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**AMOTECH Co., Ltd.**

# HOME APPLIANCES & MOBILE EMI/ESD PRODUCTS

## ESD Suppressor

- Chip Varistor
- EMI/ESD Filter



Advanced Material On **TECH**nology

# EMC PRODUCTS

## ● HIGH SPEED ESD SOLUTION

ASES Series (0402, 0603) / Single Type ESD Suppressor .....	4P
AMES Series (4-element) / Single Type ESD Suppressor .....	6P
ADUC Series (0402, 0603) / Ultra Low Capacitance Multi-Channel ESD Suppressor .....	10P

## ● GENERAL ESD SOLUTION

SF, SR Series (0402) / Newly Upgraded ESD Solution Series .....	14P
AVLC Series (0201) / Compact size & Chip Varistor .....	17P
AVL, AVLC Series / High Power, General Varistor .....	20P
AVNC Series (0603, 0805) (4-element) / General Array .....	22P
AVSC Series (0504, 0805) (4-element) / Compact Array (Space Saved) .....	24P

## ● EMI / ESD SOLUTION

AMLV 0603 (4-element) / L-C Type EMI-ESD Filter .....	28P
AVRC Series (0603, 0805) (4-element) / R-C Type .....	31P
AVRC Series (0504) (2-element) / R-C Type .....	37P
AVFC Series (0603, 0805) (4-element) / Feed-Thru Type .....	40P
AVFC Series (0504) (2-element) / Feed-Thru Type .....	43P

● Tape and Reel Specification .....	46P
● Soldering Recommendation .....	47P
● Terminology .....	48P
● Selection Guidelines & Application Field .....	50P
● Applications .....	51P

### NOTE

※ customized properties are available upon request.

\*1 Insulated Resistance after soldering is 10 MΩ min. [Reflow soldering condition] Temperature profile : 260°C max. , 20 sec.

PB free Solder paste : Tamura (Japan) TLF-204-93S, Measurement shall be made 1 hour after soldering.



Advanced **M**aterial **O**n **T**ECHnology

# HIGH SPEED ESD SOLUTION

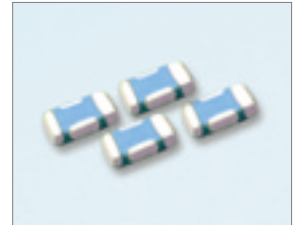
**ASES** Series (0402, 0603) / Single Type ESD Suppressor

**AMES** Series (4-element) / Single Type ESD Suppressor

**ADUC** Series (0402, 0603) / Ultra Low Capacitance Multi-Channel ESD Suppressor

### Overview

**ESD-Suppressor** is specially designed to protect sensitive electronics from the threat of the electrostatic discharge (ESD). The product reacts almost instantly to the transient voltage and effectively clamps it to the low voltage for the duration of the ESD transient. The product uses voltage variable polymers that inherently produce low capacitance and very low leakage current. Thus the device is virtually invisible to the circuit during normal operational mode. It is especially transparent to the high-speed digital circuits due to the high off-state impedance and low capacitance are not distorted or disrupted as shown by extensive testing. Using the ESD-Suppressor ESD protection, devices maintain signal integrity of highspeed data signals while protecting the circuit from ESD. The nature of the material creates a bidirectional part, which means that only one device per surge path is required to provide complete ESD protection regardless of the surge polarity.



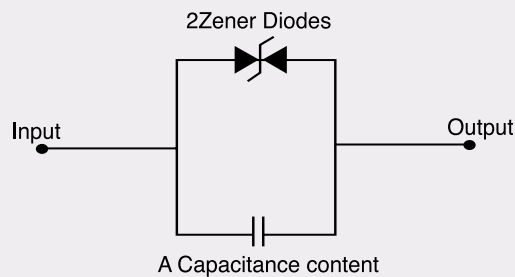
### Features

- 0402inch/1005mm size
- IEC 61000-4-2 Level4
- Ultra low capacitance (0.2pF typ.)
- Very low leakage current
- Fast response time
- Bi-directional
- Surface mount

### Application

- High Speed Data Ports ( USB 2.0, IEEE 1394 , HDMI/DVI )
- Computers & Peripherals ( D-TV, Settop Box, DVD Player, Note book, DSC, and Cell phone )

### Equivalent Circuit



### Ordering Information

**ASES**   **12**   **U**   **02**   **0R2**  
 ①   ②   ③   ④   ⑤

① **Series Name**

**ASES** : Amotech **S**ingle type **ESD** **S**uppressor

② **Maximum continuous working voltage** : **12** : 12V

③ **Capacitance group** : **U** : Ultra low capacitance

④ **Chip Size** : **02** : 1.0 x 0.5 mm   **03** : 1.6 x 0.8 mm

⑤ **Typical Capacitance** : **0R2** : 0.2 pF

### Electrical Characteristics

Part No.	Rated Voltage Vdc <sup>(1)</sup>	Clamping Voltage <sup>1</sup> (Vc_ESD)	Trigger Voltage <sup>2</sup> (Vt)	Capacitance (Cp, @ 1MHz)	Leakage Current (IL, @ 12Vdc)	ESD Capability @ IEC61000-4-2 Contact, Air discharge	ESD Pulse Withstand <sup>1</sup>	Operating Temperature
unit	(V)	(V)	(V)	(pF)	(nA)	(KV)		(°C)

#### 0402 (1005) Size

ASES 12U 02 0R2	12 typ	65 typ, 100 max	100 typ	0.2 typ, 0.3 max.	0.1 typ	8 typ, 15 typ.	>1,000 typ.	-40 to +85
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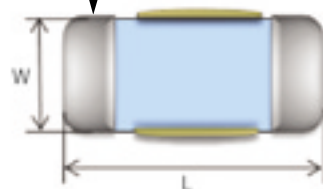
#### 0603 (1608) Size

ASES 12U 03 0R2	12 typ	65 typ, 100 max	100 typ	0.2 typ, 0.3 max.	0.1 typ	8 typ, 15 typ.	>1,000 typ.	-40 to +85
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<sup>(1)</sup>Maximum continuous DC working voltage

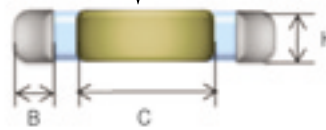
### Dimension Specification (single type)

Terminal Electrode



Suppression Material

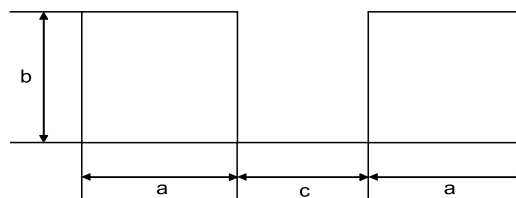
(Not connectable with SMD Board)



(mm)

Symbol	L	W	H	B	C
ASES 12U 02 0R2	1.0 ± 0.1	0.5 ± 0.1	0.30 ± 0.05	0.15 ± 0.05	0.55 max
ASES 12U 03 0R2	1.6 ± 0.1	0.8 ± 0.1	0.4 ± 0.05	0.2 ± 0.1	0.55 max

### Solder Pad Layout (single type)



(mm)

Symbol	A	B	C
ASES 12U 02 0R2	0.4	0.6	0.64
ASES 12U 03 0R2	0.6	0.8	1.1

### Overview

AMES series is specially designed to protect sensitive electronics from the threat of the electrostatic discharge (ESD). The product reacts almost instantly to the transient voltage and effectively clamps it to the low voltage for the duration of the ESD transient. The product uses voltage variable polymers that inherently produce low capacitance and very low leakage current. Thus the device is virtually invisible to the circuit during normal operational mode. It is especially transparent to the high-speed digital circuits due to the high off-state impedance and low capacitance. Signals are not distorted or disrupted as shown by extensive testing. Using the ESD-Suppressor ESD protection, devices maintain signal integrity of high-speed data signals while protecting the circuit from ESD. The nature of the material creates a bi-directional part, which means that only one device per surge path is required to provide complete ESD protection regardless of the surge polarity.



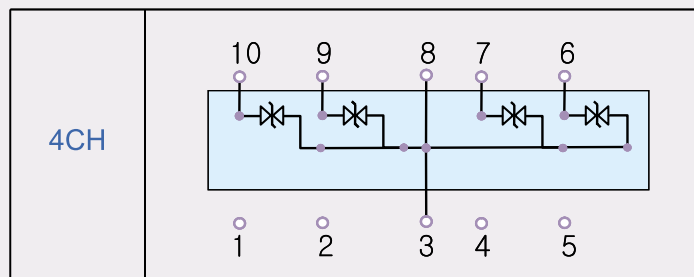
### Features

- 2510mm size
- 4 line ESD protection
- IEC 61000-4-2 Level 4
- Ultra low capacitance (0.2pF typ.)
- Very low leakage current
- Fast response time
- Bi-directional
- Surface mounting package RoHS compliant for global applications.

### Application

- High Speed Data Ports ( IEEE 1394 , HDMI/DVI )
- Computers & Peripherals ( HDTV, Set top box, Notebook, DVD players )

### Equivalent Circuit



### Ordering Information

**AMES** **12** **U** **05** **Q** **0R2**

①      ②      ③      ④      ⑤      ⑥

- ① **Series Name**  
AMES : Amotech Multi-Channel type ESD Suppressor
- ② **Maximum continuous working voltage** : 12 : 12V
- ③ **Capacitance group** : U : Ultra low capacitance

- ④ **Chip Size** : 05 : 2.5 x 1.0 mm
- ⑤ **Configuration** : Q : Quad array (4-element)
- ⑥ **Typical Capacitance** : 0R2 : 0.2 pF

### Electrical Characteristics

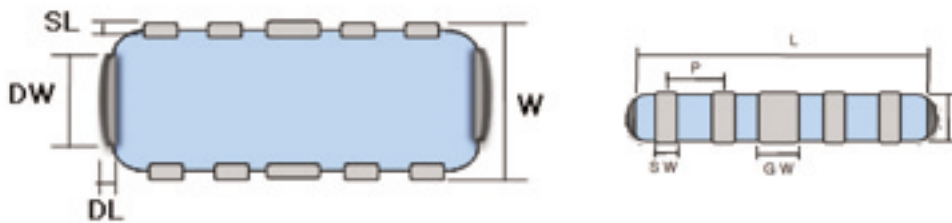
Part No.	Rated Voltage Vdc <sup>(1)</sup>	Clamping Voltage <sup>1</sup> (Vc_ESD)	Trigger Voltage <sup>2</sup> (Vt)	Capacitance (Cp, @ 1MHz)	Leakage Current (IL, @ 12Vdc)	ESD Capability @ IEC61000-4-2 Contact, Air discharge	ESD Pulse Withstand <sup>1</sup>	Operating Temperature
<b>unit</b>	(V)	(V)	(V)	(pF)	(nA)	(KV)		(°C)

#### Array type 2510 size (4-element)

AMES 12U 05Q 0R2	12 typ	65 typ, 100 max	100 typ	0.2 typ, 0.3 max.	0.1 typ	8 typ, 15 typ.	>1,000 typ.	-40 to +85
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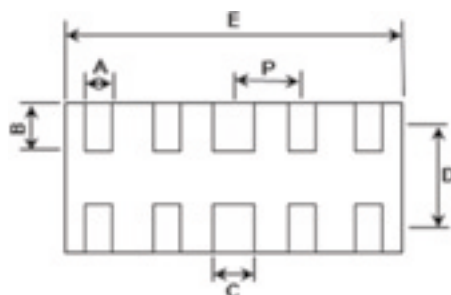
<sup>(1)</sup>Maximum continuous DC working voltage

### Dimension Specification



Symbol	L	W	T	DL	DW	SL	SW	GW	P
2510 (4-element)	2.5 ±0.10	1.0 ±0.10	0.58 ±0.10	MAX. 0.2	MAX. 0.7	0.25 ±0.10	0.20 ±0.10	0.40 ±0.10	0.50 ±0.10

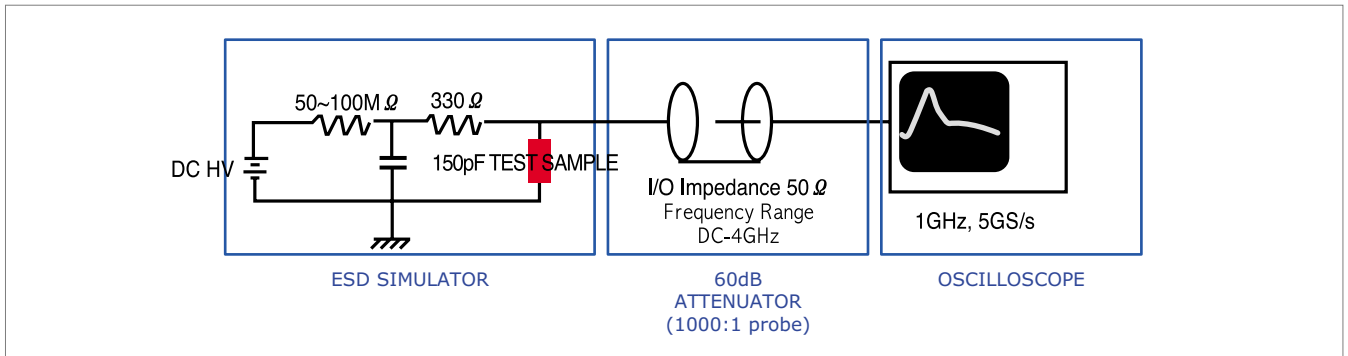
### Solder Pad Layout



Symbol	A	B	C	D	E	F
2510 (4-element)	0.20	0.42	0.40	1.02	2.50	0.50

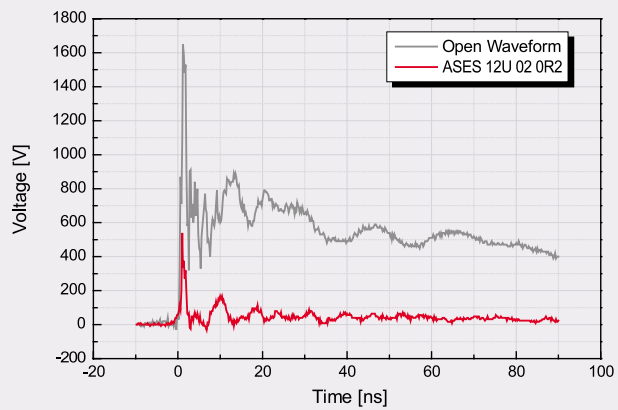


### ESD Attenuation Test setup

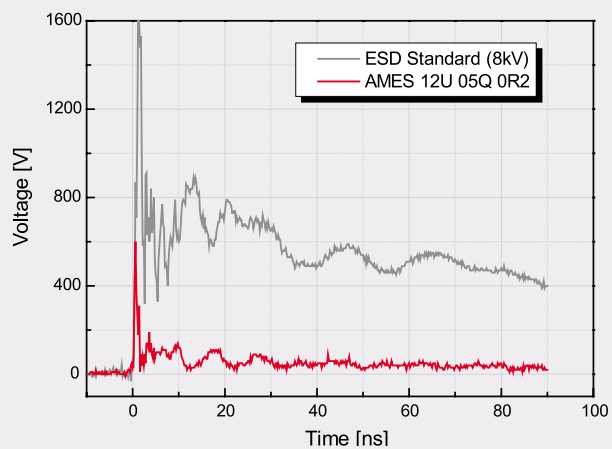


### ESD absorption characteristics (voltage waveform)

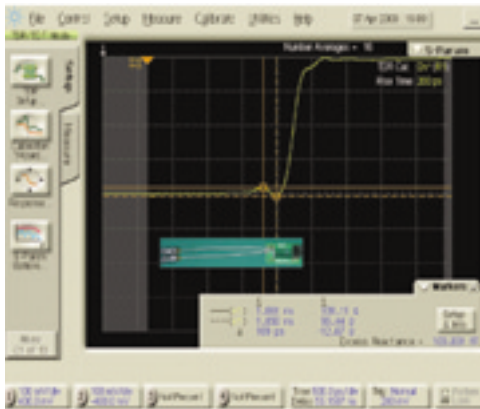
#### ESD Suppressor (Single type)



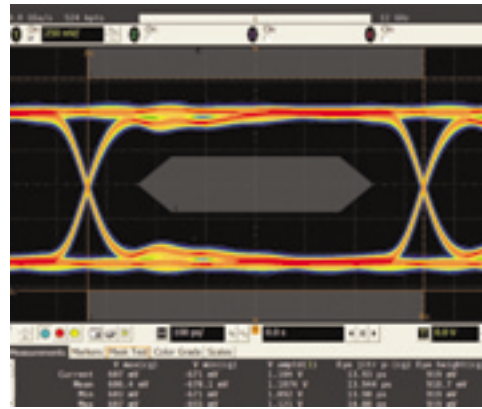
#### ESD Suppressor (Array type)



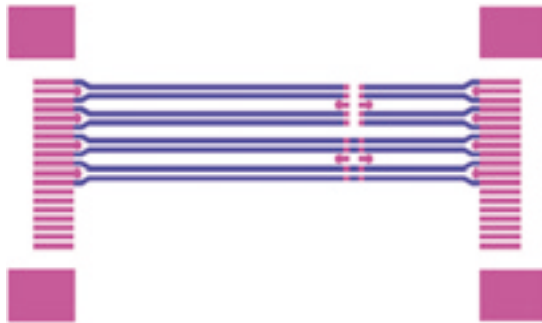
Suppressor TDR data for HDMI



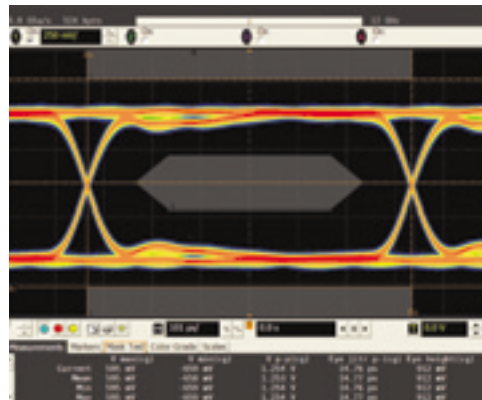
Suppressor Eye Pattern data for HDMI



HDMI Eye Pattern Result(1.4Gbps)



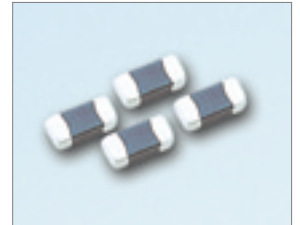
100Ω Differential Impedance  
Max 109Ω, Min 96Ω



HDMI Eye Pattern Result(2.25Gbps)

### Overview

AMO-CAP is an enhanced ESD protection device with low capacitance. This product uses metal-oxide material which has low dielectric constant and high over-current endurance. Using this product ESD protect, devices maintain signal integrity of high speed data line while protecting the circuit from ESD. Thus, this product is suitable for high speed data line and RF part.



