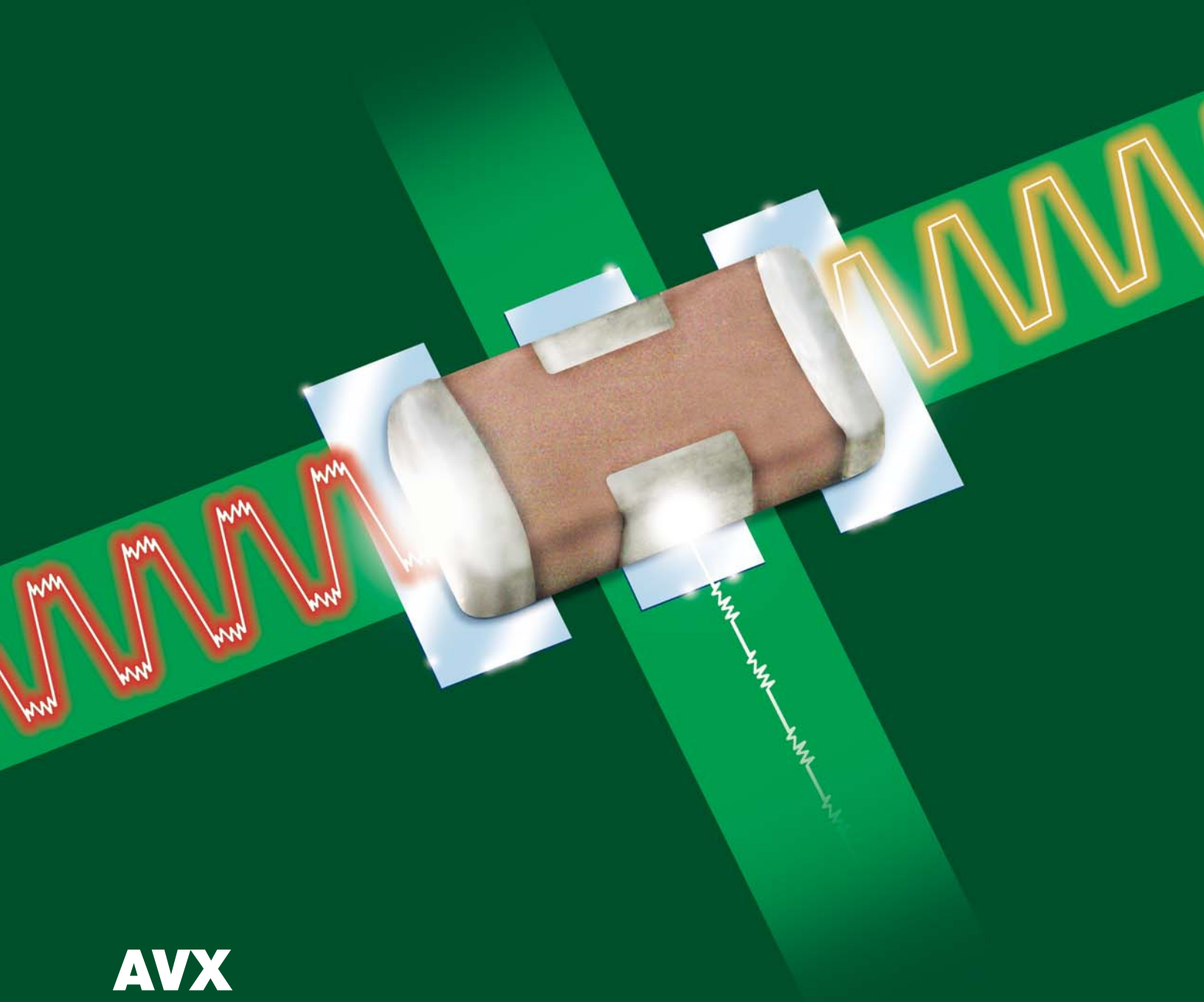
A KYOCERA GROUP COMPANY



AVX
Multilayer Ceramic Feedthru Chip Capacitors And Arrays

Feedthru 0805/1206 Capacitors

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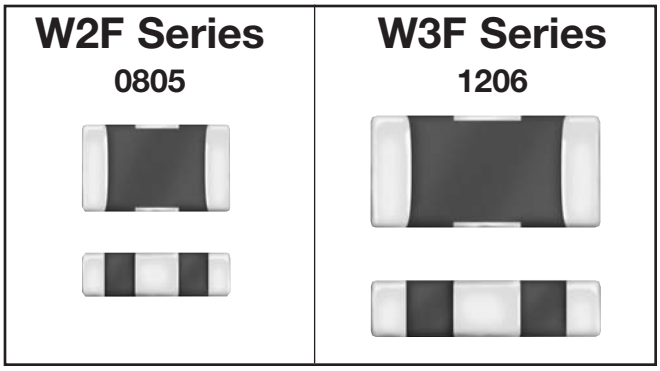
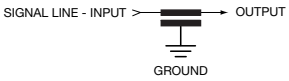
Feedthru 0805/1206 Capacitors

W2F/W3F Series

GENERAL DESCRIPTION

Available in both a standard 0805 and 1206 size, AVX's line of feedthru capacitors are ideal choices for EMI suppression, broadband I/O filtering, or Vcc power line conditioning. The unique construction of a feedthru capacitor provides low parallel inductance and offers excellent decoupling capability for all high di/dt environments and provides significant noise reduction in digital circuits to <5 GHz. A large range of capacitor values are available in either NP0 or X7R ceramic dielectrics. AVX FeedThru filters are AEC Q200 qualified. High reliability screening options are available for spacecraft designs.





CAPACITOR VALUES

Part Number	Size	Voltage	Dielectric	Capacitance
W2F11A 220 8ATxx	0805	100V	NP0	22pF
W2F11A 470 8ATxx	0805	100V	NP0	47pF
W2F11A 101 8ATxx	0805	100V	NP0	100pF
W2F11A 221 8ATxx	0805	100V	NP0	220pF
W2F11A 471 8ATxx	0805	100V	NP0	470pF
W2F15C 102 8ATxx	0805	50V	X7R	1000pF
W2F15C 222 8ATxx	0805	50V	X7R	2200pF
W2F15C 472 8ATxx	0805	50V	X7R	4700pF
W2F15C 103 8ATxx	0805	50V	X7R	10000pF
W2F15C 223 8ATxx	0805	50V	X7R	22000pF
W2F15C 473 8ATxx	0805	50V	X7R	47000pF
W3F11A 220 8ATxx	1206	100V	NP0	22pF
W3F11A 470 8ATxx	1206	100V	NP0	47pF
W3F11A 101 8ATxx	1206	100V	NP0	100pF
W3F11A 221 8ATxx	1206	100V	NP0	220pF
W3F11A 471 8ATxx	1206	100V	NP0	470pF
W3F15C 102 8ATxx	1206	50V	X7R	1000pF
W3F15C 222 8ATxx	1206	50V	X7R	2200pF
W3F15C 472 8ATxx	1206	50V	X7R	4700pF
W3F15C 103 8ATxx	1206	50V	X7R	10000pF
W3F15C 223 8ATxx*	1206	50V	X7R	22000pF
W3F15C 473 8ATxx	1206	50V	X7R	47000pF

PERFORMANCE CHARACTERISTICS

	NP0	X7R
Capacitance Tolerance	+50%, -20%	+50%, -20%
Voltage Rating	100V	50V
Current Rating	300mA	300mA
Insulation Resistance	1000MΩ	1000MΩ
DC Resistance	<0.6Ω	<0.6Ω
Operating Temperature Range	-55 to +125°C	

RoHS COMPLIANT

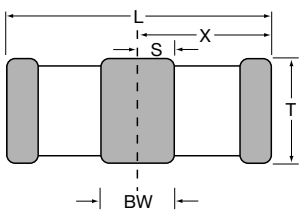
HOW TO ORDER

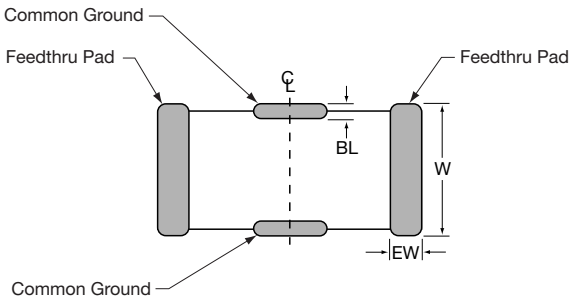
W	3	F	1	5	C	223	8	A	T	3	A
Style W = Plated Ni & Sn L = Plated SnPb	**Size** 2 = 0805 3 = 1206	**Feedthru**	**Number of Elements**	**Voltage**** 1 = 100V 5 = 50V	**Dielectric** A = NP0 C = X7R	**Capacitance Code**	**Capacitance Tolerance** 8 = +50/-20%	**Failure Rate** A = Not Applicable 4 = AUTOMOTIVE	**Termination** T = Plated Ni & Sn B = Plated SnPb	**Packaging Code (Reel Size)** 1 = 7" Reel Embossed Tape 3 = 13" Reel Embossed Tape	**Quantity Code (Pcs./Reel)** F = 1,000 A = 2,000, 4,000 or 10,000

*AECQ-200 Qualified. Contact factory for other values.
**Note: NP0 available in 100V only and X7R available in 50V only.

Feedthru 0805/1206 Capacitors

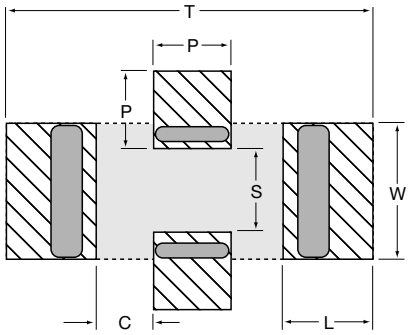
W2F/W3F Series





DIMENSIONS

	L	W	T	BW	BL	EW	X	S
0805 MM	2.01 ± 0.20	1.25 ± 0.20	1.14 Max.	0.46 ± 0.10	0.18 + 0.25 -0.08	0.25 ± 0.13	1.02 ± 0.10	0.23 ± 0.15
(in.)	(0.079 ± 0.008)	(0.049 ± 0.008)	(0.045 Max.)	(0.018 ±0.004)	(0.007 + 0.010 -0.003)	(0.010 ± 0.005)	(0.040 ± 0.004)	(0.009 ± 0.006)
1206 MM	3.20 ± 0.20	1.60 ± 0.20	1.27 Max.	0.89 ± 0.10	0.18 + 0.25 -0.08	0.38 ± 0.18	1.60 ± 0.10	0.46 ± 0.15
(in.)	(0.126 ± 0.008)	(0.063 ± 0.008)	(0.050 Max.)	(0.035 ± 0.004)	(0.007 + 0.010 -0.003)	(0.015 ± 0.007)	(0.063 ± 0.004)	(0.018 ± 0.006)

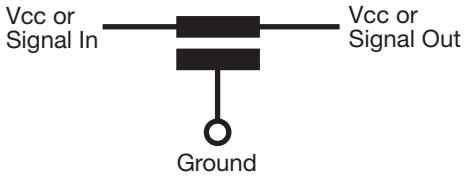


RECOMMENDED SOLDER PAD LAYOUT (TYPICAL DIMENSIONS)

	T	P	S	W	L	C
0805 MM	3.45	0.51	0.76	1.27	1.02	0.46
(in.)	(0.136)	(0.020)	(0.030)	(0.050)	(0.040)	(0.018)
1206 MM	4.54	0.94	1.02	1.65	1.09	0.71
(in.)	(0.179)	(0.037)	(0.040)	(0.065)	(0.043)	(0.028)

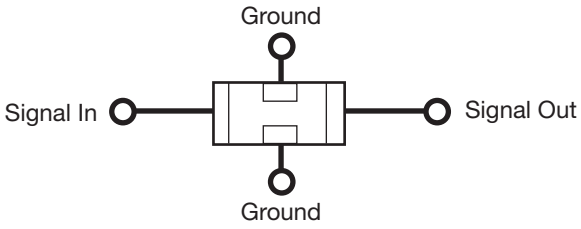
TYPICAL FEEDTHRU CHIP CAP CONNECTION

Feedthru Chip Component Model

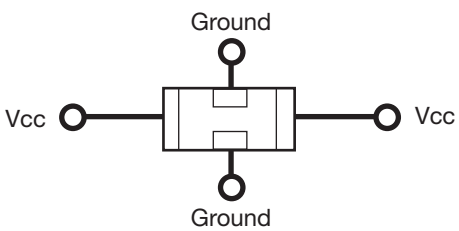


The terminals are connected internally side to side. Left side and right side are connected and front and back are connected internally.
For Decoupling, the chip is usually surrounded by four vias, two for Vcc and two for GND.
For Signal Filtering, the in and out lines need to be separated on the circuit board.

