



MCI



Microwave Components, Inc.

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Miniature Electronic Air Core Inductors.
It's what we do. It's ALL we do.



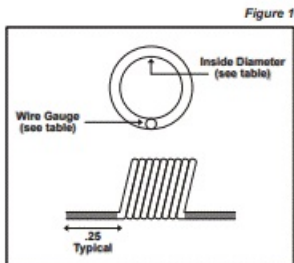
DEFINITION OF TERMS

The process of specifying a desired value of inductance is a relatively simple one. It is based on the conventional terms and abbreviations that identify the component parameters (see Inductance Calculation on page 3).

MCI's part number (P/N) includes four alpha-numerical groupings: (1) the number of turns in the coil; (2) the inside diameter of the coil (Figure 1); (3) the American Wire Gauge (AWG) of the wire; and (4) the coil material and composition.

The first two numerical groupings are relatively self-explanatory. The first being the number of turns in the coil. The second grouping is composed of the inside coil diameter and gauge of the wire. The gauge selection available at MCI ranges from 0.001 inches to 0.0126 inches. In terms of AWG numbers, the range is from AWG 28 to AWG 50. A complete breakdown of these dimensions is presented in the Design Guide on page 3.

The final grouping represents the wire material and composition of the coil and is an abbreviation identifying the wires composition or metal and its mechanical characteristics. The more popular of these abbreviations can be found in the Design Guide on page 3.



HOW TO SPECIFY

As previously discussed, each MCI part number is divided into the same categories and sequences. Using the Design Guide as a source of information, one can determine a part number for their specific application or requirement.

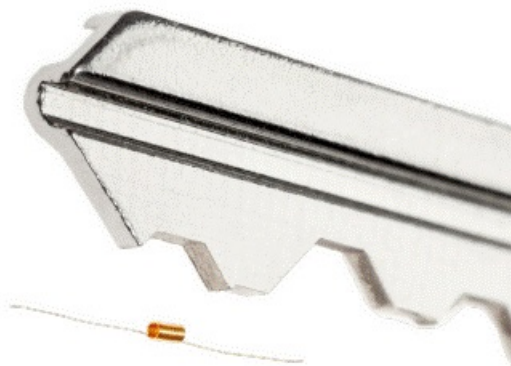
As an example, let's assume that your requirement calls for an inductance value of 65 nH. In order to create a component with this value, it is determined that the specifications require a coil made using insulated gold, with the leads stripped, having 15 turns bonded together, and an inside dimension of 0.018 inches using 47-gauge wire.

Referring to the Design Guide, the part number would be as follows:

1. Number of Turns - 15
2. Inside Diameter - 0.018 inches
3. Wire Gauge - #47
4. Wire Composition - GCCAS

With this information, we obtain the part number 15-1847-GCCAS.

Using the above guidelines, together with the included data, it is possible to develop a part number for any required inductance. Any remaining questions or assistance can be addressed by simply calling MCI's customer service team at (978) 453-6016 or by emailing Sales@mccicoils.com.



DESIGN GUIDE

Provide MCI with the inductance required, along with any other key parameters (i.e. material, bonding method, height/length restrictions, max current, cost targets, application requirements, etc.) and we will calculate the coil dimensions, build, and send samples in one week (ISO 9001:2015 Registered).

ANOTHER EXAMPLE P/N 5-1847-CA

NUMBER OF TURNS	INSIDE DIAMETER (ML.S)	WIRE GAUGE	COIL TYPE
5	18 (.018" DIAM.)	47 (#47 AWG 0.0014" DIAM. 0.036 MM)	CA (COPPER COIL; POLYNYLON INSULATION; TURNS BONDED TOGETHER)

Inductance for this example is 15.5 nH, calculated using the equation below:

STANDARD INSIDE COIL DIAMETER

INCH MM	0.010 0.25	0.013 0.33	0.015 0.38	0.018 0.45	0.020 0.51	0.025 0.64	0.030 0.76	0.035 0.89	0.040 1.0	0.045 1.14	0.050 1.27
TYP.	#50	#50	#50	#50	#48	#47	#44	#42	#40	#40	#38
AWG	#48	#48	#48	#48	#47	#44	#42	#40	#40	#40	#38
WIRE	#47	#47	#47	#47	#46	#42	#40	#38	#38	#38	#36
SIZE	#44	#46	#46	#46	#44	#40	#38	#36	#36	#36	#34
FOR		#44	#44	#44	#42	#38	#36	#34	#34	#34	#32
COIL			#42	#42	#40	#36	#34	#32	#32	#32	#30
DIAM.				#40	#40	#38		#32	#30	#30	#28
				#38	#38	#36					
				#36	#36						

COIL MATERIAL AND COMPOSITION

A	COPPER COIL, POLYNYLON INSULATION, TURNS ARE NOT BONDED TOGETHER	GA	GOLD COIL, BARE WIRE, TURNS ARE TOUCHING
CA	COPPER COIL, POLYNYLON INSULATION, TURNS ARE BONDED TOGETHER	GSA	GOLD COIL, BARE WIRE, TURNS ARE SEPARATED ONE WIRE WIDTH
CAT	COPPER COIL, POLYNYLON INSULATION, TURNS ARE BONDED TOGETHER, LEADS ARE TINNED	GSCAS	GOLD COIL, POLYIMIDE INSULATION, TURNS ARE SEPARATED ONE WIRE WIDTH, LEADS ARE STRIPPED
SA	COPPER COIL, POLYNYLON INSULATION, TURNS ARE SPACED AND SEPARATED ONE WIRE WIDTH	GCCAS	GOLD COIL, POLYIMIDE INSULATION, TURNS ARE BONDED TOGETHER, LEADS ARE STRIPPED
SAT	COPPER COIL, POLYNYLON INSULATION, TURNS ARE SPACED AND SEPARATED ONE WIRE WIDTH, LEADS ARE TINNED	NCA	NICKEL-COPPER ALLOY WIRE, POLYNYLON INSULATION, TURNS ARE BONDED TOGETHER

TYPICAL AWG WIRE SPECIFICATIONS

WIRE SIZE (AWG)	BARE WIRE DIAMETER (INCHES)	SINGLE BUILD TOTAL DIAMETER (INCHES)	OHMS/1000 FEET (25°C)
28	0.0126	0.0137	65.31
29	0.0113	0.0123	81.22
30	0.01	0.0109	103.7
31	0.0089	0.0097	130.9
32	0.008	0.0088	162.1
33	0.0071	0.0078	205.7
34	0.0063	0.007	261.3
35	0.0056	0.0062	330.7
36	0.005	0.0056	414.8
37	0.0045	0.005	512.2
38	0.004	0.0045	648.2
39	0.0035	0.0039	846.6
40	0.0031	0.0035	1079
41	0.0028	0.0031	1323
42	0.0025	0.0028	1659
43	0.0022	0.0025	2143
44	0.002	0.0022	2593
45	0.00176	0.00195	3348
46	0.00157	0.00175	4207
47	0.0014	0.0016	5291
48	0.00124	0.0014	6745
49	0.00111	0.00125	8417
50	0.00099	0.00115	10580

INDUCTANCE CALCULATIONS (CLOSE APPROXIMATION)

$$L = \frac{17N^{1.5} (D + D1)^{1.7}}{(D1 + S)^{1.7}}$$

L = NANOHENRIES
 N = NUMBER OF TURNS
 D = INSIDE DIAMETER (INCHES)
 D1 = BARE WIRE DIAMETER (INCHES)
 S = SPACE BETWEEN TURNS

ABOUT US

As a leading manufacturer of air coils for microelectronics applications, Microwave Components, Inc. offers a comprehensive line of standard as well as derivative or custom components, engineered to meet the widest possible range of requirements.

MCI's entire product offering is available in a variety of materials: gold, silver, copper, copper plated gold, aluminum and nickel copper alloy, in both bare and insulated wire.

MCI inductances range from 1 nH to 1000 nH. Customers have reported using MCI coils at frequencies as high as 50 GHz. Configurations include: spaced or non-spaced, bonded or non-bonded windings; stripped or non-stripped, tinned or non-tinned leads.

