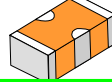


用在電源的三端子濾波器

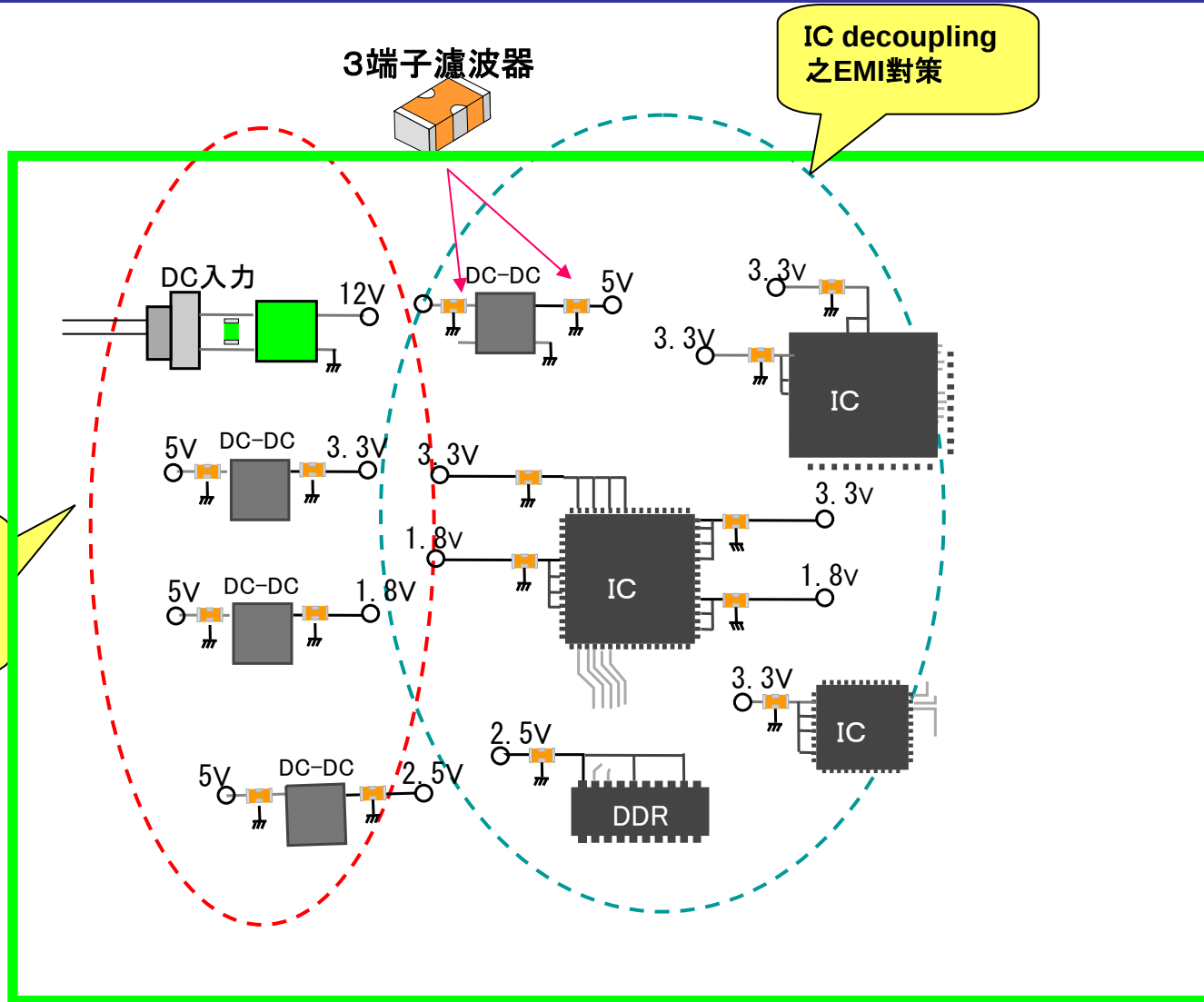
3端子濾波器



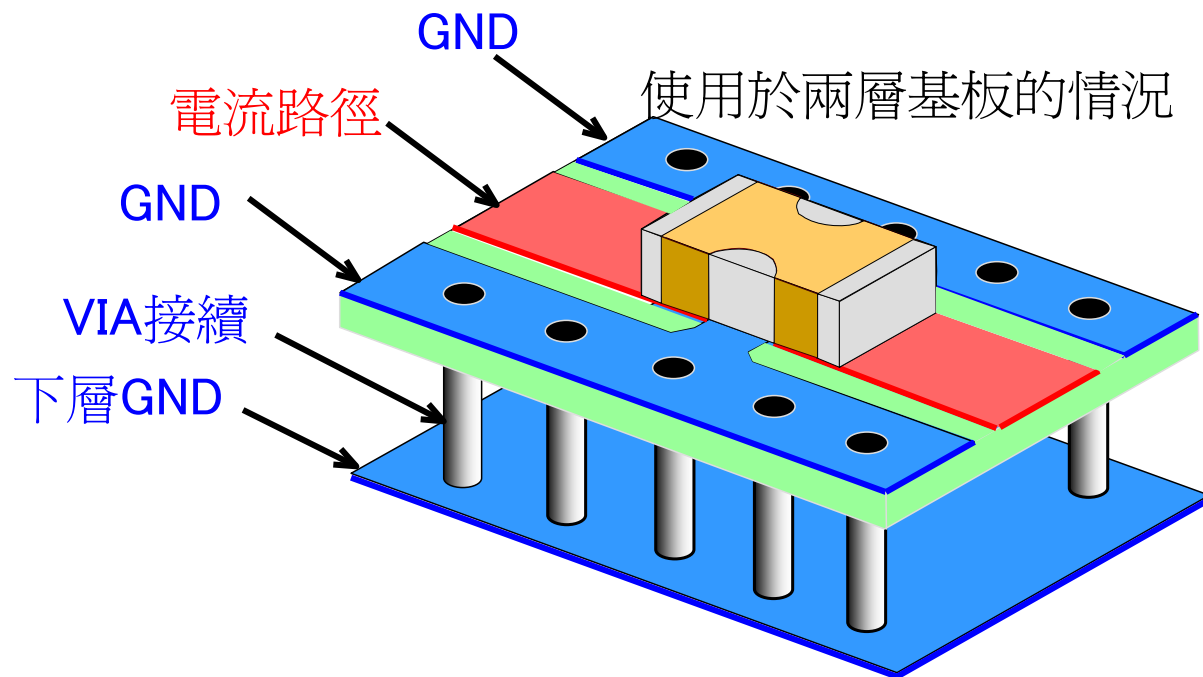
IC decoupling
之EMI對策

電源迴路

濾波迴路等的高頻EMI對策



三端子電容之Land pattern

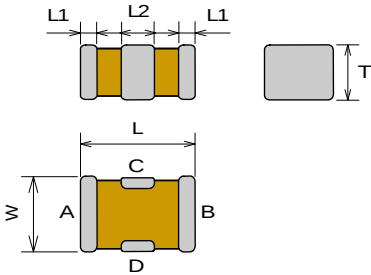


三端子濾波器

CNH20, 30及32系列(高容值三端子濾波器)

RoHS對應
無鉛、無鹵

■ 寸法



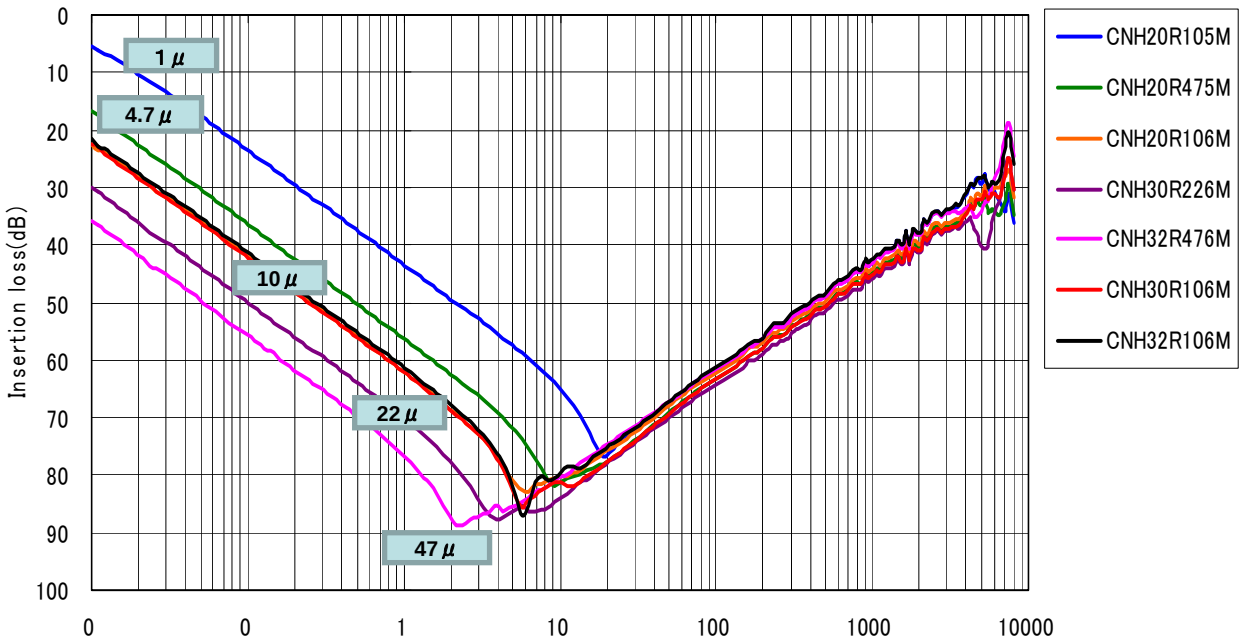
単位:mm

形式	L	W	T	L1	L2
20	2.0±0.2	1.25±0.2	1.0±0.2	0.3±0.2	0.6±0.2
30	3.2±0.3	1.6±0.3	1.3±0.3	0.4±0.3	1.1±0.3
32	3.2±0.3	2.5±0.3	1.6±0.3	0.4±0.3	1.1±0.3

■ 品名及規格

形 名	静電容量	容量許容差	定格電圧	定格電流	絶縁抵抗Min.	直流抵抗Max.	使用温度範囲
CNH20R105M-TM	1.0 μ F	±20%	16V DC	4A	500M Ω	20m Ω	-55~+85℃
CNH20X105M-TM	1.0 μ F	±20%	16V DC	4A	500M Ω	20m Ω	-55~+125℃
CNH20R475M-TM	4.7 μ F	±20%	6.3V DC	5A	100M Ω	15m Ω	-55~+85℃
CNH20R106M-TM	10 μ F	±20%	6.3V DC	6A	50M Ω	10m Ω	-55~+85℃
CNH20R106M-TMT	10 μ F	±20%	10V DC	6A	50M Ω	10m Ω	-55~+85℃
CNH30R226M-TM	22 μ F	±20%	6.3V DC	6A	25M Ω	10m Ω	-55~+85℃
CNH32R476M-TM	47 μ F	±20%	4.0V DC	8A	10M Ω	5m Ω	-55~+85℃
CNH30R106M-TM	10 μ F	±20%	16V DC	6A	50M Ω	10m Ω	-55~+85℃
CNH30R106M-TMC	10 μ F	±20%	25V DC	6A	50M Ω	10m Ω	-55~+85℃
CNH32R106M-TM	10 μ F	±20%	25V DC	6A	50M Ω	10m Ω	-55~+85℃

■ 挿入損失特性圖



Chip Type EMI Filters

For DC Power Line[CNG41 Series]

The CNG41 Series is a 3-terminal EMI filter for SMT based on multilayer chip capacitor technology.

Feature

- Due to its small size and low residual inductance, it performs noise reduction at higher frequencies than conventional capacitors.
- Allows setting priority for either High Current(A-B input-output) or for high frequency characteristic (C-D input-output) by changing mounting direction.

Applications

- Noise reduction for DC lines in computers, computer peripheral equipment, digital TV, etc.



Part Number System

CNG
Series

41
Style
41:4.5×1.6
(L) (W)

R
Temperature
characteristics
R: ±15%

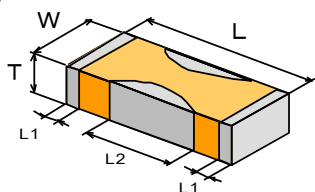
184
Cap.

S
Cap. tolerance
S: +50,-20%

- T
Packing form
T: Taping
B: Bulk

M
Termination
M: Ni/Sn plated

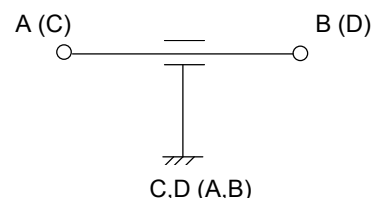
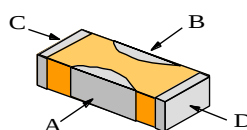
Dimensions



Unit: mm

Type	L	W	T	L1	L2
CNG41	4.5±0.3	1.6±0.3	1.0±0.3	2.8±0.2	0.3±0.2

Equivalent circuit

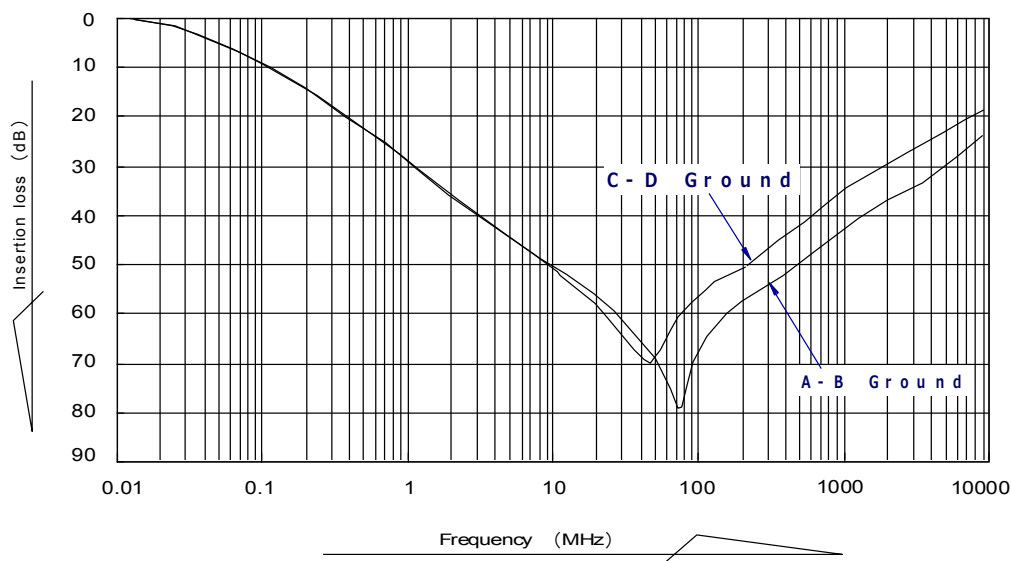


Part Number List · Specifications

Part number	Capacitance	Capacitance tolerance	Rated voltage	Rated current	IR	DC resistance	Temp. range
CNG41R184S-□M	0.18μF	+50,-20%	50V DC	6A DC(A-B) 2A DC(D-C)	1,000MΩmin.	0.01Ωmax(A-B) 0.05Ωmax(D-C)	-55~+125°C

□: "T" stands for taping package and "B" stands for bulk package.

