

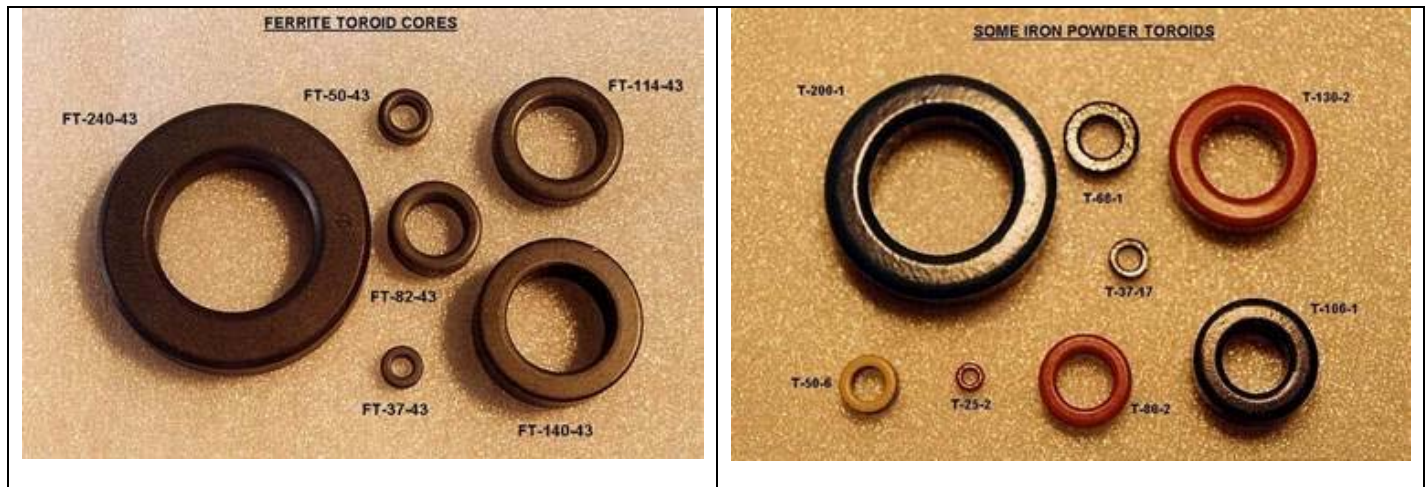
Toroid notes:

Apart from the physical dimensions of a toroid (outside and inside diameter, thickness) there is a value given for each particular core size and material, which is usually called the AL value, and is the manufacturer's inductance index for the core. Manufacturer's data for iron powder and ferrite cores are in the data tables and show all the required information. The AL figure for iron powder cores is given as uH/100 turns, but for ferrite cores it is quoted as mH/1000 turns. Note that many other manufacturers quote AL as nH/t² for both types of material. The conversion from uH/100 turns to nH/t² gives a result which is divided by 10. The relevant AL value is used in many calculations involving cores. One of the most common uses is to calculate the turns required to produce a given value of inductance on a particular core, as shown below:

Iron powder: turns = 100 ((desired L/AL) 0.5) (where L in uH)

Ferrite: turns = 1000 ((desired L/AL) 0.5) (where L in mH)

Note: doubling the turns produces four times the inductance.



IRON POWDER TOROIDS - A_L Values **

Core Size	Material ()								
	26	3	15	1	2	6	10	12/17	0
T-12-()	*	60	50	48	20	17	12	7.5	2.4
T-16-()	145	61	55	44	22	19	13	8	3
T-20-()	185	76	65	52	25	22	16	10	3.5
T-25-()	245	100	85	70	34	27	19	12	4.5
T-30-()	335	140	93	85	43	36	25	16	6
T-37-()	285	120	90	80	40	30	25	15	4.9
T-44-()	370	180	160	105	52	42	33	18.5	6.5
T-50-()	330	175	135	100	49	40	31	18	6.4
T-68-()	435	195	180	115	57	47	32	21	7.5
T-80-()	460	180	170	115	55	45	32	22	8.5
T-94-()	600	248	200	160	84	70	58	*	10.6
T-106-()	930	450	345	325	135	116	*	*	19
T-130-()	810	350	250	200	110	96	*	*	15
T-157-()	1000	420	*	320	140	115	*	*	*

