

# CHIP MULTILAYER VARISTORS

## Features

(Multilayer Varistors)

1. SMD Type Chip Varistors provide highly reliable surface mount application.
2. Wide operating voltage range. ( $V_{W(DC)}=3.5V$  to  $48V$ ).
3. High Transient current capability.
4. Good solderability. (Ni, Sn plating)

## Applications

1. Transient Voltage Protection for IC, Transistor.
2. ESD and I/O Protection.
3. Telecommunication Transient Protection.
4. EFT/Burst protection.

## Ordering Information

$\frac{VA}{(1)}$  -  $\frac{C}{(2)}$   $\frac{2012}{(3)}$  -  $\frac{180}{(4)}$   $\frac{J}{(5)}$   $\frac{J}{(6)}$   $\frac{T}{(7)}$

### (1) Series

- VA : IEC-1000-4-5, Surge( $8/20\mu s$ ,  $10/1000\mu s$ ) protection  
Low voltage(3.5~48V), High capacitance series
- VL : IEC-1000-4-2, ESD( $1/30\mu s$ , Human body model) protection  
Low voltage(180V), Low capacitance series (max. 200pF)
- VH : IEC-1000-4-5, Surge( $10/1000\mu s$ ) protection  
High voltage very low capacitance series

### (6) Termination

J : Nickel barrier

### (7) Packing

- B : Bulk Pack
- T : Tape & Reel ( " 178mm [ 7 inches ] )
- L : Tape & Reel ( " 254mm [ 10 inches ] )

### (2) Material

### (3) Dimensions

- The first two digits : length(mm)
- The last two digits : width(mm)

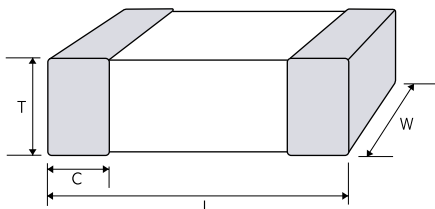
### (4) Maximum continuous working voltage

### (5) Surge Energy

Code	A	B	C	D	E	F	G	H	I	J	K	L
Surge Energy	0.01J	0.02J	0.03J	0.04J	0.05J	0.06J	0.07J	0.08J	0.09J	0.1J	0.2J	0.3J
Code	M	N	O	P	Q	R	S	T	U	V	W	X
Surge Energy	0.4J	0.5J	0.6J	0.7J	0.8J	0.9J	1.0J	1.2J	1.5J	2.0J	2.5J	3.0J

## Shape and Dimensions

unit : mm[inches]



Type	L	W	T(max.)	C(max.)
V - 1005-	1.0 ± 0.05 [.039 ± .002]	0.5 ± 0.05 [.020 ± .002]	0.55 [.022]	0.3 [.012]
V - 1608-	1.6 ± 0.15 [.063 ± .006]	0.8 ± 0.15 [.031 ± .006]	0.95 [.037]	0.5 [.020]
V - 2012-	2.0 ± 0.2 [.079 ± .008]	1.25 ± 0.2 [.049 ± .008]	1.2 [.047]	0.6 [.024]
V - 3216-	3.2 ± 0.2 [.126 ± .008]	1.6 ± 0.2 [.063 ± .008]	1.4 [.055]	0.6 [.028]

## Specifications

### VA series

#### 1005 Series

Part No.	Maximum Ratings				Electrical Characteristics			
	Working Voltage		Rated single Pulse Transient		Varistor voltage @1mA DC		Maximum Clamping Voltage	Typical Capacitance
	AC RMS	DC	Energy 10/1000 $\mu$ s <sup>∧</sup>	peak 8/20 $\mu$ s <sup>∧</sup>	min.	max.	8/20 $\mu$ s <sup>∧</sup>	@1MHz
	Volts	Volts	Joules	Amps	Volts	Volts	Volts	pF
	V <sub>WAC</sub>	V <sub>WDC</sub>	W <sub>s</sub>	I <sub>s</sub>	V <sub>B</sub>		V <sub>C</sub>	C
VA -C1005-5R5E	4.0	5.5	0.05	20	7.6	9.3	15.5	360
VA -C1005-090E	6.4	9.0	0.05	20	11.0	14.0	20.0	230
VA -C1005-140E	10.0	14.0	0.05	20	16.5	20.3	30.0	120
VA -C1005-180E	12.7	18.0	0.05	20	22.9	28.0	40.0	90

\* = V<sub>C</sub>... Maximum Peak voltage at a specified pulse current current and waveform

Energy Rating	Pulse & Waveform
0.05 Joule	1A 8/20 $\mu$ s <sup>∧</sup>

∧ Parts with other electrical characteristics can be provided upon customer ∫ request.

1608 Series

Part No.	Maximum Ratings				Electrical Characteristics				
	Working Voltage		Rated single Pulse Transient		Varistor voltage @1mA DC		Maximum Clamping Voltage	Typical Capacitance	
	AC RMS	DC	Energy 10/1000 $\mu$ s <sup>-1</sup>	peak 8/20 $\mu$ s <sup>-1</sup>	min.	max.	8/20 $\mu$ s <sup>-1</sup>	@1kHz	@1MHz
	Volts	Volts	Joules	Amps	Volts	Volts	Volts	pF	
	V <sub>WAC</sub>	V <sub>WDC</sub>	W <sub>s</sub>	I <sub>s</sub>	V <sub>B</sub>		V <sub>C</sub>	C	
Low Capacitance Series									
VA -C1608-3R5J	2.5	3.5	0.1	30	4.1	6.0	10	1800	1230
VA -C1608-5R5J	4.0	5.5	0.1	30	7.6	9.3	15.5	1000	825
VA -C1608-090J	6.4	9.0	0.1	30	11.0	14.0	20	650	550
VA -C1608-140J	10.0	14.0	0.1	30	16.5	20.3	30	500	424
VA -C1608-180J	12.7	18.0	0.1	30	22.9	28.0	40	275	225
VA -C1608-260J	18.4	26.0	0.1	30	31.0	38.0	58	200	160
VA -C1608-300J	21.3	30.0	0.1	30	37.0	46.0	65	175	150
Very Low Capacitance Series									
VA -C1608-3R5E	2.5	3.5	0.05	20	4.1	6.0	10	430	360
VA -C1608-5R5E	4.0	5.5	0.05	20	7.6	9.3	15.5	300	250
VA -C1608-090E	6.4	9.0	0.05	20	11.0	15.8	20	250	210
VA -C1608-140E	10.0	14.0	0.05	20	16.5	20.3	30	220	180
VA -C1608-180E	12.7	18.0	0.05	20	22.9	28.0	40	187	150
VA -C1608-260E	18.4	26.0	0.05	20	31.0	38.0	58	100	70
VA -C1608-300E	21.3	30.0	0.05	20	37.0	46.0	65	95	60

\* = V<sub>C</sub>... Maximum Peak voltage at a specified pulse current current and waveform

Energy Rating	Pulse & Waveform
0.05 Joule	1A 8/20 $\mu$ s <sup>-1</sup>
0.10 Joule	2A 8/20 $\mu$ s <sup>-1</sup>

† Parts with other electrical characteristics can be provided upon customer † request.

