

Date : September 05.2012

To: PIEキャラバン

# PRODUCT REFERENCE DATA SHEET

Product Description : ZNR SURGE ABSORBER  
Product Part Number : ERZE07A  
                          : ERZE07A       C S  
                          : ERZE07B       C S  
                          : ERZE07E  
                          : ERZE07F

**Circuit Components Business Unit**  
**Industrial Devices Company,**  
**Panasonic Corporation**

1037-2 Kamiosatsu, Chitose City,  
Hokkaido 066-8502 Japan

Prepared by : Engineering Section  
Contact Person : Masayoshi Kanazawa  
Title : Charge

Check by : Masashi Goto  
Title : Engineer

**Panasonic**

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	1 - 22
		DATE Aug. 1, 2012

## [HANDLING PRECAUTIONS]

### ⚠ Precautions for Safety

In the case that a ZNR surge absorber (Type D, Series E ) (hereafter referred to as the ZNR ,or product name) is used , if an abnormality takes place because of peripheral conditions of the ZNR (material, environments, power source conditions, circuit conditions, etc. in equipment design), fire, electric shock, burn, or product failure may be occur.  
The precautions for this product are described below, understand the content thoroughly before usage.  
For more questions, contact us.

### 1. ⚠ Precautions to be strictly observe

#### 1.1 Confirmation of performance ratings

Use the ZNR within its rated range of performance such as the Max. allowable voltage, withstanding surge current, withstanding energy, impulse life (surge life), average pulse power, and operating temperature range. If used outside the range, the ZNR can be degrade and have element fracture, which may result in smoking and ignition.

#### 1.2 To avoid accidents due to unexpected phenomena, take the following measures

- 1) In the event of fracture of the ZNR, its pieces may scatter ; hence, put the case or cover of the set product in place.
- 2) Do not install the ZNR near combustible substances (polyvinyl chloride wires, resin moldings, etc.).

If it is difficult to do, install a nonflammable cover.

#### 3) Across-the-line use

When the ZNR is used across a line, put a current fuse in series with the ZNR.

(Refer to Item 2.1, 1) (4) and Table 1.)

#### 4) Use between line to ground

- (1) In the case that the ZNR is used between a line to the ground, the short-circuit of the ZNR may not blow the current fuse because of grounding resistance, which may cause smoking and ignition of the ZNR's exterior resin. As the measure against it, install an earth leakage breaker on the power supply side of the ZNR position.

If no earth leakage breaker is installed, use a thermal fuse together with a current fuse in series.

(Refer to Table 1.)

- (2) In the case that the ZNR is used between a live part and metal case, a electric shock may develop at a short circuit of the ZNR ; hence, ground the metal case to the ground or keep it from the human body.

## 2. Application notes

### 2.1 Pay attention to the following items to avoid the shortened life and failure of the ZNR

#### 1) Circuit conditions

- (1) Select a ZNR of which the maximum voltage including fluctuations in source voltage allows for the maximum permissible circuit voltage. (Refer to Table 1.)

- (2) In cases that surges are intermittently applied at short intervals (for example, in the case that the voltage of the noise simulator test is impressed), do not cause them to exceed the ZNR's rated pulse power.

- (3) Select a ZNR recommended in Table 1.

#### <1> Across the Line (Line to Line) use

If possible, use a part No. marked with \* incase of voltage temporarily rises load unbalance of separately-wired loads, short between hot and neutral-line, open of neutral line in single-phase-three-wired system, and due to resonance at switching for a capacitive, inductive load.

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<2> Used between line to ground

Use a different Part No. from "Across-the-line use" as table 1, because of raising voltage in case of "Line to Ground Fault".

Use a part No. marked with \*\* in table 1, in case of the insulation resistance test (500VDC) for equipment.

When using a part of the varistor voltage that the insulation efficiency examination can not be cleared, there is a case where the surge absorber can be done by removing it from the circuit depending on the circuit condition (Refer examination of Japan Domestic Safety Regulations).

(4) Concerning current fuse

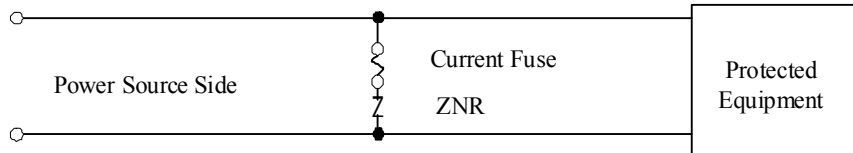
<1> We recommended to selecting a ZNR and the rated current of a current fuse as follows.

Finally, please be sure that there is no danger if the ZNR mounted on equipment breaks.

Series	E5	E7	E10
Standard Part Numbers	ERZE05+++	ERZE07+++	ERZE10+++
Fuse rated current	5A max.	7A max.	10A max.

\* Fuses shall use rated voltages appropriate for circuits.

<2> The recommended fuse position is shown in table 1, "Example of ZNR application", however, if the load current of protected equipment is larger than that of the above recommended fuse rated current, install a current fuse at the position shown below.



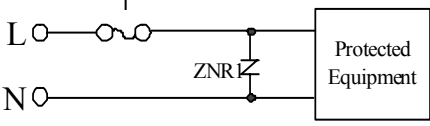
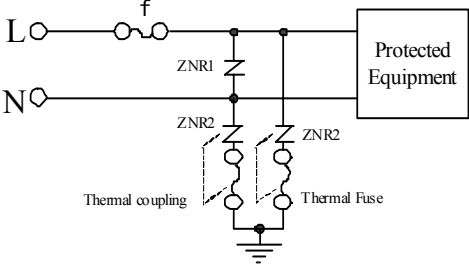
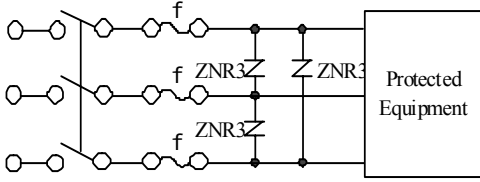
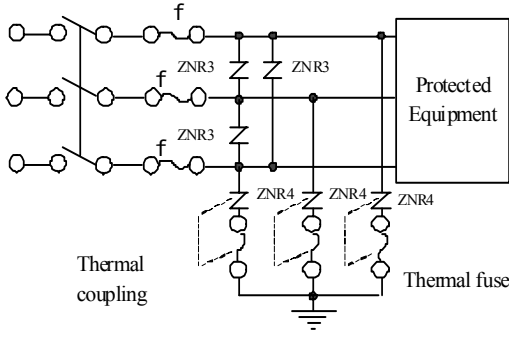
(5) Concerning thermal fuse

Set a thermal fuse to get high thermal conductivity with ZNR.

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**Table 1 Example of ZNR application**

Connection example	Measure against across-the-line surge		Measure against surge across the line and between the line and ground			
		DC/AC single-phase	DC/AC single-phase			
	 <p style="text-align: center;">f : fuse</p>	 <p style="text-align: center;">f : fuse</p>				
	AC 3-phase	AC 3-phase				
	 <p style="text-align: center;">f : fuse</p>	 <p style="text-align: center;">f : fuse</p>				
Example of rating selection	Across the Line (Line to Line) use		Line to Ground use			
	ZNR	Source voltage	Nominal varistor voltage	ZNR	Source voltage	Nominal varistor voltage
	ZNR1 ZNR3	AC100V	201 to 361*	ZNR2 ZNR4	AC100V ~ AC220V	471
		AC120V	241 to 431*			511
		AC200V	471 to 621*			621*
		AC220V	471 to 621*		821**	
		AC240V	511,621*		AC230V ~ AC240V	511
AC380V		751,821*	621*			
			AC380V	821**	112**	

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2) Operating environments

- (1) The ZNR is designed to use indoors. Do not use it exposed outdoors.
- (2) Do not use the ZNR in places exposed to temperatures beyond the operating temperature range, such as places exposed to sunlight and vicinities of heating equipment.
- (3) Do not use the ZNR in places exposed to high temperatures and high humidity, such as places exposed directly to rain, wind, dew condensation, and vapor.
- (4) Do not use the ZNR in dusty and salty places and atmospheres polluted by corrosive gases.

3) Processing conditions

- (1) Do not wash the ZNR by such solvents (thinner, acetone, etc.) as its exterior resin deteriorates.
- (2) Do not apply a strong vibration, shock (by falling, etc.) to the ZNR, cracking to its exterior resin and element may occur.
- (3) When coating the ZNR with resin (including molding), do not use such resin.
- (4) Do not bend the ZNR lead wires at the position close to its ZNR exterior resin, or apply external force to the position.
- (5) When soldering the ZNR lead wires, follow the recommended condition and do not melt the solder and insulating materials constituting the ZNR.

Type D	Soldering Method	Recommended Condition	Attention
	Flow soldering	260deg.C, within 10sec.	Type D is not Reflow soldering object part.

\*1 When using at the thing except the condition that it is possible to suggest to the above, confirm that there is not a problem.

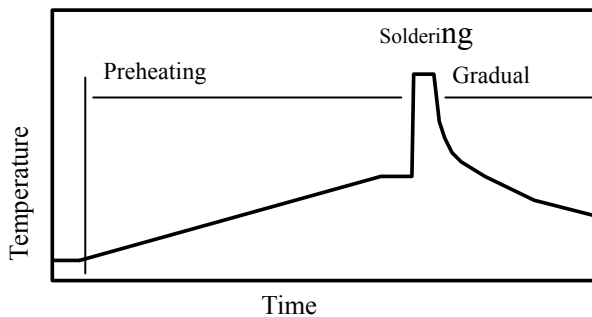
The limit of the repair be once and go in solder temperature within 400deg.C and moreover within 5 seconds.

\*2 Profile be careful because there is a margin of error in the way of measuring.

\*3 The temperature depend on the size and the package density of the substrate.

Therefore, confirm every kind of the substrate.

