

Applications

- Telephone, PBX, Wireless base station, Optical transmission equipments, CATV transmission equipments, Fire alarm systems and Home security systems.

Dimensions



Safety Standard		File No.
UL	:UL497B	E139599
	:UL1449 3rd.	E332107



Model numbering system

R	2	8	- 3 5 1 -			B	H	L
			DC Breakdown Voltage					
			351	35X10 ³ =350V				
Series Name						Type of taping		
R38 3 electrode arrester						B Bulk		
						Type of wire		
						L	With lead	
						None	Without lead	
						Length		
						H	5.7mm	
						J	6.05mm	
						K	7.5mm	
						R	9.0mm	

Electrical Specifications (Low Voltage Type)

(Conforms to ITU-T)

Safety Standard		Model Number	DC Breakdown Voltage 100V/s~2,000V/s (V) ±20	Impulse Sparkover Voltage 100V/μs (V) max	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Impulse Life Test 10/1,000μs (A)300 times	Alternating Discharge Current 50Hz, 1s 10 times (A)	Impulse Discharge Current 8/20ms (A) 10times
UL 497B	UL 1449								
○	-	R28-900-BHL	90	450	10,000(DC50V)	1.5	100	10	10,000
○	-	R28-151-BHL	150	500					
○	-	R28-231-BHL	230	600					
○	-	R28-251-BHL	250						
○	○ ^{*1}	R28-301-BHL	300	650	10,000(DC100V)				
○	○ ^{*1}	R28-351-BHL	350	750					
○	○ ^{*1}	R28-401-BHL	400	800					
○	○ ^{*1}	R28-471-BHL	470	900					
○	○ ^{*2}	R28-601-BHL	600	1,300					

Electrical Specifications (High Voltage Type)

Safety Standard	Model Number	DC Breakdown Voltage	Insulation Resistance	Capacitance	Withstanding Voltage	Impulse Life Test	Impulse Discharge Current
UL 1449		500V/s (V)±20	(MΩ) min.	1MHz (pF) max.		8/20μs (A)300A times	8/20μs (A)
○ ^{*1} ₂	R28-801-BHL	800	10,000(DC250V)	1.5	-	1000	10,000
○ ^{*1} ₂	R28-102-BHL	1,000	10,000(DC500V)		-		
○ ^{*1} ₂	R28-152-BHL	1,500			-		
○ ^{*1} ₂	R28-242-BJL	2,400			AC1,250V 3s		
○ ^{*1} ₂	R28-302-BKL	3,000			AC1,500V 60s		
○ ^{*1} ₂	R28-362-BKL	3,600			AC1,800V 3s		
○ ^{*1} ₂	R28-402-BKL	4,000			AC2,000V 60s		
○ ^{*1} ₂	R28-452-BKL	4,500	10,000(DC1000V)		AC3,000V 60s		
○ ^{*1} ₂	R28-602-BRL	6,000					

*1 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 14mm).

*2 Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA≥470V, D≥φ 14mm).



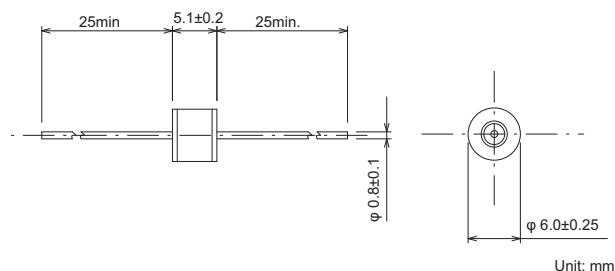
Features

- Quick response for surge.
- High impulse current capacity.
- It can withstand alternating current.
- Excellent insulation resistance and small capacitance.
- Recommendation of ITU-T conformity.

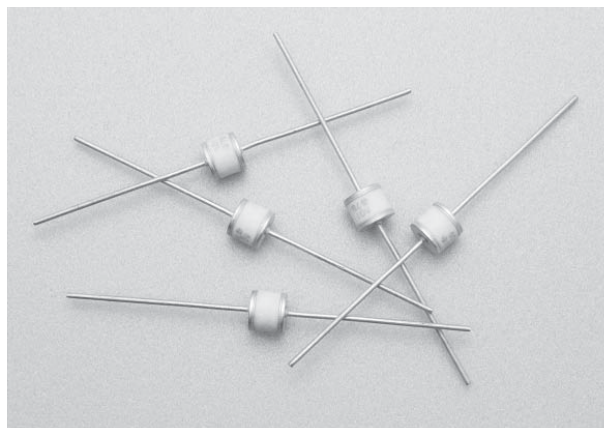
Applications

- Telephone, PBX, Wireless base station, Optical transmission equipments, CATV transmission equipments, Fire alarm systems and Home security systems. RoHS restriction complied.

Dimensions



Safety Standard		File No.
UL	:UL497B	E139599
	:UL1449 3rd.	E332107



Model numbering system

R	2	6	-	3	5	1	-	B	G	L
Series Name			DC Breakdown Voltage			Type of taping		Type of wire		
R26 2 electrode arrester			351 35X10 ¹ =350V			B Bulk		L With lead		
								None Without lead		
								Length G 5.1mm		

Electrical Specifications (Low Voltage Type)

(Conforms to ITU-T)

Safety Standard		Model Number	DC Breakdown Voltage	Impulse Sparkover Voltage	Insulation Resistance	Capacitance	Impulse Life Test	Alternating Discharge Current	Impulse Discharge Current
UL 497B	UL 1449		100V/s ~ 500V/s (V) ±20%	100V/μs (V)max.	(MΩ) min.	1MHz (pF) max.	10/1,000μs (A)300A times	50Hz, 1s 10 times (A)	8/20μs (A) 10 times
○	-	R26-900-BGL	90	450	10,000(DC50V)	1.0	50	5	5,000
○	-	R26-151-BGL	150	500					
○	-	R26-231-BGL	230	600					
○	-	R26-251-BGL	250						
○	○ ^{*1}	R26-301-BGL	300		650				
○	○ ^{*1}	R26-351-BGL	350	750					
○	○ ^{*1}	R26-401-BGL	400	800					
○	○ ^{*1}	R26-471-BGL	470	900					
○	○ ^{*2}	R26-601-BGL	600	1,300					

Electrical Specifications (High Voltage Type)

Safety Standard	Model Number	DC Breakdown Voltage 500V/s (V) ±20%	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Withstanding Voltage test	Impulse Life Test 8/20μs (A)300 times	Impulse Discharge Current 8/20μs (A)
UL 1449							
○ ^{*1} ○ ^{*2}	R26-801-BGL	800	10,000(DC250V)	1.0	-	500	5,000
○ ^{*1} ○ ^{*2}	R26-102-BGL	1,000	10,000(DC500V)		-		
○ ^{*1} ○ ^{*2}	R26-152-BGL	1,500			-		
○ ^{*1} ○ ^{*2}	R26-242-BGL	2,400			AC1,250V 3s		
○ ^{*1} ○ ^{*2}	R26-302-BGL	3,000			AC,1500V 60s		
○ ^{*1} ○ ^{*2}	R26-362-BGL	3,600			AC1,800V 3s		

^{*1} Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 14mm).

^{*2} Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA≥470V, D≥φ 14mm).

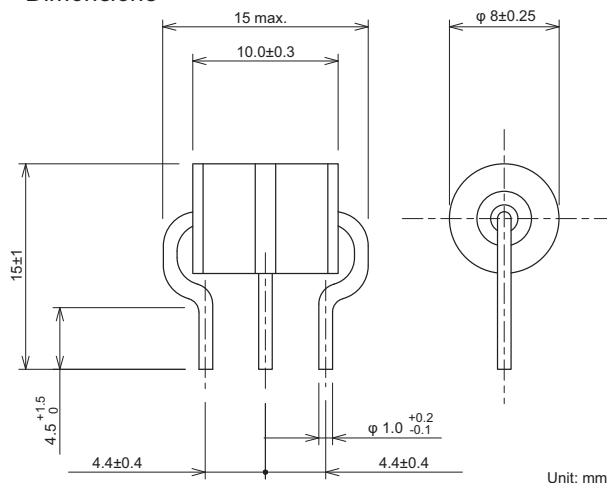
Features

- Quick response for surge.
- High impulse current capacity.
- It can withstand alternating current.
- Excellent insulation resistance and small capacitance.
- Recommendation of ITU-T conformity.

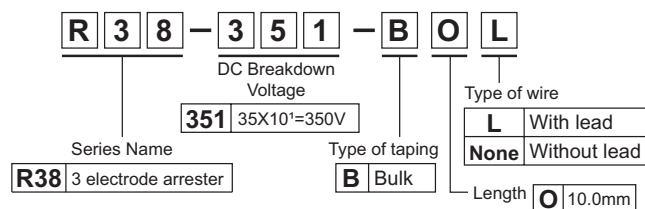
Applications

- Telephone, PBX, Wireless base station, Optical transmission equipments, CATV transmission equipments, Fire alarm systems and Home security systems. RoHS restriction complied.

Dimensions



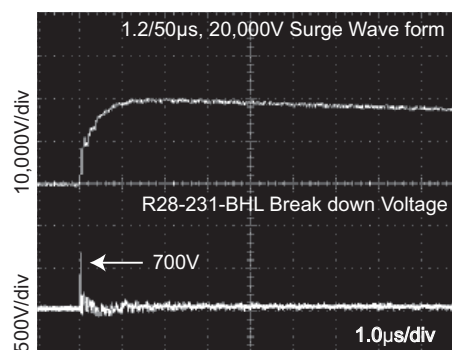
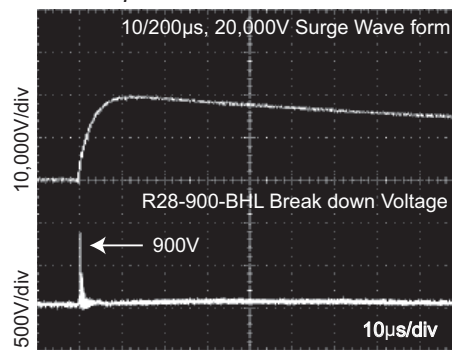
Model numbering system



Safety Standard	File No.
UL :UL497B	E139599



Impulse Absorption Characteristics



Electrical Specifications

(Conforms to ITU-T)

Safety Standard	Model Number	DC Breakdown Voltage 100V/s ~ 2,000V/s (V) ±20%	Impulse Sparkover Voltage 100V/μs (V) max.	Insulation Resistance (MΩ) min.	Capacitance 1MHz max. (pF)	Impulse Life Test 10/1,000μs (A) 300 times	Alternating Discharge Current 50Hz, 1s 10 times (A)	Impulse Discharge Current 8/20μs (A) 10 times
	R38-900-BOL	90	450	10,000(DC50V)	1.5	100	10	10,000
	R38-231-BOL	230	600	10,000(DC100V)				
	R38-251-BOL	250						
	R38-351-BOL	350	750					
	R38-421-BOL	420	900					
	R38-601-BOL	600	1,300					

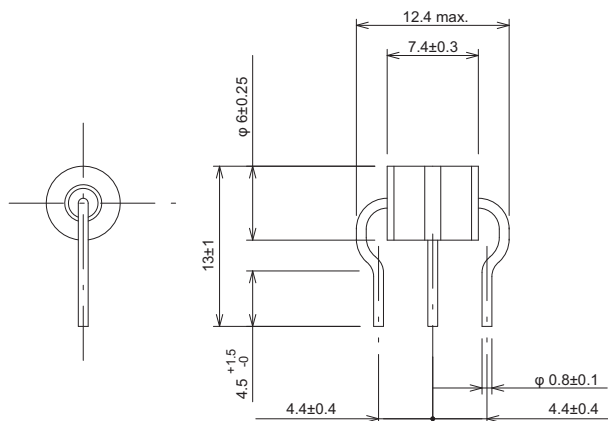
Features

- Quick response for surge.
- High impulse current capacity.
- It can withstand alternating current.
- Excellent insulation resistance and small capacitance.
- Recommendation of ITU-T conformity.

Applications

- Telephone, PBX, Wireless base station, Optical transmission equipments, CATV transmission equipments, Fire alarm systems and Home security systems. RoHS restriction complied.

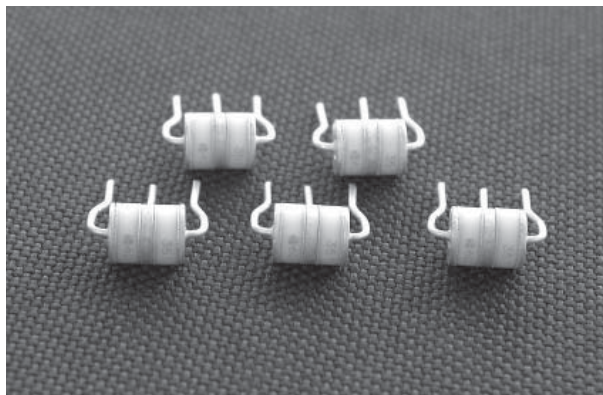
Dimensions



Unit: mm



Safety Standard	File No.
UL :UL497B	E139599



Model numbering system

R	3	6	-	3	5	1	-	B	P	L
Series Name			DC Breakdown Voltage			Type of wiring			Type of tapping	
R36 3 electrode arrester			351 35X10 ¹ =350V			L With lead			None With out lead	
						B Bulk			Length	
									P 7.4mm	

Electrical Specifications

(Conforms to ITU-T)

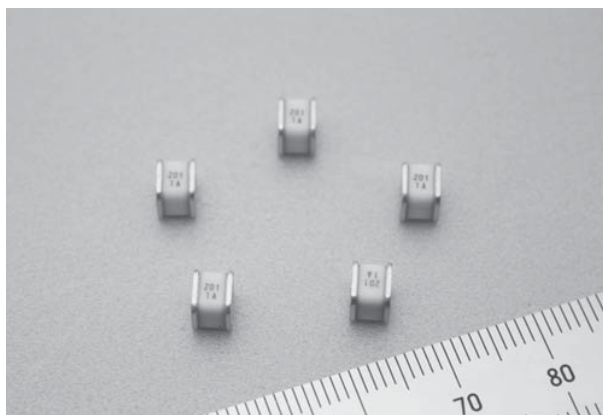
Safety Standard	Model Number	DC Breakdown Voltage 100V/s ~ 2,000V/s (V) ±20%	Impulse Sparkover Voltage 100V/μs (V)max.	Insulation Resistance (MΩ)min.	Capacitance 1MHz (pF) max.	Impulse Life Test 10/1,000μs (A)300 times	Alternating Discharge Current 50Hz, 1s 10 times (A)	Impulse Discharge Current 8/20μs (A)
	R36-900-BPL	90	450	10,000(DC50V)	1.0	50	5	5,000
	R36-231-BPL	230	600	10,000(DC100V)				
	R36-251-BPL	250						
	R36-351-BPL	350	750					
	R36-421-BPL	420	900					
	R36-601-BPL	600	1,300					

Features

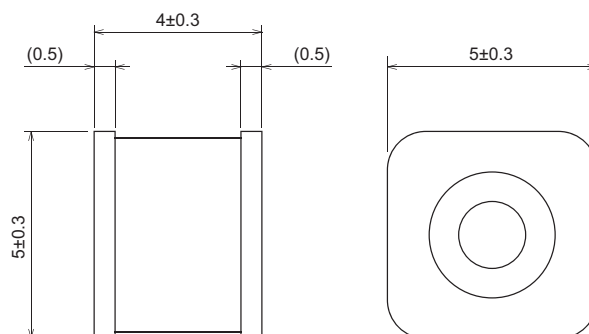
- Small surface mount type corresponding to reflow solder
- High impulse current capacity 8/20 μ s-5,000A
- Quick response for surge
- Excellent insulation resistance and small capacitance 1.0pF max.
- Recommendation of ITU-T conformity

Applications

- Homegateway equipments
- Telephone, PBX, Wireless base station
- Optical transmission equipments
- CATV transmission equipments, BS / CS broadcasts equipments
- Fire alarm systems and Home security systems


NEW

Dimensions



Unit: mm

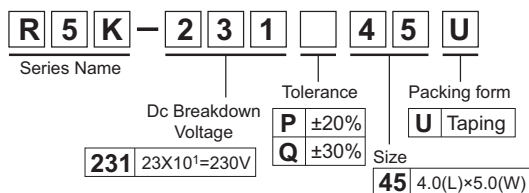
Electrical Specifications

Model Number*1	DC Breakdown Voltage (V)	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Impulse Life Test	Impulse Current Capacity*2	Impulse Withstanding Voltage Capacity
R5K-750□45U	75	1,000(DC50V)	1.0	8/20μs, 100A 300 times	8/20μs, 5,000A Positive/Negative 5 times	10/700μs 15,000V (R=25Ω) Positive/Negative 5times
R5K-900□45U	90					
R5K-151□45U	150					
R5K-231□45U	230	1,000(DC100V)				
R5K-251□45U	250					
R5K-351□45U	350					
R5K-421□45U	420					
R5K-501□45U	500					
R5K-601□45U	600					

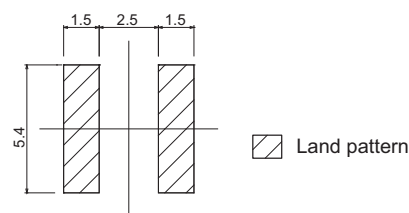
*1 □: Tolerance $\pm 20\%$ =P, Tolerance $\pm 30\%$ =Q

*2 Comforms to ITU-T K.20,K.21 Enhanced test

• Model numbering system



• Recommended Land Pattern (Typical value)

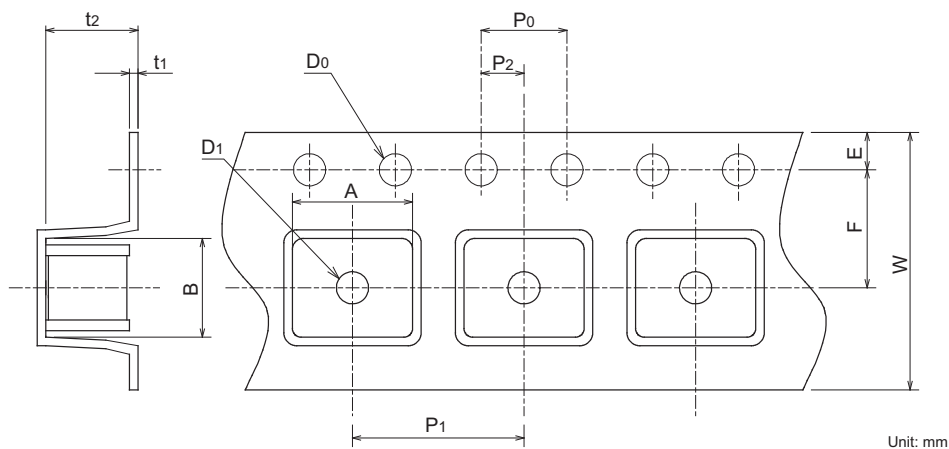


Recommended thickness of copper foil is 70μm for upgrading of withstand surge current.

