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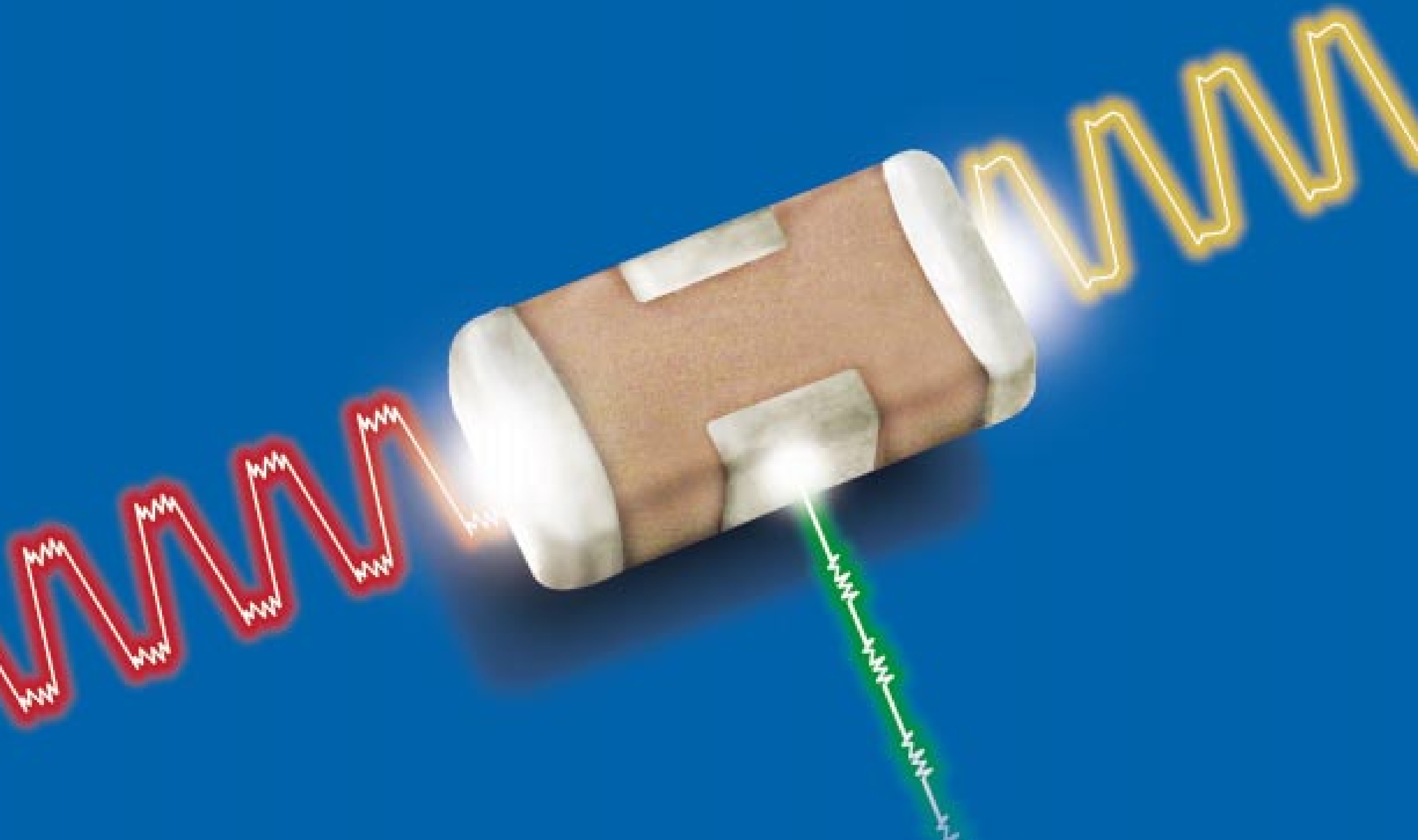


