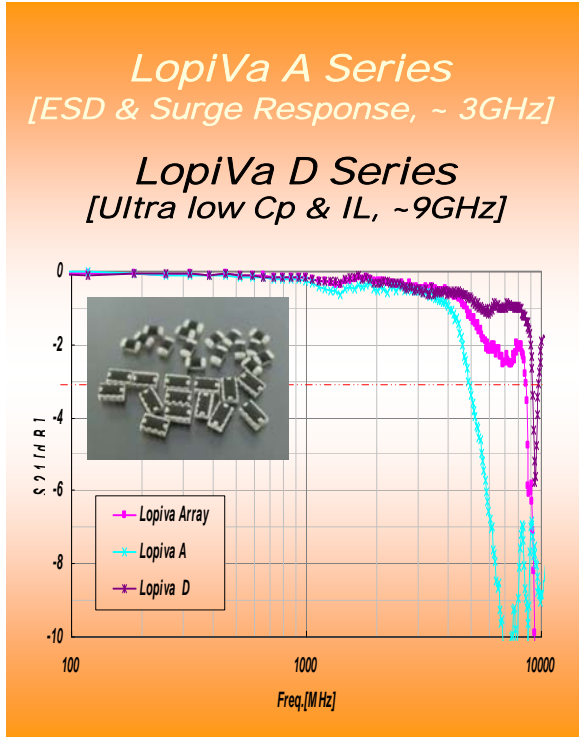


I. LOPIVA™



1 What is LOPIVA™ ?

LOPIVA™ means the ESD protective device which has a low capacitance value below 1pF, it is suitable for high speed data transmission line or high frequency application to protect the circuit against ESD impulse attack.

LOPIVA™ construction is quite different to Multilayer Varistor which is made by traditional “sheet stacking” method. It is designed for purpose of a high mechanical strength and low profile with a wide range of Cp, 0.2pF to 1pF.

2 Features

- Low Capacitance , High cut-off freq.
- Fast response to ESD : ~ 1ns
- Bi-directional
- IEC61000-4-2 Level 4 & EU-RoHS Compliant

3 Application

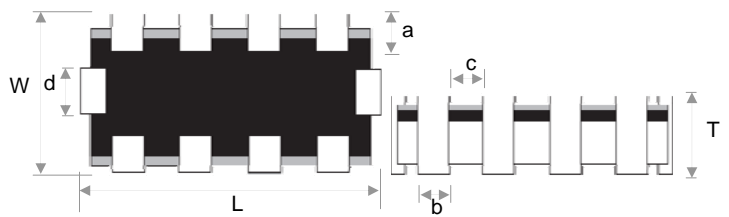
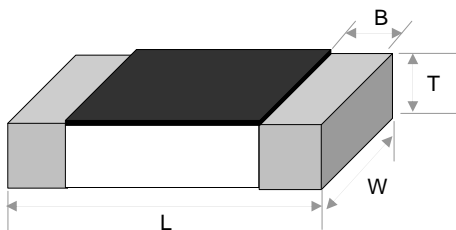
- HDMI & USB Interface : TV (LCD, LED, PDP), etc.
- Satellite Radio System, Mobile Phone, Navigation, etc.
- Hand-Held & Home Appliance

4 How to Order

Part No. : LOPIVA 16 G 12 A
 (1) (2) (3) (4) (5) (6)

(1)	Product	LOPIVA	Low Capacitance ESD Protective Device	(4)	Working Voltage	12	05 : 5.5V, 12 : 12V, 24 : 24V
(2)	Size	05	05 : 1005, 16 : 1608 20 : 2012	(5)	Capacitance [typical @1MHz]	A	A : 0.8pF, B : 0.5pF, D : 0.15pF, S 0.35pF
(3)	ESD Level	G	IEC61000-4-2 Level 4	(6)	Spare Code		For special Product
					Termination [Array]	4G	Array Type : 4 Channel

5 Dimension



Code [Single]	Dimension [mm]			
	L	W	T	BW
1005	1.0 +/- 0.1	0.5 +/- 0.1	0.5 +/- 0.1	0.2 +/- 0.1
1608	1.6 +/- 0.2	0.8 +/- 0.2	0.8 +/- 0.2	0.4 +/- 0.2

Code [Array]	Dimension [mm]			
	L	W	T	
2012	2.0 +/- 0.2	1.25 +/- 0.2	0.6 +/- 0.2	
	a	b	c	d
	0.2 +/- 0.1	0.25 +/- 0.1	0.25 +/- 0.1	0.3 +/- 0.1