2012 Series

Part No.	Maximum Ratings				Electrical Characteristics					
	Working Voltage		Rated single Pulse Transient		Varistor voltage @1mA DC		Maximum Clamping Voltage	Typical Capacitance		
	AC RMS	DC	Energy 10/1000s`	peak 8/20s`	min.	max.	8/20s`	@1kHz	@1MHz	
	Volts	Volts	Joules	Amps	Volts	Volts	Volts	pF		
	V <sub>WAC</sub>	V <sub>WDC</sub>	W <sub>s</sub>	I <sub>s</sub>	V <sub>B</sub>		V <sub>C</sub>	C		
VA -C2012-3R5L	2.5	3.5	0.3	150	3.7	5.6	10	5500	4000	
VA -C2012-5R5L	4.0	5.5	0.3	150	7.1	8.7	15.5	3500	2400	
VA -C2012-090L	6.4	9.0	0.3	150	11.0	15.8	20	2200	1600	
VA -C2012-140L	10.0	14.0	0.3	150	15.9	19.4	30	1100	820	
VA -C2012-180L	12.7	18.0	0.3	100	22.5	27.5	40	650	500	
VA -C2012-260L	18.4	26.0	0.3	100	30.5	37.3	58	250	190	
VA -C2012-300L	21.3	30.0	0.3	100	37.0	46.0	65	180	130	
Low Capacitance Series										
VA -C2012-3R5J	2.5	3.5	0.1	40	4.1	6.0	10	1300	930	
VA -C2012-5R5J	4.0	5.5	0.1	40	7.6	9.3	15.5	1250	860	
VA -C2012-090J	6.4	9.0	0.1	40	11.0	14.0	20	780	585	
VA -C2012-140J	10.0	14.0	0.1	40	16.5	20.3	30	375	280	
VA -C2012-180J	12.7	18.0	0.1	40	22.9	28.0	40	350	275	
VA -C2012-260J	18.4	26.0	0.1	30	31.0	37.9	58	140	110	
VA -C2012-300J	21.3	30.0	0.1	30	37.0	46.0	65	100	80	
Very Low Capacitance Series										
VA -C2012-3R5E	2.5	3.5	0.05	20	4.1	6.0	10	430	360	
VA -C2012-5R5E	4.0	5.5	0.05	20	7.6	9.3	15.5	300	250	
VA -C2012-090E	6.4	9.0	0.05	20	11.0	15.8	20	250	210	
VA -C2012-140E	10.0	14.0	0.05	20	16.5	20.3	30	220	180	
VA -C2012-180E	12.7	18.0	0.05	20	22.9	28.0	40	187	150	
VA -C2012-260E	18.4	26.0	0.05	20	31.0	38.0	58	100	70	
VA -C2012-300E	21.3	30.0	0.05	20	37.0	46.0	65	95	60	

\* = Vc... Maximum Peak voltage at a specified pulse current current and waveform

Energy Rating	Pulse & Waveform
0.05 Joule	1A 8/20s`
0.10 Joule	2A 8/20s`
0.20-0.30 Joule	5A 8/20s`

; Parts with other electrical characteristics can be provided upon customer ; request.

3216 Series

Part No.	Maximum Ratings				Electrical Characteristics				
	Working Voltage		Rated single Pulse Transient		Varistor voltage @1mA DC		Maximum Clamping Voltage	Typical Capacitance	
	AC RMS	DC	Energy 10/1000 $\mu$ s <sup>∞</sup>	peak 8/20 $\mu$ s <sup>∞</sup>	min.	max.	8/20 $\mu$ s <sup>∞</sup>	@1kHz	@1MHz
	Volts	Volts	Joules	Amps	Volts	Volts	Volts	pF	
	V <sub>WAC</sub>	V <sub>WDC</sub>	W <sub>s</sub>	I <sub>s</sub>	V <sub>B</sub>		V <sub>C</sub>	C	
VA -C3216-3R5M	2.5	3.5	0.4	150	3.7	5.6	10	4700	3800
VA -C3216-5R5M	4.0	5.5	0.4	150	7.1	8.7	15.5	3000	2300
VA -C3216-090M	6.4	9.0	0.4	150	11.0	15.8	20	2000	1650
VA -C3216-140M	10.0	14.0	0.4	150	15.9	19.4	30	1200	900
VA -C3216-180M	12.7	18.0	0.4	120	22.5	27.5	40	800	635
VA -C3216-260M	18.4	26.0	0.4	120	30.5	37.3	58	550	450
VA -C3216-300M	21.3	30.0	0.4	120	37.0	46.0	65	500	400
VA -C3216-480M	34.1	48.0	0.4	100	56.0	68.0	100	225	185
Low Capacitance Series									
VA -C3216-3R5J	2.5	3.5	0.1	40	4.1	6.0	10	2000	1500
VA -C3216-5R5J	4.0	5.5	0.1	40	7.6	9.3	15.5	1200	870
VA -C3216-090J	6.4	9.0	0.1	40	11.0	14.0	20	850	650
VA -C3216-140J	10.0	14.0	0.1	40	16.5	20.3	30	600	500
VA -C3216-180J	12.7	18.0	0.1	30	22.9	28.0	40	350	270
VA -C3216-260J	18.4	26.0	0.1	30	31.0	38.0	58	310	250
Very Low Capacitance Series									
VA -C3216-3R5E	2.5	3.5	0.05	20	4.1	6.0	10	430	360
VA -C3216-5R5E	4.0	5.5	0.05	20	7.6	9.3	15.5	300	250
VA -C3216-090E	6.4	9.0	0.05	20	11.0	15.8	20	250	210
VA -C3216-140E	10.0	14.0	0.05	20	16.5	20.3	30	220	180
VA -C3216-180E	12.7	18.0	0.05	20	22.9	28.0	40	100	70
VA -C3216-260E	18.4	26.0	0.05	20	31.0	38.0	58	95	60

\* = V<sub>C</sub>... Maximum Peak voltage at a specified pulse current current and waveform

Energy Rating	Pulse & Waveform
0.05 Joule	1A 8/20 $\mu$ s <sup>∞</sup>
0.10 Joule	2A 8/20 $\mu$ s <sup>∞</sup>
0.40 Joule	10A 8/20 $\mu$ s <sup>∞</sup>

∞ Parts with other electrical characteristics can be provided upon customer ∞ request.