Physical Layout - A

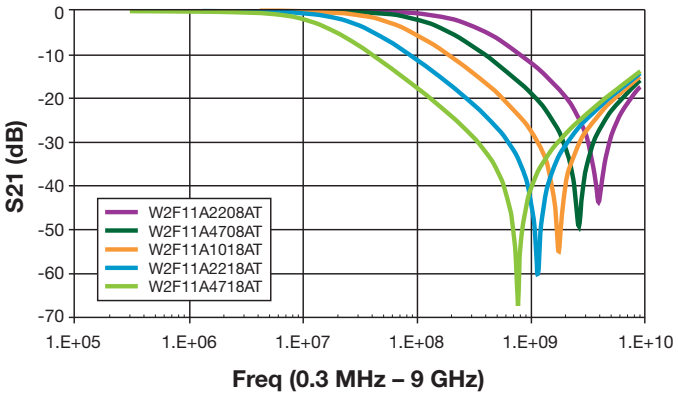


Physical Layout - B

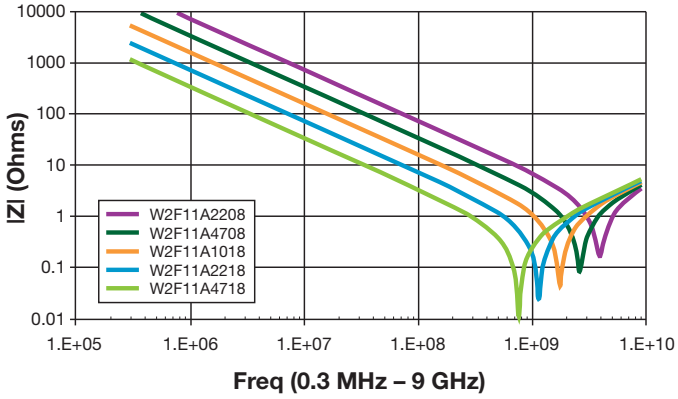


PERFORMANCE CHARACTERISTICS

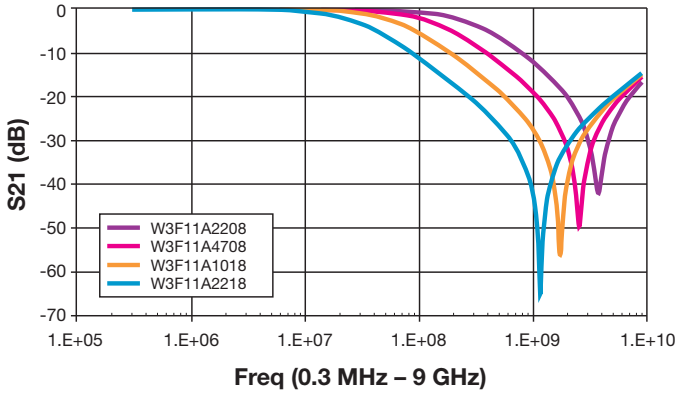
S21 0805 – 100V



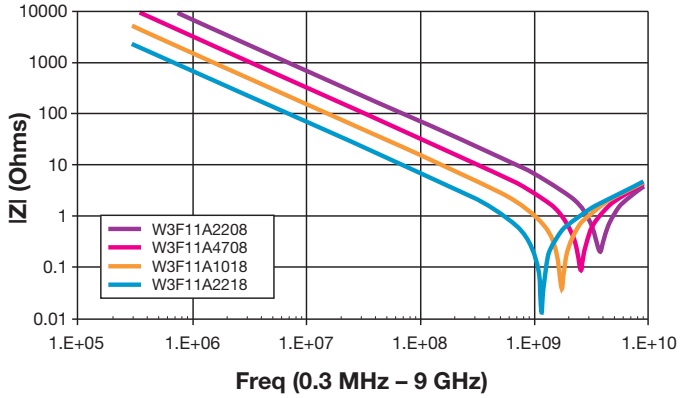
IMPEDANCE 0805 – 100V



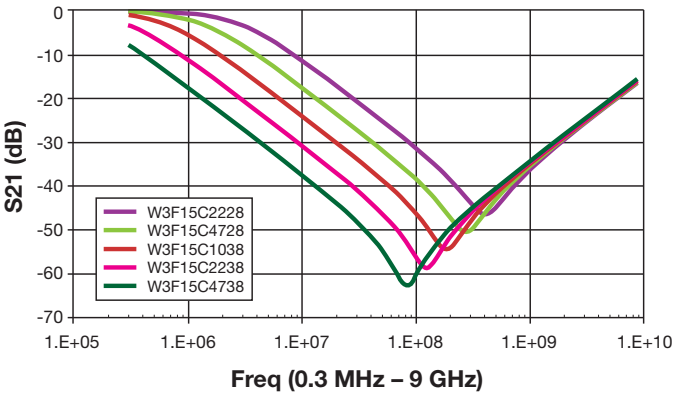
S21 1206 – 100V



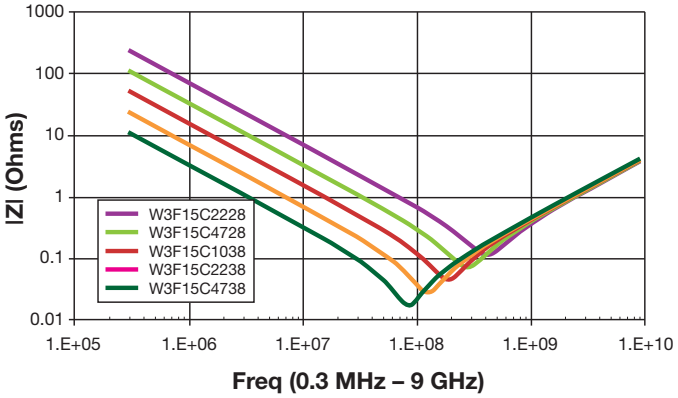
IMPEDANCE 1206 – 100V



S21 1206 – 50V

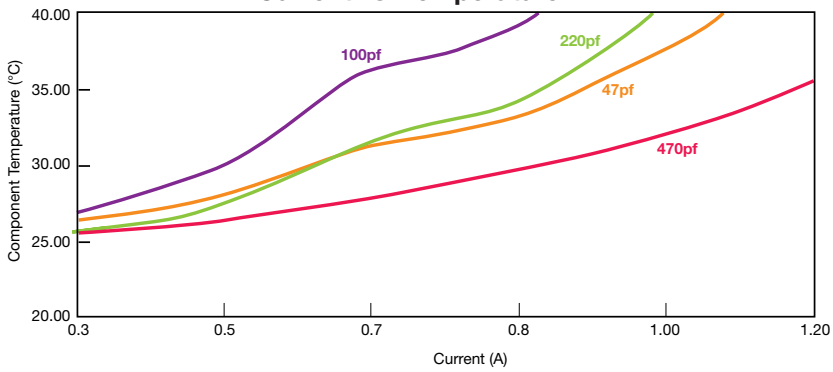


IMPEDANCE 1206 – 50V

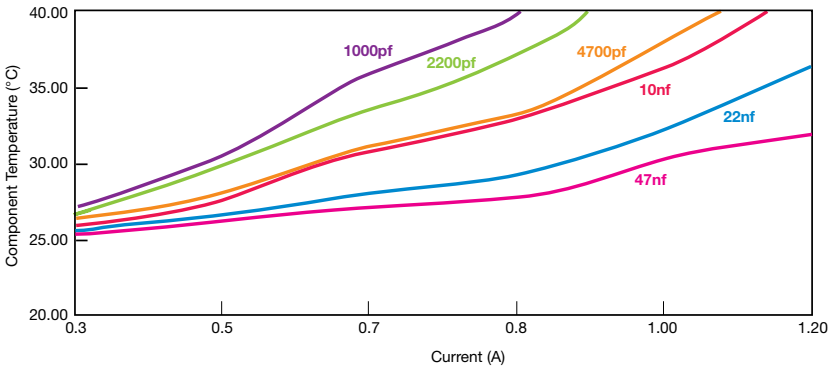


PERFORMANCE CHARACTERISTICS

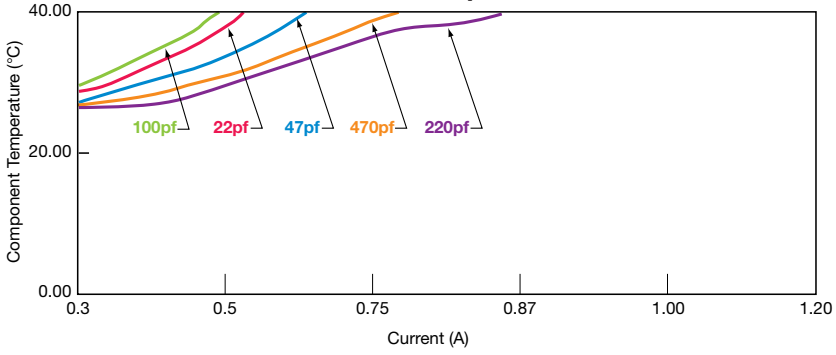
0805 NP0
Current vs. Temperature



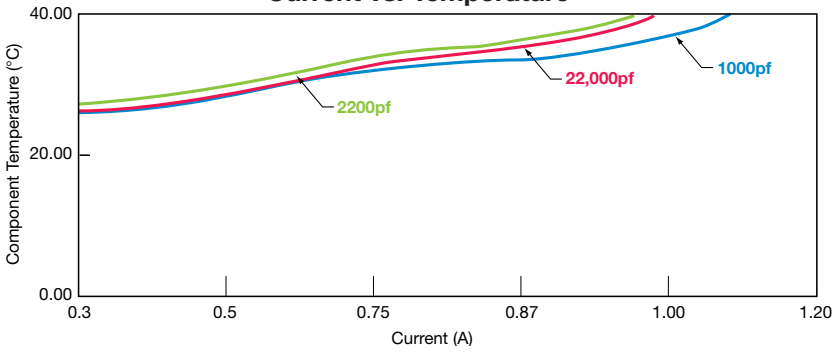
0805 X7R
Current vs. Temperature



1206 NP0
Current vs. Temperature



1206 X7R
Current vs. Temperature



High Current Feedthru Capacitors

W2H/W3H Series

GENERAL DESCRIPTION

High current feedthru capacitors are designed as a broad-band EMI filter that is specially designed to have high current handling capability. These SMT feedthru filters offer an optimized frequency response with high attenuation across a wide RF spectrum due to optimized parallel and series inductances. These W2H/W3H feedthru filters can actually replace discrete L/C filter networks.

FEATURES

- Low parallel inductance provides significant noise reduction in circuits with operating frequencies up to 5GHz
- Broad frequency response with high attenuation
- High rated current – up to 2A for 0805 and up to 5A for 0612
- Small size – 0805 and 0612 case size
- Reeling in accordance with EIA-481

MECHANICAL CHARACTERISTICS

- Available in EIA 0805 and 0612 cases
- Plated Tin over Nickel Barrier
- Packaged in Tape & Reel

TYPICAL APPLICATIONS

- High current power (Vcc) lines
- PA decoupling
- DC:DC converters
- Regulators
- Power supervisory circuits

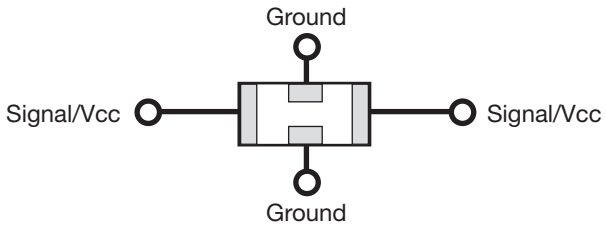
HOW TO ORDER

W2H1	5	C	473	8	A	T	1A
Size & Style W2H1=0805 W3H1=0612 W=Plated Ni & Sb L=Plated SnPb	**Voltage** 3=25v 5=50v 1=100v	**Dielectric** A=NP0 C=X7R	**Capacitance Code**	**Capacitance Tolerance** 8=+50/-20% M=±20%	**Failure Rate** A=Not Applicable	**Terminations** T=Plated Ni & Sn B=Plated SnPb	**Packaging** 1A=7" Reel 4000 pcs 3A=13" Reel 4000 pcs

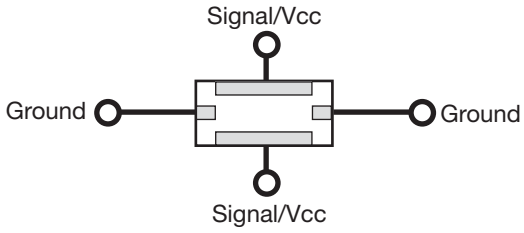
LEAD-FREE
LEAD-FREE COMPATIBLE COMPONENT