- Soldering temperature-time profile to recommend



Preheating	The normal 130deg.C	max.120s
Soldering	max.260deg.C	max.10s
Gradual cooling	Gradual cooling	

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<p>4) Long-term storage</p> <p>(1) Do not store the ZNR under high temperatures and high humidity. Store it at temperature up to 40 degree-C and at humidity below 75%RH, and use it within two years. Before using the ZNR that has been stored for a long period (two year or longer), confirm the solderability.</p> <p>(2) Avoid atmospheres full of corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc.).</p> <p>(3) Avoid direct sunlight and dew condensation.</p> <p><b>3. Notices</b></p> <p><b>3.1 In cases that the ZNR is used in equipment (aerospace equipment, medical equipment, etc.) requiring extremely high reliability, ask us for selection of part No., and protection coordination, etc. in advance.</b></p> <p><b>3.2 There is possibility that the ZNR will unexpectedly smoke or ignite because of abnormal rise of the circuit voltage and invasion of excessive surge. To prevent that accident from spreading over the equipment and not to expand the damage, use multiplex protection such as the adoption of frame-retardant materials for housing parts and structural parts.</b></p> <p><b>3.3 Package marking includes the product number, quantity, and country of origin. As a rule, country of origin should be indicated in English.</b></p> <p><b>4. Substances of this product</b></p> <p>4.1 This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.</p> <p>4.2 This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) Directive(2002/95/EC).</p> <p>4.3 All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance</p>		
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**[REFERENCE]**

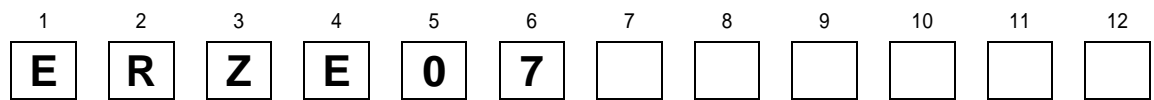
**1. Scope, Part Numbers, Construction**

1.1 Scope

This specification applies to the ZNR Surge Absorbers (Bulk Type).

1.2 Part Numbers

Explanation of Part Numbers



Series	
E05	Series E5
E07	Series E7
E08	Series E8
E10	Series E10
E11	Series E11
E14	Series E14

Lead Configuration		
symbol	Lead Configuration	Packaging
A	Straight Lead	Bulk
<sup>1)</sup> B	Crimped Lead	Bulk
<sup>2)</sup> E	Straight Lead	Taped
<sup>2)</sup> F	Crimped Lead	Taped

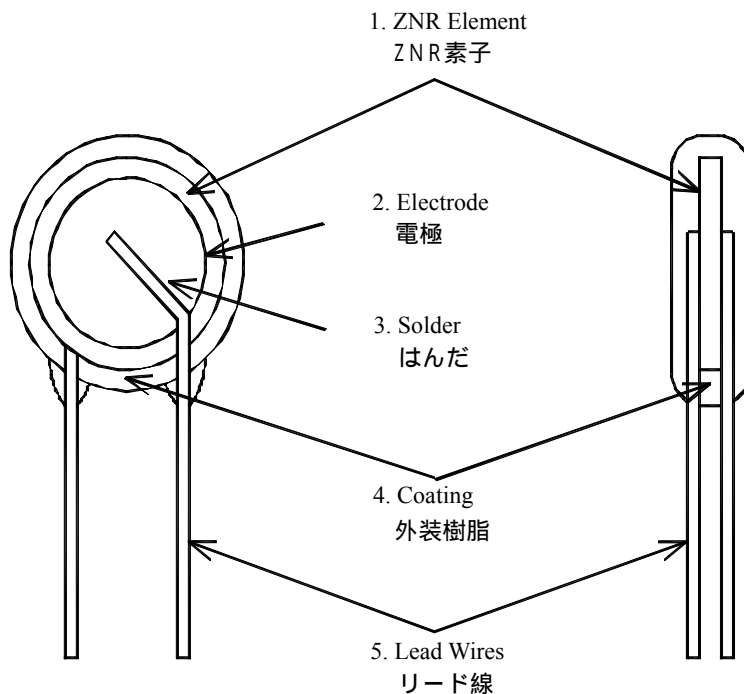
Nominal Varistor Voltage
The first two digits are significant figures and the third one denotes the number of zeros following.

<sup>1)</sup> Cut Type  
<sup>2)</sup> Series E5, E7, E8, E10, E11

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1.3 Construction



Item 部品名		Material 材質
1. ZNR Element ZNR素子		ZnO Ceramics etc. 酸化亜鉛 他
2. Electrode 電極		Silver 銀
3. Internal solder material 内部はんだ		Sn-Ag-Cu
4. Coating 外装樹脂		Epoxy Resin (UL94 V-0 Approved) エポキシ樹脂 (UL94 V-0 認定品)
5. Lead Wires リード線	Series : E5,E7 シリーズ : E5,E7	Tin(Sn100%) plated Copper-covered Steel 錫(Sn100%)メッキ銅覆鋼線
	Series : E8,E10,E11,E14 シリーズ : E8,E10,E11,E14	Tin(Sn100%) Plated Copper 錫(Sn100%)メッキ銅線

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## 2. Appearance, Dimensions

### 2.1 Appearance

Without dirt and crack, marking should be clear.

### 2.2 Dimensions

Refer to Figure 1.1 and 1.2 and table 1.1 to 1.3.

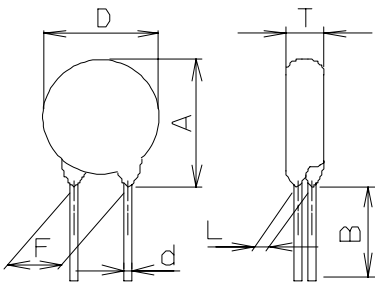


Fig. 1.1

Straight Lead Type

Part No :ERZE\*\*A

Part No :ERZE\*\*A CS

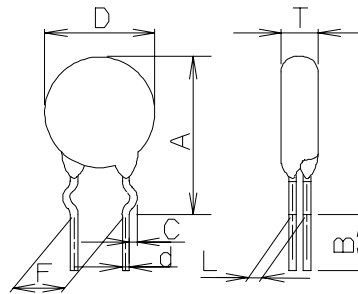


Fig. 1.2

Crimped Leads Cut Type

Part No :ERZE\*\*B CS

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### 3. Electrical Requirements

Listed below of Specifications, Test Specifications, and Test Methods.  
Individual specifications is in the table 2 .

Characteristics		Specifications	Test Specifications
3.1	Max. allowable voltage	AC: Table 2 DC: Table 2	
3.2	Rated wattage	Table 2	
3.3	Varistor voltage	$V_1$ : Table 2	Measuring current : 1mA DC
3.4	Clamping voltage	Table 2	Measuring current : Table 2
			Current Waveform : 8/20 $\mu$ s
3.5	Maximum peak current (Withstanding surge current)	1pulse: Table 2	Impulse : 8/20 $\mu$ s
		2pulse: Table 2	Impulse : 8/20 $\mu$ s at interval 5min
3.6	Maximum energy	Table 2	Impulse : 2ms, 1 pulse
		Table 2	Impulse : 10/1000 $\mu$ s, 1pulse
3.7	Temperature coefficient of varistor voltage	0 to -0.05%/deg.C	Measured voltage : $V_1$
			Temp. range : + 25deg.C to + 85deg.C
3.8	Capacitance	Table 2	Measuring frequency : 1kHz 1MHz (below 100pF)
3.9	Dielectric loss	Table 2	Measuring frequency : 1kHz 1MHz (below 100pF)
3.10	Withstand voltage	No breakdown	Applied voltage : Table 2
			Time : 1min

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Characteristics		Test Methods/Description
	Standard test condition	Environmental conditions under which every measuring is done without doubt on the measuring results. Unless specially, specified, temperature, relative humidity are 5deg.C to 35deg.C, 45 to 85%RH. respectively.
3.1	Maximum allowable voltage	The maximum Sine wave voltage (rms) that can be applied continuously or maximum DC voltage in the specified environmental temperature range.
3.2	Rated wattage	The maximum power to be loaded with in the specified environmental temperature
3.3	Varistor voltage	Voltage between both terminals of ZNR measured when CmA of DC current is applied under standard conditions. It is called Vc. Measuring the varistor voltage should be made promptly to avoid heat affection.
3.4	Clamping voltage	The maximum voltage between two terminals with the specified standard impulse current (8/20 $\mu$ s).
3.5	Maximum peak current (Withstanding surge current)	The maximum current within the varistor voltage change of $\pm 10\%$ with the standard impulse (8/20 $\mu$ s) applied by the specified condition.
3.6	Maximum energy	The maximum energy within the varistor voltage change of $\pm 10\%$ when the specified impulse is applied.
3.7	Temperature coefficient of varistor voltage	Coefficient indicating dependency of varistor voltage on specified temperature.
3.8	Capacitance	Capacitance shall be measured at 1kHz $\pm 10\%$ , 1Vrms max. ( 1MHz $\pm 10\%$ below 100pF ), 0V bias and 20 $\pm 2$ deg.C.
3.9	Dielectric loss	Dielectric loss tangent shall be measured at 1kHz $\pm 10\%$ , 1Vrms max. ( 1MHz $\pm 10\%$ below 100pF ), 0V bias and 20 $\pm 2$ deg.C.
3.10	Withstand voltage	The specified voltage shall be applied both terminals of the specimen connected together and metal foil closely wrapped round its body for 1 minute.

Note : Varistor Voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.

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#### 4. Mechanical Requirements

Listed below of Specifications, Test Specifications, and Test Methods.

Characteristics		Specifications	Test Specifications
4.1	Robustness of terminations (Tensile)	No outstanding damage	Force : 9.8N(Series E5,E7,E8,E10,E11) 19.6N(Series E14) Time : 10 sec
4.2	Robustness of terminations (Bending)	No outstanding damage	Force : 4.9N(Series E5,E7,E8,E10,E11) 9.8N(Series E14)
4.3	Vibration	No outstanding damage	Frequency : 10 to 55Hz Amplitude : 0.75mm Time : each 2 hours
4.4	Solderability	Minimum 95% of the terminals should be covered with solder uniformly	Solder temp. : 235+/-5deg.C Immersed time : 2+/-0.5s
4.5	Resistance to soldering heat	$\Delta V_1$ +/- 5%	Solder temp. : 260+/-5deg.C Immersed time : 10+/-1sec

Characteristics		Test Methods/Description
4.1	Robustness of terminations (Tensile)	After gradually applying the specified load and keeping the unit fixed for 10 seconds, the terminal shall be visually examined for any damage.
4.2	Robustness of terminations (Bending)	The unit shall be secured with its terminals kept vertical and the specified load is applied, gradually bent by 90° in one direction, back to the original position, then 90° in the opposite direction, and again back to the original position. The damage of the terminals is visually examined.
4.3	Vibration	After repeatedly applying a single harmonic vibration (amplitude ; 0.75mm ; double amplitude ; 1.5mm with 1 minute vibration frequency cycles(10Hz to 55Hz to 10Hz) to each of three perpendicular directions for 2 hours. The varistor shall then be visually examined.
4.4	Solderability	After dipping the terminals to a depth of about 3mm from the body, in the melted solder of 235+/-5deg.C for 2+/-0.5 seconds, the terminals are visually examined.
4.5	Resistance to Soldering Heat	After each lead shall be dipped into a solder bath having a temperature 260+/-5deg.C to a point 2.0 ~ 2.5mm from the body of the unit, be held there for specified time, and then be stored at room temperature and humidity for 1 to 2 hour. The change of Vc and mechanical damages are examined.

Note : Varistor Voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.