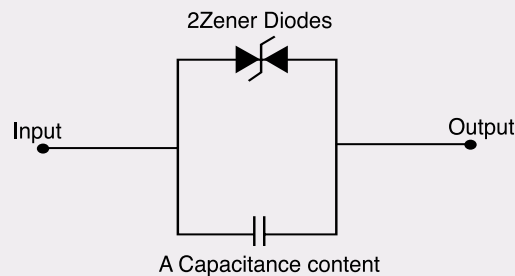
### Features

- Multilayer laminated structure
- Ultra low capacitance ideal for high speed data applications.
- High reliability over multi surge
- Forward & Reverse (+, -) direction property
- Low leakage current and inductance
- Easy to control electric capacity
- Excellent reliability against ESD

### Application

- This surface mount package protects mobile communications, computers, data processing, test equipment, and many other electronic applications from ESD.
- RF system
- Mobile Phone / PDAs
- ESD Protection for RF Transceiver
- SAW filter
- Wireless Handsets
- Diode switch

### Equivalent Circuit



### Ordering Information

AD   UC   10   S   02   1R1  
 ①   ②   ③   ④   ⑤   ⑥

① **Product group**

**AD** : Advance metal oxide diode (New varistor material)

② **Capacitance group :**

**UC** : ~ 10 pF, **LC** : 10 ~ 100 pF, **MC** : 200 pF ~

③ **Working voltage :** **5** : 5.5 V, **10** : 10 V, **30** : 30 V, **40** : 40 V

④ **Vn tolerance :** **S** : Special order **M** : 20 % tolerance

⑤ **Chip Size :** **02** : 1.0 × 0.5 mm, **03** : 1.6 × 0.8 mm

⑥ **Typical Capacitance :**

**1R1** : 1.1pF, **3R3** : 3.3 pF, **010** : 10 pF, **200** : 200 pF

### Electrical Characteristics

Part No.	Working Voltage Vdc <sup>(1)</sup>	Breakdown Voltage (Vn) @ 1mA dc	Typical Capacitance (Cp) @ 1MHz, 0.5Vrms	Leakage Current (IL) @Vdc	Insulation Resistance (IR) @ 3.6 Vdc
unit	(V)	(V)	(pF)	( $\mu$ A)	( $\Psi$ )

#### 0402 (1005) size

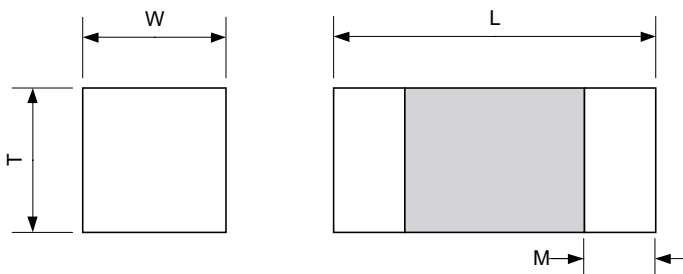
ADUC 10S 02 0R5	10 max.	95 (75~115)	0.5 (0.3~0.7)	20 max.	10 min.
ADUC 10S 02 1R1	10 max.	85 (65~105)	1.1 (0.8~1.4)	20 max.	10 min.
ADUC 10S 02 1R5	10 max.	50 (30~70)	1.5 (1.0~1.9)	20 max.	10 min.
ADUC 10S 02 3R3	10 max.	30 (21~39)	3.3 (2.3~4.3)	20 max.	10 min.
ADUC 10S 02 005	10 max.	20 (14~26)	5.0 (3.5~6.5)	20 max.	10 min.
ADUC 10S 02 010	10 max.	20 (14~26)	10.0 (7.0~13.0)	20 max.	10 min.

#### 0603 (1608) size

ADUC 10S 03 1R1	10 max.	85 (65~105)	1.1 (0.8~1.4)	20 max.	10 min.
ADUC 10S 03 1R5	10 max.	50 (30~70)	1.5 (1.0~1.9)	20 max.	10 min.
ADUC 10S 03 3R3	10 max.	30 (21~39)	3.3 (2.3~4.3)	20 max.	10 min.
ADUC 10S 03 005	10 max.	20 (14~26)	5.0 (3.5~6.5)	20 max.	10 min.
ADUC 10S 03 010	10 max.	20 (14~26)	10 (7~13)	20 max.	10 min.
ADUC 30S 03 010	30 max.	50 min	10 (7~13)	10 max.	10 min.
ADMC 5M 03 200	5.5 max.	6.4 min	200 typ.	10 @ 3.3V	10 min.
ADMC 5S 03 200	5.5 max.	12 (8.4~15.6)	200 typ.	10 max.	10 min.

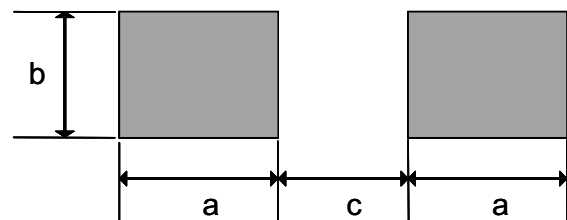
(1) Maximum continuous DC working voltage

### Dimension Specification



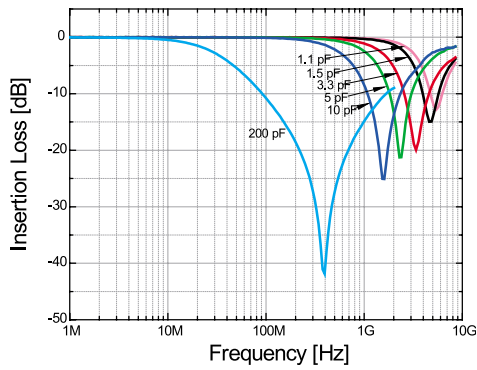
Type	L	W	T	M
0402 (1005)	1.0 ± 0.1	0.5 ± 0.1	Max. 0.6	0.2 ± 0.1
0603 (1608)	1.6 ± 0.15	0.8 ± 0.15	Max. 0.9	0.35 ± 0.15

### Solder Pad Layout

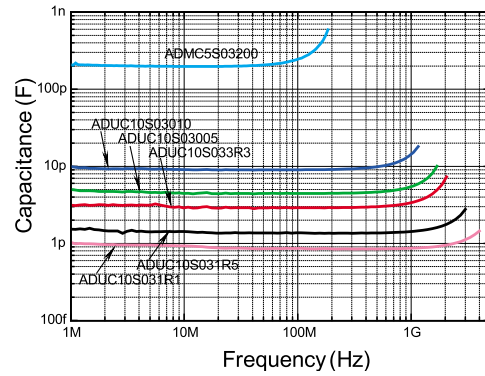


Type	a	b	c
0402 (1005)	0.61	0.51	0.51
0603 (1608)	0.9	0.8	0.8

### Frequency Response

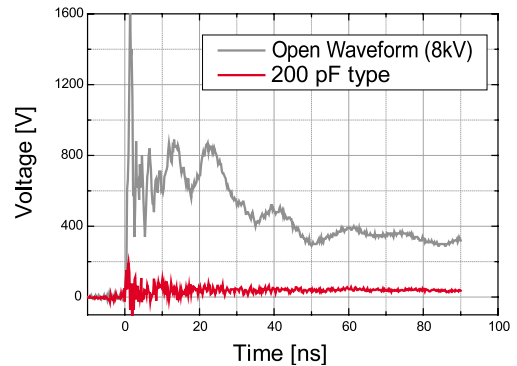
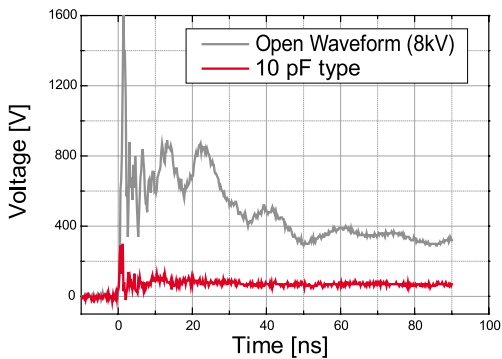
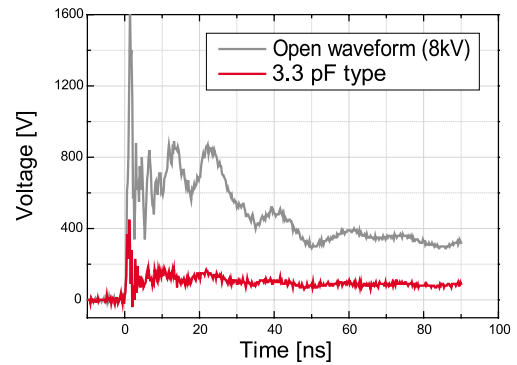
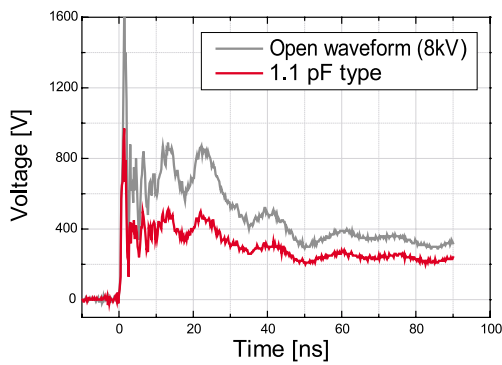
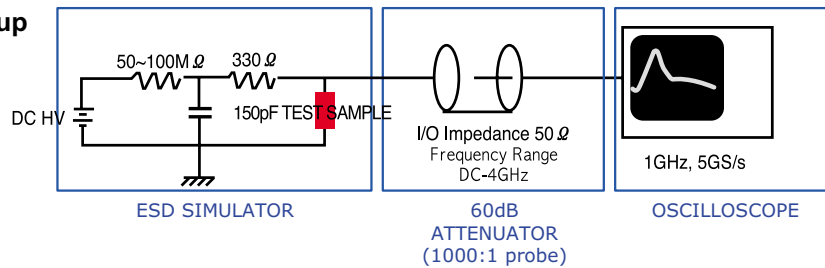


### Capacitance vs Frequency characteristics



### ESD Attenuation Data

#### - Test Setup



SF, SR Series (0402) / Newly Upgraded ESD Solution Series

AVLC Series (0201) / Compact size & Chip Varistor

AVL, AVLC Series / High Power, General Varistor

AVNC Series (0603, 0805) (4-element) / General Array

AVSC Series (0504, 0805) (4-element) / Compact Array (Space Saved)

Advanced Material On **TECH**nology

# GENERAL ESD SOLUTION



# SR/SF Series

# AMO-Diode

## SINGLE RESISTOR TYPE & SINGLE FEED-THRU TYPE

### Overview

This product is AMO Diode with more enhanced ESD suppression function than general chip varistor. Its main application fields are various key button-navigation key, side key and key pads and audio part-speaker, receiver, microphone and ear jack. Moreover it shows wide band noise reduction performance.



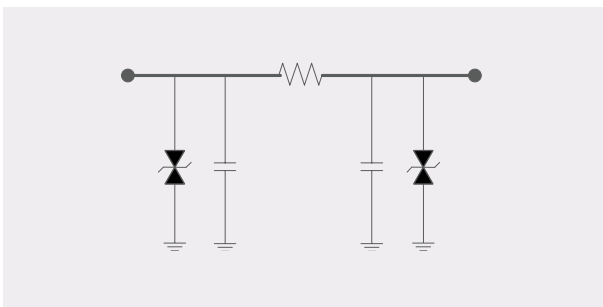
### Features

- Three terminal structure (in, out, 2 GND)
- 0402(1005 mm) size
- IEC 61000-4-2(ESD) Level #4
- Multilayer laminated structure
- Superior ESD performance
- No direction

### Application

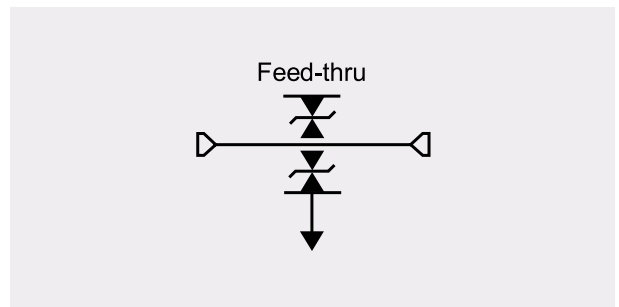
- Protection for ESD coming into key button, Audio part, etc.,
- Possible to apply variously for elimination of high frequency noise and protection of ESD.

### SR Equivalent Circuit



Single SR type

### SF Equivalent Circuit



Single SF type

### Ordering Information

**SR** **5** **S** **02** **050** **100R**  
① ② ③ ④ ⑤ ⑥

① **Product group**

**SR** : Single Resistor Type **SF** : Single Feed - Thru Type

② **Working Voltage :**

**5** : 5.5V **10** : 10V **30** : 30V **40** : 40V

③ **Vn tolerance :** **S** : Special order **M** : 20 % tolerance

④ **Chip Size :** **02** : 1.0 x 0.5 mm, **03** : 1.6 x 0.8 mm

⑤ **Typical Capacitance :**

**010** : 10pF, **020** : 20 pF, **030** : 30 pF, **050** : 50 pF

⑥ **Typical Resistance :**

**010R** : 10Ω, **050R** : 50Ω, **100R** : 100Ω

### Electrical Characteristics

Part No.	Working Voltage (Vdc)	Breakdown Voltage (Vn) @ 1mA dc	Series resistance between I/O(Rdc)	Rdc tolerance	Capacitance (Cp) @ 1MHz, 0.5Vrms	Capacitance tolerance	Insulation resistance (IR) @3.6 V DC
	(V)	(V)	( $\Omega$ )	(%)	(pF)	(%)	(M $\Omega$ )

#### SR Series 0402(1005) size

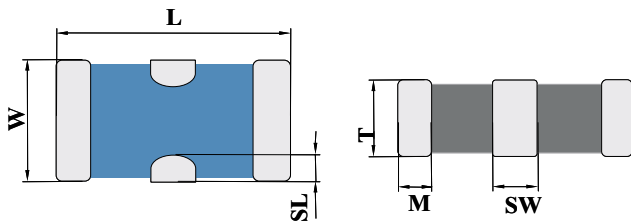
SR 5S 02 010 010R	5.5	14 ± 4	10	± 30	5+5	± 30	> 10
SR 5S 02 010 050R	5.5	14 ± 4	50	± 30	5+5	± 30	> 10
SR 5S 02 010 100R	5.5	14 ± 4	100	± 30	5+5	± 30	> 10
SR 5S 02 020 100R	5.5	14 ± 4	100	± 30	10+10	± 30	> 10
SR 5S 02 030 010R	5.5	14 ± 4	10	± 30	15+15	± 30	> 10
SR 5S 02 030 050R	5.5	14 ± 4	50	± 30	15+15	± 30	> 10
SR 5S 02 050 050R	5.5	14 ± 4	50	± 30	25+25	± 30	> 10
SR 5S 02 050 100R	5.5	14 ± 4	100	± 30	25+25	± 30	> 10

#### SF Series 0402(1005) size

SF 5S 02 010	5.5	14 ± 4			10	± 30	> 10
SF 5S 02 030	5.5	14 ± 4			30	± 30	> 10
SF 5S 02 050	5.5	14 ± 4			50	± 30	> 10
SF 5S 02 100	5.5	14 ± 4			100	± 30	> 10

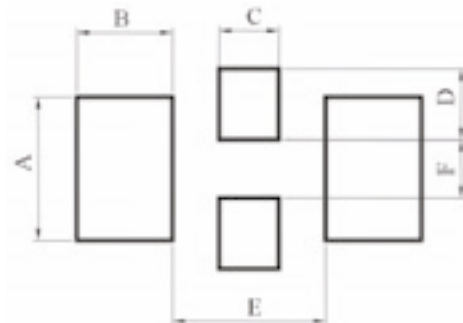
(1) Maximum continuous DC working voltage

### Dimension Specification



Symbol	L	W	T	M	SW	SL
0402 (1005)	1.0 ± 0.05	0.5 ± 0.05	0.30 ± 0.05	0.15 ± 0.03	0.2 ± 0.05	0.2 ± 0.05

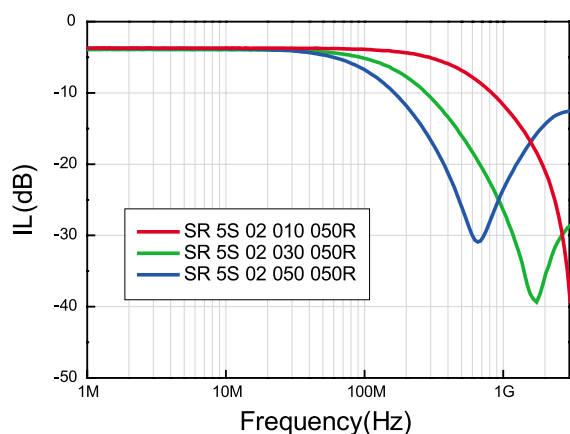
### Solder Pad Layout



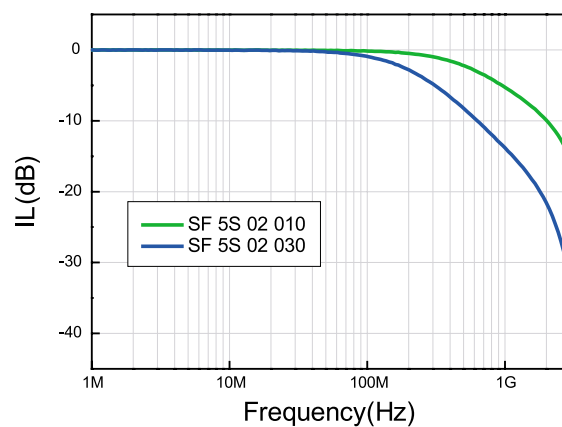
Symbol	A	B	C	D	E	F
0402 (1005)	0.6	0.4	0.25	0.3	0.64	0.24



### SR Frequency Response

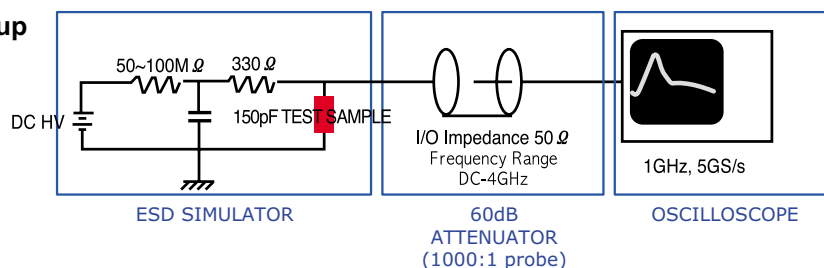


### SF Frequency Response

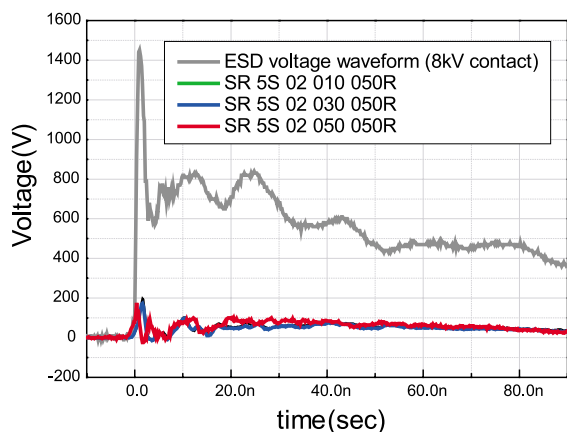


### ESD Attenuation Data

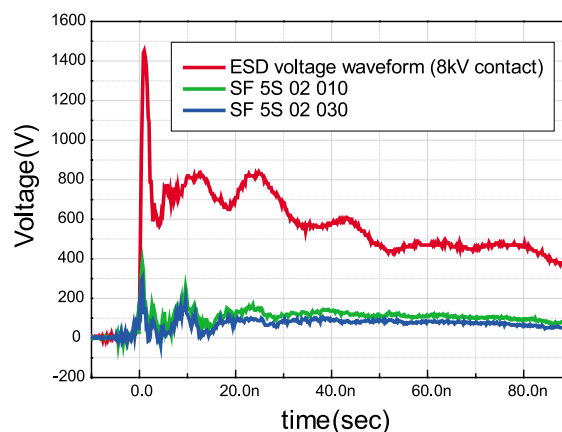
#### - Test Setup



### SR ESD Attenuation Characteristics



### SF ESD Attenuation Characteristics



# AVLC(0201) Series

# Compact Varistor

COMPACT SIZE LOW CAPACITANCE

## Overview

This Varistor is a component which acts as a non-conductor on the circuit in normal circumstances. When over-voltage is loaded, it becomes a conductor which diverts over-current from circuits to ground at critical voltage level. Especially, new ultra compact size chip varistor with 0.6 × 0.3 mm dimension can save design space in mobile phone and show even enhanced ESD performance.



