

Document	Datasheet
Type	Disk Varistor
Application	Overvoltage Protection
Part No.	D series
Revision	0

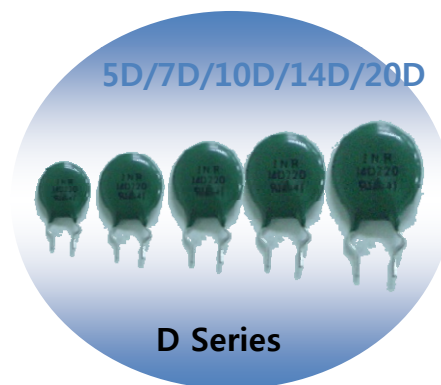
DATASHEET

Applications

- AC/DC Power LINE Overvoltage Protection
- Semiconductor / Solenoid / Switch protection
- Telecommunication Protection

Features

- Wide operating voltage (V1mA : 18~1800V)
- Excellent clamp voltage ratio
- Fast response time to transient overvoltage
- Low stand by power
- Low leakage current
- Symmetric V-I Characteristics
- No derating up to 85°C ambient temperature



AMOTECH

Notes

The contents of this datasheet are subject to change without notice. Please confirm the specifications and delivery conditions when placing your order.



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

1/12

Construction

1. Description
2. Designation Method of Part Number
3. Application Notes(UL)
4. Type and Shape
5. Electrical Spectification
6. Reliability Testing Procesdures
7. Lead Free Profile
8. Making and Illustration
9. Materials Compnent
10. Box Pakage
11. Manufacturer and Place
12. Comment

