SDMM Multilayer Common Mode Filter

2013.12.10

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MIPI and EMC Solution

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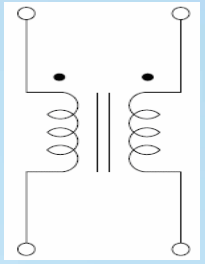
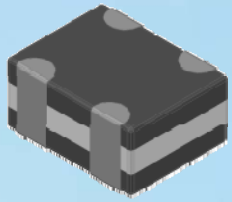
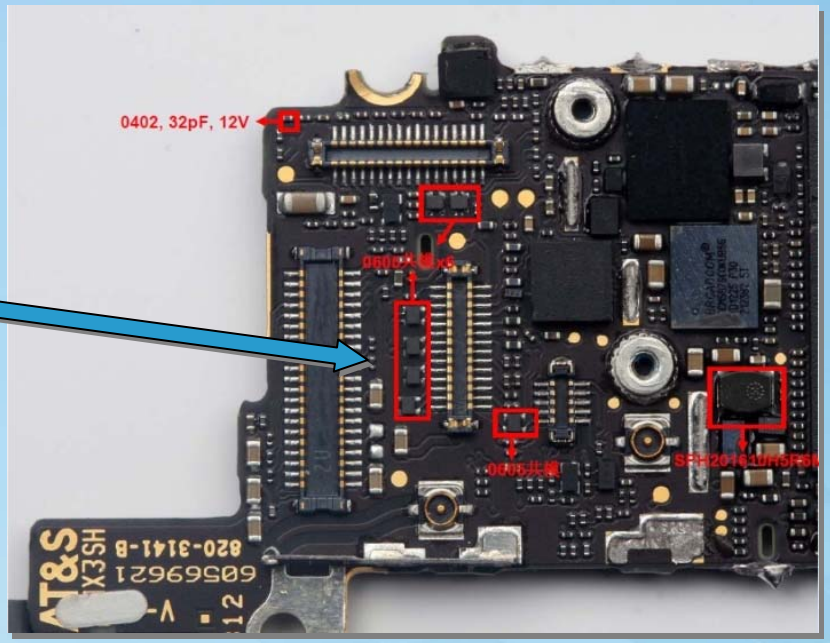
- MIPI can transmit low speed and high speed signal at the same time, so it saves FPC space and is widely used as camera and screen interface of smart phone and tablet.
- When high speed signal transmitting in MIPI, RF signal may interrupt it, therefore common mode filter is a good idea for EMI suppression.







Conventional wire wound CMC

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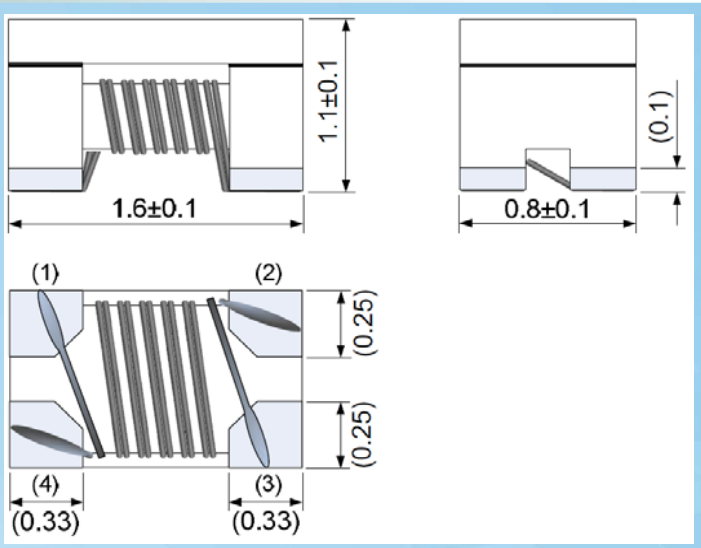
- Conventional wire wound common mode choke has low differential impedance due to the closed magnetic circuit.
- Conventional wire wound CMC has low stray capacitance and high cut off frequency due to the low permittivity material between each electrodes.
- The smallest wire wound CMC is 1.6mm×0.8mm, that is too big to be used in smart phone.



