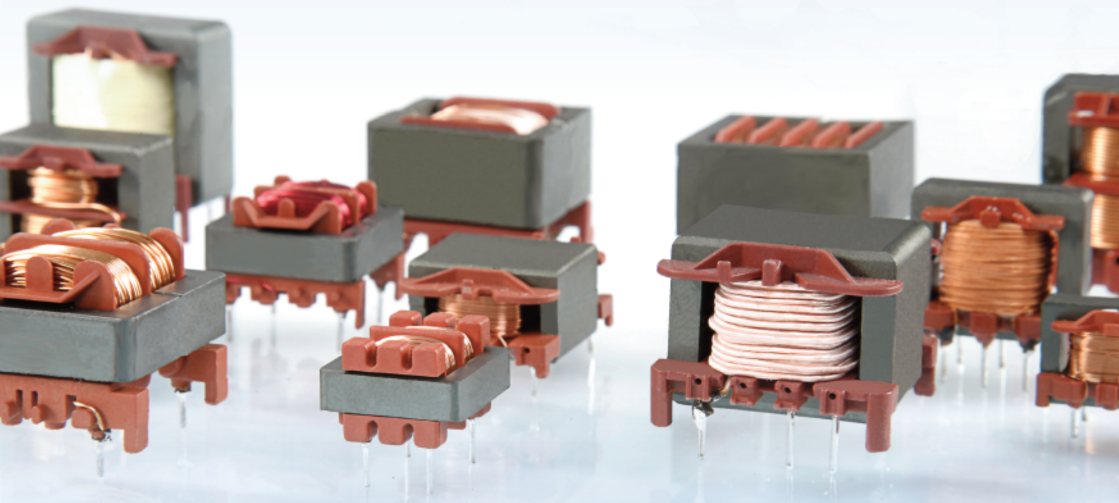
sumida

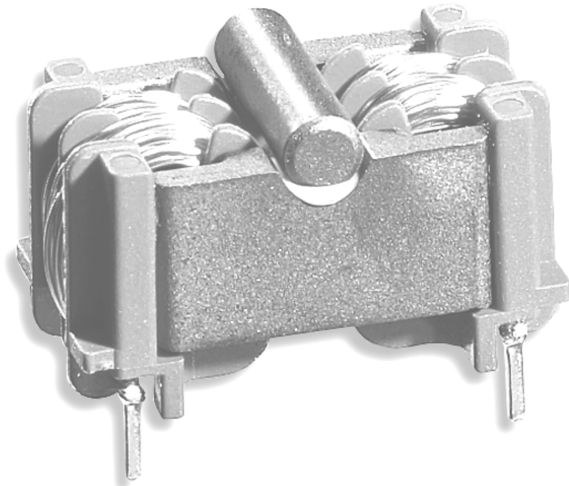


COMPONENTS | MODULES | CORES

A INDUCTIVE COMPONENTS 005 - 104

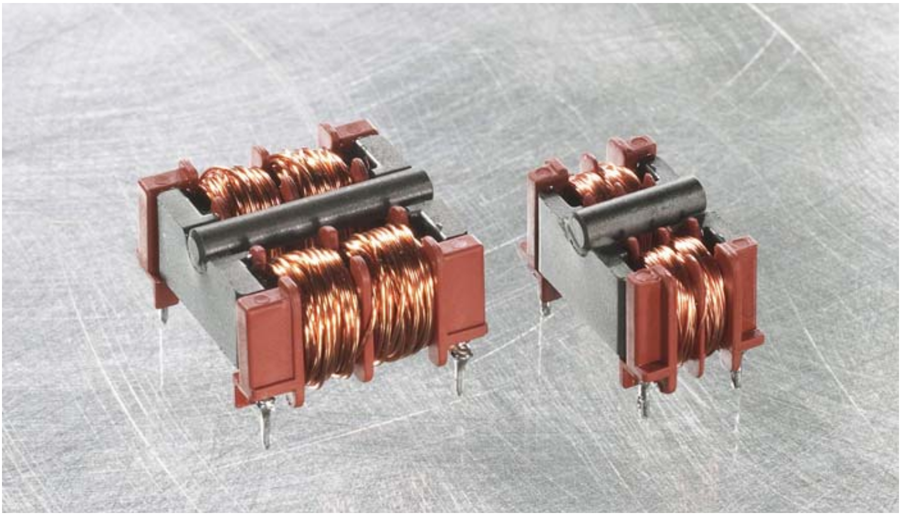
B MAGNETIC MATERIAL + CORES 105 - 212

C MODULES & APPLICATIONS 213-222

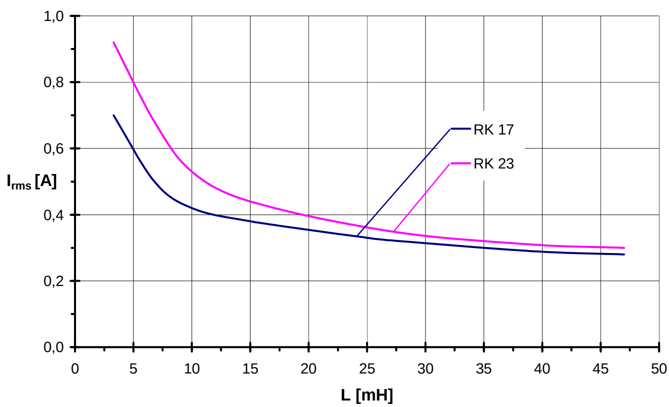


A1.1 COMMON MODE CHOKES WITH BYPASS

Common mode and differential inductance in one component



Current as a function of inductance and component size



A1.1 COMMON MODE CHOKES WITH BYPASS

Application

In devices with a protective conductor terminal, such as electronic ballasts, washing machines or electrical tools, symmetrical interference often occurs in addition to asymmetrical interference. As a rule, this requires the use of a further component for in-line inductance.

Structure

- Closed cores made of high permeability VOGT ferrites Fi340 and Fi360
- Coil-former with four chambers

Technical data

- Suitable for use in equipment to EN 50176, EN 61347, EN 61800, EN 60335, EN 60065,
- Climate category 40/125/56 in accordance with IEC 68-1
- Nominal inductance at 10 kHz, 25°C
- Testing voltage (winding – winding) 1500 V, 50 Hz, 2 sec.
- Max. permissible temperature of windings 115° C
- Inductance loss (with current compensated circuit) ≤ 15% DC preload with I_{sat} and ambient temperature T_U = 80°C

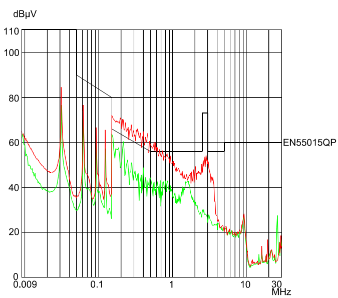
Advantages

- Very flat (e.g. for use in electronic ballasts)
- Full utilisation of material permeability due to closed core
- Low capacity winding design with four chambers
- Environmentally friendly since no adhesives or resins are used
- Low-Cos due to automated mass production

Function description

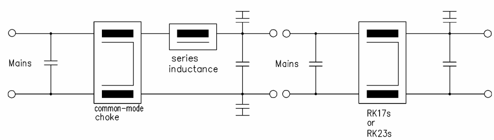
Due to their special magnetic design, the new VOGT combined noise suppression chokes enable the suppression of both the asymmetrical and symmetrical interference component in a single unit. Combining the characteristics of two separate components in one unit lowers costs considerably, as well as reduces the space requirement within the device.

EMV-measurement with and without bypass:

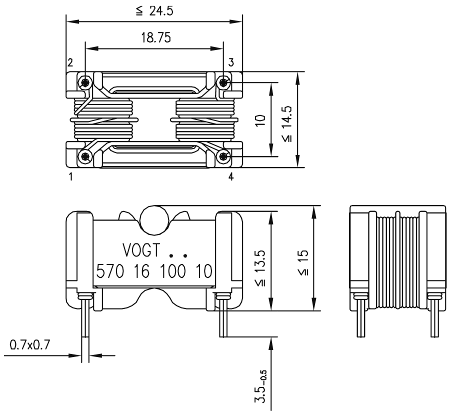


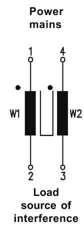
- RK choke without bypass
- RK choke with bypass

(measured at electronic ballast, in a typical RFI suppression circuit in accordance with EN55015)



A1.1 COMMON MODE CHOKES WITH BYPASS | RK 17

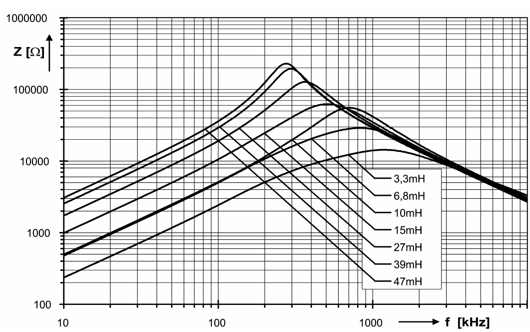




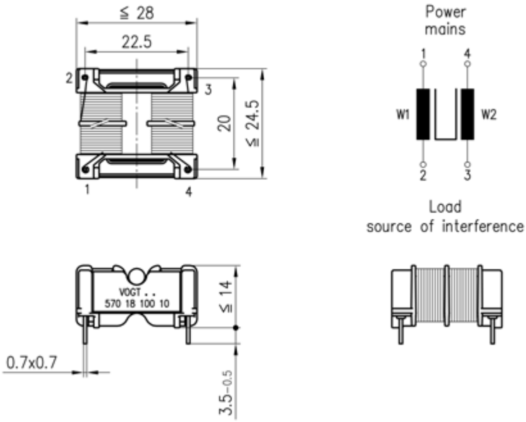
L_N [1] (mH)	R_{cu} [1] (Ω)	I_{RMS} (A)	I_{sat} [2] (A)	$L_{Leakage}$ (µH)	Part number
3.3	0.18	0.70	1.00	120	570 16 033 1H
6.8	0.27	0.50	0.70	220	570 16 068 1H
10	0.50	0.46	0.65	330	570 16 100 1H
15	0.65	0.43	0.64	500	570 16 150 20
27	1.30	0.40	0.55	900	570 16 270 1H
39	2.25	0.30	0.42	1250	570 16 390 20
47	2.50	0.28	0.40	1500	570 16 470 10

[1] per winding, [2] max. value

Impedance curves



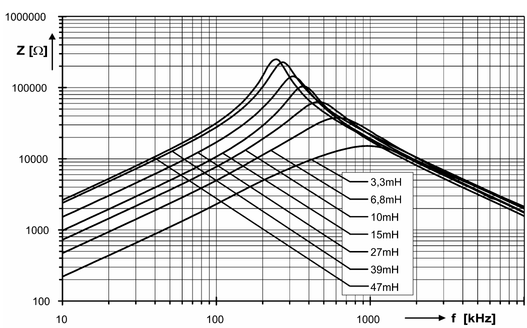
A1.1 COMMON MODE CHOKES WITH BYPASS | RK 23



L_N [1] (mH)	R_{cu} [1] (Ω)	I_{RMS} (A)	I_{sat} [2] (A)	$L_{Leakage}$ (µH)	Part number
3.3	0.08	0.92	1.30	120	570 18 033 1H
6.8	0.14	0.78	1.10	220	570 18 068 10
10	0.19	0.53	0.75	330	570 18 100 10
15	0.30	0.45	0.65	500	570 18 150 1H
27	0.45	0.35	0.50	900	570 18 270 1H
39	0.61	0.32	0.45	1250	570 18 390 10
47	0.75	0.30	0.42	1500	570 18 470 1S

[1] per winding, [2] typical value

Impedance curves



A1.2 COMMON MODE CHOKES

Application

These chokes are preferably used in equipment that is fitted with switched mode power supplies. Together with suitable capacitors, these chokes form filters in the power supply line, which reduce the level of the noise that occurs inside the device, as well as the penetration of line noise.

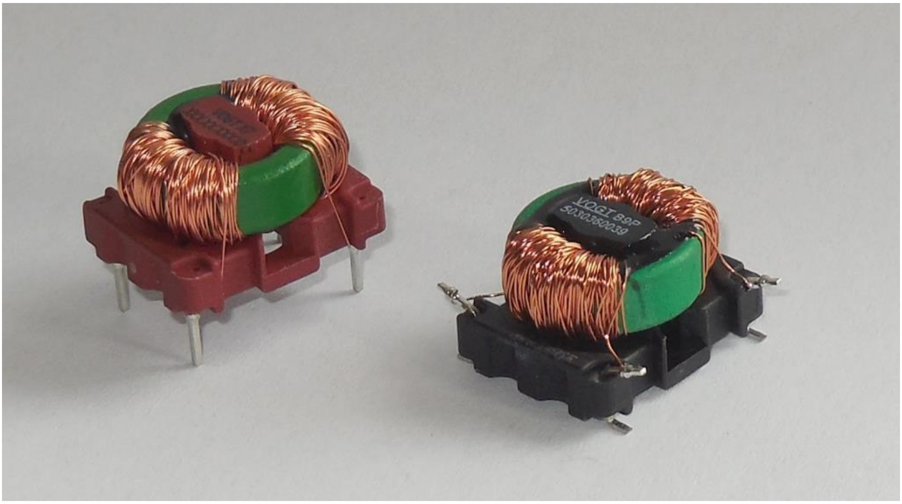
Construction

- High permeability cores from the VOGT Fi360 electronic ferrites
- Plastic cap with standard pinning (vertical and horizontal)

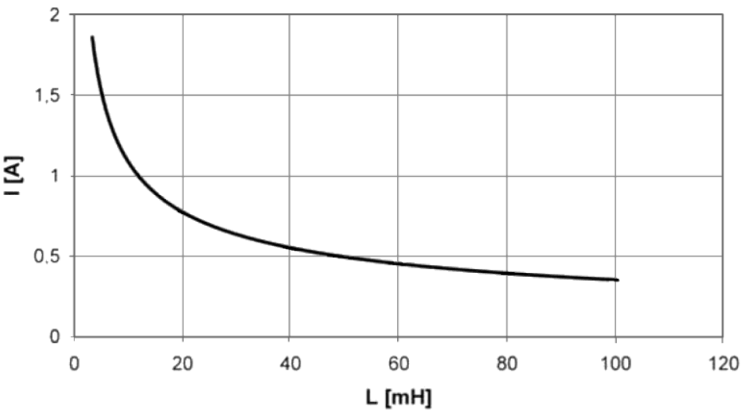
Technical specifications

- Climate category 40/125/56 in accordance with IEC 68-1
- Nominal inductance at 10 kHz, 25°C
- Inductance tolerance +50%/-30%
- Inductance loss (with common mode configuration) < 10% for DC initial load with IN
- Test voltage (winding-winding) 1500 V, 50 Hz, 2 sec.
- Ambient temperature 60°C
- Temperature increase of windings < 55°C
- Max. permissible temperature of windings 115°C

A1.2 COMMON MODE CHOKES | DP-F14



Current as a function of inductance and size



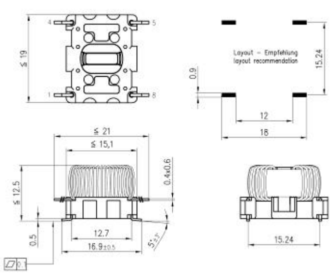
Standards

| EN 60938-2

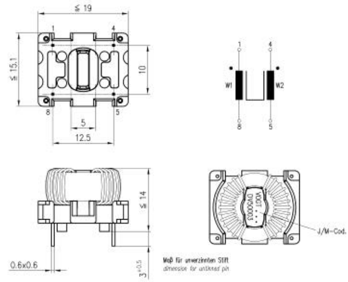
A1.2 COMMON MODE CHOKES | DP-F14

DP-F 14

SMD



THD



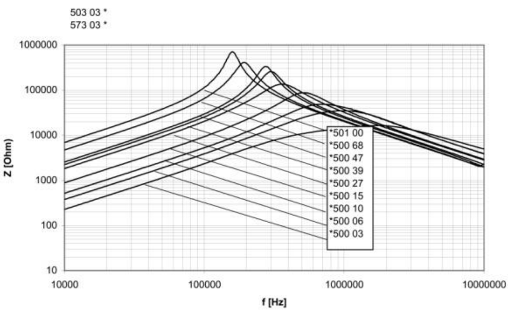
L_N[1] (mH)	I_{rms} (A)	I_{sat} (A)[2]	R_{Cu} (mΩ)	L_S (µH)	Part number SMD	Part number THD
3.3	1.3	2.26	110	32	503 03 600 03	573 03 500 03
6.8	1.15	1.62	210	70	503 03 600 06	573 03 500 06
10	0.95	1.34	350	110	503 03 600 10	573 03 500 10
15	0.75	1.06	490	170	503 03 600 15	573 03 500 15
27	0.57	0.80	810	300	503 03 600 27	573 03 500 27
39	0.45	0.63	1300	400	503 03 600 39	573 03 500 39
47	0.35	0.5	1730	510	503 03 600 47	573 03 500 47
68	0.28	0.4	2700	805		573 03 500 68
100	0.25	0.35	3700	1100		573 03 501 00

[1] per winding

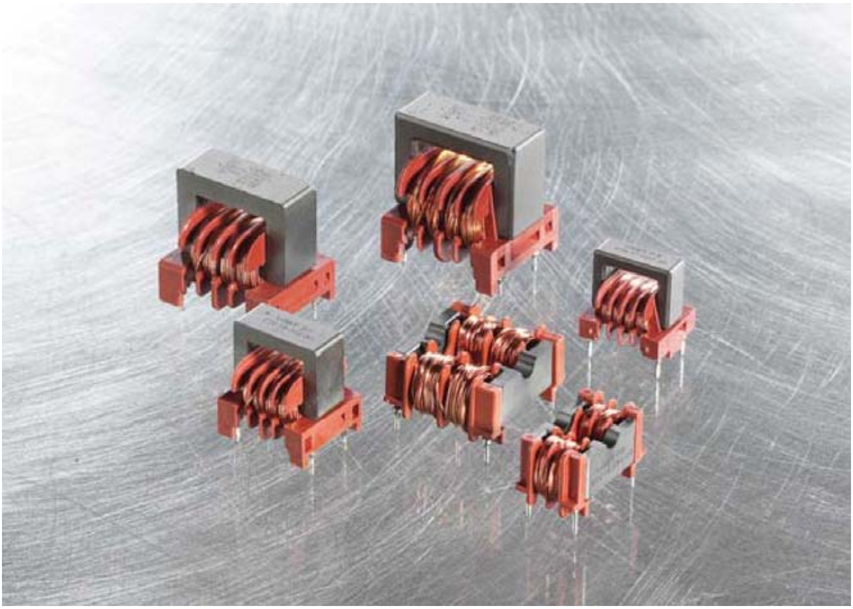
[2] = L-inductance; loss < 15% (with common mode configuration)

Standard components, other values available on request

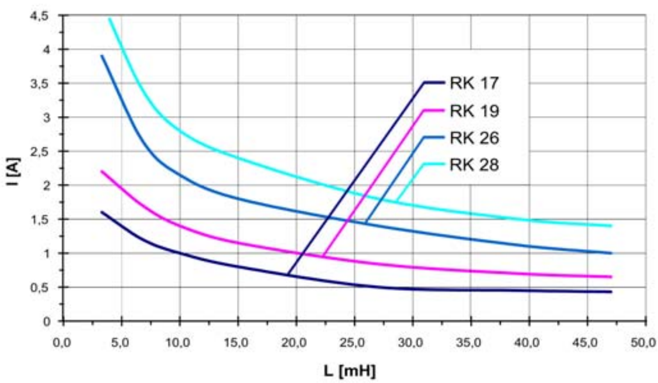
Impedance curves



A1.2 COMMON MODE CHOKES | RK



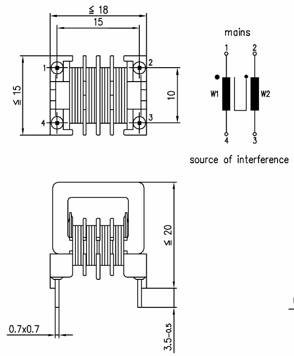
Current as a function of inductance and component size



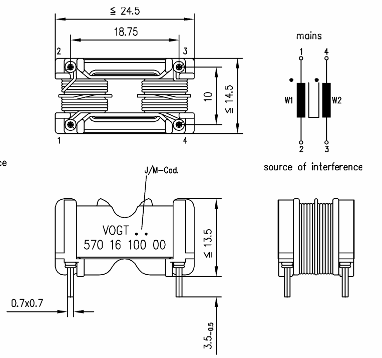
sumida

A1.2 COMMON MODE CHOKES | RK 17

vertical



horizontal

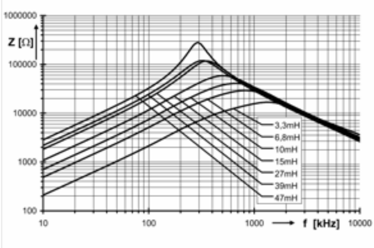


L_N [1] (mH) +50% - 30%	RK 17 vertical (R_{th} [2] = 70 K/W)				RK 17 horizontal (R_{th} [2] = 50 K/W)			
	I_N [1] (A)	R_{Cu} [1], [2] (Ω)	$L_{Leakage}$ [2] (µH)	Part number	I_N [1] (A)	R_{Cu} [1], [2] (Ω)	$L_{Leakage}$ [2] (µH)	Part number
3.3	1.50	0.19	25	570 17 001 00	1.50	0.20	65	570 16 033 0H
6.8	1.20	0.29	50	570 17 002 00	1.20	0.30	125	570 16 068 0H
10	0.90	0.51	75	570 17 003 00	0.90	0.55	190	570 16 100 30
15	0.80	0.65	110	570 17 004 00	0.80	0.70	285	570 16 150 0H
27	0.50	1.30	200	570 17 005 00	0.50	1.45	510	570 16 270 0H
39	0.45	2.40	300	570 17 006 00	0.45	2.55	740	570 16 390 0S
47	0.40	2.70	350	570 17 007 00	0.40	2.90	880	570 16 470 0H

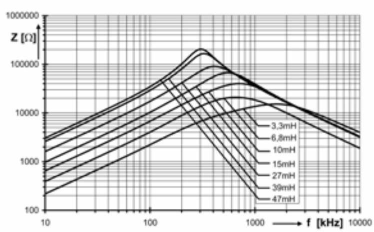
[1] per winding, [2] max. value

Impedance curves

vertical

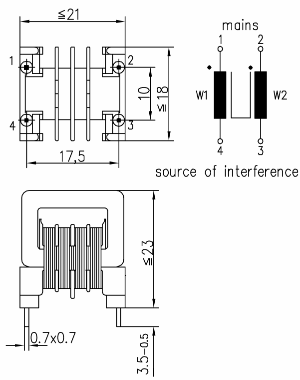


horizontal

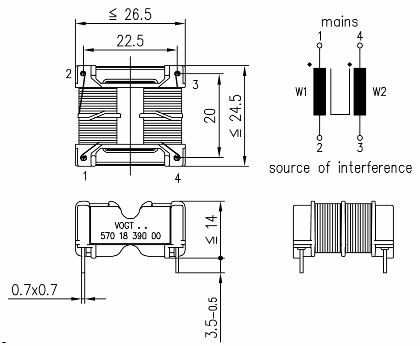


A1.2 COMMON MODE CHOKES | RK 19 + RK 23

RK 19 vertical



RK 23 horizontal

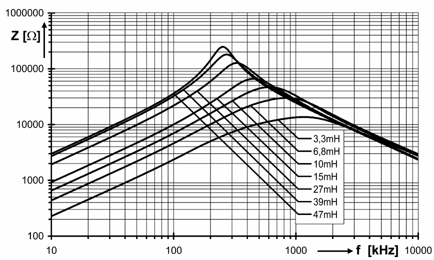


L_N[1)] (mH) +50% - 30%	RK 19 vertical (R_{th}[2)] = 52 K/W)				RK 23 horizontal (R_{th}[2)] = 33 K/W)			
	I_N[1)] (A)	R_{Cu} 1), 2) (Ω)	$L_{Leakage}$[2)] (µH)	Part number	I_N[1)] (A)	R_{Cu} 1), 2) (Ω)	$L_{Leakage}$[2)] (µH)	Part number
3.3	2.1	0.12	25	570 19 001 00	2.25	0.09	65	570 18 033 00
6.8	1.6	0.20	50	570 19 002 00	1.75	0.16	140	570 18 068 00
10	1.4	0.27	70	570 19 003 00	1.55	0.22	210	570 18 100 0H
15	1.1	0.45	110	570 19 004 00	1.25	0.33	330	570 18 150 00
27	0.8	0.75	180	570 19 005 00	1.10	0.53	590	570 18 270 0H
39	0.7	1.10	280	570 19 006 00	1.00	0.70	810	570 18 390 00
47	0.6	1.20	330	570 19 007 00	0.90	0.87	1000	570 18 470 0S

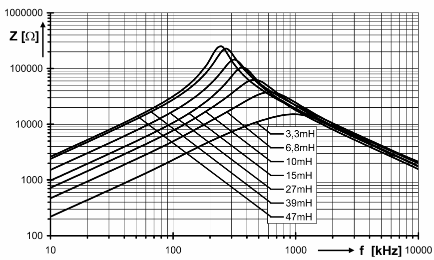
[1)] per winding, [2)] typical value

Impedance curves

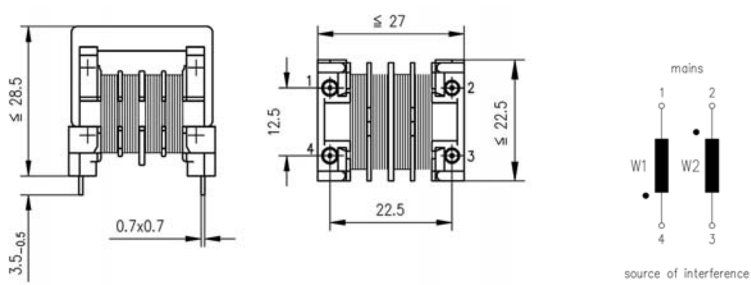
RK 19 vertical



RK 23 horizontal



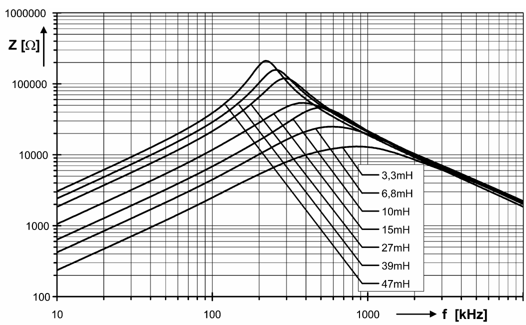
A1.2 COMMON MODE CHOKES | RK 26



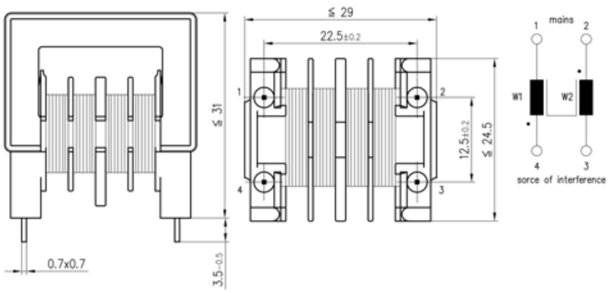
RK 26 vertical (R_{th}[2)] = 35 K/W)				
L_N[1)] (mH) +50%/-30%	I_N[1)] (A)	R_{Cu}[1), 2)] (Ω)	$L_{Leakage}$[2)] (µH)	Part number
3.3	3.9	0.054	25	570 26 001 00
6.8	2.4	0.14	50	570 26 002 00
10	2.2	0.17	70	570 26 003 00
15	1.7	0.29	100	570 26 004 00
27	1.4	0.45	180	570 26 005 00
39	1.1	0.75	280	570 26 006 00
47	1.0	0.82	330	570 26 007 00

[1)] per winding, [2)] typical value

Impedance curves



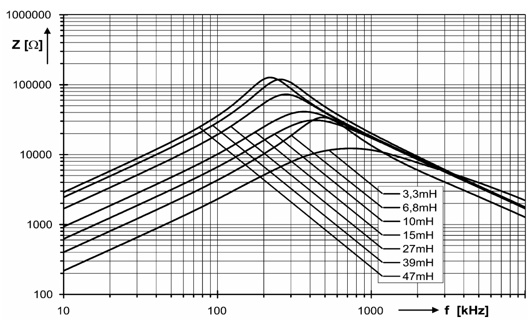
A1.2 COMMON MODE CHOKES | RK 28



RK 28 vertical (R_{th}[2)] = 30 K/W)				
L_N[1)] (mH) +50%/-30%	I_N[1)] (A)	R_{Cu}[1), 2)] (Ω)	$L_{Leakage}$[2)] (μH)	Part number
3.3	4.6	0.048	25	570 28 001 00
6.8	3.2	0.095	45	570 28 002 00
10	2.6	0.15	70	570 28 003 00
15	2.4	0.18	100	570 28 004 00
27	1.8	0.31	180	570 28 005 00
39	1.5	0.48	250	570 28 006 00
47	1.4	0.52	310	570 28 007 00

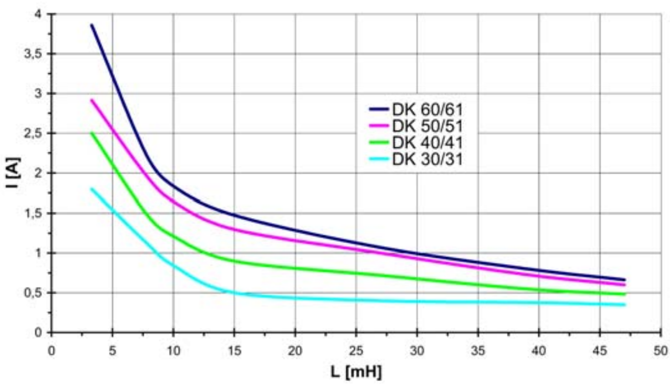
[1)] per winding, [2)] typical value

Impedance curves



A1.2 COMMON MODE CHOKES | DK

Current as a function of inductance and size



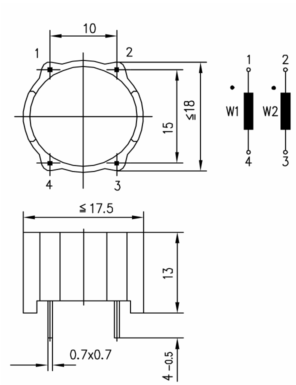
Standards

EN 60938-2

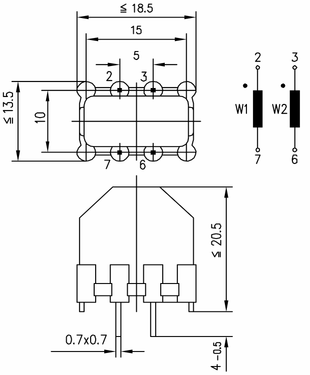
UL 1283-FOKY2.E151145
UL 1446 Class B-OBJY2.E143220

A1.2 COMMON MODE CHOKES | DK 30 + DK 31

DK 30



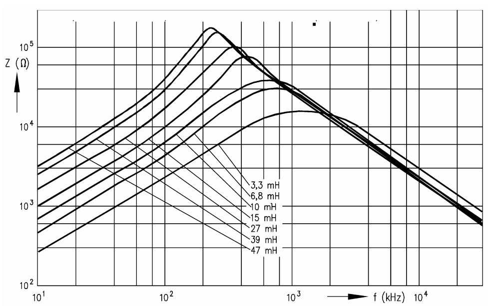
DK 31



L_N[1] (mH) +50% -30%	I_N[1] (A)	R_{Cu} [1), 2)] (Ω)	$L_{Leakage}$[2] (µH)	DK 30 ($Rth^{2)}$ = 65 K/W)		DK 31 ($Rth^{2)}$ = 58 K/W)	
				Type	Part number	Type	Part number
3.3	1.5	0.17	35	K30	573 30 030 00	K31	573 31 030 00
6.8	1.2	0.28	75	K30	573 30 060 00	K31	573 31 060 00
10	0.7	0.55	105	K30	573 30 100 00	K31	573 31 100 00
27	0.4	1.7	300	K30	573 30 270 00	K31	573 31 270 00
39	0.4	2	450	K30	573 30 390 00	K31	573 31 390 00
47	0.3	2.5	540	K30	573 30 470 00	K31	573 31 470 00

1) per winding, 2) typical value

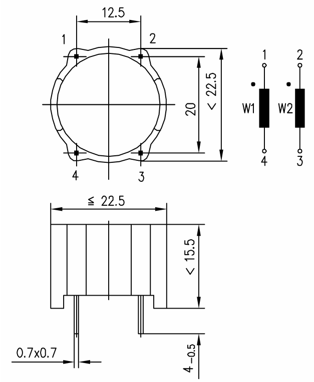
Impedance curves



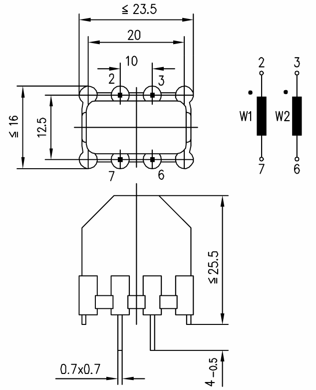
sumida

A1.2 COMMON MODE CHOKES | DK 40 + DK 41

DK 40



DK 41

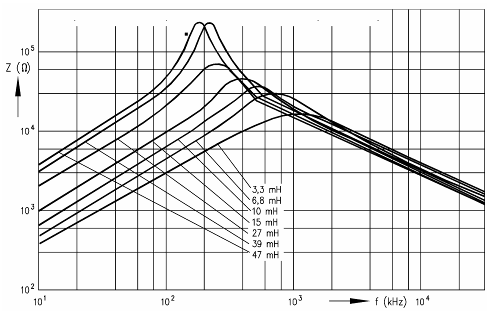


L_N [1] (mH) +50% -30%	I_N [1] (A)	R_{Cu} [1), 2)] (Ω)	$L_{Leakage}$ [2] (µH)	DK 40 (Rth[2] = 50 K/W)		DK 41 (Rth[2] = 45 K/W)	
				Type	Part number	Type	Part number
3.3	2.5	0.07	0	K40	573 40 030 00	K41	573 41 030 00
6.8	1.5	0.20	60	K40	573 40 060 00	K41	573 41 060 00
10	1.2	0.29	90	K40	573 40 100 00	K41	573 41 100 00
27	0.8	0.60	240	K40	573 40 270 00	K41	573 41 270 00

[1] per winding, [2] typical value

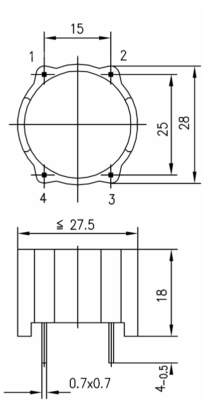
Other types on request!

Impedance curves

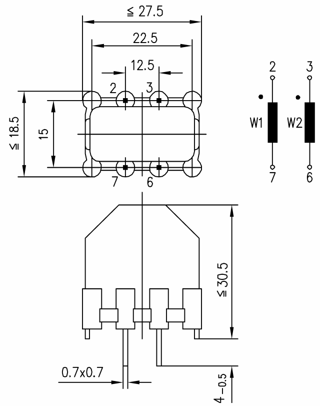


A1.2 COMMON MODE CHOKES | DK 50 + DK 51

DK 50



DK 51

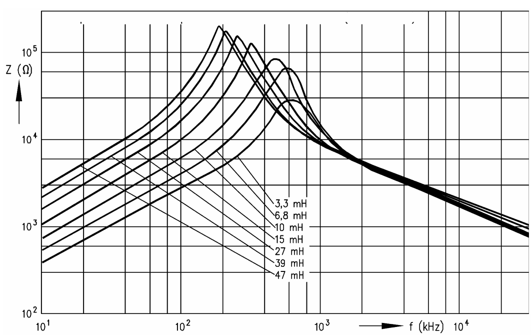


L_N [1] (mH) +50% -30%	I_N [1] (A)	R_{Cu} [1), 2)] (Ω)	$L_{Leakage}$ [2] (µH)	DK 50 (Rth[2] = 37 K/W)		DK 51 (Rth[2] = 34 K/W)	
				Type	Part number	Type	Part number
3.3	2.8	0.06	40	K50	573 50 030 00	K51	573 51 030 00
6.8	2.0	0.15	80	K50	573 50 060 00	K51	573 51 060 00
10	1.6	0.21	120	K50	573 50 100 00	K51	573 51 100 00
27	1.0	0.64	330	K50	573 50 270 00	K51	573 51 270 00
47	0.6	1.10	600	K50	573 50 470 00	K51	573 51 470 00

[1] per winding, [2] typical value

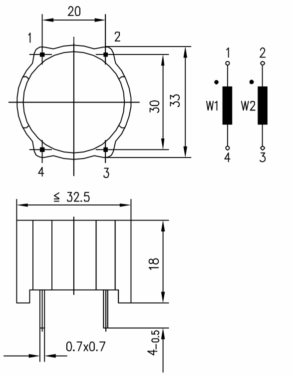
Other types on request!

Impedance curves

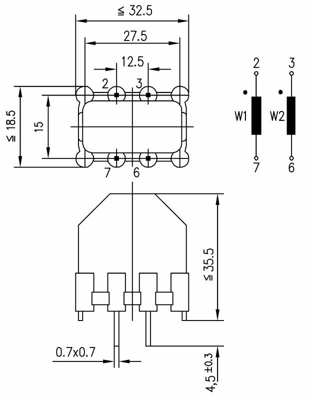


A1.2 COMMON MODE CHOKES | DK 60 + DK 61

DK 60



DK 61

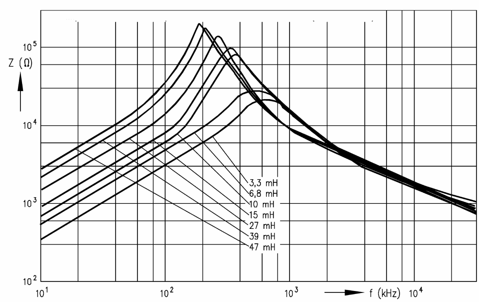


L_N [1] (mH) +50% - 30%	I_N [1] (A)	R_{Cu} [1), 2)] (Ω)	$L_{Leakage}$ [2] (µH)	DK 60 ($Rth^{2)}$ = 30 K/W)		DK 61 ($Rth^{2)}$ = 24 K/W)	
				Type	Part number	Type	Part number
3.3	4.0	0.06	35	K60	573 60 030 00	K61	573 61 030 00
6.8	2.2	0.18	85	K60	573 60 060 00	K61	573 61 060 00
10	1.8	0.22	130	K60	573 60 100 00	K61	573 61 100 00

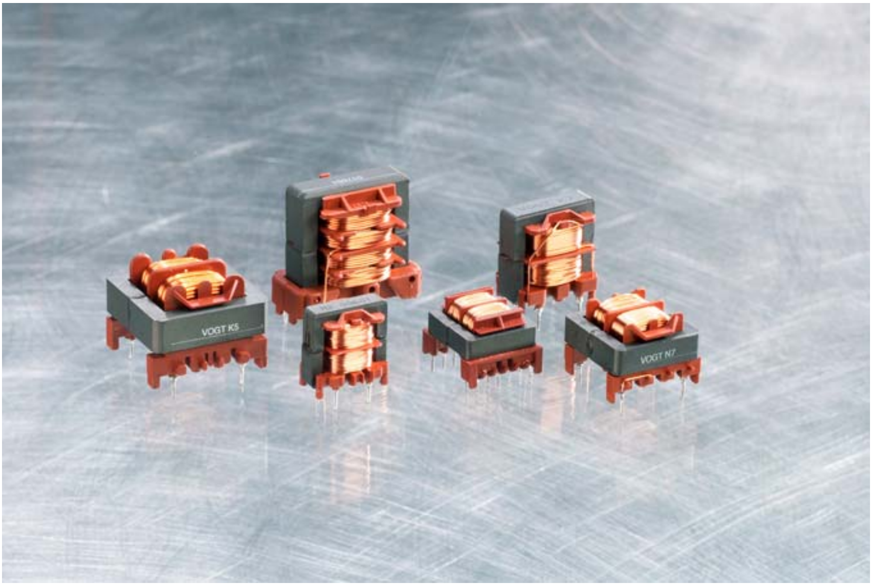
[1] per winding, [2] typical value

Other types on request!

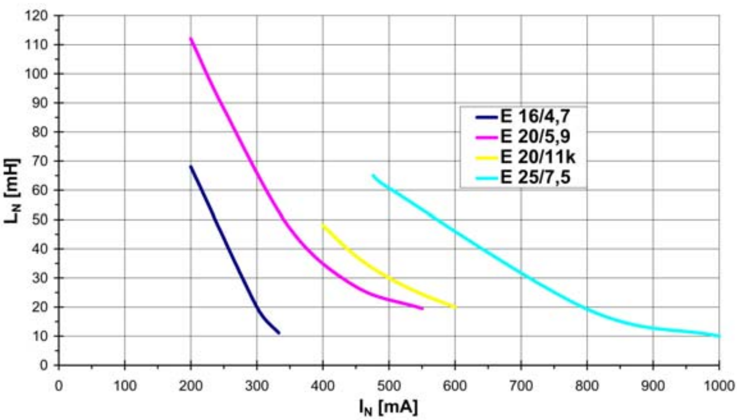
Impedance curves



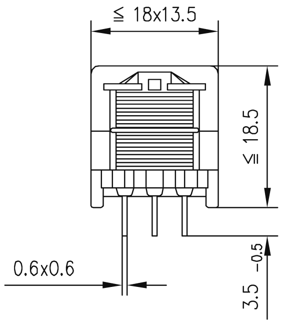
A1.2 COMMON MODE CHOKES | E-CORE

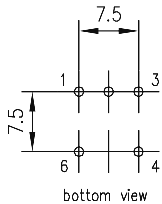


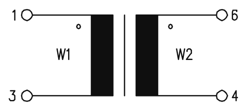
Current as a function of inductance and component size



A1.2 COMMON MODE CHOKES | E 16/4.7







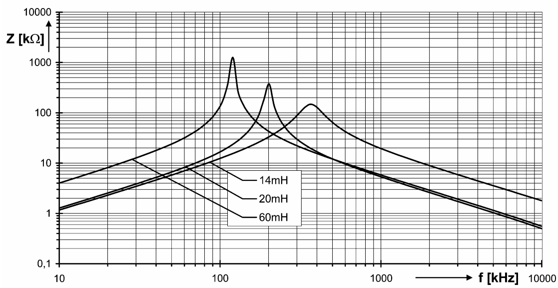
EXAMPLES:

E 16/4.7 (R_{th}[2] = 76 K/W)				
L_N[1] (mH) +50%/-30%	I_N[1] (mA)	R_{Cu}[1] (Ω)	$L_{Leakage}$[2] (µH)	Part number
14	320	≤ 1.8	270	575 09 XXX 00
20	300	≤ 1.8	400	575 09 XXX 00
60	200	≤ 4.1	1220	575 09 XXX 00

[1] per winding, [2] typical value

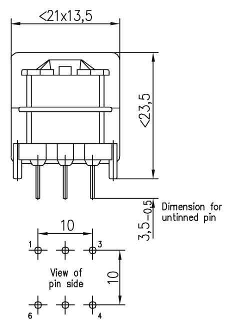
Other types on request!

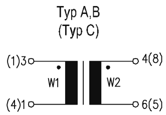
Impedance curves

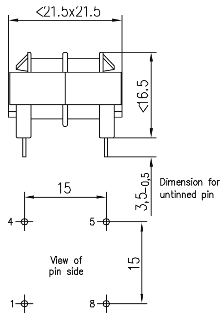


A1.2 COMMON MODE CHOKES | E 20/5.9

Typ B **Typ A**



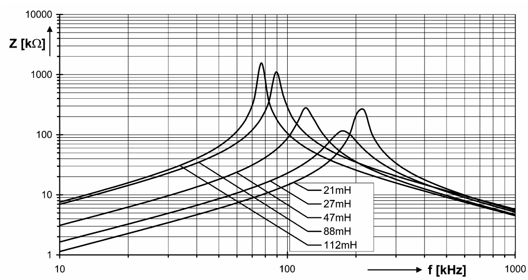




E 20/5.9 (R_{th}[2] Type: A/B/C = 57/56/55 K/W)					
L_N[1] (mH) +50%/-30%	I_N[1] (mA)	R_{Cu}[1] (Ω)	$L_{Leakage}$[2] (mH)	Type	Part number
21	550	≤ 0.78	0.35	B	575 04 158 00
27	450	≤ 1.1	0.45	B B	575 04 156 00 575 04 152 00
47	350	≤ 1.9	0.8	C	575 04 162 00
112	200	≤ 5.2	1.8	A	575 04 128 00

[1] per winding, [2] typical value

Impedance curves



A1.3 COMMON MODE CHOKES AMORPH

Application

These chokes are mostly used in power electronics devices. In conjunction with suitable capacitors, these chokes, form filters which reduce the effects of line interference as well as propagation of interference caused by the device. The filters are one-phase or three-phase.

Construction

The series DP-A and DK-A chokes feature amorphous toroidal cores. This results in the following advantages, compared with chokes with ferrite cores:
Considerably greater impedance values for the same component size, or much smaller component size for the same electrical values.

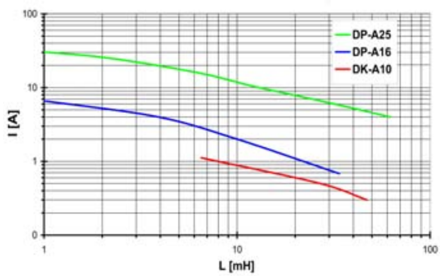
Technical specifications

- Comply with the requirements of EN 60950, EN 60065, 60335, 61800 or EN 50178
- Climate category 40/125/56 in accordance with IEC 68-1
- Nominal inductance at 10 kHz, 25°C
- Inductance reduction (in common mode circuit) < 10% assuming DC bias with I_N and ambient temperature T_U = 25°C
- Test voltage (winding – winding) 1500 V, 50 Hz, 2 sec.
- Ambient temperature 60°C
- Temperature rise of windings < 55°C
- Maximum permissible temperature of windings 115° C

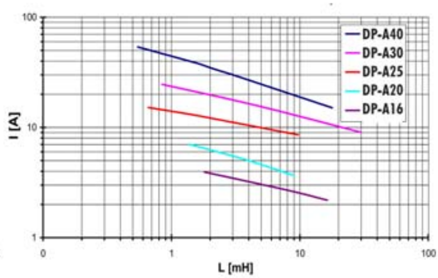
A1.3 COMMON MODE CHOKES AMORPH

Inductance as a function of current and component size

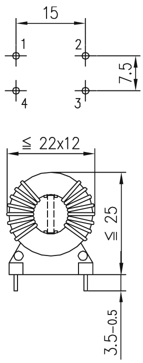
Common mode 2-phase choke

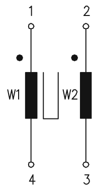


Common mode 3-phase choke



A1.3 COMMON MODE CHOKES AMORPH | DP-A16



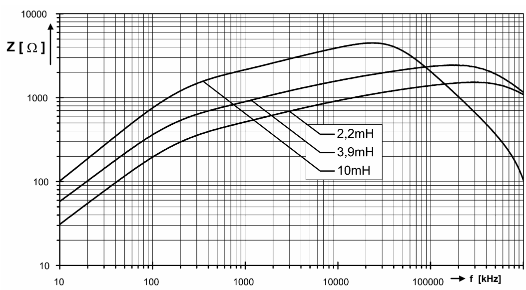


DP-A16 (R_{th}[2] = 63 K/W)				
L_N[1] (mH) +50%/-30%	I_N[1] (A)	R_{Cu}[1] (mΩ)	$L_{Leakage}$[2] (µH)	Part number
3.9	4	≤ 40	2.3	573 03 502 00
10	2	≤ 71	8.2	573 03 503 00

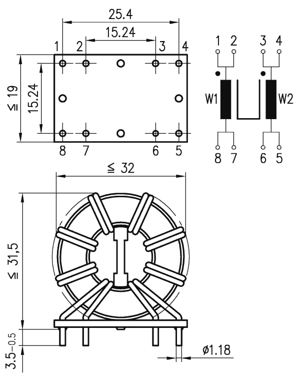
[1] per winding, [2] typical value

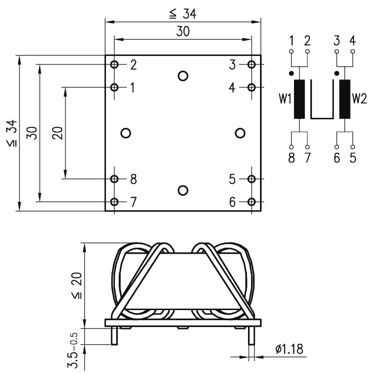
Other types on request!