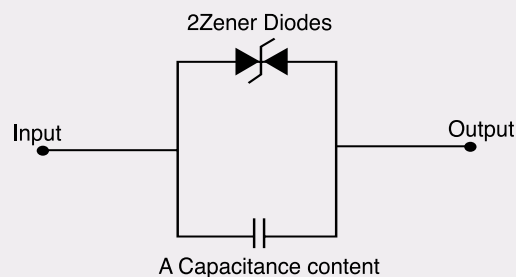
## Features

- 0201 : 0.6 × 0.3 mm
- Meets IEC 61000-4-2 (ESD) level 4 requirements
- ESD protection > 30 kV
- Fast response time < 1 ns

## Application

- All electronic appliances which need ESD protection.
  - LCD Module
  - Mobile Phone / PDAs
  - MP3 Player
  - Digital Camera
  - ESD Protection for sensitive IC
  - I/O Port, Keypad
  - Wireless Handsets
  - Lap top computer
  - Desk top computer
  - Notebook

## Equivalent Circuit



## Ordering Information

**AVLC** **5** **S** **01** **015**

①      ②      ③      ④      ⑤

① **Series name**

**AVLC** : Low Capacitance single varistor

② **Working voltage** : **5** : 5.5 V   **10** : 10 V

③ **Vn tolerance** : **K** : ± 10 %   **L** : ± 20 %  
**S** : Special order

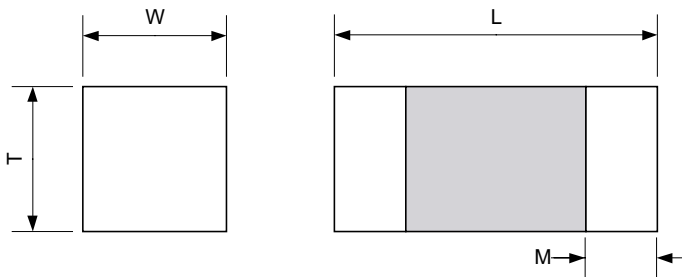
④ **Chip Size** : **01** : 0.6 × 0.3 mm

⑤ **Typical Capacitance** : **005** : 5 pF  
**015** : 15 pF   **030** : 30 pF   **100** : 100 pF

### Electrical Characteristics

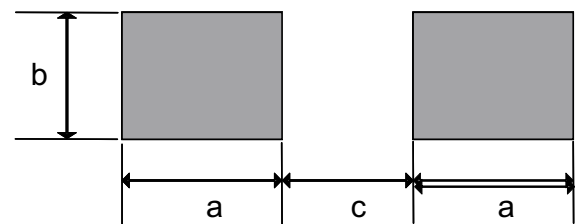
Part No.	Working Voltage (Vdc)	Breakdown Voltage (Vn) @ 1mA dc	Typical Capacitance (Cp) @ 1kHz, 0.5Vrms	Leakage Current (IL) @Vdc	Insulation Resistance (IR) @ 3.6 Vdc
unit	(V)	(V)	(pF)	( $\mu$ A)	( $\Omega$ )
AVLC 10S 01 005	10 max.	25 (18 ~32)	5 (3.5 ~ 6.5)	20 max.	10 min.
AVLC 5S 01 015	5.5 max.	12.8 (10 ~15.6)	15 (10.5 ~ 19.5)	50 max.	10 min.
AVLC 5S 01 033	5.5 max.	12.8 (10 ~15.6)	33 (23.1 ~ 42.9)	50 max.	10 min.
AVLC 5S 01 050	5.5 max.	12.8 (10 ~15.6)	50 (35.0 ~ 65.0)	50 max.	10 min.
AVLC 5S 01 100	5.5 max.	12.8 (10 ~15.6)	100 (70.0 ~ 130)	50 max.	10 min.

### Dimension Specification



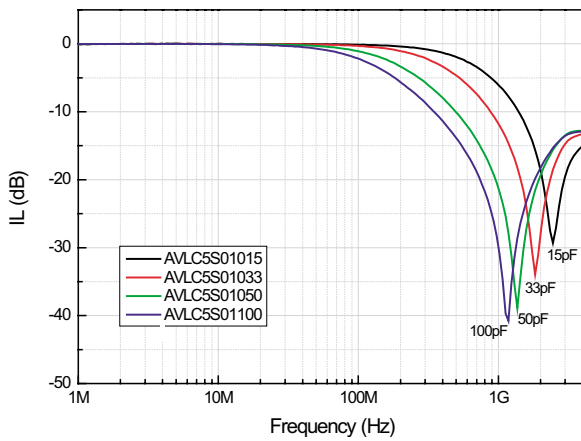
Type	L	W	T	M
0201(0603)mm	0.60 $\pm$ 0.03	0.30 $\pm$ 0.03	0.30 $\pm$ 0.03	Min. 0.1

### Solder Pad Layout

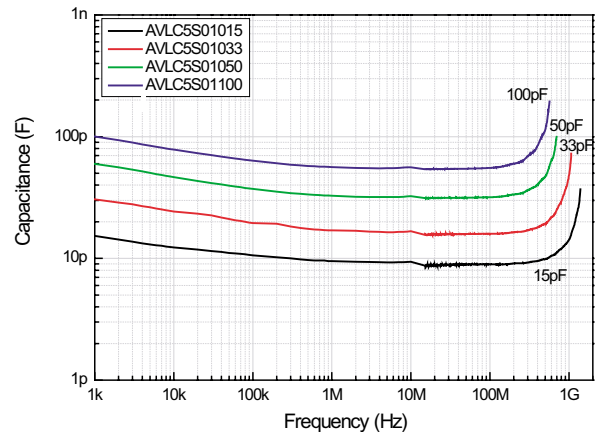


Type	A	B	C
0201(0603)mm	0.2~0.3	0.25~0.3	0.25~0.35

### Frequency Response

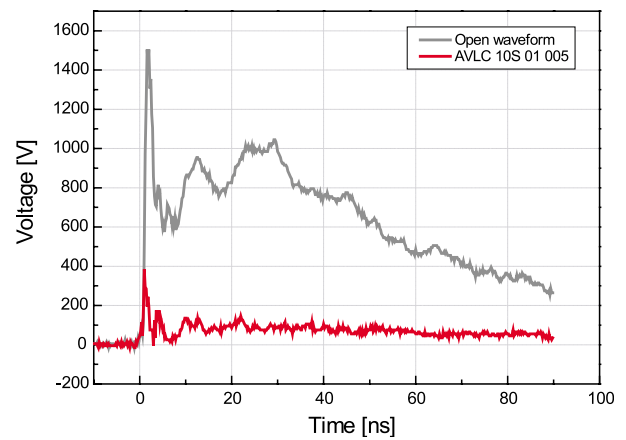
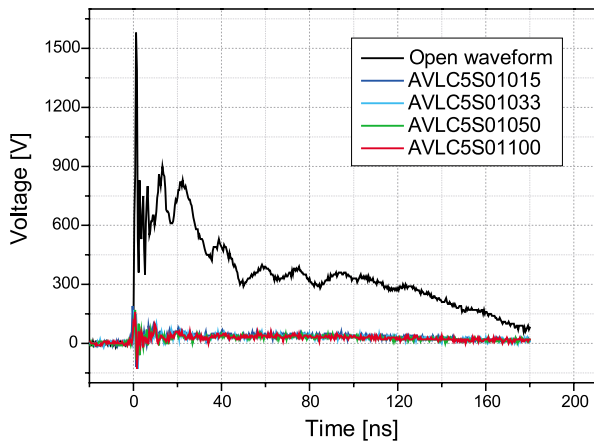
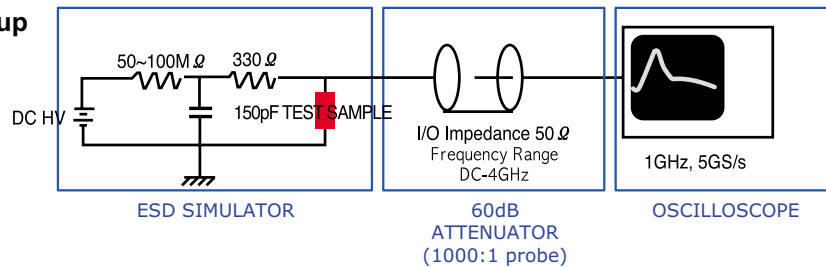


### Frequency Response



### ESD Attenuation Data

#### - Test Setup



### Overview

This Varistor is a component which acts as a non-conductor on the circuit in normal circumstances. When over-voltage is loaded, it becomes a con-ductor which diverts over-current from circuits to ground at critical voltage level.



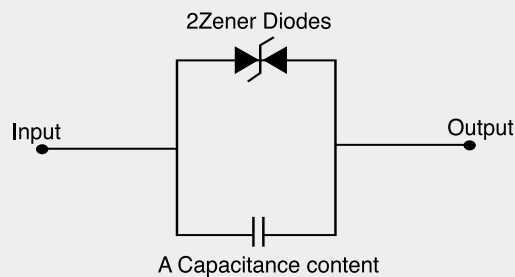
### Features

- Multilayer construction technology
- Meets IEC 61000-4-2 (ESD), Level 4 requirements
- ESD protection > 30 kV
- Bidirectional clamping and low clamping voltage
- -55°... to + 125°... operating temperature range
- Fast response time < 1 ns

### Application

- Mobile Phone / PDAs
- Digital Camera
- ESD Protection for sensitive IC devices
- I/O Port, Keypad for portable devices
- Lap top computer
- Desk top computer
- DVD
- MP3 Player
- Wireless Handsets
- Digital TV
- HDD

### Equivalent Circuit



### Ordering Information

**AVL**   **5**   **M**   **02**   **200**  
 ①   ②   ③   ④   ⑤

① **Series name**

**AVL** : Standard Single varistor

**AVLC** : Low Capacitance single varistor

② **Working Voltage** : **5** : 5.5 V   **14** : 14 V   **18** : 18 V

③ **Vn tolerance** : **S** : Special order   **M** : 20 % tolerance

④ **Chip Size** : **02** : 0402inch (1.0 × 0.5 mm)

**03** : 0603inch (1.6 × 0.8 mm)

⑤ **Typical Capacitance** : **AVL** Peak Current : **200** : 20A

**AVLC** Typical Capacitance : **003** : 3 pF   **015** : 15 pF

**050** : 50 pF   **100** : 100 pF   **200** : 200 pF

# AVL/AVLC Series General Varistor

**HIGH POWER / GENERAL APPLICATION**

## Electrical Characteristics

Part No.	(Vdc) <sup>(1)</sup>	Varistor voltage (Vn) @1mA DC	Leakage Current (IL)@Vdc	Cp (@ 1KHz, Vrms =0.5V)	Clamping Voltage (VC)	Peak Current (Imax)	Transient Energy (Wmax)	Insulation Resistance (IR) @3.6V
	(V)	(V)	( $\mu$ A)	(pF)	(V)	(A)	(J)	(M $\Omega$ )

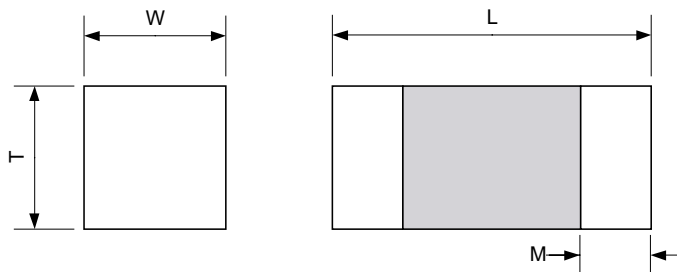
### 0402 (1005) size

AVL 5M 02 200	5.5	8 (6.4~9.6)	Max. 20	480 (336~624)	Max. 15.5	Min. 20	Min. 0.05	Min. 10
AVL 14K 02 200	14	18 (16.2~19.8)	Max. 20	160 (112~208)	Max. 35	Min. 20	Min. 0.05	Min. 10
AVLC 5S 02 050	5.5	12 (10 ~ 14)	Max. 20	50 (35 ~ 65)	Max. 25	Min. 10	Min. 0.03	Min. 10
AVLC 5S 02 100	5.5	12 (10 ~ 14)	Max. 20	100 (70 ~ 130)	Max. 25	Min. 10	Min. 0.05	Min. 10
AVLC 5S 02 200	5.5	12 (10 ~ 14)	Max. 20	200 (140 ~ 260)	Max. 25	Min. 10	Min. 0.05	Min. 10
AVLC 14S 02 050	14	21 (18 ~ 24)	Max. 20	50 (35 ~ 65)	Max. 40	Min. 10	Min. 0.03	Min. 10
AVLC 14S 02 100	14	21 (18 ~ 24)	Max. 20	100 (70 ~ 130)	Max. 40	Min. 20	Min. 0.05	Min. 10
AVLC 15S 02 036	15	27 (21.6~32.4)	Max. 20	33 (23.1~42.9)	Max. 40	Min. 10	Min. 0.03	Min. 10
AVLC 18S 02 003	18	125 (90 ~ 160)	Max. 20	@ 1MHz	Max. 300	Min. 1	Min. 0.005	Min. 10
AVLC 18S 02 015	18	28 (24 ~32)	Max. 20	15 (10.5 ~ 19.5)	Max. 45	Min. 10	Min. 0.005	Min. 10

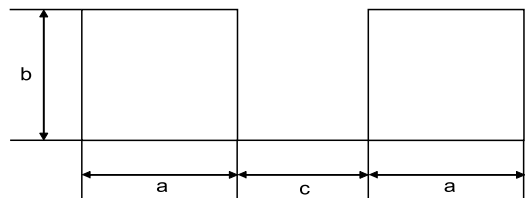
### 0603 (1608) size

AVL 5M 03 300	5.5	8 (6.4 ~ 9.6)	Max. 20	800 (560 ~ 1040)	Max. 15	Min. 30	Min. 0.1	Min. 10
AVL 14K 03 300	14	18 (16.2 ~ 19.8)	Max. 20	350 (245 ~ 455)	Max. 35	Min. 30	Min. 0.1	Min. 10
AVL 18S 03 300 LC75	18	28 (24~32)	Max. 20	75 (52.5 ~ 97.5)	Max. 40	Min. 30	Min. 0.05	Min. 10
AVL 18S 03 300 LC120	18	28 (24~32)	Max. 20	120 (84 ~ 156)	Max. 40	Min. 30	Min. 0.05	Min. 10

## Dimension Specification



## Solder Pad Layout



Size(mm)	L	W	T	M
0402 (1005)	1.0 $\pm$ 0.10	0.5 $\pm$ 0.10	Max. 0.6	0.25 $\pm$ 0.15
0603 (1608)	1.6 $\pm$ 0.15	0.8 $\pm$ 0.15	Max. 0.9	0.35 $\pm$ 0.15

Size(mm)	A	B	C
0402 (1005)	0.61	0.51	0.51
0603 (1608)	0.9	0.8	0.8

### Overview

Varistor is a component which acts as a nonconductor on the circuit in normal circumstances. When overvoltage is loaded, it becomes a conductor which diverts overcurrent from circuits to ground at critical voltage level.



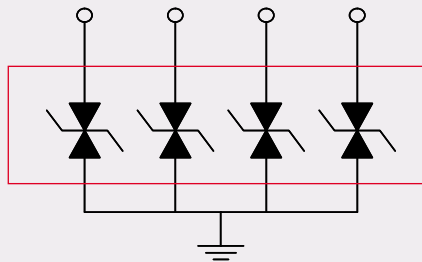
### Features

- Multilayer laminated structure
- Ultra low capacitance (0.5pF typ.) ideal for high speed data applications.
- High reliability over multi surge
- Forward & Reverse (+, -) direction property
- Low leakage current and inductance
- Easy to control electric capacity
- Excellent reliability against ESD

### Application

- The low impedance surface mount package
- LCD Module
- I/O Port Application
- Cellular Phone
- PCMCIA / Compact Flash Card
- RS-232 & RS-423 Data Lines
- DSP Products

### Equivalent Circuit



### Ordering Information

**AVNC** **18** **S** **03** **Q** **015**

①      ②      ③      ④      ⑤      ⑥

① **Series name**

**AVNC** : General type Chip Array Varistor

② **Maximum continuous working voltage (Vdc) :**

**5** : 5.5V **14** : 14V **18** : 18V

③ **Vn tolerance : S** : Special order

④ **Chip dimension : 03** : 0603 (1.60 × 0.80 mm)

**05** : 0805 (2.00 × 1.20 mm)

⑤ **Configuration : Q** : 4 elements

⑥ **Capacitance : 015** : 15 pF

**050** : 50 pF

## MULTILAYER CHIP ARRAY VARISTOR

### Electrical Characteristics

Part No.	(Vdc) <sup>(1)</sup>	Varistor voltage (Vn) @1mA DC	Cp (@ 1kHz, Vrms=0.5V)	Clamping Voltage (VC)	Peak Current (Imax)	Transient Energy	Insulation Resistance (IR) @3.6V
	(V)	(V)	(pF)	(V)	(A)	(J)	(MΩ)

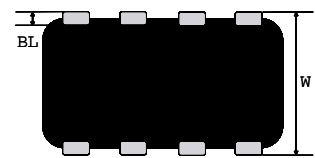
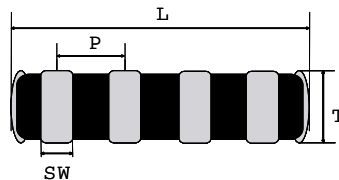
#### 0603(1608mm)Size

AVNC 18S 03Q 015	18 max.	28 (24 ~ 32)	15 (10.5 ~ 19.5)	65	5	0.005	Min. 10
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#### 0805(2012mm)Size

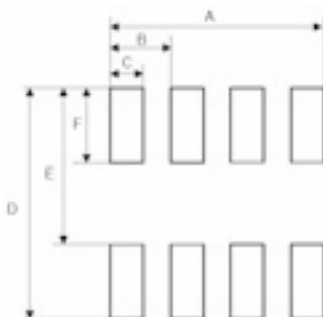
AVNC 5S 05Q 050	5.5 max.	12 (10 ~ 14)	50	25	10	0.03	Min. 10
AVNC 14S 05Q 050	14 max.	21 (18 ~ 24)	50	40	10	0.03	Min. 10
AVNC 18S 05Q 050	18 max.	28 (24 ~ 32)	50	65	5	0.03	Min. 10
AVNC 18S 05Q 015	18 max.	28 (24 ~ 32)	15	65	5	0.005	Min. 10

### Dimension Specification



Item	L	W	T	BW	BL	P
0603 (1608) mm	1.60 ± 0.10	0.80 ± 0.10	0.44 ± 0.05	0.20 ± 0.05	0.15 ± 0.05	0.400 ± 0.05
0805 (2012) mm	2.05 ± 0.10	1.25 ± 0.10	0.55 ± 0.10	0.25 ± 0.10	0.25 ± 0.10	0.50 ± 0.10

### Solder Pad Layout



Item	A	B	C	D	E	F
0603 (1608) mm	1.4	0.4	0.2	1.20	0.8	0.4
0805 (2012) mm	1.81	0.51	0.28	1.91	1.27	0.64



### Overview

Varistor is a component which acts as a nonconductor on the circuit in normal circumstances. When overvoltage is loaded, it becomes a conductor which diverts overcurrent from circuits to ground at critical voltage level.