Insertion loss (Reference)



三端子濾波器

電源用・高減衰三端子濾波器

【CNR10系列】

三端子CNR10系列應用陶瓷電容的技術。

■特長

- 該三端子的特點是將接地放大，可大幅的降低等效串聯電感(ESL)等效串聯電阻(ESR)及提高共振點頻率，且在廣域頻率的範圍上，發揮優越的插入損失
- 額定電流設定2A、適用於DC電源的EMI對策

■用途

- 手機, 數位電視, DSC, DV等的DC電源

■零件編號系統

CNR

系列名稱

10

形狀

10:1.6×0.8
(L) (W)

R

溫度特性

R:±15%

105

容值

M

容值公差

M:±20%

-

T

包裝形態

T:Taping

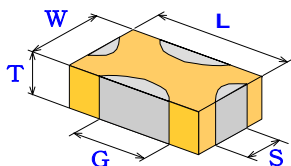
B:散裝

M

端點種類

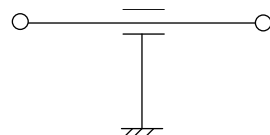
M:鍍電鍍

■形狀・寸法



形式	L	W	T	G	S
CNR10	1.6±0.1	0.8±0.1	0.6±0.1	0.8 +0.2/-0.1	0.4±0.1

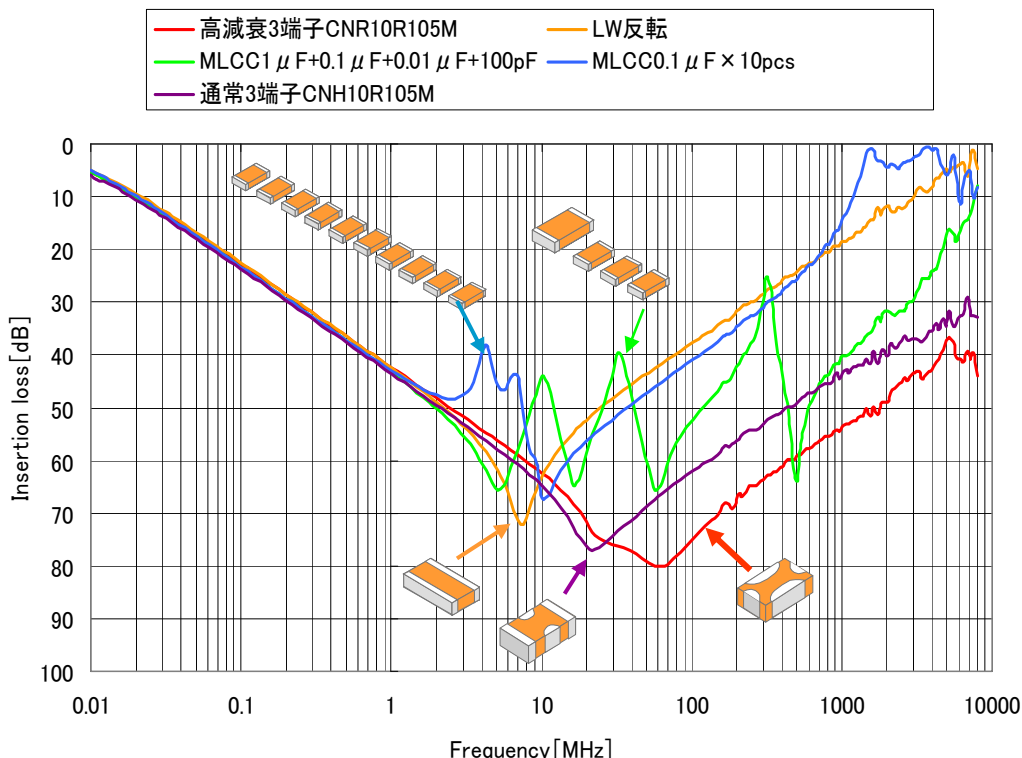
■等效迴路



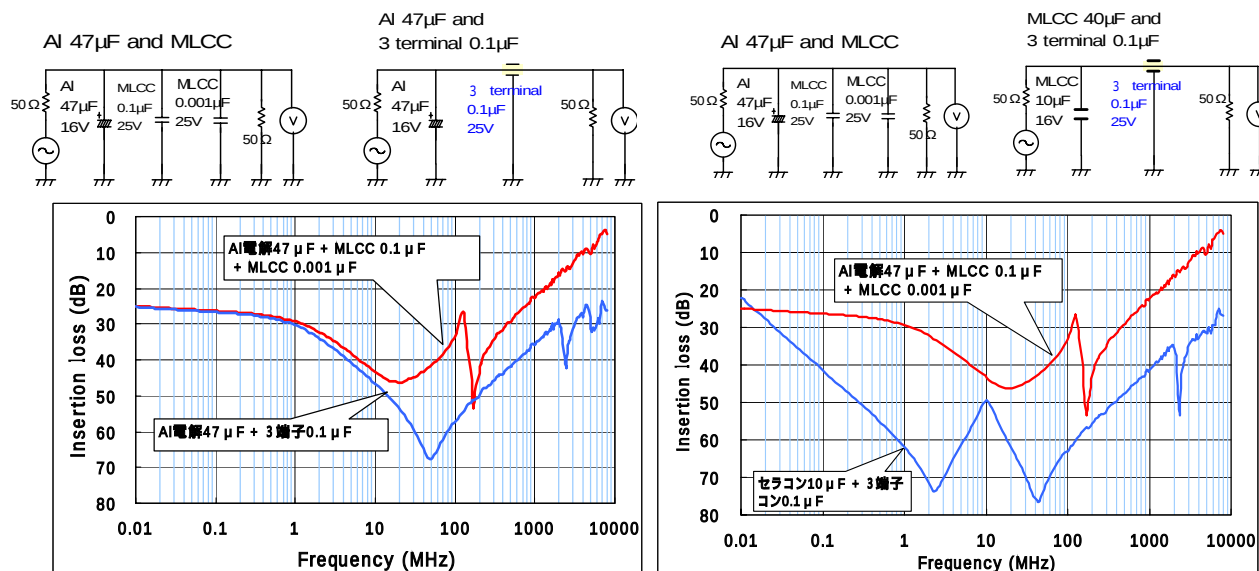
■品名及規格

形名	靜電容量	靜電容量許容差	定格電壓	定格電流	絕緣抵抗	直流抵抗	使用溫度範圍
CNR10R105M-□M	1 μF	±20%	10V DC	2A DC	500M Ω min.	0.06 Ω max	-55~+85℃

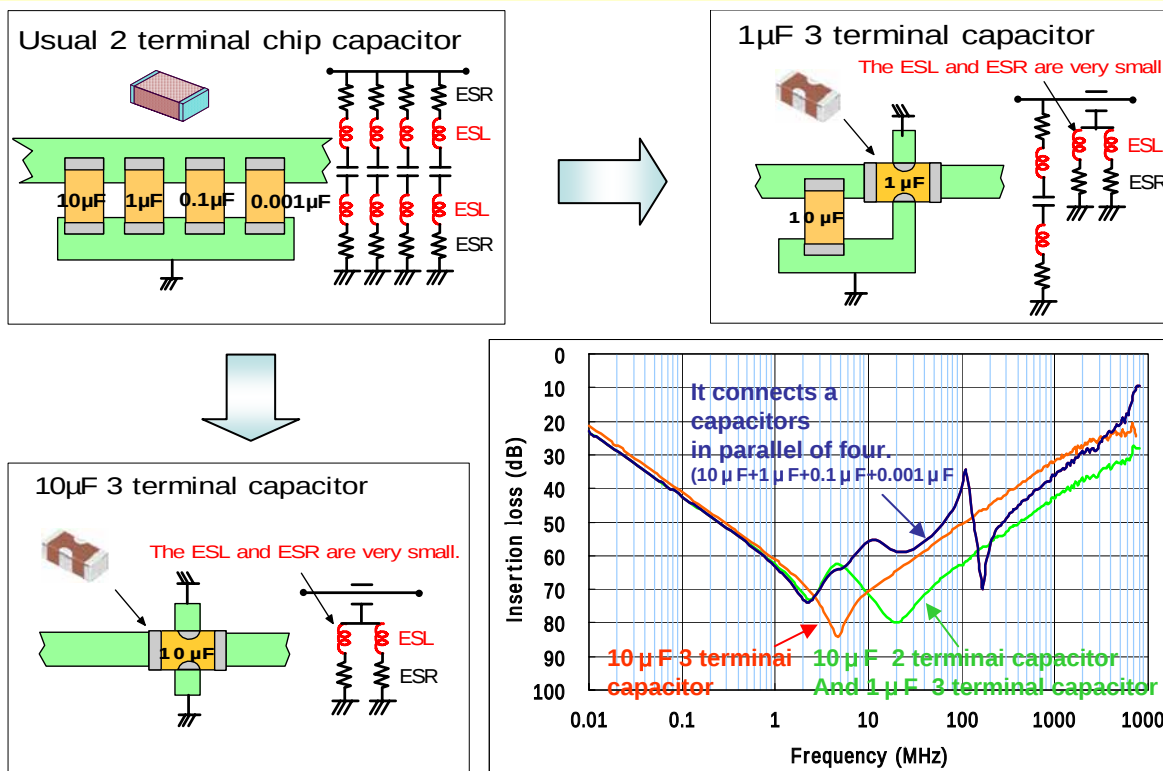
■插入損失特性圖 (參考)



The improvement of the high frequency decoupling characteristic by the combination of the 3 terminal chip EMI filter CNH series (Combines CNH20F104Z and an aluminum electrolytic capacitors and MLCC.)



In to replace usual capacitors with the 3 terminal capacitor, there is an effect in the reduction of the number of parts and the improvement of the high frequency characteristic.



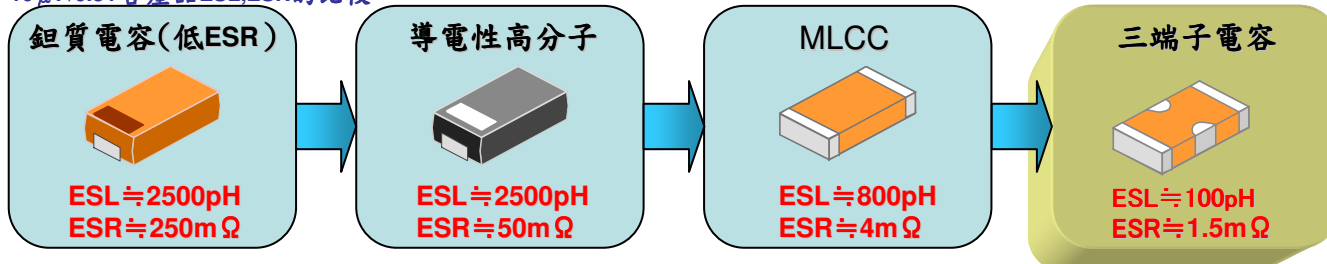
高容值三端子濾波器的特點

IC高速化
減少NOISE
減少零件

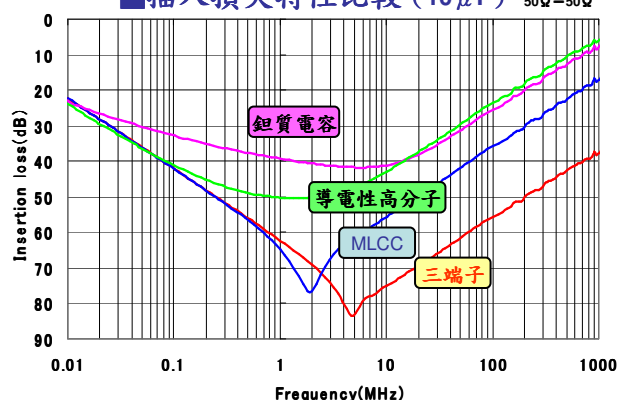
要求可對應
更高頻的電容

電容的
低ESL、低ESR化

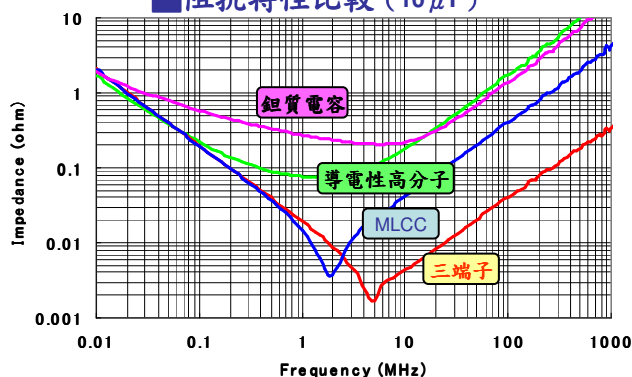
10 μ F/6.3V各產品ESL,ESR的比較



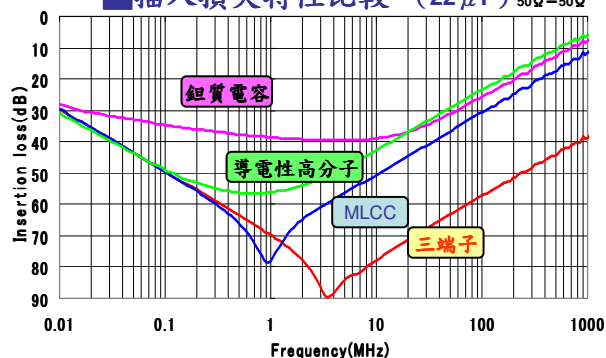
■插入損失特性比較 (10 μ F) 50 Ω —50 Ω



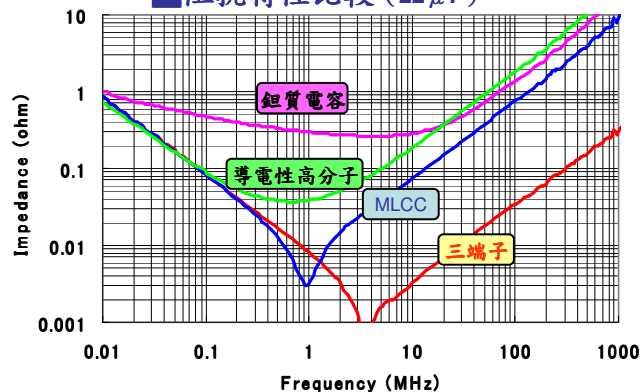
■阻抗特性比較 (10 μ F)



