

Surface Mount Multilayer Varistors

Product Identification:

MLV 0402 ES 012V 0100 N

(1) (2) (3) (4) (5) (6)

(1) Series Code:

MLV – Surface Mount Multilayer Varistor

MVA -- MLV Array

(2) Size Code:

Standard EIA Chip Size

(3) Application Code:

ES – Electro-static Discharge Protection

NA – Normal Surge Protection

HA – High Surge Protection

(4) Max. Working Voltage:

012V – 12 V

(5) Capacitance for ES Series:

0100 – 100 pF

02R5 – 2.5 pF

Peak Current for HA/NA Series: **0100** – 100 A

(6) Capacitance Tolerance for ES Series:

N – $\pm 30\%$

P – **Special**

B – Bulk

Operating Temperatures:

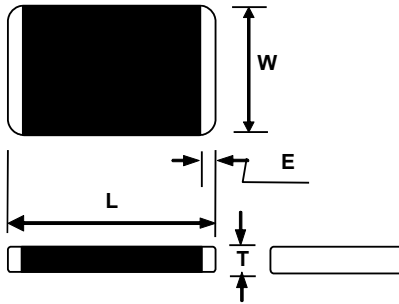
-55°C to +85°C for size 0603 or smaller

-55°C to +125°C for size 0805 or larger

Surface Mount Multilayer Varistors

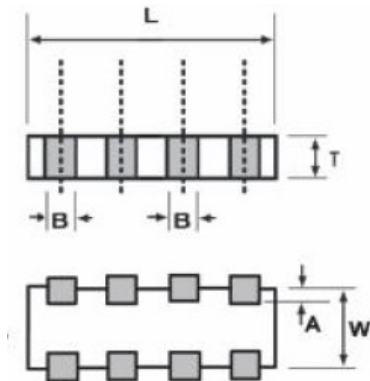
Shape and Dimensions:

MLV Series



Size	L (mm)	W (mm)	T (mm)	E (mm)
0201	0.60 ± 0.03	0.30 ± 0.03	0.30 ± 0.03	0.30 ± 0.03
0402	1.00 ± 0.10	0.50 ± 0.10	0.50 ± 0.10	0.25 ± 0.10
0603	1.60 ± 0.15	0.80 ± 0.15	0.90 max.	0.30 ± 0.10
0805	2.00 ± 0.20	1.25 ± 0.15	1.00 max.	0.30 ± 0.10
1206	3.20 ± 0.20	1.60 ± 0.15	1.20 max.	0.50 ± 0.20
1210	3.20 ± 0.20	2.50 ± 0.20	1.50 max.	0.50 ± 0.20
1812	4.50 ± 0.20	3.20 ± 0.20	2.00 max.	0.60 ± 0.20
2220	5.70 ± 0.20	5.00 ± 0.20	3.00 max.	0.60 ± 0.20

ESD Array



Size	0508	0612
L (mm)	2.00 ± 0.20	3.20 ± 0.20
W (mm)	1.25 ± 0.20	1.60 ± 0.15
T (mm)	0.80 max.	0.95 max.
A (mm)	0.20 ± 0.10	0.20 ± 0.10
B (mm)	0.25 ± 0.05	0.40 ± 0.15

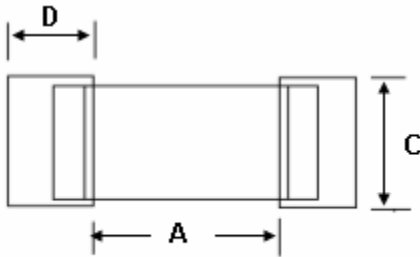
Terms and Definitions:

Term	Definition
Max. Working Voltage	Maximum steady-state DC operating voltage with typical leakage current less than 50 μ A at 25°C
Varistor Voltage (BDV)	Breakdown DC voltage measured at current of 1 mA
Max. Clamping Voltage	Maximum peak voltage across the part, measured at a specified pulse current and waveform
Surge Current	Maximum peak current with the specified 8/20 μ s waveform without
Surge Shift Δ V/V	The change of varistor voltage after applying the specified surge current
Energy Absorption	Maximum energy dissipated with a specified 10/1000 μ s waveform
Typical Capacitance	Capacitance measured with voltage bias less than 0.5 V_{RMS} at 1 KHz or 1 MHz
Nonlinear Exponent α	$\alpha = \frac{\log(V_{1mA}/V_{0.1mA})}{\log(I_{V1mA}/I_{V0.1mA})}$
Leakage Current	Typical leakage current at 25 °C < 50 μ A; Maximum leakage 200 μ A.
Cut-off Frequency	The frequency of -3 dB insertion loss

Surface Mount Multilayer Varistors

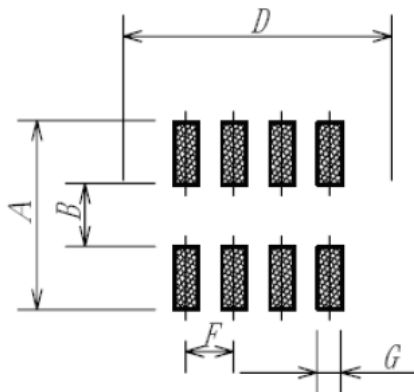
Recommended Land Patterns:

MLV Series



Size	Solder pad layout		
	A (mm)	C (mm)	D (mm)
0201	0.25~0.35	0.20~0.30	0.25~0.35
0402	0.4~0.6	0.5~0.6	0.5~0.7
0603	0.9~1.2	0.6~1.0	0.8~1.2
0805	1.0~1.5	1.2~1.5	1.0~1.4
1206	1.8~2.5	1.2~1.8	1.0~1.4
1210	1.8~2.5	2.2~3.0	1.0~1.4
1812	2.5~3.3	2.8~3.6	1.2~1.8
2220	3.8~4.6	4.8~5.5	1.2~1.8

