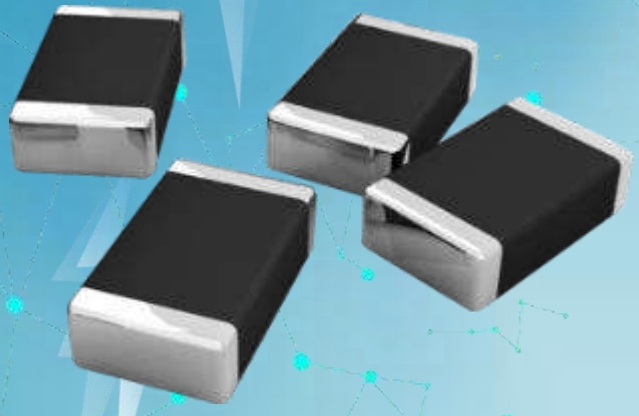
OVER VOLTAGE PROTECTION

ORIGINAL MANUFACTURER









CATALOGUE

CERAMIC TECHNOLOGY

Overview

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Overview

Company Information

Introduction

SFI

is a professional manufacturer in full range over voltage products in mono-chip, multilayer chip and advanced varistor.
We have the largest production capability and production line of the over voltage protection components to supply customer the circuit protection in the world market.

Material
Body material：Ceramic
Termination：All size from 0201 to 6420(inch) size are all Nickel Barrier (Ag/Ni/Sn)
Our products meet RoHS compliant.



Technischer Überwachungsverein
File No.B101736 0001

Underwriters Laboratories
File No.:E334409

RoHS 2002/95/EC

Advanced Techniques Applied
In order to meet the market trend and fast market change, we build our R&D team to control reliability and stability of the products. We have been utilizing the advanced material and manufacturing techniques on producing the electronic elements and parts. In Taiwan, we are the first company to launch the Zinc Oxide based Ceramic Semiconductor devices with full range and with the highly advanced multilayer formation technologies to apply the high density circuit assemblies. We obtained many kinds of patents for excellent product designs.

SFI's Varistors with high reliability can protect the electronics systems from over voltages by limited surge voltages and absorbing energy. They are used to safeguard the components to ensure more electromagnetic compatibility and to suppress transients caused by electrostatic discharge. In other words, they have the added advantage of greater surge current and energy handling capabilities as well as EMI / RFI attenuation.
SFI's Varistors have established themselves as a secure and low-cost means of protection in general-purpose use.

Overview

Product Overview

Series Table

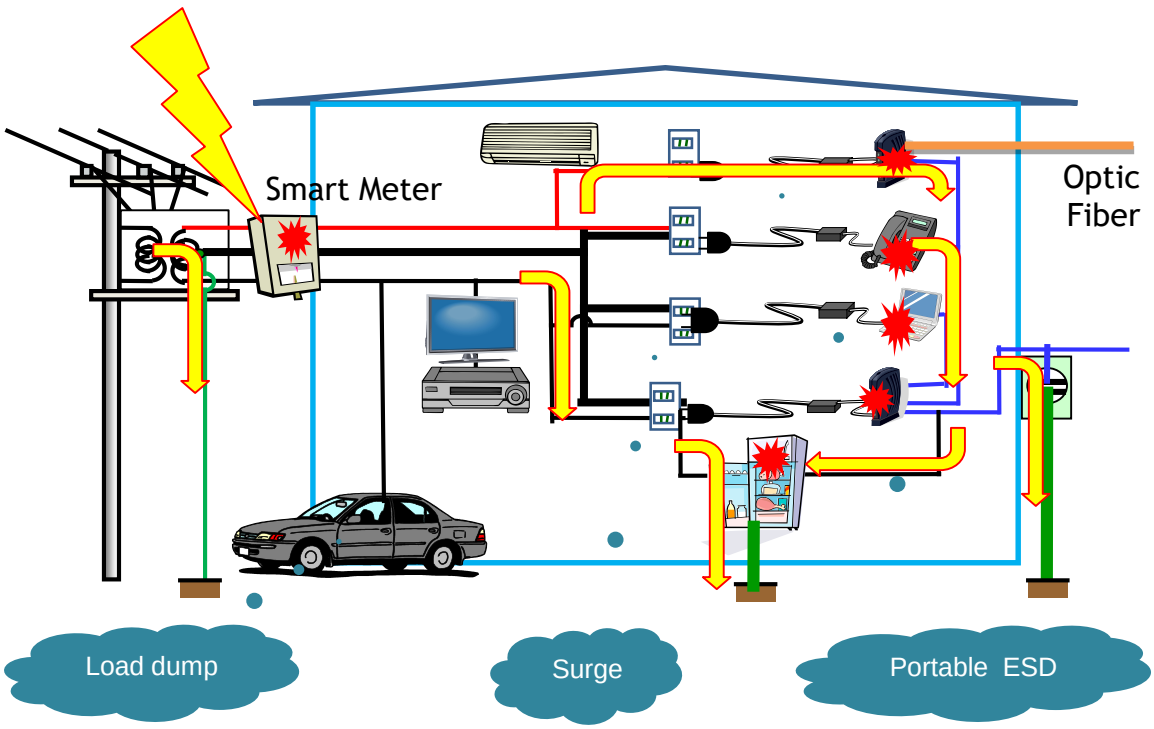
Type	Transient	Series	Main Application	Standard	Max. Value Parameter	Remark
General	Surge/ESD	MLV-C MLV-A	All	IEC61000-4-5 IEC61000-4-2	Basic	
	ESD	MLV-E	ALL	IEC61000-4-2	ESD 8KV/15KV	
Enhance	Load Dump	SHA	Auto Power ECU	ISO7637-2 Pulse 5 ISO16750	Load Dump 160J	Can replace TVS ,MOV
	Surge	SHC	Industrial Control	IEC61000-4-5	Surge Current： 20KA (8/20 μs)	Can replace MOV , MLV
		SHN	Network Security	IEC61000-4-5 K21	Surge Voltage： 4~8KV (10/700 μs)	Can replace GDT, Sidactor
		SHV SHR (Ring Wave)	LED Lighting Power	IEC61000-4-5 IEC61000-4-12	Breakdown Voltage： 470V / Surge： 100~3000A	Can replace MOV, GDT
New Design	ESD	SEA	Auto CAN BUS	ISO10605 ISO7637-2 Pulse 1, 2, 3	ESD 30KV	Can replace TVS
		TVS(STA)	Auto CAN BUS	ISO10605	ESD 30KV	Can replace TVS
		TVS(STS)	Mobile	IEC61000-4-2	Clamping Voltage <12.5V	Can replace TVS
		TVS(STN)	Telecom Ethernet (PHY Sided)		ESD 15KV L-L 2KV/40 ohm	Can replace TVS
		SEH	Ultra High Speed		Breakdown voltage ： 100V / Cap. 0.2pF	Can replace TVS
Dual Function (*)	Surge +Current Limited	SMP	Power (CSPD+PTC)	IEC61000-4-5	Fail mode at open circuit	Under Developing

(*) Remark ： Dual function products are under developing

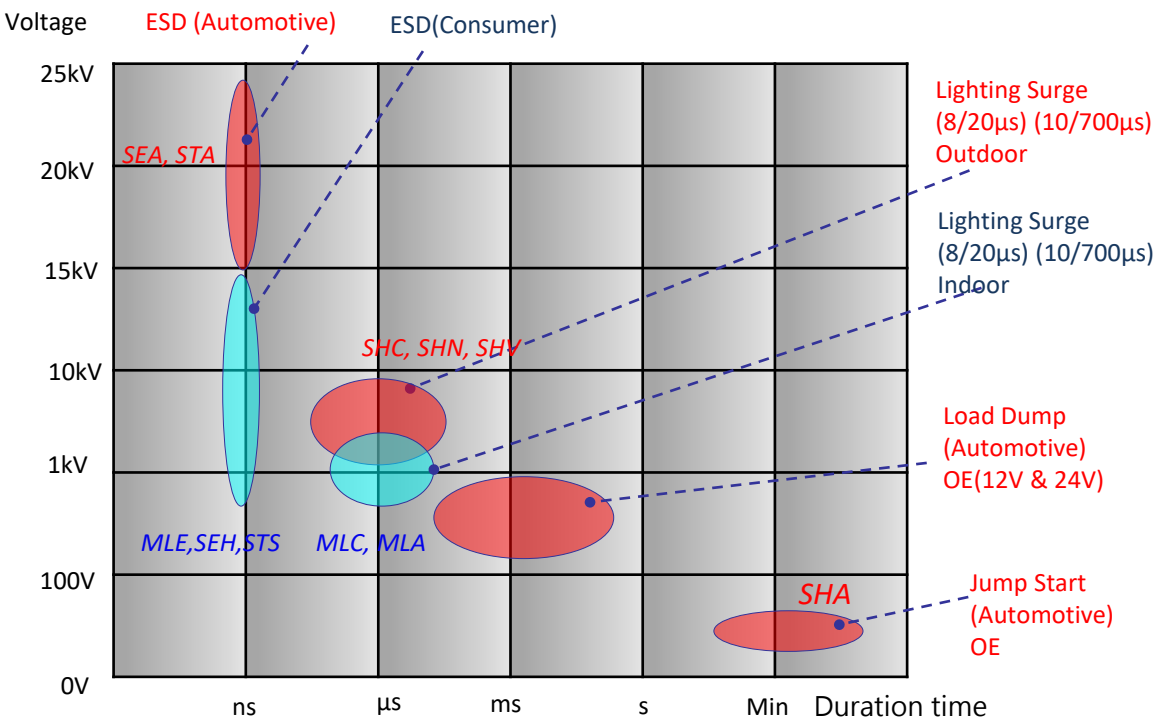
Overview

Over Voltage Pulse Introduction

Environment



Energy vs Time

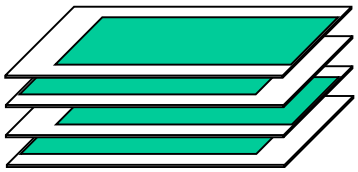


Overview

Inner Structure & Certification

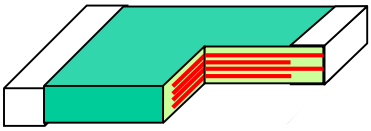
Multilayer Inner Structure

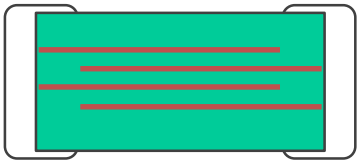
Multilayer Surface Mount Varistors are made from semi-conducting ceramics by highly advanced multilayer formation technologies, which could offer strong protection, excellent transient energy absorption and internal heat dissipation. The devices are chip form without leads. Eliminating lead inductance and guaranteeing a faster speed response time of less than 0.5ns , which make them fast enough to ensure reliable protection against ESD pulse and other specific transient events. These transient suppression devices are significantly smaller footprints and lower profiles than traditional zener diodes or radial MOVs.



Multilayer formation technologies







Certification



A. ISO 9001 ：2015



B. ISO 14001 ： 2015



C. IATF 16949-2016

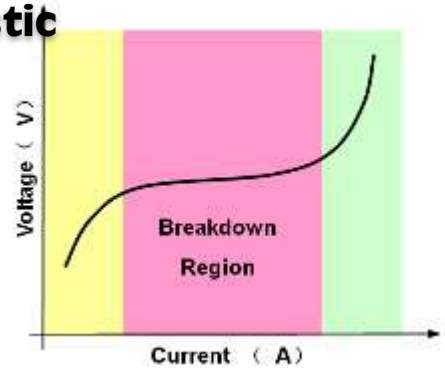
Overview

Operation Theory & Function Diagram

OVERVIEW

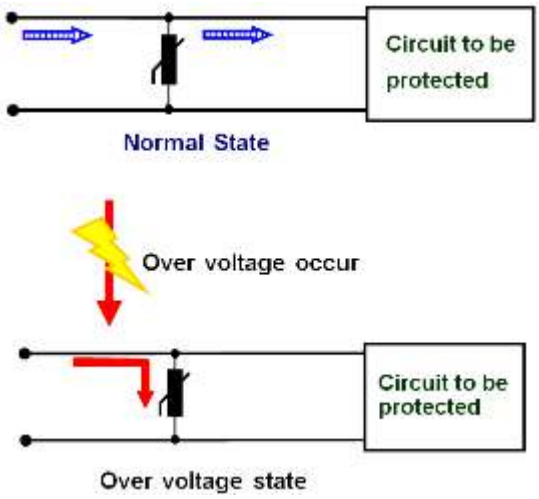
Voltage Dependent Characteristic

Transient voltage suppressors（Varistors） are voltage-dependent electrical resistors with symmetrical V/I characteristic and breakdown region. Their resistance value decreases with increasing voltage, and thus “short-circuiting” further rises in over voltage.

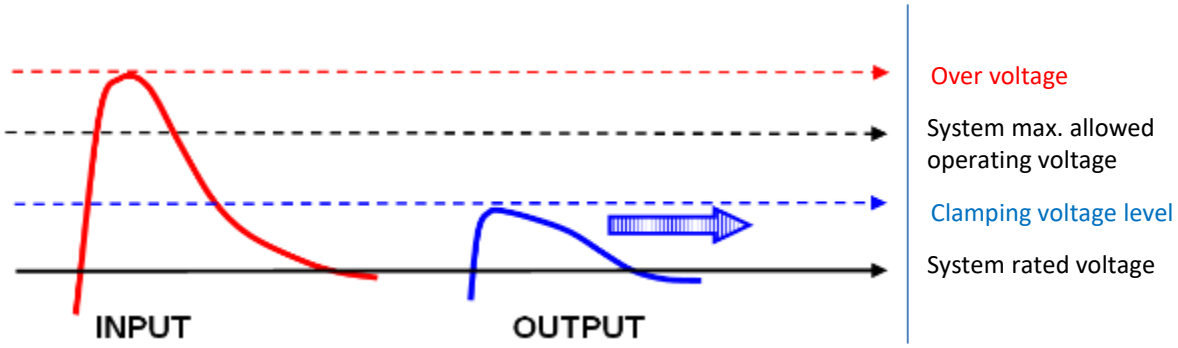


The Prevention Over Voltage

In other words, as long as the voltage increases above the threshold of the Transient voltage suppressors , the suppressor will draws a rapidly increasing current; then the over voltage is considerably attenuated away from the protected circuit, that is why the inherent protection of equipment should be supplemented by including specific components which will raise the withstand capabilities to required level.
Varistors provide protection against all kinds of over voltage and prevent electronic equipment from being damaged by transient events.



