

PASSIVE COMPONENTS

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C E R A M I C T E C H N O L O G Y



We are in the Strength, Future & International position



Content

Company Information.....	2
Product Overview.....	3
Over Voltage Pulse Introduction.....	4
Inner Structure & Certification.....	5
Operation Theory & Function Diagram.....	6
CSPD(Chip Surge Protection Device) Introduction.....	7
CSPD Series Advantage.....	8
CSPD Comparison & Patents.....	9
Part Number Definition.....	10~11
Application Fields	12
SHC(Super High Current Series).....	13~15
SHN(Super High Networking Series).....	16~17
SHV(Super High Voltage Series).....	18~21
SHA(Super High Automotive Series).....	22~25
SEA(Super ESD in Automotive CAN Bus).....	26
SGD Package Introduction.....	27
STS Series (Semiconductor TVS Diode).....	28
STS Advantage.....	29
General Single Type (MLV A Series).....	30
General Single Type (MLV C Series).....	31~32
General Single Type (MLE Series).....	33~34
ULC Series(Ultra Low Capacitance).....	35
MVA Series(Array Type).....	36
Application for IP-CAM.....	37
Application for Ethernet PoE.....	38
Application for Ethernet.....	39
Application for Automotive.....	40
Application Table.....	41
Surge Specification.....	42
Characteristic Definition.....	43
Transmission vs Capacitance.....	44
Series size table.....	45~46

OVER VOLTAGE PROTECTION DEVICE

Company Information



Company Profile

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 3220 size are all Nickel Barrier (Ag/Ni/Sn)

Our products meet RoHS compliant.



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.

OVER VOLTAGE PROTECTION DEVICE

Product Overview



Type	Transient	Series	Main Application	Standard	Max. Value Parameter	Remark
General	Surge/ ESD	General	Whole	IEC61000-4-5	Basic	Basic
Enhance	Load Dump	SHA	Auto Power	ISO7637-2 Pulse 5	Load Dump 80J	Can replace TVS ,MOV
	Surge	SHC	Industrial Control	IEC61000-4-5	Surge Current : 3000A (8/20 μs)	Can replace MOV , MLV
		SHN	Network Security	IEC61000-4-5 K21	Surge Voltage : 6KV (10/700 μs)	Can replace GDT, Sidactor
		SHV	Power	IEC61000-4-5	Breakdown Voltage : 470V / Surge : 100~3000A	Can replace MOV, GDT
New Design	ESD	SEA	Auto CAN BUS	ISO10650 ISO7637-2 Pulse 1, 2, 3	ESD 30KV	Available
		TVS(STS)	Mobile	IEC61000-4-2	Clamping Voltage <12.5V	Available
		ULC	Ultra High Speed		Breakdown voltage : 100V / Cap. 0.05pF	Available
Dual Function (*)	ESD+EMI	SML	I/O port (CSPD+Inductor)	IEC61000-4-2	ESD : 8KV EMI : 300M Hz	Available
	Surge +Current Limited	SMP	Power (CSPD+PTC)	IEC61000-4-5	Fail mode at open circuit	Under Developing
	Surge+ EMI	SMC	Power (CSPD+E-cap)	IEC61000-4-5	Breakdown Voltage : 270~470V Cap : 1μF~4.7μF	Under Developing

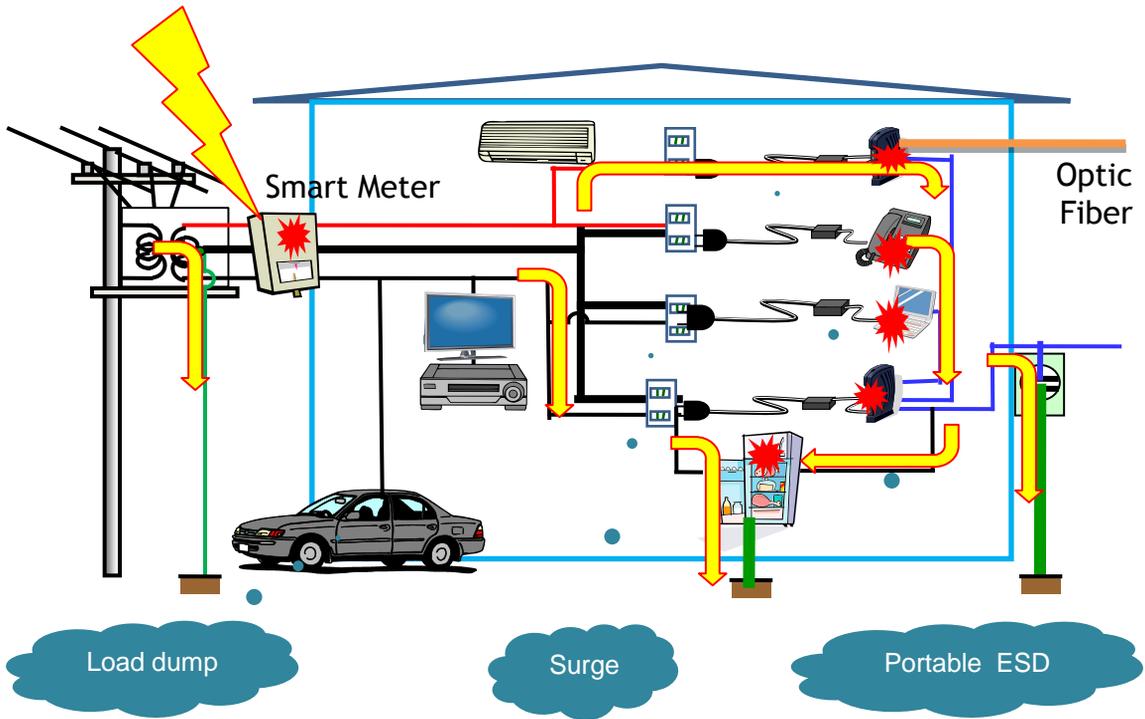
(*) Remark : Dual function products are under developing

OVER VOLTAGE PROTECTION DEVICE

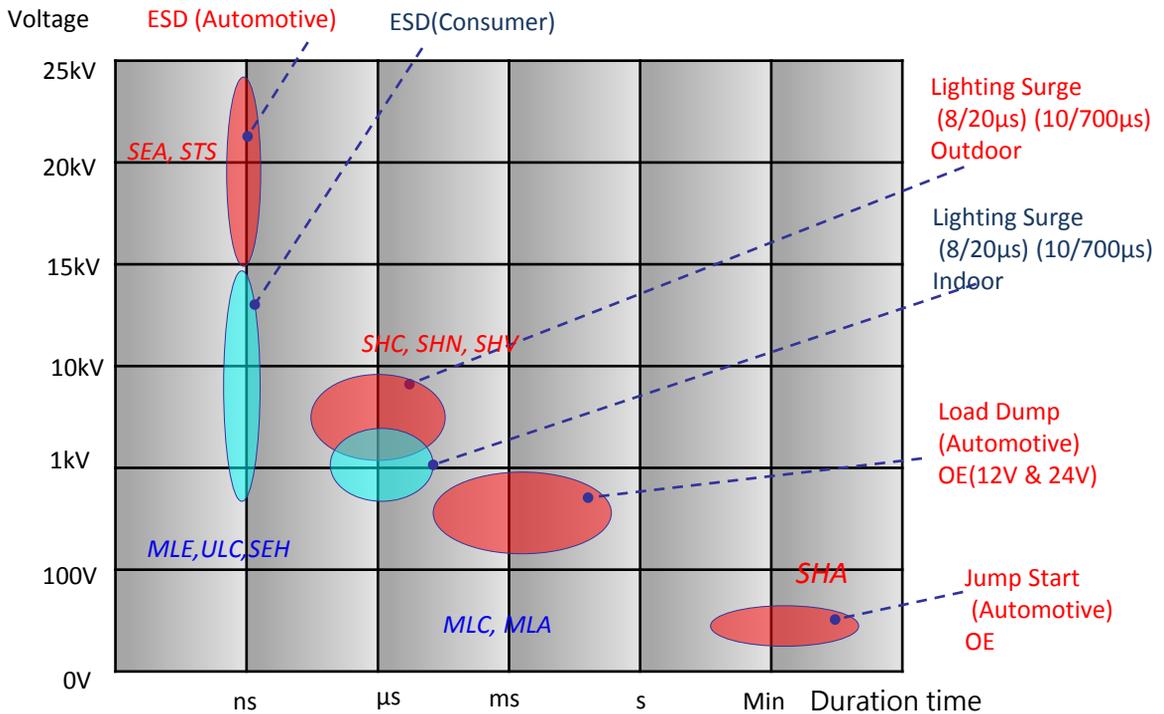
Over Voltage Pulse Introduction



Environment



Energy vs Time



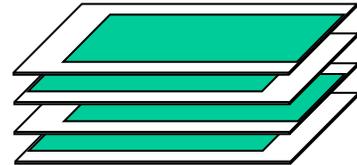
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Inner Structure & Certification

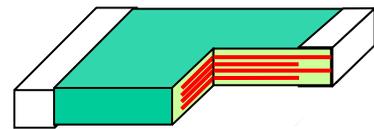


Structure

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 : 2008
- B. ISO 14001 : 2004
- C. ISO/TS16949



認證證書

標準 **ISO / TS 16949:2009**
(第 3 版, 2009-08-15)

證書登記號碼 **01 111 90883301**
IAF 證書號碼 **0172974**

證書持有者: **立昌先進科技股份有限公司**
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包括其過程均已列於證書附件上:

認證範圍: **晶片型表面電壓抑制器之設計與製造**

證明滿足了 ISO/TS 16949:2009 標準的要求。

發給日/到期日: **證書有效期限 2013-10-30 至 2016-10-29,**

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驗證證書

標準 **ISO 9001:2008**

證書登記號碼 **01 100 822 008833**

證書持有者: **德國家庭設備機構 茲證明:**
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驗證範圍: **晶片型表面電壓抑制器之設計、開發、製造與銷售**

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驗證證書

標準 **ISO 14001:2004**

證書登記號碼 **01 104 822 008833**

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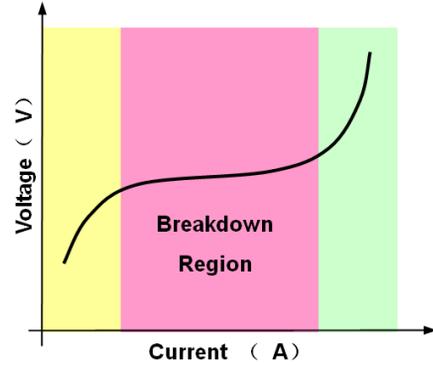
OVER VOLTAGE PROTECTION DEVICE

Operation Theory & Function Diagram



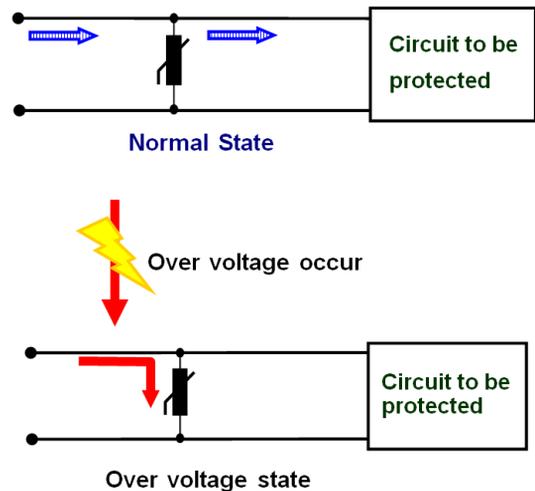
Voltage Dependent Characteristic

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.

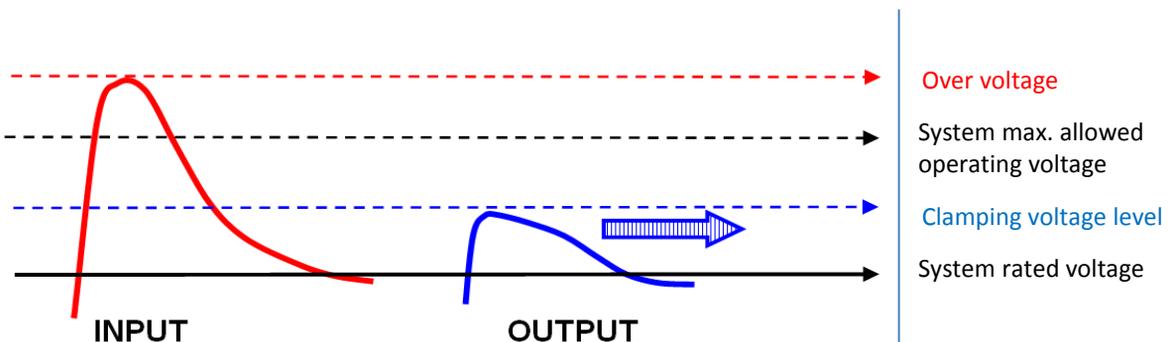


The Prevention of Over Voltage

In other words, as long as the voltage increases above the threshold of the Transient voltage suppressors, the suppressor will draw 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



OVER VOLTAGE PROTECTION DEVICE

CSPD Introduction



Special Introduction CSPD

CSPD (Chip Surge Protection Device) is a kind of surface mount surge voltage protector. SFI utilized exclusive powder material and product technology to develop a creative new concept. We also get many innovative patents from many countries. This series has the better non-linear Ω with higher withstanding peak current compared to conventions.