All of MCI coils afford multi-octave performance, high Q and low loss. Applications include; filters, switches, mixers, amplifiers, attenuators and multipliers.



Microwave Components, a small, veteran owned, leading producer of custom miniature air coils, has been proudly delivering to the aerospace, defense, and space markets since 1978.

Since our inception, MCI has been an industry leading developer and manufacturer of miniature microelectronic coils by maintaining an unparalleled record of delivery, performance, quality and repeatability.

Supporting this record is a carefully controlled production process that incorporates the highest possible standards of material selection and quality control from incoming inspection to final assembly, packaging and delivery.

To assure the quickest possible response to customer requirements, MCI maintains a wide inventory of basic materials, including copper, gold and nickel copper alloys, as well as specialty metals that include aluminum, silver, and gold-plated copper.

All materials are purchased in accordance with military specifications, regardless of application. MCI material suppliers provide a certificate of compliance (C of C),

which can be shared with MCI's customers. MCI products can be traced to the original wire source.

During the production process, MCI uses machines that are custom designed to meet these very demanding requirements. The process itself takes place in a tightly controlled environment designed to eliminate dust and impurities. Frequent inspection steps assure the tightest possible control of quality and configuration integrity. The result is an exceptional product that has virtually no customer rejections.

MCI supplements this tightly-controlled in-house production capability with the services of a technical staff that is available to discuss customer applications and design requirements in a knowledgeable and helpful manner. Assistance may be obtained at any time by calling MCI at (978) 453-8016 or by emailing Sales@mcicoils.com.



Brochure design by: [Something More Design](http://www.somthingmore.com) - Sabet Meyers, MA



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Frequently Asked Questions

1. What does a coil do for the RF circuit card?
A. Air coils are the simplest inductors. These are solenoidal coils that use an air core and can have a single wind of wire to a large number of turns depending upon the range of frequency they are designed for. These inductors have low nominal values of inductance but offer a high-quality factor. As there is no magnetic core, they do not suffer from operating losses due to the hysteresis, eddy current, or distortion common in magnetic cores. Because non-magnetic cores do not easily heat up when the high current flows through the coil, these inductors have a high Q-factor as there is minimal loss of energy by the core in the form of heat. As the frequency of the signal increases, the value of required inductance decreases, making air coil inductors suitable for high-frequency applications. The circuits processing ultra-high frequency usually needs air coils with a single turn.
2. What specifications are engineers looking for when selecting a coil?
A. In most cases, the Design Engineer has already calculated the value of the inductor required for the specific application. He or she provides the value, typically in nH (nano) or μ H (micro) Henry. Other parameters which may or may not be known by the design Engineer are:
 - i. Wire material – This is usually driven by the bonding method being used by the customer**
 - ii. Insulated or bare wire**
 - iii. Spaces between the winds or not - Spaced coils allow for some tuning at installation**
 - iv. If not spaced winds bonded or not bonded – Bonded coils are mechanically stronger and are easier to handle**
 - v. Some additional requirements could be height or length restrictions or maximum current required****Once agreed specifications are agreed upon MCI will build a sample lot of 6 pieces and provide to the customer to make sure the part performs as required in the next assembly. Lead time for samples is typically 1 week.**
3. What / how does an engineer determine when to use multiple coils or additional turns?
A. The value of the coil depends on the circuit and application. Each application most likely will require a different value or different coil type. MCI manufactures coils with spacing in between the turns. This provides the user some flexibility in “tuning” the device. This tuning does not greatly change the inductance of the coil, but it can assist the Engineer in dialing in the circuit.