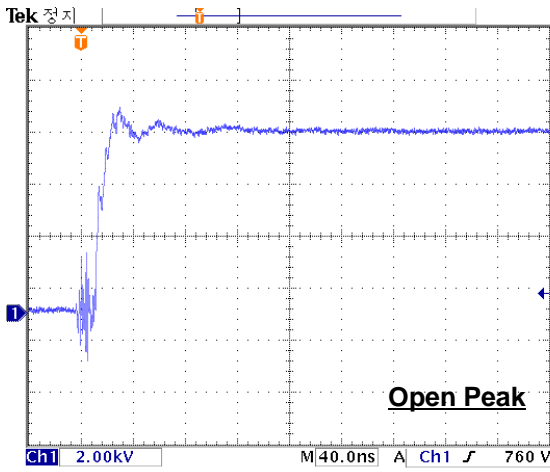
6 Part List

No	Part Number	Size	Cp[pF]		Vw [Vdc]	IL [uA]	ESD [typical]			
			Typ.	Max			Capability	Vt[kV]	Vc[V]	Repetitive Withstand
								8kV	30ns	
1	LOPIVA 05G05A	1005	0.8	1	5.5	< 1	IEC61000-4-2 Level 4	< 1.5	< 30	100times
2	LOPIVA 05G12A	1005	0.8	1	12	< 1			< 30	
3	LOPIVA 16G05A	1608	0.8	1	5.5	< 1			< 30	
4	LOPIVA 16G12A	1608	0.8	1	12	< 1			< 30	
5	LOPIVA 16G14A	1608	0.8	1	14	< 1			< 30	
6	LOPIVA 05G05B	1005	0.5	0.7	5.5	< 1		< 1.5	< 30	
7	LOPIVA 16G05B	1608	0.5	0.7	5.5	< 1			< 30	
8	LOPIVA 05G12D	1005	0.2	0.3	12	< 0.5		< 1.8	< 30	
9	LOPIVA 16G12D	1608	0.2	0.3	12	< 0.5			< 30	
10	LOPIVA 16G24D	1608	0.2	0.3	24	< 0.5			< 30	
11	LOPIVA 20G12S4G	2012	0.35	0.55	12	< 1		< 1.5	< 30	

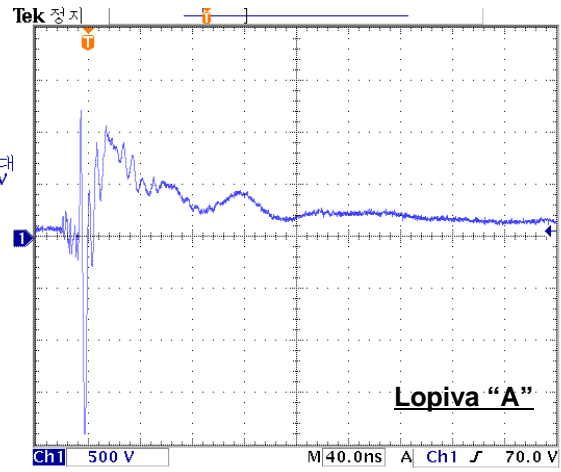
- Vw : Working Voltage
- IL : Leakage Current – The current flow across Lopiva when Vw is applied.
- Vt : ESD trigger voltage
- Vc : ESD clamping voltage – The clamped voltage at the point of 30ns lasting after ESD pulse rising.

7 Electrical Characteristics

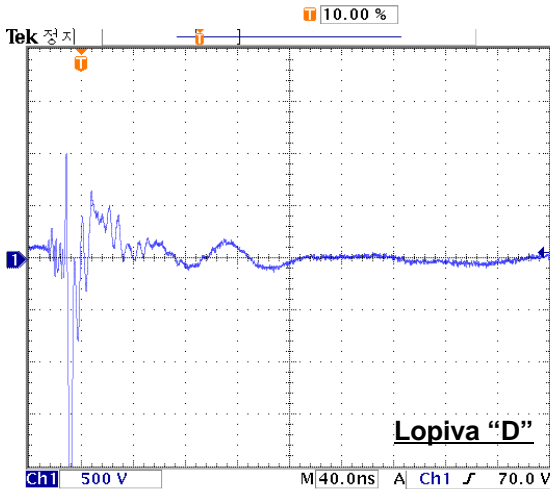
ESD Clamping Effect [IEC61000-4-2, Contact 8kV]