RoHS COMPLIANT

PINOUT CONFIGURATION



W2H1 – 0805 Style



W3H1 – 0612 Style

High Current Feedthru Capacitors

W2H/W3H Series

ELECTRICAL PARAMETERS

Insulation Resistance	1000 MΩ Minimum
DC Resistance	<0.150 Ω
Operating Temperature	-55C to +125C

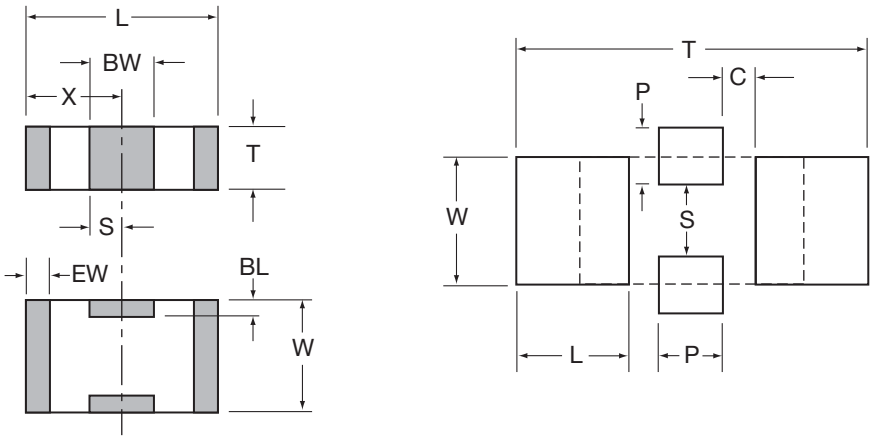
CAPACITOR VALUES

Part Number	Size	Dielectric	Capacitance	Tolerance	Voltage	Current
W2H13C 104 8AT	0805	X7R	100,000pF	+50%, -20%	25V	2A
W2H15C 473 8AT	0805	X7R	47,000pF	+50%, -20%	50V	2A
W2H15C 223 8AT	0805	X7R	22,000pF	+50%, -20%	50V	1A
W2H15C 103 8AT	0805	X7R	10,000pF	+50%, -20%	50V	1A
W2H15C 102 8AT	0805	X7R	1,000pF	+50%, -20%	50V	1A
W2H11A 471 8AT	0805	NP0	470pF	+50%, -20%	100V	0.5A
W2H11A 221 8AT	0805	NP0	220pF	+50%, -20%	100V	0.5A
W2H11A 101 8AT	0805	NP0	100pF	+50%, -20%	100V	0.5A
W2H11A 470 8AT	0805	NP0	47pF	+50%, -20%	100V	0.5A
W2H11A 220 8AT	0805	NP0	22pF	+50%, -20%	100V	0.5A
W3H13C 104 8AT	0612	X7R	100,000pF	+50%, -20%	25V	up to 5A
W3H15C 473 8AT	0612	X7R	47,000pF	+50%, -20%	50V	up to 5A
W3H15C 223 8AT	0612	X7R	22,000pF	+50%, -20%	50V	up to 4A
W3H15C 103 8AT	0612	X7R	10,000pF	+50%, -20%	50V	up to 3A
W3H11A 471 8AT	0612	NP0	470pF	+50%, -20%	100V	up to 4A
W3H11A 221 8AT	0612	NP0	220pF	+50%, -20%	100V	up to 4A
W3H11A 101 8AT	0612	NP0	100pF	+50%, -20%	100V	up to 4A
W3H11A 470 8AT	0612	NP0	47pF	+50%, -20%	100V	up to 3A
W3H11A 220 8AT	0612	NP0	22pF	+50%, -20%	100V	up to 3A

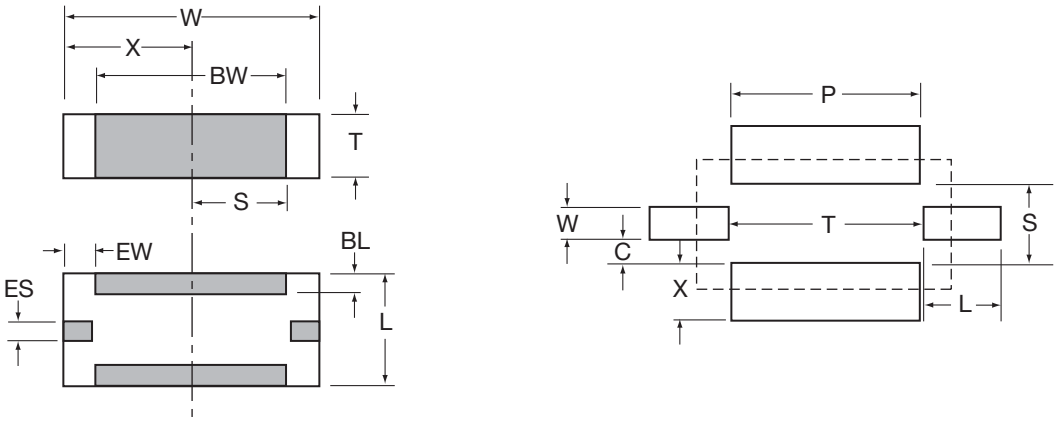
High Current Feedthru Capacitors

W2H/W3H Series

PHYSICAL DIMENSIONS AND PAD LAYOUT



W2H1 – 0805 Style



W3H1 – 0612 Style

PHYSICAL DIMENSIONS

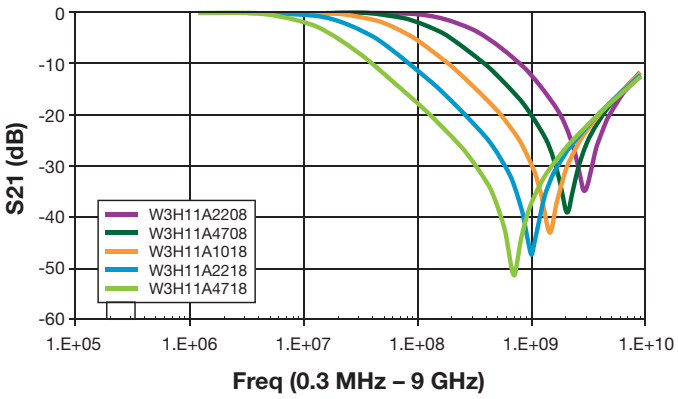
	L	W	T	BW	BL	ES	EW	X	S
W2H1– 0805 MM	2.01 ± 0.20	1.25 ± 0.20	1.14 Max.	0.46 ± 0.10	0.18 + 0.25 -0.08	NA	0.25 ± 0.13	1.02 ± 0.10	0.23 ± 0.05
(in.)	(0.079 ± 0.008)	(0.049 ± 0.008)	(0.045 Max.)	(0.018 ±0.004)	(0.007 + 0.010 -0.003)		(0.010 ± 0.005)	(0.040 ± 0.004)	(0.009 ± 0.002)
W3H1– 0612 MM	1.60 ± 0.20	3.20 ± 0.20	1.22 Max.	2.80 ± .127	0.18 + 0.25 -0.08	0.41 ± 0.10	0.41 ± 0.10	1.60 ± 0.10	1.40 ± 0.07
(in.)	(0.063 ± 0.008)	(0.126 ± 0.008)	(0.048 Max.)	(0.110 ± 0.005)	(0.007 + 0.010 -0.003)	(0.016 ± 0.004)	(0.016 ± 0.004)	(0.063 ± 0.004)	(0.055 ± 0.003)

PAD DIMENSIONS

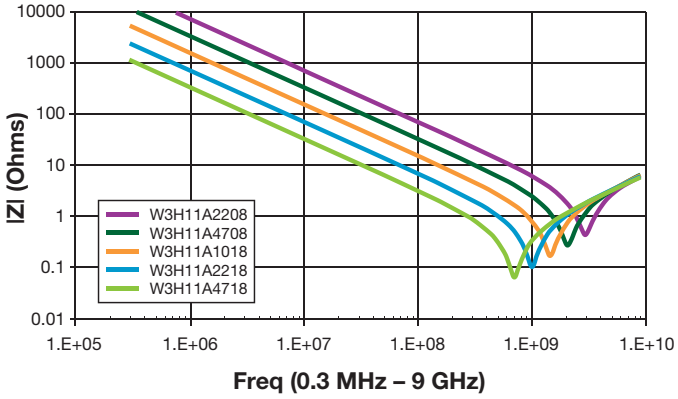
	T	P	S	W	L	C	X
W2H1– 0805 MM	3.45	0.51	0.76	1.27	1.02	0.46	NA
(in.)	(0.136)	(0.020)	(0.030)	(0.050)	(0.040)	(0.018)	
W3H1– 0612 MM	2.54	3.05	1.12	.460	.610	.330	.710
(in.)	(0.100)	(0.120)	(0.044)	(0.018)	(0.024)	(0.013)	(0.028)

PERFORMANCE CHARACTERISTICS

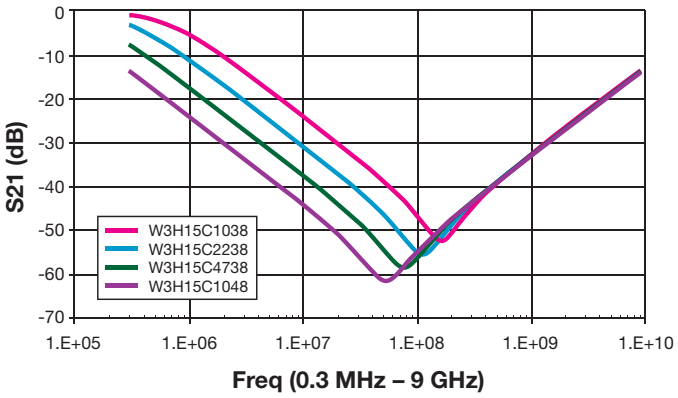
S21 0612 – 100V



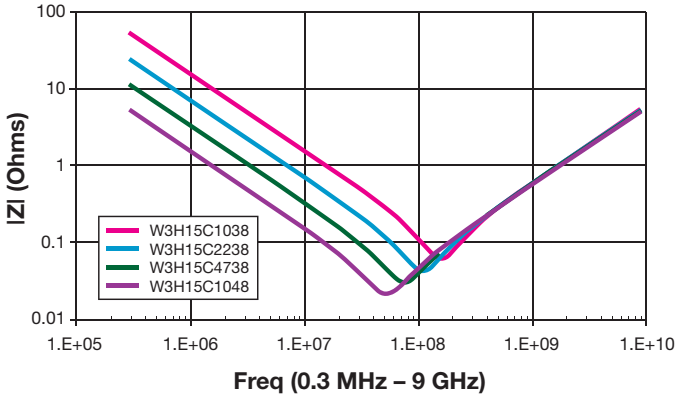
IMPEDANCE 0612 – 100V



S21 0612 – 50V / 25V



IMPEDANCE 0612 – 50V / 25V



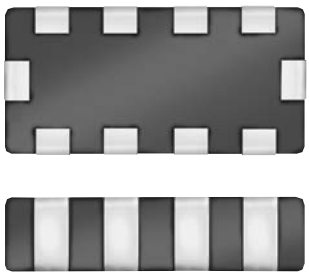
Feedthru Filters – W2F4 / W3F4 Series

EMI Filtering, Broadband Filtering, LCD Filtering

GENERAL DESCRIPTION

Available in a 4-Element 0508 and 0612 Feedthru Array package, AVX's line of Feedthrus is an ideal choice for EMI suppression, broadband I/O filtering, LCD filtering and V_{CC} power line conditioning. The unique construction of the Feedthru capacitor provides low parallel inductance and offers excellent decoupling capability for all high di/dt environments and provides significant noise reduction in digital circuits up to 5 GHz. A range of filtering characteristics is available. The Feedthru Array contains four elements with a common ground connection, making it an ideal choice for multi-line designs. Additional benefits of the multi-element array package are reduced placement costs, reduced component counts and PCB space savings. Feedthru filters can be used to meet IEC, MIL-STD-461E, FCC, and SAE radiated and conducted emission requirements.

