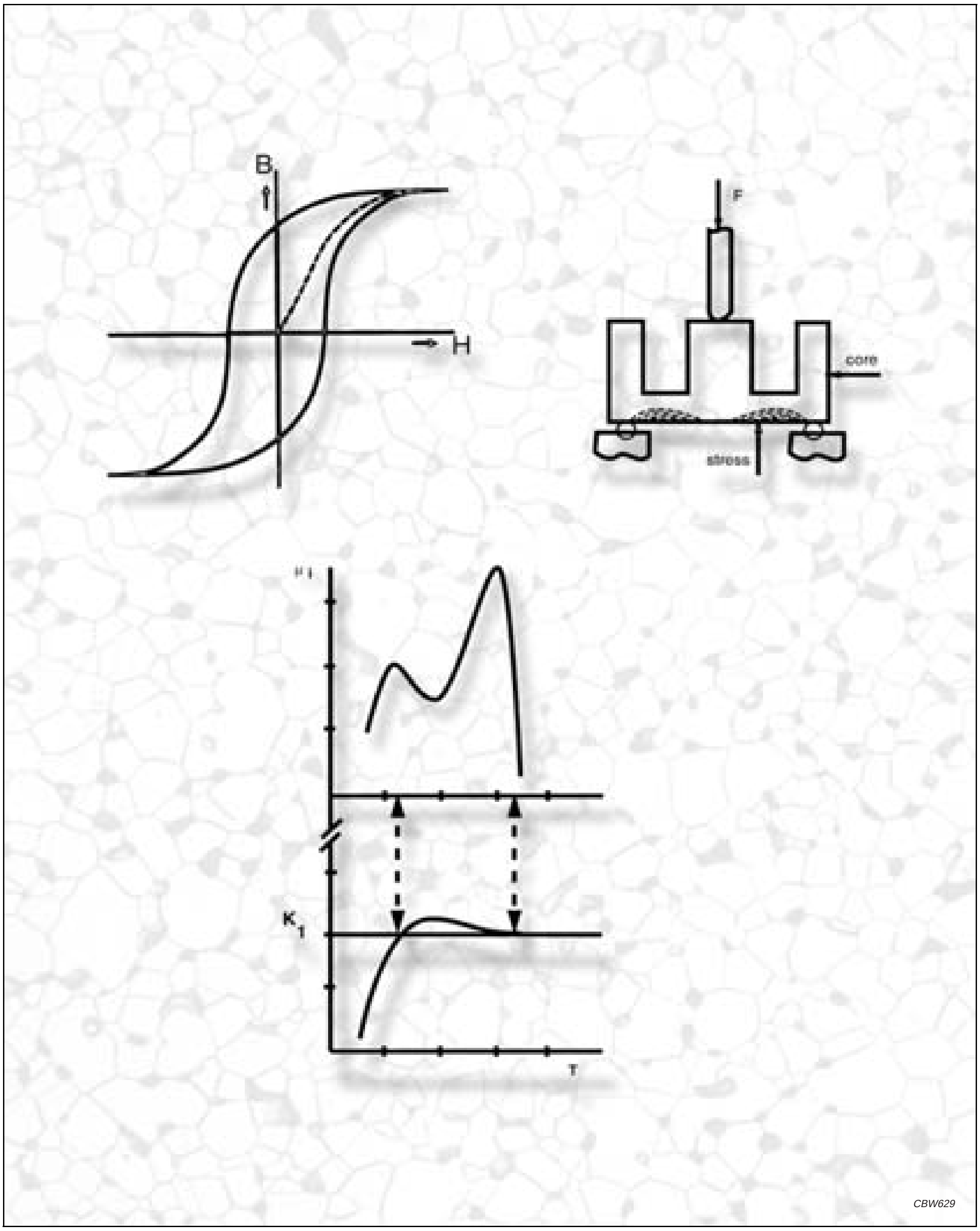

B
H
F
core
stress
μ i
K1
T
CBW629

Properties specified in this section are related to room temperature (25 °C) unless otherwise stated. They have been measured on sintered, non ground ring cores of dimensions ∅25 × ∅15 × 10 mm which are not subjected to external stresses. Products generally comply with the material specification. However, deviations may occur due to shape, size and grinding operations etc. Specified product properties are given in the data sheets or product drawings.

Ferrite material survey

MAIN APPLICATION AREA	FREQUENCY RANGE (MHZ)	MATERIAL	μ_i at 25 °C	B_{sat} (mT) at 25 °C (1200 A/m)	T_C (°C)	ρ (Ωm)	FERRITE TYPE	AVAILABLE CORE SHAPES
Telecom filters Proximity sensors		3B46	3800	≈ 545	≥ 255	≈ 10	MnZn	RM, P, PT, PTS, EP, E, Planar ER, RM/I, RM/ILP, PH
	< 0.1	3B7	2300	≈ 440	≥ 170	≈ 1	MnZn	
	0.2 – 2	3D3	750	≈ 380	≥ 200	≈ 2	MnZn	
	< 0.2	3H3	2000	≈ 360	≥ 160	≈ 2	MnZn	
Wideband signal transformers Pulse transformers Delay lines		3E27	6000	≈ 430	≥ 150	≈ 0.5	MnZn	RM, P, PT, PTS, EP, EP/LP, EPX, E, Planar ER, RM/I, RM/ILP, Toroids
		3E28	4000	≈ 440	≥ 145	≈ 1	MnZn	
		3E5	10000	≈ 380	≥ 125	≈ 0.5	MnZn	
		3E55	10000	≈ 370	≥ 100	≈ 0.1	MnZn	
		3E6	12000	≈ 390	≥ 130	≈ 0.1	MnZn	
		3E7	15000	≈ 390	≥ 130	≈ 0.1	MnZn	Toroids
		3E8	18000	≈ 380	≥ 100	≈ 0.1	MnZn	
		3E9	20000	≈ 380	≥ 100	≈ 0.1	MnZn	
Line output transformers (LOT)	< 0.2	3C30	2100	≈ 500	≥ 240	≈ 2	MnZn	UR
	< 0.3	3C34	2100	≈ 500	≥ 240	≈ 5	MnZn	
Power transformers Power inductors General purpose transformers and inductors	< 0.2	3C81	2700	≈ 450	≥ 210	≈ 1	MnZn	E, EI, Planar E, EC, EFD, EP, ETD, ER, Planar ER, U, RM/I, RM/ILP, P, P/I, PT, PTS, PM, PQ, Toroids (gapped), Bobbin cores
	< 0.2	3C90	2300	≈ 470	≥ 220	≈ 5	MnZn	
	< 0.3	3C91	3000	≈ 470	≥ 220	≈ 5	MnZn	
	< 0.2	3C92	1500	≈ 520	≥ 280	≈ 5	MnZn	
	< 0.3	3C93	1800	≈ 500	≥ 240	≈ 5	MnZn	
	< 0.3	3C94	2300	≈ 470	≥ 220	≈ 5	MnZn	
	< 0.3	3C95	3000	≈ 530	≥ 215	≈ 5	MnZn	
	< 0.4	3C96	2000	≈ 500	≥ 240	≈ 5	MnZn	
	0.2 – 0.5	3F3	2000	≈ 440	≥ 200	≈ 2	MnZn	
	0.5 – 1	3F35	1400	≈ 500	≥ 240	≈ 10	MnZn	
	1 – 2	3F4	900	≈ 410	≥ 220	≈ 10	MnZn	
	1 – 2	3F45	900	≈ 420	≥ 300	≈ 10	MnZn	
	2 – 4	3F5	650	≈ 380	≥ 300	≈ 10	MnZn	
	4 – 10	4F1	80	≈ 320(1)	≥ 260	≈ 10^5	NiZn	
Wideband EMI-suppression Wideband transformers Balun transformers	10 – 100	3B1	900	≈ 380	≥ 150	≈ 0.2	MnZn	BD, BDW, BDS, MLS, CMS, Cable shields, Rods, Toroids, WBS, WBC
	1 – 30	3S1	4000	≈ 400	≥ 125	≈ 1	MnZn	
	30 – 1000	3S3	350	≈ 320	≥ 225	≈ 10^4	MnZn	
	10 – 300	3S4	1700	≈ 320	≥ 110	≈ 10^3	MnZn	
	1 – 30	3S5	3800	≈ 545	≥ 255	≈ 10	MnZn	
	30 – 1000	4A11	850	≈ 340	≥ 125	≈ 10^5	NiZn	
	10 – 300	4A15	1200	≈ 350	≥ 125	≈ 10^5	NiZn	
	10 – 300	4A20	2000	≈ 260	≥ 100	≈ 10^5	NiZn	
	30 – 1000	4B1	250	≈ 360(1)	≥ 250	≈ 10^5	NiZn	
	50 – 1000	4C65	125	≈ 380(1)	≥ 350	≈ 10^5	NiZn	
	30 – 1000	4S2	850	≈ 340	≥ 125	≈ 10^5	NiZn	
	30 – 1000	4S3	250	≈ 360(1)	≥ 250	≈ 10^5	NiZn	