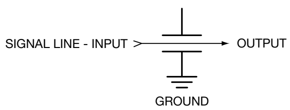
AVX
Multilayer Ceramic Feedthru Chip Capacitors

Feedthru 0805/1206 Capacitors

W2F/W3F Series

GENERAL DESCRIPTION

AVX's line of feedthru capacitors now includes an 0805 chip size, designated W2F Series. This new size joins the 1206 chip W3F product. Both series are ideal choices for EMI suppression, broadband I/O filtering, and Vcc power line conditioning. In addition, the unique construction of a feedthru capacitor (low parallel inductance) 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 cap values are available in either NP0 or X7R ceramic dielectrics.



W2F Series
0805

W3F Series
1206

PERFORMANCE CHARACTERISTICS 0805 & 1206

	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	

CAPACITANCE RANGE

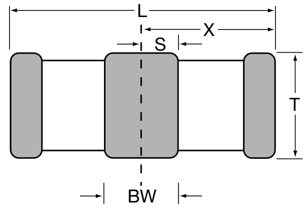
0805 (W2F)		1206 (W3F)	
NP0	**X7R**	**NP0**	**X7R**
22pf	1000pf	22pf	1000pf
47pf	2200pf	47pf	2200pf
100pf	4700pf	100pf	22000pf
220pf	10000pf	220pf	
470pf	22000pf	470pf	
	47000pf		

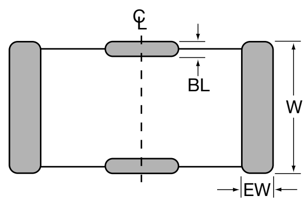
HOW TO ORDER

W	3	F	1	5	C	223	8	A	T	3	A
Style	**Size** 2=0805 3=1206	**Feedthru**	**Number of Elements**	**Voltage** 5=50v 1=100v	**Dielectric** A=NP0 C=X7R	**Capacitance Code**	**Capacitance Tolerance** 8=+50/-20%	**Failure Rate** A=Not Applicable	**Terminations** T=Plated	**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

Feedthru 0805/1206 Capacitors

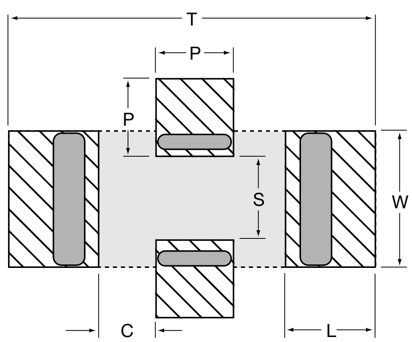
W2F/W3F Series





DIMENSIONS

	L	W	T	BW	BL	EW	X	S
0805 MM (in.)	2.01 ± 0.20 (.079 ± .008)	1.25 ± 0.20 (.049 ± .008)	0.76 ± 0.03 (.030 ± .003)	0.46 ± 0.10 (.018 ± .004)	0.18 + 0.25 -0.08 (.007 + .010 -.003)	0.25 ± 0.13 (.010 ± .005)	1.02 ± 0.10 (.040 ± .004)	0.23 ± 0.05 (.009 ± .002)
1206 MM (in.)	3.20 ± 0.20 (.126 ± .008)	1.60 ± 0.20 (.063 ± .008)	1.22 ± 0.08 (.048 ± .003)	0.89 ± 0.10 (.035 ± .004)	0.18 + 0.25 -0.08 (.007 + .010 -.003)	0.38 ± 0.18 (.015 ± .007)	1.60 ± 0.10 (.063 ± .004)	0.46 ± 0.05 (.018 ± .002)



RECOMMENDED SOLDER PAD LAYOUT (TYPICAL DIMENSIONS)