Unit: mm

	Dimensions (mm)		
	a	b	c
Reflow Soldering	2.5	5.5	5.4

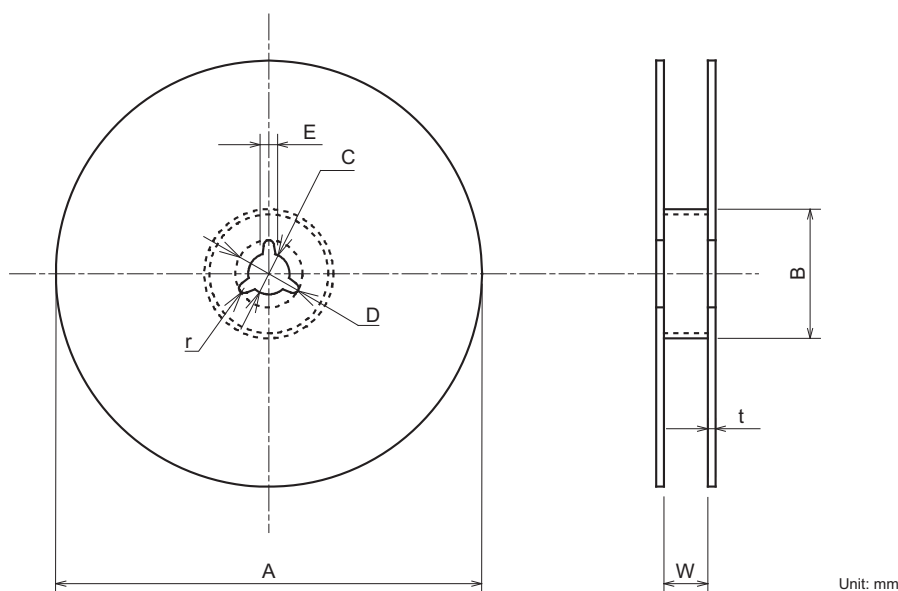
• Taping Dimensions



Unit: mm

Dimensions (mm)	
A	5.6±0.3
B	4.6±0.3
W	12.0±0.4
F	5.5±0.2
E	1.75±0.2
P ₁	8.0±0.2
P ₂	2.0±0.2
P ₀	4.0±0.2
D ₀	φ 1.5±0.1
D ₁	φ 1.5 min.
t ₁	0.35±0.2
t ₂	5.35±0.2

• Reel Dimensions (2,000pcs per one reel)



Unit: mm

Dimensions (mm)	
A	φ 380±3
B	φ 80±2
C	φ 13.0±0.5
D	φ 21±1
E	2±1
W	13.5±2.0
t	2.0±0.5
r	1.0±0.2

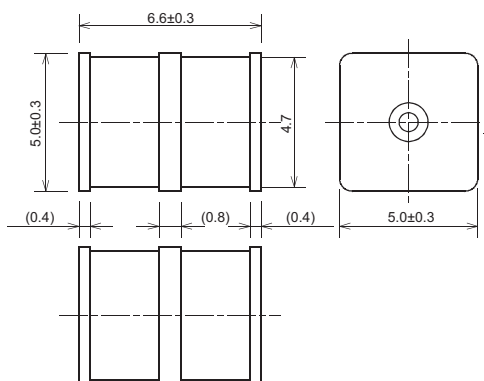
Features

- Small surface mount type corresponding to reflow solder
- High impulse current capacity 8/20 μ s-5,000A
- Quick response for surge
- Excellent insulation resistance and small capacitance (1.0pF max.)
- Recommendation of ITU-T conformity

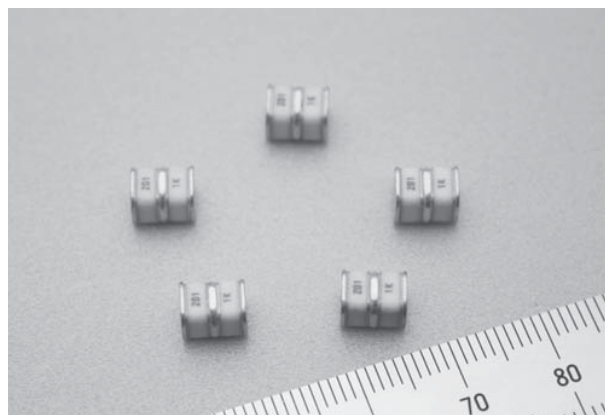
Applications

- Homegateway equipments
- Telephone, PBX, Wireless base station
- Optical transmission equipments
- CATV transmission equipments, BS / CS broadcasts equipments
- Fire alarm systems and Home security systems

Dimensions

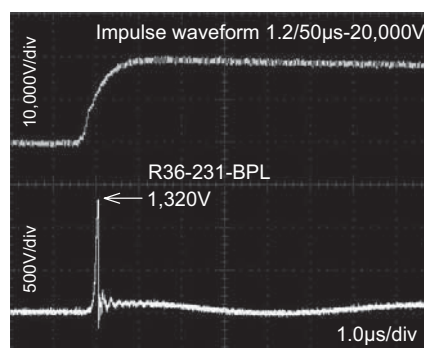
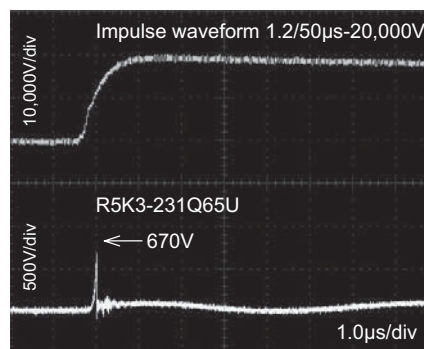


Unit: mm



NEW

Impulse Absorption Characteristics



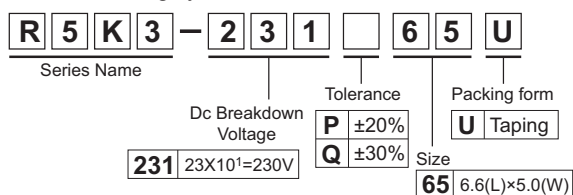
Electrical Specifications

Model Number*1	DC Breakdown Voltage (V)	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF)max.	Impulse Life Test	Impulse Current Capacity*2	Impulse Withstanding Voltage Capacity
R5K3-750□65U	75	1,000(DC50V)	1.0	8/20μs, 100A 300 times	8/20μs, 5,000A Positive/Negative 5 times	10/700μs 15,000V (R=25Ω) Positive/Negative 5times
R5K3-900□65U	90					
R5K3-151□65U	150					
R5K3-231□65U	230	1,000(DC100V)				
R5K3-251□65U	250					
R5K3-351□65U	350					
R5K3-421□65U	420					
R5K3-501□65U	500					
R5K3-601□65U	600					

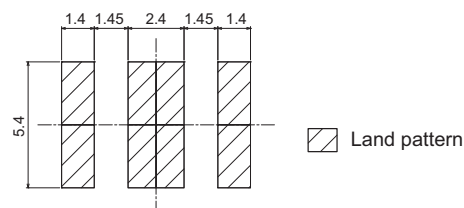
*1 □: Tolerance $\pm 20\%$ =P, Tolerance $\pm 30\%$ =Q

*2 Comforms to ITU-T K.20,K.21 Enhanced test

• Model numbering system



• Recommended Land Pattern (Typical value)

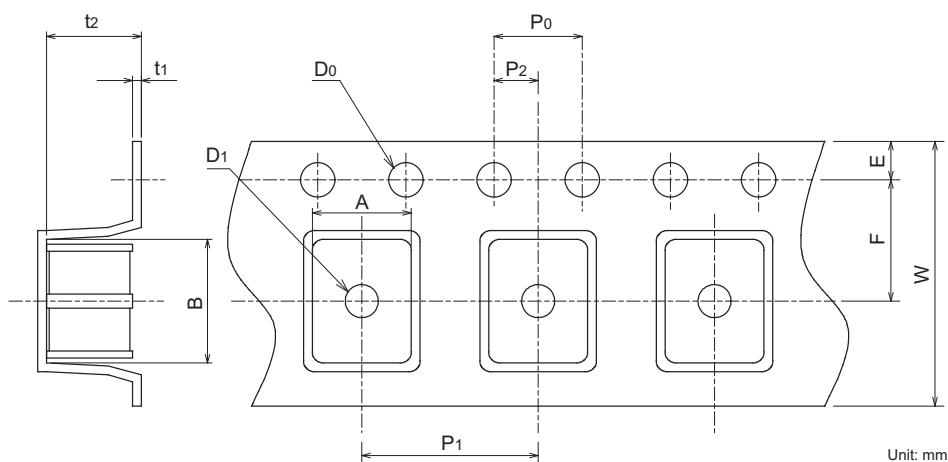


Recommended thickness of copper foil is
70 μ m for upgrading of withstand surge current.

Unit: mm

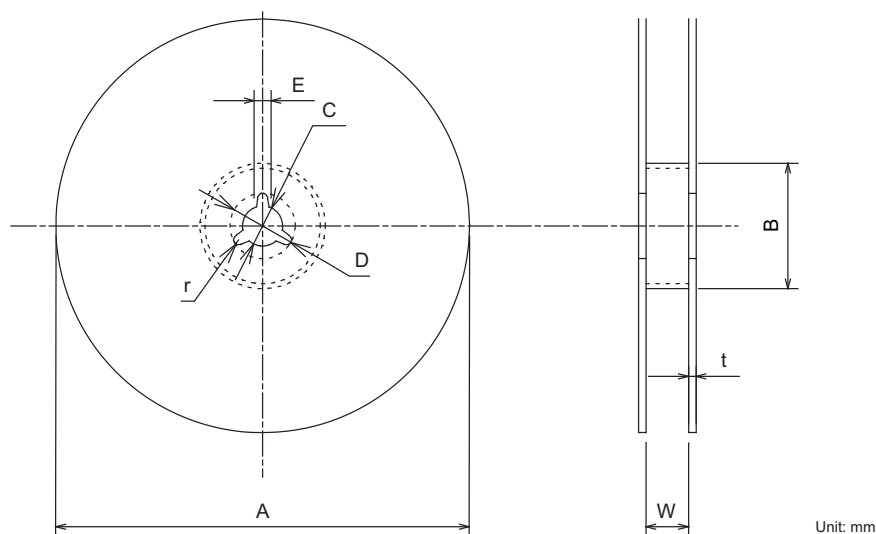
	Dimensions (mm)				
	a	b	c	d	e
Reflow Soldering	1.8	1.8	5.3	8.1	5.4

• Taping Dimensions



Dimensions (mm)	
A	5.6 $\pm$ 0.3
B	7.3 $\pm$ 0.3
W	16.0 $\pm$ 0.4
F	7.5 $\pm$ 0.2
E	1.75 $\pm$ 0.2
P1	8.0 $\pm$ 0.2
P2	2.0 $\pm$ 0.2
P0	4.0 $\pm$ 0.2
D0	ϕ 1.55 $\pm$ 0.1
D1	ϕ 1.5 min.
t1	0.40 $\pm$ 0.2
t2	5.35 $\pm$ 0.2

• Reel Dimensions (2,000pcs per one reel)



Dimensions (mm)	
A	ϕ 380 $\pm$ 3
B	ϕ 80 $\pm$ 2
C	ϕ 13.0 $\pm$ 0.5
D	ϕ 21 $\pm$ 1
E	2 $\pm$ 1
W	17.5 $\pm$ 2.0
t	2.0 $\pm$ 0.5
r	1.0 $\pm$ 0.2

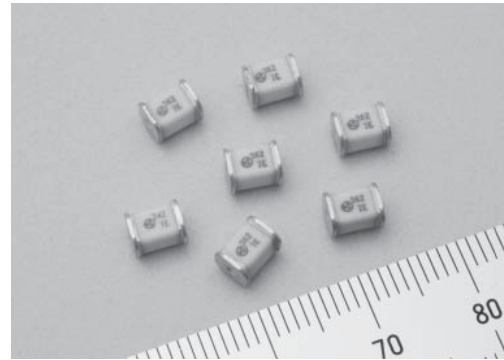
RHCA5039 series is suitable for products that need DC insulation resistance test on Line-FG, SG of a communications / signal line. Impulse current capacity is 2,000A 8/20 μ s.

Features

- Chip surge absorber for protection from indirect lighting surge, adaptable to high density surface mount technology
- Impulse current capacity 2,000A 8/20 μ s
- Small electrostatic capacity(Maximum 0.6pF)

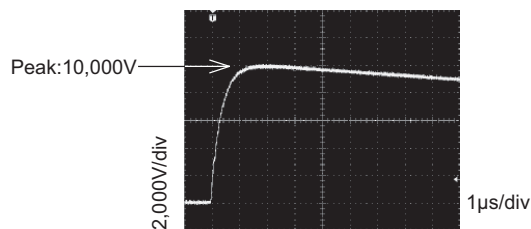


Safety Standard		File No.
UL	:UL1449 3rd.	E322107
cUL	:C22.2 No.8	

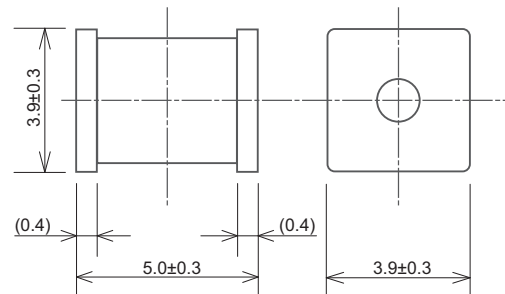


Impulse Absorption Characteristics

Impulse waveform 1.2/50 μ s-10,000V

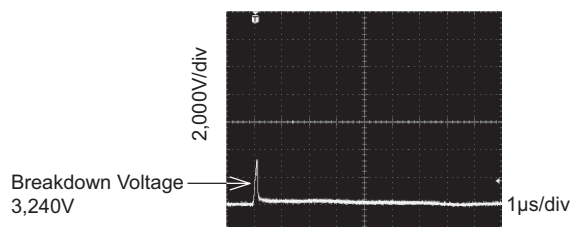


Dimensions

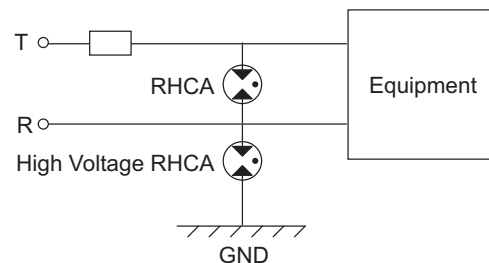


Unit: mm

RHCA-242H53U



Application (Example: Telecommunication Line)



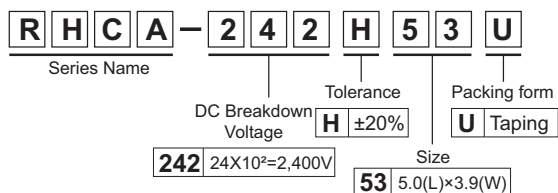
Electrical Specifications

Safety Standard	Model Number	Impulse Sparkover Voltage 1.2/50 μ s (V) max.		Withstanding Voltage 50/60Hz	Insulation Resistance (M Ω) Min.	Capacitance 1MHz (pF) Max.	Impulse Life Test	Impulse Current Capacity	DC Breakdown voltage Reference Value (V) $\pm$ 20%
		Applied Voltage	Specification						
	RHCA-242H53U *1	5,000V	4,500	AC1,000V-60sec AC1,200V-3sec	1,000 (DC500V)	0.6	8/20 μ s 100A 300 times	8/20 μ s 2,000A	2,400
	RHCA-302H53U *1,2		4,700	AC1,500V-60sec AC1,500V-60sec					3,000
	RHCA-362H53U *1,2		4,950	AC1,800V-3sec					3,600

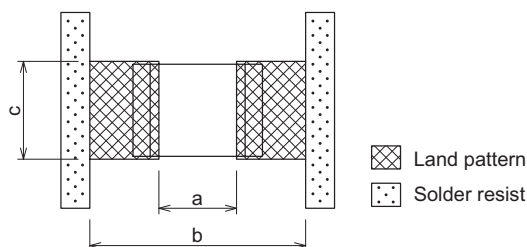
*1 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA $\geq$ 270V, D $\geq$ 7mm).

*2 Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA $\geq$ 470V, D $\geq$ 7mm).

• Model numbering system



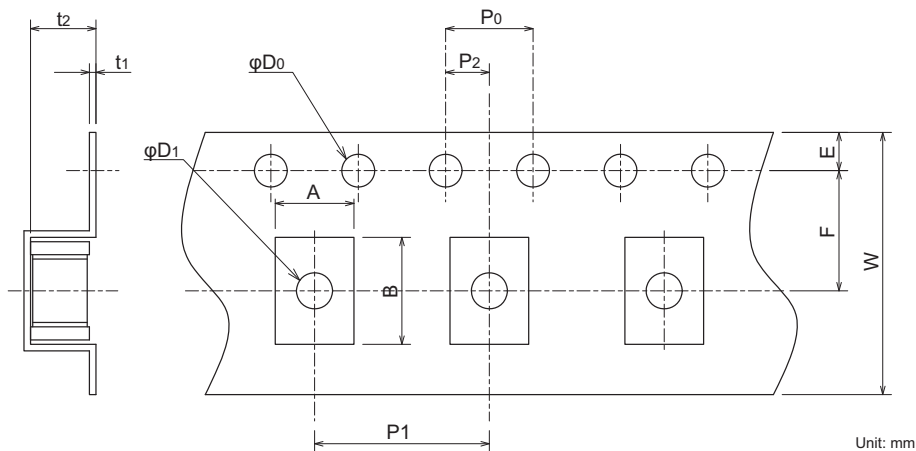
• Recommended Land Pattern (Typical value)



Unit: mm

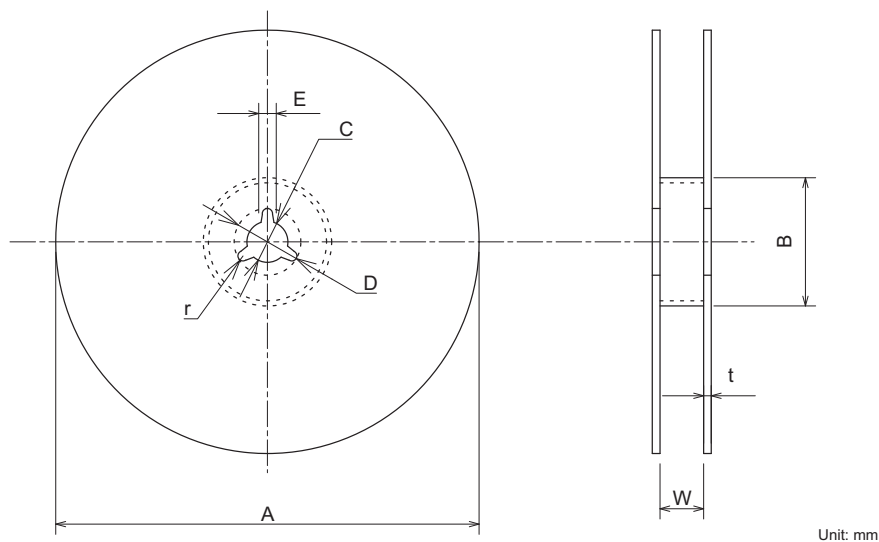
	Dimensions (mm)		
	a	b	c
Reflow Soldering	3.7	6.5	4.3

• Taping Dimensions



Dimensions (mm)	
A	4.5±0.3
B	5.6±0.3
W	12.0±0.3
F	5.5±0.1
E	1.75±0.1
P ₁	8.0±0.1
P ₂	2.0±0.1
P ₀	4.0±0.1
D ₀	φ 1.55±0.1
D ₁	φ 1.5 min.
t ₁	0.40±0.2
t ₂	4.3±0.2

• Reel Dimensions (2,500pcs per one reel)



Dimensions (mm)	
A	φ 380±3
B	φ 80±2
C	φ 13.0±0.5
D	φ 21±1
E	2±1
W	13.5±2.0
t	2.0±0.5
r	1.0±0.2

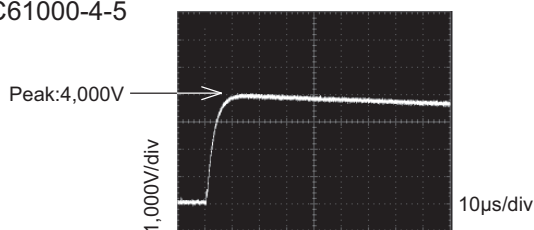
RHCA4532 series is chip surge absorber for protection from indirect lighting surge, smaller and thinner than ceramic tube lead type, adaptable to high density surface mount technology. Impulse current capacity is 2,000A 8/20 μ s.

