Ferrite Cores

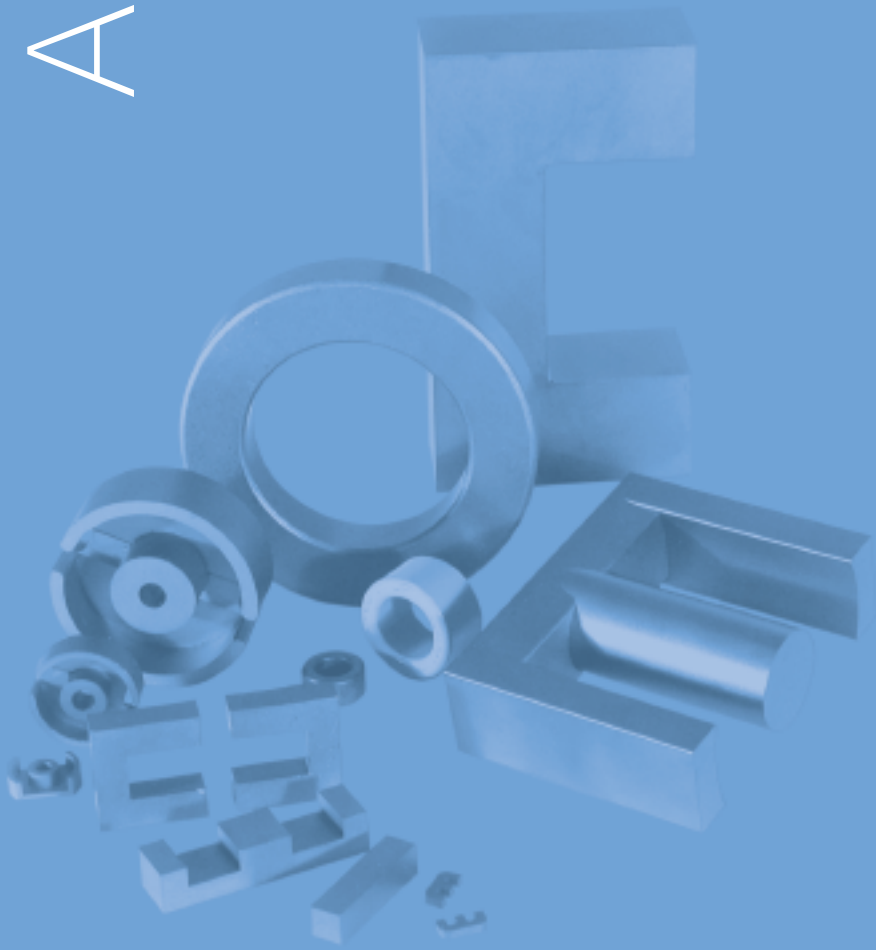
MAGNETICS®

About Magnetics

Magnetics® offers the confidence of over fifty years of expertise in the research, design, manufacture and support of high quality magnetic materials and components.

A major supplier of the highest performance materials in the industry including; MPP, High Flux, Kool Mμ®, power ferrites, high permeability ferrites and strip wound cores, Magnetics products set the standard for providing consistent and reliable electrical properties for a comprehensive range of core materials and geometries. Magnetics is the best choice for a variety of applications ranging from simple chokes and transformers used in telephone equipment to sophisticated devices for aerospace electronics.

Magnetics backs its products with unsurpassed technical expertise and customer service. Magnetics' Application Engineering staff offers the experience necessary to assist the designer from the initial design phase through prototype approval. The knowledgable Sales staff is available to help with all of your customer service needs. This support, combined with a global presence via a worldwide distribution network, including a Hong Kong distribution center, makes Magnetics a premier supplier to the international electronics industry.



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PLANAR CORES are available in a number of parts as indicated with an * in the index. Note that most cores can be pressed as planar types upon request. Check with the factory for cores that may already have an assigned planar part number or for any other parts for which you may have an interest.

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44011	Metric E40	11.4
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***PLANAR CORES**

Contact Sales Department for newest parts. For sizes not listed here, contact the Magnetics Sales Department.

WARRANTY

All standard parts are guaranteed to be free from defects in material and workmanship, and are warranted to meet the Magnetics published specification. No other warranty, expressed or implied, is made by Magnetics. All special parts manufactured to a customer's specification are guaranteed only to the extent agreed upon, in writing, between Magnetics and the user.

Magnetics will repair or replace units under the following conditions:

1. The buyer must notify Magnetics, Pittsburgh, PA 15238 in writing, within 30 days of the receipt of material, that he requests authorization to return the parts. A description of the complaint must be included.

2. Transportation charges must be prepaid.

3. Magnetics determines to its satisfaction that the parts are defective, and the defect is not due to misuse, accident or improper application.

Magnetics liability shall in no event exceed the cost of repair or replacement of its parts, if, within 90 days from date of shipment, they have been proven to be defective in workmanship or material at the time of shipment. No allowance will be made for repairs or replacements made by others without written authorization from Magnetics.

Under no conditions shall Magnetics have any liability whatever for the loss of anticipated profits, interruption of operations, or for special, incidental or consequential damages.

ORDERING

When ordering, please use Magnetics part numbers, or specify material, size, and A_L value. Magnetics customer service representatives and applications engineers are available to help you.

PACKING UNIT

A packing unit is the quantity in a standard full package for a particular part. Special consideration, such as expedited deliveries, is given when ordering stocked standard sized packing units. Contact the factory for details.

UL RECOGNITION

Magnetics is a UL-recognized molder in the QMMY2 fabricated parts program. Many bobbins shown in this catalog are covered. Contact Magnetics for details on specific parts.

Introduction

WHAT ARE FERRITES?

Ferrites are dense, homogeneous ceramic structures made by mixing iron oxide (Fe_2O_3) with oxides or carbonates of one or more metals such as manganese, zinc, nickel, or magnesium. They are pressed, then fired in a kiln up to 2000° F, and machined as needed to meet various operational requirements.

ADVANTAGES OF FERRITES

Ferrites have a paramount advantage over other types of magnetic materials: high electrical resistivity and resultant low eddy current losses over a wide frequency range. Additional characteristics such as high permeability and time/temperature stability have expanded ferrite uses into quality filter circuits, high frequency transformers, wide band transformers, adjustable inductors, delay lines, and other high frequency electronic circuitry. As the high frequency performance of other circuit components continues to be improved, ferrites are routinely designed into magnetic circuits for both low level and power applications. For the most favorable combination of low cost, high Q, high stability, and lowest volume, ferrites are the best core material choice for frequencies from 10 KHz to 50 MHz. Ferrites offer an unmatched flexibility in magnetic and mechanical parameters.

FERRITE ADVANTAGES

- LOW COST
- LARGE SELECTION OF MATERIALS
- SHAPE VERSATILITY
- ECONOMICAL ASSEMBLY
- TEMPERATURE AND TIME STABILITY
- HIGH RESISTIVITY
- WIDE FREQUENCY RANGE (10KHz TO 50 MHz)
- HIGH Q/SMALL PACKAGE

MAGNETICS® FERRITES

Magnetics' ferrite cores are manufactured for a wide variety of applications. Magnetics has developed and produces the leading MnZn ferrite materials for power transformers, power inductors, wideband transformers, common mode chokes, and many other applications. In addition to offering the leading materials, other advantages of ferrites from Magnetics include: the full range of standard planar E and I cores; rapid prototyping capability for new development; the widest range of toroid sizes in power and high permeability materials; standard gapping to precise inductance or mechanical dimension; wide range of coil former and assembly hardware available; and superior toroid coatings available in several options.

Properties

TYPICAL MECHANICAL AND THERMAL PROPERTIES OF FERRITE MATERIALS

MECHANICAL DATA		UNITS	THERMAL DATA		UNITS
Bulk Density	4.85	gm/cm^3	Coefficient of Linear Expansion	$10.5X10^{-6}$	$°C^{-1}$
Tensile Strength	$5.0, 7.0X10^3$	$kgf.mm^{-2}$, $lbs.in^{-2}$	Specific Heat (25°)	1100, .26	$J.kg^{-1}°C^{-1}$, $cal.g^{-1}.°C^{-1}$
Compressive Strength	$45, 63X10^3$	$kgf.mm^{-2}$, $lbs.in^{-2}$	Thermal Conductivity (25-85°C)	3500-4300	$\mu W.mm^{-1}.°C^{-1}$
Youngs Modulus	$12.4X10^3, 1.8X10^7$	$kgf.mm^{-2}$, $lbs.in^{-2}$		35-43	$mW.cm^{-1}.°C^{-1}$
Hardness (Knoop)	650 Typical			.0083-.010	$cal.s^{-1}.cm^{-1}.°C^{-1}$
Resistivity	10^2-10^3	ohm-cm			

Above properties are averages measured on a range of commercially available MnZn ferrite materials.

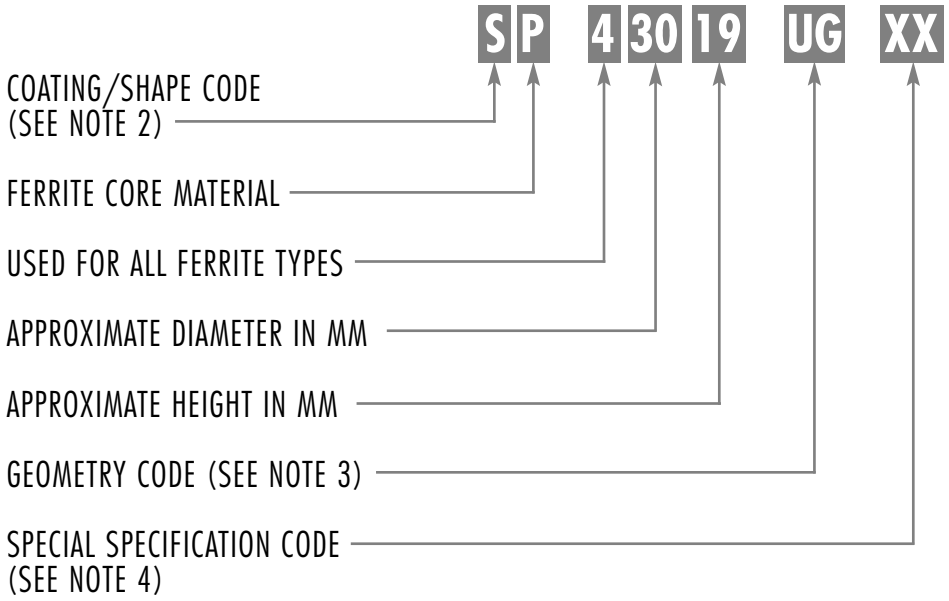
Applications

FERRITE APPLICATION AREAS

APPLICATIONS	DESIRED PROPERTIES	PREFERRED MATERIALS	AVAILABLE SHAPES
Common Mode Chokes	Very high μ.	J, W, H	Toroids
Differential Inductors	Low losses and high temperature stability.	F, P, R	Pot cores, EP cores, E-cores, RM cores, Planar cores
Power Transformers	High μ and low losses at high flux densities and temperatures. High saturation.	F, P, R	Ungapped pot cores, E, U & I cores, toroids, EP cores, RS cores, PQ cores, Planar cores
Power Inductors	Low losses at high flux densities and temperatures. High saturation.	F, P, R	Pot cores, E cores, PQ cores, RM cores, Planar cores
Converter and Inverter Transformers	Low losses, high saturation.	F, P, R	Toroids, E, U, & I cores, pot cores, RS cores, Planar cores
Pulse Transformers	High μ, low loss, high Vt product.	J, W, H	Toroids
Broadband Transformers	Low loss, high μ.	J, W, H	Pot cores, toroids, E, U & I cores, RM, EP cores
Narrow Band Transformers	Moderate Q, high μ, high stability.	F	Pot cores, toroids
Telecom Inductors	Low losses and high temperature stability.	F, P, R	Pot cores, EP cores, E cores, RM cores, Planar cores
Noise Filters	Very high μ.	J, W, H	Toroids
Machining and Prototyping	High μ, low losses, high saturation.	J, R	Ferrite blocks for machined parts

Ungapped Cores and Toroids

1. TYPICAL PART NUMBER



2. COATING/SHAPE CODE

For some cores, a designation letter precedes the material code.

COATING/SHAPE CODE

CODE	MEANING	EXAMPLE
C	Planar E-core with clip recesses	CR45810EC
D	DS core with solid centerpost	DF42311UG
F	Planar E-core option: no clip recesses	FR45810EC
H	DS core with a center hole	HP41408UG
N	RM core with solid centerpost	NP41510UG
P	EP core	PJ41313UG
R	RM core with a center hole	RG41510UG
S	RS core	SD41408UG
V	Nylon toroid coating	VJ42206TC
X	Black coating (contact factory)	XW41003TC
Y	Parylene toroid coating	YA40603TC
Z	Epoxy toroid coating	ZJ42915TC
0	No meaning (e.g.0P-41808-EC is the same as P-41808-EC)	

Ungapped Cores and Toroids

3. GEOMETRY CODE

For standard ungapped cores, a two letter code indicates the geometry.

GEOMETRY CODE

CODE	GEOMETRY	EXAMPLE	UNIT OF MEASURE
EC	All E-cores, including ETD, EC, EER, EEM, EFD, planar and lamination size.	0P44317EC	Piece
IC	I-Core	0J42516IC	Piece
TC	Toroid	ZJ42915TC	Piece
UC	U-Core	0J41106UC	Piece
UG	POT, RS, DS, RM, PQ, EP	DF42311UG	Set

4. SPECIAL SPECIFICATION CODE

A variety of features over and above the standard specifications are available. For details, see the section on page 1.7, "Special Specification Codes."

5. UNIT OF MEASURE

POT, RS, DS, RM, PQ, and EP cores are ordered in sets. One set is a pair of two pieces. One set usually is ordered for each transformer, inductor, or device to be built.

E-, U-, and I-Cores are ordered in individual pieces. Two pieces usually are ordered for each transformer, inductor, or device to be built.

Toroids are ordered in individual pieces.

HARDWARE

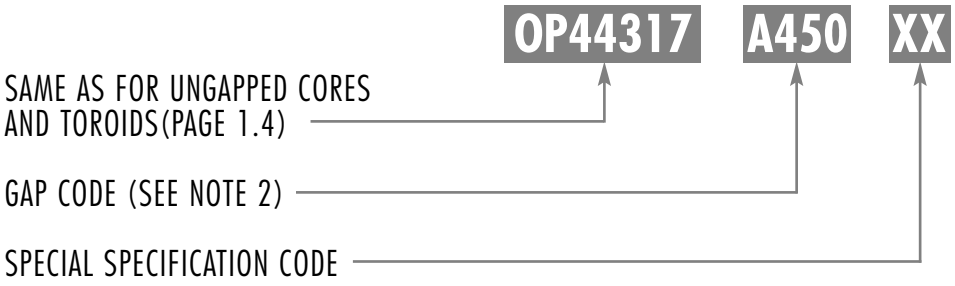
Accessory hardware is offered for nearly all of the cores shown in this catalog. Available items are shown together with the appropriate cores.

Magnetics is a UL-recognized molder in the QMMY2 fabricated parts program. Many bobbins shown in this catalog are covered. Contact the factory for details on specific parts.

The part number and material are shown with the drawing for each bobbin. Every bobbin is provided in the material defined by the part number, whether the bobbin is covered in the UL QMMY2 program or not.

Gapped Cores

1. TYPICAL PART NUMBER



2. GAP CODE

The letter indicates the type of gap and a three-digit number defines the value.

GAP CODE

CODE	MEANING	EXAMPLE
A_ _ _	A_L (if < 1000)	DF42311A275 (A_L = 275)
X_ _ _	A_L if 1000 or greater (add 1000 to code)	OP44721X250 (A_L = 1250)
F_ _ _	A_L if < 100, non-integer (divide code by10)	OR42510F807 (A_L = 80.7)
G_ _ _	Depth of grind in mils (1000^{ths} of an inch)	OF44317G079 (Gap = 0.079")
M_ _ _	Depth of grind, mm (divide code by 10)	OF43019M015 (Gap = 1.5mm)

A_L is inductance factor, mH/1000 Turns, or nH/T^2 (see page 14.2 for definitions, page 2.1 for measurement setup.) See the chart on pages 1.8-1.11 for tolerances. The standard gap codes do not apply to U-Cores, toroids, I-Cores, or some E-I combinations.

3. UNIT OF MEASURE

See Note 5 on page 1.5. For parts ordered in pieces (E-Cores), the depth of grind is given for each piece. For parts ordered in sets, the depth of grind is given as a total for the set, and may be UG/G or G/G (see the chart on page 1.8 to determine which is standard.)

When ordering E-cores gapped to an A_L value it is critical to understand whether the standard is UG/G or G/G. See Note 1 on page 1.9.

4. SPECIAL REQUIREMENTS

Many non-standard features are available, including gap values and tolerances that are different from those shown on the tables in this catalog. The next section on this page, "Special Specification Codes" explains how part numbers are defined for non-standard requirements.

For assistance with any special requirements, Magnetics customer service representatives and applications engineers are available to help you.

Special Specification Codes

SPECIAL SPECIFICATION CODES

For special customer requirements, a detailed product specification is written. This special specification is referenced to a unique two-character part number suffix. The resulting part number is reserved for the exclusive use of the originating customer and any sub-contractors that the originating customer designates.

Special specifications can be written to meet a wide variety of requirements, including:

- CUSTOM PACKAGING
- CUSTOM MARKING
- NON-STANDARD TOLERANCES
- NON-STANDARD UNITS OF MEASURE
- CUSTOM ELECTRICAL PERFORMANCE
- MODIFIED HEIGHTS
- SPECIAL TESTING
- MANY OTHER NEEDS

For five common requirements, a standard letter code is used in the suffix location:

SPECIAL SPECIFICATION CODE

CODE	MEANING	EXAMPLE
NS	Not stamped; the standard part marking is omitted.	DF42311UGNS
CC	Color coded; see page 13.3 for the color index.	ZP42915TCCC
EI	E-core gapped to an A_L value when mated with the standard I-core.	CR42216A160EI *A_L = 160±3% with CR42216IC*

Depth of Grind Tolerance Ranges

Either the A_L or the depth of grind (not both) is controlled during production of gapped cores. Part numbering for gapped cores is explained on page 1.6. Codes A, X and F define A_L values. Codes G and M define depths of grind.

In most applications, defining the gap with the A_L results in inductors with the least variation. Electrical measurement is inherently more precise, and compensation is made for variability in material permeability and core geometry. For deep gaps, however, better consistency often results when the depth of grind is specified. In such cases, variation in the finished inductor is dominated by the variation in the windings, especially if the number of turns is low.

"Ungapped to gap combination" means an asymmetrical gap; the entire gap is taken from one piece, and the other piece is ungapped. "Gap to gap combination" means the gap is symmetrical; half of the total gap is ground into each piece.

INCHES			MILLIMETERS	
GAP	**TOLERANCE**	For shapes: POT, RS, DS, RM, PQ, and EP Cores.	**GAP**	**TOLERANCE**
0.001"–0.038"	±0.0005"	Ungapped to gap combination.	0.1mm–0.9mm	±0.03mm
0.039"–0.076"	±0.001"	Ungapped to gap combination *(Except if the gap is more than 10% of the minimum bobbin depth for the set*. Then gap-to-gap combination.)*	1.0mm–1.9mm	±0.04mm
0.077"–0.114"	±0.002"	Gap to gap combination *(Except if the gap is less than 10% of the minimum bobbin depth for the set*. Then ungapped-to-gap combination.)*	2.0mm–2.9mm	±0.07mm
0.115"–0.152"	±0.002"	Gap to gap combination.	3.0mm–3.8mm	±0.07mm
0.153"–0.228"	±0.004"	Gap to gap combination.	3.9mm–5.0mm	±0.12mm

**The bobbin depth for the set is the 2D dimension, or 2 times the D dimension.*

INCHES			MILLIMETERS	
GAP	**TOLERANCE**	For E-Cores: Lamination Size, EFD, EEM, EC, ETD, ER, EER, Planar E, and other E-Cores.	**GAP**	**TOLERANCE**
0.001"–0.038"	±0.0005"		0.1mm–0.9mm	±0.03mm
0.039"–0.076"	±0.001"		1.0mm–1.9mm	±0.04mm
0.077"–0.152"	±0.002"		2.0mm–3.8mm	±0.07mm
0.153"–0.228"	±0.004"		3.9mm–5.0mm	±0.12mm

E-cores are sold as pieces, not sets. To make an ungapped/gapped set, use one piece of each. For example, use OR41808G050 with OR41808EC for an asymmetrical gap of 0.050" ± 001". For the same gap, but symmetric, use two pieces of OR41808G025.

For more information about gapped cores and using them, please see pages 4.13-4.19. For tolerance requirements other than those shown below, please contact the factory.

Gapping for A_L

1. UNIT OF MEASURE

When specifying and ordering E-Cores gapped to an A_L, it is important to note which cores are produced in gap-to-gap combination, because two gapped pieces are assembled to achieve the A_L. Alternatively, for E-Cores provided ungapped-to-gap, an ungapped piece must be used with the gapped part to achieve the A_L. POT, RS, DS, RM, PQ, and EP cores are sold as sets whether the combination is G/G or UG/G.

2. SIGNIFICANT FIGURES

A_L testing and limits are calculated to three significant digits, based on the nominal value. For example, A_L = 99±3% is interpreted as 96.0 Minimum, 99.0 Nominal, and 102.0 Maximum.

3. CORRELATION

Magnetics tests gapped A_L values with full bobbins, usually 100 turns, or 250 turns for deep gaps. The drive level is low (5 Gauss) and the frequency is set low enough to avoid resonance effects. Measured inductance in an application may vary significantly from the theoretical value due to low turns, low bobbin fill, leakage effects, resonance effects, or elevated drive levels.

It is important for the user to verify the correlation between the test of the core and the specific test being applied to the inductor or transformer. Planar E Cores and planar PQ cores are especially susceptible to correlation discrepancies.

PC (POT) CORES

FOUND IN SECTION 6

	GAP TO GAP	UNGAPPED TO GAP COMBINATION			
	±3%	±3%	±5%	±7%	±10%
40704	25-35	36-62	63-95	96-125	126-175
40905	25-48	49-87	88-135	136-180	181-240
41107	25-75	76-135	136-220	221-285	286-399
41408	71-113	114-210	211-307	308-417	418-574
41811	96-174	175-326	≤ 523	≤ 712	≤ 988
42213	113-204	205-482	≤ 779	≤ 1060	≤ 1459
42616	139-249	250-695	≤ 1125	≤ 1543	≤ 1999
43019	170-304	305-1015	≤ 1642	≤ 1999	
43622	222-399	400-1494	≤ 1999		
44229	169-389	390-1965	≤ 1999		
44529	172-549	550-1999			

Charts show type of combination and the guaranteed tolerance for corresponding A_L ranges. For special tolerances, or for A_L = 2000 or higher, contact the factory.

Ranges indicated are the tolerances for standard gapped cores.

For ± 5%, ± 7%, and ± 10%, the maximum A_L for each tolerance is shown. Standard cores are manufactured to the smallest allowed tolerance.

RS (ROUND-SLAB) CORES

FOUND IN SECTION 7

	GAP TO GAP	UNGAPPED TO GAP COMBINATION			
	±3%	±3%	±5%	±7%	±10%
41408		25-177	≤ 283	≤ 385	≤ 530
42311	25-39	40-347	≤ 708	≤ 963	≤ 1325
42318	25-39	40-452	≤ 731	≤ 994	≤ 1378
42616	25-39	40-622	≤ 998	≤ 1369	≤ 1884
43019	25-62	63-918	≤ 1485	≤ 1999	

Gapping for A_L

DS (DOUBLE-SLAB) CORES
FOUND IN SECTION 7

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION ±3%	±5%	±7%	±10%
42311	109-195	196-386	≤ 625	≤ 850	≤ 1170
42318	78-135	136-441	≤ 706	≤ 961	≤ 1332
42616	117-205	206-580	≤ 930	≤ 1276	≤ 1756
43019	149-264	265-873	≤ 1412	≤ 1922	≤ 1999

RM CORES
FOUND IN SECTION 8

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION ±3%	±5%	±7%	±10%
41110	25-50	51-55	≤ 75	≤ 170	≤ 250
41510	56-99	100-162	≤ 258	≤ 352	≤ 484
41812	69-120	121-238	≤ 381	≤ 519	≤ 714
41912	69-120	121-238	≤ 381	≤ 519	≤ 714
42316	84-150	151-395	≤ 633	≤ 862	≤ 1195
42819	126-200	201-625	≤ 1002	≤ 1374	≤ 1892
43723	145-250	251-977	≤ 1580	≤ 1999	

EP CORES
FOUND IN SECTION 9

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION ±3%	±5%	±7%	±10%
40707	25-63	64-75	≤ 125		≤ 160
41010	25-55	56-75	≤ 125		≤ 160
41313	25-75	76-110	≤ 175	≤ 275	≤ 315
41717	25-100	101-175	≤ 275	≤ 400	≤ 630
42120	25-180	181-450	≤ 630	≤ 850	≤ 1250

Charts show type of combination and the guaranteed tolerance for corresponding A_L ranges. For special tolerances, or for A_L = 2000 or higher, contact the factory.

Ranges indicated are the tolerances for standard gapped cores.

For ± 5%, ± 7%, and ± 10%, the maximum A_L for each tolerance is shown. Standard cores are manufactured to the smallest allowed tolerance.

PQ CORES
FOUND IN SECTION 10

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION ±3%	±5%	±7%	±10%
42016	60-184	185-467	≤ 755	≤ 1027	≤ 1425
42020	50-139	140-467	≤ 754	≤ 1026	≤ 1422
42610	200-396	397-777	≤ 1258	≤ 1728	≤ 1999
42614	103-334	335-645	≤ 1044	≤ 1421	≤ 1972
42620	95-296	297-888	≤ 1436	≤ 1955	≤ 1999
42625	77-234	235-880	≤ 1423	≤ 1936	≤ 1999
43214	127-416	417-548	≤ 885	≤ 1207	≤ 1661
43220	128-409	410-846	≤ 1369	≤ 1878	≤ 1999
43230	84-241	242-808	≤ 1305	≤ 1775	≤ 1999
43535	89-255	256-980	≤ 1575	≤ 1999	
44040	83-230	231-1006	≤ 1625	≤ 1999	

LAMINATION SIZE E-CORES
FOUND IN SECTION 11

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION ±3%	±5%	±7%	±10%
41203	16-27	28-55	≤ 86	≤ 117	≤ 160
41707	22-37	38-89	≤ 140	≤ 190	≤ 259
41808	27-42	43-121	≤ 192	≤ 258	≤ 355
42510	37-61	62-200	≤ 318	≤ 432	≤ 595
43009	55-91	92-222	≤ 353	≤ 475	≤ 653
43515	54-87	88-429	≤ 687	≤ 934	≤ 1284
44317	81-136	137-762	≤ 1222	≤ 1676	≤ 1999
44721	107-180	181-1188	≤ 1920	≤ 1999	
45724	129-218	219-1732	≤ 1999		

EFD, EEM CORES
FOUND IN SECTION 11

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION ±3%	±5%	±7%	±10%
41515	19-30	31-81	≤ 127	≤ 172	≤ 236
42523	41-66	67-296	≤ 475	≤ 646	≤ 888

Gapping for A_L

PLANAR E-CORES*

FOUND IN SECTION 11

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION			
		±3%	±5%	±7%	±10%
41425	19-37	38-76	≤ 122	≤ 166	≤ 228
41434	17-31	32-77	≤ 123	≤ 167	≤ 230
41805	18-32	33-205	≤ 329	≤ 448	≤ 617
42107	35-66	67-188	≤ 304	≤ 414	≤ 569
42216	78-141	142-405	≤ 656	≤ 892	≤ 1239
43208	118-216	217-643	≤ 1040	≤ 1427	≤ 1964
43618	119-222	223-673	≤ 1088	≤ 1491	≤ 1999
43808	173-315	316-956	≤ 1547	≤ 1999	
44008	106-189	190-507	≤ 821	≤ 1116	≤ 1548
44308	201-367	368-1130	≤ 1828	≤ 1999	
44310	169-305	306-1130	≤ 1828	≤ 1999	
45810	266-481	482-1496	≤ 1999		
46410	379-701	702-1999			
49938	336-594	595-1999			

** These tolerances also apply to Planar E-I combinations.*

OTHER E-CORES

FOUND IN SECTION 11

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION			
		±3%	±5%	±7%	±10%
41205	28-47	48-107	≤ 170	≤ 229	≤ 316
41810	44-74	75-235	≤ 376	≤ 512	≤ 704
42515	28-43	44-210	≤ 333	≤ 452	≤ 616
42520	107-190	191-397	≤ 643	≤ 874	≤ 1202
42530	45-72	73-409	≤ 655	≤ 891	≤ 1225
43007	42-67	68-307	≤ 491	≤ 668	≤ 919
43520	65-111	112-461	≤ 738	≤ 1003	≤ 1380
44011	59-95	96-642	≤ 1029	≤ 1400	≤ 1940
44016	52-83	84-545	≤ 872	≤ 1185	≤ 1629
44020	78-126	127-916	≤ 1480	≤ 1999	
44022	94-156	157-1187	≤ 1903	≤ 1999	
45528	113-186	187-1736	≤ 1999		
45530	129-215	216-1999			
46016	102-129	130-1231	≤ 1989	≤ 1999	
47228	120-199	200-1823	≤ 1999		
48020	99-158	159-1922	≤ 1999		

EC CORES

FOUND IN SECTION 12

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION			
		±3%	±5%	±7%	±10%
43517	49-79	80-438	≤ 702	≤ 954	≤ 1312
44119	61-98	99-627	≤ 1004	≤ 1365	≤ 1891
45224	76-123	124-911	≤ 1471	≤ 1999	
47035	83-135	136-1403	≤ 1999		

ETD, EER CORES

FOUND IN SECTION 12

	GAP TO GAP ±3%	UNGAPPED TO GAP COMBINATION			
		±3%	±5%	±7%	±10%
40906	15-30	31-52	53-80	81-105	106-142
43434	55-88	89-500	≤ 806	≤ 1095	≤ 1507
43521	54-86	87-566	≤ 913	≤ 1241	≤ 1707
43939	95-156	157-641	≤ 1028	≤ 1398	≤ 1935
44216	71-117	118-876	≤ 1415	≤ 1925	≤ 1999
44444	73-117	118-881	≤ 1423	≤ 1935	≤ 1999
44949	81-130	131-1075	≤ 1736	≤ 1999	
45959	51-118	119-1822	≤ 1999		

Charts show type of combination and the guaranteed tolerance for corresponding A_L ranges. For special tolerances, or for A_L = 2000 or higher, contact the factory.

Ranges indicated are the tolerances for standard gapped cores.

For ± 5%, ± 7%, and ± 10%, the maximum A_L for each tolerance is shown. Standard cores are manufactured to the smallest allowed tolerance.

Notes

EQUIPMENT

The test data included in this catalog was primarily obtained using bridges such as a Hewlett-Packard 419A impedance analyzer. The HP 4192A was used for permeability and loss factor data from 10kHz to 1MHz. A Wayne-Kerr 3245 inductance analyzer was used for DC bias to 100kHz. Also, for Permeability vs. Temperature, Permeability vs. Frequency, and Disaccommodation, an HP 4192A was coupled with a computer controlled temperature cabinet and an HP 9836 computer.

Core loss up to and including 100kHz is measured using a 11401 Tektronix oscilloscope connected to an HP Vectra computer. This is a fully automated system. Other measurements include core loss using a Tektronix 7854 digital oscilloscope and an HP 9836 computer to measure losses at 500kHz to 1MHz. This test setup is also used to obtain B-H loops in the 1kHz to 100kHz ranges.

High level readings such as Permeability vs. Flux Density were measured on a General Radio 1632-A incremental bridge.

Q measurements were made on a Boonton 260A Q-meter.

MEASUREMENT

For initial permeability and inductance measurements, excitation levels are kept at values insuring flux densities below 10 gauss.

Temperature measurements normally are obtained between -30° and 70°C but additional temperatures to - 65° and 260°C are used to indicate trends and changes in materials properties outside the normal guaranteed range. Inductance measurements for disaccommodation are made at 10 and 100 minutes after the test core has been demagnetized. Disaccommodation Factor is calculated mathematically.

Test bobbins are carefully layer wound with magnet wire or litz wire whose size is chosen so that the calculated number of turns completely fills the bobbin.

Before core halves are assembled, the mating surfaces should be clean and free from dust. After aligning the two core halves, pressure indicated in the table below should be applied. Magnetics clamping hardware will handle these pressures.

STANDARD POT CORES				RM CORES	
40704	4 lbs.	42213	15 lbs.	41110	5 lbs.
40905	5 lbs.	42616	20 lbs.	41510, 41912	7 lbs.
41107	7 lbs.	43019	20 lbs.	41812	7 lbs.
41408	7 lbs.	43622	30 lbs.	42316	15 lbs.
41811	12 lbs.	44229	35 lbs.	42819	20 lbs.
RS CORES		**PQ CORES**		**EP CORES**	
41408	7 lbs.	42016, 42020	15 lbs.	40707	6 lbs.
42311, 42318	15 lbs.	42620, 42020	20 lbs.	41010	7 lbs.
42616	20 lbs.	43220, 42330	30 lbs.	41313	7 lbs.
43019	20 lbs.	43535	30 lbs.	41717	13 lbs.
		44040	35 lbs.	42020	15 lbs.

VOLTAGE BREAKDOWN MEASUREMENT

Core finishes (toroids) are tested for voltage breakdown by inserting the core between two weighted wire mesh pads. Force is adjusted to produce a uniform pressure of 10psi, simulating winding pressure. The test condition to guarantee minimum breakdown (see 13.2) is a 60 Hertz r.m.s. voltage equal to 1.25 times the minimum.

CONVERSION TABLE

MULTIPLY NUMBER OF	BY	TO OBTAIN NUMBER OF
oersteds	79.5	ampere-turns/m
oersteds	0.795	ampere-turns/cm
gausses	10^{-4}	teslas (webers/m^2)
gausses	0.10	milliTeslas
in^2	6.452	cm^2
circular mils	5.07 x 10^{-6}	cm^2
mWatts/cm^3	0.094	watts/lb.

CALIBRATION

All measurement equipment is periodically checked against our NSB traceable standards. These standards include an EDC 2902 DC voltage standard, an EDC 3200 AC/DC current calibrator, a Fluke 5200A AC calibrator, and various resistance, capacitive, and Q standards.

PHYSICAL MEASUREMENTS

Specific "+" or "-" tolerances on part dimensions indicated as "normal" in this catalog can be provided if needed. If a dimension is listed as "typical", it is the same as nominal except it covers a plurality.

RESEARCH AND DEVELOPMENT

Magnetics Technology has a continuing program aimed at improving existing products and introducing new materials and geometries. Technology efforts and concentrated programming have made Magnetics a leader in many other magnetic materials, in addition to having a steady growth in ferrites. Technology also provides technical data which may not be regularly available.

Materials

MATERIALS

Magnetics has developed and produces leading MnZn ferrite materials for a variety of applications.

POWER MATERIALS

Three low loss materials are engineered for optimum frequency and temperature performance in power applications. Magnetics' R, P and F materials provide superior saturation, high temperature performance, low losses and product consistency.

SHAPES: E cores, Planar E cores, ETD, EC, U cores, I cores, PQ, Planar PQ, RM, Toroids (2mm to 86mm), Pot cores, RS (round-slab), DS (double slab), EP, Special Shapes.

APPLICATIONS: Telecomm Power Supplies, Computer Power Supplies, Commercial Power Supplies, Consumer Power Supplies, Automotive, DC-DC Converters, Telecomm Data Interfaces, Impedance Matching Transformers, Handheld Devices, High power control (gate drive), Computer Servers, Distributed Power (DC-DC), EMI Filters, Aerospace, Medical.

HIGH PERMEABILITY MATERIALS

Three high permeablility materials (5000µ J material, 10000µ W material and 15000µ H material) are engineered for optimum frequency and impedance performance in signal, choke and filter applications. These Magnetics' materials provide superior loss factor, frequency response, temperature performance, and product consistency.

SHAPES: Toroids (2 mm to 86 mm), E cores, U cores, RM, Pot cores, RS (round-slab), DS (double slab), EP, Special Shapes.

APPLICATIONS: Common Mode Chokes, EMI Filters, Other Filters, Current Sensors, Telecomm Data Interfaces, Impedance matching interfaces, Handheld devices, Spike Suppression, Gate Drive Transformers.

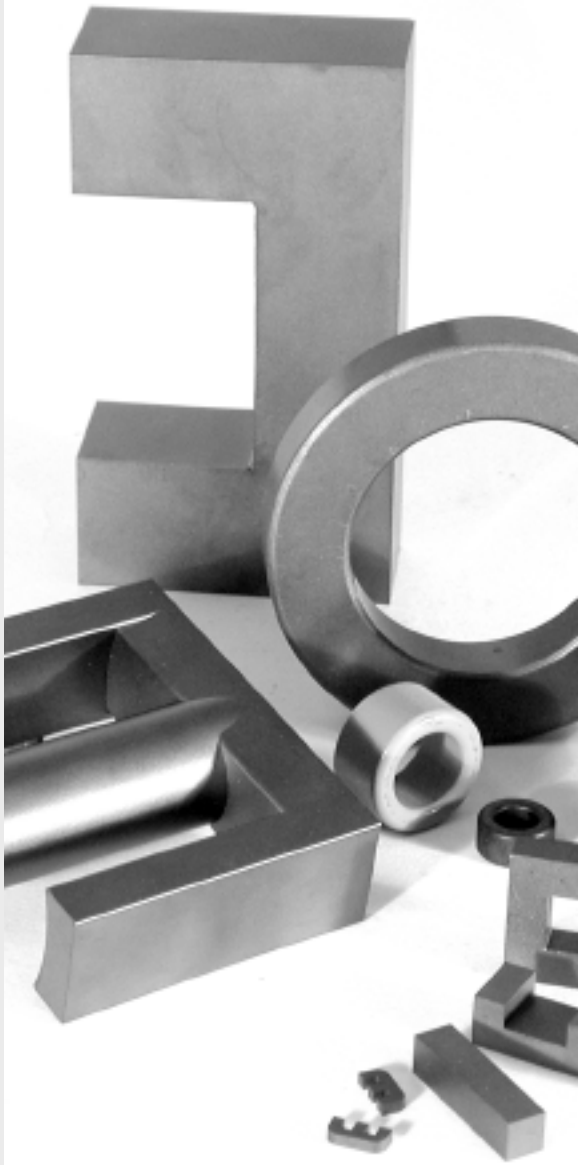
SPECIAL MATERIALS

A number of special materials are engineered for specific performance results, including frequency response, temperature factor, Curie temperature, permeability across temperature for GFCI and telecomm performance, and loss factor. Magnetics' special materials provide outstanding performance, customization options and superior product consistency.

SHAPES: E cores, Planar E cores, ETD, EC, U cores, I cores, PQ, Planar PQ, RM, Toroids (2mm to 86mm), Pot cores, RS (round-slab), DS (double slab), EP, Special Shapes.

APPLICATIONS: EMI Filters, Current sensors, Chokes, Tuned Filters, Data interfaces, Special temperature requirements, Other Special Requirements.

Contact Magnetics' Application Engineering for additional information.



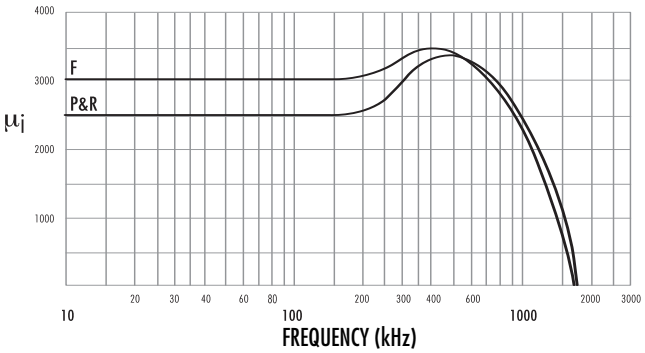
Characteristics

			INDUCTORS & POWER TRANSFORMERS			EMI/RFI FILTERS & BROADBAND TRANSFORMERS		
			R	P	F	J	W	H
Initial Permeability	μ_i	—	2,300 ± 25%	2,500 ± 25%	3,000 ± 20%	5,000 ± 20%	10,000 ± 30%	15,000 ± 30%
Maximum Usable Frequency (50% roll-off)	f	MHz	<1.5	<1.2	<1.3	<1	<0.25	<015
Relative Loss Factor	$\frac{\tan \delta}{\mu_{iac}}$	10^{-6}			<8 (100kHz)	<20 (100kHz)	<7 (10kHz)	<15 (10kHz)
*Curie Temperature	T_c	°C	>230	>230	>210	>140	>125	>120
* Relative Temp. Factor -30°C to +20°C +20°C to 70°C	/°C	10^{-6}/°C						
* Flux Density @ 1,194 A/m (15 Oe)	B_m	G mT	5,000 500	5,000 500	4,900 490	4,300 430	4,300 430	4,200 420
* Remanence	B_r	G mT	1,100 110	1,100 110	1,200 120	1,000 100	800 80	800 80
* Coercivity	Hc	Oe A/m	0.18 14	0.18 14	0.2 16	0.1 8	0.04 3	0.04 3
Disaccommodation Factor	D_F	10^{-6}				<3	<3	<2.5
* Resistivity	ρ	Ω-m	6	5	2	1	0.15	0.1
* Density	δ	g/cm^3	4.8	4.8	4.8	4.8	4.8	4.9
Power Loss (P_L) Sine Wave, in mW/cm^3 (typical)	25kHz 200mT (2,000G)	@25°C @60°C @100°C @120°C	130 85 70 85	120 90 95 130	90 160 240			
	100kHz 100mT (1,000G)	@25°C @60°C @100°C @120°C	140 100 70 90	125 90 125 165	100 180 225			
	500kHz 50mT (500G)	@25°C @60°C @100°C @120°C	375 300 250 300	300 250 275 350				
	700kHz 50mT (500G)	@25°C @60°C @100°C @120°C						
Available In:	Pot Cores		X	X	X	X	X	
	RS Cores		X	X	X	X	X	
	DS Cores		X	X	X	X	X	
	RM Cores		X	X	X	X	X	
	EP Cores		X	X	X	X	X	
	E, U Cores		X	X	X	X	X	
	EC, ETD Cores		X	X	X			
	PQ Cores		X	X	X			
	Toroids		X			X	X	X
	Blocks					X		

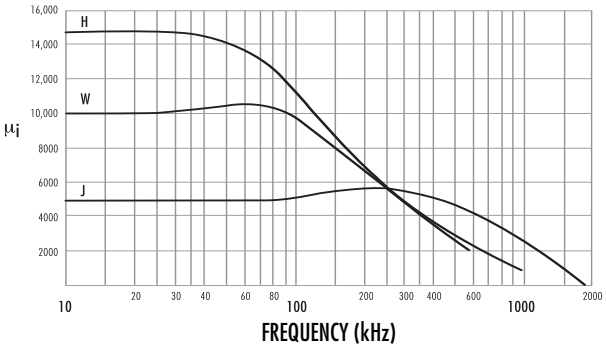
Note: These characteristics are typical for a 42206 size (0.870" O.D.) toroid. Specific core data will usually differ from these numbers due to the influence of geometry and size. Characteristics with a * are typical.

Material Curves

GRAPH 1 - FREQUENCY RESPONSE CURVES



GRAPH 2 - FREQUENCY RESPONSE CURVES



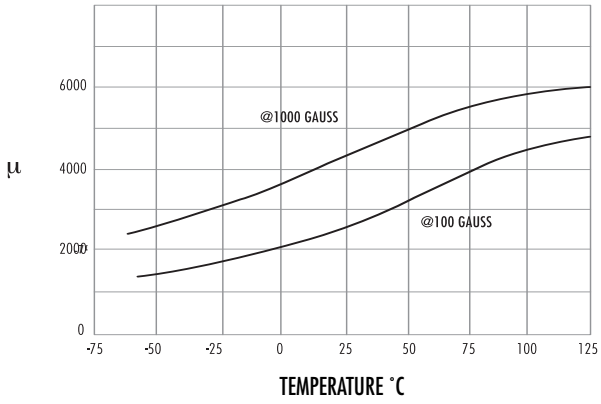
R Material

Saturation Flux Density - gausses 5,000 (at 15 oersted, 25°C) (500 mT)
Coercive Force - oersted 0.18 (14A/m)
Curie Temperature . . . . . 230°C

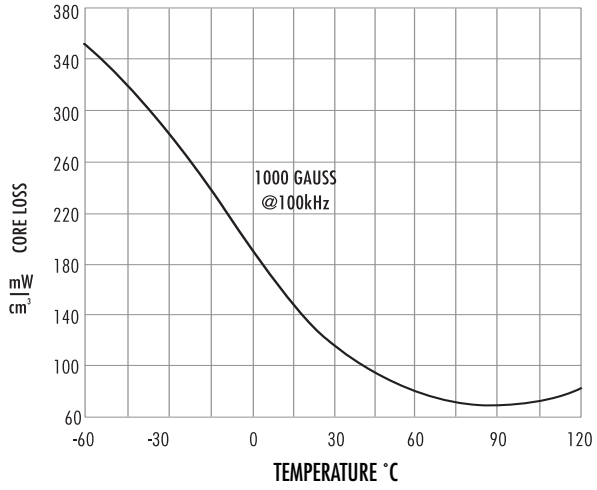
μ_i 2,300 ±25%

NOTE: The core loss curves are developed from empirical data. For best results and highest accuracy, use them. The formula on page 3.10 yields a fair approximation and can be useful in computer programs.

PERMEABILITY vs. TEMPERATURE

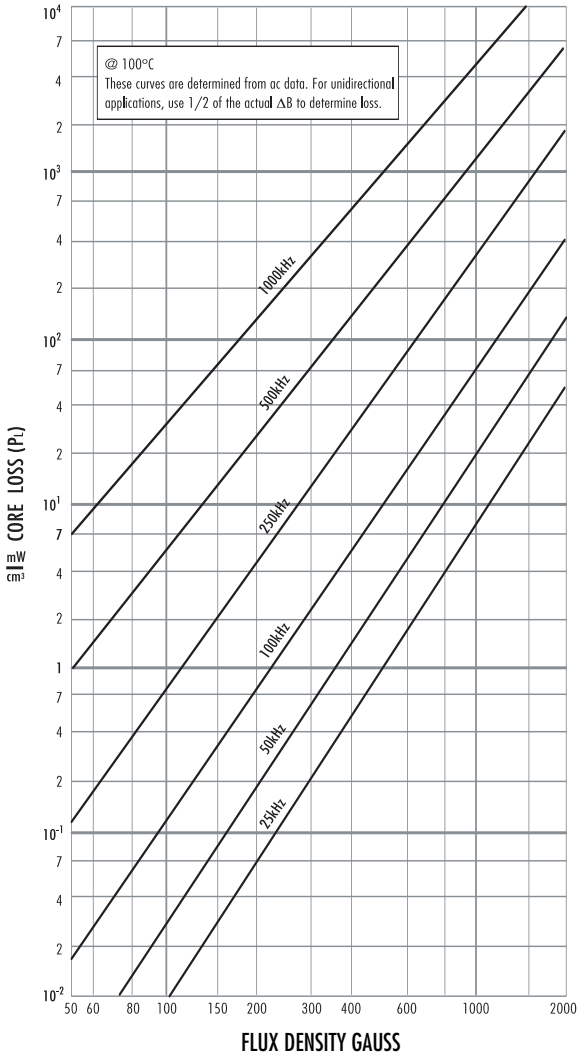


CORE LOSS vs. TEMPERATURE

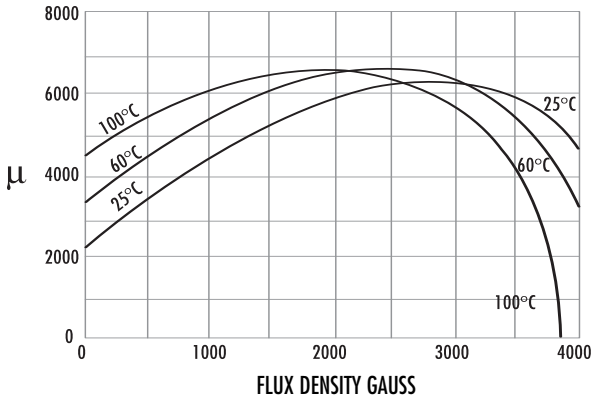


FLUX DENSITY GAUSS

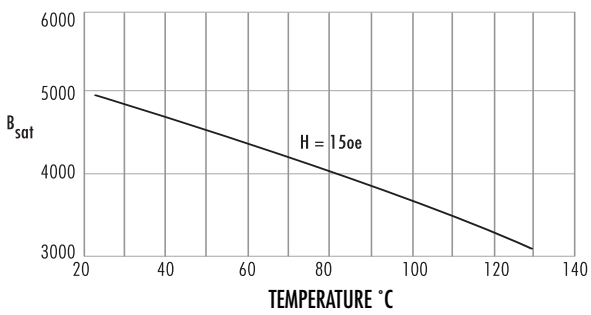
CORE LOSS vs. FLUX DENSITY



PERMEABILITY vs. FLUX DENSITY



FLUX DENSITY vs. TEMPERATURE



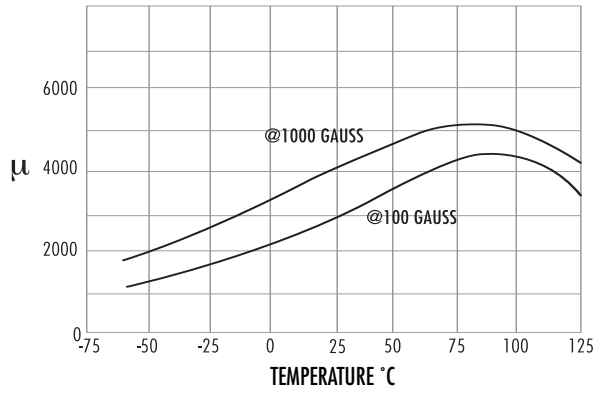
See Page 3.11 for B-H Data

Saturation Flux Density - gausses 5,000 (at 15 oersted, 25°C) (500 mT)
Coercive Force - oersted. 0.18 (14A/m)
Curie Temperature. . . . . 230°C

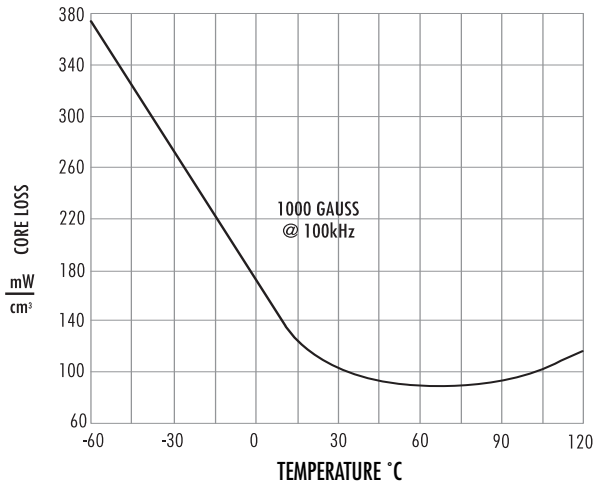
NOTE: The core loss curves are developed from empirical data.
For best results and highest accuracy, use them. The formula on page 3.10 yields a fair approximation and can be useful in computer programs.

μ_i 2,500 ±25%

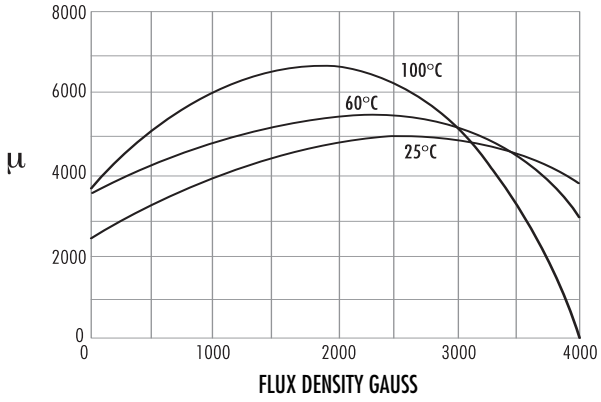
PERMEABILITY vs. TEMPERATURE



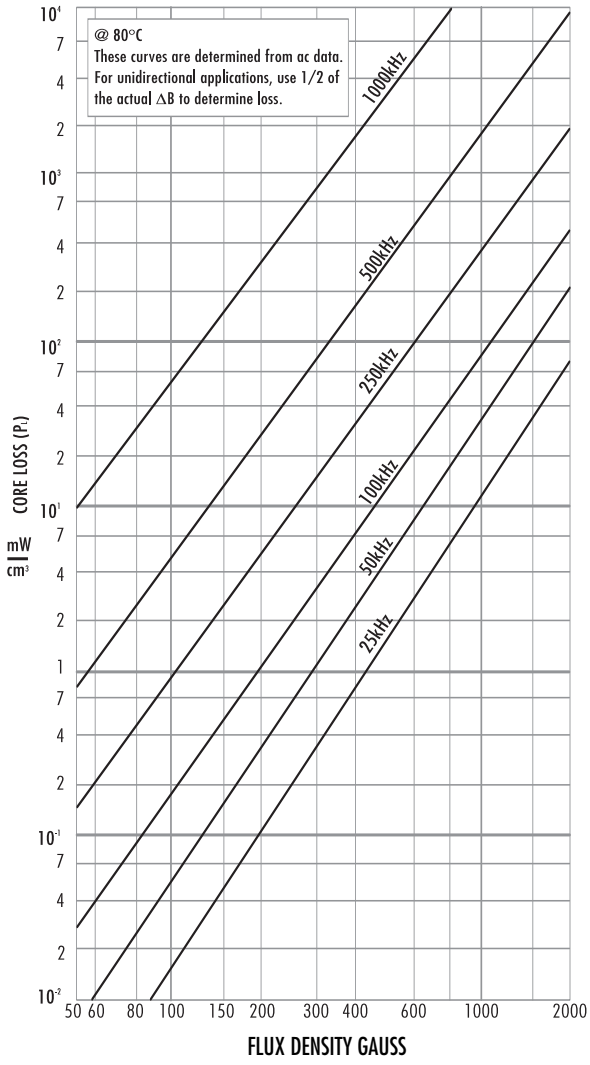
CORE LOSS vs. TEMPERATURE



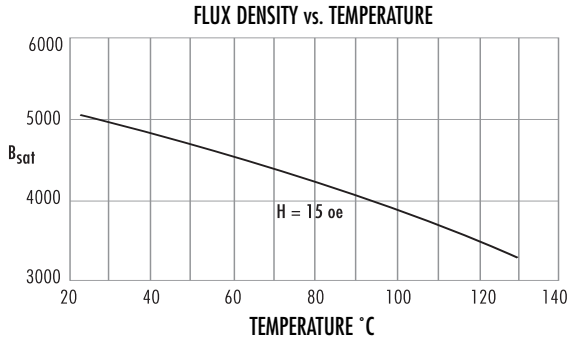
PERMEABILITY vs. FLUX DENSITY



CORE LOSS vs. FLUX DENSITY



FLUX DENSITY vs. TEMPERATURE



See Page 3.11 for B-H Data

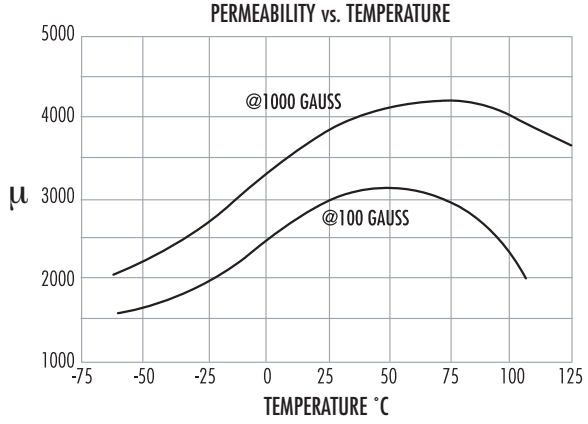
F Material

Saturation Flux Density - gausses 4,900 (at 15 oersted., 25°C) (490 mT)
Coercive Force - oersted 0.20 (16A/m)
Curie Temperature. . . . . 210°C

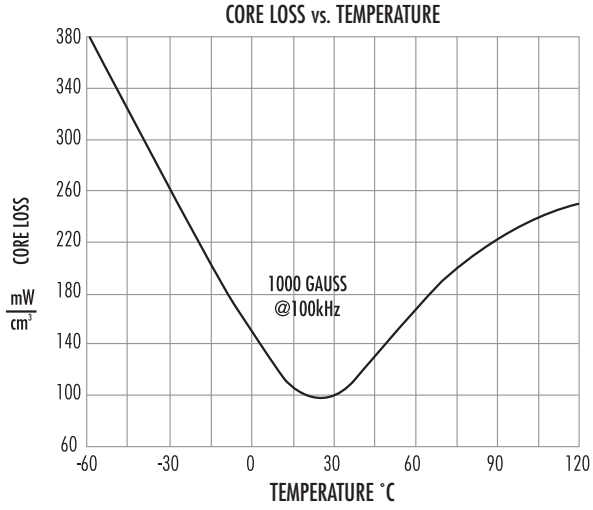
μ_i 3,000 ±20%

NOTE: The core loss curves are developed from empirical data. For best results and highest accuracy, use them. The formula on page 3.11 yields a fair approximation and can be useful in computer programs.