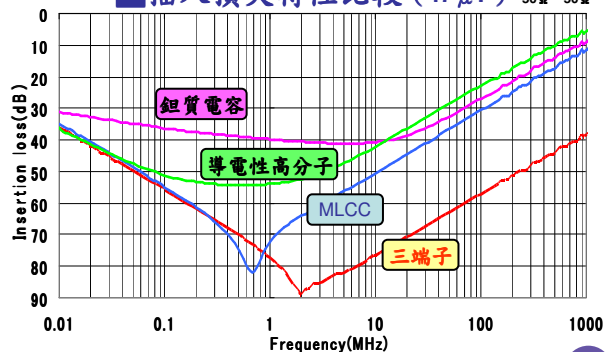
■插入損失特性比較 (22 μ F) 50 Ω —50 Ω



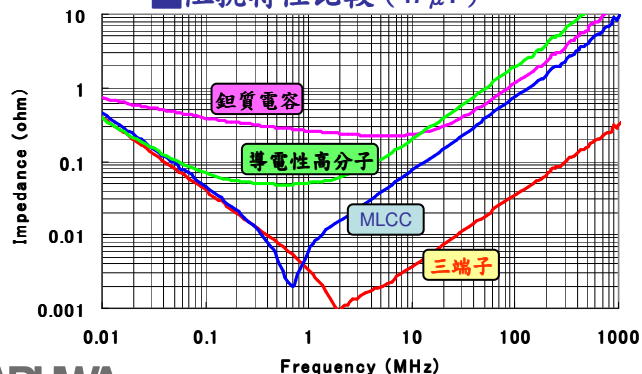
■阻抗特性比較 (22 μ F)



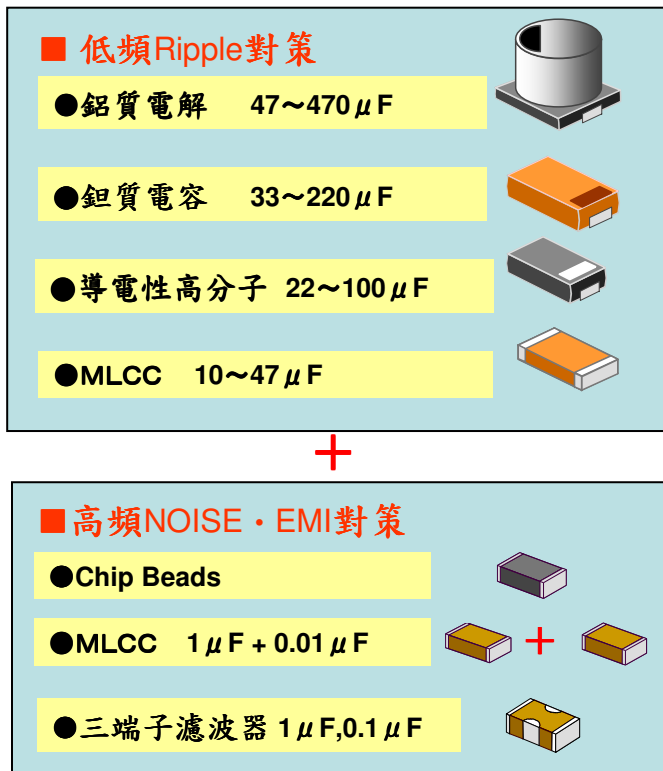
■插入損失特性比較 (47 μ F) 50 Ω —50 Ω



■阻抗特性比較 (47 μ F)



單顆三端子濾波器取代多顆零件



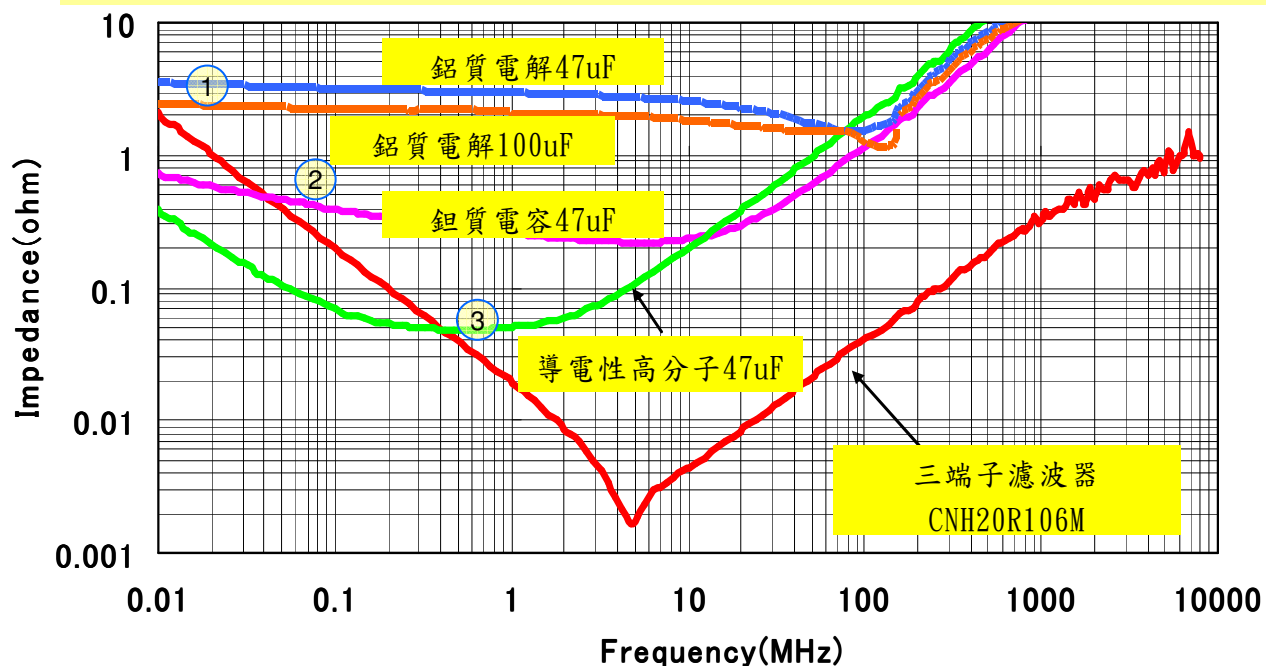
在電源回路端，針對低頻Ripple及高頻EMI的對策，使用單顆元件即可對應。



小容值三端子濾波器即可取代大容值電容

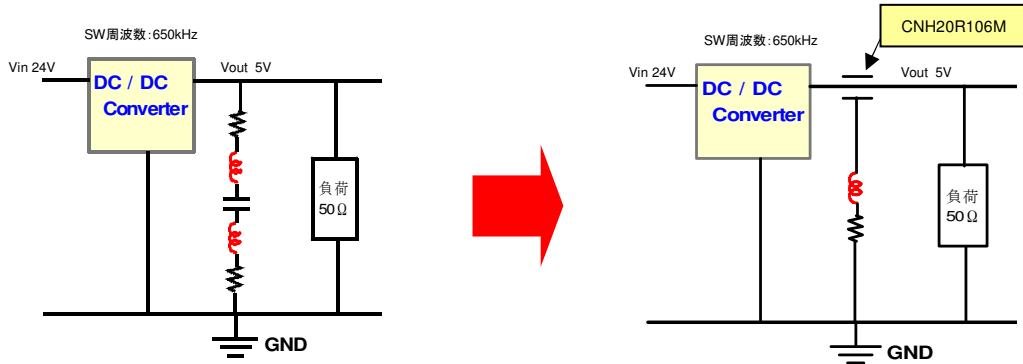
阻抗頻率特性比較圖

- ① 三端子10 μ F在頻率10kHz以上的阻抗比鋁質電解電容100 μ F還低。
 - ② 三端子10 μ F在頻率30kHz以上的阻抗比鉮質電容47 μ F還低。
 - ③ 頻率300kHz以上阻抗比導電性高分子固體電解電容47 μ F還低。
- 可一併強化低頻Ripple對策及高頻NOISE對策及減少使用零件數量。

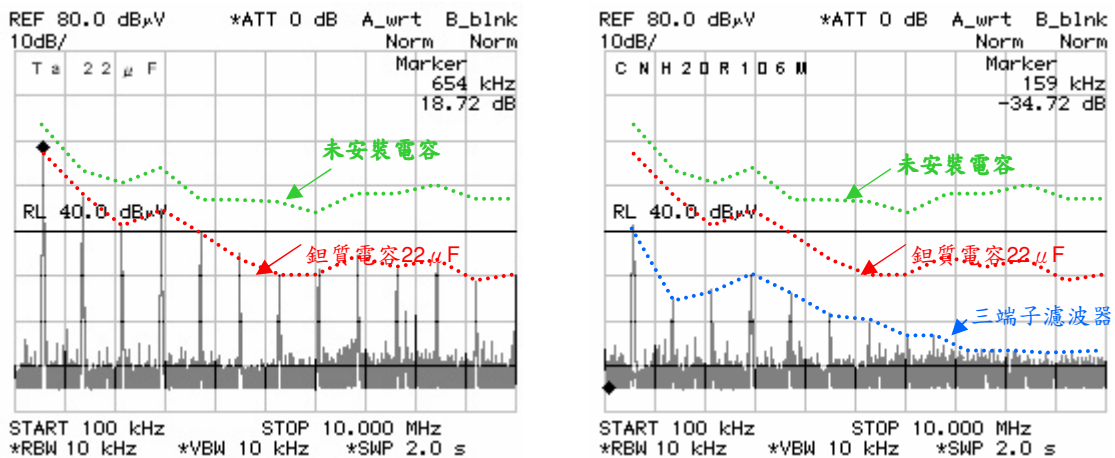


三端子濾波器 $10\mu\text{F}$ 在DC/DC Converter輸出端NOISE的對策實例

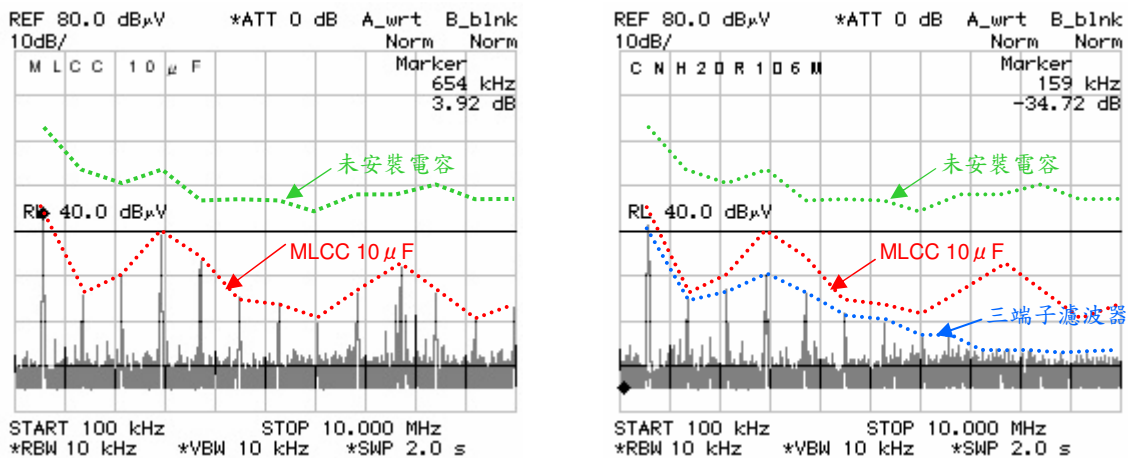
三端子濾波器的ESR值遠低於目前的電容、可高效率抑制Switching所發生的突波異常雜訊；此外低的ESL值也提高共振點的頻率，且大幅的抑制寬廣頻率的NOISE。