Description :

The non-linear impedance of ceramic comes from Schottky barrier between two pieces of ZnO particles (double Schottky barrier). It means, in sintering process of ZnO, it also realizes the semi-conductive of ZnO particle and makes the grain boundary more tight. (Fig. (1) & (2))

CSPD peak current protection mode as below.

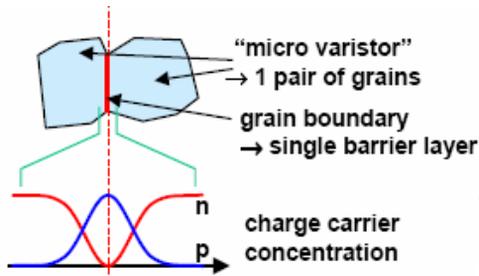


Fig. (1)

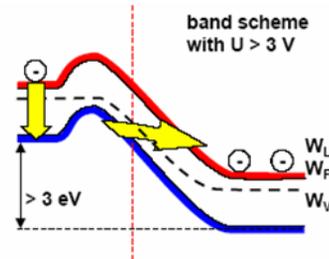


Fig. (2)

Conventional process vs CSPD process

Convention	CSPD
(1) \ Mixture of ZnO	
At same sintering process, 1.The ZnO particle becomes ion mixture and increase semi-conductive. 2.Forming the boundary of covering ZnO particles.	The ZnO mixture and covering and the high impedance materials of particle are divided to two individual process (innovation) and ZnO particle mixture to make more semi-conductive.
(2) \ Distribution of boundary	
If the particle of ZnO is too rough and few, it's difficult to cover on surface evenly. The result will make the high resistance of Bi2O3 not evenly and affect dispersion higher, alpha value lower, clamping voltage higher and affect functions of varistor.	The product is made by nanotech process and makes the boundary grains in nano to make a chemical compound. It makes the boundary cover the ZnO evenly and makes each double Schottky barrier more higher and even the same height, the function more concentrative, dispersion lower, higher alpha and low clamping voltage. The functions of varistor is upgraded.

OVER VOLTAGE PROTECTION DEVICE

CSPD Series Advantage



Special Character

- ★_ **Micro Package Size (SMD) type** : to achieve large space and solve height Limit
- ★_ **High Surge Current** : Withstand 10/700μs 6KV Surge
- ★_ **Low BDV** : 12V can provide the best solution for protective systems
- ★_ **High reliability** : Low leakage after high reliability
- ★_ Low Clamping
- ★_ Electric Distribution Concentricity
- ★_ **High Non-linear α Value** : Over 25 and it will upgrade IV curve sensitivity
- ★_ **Quick response time** : Solve the problem “extinguish” of GDT
- ★_ **High performance** : Surge sparks over 10 times on waveform 10/700μs
- ★_ **Good Temperature Features** : Operating range -55 °C~125 °C

Comparison with Other Competitors

Series	Parameter		0805 (2.0x1.2)	1206 (3.2x1.6)	1210 (3.2x2.5)	1812 (4.5x3.2)	2220 (5.2x5.2)	3220 (8.1x5.2)
SHC	Surge Current (@8/20μs)*1	Others	0.1KA	0.2KA	0.4KA	0.8KA	1.2KA	<3KA
		SFI	0.25KA	1KA	1KA	5KA	10KA	20KA
SHA	Load Dump Ability*2	Others	1J	3J	6J	12J	25J	None
		SFI	1.5J	9J	12J	25J	50J	80J
SHN	Surge Voltage (@ 10/700μs) *3	Others	None	1KV	2KV	4KV	None	
		SFI	1.5KV	6KV	8KV	8KV	8KV	
SHV	Surge Current (@ 8/20μs) *1	Others	None	None	None	None	None	470V/ 0.5KA
		SFI	470V /0.1KA	470V /0.35KA	470V /0.8KA	470V /2KA	470V /2KA	470 /3KA

*1 : ACC. IEC61000-4-5 STD , Impedance 2 Ω

*2 : ACC. ISO7637-2 Pulse 5A STD

*3 : ACC. IEC61000-4-5 STD , Impedance 40 Ω

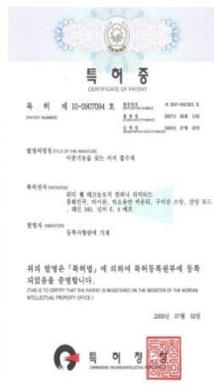
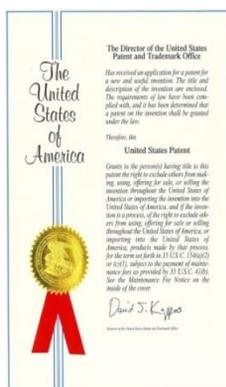
*4 : Compared with EPXXS(TXK) , AXX , TXXXkXXX

OVER VOLTAGE PROTECTION DEVICE CSPD Comparison & Patents



Type					
	SFI CSPD	MLV	TVS	MOV	GDT
Electric Functions					
Operating Volt	5V~470V	5V~100V	5V~100V	18V~1800V	75V~6KV
Clamping Volt	Low	Low	Low	High	High
Surge Current	100A~20000A	20A~1200A	N.D.	250A~10000A	2KA~15KA
Operating Temp	-55°C~125°C	-45°C~125°C	-45°C~125°C	-45°C~125°C	-45°C~125°C
Load Dump(J)	1.5J~50J	12J~25J	N.D.	12J~50J	N.D.
Leakage Current	Low	Low	Low	High	Low
Inductance Effective	Low	Low	Low	High	Low
Applications Functions					
Response Time	<0.5ns	<0.5ns	<0.5ns	<10ns	<50ns
ESD Protection	Yes	Yes	Yes	No	No
Surge Protection	Yes	Yes	No	Yes	Yes
Design Position	Primary side/Second	Second	Primary side/second	Primary	Primary
Polarity	Bi-Direction	Bi-Direction	Single Direction	Bi-Direction	Bi-Direction
Reliability					
Sparks	>10 Times	High	Low	High	High
Response Time	<0.5ns	<0.5ns	<0.5ns	<10ns	<50ns
Degradation	No	Yes	No	Yes	No
Potential Issues					
Extinguish	No	No	No	No	Yes
Explosion	No	No	No	Yes	No
Temperatue Derating	No	No	Yes	No	No

Patents

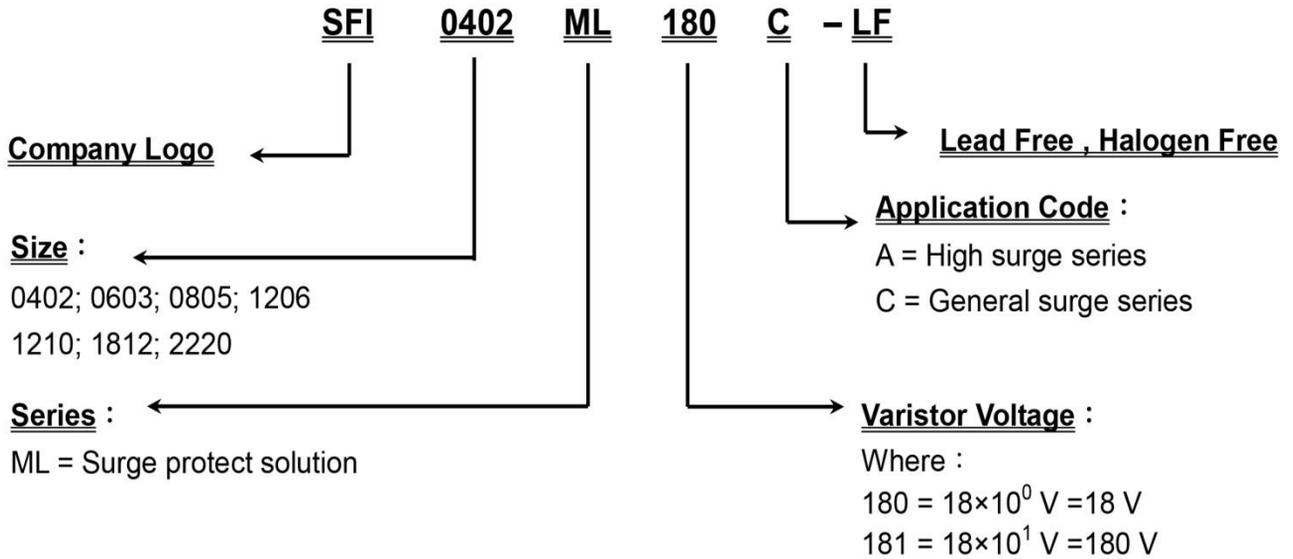


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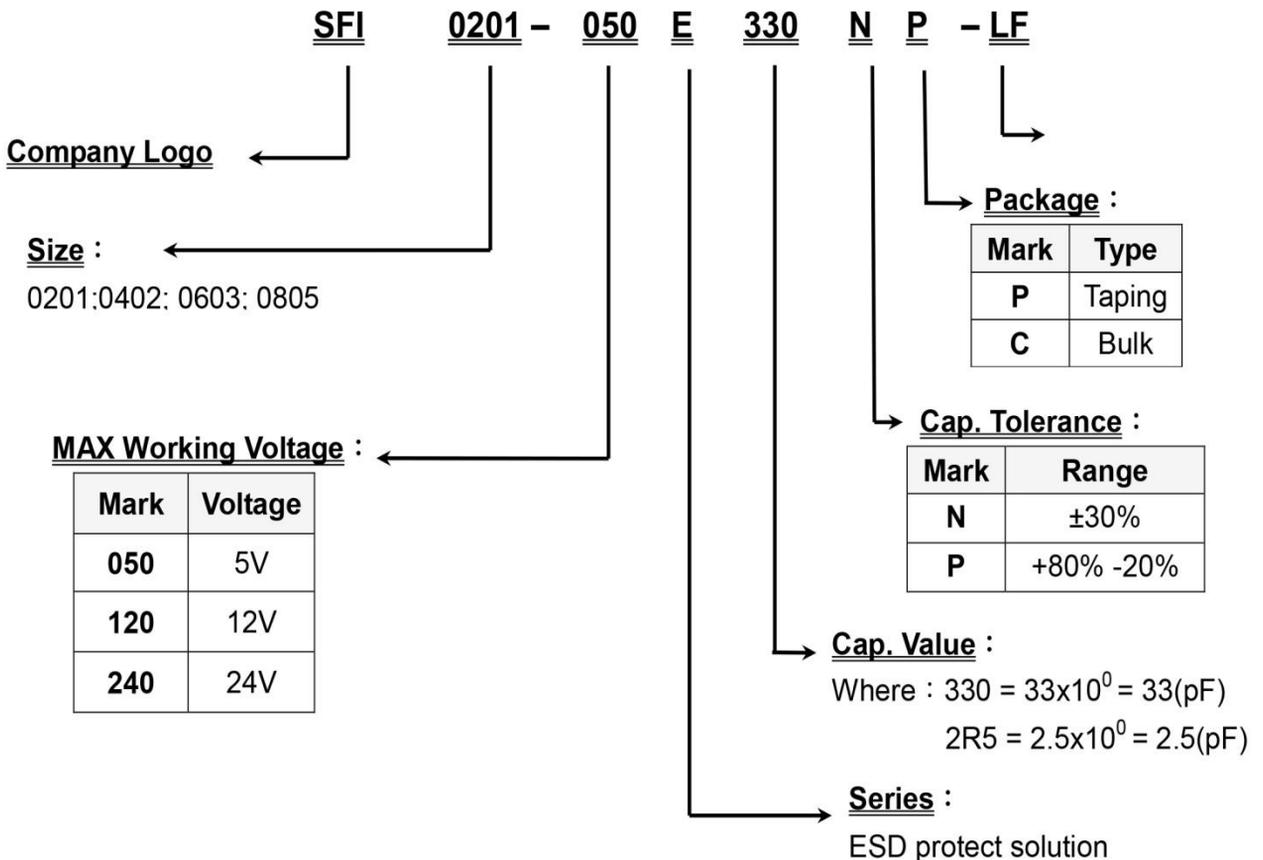


Part number Definition

1. ML Series



2. ESD Series



OVER VOLTAGE PROTECTION DEVICE



Part number Definition

SFI	1812	SC	240	-	102	A
Logo	Size (inch)	Series	Breakdown Voltage (V)	-	Surge Current (A)	Inner Code
SFI	0805 1206 1210 1812 2220 3220 6420	SHC	24V 30V 36V 47V 56V 75V 82V	-	202=2000 302=3000 402=4000	

SFI	1210	SN	750	-	060	K
Logo	Size (inch)	Series	Breakdown Voltage (V)	-	Surge Voltage (V)	Inner Code
SFI	0805 1206 1210 1812 2220	SHN	470=47V 750=75V	-	060=6KV 040=4KV 030=3KV	

SFI	1812	SV	471	-	801	A
Logo	Size (inch)	Series	Breakdown Voltage (V)	-	Surge Current (A)	Inner Code
SFI	0603 0806 1206 1208 1210 1812 2220 3220	SHV	241=240 V 271=270 V 431=430 V 471=470 V	-	501=500A 801=800A 102=1000A 202=2000A	

SFI	2220	SA	240	-	250	J
Logo	Size (inch)	Series	Breakdown Voltage (V)	-	Load Dump (J)	Inner Code
SFI	0805 1206 1210 1812 2220 3220 6420	SHA	24 V 26 V 33 V 36 V 47 V 56 V	-	120=12J 250=25J 500=50J 800=80J	

OVER VOLTAGE PROTECTION DEVICE

Application Fields



Suggestion Table

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

OVER VOLTAGE PROTECTION DEVICE

Super High Current Type (SHC)



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.