MAIN APPLICATION AREA	FREQUENCY RANGE (MHZ)	MATERIAL	μ_i at 25 °C	B_{sat} (mT) at 25 °C (1200 A/m)	T_C (°C)	ρ (Ωm)	FERRITE TYPE	AVAILABLE CORE SHAPES
EMI-filters Current compensated chokes		3C11	4300	≈ 390	≥ 125	≈ 1	MnZn	Toroids E, EI, U
		3E25	6000	≈ 390	≥ 125	≈ 0.5	MnZn	
		3E26	7000	≈ 430	≥ 155	≈ 0.5	MnZn	
		3E5	10000	≈ 380	≥ 125	≈ 0.5	MnZn	
		3E6	12000	≈ 390	≥ 130	≈ 0.1	MnZn	
		4A11	850	≈ 340	≥ 125	≈ 10^5	NiZn	
HF Tuning	< 1	3B1	900	≈ 380	≥ 150	≈ 0.2	MnZn	Rods, Tubes, Wideband chokes
	< 2	3D3	750	≈ 380	≥ 200	≈ 2	MnZn	
	< 5	4B1	250	≈ 360(1)	≥ 250	≈ 10^5	NiZn	
	< 5	4B2	250	≈ 360(1)	≥ 335	≈ 10^5	NiZn	
	< 20	4C65	125	≈ 380(1)	≥ 350	≈ 10^5	NiZn	
	< 50	4D2	60	≈ 250(2)	≥ 400	≈ 10^5	NiZn	
	< 200	4E1	15	≈ 220(3)	≥ 500	≈ 10^5	NiZn	
magnetic regulators	< 0.2	3R1	800	≈ 410	≥ 230	≈ 10^3	MnZn	Toroids
absorber tiles	< 1000	4S60	2000	≈ 260	≥ 100	≈ 10^5	NiZn	Tiles
scientific particle accelerators	< 10	4B3	300	≈ 420(1)	≥ 250	≈ 10^5	NiZn	Large toroids Machined ferrite products
	< 100	4E2	25	≈ 350(2)	≥ 400	≈ 10^5	NiZn	
	< 10	4M2	140	≈ 310(1)	≥ 200	≈ 10^5	NiZn	
	< 1	8C11	1200	≈ 310	≥ 125	≈ 10^5	NiZn	
	< 10	8C12	900	≈ 260	≥ 125	≈ 10^5	NiZn	

1. At 3000 A/m
2. At 10 kA/m
3. At 20 kA/m

Iron powder material grade survey

IRON POWDER MATERIAL	μ_i at 25 °C	B_{sat} (mT) at 25 °C (3000 A/m)	MAXIMUM OPERATING TEMPERATURE (°C)	MAIN APPLICATION AREA	AVAILABLE CORE SHAPES
2P40	40	950	140	EMI-suppression Output inductors	Toroids
2P50	50	1000	140		
2P65	65	1150	140		
2P80	80	1400	140		
2P90	90	1600	140		

Typical mechanical and thermal properties

PROPERTY	MnZn FERRITE	NiZn FERRITE	UNIT
Young's modules	(90 to 150) × 10^3	(80 to 150) × 10^3	N/mm^2
Ultimate compressive strength	200 to 600	200 to 700	N/mm^2
Ultimate tensile strength	20 to 65	30 to 60	N/mm^2
Vickers hardness	600 to 700	800 to 900	N/mm^2
Linear expansion coefficient	(10 to 12) × 10^{-6}	(7 to 8) × 10^{-6}	K^{-1}
Specific heat	700 to 800	750	$Jkg^{-1} \times K^{-1}$
Heat conductivity	(3.5 to 5.0) × 10^{-3}	(3.5 to 5.0) × 10^{-3}	$Jmm^{-1}s^{-1} \times K^{-1}$

RESISTIVITY

Ferrite is a semiconductor with a DC resistivity in the crystallites of the order of 10^{-3} Ωm for a MnZn type ferrite, and about 30 Ωm for a NiZn ferrite.

Since there is an isolating layer between the crystals, the bulk resistivity is much higher: 0.1 to 10 Ωm for MnZn ferrites and 10^4 to 10^6 Ωm for NiZn and MgZn ferrites.

This resistivity depends on temperature and measuring frequency, which is clearly demonstrated in Tables 1 and 2 which show resistivity as a function of temperature for different materials.

Table 1 Resistivity as a function of temperature of a MnZn-ferrite (3C94)

TEMPERATURE (°C)	RESISTIVITY (Ωm)
−20	≈10
0	≈7
20	≈4
50	≈2
100	≈1

Table 2 Resistivity as a function of temperature of a NiZn-ferrite (4C65)

TEMPERATURE (°C)	RESISTIVITY (Ωm)
0	≈5.10^7
20	≈10^7
60	≈10^6
100	≈10^5

At higher frequencies the crystal boundaries are more or less short-circuited by heir capacitance and the measured resistivity decreases, as shown in Tables 3 and 4.