Features

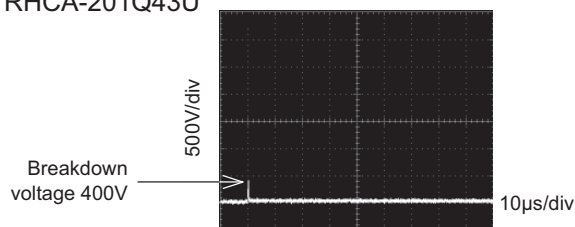
- Chip surge absorber for protection from indirect lighting surge, adaptable for high density surface mount technology
- Usable for reflow / flow soldering
- Compliance with IEC61000-4-5, ITU-T
 1. Impulse current capacity 2,000A 8/20 μ s
 2. 10/700 μ s-4,000V
- Good impulse absorbency
- Small electrostatic capacity(Maximum 0.6pF)
- Embossed tapping

Impulse Absorption Characteristics

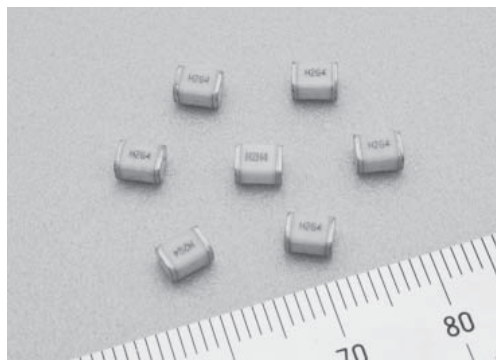
Impulse waveform 10/700 μ s-4,000V, IEC61000-4-5



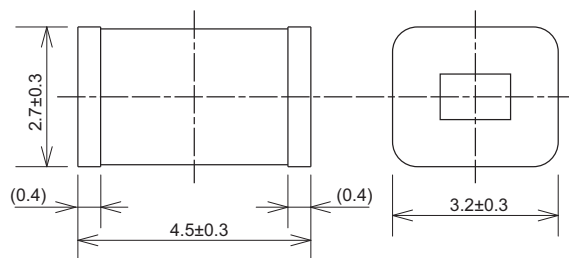
RHCA-201Q43U



Safety Standard	File No.
UL :UL497B	E139599

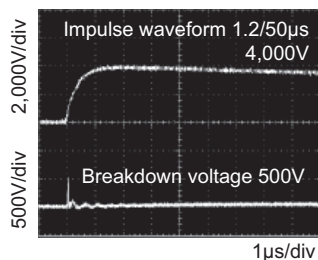


Dimensions

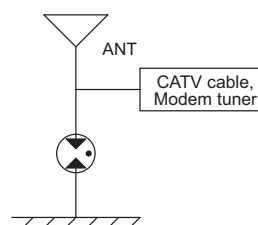


Unit: mm

Combination wave
1.2/50 μ s-8/20 μ s, 4,000V
IEC61000-4-5



Example



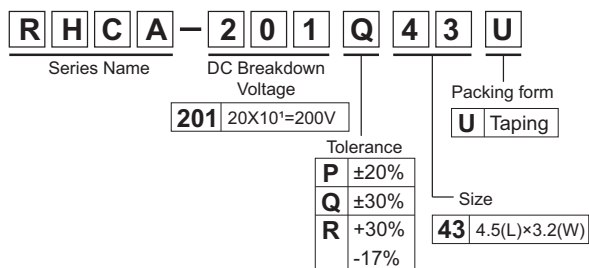
Electrical Specifications

Safety Standard	Model Number*1	DC Breakdown Voltage (V)	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Impulse Life Test	Impulse Current Capacity *2	Impulse Withstanding Voltage Capacity *2
	RHCA-900□43U	90	1,000(DC50V)	0.6	8/20μs 100A 300 times	8/20μs, 2,000A Positive/Negative 5 times	10/700μs 4,000V (R=25Ω) Positive/Negative 5 times
	RHCA-201□43U	200	1,000(DC100V)				
	RHCA-301□43U	300					
	RHCA-351□43U	350					
	RHCA-401□43U	400					
	RHCA-401R43U*2	400 ⁺³⁰ ₋₁₇ %					
	RHCA-501□43U	500					
	RHCA-601□43U	600					

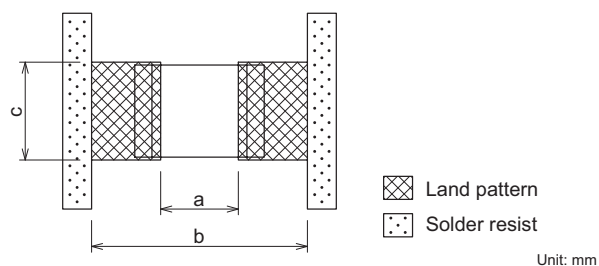
*1 □: Tolerance $\pm 20\%$ =P, Tolerance $\pm 30\%$ =Q

*2 Conforms to ITU-T K.20,K.21 Enhanced test

● Model numbering system

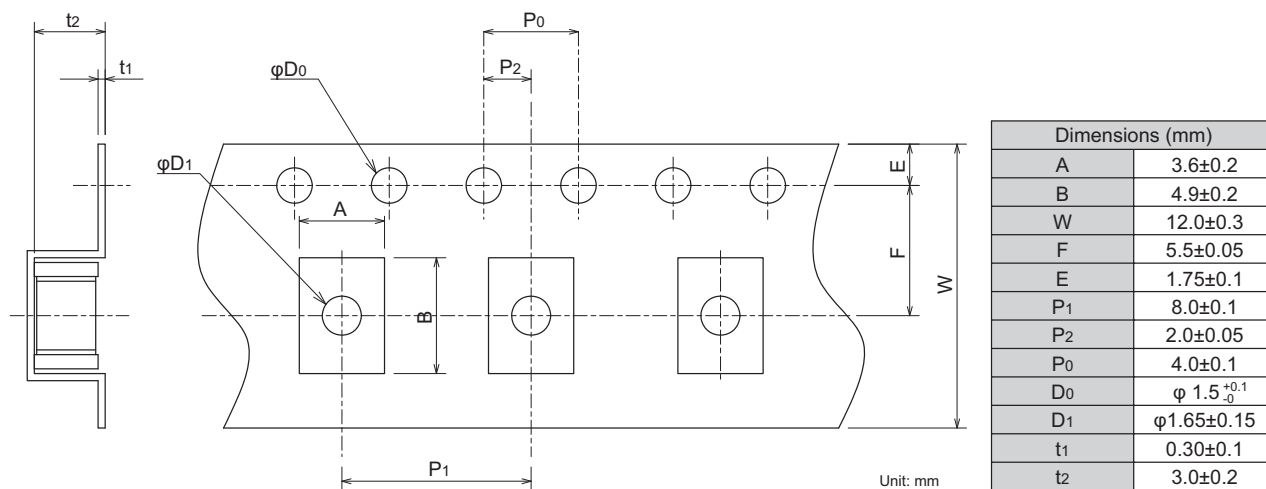


● Recommended Land Pattern(Typical value)

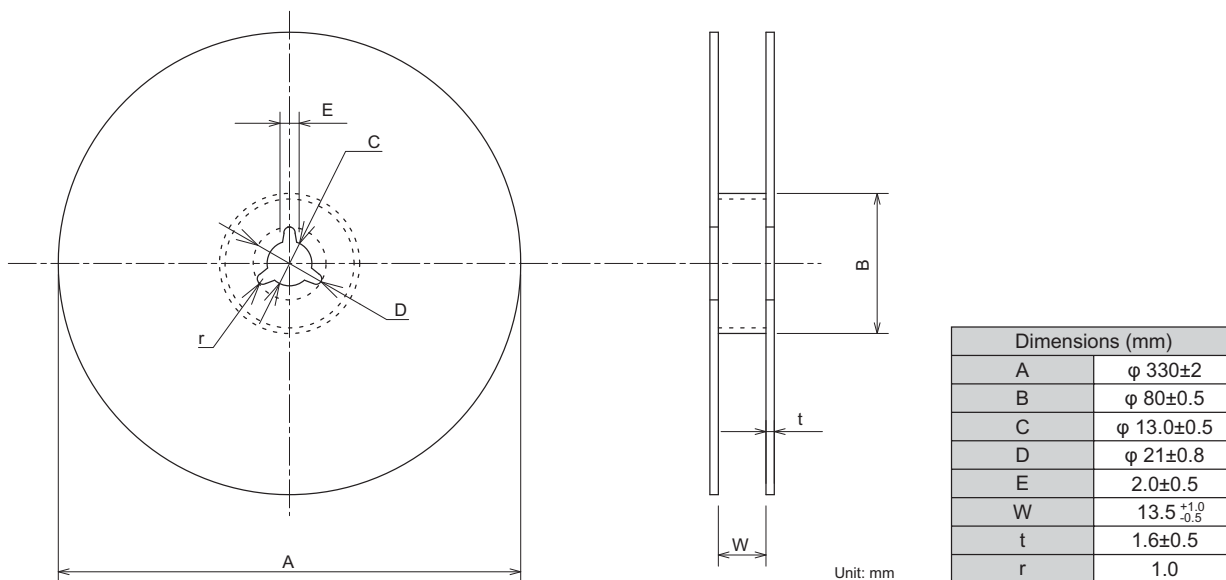


	Dimensions (mm)		
	a	b	c
Reflow Soldering	2.7	6.5 ~ 8.5	3.4
Flow Soldering	2.9	6.5 ~ 9.5	3.6

● Taping Dimensions



● Reel Dimensions (3,000pcs per one reel)



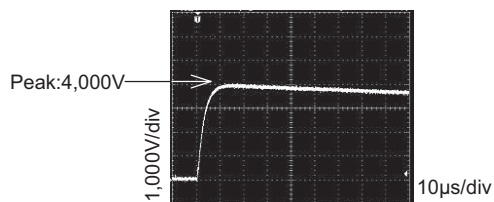
RHCA3216 series is chip surge absorber for protection from static electricity/indirect lighting surge, smaller and thinner than ceramic tube lead type, adaptable for high density surface mount technology. Impulse current capacity is 2,000A 8/20 μ s.

Features

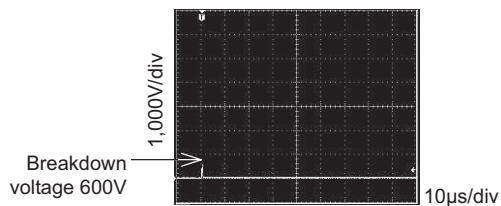
- Chip surge absorber for protection from static electricity/indirect lighting surge, adaptable to high density surface mount technology
- Usable for reflow / flow soldering
- Compliance with IEC61000-4-5
 1. Surge current capacity 8/20 μ s-500A $\pm$ 5times
 2. 10/700 μ s 4,000V (R=25 Ω) $\pm$ 5times
- Good impulse absorbency
- Electrostatic capacity (Maximum 0.3pF)
- Embossed tapping
- RoHS Directive-compliant components

• Impulse Absorption Characteristics

Impulse waveform 10/700 μ s-4,000V,
IEC61000-4-5



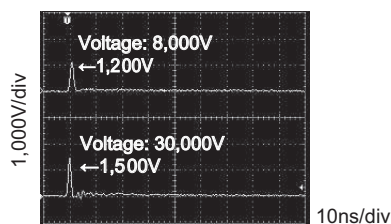
RHCA-201Q31U



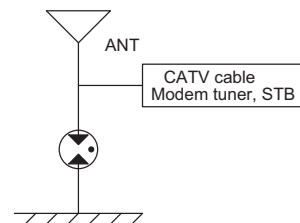
IEC61000-4-2 150pF-330 Ω -XkV

RHCA-201Q31U

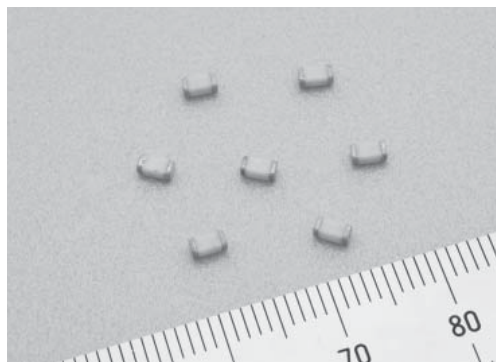
ESD impulse waveform



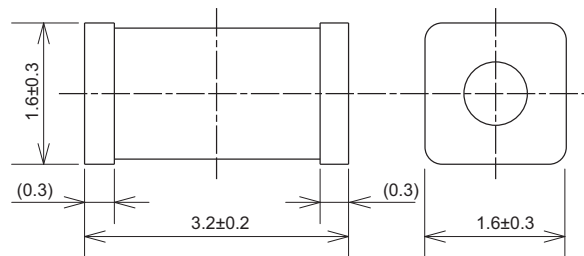
• Example



Safety Standard	File No.
UL :UL497B	E139599



• Dimensions



Unit: mm

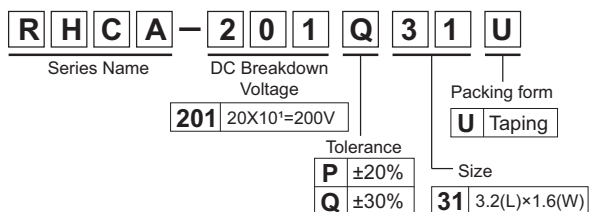
Electrical Specifications

Safety Standard	Model Number *1	DC Breakdown Voltage (V)	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max	Impulse Life Test	Impulse Current Capacity	Impulse Withstanding Voltage Capacity*2
	RHCA-900□31U	90	100(DC50V)	0.3	8/20μs, 50A 300 times	8/20μs, 500A Positive/Negative 5 times	10/700μs, 4,000V (R=25Ω) Positive/Negative 5 times
	RHCA-201□31U	200	100(DC100V)				
	RHCA-301□31U	300					
	RHCA-401□31U	400					
	RHCA-501□31U	500					

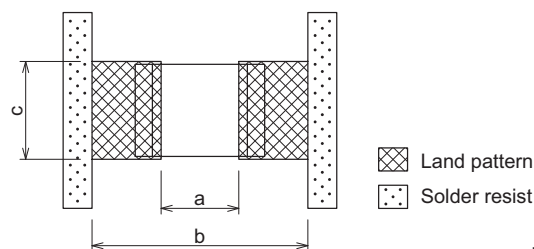
*1 □: Tolerance $\pm$ 20%=P, Tolerance $\pm$ 30%=Q

*2 Comforms to ITU-T K.20,K.21 Enhanced test

• Model numbering system

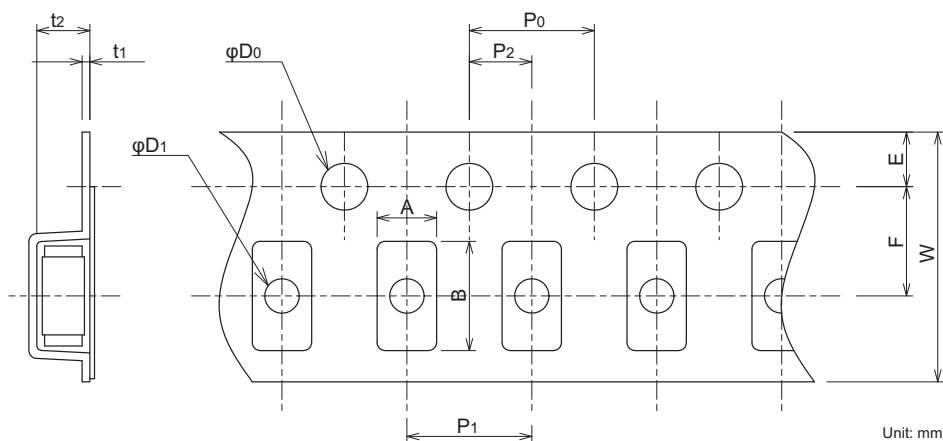


• Recommended Land Pattern (Typical value)



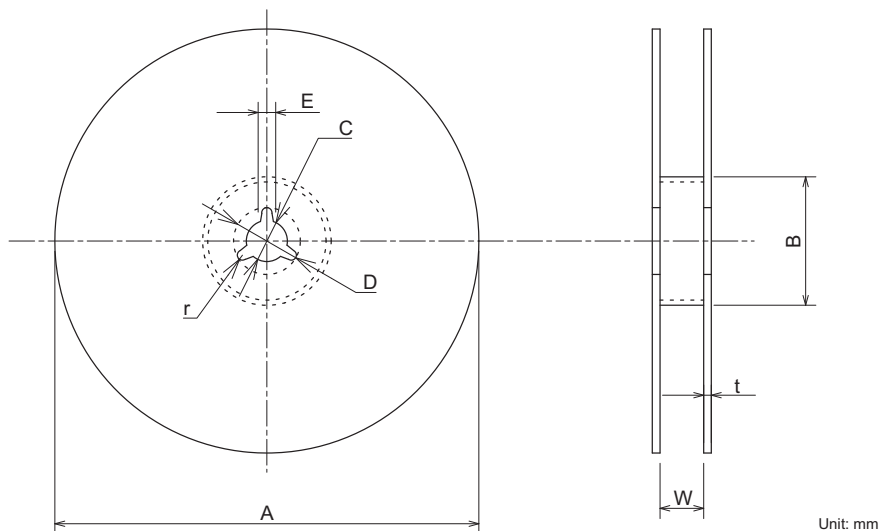
	Dimensions (mm)		
	a	b	c
Reflow Soldering	1.8 ~ 2.5	3.8 ~ 5.5	1.2 ~ 2.0
Flow Soldering		2.4 ~ 3.6	1.2 ~ 1.6

• Taping Dimensions



Dimensions (mm)	
A	1.9 ^{+0.2} _{-0.1}
B	3.5±0.1
W	8.0±0.3
F	3.5±0.05
E	1.75±0.1
P ₁	4.0±0.1
P ₂	2.0±0.05
P ₀	4.0±0.1
D ₀	φ 1.5 ^{+0.1} ₋₀
D ₁	φ 1.1±0.1
t ₁	0.3±0.04
t ₂	2.0

• Reel Dimensions (2,000pcs per one reel)



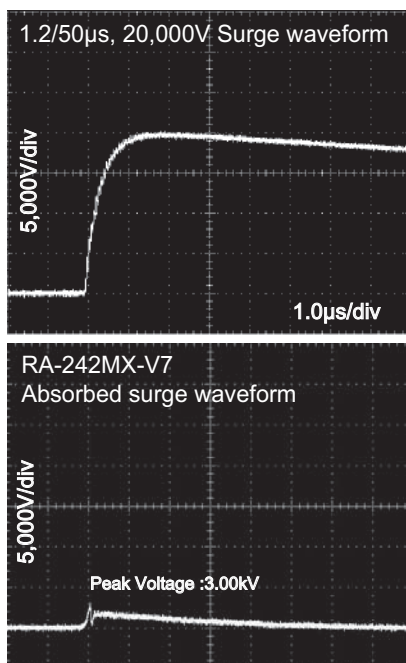
Dimensions (mm)	
A	φ 180.0 ⁺⁰ _{-1.5}
B	φ 60 ⁺¹ ₋₀
C	φ 13.0±0.2
D	φ 21.0±0.8
E	2.0±0.5
W	9.0 ^{+1.0} _{-0.5}
t	1.6±0.5
r	1.0

Features

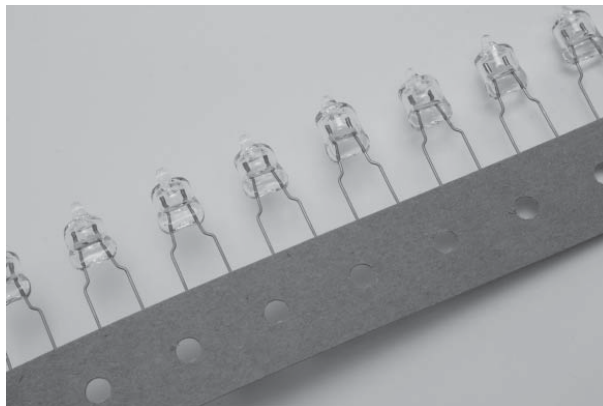
- Invented 3mm height smaller size of RA-V7 Series compare with present productions
- Dielectric strength voltage test compliant
- High-speed response of surge
- Wide range of lineup from DC500V to DC4,500V
- Will be soon approved for UL, CSA, TÜV, SEMKO

Applications

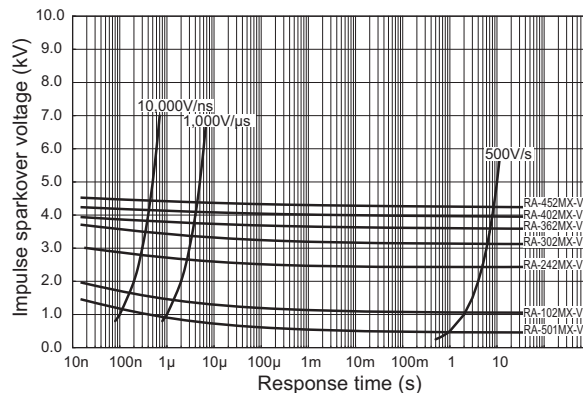
- Switching power supply, Inverter power supplies
- Refrigerator, Laundry machine, Air conditioner
- LED Lighting
- Copier, Telecommunication equipment
- *Impulse Absorption Characteristics*



Safety Standard		File No.
UL	:UL1449 3rd.	E322107
CSA	:C22.2 No.60065	105073
TÜV	:EN60065 :EN60950-1	J50114145
SEMKO	:IEC61643-1 :EN61643-11	SE-66249A1 1312809



V-t Characteristics



Electrical Specifications

Safety Standard				Model Number	DC Breakdown Voltage (V)	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Impulse Current Capacity 8/20μs (A)	Impulse Life test 8/20μs 100A	Withstanding Voltage
UL	CSA	TÜV	SEMKO							
○ ^{*1} _{*3}	○ ^{*4} _{*5}	-	○	RA-501MX-V7-Y/Y(5)	500(400~600)	1000(DC100V)	1.0	300 times	3,500	—
○ ^{*1} _{*3}	○ ^{*4} _{*5}	-	○	RA-601MX-V7-Y/Y(5)	600(480~720)	1000(DC250V)				—
○ ^{*2} _{*3}	○ ^{*4} _{*5}	-	○	RA-102MX-V7-Y/Y(5)	1,000(800~1,200)	1000(DC500V)				—
○ ^{*2} _{*3}	○ ^{*4} _{*5}	-	○	RA-152MX-V7-Y/Y(5)	1,500(1,200~1,800)					—
○ ^{*2} _{*3}	○ ^{*4} _{*5}	-	○	RA-242MX-V7-Y/Y(5)	2,400(1,920~2,880) ^{*7}					AC1,250V 3s
○ ^{*1} _{*3}	○ ^{*4} _{*5}	○ ^{*6}	○	RA-302MX-V7-Y/Y(5)	3,000(2,400~3,600) ^{*7}					AC1,500V 60s
○ ^{*1} _{*3}	○ ^{*4} _{*5}	○ ^{*6}	○	RA-362MX-V7-Y/Y(5)	3,600(2,880~4,320) ^{*7}					AC1,800V 3s
○ ^{*1} _{*3}	○ ^{*4} _{*5}	○ ^{*6}	○	RA-402MX-V7-Y/Y(5)	4,000(3,200~4,800) ^{*7}					AC2,000V 60s
○ ^{*1} _{*3}	○ ^{*4} _{*5}	○ ^{*6}	○	RA-452MX-V7-Y/Y(5)	4,500(3,600~5,400) ^{*7}	1000(DC1000V)				AC2,000V 60s

*1 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 7mm).