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## 5. Environmental Requirements

Listed below of Specifications, Test Specifications, and Test Methods.  
Individual specifications is in the table 2.1 to 2.3 .

Characteristics		Specifications	Test Specifications		
5.1	High temperature storage (Dry heat)	$\Delta V1$ +/- 5%	Ambient temp. :	125+/-2deg.C	
			Time :	1000h	
5.2	Damp heat	$\Delta V1$ +/- 5%	Ambient condition :	40+/-2deg.C, .0 to 95%RH	
			Time :	1000h	
5.3	Low temperature storage (Cold)	$\Delta V1$ +/- 5%	Ambient temp. :	-40+/-2deg.C	
			Time :	1000 h	
5.4	Heat cycle	$\Delta V1$ +/- 5% No outstanding damage	Step	Temp.	Period
			1	- 40+/-3deg.C	30min.
			2	Room Temp.	15min.
			3	+ 125+/-2deg.C	30min.
			4	Room Temp.	15min.
			5 cycles		
5.5	High temperature load (Dry heat load)	$\Delta V1$ +/- 10%	Ambient temp. :	85+/-2deg.C	
			Time :	1000 h	
5.6	Damp heat load	$\Delta V1$ +/- 10%	Ambient condition :	40+/-2deg.C, 90 to 95%RH.	
			Time :	1000 h	
5.7	Impulse life I (Surge life I)	$\Delta V1$ +20% / -0% at listed table 2.	Impulse :	8/20 $\mu$ s	
			Applied condition :	10 <sup>4</sup> times by interval 10s	
5.8	Impulse life II (Surge life II)	$\Delta V1$ +20% / -0% at listed table 2	Impulse :	8/20 $\mu$ s	
			Applied condition :	10 <sup>5</sup> times by interval 10s	
Operating Temperature Range		-40deg.C to + 85deg.C			
Storage Temperature Range		-40deg.C to +125deg.C			

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Characteristics		Test Methods/Description
5.1	High temperature storage (Dry heat)	The specimen shall be subjected to 125+/-2deg.C for 1000 hours in a thermostatic bath without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.2	Damp heat	The specimen shall be subjected to 40+/-2deg.C, 90 to 95%RH for 1000 hours without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.3	Low temperature storage (Cold)	The specimen shall be subjected to - 40+/-2deg.C without load for 1000 hours and then stored at room temperature for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.4	Heat cycle	The temperature cycling shall be repeated 5 times and stored at room temperature and humidity for 1 to 2 hours. The change of Vc as well as mechanical damage shall be examined.
5.5	High temperature load (Dry heat load)	After being continuously applied the maximum allowable voltage at 85+/-2deg.C for 1000 hours, the specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.6	Damp heat load	The specimen shall be subjected to 40+/-2deg.C, 90 to 95%RH and the maximum allowable voltage for 1000 hours and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.7	Impulse life I (Surge life I)	After the specified impulse is applied 10000 times continuously with the interval 10 seconds at room temperature, the specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.8	Impulse life II (Surge life II)	After the specified impulse is applied 100000 times continuously with the interval 10 seconds at room temperature, the specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
Note : Varistor Voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.		

**Individual specifications of Dimensions and Electrical Requirements and Environmental Requirements are indicated below.**

Dimensions : Table 1.1 to 1.3  
Electrical Requirements : Table 2  
Environmental Requirements : Table 2

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Table 1.1 Series E7 Straight Lead Type

品番 Part No.	付図番号 Fig. No.	D max. (mm)	A max. (mm)	T max. (mm)	F +/-1.0 (mm)	L +/-1.0 (mm)	B min. (mm)	C +/-0.4 (mm)	Φd +/- (mm)	<sup>1)</sup> Weight Approx. (g)		
ERZE07A201	付図 1.1 Fig. 1.1	9.0	12.0	5.3	7.5	3.1	20.0	-	0.80 +0.08 -0.05	0.7		
ERZE07A221				5.4		3.3				0.8		
ERZE07A241				5.5		3.3				0.8		
ERZE07A271				5.7		3.5				0.9		
ERZE07A331				6.0		3.8				1.0		
ERZE07A361				6.2		3.9				1.0		
ERZE07A391				6.3		4.0				1.0		
ERZE07A431				6.5		4.1				1.1		
ERZE07A471				6.8		4.3				1.2		
ERZE07A511				7.0		4.5				1.2		
ERZE07A561				7.4		4.8				1.3		
ERZE07A621				10.0		13.0				7.8	5.0	1.4

<sup>1)</sup>参考値, Typical

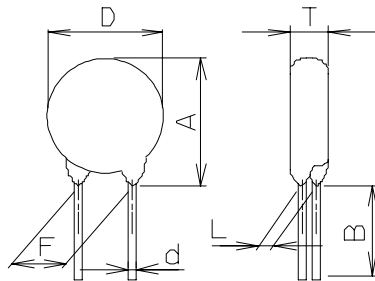


Fig. 1.1

Straight Lead Type

Part No. : ERZE\*\*A

Part No. : ERZE\*\*A CS

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Table 1.2 Series E7 Straight Leads Cut Type

品番 Part No.	付図番号 Fig. No.	D max. (mm)	A max. (mm)	T max. (mm)	F +/-1.0 (mm)	L +/-1.0 (mm)	B +/-1.0 (mm)	C +/-0.4 (mm)	Φd +/- (mm)	<sup>1)</sup> Weight Approx. (g)		
ERZE07A201CS	付図 1.1 Fig. 1.1	9.0	12.0	5.3	7.5	3.1	4.0	-	0.80 +0.08 -0.05	0.7		
ERZE07A221CS				5.4		3.3				0.8		
ERZE07A241CS				5.5		3.3				0.8		
ERZE07A271CS				5.7		3.5				0.9		
ERZE07A331CS				6.0		3.8				1.0		
ERZE07A361CS				6.2		3.9				1.0		
ERZE07A391CS				6.3		4.0				1.0		
ERZE07A431CS				6.5		4.1				1.1		
ERZE07A471CS				6.8		4.3				1.2		
ERZE07A511CS				7.0		4.5				1.2		
ERZE07A561CS				7.4		4.8				1.3		
ERZE07A621CS				10.0		13.0				7.8	5.0	1.4

<sup>1)</sup>参考値, Typical

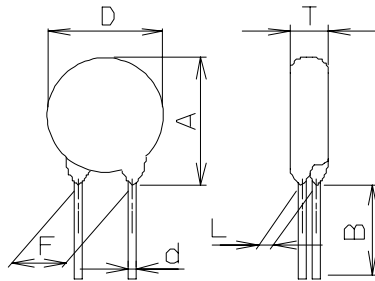


Fig. 1.1

Straight Lead Type

Part No. : ERZE\*\*A

Part No. : ERZE\*\*A CS

Note/Revision



CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	
		16 - 22

Table 1.3 Series E7 Crimped Leads Cut Type

品番 Part No.	付図番号 Fig. No.	D max. (mm)	A max. (mm)	T max. (mm)	F +/-1.0 (mm)	L +/-1.0 (mm)	B +/-1.0 (mm)	C +/-0.4 (mm)	Φd +/- (mm)	<sup>1)</sup> Weight Approx. (g)						
ERZE07B201CS	付図 1.2 Fig. 1.2	9.0	15.0	5.3	7.5	5.0	4.0	1.4	0.80 +0.08 -0.05	0.7						
ERZE07B221CS				5.4						3.3	0.8					
ERZE07B241CS				5.5						3.3	0.8					
ERZE07B271CS				5.7						3.5	0.9					
ERZE07B331CS				6.0						3.8	1.0					
ERZE07B361CS				6.2						3.9	1.0					
ERZE07B391CS				6.3						4.0	1.0					
ERZE07B431CS				6.5						4.1	1.1					
ERZE07B471CS				6.8						4.3	1.2					
ERZE07B511CS				7.0						4.5	1.2					
ERZE07B561CS				7.4						4.8	1.3					
ERZE07B621CS				10.0						16.0	7.8	5.0				1.4

<sup>1)</sup>参考値, Typical

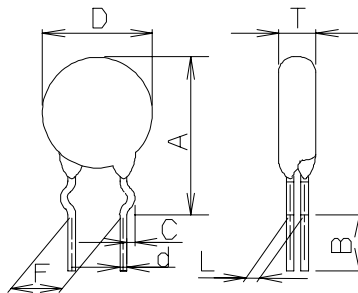


Fig. 1.2

Crimped Leads Cut Type

Part No. : ERZE\*\*B CS

Note/Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	
		17 - 22

Table 2 Series E7

Part Number	Applicable Standards		Electrical													Environmental			
	Abbreviation of Part No.	Authorized Standard	Maximum Allowable Voltage		Rated watt-age	Varistor Voltage (V)	Clamping Voltage		Maximum Peak Current		Maximum Energy		Capacitance (max.)	Dielectric Loss (max.)	Withstand voltage (V)	Impulse Life (Surge Life)			
			ACrms	DC			(V)	x(A)	1 time	2 times	2ms	10/1000 us				(A)	(J)	(A)	(A)
			(V)	(V)															
ERZE07*201++	E7201		130	170	0.25	185 to 225	340	25	2500	1250	19	26	430	10	1500	100	70		
ERZE07*221++	E7221		140	180	0.25	198 to 242	360	25	2500	1250	22	30	410	10	1500	100	70		
ERZE07*241++	E7241		150	200	0.25	216 to 264	395	25	2500	1250	24	33	380	10	1500	100	70		
ERZE07*271++	E7271		175	225	0.25	247 to 303	455	25	2500	1250	28	39	350	10	1500	100	70		
ERZE07*331++	E7331		210	270	0.25	297 to 363	545	25	2500	1250	32	44	300	10	1500	100	70		
ERZE07*361++	E7361		230	300	0.25	324 to 396	595	25	2500	1250	36	50	300	10	1500	100	70		
ERZE07*391++	E7391		250	320	0.25	351 to 429	650	25	2500	1250	38	53	300	10	1500	100	70		
ERZE07*431++	E7431		275	350	0.25	387 to 473	710	25	2500	1250	43	60	270	10	1500	100	70		
ERZE07*471++	E7471		300	385	0.25	423 to 517	775	25	2500	1250	47	65	230	10	1500	100	70		
ERZE07*511++	E7511		320	410	0.25	459 to 561	845	25	2500	1250	50	70	210	10	1500	100	70		
ERZE07*561++	E7561		350	450	0.25	504 to 616	930	25	2500	1250	55	75	200	10	1500	100	70		
ERZE07*621++	E7621		385	505	0.25	558 to 682	1025	25	2500	1250	60	80	190	10	1500	100	70		

<sup>1)</sup> Authorized Standard

:UL1449 Ed.3, :UL1449 Ed.3 Type3(or Code-Connected and Direct plug-in), :UL1449 Ed.3 Type2(or Permanently Connected)

:VDE(IEC61051-1, -2, -2-2), :VDE(IEC60950-1 Ed.2 Annex.Q)

Approval number (File No.) of safety regulations are subject to revision without notice. Ask factory for a copy of the latest file No..