Impedance curves



A1.3 COMMON MODE CHOKES AMORPH | DP-A25



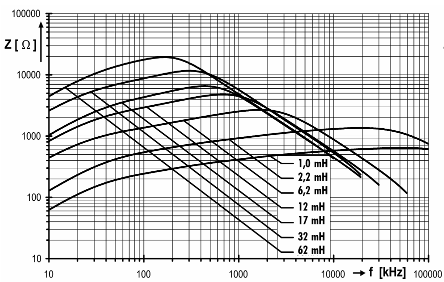


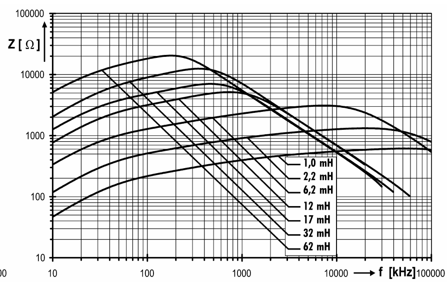
L_N[1] (mH) +50%/-30%	I_N[1] (A)	R_{Cu}[1] (mΩ)	$L_{Leakage}$[2] (µH)	DP-A25/1 (2)[3] Rth[2] = 22 K/W Part number	DP-A25/L1 (2)[3] Rth[2] = 21 K/W Part number
6.8	16	≤ 10.5	4.7	573 05 513 00[3]	
12	10	≤ 27	10	573 05 514 00[3]	573 05 554 00[3]
18	8	≤ 32	14		573 05 555 00[3]

1) per winding, 2) typical value, 3) winding with 2 wires

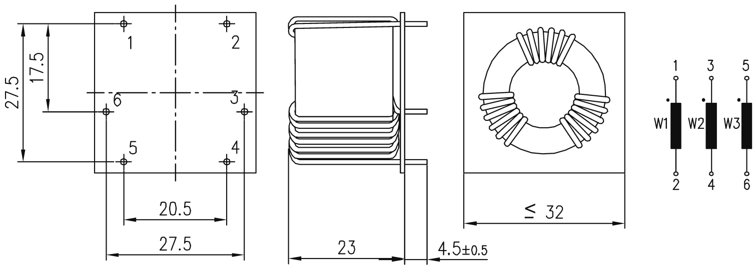
Other types on request!

Impedance curves





A1.3 COMMON MODE CHOKES AMORPH | DP-A25

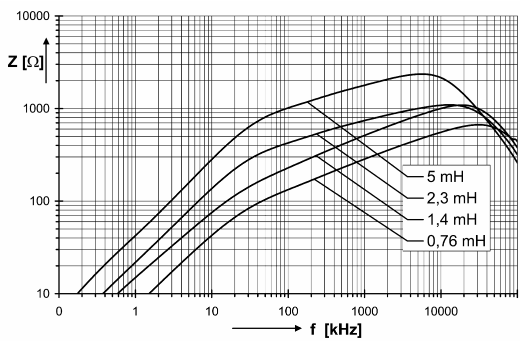


L_N [1] (mH) +50%/-30%	I_N [1] (A)	R_{Cu} [1] (mΩ)	$L_{Leakage}$ [2] (µH)	Part number
5.00	10	≤ 7.2	4.4	573 05 604 00

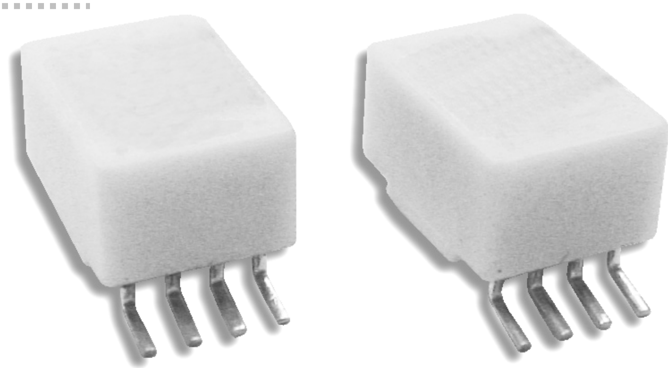
[1] per winding, [2] typical value

Other types on request!

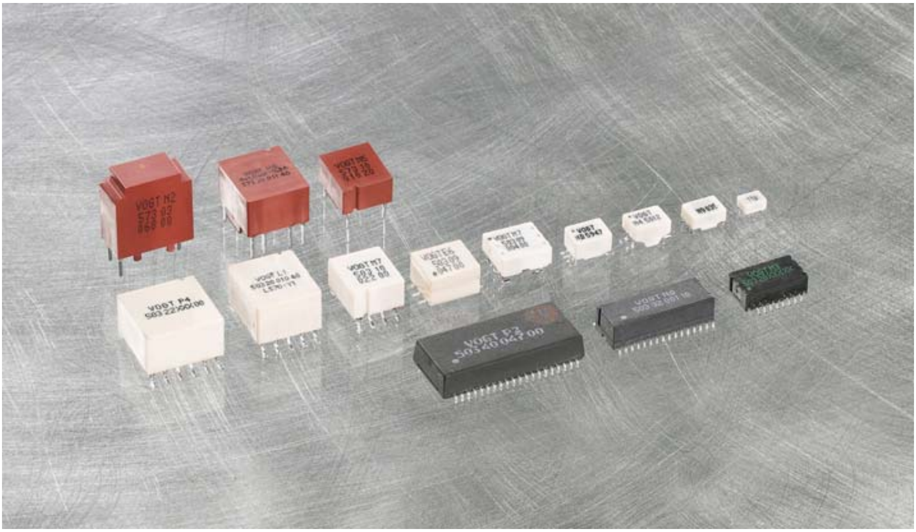
Impedance curves



A2 EMC DATA LINE



A2.1 CAN-BUS (TOROIDAL CORE)



Our common mode chokes and common mode RFI suppression chokes are designed specifically for suppressing broadband interference in digital telecommunication systems. We offer a wide range of multiple chokes and choke modules in various shapes and sizes for use in signal and data lines.

Most of these are built on the basis of ferrite toroidal cores and feature exceptional electrical properties.

- **Inductance values up to 68 mH**
- **Usable for frequencies up to 500 MHz (CAN bus chokes)**
- **High insertion loss**

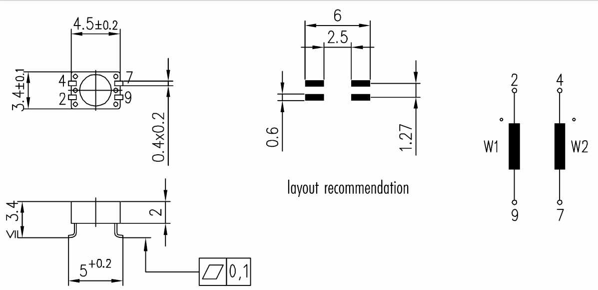
A2.1 CAN-BUS (TOROIDAL CORE)| MINIATURE TYPE K2 SMD

Frequency range 1 MHz - 500 MHz
Application e.g. as CAN bus choke

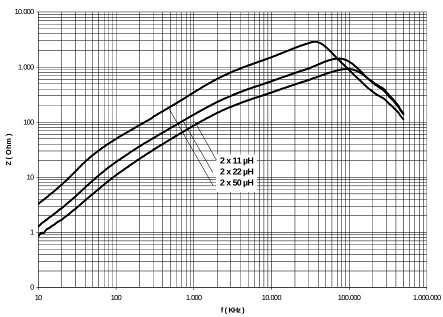
Nominal current: per winding
Nominal voltage: 80 V -/42 V ~
Inductance tolerance: +50%/-30%
DC resistance: per winding (approximate value)
Test voltage: 500 V, 50 Hz
Thermal properties: heating measurement according to VDE 0565-2
Climate category: according to IEC 68-1 25/85/56

Part number	L_N (µH)	I_N (mA)	R_{Cu} (mΩ)
503 02 022 00	2x22	100	195
503 02 050 00	2x50	100	390

Mechanical dimensions and circuit diagram



Impedance curves



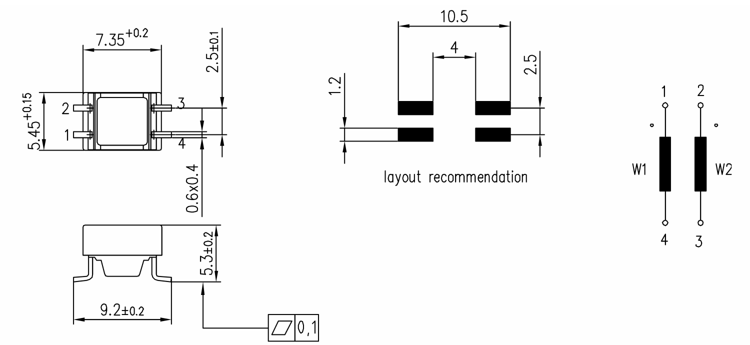
A2.1 CAN-BUS (TOROIDAL CORE)| MINIATURE TYPE K5 SMD

Frequency range 1 MHz - 500 MHz
Application e.g. as CAN bus chokes

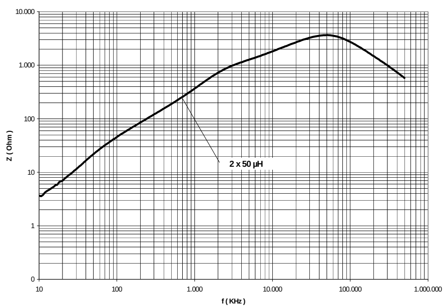
Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

Part number	L_N (µH)	I_N (mA)	R_{Cu} (mΩ)
503 05 501 20	2x50	500	250

Mechanical dimensions and circuit diagram



Impedance curves



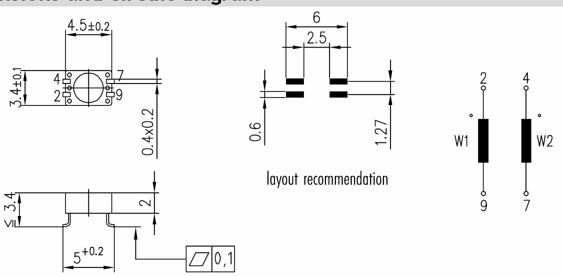
A2.2 TOROIDAL CORE | MINIATURE TYPE K2 SMD

Frequency range 10 kHz - 30 MHz

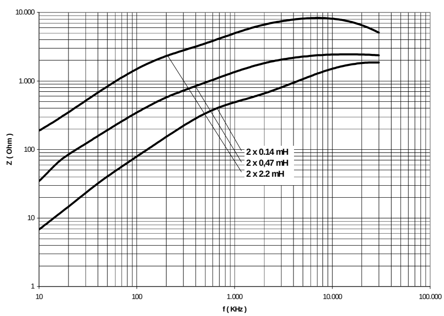
Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 02 140 00	2x0.14	100	215
503 02 910 00	2x1.0	100	660
503 02 922 00	2x2.2	100	840
503 02 947 00	2x4.7	100	1800

Mechanical dimensions and circuit diagram



Impedance curves



sumida

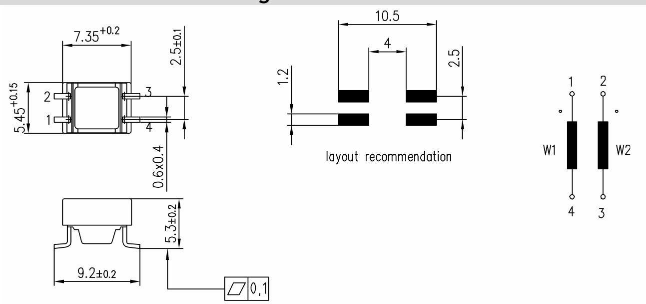
A2.2 TOROIDAL CORE | MINIATURE TYPE K5 SMD

Frequency range 10 kHz - 30 MHz

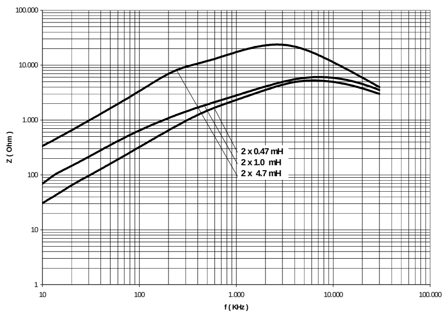
Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 05 505 20	2x0.47	250	200
503 05 510 20	2x1.0	150	340
503 05 522 20	2x2.2	150	620
503 05 547 20	2x4.7	150	900
503 05 647 20	2x47	100	3850

Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE K9 SMD

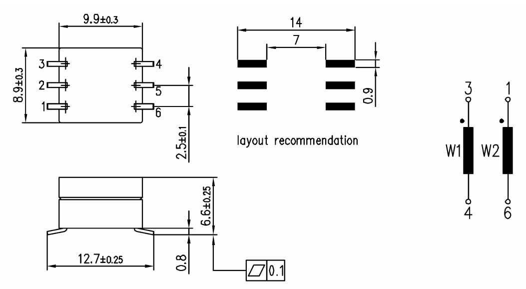
Frequency range 10 kHz - 30 MHz

Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

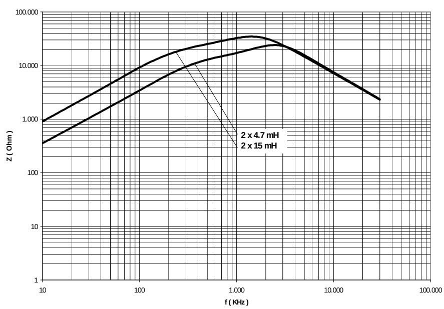
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 09 150 20	2x15	200	1500

Other types on request!

Mechanical dimensions and circuit diagram



Impedance curves



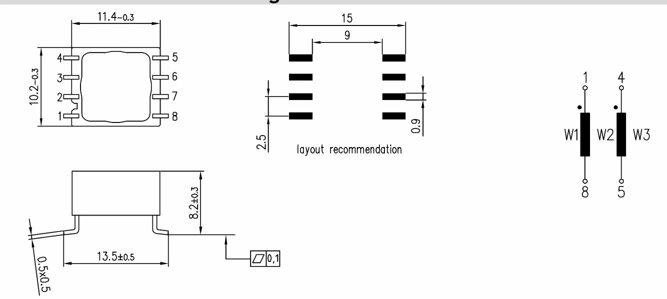
A2.2 TOROIDAL CORE | TYPE K10 SMD

Frequency range 10 kHz - 30 MHz

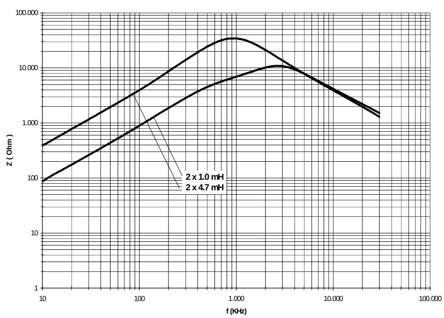
Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 10 033 20	2x3.3	200	1200
503 10 047 20	2x4.7	200	1400
503 10 068 20	2x6.8	200	1700

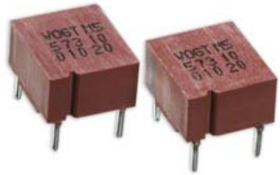
Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE K10 SMD



Frequency range 10 kHz - 30 MHz

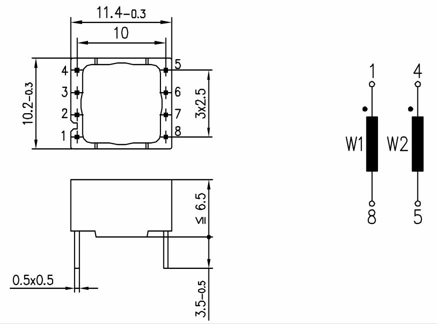
Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

EXAMPLES:

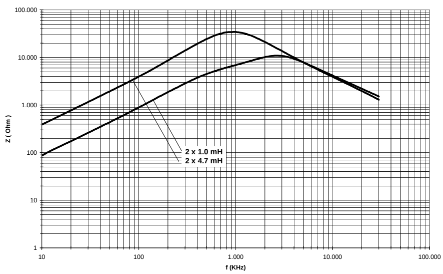
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
573 10 XXX 20	2x1.0	200	340
573 10 XXX 20	2x4.7	200	1400

Other types on request!

Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE K20 SMD

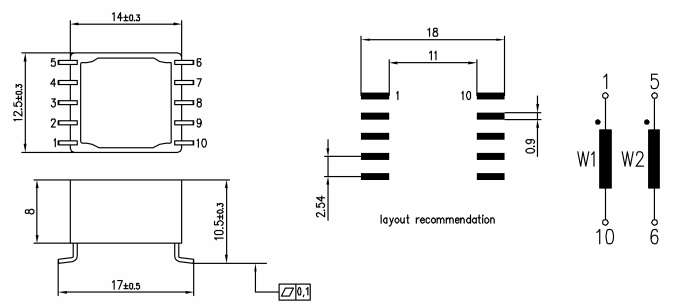
Frequency range 10 kHz - 30 MHz

Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

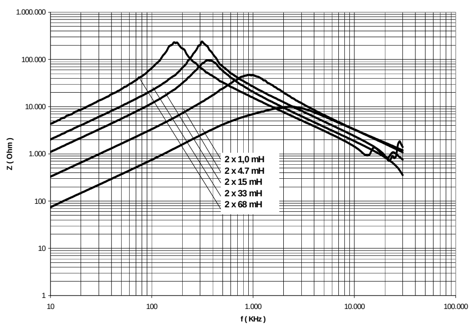
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 20 011 20	2x1.0	300	180
503 20 330 20	2x33	300	3600

Other types on request!

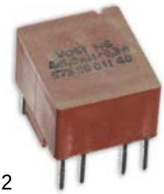
Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE K20 THD



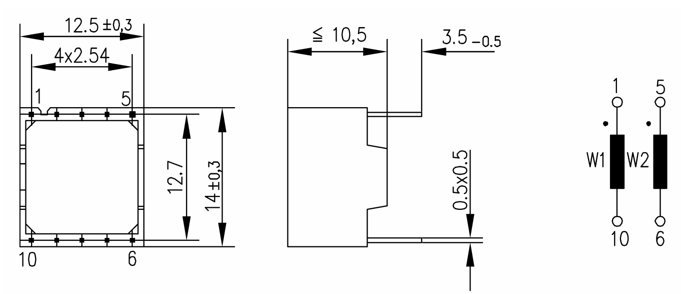
Frequency range 10 kHz - 30 MHz

Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

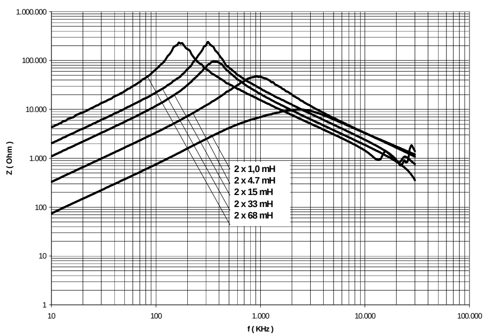
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
573 20 022 20	2x2.2	300	500
573 20 100 20	2x10	300	1500
573 20 470 20	2x47	300	4000
573 20 680 20	2x68	300	3600

Other types on request!

Mechanical dimensions and circuit diagram



Impedance curves



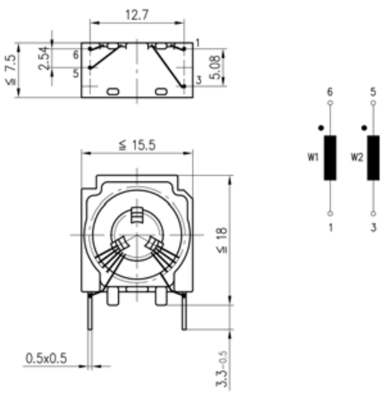
A2.2 TOROIDAL CORE | TYPE K48 THD

Frequency range 10 kHz - 30 MHz
Nominal current: per winding
Nominal voltage: 80 V - / 42 V ~
Inductance tolerance: +50% / -30%
DC resistance: per winding (nominal winding)
Testing voltage: 500 V, 50 Hz
Thermal characteristics: heating measurement according to VDE 0565-2
Climate category: according to IEC 68-1 25/85/56

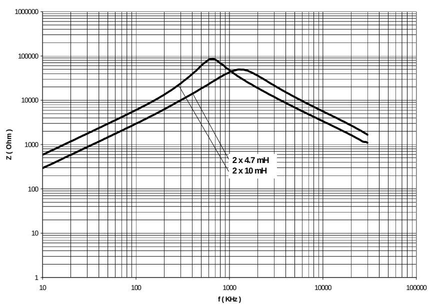
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
573 03 095 00	2x4.7	100	1000

Other types on request!

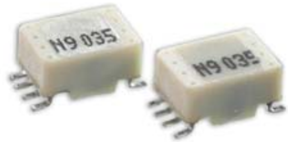
Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | MINIATURE TYPE K3 SMD

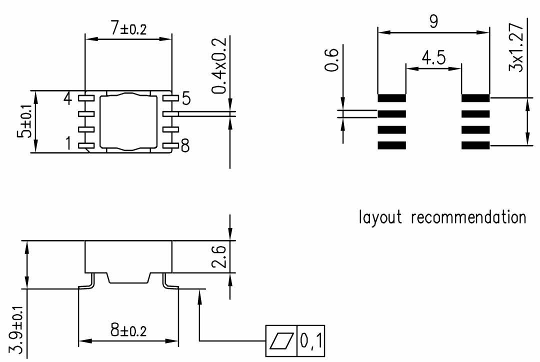


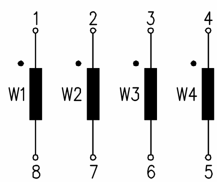
Frequency range 1 MHz - 500 MHz
Application e.g. as CAN bus chokes

Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

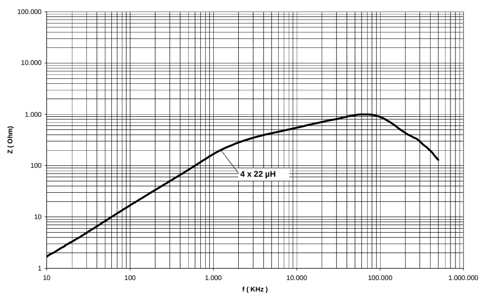
Part number	L_N (µH)	I_N (mA)	R_{Cu} (mΩ)
503 03 022 40	4x22	100	125

Mechanical dimensions and circuit diagram





Impedance curve



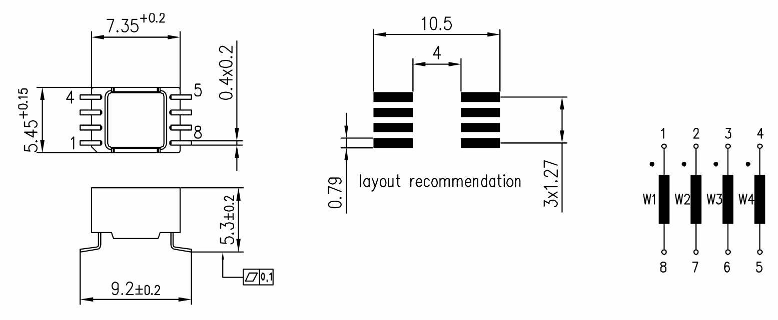
A2.2 TOROIDAL CORE | MINIATURE TYPE K5 SMD

Frequency range 1 MHz - 500 MHz
Application e.g. as CAN bus chokes

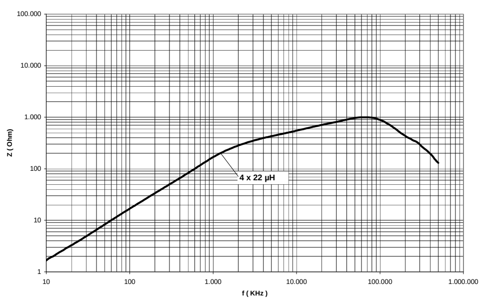
Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

Part number	L_N (µH)	I_N (mA)	R_{Cu} (mΩ)
503 05 902 40	4x22	100	125

Mechanical dimensions and circuit diagram



Impedance curve



A INDUCTIVE COMPONENTS
A2 EMC DATA LINE

A2.2 TOROIDAL CORE | MINIATURE TYPE K5 SMD

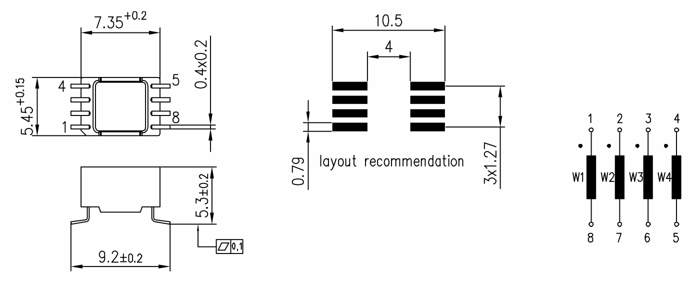
Frequency range 10 kHz - 30 MHz

Nominal current:	per winding
Nominal voltage:	80 V - / 42 V ~
Inductance tolerance:	+50% / -30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

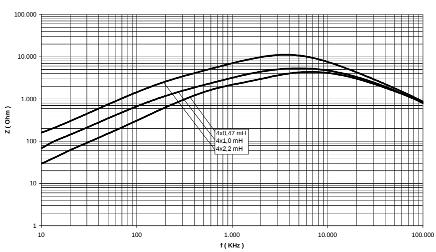
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 05 904 40	4x0.47	150	420
503 05 947 40	4x4.7	150	1200

Other types on request!

Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE K10 SMD

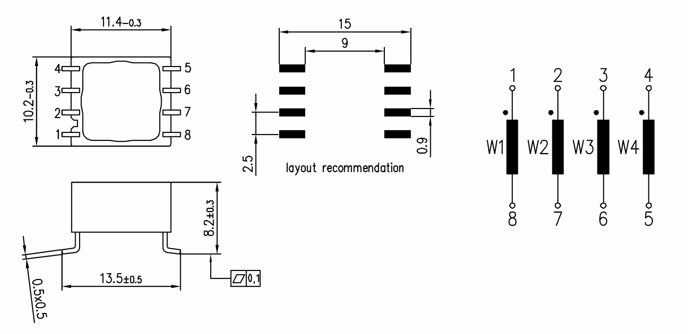
Frequency range 10 kHz - 30 MHz

Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

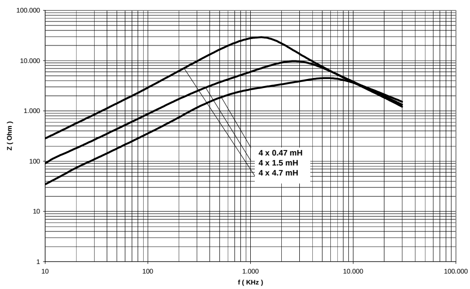
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 10 015 40	4x1.5	200	820
503 10 047 40	4x4.7	200	1200

Other types on request!

Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE K20 SMD

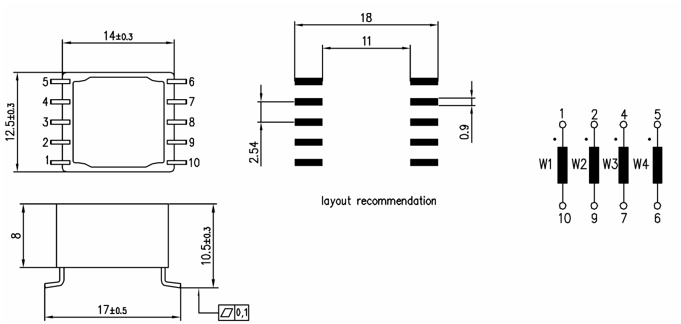
Frequency range 10 kHz - 30 MHz

Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

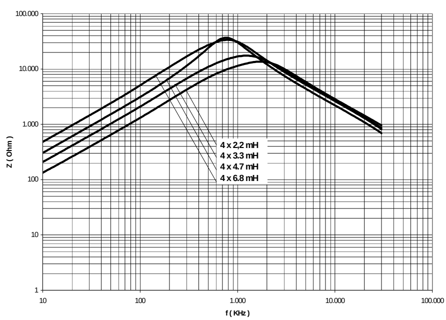
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
503 20 011 40	4x1.0	300	340

Other types on request!

Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE S0 32 SMD

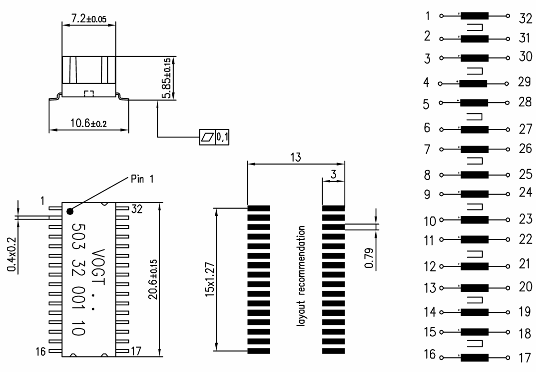
Choke module

Nominal current:	per winding
Nominal voltage:	80 V - / 42 V ~
Inductance tolerance:	+50% / -30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

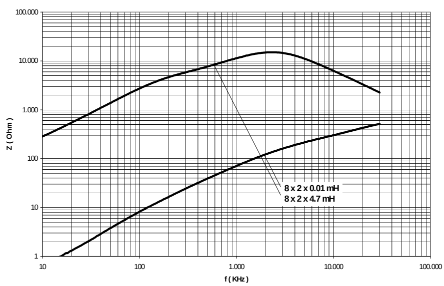
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
513 32 047 10	8x2x4.7	150	1700

Other types on request!

Mechanical dimensions and circuit diagram



Impedance curves



A2.2 TOROIDAL CORE | TYPE S0 41 SMD

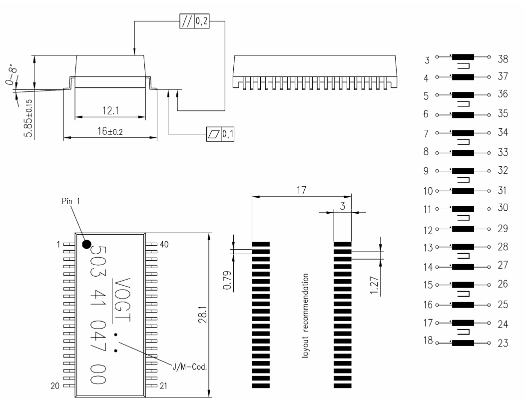
Choke module

Nominal current:	per winding
Nominal voltage:	80 V -/42 V ~
Inductance tolerance:	+50%/-30%
DC resistance:	per winding (nominal winding)
Testing voltage:	500 V, 50 Hz
Thermal characteristics:	heating measurement according to VDE 0565-2
Climate category:	according to IEC 68-1 25/85/56

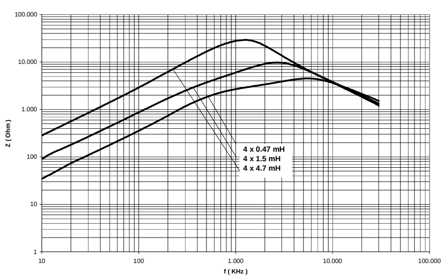
Part number	L_N (mH)	I_N (mA)	R_{Cu} (mΩ)
513 41 047 00	8x2x4.7	200	800

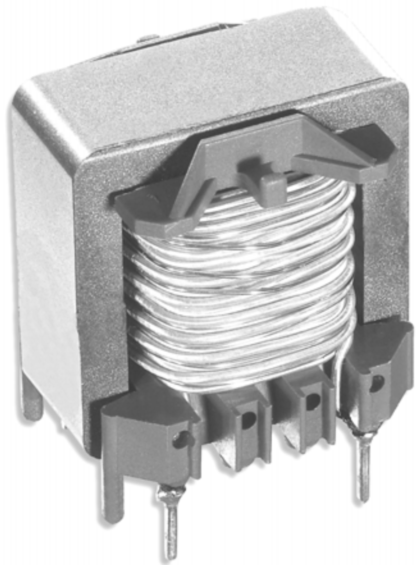
Other types on request!

Mechanical dimensions and circuit diagram



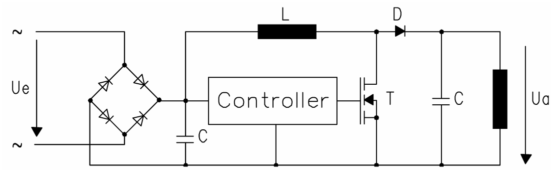
Impedance curves



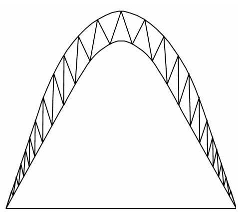


There are various types of circuits that involve controlling not only the output voltage but also the input current.

Circuit diagram

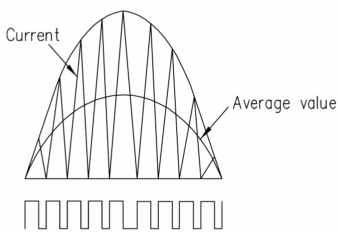


Continuous mode



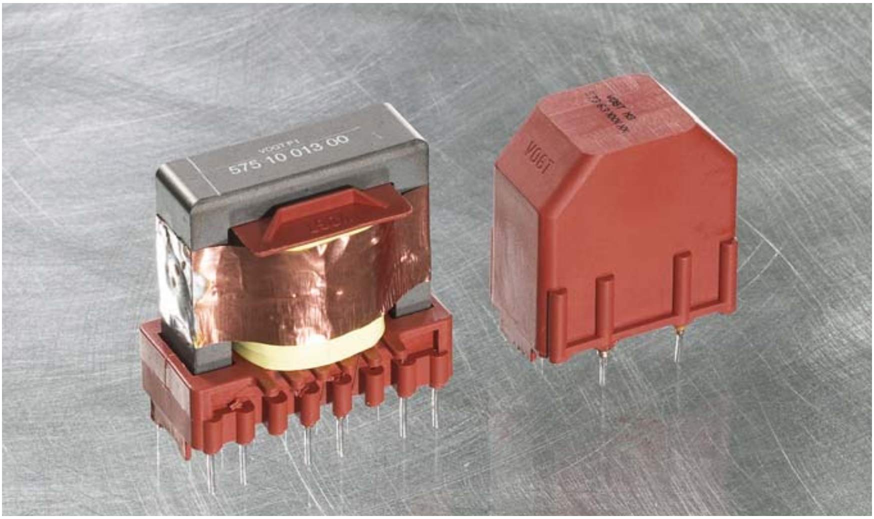
Suitable for high power

Discontinuous mode



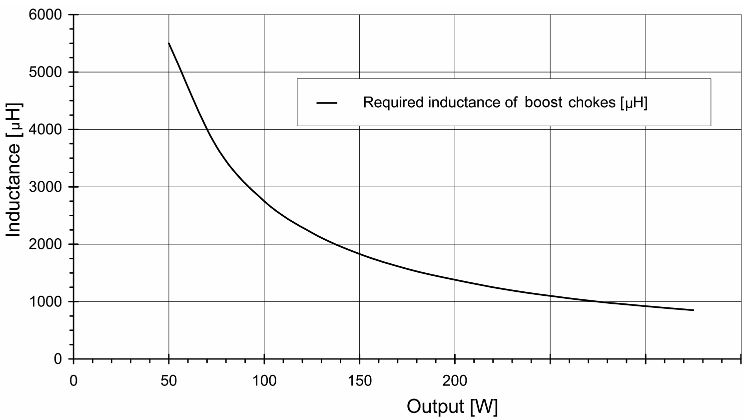
Suitable for low power

A3.1 CONTINUOUS MODE



Continuous mode boost choke

Input voltage: 90-265 VAC; output voltage: 400 VDC
Switching frequency 100 kHz; ripple of the choke current = 20%



A3.1 CONTINUOUS MODE

Application

PFC chokes for continuous mode.
With this application, the existing switched mode power supply has to be signed for PFC.

Design DK 63

- Core: R 27 – high flux
- Case: DK 63
- Primary coil and secondary coil for IC voltage supply

Design E 36/11

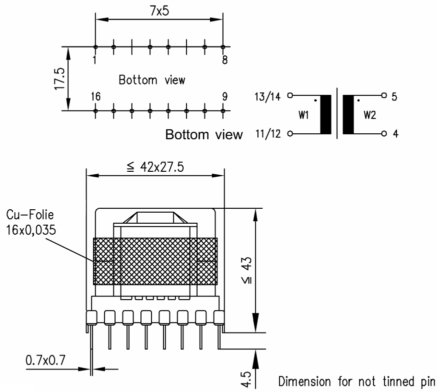
- Core: E 36/11
- Coil former: E 36/11 vertical

Technical data

- Climate category 40/125/56 according to IEC 68-1
- Nominal inductance at 10 kHz, 25°C
- DC resistance per winding (reference values measured according to VDE 0565-2)
- Ambient temperature: 60°C
- Temperature rise of windings < 55°C
- Max. permissible temperature of windings 115°C
- Input voltage 90 – 265 V
- Typical switching frequency 100 kHz

A3.1 CONTINUOUS MODE | DK 63 + E 36/11

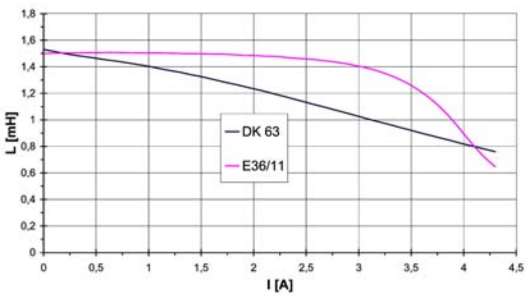
E 36/11



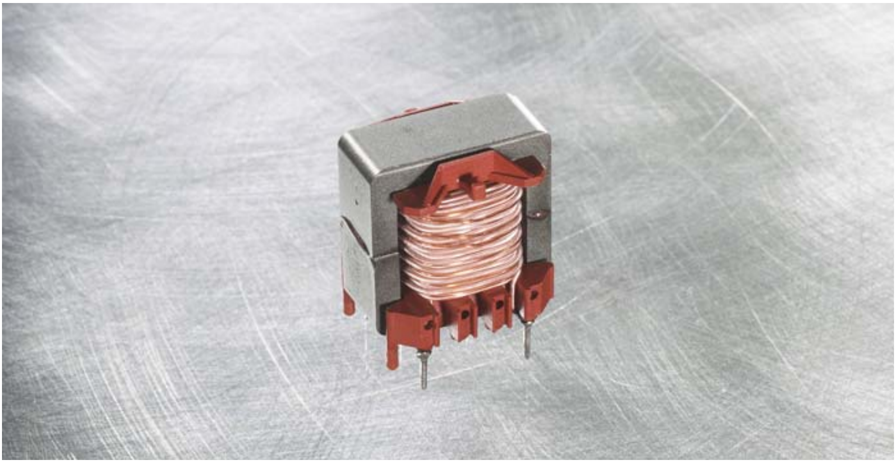
Output power (W)	I_{peak} (A)	E 36/11 vertical (R_{th} [1)] = 23 K/W)		
		L (mH) ± 10%	R_{Cu} [1)] (Ω)	Part number
150	3	1.5	≤ 0.42	575 10 013 00

1) Reference value

Saturation curve

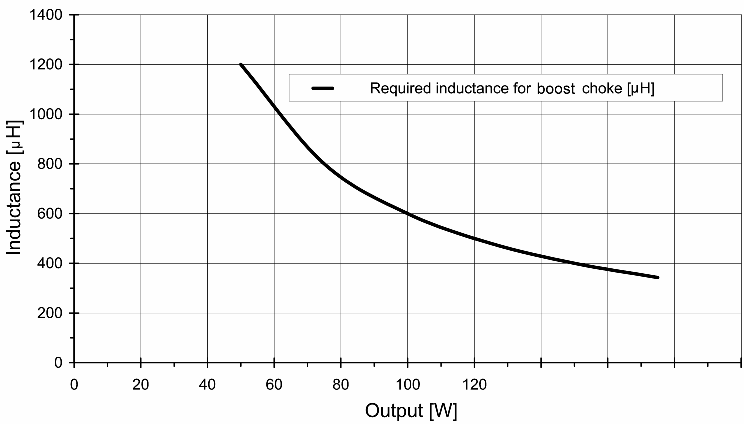


A3.2 DISCONTINUOUS MODE



Discontinuous mode boost choke

Input voltage: 90-265 VAC; output voltage: 410 VDC
Switching frequency 40 kHz



A3.2 DISCONTINUOUS MODE

Application

PFC choke for discontinuous mode.
With this application, the existing switched mode power supply has to be designed for PFC.

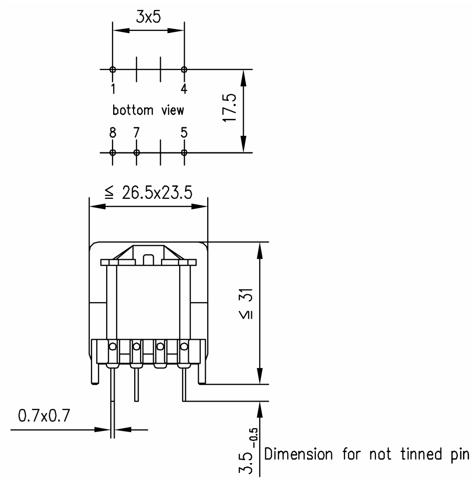
Construction

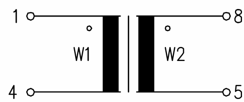
- Core: EF 25/11
- Coilformer: EF 25/11 vertical

Technical data

- Climate category 40/125/56 according to IEC 68-1
- Nominal inductance at 10 kHz, 25°C
- Inductance tolerance ± 10%
- DC resistance per winding (reference values measured according to VDE 0565-2)
- Ambient temperature 60°C
- Temperature rise of windings < 55°C
- Max. permissible temperature of windings 115°C
- Input voltage 90 – 265 V
- Typical switching frequency 40 kHz

A3.2 DISCONTINUOUS MODE |EF 25/11

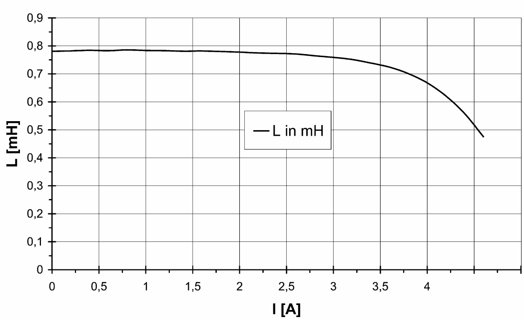




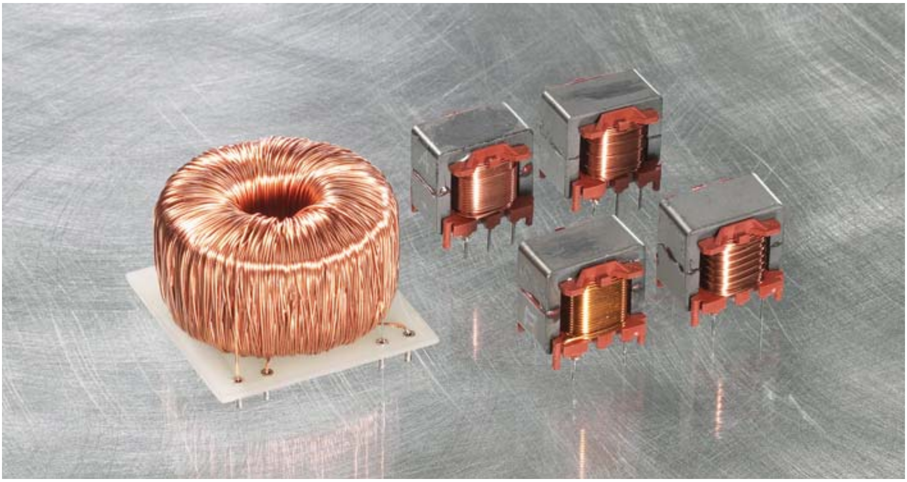
EF 25/11 vertical (R_{th}[1)] = 32 K/W)				
Output power (W)	I_{peak} (A)	L (µH) ± 15%	R_{Cu} [1)] (Ω)	Part number
75	2.8	800	≤ 0.56	575 06 045 00

[1)] Reference value

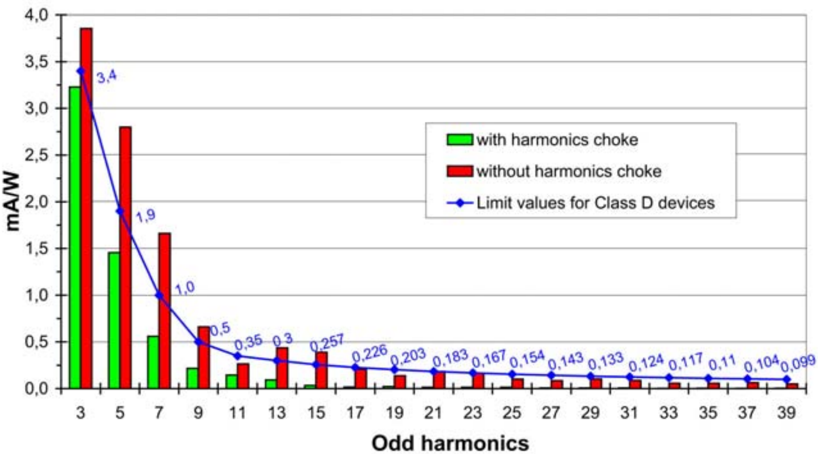
Saturation curve



A3.3 PASSIVE SOLUTIONS



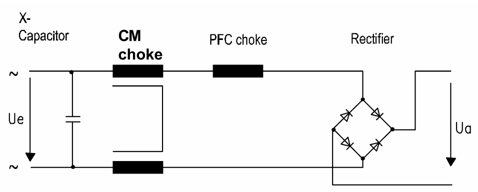
Harmonics for Class D devices (at approx. 75 W)



A3.3 PASSIVE SOLUTIONS

To A 3.3 Harmonics chokes

For existing power supplies, harmonic chokes, can be switched in front of the switched mode power supply.