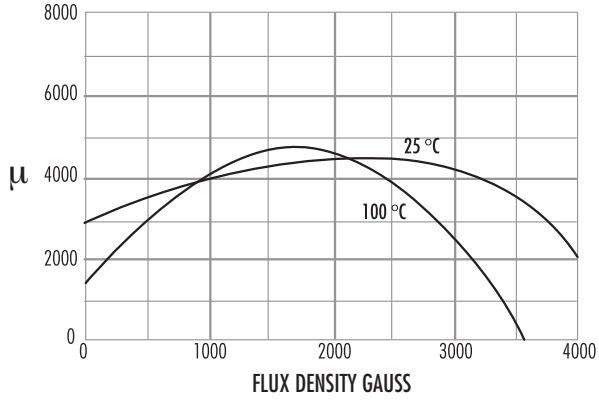
PERMEABILITY vs. TEMPERATURE



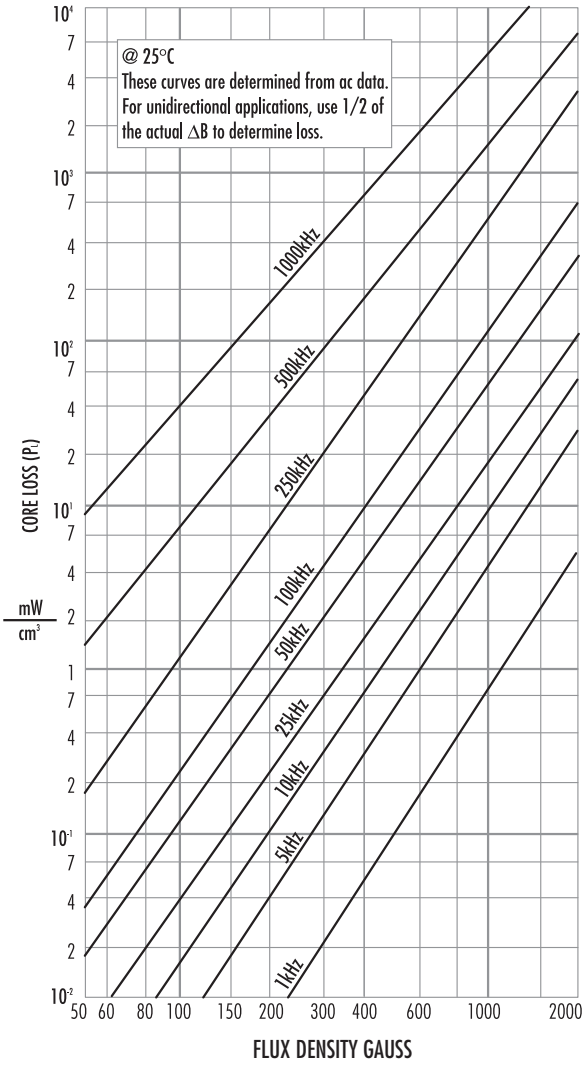
CORE LOSS vs. TEMPERATURE



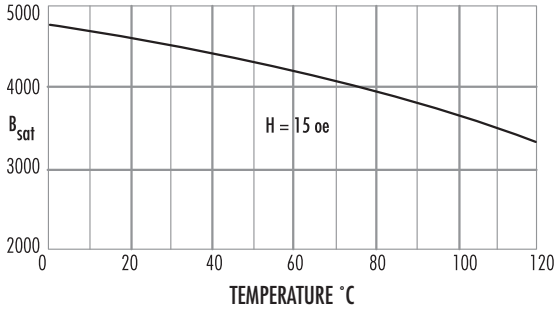
PERMEABILITY vs. FLUX DENSITY



CORE LOSS vs. FLUX DENSITY



FLUX DENSITY vs. TEMPERATURE



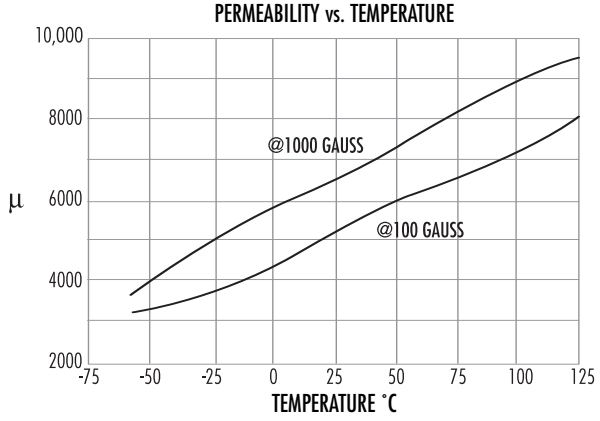
See Page 3.12 for B-H Data

Saturation Flux Density - gausses 4,300 (at 15 oersted, 25˚C) (430 mT)
Coercive Force - oersted. 0.1 (8A/m)
Curie Temperature. . . . . 140˚C
Disaccomadation Factor . . . . . $<3.0 \times 10^{-6}$

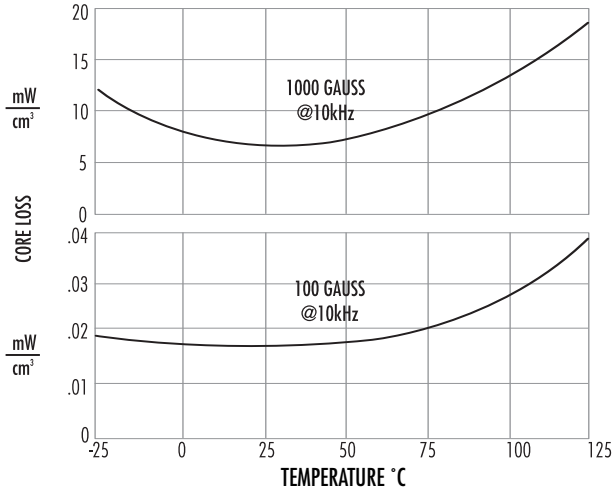
NOTE: The core loss curves are developed from empirical data.
For best results and highest accuracy, use them. The formula on page 3.10 yields a fair approximation and can be useful in computer programs.

μ_i 5,000 ±20%

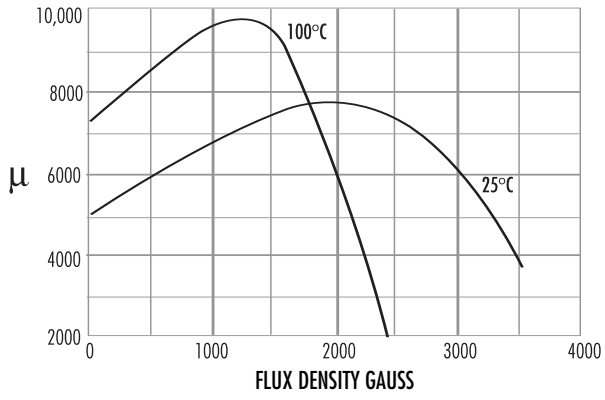
PERMEABILITY vs. TEMPERATURE



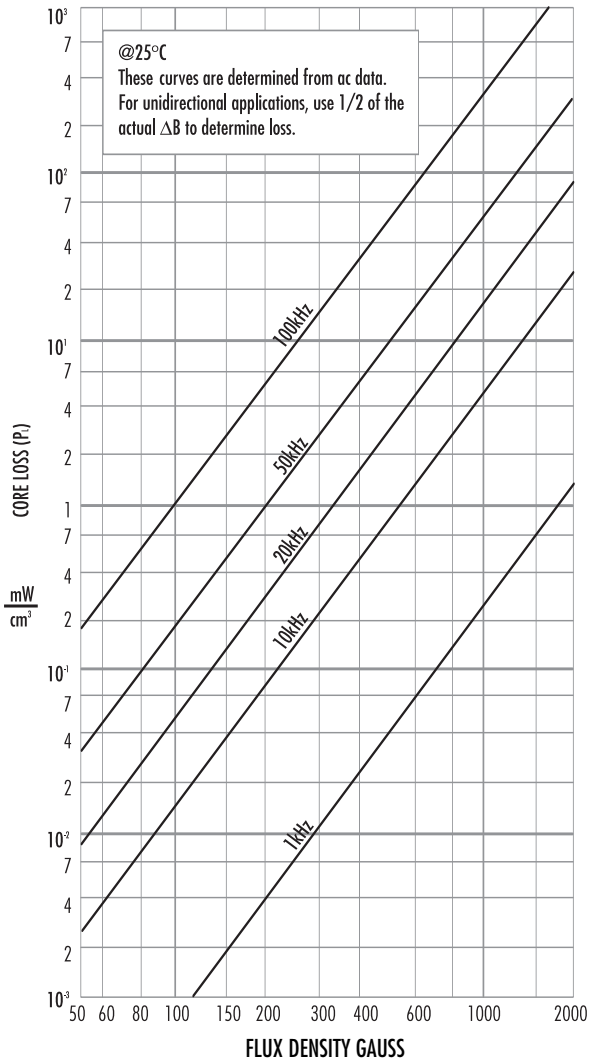
CORE LOSS vs. TEMPERATURE



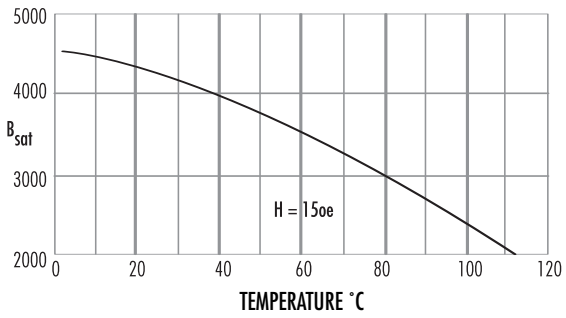
PERMEABILITY vs. FLUX DENSITY



CORE LOSS vs. FLUX DENSITY



FLUX DENSITY vs. TEMPERATURE



See Page 3.11 for B-H Data

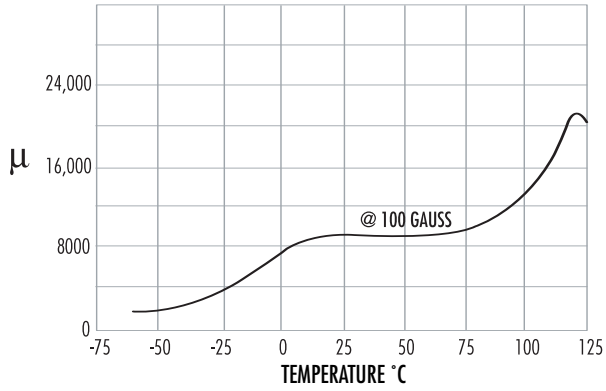
W Material

Saturation Flux Density - gausses 4,300 (at 15 oersted, 25°C) (430 mT)
Coercive Force - oersted. 0.04 (3A/m)
Curie Temperature . . . . . 125°C
Disaccomadation factor. . . . . <3 x 10^{-6}

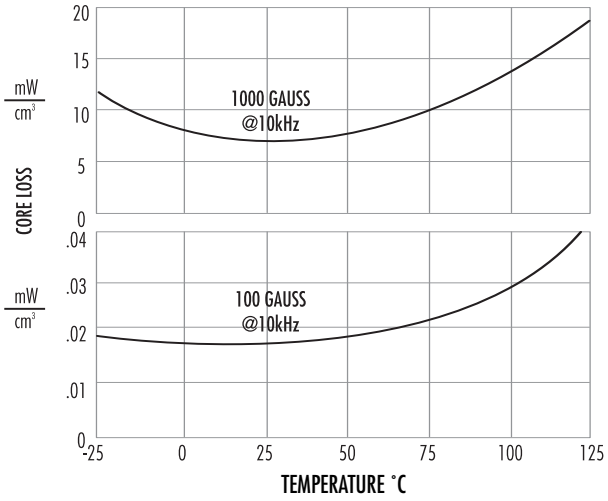
μ_i 10,000 ±30% at 10kHz

NOTE: The core loss curves are developed from empirical data. For best results and highest accuracy, use them. The formula on page 3.10 yields a fair approximation and can be useful in computer programs.

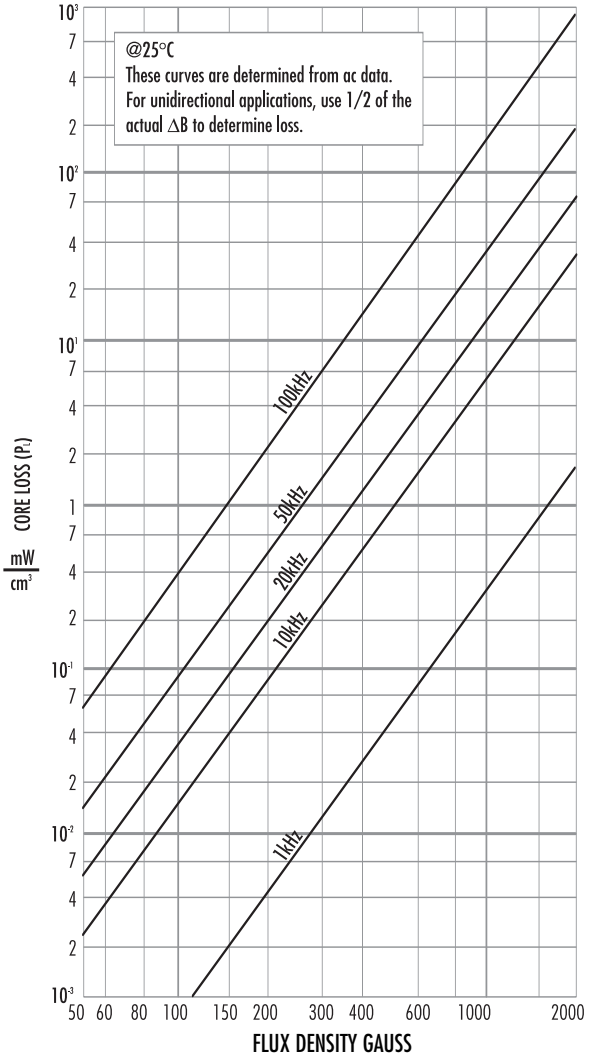
PERMEABILITY vs. TEMPERATURE



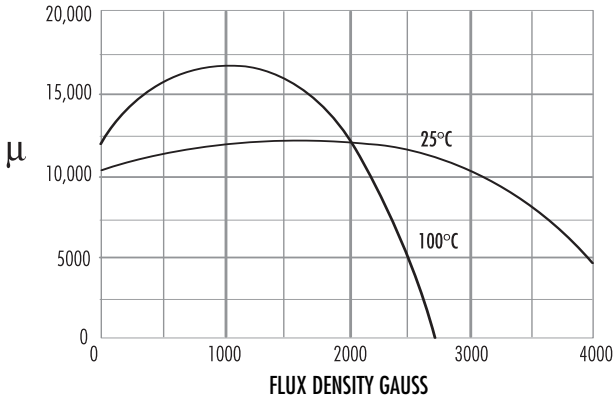
CORE LOSS vs. TEMPERATURE



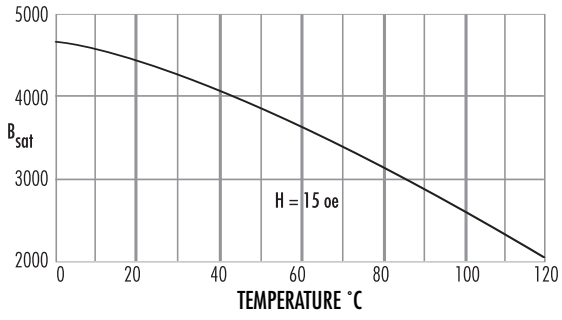
CORE LOSS vs. FLUX DENSITY



PERMEABILITY vs. FLUX DENSITY



FLUX DENSITY vs. TEMPERATURE



See Page 3.11 for B-H Data

Core Loss Equation

Included on pages Pages 3.4-3.9 are material characteristics for the various Magnetics power and inductor materials. For computer programming purposes, the core loss curves can be represented by the equation below.

The factors indicated in the chart are split into discrete frequency ranges, so that the equation offers a close approximation to the core loss curves on the above pages.

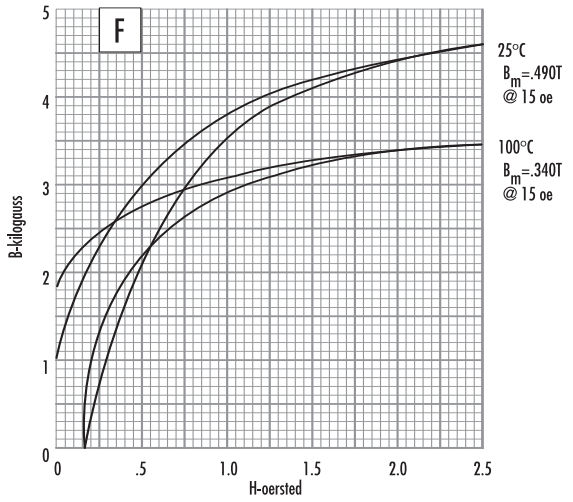
CORE LOSS EQUATION: $P_L = af^cB^d$

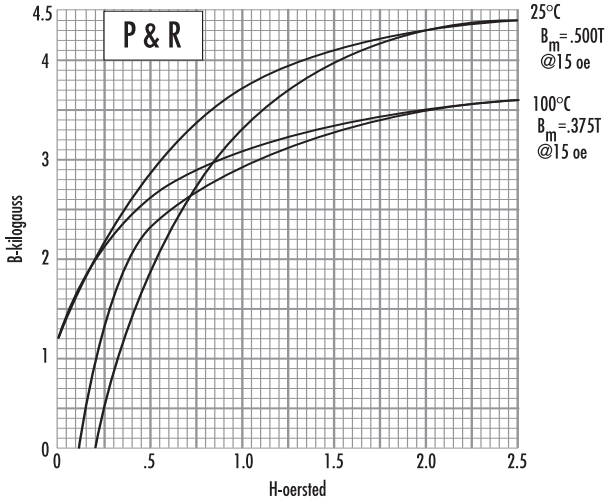
P is in mW/cm^3
B is in kG
f is in kHz

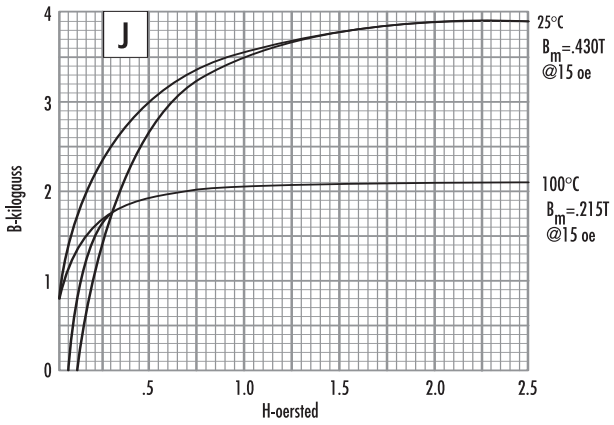
FACTORS APPLIED TO THE ABOVE FORMULA

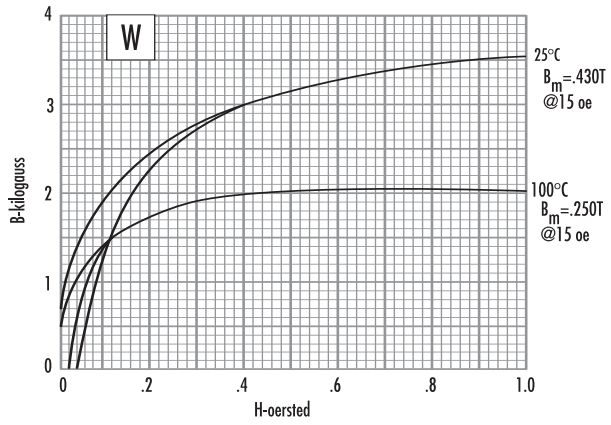
		a	c	d
R Material	f<100 kHz	0.074	1.43	2.85
	100 kHz ≤f<500 kHz	0.036	1.64	2.68
	f≥500 kHz	0.014	1.84	2.28
P Material	f<100 kHz	0.158	1.36	2.86
	100 kHz≤f<500 kHz	0.0434	1.63	2.62
	f≥500 kHz	$7.36*10^{-7}$	3.47	2.54
F Material	f<10 kHz	0.790	1.06	2.85
	10 kHz≤f<100 kHz	0.0717	1.72	2.66
	100 kHz≤f<500 kHz	0.0573	1.66	2.68
	f≥500 kHz	0.0126	1.88	2.29
J Material	f≤20 kHz	0.245	1.39	2.50
	f>20 kHz	0.00458	2.42	2.50
W Material	f≤20 kHz	0.300	1.26	2.60
	f>20 kHz	0.00382	2.32	2.62
H Material	f≤20 kHz	0.148	1.50	2.25
	f>20 kHz	0.135	1.62	2.15

B vs. H Curves (dc)









CONVERSION TABLE

MULTIPLY NUMBER OF	BY	TO OBTAIN
Oersteds	79.5	A/m
Oersteds	0.795	A/cm
Gausses	0.100	milli Teslas
Gausses	10^{-4}	Teslas
Teslas	10^{4}	Gausses

Ferrite Blocks

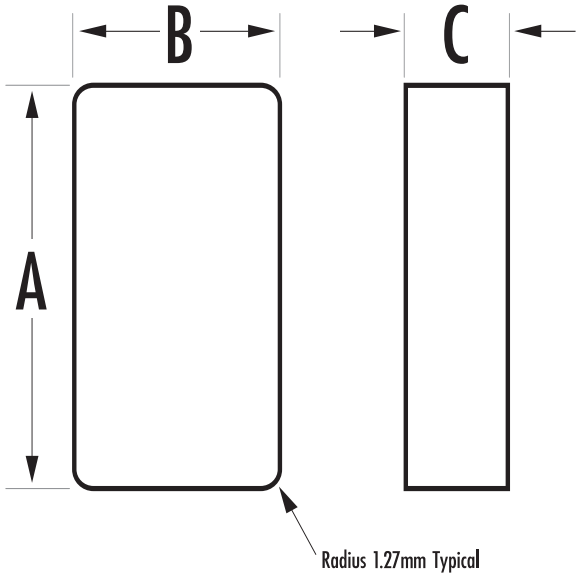
FEATURES OF MAGENTICS FERRITE BLOCKS

- LOW POROSITY
- EXTREME HARDNESS
- UNIFORM PHYSICAL PROPERTIES
- HIGH DENSITY
- EASE OF MACHINING

Ferrites can be pressed in block form and then machined into intricate shapes. Where large sizes are required, it is possible to assemble them from two or more smaller machined or pressed sections; the variety of sizes and shapes becomes limitless.

Without sacrificing magnetic properties, many manufacturing operations can be performed on ferrites, providing strict dimensional or mechanical tolerances:

Surface grinding
Cutting, slicing, slotting
ID and OD machining
Hole drilling
Special machining
Assembly of smaller parts



MATERIAL SELECTION

J material offers high permeability, see page 3.7.
R material is suitable for power applications, see page 3.4.

STANDARD BLOCKS and HOW TO ORDER

PART NUMBER	Dimensions (mm)			Wt. (gms)	Vol. (cm^3)
	A	B	C		
J42500FB	63.5	2.54	12.7	98.3	20.5
J46213FB	62.23	49.53	12.7	188	39.2
R42500FB	63.5	25.4	12.7	98.3	20.5
R46213FB	62.23	49.53	12.7	188	39.2

Notes

Power Design

Section 4

Ferrite is an ideal core material for transformers, inverters and inductors in the frequency range 20 kHz to 3 MHz, due to the combination of low core cost and low core losses.

Ferrite is an excellent material for high frequency (20 kHz to 3 MHz) inverter power supplies. Ferrites may be used in the saturating mode for low power, low frequency operation (<50 watts and 10 kHz). For high power operation a two transformer design, using a tape wound core as the saturating core and a ferrite core as the output transformer, offers maximum performance. The two transformer design offers high efficiency excellent frequency stability, and low switching losses.

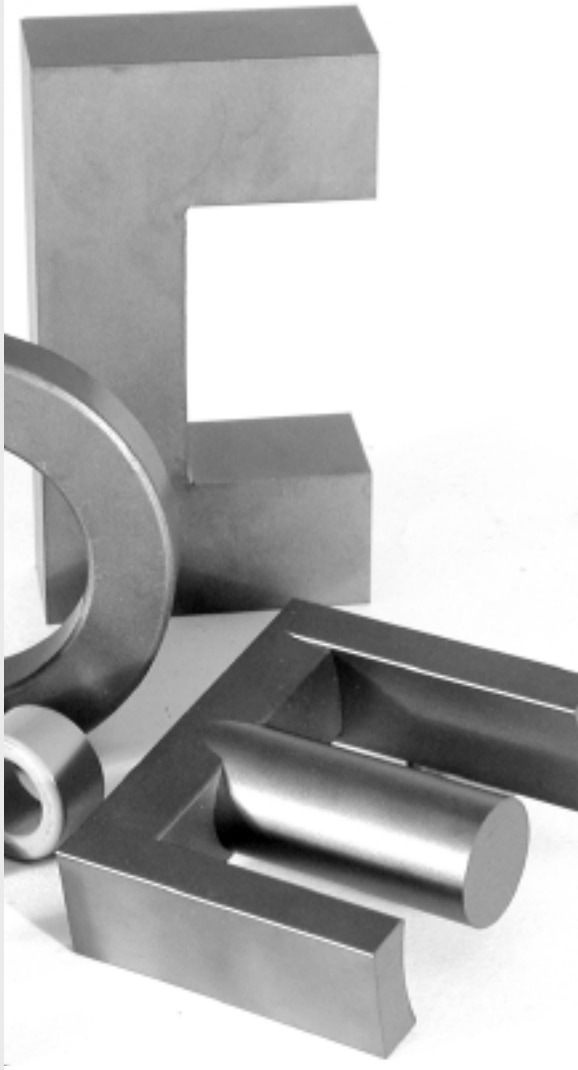
Ferrite cores may also be used in fly-back transformer designs, which offer low core cost, low circuit cost and high voltage capability. Powder cores (MPP, High Flux, Kool Mμ®) offer soft saturation, higher B_{max} and better temperature stability and may be the best choice in some flyback applications or inductors.

High frequency power supplies, both inverters and converters, offer lower cost, and lower weight and volume than conventional 60 hertz and 400 hertz power sources.

Many cores in this section are standard types commonly used in the industry. If a suitable size for your application is not listed, Magnetics will be happy to review your needs, and, if necessary, quote tooling where quantities warrant.

Cores are available gapped to avoid saturation under dc bias conditions. J and W materials are available with lapped surfaces.

Bobbins for many cores are available from Magnetics. VDE requirements have been taken into account in bobbin designs for EC, PQ and metric E Cores. Many bobbins are also available commercially.



Materials and Geometries

CORE MATERIALS

F, P, and R materials, offering the lowest core losses and highest saturation flux density, are most suitable for high power/high temperature operation. P material core losses decrease with temperature up to 70°C; R material losses decrease up to 100°C.

J and W materials offer high impedance for broad transformers, and are also suitable for low-level power transformers.

FERRITE
POWER MATERIALS SUMMARY

		F	P	R	J	W+
μi (20 gauss)	25°C	3,000	2,500	2,300	5,000	10,000
μp (2000 gauss)	100°C	4,600	6,500	6,500	5,500	12,000
Saturation Flux Density (B_m Gauss)	25°C	4,900	5,000	5,000	4,300	4,300
	100°C	3,700	3,900	3,700	2,500	2,500
Core Loss (mw/cm^3) (Typical) @100 kHz, 1000 Gauss	25°C	100	125	140		
	60°C	180	80*	100		
	100°C	225	125	70		

*@80°C +@10kHz

CORE GEOMETRIES

POT CORES

Pot Cores, when assembled, nearly surround the wound bobbin. This aids in shielding the coil from pickup of EMI from outside sources. The pot core dimensions all follow IEC standards so that there is interchangeability between manufacturers. Both plain and printed circuit bobbins are available, as are mounting and assembly hardware. Because of its design, the pot core is a more expensive core than other shapes of a comparable size. Pot cores for high power applications are not readily available.

DOUBLE SLAB AND RM CORES

Slab-sided solid center post cores resemble pot cores, but have a section cut off on either side of the skirt. Large openings allow large size wires to be accommodated and assist in removing heat from the assembly. RM cores are also similar to pot cores, but are designed to minimize board space, providing at least a 40% savings in mounting area. Printed circuit or plain bobbins are available. Simple one piece clamps allow simple assembly. Low profile is possible. The solid center post generates less core loss and this minimizes heat buildup.

EP CORES

EP Cores are round center-post cubical shapes which enclose the coil completely except for the printed circuit board terminals. The particular shape minimizes the effect of air gaps formed at mating surfaces in the magnetic path and provides a larger volume ratio to total space used. Shielding is excellent.

PQ CORES

PQ cores are designed especially for switched mode power supplies. The design provides an optimized ratio of volume to winding area and surface area. As a result, both maximum inductance and winding area are possible with a minimum core size. The cores thus provide maximum power output with a minimum assembled transformer weight and volume, in addition to taking up a minimum amount of area on the printed circuit board. Assembly with printed circuit bobbins and one piece clamps is simplified. This efficient design provides a more uniform cross-sectional area; thus cores tend to operate with fewer hot spots than with other designs.

E CORES

E cores are less expensive than pot cores, and have the advantages of simple bobbin winding plus easy assembly. Gang winding is possible for the bobbins used with these cores. E cores do not, however, offer self-shielding. Lamination size E shapes are available to fit commercially available bobbins previously designed to fit the strip stampings of standard lamination sizes. Metric and DIN sizes are also available. E cores can be pressed to different thickness, providing a selection of cross-sectional areas. Bobbins for these different cross sectional areas are often available commercially.

E cores can be mounted in different directions, and if desired, provide a low-profile. Printed circuit bobbins are available for low-profile mounting. E cores are popular shapes due to their lower cost, ease of assembly and winding, and the ready availability of a variety of hardware.

PLANAR E CORES

Planar E cores are offered in all of the IEC standard sizes, as well as a number of other sizes. Magnetics R material is perfectly suited to planar designs due to its low AC core losses and minimum losses at 100°C. Planar designs typically have low turns counts and favorable thermal dissipation compared with conventional ferrite transformers, and as a consequence the optimum designs for space and efficiency result in higher flux densities. In those designs, the performance advantage of R material is especially significant.

The leg length and window height (B and D dimensions) are adjustable for specific applications without new tooling. This permits the designer to adjust the final core specification to exactly accommodate the planar conductor stack height, with no wasted space. Clips and clip slots are avail-

Materials and Geometries

able in many cases, which is especially useful for prototyping. I-cores are also offered standard, permitting further flexibility in design. E-I planar combinations are useful to allow practical face bonding in high volume assembly, and for making gapped inductor cores where fringing losses must be carefully considered due to the planar construction.

EC, ETD, EER AND ER CORES

These shapes are a cross between E cores and pot cores. Like E cores, they provide a wide opening on each side. This gives adequate space for the large size wires required for low output voltage switched mode power supplies. It also allows for a flow of air which keeps the assembly cooler. The center post is round, like that of the pot core. One of the advantages of the round center post is that the winding has a shorter path length around it (11% shorter) than the wire around a square center post with an equal area. This reduces the losses of the windings by 11% and enables the core to handle a higher output power. The round center post also eliminates the sharp bend in the wire that occurs with winding on a square center post.

TOROIDS

Toroids are economical to manufacture; hence, they are least costly of all comparable core shapes. Since no bobbin is required, accessory and assembly costs are nil. Winding is done on toroidal winding machines. Shielding is relatively good.

SUMMARY

Ferrite geometries offer a wide selection in shapes and sizes. When choosing a core for power applications, parameters shown in Table 1 should be evaluated.

TABLE 1: FERRITE CORE COMPARATIVE GEOMETRY CONSIDERATIONS

	POT CORES	DOUBLE SLAB, RM CORES	EP CORES	PQ CORES	E CORES	EC, ETD, EER, ER CORES	TOROIDS
See Catalog Section	6	7-8	9	10	11	12	13
Core Cost	High	High	Medium	High	Low	Medium	Very Low
Bobbin Cost	Low	Low	High	High	Low	Medium	None
Winding Cost	Low	Low	Low	Low	Low	Low	High
Winding Flexibility	Good	Good	Good	Good	Excellent	Excellent	Fair
Assembly	Simple	Simple	Simple	Simple	Simple	Medium	None
Mounting Flexibility**	Good	Good	Good	Fair	Good	Fair	Poor
Heat Dissipation	Poor	Good	Poor	Good	Excellent	Good	Good
Shielding	Excellent	Good	Excellent	Fair	Poor	Poor	Good

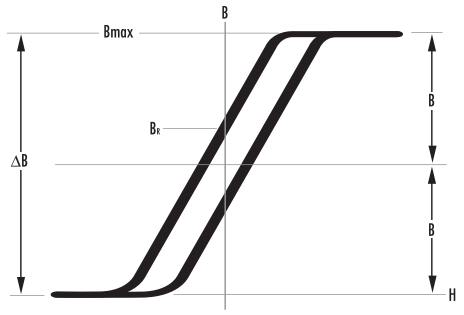
** Hardware is required for clamping core halves together and mounting assembled core on a circuit board or chassis.

General Formulas

TRANSFORMER CORE SIZE SELECTION

The power handling capacity on a transformer core can be determined by its WaAc product, where Wa is the available core window area, and Ac is the effective core cross-sectional area.

FIGURE 1



The WaAc/power-output relationship is obtained by starting with Faraday's Law:

$E=4B\ Ac\ Nf \times 10^{-8}$ (square wave) (1)

$E=4.44\ BAc\ Nf \times 10^{-8}$ (sine wave) (1a)

Where:
- E=applied voltage (rms)
- B=flux density in gauss
- Ac=core area in cm^2
- N=number of turns
- f=frequency in Hz
- Aw=wire area in cm^2
- Wa=window area in cm^2:
  - Core window for toroids
  - Bobbin window for other cores
- C=current capacity in cm^2/amp
- K=winding factor
- I=current (rms)
- P_i=input power
- P_o=output power
- e=transformer efficiency

Solving (1) for NAc

$$NAc=\frac{E \times 10^8}{4Bf} \quad (2)$$

The winding factor

$$K=\frac{NAw}{Wa} \text{ thus } N=\frac{KWa}{Aw} \text{ and } NAc=\frac{KWaAc}{Aw} \quad (3)$$

Combining (2) and (3) and solving for WaAc:

$$WaAc=\frac{E\ Aw \times 10^8}{4B\ fK}, \text{ where WaAc=cm}^4 \quad (4)$$

In addition:

$C=Aw/I$ or $Aw=IC$ $e=P_o/P_i$ $P_i=EI$

Thus:

$E\ Aw=EIC=P_i\ C=P_o\ C/e$

Substituting for EAw in (4), we obtain:

$$WaAc=\frac{P_o C \times 10^8}{4eB\ fK}$$

Assuming the following operational conditions:

$C=4.05 \times 10^{-3} cm^2$/Amp (square wave) and
$2.53 \times 10^{-3} cm^2$/Amp (sine wave) for toroids

$C=5.07 \times 10^{-3} cm^2$/Amp (square wave) and
$3.55 \times 10^{-3} cm^2$/Amp (sine wave) for pot cores and E-U-I cores.

e= 90% for transformers

e= 80% for inverters (including circuit losses)

K= 0.30 for pot cores and E-U-I cores (primary side only)

K= 0.20 for toroids (primary side only)

With larger wire sizes, and/or higher voltages, these K factors may not be obtainable. To minimize both wire losses and core size, the window area must be full.

NOTE: For Wire Tables and turns/bobbin data, refer to pgs 5.8.

We obtain the basic relationship between output power and the WaAc product:

$$WaAc=\frac{k' P_O \times 10^8}{Bf}, \text{ Where } k'=\frac{C}{4eK}$$

For square wave operation

k' = .00633 for toroids, k' = .00528 for pot cores, k' = .00528 for E-U-I cores

A core selection chart (Table 3) using WaAc can be found on page 4.7. In addition a A core selection procedure which varies by topology can also be found on page 4.8. This procedure is based on the book "Switching Power Supply Design" by A.I. Pressman. While the formula above allows WaAc to be adjusted based on selected core geometry, the Pressman approach uses topology as the key consideration and allows the designer to specify current density.

GENERAL INFORMATION

An ideal transformer is one that offers minimum core loss while requiring the least amount of space. The core loss of a given core is directly effected by the flux density and the frequency. Frequency is the most important characteristic concerning a transformer. Faraday's Law illustrates that as frequency increases, the flux density decreases proportionately. Core losses decrease more when the flux density drops than when frequency rises.

For example, if a transformer were run at 250 kHz and 2 kG on R material at 100°C, the core losses would be approximately 400 mW/cm^3. If the frequency were doubled and all other parameters untouched, by virtue of Faraday's law, the flux density would become 1kG and the resulting core losses would be approximately 300mW/cm^3.

Typical ferrite power transformers are core loss limited in the range of 50-200mW/cm^3. Planar designs can be run more aggressively, up to 600 mW/cm^3, due to better power dissipation and less copper in the windings.

Specific Circuit Examples

CIRCUIT TYPES

Some general comments on the different circuits are:

The push-pull circuit is efficient because it makes bi-directional use of a transformer core, providing an output with low ripple. However, circuitry is more complex, and the transformer core saturation can cause transistor failure if power transistors have unequal switching characteristics.

Feed forward circuits are low in cost, using only one transistor. Ripple is low because relatively steady state current flows in the transformer whether the transistor is ON or OFF. The flyback circuit is simple and inexpensive. In addition, EMI problems are less. However, the transformer is larger and ripple is higher.

TABLE 2 CIRCUIT TYPE SUMMARY

CIRCUIT	ADVANTAGES	DISADVANTAGES
Push-pull	Medium to high power Efficient core use Ripple and noise low	More components
Feed forward	Medium power Low cost Ripple and noise low	Core use inefficient
Flyback	Lowest cost Few components	Ripple and noise high Regulation poor Output power limited (< 100 watts)

PUSH-PULL CIRCUIT

A typical push-pull circuit is shown in Figure 2A. The input signal is the output of an IC network, or clock, which switches the transistors alternately ON and OFF. High frequency square waves on the transistor output are subsequently rectified, producing dc.

FIGURE 2A – TYPICAL PUSH-PULL SPS CIRCUIT

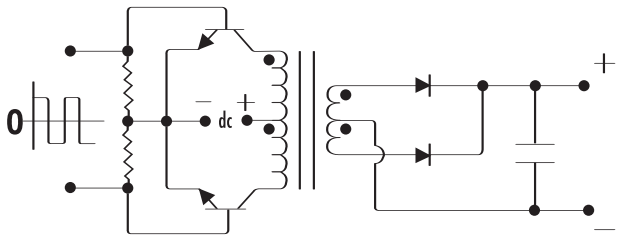
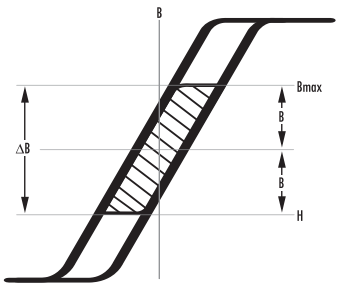


FIGURE 2B – HYSTERESIS LOOP OF MAGNETIC

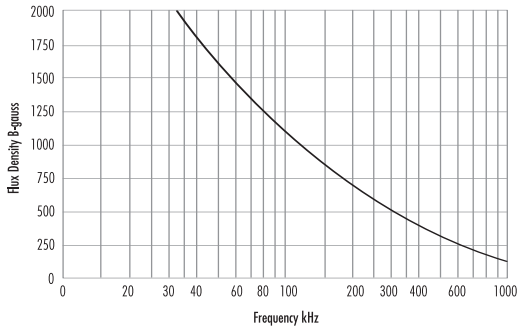


CORE IN PUSH-PULL CIRCUIT

For ferrite transformers, at 20 kHz, it is common practice to apply equation (4) using a flux density (B) level of ±2 kG maximum. This is illustrated by the shaded area of the Hysteresis Loop in Figure 2B. This B level is chosen because the limiting factor in selecting a core at this frequency is core loss. At 20 kHz, if the transformer is designed for a flux density close to saturation (as done for lower frequency designs), the core will develop an excessive temperature rise. Therefore, the lower operating flux density of 2 kG will usually limit the core losses, thus allowing a modest temperature rise in the core.

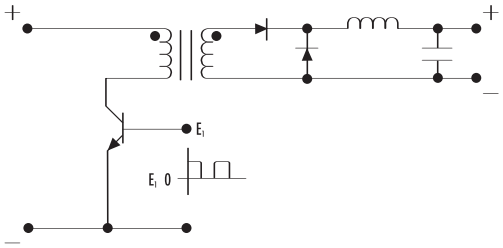
Above 20 kHz, core losses increase. To operate the SPS at higher frequencies, it is necessary to operate the core flux levels lower than ±2 kg. Figure 3 shows the reduction in flux levels for MAGNETICS "P" ferrite material necessary to maintain constant 100mW/cm^3 core losses at various frequencies, with a maximum temperature rise of 25°C.

FIGURE 3



FEED FORWARD CIRCUIT

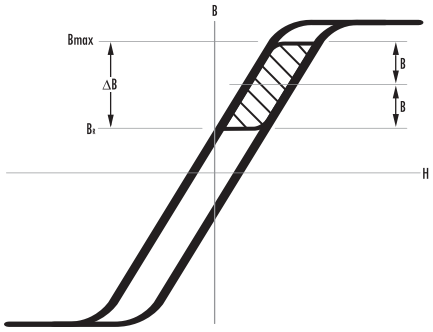
FIGURE 4A – TYPICAL FEED FORWARD SPS CIRCUIT



In the feed forward circuit shown in Figure 4A, the transformer operates in the first quadrant of the Hysteresis Loop. (Fig 4B). Unipolar pulses applied to the semiconductor device cause the transformer core to be driven from its B_R value toward saturation. When the pulses are reduced to zero, the core returns to its B_R value. In order to maintain a high efficiency, the primary inductance is kept high to reduce magnetizing current and lower wire losses. This means the core should have a zero or minimal air gap.

Specific Circuit Examples

FIGURE 4B
HYSTERESIS LOOP OF MAGNETIC CORE IN FEED FORWARD CIRCUIT

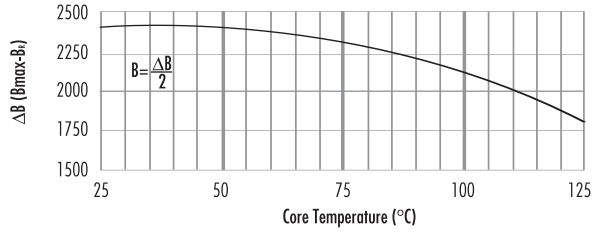


For ferrites used in this circuit, ΔB (or B max-B_R) is typically 2400 gauss or B (as applied to Equation 4) is ±1200 gauss as shown in Figure 4B. In the push-pull circuit, it was recommended that the peak flux density in the core should not exceed B = ±2000 gauss in order to keep core losses small. Because of the constraints of the Hysteresis Loop, the core in the feed forward circuit should not exceed a peak value of B = ±1200 gauss.

Core selection for a feed forward circuit is similar to the push-pull circuit except that B for Equation 4 is now limited to ±1200 gauss.

If the transformer operating temperature is above 75˚, the value of B will be further reduced. Figure 5 shows the variation of ΔB with temperature. Therefore the recommended ΔB value of 2400 (B= ±1200) gauss has to be reduced, the amount depending on the final projected temperature rise of the device.

FIGURE 5



The value of ΔB remains virtually unchanged over a large frequency range above 20 kHz. However, at some frequency, the adjusted value of B, as shown in Figure 3, will become less than the B determined by the above temperature considerations (Figure 5). Above this frequency, the B used to select a core will be the value obtained form Figure 3.

FLYBACK CIRCUIT

A typical schematic is shown in Figure 6A. Unipolar pulses cause dc to flow through the core winding, moving the flux in the core from B_R towards saturation (Fig. 6B). When the pulses go to zero the flux travels back to B_R as in the feed forward design. However, the difference between the feed forward and the flyback circuit is that the flyback requires the transformer to act as an energy storage device as well as to perform the usual transformer functions. Therefore, to be an effective energy storage unit, the core must not saturate and is usually a gapped structure.

FIGURE 6A
TYPICAL FLYBACK REGULATOR CIRCUIT

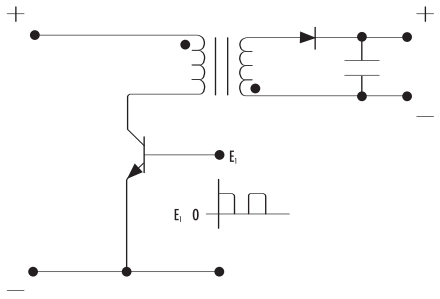
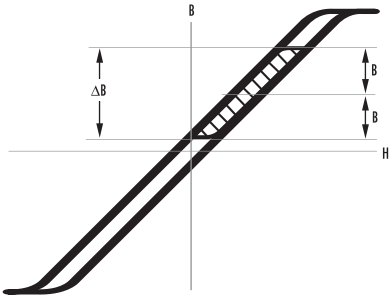


FIGURE 6B
HYSTERESIS LOOP OF MAGNETIC CORE IN FLYBACK CIRCUIT



In most designs, the air gap is large; therefore, B_R is small as noted on the Hysteresis Loop in Figure 6B and can be considered zero. The maximum flux density available is approximately 3600. This means ΔB is 3600 or B = ±1800 gauss. Core selection for this circuit can be done using Equation 4. The B value in Equation 4 is ±1800 gauss at 20 kHz and is used until a higher frequency (Figure 3) dictates a lower B required.

GENERAL FORMULA – CORE SELECTION FOR DIFFERENT TOPOLOGIES

The following formula has been gained from derivations in Chapter 7 of A.I. Pressman's book "Switching Power Supply Design" (see Reference No. 13, pg 14.4.)

$$WaAc = \frac{P_o D_{cma}}{K_t B_{max} f}$$

WaAc = Product of window area and core area (cm^4)
Po = Power Out (watts)
Dcma = Current Density (cir. mils/amp)
B_{max} = Flux Density (gauss)
f = Frequency (hertz)
K_t = Topology constant (for a space factor of 0.4):

Forward converter = .0005	Push-Pull = .001
Half-bridge = .0014	Full-bridge = .0014
Flyback = .00033 (single winding)	
Flyback = .00025 (multiple winding)	

For individual cores, WaAc is listed in this catalog under "Magnetic Data." Choice of B_{max} at various frequencies, D_{cma} and alternative transformer temperature rise calculation schemes are also discussed in Chapter 7 of the Pressman book.

Area Product Distribution (WaAc*)

TABLE 3 – FERRITE CORE SELECTION BY AREA PRODUCT DISTRIBUTION

WaAc* (cm^4)	PC	RS,DS,HS	RM, EP	RM SOLID	PQ	EE LAM	EE,EEM,EFD	EE,EI PLANAR	UU, UI	ETD, EER	EC	TC
See Section	6	7	8/9	8	10	11	11	11	11	12	12	13
0.001	40704							41309 (EE)				40601
0.002	40905		40707 (EP)				40904 40906					40603
0.004												
0.007	41107		41110(RM)									40705
0.010		41408 (RS,DS)	41010(EP)			41203			41106 (UI)		41003	41005
0.020	41408		41510(RM) 41313(EP)	41510		41205	41208 41209 41515 41707		41106(UU)		40907	41303
0.040			41812(RM)	41812			41709 42110					41206 41305
0.070	41811	42311 (RS,DS,HS)	41717(EP)		42610	41808						41306 41605
0.100	42213	42318 (HS)	42316(RM)	42316	42016 42614	41810 42510		42216(EE)				
0.200	42616	42318 (RS,DS) 42616 (RS,DS,HS)	42819(RM) 42120(EP)		42020 42620 43214		42211 42810 43009 42523	43618(EI) 43208(EI)	42515 (UI)			41809 42206
0.400		43019 (RS,DS,HS)		42819	42625	42520	42515 43007	43618(EE) 43208(EE)				42207
0.700	43019		43723(RM)		43220	43515	43013		42220(UU) 42512(UU) 42515(UU)	43517		42507
1.00	43622	43622 (RS,DS,HS)		43723	43230	44317	43520 43524 44011	44308(EI)	42530(UU)	44119	43434 43521(EER)	42908
2.00	44229 44529	44229 (RS,DS,HS)			43535	44721	44020 44924	44308(EE) 45810(EI)	44119(UU) 44121(UU)	45224 44216(EER)	43939 43615 44444 45032	43610 43813
4.00					44040	45724	44022 45021	46410(EI)	44125(UU) 44130(UU)	44949	44416	
7.00							45528 46016	45810(EE) 46409(EE)				
10.00							45530	46410(EE)		47035 47228		44916 44925 46113
20.00							48020				47054	47313 47325
40.00								49938(EE)				48613
100							49928		49925(UU) 49925(UI)			

*Bobbin window and core area product. For bobbins other than those in this catalog, WaAc may need to be recalculated.

Typical Power Handling

TABLE 4 – FERRITE CORE SELECTION LISTED BY TYPICAL POWER HANDLING CAPABILITIES (WATTS) (F, P AND R MATERIALS) (FOR PUSH-PULL SQUARE WAVE OPERATIONS, SEE NOTES BELOW)

WATTAGE											
@F= 20KHZ	@F= 50KHZ	@F= 100KHZ	@F= 250KHZ	POT-RS-RM CORES	DS CORES	EP CORES	PQ CORES	E-CORES	LOW-PROFILE PLANAR CORES	EC-ETD U CORES	TC TOROIDS
See Section				6/7/8	7	9	10	11	11	12	13
2	3	4	7	41408-PC		41313		41707	41709 42107 42110		41206 41303
5	8	11	21	41811-PC 42311-RS 42809-RM	42311	41717		41808	42610-PQ 42216-EC		41306 41605
12	18	27	53	42316-RM			42016	41810, 42211	42614-PQ		
13	20	30	59					42510			
15	22	32	62	42213-PC							
18	28	43	84	42318-RS	42318		42020		43618-E, I		42106
19	30	48	94		42616	42120			43208-E, I 44008-E, I		41809
26	42	58	113					42810, 42520			42206
28	45	65	127	42819-RM				42515			42109
30	49	70	137	42616-PC			42620				42207
33	53	80	156		43019				43618-EC		
40	61	95	185	43019-RS				43007	44008-EC		43205
42	70	100	195				42625		43208-EC		
48	75	110	215					43013			42212, 42507
60	100	150	293	43019-PC 43723-RM			43220	42530, 43009 43515 (E375)		43517 (EC35)	
70	110	170	332		43622				44308-E, I	43434 (ETD34)	42908
105	160	235	460					44011 (E40)			
110	190	250	480	43622-PC			43230				
120	195	270	525							44119 (EC41)	
130	205	290	570					43524, 43520		43521	43806
140	215	340	663					44317 (E21)			42915, 43113
150	240	380	741						44308-EC	43939 (ETD39)	
190	300	470	917		44229						43610
200	310	500	975					44721 (E625)		45032	
220	350	530	1,034				43535				43813
230	350	550	1,073					44020 (42/15)		44216	
260	400	600	1,170								43615
280	430	650	1,268	44229-PC				45021 (E50) 44924		45224 (EC52)	
300	450	700	1,365	44529-PC				44022 (42/20)	45810-EC	44444 (ETD44)	
340	550	850	1,658				44040				
360	580	870	1,697								43825
410	650	1,000	1,950					45724 (E75)	46410-E, I	44949 (ETD49)	44416
550	800	1,300	2,535					45528 (55/21) 46016 (E60)	45810-EC		44715
650	1,000	1,600	3,120								44916 44920
700	1,100	1,800	3,510					45530 (55/25)	46409-EC		
850	1,300	1,900	3,705						46410-EC		44925
900	1,500	2,000	3,900							47035 (EC70)	
1,000	1,600	2,500	4,875							45959 (ETD59)	46113
1,000	1,700	2,700	5,265					47228			
1,400	2,500	3,200	6,240								44932
1,600	2,600	3,700	7,215								47313
2,000	3,000	4,600	8,970					48020		47054	
2,800	4,200	6,500	12,675						49938-EC		48613
11,700	19,000	26,500	51,500							49925 (U)	

Above is for push-pull converter. De-rate by a factor of 3 or 4 for flyback. De-rate by a factor of 2 for feed-forward converter.

NOTE: Assuming Core Loss to be Approximately 100mW/cm^3,
B Levels Used in this Chart are:@ 20kHz-2000 gauss @ 50kHz-1300 gauss @ 100kHz-900 gauss @ 250kHz-700 gauss.

SEE PAGE 4.7 — Area Product Distribution

Considerations

TEMPERATURE CONSIDERATIONS

The power handling ability of a ferrite transformer is limited by either the saturation of the core material or, more commonly, the temperature rise. Core material saturation is the limiting factor when the operating frequency is below 20kHz. Above this frequency temperature rise becomes the limitation.

Temperature rise is important for overall circuit reliability. Staying below a given temperature insures that wire insulation is valid, that nearby active components do not go beyond their rated temperature, and overall temperature requirements are met. Temperature rise is also very important for the core material point of view. As core temperature rises, core losses can rise and the maximum saturation flux density decreases. Thermal runaway can occur causing the core to heat up to its Curie temperature resulting in a loss of all magnetic properties and catastrophic failure. Newer ferrite power materials, like P and R material, attempt to mitigate this problem by being tailored to have decreasing losses to temperature of 70°C and 100°C respectively.

CORE LOSS—One of the two major factors effecting temperature rise is core loss. In a transformer, core loss is a function of the voltage applied across the primary winding. In an inductor core, it is a function of the varying current applied through the inductor. In either case the operating flux density level, or B level, needs to be determined to estimate the core loss. With the frequency and B level known, core loss can be estimated from the material core loss curves. A material loss density of 100mw/cm^3 is a common operating point generating about a 40°C temperature rise. Operating at levels of 200 or 300 mw/cm^3 can also be achieved, although forced air or heat sinks may need to be used.

WINDING CONSIDERATIONS—Copper loss is the second major contributor to temperature rise. Wire tables can be used as a guide to estimate an approximate wire size but final wire size is dependent on how hot the designer allows the wire to get. Magnet wire is commonly used and high frequency copper loss needs to be considered. Skin effects causes current to flow primarily on the surface of the wire. To combat this, multiple strands of magnet wire, which have a greater surface area compared to a single heavier gauge, are used. Stranded wire is also easier to wind particularly on toroids. Other wire alternatives, which increase surface areas, are foil and litz wire. Foil winding allows a very high current density. Foil should not be used in a core structure with significant air gap since excessive eddy currents would be present in the foil. Litz wire is very fine wire bundled together. It is similar to stranded wire except the wire is woven to allow each strand to alternate between the outside and the inside of the bundle over a given length.

CORE GEOMETRY—The core shape also affects temperature and those that dissipate heat well are desirable. E core shapes dissipate heat well. Toroids, along with power shapes like the PQ, are satisfactory. Older telecommunication shapes, such as pot cores or RM cores, do a poor job of dissipating heat but do offer shielding advantages. Newer shapes, such as planar cores, offer a large flat surface ideal for attachment of a heat sink.

TRANSFORMER EQUATIONS

Once a core is chosen, the calculation of primary and secondary turns and wire size is readily accomplished.

$$Np = \frac{V_p \times 10^8}{4BAf} \qquad Ns = \frac{V_s}{V_p} Np$$

$$I_p = \frac{P_{in}}{P_{in}} = \frac{P_{out}}{eE_{in}} \qquad I_s = \frac{P_{out}}{E_{out}}$$

$$KWa = N_pA_{wp} = N_sA_{ws}$$

Where

A_{wp} = primary wire area A_{ws} = secondary wire area

Assume K = 0.40 for toroids; 0.60 for pot cores and E-U-I cores

Assume $N_pA_{wp} = 1.1\ N_sA_{ws}$ to allow for losses and feedback winding

$$\text{efficiency } e = \frac{P_{out}}{E_{in}} = \frac{P_{out}}{P_{out} + \text{wire losses} + \text{core losses}}$$

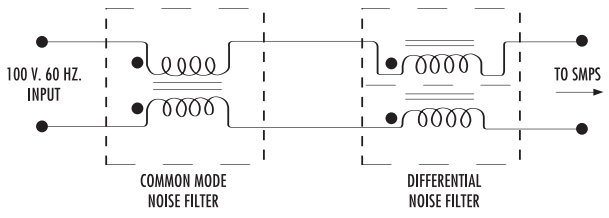
$$\text{Voltage Regulations (\%)} = \frac{R_s + (N_s/N_p)^2 R_p}{R_{load}} \times 100$$

INDUCTOR CORE SELECTION

EMI FILTERS

Switch Mode Power Supplies (SMPS) normally generate excessive high frequency noise which can affect electronic equipment like computers, instruments and motor controls connected to these same power lines. An EMI Noise Filter inserted between the power line and the SMPS eliminates this type of interference (Figure 8). A differential noise filter and a common mode noise can be in series, or in many cases, the common mode filter is used alone.

