Wire Gauge Tables

Appendix C: Core Specifications

Reference specifications for magnetic cores commonly used in VIC choke design. Includes ferrite toroids, iron powder cores, and E-cores.

Core Material Overview

Material Type	μ_r Range	Frequency Range	Best For
MnZn Ferrite	800-10,000	1 kHz - 2 MHz	High L, moderate f
NiZn Ferrite	15-1,500	500 kHz - 100 MHz	High frequency
Iron Powder	8-100	10 kHz - 10 MHz	High current, low cost
MPP (Molypermalloy)	14-550	DC - 1 MHz	Low loss, stable
Kool Mµ	26-125	DC - 500 kHz	High current, moderate loss
Air Core	1	Any	No saturation, linear

Common Ferrite Materials

MnZn Ferrite Materials

Material	μ_i	B_{sat} (mT)	Frequency	Notes
Fair-Rite 77	2000	480	<1 MHz	General purpose, high µ
Fair-Rite 78	2300	480	<500 kHz	Very high µ

Material	μ_i	B_{sat} (mT)	Frequency	Notes
TDK N87	**2200**	**490**	**<500 kHz**	**Popular, low loss**
TDK N97	2300	410	<300 kHz	Very low loss
Ferroxcube 3C90	2300	470	<200 kHz	Low loss at high B
Ferroxcube 3F3	2000	440	<500 kHz	Higher frequency

Iron Powder Core Mix Chart

Iron powder cores (Micrometals/Amidon) are identified by color code:

Mix	Color	μ_r	Frequency Range	Application
-26	Yellow/White	75	DC - 1 MHz	EMI/RFI filters
-2	**Red/Clear**	**10**	**250 kHz - 10 MHz**	**RF, resonant circuits**
-6	Yellow/Clear	8.5	3 - 40 MHz	Higher frequency
-1	Blue/Clear	20	500 kHz - 5 MHz	Medium frequency
-3	Gray/Clear	35	50 kHz - 500 kHz	Medium µ, low f
-52	Green/Blue	75	DC - 200 kHz	High µ, DC bias

Common Toroid Sizes

FT (Ferrite Toroid) Series

Size	OD (mm)	ID (mm)	H (mm)	A_l (77 mat)	A_l (43 mat)
FT-37	9.5	4.7	3.2	884	440
FT-50	12.7	7.1	4.8	1140	570
FT-82	**21.0**	**13.0**	**6.4**	**2170**	**557**
FT-114	29.0	19.0	7.5	2640	603

Size	OD (mm)	ID (mm)	H (mm)	A_l (77 mat)	A_l (43 mat)
FT-140	35.5	23.0	12.7	3170	885
FT-240	**61.0**	**35.5**	**12.7**	**4820**	**1075**

A_l values in nH/turn^2. Highlighted sizes are commonly used for VIC chokes.

T (Iron Powder Toroid) Series

Size	OD (mm)	ID (mm)	H (mm)	A_l (-2 mix)	A_l (-26 mix)
T-37	9.5	4.9	3.2	4.0	27
T-50	12.7	7.7	4.8	4.9	33
T-68	17.5	9.4	4.8	5.7	38
T-80	**20.2**	**12.6**	**6.4**	**8.5**	**55**
T-94	24.0	14.5	7.9	8.4	70
T-106	26.9	14.0	11.1	13.5	90
T-130	**33.0**	**19.7**	**11.1**	**11.0**	**96**
T-200	50.8	31.8	14.0	12.0	120

Inductance Calculations

Using A? Value:

$L\ (nH) = A? \times N^2$

N = ?(L / A?)

Example:

> - Want L = 10 mH = 10,000,000 nH
> - Using FT-240-77 (A_l = 4820 nH/turn^2)
> - $N = \sqrt{(10,000,000 / 4820)} = 45.6$ turns
> - Use 46 turns for L ≈ 10.2 mH

Saturation Considerations

Saturation Flux Density (B_{sat}):

Material Type	B_{sat} (mT)
MnZn Ferrite	400-500
NiZn Ferrite	250-350
Iron Powder	800-1000
MPP	750

Calculating Peak Flux:

$B = (V \times t) / (N \times A_e)$

Where A_e is effective core area. Keep $B < 0.5 \times B_{sat}$ for linear operation.

Temperature Effects

Material	Curie Temp (°C)	Max Operating (°C)	μ vs. Temp
MnZn Ferrite	200-250	100-120	Peaks near 80°C, then drops
NiZn Ferrite	300-500	150	Relatively stable
Iron Powder	770 (iron)	125 (coating limited)	Stable

Core Selection Guide for VIC

For Primary Choke (L1):

- Moderate L (1-50 mH typical)
- Moderate current handling
- Consider: FT-82-77, FT-114-77, T-106-26

For Secondary Choke (L2):

- May need higher L (10-100 mH) for high Q
- Lower current typically
- Consider: FT-140-77, FT-240-77

For High Frequency (>100 kHz):

- Use lower-μ materials to maintain SRF margin
- Consider: Iron powder -2 or -6 mix, NiZn ferrite

Quick Reference: Turns Calculation

Desired L	FT-82-77	FT-240-77	T-106-26
1 mH	21 turns	14 turns	105 turns

Desired L	FT-82-77	FT-240-77	T-106-26
5 mH	48 turns	32 turns	236 turns
10 mH	68 turns	46 turns	333 turns
25 mH	107 turns	72 turns	527 turns
50 mH	152 turns	102 turns	745 turns

Approximate values. Verify with actual A_L from manufacturer datasheet.

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