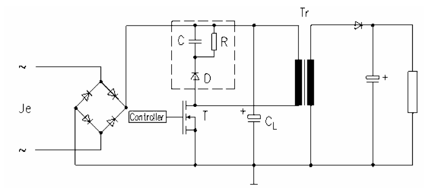


The **X-capacitor** has to be switched between the voltage supply and CM choke, otherwise resonance fluctuations can occur between the **PF choke** and X-capacitor.

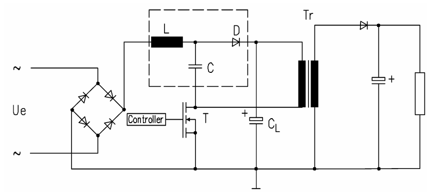
To A 3.3 Sinusoidal chokes for pump circuit

In this example with a standard switched mode power supply, a pump circuit is integrated instead of the cut-off circuit.

With the standard cut-off circuit:



Circuit diagram of the new pump circuit:



A3.3 PASSIVE SOLUTIONS | HARMONICS CHOKES

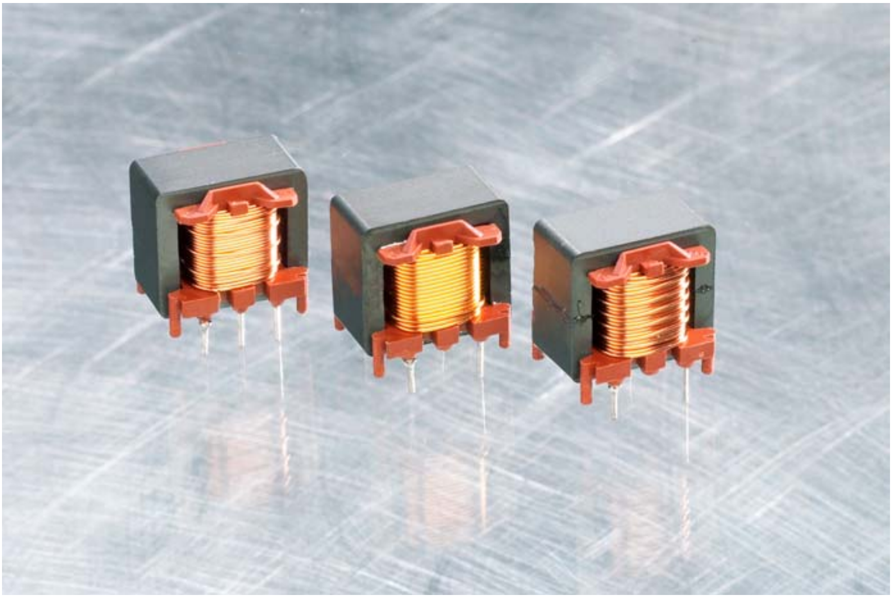
The use of a harmonics choke is the simplest and cheapest solution for maintaining standard EN 61000-3-2 requirements for harmonics since it is not necessary to redesign an existing power supply. Harmonic chokes are most frequently designed with ferrous powder cores or with laminated cores.

Advantages

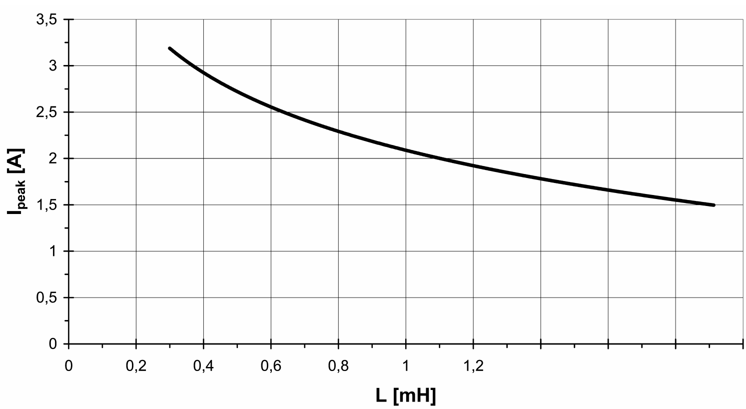
- Cheapest possibility for maintaining harmonics limits
- No redesign of existing power supplies
- Reduction of the reactive power component
- Increase in power factor

Customer-specific types available on request.

A3.3 PASSIVE SOLUTIONS | SINUSOIDAL CHOKE



I_{peak} as a function of inductance



A3.3 PASSIVE SOLUTIONS | SINUSOIDAL CHOKE

Application

These chokes are used in switched mode power supplies, typically for PCs, monitors for PCs, televisions, etc. Together with the so-called pump circuit, switched mode power supplies can now be modified so that they observe the permitted limit values for class-D equipment.

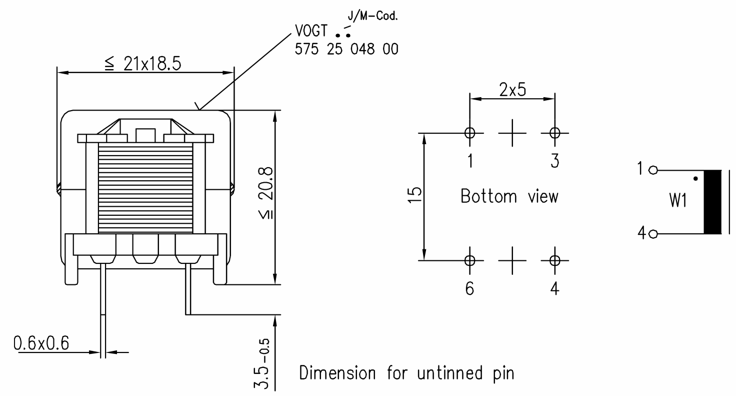
Structure

- E 20/11 k vertical design
- Installation height = 21 mm

Technical data

- Climate category 40/125/56 according to IEC 68-1
- Nominal inductance at 10 kHz, 25°C
- Inductance tolerance ± 10%
- DC resistance per winding (reference values measured according to VDE 0565-2)
- Ambient temperature 60°C
- Temperature rise of windings < 55°C
- Max. permissible temperature of windings 115°C

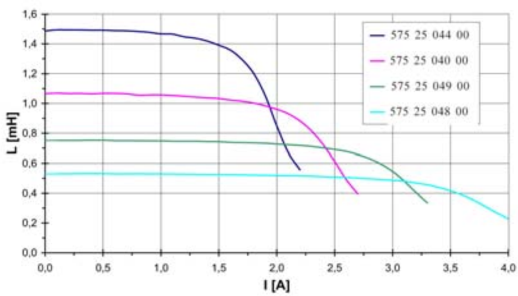
A3.3 PASSIVE SOLUTIONS | SINUSOIDAL CHOKE| EF 20/11 K

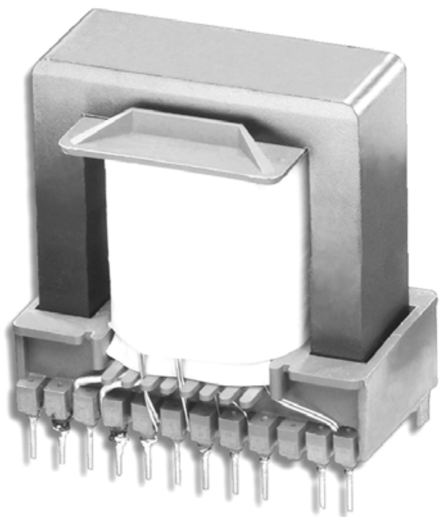


EF 20/11 k for pump circuit			
I_{peak} [1] (A)	L_N [1] (mH) ± 10%	R_{Cu} [1] (mΩ)	Part number
≤ 2.0	1.00	≤ 480	575 25 040 00
≤ 1.7	1.50	≤ 690	575 25 044 00

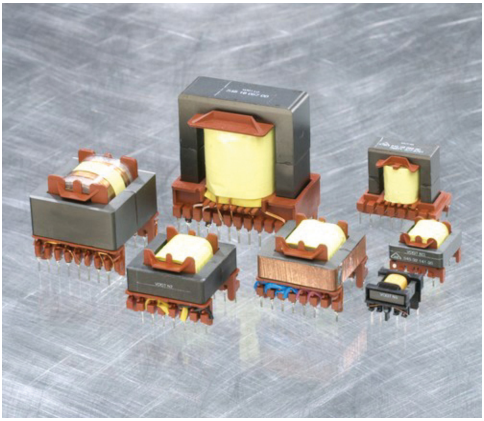
[1] Reference value

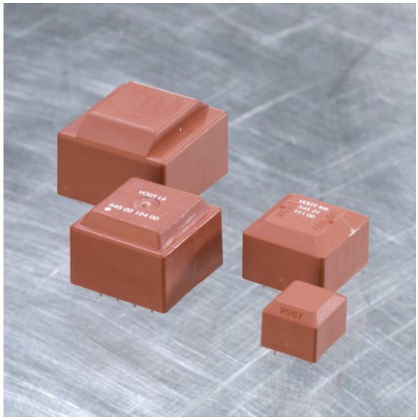
Saturation curves





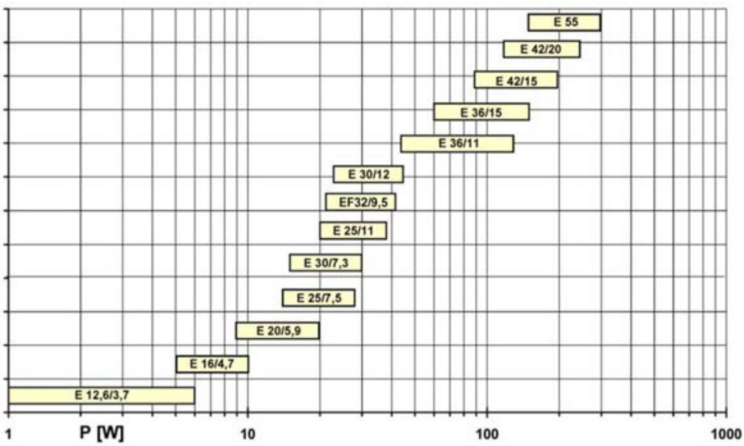
A4.1 FLYBACK/FORWARD CONVERTER E-CORE





Power comparison of various E kits

Flyback converter mode at 100 kHz
Secondary power P



A4.1 FLYBACK/FORWARD CONVERTER E-CORE

Application

- Standby transformers
- Video recorders
- SAT systems
- TV sets
- Low-cost applications, etc.

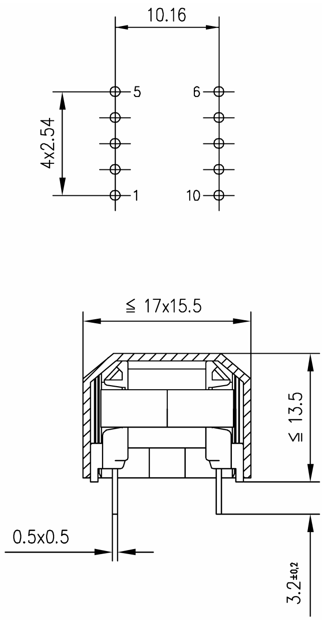
Construction

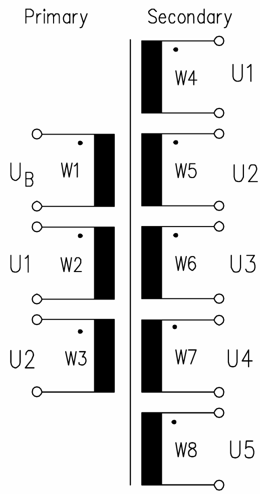
- E 12,6 – E 55 kits
- Upright and flat versions
- Open or molded structures
- E 16/4,7 kit with open structure

Technical data

- Climate category 40/125/56 in accordance with IEC 68-1
- Maximum permissible temperature of windings 115°C
- Additional technical data and standards: see the following data sheets

A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 12.6/3.7





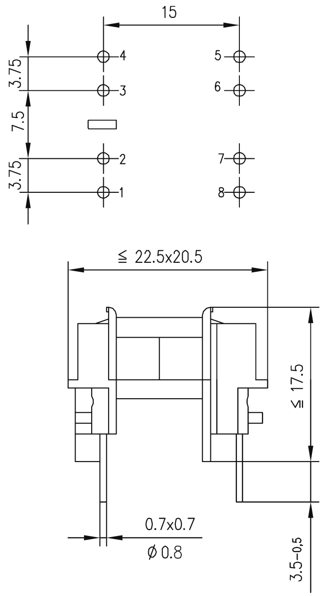
Standard	Structure	U_P[1)] Prim. -Sec. (kV)	Secondary					Part no.
			U1 (I_{max})	U2 (I_{max})	U3 (I_{ma})	U4 (I_{max})	U5 (I_{max})	
EN 61558	molded	4.0	5 V (40mA)					545 19 XXX XX

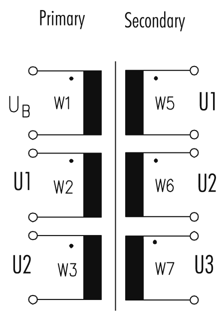
1) Test voltage U_P (f = 50 Hz; t = 1 sec)

Other types on request!

A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 16/4.7

Open E core structures



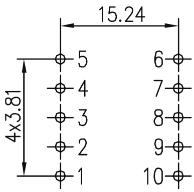


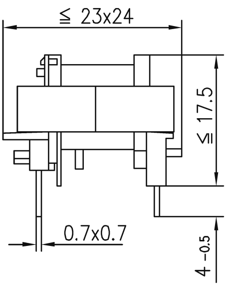
Working frequency (kHz)	Primary				U_P 1) Prim. -Sec. (kV)	Secondary			Part no. 2)
	U_B (V_{DC}) min	U_B (V_{DC}) max	U1 (V)	U2 (V)		U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	
60...100...130	130	375			4.2	12V (0.4A)	5V (1.0A)		545 23 315 00
115...140	120	400	15		4.2	24V (0.25A)			545 23 211 00
124...140	240	375			4.2	28V (0.28A)			545 23 224 00
60...100...130	130	375			4.2	12V (0.4A)	12V (0.4A)		545 23 314 00

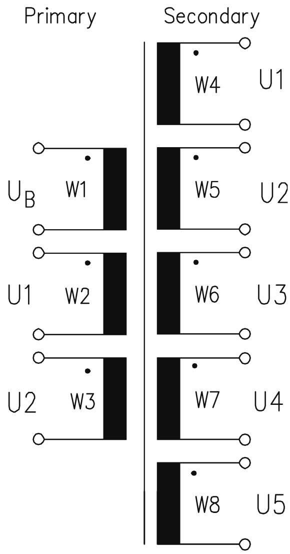
1) Test voltage U_P (f = 50 Hz; t = 1 sec)
2) Group Approval EN 60065/EN 60950/EN 61558-2-17

Other types on request!

A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 20/5.9 S







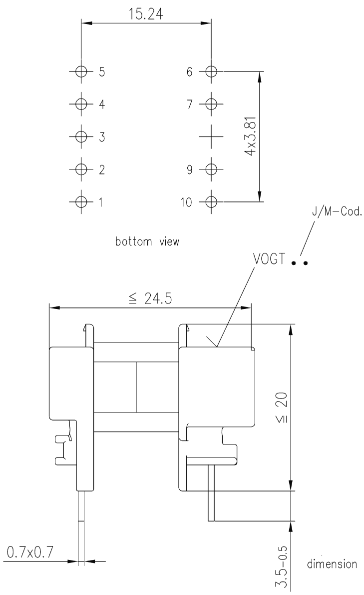
Working frequency (kHz)	Primary				Stand-ard	U_P[1] Prim.-Sec. (kV)	Secondary					Part no.
	U_B (V_{DC})		U1 (V)	U2 (V)			U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
	min	max										
130	120	375			VDE 0860	3.0	12V (0.42A)					545 09 010 00
60	125	374	13		VDE 0860	4.2	5V (0.4A)					545 09 012 00

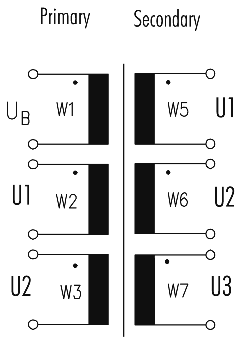
[1] Test voltage U_P (f = 50 Hz; t = 1 sec)

Other types on request!

A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 20/5.9

Open E-core structures





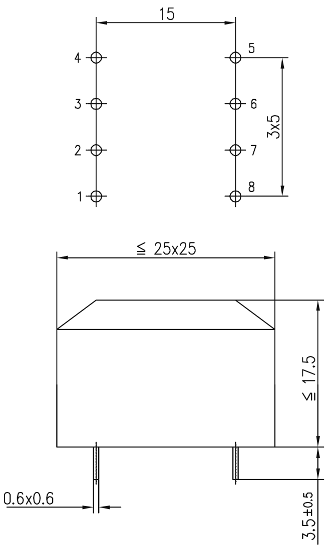
Working frequency (kHz)	Primary				U_P [1] Prim.-Sec. (kV)	Secondary			Part number[2]
	U_B (V_{DC})		U1 (V)	U2 (V)		U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	
	min	max							
60...100...130	130	375			4.5	12V (0.65A)	5V (1.5A)		545 01 273 00
60...100...130	130	375			4.5	12V (0.65A)	12V (0.65A)		545 01 274 00

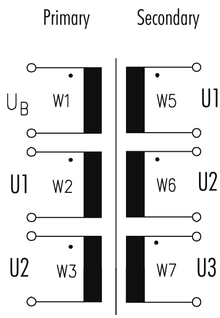
[1] Test voltage U_p (f = 50 Hz; t = 1 sec)
[2] Group Approval EN 60065/EN 60950/EN 61558-2-17

Other types on request!

A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 20/5.9

Molded E core structures





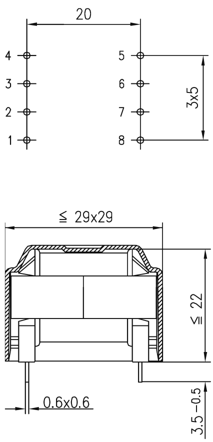
Working Fre-quency	Primary				Stand-ard	Struc-ture	U_P [1)]	Secondary					Part number
	U_B (V_{DC})		U1	U2			Prim.-Sec.	U1	U2	U3	U4	U5	
(kHz)	min	max	(V)	(V)			(kV)	(I_{max})	(I_{max})	(I_{max})	(I_{max})	(I_{max})	
100	255	358	24		VDE 0805 EN 60950	molded	3.0	24V (0.8A)					545 01 151 00

1) Test voltage U_P (f = 50 Hz; t= 1 sec)

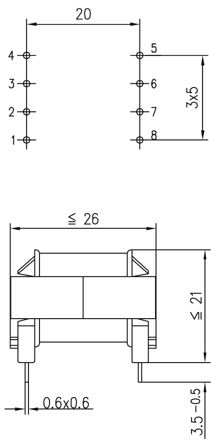
Other types on request!

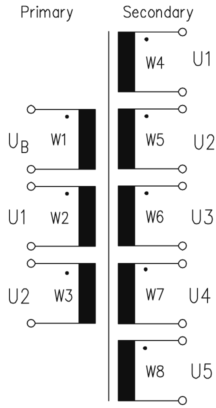
A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 25/7.5

Type A



Type B



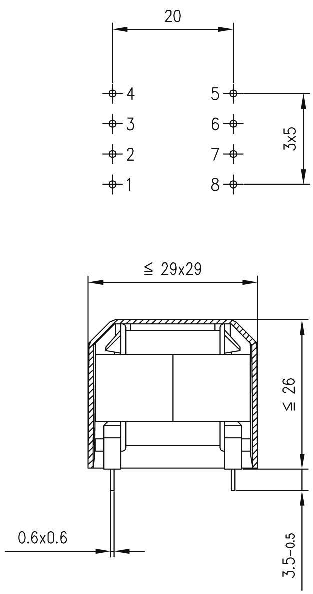


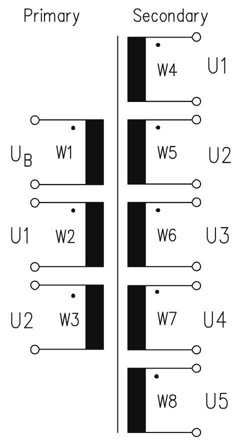
Working frequency (kHz)	Primary				Stand-ard	Struc-ture	U_P[1] Prim.-Sec. (kV)	Secondary					Part no.
	U_B (V_{DC})		U1 (V)	U2 (V)				U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
	min	max											
132	80	375	12			Type B	3.0	24V (1.25A)					545 02 150 00

[1] Test voltage U_P (f = 50 Hz; t= 1 sec)

Other types on request!

A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 25/11



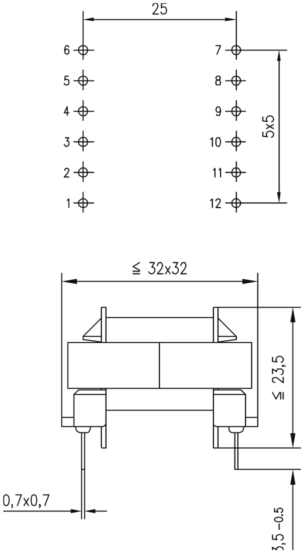


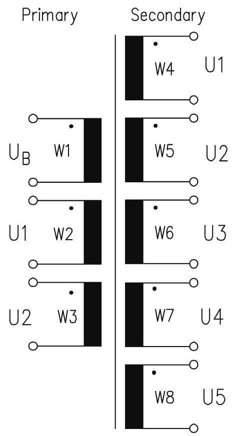
Working frequency (kHz)	Primary				Standard	Structure	U_P 1) Prim.-Sec. (kV)	Secondary					Part no.
	U_B (V_{DC})		U1 (V)	U2 (V)				U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
	min	max											
100	270	360	12		VDE 0805	molded	3.5	18V (1.3A)					545 27 XXX 00
100	290	360	12		VDE 0805	molded	3.5	5V (2.3A)					545 27 XXX 00

1) Test voltage U_P (f = 50 Hz; t= 1 sec)

Other types on request!

A4.2 FLYBACK/FORWARD CONVERTER 1-30 WATT | E 30/7.3



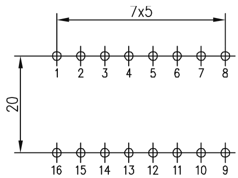


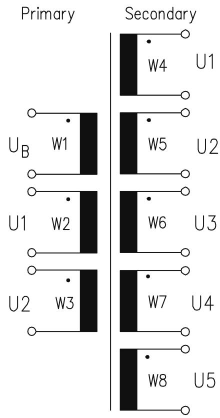
Working frequency (kHz)	Primary				Standard	U_P[1)] Prim.-Sec. (kV)	Secondary					Part no.
	U_B (V_{DC})		U1 (V)	U2 (V)			U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
	min	max										
100	120	380	12		VDE 712 (Part 24 A1) EN 60928	4.0	24V (1A)					545 03 XXX 00

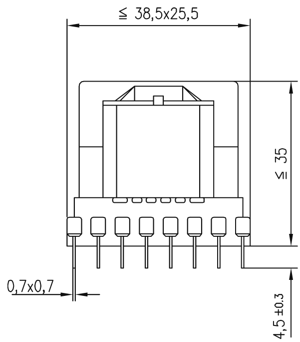
1) Test voltage U_P (f = 50 Hz; t= 1 sec)

Other types on request!

A4.3 FLYBACK/FORWARD CONVERTER 30->100 WATT | E 30/12





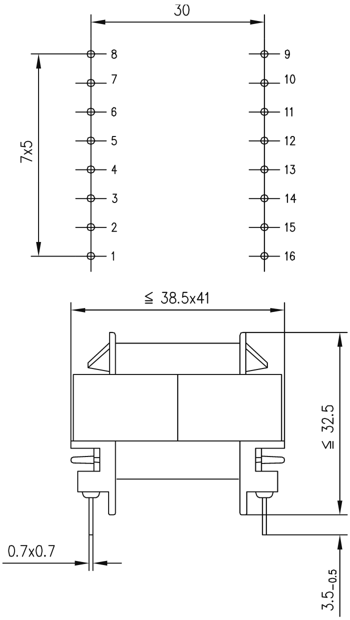


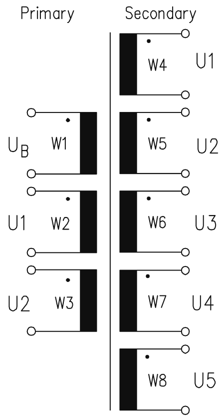
Working frequency (kHz)	Primary U_B (V_{DC}) min	Primary U_B (V_{DC}) max	Primary U1 (V)	Primary U2 (V)	Standard	U_P[1] Prim.-Sec. (kV)	Secondary U1 (I_{max})	Secondary U2 (I_{max})	Secondary U3 (I_{max})	Secondary U4 (I_{max})	Secondary U5 (I_{max})	Part no.
130	180	270	12		VDE 0860 EN 60065	3.0	25V (0.3A)	5V (1.5A)	3.3V (3A)			545 08 XXX 00
130	275	360	12		VDE 0860	3.0	12V (1.4A)	5V (2.75A)				545 08 XXX 00

[1] Test voltage U_P (f = 50 Hz; t= 1 sec)

Other types on request!

A4.3 FLYBACK/FORWARD CONVERTER 30->100 WATT | E 36/11



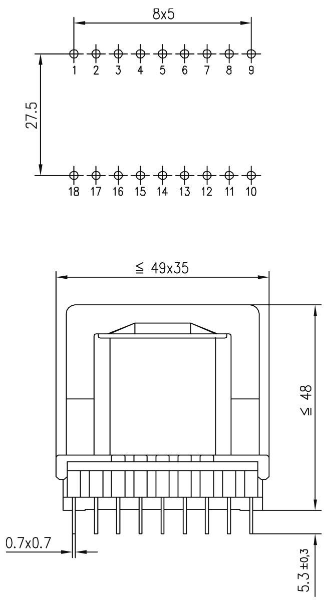


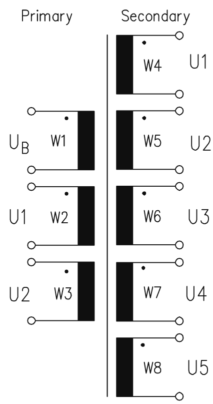
Working frequency (kHz)	Primary				Standard	U_P 1) Prim.-Sec. (kV)	Secondary					Part no.
	U_B (V) min	U_B (V) max	U1 (V)	U2 (V)			U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
100	250	370	15		EN 60950	3.0	14.5V (6A)					545 11 093 00
60	100	375	15		EN 60950 UL 60950	3.0	19V (50mA)	12V (2.9A)	5V (2.25A)			545 11 100 00

1) Test voltage U_P (f = 50 Hz; t= 1 sec)

Other types on request!

A4.3 FLYBACK/FORWARD CONVERTER 30->100 WATT | E 42/15



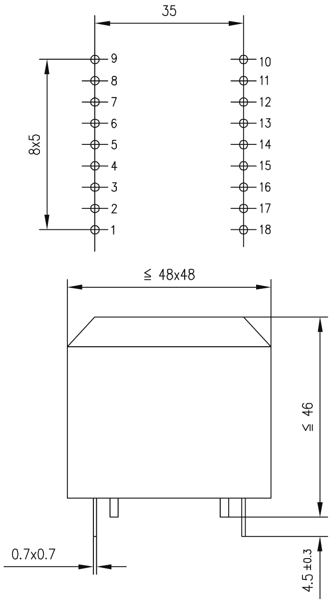


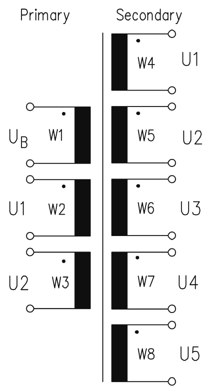
Working frequency (kHz)	Primary				Standard	U_P[1] Prim.-Sec. (kV)	Secondary					Part no.
	U_B (V_{DC}) min	U_B (V_{DC}) max	U1 (V)	U2 (V)			U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
40	180	270	12		VDE 0860 EN 60065 IEC 60065	3.0	5V (7A)	12V (1.6A)	25V (1.3A)	40V (50mA)		545 13 XXX 00

[1] Test voltage U_P (f = 50 Hz; t= 1 sec)

Other types on request!

A4.3 FLYBACK/FORWARD CONVERTER 30->100 WATT | E 42/20



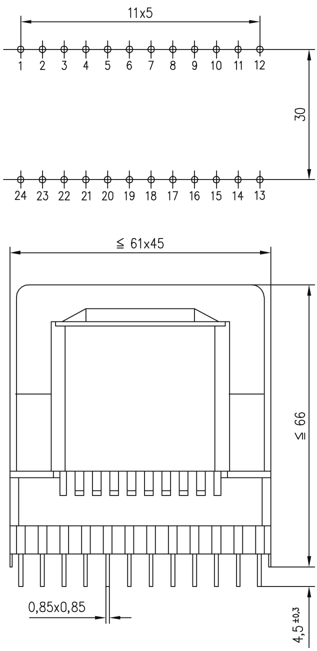


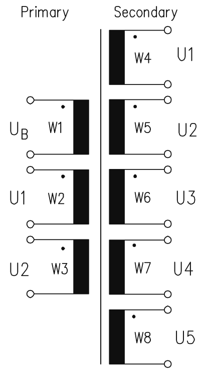
Working frequency (kHz)	Primary				Stand-ard	Struc-ture	U_P[1)] Prim.-Sec. (kV)	Secondary					Part no.
	U_B (V)		U1 (V)	U2 (V)				U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
	min	max											
50	220	420	12	15V 1A	VDE 805	molded	3.75	31V (6A)	15V (1A)				545 17 104 00

[1)] Test voltage U_P (f = 50 Hz; t = 1 sec)

Other types on request!

A4.3 FLYBACK/FORWARD CONVERTER 30->100 WATT | E 55



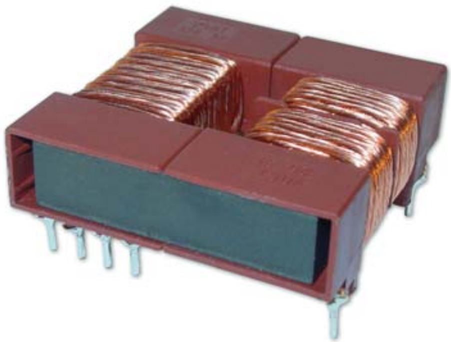


Working frequency (kHz)	Primary				Stand-ard	U_P[1] Prim. -Sec. (kV)	Secondary					Part number
	U_B (V)		U1 (V)	U2 (V)			U1 (I_{max})	U2 (I_{max})	U3 (I_{max})	U4 (I_{max})	U5 (I_{max})	
	min	max										
100	238	370	15		VDE 0805	3.0	100V (4A)	15V (0.2A)	15V (0.2A)			545 16 056 00
40	260	420	12		VDE 0551	3.75	5V (0.6A)					545 16 057 00

[1] Test voltage U_P (f = 50 Hz; t = 1 sec)

Other types on request!

A4.4 RESONANT CONVERTER (U-CORE)



Application

- Half bridge resonant mode converter
- Flat switch mode power supplies

Construction

- U core
- 2,3 or 4 chambers possible
- defined high leakage inductance

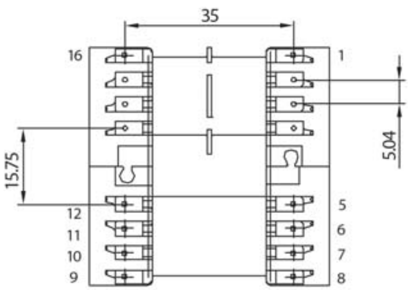
Technical data

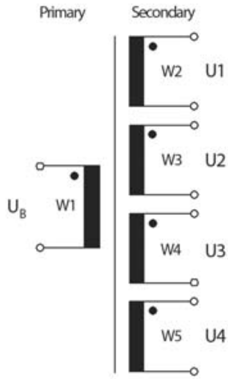
- Group approval EN 60065/EN 60950/EN 61558-2-17
- Creepage and clearance distance 8 mm
- Climate category 40/125/56 in accordance with IEC 68-1
- Insulation class B according to IEC 60085
- UL 94 V-0

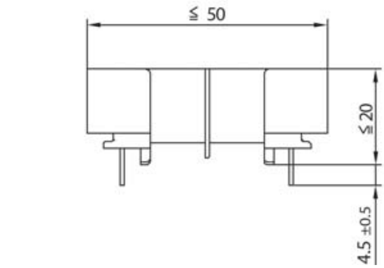
Advantages

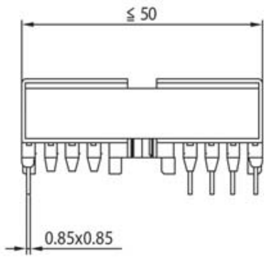
- Non-potted – environmentally friendly since no adhesives or resins are used
- Compact size, total height ≤ 20 mm
- High efficiency

A4.4 RESONANT CONVERTER (U-CORE) | U 43





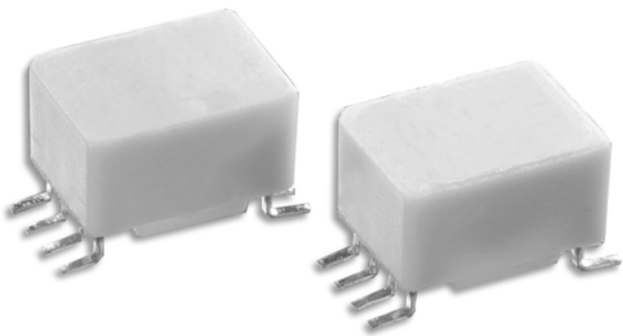




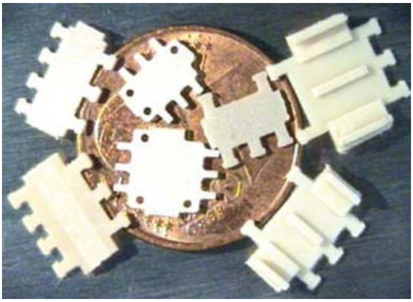
Working frequency (kHz)	Primary U_B (V_{DC}) min	Primary U_B (V_{DC}) max	Standard	U_P[1)] Prim. - Sec. (kV)	Secondary U1 (I_{max})	Secondary U2 (I_{max})	Secondary U3 (I_{max})	Secondary U4 (I_{max})	Part number
100 - 400	380	410	EN 60065 EN 60950	4.5	24 V (2.6 A)	24 V (2.6 A)	24 V (2.6 A)	24 V (2.6 A)	546 13 002 00

[1)] Test voltage U_P (f = 50 Hz; t = 2 sec)

Customer-specific types on request



A5.1 RF-TRANSFORMER

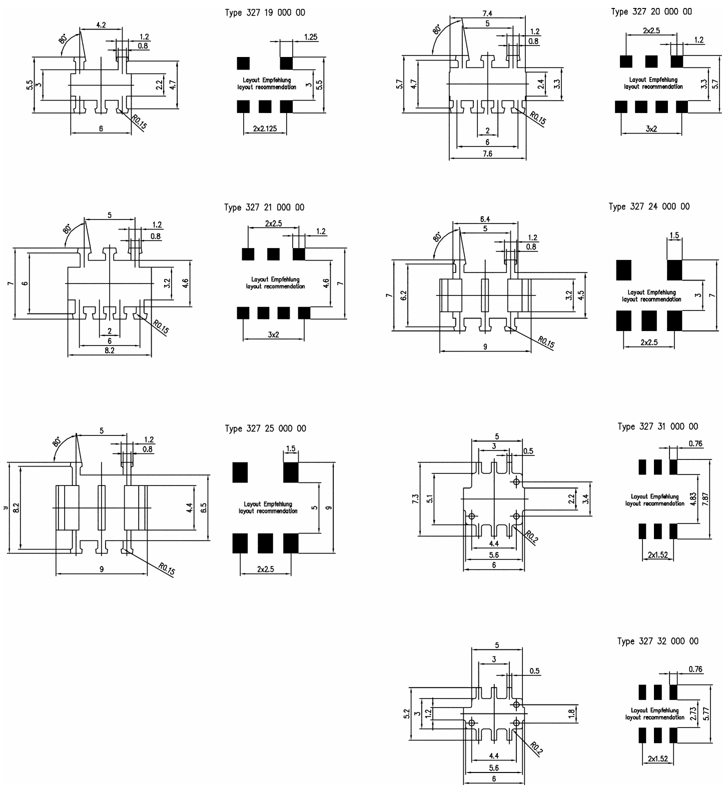


Individual design

We manufacture many customer-specific radio-frequency transformers, and therefore request that you send us your requirements.

The following base plates are available along with complete RF-transformers.

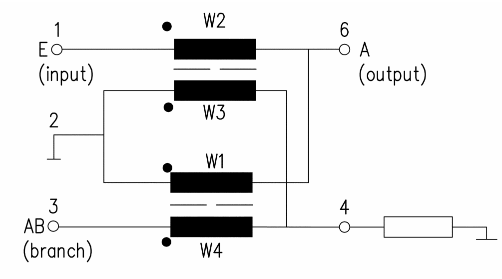
The shape and dimensions of the double-aperture cores are described in chapter **"B CORES AND KITS".**



A5.1 RF-TRANSFORMER

Example for test circuit for directional couplers

Circuit / measurement arrangement



E-A	Insertion attenuation	**S 21**
E-AB	Coupling attenuation	**S 21**
A-AB	Isolation	**S 21**

The function of directional couplers is to decouple a portion of the RF energy at defined levels **(see table)** at the branch.

A linear characteristic curve at the nominal coupling value, a high degree of directionality and low transmission attenuation allow use of directional couplers in many communications applications

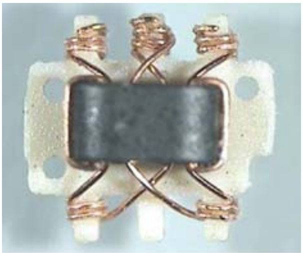
The directional couplers must allow bi-directional transmissions (e.g. interactive and multimedia applications), in order to handle future requirements.

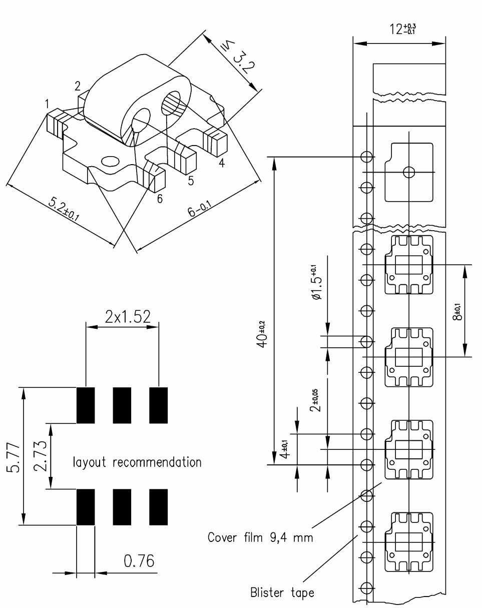
	7 dB	**10 dB**	**13 dB**	**15 dB**	**17 dB**
Broadband cable frequencies (4-862 MHz)	503 00 012 00	503 00 013 00	503 00 014 00	503 00 015 00	503 00 016 00
Satellite frequencies (47-2500 MHz)					
Expanded frequencies (4-2500 MHz)					

A5.1 RF-TRANSFORMER

New standard

Component and tape dimensions as well as layout recommendation





Technical specifications

- Compact shape
- Requires little space
- Bonded with reflow soldering
- Automatic insertion possible
- Blister pack

A5.1 RF-TRANSFORMER

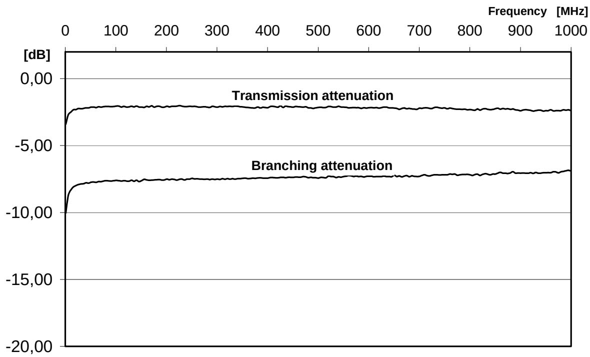
New standard

7 dB Directional coupler

Part number: 503 00 012 00

Ratio: 2 : 4 : 4 : 2

Typical values



Frequency [MHz]	Transmission attenuation [dB]	Branching attenuation [dB]
5.00	-2.84	-8.84
47.00	-2.16	-7.63
606.00	-2.22	-7.33
862.00	-2.27	-7.07

Measured with Vogt test adapter

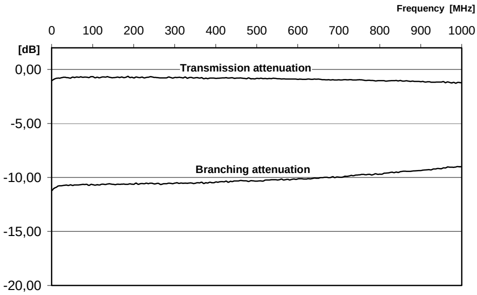
A5.1 RF-TRANSFORMER

New standard

10 dB Directional coupler

Part number: 503 00 013 00 **Ratio:** 2 : 6 : 7 : 2

Typical values



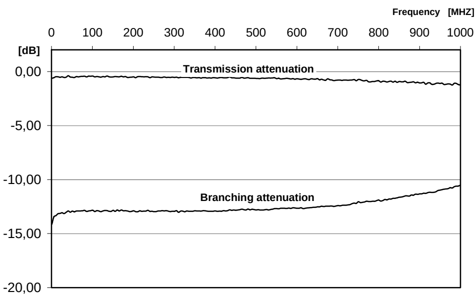
Frequency [MHz]	Transmission attenuation [dB]	Branching attenuation [dB]
5.00	-0.94	-11.03
47.00	-0.75	-10.73
606.00	-0.89	-10.20
862.00	-1.05	-9.49

Measured with Vogt test adapter

13 dB Directional coupler

Part number: 503 00 014 00 **Ratio:** 1 : 4 : 8 : 2

Typical values



Frequency [MHz]	Transmission attenuation [dB]	Branching attenuation [dB]
5.00	-0.59	-13.65
47.00	-0.50	-13.00
606.00	-0.68	-12.71
862.00	-0.96	-11.60

Measured with Vogt test adapter

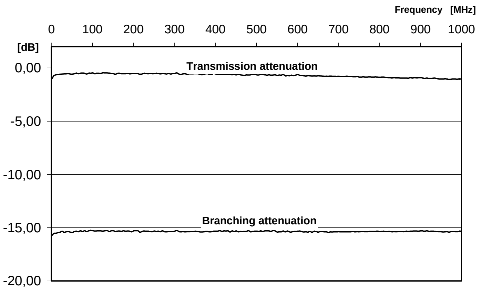
A5.1 RF-TRANSFORMER

New standard

15 dB Directional coupler

Part number: 503 00 015 00 **Ratio:** 1 : 5 : 6 : 1

Typical values



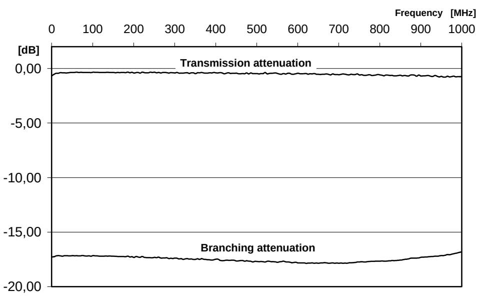
Frequency [MHz]	Transmission attenuation [dB]	Branching attenuation [dB]
5.00	-0.80	-18.59
47.00	-0.58	-15.40
606.00	-0.73	-15.35
862.00	-0.96	-15.32

Measured with Vogt test adapter

17 dB Directional coupler

Part number: 503 00 016 00 **Ratio:** 1 : 7 : 7 : 1

Typical values



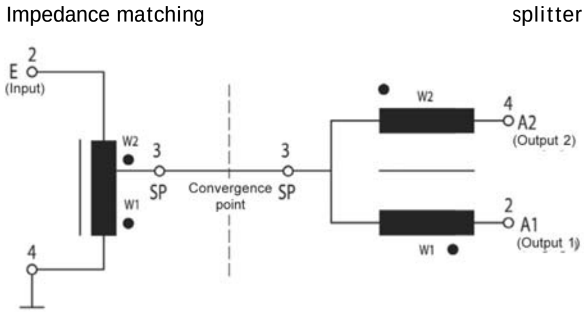
Frequency [MHz]	Transmission attenuation [dB]	Branching attenuation [dB]
5.00	-0.54	-17.23
47.00	-0.38	-17.14
606.00	-0.50	-17.83
862.00	-0.65	-17.51

Measured with Vogt test adapter

A5.1 RF-TRANSFORMER

Test circuit for power splitting with impedance matching

Test circuit



E-A1	Insertion attenuation	**S 21**
E-A2	Insertion attenuation	**S 21**
A1-A2	Isolation	**S 21**

A circuit variation combining an impedance transformer with splitter is a standard circuit in communication technology for splitting radio-frequency energy.

Splitting the power at the splitter input causes a mismatch. A corresponding impedance transformer must be placed before the splitter.

The goal is a linearized attenuation curve and good decoupling of the outputs.

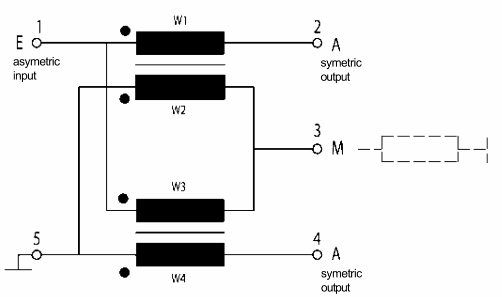
New products are in design.

Customer-specific types on request

A5.1 RF-TRANSFORMER

Test arrangement for baluns

Test circuit



Baluns convert an ungrounded symmetrical signal **(RF twin lead)** to a ground-referenced unsymmetrical signal **(coax cable).**

New products are in design.