Features

- ※Size : 0805~6420 (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

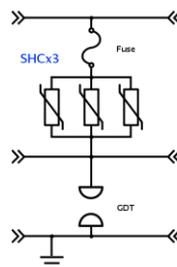
	SHC	Others
Circuit	Fig(1)	Fig(2)
Size	2220	2220
Surge	5000A	1200A
Usage	3 pcs	13 pcs
Total cost	Low	High
Space rate	1/4	1

Equal

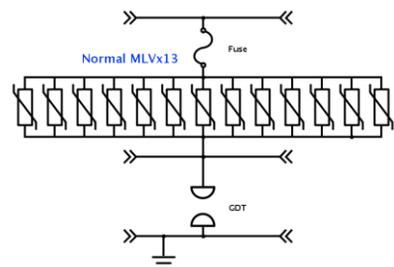


1 pcs (CSPD) = 4 pcs(Others)

Circuit



Fig(1)



Fig(2)

OVER VOLTAGE PROTECTION DEVICE

Super High Current Series (SHC)



SHC Series 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
		VDC	$V_B(1mA)$	$V_C(max.)$	$I_{Peak}(8/20\mu s)$	$C(1KHz)$
0805	SFI0805SC180-251A	14V	18V($\pm 10\%$)	30V	250A	750pF
	SFI0805SC240-251A	18V	24V($\pm 10\%$)	45V	250A	1800pF
	SFI0805SC470-251A	38V	47V($\pm 10\%$)	85V	250A	250pF
1206	SFI1206SC120-501A	9V	12V($\pm 10\%$)	30V	500A	3500pF
	SFI1206SC240-501A	18V	24V($\pm 10\%$)	45V	500A	2300pF
	SFI1206SC360-501A	30V	36V($\pm 10\%$)	65V	500A	590pF
	SFI1206SC470-501A	38V	47V($\pm 10\%$)	85V	500A	690pF
	SFI1206SC560-102A	45V	56V($\pm 10\%$)	90V	1000A	800pF
	SFI1206SC680-501A	56V	68V($\pm 10\%$)	90V	500A	700pF
	SFI1206SC750-501A	60V	75V($\pm 10\%$)	100V	500A	300pF
1210	SFI1210SC240-102A	18V	24V($\pm 10\%$)	45V	1000A	2300pF
	SFI1210SC470-102A	38V	47V($\pm 10\%$)	85V	1000A	1550pF
	SFI1210SC680-102A	56V	68V(61.7~75.3)	90V	1000A	950pF
	SFI1210SC101-401A	85V	100V($\pm 10\%$)	165V	400A	250pF
	SFI1210SC750-102A-UL	60V	75V($\pm 10\%$)	100V	1000A	930pF
	SFI1210SC750-122A-UL	60V	75V(+0~+10%)	100V	1200A	930pF
1812	SFI1812SC240-202A	18V	24V($\pm 10\%$)	45V	2000A	4500pF
	SFI1812SC240-502A	18V	24V($\pm 10\%$)	45V	5000A	8300pF
	SFI1812SC360-302A	30V	36V($\pm 10\%$)	65V	3000A	4300pF
	SFI1812SC470-202A	38V	47V($\pm 10\%$)	85V	2000A	2100pF
	SFI1812SC560-202A	45V	56V(51~60)	90V	2000A	2000pF
	SFI1812SC750-202A	60V	75V($\pm 10\%$)	100V	2000A	1650pF

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(205A) ,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.

OVER VOLTAGE PROTECTION DEVICE

Super High Current Series (SHC)



SHC Series 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
		VDC	VB(1mA)	VC(max.)	I _{Peak} (8/20μs)	C(1KHz)
1812	SFI1812SC750-402A	60V	75V(±10%)	105V	4000A	3100pF
	SFI1812SC820-302A	65V	82V(±10%)	135V	3000A	1300pF
2220	SFI2220SC240-302A	18V	24V(±10%)	45V	3000A	5500pF
	SFI2220SC240-103A	16V	24V(24~30)	45V	10000A	18000pF
	SFI2220SC470-302A	38V	47V(±10%)	85V	3000A	8000pF
	SFI2220SC470-452A	38V	47V(±10%)	85V	4500A	9000pF
	SFI2220SC470-502A	38V	47V(±10%)	85V	5000A	9900pF
	SFI2220SC470-802A	38V	47V(±10%)	85V	8000A	7500pF
	SFI2220SC560-302A	45V	56V(±10%)	90V	3000A	3500pF
	SFI2220SC680-802A	56V	68V(±10%)	100V	8000A	5600pF
	SFI2220SC750-302A	60V	75V(±10%)	100V	3000A	2000pF
	SFI2220SC750-452A	60V	75V(±10%)	100V	4500A	2500pF
	SFI2220SC750-502A	60V	75V(±10%)	100V	5000A	2700pF
	SFI2220SC820-302A	65V	82V(±10%)	135V	3000A	2000pF
	SFI2220SC820-452A	65V	82V(±10%)	135V	4500A	4800pF
	SFI2220SC820-502A	65V	82V(±10%)	135V	5000A	3300pF
	SFI2220SC820-602A	65V	82V(±10%)	135V	6000A	3500pF
	SFI2220SC101-502A	85V	100V(±10%)	165V	5000A	2600pF
3220	SFI3220SC240-123A	18V	24V(±10%)	45V	12000A	22000pF
	SFI3220SC240-203A	18V	24V(±10%)	45V	20000A	22000pF
	SFI3220SC390-203A	30V	39V(±10%)	70V	20000A	23500pF
6420	SFI6420SC240-203A	18V	24V(±10%)	45V	20000A	60000pF

Notes :

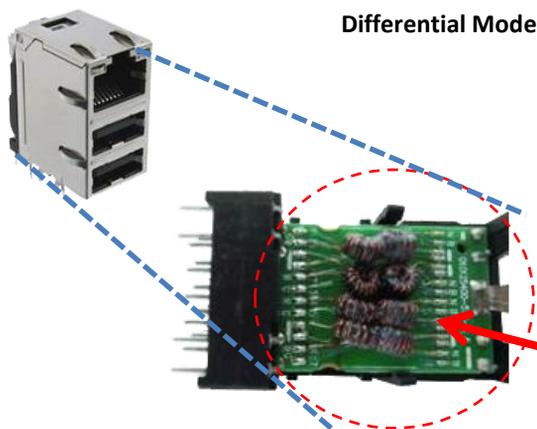
- * 1 The breakdown voltage was measured at 1 mA current.
- * 2 The Clamping voltage was measured at 8/20 μs standard current, 0806(1A) ,1206(1A) ,1210(205A) ,1812(5A) , 2220(10A) ,3220(10A) ,6420(10A).
- * 3 The surge current was tested at 8/20 μs waveform.
- * 4 The capacitance value only for customer reference, it's not formal specification.
- * 5 The components shall be employed within 1 year, in nitrogen condition.

OVER VOLTAGE PROTECTION DEVICE

Super High Network Series (SHN)

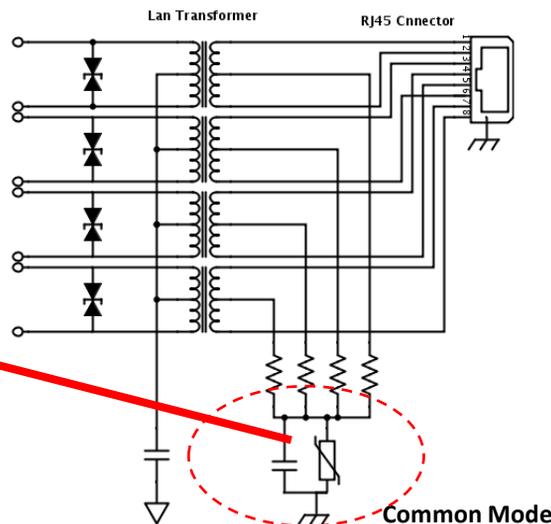


Description



Circuit for Non-PoE

Differential Mode



Common Mode

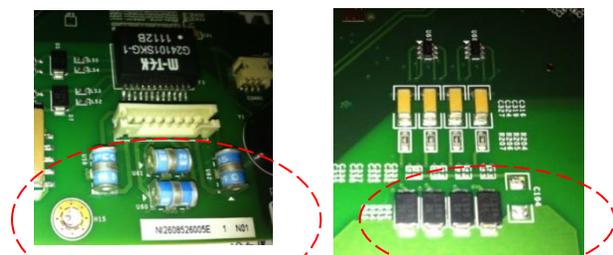
Features

- ◆ Size : 0805~2220
- ◆ Meet IEC61000-4-5
Pass 10/700 μ s 40 Ω surge 4~8KV test
- ◆ Lower clamping voltage than GDT
- ◆ Faster response time <0.5ns than GDT & Sidactor
- ◆ No extinguish problem
- ◆ Bi-directional
- ◆ Wide operation temperature : - 55 ~ +125°C
- ◆ Ultra Low leakage current : < 1 μ A

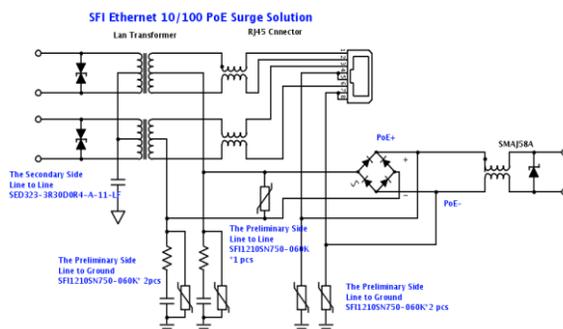
Comparison with other Solution

When the network port using GDT in telecom application after the end of current, the protected system operating voltage to maintain the existence of the arc discharge channel, a condition called extinguish. Extinguish exist will damage the protection systems. To resolve this issue, mostly in the GDT use sidactor or MLV with its relatively fast response speed will be continuing to help GDT discharge current is cut off, "turn off" to identify the problem.

Equal



Circuit for PoE



OVER VOLTAGE PROTECTION DEVICE

Super High Network Series (SHN)



SHN Series Specification

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

	Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Surge Voltage	Surge Current	Typical Capacitance
		VDC	VB(1mA)	Vc(max)	V _{Surge} (10/700μs)	I _{Peak} (10/700μs)	C(1KHz)
0805	SFI0805SN240-1R5K	18V	24V(±10%)	45V	1.5KV	37.5A	720pF
1206	SFI1206SN120-040K	9V	12V(±10%)	30V	4KV	100A	3850pF
	SFI1206SN120-060K	9V	12V(±10%)	30V	6KV	150A	3200pF
	SFI1206SN240-040K	12V	24V(±10%)	35V	4KV	100A	1900pF
	SFI1206SN240-060K	12V	24V(±10%)	40V	6KV	150A	2100pF
1210	SFI1210SN470-040K	38V	47V(±10%)	75V	4KV	100A	1400pF
	SFI1210SN470-060K	38V	47V(±10%)	75V	6KV	150A	1670pF
	SFI1210SN750-030K	60V	75V(±10%)	100V	3KV	100A	930pF
	SFI1210SN750-080K	60V	75V(±10%)	105V	8KV	200A	1350pF
	SFI1210SN750-040K-UL	60V	75V(±10%)	100V	4KV	100A	1000pF
	SFI1210SN750-060K-UL	60V	75V(±10%)	100V	6KV	150A	1300pF
1812	SFI1812SN240-080K	18V	24V(±10%)	45V	8KV	200A	8000pF
	SFI1812SN750-080K	60V	75V(±10%)	105V	8KV	200A	8000pF
2220	SFI2220SN240-080K	18V	24V(±10%)	45V	8KV	200A	3100pF

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

SHN vs GDT



CSPD vs GDT

Function	CSPD	(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

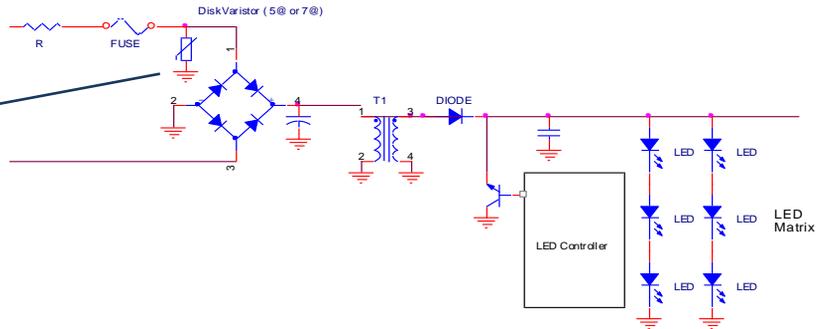
OVER VOLTAGE PROTECTION DEVICE

Super High Voltage Type (SHV)



Description

Circuit



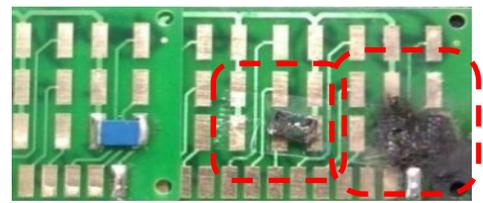
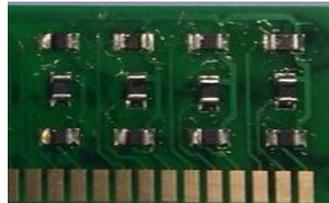
Features