## VL series

Part No.	Maximum Ratings			Electrical Characteristics		
	Working Voltage	Rated single Pulse Transient		Maximum Clamping Voltage Voltage 8/20 $\mu$ s	Maximum Leakage current	Typical Capacitance @1MHz
	Maximum Working Voltage	Energy 10/1000 $\mu$ s	peak 8/20 $\mu$ s			
	Volts	Joules	Amps	Volts	$\mu$ A	pF
	V <sub>w</sub>	W <sub>s</sub>	I <sub>s</sub>	V <sub>c</sub>	I <sub>L</sub>	C
VL -B1005-180B	18.0	0.02	15	50	30	40
VL -B1608-180E	18.0	0.05	20	50	30	75
VL -B2012-180J	18.0	0.1	30	50	30	100
VL -B3216-180J	18.0	0.1	30	50	30	200

\* = V<sub>c</sub>... Maximum Peak voltage at a specified pulse current current and waveform

Energy Rating      Pulse & Waveform

0.05 Joule          1A 8/20 $\mu$ s

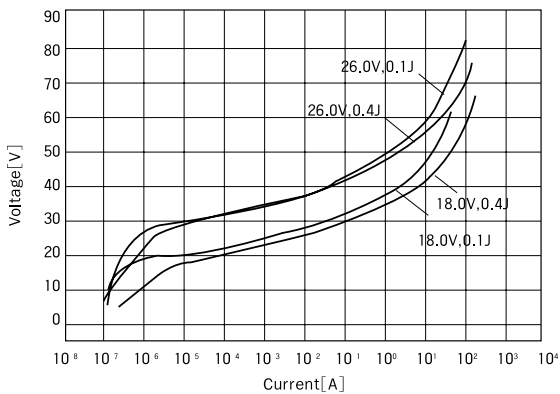
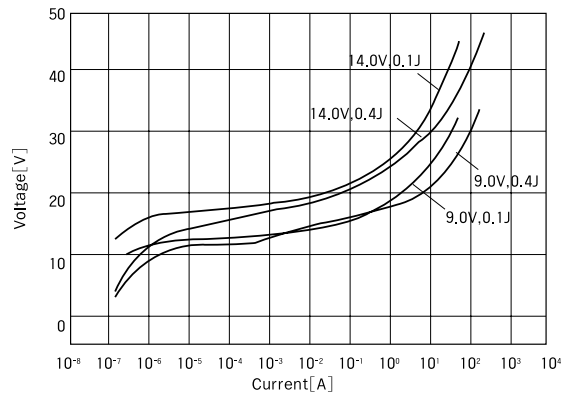
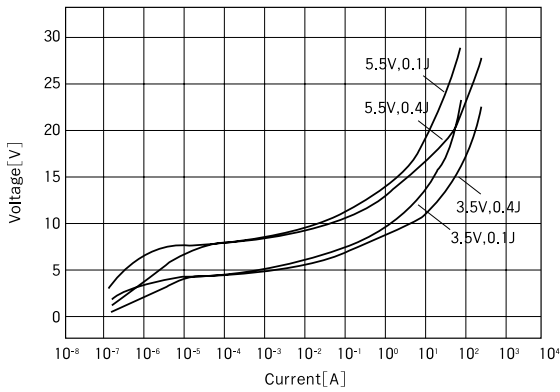
0.10 Joule          2A 8/20 $\mu$ s

⌋ / Typical ESD Failure voltage for CMOS or Bi Polar is ⌋ ~200V

⌋ / Low Capacitance(<200pF) is required for high-speed data transmission

⌋ Parts with other electrical characteristics can be provided upon customer ⌋ request.

### Electrical Characteristics(Typical)



## VM series

### Ordering Information

$\overline{\text{VM}} - \overline{4} \quad \overline{\text{B}} \quad \overline{3216} - \overline{180} \quad \overline{\text{E}} \quad \overline{\text{J}} \quad \overline{\text{T}}$   
 (1) (2) (3) (4) (5) (6) (7) (8)

(1) Varistor Array Series

(2) Configuration

4 : 4Arrays  
2 : 2Arrays

(3) Material

A, B

(4) Diminsions

The first two digits : length(mm)  
The last two digits : width(mm)

(5) Maximum continuous working voltage

(6) Surge Energy Rating

IEC-1000-4-5, Surge(8/20 $\mu$ s, 10/1000 $\mu$ s) protection  
IEC-1000-4-2, ESD(1/30ns) protection

(7) Termination

J : Nickel barrier

(8) Packing

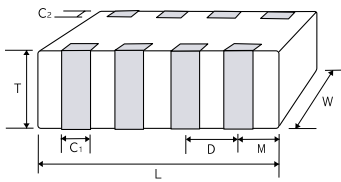
B : Bulk Pack

T : Tape & Reel (1" x 178mm [ 7 inches ])

L : Tape & Reel (1" x 254mm [ 10 inches ])

### Shape and Dimensions

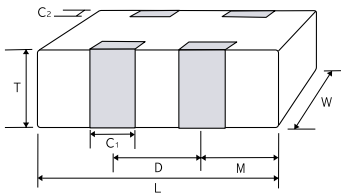
fU4 Array



unit ; mm[inches]