The Function Diagram



Overview

Application Filed

OVERVIEW

Multilayer Inner Structure



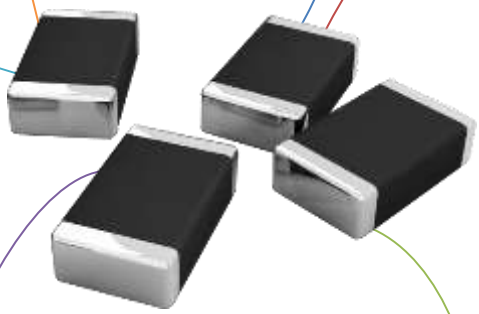
Communication
- GSM/CDMA
- Smart Phone



Automotive
- OEM / Aftermarket
- Automotive electronics



Consumer &Computer
- LCD TV / Monitor
- DSC/ MP4
- Tablet /NB





LED Lighting
AC to DC Driver



Industrial
- IP CAM / IPC
- DVR / NVR
- IGBT Control





Telecom & I-Cloud
- VOIP
- LAN
- IAD, AP, Router
- RJ45 /Connector

Suggestion Table

	Issue	SHA	SHC	SHV/R	SHN	SEA	MLE	SEH	STS	STA	STN	MLC/A
Automotive	Load Dump/ESD	V				V				V		V
Industry & IP Cam	Surge / ESD		V		V		V	V	V		V	V
Telecom & I cloud	Surge/ESD		V		V		V	V	V		V	V
Consumer & Computer	ESD						V	V	V			V
Mobile	ESD						V	V	V			
LED Lighting	Surge/ESD/ Ring		V	V			V					

Overview

Product Identified

OVERVIEW

Ceramic CSPD Family

Series	Function	Character	Application
SHN	Surge	Size (Inch)：0805~1812 Breakdown Voltage：12V~75V Surge Voltage ：1.5KV~8KV(10/700μs)	Telecom Equipment Ex ： Ethernet、PoE 、Hub、Router、RJ45 Connector
SHC	Surge	Size (Inch)：0805~4032 Breakdown Voltage：12V~100V Surge Current ：250A~20KA(8/20 μs)	DC Power Ex ： DC、Low voltage AC 、Base Station
SHA SEA	Load Dump ESD	Size (Inch)：0402~0603(ESD Auto) Size (Inch)：0805~4032(Load Dump) Working Voltage：12V~60V Load Dump ：1.5J~160J(Pulse 5A) ESD robustness： 25KV	Automotive Ex ： All ECU、CAN Bus、other Control I/O
SHV	Surge	Size (Inch)：0604~3220 Breakdown Voltage：170V~680V Surge Current ： 20A~3000A(8/20μs)	AC Power Ex ： LED Lamp、others
SHR	Ring Wave	Size (Inch)：0604 Breakdown Voltage：270V Ring Wave： 2.5KV	LED Power Ex ： LED DOB
SEH	ESD	Size (Inch)：0402~0603 Working Voltage：5V~24V Surge Current ： 5A~10A(8/20μs) Capacitance： 0.2pF	Ultra high speed protection Ex ： Antenna、HDMI、DP、USB3.0

Semiconductor SGD Family

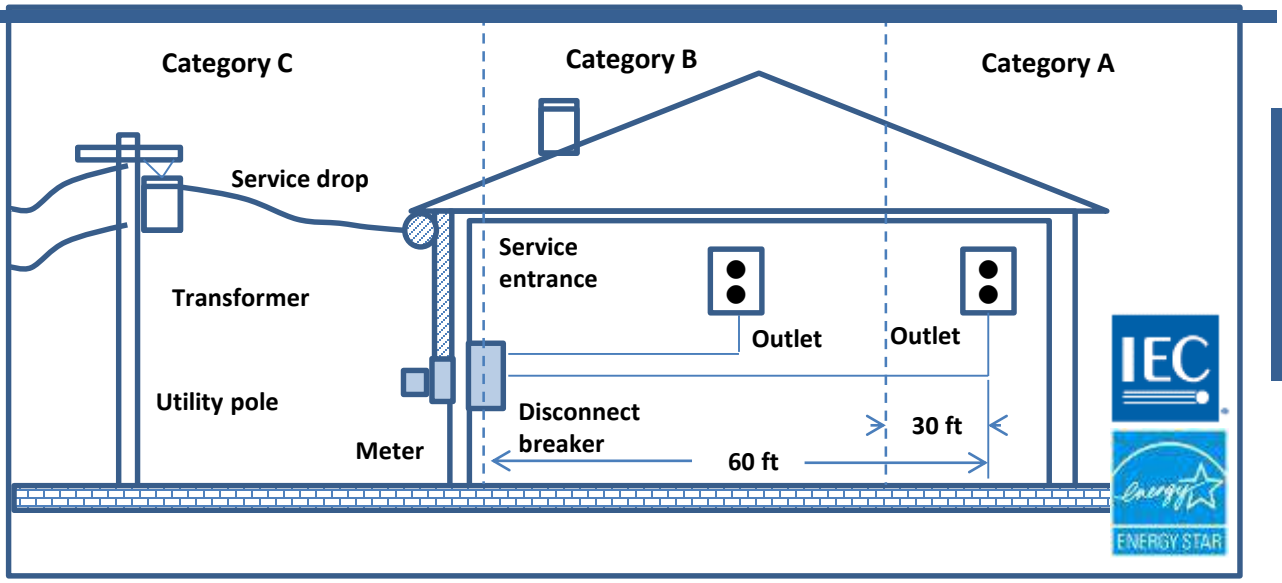
Series	Function	Character	Application
STS STD	ESD	Size (Inch)：0201~0603 Working Voltage：3.3V~5V Surge Current ：1A~8A(8/20μs) Capacitance： 0.35pF~17pF	Normal I/O protection Ex ： Video、Audio 、DVI、USB2.0/USB3.0
STN	ESD Line to Line (10/700us)	Size (Inch)：0402 Working Voltage：5V Surge Current ： 7A~15A(8/20μs) Capacitance： 0.8pF~1.5pF	Signal speed Ex ： Ethernet、USB2.0
STA	ESD	Size (Inch)：0402~0603 Working Voltage：3.3V~12V Surge Current ： 3A~8A(8/20μs) Capacitance： 0.35pF~17pF	Auto ECU control line Ex ： Data line

Ceramic MLV Family

Series	Function	Character	Application
ML MLA	ESD Surge	Size (Inch)：0402~2220 Working Voltage：5V~82V Surge Current ：20A~1200A(8/20μs)	Normal I/O protection Ex ： Video、Audio 、DVI、USB2.0
MLE	ESD	Size (Inch)：0201~0805 Working Voltage：5V~24V Surge Current ： 5A~10A(8/20μs) Capacitance： 0.8pF~100pF	Signal speed Ex ： Video、Audio 、DVI、VGA、USB2.0、D-DUB
SEH	ESD	Size (Inch)：0402~0603 Working Voltage：5V~24V Surge Current ： 5A~10A(8/20μs) Capacitance： 0.2pF	Ultra high speed protection Ex ： Antenna、HDMI、DP、USB3.0

Overview

Surge Definition



OVERVIEW

Category C： Service entrance, more severe environment： 10KV, 10KA surge.
Category B： Downstream, 30 ft from category C, less severe environment： 6KV, 3KA surge.
Category A： Further downstream, 60 ft from category C, least severe environment： 6KV, 0.5KA surge.

Category	Voltage 1.2/50 μs	Current 8/20 μs	Impedance Ω	Application
C(Outdoor)	6KV	3KA	2	Outdoor Commercial , Industrial / Parking
B	6KV	3KA	2	Lighting near Service Entrance
A(Indoor)	6KV	0.5KA	12	Indoor /Offices/ Retail

	United States	Europe / America	Taiwan	China
Surge Immunity 1.2/50 μs and 8/20 μs LED light bulbs inside	IEEE62.41.2 Ring wave 2.5KV 100KHz Class A	IEC/EN61547 (IEC61000-4-5) 500V/250A,1KV/500A	CNS14676-5 (IEC/EN61000-4-5) 500V/250A 1KV/500A	GB/T18595 (IEC/EN61547) 500V/250A 1KV/500A
Surge Immunity 1.2/50 μs and 8/20 μs LED outdoor Luminaires	IEEE62.41.2 (Category C) 6KV/3KA 20KV/10KA	IEC/EN61547 IEC/EN61000-4-5 4KV/2KA, 6KV/3KA, 10KV/5KA	IEC/EN61000-4-5 4KV/2KA	IEC/EN61000-4-5 4KV/2KA
Safety	UL8750, UL1310 UL1993, UL1598	IEC/EN62560,IEC/EN60598 IEC/EN61347,IEC/EN62031	CNS STD.	GB24819-2009 IEC62031

Character	Test Level		
	Device		
	Self-ballasted Lamp & Semi-luminaries	Luminaries & independent auxiliaries	
		< =25W	> 25W
Surge waveform	1.2/50μs	1.2/50μs	1.2/50μs
Line to Line	1.0KV	1.0KV	1.0KV
Line to Ground	1.0KV	1.0KV	2.0KV

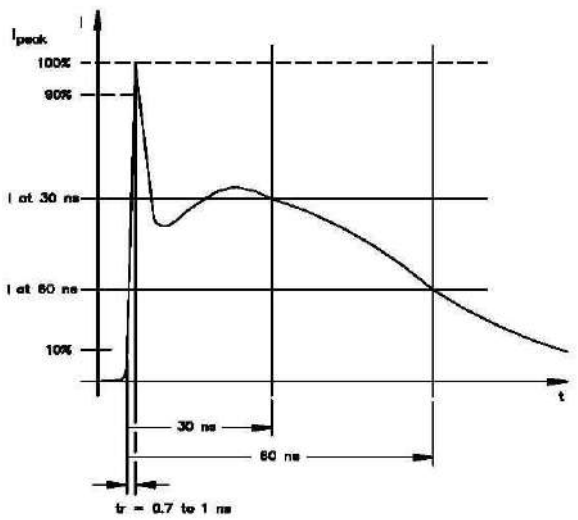
Overview

Characteristic Definition

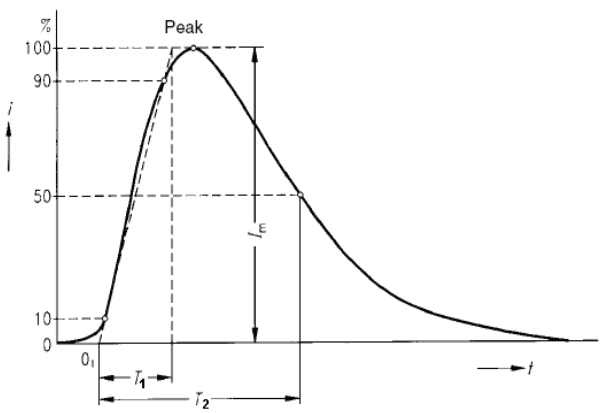
OVERVIEW

Characteristic Definition Characteristics	Test Method or Description
Max. Working Voltage	Maximum steady-state DC operating voltage the device can maintain and typical leakage current at 25℃ not exceed 50 μA.
Varistor Voltage（BDV）	With the specified measuring current of 1mA DC applied. Tolerance of breakdown voltage： 5~8V= ±20%; 12~18V= ±15%; 18~430V= ±10%
Max. Clamping Voltage	Maximum peak voltage across the TVS measured at a specified pulse current（A）and waveform 8/20μs.
Surge Current	Maximum peak current within Varistor voltage change of ±10% may be applied with the specified waveform 8/20μs.
Surge Shift △V/V	The shift of Varistor voltage after suffering the specified surge current.
Energy Absorption	Maximum energy within the Varistor voltage change of ±10% may be dissipated with a specified waveform 10/1000μs .
Typical Capacitance	Device Capacitance measured with the zero voltage bias $0.5V_{RMS}$ $1KH_Z$; under 100pF measure at 1MHz; Surge series the capacitance is only for reference. The tolerance is 100%
Nonlinear exponentα	α=〔log（$V_{1mA}/V_{0.1mA}$）/log（$I_{mA}/I_{0.1mA}$）〕
Leakage Current	Typical leakage current at 25℃＜50μA; Maximum leakage 200μA
Cut-off Frequency	It is named of cut-off frequency for the frequency of -3dB insertion loss.

※Standard Test Condition：
Environmental condition under which every measuring is done without doubt on the measuring results.
Unless specially specified, temperature, relative humidity are 5 to 35℃, 45 to 85 % RH.



※ ESD protection waveform current



※ 8/20μs waveform current（A）

IEC 61000-4-5, EN 61000-4-5, This generator complies with UL 1449 August 15. 1996 Table B1.1

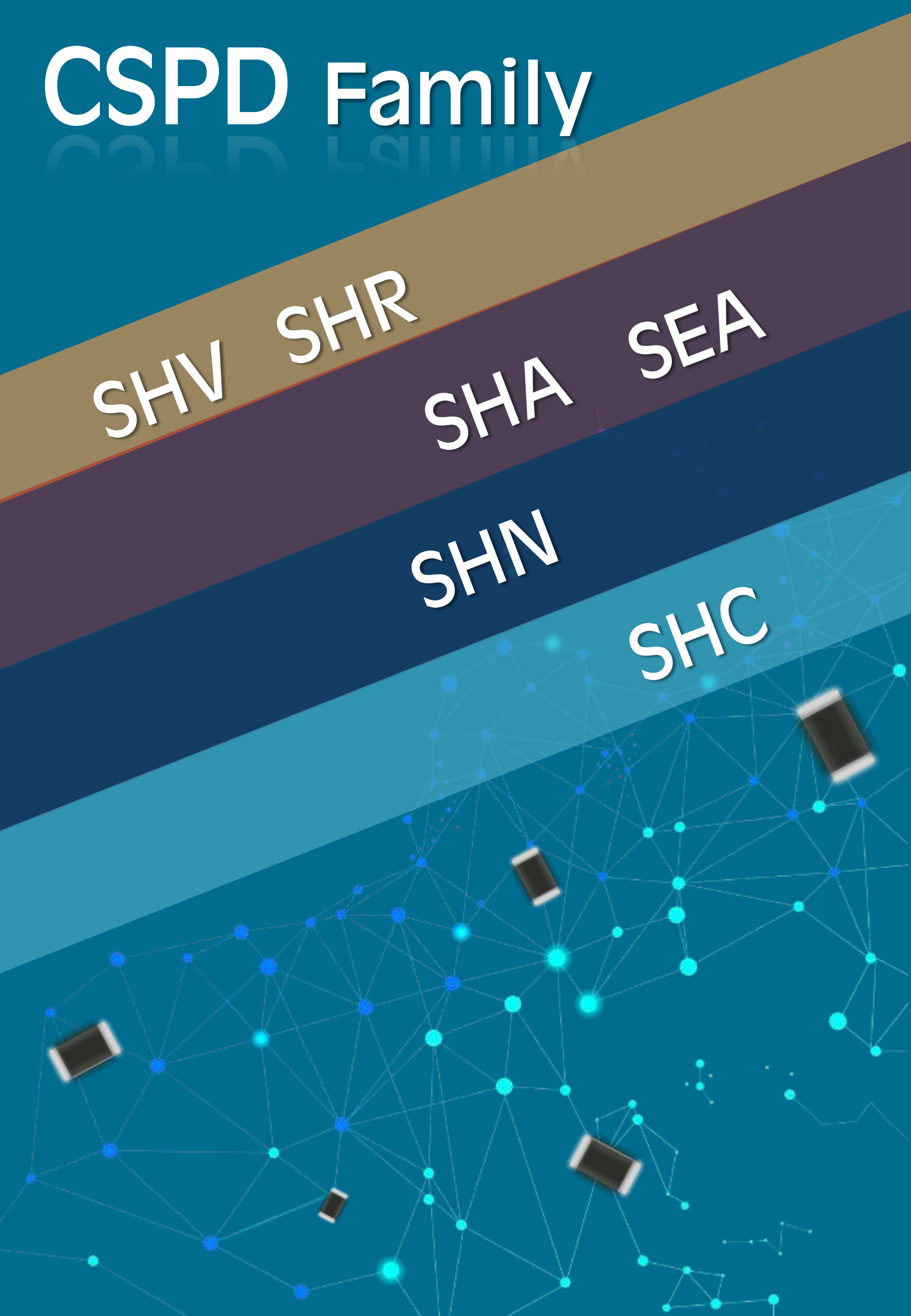
CSPD Family

SHV SHR

SHA SEA

SHN

SHC



CSPD Family

CERAMIC

SHV Series (LED Lighting / AC Power)

Requirement

LED Lighting is generally driven in two ways: switch-type drive and linear drive. Although the switch-type drive can obtain good current control accuracy and high overall efficiency, due to production efficiency and application requirements, linear drive applications have gradually become the mainstream in recent years. Most of the traditional LED lighting surge solutions are used. MOV (DIP Varistor) protects, when a surge voltage (flow) occurs, MOV will quickly decrease from high impedance to low impedance, providing a conduction path to conduct energy to the earth, but MOV still has some problems, such as excessive volume. It is not easy to assemble, and the product is more susceptible to cracking.