Table 3 Resistivity as function of frequency for MnZn ferrites

FREQUENCY (MHz)	RESISTIVITY (Ωm)
0.1	≈2
1	≈0.5
10	≈0.1
100	≈0.01

Table 4 Resistivity as function of frequency for NiZn ferrites

FREQUENCY (MHz)	RESISTIVITY (Ωm)
0.1	≈10^5
1	≈5.10^4
10	≈10^4
100	≈10^3

PERMITTIVITY

The basic permittivity of all ferrites is of the order of 10. This is valid for MnZn and NiZn materials. The isolating material on the grain boundaries also has a permittivity of approximately 10. However, if the bulk permittivity of a ferrite is measured, very different values of apparent permittivity result. This is caused by the conductivity inside the crystallites. The complicated network of more or less leaky capacitors also shows a strong frequency dependence.

Tables 5 and 6 show the relationship between permittivity and frequency for both MnZn and NiZn ferrites.

Table 5 Permittivity as a function of frequency for MnZn ferrites

FREQUENCY (MHz)	PERMITTIVITY (ε_r)
0.1	≈2.10^5
1	≈10^5
10	≈5.10^4
100	≈10^4

Table 6 Permittivity as a function of frequency for NiZn ferrites

FREQUENCY (MHz)	PERMITTIVITY (ε_r)
0.001	≈100
0.01	≈50
1	≈25
10	≈15
100	≈12

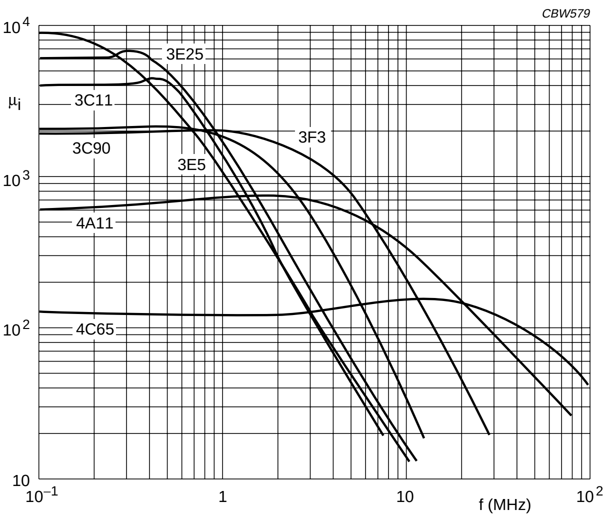


Fig.37 Permeability as a function of frequency of different materials.

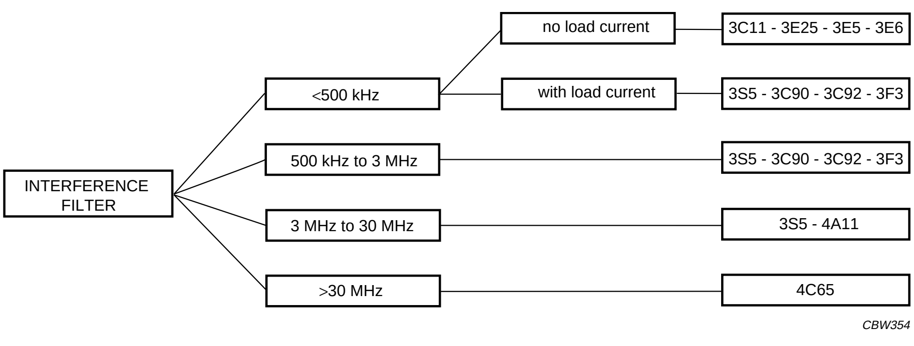


Fig. 38 Selection chart for materials used in input filters.

3C11 SPECIFICATIONS

A medium permeability material mainly for use in current compensated chokes in EMI-suppression filters.

SYMBOL	CONDITIONS	VALUE	UNIT
μ_i	25 °C; ≤10 kHz; 0.25 mT	4300 ± 20%	
B	25 °C; 10 kHz; 1200 A/m	≈ 390	mT
	100 °C; 10 kHz; 1200 A/m	≈ 230	
$\tan\delta/\mu_i$	25 °C; 100 kHz; 0.25 mT	$\leq 20 \times 10^{-6}$	
	25 °C; 300 kHz; 0.25 mT	$\leq 200 \times 10^{-6}$	
ρ	DC; 25 °C	≈ 1	Ωm
T_C		≥ 125	°C
density		≈ 4900	kg/m^3

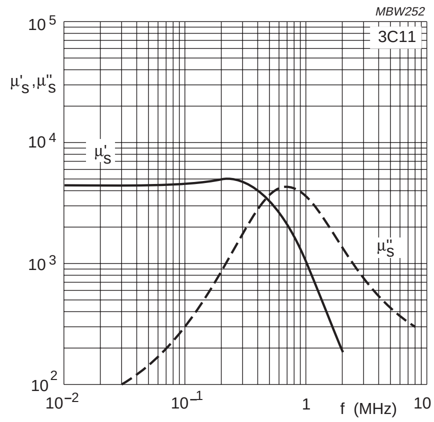


Fig.1 Complex permeability as a function of frequency.

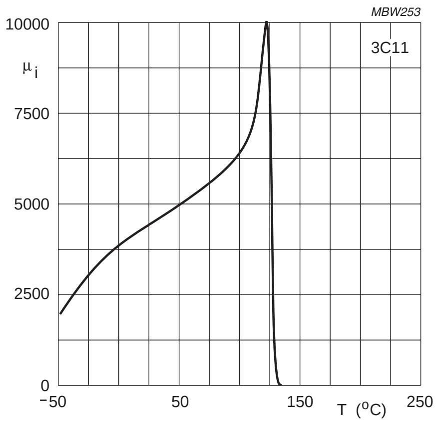


Fig.2 Initial permeability as a function of temperature.

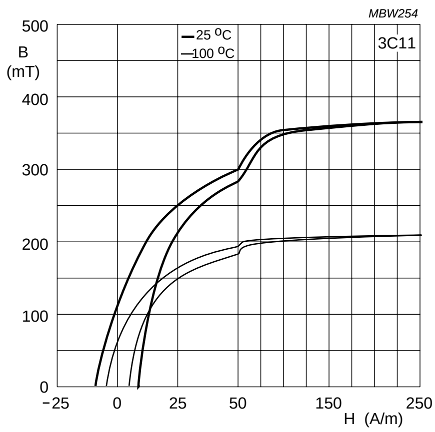


Fig.3 Typical B-H loops.