Note/Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	
		18 - 22

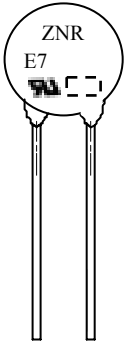
## 6. Marking Contents

Refer to table 3.

Applicable Part No. : ERZE07A□□□, ERZE07A□□□CS, ERZE07B□□□CS

Table 3.

Part Numbers symbol : ++is None or CS.

Part Number 品番	Marking Contents 表示の内容
ERZE07A(B)201++ to ERZE07A(B)621++	ZNR E7
	
部品表示の一例 Example	

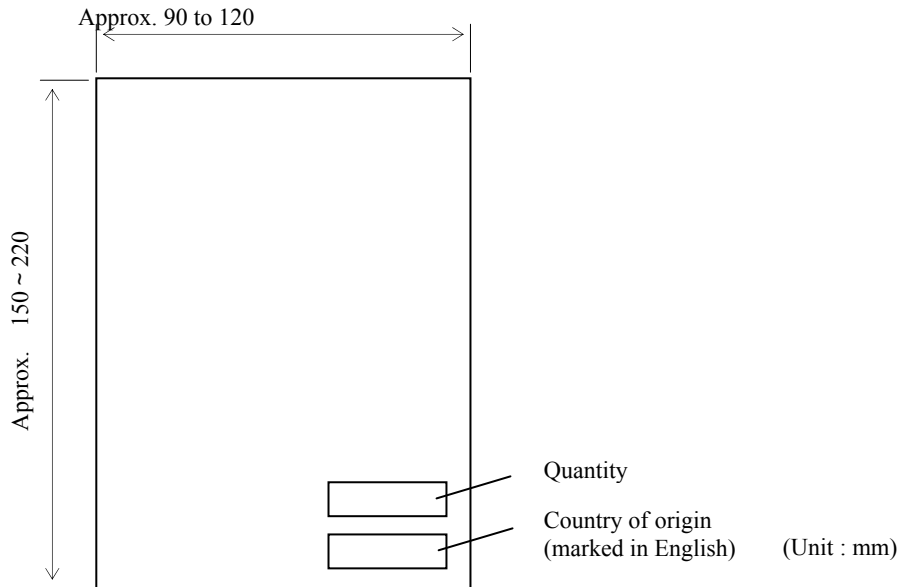
Explanation of the content 内容の説明																															
ZNR	Product Name 品名																														
E7	Registered Part No.(VDE) Type Designation(UL), 登録品番 … Nominal Varistor Voltage 公称バリスタ電圧略称																														
	UL Recognized Component Mark UL 認定マーク																														
	Factory Identification Marking 工場識別コード None 表記なし …Japan 日本国 Q …Indonesia インドネシア																														
	Year Code(example) 年コード(例)																														
	<table border="1"> <tr> <td>2010</td><td>0</td><td>2020</td><td>K</td><td>2030</td><td>0</td> </tr> <tr> <td>2011</td><td>1</td><td>2021</td><td>A</td><td>2031</td><td>1</td> </tr> <tr> <td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td> </tr> <tr> <td>2018</td><td>8</td><td>2028</td><td>H</td><td>2038</td><td>8</td> </tr> <tr> <td>2019</td><td>9</td><td>2029</td><td>J</td><td>2039</td><td>9</td> </tr> </table> <ul style="list-style-type: none"> <li>When the tens digit of Christian era is even number, an alphabetic character (1:A, 2:B...9:J, 0:K, I is excluded.) shall be used for the abbreviation of end of Christian era.</li> <li>西暦年の + の位が偶数年は末尾略称に英字 (1:A, 2: B ... 9:J, 0:K, I を除く)を使用する。</li> <li>When the tens digit of Christian era is odd number, a numeric character (End of Christian era) shall be used for the abbreviation of end of Christian era.</li> <li>西暦年の + の位が奇数年は末尾略称に数字(西暦末尾)を使用する。</li> </ul>	2010	0	2020	K	2030	0	2011	1	2021	A	2031	1	⋮	⋮	⋮	⋮	⋮	⋮	2018	8	2028	H	2038	8	2019	9	2029	J	2039	9
2010	0	2020	K	2030	0																										
2011	1	2021	A	2031	1																										
⋮	⋮	⋮	⋮	⋮	⋮																										
2018	8	2028	H	2038	8																										
2019	9	2029	J	2039	9																										
	Monthly Code 月コード																														
	<table border="1"> <tr> <td>Jan.</td><td>1</td><td>Jul.</td><td>7</td> </tr> <tr> <td>Feb.</td><td>2</td><td>Aug.</td><td>8</td> </tr> <tr> <td>Mar.</td><td>3</td><td>Sep.</td><td>9</td> </tr> <tr> <td>Apr.</td><td>4</td><td>Oct.</td><td>0</td> </tr> <tr> <td>May.</td><td>5</td><td>Nov.</td><td>N</td> </tr> <tr> <td>Jun.</td><td>6</td><td>Dec.</td><td>D</td> </tr> </table>	Jan.	1	Jul.	7	Feb.	2	Aug.	8	Mar.	3	Sep.	9	Apr.	4	Oct.	0	May.	5	Nov.	N	Jun.	6	Dec.	D						
Jan.	1	Jul.	7																												
Feb.	2	Aug.	8																												
Mar.	3	Sep.	9																												
Apr.	4	Oct.	0																												
May.	5	Nov.	N																												
Jun.	6	Dec.	D																												

Note/Revision

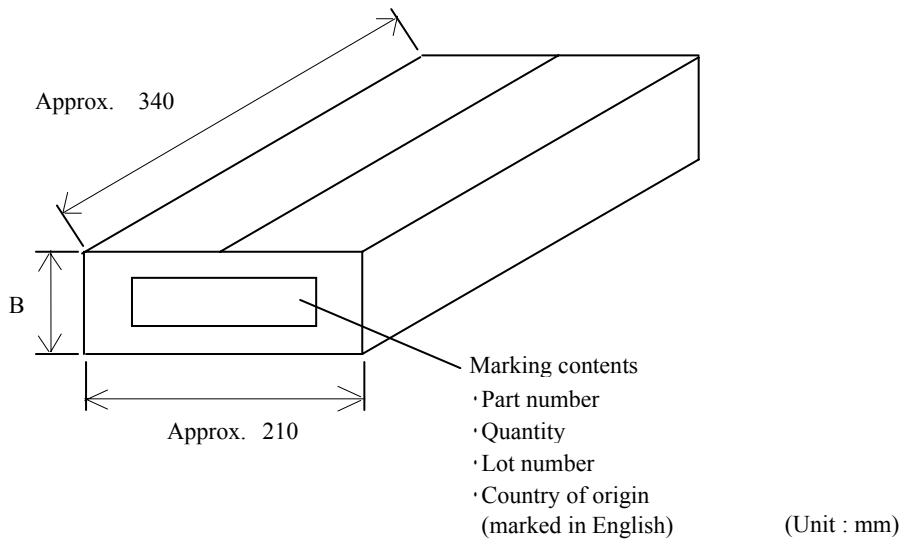
CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	
		19 - 22

### 7. Packing

- 7.1 Packing quantity shall be shown Table 4.
- 7.2 ZNR Surge Absorbers shall be packed in plastic bag, and then packed into carton box.
- 7.3 Dimensions of packing materials and marking on the packing materials shall be shown Fig. 2.1 and Fig. 2.2



**Fig 2.1 Bag**



**Fig 2.2 Carton box**

Note/Revision

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SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	
		20 - 22

Table 4 Series E7  
Part Numbers symbol : \* is A or B

Part Numbers	Quantity in Packing Unit pcs.	Packing Quantity in Carton pcs.	Dimension B (mm)
ERZE07A201 to ERZE07A621	50	3,000	Approx. 110
ERZE07*201CS to ERZE07*3911CS	100	4,000	Approx. 110
ERZE07*431CS to ERZE07*621CS	50	4,000	Approx. 110

Note/Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	
		21 - 22

7.4 Packing Indication Contents of Label

7.4.1 Bar Code Label Specification

Bar code symbology :EIAJ Code39  
 Label size :90.0 mm x 45.0 mm  
 Bar code height :5 mm  
 Bar code dimension  
 Wide element width :0.334 mm  
 Narrow/Wide bar ratio :1:2  
 Inter character gap :0.167 mm  
 Quiet zone :3.81 mm  
 Bar code resolution :11.70 character/inch

7.4.2 Bar Code Contents

Bar Code 1	* 3N 1 Panasonic P/N SP Quantity *	symbols of things
Bar Code 2	* 3N 2 SP Serial No. SP Vender code *	
Bar Code 3	* 1P Panasonic P/N *	

Part No. **ERZE07A221** Quantity 1000 pcs  
**ZNR**  
 MADE IN JAPAN

issued date 2012/04/02 Lot No. **2403GHA33**

**Panasonic** Panasonic Corporation

7.4.3 Constitution of Lot No.

2 4 03 GH A33  
 | | day Fix Consecutive No(ex. A01,A02,...,A99,B01,...)  
 | Month(1,2,...,9,O,N,D)  
 Year(Last digit)

7.4.4 Label Form and Examples (ERZE07A221)



Note/Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Bulk Type)	
		22 - 22

### 8. Country of origin

8.1 Country of origin	Japan	Indonesia
8.2 Factory name	Panasonic Corporation	PT. Panasonic Industrial Devices Batam
8.3 Address	1037-2 Kamiosatsu, Chitose City, Hokkaido 066-8502 Japan	Puri Industrial Park 2000, Batam Centre, Kelurahan Baloi Permai Batam
8.4 Factory Identification Method	Factory Identification Marking : None	Factory Identification Marking : Q

Note/Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	1 - 23
		DATE Aug. 1, 2012

## [PRECAUTIONS FOR HANDLING]

### **⚠️ Precautions for Safety**

In the case that a ZNR surge absorber (Type D, Series E ) (hereafter referred to as the ZNR ,or product name) is used in mounted condition, if an abnormality takes place because of peripheral conditions of the ZNR (material, environments, power source conditions, circuit conditions, etc. in equipment design), fire, electric shock, burn, or product failure may be occur.  
The precautions for this product are described below, understand the content thoroughly before usage.  
For more questions, contact us.

### **1. ⚠️ Precautions to be strictly observe**

#### 1.1 Confirmation of performance ratings

Use the ZNR within its rated range of performance such as the Max. allowable voltage, withstanding surge current, withstanding energy, impulse life (surge life), average pulse power, and operating temperature range. If used outside the range, the ZNR can be degrade and have element fracture, which may result in smoking and ignition.