T-184-()	1690	720	*	500	240	195	*	*	*
T-200-()	920	425	*	250	120	100	*	*	*
T-200A-()	1600	*	*	*	218	*	*	*	*

* size not available in this material

** $A_L = \mu H / 100$ turns

FERRITE TOROIDS - A_L Values **

Core Size	Material ()								
	43	61	63	67	68	75	77	F	J
FT-23-()	188	248	*	7.8	4.0	990	356	*	*
FT-37-()	420	55.3	*	19.7	8.8	2110	884	*	*
FT-50-()	523	68.0	*	22.0	11.0	*	990	*	2750
FT-50A-()	570	75.0	*	24.0	12.0	*	1080	*	2990
FT-50B-()	1140	150.0	*	48.0	24.0	*	2160	*	*
FT-82-()	557	73.3	*	22.4	11.7	*	1060	*	*
FT-87-()	*	*	*	*	*	*	*	*	3020
FT-87A-()	*	*	*	*	*	*	*	3700	6040
FT-114-()	603	79.3	*	25.4	12.7	*	1270	1902	3170
FT-114A-()	*	146.0	*	*	*	*	2340	*	*
FT-140-()	952	140.0	*	45.0	*	*	2340	*	*
FT-140A-()	*	*	*	*	*	*	*	*	6736
FT-150-()	*	*	*	*	*	*	*	2640	4400
FT-150A-()	*	*	*	*	*	*	*	5020	8370
FT-193-()	*	*	*	*	*	*	*	3640	6065
FT-193A-()	*	*	*	*	*	*	*	4460	7435
FT-240-()	1240	173.0	53.0	53.0	*	*	3130	*	6845

* size not available in this material

** $A_L = mH / 1000$ turns

IRON POWDER MATERIAL PROPERTIES

Material	Colour	Permeability (μ_i)	Temp. Coeff. ¹ (+ppm/C)	Range for Best Q (MHz)
#26 ²	yellow/white	75	822	0 - 1.0
#3	gray/clear	35	370	0.02 - 1.0
#15	red/white	25	190	0.15 - 3.0
#1	blue/clear	20	280	0.15 - 3.0

#2	red/clear	10	95	0.25 - 10
#6	yellow/clear	8.5	35	3 - 40
#10	black/clear	6.0	150	15 - 100
#12	green/white	4.0	170 ³	30 - 250
#17	blue/yellow	4.0	50	20 - 200
#0	tan/tan	1.0	0	50 - 350

1. Value averaged from -55 to +125°C.

2. Mainly used for dc chokes, differential-mode chokes, power factor correction inductors, continuous-mode flyback inductors, light dimmer chokes and other EMI/RFI applications.

3. Non-linear. #17 has stable temp coeff., but provides about 10% lower Q than #12.

FERRITE MATERIAL PROPERTIES

Material

	43	61	64	67	68	73	77	F	J/75
Initial Perm.	850	125	250	40	20	2500	2000	3000	5000
Max. Perm.	3000	450	375	125	40	4000	6000	4300	9500
Max. Flux Density @ 10oer. (gauss)	2750	2350	2200	3000	2000	4000	4600	4700	4300
Residual Flux Density (gauss)	1200	1200	1100	1000	1000	1000	1150	900	500
Vol. Resistivity (ohms/cm)	1x10 ⁵	1x10 ⁸	1x10 ⁸	1x10 ⁷	1x10 ⁷	1x10 ²	1x10 ²	1x10 ²	1x10 ²
Temp. Coeff. (%/C) -20 to 70 °C	1	0.15	0.15	0.13	0.06	0.8	0.25	0.25	0.4

Loss Factor (x 10 ⁻⁶)	120@ 1MHz	32@ 2.5MHz	100@ 2.5MHz	150@ 50MHz	400@ 100MHz	7.0@ 0.1MHz	4.5@ 0.1MHz	4.0@ 0.1MHz	15@ 0.1MHz
Coercive Force (Oersteds)	0.3	1.6	1.4	3	10	0.18	0.22	0.2	0.1
Curie Temp. (°C)	130	350	210	500	500	160	200	250	140
Resonant Circ. Freq. (MHz)	.01-1	.2-10	0.05-4	10-80	80-180	.001-1	.001-2	.001-1	.001-1
Wideband Circ. Freq. (MHz) *	1-50	10-200	50-500	50-500	200-1000	.2-15	.5-30	.5-30	1-15
Noise Attenuation MHz	20-400	>200	>200	>1000	>10000	1-40	1-40	1-20	0.5-10

* Based on low power, small core applications. Listed frequencies will be lower with high power.