Multilayer Common Mode Filter

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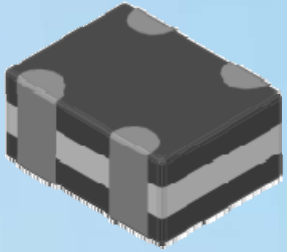
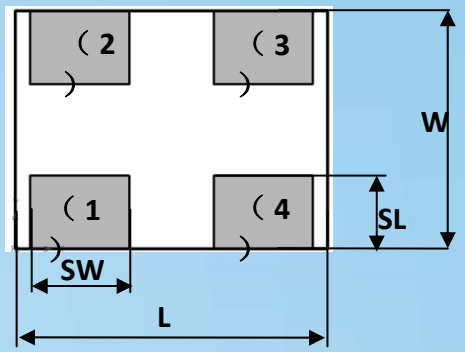
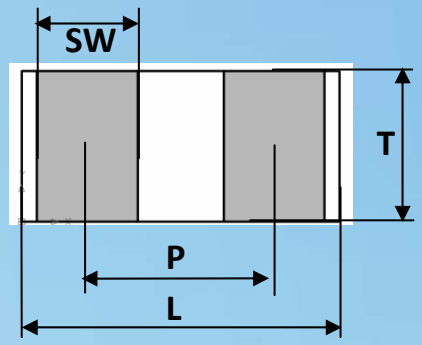
- Small size common mode filter, 0806 size (0.85mm×0.65mm×0.40mm) at present, can be made based on multilayer process







Type	L	W	T	SL	SW	P
0806	0.85±0.05	0.65±0.05	0.40±0.05	0.20+0.05/-0.10	0.27±0.05	0.50±0.05

Unit (mm)

Sunlord SDMM Part Number

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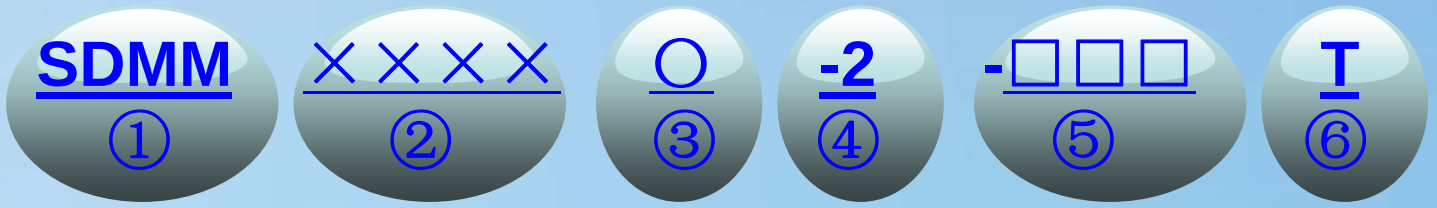

①SDMM: Multilayer Common Mode Filter

② 0806: 0.85mm*0.65mm

③S: Standard

④-2: 2 lines

⑤300: 30ohm

⑥T: Tape & Reel

SDMM0806 Structure

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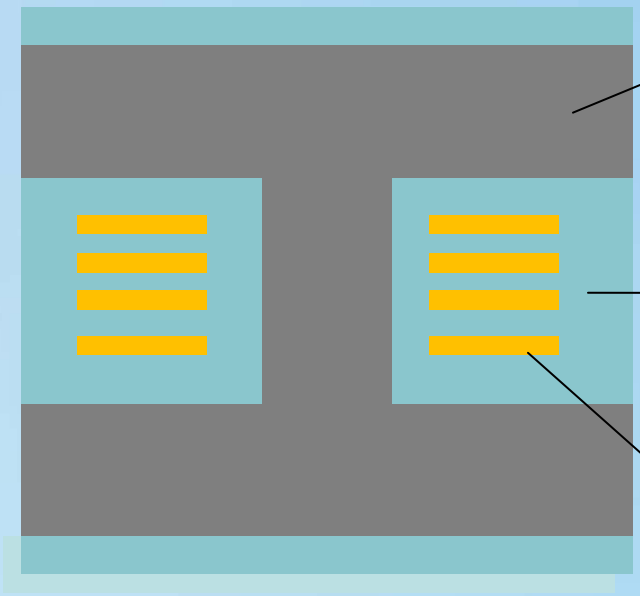
- Based on different material co-firing technology, SDMM common mode filter shows "工" type magnetic core and the electrode is within non-magnetic material, which make high performance possible.



Ferrite: "工" type core，helpful to high common mode impedance.

No-magnetic, low permittivity ceramic: helpful to low stray capacitance and high cut-off frequency.

Silver: construct the coil electrode, can co-fire with ferrite and ceramic.

