

## **Ceramic transient voltage suppressors**

SMD multilayer transient voltage suppressors,  
standard series

Series/Type:

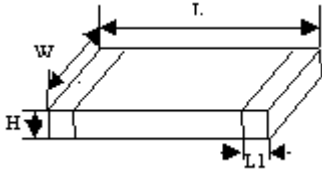
Date: November 2014

## 1 . Standard series

KRVV      1206      G      8R0      N      X      I  
 ①              ②              ③              ④              ⑤              ⑥              ⑦

- ① production series: **DCY** Varistor
- ② size: 1206(3216)
- ③ type: G:general ; E: ESD ; H: high energy
- ④ Varistor voltage ( $V_{1mA}$ ): 390=39V, 8R0=8.0V
- ⑤ end termination: S: Ag/Pd      N: Ag/Ni/Sn
- ⑥ typical capacitance value measured : A:0-5PF, B:5.1-10PF, C:10.1-50pf, D:50.1-100PF, E:100-500PF, X:无容值要求; 201=200pf ,250=25PF,100=10PF,3R0=3PF,0R2=0.2PF
- ⑦ package: T: taping      B: bulk

## 2 . Size



Model	0402(1005)	0603(1608)	0805(2012)	1206(3216)	1210(3225)	1812(4532)	2220(5650)	3220(08CL)	4032(10CL)	4840(12CL)
Length(L)	1.00±0.20	1.60±0.20	2.00±0.20	3.20±0.20	3.20±0.20	4.50±0.20	5.60±0.20	8.00±0.30	10.0±0.30	12.0±0.30
Width(W)	0.50±0.20	0.80±0.20	1.20±0.20	1.60±0.20	2.50±0.20	3.20±0.20	5.00±0.20	5.00±0.30	8.00±0.30	10.0±0.30
High(H)	0.50±0.20	0.80±0.20	0.80±0.20	1.20±0.20	1.20±0.20	1.30±0.20	1.50±0.20	2.00±0.30	2.00±0.30	2.50±0.30
L1	0.30±0.20	0.30±0.20	0.40±0.20	0.40±0.30	0.40±0.30	0.50±0.30	0.80±0.30	0.80±0.30	0.80±0.30	2.50±0.30

### 3 . Electrical specifications and ordering codes

Type: 0402~0805

- Leadless, size 0402~0805
- Multilayer ceramic construction
- Wide operating temperature : -55°C to +125°C
- Fast response ( $\leq 1\text{ns}$ )
- High transient current capability
- Low leakage current

Varistor Part number	Working voltage		Breakdown voltage		Clamping voltage	Transient energy	Peak current	Capacitance
	AC	DC	@1mA DC		8/20 $\mu\text{s}$ 1A	10/100 $\mu\text{s}$	8/20 $\mu\text{s}$	@ 1kHz
	$V_{\text{RMS}}$ (V)	$V_{\text{DC}}$ (V)	$V_{\text{B}}$ (V)		$V_{\text{c}}$ (V)	$E_{\text{T}}$ (J)	$I_{\text{p}}$ (A)	C (pF)
KRVV0402G35R0NXT	2.5	3.3	5	$\pm 10\%$	10	0.02	10	80
KRVV0402G120N121T	4	5.6	12	$\pm 10\%$	55	0.05	10	120
KRVV0403G120N201T	4	5.6	12	$\pm 10\%$	20	0.03	10	200
KRVV0402G120N361T	4	5.6	12	$\pm 10\%$	55	0.05	10	360
KRVV0403G120N481T	4	5.6	12	$\pm 10\%$	20	0.03	10	480
KRVV0603G5R0NXT	2.5	3.3	5	$\pm 10\%$	10	0.10	20	360
KRVV0603G8R0NXT	4	5.6	8	$\pm 10\%$	15.5	0.10	20	270
KRVV0603G120N121T	4	5.6	12	$\pm 10\%$	18	0.10	30	120
KRVV0603G120N251T	4	5.6	12	$\pm 10\%$	18	0.10	30	250
KRVV0603G120N361T	4	5.6	12	$\pm 10\%$	18	0.10	30	360
KRVV0603G120N481T	4	5.6	12	$\pm 10\%$	18	0.10	30	480
KRVV0603G140N551T	6.4	9	14	$\pm 10\%$	26	0.20	30	550
KRVV0603G140N821T	6.4	9	14	$\pm 10\%$	26	0.20	30	820
KRVV0603G270N121T	14	18	27	$\pm 10\%$	40	0.20	30	120
KRVV0603G270N251T	14	18	27	$\pm 10\%$	40	0.20	30	250
KRVV0603G330N121T	18	26	33	$\pm 10\%$	58	0.10	30	120
KRVV0805G8R0NXT	4	5.6	8	$\pm 10\%$	15.5	0.10	30	1200
KRVV0805G120NXT	6	8	12	$\pm 10\%$	25	0.10	30	900
KRVV0805G180NXT	11	14	18	$\pm 10\%$	35	0.10	40	800
KRVV0805G240NXT	14	18	24	$\pm 10\%$	45	0.20	40	600
KRVV0805G270NXT	17	22	27	$\pm 10\%$	58	0.20	40	520
KRVV0805G330NXT	20	26	33	$\pm 10\%$	65	0.20	40	450
KRVV0805G390NXT	25	30	39	$\pm 10\%$	72	0.20	40	400
KRVV0805G470NXT	30	38	47	$\pm 10\%$	81	0.20	40	330
KRVV0805G560NXT	35	45	56	$\pm 10\%$	90	0.20	40	230