IRON POWDER CORE SIZE vs WIRE SIZE/TURNS (Single layer winding)

Core Size	Wire Gauge (Awg)											
	14	16	18	20	22	24	26	28	30	32	34	36
T-12	0	1	1	1	2	4	5	8	11	15	21	29
T-16	1	1	1	3	3	5	8	11	16	21	29	38
T-25	1	3	4	5	7	11	15	21	28	37	48	62
T-37	5	7	9	12	17	23	31	41	53	67	87	110
T-50	8	11	16	21	28	37	49	63	81	103	131	166
T-68	12	15	21	28	36	47	61	79	101	127	162	205
T-80	17	23	30	39	51	66	84	108	137	172	219	276
T-94	20	27	35	45	58	75	96	123	156	195	248	313
T-106	20	27	35	45	58	75	96	123	156	195	248	313
T-130	30	40	51	66	83	107	137	173	220	275	348	439
T-157	38	50	64	82	104	132	168	213	270	336	426	536
T-184	38	50	64	82	104	132	168	213	270	336	426	536
T-200	53	68	86	109	139	176	223	282	357	445	562	707

FERRITE CORE SIZE vs WIRE SIZE/TURNS (Single layer winding)

Core Size	Wire Gauge (Awg)											
	14	16	18	20	22	24	26	28	30	32	34	36
FT-23	0	0	2	4	7	11	15	21	28	37	48	62

FT-37	2	4	7	11	15	21	28	36	48	61	79	100
FT-50	7	10	14	19	26	34	45	58	75	95	121	154
FT-50A	8	13	19	22	30	39	51	66	84	106	135	171
FT-50B	8	13	19	22	30	39	51	65	84	106	135	171
FT-82	18	22	32	41	53	69	88	112	143	180	228	288
FT-87	19	25	34	43	56	72	92	118	150	188	239	239
FT-114	29	38	49	63	80	100	131	166	211	263	334	334
FT-140	36	42	60	77	97	125	158	201	255	318	403	403
FT-150	29	38	49	63	80	100	131	166	211	263	334	334
FT-193	53	68	86	109	139	176	223	282	357	445	562	562
FT-240	60	77	98	123	156	198	250	317	400	499	631	631

IRON POWDER TOROIDS - PHYSICAL DIMENSIONS

Core Number	O.D. (inches)	I.D. (inches)	Hgt (inches)
T-12-()	.125	.062	.050
T-16-()	.160	.078	.060
T-20-()	.200	.088	.070
T-25-()	.255	.120	.096
T-30-()	.307	.151	.128
T-37-()	.375	.205	.128
T-44-()	.440	.229	.159
T-50-()	.500	.303	.190
T-68-()	.690	.370	.190
T-80-()	.795	.495	.250
T-94-()	.942	.560	.312
T-106-()	1.060	.570	.437
T-130-()	1.300	.780	.437
T-157-()	1.570	.950	.570
T-184-()	1.840	.950	.710
T-200-()	2.000	1.250	.550
T-200A-()	2.000	1.250	1.000

FERRITE TOROIDS - PHYSICAL DIMENSIONS

Core Number	O.D. (inches)	I.D. (inches)	Hgt (inches)
FT-23-()	.230	.120	.060
FT-37-()	.375	.187	.125
FT-50-()	.500	.281	.188

FT-50A-()	.500	.312	.250
FT-50B-()	.500	.312	.500
FT-82-()	.825	.516	.250
FT-87-()	.870	.540	.250
FT-87A-()	.870	.540	.500
FT-114-()	1.142	.750	.295
FT-114A-()	1.142	.750	.545
FT-140-()	1.400	.900	.500
FT-140A-()	1.400	.900	.590
FT-150-()	1.500	.750	.250
FT-150A-()	1.500	.750	.500
FT-193-()	1.932	1.250	.625
FT-193A-()	1.932	1.250	.750
FT-240-()	2.400	1.400	.500