Type	L	W	T	D	C'β	C'	M
VM-4 3216-	3.20±0.20 [.126±.008]	1.60±0.20 [.063±.008]	0.8±0.10 [.031±.004]	0.80±0.10 [.031±.004]	0.40±0.15 [.016±.006]	0.20~0.45 [.008~.018]	0.40±0.10 [.016±.004]
VM-2 2012-	2.0±0.2 [.079±.008]	1.25±0.20 [.049±.008]	[.031±.004]	0.76±0.10 [.030±.004]	0.40±0.15 [.016±.006]	0.10~0.18 [.007~.004]	0.62±0.10 [.024±.008]

fU2 Array



## Specifications

Part No.	Maximum Ratings			Electrical Characteristics				
	Working Voltage	Rated single Pulse Transient		Varistor voltage @1mA DC		Maximum Clamping Voltage	Typical Capacitance	
	DC Working Voltage	Energy 10/1000 $\mu$ s`	peak 8/20 $\mu$ s`	min.	max.	8/20 $\mu$ s`	@1kHz	@1MHz
	Volts	Joules	Amps	Volts	Volts	Volts	pF	
	V <sub>WDC</sub>	W <sub>s</sub>	I <sub>s</sub>	V <sub>B</sub>		V <sub>C</sub>	C	
2-Arrays 2012								
VM -2B2012-5R5J	5.5	0.1	30	6.8	9.3	15.5	825	
VM -2B2012-090J	9.0	0.1	30	10.0	14.0	20	550	
VM -2B2012-140J	14.0	0.1	30	14.7	20.3	30	455	
VM -2B2012-180J	18.0	0.1	30	20.4	28.0	40	225	
VM -2B2012-180E	18.0	0.05	20	N/A		50	<75	
4-Arrays 3216								
VM -4A3216-140E	14.0	0.05	10	15.9	20.3	40	150	
VM -4A3216-180E	18.0	0.05	10	21.5	28.0	50	75	
VM -4A3216-5R5J	5.5	0.1	30	6.8	9.3	15.5	825	
VM -4A3216-090J	9.0	0.1	30	10.0	14.0	20	550	
VM -4A3216-140J	14.0	0.1	30	14.7	20.3	30	425	
VM -4A3216-180J	18.0	0.1	30	20.4	28.0	40	225	
VM -4A3216-180E	18.0	0.05	20	N/A		50	<75	

\* = V<sub>C</sub>... Maximum Peak voltage at a specified pulse current current and waveform

Energy Rating	Pulse & Waveform
0.05 Joule	1A 8/20 $\mu$ s`
0.10 Joule	2A 8/20 $\mu$ s`

\*\* = Capacitance..... Measured at 260kHz

¡ /Typical ESD Failure voltage for CMOS or Bi Polar is ¡ ~200V

¡ /Low Capacitance(<200pF) is required for high-speed data transmission

¡ Parts with other electrical characteristics can be provided upon customer ¡ request.



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## Terms and Descriptions

; / Working DC Voltage (  $V_{W(DC)}$  )

This is the maximum continuous DC voltage which may be applied up to the maximum operating temperature of the device. The rated DC operating voltage (working voltage) is also used as the reference point for leakage current.

This voltage is always less than the breakdown voltage of the device.

; / Working AC Voltage (  $V_{W(DC)}$  )

This is the maximum continuous sinusoidal RMS voltage which may be applied at any temperature up to the maximum operating temperature of the device.

; / Maximum Surge Current (  $I_S$  )

This is the maximum Peak current which may be applied for an 8/20 $\mu$ s impulse, with rated line voltage also applied, without causing device failure. The pulse can be applied to the device in either polarity with the same confidence factor.

; / Maximum Surge Energy (  $W_S$  )

This is the maximum rated transient energy which may be dissipated for a single current pulse at a specified impulse duration (10/100 $\mu$ s) with the rated DC or RMS voltage applied, without causing device failure.

; / Leakage (  $I_L$  ) at Rated DC Voltage

In the nonconduction mode, the device is at a very high impedance (approaching  $10^9 \Omega$ ) and appears as an almost open circuit in the system. The leakage current drawn at this level is very low (<50 $\mu$ A, at ambient temperature).

; / Varistor Voltage (  $V_{B(DC)}$  )

This is the voltage at which the device changes from the off-state to the on-state and enters its conduction mode of operation. The voltage is usually characterized at the 1 $\mu$ A point and has a specified minimum and maximum voltage listed.

; / Clamping Voltage (  $V_C$  )

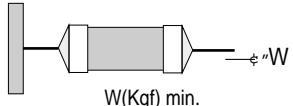
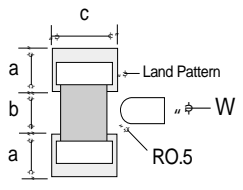
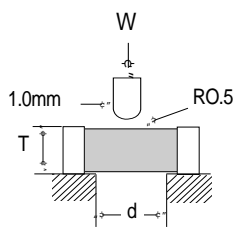
This is the peak voltage appearing across the suppressor when measured at conditions of specified pulse current and specified waveform (8/20 $\mu$ s). It is important to note the peak current and peak voltage may not necessarily be coincidental in time.

; / Capacitance (  $C$  )

This is the capacitance of the device at a specified frequency (1 $\mu$ s) and bias. (1Vp.p).

# RELIABILITY AND TEST CONDITIONS

## CHIP VARISTORS

ITEM	REQUIREMENTS					TEST CONDITION	
	1005	1608	2012	3216	4532		
Operating temp. range	-55 ; ~+125 ;					—	
Storage temp. & humidity range	40 ; max. , 70% RH max.					at packing condition	
Resistance to solder heat	1. No damage such as cracks should be caused in chip element. 2. More than 75% of the terminal electrode shall be covered with new solder.					Preheat temperature : 100 to 150 ; Preheat time : 1min. Solder temperature : 260 ; 10 ; Dipping time : 10 ; 0.5sec.	
Solderability	1. More than 90% of the terminal electrode shall be covered with new solder.					Preheat temperature : 100 to 150 ; Preheat time : 1min. Solder temperature : 230 ; 10 ; Dipping time : 3 ; 1sec.	
Reflow soldering	1. More than 50% of the terminal electrode shall be covered with new solder. 2. Varistor voltage change : ; within 10%					Preheat temperature : 150 ; Preheat time : 1min. Solder temperature : 230 ; Soldering time: 10 sec. max. (Reflow soldering profile)	
Tensile strength (Terminal strength)	1. No mechanical damage					 unit:Kgf (W) W(Kgf) min.	
	W	-	1.0	2.0	2.5		-
Adhesion of terminal electrode (Flexure strength)	1. No mechanical damage						
	unit: mm (a,b,c) , Kgf (W)						
	a	-	1.0	1.0	1.3		1.5
	b	-	0.8	1.0	1.5		3.6
	c	-	1.3	1.3	3.0		3.8
W	-	2.0	4.0	5.0	5.0		
Body strength (Bending strength)	1. The body shall not be damaged by forces applied on the right.						
	unit: mm (d) , Kgf (W)						
	d	-	1.3	1.3	2.0		-
W	-	2.0	3.0	4.0	-		

