

Surface Mount High Surge Protection (HSP) Devices Super High Automotive (SA) Series

Features:

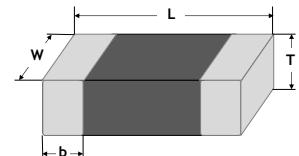
- SMD type with small size package – 1206 to 3220
- Meet ISO7637-2 pulse 5
- Qualified base on AEC-Q200
- Bidirectional and symmetrical V/I characteristics
- Large withstanding surge current capability – 200~5000A (@ 8/20μs)
- Excellent low leakage current <5μA
- The jump start is 24.5V (for BDV 24V products) or 45V (for BDV 47V products) of 5 min.
- Large load dump withstanding capability – 1.5 to 50J (10 times)
- Operating temperature is -55 ~ +125 °C
- Halogen-free and RoHS compliant

Application Fields:

- Power Window, Power Seat, Sunroof, Wipers, Rear-view Mirror, Multi-Media and the other Electrical control units (ECUs)

Shape and Dimensions:

Unit (mm)	1206	1210	1812	2220	3220
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	8.1 +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	5.3 +0.6/-0.3
Thickness (T)	1.90 Max.	2.60 Max.	3.50 Max.	3.60 Max.	3.70 Max.
Termination bandwidth (b)	0.5±0.20	0.5±0.25	0.5 +0.35/-0.1	0.5 +0.35/-0.1	0.8 +0.5/-0.1



Product Identification:

HSP	1206	SA	024V	006J
<u>Category Code</u>	<u>Size Code</u>	<u>Application Code</u>	<u>Breakdown Voltage Code</u>	<u>Load Dump Code</u>
HSP = High Surge Protection Device	Inch (mm) 1206 (3216) 1210 (3225) 1812 (4532) 2220 (6053) 3220 (8153)	SN = Super High Automotive	024V = 24V 036V = 36V 047V = 47V	006J = 6J 050J = 50J

Electrical Characteristics:

Part Number	Size	Working Voltage (VDC)	Breakdown Voltage (V) ¹	Clamping Voltage (V) ²	Peak Current for 1 time (A) ³	Load Dump for 10 times (J) ⁴	Jump Start Voltage, 5 min. (V)
HSP1206SA024V006J	1206	16	24 (±10%)	<40	500	6	24.5
HSP1206SA036V009J			36 (±10%)	<55	500	9	35.0
HSP1210SA024V006J	1210	16	24 (±10%)	<40	800	6	24.5
HSP1210SA024V012J			36 (±10%)	<55	800	12	35.0
HSP1210SA036V012J	1812	16	24 (±10%)	<40	2000	20	24.5
HSP1812SA024V020J			24 (±10%)	<40	3000	25	24.5
HSP2220SA024V025J	2220	16	23.0~27.5	<42	5000	50	35.0
HSP2220SA024V050J			36 (±10%)	<55	4000	50	35.0
HSP2220SA036V050J	3220	16	24 (±10%)	<40	5500	80	24.5
HSP3220SA024V080J			24 (±10%)	<40	3000	25	45.0
HSP2220SA047V025J	2220	34	47 (±10%)	<77	4000	50	45.0
HSP2220SA047V050J			47 (±10%)	<77	4500	80	45.0
HSP3220SA047V080J	3220	34	47 (±10%)	<77	4500	80	45.0

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), 2220 (10A) and 3220 (10A).

³ The peak current is tested at 8/20μs waveform.

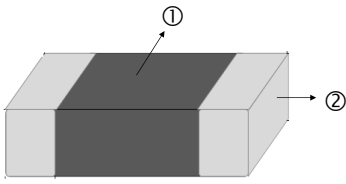
⁴ Load dump meet ISO7637-2 pulse 5.

Part Number	Non-linear Coefficient (α)	Leakage Current (μA) ⁵		Capacitance ⁶ @ 1kHz (pF)	Response Time (T _{rise})	Operating Temperature (°C)
		Before Surge Test	After Surge Test			
HSP1206SA024V006J	20	<5	<50	2100	< 1ns	-55 to +125
HSP1206SA036V009J				830		
HSP1210SA024V006J	20	<5	<50	2000		
HSP1210SA024V012J				3500		
HSP1210SA036V012J	20	<10	<50	1750		
HSP1812SA024V020J				6900		
HSP2220SA024V025J	20	<10	<50	7000		
HSP2220SA024V050J				18000		
HSP2220SA036V050J	15	<50	<200	16000		
HSP3220SA024V080J	20	<10	<50	31400		
HSP2220SA047V025J	20	<10	<50	8000		
HSP2220SA047V050J				12800		
HSP3220SA047V080J	20	<10	<50	14600		

⁵ The leakage current is tested at working voltage, 16 V (for BDV 24V products) and 34V (for BDV 47V products).

⁶ The capacitance value only for customer reference, it's not formal specification.

