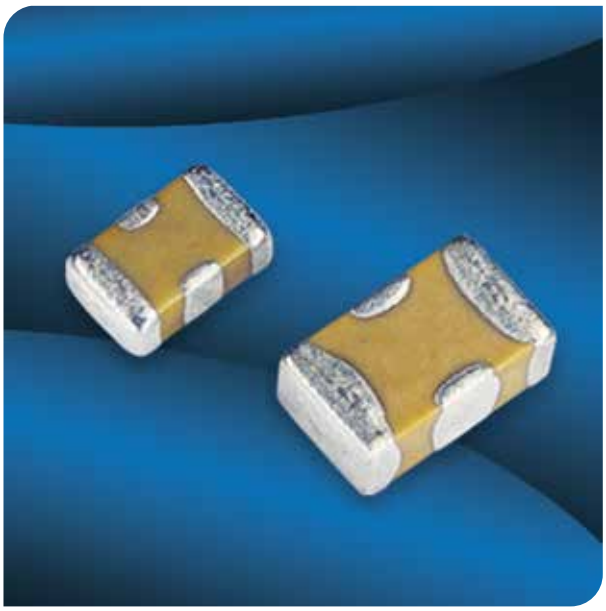
EMI X2Y Filters



Features:

- Voltages from 6.3VDC to 500VDC+
- Available in EIA sizes from 0402 to 1812 depending on voltage rating.
- Effective attenuation from 100KHz to 17GHz with various bandwidths.
- Designed to attenuate unwanted electromagnetic interference such as noise or spurious emissions at specific frequencies.
- Can be used in both single ended (one source signal) and differential (+/- signal) applications.
- AEC-Q200 automotive qualification (as required)

Common Applications:

- Power Bypass
- FPGA / ASIC / µ-P Decoupling
- Amplifier Filter & Decoupling
- DC-DC Converter Designs
- High Speed Data Filtering
- DC Drives & Motors
- Mil/Aero Electronics
- Medical Electronics
- Wireless Charging
- GSM/Antennas
- EMC I/O Filtering
- Electric Vehicles
- IT & Networking
- Industrial

Expert Design Support:

At Johanson, we understand the complexity and difficulty associated in dealing with unwanted issues in your circuit.

Our engineers are ready to support with:

- Identifying the right component(s) to solve your unwanted EMI X2Y Filters spikes.
- How to design-in and connect Johanson EMI X2Y Filters to your product's schematic to achieve the most effective results.
- Reviewing and optimize your PCB layout, and where required, advise on any necessary changes that can be made to improve EM compliance.

Designer's Tool: S21 Plotter:

Try out Johanson's S21 Plotter, an on-line tool for designers to quickly select different values or sizes and see the responses of each configuration: Visit JOHANSON Dielectrics website at: https://s21plotter.johansondielectrics.com/

EMI X2Y Filters

Capacitance Values

EMI Filtering (1 Y-Cap.)		<10pF	10pF	22pF	27pF	33pF	47pF	100pF	220pF	470pF	1000pF	1500pF	2200pF	4700pF	.010µF	.015µF	.022µF	.039µF	.047µF	0.10µF	0.18µF	0.22µF	0.33µF	0.40µF	0.47µF	1.0µF
Power Bypass (2 Y-Caps.)		<20pF	20pF	44pF	54pF	66pF	94pF	200pF	440pF	940pF	2000pF	3000pF	4400pF	9400pF	.020µF	.030µF	.044µF	.078µF	.094µF	0.20µF	0.36µF	0.44µF	0.66µF	0.80µF	0.94µF	2.0µF
Power Bypass	CAP. CODE	XRX	100	220	270	330	470	101	221	471	102	152	222	472	103	153	223	393	473	104	184	224	334	404	474	105
0402	NP0	50	50	50	50	50	50	50																		
	X7R								50	50	50	50	50	50	16											
0603	NP0	100	100	100	100	100	100	50	50																	
	X7R						100	100	100	100	100	100	100	100	50	25	25		16	10		10				
0805	NP0		100	100	100	100	100	100	100	50																
	X7R							100	100	100	100	100	100	100	100	50	50		50	25						
1206	NP0			VOLTAGE RATINGS 6.3 = 6.3 VDC 10 = 10 VDC 16 = 16 VDC 25 = 25 VDC 50 = 50 VDC 100 = 100 VDC 500 = 500 VDC							100																
	X7R														100	100	100		100	100*		16	16		10	
1210	X7R														500					100		100	100		25	16
1410	X7R															500								100		
1812	X7R																	500							100	