Customer-specific types on request

A5.2 SIGNAL TRANSMISSION - APPLICATIONS

For terminals
(Telephones, fax machines, PC cards, PCMCIA cards, video telephones)

- S_0 interface transformers
- S_0 interface modules
- U_{P0} interface transformers
- U_{PN} interface transformers
- Interface transformers in general
- DSL transformers
- LAN components / 10, 100, 1.000 Base T transformers and modules

For public branch exchanges

- Interface transformers in general
- S_{2M} interface transformers
- U_{K0} interface modules
- DSL transformers

For the NTBA
(Network Termination Basic Access)

- S_0 interface transformers
- S_0 interface modules
- U_{K0} interface modules
- Transformers for DC/DC converters

For private branch exchanges (PABX)

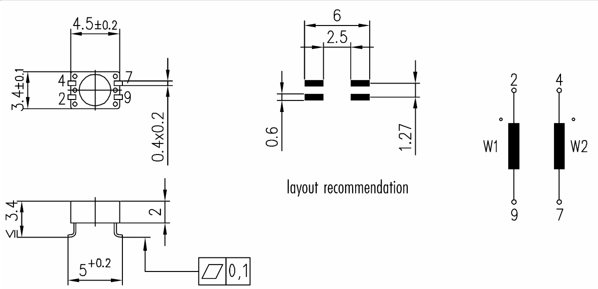
- S_0 interface transformers
- S_0 interface modules
- U_{P0} interface transformers
- U_{PN} interface transformers
- U_{K0} interface transformers
- Interface transformers in general
- Transformers for DC/DC converters
- LAN components / 10, 100, 1.000 Base T transformers and modules
-

A5.2 INTERFACE TRANSFORMER

Type K2 503 02 XXX XX

- Design: according to ITU-I.430
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

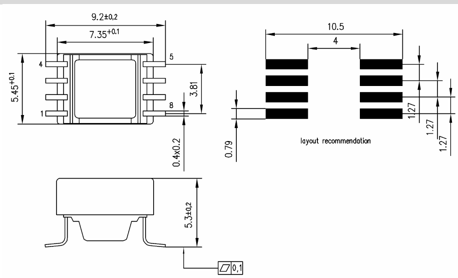
Mechanical dimensions



Type K5 503 05 XXX XX

- Design: according to ITU-I.430
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

Mechanical dimensions



Applications

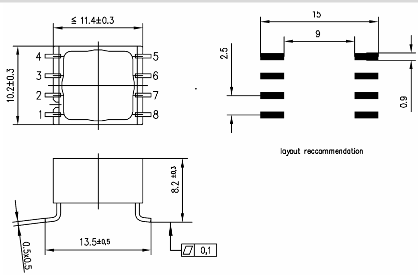
- Data – and signal line chokes

A5.2 INTERFACE TRANSFORMER

Type K10 503 10 XXX XX

- Design: according to ITU-I.430
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

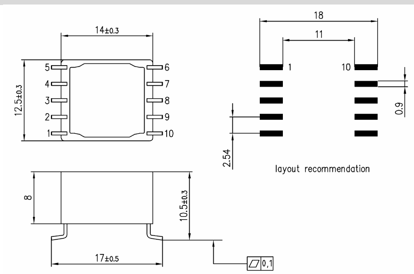
Mechanical dimensions



Type K20 503 20 XXX XX

- Design: according to ITU-I.430
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

Mechanical dimensions



Applications

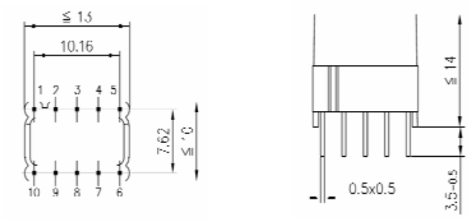
- Data – and signal line chokes
- So – interface transformers
- Line – transformers

A5.2 INTERFACE TRANSFORMER

Type K21 543 21 XXX XX

- Design: according to ITU-T G.703
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

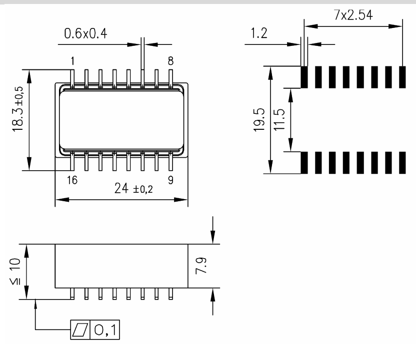
Mechanical dimensions



Type K74 503 74 XXX XX

- Design: according to ITU-I.430
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

Mechanical dimensions



Applications

- Data – and signal line chokes
- So – interface transformers
- Line - transformers

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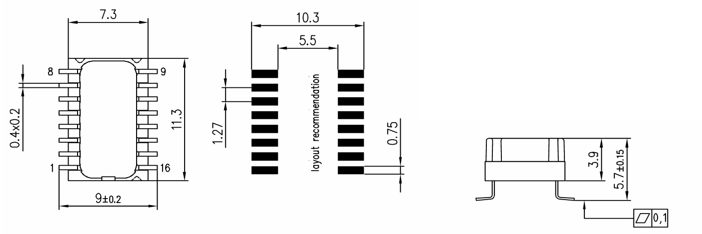
A5.2 INTERFACE TRANSFORMER

Type S016 (RM 1.27 mm) 503 16 XXX XX

- Design: according to ITU-T G.703
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

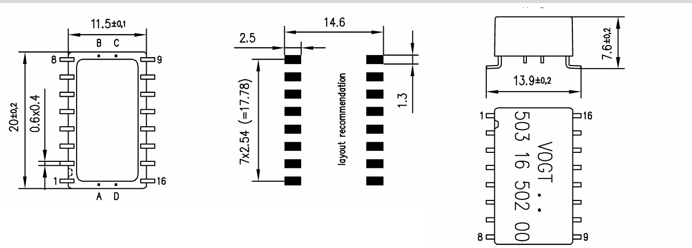
Mechanical dimensions



Type S016 (RM 2.54 mm) 503 16 XXX XX

- Design: according to ITU-I.430
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

Mechanical dimensions



Applications

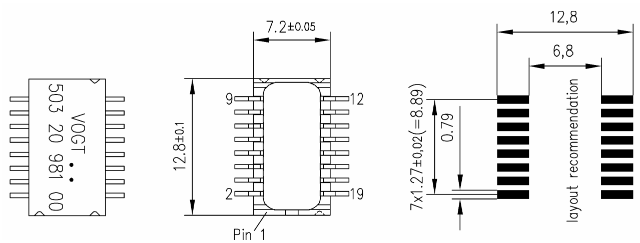
- 10, 100, 1.000 Base T modules
- Data – and signal line modules
- So – interface modules

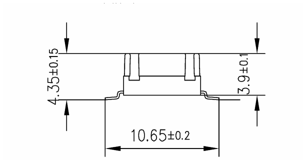
A5.2 INTERFACE TRANSFORMER

Type S020 503 20 XXX XX

- Design: according to ITU-I.430
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

Mechanical dimensions



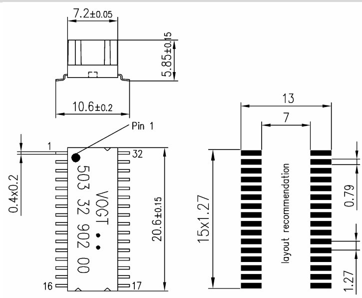


A5.2 INTERFACE TRANSFORMER

Type S032 503 32 XXX XX

- Design: according to ITU-T G.703
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950
-

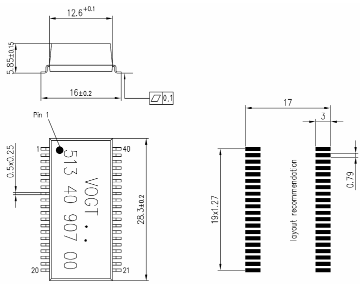
Mechanical dimensions



Type S040 513 40 XXX XX

- Design: according to ITU-T G.703
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

Mechanical dimensions



Applications

- 10, 100, 1.000 Base T modules
- Data – and signal line modules
- So – interface modules

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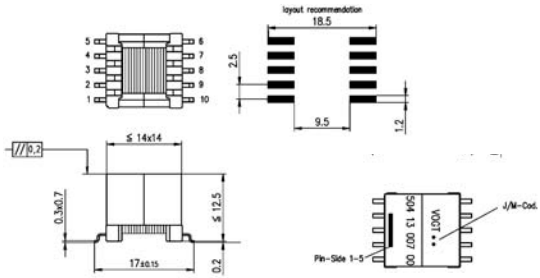
A5.2 INTERFACE TRANSFORMER

Type EP13 SMD 504 13 XXX XX

- Design: according to ITU-T G.691
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

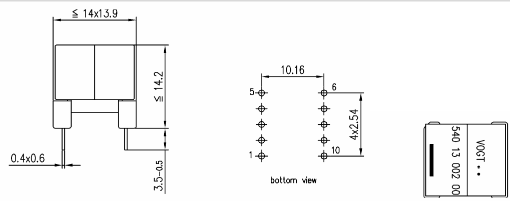
Mechanical dimensions



Type EP13 THD 540 13 XXX XX

- Design: according to ITU-T G.691
- Climate category: according to IEC 68-1 25/85/56
- Dielectric strength: according to EN-60950

Mechanical dimensions



Applications

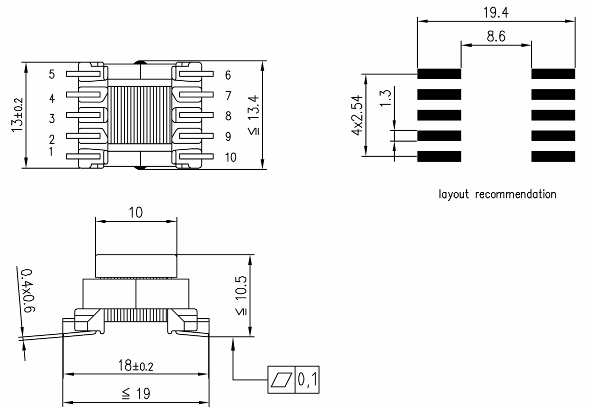
- DSL Transformers
- DSL Filter Coils
- Transformers for DC/DC Converters
- Interface Transformers

A5.2 INTERFACE TRANSFORMER

Design EF12/6 505 03 XXX XX

- Climate category: in accordance with IEC 68-1 25/85/56
- Dielectric strength: in accordance with EN-60950

Mechanical dimensions



Applications

- Line Transformers
- Interface Transformers
- Upn Transformers
- Transformers for DC/DC Converters

A6.1 TRANSFORMERS

Name	
Department	
Company	
Street	
Zip/City/Country	
Phone	
Fax	
E-Mail	
Series start	
Quantity per year	
Target price	
Deadline for samples	
Application	

Technical Data:

Mode:

☐ Flyback converter ☐ Forward converter ☐ Others

☐ Push-pull converter ☐ Half-bridge converter

Test voltage/nec. Standards

Standards to be applied (e. g. VDE0805, EN60950)		
Type of isolation (e. g. functional, basic, reinforced isolation)		
Rated voltage of the supply circuit		Veff
Working or rated isolation voltage primary to secondary		Veff
Input power	max.	VA
Rated switching frequency	max.	kHz
Peak voltage (with overshoots)	max.	V_S

Pollution degrees in the instrument	☐ = no contact ☐ = middle ☐ = heavy pollution
Overvoltage category	☐ I ☐ II ☐ III
Flammability class from used materials according to UL 94	☐ V0 ☐ V1 ☐ V2 ☐ HB ☐ no
System of insulating materials UL 1446 (specify temperature class)	

Driver			
Frequency	Fixed/min.	max.	kHz
Duty cycle	min.	max.	%
Input voltage	min.	max.	V
Ambient temperature on the transformer			°C
Maximal dimensions	l x	w x	h mm
Prefered Kit			

Circuit diagram

Primary:			Secondary:		
W1:	U:	I:	W1:	U:	I:
W2:	U:	I:	W2:	U:	I:
W3:	U:	I:	W3:	U:	I:
W4:	U:	I:	W4:	U:	I:
W5:	U:	I:	W5:	U:	I:
W6:	U:	I:	W6:	U:	I:
W7:	U:	I:	W7:	U:	I:
W8:	U:	I:	W8:	U:	I:
W9:	U:	I:	W9:	U:	I:

Comment:

On request, the checklist is also available as pdf-file or on our homepage: www.sumida-eu.com

A6.2 CHOKES

Name	
Department	
Company	
Street	
Zip/City/Country	
Phone	
Fax	
E-Mail	
Series start	
Quantity per year	
Target price	
Deadline for samples	
Application	

Technical Data:

☐ Output choke ☐ Noise suppression choke ☐ Common mode choke

☐ PFC-choke: Input voltage in V: min. /max. , Output DC power in VA:

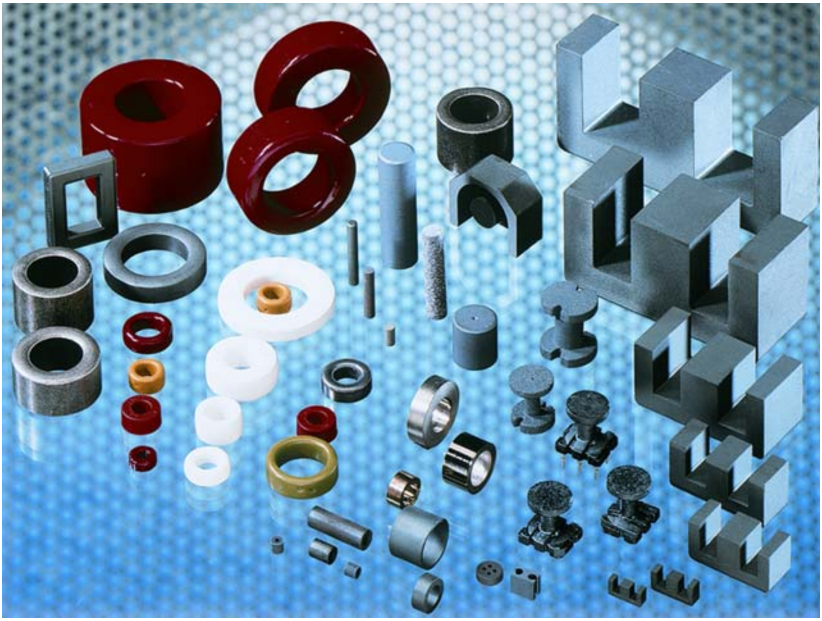
Inductance (no-load/load)	☐ µH, ☐ mH, ☐ H
Switching frequency	kHz
Peak current	A
Effective current	A
Current ripple	%
DC resistance	Ohm
Ambient temperature oh the choke	max. °C
Maximal dimensions	l x w x h mm

Circuit diagram

Primary:	Secondary
W1: U: I:	W1: U: I:
W2: U: I:	W2: U: I:
W3: U: I:	W3: U: I:
W4: U: I:	W4: U: I:
W5: U: I:	W5: U: I:
W6: U: I:	W6: U: I:
W7: U: I:	W7: U: I:
W8: U: I:	W8: U: I:
W9: U: I:	W9: U: I:
W10 U: I:	W10 U: I:
W11 U: I:	W11 U: I:
W12 U: I:	W12 U: I:

Comment:

On request, the checklist is also available as pdf-file or on our homepage: www.sumida-eu.com



OVERVIEW

- MnZn ferrite
- NiZn ferrite
- Plastoferrite
- Injection molding ferrite
- Metal powder cores

ADVANTAGES

- Many different material grades and core-shapes are available
- Flexibility due to small volume production and own R&D department
- Fast supply of samples
- Individual solutions (special core shapes, ferrite applications)
- Own development and research in the field of magnetic materials
- Small quantities are available due to flexible powder production
- Direct sale of cores
- Large cores
- Secure supply chain in the case of a shortfall of magnetic cores on the market
- R&D-package of inductive components and material

B1.1 FERROCARIT | OVERVIEW

List of used Symbols, designations and units:

Symbol	Designation	Unit
A	Cross-sectional area of magnetic path in general	mm^2
A_e	Effective cross-sectional area	mm^2
A_L	Inductance factor	nH
A_W	Cross-sectional area of winding space	mm^2
a_F	Relative temperature factor of permeability	$10^{-6} \cdot K^{-1}$
B	Magnetic induction, flux density	T
$\hat{B}$	Peak value of induction	T
D_F	Relative disaccomodation factor	10^{-6}
η_B	Hysteresis material constant	$10^{-6} \cdot mT^{-1}$
f	Frequency in general	Hz
f_{in}	Input frequency	Hz
H	Magnetic field strength	A/m
$\hat{H}$	Peak value of magnetic field strength	A/m
H_c	Coercivity	A/m
H_e	Effective magnetic field strength in the core	A/m
I	Current intensity	A
K	Coupling factor	1
L	Inductance in general	H
L_0	Inductance of a coil without core	H
L_K	Inductance of a coil with core	H
l	Magnetic path length	mm
l_e	Effective magnetic path length	mm
l_W	Mean winding length	mm
$\Sigma \frac{l}{A} = C_1$	Magnetic core constant	mm^{-1}
$\Lambda_o = c$	Permeance factor	nH
μ	Permeability in general	1

Symbol	Designation	Unit
μ_a	Amplitude permeability	1
$\mu_w = \mu_{app}$	Apparent permeability	1
μ_e	Effective permeability	1
μ_i	Initial permeability	1
μ_o	Absolute permeability of vacuum = $4 \cdot \pi \cdot 10^{-7}$	T · m/A
$\underline{\mu}$	Complex permeability	1
μ_Δ	Incremental permeability	1
n	Number of winding turns	1
P_v	Relative core dissipation power	mW/cm^3
Q	Coil quality factor	1
Q_o	Zero-load quality factor	1
R_v	Loss resistance	Ω
$R_=$	DC-resistance	Ω
ρ	DC-resistivity	Ω · m
s	air gap	mm
t	time	s
tanδ	loss factor in general	1
$\tan\delta_h$	Hysteresis loss factor	1
$\tan\delta_l$	Coil loss factor	1
$\tan\delta_n$	Loss factor due to residual losses	1
$\tan\delta_w$	Loss factor due to eddy current	1
tanδwi	Loss factor due to winding loss	1
$\tan\delta / \mu_i$	Relative loss factor	10^{-6}
ϑ / T	Temperature in general	°C
ϑ_c	Curie temperature	°C
V_e	Effective magnetic volume	mm^3
$\lvert\dot{z}\rvert$	Specific impedance	Ω/cm

Terms and Definitions

A list of the symbols and units used in this catalogue is given above.

Most of the equations used in the following passages are equations of quantities. Where other kinds of equations are given please use the units listed next to them.

1 Permeability

1.1 Magnetic field constant μ_O

$$\mu_O = 1{,}257 \cdot 10^{-6} \qquad T \cdot m \cdot A^{-1}$$

The quantity μ_O is also called the Absolute permeability of vacuum.

In contrast to μ_O the permeabilities defined below are relative quantities. They are related to μ_O and represent plain numerical values without dimensional units.

1.2 Initial permeability μ_i

μ_i is the permeability of a magnetic material at an infinitely small amplitude of the magnetizing field, measured without pre magnetization and without exterior shearing influence:

$$\mu_i = \frac{1}{\mu_O} \cdot \frac{\Delta B}{\Delta H} \qquad (H = 0; \quad \Delta H \rightarrow 0)$$

In practice μ_i is derived from the inductance of a toroidal core coil:

$$\mu_i = \frac{1}{\mu_O} \cdot \frac{L}{n^2} \cdot \frac{l}{A}$$

L in µH

l in mm

A in mm^2

With cores of closed magnetic circuit having changing cross-sectional areas along the magnetic path length, the expression l/A has to be replaced by Σ l/A (core constant C_1).

$$\mu_i = \frac{1}{\mu_O} \cdot \frac{L}{n^2} \cdot \sum \frac{l}{A}$$

This equation is valid only for cores without any magnetic shearing. It should be recognized, however, that composite cores (e.g. pot or E-cores) must be considered as slightly sheared, even if they are declared as non-gapped.

The initial permeability is also called toroidal or material permeability. Over a wide range μ_i is independent on frequency. On our material data tables $f_{0,8}$ marks that frequency at which μ_i decreases to 80% of the tabulated value.

1.3 Effective permeability μ_e

If in a closed magnetic circuit an air gap exists (shearing) the initial permeability is reduced to a smaller value called effective permeability μ_e.

The effective permeability μ_e equals the initial permeability μ_i of a core material which unsheared with the same shape of core, the same course of magnetic flux, and under equal measuring conditions would give the same electrical performance. Because of the presupposition of the same course of the magnetic flux μ_e is applicable only to cores with relatively high permeability, which are but slightly sheared so that the magnetic stray field remains negligible. This presupposition is fulfilled e.g. with pot or E-cores having customary air gap.

The quotient μ_e/μ_i is called the shearing ratio.

With the aid of μ_e and of the material characteristics shown on the material data tables all important properties of a coil (e.g. losses, thermal performance, temporal instability - see sections 4, 6, and 7) are easily calculable.

If the effective permeability μ_e of a core is unknown, it can be found out by an inductance measurement and by making use of the reduced magnetic conductivity Λ_o, also called permeance factor c (see section 3).

$$\mu_e = \frac{10^6 \cdot L}{n^2 \cdot \Lambda_0}$$

L in mH
Λ_0 in nH

The numerical values of c are contained in the data sheets of the appropriate core types.

A merely mathematical way of ascertaining μ_e may be used, if the initial permeability μ_i of the core material, the core constant $C_1 = \Sigma\ l/A$, the air gap length s, and the magnetic cross-sectional area A_s in the gap are known:

$$\mu_e = \frac{\mu_i}{1 + \frac{s}{A_s \quad \Sigma \frac{l}{A}}(\mu_i - 1)} = \frac{\mu_i}{1 + \frac{s \cdot \Lambda_O}{A_s \cdot \mu_O}(\mu_i - 1)}$$

s in mm
As in mm²
$\Sigma \frac{l}{A}$ in mm^{-1}

1.4 Apparent permeability μ_{app}

The ratio of the inductance L_k of a cored coil and the inductance L_O of the same coil without core is called apparent permeability μ_{app}.

$$\mu_{app} = \mu_w = \frac{L_k}{L_O}$$

μ_{app} is used with coils having magnetically open cores (strong shearing) with large stray fields, as e.g. rod, tube, or screw cores. The numerical values of μ_{app} depend not only on core material and core shape, but also on the kind of winding and its position relatively to the core. μ_{app}-values are comparable only if evaluated under equal measuring conditions.

1.5 Amplitude permeability μ_a

The amplitude permeability is defined by the equation

$$\mu_a = \frac{1}{\mu_O} \cdot \frac{\hat{B}}{\hat{H}}$$

where sinusoidal induction being assumed.
The numerical values of μ_a as well the measuring conditions under which they were evaluated are contained in the respective data sheets of the appropriate cores, as e.g. E- or U-cores.

1.6 Incremental permeability μ_Δ

It corresponds to the amplitude permeability μ_a with pre-magnetization and is defined by the equation

$$\mu_\Delta = \frac{1}{\mu_O} \cdot \frac{\Delta B}{\Delta H}$$

The incremental permeability is usually understood to be a function of a DC. pre-magnetization by a fieldstrengh H_. In order to evaluate μ_Δ the alternating field ΔH is rated in such a way that the alternating induction ΔB for any value of the pre-magnetizing field H_ remains constant, e.g. 10 mT.

1.7 Complex permeability $\underline{\mu}$

In alternating-current engineering complex values are used for describing the phase position. A perfectly lossless coil with a core of permeability μ causes a phase shift of 90° between voltage U and current I. In complex writing this is described as follows (concerning the introduction of Λ_O for describing the core geometry of any core shape see paragraph 3.2):

$$\frac{\underline{U}}{\underline{I}} = \underline{Z} = j\omega L = j\omega \Lambda_O n^2 \mu$$

If in the core material losses are occurring, an active resistance R is added to the reactance jωL, which causes a diminution of the phase angle 90° by the angle δ, usually described by:

$$\tan\delta = \frac{R}{\omega L}.$$

In this case the complex writing is as follows:

$$\frac{\underline{U}}{\underline{I}} = \underline{Z} = R + j\omega L = j\omega L \ (1 - j\tan\delta) = j\omega\Lambda_O n^2 \underline{\mu} \qquad (2)$$

$$\text{with} \quad \underline{\mu} = \mu(1 - j\tan\delta) = \mu'_s - j\mu''_s$$

The phase shift is described by a complex permeability. Its real and imaginary parts are usually described by μ'_s and μ''_s (the index s shall indicate that active resistance and reactance are connected in series).
Hence follows:

$$\mu'_s = \frac{L}{\Lambda_O n^2} \qquad (3)$$

$$\mu''_s = \mu'_s \ \tan\delta = \frac{R}{\omega\Lambda_O n^2}$$

For toroids is valid:

$$L = n^2 \Lambda_O \mu_i$$

Hence follows:

$$\mu`_s = \mu_i$$

and

$$\mu''_s = \frac{R}{\omega L} \cdot \mu_i = \tan\delta \cdot \mu_i$$

The diagrams for **FERROCARIT**-materials in this catalogue are presenting the complex permeability in series connection, measured on toroids.

The real component μ'_s of those diagrams corresponds to the initial permeability μ_i of the material. The dependence of the initial permeability from the frequency is directly obvious. It has to be noted that from a certain frequency the initial permeability gradually decreases.

μ''_s is particularly of interest for wide-band applications (transformers, attenuation chokes): at each frequency you can read from the relation μ''_s / μ'_s the share of the losses and of the pure inductance in relation to the total impedance or attenuation.

At that frequency, where the curves μ'_s and μ''_s are intersecting, both contributions are equal. In the frequency range below, the inductance contribution is determining. Above, the inductive effect is decreasing and the attenuating effect is increasing by energy absorption. As by decreasing μ'_s the magnetization processes are disappearing, the losses caused by that are also disappearing.
For the circuit design it is often useful to consider the admittance instead of the impedance and to describe it as parallel connection of a resistance Rp and an inductance Lp. From (2) follows:

$$\underline{Y} = \frac{1}{\underline{Z}} = \frac{1}{R_p} + \frac{1}{j\omega L_p} = \frac{1}{j\omega \Lambda_O n^2 \underline{\mu}} \qquad (4)$$

$$\text{or} \qquad \frac{1}{\underline{\mu}} = \frac{n^2 \Lambda_O}{L_p} + j\frac{\omega n^2 \Lambda_O}{R_p} = \frac{1}{\mu'_p} + j\frac{1}{\mu''_p}$$

From this results analogues to (3) simple relations for the values μ'_p and μ''_p follow:

$$\mu'_p = \frac{L_p}{n^2 \Lambda_O} \qquad (5)$$

$$\mu''_p = \frac{R_p}{\omega n^2 \Lambda_O}$$

From (3) and (5) follows:

$$\mu'_p = \mu'_s \ (1 + \tan^2\delta)$$

$$\mu''_p = \mu''_s \ (1 + \frac{1}{\tan^2\delta})$$

In the diagrams for **FERROCARIT**-materials in this catalogue curves of the complex permeability for parallel connection are shown, sometimes they are described as products $\omega\mu'_p$ and $\omega\mu''_p$, for easier calculating transformers.

Also in this case the influence of the inductance is equal to the influence of the losses by the intersection of both curves for the admittance value of the transformer.

1.8 Specific impedance $|\dot{z}|$

The suppression quality of a component is essentially specified by its impedance:

$$Z = j\omega L + R$$

The amount of impedance includes a material specific component $|\dot{z}|$:

$$|Z| = \frac{A_e}{l_e} \cdot N^2 \cdot |\dot{z}|$$

This material specific impedance can be formulated as follows:

$$|\dot{z}| = \mu_0 \omega \sqrt{\mu'^2 + \mu''^2}$$

2. Effective magnetic parameters

They are applicable only to cores of a closed magnetic circuit (e.g. pot, E-, and U-cores), having changing cross-sectional areas along the magnetic path length. They are also applicable to sheared cores having negligible magnetic stray fields.

The effective parameters permit a simple way of calculating the magnetic properties of closed cores of arbitrary geometry. For this method of calculation, the core is substituted by an ideal toroid giving the same magnetic performance as the original core. (IEC publication 205)

2.1 Core constant C_1

C_1 results from the summation of the quotients of the partial magnetic path lengths l and the corresponding cross-sectional areas A of a core of closed magnetic circuit subdivided into uniform sections:

$$C_1 = \Sigma \frac{l}{A}$$

2.2 Effective magnetic path length l_e

l_e is defined by the equation:

$$l_e = \frac{(\Sigma \frac{l}{A})^2}{\Sigma \frac{l}{A^2}}$$

2.3 Effective cross-sectional area A_e

A_e is defined by the equation:

$$A_e = \frac{\Sigma \frac{l}{A}}{\Sigma \frac{l}{A^2}}$$

2.4 Effective magnetic volume V_e

From $l_e \cdot A_e$ results:

$$V_e = \frac{\left(\Sigma \frac{l}{A}\right)^3}{\left(\Sigma \frac{l}{A^2}\right)^2}$$

The numerical values of the effective parameters are given on the data sheets of cores of closed magnetic circuit.

3. Inductance factor and Permeance factor

3.1. Inductance factor A_L

A_L is used to calculate the number of winding turns of a coil in order to achieve a given inductance L with cores of closed magnetic circuit with cores of closed magnetic circuit with or without air gap.

$$A_L = \frac{L}{n^2} = \mu_e \frac{\mu_O}{\Sigma \frac{l}{A}}$$

Thus A_L is the inductance L related to one winding turn (w=1). It is usually given in nH. To strongly sheared core shapes A_L is only applicable, if the kind of winding and the position of the winding relatively to the core are exactly defined. As this holds true for our coil kits, A_L-values are given on the appropriate data sheets. They are approximate values supposing the coil formers to be nearly fully wound.

The inductance factor A_L is not applicable to magnetic circuits with large stray fields, e.g. rod or screw cored coils.

3.2 Permeance factor c

If the expression

$$A_L = \mu_e \frac{\mu_O}{\Sigma \frac{l}{A}}$$

is reduced to $\mu_e = 1$, the portion conditioned by the core material is eliminated. The rest conditioned only by the core configuration represents the Permeance factor c which may be derived also from the magnetic field constant and the core constant C_1.

$$c = \Lambda_O = \frac{A_L}{\mu_e} = \frac{\mu_O}{\Sigma \frac{l}{A}}$$

$$\text{From } A_L = \frac{L}{n^2} \text{ and } c = \frac{A_L}{\mu_e} \text{ results:}$$

$$L = n^2 \cdot \mu_e \cdot c$$

Thus the inductance L of a closed magnetic circuit depends on three factors, one being conditioned by the winding (n^2), another one by the core material (μ_e, which takes into account an eventual air gap), and a third one by the core configuration Λ_O.

This fundamental relation holds true for any calculation concerning the selection of core shape, core material, and winding of magnetic circuits.

4. Loss at small magnetizing force

4.1 Loss angle $\tan\delta_L$ and Quality factor Q:

When small magnetizing forces predominate in electronics (small signal applications), the total loss of a coil can be expressed by the loss angle

$$\tan\delta_L = \frac{R_V}{2\pi \cdot f \cdot L}$$

The loss resistance R_V is supposed to be in series to the no-loss inductance L. From R_V and the effective coil current I the dissipation power $R_V \cdot I^2$ may be easily calculated.

The reciprocal value of the loss angle is called Quality factor Q:

$$Q = \frac{1}{\tan\delta_L} = \frac{2\pi \cdot f \cdot L}{R_V}$$

The total loss angle of a coil is composed of different loss portions originating from the core, the winding, and possibly from a screening:

$\tan\delta_L = \tan\delta_h + \tan\delta_w + \tan\delta_n + \tan\delta_{wi}$

Hysteresis loss	$\tan\delta_h$	Residual loss	$\tan\delta_n$
Eddy current loss	$\tan\delta_w$	Winding loss	$\tan\delta_{wi}$

4.2 Hysteresis loss

4.2.1 Hysteresis coefficient

At small magnetizing forces, where the Rayleigh relations are valid, there is a practically linear increase of hysteresis loss as a function of field strength or flux density respectively.

$$\tan\delta_h = \eta_B \cdot \hat{B} \cdot \mu_i$$

According to the IEC publication 401 the linearity constant η_B is called hysterersis material constant.

4.2.2 Hysteresis material constant

For determining the hysteresis material constant two measurement points at low induction $\hat{B}_1$ and $\hat{B}_2$ are relevant

$\tan\delta(\hat{B}_1)$; $\hat{B}_1 = 1{,}5$ mT
$\tan\delta(\hat{B}_2)$; $\hat{B}_2 = 3{,}0$ mT

The measurement of the loss angle $\tan\delta$ is performed at a frequency f=10 kHz for $\mu_i \leq 500$ and f=100 kHz for $\mu_i > 500$.

η_B now can be calculated by

$$\eta_B = \frac{\tan\delta(\hat{B}_2) - \tan\delta(\hat{B}_1)}{\mu_i \cdot (\hat{B}_2 - \hat{B}_1)}$$

The equation given above holds for homogeneous toroids. When sheared cores with negligible stray field are used, μ_i is to be replaced by μ_e.

4.3. Eddy current, Residual loss and Relative loss factor $\tan\delta/\mu_i$

The loss factor related to $\mu_i = 1$ is ascertained by loss angle measurements at two magnetizing forces and by extrapolation to H = 0. Magnetizing forces for the tabulated values of our material data sheets are 0,1 and 0,5 Am^{-1}.

By extrapolation of the magnetizing force to zero, loss caused by this force (hysteresis) becomes zero too. Thus the relative loss factor $\tan\delta/\mu_i$ is a characteristic for the remaining eddy current and residual losses.
If gapped cores with negligible stray field are used, the loss factor becomes effective with the shearing ratio μ_e/μ_i.

Therefore the tabulated $\tan\delta/\mu_i$ values are to be multplied with μ_e.

4.4 Winding loss $\tan\delta_{wi}$

Winding loss is composed of copper loss, eddy current loss in the conductor material, and dielectric loss due to the intrinsic capacity of the winding.

Copper loss results from the ohmic resistance of the conductor material and the resistance increase due to skin effect. The ohmic resistance can be deduced from the nominal conductor diameter D, the mean length of winding turn l_w, the number of turns n, and the resistivity of the conductor material. The increase of resistance due for skin effect is involved by the dimensionless value ß which is the relation of the effective cross section caused by skin effect to the physical one of the wire. For low frequency ß is equal to 1. The total copper loss can be calculated by the aid of the following equation:

$$\tan\delta_{wi} = 3{,}5 \cdot 10^{-6} \frac{l_w \cdot n \cdot ß}{D^2 \cdot f \cdot L}$$

l_w in mm
D in mm
f in Hz
L in H

This formula may be used, if dielectric loss is negligibly small. This is true of cores of closed magnetic circuit like pot or E-cores, made out of high-permeability materials and used at frequencies up to 100 kHz.

There exists no practicable formula for calculating dielectric loss conditioned by the intrinsic capacity of the winding at higher frequencies.

4.5 Screening loss

If coils are screened, eddy current loss within the screening material must not be neglected. It depends on the extent of the stray field, the distance between coil and screening can, the screening material and the operating frequency. As there exists no practicable formula for calculation of screening loss, empirical ascertainment or advanced computer simulation such as FEM is recommended.

If high permeability cores of closed magnetic circuit are used screening may often be dispensed with.

5 Power loss at high magnetizing force

Inductors and transformers for power application use to take strong current loads. Magnetizing force and flux density then are beyond the Rayleigh range with its simple linear relations between these two quantities.

5.1 Bipolar losses at high magnetizing force

In our data sheets of cores designed for power application the total power loss in W as well as the specific power loss in $mW \cdot cm^{-3}$ is given for defined values of frequency, flux density, and temperature.

The dependence of power loss on frequency f and peak flux density within the ranges of frequency and current used in electronic power applications, is expressed by an empirical formula (Steinmetz relation). P_V being the specific power loss, i.e. the power loss related to the unit of volume, this formula reads:

$$P_V = K \cdot f^a \cdot B^b \qquad \begin{array}{l} K = \text{const} \\ a \approx 1 \ldots 2 \\ b \approx 2 \ldots 3 \end{array}$$

P_V is given in $mW \cdot cm^{-3}$. K is a constant, a and b are constant powers to f and B. The quantities K, a and b ascertained by loss measurements at different frequencies and flux densities. Where in our core data sheets the dependence of loss on frequency and flux density is specified, the graphs are in accordance with the formula given above.

5.2 Unipolar losses at high magnetizing force

If an inductive component is forced by a DC - magnetization with an additional AC - component so called unipolar losses are induced in the core material. These losses depend on the amplitude of DC - magnetization, which defines the working point on the magnetization curve of the core material, and the frequency and amplitude of the alternating field component.

This application is typical for output chokes. Therefore in our data sheets for the preferred **FERROCART** materials for output chokes unipolar power loss values are given for different frequencies and ripple percentages. Ripple is defined as ratio of peak-to-peak value of the AC- to amplitude of the DC - component.

6. Temperature-dependence of Inductance, Temperature Factor of Permeability α_F

The temperature-dependent alternations of initial permeability are described by the relative temperature factor, i.e. the alternation per Kelvin. In accordance with IEC-publication 401 for this quantity the symbol α_F is used, the signification of which is identical with the former expression α_μ/μ_i

α_F is ascertained from measurements of the initial permeabilities μ_{i1} and μ_{i2} at the temperatures ϑ_1 and ϑ_2

The values indicated in our material table were achieved by measurements at 20°C and 70°C

$$\alpha_F = \frac{\mu_{i_2} - \mu_{i_1}}{\mu_{i_1} \cdot \mu_{i_2} \left(\vartheta_2 - \vartheta_1\right)}$$

If coils with gapped cores and negligible stray field are used, the tabulated α_F -values must be multiplied by μ_e. The alteration of inductance of such a coil caused by changes of temperature may be calculated by aid of the formula:

$$\frac{\Delta L}{L} = \alpha_F \cdot \mu_e \cdot \Delta\vartheta$$

This equation is not applicable to coils with large stray fields as e.g. rod or screw cored coils. The temperature performance of such a coil depends not only on the temperature factor of the core but also, in a proportion not be neglected, on the temperature performance of the winding and of the whole assembly.

In cases of this kind α_F cannot be more than an aid to comparison of different core materials.

7. Temporal Alternation of Inductance, Disaccommodation Factor D_F

A change of the magnetic state of a core by magnetic or thermic demagnetization causing a sudden increase of permeability, is followed even under constant environmental conditions by a limited permeability decrease taking a logarithmic course.

This temporal instability is called disaccommodation. It is described by the disaccommodation factor D_F relating to an initial permeability $\mu_i = 1$. According to an IEC recommendation D_F replaces the physically identical expression d/μ_i. D_F is ascertained by measuring the initial permeabilities μ_{i1} and μ_{i2} at the timings t_1 and t_2 after demagnetization. The tabulated D_F-values of our materials were calculated from measurements at the timings 5 and 30 minutes.

$$D_F = \frac{1}{\mu_i} \cdot \frac{\mu_{i1} - \mu_{i2}}{\mu_{i1} \cdot lg \frac{t_2}{t_1}}$$

If coils with gapped cores and a negligible stray field are used, the tabulated values must be multiplied with μ_e. The alternation of inductance of such a coil between the timings t_1 and t_2 after demagnetization may be calculated by the aid of the formula:

$$\frac{\Delta L}{L} = -D_F \cdot \mu_e \cdot lg \frac{t_2}{t_1}$$

Changes of the magnetic state by DC pre-magnetization will as a rule cause smaller alterations of inductance than a calculation by the aid of the disaccommodation factor D_F will show.

8. Curie point

We define Curie point as that temperature, at which the initial permeability has decreased to 10% of the tabulated value.

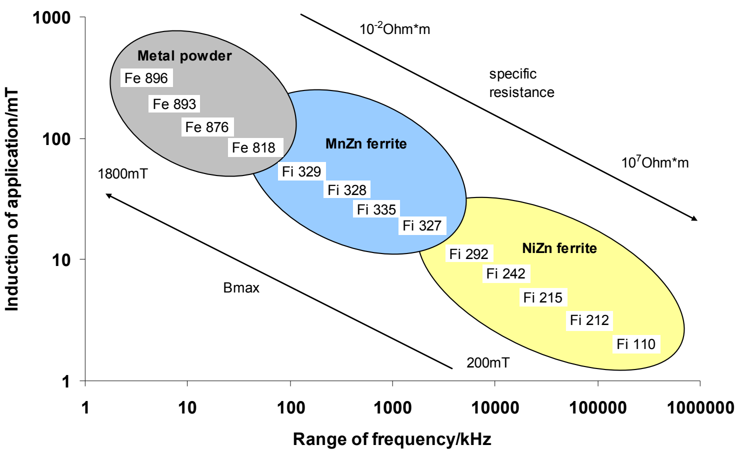
B1.1 FERROCARIT | SUMMARY

Ferrite materials		f - MHz	µi (25°C)	Tc	DC-resist. Ωm	Bmax - mT	Pv - mW /cm³	
Fi 415	Highest permeability MnZn ferrite	≤ 0,2	15000	130	≥ 0,05			
Fi 412	High permeability MnZn ferrite	≤ 0,2	12000	125	≥ 0,05			
Fi 410	High permeability MnZn ferrite	≤ 0,2	10000	135	≥ 0,05			
Fi 360	High permeability MnZn ferrite	≤ 0,4	6000	150	≥ 0,05			
Fi 340	Medium permeability MnZn ferrite	≤ 0,4	4300	130	≥ 0,5			
Fi 395	Power MnZn ferrite with const. low losses up to 120°C.	≤ 0,4	2700	220		> 330 250A/m/100°C	520 100kHz/200mT/25°C	450 100kHz/200mT/100°C
Fi 335	Power MnZn ferrite with low losses and high saturation flux density	≤ 1	2000	230		> 350 250A/m/100°C	140 200kHz/100mT/100°C	310 100kHz/200mT/100°C
Fi 329	Power MnZn ferrite with highest saturation flux density	≤ 0,5	1500	275	≥ 1,5	> 400 250A/m/100°C	1000 100kHz/200mT/25°C	500 100kHz/200mT/100°C
Fi 328	Power MnZn ferrite with high saturation flux density	≤ 0,5	1800	260	≥ 2	> 370 250A/m/100°C	670 100kHz/200mT/25°C	450 100kHz/200mT/100°C
Fi 327	High frequency power MnZn ferrite	≤ 3	1200	240	≥ 30	> 300 250A/m/100°C	560 1000kHz/50mT/25°C	540 1000kHz/50mT/100°C
Fi 326	Power MnZn ferrite with lowest power losses around 140°C.	≤ 0,4	1500	250		> 310 250A/m/140°C	900 100kHz/200mT/25°C	400 100kHz/200mT/140°C
Fi 325	Medium frequency power MnZn ferrite	≤ 1	1800	230	≥ 6	> 340 250A/m/100°C	320 200kHz/100mT/25°C	170 200kHz/100mT/100°C
Fi 324	Standard power MnZn ferrite	≤ 0,3	2300	230	≥ 3	> 340 250A/m/100°C	685 100kHz/200mT/25°C	560 100kHz/200mT/100°C
Fi 301	High permeability ferrite with broad frequency range	≤ 100	3000	140		> 380 3000A/m/25°C		
Fi 292	High permeability NiZn ferrite	≤ 100	900	140	$\geq 10^7$			
Fi 262	Medium permeability MnZn ferrite	≤ 5	650	290	≥ 1			
Fi 242	Low power loss NiZn ferrite with high specific resistance	≤ 400	400	230	$\geq 10^7$	> 300 3000A/m/100°C	700 100kHz/100mT/25°C	550 100kHz/100mT/100°C
Fi 248	Medium permeability NMnZn ferrite for noise suppression applications	≤ 400	440	240	≥ 100	> 370 3000A/m/25°C		
Fi 221	Medium permeability NiZn ferrite	≤ 400	250	330	$\geq 10^4$			
Fi 215	Low permeability NiZn ferrite for high ignition applications	≤ 400	150	385	$\geq 10^7$	> 310 3000A/m/170°C	1800 100kHz/100mT/25°C	1500 100kHz/100mT/100°C
Fi 212	Low permeability NiZn ferrite	≤ 400	100	420	$\geq 10^4$	300 3000A/m/100°C	580 100kHz/50mT/25°C	770 100kHz/50mT/100°C
Fi 150	Low permeability NiZn ferrite	≤400	50	430	$\geq 10^3$			
Fi 130	Low permeability NiZn ferrite	≤ 500	30	500	$\geq 10^3$			
Fi 110	Low permeability NiZn ferrite	≤ 1000	12	580	$\geq 10^4$			

B1.1 FERROCARIT | SUMMARY

Plasto ferrite materials		f - MHz	µi (25°C)	Tc	DC-resist. Ωm			
Fi 520	Wide band material with high temperature-consistency of permeability	≤ 400	20	150	> 3,0			
Fi 522	Wide band material with high temperature-consistency of permeability up to 200°C.	≤ 400	19	200	> 1,0			

Ferrocart materials		f - MHz	µi (25°C)	Tmax	tanδ/µi * 10^{-6}		µΔ @ 5000 A/m	Pv-mW/cm³ 100kHz/40mT
Fe 897	High amplitude permeability material	≤ 0,2	125	200		1600 0,16 MHz	37	
Fe 896	High permeability material	≤ 0,2	140	200		1200 0,16 MHz	45	570
Fe 893	High permeability material for high premagnetization	≤ 0,2	110	200	190 0,01 MHz	1400 0,16 MHz	50	650
Fe 892	Noise suppression material	≤ 0,2	100	200	120 0,01 MHz	1600 0,16 MHz	36	650
Fe 876	Wide band material for high premagnetization with low losses	≤ 0,2	75	180		100 0,16 MHz	46	310
Fe 850	Wide band material for high premagnetization with low losses	≤ 0,3	55	180	140 0,02 MHz	800 0,3 MHz	43	440
Fe 835	Wide band material	≤ 0,5	35	150	100 0,05 MHz	180 0,5 MHz	33	390
Fe 818	Wide band material	≤ 10	18	150	110 0,05 MHz	200 0,5 MHz		
Fe 810	Wide band material	≤ 100	10	120	500 12 MHz	2000 100 MHz		



B1.1 FERROCARIT

Production and composition of ferrites

Ferrites are compounds of the iron oxide Fe_2O_3 and one or more oxides of bivalent metal. The most frequently used oxides are those of nickel, manganese, magnesium and zinc. The oxide powder is prepared in various processing steps before being pressed to a core of the desired shape. After that the core is sintered at temperatures between 1150 and 1400°C depending on the type of ferrite. The resulting material is hard and brittle like porcelain ("black ceramics") and can only be machined by grinding. The shrinkage of the cores during the sintering process results in tolerances of the non-machined dimensions similar to those of other ceramics (± 2 to ± 3%).

An important characteristic of **FERROCARIT** materials is their high electric resistivity, covering according to grade a range from 1 up to 10^7 Ωm, as opposed to approx. 10^{-5} Ωm with metals. Consequently eddy current loss is relatively low and may be neglected over a wide frequency range.

General technical characteristics

Density	≈	4,5 . . . 5,1	$g \cdot cm^{-3}$
Tensile strength	≈	20 . . . 60	$N \cdot mm^{-2}$
Compressive strength	≈	100 . . . 800	$N \cdot mm^{-2}$
Modulus of elasticity	≈	150	$kN \cdot mm^{-2}$
Thermal conductivity	≈	$5 \cdot 10^{-3}$	$J \cdot mm^{-1} \cdot s^{-1} \cdot K^{-1}$
Specific heat	≈	1000	$J \cdot kg^{-1} \cdot K^{-1}$
Coefficient of linear expansion	≈	$7 \cdot 10^{-6}$ . . . $12 \cdot 10^{-6}$	K^{-1}
Vickers hardness	≈	500	$N \cdot mm^{-2}$

PSPICE –parameters for FERROCARIT materials are available on your inquiry.