*2 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 5mm).

*3 Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA≥390V, D≥φ 7mm).

*4 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 14mm).

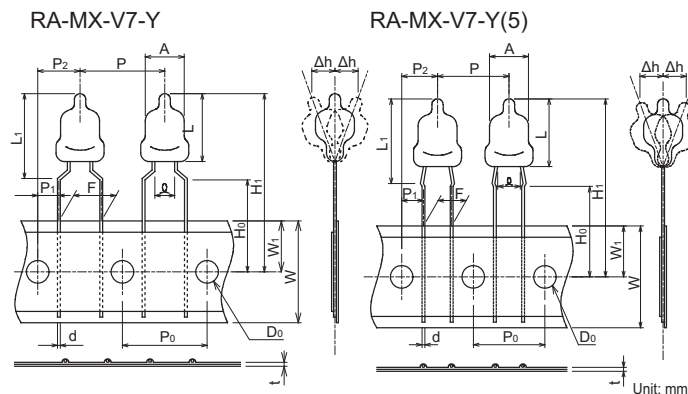
*5 Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA≥470V, D≥φ 14mm).

*6 Rated voltage AC125V/250V: Approved if it is connected to UL approved varistor (V1.0mA≥470V, D≥φ 5mm).

*7 Reference Value

RA-MX-V7-Y

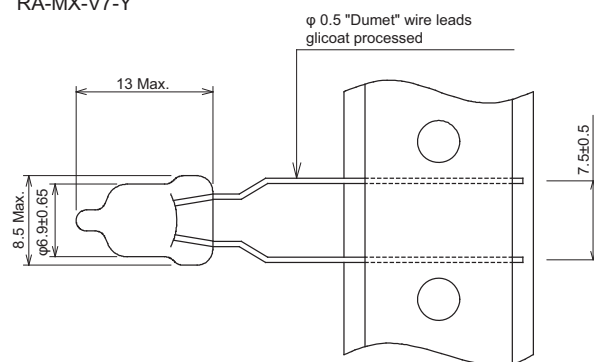
• Taping Dimensions



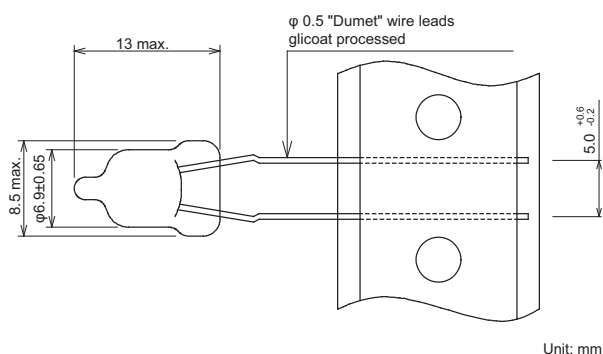
Description	Symbol	Dimension (mm)	
		RA-MX-V7-Y	RA-MX-V7-Y(5)
High	L	13.0 max.	
Lamp Diameter	A	$\phi 6.9 \pm 0.65$	
Lead Diameter	d	$\phi 0.5 \pm 0.05$	
Leads clearance	Q	4.0 min.	
Height from PCB top	L ₁	18.0 max.	
Lamp pitch	P	15.0 $\pm$ 1.0	12.7 $\pm$ 1.0
Hole pitch	P ₀	15.0 $\pm$ 0.3	12.7 $\pm$ 0.3
Hole position	P ₁	3.75 $\pm$ 0.7	3.85 $\pm$ 0.7
	P ₂	7.5 $\pm$ 1.3	6.35 $\pm$ 1.3
Lead pitch	F	7.5 $\pm$ 0.5	5.0 $\pm$ _{0.2} ^{0.6}
Declining	Δh	± 2.0	
Paper width	W	18.0 $\pm$ 0.5	
Hole position	W ₁	9.0 $\pm$ 0.5	
Lead clinch height	H ₀	16.0 $\pm$ 0.5	
Product height*	H ₁	(34.5)	
Hole diameter	D ₀	$\phi 4.0 \pm 0.2$	
Paper thickness	t	0.9 max.	

• Forming Dimensions

RA-MX-V7-Y



RA-MX-V7-Y(5)

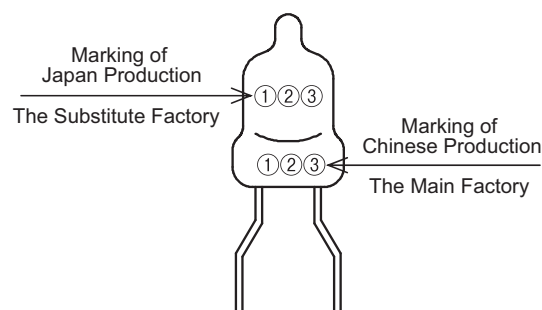


• Packing Quantity per Carton

RA-MX-V7-Y Series: 1,500 pcs

RA-MX-V7-Y(5) Series: 1,800 pcs

• Packing Description of Marking



①DC Breakdown Voltage

DC Sparkover voltage brevity code	501	601	102	152	242	302	362	402	452
Code	F	A	J	K	T	L	S	V	Y

②The year manufactured eg.) 2013→3

③The month manufactured (see below)

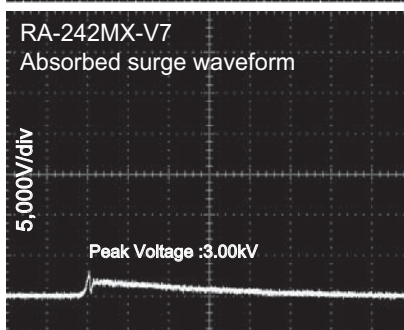
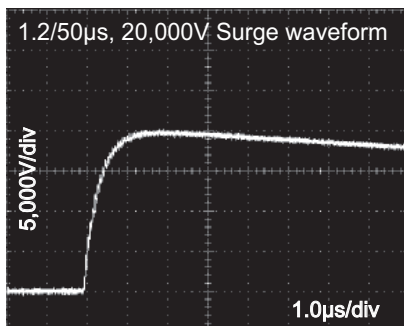
Month	1	2	3	4	5	6	7	8	9	10	11	12
Symbol	A	B	D	E	F	G	H	J	K	L	M	N

Features

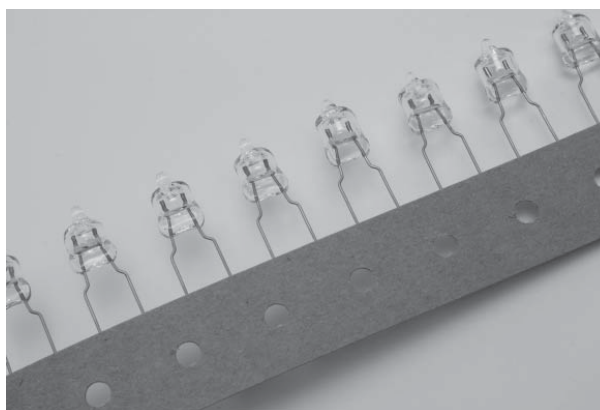
- Invented 3mm height smaller size of RA-V7 Series compare with present productions
- Dielectric strength voltage test compliant
- High-speed response of surge
- Wide range of lineup from DC500V to DC4500V
- Approved for UL, CSA, TÜV, SEMKO

Applications

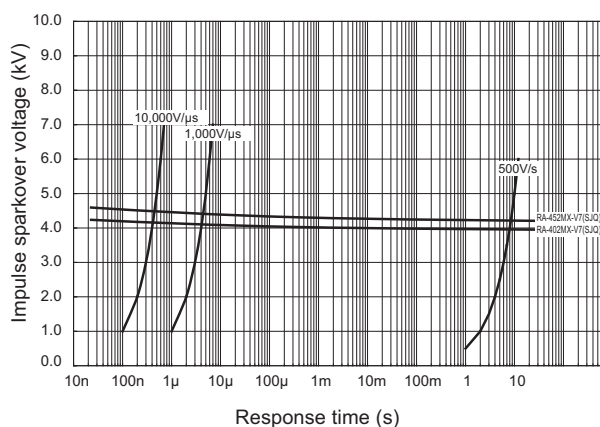
- LCD-TV, PDP-TV
- Blue-Ray recorder
- Antenna amplifier (Booster)
- Copier, Telecommunication equipment
- *Impulse Absorption Characteristics*



Safety Standard		File No.
UL	:UL1449	E322107
CSA	:C22.2 No.60065	CA105073
TÜV	:EN60065-11 :EN60950	J50114145
SEMKO	:IEC61643-1 :EN61643-11	SE-66249 1115778
JQA	:J60065(H20)	JQ10641-1



V-t Characteristics



Electrical Specifications

Safety Standard					Model Number	DC Breakdown Voltage (V)	Capacitance 1MHz (pF) max.	Impulse Life test 8/20µs 100A	Impulse Current Capacity 8/20µs (A)	Withstanding Voltage
UL 1449	CSA	TÜV	SEMKO	JQA						
○ *1 ○ *2	○ *3 ○ *4	○ *5	○	○	RA-402MX-V7-Y(SJQ)	4,000(3,200~4,800)*5	1.0	300 times	3,500	AC2,000V 60s
○ *1 ○ *2	○ *3 ○ *4	○ *5	○	○	RA-452MX-V7-Y(SJQ)	4,500(3,600~5,400)*5				AC2,000V 60s

*1 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 7mm).

*2 Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA≥390V, D≥φ 7mm).

*3 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 14mm).

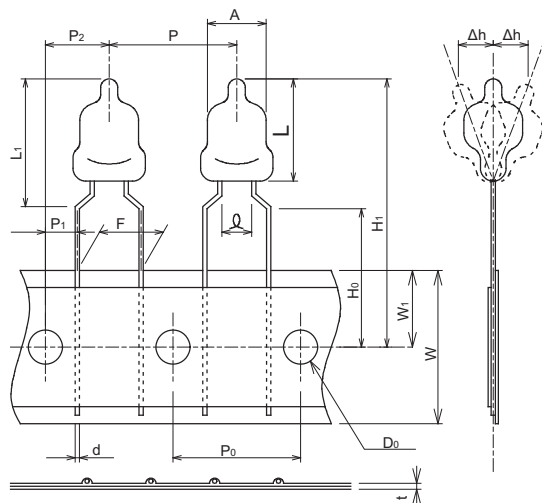
*4 Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA≥470V, D≥φ 14mm).

*5 Rated voltage AC125V / 250V: Approved if it is connected to UL approved varistor (V1.0mA≥470V, D≥φ 5mm).

*5 Reference Value

• Taping Dimensions

RA-MX-V7-Y(SJQ)



Unit: mm

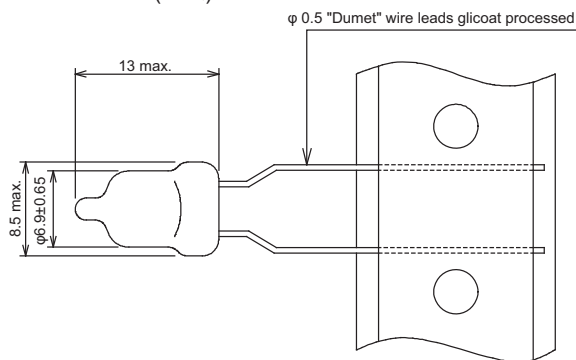
Description		Symbol	Dimension	
			RA-MX-V7-Y(SJQ)	
RA	Height	L	13.0 max.	
	Lamp Diameter	A	φ 6.9±0.65	
	Lead Diameter	d	φ 0.5±0.05	
	Width between leads	Q	4.0 min.	
Product height from board		L ₁	18.0 max.	
Lamp pitch		P	15.0±1.0	12.7±1.0
Hole pitch		P ₀	15.0±0.3	12.7±0.3
Hole position		P ₁	3.75±0.7	3.85±0.7
		P ₂	7.5±1.3	6.35±1.3
Pitch between leads		F	7.5±0.5	5.0 ^{+0.6} _{-0.2}
Declining		Δh	±2.0	
Paper width		W	18.0±0.5	
Hole position		W ₁	9.0±0.5	
Lead clinch height		H ₀	16.0±0.5	
Product height		H ₁	(34.5)	
Hole diameter		D ₀	φ 4.0±0.2	
Paper thickness		t	0.9 max.	

• Packing Quantity per Carton

RA-MX-V7-Y(SJQ) Series: 1,500 pcs/1 carton

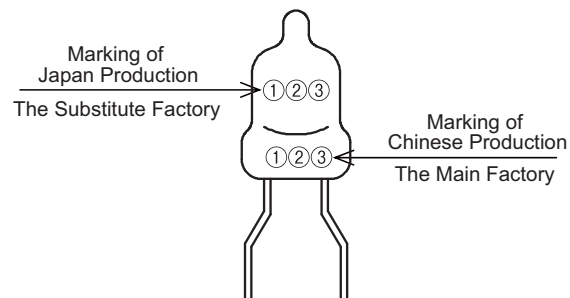
• Forming Dimensions

RA-MX-V7-Y(SJQ)



Unit: mm

• Packing Description of Marking



①DC Sparkover Voltage

DC Sparkover voltage brevity code	402(SJQ)	452(SJQ)
Code	X	Z

②The year manufactured eg.(2013→3

③The month manufactured (see below)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Symbol	A	B	D	E	F	G	H	J	K	L	M	N

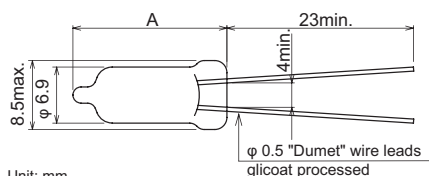
Features

- Fast response time.
- Bi-polar surge absorber, it will fail open if the surge withstand capacity is exceeded.
- Small inter-terminal capacitance.
- High insulation resistance ($10^9\Omega \cdot \text{min}$).
- Excellent surge withstand capability (300 times at 100A, 8/20 μs).
- Small size for compact circuit design.

Applications

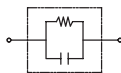
- Switching supply, Inverter power supplies, Refrigerator, Laundry machine, Air conditioner, DVD players, DVD recorders, Copiers, xDSL modems, Splitters, BS tuner, CRT, VCR, Telephone, Modems, Car audio and GPS.

Dimensions



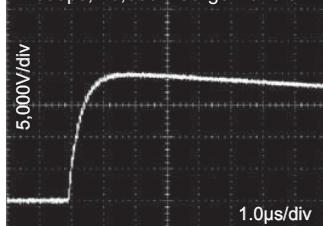
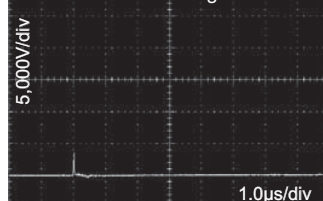
Unit: mm

Circuit

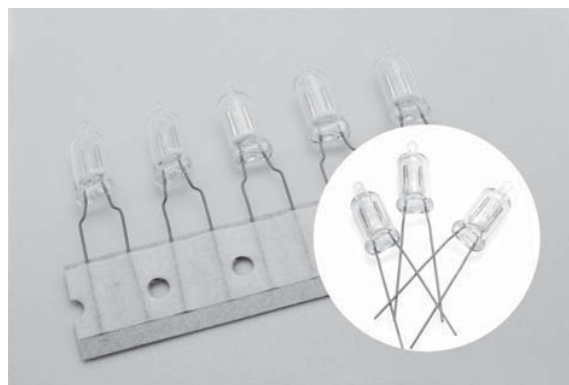


Dimensions max.(mm)	
A	
RA-M-V7	19
RA-MS-V7	16

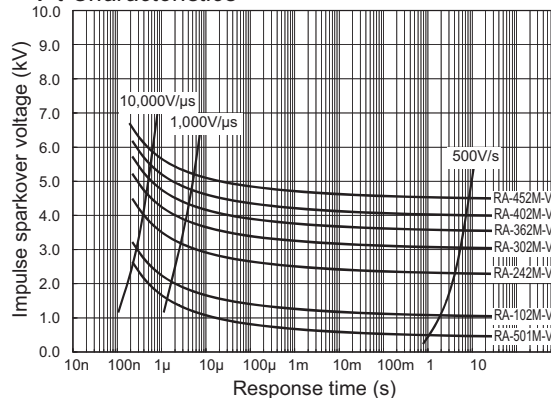
Impulse Absorption Characteristics

1.2/50 μs , 20,000V Surge waveformRA-242M-V7
Absorbed surge waveform

Safety Standard		File No.
UL	:UL1449 3rd.	E332107
CSA	:C22.2 No.1	LR105073
TÜV	:EN60065 :EN60950-1	J50114145
SEMKO	:IEC-61643-1 :EN61643-11	SE-66249A1 No.1312809



V-t Characteristics



Electrical Specifications

Safety Standard				Model Number	DC Breakdown Voltage (V)	Insulation Resistance (MΩ) min.	Capacitance 1MHz (pF) max.	Impulse Life test 8/20μs 100A	Inpulse Current Capacity 8/20μs (A)	Withstanding Voltage	
UL 1449	CSA	TÜV	SEMKO								
○ ^{*1}	-	-	○	RA-501M/MS-V7	500(400~600)	1,000(DC100V)	2.0	300 times	3,500	—	
○ ^{*1} ₂	-	-	○	RA-601M/MS-V7	600(480~720)	1,000(DC250V)				—	
○ ^{*1} ₂	-	-	○	RA-102M/MS-V7	1,000(800~1,200)	1,000(DC500V)				—	
○ ^{*1} ₂	○	-	○	RA-152M/MS-V7	1,500(1,200~1,800)					—	
○ ^{*1}	○ ^{*1}	-	○	RA-242M-V7	2,400(1,920~2,880) ^{*5}					AC1,250V 3s	
○ ^{*1} ₂	○ ^{*3}	○ ^{*4}	○	RA-302M-V7	3,000(2,400~3,600) ^{*5}					AC1,500V 60s	
○ ^{*1} ₂	○ ^{*3}	○ ^{*4}	○	RA-362M-V7	3,600(2,880~4,320) ^{*5}					AC1,800V 3s	
○ ^{*2}	○ ^{*3}	○ ^{*4}	○	RA-402M-V7	4,000(3,200~4,800) ^{*5}					AC2,000V 60s	
○ ^{*2}	○ ^{*3}	○ ^{*4}	○	RA-452M-V7	4,500(3,600~5,400) ^{*5}					AC2,000V 60s	
○ ^{*1}	○ ^{*1}	-	○	RA-242MS-V7	2,400(1,920~2,880) ^{*5}					~	AC1,250V 3s
○ ^{*1} ₂	○ ^{*3}	○ ^{*4}	○	RA-302MS-V7	3,000(2,400~3,600) ^{*5}						AC1,500V 60s
○ ^{*1} ₂	○ ^{*3}	○ ^{*4}	○	RA-362MS-V7	3,600(2,880~4,320) ^{*5}						AC1,800V 3s
○ ^{*2}	○ ^{*3}	○ ^{*4}	○	RA-402MS-V7	4,000(3,200~4,800) ^{*5}						AC2,000V 60s
○ ^{*2}	○ ^{*3}	○ ^{*4}	○	RA-452MS-V7	4,500(3,600~5,400) ^{*5}						1,000(DC1000V)
○ ^{*2}	○ ^{*3}	○ ^{*4}	○	RA-452MS-V7	4,500(3,600~5,400) ^{*5}	AC2,000V 60s					

^{*1} Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA $\geq$ 270V, D $\geq$ 5mm).