Electrical Characteristic

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SDMM0806 electrical characteristic

	Common Mode Impedance (100MHz)	Max. DC Resistance	Max. Rated Current	Rated Voltage	Min. Insulation Resistance
Unit	Ohm	Ohm	mA	Volts	Mohm
Symbol	Z	RDC	Ir	Vdc	IR
SDMM0806S-2-300T	30±20%	1.5	100	5	10

Feature

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- Sunlord SDMM series common mode filter has high common mode impedance to suppress common mode noise well at high frequency due to open magnetic circuit structure design.
- “工” type magnetic core can constraint magnetic field and help to generate low differential impedance to keep differential mode signal integrity.
- Monolithic structure base on multilayer process keeps high reliability.
- Multilayer process is very suitable for large volume mass production and thus SDMM series have advantage at cost and manufacturing capacity.

How Common Mode Filter Works

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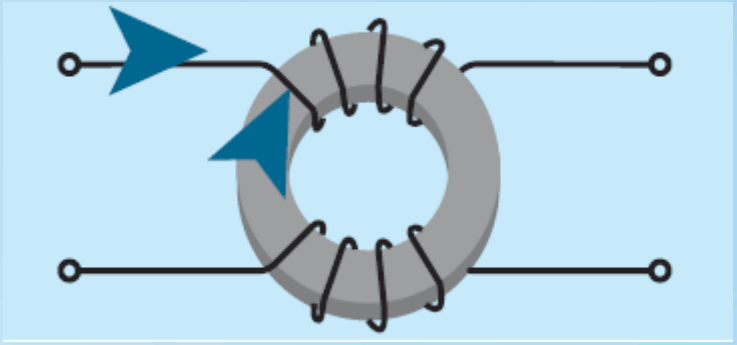
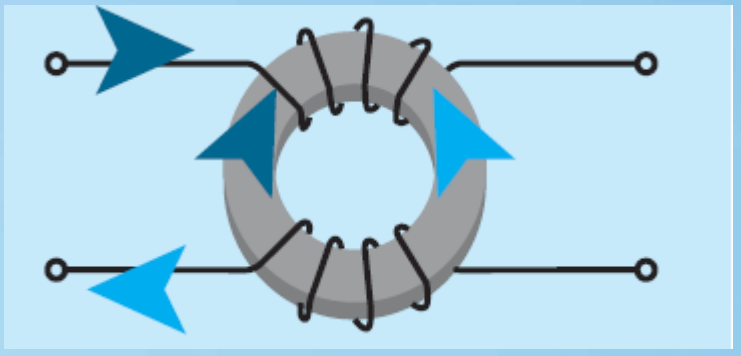
Common mode filter has one pair coils:

- Common mode signal current (the same direction currents flow in two lines) generates the superposed magnetic field to result in high impedance which can suppress the common mode noise.
- Differential mode signal current (the opposite direction currents flow in two lines) generates the counterbalanced magnetic field to result in low impedance which can avoid differential mode signal attenuation.



Magnetic field superpose by common mode current



Magnetic field counteract by differential mode current

Requirements of CMC in MIPI

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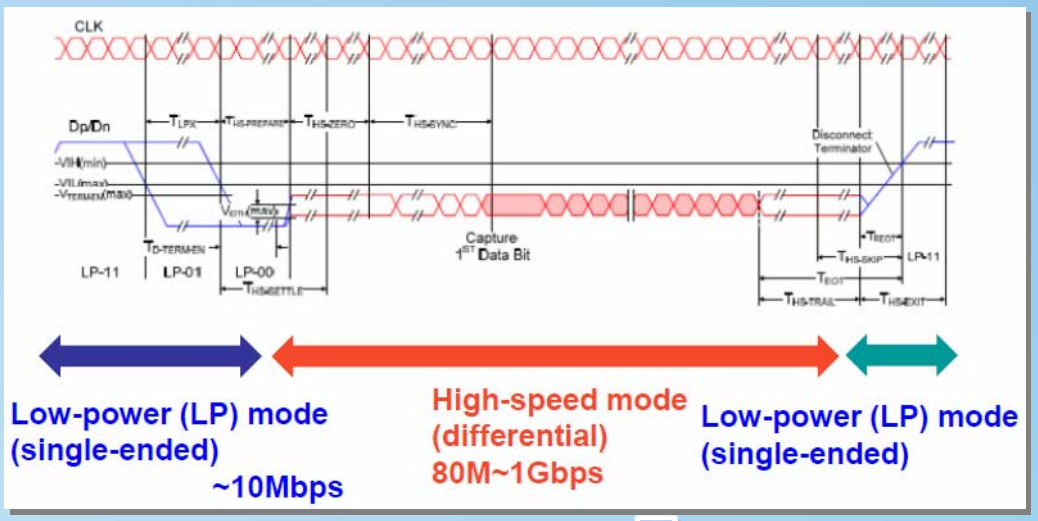
- MIPI transmits low frequency single-ended signal (lower than 10MHz) and high frequency differential mode signal (80MHz~1GHz) at the same time to save FPC space.



