

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)	Clamping Voltage (Max)	Leakage Current (Max)	Typical Capacitance Value (1 MHz)	Tolerance of Cap.
	DC(V)	(V)	ILDC(μ A)	C (pF)	(%)
MLV0402ES005V0100N	5.5	55	1	100	\pm 30
MLV0402ES005V0056N	5.5	55	1	56	\pm 30
MLV0402ES005V0033N	5.5	55	1	33	\pm 30
MLV0402ES005V0022N	5.5	55	1	22	\pm 30
MLV0402ES005V0010N	5.5	60	1	10	\pm 30
MLV0402ES005V0005P	5.5	76	1	5	5~9 pF
MLV0402ES012V0100N	12	55	1	100	\pm 30
MLV0402ES012V0056N	12	55	1	56	\pm 30
MLV0402ES012V0033N	12	55	1	33	\pm 30
MLV0402ES012V0022N	12	55	1	22	\pm 30
MLV0402ES012V0010N	12	60	1	10	\pm 30
MLV0402ES012V0005P	12	80	1	5	5~9 pF
MLV0402ES024V0003N	24	120	1	3	\pm 30
MLV0402ES024V02R5P	24	198	1	2.5	2~4 pF
MLV0402ES024V00R8P	24	200	1	0.8	0.8~1.5 pF
MLV0603ES005V0100N	5.5	55	1	100	\pm 30
MLV0603ES005V0056N	5.5	55	1	56	\pm 30
MLV0603ES005V0033N	5.5	55	1	33	\pm 30
MLV0603ES005V0022N	5.5	55	1	22	\pm 30
MLV0603ES005V0010N	5.5	60	1	10	\pm 30
MLV0603ES005V0005P	5.5	76	1	5	5~9 pF
MLV0603ES012V0100N	12	55	1	100	\pm 30
MLV0603ES012V0056N	12	55	1	56	\pm 30
MLV0603ES012V0033N	12	55	1	33	\pm 30
MLV0603ES012V0022N	12	55	1	22	\pm 30
MLV0603ES012V0010N	12	60	1	10	\pm 30
MLV0603ES012V0005P	12	80	1	5	5~9 pF
MLV0603ES024V0003N	24	120	1	3	\pm 30
MLV0603ES024V02R5P	24	198	1	2.5	2~4 pF
MLV0603ES024V00R8P	24	200	1	0.8	0.8~1.5 pF
MLV0805ES005V0100N	5.5	50	1	100	\pm 30
MLV0805ES005V0056N	5.5	50	1	56	\pm 30

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 1 mA (V)	Peak Current (max) 8/20 μ s (A)	Clamping Voltage (max)		Energy Absorption (max) 10/1000 μ s (J)	Typical Capacitance Ref. 1 KHz (pF)
	AC (V _{RMS})	DC (V)			(A)	(V)		
MLV0402NA006V0020	4	5.5	8 (7.5~10.5)	20	1	20	0.05	200
MLV0402NA009V0020	6	9	12 (10.2~13.8)	20	1	23	0.05	135
MLV0402NA011V0020	8	11	15 (12.8~17.3)	20	1	25	0.05	75
MLV0402NA014V0020	11	14	18 (15.3~20.7)	20	1	30	0.05	50
MLV0402NA018V0020	14	18	24 (21.6~26.4)	20	1	39	0.05	45
MLV0603NA006V0030	4	5.5	8 (7.5~10.5)	30	1	20	0.1	360
MLV0603NA009V0030	6	9	12 (10.2~13.8)	30	1	23	0.1	300
MLV0603NA014V0030	11	14	18 (15.3~20.7)	30	1	30	0.1	210
MLV0603NA018V0030	14	18	24 (21.6~26.4)	30	1	39	0.1	160
MLV0603NA022V0030	17	22	27 (24.3~29.7)	30	1	44	0.1	145
MLV0603NA030V0030	25	30	39 (35.1~42.9)	30	1	65	0.1	110
MLV0603NA038V0030	30	38	47 (42.3~51.7)	30	1	77	0.1	90
MLV0805NA006V0080	4	5.5	8 (7.5~10.5)	80	1	20	0.1	1400
MLV0805NA009V0080	6	9	12 (10.2~13.8)	80	1	23	0.1	650
MLV0805NA011V0100	8	11	15 (12.75~17.25)	100	1	25	0.2	410
MLV0805NA014V0100	11	14	18 (15.3~20.7)	100	1	30	0.2	350
MLV0805NA018V0100	14	18	24 (21.6~26.4)	100	1	39	0.2	300
MLV0805NA022V0100	17	22	27 (24.3~29.7)	100	1	44	0.2	250
MLV0805NA026V0100	20	26	33 (29.7~36.3)	100	1	54	0.3	220
MLV0805NA030V0100	25	30	39 (35.1~42.9)	100	1	65	0.3	200
MLV0805NA038V0100	30	38	47 (42.3~51.7)	100	1	77	0.3	150
MLV0805NA045V0080	35	45	56 (50.4~61.6)	80	1	90	0.3	110
MLV1206NA006V0100	4	5.5	8 (7.5~10.5)	100	1	20	0.2	3100
MLV1206NA014V0100	11	14	18 (15.3~20.7)	100	1	30	0.3	800
MLV1206NA018V0100	14	18	24 (21.6~26.4)	100	1	38	0.3	620
MLV1206NA022V0100	17	22	27 (24.3~29.7)	100	1	44	0.4	700
MLV1206NA026V0100	20	26	33 (29.7~36.3)	100	1	54	0.5	480
MLV1206NA030V0100	25	30	39 (35.1~42.9)	100	1	65	0.6	400