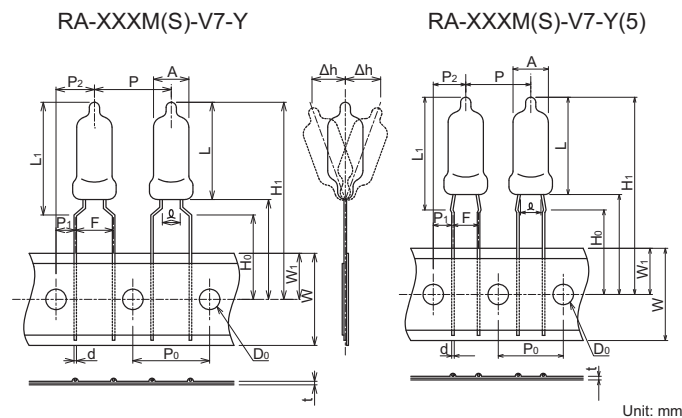
^{*2} Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA $\geq$ 390V, D $\geq$ 7mm).

^{*3} Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA $\geq$ 270V, D $\geq$ 5mm).

^{*4} Rated voltage AC125V / AC250V: Approved if it is connected to UL approved varistor (V1.0mA $\geq$ 470V, D $\geq$ 5mm).

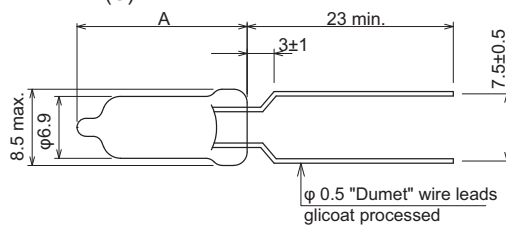
^{*5} Reference Value

• Taping Dimensions

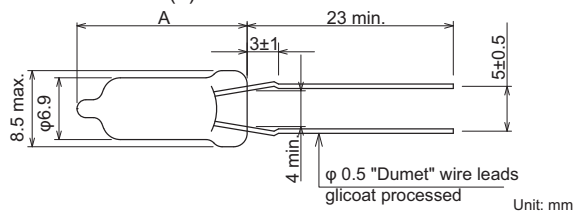


• Forming Dimensions

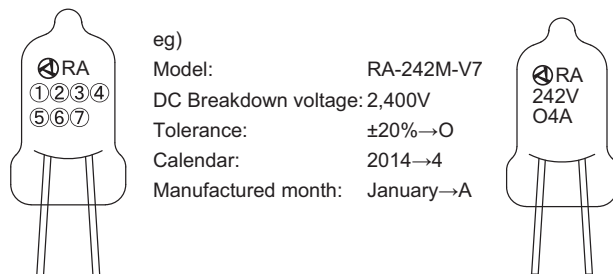
RA-XXXM(S)-V7-F



RA-XXXMS-V7-F(5)



• Description of marking



- ①②③..... DC Breakdown Voltage ①②×10^③
 ④..... V (Radial)
 ⑤..... Tolerance

Tolerance	±20%	$\begin{smallmatrix} +30\% \\ -10\% \end{smallmatrix}$	Other
Symbol	O	R	-

⑥..... Identification of manufacture year eg.) 2013→3

⑦..... Manufacture month (see below)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Symbol	A	B	D	E	F	G	H	J	K	L	M	N

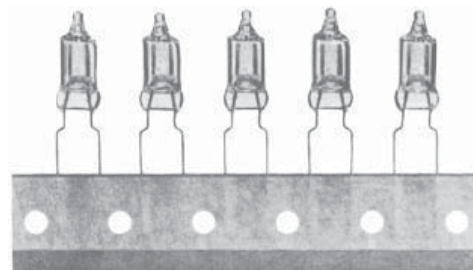
Description		Symbol	Dimension (mm)	
			RA-M(S)-V7-Y	RA-M(S)-V7-Y(5)
RA	High	L	19.0 max. (16.0 max.)	
	Lamp Diameter	A	φ 6.9±0.65	
	Lead Diameter	d	φ 0.5±0.05	
	Lead clearance	ℓ	4.0 min.	
Height from PCB top		L ₁	22.0 max. (19.0 max.)	
Lamp pitch		P	15.0±1.0	12.7±1.0
Hole pitch		P ₀	15.3±0.3 *1	12.7±0.3 *1
Hole position		P ₁	3.75±0.7	3.85±0.7
		P ₂	7.5±1.3	6.35±1.3
Lead pitch		F	7.5±0.5	5.0± ^{0.6} _{0.2}
Declining		Δh	±2.0	
Paper width		W	18.0±0.5	
Hole position		W ₁	9.0±0.5	
Lead clinch height		H ₀	16.0±0.5	
Product height *2		H ₁	38.5 (35.5)	
Hole diameter		D ₀	φ 4.0±0.2	
Paper thickness		t	0.7±0.2	

*2 Nominal value

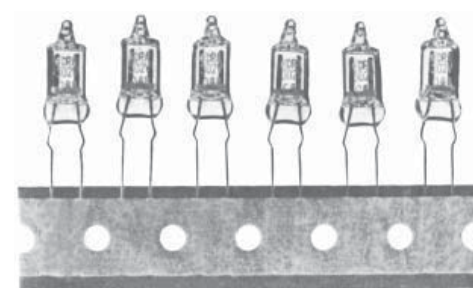
*1 Accumulative pitch error:

	4 pitch	20 pitch
RA-M(S)-V7-Y	60.0±0.6	300±1.5
RA-M(S)-V7-Y(5)	50.8±0.6	254±1.5

RA-XXXM(S)-V7-Y



RA-XXXM(S)-V7-Y(5)



• Packing Quantity per Carton

RA-XXXM(S)-V7-Y Series: 1,500 pcs

RA-XXXM(S)-V7-Y(5) Series: 1,800 pcs



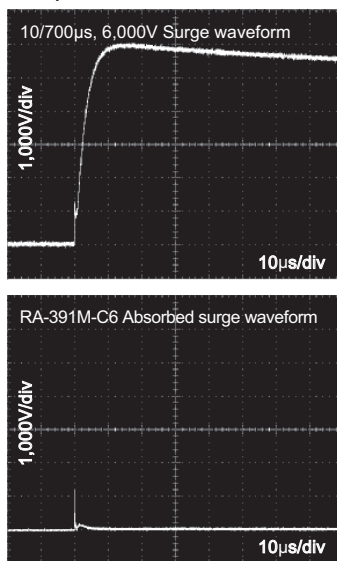
Features

- Fast response time.
- Large surge withstand capability 2,000A.
- Protects electronic components from impulse breakdown voltage.
- Small inter-terminal capacity.

Applications

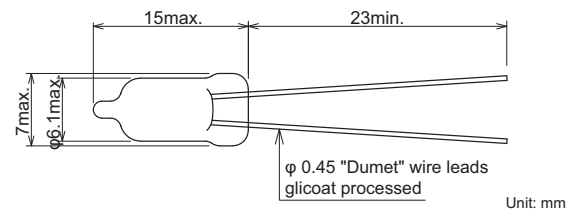
- xDSL modems, Splitters, BS tuner, CRT, VCR, Telephone, Modems, Car audio and GPS.

Impulse Absorption Characteristics

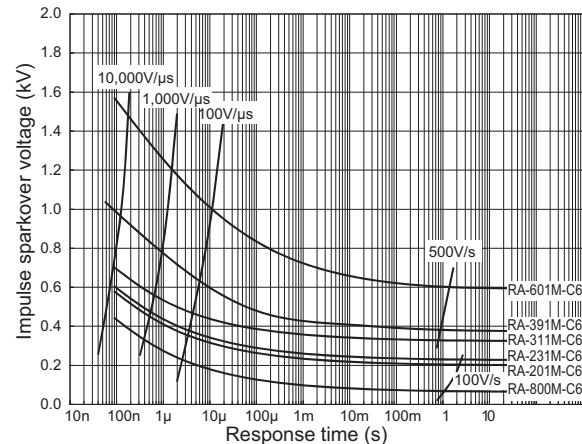


Safety Standard	File No.
UL :UL497B	E139599
UL :UL1449 3rd.	E332107
cUL :C22.2 No.8	
SEMKO :EN61643-11	SE-44153 1312808

Dimensions



V-t Characteristics



Electrical Specifications

Safety Standard				Model Number P: Without Marking M: Marking	DC Breakdown Voltage (V)	Insulation Resistance(MΩ)min.	Electrostatic Capacitance 1MHz (pF) max.	Impulse Life Test 8/20μs 100A	Impulse Current Capacity 8/20μs (A)	Withstanding Voltage
UL 497B	UL 1449	UL 1449 cUL	SEMKO							
O	-	-	-	RA-800P/M-C6	80 (64 ~ 96)	1,000 (DC50V)	1.0	300 times	2,000	-
O	-	-	-	RA-151P/M-C6	150 (120 ~ 180)					
O	-	-	-	RA-201P/M-C6	200 (160 ~ 240)	1,000 (DC100V)				
O	-	-	-	RA-231P/M-C6	230 (184 ~ 276)					
O	O*1	-	-	RA-311P/M-C6	310 (264 ~ 356)					
O	O*1	-	-	RA-351P/M-C6	350 (280 ~ 420)					
O	O*1	-	-	RA-391P/M-C6	390 (312 ~ 468)					
O	O*1	-	O*3	RA-501P/M-C6	500 (400 ~ 600)					
-	O*1 #2	-	O*3	RA-601P/M-C6	600 (480 ~ 720)	1,000 (DC250V)				
-	O*1 #2	-	O*3	RA-102P/M-C6	1,000 (800 ~ 1,200)	1,000 (DC500V)				
-	O*1 #2	-	O*3	RA-152P/M-C6	1,500 (1,200 ~ 1,800)					
-	O*1	-	-	RA-202P/M-C6	2,000 (1,600 ~ 2,400)*4					AC1,000V60s
-	O*1	O*1	O	RA-242M-C6	2,400 (1,920 ~ 2,880)*4					AC1,250V3s
-	O*1	O*1	O	RA-272M-C6	2,700 (2,160 ~ 3,240)*4					AC1,250V3s
-	O*1 #2	O*3	O	RA-302M-C6	3,000 (2,400 ~ 3,600)*4					AC1,500V60s
-	O*1 #2	O*3	O	RA-302M-C6(AC)	3,000 (2,700 ~ 3,900)*4	AC1,800V3s				

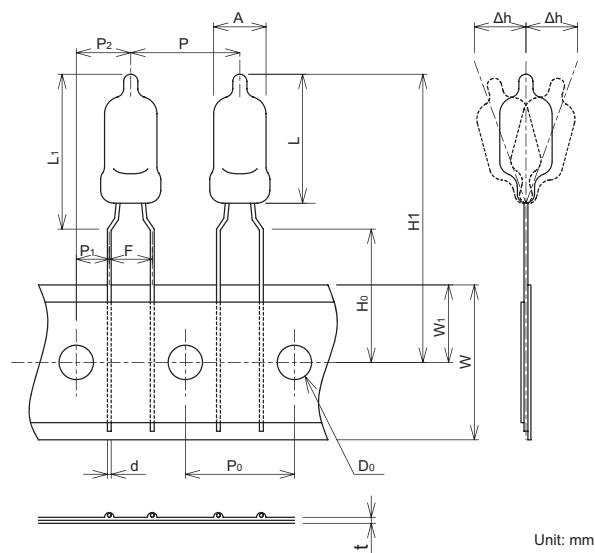
*1 Rated voltage AC125V: Approved if it is connected to UL approved varistor (V1.0mA≥270V, D≥φ 5mm).

*2 Rated voltage AC250V: Approved if it is connected to UL approved varistor (V1.0mA≥390V, D≥φ 7mm).

*3 P: Those with no markings are not SEMKO compliant.

*4 Reference Value

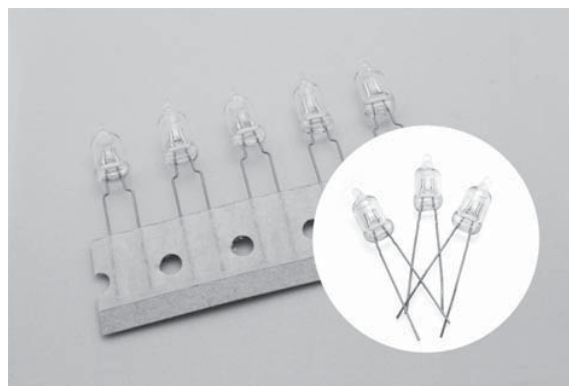
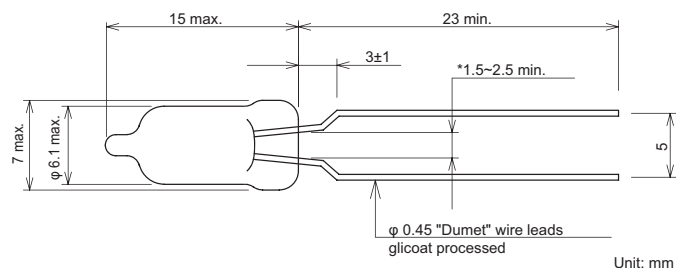
• Taping Dimensions (RA-XXXP/M-C6-Y)



Description		Symbol	Dimension (mm)
RA	Height	L	15.0 max.
	Lamp Diameter	A	φ 6.1 max.
	Lead Diameter	d	φ 0.45±0.05
Height from PCB top		L ₁	17.0 max.
Lamp pitch		P	12.7±1.0
Hole pitch		P ₀	12.7±0.3*
Hole position		P ₁	3.85±0.7
		P ₂	6.35±1.3
Lead pitch		F	5.0 ^{+0.6} _{-0.2}
Declining		Δh	±2.0
Paper width		W	18.0±0.5
Hole position		W ₁	9.0±0.5
Lead clinch height		H ₀	16.0±0.5
Product height		H ₁	(33.5)
Hole diameter		D ₀	φ 4.0±0.2
Paper thickness		t	0.7±0.2

* Accumulative pitch error: 4 pitches 50.8±0.6mm,
20 pitches 254±1.5mm

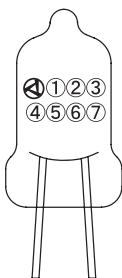
• Forming Dimensions (RA-XXXP/M-C6-F)



• Packing Quantity per Carton

RA-C6-Y: 2,000 pcs

• Description of marking

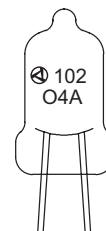


- ①②③..... DC Breakdown Voltage ①②×10^③
 ④..... T : China production
 None : Japan production
 ⑤..... Tolerance ±20% (Symbol O)*¹
 ⑥..... Identification of manufacture year eg.) 2013→3
 ⑦..... Manufacture month (see below)

*¹ Tolerance of 311 ±15% (Symbol M)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Symbol	A	B	D	E	F	G	H	J	K	L	M	N

eg) In case of japan production
 Model: RA-102M-C6
 DC Breakdown voltage: 1,000V
 Tolerance: ±20%→O
 Calendar: 2014→4
 Manufactured month: January→A



Power surges, both voltage and current, are occurring continually in today's power systems. Whether they occur naturally, such as from lightning and static electricity; or are man made, such as inductive surges from motor, transformers, solenoids, etc. power surges are a fact of life. These power surges have a very high voltage and current level as compared to electrical noise.

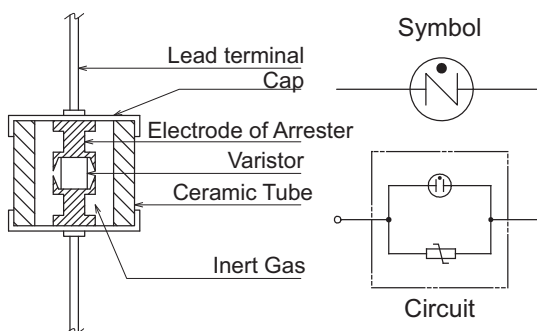
Recent developments in electronic designs have tended toward smaller and higher density packaging of circuitry. This results in a greater susceptibility to surges. Once attacked by a surge, electronic circuits can be destroyed in as short as 0.1 μ sec. The designer of electronic equipment must be aware of, and be able to deal with, power surges in product design.

OKAYA's R·A·V surge absorbers are designed to assist in dealing with the problem of power surges. The R·A·V series is a unique new approach which combines the features of two well known technologies. Combining the high speed capabilities of Metal Oxide Varistor (MOV) with the large power handling capability of Gas Arrester, OKAYA has developed a product which can clamp power surges faster than gas arrester alone and handle large power surges far beyond the capability of MOV.

OPERATING PRINCIPAL

The R·A·V connected between lines will shunt the surge from one side of the line to the other. The high speed varistor quickly shunts the surge until the slower, but more powerful gas arrester takes over. This allows the gas arrester to handle the high energy portion of the surge and protect the MOV from damage. This interaction of the R·A·V assures safe handling of the power surge and long life stability to the MOV.

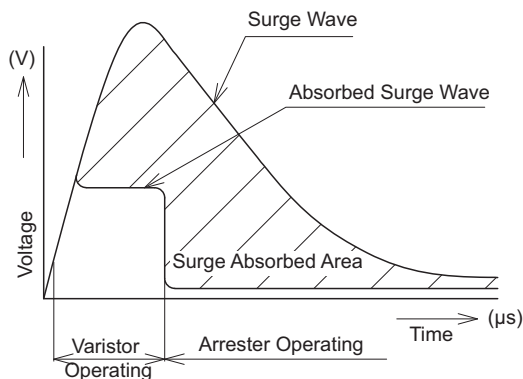
Structure



FEATURES

The R·A·V Surge Absorber is applicable for the protection of many types of electrical equipment. The R·A·V has the following features:

- 1) Large capacity surge protection
- 2) Fast response time
- 3) Good endurance to repetitive lightning
- 4) High clipping performance
- 5) Low internal capacitance
- 6) No environmentally hazardous materials



DYNAMIC CHARACTERISTICS

Fig. 1 Shows the dynamic characteristics of Varistor, Gas Arrester & R·A·V.