ESD Array Series



Size	A (mm)	B (mm)	D (mm)	F (mm)	G (mm)
0508	2.10	0.40	2.50	0.50	0.35
0612	2.60	0.80	3.60	0.80	0.50

Surface Mount Multilayer Varistors

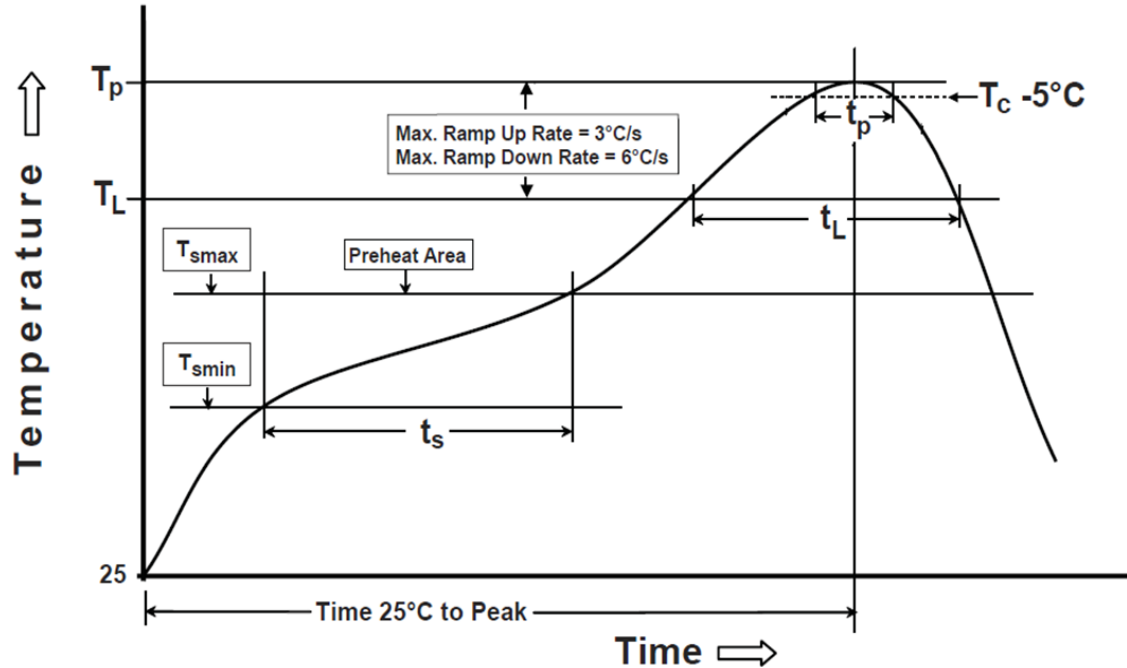
Environmental Tests:

No.	Test	Requirement	Test condition	Test reference
1	Soldering heat resistance	BDV change $\leq \pm 10\%$ No mechanical damage	One dip at 260°C for 5 sec.	MIL-STD-202 Method 210 IEC 60068-2-20
2	Solderability	New solder coverage $\geq 80\%$	One dip at 255°C for 5 sec. Non-active flux	MIL-STD-202 Method 208 IEC 60068-2-20
3	Maximum surge current	BDV change $\leq \pm 10\%$ No mechanical damage	100 pulses of 8/20 μs with maximum surge current and 30 sec. interval at 25°C and 30 ~ 65% RH	CECC 42000 IEC 1051-1 Test 4.5
4	Maximum surge energy	BDV change $\leq \pm 10\%$ No mechanical damage	100 pulses of 10/1000 μs with maximum surge current and 90 sec. interval at 25°C and 30 ~ 65% RH	CECC 42000
5	Thermal cycling	BDV change $\leq \pm 10\%$ No mechanical damage Leakage current $\leq 200 \mu\text{A}$	5 cycles between -40°C and 125°C with 30 min. dwell time at the temperature extremes and 60 min. dwell time at 25°C	CECC 42000 IEC 60068-2-14
6	Low temperature resistance	BDV change $\leq \pm 10\%$ No mechanical damage Leakage current $\leq 200 \mu\text{A}$	1000 hr at -50°C	IEC 60068-2-1
7	Low temperature load resistance	BDV change $\leq \pm 10\%$ No mechanical damage Leakage current $\leq 200 \mu\text{A}$	1000 hr at -50°C with working voltage applied	IEC 60068-2-1
8	High temperature resistance	BDV change $\leq \pm 10\%$ No mechanical damage Leakage current $\leq 200 \mu\text{A}$	1000 hr at 150°C	MIL-STD-202 Method 108 CECC 42000
9	High temperature load resistance	BDV change $\leq \pm 10\%$ No mechanical damage Leakage current $\leq 200 \mu\text{A}$	1000 hr at 85°C with working voltage applied	CECC 42000
10	Humidity resistance	BDV change $\leq \pm 10\%$ No mechanical damage Leakage current $\leq 200 \mu\text{A}$	500 hr at 40°C and 90 ~ 95% RH	MIL-STD-202 Method 103 IEC 60068-2-3 CECC 42000;
11	Humidity load resistance	BDV change $\leq \pm 10\%$ No mechanical damage Leakage current $\leq 200 \mu\text{A}$	500 hr at 40°C and 90 ~ 95% RH with working voltage applied	MIL-STD-202 Method 103 IEC 60068-2-3 CECC 42000
12	ESD contact test*	Varistor voltage change > 115% working voltage	Contact electrostatic discharge 100 times with 1 second intervals at 8 KV (Level 4) and polarity: +,-	IEC 61000-4-2
13	ESD air test*	Varistor voltage change > 115% working voltage	Air contact electrostatic discharge 100 times with 1 second intervals at 15 KV (Level 4) and polarity:+,-	IEC 61000-4-2

* For ES series only.