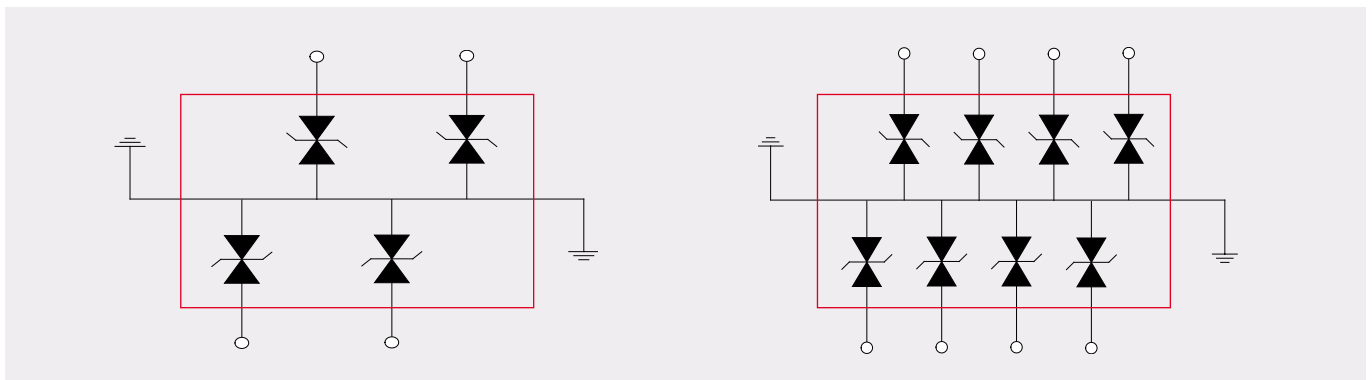
### Features

- 0504 (1409 mm) size - 4 elements in one chip
- 0805 (2012 mm) size - 8 elements in one chip
- ESD protection > 30 kV
- Fast response time < 1 ns

### Application

- LCD Module
- MP3 Player
- ESD Protection for sensitive IC
- Lap top computer
- I/O Port, Keypad for portable devices
- Mobile Phone / PDAs
- Digital Camera
- Wireless Handsets
- Desk top computer

### Equivalent Circuit



### Ordering Information

**AVSC** **5** **S** **04** **F** **050**

①      ②      ③      ④      ⑤      ⑥

- |   |   |
|---|---|
| <p>① <b>Series name</b><br/>AVSC : Compact Array Varistor</p> <p>② <b>Maximum continuous working voltage (Vdc) :</b><br/>5 : 5.5V 14 : 14V 18 : 18V</p> <p>③ <b>Vn tolerance : S:</b> Special order</p> | <p>④ <b>Chip dimension :</b> 04 : 0504 (1.4 × 0.9 mm)<br/>05 : 0805 (2.0 × 1.2 mm)</p> <p>⑤ <b>Configuration :</b> F : Four array E : Eight array</p> <p>⑥ <b>Capacitance :</b> 007 : 07 pF typical 015 : 15 pF typical<br/>025 : 25 pF typical 050 : 50 pF typical</p> |
|---|---|

### Electrical Characteristics

Part No.	Max. cont. Vdc <sup>(1)</sup>	Varistor voltage (Vn)	Response time	Cp (@ 1MHz)	Cp toleranc	IR
Unit	(V)	(V)	(nS)	(pF)	(%)	(Ω)

#### 0504 (1409mm) Size

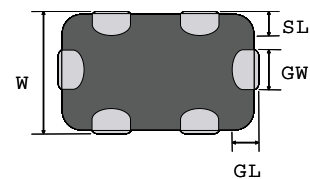
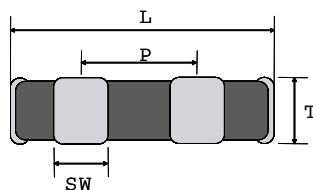
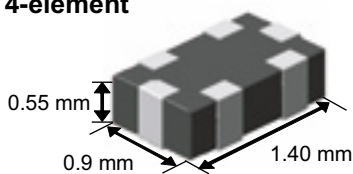
AVSC 18S 04F 007	18	30 (24~36)	<1	7	± 30	Min. 10
AVSC 14S 04F 015	14	23 (18~28)	<1	15	± 30	Min. 10
AVSC 5S 04F 025	5.5	14 (10~18)	<1	25	± 30	Min. 10
AVSC 5S 04F 050	5.5	10 (10~18)	<1	50	± 30	Min. 10

#### 0805 (2012mm) Size

AVSC 18S 05E 007	18	30 (24~36)	<1	7	± 30	Min. 10
AVSC 14S 05E 015	14	23 (18~28)	<1	15	± 30	Min. 10
AVSC 5S 05E 025	5.5	14 (10~18)	<1	25	± 30	Min. 10
AVSC 5S 05E 050	5.5	10 (10~18)	<1	50	± 30	Min. 10

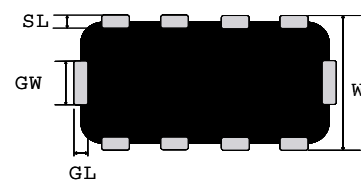
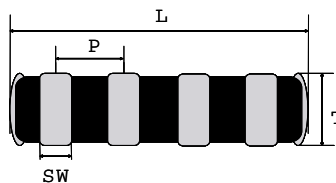
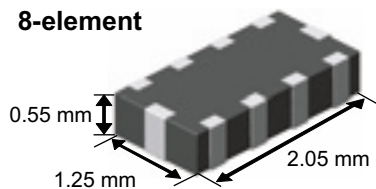
### Dimension Specification

#### 4-element



Item	L	W	T	GL	GW	SL	SW	P
0504(1409) mm	1.40±0.10	0.90±0.0	0.55±0.15	0.25±0.10	0.30±0.05	0.25±0.10	0.30±0.05	0.64±0.05

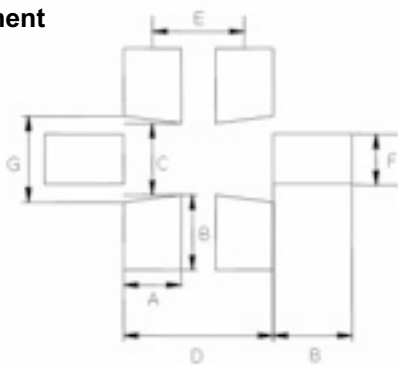
#### 8-element



Item	L	W	T	GL	GW	SL	SW	P
0805(2012) mm	2.05±0.10	1.25±0.10	0.55±0.10	0.25±0.10	0.30±0.10	0.25±0.10	0.25±0.10	0.50±0.10

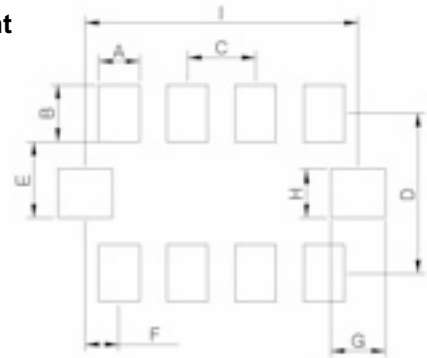
### Solder Pad Layout

4-element



Size(mm)	A	B	C	D	E	F	G
0504(1409)	0.35	0.5	0.5	1.04	0.64	0.35	0.65

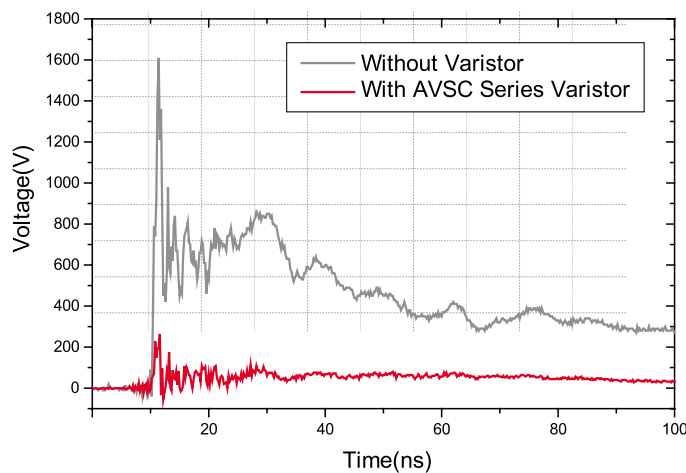
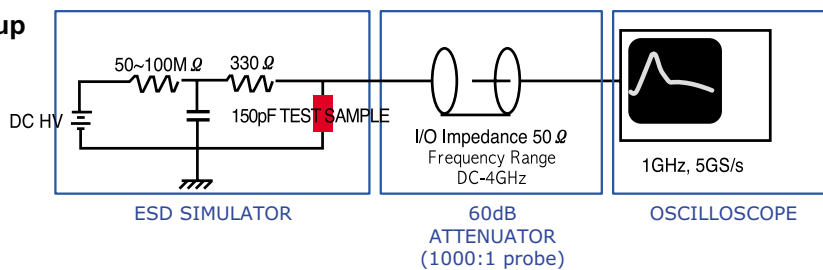
8-element



Size(mm)	A	B	C	D	E	F	G	H	I
0805(2012)	0.3	0.42	0.5	1.17	0.55	0.25	0.4	0.35	2

### ESD Attenuation Data

- Test Setup





Advanced **M**aterial **O**n **T**ECHnology

# EMI/ESD SOLUTION

AMLV 0603 (4-element) / L-C Type EMI-ESD Filter

AVRC Series (0603, 0805) (4-element) / R-C Type

AVRC Series (0504) (2-element) / R-C Type

AVFC Series (0603, 0805) (4-element) / Feed-Thru Type

AVFC Series (0504) (2-element) / Feed-Thru Type

# AMLV Series

# EMI/ESD Filter

L-C Type 4 Array

## Overview

This product is a multi-functioned filter for EMI/ESD protection with L-C structure of type "L", and mainly uses it to interrupt EMI noise at the end of camera and LCD, and uses to protect ESD of high voltage. Especially, it shows its excellent reduction characteristics at the 800 ~ 3,000GHz band in the receiving base band of terminal.



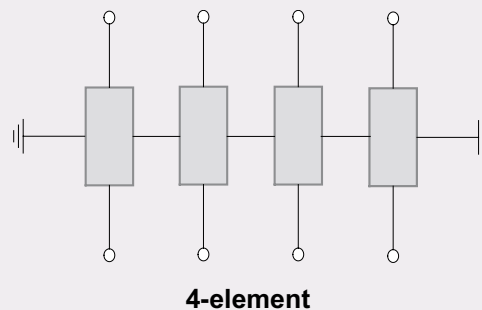
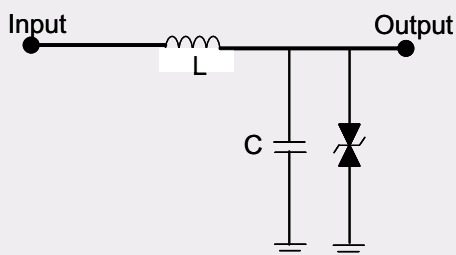
## Features

- L-C type 4 channels array filter
- 0603 size
- IEC 61000-4-2 (ESD) Level #4,
- Multilayer laminated structure

## Application

- Possible to apply variously for elimination of high frequency noise, and protection of ESD.
- Intercept noise generating from control line and data line of LCD & Camera module.
- Interrupt ESD flowing into the LCD and camera module.

## Equivalent Circuit



## Ordering Information

AMLV    14    S    03    Q    022    200F  
①        ②        ③        ④        ⑤        ⑥        ⑦

### ① Product group

AM LV : L-C Type EMI & ESD filter

### ② Working voltage :

5 : 5.5V    14 : 14V    18 : 18V

### ③ Vn tolerance : S : Special order    M : 20 % tolerance

### ④ Chip Size : 03 : 1.6 x 0.8 mm

### ⑤ Configuration : Q : Quad array (4-element)

### ⑥ Typical Capacitance : 022 : 22 pF

### ⑦ Typical cut-off Frequency :

200F : 200MHz

# AMLV Series

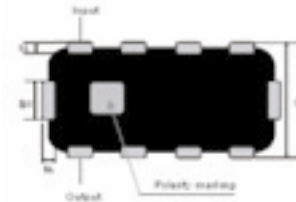
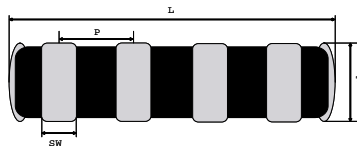
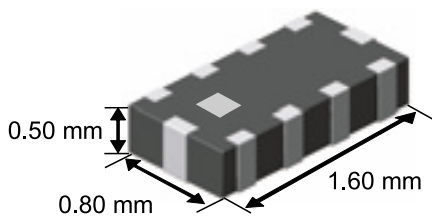
# EMI/ESD Filter

L-C Type 4 Array

## Electrical Characteristics

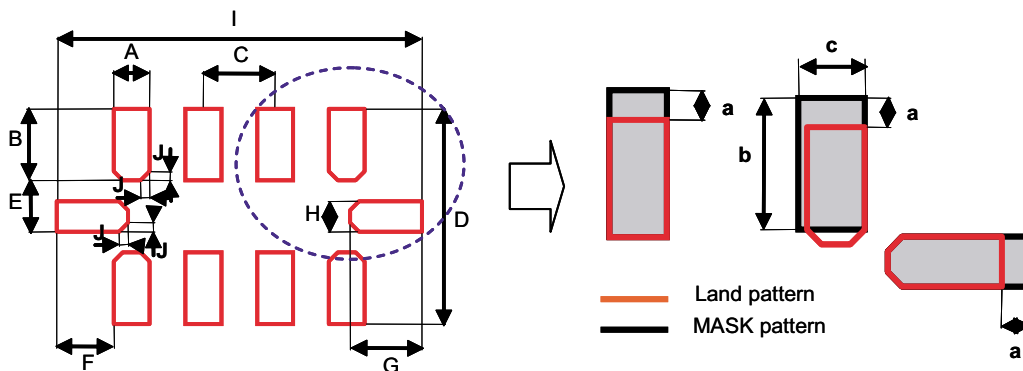
Part No.	(Vdc) <sup>(1)</sup>	Varistor voltage (Vn) @1mA DC	Cp (@ 1MHz, Vrms=0.5V)	Cp tolerance	IR (@3V DC)	Cut-off Frequency (-3dB)	Minimum -20dB ATT. Band
	(V)	(V)	(pF)	(%)	(MΩ)	MHz	MHz
AMLV 14S 03Q 012 300F	14	23±5	12	±30	> 10	300	900~6000
AMLV 14S 03Q 022 200F	14	23±5	22	±30	> 10	200	700~6000

## Dimension Specification



Item	L	W	T	GL	GW	SL	SW	P
Size	1.6±0.1	0.8±0.1	0.5(max.)	0.15±0.05	0.2±0.05	0.15±0.05	0.2±0.05	0.4±0.05

## Solder Pad Layout



Item	A	B	C	D	E	F	G	H	I	J
Size (mm)	0.2	0.4	0.4	1.2	0.285	0.32	0.4	0.17	2.04	0.05

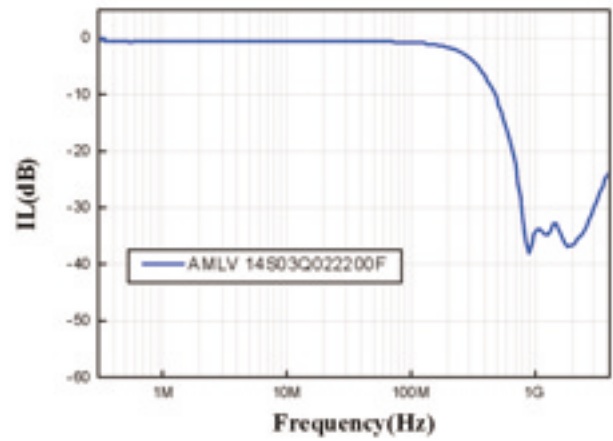
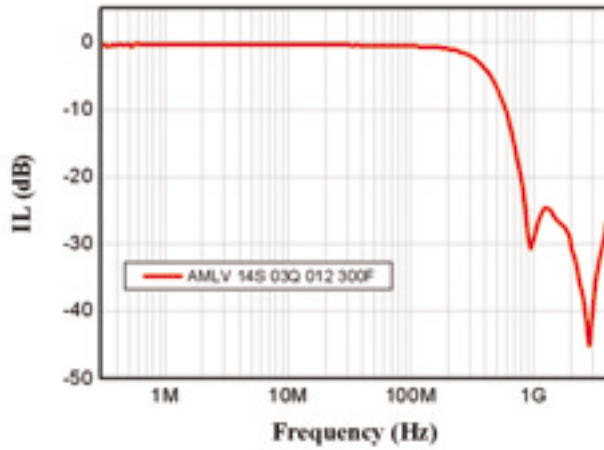
Item	A	B	C
Size (mm)	0.1	0.45	0.23

# AMLV Series

# EMI/ESD Filter

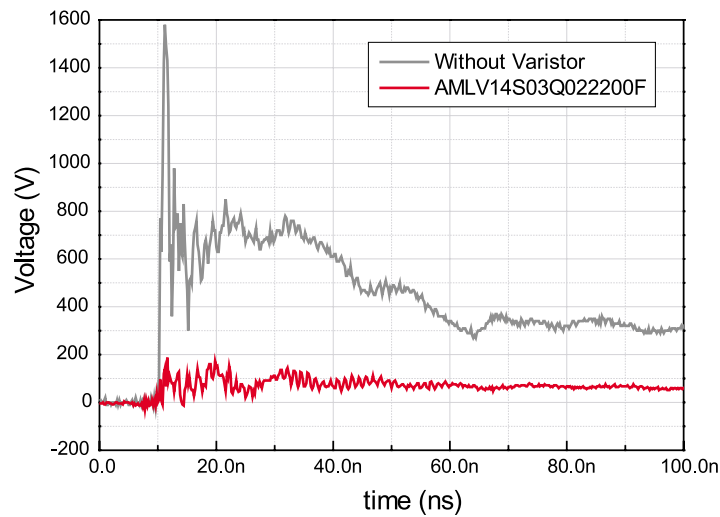
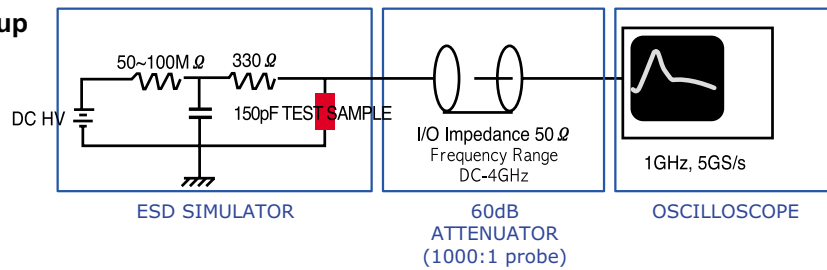
L-C Type 4 Array

## Frequency Response



## ESD Attenuation Data

### - Test Setup



# AVRC Series

# EMI/ESD Filter

R-C Type 4 Array

## Overview

EMI/ESD filter of AMOTECH is an ultra compact sized and multi-functioned filter for EMI/ESD protection with C-R-C structure of type “ $\pi$ ” (pi), and mainly uses it to interrupt EMI noise at the end of camera and LCD, and uses to protect ESD of high voltage. Especially, it shows its excellent reduction characteristics at the 800 ~ 3,000GHz band in the receiving base band of terminal.