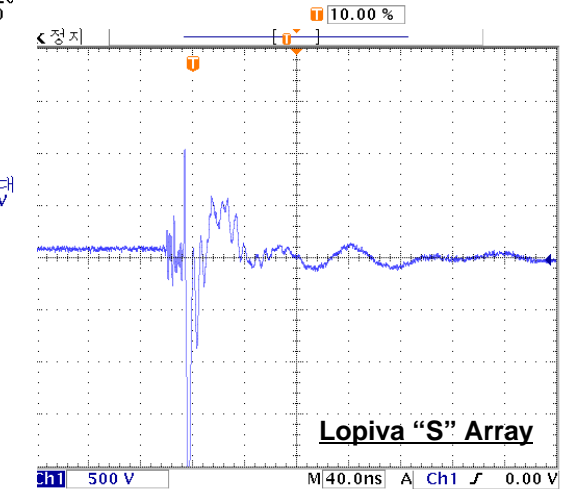
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14:54:50



28 5월 2009
15:38:51

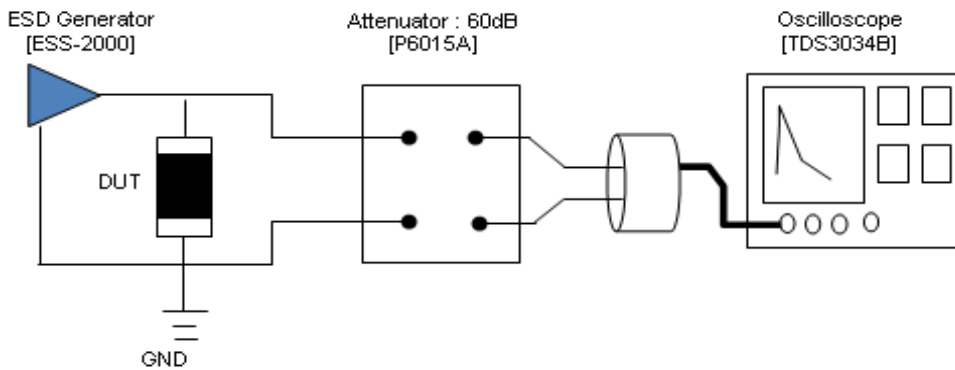


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28 5월 2009
14:44:00

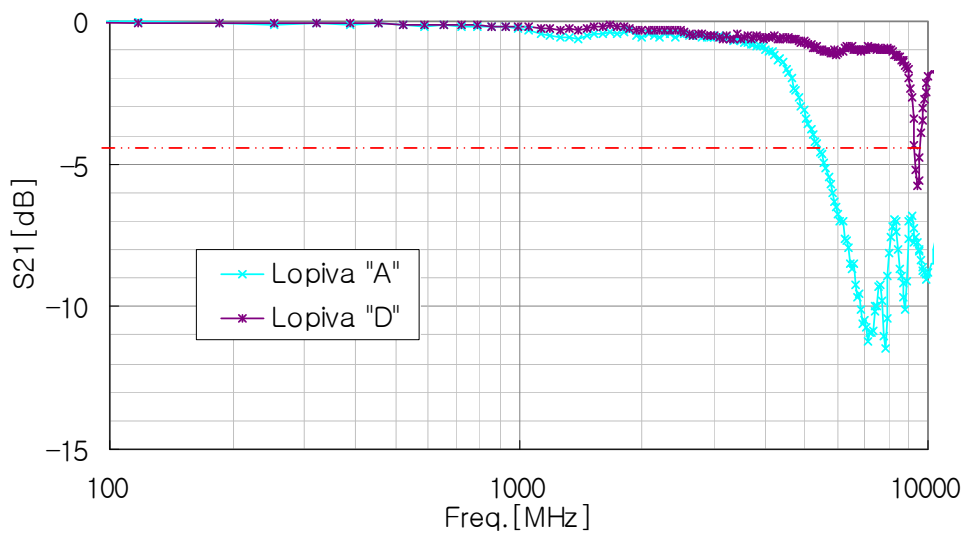
Test Circuit



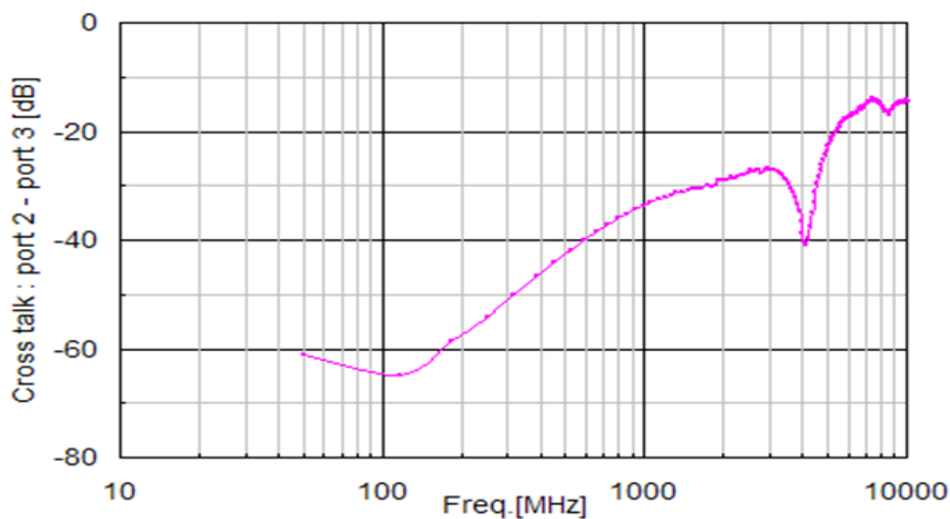
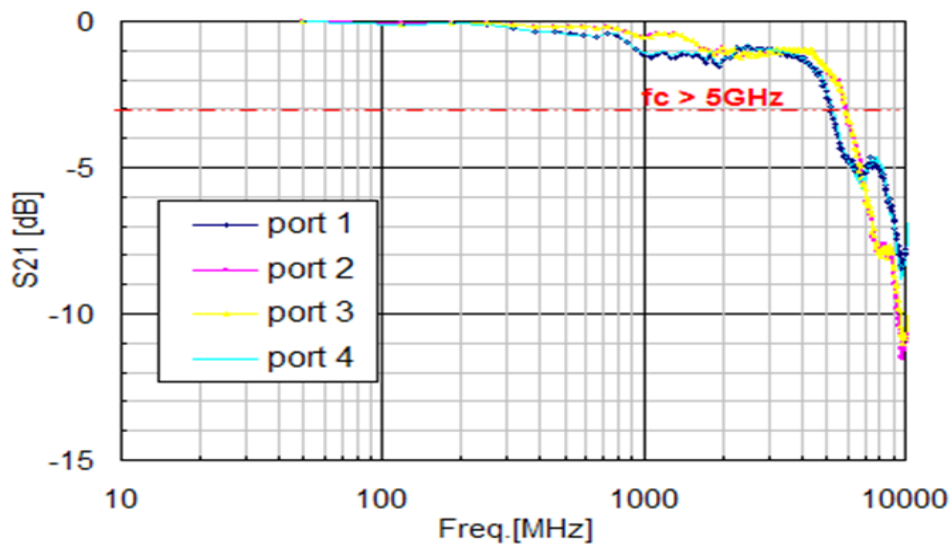
- Above wave form and suppression peak value may be differently shown as test circuit

Frequency Characteristics [Insertion Loss]

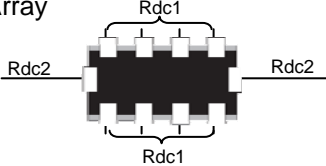

Single type



Array type



8 Specification & Reliability

No	Item	Requirements	Test method
1	Leakage current	1. Satisfaction to the specification, * Refer to the part list	1. Applying working voltage : Keithley 2400
2	Capacitance	1. Satisfaction to the specification * Refer to the part list	1. 1MHz, 0.5Vrms, 25C
3	Rdc	1. Rdc1 (Signal Line) : $\leq 500\text{mohm}$ 2. Rdc2 (Ground Line) : $\leq 500\text{mohm}$	1. Only for Array 
4	Solder ability	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 : $\leq 10\text{uA}$	1. Type of solder : H63A 2. Temp & Time : max 260+/-5°C, min 10sec * Refer to the soldering profile of page 6
6	Adhesive strength	1. No Serious mechanical damage 2.1005 : min 0.5kgf 1608 : min 1.0kgf, 2012 : min 1.2kgf	
Reliability part 1			
7	Humidity	1. No Serious mechanical damage 2. Leakage Current : $\leq 10\text{uA}$	1. Test Temp. & Relative Humidity & Time : 85+/- 5°C, 85 +/- 5% RH, 500 +/- 12hrs
8	Thermal Shock		1. Step 1 : -40 +/- 5°C, Step 2 : 85 +/- 5°C 2. Cycle : 30min \pm 3min, each 5 cycles
9	High Temp. Test		1. Temp. & time : 85+/-5°C , 1000 +/- 24hrs
Reliability part 2.(IEC61000-4-2 standard)			
10	ESD	1. No mechanical damage after test 2. Leakage Current : $\leq 10\text{uA}$ * ESD gun (IEC61000-4-2 standard) * C=150pF R=330Ω	2. Air discharge * Voltage :+/-15kV(Level 4) * Number : 10 times in 10sec