FIGURE 8



Inductor Design

INDUCTOR CORE SELECTION CONT...

COMMON MODE FILTER

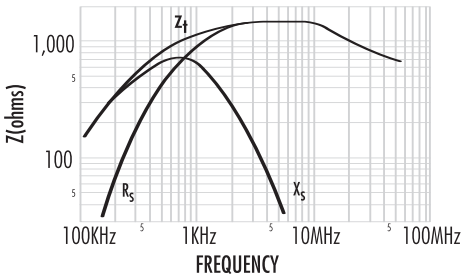
In a CMN filter, each winding of the inductor is connected in series with one of the input power lines. The connections and phasing of the inductor windings are such that flux created by one winding cancels the flux of the second winding. The insertion impedance of the inductor to the input power line is thus zero, except for small losses in the leakage reactance and the dc resistance of the windings. Because of the opposing fluxes, the input current needed to power the SMPS therefore will pass through the filter without any appreciable power loss.

Common mode noise is defined as unwanted high frequency current that appears in one or both input power lines and returns to the noise source through the ground of the inductor. This current sees the full impedance of either one or both windings of the CMN inductor because it is not canceled by a return current. Common mode noise voltages are thus attenuated in the windings of the inductor, keeping the input power lines free from the unwanted noise.

CHOOSING THE INDUCTOR MATERIAL

A SMPS normally operates above 20kHz. Unwanted noises generated in these supplies are at frequencies higher than 20kHz, often between 100kHz and 50MHz. The most appropriate and cost effective ferrite for the inductor is one offering the highest impedance in the frequency band of the unwanted noise. Identifying this material is difficult when viewing common parameters such as permeability and loss factor. Figure 9 shows a graph of impedance Z_t vs. frequency for a ferrite toroid, J42206TC wound with 10 turns.

FIGURE 9



The wound unit reaches its highest impedance between 1 and 10MHz. The series inductive reactance X_S and series resistance R_S (functions of the permeability and loss factor of the material) together generate the total impedance Z_t.

Figure 10 shows permeability and loss factor of the ferrite material in Figure 9 as a function of frequency. The falling off of permeability above 750kHz causes the inductive reactance to fall. Loss factor, increasing with frequency, cause the resistance to dominate the source of impedance at high frequencies.

Additional detailed brochures and inductors design software for this application are available from Magnetics.

FIGURE 10

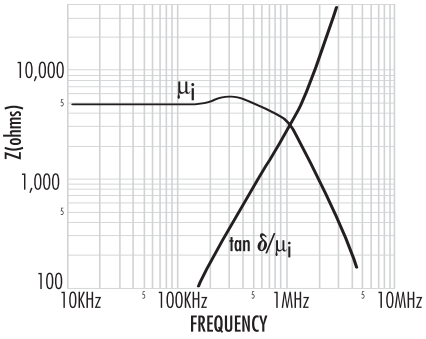
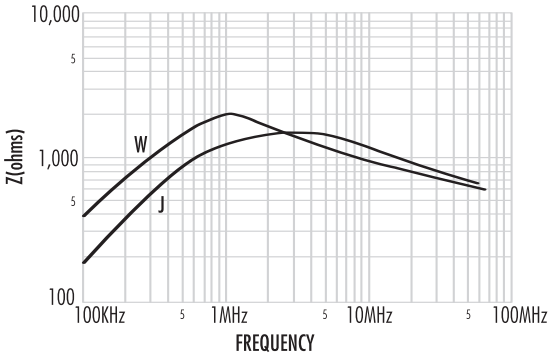


Figure 11 shows total impedance vs. frequency for two different materials. J material has a high total impedance over the range of 1 to 20MHz. It is most widely used for common mode filter chokes. Under 1MHz, W material has 20-50% more impedance than J. It is often used in place of J when low frequency noise if the major problem. For filter requirements specified at frequencies above and below 2MHz, either J or W is preferred.

FIGURE 11



CORE SHAPE

Toroids are most popular for a CMN filter as they are inexpensive and have low leakage flux. A toroid must be wound by hand (or individually on a toroid winding machine). Normally a non-metallic divider is placed between the two windings, and the wound unit is epoxied to a printed circuit header for attaching to a pc board.

An E core with its accessories is more expensive than a toroid, but assembly into a finished unit is less costly. Winding E core bobbins is relatively inexpensive. Bobbins with dividers for separating the two windings are available for pc board mounting.

E cores have more leakage inductance, useful for differential filtering in a common mode filter. E cores can be gapped to increase the leakage inductance, providing a unit that will absorb both the common mode and differential unwanted noise.

Inductor Design

CORE SELECTION

The following is a design procedure for a toroidal, single-layer common mode inductor, see Figure 12. To minimize winding capacitance and prevent core saturation due to asymmetrical windings, a single layer design is often used. This procedure assumes a minimum of thirty degrees of free spacing between the two opposing windings.

The basic parameters needed for common mode inductor design are current (I), impedance (Z_S), and frequency (f). The current determines the wire size. A conservative current density of 400 amps/cm^2 does not significantly heat up the wire. A more aggressive 800 amps/cm^2 may cause the wire to run hot. Selection graphs for both levels are presented.

The impedance of the inductor is normally specified as a minimum at a given frequency. This frequency is usually low enough to allow the assumption that the inductive reactance, X_S, provides the impedance, see Figure 9. Subsequently, the inductance, L_S can be calculated from:

$$L_S = \frac{X_S}{2\pi f} \qquad (1)$$

With the inductance and current known, Figures 13 and 14 can be used to select a core size based on the LI product, where L is the inductance in mH and I is the current in amps. The wire size (AWG) is then calculated using the following equation based on the current density (C_d) of 400 or 800 amps/cm^2:

$$AWG = -4.31 \times \ln\left(\frac{1.889I}{C_d}\right) \qquad (2)$$

The number of turns is determined from the core's A_L value as follows:

$$N = \left(\frac{L_S \times 10^6}{A_L}\right)^{1/2} \qquad (3)$$

DESIGN EXAMPLE

An impedance of 100Ω is required at 10kHz with a current of 3 amps. Calculating the inductance from equation 1, L_S = 1.59 mH.

With an LI product of 4.77 at 800 amps/cm^2, Figure 14 yields the core size for chosen material. In this example, W material is selected to give high impedance up to 1MHz, see Figure 11. Figure 14 yields the core W41809TC. Page 13.6 lists the core sizes and A_L values. Using an A_L of 12,200 mH/1,000 turns, equation 3 yields N = 12 turns per side. Using 800 amps/cm^2, equation 2 yields AWG = 21.

FIGURE 12: COMMON MODE INDUCTOR WINDING ARRANGEMENT

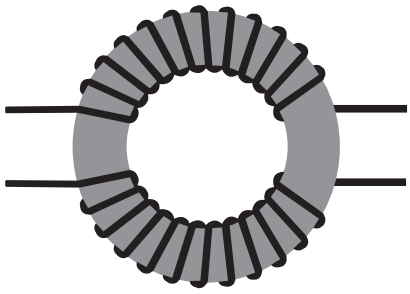


FIG. 13: CORE SELECTION AT 400 amps/cm^2

CMF, LI vs AP at 400 amps/cm^2

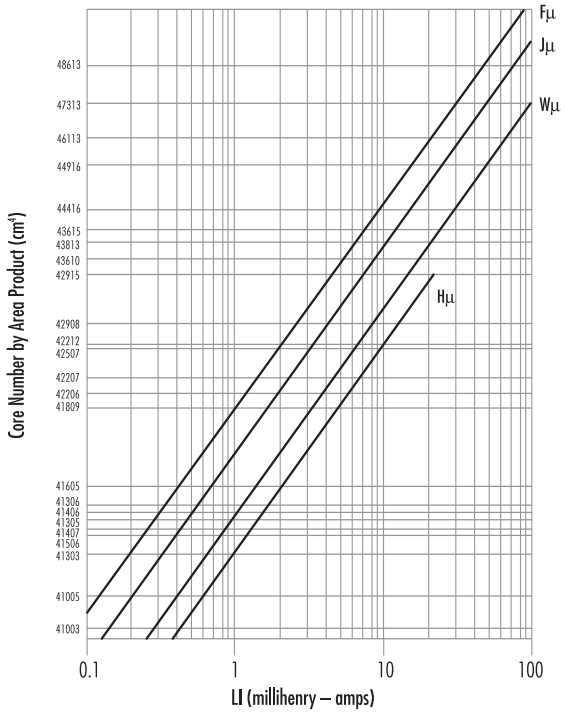
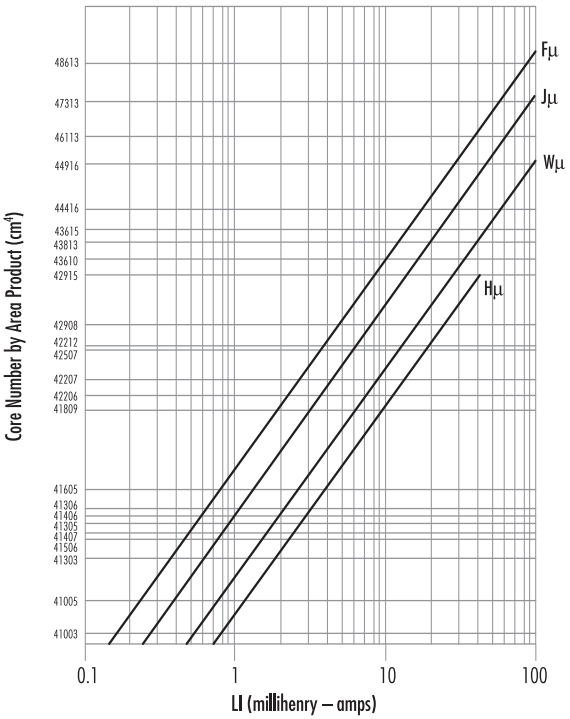


FIG. 14: CORE SELECTION AT 800 amps/cm^2

CMF, LI vs AP at 800 amps/cm^2



Inductor Design

HALL EFFECT DEVICES

Edwin H. Hall observed the "Hall Effect" phenomenon at John Hopkins University in 1897. He monitored the current flowing from top to bottom in a thin rectangular strip of gold foil by measuring the voltages at the geometric center of the left edge and the right edge of the strip. When no magnetic field was present, the voltages were identical. When a magnetic field was present perpendicular to the strip, there was a small voltage difference of a predictable polarity and magnitude. The creation of the transverse electric field, which is perpendicular to both the magnetic field and the current flow, is called the Hall Effect or Hall Voltage.

In metals the effect is small, but in semiconductors, considerable Hall voltages can be developed. Designers should consider using Hall sensors in many applications where mechanical or optical sensors have traditionally been used. To monitor ac or dc current flow in a wire, the wire is wrapped around a slotted ferromagnetic core, creating an electromagnet. The strength of the resulting magnetic field is used by the Hall sensor, inserted in the air gap, to measure the magnitude and direction of current flowing in the wire.

CORE SELECTION

In all cases, the effective permeability of a gapped core will be a function of the size of the air gap and the initial permeability of the core material. Once the gap becomes greater than a few thousandths of an inch, the effective permeability is determined essentially by the air gap.

ANALYTICAL METHOD

1. Determine the flux operating extremes based on either the $\Delta V/\Delta B$ of the circuit (volts/gauss), or the maximum flux sensitivity (gauss) of the sensor (as provided by the sensor data sheet).

2. Choose a core based on the maximum or minimum dimension requirements to allow windings, and based on the core cross-section dimensions. The cross-section dimensions should be at least twice the gap length to ensure a relatively homogeneous flux distribution bridging the gap.

3. Calculate the maximum required μ_e for the core:

$$\mu_e = \frac{b\ell_e}{.4\pi NI} \qquad (1)$$

where B = flux density (gauss)
ℓ_e = path length (cm)
N = turns
I = current (amps peak)

4. Calculate the minimum required gap length (inches):

$$\ell_g = \ell_e \left(\frac{1}{\mu_e} - \frac{1}{\mu_i} \right) (0.3937) \qquad (2)$$

where ℓ_g = gap length (inches)
ℓ_e = path length (cm)
μ_e = effective permeability
μ_i = initial permeability

5. If the minimum required gap is greater than the sensor thickness, ensure that the cross-section dimensions (length and width) are at least twice the gap length. If not, choose a larger core and recalculate the new gap length.

GRAPHICAL METHOD

1. Calculate NI/B (amp turns per gauss), knowing the flux operating extremes of $\Delta V/\Delta B$ or the maximum B sensitivity of the sensor.

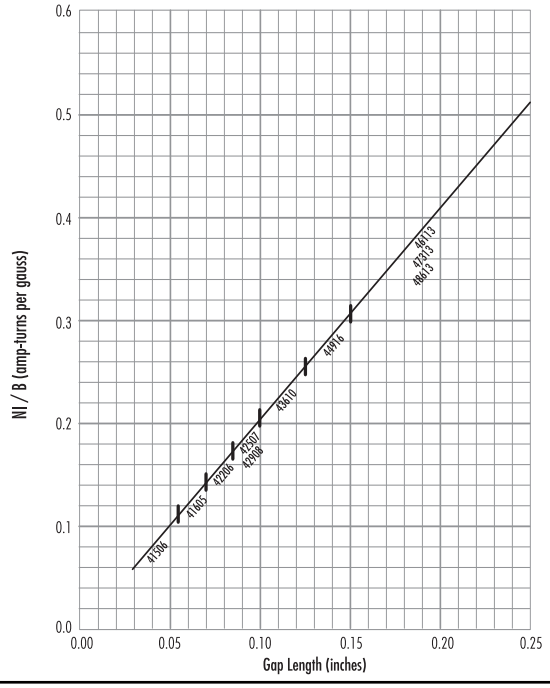
2. Using Figure 15, follow the NI/B value from the vertical axis to the diagonal line to choose a ferrite core size. Drop down from the diagonal line to the horizontal axis to determine the gap length. The core sizes indicated on the selector chart take into account gap length versus cross-section dimensions in order to maintain an even flux distribution across the gap under maximum current.

TOROID GAPPING

Ferrite cores are a ferromagnetic ceramic material. As such, they exhibit a very high hardness characteristic, they are very brittle, and they do not conduct heat very efficiently. Machining a slot into one side of a ferrite toroid can be a difficult process. Special techniques must be used to prevent chipping, cracking, or breaking of the cores.

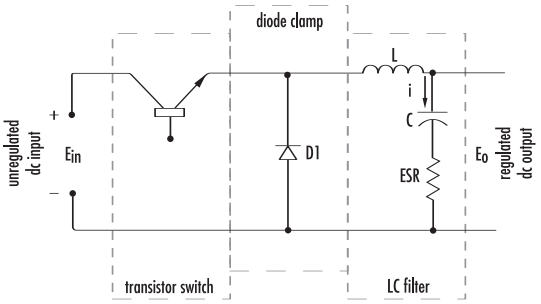
Diamond bonded-tool machining is the preferred method of cutting ferrite. The bonded diamond particle size should be approximately 100 to 170 mesh (150 to 90 µm). The peripheral speed of the cutting wheel should be 5,000 to 6,000 feet/minute (1,500 to 1,800 meters/minute). The depth of the cut may be as deep as 1" (25 mm), but in order to minimize residual stress, the cut should be limited to a maximum of 0.250" (6 mm) per pass, the smaller the better. During all cutting, the wheel and core should be flooded with ample amounts of coolant water to provide a lubricant as well as remove heat buildup that would cause thermal stress cracking of the core.

GAPPED TOROID SELECTOR CHART



Inductor Design

FIG. 15: HALL EFFECT DEVICE, CORE SELECTOR CHART



INDUCTOR CORE SIZE SELECTION (USING CORE SELECTOR CHARTS) DESCRIPTION

A typical regulator circuit consists of three parts: transistor switch, diode clamp, and an LC filter. An unregulated dc voltage is applied to the transistor switch which usually operates at a frequency of 1 to 50 kilohertz. When the switch is ON, the input voltage, E_{in}, is applied to the LC filter, thus causing current through the inductor to increase; excess energy is stored in the inductor and capacitor to maintain output power during the OFF time of the switch. Regulation is obtained by adjusting the ON time, t_{on}, of the transistor switch, using a feedback system from the output. The result is regulated dc output, expressed as:

$$E_{out} = E_{in}\, t_{on}\, f \qquad (1)$$

COMPONENT SELECTION

The switching system consists of a transistor and a feedback from the output of the regulator. Transistor selection involves two factors – (1) voltage ratings should be greater than the maximum input voltage, and (2) the frequency cut-off characteristics must be high compared to the actual switching frequency to insure efficient operation. The feedback circuits usually include operational amplifiers and comparators. Requirements for the diode clamp are identical to those of the transistor. The design of the LC filter stage is easily achieved. Given (1) maximum and minimum input voltage, (2) required output, (3) maximum allowable ripple voltage, (4) maximum and minimum load currents, and (5) the desired switching frequency, the values for the inductance and capacitance can be obtained. First, off-time (t_{off}) of the transistor is calculated.

$$t_{off} = (1 - E_{out}/E_{in\ max})\ /f \qquad (2)$$

When E_{in} decreases to its minimum value,

$$f_{min} = (1 - E_{out}/E_{in\ min})\ /t_{off} \qquad (3)$$

With these values, the required L and C can be calculated.

Allowing the peak to peak ripple current (Δi) through the inductor to be given by

$$\Delta i = 2\, I_{o\ min} \qquad (4)$$

the inductance is calculated using

$$L = E_{out}\, t_{off} / \Delta i \qquad (5)$$

The value calculated for (Δi) is somewhat arbitrary and can be adjusted to obtain a practical value for the inductance.The minimum capacitance is given by

$$C = \Delta i\ /8f_{\ min}\ \Delta e_o \qquad (6)$$

Finally, the maximum ESR of the capacitor is

$$ESR\ max = \Delta e_o/\Delta_i \qquad (7)$$

INDUCTOR DESIGN

Ferrite E cores and pot cores offer the advantages of decreased cost and low core losses at high frequencies. For switching regulators, F or P materials are recommended because of their temperature and dc bias characteristics. By adding air gaps to these ferrite shapes, the cores can be used efficiently while avoiding saturation.

These core selection procedures simplify the design of inductors for switching regulator applications. One can determine the smallest core size, assuming a winding factor of 50% and wire current carrying capacity of 500 circular mils per ampere.

Only two parameters of the two design applications must be known:

(a) Inductance required with dc bias
(b) dc current

1. Compute the product of LI^2 where:
   L= inductance required with dc bias (millihenries)
   I= maximum dc output current - $I_{o\ max} + \Delta_i$

2. Locate the LI^2 value on the Ferrite Core Selector charts on pgs 4.15–4.18. Follow this coordinate in the intersection with the first core size curve. Read the maximum nominal inductance, A_L, on the Y-axis. This represents the smallest core size and maximum A_L at which saturation will be avoided.

3. Any core size line that intersects the LI^2 coordinate represents a workable core for the inductor of the core's A_L value is less than the maximum value obtained on the chart.

4. Required inductance L, core size, and core nominal inductance (A_L) are known. Calculate the number of turns using

$$N = 10^3\sqrt{\frac{L}{A_L}}$$

   where L is in millihenries

5. Choose the wire size from the wire table on pg 5.8 using 500 circular mils per amp.

Inductor Design

EXAMPLE

Choose a core for a switching regulator with the following requirements:

E_o =5 volts
Δe_o =0.50 volts
$I_{o\ max}$ =6 amps
$I_{o\ min}$ =1 amp
$E_{in\ min}$ =25 volts
$E_{in\ max}$ =35 volts
f =20 KHz

1. Calculate the off-time and minimum switching, f_{min}, of the transistor switch using equations 2 and 3.

   $t_{off} = (1 - 5/35)/20{,}000 = 4.3 \times 10^{-5}$ seconds and

   $f_{min} = (1 - 5/25)/4.3 \times 10^{-5}$ seconds = 18,700 Hz.

2. Let the maximum ripple current, Δi, through the inductor be

   $\Delta i = 2(1) = 2$ amperes by equation 4.

3. Calculate L using equation 5.

   $L = 5(4.3 \times 10^{-5})/2 = 0.107$ millihenries

4. Calculate C and ESR max using equations 6 and 7.

   C = 2/8 (18,700) (0.50) = 26.7 μ farads
   and ESR max = 0.50/2 = .25 ohms

5. The product of $LI^2 = (0.107)\ (8)^2 = 6.9$ millijoules

6. Due to the many shapes available in ferrites, there can be several choices for the selection. Any core size that the LI^2 coordinate intersects can be used if the maximum A_L is not exceeded.
   Following the LI^2 coordinate, the choices are:

(a) 45224 EC 52 core,	A_L315
(b) 44229 solid center post core,	A_L315
(c) 43622 pot core,	A_L400
(d) 43230 PQ core,	A_L250

7. Given the A_L, the number of turns needed for the required inductance is:

A_L	Turns
250	21
315	19
400	17

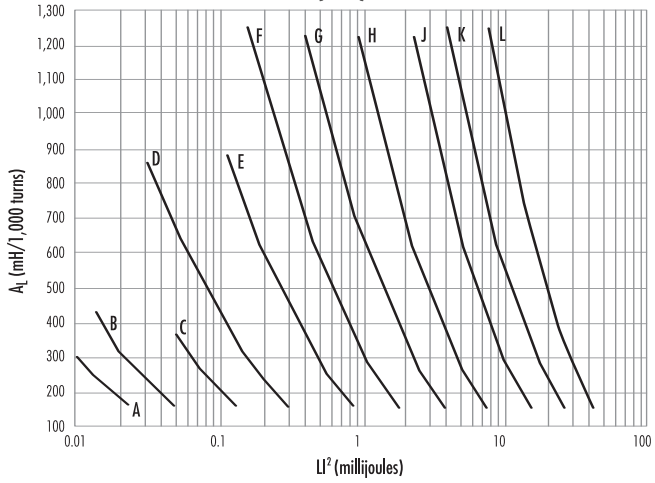
8. Use #14 wire

Note: MAGNETICS® Molypermalloy and Kool Mu® powder cores have a distributed air gap structure, making them ideal for switching regulator applications. Their dc bias characteristics allow them to be used at high drive levels without saturating. Information is available in Magnetics Powder Core Catalog and Brochure SR-IA, "Inductor Design in Switching Regulators."

FOR REFERENCES, SEE PAGE 14.4

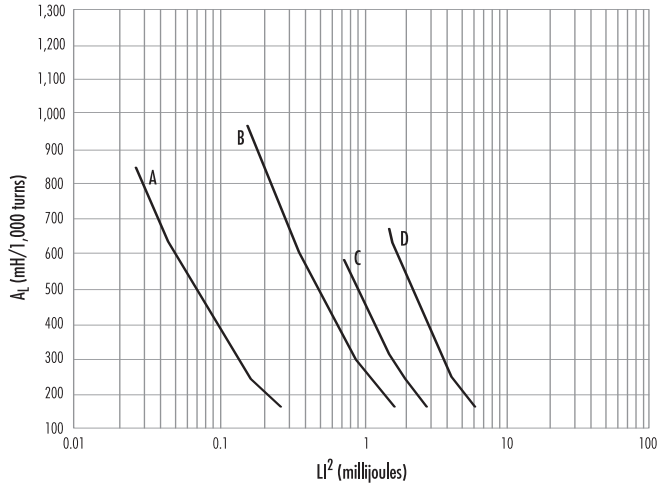
Selector Charts

PC (POT) CORES



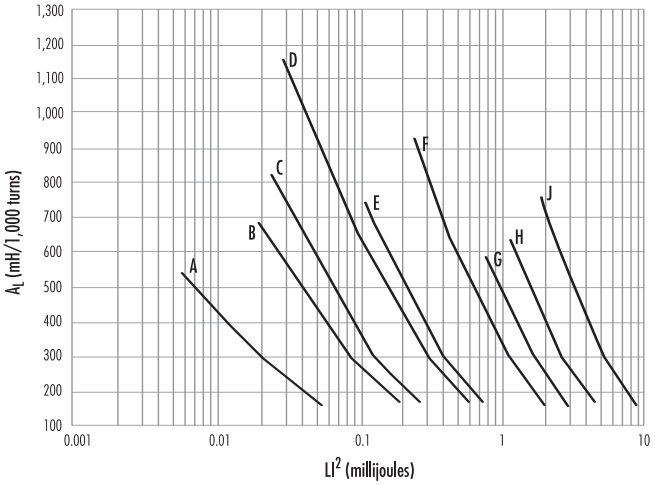
A — 40704
B — 40905
C — 41107
D — 41408
E — 41811
F — 42213
G — 42616
H — 43019
J — 43622
K — 44229
L — 44529

RS (ROUND-SLAB) & DS (DOUBLE-SLAB) CORES



A — 41408 (RS)
B — 42311 (DS, RS)
42318 (DS, RS)
C — 42616 (DS)
D — 43019 (DS, RS)

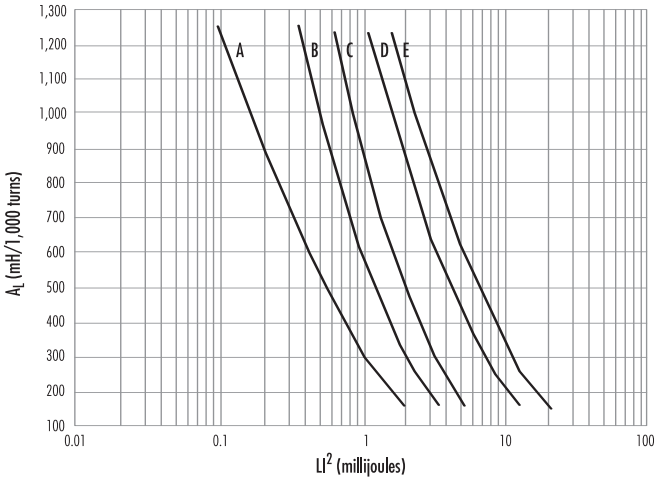
RM AND EP CORES



A — 40707 (EP7)
41010 (EP10)
41110 (RM4)
B — 41313 (EP13)
C — 41510 (RM5)
D — 41717 (EP17)
E — 41812 (RM6)
F — 42316 (RM8)
G — 42120 (EP20)
H — 42819 (RM10)
J — N43723 (RM12)

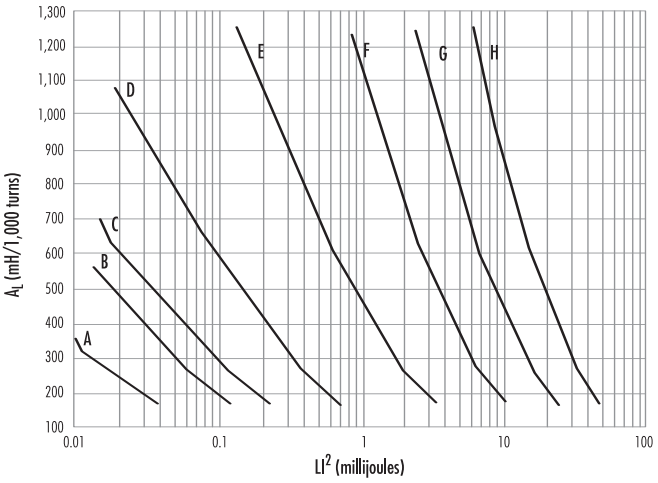
Selector Charts

PQ CORES



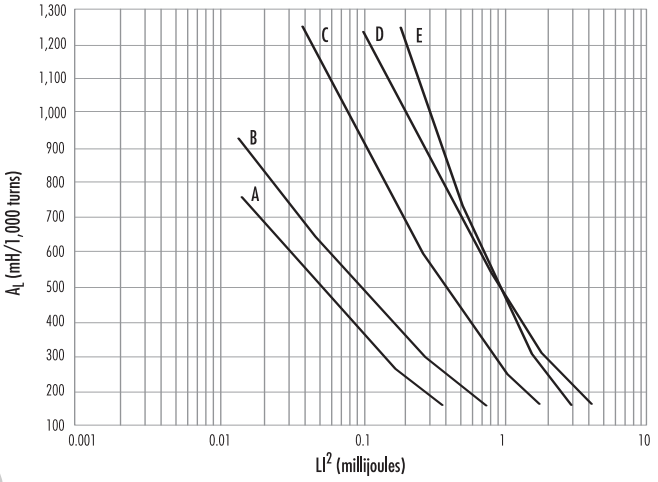
A — 42016
42020
B — 42614
C — 42610
42620
42625
43214
D — 43220
43230
E — 43535
44040

LAMINATION SIZE E CORES



A — 41203 (EE)
B — 41707 (EE)
C — 41808 (EE)
D — 42510 (EE)
E — 43009 (EE)
43515 (EE)
F — 44317 (EE)
G — 44721 (EE)
H — 45724 (EE)

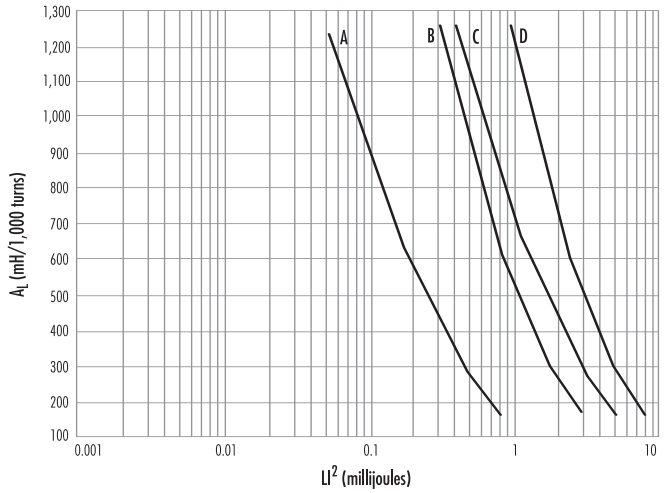
E CORES



A — 41205 (EE)
B — 42515 (EE)
C — 41810 (EE)
43007 (EE)
D — 42530 (EE)
43520 (EE)
E — 42520 (EE)

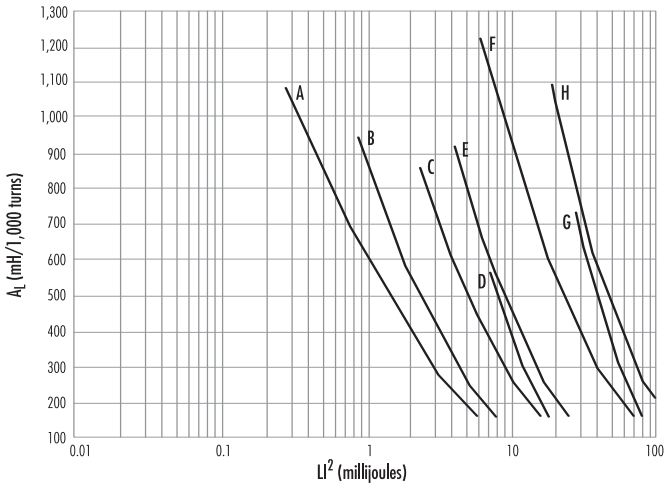
Selector Charts

E, EI CORES



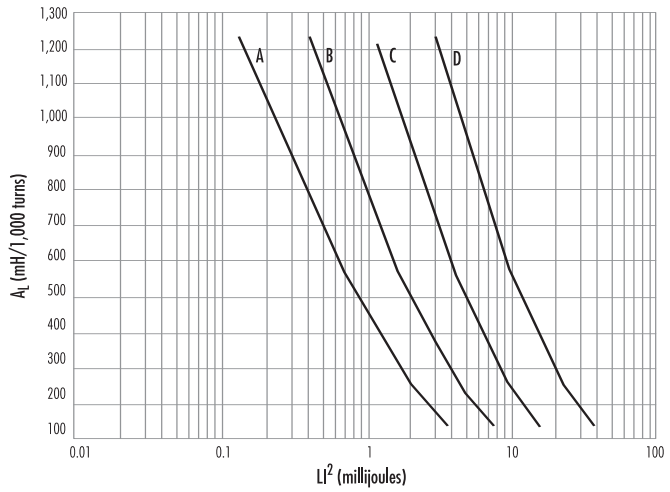
A — 41805 (EE, EI)
B — 42216 (EE, EI)
C — 44008 (EE, EI)
D — 43618 (EE, EI)

E, EI CORES



A — 44016 (EE)
B — 44011 (EE)
C — 44020 (EE)
D — 44308 (EE, EI)
E — 44022 (EE)
46016 (EE)
F — 45528 (EE)
45530 (EE)
47228 (EE)
48020 (EE)
G — 46410 (EE)
H — 49938 (EE, EI)

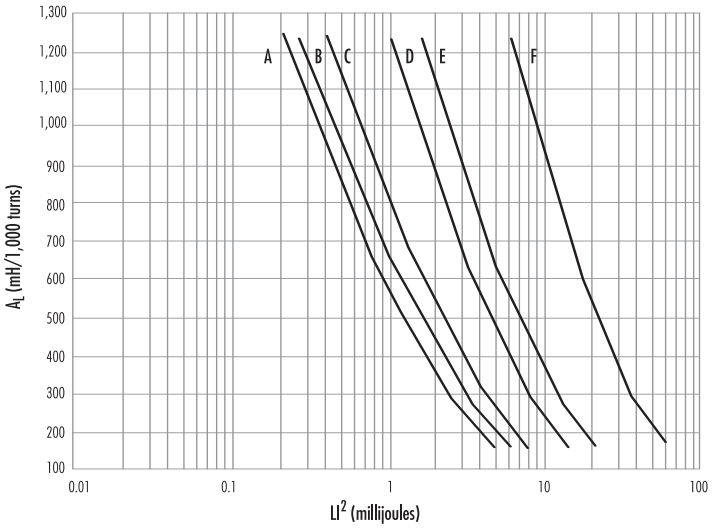
EC CORES



A — 43517
B — 44119
C — 45224
D — 47035

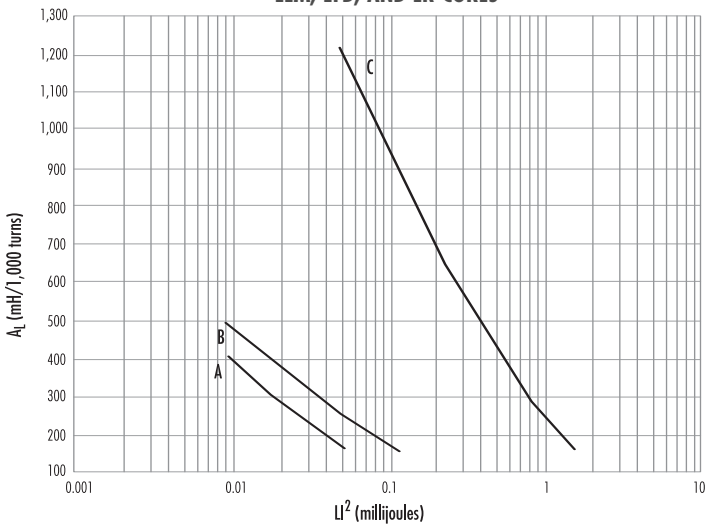
Selector Charts

ETD AND EER CORES



A — 43434 (ETD34)
B — 43521 (EER35L)
C — 43939 (ETD39)
D — 44216 (EER42)
44444 (ETD44)
E — 44949 (ETD49)
F — 45959 (ETD59)

EEM, EFD, AND ER CORES

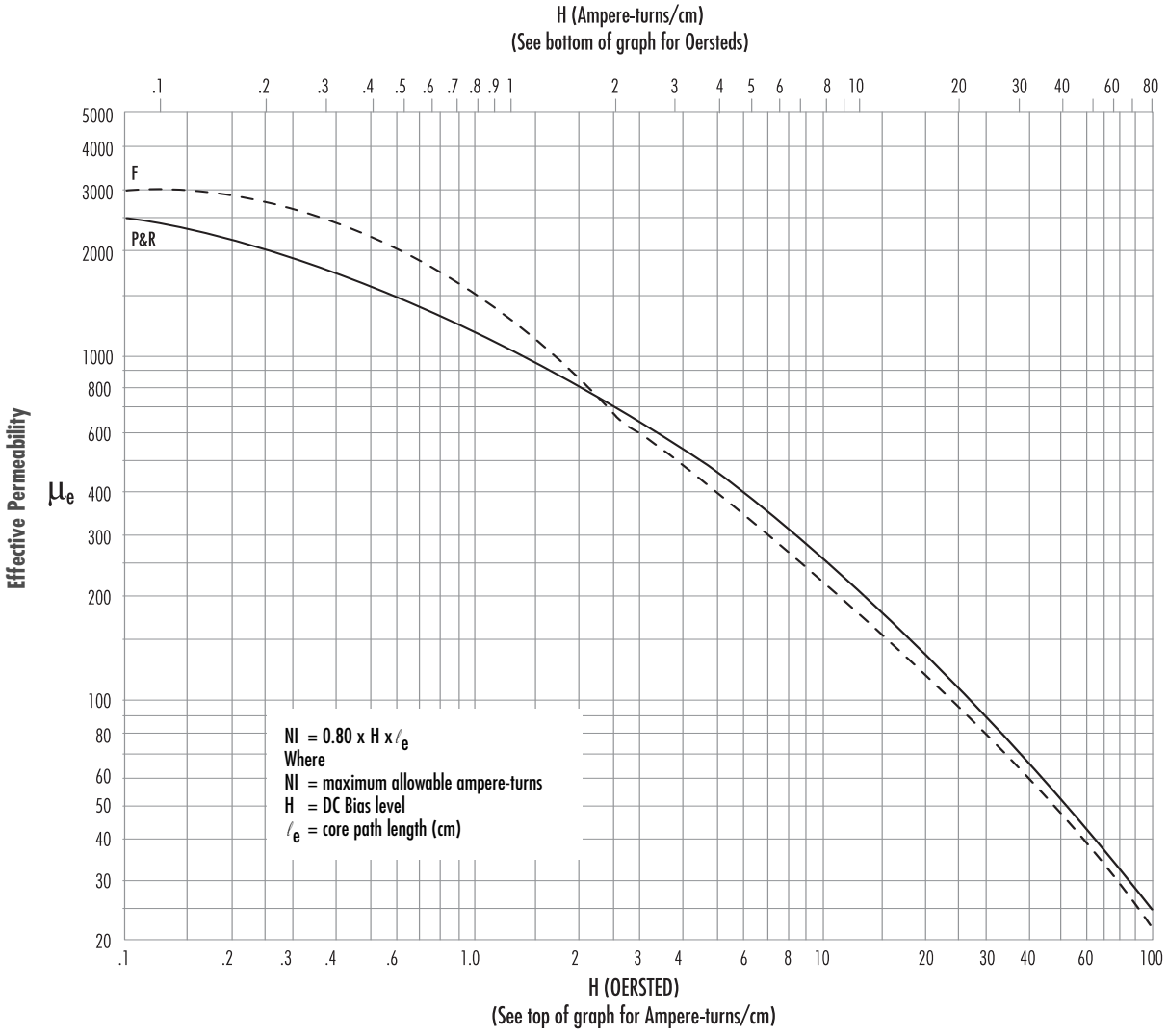


A — 40906 (ER 9.5)
B — 41515 (EFD15)
C — 42523 (EFD25)

DC Bias Data

DC BIAS DATA — FOR GAPPED APPLICATIONS

μ_e vs. H



The above curves represent the locus of points up to which *effective permeability* remains constant. They show the maximum allowable DC bias, in ampere-turns, without a reduction in inductance. Beyond this level, inductance drops rapidly.

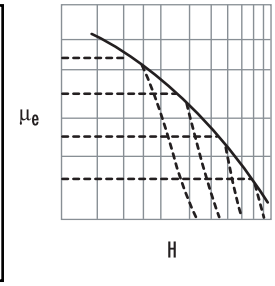
Example: How many ampere-turns can be supported by an R42213A315 pot core without a reduction in inductance value?
ℓ_e = 3.12 cm μ_e = 125

Maximum allowable H = 25 Oersted (from the graph above)
NI (maximum) = 0.80 x H x ℓ_e = 62.4 ampere-turns
OR (Using top scale, maximum allowable H = 20 A-T/cm.)
NI (maximum) = A-T/cm x ℓ_e
= 20 x 3.12
= 62.4 A-T

$$\mu_e = \frac{A_L \bullet \ell_e}{4\pi A_e}$$

$$\frac{1}{\mu_e} = \frac{1}{\mu_i} + \frac{\ell_g}{\ell_e}$$

A_e = effective cross sectional area (cm^2)
A_L = inductance/1,000 turns (mH)
μ_i = initial permeability
ℓ_g = gap length (cm)



Notes

Pot Cores Low Level Applications

Section 5

The information contained in this section is primarily concerned with the design of linear inductors for high frequency LC tuned circuits using ferrite pot cores. Magnetics has arranged the data in this section for ease in (1) determining the optimum core for these LC circuits and (2) ordering the items necessary for any particular Pot Core assembly.

Featured are magnetic data, temperature characteristics, core dimensions, accessories, and other important design criteria. *Standard Q curves are available on special request, contact Magnetics Application Engineering.*

The data presented in this section are compiled mainly for selecting cores for high Q resonant LC circuits. However, much of this information can also be used to design pot cores into many other applications, including high frequency transformers, chokes, and other magnetic circuit elements.

POT CORE ASSEMBLY

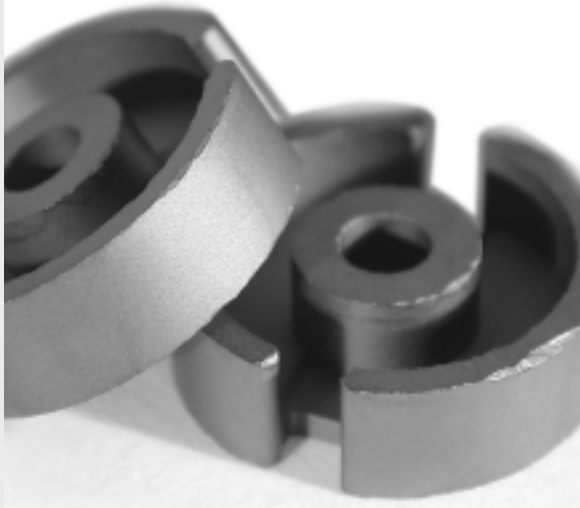
A ferrite pot core assembly includes the following items:

1. TWO MATCHED POT CORE HALVES
2. BOBBIN ON WHICH THE COILS ARE WOUND
3. TUNING ASSEMBLY
4. A CLAMP FOR HOLDING THE CORE HALVES TOGETHER

The pot core shape provides a convenient means of adjusting the ferrite structure to meet the specific requirements of the inductor. Both high circuit Q and good temperature stability of inductance can be obtained with these cores. The self-shielded pot core isolates the winding from stray magnetic fields or effects from other surrounding circuit elements.

The effective permeability (μ_e) is adjusted by grinding a small air gap in the center post of the pot core. For transformers and some inductors, no ground air gap is introduced, and the effective permeability is maximized. The effective permeability of the pot core will always be less than the material initial permeability (μ_i) because of the small air gap at the mating surfaces of the pot core halves. For other inductors where stability of inductance, Q, and temperature coefficient must be closely specified, a controlled air gap is carefully ground into the center post of one or both of the pot core halves. When fitted together, the total air gap then will determine the effective permeability and control the magnetic characteristics of the pot core. Finer adjustment of the effective permeability (gapped pot core inductance) can be accomplished by moving a ferrite cylinder or rod into the air gap through a hole in the center post.

Magnetics ferrites are available in various initial permeabilities (μ_i) which for filter applications cover frequency ranges into the megahertz region. Magnetics produces a wide variety of pot core sizes which include fourteen (14) international standard sizes*. These range from 7 x 4 mm to 42 x 29 mm, these dimensions representing OD and height of a pair. Each pot core half is tested and matched with another half to produce a core with an inductance tolerance of ± 3% for most centerpost ground parts.



*IEC Publication No. 133 (1961).

Advantages of Pot Core Assemblies

ADVANTAGES OF POT CORE ASSEMBLIES

- SELF-SHIELDING
  Because the wound coil is enclosed within the ferrite core, self-shielding prevents stray magnetic fields from entering or leaving the structure.

- COMPACTNESS
  Self-shielding permits more compact arrangement of circuit components, especially on printed circuit boards.

- MECHANICAL CONVENIENCE
  Ferrite pot cores are easy to assemble, mount, and wire to the circuit.

- LOW COST
  As compared to other core materials, ferrites are easier to make in unusual configurations (such as pot cores), resulting in a lower cost component. In addition, winding a pot core is usually quick and inexpensive because coils can be pre-wound on bobbins. When other costs of assembly, mounting, wiring, and adjustment are added, the total cost is often less than with other core materials or shapes.

- ADJUSTABILITY
  Final adjustment is accomplished by moving a threaded core in and out of the centerpost, and adjustment in the field is relatively easy as compared to any other type of construction.

- IMPROVED TEMPERATURE STABILITY AND Q
  Air gaps inserted between the mating surfaces of the centerposts provide good temperature stability and high Q.

- WIDE CORE SELECTION
  Many combinations of materials, physical sizes, and inductances offer the design engineer a large number of choices in core selection.

- LOW LOSSES AND LOW DISTORTION
  Since ferrites have high resistivities, eddy current losses are extremely low over the applicable frequency range and can be neglected. Hysteresis losses can be kept low with proper selection of material, core size, and excitation level.

SPECIAL ADVANTAGES OF MAGNETICS POT CORE ASSEMBLIES

- UNIQUE ONE PIECE CLAMP
  Provides simple assembly of the two core halves. Easy bending action allows insertion of the core assembly into the clamp, and spring tension holds the assembly rigidly and permanently in place. Rivet, screw, or circuit board tab mounting is available.

- CHOICE OF LINEAR OR FLAT TEMPERATURE CHARACTERISTICS
  Provides a close match to corresponding capacitors.

- CONSISTENCY AND UNIFORMITY
  Modern equipment with closely controlled manufacturing processes produce ferrite pot cores that are magnetically uniform, not only within one lot but from lot to lot.

Important Considerations

The selection of a pot core for use in LC resonant circuits and high frequency inductors requires a careful analysis of the design, including the following:

- OPERATING FREQUENCY.
- INDUCTANCE OF THE WOUND POT CORE ASSEMBLY.
- TEMPERATURE COEFFICIENT OF THE INDUCTOR.
- Q OF THE INDUCTOR OVER THE FREQUENCY RANGE.
- DIMENSIONAL LIMITATIONS OF THE COIL ASSEMBLY.
- MAXIMUM CURRENT FLOWING THROUGH THE COIL.
- LONG TERM STABILITY.

The important characteristics which strongly influence the above requirements are:

1. Relative loss factor - $\frac{1}{\mu_i Q}$. This factor reflects the relative losses in the core and varies with different ferrite materials and changes in operating frequency. When selecting the proper material, it is best to choose the one giving the lowest $\frac{1}{\mu_i Q}$ over the range of operating frequencies. In this way, the highest circuit Q can be expected. In a situation where the $\frac{1}{\mu_i Q}$ curves may cross over or coincide at various frequencies, each ferrite material should be considered in view of all circuit parameters of importance, including size, temperature coefficient, and disaccommodation, as well as Q. With this analysis, little doubt is left concerning the optimum selection of a proper core material.

2. Inductance factor (A_L). The selection of this parameter is based on a logarithmic progressive series of values obtained by dividing a logarithmic decade into 5 equal parts (International Standardization Organization R5 series of preferred numbers). Since the (A_L) values for the various core sizes are standard, they may be graphed or charted for ease of determining the required turns (N) to give the value of inductance needed. Pot cores with various (A_L) values are obtained by grinding closely-controlled air gaps in the centerposts of the cores. Small gaps are processed by gapping one core half. For larger gaps, both halves are gapped.

3. Temperature Coefficient (TC_e). The temperature coefficient of the pot core is important in LC tuned circuits and filters when attempting to stabilize the resonant frequency over a wide range of temperatures. This temperature coefficient (TC_e) is determined by the properties of the ferrite material and the amount of air gap introduced. Ferrite materials have been designed to produce gapped pot core temperature coefficients that balance the opposite temperature characteristics of polystyrene capacitors, or match similar flat temperature coefficients of silvered mica capacitors. Therefore, careful selection of both capacitors and pot cores with regard to temperature coefficient will insure the optimum temperature stability.

4. Quality Factor (Q)*. The quality factor is a measure of the effects of the various losses on circuit performance. From the designer's point of view, these losses should include core losses, copper losses, and winding capacitive losses. Therefore, Q will be affected greatly by the number and placement of the turns on the bobbin, and the type and size of wire used. At higher frequencies, litz wire would reduce the eddy current losses in the windings and produce a higher Q than solid wire. Q data include the effects of winding and capacitive losses, which, if removed, would produce significantly higher calculated Q values. Consequently, the Q curves represent more realistically the actual Q values that would be obtained from circuit designs.

5. Dimensional Limitations. Many circuit designs contain dimensional and weight limitations which restrict the size of the inductor and the mounting techniques used. Sometimes, minimum weight or volume is sacrificed to obtain better circuit performance.

6. Current Carrying Capacity. Inductive circuits containing ferrite pot cores are normally operated at extremely low levels of AC excitation to insure the best possible performance. However, the current flowing in the coil may be much higher than anticipated due to superimposed DC currents, or unexpected surges of AC. Therefore, the selection of the wire size used in an inductor design is influenced by both of these factors. Wire data is presented in this catalog as a guide in considering these operating conditions. - Refer to Tables 5 and 6, pages 5.8 and 5.9.

7. Long Term Stability (DF_e). In critical inductive designs, especially resonant circuits, the designer must be concerned with long term drift in resonant frequency. This stability drift (or decrease in inductance), known as disaccommodation, can be calculated for each pot core size and inductance factor (A_L). It occurs at a logarithmic rate, and the long term change of inductance may be calculated from the formula: $\frac{\Delta L}{L} = DFe \times \log \frac{t_2}{t_1}$

where $\frac{\Delta L}{L}$ is the decrease in inductance between the times t_1 and t_2, DF_e is the Effective Disaccommodation Coefficient of the core selected, and t_1 is the elapsed time between manufacture of the core (stamped on shipping container) and its assembly into the circuit, while t_2 is the time from manufacture of the core to the end of the expected life of the device. Disaccommodation starts immediately after the core is manufactured as it cools through its Curie Temperature. At any later time as the core is demagnetized, or thermally or mechanically shocked, the inductance may increase to its original value and disaccommodation begins again. Therefore, consideration must be given to increases in inductance due to magnetic, thermal or physical shock, as well as decreases in inductance due to time. If no extreme conditioning is expected during the equipment life, changes in inductance will be small, because most of the change occurs during the first few months after manufacture of the core.

*Q curves referred to here are available on special request. Contact Magnetics Applications Engineering.

Important Considerations

LIMITS ON EXCITATION

Inductors designed using pot cores are usually identified as linear magnetic components because they are operated within the range of negligible change of effective permeability with excitation. To calculate suggested maximum AC excitation levels, use the following formula:

$$B = \frac{E_{rms} \times 10^8}{4.44\ A_e N f}$$

4.44 for sine wave
4.0 for square wave

where B = 200 gausses, the suggested conservative limit.
N = turns on pot core
f = operating frequency in hertz.
A_e = effective area of the pot core in cm^2.

Because superimposed DC current also affects linearity of inductance in pot cores, consideration for DC currents must also be given. The equation shown above must be modified to include effect of DC bias. The combined equation now becomes:

$$B_{(combined)} = \frac{E_{rms} \times 10^8}{4.44\ A_e N f} + \frac{N I_{dc}\ A_L}{10 A_e}$$

where B = 200 gausses, the suggested conservative limit.
I_{dc} = bias current in amperes.

See pages 4.15 - 4.19 for DC bias data on Magnetics power ferrites.

Notes

Assembly Notes

Magnetics ferrite pot cores can be assembled with or without clamping hardware or tuning devices.

Mounting clamps are available for the 40905, 41107, 41408, 41811, 42213, 42616, 43019, 43622, and 44229 pot core sizes. These clamps normally eliminate the need to cement the pot core halves together. The mating surfaces of the pot core must be cleaned to remove moisture, grease, dust, or other foreign particles, before clamping or cementing.

If the cementing method is chosen, a small amount of cement is placed on the mating surface of the pot core skirt, being careful to keep the centerpost free of all cement. The pot core halves are brought together and rotated together under slight pressure to distribute the cement evenly around the skirt. The halves are separated and the wound bobbin is set in place. A small amount of cement is now placed on the exposed flange of the bobbin to bond it in the pot core assembly and thus insure no movement. The other core half is replaced, the centerpost holes and wire aperture aligned, and the unit clamped together in a pressure jig. Permanent bonding is accomplished by curing the cement at elevated temperatures according to the manufacturer's recommendations. After curing, storage for a minimum of 24 hours, and heat cycling between room temperature and 70°C may be required before final testing or tuning is completed.

The tuning adjusters can be inserted into the pot core immediately after the cemented core halves have been cured and the assembly can then be heat cycled. Some adjusters require insertion of the base into the centerpost hole prior to assembly of the pot core into the clip when a clip is used for mounting. The adjuster is usually made in two parts - the plastic base with a threaded hole, and a ferrite cylinder imbedded in a plastic screw. The base is pressed into the centerpost of the pot core, and the plastic screw is turned into the base until the ferrite cylinder enters the air gap. Tuning is completed when the inductance of the pot core assembly reaches the proper value. If this initial adjustment is expected to be the final one, cementing is recommended to prevent accidental detuning. If precise inductance values are expected, final tuning should not be completed earlier than 24 hours after the pot core assembly has been cured or clamped.

"TB-P" bases, which are polypropylene, may be etched in order to roughen the adhering surface and improve the bonding that is achieved.

Plastic screw drivers are available upon request for use in final tuning.

Tuning assemblies are available for most standard size pot cores. Contact Magnetics Application Engineering for details.

Assembly Notes

FIGURE 1

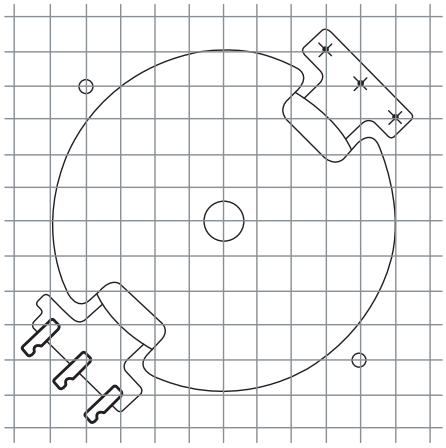


FIGURE 2

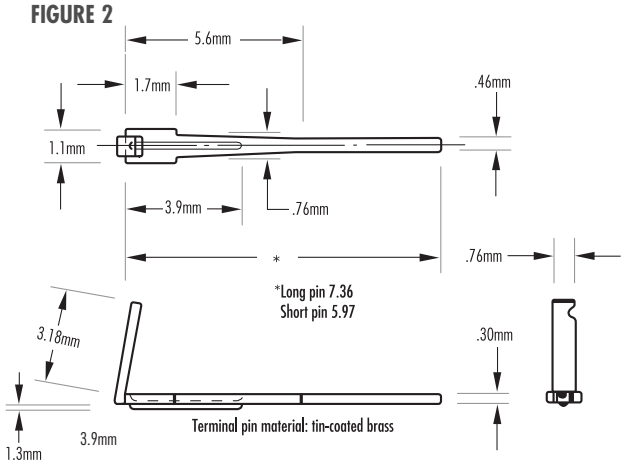
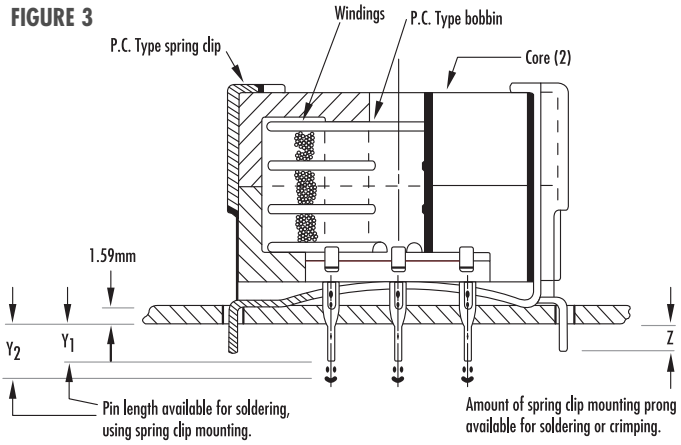


FIGURE 3



PRINTED CIRCUIT BOBBINS AND MOUNTING HARDWARE

Many sizes in the standard pot cores can be supplied with printed circuit board bobbins. The grid pattern (Figure 1) illustrates the location of 6 pin type bobbins. The soldering pins are arranged to fit a grid of 2.50 mm. The pin length is sufficient for a board thickness up to 4.75mm. Terminal pin details are illustrated in Figure 2. The board holes should be 1.17mm + .08mm in diameter (#56 drill). The bobbin should be cemented to the lower pot core half.