## CHIP VARISTORS

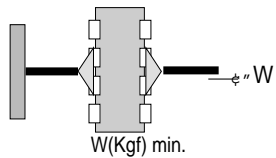
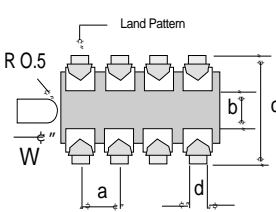
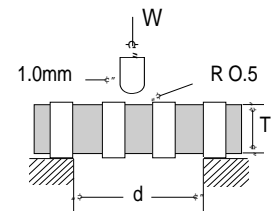
ITEM	REQUIREMENTS					TEST CONDITION
	1005	1608	2012	3216	4532	
Drop	1. No mechanical damage					Drop 10 times on a concrete floor from a height of 91cm.
Vibration	1. No mechanical damage					Frequency : 10-55-10Hz Amplitude : 1.52 mm Direction and time : X,Y,Z directions for 2 hours
Thermal shock (Temperature cycle)	1. No mechanical damage 2. Varistor voltage change : $\pm$ within 10%					Step1. -40 $\pm$ 3 ; 30 $\pm$ 3min. Step2. 85 $\pm$ 3 ; 30 $\pm$ 3min. Number of cycle : 100 times
Heat load resistance	1. No mechanical damage 2. Impedance change : $\pm$ within 10%					Temperature : 85 $\pm$ 2 ; Applied Voltage : Working Voltage Time : 1,000 hours Measured at room ambient temperature after placing for 24 hours
Low temp. resistance	1. No mechanical damage 2. Varistor voltage change : $\pm$ within 10%					Temperature : -40 $\pm$ 5 ; Time : 1,000 hours Measured at room ambient temperature after placing for 24 hours
Humidity resistance	1. No mechanical damage 2. Varistor voltage change : $\pm$ within 10%					Temperature : 40 $\pm$ 2 ; Humidity : 90-95% RH Time : 500 hours Measured at room ambient temperature after placing for 24 hours
Humidity load resistance	1. No mechanical damage 2. Varistor voltage change : $\pm$ within 10%					Temperature : 40 $\pm$ 2 ; Humidity : 90-95% RH Applied Voltage : Working Voltage Time : 500 hours Measured at room ambient temperature after placing for 24 hours

## CHIP VARISTORS

ITEM	REQUIREMENTS					TEST CONDITION
	1005	1608	2012	3216	4532	
Maximum surge current	1. Varistor voltage change : $\pm$ within 10%  IEC 1000-4-5 standard 1.2/50 $\mu$ s - 8/20 $\mu$ s voltage - current combination pulse					Test condition Temperature : 25 $\pm$ 5 Humidity : 30~65% RH Polarity : +, - Number of hit : each 1time Surge pulse : 8/20 $\mu$ s pulse Applied current : maximum surge current(Is)
Maximum surge energy	1. Varistor voltage change : $\pm$ within 10%  IEC 1000-4-5 standard 10/1000 $\mu$ s current pulse					Test condition Temperature : 25 $\pm$ 5 Humidity : 30~65% RH Number of hit : each 1time Surge pulse : 10/1000 $\mu$ s pulse Applied energy : maximum surge energy(Ws)
ESD life	1. No mechanical damage 1. Varistor voltage change : $\pm$ within 10% ESD gun (IEC 1000-4-2 standard) C=150pF R=330 $\Omega$					Discharge : Contact discharge Voltage : 8,000(level 4) Polarity : +, - Number : 10 time in 10 sec.
ESD test	1. No mechanical damage 1. Varistor voltage change : $\pm$ within 10% ESD gun (IEC 1000-4-2 standard) C=150pF R=330 $\Omega$					Discharge : Air discharge Voltage : 25,000V(special level) Polarity : +, - Number : 10 time in 10 sec.

# RELIABILITY AND TEST CONDITIONS

## CHIP VARISTORS ARRAY

ITEM	REQUIREMENTS				TEST CONDITION		
	2 array	4 array					
Operating temp. range	-55 ; ~+125 ;				—		
Storage temp. & humidity range	40 ; max. , 70% RH max.				at packing condition		
Resistance to solder heat	1. No damage such as cracks should be caused in chip element. 2. More than 75% of the terminal electrode shall be covered with new solder.				Preheat temperature : 100 to 150 ; Preheat time : 1min. Solder temperature : 260 ; 10 ; Dipping time : 10 ; 0.5sec.		
Solderability	1. More than 90% of the terminal electrode shall be covered with new solder.				Preheat temperature : 100 to 150 ; Preheat time : 1min. Solder temperature : 230 ; 10 ; Dipping time : 3 ; 1sec.		
Reflow soldering	1. More than 30% of the terminal electrode shall be covered with new solder. 2. Varistor voltage change : ; within 10%				Preheat temperature : 150 ; Preheat time : 1min. Solder temperature : 230 ; Soldering time : 10 sec. max. (Reflow soldering profile)		
Tensile strength (Terminal strength)	1. No mechanical damage						
	W	1.2	1.2	-		-	
Adhesion of terminal electrode (Flexure strength)	1. No mechanical damage						
		unit: mm (a,b,c) , Kgf (W)					
	a	0.8	2.0	0.8		-	-
	b	0.8	0.8	0.8		-	-
	c	2.2	3.0	3.0		-	-
	d	0.4	0.4	0.4		-	-
Body strength (Bending strength)	1. The body shall not be damaged by forces applied on the right.						
		unit: mm (d) , Kgf (W)					
	d	1.3	2.0	2.0		-	-
W	3.0	3.0	3.0	-	-		