Advanced Material On Technology



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

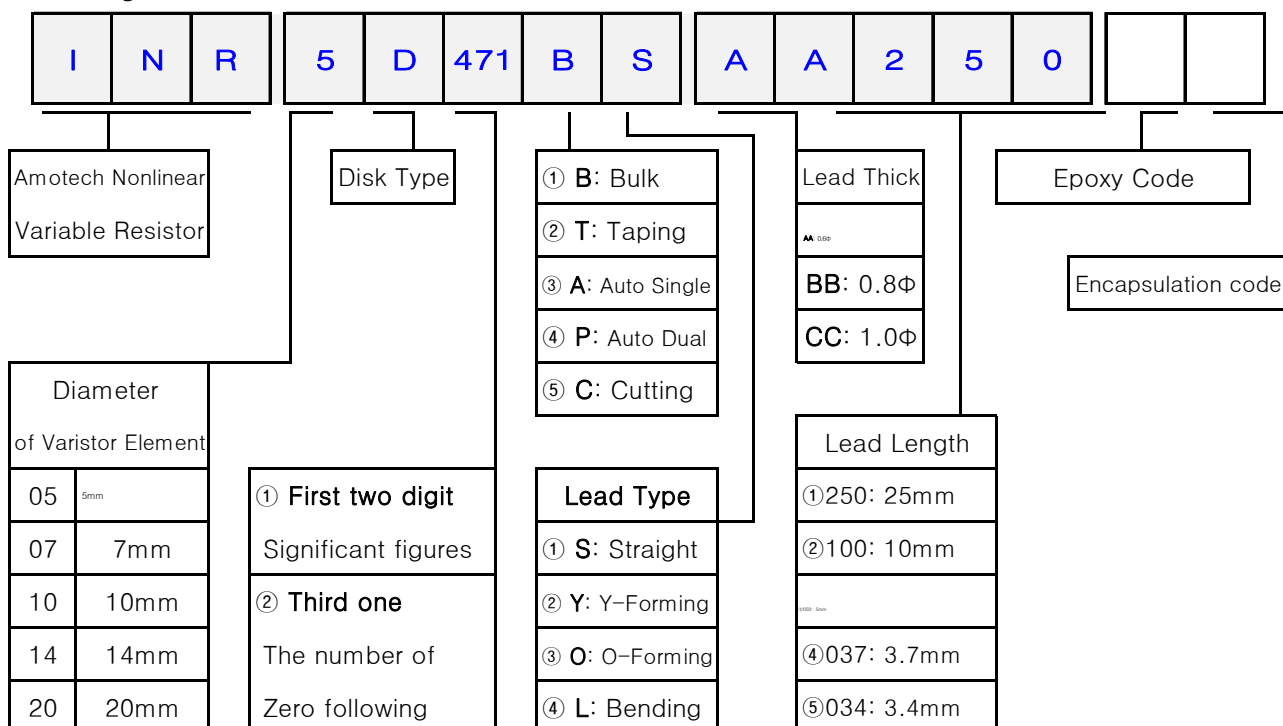
2/12

1. Description

INR Varistor is a non-linear resistance material in which the current varies as a power of the applied voltage.

Voltage sensitive varistor have been used to great advance in many important application in the electrical power communications and electronic industries.

2. Designation Method of Part Number



3. Application Notes for UL and CSA Recognized Components

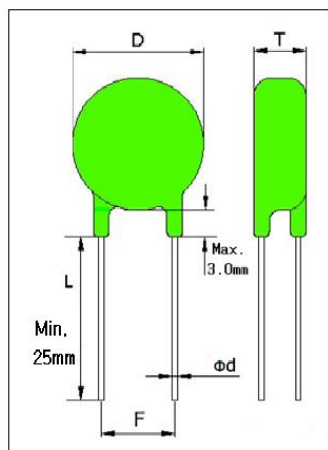
– Related Standards

Standards	File No.	Title
UL	E332687	Component – Transient Voltage Surge Suppressors.
	E121315	Component – Across-the-line capacitors, antenna-coupling and line-by-pass components.
CSA	LR83026-2	Accessories and Patrs for Electronic Products – Metal oxide varistors for across-the-line use on 120Vac nominal systems.
VDE	Re.Nr 114190	Surge suppression Varistors Zinc oxide, disk form, insulated with unidirectional leads.