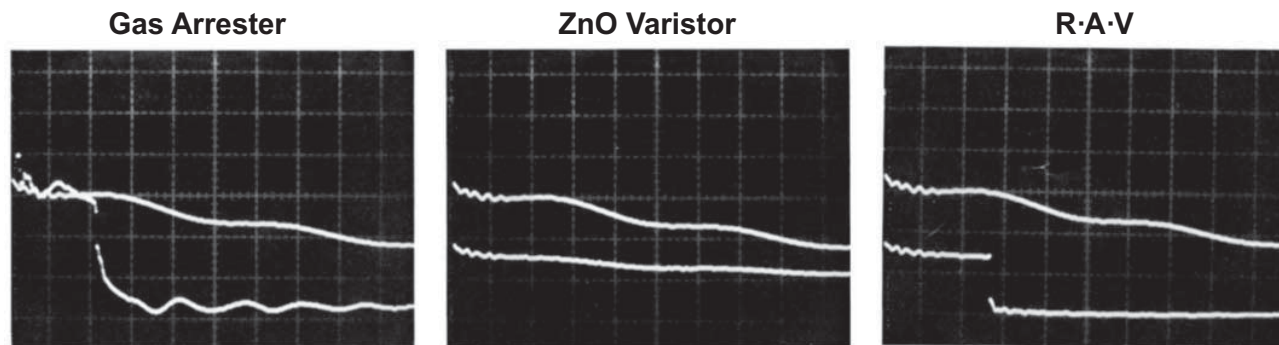


Fig. 1

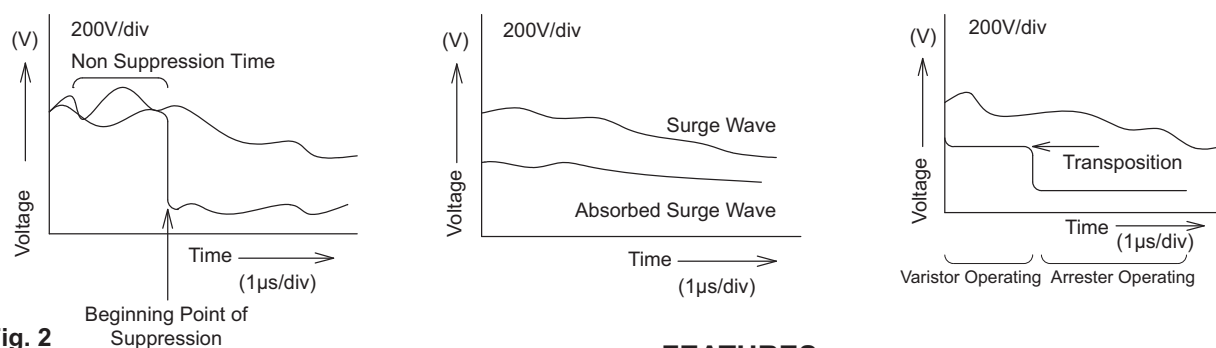
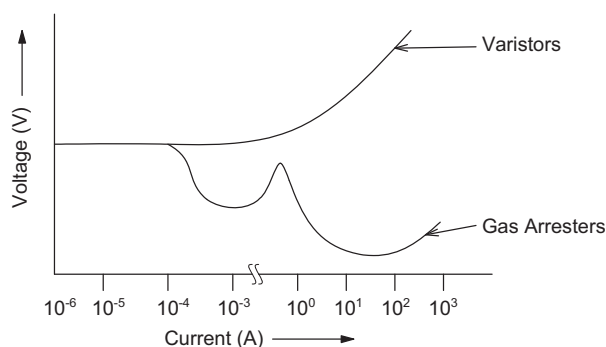


Fig. 2

Lightning surges have precipitous dv/dt values and huge electrical charge. Surge absorbers must assimilate this surge. This limiting voltage capability varies depending upon the type of absorber. The voltage and current curves in Fig. 2 characterize varistors and gas arresters.



FEATURES

Varistor voltage is specified by the manufacturer at low current (ie, 0.1-1.0 mA). The clamping voltage of the Varistor at higher current (ie, 1.0 Amp) can be several times higher and will increase as the current goes higher (See Fig. 2). Varistors have a very fast response time (ie, 50 nsec.) and will clamp at rated voltage for low currents or short periods of time. However, as a power surge increases in either current or duration, the Varistor clamping voltage can rise to unsafe levels, ultimately failing when its maximum energy level is exceeded. Although the Varistor may survive most power surges, each time it absorbs a power surge, damage occurs to the Varistor. Ultimately the MOV is rendered inoperative and unable to perform its suppression task.

GAS ARRESTERS

The rated voltage of the Gas Arrester is defined as a DC breakdown Voltage (E_z). In contrast to the Varistor, as the surge current increases this voltage decreases. Therefore, once the Gas Arrester is triggered, the voltage level is maintained at a safe level, regardless of the increase in current or duration of the power surge. Typically the trigger response time is 1μsec.



R·A·V CHARACTERISTICS

Power surges resulting from indirect lightning strikes occur with precipitous speed. The dv/dt of the rising waveform will exceed $100\text{V}/\mu\text{sec}$. As a result, a surge absorber without excellent response performance will be unable to protect equipment from damage. The element performance of gas arresters and other general surge absorbers is evaluated by means of the Voltage-Time characteristic curve, which expresses the relationship between the rise time of the voltage and the firing potential voltage of the device at the time of the surge rise. The accompanying graph shows an example of V-T characteristics.

The electrical characteristics of gas arresters are normally measured by the element performance, expressed in terms of the DC breakdown voltage. When such devices are used as surge absorbers, however, the more important value is the surge firing potential voltage (V_f : the voltage at which surge discharge begins). For example, even in the case of a gas arrester with DC breakdown voltage of 90V , the V_f value at $1,000\text{V}/\mu\text{s}$ indicates a surge firing potential of about 500V (See Fig.3). The surge cannot be discharged until the voltage rises to this value. This characteristic forms the chief failing of gas arresters. With the R·A·V surge absorber, however, the same 90V type permits the discharge operation to begin at a V_f (at $1,000\text{V}/\mu\text{s}$), of about 210V . As a result, the discharge operation begins at a level 290V lower than the gas arrester.

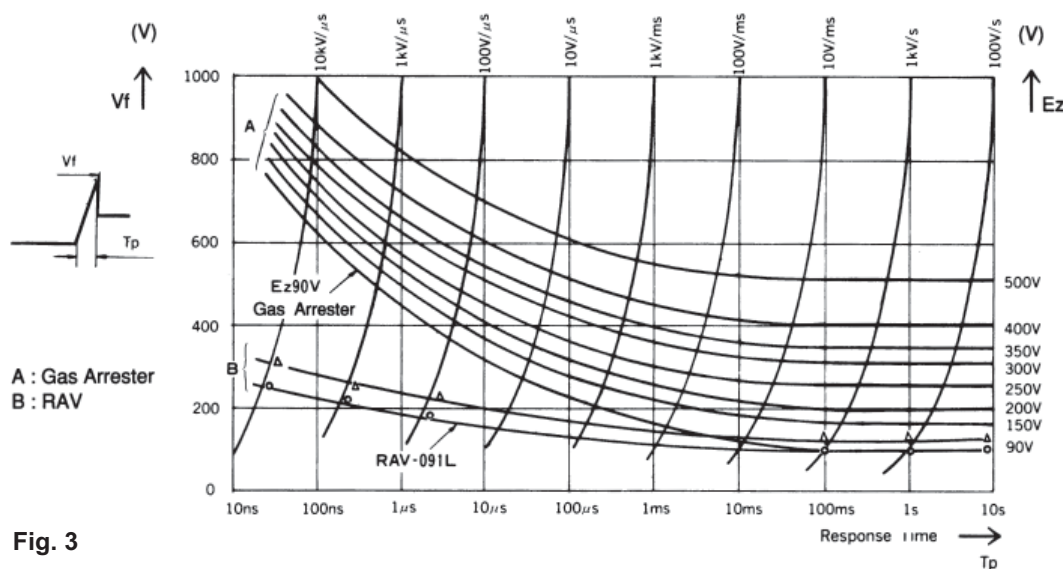


Fig. 3

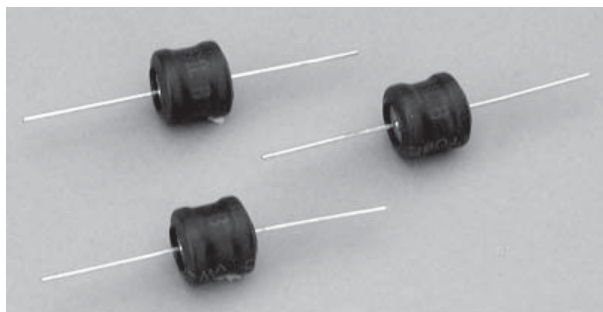
There are two standard tests which are used to classify surge absorbers. Each test uses a signal pulse which is imposed on the device under test (DUT). This pulse is described by two sets of numbers ($1.2/50\mu\text{sec}$. and $8/20\mu\text{sec}$.). The first number in each set is the duration of the rise time of the signal imposed on the DUT. The second number is $1/2$ of the duration of the fall time of the signal imposed on the DUT.

The $1.2/50\mu\text{sec}$. test is used to determine the peak surge voltage the DUT can withstand. The $8/20\mu\text{sec}$. test is used to determine the maximum discharge current the DUT can withstand. These wave forms are derived from IEEE-587, 1980 (ANSI-62.41). This standard defines the open circuit and short circuit current waveforms which can be expected to occur on AC power lines of 600 Volts or less.

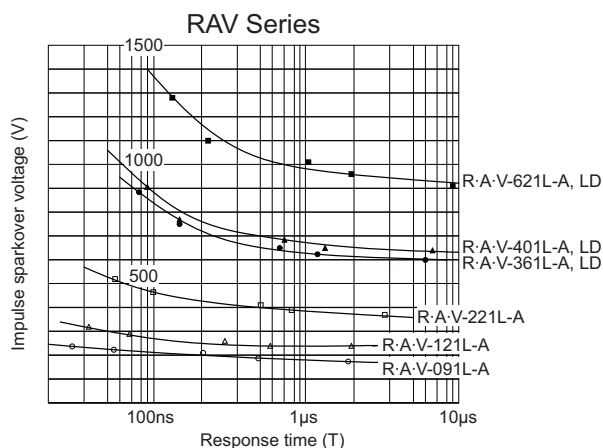
R·A·V-L-A (for protecting network line)

R·A·V was developed to absorb high current surge such as indirect lighting. specially, the R·A·V applied to communication circuits will protect it. The R·A·V is suitable for use with equipment which requires high reliability protection from external surges.

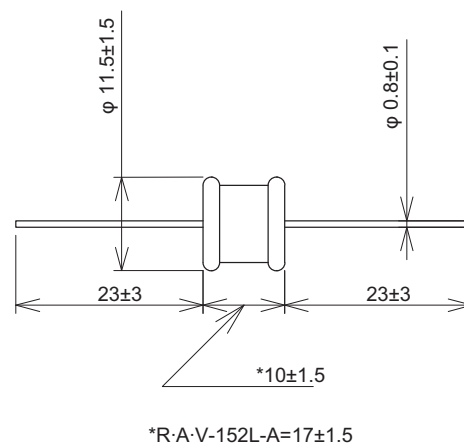
- Response time: 50ns max.
- Life: Possible to absorb 1,000A for 300 times repeatedly(surge wave form: 8/20 μ s).



• V-t Characteristics

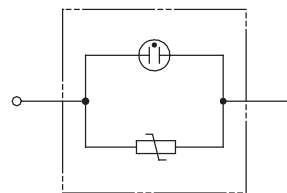


• Dimensions



Unit: mm

• Circuit



Electrical Specifications

Model Number	Clamping Voltage (V) $\pm 10\%$ *1	Impulse Discharge Current 8/20 μ s (A)	Withstanding Impulse Voltage 1.2/50 μ s (V)	Response Time (ns)	Capacitance (pF) *2	Operating Temp. Range (°C)
R-A-V-091L-A	90	2,400	20,000	50	150	-20 ~ +70
R-A-V-121L-A	120				14	
R-A-V-181L-A	180				100	
R-A-V-221L-A	220				60	
R-A-V-361L-A	360				30	
R-A-V-401L-A	400				40	
R-A-V-621L-A	620				30	
R-A-V-901L-A	900				20	
R-A-V-152L-A	1,500					

*1 Equivalent varistor voltage@1mA

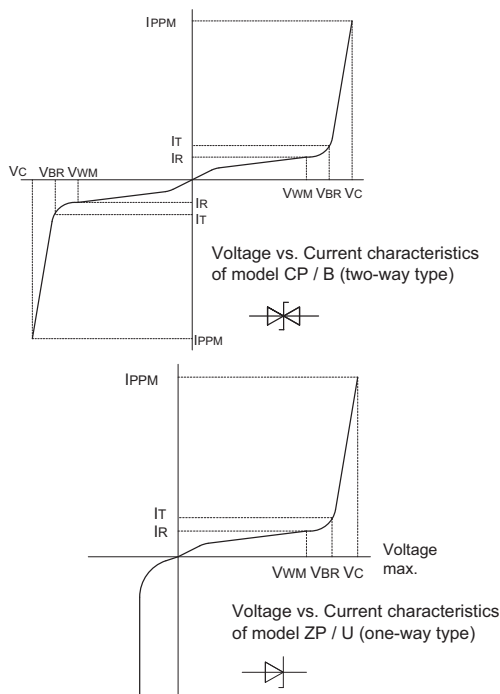
*2 Reference Value

Features

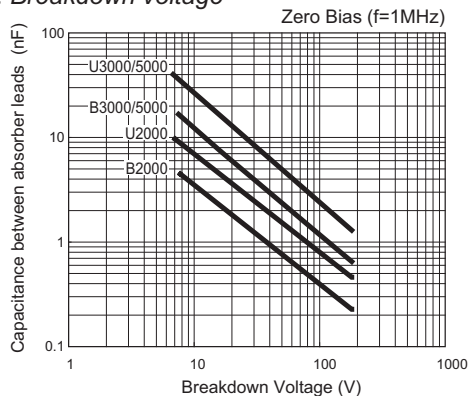
- Fast response to rapid surge (10⁻¹² sec).
- Almost no performance degradation against repetitive surge.
- Very low internal resistance during operation.
- Very small leak current.
- Mesa chip design provides high invulnerability to impulse surges.

Applications

- Air conditioners, Amusement machines, Telecommunication equipments, Data transmitters.

• **Electrical Specifications**

Typical capacitance between absorber's lead vs. Breakdown voltage

**Nominal Breakdown Voltage (VBR)**

Voltage at which avalanche current may begin to flow, normally the voltage between the surge absorber's leads when 1mA of current is applied.

Maximum Working Voltage (VWM)

A maximum voltage that can be applied to the surge absorber continuously.

Leakage Current (IR)

A maximum current flowing through the surge absorber when the standoff voltage is applied to the surge absorber.

Rated Peak Impulse Current (IPPM)

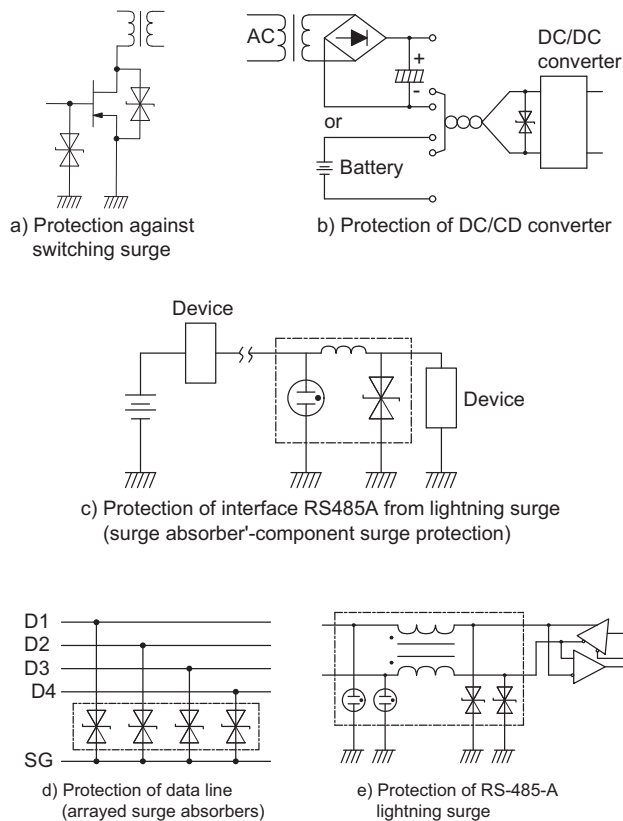
A maximum surge current that can flow through the surge absorber, but not repetitively. The waveform in the table is 8/20μsec.

Clamping Voltage (VC)

A maximum voltage that may be generated between the surge absorber's leads when the peak surge current is applied to the surge absorber.

Rated Peak Impulse Power Dissipation (PPPM)

$$(PPPM) = (VPPM) \times (VC)$$

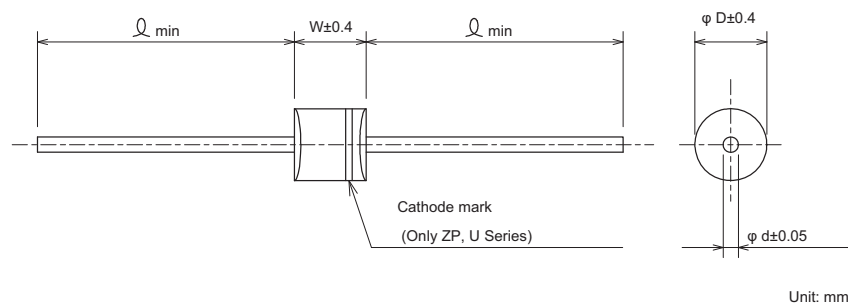
• **Applications**

The Silicon Surge Absorber is available in five series that support the countermeasure against a wide range of surge from low to high, including electrostatic discharges and lightning surges. The device may also be used as a constant voltage device where high voltage or high power is required.



Series	Uni-Polar Type	Bi-Polar Type	Rated Peak Impulse Current Dissipation	
			8/20 μ s	10/100 μ s
1000	ZP	CP	6,000 W	500 W
2000	U	B	18,000W	1,500W
3000	U	B	34,000W	3,500W
5000	U	B	44,000W	5000W

• Dimensions



Dimensions (mm)				
Series	D	W	d	Q
1000	2.8	5.0	0.6	20
1500	5.3	9.7	1.0	
2000				
3000	8.5	8.6	1.2	
5000	9.7	12.3		

Electrical Specifications

1000 Series

Rated Peak Impulse Power Dissipation 6,000W (8/20 μ sec)

Model Number*1	Nominal Breakdown Voltage		Maximum Working Voltage		Rated Peak Impulse Current	
	V _{BR} (V)	I _T (mA)	V _{WM} (V)	I _R (μ A)	I _{PPM} (A)	V _C (V)
□□1007	7.5	1	6.05	200	419	14.3
ZP1010	10		8.10	10	311	19.5
□□1012	12		9.72	5	267	22.7
□□1016	16		12.9		213	28.4
□□1018	18		14.5		178	34.0
ZP1027	27		21.8		120	50.5
ZP1040	40		32.4		83	73.0
□□1050*2	50		40.5		68.9	88.0
ZP1060	60		48.6		52.6	114
ZP1075*2	75		60.7		42.2	142
ZP1120	120		97.0		27.3	222

*1 ZP: Uni-Polar Type, CP: Bi-Polar Type, □□: Both ZP and CP

*2 Requirements may vary depending on the quantity orderd. Please ask for details.



