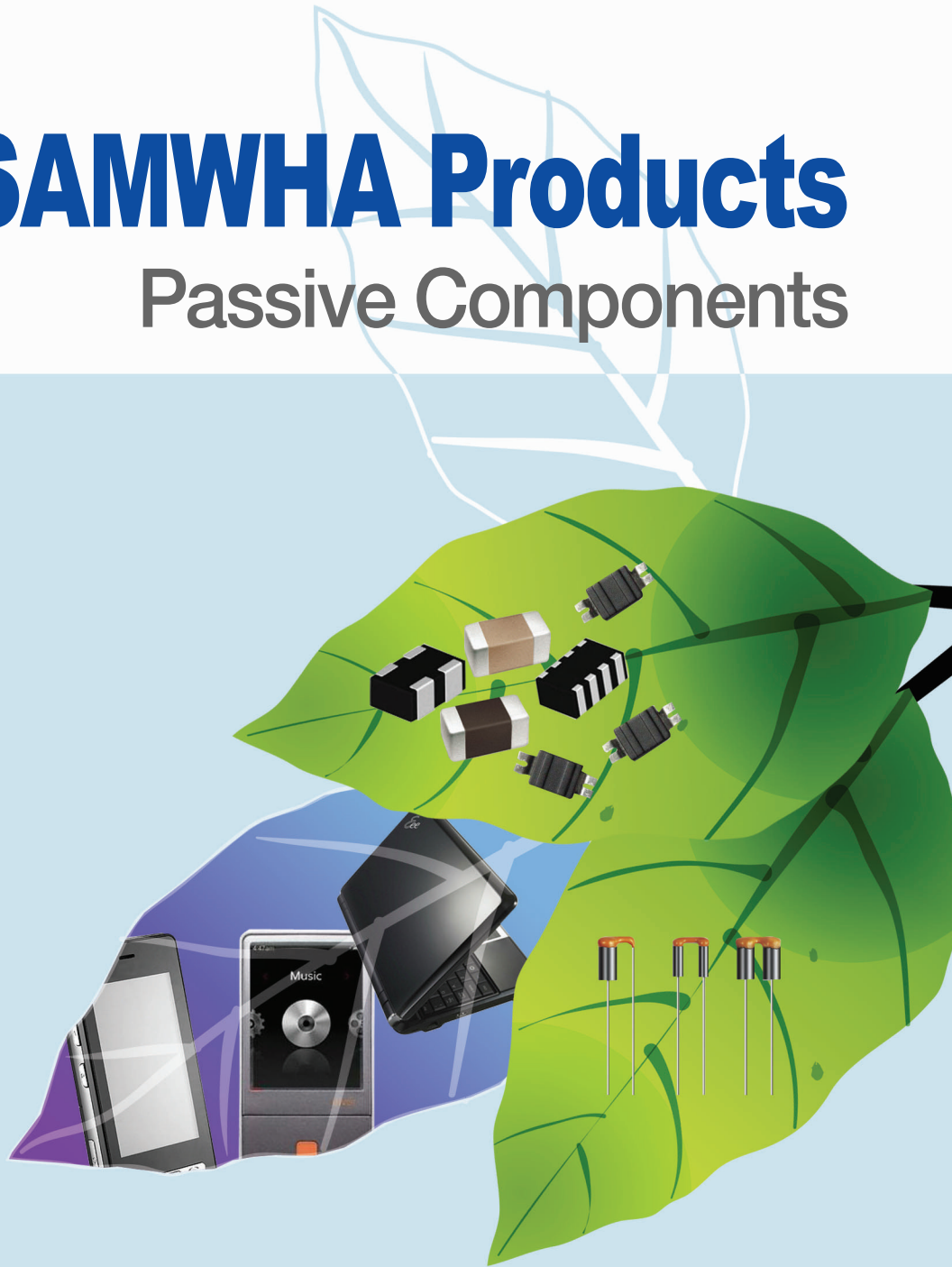


Cutting Edge Technology Inside Your Valuables

# **SAMWHA Products**

## Passive Components

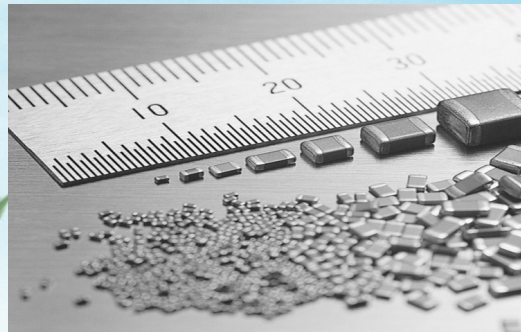


**SAMWHA CAPACITOR CO., LTD.**



# Company Profile

- COMPANY NAME : SAMWHA CAPACITOR CO., LTD.
- ESTABLISHMENT : AUGUST 1956
- HEADQUARTER : 124, BUK-RI, NAMSA-MYEON, YONGIN-SI, KYUNGGI-DO, KOREA
- CAPITAL : \$ 10M
- REVENUE : \$ 110M (2009)
- CORPORATIONS : MANUFACTURING - KOREA, THAILAND, INDONESIA  
SALES - HONGKONG, USA, EUROPE, CHINA
- PERSONNEL : 400 (EXCLUDING OVERSEAS)



## Contents

- |   |   |
|---|---|
| Company Profile _ 2P                      | Chip Bead _ 13P                           |
| Organization _ 4P                         | Chip Inductor _ 13P                       |
| Products Overview _ 5P                    | DCC (Disc Ceramic Capacitor) _ 14P        |
| MLCC (Multi-Layer Ceramic Capacitor) _ 6P | EMI Filter _ 15P                          |
| MLV (Multi-Layer Chip Varistor) _ 10P     | SMDC (Surface Mount Disc Capacitor) _ 15P |
| Chip Power Inductor _ 11P                 |   |