鉭質電容 $22\mu\text{F}$ 與三端子濾波器 $10\mu\text{F}$ 的比較圖

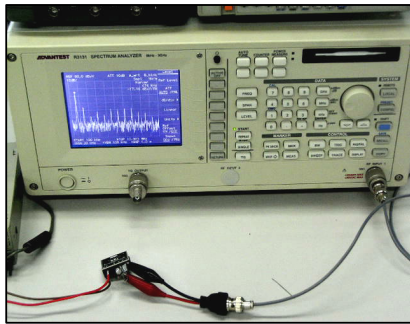


MLCC $10\mu\text{F}$ 與三端子濾波器 $10\mu\text{F}$ 的比較圖

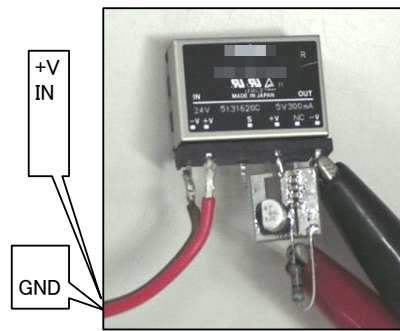


DC-DC Converter の Ripple NOISE 抑制效果比較

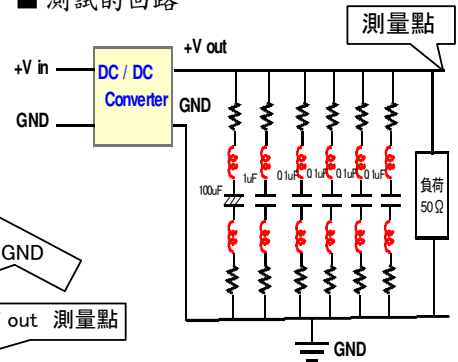
■ 頻譜分析儀



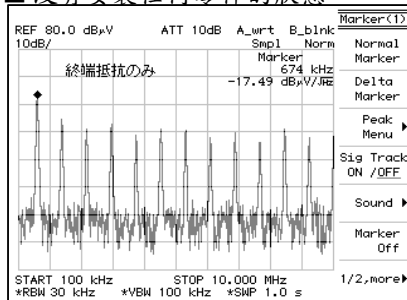
■ 接続状態



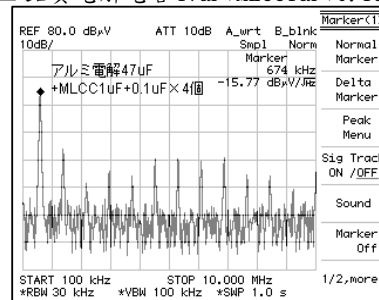
■ 測試的回路



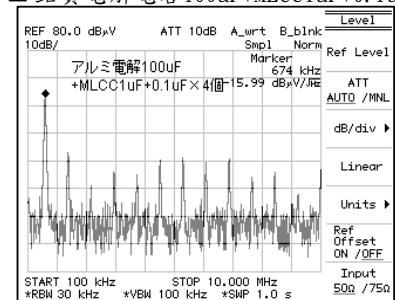
■ 沒有安裝任何零件的狀態



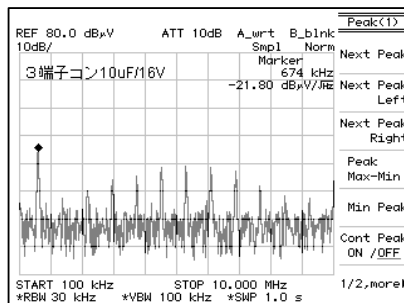
■ 鋁質電解電容47uF+MLCC1uF+0.1uF4個



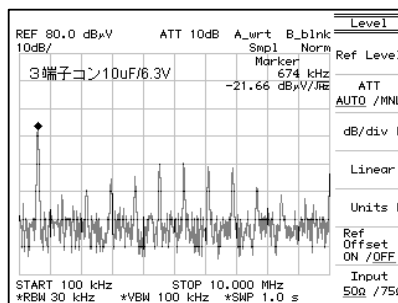
■ 鋁質電解電容100uF+MLCC1uF+0.1uF4個



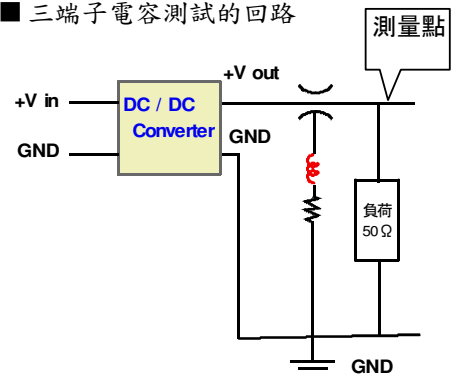
■ 三端子電容10uF/16V



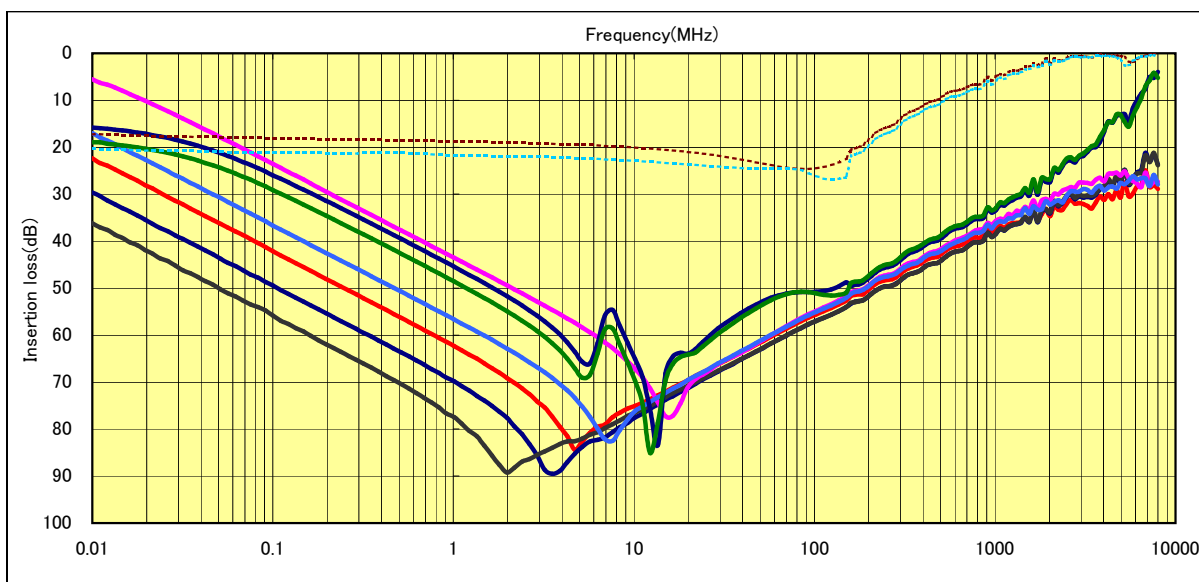
■ 三端子電容10uF/6.3V

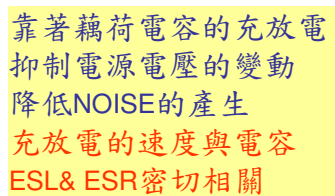


■ 三端子電容測試的回路



■ 插入損失特性比較





Switching Ripple電壓與NOISE

輸入

輸出

DC 電源

ESR

ESL

充電

放電

C1

ESR

ESL

GND

C1:高容值電容
47uF~470uF

電壓的變動與NOISE的發生

IC動作的脈衝電流

時序動作

IC

ESR

ESL

C2

ESR

ESL

GND

C2:低頻用高容值電容
10uF~100uF

ESR

ESL

C3

ESR

ESL

GND

C3,C4:高頻用低容值電容
1uF, 0.1uF, 0.01uF

ESR

ESL

C4

ESR

ESL

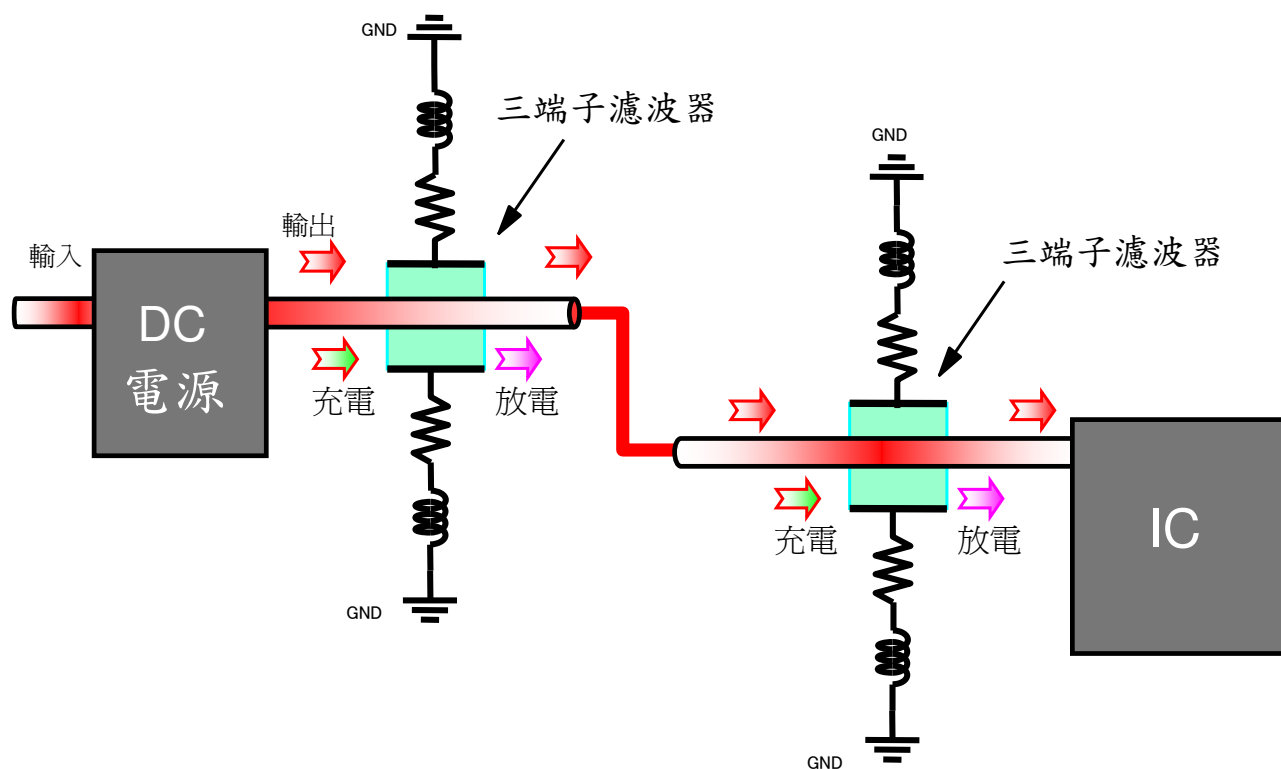
GND

並聯多個電容對應低頻Ripple與高頻NOISE

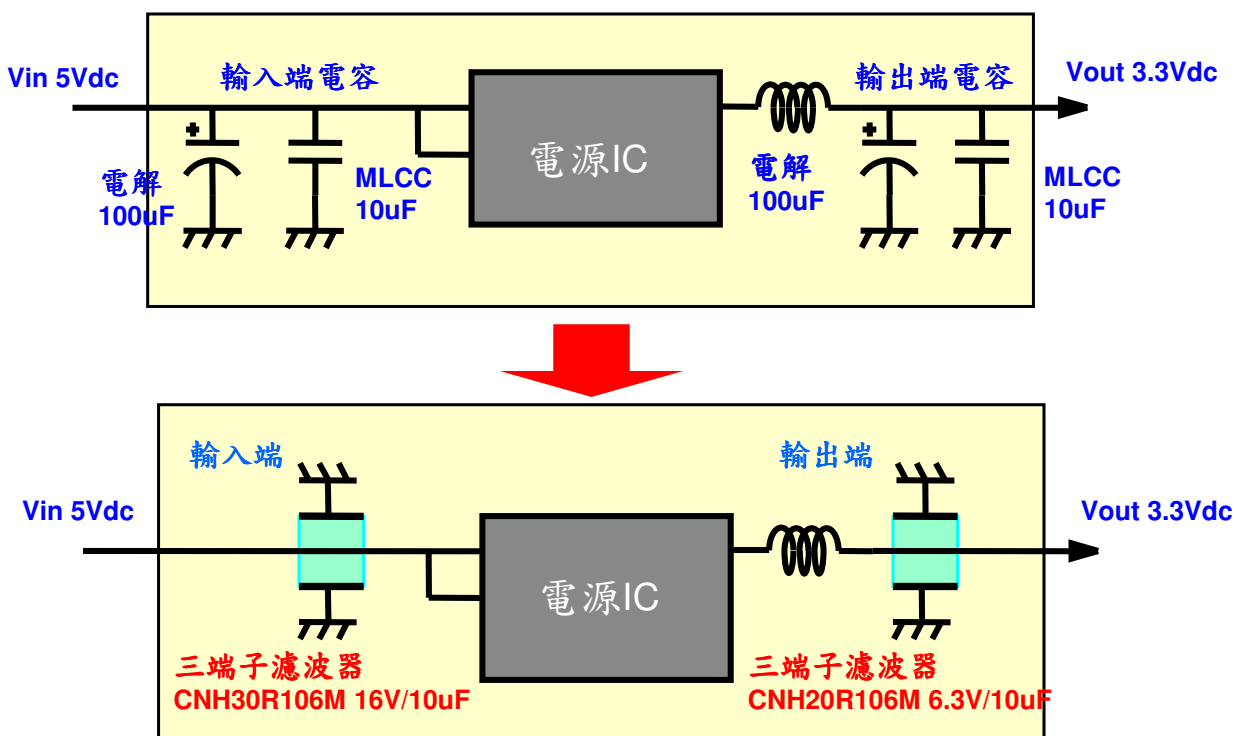
動作頻率提高時，高的殘留電感值將造成阻礙，在充放電的速度無法對應下，電源電壓產生變動而產生NOISE

高容值三端子濾波器高速對應DC電源

導入三端子濾波器，對應高速充放電，抑制電源電壓的變動，吸收NOISE

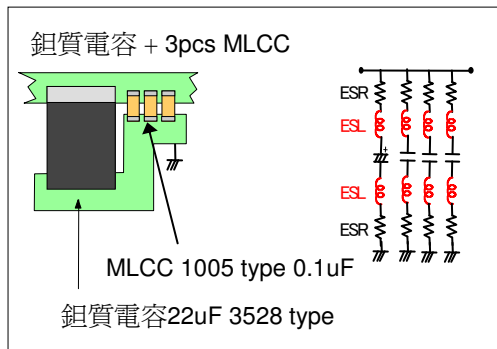


DC-DC Converter 輸出與輸入端之對應方式

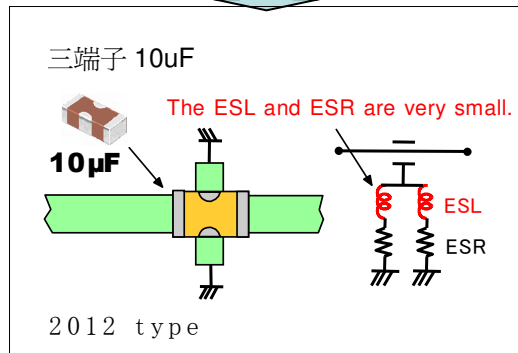
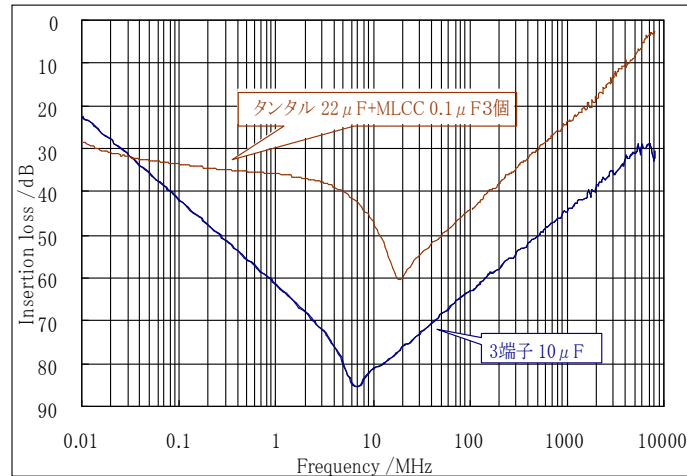


高容値三端子濾波器減少零件使用數量

鉭質電容22 μ F + MLCC 0.1 μ F x3個 → 高容値三端子濾波器10 μ F

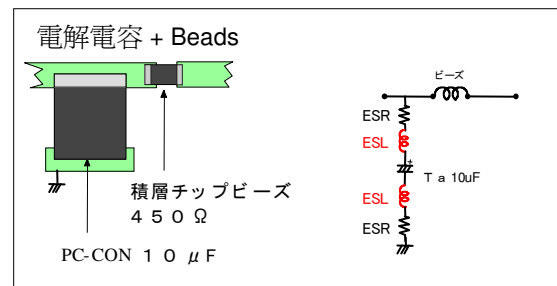


■ 插入損失特性比較表

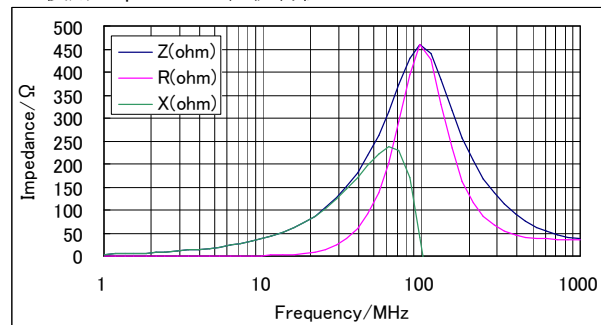
(at 50 Ω - 50 Ω)