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4. Are there limitations how many turns and diameter of coils one can specify? What impact does the tighter the diameter cause? Wire diameter? Number of turns?
A. The best answer is YES. The total amount of turns will depend upon several factors, including wire type and diameter. MCI manufactures a range of coils that have 1 to 100 turns. MCI products span an inductance range of 1 nH to 1000nH. Wire type, turns, diameter (inner and wire) all impact the inductance of the coil. For example:
 - i. The greater the inside coil diameter of the windings, the greater the inductance**
 - ii. The smaller diameter wire, the greater the inductance**
 - iii. The greater number of turns in the coil, the greater the inductance**
5. Material selection and composition? Can the engineer change the materials of a coil to affect the performance? What is affected and by how much?
A. Changing the material of the wire (Silver, Gold, Copper, Aluminum, etc.) will impact the inductance. Normally the wire type is chosen for cost and mounting requirements. This is usually done in conversations with MCI.
6. Can coils be surface mounted to a PCB?
A. MCI coils are axial lead and can be used in multiple applications (thru hole, Stripline, microstrip, etc.). MCI coils are primarily surface mounted, but the coils are not conducive to automated pick and place due to their cylindrical shape.
7. How can one tell that a coil is not performing the task intended?
A. The performance of the circuit will be impacted if the wrong value coil is used.
8. Can coils be re-used?
A. Coils are passive devices and can be soldered, unsoldered and resoldered. The miniature air coils are very small, and care needs to be used when installing or removing the devices.
9. Competitors?
A. MCI's main competitor is Piconics. Piconics does produce several types of products, but their miniature air coils compete directly with MCI. Some additional competitors include M.C. Davis, Gowanda and Precision. Coilcraft also has a line of air coils, along with multiple other larger product offerings. In the past MCI has provided a slightly higher priced product. Customers have stated that MCI's lead time, on time delivery and quality, more than compensate for a slightly higher price. MCI is typically the lowest cost solution for our customers miniature air coil requirements.
10. Selling against packaged coil?
A. Packaged coils are used for different applications and are very inexpensive. Pennies verses

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dollars: however, the packaged parts do not have the Q rating necessary to perform in the circuitry in which MCI products are utilized.

11. How does MCI Coil differentiate from competitors?
A. See the answer to Number 9.
12. What questions should we be asking in our prospecting efforts for coil opportunities?
A. Does the customer have a need for high frequency, high Q, low loss inductors?
13. What applications/markets utilize coils?
A. Typically, the MCI products are used in Defense, Satellite, Radar, Comms, EW and any Hi-Rel applications. MCI has product on several aircraft, missile and satellite programs. In addition, MCI coils are used in ATE (Automatic Test Equipment) Amplifiers and Pre-amplifiers, as well as medical equipment.

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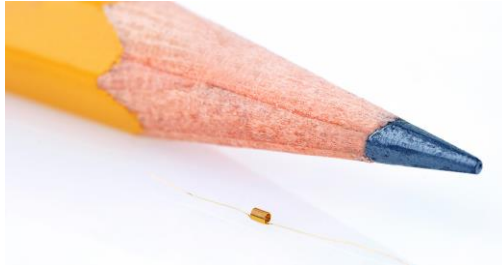
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"Let our team at MCI help unwind your coil needs!"



Veteran owned, 2nd generation family, small business located in Dracut, MA since 1978

Specializing in miniature air coils servicing Defense, Space and Hi-Rel Markets

Designed for use in Communications, Electronic Warfare, Radar applications

Filters, Switches, Amplifiers, Transmitters, Receivers, Oscillators

MCI develops, manufactures, and inspects the product

Inductances from 1 to 1000 nHenries

1 to 100+ turns

High Q, Low Loss

Operates over broad frequencies

Turns Bonded or Not Bonded

Turns Spaced or Together

Leads Tinned/Untinned (copper)

Leads Stripped/Unstripped (gold)

Multiple wire types: Gold, Silver, Copper, Gold plated copper, Aluminum, Alloy

Wire sizes: 50 AWG (American Wire Gauge) to 30 AWG

Quantities from 25 pieces to 100K+ pieces

Over 1000 custom product variations, based on standard formats

Time and volume proven manufacturing techniques

Highly repeatable manufacturing process

Products developed, specifically to customer's requirements and application

Production return rate is below 0.75% per year

Annual production rate >600K parts per year

2020 On Time Delivery (OTD) Performance >99%

Customers notified in advance of any delivery issues

Typical product lead time 6 weeks

ISO 9001 Registered

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