II. Multilayer Varistor, MLV

ECVAL & ECVAS Series



1 What is MLV?

Multilayer Varistor, MLV means the ESD protective device which is composed of ZnO based ceramic, internal & external electrode by a traditional sheet stacking process. MLV is normally working as a kind of insulator but it is transiently doing as a switching device when ESD impulse is rising, then it comes back to its normal state. Joinset's MLV has an unique insulation coating layer on the body surface for its high reliability.

2 Features

- High Reliability Performance
- Fast response to ESD : ~ 1ns
- Bi-directional
- IEC61000-4-2 Level 4 & EU-RoHS Compliant

3 Application

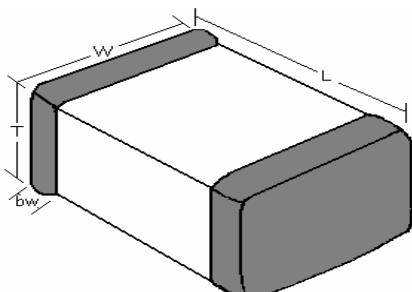
- CMOS, MOSFET Protection
- I/O Interface Protection
- Hand-Held & Home Appliance

4 How to Order

Part No. : ECVAL 0603 05 X 30 015 N B T
 (1) (2) (3) (4) (5) (6) (7) (8) (9)

(1)	Product	ECVAL	Low Cp	(5)	Clamping Voltage	30	Examples 15 : 15.5V, 30 : 30V
		ECVAS	Standard Cp				
(2)	Size	0603	0603, 1005, 1608 [mm]	(6)	Capacitance	015	Examples 015 : 15pF, 003 : 3pF 120 : 120pF
(3)	Working Voltage	05	05 : 5.5V, 09 : 9.0V 12 : 12V, 18 : 18V, 24 : 24V	(7)	Termination	N	Ni barrier, Solder plating
(4)	Transient Energy	12	Refer to the part list	(8)	Material	B	Pb Free
				(9)	Taping	T	B : Bulk, T : Taping

5 Dimension



Code [Single]	Dimension [mm]			
	L	W	T	BW
0603	0.6 +/- 0.03	0.3 +/- 0.03	0.3 +/- 0.03	Min 0.1
1005	1.0 +/- 0.1	0.5 +/- 0.1	0.5 +/- 0.1	0.2 +/- 0.1
1608	1.6 +/- 0.2	0.8 +/- 0.2	0.8 +/- 0.2	0.4 +/- 0.2

6 Part List

Multilayer Varistor, MLV

ECVAS Series

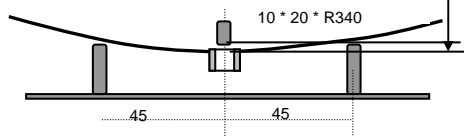
No.	Part No	Size [mm]	Electrical specifications						
			V _w [V]	V _{1mA} [V]	V _c [V]	I _p [A]	E _t [J]	C _p [pF]	
1	ECVAS0603 05X30 100NBT	0603	5.5	7.0 ~ 18.0	30	1	0.005	100	1kHz
2	ECVAS1005 05E15 180NBT	1005	5.5	6.4 ~ 9.6	15.5	5	0.03	180	1MHz
3	ECVAS1005 05A15 360NBT		5.5	6.4 ~ 9.6	15.5	10	0.05	360	1MHz
4	ECVAS1005 05A15 480NBT		5.5	6.4 ~ 9.6	15.5	10	0.05	480	1kHz
5	ECVAS1005 09A20 230NBT		9	11.0 ~ 14.0	20	20	0.05	230	1MHz
6	ECVAS1005 14A30 120NBT		14	16.5 ~ 20.3	30	15	0.05	120	1MHz
7	ECVAS1005 14A30 160NBT		14	16.5 ~ 20.3	30	15	0.05	160	1kHz
8	ECVAS1005 18A40 090NBT		18	22.9 ~ 28.0	40	20	0.05	90	1MHz
9	ECVAS1608 05B15 825NBT		1608	5.5	6.4 ~ 9.6	15.5	20	0.1	825
10	ECVAS1608 09B20 550NBT	9		11.0 ~ 14.0	20	30	0.1	550	1MHz
11	ECVAS1608 14E30 160NBT	14		16.5 ~ 20.3	30	10	0.03	160	1kHz
12	ECVAS1608 14A35 350NBT	14		18.0 ~ 24.0	35	10	0.05	350	1kHz
13	ECVAS1608 14B30 425NBT	14		16.5 ~ 20.3	30	30	0.1	425	1MHz
14	ECVAS1608 18B40 225NBT	18		22.9 ~ 28.0	40	30	0.1	225	1MHz
15	ECVAS1608 26B58 160NBT	26		31.0 ~ 38.0	58	30	0.1	160	1MHz
16	ECVAS1608 30B65 150NBT	30		37.0 ~ 46.0	65	30	0.1	150	1MHz