Requirements for common mode filter:

- High common mode impedance and attenuation below 2GHz to suppress common mode noise;
- Low differential mode impedance and insertion loss below 1GHz to avoid differential mode signal loss.

Requirements of CMC in MIPI

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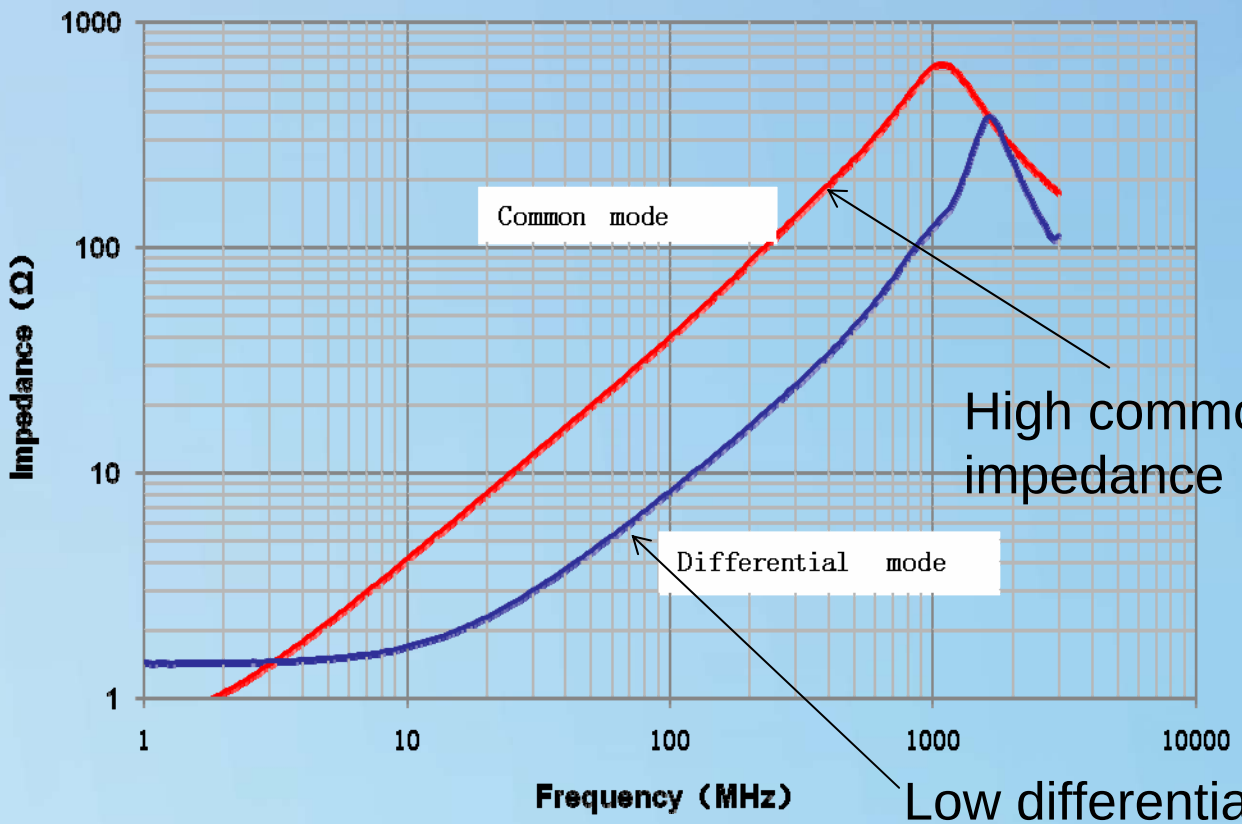