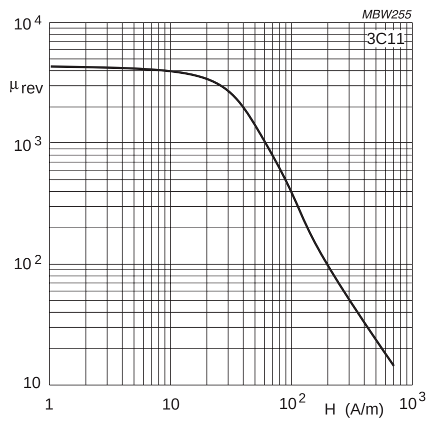


Fig.4 Reversible permeability as a function of magnetic field strength.

3E25 SPECIFICATIONS

A medium permeability material mainly for use in current compensated chokes in EMI-suppression filters.

SYMBOL	CONDITIONS	VALUE	UNIT
μ_i	25 °C; ≤10 kHz; 0.25 mT	6000 ± 20%	
B	25 °C; 10 kHz; 1200 A/m	≈ 390	mT
	100 °C; 10 kHz; 1200 A/m	≈ 220	
$\tan\delta/\mu_i$	25 °C; 100 kHz; 0.25 mT	$\leq 25 \times 10^{-6}$	
	25 °C; 300 kHz; 0.25 mT	$\leq 200 \times 10^{-6}$	
ρ	DC; 25 °C	≈ 0.5	Ωm
T_C		≥ 125	°C
density		≈ 4900	kg/m^3

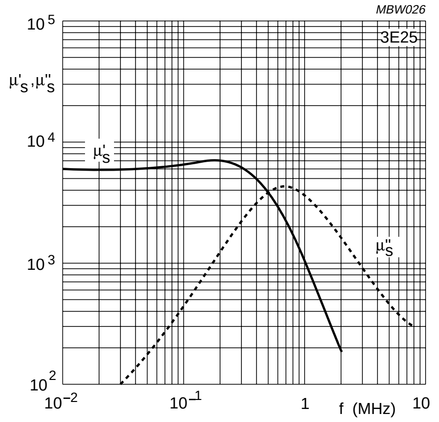


Fig.1 Complex permeability as a function of frequency.

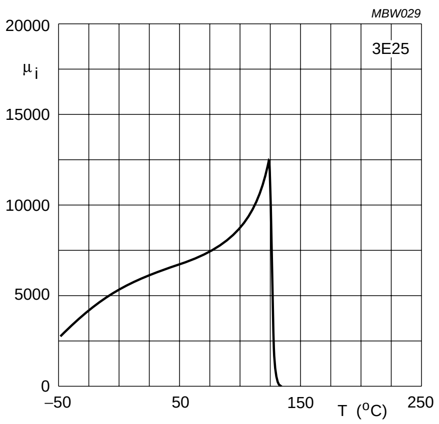


Fig.2 Initial permeability as a function of temperature.

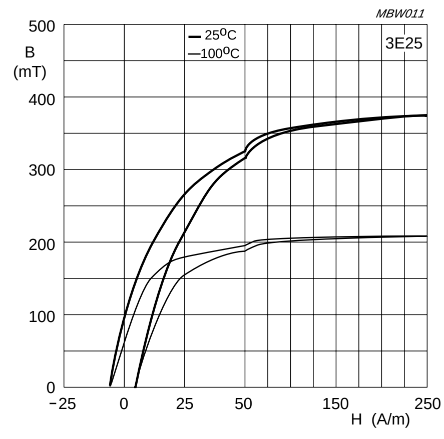


Fig.3 Typical B-H loops.

Material specification 3E25

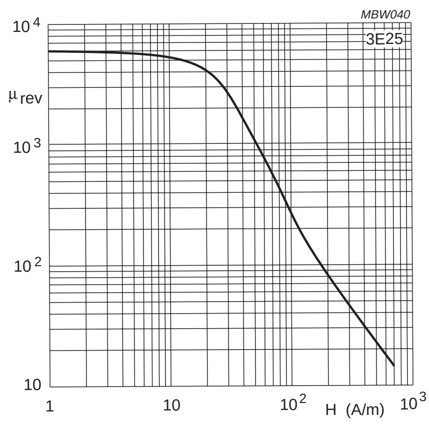


Fig.4 Reversible permeability as a function of magnetic field strength.

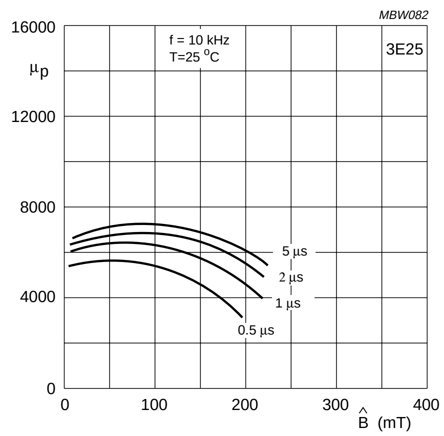


Fig.5 Pulse characteristics (unipolar pulses).

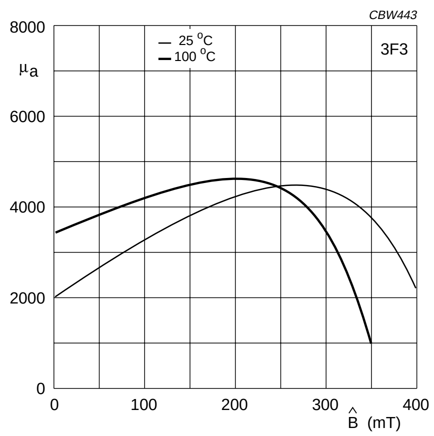


Fig.4 Amplitude permeability as function of peak flux density.

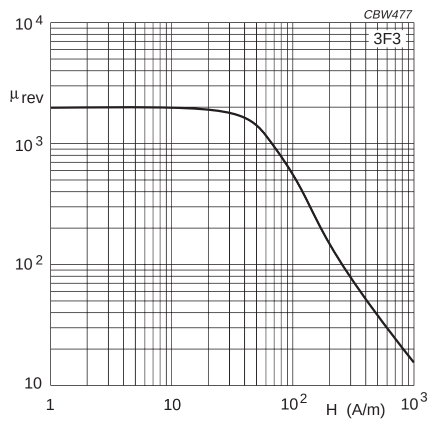


Fig.5 Reversible permeability as a function of magnetic field strength.

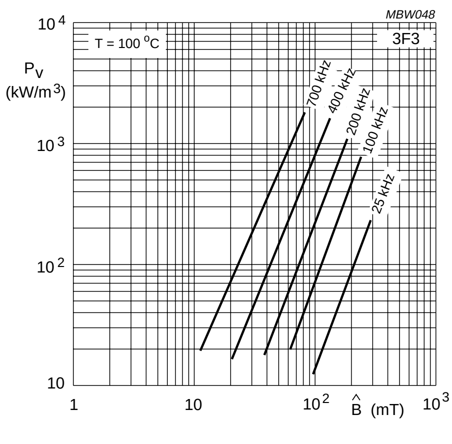


Fig.6 Specific power loss as a function of peak flux density with frequency as a parameter.