Surface Mount Multilayer Varistors

Normal Surge Protection (NA) Series

Ordering Information:

Part Number	Working Voltage (max)		Breakdown Voltage 1 mA (V)	Peak Current (max) 8/20 μ s (A)	Clamping Voltage (max)		Energy Absorption (max) 10/1000 μ s (J)	Typical Capacitance 1 KHz (pF)
	AC (V _{RMS})	DC (V)			(A)	(V)		
MLV1206NA038V0100	30	38	47 (42.3~51.7)	100	1	77	0.7	260
MLV1206NA045V0100	35	45	56 (50.4~61.6)	100	1	90	0.8	230
MLV1206NA056V0100	40	56	68 (61.2~74.8)	100	1	110	1.0	200
MLV1206NA065V0100	50	65	82 (73.8~90.2)	100	1	135	0.5	175
MLV1206NA085V0100	60	85	100 (90~110)	100	1	165	0.6	150
MLV1210NA006V0250	4.5	5.5	8 (7.5~10.5)	250	2.5	20	0.5	5200
MLV1210NA018V0250	14	18	24 (21.6~26.4)	250	2.5	38	0.8	1150
MLV1210NA022V0250	17	22	27 (24.3~29.7)	250	2.5	44	1.0	1720
MLV1210NA026V0250	20	26	33 (29.7~36.3)	250	2.5	54	1.2	610
MLV1210NA030V0250	25	30	39 (35.1~42.9)	250	2.5	65	1.4	920
MLV1210NA038V0250	30	38	47 (42.3~51.7)	250	2.5	77	1.6	780
MLV1210NA045V0250	35	45	56 (50.4~61.6)	250	2.5	90	2.0	400
MLV1210NA056V0250	40	56	68 (61.2~74.8)	250	2.5	110	2.3	300
MLV1210NA085V0200	60	85	100 (90~110)	200	2.5	165	1.4	210
MLV1812NA018V0500	14	18	24 (21.6~26.4)	500	5	38	1.7	2000
MLV1812NA030V0500	25	30	39 (35.1~42.9)	500	5	65	2.9	2500
MLV1812NA038V0500	30	38	47 (42.3~51.7)	500	5	77	3.5	2200
MLV1812NA045V0500	35	45	56 (50.4~61.6)	500	5	90	4.2	1000
MLV2220NA018V1000	14	18	24 (21.6~26.4)	1000	10	38	3.1	8500
MLV2220NA030V1000	25	30	39 (35.1~42.9)	1000	10	65	5.5	3900
MLV2220NA038V1000	30	38	47 (42.3~51.7)	1000	10	77	6.3	4600
MLV2220NA056V1000	40	56	68 (61.2~74.8)	1000	10	110	8.8	4000