高容値三端子濾波器減少零件使用數量

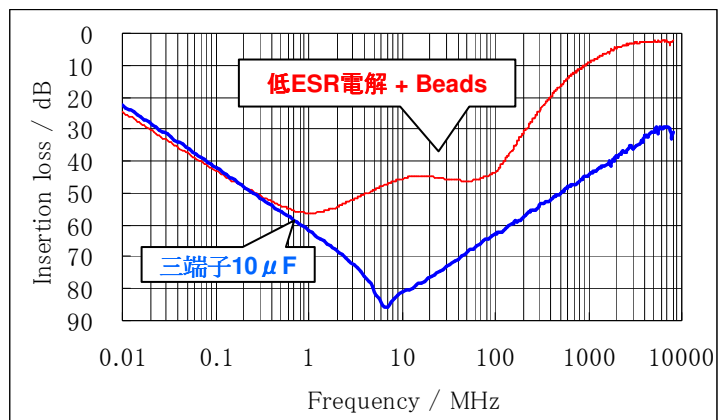
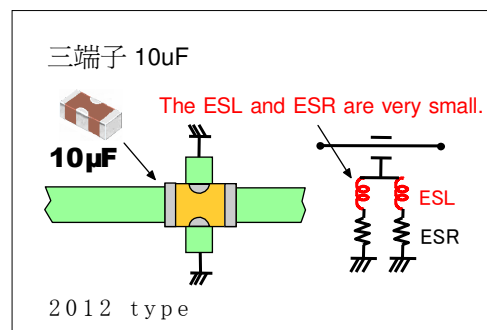
導電性高分子 + Beads → 高容値三端子濾波器10 μ F



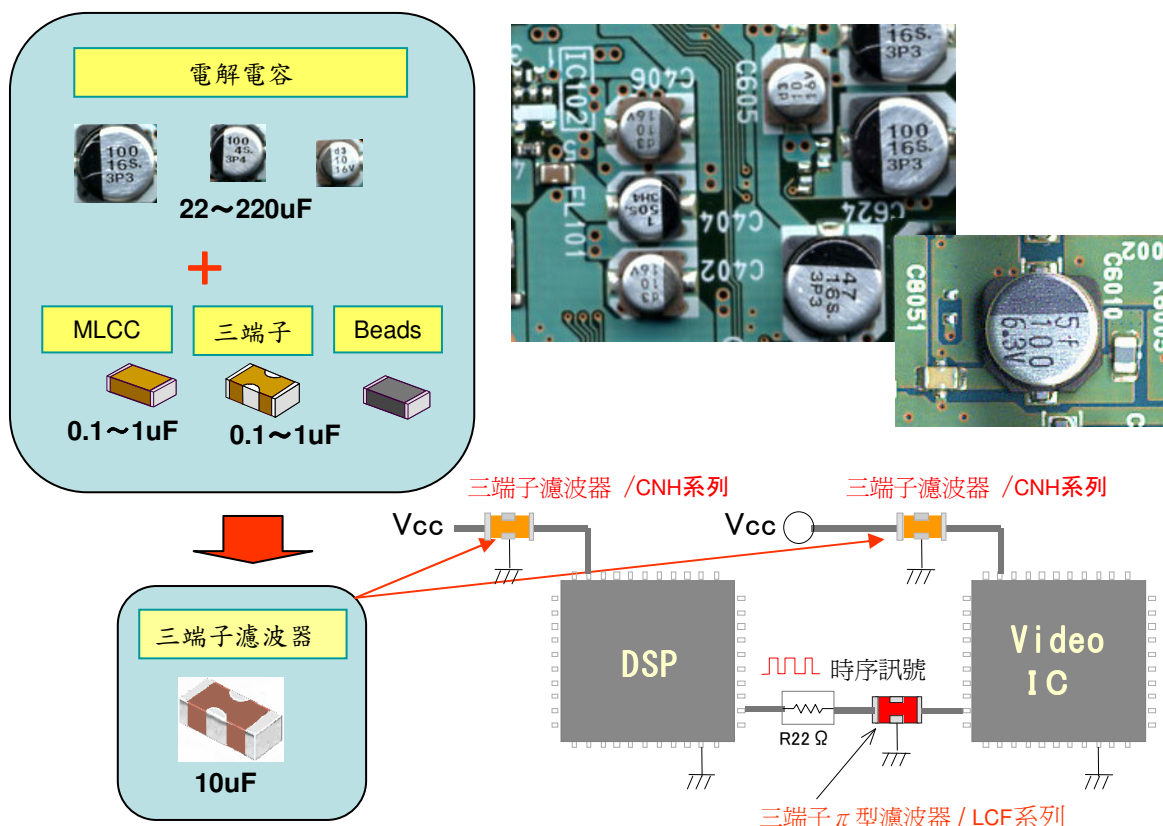
■ 使用Chip Beads之阻抗特性



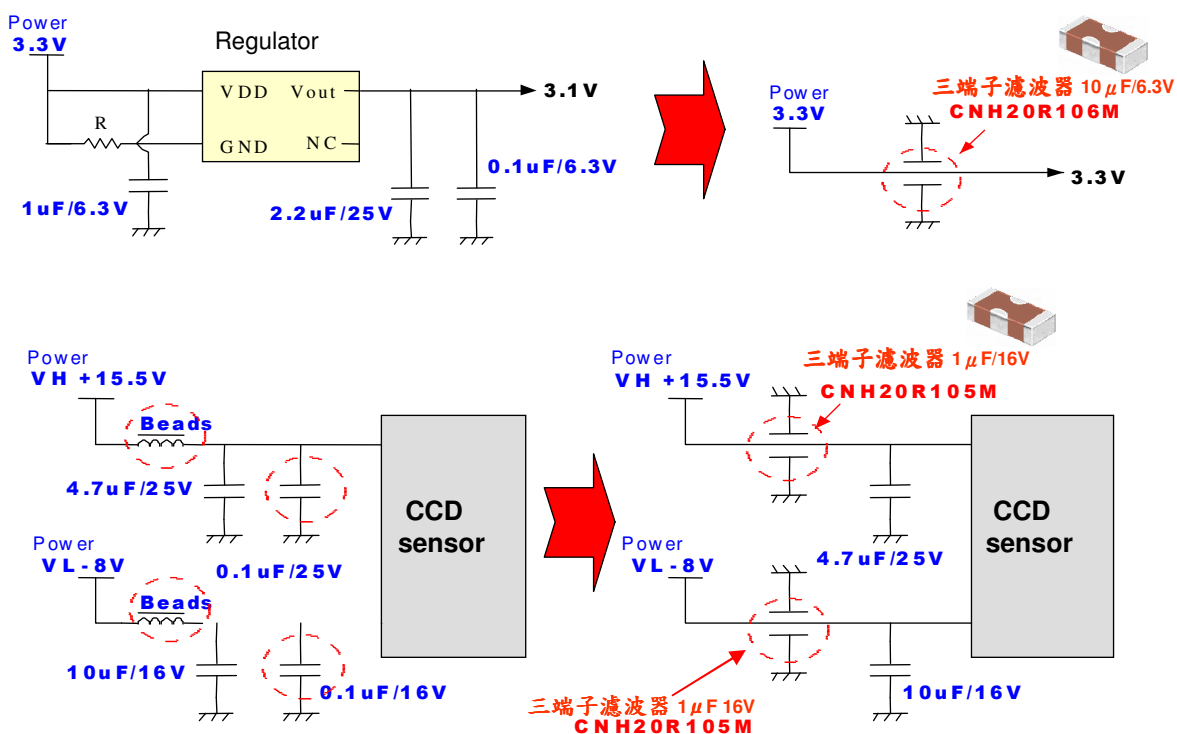
■ 插入損失特性比較表



MARUWA三端子濾波器對應DSP之置放圖例



Digital Camera之適用圖例

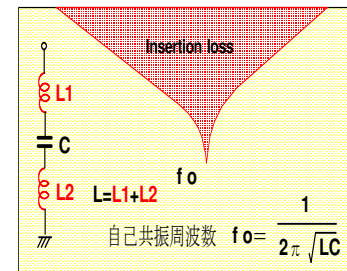
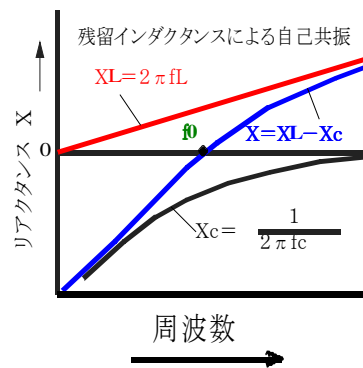
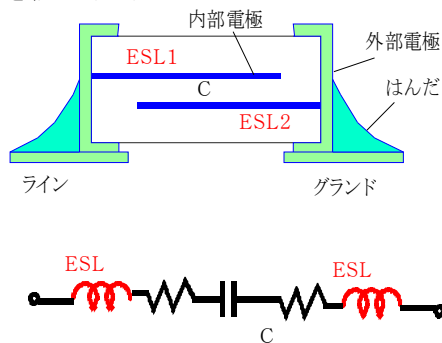


電容の残留電感値與共振點

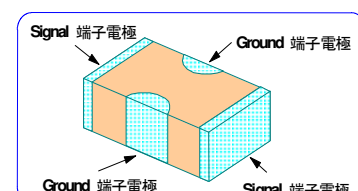
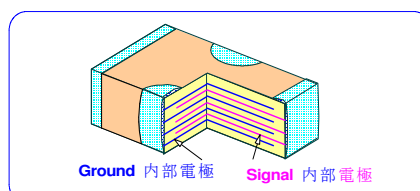
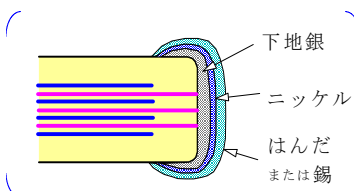
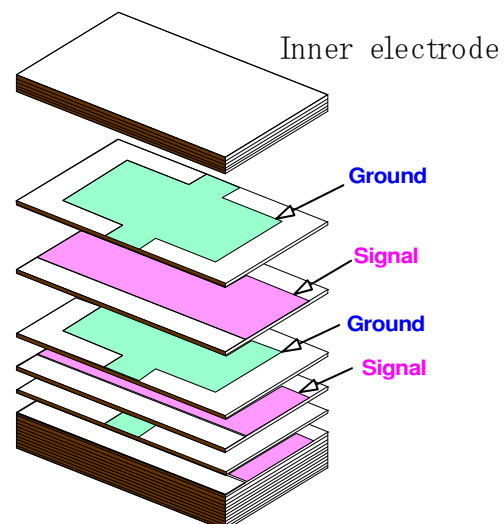
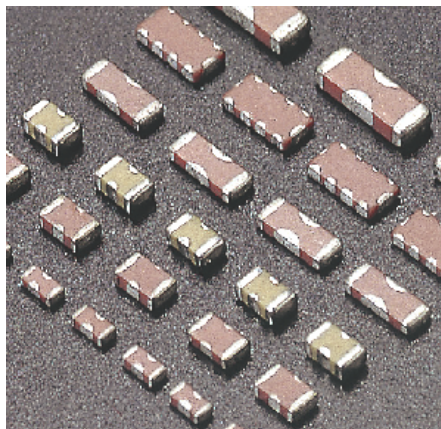
■電容之共振頻率(f0)

電容因本身產生容抗(X_c)及感抗(X_L)的因素,而發生共振現象;電容的共振也就是當電抗=0時(reactance=0),產生的共振頻率,即 $X_L + X_C = 0$ 時,產生共振點,共振頻率為 $f_0 = \frac{1}{2\pi\sqrt{LC}}$

通常のコンデンサ

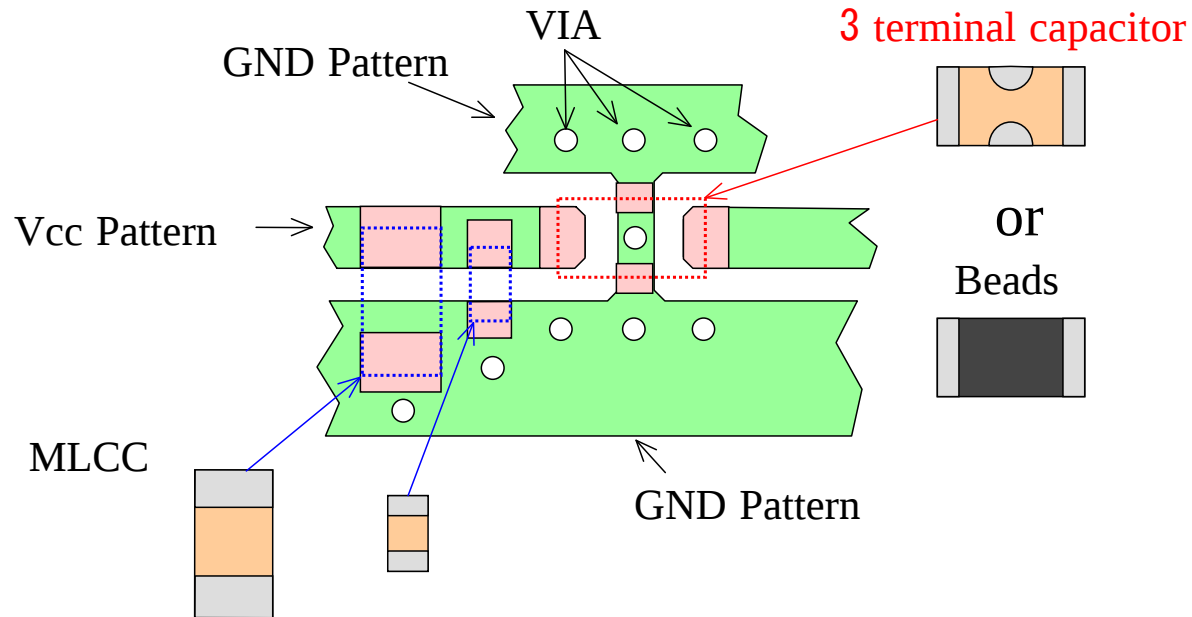


三端子濾波器的外觀與構造



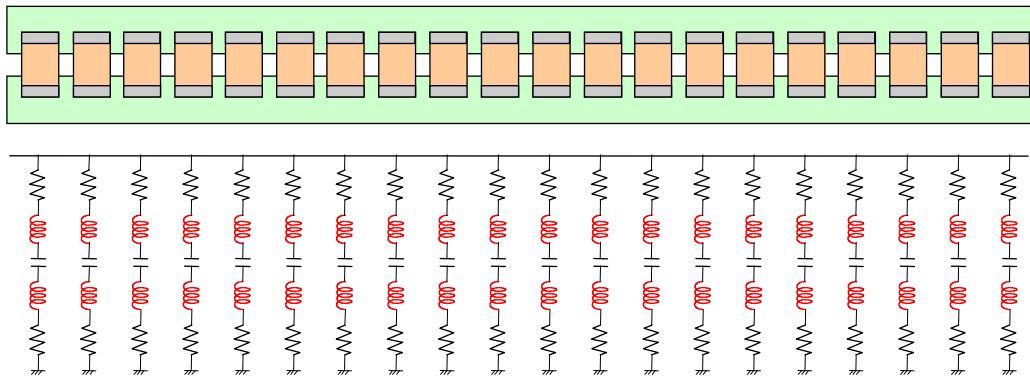
三端子電容實裝例(1)