#### 1.2 To avoid accidents due to unexpected phenomena, take the following measures

1) In the event of fracture of the ZNR, its pieces may scatter ; hence, put the case or cover of the set product in place.

2) Do not install the ZNR near combustible substances (polyvinyl chloride wires, resin moldings, etc.).

If it is difficult to do, install a nonflammable cover.

3) Across-the-line use

When the ZNR is used across a line, put a current fuse in series with the ZNR.

(Refer to Item 2.1, 1) (4) and Table 1.)

4) Use between line to ground

(1) In the case that the ZNR is used between a line to the ground, the short-circuit of the ZNR may not blow the current fuse because of grounding resistance, which may cause smoking and ignition of the ZNR's exterior resin.

As the measure against it, install an earth leakage breaker on the power supply side of the ZNR position.

If no earth leakage breaker is installed, use a thermal fuse together with a current fuse in series.

(Refer to Table 1.)

(2) In the case that the ZNR is used between a live part and metal case, a electric shock may develop at a short circuit of the ZNR ; hence, ground the metal case to the ground or keep it from the human body.

### **2. Application notes**

#### 2.1 Pay attention to the following items to avoid the shortened life and failure of the ZNR

##### 1) Circuit conditions

(1) Select a ZNR of which the maximum voltage including fluctuations in source voltage allows for the maximum permissible circuit voltage. (Refer to Table 1.)

(2) In cases that surges are intermittently applied at short intervals (for example, in the case that the voltage of the noise simulator test is impressed), do not cause them to exceed the ZNR's rated pulse power.

(3) Select a ZNR recommended in Table 1.

##### <1> Across the Line (Line to Line) use

If possible, use a part No. marked with \* incase of voltage temporarily rises load

unbalance of separately-wired loads, short between hot and neutral-line, open of neutral line in single-phase-three-wired system, and due to resonance at switching for a capacitive, inductive load.

Note / Revision



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SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	2 - 23

<2> Used between line to ground

Use a different Part No. from "Across-the-line use" as table 1, because of raising voltage in case of "Line to Ground Fault".

Use a part No. marked with \*\* in table 1, in case of the insulation resistance test (500VDC) for equipment.

When using a part of the varistor voltage that the insulation efficiency examination can not be cleared, there is a case where the surge absorber can be done by removing it from the circuit depending on the circuit condition (Refer examination of Japan Domestic Safety Regulations).

(4) Concerning current fuse

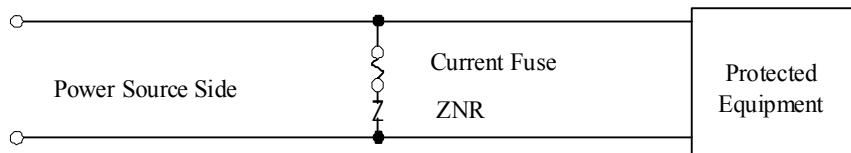
<1> We recommended to selecting a ZNR and the rated current of a current fuse as follows.

Finally, please be sure that there is no danger if the ZNR mounted on equipment breaks.

Series	E5	E7	E10
Standard Part Numbers	ERZE05+++	ERZE07+++	ERZE10+++
Fuse rated current	5A max.	7A max.	10A max.

\* Fuses shall use rated voltages appropriate for circuits.

<2> The recommended fuse position is shown in table 1, "Example of ZNR application", however, if the load current of protected equipment is larger than that of the above recommended fuse rated current, install a current fuse at the position shown below.



(5) Concerning thermal fuse

Set a thermal fuse to get high thermal conductivity with ZNR.

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		3 - 23

**Table 1 Example of ZNR application**

Connection example	Measure against across-the-line surge			Measure against surge across the line and between the line and ground		
	DC/AC single-phase			DC/AC single-phase		
	<p style="text-align: center;">f : fuse</p>			<p style="text-align: center;">f : fuse</p>		
	AC 3-phase			AC 3-phase		
<p style="text-align: center;">f : fuse</p>			<p style="text-align: center;">f : fuse</p>			
Example of rating selection	Across the Line (Line to Line) use			Line to Ground use		
	ZNR	Source voltage	Nominal varistor voltage	ZNR	Source voltage	Nominal varistor voltage
	ZNR1 ZNR3	AC100V	201 to 361*	ZNR2 ZNR4	AC100V ~ AC220V	471
		AC120V	241 to 431*			511
		AC200V	471 to 621*			621*
		AC220V	471 to 621*		821**	
		AC240V	511,621*		AC230V ~ AC240V	511
		AC380V	751,821*			621*
			AC380V	112**	821**	

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	4 - 23

2) Operating environments

- (1) The ZNR is designed to use indoors. Do not use it exposed outdoors.
- (2) Do not use the ZNR in places exposed to temperatures beyond the operating temperature range, such as places exposed to sunlight and vicinities of heating equipment.
- (3) Do not use the ZNR in places exposed to high temperatures and high humidity, such as places exposed directly to rain, wind, dew condensation, and vapor.
- (4) Do not use the ZNR in dusty and salty places and atmospheres polluted by corrosive gases.

3) Processing conditions

- (1) Do not wash the ZNR by such solvents (thinner, acetone, etc.) as its exterior resin deteriorates.
- (2) Do not apply a strong vibration, shock (by falling, etc.) to the ZNR, cracking to its exterior resin and element may occur.
- (3) When coating the ZNR with resin (including molding), do not use such resin.
- (4) Do not bend the ZNR lead wires at the position close to its ZNR exterior resin, or apply external force to the position.
- (5) When soldering the ZNR lead wires, follow the recommended condition and do not melt the solder and insulating materials constituting the ZNR.

Type D	Soldering Method	Recommended Condition	Attention
	Flow soldering	260deg.C, within 10sec.	Type D is not Reflow soldering object part.

\*1 When using at the thing except the condition that it is possible to suggest to the above, confirm that there is not a problem.

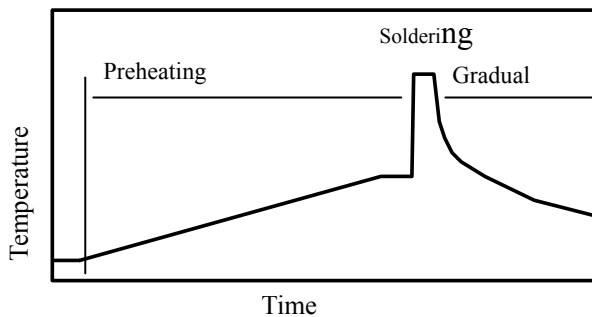
The limit of the repair be once and go in solder temperature within 400deg.C and moreover within 5 seconds.

\*2 Profile be careful because there is a margin of error in the way of measuring.

\*3 The temperature depend on the size and the package density of the substrate.

Therefore, confirm every kind of the substrate.

- Soldering temperature-time profile to recommend



Preheating	The normal 130deg.C	max.120s
Soldering	max.260deg.C	max.10s
Gradual cooling	Gradual cooling	

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	5 - 23
<p>4) Long-term storage</p> <p>(1) Do not store the ZNR under high temperatures and high humidity. Store it at temperature up to 40 degree-C and at humidity below 75%RH, and use it within two years. Before using the ZNR that has been stored for a long period (two year or longer), confirm the Solderability.</p> <p>(2) Avoid atmospheres full of corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc.).</p> <p>(3) Avoid direct sunlight and dew condensation.</p> <p><b>3. Notices</b></p> <p><b>3.1 In cases that the ZNR is used in equipment (aerospace equipment, medical equipment, etc.) requiring extremely high reliability, ask us for selection of part No., and protection coordination, etc. in advance.</b></p> <p><b>3.2 There is possibility that the ZNR will unexpectedly smoke or ignite because of abnormal rise of the circuit voltage and invasion of excessive surge. To prevent that accident from spreading over the equipment and not to expand the damage, use multiplex protection such as the adoption of frame-retardant materials for housing parts and structural parts.</b></p> <p><b>3.3 Package marking includes the product number, quantity, and country of origin. As a rule, country of origin should be indicated in English.</b></p> <p><b>4. Substances of this product</b></p> <p>4.1 This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.</p> <p>4.2 This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) Directive(2002/95/EC).</p> <p>4.3 All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance</p>		
Note / Revision		

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		6 - 23

**[REFERENCE]**

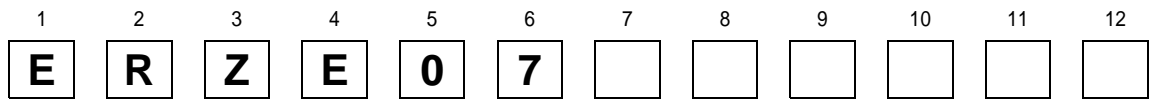
**1. Scope, Part Numbers, Construction**

1.1 Scope

This specification applies to the ZNR Surge Absorbers(Taping Type).

1.2 Part Numbers

Explanation of Part Numbers



**Product Code**

**Series**

**Design no.**

Series	
E05	Series E5
E07	Series E7
E08	Series E8
E10	Series E10
E11	Series E11

Lead Configuration		
symbol	Lead Configuration	Packaging
A	Straight Lead	Bulk
<sup>1)</sup> B	Crimped Lead	Bulk
<sup>2)</sup> E	Straight Lead	Taped
<sup>2)</sup> F	Crimped Lead	Taped

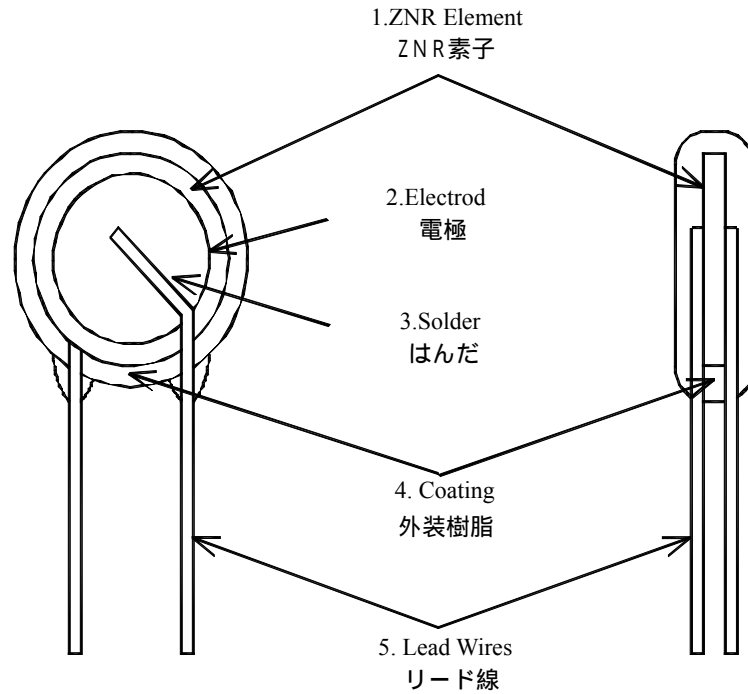
Nominal Varistor Voltage
The first two digits are significant figures and the third one denotes the number of zeros following.