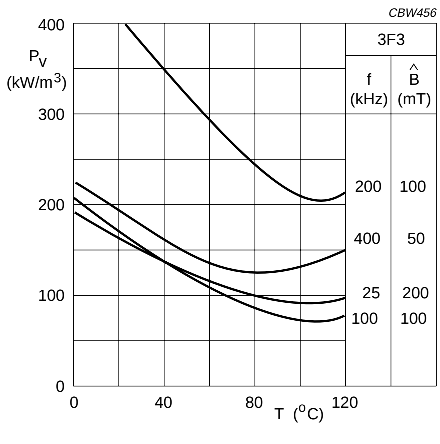


Fig.7 Specific power loss for several frequency/flux density combinations as a function of temperature.

3F3 SPECIFICATIONS

A medium frequency power material for use in power and general purpose transformers at frequencies of 0.2 - 0.5 MHz.

SYMBOL	CONDITIONS	VALUE	UNIT
μ_i	25 °C; ≤10 kHz; 0.25 mT	2000 ±20%	
μ_a	100 °C; 25 kHz; 200 mT	≈ 4000	
B	25 °C; 10 kHz; 1200 A/m	≈ 440	mT
	100 °C; 10 kHz; 1200 A/m	≈ 370	
P_V	100 °C; 100 kHz; 100 mT	≤80	kW/m^3
	100 °C; 400 kHz; 50 mT	≤150	
ρ	DC; 25 °C	≈ 2	Ωm
T_C		≥200	°C
density		≈ 4750	kg/m^3

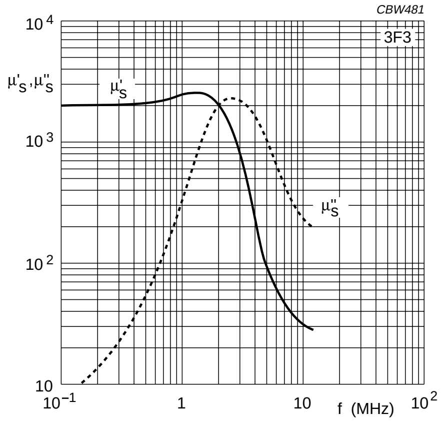


Fig.1 Complex permeability as a function of frequency.

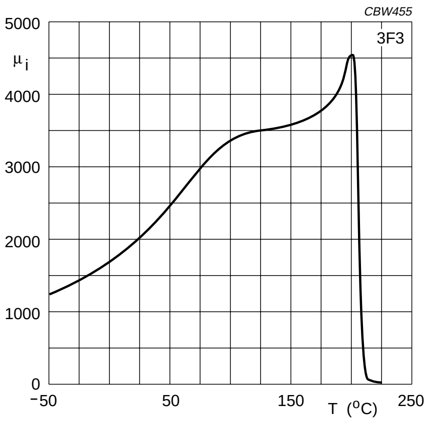


Fig.2 Initial permeability as a function of temperature.

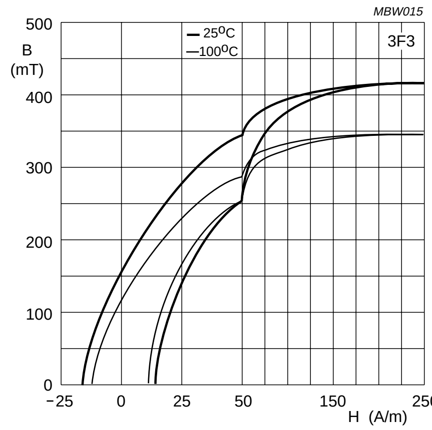


Fig.3 Typical B-H loops.

4A11 SPECIFICATIONS

Medium permeability NiZn ferrite for use in wideband EMI-suppression (30 - 1000 MHz) as well as RF wideband and balun transformers.

SYMBOL	CONDITIONS	VALUE	UNIT
μ_i	25 °C; ≤10 kHz; 0.25 mT	850 ±20%	
B	25 °C; 10 kHz; 1200 A/m	≈ 340	mT
	100 °C; 10 kHz; 1200 A/m	≈ 230	
$\tan\delta/\mu_i$	25 °C; 1 MHz; 0.25 mT	$\leq 100 \times 10^{-6}$	
	25 °C; 3 MHz; 0.25 mT	$\leq 1000 \times 10^{-6}$	
ρ	DC; 25 °C	$\approx 10^5$	Ωm
T_C		≥ 125	°C
density		≈ 5100	kg/m^3

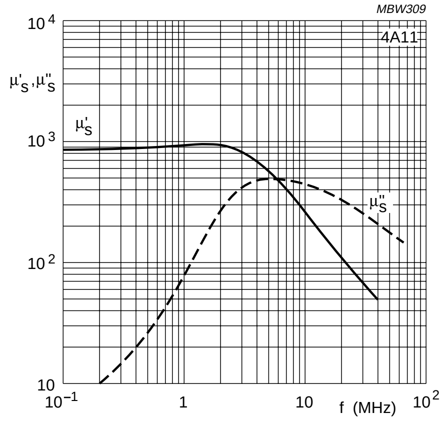


Fig.1 Complex permeability as a function of frequency.

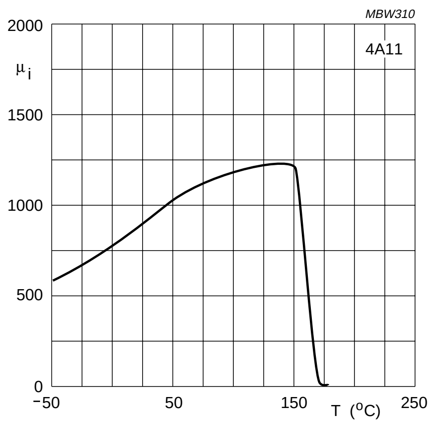


Fig.2 Initial permeability as a function of temperature.

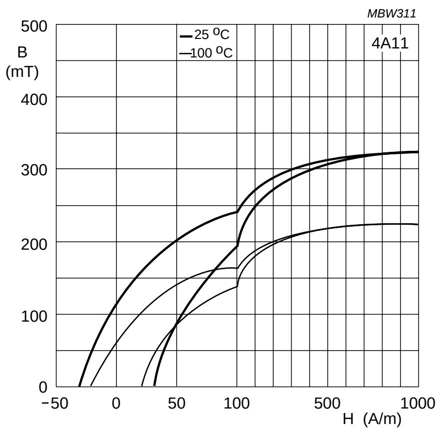


Fig.3 Typical B-H loops.

4C65 SPECIFICATIONS

Low permeability NiZn ferrite for use in RF tuning, wideband and balun transformers.