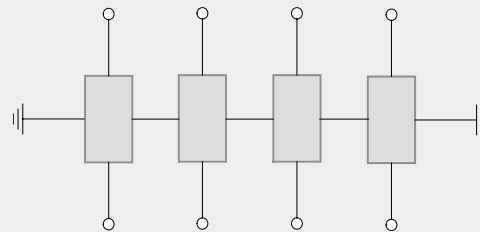
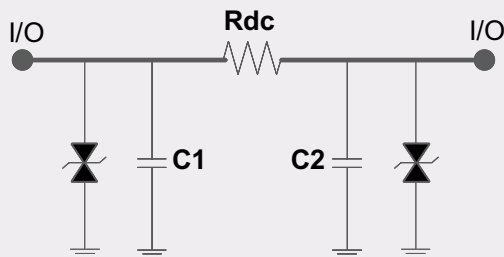
## Features

- RC type four channel array filter
- Meets IEC 61000-4-2 (ESD) level 4 requirements
- MLS level #1
- ESD protection > 30 kV
- Fast response time < 1 ns

## Application

- Electronic appliance for elimination of high frequency noise, and protection on ESD.
  - LCD module
  - Mobile Phone / PDAs
  - MP3 player
  - Digital camera
  - ESD Protection for sensitive IC
- I/O connection
- Camera module
- Wireless Handsets
- Desk top computer
- Notebook

## Equivalent Circuit



4-array type

## Ordering Information

**AVRC**   **14**   **S**   **03**   **Q**   **030**   **050R**  
 ①   ②   ③   ④   ⑤   ⑥   ⑦

① **Series name**

**AVRC** : R-C Type EMI & ESD filter

② **Maximum continuous working voltage (Vdc) :**

5 : 5 V   14 : 14 V   18 : 18 V

③ **Varistor voltage tolerance : S : Special order**

④ **Chip Size : 03 : 0603 (1.6 × 0.8 mm) 05 : 0805 (2.0 × 1.2 mm)**

⑤ **Configuration : Q : Quad array (4 elements)**

⑥ **Capacitance : 015 : 15pF 030 : 30pF 050 : 50pF 100 : 100pF**

⑦ **Series Resistance : 010R : 10 ohm 050R : 50 ohm**

**100R : 100 ohm**



# AVRC Series

# EMI/ESD Filter

R-C Type 4 Array

## Electrical Characteristics

Part No.	(Vdc) <sup>(1)</sup>	Varistor voltage (Vn) @1mA DC	Rdc R series between I/O (2)	Rdc tolerance	Cp (@ 1MHz, Vrms =0.5V) C1+C2	Cp tolerance	IR (@3V DC)	Cut-off Frequency (-3dB)	Minimum -20dB ATT. Band
	(V)	(V)	(Ω)	(%)	(pF)	(%)	(MΩ)	MHz	MHz

### 0603 (1608) size

AVRC 5S 03Q 050 050R	5.5	14±4	50	±30	25+25	±30	> 10	70	600~3000
AVRC 5S 03Q 050 100R	5.5	14±4	100	±30	25+25	±30	> 10	70	450~3000
AVRC 5S 03Q 050 200R	5.5	14±4	200	±30	25+25	±30	> 10	70	350~3000
AVRC 5S 03Q 050 400R	5.5	14±4	400	±30	25+25	±30	> 10	70	300~3000
AVRC 14S 03Q 030 050R	14	23±5	50	±30	15+15	±30	> 10	100	800~3000
AVRC 14S 03Q 030 100R	14	23±5	100	±30	15+15	±30	> 10	100	700~3000
AVRC 14S 03Q 030 200R	14	23±5	200	±30	15+15	±30	> 10	100	650~3000
AVRC 18S 03Q 015 010R	18	30±6	10	±30	7.5+7.5	±30	> 10	350	1700~3000
AVRC 18S 03Q 015 050R	18	30±6	50	±30	7.5+7.5	±30	> 10	350	1500~3000
AVRC 18S 03Q 015 100R	18	30±6	100	±30	7.5+7.5	±30	> 10	350	1100~3000
AVRC 18S 03Q 007 010R	18	40±8	10	±30	3.5+3.5	±30	> 10	850	3500~5000
AVRC 18S 03Q 007 050R	18	40±8	50	±30	3.5+3.5	±30	> 10	850	3100~5000

### 0805 (2012) size

AVRC 5S 05Q 050 050R	5.5	14±4	50	±30	25+25	±30	> 10	100	550~3000
AVRC 5S 05Q 050 100R	5.5	14±4	100	±30	25+25	±30	> 10	100	400~3000
AVRC 5S 05Q 050 200R	5.5	14±4	200	±30	25+25	±30	> 10	80	300~3000
AVRC 5S 05Q 100 100R	5.5	14±4	100	±30	50+50	±30	> 10	45	200~3000
AVRC 14S 05Q 030 050R	14	23±5	50	±30	15+15	±30	> 10	150	750~3000
AVRC 14S 05Q 030 100R	14	23±5	100	±30	15+15	±30	> 10	150	700~3000
AVRC 14S 05Q 030 200R	14	23±5	200	±30	15+15	±30	> 10	120	400~3000
AVRC 18S 05Q 007 050R	18	105±45	50	±30	3.5+3.5	±30	> 10	1000	3000~5000
AVRC 18S 05Q 007 100R	18	105±45	100	±30	3.5+3.5	±30	> 10	1000	2800~5000
AVRC 18S 05Q 015 010R	18	30±6	10	±30	7.5+7.5	±30	> 10	700	1900~5000
AVRC 18S 05Q 015 050R	18	30±6	50	±30	7.5+7.5	±30	> 10	450	1500~3000
AVRC 18S 05Q 015 100R	18	30±6	100	±30	7.5+7.5	±30	> 10	400	1100~3000

(1) Maximum continuous DC working voltage

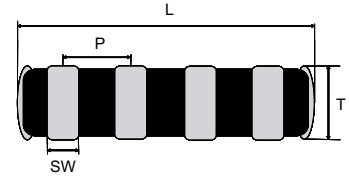
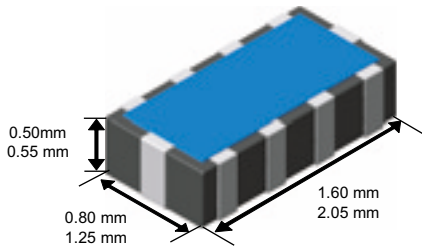
(2) Series resistance between input and output

# AVRC Series

# EMI/ESD Filter

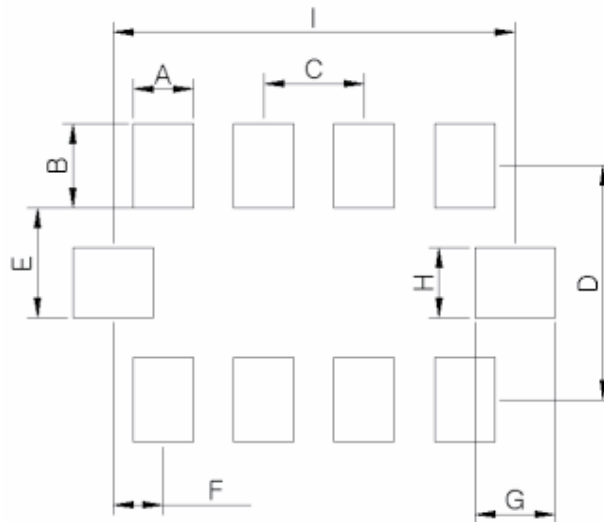
R-C Type 4 Array

## Dimension Specification



Symbol	L	W	T	GL	GW	SL	SW	P
<b>0603</b> <b>(1608) size</b>	1.60±0.10	0.80±0.10	0.50 max	0.15±0.05	0.20±0.05	0.15±0.05	0.20±0.05	0.40±0.05
<b>0805</b> <b>(2012) size</b>	2.05±0.10	1.25±0.10	0.55±0.10	0.25±0.10	0.30±0.10	0.25±0.10	0.25±0.10	0.50±0.10

## Solder Pad Layout



Symbol	A	B	C	D	E	F	G	H	I
<b>0603(1608)size</b>	0.2	0.4	0.4	1.2	0.285	0.32	0.4	0.17	2.04
<b>0805(2012)size</b>	0.3	0.42	0.5	1.17	0.55	0.25	0.4	0.35	2

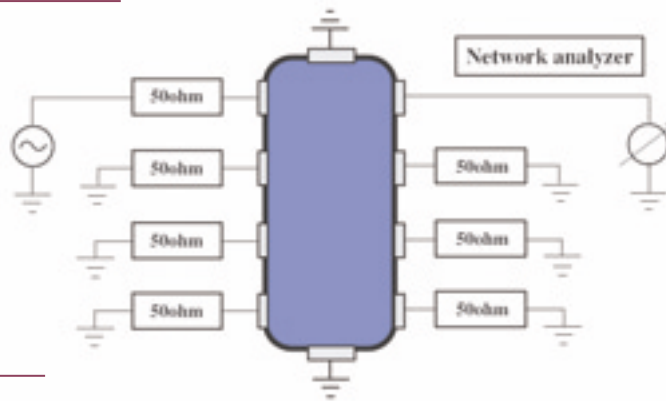
# AVRC Series

# EMI/ESD Filter

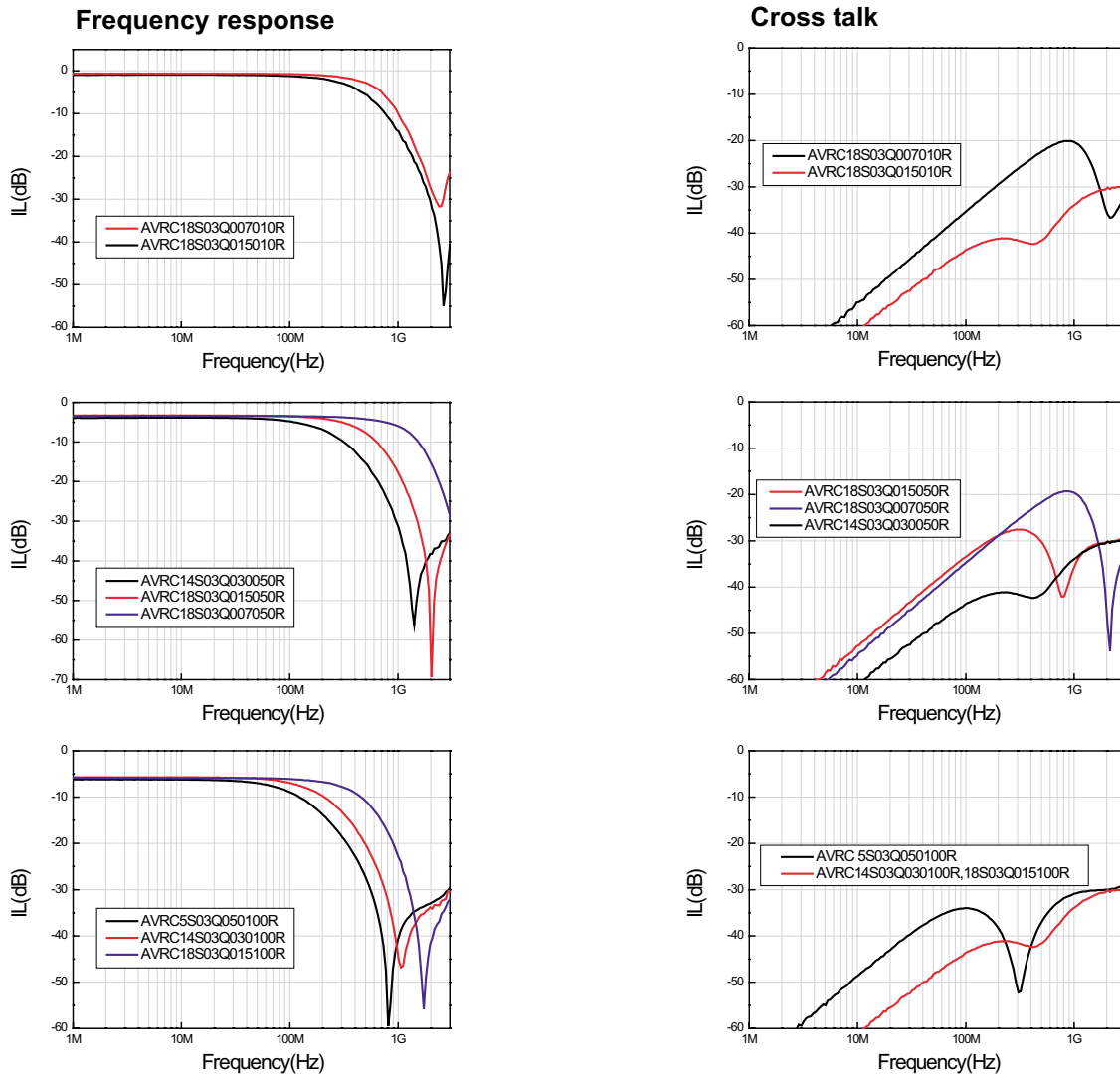
R-C Type 4 Array

## EMI Attenuation Characteristics

### - Test Setup



## 0603 (1608) size



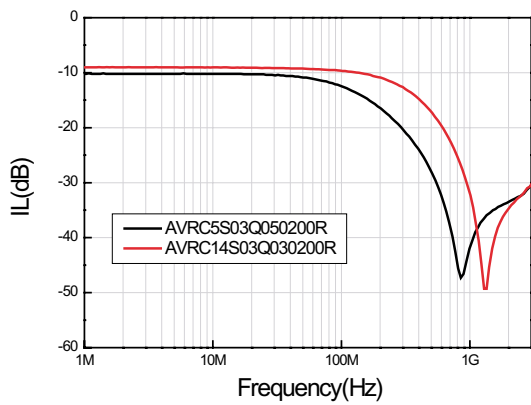
# AVRC Series

# EMI/ESD Filter

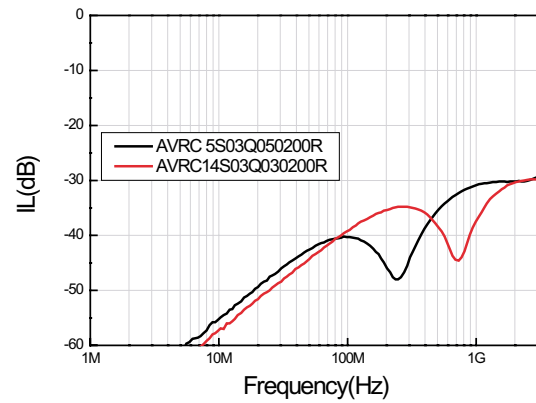
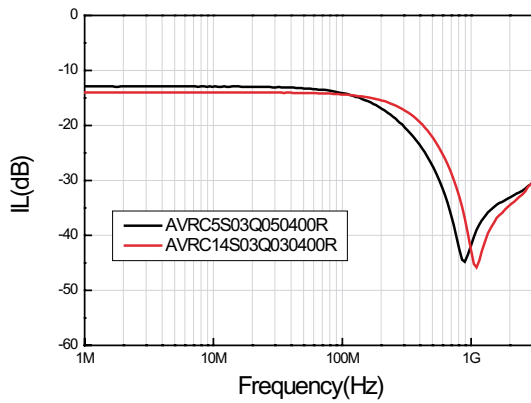
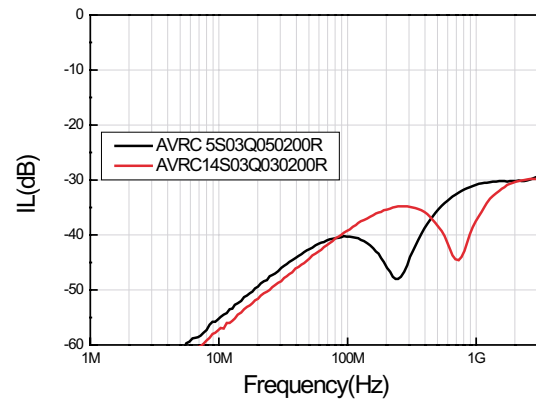
R-C Type 4 Array

● 0603 (1608) size

Frequency response



Cross talk



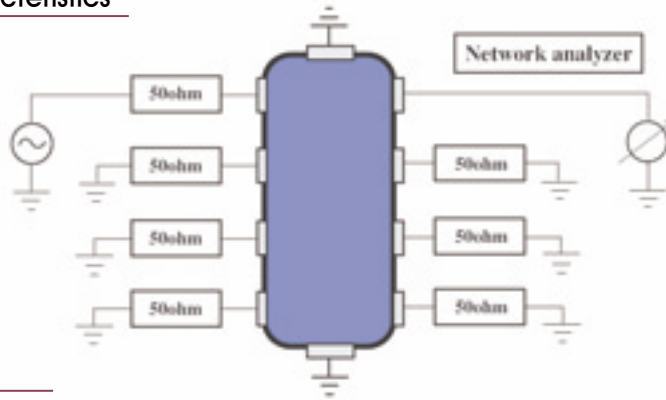
# AVRC Series

# EMI/ESD Filter

R-C Type 4 Array

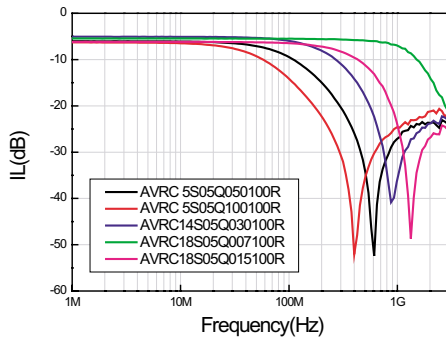
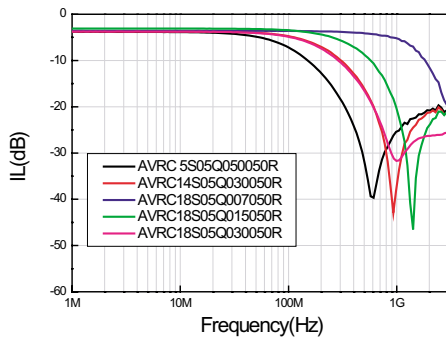
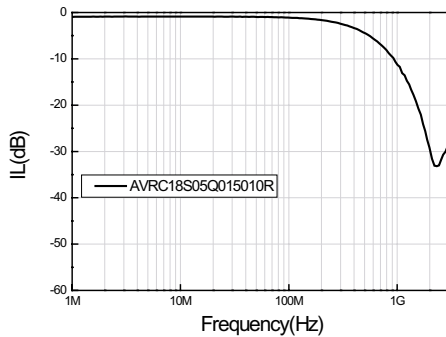
## EMI Attenuation Characteristics

### - Test Setup

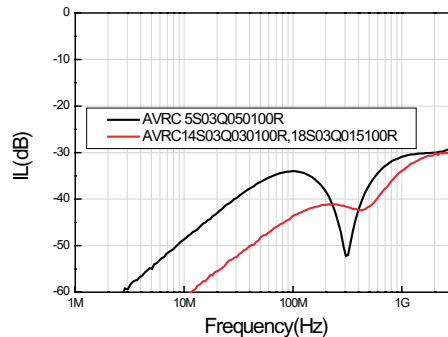
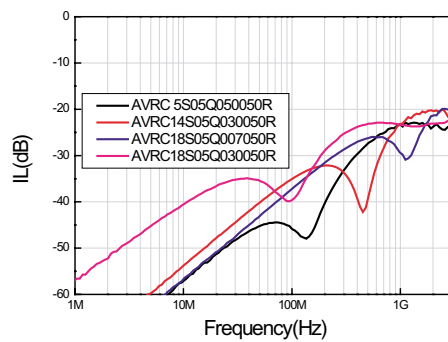
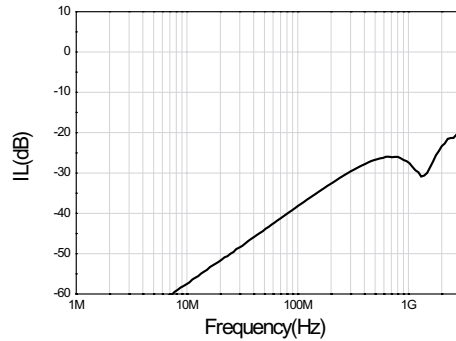


## 0805 (2012) size

### Frequency response



### Cross talk



# AVRC Series

# EMI/ESD Filter

R-C Type 2 Array (Audio part)

## Overview

New EMI/ESD filter of AMOTECH is a ultra compact sized and multi-functioned filter for EMI/ESD protection with C-R-C structure of type  $\pi$ (pi), and mainly uses it to interrupt EMI noise at the end of audio part, and uses to protect ESD of high voltage. Especially, it shows its excellent reduction characteristics at the receiving base band of terminal.