- ※Size : 0603~3220(Inch)
- ※Meet : IEC61000-4-5
1.2/50 μ s or 8/20 μ s
- ※BDV : 170V~680V
- ※Peak surge : 800A(max.)
- ※Low leakage : <1 μ A
- ※Operating temperature : 125°C.
- ※UL 1449 approval
- ※Bi-directional clamping
- ※**SMD package, non-combustible**

Comparison

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%



	SFI SHV	LixxxIFxxx	EPXXX
Construction	Displaced electrodes	Displaced electrodes	Plastic encapsulated
Technology	New technology	Chip epoxy	SMD plastic package
Size compare	0806 available(inch)	3220(inch)	3225(inch)
UL test compare (Need pass 15 times)	Pass	Pass	Pass
Derating	No	Yes	Yes
High temperature	Good	Bad	Bad
High humidity	Good	Bad	Bad
Termination	Ag/Ni/ Sn	Ag/Pt	Tinned copper

OVER VOLTAGE PROTECTION DEVICE

Super High Voltage Type (SHV)



SHV Series Specification

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

	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Cap.
		VAC	VDC	VB(1mA)	Vc(max.)	I _{peak} (8/20μs)	C(1KHz)
0603	SFI0603SV241-200A	150V	200V	240V(±10%)	395V	20A	15pF
0806	SFI0806SV271-201A	175V	225V	270V(±10%)	450V	200A	90pF
	SFI0806SV271-251A	175V	225V	270V(±10%)	450V	250A	90pF
	SFI0806SV391-101A	250V	320V	390V(±10%)	565V	100A	40pF
1206	SFI1206SV271-351A	175V	225V	270V(±10%)	450V	350A	170pF
	SFI1206SV391-101A	250V	320V	390V(±10%)	647V	100A	40pF
	SFI1206SV471-101A	300V	385V	470V(±10%)	775V	100A	30pF
	SFI1206SV471-201A	300V	385V	470V(±10%)	775V	200A	55pF
1208	SFI1208SV241-501A	150V	200V	240V(±10%)	395V	500A	320pF
	SFI1208SV271-501A	175V	225V	270V(±10%)	450V	500A	300pF
1210	SFI1210SV241-201S	150V	200V	200V(±10%)	395V	200A	110pF
	SFI1210SV271-201A	175V	225V	270V(±10%)	450V	200A	105pF
	SFI1210SV271-801A	175V	225V	270V(±10%)	450V	800A	350pF
	SFI1210SV431-501A	275V	350V	430V(±10%)	705V	500A	200pF
1812	SFI1812SV241-202A	150V	200V	240V(±10%)	395V	2000A	900pF
	SFI1812SV271-202A	175V	225V	270V(±10%)	450V	2000A	860pF
	SFI1812SV431-102A	275V	350V	430V(±10%)	705V	1000A	320pF
	SFI1812SV471-102A	300V	385V	470V(±10%)	775V	1000A	300pF
2220	SFI2220SV271-401A	175V	225V	270V(±10%)	450V	400A	200pF
	SFI2220SV271-801A	175V	225V	270V(±10%)	450V	800A	350pF
	SFI2220SV471-122A	330V	385V	470V(±10%)	775V	1200A	320pF
	SFI2220SV471-202A	300V	385V	470V(±10%)	775V	2000A	700pF
	SFI2220SV521-801A	323V	415V	520V(±10%)	860V	500A	280pF
	SFI2220SV681-801A	420V	560V	680V(±10%)	1120V	800A	210pF
3220	SFI3220SV271-501A	175V	225V	270V(±10%)	450V	500A	340pF
	SFI3220SV271-501A	175V	225V	270V(±10%)	450V	500A	340pF
	SFI3220SV471-302A	300V	385V	470V(±10%)	775V	3000A	750pF
	SFI3220SV471-302A	300V	385V	470V(±10%)	775V	3000A	750pF
	SFI3220SV511-252A	315V	410V	510V(±10%)	845V	2500A	600pF
	SFI3220SV821-102A	500V	650V	820V(±10%)	1350V	1000A	1100pF

OVER VOLTAGE PROTECTION DEVICE

Super High Voltage Type (SHV-UL)



SHV-UL Series Specification

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

	Part No.	Working Voltage		Breakdown Voltage	Clamping Voltage	Surge Current	Typical Cap.
		VAC	VDC	V _B (1mA)	V _c (max.)	I _{peak} (8/20μS)	C(1KHz)
0806	SFI0806SV241-201A-UL	150V	200V	240V(±10%)	395V	200A	95pF
	SFI0806SV431-101A-UL	275V	350V	430V(±10%)	705V	100A	45pF
1206	SFI1206SV241351A-UL	150V	200V	240V(±10%)	395V	350A	180pF
	SFI1206SV431-201A-UL	275V	350V	430V(±10%)	705V	200A	60pF
1208	SFI1208SV471-401A-UL	300V	385V	470V(±10%)	775V	400A	120pF
1210	SFI1210SV171-251A-UL	95V	135V	170V(±10%)	250V	250A	195pF
	SFI1210SV241-201A-UL	150	200	240V(±10%)	395V	200A	110pF
	SFI1210SV391-201A-UL	250	320	390V(±10%)	647V	200A	105pF
	SFI1210SV471-251A-UL	300	385	470V(±10%)	775V	250A	100pF
	SFI1210SV471-501A-UL	300V	385V	470V(±10%)	775V	500A	190pF
	SFI1210SV171-251A-UL	95V	135V	170V(±10%)	250V	250A	195pF
1812	SFI1812SV271-102A-UL	175V	225V	270V(±10%)	450V	1000A	600pF
	SFI1812SV271-501A-UL	175V	225V	270V(±10%)	450V	500A	275pF
	SFI1812SV431-801A-UL	275V	350V	430V(±10%)	705V	800A	340pF
	SFI1812SV471-501A-UL	275V	385V	470V(±10%)	775V	500A	200pF
	SFI1812SV471-801A-UL	300V	385V	470V(±10%)	775V	800A	310pF
2220	SFI2220SV241-801A-UL	139V	195V	240V(±10%)	395V	800A	430pF
	SFI2220SV271-501A-UL	175V	225V	270V(±10%)	450V	500A	390pF
	SFI2220SV391-501A-UL	250V	320V	390V(±10%)	647V	500A	235pF
	SFI2220SV391-801A-UL	250V	320V	390V(±10%)	647V	800A	320pF
	SFI2220SV431-501A-UL	275V	350V	430V(±10%)	705V	500A	215pF
	SFI2220SV431-801A-UL	275V	350V	430V(±10%)	705V	800A	305pF
	SFI2220SV471-501A-UL	300V	385V	470V(±10%)	775V	500A	195pF
	SFI2220SV471-801A-UL	300V	385V	470V(±10%)	775V	800A	290pF
3220	SFI3220SV271-801A-UL	175V	225V	270V(±10%)	450V	1000A	550pF
	SFI3220SV431-801A-UL	275V	350V	430V(±10%)	705V	1000A	490pF
	SFI3220SV471-801A-UL	300V	385V	470V(±10%)	775V	1000A	450pF
	SFI3220SV681-102A-UL	420V	560V	680V(±10%)	1120V	1000A	1300pF

OVER VOLTAGE PROTECTION DEVICE

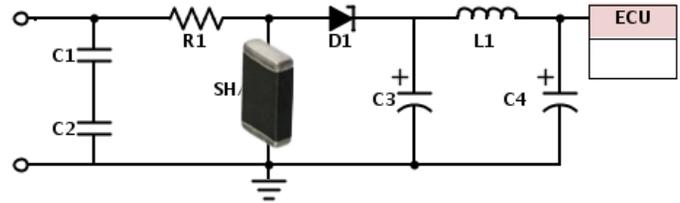
Super High Automotive Type (SHA)



Description



Circuit for Auto Power



Features

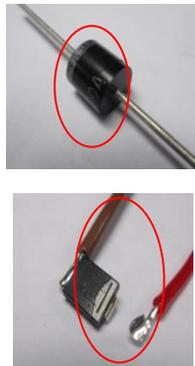
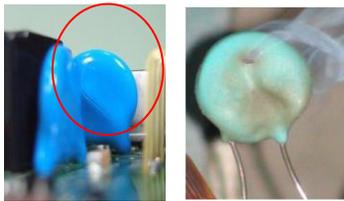
SHA series special for worst environment design, for customer to choice operating temperature, it also meet **AEC-Q200** requirement

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**

Application Area

- All ECU
- LED Car Lighting
- Muti-Media System
- GPS Navigator

Comparison

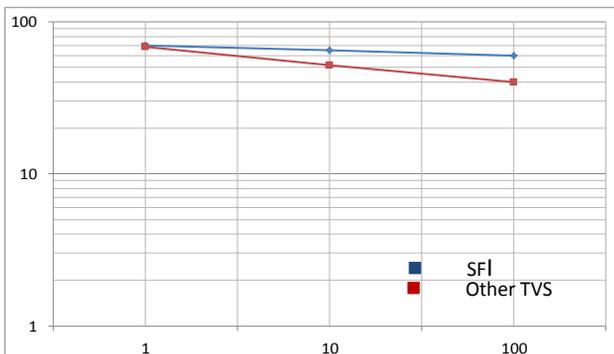


General (Load Dump) solution :

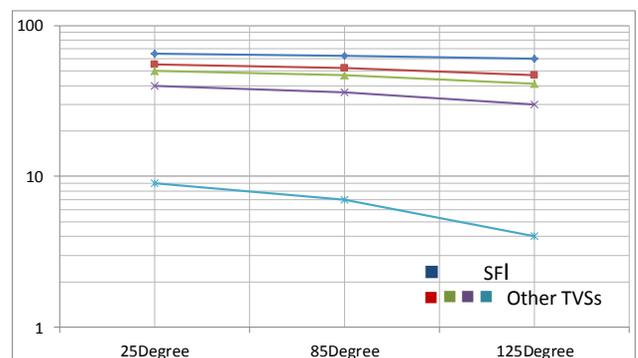
- Using MOV (Disk Varistor), after thermal shock $-40 \sim 90^{\circ}\text{C} / 72\text{hr}$, the surface will be broken. This is caused by Epoxy not withstand high temperature and will burn after continuous using.
- Test TVS axial type, the part is broken.
- Test TVS SMD type, it will be peeled off at terminals.

Comparison Load Dump Strike

SHA surge strike advantages



SHA temperature withstand ability



Acc. ISO7637-2 Load Dump : 87V, 0.5 Ω . 400ms)

OVER VOLTAGE PROTECTION DEVICE

Super High Automotive Type (SHA)



SHA Series Specification

12V System

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 (5min)
		VDC	VB(1mA)	VC(max.)	IPeak(8/20μs)	W _{LD}	V _{JUMP}
0805	SFI0805SA240-1R5J	16V	24V(±10%)	40V	200A (for +/- 1 time)	1.5J (for 10 times)	24.5V
	SFI0805SA240-4R5J	16V	24V(±10%)	40V	200A (for +/-1 time)	4.5J (for 10 time)	24.5V
	SFI0805SA240-060J	16V	24V(±10%)	40V	200A (for +/- 1 time)	6J (for 10 time)	24.5V
	SFI0805SA270-060J	16V	27V(±10%)	43V	200A (for +/- 1 time)	6J (for 10 time)	27.0V
	SFI0805SA360-030J	16V	36V(33.0~39.0)	55V	100A (for +/- 1 time)	5B	36.0V
1206	SFI1206SA240-1R5J	16V	24V(±10%)	40V	200A (for +/- 1 time)	1.5J (for 10 times)	24.5V
	SFI1206SA240-030J	16V	24V(±10%)	40V	400A (for +/- 1 time)	3J (for 10 times)	24.5V
	SFI1206SA240-060J	16V	24V(±10%)	40V	500A (for +/- 1 time)	6J (for 10 times)	24.5V
	SFI1206SA260-060J	16V	24V(±10%)	43V	500A (for +/- 1 time)	6J (for 10 times)	27.0V
	SFI1206SA330-060J	16V	33V(±10%)	53V	200A (for +/- 1 time)	6J (for 10 times)	32.5V
	SFI1206SA360-060J	16V	36V(±10%)	55V	500A (for +/- 1 time)	9J (for 10 times)	35.0V
	SFI1206SA360-090J	16V	36V(±10%)	55V	500A (for +/- 1 time)	9J (for 10 times)	35.0V
1210	SFI1210SA101-120J	16V	100V(±10%)	40V	200A (for +/- 1 time)	12J (for 10 times)	93.0V
	SFI1210SA240-030J	16V	24V(±10%)	40V	400A (for +/- 1 time)	3J (for 10 times)	24.5V
	SFI1210SA240-060J	16V	24V(±10%)	40V	800A (for +/- 1 time)	6J (for 10 times)	24.5V
	SFI1210SA240-120J	16V	24V(±10%)	40V	400A (for +/- 1 time)	3J (for 10 times)	24.5V
	SFI1210SA280-150J	16V	28V(±10%)	45V	1000A (FOR +/- 1 time)	15J (for 10 times)	28.0V
	SFI1210SA330-030J	16V	33V(±10%)	54V	400A (for +/- 1 time)	3J (for 10 times)	32.5V
	SFI1210SA360-120J	16V	36V(±10%)	55V	800A (for +/- 1 time)	12J (for 10 times)	35.0V
1812	SFI1812SA240-120J	16V	24V(±10%)	40V	1600A (for +/- 1 time)	12J (for 10 times)	24.5V
	SFI1812SA240-200J	16V	24V(±10%)	40V	2000A (for +/- 1 time)	20J (for 10 times)	24.5V
	SFI1812SA330-250J	16V	33V(±10%)	53V	2000A(for +/- 1 time)	25J (for 10 times)	32.5V
	SFI1812SA360-250J	16V	38V(±10%)	55V	2000A (for +/- 1 time)	25J (for 10 times)	35.0V