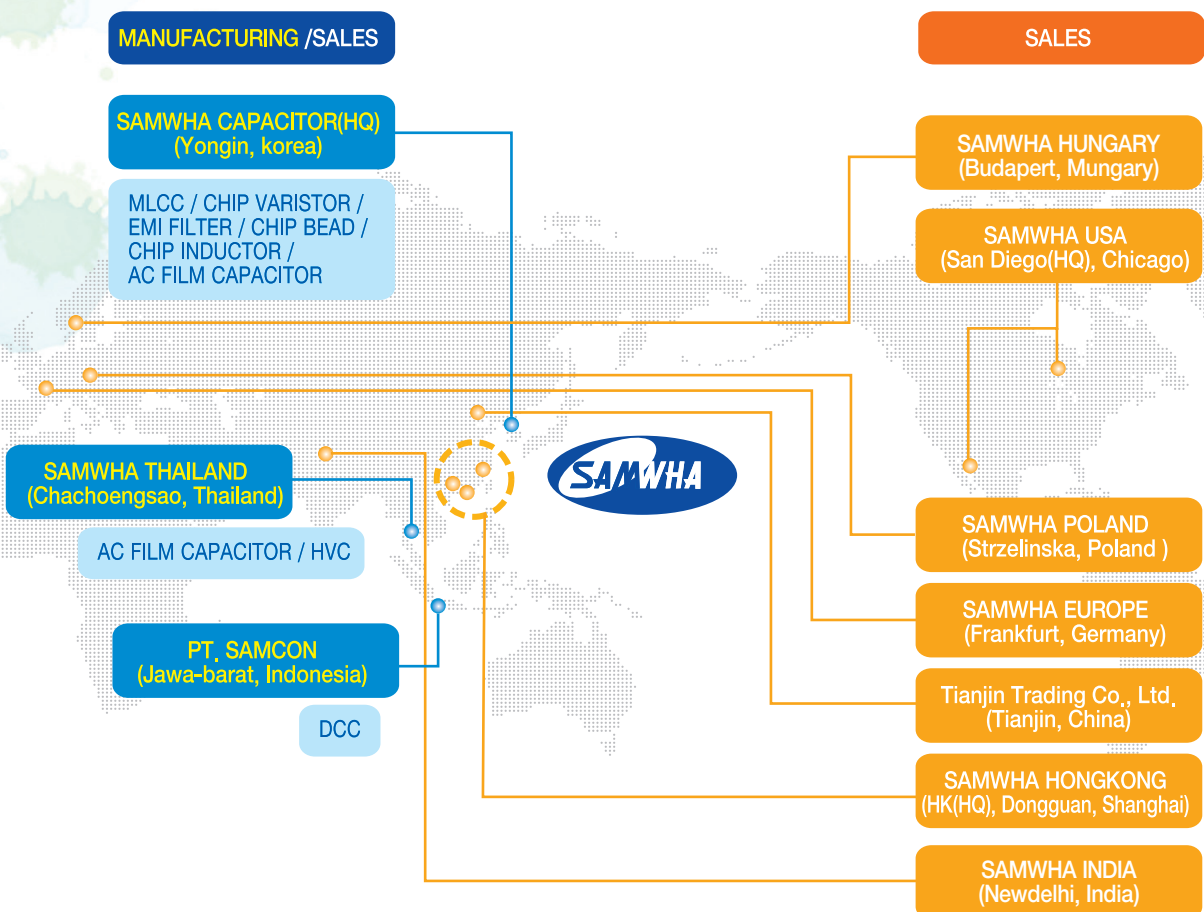
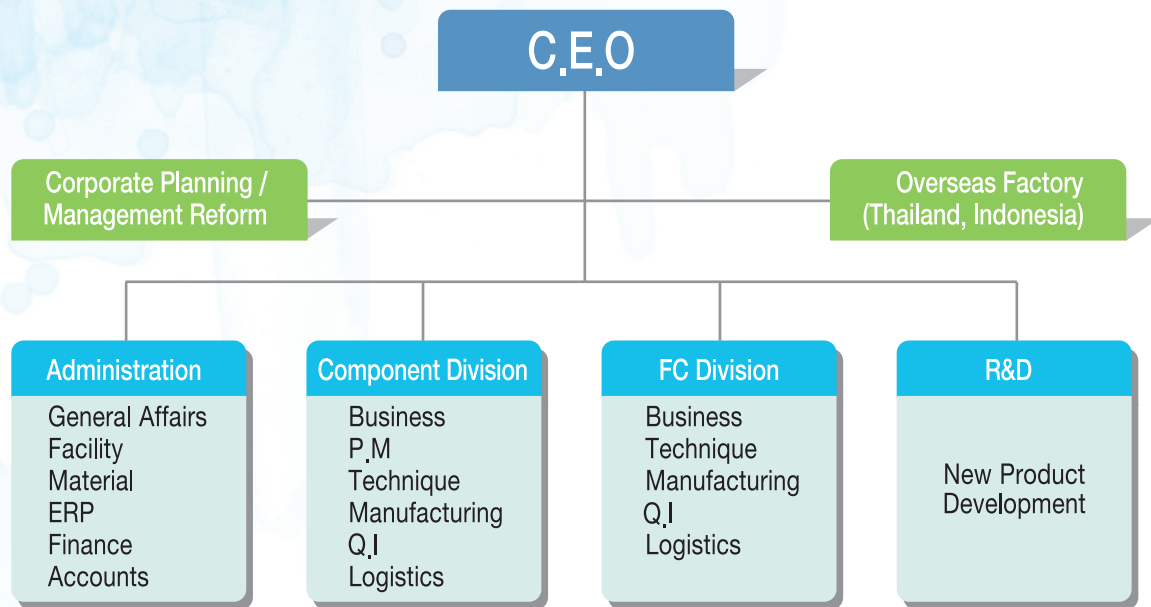




## History

- Nov. 2009 Establishes SAMWHA India
- Aug. 2009 Establishes SAMWHA Hungary
- 2009 About \$110 million in net sales
- Oct. 2007 Establishes SAMWHA Poland
- Sep. 2006 ISO/TS16949 Certification
- Feb. 2005 SAMSUNG/LG Eco-Partner Certification
- Oct. 2004 ISO14001 Certification
- May. 2001 Establishes SAMWHA Europe
- Jan. 2000 Begins mass-production of Chip Inductors / Beads
- Oct. 1999 Begins mass-production of Feed Through Capacitors
- Sep. 1999 Begins mass-production of Chip Varistors
- Nov. 1997 Establishes SAMWHA Thailand
- Sep. 1997 Establishes SAMWHA USA
- Feb. 1997 Establishes PT. SAMCON
- Aug. 1994 ISO 9001 Certification
- Jan. 1990 Begins production of EMI Filters
- Feb. 1985 Begins Korea's first mass-production of MLCCs
- Apr. 1969 Begins Korea's first mass-production of Ceramic Capacitors
- Sep. 1963 Begins Korea's first mass-production of Power Capacitors
- Aug. 1956 Established

# Organization






# Products Overview

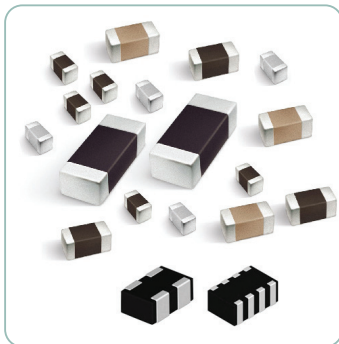
'03
'04
'05
'06

Coating part  
Lead Free

Abolish 6 harmful stuffs  
(Cd, Pb, Hg, Cr<sup>+6</sup>,  
PBB, PBDEs)



Supply pro-environmental products  
(Dec. 2004)



## MLCC (Multi-Layer Ceramic Capacitor)

SAMWHA provides MLCCs in various sizes (0603~9595<mm>, 0201~3838 <inch>) and temperature characteristics (C0G, X7R, X5R, Y5V).

## MLV (Multi-Layer Chip Varistor)

Chip Varistors are widely used for problems of transient over-voltage caused by ESD (Electro Static Discharge).

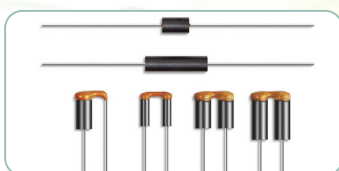
## Chip Bead/Inductor

Ferrite paste and electric conductor paste are layered and sintered into a monolithic structure to form an inductor with an excellent magnetic shield and high reliability.



## DCC (Disc Ceramic Capacitor)

SAMWHA Provides 3 major types of DCCs, Temperature Compensation Type, High dielectric Constant Type and Safety recognized Type.



## EMI (Electro-Magnetic Interference) Filter

EMI filters are broadly applied to protect electronic equipment against the EMI. The major product lines of Samwha include beads filters and LC filters.



## SMDC (Surface mount Disc Capacitor)

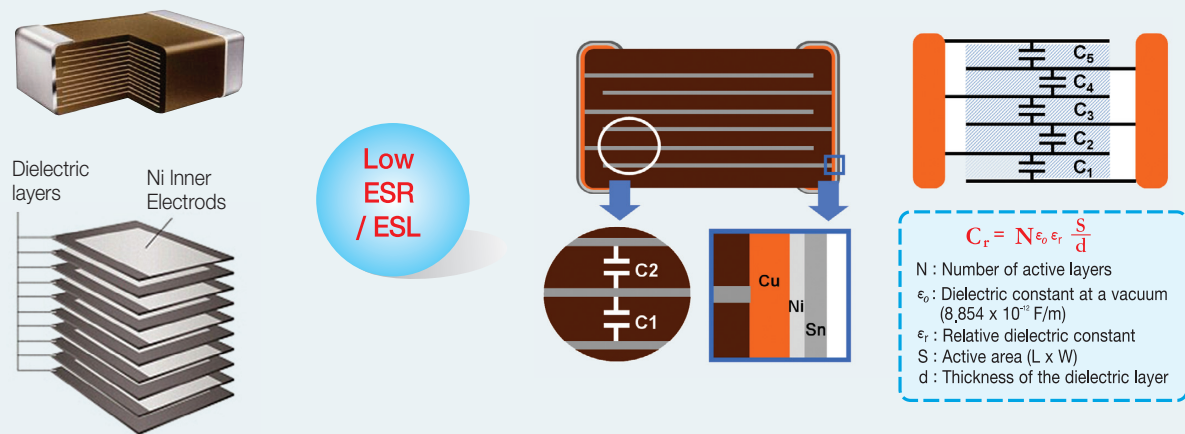
SMDC are specially designed for surface mounting with has High reliability and design flexibility.