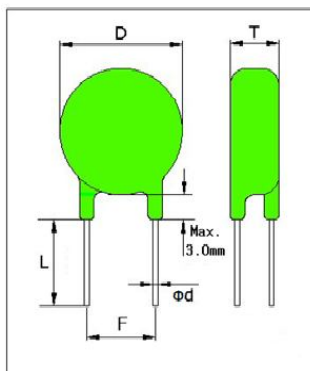
Advanced Material On Technology

4. Type and Shape

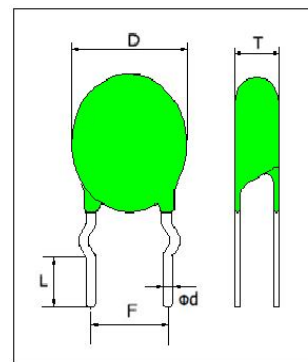
4-1) Bulk-Straight



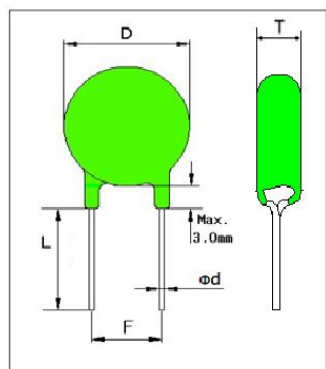
4-2) Cutting Type



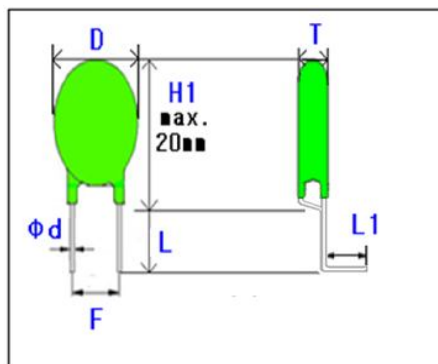
4-3) Cutting Out-Forming



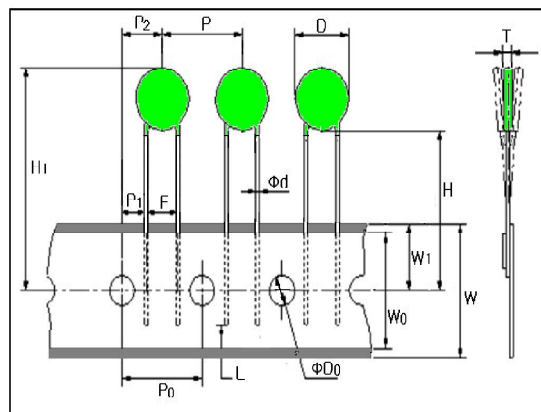
4-4) Cutting Y-Forming



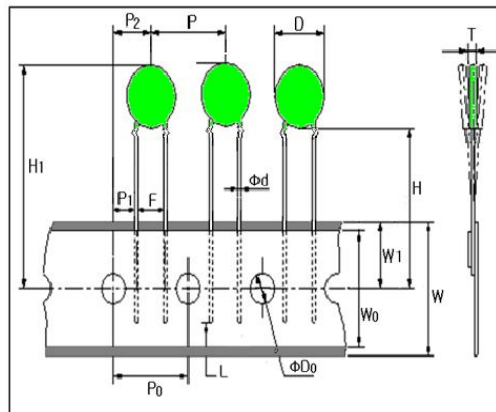
4-5) Bending Type



4-5) Taping Type(Straight & Y-Forming)



4-6) Taping Type(Out-Forming Taping)





SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

4/12

5-1 Electrical Specification : $\Phi 05$ Series

K grade tolerance = $V_n(\text{dc}) \pm 10\%$

Model no.	Varistor Voltage 0.1mA(V)			Max. Continuous Voltage(V)		Max. Clamping Voltage(V)		Power dissipation	Energy (10/1000 μ s)	Peak Current (8/20 μ s)
	Min	VN(DC)	Max.	Vm(ac)	Vm(dc)	Vc(V)	Ip(A)	Ptam(W)	Wtm(J)	Itm(A)
INR5D180K	16	18	20	11	14	40	1	0.01	0.3	100
INR5D220K	20	22	24	14	18	48	1	0.01	0.4	100
INR5D270K	24	27	30	17	22	60	1	0.01	0.5	100
INR5D330K	30	33	36	20	26	73	1	0.01	0.6	100
INR5D390K	35	39	43	25	31	86	1	0.01	0.8	100
INR5D470K	42	47	52	30	38	104	1	0.01	1.0	100
INR5D560K	50	56	62	35	45	123	1	0.01	1.0	100
INR5D680K	61	68	75	40	56	150	1	0.01	1.2	100
INR5D820K	74	82	90	50	65	145	5	0.1	1.7	400
INR5D101K	90	100	110	60	85	175	5	0.1	2.0	400
INR5D121K	108	120	132	75	100	210	5	0.1	2.5	400
INR5D151K	135	150	165	95	125	260	5	0.1	3.0	400
INR5D181K	162	180	198	115	150	315	5	0.1	3.5	400
INR5D201K	180	200	220	130	170	355	5	0.1	4.0	400
INR5D221K	198	220	242	140	180	380	5	0.1	4.5	400
INR5D241K	216	240	264	150	200	415	5	0.1	5.0	400
INR5D271K	243	270	297	175	225	475	5	0.1	6.0	400
INR5D331K	297	330	363	210	275	580	5	0.1	6.5	400
INR5D361K	324	360	396	230	300	620	5	0.1	7.5	400
INR5D391K	351	390	429	250	320	675	5	0.1	8	400
INR5D431K	387	430	473	275	350	745	5	0.1	9	400
INR5D471K	423	470	517	300	385	810	5	0.1	10	400
INR5D511K	459	510	561	320	415	845	5	0.1	10	400
INR5D561K	504	560	616	350	460	925	5	0.1	11	400
INR5D621K	558	620	682	385	505	1,025	5	0.1	11	400