B1.1 FERROCARIT | SUMMARY

Application	Frequency range MHz	magnetic load low	magnetic load high	Ferrite materials **FERROCARIT**	Core shape
High Q circuits (Input and oscillator coils, variometers, IF-transformers LF-coils, MW and LW antennas etc.)	≤ 1,6	X		Fi 262	Rod, tube, screw, nipple, saddle and cup cores
	0,2 ... 5	X		Fi 221	
	0,5 … 10	X		Fi215	
	1 ... 12	X		Fi 212	
	5 ... 40	X		Fi 150	
	10 ... 60	X		Fi 130	
	50 ... 150	X		Fi 110	
Anti-interference and damping coils	≤ 0,5	X		Fi 415	Rod, tube, drum and multi-aperture cores toroids, screening beads
		X		Fi 412	
		X		Fi 410	
		X		Fi 360	
	≤ 1	X		Fi 350	
		X		Fi 340	
	≤ 6	X		Fi 262	
	≤ 400	X		Fi 248	
	2 ... 1000	X		Fi 292	
		X		Fi 221	
		X		Fi 150	
Wide-band transformers (Antenna-transformers for TV and radio, pulse transformers, etc.)	≤ 2	X		Fi 415	Pot and E-cores, toroids, two- and multi-aperture cores
		X		Fi 412	
		X		Fi 410	
		X		Fi 360	
		X		Fi 340	
	≤ 10	X		Fi 292	Rod, tube, two- and multi-aperture cores
		X		Fi 262	
	≤ 100	X		Fi 221	
	≤ 250	X		Fi215	
		X		Fi 212	
	≤ 400	X		Fi 242	
		X		Fi 150	
		X		Fi 130	
		X		Fi 110	
Power applications (Fly-back transformers, DC converters, audio frequency chokes, TV correcting coils, audio frequency filters)	≤ 0,3		X	Fi 395	E-, U-, E+I-, screw, rod, tube, nipple and drum cores
			X	Fi328	
			X	Fi326	
			X	Fi 324	
	≤ 1		X	Fi335	
			X	Fi325	
	≤ 3		X	Fi 327	
	≤ 0,5		X	Fi 329	

B1.1 FERROCARIT | SUMMARY

FERROCARIT			Fi 415		Fi 412		Fi 410		Fi 360		Fi 340	
Initial permeability	μ_i	1	15000 ± 30%		12000 ± 30%		10000 ± 30%		6000 ± 30%		4300 ± 20%	
Relative loss factor	$\frac{\tan\delta}{\mu_i}$	10^{-6}	< 6	< 70	< 6	< 50	< 6	< 70	< 4	< 20	< 4	< 20
frequency	f	MHz	0,01	0,1	0,01	0,1	0,01	0,1	0,01	0,1	0,01	0,1
Hysteresis material constant	η_B	$\frac{10^{-6}}{mT}$	< 0,6		< 1,2		< 0,6		< 0,8		< 0,6	
Induction *H* = 1200 A/m	B	mT	430		430		420		440		390	
Coercivity	H_C	A/m	9		8		8		9		10	
Curie temperature	T_C	°C	130		125		135		150		130	
Rel. temperature factor +23...+70°C	α_F	$\frac{10^{-6}}{K}$	≤ 1,5		≤ 1,5		≤ 1,5		≤ 1,5		≤ 1,5	
Rel. disaccommodation factor T = 40°C	D_F	10^{-6}	< 3		< 3		< 3		< 3		< 6	
DC - Resistivity	ρ	Ωm	≥ 0,05		≥ 0,05		≥ 0,05		≥ 0,05		> 0,5	

B1.1 FERROCARIT | SUMMARY

FERROCARIT			Fi 395	Fi 335	Fi 329	Fi 328	Fi 327
Initial permeability	μ_i	1	2700 ± 25%	2000 ± 25%	1500 ± 25%	1800 ± 25%	1200 ± 25%
Relative loss factor	$\frac{\tan\delta}{\mu_i}$	10^{-6}	< 3,5	2,6	< 8	< 3,5	< 2,5
frequency	f	MHz	0,1	0,1	0,1	0,1	0,1
Hysteresis material constant	η_B	$\frac{10^{-6}}{mT}$				< 1	< 0,9
Induction H = 1200 A/m	B	mT	460	500	525	480	430
Coercivity	H_C	A/m	12	15	12	15	50
Curie temperature	T_C	°C	250	230	275	260	240
Rel. temperature factor +23...+70°C	α_F	$\frac{10^{-6}}{K}$					
Rel. disaccommodation factor T = 40°C	D_F	10^{-6}					
DC - Resistivity	ρ	Ωm			> 1,5	> 2	> 30

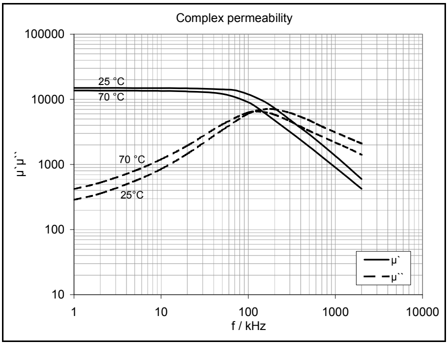
B1.1 FERROCARIT | SUMMARY

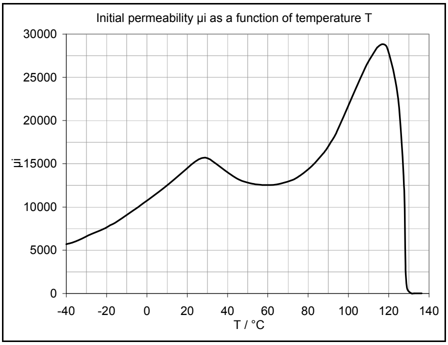
FERROCARIT			Fi 326	Fi 325	Fi 324		
Initial permeability	μ_i	1	1500 ± 25%	1800 ± 25%	2300 ± 25%		
Relative loss factor	$\frac{\tan\delta}{\mu_i}$	10^{-6}	<5	< 3,5	< 4,5		
frequency	f	MHz	0,1	0,1	0,1		
Hysteresis material constant	η_B	$\frac{10^{-6}}{mT}$		< 0,42	≤ 1		
Induction H = 1200 A/m	B	mT	500	500	490		
Coercivity	H_C	A/m	15	16	15		
Curie temperature	T_C	°C	250	230	230		
Rel. temperature factor +23...+70°C	α_F	$\frac{10^{-6}}{K}$					
Rel. disaccommodation factor T = 40°C	D_F	10^{-6}					
DC - Resistivity	ρ	Ωm		≥ 6	≥ 3		

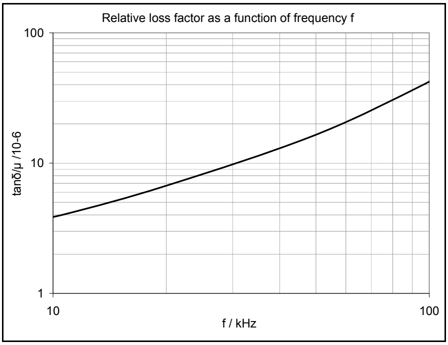
B1.1 FERROCARIT | FI 415

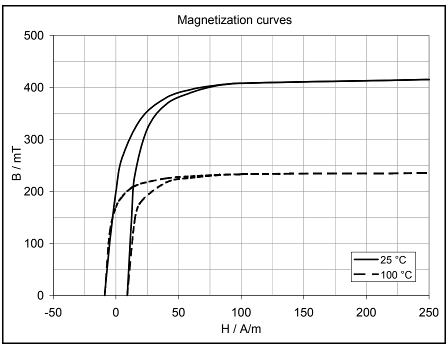
A highest permeability material optimized for broadband transmission and miniature inductors with high inductance values

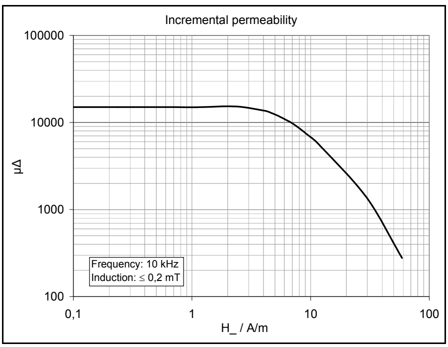
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	15000 ± 30%	1	25°C ; <= 10 kHz <= 0,25 mT
$\tan\delta$ / μ_i	< 70	10^{-6}	25°C ; 0,1 MHz <= 0,25 mT
η_B	< 0,6	10^{-6} / mT	25°C ; 10 kHz <=1,5mT to 3mT
B	415	mT	25°C ; 16 kHz 250 A/m
	235		100°C ; 16 kHz 250 A/m
P_V			
T_C	130	°C	







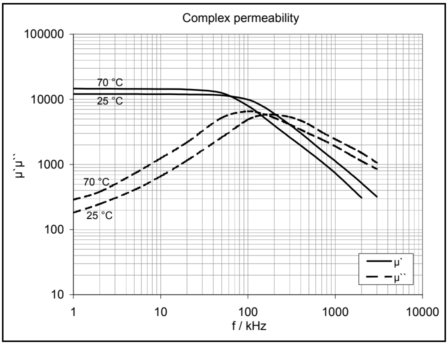


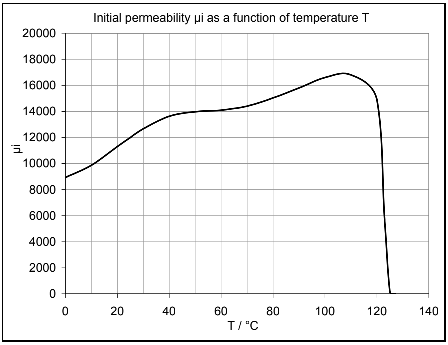


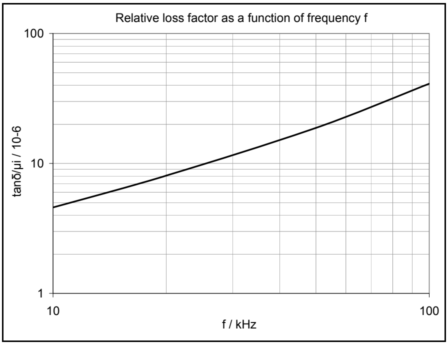
B1.1 FERROCARIT | FI 412

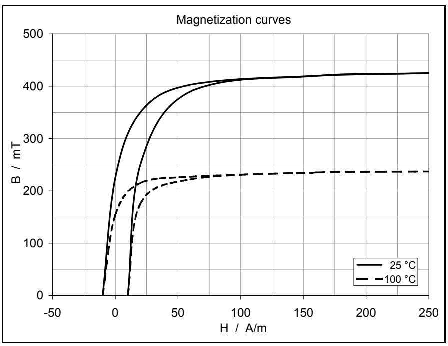
A high permeability material optimized for broadband transmission, common mode chokes as well as suppression filters

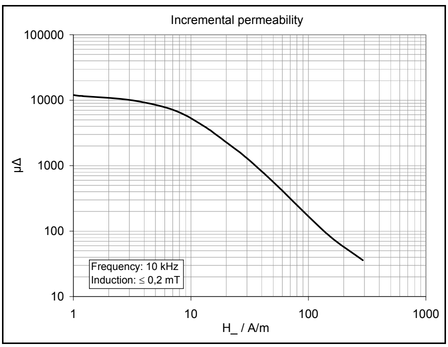
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	12000 ± 30%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 50	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	< 1,2	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	425	mT	25°C ; 16 kHz 250 A/m
	235		100°C ; 16 kHz 250 A/m
P_V		mW / cm³	25°C ; ..... kHz .... mT
			100°C ; ..... kHz .... mT
T_C	125	°C	10 kHz ≤ 0,25 mT







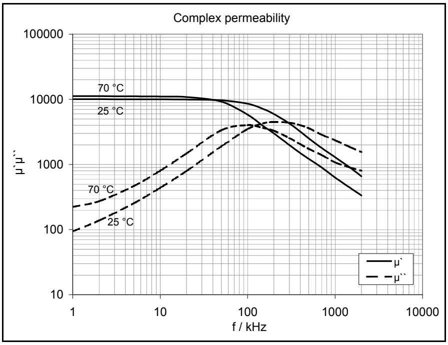


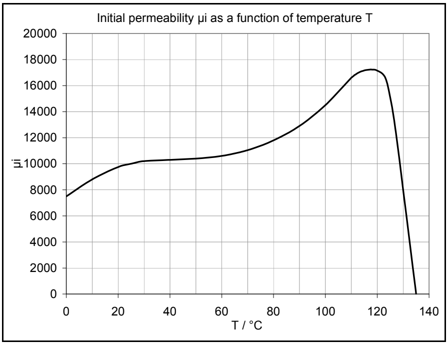


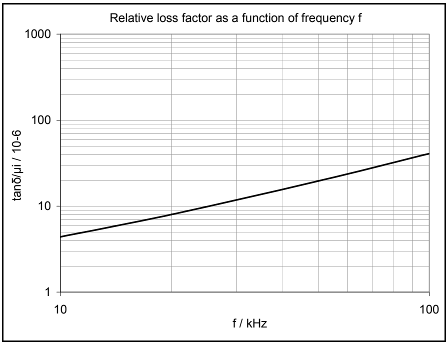
B1.1 FERROCARIT | FI 410

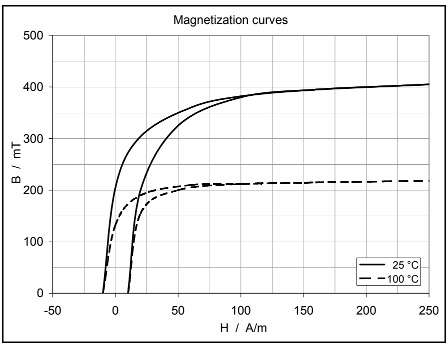
A high permeability material optimized for broadband transmission, common mode chokes as well as suppression filters

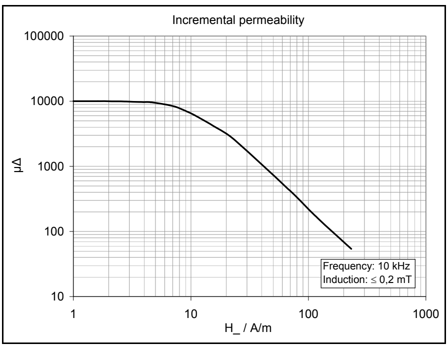
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	10000 ± 30%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 70	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	< 0,6	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	405	mT	25°C ; 16 kHz 250 A/m
	220		100°C ; 16 kHz 250 A/m
P_v		mW / cm³	25°C ; ..... kHz .... mT
			100°C ; ..... kHz .... mT
T_c	135	°C	10 kHz ≤ 0,25 mT







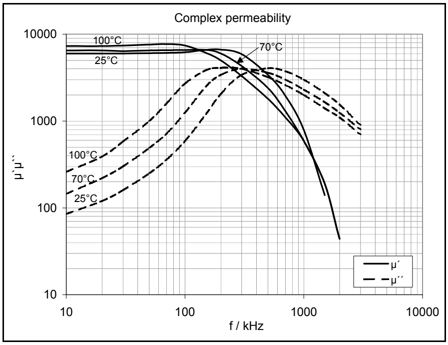


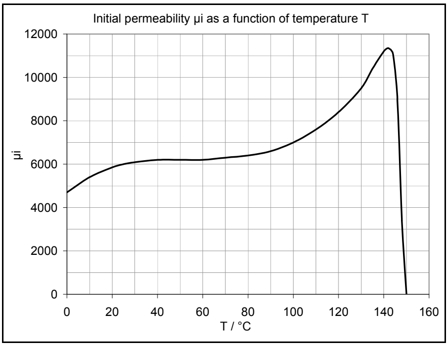


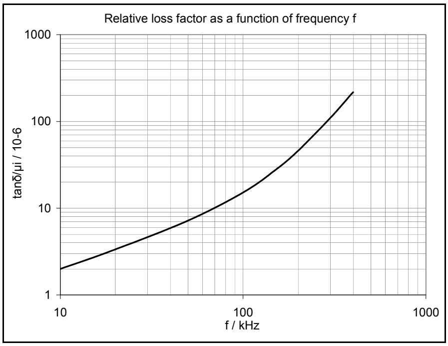
B1.1 FERROCARIT | FI 360

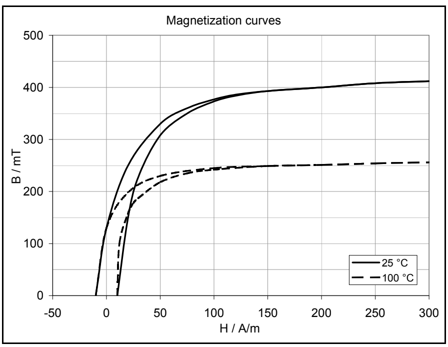
A medium permeability material with a frequency stability up to 0,2 MHz and a high Tc for broadband transmission, current transformers as well as suppression filters

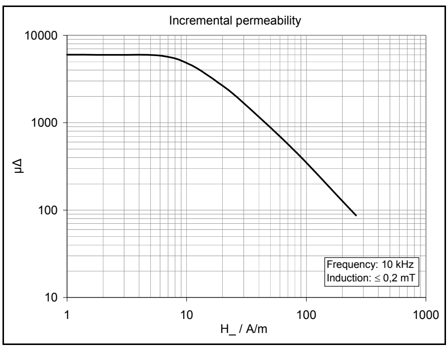
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	6000 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 20	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	< 0,8	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	410	mT	25°C ; 16 kHz 250 A/m
	255		100°C ; 16 kHz 250 A/m
P_V		mW / cm³	25°C ; ..... kHz .... mT
			100°C ; ..... kHz .... mT
T_c	150	°C	10 kHz ≤ 0,25 mT







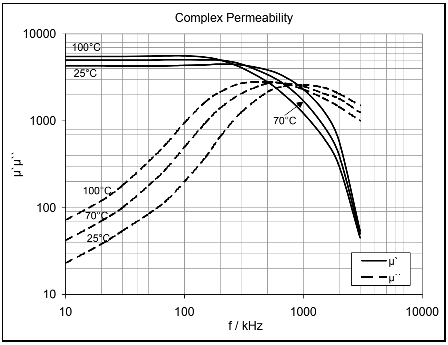


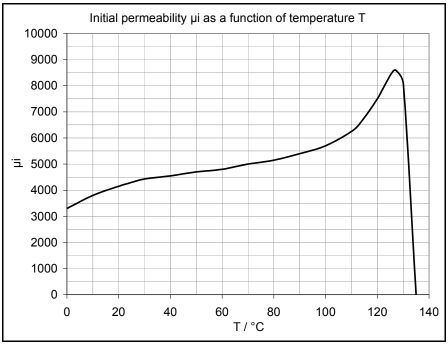


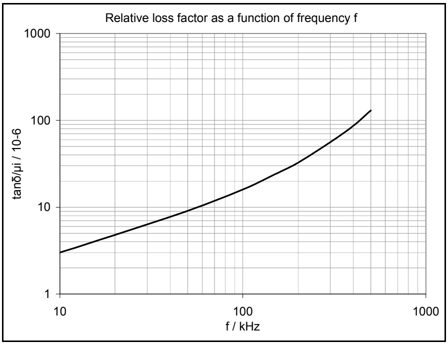
B1.1 FERROCARIT | FI 340

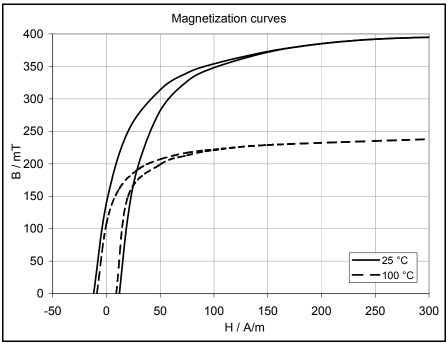
A medium permeability material with a low temperature dependence of the initial permeability and a frequency stability up to 0,4 MHz. Optimized for use in broadband transformers with high DC-bias current

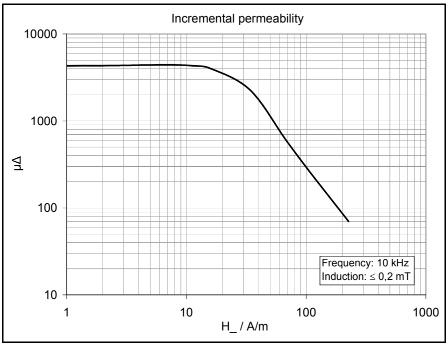
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	4300 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 20	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	< 0,6	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	390	mT	25°C ; 16 kHz 250 A/m
	235		100°C ; 16 kHz 250 A/m
P_v		mW / cm³	25°C ; ..... kHz .... mT
			100°C ; ..... kHz .... mT
T_c	130	°C	10 kHz ≤ 0,25 mT







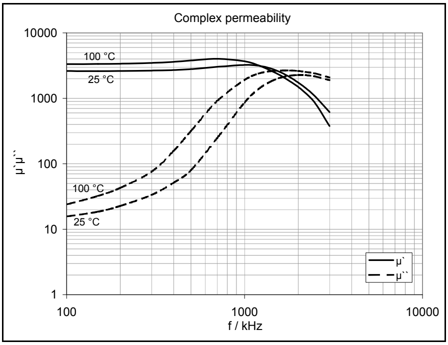


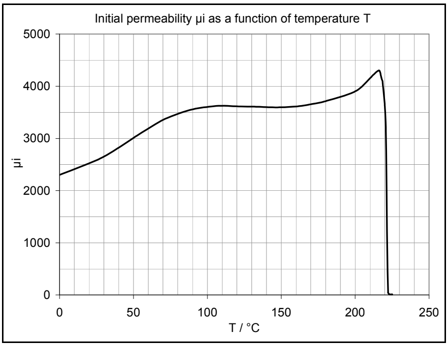


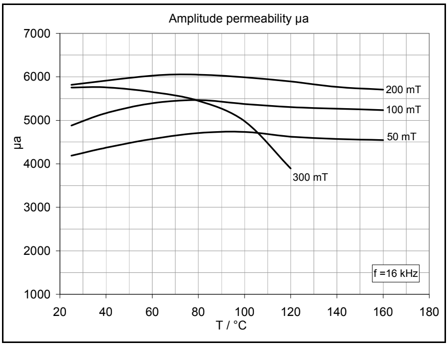
B1.1 FERROCARIT | FI 395

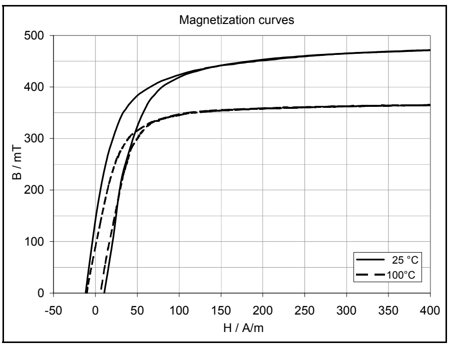
A low frequency power material with a flat power loss curve from 25°C to 120°C for use in general purpose transformers up to 0,3 MHz. Especially suited for broad temperature range applications

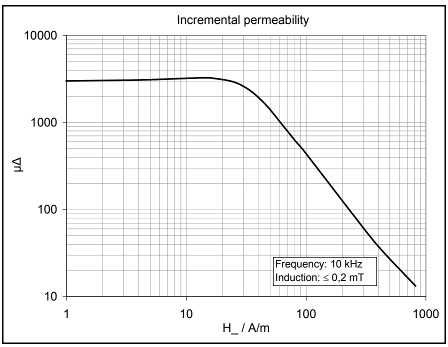
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	2700 ± 25%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 3,5	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B		10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	460	mT	25°C ; 16 kHz 250 A/m
	> 330		100°C ; 16 kHz 250 A/m
P_V	520	mW / cm³	25°C ; 100 kHz 200 mT
	450		100°C ; 100 kHz 200 mT
T_C	220	°C	10 kHz ≤ 0,25 mT

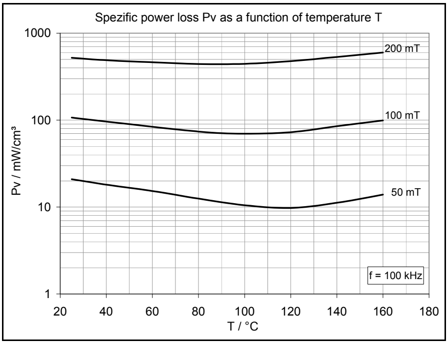


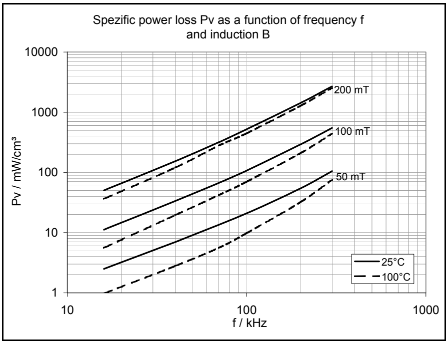


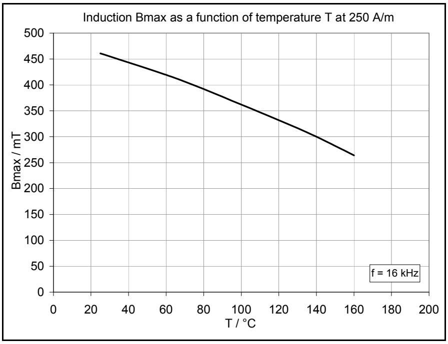







Spezific power loss Pv as a function of temperature T
Pv / mW/cm³
T / °C
1000
100
10
1
20
40
60
80
100
120
140
160
180
200 mT
100 mT
50 mT
f = 100 kHz

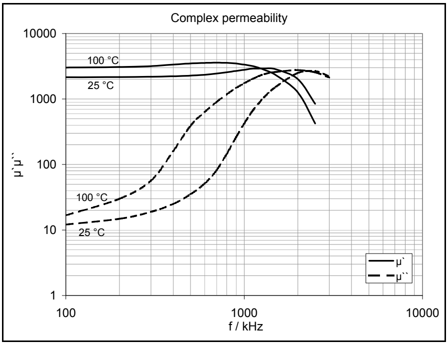

Spezific power loss Pv as a function of frequency f and induction B
Pv / mW/cm³
f / kHz
10000
1000
100
10
1
10
100
1000
200 mT
100 mT
50 mT
25°C
100°C

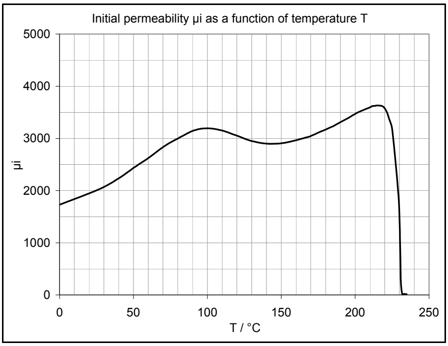

Induction Bmax as a function of temperature T at 250 A/m
Bmax / mT
T / °C
500
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
180
200
f = 16 kHz

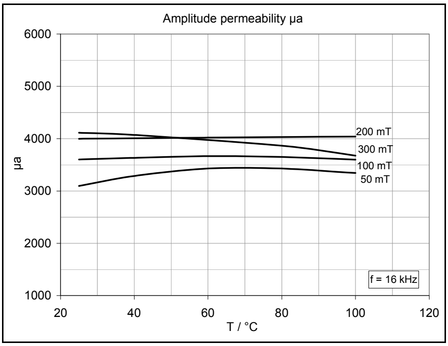
B1.1 FERROCARIT | FI 335

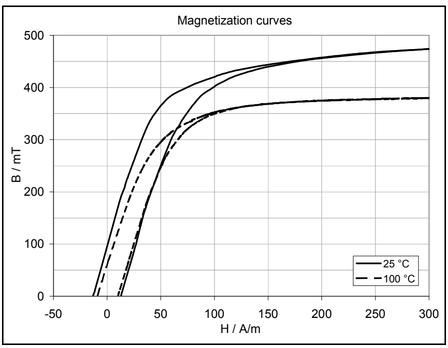
A low to medium frequency power material with low losses and high saturation flux density in a operating frequency range up to 0,4 MHz

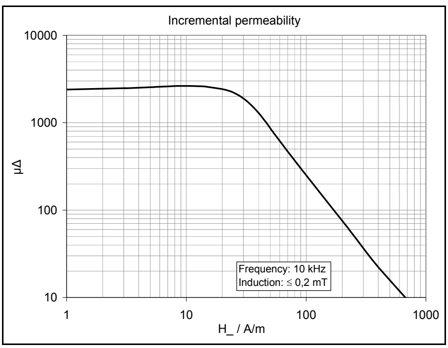
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	2000	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	2,6	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	0,35	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	470	mT	25°C ; 16 kHz 250 A/m
B	> 350	mT	100°C ; 16 kHz 250 A/m
P_V	< 450	mW / cm³	100°C ; 100 kHz 200 mT
P_V	< 190	mW / cm³	100°C ; 200 kHz 100 mT
T_C	230	°C	10 kHz ≤ 0,25 mT

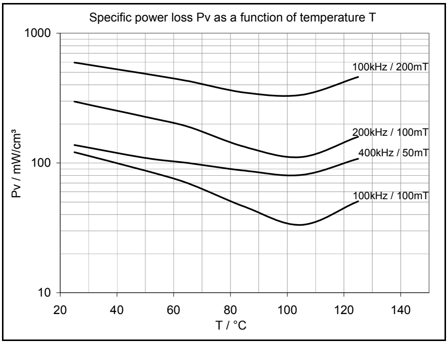


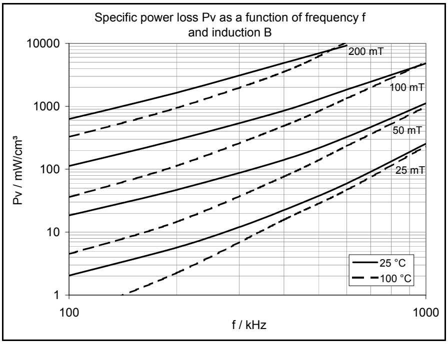


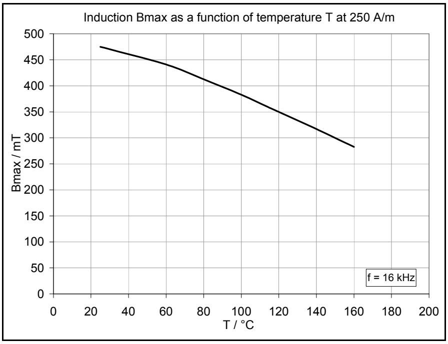







Specific power loss Pv as a function of temperature T
1000
100
10
Pv / mW/cm³
20
40
60
80
100
120
140
T / °C
100kHz / 200mT
200kHz / 100mT
400kHz / 50mT
100kHz / 100mT

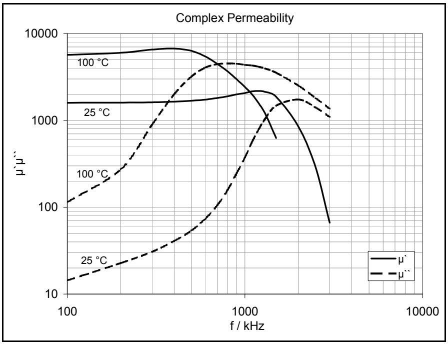

Specific power loss Pv as a function of frequency f
and induction B
10000
1000
100
10
1
Pv / mW/cm³
100
1000
f / kHz
200 mT
100 mT
50 mT
25 mT
25 °C
100 °C

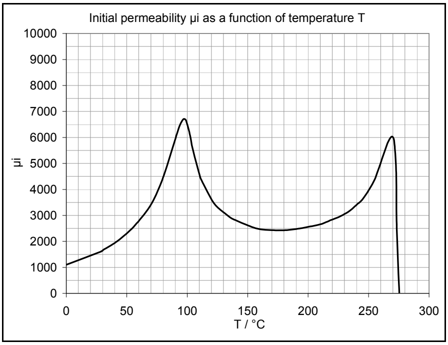

Induction Bmax as a function of temperature T at 250 A/m
500
450
400
350
300
250
200
150
100
50
0
Bmax / mT
0
20
40
60
80
100
120
140
160
180
200
T / °C
f = 16 kHz

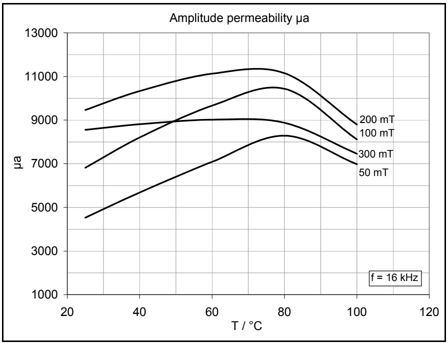
B1.1 FERROCARIT | FI 329

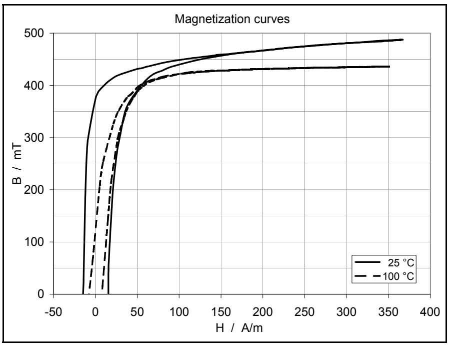
A low to medium frequency power material with high saturation flux density for applications up to 0,2 MHz

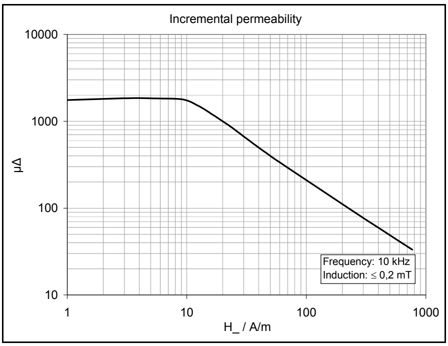
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	1500 ± 25%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 8	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B		10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	475	mT	25°C ; 16 kHz 250 A/m
	> 400		100°C ; 16 kHz 250 A/m
P_V	1000	mW / cm³	25°C ; 100 kHz 200 mT
	500		100°C ; 100 kHz 200 mT
T_C	275	°C	

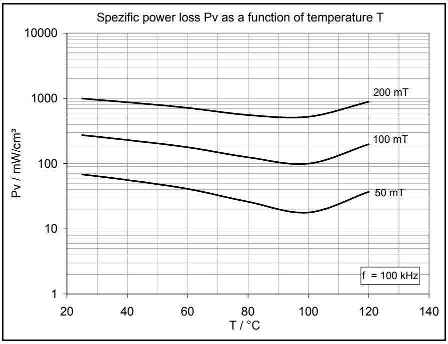


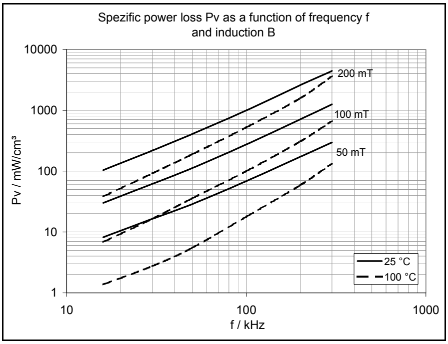


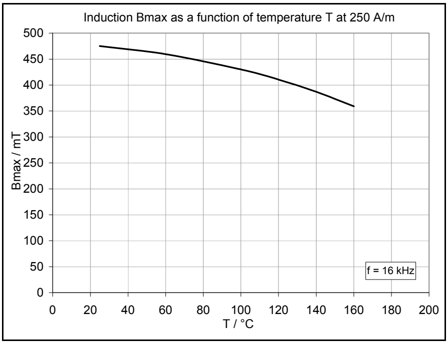







Spezific power loss Pv as a function of temperature T
Pv / mW/cm³
T / °C
200 mT
100 mT
50 mT
f = 100 kHz

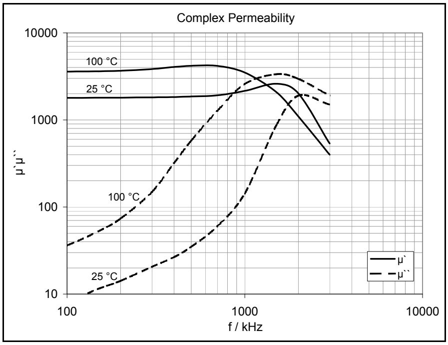

Spezific power loss Pv as a function of frequency f
and induction B
Pv / mW/cm³
f / kHz
200 mT
100 mT
50 mT
25 °C
100 °C

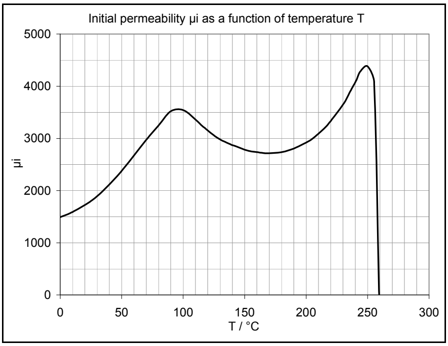

Induction Bmax as a function of temperature T at 250 A/m
Bmax / mT
T / °C
f = 16 kHz

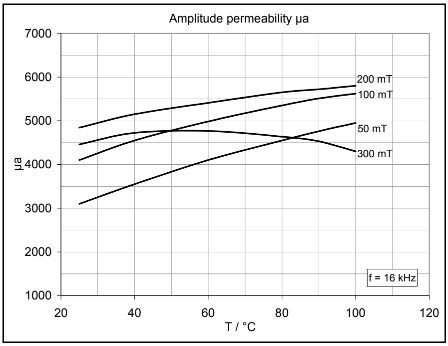
B1.1 FERROCARIT | FI 328

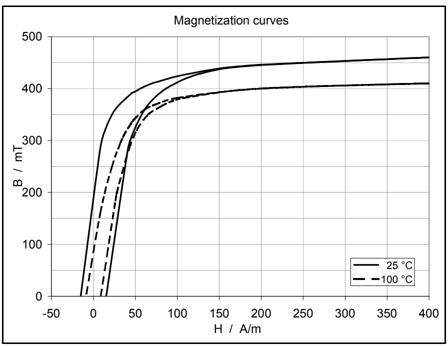
A low to medium frequency power material with high saturation flux density and low losses for applications up to 0,2 MHz

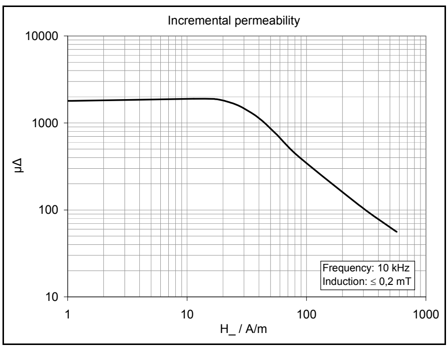
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	1800 ± 25%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 3,5	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	< 1	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	450	mT	25°C ; 16 kHz 250 A/m
	> 370		100°C ; 16 kHz 250 A/m
P_V	670	mW / cm³	25°C ; 100 kHz 200 mT
	450		100°C ; 100 kHz 200 mT
T_C	260	°C	10 kHz ≤ 0,25 mT

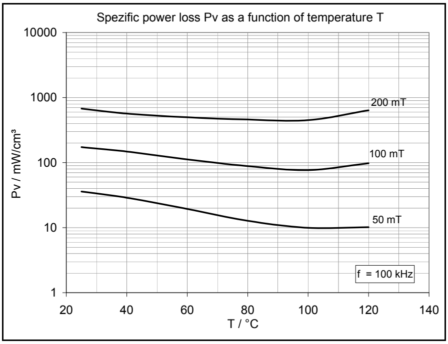


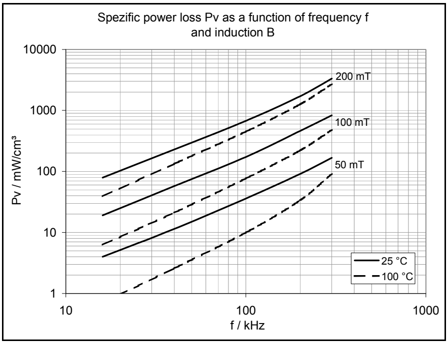


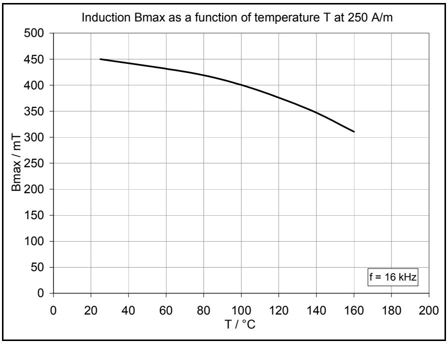


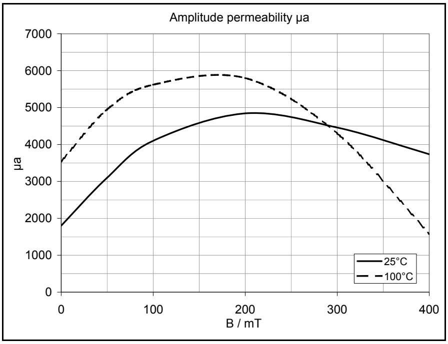





Spezific power loss Pv as a function of temperature T
Pv / mW/cm³
T / °C
200 mT
100 mT
50 mT
f = 100 kHz


Spezific power loss Pv as a function of frequency f and induction B
Pv / mW/cm³
f / kHz
200 mT
100 mT
50 mT
25 °C
100 °C

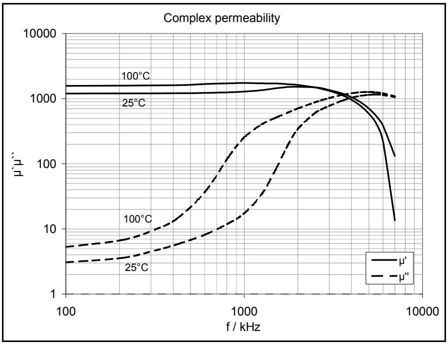

Induction Bmax as a function of temperature T at 250 A/m
Bmax / mT
T / °C
f = 16 kHz

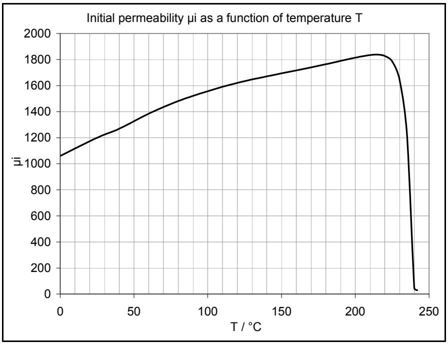

Amplitude permeability μa
μa
B / mT
25°C
100°C

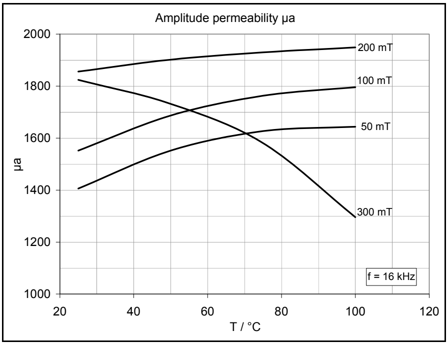
B1.1 FERROCARIT | FI 327

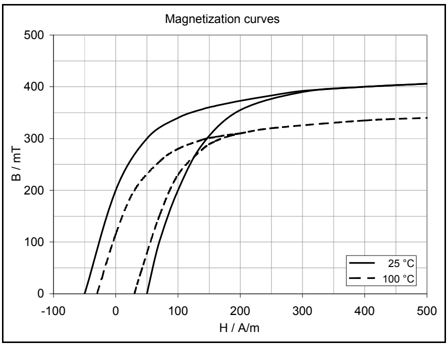
A high frequency power material suitable for power and standard transformers in a frequency range of 0,5 to 2 MHz

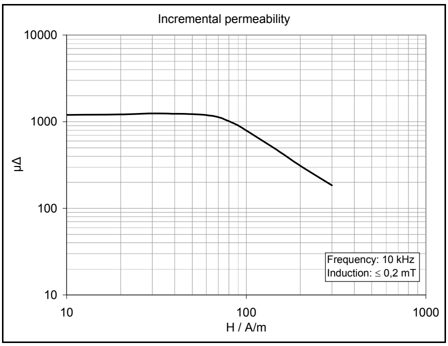
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	1200 ± 25%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 2,5	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	< 0,9	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	380	mT	25°C ; 16 kHz 250 A/m
	>300		100°C ; 16 kHz 250 A/m
P_V	560	mW / cm³	25°C ; 1000 kHz 50 mT
	540		100°C ; 1000 kHz 50 mT
T_C	240	°C	10 kHz ≤ 0,25 mT

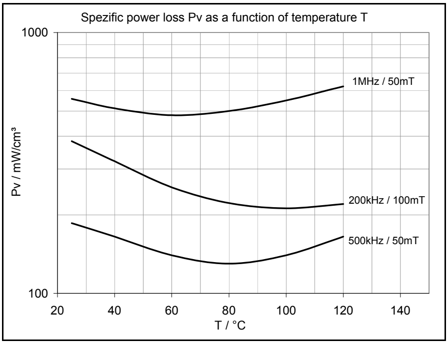


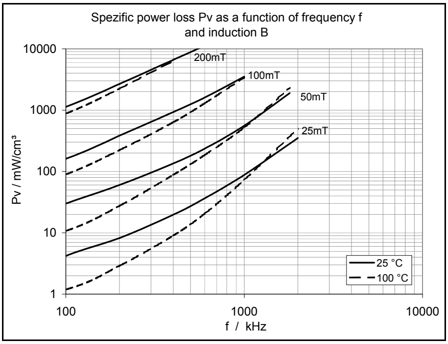


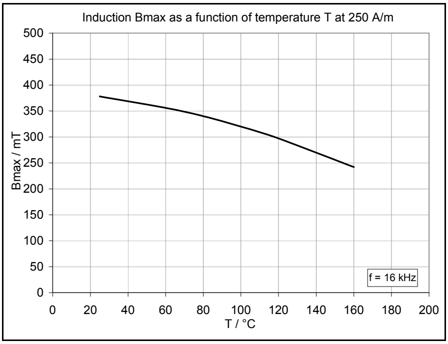







Spezific power loss Pv as a function of temperature T
1000
100
Pv / mW/cm³
20
40
60
80
100
120
140
T / °C
1MHz / 50mT
200kHz / 100mT
500kHz / 50mT

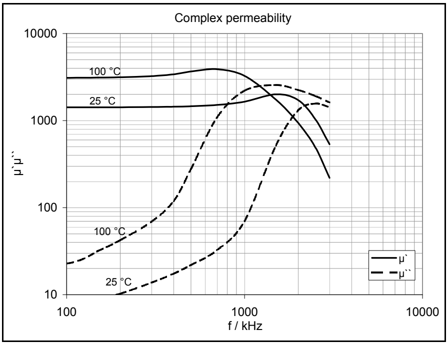

Spezific power loss Pv as a function of frequency f
and induction B
10000
1000
100
10
1
Pv / mW/cm³
100
1000
10000
f / kHz
200mT
100mT
50mT
25mT
25 °C
100 °C