W3F4 Series
0612



HOW TO ORDER

W3F4	5	C	221	8	A	T	3A
Size & Style W2H1=0805 W3H1=0612 W=Plated Ni & Sb L=Plated SnPb	**Voltage**	**Dielectric**	**Capacitance Code**	**Capacitance Tolerance**	**Failure Rate**	**Terminations** T=Plated Ni & Sn B=Plated SnPb	**Packaging**

FREQUENCY CHARACTERISTICS

Part Number	Roll Off Frequency	Center Frequency	10 db Point	20 db Range	
W3F41A2208AT	270 MHz	2640 MHz	970 MHz	1780 MHz	3500 MHz
W3F41A4708AT	65 MHz	2000 MHz	185 MHz	600 MHz	3400 MHz
W3F41A1018AT	65 MHz	2030 MHz	185 MHz	560 MHz	3500 MHz
W3F45C2218AT	35 MHz	1885 MHz	120 MHz	470 MHz	3300 MHz
W3F45C4718AT	20 MHz	1860 MHz	60 MHz	220 MHz	3500 MHz
W2F43A2208AT	208 MHz	4750 MHz	616 MHz	1407 MHz	7300 MHz
W2F43A4708AT	110 MHz	2750 MHz	330 MHz	900 MHz	4600 MHz
W2F43A1018AT	60 MHz	1300 MHz	179 MHz	501 MHz	7200 MHz

CAPACITOR VALUES & PERFORMANCE CHARACTERISTICS

Part Number	Typical Capacitance	Insulation Resistance	Temperature Characteristics
W3F41A2208AT	22pF	> 1000 MΩ	NP0
W3F41A4708AT	47pF	> 1000 MΩ	NP0
W3F41A1018AT	100pF	> 1000 MΩ	NP0
W3F45C2218AT	220pF	> 1000 MΩ	X7R
W3F45C4718AT	470pF	> 1000 MΩ	X7R
W2F43A2208AT	22pF	> 1000 MΩ	NP0
W2F43A4708AT	47pF	> 1000 MΩ	NP0
W2F43A1018AT	100pF	> 1000 MΩ	NP0

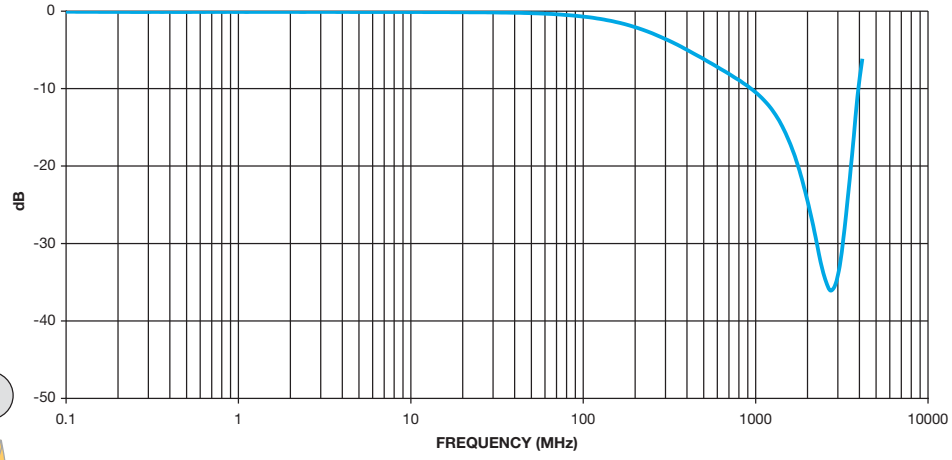
CASE SIZE & VOLTAGE RATINGS

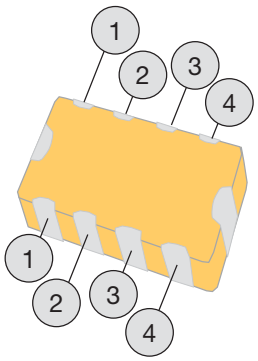
Part Number	Case Size	Current Rating	DC Resistance	Voltage Rating
W3F41A2208AT W3F41A4708AT W3F41A1018AT	0612	300 mA	< 0.6Ω	100 V
W3F45C2218AT W3F45C4718AT	0612	300 mA	< 0.6Ω	50 V
W2F43A2208AT W2F43A4708AT W2F43A1018AT	0508	50 mA	< 3.0Ω	25 V

W3F41A2208AT S_{21} Curves

Typical

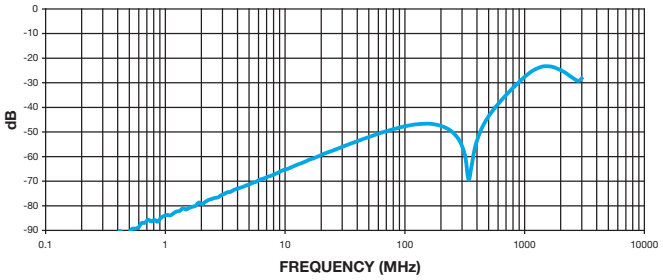
AVX W3F41A2208AT Typical S_{21}



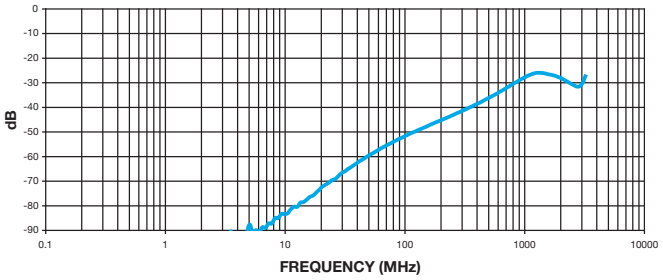


Far Side Crosstalk

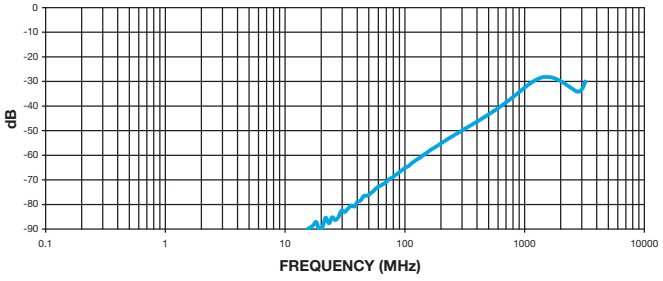
Typical
AVX W3F41A2208AT
Typical Far-side XTALK
Elements 1 - 2



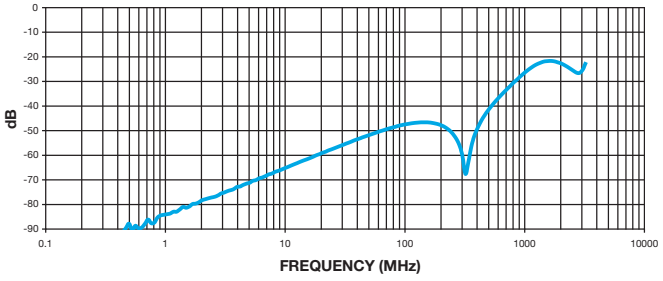
Typical
AVX W3F41A2208AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W3F41A2208AT
Typical Far-side XTALK
Elements 1 - 4



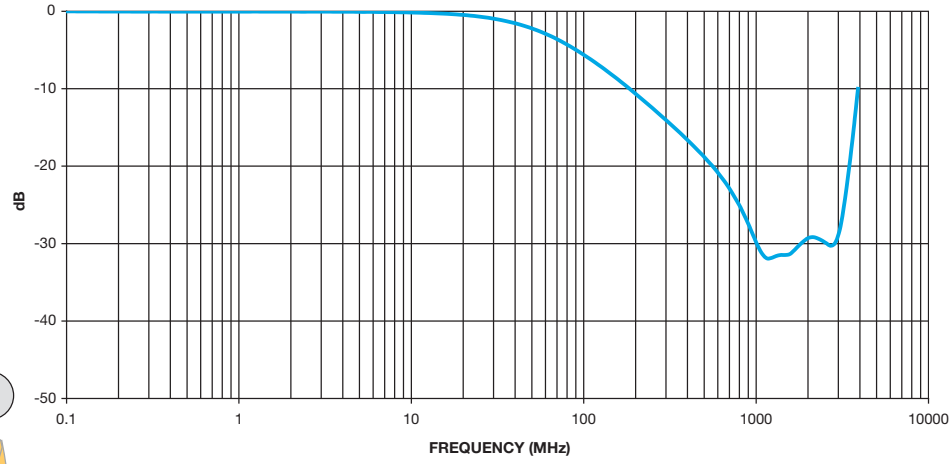
Typical
AVX W3F41A2208AT
Typical Far-side XTALK
Elements 2 - 3

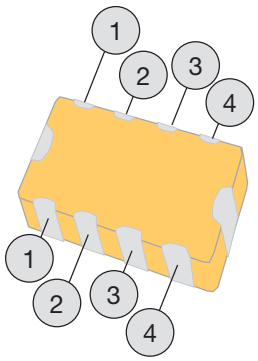


W3F41A4708AT S_{21} Curves

Typical

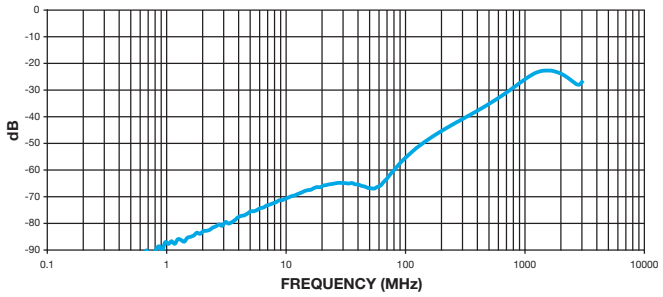
AVX W3F41A4708AT Typical S_{21}



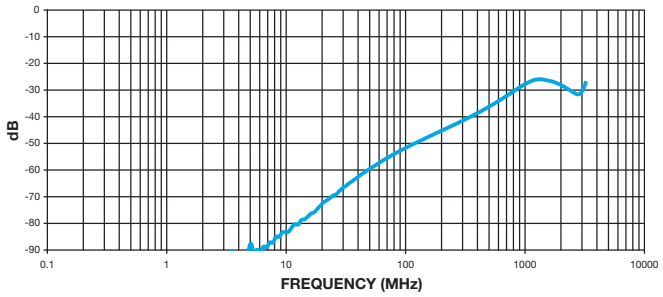


Far Side Crosstalk

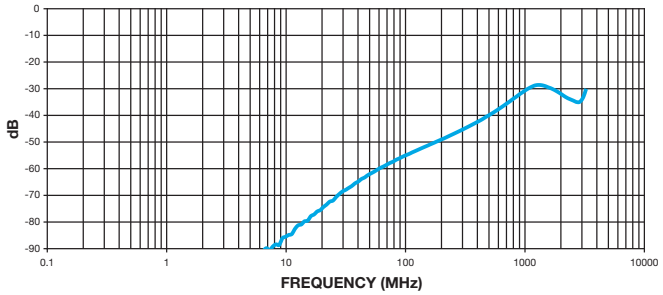
Typical
AVX W3F41A4708AT
Typical Far-side XTALK
Elements 1 - 2



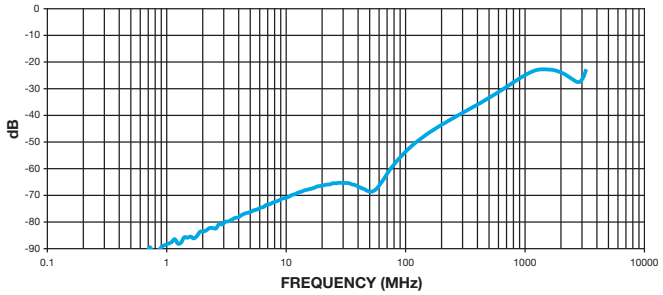
Typical
AVX W3F41A4708AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W3F41A4708AT
Typical Far-side XTALK
Elements 1 - 4



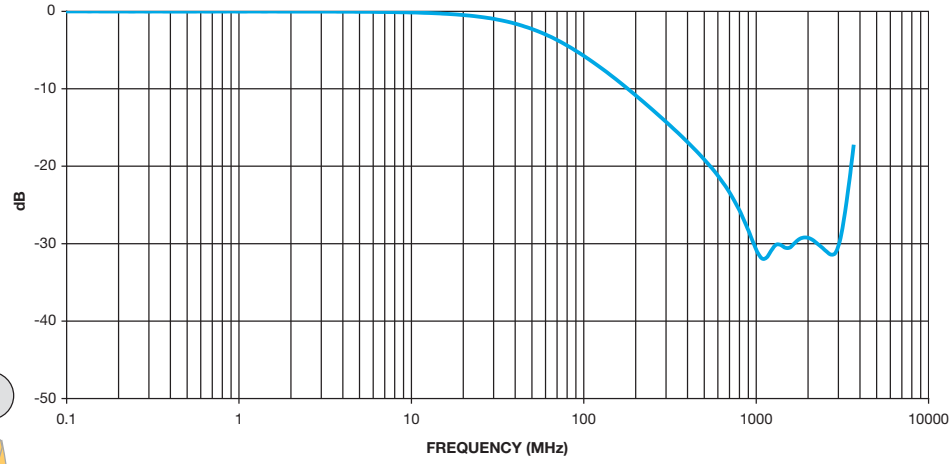
Typical
AVX W3F41A4708AT
Typical Far-side XTALK
Elements 2 - 3