## CHIP VARISTORS ARRAY

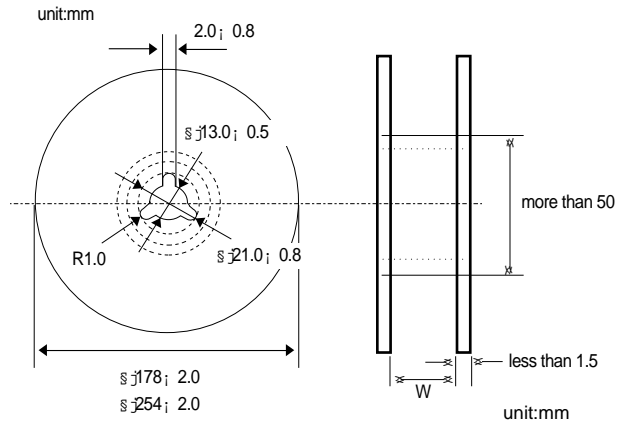
ITEM	REQUIREMENTS				TEST CONDITION
	2 array	4 array			
Drop	1. No mechanical damage				Drop 10 times on a concrete floor from a height of 91cm.
Vibration	1. No mechanical damage				Frequency : 10~55~10Hz Amplitude : 1.52 mm Direction and time : X,Y,Z directions for 2 hours
Thermal shock (Temperature cycle)	1. No mechanical damage 2. Varistor voltage change : ; within 10%				Step1. -40 ; 3 ; 30 ; 3min. Step2. 85 ; 3 ; 30 ; 3min. Number of cycle : 100 times
Heat load resistance	1. No mechanical damage 2. Varistor voltage change : ; within 10%				Temperature : 85 ; 2 ; Applied current : rated current Time : 1,000 hours Measured at room ambient temperature after placing for 24 hours
Low temp. resistance	1. No mechanical damage 2. Varistor voltage change : ; within 10%				Temperature : -40 ; 5 ; Time : 1,000 hours Measured at room ambient temperature after placing for 24 hours
Humidity resistance	1. No mechanical damage 2. Varistor voltage change : ; within 10%				Temperature : 40 ; 2 ; Humidity : 90~95% RH Time : 500 hours Measured at room ambient temperature after placing for 24 hours
Humidity load resistance	1. No mechanical damage 2. Varistor voltage change : ; within 10%				Temperature : 40 ; 2 ; Humidity : 90~95% RH Applied voltage : rated voltage Time : 500 hours Measured at room ambient temperature after placing for 24 hours
Maximum surge current	1. Varistor voltage change : ; within 10%  IEC 1000-4-5 standard 1.2/50 $\mu$ s - 8/20 $\mu$ s voltage - current combination pulse				Test condition Temperature : 25 ; 5 ; Humidity : 30~65% RH Polarity : +, - Number of hit : each 1time Surge pulse : 8/20 $\mu$ s pulse Applied current : maximum surge current(Is)
Maximum surge energy	1. Varistor voltage change : ; within 10%  IEC 1000-4-5 standard 10/1000 $\mu$ s current pulse				Test condition Temperature : 25 ; 5 ; Humidity : 30~65% RH Number of hit : 1time Surge pulse : 10/1000 $\mu$ s pulse Applied current : maximum surge energy(Ws)
ESD life	1. No mechanical damage 1. Varistor voltage change : ; within 10% ESD gun (IEC 1000-4-2 standard) C=150pF R=330 $\Omega$				Discharge : Contact discharge Voltage : 8,000(level 4) Polarity : +, - Number : 10,000 time in 10 sec.
ESD test	1. No mechanical damage 1. Varistor voltage change : ; within 10% ESD gun (IEC 1000-4-2 standard) C=150pF R=330 $\Omega$				Discharge : Air discharge Voltage : 25,000V(special level ) Polarity : +, - Number : 10 time in 10 sec.

# PACKING

## STANDARD QUANTITY

Type	Q <sub>i</sub> (PCS)	REMARKS
0603	15,000	
	10,000	
1005	50,000	BULK CASSETTE
	10,000	
1608	4,000	4mm pitch
	8,000	
2012	3,000	
	7,000	254mm
3216	3,000	
	7,000	254mm
4516	3,000	
4532	1,500	
5750	1,000	

## REEL DIMENSION

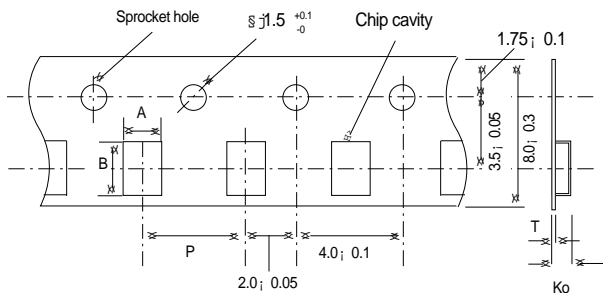


Type	W[mm]
0603, 1005, 1608, 2012, 3216 Array	9.0 ± 0.3
4516, 4532, 5750	13.0 ± 0.3

## TAPING DIMENSION / 8mm wide

Embossing Tape

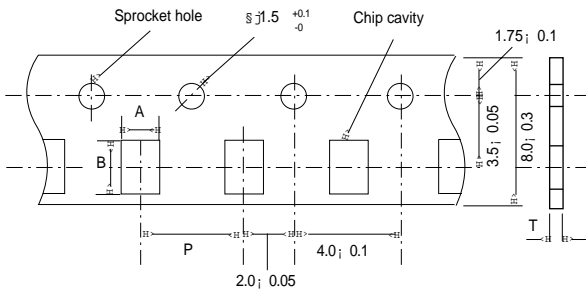
unit:mm



PRODUCT	Type	A <sub>i</sub> 0.1	B <sub>i</sub> 0.1	P <sub>i</sub> 0.1	Ko <sub>i</sub> 0.1	T(max.)
CHIP BEADS	1608	1.00	1.80	4.0	0.95	0.3
CHIP BEADS ARRAY						
CHIP FERRITE INDUCTOR	2012	1.45	2.25	4.0	0.08	0.3
CHIP EMI SUPPRESSION FILTER					1.00	
CHIP EMI FILTER ARRAY	2012	1.90	2.25	4.0	1.35	0.3
CHIP LC FILTER						
CHIP COMMON MODE FILTER	3216	1.90	3.60	4.0	1.00	0.3
CHIP FEEDTHRU						
CHIP VARISTOR	3216	1.90	3.60	4.0	1.35	0.3
CHIP VARISTOR ARRAY						
CHIP SURGE ABSORBER						