SYMBOL	CONDITIONS	VALUE	UNIT
μ_i	25 °C; ≤10 kHz; 0.25 mT	125 ±20%	
B	25 °C; 10 kHz; 3000 A/m	≈ 380	mT
	100 °C; 10 kHz; 3000 A/m	≈ 340	
$\tan\delta/\mu_i$	25 °C; 3 MHz; 0.25 mT	$\leq 80 \times 10^{-6}$	
	25 °C; 10 MHz; 0.25 mT	$\leq 130 \times 10^{-6}$	
ρ	DC; 25 °C	$\approx 10^5$	Ωm
T_C		≥ 350	°C
density		≈ 4500	kg/m^3

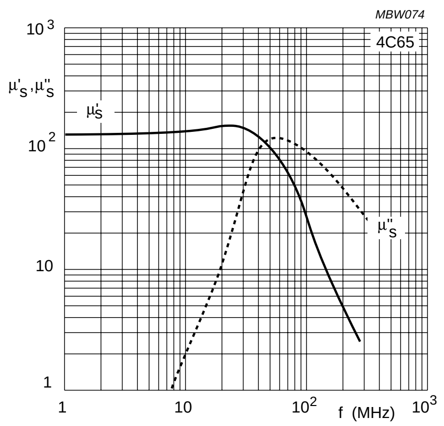


Fig.1 Complex permeability as a function of frequency.

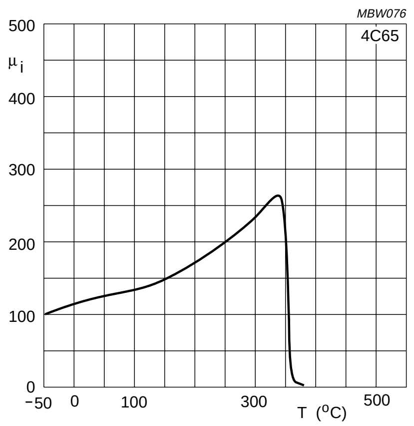


Fig.2 Initial permeability as a function of temperature.

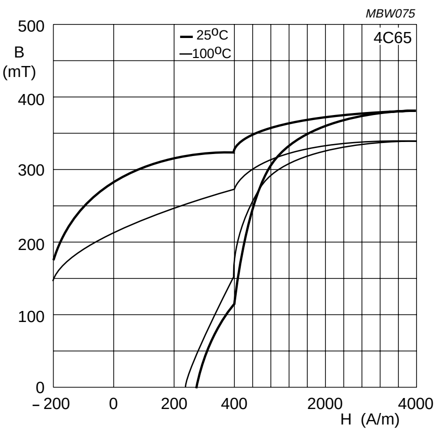


Fig.3 Typical B-H loops.

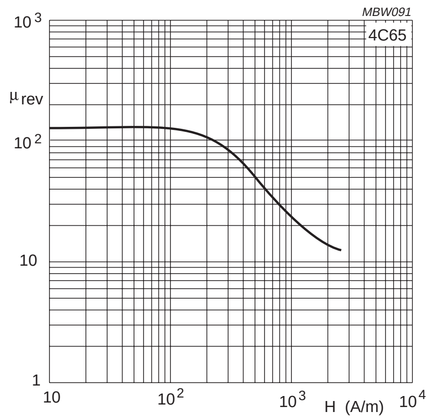


Fig.4 Reversible permeability as a function of magnetic field strength.

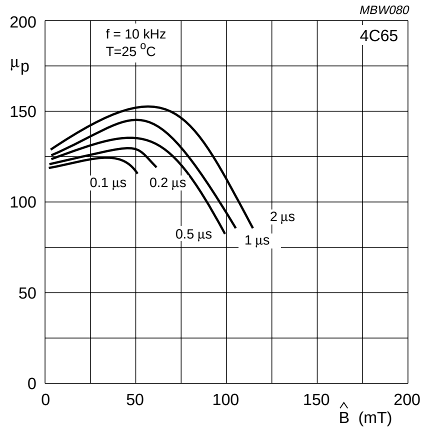


Fig.5 Pulse characteristics (unipolar pulses).

RING CORES (TOROIDS)

Effective core parameters

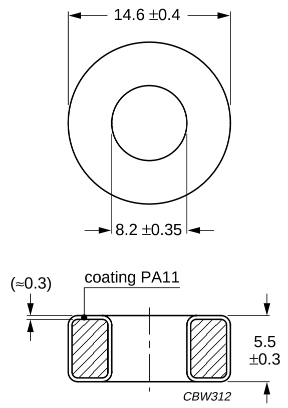
SYMBOL	PARAMETER	VALUE	UNIT
Σ(I/A)	core factor (C1)	2.84	mm^{-1}
V_e	effective volume	430	mm^3
l_e	effective length	35	mm
A_e	effective area	12.3	mm^2
m	mass of core	≈ 2.1	g

Coating

The cores are coated with polyamide 11 (PA11), flame retardant in accordance with *"UL 94V-2"*; UL file number E 45228 (M). The colour is white.
Maximum operating temperature is 160 °C.

Isolation voltage

DC isolation voltage: 1500 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.



Dimensions in mm.

Fig.1 TN14/9/5 ring core.

Ring core data

GRADE	A_L (nH)	μ_i	TYPE NUMBER
4C65	55 ± 25%	≈ 125	TN14/9/5-4C65
4A11	310 ± 25%	≈ 700(1)	TN14/9/5-4A11
3R1(2)	–	≈ 800	TN14/9/5-3R1
3F3	790 ± 25%	≈ 1800	TN14/9/5-3F3
3C90	1015 ± 25%	≈ 2300	TN14/9/5-3C90
3C11	1900 ± 25%	≈ 4300	TN14/9/5-3C11
3E25	2430 ± 30%	≈ 5500	TN14/9/5-3E25

1. Old permeability specification maintained.
2. Due to the rectangular BH-loop of 3R1, inductance values strongly depend on the magnetic state of the ring core and measuring conditions. Therefore no A_L value is specified. For the application in magnetic amplifiers A_L is not a critical parameter.

WARNING
Do not use 3R1 cores close to their mechanical resonant frequency. For more information refer to *"3R1"* material specification in this data handbook.

Properties of cores under power conditions

GRADE	B (mT) at	CORE LOSS (W) at		
	H = 250 A/m; f = 25 kHz; T = 100 °C	f = 25 kHz; $\hat{B}$ = 200 mT; T = 100 °C	f = 100 kHz; $\hat{B}$ = 100 mT; T = 100 °C	f = 400 kHz; $\hat{B}$ = 50 mT; T = 100 °C
3C90	≥320	≤0.048	≤0.048	
3F3	≥320		≤0.05	≤0.08

Ferrite toroids

RING CORES (TOROIDS)

Effective core parameters

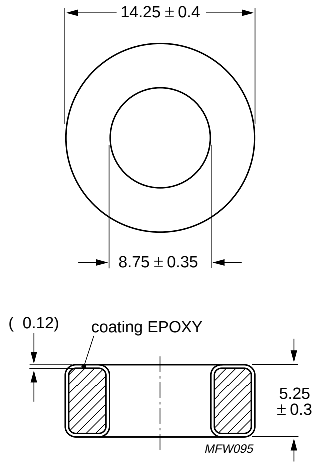
SYMBOL	PARAMETER	VALUE	UNIT
Σ(I/A)	core factor (C1)	2.84	mm^{-1}
V_e	effective volume	430	mm^3
l_e	effective length	35	mm
A_e	effective area	12.3	mm^2
m	mass of core	≈ 2.1	g

Coating

The cores are coated with epoxy, flame retardant in accordance with *"UL 94V-0"*; UL file number E 228348. The colour is white.
Maximum operating temperature is 200 °C.

