ESD Protection Diode

1.1 Technology Data	Symbol		Value	Unit
Maximum allowable continuous DC voltage	V_{DC}		16	V
Breakdown voltage	V_B		28~38	V
Maximum allowable clamping voltage	V_C		57	V
Maximum ESD protection	V_{ESD}		25	KV

1.2 Reference Data				
Typical capacitance value measured at 1MHz	C		10	pF
Capacitance range	t		±30	%
Response time	T_{rise}	<	1	ns
Non-linear coefficient	α	>	20	
Leakage current (at initial state)	I_{LDC}	<	0.8	μA
Leakage current (after ESD test)	I_{LDCA}	<	4	μA
Operation ambient temperature	T_{OPT}		-55~+125	℃
Storage temperature range	T_{STG}		-55~+150	℃

1.3 Other Data			
Body		Nano special ceramic	
End termination		Ag/Ni/Sn	
Packaging		Reel	
Complies with standards		ISO10605 AEC-Q200 Rev.C	
Complies with ISO7637-2 standards		Pulse 2A, 2B, 3A and 3B	
Complies with RoHs sandard		Yes	
Lead content	<	1000	ppm
Marking		None	

Notes :

＊1 The breakdown voltage was measured at 1mA.

＊2 The clamping voltage was measured at 8/20μs standard current.

＊3 The leakage current was tested at working voltage.

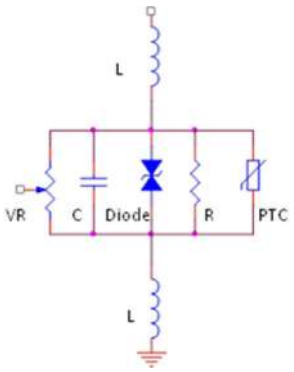
＊4 The components shall be employed within 1 year, in the nitrogen condition.

1.4 Features of SEA Device

1. RoHS compliant
2. SMD type body size 0603
3. Meet ISO10605 and IEC61000-4-2 standards
4. Meet ISO7637-2 standards, pulse 2A, 2B, 3A and 3B
5. Large withstanding ESD voltage capability : 25KV
6. Qualified based on AEC-Q200
7. Bidirectional and symmetrical V/I characteristics
8. Overvoltage withstanding of 18V for 60 min
9. Excellent low leakage current : <0.8μA
10. Operating temperature range : -55~+125℃
11. Multi-Layers construction provides higher power dissipation

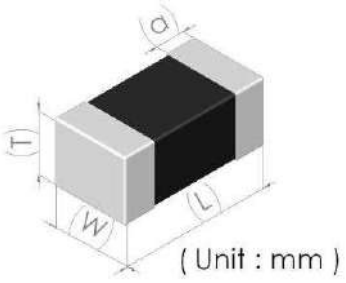
Equivalent Circuit

☆L Body Inductance
☆C Device Capacitance
☆VR Voltage Variable Resistor
☆R Insulation Resistor
☆Diode Voltage Clamped
☆PTC for Low Leakage Current

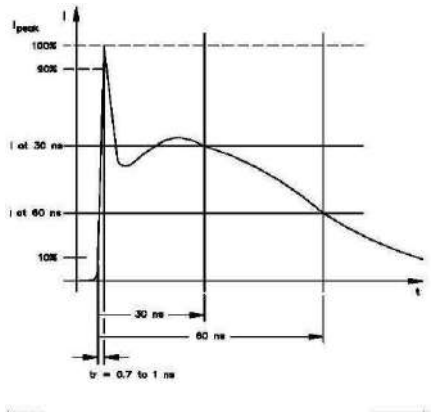


2. Size

Model	0603 Series
Length(L)	1.60±0.15
Width(W)	0.80±0.10
Thickness(T)	0.90 max.
Termination(a)	0.30±0.10