For some core types, printed circuit board mounting clamps are also available. A cross section of a completed core assembly using clamps is shown in Figure 3. When clamps are not available, the pot core halves must be cemented together.

Printed circuit board hardware for EP, RM and RS cores is described in the sections covering these core types.

PRINTED CIRCUIT BOBBINS SOLDERING INSTRUCTIONS

1. A solder pot should be used to solder the leads to the terminals. Preferred solder is 63/37 tin/lead eutectic. The solder temperature should be between 275°-300°C. Lower or higher temperatures will both damage the bobbin. Modern soldering techniques commonly use temperatures in excess of the softening points of all thermoplastic bobbin materials. Extreme care is required to prevent loosening of the terminals during soldering.

2. Insulation should be removed from the ends of the wire before soldering. This is especially important when litz wire is used. The preferred method is by burning.

3. Dip wound terminals into liquid soldering flux. A rosin based flux in alcohol solution should be used. Allow flux to air dry.

4. The bobbin should be immersed only far enough to cover the terminals.

5. The part should be immersed in the solder for 2-4 seconds, depending on the size of the wire used.

Wire Tables

TABLE 5 - MAGNET WIRE

WIRE SIZE AWG	**WIRE AREA (MAX.)* HEAVY** Circular Mils	$cm^2\ 10^{-3}$	**TURNS**** per cm^2	**RESISTANCE** Ohms/1000	**CURRENT CAPACITY (MA)** @750 Cir. Mil/amp	@500 Cir. Mil/amp
10	11,470	58.13	13.8	.9987	13,840	20,768
11	9,158	46.42	17.4	1.261	10,968	16,452
12	7,310	37.05	21.7	1.588	8,705	13,058
13	5,852	29.66	27.3	2.001	6,912	10,368
14	4,679	23.72	34.1	2.524	5,479	8,220
15	3,758	19.05	40.3	3.181	4,347	6,520
16	3,003	15.22	51.2	4.020	3,441	5,160
17	2,421	12.27	63.6	5.054	2,736	4,100
18	1,936	9.812	79.1	6.386	2,165	3,250
19	1,560	7.907	98.4	8.046	1,719	2,580
20	1,246	6.315	124	10.13	1,365	2,050
21	1,005	5.094	155	12.77	1,083	1,630
22	807	4.090	186	16.20	853	1,280
23	650	3.294	232	20.30	681	1,020
24	524	2.656	294	25.67	539	808
25	424	2.149	372	32.37	427	641
26	342	1.733	465	41.0	338	506
27	272	1.379	558	51.4	259	403
28	219	1.110	728	65.3	212	318
29	180	0.9123	868	81.2	171	255
30	144	0.7298	1,085	104	133	200
31	117	0.5930	1,317	131	106	158
32	96.0	0.4866	1,628	162	85	128
33	77.4	0.3923	2,015	206	67	101
34	60.8	0.3082	2,480	261	53	79
35	49.0	0.2484	3,100	331	42	63
36	39.7	0.2012	3,876	415	33	50
37	32.5	0.1647	4,961	512	27	41
38	26.0	0.1318	5,736	648	21	32
39	20.2	0.1024	7,752	847	16	25
40	16.0	0.0811	10,077	1,080	13	19
41	13.0	0.0659	12,403	1,320	11	16
42	10.2	0.0517	15,504	1,660	8.5	13
43	8.40	0.0426	19,380	2,140	6.5	10
44	7.30	0.037	23,256	2,590	5.5	8
45	5.30	0.0269	28,682	3,348	4.1	6.2

Wire Tables

TABLE 6 - LITZ WIRE

LITZ Wire Size	**TURNS***** per cm^2	**LITZ** Wire Size	**TURNS***** per cm^2
5/44	4,341	72/44	232
6/44	3,876	80/44	217
7/44	3,410	90/44	186
12/44	2,016	100/44	170
20/44	1,147	120/44	140
30/44	620	150/44	108
40/44	465	180/44	77
50/44	356	360/44	38
60/44	294		

*Areas are for maximum wire area plus maximum insulation buildup.

** Based on a typical machine layer wound coil.

*** Based on a typical layer wound coil.

	Specific Gravity	Water Absorption, 24h 73°F (%)	Tensile Strength (10^3 psi)	Tensile Modulus (10^3 psi)	Flexural Strength (10^3 psi)	Flexural Modulus (10^5 psi)	Izod Impact, Notched (ft.-lb/in)	Temperature Class*	Coefficient of expansion (10^{-5} in/in°C)	Deflection Temperature 264 psi (°C)	Dielectric Strength (v/mil)	Dielectric Constant (@1kHz)	Dissipation Factor (@1kHz)	Vol. Resistivity @73°F, 50% RH (ohm-cm)	Arc Resistance (Sec)	Flammability	Oxygen Index (%O_2)	UL Card No.	Max solder temperature (°C)
ASTM Test	D792	D570	D638	D638	D790	D790	D256		D696	D648	D149	D150	D150	D257	D495	UL94			
Rynite FR-515	1.53	0.07	15.5		23	8.5	1.2	H	1.7	210	670	3.1	0.004	10^{15}	67	V-0	30	E69578	250
Rynite FR-530	1.67	0.05	22		32	1.5	1.6	H	1.4	224	650	3.8	0.011	10^{15}	117	V-0	33	E69578, E69939, E81777	270
Delrin	1.42	0.25	19.5		29	1.4	1.6	A	2.3	1.63	550	3.8				HB	16	E66288R	
Delrin 900	1.42	0.25	10	4.5		4.2	1.3		10.4	130	500	3.7	0.005	10^{15}	220	HB		E66288	175
Zytel 101	1.14	1.2	12		23	0.41	1.0	B	4.0	232	480	3.9	0.02	10^{13}		HB	28	E41938	250
Zytel FR-50	1.56	0.6	22.8			11.9	1.9	B	2.2	241	437	3.6	0.009	10^{14}	103	V-0		E41938	250
Zytel 70G33L	1.38		18			9.0	2.0			249	530	3.7			135	HB		E41938	255
RTP 205FR	1.66	0.6	21	16	33	15.0	2.0		3.4	232	475	3.8	0.015	10^{14}		V-0		E84658	248
LNP RF1008	1.46	0.6	31		42	16.0	2.60			260						HB		E45195	260
Technyl A20-V25	1.38	0.75	19.6		29.7				2.5	250				10^{14}		V-0	32	E44716	
Crastin S660FR	1.45		7.5		11.7	3.9	0.8	B		179	560	3.1	0.002	10^{16}		V-0	30	E69578(M)	240
E4008	1.70	0.02	21.7		20.1	17.7	2.0					4.5		10^{13}	130	V-0	48	E54705(M)	330
Rogers RX630	1.75	0.07	12		23-28	22	1.2	B	1.9	232	500	4.5	0.019	10^{13}	180	V-0	40	E20305	400
Rogers RX660B	1.75	0.07	12		23-28	22	1.2	B	1.9	232	500	4.5	0.019	10^{13}	180	V-0	40	E123472	400
Vyncolite X-611	1.75	0.07	12		23-28	22	1.2	B	1.9	232	500	4.5	0.019	10^{13}	180	V-0	40	E63312(M)	400
Fiberite 4017F	1.79		9.5		17.5	23	0.6	B	1.9	229	400	4.6 @1MHz	0.026 @1MHz	$2x10^{13}$	180	V-0	42.1	E46372	
PM9630	1.82				27				1.5	249	305			10^{11}	80	V-0		E41429	
T3733J	1.41	0.40	8		11		42			170	300			10^{12}		V-1		E59481(S)	

*A-105°C, B-130°C, H-180°C

THERMOPLASTIC MATERIALS

NAME	TYPE
Rynite FR-515	Thermoplastic Polyester (PET)
Rynite FR-530	Thermoplastic Polyester (PET)
Delrin, Delrin 900	Acetal Resin
LNP RF1008	6/6 Nylon, 40 % glass-filled
Zytel 70633L	6/6 Nylon, 33% glass-filled
RTP 205FR	6/6 Nylon, 30% glass-filled
Zytel 101	6/6 Nylon, 30% glass-filled
Technyl A20-V25	6/6 Nylon, 25% glass-filled
Zytel FR-50	6/6 Nylon, 25% glass-filled
Crastin S660FR	PBT
E-4008	Thermoplastic LCP

THERMOSET PHENOLIC MATERIALS

Rogers RX360	Fiberlite 4017F
Rogers RX660B	PM9630
Vyncolyte X-611	T373J

Magnetics is a UL-recognized molder in the QMMY2 fabricated parts program. Many bobbins shown in this catalog are covered. Contact Magnetics for details on specific parts.

This document reports typical data as compiled from various suppliers' literature. Magnetics assumes no responsibility for the use of the information presented herein and hereby disclaims all liability in regard to use.

Modern soldering techniques commonly use temperatures in excess of the softening points of all thermoplastic bobbin materials. These typically run from 400°C - 600°C. Extreme care is required to prevent loosening of the terminals during soldering.

Crastin-DuPont, Wilmington, DE
Delrin-DuPont, Wilmington, DE
Rynite-DuPont, Wilmington, DE
Zytel DuPont, Wilmington, DE
Rogers RX630-Rogers Corporation, Manchester, CT
Rogers RX660B-Rogers Corporation, Manchester, CT
PM9360-Sumitomo Chemical Company. Ltd., Tokyo, Japan
E-4008-Sumitomo Chemical Company. Ltd., Tokyo, Japan
Fiberite-ICI Inc., Winona, MN
LNP-LNP engineering Plastics, Exton,PA
RTP-RTP Company, Winona, MN
Technyl-Nytech, Lyon, France
T373J-Chang Chun Plastics Co. Ltd., Taipei, Taiwan
Vyncolite RX611-31-Vynckier S.A., Belgium

Notes

Pot Cores

POT CORES

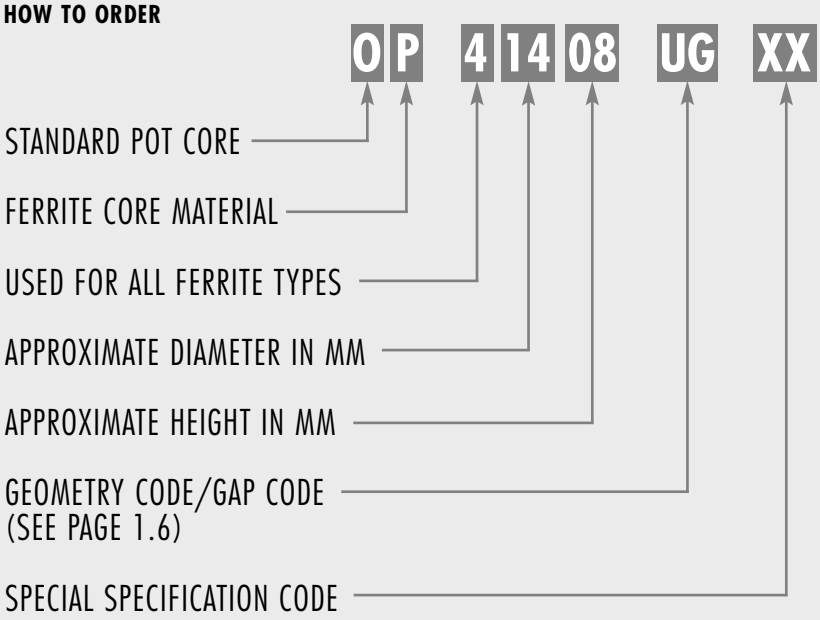
The pot core shape is a convenient means of adjusting the ferrite structure to meet the specific requirements of an application. Both high circuit Q and good temperature stability of inductance can be obtained with these cores. Pot cores, when assembled, nearly surround the wound bobbin. This self-shielded geometry isolates the winding from stray magnetic fields or effects from other surrounding circuit elements.

Both plain and printed circuit bobbins are available, as are mounting and assembly hardware.

Typical applications for pot cores include; differential inductors, power transformers, power inductors, converter and inverter transformers, filters, both broadband and narrow transformers and telecom inductors.

Magnetics produces a wide variety of sizes, which include fourteen (14) international standard sizes. Standard pot cores are ungapped, but any practical gap is also available (see page1.8-1.11)

HOW TO ORDER



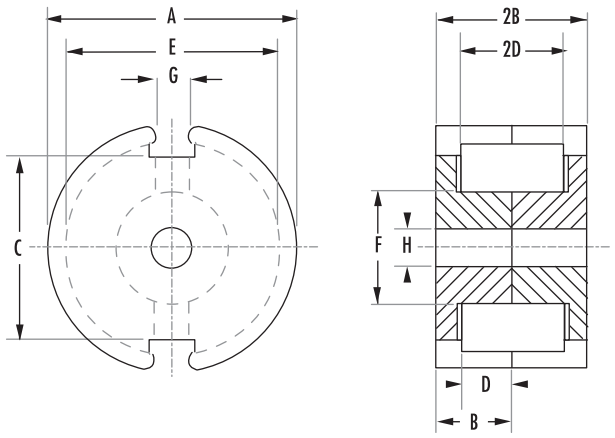
Pot Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

		MECHANICAL DIMENSIONS (mm)									
PART	FIG.	A	B	2B	C	D	2D	E	F	G	H
0_40704UG	**1**	7.24 ± .15	2.08 ± .05	4.16 ± .1	4.72 nom	1.4 min	2.79 min	5.74 min	3 max	1.52 min	1.09 ± .05
0_40905UG	**1**	9.3 + 0, - .3	2.7 + 0, - .15	5.4 + 0, - .3	6.5 ± .25	1.8 + .15, - 0	3.6 + .3, - 0	7.5 + .25, - 0	3.9 + 0, - .2	2 ± .2	2.04 + .06, - 0
0_41107UG	**1**	11.1 ± .2	3.25 ± .05	6.5 ± .1	6.8 ± .25	2.2 + .15, - 0	4.4 + .3, - 0	9 + .4, - 0	4.7 + .2, - 0	2.2 ± .3	2.1 ± 0.1
0_41408UG	**1**	14.3 +.0, - .5	4.2 ± .05	8.4 ± .1	9.5 ± .3	2.8 + .2, - 0	5.6 + .4, - 0	11.6 + .4, - 0	6 + 0, -.2	2.7 + 1.2, - 0	3 + .01, - 0
0_41811UG	**1**	18 ± .4	5.3 ± .05	10.6 ± .1	13.4 ± .3	3.7 ± .1	7.4 ± .2	15.15 ± .25	7.45 ± .15	3.8 ± 0.6	3.1 ± .1
0_42213UG	**1**	22 + 0, - .8	6.7 ± .1	13.4 ± .2	15 ± .4	4.6 + .2, - 0	9.2 + .4, - 0	17.9 + .6, - 0	9.4 + 0, - .3	3.8 ± .6	4.4 + .3, - 0
0_42616UG	**1**	25.5 ± .5	8.05 ± .1	16.1 ± .2	18 ± .4	5.5 + .2, - 0	11 + 4, - 0	21.6 ± .4	11.3 ± .2	3.8 ± .6	5.5 ± .1
0_43019UG	**1**	30 ± .5	9.45 ± .05	18.9 ± .1	20.5 ± .5	6.6 ± .1	13.2 ± .2	25.4 ± .4	13.3 ± .2	4.3 ± .6	5.5 ± .1
0_43622UG	**1**	35.6 ± .6	10.95 ± .05	21.9 ± .1	26.2 ± .6	7.4 ± .1	14.8 ± .2	30.4 ± .5	15.9 ± .3	4.9 ± .6	5.55 ± .15
0_44229UG	**1**	42.4 ± .7	14.7 ± .05	29.4 ± .1	32 ± .7	10.25 ± .1	20.5 ± .2	36.3 ± .7	17.4 ± .3	5.1 ± .6	5.55 ± .15

To order, add material code to part number.

FIGURE 1



Pot Core Data (ungapped)

A_L (mH/1000T) min

PART	FIG.	POWER MATERIALS R	P	F*	HIGH PERMEABILITY MATERIALS J	W	MAGNETIC DATA l_e (mm)	A_e (mm^2)	Amin (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc
0_40704UG	**1**	620	675	1,200	1,580	3,000	9.9	7.0	5.9	69	0.5	-
0_40905UG	**1**	760	825	1,365	2,045	4,220	12.5	10.1	8	126	1	0.003
0_41107UG	**1**	1,150	1,250	2,000	2,925	6,300	15.5	16.2	13.2	251	1.8	0.008
0_41408UG	**1**	1,540	1,680	2,800	3,805	6,300	19.8	25.1	19.8	495	3.2	0.02
0_41811UG	**1**	2,300	2,500	4,000	5,625	8,400	25.8	43.3	36	1,120	7.3	0.07
0_42213UG	**1**	3,030	3,300	4,900	6,825	11,200	31.5	63.4	50.9	2,000	13	0.18
0_42616UG	**1**	3,910	4,250	6,350	8,775	14,000	37.6	93.9	77.4	3,530	20	0.39
0_43019UG	**1**	5,010	5,450	8,100	11,325	18,968	45.2	137	116	6,190	34	0.73
0_43622UG	**1**	6,530	7,100	10,200	13,125	24,500	53.2	202	172	10,700	57	1.53
0_44229UG	**1**	6,900	7,500	12,000	15,000	28,000	68.6	265	214	18,200	104	3.69

* F material nominal ± 25%
** See page 5.6 for tuning assembly information

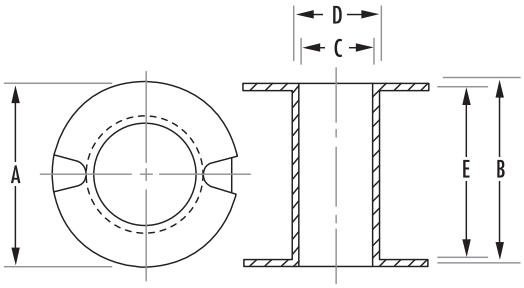
AVAILABLE HARDWARE	STANDARD BOBBIN	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP	TUNING ASSEMBLY**
0_40704UG	✓			
0_40905UG	✓		✓	
0_41107UG	✓		✓	
0_41408UG	✓	✓	✓	
0_41811UG	✓	✓	✓	✓

AVAILABLE HARDWARE	STANDARD BOBBIN	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP	TUNING ASSEMBLY**
0_42213UG	✓	✓	✓	✓
0_42616UG	✓	✓	✓	✓
0_43019UG	✓	✓	✓	✓
0_43622UG	✓	✓	✓	✓
0_44229UG	✓		✓	✓

Bobbins

			MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	MATERIAL
PART	FIG.	CORE SIZE	A MAX	B MAX	C MIN	D MAX	E NOM	cm^2		
00B070401	**1**	**40704**	5.74	2.74	3.04	3.65	2.08	0.025	15	Glass-filled nylon
00B090501	**2**	**40905**	7.41	3.53	3.96	5.18	2.54	0.03	19	Delrin
00B090501FR	**2**	**40905**	7.41	3.53	3.96	5.18	2.54	0.03	19	Crastin S660FR
00B110701	**2**	**41107**	8.91	4.31	4.77	5.99	3.32	0.05	23	Delrin
00B140801	**2**	**41408**	11.5	5.51	6.07	7.28	4.52	0.098	29	Delrin
00B140802 2 Section	**2**	**41408**	11.53	5.51	6.07	7.28	2.03	0.044	29	Delrin
00B140802FR 2 Section	**2**	**41408**	11.53	5.51	6.07	7.28	2.03	0.044	29	Crastin S660FR

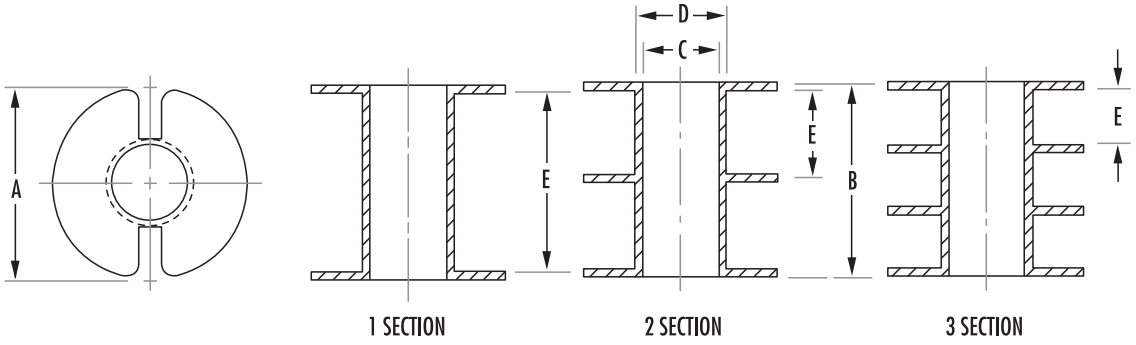
FIGURE 1



Bobbins

			MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	MATERIAL
PART	FIG.	CORE SIZE	A MAX	B MAX	C MIN	D MAX	E NOM	cm^2		
00B181101	**2**	**41811**	14.9	7.13	7.67	8.89	6.09	0.17	37	Delrin
00B181101FR	**2**	**41811**	14.9	7.13	7.67	8.89	6.09	0.17	37	Crastin S660FR
00B181102 2 Section	**2**	**41811**	14.9	7.13	7.67	8.89	2.81	0.084	37	Delrin
00B181102FR	**2**	**41811**	14.9	7.13	7.67	8.89	2.81	0.084	37	Crastin S660FR
00B181103 3 Section	**2**	**41811**	14.9	7.13	7.67	8.89	1.72	0.049	37	Delrin
00B221301	**2**	**42213**	17.83	9.11	9.47	10.69	8.12	0.292	44	Delrin
00B221301FR	**2**	**42213**	17.83	9.11	9.47	10.69	8.12	0.292	44	Crastin S660FR
00B221302 2 Section	**2**	**42213**	17.83	9.11	9.47	10.69	3.83	0.138	44	Delrin
00B221302FR 2 Section	**2**	**42213**	17.83	9.11	9.47	10.69	3.83	0.138	44	Crastin S660FR
00B221303 3 Section	**2**	**42213**	17.83	9.11	9.47	10.69	2.41	0.087	44	Delrin

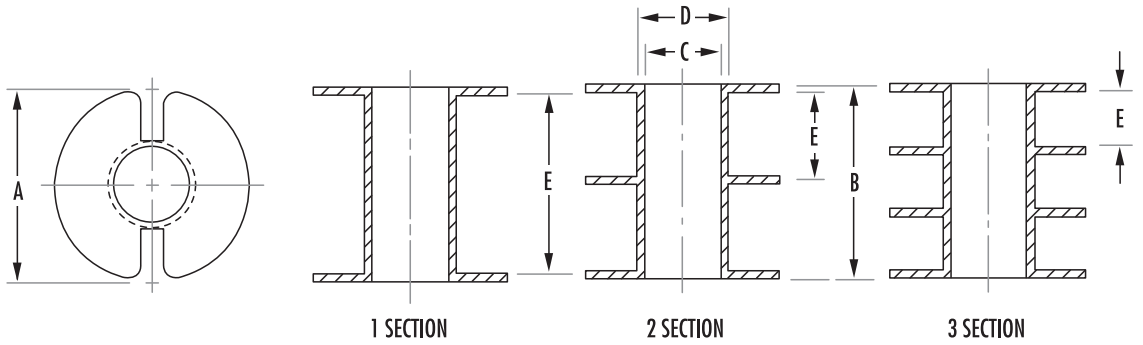
FIGURE 2



Bobbins (con't)

			MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	MATERIAL
PART	FIG.	CORE SIZE	A MAX	B MAX	C MIN	D MAX	E NOM	cm^2		
00B261601	**2**	**42616**	21.13	10.92	11.55	12.77	9.93	0.4210	53	Delrin
00B261601FR	**2**	**42616**	21.13	10.92	11.55	12.77	9.93	0.4210	53	Crastin S660FR
00B261602 2 Section	**2**	**42616**	21.13	10.92	11.55	12.77	4.74	0.2020	53	Delrin
00B261603 3 Section	**2**	**42616**	21.13	10.92	11.55	12.77	3.02	0.1280	53	Delrin
00B261603FR 3 Section	**2**	**42616**	21.13	10.92	11.55	12.77	3.02	0.1280	53	Crastin S660FR

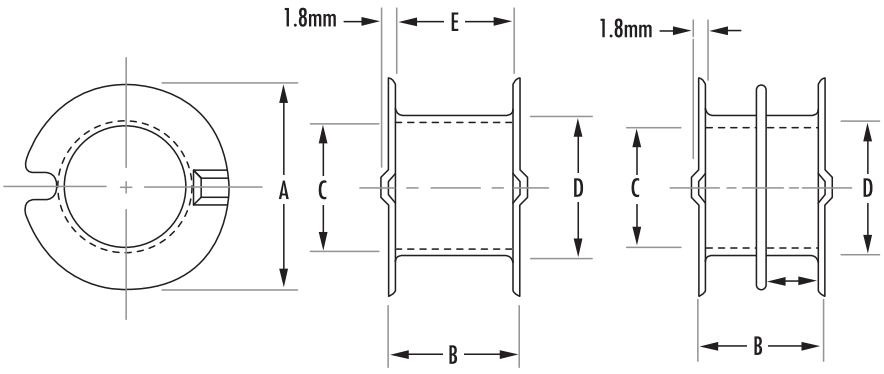
FIGURE 2



Bobbins (con't)

			MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	MATERIAL
PART	FIG.	CORE SIZE	A MAX	B MAX	C MIN	D MAX	E NOM	cm^2		
00B301901	**2**	**43019**	24.91	12.92	13.56	15.03	11.68	0.54	62	Delrin
00B301902 2 Section	**2**	**43019**	24.91	12.92	13.56	15.03	5.56	0.25	62	Delrin
00B301903 3 Section	**2**	**43019**	24.91	12.92	13.56	15.03	3.5	0.15	62	Delrin
00B362201	**2**	**43622**	29.76	14.47	16.23	18.05	12.97	0.75	74	Delrin
00B362202 2 Section	**2**	**43622**	29.76	14.47	16.23	18.05	6.14	0.35	74	Delrin
00B362203 3 Section	**2**	**43622**	29.76	14.47	16.23	18.05	3.86	0.22	74	Delrin
00B422901	**3**	**44229**	35.4	20.01	17.98	19.71	17.8	1.39	86	Delrin
00B422902 2 Section	**33**	**44229**	35.4	20.01	17.98	19.71	8.4	0.63	86	Delrin

FIGURE 3



Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)											
PART	FIG.	CORE SIZE	A MAX	B MAX	C MAX	D NOM	E MAX	F MAX	G NOM	X_1 NOM	X_2 NOM
PCB140811	**1A**	**41408**	11.5	7.11	5.41	4.44	18.99	5.89	16.2	4.74	-
PCB140821	**1A**	**41408**	11.5	7.11	5.41	4.44	18.99	5.89	16.2	-	7.13
PCB140812 2 Section	**1B**	**41408**	11.5	7.11	5.41	2.03	18.99	5.89	16.2	4.74	-
PCB140822 2 Section	**1B**	**41408**	11.5	7.11	5.41	2.03	18.99	5.89	16.2	-	7.13
PCB1408S1	**2A**	**41408**	11.5	7.11	5.41	4.44	18.99	10.66	16.2	-	7.13
PCB181111	**2A**	**41811**	14.8	8.81	7.03	6.04	23.79	10.21	21.53	4.74	-
PCB181121	**2A**	**41811**	14.8	8.81	7.03	6.04	23.79	10.21	21.53	-	7.13
PCB181112 2 Section	**2B**	**41811**	14.8	8.81	7.03	2.79	23.79	10.21	21.53	4.74	-
PCB181122 2 Section	**2B**	**41811**	14.8	8.81	7.03	2.79	23.79	10.21	21.53	-	7.13
PCB221311	**2A**	**42213**	17.8	10.69	8.99	7.79	27.2	10.21	25.14	4.74	-
PCB221321	**2A**	**42213**	17.8	10.69	8.99	7.79	27.2	10.21	25.14	-	7.13
PCB221312 2 Section	**2B**	**42213**	17.8	10.69	8.99	3.68	27.2	10.21	25.14	4.74	-

FIGURE 1

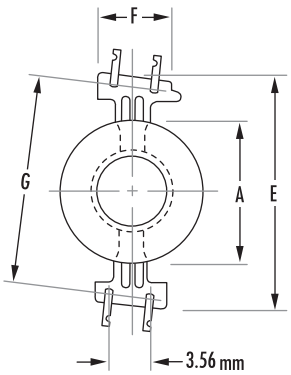


FIGURE 2

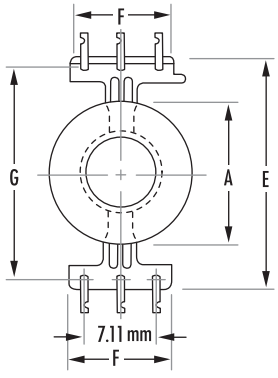


FIGURE A

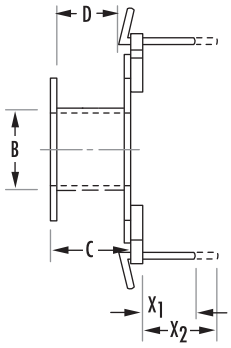
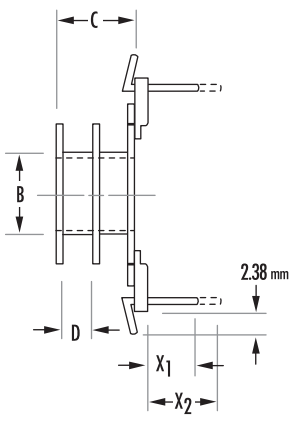


FIGURE B



Printed Circuit Bobbins

			MECHANICAL DIMENSIONS (mm)		NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL
PART	FIG.	CORE SIZE	Y_1 NOM	Y_2 NOM	cm^2			
PCB140811	**1A**	**41408**	1.54	3.93	0.084	29	Glass-filled nylon	Tin coated brass
PCB140821	**1A**	**41408**	1.54	3.93	0.084	29	Glass-filled nylon	Tin coated brass
PCB140812 2 Section	**1A**	**41408**	1.54	3.93	0.039	29	Glass-filled nylon	Tin coated brass
PCB140822 2 Section	**1A**	**41408**	1.54	3.93	0.039	29	Glass-filled nylon	Tin coated brass
PCB1408S1	**2A**	**41408**	1.54	3.93	0.084	29	Glass-filled nylon	Tin coated brass
PCB181111	**2B**	**41811**	1.44	3.83	0.151	37	Glass-filled nylon	Tin coated brass
PCB181121	**2B**	**41811**	1.44	3.83	0.151	37	Glass-filled nylon	Tin coated brass
PCB181112 2 Section	**2B**	**41811**	1.44	3.83	0.064	37	Glass-filled nylon	Tin coated brass
PCB181122 2 Section	**2B**	**41811**	1.44	3.83	0.064	37	Glass-filled nylon	Tin coated brass
PCB221311	**2B**	**42213**	0.58	2.97	0.28	44	Glass-filled nylon	Tin coated brass
PCB221321	**2B**	**42213**	0.58	2.97	0.28	44	Glass-filled nylon	Tin coated brass
PCB221312 2 Section	**2B**	**42213**	0.58	2.97	0.13	44	Glass-filled nylon	Tin coated brass

NOTES: If short pin (X_1) is desired, part number is -11 or -12. If long pin (X_2) is desired, part number is -21 or -22. Y-Pin length available under board for soldering, using spring clip mounting (on 1.59mm board).

FIGURE C

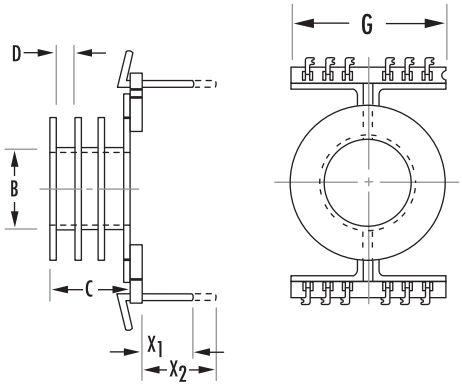
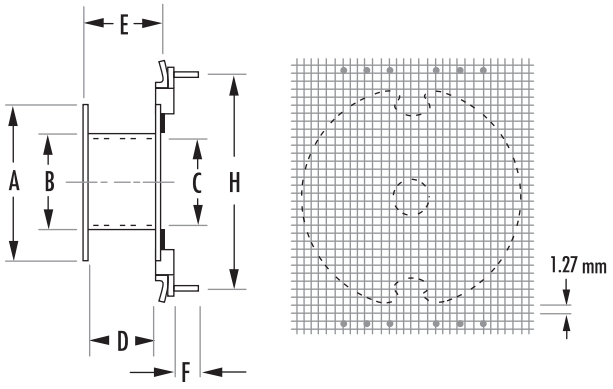


FIGURE 3



Printed Circuit Bobbins (con't)

MECHANICAL DIMENSIONS (mm)												
PART	FIG.	CORE SIZE	A MAX	B MAX	C MAX	D NOM	E MAX	F MAX	G NOM	H	X_1 NOM	X_2 NOM
PCB221322 2 Section	**2B**	**42213**	17.8	10.69	8.99	3.68	27.2	10.21	25.14	-	-	7.13
PCB221313 3 Section	**2C**	**42213**	17.8	10.69	8.99	2.31	27.2	10.21	25.14	-	4.74	-
PCB221323 3 Section	**2C**	**42213**	17.8	10.69	8.99	2.31	27.2	10.21	25.14	-	-	7.13
PCB261611	**2A**	**42616**	20.9	12.8	10.79	9.6	30.68	10.21	28.72	-	4.74	-
PCB261621	**2A**	**42616**	20.9	12.8	10.79	9.6	30.68	10.21	28.72	-	-	7.13
PCB261612 2 Section	**2B**	**42616**	20.9	12.8	10.79	4.57	30.68	10.21	28.72	-	4.74	-
PCB261622 2 Section	**2B**	**42616**	20.9	12.8	10.79	4.57	30.68	10.21	28.72	-	-	7.13
PCB261613 3 Section	**2C**	**42616**	20.9	12.8	10.79	2.89	30.68	10.21	28.72	-	4.74	-
PCB261623 3 Section	**2C**	**42616**	20.9	12.8	10.79	2.89	30.68	10.21	28.72	-	-	7.13
PCB301911	**2A**	**43019**	24.94	14.88	12.87	11.68	38.15	10.21	35.91	-	4.74	-
PCB301921	**2A**	**43019**	24.94	14.88	12.87	11.68	38.15	10.21	35.91	-	-	7.13
PCB362211	**3**	**43622**	29.84	18.03	16.17	12.85	14.47	5.58	29.21	40.64	-	-

FIGURE 2

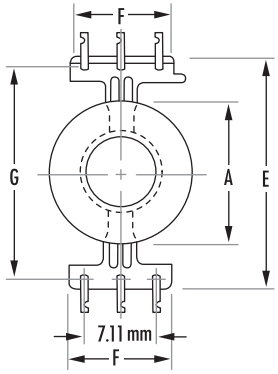


FIGURE A

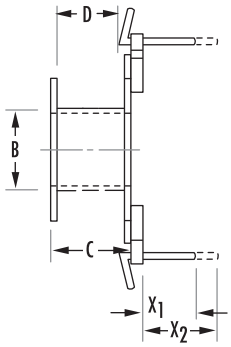


FIGURE B

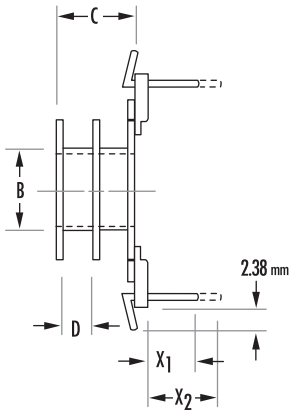
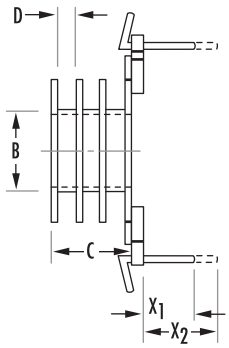


FIGURE C

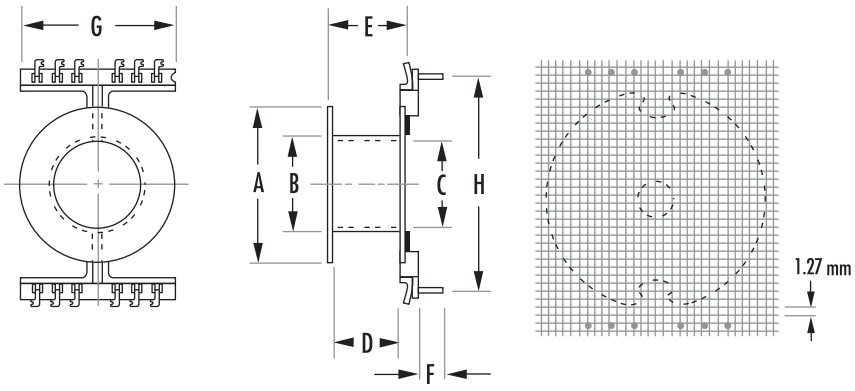


Printed Circuit Bobbins (con't)

			MECHANICAL DIMENSIONS (mm)		NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL
PART	FIG.	CORE SIZE	Y_1 NOM	Y_2 NOM	cm^2			
PCB221322 2 Section	**2B**	**42213**	0.58	2.97	0.13	44	Glass-filled nylon	Tin coated brass
PCB221313 3 Section	**2B**	**42213**	0.58	2.97	0.08	44	Glass-filled nylon	Tin coated brass
PCB221323 3 Section	**2B**	**42213**	0.58	2.97	0.08	44	Glass-filled nylon	Tin coated brass
PCB261611	**2B**	**42616**	1.06	3.45	0.39	53	Glass-filled nylon	Tin coated brass
PCB261621	**2B**	**42616**	1.06	3.45	0.39	53	Glass-filled nylon	Tin coated brass
PCB261612 2 Section	**2B**	**42616**	1.06	3.45	0.19	53	Glass-filled nylon	Tin coated brass
PCB261622 2 Section	**2B**	**42616**	1.06	3.45	0.19	53	Glass-filled nylon	Tin coated brass
PCB261613 3 Section	**2B**	**42616**	1.06	3.45	0.12	53	Glass-filled nylon	Tin coated brass
PCB261623 3 Section	**2B**	**42616**	1.06	3.45	0.12	53	Glass-filled nylon	Tin coated brass
PCB301911	**2A**	**43019**	0.43	2.81	0.58	60	Glass-filled nylon	Tin coated brass
PCB301921 2 Section	**2B**	**43019**	0.43	2.81	0.58	60	Glass-filled nylon	Tin coated brass
PCB362211	**3**	**43622**	-	-	0.755	74	Glass-filled nylon Phosphor Bronze	Tin coated brass

NOTES: If short pin (X_1) is desired, part number is -11 or -12. If long pin (X_2) is desired, part number is -21 or -22. Y-Pin length available under board for soldering, using spring clip mounting (on 1.59mm board).

FIGURE 3



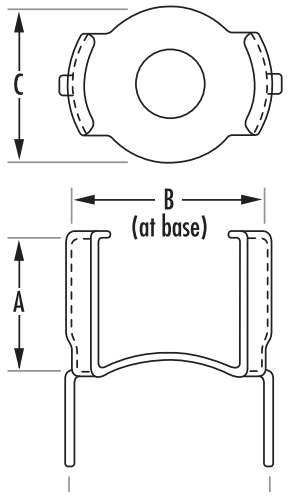
Mounting Clamps

PART	FIG.	CORE SIZE	MECHANICAL DIMENSIONS (mm) A NOM	B NOM	C NOM	D ± .5*	F NOM	TAB DIMENSIONS LENGTH	TAB DIMENSIONS WIDTH	MATERIAL	MATERIAL THICKNESS	MACHINE SCREW IMPRESSIONS	WASHER**	WASHER DIMENSIONS	WASHER THICKNESS
00C090511	**1**	**40905**	5.68	9.49	8	10	-	4.39	1.01	Phosphor Bronze	.23	-	-	-	
00C110711	**1**	**41107**	6.98	11.48	9.19	12.49	-	5	1.19	Phosphor Bronze	.25	-	-	-	
00C140811	**2**	**41408**	9.65	14.47	13.2	13.2	-	3.96	2.15	Spring Steel	.25	-	00W140815	13.7 ± .2	.25
00C181111	**3**	**41811**	11.68	18.54	16.76	16.51	-	3.96	2.03	Spring Steel	.50	-	00W181118	17.8 ± .2	.50
00C221314	**4**	**42213**	14.85	22.25	20.82	27.94	33.02	-	-	Spring Steel	.36	#4-40	00W221324	.84 ± .2	.50
0PC221314	**5**	**42213**	14.85	22.25	20.82	21.48	3.58	-	-	Spring Steel	.36		00W221324	21.3 ± .2	.50
00C261614	**4**	**42616**	16.63	26.28	21.08	32.81	38.4	-	-	Spring Steel	.36	#4-40	-	-	-
0PC261614	**7**	**42616**	16.63	26.28	21.08	24.63	5.08	-	-	Spring Steel	.36	#4-40	-	-	-
00C301917	**4**	**43019**	20.32	30.73	28.57	38.6	44.19	-	-	Spring Steel	.43	#6-32	-	-	-
00C362217	**6**	**43622**	23.24	36.32	21.59	44.45	50.03	-	-	Spring Steel	-	#6-32	-	-	-
00C422917	**6**	**44229**	56.38	50.8	43.18	25.4	6.6	-	-	Spring Steel	-	#6-32	-	-	-

* The C090511, C110711 and C140811 have a D dimension tolerance of ± .254mm

** Mounting Clamps are made to allow for tuning adjusters. If these adjusters are not used a polypropylene washer must be inserted to take up extra space. The part number and dimension of available washers are detailed above.

FIGURE 1



Mounting Clamps

FIGURE 2

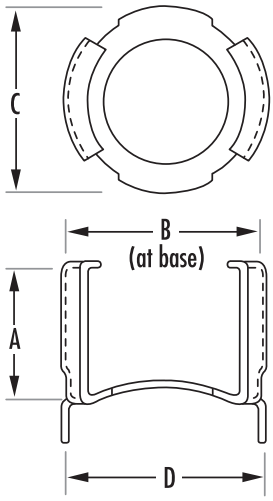


FIGURE 3

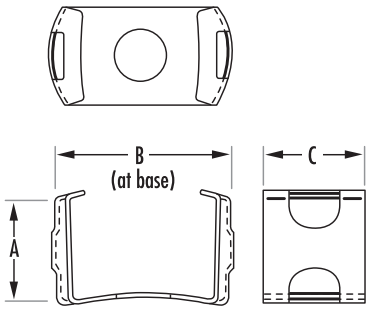


FIGURE 4

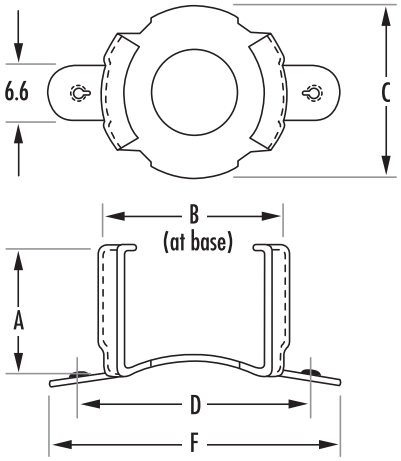


FIGURE 5

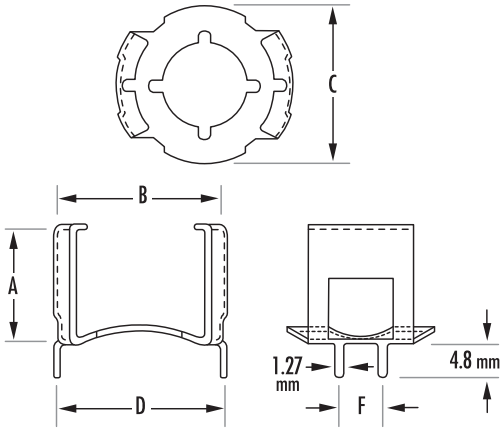


FIGURE 6

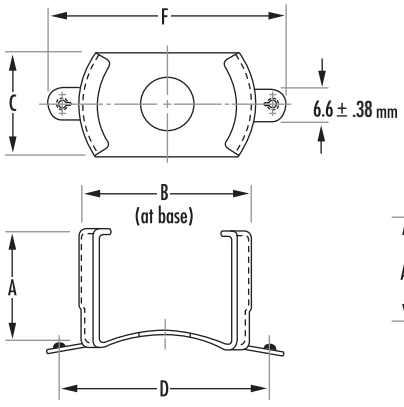
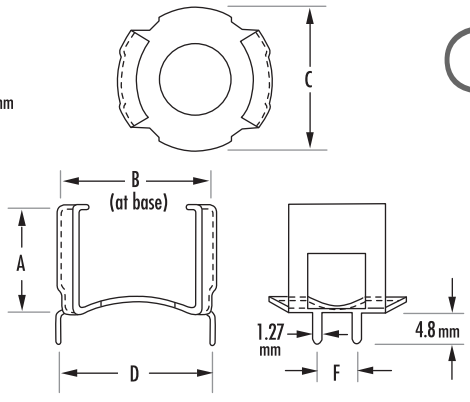


FIGURE 7



Notes

RS/DS Cores

RS/DS CORES

Slab cores are modified pot cores with the sides removed. The slabs can be paired with one round half of a standard pot core (RS combination) or two slabs can be paired together for a double slab (DS combination).

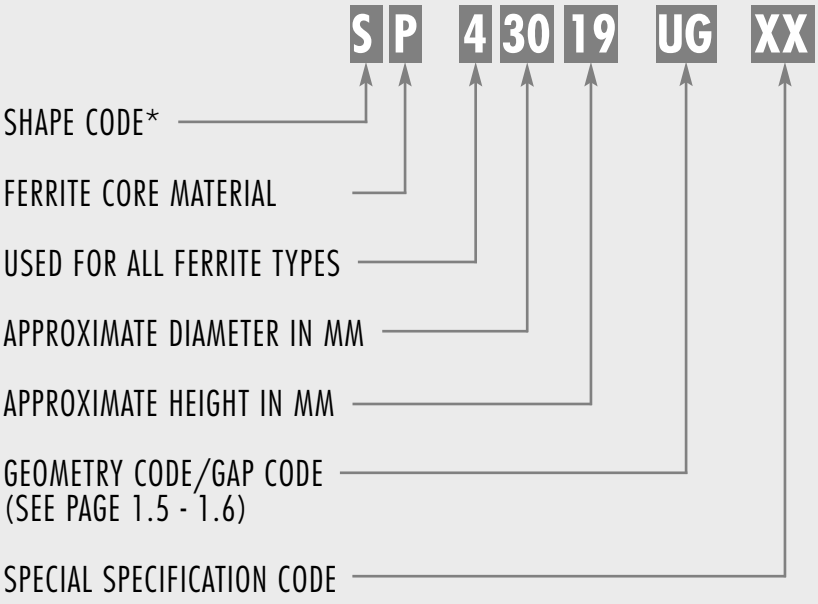
Available in seven sizes, the RS geometry offers all the advantages of pot cores for filter applications, plus many additional features for power applications.

DS cores, available in six sizes, accommodate large size wire and assist in removing heat from the assembly.

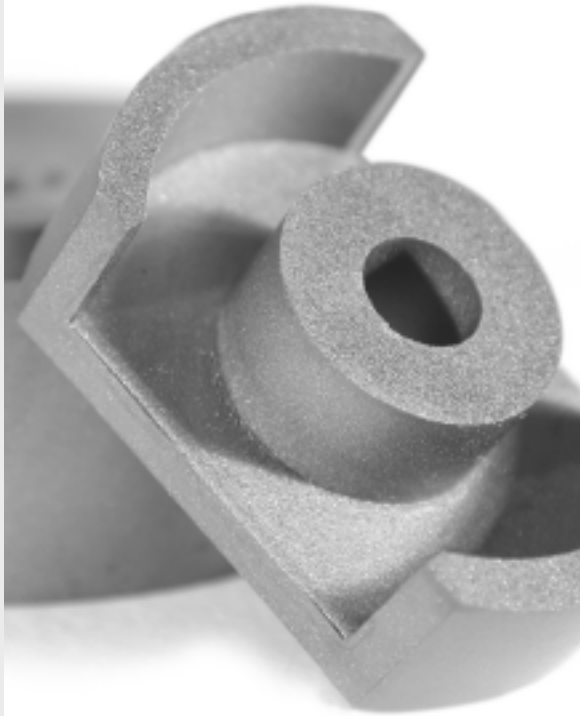
Both plain and printed circuit bobbins are available for both types of cores.

Typical applications for RS/DS combinations include; low and medium power transformers, switched-mode power supplies, and converter and inverter transformers.

HOW TO ORDER



**SHAPE CODES*
D – DS Core with solid centerpost
H – DS Core with center hole
S – RS Core



RS/DS
Core Data (ungapped)

Any practical gap available. See page 1.8 - 1.11

			MECHANICAL DIMENSIONS (mm)			
PART	**FIG.**	**COMBINATION**	**A**	**B**	**2B**	**C**
H_41408UG	**1**	DS with center hole	14 ± .25	4.24 + .0, -.13	8.48 + .0, -.28	9.4 ± .15
S_41408UG	**1**	RS	14 ± .25	4.24 + .0, -.13	8.48 + .0, -.28	9.4 ± .15
D_42311UG	**3**	DS	22.86 ± .46	5.54 ± .13	11.08 ± .26	15.24 ± .25
H_42311UG	**4**	DS with center hole	22.86 ± .46	5.54 ± .13	11.08 ± .26	15.24 ± .25
S_42311UG	**2**	RS	22.9 ± .45	5.5 ± .13	11 ± .25	15.2 ± .25
D_42318UG	**3**	DS	22.86 ± .46	9 ± .18	18 ± .36	15.24 ± .25
H_42318UG	**4**	DS with center hole	22.86 ± .46	9 ± .18	18 ± .36	15.24 ± .25
S_42318UG	**2**	RS	22.9 ± .45	9 ± .18	18.0 ± .35	15.25 ± .25

To order, add material code to part number.

FIGURE 1

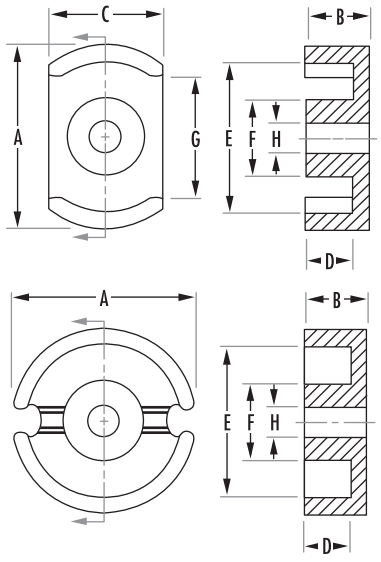
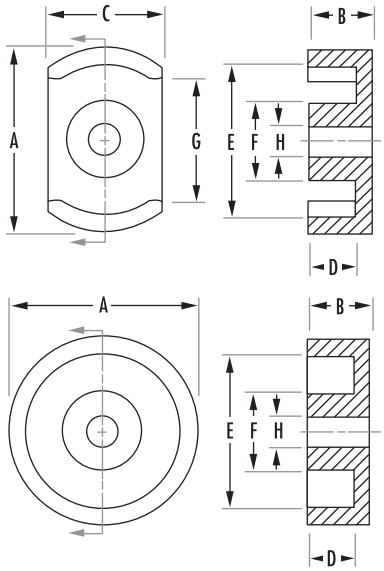


FIGURE 2



RS/DS
Core Data (ungapped)

MECHANICAL DIMENSIONS (mm)							
PART	FIG.	D	2D	E	F	G	H
H_41408UG	**1**	2.8 min	5.58 min	11.6 min	5.99 max	7.6 min	3.1 ± .08
S_41408UG	**1**	2.8	5.58	11.6	5.99	7.6	3.1 ± .08
D_42311UG	**3**	3.63 min	7.26 min	17.93 min	9.9 max	13.21 min	-
H_42311UG	**4**	3.63 min	7.26 min	17.93 min	9.9 max	13.21 min	5.1 ± .1
S_42311UG	**2**	3.75 ± .13	7.5 ± .25	18.3 ± .35	9.7 ± .2	13.2	5.1 ± .1
D_42318UG	**3**	6.93 min	13.86 min	17.93 min	9.9 max	13.2 min	-
H_42318UG	**4**	6.93 min	13.86 min	17.93 min	9.9 max	13.2 min	5.08 ± .1
S_42318UG	**2**	7.2 ± .18	14.4 ± .35	18.3 ± .35	9.7 ± .2	13.2	5.1 ± .1

FIGURE 3

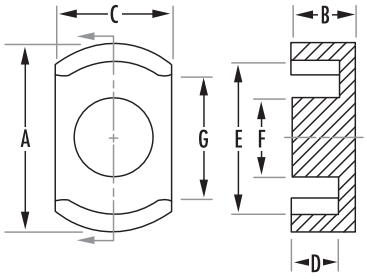
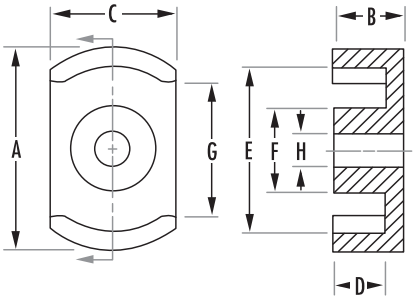


FIGURE 4



RS/DS
Core Data (ungapped)

Any practical gap available. See page 1.8 - 1.11

			MECHANICAL DIMENSIONS (mm)			
PART	**FIG.**	**COMBINATION**	**A**	**B**	**2B**	**C**
D_42616UG	**3**	DS	25.5 ± .51	8.05 ± .1	16.1 ± .2	17.09 nom
H_42616UG	**4**	DS with center hole	25.5 ± .51	8.05 ± .1	16.1 ± .2	17.09 nom
S_42616UG	**1**	RS	25.5 ± .51	8.05 ± .1	16.1 ± .2	17.09 nom
D_43019UG	**3**	DS	30 ± .51	9.4 ± .1	18.8 ± .2	20.32 ± .25
H_43019UG	**4**	DS with center hole	30 ± .51	9.4 ± .1	18.8 ± .2	20.32 ± .25
S_43019UG	**1**	RS	30 ± .51	9.4 ± .1	18.8 ± .2	20.32 ± .25

To order, add material code to part number.