# MLCC (Multi-Layer Ceramic Capacitor)

## Internal Structure

MLCCs have small case size consisted of multi-layered dielectrics and electrodes.

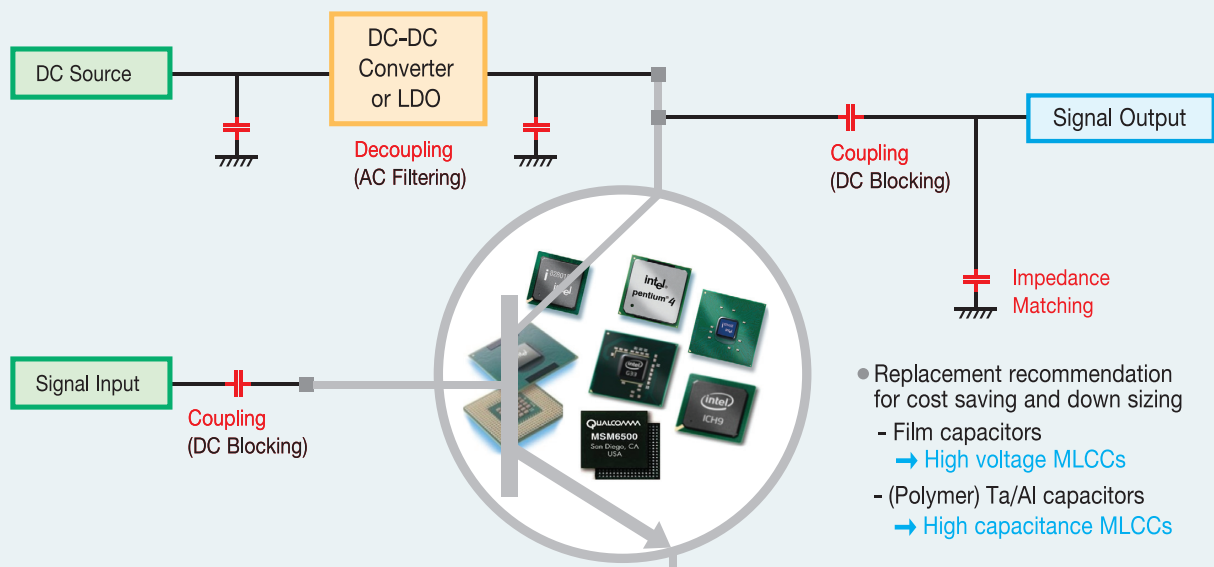
Good frequency characteristics result from low ESR and ESL of MLCCs



## General Applications

- PC and peripheral equipments : Desktop, Notebook, Netbook, HDD, ODD, WLAN, Graphic, Memory...
- Mobile Electronic Equipments : Cellular Phone, MP3, Navigation, DSC...
- LCD : TV, Monitor, Mobile... / AV etc. : PDP, Camcorder, DVD Player...

※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives

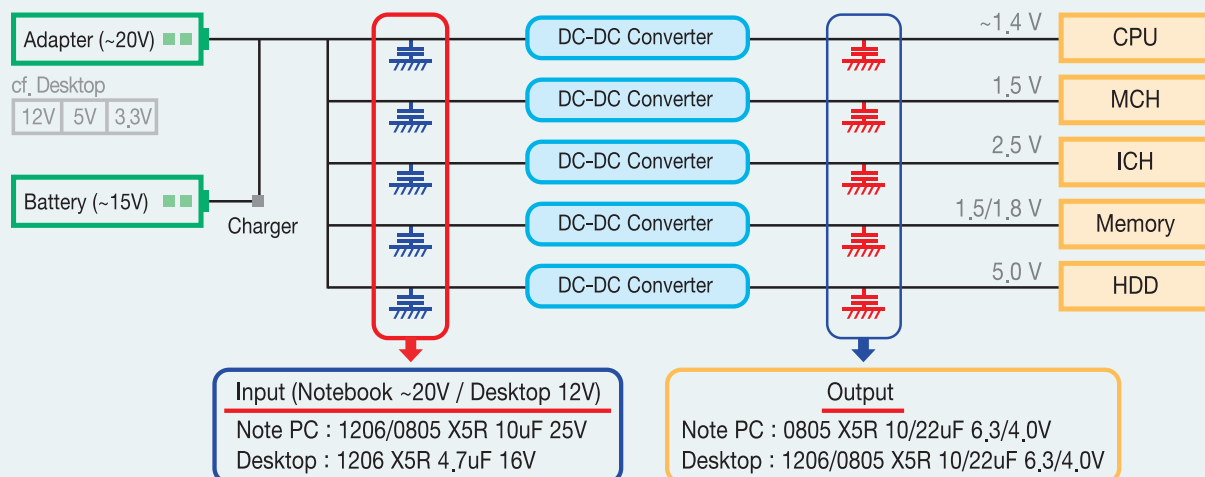




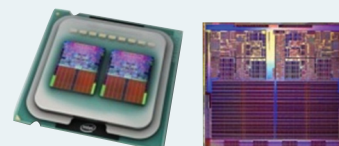
# MLCC (Multi-Layer Ceramic Capacitor)

## Main Decoupling MLCC for PC

- Input : Filtering Noise of wide frequency range along with good frequency characteristics of MLCCs
- Output : Filtering Middle(or High) frequency noise due to low ESL and ESR of MLCCs



- Needs : Multi-Function, High Speed, Smaller & Thinner Size
- MLCC Trend : High Capacitance, Miniaturization



Classification		Vr	Main Parts		Samwha Product Code (*Developing spec.)
Notebook (or Netbook / UMPC)	Input	25V	Current	0805 X5R 4.7uF	CS2012X5R475K250NRE
			Current	1206 X5R 10uF	CS3216X5R106K250NRI
			Next	0805 X5R 10uF	*CS2012X5R106K250NRE
	Output	6.3V	Current	0805 X5R 10uF	CS2012X5R106K6R3NRE
			Current	/22uF	CS2012X5R226M6R3NRE
			Next	0603 X5R 10uF	CS1608X5R106M6R3NRB
		10V	Current	0805 X5R 10uF	CS2012X5R106K100NRE
			Next	0603 X5R 10uF	CS1608X5R106M100NRB
			Current	1206 X5R 10uF	CS3216X5R106K160NRI
Desktop	Input	16V	Current	1206 X5R 10uF	CS3216X5R106K160NRI
			Next	0805 X5R 10uF	CS2012X5R106K160NRE
	Output	6.3V	Current	0805 X5R 10uF	CS2012X5R106K6R3NRE
			Current	/22uF	CS2012X5R226M6R3NRE
		10V	Current	1206 X5R 10uF	CS3216X5R106K100NRI
			Next	0805 X5R 10uF	CS2012X5R106K100NRE