OVER VOLTAGE PROTECTION DEVICE

Super High Automotive Type (SHA)



SHA Series Specification

12V System

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 (5min)
		VDC	VB(1mA)	VC(max.)	I _{Peak} (8/20μs)	W _{LD}	V _{JUMP}
2220	SFI2220SA240-120J	16V	24V(±10%)	40V	1200A (for +/- 1 time)	12J (for 10 times)	24.5V
	SFI2220SA240-250J	16V	24V(±10%)	40V	3000A (for +/- 1 time)	25J (for 10 times)	24.5V
	SFI2220SA240-400J	16V	24V(±10%)	40V	4000A (for +/- 1 time)	40J (for 10 times)	24.5V
	SFI2220SA240-500J	16V	24V(23.0~27.5)	42V	5000A (for +/- 1 time)	50J (for 10 times)	24.5V
	SFI2220SA260-500J	16V	26V(24.0~28.6)	43V	5000A (for +/- 1 time)	50J (for 10 times)	26.0V
	SFI2220SA330-500J	16V	33V(±10%)	53V	5000A (for +/- 1 time)	50J (for 10 times)	32.5V
	SFI2220SA360-500J	16V	36V(±10%)	55V	4000A (for +/- 1 time)	50J (for 10 times)	35.0V
3220	SFI3220SA240-500J	16V	24V(±10%)	40V	5000A(for +/- 1 time)	50J (for 10 times)	24.5V
	SFI3220SA240-800J	16V	24V(±10%)	40V	5500A (for +/- 1 time)	80J (for 10 times)	24.5V
	SFI3220SA270-250J	16V	27V(±10%)	44V	3000A (for +/- 1 time)	JASO : A,A1	27.0V
6420	SFI6420SA240-161J	16V	24V(±10%)	40V	6000A (for +/- 1 time)	160J (for 10 times)	24.5V

OVER VOLTAGE PROTECTION DEVICE

Super High Automotive Type (SHA)



SHA Series Specification

24V System

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 (5min)
		VDC	VB(1mA)	VC(max.)	IPeak(8/20μs)	WLD	VJUMP
1206	SFI1206SA470-030J	34V	47V(±10%)	77V	200A (for +/- 1 time)	3J (for 10 times)	45.0V
1210	SFI1210SA470-060J	34V	47V(±10%)	77V	500A (for +/- 1 time)	6J (for 10 times)	45.0V
	SFI1210SA470-120J	34V	47V(±10%)	77V	500A (for +/- 1 time)	12J (for 10 times)	45.0V
	SFI1210SA560-030J	34V	56V(±10%)	91V	400A(for +/- 1 time)	3J (for 10 times)	53.0V
1812	SFI1812SA470-250J	34V	47V(±10%)	77V	2000A (for +/- 1 time)	25J (for 10 times)	45.0V
	SFI1812SA750-200J	34V	47V(±10%)	105V	2000A(for +/- 1 time)	20J (foe 10 times)	70.5V
2220	SFI2220SA470-120J	34V	47V(±10%)	77V	1200A (for +/- 1 time)	12J (for 10 times)	45.0V
	SFI2220SA470-250J	34V	47V(±10%)	77V	3000A (for +/- 1 time)	25J (for 10 times)	45.0V
	SFI2220SA470-500J	34V	47V(±10%)	77V	4000A (for +/- 1 time)	50J (for 10 times)	45.0V
3220	SFI3220SA470-500J	34V	47V(±10%)	77V	4000A (for +/- 1 time)	50J (for 10 times)	45.0V
	SFI3220SA470-800J	34V	47V(±10%)	77V	4500A (for +/- 1 time)	80J (for 10 times)	45.0V
6420	SFI6420SA470-161J	34V	47V(±10%)	77V	6000A (for +/- 1 time)	160J (for 10 times)	45.0V

12-24V System

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 (5min)
		VDC	VB(1mA)	VC(max.)	IPeak(8/20μs)	WLD	VJUMP
1206	SFI1206SA360-090V	24V	36V(±10%)	55V	500A (for +/- 1 time)	9J (for 10 times)	35.0V
1210	SFI1210SA360-120V	24V	36V(±10%)	55V	800A (for +/- 1 time)	12J (for 10 times)	35.0V
1812	SFI1812SA360-250V	24V	38V(±10%)	55V	2000A (for +/- 1 time)	25J (for 10 times)	35.0V
2220	SFI2220SA360-500V	24V	36V(±10%)	55V	4000A (for +/- 1 time)	50J (for 10 times)	35.0V

OVER VOLTAGE PROTECTION DEVICE SEA (Super ESD Automotive CAN Bus)



Description

CAN Bus is automotive ESD requirement. It is one of the widely used international bus and it's smart electrical control equipment to transfer data between every electronic devices in automobile. It achieves a regional network control systems in whole vehicle and exchanges information between ECU electronic controls to become the automotive electronic control network. This series is designed for this request.

Features

- ◆ Compliant with IEC61000-4-2 contact +/-30 KV
- ◆ Quick response time : <0.5 ns
- ◆ Low reverse leakage current : <1.5 μ A
- ◆ Operating temperature exceeds : 125 °C
- ◆ Bi-directional
- ◆ SMD package
- ◆ Products with Lead-Free
- ◆ Different capacitance values correspond to the different speed signal bus (CAN Bus)
- ◆ Compatible with (ISO7637-2 : 2004(E))
- ◆ Pulse 1 (max. -50 V)/ Pulse 2 (max. 125 V)
- ◆ Pulses 3A and 3B

Application Area

- ★ Can bus system A B C
- ★ Other special requirements

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}
0603	SFI0603EA240-LSP	16V	28.0~38.0V	57V	50pF(±30%)	<1.5 μ A	25KV
	SFI0603EA240-MSP	16V	28.0~38.0V	57V	25pF(±30%)	<1.5 μ A	25KV
	SFI0603EA240-HSP	16V	28.0~38.0V	57V	10pF(±30%)	<1.5 μ A	25KV
	SFI0603EA410-LSP	30V	40.0~48.0V	67V	70pF(±30%)	<1.5 μ A	25KV
	SFI0603EA470-LSP	28V	48.0~72.0V	108V	50pF(±30%)	<1.5 μ A	25KV
	SFI0603EA470-HSP	28V	48.0~72.0V	108V	15pF(±30%)	<1.5 μ A	25KV
0805	SFI0805EA240-LSP	16V	28.0~38.0V	57V	50pF(±30%)	<1.5 μ A	25KV
	SFI0805EA470-XSP	36V	42.3~51.7V	77V	200pF(±30%)	<2.0 μ A	25KV

Notes :

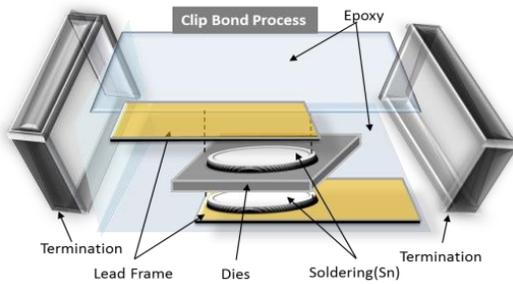
- * 1 The breakdown voltage was measured at 1 mA current.
- * 2 The clamping voltage was measured at standard current, 0603(1A).
- * 3 The leakage current was tested at working voltage.
- * 4 The components shall be employed within 1 year, in nitrogen condition.

OVER VOLTAGE PROTECTION DEVICE SGD Package Introduction

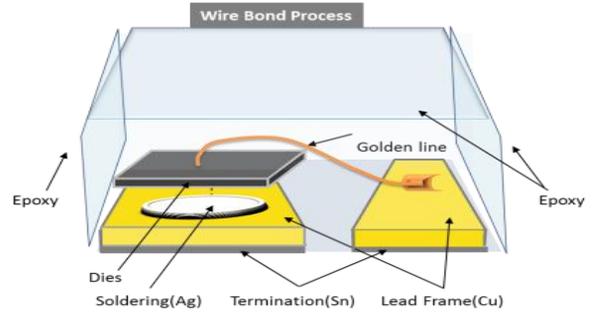


Description for SGD Package

NEW Technology



General Technology



Features

- ◆ Special design for ESD protection solution
- ◆ Pin to Pin compatible DFN package
- ◆ Easy debug & soldering
- ◆ High ESD & Surge robustness
- ◆ High QC sampling & Reliable
- ◆ Cost Saving

Application Area

- ★ ESD protection
- ★ Smart Phone
- ★ Consumer Device

Comparison

Product exterior and structure

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

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

OVER VOLTAGE PROTECTION DEVICE

STS Series (Semiconductor TVS Diode)



Advantage

New TVS(SGD)	Old TVS(DFN)
Soldering Pad : 5 Sides (Same as MLCC)	Soldering Pad : Button Side

STS 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	SFI0402TS050-0R3A-11	5V	0.3pF	0.001μA	±20KV	±20KV	30V	30V	60W	3A
	SFI0201TS050-100W-11	5V	10pF	0.001μA	±20KV	±20KV	12V	12V	72W	6A
0402	SFI0402TS050-0R3W-11	5V	0.3pF	0.001μA	±20KV	±20KV	30V	30V	54W	3A
	SFI0402TS050-2R5A-11	5V	2.5pF	0.001μA	±15KV	±15KV	16V	16V	45W	3A
	SFI0402TS050-050A-11	5V	5pF	0.001μA	±15KV	±15KV	15V	15V	64W	4A
	SFI0402TS050-100A-11	5V	10pF	0.001μA	±12KV	±12KV	12V	12V	96W	8A
	SFI0402TS050-170K-11	5V	17pF	0.001μA	±12KV	±12KV	12V	12V	80W	8A
0603	SFI0603TS050-2R5A-11	5V	2.5pF	0.001μA	±15KV	15KV	16V	16V	45W	3A
	SFI0603TS050-100A-11	5V	10pF	0.001μA	±25KV	25KV	12V	12V	96W	8A

SFI Product vs Other Competitors

SFI Product		Competitor			Package
		NXX	PXXSXXX	WXXXSXXX	
0402TS050-0R3A-11	0.3pF	PESD5V0F1BL	PESDUC2FD5VB	ESD5311N	SGD0402/ DFN1006-2
0402TS050-2R5A-11	2.5pF	PESD5V0U1BL	PESDWC2FD5VB	...	SGD1006/ DFN1006-2
0402TS050-100A-11	10pF	PESD5V0V1BL	PESDNC2FD5VBS	ESD5471R	SGD1006/ DFN1006-2
0201TS050-100W-11		PESD5V0L1BSF	PESDNC2XD5VB	ESD5471Z	SGD0201/ DFN0603-2
0402TS050-170K-11	17pF	PESD12VV1BL	PESDNC2FD5VB	ESD5451R	SGD0402/ DFN1006-2

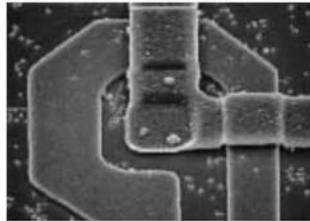
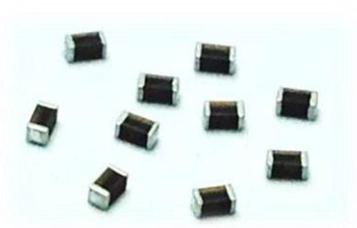
OVER VOLTAGE PROTECTION DEVICE

STS Advantage

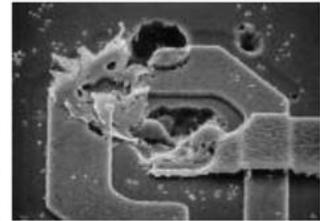


STS Advantage

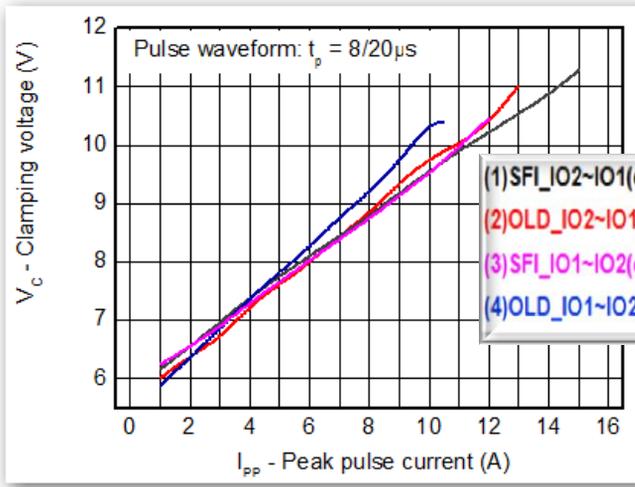
Background : With the progress of integrated circuits to the nanometer (nm) process, more and more speed, more functional design in one integrated circuit. Such miniaturization design, so as to increase the doping concentration also led thinner gate oxide layer, PN junction width reduction. Resulting 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