Automotive version currently available for those values only

HOW TO ORDER

EM	CF	500	G	100	M	1	GV	001	B
Subfamily	**Size**	**Voltage**	**DTC**	**Capacitance**	**Tol**	**Mark**	**Termination**	**Special Code**	**Pack**
EM = EMI X2Y Filters	**CF** = 0402 **CP** = 0603 **CT** = 0805 **DD** = 1206 **DF** = 1210 **DK** = 1410 **DR** = 1812	**6R3** = 6.3 V **100** = 10 V **160** = 16 V **250** = 25 V **500** = 50 V **101** = 100 V **501** = 500 V	**G** = NP0/C0G **W** = X7R	1st two digits are significant; third digit denotes number of zeros. **101** = 100 pF **102** = 1000 pF	**A** = ±0.05pF **M** = ±20%	**1** = No Mark	**GV** = Ni/Sn (RoHs) **GF** = Polyterm Sn (RoHs) **NT** = Sn/Pb	**001** = Default catalog item **002** = AEC-Q200	**B** = Bulk **E** = 7" Reel Emb Tape

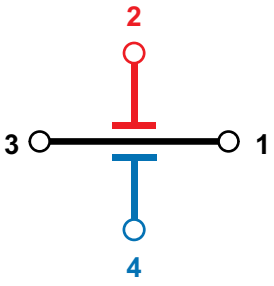
Example: **EMCF500G100M1GV001B** EMI X2Y Filters , 0402, 50 V, NP0/C0G, 10.000pF, ±20%, no mark, Ni/Sn (RoHs), default catalog item, bulk

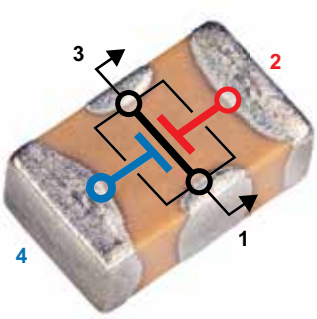
EMI X2Y Filters

Mechanical Characteristics

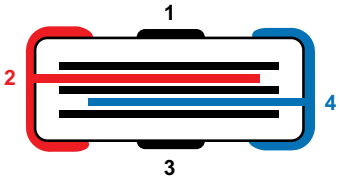
	EIA 0402 EMCF Series		EIA 0603 EMCP Series		EIA 0805 EMCT Series		EIA 1206 EMDD Series		EIA 1210 EMFD Series		EIA 1410 EMDK Series		EIA 1812 EMDR Series	
	In	mm	In	mm	In	mm	In	mm	In	mm	In	mm	In	mm
L	0.045 ± 0.003	1.143 ± 0.076	0.064 ± 0.005	1.626 ± 0.127	0.080 ± 0.008	2.032 ± 0.203	0.124 ± 0.010	3.150 ± 0.254	0.125 ± 0.010	3.175 ± 0.254	0.140 ± 0.010	0.140 ± 0.010	0.174 ± 0.010	4.420 ± 0.254
W	0.025 ± 0.003	0.635 ± 0.076	0.035 ± 0.005	0.889 ± 0.127	0.050 ± 0.008	1.270 ± 0.203	0.063 ± 0.010	1.600 ± 0.254	0.098 ± 0.010	2.489 ± 0.254	0.098 ± 0.010	2.490 ± 0.254	0.125 ± 0.010	3.175 ± 0.254
T	0.02 max.	0.508 max.	0.026 max	0.660 max.	0.040 max	1.016 max.	0.050 max.	1.270 max.	0.070 max	1.778 max	0.070 max.	1.778 max.	0.090 max	2.286 max.
EB	0.008 ± 0.003	0.203 ± 0.076	0.010 ± 0.006	0.254 ± 0.152	0.012 ± 0.008	0.305 ± 0.203	0.016 ± 0.010	0.406 ± 0.254	0.018 ± 0.010	0.457 ± 0.254	0.018 ± 0.010	0.457 ± 0.254	0.022 ± 0.012	0.559 ± 0.305
CB	0.012 ± 0.003	0.305 ± 0.076	0.018 ± 0.004	0.457 ± 0.102	0.022 ± 0.005	0.559 ± 0.127	0.040 ± 0.005	1.016 ± 0.127	0.045 ± 0.005	1.143 ± 0.127	0.045 ± 0.005	1.143 ± 0.127	0.045 ± 0.005	1.143 ± 0.127