Surface Mount Multilayer Varistors

Soldering Temperature Profile:



Profile Feature	Pb-Free Assembly
Preheat/Soak Temperature Min (T_{smin}) Temperature Max (T_{smax}) Time (t_s) from (T_{smin} to T_{smax})	150°C 200°C 60~120 seconds
Ramp-uprate (T_L to T_p)	3°C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217°C 60~150 seconds
Peak package body temperature (T_p)	260°C
Time (t_p)*within 5°C of the specified classification temperature (T_c)	30 seconds *
Ramp-down rate (T_p to T_L)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.
* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum	

Surface Mount Multilayer Varistors

ESD Protection (ES) Series

Features:

- Fast Response < 0.5 ns
- Low Working Voltage 5 V
- Low Capacitance
- Low Leakage Current < 1 μ A
- Low Clamping Voltage

Application Fields:

- Cell Phones
- Digital Cameras
- PDAs
- MP3
- Notebooks

Part Number	Working Voltage (Max)	Breakdown Voltage	Clamping Voltage (Max)	Typical Capacitance Value (1 MHz)	ESD Contact	ESD Air
	DC(V)	(1mA)	(max.)	C (pF)	V_{ESD}	V_{ESD}
MLV0402ES012V0056N	12V	20V~30V	55V	56pF (\pm 30%)	8KV	15KV
MLV0402ES024V0003N	24V	48V~72V	110V	3.0pF (+80~-20%)	8KV	15KV
MLV0402ES005V0010N	5V	28V ~ 38V	72V	10pF (\pm 30%)	8KV	15KV
MLV0402ES005V0022N	5V	18V ~ 28V	52V	22pF (\pm 30%)	8KV	15KV
MLV0402ES005V0033N	5V	18V ~ 28V	52V	33pF (\pm 30%)	8KV	15KV
MLV0402ES005V0056N	5V	18V ~ 28V	52V	56pF (\pm 30%)	8KV	15KV
MLV0402ES012V0005P	12V	28V ~ 38V	72V	5.0pF (+80~-20%)	8KV	15KV
MLV0402ES012V0010N	12V	28V ~ 38V	72V	10pF (\pm 30%)	8KV	15KV
MLV0402ES024V02R5P	24V	100V ~ 150V	200V	2.5pF (+80~-20%)	8KV	15KV
MLV0402ES024V00R8P	24V	100V ~ 150V	200V	0.8pF (+80~-20%)	8KV	15KV
MLV0603ES005V0005P	5V	20V ~ 30V	55V	5.0pF (+80~-20%)	8KV	15KV
MLV0603ES005V0010N	5V	24V ~ 36V	65V	10pF (\pm 30%)	8KV	15KV
MLV0603ES005V0022N	5V	15V ~ 25V	34V	22pF (\pm 30%)	8KV	15KV
MLV0603ES005V0033N	5V	15V ~ 25V	34V	33pF (\pm 30%)	8KV	15KV
MLV0603ES005V0056N	5V	15V ~ 25V	36V	56pF (\pm 30%)	8KV	15KV
MLV0603ES012V0010N	12V	27V ~ 42V	60V	10pF (\pm 30%)	8KV	15KV
MLV0603ES012V0022N	12V	20V ~ 30V	55V	22pF (\pm 30%)	8KV	15KV
MLV0603ES012V0033N	12V	20V ~ 30V	55V	33pF (\pm 30%)	8KV	15KV
MLV0603ES012V0100N	12V	20V ~ 30V	55V	100pF (\pm 30%)	8KV	15KV
MLV0603ES024V02R5P	24V	100V ~ 150V	200V	2.5pF (+80~-20%)	8KV	15KV
MLV0603ES024V0003N	24V	48V ~ 72V	110V	3.0pF(+80~-20%)	8KV	15KV
MLV0603ES024V00R8P	24V	100V ~ 150V	200V	0.8pF (+80~-20%)	8KV	15KV

Surface Mount Multilayer Varistors

Normal Surge Protection (NA) Series

Features:

- Fast Response < 0.5 ns
- Low Capacitance
- Low Clamping Voltage and High Energy Absorption

Application Fields:

- Telecommunications
- Automotive Systems
- Data Systems
- Power Supplies

Ordering Information:

Part Number	Working Voltage (max)		Breakdown Voltage	Clamping Voltage	Surge Current (max)	Typical Capacitance Ref.
	AC (V _{RMS})	DC (V)	1 mA (V)	(V)	8/20 μs (A)	1 kHz (pF)
MLV0402NA006V0020	4	5.5	8 (7.5~10.5)	20	20	200
MLV0402NA009V0020	6	9	12 (10.2~13.8)	24	20	135
MLV0402NA011V0020	6	9	12 (10.2~13.8)	24	20	135
MLV0402NA014V0020	11	14	18 (15.3~20.7)	35	20	50
MLV0402NA018V0020	14	18	24 (21.6~26.4)	44	20	45
MLV0603NA006V0030	4	5.5	8 (7.5~10.5)	20	30	650
MLV0603NA009V0030	6	9	12 (10.2~13.8)	24	30	300
MLV0603NA014V0030	11	14	18 (15.3~20.7)	30	30	210
MLV0603NA018V0030	14	18	24 (21.6~26.4)	39	30	160
MLV0603NA022V0030	17	22	27 (24.3~29.7)	44	30	145
MLV0805NA006V0080	4	5.5	8 (7.5~10.5)	20	80	1400
MLV0805NA009V0080	6	9	12 (10.2~13.8)	24	80	650
MLV0805NA011V0100	6	9	12 (10.2~13.8)	24	80	650
MLV0805NA014V0100	11	14	18 (15.3~20.7)	30	100	350
MLV0805NA022V0100	17	22	27 (24.3~29.7)	44	100	250
MLV0805NA026V0100	20	26	33 (29.7~36.3)	54	100	220
MLV0805NA030V0100	25	30	39 (35.1~42.9)	65	100	200
MLV0805NA038V0100	30	38	47 (42.3~51.7)	77	100	150
MLV0805NA045V0080	35	45	56 (50.4~61.6)	90	80	110
MLV1206NA014V0100	11	14	18 (15.3~20.7)	30	100	800
MLV1206NA018V0100	14	18	24 (21.6~26.4)	39	100	620
MLV1206NA022V0100	17	22	27 (24.3~29.7)	44	100	700
MLV1206NA026V0100	20	26	33 (29.7~36.3)	54	100	480
MLV1206NA030V0100	25	30	39 (35.1~42.9)	65	100	400