Description

SFI has developed a dedicated SHV series of multi-function overvoltage protectors for LED lighting.

SHV provides "small size SMD patch" packaging, which is the world's smallest chip package with high collapse pressure and high flow capacity.

It has passed UL and TUV certification and has been mass-produced SHV protection components.

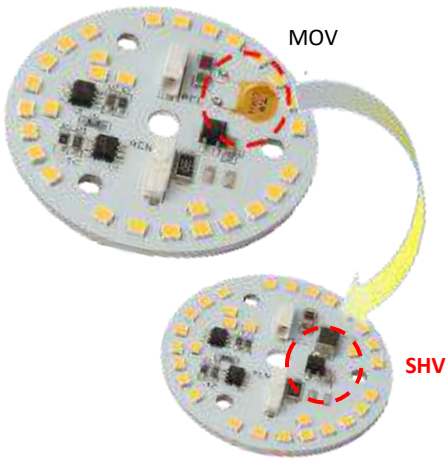
LED manufacturers use.

Features

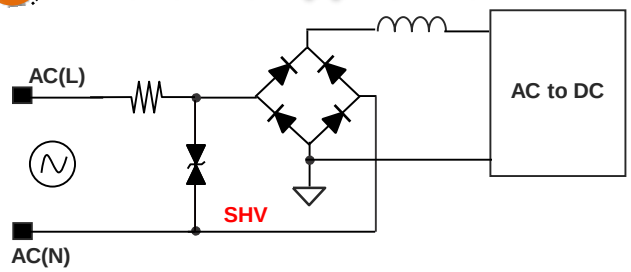
-Size：0806~3220(Inch)
-Meet ：IEC61000-4-5
1.2/50 μs or 8/20 μs
-BDV ：170V~680V
-Peak surge：3000A(max.)
-Operating temperature ：125°C.
-**UL 1449 /TUV approval**
-Bi-directional clamping
-**SMD package, non-combustible**

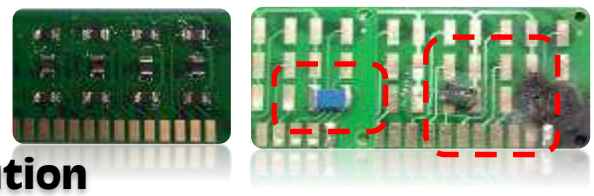
Application Area

-LED Lighting



Reference Application Circuit





Comparison with Other Solution

	SFI SHV	LixxxIFxxx	EPXXX
			
Construction	Displaced electrodes	Displaced electrodes	Plastic encapsulated
Size compare	0806 available(inch)	3220(inch)	3225(inch)
UL test compare (Need pass 15 times)	Pass	Pass	Pass
High temperature	Good	Bad	Bad
High humidity	Good	Bad	Bad
Termination	Ag/Ni/ Sn	Ag/Pt	Tinned copper

The current overvoltage surge protection parts are using plastic epoxy, after thermal shock, products will be degraded and burned. SHV series won't have situation such this.

High humidity and high temperature (Reliable)
After IEC environment test condition at 85°C and high humidity 40°C 95% load test, the variation of BDV is under 10%

CSPD Family

CERAMIC

SHV Series (LED Lighting / AC Power)

Specification

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Cap.
		V_{AC}	V_{DC}	V_B(1mA)	V_c(max.)	I_{peak}(8/20μS)	C(1KHz)
0806	0806SV271-201A	175V	225V	270V(±10%)	450V	200A	90pF
1206	1206SV391-101A	250V	320V	390V(±10%)	647V	100A	40pF
1210	1210SV271-801A	175V	225V	270V(±10%)	450V	800A	350pF
1812	1812SV271-202A	175V	225V	270V(±10%)	450V	2000A	860pF
	1812SV471-102A	300V	385V	470V(±10%)	775V	1000A	300pF
2220	2220SV271-801A	175V	225V	270V(±10%)	450V	800A	350pF
	2220SV471-202A	300V	385V	470V(±10%)	775V	2000A	700pF
	2220SV681-801A	420V	560V	680V(±10%)	1120V	800A	210pF
3220	3220SV271-501A	175V	225V	270V(±10%)	450V	500A	340pF
	3220SV471-302A	300V	385V	470V(±10%)	775V	3000A	750pF
	3220SV511-252A	315V	410V	510V(±10%)	845V	2500A	600pF
	3220SV821-102A	500V	650V	820V(±10%)	1350V	1000A	1100pF

SHV-UL + TUV Series Specification

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Cap.
		V_{AC}	V_{DC}	V_B(1mA)	V_c(max.)	I_{peak}(8/20μS)	C(1KHz)
0806	0806SV431-101A	275V	350V	430V(±10%)	705V	100A	45pF
1206	1206SV431-201A	275V	350V	430V(±10%)	705V	200A	60pF
1210	1210SV431-501A	275V	350V	430V(±10%)	705V	500A	200pF
1812	1812SV431-801A	275V	350V	430V(±10%)	705V	800A	340pF
	1812SV471-501A	300V	385V	470V(±10%)	775V	500A	200pF
	1812SV471-801A	300V	385V	470V(±10%)	775V	800A	310pF
2220	2220SV431-501A	275V	350V	430V(±10%)	705V	500A	215pF
	2220SV431-801A	275V	350V	430V(±10%)	705V	800A	305pF
	2220SV471-501A	300V	385V	470V(±10%)	775V	500A	195pF
	2220SV471-801A	300V	385V	470V(±10%)	775V	800A	290pF

CSPD Family

CERAMIC

SHV Series (LED Lighting / AC Power)

Specification (for UL Certification)

Underwriters Laboratories

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Cap.
		V_{AC}	V_{DC}	V_B(1mA)	V_c(max.)	I_{peak}(8/20μS)	C(1KHz)
0806	0806SV241-201A	150V	200V	240V(±10%)	395V	200A	95pF
	0806SV431-101A	275V	350V	430V(±10%)	705V	100A	45pF
1206	1206SV241-351A	150V	200V	240V(±10%)	395V	350A	180pF
	1206SV431-201A	275V	350V	430V(±10%)	705V	200A	60pF
1210	1210SV241-201A	139V	195V	240V(±10%)	395V	200A	110pF
	1210SV391-201A	250V	320V	390V(±10%)	647V	200A	105pF
	1210SV471-251A	300V	385V	470V(±10%)	775V	250A	100pF
	1210SV471-501A	300V	385V	470V(±10%)	775V	500A	190pF
1812	1812SV271-102A	175V	225V	270V(±10%)	450V	1000A	600pF
	1812SV271-501A	175V	225V	270V(±10%)	450V	500A	275pF
	1812SV431-801A	275V	350V	430V(±10%)	705V	800A	340pF
	1812SV471-501A	300V	385V	470V(±10%)	775V	500A	200pF
	1812SV471-801A	300V	385V	470V(±10%)	775V	800A	310pF
2220	2220SV241-801A	139V	195V	240V(±10%)	395V	800A	430pF
	2220SV271-501A	175V	225V	270V(±10%)	450V	500A	390pF
	2220SV391-501A	250V	320V	390V(±10%)	647V	500A	235pF
	2220SV391-801A	250V	320V	390V(±10%)	647V	800A	320pF
	2220SV431-501A	275V	350V	430V(±10%)	705V	500A	215pF
	2220SV431-801A	275V	350V	430V(±10%)	705V	800A	305pF
	2220SV471-501A	300V	385V	470V(±10%)	775V	500A	195pF
	2220SV471-801A	300V	385V	470V(±10%)	775V	800A	290pF
3220	3220SV271-801A	175V	225V	270V(±10%)	450V	1000A	550pF
	3220SV431-801A	275V	350V	430V(±10%)	705V	1000A	490pF
	3220SV471-801A	300V	385V	470V(±10%)	775V	1000A	450pF
	3220SV681-102A	420V	560V	680V(±10%)	1120V	1000A	1300pF

CSPD Family

CERAMIC

SHV Series (LED Lighting / AC Power)

Specification (for TUV Certification)

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Cap.
		V_{AC}	V_{DC}	V_B(1mA)	V_c(max.)	I_{peak}(8/20μS)	C(1KHz)
0806	0806SV431-101A	275V	350V	430V(±10%)	705V	100A	45pF
1206	1206SV431-201A	275V	350V	430V(±10%)	705V	200A	60pF
	1206SV471-101A	300V	385V	470V(±10%)	775V	100A	30pF
	1206SV471-201A	300V	385V	470V(±10%)	775V	200A	55pF
	1206SV511-101A	315V	410V	510V(±10%)	845V	100A	35pF
1210	1210SV431-501A	275V	350V	430V(±10%)	705V	500A	200pF
	1210SV471-501A	300V	385V	470V(±10%)	775V	500A	190pF
	1210SV511-351A	315V	410V	510V(±10%)	845V	350A	12pF
1812	1812SV431-801A	275V	350V	430V(±10%)	705V	800A	340pF
	1812SV471-501A	300V	385V	470V(±10%)	775V	500A	200pF
	1812SV471-801A	300V	385V	470V(±10%)	775V	800A	310pF
2220	2220SV431-501A	275V	350V	430V(±10%)	705V	500A	215pF
	2220SV431-801A	275V	350V	430V(±10%)	705V	800A	305pF
	2220SV471-501A	300V	385V	470V(±10%)	775V	500A	195pF
	2220SV471-801A	300V	385V	470V(±10%)	775V	800A	290pF
	2220SV471-182A	300V	385V	470V(±10%)	775V	1800A	600pF

SHR Series Specification

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Ring Wave	Typical Cap.
		V_{AC}	V_{DC}	V_B(1mA)	V_c(max.)	I_{peak}(8/20μS)	C(1KHz)
0604	0604SR271-2R5K	175V	225V	270V(±10%)	450V	2.5KV	20pF

CSPD Family

CERAMIC

SHA Series (Automotive Application)

Requirement

Automotive electronics require safety certification. Currently, the car manufacturer must pass the ISO7637 pulse 5a test, the so-called Load dump test. Because this specification has a so-called destructive experimental wave, the reason for this regulation is because when the car starts, the engine Drive the battery to the battery, and then use the 12V or 24V power supply from the electric cigarette lighter to use the electronic products in the car. Once the car electronics are off, the engine will directly charge the car's electronic products, which will cause fire or safety hazard. Car manufacturers have demanded that automotive electronics require the adoption of this regulation.



CSPD SHA

Description

SHA series special for worst environment design, for customer to choice operating temperature, it also meet **AEC-Q200** requirement, This type have several advantages, technology for multilayer to provide large **surface area** and **small size,** for mostly application **replace bigger** surface TVS diode. Besides, this series have more wide operating than zener diode.

SHA automotive zener diode using **Nano glass technology coating**，no need plastic cover and also **smallest**

Features

-Size：0806~4032(Inch)
-Meet STD：ISO7637/ISO16750 Pulse5A/B
-BDV ：24V~75V
-Load Dump ：1.5J~160J
-Operating temperature ：125°C.
-Meet AECQ 200/ PPAP
-Bi-directional clamping
-IATF 16949

Application Area

-All ECU DC Power
-ADAS
-Car Lighting
-Muti-Media System
-GPS Navigator
-T-Box
-OBU

Comparison with Other Solution

General (Load Dump) solution：

1.Using MOV (Disk Varistor), after thermal shock -40 ~ 90℃/72hr, the surface will be broken. This is caused by Epoxy not withstand high temperature and will burn after continuous using. (Figure 1)
2.Test TVS axial type, the part is broken. (Figure 2)
3.Test TVS SMD type, it will be peeled off at terminals.(Figure 3)

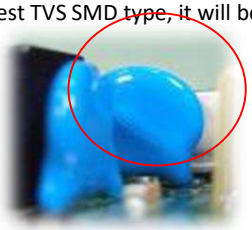
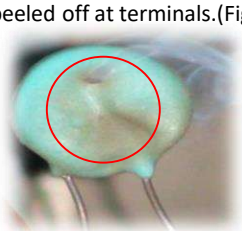


Figure1



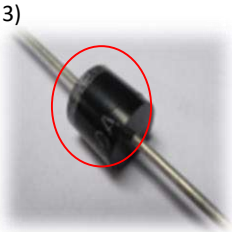
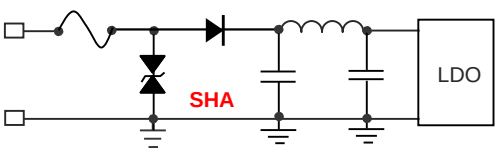


Figure 2



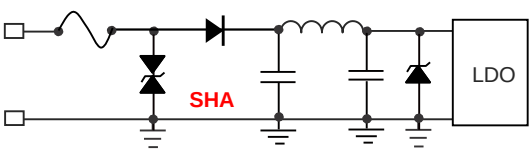
Figure 3

Reference Application Circuit



The single Stage Load Dump Protection
Application for 12 V system





TVS

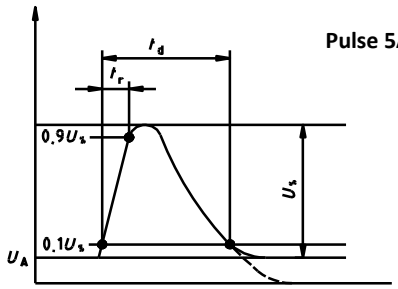
The twice Stages Load Dump Protection
Application for 24 V system
(Due to Clamping Voltage issue)

CSPD Family

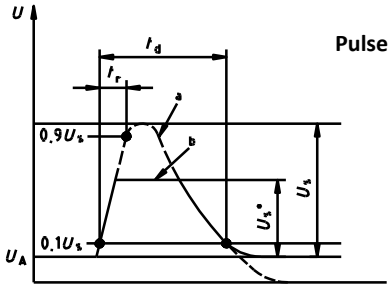
CERAMIC

SHA Series (Automotive Load Dump Test STD.