FIGURE 1

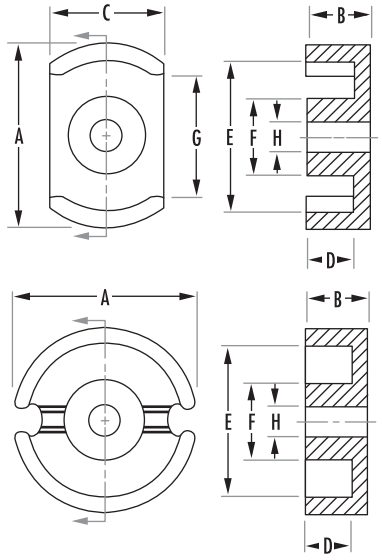
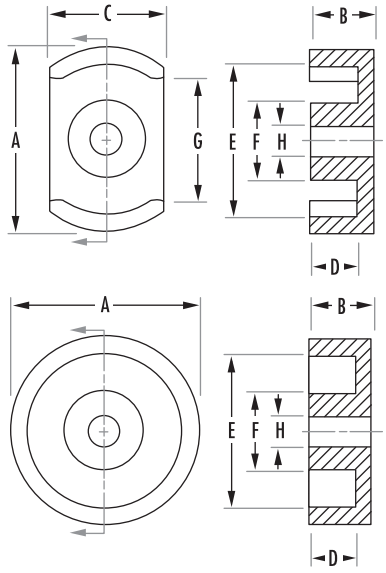


FIGURE 2



RS/DS
Core Data (ungapped)

MECHANICAL DIMENSIONS (mm)							
PART	FIG.	D	2D	E	F	G	H
D_42616UG	**3**	5.51 min	11.02 min	21.21 min	11.48 max	15.5 min	-
H_42616UG	**4**	5.51 min	11.02 min	21.21 min	11.48 max	15.5 min	5.56 ± .1
S_42616UG	**1**	5.51 min	11.02 min	21.21 min	11.48 max	15.5 min	5.56 ± .1
D_43019UG	**3**	6.5 min	13 min	25 min	13.51 max	15.49 min	-
H_43019UG	**4**	6.5 min	13 min	25 min	13.51 max	15.49 min	5.56 ± .1
S_43019UG	**1**	6.5 min	13 min	25 min	13.51 max	15.49 min	-

FIGURE 3

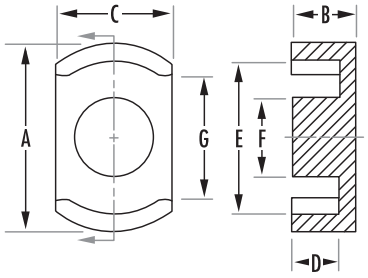
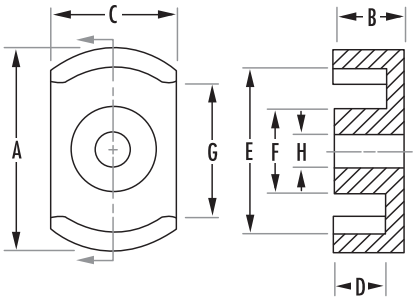


FIGURE 4



RS/DS
Core Data (ungapped)

Any practical gap available. See page 1.8 - 1.11

		A_L (mH/1000T) min				
		POWER MATERIALS			HIGH PERMEABILITY MATERIALS	
PART	COMBINATION	R	P	F*	J	W
H_41408UG	DS with center hole	1,150	1,250	1,990	3,080	4,930
S_41408UG	RS	1,320	1,435	2,274	3,375	5,350
D_42311UG	DS	2,580	2,810	4,460	6,300	11,245
H_42311UG	DS with center hole	2,400	2,595	4,170	5,890	9,815
S_42311UG	RS	2,950	3,210	5,200	6,300	11,250
D_42318UG	DS	2,180	2,370	3,800	4,760	7,000
H_42318UG	DS with center hole	1,950	2,115	3,350	4,000	7,000
S_42318UG	RS	2,300	2,500	4,000	4,800	8,400
D_42616UG	DS	2,870	3,120	5,000	6,070	9,100
H_42616UG	DS with center hole	-	2,880	4,600	6,080	9,100
S_42616UG	RS	3,270	3,550	5,300	6,700	11,000
D_43019UG	DS	3,330	3,620	5,800	7,120	10,500
H_43019UG	DS with center hole	3,170	3,450	5,525	7,130	10,500
S_43019UG	RS	4,150	4,520	6,700	8,360	13,000

To order, add material code to part number.
* F material nominal ±25%

RS/DS
Core Data (ungapped)

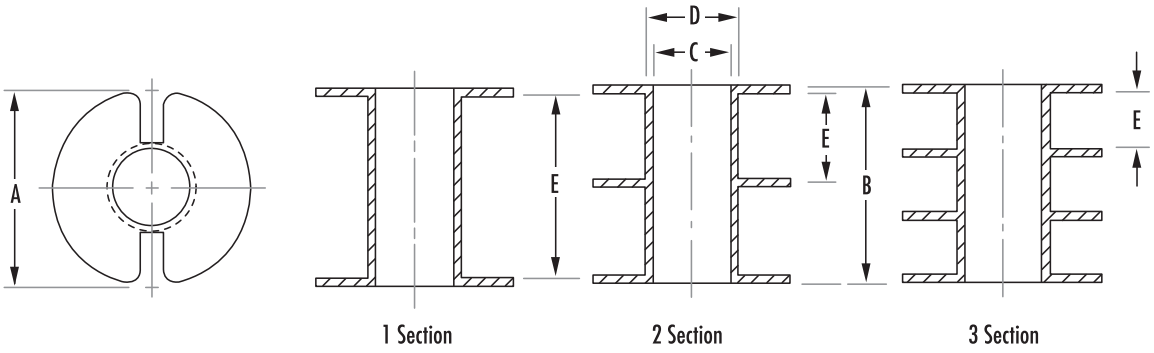
MAGNETIC DATA							AVAILABLE HARDWARE		
							STANDARD BOBBIN	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP
PART	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc			
H_41408UG	20.6	21	19.2	433	-	-			
S_41408UG	20.2	23	19.2	460	2.8			✓	✓
D_42311UG	26.8	51.2	37.8	1,370	10	0.08		✓	
H_42311UG	27	48.2	37.8	1,300	-	-		✓	
S_42311UG	28.6	61	53.6	1,740	11.65	0.09		✓	
D_42318UG	39.9	58	40.7	2,310	13	0.21		✓	
H_42318UG	40.1	53.4	40.7	2,130	-	-		✓	
S_42318UG	41.6	62.2	53.6	2,590	17.4	0.22		✓	
D_42616UG	38.9	77	62.7	3,000	15	0.28	✓	✓	
H_42616UG	39	72.1	62.7	2,810	-	-			
S_42616UG	38.3	82.6	62.7	3,180	20	0.39			
D_43019UG	46.2	117	96	5,410	22	0.6	✓	✓	
H_43019UG	46.1	111	96	5,110	-	-	✓	✓	
S_43019UG	45.6	123	96	5,610	30.95	0.63		✓	

Bobbins

PART	CORE SIZE	FIG.	MECHANICAL DIMENSIONS (mm) A MAX	B MAX	C MIN	D MIN	E NOM	NOMINAL WINDING AREA PER SECTION cm^2	AVERAGE LENGTH OF TURN (mm)	MATERIAL
00B261601	**42616**	**1**	21.13	10.92	11.55	12.77	9.93	0.421	53	Delrin
00B261601FR 2 Section	**42616**	**1**	21.13	10.92	11.55	12.77	9.93	0.421	53	Crastin S660FR
00B261602 3 Section	**42616**	**1**	21.13	10.92	11.55	12.77	4.74	0.202	53	Delrin
00B261603 3 Section	**42616**	**1**	21.13	10.92	11.55	12.77	3.02	0.128	53	Delrin
00B261603FR 3 Section	**42616**	**1**	21.13	10.92	11.55	12.77	3.02	0.128	53	Crastin S660FR
00B301901	**43019**	**1**	24.91	12.92	13.56	15.03	11.68	0.542	62	Delrin
00B301902 2 Section	**43019**	**1**	24.91	12.92	13.56	15.03	5.56	0.254	62	Delrin
00B301903 3 Section	**43019**	**1**	24.91	12.92	13.56	15.03	3.5	0.159	62	Delrin

Bobbins

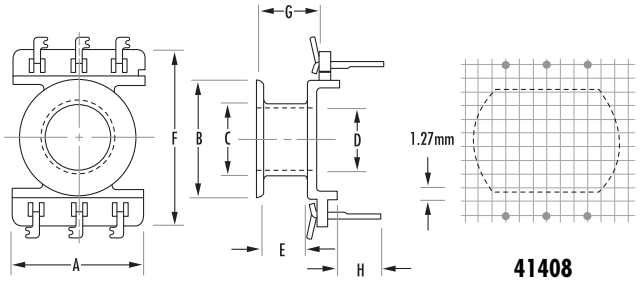
FIGURE 1



Printed Circuit Bobbins

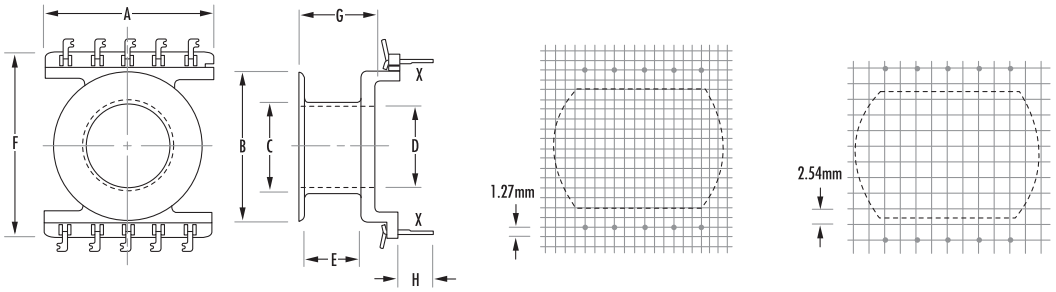
MECHANICAL DIMENSIONS (mm)										
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D MIN	E NOM	F MAX	G MAX	H NOM
PCB4140861	**41408**	**1**	12.77 ref	11.53	7.29	6.07	4.06	16.58 ref	5.48	4.77
PCB2311T1	**42311**	**2**	19.81	17.78	11.43	10.03	5.15	23.24	6.85	5.58
PCB2318T1	**42318**	**2**	23.11	17.78	11.4	10.03	11.88	22.86	13.66	5.53
PCB2616TA	**42616**	**3**	25.52	28.19	12.87	11.55	8.89	21.13	10.92	5.58
PCB3019T1	**43019**	**2**	28.19	24.76	14.93	13.56	10.74	30.09	12.77	4.77

FIGURE 1



41408

FIGURE 2



42311 & 42318

43019

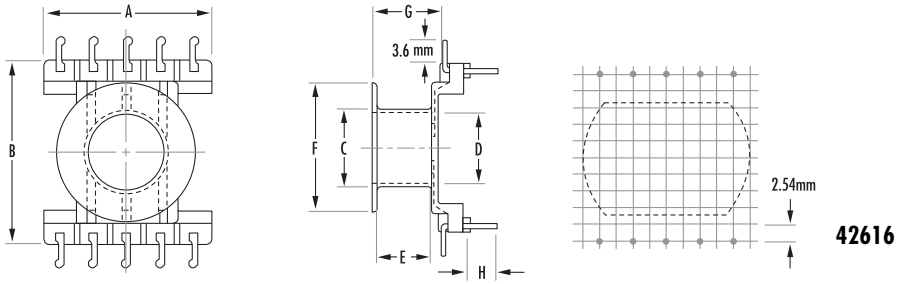
PCB2311T1 and PCB2318T1 have no standoff at X

Printed Circuit Bobbins

	NOMINAL WINDING AREA PER SECTION cm^2	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIMENSIONS (mm)	BOARD CLEARANCE (mm)*		
						Length	Width	Height
PCB4140861	0.086	29	Glass-filled nylon	Tin coated Phosphor bronze	1.06 x .381	14.35	21.59	9.52
PCB2311T1	0.159	44	Glass-filled nylon	Tin coated Phosphor bronze	1.06 x .381	23.5	26.16	11.43
PCB2318T1	0.368	44	Glass-filled Nylon	Tin coated Phosphor bronze	1.06 x .381	23.5	26.16	18.7
PCB2616TA	0.368	53	Rynite FR530	Tin-lead plated brass	1.14 x .381	26.1	38.1	18.8
PCB3019T1	0.514	63	Glass-filled nylon	Tin coated Phosphor bronze	1.06 x .381	30.8	33.8	19.7

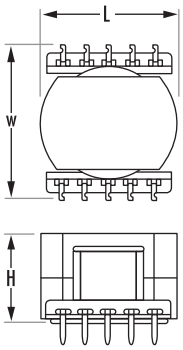
*reference figure 4 for board clearance

FIGURE 3



42616

FIGURE 4



Notes

RM Cores

RM CORES

RM Cores are square-designed cores that offer all the magnetic and mechanical advantages of pot cores, plus the added feature of maximizing magnetic performance while minimizing PC board space.

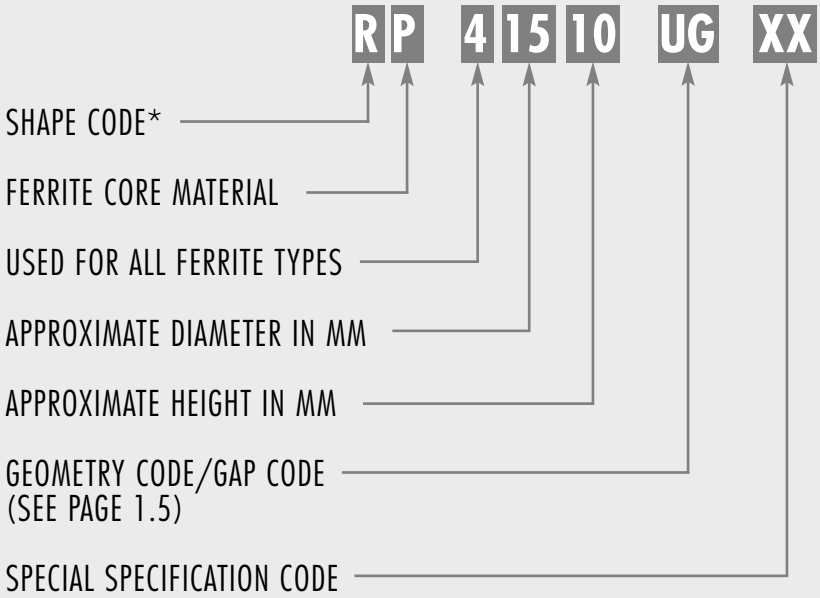
Easy to assemble and adaptable to automation, completed units provide at least 40% savings in mounting area compared to a similar size pot core assembly.

RM cores are available in seven standard sizes.

Printed circuit bobbins or plain bobbins are available.

Typical applications include differential inductors, power inductors, filter inductors, telecom inductors and broadband transformers.

HOW TO ORDER



**SHAPE CODES*
N – RM Core with solid centerpost
R – RM Core with center hole

RM
Core Data (ungapped)

Any practical gap available. See page 1.8 - 1.11

			MECHANICAL DIMENSIONS (mm)				
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**2B**	**C**	**D**
N_41110UG	RM4 no center hole	**1**	11 + 0, - .5	5.2 ± .05	10.4 ± .1	4.6 + 0, - .2	3.5 + .2, - 0
R_41110UG	RM4	**1**	11.8	5.2 ± .05	10.4 ± .1	4.45 nom	3.61 ± .1
R_41510UG	RM5	**2**	14.9 max	5.2 ± .05	10.4 ± .1	6.6 nom	3.25 ± .1
N_41510UG	RM5 no center hole	**2**	14.6 + 0, - .6	5.2 ± .05	10.4 ± .1	6.8 +0, -.4	3.25 ± .1
R_41812UG	RM6-R	**3**	18.3 max	6.2 ± .05	12.4 ± .1	7.4 nom	4.1 ± .1
N_41812UG	RM6-R no center hole	**3**	17.9 + 0, - .7	6.2 ± .05	12.4 ± .1	7. + 0, - .4	4 + .2, - 0
R_41912UG	RM6-S	**4**	18.3 max	6.2 ± .05	12.4 ± .1	8.2 nom	4.1 ± .10

To order, add material code to part number.

FIGURE 1

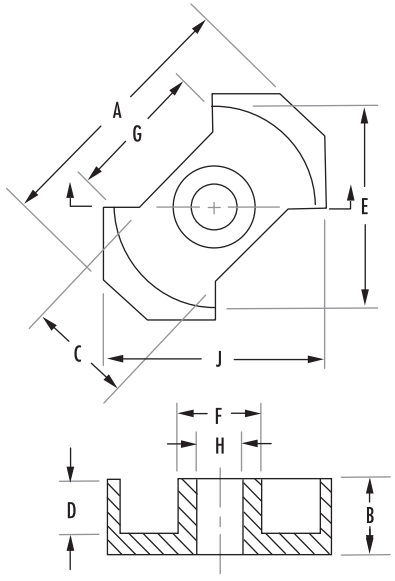
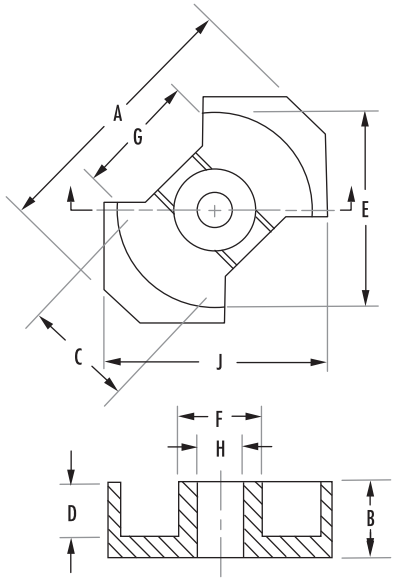


FIGURE 2



RM
Core Data (ungapped)

MECHANICAL DIMENSIONS (mm)							
PART	FIG.	2D	E	F	G	H	J
N_41110UG	**1**	7 + .4, - 0	7.95 + .4, - 0	3.9 + 0, - .2	5.8 min		9.8 + 0, - .4
R_41110UG	**1**	7.21 ± .2	8.15 ± .2	3.8 ± .10	5.79 ref	2.05 ± .05	9.6 ± .2
R_41510UG	**2**	6.5 ± .2	10.4 ± .2	4.8 ± .1	6.71 nom	2.05 ± .05	12.05 ± .25
N_41510UG	**2**	6.5 ± .2	10.2 + .4, - 0	4.9 + 0, - .2	6 min	-	12.3 + 0, - .5
R_41812UG	**3**	8.2 ± .2	12.65 ± .25	6.25 ± .15	5.85 nom	3.05 ± .05	14.4 ± .3
N_41812UG	**3**	8 + .4, - 0	12.4 + .5, - 0	6.4 + 0, - .2	5.85 nom	-	14.7 + 0, - .6
R_41912UG	**4**	8.2 ± .2	12.65 ± .25	6.25 ± .15	9 nom	3.05 ± .05	14.4 ± .3

FIGURE 3

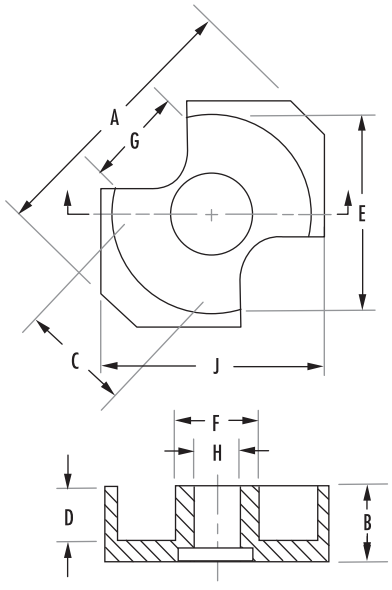
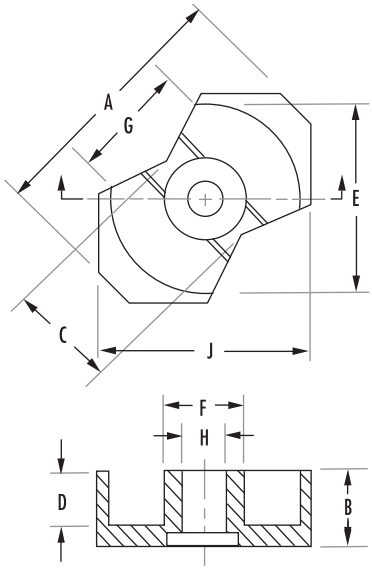


FIGURE 4



RM
Core Data (ungapped)

Any practical gap available. See page 1.8 - 1.11

			MECHANICAL DIMENSIONS (mm)				
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**2B**	**C**	**D**
N_41912UG	RM6-S no center hole	**4**	18.3 max	6.2 ± .05	12.4 ± .1	8.2 nom	4.1 ± .1
N_42013UG	RM7 no center hole	**5**	20.3 + 0. - .8	6.7 ± .05	13.4 ± .1	-	4.2 + .25 - 0
R_42316UG	RM8	**2**	23.2 max	8.2 ± .05	16.4 ± .1	10.8 nom	5.53 ± .13
N_42316UG	RM8 no center hole	**2**	23.2 + 0, - .9	8.2 ± .05	16.4 ± .1	11.0 + 0, - .5	5.5 ± .1
N_42819UG	RM10 no center hole	**2**	28.5 + 0, - 1.3	9.3 ± .05	18.6 ± .1	13.5 + 0, - .5	6.2 + .3, - 0
N_43723UG	RM12	**4**	37.4 + 0, - 1.3	12.25 ± .05	24.5 ± .1	16.1 + 0, - .5	8.4 + .3, - 0
N_44230UG	RM14 no center hole	**2**	42.2 + 0, - 1.4	15.05 ± .05	30.1 ± .1	19 + 0, -.6	10.4 + .3, - 0

To order, add material code to part number.

FIGURE 2

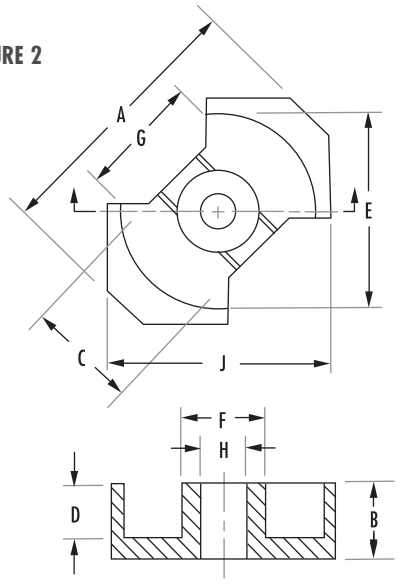
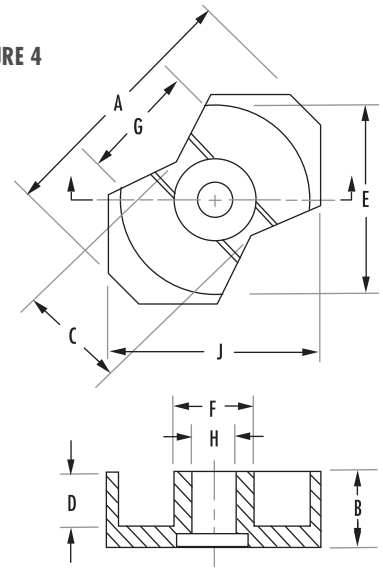


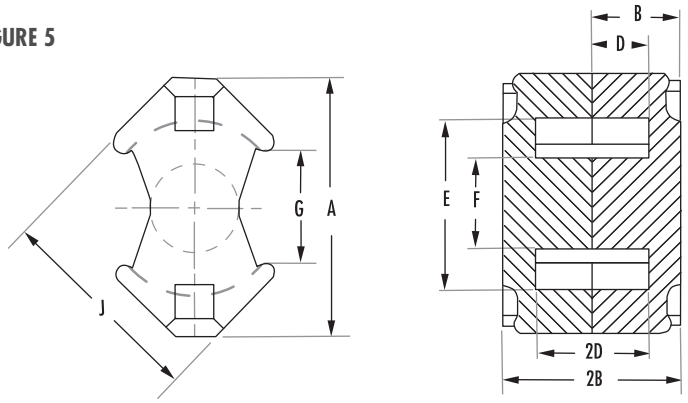
FIGURE 4



RM
Core Data (ungapped)

MECHANICAL DIMENSIONS (mm)							
PART	FIG.	2D	E	F	G	H	J
N_41912UG	**4**	8.2 ± .2	12.65 ± .25	6.25 ± .15	9 nom	-	14.4 ± .3
N_42013UG	**5**	8.4 ± .5, - 0	20.3 ± .25, - .8	7.25 + 0, - .3	9.3 min	-	17.2 + 0, - .7
R_42316UG	**2**	11.05 ± .25	17.35 ± .35	8.4 ± .15	11.7 nom	4.5 ± .1	19.3 ± .4
N_42316UG	**2**	11 ± .2	17.0 + .6, - 0	8.55 + 0, -.3	9.5 min	-	19.7 + 0, -.8
N_42819UG	**2**	12.4 + .6, - 0	21.2 + .9, - 0	10.9 + 0, -.4	10.9 min	-	24.7 + 0, - 1.1
N_43723UG	**4**	16.8 + .6, - 0	24.9 + 1.1, - 0	12.8 + 0, - .4	12.9 min	-	29.8 + 0, - 1.1
N_44230UG	**2**	20.8 + .6, - 0	29 + 1.2, - 0	15 + 0, - .6	17 nom	-	34.8 + 0, - 1.3

FIGURE 5



RM
Core Data (ungapped)

Any practical gap available. See page 1.8 - 1.11

			A_L (mH/1000T) min				
			POWER MATERIALS			HIGH PERMEABILITY MATERIALS	
PART	CORE TYPE	FIG.	R	P	F*	J	W
N_41110UG	RM4 no center hole	**1**	844	893	1589	1314	2463
R_41110UG	RM4	**1**	690	750	1,200	1,480	2,100
R_41510UG	RM5	**2**	1,290	1,400	2,100	3,100	4,200
N_41510UG	RM5 no center hole	**2**	1,290	1,400	2,100	3,100	4,200
R_41812UG	RM6-R	**3**	1,640	1,750	2,800	4,480	5,400
N_41812UG	RM6-R no center hole	**3**	1,790	1,950	3,080	5,030	6,020
R_41912UG	RM6-S	**4**	1,490	1,620	2,600	4,040	5,400

To order, add material code to part number.
* F material nominal ±25%

FIGURE 1

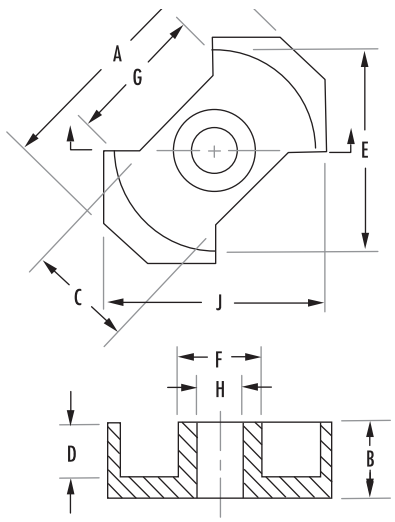
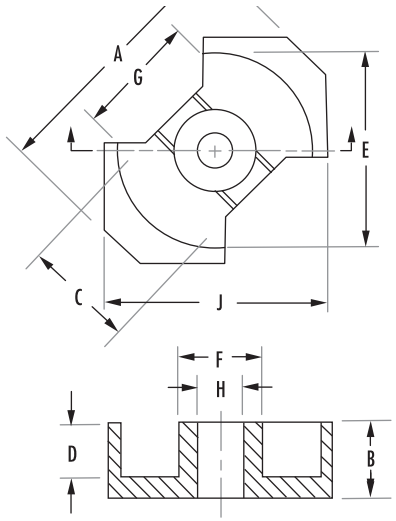


FIGURE 2



RM
Core Data (ungapped)

PART	MAGNETIC DATA l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc	AVAILABLE HARDWARE: PRINTED CIRCUIT BOBBIN	AVAILABLE HARDWARE: MOUNTING CLAMP
N_41110UG	23.3	13.8	23.3	322	1.5	-		✓
R_41110UG	20.6	10.8	7.9	222	1.6	0.008		✓
R_41510UG	21.4	21	13.9	449.0	3	0.02	✓	✓
N_41510UG	23.2	24.8	18.1	574	3.3	0.02	✓	✓
R_41812UG	25.6	32	22.6	819	5.1	0.05	✓	✓
N_41812UG	27.5	38	31.2	1,040	5.400	0.05	✓	✓
R_41912UG	27	31	22.6	837	4.8	0.05	✓	✓

FIGURE 3

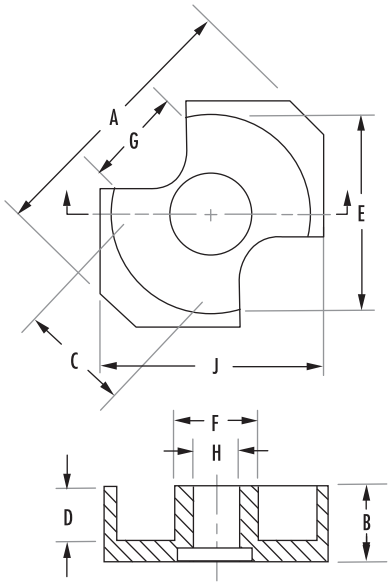
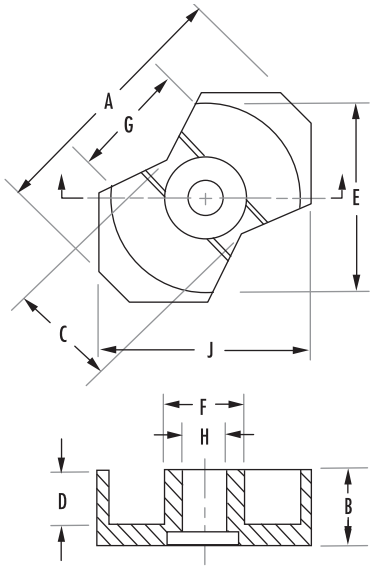


FIGURE 4



RM
Core Data (ungapped)

Any practical gap available. See page 1.8 - 1.11

			A_L (mH/1000T) min				
			POWER MATERIALS			HIGH PERMEABILITY MATERIALS	
PART	CORE TYPE	FIG.	R	P	F*	J	W
N_41912UG	RM6-S no center hole	**4**	1,660	1,800	2,880	4,500	6,020
N_42013UG	RM7 no center hole	**4**	2,294	2,433	4,247	3,751	6,700
R_42316UG	RM8	**6**	1,760	1,920	3,500	5,220	7,420
N_42316UG	RM8 no center hole	**6**	2,025	2,200	5,210	6,000	8,540
N_42819UG	RM10 no center hole	**2**	3,035	3,300	5,500	7,490	11,200
N_43723UG	RM12	**4**	3,450	3,750	6,000	8,850	15,820
N_4423OUG	RM14 no center hole	**2**	5,250	5,655	9,449	9,822	13,900

To order, add material code to part number.
* F material nominal ±25%

FIGURE 2

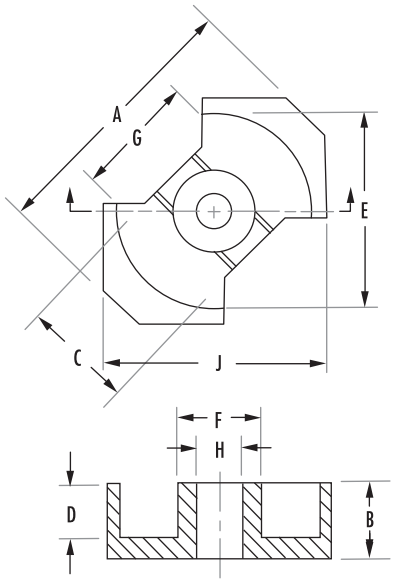
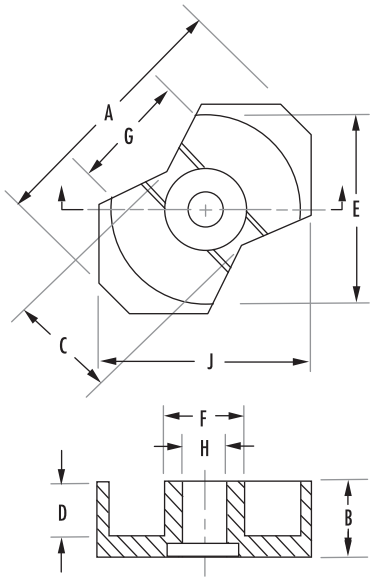


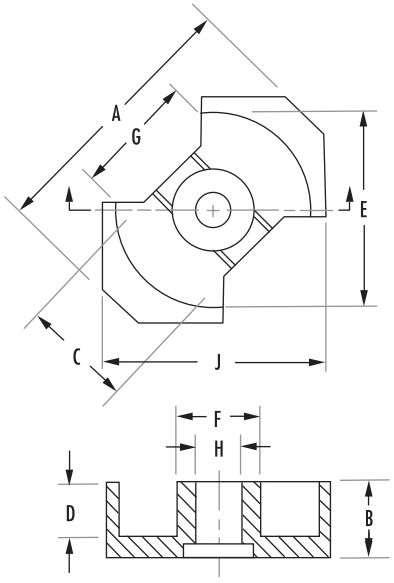
FIGURE 4



RM
Core Data (ungapped)

MAGNETIC DATA							PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP
PART	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc	AVAILABLE HARDWARE	
N_41912UG	29.2	37	31.2	1,090	5.1	0.05	✓	✓
N_42013UG	30	44.1	39.6	1325	6	-		
R_42316UG	35.5	52	36.9	1,850	10.4	0.15	✓	✓
N_42316UG	38.4	63	55.4	2,440	13	0.15	✓	✓
N_42819UG	44.6	96.6	89.1	4,310	23.0	0.44	✓	✓
N_43723UG	56.6	146	125	8,340	42	1.02	✓	
N_44230UG	70	198	168	13,900	34	-		

FIGURE 6



Printed Circuit Bobbins

			MECHANICAL DIMENSIONS (mm)						
PART	CORE SIZE	FIG.	A MAX	B MAX	C MIN	D NOM	E MAX	F NOM	G NOM
PCB15104A	**41510**	**1**	10.10	5.94	4.97	5.08	6.09	5.0	-
PCB15104B 2 section	**41510**	**1**	10.1	5.94	4.97	5.08	6.09	5.0	-
PCB151061	**41510**	**2**	10.1	6.04	4.97	4.92	6.14	4.57	-
PCB151081	**41510**	**3**	10.1	6.04	4.97	4.92	6.14	4.57	-
PCB181241	**41812/41912**	**4**	12.29	7.39	6.5	6.7	7.89	4.49	0.76

FIGURE 1

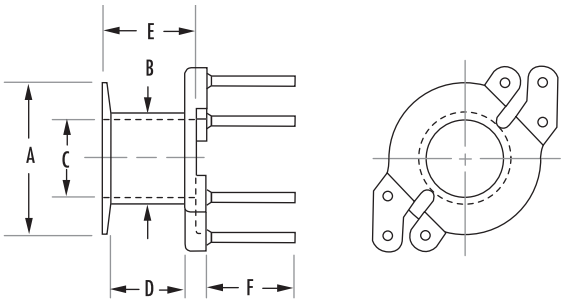
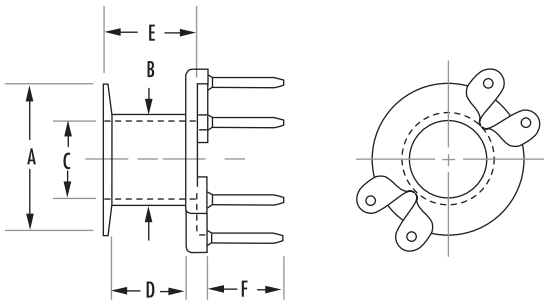


FIGURE 2



Printed Circuit Bobbins

PART	NOMINAL WINDING AREA PER SECTION cm^2	AVERAGE LENGTH OF TURN MM	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER
PCB15104A	0.096	25	Thermoset Phenolic	Tin coated Phosphor bronze	0.56
PCB15104B 2 section	0.096	25	Thermoset Phenolic	Tin coated Phosphor bronze	0.56
PCB151061	0.096	25	Thermoset Phenolic	Tin coated Phosphor Bronze	0.53
PCB151081	0.096	25	Thermoset Phenolic	Tin coated Phosphor Bronze	0.48
PCB181241	0.160	29.8	Thermoset Phenolic	Tin coated Phosphor Bronze	0.50 square/round

FIGURE 3

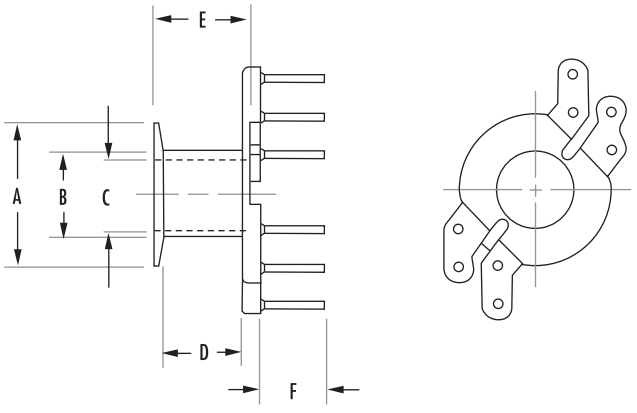
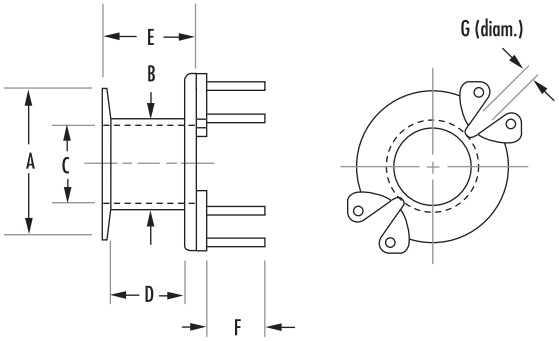
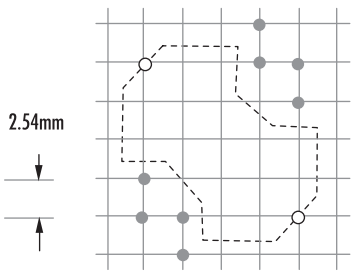


FIGURE 4

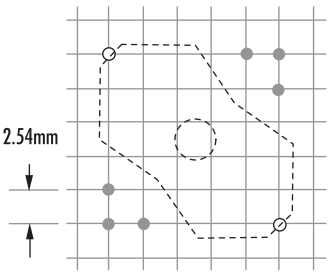


PIN LAYOUTS

- ● Holes for bobbin pins
- ○ Holes for clip pins



41510



41812
41912

Printed Circuit Bobbins

			MECHANICAL DIMENSIONS (mm)						
PART	CORE SIZE	FIG.	A MAX	B MAX	C MIN	D NOM	E MAX	F NOM	G NOM
PCB181261	**41812/41912**	**5**	12.29	7.39	6.5	6.7	7.89	4.49	0.76
PCB231651	**42316**	**6**	16.89	9.95	8.68	9.04	10.59	5.48	-
PCB231652 2 section	**42316**	**6**	16.89	9.95	8.68	4.24	10.59	5.48	-
PCB231681	**42316**	**6**	16.89	9.95	8.68	9.04	10.59	5.48	-
PCB231682 2 section	**42316**	**6**	16.89	9.95	8.68	4.24	10.59	5.48	-
PCB2819L1	**42819**	**7**	21.0	12.24	11.1	10.59	12.19	5.2	1.29
PCB3723L1	**43723**	**8**	24.7	14.	13.0	14.68	16.45	6.09	1.21

FIGURE 5

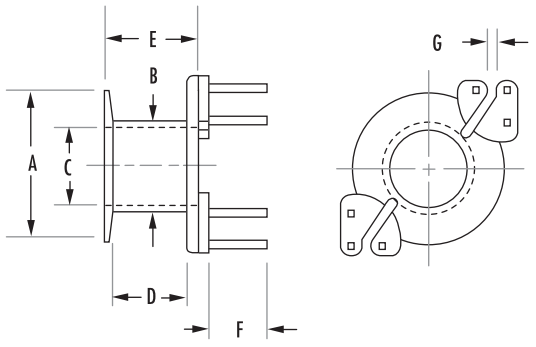


FIGURE 7

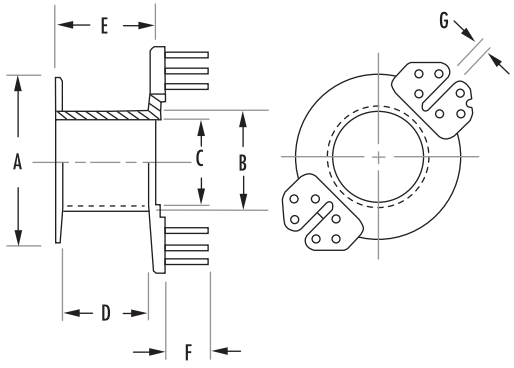
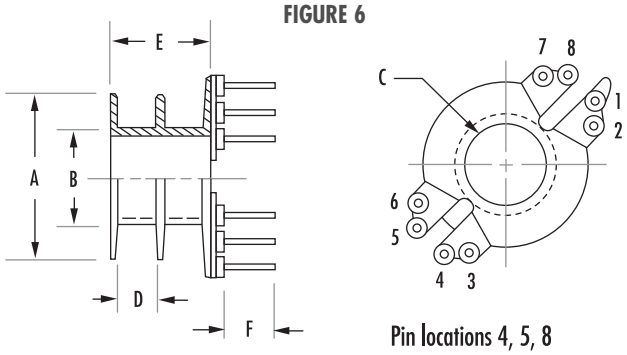


FIGURE 6

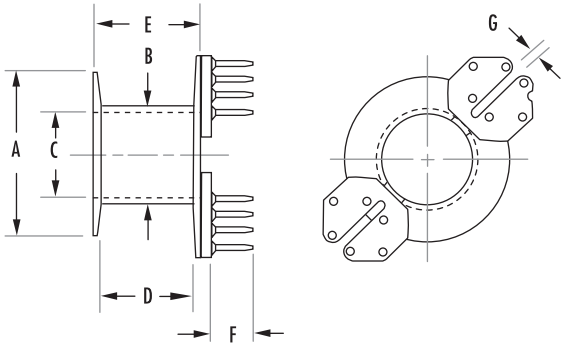


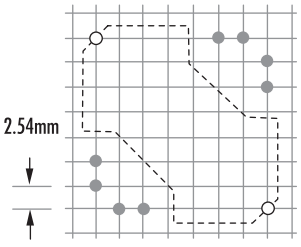
Pin locations 4, 5, 8
blank on 5 pin bobbin

Printed Circuit Bobbins

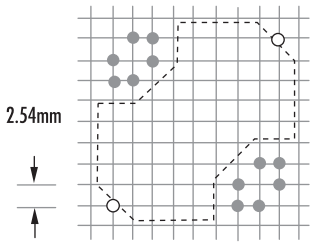
PART	NOMINAL WINDING AREA PER SECTION cm^2	AVERAGE LENGTH OF TURN MM	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER
PCB181261	0.160	29.8	Thermoset Phenolic	Tin coated Phosphor Bronze	0.50 square/round
PCB231651	0.300	42	Thermoset Phenolic	Tin coated Phosphor Bronze	0.66
PCB231652 2 section	0.142	42	Thermoset Phenolic	Tin coated Phosphor Bronze	0.66
PCB231681	0.300	42	Thermoset Phenolic	Tin coated Phosphor Bronze	0.66
PCB231682	0.142	42	Thermoset Phenolic	Tin coated Phosphor Bronze	0.66
PCB2819L1	0.452	52.4	Thermoset Phenolic	Tin coated Phosphor Bronze	0.61
PCB3723L1	0.730	61	Thermoset Phenolic	Tin coated Phosphor Bronze	0.84

FIGURE 8

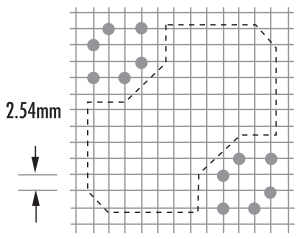




42316



42819



43723

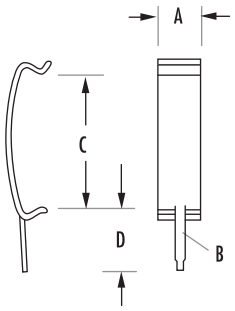
- Holes for bobbin pins
- Holes for clip pins

RM
Mounting Clamps

			MECHANICAL DIMENSIONS (mm)				MATERIAL	MATERIAL THICKNESS
PART	CORE SIZE	FIG.	A NOM	B NOM				
00C111012	**41110/41510**	**1**	2.08	.68 x .30	8.38	4.34	Spring Steel	0.30
00C181211	**41812/41912**	**1**	2.59	.71 x .38	9.85	4.34	Spring Steel	0.38
00C231615	**42316**	**1**	4.49	.71 x .35	13.58	4.59	Spring Steel	0.36
00C281916	**42819**	**1**	4.49	.71 x .4	15.54	5.05	Spring Steel	0.41

Two mounting clamps are required per core set.

FIGURE 1



EP Cores

EP CORES

EP cores are round center-post cubical shapes which enclose the coil completely except for the printed circuit board terminals. This particular shape minimizes the effect of air gaps formed at mating surfaces in the magnetic path and provides a larger volume ratio to total space used. EP cores provide excellent shielding.

Typical applications for EP cores include differential and telecom inductors and power transformers.

HOW TO ORDER

P	W	4	10	10	UG	XX

SHAPE CODE*

FERRITE CORE MATERIAL

USED FOR ALL FERRITE TYPES

APPROXIMATE DIAMETER IN MM

APPROXIMATE HEIGHT IN MM

GEOMETRY CODE/GAP CODE
(SEE PAGE 1.5)

SPECIAL SPECIFICATION CODE

**SHAPE CODES: P – EP core*

EP
Core Data (ungapped)

Any practical gap is available. See page 1.8-1.11

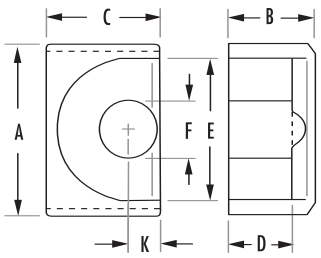
			MECHANICAL DIMENSIONS (mm)			
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**2B**	**C**
P_40707UG	**EP7**	**1**	9.2 ± .2	3.7 ± .05	7.4 ± .1	6.35 ± .15
P_41010UG	**EP10**	**1**	11.5 ± .3	5.15 ± .1	10.3 ± .2	7.6 ± .2
P_41313UG	**EP13**	**1**	12.8 + 0, - .6	6.45 ± .08	12.9 ± .16	9 + 0, - .4
P_41717UG	**EP17**	**1**	18 ± .4	8.4 ± .1	16.8 ± .2	11 ± .25
P_42120UG	**EP20**	**1**	24 ± .5	10.7 ± .1	21.4 ± .2	15 ± .35

To order, add material code to part number.

			A_L (mH/1000T) min				
			POWER MATERIALS			HIGH PERMEABILITY MATERIALS	
PART	**CORE TYPE**	**FIG.**	**R**	**P**	**F***	**J**	**W**
P_40707UG	**EP7**	**1**	810	880	1,240	1,930	3,600
P_41010UG	**EP10**	**1**	780	850	1,200	1,850	3,360
P_41313UG	**EP13**	**1**	1,150	1,250	2,000	2,800	5,000
P_41717UG	**EP17**	**1**	1,790	1,950	3,100	4,400	8,000
P_42120UG	**EP20**	**1**	3,170	3,450	5,000	7,200	13,500

* F material nominal ±25%

FIGURE 1



EP
Core Data (ungapped)

MECHANICAL DIMENSIONS (mm)						
PART	FIG.	D	2D	E	F	K
P_40707UG	1	2.5 min	5.0 min	7.2 min	3.4 max	1.7 ± .1
P_41010UG	1	3.6 min	7.2 min	9.2 min	3.45 max	1.85 ± .1
P_41313UG	1	4.5 + .2, - 0	9 + .4, - 0	9.7 + .6, - 0	4.5 + 0, - .3	2.4 ± .1
P_41717UG	1	5.7 ± .15	11.4 ± .3	12 ± .4	5.7 ± .18	3.3 ± .2
P_42120UG	1	7.2 ± .15	14.4 ± .3	16.5 ± .4	8.8 ± .25	4.5 ± .2

MAGNETIC DATA							
PART	FIG.	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc (cm^4)
P_40707UG	1	15.5	10.7	8.55	165	1.4	0.003
P_41010UG	1	19.3	11.3	8.55	215	2.8	0.01
P_41313UG	1	24.2	19.5	14.0	472	5.1	0.03
P_41717UG	1	29.5	33.7	25.5	999	11.6	0.08
P_42120UG	1	41.1	78.7	60.8	3,230	27.6	0.24

AVAILABLE HARDWARE	SURFACE MOUNT BOBBIN	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP
P_40707UG	✓	✓	✓
P_41010UG	✓	✓	✓
P_41313UG	✓		✓
P_41717UG		✓	✓
P_42120UG			✓

Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)													
PART	CORE SIZE	FIG.	A REF	B REF	C MAX	D MIN	E NOM	F NOM	G NOM	H REF	J MAX	K REF	L REF
PCB07076B	**40707**	**1**	9.14	7.39	7.11	3.42	3.5	4.49	3.73	4.57	4.72	2.51	5.05
PCB10108A	**41010**	**2**	10.99	10.99	8.99	3.55	5.58	4.9	3.4	5.38	7.11	2.48	7.49
PCB17178A	**41717**	**3**	18.99	18.99	11.45	5.99	9.47	7.11	4.69	7.49	11.1	-	-

FIGURE 1

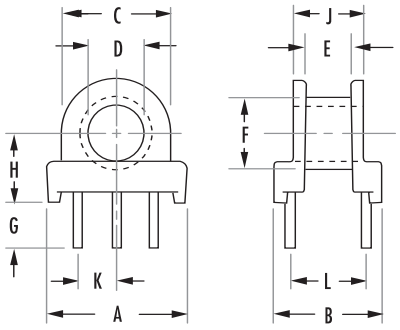


FIGURE 2

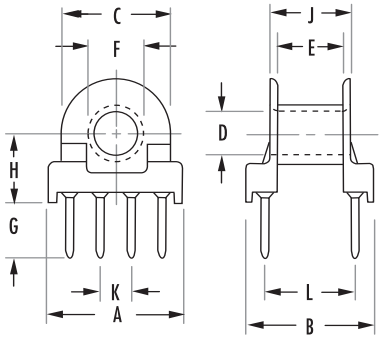
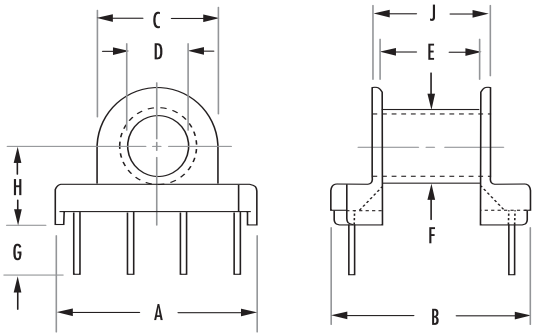


FIGURE 3

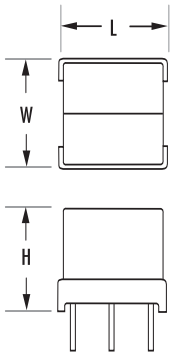


Printed Circuit Bobbins

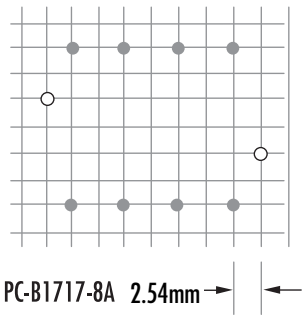
	NOMINAL WINDING AREA PER SECTION cm^2	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)	BOARD CLEARANCE (mm)*			
							Length	Width	Height
PCB07076B	0.04	18	Phenolic	Tin coated Phosphor Bronze	0.40 square	with clamp	12.3	9.8	10.4
						no clamp	9.5	72.6	9.9
PCB10108A	0.11	21.3	Phenolic	Tin coated Phosphor Bronze	0.66	with clamp	14	13	12
						no clamp	72	11.1	11.3
PCB17178A	0.18	28.7	Phenolic	Tin coated Phosphor Bronze	0.66	with clamp	21.3	20.3	16.3
						no clamp	19.3	19.3	15.7

*reference figure 4 for board clearance

FIGURE 4



PIN LAYOUTS



● Holes for bobbin pins
o Holes for clip pins

Surface Mount Bobbins

			MECHANICAL DIMENSIONS (mm)									
PART	CORE SIZE	FIG.	A REF	B REF	C MAX	D MIN	E NOM	F NOM	H REF	J MAX	K REF	L REF
SMB07076A	**40707**	**1**	9.19	8.58	7.11	3.4	3.6	4.49	3.5	4.9	10.59	12.7
SMB10108A	**41010**	**2**	11.5	10.49	9.09	3.5	5.79	4.8	4.49	7.11	12.49	14.6
SMB1313TA	**41313**	**3**	12.8	13.005	9.6	4.49	7.59	5.79	5.25	8.78	15.39	16.99

FIGURE 1

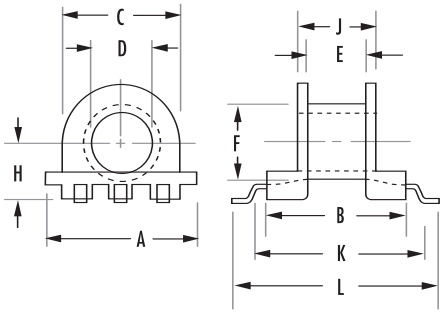


FIGURE 2

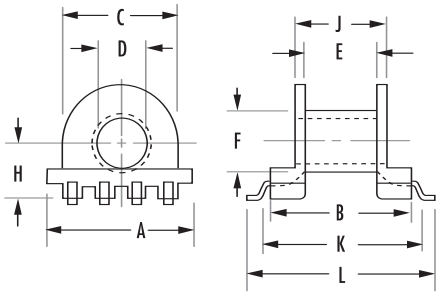
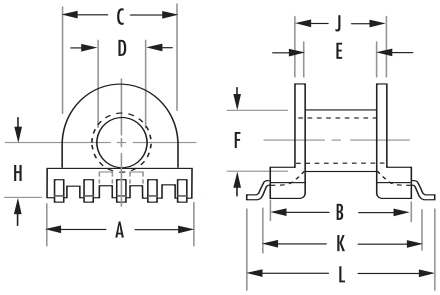


FIGURE 3



Surface Mount Bobbins

	NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN THICKNESS (mm)
	cm^2			
SMB07076A	0.044	17.7	L.C.P.	0.30
SMB10108A	0.120	21.3	L.C.P.	0.30
SMB1313TA	0.138	23.8	L.C.P.	0.30

Mounting Clamps

			MECHANICAL DIMENSIONS (NOMINAL) (mm)									MATERIAL
PART	CORE SIZE	FIG.	A	B	C	D	E	F	G	H	MATERIAL	THICKNESS
0AC070716 YOKE	**40707**	**2**	9.6	12.16	4.97	3.98	2.08	5.89	0.4	-	Nickel Silver	0.40
0BC070712 CLAMP	**40707**	**1**	10.38	7.18	4.97	-	-	-	-	-	Nickel Silver	0.30
00C10102A	**41010**	**3**	16.51	12.14	6.4	4.95	2.59	9.52	2.48	1.01	Phosphor Bronze	0.38
YOKE/ CLAMP	**41010**	**1**	13.005	8.59	6.5	-	-	-	-	-	Phosphor Bronze	0.30
0AC131316 YOKE	**41313**	**4**	16.51	13.004	7.51	3.98	2.59	11.68	2.99	1.21	Nickel Silver	0.40
0BC131314 CLAMP	**41313**	**1**	14.07	12.64	7.51	-	-	-	-	-	Nickel Silver	0.36
00C17172A	**41717**	**5**	19.99	18.59	8.99	5.004	5.004	15.59	5.004	0.99	Phosphor Bronze	0.40
YOKE/ CLAMP	**41717**	**1**	19.17	16.58	8.99	-	-	-	-	-	Phosphor Bronze	0.30
0AC212016 YOKE	**42120**	**6**	22.27	24.61	11.98	3.5	4.57	17.6	2.54	0.99	Nickel Silver	0.40
0BC212016 CLAMP	**42120**	**1**	24.99	21.48	11.98	-	-	-	-	-	Nickel Silver	0.40

Yoke and Clamp are required for assembly.

Part numbers 00C10102A & 00C17172A are for yoke/clamp set.

Mounting Clamps

FIGURE 1

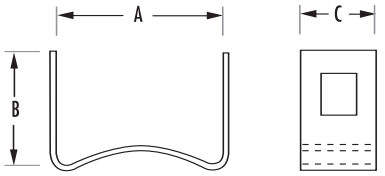


FIGURE 2

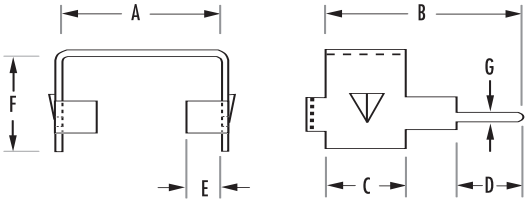


FIGURE 3

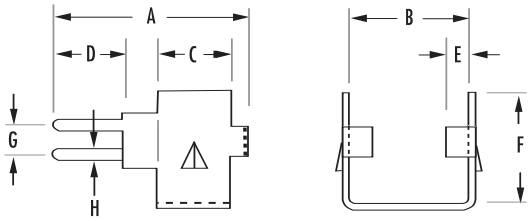


FIGURE 4

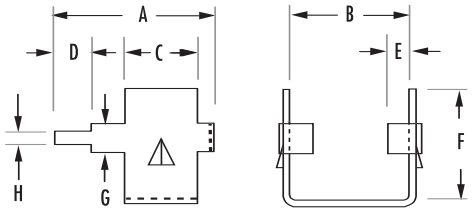


FIGURE 5

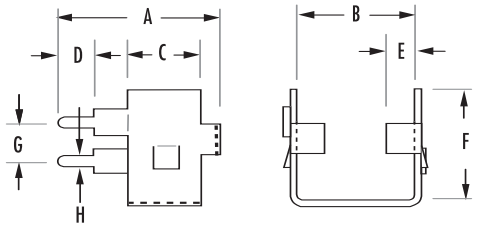
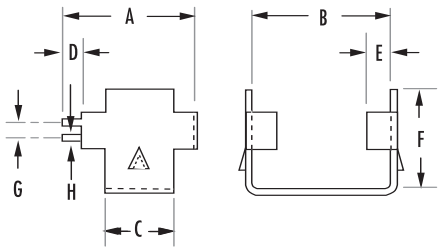


FIGURE 6



Notes

PQ Cores

PQ CORES

PQ cores are designed specifically for switched mode power supplies. This design provides an optimized ratio of volume to winding area and surface area. As a result, both maximum inductance and winding area are possible with a minimum core size. The cores provide maximum power output with minimum assembled transformer weight and volume, in addition to taking up a minimum amount of area on the printed circuit board.