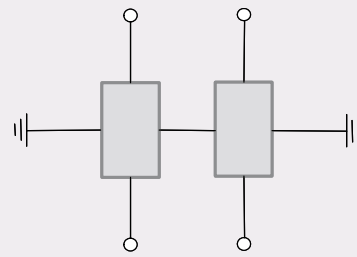
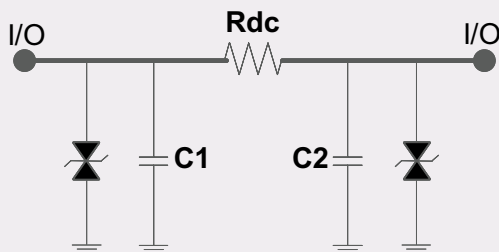
## Features

- RC type two channel array filter
- 0504 (1409 mm) size
- Meets IEC 61000-4-2 (ESD) level 4 requirements
- ESD protection > 30 kV
- Fast response time < 1 ns

## Application

- Electronic appliance for elimination of high frequency noise, and protection on ESD.
  - Mobile Phone / PDAs
  - MP3 player
  - Digital camera
  - ESD Protection for sensitive IC
  - I/O connection
  - Wireless Handsets
  - Desk top computer
  - Notebook

## Equivalent Circuit



2-array type

## Ordering Information

AVRC    14    S    04    D    015    100R  
①            ②            ③            ④            ⑤            ⑥            ⑦

① **Series name**

**AVRC** : R-C Type EMI & ESD filter

② **Maximum continuous working voltage (Vdc) :**

5 : 5V    14 : 14V    18 : 18V

③ **Varistor voltage tolerance : S** : Special order

④ **Chip Size : 04** : 0504 (1.4 x 0.9 mm)

⑤ **Configuration : D** : Double array (2 elements)

⑥ **Capacitance : 015** : C1+C2 = 15 pF    **030** : C1+C2 = 30 pF

**200** : C1+C2 = 200 pF    **350** : C1+C2 = 350 pF

⑦ **Typical Resistance : 010R** :  $10 \pm 3\Omega$     **050R** :  $050 \pm 15\Omega$

**100R** :  $100 \pm 30\Omega$

# AVRC Series

## Ultra Compact size EMI/ESD Filter

R-C Type 2 Array (Audio part)

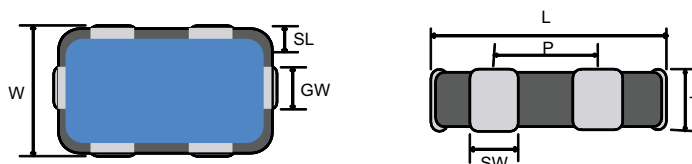
### Electrical Characteristics

Part No.		(Vdc) <sup>(1)</sup>	Varistor voltage (Vn) @1mA DC	Rdc R series between I/O s	Rdc tolerance	Cp (@1KHz, Vrms=0.5V) C1+C2	Cp tolerance	Insulated Resistance (IR) @3V DC	Cut-off Frequency (-3dB)	Minimum -20dB ATT. Band
		(V)	(V)	(Ω)	(%)	(pF)	(%)	(MΩ)	MHz	MHz
Mic.	AVRC 18S 04D 015 100R	18	30±6	100	±30	7.5+7.5	±30	> 10	700	1900~5000
	AVRC 5S 04D 050 100R	5.5	14±4	100	±30	25+25	±30	> 10	100	500~2500
	AVRC 5S 04D 200 100R	5.5	14±4	100	±30	100+100	±30	> 10	100	200~2500
	AVRC 5S 04D 350 100R	5.5	14±4	100	±30	175+175	±30	> 10	100	100~2500
Spk. Rcv.	AVRC 14S 04D 030 010R	14	23±6	10	±30	15+15	±30	> 10	100	1000~2500
	AVRC 5S 04D 200 010R	5.5	14±4	10	±30	100+100	±30	> 10	100	400~2500
	AVRC 5S 04D 350 010R	5.5	14±4	10	±30	175+175	±30	> 10	100	300~2500

(1) Maximum continuous DC working voltage

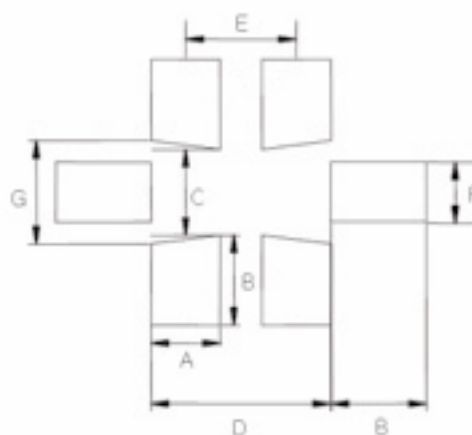
(2) Series resistance between input and output

### Dimension Specification



Symbol	L	W	T	GL	GW	SL	SW	P
<b>0504 (1409) size</b>	1.4±0.1	0.9±0.1	0.55±0.15	0.25±0.1	0.3±0.05	0.25±0.1	0.3±0.05	0.64±0.05

### Solder Pad Layout



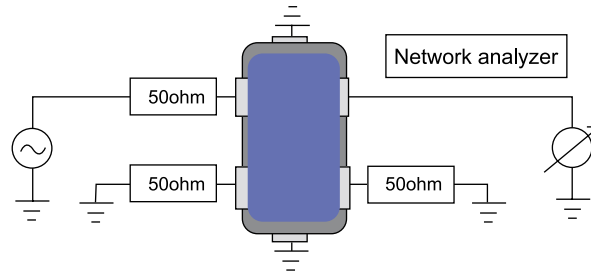
Symbol	A	B	C	D	E	F	G
<b>0504 (1409) size</b>	0.35	0.5	0.5	1.04	0.64	0.35	0.65

# AVRC Series

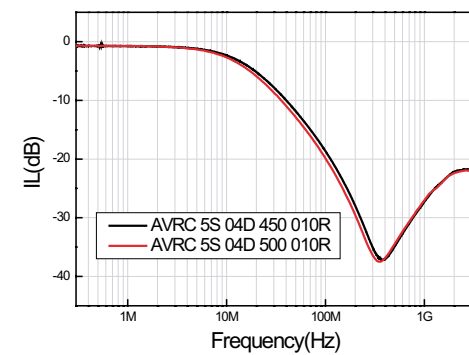
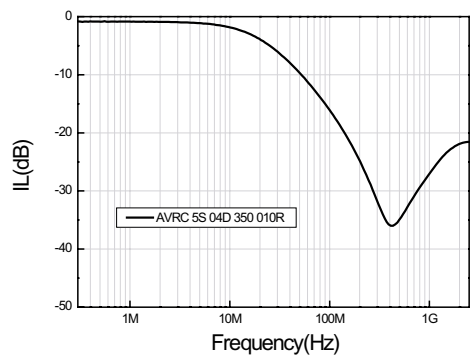
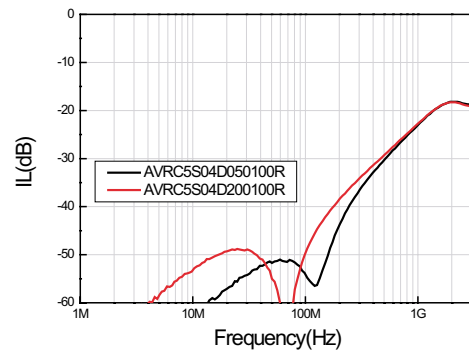
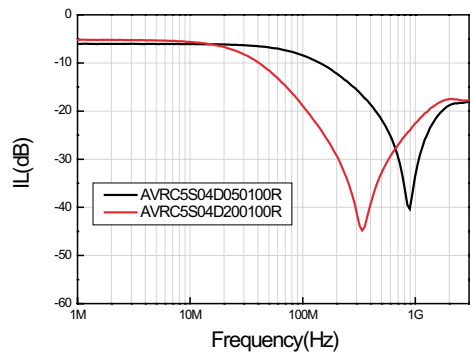
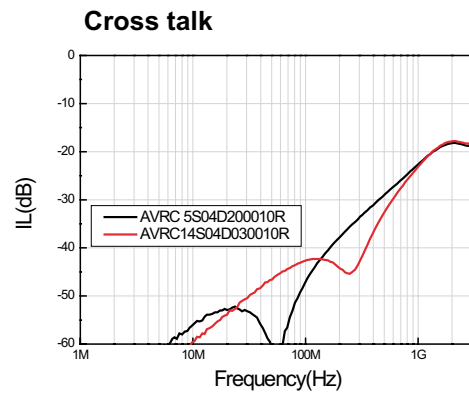
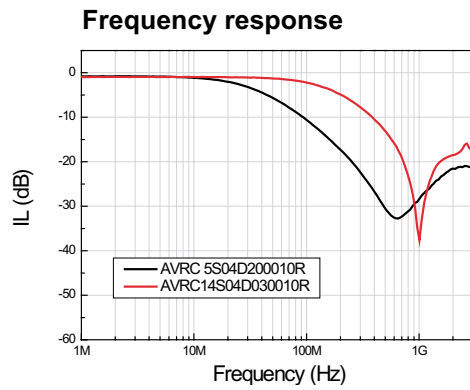
# Ultra Compact size EMI/ESD Filter

R-C Type 2 Array (Audio part)

## EMI Attenuation Characteristics



## 0504 (1409) size





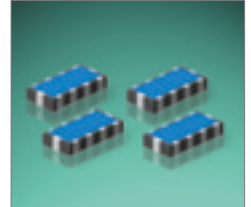
# AVFC Series

# EMI/ESD Filter

Feed Thru Type 4 Array

## Overview

This product is a multi-functioned filter for EMI/ESD protection of Feed through type, and main application fields are ESD protection of power line, remove noise, ESD prevention occurring from audio line such as speaker, receiver, microphone, and ear-jack, also eliminate TDMA noise to enhance audio performance.



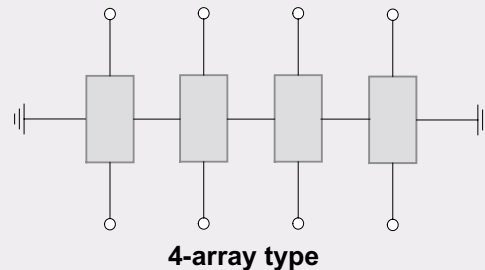
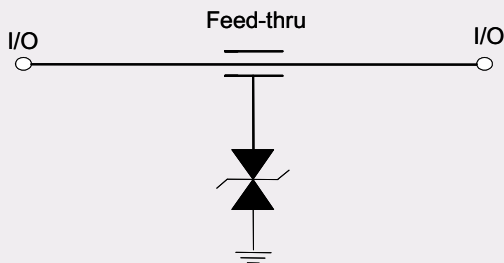
## Features

- Feed Thru type four channel array filter
- 0805 (2012 mm) size
- 0603 (1608 mm) size
- Meets IEC 61000-4-2 (ESD) level 4 requirements
- ESD protection > 30 kV
- Fast response time < 1 ns

## Application

- Electronic appliance for elimination of high frequency noise, and protection on ESD.
  - I/O connection
  - Mobile Phone / PDAs
  - MP3 player
  - Digital camera
  - ESD Protection for sensitive IC
  - power line
  - Serial line
  - Wireless Handsets
  - Desk top computer
  - Notebook

## SR Equivalent Circuit



## Ordering Information

**AVFC** **5** **S** **05** **Q** **050**

① ② ③ ④ ⑤ ⑥

- ① **Series Name**  
AVFC : Feed Thru Type EMI/ESD Filter
- ② **Maximum continuous working voltage :**  
5 : 5.5V 12 : 12V 14 : 14V
- ③ **Varistor voltage tolerance : S :** Special order

- ④ **Chip Size :** 05 : 0805 (2.0 x 1.2mm)  
03 : 0603 (1.6 x 0.8 mm)
- ⑤ **Configuration :** Q : 4 element
- ⑥ **Typical Capacitance :** 050 : 50 pF

# AVFC Series

# EMI/ESD Filter

Feed Thru Type 4 Array

## Electrical Characteristics

Part No.	(Vdc) <sup>(1)</sup>	Varistor voltage (Vn) @1mA DC	Cp (@ 1MHz, Vrms=0.5V)	Cp tolerance	Insulated Resistance IR (@3V DC)	Cut-off Frequency (-3dB)	Minimum -20dB ATT. Band
	(V)	(V)	(pF)	(%)	(MΩ)	MHz	MHz

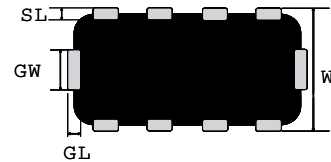
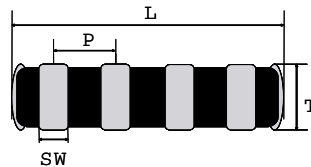
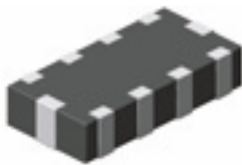
### 0603 (1608) Size

AVFC 5S 03Q 033	5.5	14±4	33	±30	> 10	150	1500~3000
-----------------	-----	------	----	-----	------	-----	-----------

### 0805 (2012) Size

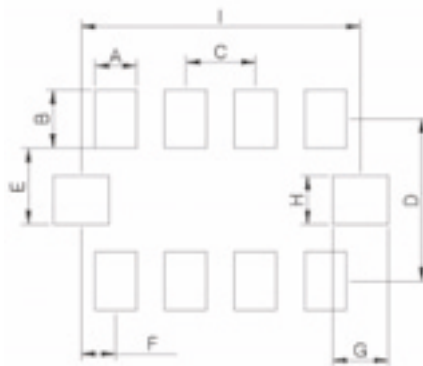
AVFC 5S 05Q 100	5.5	14±4	100	±30	> 10	50	550~3000
AVFC 5S 05Q 050	5.5	14±4	50	±30	> 10	120	1000~3000
AVFC 14S 05Q 030	14	23±5	30	±30	> 10	210	1500~3000
AVFC 18S 05Q 015	18	30±6	15	±30	> 10	450	2500~3000

## Dimension Specification



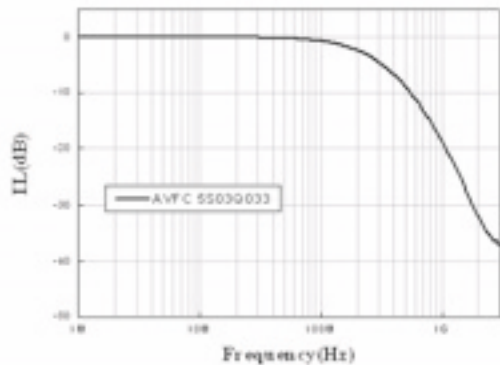
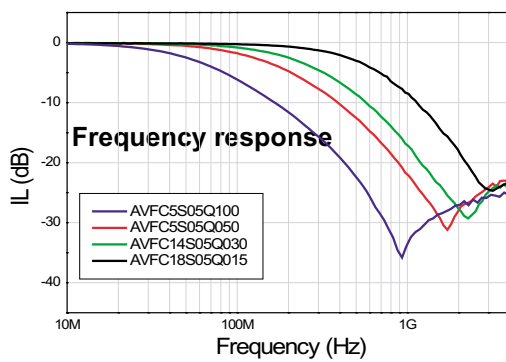
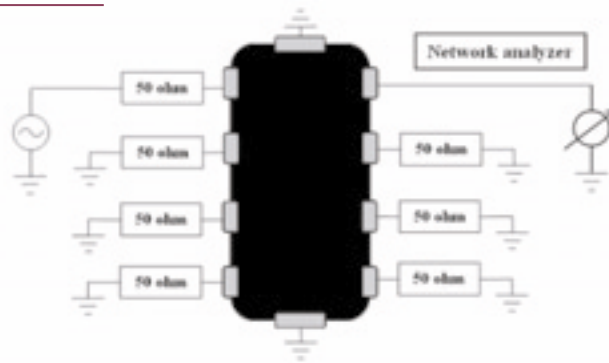
Symbol	L	W	T	GL	GW	SL	SW	P
<b>0603 (1608)</b>	1.6±0.1	0.8±0.1	0.44±0.05	0.15±0.05	0.2±0.05	0.15±0.05	0.2±0.05	0.4±0.05
<b>0805 (2012)</b>	2.05±0.1	1.25±0.1	0.55±0.1	0.25±0.1	0.3±0.1	0.25±0.1	0.25±0.1	0.5±0.1

## Solder Pad Layout



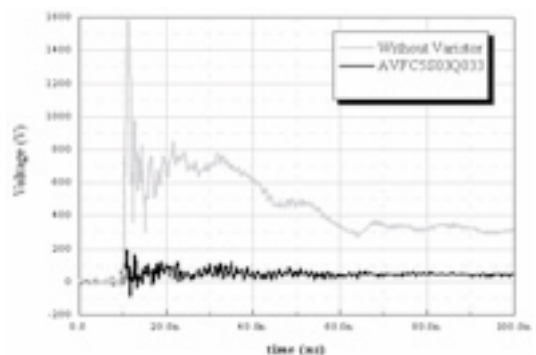
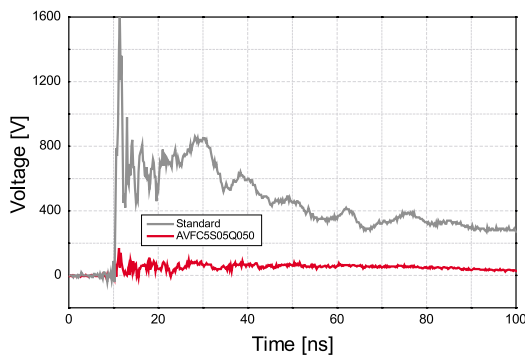
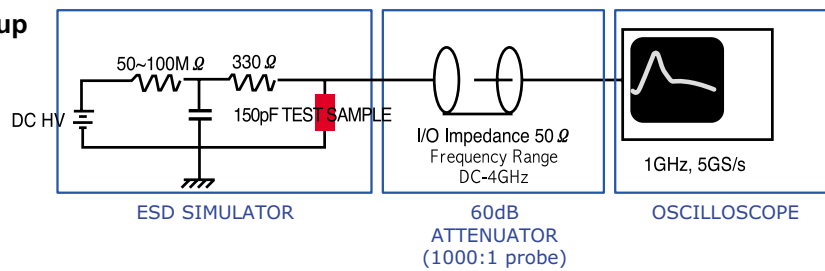
Symbol	A	B	C	D	E	F	G	H	I
<b>0603 (1608)</b>	0.2	0.4	0.4	1.2	0.285	0.32	0.4	0.17	2.04
<b>0805 (2012)</b>	0.3	0.42	0.5	1.17	0.55	0.25	0.4	0.35	2

### EMI Attenuation Characteristics



### ESD Attenuation Characteristics

#### - Test Setup



# AVFC Series

# EMI/ESD Filter

Feed Thru Type 2 Array

## Overview

This product is a multi-functioned filter for EMI/ESD protection of Feed through type, and main application fields are ESD protection of power line, remove noise, ESD prevention occurring from audio line such as speaker, receiver, microphone, and ear-jack, also eliminate TDMA noise to enhance audio performance.