<sup>1)</sup> Cut Type

<sup>2)</sup> Series E5, E7, E8, E10, E11

Note / Revision

1.3 Construction



Item 部品名		Material 材質
1. ZNR Element ZNR素子		ZnO Ceramics etc. 酸化亜鉛 他
2. Electrode 電極		Silver 銀
3. Internal solder material 内部はんだ		Sn-Ag-Cu
4. Coating 外装樹脂		Epoxy Resin (UL94 V-0 Approved) エポキシ樹脂 (UL94 V-0 認定品)
5. Lead Wires リード線	Series : E5,E7 シリーズ : E5,E7	Tin(Sn100%) plated Copper-covered Steel 錫(Sn100%)メッキ銅覆鋼線
	Series : E8,E10,E11,E14 シリーズ : E8,E10,E11,E14	Tin(Sn100%) Plated Copper 錫(Sn100%)メッキ銅線

Note / Revision

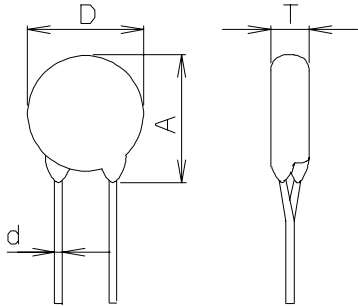
**2. Appearance, Dimensions**

2.1 Appearance

Without dirt and crack, marking should be clear.

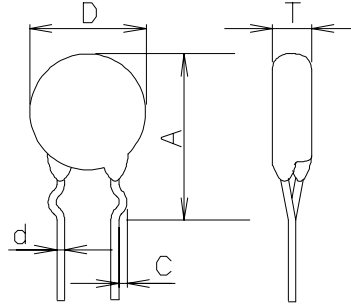
2.2 Dimensions

Refer to Figure 1.1 , 1.2 and table 1.1, 1.2.



**Fig. 1.1 Straight Leads and Taping**

Part No. : ERZE\*\*E

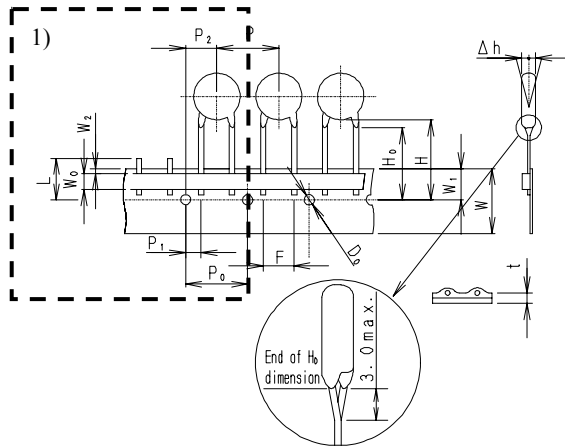


**Fig. 1.2 Crimped Leads and Taping**

Part No. : ERZE\*\*F

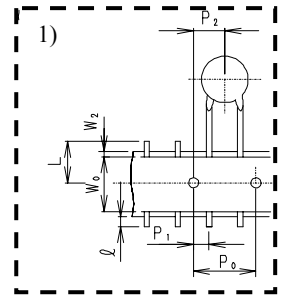
2.3 Taping Dimensions

Refer to Figure 1.3 , 1.4 and table 1.3, 1.4.

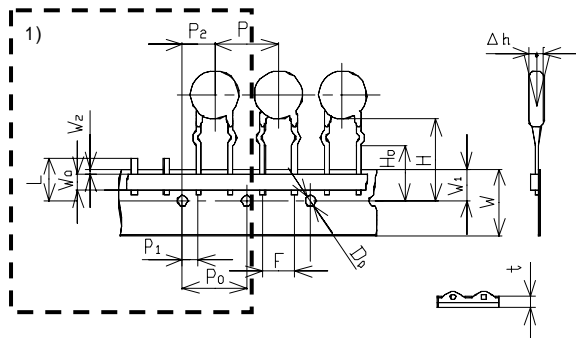


**Fig. 1.3 Straight Leads and taping**

Part No. : ERZE\*\*E□□□

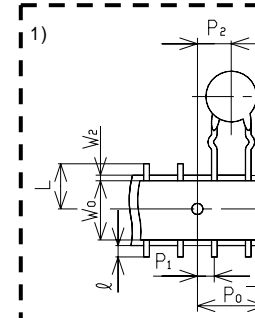


1) There are two types of W<sub>0</sub>.



**Fig. 1.4 Crimped Leads and Taping**

Part No. : ERZE\*\*F□□□



1) There are two types of W<sub>0</sub>.

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	9 - 23

### 3. Electrical Requirements

Listed below of Specifications, Test Specifications, and Test Methods.  
Individual specifications is in the table 2 .

Characteristics		Specifications	Test Specifications
3.1	Max. allowable voltage	AC : Table 2 DC : Table 2	
3.2	Rated wattage	Table 2	
3.3	Varistor voltage	$V_1$ : Table 2	Measuring current : 1mA DC
3.4	Clamping voltage	Table 2	Measuring current : Table 2
			Current Waveform : 8/20 $\mu$ s
3.5	Maximum peak current (Withstanding surge current)	1pulse : Table 2	Impulse : 8/20 $\mu$ s
		2pulse : Table 2	Impulse : 8/20 $\mu$ s at interval 5min
3.6	Maximum energy	Table 2	Impulse : 2ms, 1 pulse
		Table 2	Impulse : 10/1000 $\mu$ s, 1pulse
3.7	Temperature coefficient of varistor voltage	0 to -0.05%/deg.C	Measured voltage : $V_1$
			Temp. range : + 25deg.C to + 85deg.C
3.8	Capacitance	Table 2	Measuring frequency : 1kHz 1MHz (below 100pF)
3.9	Dielectric loss	Table 2	Measuring frequency : 1kHz 1MHz (below 100pF)
3.10	Withstand voltage	No breakdown	Applied voltage : Table 2
			Time : 1min

Note / Revision



CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		10 - 23

Characteristics		Test Methods/Description
	Standard test condition	Environmental conditions under which every measuring is done without doubt on the measuring results. Unless specially, specified, temperature, relative humidity are 5deg.C to 35deg.C, 45 to 85%RH. respectively.
3.1	Maximum allowable voltage	The maximum Sine wave voltage (rms) that can be applied continuously or maximum DC voltage in the specified environmental temperature range.
3.2	Rated wattage	The maximum power to be loaded with in the specified environmental temperature
3.3	Varistor voltage	Voltage between both terminals of ZNR measured when CmA of DC current is applied under standard conditions. It is called Vc. Measuring the varistor voltage should be made promptly to avoid heat affection.
3.4	Clamping voltage	The maximum voltage between two terminals with the specified standard impulse current (8/20 $\mu$ s).
3.5	Maximum peak current (Withstanding surge current)	The maximum current within the varistor voltage change of $\pm 10\%$ with the standard impulse (8/20 $\mu$ s) applied by the specified condition.
3.6	Maximum energy	The maximum energy within the varistor voltage change of $\pm 10\%$ when the specified impulse is applied.
3.7	Temperature coefficient of varistor voltage	Coefficient indicating dependency of varistor voltage on specified temperature.
3.8	Capacitance	Capacitance shall be measured at 1kHz $\pm 10\%$ , 1Vrms max. ( 1MHz $\pm 10\%$ below 100pF ), 0V bias and 20 $\pm 2$ deg.C.
3.9	Dielectric loss	Dielectric loss tangent shall be measured at 1kHz $\pm 10\%$ , 1Vrms max. ( 1MHz $\pm 10\%$ below 100pF ), 0V bias and 20 $\pm 2$ deg.C.
3.10	Withstand voltage	The specified voltage shall be applied both terminals of the specimen connected together and metal foil closely wrapped round its body for 1 minute.

Note : Varistor Voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		11 - 23

#### 4. Mechanical Requirements

Listed below of Specifications, Test Specifications, and Test Methods.

Characteristics		Specifications	Test Specifications	
4.1	Robustness of terminations (Tensile)	No outstanding damage	Force :	9.8N(Series E5,E7,E8,E10,E11) 19.6N(Series E14)
			Time :	10 sec
4.2	Robustness of terminations (Bending)	No outstanding damage	Force :	4.9N(Series E5,E7,E8,E10,E11) 9.8N(Series E14)
4.3	Vibration	No outstanding damage	Frequency :	10 to 55Hz
			Amplitude :	0.75mm
			Time :	each 2 hours
4.4	Solderability	Minimum 95% of the terminals should be covered with solder uniformly	Solder temp. :	235+/-5deg.C
			Immersed time :	2+/-0.5s
4.5	Resistance to soldering heat	$\Delta V_1$ +/- 5%	Solder temp. :	260+/-5deg.C
			Immersed time :	10+/-1sec

Characteristics		Test Methods/Description
4.1	Robustness of terminations (Tensile)	After gradually applying the specified load and keeping the unit fixed for 10 seconds, the terminal shall be visually examined for any damage.
4.2	Robustness of terminations (Bending)	The unit shall be secured with its terminals kept vertical and the specified load is applied, gradually bent by 90° in one direction, back to the original position, then 90° in the opposite direction, and again back to the original position. The damage of the terminals is visually examined.
4.3	Vibration	After repeatedly applying a single harmonic vibration (amplitude ; 0.75mm ; double amplitude ; 1.5mm with 1 minute vibration frequency cycles(10Hz to 55Hz to 10Hz) to each of three perpendicular directions for 2 hours. The varistor shall then be visually examined.
4.4	Solderability	After dipping the terminals to a depth of about 3mm from the body, in the melted solder of 235+/-5deg.C for 2+/-0.5 seconds, the terminals are visually examined.
4.5	Resistance to Soldering Heat	After each lead shall be dipped into a solder bath having a temperature 260+/-5deg.C to a point 2.0 ~ 2.5mm from the body of the unit, be held there for specified time, and then be stored at room temperature and humidity for 1 to 2 hour. The change of Vc and mechanical damages are examined.

Note : Varistor Voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	12 - 23

### 5. Environmental Requirements

Listed below of Specifications, Test Specifications, and Test Methods.  
Individual specifications is in the table 2 .