Isolation voltage

DC isolation voltage: 1500 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.



Dimensions in mm.

Fig.1 TX14/9/5 ring core.

Ring core data

GRADE	A_L (nH)	μ_i	TYPE NUMBER
3E5	3760 ± 30%	≈ 8500	TX14/9/5-3E5
3E6 des	4415 ± 30%	≈ 10000	TX14/9/5-3E6

RING CORES (TOROIDS)

Effective core parameters

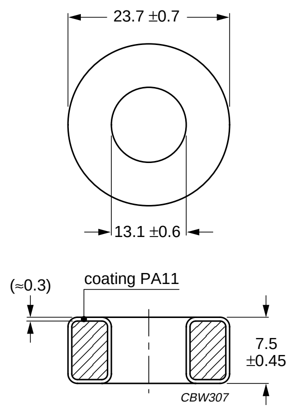
SYMBOL	PARAMETER	VALUE	UNIT
Σ(I/A)	core factor (C1)	1.81	mm^{-1}
V_e	effective volume	1722	mm^3
l_e	effective length	55.8	mm
A_e	effective area	30.9	mm^2
m	mass of core	≈ 8.4	g

Coating

The cores are coated with polyamide 11 (PA11), flame retardant in accordance with *"UL 94V-2"*; UL file number E 45228 (M).
The colour is white.
Maximum operating temperature is 160 °C.

Isolation voltage

DC isolation voltage: 2000 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.



Dimensions in mm.

Fig.1 TN23/14/7 ring core.

GRADE	A_L (nH)	μ_i	TYPE NUMBER
4C65	87 ± 25%	≈ 125	TN23/14/7-4C65
4A11	486 ± 25%	≈ 700(1)	TN23/14/7-4A11
3R1(2)	–	≈ 800	TN23/14/7-3R1
3F3	1250 ± 25%	≈ 1800	TN23/14/7-3F3
3C90	1600 ± 25%	≈ 2300	TN23/14/7-3C90
3C11 des	3000 ± 25%	≈ 4300	TN23/14/7-3C11
3E25	3820 ± 25%	≈ 5500	TN23/14/7-3E25

1. Old permeability specification maintained.
2. Due to the rectangular BH-loop of 3R1, inductance values strongly depend on the magnetic state of the ring core and measuring conditions. Therefore no A_L value is specified. For the application in magnetic amplifiers A_L is not a critical parameter.

WARNING
Do not use 3R1 cores close to their mechanical resonant frequency. For more information refer to *"3R1"* material specification in this data handbook.

Ferrite toroids TN25/15/10

RING CORES (TOROIDS)

Effective core parameters

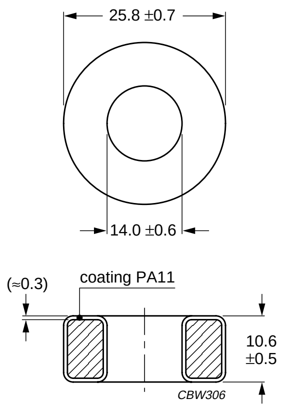
SYMBOL	PARAMETER	VALUE	UNIT
Σ(I/A)	core factor (C1)	1.23	mm^{-1}
V_e	effective volume	2944	mm^3
l_e	effective length	60.2	mm
A_e	effective area	48.9	mm^2
m	mass of core	≈ 15	g

Coating

The cores are coated with polyamide 11 (PA11), flame retardant in accordance with *"UL 94V-2"*; UL file number E 45228 (M).
The colour is white.
Maximum operating temperature is 160 °C.

Isolation voltage

DC isolation voltage: 2000 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.



Dimensions in mm.

Fig.1 TN25/15/10 ring core.

Ring core data

GRADE	A_L (nH)	μ_i	TYPE NUMBER
3F3	1840 ± 25%	≈ 1800	TN25/15/10-3F3
3C90	2350 ± 25%	≈ 2300	TN25/15/10-3C90
3C11	4400 ± 25%	≈ 4300	TN25/15/10-3C11
3E25	5620 ± 25%	≈ 5500	TN25/15/10-3E25

Properties of cores under power conditions

GRADE	B (mT) at	CORE LOSS (W) at		
	H = 250 A/m; f = 25 kHz; T = 100 °C	f = 25 kHz; $\hat{B}$ = 200 mT; T = 100 °C	f = 100 kHz; $\hat{B}$ = 100 mT; T = 100 °C	f = 400 kHz; $\hat{B}$ = 50 mT; T = 100 °C
3C90	≥320	≤ 0.33	≤ 0.33	–
3F3	≥320	–	≤ 0.32	≤ 0.56

RING CORES (TOROIDS)

Effective core parameters

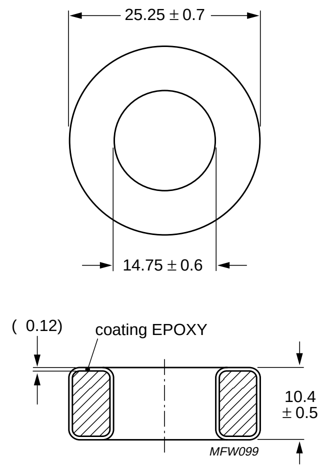
SYMBOL	PARAMETER	VALUE	UNIT
Σ(I/A)	core factor (C1)	1.23	mm^{-1}
V_e	effective volume	2944	mm^3
l_e	effective length	60.2	mm
A_e	effective area	48.9	mm^2
m	mass of core	≈ 15	g

Coating

The cores are coated with epoxy, flame retardant in accordance with *"UL 94V-0"*; UL file number E 228348. The colour is white.
Maximum operating temperature is 200 °C.

Isolation voltage

DC isolation voltage: 2000 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.



Dimensions in mm.

Fig.1 TX25/15/10 ring core.

Ring core data

GRADE	A_L (nH)	μ_i	TYPE NUMBER
3E5	8680 ± 30%	≈ 8500	TX25/15/10-3E5
3E6 des	10200 ± 30%	≈ 10000	TX25/15/10-3E6

RING CORES (TOROIDS)

Effective core parameters

SYMBOL	PARAMETER	VALUE	UNIT
$\Sigma(I/A)$	core factor (C1)	1.08	mm^{-1}
V_e	effective volume	3360	mm^3
l_e	effective length	60.1	mm
A_e	effective area	55.9	mm^2
m	mass of core	≈ 17	g

Coating

The cores are coated with polyamide 11 (PA11), flame retardant in accordance with *"UL 94V-2"*; UL file number E 45228 (M).
The colour is white.
Maximum operating temperature is 160 °C.