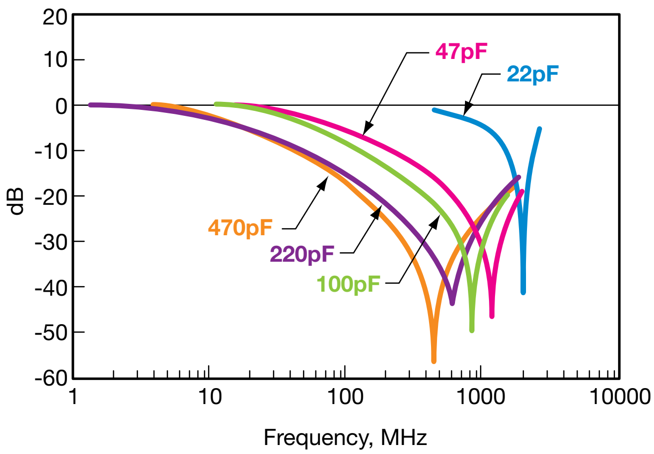
	T	P	S	W	L	C
0805 MM (in.)	3.45 (.136)	0.51 (.020)	0.76 (.030)	1.27 (.050)	1.02 (.040)	0.46 (.018)
1206 MM (in.)	4.45 (.175)	0.94 (.037)	1.02 (.040)	1.65 (.065)	1.09 (.043)	0.71 (.028)