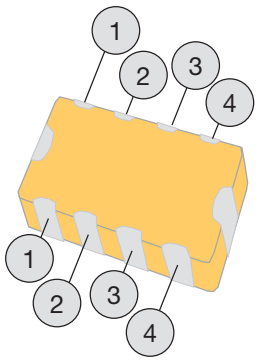


W3F41A1018AT S_{21} Curves

Typical

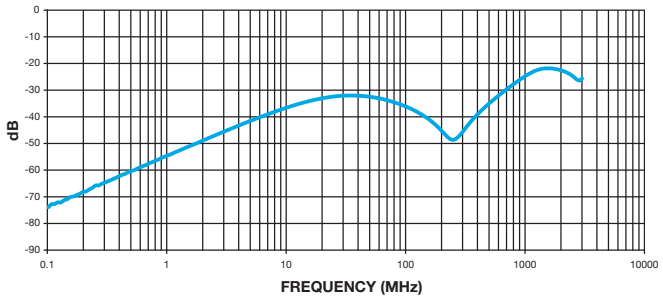
AVX W3F41A1018AT Typical S_{21}



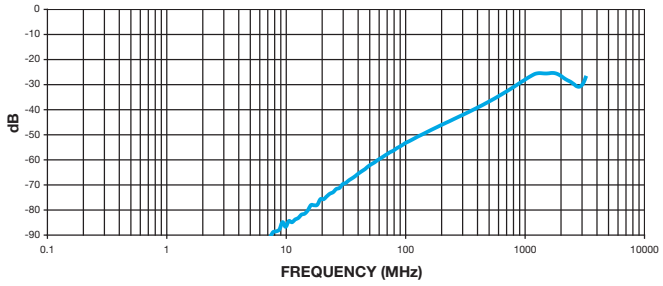


Far Side Crosstalk

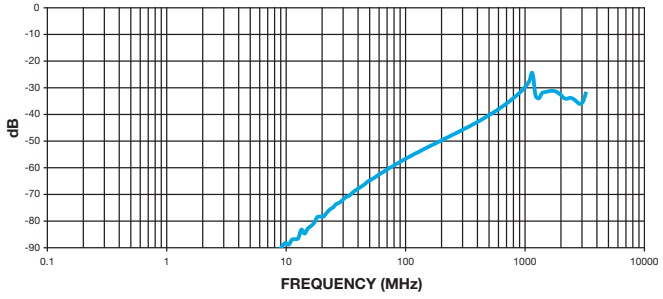
Typical
AVX W3F41A1018AT
Typical Far-side XTALK
Elements 1 - 2



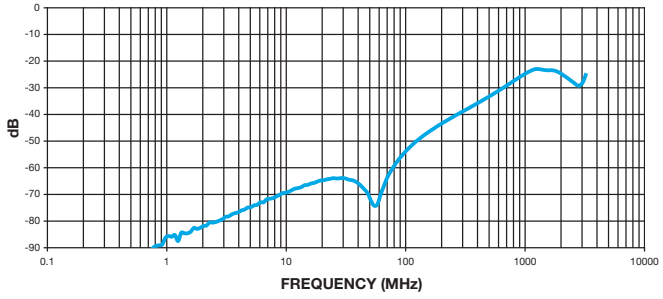
Typical
AVX W3F41A1018AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W3F41A1018AT
Typical Far-side XTALK
Elements 1 - 4



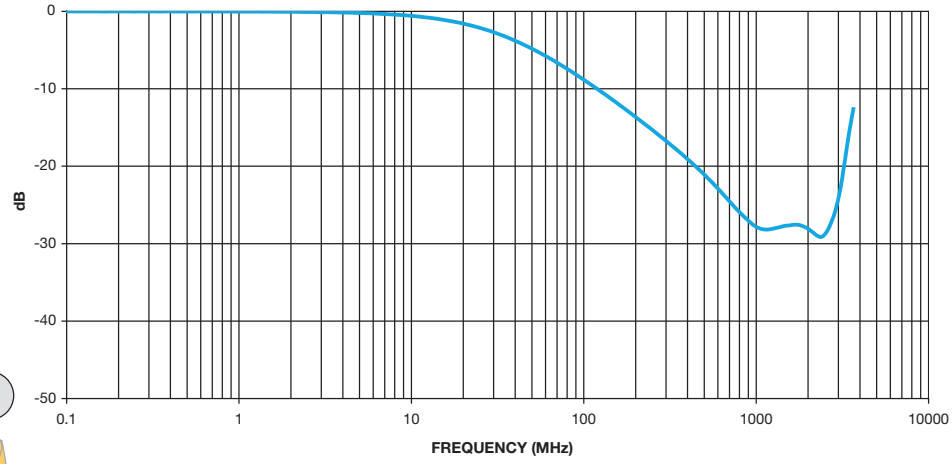
Typical
AVX W3F41A1018AT
Typical Far-side XTALK
Elements 2 - 3

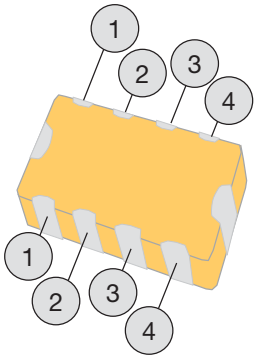


W3F45C2218AT S_{21} Curves

Typical

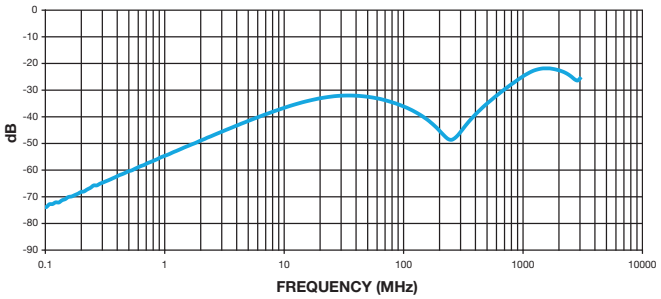
AVX W3F45C2218AT Typical S_{21}



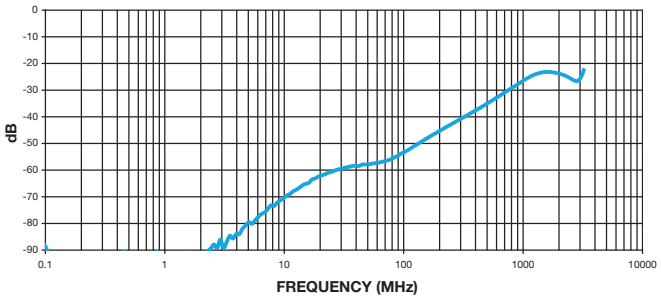


Far Side Crosstalk

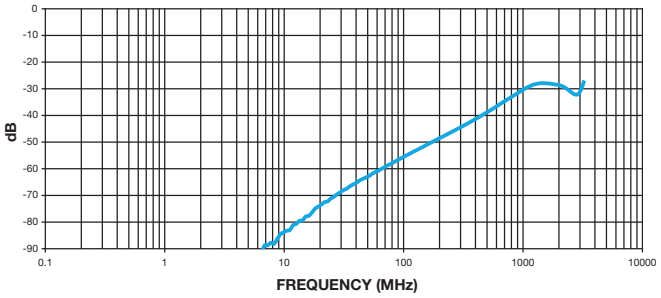
Typical
AVX W3F45C2218AT
Typical Far-side XTALK
Elements 1 - 2



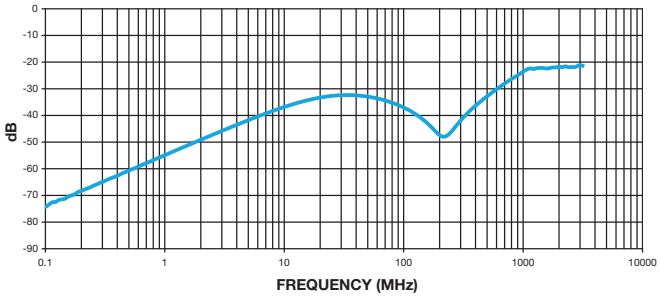
Typical
AVX W3F45C2218AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W3F45C2218AT
Typical Far-side XTALK
Elements 1 - 4



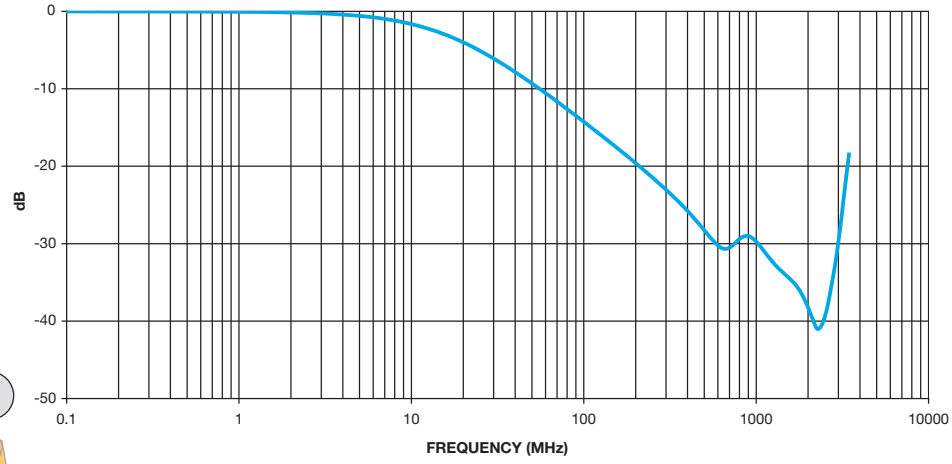
Typical
AVX W3F45C2218AT
Typical Far-side XTALK
Elements 2 - 3

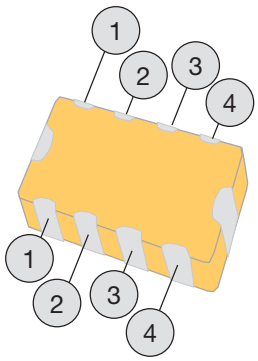


W3F45C4718AT S_{21} Curves

Typical

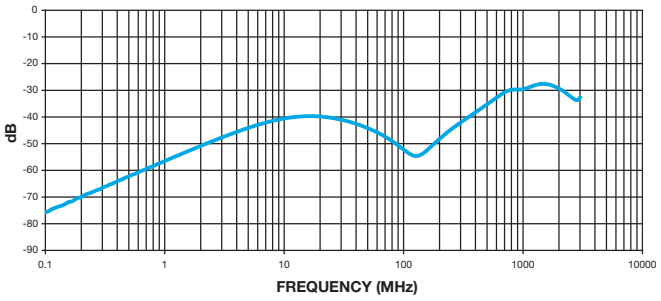
AVX W3F45C4718AT Typical S_{21}



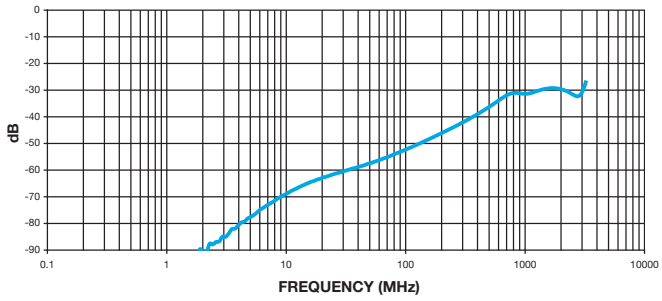


Far Side Crosstalk

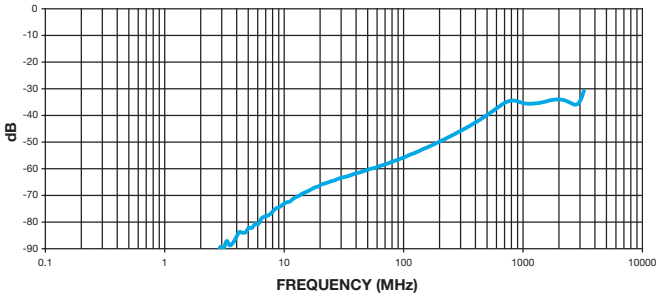
Typical
AVX W3F45C4718AT
Typical Far-side XTALK
Elements 1 - 2



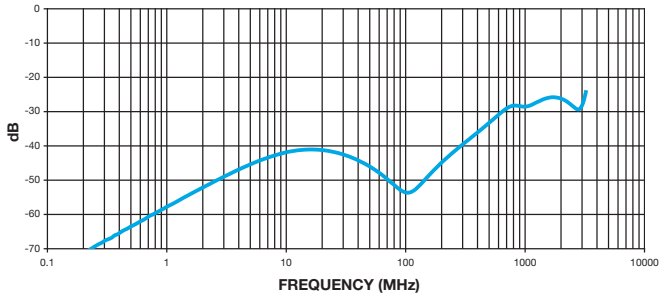
Typical
AVX W3F45C4718AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W3F45C4718AT
Typical Far-side XTALK
Elements 1 - 4