ISO 7637-2 Pulse 5A/5B

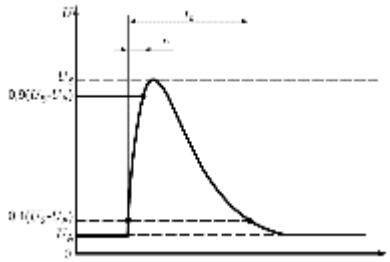


	12V	24V
Us	65V~ 87V	123V~ 174V
Ri	0.5Ω~4Ω	1Ω~8Ω
td	40ms~400 ms	100ms~350 ms
tr	(10 +0/−5)ms	

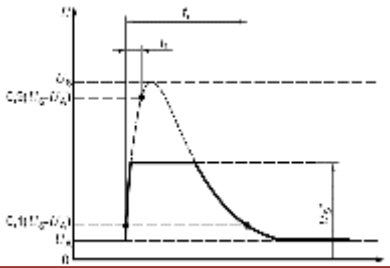


	12V	24V
Us	65V~ 87V	123V~ 174V
Us*	Defined by Customer	
td	Same as 5A	

ISO 16750-2 Test A/B



	12V	24V
Us	79V~ 101V	151V~ 202V
Ri	0.5Ω~4Ω	1Ω~8Ω
td	40ms~400 ms	100ms~350 ms
tr	(10 +0/−5)ms	



	12V	24V
Us	79V~ 101V	151V~ 202V
Us*	35V	65V
td	Same as 5A	

* All the input voltage include Ua value(14V/ 28V)

Compare with ISO7637-2 & ISO16750-2

Parameter	ISO16750-2			ISO7637-2		
	12V	24V	Pulse(min)	12V	24V	Pulse (min)
Us(V)	79≦Us≦101 (65+14) ≦US≦(87+14)	151≦Us≦202 (123+28) ≦Us≦(174+28)	10 times (Duration 1 minute)	65≦Us≦87	123≦Us≦174	1 time
Us*(V)	35(14+21)	65(28+37)		By Customer	By Customer	
Ua(V)	14	28		13.5	27	
Ri(Ω)	0.5≦Ri≦4	1≦Ri≦8		0.5≦Ri≦4	1≦Ri≦8	
Td(ms)	40≦Td≦400	100≦Td≦350		40≦Td≦400	100≦Td≦350	
Tr(ms)	10/-5	10/-5		10/-5	10/-5	

CSPD Family

CERAMIC

SHA Series (Automotive)

CSPD SHA

CSPD SHA

Specification(System for 12V)

All specification is base on datasheets and subject to change without notice.

	Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Peak Current	Load Dump	Jump Start Voltage
		V_{DC}(max.)	V_B(1mA)	V_C(max.)	I_{Peak}(8/20μs)	W_{LD}	V_{JUMP}
0805	0805SA240- 1R5J	16V	24V(±10%)	40V	200A (for +/- 1 time)	1.5J (for 10 times)	24.5V/5min
0806	0806SA240-060J	16V	24V(±10%)	40V	300A (for +/- 1 time)	6J (for 10 times)	24.5V/5min
	0806SA300-090J	16V	30V(±10%)	48V	300A (for +/- 1 time)	9J (for 10 times)	30.0V/5min
	0806SA330-090J	16V	33V(±10%)	53V	300A (for +/- 1 time)	9J (for 10 times)	32.5V/5min
1206	1206SA240-030J	16V	24V(±10%)	40V	400A (for +/- 1 time)	3J (for 10 times)	24.5V/5min
	1206SA240-060J	16V	24V(±10%)	40V	500A (for +/- 1 time)	6J (for 10 times)	24.5V/5min
	1206SA330-060J	16V	33V(±10%)	53V	200A (for +/- 1 time)	6J (for 10 times)	32.5V/5min
	1206SA360-090J	16V	36V(±10%)	55V	500A (for +/- 1 time)	9J (for 10 times)	35.0V/5min
1210	1210SA240-060J	16V	24V(±10%)	40V	800A (for +/- 1 time)	6J (for 10 times)	24.5V/5min
	1210SA240-120J	16V	24V(±10%)	40V	1000A (for +/- 1 time)	12J(for 10 times)	24.5V/5min
	1210SA360-120J	16V	36V(±10%)	55V	800A (for +/- 1 time)	12J (for 10 times)	35.0V/5min
1812	1812SA240-120J	16V	24V(±10%)	40V	1600A (for +/- 1 time)	12J (for 10 times)	24.5V/5min
	1812SA240-250J	16V	24V(±10%)	40V	2000A (for +/- 1 time)	25J (for 10 times)	24.5V/5min
	1812SA360-250J	16V	36V(±10%)	55V	2000A (for +/- 1 time)	25J (for 10 times)	35.0V/5min
2220	2220SA240-500J	16V	24V(±10%)	40V	5000A (for +/- 1 time)	50J (for 10 times)	24.5V/5min
	2220SA330-500J	16V	33V(±10%)	53V	5000A (for +/- 1 time)	50J (for 10 times)	32.5V/5min
	2220SA360-500J	16V	36V(±10%)	55V	4000A (for +/- 1 time)	50J (for 10 times)	35.0V/5min
3220	3220SA240-800J	16V	24V(±10%)	40V	5500A (for +/- 1 time)	80J (for 10 times)	24.5V/5min
4032	4032SA240-161J	16V	24V(±10%)	40V	6000A (for +/- 1 time)	160J (for 10 times)	24.5V/5min

CSPD Family

CERAMIC

SHA Series (Automotive)

Specification(System for 24V)

All specification is base on datasheets and subject to change without notice.

	Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Peak Current	Load Dump	Jump Start Voltage
		V_{DC}(max.)	V_B(1mA)	V_C(max.)	I_{Peak}(8/20μs)	W_{LD}	V_{JUMP}
1206	1206SA470-030J	34V	47V(±10%)	77V	200A (for +/- 1 time)	3.0J (for 10 times)	45.0V/5min
1210	1210SA470-120J	34V	47V(±10%)	77V	500A (for +/- 1 time)	12J (for 10 times)	45.0V/5min
1812	1812SA470-250J	34V	47V(±10%)	77V	2000A (for +/- 1 time)	25J (for 10 times)	45.0V/5min
2220	2220SA470-250J	34V	47V(±10%)	77V	3000A (for +/- 1 time)	25J (for 10 times)	45.0V/5min
	2220SA470-500J	34V	47V(±10%)	77V	4000A (for +/- 1 time)	50J (for 10 times)	45.0V/5min
3220	3220SA470-800J	34V	47V(±10%)	77V	4500A (for +/- 1 time)	80J (for 10 times)	45.0V/5min
	3220SA510-800J	34V	47.6~56.1	83.5V	4500A (for +/- 1 time)	80J (for 10 times)	50.6V/5min
4032	4032SA470-161J	36V	45~53	77V	6000A (for +/- 1 time)	160J (for 10 times)	48V/5min

Specification(System for 12/24V)

All specification is base on datasheets and subject to change without notice.

	Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Peak Current	Load Dump	Jump Start Voltage
		VDC(max.)	VB(1mA)	VC(max.)	IPeak(8/20μs)	W_{LD}	V_{JUMP}
1206	1206SA360-090V	24V	36V(±10%)	55V	500A (for +/- 1 time)	9J (for 10 times)	35.0V/5min
1210	1210SA360-120V	24V	36V(±10%)	55V	800A (for +/- 1 time)	12J (for 10 times)	35.0V/5min
1812	1812SA360-250V	24V	36V(±10%)	55V	2000A (for +/- 1 time)	25J (for 10 times)	35.0V/5min
2220	2220SA360-500V	24V	36V(±10%)	55V	4000A (for +/- 1 time)	50J (for 10 times)	35.0V/5min
4032	4032SA360-161V	24V	36V(±10%)	55V	6000A (for +/- 1 time)	160J (for 10 times)	35.0V/5min

CSPD Family

CERAMIC

SHN Series (Telecom/ Ethernet Non-PoE Application)

CSPD SHN

Requirement

Now more popular in networking application in indoor and outdoor security all need for the overvoltage and lightning protected. The interface of RJ45, the circuit is 4 wires protection (1,2/3,6). In order to have full protection for 8 wires (1, 2; 3,6; 4,5; 7,8）and prevent the surge attacked, our CSPD products have the good characteristic and small size devices conjunction with the wires and will protect devices.

Description

SHN Now more popular in networking application in indoor and outdoor security all need for the overvoltage and lightning protected. The interface of RJ45, the circuit is 4 wires protection (1,2/3,6).

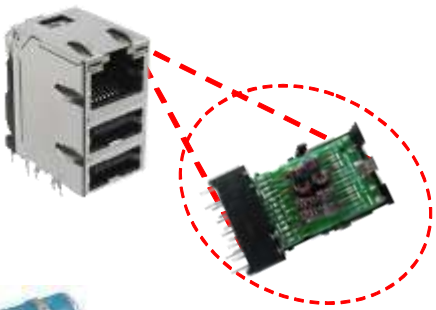
In order to have full protection for 8 wires (1,2; 3,6; 4,5;7,8）and prevent the surge attacked, our CSPD products have the good characteristic and small size devices conjunction with the wires and will protect devices.

Features

-Size： 1206~1812
-Meet IEC61000-4-5 10*700 us 4~8KV
-Faster response time <0.5ns
-No extinguish problem
-Bi-direction

Application

-Ethernet Device
-HUB/Switch/IAD
-RJ45 Socket

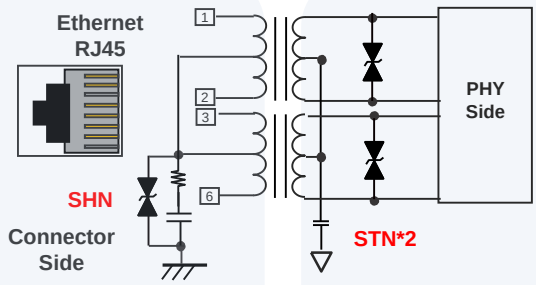


Comparison with Other Solution



CSPD vs GDT				
Function	**CSPD**		**(GDT)**	**GDT**
Size	**1206, 1210**	Φ5 x5.6	1206(3216)	1812(4532)
BDV	**12 V**	75V	200V	75V
Clamping Voltage	**<25 V**	>300V	>500V	>300V
Surge (10/700μs)	**6 KV**	6 KV	4 KV	4 KV
Respond time	**<1 ns**	> 500ns	>100 ns	>100 ns
Extinguishment	**No**	Yes	Yes	Yes

Reference Application Circuit Non-PoE



Common Mode(L-G)

Differential Mode(L-L)

Ethernet (RJ45) surge protection		
	Pass Level	Part No.
L-G	6KV	SFI1206SN120-060K
L-G	4KV	SFI1206SN120-040K
L-L	2KV	SFI0402TN050-1R5A-11
L-L	2KV	SFI0603TN050-1R5A-11

CSPD Family

CERAMIC

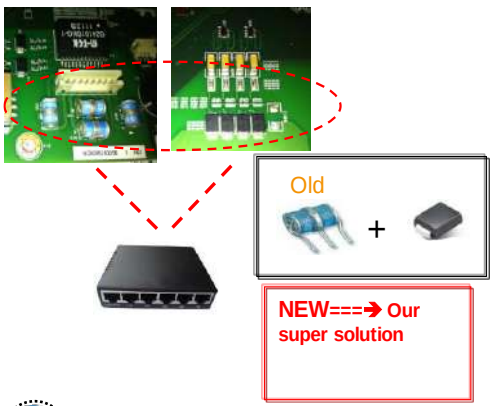
SHN Series (Telecom/ Ethernet with PoE)

Requirement

Power over Ethernet (PoE) is a technology which transfer power and data through Ethernet cables. They are including telecom systems, IP phone, wireless station, IP camera, hub, computers which get power by PoE. Therefore, it must be use surge protection for Ethernet RJ45 connectors. In telecom systems are connected by Ethernet and will also have the surge or voltage problem caused by power off by the surge. The surge protective device and pass the overvoltage to earth and clamp the voltage to avoid the system damage and broken. Now the standard of 100/1000M of Ethernet speed requirement and these precise devices protected is more important.

Description

SFI has developed a dedicated in the Telecom PoE SHN series. SHN provides "small size SMD patch" packaging, which is the world's smallest chip package with fast response and high flow capacity, and avoids the problem of flameout caused by GDT. The current SHN protection components have been widely used by Netcom manufacturers.



Features

-Size： 1210
-Meet IEC61000-4-5
-Faster response time <0.5ns than GDT
-No extinguish problem
-Bi-directional

Application

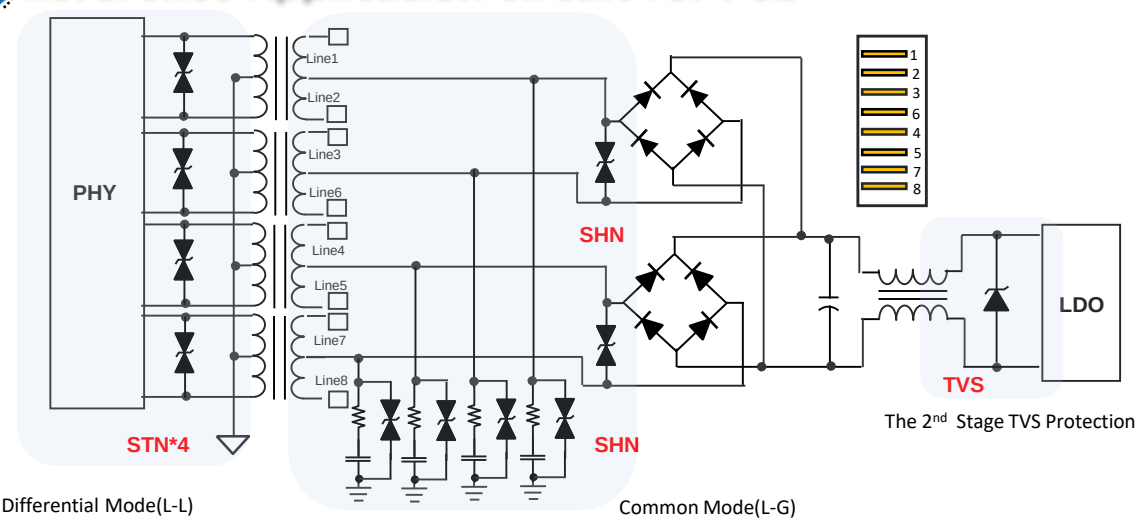
-AP Router/Switch
-IAD
-IP CAM
-Others

Comparison Traditional Solution

GDT Disadvantage ： On application of PoE, due to the arc voltage is less than working after GDT discharge. Because the GDT will break and burn out and short, it becomes huge damage due to it's extinguish problem. In order to solve the issue, it's usually to put series of varistors or Sidactor after GDT to prevent extinguishment.