Advanced Material On Technology



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

5/12

5-2. Electrical Specification : Φ07 Series

K grade tolerance = $V_n(\text{dc}) \pm 10\%$

Model no.	Varistor Voltage 1mA(V)			Max. Continuous Voltage(V)		Max. Clamping Voltage(V)		Power dissipation	Energy (10/1000 μ s)	Peak Current (8/20 μ s)
	Min	VN(DC)	Max.	Vm(ac)	Vm(dc)	Vc(V)	Ip(A)	Ptam(W)	Wtm(J)	I _{tm} (A)
INR7D180K	16	18	20	11	14	36	2.5	0.02	0.8	250
INR7D220K	20	22	24	14	18	43	2.5	0.02	0.9	250
INR7D270K	24	27	30	17	22	53	2.5	0.02	1.0	250
INR7D330K	30	33	36	20	26	65	2.5	0.02	1.2	250
INR7D390K	35	39	43	25	31	77	2.5	0.02	1.5	250
INR7D470K	42	47	52	30	38	93	2.5	0.02	1.8	250
INR7D560K	50	56	62	35	45	110	2.5	0.02	2.2	250
INR7D680K	61	68	75	40	56	135	2.5	0.02	2.5	250
INR7D820K	74	82	90	50	65	155	10	0.25	3.5	1,200
INR7D101K	90	100	110	60	85	165	10	0.25	4.0	1,200
INR7D121K	108	120	132	75	100	200	10	0.25	5.0	1,200
INR7D151K	135	150	165	95	125	250	10	0.25	6.0	1,200
INR7D181K	162	180	198	115	150	300	10	0.25	8.0	1,200
INR7D201K	180	200	220	130	170	340	10	0.25	10.0	1,200
INR7D221K	198	220	242	140	180	360	10	0.25	10.0	1,200
INR7D241K	216	240	264	150	200	395	10	0.25	10.0	1,200
INR7D271K	243	270	297	175	225	455	10	0.25	12.0	1,200
INR7D331K	297	330	363	210	275	550	10	0.25	14	1,200
INR7D361K	324	360	396	230	300	595	10	0.25	15	1,200
INR7D391K	351	390	429	250	320	650	10	0.25	17	1,200
INR7D431K	387	430	473	275	350	710	10	0.25	20	1,200
INR7D471K	423	470	517	300	385	775	10	0.25	20	1,200
INR7D511K	459	510	561	320	415	845	10	0.4	20	1,200
INR7D561K	504	560	616	350	460	925	10	0.4	22	1,200
INR7D621K	558	620	682	385	505	1,025	10	0.4	22	1,200
INR7D681K	612	680	748	420	560	1,120	10	0.4	24	1,200
INR7D751K	675	750	825	460	615	1,240	10	0.4	25	1,200
INR7D781K	702	780	858	485	640	1,290	10	0.4	25	1,200
INR7D821K	738	820	902	510	670	1,335	10	0.4	27	1,200