1. Case sizes are based on <inch> scale.

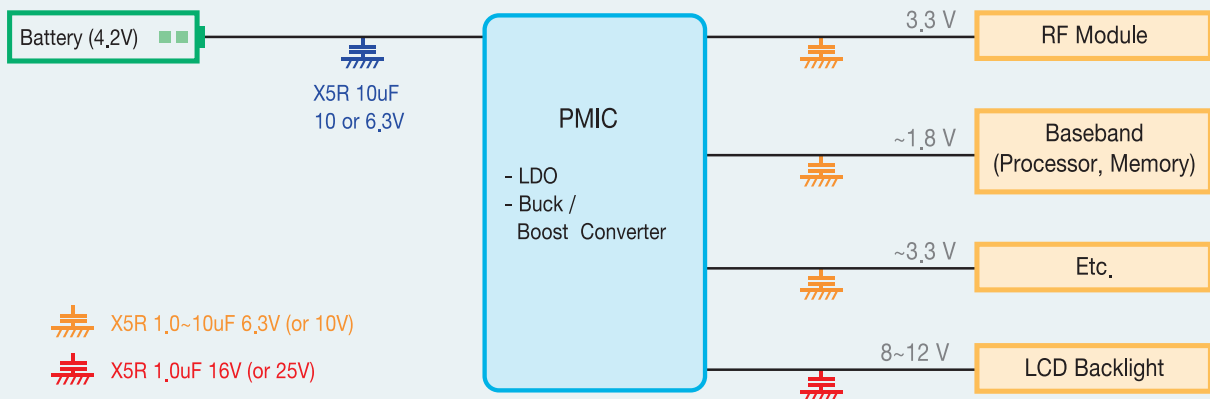
2. Case sizes in Samwha Product Code are based on <mm> scale.

# MLCC (Multi-Layer Ceramic Capacitor)

## Main Decoupling MLCC for Mobile Phone

Filtering Noise of wide frequency range along with good frequency characteristics of MLCCs

Ultra small size MLCCs of 0201(~220nF) can save 50% of mounting space compare with 0402 size.



● Needs : Miniaturization, Slim, Multi-Function (IC Convergence)

● MLCC Trend : Miniaturization, High Capacitance

Classification	Vr	Main Parts		Samwha Product Code (*Developing spec.)
Input	6.3V	Current	0603 X5R 10uF	CS1608X5R106M6R3NRB
		Current	0805 X5R 22uF	CS2012X5R226M6R3NRE
		Next	0603 X5R 22uF	CS1608X5R226M6R3NRB
	10V	Current	0805 X5R 10uF	CS2012X5R106K100NRE
		Current	0603 X5R 4.7uF	CS1608X5R475K100NRB
		Next	0603 X5R 10uF	CS1608X5R106M100NRB
Output	6.3V	Current	0402 X5R 1.0uF	CS1005X5R105K6R3NR
		Current	/2.2uF	CS1005X5R225M6R3NR
		Current	0603 X5R 4.7uF	CS1608X5R475K6R3NRB
		Current	/10uF	CS1608X5R106M6R3NRB
		Next	0402 X5R 4.7uF	CS1005X5R475M6R3NR
	10V	Current	0402 X5R 1.0uF	CS1005X5R105K100NR
		Current	0603 X5R 2.2uF	CS1608X5R225K100NRB
		Next	0402 X5R 2.2uF	CS1005X5R225M100NR
	16V	Current	0402 X5R 1.0uF	CS1005X5R105K160NR
	Small size	Current	0201 X5R 100nF 6.3V	CS0603X5R104K6R3NR
		Current	/10V	CS0603X5R104K100NR

1. Case sizes are based on <inch> scale.

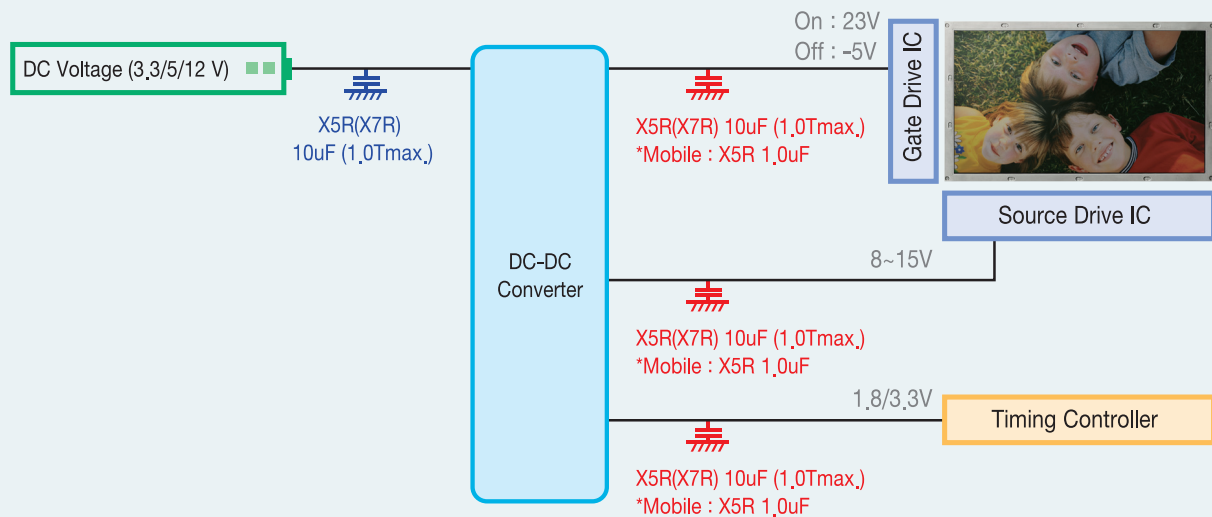
2. Case sizes in Samwha Product Code are based on <mm> scale.



# MLCC (Multi-Layer Ceramic Capacitor)

## Main Decoupling MLCC for LCD

Filtering Noise of wide frequency range along with good frequency characteristics of MLCCs  
Small and low profile MLCCs can easily achieve slim LCD, as well as PCB down sizing to save cost.



### ● MLCC main parts and Samwha product code for LCD by application

Classification	Vr	Main Parts	Samwha Product Code (*Developing spec.)
LCD TV	6.3V	0805 X5R(X7R) 10uF	CS2012X5R(X7R)106K6R3NRE
	10V	0805 X5R 10uF	CS2012X5R106K100NRE
	16V	0805 X5R 10uF	CS2012X5R106K160NRE
		1206 X5R(X7R) 10uF	CS3216X5R(X7R)106K160NRI
	25V	1206 X5R(X7R) 10uF	CS3216X5R(X7R)106K250NRI
Monitor	6.3V	0805 X5R 10uF (1.0Tmax.)	CS2012X5R106K6R3NRB
		1206 X5R 10uF (1.0Tmax.)	CS3216X5R106K6R3NRB
	16V	0805 X5R 10uF (1.0Tmax.)	CS2012X5R106K160NRB
		1206 X5R 10uF (1.0Tmax.)	CS3216X5R106K160NRB
	25V	1206 X5R 10uF (1.0Tmax.)	CS3216X5R106K250NRB
Mobile LCD	10V	0402 X5R 1.0uF	CS1005X5R105K100NR
	16V	0402 X5R 1.0uF	CS1005X5R105K160NR
	25V	0603 X5R 1.0uF	CS1608X5R105K250NRB

1. Case sizes are based on <inch> scale.
2. Case sizes in Samwha Product Code are based on <mm> scale.

## Main Decoupling MLCC for Industrial Applications

SAMWHA high voltage MLCC products with the temperature characteristics of C0G and X7R are designed for commercial and industrial applications. The products are applied to DC-DC converters and ballast circuit to reduce ripple noise and diverting potentially unsafe transients in various sizes with working voltage up to DC 7kV. These high voltage capacitors feature a special internal electrode design which has capacitor network to reduce voltage concentrations by distributing voltage throughout the entire capacitor.