Our SHN strong characteristics：
1. Chip size
2. High flow ability
3. Low clamping volt
4. Quick response time and provide better solution than that.

Reference Application Circuit for PoE



The 2nd Stage TVS Protection

Differential Mode(L-L)

	Pass Level	Part No.
L-L	2KV	SFI0402TN050-1R5A-11
L-L	2KV	SFI0603TN050-1R5A-11

Common Mode(L-G)

	Pass Level	Part No.
L-G	6KV	SFI1210SN750-060K
L-G	4KV	SFI1210SN750-040K

CSPD Family

CERAMIC

SHN Series (Telecom/ Ethernet)

CSPD SHN

CSPD SHN

Specification

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Working Voltage	Breakdown Voltage(*1)	Clamping Voltage(*2)	Surge Voltage	Surge Current(*3)	Typical Capacitance(*4)
		V_{DC}	V_B(1mA)	V_C(max)	V_{Surge} (10/700μs)	I_{Peak} (10/700μs)	C(1KHz)
0806	0806SN750-010K	60V	75V(±10%)	100V	1KV	300A	180pF
1206	1206SN120-040K	9V	12V(12~20)	30V	4KV	100A	3200pF
	1206SN120-060K	9V	12V(12~20)	30V	6KV	150A	3850pF
1210	1210SN470-040K	38V	47V(±10%)	75V	4KV	100A	1400pF
	1210SN470-060K	38V	47V(±10%)	75V	6KV	150A	1670pF
	1210SN750-080K	60V	75V(±10%)	105V	8KV	200A	1350pF
	(*6)1210SN750-040K-UL	60V	75V(±10%)	100V	4KV	100A	1000pF
	(*6)1210SN750-060K-UL	60V	75V(±10%)	100V	6KV	150A	1300pF
	1210SN820-060S	60V	67.5V(min)	100V	6KV	150A	1350pF
1812	1812SN471-030K	385V	470V(±10%)	775V	3KV	75A	300pF

Notes：

＊1 The breakdown voltage was measured at 1 mA current.

＊2 The Clamping voltage was measured at 8/20 μs standard current, 0805~1206(1A),1210(2.5A),1812(5A) ,2220(10A)

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

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

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

＊6 SFI1210SN750-040K & SFI1210SN750-060K with UL Certification

CSPD Family

CERAMIC

SHC Series (Bigger Current)

Description

Most applications in communications base voltage of 48VDC voltage, lightning likely path through a coaxial cable or antenna to damage to the internal IC, will have a lot of power surges and voltage spikes on it. For a combination of lightning within base station power system, lightning protection circuit is relatively simple, but also more mature, usually in combination with through the DC side of the power flow to 15KA(8/20μs waveform) ways to DC SPD.



CSPD SHC

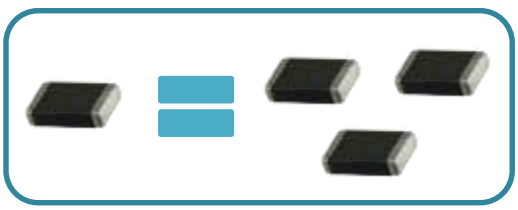
Features

-Size：0805~3220 (Inch)
-Meet：IEC61000-4-5
1.2/50μs and 8/20μs combined wave
-Respond ：< 0.5 ns
-BDV：24V~82V
-Peak surge current：200A~20KA
-Low leakage ：<1μA
-Operating temperature ：125°C
-Bi-directional
-SMD package

Comparison with Other Solution

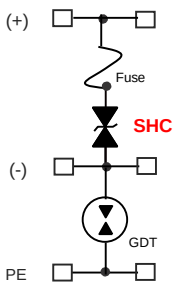
	SHC	Others
Circuit	(A)	(B)
Size	2220	2220
Surge	10KA	4.5KA
Usage	1~2 pcs	3~5 pcs
Total cost	Low	High
Space rate	1/3	1

Equal

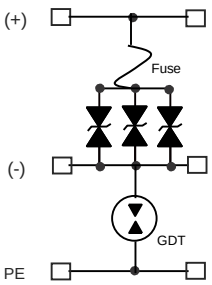


1 pcs (CSPD) = 3 pcs(Others)

Reference Application Circuit



(A)



(B)

Recommend Part No.

	Part Number	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current (8/20 μs)
	Symbol	AC	DC	V（1mA）	V	A
	SFI2220SC750-103A	48	60	75(±10%)	＜100	10KA
★	SFI2220SC240-103A	14	18	24(±10%)	＜45	10KA
★	SFI3220SC240-203A	14	18	24(±10%)	＜45	20KA

CSPD Family

CERAMIC

SHC Series (Bigger Current)

Specification

All specification is base on datasheets and subject to change without notice.

	Part No.	Working Voltage	Breakdown Voltage(*1)	Clamping Voltage(*2)	Surge Current(*3)	Typical Capacitance(*4)
		V_{DC}(max.)	V_{BDV}(1mA)	V_C(max.)	I_{Peak}(8/20μs)	Cap.(1K$_{Hz}$)
1206	1206SC120-501A	9V	12V(12~20)	30V	500A	3500pF
	1206SC240-501A	18V	24V(±10%)	45V	500A	2300pF
	1206SC470-501A	38V	47V(±10%)	85V	500A	690pF
	1206SC560-102A	45V	56V(±10%)	90V	1000A	800pF
	1206SC750-501A	60V	75V(±10%)	100V	500A	300pF
1210	1210SC240-102A	18V	24V(±10%)	45V	1000A	2300pF
	1210SC470-102A	38V	47V(±10%)	85V	1000A	1550pF
	1210SC101-401A	85V	100V(±10%)	165V	400A	250pF
	1210SC750-182A	60V	75V(±10%)	100V	1800A	980pF
	1210SC750-102A-UL	60V	75V(±10%)	100V	1000A	930pF
1812	1812SC240-202A	18V	24V(±10%)	45V	2000A	4500pF
	1812SC470-202A	38V	47V(±10%)	85V	2000A	2100pF
	1812SC750-202A	60V	75V(±10%)	100V	2000A	1650pF
2220	2220SC240-302A	18V	24V(±10%)	45V	3000A	5500pF
	2220SC240-103A	16V	24V(24~30)	45V	10000A	18000pF
	2220SC470-502A	38V	47V(±10%)	85V	5000A	9900pF
	2220SC470-802A	38V	47V(±10%)	85V	8000A	7500pF
	2220SC680-802A	56V	68V(±10%)	100V	8000A	5600pF
	2220SC720-402A	58V	72V(±10%)	100V	4000A	4000pF
	2220SC750-302A	60V	75V(±10%)	100V	3000A	2000pF
	2220SC820-602A	65V	82V(±10%)	135V	6000A	3500pF
3220	3220SC240-203A	18V	24V(±10%)	45V	20000A	22000pF

Notes：

＊1 The breakdown voltage was measured at 1 mA current.

＊2 The Clamping voltage was measured at 8/20 μs standard current, 0806(1A) ,1206(1A) ,1210(2.5A) ,1812(5A) , 2220(10A) ,3220(10A) ,6420(10A).

＊3 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 components shall be employed within 1 year, in nitrogen condition.

CSPD Family

CERAMIC

SEA Series (Automotive ESD)

CSPD SEA

Requirement

CAN Bus is automotive signal interface. It is widwly used in the automotive to transfer data between every electronic devices. It achieves a regional network control systems in whole vehicle and exchanges information between ECU electronic controls to become the automotive electronic control network. **SEA** series is designed for this request.

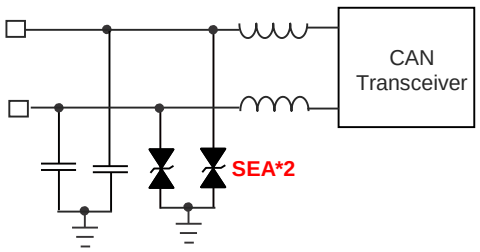
Features

-Compliant with IEC61000-4-2 contact +/-30 KV
-Different capacitance values correspond to the different speed signal bus (CAN Bus)
-Compatible with (ISO7637-2)
Pulse 1 (max. -50 V)/ Pulse 2 (max. 125 V)
Pulses 3A and 3B
-Operating temperature exceeds ：125 ° C
-Bi-directional
-Products with Lead-Free

Application Area

-CAN BUS system
-Other special requirements

Reference Application Circuit



SEA Specification

All specification is base on datasheets and subject to change without notice.

	Part No.	Stand-off Voltage	Breakdown Voltage	Clamping Voltage	Typical Capacitance	Leakage Current	ESD Ability
		V_{DC}(max.)	V_B(1mA)	V_C(max.)	C(1MHz)	I_{LDC}	V_{ESD}
0402	0402EA240-HSP	16V	28.0~38.0V	57V	15pF(±30%)	<0.8μA	25KV
	0402EA470-HSP	28V	48.0~72.0V	108V	15pF(±30%)	<0.8μA	25KV
0603	0603EA240-LSP	16V	28.0~38.0V	57V	50pF(±30%)	<0.8μA	25KV
	0603EA240-MSP	16V	28.0~38.0V	57V	25pF(±30%)	<0.8μA	25KV
	0603EA240-HSP	16V	28.0~38.0V	57V	10pF(±30%)	<0.8μA	25KV
	0603EA470-LSP	28V	48.0~72.0V	108V	50pF(±30%)	<0.8μA	25KV
	0603EA470-HSP	28V	48.0~72.0V	108V	15pF(±30%)	<0.8μA	25KV
	0603EA510-LSP	32V	52.0~76.0V	110V	50pF(±30%)	<0.8μA	25KV
	0603EA680-HSP	42V	70.0~95.0V	140V	15pF(±30%)	<0.8μA	25KV
	0603EA111-HSP	70V	110~140V	200V	15pF(±30%)	<0.8μA	25KV
0805	0805EA470-XSP	36V	42.3~51.7V	77V	200pF(±30%)	<2.0μA	25KV

CSPD Family

CERAMIC

SEH Series (Ultra Low Capacitance)

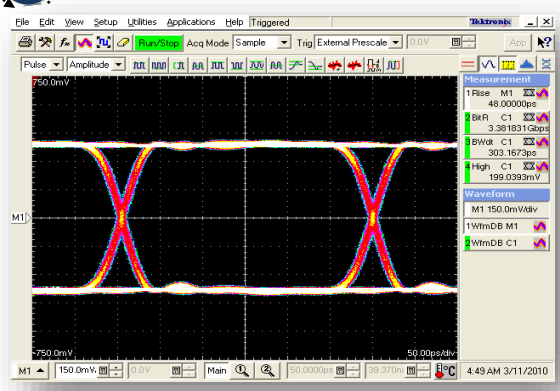
Feature

-Protection against high ESD voltages
-Compact size for EIA 0402 and 0603
-Quick response time (<0.5ns)
-Low capacitance (<0.05pF)
-Low leakage current
-Bi-directional
-RoHS compliance

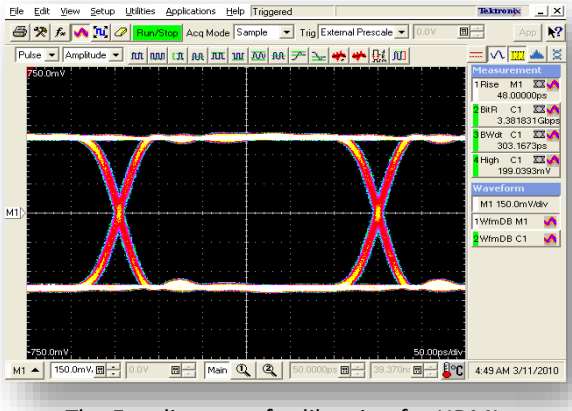
Application Area

-USB2.0 / USB3.0 /HDMI /DVI
-Motherboard
-Notebook
-Smart Phone
-STB
-DSC, DV, Scanner

Characteristic



The Eye diagram of calibration for HDMI pattern (0.2pF at 3.4GHz)



The Eye diagram of calibration for HDMI pattern (0.05pF at 3.4GHZ)

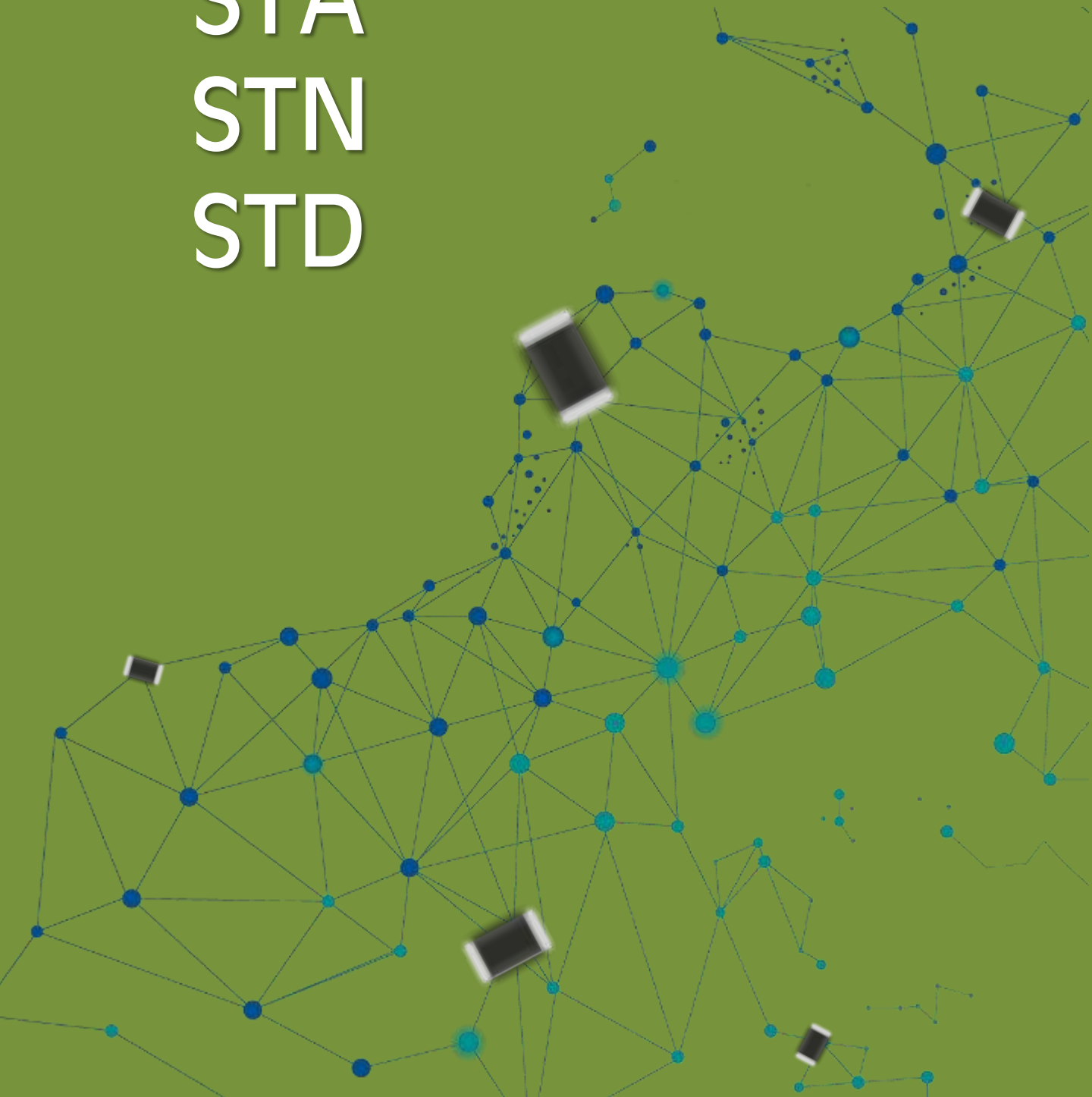
Specification

All specification is base on datasheets and subject to change without notice.