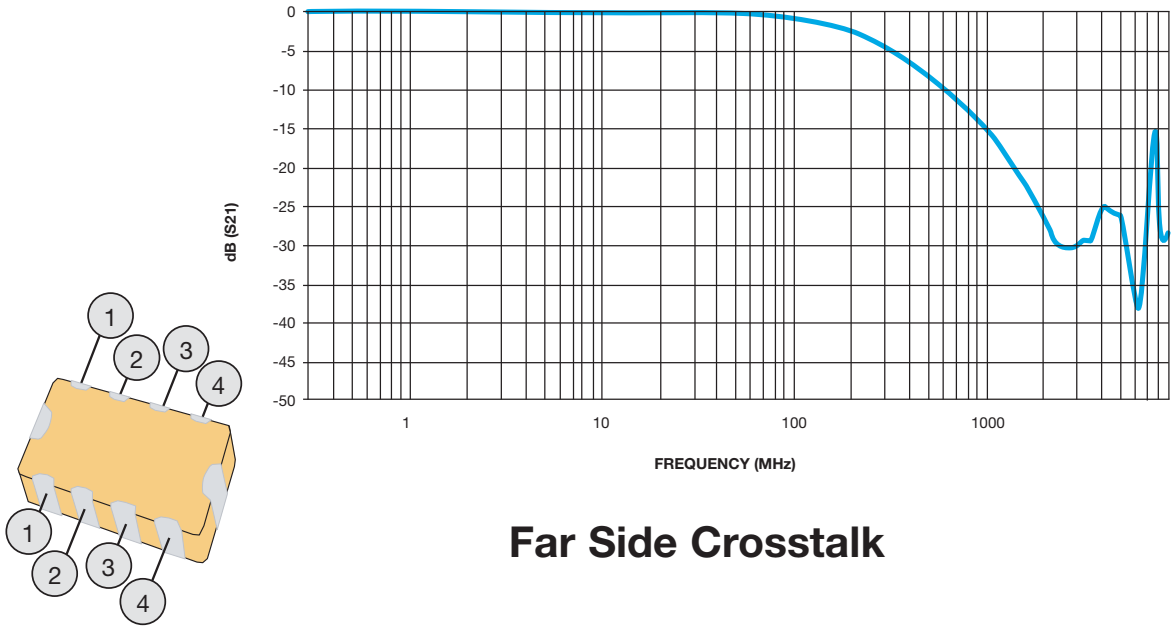
Typical
AVX W3F45C4718AT
Typical Far-side XTALK
Elements 2 - 3



W2F43A2208AT S_{21} Curves

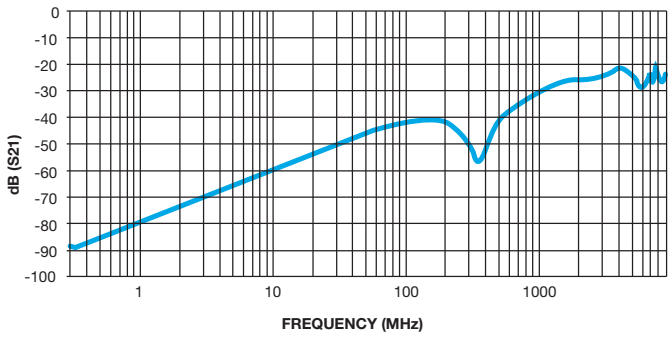
Typical

AVX W2F43A2208AT Typical S_{21}

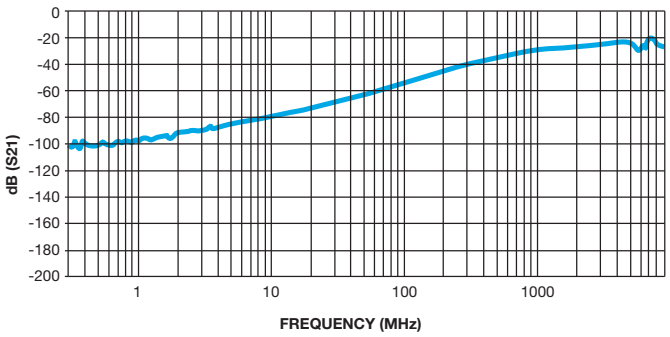


Far Side Crosstalk

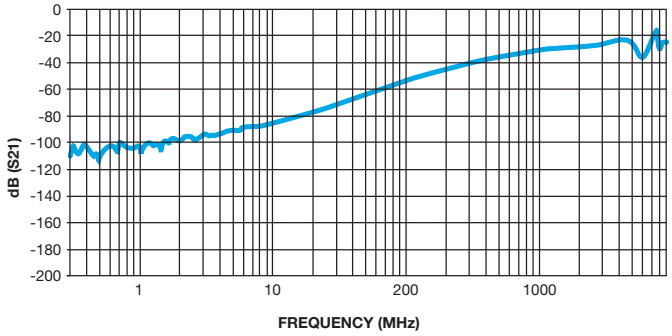
Typical
AVX W2F43A2208AT
Typical Far-side XTALK
Elements 1 - 2



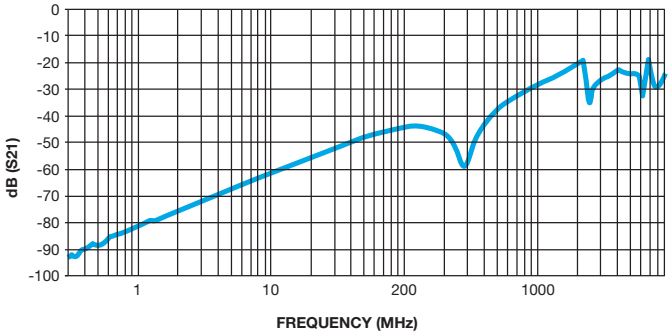
Typical
AVX W2F43A2208AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W2F43A2208AT
Typical Far-side XTALK
Elements 1 - 4



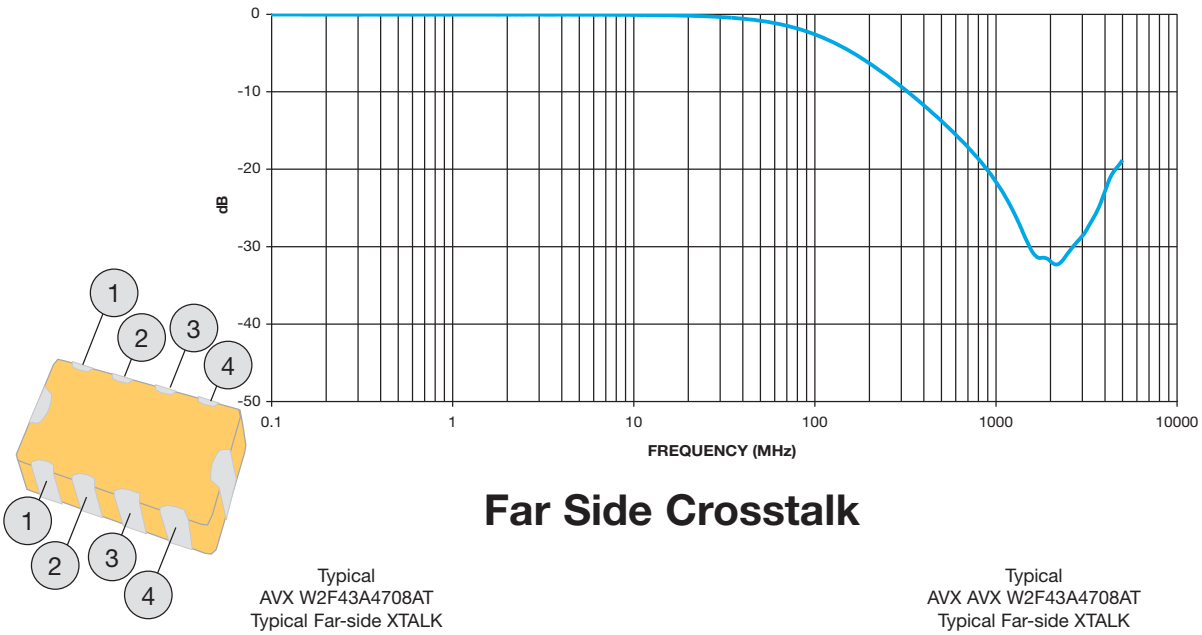
Typical
AVX W2F43A2208AT
Typical Far-side XTALK
Elements 2 - 3



W2F43A4708AT S_{21} Curves

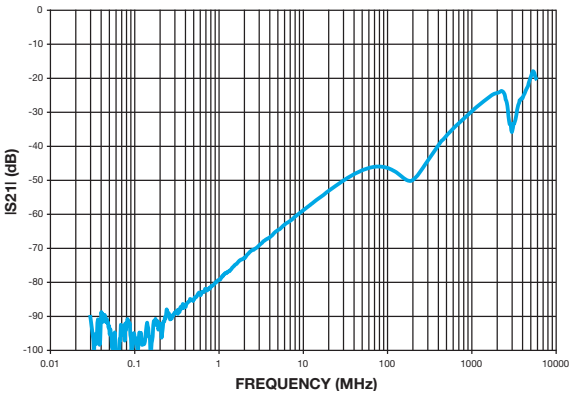
Typical

AVX W2F43A4708AT Typical S_{21}

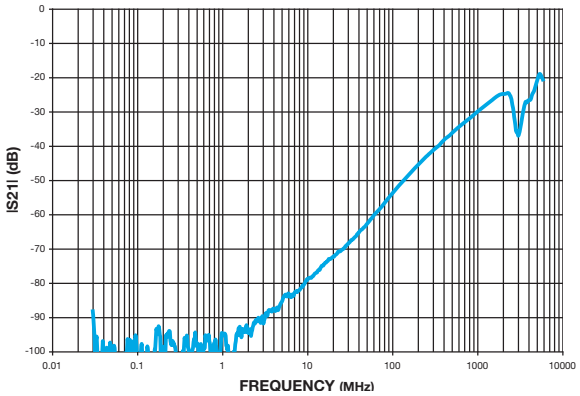


Far Side Crosstalk

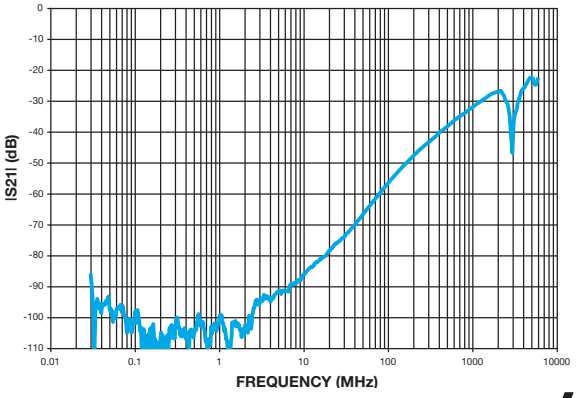
Typical
AVX W2F43A4708AT
Typical Far-side XTALK
Elements 1 - 2



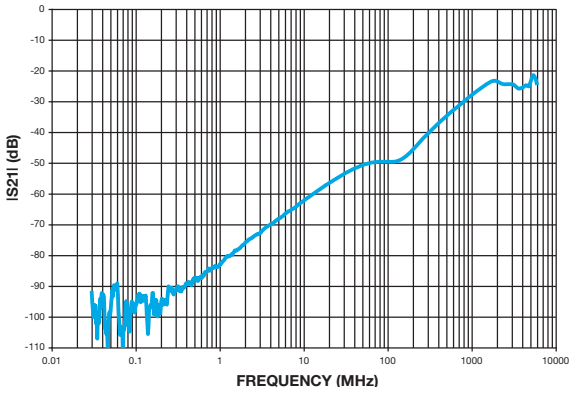
Typical
AVX AVX W2F43A4708AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W2F43A4708AT
Typical Far-side XTALK
Elements 1 - 4