Assembly with printed circuit bobbins and one piece clamps is simplified. This efficient design provides a more uniform cross-sectional area; thus cores tend to operate with fewer hot spots than with other designs.

Typical applications include power transformers and power inductors.

HOW TO ORDER

O	P	4	20	16	UG	XX

STANDARD CORE

FERRITE CORE MATERIAL

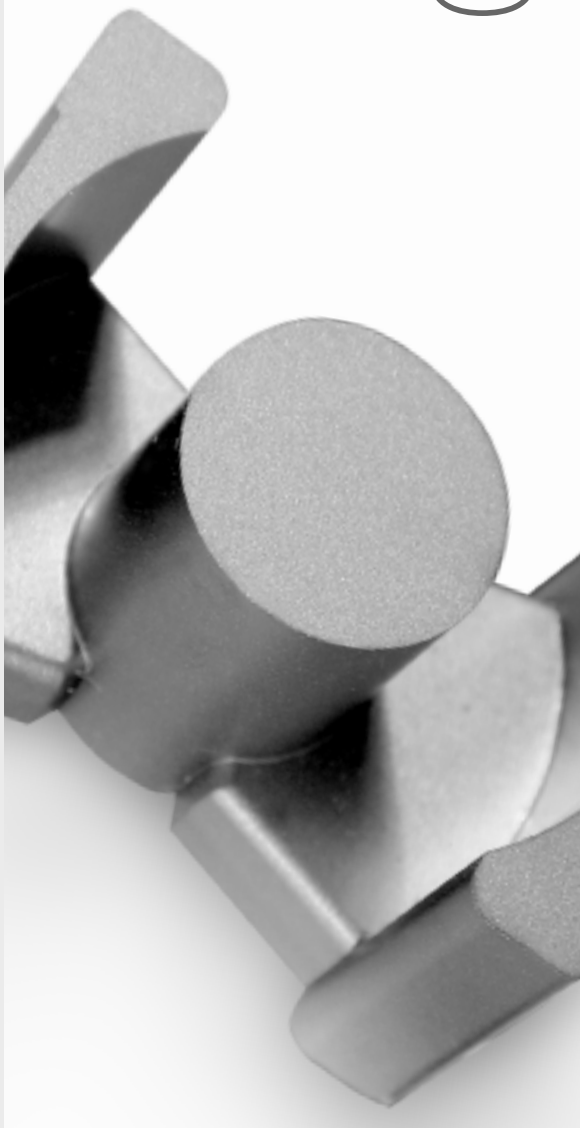
USED FOR ALL FERRITE TYPES

APPROXIMATE DIAMETER IN MM

APPROXIMATE HEIGHT IN MM

GEOMETRY CODE/GAP CODE
(SEE PAGE 1.5)

SPECIAL SPECIFICATION CODE



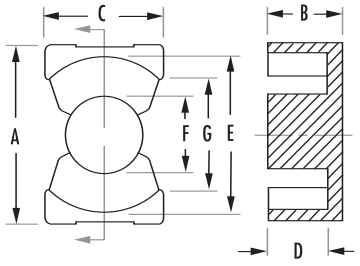
PQ
Core Data (ungapped)

Any practical gap is available. See page 1.8-1.11

			MECHANICAL DIMENSIONS (mm)								
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**2B**	**C**	**D**	**2D**	**E**	**F**	**G**
0_42016UG	**PQ 20/16**	**1**	21.3 ± .4	8.1 ± .1	16.2 ± .2	14 ± .4	5.15 ± .15	10.3 ± .3	18 ± .4	8.8 ± .2	12 min
0_42020UG	**PQ 20/20**	**1**	21.3 ± .4	10.1 ± .1	20.2 ± .2	14. ± .4	7.15 ± .15	14.3 ± .3	18 ± .4	8.8 ± .2	12 min
0_42610UG		**1**	27.2 ± .45	5.1 ± .1	10.2 ± .2	19 ± .45	1.2 min	2.39 min	22.05 min	12.2 max	15.5 min
0_42614UG		**1**	27.2 ± .45	5.94 ± .1	11.9 ± .2	19. ± .45	3.4 min	6.7 min	22.05 min	12.2 max	15.5 min
0_42620UG	**PQ 26/20**	**1**	27.3 ± .46	10.1 ± .13	20.2 ± .25	19 ± .45	5.75 ± .15	11.5 ± .3	22.5 ± .45	12 ± .2	15.5 min
0_42625UG	**PQ 26/25**	**1**	27.3 ± .46	12.35 ± .13	24.7 ± .25	19 ± .45	8.05 ± .15	16.1 ± .3	22.5 ± .46	12 ± .2	15.5 min
0_43214UG		**1**	33 ± .5	5.94 ± .1	11.9 ± .2	22 ± .5	3.4 min	6.7 min	27 min	13.75 max	19 min
0_43220UG	**PQ 32/20**	**1**	33 ± .5	10.3 ± .13	20.6 ± .25	22 ± .5	5.75 ± .15	11.5 ± .3	27.5 ± .5	13.5 ± .25	19 min
0_43230UG	**PQ 32/30**	**1**	33 ± .5	15.15 ± .13	30.3 ± .25	22 ± .5	10.65 ± .15	21.3 ± .3	27.5 ± .5	13.5 ± .25	19 min
0_43535UG	**PQ 35/35**	**1**	36.1 ± .6	17.35 ± .13	34.7 ± .25	26 ± .5	12.5 ± .15	25 ± .3	32 ± .5	14.4 ± .25	23.5 min
0_44040UG	**PQ 40/40**	**1**	41.5 ± .9	19.9 ± .15	39.8 ± .3	28 ± .6	14.75 ± .2	29.5 ± .4	37 ± .6	14.9 ± .3	29 ± 1
0_45050UG	**PQ 50/50**	**1**	51 ± .7	25 ± .25	50 ± .5	32 ± .6	18.05 ± .3	36.1 ± .6	44 ± .7	20 ± .35	32 min

To order, add material code to part number.

FIGURE 1



PQ
Core Data (ungapped)

A_L (mH/1000T) min

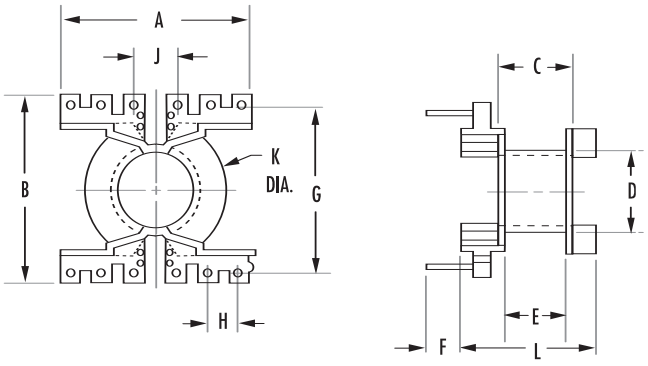
	POWER MATERIALS			MAGNETIC DATA						AVAILABLE HARDWARE	
PART	R	P	F	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc (cm^4)	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP
0_42016UG	2,690	2,930	4,690	37.6	61.9	59.1	2,330	13	0.15	✓	✓
0_42020UG	2,210	2,410	3,860	45.7	62.6	59.1	2,850	15	0.23		✓
0_42610UG	5,800	6,310	8,080	29.4	105	93.8	3,090	15	0.09		
0_42614UG	4,210	4,585	7,335	33.3	86.4	70.9	2,880	14	0.17		
0_42620UG	4,170	4,540	7,270	45	121	109	5,470	31	0.39	✓	✓
0_42625UG	3,450	3,750	6,010	54.3	120	108	6,530	36	0.59	✓	✓
0_43214UG	5,150	5,600	8,960	34.4	109	92	3,750	21	0.3		
0_43220UG	4,980	5,410	9,737	55.9	169	142	9,440	42	0.8	✓	✓
0_43230UG	3,500	3,810	6,100	74.7	167	142	12,500	55	1.6	✓	✓
0_43535UG	3,610	3,930	7,347	86.1	190	162	16,300	73	3.12	✓	✓
0_44040UG	3,200	3,480	5,580	102	201	175	20,500	95	5	✓	✓
0_45050UG	5,550	6,146	9,639	113	328	314	37,100	195	—		

*F material nominal ±25%

Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)													
PART	CORE SIZE	FIG.	A NOM	B NOM	C MAX	D NOM	E NOM	F NOM	G NOM	H NOM	J NOM	K NOM	L NOM
PCB2620LA	**42620**	**1**	26.49	29.31	10.99	14.19	8.99	7.36	25.4	3.81	7.62	21.59	21.64
PCB2625LA	**42625**	**1**	26.49	29.31	15.74	14.19	13.58	7.36	25.4	3.81	7.62	21.59	26.23
PCB3220LA	**43220**	**1**	32	33.98	10.99	15.9	8.78	6.35	30.48	5.08	7.62	26.59	22.83
PCB3230LA	**43230**	**1**	32	33.98	20.7	15.9	18.59	6.35	30.48	5.08	7.62	26.59	32.63
PCB3535LA	**43535**	**1**	35	38.98	24.46	16.78	22.3	6.35	35.56	5.08	10.16	31.09	37.16

FIGURE 1

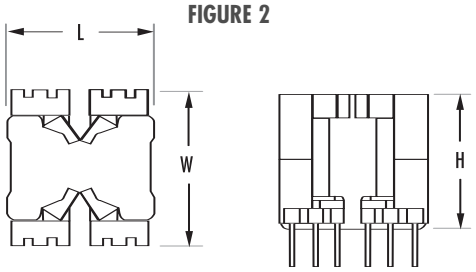


Printed Circuit Bobbins

PART	NOMINAL WINDING AREA PER SECTION cm^2	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)	BOARD CLEARANCE (mm)*			
							Length	Width	Height
PCB2620LA	0.332	4.7	Rynite	Tin plated Brass	.91	no clamp	27.9	29.7	23.1
						with clamp	28.3	92.7	25.4
PCB2625LA	0.502	4.7	Rynite	Tin plated Brass	.91	no clamp	27.9	29.7	25.8
						with clamp	28.3	29.7	30
PCB3220LA	0.47	5.6	Rynite	Tin plated Brass	.91	no clamp	34	34.3	24.1
						with clamp	34.4	34.3	26.2
PCB3230LA	0.994	5.6	Rynite	Tin plated Brass	.91	no clamp	34	34.3	34
						with clamp	34.4	34.3	36
PCB3535LA	1.59	6.3	Rynite	Tin plated Brass	.91	no clamp	37.3	39.4	38.5
						with clamp	37.3	39.4	40.3

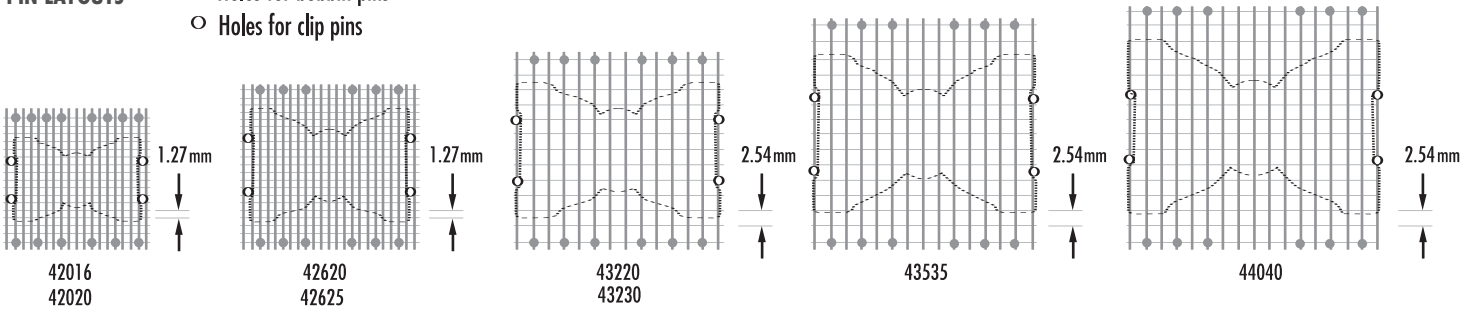
*reference figure 2 for board clearance

FIGURE 2



PIN LAYOUTS

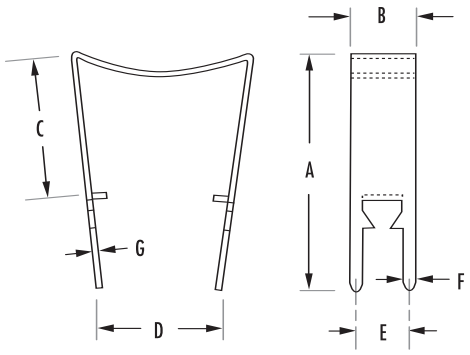
● Holes for bobbin pins
○ Holes for clip pins



Mounting Clamps

PART	CORE SIZE	FIG.	MECHANICAL DIMENSIONS (mm)						MATERIAL	MATERIAL THICKNESS (mm)
			A±.51	B±.08	C±.25	D REF	E NOM	F NOM		
00C201612	**42016**	**1**	29	7.89	17.5	14.98	6.4	1.49	Nickel Silver	0.304
00C202012	**42020**	**1**	32.99	7.89	21.48	14.98	6.4	1.49	Nickel Silver	0.304
00C262012	**42620**	**1**	32.99	10.49	21.48	21	8.99	1.49	Nickel Silver	0.304
00C262512	**42625**	**1**	37.49	10.49	26.11	21	8.99	1.49	Nickel Silver	0.304
00C322017	**43220**	**1**	36.5	12.293	21.99	27.0	10.59	1.7	Nickel Silver	0.432
00C323017	**43230**	**1**	46.5	12.29	31.8	27.0	10.59	1.7	Nickel Silver	0.432
00C353517	**43535**	**1**	50.49	12.7	36.19	29.99	11.3	1.7	Nickel Silver	0.432
00C404017	**44040**	**1**	55.49	13.48	41.19	35	11.78	1.7	Nickel Silver	0.432

FIGURE 1



E, I, U Cores

E, I, U CORES

E cores are less expensive than pot cores, and have the advantage of simple bobbin winding plus easy assembly. E cores do not, however, offer self-shielding. Lamination size E cores are available to fit commercially offered bobbins previously designed to fit the strip stampings of standard lamination sizes. Metric and DIN sizes are also available. E cores can be pressed to different thicknesses, providing a selection of cross-sectional areas. Bobbins for these different cross sections are often available commercially.

E cores can be mounted in different directions and, if desired, provide a low profile. Printed circuit bobbins are available for low profile mounting. Typical applications for E cores include differential, power and telecom inductors, as well as, broadband, power, converter and inverter transformers.

U cores, which offer a larger window/cross-sectional area, provide more power handling capability than E cores of the same size. Typical applications are similar to E cores.

HOW TO ORDER

C	R	4	14	34	EC	XX

SHAPE CODE

FERRITE CORE MATERIAL

USED FOR ALL FERRITE TYPES

APPROXIMATE DIAMETER IN MM

APPROXIMATE HEIGHT IN MM

GEOMETRY CODE/GAP CODE
(SEE PAGE 1.5)

SPECIAL SPECIFICATION CODE

SHAPE CODE

0 – Standard
C – Planar E core with clip recesses
F – Planar E core option: no clip recesses

GEOMETRY CODE

EC – All E cores including ETD, EC, ER, EER, EEM, EFD, planar and lamination sizes
IC – I cores
UC – U cores

GAP CODE – see page 1.5

Note – Standard gap codes do not apply to U cores, I cores and some EI combinations.

Cores are sold per piece (for sets multiply by 2). Gapped pieces are normally packed separately from ungapped pieces. If desired in sets, this must be specified.

E, I Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**C**	**D**	**E**	**F**	**L**	**M**
0_41203EC	Lam E2829	**1**	12.7 ± .25	5.69 ± .18	3.18 ± .13	3.96 min	9.19 min	3.18 ± .08	1.57 nom	3.05 min
0_41205EC Double stack	Lam E2829	**1**	12.7 ± .25	5.69 ± .18	6.4 ± .15	3.96 min	9.2 min	3.2 ± .13	1.57 ref	3.05 min
0_41707EC	Lam E3233	**1**	16.8 ± .38	7.11 ± .18	3.56 ± .12	3.94 min	10.4 min	3.56 ± .13	2.79 nom	3.63 min
0_41808EC	Lam EI187	**1**	19.1 ± .4	8.1 ± .13	4.75 ± .2	5.7 ± .13	14.33 ± .33	4.75 ± .2	2.38 nom	4.79 nom
0_41810EC Double stack	Lam EI187	**1**	19.3 ± .4	8.1 ± .18	9.53 ± .13	5.7 min	14 min	4.75 ± .2	2.38 ref	4.89 ref
0_42510EC	Lam E2425	**1**	25.4 ± .6	9.65 ± .2	6.35 ± .25	6.4 min	18.8 min	6.25 ± .25	3.3 nom	6.1 min
0_42513EC	EF25	**1**	25 + .8, - .7	12.8 + 0, - .4	7.5 + 0, - .6	8.7 + .6, - 0	17.5 + .9, - 0	7.5 + 0, - .5	3.55 ref	5.35 ref
0_42515EC	Lam EL2425	**1**	25.4 ± .38	15.9 ± .25	6.35 ± .25	12.6 min	18.8 min	6.35 ± .13	3.12 ± .13	6.4 ± .25
0_42515IC	I core	**2**	26.4 ± .38	3.18 ± .12	7.37 ± .25	-	-	-	-	-
0_42520EC Double stack	Lam E2425	**1**	25.4 ± .6	9.65 ± .2	12.7 ± .25	6.4 min	18.8 min	6.35 ± .25	3.6 max	6.1 min

To order, add material code to part number.

FIGURE 1

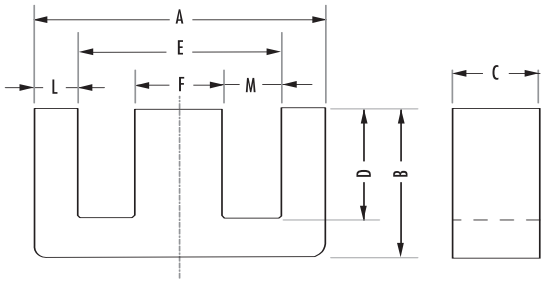
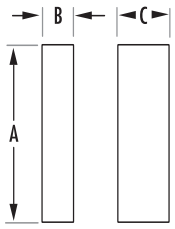


FIGURE 2



E, I Core Data (ungapped)

A_L (mH/1000T) min

		POWER MATERIALS			HIGH PERMEABILITY MATERIALS		MAGNETIC DATA					
PART	COMB.	R	P	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WαAc (cm^4)
0_41203EC	E-E	440	480	770	1,025	-	27.8	10.1	10.1	279	1.3	0.01
0_41205EC	E-E	1,100	1,200	1,950	2,475	-	27.7	20.2	20	558	2.6	0.03
0_41707EC	E-E	760	825	1,300	1,425	-	30.4	16.6	12.6	505	3.0	0.03
0_41808EC	E-E	865	940	1,500	1,875	3,220	39.9	22.6	22.1	900	4.4	0.07
0_41810EC	E-E	1,725	1,875	3,000	3,750	7,420	40.1	45.5	45.4	1,820	8.5	0.15
0_42510EC	E-E	1,325	1,440	2,300	2,775	4,635	49	39.5	37	1,930	9.5	0.16
0_42513EC	E-E	1,425	1,736	2,460	3,000	-	57.8	51.8	51.8	2,990	16	-
0_42515EC	E-E	865	940	1,500	1,800	3,080	73.5	40.1	39.7	2,950	15	0.42
0_42515IC	E-I	1,320	1,435	2,290	2,750	4,690	48.1	40.1	39.7	1,930	10	0.21
0_42520EC	E-E	2,650	2,880	4,600	5,500	10,360	48	78.4	76.8	3,760	19	0.4

* F material nominal ± 25%

AVAILABLE HARDWARE	STANDARD BOBBIN	SURFACE MOUNT BOBBIN	PRINTED CIRCUIT BOBBIN
0_41203EC		✓	
0_41808EC	✓		
0_42510EC	✓		✓
0_42515EC	✓		
0_42520EC			✓

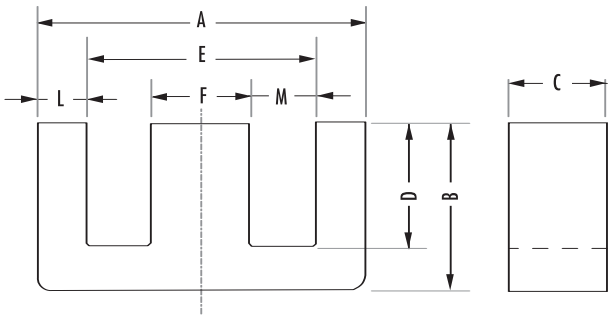
E, I Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**C**	**D**	**E**	**F**	**L**	**M**
0_42526EC		**1**	25 + .8, - .7	12.8 + 0, - .5	11+ 0, - .5	8.7 + .5, - 0	17.5 + 1, - 0	7.5 + 0, - .5	3.53 ref	5.37 ref
0_42530EC Double stack	EL2425	**1**	25.4 ± .38	15.9 ± .25	12.7 ± .25	12.6 min	18.8 min	6.35 ± .13	3.12 ± .13	6.4 ± .25
0_43007EC	DIN 30/7	**1**	30.8 + 0, - 1.4	15.01 ± .2	7.3 + 0, - .5	9.71 + .5, - 0	19.5	7.2 + 0, - .5	5.65 nom	6.15 nom
0_43009EC	Lam E2627	**1**	30.95 ± .5	13.1 ± .25	9.4 ± .3	8.5 min	21.41 min	9.4 ± .13	4.29 nom	6.0 min
0_43515EC	Lam EI375	**1**	34.2 ± .6	14.1 ± .15	9.3 ± .25	9.8 ± .13	25.5 min	9.3 ± .2	4.7 max	8.0 min
0_43520EC	E core	**1**	34.9 ± .38	20.62 ± .25	9.53 ± .18	15.6 min	25.1 min	9.53 ± .25	4.75 ± .25	7.95 nom
0_44011EC	Metric E40	**1**	40.01 ± .51	17 ± .31	10.69 ± .31	10 min	27.6 min	10.7 ± .31	5.99 ± .25	8.86 nom
0_44016EC	E core	**1**	42.15 ± .85	21.1 ± .2	9 ± .25	14.9 min	29.5 min	11.95 ± .25	5.94 ± .13	8.9 ± .25
0_44020EC	DIN 42/15	**1**	43 + 0, - 1.7	21 ± .2	15.2 + 0, - .6	14.8 + .6, - 0	29.5 + 1.4, - 0	12.2 + 0, - .5	6.75 nom	8.65 nom
0_44022EC Double stack	DIN 42/20	**1**	43 + 0, - 1.7	21 ± .2	20 + 0, - 8	14.8 + .6, - 0	29.5 + 1.4, - 0	12.2 + 0, -.5	6.75 nom	8.65 nom

To order, add material code to part number.

FIGURE 1



E, I Core Data (ungapped)

A_L (mH/1000T) min

		POWER MATERIALS			HIGH PERMEABILITY MATERIALS		MAGNETIC DATA					
PART	COMB.	R	P	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WαAc (cm^4)
0_42526EC	E-E	2,100	2,838	4,438	4,463	-	57.5	78.4	78.4	4,500	-	-
0_42530EC	E-E	1,730	1,880	3,000	3,600	6,160	73.5	80.2	79.4	5,900	30	0.84
0_43007EC	E-E	1,545	1,680	2,700	2,850	5,740	67	60	49	4,000	20	0.5
0_43009EC	E-E	2,170	2,360	3,780	4,420	8,500	61.9	83.2	83.2	5,150	26	0.74
0_43515EC	E-E	2,000	2,180	3,500	4,360	7,990	69.3	87	87	5,590	33	0.85
0_43520EC	E-E	1,460	1,590	2,555	3,180	6,440	94.3	90.6	90.5	8,540	42	1.68
0_44011EC	E-E	3,000	3,260	5,200	5,470	11,550	76.7	127	114	9,780	49	1.39
0_44016EC	E-E	2,000	2,180	3,495	4,235	7,905	98.4	107	106	10,500	52	2.08
0_44020EC	E-E	3,450	3,750	6,000	7,275	13,580	97	178	175	17,300	87	3.55
0_44022EC	E-E	4,150	4,510	7,600	7,960	18,200	97	233	233	22,700	114	4.59

* F material nominal ± 25%

AVAILABLE HARDWARE	STANDARD BOBBIN	PRINTED CIRCUIT BOBBIN
0_43007EC		✓
0_43009EC		✓
0_43515EC	✓	
0_44020EC	✓	

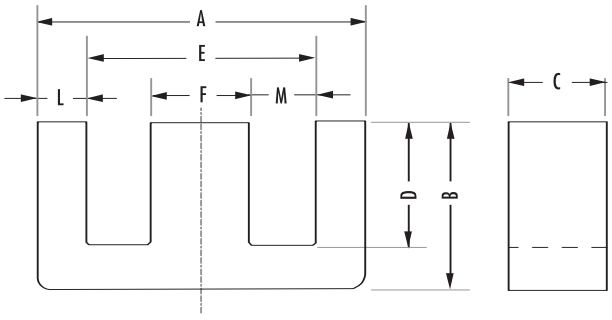
E, I Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**C**	**D**	**E**	**F**	**L**	**M**
0_44033EC		**1**	42 + 1, - .7	32.8 + 0, - .4	20 + 1, - .8	26 + 1, - 0	29.5 + 1.4, - 0	12.2 + 0, - .5	5.98 ref	9.13 ref
0_44317EC	Lam EI21	**1**	40.6 ± .65	16.6 ± .2	12.4 ± .3	10.4 min	28.6 min	12.45 ± .25	6.33 max	7.95 min
0_44721EC	Lam EI625	**1**	46.9 ± .8	19.6 ± .2	15.6 ± .25	12.1	32.4 ± .65	15.6 ± .25	7.54 nom	7.87 max
0_45528EC	DIN 55/21	**1**	56.2 + 0, - 2.1	27.5 ± .3	21 + 0, - .8	18.5 + .8, - 0	37.5 + 1.5, - 0	17.2 + 0, - .5	9.35 ref	10.15 ref
0_45530EC	DIN 55/25	**1**	56.2 + 0, - 2.1	27.6 ± .38	24.61 ± .38	18.5 min	37.5 min	17.2 + 0, - .5	9.35 min	10.15 ref
0_45724EC	Lam EI75	**1**	56.1 ± 1.0	23.6 ± .25	18.8 ± .25	14.6 ± .13	38.1 min	18.8 ± .25	9.5 nom	9.03 nom
0_46016EC	Metric E60	**1**	59.99 ± .78	22.3 ± .3	15.62 ± .38	13.8 min	44 min	15.62 ± .38	7.7 ± .25	14.49 ± .25
0_46527EC		**1**	65 + 1.5, - 1.2	32.8 + 0, - .6	27.4 + 0, - .8	22 + .8, - 0	44.2 + 1.8, - 0	20 + 0, - .7	10.4 nom	12.1 min
0_47228EC	F11	**1**	72.4 ± .76	27.9 ± .33	19.0 ± .33	17.8 min	56.6 min	19 ± .38	9.53 ± .38	16.9 min
0_48020EC	Metric E80	**1**	80 ± 1.6	38.1 ± .3	19.8 ± .4	28.2 ± .3	59.1 min	19.8 ± .4	11.25 nom	19.45 min
0_49928EC	E-100	**1**	100.3 ±2.03	59.4 ± .47	27.5 ± .5	46.85 ± .38	72 min	27.5 ± .5	13.75 ± .38	22.65 ± .5

To order, add material code to part number.

FIGURE 1



E, I Core Data (ungapped)

A_L (mH/1000T) min

		POWER MATERIALS			HIGH PERMEABILITY MATERIALS		MAGNETIC DATA					
PART	COMB.	R	P	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WαAc (cm^4)
0_44033EC	E-E	3,000	3,531	5,562	6,545	-	145	236	234	34,200	164	-
0_44317EC	E-E	2,925	3,180	5,900	7,350	13,720	77	149	142	11,500	57	1.48
0_44721EC	E-E	4,020	4,370	8,300	10,600	19,810	88.9	234	226	20,800	103	2.77
0_45528EC	E-E	4,720	5,130	8,220	-	-	124	353	345	44,000	212	9.91
0_45530EC	E-E	5,640	6,130	9,800	11,190	-	123	420	411	52,000	255	11.8
0_45724EC	E-E	6,070	6,600	10,400	10,610	18,000	107	337	337	36,000	179	6.34
0_46016EC	E-E	4,300	4,680	6,590	7,445	-	110	248	240	27,200	135	7.16
0_46527EC	E-E	6,450	7,982	-	-	-	147	540	530	79,000	410	-
0_47228EC	E-E	4,470	4,860	7,780	8,885	-	137	368	363	50,300	264	14.8
0_48020EC	E-E	3,505	3,810	6,000	6,940	-	184	392	392	72,300	357	30.8
0_49928EC	E-E	4,670	5,080	8,120	-	-	274	738	692	202,000	-	156

* F material nominal ± 25%

AVAILABLE HARDWARE	STANDARD BOBBIN	PRINTED CIRCUIT BOBBIN
0_44317EC	✓	✓
0_44721EC	✓	
0_45528EC		✓
0_45530EC		✓
0_45724EC	✓	
0_47228EC	✓	
0_48020EC	✓	

U, I Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**C**	**D**	**E**	**L**	**S**	**T**
0_41106UC	U core	**1**	10.85 ± .2	4.19 ± .13	6.3 ± .13	2.24 ± .13	7.19 ± .2	1.83 ± .13	-	-
0_41106IC	I core	**2**	10.8 ± .2	1.83 ± .12	6.3 ± .12	-	-	-	-	-
0_42220UC	U core	**1**	22.1 ± .38	20.6 ± .38	6.27 ± .18	13.98 min	9.5 ± .38	6.27 ± .18	-	-
0_42512UC	U core	**1**	25.4 ± .5	12.9 ± .4	12.7 ± .4	6.35 min	12.8 ref	6.3 ± .13	-	-
0_42515UC	U core	**1**	25.4 ± .51	15.9 ref	6.35 ± .12	9.27 min	12.7 ref	6.35 + 0, - .12	-	-
0_42516IC	I core	**2**	25.4 +.64, -.51	6.35 ± .13	6.35 ± .13	-	-	-	-	-
0_42530UC	U core	**1**	25.4 ± .51	15.9 ref	12.7 ± .25	9.27 min	12.7 ref	6.35 ± .12	-	-
0_44119UC	U core	**3**	41.78 ± .81	20.9 ± .12	11.9 ± .25	13.4 min	18.8 ± .56	-	3.18 nom	35.3 ref
0_44121UC	U core	**3**	41.78 ± .81	20.6 ± .13	11.94 ± .25	11.1 ± .2	18.8 ± .56	-	3.18 ± .13	34.66 nom

To order, add material code to part number.

FIGURE 1

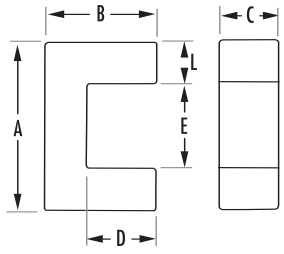


FIGURE 2

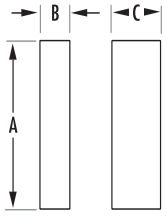
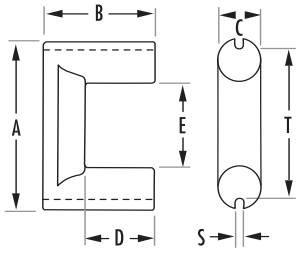


FIGURE 3



U, I Core Data (ungapped)

A_L (mH/1000T) min

	POWER MATERIALS				HIGH PERMEABILITY MATERIALS		MAGNETIC DATA					
PART	COMB.	R	P	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WαAc (cm^4)
0_41106UC	U-U	770	840	1,010	1,330	-	29.2	12	11.5	350	1.8	0.02
0_41106IC	U-I	710	770	1,150	1,580	-	24.6	11.5	11.5	283	1.5	0.01
0_42220UC	U-U	670	730	1,360	1,580	2,400	95.8	39.7	39.7	4,130	19	0.91
0_42512UC	U-U	1,430	1,550	2,480	3,300	-	68.9	80	80	4,170	29	0.67
0_42515UC	U-U	830	1,000	1,600	1,880	2,730	83.4	40.4	40.4	3,370	17	0.63
0_42516IC	U-I	1,110	2,180	1,770	-	-	64.3	40.3	40.3	2,590	13	0.32
0_42530UC	U-U	1,570	1,710	2,740	3,650	-	83.4	80.8	80.8	6,740	34	1.27
0_44119UC	U-U	1,220	1,330	2,130	2,830	4,000	121.2	91.1	80.5	11,000	54	2.86
0_44121UC	U-U	1,410	1,535	2,465	3,290	4,600	115.2	114.3	105.4	13,172	55	3.09

* F material nominal ± 25%

U, I Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**C**	**D**	**E**	**L**	**S**	**T**
0_44125UC	U core	**3**	41.78 ± .81	25.4 ± .13	11.94 ± .25	15.9 ± .2	18.8 ± .56	-	3.18 ± .13	34.66 nom
0_44130UC	U core	**3**	41.78 ± .11	30.5 ± .3	11.94 ± .25	20.8 min	18.8 ± .56	-	3.18 ± .13	34.66 nom
0_45716UC	U core	**3**	57.65 ± 1.7	28.6 + 0, - .4	15.9 ± 4	15.5 + 1, - 0	27.8 ± .9	-	4.8 ± .2	49.8 ± .8
0_45917UC	U core	**3**	59.34 ± 1.75	35.8 ± .4	17 ± .4	21.5 ± .8	26.5 ± .1	-	4.5 ± .2	50.5 ± 1
0_46420UC	U core	**4**	64 ± 1.95	40.5 ± .2	24 ± .3	26.5 ± .4	24.1 ± .9	20 ± .4	4 min	44 ± .6
0_49316UC	U core	**1**	93 ± 1.8	76 ± .5	16 ± .6	48 ± .9	36.2 ± 1.2	28.4 ref	-	-
0_49920UC	U core	**1**	126 ± 4	91 ± 1	20 ± .6	63 ± 2	70 ± 2	-	-	-
0_49925IC	I100/25/25	**2**	101.6 ± 1.5	25.4 ± .4	25.4 ± .6	-	-	-	-	-
0_49925UC	U/100/57/25	**4**	101.6 ± 1.5	57.1 ± .4	25.4 ± .6	30.95	50.7	25.4 ± .8	-	-

To order, add material code to part number.

FIGURE 1

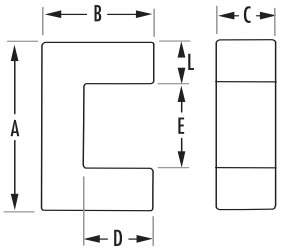


FIGURE 2

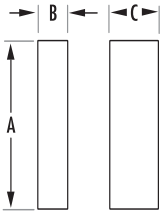
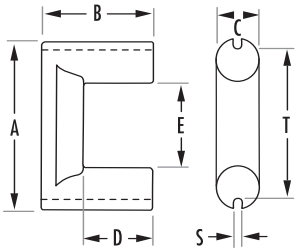


FIGURE 3



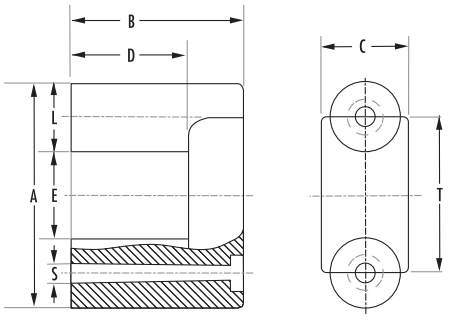
U, I Core Data (ungapped)

A_L (mH/1000T) min

		POWER MATERIALS			HIGH PERMEABILITY MATERIALS		MAGNETIC DATA					
PART	COMB.	R	P	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WαAc (cm^4)
0_44125UC	U-U	1,200	1,310	2,105	2,800	-	134.4	113.1	105.4	15,196	64	4.44
0_44130UC	U-U	1,050	1,140	1,830	2,440	3,420	154.8	112.1	105.4	17,346	75	5.88
0_45716UC	U-U	1,950	2,296	3,622	-	-	163	171	171	27,900	140	-
0_45917UC	U-U	2,270	2,456	3,881	-	-	189	210	210	39,700	198	-
0_46420UC	U-U	2,840	3,074	4,995	-	-	210	290	290	61,000	320	-
0_49316UC	U-U	2,550	3,894	6,173	7,443	-	258	447	447	115,000	800	-
0_49920UC	U-U	2,250	2,679	4,265	5,226	-	480	560	560	268,800	1,360	-
0_49925IC	U-I	4,280	4,650	7,440	-	-	245	645	645	158,000	324	102
0_49925UC	U-U	3,400	3,650	5,900	-	-	308	645	645	199,000	975	168

* F material nominal ± 25%

FIGURE 4



Bobbins

			MECHANICAL DIMENSIONS (mm)						NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	MATERIAL
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D MAX	E MIN	F NOM	cm^2		
00B180801	**41808EC**	**1**	13.84	-	11.04	6.47	4.95	9.52	0.3420	39.4	Nylon*
00B251001	**42510EC**	**1**	18.49	-	12.34	8.4	6.62	10.31	0.510	56	Nylon*
00B251501	**42515EC**	**2**	15.08	15.08	22.09	6.35	20.57	6.35	0.716	45.4	Glass filled Nylon
00B351501	**43515EC**	**1**	24.84	-	18.92	11.98	9.9	17.14	1.130	72	Nylon*
00B402001	**44020EC**	**3**	29.84	35.05	16.12	12.31	26.16	29.21	2.07	97.5	Glass filled Nylon*
00B431701	**44317EC**	**1**	28.01	-	20.47	14.6	12.82	18.94	1.260	84.4	Nylon*
00B472101	**44721EC**	**1**	31.19	-	23.57	18.41	16.12	21.38	1.410	97.5	Nylon*
00B572401	**45724EC**	**1**	37.84	-	28.57	21.59	19.12	26.54	2.14	118.2	Nylon*
00B722801	**47228EC**	**4**	51.07	51.07	19.76	19.76	34.46	30.4	4.08	149.3	Zytel 50
00B802001	**48020EC**	**4**	57.58	57.58	20.54	20.54	55.11	51.05	8.06	165	Zytel 50

* UL 94 HB rated

Bobbins

FIGURE 1

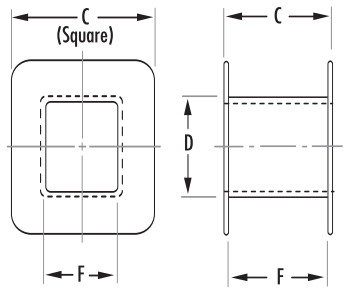


FIGURE 2

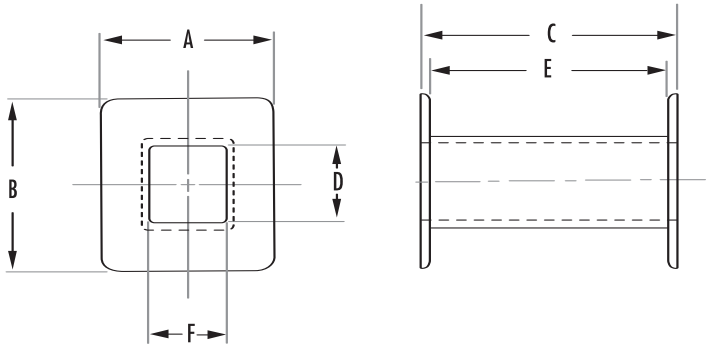


FIGURE 3

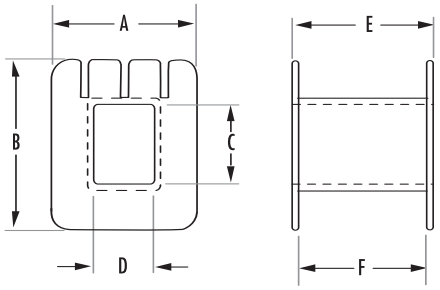
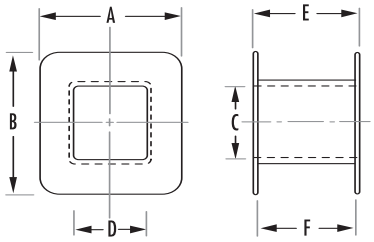


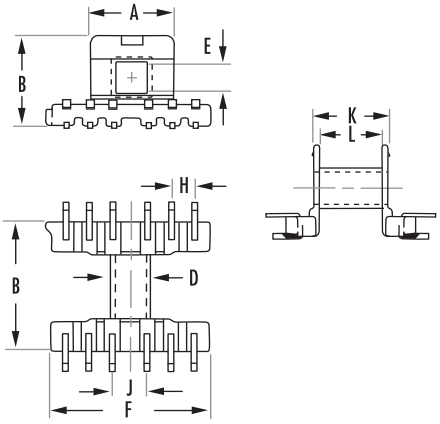
FIGURE 4



Surface Mount Bobbins

MECHANICAL DIMENSIONS (mm)											
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D MAX	E MIN	F MAX	G MIN	H NOM	J NOM
SMB1203LA	**41203EC**	**1**	9.11	10.49	14.07	4.49	3.3	17.22	-	2.54	3.81

FIGURE 1



Surface Mount Bobbins

MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)
PART	CORE SIZE	FIG.	K MAX	L NOM	cm^2				
SMB1203LA	**41203EC**	**1**	7.92	6.9	.162	26.5	LCP**	Phosphor Bronze	0.51 square

** UL 94 V-O rated

Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)												
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D MAX	E MIN	F MAX	G MIN	H NOM	J NOM	K MAX
PCB2510T1	**42510EC**	**1**	18.66	20.37	20.95	8.89	6.62	26.28	4.19	3.81	5.08	12.31
PCB2520TA	**42520EC**	**2**	26.28	21.2	13.33	6.68	18.54	27.94	12.36	10.66	15.74	3.42
PCB3007T1	**43007EC**	**3**	24.0	32.08	7.44	7.44	18.79	18.79	19.05	17.27	25.4	3.04
PCB3009LA	**43009EC**	**4**	21.38	26.03	30.73	12.19	9.65	33.9	5.08	5.08	-	17.14
PCB4317L2 2 Section	**44317EC**	**3**	28.06	28.82	29.21	15.26	12.82	41.4	4.31	5.08	6.35	20.32
PCB4721L2 2 Section	**44721EC**	**3**	31.36	32.13	32.89	18.41	16.12	44.57	4.44	5.08	7.62	23.49
PCB5528WA	**45528EC**	**5**	54.99	51.18	21.13	17.12	37.03	50.29	36.06	35.56	45.72	4.06
PCB5530FA	**45530EC**	**6**	37.16	40.15	27.73 min	17.55 min	37.0	49.4	35.61	33.4	40.0	4.49

FIGURE 1

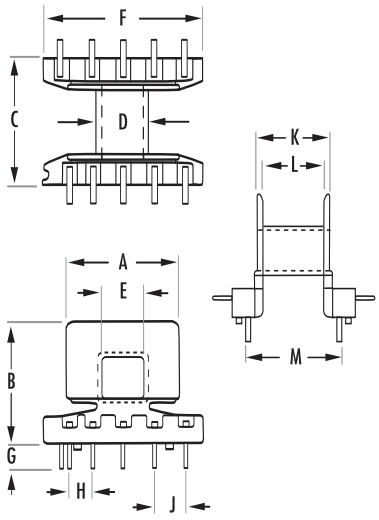


FIGURE 2

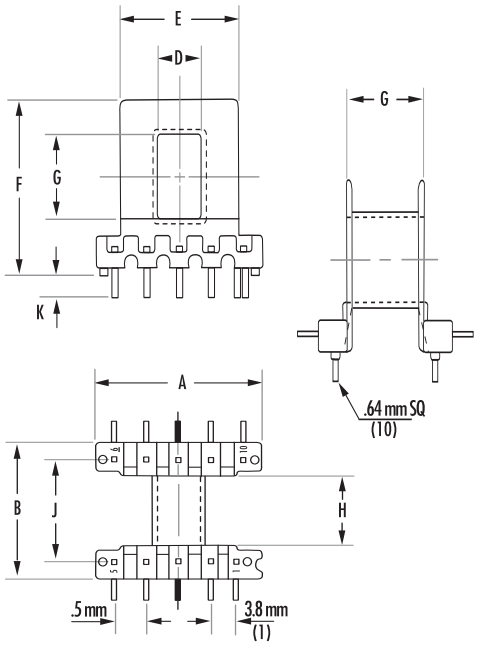
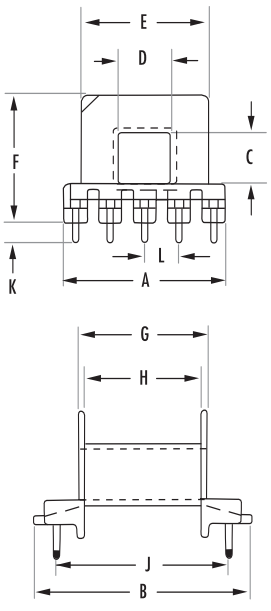


FIGURE 3



Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)
PART	CORE SIZE	FIG.	L NOM	M NOM	cm^2				
PCB2510T1	**42510EC**	**1**	10.26	15.62	0.406	25.6	Glass filled Nylon*	Phosphor Bronze	0.64 square
PCB2520TA	**42520EC**	**2**	-	-	0.630	68.6	PET Polyester	-	0.64 square
PCB3007T1	**43007EC**	**3**	5.08	-	0.833	54.8	Thermoset Phenolic	-	0.76
PCB3009LA	**43009EC**	**4**	14.73	22.86	0.714	66.4	DAP**	Alloy 510 tin plated	0.91 square
PCB4317L2 2 Section	**44317EC**	**3**	18.11	24.13	1.010	84.3	Rynite	Phosphor Bronze	0.64 square
PCB4721L2 2 Section	**44721EC**	**3**	21.08	27.94	1.193	99	Glass filled Nylon*	Phosphor Bronze	0.64 square
PCB5528WA	**45528EC**	**5**	52.07	-	3.020	107.3	Glass filled Nylon**	-	0.91 square
PCB5530FA	**45530EC**	**6**	37.0	-	2.890	133.9	Glass filled Nylon**	-	0.89 square

* UL 94 HB rated ** UL 94 V-0 rated

FIGURE 4

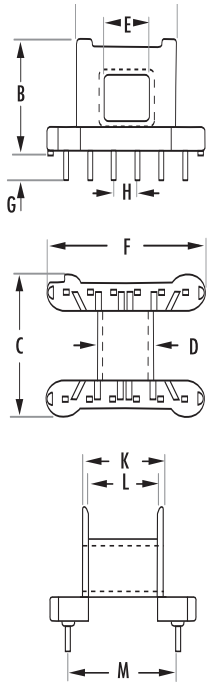


FIGURE 5

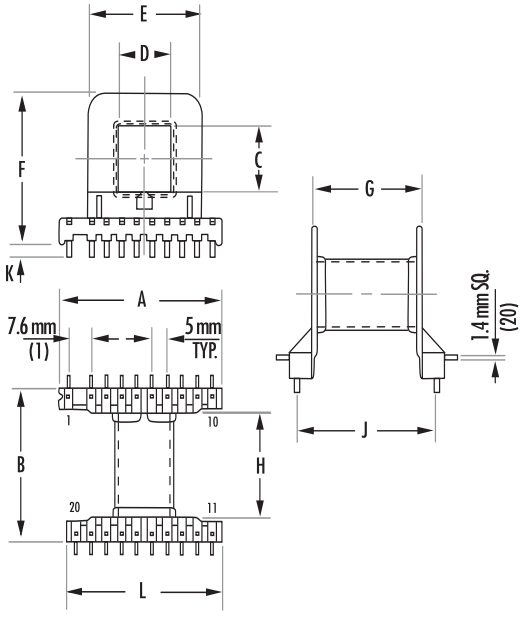
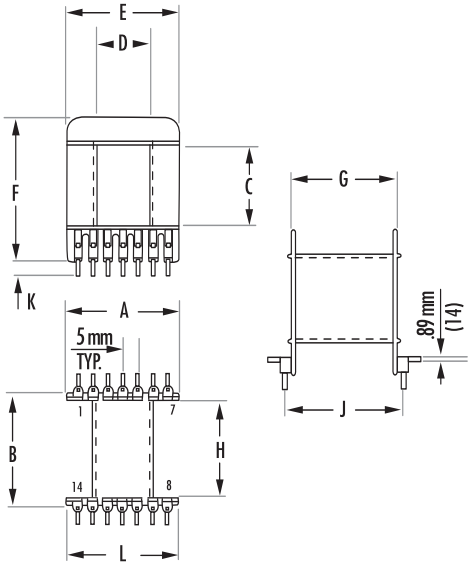


FIGURE 6



Planar Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**C**	**D**	**E**	**F**	**L**	**M**
0_41425EC		**1**	14 ± .3	2.5 ± .1	5 ± .1	1 ± .1	11 ± .25	3 ± .1	1.5 ref	4 ref
C_41434EC*	E14	**2**	14 ± .3	3.5 ± .1	5 ± .15	1.91 min	10.5 min	3 ± .1	1.5 ref	4 ref
C_41434IC	I14	**3**	14 ± .3	1.8 ± .05	5 ± .15	1.5 ± .1	2.5 ± 2, - 0	-	-	-
C_41805EC*	E18	**2**	18 ± .35	4 ± .1	10 ± .2	2 ± .1	14 ± .3	4 ± .1	2.0 ref	5.0 ref
C_41805IC	I18	**3**	18 ± .35	2.4 ± .05	10 ± .2	2 ± 1	2.5 ± .2, - 0	-	-	-
F_41805EC	E18	**1**	18 ± .35	4 ± .1	10 ± .2	2 ± .1	13 min	4 ± .1	2 ref	5 ref
F_41805IC	I18	**4**	18 ± .41	2.39 ± .1	10 ± .2	-	-	-	-	-
0_42107EC		**1**	21.8 ± .4	3.91 ± .08	7.8 ± .5	1.73 ± .2	16.8 ± .3	5 ± .2	2.5 ± .12	5.89 ± .25
C_42216EC*	E22	**2**	21.8 ± .4	5.7 ± .1	15.8 ± .3	3.2 ± .1	16.8 ± .4	5 ± .1	2.5 ref	5.9 ref
C_42216IC	I22	**3**	21.8 ± .4	2.9 ± .05	15.8 ± .3	2.5 ± .1	2.9 ± .2, - 0	-	-	-
F_43208EC	E32	**1**	31.75 ± .64	6.35 ± .13	20.32 ± .41	3.18 ± .2	24.9 min	6.35 ± .13	3.18	9.27
F_43208IC	I32	**4**	31.75 ± .64	3.18 ± .13	20.32 ± .41	-	-	-	-	-
0_43618EC		**1**	35.56 ± .5	6.35 ± .13	17.8 ± .4	2.41 min	27.2 min	7.62 ± .18	3.81 ± .13	10.16 ± .25
0_43618IC		**4**	36.58 ± .51	3.81 ± .25	18.29 ± .38	-	-	-	-	-
F_43808EC	E38	**1**	38.1 ± .76	8.26 ± .13	25.4 ± .51	4.45 ± .13	30.23 min	7.62 ± .15	3.81	11.43

To order, add material code to part number.
NOTE: Clamps are available for the EI combination of parts 41434, 41805 and 42216 only.

FIGURE 1

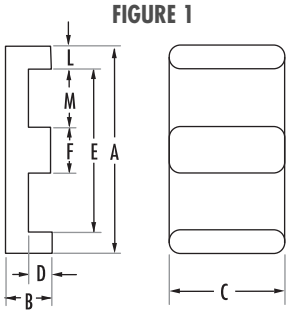


FIGURE 2

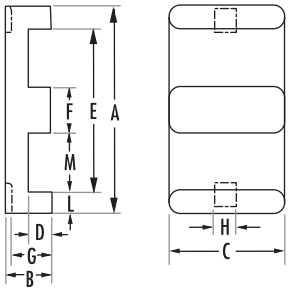


FIGURE 3

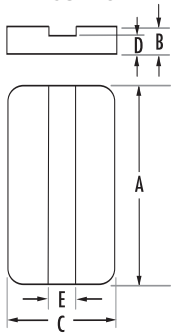
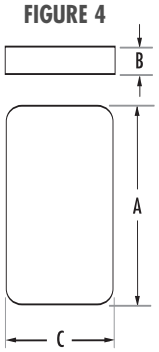


FIGURE 4



Planar Core Data (ungapped)

A_L (mH/1000T) min

		POWER MATERIALS			HIGH PERMEABILITY MATERIALS		MAGNETIC DATA						
PART	COMB.	P	R	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	BOBBIN WINDOW AREA (cm^2)	WaAc (cm^4)
0_41425EC	E-E	1,196	1,139	1,765	2,650	4,260	16.7	14.7	14.7	244	1.2	0.064	0.009
C_41434EC*	E-E	1,049	995	1,563	2,140	3,420	20.7	14.66	14.66	303.9	1.5	0.128	0.01
C_41434IC	E-I	1,185	1,124	1,749	2,880	-	16.4	14.2	11.4	230	1.2	0.064	0.009
C_41805EC*	E-E	2,520	2,433	4,380	5,470	-	24.2	40.1	39.9	972	4.9	0.16	0.06
C_41805IC	E-I	2,851	2,705	4,241	6,450	-	20.3	39.5	35.9	830	4.1	0.08	0.03
F_41805EC*	E-E	2,573	2,433	3,853	-	-	24.2	40.1	39.9	972	-	-	-
F_41805IC	E-I	2,878	2,731	4,278	-	-	20.3	40.1	39.9	813	-	-	-
0_42107EC	E-E	2,769	2,586	4,271	4,350	8,260	25.7	37.1	36	960	4.2	0.15	0.05
C_42216EC*	E-E	4,040	3,800	6,131	8,640	13,300	32.3	76	73.1	2,451	-	-	-
C_42216IC	E-I	4,880	4,610	7,327	10,750	-	26.1	80.4	72.5	2,100	10.4	0.15	0.12
F_43208EC	E-E	5,673	5,318	8,672	10,930	-	41.4	130	130	5,380	26	0.51	0.66
F_43208IC	E-I	6,422	6,036	9,760	12,892	-	35.1	130	130	4,560	22	0.25	0.33
0_43618EC	E-E	5,800	5,435	8,877	-	-	42.4	135	135	5,750	28	0.412	0.55
0_43618IC	E-I	6,382	5,991	9,725	12,760	21,600	37.4	135	135	5,060	25	0.206	0.27
F_43808EC	E-E	7,006	6,548	10,784	-	-	52.4	194	194	10,200	50.9	0.813	1.56

* F material nominal ± 25%

AVAILABLE HARDWARE	MOUNTING CLAMP
C_41434IC	✓
C_41805IC	✓
C_42216IC	✓

Planar Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	**CORE TYPE**	**FIG.**	**A**	**B**	**C**	**D**	**E**	**F**	**L**	**M**
F_43808IC	I38	**4**	38.1 ± .76	3.81 ± .13	25.4 ± .51	-	-	-	-	-
0_44008EC		**1**	46.65 ± .5	8.51 ± .25	10.7 ± .25	4.06 ± .25	30.45 ± .3	10.15 ± .15	5.1 ref	10.15 ref
0_44008IC		**4**	40.64 ± .51	4.45 ± .25	10.7 ± .25	-	-	-	-	-
0_44308EC		**1**	43.2 ± .9	8.51 ± .25	27.9 ± .6	4.19 min	34.7 min	8.1 ± .2	4.7 max	13.2 min
0_44308IC		**4**	43.2 ± .9	4.1 ± .13	27.9 ± .6	-	-	-	-	-
F_44310EC	E43	**1**	43.2 ± .9	9.53 ± .13	27.9 ± .6	5.4 ± .13	34.7 min	8.1 ± .2	4.7 max	13.2 min
F_44310IC	I43	**4**	43.18 ± .51	4.06 ± .12	27.9 ± .38	-	-	-	-	-
C_45810EC*	E58	**5**	58.42 ± 1.17	10.54 ± .2	38.1 ± .78	6.35 min	50.39 min	8.1 ± .2	3.66 ref	21.5 ± .25
C_45810IC	I58	**6**	58.42 ± 1.17	4.04 ± .12	38.1 ± .78	-	-	-	-	-
F_45810EC	E58	**1**	58.42 ± 1.17	10.54 ± .2	38.1 ± .78	6.35 min	50.39 min	8.1 ± .2	3.66 ref	21.5 ± .25
F_45810IC	I58	**4**	58.42 ± 1.17	4.06 ± .6	38.1 ± .78	-	-	-	-	-
C_46410EC*	E64	**5**	64 ± .76	10.2 ± .1	50.8 ± .81	5.03 min	53.16 min	10.16 ± .18	5.08 ± .12	21.8 ± .25
C_46410IC	I64	**6**	64.01 ± 1.27	5.08 ± .13	50.8 ± 1.02	-	-	-	-	-
F_46410EC	E64	**1**	64 ± .76	10.2 ± .1	50.8 ± .81	5.03 min	53.16 min	10.16 ± .18	5.08 ± .12	21.8 ± .25
F_46410IC	I64	**4**	64.01 ± 1.27	5.08 ± .13	50.8 ± 1.02	-	-	-	-	-
0_49938EC	E102	**1**	102 ± 1.52	20.3 ± .25	37.5 ± .4	13.3 ± .25	86 ± 1	14 ± .25	8 ref	36 ref

To order, add material code to part number.
Clips are available for the EI combination of parts 41434, 41805 and 42216 only.