	Part No. (Unit)	Working Voltage	ESD Trigger Voltage	Clamping Voltage At 30ns.	Leakage Current	Capacitance Value	ESD (Contact)	ESD (Air)
		V_{DC} (max.)	V_T(typ.)	Vc(typ.)	I_{LDC}	C(1MHz)	V_{ESD}	V_{ESD}
0402	0402EH060-0R20P	6V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	0402EH120-0R20P	12V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	0402EH240-0R20P	24V	300V	30V	<0.05μA	0.20pF	8KV	15KV
0603	0603EH060-0R20P	6V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	0603EH120-0R20P	12V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	0603EH240-0R20P	24V	300V	30V	<0.05μA	0.20pF	8KV	15KV

SGD Family

STS
STA
STN
STD



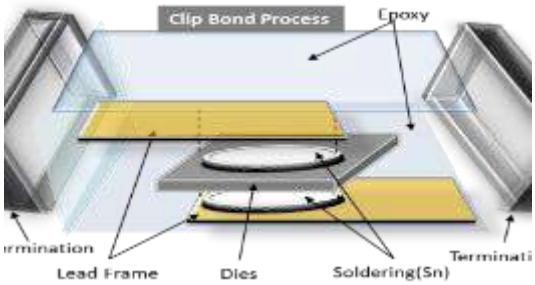
SGD Family

SEMI-CONDUCTOR

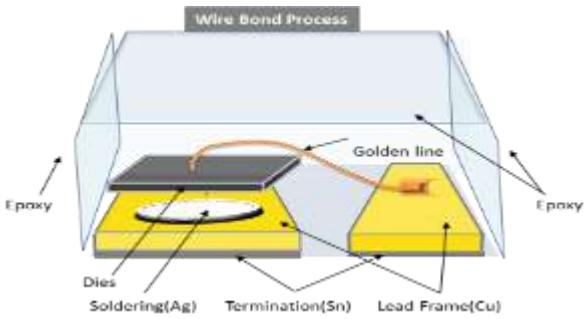
SGD Introduction

Specification

New Technology

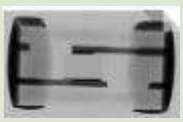
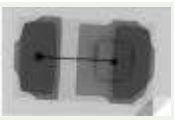


General Technology



Comparison inner Structure

Product exterior and structure

Item	Exterior Diagram	X-ray photo	
		Top View	Flank View
NEW TVS (SGD Clip)			
OLD TVS (DFN Wire)			

SGD Package Advantage

	SGD (New TVS)	DFN (Old TVS)
Package	Clipped	Wire Bond
Contact Wafer	Surface	Point
ESD Robustness	25KV~30KV	15KV
Soldering ability	Good (5 Sides) 	Poor(Button Side) 
QC sampling	10,000pcs/ per set	77 pcs/ per set

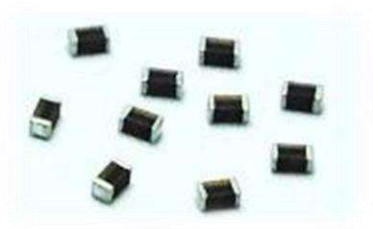
SGD Family

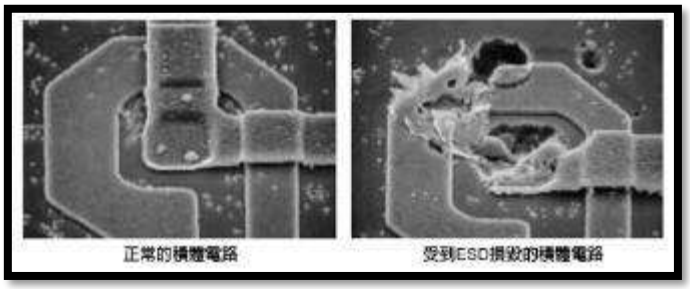
STS Series (TVS Diode)

SGD STS

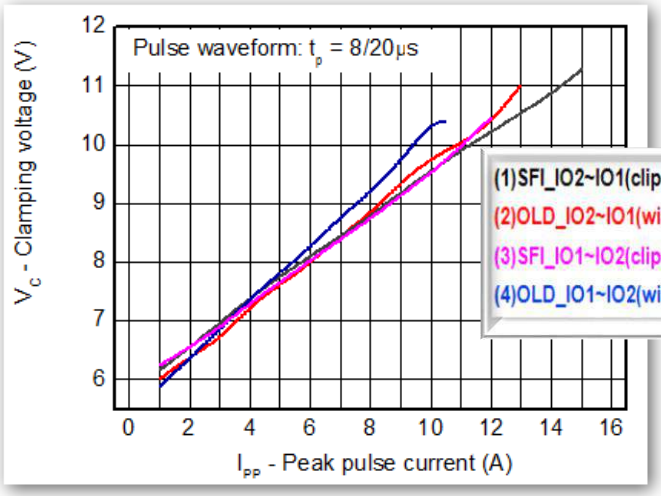
STS Advantage

Background：With the progress of integrated circuits to the nanometer (nm) process, more and more speed, more functional design in one integrated circuit. Such miniaturization design, so as to increase the doping concentration also led thinner gate oxide layer, PN junction width reduction. Resulting IC can easily be damaged by static shock. At this time of protection elements, preferably inhibit low voltage, dynamic resistance is much lower than the protected IC, and has a very fast response time.
SFI develops this product use Si wafer to develop TVS chip for smallest size 0201 vs 0402 TVS protect devices.



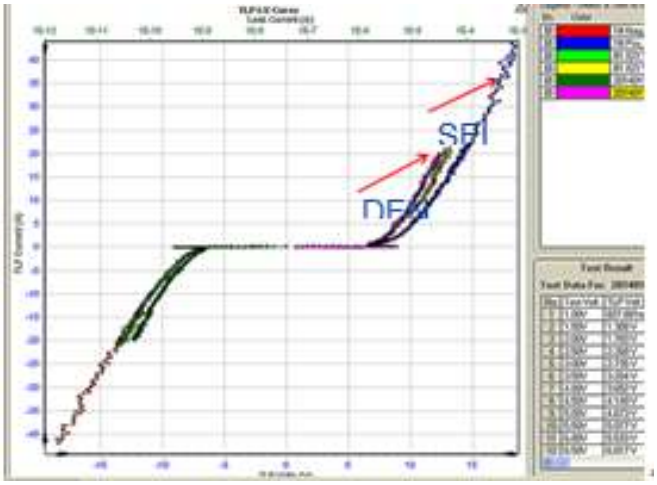


Normal Integrated Circuit　　After ESD Strike Integrated Circuit



Surge good

The surge ability of SFI product is better than DFN product about 2A.
IO1~IO2…positive



TLP ability

The TLP ability of SFI product is better than DFN product.
TLP(DFN) ability about 20A
TLP(SFI) ability about 40A

SGD Family

SEMI-CONDUCTOR

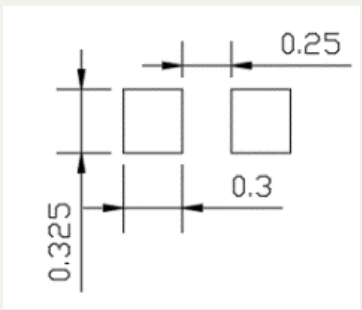
SGD Footprint

SGD STS

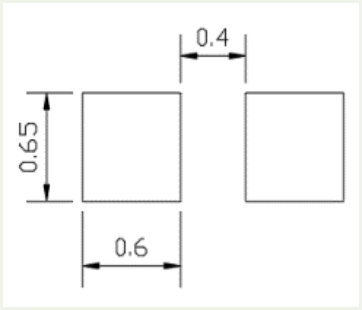
SGD STS

SGD series recommend footprint (mm)

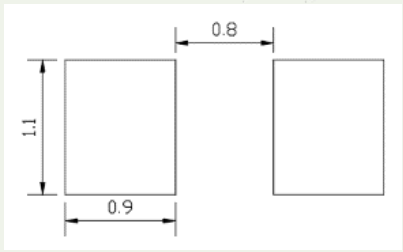




SGD 0201

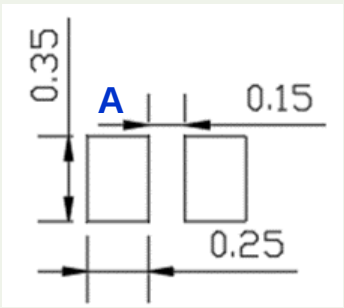


SGD 0402

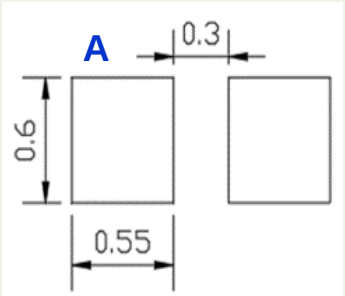


SGD 0603

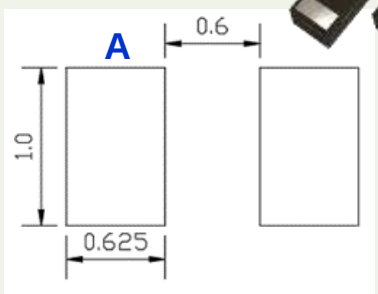




DFN 0603

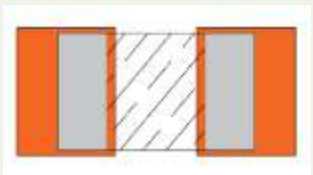


DFN 1006

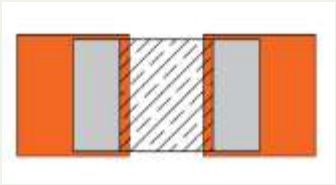


DFN 1610

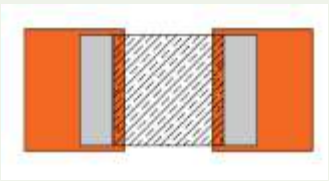
Comparison DFN footprint



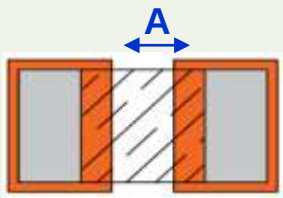
SGD 0201



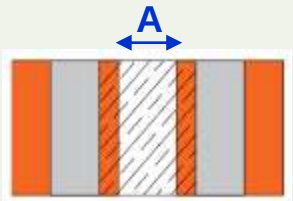
SGD 0402



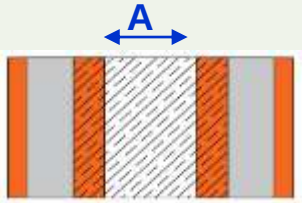
SGD 0603



DFN 0603



DFN 1006



DFN 1610

SGD and DFN can be pin to pin compatible in normal situation , but it due to DFN (A) distance is shorter than SGD (A), It is recommended that the thickness of SMT steel should be ≦0.1mm to achieve the best SMT compatibility.

SGD Family

STS Series (TVS General Used)

SEMI-CONDUCTOR

Specification

All specification is base on datasheets and subject to change without notice.