## Features

- High reliability
- The highest voltage rating by the special internal electrode design
- Wide voltage level : from 100VDC to 7,000V<sub>DC</sub>
- Surface mount suited for wave and reflow soldering
- RoHS compliant

## Applications

- DC-DC Converters
- Network Equipments
- Back-Lighting Inverter
- Lighting Ballast
- Modem & Power Supply
- LAN/WLAN Interface

## Special Options for the Safety

- Inset electrode margins to prevent short mode failure resulted from the crack by mechanical bending stress
- Soft termination is optionally available to reduce possibility for the crack of MLCCs by mechanical bending stress

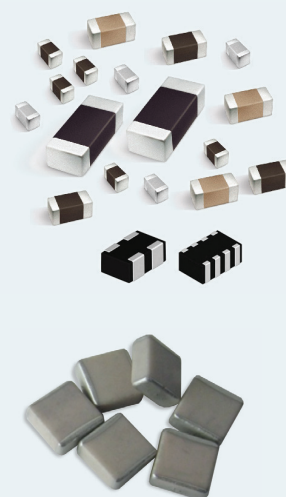


Fig. 1. Appearances of various MLCCs

### C0G Lineup

Size(Inch)	Vr(V)	100pF	220pF	470pF	1.0nF	2.2nF	4.7nF	10nF	22nF
0603	100								
	250								
0805	100								
	250								
1206	100								
	250								
	630								
1210	1,000								
	100								
	250								
	630								
1808	1,000								
	2,000								
	3,000								
	100								
1812	250								
	630								
	1,000								
	2,000								
3026	3,000								
	4,000								
3838	3,000								
	4,000								
	5,000								
	7,000								

### X7R Lineup

Size(Inch)	Vr(V)	2.2nF	4.7nF	10nF	22nF	47nF	100nF	220nF	470nF	1.0uF
0603	100									
	250									
0805	100									
	250									
1206	100									
	250									
	630									
1210	1,000									
	100									
	250									
	630									
1808	1,000									
	2,000									
	3,000									
	100									
1812	250									
	630									
	1,000									
	2,000									
3026	3,000									
	4,000									
3838	3,000									
	4,000									
	5,000									
	7,000									

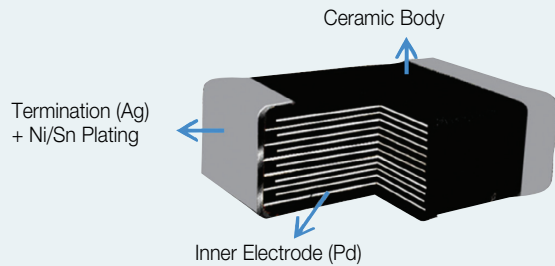
※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives



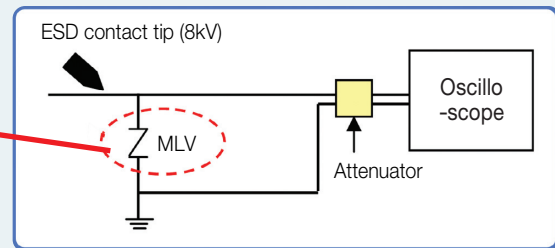
# MLV (Multi-Layer Chip Varistor)

MLVs are good protective components for the transient over-voltage caused by the ESD.  
Good nonlinear voltage-current characteristics and high capability for the electrical surge.

## Internal Structure & Electrical Performance



### Example for the electrical performance test



### Test result for the electrical performance



Insert MLV >>>>

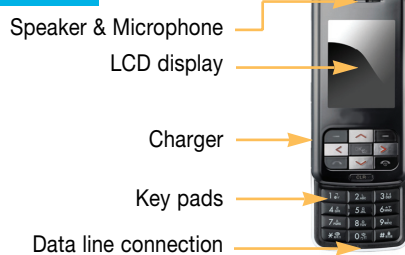


## General Applications

Latch up protection for CMOS, MOSFET protection for ESD / EOS, High speed data I/O port protection  
Keypad, Keyboard protection, CDMA, GSM, Cordless phone

※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives

### Mobile Phone



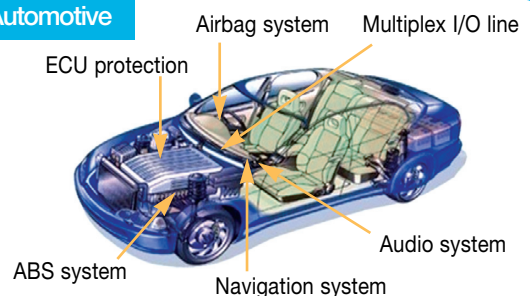
### Mobile AV



### PC (Notebook)



### Automotive



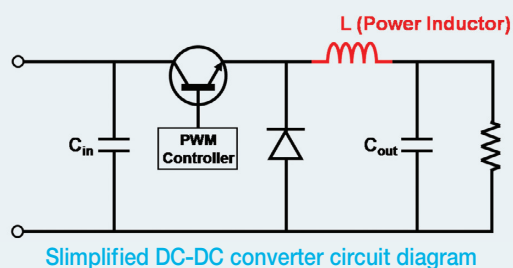
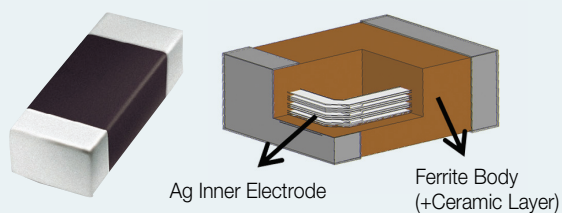
# Chip Power Inductor

## Internal Structure & General Applications

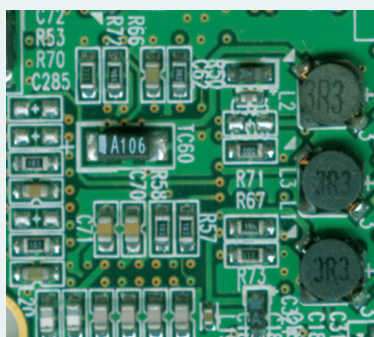
Minimized and magnetic shielded design with co-fired ceramic and magnetic material (Ferrite).

Applied to DC-DC converter to reduce AC noise for the entire portable electronic equipments.

※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives

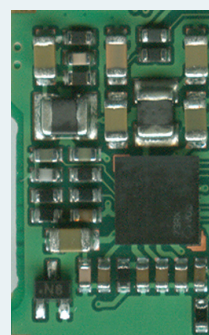


## Replacement for Winding Type Power Inductor



Traditional DC-DC converter circuit with winding type power inductor

Minimize with Multilayer Type Chip Power Inductors



Improved DC-DC converter circuit with multilayer type chip power inductor

### ● Comparison between winding type and multilayer type chip power inductor

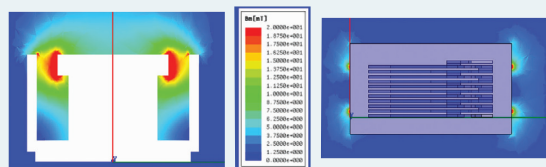
	Winding Type	Multilayer Type
Shape		
Cost	Δ	◎
Size	Δ	○
Thickness	Δ	◎
Mounting	Δ	◎
Resistance to Heat	Δ	◎
Body Strength	Δ	◎
Productivity	Δ	◎
EMI Radiation	Δ	○
Electrical Properties	◎	○
Environmental Problems	Δ	○