Equivalent Circuits

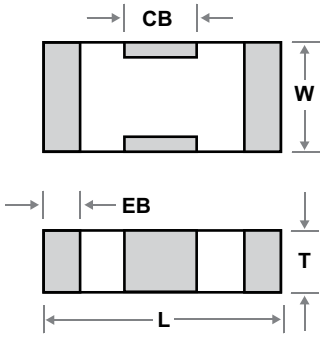




Cross Sectional View



Dimension View



Electrical Characteristics

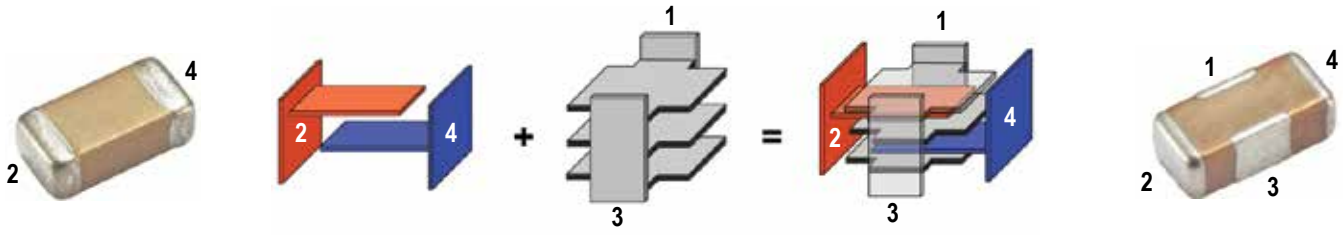
Type	NP0	X7R
Temperature Coefficient	0±30ppm/°C (-55 to +125°C)	±15% (-55 to +125°C)
Dielectric Strength	Vrated ≤100VDC: DWV = 2.5 X WVDC, 25°C, 50mA max. Vrated = 500VDC: DWV = 1.5 X WVDC, 25°C, 50mA max.	
Disspation Factor	0.1% max.	WVDC ≥ 50 VDC: 2.5% max. WVDC = 25 VDC: 3.5% max. WVDC = 10-16 VDC: 5.0% max. WVDC = 6.3 VDC: 10% max
Insulation Resistance (Min @ 25°C WVDC)	C≤ 0.047µF: 1000 ΩF or 100 GΩ, whichever is less C> 0.047µF: 500 ΩF or 10 GΩ, whichever is less	
Test Conditions	C > 100 pF; 1kHz ±50Hz; 1.0±0.2 VRMS C ≤ 100 pF; 1Mhz ±50kHz; 1.0±0.2 VRMS	1.0kHz±50Hz @ 1.0±0.2 Vrms

EMI X2Y Filters

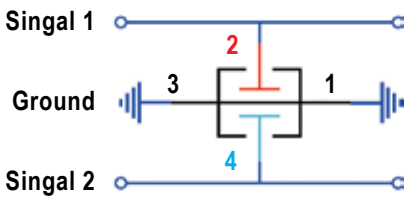
Decoupling Characteristics

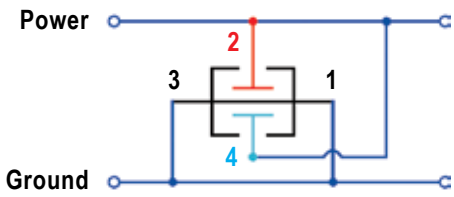
The EMI Design - A Balanced, Low ESL, "Capacitor Circuit"

The EMI capacitor design starts with standard 2 terminal MLC capacitor's opposing electrode sets, 2 & 4, and adds a third electrode set (1 and 3) which surround each 2 & 4 electrode. The result is a highly versatile three node capacitive circuit containing two tightly matched, low inductance capacitors in a compact, four-terminal SMT chip.



EMI Filtering	Power Bypass S21





EMI Filtering:

The EMI component contains two shunt or "line-to-ground" Y capacitors. Ultra-low ESL (equivalent series inductance) and tightly matched inductance of these capacitors provides unequaled high frequency Common-Mode noise filtering with low noise mode conversion. EMI components reduce EMI emissions far better than unbalanced discrete shunt capacitors or series inductive filters. Differential signal loss is determined by the cut off frequency of the single line-to-ground (Y) capacitor value of an EMI.

Power Bypass / Decoupling:

For Power Bypass applications, EMI's two "Y" capacitors are connected in parallel. This doubles the total capacitance and reduces their mounted inductance by 80% or 1/5th the mounted inductance of similar sized MLC capacitors enabling high-performance bypass networks with far fewer components and vias. Low ESL delivers improved High Frequency performance into the GHz range.