Notes:

1. Typical leakage at 25°C < 50uA, maximum leakage 100uA.
2. At normal:  $\Delta C_p \pm 30\%$ , In order to satisfy the applications of customer in various fields, the capacitance range can be designed during manufacturing according to the request, please contact our sales department if needed

**Type: 1206~1812**

- Leadless, size 3216~4532
- Multilayer ceramic construction
- Wide operating temperature : -55°C to +125°C
- Fast response ( $\leq 1\text{ns}$ )
- High transient current capability
- Low leakage current

Varistor Part number	Working voltage		Breakdown voltage		Clamping voltage	Transient energy	Peak current	Capacitance
	AC	DC	@1mA DC		8/20 $\mu\text{s}$ 1A	10/100 $\mu\text{s}$	8/20 $\mu\text{s}$	@ 1kHz
	$V_{\text{RMS}}$ (V)	$V_{\text{DC}}$ (V)	$V_{\text{B}}$ (V)		$V_{\text{C}}$ (V)	$E_{\text{T}}$ (J)	$I_{\text{p}}$ (A)	C (pF)
KRVV1206G8RONXT	4	5.6	8	$\pm 10\%$	15.5	0.02	100	1500
KRVV1206G120NXT	6	8	12	$\pm 10\%$	25	0.02	100	1300
KRVV1206G180NXT	11	14	18	$\pm 10\%$	35	0.02	100	1200
KRVV1206G240NXT	14	18	24	$\pm 10\%$	45	0.02	100	1000
KRVV1206G330NXT	20	26	33	$\pm 10\%$	65	0.20	150	990
KRVV1206G390NXT	25	30	39	$\pm 10\%$	72	0.20	150	950
KRVV1206G470NXT	30	38	47	$\pm 10\%$	81	0.50	180	880
KRVV1206G560NXT	35	45	56	$\pm 10\%$	110	0.50	180	780
KRVV1210G8RONXT	4	5.6	8	$\pm 10\%$	15.5	0.50	100	1600
KRVV1210G120NXT	6	8	12	$\pm 10\%$	25	0.50	100	1600
KRVV1210G180NXT	11	14	18	$\pm 10\%$	35	1.00	200	1500
KRVV1210G240NXT	14	18	24	$\pm 10\%$	45	1.00	200	1500
KRVV1210G270NXT	17	22	27	$\pm 10\%$	58	1.00	200	1500
KRVV1210G330NXT	20	25	33	$\pm 10\%$	65	1.00	200	1400
KRVV1210G390NXT	25	30	39	$\pm 10\%$	72	1.00	200	1300
KRVV1210G470NXT	30	38	47	$\pm 10\%$	81	1.00	200	600
KRVV1210G560NXT	35	45	56	$\pm 10\%$	110	2.00	250	500
KRVV1210G680NXT	40	56	68	$\pm 10\%$	120	2.00	250	400
KRVV1210G101NXT	60	85	100	$\pm 10\%$	165	2.50	200	300
KRVV1812G240NXT	14	18	24	$\pm 10\%$	35	1.00	400	1600
KRVV1812G330NXT	20	26	33	$\pm 10\%$	45	1.00	400	1500
KRVV1812G390NXT	25	30	39	$\pm 10\%$	55	1.00	400	1400
KRVV1812G470NXT	30	38	47	$\pm 10\%$	77	1.00	400	1300
KRVV1812G560NXT	35	45	56	$\pm 10\%$	77	1.00	400	1200
KRVV1812G680NXT	40	56	68	$\pm 10\%$	120	2.00	500	1100
KRVV1812G820NXT	50	65	82	$\pm 10\%$	135	2.00	500	1000
KRVV1812G101NXT	60	85	100	$\pm 10\%$	160	2.00	600	900
KRVV1812G121NXT	75	100	120	$\pm 10\%$	250	2.50	800	800

**Notes:**

1. Typical leakage at 25°C < 50uA, maximum leakage 100uA.
2. In order to satisfy the applications of customer in various fields, the capacitance range can be designed during manufacturing according to the request, please contact our sales department if needed.