◎ : Excellent

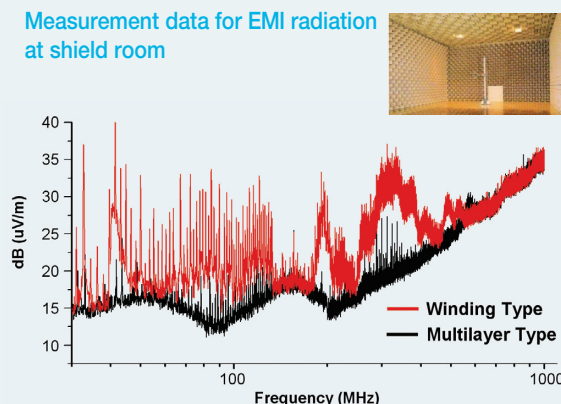
○ : Good

Δ : Normal

### Simulation for EMI radiation



### Measurement data for EMI radiation at shield room

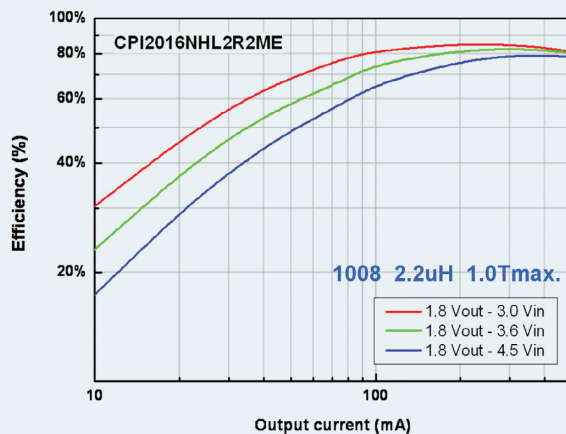
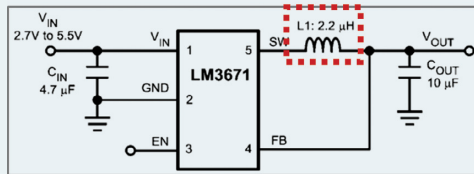




# Chip Power Inductor

## Electrical Performance

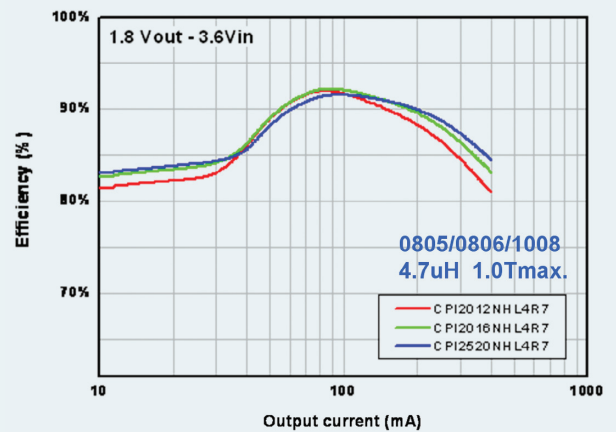
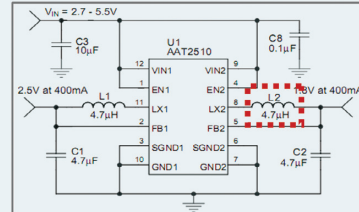
Switching Frequency : 2 MHz



Chip power Inductor

- CPI series offers a high efficiency at the high current and frequency

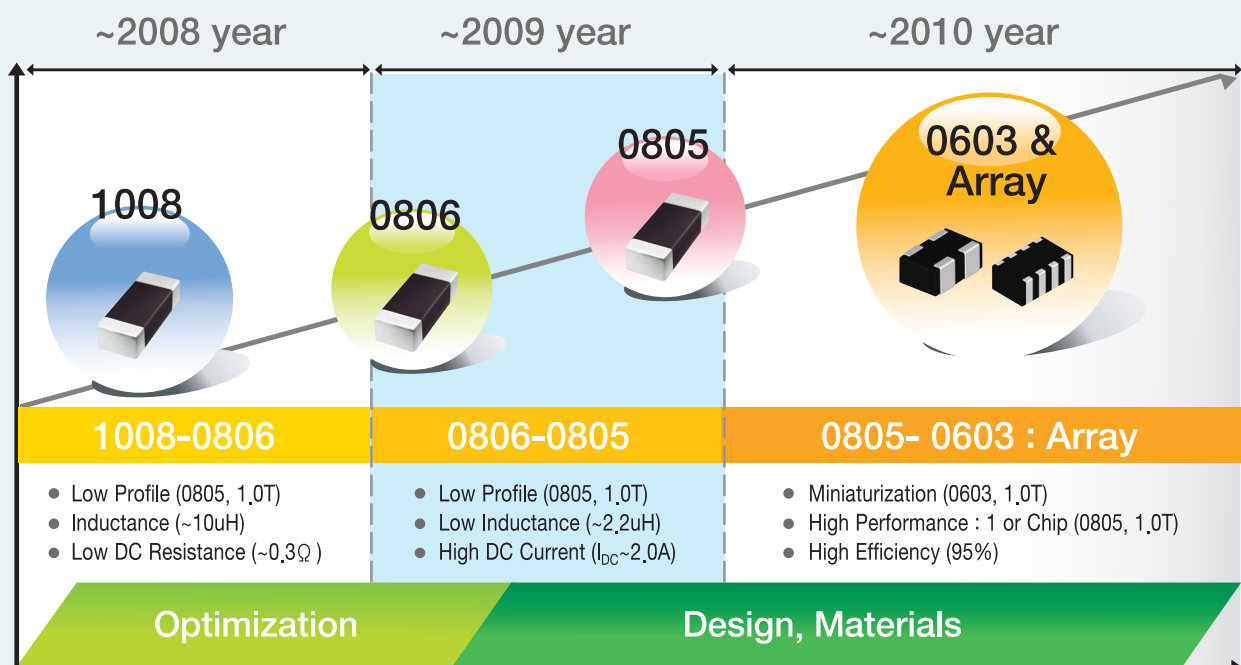
Switching Frequency : 1 MHz



Chip power Inductor

- High efficiency more than 90% at the input voltage of 3.6 V and the output voltage of 1.8 V

## Development Roadmap (Cutting Edge Technology)



DC-DC Switching Frequency

※ Case Size are based on (inch) scale.

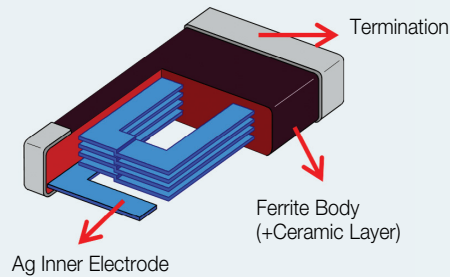
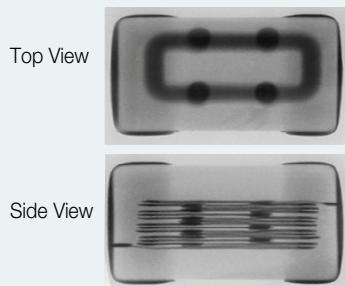
# Chip Bead & Inductor

Chip beads are suitable to eliminate high frequency noise.

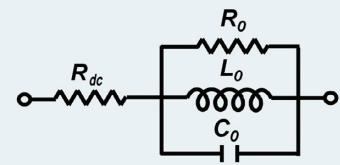
Chip inductors are good components for impedance matching and frequency noise filtering.