MLCC 10uF + 0.1uF + Beads → 3 terminal capacitor 10uF



同時具有MLCC與三端子電容組合的layout上，
當不需要三端子電容的時候，可以使用MLCC+Chip Beads的組合，或是
jumper chip。

一般電容與三端子濾波器残留電感值的比較

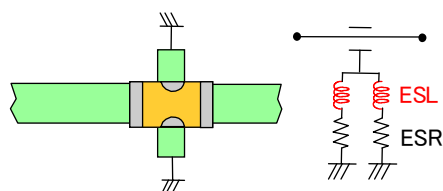


MLCC 30個
並聯連接

$$ESL \div 1/30$$

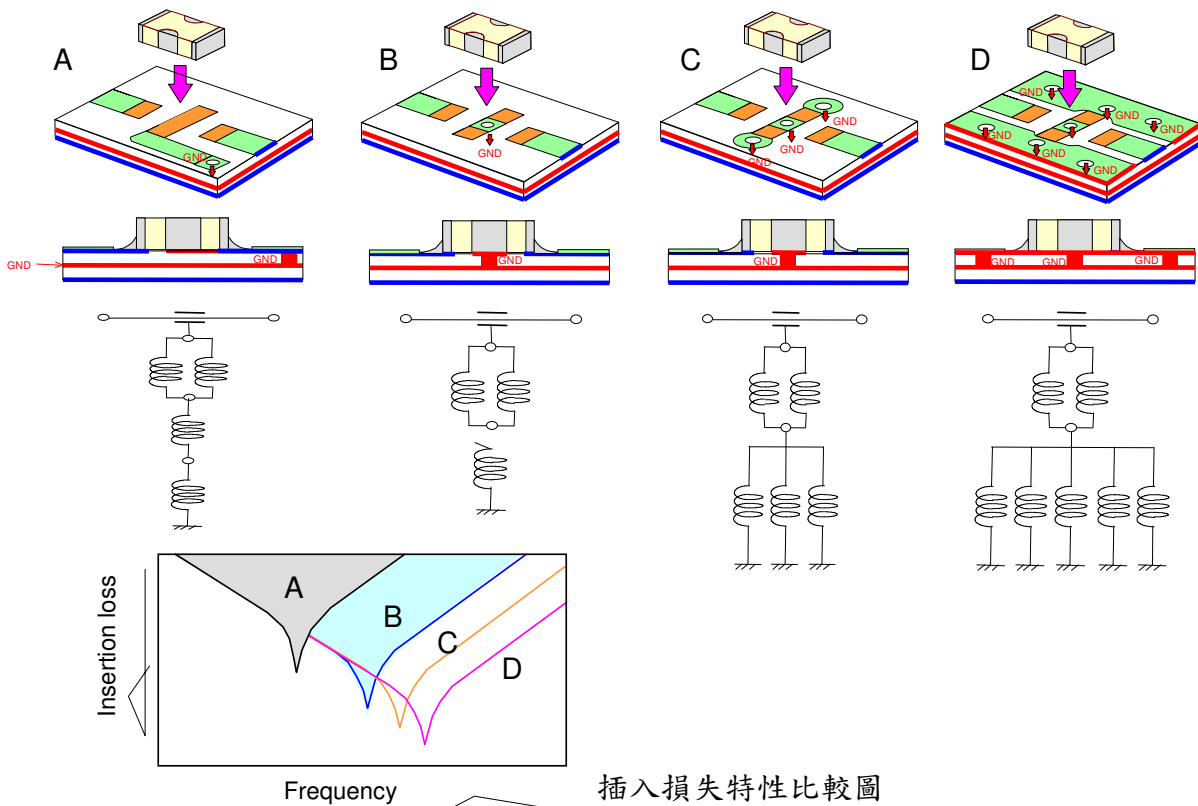


等同1個三端子濾波器



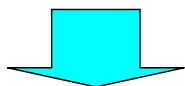
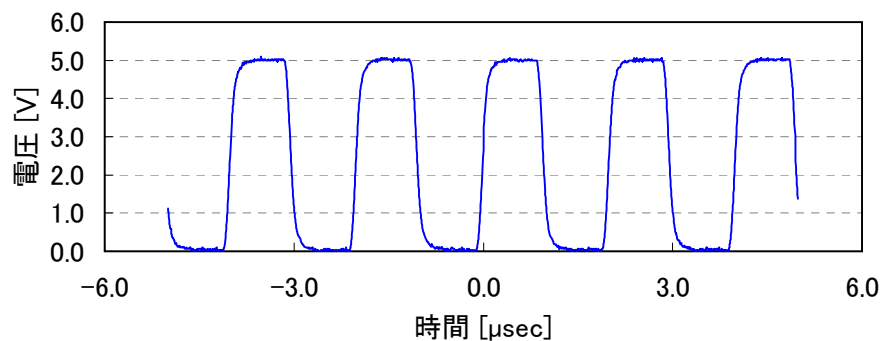
三端子濾波器之Land pattern設計與插入損失特性的關係

三端子濾波器的Land pattern必須採以下設計才可發揮特性。

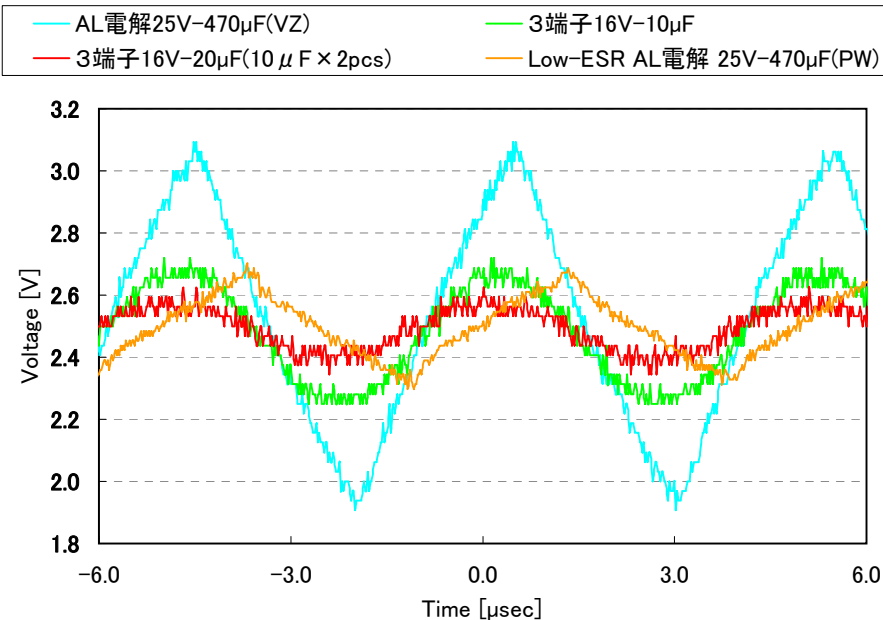


アルミ電解コンデンサと3端子コンデンサのリプル吸収性能比較

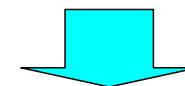
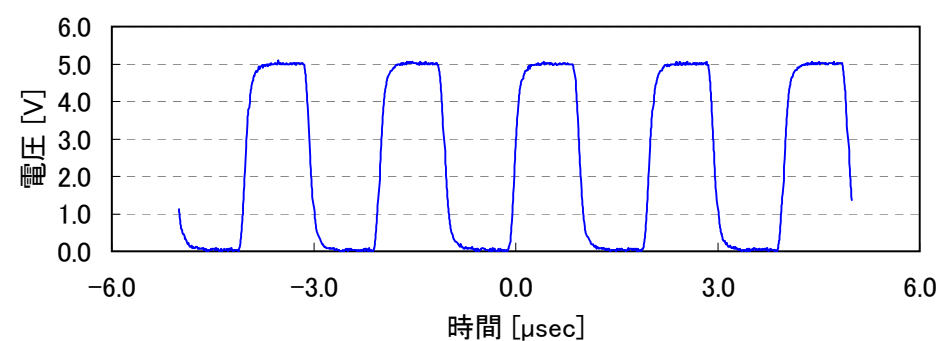
SW周波数200kHz、Vp5V（元波形）



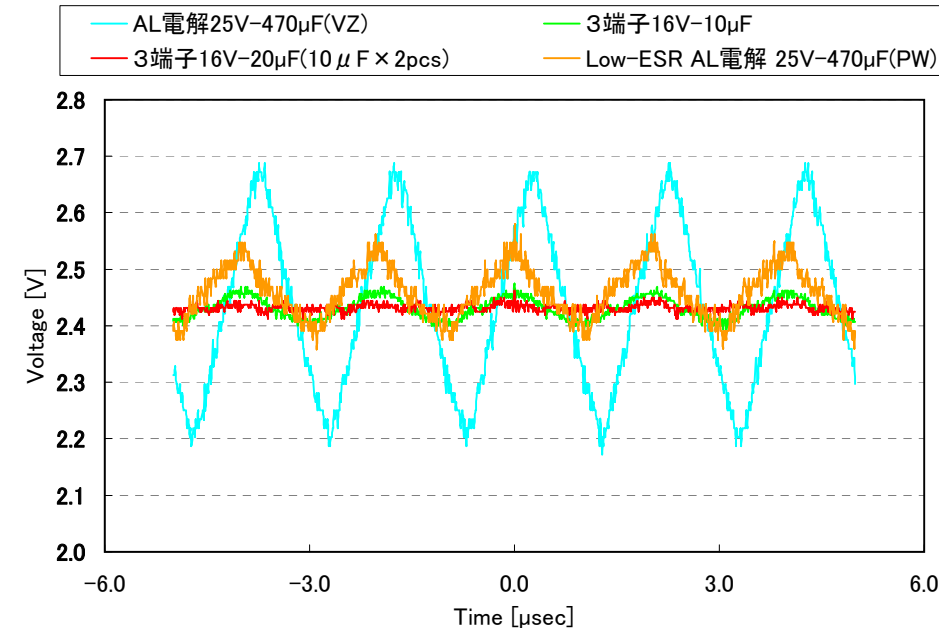
SW周波数200kHz平滑後Lipple比較



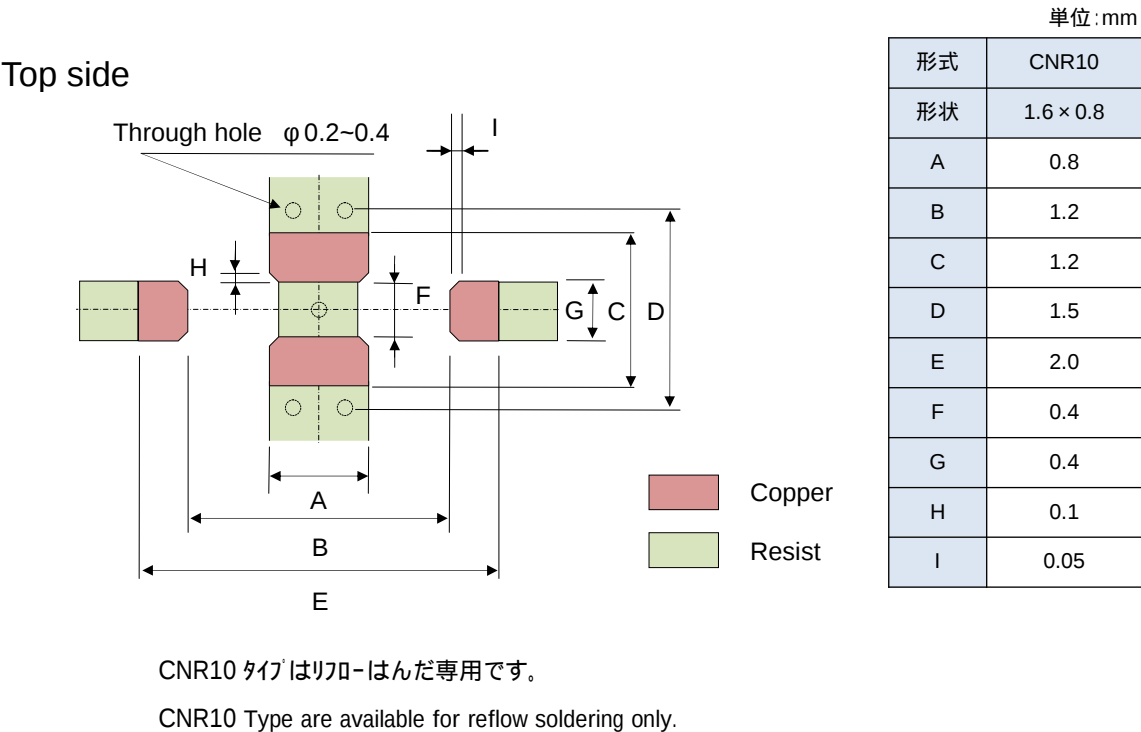
SW周波数500kHz、Vp5V（元波形）



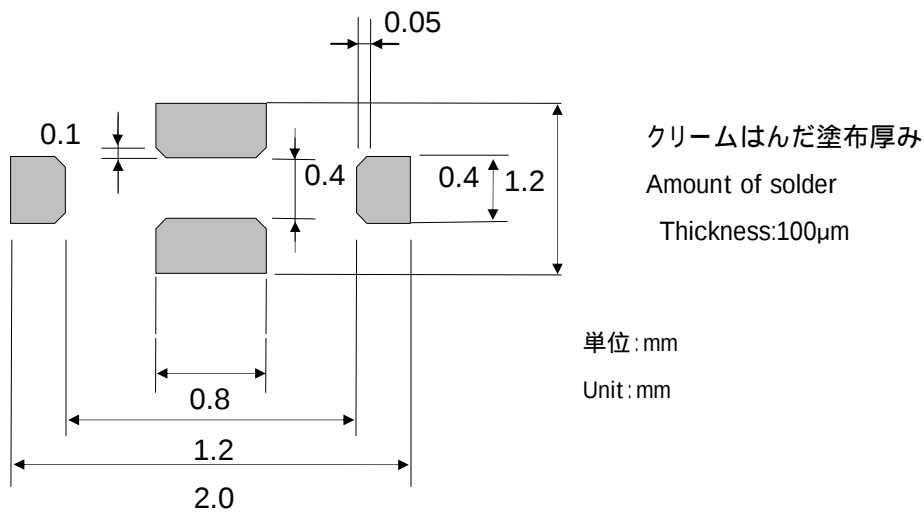
SW周波数500kHz平滑後Lipple比較



8 . CNR10 タイプ はんだ付け推奨ランドパターン
CNR10 Type Recommended board pattern



9 . CNR10 タイプ クリームはんだ印刷条件
CNR10 Type solder paste printing conditions

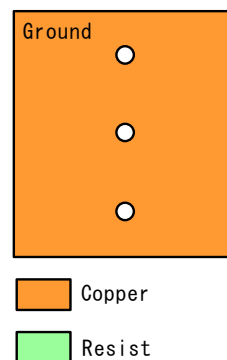
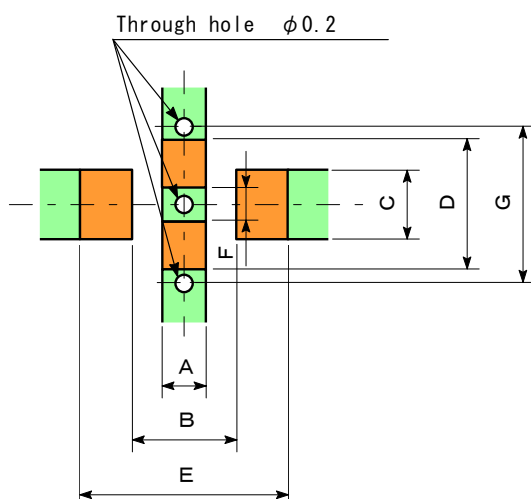