**Type: 2220~4840**

- Leadless, size 2220~4840
- Multilayer ceramic construction
- Wide operating temperature : -55°C to +125°C
- Fast response ( $\leq 1\text{ns}$ )
- High transient current capability
- Low leakage current

Varistor Part number	Working voltage		Breakdown voltage		Clamping voltage	Transient energy	Peak current	Capacitance
	AC	DC	@1mA DC		8/20 $\mu\text{s}$ 1A	10/100 $\mu\text{s}$	8/20 $\mu\text{s}$	@ 1kHz
	$V_{\text{RMS}}$ (V)	$V_{\text{DC}}$ (V)	$V_{\text{B}}$ (V)		$V_{\text{c}}$ (V)	$E_{\text{T}}$ (J)	$I_{\text{p}}$ (A)	C (pF)
KRVV2220G240NXT	14	18	24	$\pm 10\%$	38	2.00	600	4000
KRVV2220G330NXT	20	26	33	$\pm 10\%$	45	2.00	600	3500
KRVV2220G390NXT	25	30	39	$\pm 10\%$	55	2.00	600	3000
KRVV2220G470NXT	30	38	47	$\pm 10\%$	77	2.00	600	2500
KRVV2220G560NXT	35	45	56	$\pm 10\%$	85	2.00	600	2000
KRVV2220G121NXT	75	100	120	$\pm 10\%$	200	2.50	600	1000
KRVV3220G121NXT	75	100	120	$\pm 10\%$	200	3.00	500	450
KRVV3220G241NXT	150	200	240	$\pm 10\%$	360	3.00	500	300
KRVV3220G271NXT	175	225	270	$\pm 10\%$	380	3.00	500	250
KRVV3220G391NXT	250	310	390	$\pm 10\%$	650	3.00	500	120
KRVV3220G431NXT	275	350	430	$\pm 10\%$	710	4.50	500	100
KRVV3220G471NXT	300	380	470	$\pm 10\%$	775	5.00	500	80
KRVV4032G121NXT	75	100	120	$\pm 10\%$	200	5.00	500	500
KRVV4032G391NXT	250	300	390	$\pm 10\%$	650	5.00	500	200
KRVV4032G431NXT	275	350	430	$\pm 10\%$	710	5.00	500	160
KRVV4032G471NXT	300	380	470	$\pm 10\%$	775	5.00	500	135
KRVV4840G121NXT	75	100	120	$\pm 10\%$	200	5.00	500	350
KRVV4840G391NXT	250	300	390	$\pm 10\%$	650	5.00	500	320
KRVV4840G431NXT	275	350	430	$\pm 10\%$	710	5.00	500	180
KRVV4840G471NXT	300	380	470	$\pm 10\%$	775	5.00	500	150

**Notes:**

1. Typical leakage at 25°C < 50uA, maximum leakage 100uA.
2. In order to satisfy the applications of customer in various fields, the capacitance range can be designed during manufacturing according to the request, please contact our sales department if needed.
3. The peak current can be adjust according to the request of customer

## ESD Solutions suppressor series

### Electro Static discharge (ESD)

is the transients as short duration excursion.

Our ESD products are based on Multilayer fabrication technology design to suppress ESD events.

Our products meets IEC61000-4-2 standard for Electromagnetic Compliance testing.