FIGURE 1

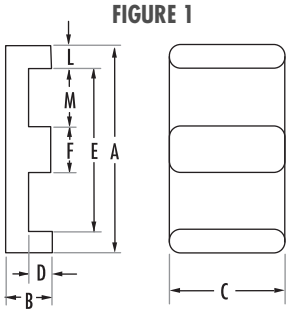


FIGURE 2

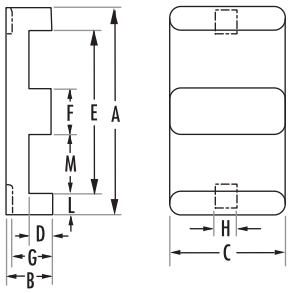
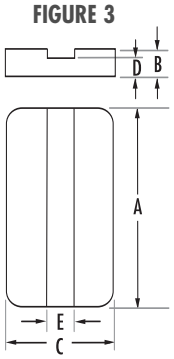


FIGURE 3



Planar Core Data (ungapped)

A_L (mH/1000T) min

	POWER MATERIALS				HIGH PERMEABILITY MATERIALS		MAGNETIC DATA						
PART	COMB.	P	R	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	BOBBIN WINDOW AREA (cm^2)	WaAc (cm^4)
F_43808IC	E-I	8,132	7,618	12,458	-	-	43.7	194	194	8,460	42.5	0.406	0.78
0_44008EC	E-E	3,748	3,500	5,785	6,338	-	51.9	101	95.1	5,220	26	0.66	0.66
0_44008IC	E-I	4,245	3,971	6,523	7,035	-	43.8	99.5	95.1	4,360	21	0.33	0.32
0_44308EC	E-E	7,611	7,106	11,750	13,966	-	57.5	227	227	13,100	64	0.96	2.18
0_44308IC	E-I	8,525	7,973	13,107	16,400	-	50.4	229	229	11,500	54	0.48	1.09
F_44310EC	E-E	7,292	6,804	11,275	13,000	22,800	61.1	229	229	18,900	70.6	1.18	2.68
F_44310IC	E-I	8,525	7,973	13,107	15,900	27,900	50.4	229	229	11,500	58	0.588	1.34
C_45810EC*	E-E	7,546	7,019	11,753	12,100	-	81.2	301	279	24,600	125	2.5	7.53
C_45810IC	E-I	8,525	7,973	13,107	14,500	-	68.3	305	281	20,829	105	1.25	3.79
F_45810EC	E-E	7,546	7,019	11,753	-	-	81.2	301	279	24,600	-	-	-
F_45810IC	E-I	8,844	8,242	13,713	-	-	68.3	305	281	20,829	-	-	-
C_46410EC*	E-E	13,020	12,116	20,260	21,200	37,200	80.2	516	516	41,400	195	2.02	10.4
C_46410IC	E-I	14,515	13,524	22,200	24,100	42,200	69.9	511	511	35,539	170	1.01	5.21
F_46410EC	E-E	13,020	12,116	20,260	-	-	80.2	516	516	41,400	-	-	-
F_46410IC	E-I	14,567	12,473	22,594	-	-	69.9	511	511	35,539	-	-	-
0_49938EC	E-E	7,949	7,358	12,530	-	-	148	540	525	79,800	400	8.5	46

* F material nominal ± 25%

FIGURE 4

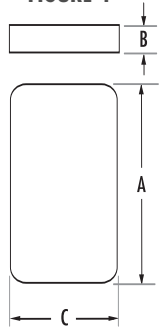


FIGURE 5

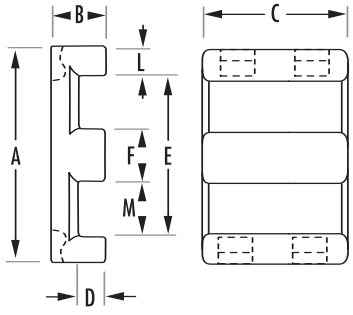
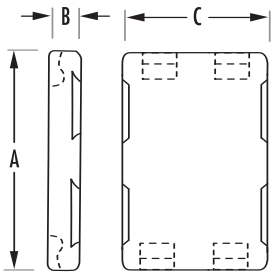


FIGURE 6



AVAILABLE HARDWARE

MOUNTING CLAMP

C_45810EC*	✓
C_45810IC	✓
C_46410EC*	✓
C_46410IC	✓

Clamps

MECHANICAL DIMENSIONS (mm)								
PART	CORE SIZE	FIG.	A	B	C	D	E	MATERIAL
00C143420	**41434EC/IC**	**1**	14	5.4	2.21	13.59	0.3	Stainless Steel
00C180520	**41805EC/IC**	**1**	18.01	6.61	2.2	17.6	0.4	Stainless Steel
00C221620	**42216EC/IC**	**3**	22.2	8.74	2.48	21.41	0.4	Stainless Steel

FIGURE 1

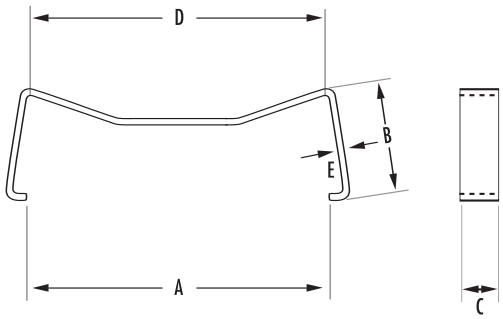
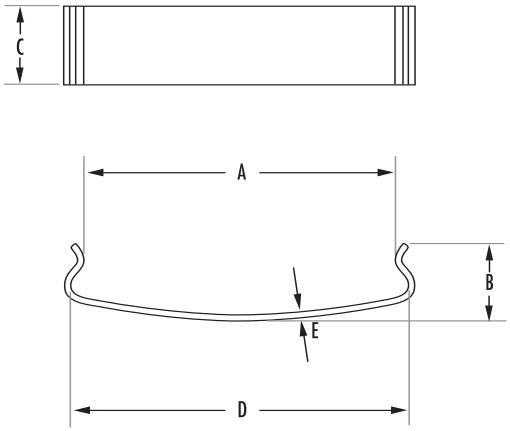


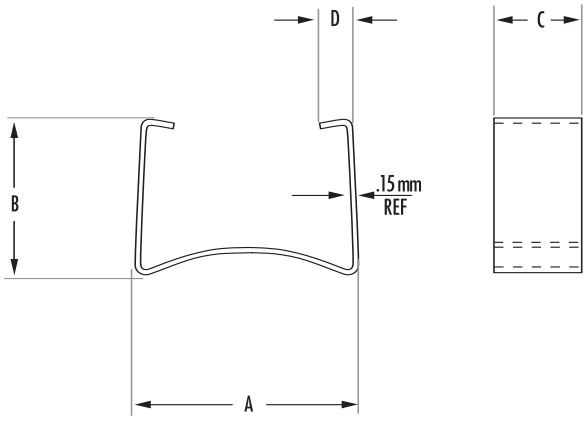
FIGURE 2



Clamps

MECHANICAL DIMENSIONS (mm)								
PART	CORE SIZE	FIG.	A	B	C	D	E	MATERIAL
00C581001	**45810EC/EC**	**2**	18.24	4.57	4.5	19.87	0.38	Stainless Spring Steel
00C581002	**45810EC/IC**	**2**	11.61	-	4.5	13.23	0.38	Stainless Spring Steel
00C641001	**46410EC/EC**	**2**	17.58	4.57	4.5	9.2	0.38	Stainless Spring Steel
00C641002	**46410EC/IC**	**2**	11.86	4.57	4.5	13.72	0.38	Stainless Spring Steel

FIGURE 3



EFD Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)								
PART	CORE TYPE	FIG.	A	B	C	D MIN	E MIN	F	K	L	M
0_41009EC	EFD 10	**1**	10.5 ± .3	5.2 ± .1	2.7 ± .1	3.75 ± .15	7.65 ± .25	4.55 ± .15	4.45 ± .05	1.43 ref	1.55 ref
0_41212EC	EFD 12	**1**	12.5 ± .3	6.2 ± .1	3.5 ± .1	4.55 ± .15	9 ± .25	5.4 ± .15	2 ± .1	1.75 ref	1.8 ref
0_41515EC	EFD 20	**1**	15 ± .4	7.5 ± .15	4.65 ± .15	5 ± .25	11 ± .35	5.3 ± .15	2.4 ± .1	2 nom	2.85 nom
0_42019EC	EFD 15	**2**	20 ± .55	10 ± .15	6.65 ± .15	7.7 ± .25	15.4 ± .5	8.9 ± .2	3.6 ± .15	2.3 ref	3.25 ref
0_42523EC	EFD 25	**2**	25 ± .66	12.5 ± .15	9.1 ± .2	9.1 min	18.1 min	11.4 ± .2	5.2 ± .15	3.15 ± .2	3.65 ± .2
0_43030EC	EFD 30	**2**	30 ± .8	15 ± .15	9.1 ± .2	11.2 ± .3	22.4 ± .75	14.6 ± .25	4.9 ± .15	3.8 ref	3.9 ref

To order, add material code to part number.

FIGURE 1

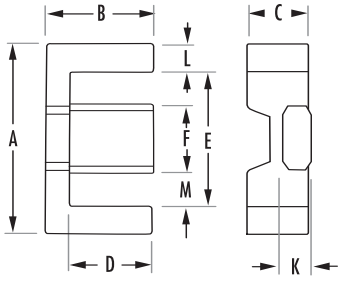
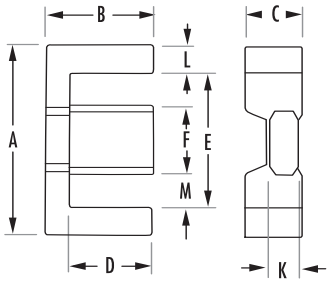


FIGURE 2



EFD Core Data (ungapped)

A_L (mH/1000T) min

	POWER MATERIALS			HIGH PERMEABILITY MATERIALS		MAGNETIC DATA						
PART	R	P	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	BOBBIN WINDOW AREA (cm^2)	WaAc (cm^4)
0_41009EC	438	466	698	692	-	23.7	7.2	6.5	171	.90	-	-
0_41212EC	570	600	844	1,950	-	28.5	11.4	10.7	325	1.8	-	-
0_41515EC	670	730	1,170	1,450	2,150	34	15	12.2	510	2.8	0.167	0.02
0_42019EC	975	1,225	1,881	2,022	-	47	31	29	1,460	7	-	-
0_42523EC	1,570	1,710	2,730	3,380	5,820	57	58	55	3,300	16.2	0.402	0.23
0_43030EC	1,650	2,021	3,137	3,501	-	68	69	66	4,700	24	-	-

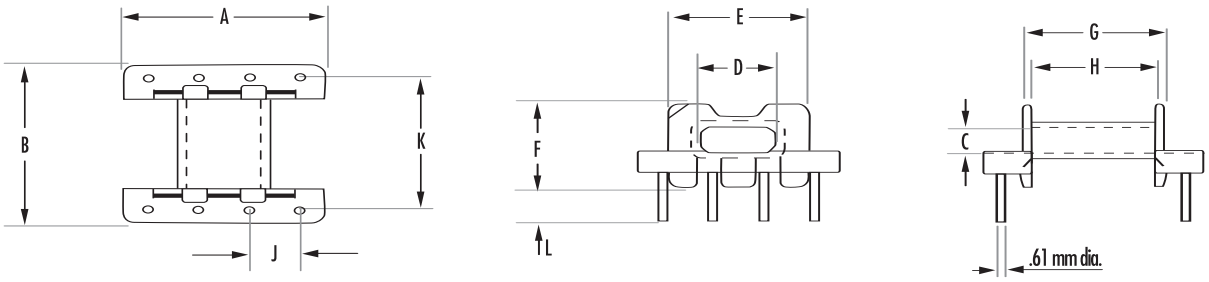
* F material nominal ± 25%

AVAILABLE HARDWARE	SURFACE MOUNT BOBBIN	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP
0_41515EC	✓	✓	✓
0_42523EC		✓	✓

Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)											
PART	CORE SIZE	FIG.	A NOM	B NOM	C MIN	D MIN	E MAX	F NOM	G MAX	H NOM	J TYP
PCB15158A	**41515EC**	**1**	14.98	16.3	2.48	5.43	10.59	8.5	10.59	9.19	3.75
PCB2523TA	**42523EC**	**2**	24.99	25.85	5.38	11.6	18.11	13.2	18.0	16.68	5

FIGURE 1

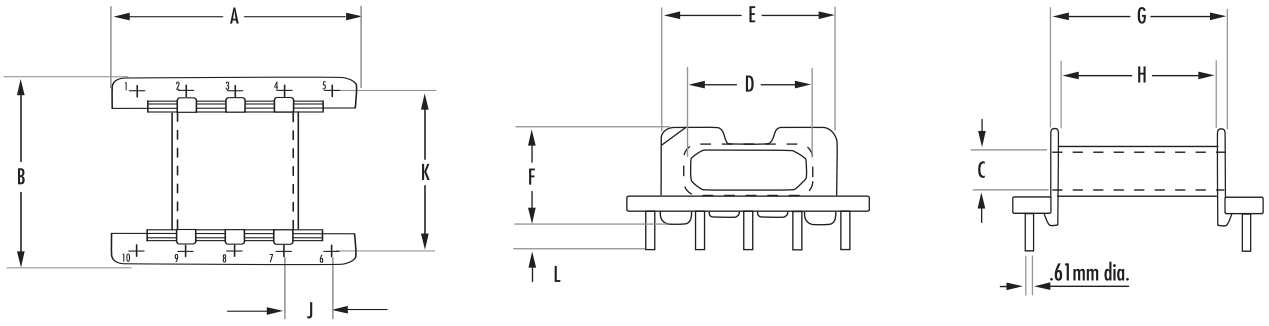


Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)
PART	CORE SIZE	FIG.	K NOM	L ± .30	cm^2				
PCB15158A	**41515EC**	**1**	13.74	3.51	0.169	36	Phenolic*	CP Wire	0.61
PCB2523TA	**42523EC**	**2**	22.5	3.51	0.412	59.7	Phenolic*	CP Wire	0.61

* UL 94 V-0 rated

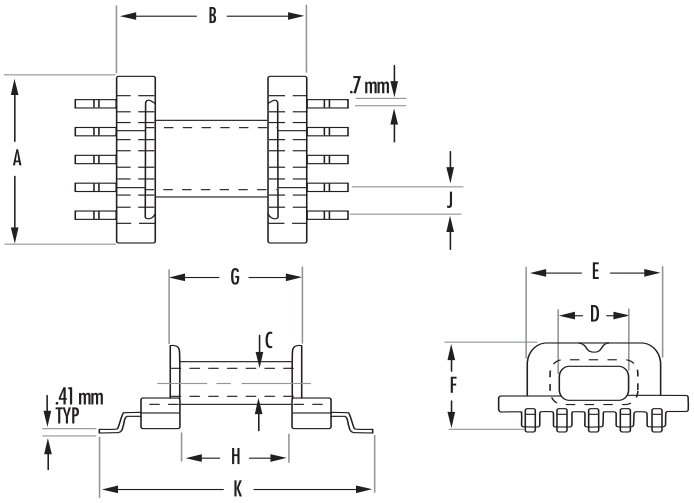
FIGURE 2



Surface Mount Bobbins

MECHANICAL DIMENSIONS (mm)											
PART	CORE SIZE	FIG.	A NOM	B NOM	C MIN	D MIN	E MAX	F NOM	G MAX	H NOM	J TYP
SMB1515TA	**41515EC**	**1**	14.73	14.73	2.48	5.38	10.85	7.49	10.49	8.89	2.48

FIGURE 1



Surface Mount Bobbins

MECHANICAL DIMENSIONS (mm)				NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)
PART	CORE SIZE	FIG.	K NOM	cm^2				
SMB1515TA	**41515EC**	**1**	21.59	0.175	36.5	L.C.P.*	Nickel Bronze	0.41

* UL 94 V-0 rated

Clamps

MECHANICAL DIMENSIONS (mm)							
PART	CORE SIZE	FIG.	A	B	C	D	MATERIAL
00C15151A*	**41515EC**	**1**	4.49	5.2	18.79	0.25	Stainless Steel
00C25231A*	**42523EC**	**2**	8.0	5.38	29.0	0.3	Stainless Steel

*Two clamps required per core set

FIGURE 1

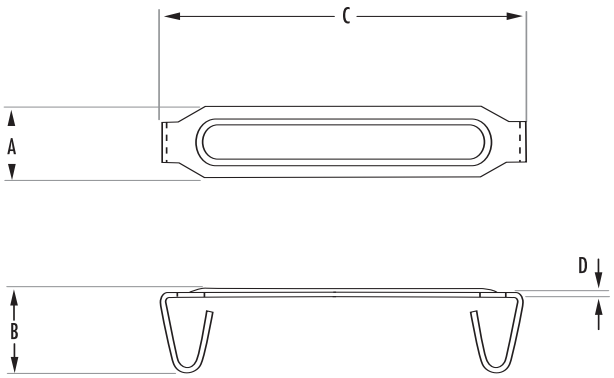
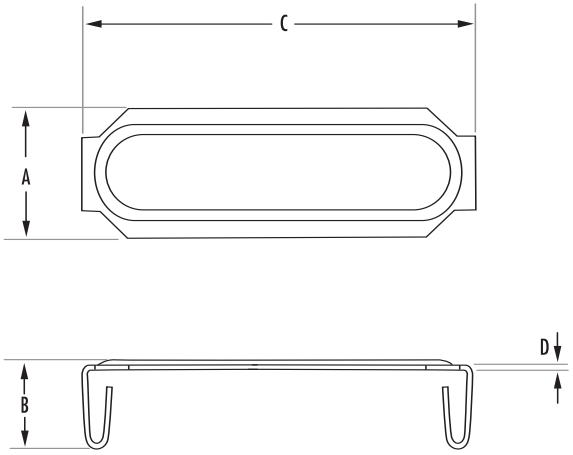


FIGURE 2

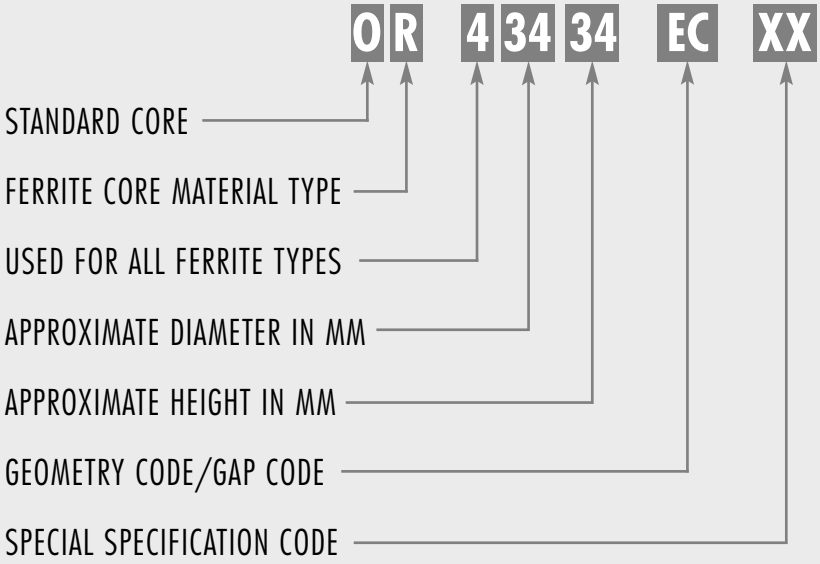


EC, ETD, EER AND ER CORES

EC, ETD, EER, and ER cores are a cross between E cores and pot cores. Like E cores they provide a wide opening on each side. This gives adequate space for the large size wire required for low output voltage switched mode power supplies. It also allows for a flow of air which keeps the assembly cooler.

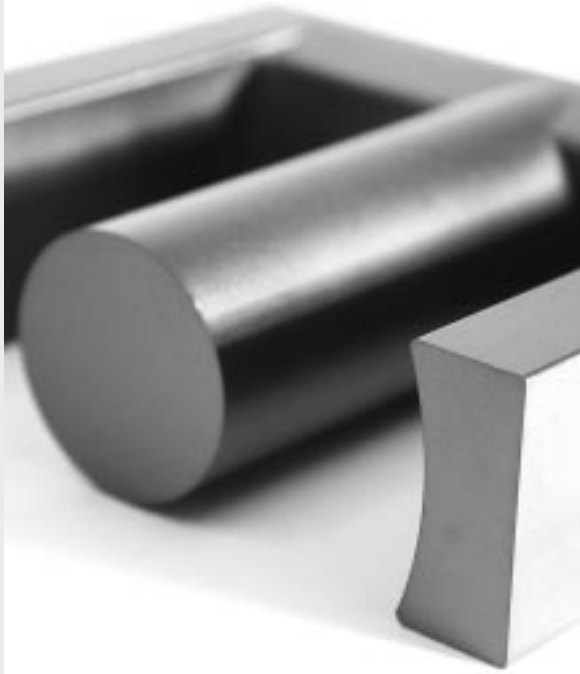
The center posts of these cores are round, like that of the pot core. One of the advantages of the round center post is that the winding has a shorter path length (11% shorter) than the wire around a square center post with an equal area. This reduces the losses of the windings by 11% and enables the core to handle a higher output power. The round center post also eliminates the sharp bend in the wire that occurs with winding on a square center post. The most common application is switched mode power supplies.

HOW TO ORDER



GEOMETRY CODE

EC – All E cores including ETD, EC, ER, EER, EEM, EFD, planar and lamination sizes.



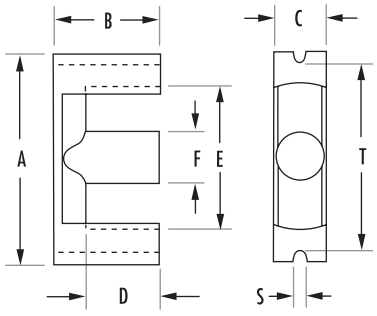
Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)							
PART	CORE TYPE	FIG.	A	B	C	D	E	F	S	T
0_43517EC	**EC 35**	**1**	34.5 ± .8	17.3 ± .15	9.5 ± .3	12.3 ± .4	22.75 ± .55	9.5 ± .3	2.75 ± .25	28.5 ± .8
0_44119EC	**EC41**	**1**	40.6 ± 1.0	19.5 ± .15	11.6 ± .3	13.9 ± .4	27 + .7	11.6 ± .3	3.25 ± .25	33.6 ± 1
0_45224EC	**EC52**	**1**	52.2 ± 1.3	24.2 ± .15	13.4 ± .35	15.9 ± .4	33 ± .9	13.4 ± .35	3.75 ± .25	44 ± 1.3
0_47035EC	**EC70**	**1**	70 ± 1.7	34.5 ± .15	16.4 ± .4	22.75 ± .45	44.5 ± 1.2	16.4 ± .4	4.75 ± .25	59.6 ± 1.7

To order, add material code to part number.

FIGURE 1



Core Data (ungapped)

A_L (mH/1000T) min

POWER MATERIALS				HIGH PERMEABILITY MATERIALS		MAGNETIC DATA					
PART	R	P	F*	J	W	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc (cm^4)
0_43517EC	1,660	1,800	3,000	-	-	77.4	84.3	71	6,530	36	0.833
0_44119EC	2,605	2,400	3,700	-	-	89.3	121	106	10,800	52	1.67
0_45224EC	2,900	3,150	5,040	-	-	105	180	141	18,800	111	3.87
0_47035EC	3,310	3,600	5,760	-	-	144	279	211	40,100	253	13.4

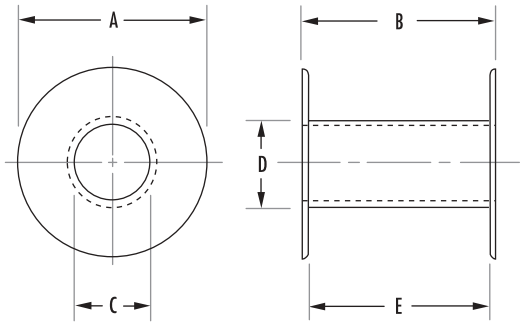
* F material nominal ± 25%

AVAILABLE HARDWARE	STANDARD BOBBIN	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP
0_43517EC	✓	✓	✓
0_44119EC	✓	✓	✓
0_45224EC	✓	✓	✓
0_47035EC	✓	✓	✓

Bobbins

			MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVG. LENGTH OF TURN (mm)	MATERIAL
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D MAX	E NOM	cm^2		
00B351701	**43517EC**	**1**	21.94	23.57	9.88	11.65	21.79	1.12	52.4	Glass filled Nylon*
00B411901	**44119EC**	**1**	26.03	26.74	12.06	14.09	24.61	1.45	62.4	Glass filled Nylon*

FIGURE 1



Bobbins

			MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVG. LENGTH OF TURN (mm)	MATERIAL
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D MAX	E NOM	cm^2		
00B703501	**47035EC**	**1**	42.79	44.32	16.91	19.48	41.60	4.82	97.2	Glass filled Nylon*

* UL 94 HB rated

Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)									
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D NOM	E NOM	F MAX	G NOM
PCB351701	**43517EC**	**1**	34.11	28.8	31.64	2.03	10	23.74	21.48
PCH351701	**43517EC**	**3**	34.1	29	26.7	2.03	10	23.62	21.49
PCB411901	**44119EC**	**1**	38.63	28.62	36.55	2.03	12.09	26.94	24.51
PCH411901	**44119EC**	**3**	38.65	28.9	31.19	2.03	12.09	26.82	24.51
PCB522401	**45224EC**	**2**	44.52	44.01	41.63	2.03	13.94	30.7	28.29
PCH522401	**45224EC**	**4**	44.55	44.09	36.49	2.03	13.94	30.7	28.29
PCB703501	**47035EC**	**2**	57.93	56.79	51.81	4.49	17.14	44.27	41.45
PCH703501	**47035EC**	**4**	57.93	56.89	47.11	4.49	17.14	44.27	41.45

FIGURE 1

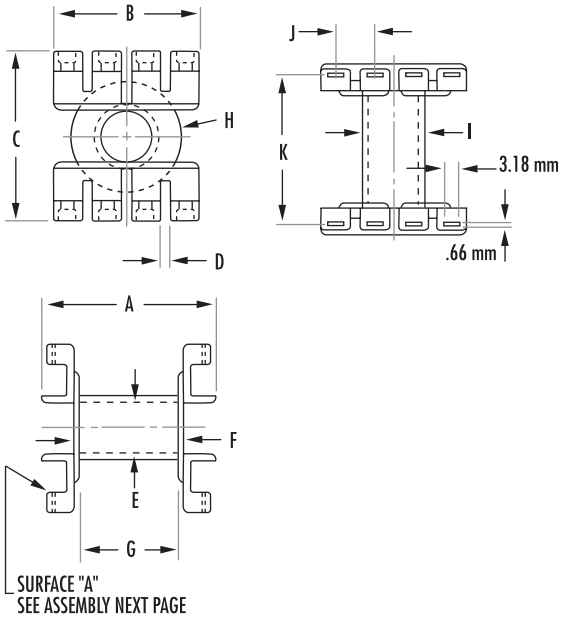
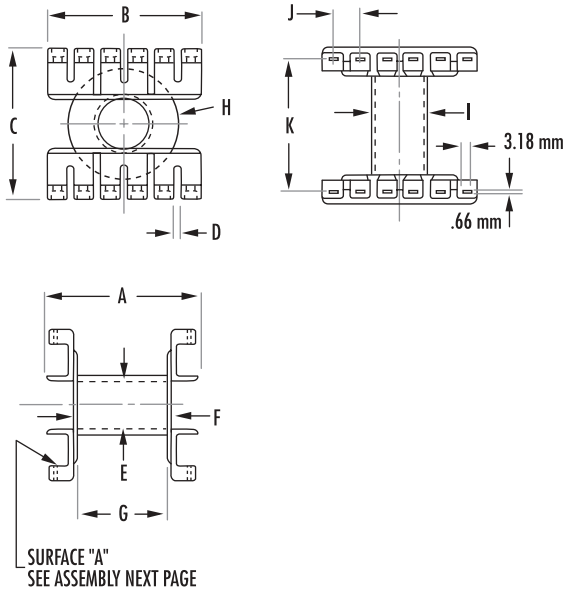


FIGURE 2



Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)					NOMINAL WINDING AREA PER SECTION	AVG. LENGTH OF TURN (mm)	BOBBIN MATERIAL
PART	H NOM	I NOM	J NOM	K MAX	cm^2		
PCB351701	21.64	12.19	7.62	30.48	0.97	50	Glass Filled Nylon*
PCH351701	21.64	12.19	7.62	30.48	0.97	50	Glass Filled Nylon*
PCB411901	25.65	14.09	7.62	33.02	1.35	60	Glass Filled Nylon*
PCH411901	25.65	14.09	7.62	33.02	1.35	60	Glass Filled Nylon*
PCB522401	31.44	16.2	7.62	38.1	2.13	72.8	Glass Filled Nylon*
PCH522401	31.44	16.2	7.62	38.1	2.13	72.8	Glass Filled Nylon*
PCB703501	42.44	19.5	10.16	50.8	4.77	95.1	Glass Filled Nylon*
PCH703501	42.54	19.5	10.16	50.8	4.77	95.1	Glass Filled Nylon*

* UL 94 V-1 rated

FIGURE 3

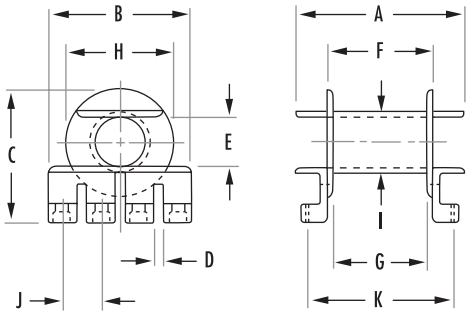
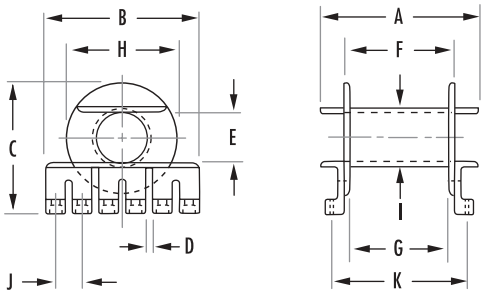
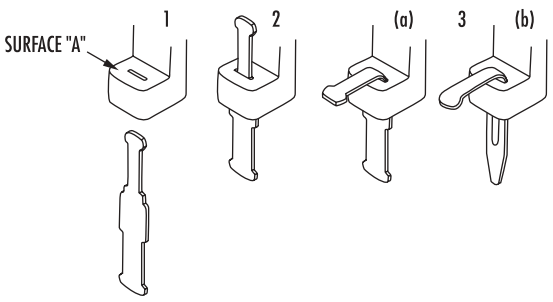
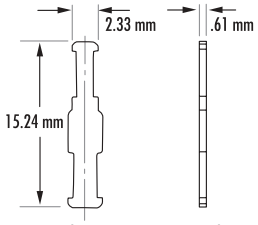


FIGURE 4

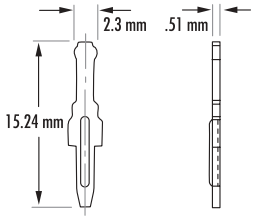


TERMINAL ASSEMBLY





General Purpose Terminal
PNEC01000



Printed Circuit Terminal
PNEC02000

NOTE: Terminals are not normally inserted but shipped separately in strip form. See above Terminal Assembly.

Mounting Clamps

				MECHANICAL DIMENSIONS (mm)				
PART	ITEM	CORE SIZE	FIG.	A	B	C	D	E
0AC351717	U Bolt	**43517EC**	**3**	32.38	42.16	2.11	12.7	-
0BC351740	Plate	**43517EC**	**1**	39.37	9.52	31.59	3.88	4.44
0CC351700	Nut (2 required)	**43517EC**	**-**	-	-	-	-	-
0AC411919	U Bolt	**44119EC**	**4**	38.1	47	2.36	12.7	-
0BC411940	Plate	**44119EC**	**1**	46.73	11.12	37.21	4.77	4.69
0CC411900	Nut (2 required)	**44119EC**	**-**	-	-	-	-	-
0AC522440	U Bolt	**45224EC**	**3**	49	57.1	2.92	15.24	-
0BC522440	Plate	**45224EC**	**1**	59.69	12.70	48.1	5.91	5.71
0CC522400	Nut (2 required)	**45224EC**	**-**	-	-	-	-	-
0AC703531	U Bolt	**47035EC**	**3**	65.4	78.7	2.92	15.24	-
0BC703540	Plate	**47035EC**	**2**	76.96	15.87	64.69	6.27	5.71

FIGURE 1

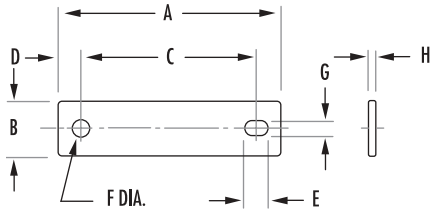
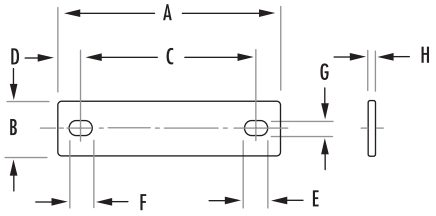


FIGURE 2



Mounting Clamps

MECHANICAL DIMENSIONS (mm)								
PART	**ITEM**	**CORE SIZE**	**FIG.**	**F**	**G**	**H**	**THREAD**	**MATERIAL**
0AC351717	U Bolt	**43517**	**3**	-	-	-	#3–48–2A	Brass
0BC351740	Plate	**43517EC**	**1**	2.64	2.64	1.01	-	Aluminum
00C351700	Nut (2 required)	**43517**	**-**	-	-	-	-	-
0AC411919	U Bolt	**44119**	**4**	-	-	-	#4–40–2A	Brass
0BC411940	Plate	**44119EC**	**1**	3.04	3.04	1.01	-	Aluminum
0CC411900	Nut (2 required)	**44119**	**-**	-	-	-	-	-
0AC522440	U Bolt	**45224EC**	**3**	-	-	-	#6–32–2A	Brass
0BC522440	Plate	**45224EC**	**1**	3.65	3.65	1.01	-	Aluminum
0CC522400	Nut (2 required)	**45224EC**	**-**	-	-	-	-	-
0AC703531	U Bolt	**47035EC**	**3**	-	-	-	#6–32–2A	Brass
0BC703540	Plate	**47035EC**	**2**	5.71	3.65	1.01	-	Aluminum

FIGURE 3

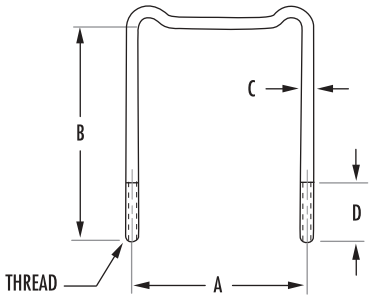
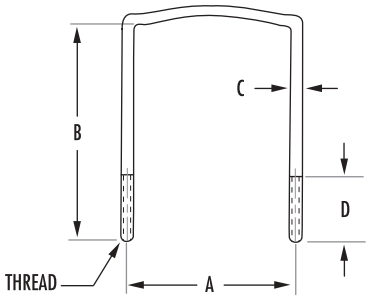


FIGURE 4



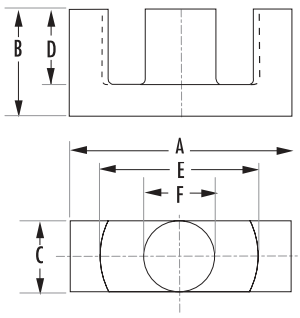
Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)					
PART	CORE TYPE	FIG.	A	B	C	D	E	F
0_42929EC	**ETD 29**	**1**	30.6 + 0,-1.6	15.8 ± .2	9.8 + 0, - 6	11 ± .3	22 + 1.4, -0	9.8 + 0, -.6
0_43434EC	**ETD 34**	**1**	35 + .0,-1.6	17.3 ± .2	11.1 + 0, -.6	11.8 + 0, -.6	25.6 + 1.4, -0	11.1 + 0, -.6
0_43939EC	**ETD 39**	**1**	40 + 0, -1.8	19.8 ± .2	12.8 + 0, -.6	14.2 + .8, -0	29.3 + 1.6, -0	12.8 + 0, -.6
0_44444EC	**ETD 44**	**1**	45 + .0, -.2	22.3 ± .2	15.2 + .0, -.6	16.1 + .8, -0	32.5 + 1.6, -0	15.2 + 0, -.6
0_44949EC	**ETD 49**	**1**	49.8 + 0, -2.2	24.7 ± .2	16.7 + 0, -.6	17.7 + .8, -0	36.1 + 1.8, -0	16.7 + 0, -.6
0_45454EC	**ETD 54**	**1**	54.5 ± 1.3	27.6 ± .2	18.9 ± .4	20.2 ± .4	41.2 ± 1.1	18.9 ± .4
0_45959EC	**ETD 59**	**1**	59.8 ± 1.3	31 ± .2	21.65 ± .45	22.1 min	44.7 ± 1.09	21.65 ± .45

To order, add material code to part number.

FIGURE 1



Core Data (ungapped)

A_L (mH/1000T) min

POWER MATERIALS				MAGNETIC DATA					
PART	R	P	F*	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc (cm^4)
0_42929EC	1,688	2,132	3,316	72	76	71	5,470	28	-
0_43434EC	2,030	2,200	3,600	78.6	97.1	91.6	7,640	40	1.21
0_43939EC	2,230	2,420	4,050	92.2	125	123	11,500	60	2.21
0_44444EC	2,750	3,000	4,950	103	173	172	17,800	94	3.75
0_44949EC	3,070	3,330	5,400	114	211	209	24,000	124	5.83
0_45454EC	3,900	4,711	7,400	127	280	280	35,500	180	-
0_45959EC	4,310	4,680	7,500	139	368	360	51,500	248	13.7

* F material nominal ± 25%

AVAILABLE HARDWARE	PRINTED CIRCUIT BOBBIN	MOUNTING CLAMP
0_43434EC		✓
0_43939EC	✓	✓
0_44444EC		✓
0_44949EC	✓	✓
0_45959EC	✓	✓

Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)										
PART	CORE SIZE	FIG.	A MAX	B MAX	C MAX	D NOM	E NOM	F MAX	G NOM	H NOM
PCB3939SA	**43939EC**	**1**	44.29	26.18 nom	15.29	12.7 min	30.2	32.79 ref	5.58	40.1 min
PCB4949WA	**44949EC**	**2**	53.79	33.09 nom	19.5	16.48 min	40.38	40.69 ref	5.08	49.5 min
PCB5959AA	**45959EC**	**3**	66.04	41.37 nom	24.86	22.35 min	50.8	48.51 ref	4.19	61.34 min

FIGURE 1

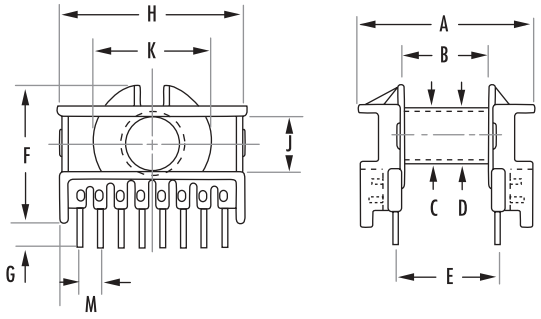


FIGURE 2

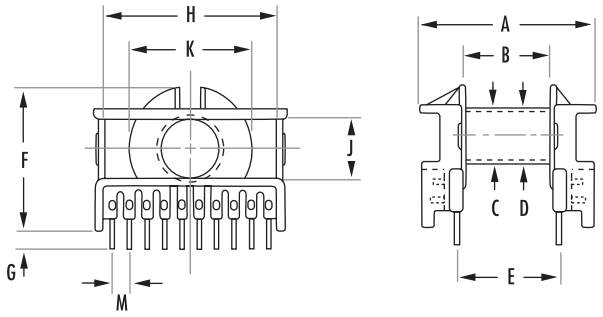
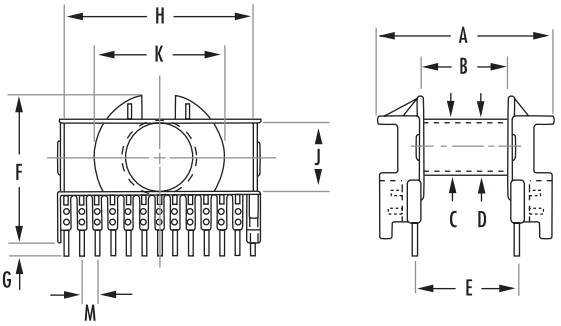


FIGURE 3



Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)				NOMINAL WINDING AREA PER SECTION	AVG. LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)	BOARD CLEARANCE (mm)		
PART	J NOM	K MAX	M NOM	cm^2					L	W	H
PCB3939SA	13.0 min	28.9	5.0	1.740	67	Phenolic*	CP Wire	.99	48.2	45.7	37.5
PCB4949WA	16.89 min	35.5	5.0	2.71	85.3	Phenolic*	CP Wire	.99	57.8	55.2	42.7
PCB5959AA	22.35 min	43.18	5.08	3.72	106.7	Rynite FR530L**	Phosphor Bronze	.90	72.2	66.9	49.2

* UL 94 V-1 rated **UL 94 V-0 rated

Mounting Clamps

MECHANICAL DIMENSIONS (mm)							
PART	**ITEM**	**CORE SIZE**	**FIG.**	**A**	**B**	**C**	**MATERIAL**
00C343416	Clamp (2 required per set)	**43434EC**	**1**	22.8	10.8	39.6	Stainless Steel
00C393916	Clamp (2 required per set)	**43939EC**	**1**	25.3	12.5	44.7	Stainless Steel
00C444416	Clamp (2 required per set)	**44444EC**	**1**	28.6	14.9	49.6	Stainless Steel
00C494916	Clamp (2 required per set)	**44949EC**	**1**	30.8	16.3	54.61	Stainless Steel
00C595916	Clamp (2 required per set)	**45959EC**	**2**	12.9	22	65.4	Stainless Steel

FIGURE 1

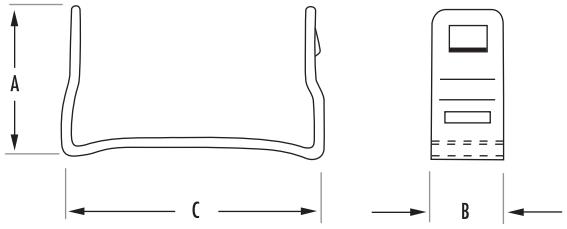
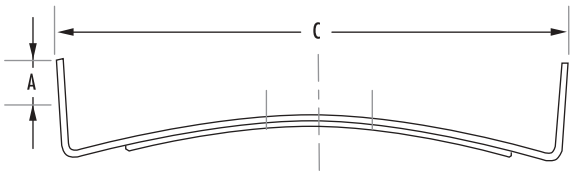


FIGURE 2



Notes

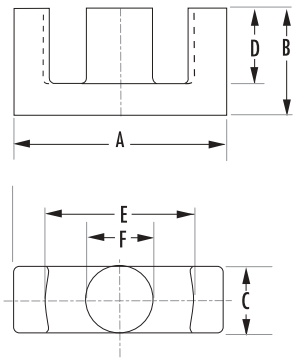
Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

			MECHANICAL DIMENSIONS (mm)					
PART	CORE TYPE	FIG.	A	B	C	D MIN	E	F
0_42814EC		**1**	28.55 ± .55	14 ± .2	11.4 ± .35	9.75 ± .4	21.75 ± .5	9.9 ± .2
0_42817EC		**1**	28.55 ± .55	16.7 ± .25	11.4 ± .35	12.65 ± .4	21.75 ± .5	9.9 ± .25
0_43521EC	**EER 35L**	**1**	35 ± .65	20.7 ± .2	11.4 ± .35	14.75 ± .35	26.15 ± .55	11.3 ± .25
0_44013EC		**1**	40 ± .7	22.4 ± .2	13.4 ± .35	15.45 ± .35	29.6 ± .6	13.3 ± .25
0_44216EC	**EER 42**	**1**	42.15 ± .85	21.6 ± .2	14.7 ± .3	15.6 min	31 ± .6	14.7 ± .3
0_44818EC		**1**	48 ± 1	18 ± .2	17.6 ± .4	11.45 ± .25	36.8 ± .8	17.6 ± .4
0_44821EC		**1**	48 ± 1	21.2 + 0, -.4	21 + .3, -.5	14.7 + .7, -0	38 + .5, -.8	18 ± .3
0_45418EC		**1**	53.5 ± 1	18.3 ± .2	17.95 ± .35	11.1 ± .3	40.65 ± .85	17.9 ± .4

To order, add material code to part number.

FIGURE 1



Core Data (ungapped)

A_L (mH/1000T) min

POWER MATERIALS				MAGNETIC DATA					
PART	R	P	F*	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc (cm^4)
0_42814EC	2,025	2,514	3,896	64	81.4	77	5,260	28	-
0_42817EC	1,875	2,184	3,400	75.5	81.4	77	6,142	32	-
0_43521EC	2,020	2,220	3,550	90.8	107	100	9,710	49	1.91
0_44013EC	2,475	2,640	-	98	149	139	14,600	74	-
0_44216EC	2,880	3,130	5,000	98.7	175	166	17,300	106	3.55
0_44818EC	4,800	5,140	7,950	86	232	223	19,900	102	-
0_44821EC	4,275	5,294	8,274	100	255	248	25,500	128	-
0_45418EC	4,575	4,875	7,440	91.8	250	240	23,000	122	-

* F material nominal ± 25%

PRINTED CIRCUIT BOBBIN

AVAILABLE HARDWARE	
0_43521EC	✓
0_44216EC	✓

Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)										
PART	CORE SIZE	FIG.	A	B	C	D	E	F	G	H
PCB3521LA	**43521EC**	**1**	29.21 nom	26.16 nom	14.17 max	11.65 min	25.4 nom	39.82 ref	4.82 nom	29.21 min
PCB4216FA	**44216EC**	**2**	30.98 max	27.3 nom	17.98 max	15.39 min	24.99 nom	45.59 ref	5.08 nom	39.87 min

FIGURE 1

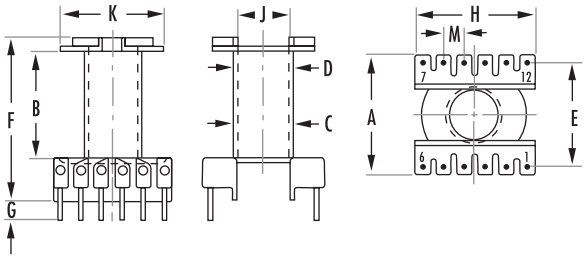
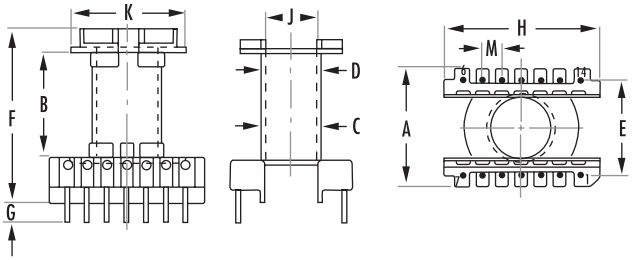


FIGURE 2



Printed Circuit Bobbins

MECHANICAL DIMENSIONS (mm)				NOMINAL WINDING AREA PER SECTION	AVG. LENGTH OF TURN (mm)	BOBBIN MATERIAL	PIN MATERIAL	PIN DIAMETER (mm)
PART	J NOM	K MAX	M NOM	cm^2				
PCB3521LA	12.7	25.5	5.08	1.48	61	Rynite FR530*	CP Wire	.79
PCB4216FA	15.69	30.48 ref	5	3.15	91.4	Rynite FR530*	CP Wire	.99

*UL 94 V-0 rated

Core Data (ungapped)

Any practical gap available. See pages 1.8-1.11

		MECHANICAL DIMENSIONS (mm)						
PART	**FIG.**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
0_40906EC	**1**	9.5 + 0, -.3	2.45 ± .05	5 + 0, -.2	1.6 + .15, -0	7.5 + .25,-0	3.5 + 0, -.2	7.21 ± .10
0_41126EC	**1**	11 + 0, -.35	2.45 ± .05	6 + 0, -.2	1.5 + .15, -0	8.7 + .3,-0	4.25 + 0, -.25	8 + .2, -0
0_41308EC	**1**	12.8 ± .3	2.85 ± .08	8.7 ± .25	1.75 ±.13	11.2 ± .3	5 ± .15	9.05 ± .3
0_41308IC	**2**	12.8 ± .3	1.1 ± .1	8.7 ± .25	-	-	-	-
0_41426EC	**1**	14.7 + 0, -.4	2.95 ± .05	6.8 + 0, -.2	1.55 + .2, -0	11.6 + .4, -0	4.8 + 0. -.2	-
0_41826EC	**1**	18 ± .35	3.15 ± .1	9.7 ± .2	1.6 ± .1	15.6 ± .3	6.2 ± .15	13.5 min
0_42014EC	**3**	20 ± .35	6.8 ± .1	14 ± .3	4.6 ± .15	18 ± .35	8.8 ± .15	-
0_42014IC	**2**	20 ± .35	1.9 ± .05	14 ± .3	-	-	-	-
0_42313EC	**1**	23.2 ± .45	3.6 ± .1	12.5 ± .25	1.6 ± .1	20.2 ± .4	8 ± .217.5 min	
0_42517EC	**1**	25 ± .4	5.6 ± .1	18 ± .3	2.75 ± .15	22 ± .4	11 ± .2	15.2 ± .7
0_42517IC	**2**	25 ± .4	2.3 ± .05	18 ± .3	-	-	-	-
0_42521EC	**1**	25 ± .4	8 ± .1	18 ± .3	5.15 ± .15	22 ± .4	11 ± .2	15.2 ± .7
0_43021EC	**1**	30 ± .4	8 ± .15	20 ± .3	5.3 ± .2	26 ± .4	11 ± .2	19.45 ± .4
0_43021IC	**2**	30 ± .4	2.7 ± .1	20 ± .3	-	-	-	-

To order, add material code to part number.

FIGURE 1

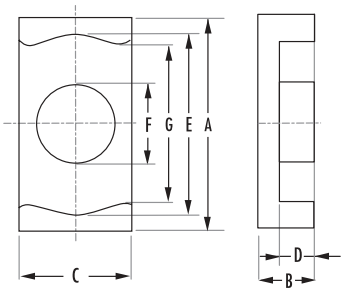
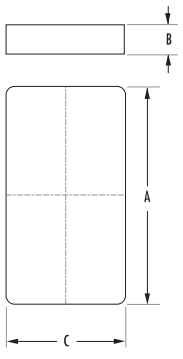


FIGURE 2



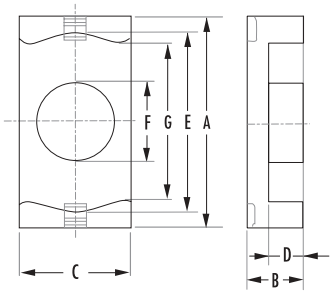
Core Data (ungapped)

A_L (mH/1000T) min

POWER MATERIALS					MAGNETIC DATA					
PART	COMB.	R	P	F*	l_e (mm)	A_e (mm^2)	A min (mm^2)	V_e (mm^3)	CORE WEIGHT (grams per set)	WaAc (cm^4)
0_40906EC	**EE**	730	790	1,270	14.2	8.47	7.6	120	0.6	.0026
0_41126EC	**EE**	1,200	1,267	1,780	14.7	11.9	10.3	174	1	-
0_41308EC	**EE**	1,275	1,350	1,950	17.5	19.9	19.2	348	1.6	-
0_41308IC	**EI**	1,350	1,425	2,000	15.9	19.8	19.2	315	1.4	-
0_41426EC	**EE**	1,200	1,275	1,850	19	17.6	17.3	333	1.8	-
0_41826EC	**EE**	1,967	2,078	3,104	22.1	30.2	30.1	667	3.2	-
C_42014EC	**EE**	2,841	3,019	4,575	33.2	59	55	1,960	10.2	-
0_42014IC	**EI**	3,359	3,555	5,338	25.5	57.3	52.5	1,460	8.1	-
0_42313EC	**EE**	2,850	3,025	4,540	26.6	50.2	50	1,340	6.4	-
0_42517EC	**EE**	5,266	5,586	8,427	26.4	89.7	82.8	2,370	16.4	-
0_42517IC	**EI**	5,266	5,586	8,427	26.4	89.7	82.8	2,370	13.1	-
0_42521EC	**EE**	4,080	4,351	6,649	41.4	100	95	4,145	22	-
0_43021EC	**EE**	4,098	4,381	6,729	46	108	95	4,970	26.4	-
0_43021IC	**EI**	4,913	5,838	8,850	36.2	108	95	3,910	20.8	-

* F material nominal ± 25%

FIGURE 3

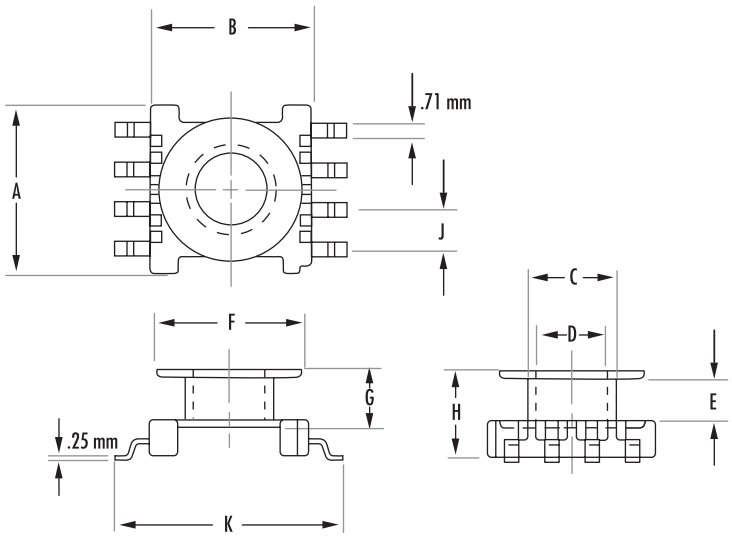


AVAILABLE HARDWARE	MOUNTING CLAMP	SURFACE MOUNT HEADER
0_40906EC	✓	✓

Surface Mount Bobbin

			MECHANICAL DIMENSIONS (mm)										NOMINAL WINDING AREA PER SECTION	AVERAGE LENGTH OF TURN (mm)
PART	CORE SIZE	FIG.	A NOM	B NOM	C MAX	D MIN	E NOM	F MAX	G MAX	H NOM	J TYP	K NOM	cm^2	
SMB09068A	**40906EC**	**1**	8.5	8.1	4.55	3.5	2.15	7.39	2.99	4.29	2.0	11.55	.030	8.64

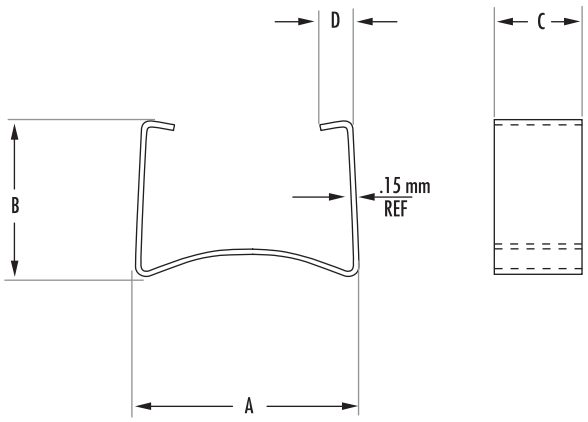
FIGURE 1



Mounting Clamps

MECHANICAL DIMENSIONS (mm)								
PART	**ITEM**	**CORE SIZE**	**FIG.**	**A**	**B**	**C**	**D**	**E**
00C09061A	Clamp	**40906EC**	**1**	10	5.38	3.98	13.97	Stainless Steel

FIGURE 1



Notes

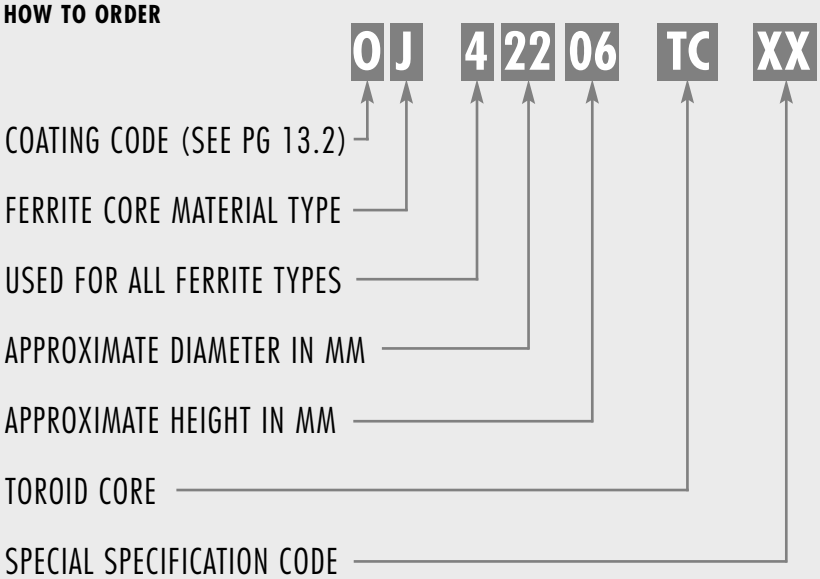
Toroids

TOROIDS

Ferrite toroids offer high magnetic efficiency as there is no air gap, and the cross sectional area is uniform. Available in many sizes (O.D.s from 2.54mm to 107mm) and materials (permeabilities ranging from 750 to 15,000), this section lists common sizes. For additional sizes contact Magnetics Sales.