High common mode impedance below 2GHz

Low differential mode impedance below 1GHz

Requirements of CMC in MIPI

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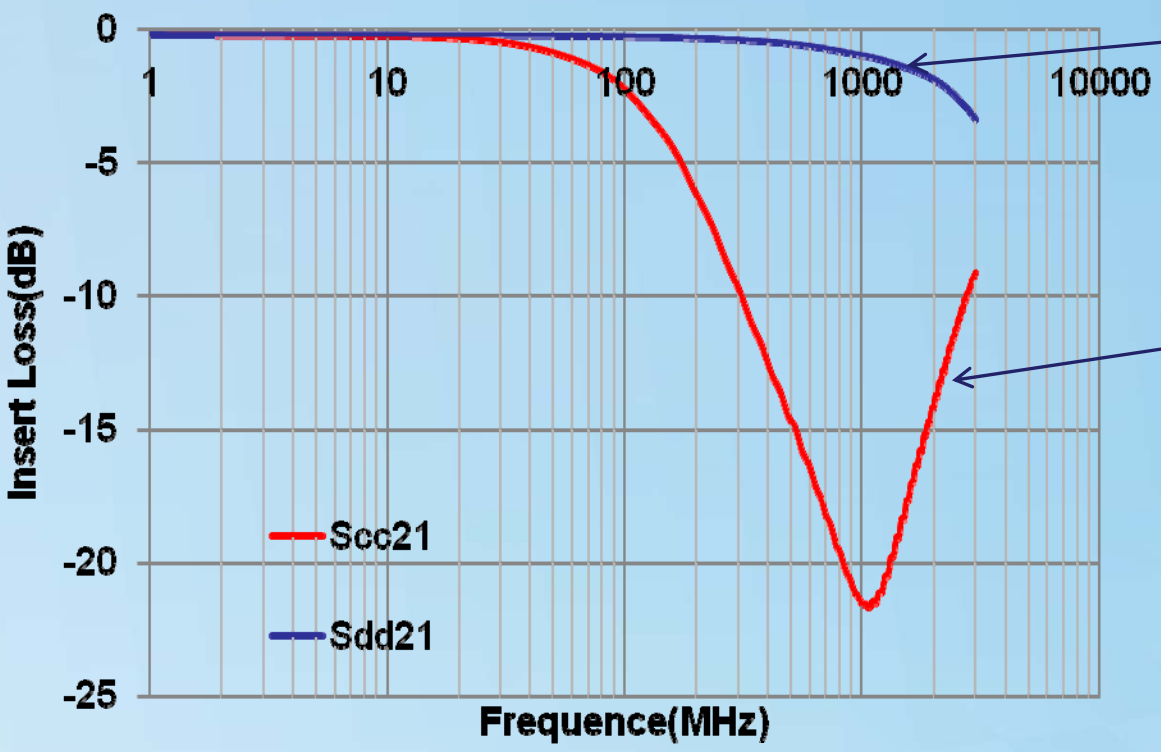
- The higher common mode insertion loss is, the better. As for differential mode insertion loss, it is opposite.



Low differential mode insertion loss below 1GHz

High common mode insertion loss below 2GHz

Benchmarking Comparison

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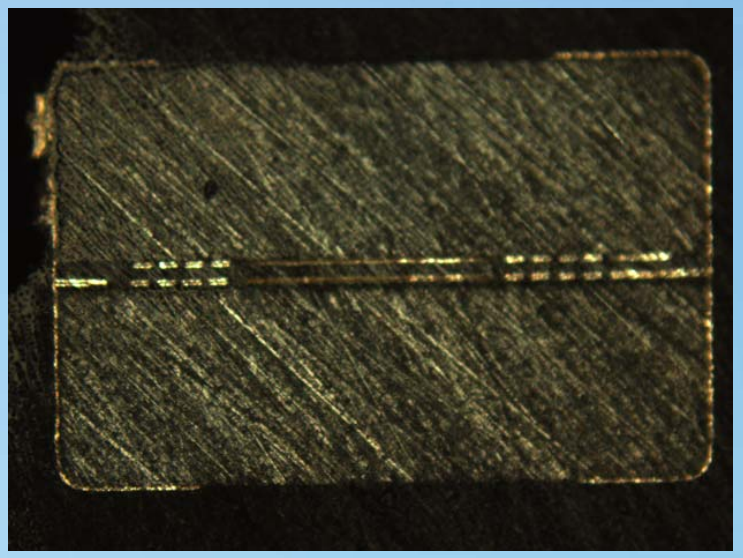
Thin film common mode filter



- Thin film common mode filter has spiral coils in one layer and behaves good electrical characteristics.
- Thin film CMC shows high cost because of the high cost manufacturing process.