Feedthru 0805/1206 Capacitors

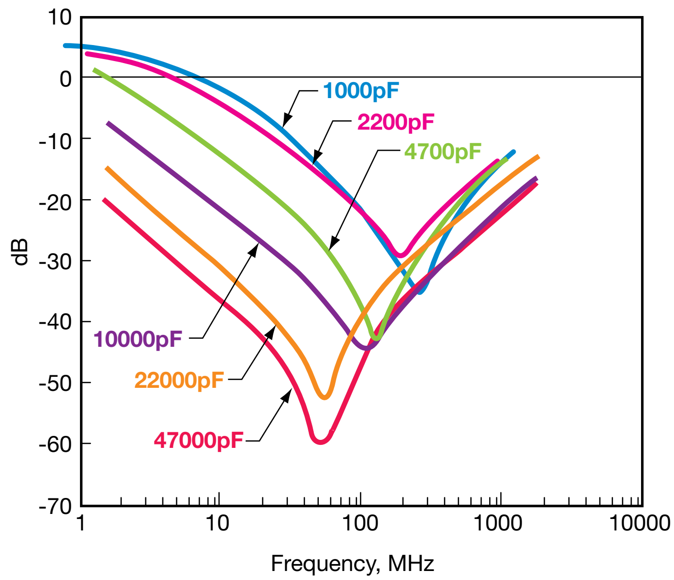
W2F/W3F Series

PERFORMANCE CHARACTERISTICS

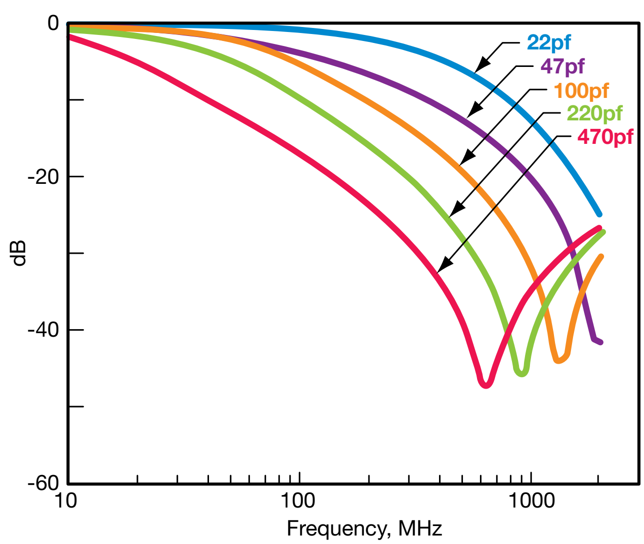
0805 - dB vs. Frequency
NP0



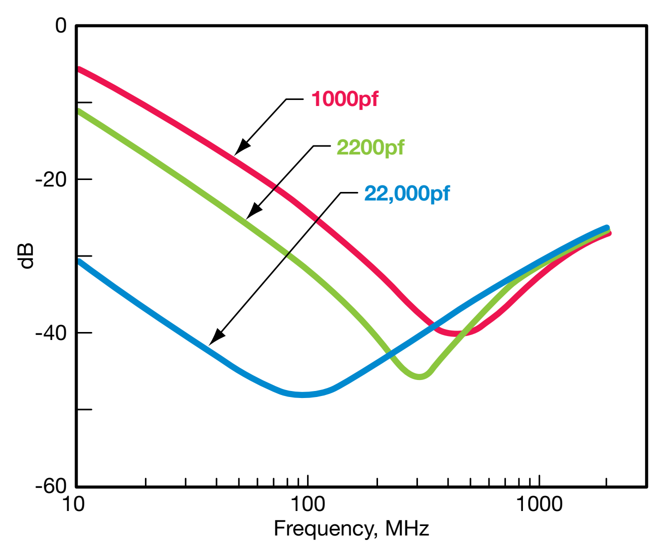
X7R



1206 - dB vs. Frequency
NP0



X7R

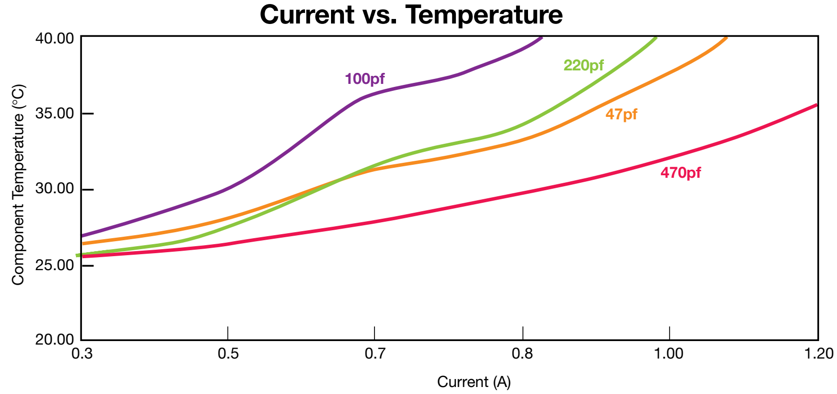


Feedthru 0805/1206 Capacitors

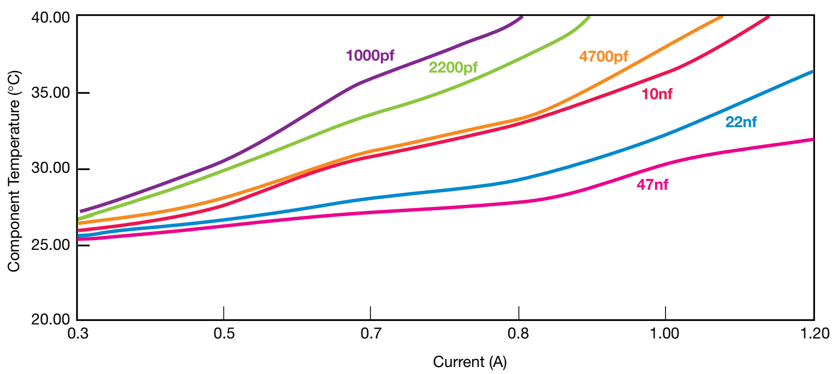
W2F/W3F Series