Advanced Material On Technology



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

6/12

5-3. Electrical Specification : $\Phi 10$ Series

K grade tolerance = $V_n(\text{dc}) \pm 10\%$

Model no.	Varistor Voltage 1mA(V)			Max. Continuous Voltage(V)		Max. Clamping Voltage(V)		Power dissipation	Energy (10/1000 μs)	Peak Current (8/20 μs)
	Min	VN(DC)	Max.	Vm(ac)	Vm(dc)	Vc(V)	Ip(A)			
INR10D180K	16	18	20	11	14	36	5	0.05	1.5	500
INR10D220K	20	22	24	14	18	43	5	0.05	2.0	500
INR10D270K	24	27	30	17	22	53	5	0.05	2.5	500
INR10D330K	30	33	36	20	26	65	5	0.05	3.0	500
INR10D390K	35	39	43	25	31	77	5	0.05	3.5	500
INR10D470K	42	47	52	30	38	93	5	0.05	4.5	500
INR10D560K	50	56	62	35	45	110	5	0.05	5.5	500
INR10D680K	61	68	75	40	56	135	5	0.05	6.5	500
INR10D820K	74	82	90	50	65	155	25	0.4	8	2,500
INR10D101K	90	100	110	60	85	165	25	0.4	10	2,500
INR10D121K	108	120	132	75	100	200	25	0.4	12	2,500
INR10D151K	135	150	165	95	125	250	25	0.4	16	2,500
INR10D181K	162	180	198	115	150	300	25	0.4	18	2,500
INR10D201K	180	200	220	130	170	340	25	0.4	20	2,500
INR10D221K	198	220	242	140	180	360	25	0.4	23	2,500
INR10D241K	216	240	264	150	200	395	25	0.4	25	2,500
INR10D271K	243	270	297	175	225	455	25	0.4	30	2,500
INR10D331K	297	330	363	210	275	550	25	0.4	30	2,500
INR10D361K	324	360	396	230	300	595	25	0.4	35	2,500
INR10D391K	351	390	429	250	320	650	25	0.4	40	2,500
INR10D431K	387	430	473	275	350	710	25	0.4	45	2,500
INR10D471K	423	470	517	300	385	775	25	0.4	45	2,500
INR10D561K	504	560	616	350	455	925	25	0.4	45	2,500
INR10D621K	558	620	682	385	505	1,025	25	0.4	45	2,500
INR10D681K	612	680	748	420	560	1,120	25	0.4	45	2,500
INR10D751K	675	750	825	460	615	1,240	25	0.4	50	2,500
INR10D781K	702	780	858	485	640	1,290	25	0.4	50	2,500
INR10D821K	738	820	902	510	670	1,355	25	0.4	55	2,500
INR10D911K	819	910	1,001	550	745	1,500	25	0.4	60	2,500
INR10D102K	900	1,000	1,100	625	825	1,650	25	0.4	65	2,500
INR10D112K	990	1,100	1,210	680	895	1,815	25	0.4	70	2,500

Advanced Material On Technology



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

1900-01-00

REV. NO.

2010. 2. 18

PAGE

7/12

5-4. Electrical Specification : $\Phi 14$ Series

K grade tolerance = $V_n(\text{dc}) \pm 10\%$

Model no.	Varistor Voltage 1mA(V)			Max. Continuous Voltage(V)		Max. Clamping Voltage(V)		Power dissipation	Energy (10/1000 μ s)	Peak Current (8/20 μ s)
	Min	VN(DC)	Max.	Vm(ac)	Vm(dc)	Vc(V)	Ip(A)	Ptam(W)	Wtm(J)	Itm(A)
INR14D180K	16	18	20	11	14	36	10	0.1	3.5	1,000
INR14D220K	20	22	24	14	18	43	10	0.1	4	1,000
INR14D270K	24	27	30	17	22	53	10	0.1	5	1,000
INR14D330K	30	33	36	20	26	65	10	0.1	6	1,000
INR14D390K	35	39	43	25	31	77	10	0.1	7	1,000
INR14D470K	42	47	52	30	38	93	10	0.1	8.5	1,000
INR14D560K	50	56	62	35	45	110	10	0.1	10	1,000
INR14D680K	61	68	75	40	56	135	10	0.1	12	1,000
INR14D820K	74	82	90	50	65	155	50	0.6	14	4,500
INR14D101K	90	100	110	60	85	165	50	0.6	18	4,500
INR14D121K	108	120	132	75	100	200	50	0.6	20	4,500
INR14D151K	135	150	165	95	125	250	50	0.6	25	4,500
INR14D181K	162	180	198	115	150	300	50	0.6	30	4,500
INR14D201K	180	200	220	130	170	340	50	0.6	35	4,500
INR14D221K	198	220	242	140	180	360	50	0.6	40	4,500
INR14D241K	216	240	264	150	200	395	50	0.6	40	4,500
INR14D271K	243	270	297	175	225	455	50	0.6	50	4,500
INR14D331K	297	330	363	210	275	550	50	0.6	60	4,500
INR14D361K	324	360	396	230	300	595	50	0.6	65	4,500
INR14D391K	351	390	429	250	320	650	50	0.6	70	4,500
INR14D431K	387	430	473	275	350	710	50	0.6	75	4,500
INR14D471K	423	470	517	300	385	775	50	0.6	80	4,500
INR14D561K	504	560	616	350	455	925	50	0.6	80	4,500
INR14D621K	558	620	682	385	505	1,025	50	0.6	85	4,500
INR14D681K	612	680	748	420	560	1,120	50	0.6	90	4,500
INR14D751K	675	750	825	460	615	1,240	50	0.6	100	4,500
INR14D781K	702	780	858	485	640	1,290	50	0.6	105	4,500
INR14D821K	738	820	902	510	670	1,355	50	0.6	110	4,500
INR14D911K	819	910	1,001	550	745	1,500	50	0.6	120	4,500
INR14D102K	900	1,000	1,100	625	825	1,650	50	0.6	130	4,500
INR14D112K	990	1,100	1,210	680	895	1,815	50	0.6	140	4,500
INR14D182K	1,620	1,800	1,980	1,000	1,465	2,970	50	0.6	240	4,500