Typical applications for high permeability toroids (J, W, and H materials) include common mode chokes, broadband transformers, pulse transformers and current transformers. R, P and F material toroids are excellent choices for high frequency transformers. Special sizes in J material are available for Ground Fault Interrupter applications.

HOW TO ORDER



***COATING CODES**

0 – Bare core
V – Nylon coating
Y – Parylene C®
Z – Epoxy coating

***SPECIAL SPECIFICATION CODES**

CC – Color Coded

*See page 13.2 – 13.3 for discussion of coating and other special requirements.

COATINGS

In order to increase winding ease and improve voltage breakdown, toroids are available coated. There are three categories of coatings available; Parylene, Nylon and Epoxy.

Parylene C® is a vacuum-deposited material which has a uniform coating (including edges) with a thickness of .013mm to .05mm, a smooth winding surface, and good moisture resistance to organic solvents and acid bases. The electrical characteristics are superior to other coatings. To specify Parylene use "Y" as the coating code when ordering.

Parylene C® is available for cores with O.D.s up to 12.7mm. The continuous maximum rating is 130° C.

Parylene C® offers a minimum voltage breakdown of 600 volts wire to wire.

Nylon coating (V designation) provides good adhesion, a smooth winding surface and excellent resistance to moisture and organic solvents. Typically, Nylon coating is .10mm to .20mm thick.

Available in the 12.7 mm to 29 mm size range, Nylon is a good finish for continuous operation from -65° C to +155° C. Nylon coating offers a minimum voltage breakdown of 1000 volts (wire to wire).

Epoxy is rated to 200° C continuous operation. Coating thickness with Epoxy is typically less than with Nylon.

The size range for Epoxy is from 9.5 mm to 86 mm.

NOTE: W & H materials are not available in Nylon coating.

SPECIAL SPECIFICATION CODES

COLOR CODING

Toroids (as well as other cores) can be marked with a color code to help differentiate different materials. When ordering add "CC" as the special specification code.

MATERIAL	ASSIGNED COLOR CODES
R	Blue
P	Green
F	White
J	Red
W	Yellow
H	Purple

HIGH VOLTAGE

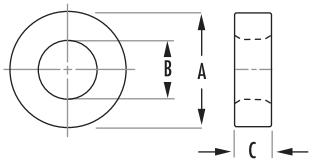
Voltage breakdown higher than the standard guarantees can be provided. Dimensional tolerances are relaxed to allow for the added coating. Contact Magnetics Application Engineering for specifications.

Toroid Core Data

A_L (mH/1000T) min

	MECHANICAL DIMENSIONS (mm)			POWER MATERIALS			HIGH PERMEABILITY MATERIALS		
PART	A (O.D.)	B (I.D.)	C (HGT.)	R 2300µ ± 25%	P 2500µ ± 25%	F 3000µ ± 20%	J 5000µ ± 20%	W 10,000µ ± 30%	H 15,000µ ± 30%
40200TC	2.54	1.27	1.27	400	454	525	875	1,750	2,625
40301TC	3.51	1.83	1.27	380	410	495	825	1,650	2,475
40502TC	3.94	2.24	1.27	340	368	440	735	1,470	2,205
40503TC	3.94	2.24	2.54	670	716	885	1,475	2,950	4,425
40401TC	4.83	2.29	1.27	440	474	570	950	1,900	2,850
40402TC	4.83	2.29	2.54	870	948	1,140	1,900	3,800	5,700
40601TC	5.84	3.05	1.52	450	488	585	980	1,960	2,940
40603TC	5.84	3.05	3.18	940	1,020	1,225	2,040	4,080	6,120
40705TC	7.62	3.18	4.78	1,920	2,088	2,505	4,175	8,350	12,500
40907TC	9.53	5.59	7.11	1,730	1,884	2,260	3,765	7,530	11,300
41003TC	9.53	4.75	3.18	1,000	1,095	1,314	2,196	4,392	6,590
41005TC	9.53	4.75	4.78	1,510	1,650	1,980	3,308	6,616	992
41206TC	12.7	5.16	6.35	2,600	2,820	3,384	5,640	11,280	16,900
41303TC	12.7	8.14	3.15	680	745	894	1,488	2,976	4,460
41305TC	12.7	8.14	5.08	1,090	1,190	1,430	2,380	4,760	7,140
41306TC	12.7	8.14	6.35	1,360	1,485	1,782	2,968	5,936	8,900

To order, add coating and material code.



For the cores listed here, dimensional tolerances for bare and coated cores are on pages 13.10-13.12.

Other core heights are available upon special request.

Toroid Core Data

MAGNETIC DATA							AVAIL. COATINGS
PART	l_e (mm)	A_e (mm^2)	V_e (mm^3)	WINDOW AREA (cm^2)	CORE WEIGHT (g)	WaAc (cm^4)	
40200TC	5.53	0.77	4.3	0.01	0.03	-	**Y**
40301TC	7.65	1.03	7.87	0.02	0.04	-	**Y**
40502TC	9.2	1.05	9.7	0.03	0.05	-	**Y**
40503TC	9.2	2.1	19.4	0.03	0.10	-	**Y**
40401TC	10.2	1.5	15.7	0.04	0.09	-	**Y**
40402TC	10.21	3.08	31.4	0.04	0.17	-	**Y**
40601TC	13.0	2	26.7	0.07	0.14	-	**Y**
40603TC	13.0	4.3	56	0.07	0.3	-	**Y**
40705TC	15	9.9	149	0.07	0.9	-	**Y**
40907TC	22.7	13.7	310	0.24	1.6	0.03	**Y, Z**
41003TC	20.7	7.3	151	0.17	0.82	-	**V, Y, Z**
41005TC	20.7	10.9	227	0.17	1.2	0.01	**Y, Z**
41206TC	25	22	550	0.2	3.3	0.04	**Y, Z**
41303TC	31.7	7.1	226	0.49	1.2	0.03	**V, Y, Z**
41305TC	31.7	11.4	361	0.49	1.9	0.05	**V, Y, Z**
41306TC	31.7	14.2	451.2	0.49	2.4	0.07	**V, Y, Z**

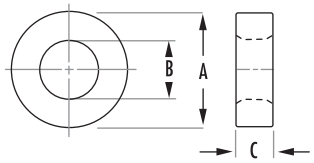
Toroid Core Data (con't)

A_L (mH/1000T) min

	MECHANICAL DIMENSIONS (mm)			POWER MATERIALS			HIGH PERMEABILITY MATERIALS		
PART	A (O.D.)	B (I.D.)	C (HGT.)	R 2300μ ± 25%	P 2500μ ± 25%	F 3000μ ± 20%	J 5000μ ± 20%	W 10,000μ ± 30%	H 15,000μ ± 30%
***41406TC**	12.7	7.14	6.35	1,660	1,805	2,166	3,612	7,224	10,800
***41407TC**	12.7	7.14	4.78	1,240	1,356	1,630	2,715	5,430	8,140
41506TC	13.2	7.37	3.96	1,020	1,111	1,334	2,295	4,590	6,880
41450TC	14.0	8.99	5	990	1,080	1,290	2,160	4,320	6,480
41605TC	15.9	9.07	4.7	1,260	1,375	1,650	2,760	5,520	8,280
41809TC	18.4	9.75	10.3	2,810	3,050	3,660	6,115	12,200	18,300
42106TC	20.6	12.7	6.35	1,380	1,500	1,680	2,800	5,600	8,400
42109TC	20.6	12.7	8.89	1,930	2,100	2,520	4,200	8,400	12,600
42206TC	22.1	13.7	6.35	1,380	1,510	1,812	3,020	6,040	9,060
42207TC	22.1	13.7	7.9	1,720	1,875	2,250	3,700	7,400	11,100
***42212TC**	22.1	13.7	12.7	2,770	3,020	3,624	6,040	12,080	18,100
***42507TC**	25.34	15.45	7.66	1,800	1,958	2,348	3,913	7,825	11,700
***42508TC**	25.34	15.45	10.27	2,220	2,420	2,900	4,830	9,660	14,490
***42908TC**	29	19	7.43	1,450	1,585	1,902	3,170	6,340	9,510
42915TC	29	19	15.2	2,960	3,222	3,868	6,447	12,894	19,300

To order, add coating and material code.

*Due to changes in core design relative to material and coating, exceptions to standard parameters are noted in the table on page 13.7



For the cores listed here, dimensional tolerances for bare and coated cores are on pages 13.10-13.12.

Other core heights are available upon special request.

Toroid Core Data (con't)

MAGNETIC DATA							AVAIL. COATINGS
PART	l_e (mm)	A_e (mm^2)	V_e (mm^3)	WINDOW AREA (cm^2)	CORE WEIGHT (g)	WaAc (cm^4)	
***41406TC**	29.5	16.9	498	0.4	2.7	0.06	**V, Y, Z**
***41407TC**	29.5	12.6	373	0.4	1.9	0.05	**V, Y, Z**
41506TC	30.6	10.9	332	0.42	1.9	0.04	**Z**
41450TC	35.0	12	421	0.63	2.2	0.07	**V, Z**
41605TC	37.2	15.6	580	0.62	2.8	0.09	**V, Z**
41809TC	41.4	43.1	1,783	0.74	9.9	0.3	**V, Z**
42106TC	50.3	24.6	1,238	1.27	5.4	0.29	**V, Z**
42109TC	50	34	1,733	1.27	8.1	0.41	**V, Z**
42206TC	54.1	26.2	1,417	1.48	6.4	0.37	**V, Z**
42207TC	54.2	32.5	1,763	1.48	8.5	0.46	**V, Z**
***42212TC**	54.2	52.3	2,776	1.48	13.5	0.75	**V, Z**
***42507TC**	61.5	39	2,284	1.89	11.6	0.7	**V, Z**
***42508TC**	61.5	48	2,981	1.89	14.9	0.89	**V, Z**
***42908TC**	73.2	37	2,704	2.84	12.9	1.02	**V, Z**
42915TC	73.2	74.9	5,481	2.84	27.6	2.1	**Z**

PART	COATING	MATERIAL	A_e (mm^2)	V_e (mm^3)
41406TC	**V**	F, J	16.5	496.7
41407TC	**V**	F, J, P, R	12.4	374
42212TC	**V**	F, J, P, R	51.3	2,776
42507TC	**V**	J, P	37.1	2,284
42508TC	**V**	R	48.45	2,981
42908TC	**V**	F, J, P, R	37	2,704

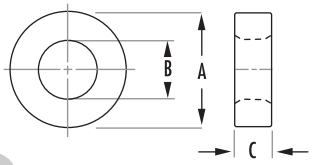
Toroid Core Data (con't)

A_L (mH/1000T) min

	MECHANICAL DIMENSIONS (mm)			POWER MATERIALS			HIGH PERMEABILITY MATERIALS	
PART	A (O.D.)	B (I.D.)	C (HGT.)	R 2300μ ± 25%	P 2500μ ± 25%	F 3000μ ± 20%	J 5000μ ± 20%	W 10,000μ ± 30%
43113TC	30.83	19.06	12.74	2,850	3,100	3,720	6,200	12,400
43205TC	32	15	4.5	1,480	1,610	1,930	3,220	6,440
***43610TC**	36	23	10	2,030	2,210	2,726	4,543	9,085
***43615TC**	36	23	15	3,100	3,366	4,040	6,736	13,400
***43806TC**	38	19	6.35	2,020	2,200	2,640	4,400	8,800
***43813TC**	38.1	19	12.7	3,850	4,185	5,020	8,365	16,700
***43825TC**	38.1	19.0	25.4	8,060	8,762	10,040	16,730	33,400
44015TC	41.8	26.2	18	-	4,208	-	-	-
***44416TC**	44.3	19	15.9	5,360	5,830	7,000	11,600	23,200
***44715TC**	46.9	27	15	3,700	4,030	4,840	8,075	16,100
***44916TC**	49.1	33.8	15.9	2,710	2,950	3,540	5,900	11,800
***44920TC**	49.1	31.8	15.9	2,790	3,032	3,640	6,065	12,130
***44925TC**	49.1	31.8	19.05	3,420	3,718	4,460	7,435	14,870
***44932TC**	49.1	33.8	31.3	5,430	5,900	7,080	11,800	23,600
46113TC	61	35.6	12.7	3,140	3,491	4,107	6,845	13,690
***46326TC**	63	38	24.5	5,770	6,270	7,530	12,500	25,100
***47313TC**	73.7	38.9	12.5	3,700	4,024	4,880	8,140	16,280
48613TC	85.7	55.5	12.7	2,510	2,726	3,310	5,520	11,040
49715TC	102	65.8	15	3,025	3,464	-	6,575	11,178
49718TC	107	65	18	4,127	4,486	-	8,972	15,252
49725TC	107	65	25	5,732	6,230	-	9,346	-

*Due to changes in core design relative to material and coating, exceptions to standard parameters are noted in the tables on page 13.9.

To order, add coating and material code.



For the cores listed here, dimensional tolerances for bare and coated cores are on pages 13.10-13.12.

Other core heights are available upon special request.

Toroid Core Data (con't)

	MAGNETIC DATA						AVAIL. COATINGS
	l_e (mm)	A_e (mm^2)	V_e (mm^3)	WINDOW AREA (cm^2)	CORE WEIGHT (g)	WaAc (cm^4)	
43113TC	75.4	73.6	5,547	2.83	29.3	2.11	**Z**
43205TC	67.2	34.5	2320	1.77	12.9	0.61	**Z**
***43610TC**	89.7	62.6	5,616	4.15	29.4	2.61	**Z**
***43615TC**	89.6	95.9	8,366	4.15	44	3.93	**Z**
***43806TC**	82.9	58.3	4,644	2.85	26.4	1.62	**Z**
***43813TC**	82.9	115.6	9,452	2.85	51.7	3.27	**Z**
***43825TC**	82.8	231	19,304	2.85	103.4	6.58	**Z**
44015TC	103	138	14,205	-	-	-	**Z**
***44416TC**	84	189	16,770	2.85	80.8	5.33	**Z**
***44715TC**	110	145.5	16,063	5.72	84	8.12	**Z**
***44916TC**	127	118	15,010	8.99	75.3	10.4	**Z**
***44920TC**	123	119	14,700	7.94	74.6	9.45	**Z**
***44925TC**	123.2	161.8	19,927	7.94	91	11.6	**Z**
***44932TC**	127	236	30,000	8.99	150.6	21.2	**Z**
46113TC	145	156	22,500	9.93	117.3	15.5	**Z**
***46326TC**	152	300	45,598	11.3	231	34.4	**Z**
***47313TC**	165	210	34,771	11.9	177	25.2	**Z**
48613TC	214.9	188.8	40,582	24.2	203	45.2	**Z**
49715TC	255.3	267.2	68,821	-	-	-	**Z**
49718TC	259.31	370.27	96,013	-	-	-	**Z**
49725TC	259.31	514.3	133,351	-	-	-	**Z**

PART	COATING	MATERIAL	A_e (mm^2)	V_e (mm^3)
43610TC	**Z**	F, J	62.6	-
43615TC	**Z**	F, J, P, R	93.3	-
43806TC	**Z**	J	56.1	4,644
43813TC	**Z**	F, J, P	-	9,462
43813TC	**Z**	W	48.45	9,576
43825TC	**Z**	F, J	-	19,152
43825TC	**Z**	W	-	19,190
44416TC	**Z**	P	187	16,559

PART	COATING	MATERIAL	A_e (mm^2)	V_e (mm^3)
44715TC	**Z**	P	143.5	15,848
44916TC	**Z**	F, J, P	133.7	16,466
44920TC	**Z**	J, P	133.7	16,466
44925TC	**Z**	F, J, P	160.1	19,717
44932TC	**Z**	W	239	30,405
46326TC	**Z**	J	297	45,226
47313TC	**O, Z**	W	214	35,298

Bare Core Limiting Dimensions (mm)

	R, P, F AND J MATERIALS			W AND H MATERIALS				R, P, F AND J MATERIALS			W AND H MATERIALS		
PART	O.D. MAX	I.D. MIN	HGT. MAX	O.D. MAX	I.D. MIN	HGT. MAX	PART	O.D. MAX	I.D. MIN	HGT. MAX	O.D. MAX	I.D. MIN	HGT. MAX
40200TC	2.75	1.06	1.45	2.75	1.06	1.45	**42212TC**	22.48	13.33	12.96	22.69	13.13	13.09
40301TC	3.71	1.62	1.45	3.71	1.62	1.45	**42507TC**	25.84	15.05	8.18	26.17	14.73	8.31
40502TC	4.14	2.03	1.45	4.14	2.03	1.45	**42508TC**	25.91	14.98	10.27	26.17	14.73	10.39
40503TC	4.14	2.03	2.80	4.14	2.03	2.80	**42908TC**	29.52	18.49	7.68	29.77	18.23	7.78
40401TC	5.03	2.08	1.45	5.03	2.08	1.45	**42915TC**	29.52	18.49	15.63	29.77	18.23	15.83
40402TC	5.03	2.08	2.80	5.03	2.08	2.80	**43113TC**	31.5	18.49	13.26	31.75	18.23	13.39
40601TC	6.13	2.76	1.71	6.13	2.76	1.71	**43205TC**	32.52	14.5	4.63	32.77	14.24	4.7
40603TC	6.13	2.76	3.43	6.13	2.76	3.43	**43610TC**	36.7	22.5	10.27	36.76	22.25	10.39
40705TC	7.88	2.92	4.91	8.01	2.79	5.03	**43615TC**	36.7	22.5	15.24	36.76	22.25	15.37
40907TC	9.78	5.33	7.29	9.91	5.2	7.40	**43806TC**	38.87	18.28	6.53	39.25	17.9	6.63
41003TC	9.78	4.49	3.31	9.91	4.36	3.43	**43813TC**	38.87	18.28	12.96	39.25	17.9	13.09
41005TC	9.78	4.49	4.91	9.91	4.36	5.03	**43825TC**	38.87	18.28	25.91	39.25	17.9	26.17
41206TC	12.96	4.9	6.53	13.09	4.77	6.63	**44015TC**	42.8	25.6	18.4	42.8	25.6	18.4
41303TC	12.96	7.67	3.31	13.09	7.54	3.43	**44416TC**	45.22	18.28	16.26	45.6	17.9	16.46
41305TC	12.96	7.67	5.26	13.09	7.54	5.36	**44715TC**	47.65	26.23	15.27	48.04	25.85	15.4
41306TC	12.96	7.67	6.53	13.09	7.54	6.63	**44916TC**	49.84	33.07	16.26	50.22	32.69	16.46
41406TC	12.96	6.88	6.53	13.09	6.75	6.63	**44920TC**	49.84	31.03	16.26	50.22	30.65	16.46
41407TC	12.96	6.88	4.91	13.09	6.75	5.03	**44925TC**	49.84	31.03	19.44	50.22	30.65	19.64
41506TC	13.47	7.11	4.09	13.59	6.98	4.22	**44932TC**	49.84	33.07	32.26	50.22	32.69	32.52
41450TC	14.25	8.73	5.14	14.38	8.61	5.26	**46113TC**	61.85	34.67	12.96	62.31	34.21	13.09
41605TC	16.26	8.5	4.83	16.46	8.3	4.96	**46326TC**	63.89	37.1	25.38	64.34	36.65	25.58
41809TC	18.83	9.37	10.52	19.03	9.16	10.65	**47313TC**	74.68	37.9	12.96	75.19	37.33	13.29
42106TC	20.96	12.31	6.53	21.16	12.11	6.63	**48613TC**	87	54.28	12.96	87.63	53.64	13.29
42109TC	20.96	12.31	9.15	21.16	12.11	9.28	**49715TC**	104	64.5	15.5	104	64.5	15.5
42206TC	22.48	13.33	6.53	22.69	13.13	6.63	**49718TC**	109	63.7	18.35	109	63.7	18.33
42207TC	22.48	13.33	8.18	22.69	13.13	8.31	**49725TC**	109	63.7	25.75	109	63.7	25.75

V and Z Coated Limiting Dimensions (mm)

	R, P, F AND J MATERIALS			W AND H MATERIALS				R, P, F AND J MATERIALS			W AND H MATERIALS		
PART	O.D. MAX	I.D. MIN	HGT. MAX	O.D. MAX	I.D. MIN	HGT. MAX	PART	O.D. MAX	I.D. MIN	HGT. MAX	O.D. MAX	I.D. MIN	HGT. MAX
40907TC	10.16	4.95	7.68	10.29	4.82	7.78	**43113TC**	31.88	18.11	13.64	32.14	17.85	13.77
41003TC	10.17	4.20	3.73	10.29	3.98	3.81	**43205TC**	32.9	14.12	5.01	33.15	13.86	5.08
41005TC	10.17	4.20	5.33	10.29	3.98	5.41	**43610TC**	37.15	22.05	10.65	37.14	21.86	10.77
41206TC	13.55	4.21	7.10	13.47	4.39	7.01	**43615TC**	37.15	22.05	15.6	37.14	21.86	15.75
41303TC	13.55	7.09	3.81	13.47	7.16	3.81	**43806TC**	39.25	17.9	6.91	39.63	17.52	7.01
41305TC	13.55	7.09	5.75	13.47	7.16	5.75	**43813TC**	39.25	17.9	13.34	39.63	17.52	13.47
41306TC	13.55	7.09	7.1	13.47	7.16	7.01	**43825TC**	39.25	17.9	26.29	39.63	17.52	26.55
41406TC	13.55	6.30	7.1	13.47	6.37	7.01	**44015TC**	43.15	25.15	19.20	-	-	-
41407TC	13.55	6.30	5.43	13.47	6.37	5.41	**44416TC**	45.6	17.9	16.64	45.98	17.52	16.85
41506TC	13.84	6.73	4.47	13.97	6.6	4.6	**44715TC**	48.04	25.85	15.65	48.42	25.47	15.78
41450TC	15	7.85	5.8	14.76	8.23	5.64	**44916TC**	50.22	32.69	16.64	50.6	32.3	16.85
41605TC	17.1	7.64	5.5	16.84	7.92	5.34	**44920TC**	50.22	30.65	16.64	50.6	30.27	16.85
41809TC	19.7	8.45	11.3	19.41	8.78	11.03	**44925TC**	50.22	30.65	19.82	50.6	30.27	20.02
42106TC	21.9	11.4	7.25	21.54	11.73	7.01	**44932TC**	50.22	32.69	32.64	50.6	32.3	32.9
42109TC	21.9	11.4	9.89	21.54	11.73	9.66	**46113TC**	62.23	34.29	13.34	62.69	33.83	13.47
42206TC	23.4	12.5	7.25	23.07	12.75	7.01	**46326TC**	64.9	36.4	25.8	64.72	36.27	25.96
42207TC	23.4	12.5	8.9	23.07	12.75	8.69	**47313TC**	75.06	37.46	13.34	75.57	36.95	13.67
42212TC	23.4	12.5	13.49	23.07	12.75	13.47	**48613TC**	87.38	53.89	13.34	88.02	53.26	13.67
42507TC	26.64	14.15	8.66	26.55	14.35	8.69	**49715TC**	104.5	64.1	16.0	104.5	64.1	16.0
42508TC	26.64	14.15	11.0	26.55	14.35	10.77	**49718TC**	109.5	63.3	18.85	109.5	63.3	18.85
42908TC	30.4	17.6	8.60	30.15	17.85	8.16	**49725TC**	109.5	63.3	26.05	109.5	63.3	26.05
42915TC	30.15	17.85	16.21	30.15	17.85	16.21							

Y Coated Limiting Dimensions (mm)

	R, P, F AND J MATERIALS			W AND H MATERIALS				R, P, F AND J MATERIALS			W AND H MATERIALS		
PART	O.D. MAX	I.D. MIN	HGT. MAX	O.D. MAX	I.D. MIN	HGT. MAX	PART	O.D. MAX	I.D. MIN	HGT. MAX	O.D. MAX	I.D. MIN	HGT. MAX
40200TC	2.82	0.99	1.53	2.82	0.99	0.53	**40907TC**	9.86	5.25	7.37	9.99	5.13	7.47
40301TC	3.79	1.54	1.53	3.79	1.54	1.53	**41003TC**	9.86	4.42	3.38	9.99	4.29	3.51
40502TC	4.22	1.95	1.53	4.22	1.95	1.53	**41005TC**	9.86	4.42	4.98	9.99	4.29	5.11
40503TC	4.22	1.95	2.87	4.22	1.95	2.87	**41206TC**	13.03	4.82	6.61	13.16	4.69	6.71
40401TC	5.11	2	1.53	5.11	2	1.53	**41303TC**	13.03	7.59	3.38	13.16	7.46	3.51
40402TC	5.11	2	2.87	5.11	2	2.87	**41305TC**	13.03	7.59	5.34	13.16	7.46	5.44
40601TC	6.2	2.69	1.78	6.2	2.69	1.78	**41306TC**	13.03	7.59	6.61	13.16	7.46	6.71
40603TC	6.2	2.69	3.51	6.2	2.69	3.51	**41406TC**	13.03	6.8	6.61	13.16	6.68	6.71
40705TC	7.95	2.84	4.98	8.08	2.71	5.11	**41407TC**	13.03	6.8	4.98	13.16	6.68	5.11

Toroid Mounts

DIMENSIONS (mm)												
PART	FIG	FOR CORE O.D	A NOM	B NOM	C REF	D NOM	E REF	F TYP	G TYP	H NOM	J REF	K REF
TVB22066A (6 pins)	**1**	12.7 - 22.1	19	10.8	12	3.5	4.8	6	7.5	5.9	5.5	2
TVB2908TA (10 pins)	**2**	20.6 - 31.7	27	1.8	16	5	7	14.9	5	7.5	8.1	3.5
TVB3610FA (14 pins)	**3**	29 - 38.1	35.8	20.8	11	5	7	16	G_1 6.3 G_2 5	7.6	9.8	4.5

These vertical mount accessories are designed to accommodate a variety of toroidal core sizes on to printed circuit board or other assemblies.
(Contact Magnetics Application Engineering for new parts not shown here)

FIGURE 1
For use with P/N's 41206TC – 42212TC

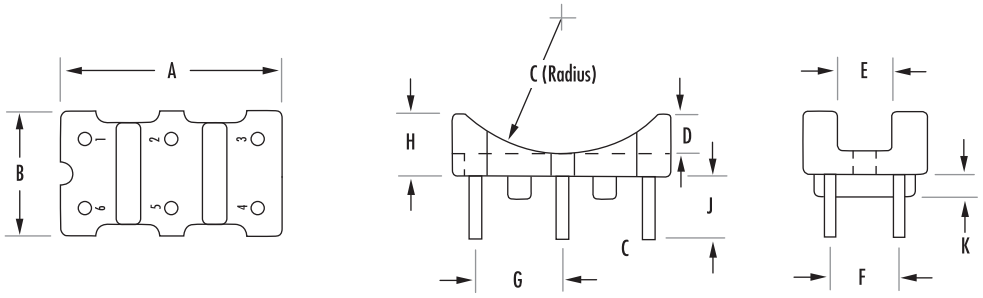


FIGURE 2
For use with P/N's 42507TC – 43113TC

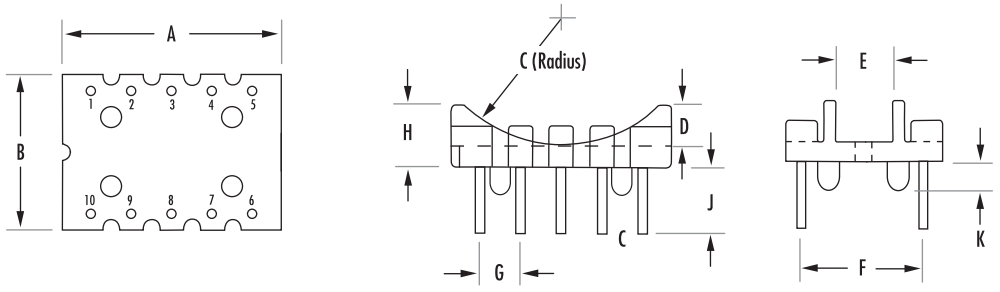
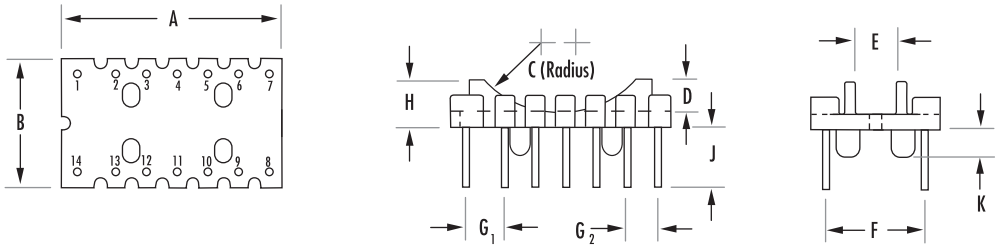


FIGURE 3
For use with P/N's 42908TC – 43825TC

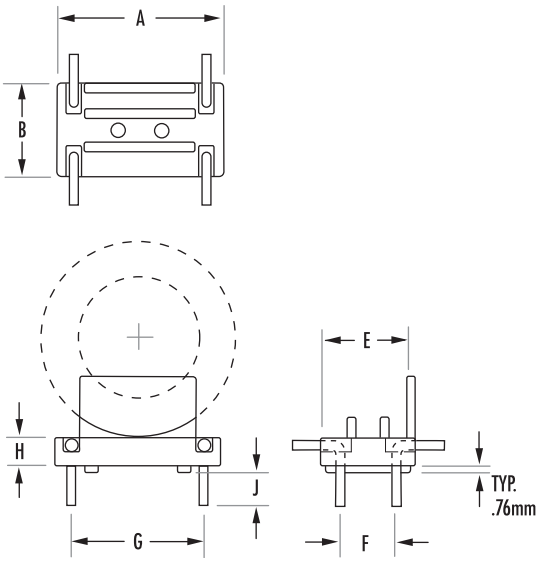


All parts
Material: Phenolic
UL 94 VO rated
Pin Material: CP Wire
Pin Diameter: .99mm

Toroid Mounts (con't)

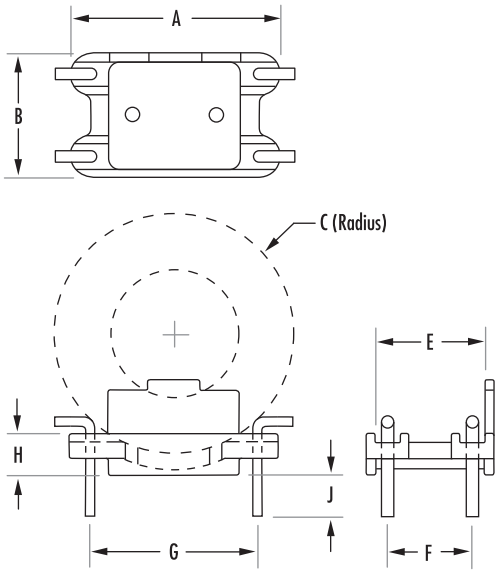
			DIMENSIONS (mm) nom							
PART	FIG	FOR CORE O.D.	A	B	C	E	F	G	H	J
TVH22064A	**1**	12.7 - 25.4	19	10.8	-	9.8	6.35	15.2	3.2	3.8
TVH25074A	**2**	20.6 - 29	25.4	15.2	15.2	13	10.2	20.3	5	5
TVH38134A	**2**	31.8 - 38.1	27.9	20.3	20.3	18	15.2	22.9	5	5
TVH49164A	**2**	38.1 - 63.5	35.6	22.9	32.2	20.6	17.8	30.5	5	5
TVH61134A	**2**	48.2 - 71.1	43.2	27.9	35.6	25.3	22.9	38.1	5	5

FIGURE 1



Material: Nylon
UL 94 VO rated
Pin Material: CP Wire
Pin Diameter: 1mm

FIGURE 2

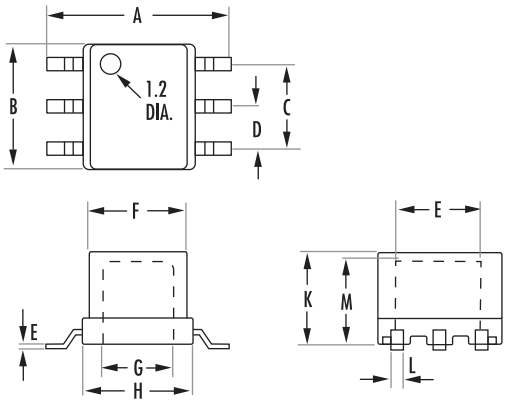


Material: Nylon
UL 94 VO rated
Pin Material: CP Wire
Pin Diameter: 1.3mm

Toroid Cups and Headers

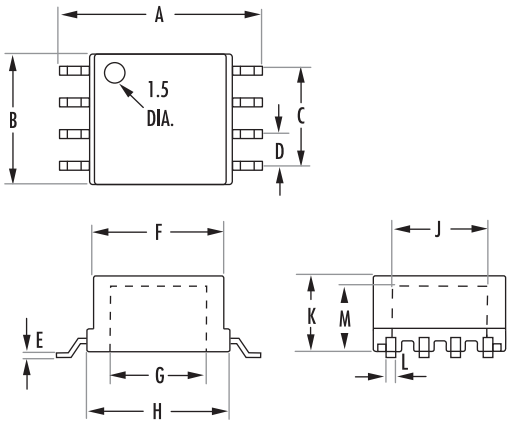
DIMENSIONS (mm)														
PART	FIG	FOR CORE O.D.	A MAX	B MAX	C NOM	D TYP	E NOM	F MAX	G MIN	H NOM	J MIN	K MAX	L NOM	M MIN
SMC03016A	**1**	<3.9	10.9	7.7	5	2.54	.25	5.9	4.1	6.7	5	5.8	.7	4.8
SMC06018A	**2**	<6.3	16.2	10.4	7.6	2.54	.30	10.4	7.6	11.4	7.6	6.1	.6	5.2
SMH05025A	**3**	<5.0	6.1	15.5	4	2	.25	6.3	-	-	-	1.1	.6	-
SMH07058A	**4**	<7.9	10.1	9.6	7.5	2.5	.25	12.5	-	-	-	1.6	.6	-

FIGURE 1



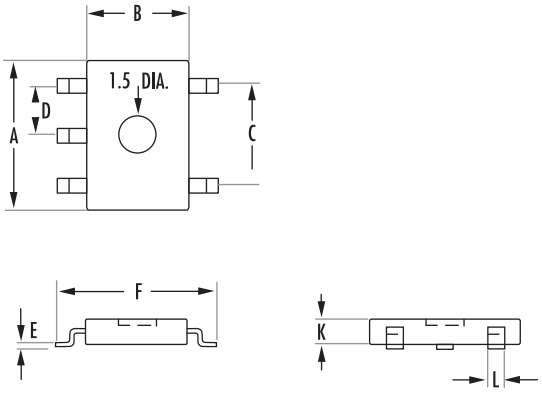
Material: L.C.P.
UL 94 VO rated
Pin Material: Phosphor Bronze

FIGURE 2



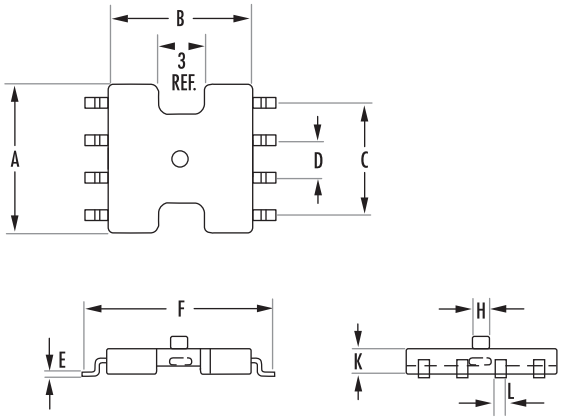
Material: Phenolic
UL 94 VO rated
Pin Material: Phosphor Bronze

FIGURE 3



Material: Phenolic
UL 94 VO rated
Pin Material: Phosphor Bronze

FIGURE 4



Material: L.C.P.
UL 94 VO rated
Pin Material: Phosphor Bronze

Notes

MAGNETICS®

General Information

Section 14

Definitions

SYMBOL	UNITS	DEFINITION
μ	—	Permeability—The ratio of magnetic flux density in gausses to magnetic field strength in oersteds. $\mu = \frac{B}{H}$
μ_i	—	Initial Permeability—The value of the permeability at very low magnetic field strengths. $\mu_i = \lim_{H \to 0} \frac{B}{H}$
μ_e	—	Effective Permeability—If a magnetic circuit is not homogeneous (i.e., contains an air gap), the effective permeability is the permeability of a hypothetical homogeneous (ungapped) structure of the same shape, dimensions, and reluctance, that would give the inductance equivalent to the gapped structure.
A_L	millihenries per 1,000 turns or nanohenries/turn^2	Inductance factor—In a wound core, the inductance per unit turn when L is in henries. More often, when L is expressed in millihenries, A_L is the inductance as measured using a thousand turn coil. When calculating for other turns, use: $L\ (mH) = A_L n^2/1{,}000^2$.
TC	/°C	Temperature Coefficient—The relative change in permeability per °C when measured at two different temperatures. $TC = \frac{\mu_2 - \mu_1}{\mu_2 (T_2 - T_1)}$
TF	/°C	Temperature Factor—The temperature coefficient of a material per unit of permeability. $TF = \frac{TC}{\mu_i}$
TC_e	/°C	Effective Temperature Coefficient—The actual temperature coefficient of a magnetic structure whose material permeability has been reduced to μ_e by gapping. $TC_e = TF \times \mu_e$
DA	—	Disaccommodation—The relative decrease in permeability of a magnetic material with time after magnetic conditioning (demagnetization). $DA = \frac{\Delta\mu}{\mu_1} \Big/ \log \frac{t_2}{t_1}$ t1 = time from demagnetization to 1st measurement; t2 = time from demagnetization to 2nd measurement. For each decade of time, when $t_2 = 10t_1$, $DA = \frac{\Delta\mu}{\mu_i}$
DF	—	Disaccommodation Factor—The disaccommodation of a material per unit of permeability. $DF = \frac{DA}{\mu_i}$

SYMBOL	UNITS	DEFINITION
DF_e	—	Effective Disaccommodation Coefficient—The actual disaccommodation of a magnetic circuit whose material permeability has been reduced to μ_e by gapping. $DF_e = DF \times \mu_e$
Q	—	Q Factor—The efficiency of an inductor, that is the ratio of series inductive reactance to loss resistance. $Q = \frac{\omega L_S}{R_S}$
$\tan\delta$	—	Loss angle—Deviation from ideal phase angle (90°) due to losses. $\tan\delta = \frac{R_S}{\omega L_S} = \frac{1}{Q}$
$\frac{\tan\delta}{\mu_i}$	—	Relative loss factor—Losses per unit of permeability. Figure of merit of a material. $\frac{\tan\delta}{\mu_i} = \frac{1}{\mu_i Q}$
C_h	/gausses	Hysteresis coefficient—The coefficient in the Legg** equation which separates the hysteresis losses from the eddy current and residual losses. $\frac{R_S}{\mu_i f L_S} = C_h B + C_e f + C_r$ This coefficient can be evaluated by noting the variation of series resistance with B.
$\frac{C_h}{\mu_i 2}$	/gausses	Relative Hysteresis Factor. This hysteresis coefficient normalized to unit permeability so that it is strictly a material property.
$C_{h(e)}$	/gausses	Effective Hysteresis Coefficient—The actual hysteresis loss in a magnetic structure whose permeability has been reduced to μ_e by gapping. $C_{h(e)} = \frac{C_h}{\mu_i 2} \times \mu_e^2$
B	gausses	Flux density—The magnetic flux in maxwells per cm^2 of cross sectional area.
B_{max}	gausses Teslas	The flux density at high field strengths (normally 25 oersteds). 10^4 gausses = 1 Tesla
H	oersteds	Field strength—The externally applied magnetizing field in oersteds.
Hc	oersteds amp-turns/m	Coercive force—The reverse magnetic field needed to reduce a magnetically saturated structure from remanence to zero magnetic induction. 1oersted = 79.5 amp-turns/m
L	henries	Inductance—The magnetic flux linkages in maxwells-turns per ampere of magnetizing current. $L = -N \frac{d\phi}{di}$
l_e	cm	Effective magnetic path length—In a structure containing a non-uniform cross section, the effective magnetic path length is that length of a similar structure with uniform cross section which is equivalent to the first for purposes of magnetic calculations.
A_e	cm^2	Effective cross-sectional area—In a structure containing a non-uniform cross section, the effective magnetic cross section is the area of a structure with uniform cross section which is equivalent to the first for purposes of magnetic calculations.
V_e	cm^3	Effective magnetic volume.
T_c	°C	Curie Temperature—Temperature at which a ferromagnetic material loses its ferromagnetism and becomes paramagnetic (μ_e approaches 1).

**V.E. Legg, Magnetic Measurements at Low Flux Densities Using the Alternating Current Bridge, Bell System Technical Journal, 15, 39 (1936)

References

1.* Handbook of Modern Ferromagnetic Materials
Alex Goldman
Klywer Academic Publishers, Norwell, MA 02061

2.* Magnetic Core Selection for Transformers & Inductors,
Colonel Wm. T. McLyman
Marcel Dekker, 270 Madison Avenue, New York, NY 10016-0602

3.* Transformer and Inductor Design Handbook (second edition)
Colonel Wm. T. McLyman
270 Madison Avenue, New York, NY 10016-0602

4.* Fundamentals of Power Electronics
Robert Erickson
Chapman and Hall, New York, NY 10003

5.* Introduction to Power Electronics
Daniel Hart
Prentice-Hall, Upper Saddle River, NJ 07458

6.* Resonant Power Converters
Marian Kazimierczok
John Wiley & Sons, Inc., New York, NY 10158

7.* Power Switching Coverters
Simon Ang
Marcel Dekker, 270 Madison Avenue, New York, NY 10016

8.* Designing Magnetic Components for High Frequency DC-DC Converters
Colonel W.T. McLyman
Kg Magnetics, Idyllwild, CA 92549

9.* Elements of Power Electronics
Philip Krein
Oxford University Press, Cary, NC 27513

10.* Modern DC-DC Switchmode Power Converter Circuits (reprint)
Severns & Bloom, e/j Bloom associates inc.

11.* Switchmode Power Conversion
K. Kit Sum
Marcel Dekker, 270 Madison Avenue, New York, NY 10016-0602

12.* Applications of Magnetism, J.K. Watson, (self-published).

13.* Switching Power Supply Design (second edition)
A.I. Pressman
McGraw-Hill Publishing Co., 1221 Avenue of Americas, New York, NY 10020

14.* EMI Filter Design
R. Ozenbaugh
Marcel Dekker, 270 Madison Avenue, New York, NY 10016-0602

15.* Handbook of Switch Mode Power Supply Design
K. Billings
McGraw-Hill Publishing Co., 1221 Avenue of Americas, New York, NY 10020

16.* Handbook of Transformer Applications (second edition)
W. Flanagan
McGraw-Hill Publishing Co., 1221 Avenue of Americas, New York, NY 10020

17.* Practical Switching Power Supply Design,
Marty Brown
Academic Press Inc., San Diego, CA 92101

18. Modern Ferrite Technology
Alex Goldman
Van Nostrand Reinhold, 115 Fifth Avenue, New York, NY 10003

19. Power Line Filter Design for Switch-Mode Power Supplies
Mark J. Nave
EMC Services, P.O. Box 2504, Huntsville, AL, Telephone 205-461-0241

20.* Solid-State Power Conversion Handbook
R. Tarter
John Wiley & Sons Inc., 605 Third Avenue, New York, NY 10158

21.* Power Electronics: Converters, Applications & Design (second edition)
N. Mohan et. al.
John Wiley & Sons Inc., 605 Third Avenue, New York, NY 10158

22.* Power Supply Cookbook
Marty Brown
Butterworth - Heinemann, 313 Washington Street, Newton, MA 02158

23.* Designing Magnetic Components for High Frequency DC-DC Converters
Colonel Wm. T. McLyman
KG Magnetics Inc., P.O. Box 3703, 26504 Crestview Dr.,
Idyllwild, CA 92549, Telephone 909-659-4548

24.* Pulse Width Modulated DC-DC Converters
Keng Wu
Chapman and Hall, New York, NY 10003

25.* Power Electronics-Principles & Applications
Joseph Vithayathil
McGraw Hill Inc., 1221 Avenue of Americas, New York, NY 10020

26. MMPA Publications of Soft Ferrites
PC 110 Pot Core Standard
UEI 310 U, E and I Core Standard
FTC 410 Toroid Standard
Soft Ferrites, A User's Guide
Available from: Magnetic Materials Producers Association,
8 South Michigan Avenue, Suite 1000, Chicago, IL 60603,
Telephone 312-456-5590, Fax 312-580-0165

*Available from: e/j Bloom associates inc.,
115 Duran Drive, San Rafael, CA 94903-2317
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ADDITIONAL MAGNETICS FERRITE LITERATURE

CG-01 - A Critical Comparison of Ferrites with other Magnetic Materials
FC-S1 - Ferrite Material Selection Guide
FC-S2 - EMI-RFI Filter, Common Mode Filter - Material Selection
FC-S3 - Qcurves for Ferrite Cores
FC-S4 - Step Gap E-Core Swing Chokes
FC-S7 - Curve Fit Equations for Ferrite Materials
FC-S8 - Designing with Ferrite Planar Cores
CG-2 - Material Selection Charts for Frequency, Temperature, Geometry, Stability
PS-01 - Cores for SMPS
CG-03 - Cores for Flybacks
HED-01 - Cores for Hall Effect Devices

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POWDER CORES

Powder cores are excellent as low loss inductors for switched-mode power supplies, switching regulators and noise filters. Most core types can be shipped immediately from stock.

Molypermalloy powder cores (MPP) are available in ten permeabilities ranging from 14 through 550, and have guaranteed inductance limits of ±8%. Insulation on the cores is a high dielectric strength finish not affected by normal potting compounds and waxes. Thirty sizes include I.D.s from 0.070" (1.78 mm) to 1.938" (49.2 mm) and O.D.s from 0.140" (3.56 mm) to 3.063" (77.8 mm). Standard cores include either temperature stabilized (as wide as -65° C at 125° C for stable operation) or standard stabilization.

High Flux powder cores have a much higher energy storage capacity than MPP cores and are available in six permeabilities from 26µ through 160µ. High Flux cores a re available in sizes identical to MPP cores.

Kool Mµ® powder cores have a higher energy storage capacity than MPP cores and are available in five permeabilities from 26µ through 125µ. Kool Mµ toroids are available in sizes identical to MPP cores, and this material is also available in a number of E-core sizes. Permeability for Kool Mµ E-cores is from 26 to 90 and sizes are tooled ranging from the EF 12.6 to the Metric E80 size.

MPP THINZ® are extremely low height (<1 mm) self-shielded power inductor cores, allowing finished inductor heights in the 1.5 mm to 2mm range. THINZ come in 5 sizes with O.D.s ranging from 0.120" through 0.310" and four permeabilities: 125µ, 160µ, 200µ and 250µ.

For further information view Powder Cores Design Manual at www.mag-inc.com.

STRIP WOUND CORES

Tape wound cores are made from high permeability alloys of nickel-iron, grain oriented silicon-iron. The alloys are known as Orthonol®, Alloy 48, Square Permalloy 80, Supermalloy and Magnesil® . Cores are available in more than 50 standard sizes. For a wide range of frequency applications, materials are produced in thicknesses from 1/2 mil(0.013 mm) through 14 mils (0.356 mm). Cases are robust nylon boxes, rated for 200° C continuous operation and 2000 voltage minimum breakdown.

Applications include: magnetic amplifiers, reactors, regulators, static magnetic devices and current transformers.

For further information view the Tape Wound Core Design Manual at www.mag-inc.com.

Miniature Tape Wound Bobbin Cores are manufactured from Permalloy 80 and Orthonol ultra-thin tape (0.000125" to 0.001" thick). They are available in widths from 0.031" to 0.250" (wider on special request). Wound on non-magnetic stainless steel bobbins, core diameters are available down to 0.050", with flux capacities as low as several maxwells.

Magnetics' sophisticated pulse test equipment reproduces most test programs and can measure accurately in the millivolt-microsecond region.

Applications include: magnetometers, flux gates, oscillators, inverters and magnetic amplifiers.

For further information view the Bobbin Core Design Manual at www.mag-inc.com.

RAPID PROTOTYPING SERVICE

Magnetics' world-class materials offer unique and powerful advantages to almost any application. An even greater competitive edge can be gained through innovations in new core shapes and custom geometries, and Magnetics is poised to help. Our Rapid Prototyping Service can quickly make a wide variety of core shapes in ferrite, MPP, High Flux, or Kool Mu®. The time between receipt of your drawing and delivery of the parts to you is usually less than 10 days. This quick turnaround time results in a shorter design period, which gets your product to market faster. Plus, our application engineers may be able to provide design assistance that could lead to a lower piece price. To learn more about how our Rapid Prototyping Service can help you shorten your design cycle, contact a Magnetics Application Engineer.

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Visit MAGNETICS' website for a wealth of easy to access information on soft magnetic cores and materials…

All product specifications for MAGNETICS' ferrite cores, powder cores and strip wound cores can be found quickly by using the menu driven product locator.

MAGNETICS' Digital Library contains all of the company's technical bulletins, white papers and design manuals, which can be viewed on-screen or downloaded.

The Software section of the website provides access to the MAGNETICS' software design aids for designing Common Mode Filters, Current Transformers, Inductors and MagAmps.

Contact information for MAGNETICS' global distribution network, including access to STOCKCHECK, an easy way to check distributor inventory via the web.

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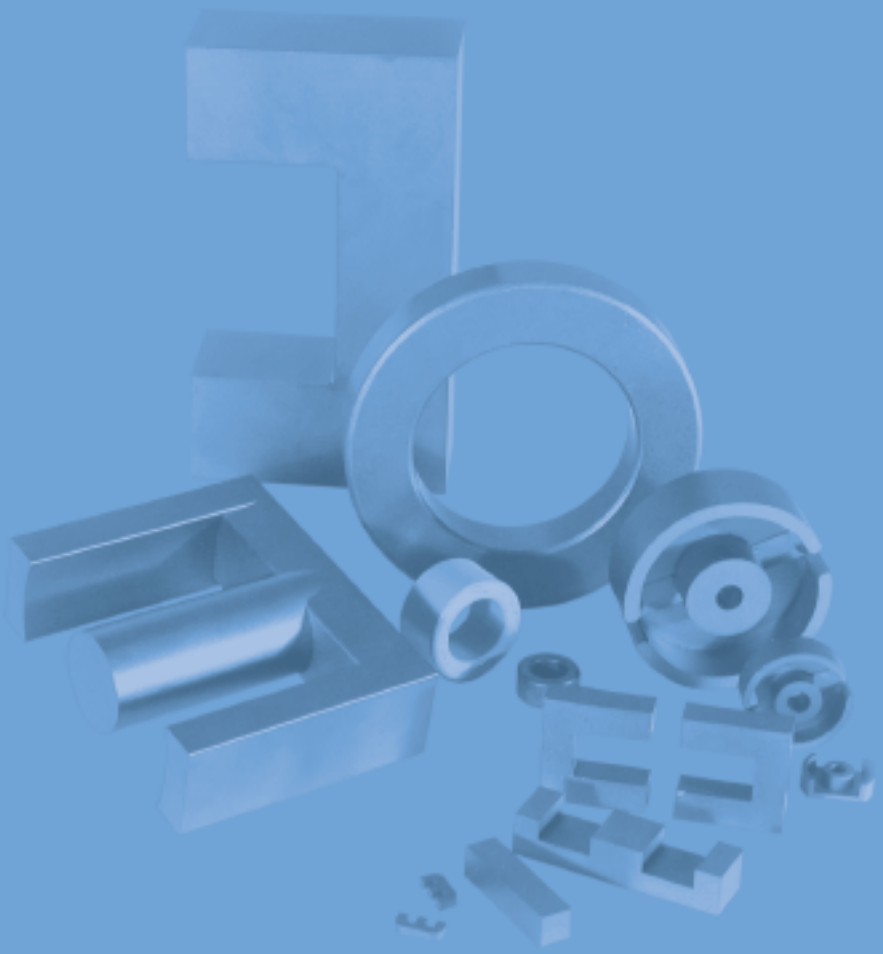

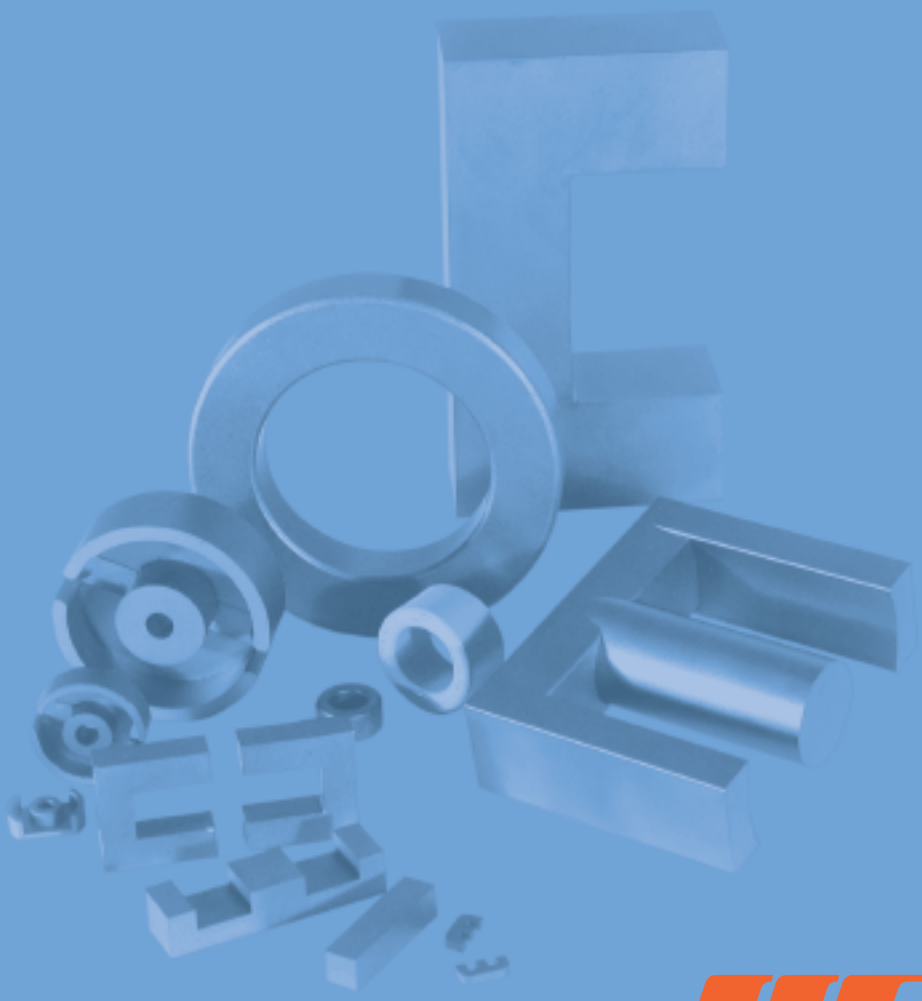

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