Surface Mount Multilayer Varistors

Normal Surge Protection (NA) Series

Ordering Information:

Part Number	Working Voltage (max)		Breakdown Voltage 1 mA (V)	Clamping Voltage (max) (V)	Surge Current (max) 8/20 μ s (A)	Typical Capacitance Ref. 1 kHz (pF)
	AC (V _{RMS})	DC (V)				
MLV1206NA038V0100	30	38	47 (42.3~51.7)	77	100	260
MLV1206NA045V0100	35	45	56 (50.4~61.6)	90	100	230
MLV1206NA056V0100	40	56	68 (61.2~74.8)	110	100	200
MLV1206NA065V0100	50	65	82 (73.8~90.2)	135	100	175
MLV1206NA085V0100	60	85	100 (90~110)	165	100	150
MLV1210NA018V0250	14	18	24 (21.6~26.4)	39	250	1150
MLV1210NA022V0250	17	22	27 (24.3~29.7)	44	400	1500
MLV1210NA026V0250	20	26	33 (29.7~36.3)	54	250	610
MLV1210NA030V0250	25	30	39 (35.1~42.9)	65	400	800
MLV1210NA038V0250	30	38	47 (42.3~51.7)	77	400	530
MLV1210NA045V0250	35	45	56 (50.4~61.6)	90	250	400
MLV1210NA056V0250	40	56	68 (61.2~74.8)	110	250	300
MLV1210NA085V0200	60	85	100 (90~110)	165	200	210
MLV1812NA030V0500	25	30	39 (35.1~42.9)	65	800	2350
MLV1812NA038V0500	30	38	47 (42.3~51.7)	77	800	1600
MLV1812NA045V0500	35	45	56 (50.4~61.6)	90	500	1000
MLV2220NA018V1000	14	18	24 (21.6~26.4)	39	1200	8500
MLV2220NA030V1000	25	30	39 (35.1~42.9)	65	1200	7500

Surface Mount Multilayer Varistors

High Surge Protection (HA) Series

Features:

- Fast Response < 0.5 ns
- Low Capacitance
- Low Clamping Voltage and High Energy Absorption

Application Fields:

- Telecommunications
- Automotive Systems
- Data Systems
- Power Supplies

Ordering Information:

Part Number	Working Voltage (max)		Breakdown Voltage 1 mA (V)	Clamping Voltage (max) (V)	Surge Current (max) 8/20 μ s (A)	Typical Capacitance 1 kHz (pF)
	AC (V _{RMS})	DC (V)				
MLV0805HA018V0150	14	18	24 (21.6~26.4)	39	150	710
MLV1206HA014V0200	11	14	18 (15.3~20.7)	30	200	1200
MLV1206HA018V0200	14	18	24 (21.6~26.4)	39	200	780
MLV1206HA022V0200	17	22	27 (24.3~29.8)	44	200	750
MLV1206HA026V0200	20	26	33 (29.7~36.3)	54	200	700
MLV1206HA030V0200	25	30	39 (35.1~42.9)	65	200	510
MLV1206HA038V0200	30	38	47 (42.3~51.7)	77	200	440
MLV1206HA045V0200	35	45	56(50.4~61.6)	90	200	400
MLV1210HA018V0400	14	18	24 (21.6~26.4)	39	400	1600
MLV1210HA022V0400	17	22	27 (24.3~29.7)	44	400	1500
MLV1210HA026V0400	20	26	33 (29.7~36.3)	54	400	880
MLV1210HA030V0400	25	30	39 (35.1~42.9)	65	400	800
MLV1210HA038V0400	30	38	47 (42.3~51.7)	77	400	530
MLV1812HA018V0800	14	18	24 (21.6~26.4)	39	800	3500
MLV1812HA030V0800	25	30	39 (35.1~42.9)	65	800	2350
MLV1812HA038V0800	30	38	47 (42.3~51.7)	77	800	1600
MLV1812HA045V0800	35	45	56 (50.4~61.6)	90	800	1200
MLV2220HA018V1200	14	18	24 (21.6~26.4)	39	1200	8500
MLV2220HA030V1200	25	30	39 (35.1~42.9)	65	1200	7500
MLV2220HA038V1200	30	38	47 (42.3~51.7)	77	1200	4600
MLV2220HA045V1200	35	45	56 (50.4~61.6)	90	1200	3500

Surface Mount Multilayer Varistors

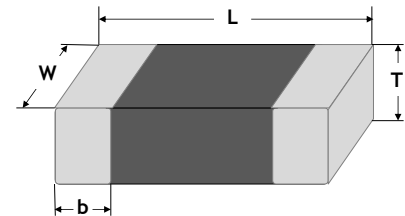
High Voltage (HV) Series

Features:

- Bidirectional and symmetrical V/I characteristics Low Capacitance
- Meet IEC61000-4-2 Standard
- Large withstanding surge current capability - 400~500A (@8/20 μ s)
- Multilayer construction provides higher power dissipation

Shape and Dimensions:

Unit (mm)	Length (L)	Width (W)	Thickness (T)	Termination bandwidth (b)
MLV3220HV240V0500	8.1 \pm 0.30	5.0 \pm 0.30	1.7 \pm 0.30	0.8 +0.5/-0.1
MLV3220HV270V0500				
MLV3220HV390V0500				
MLV3220HV430V0450				
MLV3220HV470V0400			2.2 \pm 0.30	