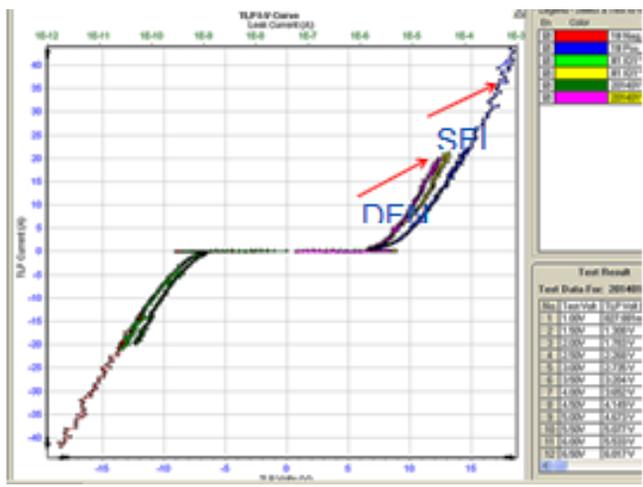


After ESD Strike Integrated Circuit



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

OVER VOLTAGE PROTECTION DEVICE

General Single Type (MLV A Series)



MLV -A 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	V _B (1mA)	V _C (max.)	I _{Peak} (8/20μs)	C(1KHz)
0805	SFI0805ML240A-LF	14V	18V	24V(21.6~26.4)	39V	150A	710pF
1206	SFI1206ML180A-LF	11V	14V	18V(15.3~20.7)	30V	200A	1200pF
	SFI1206ML240A-LF	14V	18V	24V(21.6~26.4)	39V	200A	780pF
	SFI1206ML330A-LF	20V	26V	33V(29.7~36.3)	54V	200A	700pF
	SFI1206ML390A-LF	25V	30V	39V(35.1~42.9)	65V	200A	510pF
	SFI1206ML470A-LF	30V	38V	47V(42.3~51.7)	77V	200A	440pF
1210	SFI1210ML240A-LF	14V	18V	24V(21.6~26.4)	39V	400A	1600pF
	SFI1210ML270A-LF	17V	22V	27V(24.3~29.7)	44V	400A	1500pF
	SFI1210ML330A-LF	20V	26V	33V(29.7~36.3)	54V	400A	880pF
	SFI1210ML390A-LF	25V	30V	39V(35.1~42.9)	65V	400A	800pF
	SFI1210ML470A-LF	30V	38V	47V(42.3~51.7)	77V	400A	530pF
1812	SFI1812ML240A-LF	14V	18V	24V(21.6~26.4)	39V	800A	3500pF
	SFI1812ML390A-LF	25V	30V	39V(35.1~42.9)	65V	800A	2350pF
	SFI1812ML470A-LF	30V	38V	47V(42.3~51.7)	77V	800A	1600pF
	SFI1812ML560A-LF	35V	45V	56V(50.4~61.6)	90V	800A	1200pF
2220	SFI2220ML180A-LF	11V	14V	18V(15.3~20.7)	30V	1200A	10500pF
	SFI2220ML240A-LF	14V	18V	24V(21.6~26.4)	39V	1200A	8500pF
	SFI2220ML270A-LF	17V	22V	27V(24.3~29.7)	44V	1200A	8300pF
	SFI2220ML330A-LF	20V	26V	33V(29.7~36.3)	54V	1200A	8000pF
	SFI2220ML390A-LF	25V	30V	39V(35.1~42.9)	65V	1200A	7500pF
	SFI2220ML470A-LF	30V	38V	47V(42.3~51.7)	77V	1200A	4600pF
	SFI2220ML560A-LF	35V	45V	56V(50.4~61.6)	90V	1200A	3500pF

OVER VOLTAGE PROTECTION DEVICE

General Single Type (MLV C Series)



MLV -C 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	V _B (1mA)	V _C (max.)	I _{Peak} (8/20μs)	C(1KHz)
0402	SFI0402ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	20A	200pF
	SFI0402ML120C-LF	6V	9V	12V(10.2~13.8)	24V	20A	135pF
	SFI0402ML180C-LF	11V	14V	18V(15.3~20.7)	35V	20A	50pF
	SFI0402ML240C-LF	14V	18V	24V(21.6~26.4)	44V	20A	45pF
0603	SFI0603ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	30A	650pF
	SFI0603ML080CS-LF	4V	5.5V	8V(7.5~10.5)	20V	30A	300~385pF
	SFI0603ML120C-LF	6V	9V	12V(10.2~13.8)	24V	30A	300pF
	SFI0603ML180C-LF	11V	14V	18V(15.3~20.7)	30V	30A	210pF
	SFI0603ML240C-LF	14V	18V	24V(21.6~26.4)	39V	30A	160pF
	SFI0603ML270C-LF	17V	22V	27V(24.3~29.7)	44V	30A	145pF
	SFI0603ML330C-LF	20V	26V	33V(29.7~36.3)	54V	30A	130pF
	SFI0603ML390C-LF	25V	30V	39V(35.1~42.9)	65V	30A	110pF
	SFI0603ML470C-LF	30V	38V	47V(42.3~51.7)	77V	30A	90pF
0805	SFI0805ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	80A	1400pF
	SFI0805ML120C-LF	6V	9V	12V(10.2~13.8)	24V	80A	650pF
	SFI0805ML180C-LF	11V	14V	18V(15.3~20.7)	30V	100A	350pF
	SFI0805ML240C-LF	14V	18V	24V(21.6~26.4)	39V	100A	300pF
	SFI0805ML270C-LF	17V	22V	27V(24.3~29.7)	44V	100A	250pF
	SFI0805ML330C-LF	20V	26V	33V(29.7~36.3)	54V	100A	220pF
	SFI0805ML390C-LF	25V	30V	39V(35.1~42.9)	65V	100A	200pF
	SFI0805ML470C-LF	30V	38V	47V(42.3~51.7)	77V	100A	150pF
	SFI0805ML560C-LF	35V	45V	56V(50.4~61.6)	90V	80A	110pF

OVER VOLTAGE PROTECTION DEVICE

General Single Type (MLV C Series)



MLV -C 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	V _B (1mA)	V _C (max.)	I _{Peak} (8/20μs)	C(1KHz)
1206	SFI1206ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	100A	3100pF
	SFI1206ML180C-LF	11V	14V	18V(15.3~20.7)	30V	100A	800pF
	SFI1206ML240C-LF	14V	18V	24V(21.6~26.4)	39V	100A	620pF
	SFI1206ML270C-LF	17V	22V	27V(24.3~29.7)	44V	100A	700pF
	SFI1206ML330C-LF	20V	26V	33V(29.7~36.3)	54V	100A	480pF
	SFI1206ML390C-LF	25V	30V	39V(35.1~42.9)	65V	100A	400pF
	SFI1206ML470C-LF	30V	38V	47V(42.3~51.7)	77V	100A	260pF
	SFI1206ML560C-LF	35V	45V	56V(50.4~61.6)	90V	100A	230pF
	SFI1206ML680C-LF	40V	56V	68V(61.2~74.8)	110V	100A	200pF
	SFI1206ML820C-LF	50V	65V	82V(73.8~90.2)	135V	100A	175pF
	SFI1206ML101C-LF	60V	85V	100V(90.0~110)	165V	100A	150pF
1210	SFI1210ML080C-LF	4V	5.5V	8V(7.5~10.5)	20V	250A	5200pF
	SFI1210ML240C-LF	14V	18V	24V(21.6~26.4)	39V	250A	1150pF
	SFI1210ML330C-LF	20V	26V	33V(29.7~36.3)	54V	250A	610pF
	SFI1210ML390C-LF	25V	30V	39V(35.1~42.9)	65V	250A	550pF
	SFI1210ML560C-LF	35V	45V	56V(50.4~61.6)	90V	250A	400pF
	SFI1210ML680C-LF	40V	56V	68V(61.2~74.8)	110V	250A	300pF
	SFI1210ML101C-LF	60V	85V	100V(90.0~110)	165V	200A	210pF
1812	SFI1812ML470C-LF	30V	38V	47V(42.3~51.7)	77V	500A	2200pF
	SFI1812ML560C-LF	35V	45V	56V(50.4~61.6)	90V	500A	1000pF
	SFI1812ML151C-LF	95V	127V	150V(135~165)	270V	600A	330pF
2220	SFI2220ML270C-LF	17V	22V	27V(24.3~29.7)	44V	1000A	6600pF
	SFI2220ML330C-LF	20V	26V	33V(29.7~36.3)	54V	1000A	6300pF
	SFI2220ML390C-LF	25V	30V	39V(35.1~42.9)	65V	1000A	6000pF
	SFI2220ML470C-LF	30V	38V	47V(42.3~51.7)	77V	1000A	4000pF
	SFI2220ML680C-LF	40V	56V	68V(61.2~74.8)	110V	1000A	2000pF

OVER VOLTAGE PROTECTION DEVICE

General Single Type (MLE Series)



Description

Electro Static discharge (ESD) is the transients as short duration excursion. Our ESD products are based on the design of multilayer fabrication technology to suppress ESD events. Our products meet IEC61000-4-2 standard for Electromagnetic Compliance testing. We supply extra low capacitance and protect integrated circuits.

Features

■ Fast Response < 0.5ns	■ Low Working Voltage	■ Low Capacitance 0.05pF
■ Low Leakage Current < 1 μ A	■ Low Clamping Voltage	■ Bi-directional

MLE Specification

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

	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	SFI0201-050E050PP-LF	5V	28~38V	72V	5.0pF(+80~-20%)	8KV	15KV
	SFI0201-050E100NP-LF	5V	28~38V	72V	10pF(\pm 30%)	8KV	15KV
	SFI0201-050E330NP-LF	5V	18~28V	48V	33pF(\pm 30%)	8KV	15KV
	SFI0201-120E0R8PP-LF	12V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	SFI0201-120E2R5PP-LF	12V	60~80V	130V	2.5pF(+80~-20%)	8KV	15KV
0402	SFI0402-050E050PP-LF	5V	28~38V	72V	5.0pF(+80~-20%)	8KV	15KV
	SFI0402-050E100NP-LF	5V	28~38V	72V	10pF(\pm 30%)	8KV	15KV
	SFI0402-050E220NP-LF	5V	18~28V	52V	22pF(\pm 30%)	8KV	15KV
	SFI0402-050E330NP-LF	5V	18~28V	52V	33pF(\pm 30%)	8KV	15KV
	SFI0402-050E560NP-LF	5V	18~28V	52V	56pF(\pm 30%)	8KV	15KV
	SFI0402-050E101NP-LF	5V	18~28V	52V	100pF(\pm 30%)	8KV	15KV
	SFI0402-120E050PP-LF	12V	28~38V	72V	5.0pF(+80~-20%)	8KV	15KV
	SFI0402-120E100NP-LF	12V	28~38V	72V	10pF(\pm 30%)	8KV	15KV
	SFI0402-120E220NP-LF	12V	20~30V	55V	22pF(\pm 30%)	8KV	15KV
	SFI0402-120E330NP-LF	12V	20~30V	55V	33pF(\pm 30%)	8KV	15KV
	SFI0402-120E560NP-LF	12V	20~30V	55V	56pF(\pm 30%)	8KV	15KV
	SFI0402-120E101NP-LF	12V	20~30V	55V	100pF(\pm 30%)	8KV	15KV

Specification

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

OVER VOLTAGE PROTECTION DEVICE

General Single Type (MLE Series)



MLE Specification

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

	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	SFI0402-240E0R8PP-LF	24V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	SFI0402-240E1R8PP-LF	24V	100~150V	200V	1.8pF(+80~-20%)	8KV	15KV
	SFI0402-240E2R5PP-LF	24V	100~150V	200V	2.5pF(+80~-20%)	8KV	15KV
	SFI0402-240E3R0PP-LF	24V	48~72V	110V	3.0pF(+80~-20%)	8KV	15KV
	SFI0402-420E0R8PP-LF	42V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	SFI0402-420E2R5PP-LF	42V	100~150V	200V	2.5pF(+80~-20%)	8KV	15KV
0603	SFI0603-050E050PP-LF	5V	20~30V	55V	5.0pF(+80~-20%)	8KV	15KV
	SFI0603-050E100NP-LF	5V	24~36V	65V	10pF(±30%)	8KV	15KV
	SFI0603-050E220NP-LF	5V	15~25V	34V	22pF(±30%)	8KV	15KV
	SFI0603-050E330NP-LF	5V	15~25V	34V	33pF(±30%)	8KV	15KV
	SFI0603-050E560NP-LF	5V	15~25V	36V	56pF(±30%)	8KV	15KV
	SFI0603-050E101NP-LF	5V	15~25V	36V	100pF(±30%)	8KV	15KV
	SFI0603-5R5T100NP-LF	5V	15~20V	36V	10pF(±30%)	8KV	15KV
	SFI0603-120E050PP-LF	12V	33~50V	85V	5.0pF(+80~-20%)	8KV	15KV
	SFI0603-120E100NP-LF	12V	27~42V	60V	10pF(±30%)	8KV	15KV
	SFI0603-120E220NP-LF	12V	20~30V	55V	22pF(±30%)	8KV	15KV
	SFI0603-120E330NP-LF	12V	20~30V	55V	33pF(±30%)	8KV	15KV
	SFI0603-120E101NP-LF	12V	20~30V	55V	100pF(±30%)	8KV	15KV
	SFI0603-240E0R8PP-LF	24V	100~150V	200V	0.8pF(+80~-20%)	8KV	15KV
	SFI0603-240E2R5PP-LF	24V	100~150V	200V	2.5pF(+80~-20%)	8KV	15KV
SFI0603-240E3R0PP-LF	24V	48~72V	110V	3.0pF(+80~-20%)	8KV	15KV	
0805	SFI0805-050E560NP-LF	5V	20~28V	60V	56pF(±30%)	8KV	15KV
	SFI0805-120E560NP-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