CNF,CNH Series Recommended Land pattern

■ CNF10,CNH10 type

Top side

Bottom side



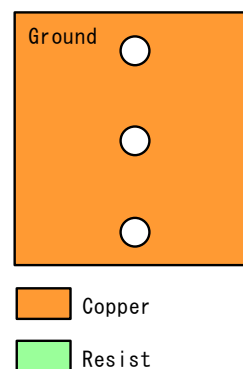
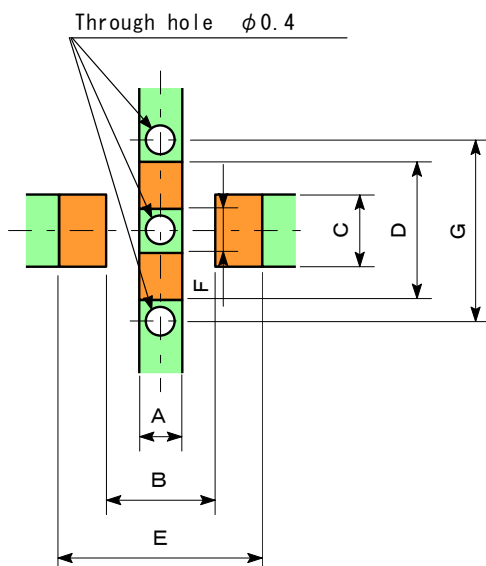
Unit:mm

タイプ	A	B	C	D	E	F	G
10	0.5	1.2	0.8	1.5	2.4	0.4	1.8

■ CNF20,CNH20 type

Top side

Bottom side

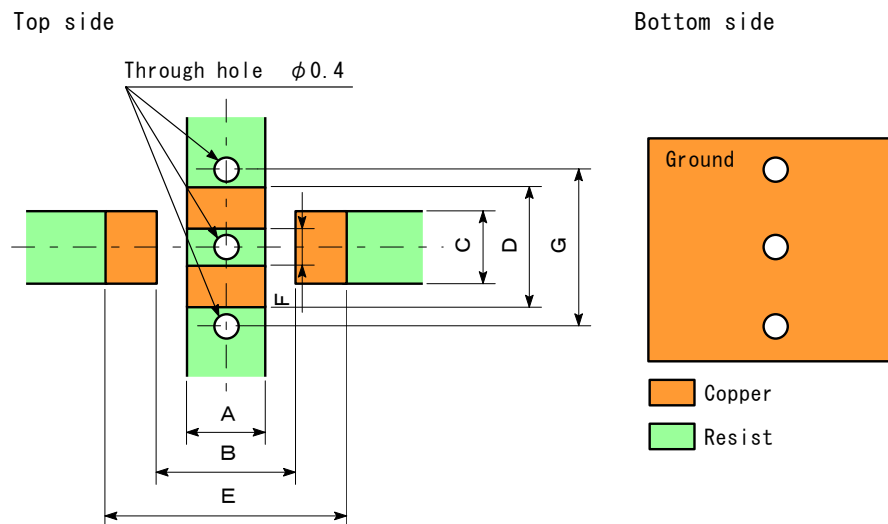


Unit:mm

タイプ	A	B	C	D	E	F	G
20	0.6	1.5	1.0	1.9	2.8	0.6	2.5

CNF,CNH Series Recommended Land pattern

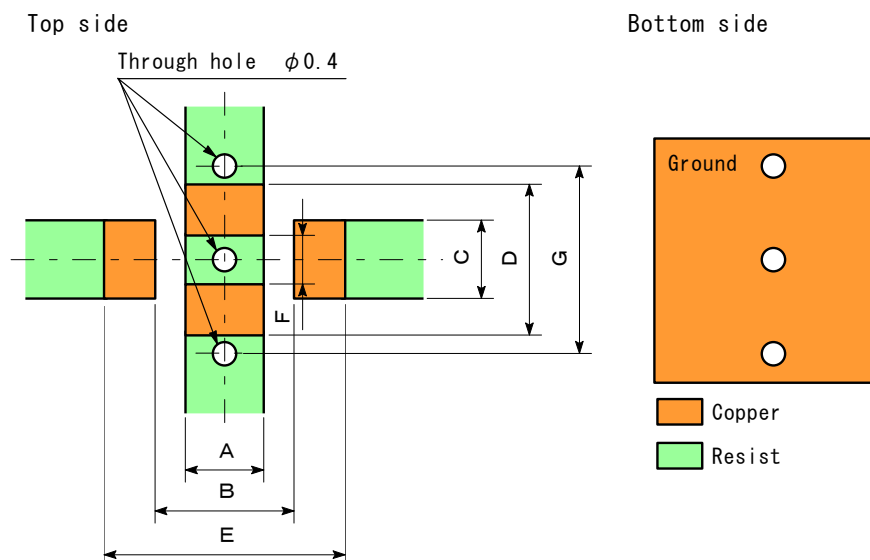
■ CNF31,CNH31 type



Unit: mm

タイプ	A	B	C	D	E	F	G
31	1.3	2.3	1.2	2.0	4.0	0.6	2.6

■ CNH30 type

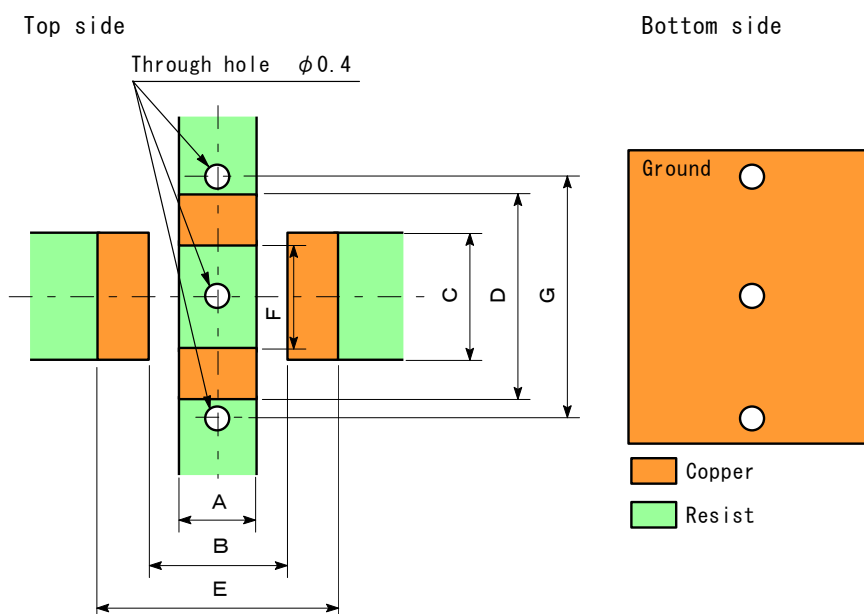


Unit: mm

タイプ	A	B	C	D	E	F	G
30	1.3	2.3	1.3	2.5	4.0	0.8	3.1

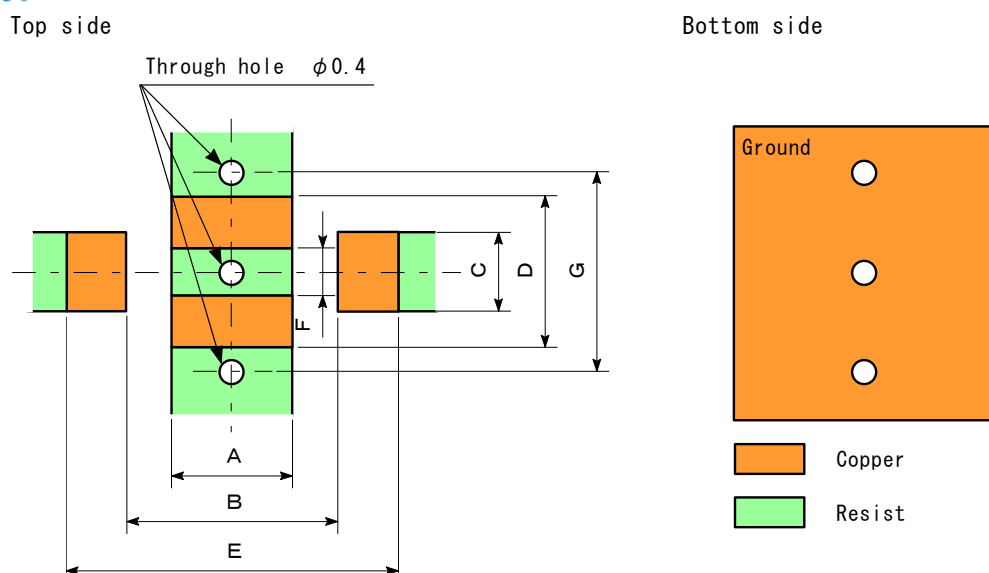
CNF,CNH Series Recommended Land pattern

■ CNH32 type



タイプ	A	B	C	D	E	F	G
32	1.3	2.3	2.1	3.4	4.0	1.7	4.0

■ CNF41,CNH41 type



タイプ	A	B	C	D	E	F	G
41	2.0	3.5	1.3	2.5	5.5	0.8	3.3

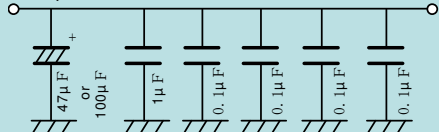
高容值三端子濾波器使用實例

電解電容+積層陶瓷電容 → 高容值三端子濾波器 $10\mu\text{F}$

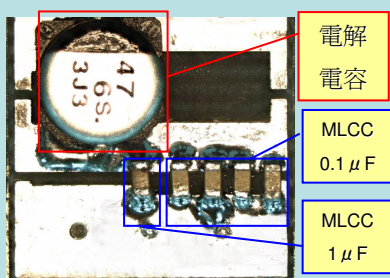
● IC回路上電解電容+MLCC的組合

零件	容值	使用數量
鋁質電解電容	$47\mu\text{F}$ 或 $100\mu\text{F}$	1pcs
MLCC	$1\mu\text{F}$	1pcs
MLCC	$0.1\mu\text{F}$	4pcs

● 等效回路



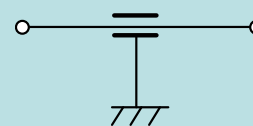
實裝狀態



單顆化
零件數量減少1/6
實裝COST減少1/6
NOISE抑制效果UP

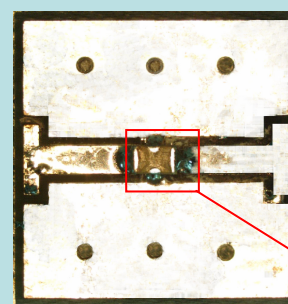
● 高容值三端子濾波器

● 等效回路



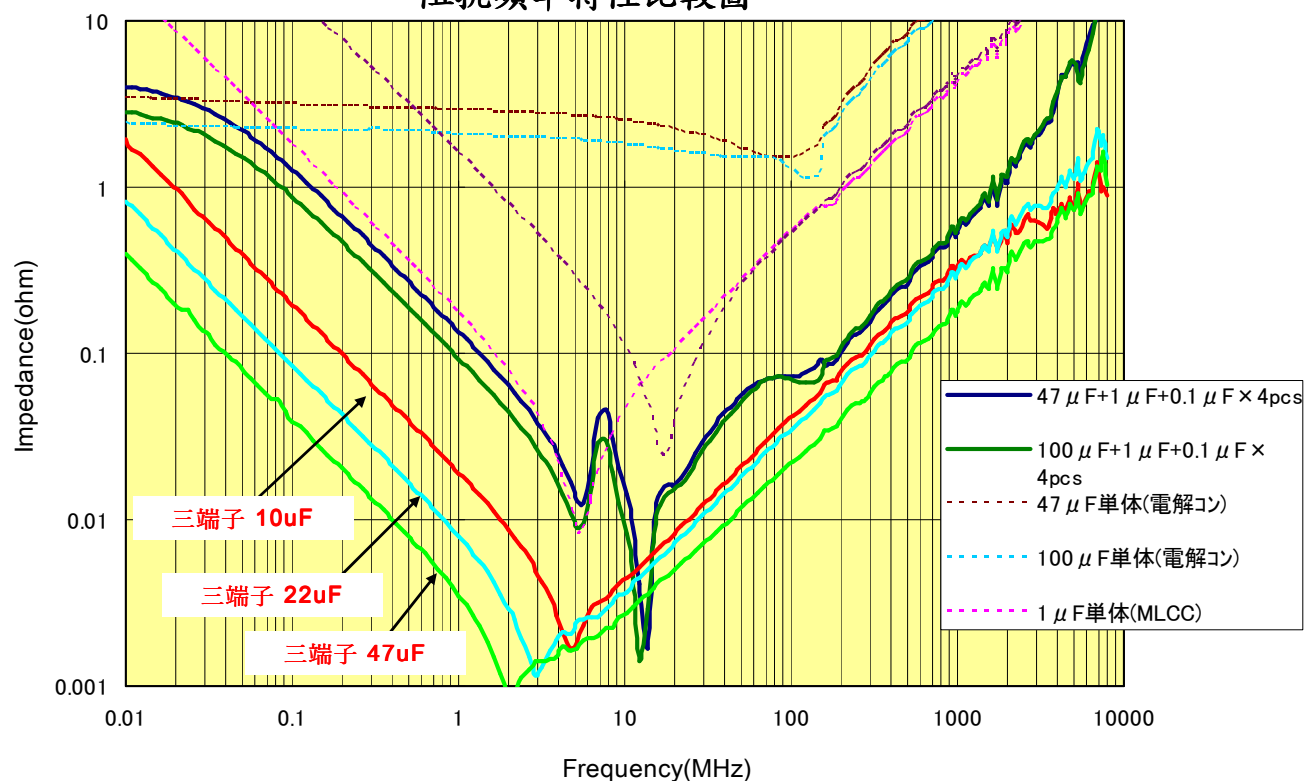
三端子電容

CNH20R106M



三端子濾波器與鋁質電解電容 $100\mu\text{F}$ + MLCC $1\mu\text{F}$ + MLCC $0.1\mu\text{F} \times 4\text{pcs}$

阻抗頻率特性比較圖



Examination sample

Drawing No.CE-9F06

2009/6/8

MARUWA CO.,LTD.