2000 Series

Rated Peak Impulse Power Dissipation 18,000W (8/20μsec)

Model Number*	Nominal Breakdown Voltage		Maximum Working Voltage		Rated Peak Impulse Current 8/20μsec	
	V _{BR} (V)	I _T (mA)	V _{WM} (V)	I _R (μA)	I _{PPM} (A)	V _C (V)
U2006	6.8	10	5.50	2,000	1343.0	13.4
B2007	7.5		6.05	1,000	1241.0	14.5
B2008	8.2		6.63	400	1161.0	15.5
B2010	10.0		8.10	20	968.0	18.6
B2012	12.0	1	9.72	5	829.0	21.7
□2018	18.0		14.50		554.0	32.5
□2022	22.0		17.80		458.0	39.3
B2027	27.0		21.80		373.0	48.3
□2033	33.0		26.80		305.0	59.0
□2039	39.0		31.60		258.0	69.7
□2047	47.0		38.10		214.0	84.0
B2056	56.0		45.50		180.0	100.0
B2068	68.0		55.10		148.0	121.0
B2082	82.0		66.40		123.0	146.0
B2100	100.0		81.00		101.0	178.0
B2150	150.0		121.00		68.0	265.0
□2180	180.0		146.00		57.0	317.0
B2220	220.0		175.00		46.5	388.0
B2250	250.0		202.00		40.7	442.0
B2300	300.0		243.00		34.0	529.0
B2400	400.0		324.00		25.5	706.0

* U: Uni-Polar type, B: Bi-Polar Type, □: Both U and B

3000 Series

Rated Peak Impulse Power Dissipation 34,000W (8/20μsec)

Model Number*	Nominal Breakdown Voltage		Maximum Working Voltage		Rated Peak Impulse Current 8/20μsec	
	V _{BR} (V)	I _T (mA)	V _{WM} (V)	I _R (μA)	I _{PPM} (A)	V _C (V)
B3007	7.5	10	6.05	2,000	2313	14.7
B3008	8.2		6.63		2208	15.4
B3010	10.0	1	8.10	100	1717	19.8
□3015	15.0		12.10		1145	29.7
□3018	18.0		14.50		955	35.6
U3022	22.0		17.80		780	43.6
□3033	33.0		26.80		521	63.5
B3036	36.0		29.16		478	71.0
U3039	39.0		31.60		440	77.2
B3056	56.0		45.50		307	111.0
□3068	68.0		55.10		252	135.0
B3082	82.0		66.40		210	162.0
U3180	180.0		146.00		96	356.0

* U: Uni-Polar type, B: Bi-Polar Type, □: Both U and B

5000 Series

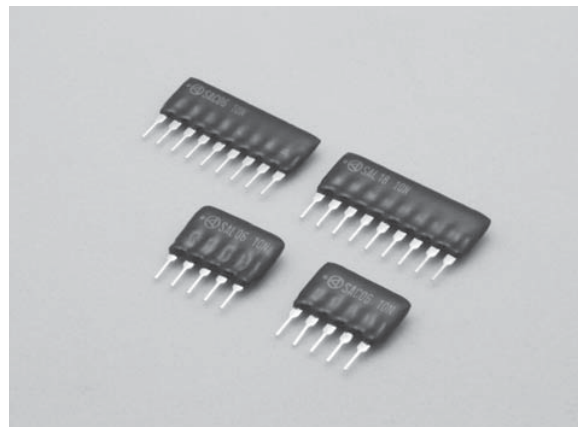
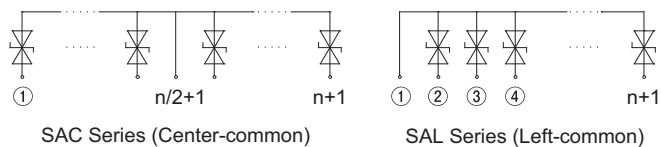
Rated Peak Impulse Power Dissipation 44,000W (8/20μsec)

Model Number*	Nominal Breakdown Voltage		Maximum Working Voltage		Rated Peak Impulse Current 8/20μsec	
	V _{BR} (V)	I _T (mA)	V _{WM} (V)	I _R (μA)	I _{PPM} (A)	V _C (V)
B5007	7.5	10	6.05	2,000	2963	15.1
B5008	8.2		6.63		2819	15.9
B5010	10.0	1	8.10	100	2426	18.5
□5015	15.0		12.10		1621	27.6
□5018	18.0		14.50		1352	33.1
U5022	22.0		17.80		1104	40.5
□5033	33.0		26.80		737	60.7
B5036	36.0		29.16		679	64.8
U5039	39.0		31.60		622	71.9
B5056	56.0		45.50		434	103.0
□5068	68.0		55.10		358	126.0
B5082	82.0		66.40		298	150.0
U5180	180.0		146.00		135	331.0

* U: Uni-Polar type, B: Bi-Polar Type, □: Both U and B

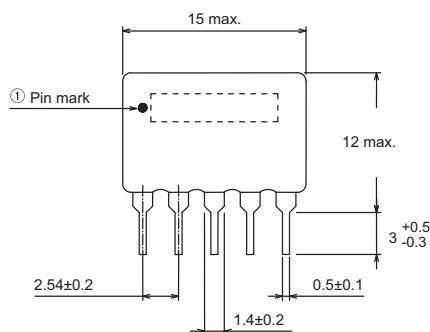
This array type of silicon surge absorber is designed for use in signal line applications. The element's integration is enhanced, so space factor and process times are much improved. You can choose 4 or 8 elements, and center-common or left-common.

● Circuit

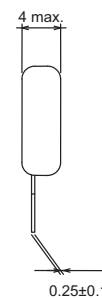
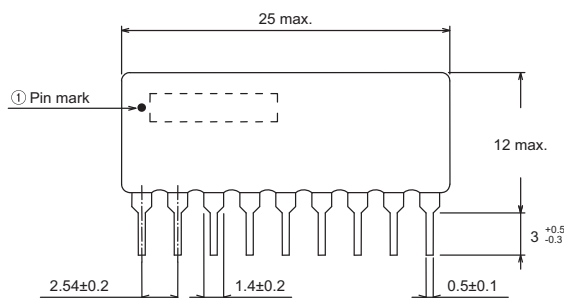


● Dimensions

4 elements



8 elements



Unit: mm

Electrical Specifications

Rated Peak Impulse Power Dissipation 4,200W (8/20μsec)

Model Number*	Nominal Breakdown Voltage		Maximum Working Voltage		Rated Peak Impulse Current 8/20μsec	
	V _{BR} (V)	I _T (mA)	V _{WM} (V)	I _R (μA)	I _{PPM} (A)	V _C (V)
SA□06-○	6.8	1	5.5	500	284.0	14.8
SA□18-○	18.0		14.5		128.0	32.7
SA□22-○	22.0		17.8		105.0	40.0
SA□33-○	33.0		26.8		70.1	59.9

*□: Circuit symbol: C= Center-common, L= left-common ○: Number of element: 4 or 8

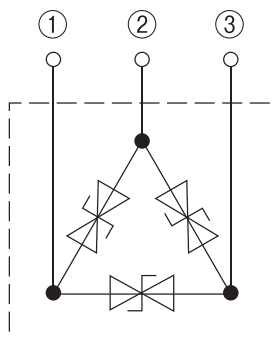
RSP-DC series is surge protective device for DC power circuit, protects line-in driver, receiver IC from indirect lightning surge, static electricity.

Features

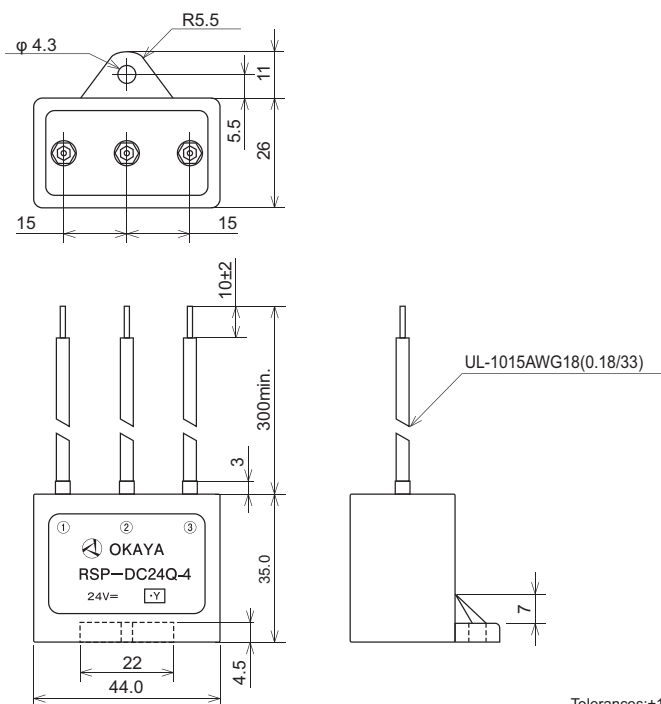
- Quick response for surge
- Internal resistance is very small at work
- Able to withstand impulse due to mesa-shaped chip
- Complex product of silicon surge absorber



• Circuit

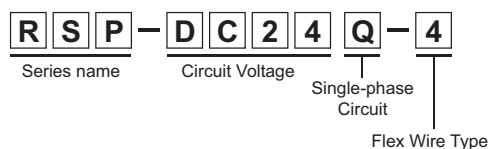


• Dimensions



Tolerances: ±1.0
Unit: mm

• Model Numbering System



Electrical Specifications

Model Number	DC Circuit Voltage (V)	Nominal Breakdown Voltage (±10%)		standoff Voltage		Surge Waveform 8/20μsec 1.2/50μs-8/20μs	
		V _{BR} (V)	I _T (mA)	V _{WM} (V)	I _R (μA)	I _{PPM} (A)	V _C (V)*
RSP-DC05Q-4	5	7.5	10	6.05	2,000	1,241	180
RSP-DC12Q-4	12	18.0	1	14.50	10	554	110
RSP-DC24Q-4	24	33.0		26.80		305	90
RSP-DC48Q-4	48	68.0		55.10		148	130
RSP-DC60Q-4	60	82.0		66.40		128	150

*V_C of maximum impulse rating includes voltage rise of code impedance.

Please set shortest possible length when connect the cord to prevent voltage rise.

<Term meaning> Breakdown voltage (V_{BR}): Current that starts to flow the avalanche current. Between terminals voltage that flows current (I_T(mA)).
Stand voltage (V_{WM}): Maximum voltage capable to apply continuously between terminals.
Maximum impulse rating : Current value capable to flow the surge current (8/20μsec) between terminals.

Features

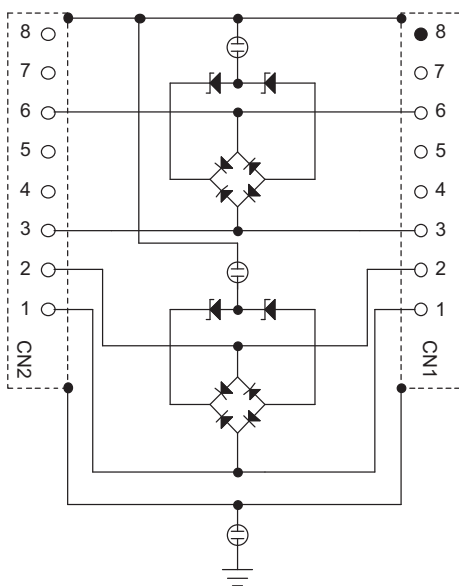
- RSP-LAN-B is a surge protector for Ethernet LAN10/100BASE-T that prevails in LAN network and it protects a network system from lightning surge by attaching this between the application and cables.

Applications

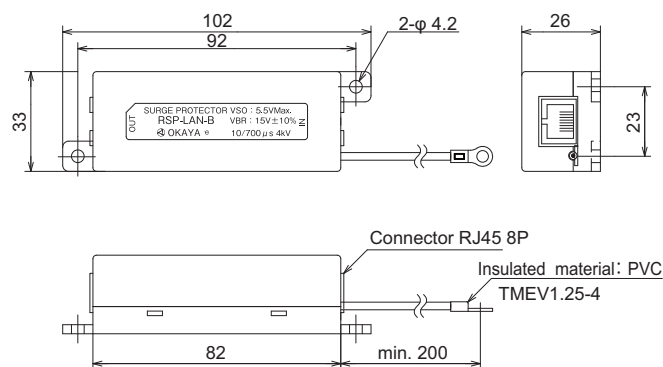
- Counter measure against surge can be taken easily just by attaching this between the application and cables due to hook-up box.
- With a complex circuit, electrostatic capacity got small and usable for high speed communication.



Circuit



Dimensions

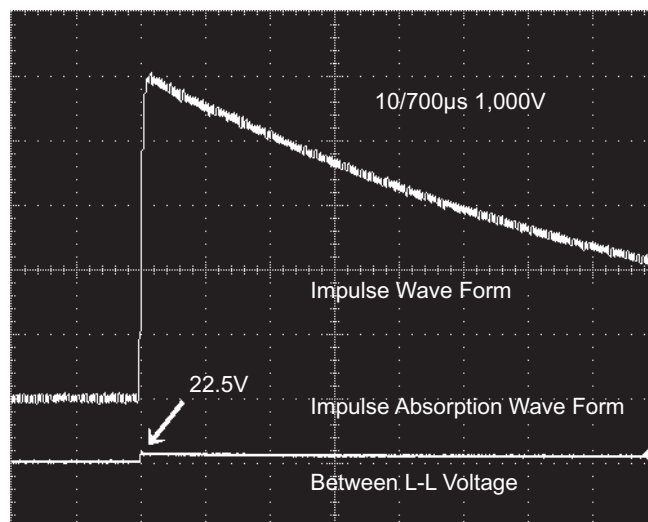


Unit: mm

Electrical Specifications

Max. Line Voltage	5.5V
Impulse Withstand Voltage Capacity	4,000V (10/700μs ITU-T K20 R=25)
Breakdown Voltage	15.0V±10% (L-L) 635V±15% (L-G)
Capacitance	20pF Max. (L-L) 1pF Max. (L-G)
Ambient Temperature	25°C

Impulse Absorption Characteristics





RSP-232-9 series is designed for RS(EIA)-232 which is widely used as standard specifications for data input-output in serial data terminals. These protectors will be installed between equipment and cable to protect equipment from surge caused by electrostatic discharge and switching surge.

This will be installed in both ends of the cable. Also 9 pin type is available for the use in IBM PC.

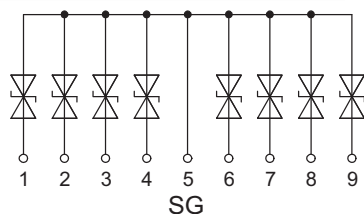
Electrical Specifications

- Breakdown voltage: 22V @1mA (L-SG)
- Impulse life: 25,000V 500pF 0Ω, more than 5,000 times

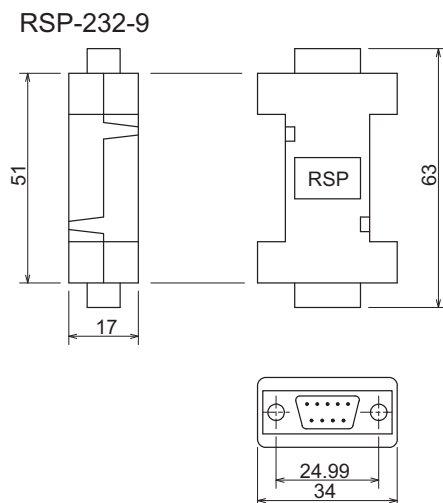


• RSP-232-9

• Circuit



• Dimensions



Unit: mm

Features

- For telephone line use.
- This protector consists of RSSA (silicon surge absorber) and R·A·V.
- Excellent response time and endurance.
- Available in PCB mounting type and box with modular jack type.

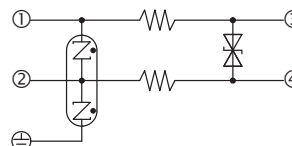


• RSP-TEL

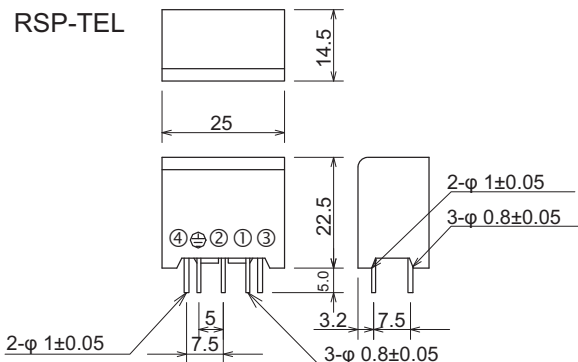


• RSP-TEL-B

• Circuit

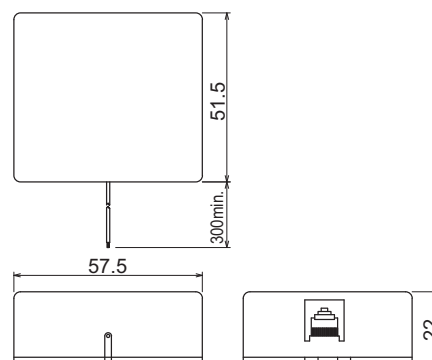


• Dimensions



Unit: mm
Tolerance: ±0.5

RSP-TEL-B



Unit: mm
Tolerance: ±1.0



RSP-485 Series

These are surge protection devices designed for RS-485, protecting driver/ receiver ICs in input-output terminals, from surge such as lightning.

Features

- This protector consists of RSSA (silicon surge absorber) and R·A·V.
- Excellent response time and endurance.
- Small gain loss in long distance communication by the use of common mode choke coils in impedance blocks.
- PCB mounting type, terminal block type and DIN rail box type available.

Electrical Specifications

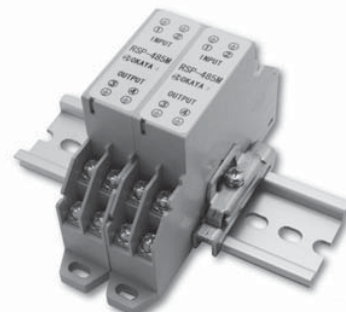
- Maximum circuit voltage: 6.05V(L-G)
- Clamp voltage: 15Vmax. (@1.2/50 μ s-1,000V)
- Repetitive surge guaranteed: 8/20 μ s-1,000A 100 times



PCB mounting type

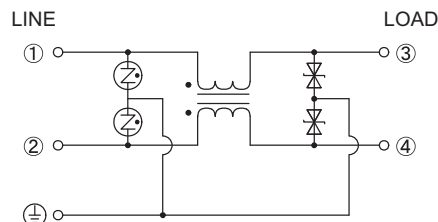


Terminal block type

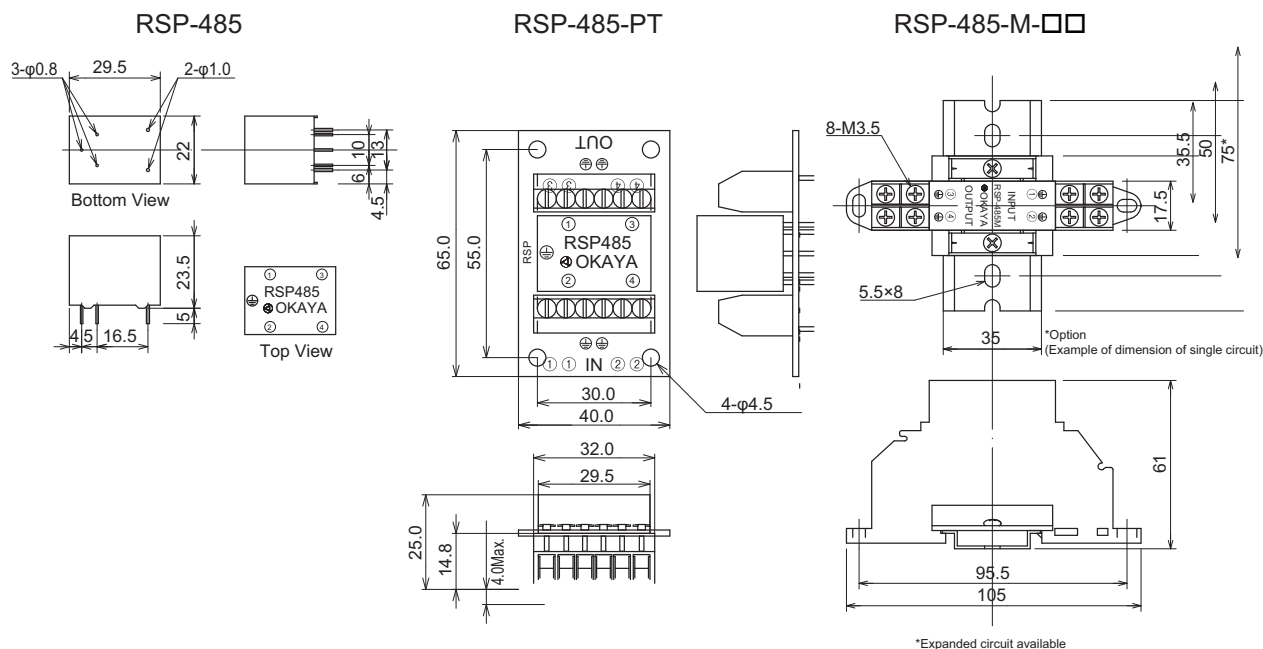


DIN rail box type

• Circuit



• Dimensions



Unit: mm
Tolerance: ± 1.0

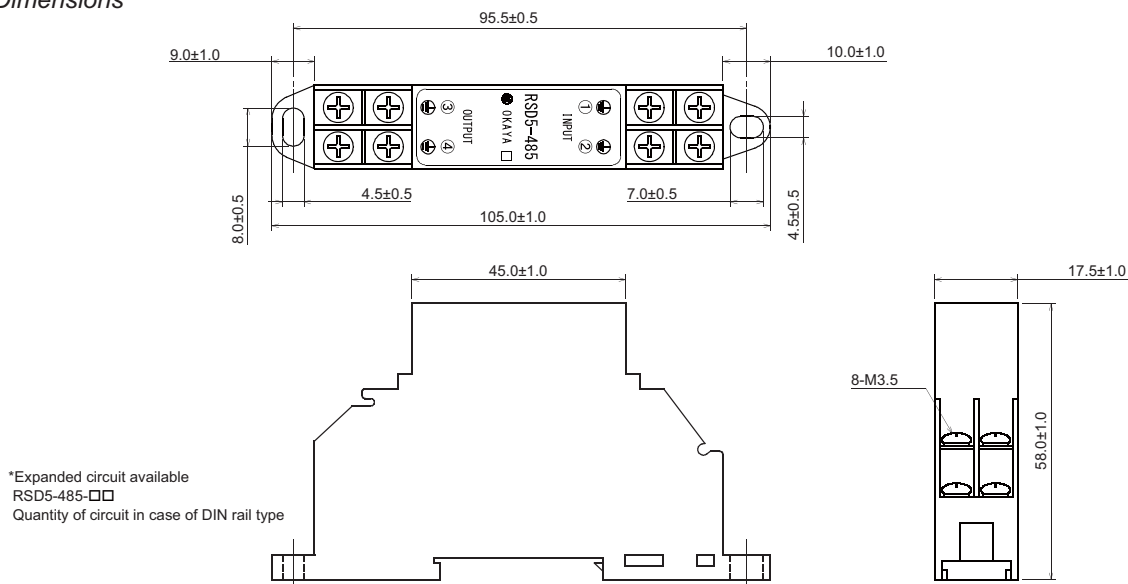
Features

- SPD for RS-485 and RS422 signal circuit
- Compliance to JIS C 5381-2 and category C2/D1
- Impulse withstand current C2: 8/20 μ s-5kA
D1: 10/350 μ s-2.5kA
- Available to DIN rail
- Longer impulse current life and higher impulse withstand current than old RSP-485M.