We supply extra low capacitance and protect integrated circuits protection

- Fast Response < 0.5nS
- Low Working Voltage 3.3V
- Low Capacitance 2.5pF
- Low Leakage Current < 0.1 uA
- Low Clamping Voltage

Type: 0402~0603

#### ■ Specifications

Varistor Part number	Working voltage		Breakdown voltage		Clamping voltage	Transient energy	Peak current	Capacitance
	AC	DC	@1mA DC		8/20 $\mu$ s 1A	10/100 $\mu$ s	8/20 $\mu$ s	@ 1kHz
	$V_{RMS}$ (V)	$V_{DC}$ (V)	$V_B$ (V)		$V_C$ (V)	$E_T$ (J)	$I_P$ (A)	C (pF)
KRVV0201E120N101T	4	5.5	12	$\pm 10\%$	35	0.01	5	100
KRVV0201E140N150T	9	12	14	$\pm 10\%$	55	0.01	5	15
KRVV0402E6R0N500T	4	5.5	8	$\pm 10\%$	55	0.02	10	50
KRVV0402E8R0N330T	4	5.5	8	$\pm 10\%$	55	0.02	10	33
KRVV0402E140N100T	9	12	14	$\pm 10\%$	55	0.05	10	10
KRVV0402E180N500T	11	14	18	$\pm 10\%$	55	0.05	10	40
KRVV0402E270N150T	14	18	27	$\pm 10\%$	55	0.05	10	15
KRVV0402E101N2R5T		24	100	$\pm 10\%$	198	0.05	10	2.5
KRVV0603E120N500T	4	5	12	$\pm 10\%$	18	0.20	30	50
KRVV0603E270N100T	14	18	27	$\pm 10\%$	50	0.20	30	10
KRVV0603E101N2R5T		24	100	$\pm 10\%$	198	0.20	30	2.5

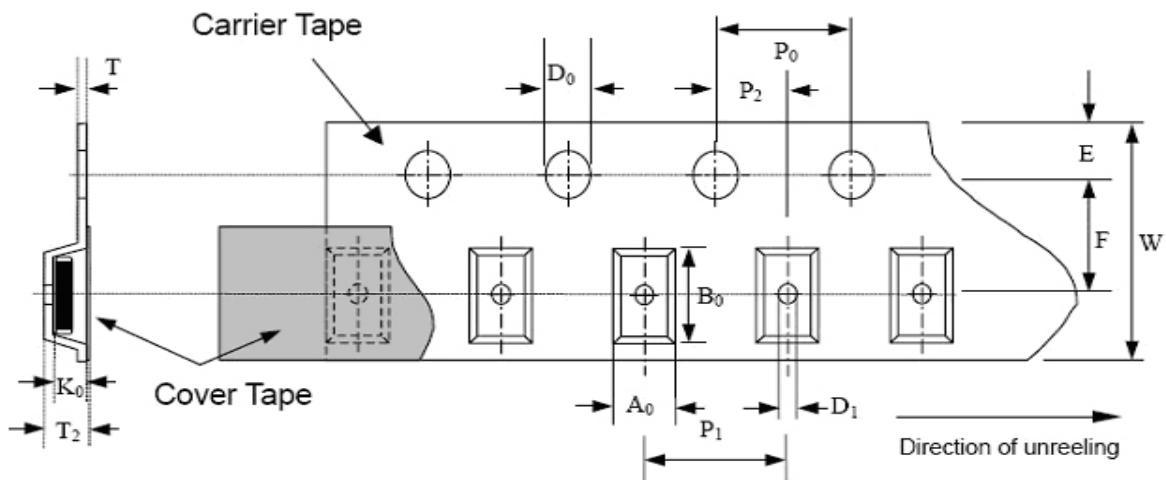
Notes:

1. Typical leakage at 25°C < 50uA, maximum leakage 100uA.

2. At normal:  $\Delta C_p \pm 30\%$ , In order to satisfy the applications of customer in various fields, the capacitance range can be designed during manufacturing according to the request, please contact our sales department if needed