Advanced Material On Technology



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

8/12

5-5. Electrical Specification : $\Phi 20$ Series

K grade tolerance = $V_n(\text{dc}) \pm 10\%$

Model no.	Varistor Voltage 1mA(V)			Max. Continuous Voltage(V)		Max. Clamping Voltage(V)		Power dissipation	Energy (10/1000 μ s)	Peak Current (8/20 μ s)
	Min	VN(DC)	Max.	Vm(ac)	Vm(dc)	Vc(V)	Ip(A)	Ptam(W)	Wtm(J)	Itm(A)
INR20D180K	16	18	20	11	14	36	20	0.2	10	2,000
INR20D220K	20	22	24	14	18	43	20	0.2	13	2,000
INR20D270K	24	27	30	17	22	53	20	0.2	15	2,000
INR20D330K	30	33	36	20	26	65	20	0.2	20	2,000
INR20D390K	35	39	43	25	31	77	20	0.2	24	2,000
INR20D470K	42	47	52	30	38	93	20	0.2	30	2,000
INR20D560K	50	56	62	35	45	110	20	0.2	35	2,000
INR20D680K	61	68	75	40	56	135	20	0.2	40	2,000
INR20D820K	74	82	90	50	65	155	100	1	27	6,500
INR20D101K	90	100	110	60	85	165	100	1	30	6,500
INR20D121K	108	120	132	75	100	200	100	1	40	6,500
INR20D151K	135	150	165	95	125	250	100	1	50	6,500
INR20D181K	162	180	198	115	150	300	100	1	60	6,500
INR20D201K	180	200	220	130	170	340	100	1	70	6,500
INR20D221K	198	220	242	140	180	360	100	1	75	6,500
INR20D241K	216	240	264	150	200	395	100	1	80	6,500
INR20D271K	243	270	297	175	225	455	100	1	90	6,500
INR20D331K	297	330	363	210	275	550	100	1	105	6,500
INR20D361K	324	360	396	230	300	595	100	1	120	6,500
INR20D391K	351	390	429	250	320	650	100	1	130	6,500
INR20S431K	387	430	473	275	350	710	100	1	303	10,000
INR20D471K	423	470	517	300	385	775	100	1	150	6,500
INR20D561K	504	560	616	350	455	925	100	1	150	6,500
INR20D621K	558	620	682	385	505	1025	100	1	150	6,500
INR20D681K	612	680	748	420	560	1,120	100	1	160	6,500
INR20D751K	675	750	825	460	615	1,240	100	1	175	6,500
INR20D781K	702	780	858	485	640	1,290	100	1	180	6,500
INR20D821K	738	820	902	510	670	1,355	100	1	190	6,500
INR20D911K	819	910	1,001	550	745	1,500	100	1	215	6,500
INR20D102K	900	1,000	1,100	625	825	1,650	100	1	230	6,500
INR20D112K	990	1,100	1,210	680	895	1,815	100	1	250	6,500