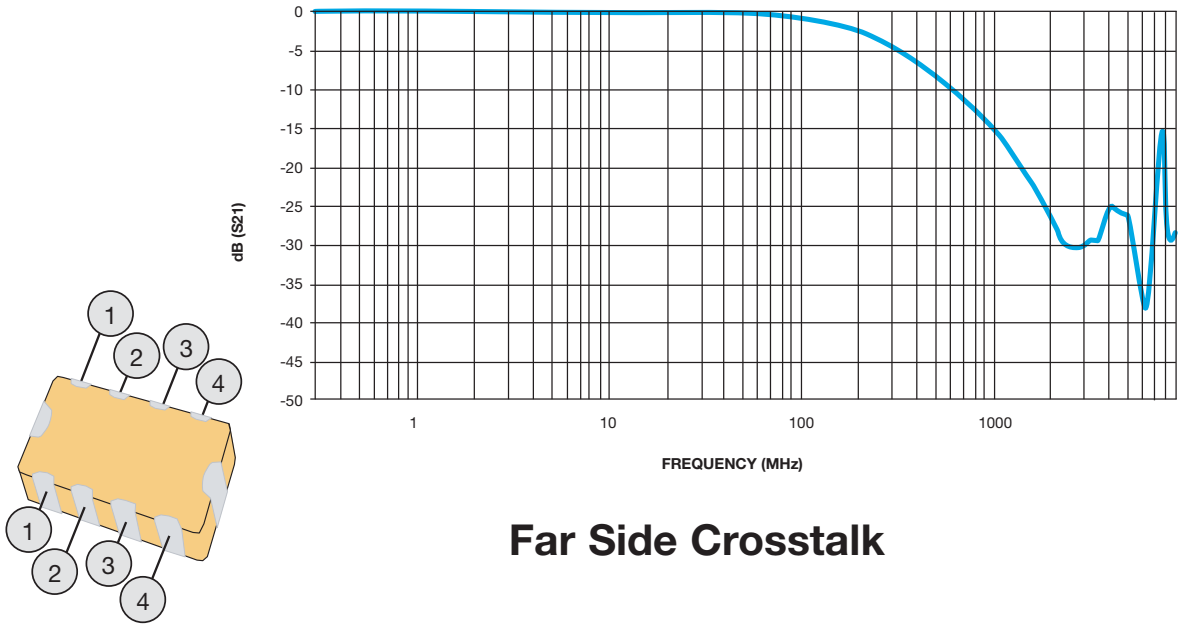
Typical
AVX W2F43A4708AT
Typical Far-side XTALK
Elements 2 - 3



W2F43A1018AT S_{21} Curves

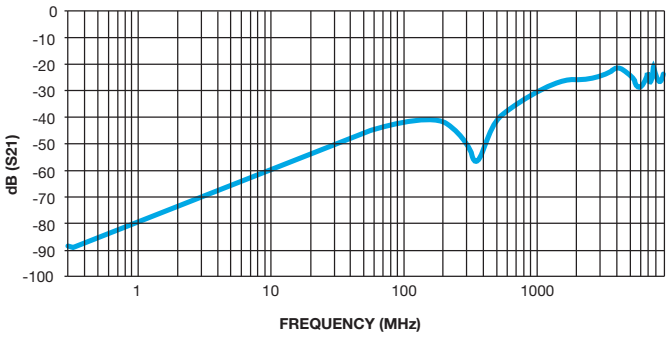
Typical

AVX W2F43A1018AT Typical S_{21}

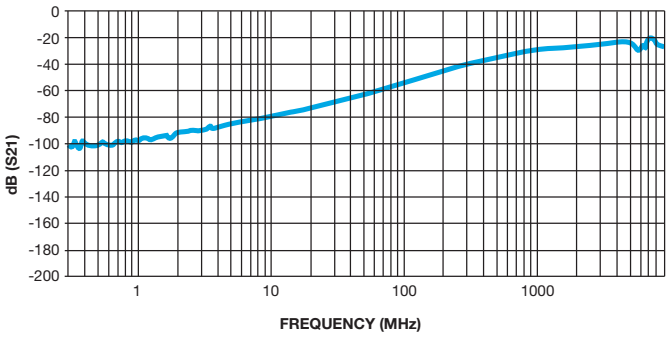


Far Side Crosstalk

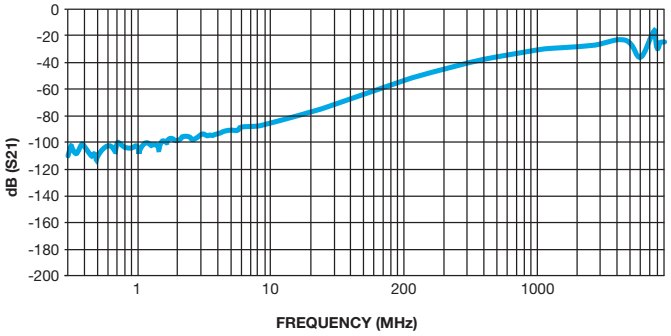
Typical
AVX W2F43A1018AT
Typical Far-side XTALK
Elements 1 - 2



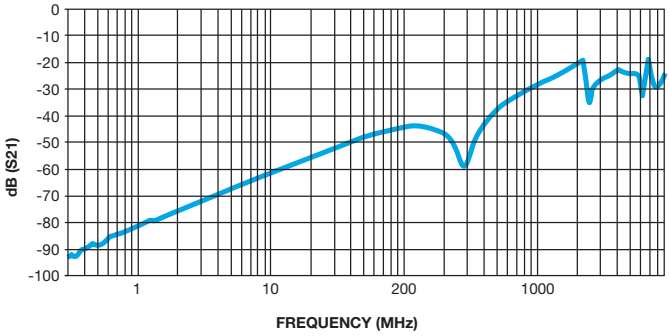
Typical
AVX W2F43A1018AT
Typical Far-side XTALK
Elements 1 - 3



Typical
AVX W2F43A1018AT
Typical Far-side XTALK
Elements 1 - 4

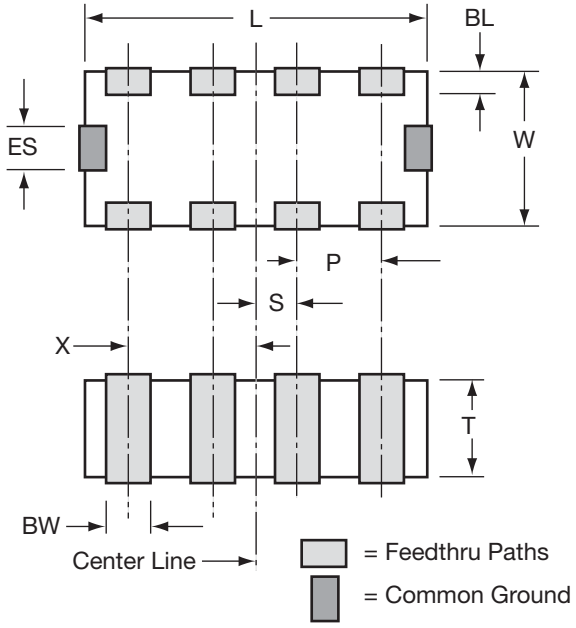


Typical
AVX W2F43A1018AT
Typical Far-side XTALK
Elements 2 - 3



Feedthru Filters – W2F4 / W3F4 Series

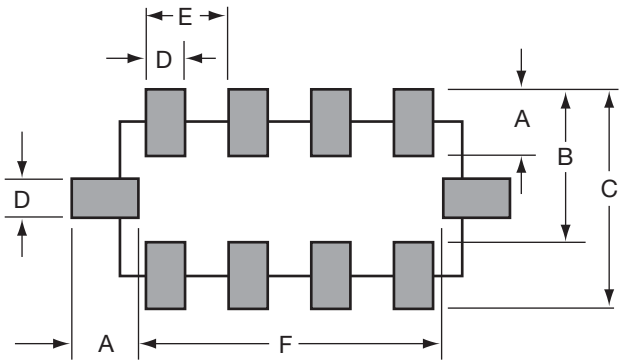
EMI Filtering, Broadband Filtering, LCD Filtering



DIMENSIONS

millimeters (inches)

L	W	T	BW	BL	P	X	S	ES
3.25±0.15 (0.128±0.006)	1.60±0.20 (0.063±0.008)	1.22 max (0.048 max)	0.41±0.10 (0.016±0.004)	0.18 $^{+0.25}_{-0.06}$ (0.007 $^{+0.010}_{-0.003}$)	0.76 REF. (0.030 REF.)	1.14±0.10 (0.045±0.004)	0.38±0.10 (0.015±0.004)	0.41±0.10 (0.016±0.004)
2.10±0.15 (0.083±0.006)	1.30±0.20 (0.051±0.006)	1.02 max (0.040 max)	0.25±0.10 (0.010±0.004)	0.18 $^{+0.25}_{-0.08}$ (0.007 $^{+0.010}_{-0.003}$)	0.50 REF. (0.020 REF.)	0.75±0.10 (0.030±0.004)	0.25±0.10 (0.010±0.004)	0.25±0.10 (0.010±0.004)



PAD LAYOUT DIMENSIONS

millimeters (inches)

CASE SIZE	A	B	C	D	E	F
0612	0.6 (0.024)	1.6 (0.064)	2.2 (0.088)	0.35 (0.014)	0.76 (0.030)	2.6 (0.104)
0508	0.56 (0.022)	1.32 (0.052)	1.88 (0.074)	0.25 (0.010)	0.50 (0.020)	1.80 (0.071)

Applications

APPLICATIONS
EMI Suppression
Broadband I/O Filtering
Vcc Line Conditioning

FEATURES
Standard EIA Sizes
Broad Frequency Response
Low ESR
8 mm Tape and Reel

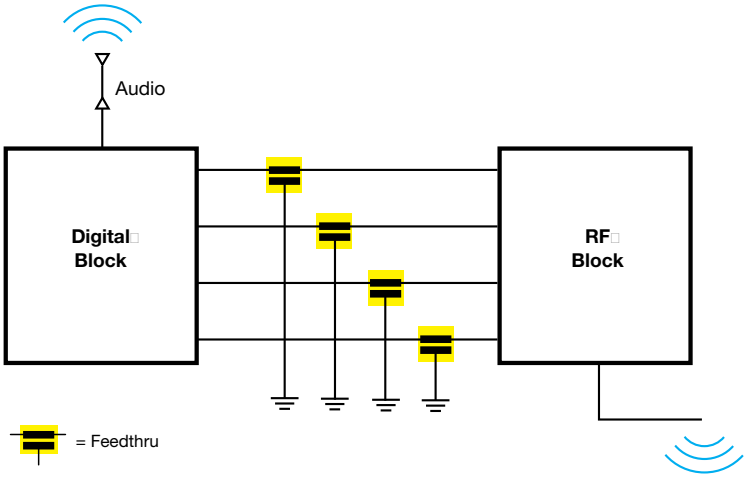
MARKET SEGMENTS
Computers
Automotive
Power Supplies
Multimedia Add-On Cards
Bar Code Scanners and Remote Terminals
PCMCIA Cards
Medical Instrumentation
Test Equipment
Transceivers/Cell Phones

Typical Circuits Requiring EMI Filtering

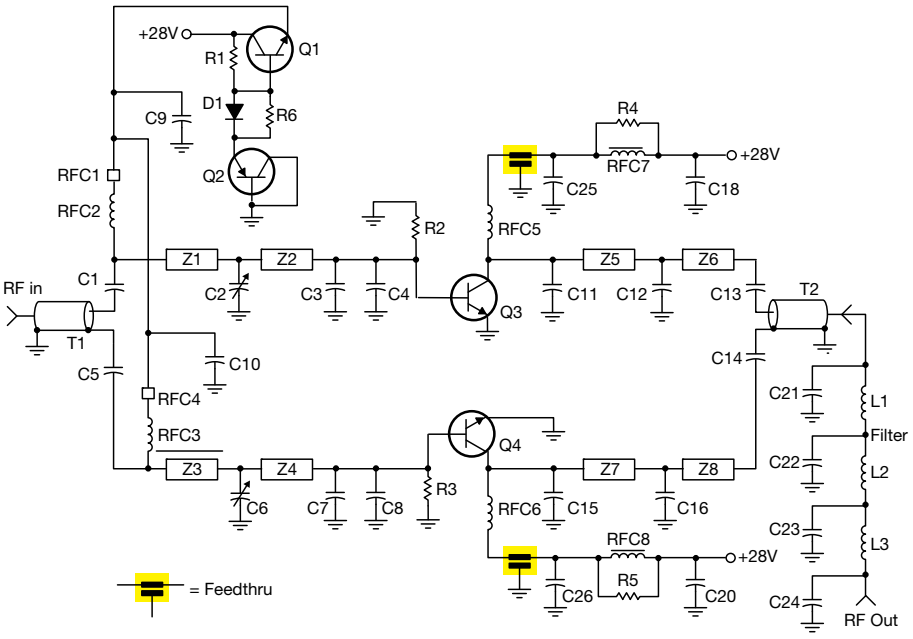
THE FOLLOWING APPLICATIONS AND SCHEMATIC DIAGRAMS SHOW WHERE FEEDTHRU CAPACITORS MIGHT BE USED FOR EMI SUPPRESSION

- Digital to RF Interface Filtering
- Voltage Conditioning in RF Amplifiers
- Power Decoupling GaAs FET Transistor Preamplifier
- Vcc Line Filtering on Frequency Control Circuit
- Clock, Data, Control Line High Frequency Decoupling (Frequency Synthesizer) (SEE APPLICATION NOTES)