PERFORMANCE CHARACTERISTICS

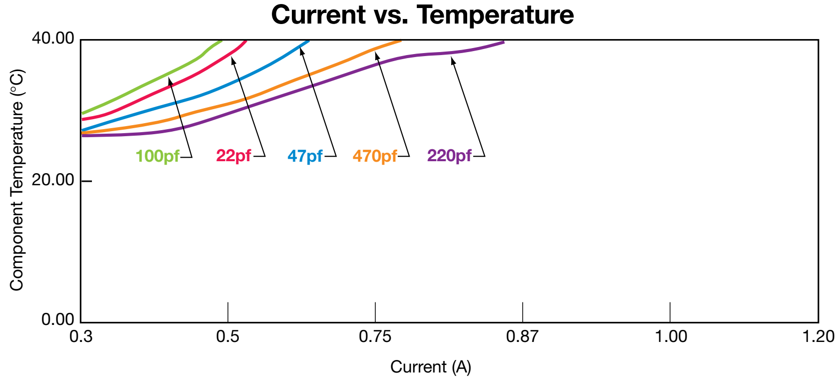
0805 NP0
Current vs. Temperature



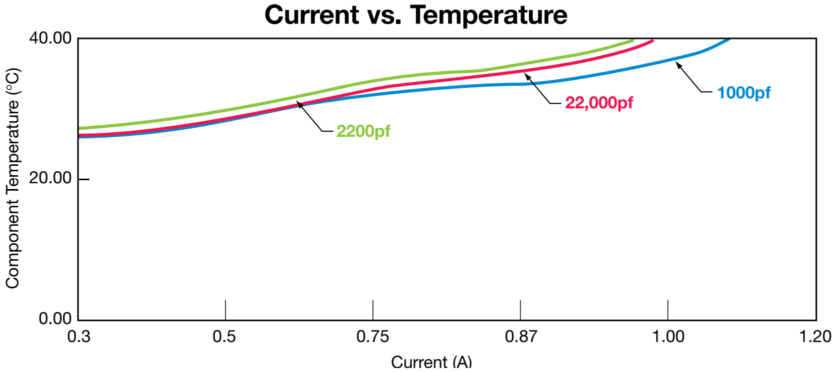
0805 X7R
Current vs. Temperature



1206 NP0
Current vs. Temperature



1206 X7R
Current vs. Temperature



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

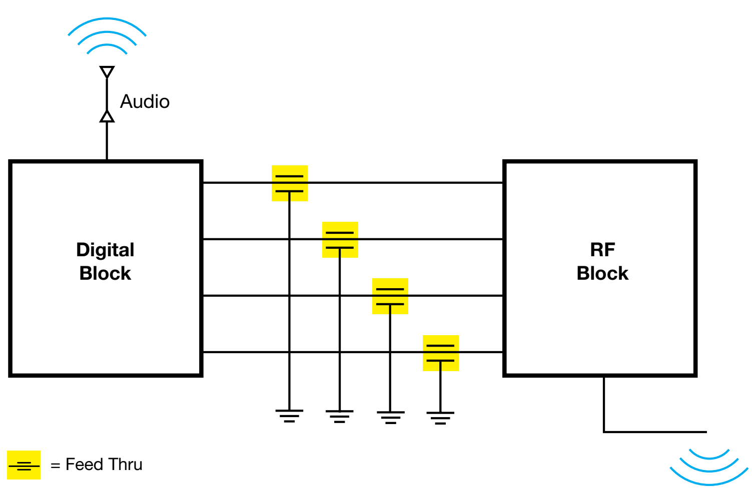
Transceivers/Cell Phones

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)