Advanced Material On Technology



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

9/12

6. Reliability testing Procedures

Term	Test	Test method & Remarks	Specifications
Pulse current capability	I_{max} 8/20 μs	<u>IEC 1051-1, Test 4.5.</u> 1 pulse at maximum peak current	
Energy capability	I_p 10/1,000 μs	<u>IEC 1051-1, Test 4.5.</u> 1 pulse at maxium energy value $E = 1.4 \times V_c \times I_p \times T$ V_c : clamping voltage at peak current I_p : peak current of 10/1,000 μs pulse T : energy duration time.	(a) $\Delta V_{0.1mA}/V_{0.1mA} \leq 10\%$ (b) No visible damage
Environmental reliability	① Thermal shock	Condition for 1 cycle Step 1 : Min. $-40^\circ C$, 30 \pm 3 min. Step 2 : Max. $+85^\circ C$, 30 \pm 3 min. Number of cycles: 5 times	(a) $\Delta V_{0.1mA}/V_{0.1mA} \leq 10\%$ (b) No visible damage
	② Heat resistance	Apply the rated voltage for 1000 \pm 48hrs at $85\pm 3^\circ C$ Remove and place for 24 \pm 2hrs at room temp. condition, then measure.	
	③ Damp Heat (Steady State)	The specimen shall be subjected to $40\pm 2^\circ C$, 90 to 95%RH and the max continuous voltage for 1000 hours and then stored at room temp. and normal humidity for one to two hours.	
	④ High Temperature Storage	The specimen shall be subjected to $125\pm 2^\circ C$ for 1000 hours in a thermostatic bath without load and then stored at room temperature and normal humidity for one to two hours.	
	⑤ Humidity resistance	Place the disk at $40\pm 2^\circ C$ and 90 to 95% humidity for 1000 \pm 24hrs. Remove and place for 24 \pm 2hrs at room temp. condition, then measure.	(a) $\Delta V_{0.1mA}/V_{0.1mA} \leq 5\%$
	⑥ Cold/Low Temperature	The specimen shall be subjected to $-40\pm 2^\circ C$ without load for 1000hours and then stored at room temperature and normal humidity for one to two hours.	(b) No visible damage