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	Peak Current (max)	Clamping Voltage (max)		Energy Absorption (max)	Typical Capacitance
	AC (V _{RMS})	DC (V)	1 mA (V)	8/20 μs (A)	(A)	(V)	10/1000 μs (J)	1 KHz (pF)
MLV1206HA014V0200	11	14	18 (15.3~20.7)	200	1	30	0.5	1200
MLV1206HA018V0200	14	18	24 (21.6~27.0)	200	1	39	0.5	780
MLV1206HA022V0200	17	22	27 (24.3~29.8)	200	1	44	0.7	750
MLV1206HA026V0200	20	26	33 (29.7~36.3)	200	1	54	1.0	700
MLV1206HA030V0200	25	30	39 (35.1~42.9)	200	1	65	1.0	510
MLV1206HA038V0200	30	38	47 (42.3~51.7)	200	1	77	1.1	440
MLV1210HA014V0400	11	14	18 (15.3~20.7)	400	2.5	30	1.2	2000
MLV1210HA018V0400	14	18	24 (21.6~27.0)	400	2.5	39	1.4	1600
MLV1210HA022V0400	17	22	27 (24.3~29.8)	400	2.5	44	1.7	1500
MLV1210HA026V0400	20	26	33 (29.7~36.3)	400	2.5	54	1.9	880
MLV1210HA030V0400	25	30	39 (35.1~42.9)	400	2.5	65	1.7	800
MLV1210HA038V0400	30	38	47 (42.3~51.7)	400	2.5	77	2.0	530
MLV1812HA018V0800	14	18	24 (21.6~27.0)	800	5	38	2.3	3500
MLV1812HA030V0800	25	30	39 (35.1~42.9)	800	5	65	3.7	2350
MLV1812HA038V0800	30	38	47 (42.3~51.7)	800	5	77	4.2	1600
MLV1812HA045V0800	35	45	56 (50.4~61.6)	800	5	90	4.2	1200
MLV2220HA014V1200	11	14	18 (15.3~20.7)	1200	10	30	5.4	10500
MLV2220HA018V1200	14	18	24 (21.6~27.0)	1200	10	39	5.8	8500
MLV2220HA022V1200	17	22	27 (24.3~29.8)	1200	10	44	7.2	8300
MLV2220HA030V1200	25	30	39 (35.1~42.9)	1200	10	65	9.6	6000
MLV2220HA038V1200	30	38	47 (42.3~51.7)	1200	10	77	12.0	4000
MLV2220HA045V1200	35	45	56 (50.4~61.6)	1200	10	90	12.0	3500

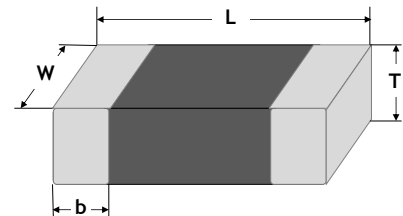
Surface Mount Multilayer Varistors High Voltage (HV) Series

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				



Product Identification:

MLV	3220	HV	270V	0500
<u>Category Code</u>	<u>Size Code</u>	<u>Application Code</u>	<u>Breakdown Voltage Code</u>	<u>Surge Current Code</u>
MLV = Multilayer Varistor	Inch (mm) 3220 (8153)	HV = High Voltage	390V = 390V 430V = 430V 470V = 470V	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).

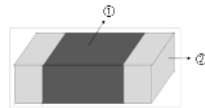
³ The surge current was tested at 8/20 μ s waveform.

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

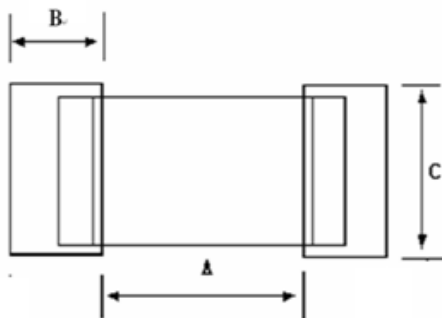


Packaging:

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

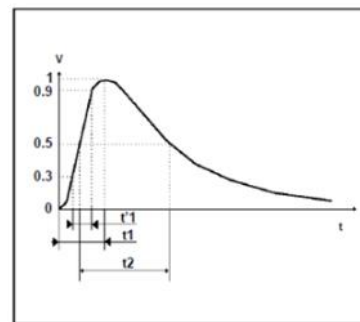
Recommended Foot Print Dimensions:

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

Surface Mount Multilayer Varistors ESD Array Series



Features:

- Low Leakage Current
- Low Leakage Inductance and Fast Response
- Four Varistors in a chip
- Minimizing Crosstalk between Adjacent Circuits

Application Fields:

- ESD protection
- ECU protection
- I/O Protection
- LCD Display

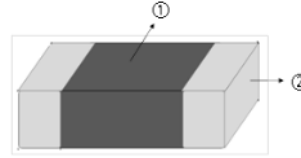
Ordering Information:

Part Number	Working Voltage (Max.)	Breakdown Voltage	Clamping Voltage (Max.)	Leakage Current (Max.)	Insulation Resistance (Min.)	Typical Capacitance Value (1 MHz)	Tolerance of Cap.
	DC(V)	(V)	(V)	(μ A)	(M Ω)	(pF)	(%)
MVA0508L4V005C0010N	5	24	60	1.0	10	10	\pm 30
MVA0612L4V018C0120N	18	28	50	1.0	10	120	\pm 30

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

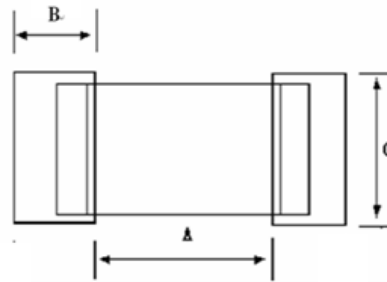
Environmental Test:

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

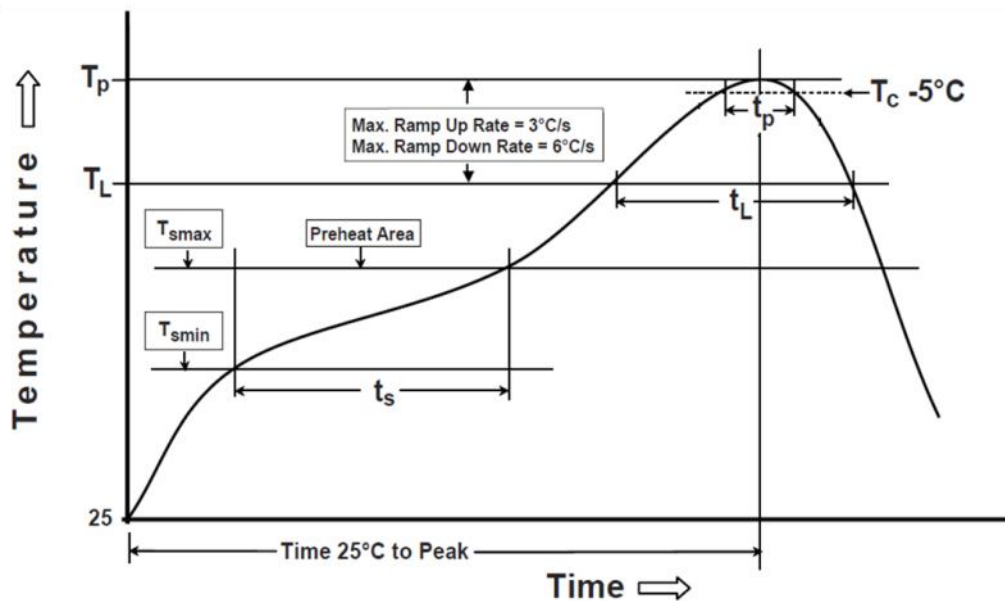
High Surge Protection Devices

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}) 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	

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:

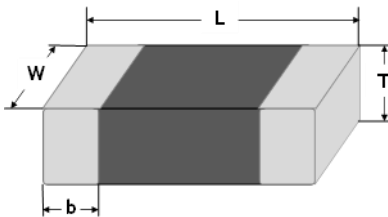
- LED lighting
- Power board
- Base station
- AC power supply
- Industrial equipment and controllers

Application Fields:

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)		Energy Max. @10/1000 µs (J)	Capacitance ⁴ @1kHz (pF)	Safety Certification	
		Vac	Vdc			1 time	15 times	1 time	15 times			UL ⁵	CSA ⁶
HSP0806SV240V0200	0806	150	200	240 (±10%)	395	0.5	200	100	4.4	95	Pending		
HSP0806SV430V0100	0806	275	350	430 (±10%)	705	0.5	100	100	4.3	45	Pending		
HSP1206SV240V0350	1206	150	200	240 (±10%)	395	0.5	350	200	7.7	180	Pending		
HSP1210SV390V0200	1210	250	320	390 (±10%)	647	0.5	200	100	7.2	105	✓		
HSP1210SV470V0250	1210	300	385	470 (±10%)	775	0.5	250	150	11.9	100	Pending		
HSP1210SV470V0500	1210	300	385	470 (±10%)	775	1.0	500	250	23.8	190	Pending		
HSP1812SV270V0500	1812	175	225	270 (±10%)	450	1.0	500	250	22.0	275	✓		
HSP1812SV470V0500	1812	300	385	470 (±10%)	775	1.0	500	250	23.0	200	✓	✓	
HSP1812SV430V0800	1812	275	350	430 (±10%)	705	2.0	800	500	38.0	340	✓	✓	
HSP1812SV470V0800	1812	300	385	470 (±10%)	775	2.0	800	500	38.0	310	✓	✓	
HSP2220SV270V0500	2220	175	225	270 (±10%)	450	1.0	500	250	13.8	390	Pending		
HSP2220SV390V0500	2220	250	320	390 (±10%)	647	1.0	500	250	19.8	235	✓		
HSP2220SV430V0500	2220	275	350	430 (±10%)	705	1.0	500	250	21.6	215	✓		
HSP2220SV470V0500	2220	300	385	470 (±10%)	775	1.0	500	250	23.7	195	✓		
HSP2220SV240V0800	2220	139	195	240 (±10%)	295	2.0	800	500	21.0	430	Pending		
HSP2220SV390V0800	2220	250	320	390 (±10%)	647	2.0	800	500	31.8	320	✓		
HSP2220SV430V0800	2220	275	350	430 (±10%)	705	2.0	800	500	34.7	305	✓	✓	
HSP2220SV470V0800	2220	300	385	470 (±10%)	775	2.0	800	500	38.0	290	✓	✓	
HSP3220SV430V1000	3220	275	350	430 (±10%)	705	2.0	1000	500	46.8	490	Pending		
HSP3220SV470V1000	3220	300	385	470 (±10%)	775	2.0	1000	500	51.5	450	Pending		

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:

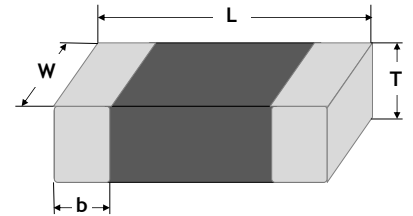
- SMD type – 1206~2220 sizes
- Bidirectional and symmetrical V/I characteristics
- Meet IEC61000-4-5/K21 standard
- Large withstanding surge current capability à 500~8000A (@8/20µs)
- Excellent low leakage current <math><15\mu\text{A}</math>
- Multilayer construction provides higher power dissipation
- 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:

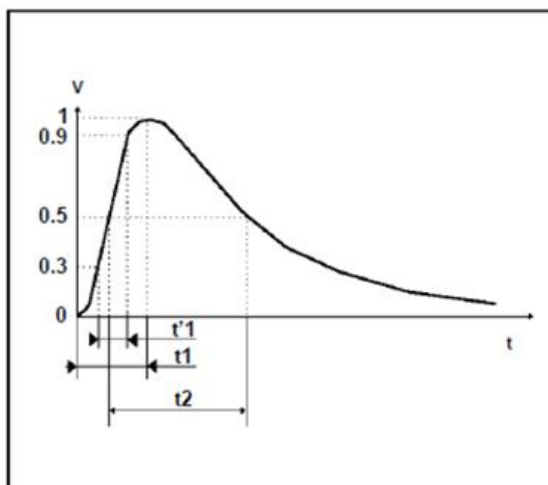
Unit (mm)	1206	1210	1812	2220
Length (L)	3.2 +0.6/-0.2	3.2 +0.6/-0.2	4.5 +0.6/-0.2	6.0 +0.7/-0.3
Width (W)	1.6 +0.4/-0.2	2.5 +0.4/-0.2	3.2 +0.5/-0.2	5.3 +0.5/-0.3
Thickness (T)	1.90 Max.	2.60 Max.	3.50 Max.	3.60 Max.
Termination bandwidth (b)	0.5±0.20	0.5±0.25	0.5 +0.35/-0.1	0.5 +0.35/-0.1