OVER VOLTAGE PROTECTION DEVICE ULC Series (Ultra Low Capacitance)



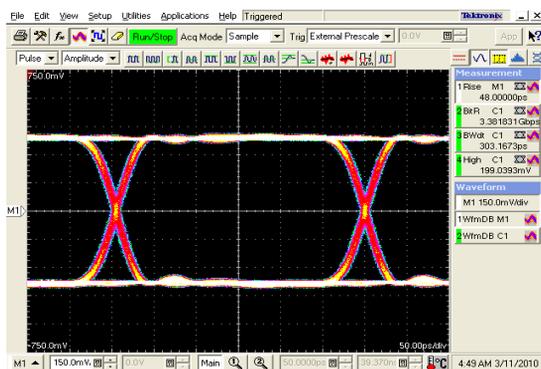
Feature

- ◆ 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

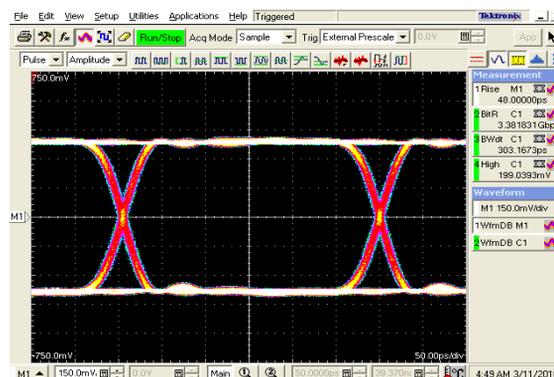
Application Area

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

Character



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)

ULC Specification

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

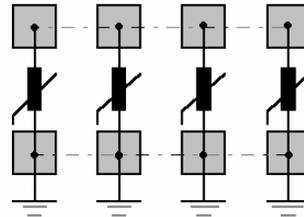
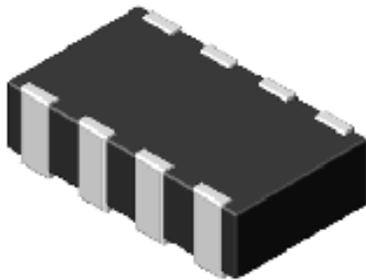
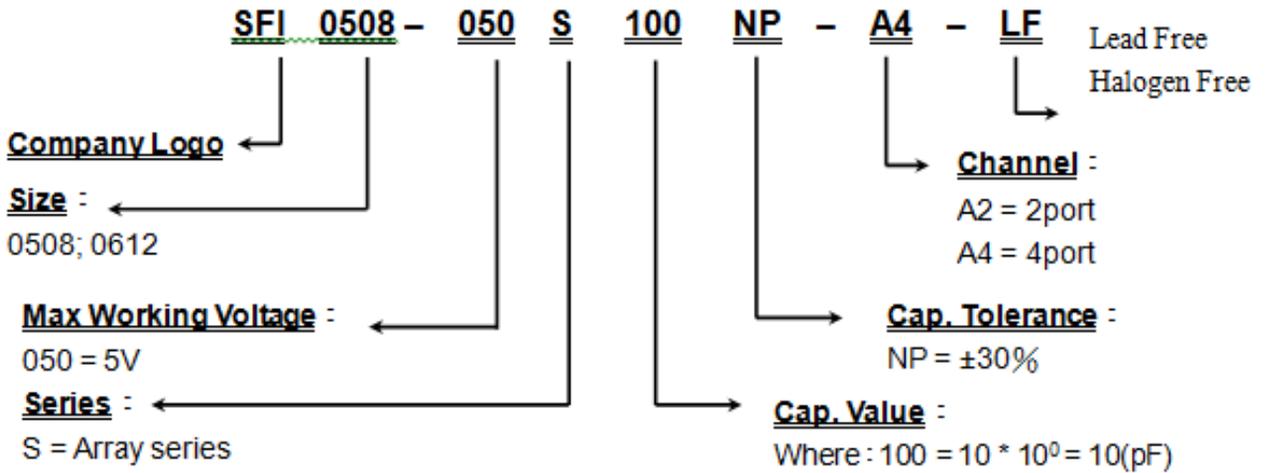
	Part No. (Unit)	Working Voltage	ESD Trigger Voltage	Clamping Voltage At 30ns.	Leakage Current	Capacitance Value	ESD (Contact)	ESD (Air)
		VDC (max.)	V _T (typ.)	V _c (typ.)	I _{DC}	C(1MHz)	V _{ESD}	V _{ESD}
0402	SFI0402EH060-OR20P	6V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	SFI0402EH120-OR20P	12V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	SFI0402EH240-OR20P	24V	300V	30V	<0.05μA	0.20pF	8KV	15KV
0603	SFI0603EH060-OR20P	6V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	SFI0603EH120-OR20P	12V	300V	30V	<0.05μA	0.20pF	8KV	15KV
	SFI0603EH240-OR20P	24V	300V	30V	<0.05μA	0.20pF	8KV	15KV

OVER VOLTAGE PROTECTION DEVICE

MVA Series(General Array Type)



Part No. Definition



MVA Specification

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

	Part No.	Working Voltage	Breakdown Voltage	Clamping Voltage	Leakage Current	Insulation Resistance	Capacitance Value
		V _{DC} (max.)	V _B (1mA)	V _C (max.)	I _{LDC}	R	C(1MHz)
0508	SFI0508-050S100NP-A4-LF	5V	19.2~26.8V	50V	<1μA	>10MΩ	10pF(±30%)
	SFI0508-050S500NP-A4-LF	5V	19.2~26.8V	50V	<1μA	>10MΩ	50pF(±30%)
	SFI0508-180S070NP-M8-LF	18V	26.0~36.0V	65V	<2μA	>10MΩ	7pF(±30%)
0612	SFI0612-180S121NP-A4-LF	18V	24.0~33.6V	50V	<1μA	>10MΩ	120pF(±30%)

OVER VOLTAGE PROTECTION DEVICE

Application for IP-CAM



Description

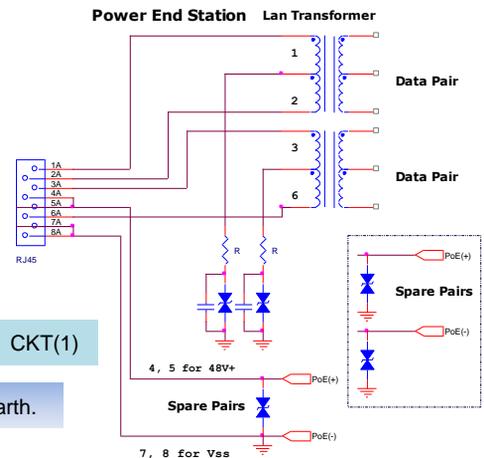
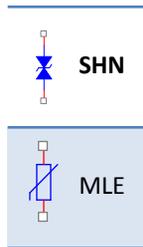
Security control systems incorporate outdoor and indoor units. The outdoor equipment must incorporate protective components to prevent damage to the circuit and equipment by the lightning protection. It's essential to install suitable overvoltage protection components. Here have some recommend part for the IP camera ESD and Surge solution.



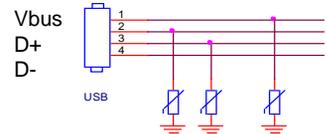
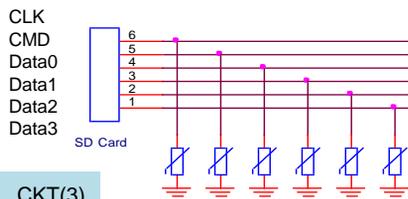
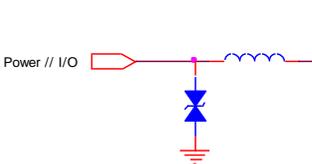
Application Table

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

IP CAM interface for ESD & Surge Solution						
Interface	Type	Requirements	Series	Part No.	Size	Ref. CKT
RJ45 Data	Surge	10/700 μ s 40 Ω 6KV	SHN	SFI1206SN120-060K	1206	Ckt(1)
RJ45 PoE	Surge	10/700 μ s 40 Ω 6KV	SHN	SFI1210SN750-060K	1210	Ckt(1)
AC 24V	Surge	10/700 μ s 40 Ω 6KV	SHN	SFI1210SN470-060K	1210	Ckt(2)
SD Card	ESD	IEC61000-4-2/8KV	MLE	SFI0402-120E050PP-LF	0402	Ckt(3)
USB	ESD	IEC61000-4-2/8KV	MLE	SFI0402-240E2R5PP-LF	0402	Ckt(4)
Video	ESD	IEC61000-4-2/8KV	MLE	SFI0402-120E050PP-LF	0402	Ckt(2)
Audio	ESD	IEC61000-4-2/8KV	MLE	SFI0402-050E330NP-LF	0402	Ckt(2)
Others I/O	ESD	IEC61000-4-2/8KV	MLE	SFI0402-050E330NP-LF	0402	Ckt(2)
Indoor I/O	Surge	IEC61000-4-5/8/20 μ s	MLE	SFI0805-120E560NP-LF	0805	---



The power surge protection solution depends if the ground is connected to earth.



OVER VOLTAGE PROTECTION DEVICE

Application for Ethernet with PoE



Description

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.

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.

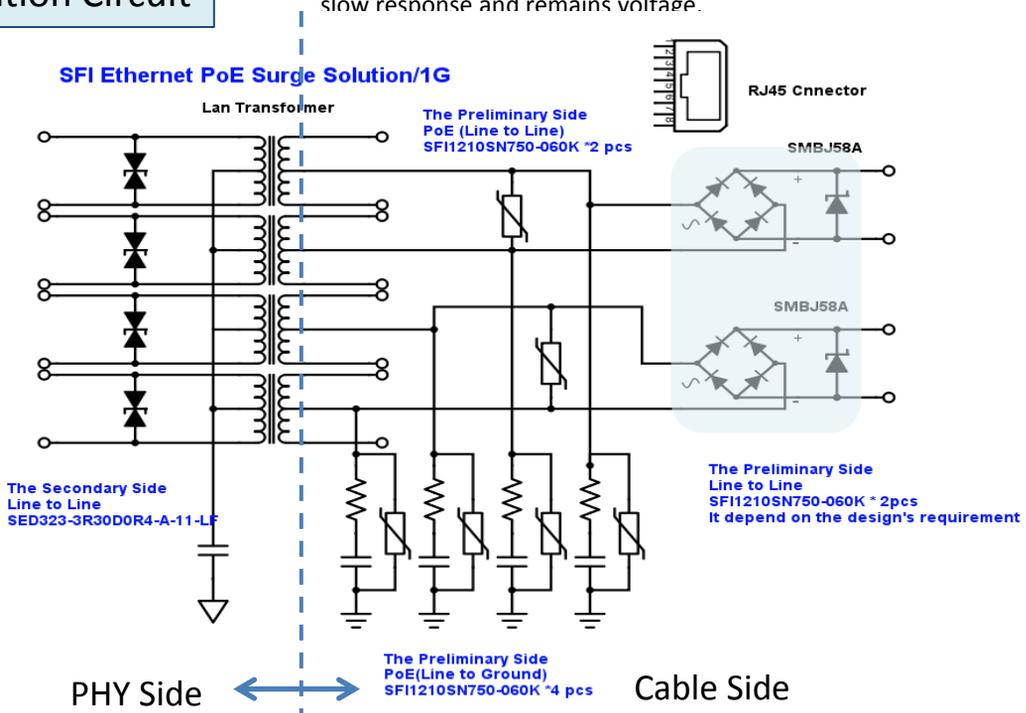
Our CSPD strong characteristics :

- 1). Chip size
- 2). High flow ability
- 3). Low clamping volt
- 4). Quick response time and provide better solution than that.



The traditional surge solution is to use GDT for protection, when transient voltage occurred, GDT will have a period of **delay** between direct current discharge and exact working. Therefore, it's generally not only use GDTs to protect electronic equipment and add some protective components after GDT. That's the reason why GDT has slow response and remains voltage.

Application Circuit



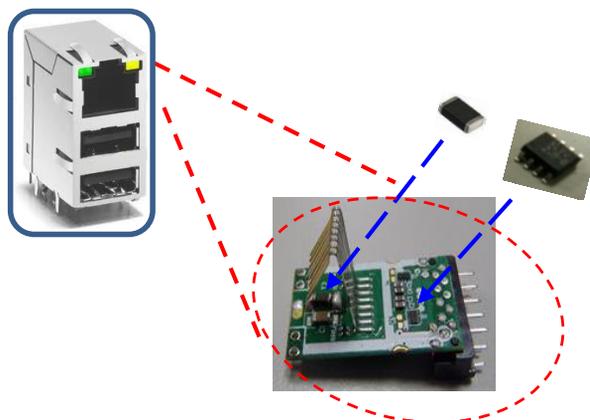
OVER VOLTAGE PROTECTION DEVICE



Application for Ethernet

Description

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.