Parts	Capacitance	Rated voltage	Size(L × W)	MARUWA Part No.
Electrolytic capacitor	100 μ F	16VDC	-	-
	220 μ F	16VDC	-	-
	470 μ F	16VDC		
	1000 μ F	16VDC	-	-
Tantalum capacitor	100 μ F	-	-	-
EMI Filter	10 μ F	6.3VDC	2.0 × 1.25(mm)	CNH20R106M-TM
	10 μ F	16VDC	3.2 × 1.6(mm)	CNH30R106M-TM
	22 μ F	6.3VDC	3.2 × 1.6(mm)	CNH30R226M-TM

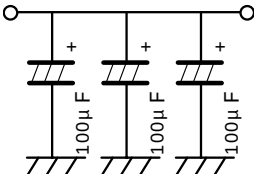
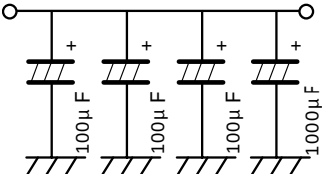
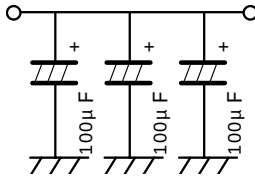
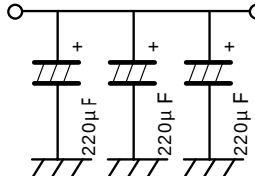
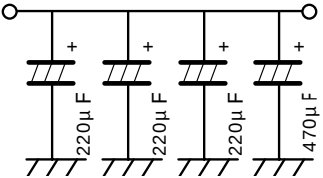
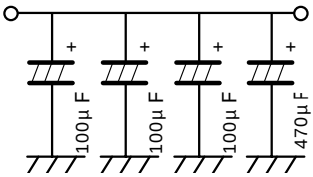
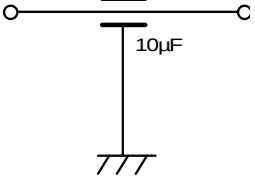
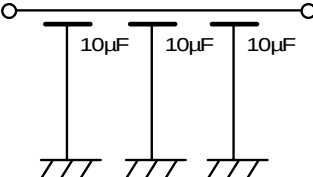
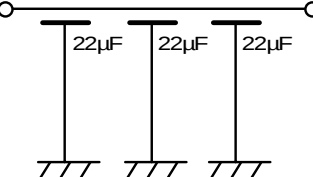
Content of evaluation

Drawing No.CE-9F06

2009/6/8

MARUWA CO.,LTD.

We measured the insertion loss characteristic of the following combination.

A)Electrolytic Cap. $100\ \mu\text{F} \times 3\text{p}$  	B)Electrolytic Cap. $100\ \mu\text{F} \times 3\text{p}$ + Electrolytic Cap. $1000\ \mu\text{F} \times 1\text{p}$  	C)Tantalum Cap. $100\ \mu\text{F} \times 3\text{p}$  	D)Electrolytic Cap. $220\ \mu\text{F} \times 3\text{p}$  	E)Electrolytic Cap. $220\ \mu\text{F} \times 3\text{p}$ + Electrolytic Cap. $470\ \mu\text{F} \times 1\text{p}$  
F)Tantalum Cap. $100\ \mu\text{F} \times 3\text{p}$ + Electrolytic Cap. $470\ \mu\text{F} \times 1\text{p}$  	G)EMI filter $10\ \mu\text{F} \times 1\text{p}$  	H)EMI filter $10\ \mu\text{F} \times 3\text{p}$  	I)EMI filter $22\ \mu\text{F} \times 3\text{p}$  	

Insertion loss characteristic data

Drawing No.CE-9F06

2009/6/8

MARUWA CO.,LTD.

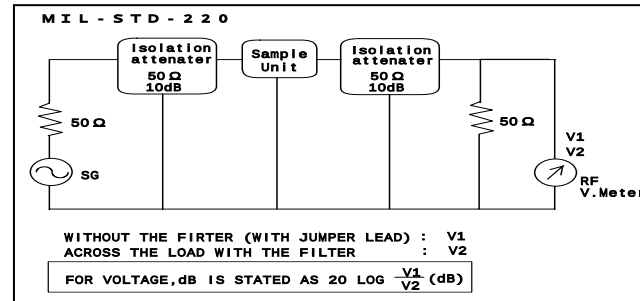
Measurement condition

ADVANTEST R3754B NETWORK ANALYZER

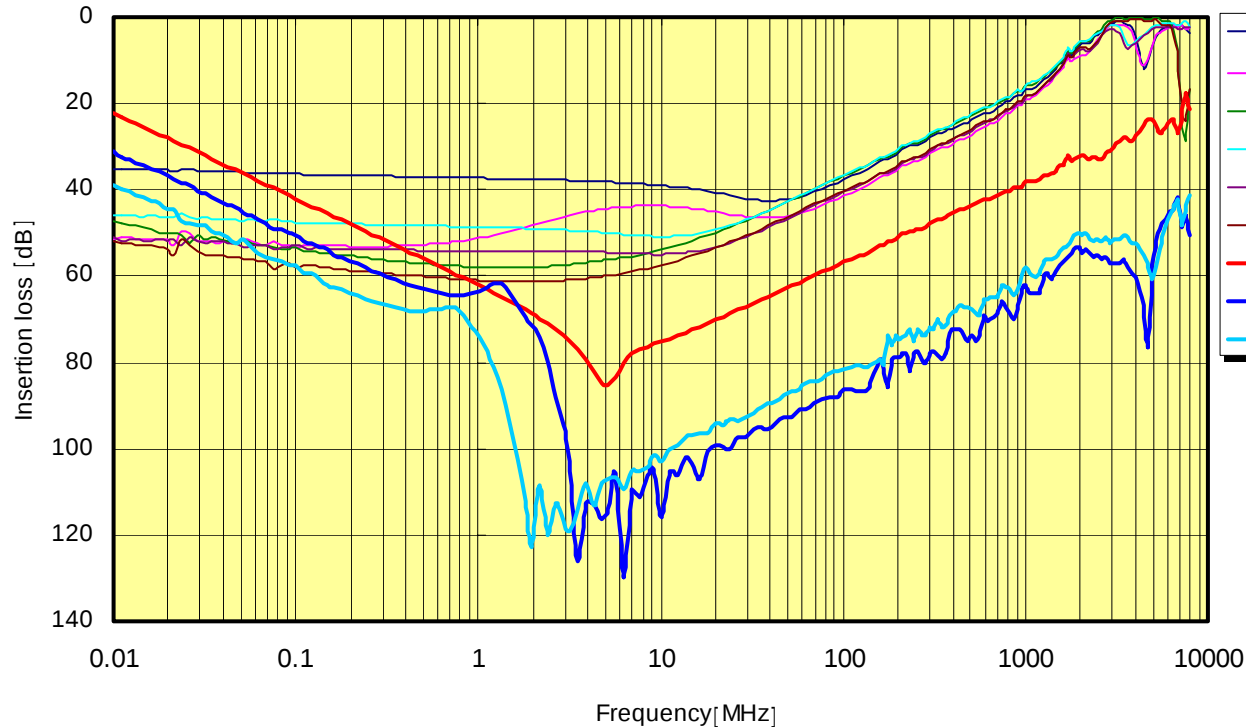
(10KHZ - 150MHZ)

ADVANTEST R3767CH NETWORK ANALYZER

(150MHZ - 80GHZ)



Insertion loss comparison data



- A) Electrolytic Cap. 100 μ F $\times$ 3p
- B) Electrolytic Cap. $\times$ 3p + Electrolytic Cap. 1000 μ F $\times$ 1p
- C) Tantalum 100 μ F $\times$ 3p
- D) Electrolytic Cap. 220 μ F $\times$ 3p
- E) Electrolytic Cap. 220 μ F $\times$ 3p + Electrolytic Cap. 470 μ F $\times$ 1p
- F) Tantalum Cap. 100 μ F $\times$ 3p + Electrolytic Cap. 470 μ F $\times$ 1p
- G) CNH20R106M-TM $\times$ 1p
- H) CNH30R106M-TM $\times$ 3p
- I) CNH30R226M-TM $\times$ 3p

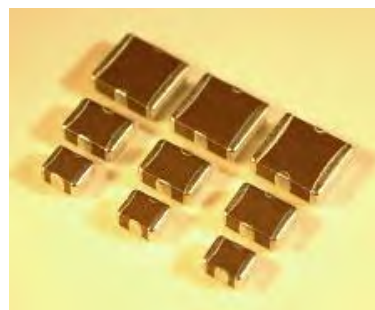
Chip Type EMI Filters

For DC Power Line [CNS Series]

The CNS40, CNS70, CNS80 Series are 3-terminal EMI filters for SMT based on multilayer chip capacitor technology. The CNS series is suited for reducing EMI noise on DC power lines.

Feature

- Due to its small size and low residual inductance, it performs noise reduction at higher frequencies than conventional capacitors.
- High capacitance enables reduction of noise over a wide frequency range.
- The large current specification ($\sim 6A$) is effective in protecting the DC power line from EMI.



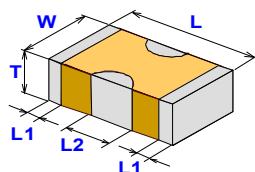
Applications

- Industrial apparatus, medical equipment, DC power supply line of car-electronics

Part Number System

<u>CNS</u>	<u>40</u>	<u>R</u>	<u>1H</u>	<u>105</u>	<u>M</u>	-	<u>T</u>	<u>M</u>
Series	Style 40:3.2 × 2.5 (L) (W)	Temperature characteristics R: ±15%	Rated voltage 50V DC	Capacitance	Capacitance tolerance M: ±20%		Packing form T: Taping B: Bulk	Termination M: Ni/Sn plated

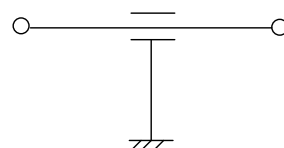
Dimensions



Unit: mm

Type	L	W	T	L1	L2
40	3.2±0.3	2.5±0.2	1.6±0.2	0.4±0.3	1.1±0.3
70	4.5±0.4	3.2±0.3	1.6±0.2	0.5±0.3	1.4±0.3
80	5.7±0.4	5.0±0.4	1.6±0.2	0.5±0.3	1.4±0.3

Equivalent circuit

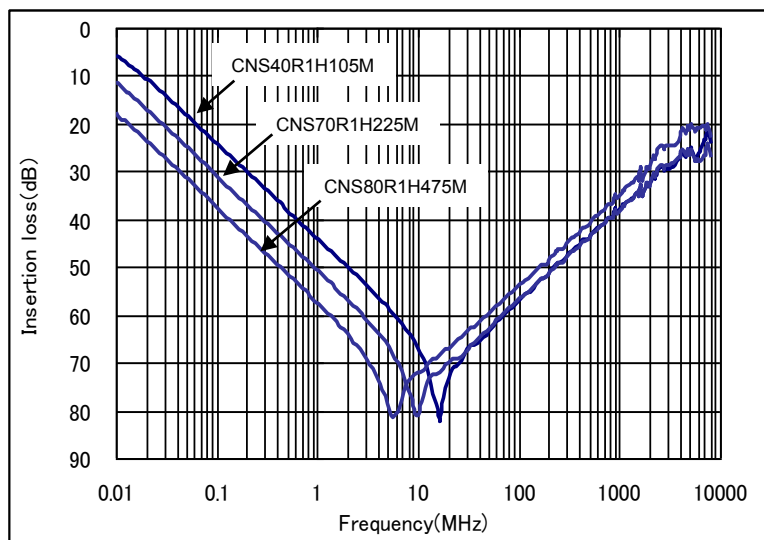


Part Number List • Specifications

Part number	Capacitance	Capacitance tolerance	Rated voltage	Rated current	IR	DC resistance	Temp. range
CNS40R1H105M-□M	1μF	±20%	50V DC	6A DC	500ΩF	10mΩmax	-55~+125°C
CNS70R1H225M-□M	2.2μF						
CNS80R1H475M-□M	4.7μF						

□: "T" stands for taping package and "B" stands for bulk package.

Insertion loss (Reference)



Chip Type EMI Filters

For DC Power Line[CNG41 Series]

The CNG41 Series is a 3-terminal EMI filter for SMT based on multilayer chip capacitor technology.

■Feature

- Due to its small size and low residual inductance, it performs noise reduction at higher frequencies than conventional capacitors.
- Allows setting priority for either High Current(A-B input-output) or for high frequency characteristic (C-D input-output) by changing mounting direction.

■Applications

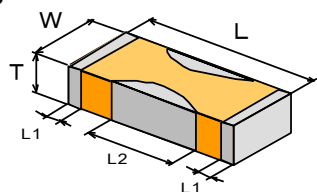
- Noise reduction for DC lines in computers, computer peripheral equipment, digital TV, etc.



■Part Number System

CNG	41	R	184	S	-	T	M
Series	Style 41:4.5×1.6 (L) (W)	Temperature characteristics R: ±15%	Cap.	Cap. tolerance S: +50,-20%		Packing form T: Taping B: Bulk	Termination M: Ni/Sn plated

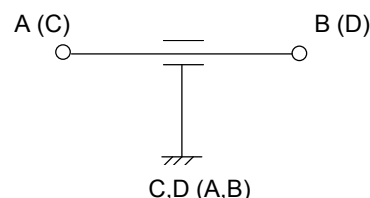
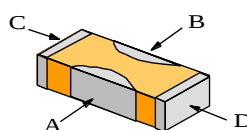
■Dimensions



Unit: mm

Type	L	W	T	L1	L2
CNG41	4.5±0.3	1.6±0.3	1.0±0.3	2.8±0.2	0.3±0.2

■Equivalent circuit



■Part Number List · Specifications

Part number	Capacitance	Capacitance tolerance	Rated voltage	Rated current	IR	DC resistance	Temp. range
CNG41R184S-□M	0.18μF	+50,-20%	50V DC	6A DC(A-B) 2A DC(D-C)	1,000MΩmin.	0.01Ωmax(A-B) 0.05Ωmax(D-C)	-55~+125°C

□: "T" stands for taping package and "B" stands for bulk package.

■Insertion loss (Reference)