Benchmarking Comparison

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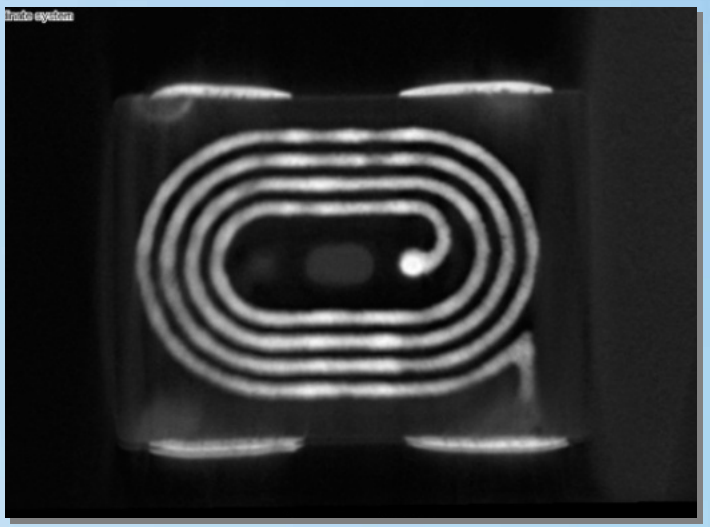
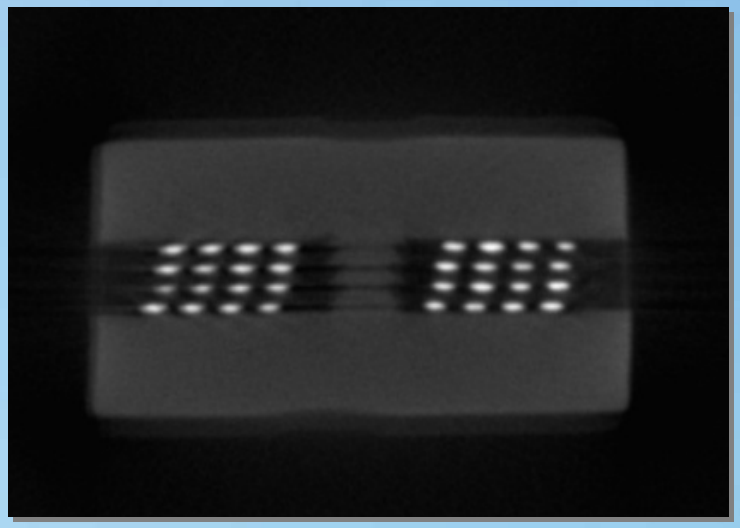
Multilayer common mode filter





- Some competitors' multilayer common mode filter is open magnetic circuit type with multiple coil in one layer.
- This kind of product has high common mode impedance at low frequency. However, its low cut-off frequency cause low common mode insertion loss at high frequency due to the high stray capacitance.

Benchmarking Comparison

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Common mode impedance and insertion loss

Company	Part Number	Type	Zcm (max)	Zcm (2GHz)	Scc21 (max)	Scc21 (2GHz)
Sunlord	SDMM0806S-2-300T	Multilayer	620	300	-22 dB	-17 dB
Mxx	0806-28ohm	Thin Film	420	90	-20 dB	-15 dB
Axx	0806-90ohm	Multilayer	570	270	-22 dB	-12 dB

Benchmarking Comparison

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Differential mode impedance and insertion loss

Company	Part Number	Type	Zdm (100MHz)	Zdm (1GHz)	Sdd21 (1GHz)
Sunlord	**SDMM0806S-2-300T**	**Multilayer**	**8**	**100**	**-1.0 dB**
Mxx	0806-28ohm	Thin Film	7	85	-0.8 dB
Axx	0806-90ohm	Multilayer	11	110	-1.5 dB

Manufacturing Plan

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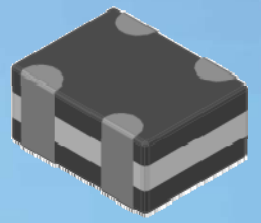
	Sample	Low Volume Production	Mass Production
0806-30ohm	Nov. 2013	Dec. 2013	Feb. 2014
0806-90ohm	Feb. 2014	Mar. 2014	Apr. 2014



- SDMM0806 Capacity Plan（Unit：KK）

2013.12	2014.1	2014.2	2014.3	2014.4	2014.5	2014.6
2	4	8	20	40	100	100
2014.7	**2014.8**	**2014.9**	**2014.10**	**2014.11**	**2014.12**	
100	100	100	100	100	100	

Thank You !