## Internal Structure

X-ray transmission image



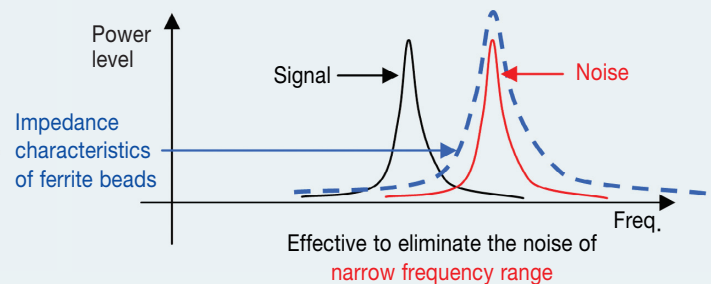
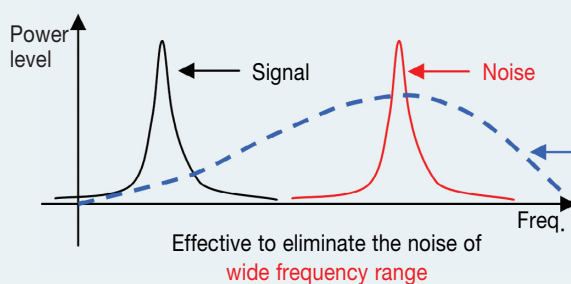
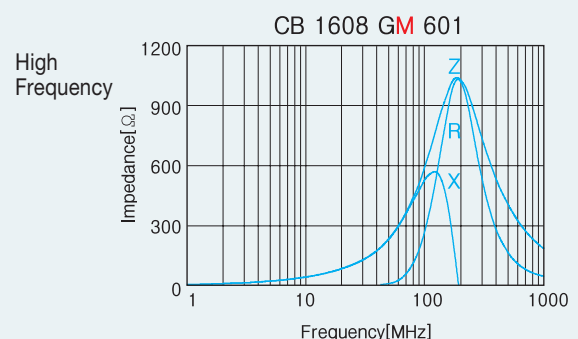
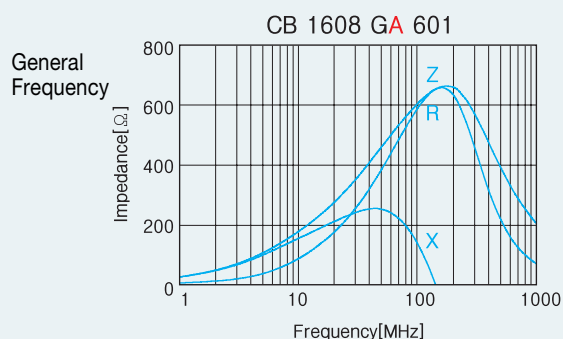
Equivalent circuit model



$R_{dc}$  : DC resistance  
 $1/R_o$  : Core Loss  
 $L_o$  : Inductance  
 $C_o$  : Parasitic Capacitance

## Electrical Characteristics

- Frequency characteristics of 600Ω chip beads with the material type



$f_R$  Case sizes in product code are based on <mm> scale.

- Inductors are filtering high or low frequency noise by their inductance

## General Applications

- PC and peripheral equipments, Mobile electronic equipments, AV / OA electronic equipments
- Chip Beads : Frequency noise suppression (I/O port, DC power lines, Signal lines)
- Chip Inductors : Impedance matching, Low / High frequency noise filtering

※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives

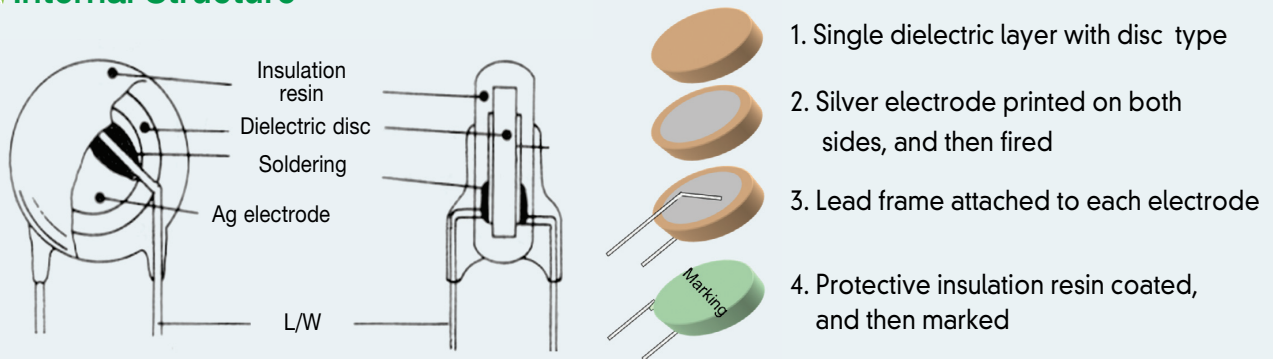


# DCC (Disc Ceramic Capacitor)

Samwha DCCs are designed and produced with high reliability and small size.

Wide production range of temperature characteristics and rated voltages for various circuit application.

## Internal Structure



## General Applications

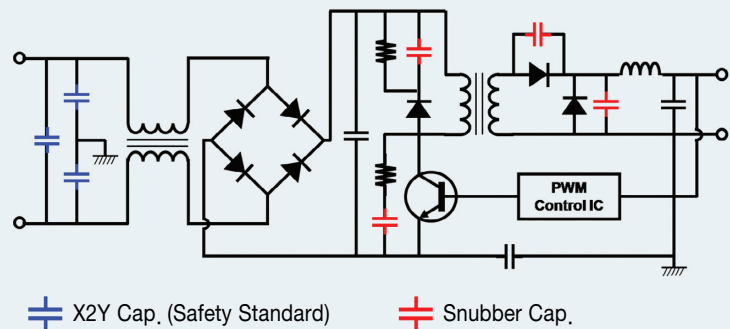
General PCB circuit for home appliances, AV equipments, TV (LCD, PDP) and industrial equipments

Especially, DCCs are widely used to SMPS for the entire electric equipments.

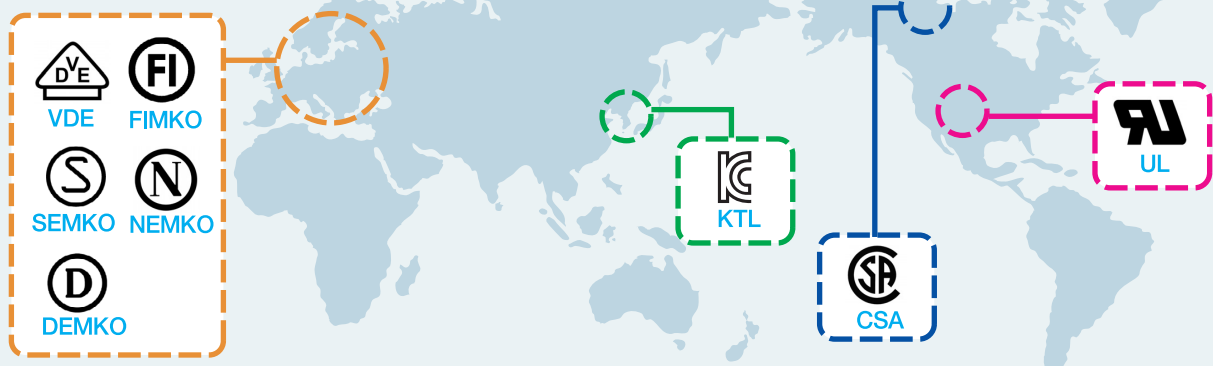
※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives



### General DCCs application for SMPS



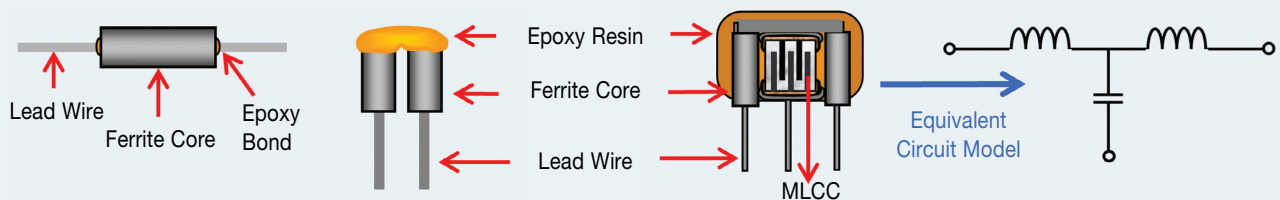
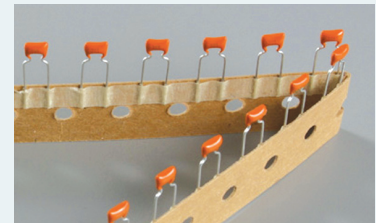
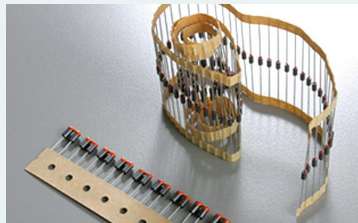
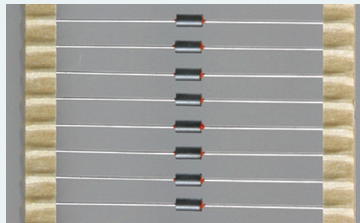
## Recognition for the Safety Standard