Characteristics		Specifications	Test Specifications		
5.1	High temperature storage (Dry heat)	$\Delta V1$ +/- 5%	Ambient temp. :	125+/-2deg.C	
			Time :	1000h	
5.2	Damp heat	$\Delta V1$ +/- 5%	Ambient condition :	40+/-2deg.C, .0 to 95%RH	
			Time :	1000h	
5.3	Low temperature storage (Cold)	$\Delta V1$ +/- 5%	Ambient temp. :	-40+/-2deg.C	
			Time :	1000 h	
5.4	Heat cycle	$\Delta V1$ +/- 5% No outstanding damage	Step	Temp.	Period
			1	- 40+/-3deg.C	30min.
			2	Room Temp.	15min.
			3	+ 125+/-2deg.C	30min.
			4	Room Temp.	15min.
			5 cycles		
5.5	High temperature load (Dry heat load)	$\Delta V1$ +/- 10%	Ambient temp. :	85+/-2deg.C	
			Time :	1000 h	
5.6	Damp heat load	$\Delta V1$ +/- 10%	Ambient condition :	40+/-2deg.C, 90 to 95%RH.	
			Time :	1000 h	
5.7	Impulse life I (Surge life I)	$\Delta V1$ +20% / -0% at listed table 2.	Impulse :	8/20 $\mu$ s	
			Applied condition :	10 <sup>4</sup> times by interval 10s	
5.8	Impulse life II (Surge life II)	$\Delta V1$ +20% / -0% at listed table 2	Impulse :	8/20 $\mu$ s	
			Applied condition :	10 <sup>5</sup> times by interval 10s	
Operating Temperature Range		-40deg.C to +85deg.C			
Storage Temperature Range		-40deg.C to +125deg.C			

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		13 - 23

Characteristics		Test Methods/Description
5.1	High temperature storage (Dry heat)	The specimen shall be subjected to 125+/-2deg.C for 1000 hours in a thermostatic bath without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.2	Damp heat	The specimen shall be subjected to 40+/-2deg.C, 90 to 95%RH for 1000 hours without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.3	Low temperature storage (Cold)	The specimen shall be subjected to - 40+/-2deg.C without load for 1000 hours and then stored at room temperature for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.4	Heat cycle	The temperature cycling shall be repeated 5 times and stored at room temperature and humidity for 1 to 2 hours. The change of Vc as well as mechanical damage shall be examined.
5.5	High temperature load (Dry heat load)	After being continuously applied the maximum allowable voltage at 85+/-2deg.C for 1000 hours, the specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.6	Damp heat load	The specimen shall be subjected to 40+/-2deg.C, 90 to 95%RH and the maximum allowable voltage for 1000 hours and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.7	Impulse life I (Surge life I)	After the specified impulse is applied 10000 times continuously with the interval 10 seconds at room temperature, the specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
5.8	Impulse life II (Surge life II)	After the specified impulse is applied 100000 times continuously with the interval 10 seconds at room temperature, the specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.
Note : Varistor Voltage change of forward direction shall be measured in the test of uni-pole surge life and DC load life.		

**Individual specifications of Dimensions and Electrical Requirements and Environmental Requirements are indicated below.**

Dimensions : Table 1.1 to 1.4  
Electrical Requirements : Table 2  
Environmental Requirements : Table 2

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		14 - 23

Table 1.1 Series E7 Straight Leads and Taping

品番 Part No.	付図番号 Fig. No.	D max. (mm)	A max. (mm)	T max. (mm)	C +/-0.4 (mm)	Φd +/- (mm)	<sup>1)</sup> Weight Approx. (g)
ERZE07E201	付図 1.1 Fig. 1.1	9.0	15.0	5.3	-	0.80 +0.08 -0.05	0.7
ERZE07E221				5.4			0.8
ERZE07E241				5.5			0.8
ERZE07E271				5.7			0.9
ERZE07E331				6.0			1.0
ERZE07E361				6.2			1.0
ERZE07E391				6.3			1.0
ERZE07E431				6.5			1.1
ERZE07E471				6.8			1.2
ERZE07E511				7.0			1.2
ERZE07E561				7.4			1.3
ERZE07E621				7.8			1.4

<sup>1)</sup>参考値, Typical

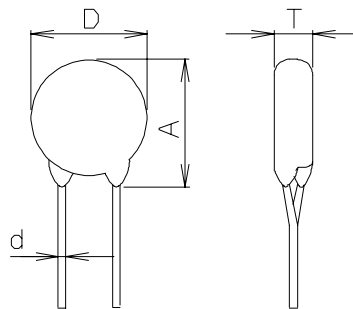


Fig. 1.1 Straight Leads and Taping  
Part No. : ERZE\*\*E

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		15 - 23

Table 1.5 Taping Dimensions Series E7 Straight Leads and Taping

品番 Part No.	P	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	F	Δh	W	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub>	H	H <sub>0</sub> or F <sub>1</sub>	L	ℓ	D <sub>0</sub>	t	
	+/-	+/-	+/-	+/-	+/-	+/-	+/-	min.	+/-	max.	typical	+/-	max.	max.	+/-	+/-	
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	
ERZE07E201	15.0	15.0	3.75	7.5	7.5	0	18.0	5.0	9.0	3.0	Approx. 22	H <sub>0</sub> : 18.0 +2.0 -0.0	11.0	5.0 or 1.0	φ4.0 +0.2 -0.2	0.6 +0.3 -0.3	
ERZE07E221	+1.0	+0.3	+0.70	+1.3	+0.5	+2	+1.0		+0.5								
ERZE07E241	-1.0	-0.3	-0.70	-1.3	-0.5	-2	-0.5		-0.5								
ERZE07E271																	
ERZE07E331																	
ERZE07E361	15.0	15.0	3.75	7.5	7.5	0	18.0	5.0	9.0	3.0	Approx. 22	F <sub>1</sub> : 16.00 +0.75 -0.50	11.0	5.0 or 1.0	φ4.0 +0.2 -0.2	0.6 +0.3 -0.3	
ERZE07E391	+1.0	+0.3	+0.70	+1.3	+0.5	+2	+1.0		+0.5								
ERZE07E431	-1.0	-0.3	-0.70	-1.3	-0.5	-2	-0.5		-0.5								
ERZE07E471																	
ERZE07E511																	
ERZE07E561																	
ERZE07E621																	

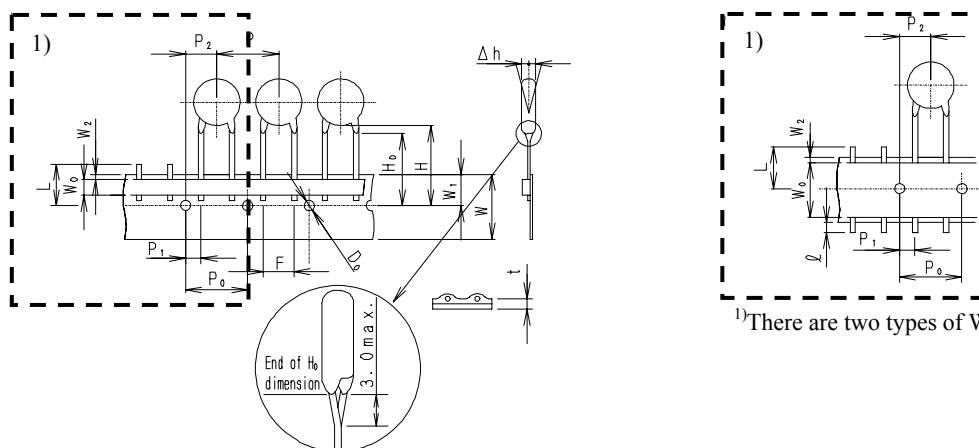


Fig. 1.3 Straight Leads and taping

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		16 - 23

Table 1.2 Series E7 Crimped Leads and Taping

品番 Part No.	付図番号 Fig. No.	D max. (mm)	A max. (mm)	T max. (mm)	C +/-0.4 (mm)	Φd +/- (mm)	<sup>1)</sup> Weight Approx. (g)
ERZE07F201	付図 1.2 Fig. 1.2	9.0	17.0	5.3	1.4	0.80 +0.08 -0.05	0.7
ERZE07F221				5.4			0.8
ERZE07F241				5.5			0.8
ERZE07F271				5.7			0.9
ERZE07F331				6.0			1.0
ERZE07F361				6.2			1.0
ERZE07F391				6.3			1.0
ERZE07F431				6.5			1.1
ERZE07F471				6.8			1.2
ERZE07F511				7.0			1.2
ERZE07F561				7.4			1.3
ERZE07F621				7.8			1.4

<sup>1)</sup>参考値, Typical

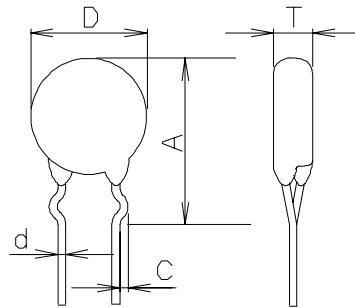


Fig. 1.2 Crimped Leads and Taping

Part No. : ERZE\*\*F

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		17 - 23

Table 1.6 Taping Dimensions Series E7 Crimped Leads and Taping.

品番 Part No.	P	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	F	Δh	W	W <sub>0</sub>	W <sub>1</sub>	W <sub>2</sub>	H	H <sub>0</sub> or F1	L	ℓ	D <sub>0</sub>	t
	+/-	+/-	+/-	+/-	+/-	+/-	+/-	min.	+/-	max.	typical	+/-	max.	max.	+/-	+/-
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
ERZE07F201	15.0	15.0	3.75	7.5	7.5	0	18.0	5.0	9.0	3.0	Approx. 22	H <sub>0</sub> : 16.0 +0.5 -0.5	11.0	5.0 or 1.0	φ4.0 +0.2 -0.2	0.6 +0.3 -0.3
ERZE07F221	+1.0	+0.3	+0.70	+1.3	+0.5	+2	+1.0		+0.5							
ERZE07F241	-1.0	-0.3	-0.70	-1.3	-0.5	-2	-0.5		-0.5							
ERZE07F271																
ERZE07F331																
ERZE07F361																
ERZE07F391																
ERZE07F431																
ERZE07F471																
ERZE07F511																
ERZE07F561																
ERZE07F621																

