Chebyshev Low Pass Coefficient Table

N	c1	l2	c3	l4	c5	l6	c7	l8	c9	r1
2	.2858	.2746								.9608
3	.4520	.7838	.4520							1.000
4	.5379	1.041	1.084	.5168						.9608
5	.5849	1.169	1.369	1.169	.5849					1.000
6	.6126	1.240	1.505	1.446	1.290	.5885				.9608
7	.6301	1.282	1.579	1.575	1.579	1.282	.6301			1.000
8	.6419	1.309	1.623	1.643	1.710	1.560	1.363	.6167		.9608
9	.6501	1.328	1.652	1.684	1.779	1.684	1.652	1.328	.6501	1.000
N	c1	l2	c3	l4	c5	l6	c7	l8	c9	r1

Coil Winding

In some cases, it may be better to wind coils rather than purchase molded inductors. Molded inductors only come in specific values and hand wound coils will often have a better Q. The following tips will be useful in designing inductors.

L = (rN)**2/(9r + 10l) where

L = Inductance in μH
r = Coil radius (center of coil to center of conductor).
N = number of turns
l = Coil length (N times the distance between centers of adjacent turns)

Example. The 3rd order filter above requires a .071 μH coil. Assume we want a coil with r = .25 and L = .5 (a length/diameter or form factor of 1) then

.071μH = (.25*N)**2/(9*.25 + 10*.5)
= .0625N**2/(2.25+5)
= .0625N**2/7.25
N**2 =.071*7.25/.0625
N = sqrt(.071*7.25/.0625) = 2.87 turns
Rounding up to 3 turns will yield a coil with an inductance of .078μH

To first order, the size of the wire is not important. However, the size of the wire and the length/diameter ratio of the coil will determine the coil's Q. Larger conductors and large length/diameter ratios will give better Qs. However, increasing the length/diameter ratio to values greater than 4 provides little improvement in Q.

Keep in mind that placing the coil in a shielded box will change the effective inductance of the coil. The amount of change depends on how far away from the shield the coil is placed. Coils with length/diameter ratios in the 1-3 range placed 5*(winding diameter) away from the shield will see approximately a 1-2% decrease in inductance. For example, a coil that is 1/4 inch in diameter and 1/4 inch long (length/diameter ratio or form factor of 1) placed 5*1/4 = 1.25 inches from a shield will have an effective inductance of .99*(unshielded inductance). The same coil placed 1/2 inch from a shield will have an effective inductance of about .85*(unshielded inductance).