Product Identification:

MLV	3220	HV	270V	0500
Category Code MLV = Multilayer Varistor	Size Code Inch (mm) 3220 (8153)	Application Code HV = High Voltage	Breakdown Voltage Code 390V = 390V 430V = 430V 470V = 470V	Surge Current Code 0400 = 400A 0450 = 450A 0500 = 500A

Electrical Characteristics:

Operating temperature: -55 to +85°C

Part Number	Size	Working Voltage		Breakdown Voltage ¹ @1mA (V)	Clamping Voltage ²		Surge Current ³ @8/20 μ s (A)	Energy (J)	Capacitance ⁴ @1kHz (pF)
		Vac	Vdc		A	V			
MLV3220HV240V0500	3220	150	200	240 (\pm 10%)	10	390	500	> 14.5	380
MLV3220HV270V0500		175	225	270 (\pm 10%)		450	500	> 16.0	340
MLV3220HV390V0500		250	330	390 (\pm 10%)		647	500	> 20.0	125
MLV3220HV430V0450		275	369	430 (\pm 10%)		705	450	> 21.0	120
MLV3220HV470V0400		300	385	470 (\pm 10%)		775	400	> 21.6	115

¹ The breakdown voltage was measured at 1 mA current.

² The clamping voltage was measured at standard current 3220 (10A).

³ The surge current was tested at 8/20 μ s waveform.

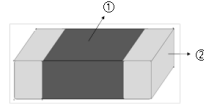
⁴ The capacitance value only for customer reference, it's not formal specification.

Surface Mount Multilayer Varistors

High Voltage (HV) Series

Construction and Materials:

Body ①	Termination ②
ZnO	Ag/Ni/Sn

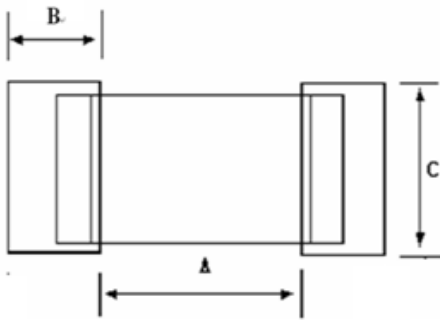


Packaging:

Chip Size	Parts on 7 inch (178mm) Reel
3220	1,000

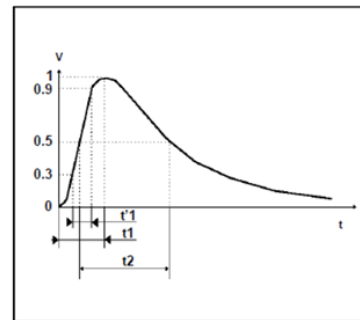
Recommended Foot Print Dimensions:

Size	A (mm)	B (mm)	C (mm)
3220	6.2~7.0	1.6~2.6	4.8~5.8



Surge Waveform:

Severity Level	t1 (=1.67t'1)	t2
1	8 μs	20 μs



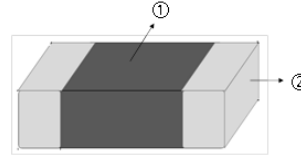
Environmental Test:

Test item	Test condition	Requirement
High Temperature Storage	* Temperature : 125±2°C * Time : 1000±2 hours * Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
High Temperature Storage	* Temperature : 125±2°C * Time : 1000±2 hours * Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
High Temperature Storage	* Temperature : 125±2°C * Time : 1000±2 hours * Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
High Temperature Load	* Temperature : 85±2°C * Rated working voltage applied * Time : 1000±2 hours * Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
High Temperature Load	* Temperature : 85±2°C * Rated working voltage applied * Time : 1000±2 hours * Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage

High Surge Protection Devices

Construction and Materials:

Body ①	Termination ②
Nano special ceramic	Ag/Ni/Sn



Packaging:

Chip Size	Parts on 7 inch (178mm) Reel
0806	2,000
1206	2,000
1210	1,500
1812	500
2220	500
3220	500

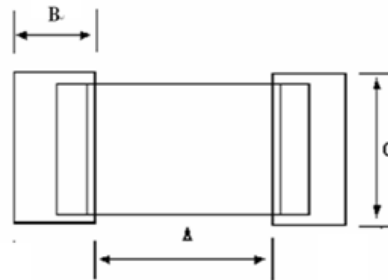
Environmental Test:

Test item	Test condition	Requirement
High Temperature Storage	*Temperature : 125±2°C *Time : 1000±2 hours *Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
Low Temperature Storage	*Temperature : -40±2°C *Time : 1000±2 hours *Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
Temperature Cycle	* Step 1 : -40±3°C for 30±3min * Step 2 : 25°C for 1 hour * Step 3 : 125±3°C for 30±3min * Step 4 : 25°C for 1 hour * Number of cycle : 5 times *Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
High Temperature Load	*Temperature : 85±2°C * Rated working voltage applied *Time : 1000±2 hours *Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage
Damp Heat Load/Humidity Load	*Temperature : 40±2°C * Humidity : 90~95% RH * Rated working voltage applied *Time : 500±2 hours *Test after placing in ambient temperature for 24 hours	* Breakdown voltage change : within ±10% * No mechanical damage