ECVAL Series

No.	Part No	Size [mm]	Electrical specifications							
			V _w [V]	V _{1mA} [V]	V _c [V]	I _p [A]	E _t [J]	C _p [pF]		
1	ECVAL0603 05X30 015NBT	0603	5.5	9.5 ~ 14.5	30	1	0.005	15	1kHz	
2	ECVAL0603 05X25 033NBT		5.5	9.5 ~ 14.5	25	1	0.005	33	1kHz	
3	ECVAL1005 05X34 010NBT	1005	5.5	10.0 ~ 14.0	34	3	0.005	10	1kHz	
4	ECVAL1005 05E20 050NBT		5.5	10.0 ~ 14.0	20	5	0.03	50	1kHz	
5	ECVAL1005 05E20100NBT		5.5	10.0 ~ 14.0	20	10	0.03	100	1kHz	
6	ECVAL1005 14E30 050NBT		14	16.5 ~ 20.3	30	5	0.03	50	1kHz	
7	ECVAL1005 14E30 100NBT		14	16.5 ~ 20.3	30	10	0.03	100	1kHz	
8	ECVAL1005 18X300 003NBT		18	90 ~ 160	300	1	0.005	3	1MHz	
9	ECVAL1005 18X50 005NBT		18	24.0 ~ 34.0	50	3	0.005	5	1MHz	
10	ECVAL1005 18X40 015NBT		18	22.9 ~ 28.0	40	5	0.005	15	1kHz	
11	ECVAL1005 18E40 060NBT		18	22.9 ~ 28.0	40	10	0.03	60	1kHz	
12	ECVAL1005 18A40 120NBT		18	22.9 ~ 28.0	40	20	0.05	120	1kHz	
13	ECVAL1608 05X25 030NBT		1608	5.5	10.0 ~ 14.0	25	3	0.005	30	1kHz
14	ECVAL1608 05E20 100NBT			5.5	10.0 ~ 14.0	20	10	0.03	100	1kHz
15	ECVAL1608 18X300 003NBT	18		90 ~ 160	300	1	0.005	3	1MHz	
16	ECVAL1608 18X58 005NBT	18		28 ~ 38	58	3	0.005	5	1kHz	
17	ECVAL1608 18X50 012NBT	18		24.0 ~ 34.0	50	3	0.005	12	1kHz	
18	ECVAL1608 18E50 020NBT	18		24.0 ~ 34.0	50	10	0.03	20	1MHz	
19	ECVAL1608 18A40 120NBT	18		22.9 ~ 28.0	40	20	0.05	120	1kHz	

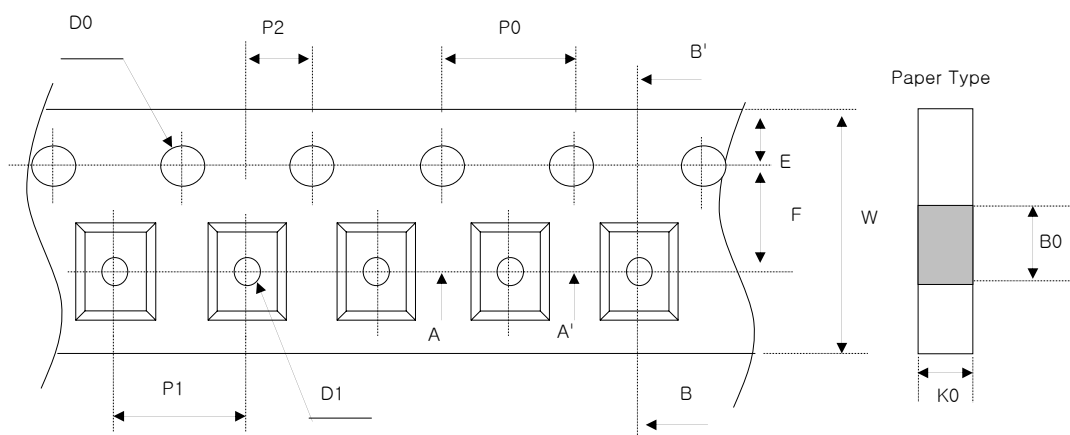
- V_w : Working Voltage
- I_L : Leakage Current – The current flow across Lopiva when V_w is applied.
- V_{1mA} : Breakdown Voltage or Varistor Voltage – The voltage across Lopiva when 1mA is applied.
- V_c : Surge Clamping, 8/20us
- I_p : Max. Surge Current, 8/20us / E_t : Transient Energy, 10/1000us