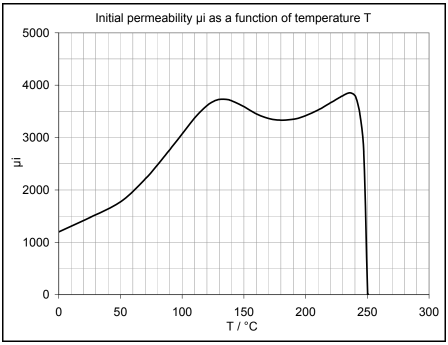

Induction Bmax as a function of temperature T at 250 A/m
500
450
400
350
300
250
200
150
100
50
0
Bmax / mT
0
20
40
60
80
100
120
140
160
180
200
T / °C
f = 16 kHz

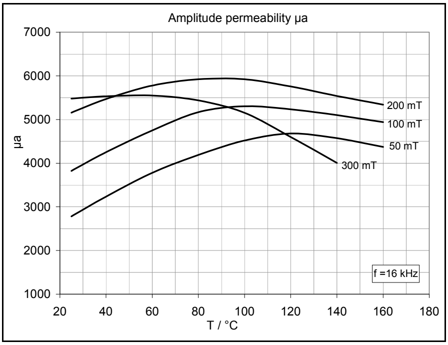
B1.1 FERROCARIT | FI 326

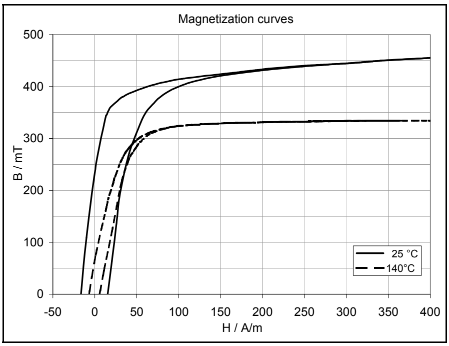
A low to medium frequency power material with lowest power losses around 140°C
Suitable for power transformers in a frequency range up to 0,3 MHz

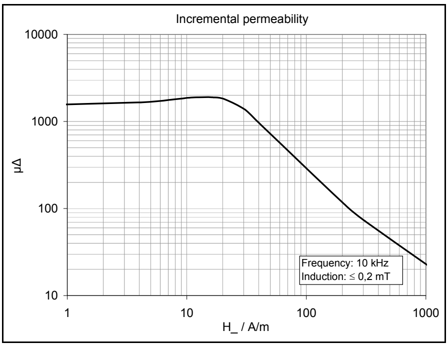
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	1500 ± 25%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 5	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B		10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	440	mT	25°C ; 16 kHz 250 A/m
	> 310		140°C ; 16 kHz 250 A/m
P_v	900	mW / cm³	25°C ; 100 kHz 200 mT
	400		140°C ; 100 kHz 200 mT
T_c	250	°C	10 kHz ≤ 0,25 mT

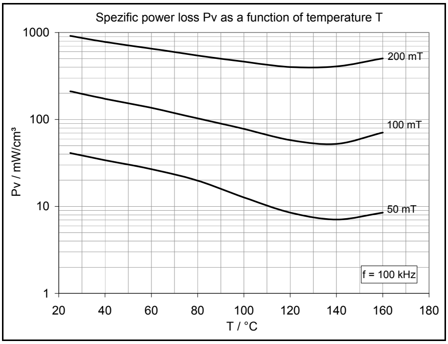


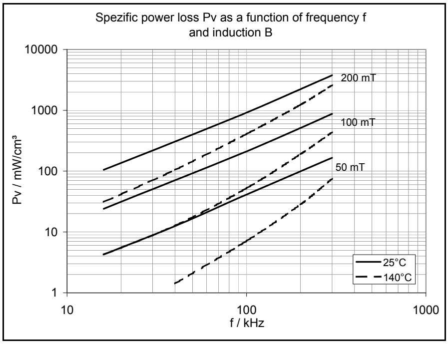


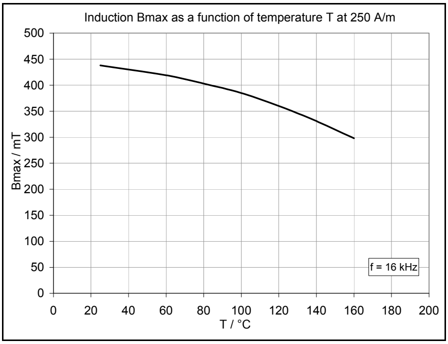







Spezific power loss Pv as a function of temperature T
1000
100
10
1
Pv / mW/cm³
200 mT
100 mT
50 mT
f = 100 kHz
20
40
60
80
100
120
140
160
180
T / °C

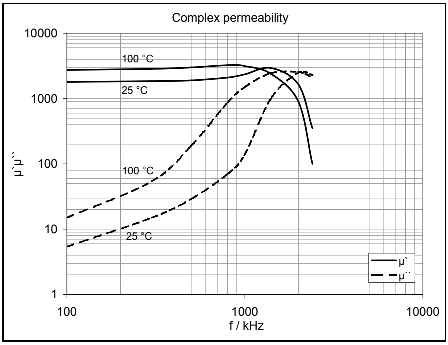

Spezific power loss Pv as a function of frequency f and induction B
10000
1000
100
10
1
Pv / mW/cm³
200 mT
100 mT
50 mT
25°C
140°C
10
100
1000
f / kHz

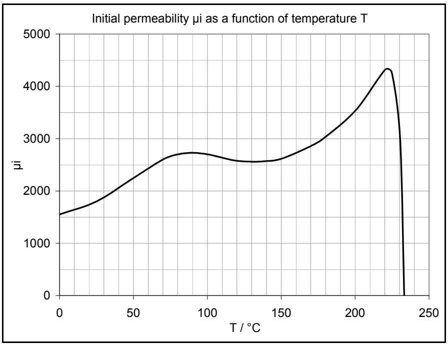

Induction Bmax as a function of temperature T at 250 A/m
500
450
400
350
300
250
200
150
100
50
0
Bmax / mT
f = 16 kHz
0
20
40
60
80
100
120
140
160
180
200
T / °C

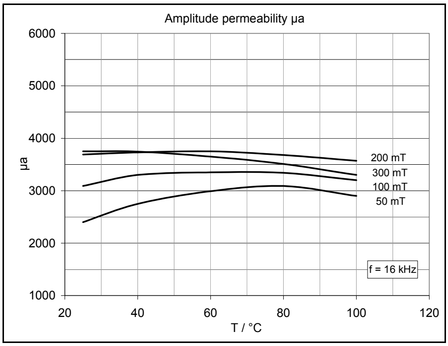
B1.1 FERROCARIT | FI 325

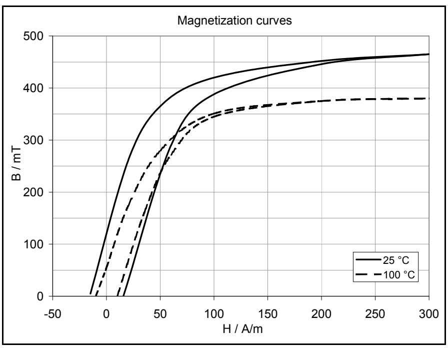
A low to medium frequency power material suitable for power and standard transformers in a frequency range up to 0,4 MHz

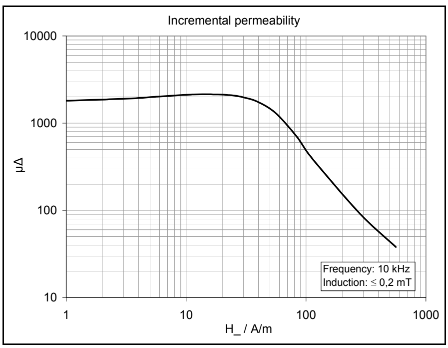
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	1800 ± 25%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
tanδ / μ_i	< 3,5	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	< 0,42	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	470	mT	25°C ; 16 kHz 250 A/m
	≥ 340		100°C ; 16 kHz 250 A/m
P_V	320	mW / cm³	25°C ; 200 kHz 100 mT
	170		100°C ; 200 kHz 100 mT
T_C	230	°C	10 kHz ≤ 0,25 mT

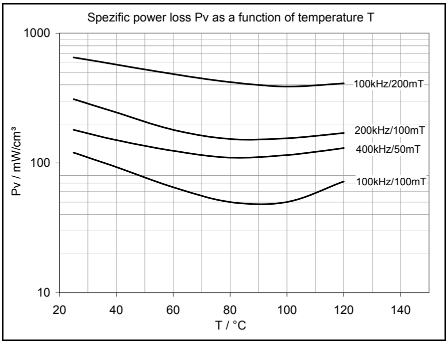


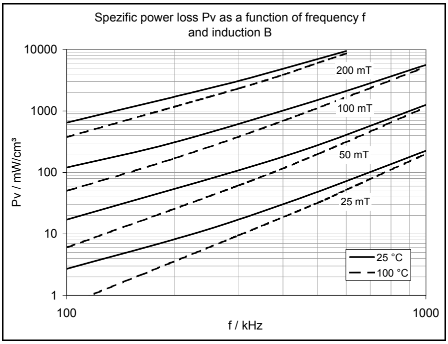


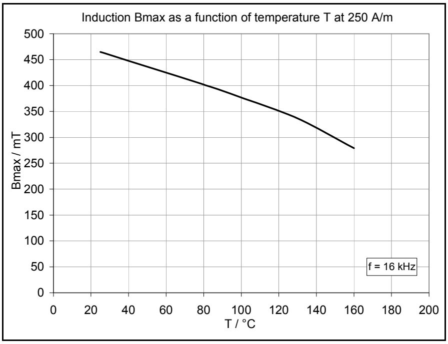


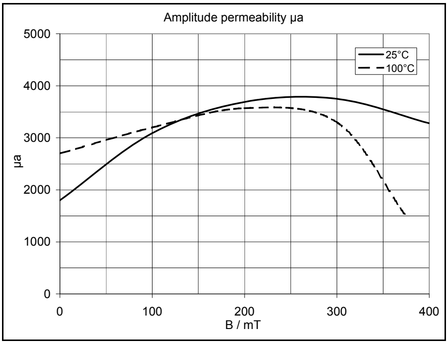





Spezific power loss Pv as a function of temperature T
Pv / mW/cm³
T / °C
100kHz/200mT
200kHz/100mT
400kHz/50mT
100kHz/100mT


Spezific power loss Pv as a function of frequency f and induction B
Pv / mW/cm³
f / kHz
200 mT
100 mT
50 mT
25 mT
25 °C
100 °C

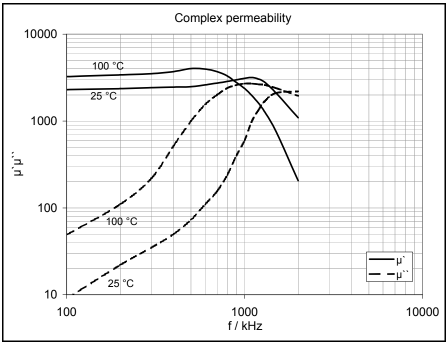

Induction Bmax as a function of temperature T at 250 A/m
Bmax / mT
T / °C
f = 16 kHz

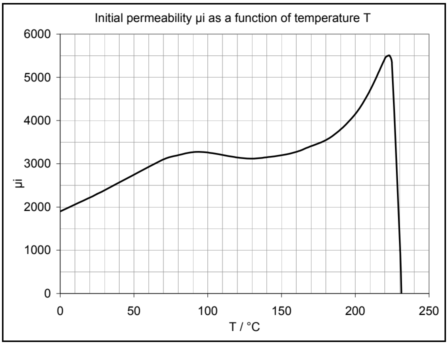

Amplitude permeability µa
µa
B / mT
25°C
100°C

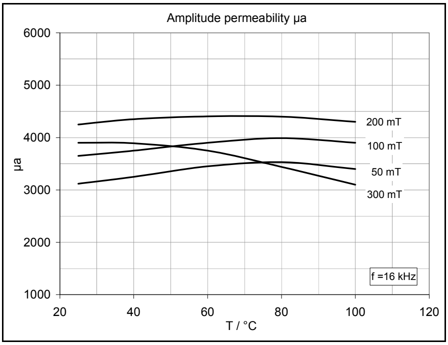
B1.1 FERROCARIT | FI 324

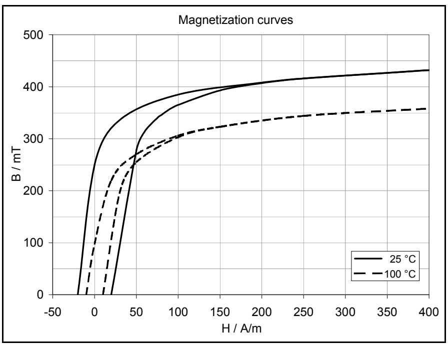
A low frequency power material for standard transformers at frequencies up to 0,2 MHz

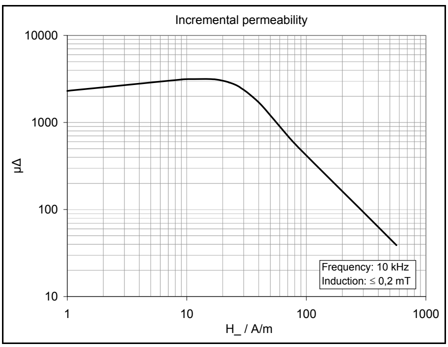
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	2300 ± 25%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 4,5	10^{-6}	25°C ; 0,1 MHz ≤ 0,25 mT
η_B	≤ 1	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	420	mT	25°C ; 16 kHz 250 A/m
	> 340		100°C ; 16 kHz 250 A/m
P_V	685	mW / cm³	25°C ; 100 kHz 200 mT
	560		100°C ; 100 kHz 200 mT
T_C	230	°C	10 kHz ≤ 0,25 mT

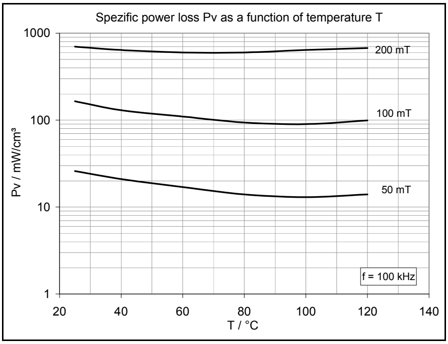


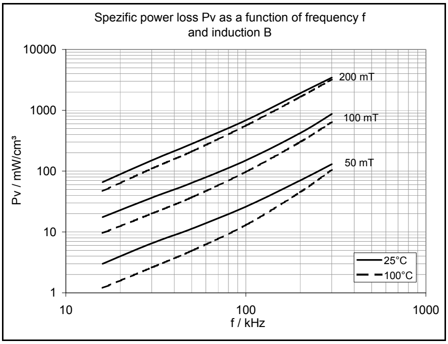


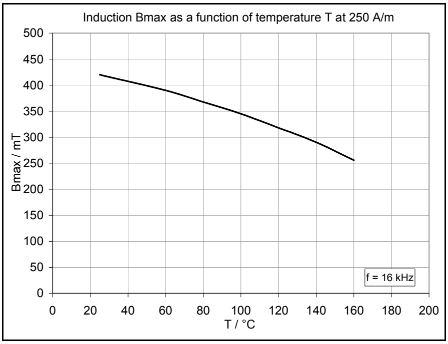


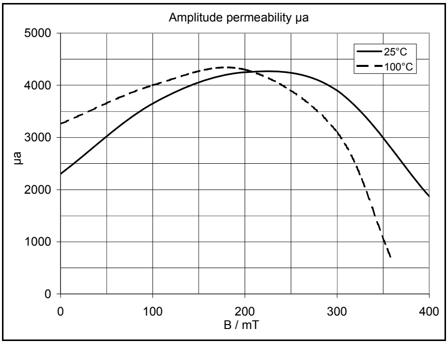





Spezific power loss Pv as a function of temperature T
Pv / mW/cm³
T / °C
200 mT
100 mT
50 mT
f = 100 kHz
1000
100
10
1
20
40
60
80
100
120
140


Spezific power loss Pv as a function of frequency f and induction B
Pv / mW/cm³
f / kHz
200 mT
100 mT
50 mT
25°C
100°C
10000
1000
100
10
1
10
100
1000


Induction Bmax as a function of temperature T at 250 A/m
Bmax / mT
T / °C
f = 16 kHz
500
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
180
200


Amplitude permeability µa
µa
B / mT
25°C
100°C
5000
4000
3000
2000
1000
0
0
100
200
300
400

B1.1 FERROCARIT | SUMMARY

FERROCARIT			Fi 292		Fi 262		Fi 248[1)]		Fi 242		Fi 221	
Initial permeability	μ_i	1	900 ± 20%		650 ± 20%		440 ± 20%		400 ± 20%		250 ± 20%	
Relative loss factor	$\frac{\tan\delta}{\mu_i}$	10^{-6}	< 12	< 30	< 10	< 50	< 300	< 1300	< 25	< 100	< 40	< 200
frequency	f	MHz	0,01	0,2	0,05	1,6	0,2	2	0,2	2	0,2	5
Hysteresis material constant	η_B	$\frac{10^{-6}}{mT}$							< 11		< 10	
Induction H = 3000 A/m	B	mT	330		480		370		400		330	
Coercivity	H_C	A/m	20		40		120		45		120	
Curie temperature	T_C	°C	140		290		240		230		330	
Rel. temperature factor +23...+70°C	α_F	$\frac{10^{-6}}{K}$			< 2,5		< 20		< 20		< 5	
Rel. disaccommodation factor T = 40°C	D_F	10^{-6}							< 6			
DC - Resistivity	ρ	Ωm	> 10^7		> 1		> 100		> 10^7		> 10^4	

1) new material

B1.1 FERROCARIT | SUMMARY

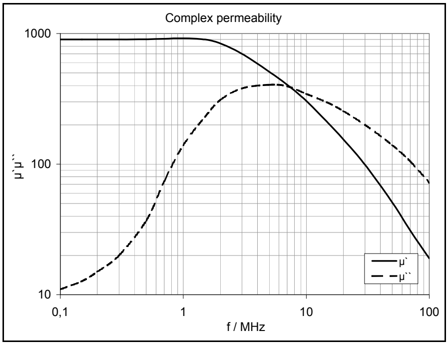
FERROCARIT			Fi 215		Fi 212		Fi 150		Fi 130		Fi 110	
Initial permeability	μ_i	1	150 ± 20%		100 ± 20%		50 ± 20%		30 ± 20%		12 ± 20%	
Relative loss factor	$\frac{\tan\delta}{\mu_i}$	10^{-6}	< 80	< 140	< 50	< 150	< 100	< 700	< 80	< 500	< 150	< 400
frequency	f	MHz	1	5	2	10	10	50	10	50	10	100
Hysteresis material constant	η_B	$\frac{10^{-6}}{mT}$										
Induction *H* = 3000 A/m	B	mT	430		310		300		270		240	
Coercivity	H_C	A/m	100		600		200		700		1800	
Curie temperature	T_C	°C	385		420		430		500		580	
Rel. temperature factor +23...+70°C	α_F	$\frac{10^{-6}}{K}$			< 7		< 20		< 25		< 80	
Rel. disaccommodation factor T = 40°C	D_F	10^{-6}										
DC - Resistivity	ρ	Ωm	> 10^{7}		> 10^{4}		> 10^{3}		> 10^{3}		> 10^{4}	

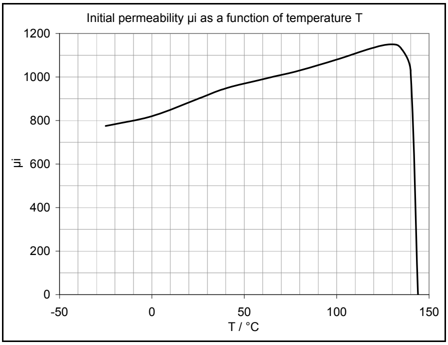
sumida

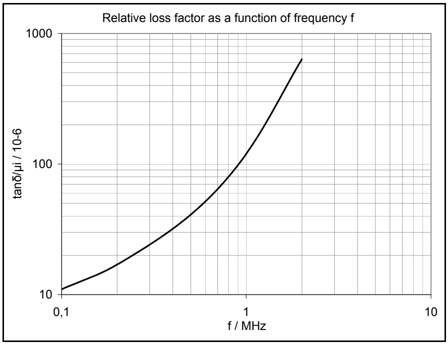
B1.1 FERROCARIT | FI 292

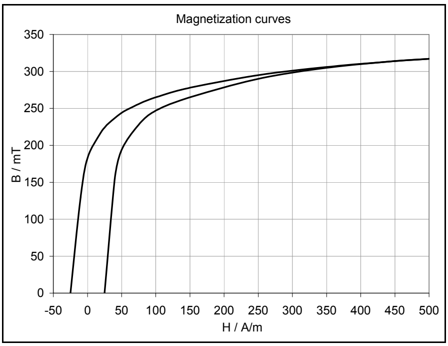
A high permeability NiZn ferrite for use in broadband EMI-suppression in a frequency range of 30 - 1000 MHz, as well as RF broadband transformers

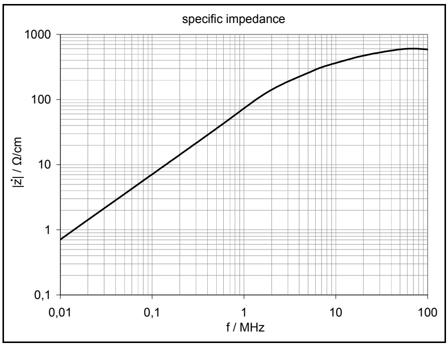
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	900 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 30	10^{-6}	25°C ; 0,2 MHz ≤ 0,25 mT
η_B			
B	340	mT	25°C ; 16 kHz 3000 A/m
P_V			
T_C	140	°C	10 kHz ≤ 0,25 mT

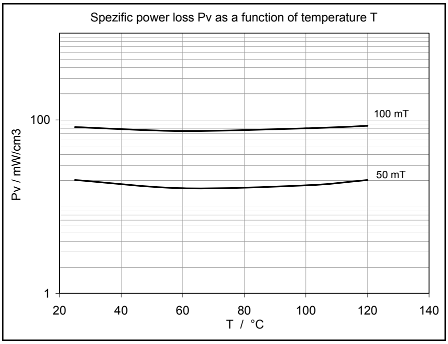


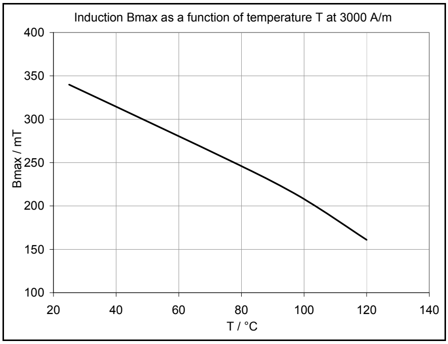


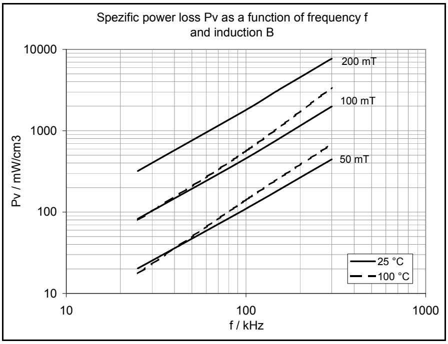







Spezific power loss Pv as a function of temperature T
Pv / mW/cm3
T / °C
100 mT
50 mT
100
1
20
40
60
80
100
120
140

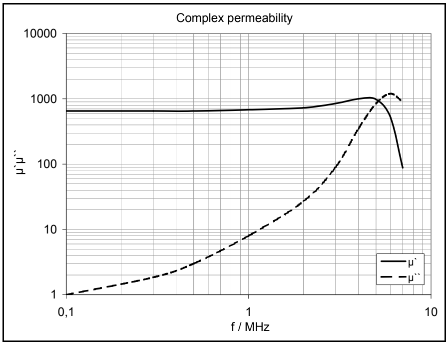

Induction Bmax as a function of temperature T at 3000 A/m
Bmax / mT
T / °C
400
350
300
250
200
150
100
20
40
60
80
100
120
140

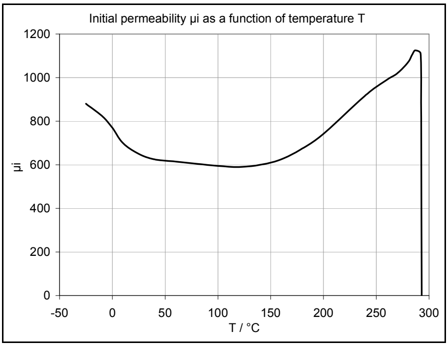

Spezific power loss Pv as a function of frequency f and induction B
Pv / mW/cm3
f / kHz
200 mT
100 mT
50 mT
25 °C
100 °C
10000
1000
100
10
10
100
1000

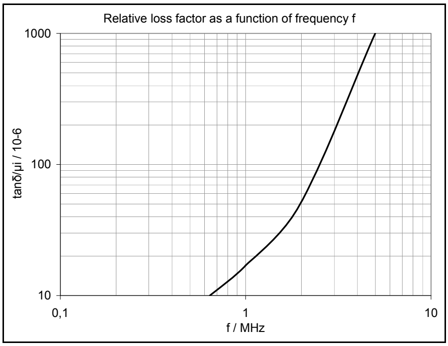
B1.1 FERROCARIT | FI 262

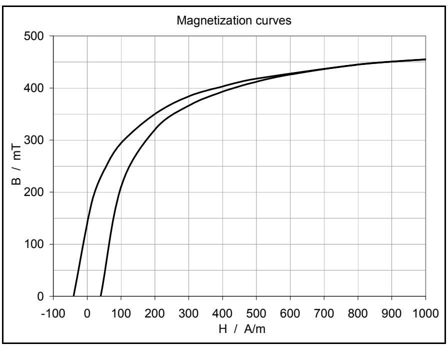
A medium permeability MnZn ferrite for broadband filters and tuning material for frequencies up to 2 MHz

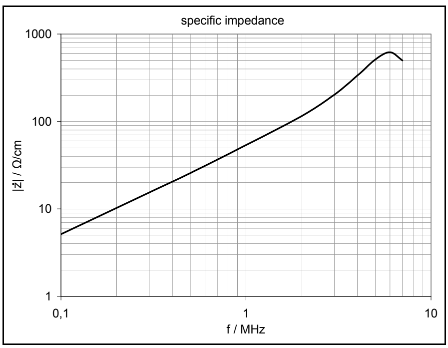
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	650 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 50	10^{-6}	25°C ; 1,6 MHz ≤ 0,25 mT
η_B			
B	480	mT	25°C ; 16 kHz 3000 A/m
P_V		mW / cm³	
T_C	290	°C	







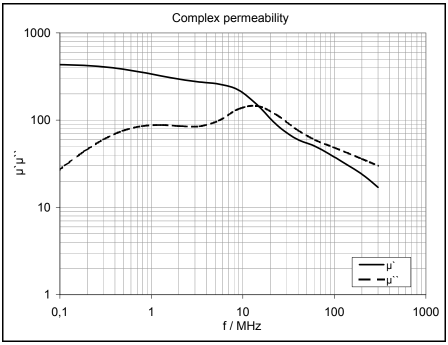


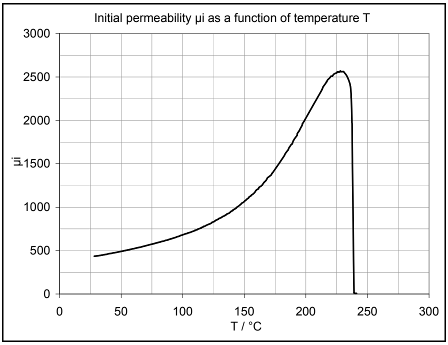


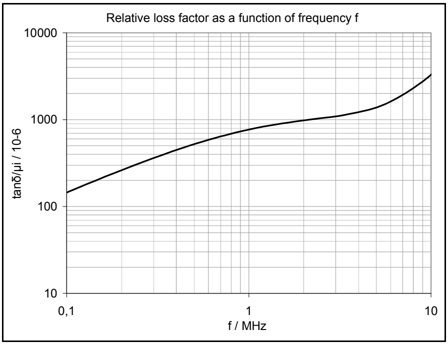
B1.1 FERROCARIT | FI 248

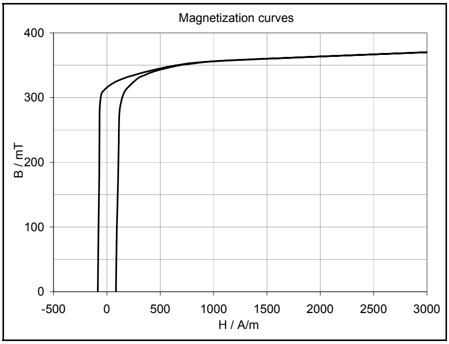
A low permeability material with a broad frequency range for noise suppression applications

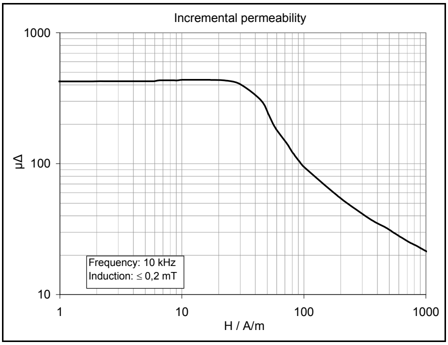
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	440	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	1400	10^{-6}	25°C ; 5 MHz ≤ 0,25 mT
η_B	10	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	370	mT	25°C ; 16 kHz 3000 A/m
			25°C ; 16 kHz 3000 A/m
P_V		mW / cm³	25°C ; 100 kHz 200 mT
			100°C ; 100 kHz 200 mT
T_C	240	°C	10 kHz ≤ 0,25 mT

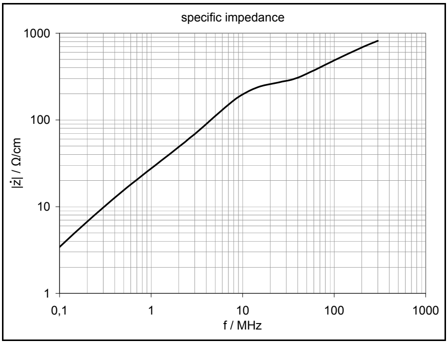


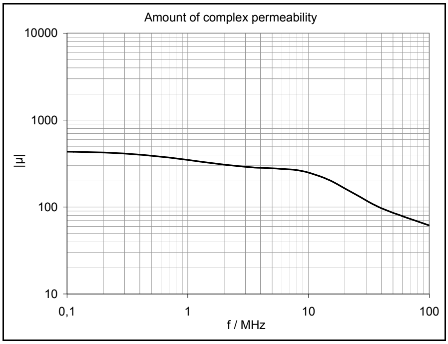









specific impedance
1000
100
10
1
|ż| / Ω/cm
0,1
1
10
100
1000
f / MHz

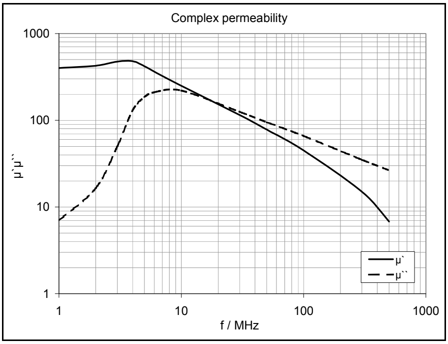

Amount of complex permeability
10000
1000
100
10
|μ|
0,1
1
10
100
f / MHz

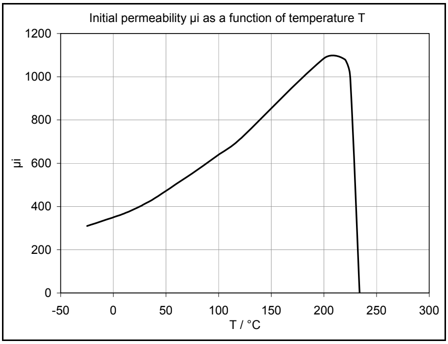
sumida

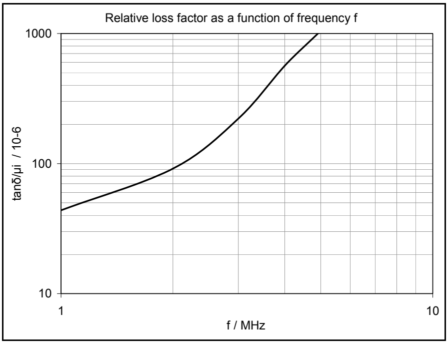
B1.1 FERROCARIT | FI 242

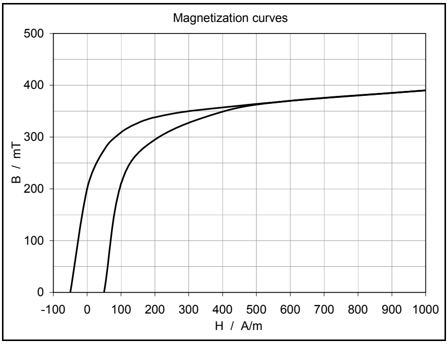
A medium permeability NiZn ferrite for applications requiring a high specific resistance by relatively low power losses

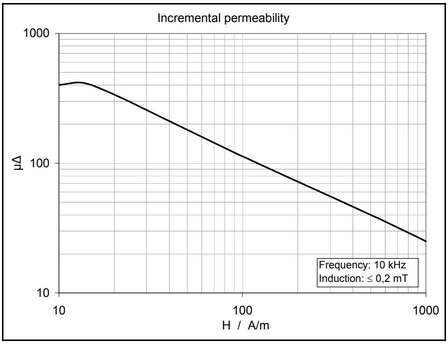
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	400 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 100	10^{-6}	25°C ; 2 MHz ≤ 0,25 mT
η_B	< 11	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	420	mT	25°C ; 16 kHz 3000 A/m
	>300		100°C ; 16 kHz 3000 A/m
P_V	700	mW / cm³	25°C ; 100 kHz 100 mT
	550		100°C ; 100 kHz 100 mT
T_C	230	°C	

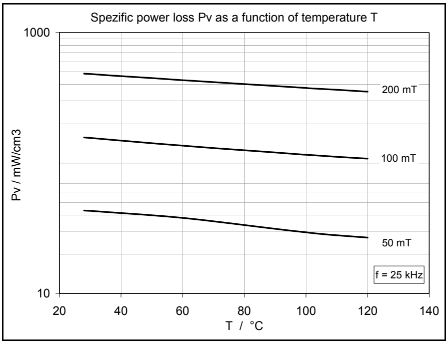




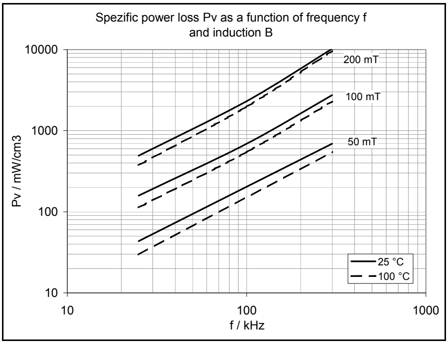




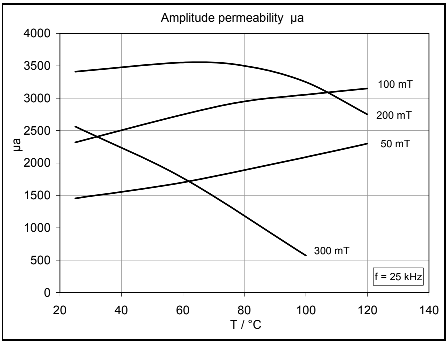




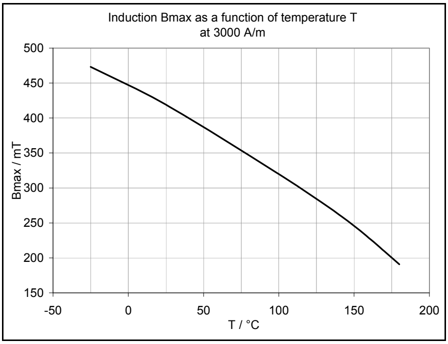
Spezific power loss Pv as a function of temperature T
1000
10
Pv / mW/cm3
200 mT
100 mT
50 mT
f = 25 kHz
20
40
60
80
100
120
140
T / °C



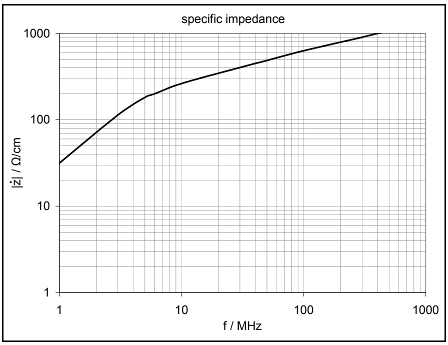
Spezific power loss Pv as a function of frequency f
and induction B
10000
1000
100
10
Pv / mW/cm3
200 mT
100 mT
50 mT
25 °C
100 °C
10
100
1000
f / kHz



Amplitude permeability µa
4000
3500
3000
2500
2000
1500
1000
500
0
µa
100 mT
200 mT
50 mT
300 mT
f = 25 kHz
20
40
60
80
100
120
140
T / °C



Induction Bmax as a function of temperature T
at 3000 A/m
500
450
400
350
300
250
200
150
Bmax / mT
-50
0
50
100
150
200
T / °C

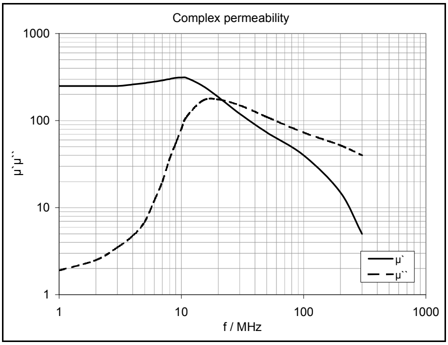


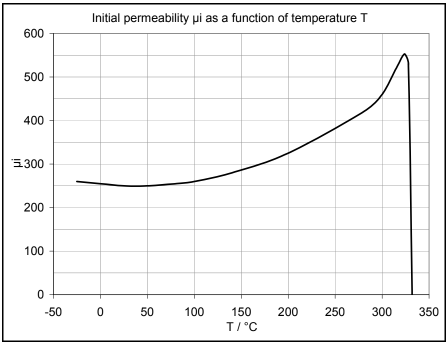
specific impedance
1000
100
10
1
|ż| / Ω/cm
1
10
100
1000
f / MHz

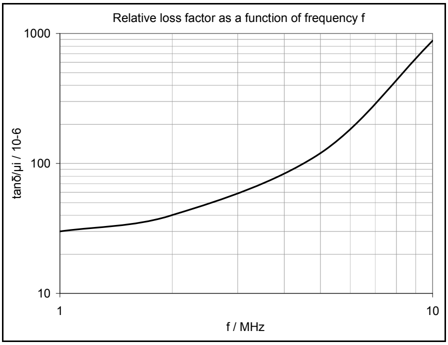
B1.1 FERROCARIT | FI 221

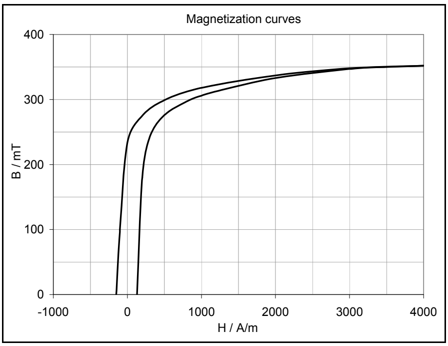
A medium permeability NiZn ferrite for use in broadband EMI-suppression in a frequency range of 30 - 1000 MHz, as well as RF broadband transformers

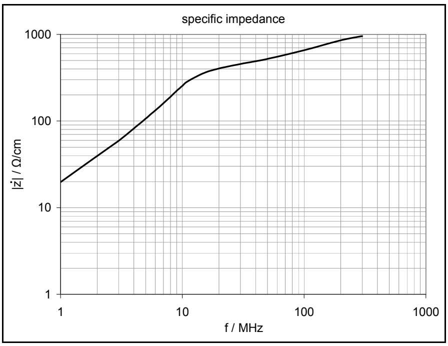
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	250 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 200	10^{-6}	25°C ; 5 MHz ≤ 0,25 mT
η_B	< 10	10^{-6} / mT	25°C ; 10 kHz ≤ 1,5mT to 3mT
B	330	mT	25°C ; 16 kHz 3000 A/m
P_V			
T_C	330	°C	











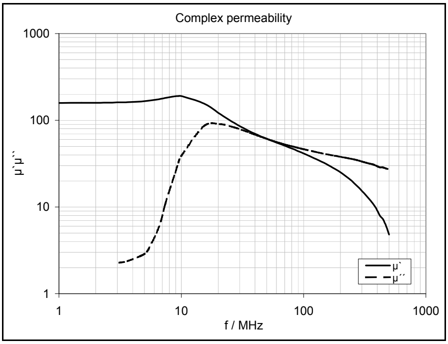
B MAGNETIC MATERIAL + CORES

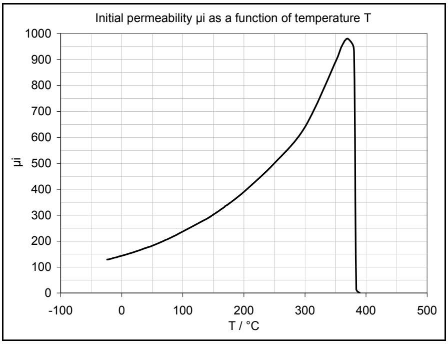
B1 MAGNETIC MATERIAL

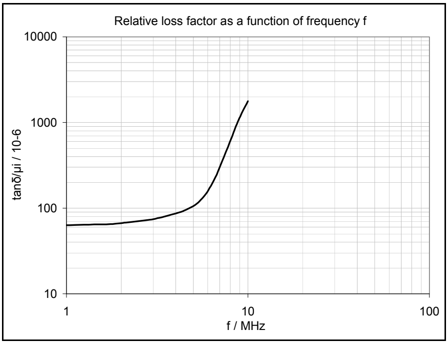
B1.1 FERROCARIT | FI 215

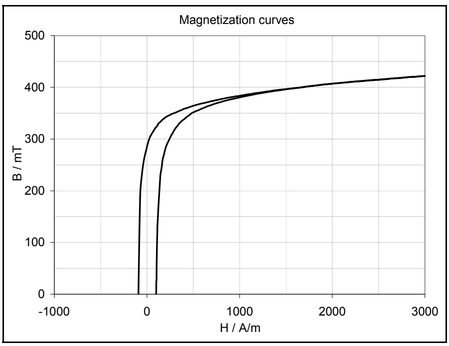
A high ohmic NiZn ferrite with optimized saturation induction at high ambient temperatures, e.g. for HID - Xenon ignition modules

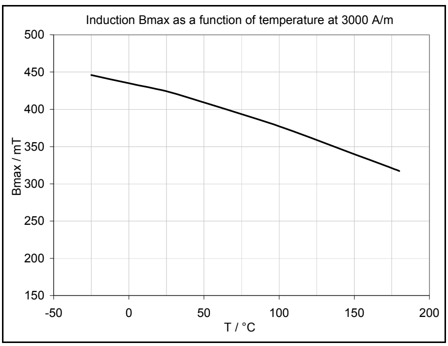
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	150 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 140	10^{-6}	25°C ; 5 MHz ≤ 0,25 mT
η_B			
B	430	mT	25°C ; 12 kHz 3000 A/m
	325		170°C ; 12 kHz 3000 A/m
P_V	1800	mW / cm³	25°C ; 100 kHz 100 mT
	1500		100°C ; 100 kHz 100 mT
T_C	390	°C	10 kHz ≤ 0,25 mT

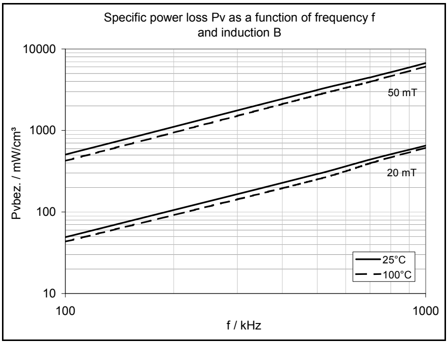


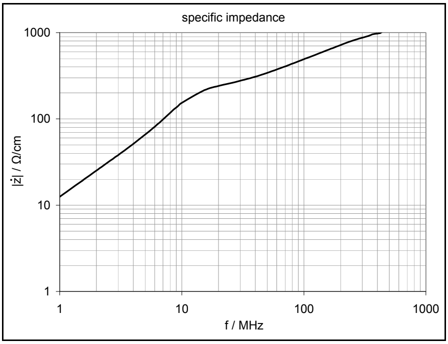








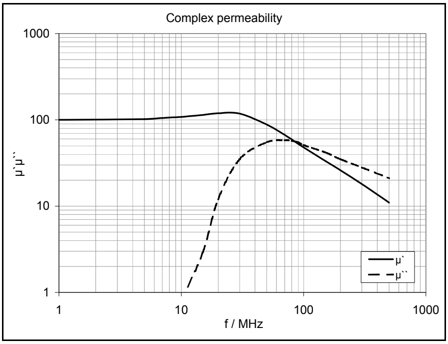

Specific power loss Pv as a function of frequency f and induction B
Pvbez. / mW/cm³
f / kHz
10000
1000
100
10
100
1000
50 mT
20 mT
25°C
100°C

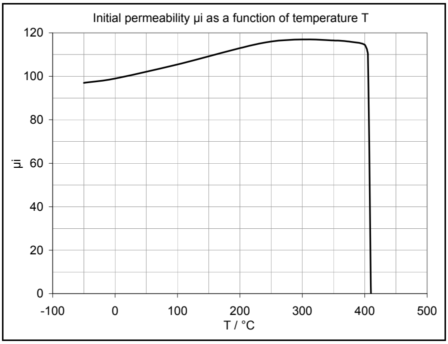

specific impedance
|ż| / Ω/cm
f / MHz
1000
100
10
1
1
10
100
1000

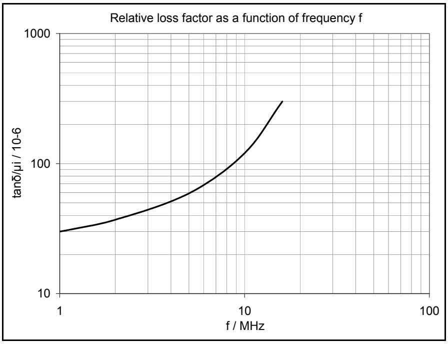
B1.1 FERROCARIT | FI 212

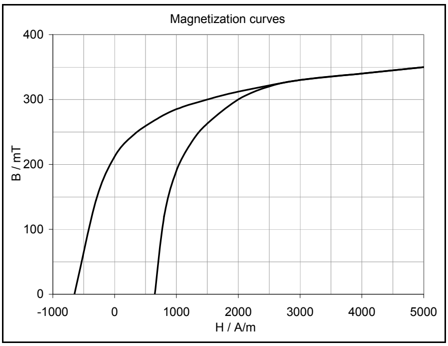
A low permeability NiZn ferrite for use in RF tuning, broadband and balance-to-unbalance transformers (baluns)