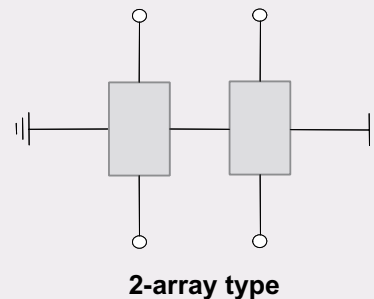
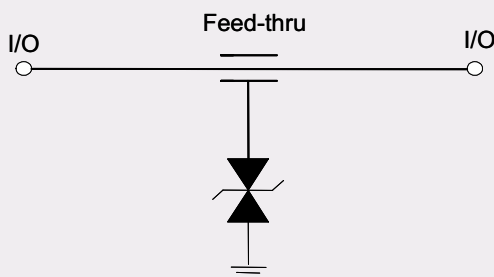
## Features

- Feed Thru type four channel array filter
- 0504 (1409 mm) size
- Meets IEC 61000-4-2 (ESD) level 4 requirements
- ESD protection > 30 kV
- Fast response time < 1 ns

## Application

- Electronic appliance for elimination of high frequency noise, and protection on ESD.
  - I/O connection
  - Mobile Phone / PDAs
  - MP3 player
  - Digital camera
  - ESD Protection for sensitive IC
  - power line
  - Serial line
  - Wireless Handsets
  - Desk top computer
  - Notebook

## SR Equivalent Circuit



## Ordering Information

**AVFC** **5** **S** **04** **D** **150**

① ② ③ ④ ⑤ ⑥

### ① Series name

**AVFC** : Feed Thru Type EMI/ESD Filter

### ② Maximum continuous working voltage (Vdc) :

**5** : 5.5V **12** : 12V **14** : 14V

### ③ Varistor voltage tolerance : **S** : Special order

### ④ Chip Size : **04** : 0504 (1.4 x 0.9 mm)

### ⑤ Configuration :

**D** : Dual Array (2-element)

### ⑥ Capacitance :

**150** : C1+C2 = 150 pF

# AVFC Series

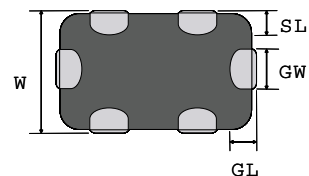
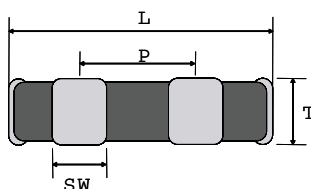
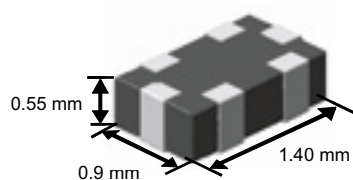
# EMI/ESD Filter

Feed Thru Type 2 Array

## Electrical Characteristics

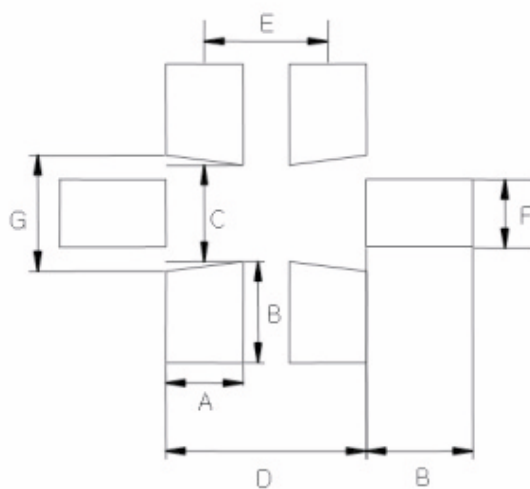
Part No.	(Vdc) <sup>(1)</sup>	Varistor voltage (Vn) @1mA DC	Cp (@ 1MHz, Vrms=0.5V)	Cp tolerance	Insulated Resistance IR (@3V DC)	Cut-off Frequency (-3dB)	Minimum -20dB ATT. Band
	(V)	(V)	(pF)	(%)	(MΩ)	MHz	MHz
AVFC 5S 04D 150	5.5	14 ± 4	100	± 30 (%)	> 10	35	550~4000

## Dimension Specification



Symbol	L	W	T	GL	GW	SL	SW	P
<b>0504 (1409) size</b>	1.4 ± 0.1	0.9 ± 0	0.55 ± 0.15	0.25 ± 0.1	0.3 ± 0.05	0.25 ± 0.1	0.3 ± 0.05	0.64 ± 0.05

## Solder Pad Layout



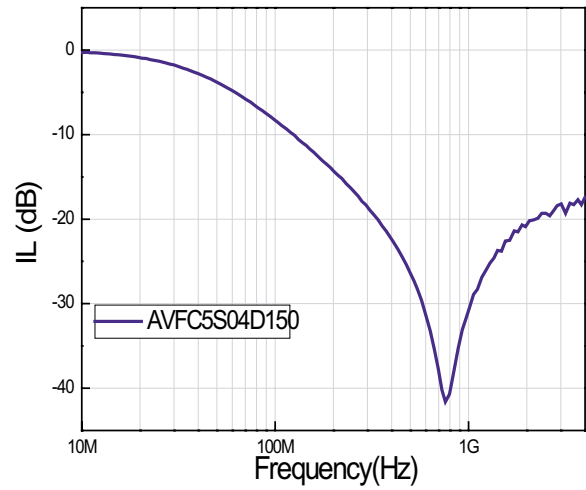
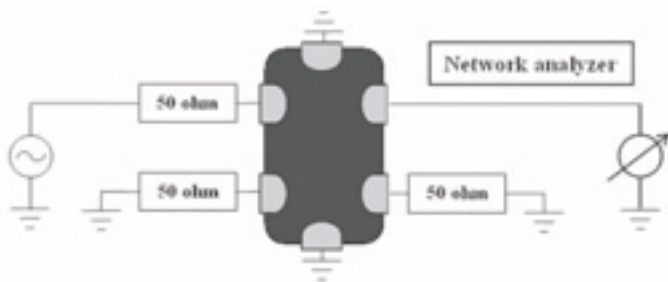
Symbol	A	B	C	D	E	F	G
<b>0504 (1409) size</b>	0.35	0.5	0.5	1.04	0.64	0.35	0.65

# AVFC Series

# EMI/ESD Filter

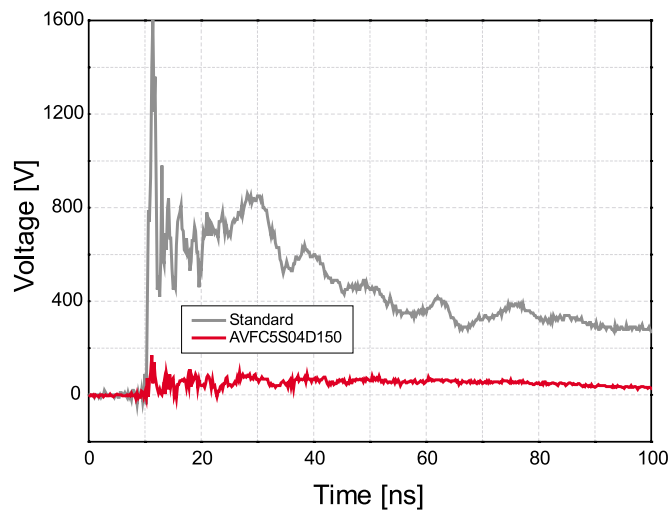
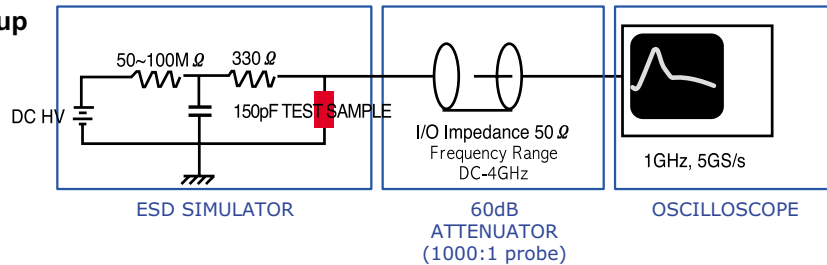
Feed Thru Type 2 Array

## EMI Attenuation Characteristics



## ESD Attenuation Characteristics

### - Test Setup



**TERMINOLOGY**

Term	Symbol	
Rated DC Voltage	Vdc	Maximum continuous DC voltage (<5% ripple) which may be applied to the component under continuous operating conditions at 25°C
Leakage Current	IL	The current passing through the varistor at Vdc and at 25°C
Varistor voltage	Vn	Voltage across the varistor measured at a given reference current In
Clamping Voltage Protection Level	Vc	The peak voltage developed across the varistor under standard atmospheric conditions when passing an 8/20µs class current pulse
Rated Single Pulse Transient Energy	Wmax	Energy which may be dissipated for a single 10/1000µs impulse of a maximum rated current, with rated RMS voltage or rated DC voltage also applied without causing device failure
Rated Peak Single Pulse Transient Current	Imax	Maximum peak current which may be applied for a single 8/20µs impulse, with rated line voltage also applied, without causing device failure
Rated Transient Average Power Dissipation	P	Maximum average which may be dissipated due to a group of pulses occurring within a specified isolated time period, without causing device failure at 25°C
Capacitance	Cp	Capacitance between two terminals of the varistor measured at 1 kHz
Response Time		The time lag between application of a surge and varistor's 'turn-on' conduction action
Insulation Resistance		Minimum resistance between shorted terminals and varistor surface
Isolation Voltage		Minimum voltage applied for one minute between shorted terminals and varistor surface
Operating Temperature		The range of ambient temperature for which the varistor is designed to operate continuously, as defined by the temperature limits of its climatic category
Storage Temperature		Storage temperature range without voltage applied
Current Energy Derating		Derating of maximum values when operated above 85°C

**SELECTION GUIDELINES & APPLICATION FIELDS**

The selection of Transient Voltage Suppressors involves comparison of device parameter with circuit conditions. The following selection guidelines are recommended:

1. **Select Transient Voltage Suppressors with a rated voltage greater than or equal to the normal operating voltage of the circuit.**
2. **Select Transient Voltage Suppressors which is capable of dissipating the expected transient peak pulse current.**
3. **The Transient Voltage Suppressors clamping voltage should be less than the maximum voltage handling capability of the protected circuit for the same pulse waveform.**
4. **For systems using high speed data rates, Transient Voltage Suppressors capacitance will have to be considered.**

There may be applications where the actual transient current cannot be defined. Often, the designer will have to meet the requirements of certain transient immunity specification. As the very least, identification of the source of the threat is necessary: lightning, inductive switching, ESD, etc.

☉ Summary of Selection

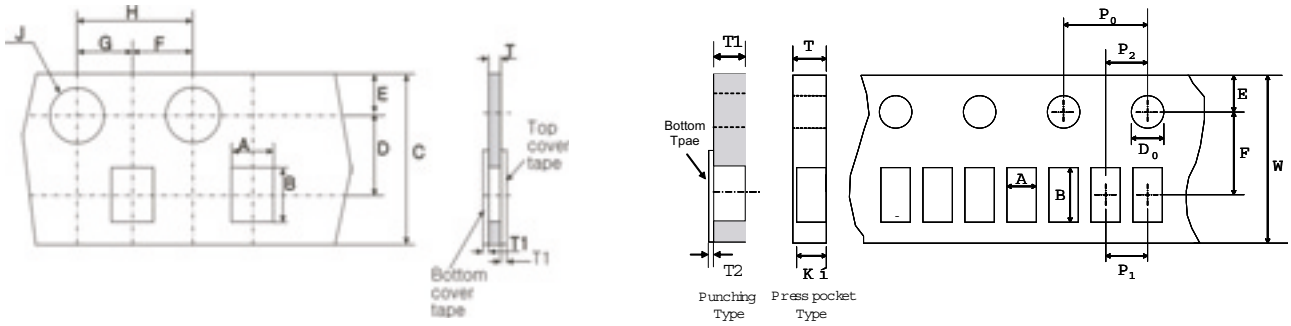
Device Parameter		Circuit Condition
Vdc (V)	≥	120% of Normal circuit operating voltage
I <sub>max</sub> (A)	≥	Expected transient current
Vc (V)	≤	Maximum allowable voltage across the protected component
Cp (pF)	<	Maximum loading capacitance for signal integrity

Market	Homeappliance	Communication	Computer & Peripheral	Consumer Product	Car Electronics
Application	<b>D-TV / STB / Notebook / Camera</b>  HDMI/Dvi Memory Card USB Key Button RF PARTS	<b>Cellular / cordless phone</b>  LCD display Programming port Charger Key pads Speaker &Microphone ASIC protection Laser diode protection FETs protection	<b>Personal computer</b>  Audio card Keyboards I/O ports RS232/RS422/IEEE 488 Interface card	<b>Security system</b>  Sensor protection Key pads Microprocessor reset & I/O protection LCD display  <b>CATV</b>  LNA FETs protection Logic box protection	<b>ECU protection</b>  <b>Multiplex I/O line</b>  <b>ABS system</b>  <b>Airbag system</b>  <b>Audio system</b>  <b>Navigation system</b>  <b>Smart sensor &amp; actuator</b>  <b>Ignition circuit</b>  <b>Motor control boards</b>
		<b>Secondary phone line</b>	<b>Printer &amp; Scanner</b>  Paper feeders Key pads Opto sensors	<b>Portable equipment</b>  Camcorder Cassette player CD player MD player Digital camera PDAs	
		<b>Data line connection</b>	<b>Hard disc drive</b>  Vcc protection		
		<b>Line card</b>	<b>FAX / MODEM</b>		
		<b>Fax machine</b>	<b>Note book computer</b>  LCD display Audio card Keyboard I/O ports Charger PCMCIA cards		



PACKAGE SPECIFICATION

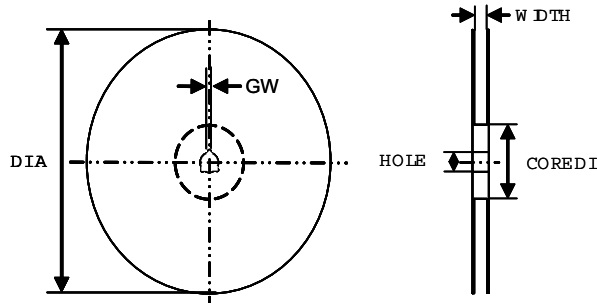
Carrier tape Specification



Type	A	B	C	D	E	F	G	H	J	T	T1
0402 (1005)	0.62	1.12	8	3.5	1.75	2	2	4	1.5	0.6	0.1
0603 (1608)	1	1.9	8	3.5	1.8	2	2	4	1.55	0.95	0.1
0805 (2012)	1.55	2.3	8	3.5	1.75	2	2	4	1.55	0.68	0.1

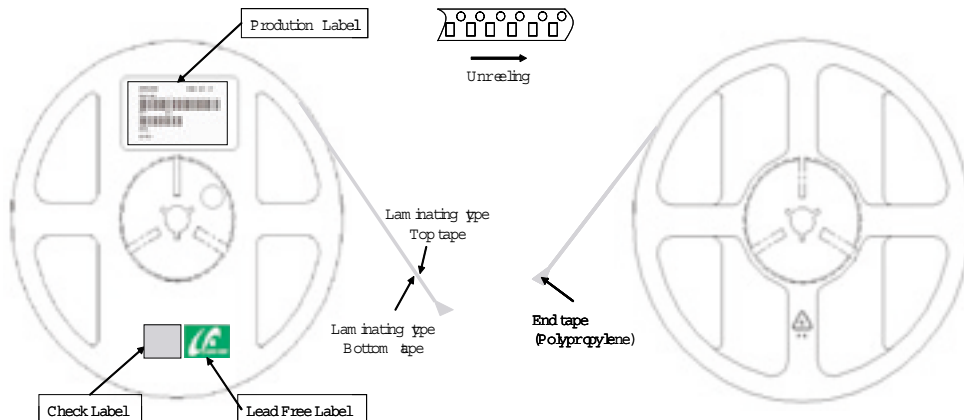
Type	A	B	D0	E	F	P0	P1	P2	W	K'	T	T1	T2
0603 (0201)	0.62	1.12	1.55	1.75	3.5	4	2	2	8	0.6	0.65	0.6	0.1
1005 SF	0.62	1.12	1.55	1.75	3.5	4	2	2	8	0.6	0.48	0.43	0.1
1005 SR	0.62	1.12	1.55	1.75	3.5	4	2	2	8	0.6	0.48	0.43	0.1

Reel Specification



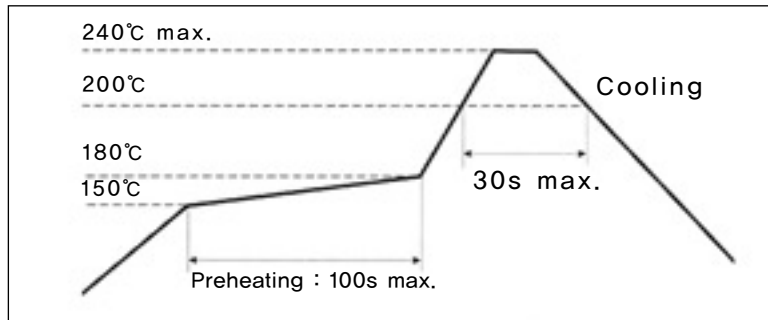
ITEM	DIA	WIDTH	CORE DIA	HOLE	GW
SIZE	178.0±0.5	9.0±0.5	60.0±1.0	13.2±0.3	2±0.3

Label adherence and winding direction

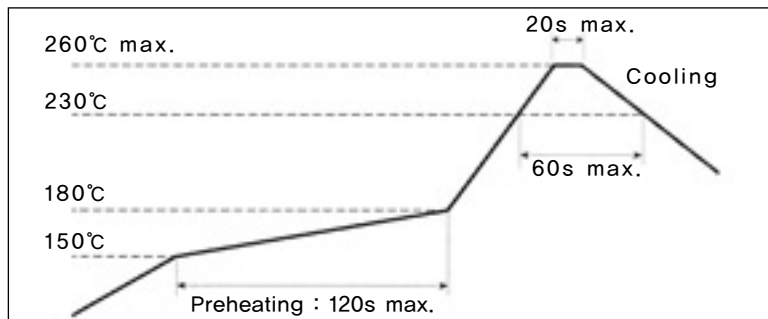


**SOLDERING RECOMMENDATION**

**Sn/Pb Solder paste**



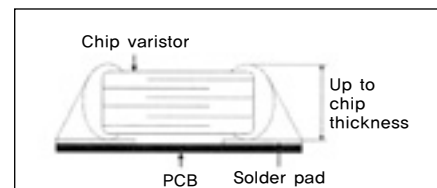
**Pb free Solder paste**



○ **Repair soldering**

Allowable time and temperature for making correction with a soldering iron :  $350 \pm 10^\circ\text{C}$ , 3 sec.

Optimum solder amount when corrections are made using a soldering iron



○ **Soldering Guidelines**

- Our chip varistors are designed for reflow soldering only. Do not use flow soldering
- Use Sn/Pb/Ag(62/36/2) or equivalent solder.
- Use non-activated flux(Cl content 0.2% max.)
- Follow the recommended soldering conditions to avoid varistor damage

○ **Storage Recommendation**

The components should be used within 6 months. They are to be left in the original package in order to avoid soldering problems caused by oxidized terminals. Air humidity should be less than 40%.