7 Specification & Reliability

No	Item	Requirements	Test method
1	Operation Temp.	1. -55 ~ 125deg.c	
2	Heat Resistance Test	1. No Serious mechanical damage 2. $\Delta V_B \leq \pm 10\%$ of initial value	1. Temp. & Time * Reflow : min. peak 260C, over 10 sec. * Soldering iron : 400 +/- 5C, max 5 sec.
3			
4	Humidity Load Test	1. No Serious mechanical damage 2. $\Delta V_B \leq \pm 10\%$ of initial value 3. Let it sit at R.T, for 24Hrs then Measure	1. Test Temp. & Relative Humidity & Time : 85+/-5deg.c, 85+/-2% RH, Vw Applied, 500+/- 24Hrs
5	Thermal Shock		1. Step 1 : -40+/-5C, Step 2 : +85+/-5C 2. Cycle : 30min+/-3min, each 100 times
6	High Temp. Test		1. Temp. & time : * 85+/-5C, 1000+/-48Hrs
7	Low Temp. resistance		1. Temp. & Time : * -40+/-5C, 1000Hrs+/-12Hrs
8	Bending Strength	1. No Serious mechanical damage	1. Add load at 0.5mm/sec until glass epoxy board bends up to 1mm [= Bending Depth] 
9	Adhesive strength	1. No Serious mechanical damage	
		Size	0603 1005 1608
		W[kgf]	0.2 0.5 1.0
10	Max. Surge Current	1. $\Delta V_B \leq \pm 10\%$ of initial value * IEC 61000-4-5 standard * 1.2/50us - 8/20us V-I Combination Pulse	1. Temp. & humidity : 25 +/- 5C, 30~65%RH 2. Polarity : +, - 3. Number of hit : each 1 time 4. Surge pulse : 8/20us pulse 5. Applied current : * maximum surge current(Ip)
12	ESD	1. No mechanical damage 2. $\Delta V_B \leq \pm 10\%$ of initial vlaue * ESD gun (IEC61000-4-2 standard) * C=150pF R=330Ω	1. Contact discharge * Voltage : 8kV(Level 4) * Polarity : +, - * Number : 10 times in 10sec 2. Air discharge * Voltage : 15kV(Level 4) * Polarity : +, - * Number : 10 times in 10sec

III. Packing Specifications

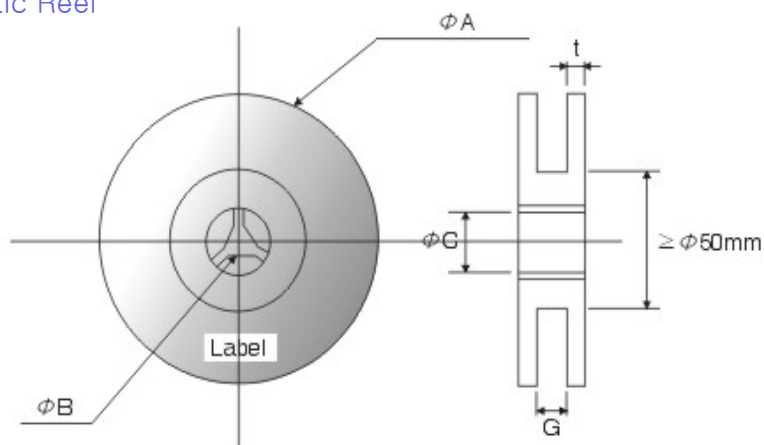
Carrier Pocket



Unit : [mm]