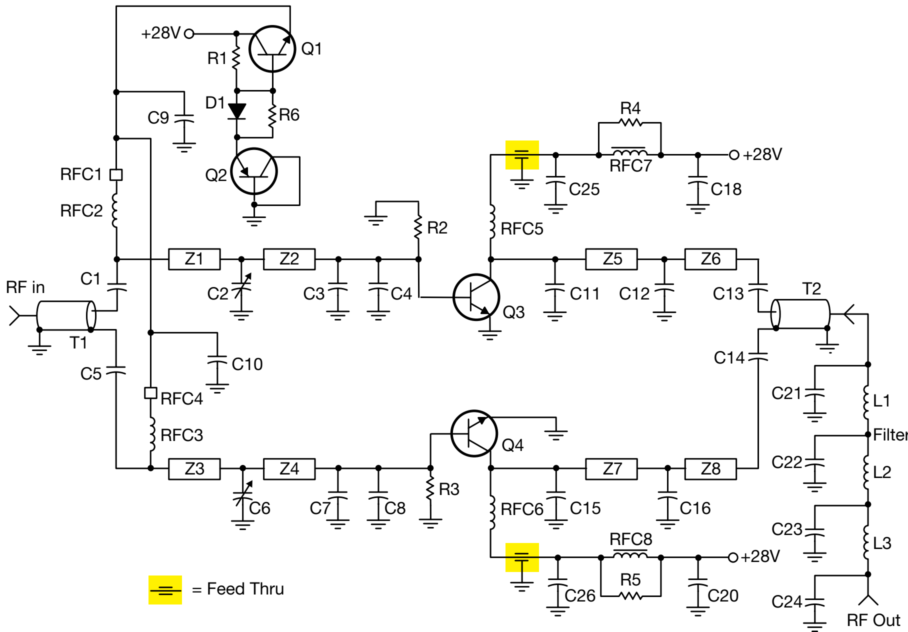
DIGITAL TO RF INTERFACE FILTERING



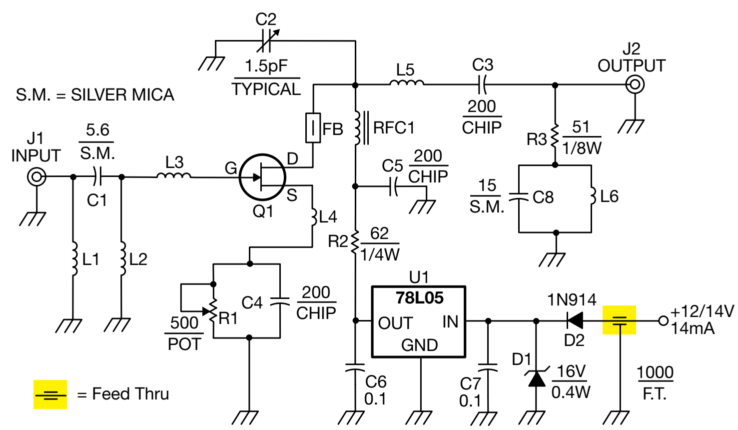
Feedthru 0805/1206 Capacitors

W2F/W3F Series

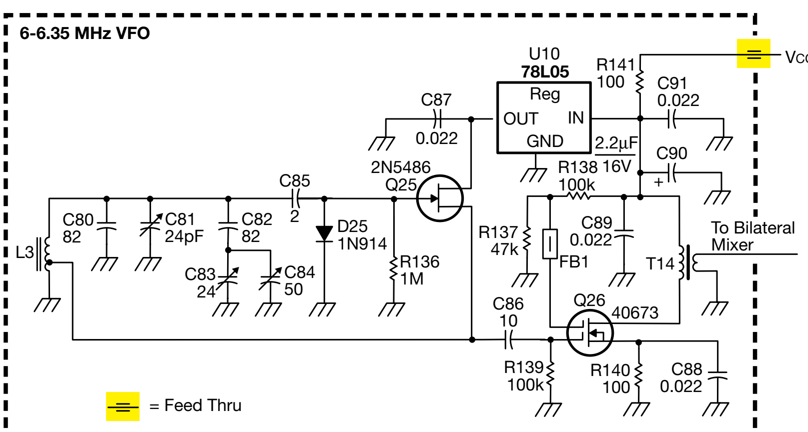
VOLTAGE CONDITIONING IN RF AMPLIFIERS



POWER DECOUPLING GaAs FET TRANSISTOR PREAMPLIFIER



Vcc LINE FILTERING ON FREQUENCY CONTROL CIRCUIT



Application Notes

EMI REDUCTION THROUGH THE USE OF SMT FEEDTHRU CAPACITORS

Feedthru 0805/1206 Capacitors

W2F/W3F Series

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.