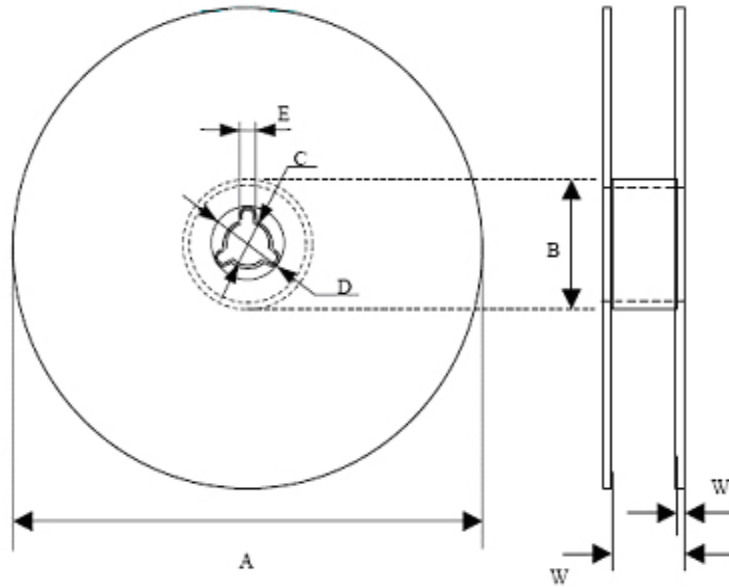
## Packaging Specification

- Carrier tape transparent cover tape should be heat-sealed to carry the products, and the reel should be used to reel the carrier tape.
- The adhesion of the heat-sealed cover tape shall be  $40 + 20 / - 15$  grams.
- Both the head and the end portion of taping shall be empty for reel package and SMT auto-pickup machine. And a normal paper tape shall be connected in the head of taping for the operator handle.



type	A <sub>0</sub> ±0.10	B <sub>0</sub> ±0.10	K <sub>0</sub> ±0.10	T ±0.05	T <sub>2</sub> ±0.05	D <sub>0</sub> +0.10 -0.00	D <sub>1</sub> ±0.05	P <sub>1</sub> ±0.10	P <sub>2</sub> ±0.05	P <sub>0</sub> ±0.05	W ±0.20	E ±0.10	F ±0.05
0402=1005	1.08	1.88	1.04	0.22	0.10	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
0603=1608	1.08	1.88	1.04	0.22	0.10	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
0805=2012	1.42	2.30	1.04	0.22	0.10	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
1206=3216	1.88	3.50	1.27	0.20	0.10	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
1210=3225	2.18	3.46	1.45	0.22	0.10	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
1812=4532	3.66	4.95	1.74	0.25	0.10	1.50	1.50	8.00	2.00	4.00	12.00	1.75	5.50
2220=5650	5.10	5.97	2.80	0.25	0.10	1.50	1.50	8.00	2.00	4.00	12.00	1.75	5.50

## Reel Dimension



Type	A	B	C	D	E	W	W <sub>1</sub>
0402=1005	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
0603=1608	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
0805=2012	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
1206=3216	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
1210=3225	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
1812=4532	178.0±1.0	60.0±0.5	13.5±0.1	21.0±0.2	2.0±0.5	13.6±0.2	1.5±0.15
2220=5650	178.0±1.0	60.0±0.5	13.5±0.1	21.0±0.2	2.0±0.5	13.6±0.2	1.5±0.15

Type	1005	1608	2012		3216	3225	4532	5650
quantity	paper	10000	4000	4000	-	-	-	-
	plastic	-	-	-	3000	3000	2000	2000
Minimum ordering	-	4000	4000	3000	3000	3000	3000	1000

# New Product I

## ■ Specifications

- Low Capacitance 1pF
- Low Leakage Current < 0.1 uA

Type: 0402~0603

GRACE Varistor Part number	Max.Operating Volitage	Breakdown voltage	Clamping voltage	Transient energy	Peak current	Capacitance
	DC	@1mA DC	8/20 μs 1A	10/100μs	8/20μs	@ 1kHz
	V <sub>DC</sub> (V)	V <sub>B</sub> (V)	V <sub>c</sub> (V)	E <sub>T</sub> (J)	I <sub>p</sub> (A)	C(pF)
KRVV0603E800N1ROT	18	64~96	240	0.01	~	1±0.3pf
KRVV0402E800N1ROT	18	64~96	240	0.01	~	1±0.3pf

Notes:

1. Typical leakage at 25°C < 50uA, maximum leakage 100uA.
2. At normal: ΔCp±30%, In order to satisfy the applications of customer in various fields, the capacitance range can be designed during manufacturing according to the request, please contact our sales department if needed

# New Product II

## ■ Specifications

- Excellent ESD clamping & Small Insertion Loss
- High transient current capability, Fastest response time
- Capacitance is designed to ultra-low value, which can be efficiently suitable to high speed data line.
- EU-RoHS Compliance

## ■ Applications

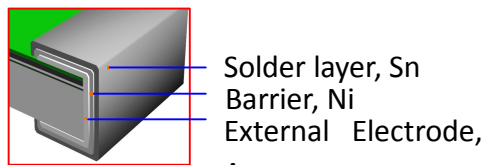
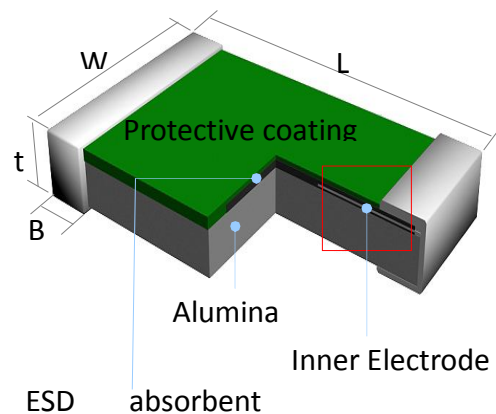
- CMOS and MOSFET protection from ESD
- Computer ESD and I/O protection
- Telecommunication transient protection
  - USB2.0 port, IEEE-1394, RF module, Antenna circuit, high speed Protocol Etc.