Construction and Materials:

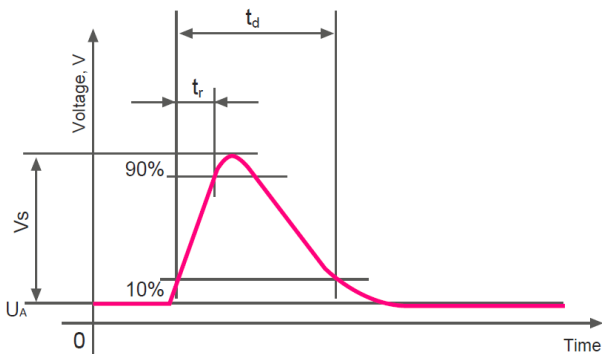


Body ①	Termination ②
Nano special ceramic	Ag/Ni/Sn

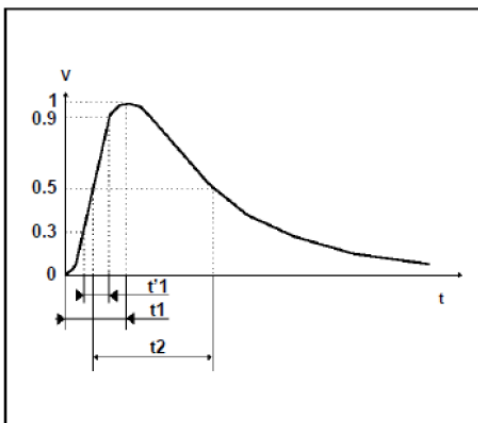
Packaging:

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

Load Dump and Surge Waveform:

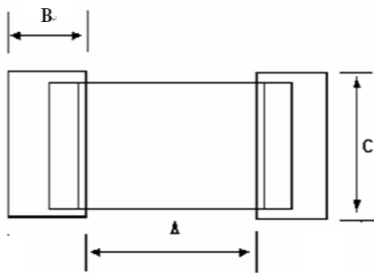


ISO7637-2: 2004 Pulse 5a		
Parameter	12V system	24V system
V_s	65 ~ 87V	123 ~ 174V
R_i	0.5 ~ 4Ω	1 ~ 8Ω
t_d	40 ~ 400ms	100 ~ 350ms
t_r	5 ~ 10ms	5 ~ 10ms



IEC61000-4-5 Standard		
Severity Level	t1 (=1.67t'1)	t2
1	8 μs	20 μs

Recommended Foot Print Dimensions:

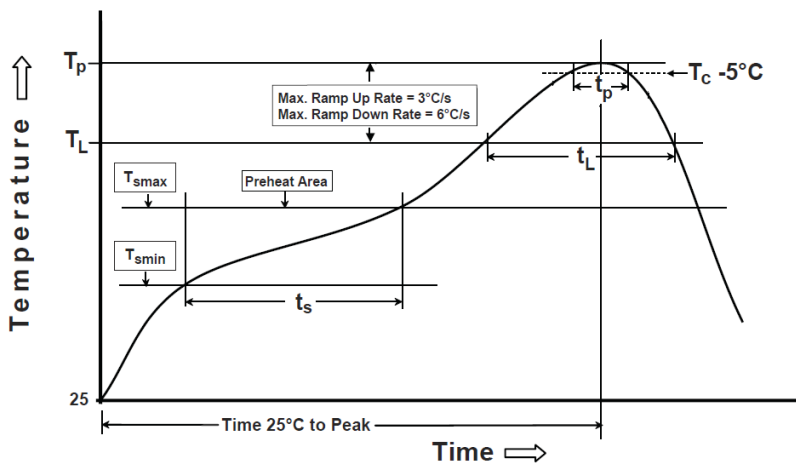


Size	A (mm)	B (mm)	C (mm)
1206	1.8~2.5	1.2~1.8	1.5~2.0
1210	1.8~2.5	1.3~2.0	2.2~3.0
1812	2.5~3.3	1.3~2.2	2.8~3.6
2220	3.8~4.6	1.3~2.2	4.8~5.5
3220	6.2~7.0	1.6~2.6	4.8~5.8

Environmental test:

Test item	Standard	Test condition	Requirement
High Temperature Storage	MIL-STD-202 Method 108	* Test temp.: 150±3°C * Duration: 1000 hours * Unpowered	1.No visible damage 2. ΔV1mA/V1mA ≤10% Measurement at 24 ± 2 hours after test conclusion
Temperature Cycle	JESD22 Method JA-104	* Lower test temp.: -40±3°C * Upper test temp.: 125±3°C * Number of cycles: 1000	
Moisture Resistance	MIL-STD-202 Method 106	* Lower test temperature: 25±3°C * Upper test temperature: 65±3°C * Rel. humidity of air: 90%~98% (during cooling phase: 80%~98%) * Duration of 1 cycle: 24 hour * Number of cycles: 10 * Unpowered	
Biased Humidity	MIL-STD-202 Method 103	* Test temp.: 85±3°C * Rel. humidity of air: 85~90% * Duration: 1000 hours * Bias at working voltage (Vdc)	
Operational Life	MIL-STD-202 Method 108	* Test temp.: 125±3°C * Duration: 1000 hours * Bias at working voltage (Vdc)	
Mechanical Shock	MIL-STD-202 Method 213	* Test Condition F * Peak value: 1500g's * Half sine waveform	
Vibration	MIL-STD-202 Method 204	* Acceleration: 5 g's * Sweep time: 20 min. * Frequency range: 10 to 2000 Hz * 3×12 cycles	
Thermal Shock	MIL-STD-202 Method 107	* Lower test temp.: -55±3°C * Upper test temp.: 125 ±3°C * Dwell time: 15 minutes. * Air-Air * Number of cycles: 300	
Electrical Transient Conduction	ISO-7637-2	* Test pulses 1 to 5	

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-uprate (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	

Note:

- HSP_SA series cannot be Soldered by wave soldered. Please contact AEM for hand soldering recommendations.
- If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.
- Compatible with Pb and Pb-free solder reflow profiles.
- Excess solder may cause a short circuit, especially during hand soldering.