Advanced Material On Technology



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

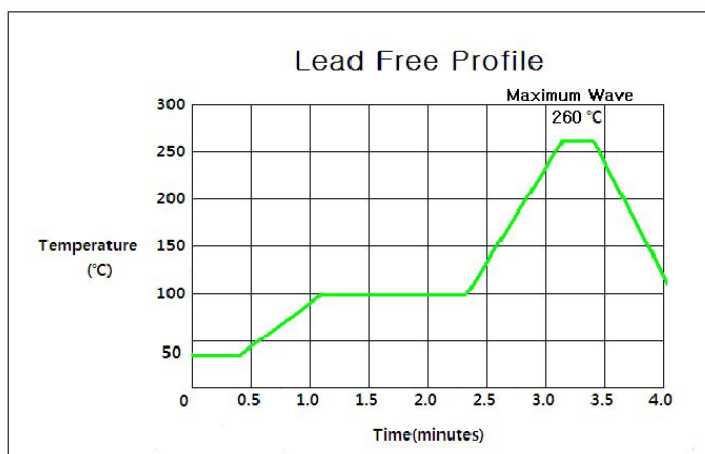
PAGE

10/12

6. Reliability testing Procedures

Term	Test	Test method & Remarks	Specifications
Mechanical Reliability	Solderability	<u>IEC 68-2-58</u> Solder bath method, $260 \pm 10^{\circ}\text{C}$, 2 ± 1 sec	At least 95% of terminal electrode is covered by new solder.
Mechanical Reliability	① Resistance to soldering heat	<u>IEC 68-2-58</u> Solder bath method, $260 \pm 5^{\circ}\text{C}$, $10 \pm 0.5\text{s}$, $270 \pm 5^{\circ}\text{C}$, $3 \pm 0.5\text{s}$	(a) $\Delta V_{0.1\text{mA}}/V_{0.1\text{mA}} \leq 5\%$ (b) No visible damage
	② Terminal Bending strength	<u>IEC 68-2-21</u> Applied force on the terminal (Duration : 5sec) ⇒ 90° bending for any direction ⇒ ordinary position of terminal ⇒ 90° bending for the opposite position ⇒ ordinary position	(a) Strength = 0.5Kg (b) No visible damage
	③ Terminal Tensile strength	<u>IEC 68-2-21</u> Applied force on the terminal to the direction of terminal, Duration : 10 sec	(a) Strength > 1.0 Kg (b) No visible damage

7. Lead Free Profile



* Heat Resistance

1) Temperature: $260 \pm 10^{\circ}\text{C}$

2) Time: 2 ± 1 Sec



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

11/12

8. Marking and Illustration



8-1) Marking

INR

Amotech Varistor

14

Disk size = 14 mm

D

Disk - Type

471

$V_{1mA} = 470V$



UL Mark



CSA Mark

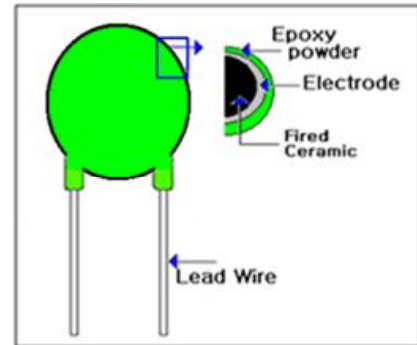


VDE Mark

10A

Production Year & Month

10=2010year, A=1 month



8-2) Illustration

9. Materials Component

9-1) Lead Free Solder

- ① Name: Lead Free Solder
- ② Chemistry Component

Chemical Name	Sn	Ag	Cu	Pb	Sb	Cd
Composition (wt%)	REM	2.8-3.2	0.3-0.7	0.05↓	0.10↓	0.002↓

9-2) Lead Wire

- ① Name: Lead Wire

9-3) Epoxy Powder

- ① Name: Green Powder(Material: Epoxy)



SPECIFICATION

Zinc Oxide Varistors INR

REV. DATE

2010. 2. 18

REV. NO.

0

PAGE

12/12

10. Box Package

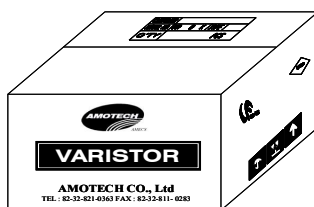
10-1) Cutting Type



355(W)*260(D)*160(T)

Quantity	
Φ05	8,000
Φ07	8,000
Φ10	4,000
Φ14	2,400 / 3,200 / 4,000
Φ20	1,600

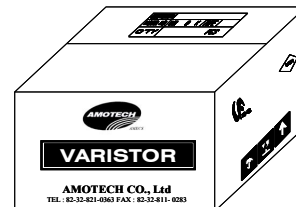
10-2) Bulk Type



355(W)*260(D)*160(T)

Quantity	
Φ05	8,000
Φ07	8,000
Φ10	4,000
Φ14	2,400 / 3,200
Φ20	1,200 / 1,600

10-3) Taping Type



350(W)*300(D)*285(T)

Quantity	
Φ05	10,000
Φ07	5,000 / 7,500
Φ10	4,000 / 4,500 / 5,000
Φ14	4,000
Φ20	—

※ Cutting & Bulk type “INR Varistors” are 200pcs in each Vinyl bag on the box.

(Except: 14D182, 20D Model are 100pcs)

11. Manufacturer and Place

11-1) Manufacture

Amotech Co., Ltd

11-2) Manufacturing Place

No. 101 Wanjie Road, High New Technology Development Area Zibo City,
Sandong Province, P.R. China

12. Comment

We notice your company when we change design,
manufacturing condition and raw material.

Advanced Material On Technology