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 (=1.67t'1)	t2
1	8 µs	20 µs

Fig. 1 8/20 µs 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 @ 8/20µs (A) ³
		VAC	VDC			
HSP1206SC012V0500	1206	6	9	12 (12~20)	<25	500
HSP1206SC024V0500	1206	14	18	24 (±10%)	<45	500
HSP1206SC047V0500	1206	30	38	47 (±10%)	<85	500
HSP1206SC075V0500	1206	48	60	75 (±10%)	<100	500
HSP1210SC024V1000	1210	14	18	24 (±10%)	<45	1000
HSP1210SC047V1000	1210	30	38	47 (±10%)	<85	1000
HSP1210SC075V1000	1210	48	60	75 (±10%)	<100	1000
HSP1812SC047V2000	1812	30	38	47 (±10%)	<85	2000
HSP1812SC075V2000	1812	48	60	75 (±10%)	<100	2000
HSP2220SC047V5000	2220	30	38	47 (±10%)	<85	5000
HSP2220SC047V8000	2220	30	38	47 (±10%)	<85	8000
HSP2220SC075V3000	2220	48	60	75 (±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 µs waveform

Part Number	Non-linear Coefficient (α)	Leakage Current (µA)		Capacitance ⁴ @ 1kHz (pF)	Response Time (T _{rise})	Operating Temperature (°C)
		Before Surge Test	After Surge Test			
HSP1206SC012V0500	20	<10	<80	3500	< 1ns	-55 to +125
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:

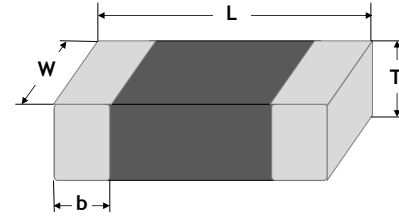
- Bidirectional and symmetrical V/I characteristics
- Meet IEC61000-4-5/K21 standard
- Large withstanding surge voltage capability: 4~6KV (@10/700 μ s)
- Excellent low leakage current <10 μ A
- Multilayer construction provides higher power dissipation

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
- PoE modules
- HUB switch
- VOIP phones
- Other Networks

Shape and Dimensions:

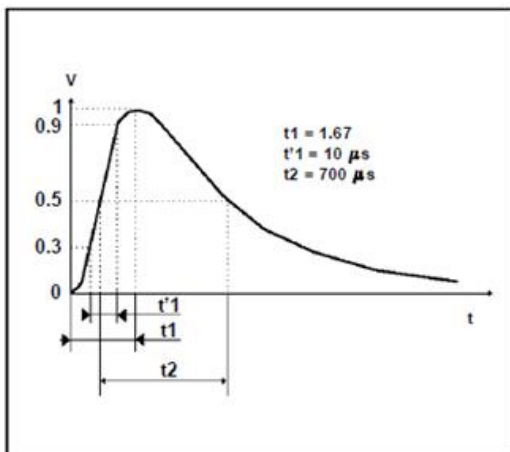
Unit (mm)	1206	1210
Length (L)	3.2 +0.6/-0.2	3.2 +0.6/-0.2
Width (W)	1.6 +0.4/-0.2	2.5 +0.4/-0.2
Thickness (T)	1.90 Max.	2.60 Max.
Termination bandwidth (b)	0.5 \pm 0.20	0.5 \pm 0.25



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 (=1.67t'1)	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)
		Before Surge Test	After Surge Test			
HSP1206SN012V4000	20	10	80	3200	< 1ns	-55 to +125
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.

Surface Mount Multilayer Varistors

Product Identification:

MLV 0402 ES 012V 0100 N I
(1) (2) (3) (4) (5) (6) (7)

(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 – ± 30%

P – **Special**

(7) Packaging Code:

T – Tape & Reel

B – Bulk

Operating Temperatures:

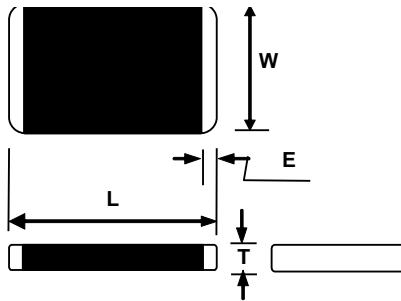
-55°C to +85°C for size 0603 or smaller

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

Surface Mount Multilayer Varistors

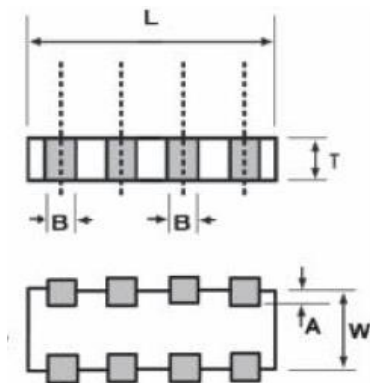
Shape and Dimensions:

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

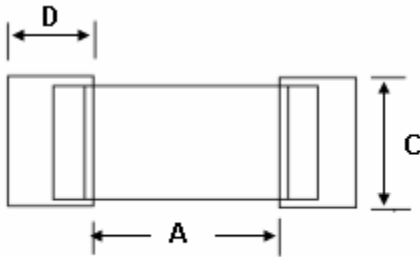
Terms and Definitions:

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 damage
Surge Shift $\Delta V/V$	The change of varistor voltage after applying the specified surge current
Energy Absorption	Maximum energy dissipated with a specified 10/1000 μ s waveform without damage
Typical Capacitance	Capacitance measured with voltage bias less than 0.5 V_{RMS} at 1 KHz or 1 MHz
Nonlinear Exponent α	$\alpha = (\log(V_{1mA}/V_{0.1mA}) / \log(I_{V1mA}/I_{V0.1mA}))$
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

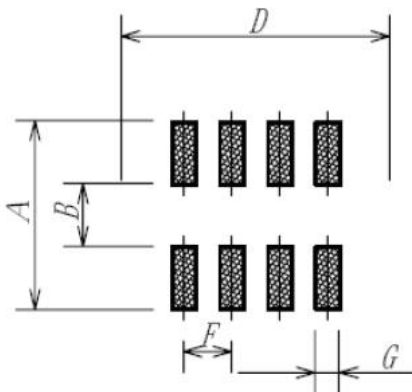
Recommended Land Patterns:

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

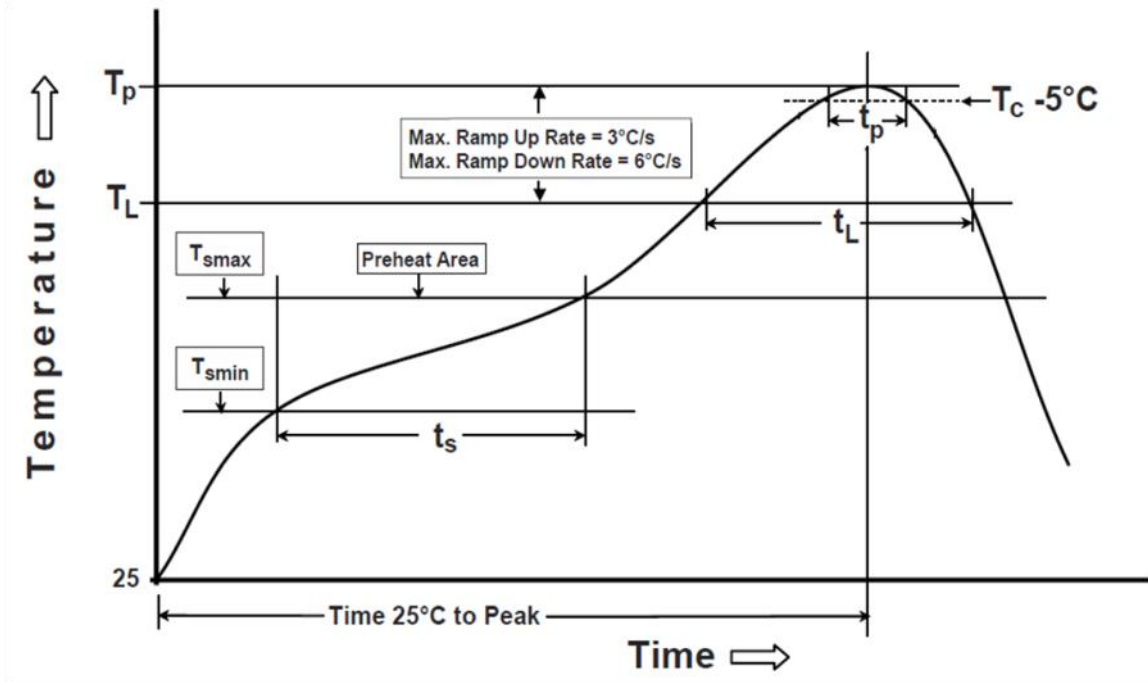
Environmental Tests:

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-up rate (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	

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