Isolation voltage

DC isolation voltage: 2000 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.

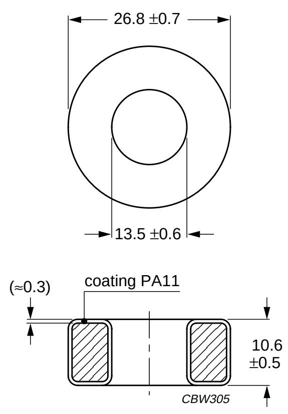


Fig.1 TN26/15/10 ring core.

Ring core data

GRADE	A_L (nH)	μ_i	TYPE NUMBER
4A11	817 ± 25%	≈ 700(1)	TN26/15/10-4A11
3C90	2645 ± 25%	≈ 2300	TN26/15/10-3C90
3C11	5000 ± 25%	≈ 4300	TN26/15/10-3C11
3E25	6420 ± 25%	≈ 5500	TN26/15/10-3E25

1. Old permeability specification maintained.

Properties of cores under power conditions

GRADE	B (mT) at	CORE LOSS (W) at	
	H = 250 A/m; f = 25 kHz; T = 100 °C	f = 25 kHz; $\hat{B}$ = 200 mT; T = 100 °C	f = 100 kHz; $\hat{B}$ = 100 mT; T = 100 °C
3C90	≥320	≤ 0.38	≤ 0.38

Ferrite toroids TX36/23/10

RING CORES (TOROIDS)

Effective core parameters

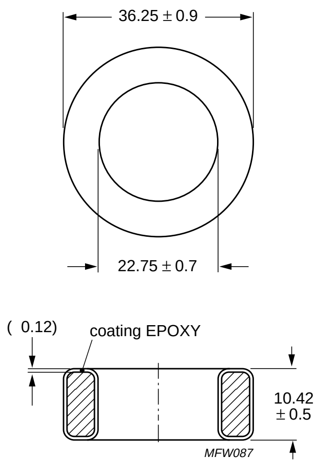
SYMBOL	PARAMETER	VALUE	UNIT
$\Sigma(I/A)$	core factor (C1)	1.38	mm^{-1}
V_e	effective volume	5820	mm^3
l_e	effective length	89.7	mm
A_e	effective area	64.9	mm^2
m	mass of core	≈ 27	g

Coating

The cores are coated with epoxy, flame retardant in accordance with *"UL 94V-0"*; UL file number E 228348. The colour is white.
Maximum operating temperature is 200 °C.

Isolation voltage

DC isolation voltage: 2000 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.



Dimensions in mm.

Fig.1 TX36/23/10 ring core.

Ring core data

GRADE	A_L (nH)	μ_i	TYPE NUMBER
4C65	112 ± 25%	≈ 125	TX36/23/10-4C65
3C90 des	2060 ± 25%	≈ 2300	TX36/23/10-3C90
3C81	2455 ± 20%	≈ 2700	TX36/23/10-3C81
3C11	3900 ± 25%	≈ 4300	TX36/23/10-3C11
3E27	4545 ± 20%	≈ 5000	TX36/23/10-3E27
3E6 des	9090 ± 30%	≈ 10000	TX36/23/10-3E6

Properties of cores under power conditions

GRADE	B (mT) at	CORE LOSS (W) at	
	H = 250 A/m; f = 25 kHz; T = 100 °C	f = 25 kHz; $\hat{B}$ = 200 mT; T = 100 °C	f = 100 kHz; $\hat{B}$ = 100 mT; T = 100 °C
3C90	≥320	≤ 0.64	≤ 0.64
3C81	≥320	≤ 1.1	–

RING CORES (TOROIDS)

Effective core parameters

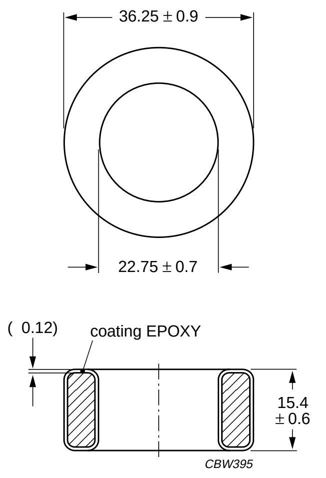
SYMBOL	PARAMETER	VALUE	UNIT
Σ(I/A)	core factor (C1)	0.919	mm^{-1}
V_e	effective volume	8740	mm^3
l_e	effective length	89.7	mm
A_e	effective area	97.5	mm^2
m	mass of core	≈ 40	g

Coating

The cores are coated with epoxy, flame retardant in accordance with *"UL 94V-0"*; UL file number E 228348.
The colour is white.
Maximum operating temperature is 200 °C.

Isolation voltage

DC isolation voltage: 2000 V.
Contacts are applied on the edge of the ring core, which is also the critical point for the winding operation.



Dimensions in mm.

Fig.1 TX36/23/15 ring core.

Ring core data

GRADE	A_L (nH)	μ_i	TYPE NUMBER
4C65	170 ± 25%	≈ 125	TX36/23/15-4C65
4A11	940 ± 25%	≈ 700(1)	TX36/23/15-4A11
3R1(2)	–	≈ 800	TX36/23/15-3R1
3S4 des	2285 ± 25%	≈ 1700	TX36/23/15-3S4
3F3	2420 ± 25%	≈ 1800	TX36/23/15-3F3
3C90	3090 ± 20%	≈ 2300	TX36/23/15-3C90
3C81	3670 ± 20%	≈ 2700	TX36/23/15-3C81
3C11	5800 ± 25%	≈ 4300	TX36/23/15-3C11
3E25	7390 ± 25%	≈ 5500	TX36/23/15-3E25
3E27 des	6800 ± 20%	≈ 5000	TX36/23/15-3E27
3E5	11400 ± 30%	≈ 8500	TX36/23/15-3E5
3E6	13600 ± 30%	≈ 10400	TX36/23/15-3E6

1. Old permeability specification maintained.
2. Due to the rectangular BH-loop of 3R1, inductance values strongly depend on the magnetic state of the ring core and measuring conditions. Therefore no A_L value is specified. For the application in magnetic amplifiers A_L is not a critical parameter.

WARNING
Do not use 3R1 cores close to their mechanical resonant frequency. For more information refer to *“3R1”* material specification in this data handbook.

Properties of cores under power conditions

GRADE	B (mT) at	CORE LOSS (W) at		
	H = 250 A/m; f = 25 kHz; T = 100 °C	**f = 25 kHz; $\hat{B}$ = 200 mT; T = 100 °C**	**f = 100 kHz; $\hat{B}$ = 100 mT; T = 100 °C**	**f = 400 kHz; $\hat{B}$ = 50 mT; T = 100 °C**
3C81	≥320	≤ 1.7	–	–
3C90	≥320	≤ 0.96	≤ 0.96	–
3F3	≥320	–	≤0.95	≤1.7