## Standard series

KRMV    0402    E    5R6    N    X    I  
 ①            ②            ③            ④            ⑤            ⑥            ⑦

- ① production series: SH Varistor
- ② size: 1206(3216)
- ③ type: G:general; E: ESD; H: high energy
- ④ working voltage (DC): 260=26V, 5R6=5.6V
- ⑤ end termination: S: Ag/Pd    N: Ag/Ni/Sn
- ⑥ typical capacitance value measured : A:0-5PF, B:5.1-10PF, C:10.1-50pf, D:50.1-100PF, E:100-500PF, X:无容值要求; 201=200pf ,250=25PF,100=10PF,3R0=3PF,0R2=0.2PF
- ⑦ package: T: taping    B: bulk

## ■ Shape & Dimension



unit : mm

SIZE	L	W	t	B
1608	1608±0.2	0.8±0.2	0.55±0.1	0.4±0.2

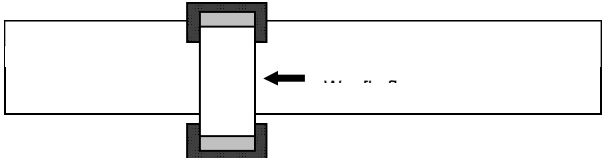
SIZE	L	W	t	B
1005	1.0±0.1	0.5±0.1	0.40±0.1	0.2±0.1

Type: 0402~0603

GRACE Varistor Part number	Capacitance	Trigger Voltage	Clamping Voltage	Continuous Operating Voltage	Attenuation	ESD Capability*
KRMV0402E5RONOR15T	0.15pf	200V	86V	5V	-0.3dB at 10GHz	8kV, contact
KRMV0402E120NOR15T	0.15pf	300V	100V	12V	-0.3dB at 10GHz	8kV, contact
KRMV0603E5RONOR15T	0.15pf	200V	86V	5V	-0.3dB at 10GHz	8kV, contact
KRMV0603E300NOR15T	0.15pf	300V	100V	30V	-0.3dB at 10GHz	8kV, contact

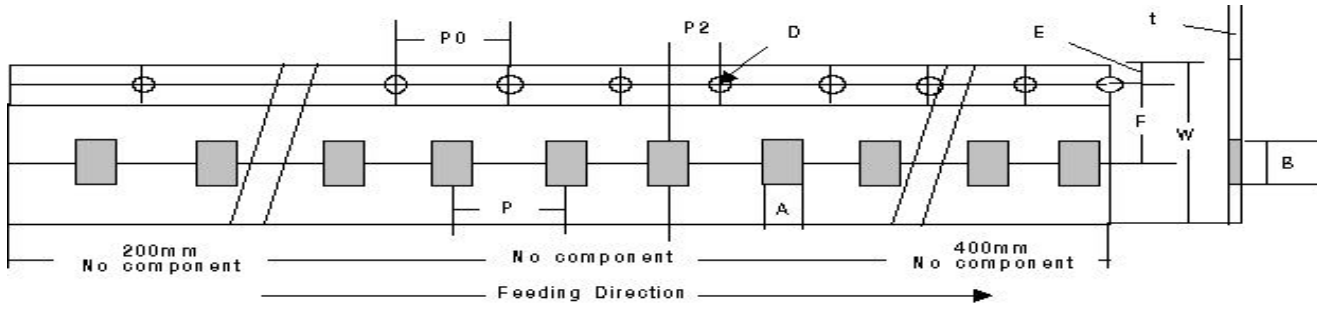
\* Per IEC 61000-4-2, 30A@8kV, level 4, clamp measurement made 30ns after initiation of pulse, . all test in contact discharge mode