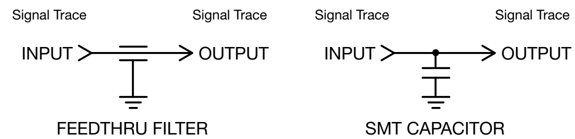


Figure 1. Comparison of Feedthru Capacitors to Discrete Capacitors

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).

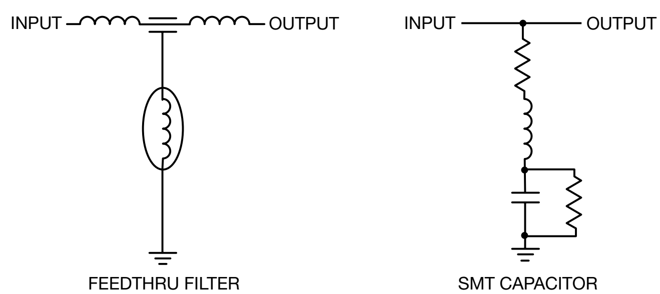


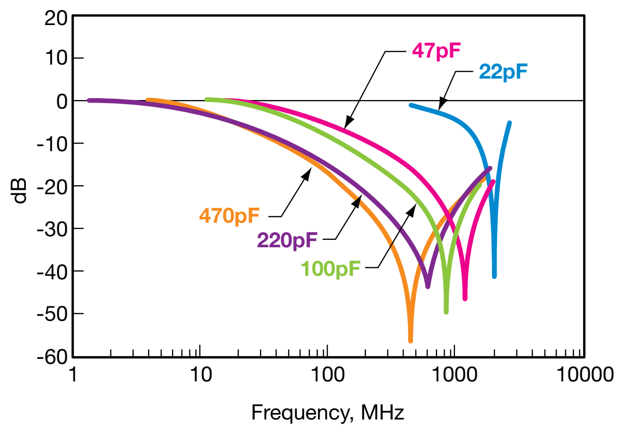
Figure 2. Comparison of Feedthru Capacitors to Discrete Capacitors

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

0805 - dB vs. Frequency
NP0



1206 - dB vs. Frequency
X7R

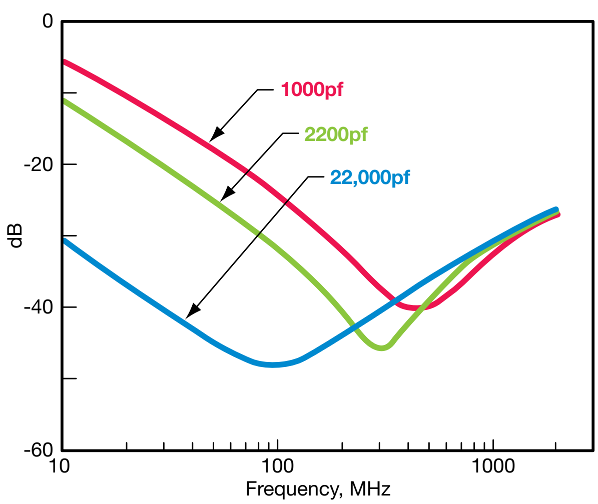


Figure 3A. Feedthru Capacitor Attenuation Graphs (Forward Transmission Characteristic - S21)

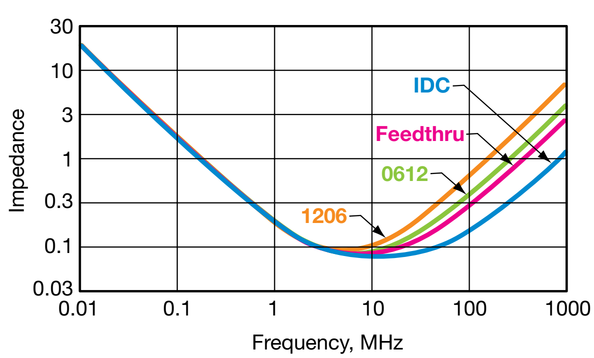


Figure 3B. Comparison of SMT Capacitor Frequency Response to Feedthru Filters

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.