Part No.		Reverse Working Voltage	Parasitic Capacitance	Leakage Current	ESD Ability		Clamping Voltage (ESD and TLP)		Peak Pulse Power	Peak Pulse Current
		VRWM (max.)	CESD (1MHz) (typ.)	IR (VRWM) (typ.)	VESD (air)	VESD (contact)	VCL (IPP 16A ,TLP) (max.)	VCL (VESD 8KV) (max.)	PPK (8/20μs)	IPP (8/20μs)
0201	0201TS3R3-100W-11	3.3V	10pF	0.001μA	±20KV	±20KV	12V	12V	70W	7A
	0201TS050-100W-11	5.0V	10pF	0.001μA	±20KV	±20KV	12V	12V	72W	6A
	0201TS050-0R3A-11	5.0V	0.3pF	0.001μA	±20KV	±20KV	30V	30V	60W	3A
	0201TS050-2R5A-11	5.0V	2.5pF	0.001μA	±20KV	±20KV	16V	16V	45W	3A
0402	0402TS3R3-100K-11	3.3V	10pF	0.001μA	±30KV	±30KV	10V	10V	80W	8A
	0402TS050-0R3W-11	5.0V	0.3pF	0.001μA	±20KV	±20KV	25V	25V	54W	3A
	0402TS050-0R5A-11	5.0V	0.35pF	0.001μA	±20KV	±20KV	15V	15V	60W	4A
	0402TS050-2R5A-11	5.0V	2.5pF	0.001μA	±15KV	±15KV	16V	16V	45W	3A
	0402TS050-050A-11	5.0V	5pF	0.001μA	±15KV	±15KV	15V	15V	64W	4A
	0402TS050-100A-11	5.0V	10pF	0.001μA	±30KV	±30KV	12V	12V	96W	8A
	0402TS050-170K-11	5.0V	17pF	0.001μA	±30KV	±30KV	12V	12V	80W	8A
	0402TS050-300A-11	5.0V	32pF	0.001μA	±30KV	±30KV	11V	11V	200W	18A
	0402TS6R5-0R3W-11	6.5V	0.3pF	0.003μA	±20KV	±20KV	30V	30V	54W	3A
	0402TS070-100A-11	7.0V	12pF	0.001μA	±30KV	±30KV	13V	13V	72W	6A
	0402TS120-060A-11	12.0V	6pF	0.001μA	±25KV	±25KV	22V	22V	130W	6A
0603	0603TS3R3-100K-11	3.3V	10pF	0.001μA	±30KV	±30KV	10V	10V	80W	8A
	0603TS050-0R3W-11	5.0V	0.3pF	0.001uA	±20KV	±20KV	30V	30V	54W	3A
	0603TS050-2R5A-11	5.0V	2.5pF	0.001μA	±15KV	±15KV	16V	16V	45W	3A
	0603TS050-100A-11	5.0V	10pF	0.001μA	±25KV	±25KV	12V	12V	96W	8A

SGD STS

SGD Family

SEMI-CONDUCTOR

STA Series (TVS Diode for Automotive)

SGD STA

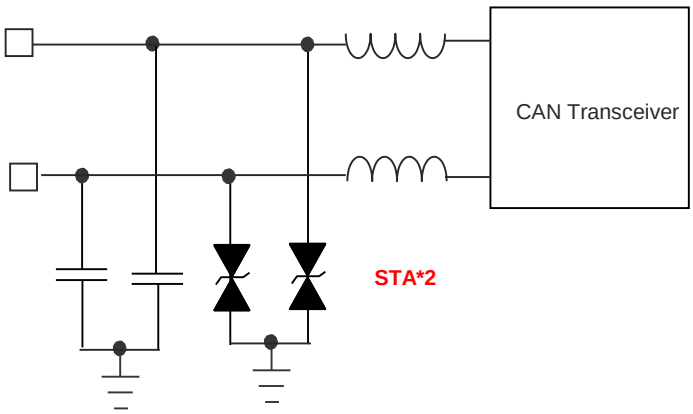
SGD STA

Specification

All specification is base on datasheets and subject to change without notice.

STA Series	Part No.	Reverse Working Voltage	Parasitic Capacitance	Leakage Current	ESD Ability		Clamping Voltage (ESD and TLP)		Peak Pulse Power	Peak Pulse Current
		V_{RWM} (max.)	C_{ESD} (1MHz) (typ.)	IR (V_{RWM}) (typ.)	V_{ESD} (air)	V_{ESD} (contact)	V_{CL} (I_{PP} 16A ,TLP) (max.)	V_{CL} (V_{ESD} 8KV) (max.)	PPK (8/20μs)	I_{PP} (8/20μs)
0402	0402TA3R3-100K-11	3.3V	10pF	0.001μA	±25KV	±25KV	10V	10V	80W	8A
	0402TA050-0R3W-11	5.0V	0.3pF	0.001μA	±20KV	±20KV	30V	30V	54W	3A
	0402TA050-2R5A-11	5.0V	2.5pF	0.001μA	±12KV	±12KV	16V	16V	45W	3A
	0402TA050-100A-11	5.0V	10pF	0.001μA	±25KV	±25KV	12V	12V	96W	8A
	0402TA050-170K-11	5.0V	17pF	0.001μA	±25KV	±25KV	12V	12V	80W	8A
	0402TA070-100A-11	7.0V	12pF	0.001μA	±25KV	±25KV	12V	12V	72W	6A
	0402TA120-060A-11	12.0V	6pF	0.001μA	±25KV	±25KV	22V	22V	130W	6A
0603	0603TA3R3-100K-11	3.3V	10pF	0.001μA	±25KV	±25KV	10V	10V	80W	8A
	0603TA050-2R5A-11	5.0V	2.5pF	0.001μA	±12KV	±12KV	16V	16V	45W	3A
	0603TA050-100A-11	5.0V	10pF	0.001μA	±25KV	±25KV	12V	12V	96W	8A

Reference Application Circuit



Feature

- Ultra small package design
- Bi-Directional protection
- Low capacitance for high-speed data lines
- Meet Automotive ESD test ISO10605 ±25kV (Contact) and ±25kV(Air)
- Protects one data, control or power line
- Low leakage current: 0.1μA @ VRWM (max)
- Low clamping voltage

Application

- In-Vehicle Networks
- Multimedia/Information buses
- CAN (Controller Area Network)
- LIN (Local Interconnected Network)
- In Data transceiver
- Ethernet , HDMI, LVDS
- USB Type C

SGD Family

SEMI-CONDUCTOR

STN Series (TVS Diode High Power)

SGD STN

SGD STN

Specification

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Reverse Working Voltage	Parasitic Capacitance	Leakage Current	ESD Ability		Clamping Voltage (ESD and TLP)		Peak Pulse Power	Peak Pulse Current
		V_{RWM} (max.)	C_{ESD} (1MHz) (typ.)	IR (V_{RWM}) (typ.)	V_{ESD} (air)	V_{ESD} (contact)	V_{CL} (I_{PP} 16A ,TLP) (max.)	V_{CL} (V_{ESD} 8KV) (max.)	PPK (8/20μs)	I_{PP} (8/20μs)
0402	0402TN050-1R5A-11	5.0V	1.5pF	0.001μA	±30KV	±30KV	12V	12V	300W	15A
	0402TN050-0R8A-11	5.0V	0.8pF	0.001μA	±30KV	±30KV	13V	13V	100W	7A

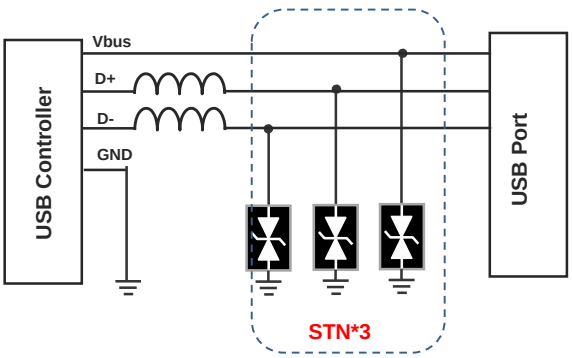
Feature

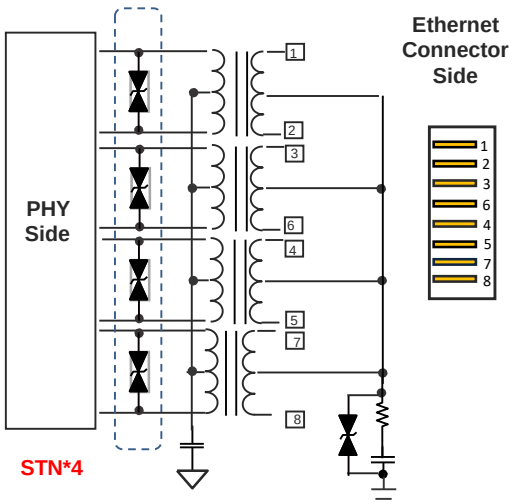
- Protect for high high-speed data lines
- High Ipp surge ability up to 15A
- IEC 61000-4-2 (ESD) ±30kV(Air),(Contact)
- Low capacitance design for high high-speed lines interface
- Ultra-small package (1.0mm* 0.6mm*0.5mm)
- Protects one data, control or power line
- Low capacitance: 1.5pF, 0.8pF (Typical)
- Low leakage current: 0.1μA @ VRWM (max)
- Low clamping voltage

Application

-Ethernet PHY Side
-USB Power Charger(Vbus)

Reference Application Circuit





Differential Mode(L-L)

SGD Family

SEMI-CONDUCTOR

STD Series (TVS Diode with Snap Back for Data Line)

SGD STD

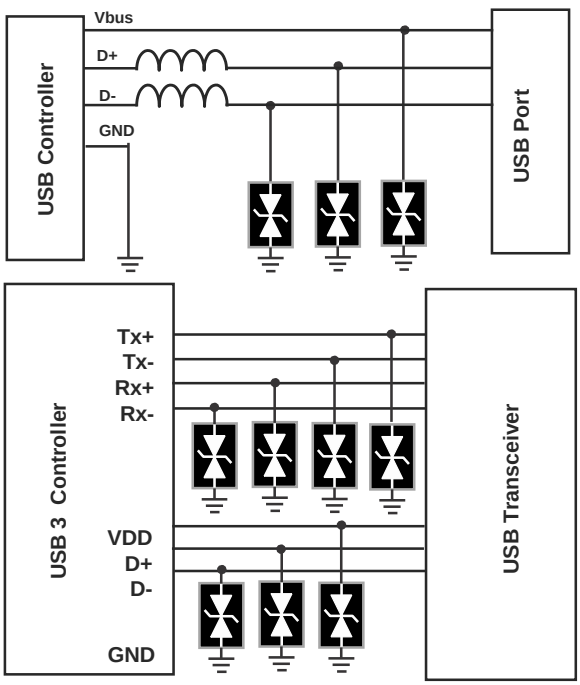
STD Series is a low-capacitance Transient Voltage Suppressor (TVS) designed to provide electrostatic discharge (ESD) protection for control data lines. is designed to protect parasitic-sensitive systems against over-voltage and over-current transient events. It complies with IEC61000-4-2(ESD), Level 4 (±15KV air, ±15KV contact discharge), IEC61000-4-4 (electrical fast transient -EFT) (20A, 5/50ns), very fast charged device model (CDM) ESD and cable discharge event (CDE), etc. STD series also built in snake back function.

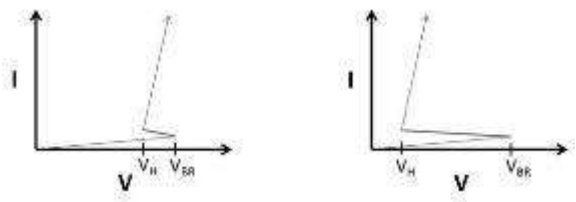
Specification

All specification is base on datasheets and subject to change without notice.

Size	Part No.	Reverse Working Voltage	Parasitic Capacitance	Leakage Current	ESD Ability		Clamping Voltage (ESD and TLP)		Peak Pulse Power	Peak Pulse Current
		V_{RWM} (max.)	C_{ESD} (1MHz) (typ.)	IR (V_{RWM}) (typ.)	V_{ESD} (air)	V_{ESD} (contact)	V_{CL} (I_{PP} 16A ,TLP) (max.)	V_{CL} (V_{ESD} 8KV) (max.)	PPK (8/20μs)	I_{PP} (8/20μs)
0402	0402TD3R3-0R5A-11	3.3V	0.35pF	0.001μA	±15KV	±15KV	11V	11V	60W	3A
	0402TD240-0R5A-11	24.0V	0.35pF	0.001μA	±15KV	±15KV	15V	15V	24W	3A

Reference Application Circuit





Each STD device can protect one data line. It offers system designers flexibility to protect single data line where space is a premium concern. STD Series also built deep snap back function

Feature

- Ultra small package design
- Bi-Directional protection
- Low capacitance for high-speed data lines
- Meet Automotive ESD test IEC61000-4-2 ±25kV (Contact) and ±25kV(Air)
- Protects one data, control or power line
- Low leakage current: 0.1μA @ VRWM (max)
- Low clamping voltage

Application

- high speed data line
- USB 2.0, USB3.0

MLV Family

MLV-A
MLV-C
MLV-E



MLV Family

A Series (General Used)

CERAMIC

Specification

All specification is base on datasheets and subject to change without notice.

	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Capacitance
		V_{AC}	V_{DC}	V_B(1mA)	V_C(max.)	I_{Peak}(8/20μs)	C(1KHz)
0805	0805ML240A-LF	14V	18V	24V(21.6~26.4)	39V	150A	710pF
1206	1206ML180A-LF	11V	14V	18V(15.3~20.7)	30V	200A	1200pF
	1206ML240A-LF	14V	18V	24V(21.6~26.4)	39V	200A	780pF
	1206ML330A-LF	20V	26V	33V(29.7~36.3)	54V	200A	700pF
	1206ML390A-LF	25V	30V	39V(35.1~42.9)	65V	200A	510pF
	1206ML470A-LF	30V	38V	47V(42.3~51.7)	77V	200A	440pF
1210	1210ML240A-LF	14V	18V	24V(21.6~26.4)	39V	400A	1600pF
	1210ML270A-LF	17V	22V	27V(24.3~29.7)	44V	400A	1500pF
	1210ML330A-LF	20V	26V	33V(29.7~36.3)	54V	400A	880pF
	1210ML390A-LF	25V	30V	39V(35.1~42.9)	65V	400A	800pF
	1210ML470A-LF	30V	38V	47V(42.3~51.7)	77V	400A	530pF
1812	1812ML240A-LF	14V	18V	24V(21.6~26.4)	39V	800A	3500pF
	1812ML390A-LF	25V	30V	39V(35.1~42.9)	65V	800A	2350pF
	1812ML470A-LF	30V	38V	47V(42.3~51.7)	77V	800A	1600pF
	1812ML560A-LF	35V	45V	56V(50.4~61.6)	90V	800A	1200pF
2220	2220ML180A-LF	11V	14V	18V(15.3~20.7)	30V	1200A	10500pF
	2220ML240A-LF	14V	18V	24V(21.6~26.4)	39V	1200A	8500pF
	2220ML270A-LF	17V	22V	27V(24.3~29.7)	44V	1200A	8300pF
	2220ML330A-LF	20V	26V	33V(29.7~36.3)	54V	1200A	8000pF
	2220ML390A-LF	25V	30V	39V(35.1~42.9)	65V	1200A	7500pF
	2220ML470A-LF	30V	38V	47V(42.3~51.7)	77V	1200A	4600pF
	2220ML560A-LF	35V	45V	56V(50.4~61.6)	90V	1200A	3500pF

MLV - A

MLV Family

CERAMIC

C Series (General Used)

Specification

All specification is base on datasheets and subject to change without notice.