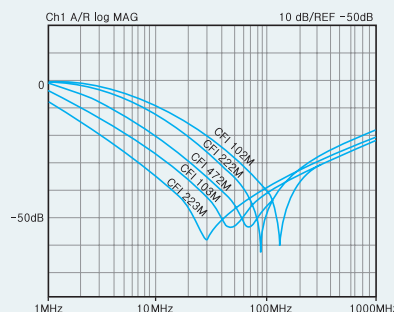
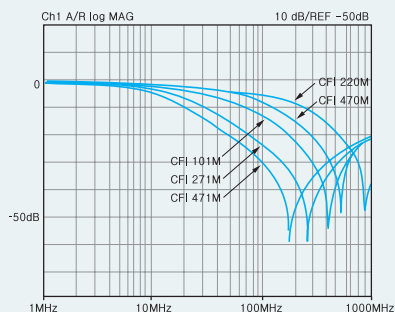
# EMI Filter & SMDC (Surface Mount Disc Capacitor)

## EMI (Electro-Magnetic Interference) Filter

EMI filters serve as an excellent countermeasure against noise, because they provide high attenuation over a wide band of frequency from 10 to 1000 MHz.



### Typical insertion loss characteristics with frequency



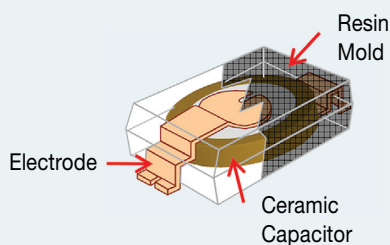
### Applications

- PC and peripheral equipments
- AV equipments
- Automotive electronic equipments

## SMDC (Surface Mount Disc Capacitor)

SMDCs are specially designed for surface mounting.

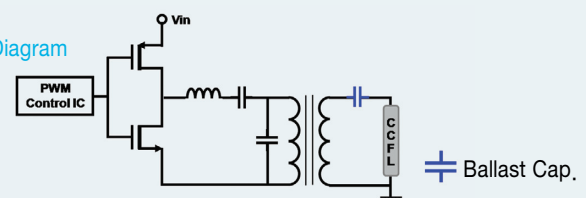
High reliability and wide rated voltage ranges from 1 kV to 6 kV



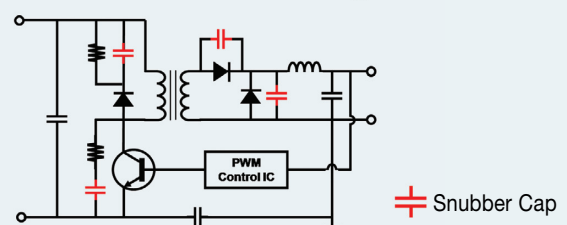
### Applications

- Inverter for LCD backlight
- Ballast circuit
- Snubber capacitor for DC-DC converter

#### Ballast Circuit Diagram



#### DC-DC Converter Circuit Diagram



※ special specification like a Automobile, Medical, Military, Aviation should be discuss with our sales representatives



## Note

Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage to a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- |                              |   |
|------------------------------|---|
| 1. Aircraft equipment        | 2. Aerospace equipment  |
| 3. Undersea equipment        | 4. Power plant equipment  |
| 5. Medical equipment         | 6. Transportation equipment (vehicles, trains, ships, etc.)   |
| 7. Traffic signal equipment  | 8. Disaster prevention / crime prevention equipment   |
| 9. Data-processing equipment | 10. Application of similar complexity and/or reliability requirements to the applications listed in the above |

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[www.samwha.com](http://www.samwha.com)



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Tel. 82-31-332-6441, 330-5985  
Fax. 82-31-339-0411  
E-mail. sales@samwha.com

**GUMI BRANCH** : 129-4, Gongdan-Dong,  
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E-mail. shyu@samwha.com

### •SAMWHA HONG KONG Co., Ltd.

Unit 3 to 9, 5th Floor, Hi-Tech Center, 9choi  
Yuen Road Sheungshui, New Territories Hongkong  
TEL, 852-2668-2460 FAX, 852-2668-2420  
E-mail, kyd@samwha.com

#### SHANGHAI BRANCH :

Rm.1502, Xinyin Mansion Caohejing Hi-Tech Park,  
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TEL, 86-21-6432-0337~8 FAX, 86-21-6432-0339  
E-mail, shanghai@samwha.com

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Room 1909, Business Center, The Center Point, No.2  
Dongzong Road, Dongguan City, Guangdong China  
TEL, 86-769-2233-3517 FAX, 86-769-2233-3537  
Mobile, 86-138-2699-6617 E-mail, mlckwon@samwha.com

### •SAMWHA HI-TEC INTERNATIONAL TRADING Co., Ltd.

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Mobile, 86-137-5230-2400 E-mail, jhmun@samwha.com

#### TIANJIN SAMWHA GAOXIN SHANDONG OFFICE :

Hainuo dasha 801, Changjiang rd, No 150, Kaifuqu, Yantai, China  
TEL, 86-535-611-6095, 611-0199 FAX, 86-535-611-6097  
Internet phone, 82-070-7671-3085 Mobile, 86-135-0535-2193  
E-mail, ksmac@samwha.com

### •SAMWHA POLAND Sp. z.o.o

ul.Finska 2, Biskupice Podgorne 55-040 Kobierzyce  
TEL, 48-71-733-7295-6 FAX, 48-71-733-7298  
E-mail, cbpark@samwha.com

### •SAMWHA THAILAND Co., Ltd.

66 MOO 4 T.Takai A,Mung Chachoengsao  
24000, Thailand  
TEL, 66-38-847571~3 FAX, 66-38-847575, 847616  
E-mail, eungjin@samwha.com

### •P.T SAMCON

JL, Raya Subang Cikumpay-Campaka Purwakarta  
Jawa-Barat Indonesia  
TEL, 62-264-216-882~7 FAX, 62-264-216-901~2  
E-mail, ytcho@samwha.com

### •SAMWHA EUROPE GmbH

SAMWHA EUROPE GmbH, Lyoner st, 44-48,  
D-60528, Frankfurt am Main, Germany  
TEL, 49-69-963-765-0 as representative number in 6 lines  
FAX, 49-69-963-765-65  
E-mail, shimtj@samwha.com

### •SAMWHA USA Inc.(HEAD OFFICE)

2555 Melksee Street, San Diego, CA 92154, USA  
TEL, 1-619-671-0870 FAX, 1-619-671-0874  
[www.samwhausa.com](http://www.samwhausa.com) E-mail, info@samwhausa.com

#### CHICAGO OFFICE :

200 Fairway Drive, Suite 170 Vernon Hills, IL 60061, USA  
TEL, 1-847-294-0081 FAX, 1-847-294-0082  
[www.samwhausa.com](http://www.samwhausa.com) E-mail, info@samwhausa.com

### •SAMWHA Hungary Kft.

1138, Marina Part Danubius u, 16, A-806 Budapest, Hungary  
TEL, 36-27-539-581 FAX, 36-27-539-580  
E-mail, jkkimid@samwha.com

### •SAMWHA INDIA ENERGY SAVINGS PVT. Ltd.

703, 7th floor, Kailash Building, Kasturba Gandhi Marg, New Delhi-110001  
TEL, 91-11-4355-3460-1 FAX, 91-11-4355-3462  
E-mail, swindia1@samwha.com