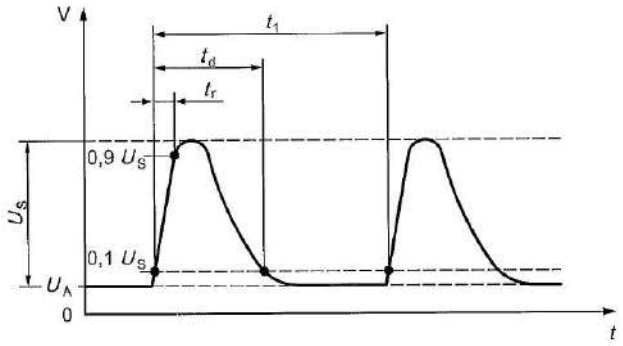
3. ESD Wave Form



ISO10605 standards

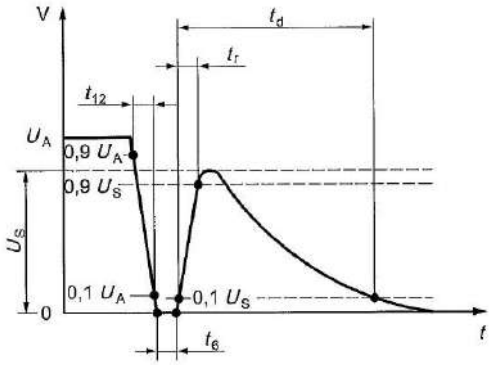
SEVERITY LEVEL	From inside vehicle	From outside vehicle
I	±4KV	±4KV
II	±8KV	±8KV
III	±14KV	±15KV
IV	±15KV	±25KV

4. ISO7637-2 Pulse 2A, 2B, 3A and 3B Wave Forms



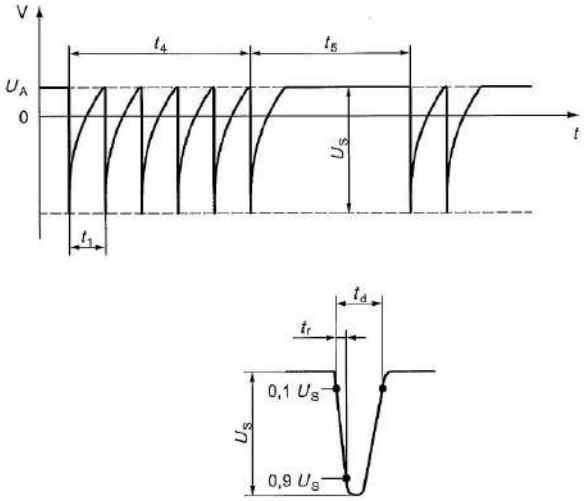
Parameters for test pulse 2A

Parameters	12V System	24V System
Pulse Voltage (Us)	37~112V	
Pulse Period (t1)	0.2~5s	
Rise Time (tr)	1μs	
Output Resistance (Ri)	2Ω	
Pulse Width (td)	0.05ms	



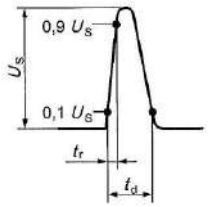
Parameters for test pulse 2B

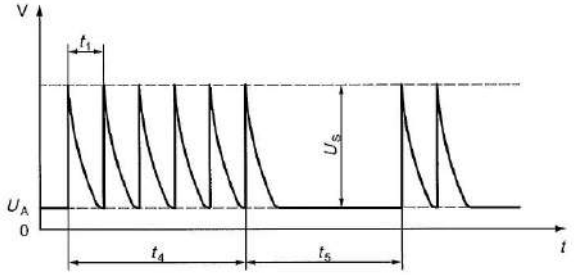
Parameters	12V System	24V System
Pulse Voltage (Us)	10V	20V
T12	1±0.5ms	
t6	1±0.5ms	
Rise Time (tr)	1±0.5ms	
Pulse Width (td)	0.2~2s	
Output Resistance (Ri)	0~0.05Ω	



Parameters for test pulse 3A

Parameters	12V System	24V System
Pulse Voltage (Us)	-112~-220V	-150~-300V
Pulse Period (t1)	100μs	
Rise Time (tr)	5±1.5ns	
Output Resistance (Ri)	50Ω	
Pulse Width (td)	150±45ns	
Burst Interval (t5)	90ms	
Burst Duration (t4)	10ms	





Parameters for test pulse 3B

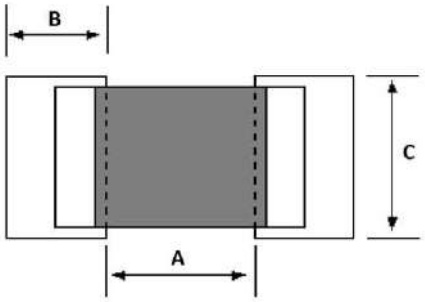
Parameters	12V System	24V System
Pulse Voltage (Us)	75~150V	150~300V
Pulse Period (t1)	100μs	
Rise Time (tr)	5±1.5ns	
Output Resistance (Ri)	50Ω	
Pulse Width (td)	150±45ns	
Burst Interval (t5)	90ms	
Burst Duration (t4)	10ms	