### ■ Performance specifications

No	Item	Requirements	Test method
1	Operation Range	1. -40°C ~ 85°C	
2	Leakage current	1. Satisfaction to the specification, under 1uA	1. Applied voltage : specified working voltage
3	Capacitance	1. Satisfaction to the specification, under 1pF	1. Frquency & OSC level : 1MHz, 1.0Vrms
4	Solderability	1. More than 90% of the terminal electrode shall be covered with new solder.	1. Type of solder : H63A 2. Soldering Temp & Time : 230+/-5°C, 5+/-1 sec
5	Reflow soldering	1. No Serious mechanical damage 2. More than 50% of the terminal electrode shall be covered with new solder 3. Leakage Current : ≤ 10uA	1. Type of solder : H63A 2. Temp & Time : max 260+/-5°C, min 10sec * Refer to the soldering profile of page 6
6	Humidity Load Test	1. No Serious mechanical damage 2. Leakage Current : ≤ 10uA	1. Test Temp. & Relative Humidity & Time : 85+/- 5°C, 85 +/- 5% RH, Vw Applied, 500 +/- 12hrs
7	Thermal Shock		1. Step 1 : -40 +/- 5°C, Step 2 : 85 +/- 5°C 2. Cycle : 30min ± 3min, each 5 cycles
8	High Temp. Test		1. Temp. & time : 85+/-5°C , 1000 +/- 24hrs
9	Adhesive strength	1. No Serious mechanical damage under condition of 1005 : min 0.5kgf, 1608 : min 1.0kgf	
10	ESD	1. No mechanical damage after test 2. Leakage Current : ≤ 10uA * ESD gun (IEC61000-4-2 standard) * C=150pF R=330Ω	1. Contact discharge * Voltage : +/-8kV(Level 4) * Number : 10 times in 10sec
			2. Air discharge * Voltage : +/-15kV(Level 4) * Number : 10 times in 10sec

## ■ Packing specifications

### 1. Carrier tape



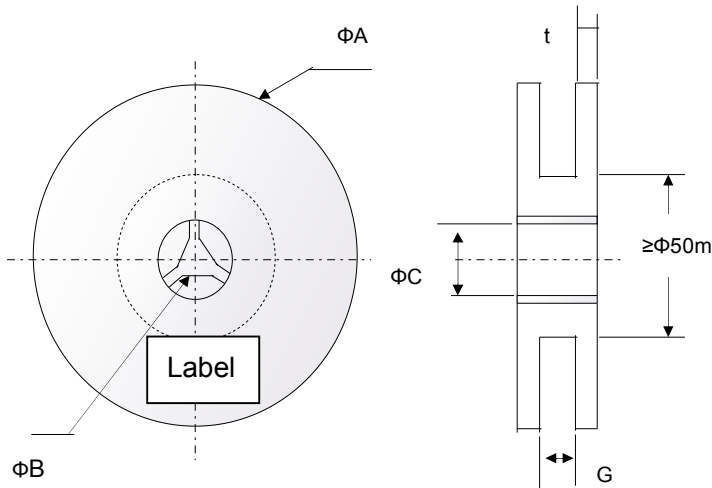
Size	A	B	W	D	E	F	P	P0	P2	t
0402=1005	0.65+/-0.10	1.15+/-0.10	8.00+/-0.20	1.50+/-0.25	1.75+/-0.10	3.50+/-0.50	2.0+/-0.1	4.0+/-0.10	2.0+/-0.10	1.1max
0603=1608	1.10+/-0.10	1.90+/-0.10					4.0+/-0.1			