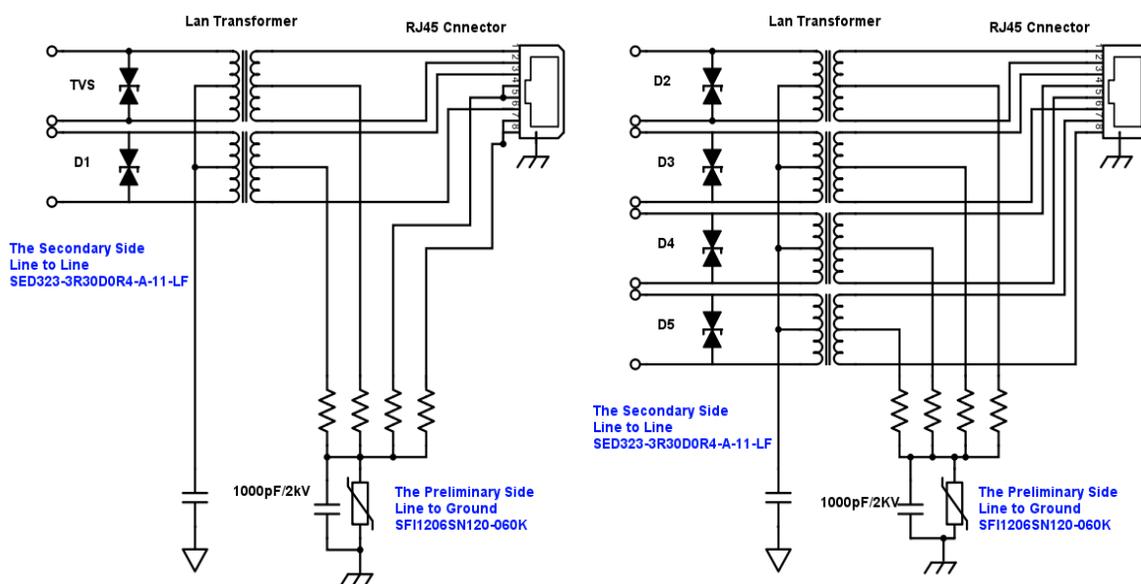
Suggestion

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

Ethernet (RJ45) surge protection

Mode	Test Standard	Series	Part No.	Package	Cap.
L-G	10/700 μ s/40 Ω /6KV	SHN	SFI1206SN120-060K	1206	---
L-G	10/700 μ s/40 Ω /4KV	SHN	SFI1206SN120-040K	1206	---
L-L	10/700 μ s/40 Ω /4KV	TVS(A)	SEDSO8-2R8S050-A-11	SO8	5.0 pF
L-L	10/700 μ s/40 Ω /2KV	TVS (B)	SEDSO8-2R8S050-B-11	SO8	5.0 pF
L-L	10/700 μ s/40 Ω /2KV	TVS(F)	SEDSO8-2R8S020-F-11	SO8	2.0pF
L-L	10/700 μ s/40 Ω /2KV	TVS	SED1006-3R30D7R0-D-11	0402	7.0pF
L-L	10/700 μ s/40 Ω /2KV	TVS	SED323-3R30R0R4-A-11-LF	SOD323	0.4pF

Application Circuit



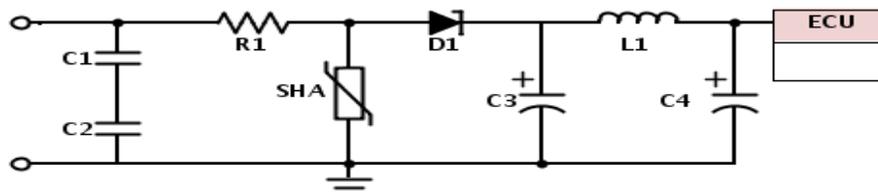
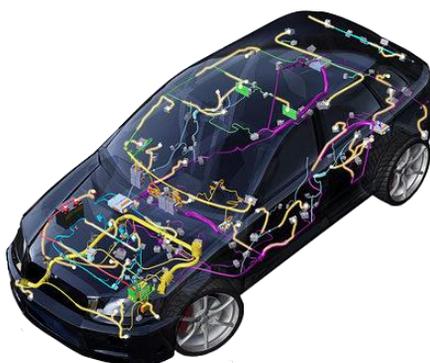
OVER VOLTAGE PROTECTION DEVICE

Application for Automotive

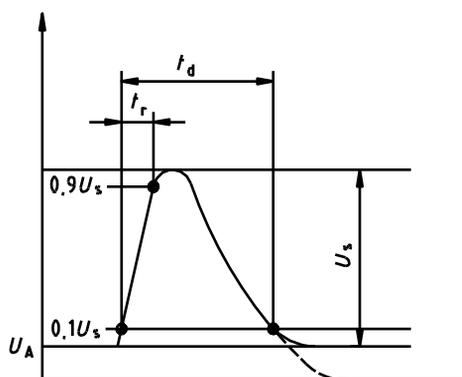


Description

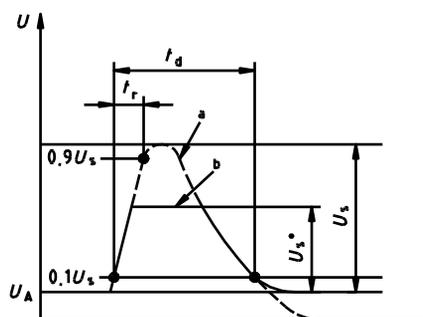
Load Dump – the battery happens short situation when the alternative power in charge process. Besides, it will occur load dump when engine starts and it's the largest energy pulse in whole car. The reason is loading suddenly withdraws when power generator works (ex. battery in charge). Due to the energy of generator release suddenly, the power circuit occurs hundreds of voltage, 5-10ms, half wave 100, 200, 300, 400 etc. Due to the different watt of generator, it will put the suppressor in parallel at the output of ECU to clamp the load dump of generator.



Pulse 5A



Pulse 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	

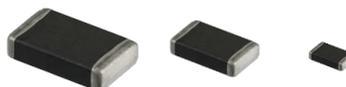
Application Table

MLV Family



Series	Function	Character	Application
MLC / 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
ULC / 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
MVA	ESD	Size (Inch) : 0508(Array type) Working Voltage : 5V Surge Current : 5A~10A(8/20μs) Capacitance : 10pF	Signal speed Ex : Data Bus line 、 FPC

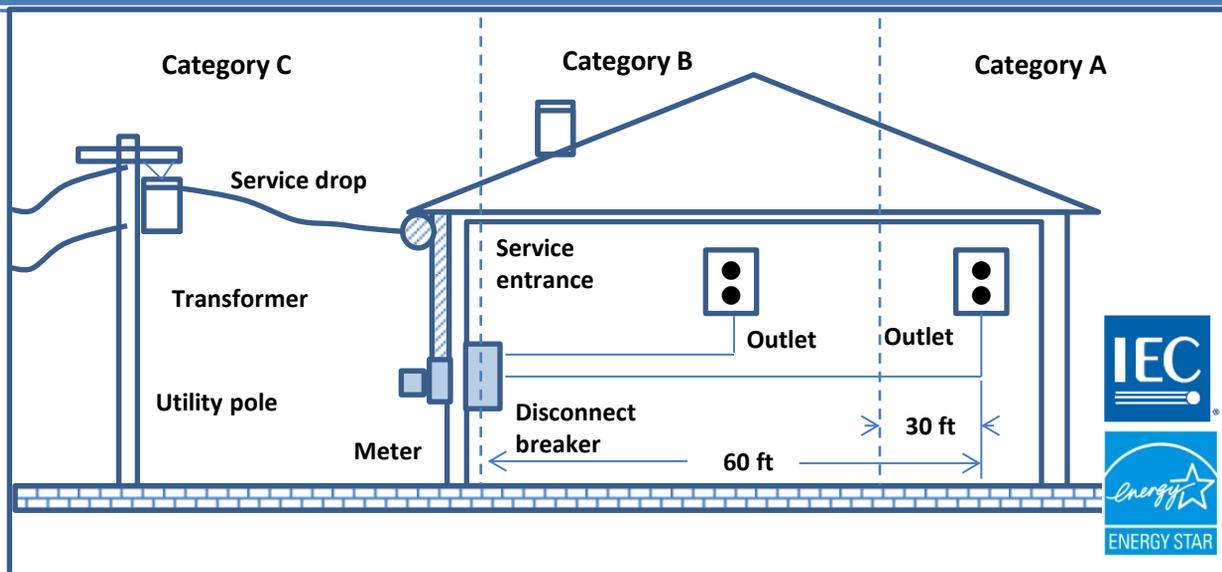
CSPD Family



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) : 0805~6420 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) : 0603(ESD Auto) Size (Inch) : 0805~6420(Load Dump) Working Voltage : 12V~42V Load Dump : 1.5J~160J(Pulse 5A) ESD robustness : 25KV	Automotive Ex : All ECU 、 CAN Bus 、 other Control I/O
SHV	Surge	Size (Inch) : 0603~3220 Breakdown Voltage : 170V~680V Surge Current : 20A~3000A(8/20μs)	AC Power Ex : LED Lamp 、 others

OVER VOLTAGE PROTECTION DEVICE

Surge Specification



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	Current	Impedance	Application
	1.2/50 μ s	8/20 μ s	Ω	
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 μ s and 8/20 μ s 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 μ s and 8/20 μ s 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	1.2/50 μ s	1.2/50 μ s	1.2/50 μ s
Line to Line	1.0KV	1.0KV	1.0KV
Line to Ground	1.0KV	1.0KV	2.0KV

OVER VOLTAGE PROTECTION DEVICE

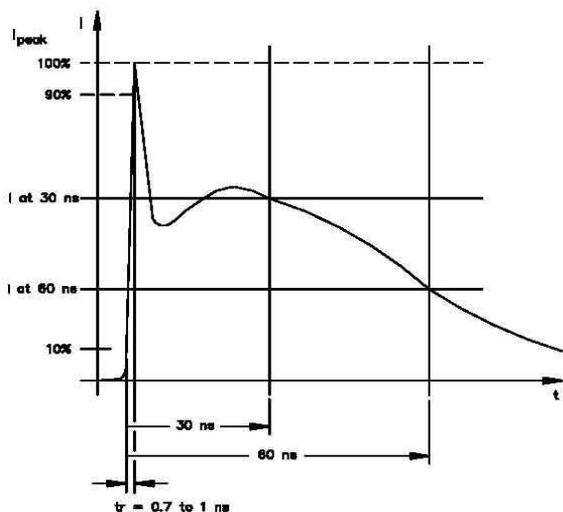
Characteristic Definition



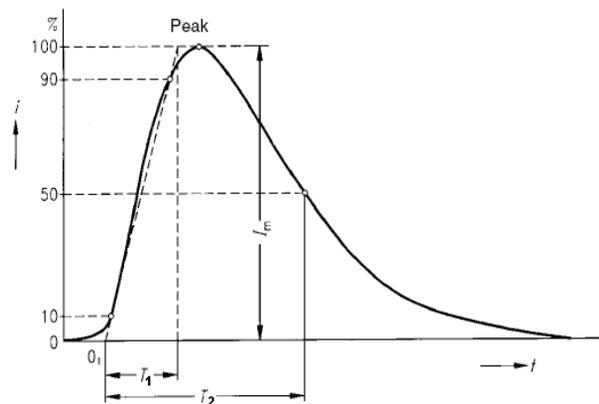
Characteristic Definition Characteristics	Test Method or Description
Max. Working Voltage	Maximum steady-state DC operating voltage the device can maintain and typical leakage current at 25°C not exceed 50 μA.
Varistor Voltage (BDV)	With the specified measuring current of 1mA DC applied. Tolerance of 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 ΔV/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} 1KHz; under 100pF measure at 1MHz; Surge series the capacitance is only for reference. The tolerance is 100%
Nonlinear exponent α	$\alpha = \left[\log (V_{1mA} / V_{0.1mA}) / \log (I_{1mA} / I_{0.1mA}) \right]$
Leakage Current	Typical leakage current at 25°C < 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°C, 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

OVER VOLTAGE PROTECTION DEVICE



Series size table

Type	Fig	Product	SFI P/N.	(mm)Max			Page
				L	W	T	
CSPD		SHC	0805SC	2.00±0.20	1.25±0.15	1.30 Max	14~15
			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	
			6420SC	16.90+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	17
			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	0603SV	1.60±0.15	0.80±0.10	0.90 Max	19~21
			0806SV	2.20±0.20	1.70±0.20	1.80 Max	
			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	
		SHA	0805SA	3.00±0.20	1.25±0.15	1.30 Max	23~25
			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	
			6420SA	16.90+0.70/-0.30	5.30+0.60/-0.30	3.70 Max	

OVER VOLTAGE PROTECTION DEVICE

Series size table



Type	Fig	Product	SFI P/N.	(mm)Max			Page
				L	W	T	
Multilayer Chip Varistor		High Surge	0805ML-A	2.00±0.20	1.25±0.15	1.20 Max	30
			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	31~32
			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	
		ESD	0201	0.60 ± 0.03	0.30 ± 0.03	0.30 ± 0.03	33~34
			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	---
		Array	0508	2.00 ± 0.15	1.20 ± 0.15	0.80 Max	36
			0612	3.20 ± 0.20	1.60 ± 0.20	0.95 Max	
		Low Cap.	0402	1.00 ± 0.10	0.50 ± 0.10	0.60 Max	35
			0603	1.60 ± 0.15	0.80 ± 0.10	0.90 Max	

SFI

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