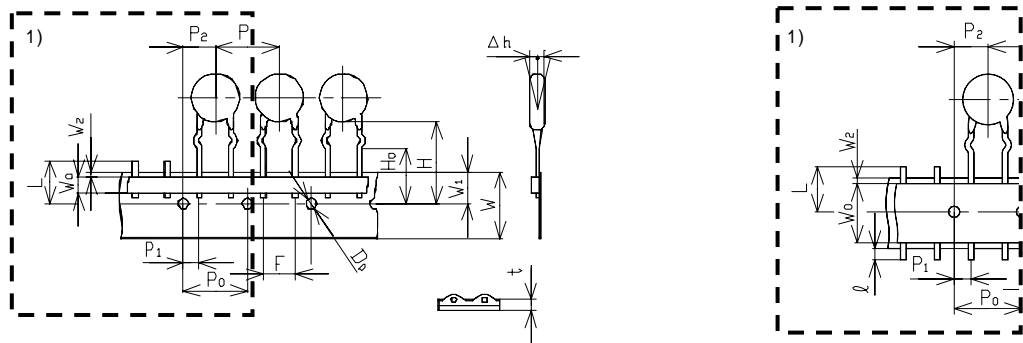


Fig. 1.4 Crimped Leads and Taping

Note / Revision



CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		18 - 23

Table 2 Series E7  
Part Numbers symbol : \* is E or F

Part Number	Applicable Standards		Electrical													Environmental	
	Nominal Part No.	1) Authorized Standard	Maximum Allowable Voltage		Rated watt-age	Varistor Voltage	Clamping Voltage		Maximum Peak Current		Maximum Energy		Capacitance	Di-electric Loss	With-stand voltage	Impulse Life (Surge Life)	
			ACrms	DC			(max.)	1 time	2 times	2ms	10/1000 $\mu$ s	(max.)	(max.)	(max.)	I	II	
			(V)	(V)	(W)	(V)		V <sub>x</sub> A(V)	xA	(A)	(A)	(J)	(J)	1kHz (pF)	1kHz (%)	(V)	(A)
ERZE07*201	E7201		130	170	0.25	185 to 225	340	25	2500	1250	19	26	430	10	1500	100	70
ERZE07*221	E7221		140	180	0.25	198 to 242	360	25	2500	1250	22	30	410	10	1500	100	70
ERZE07*241	E7241		150	200	0.25	216 to 264	395	25	2500	1250	24	33	380	10	1500	100	70
ERZE07*271	E7271		175	225	0.25	247 to 303	455	25	2500	1250	28	39	350	10	1500	100	70
ERZE07*331	E7331		210	270	0.25	297 to 363	545	25	2500	1250	32	44	300	10	1500	100	70
ERZE07*361	E7361		230	300	0.25	324 to 396	595	25	2500	1250	36	50	300	10	1500	100	70
ERZE07*391	E7391		250	320	0.25	351 to 429	650	25	2500	1250	38	53	300	10	1500	100	70
ERZE07*431	E7431		275	350	0.25	387 to 473	710	25	2500	1250	43	60	270	10	1500	100	70
ERZE07*471	E7471		300	385	0.25	423 to 517	775	25	2500	1250	47	65	230	10	1500	100	70
ERZE07*511	E7511		320	410	0.25	459 to 561	845	25	2500	1250	50	70	210	10	1500	100	70
ERZE07*561	E7561		350	450	0.25	504 to 616	930	25	2500	1250	55	75	200	10	1500	100	70
ERZE07*621	E7621		385	505	0.25	558 to 682	1025	25	2500	1250	60	80	190	10	1500	100	70

1) Authorized Standard

:UL1449 Ed.3, :UL1449 Ed.3 Type3(or Code-Connected and Direct plug-in), :UL1449 Ed.3 Type2(or Permanently Connected)

:VDE(IEC61051-1, -2, -2-2), :VDE(IEC60950-1 Ed.2 Annex Q)

Approval number (File No.) of safety regulations are subject to revision without notice. Ask factory for a copy of the latest file No..

Note / Revision

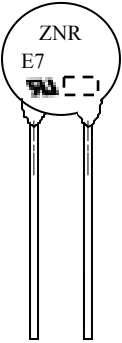
CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	19 - 23

### 6. Marking Contents

Refer to table 3.

Applicable Part No. : ERZE07E□□□,ERZE07F□□□

Table 3

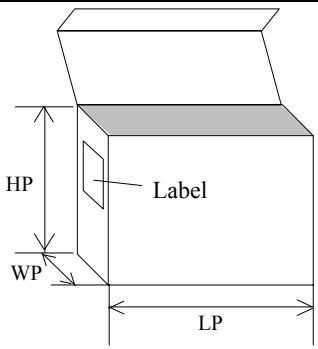
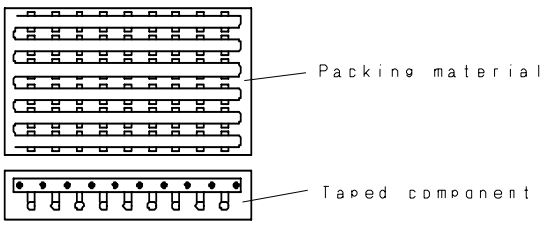
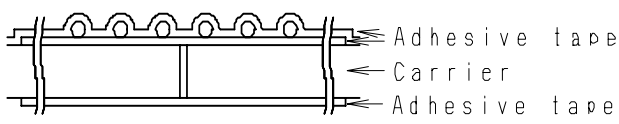
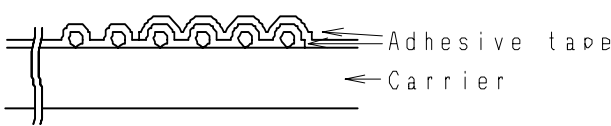
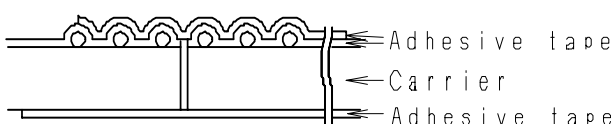
Part Number 品番	Marking Contents 表示の内容
ERZE07E(F)201 to ERZE07E(F)621	ZNR E7
	
<p>部品表示の一例 Example</p>	

Explanation of the content 内容の説明																															
ZNR	Product Name 品名																														
E7	Registered Part No.(VDE) Type Designation(UL), 登録品番 … Nominal Varistor Voltage 公称バリスタ電圧略称																														
	UL Recognized Component Mark UL 認定マーク																														
	Factory Identification Marking 工場識別コード None 表記なし …Japan 日本国 Q …Indonesia インドネシア																														
	Year Code(example) 年コード(例)																														
	<table border="1"> <tr> <td>2010</td><td>0</td><td>2020</td><td>K</td><td>2030</td><td>0</td> </tr> <tr> <td>2011</td><td>1</td><td>2021</td><td>A</td><td>2031</td><td>1</td> </tr> <tr> <td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td> </tr> <tr> <td>2018</td><td>8</td><td>2028</td><td>H</td><td>2038</td><td>8</td> </tr> <tr> <td>2019</td><td>9</td><td>2029</td><td>J</td><td>2039</td><td>9</td> </tr> </table> <ul style="list-style-type: none"> <li>When the tens digit of Christian era is even number, an alphabetic character (1:A, 2:B...9:J, 0:K, I is excluded.) shall be used for the abbreviation of end of Christian era.</li> <li>西暦年の + の位が偶数年は末尾略称に英字 (1:A,2: B ... 9:J,0:K, I を除く)を使用する。</li> <li>When the tens digit of Christian era is odd number, a numeric character (End of Christian era) shall be used for the abbreviation of end of Christian era.</li> <li>西暦年の + の位が奇数年は末尾略称に数字(西暦末尾)を使用する。</li> </ul>	2010	0	2020	K	2030	0	2011	1	2021	A	2031	1	⋮	⋮	⋮	⋮	⋮	⋮	2018	8	2028	H	2038	8	2019	9	2029	J	2039	9
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Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		20 - 23

## 7. Packing

7.1	Packing quantity	Table 4									
7.2	Packing dimensions Marking of box packing		<table border="1"> <tr> <td>LP</td> <td>340 mm max.</td> </tr> <tr> <td>WP</td> <td>55 mm max.</td> </tr> <tr> <td>HP</td> <td>330 mm max.</td> </tr> <tr> <td>Material</td> <td>Corrugated cardboard with thickness of 3.0mm</td> </tr> </table>	LP	340 mm max.	WP	55 mm max.	HP	330 mm max.	Material	Corrugated cardboard with thickness of 3.0mm
			LP	340 mm max.							
WP	55 mm max.										
HP	330 mm max.										
Material	Corrugated cardboard with thickness of 3.0mm										
		<p>Following shall be marked on packing box.</p> <ol style="list-style-type: none"> <li>1. Part number</li> <li>2. Quantity</li> <li>3. Lot number</li> </ol>									
7.3	Packing method	<p>Taped components shall be packed in ammunition packing boxes as shown below. Empty space ceiling part of boxes may be filled with packing material.</p> 									
7.4	Taping conjunction	<p>a) Carrier tape</p> 									
		<p>b) Adhesive tape</p> 									
		<p>c) Both tapes</p> 									
7.5	Tape material	Kraft paper , Adhesive tape									

Note / Revision

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SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
		21 - 23

Table 4 Series E7 Part Numbers symbol : \* is E or F.

Part Numbers	Quantity in Packing Unit pcs	Packing Quantity in Carton pcs.
ERZE07*201 to ERZE07*471	1,000	10,000
ERZE07*511 to ERZE07*621	500	5,000

Note / Revision

CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	22 - 23

7.6 Packing Indication Contents of Label

7.6.1 Bar Code Label Specification

Bar code symbology :EIAJ Code39  
 Label size :90.0 mm x 45.0 mm  
 Bar code height :5 mm  
 Bar code dimension  
 Wide element width :0.334 mm  
 Narrow/Wide bar ratio :1:2  
 Inter character gap :0.167 mm  
 Quiet zone :3.81 mm  
 Bar code resolution :11.70 character/inch

7.6.2 Bar Code Contents

Bar Code 1	* 3N 1 Panasonic P/N SP Quantity *	symbols of things
Bar Code 2	* 3N 2 SP Serial No. SP Vender code *	
Bar Code 3	* 1P Panasonic P/N *	

Part No. **ERZE07E221** Quantity **2000 pcs**  
**ZNR**  
 MADE IN JAPAN

2012/04/02 Lot No. **2403GHA33**  
 issued date

**Panasonic** Panasonic Corporation

7.6.3 Constitution of Lot No.

2 4 02 GH A67  
 | | day Fix Consecutive No(ex. A01,A02,...,A99,B01,...)  
 | Month(1,2,...,9,O,N,D)  
 Year(Last digit)

7.6.4 Label Form and Examples (ERZE07E221)



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CLASSIFICATION	PRODUCT REFERENCE DATA SHEET	
SUBJECT	ZNR SURGE ABSORBER E-SERIES (Taping Type)	
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## 8. Country of origin

8.1 Country of origin	Japan	Indonesia
8.2 Factory name	Panasonic Corporation	PT. Panasonic Industrial Devices Batam
8.3 Address	1037-2 Kamiosatsu, Chitose City, Hokkaido 066-8502 Japan	Puri Industrial Park 2000, Batam Centre, Kelurahan Baloi Permai Batam
8.4 Factory Identification Method	Factory Identification Marking : None	Factory Identification Marking : Q

Note / Revision

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А