5. Enviromental Reliability Test

Test	Standard	Requirement	Specification
High Temperature Exposure	MIL-STD-202 Method 108	Test temperature : 150±3°C Duration : 1000 h Unpowered	1.No visible damage 2. $\lvert \triangle V_{1mA}/V_{1mA} \rvert \leqq 10\%$ Measurement at 24±2 hours after test conclusion
Temperature Cycling	JESD22 Method JA-104	Lower test temperature : -40±3°C Upper test temperature : 125±3°C Number of cycles : 1000, unpowered	
Biased Humidity	MIL-STD-202 Method 103	Test temperature : 85±3°C Rel. humidity of air : 85~90% Duration : 1000 h Bias at working voltage V_{DC}	
Operational Life	MIL-STD-202 Method 108	Test temperature : 125±3°C Duration : 1000 h Bias at working voltage V_{DC}	
Mechanical Shock	MIL-STD-202 Method 213	Test condition F Peak value : 1500g's Half sine waveform, unpowered	
Vibration	MIL-STD-202 Method 204	Acceleration : 5g's Sweep time : 20min Frequency range: 10 to 2000Hz 3×12 cycles, unpowered	

6. Soldering Recommendations

6.1 Recommended solder pad layout



(Unit : mm)

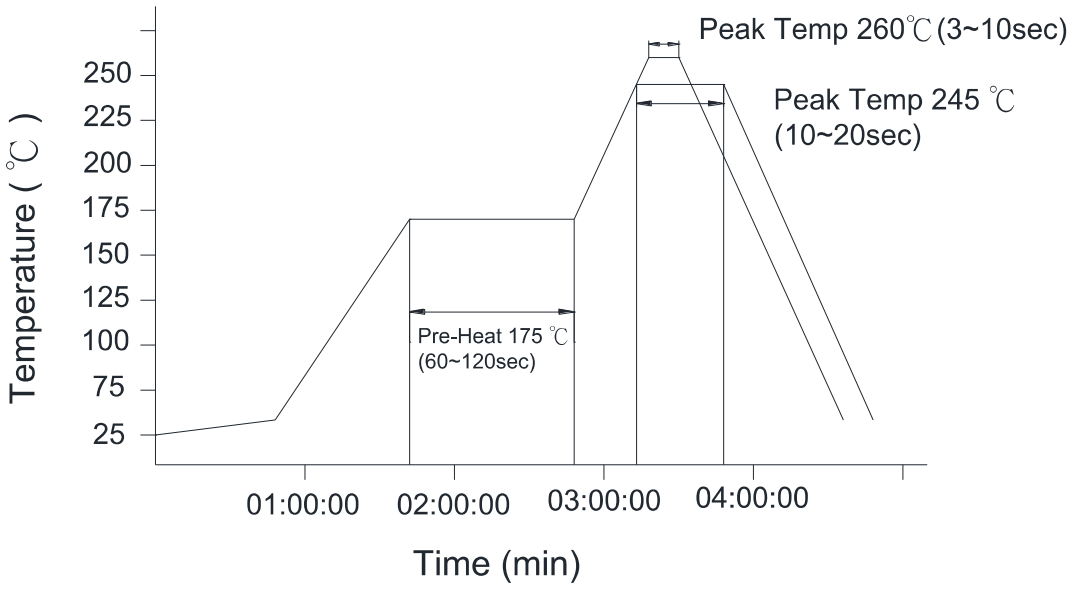
	A	B	C
0603	0.9~1.2	0.9~1.2	0.8~1.0

6.2 The SIR test of the solder paste shall be done (Based on JIS-Z-3284)

6.3 Steel plate and foot distance printing

Foot distance printing (mm)	Steel plate thickness (mm)
≧0.65mm	0.18mm
0.50~0.65mm	0.15mm
0.40~0.50mm	0.12mm
≦0.40mm	0.10mm

6.4 The IR reflow and temperature of soldering for Pb free process



☆ **IR reflow Pb free process suggestion profile**

(1) The solder recommend is Sn96.5/Ag3.5, and thickness recommend as shown in table 6.3

(2) Ramp-up rate (217℃ to peak) +3℃/second max.

(3) Temp. maintain at 175±25℃ 180 seconds max.

(4) Temp. maintain above 217℃ 60~150 seconds

(5) Peak temperature range 245 +20/-10℃ within 5℃ of actually peak temperature (t_p) 10~20 seconds

(6) Ramp down rate -6℃/second max.

※Perform adequate test in advance as the reflow temperature profile will vary according to the conditions of the manufacturing process and the specification of the reflow furnace.

6.5 Resistance to soldering heat and high temperature resistance : 260℃, 10sec 3 times

6.6 Hand soldering

In hand soldering of the SEA devices, large temperature gradient between preheated the SEA devices and the tip of soldering iron may cause electrical failures and mechanical damages such as cracking or breaking of the devices. The soldering shall be carefully controlled and carried out, so that the temperature gradient is kept minimum with following recommended conditions for hand soldering.

6.6.1 Recommended soldering condition 1 (with preheating)

(1) Solder

0.12~0.18mm thread solder (Sn96.5:Ag3.5) with soldering flux in the core, and rosin-based non-activated flux is recommended.