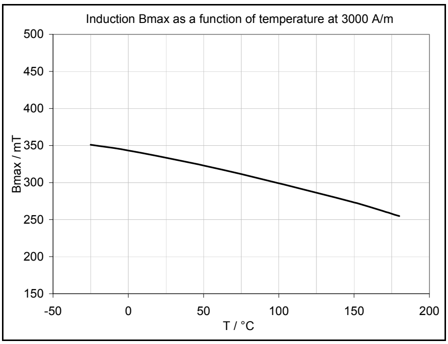
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	100 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta$ / μ_i	< 150	10^{-6}	25°C ; 10 MHz ≤ 0,25 mT
η_B			
B	330	mT	25°C ; 16 kHz 3000 A/m
	300		100°C ; 16 kHz 3000 A/m
P_v	580	mW / cm³	25°C ; 100 kHz 50 mT
	770		100°C ; 100 kHz 50 mT
T_c	420	°C	

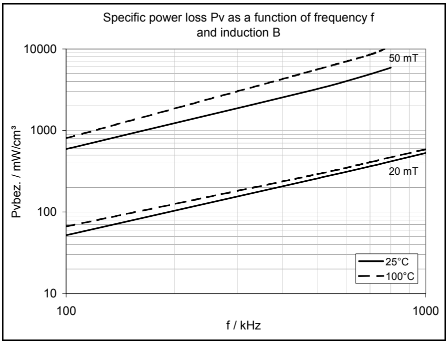


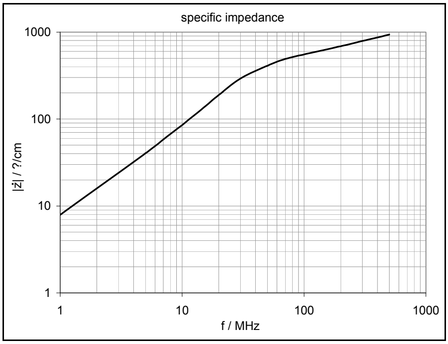








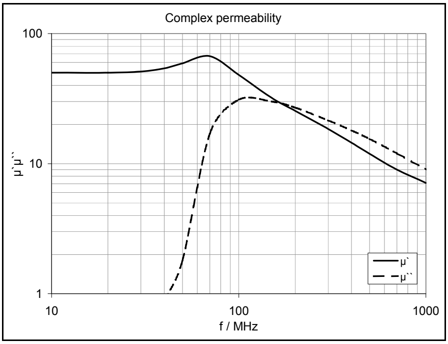

Specific power loss Pv as a function of frequency f and induction B
10000
1000
100
10
Pvbez. / mW/cm³
50 mT
20 mT
25°C
100°C
100
1000
f / kHz

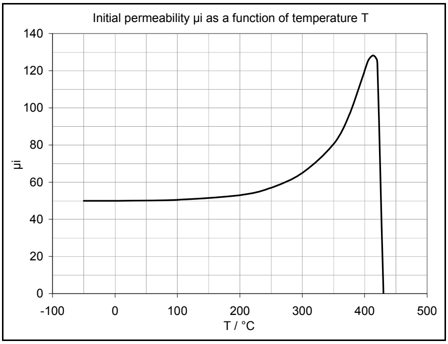

specific impedance
1000
100
10
1
|ž| / ?/cm
1
10
100
1000
f / MHz

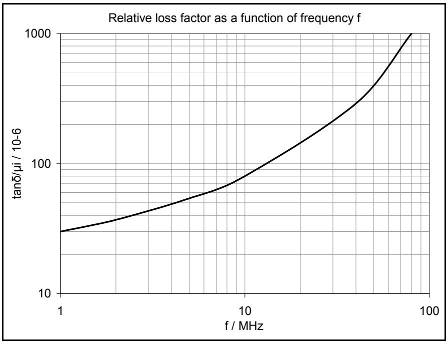
B1.1 FERROCARIT | FI 150

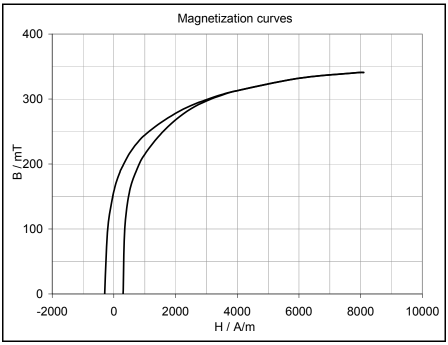
A low permeability NiZn ferrite for use in RF tuning, broadband and balance-to-unbalance transformers (baluns)

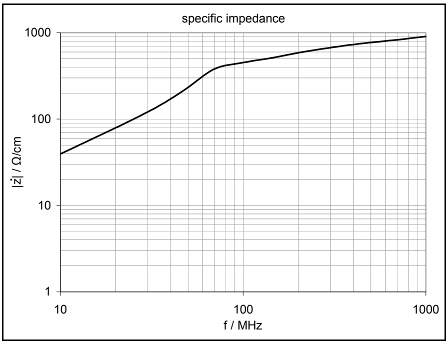
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	50 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 700	10^{-6}	25°C ; 50 MHz ≤ 0,25 mT
η_B			
B	300	mT	25°C ; 16 kHz 3000 A/m
P_V			
T_c	430	°C	







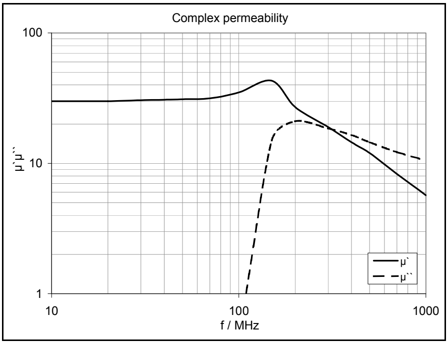


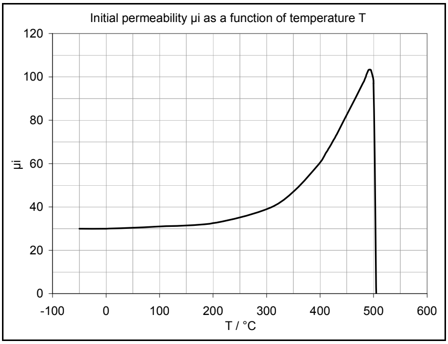


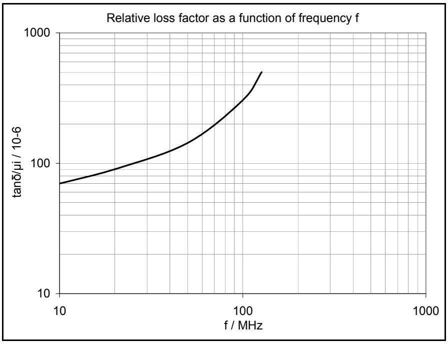
B1.1 FERROCARIT | FI 130

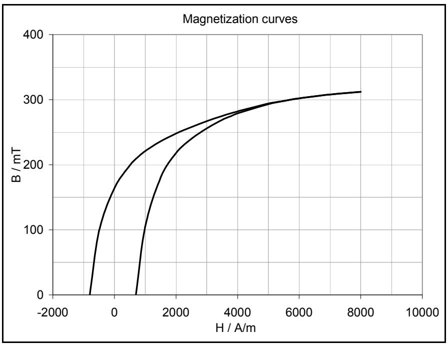
A low permeability NiZn ferrite for use in RF tuning, broadband and balance-to-unbalance transformers (baluns)

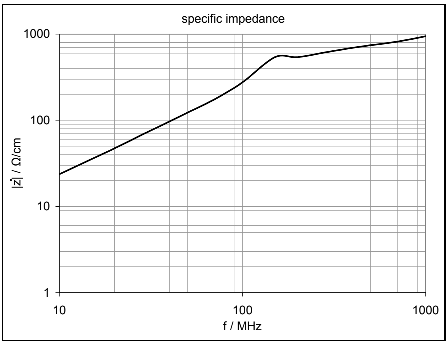
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	30 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 500	10^{-6}	25°C ; 50 MHz ≤ 0,25 mT
η_B			
B	270	mT	25°C ; 16 kHz 3000 A/m
P_V			
T_c	500	°C	







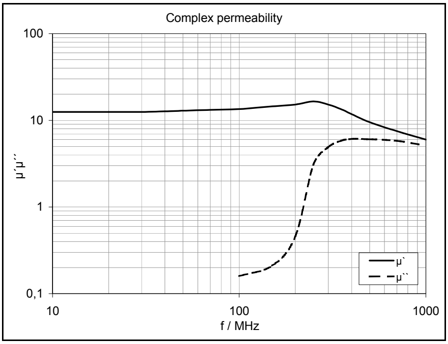


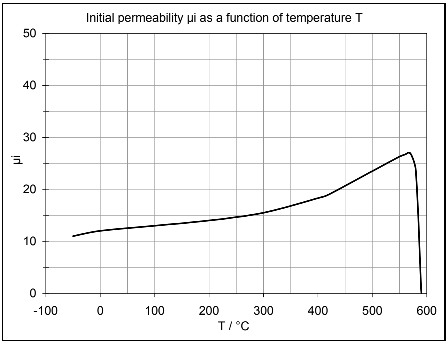


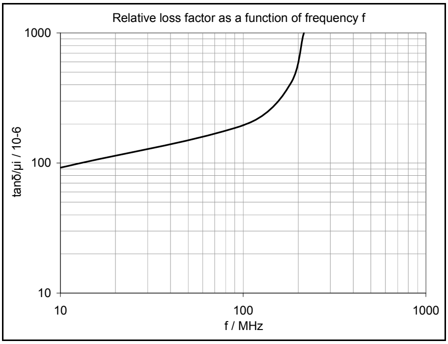
B1.1 FERROCARIT | FI 110

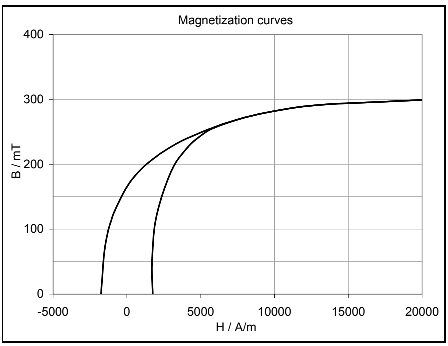
A low permeability NiZn ferrite for use in RF tuning, broadband and balance-to-unbalance transformers (baluns)

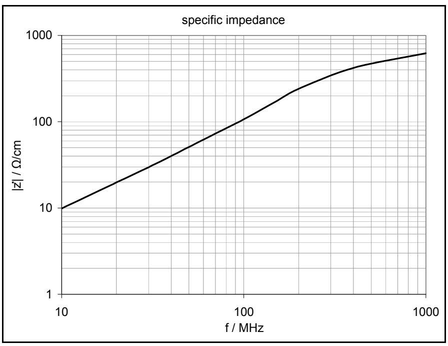
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	12 ± 20%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	< 400	10^{-6}	25°C ; 100 MHz ≤ 0,25 mT
η_B			
B	240	mT	25°C ; 16 kHz 3000 A/m
P_V			
T_C	580	°C	











B1.2 PLASTOFERRITE | GENERAL DESCRIPTION

Magnetically Soft Plastoferrite Fi520 - Fi522

Plastoferrite **Fi520 - Fi522** represent a special development in our range of soft magnetic ferrite materials.

The basis of this materials is a homogenization process which allows production of an injectable plastic compound with a high proportion of loading material from soft ferrite powder, spread evenly throughout the plastic matrix. The result is a soft magnetic material particularly suited for small signal applications but providing all the advantages of the free shaping of injection moulding, thus permitting economical production of complex core geometries with high dimensional accuracy.

Another advantage of cores made from Plastoferrite is the low brittleness of the material and consequently its insensitiveness especially to mechanical load.

The general technical data of the magnetically soft Plastoferrite is specified in the following charts. The filling ratio of this plastic compound is very high, which is indicated by the relatively high admissible magnetic load - according to the magnetization curve - and the fact that, for magnetically thinned materials meaning distributed air gaps, initial permeability is high, reaching a value of $\mu_i = 20$.
If requested, lower values of initial permeability can be individually set up by modification of the mixing ratio ferrite powder/plastic.

The particular electrical advantages are the considerable wide-band property of the material up to MHz-range and the high temperature-consistency of permeability up to values in direct vicinity of the Curie temperature for **Fi520** and up to 200°C for **Fi522**.

Thus Plastoferrite **Fi520** and **Fi522** are interesting materials for various applications, for example in sensors or for the production of magnetically active coil formers, which demand a combination of soft magnetic qualities along with the possibilities of free shaping

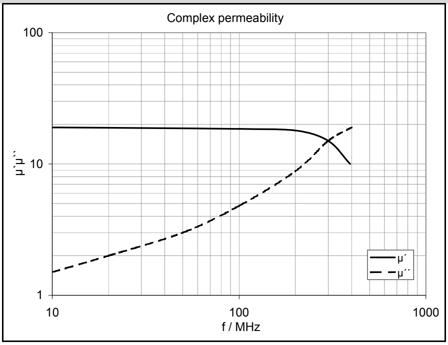
B1.2 PLASTOFERRITE | SUMMARY

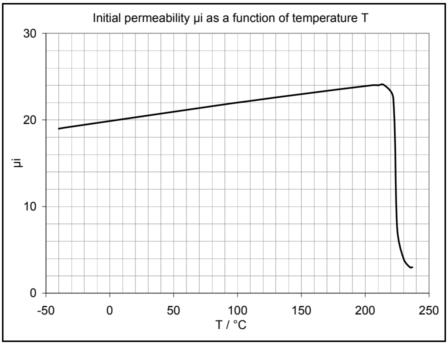
Plastoferrite			**Fi 520**	**Fi 522**
Initial permeability f = 10 kHz	μ_i	1	20 ± 10%	19 ± 10%
Relative loss factor frequency	$\frac{\tan\delta}{\mu_i}$ f	10^{-6} MHz	< 3500 10	< 5000 10
Hysteresis material constant f = 20 kHz	η_B	$\frac{10^{-6}}{mT}$	< 700	< 300
Induction H = 30000 A/m	B	mT	280	350
Coercivity	H_C	A/m	400	400
Curie temperature	T_C	°C	150	> 200
DC - Resistivity	ρ	Ωm	> 3,0	> 1,0
Rel. temperature factor 25°C - 70°C	α_F	$\frac{10^{-6}}{K}$	< 30	< 50

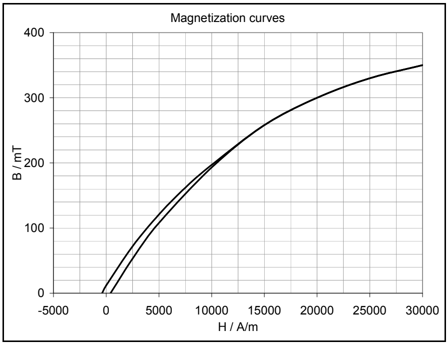
B1.2 PLASTOFERRITE | FI 522

A material with a considerable wide-band property up to MHz-range and high temperature-consistency of permeability up to 200°C. For use in sensores or magnetically active coil formers with the possibility of free
shaping

Symbol	Value	Unit	Conditions
μ_i	19 ± 10%	1	25°C ; <= 10 kHz <= 0,25 mT
$\tan\delta / \mu_i$	< 5000	10^{-6}	25°C ; 10 MHz <= 0,25 mT
η_B	< 300	10^{-6} / mT	25°C ; 20 kHz <=1,5mT to 3mT
B	350	mT	25°C ; 16 kHz 30000 A/m
Rspez.	> 1,0	Ωm	
a_F	< 50	10^{-6} / k	-25° - 70°C
Tc	> 200	°C	



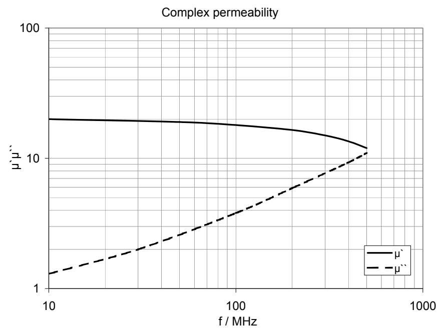


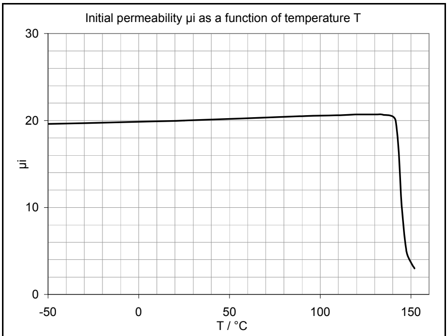


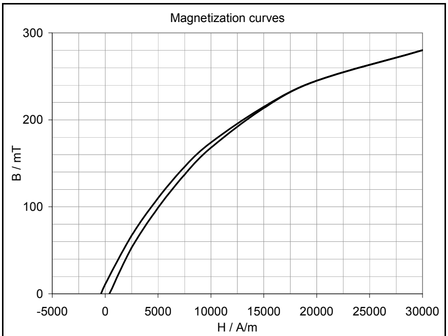
B1.2 PLASTOFERRITE | FI 520

A material with a considerable wide-band property up to MHz-range and high temperature-consistency of permeability nearly up to Curie-temperature. For use in sensors or magnetically active coil formers with the possibility of free shaping

Symbol	Value	Unit	Conditions
μ_i	20 ± 10%	1	25°C ; <= 10 kHz <= 0,25 mT
$\tan\delta / \mu_i$	< 3500	10^{-6}	25°C ; 10 MHz <= 0,25 mT
η_B	< 700	10^{-6} / mT	25°C ; 20 kHz <=1,5mT to 3mT
B	280	mT	25°C ; 16 kHz 30000 A/m
Rspez.	> 3,0	Ωm	
a_F	< 30	10^{-6} / k	-25° - 70°C
T_C	150	°C	







B1.3 FERROCART | OVERVIEW

FERROCART (IRON POWDER)

Our FERROCART material grades are manufactured by pressing; they consist of a blend of magnetically soft metal powder and isolating binder. Through fine grain dispersion, eddy currents are largely suppressed. Different FERROCART types, which are suitable for application at low frequency ranges, up to approximately 100 MHz, can be manufactured by mixture of metal powder types and isolation portions. We can fully take advantage of the metallic Magnetika, which is the high magnetization, with this material, for instance in component parts used for power electronics. Furthermore fine grain dispersion implicates internal demagnetization with the result of an extremely good stabilization. Air gaps, which have to be mostly used in strip band cores or laminated steel cores, are no more necessary. By using FERROCART material grades, it ensues in many cases, like loading coil - and noise suppression choke applications, very cheap inductive component parts.

Remark

The data of our different material grades as shown on the following tables, were measured on toroidal test cores. As is well known there is no direct relation between material characteristics as measured on test pieces and the corresponding parameters of other cores, made of the same material, but different in shape and size, especially if cores are applied outside those ranges (e.g. of frequency, induction, or temperature), within which the catalogue material properties have been ascertained.

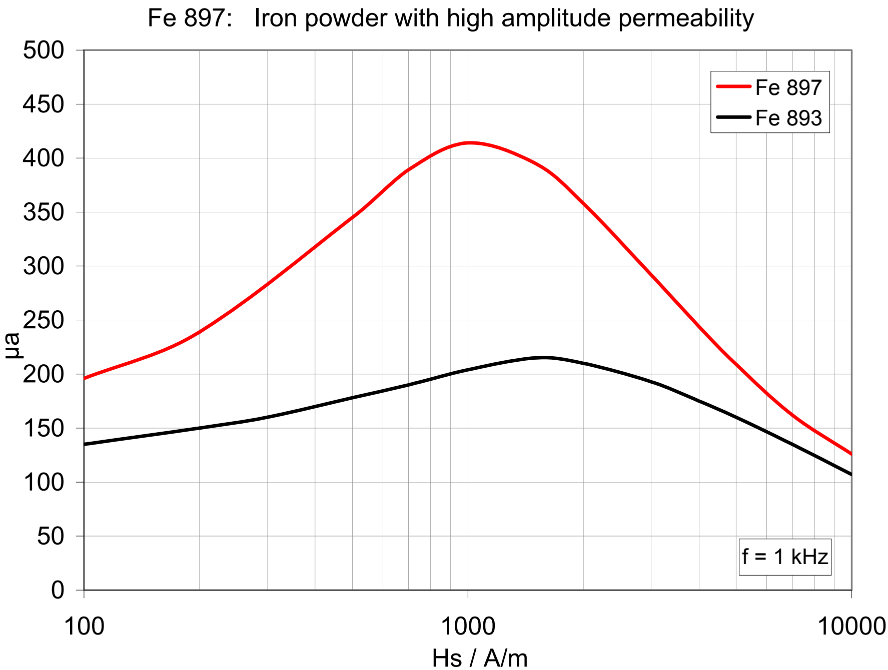
No guarantee can be given that specifications as laid down in this catalogue may not be changed before the next edition is given to press. Obligatory assurances of properties require separate agreements in writing in order to become efficacious.

For these reasons, if new components are to be designed, we ask our customers for due contact in order to agree on suitable specifications. This can be done either by fixing measuring conditions and quantities or by exchanging standard cores or components.

General technical characteristics

Density	≈	5 . . . 7,4	$g \cdot cm^{-3}$
DC Resistivity	≈	5	$\Omega \cdot m$
E-Modul	≈	30 . . . 70	$kN \cdot mm^{-3}$
Expansion Coefficient	≈	10 . . . 25	$10^{-6} \cdot K^{-1}$
Thermal Conductivity	≈	10	$W \cdot m^{-1} \cdot K^{-1}$

B1.3 FERROCART NEW MATERIAL



TASK: Development of a µa optimized iron powder material for AC applications

Result: Fe897 with a amplidude permability of 420 with low power losses

B1.3 FERROCART | SUMMARY

Application	Frequency range MHz	Magnetic load	Powder materials **FERROCART**	Core shape
High Q circuits (Coils with high thermal and temporal stability insensible of external magnetic fields)	≤ 10 ≤ 100	All powder materials have a high saturation magnetization and are therefore usable at extremely high magnetic load.	Fe 818 Fe 810	Rod, tube, screw, nipple and cup cores
Anti-interference and damping coils	≤ 10		Fe 876 Fe 850 Fe 818 Fe 810	Rod, tube, multi-aperture, E-, and pot cores, toroids
Power applications (Inductors and transformers with high thermal and temporal stability, for high AC amplitudes or high premagnetization, e.g. loading coils, noise suppression coils)	≤ 0,2		Fe 897 Fe 896 Fe 893 Fe 892 Fe 876 Fe 875 Fe 850 Fe 835 Fe 818	Toroids
Toroids for thyristor noise suppression chokes for dimmers.			Fe 896 Fe 892	Toroids

B1.3 FERROCART | SUMMARY

FERROCART			Fe 897		Fe 896		Fe 893		Fe 892		Fe 876	
Initial permeability	μ_i	1	125 ± 15%		140 ± 15%		110 ± 15%		100 ± 15%		75 ± 15%	
Relative loss factor	$\frac{\tan\delta}{\mu_i}$	10^{-6}		1600		1200	190	1400	120	1600		100
frequency	f	MHz	0,01	0,16	0,01	0,16	0,01	0,16	0,01	0,16	0,01	0,16
Rel. temperature factor 25°C - 70°C	α_F	$\frac{10^{-6}}{K}$	< 18		< 10		< 18		< 18		< 5	
Maximum operating temperature [1]		°C	200		200		200		200		180	
preferred shapes			Toroids		Toroids		Toroids		Toroids		Toroids	

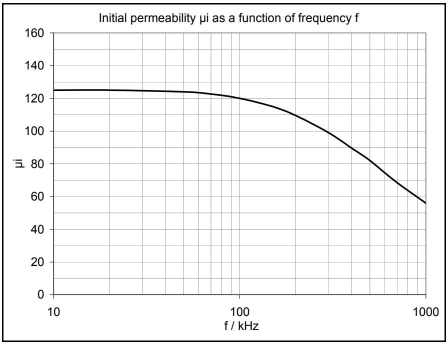
FERROCART			Fe 875		Fe 850		Fe 835		Fe 818		Fe 810	
Initial permeability	μ_i	1	75 ± 15%		55 ± 15%		35 ± 15%		18 ± 10%		10 ± 10%	
Relative loss factor	$\frac{\tan\delta}{\mu_i}$	10^{-6}	120	1300	140	800	100	180	110	200	500	2000
frequency	f	MHz	0,01	0,16	0,02	0,3	0,05	0,5	0,05	0,5	12	100
Rel. temperature factor 25°C - 70°C	α_F	$\frac{10^{-6}}{K}$	< 18		< 15		< 12		< 12		< 2	
Maximum operating temperature [1)]		°C	180		180		150		150		120	
preferred shapes			Toroids		Toroids		Toroids		Toroid, rod, tube, screw cores			

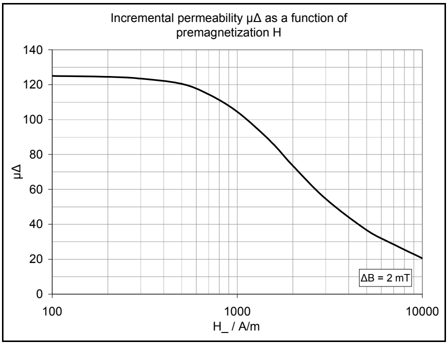
[1)] the maximum operating temperature of coated cores depends on the temperature behaviour of the coating material.

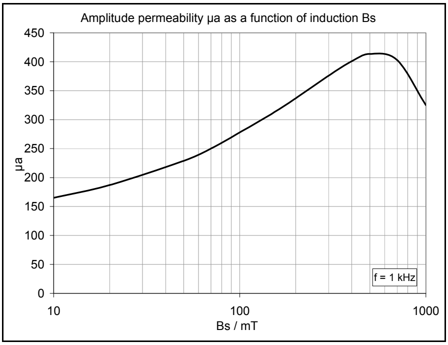
B1.3 FERROCARIT | FE 897

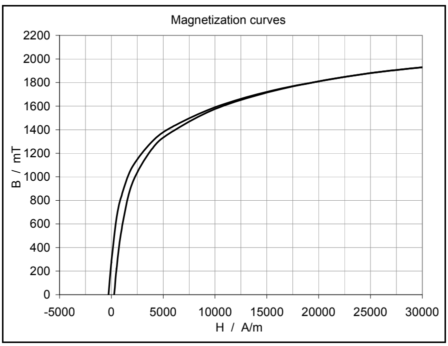
A material with high thermal and temporal stability , for high AC amplitudes or high premagnetization. For use in power applications

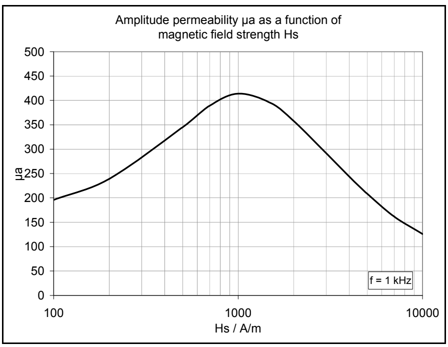
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	125 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	1600	10^{-6}	25°C ; 0,16 MHz ≤ 0,25 mT
μ_a	420	1	25°C ; 1 kHz 500 mT
μ_Δ	73	1	25°C ; 10 kHz 2000 A/m
	37		25°C ; 10 kHz 5000 A/m
a_F	≤ 18	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	200	°C	

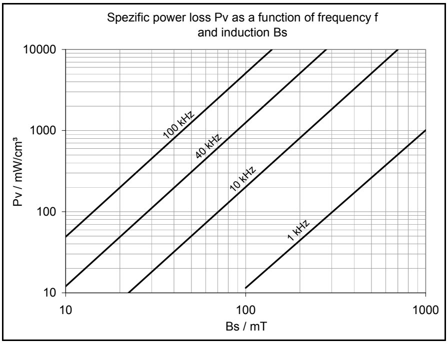








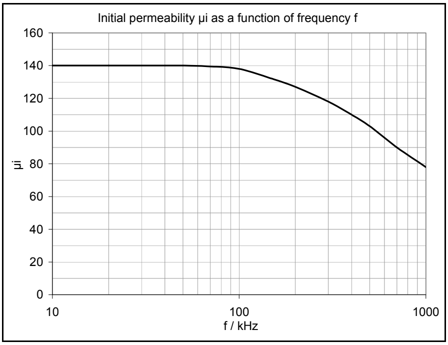


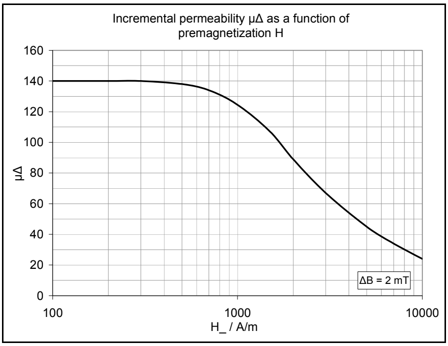

Spezific power loss Pv as a function of frequency f
and induction Bs
10000
1000
100
10
Pv / mW/cm³
10
100
1000
Bs / mT
100 kHz
40 kHz
10 kHz
1 kHz

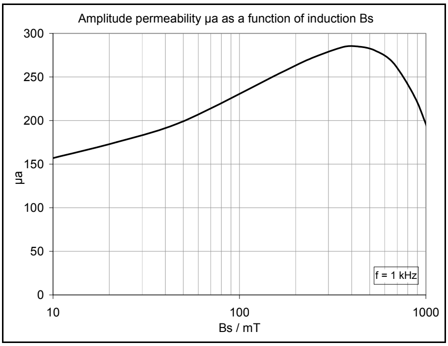
B1.1 FERROCART | FE 896

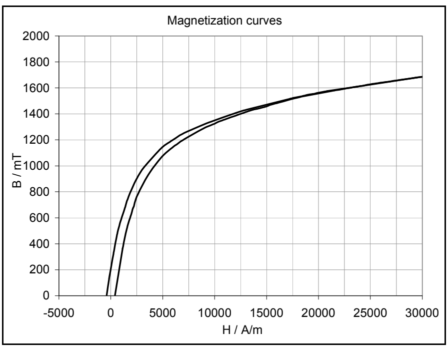
A material with high thermal and temporal stability, for high AC amplitudes or high premagnetization.
For use in power applications (e.g. loading coils, noise suppression)

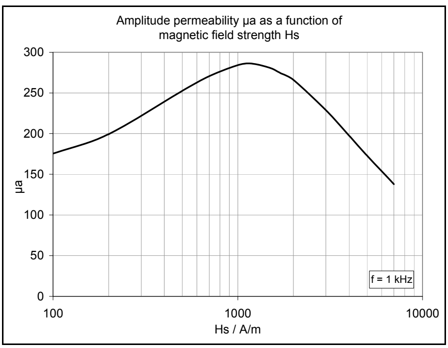
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	140 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	1200	10^{-6}	25°C ; 0,16 MHz ≤ 0,25 mT
μ_a	270	1	1 kHz 500 mT
μ_Δ	90	1	25°C ; 10 kHz 2000 A/m
	45		25°C ; 10 kHz 5000 A/m
a_F	< 10	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	200	°C	

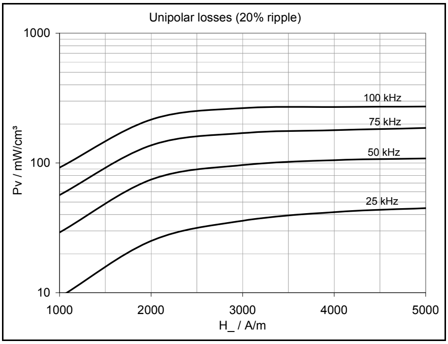


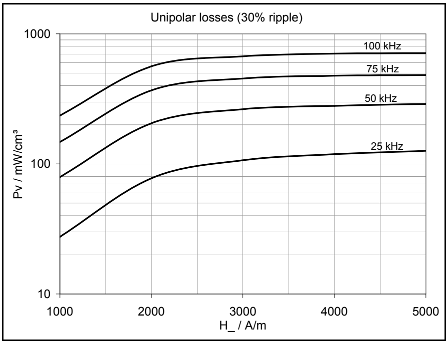


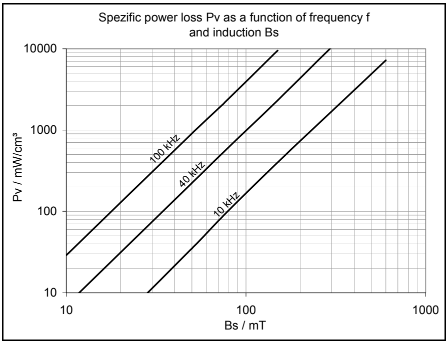







Unipolar losses (20% ripple)
Pv / mW/cm³
H_ / A/m
100 kHz
75 kHz
50 kHz
25 kHz
1000
100
10
1000
2000
3000
4000
5000

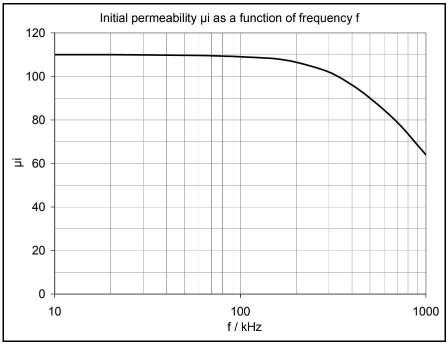

Unipolar losses (30% ripple)
Pv / mW/cm³
H_ / A/m
100 kHz
75 kHz
50 kHz
25 kHz
1000
100
10
1000
2000
3000
4000
5000

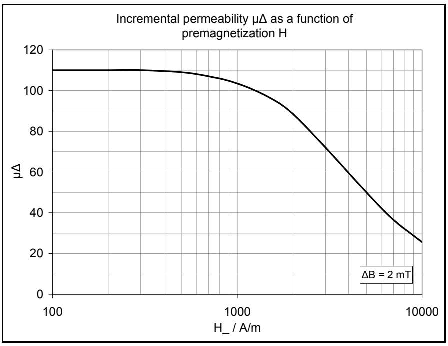

Spezific power loss Pv as a function of frequency f
and induction Bs
Pv / mW/cm³
Bs / mT
100 kHz
40 kHz
10 kHz
10000
1000
100
10
10
100
1000

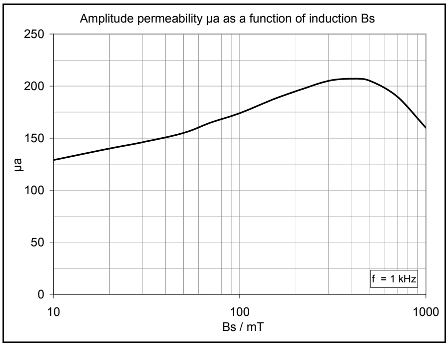
B1.3 FERROCARIT | FE 893

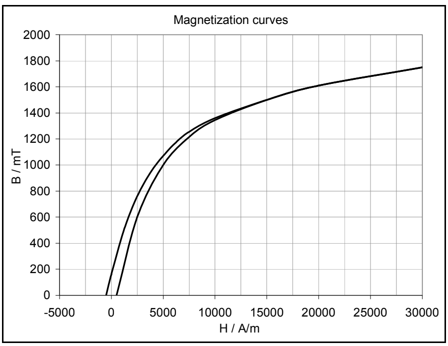
A material with high thermal and temporal stability, for high AC amplitudes or high premagnetization. For use in power applications (e.g. loading coils, noise suppression coils)

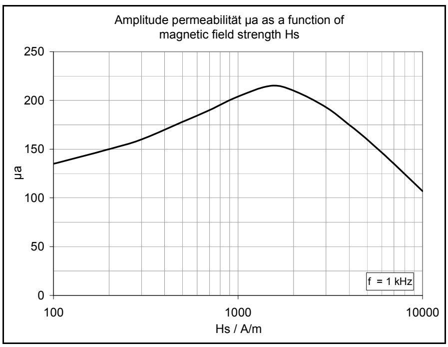
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	110 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	1400	10^{-6}	25°C ; 0,16 MHz ≤ 0,25 mT
μ_a	210	1	1 kHz 500 mT
μ_Δ	88	1	25°C ; 10 kHz 2000 A/m
	50		25°C ; 10 kHz 5000 A/m
a_F	≤ 18	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	200	°C	

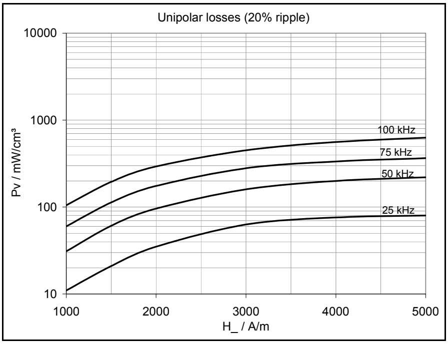


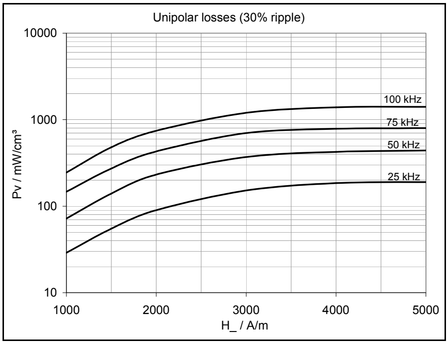


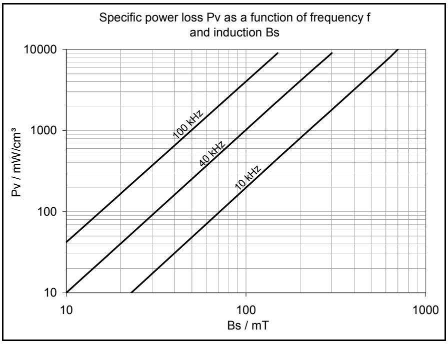







Unipolar losses (20% ripple)
10000
1000
100
10
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz
1000
2000
3000
4000
5000
H_ / A/m

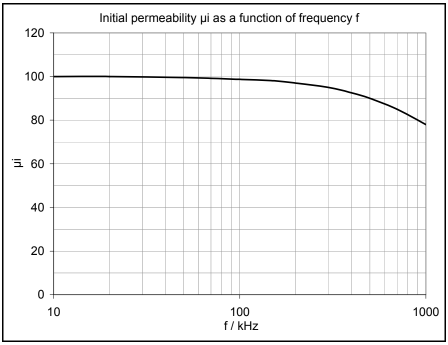

Unipolar losses (30% ripple)
10000
1000
100
10
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz
1000
2000
3000
4000
5000
H_ / A/m

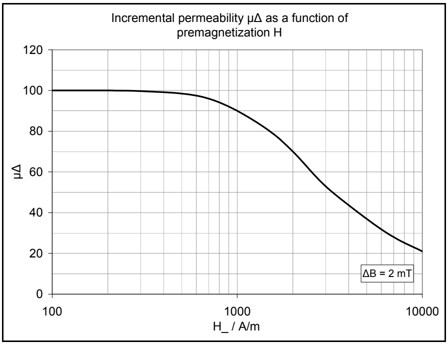

Specific power loss Pv as a function of frequency f
and induction Bs
10000
1000
100
10
Pv / mW/cm³
100 kHz
40 kHz
10 kHz
10
100
1000
Bs / mT

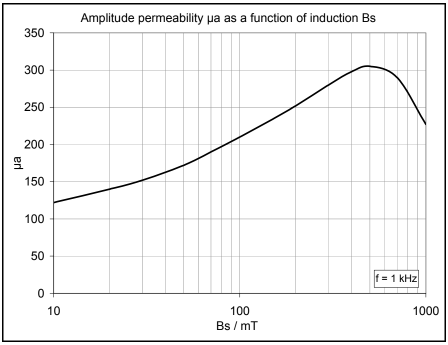
B1.3 FERROCARIT | FE 892

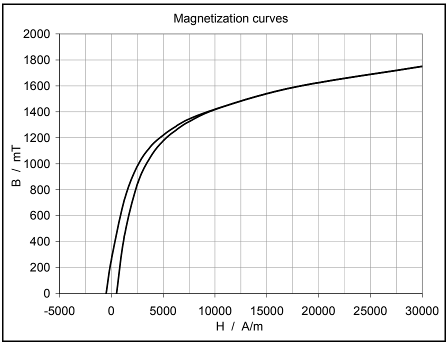
A material with high thermal and temporal stability, for high AC amplitudes or high premagnetization.
For use in noise suppression chokes for dimmers

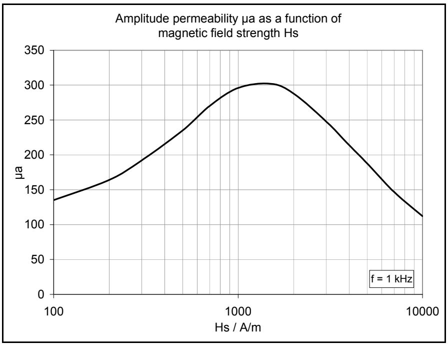
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	100 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	1600	10^{-6}	25°C ; 0,16 MHz ≤ 0,25 mT
μ_a	310	1	25°C ; 1 kHz 500 mT
μ_Δ	70	1	25°C ; 10 kHz 2000 A/m
	36		25°C ; 10 kHz 5000 A/m
a_F	≤ 18	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	200	°C	

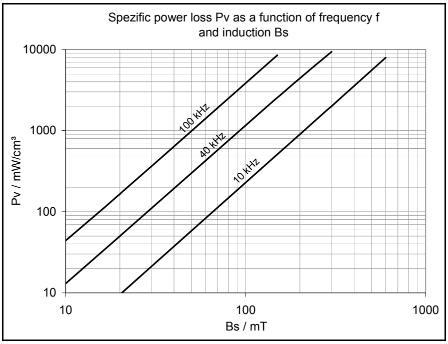








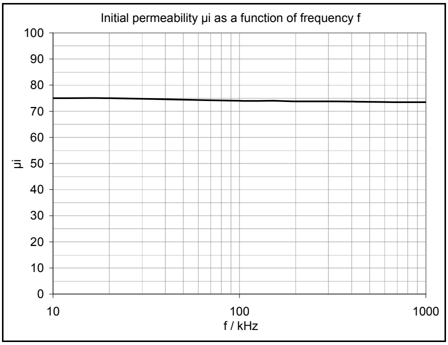


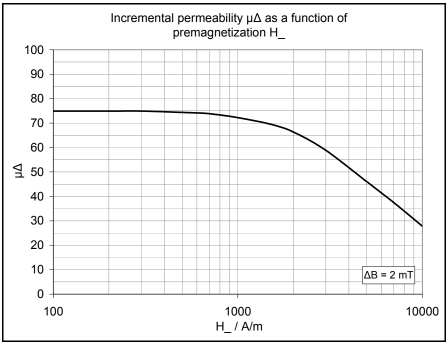

Spezific power loss Pv as a function of frequency f
and induction Bs
10000
1000
100
10
Pv / mW/cm³
10
100
1000
Bs / mT
100 kHz
40 kHz
10 kHz

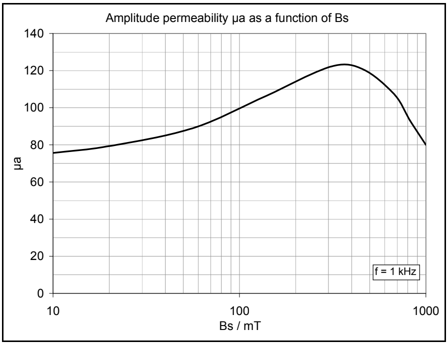
B1.3 FERROCARIT | FE 876

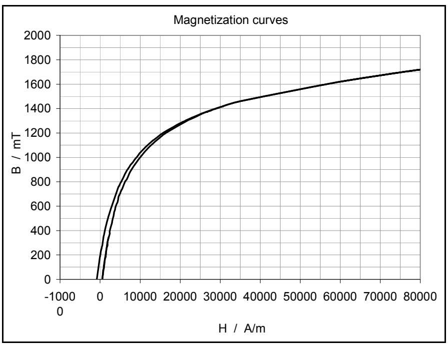
A material with high thermal and temporal stability, for high AC amplitudes or high premagnetization.
For use in anti-interference and damping coils

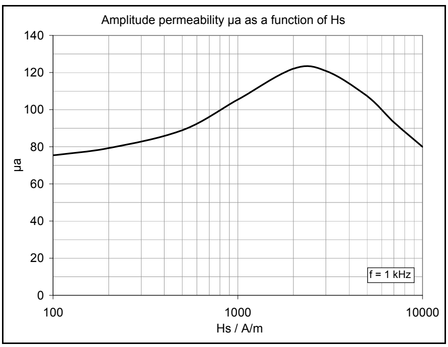
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	75 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	100	10^{-6}	25°C ; 0,16 MHz ≤ 0,25 mT
μ_a	120	1	1 kHz 500 mT
μ_Δ	66	1	25°C ; 10 kHz 2000 A/m
	46		25°C ; 10 kHz 5000 A/m
α_F	< 5	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	180	°C	

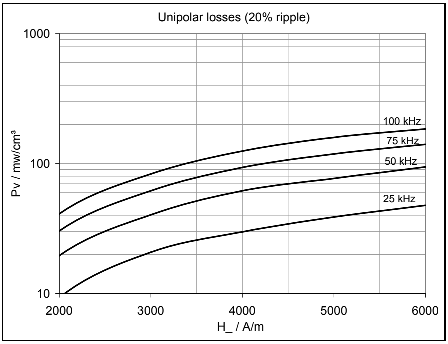




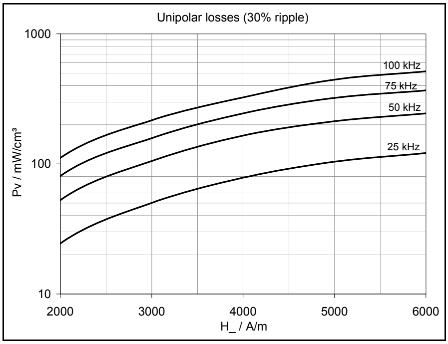




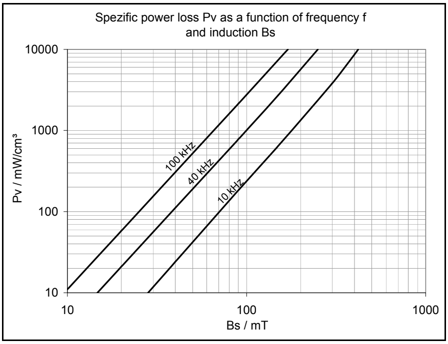




Unipolar losses (20% ripple)
1000
100
10
Pv / mw/cm³
2000
3000
4000
5000
6000
H_ / A/m
100 kHz
75 kHz
50 kHz
25 kHz



Unipolar losses (30% ripple)
1000
100
10
Pv / mW/cm³
2000
3000
4000
5000
6000
H_ / A/m
100 kHz
75 kHz
50 kHz
25 kHz