Case	type	A0	B0	W	D0	D1	E	F	P	P0	P2	K0	t
0603	Paper	0.38 +/-0.05	0.68 +/-0.05	8.0 +/-0.2	1.50 +/-0.25	-	1.75 +/-0.1	3.5 +/-0.05	2.0 +/-0.1	4.0 +/-0.1	2.0 +/-0.1	1.1max	
1005	Paper	0.65 +/-0.1	1.15 +/-0.1	8.0 +/-0.2	1.50 +/-0.25	-	1.75 +/-0.1	3.5 +/-0.05	2.0 +/-0.1	4.0 +/-0.1	2.0 +/-0.1	1.1max	
1608	Paper	1.1 +/-0.1	1.9 +/-0.1	8.0 +/-0.2	1.50 +/-0.25	-	1.75 +/-0.1	3.5 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	2.0 +/-0.1	1.1max	-
2012	Paper	1.65 +/-0.2	2.4 +/-0.2	8.00 +/-0.20	1.50 +/-0.25	-	1.75 +/-0.1	3.5 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	2.0 +/-0.1	1.1max	-

Plastic Reel



Unit : [mm]

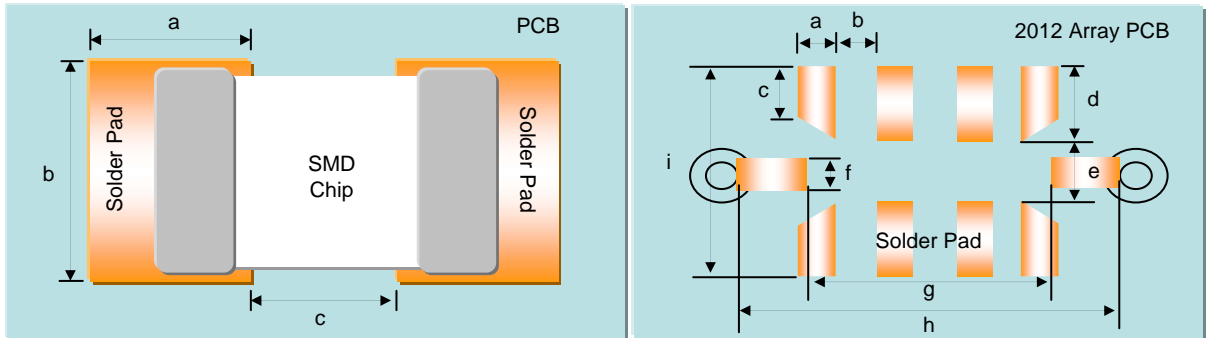
code	0603~2012
ΦA	178+/-2.0
ΦB	13.0+/-0.5
ΦC	22.0+/-2.0
G	10.0+/-1.5
t	2.5+/-0.5

Packing Unit

Size [mm]	0603	1005	1608		2012
			LOPIVA	MLV	
pcs/reel	10,000	10,000	5,000	4,000	4,000
Inner Box [pcs]	50,000	50,000	25,000	20,000	20,000
Outer Box [pcs]	500,000	500,000	250,000	200,000	200,000

IV. Recommended Soldering Condition

Solder Pad



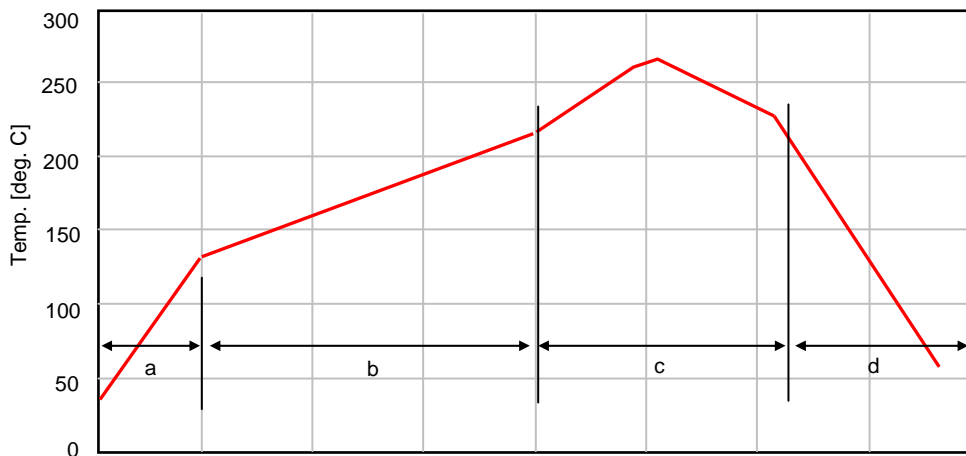
Unit : mm

code	Chip		
	0603	1005	1608
a	0.35	0.50	0.70
b	0.40	0.60	0.80
c	0.40	0.50	0.80

Unit : mm

code	size	code	size
a	0.25	f	0.25
b	0.25	g	1.50
c	0.52	h	2.45
d	0.62	i	2.00
e	0.75		

Reflow Soldering



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