; Paper Tape

unit:mm

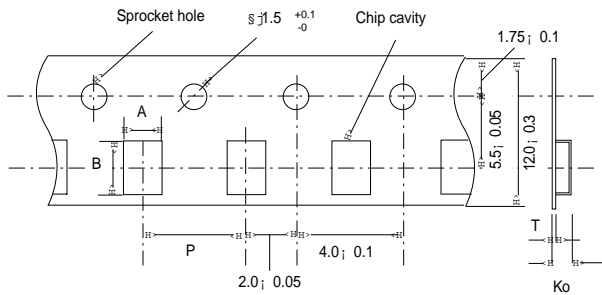


PRODUCT	Type	$A_i \ 0.1$	$B_i \ 0.1$	$P_i \ 0.1$	T(max.)
MICRO INDUCTOR CHIP BEADS CHIP INDUCTOR CHIP VARISTOR CHIP SURGE ARRAY	0603	$0.37 \pm 0.02$	$0.67 \pm 0.02$	$4.0 \pm 0.1$	0.45
	1005	$0.65 \pm 0.1$	$1.15 \pm 0.1$	$2.0 \pm 0.1$	0.8
	1608	$1.00 \pm 0.1$	$1.8 \pm 0.1$	$2.0 \pm 0.1$	1.1

TAPING DIMENSION / 12mm wide

; Embossing Tape

unit:mm

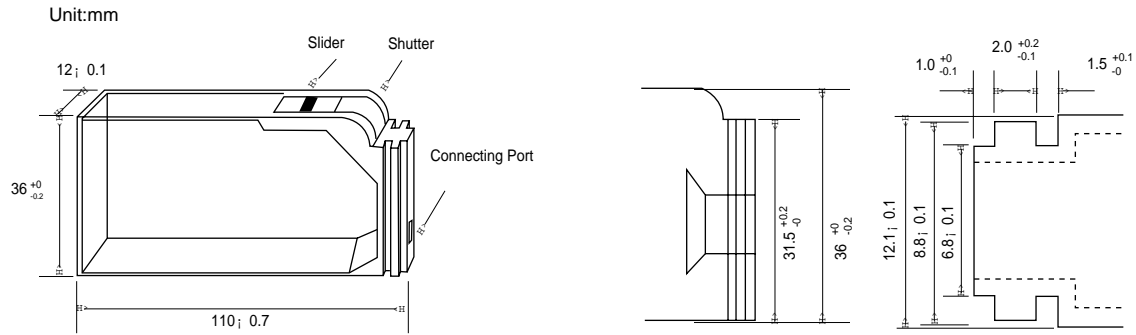


unit ; mm

PRODUCT	Type	$A_i \ 0.1$	$B_i \ 0.1$	$P_i \ 0.1$	$Ko_i \ 0.1$	T(max.)
CHIP BEADS CHIP FEEDTHRU	4516	1.90	4.90	4.0	1.00	0.3
	4516	1.90	4.90	4.0	1.35	0.3
	4532	3.60	4.90	8.0	1.40	0.3
	5750	5.20	6.10	8.0	2.05	0.3

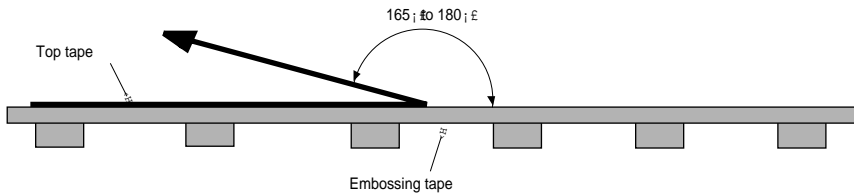


## § 1005 BULK CASSETTE DIMENSION



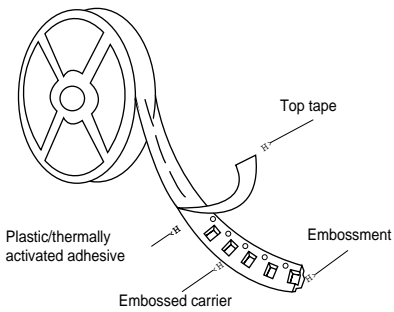
## § TOP TAPE STRENGTH

⌋ The force for tearing off top tape is 20 to 70 grams in the arrow direction.

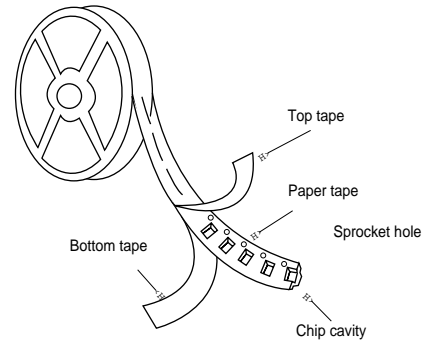


## § TAPING MATERIAL

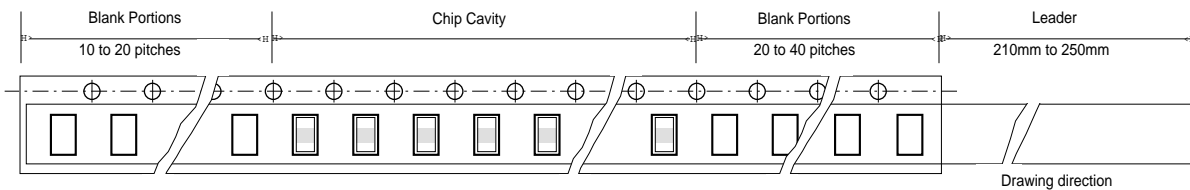
⌋ Embossed Tape



⌋ Paper Tape



## § LEADER AND BLANK PORTION

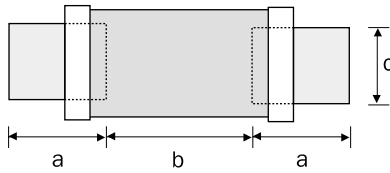


⌋ The pitch holes shift within ⌋ 0.3mm for cumulative 10 pitches.