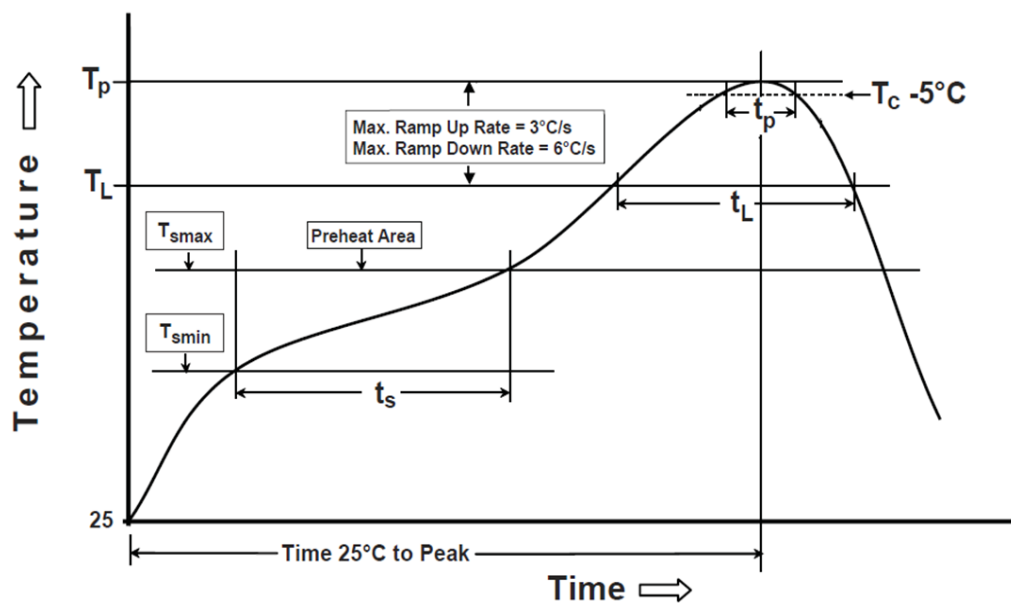
High Surge Protection Devices

Recommended Foot Print Dimensions:

Size	A (mm)	B (mm)	C (mm)
0806	1.2~1.6	0.8~1.2	1.6~2.2
1206	1.8~2.5	1.2~1.8	1.5~2.0
1210	1.8~2.5	1.3~2.0	2.2~3.0
1812	2.5~2.9	1.6~2.0	3.2~3.6
2220	3.8~4.6	1.3~2.2	4.8~5.5
3220	6.2~7.0	1.6~2.6	4.8~5.8



Recommended Reflow Soldering Profile:



Profile Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Min (T_{smin})	150°C
Temperature Max (T_{smax})	200°C
Time (t_s) from (T_{smin} to T_{smax})	60~120 seconds
Ramp-up rate (T_L to T_p)	3°C/second max.
Liquidous temperature (T_L)	217°C
Time (t_L) maintained above T_L	60~150 seconds
Peak package body temperature (T_p)	260°C
Time (t_p)*within 5°C of the specified classification temperature (T_c)	30 seconds *
Ramp-down rate (T_p to T_L)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.
* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum	

High Surge Protection Devices Super High Voltage (SV) Series

Features:

- SMD type body size 0806, 1206, 1208, 1210, 1812, 2220 and 3220
- Bidirectional and symmetrical V/I characteristics
- Meet IEC61000-4-5 Standard
- Large withstanding surge voltage capability - 0.5~2KV (@1.2/50 μ s, 2 Ω)
- Large withstanding surge current capability - 100~1000A (@8/20 μ s)
- Multilayer construction provides higher power dissipation
- RoHS compliant

Application Fields:

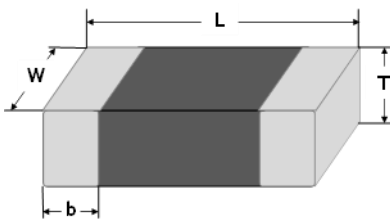
- LED lighting
- Power board
- Base station
- AC power supply
- Industrial equipment and controllers

Agency Approval:

Recognized under the components program of UL and CSA
File number: E475014

Shape and Dimensions:

Unit (mm)	0806	1206	1210	1812	2220	3220
Length (L)	2.20 \pm 0.20	3.20+0.60/-0.20	3.20+0.60/-0.20	4.50+0.60/-0.20	6.00+0.70/-0.30	8.10+0.70/-0.30
Width (W)	1.70 \pm 0.20	1.60+0.40/-0.20	2.50+0.40/-0.20	3.20+0.50/-0.20	5.30+0.50/-0.30	5.30+0.60/-0.30
Thickness (T)	1.80 Max.	1.90 Max.	2.60 Max.	3.50 Max.	3.60 Max.	3.70 Max.
Termination bandwidth (b)	0.25 \pm 0.10	0.50 \pm 0.20	0.50 \pm 0.25	0.50+0.35/-0.10	0.50+0.35/-0.10	0.80+0.50/-0.10



Product Identification:

HSP	2220	SV	390V	0800
<u>Category Code</u>	<u>Size Code</u>	<u>Application Code</u>	<u>Breakdown Voltage Code</u>	<u>Surge Current Code</u>
HSP = High Surge Protection Device	Inch 0806 1206 1210 1812 2220 3220	SV = Super High Voltage	240V = 240V 270V = 270V 390V = 390V 430V = 430V 470V = 470V	0100 = 100A 0200 = 200A 0350 = 350A 0500 = 500A 0800 = 800A 1000 = 1000A

High Surge Protection Devices Super High Voltage (SV) Series

Electrical Characteristics:

Operating temperature: -55 to +85°C

Part Number	Size	Working Voltage		Breakdown Voltage ¹ @1mA (V)	Clamping Voltage ² (V)	Surge Voltage ³ @1.2/50µs, 2Ω (kV)	Surge Current ³ @8/20µs (A)		Safety Certification	
		Vac	Vdc				1 time	15 times	UL ⁵	CSA ⁶
HSP2220SV270V0500	2220	175	225	270 (±10%)	450	1.0	500	250	✓	
HSP2220SV390V0500	2220	250	320	390 (±10%)	647	1.0	500	250	✓	
HSP2220SV430V0500	2220	275	350	430 (±10%)	705	1.0	500	250	✓	
HSP2220SV470V0500	2220	300	385	470 (±10%)	775	1.0	500	250	✓	
HSP2220SV240V0800	2220	139	195	240 (±10%)	395	2.0	800	500	✓	✓
HSP2220SV390V0800	2220	250	320	390 (±10%)	647	2.0	800	500	✓	
HSP2220SV430V0800	2220	275	350	430 (±10%)	705	2.0	800	500	✓	✓
HSP2220SV470V0800	2220	300	385	470 (±10%)	775	2.0	800	500	✓	✓
HSP3220SV430V1000	3220	275	350	430 (±10%)	705	2.0	1000	500	✓	✓
HSP3220SV470V1000	3220	300	385	470 (±10%)	775	2.0	1000	500	✓	✓

¹ The breakdown voltage was measured at 1 mA current.