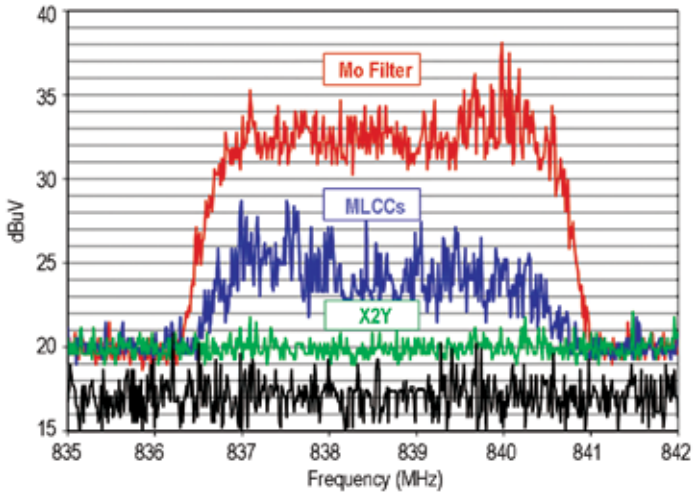
GSM RFI Attenuation in Audio & Analog

GSM handsets transmit in the 850 and 1850 MHz bands using a TDMA pulse rate of 217Hz. These signals cause the GSM buzz heard in a wide range of audio products from headphones to concert hall PA systems or "silent" signal errors created in medical, industrial process control, and security applications. Testing was conducted where an 840MHz GSM handset signal was delivered to the inputs of three different amplifier test circuit configurations shown below whose outputs were measured on a HF spectrum analyzer.

Legend:

- No input filter, 2 discrete MLC 100nF power bypass caps.
- 2 discrete MLC 1nF input filter, 2 discrete MLC 100nF power bypass caps.
- A single EMI 1nF input filter, a single EMI 100nF power bypass cap.

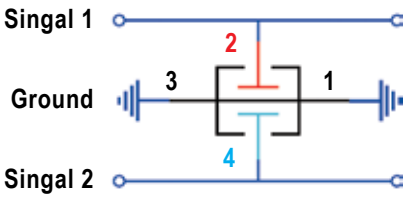
EMI configuration provided a nearly flat response above the ambient and up to 10 dB improved rejection than the conventional MLCC configuration.

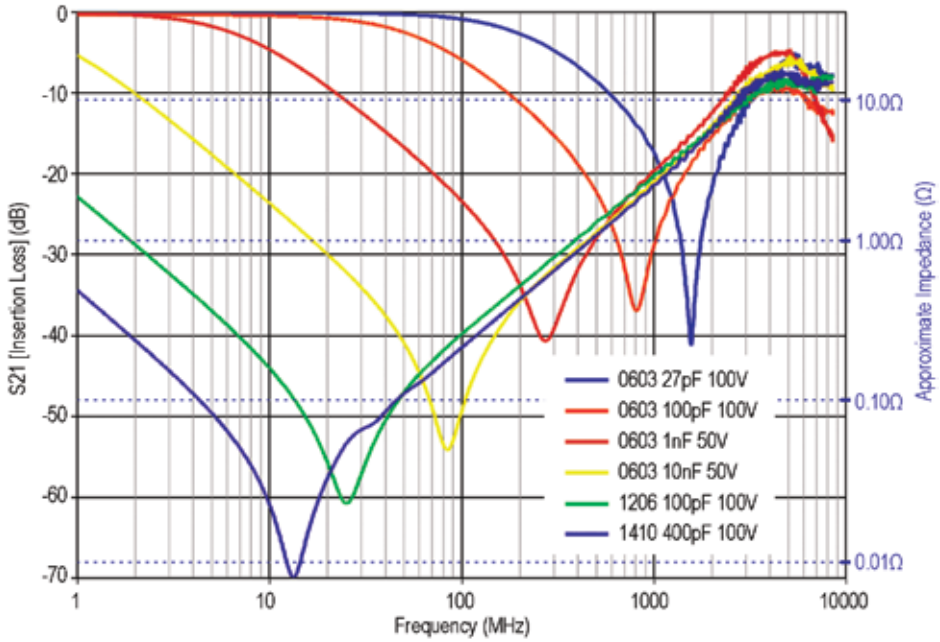


EMI X2Y Filters

EMI Filter & Decoupling Characteristics

EMI Filtering Scc21





Power Bypass S21

Labeled capacitance values follow the P/N order code (single Y cap value)

Effective capacitance measured in Circuit 2 is 2X of the labeled single Y cap value.