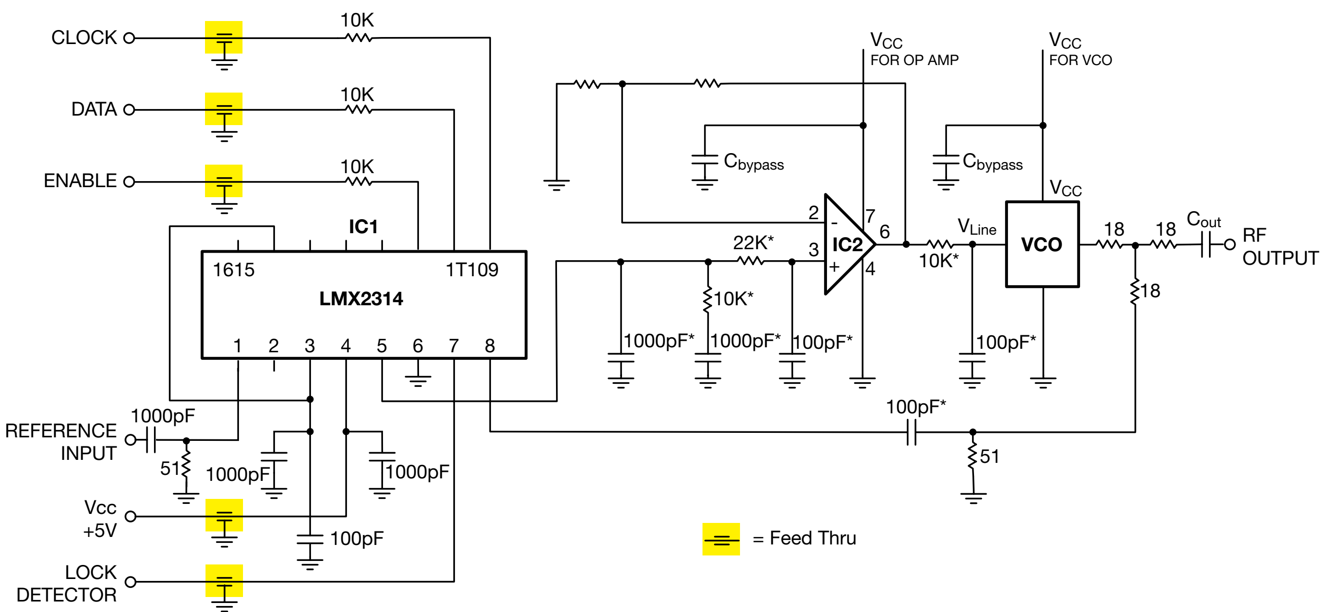
SMT feedthru filter capacitors can actually replace discrete L/C filter networks (depending on the frequency response needed). The SMT filter capacitors should first be chosen for its specific frequency response. Then the voltage rating, DCR, and current capability must be evaluated for circuit suitability. 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.

A Typical example of Data, clock control line and power line filtering is shown below:

Clock, Data, Control Line High Frequency Decoupling (Frequency Synthesizer)



CONCLUSION

EMI problems will continue to play a large role in designers priorities. AVX SMT feedthru filters are an easy way to achieve broad band EMI reduction in a small SMT package.

SMT feddthru filters can help reduce cost designs by eliminating some types of L/C filters, increasing system reliability and saving valuable PCB area. SMT feedthru filters are offered in both 0805, 1206 single element packages or in 1206 four element packages.

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