² The clamping voltage was measured at standard current 1210 (2.5A), 1812 (5A), 2220 (10A) and 3220 (10A).

³ The surge voltage was tested at 1.2/50 µs waveform and 2Ω. The surge current was tested at 8/20 µs waveform.

⁴ The capacitance value only for customer reference, it's not formal specification.

⁵ The UL safety approval complies with standard UL1449 3rd.

⁶ The CSA safety approval complies with standard CSA C22.2 No. 8.

High Surge Protection Devices Super High Current (SC) Series

Features:

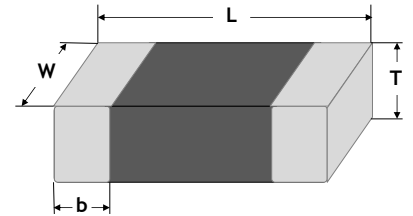
- SMD type – 1206~2220 sizes
- Bidirectional and symmetrical V/I characteristics
- Meet IEC61000-4-5/K21 standard
- Large withstanding surge current capability à 500~8000A (@8/20 μ s)
- Excellent low leakage current <15 μ A
- Multilayer construction provides higher power dissipation
- RoHS compliant

Application Fields:

- Telecom equipment RJ45, LAN connector, Ethernet
- Outdoor/Indoor AP/IAD
- Security system IP CAM
- Low voltage power line
- Base station

Shape and Dimensions:

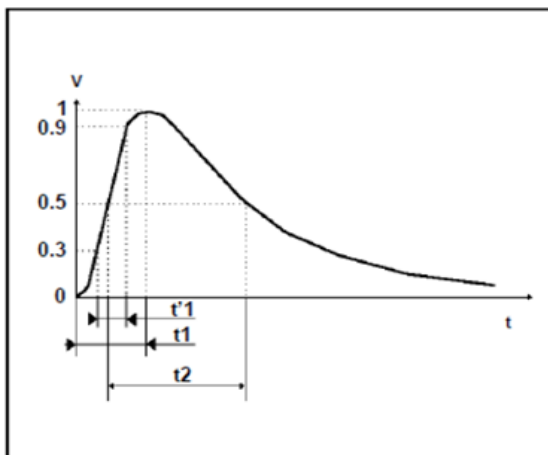
Unit (mm)	1206	1210	1812	2220
Length (L)	3.2 +0.6/-0.2	3.2 +0.6/-0.2	4.5 +0.6/-0.2	6.0 +0.7/-0.3
Width (W)	1.6 +0.4/-0.2	2.5 +0.4/-0.2	3.2 +0.5/-0.2	5.3 +0.5/-0.3
Thickness (T)	1.90 Max.	2.60 Max.	3.50 Max.	3.60 Max.
Termination band-	0.5 \pm 0.20	0.5 \pm 0.25	0.5 +0.35/-0.1	0.5 +0.35/-0.1



Product Identification:

HSP	1206	SC	012V	0500
Category Code	Size Code	Application Code	Breakdown Voltage Code	Surge Current Code
HSP = High Surge Protection Device	Inch 1206 1210 1812 2220	SC = Super High Current	012V = 12V 024V = 24V 047V = 47V 056V = 56V 075V = 75V 082V = 82V	0500 = 500A 1000 = 1000A 2000 = 2000A 3000 = 3000A 5000 = 5000A 8000 = 8000A

Surge Waveform:



Severity Level	t1	t2
1	8 μ s	20 μ s

Fig. 1 8/20 μ s surge definition

High Surge Protection Devices Super High Current (SC) Series

Electrical Characteristics:

Part Number	Size	Working Voltage		Breakdown Voltage @1mA (V) ¹	Clamping Voltage (V) ²	Surge Current @ 8/20 μ s (A) ³
		VAC	VDC			
HSP1206SC012V0500	1206	6	9	12 (12~20)	<25	500
HSP1206SC024V0500	1206	14	18	24 (\pm 10%)	<45	500
HSP1206SC047V0500	1206	30	38	47 (\pm 10%)	<85	500
HSP1206SC075V0500	1206	48	60	75 (\pm 10%)	<100	500
HSP1210SC024V1000	1210	14	18	24 (\pm 10%)	<45	1000
HSP1210SC047V1000	1210	30	38	47 (\pm 10%)	<85	1000
HSP1812SC047V2000	1812	30	38	47 (\pm 10%)	<85	2000
HSP2220SC047V5000	2220	30	38	47 (\pm 10%)	<85	5000
HSP2220SC047V8000	2220	30	38	47 (\pm 10%)	<85	8000
HSP1210SC075V1000	1210	48	60	75 (\pm 10%)	<100	1000
HSP1812SC075V2000	1812	48	60	75 (\pm 10%)	<100	2000
HSP2220SC075V3000	2220	48	60	75 (\pm 10%)	<100	3000

¹ The breakdown voltage was measured at 1 mA current

² The clamping voltage was measured at standard current 1206 (1A), 1210 (2.5A), 1812 (5A) and 2220 (10A)