Applications

- Data processing machine and control machine with RS-485 line or RS-422 line
- Fire alarm apparatus system
- Security camera
- Coin-operated parking
- Outdoor display unit

Dimensions

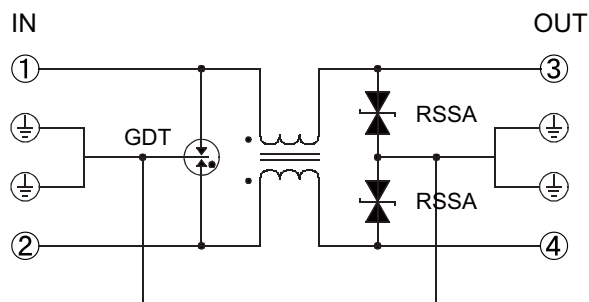


Unit: mm

Electrical Specifications

Nominal Breakdown Voltage VBR ① ②- $\pm$, ③ ④- $\pm$	7.5V(at 10mA)
Breakdown Tolerance	$\pm$ 10%
Max. Operating Voltage VWM (①-②, ③-④)	DC12.1V
Max. circuit current (①-②, ③-④)	3A
Leakage of current I _R ① ②- $\pm$, ③ ④- $\pm$	2mA max.(at 6.05V)
Impulse Discharge Current ① ②- $\pm$, ③ ④- $\pm$	Category C2 8/20 μ s-5kA, 5 times for each positive and negative
	Category D1 10/350 μ s-2.5kA, 1 time for each positive and negative

Circuit



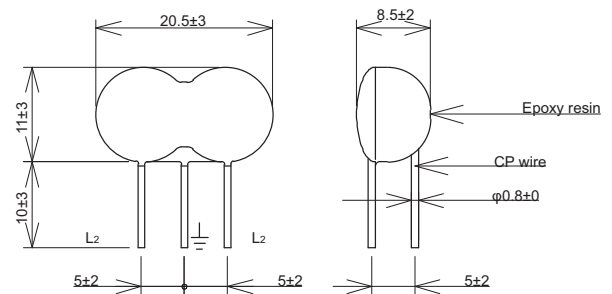
R·A·V-LD (for protecting network line)

RAV-LD series are designed as surge absorbers for protection of telecommunication lines from indirect lightning surges. They demonstrate extremely fast response time and positive surge absorption operation compared to gas arresters.

They contain two of RAV in one package with 3 leads.

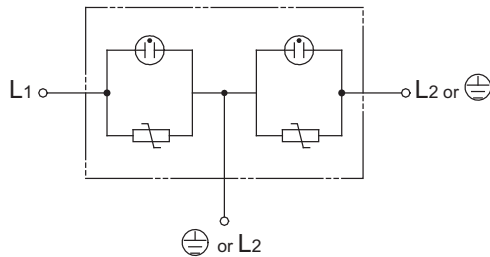


• Dimensions



Unit: mm

• Circuit



Electrical Specifications

Model Number	Clamping Voltage (V) $\pm 10\%$ * ¹	Impulse Discharge Current 8/20 μ s (A)	Withstanding Impulse Voltage 1.2/50 μ s (V)	Response Time (ns)	Capacitance (pF) * ²	Operating Temp. Range (°C)
R·A·V-221LD	220	2,400	12,000	50	90	-20 ~ +70
R·A·V-361LD	360				37	
R·A·V-401LD	400				30	
R·A·V-621LD	620				40	

*¹ Equivalent varistor voltage@1mA*² Reference Value

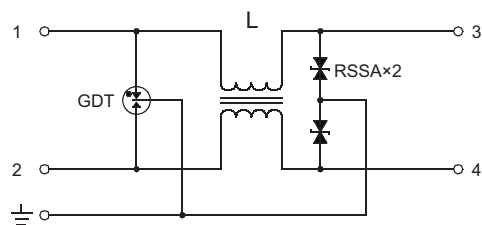
Features

- SPD for data signal line and control line
- Compliance to JIS C 5381-2 and category C2/D1
- Impulse withstand current C2: 8/20 μ s-5kA
D1: 10/350 μ s-2.5kA
- Longer impulse current life and higher impulse withstand current than old R·S·M-RL.

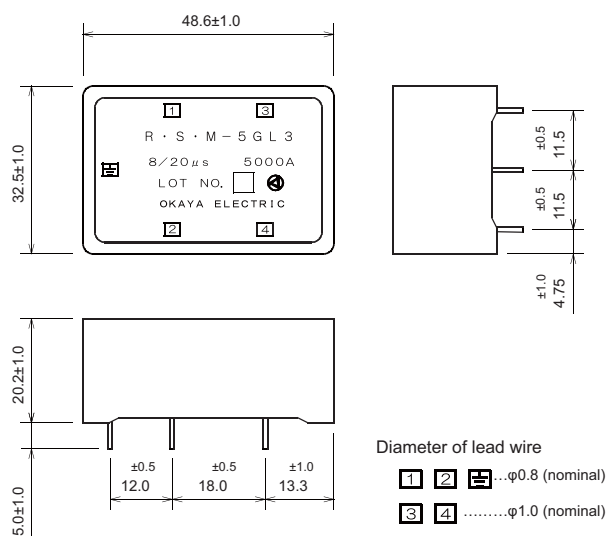
Applications

- Data processing machine and control machine with communication signal line
- LED light dimmer
- Fire alarm apparatus system
- Security camera
- Outdoor display unit

Circuit




Dimensions



Unit: mm

Electrical Specifications

Model Number			R·S·M-5GL3	R·S·M-12GL3	R·S·M-24GL3	R·S·M-48GL3
Rated Voltage	①,②- $\frac{-}{+}$	-	DC5.0V	DC12.0V	DC24.0V	DC48.0V
Max. Continuous Operating Voltage	①,②- $\frac{-}{+}$	-	DC6.05V	DC14.5V	DC26.8V	DC55.1V
Rated Current	①-③-④-②	-	3A			
Residual Voltage (representative value) 1.2/50 μ s-8/20 μ s, 10kV-5kA	③,④- $\frac{-}{+}$	-	30V	60V	70V	100V
Impulse Discharge Current	①,②- $\frac{-}{+}$	Category C2	8/20 μ s-5kA, 5 times for each positive and negative			
		Category D1	10/350 μ s-2.5kA, 1 time for each positive and negative			



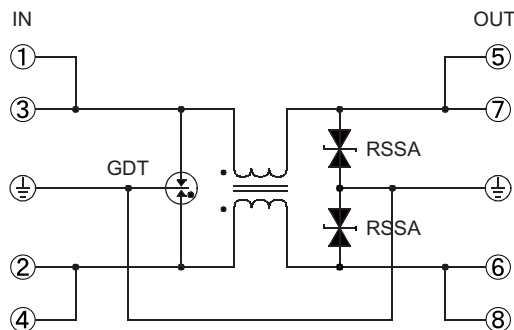
Features

- SPD for data signal line and control line
- Compliance to JIS C 5381-2 and category C2/D1
- Impulse withstand current C2: 8/20 μ s-5kA
D1: 10/350 μ s-2.5kA
- Longer impulse current life and higher impulse withstand current than old R·S·M-RL.

Applications

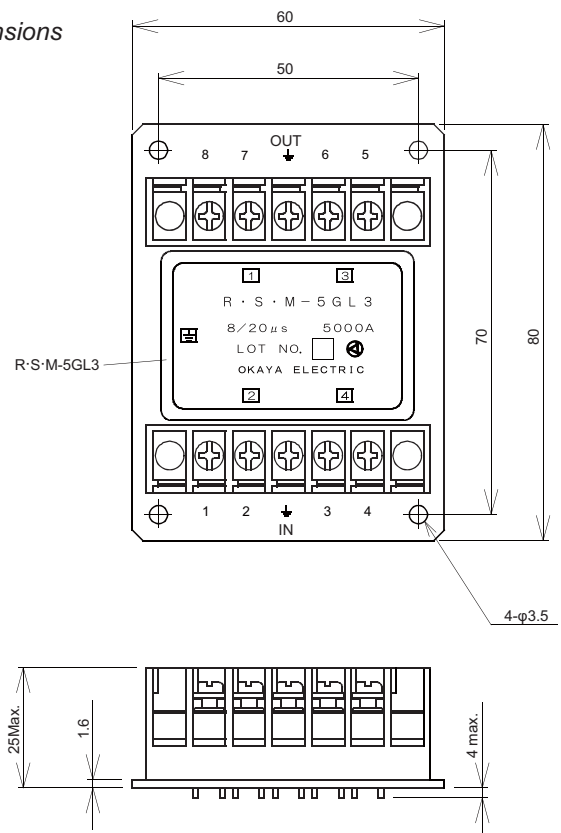
- Data processing machine and control machine with communication signal line
- LED light dimmer
- Fire alarm apparatus system
- Security camera
- Outdoor display unit

Circuit



NEW

Dimensions



Unit: mm

Electrical Specifications

	Model Number			R·S·M-5GL3-PT	R·S·M-12GL3-PT	R·S·M-24GL3-PT	R·S·M-48GL3-PT
	In	Out	Class				
Rated Voltage	①,③/②,④	⑤,⑦/⑥,⑧	-	DC5.0V	DC12.0V	DC24.0V	DC48.0V
Max. Continuous Operating Voltage	①,③/②,④	⑤,⑦/⑥,⑧	-	DC6.05V	DC14.5V	DC26.8V	DC55.1V
Rated Current	①,③/⑤,⑦			3A			
Residual Voltage (representative value) 1.2/50 μ s-8/20 μ s, 10kV-5kA	⑥,⑦- $\frac{1}{2}$	-	-	30V	60V	70V	100V
Impulse Discharge Current	①,②,③,④- $\frac{1}{2}$	-	Category C2	8/20 μ s-5kA, 5 times for each positive and negative			
	①,②,③,④- $\frac{1}{2}$	-	Category D1	10/350 μ s-2.5kA, 1 time for each positive and negative			

Features

- Recommendation of JISC5381-21
- Max. discharge current: 8/20 μ s-5,000A (Category C2)
10/350 μ s-1,000A (Category D1)
- Available for Hi-speed Lan (1000BASE-T) of Cat 5e
- Available for DIN rail installation
- Easy to connect to the earth with DIN rail

Applications

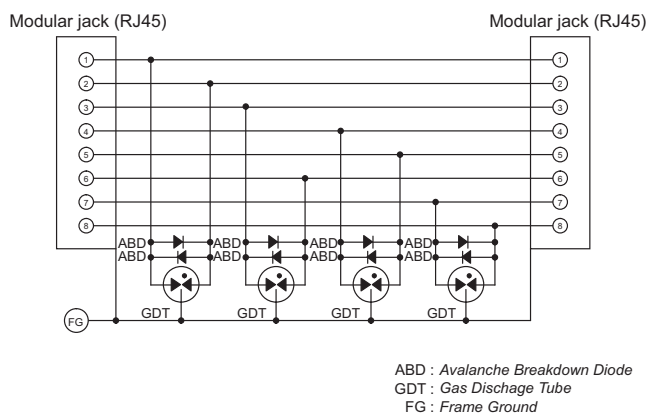
- Road traffic and related equipment
- Outdoor display
- Surveillance camera
- Office building etc. Protection of each LAN line



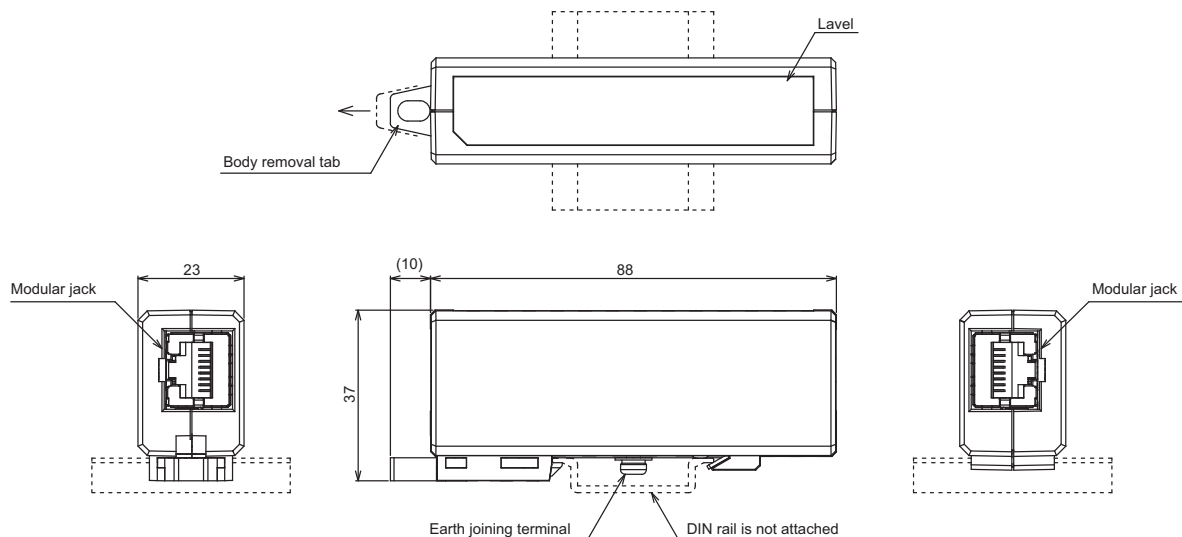
Electrical Specifications

Model Name	RLAN-1000POE5K-D
Application	10BASE-T/100BASE-Tx 1000BASE-T PoE (Power over Ethernet)
Max. Continuous Operating Voltage	DC60V
Rated Voltage	500mA
Impulse Durability	8/20 μ s-5,000A 10 times (category C2) 10/350 μ s-1,000A 2 times (category D1)
Voltage Protection Level	$\leq$ 500V (Line - Ground)
Insertion Loss	DC~100MHz $\geq$ 1.0dB
Near-end Crosstalk	DC~100MHz $\leq$ 32.3dB
Return Loss	DC~100MHz $\geq$ 12.1dB

Circuit



Dimensions



Unit: mm

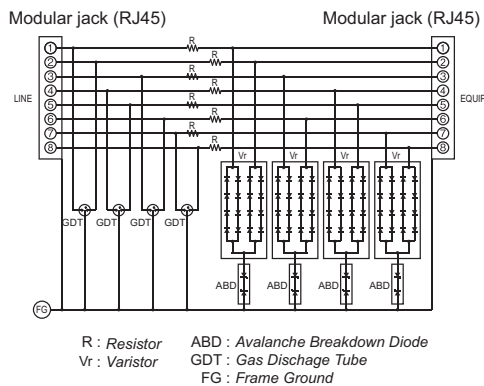
Features

- Recommendation of JISC5381-21
- Compling with land, Infrastructure and Trasportation Ministry
- Max. discharge current:
8/20 μ s-5,000A (Category C2)
10/350 μ s-2,500A (Category D1)
- Available for Hi-speed Lan (1000BASE-T) of Cat 5e
- Available for DIN rail installation
- Easy to connect to the earth with DIN rail



Applications

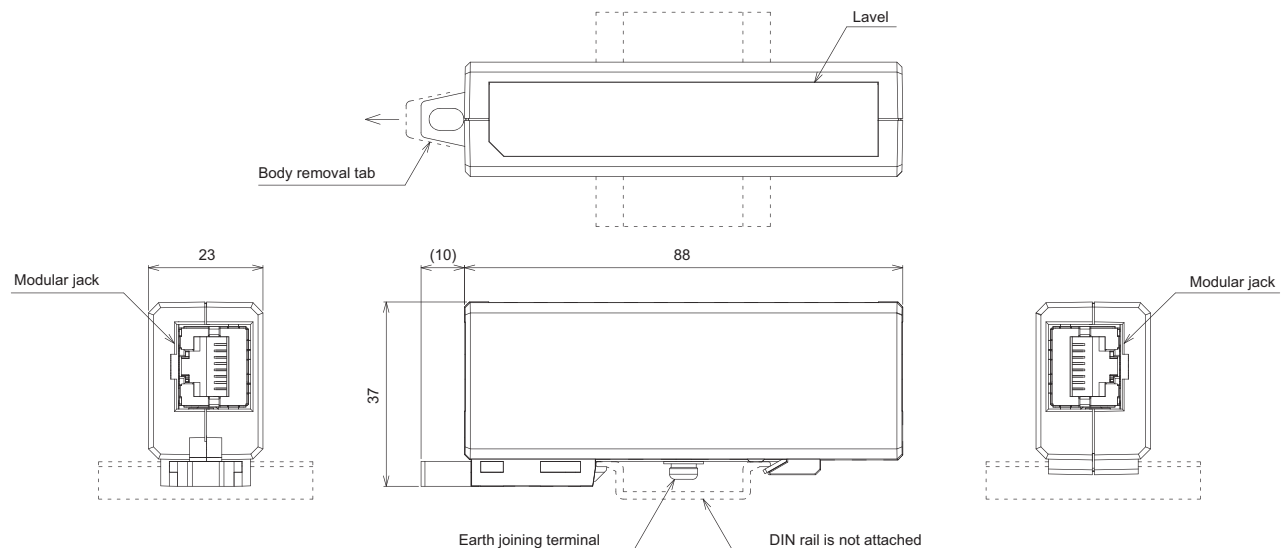
- Road traffic and related equipment
 - Outdoor display
 - Surveillance camera
 - Office building etc. Protection of each LAN line
- *Circuit*

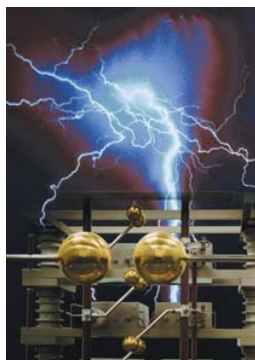


Electrical Specifications

Model Name	RLAN2-1000POE5K-D
Application	10BASE-T100BASE-Tx 1000BASE-T PoE (Power over Ethernet)/PoE Plus
Max. Continuous Operating Voltage	DC60V
Rated Current	500mA
Impulse Durability	8/20 μ s-5,000A 10 times (category C2) 10/350 μ s-2,500A 2 times (category D1)
Voltage Protection Level	$\geq 250V$ (Line - Ground)
Insertion Loss	DC~100MHz $\geq 1.0dB$
Near-end Crosstalk	DC~100MHz $\leq 32.3dB$
Return Loss	DC~100MHz $\leq 12.1dB$

Dimensions





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For improvement, specifications are subject to change without prior notice.



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- Please make inquiries for application of these products in final products such as aerospace equipment, undersea cable, nuclear reaction control system, life maintenance device, automobile, transportation equipment, and traffic control system.