# LAND PATTERN DESIGN

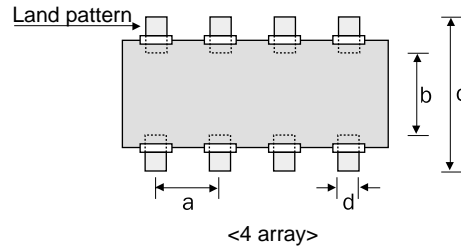
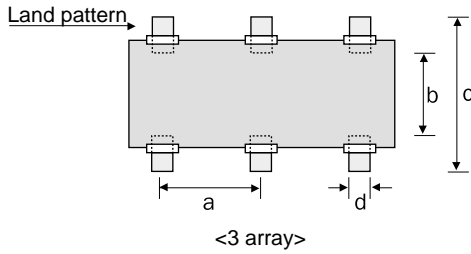
## BEAD, INDUCTOR, VARISTOR, SURGE ABSORBER

unit ; mm



SIZE	a	b	c
0603	0.22	0.25	0.32
1005	0.7	0.4	0.5
1608	1.0	0.6	0.8
2012	1.0	1.0	1.0
3216	1.1	2.2	1.4
4516	1.5	3.0	1.4
4532	1.8	3.0	3.0
5750	2.0	4.0	5.8

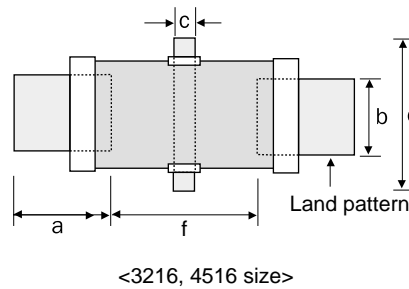
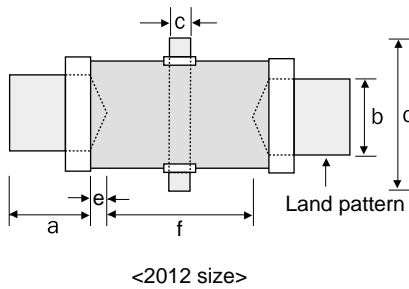
## ARRAY



unit ; mm

SIZE	array	a	b	c	d
3216	3 array	1.0	0.8	3.0	0.5
3216	4 array	0.8	0.8	3.0	0.4

## EMI SUPPRESSION FILTER, LC FILTER, FEEDTHRU CAPACITOR

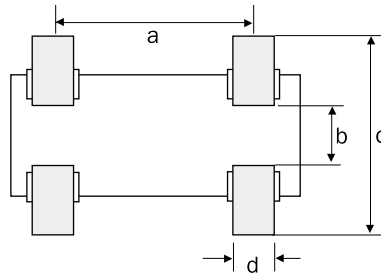


unit ; mm

SIZE	a	b	c	d	e	f
2012	1.0	1.0	0.4	2.0	0.1	1.4
3216	1.1	1.4	0.6	2.4	-	2.4
4516	1.5	1.4	0.8	2.4	-	3.4

# LAND PATTERN DESIGN

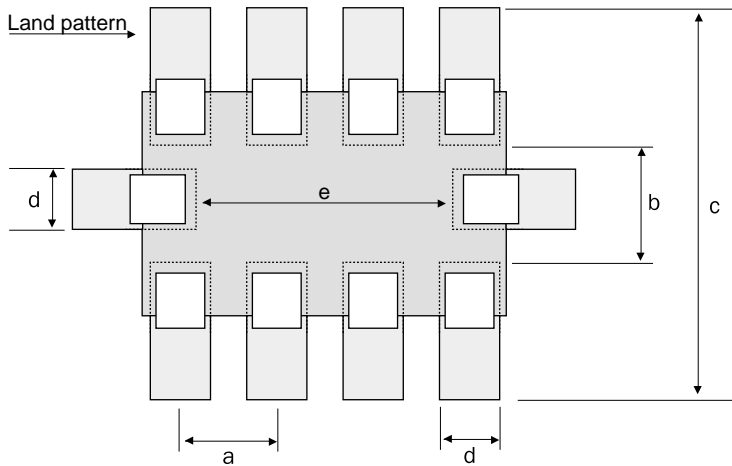
## COMMON MODE FILTER, VARISTOR ARRAY



unit ; mm

SIZE	POLE(Array)	a	b	c	d
2012	2 POLE	1.20	0.60	2.60	0.40
2012	2 Array	0.76	0.38	2.16	0.46
3216	2 POLE	2.10	0.80	3.00	0.60
3216	2 Array	1.96	0.76	2.54	0.90

## EMI FILTER ARRAY

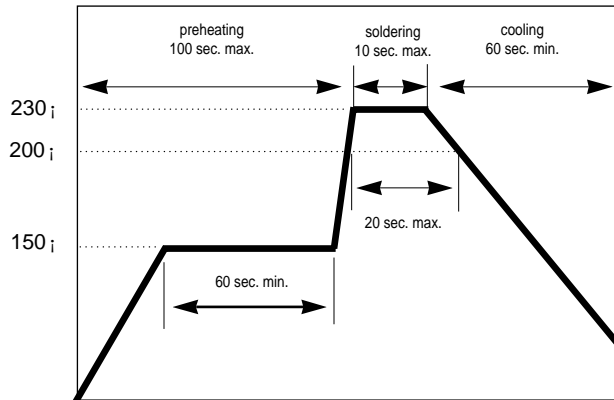


unit ; mm

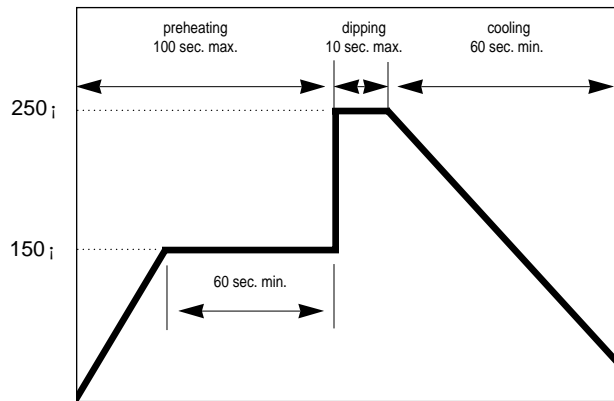
SIZE	POLE(Array)	a	b	c	d	e
3216	4 Array	0.8	0.8	3.0	0.4	2.4

# SOLDERING PROFILE

## REFLOW SOLERING PROFILE



## FLOW SOLDERING PROFILE



## MANUAL SOLDERING