³ The surge current was tested at 8/20 μ s waveform

Part Number	Non-linear Coefficient (α)	Leakage Current (μ A)		Capacitance ⁴ @ 1kHz (pF)	Response Time (T _{rise})	Operating Temperature (°C)	Storage Temperature (°C)
		Before Surge Test	After Surge Test				
HSP1206SC012V0500	20	<10	<80	3500	< 1ns	-55 to +125	-55~+150
HSP1206SC024V0500	20	<10	<80	2300			
HSP1206SC047V0500	30	<10	<80	690			
HSP1206SC075V0500	30	<10	<80	300			
HSP1210SC024V1000	20	<15	<80	2300			
HSP1210SC047V1000	30	<10	<80	1550			
HSP1210SC075V1000	30	<10	<80	930			
HSP1812SC047V2000	30	<15	<80	2100			
HSP1812SC075V2000	30	<15	<80	1650			
HSP2220SC047V5000	35	<15	<80	9900			
HSP2220SC047V8000	35	<15	<80	7500			
HSP2220SC075V3000	40	<15	<80	2000			

⁴ The capacitance value only for customer reference, it's not formal specification

High Surge Protection Devices Super High Network (SN) Series

Features:

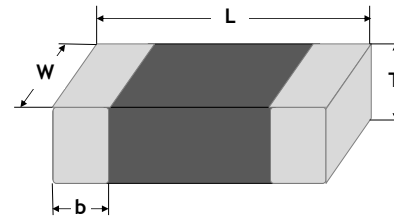
- Bidirectional and symmetrical V/I characteristics
- Meet IEC61000-4-5/K21 standard
- Large withstanding surge voltage capability: 4~6KV (@10/700 μ s)
- Excellent low leakage current <10 μ A
- Multilayer construction provides higher power dissipation

Application Fields:

- Telecom equipment RJ45, LAN connector, Ethernet
- Outdoor/Indoor AP/IAD
- Security system IP CAM
- Low voltage power line DC12V, AC24V, PoE
- ADSL/XDSL telecom equipment
- VOIP phones
- PoE modules
- HUB switch
- Other Networks

Shape and Dimensions:

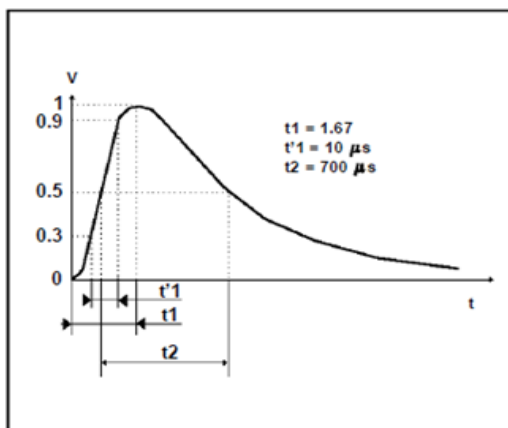
Unit (mm)	1206	1210
Length (L)	3.2 +0.6/-0.2	3.2 +0.6/-0.2
Width (W)	1.6 +0.4/-0.2	2.5 +0.4/-0.2
Thickness (T)	1.90 Max.	2.60 Max.
Termination band-width (b)	0.5 \pm 0.20	0.5 \pm 0.25



Product Identification:

HSP	1206	SN	012V	4000
<u>Category Code</u>	<u>Size Code</u>	<u>Application Code</u>	<u>Breakdown Voltage Code</u>	<u>Surge Voltage Code</u>
HSP = High Surge Protection Device	Inch (mm) 1206 (3216) 1210 (3225)	SN = Super High Network	012V = 12V 047V = 47V 075V = 75V	4000 = 4kV 6000 = 6kV

Surge Waveform:



Severity Level	t1	t2
1	10 μ s	700 μ s

Fig. 1 CCITT 7 10/700 μ s surge definition

High Surge Protection Devices

Super High Network (SN) Series

Electrical Characteristics:

Part Number	Size	Working Voltage		Breakdown Voltage @1mA (V) ¹	Clamping Voltage (V) ²	Surge Current @ 10/700μs (A) ³	Surge Voltage (kV)
		VAC	VDC				
HSP1206SN012V4000	1206	6	9	12 (12~20)	< 30	100	4
HSP1206SN012V6000	1206	6	9	12 (12~20)	< 30	150	6
HSP1210SN047V4000	1210	30	38	47 (±10%)	< 75	100	4
HSP1210SN047V6000	1210	30	38	47 (±10%)	<75	150	6
HSP1210SN075V4000	1210	48	60	75 (±10%)	< 100	100	4
HSP1210SN075V6000	1210	48	60	75 (±10%)	< 100	150	6

¹ The breakdown voltage was measured at 1 mA current.

² The clamping voltage was measured at standard current 1206(1A) and 1210 (2.5A).

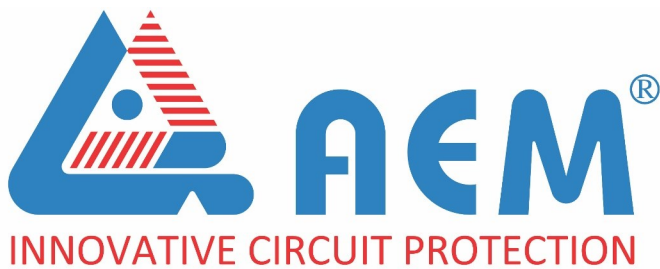
³ The surge current was tested at 10/700 μs waveform, Ri=40Ω. Common-mode testing is to test all data lines while the GND.

Part Number	Non-linear Coefficient (α)	Leakage Current (μA)		Capacitance ⁴ @ 1kHz (pF)	Response Time (T _{rise})	Operating Temperature (°C)	Storage Temperature (°C)
		Before Surge Test	After Surge Test				
HSP1206SN012V4000	20	10	80	3200	< 1ns	-55 to +125	-55~+150
HSP1206SN012V6000	20	10	80	3850			
HSP1210SN047V4000	30	10	80	1400			
HSP1210SN047V6000	30	10	80	1670			
HSP1210SN075V4000	30	10	80	1000			
HSP1210SN075V6000	30	10	80	1300			

⁴ The capacitance value only for customer reference, it's not formal specification.

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