	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Capacitance
		VAC	VDC	VB(1mA)	Vc(max.)	IPeak(8/20μs)	C(1KHz)
0402	0402ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	20A	200pF
	0402ML120C-LF	6V	9V	12V(10.2~13.8)	24V	20A	135pF
	0402ML180C-LF	11V	14V	18V(15.3~20.7)	35V	20A	50pF
	0402ML240C-LF	14V	18V	24V(21.6~26.4)	44V	20A	45pF
0603	0603ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	30A	650pF
	0603ML080CS-LF	4V	5.5V	8V(7.5~10.5)	20V	30A	300~385pF
	0603ML120C-LF	6V	9V	12V(10.2~13.8)	24V	30A	300pF
	0603ML180C-LF	11V	14V	18V(15.3~20.7)	30V	30A	210pF
	0603ML240C-LF	14V	18V	24V(21.6~26.4)	39V	30A	160pF
	0603ML270C-LF	17V	22V	27V(24.3~29.7)	44V	30A	145pF
	0603ML330C-LF	20V	26V	33V(29.7~36.3)	54V	30A	130pF
	0603ML390C-LF	25V	30V	39V(35.1~42.9)	65V	30A	110pF
	0603ML470C-LF	30V	38V	47V(42.3~51.7)	77V	30A	90pF
0805	0805ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	80A	1400pF
	0805ML120C-LF	6V	9V	12V(10.2~13.8)	24V	80A	650pF
	0805ML180C-LF	11V	14V	18V(15.3~20.7)	30V	100A	350pF
	0805ML240C-LF	14V	18V	24V(21.6~26.4)	39V	100A	300pF
	0805ML270C-LF	17V	22V	27V(24.3~29.7)	44V	100A	250pF
	0805ML330C-LF	20V	26V	33V(29.7~36.3)	54V	100A	220pF
	0805ML390C-LF	25V	30V	39V(35.1~42.9)	65V	100A	200pF
	0805ML470C-LF	30V	38V	47V(42.3~51.7)	77V	100A	150pF
	0805ML560C-LF	35V	45V	56V(50.4~61.6)	90V	80A	110pF

MLV - C

MLV Family

C Series (General Used)

CERAMIC

Specification

All specification is base on datasheets and subject to change without notice.

	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Capacitance
		VAC	VDC	VB(1mA)	Vc(max.)	IPeak(8/20μs)	C(1KHz)
1206	1206ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	100A	3100pF
	1206ML180C-LF	11V	14V	18V(15.3~20.7)	30V	100A	800pF
	1206ML240C-LF	14V	18V	24V(21.6~26.4)	39V	100A	620pF
	1206ML270C-LF	17V	22V	27V(24.3~29.7)	44V	100A	700pF
	1206ML330C-LF	20V	26V	33V(29.7~36.3)	54V	100A	480pF
	1206ML390C-LF	25V	30V	39V(35.1~42.9)	65V	100A	400pF
	1206ML470C-LF	30V	38V	47V(42.3~51.7)	77V	100A	260pF
	1206ML560C-LF	35V	45V	56V(50.4~61.6)	90V	100A	230pF
	1206ML680C-LF	40V	56V	68V(61.2~74.8)	110V	100A	200pF
	1206ML820C-LF	50V	65V	82V(73.8~90.2)	135V	100A	175pF
	1206ML101C-LF	60V	85V	100V(90.0~110)	165V	100A	150pF
1210	1210ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	250A	5200pF
	1210ML240C-LF	14V	18V	24V(21.6~26.4)	39V	250A	1150pF
	1210ML330C-LF	20V	26V	33V(29.7~36.3)	54V	250A	610pF
	1210ML390C-LF	25V	30V	39V(35.1~42.9)	65V	250A	550pF
	1210ML560C-LF	35V	45V	56V(50.4~61.6)	90V	250A	400pF
	1210ML680C-LF	40V	56V	68V(61.2~74.8)	110V	250A	300pF
	1210ML101C-LF	60V	85V	100V(90.0~110)	165V	200A	210pF
1812	1812ML470C-LF	30V	38V	47V(42.3~51.7)	77V	500A	2200pF
	1812ML560C-LF	35V	45V	56V(50.4~61.6)	90V	500A	1000pF
	1812ML151C-LF	95V	127V	150V(135~165)	270V	600A	330pF
2220	2220ML270C-LF	17V	22V	27V(24.3~29.7)	44V	1000A	6600pF
	2220ML330C-LF	20V	26V	33V(29.7~36.3)	54V	1000A	6300pF
	2220ML390C-LF	25V	30V	39V(35.1~42.9)	65V	1000A	6000pF
	2220ML470C-LF	30V	38V	47V(42.3~51.7)	77V	1000A	4000pF
	2220ML680C-LF	40V	56V	68V(61.2~74.8)	110V	1000A	2000pF

MLV - C

MLV Family

CERAMIC

E Series (General Used/ Control Capacitance)

Specification

All specification is base on datasheets and subject to change without notice.

MLV - E

	Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Capacitance Volume	ESD Contact	ESD Air
		V_{DC} (max)	V_B(1mA)	V_C(max.)	C(1MHz)	V_{ESD}	V_{ESD}
0201	0201-050E050PP-LF	5V	28~38V	72V	5.0pF(+80~-20%)	8KV	15KV
	0201-050E100NP-LF	5V	28~38V	72V	10pF(±30%)	8KV	15KV
	0201-050E330NP-LF	5V	18~28V	48V	33pF(±30%)	8KV	15KV
	0201-120E0R8PP-LF	12V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	0201-120E2R5PP-LF	12V	60~80V	130V	2.5pF(+80~-20%)	8KV	15KV
0402	0402-050E050PP-LF	5V	28~38V	72V	5.0pF(+80~-20%)	8KV	15KV
	0402-050E100NP-LF	5V	28~38V	72V	10pF(±30%)	8KV	15KV
	0402-050E220NP-LF	5V	18~28V	52V	22pF(±30%)	8KV	15KV
	0402-050E330NP-LF	5V	18~28V	52V	33pF(±30%)	8KV	15KV
	0402-050E560NP-LF	5V	18~28V	52V	56pF(±30%)	8KV	15KV
	0402-050E101NP-LF	5V	18~28V	52V	100pF(±30%)	8KV	15KV
	0402-120E050PP-LF	12V	28~38V	72V	5.0pF(+80~-20%)	8KV	15KV
	0402-120E100NP-LF	12V	28~38V	72V	10pF(±30%)	8KV	15KV
	0402-120E220NP-LF	12V	20~30V	55V	22pF(±30%)	8KV	15KV
	0402-120E330NP-LF	12V	20~30V	55V	33pF(±30%)	8KV	15KV
	0402-120E560NP-LF	12V	20~30V	55V	56pF(±30%)	8KV	15KV
	0402-120E101NP-LF	12V	20~30V	55V	100pF(±30%)	8KV	15KV

Specification

1. This Clamping Voltage at which the device stabilized during the transition from high to low impedance 8/20μs waveform current 1A.
2. All capacitance tests are under 1MHz, and the Leakage current is measured at working voltage

MLV Family

CERAMIC

E Series (General Used/ Control Capacitance)

Specification

All specification is base on datasheets and subject to change without notice.

MLV - E

	Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Capacitance Volume	ESD Contact	ESD Air
		V_{DC} (Max)	V_B(1mA)	V_C(max.)	C(1MHz)	V_{ESD}	V_{ESD}
0402	0402-240E0R8PP-LF	24V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	0402-240E1R8PP-LF	24V	100~150V	200V	1.8pF(+80~-20%)	8KV	15KV
	0402-240E2R5PP-LF	24V	100~150V	200V	2.5pF(+80~-20%)	8KV	15KV
	0402-240E3R0PP-LF	24V	48~72V	110V	3.0pF(+80~-20%)	8KV	15KV
	0402-420E0R8PP-LF	42V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	0402-420E2R5PP-LF	42V	100~150V	200V	2.5pF(+80~-20%)	8KV	15KV
0603	0603-050E050PP-LF	5V	20~30V	55V	5.0pF(+80~-20%)	8KV	15KV
	0603-050E100NP-LF	5V	24~36V	65V	10pF(±30%)	8KV	15KV
	0603-050E220NP-LF	5V	15~25V	34V	22pF(±30%)	8KV	15KV
	0603-050E330NP-LF	5V	15~25V	34V	33pF(±30%)	8KV	15KV
	0603-050E560NP-LF	5V	15~25V	36V	56pF(±30%)	8KV	15KV
	0603-050E101NP-LF	5V	15~25V	36V	100pF(±30%)	8KV	15KV
	0603-5R5T100NP-LF	5V	15~20V	36V	10pF(±30%)	8KV	15KV
	0603-120E050PP-LF	12V	33~50V	85V	5.0pF(+80~-20%)	8KV	15KV
	0603-120E100NP-LF	12V	27~42V	60V	10pF(±30%)	8KV	15KV
	0603-120E220NP-LF	12V	20~30V	55V	22pF(±30%)	8KV	15KV
	0603-120E330NP-LF	12V	20~30V	55V	33pF(±30%)	8KV	15KV
	0603-120E101NP-LF	12V	20~30V	55V	100pF(±30%)	8KV	15KV
	0603-240E0R8PP-LF	24V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	0603-240E2R5PP-LF	24V	100~150V	200V	2.5pF(+80~-20%)	8KV	15KV
	0603-240E3R0PP-LF	24V	48~72V	110V	3.0pF(+80~-20%)	8KV	15KV
0805	0805-050E560NP-LF	5V	20~28V	60V	56pF(±30%)	8KV	15KV
	0805-120E560NP-LF	12V	20~30V	60V	56pF(±30%)	8KV	15KV

Specification

1.This Clamping Voltage at which the device stabilized during the transition from high to low impedance 8/20μs waveform current 1A.

2. All capacitance tests are under 1MHz, and the Leakage current is measured at working voltage

Overview

Series Size Table

OVERVIEW

Type	Product	SFI P/N.	(mm)Max			Page
			L	W	T	
CSPD	SHC	0805SC	2.00±0.20	1.25±0.15	1.30 Max	24
		1206SC	3.20+0.60/-0.20	1.60+0.40/-0.20	1.90 Max	
		1210SC	3.20+0.60/-0.20	2.50+0.40/-0.20	2.60 Max	
		1812SC	4.50+0.60/-0.20	3.20+0.50/-0.20	3.50 Max	
		2220SC	6.00+0.70/-0.30	5.30+0.50/-0.30	3.60 Max	
		3220SC	8.10+0.70/-0.30	5.30+0.60/-0.30	3.70 Max	
	SHN	0805SN	2.00±0.20	1.25±0.15	1.30 Max	22
		1206SN	3.20+0.60/-0.20	1.60+0.40/-0.20	1.90 Max	
		1210SN	3.20+0.60/-0.20	2.50+0.40/-0.20	2.60 Max	
		1812SN	4.50+0.60/-0.20	3.20+0.50/-0.20	3.50 Max	
		2220SN	6.00+0.70/-0.30	5.30+0.50/-0.30	3.60 Max	
	SHV	0806SV	2.20±0.20	1.70±0.20	1.80 Max	13~15
		1206SV	3.20+0.60/-0.20	1.60+0.40/-0.20	1.90 Max	
		1208SV	3.20+0.60/-0.20	2.20+0.40/-0.20	2.40 Max	
		1210SV	3.20+0.60/-0.20	2.50+0.40/-0.20	2.60 Max	
		1812SV	4.50+0.60/-0.20	3.20+0.50/-0.20	3.50 Max	
		2220SV	6.00+0.70/-0.30	5.30+0.50/-0.30	3.60 Max	
		3220SV	8.10+0.70/-0.30	5.30+0.60/-0.30	3.70 Max	
	SHR	0604SR	1.60±0.15	1.05±0.10	1.15Max	
	SHA	0805SA	2.00±0.20	1.25±0.15	1.30 Max	18~19
		1206SA	3.20+0.60/-0.20	1.60+0.40/-0.20	1.90 Max	
		1210SA	3.20+0.60/-0.20	2.50+0.40/-0.20	2.60 Max	
		1812SA	4.50+0.60/-0.20	3.20+0.50/-0.20	3.50 Max	
		2220SA	6.00+0.70/-0.30	5.30+0.50/-0.30	3.60 Max	
		3220SA	8.10+0.70/-0.30	5.03+0.60/-0.30	3.70 Max	
		4032SA	10.00+0.70/-0.30	8.00+0.60/-0.30	3.70 Max	
	SEA	0603EA	1.60±0.15	0.80±0.10	0.90 Max	**25**
		0805EA	2.00±0.20	1.25±0.15	1.20 Max	

Overview

Series Size Table

Type	Fig	Product	SFI P/N.	(mm)Max			Page
				L	W	T	
SGD Series		Normal ESD	0201TS	0.60 ± 0.03	0.30 ± 0.03	0.30 ± 0.03	31
			0402TS	1.00 ± 0.05	0.60 ± 0.05	0.50 ± 0.05	
			0603TS	1.60 ± 0.10	0.80 ± 0.10	0.60 ± 0.10	
		Auto ESD	0402TA	1.00 ± 0.05	0.60 ± 0.05	0.50 ± 0.05	32
		Networking	0402TN	1.00 ± 0.05	0.60 ± 0.05	0.50 ± 0.05	33
			0603TN	1.60 ± 0.10	1.00 ± 0.10	0.60 ± 0.10	
		Data Line	0402TD	1.00 ± 0.05	0.60 ± 0.05	0.50 ± 0.05	34
Multilayer Chip Varistor		High Surge	0805ML-A	2.00 ± 0.20	1.25 ± 0.15	1.20 Max	36
			1206ML-A	3.20 ± 0.20	1.60 ± 0.15	1.50 Max	
			1210ML-A	3.20 ± 0.20	2.50 ± 0.20	1.50 Max	
			1812ML-A	4.50 ± 0.20	3.20 ± 0.20	2.00 Max	
			2220ML-A	5.70 ± 0.20	5.00 ± 0.20	2.50 Max	
		Standard Surge	0402ML-C	1.00 ± 0.10	0.50 ± 0.10	0.60 Max	37~38
			0603ML-C	1.60 ± 0.15	0.80 ± 0.10	0.90 Max	
			0805ML-C	2.00 ± 0.20	1.25 ± 0.15	1.20 Max	
			1206ML-C	3.20 ± 0.20	1.60 ± 0.15	1.50 Max	
			1210ML-C	3.20 ± 0.20	2.50 ± 0.20	1.50 Max	
			1812ML-C	4.50 ± 0.20	3.20 ± 0.20	2.00 Max	
			2220ML-C	5.70 ± 0.20	5.00 ± 0.20	2.50 Max	
		ESD	0201	0.60 ± 0.03	0.30 ± 0.03	0.30 ± 0.03	39~40
			0402	1.00 ± 0.10	0.50 ± 0.10	0.60 Max	
			0603	1.60 ± 0.15	0.80 ± 0.10	0.90 Max	
			0805	2.00 ± 0.20	1.25 ± 0.15	1.20 Max	
		High Voltage	08CH	8.10 ± 0.30	5.00 ± 0.30	2.50 Max	---
		Low Cap.	0402	1.00 ± 0.10	0.50 ± 0.10	0.60 Max	32
			0603	1.60 ± 0.15	0.80 ± 0.10	0.90 Max	
		Array	0508	2.00 ± 0.15	1.20 ± 0.15	0.80 Max	33
			0612	3.20 ± 0.20	1.60 ± 0.20	0.95 Max	

OVERVIEW

Service Feedback Immediately

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