(2) Preheating

The SEA devices shall be preheated so that temperature gradient between the devices and the tip of soldering iron is 150℃ or below.

(3) Soldering iron

Rated power of 20W max. with 3mm soldering tip in diameter

Temperature of soldering iron tip 380℃max., 3~5sec (The required amount of solder shall be melted in advance on the soldering tip.)

(4) Cooling

After soldering, the SEA devices shall be cooled gradually at room ambient temperature.

6.6.2 Recommended soldering condition 2 (without preheating)

(1) Solder iron tip shall not directly touch to ceramic dielectrics.

(2) Solder iron tip shall be fully preheated before soldering while soldering iron tip to the external electrode of SEA devices.

6.7 Post soldering cleaning

6.7.1 Residues of corrosive soldering fluxes on the PC board after cleaning may greatly have influences on the electrical characteristic and the reliability (such as humidity resistance) of the SEA devices which have been mounted on the board. It shall be confirmed that the characteristic and the reliability of the devices are not affected by the applied cleaning conditions.

6.7.2 When an ultrasonic cleaning is applied to the mounted SEA devices on PC boards. Following conditions are recommended for preventing failures or damages of the devices due to the large vibration energy and the resonance conditions caused by the ultrasonic waves.

(1) Frequency 29MHz max.

(2) Radiated power 20W/liter max.

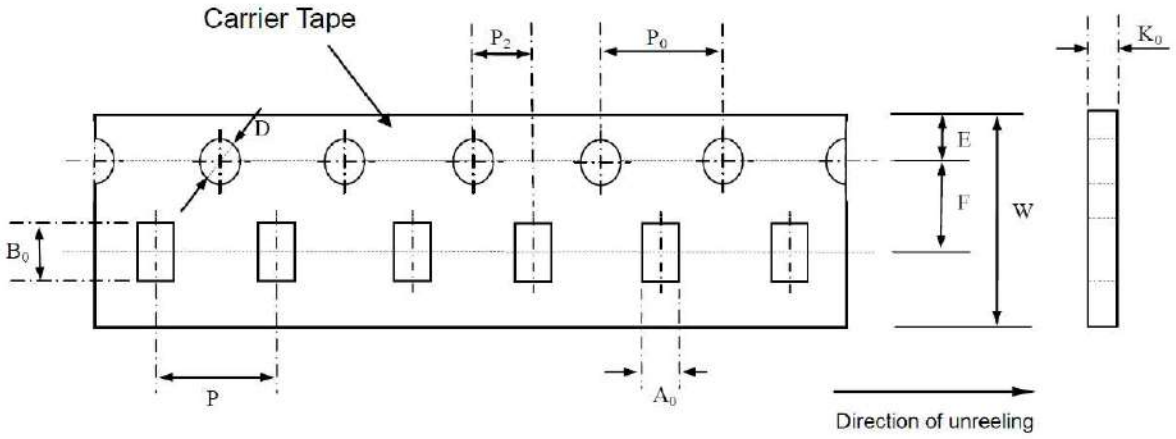
(3) Period 5 minutes max.

7. Packaging Specification

7.1 Carrier tape and transparent cover tape should be heat-sealed to carry the products, and the reel should be used to reel the carrier tape.

7.2 The adhesion of the heat-sealed cover tape shall be 40 +20/-15 grams.

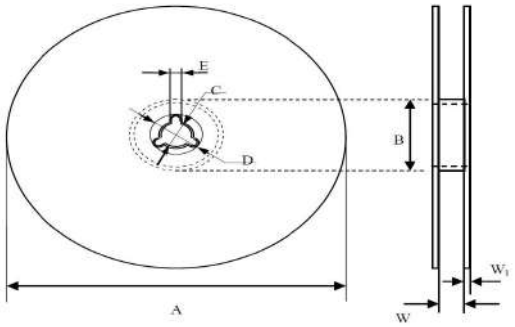
7.3 Both the head and the end portion of the taping shall be empty for reel package and SMT auto-pickup machine. And a normal paper tape shall be connected in the head of taping for the operator to handle.



(Unit : mm)

Symbol	A_0 ±0.05	B_0 ±0.05	K_0 ±0.05	D +0.10 -0.05	P ±0.10	P_2 ±0.10	P_0 ±0.10	W ±0.10	E ±0.10	F ±0.05
0603	1.10	1.90	0.95	1.50	4.00	2.00	4.00	8.00	1.75	3.50

8. Reel Dimension



(Unit : mm)

Symbol	A	B	C	D	E	W	W_1
0603	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.5	1.5±0.1

9. Standard Packaging

Size	0603
Pcs	4000