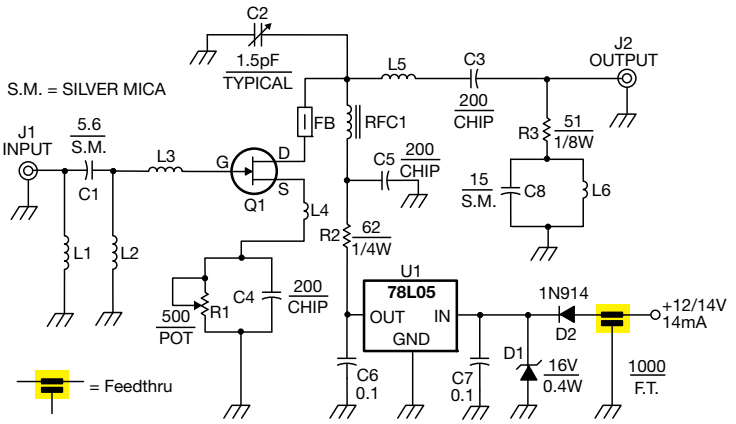
DIGITAL TO RF INTERFACE FILTERING



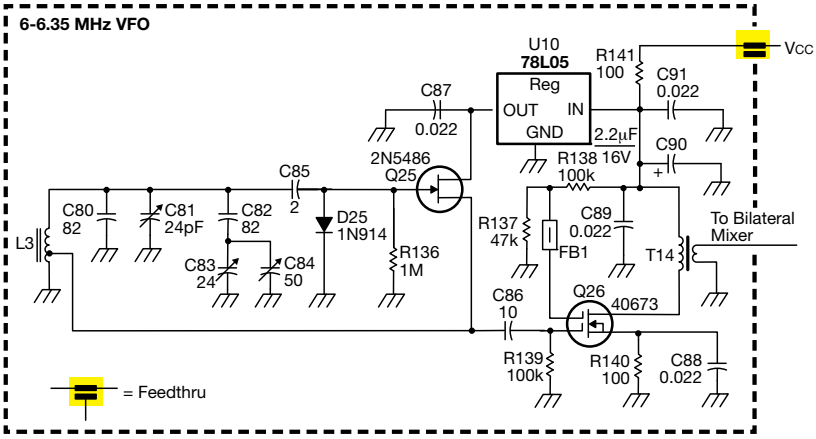
VOLTAGE CONDITIONING IN RF AMPLIFIERS



POWER DECOUPLING GaAs FET TRANSISTOR PREAMPLIFIER

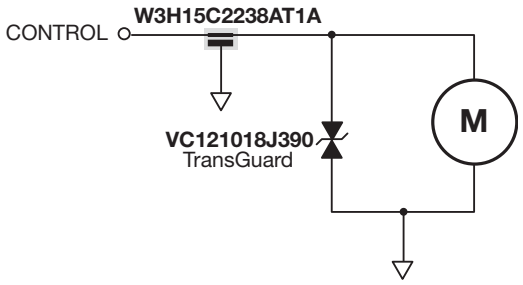


Vcc LINE FILTERING ON FREQUENCY CONTROL CIRCUIT

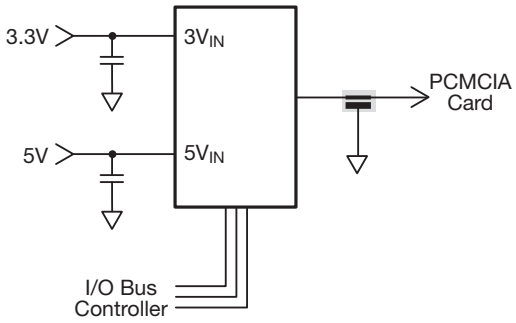


APPLICATIONS

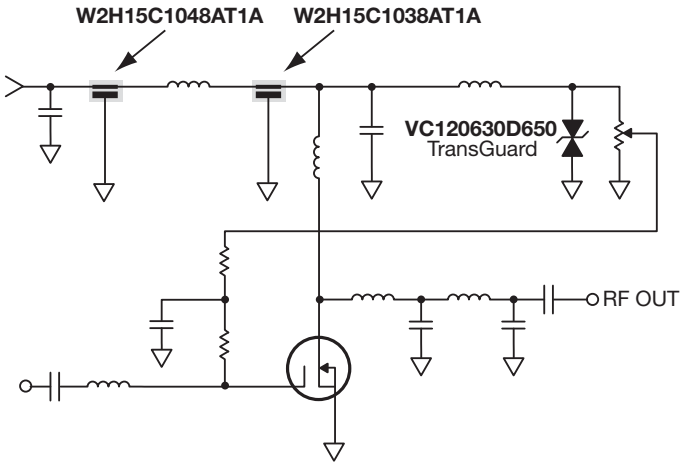
Vcc Filtering



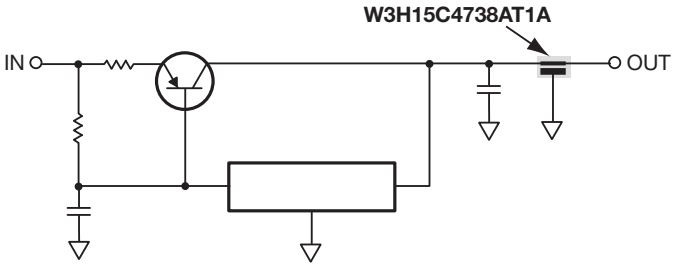
Dual Power Switch Filtering



PA Filtering



Regulator Filtering



EMI REDUCTION THROUGH THE USE OF SMT FEEDTHRU CAPACITORS

ABSTRACT

Today's high speed, miniaturized semiconductors have made EMI issues a key design consideration. This paper briefly defines EMI and illustrates the capability of SMT feedthru capacitors.

WHAT IS EMI?

The term EMI stands for Electromagnetic Interference and refers to signals/energy interfering with a circuit or systems functions.

In an electronic system, two classes of energy are generated - wanted and unwanted. Both are potential sources of EMI(1).

Wanted signals such as clocks and bus lines could cause EMI if they were not decoupled, terminated or filtered properly. Unwanted signals (cell phones, police radios, power supply noise, etc.) could be conducted or radiated into the circuit due to poor circuit layout, improper decoupling or a lack of high frequency filtering.

In either type of EMI signal interference, the system could be rendered useless or put into a state which would cause early failure of its semiconductors. Even worse, the unwanted energy could cause an incorrect answer to be generated from a computer by randomly powering a gate up or down.

From all of this we can gather that EMI is a complex problem, usually with no one solution. EMI interference can be a random single shot noise (like a SCR firing) or repetitive in nature (stepper motor or relay noise). The interference can enter into our designs either by being induced by E/B fields, or it can be conducted through control lines or a communication bus. EMI can even be self generated by internal components that generate steep risetime waveforms of voltage or current.

HOW CAN EMI BE CONTROLLED?

EMI is most efficiently controlled by realizing it to be a design parameter in the earliest stages of the design. This way, the board layout can be optimized with large power and ground planes which will be low impedance in nature. The use of SMT feedthru filters will yield optimal results.

SMT FEEDTHRU CAPACITORS

AVX introduced feedthru capacitors to supply a broadband EMI filter capacitor for source suppression and receiver noise reduction.

SMT feedthru capacitors use the same material systems as standard ceramic capacitors. They exhibit the same reliability and can be processed in the same end user production methods as standard capacitors. What feedthru capacitors offer is an optimized frequency response across a wide RF spectrum due to a modified internal electrode design.

An application comparison between an SMT feedthru and a discrete capacitor is shown in Figure 1.

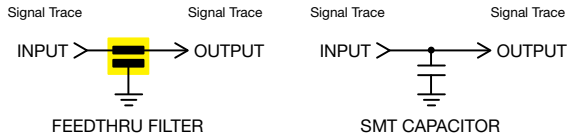


Figure 1. Comparison of Feedthru Capacitors to Discrete Capacitors

The key difference between the two filtering methods is that the feedthru has a much lower inductance between the signal line and ground than the capacitor. The difference in inductances can be in the range of roughly one order magnitude with a feedthru capacitor. This inductance can be shown in an electrical sense through the model for a feedthru and a capacitor (Figure 2).

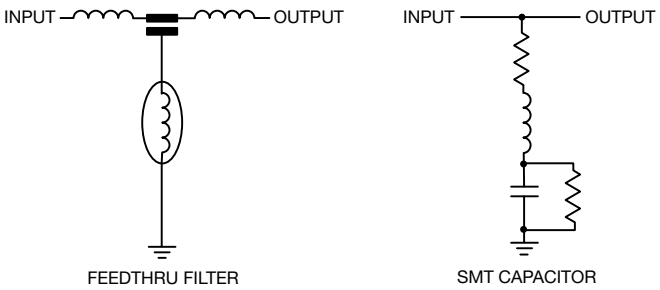


Figure 2. Comparison of Feedthru Capacitors to Discrete Capacitors

The feedthru capacitor has a minimized parallel inductance and an optimal series inductance (which broadens the frequency response curve). Typical attenuation graphs are shown in Figure 3A.

These curves demonstrate feedthru capacitors advantage of a broad frequency response with high attenuation. They also serve as a comparison to the inductance of even lower inductance devices (primarily used in extreme decoupling cases and switch mode power supplies) - see Figure 3B.

(1)Practical Design for Electromagnetic Compatibility edited by Rocco F. Ficchi Hayden Book Company 1978

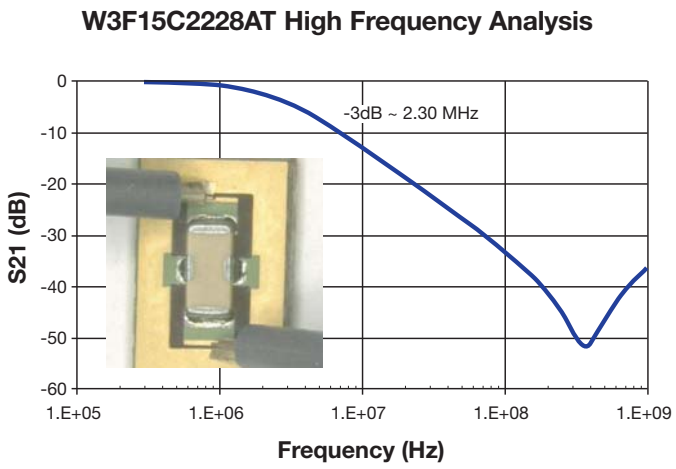


Figure 3A. Typical Attenuation Graph

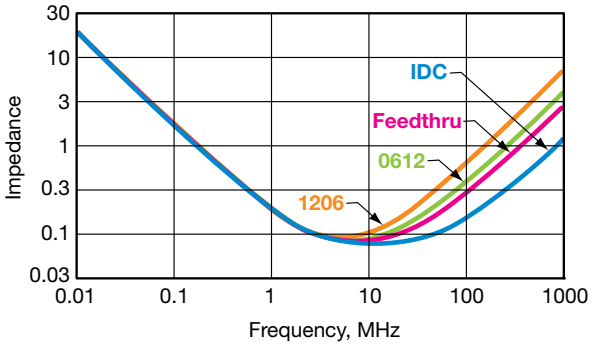


Figure 3B. Comparison of SMT Capacitor Frequency Response to Feedthru Filters

SMT FEEDTHRU CAPACITOR TERMINOLOGY

AVX's feedthru capacitors have additional technical terminologies relative to standard ceramic capacitors. The reason for this is due to the series manner in which the feedthru element is connected to the circuit.

The most important term is DC Resistance. The DC resistance of the feedthru is specified since it causes a minor signal attenuation which designers can calculate by knowing the maximum resistance of the part.

The maximum current capability of the part is also of interest to designers since the feedthru may be placed in series with the voltage line.

APPLICATION AND SELECTION OF SMT FEEDTHRU CAPACITOR FILTERS

EMI suppression and receiver noise reduction can be achieved most effectively with efficient filtering methods. Attenuations of over 100 dB are achievable depending on the complexity and size of the filters involved.

However, before filtering is discussed, another EMI reduction method is noise limiting, using a series element (inductors or resistors). This method is easy to implement and inexpensive. The problem it poses is that it can only reduce noise by -3 to -10 dB. Because of that, series element EMI reduction is primarily used where there is a poor ground.

SMT feedthru filter capacitors can actually replace discrete L/C filter networks (depending on the frequency response needed). The SMT filter capacitors should first be chosen for its specific frequency response. Then the voltage rating, DCR, and current capability must be evaluated for circuit suitability. If there is not a match on voltage, current and DC resistance ratings, the designer must select the closest available frequency response available on parts that will meet the design's power spec.

The top 5 applications for SMT feedthru filter capacitors are:

1. Digital to RF interface filtering.
2. Control line high frequency decoupling.
3. Data and clock high frequency decoupling.
4. Power line high frequency decoupling.
5. High gain and RF amplifier filtering.

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