## TYPICAL CIRCUITS REQUIRING PROTECTION

### Home Appliance

DSC & Settop Box protection

- Digital Part
  - HDMI/DVI protection
  - RGB protection
  - Memory Card protection
  - USB protection
- Analog Part
  - A/V Io protection
  - S-Video protection

### Mobile Phone Protection

Speaker Jack protection  
Power Supply protection  
Button protection  
Data Interface protection  
LCD Data Line & Module protection  
Antenna Switching Module protection  
Module protection  
Speaker protection in LCD Module  
Key Pad LED protection  
USB Interface protection

### Notebook & Desktop Computer Protection

LCD protection  
Audio Circuit protection  
Keyboard protection  
I/O port protection

### Semiconductor Device Protection

ASIC protection  
IC protection  
MOSFET protection

### Micro Controllers Relays

CMOS relay driver  
LM319 relay driver

### Sensor Protection

Typical sensor protection  
Hall device protection

### Preamplifier Protection

Preamplifier protection  
Laser Diode protection

DIGITAL TV



**Antenna**  
ASES 12U 02 OR2  
ASES 12U 03 OR2

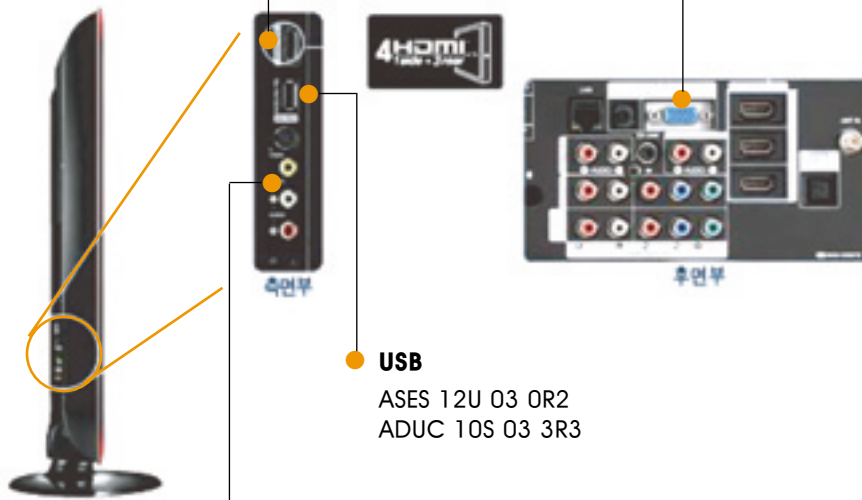
**Touch Key**  
ASES 12U 02 OR2

**HDMI/DVI Interface**

ASES 12U 02 OR2  
ASES 12U 03 OR2  
AMES 12U 05 Q OR2

**RGB Interface**

ADUC 10S 03 010  
ADUC 30S 03 010  
ADLC 10S 03 015



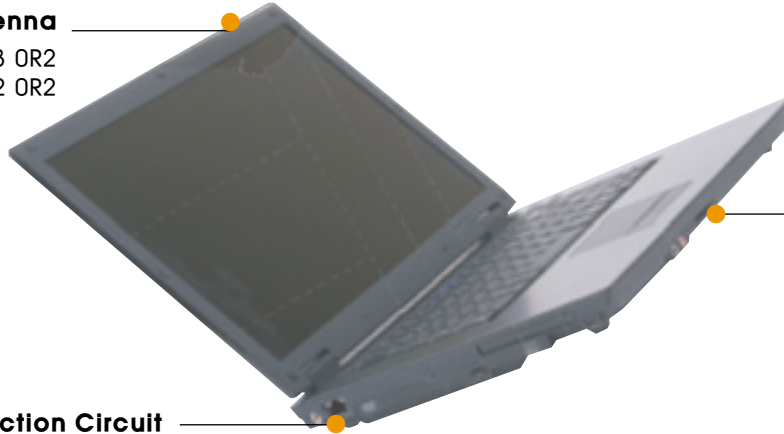
**USB**  
ASES 12U 03 OR2  
ADUC 10S 03 3R3

**A/V IO  
S-Video  
Component**  
General Varistor

APPLICATIONS

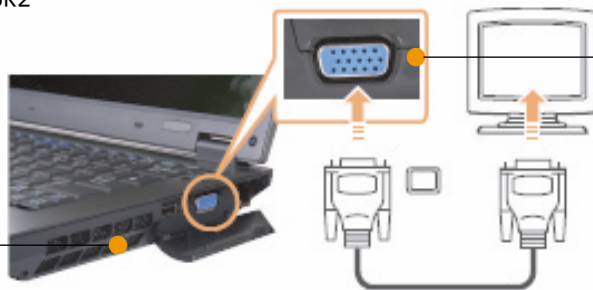
NOTE BOOK

**Antenna**  
ASES 12U 03 OR2  
ASES 12U 02 OR2



**Memory Card**  
ASES 12U 03 OR2  
ASES 12U 02 OR2  
ADUC 10S 03 1R1  
ADUC 10S 03 1R5

**Ethernet Protection Circuit**  
ASES 12U 03 OR2  
ASES 12U 02 OR2



**RGB**  
ASES 12U 02 OR2  
ASES 12U 03 OR2  
AMES 12U 05 Q OR2

**USB**  
ASES 12U 03 OR2  
ADUC 10S 03 3R3

DIGITAL CAMERA

**EHDMI/DVI**  
ASES 12U 03 OR2  
ASES 12U 02 OR2  
ADUC 10S 03 1R1  
ADUC 10S 03 1R5



**Memory Card**  
ASES 12U 03 OR2  
ASES 12U 02 OR2  
ADUC 10S 03 1R1  
ADUC 10S 03 1R5

**USB**  
ASES 12U 03 OR2  
ADUC 10S 03 3R3

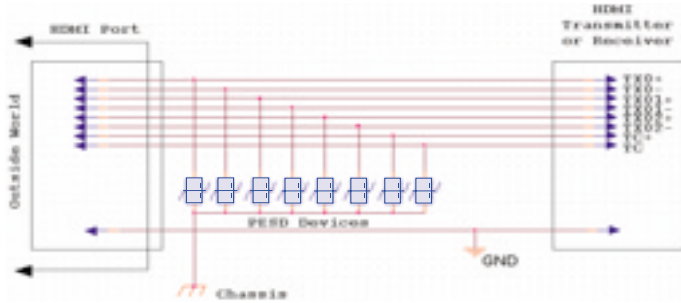
**General Date Line**  
AVRC 14S 03Q 030 100R  
AVRC 14S 05Q 030 100R

APPLICATIONS



APPLICATIONS

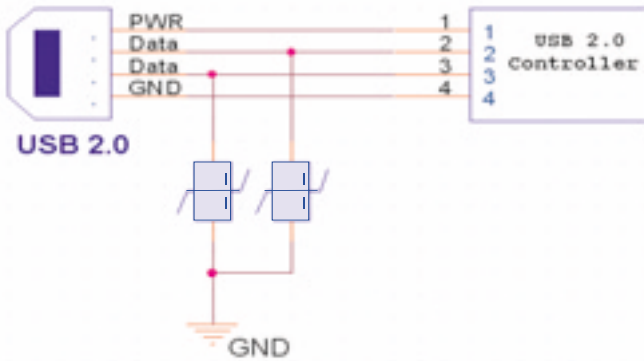
Home Appliance



HDMI Line Protection Circuit



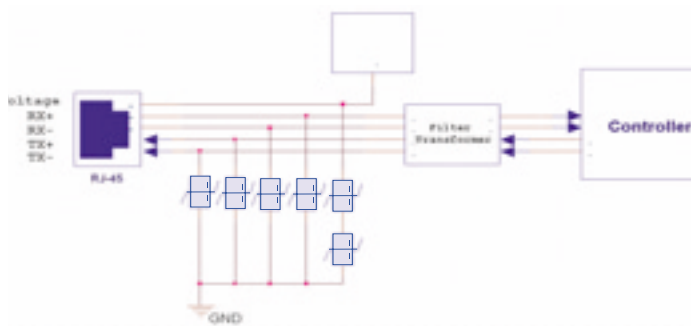
ASES 12U 02 0R2  
ASES 12U 03 0R2



USB Interface Protection Circuit



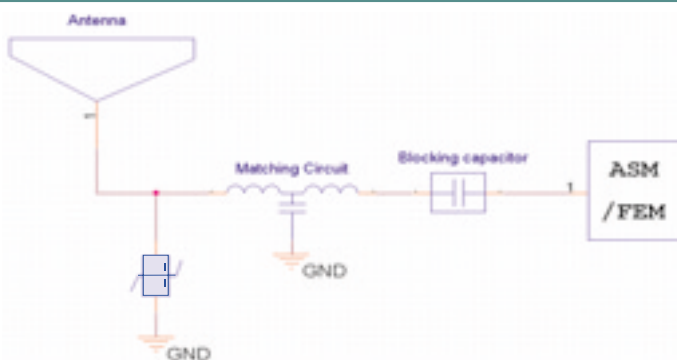
ASES 12U 02 0R2  
ASES 12U 03 0R2



Ethernet Protection Circuit



ASES 12U 02 0R2  
ASES 12U 03 0R2



Ant. Protection Circuit



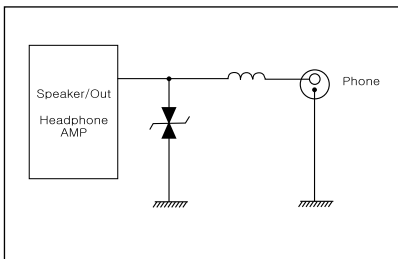
ASES 12U 02 0R2  
ASES 12U 03 0R2

### Mobile Phone Protection

#### Required characteristics of ESD Suppressors

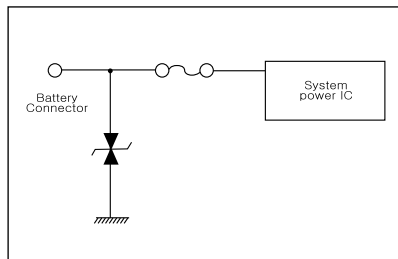
##### ■ Speaker jack Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Concern on many designs



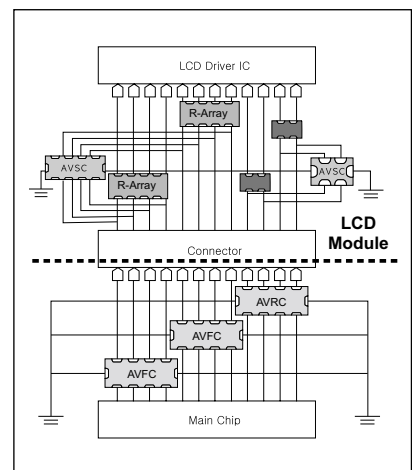
##### ■ Power Supply Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Concern on many designs



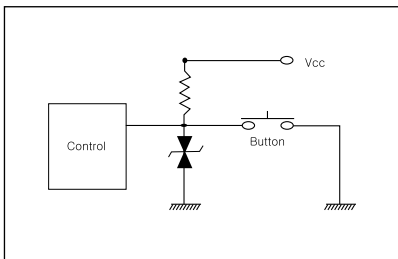
##### ■ LCD data line & Module Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Should be minimized



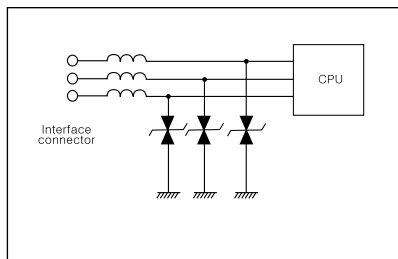
##### ■ Button Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Concern on many designs



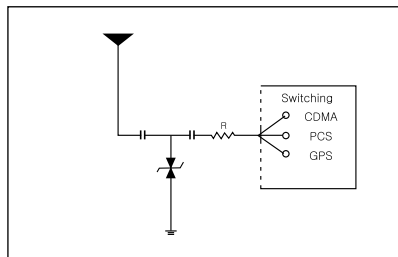
##### ■ Data interface Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Should be minimized



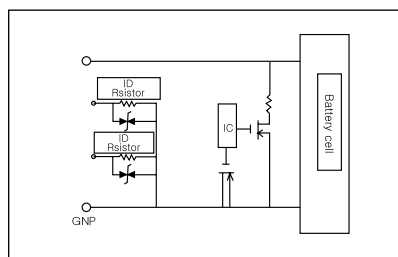
##### ■ Antenna Switching Module Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Should be minimized



##### ■ Module Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.1J
- Capacitance : No Concern



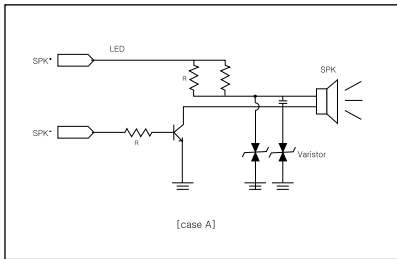


### Mobile Phone Protection

#### Required characteristics of Transient Voltage Suppressors

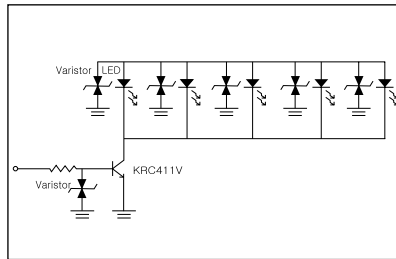
##### ■ Speaker Protection in LCD Module

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Concern on many designs



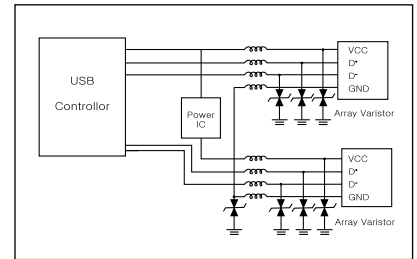
##### ■ Key Pad LED Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Concern on many designs



##### ■ USB Interface Protection

- Rated DC Volt. : < 18V
- Energy rating : < 0.05J
- Capacitance : Depend on data transmission rate

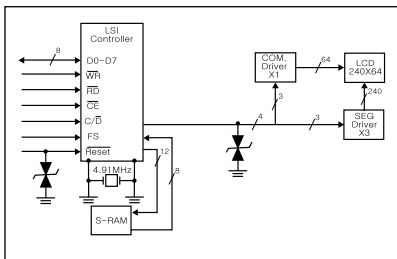


### Notebook & Desktop Computer Protection

#### Required characteristics of Transient Voltage Suppressors

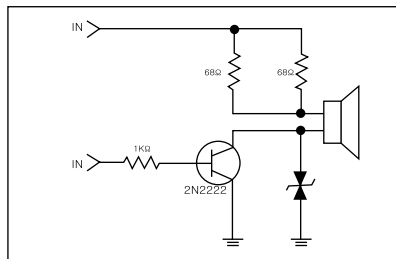
##### ■ LCD Protection

- Rated DC Volt. : < 5.6V
- Energy rating : < 0.1J
- Capacitance : Preferred to be minimum



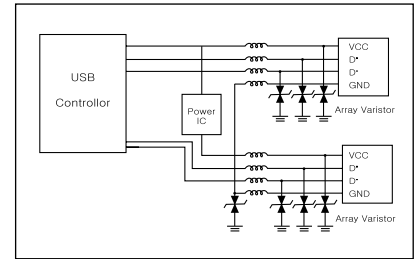
##### ■ Audio Circuit Protection

- Rated DC Volt. : 14V – 18V
- Energy rating : Typically 0.1J
- Capacitance : No concern



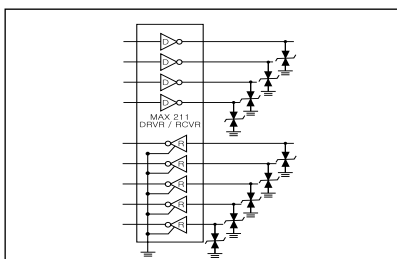
##### ■ Keyboard Protection

- Rated DC Volt. : > 5.6V
- Energy rating : < 0.4J
- Capacitance : Preferred to be minimum



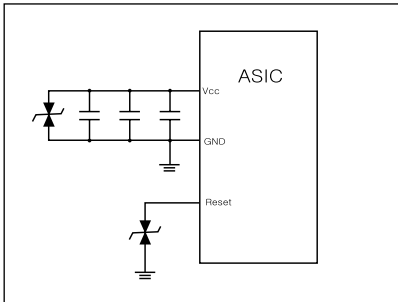
##### ■ I/O Port Protection

- Rated DC Volt. : 14V – 18V
- Energy rating : Typically 0.05J – 0.1J
- Capacitance : Should be minimized

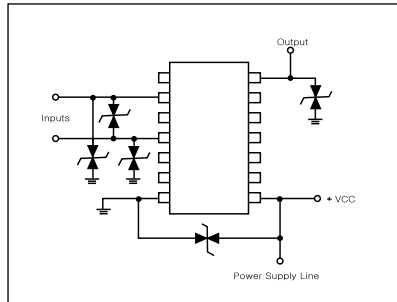


### Semiconductor Device Protection

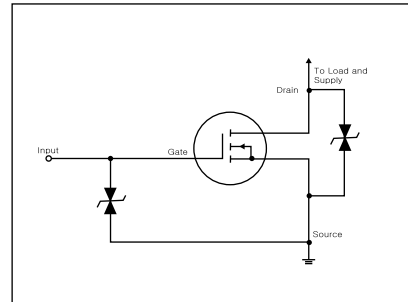
#### ■ ASIC Protection



#### ■ IC Protection



#### ■ MOSFET Protection



### Micro Controllers Relays/Sensor Protection

#### Required characteristics of Transient Voltage Suppressors

##### ■ CMOS Relay Drivers

- Rated DC Volt. :  $\geq$  Relay voltage
- Energy rating : Typically  $> 0.3J$
- Capacitance : No concern

##### ■ LM319 Relay Driver

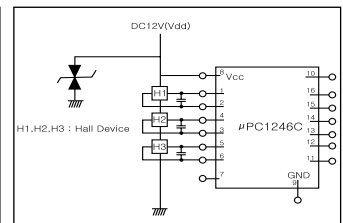
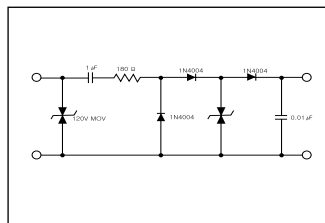
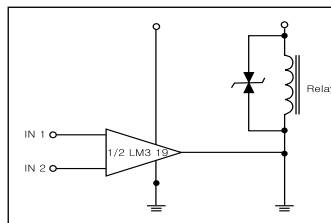
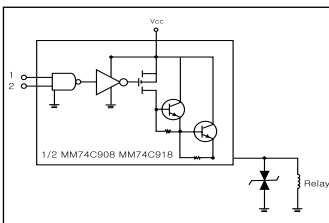
- Rated DC Volt. :  $\geq$  Relay voltage
- Energy rating : Typically  $> 0.3J$
- Capacitance : No concern

##### ■ Typical Sensor Protection

- Rated DC Volt. : Typically  $> 14V$
- Energy rating : Typically  $> 0.4J$
- Capacitance : No concern

##### ■ Hall Device Protection

- Rated DC Volt. :  $\geq$  Control voltage
- Energy rating : Typically  $> 0.3J$
- Capacitance : No concern

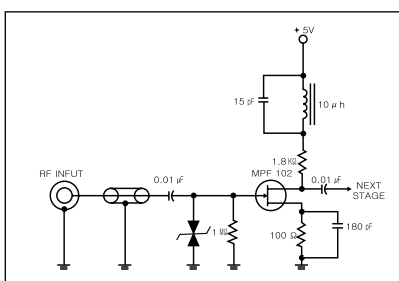


### Preamplifier/Optics Protection

#### Required characteristics of Transient Voltage Suppressors

##### ■ Preamplifier Protection

- Rated DC Volt. : Typically 18V – 26V
- Energy rating : 0.05J – 0.9J
- Capacitance : Concern on many designs



##### ■ Laser Diode Protection

- Rated DC Volt. :  $\geq 18V$
- Energy rating : 0.1J
- Capacitance : Should be minimized