\* paper type

unit :mm

type		1005	1608
quantity	paper	10000	5000
	plastic	-	-
Minimum ordering		-	5000

### 2. Reel & Label [Plastic Reel]

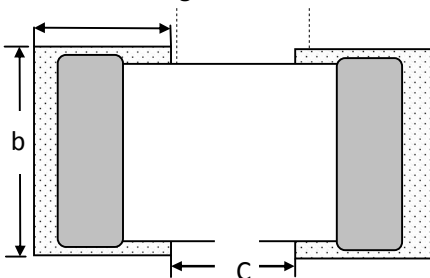


unit :  
mm

code	dimension
ΦA	178+/-2.0
ΦB	13.0+/-0.5
ΦC	22.0+/-2.0
G	10.0+/-1.5
t	2.5+/-0.5

## ■ Recommended Soldering condition

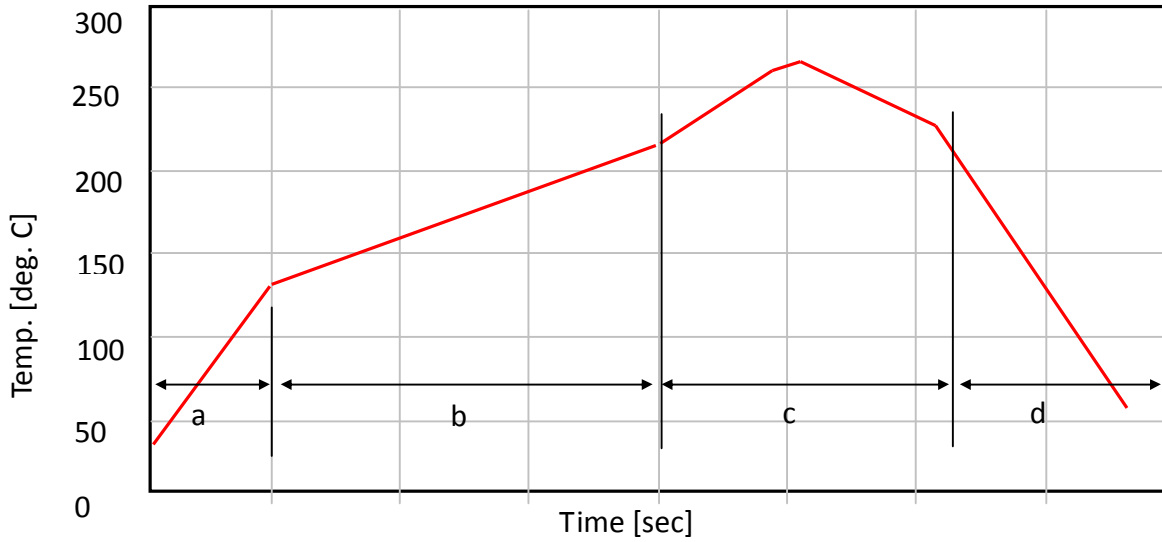
### 1) Land Pattern Design



Code	Land Dimension with Chip Size [mm]			
	0201=0603	0402=1005	0603=1608	0805=2012
a	0.20~0.35	0.30~0.50	0.60~0.70	0.60~0.70
b	0.25~0.40	0.40~0.60	0.60~0.80	0.80~1.10
c	0.25~0.40	0.30~0.50	0.60~0.80	1.00~1.20

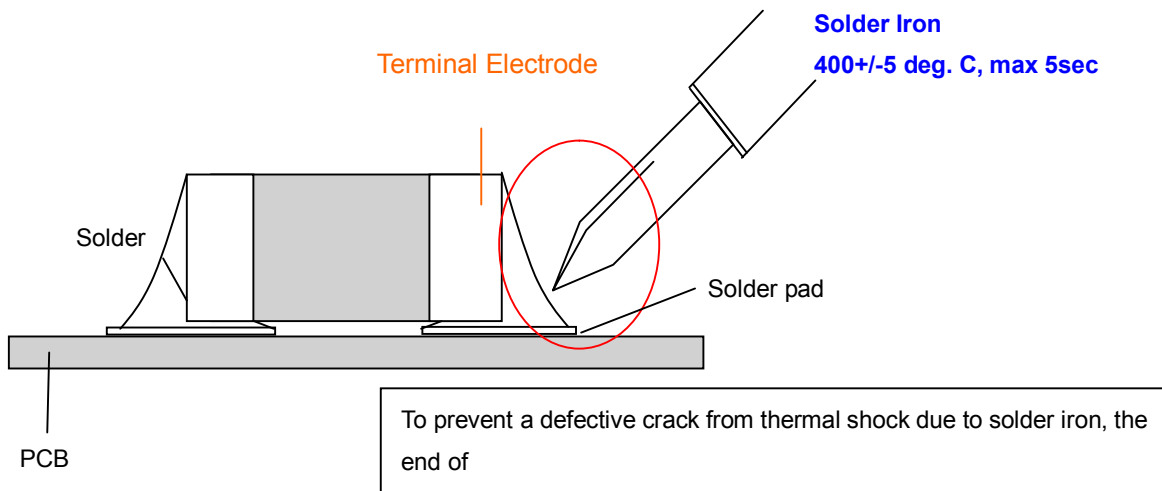


2) Reflow Soldering



Zone	temp. range [deg. C]	time [sec]	Remark
a	RT ~ 130	60	* Solder : Sn-Ag-Cu * 260deg. C, over 10sec
b	max 220	90 ~ 150	
c	220 ~ 260 [max 270]	90 ~ 150	
d	220 ~ RT	min 60	

3) Soldering Iron



To prevent a defective crack from thermal shock due to solder iron, the end of