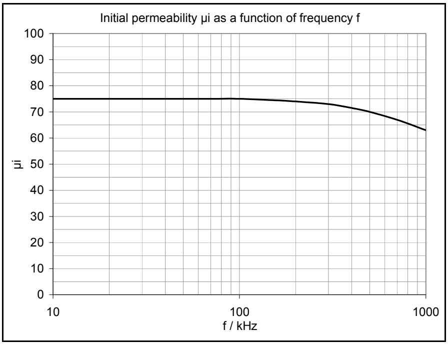


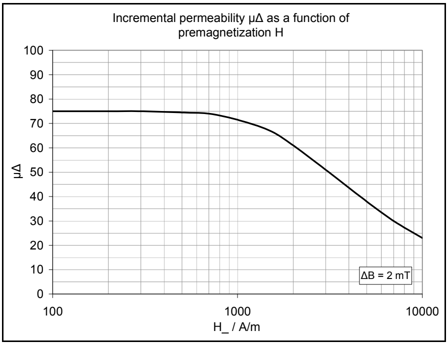
Spezific power loss Pv as a function of frequency f
and induction Bs
10000
1000
100
10
Pv / mW/cm³
10
100
1000
Bs / mT
100 kHz
40 kHz
10 kHz

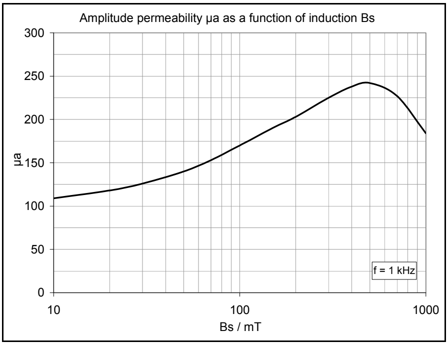
B1.3 FERROCARIT | FE 875

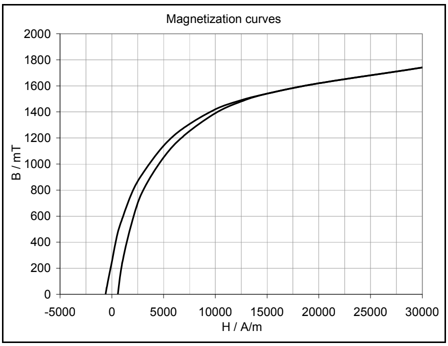
A material with high thermal and temporal stability, for high AC amplitudes or high premagnetization.
For use in power applications (e.g. loading coils, noise suppression coils)

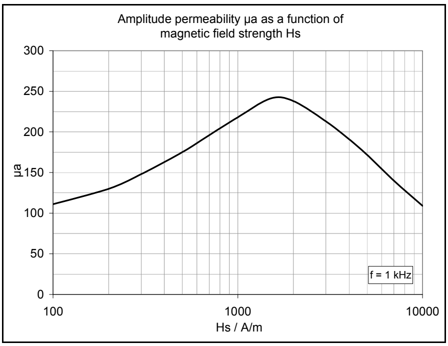
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	75 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	1300	10^{-6}	25°C ; 0,16 MHz ≤ 0,25 mT
μ_a	240	1	1 kHz 500 mT
μ_Δ	61	1	25°C ; 10 kHz 2000 A/m
	38		25°C ; 10 kHz 5000 A/m
a_F	≤ 18	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	180	°C	

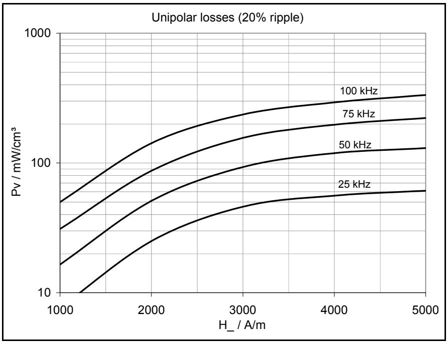




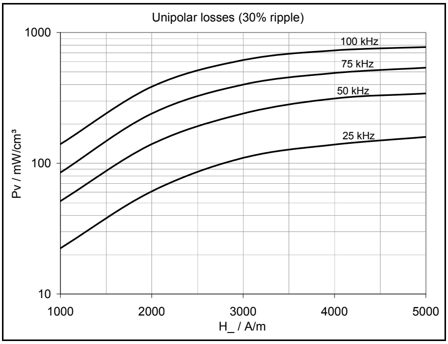




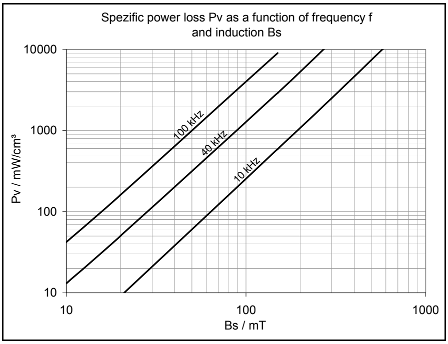




Unipolar losses (20% ripple)
1000
100
10
1000
2000
3000
4000
5000
H_ / A/m
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz



Unipolar losses (30% ripple)
1000
100
10
1000
2000
3000
4000
5000
H_ / A/m
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz

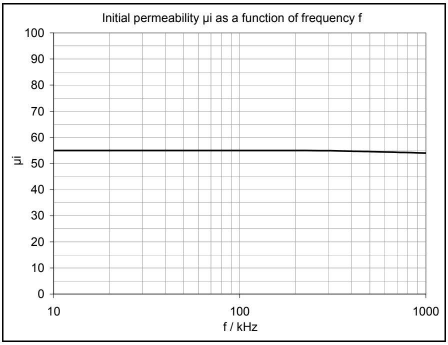


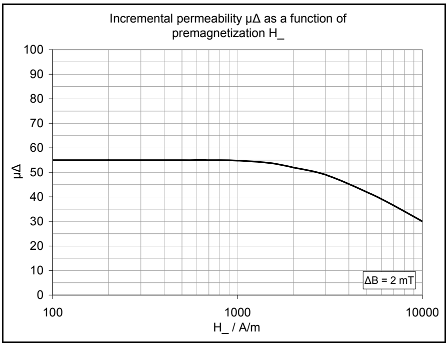
Spezific power loss Pv as a function of frequency f
and induction Bs
10000
1000
100
10
10
100
1000
Bs / mT
Pv / mW/cm³
100 kHz
40 kHz
10 kHz

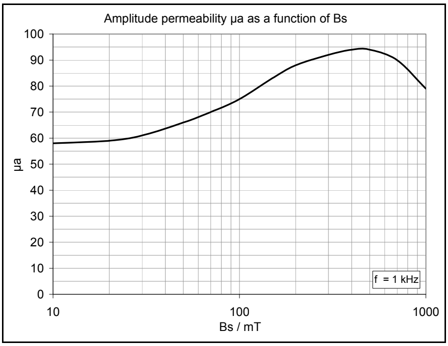
B1.3 FERROCARIT | FE 850

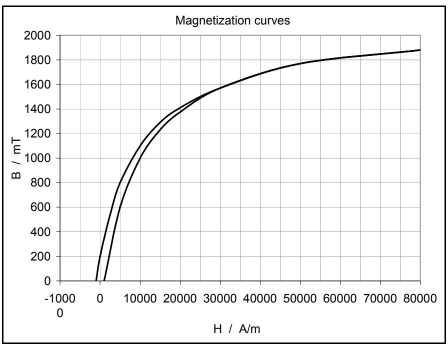
A material with high thermal and temporal stability, for high AC amplitudes or high premagnetization.
For use in anti-interference and damping coils

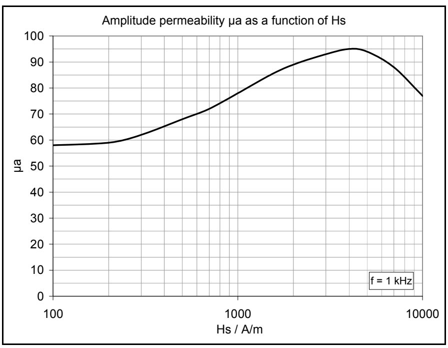
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	55 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	800	10^{-6}	25°C ; 0,3 MHz ≤ 0,25 mT
μ_a	93	1	1 kHz 500 mT
μ_Δ	52	1	25°C ; 10 kHz 2000 A/m
	43		25°C ; 10 kHz 5000 A/m
α_F	≤ 15	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	180	°C	



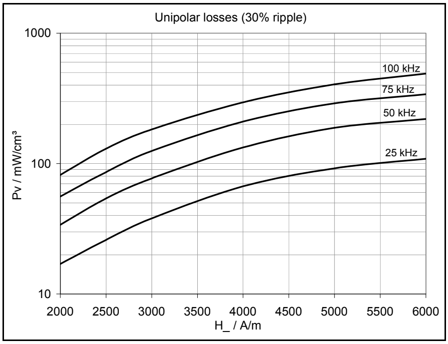




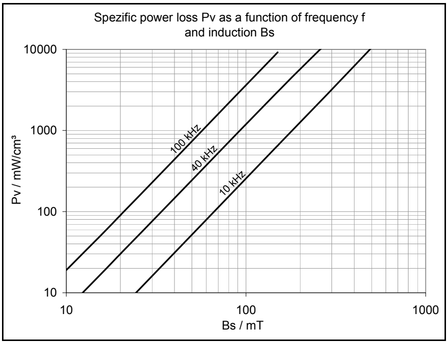




Unipolar losses (20% ripple)
1000
100
10
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz
2000 2500 3000 3500 4000 4500 5000 5500 6000
H_ / A/m



Unipolar losses (30% ripple)
1000
100
10
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz
2000 2500 3000 3500 4000 4500 5000 5500 6000
H_ / A/m

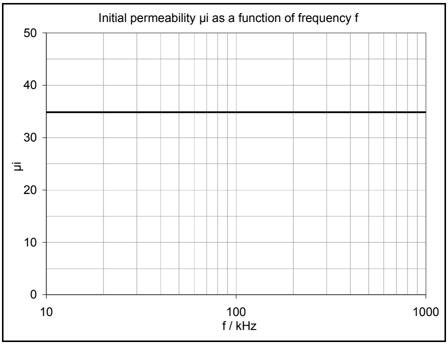


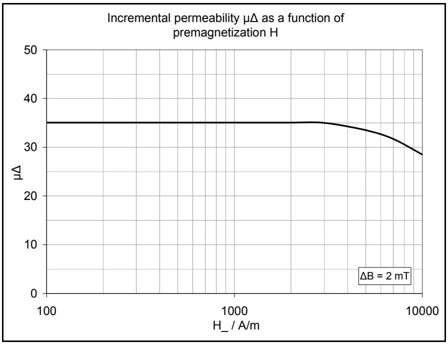
Spezific power loss Pv as a function of frequency f
and induction Bs
10000
1000
100
10
Pv / mW/cm³
100 kHz
40 kHz
10 kHz
10
100
1000
Bs / mT

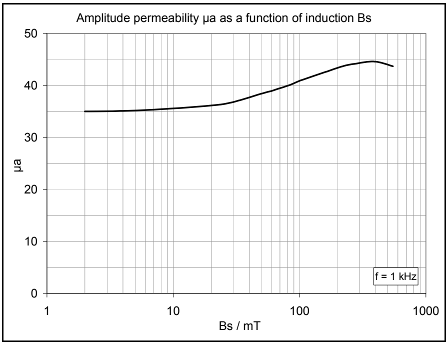
B1.3 FERROCARIT | FE 835

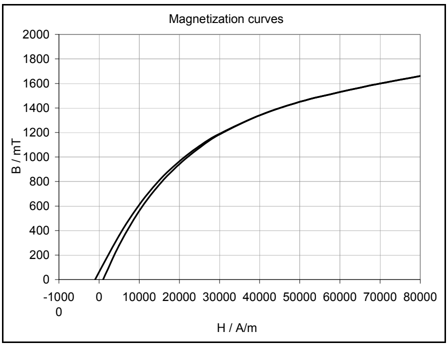
A material with high thermal and temporal stability , for high AC amplitudes or high premagnetization. For use in power applications (e.g. loading coils, noise suppression coils)

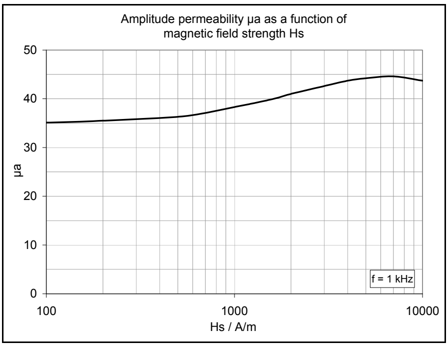
SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	35 ± 15%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	180	10^{-6}	25°C ; 0,5 MHz ≤ 0,25 mT
μ_a	44	1	1 kHz 500 mT
μ_Δ	35	1	25°C ; 10 kHz 2000 A/m
	33		25°C ; 10 kHz 5000 A/m
a_F	≤ 12	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	150	°C	

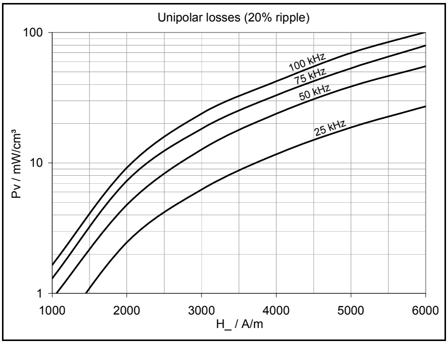


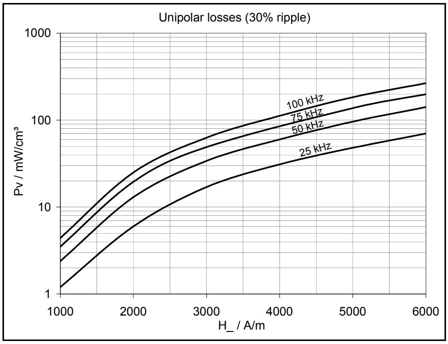


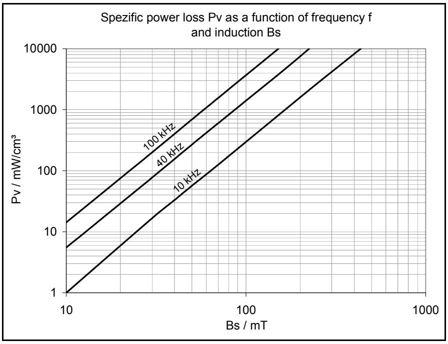







Unipolar losses (20% ripple)
100
10
1
1000
2000
3000
4000
5000
6000
H_ / A/m
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz

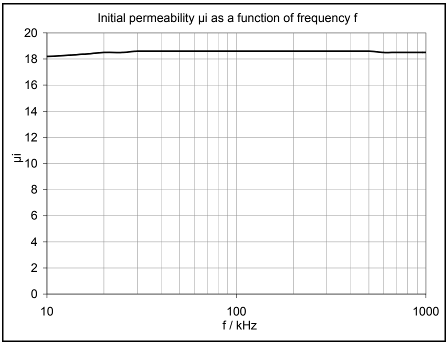

Unipolar losses (30% ripple)
1000
100
10
1
1000
2000
3000
4000
5000
6000
H_ / A/m
Pv / mW/cm³
100 kHz
75 kHz
50 kHz
25 kHz

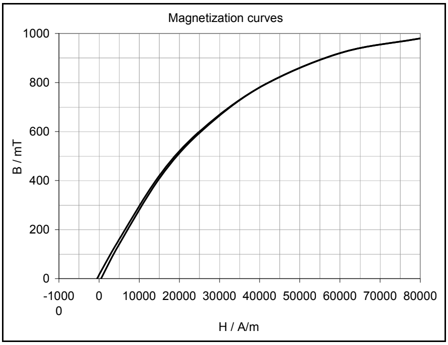

Spezific power loss Pv as a function of frequency f
and induction Bs
10000
1000
100
10
1
10
100
1000
Bs / mT
Pv / mW/cm³
100 kHz
40 kHz
10 kHz

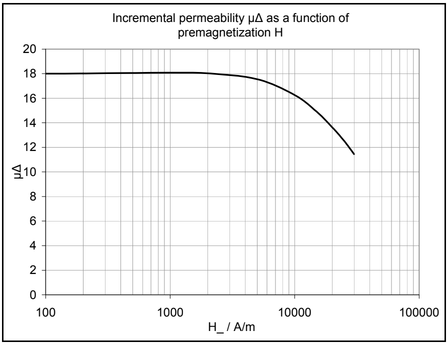
B1.3 FERROCARIT | FE 818

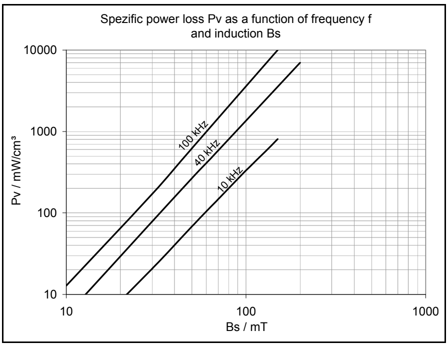
A material with high thermal and temporal stability, insensible of external magnetic fields

SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	18 ± 10%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	200	10^{-6}	25°C ; 0,16 MHz ≤ 0,25 mT
μ_a	21	1	1 kHz 500 mT
μ_Δ	16	1	25°C ; 10 kHz 10000 A/m
	11		25°C ; 10 kHz 30000 A/m
a_F	< 12	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	150	°C	





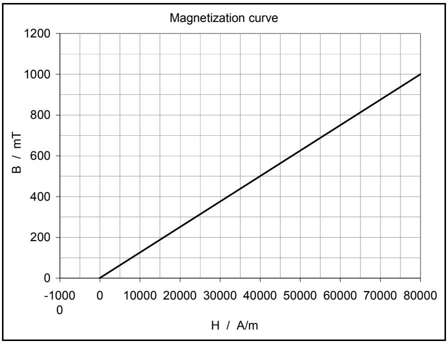


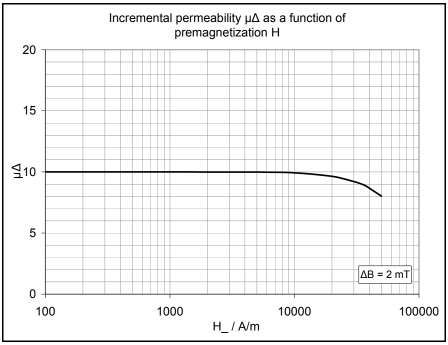


B1.3 FERROCARIT | FE 810

A material with high thermal and temporal stability , insensible of external magnetic fields

SYMBOL	VALUE	UNIT	CONDITIONS
μ_i	10 ± 10%	1	25°C ; ≤ 10 kHz ≤ 0,25 mT
$\tan\delta / \mu_i$	500	10^{-6}	25°C ; 12 MHz ≤ 0,25 mT
μ_a		1	25°C; 1 kHz 500 mT
μ_Δ	10	1	25°C ; 10 kHz 10000 A/m
	8		25°C ; 10 kHz 50000 A/m
a_F	≤ 2	10^{-6} / K	25°C - 70°C ≤ 10 kHz; ≤ 0,25 mT
T_{max}	120	°C	





Standard A_L-values for E and U cores

Core materials

For high-switching frequencies to 300 kHz, we recommend our Ferrite Fi 325 or Fi 328. This way, core losses can be minimized even at high frequencies.

Core air gaps

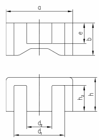
Please refer to the below table for the standard A_L values for E cores with an air gap.

Standard A_L-values nH	Final numbers of the part number
22	 70
27	 71
33	 72
39	 73
47	 74
56	 75
68	 76
82	 77
100	 78
120	 79
150	 81
180	 82
220	 83
270	 84
330	 85
390	 86
470	 87
560	 88
680	 89
820	 90
1000	 91
1200	 92
1500	 93
1800	 94
2200	 95
2700	 96
3300	 97
3900	 98

A_L-values apply to a core pair. The order number is for a single core.

Sample order: for an E core EVD 25/12.8/12.7 material **Fi 328**,
A_L = 100 nH
Part number: **255 13 328 78**

B2.1 EVD CORES



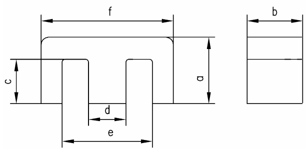
Core shape	Effective area of magnetic path A_e (mm^2)	Effective magnetic path length l_e (mm)	Core constant $\Sigma\ l/A$ (mm^{-1})	Effective magnetic volume V_e (mm^3)	a (mm)	b (mm)	d1 (mm)	d2 (mm)	h1 (mm)	h2 (mm)	e (mm)
EVD 10/5/6	11.7	25.4	2.18	270	10.7 ±0.4	5.8 -0.4	8.4 +0.5	3.6 -0.3	5.4 -0.2	3.9 +0.3	3.6 -0.3
EVD 15/9/7	26.1	37.9	1.45	990	14.8 +0.7/-0.5	7.0 -0.4	10.8 +0.6	5.8 -0.4	9.0 -0.3	6.0 +0.4	4.8 -0.4
EVD 20/10/8.5	40.1	46.6	1.17	1870	20.3 ±0.7	8.6 ±0.25	15.7 ±0.4	8.0 ±0.3	10.4 ±0.25	7.4 ±0.25	4.9 ±0.2
EVD 23/12/11	63.9	55.1	0.865	3500	22.7 ±0.7	11.2 ±0.3	17.1 ±0.4	8.1 ±0.3	12.3 ±0.3	8.9 ±0.3	7.7 ±0.25
EVD 25/12.8/ 12.7	73.1	58.9	0.807	4300	25.0 +0.8/-0.7	12.7 -0.5	18.8 +0.8	8.8 ±0.25	12.8 -0.4	9.3 +0.5	8.3 ±0.3
EVD 30/16/ 12.5	96.6	72.6	0.755	7000	29.7 ±0.8	12.5 ±0.4	22.1 ±0.5	11.6 ±0.3	16.4 ±0.3	11.9 ±0.3	8.2 ±0.3
EVD 36/19/16	150	87.4	0.582	13100	36.3 ±0.7	16.2 ±0.4	27.1 ±0.55	14.5 ±0.35	19.5 ±0.2	14.4 ±0.3	10.5 ±0.3
EVD 42/21/20	196	97.6	0.499	19100	41.5 ±0.8	20.1 ±0.5	31.5 ±0.6	15.7 ±0.4	21.0 ±0.2	16.0 ±0.3	12.7 ±0.35

Core shape	Material	Losses (W) (≤) Fi 328 f = 100 kHz / Bs = 200 mT		A_L value (nH)	μ_e	B_{max} (mT) f = 25 kHz Hs = 250 A/m 100°C	Part number
		25°C	100°C	10 kHz 50 mV Tol. = ± 25%			
EVD 10/5/6	Fi 325	≤ 0.13[1]	≤ 0.07[1]	680	1180	≥ 290	252 05 325 10
	Fi 328	≤ 0.26	≤ 0.18	680	1180	≥ 350	252 05 328 10
EVD 15/9/7	Fi 325	≤ 0.42[1]	≤ 0.24[1]	1170	1350	≥ 315	254 13 325 10
	Fi 328	≤ 0.89	≤ 0.59	1170	1350	≥ 350	254 13 328 10
EVD 20/10/8.5	Fi 325	≤ 0.79[1]	≤ 0.45[1]	1510	1400	≥ 330	254 20 325 10
	Fi 328	≤ 1.68	≤ 1.12	1510	1400	≥ 350	254 20 328 10
EVD 23/12/11	Fi 325	≤ 1.50[1]	≤ 0.84[1]	2110	1450	≥ 330	255 15 325 10
	Fi 328	≤ 3.17	≤ 2.11	2110	1450	≥ 350	255 15 328 10
EVD 25/12.8/12.7	Fi 325	≤1.83[1]	≤ 1.02[1]	2300	1480	≥ 330	255 13 325 10
	Fi 328	≤ 3.87	≤ 2.58	2300	1480	≥ 350	255 13 328 10
EVD 30/16/12.5	Fi 325	≤ 2.98[1]	≤ 1.67[1]	2540	1520	≥ 330	256 14 325 10
	Fi 328	≤ 6.31	≤ 4.20	2540	1520	≥ 350	256 14 328 10
EVD 36/19/16	Fi 325	≤ 5.58[1]	≤ 3.13[1]	3380	1560	≥ 330	258 07 325 10
	Fi 328	≤ 11.8	≤ 7.88	3380	1560	≥ 350	258 07 328 10
EVD 42/21/20	Fi 325	≤ 8.11[1]	≤ 4.54[1]	4010	1590	≥ 330	259 37 325 10
	Fi 328	≤ 17.2	≤ 11.4	4010	1590	≥ 350	259 37 328 10

[1] at Fi 325 f = 200 kHz/Bs = 100 mT

sumida

B2.2 E CORES | CORES E10 - E19

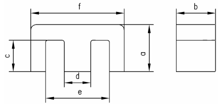


Core shape	Magnetically effective cross-section A_e (mm^2)	Magnetically effective path length l_e (mm)	Form factor $\Sigma\, l/A$ (mm^{-1})	Magnetically effective volume V_e (mm^3)	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	f (mm)
E 10/3	7.96	23.2	2.92	185	5.1 -0.2	3.0 -0.3	3.5 +0.25	3.0 -0.25	7.0 +0.5	10.0 ±0.3
E 12.6/3.7	12.4	29.7	2.4	370	6.5 -0.2	3.7 -0.3	4.5 +0.3	3.7 -0.3	8.9 +0.6	12.6 +0.5/-0.4
E 16/4.7k	20	28.5	1.43	570	5.95 -0.3	4.7 -0.4	3.45 +0.4	4.7 -0.3	11.3 +0.6	16.0 +0.7/-0.5
E 16/4.7	20.1	37.5	1.88	750	8.2 -0.3	4.7 -0.4	5.7 +0.4	4.7 -0.3	11.3 +0.6	16.0 +0.7/-0.5
E 16/7.4	31.2	28.8	0.928	900	5.95 -0.3	7.4 -0.5	2.05 ±0.15	4.7 -0.3	11.3 +0.6	16.0 +0.7/-0.5
E 16/8.4	36.3	37.6	1.03	1365	8.2 -0.3	8.4 -0.5	5.7 +0.4	4.7 -0.3	11.3 +0.6	16.0 +0.7/-0.5
E 19/5	22.6	39.6	1.76	896	8.0 ±0.2	4.8 ±0.2	5.7 ±0.2	4.8 ±0.2	14.3 ±0.3	19.0 ±0.4

Core shape	Material	Losses (W) (≤) Fi 328 f = 100 kHz/ Bs = 200 mT		A_L - value (nH)	μ_0	B_{max} (mT)	Part number
				10 kHz/50 mV		f = 25 kHz/Hs = 250 A/m	
		25°C	100°C	Tol. = ± 25 %		100°C	
E 10/3	Fi 325	0.08 [1]	0.04 [1]	500	1150		252 04 325 10
E 10/3	Fi 328	0.17	0.11	500	1150	≥ 360	252 04 328 10
E 12.6/3.7	Fi 325	0.16 [1]	0.09 [1]	660	1260	≥ 315	254 03 325 10
E 12.6/3.7	Fi 328	0.33	0.22	660	1260	≥ 360	254 03 328 10
E 16/4.7	Fi 325	0.32 [1]	0.18 [1]	900	1340	≥ 315	254 05 325 10
E 16/4.7	Fi 328	0.68	0.45	900	1340	≥ 360	254 05 328 10
E 16/4.7K	Fi 325	0.24 [1]	0.14 [1]	1090	1240	≥ 315	254 12 325 10
E 16/4.7K	Fi 328	0.51	0.34	1090	1240	≥ 360	254 12 328 10
E 16/7.4	Fi 325	0.38 [1]	0.21 [1]	1700	1250	≥ 315	254 14 325 10
E 16/7.4	Fi 328	0.81	0.54	1700	1250	≥ 360	254 14 328 10
E 16/8.4	Fi 325	0.58 [1]	0.32 [1]	1630	1340	≥ 315	254 15 325 10
E 16/8.4	Fi 328	1.23	0.82	1630	1340	≥ 360	254 15 328 10
E 19/5	Fi 325	0.38 [1]	0.21 [1]	970	1360	≥ 315	254 19 325 10
E 19/5	Fi 328	0.80	0.53	970	1360	≥ 360	254 19 328 10

1) at Fi 325 f = 200kHz/Bs = 100mT

B2.2 E CORES | CORES E20 - E30

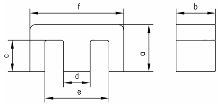


Core shape	Magnetically Effective cross-section A_e (mm^2)	Magnetically effective path length l_e (mm)	Form factor $\Sigma\, l/A$ (mm^{-1})	Magnetically effective volume V_e (mm^3)	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	f (mm)
E 20/5.3	30.8	43.2	1.41	1330	10.2 -0.4	5.3 -0.4	6.3 +0.4	5.2 -0.4	12.8 +0.6	20.0 +0.7/-0.4
E 20/5	22.5	42.6	1.9	960	8.65 -0.4	5.0 -0.4	5.95 +0.4	5.0 -0.4	15.2 +0.6	20.0 +0.7/-0.4
E 20/5.9K	32	42.7	1.34	1370	9.3 -0.4	5.9 -0.5	6.1 +0.4	5.9 -0.4	14.1 +0.6	20.0 +0.8/-0.6
E 20/5.9	32.1	46.4	1.45	1490	10.2 -0.4	5.9 -0.5	7.0 +0.4	5.9 -0.4	14.1 +0.6	20.0 + 0.8/-0.6
E 20/11K	60.9	42.8	0.703	2610	9.3 -0.4	11.0 -0.5	6.1 +0.4	5.9 -0.4	14.1 +0.6	20.0 +0.8/-0.6
E 20/11	61	46.4	0.762	2830	10.2 -0.4	11.0 -0.5	7.0 +0.4	5.9 -0.4	14.1 +0.6	20.0 +0.8/-0.6
E 25/7.5	51.9	57.7	1.12	3000	12.8 -0.5	7.5 -0.6	8.7 +0.5	7.5 -0.5	17.5 +0.8	25.0 +0.8/-0.7
E 25/11	77.4	57.7	0.747	4480	12.8 -0.5	11.0 -0.5	8.7 +0.5	7.5 -0.5	17.5 +0.8	25.0 +0.8/-0.7
E 25/13	91.8	57.8	0.629	5302	12.8 -0.5	13.0 -0.5	8.7 +0.5	7.5 -0.5	17.5 +0.8	25.0 +0.8/-0.7
E 30/7.3	60.1	65.3	1.09	3930	15.2 -0.4	7.3 -0.5	9.7 +0.6	7.2 -0.5	19.5 +0.8	30.0 +0.8/-0.6
E 30/12	105	65.3	0.624	6860	15.2 -0.4	12.6 -0.6	9.7 +0.6	7.2 -0.5	19.5 +0.8	30.0 +0.8/-0.6

Core shape	Material	Losses (W) (≤) Fi 328 f = 100 kHz/Bs = 200 mT		A_L -value (nH)	μ_0	B_{max} (mT) f = 25 kHz, Hs = 250 A/m	Part number
		25°C	100°C	10 kHz / 50 mV Tol. = ± 25%		100°C	
E 20/5.3	Fi 325	0.45 1)	0.24 1)	1230	1380	≥ 315	254 01 325 10
	Fi 328	0.95	0.60	1230	1380	≥ 360	254 01 328 10
E 20/5	Fi 325	0.41 1)	0.23 1)	920	1390	≥ 315	254 02 325 10
	Fi 328	0.86	0.58	920	1390	≥ 360	254 02 328 10
E 20/5.9	Fi 325	0.63 1)	0.35 1)	1230	1420	≥ 315	254 06 325 10
	Fi 328	1.34	0.89	1230	1420	≥ 360	254 06 328 10
E 20/5.9K	Fi 325	0.47 1)	0.25 1)	1310	1390	≥ 315	254 10 325 10
	Fi 328	1.23	0.82	1310	1390	≥ 360	254 10 328 10
E 20/11K	Fi 325	1.11 1)	0.62 1)	2470	1380	≥ 315	254 16 325 10
	Fi 328	2.35	1.56	2470	1380	≥ 360	254 16 328 10
E 20/11	Fi 325	1.20 1)	0.67 1)	2330	1410	≥ 315	254 11 325 10
	Fi 328	2.55	1.70	2330	1410	≥ 360	254 11 328 10
E 25/7.5	Fi 325	1.27 1)	0.71 1)	1660	1470	≥ 315	255 07 325 10
	Fi 328	2.69	1.80	1660	1470	≥ 360	255 07 328 10
E 25/11	Fi 325	1.90 1)	1.06 1)	2470	1470	≥ 315	255 09 325 10
	Fi 328	4.03	2.68	2470	1470	≥ 360	255 09 328 10
E 25/13	Fi 325	2.26 1)	1.26 1)	2930	1470	≥ 315	255 16 325 10
	Fi 328	4.78	3.18	2930	1470	≥ 360	255 16 328 10
E 30/7.3	Fi 325	1.33 1)	0.71 1)	1730	1500	≥ 330	256 01 325 10
	Fi 328	2.83	1.77	1730	1500	≥ 360	256 01 328 10
E 30/12	Fi 325	2.33 1)	1.23 1)	3010	1490	≥ 330	256 05 325 10
	Fi 328	4.93	3.08	3010	1490	≥ 360	256 05 328 10

1) at Fi 325 f = 200 kHz/Bs = 100 mT

B2.2 E CORES | CORES E32 - E65

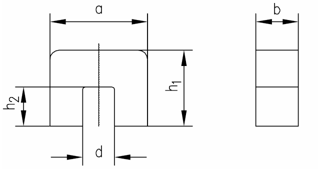


Core shape	Magnetically Effective cross-section A_e (mm^2)	Magnetically effective path length l_e (mm)	Form factor $\Sigma\, ^l/_A$ (mm^{-1})	Magnetically effective volume V_e (mm^3)	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	f (mm)
E 32/9.5	83.2	74.3	0.895	6190	16.4 -0.6	9.5 -0.7	11.2 +0.6	9.5 -0.6	22.7 +1.0	32.0 +0.9/-0.7
E 32/11	96.9	70.7	0.731	6860	15.5 -0.6	11.0 -0.7	10.3 +0.6	9.5 -0.6	22.7 +1.0	32.0 +0.9/-0.7
E 36/11	119	81	0.68	9670	18.0 -0.4	11.5 -0.5	12.0 +0.6	10.2 -0.5	24.5 +1.2	36.0 +1.0/-0.7
E 36/15	157	81	0.515	12800	18.0 -0.4	15.2 -0.7	12.0 +0.6	10.2 -0.5	24.5 +1.2	36.0 +1.0/-0.7
E 42/15	178	97.2	0.545	17400	21.2 -0.4	15.2 -0.5	14.8 +0.7	12.2 -0.5	29.5 +1.2	42.0 +1.0/-0.7
E 42/15A	178.5	98.6	0.553	17607	21.2 -0.4	15.2 -0.5	14.8 +0.6	12.2 -0.5	31.0 +1.2/-0.2	43.5 +1.0/-0.9
E 42/20	235	97.2	0.413	22900	21.2 -0.4	20.0 -0.8	14.8 +0.7	12.2 -0.5	29.5 +1.2	42.0 +1.0/-0.7
E 42/20A	235	98.6	0.419	23200	21.2 -0.4	20.0 -0.6	14.8 +0.6	12.2 -0.5	31.0 +1.2/-0.2	43.5 +1.0/-0.9
E 55/21	354	123	0.348	43700	27.8 -0.6	21.0 -0.6	18.5 +0.6	17.2 -0.5	37.5 +1.2	55.0 +1.2/-0.9
E 55/25	421	123	0.293	51900	27.8 -0.6	25.0 -0.8	18.5 +0.6	17.2 -0.5	37.5 +1.2	55.0 +1.2/-0.9
E 65/27.4	533	147	0.276	78300	32.8 -0.6	27.4 -1.2	22.2 +0.8	20.0 -0.7	44.2 +1.5	65.0 +1.5/-1.2

Core shape	**Material**	**Losses (W) (≤) Fi 328 f = 100 kHz/Bs = 200 mT**		**A_L -value (nH)**	**µ0**	**B_{max} (mT)**	**Part number**
				10 kHz / 50 mV		f = 25 kHz, Hs = 250 A/m	
		25°C	100°C	Tol. = ± 25%		100°C	
E 30/7.3	Fi 325	1.33 1)	0.71 1)	1730	1500	≥ 330	256 01 325 10
	Fi 328	2.83	1.77	1730	1500	≥ 360	256 01 328 10
E 30/12	Fi 325	2.33 1)	1.23 1)	3010	1490	≥ 330	256 05 325 10
	Fi 328	4.93	3.08	3010	1490	≥ 360	256 05 328 10
E 32/9.5	Fi 325	2.63 1)	1.47 1)	2160	1530	≥ 330	257 01 325 10
	Fi 328	5.56	3.71	2160	1530	≥ 360	257 01 328 10
E 32/11	Fi 325	2.91 1)	1.63 1)	2620	1520	≥ 315	257 08 325 10
	Fi 328	6.16	4.11	2620	1520	≥ 360	257 08 328 10
E 36/11	Fi 325	4.11 1)	2.30 1)	2860	1550	≥ 315	257 05 325 10
	Fi 328	8.71	5.80	2860	1550	≥ 360	257 05 328 10
E 36/15	Fi 325	5.43 1)	3.04 1)	3770	1550	≥ 315	257 07 325 10
	Fi 328	11.49	7.66	3770	1550	≥ 360	257 07 328 10
E 42/15	Fi 325	7.37 1)	4.13 1)	3660	1590	≥ 330	259 06 325 10
	Fi 328	15.62	10.41	3660	1590	≥ 360	259 06 328 10
E 42/15A	Fi 325	7.48 1)	4.19 1)	3610	1590	≥ 315	259 35 325 10
	Fi 328	15.84	10.56	3610	1590	≥ 360	259 35 328 10
E 42/20	Fi 325	9.72 1)	5.44 1)	4820	1580	≥ 315	259 04 325 10
	Fi 328	20.58	13.72	4820	1580	≥ 360	259 04 328 10
E 42/20A	Fi 325	9.86 1)	5.52 1)	4750	1580	≥ 315	259 20 325 10
	Fi 328	20.87	13.91	4750	1580	≥ 360	259 20 328 10
E 55/21	Fi 325	18.58 1)	10.40 1)	5870	1630	≥ 315	259 01 325 10
	Fi 328			5870	1630	≥ 360	259 01 328 10

1) at Fi 325 f = 200kHz/Bs = 100mT

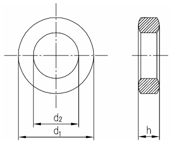
B2.3 U CORES



Core shape	Magnetically effective crosssection A_e (mm^2)	Magnetically effective path length l_e (mm)	Form factor $\Sigma\, l/A$ (mm^{-1})	Magnetically effective volume V_e (mm^3)	a mm)	b (mm)	d mm)	h1 mm)	h2 (mm)
U 13.5/5	16	49.2	3.01	800	13.5 ±0.5	5 -0.4	6.5 +0.5	9.9 -0.4	6.2 +0.2
U 15/6.7	34.2	52.3	1.53	1790	15.4 ±0.6	6.7 -0.5	5 +0.6	12 ±0.15	6.2 ±0.15
U 20/7.7	53.8	68.7	1.28	3700	19.8 ±0.6	7.7 -0.5	5.6 +0.6	16 -0.6	8.9 +0.3
U 21/12	66.5	81.2	1.22	5390	21 ±0.6	12 -0.7	9 +0.7	17 -0.6	11 +0.4
U 25/7	53.2	87	1.64	4600	24.8 +0.3/-0.4	7.3 ±0.2	10.2 +0.3/-0.4	18.2 ±0.3	10.8 +0.3
U 25/13	105	88.2	0.84	9300	24.8 ±0.7	13 -0.7	8 +0.7	20.2 -0.7	11 +0.6
U 26/16	151	84.2	0.56	12700	25.8 ±0.7	16 -0.6	9 +0.7	22.2 -0.7	13 +0.4
U 30/26	266	118	0.43	31400	30.8 ±1.2	26.5 -0.8	10.4 ±0.4	26.4 ±0.6	16 +0.5

Core shape	Material	Losses (W) (≤) f = 200 kHz/ Bs = 100 mT		A_L -value (nH)	μ_0	B_{max} (mT) f = 25 kHz Hs = 250 A/m	Part number
				10 kHz/50 mV			
		25°C	100°C	Tol. = ± 25%		100°C	
U 13.5/5	Fi 325	0.34	0.19	5995	1430	≥ 290	261 21 325 10
U 13.5/5	Fi 328	0.72	0.48	5995	1430	≥ 360	261 21 328 10
U 15/6.7	Fi 325	0.76	0.42	1180	1440	≥ 315	261 12 325 10
U 15/6.7	Fi 328	1.61	1.07	1180	1440	≥ 360	261 12 328 10
U 20/7.7	Fi 325	1.57	0.88	1490	1510	≥ 315	261 14 325 00
U 20/7.7	Fi 328	3.32	2.22	1490	1510	≥ 360	261 14 328 00
U 21/12	Fi 325	2.30	1.29	1600	1560	≥ 315	261 31 325 00
U 21/12	Fi 328	4.86	3.24	1600	1560	≥ 360	261 31 328 00
U 25/7	Fi 325	1.96	1.10	1200	1560	≥ 315	261 09 325 00
U 25/7	Fi 328	4.16	2.77	1200	1560	≥ 360	261 09 328 00
U 25/13	Fi 325	3.95	2.21	2350	1560	≥ 315	261 17 325 00
U 25/13	Fi 328	8.37	5.58	2350	1560	≥ 360	261 17 328 00
U 26/16	Fi 325	5.40	3.02	2670	1190	≥ 315	261 28 325 00
U 26/16	Fi 328	11.44	7.63	2670	1190	≥ 360	261 28 328 00
U 30/26	Fi 325			4600	1620		261 20 325 00
U 30/26	Fi 328			4600	1620		261 20 328 00

B2.4 TOROIDAL CORES | MADE OF FERROCART POWDERS (IRON POWDERS)



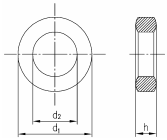
Designation	Magnetic shape parameters				Dimensions [2]			Part number [1]
	l_e (mm	A_e (mm^2)	V_e (mm^3)	Λ_0 = c (nH)	d_1 (mm)	d_2 (mm)	h (mm)	
R 12.5 x 8 x 7	31.9	14.8	471	0.58	12.5 ±0.2	8+ 0.2	7 +0.3	233 28 XXX 10
R 14.3 x 7.2 x 9.5	32.5	30.9	1006	1.2	14.3 -0.3	7.2 +0.2	9.5 ±0.2	233 18 XXX 10
R 17 x 9 x 9	39.4	35.6	1400	1.13	17 -0.2	9 ±0.1	9 ±0.2	234 39 XXX 10
R 19 x 10 x 6	43.9	25.1	1099	0.72	19 -0.3	10 ±0.1	6 ±0.25	234 16 XXX 10
R 19 x 10 x 9	43.9	38.3	1681	1.1	19 -0.3	10 ±0.1	9 ±0.25	234 24 XXX 10
R 21.5 x 12 x 6	51.2	27.8	1420	0.68	21.5 -0.3	12 +0.2	6 ±0.15	235 28 XXX 10
R 23 x 14.5 x 11	57.8	41.9	2418	0.91	23 -0.7	14.5 +0.4	11 -0.4	235 22 XXX 10
R 25 x 15 x 12.5	61.5	58.9	3623	1.2	25 -0.3	15 +0.2	12 ±0.3	235 13 XXX 10
R 30.5 x 14.5 x 15	67.6	111.7	7556	2.08	30.5 -0.3	14.5 +0.2	15 ±0.3	237 30 XXX 10
R 33 x 19 x 5.6	79.6	34.5	2747	0.54	33 -0.3	19 +0.2	5.6 ±0.15	237 10 XXX 10
R 33 x 19 x 9	79.6	57.7	4596	0.91	33 -0.3	19 +0.2	9 ±0.25	237 01 XXX 10
R 33 x 19 x 16	79.6	105.8	8429	1.67	33 -0.3	19 +0.2	16 ±0.3	237 33 XXX 10
R 33 x 20 x 5.6	81.5	32.5	2654	0.5	33 -0.3	20 +0.2	5.6 ±0.15	237 25 XXX 10
R 33 x 20 x 8	81.5	47.7	3888	0.73	33 -0.3	20 +0.2	8 ±0.15	237 24 XXX 10
R 36 x 19 x 14	83.8	120.4	10090	1.8	36.2 ±0.2	19 ±0.1	14 ±0.3	238 46 XXX 10
R 36 x 19 x 16	83.8	137.5	11530	2.06	36.2 ±0.2	19 ±0.1	16 ±0.3	238 45 XXX 10
R 36 x 22 x 6.7	89.3	46.7	4169	0.66	36.3 -0.3	21.8 +0.2	6.7 -0.3	238 34 XXX 10
R 38.6 x 21.2 x 4.4	91.3	37	3382	0.51	38.85 -0.3	21.1 +0.2	4.4 ±0.1	238 25 XXX 10
R 38.6 x 21.2 x 6	91.3	51	4661	0.7	38.85 -0.3	21.1 +0.2	6 ±0.15	238 30 XXX 10
R 38.6 x 21.2 x 8	91.3	67.2	6140	0.92	38.85 -0.3	21.1 +0.2	8 -0.3	238 32 XXX 10
R 38.6 x 21.2 x 18.5	91.3	160.4	14653	2.2	38.85 -0.3	21.1 +0.2	18.5 ±0.3	238 35 XXX 10
R 41.5 x 21.2 x 13.5	94.8	129.8	12300	1.72	41.5 -0.3	21.1 +0.2	13.6 -0.6	239 48 XXX 10
R 41.5 x 21.2 x 27	94.8	265.8	25200	3.52	41.5 -0.3	21.1 +0.2	26.8 ±0.6	239 49 XXX 10
R 50 x 32 x 13.5	126.7	111.6	14135	1.11	50 -0.3	32 +0.2	13.5 ±0.3	239 46 XXX 10
R 50 x 32 x 18	126.7	152	19190	1.5	50 -0.3	32 +0.2	18 ± 0.3	239 27 XXX 10
R 50 x 32 x 25	126.7	214	27100	2.12	50 -0.3	32 +0.2	25 ±0.3	239 47 XXX 10
R 50 x 32 x 30	126.7	258	32690	2.56	50 -0.3	32 +0.2	30 ±0.5	239 31 XXX 10
R 66 x 39 x 28	161.3	346	55801	2.7	66 -0.5	39 +0.4	28 ±0.6	239 52 XXX 10

[1] Please insert material number, [2] Dimensions without plastic coating

The A_L values for each version and each selected material can be easily calculated with the equation:
$A_L = \mu_i * \Lambda_0$ (nH) (Initial permeability (μ_i) of the selected material: see chapter D1.1)

The cores are shipped with chamfered edges and with plastic coating. The coating is 0.2 - 0.4 mm thick.

B2.4 TOROIDAL CORES | MADE OF FERROCARIT MATERIAL



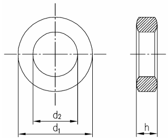
Designation	Magnetic shape parameters				Dimensions			Weight (g)	Part number [1]
	l_e (mm)	A_e (mm^2)	V_e (mm^3)	$\Lambda_0 = c$ (nH)	d_1 (mm)	d_2 (mm)	h (mm)		
R 5.2 x 2.6 x 2	12	2.5	30	0.26	5.2 ±0.2	2.6 +0.2	2 ±0.2	0.13	232 17 XXX 00
R 5.5 x 2.5 x 1.5	12	2.5	30	0.25	5.5 +0.2	2.5 +0.2	1.5 +0.3	0.12	232 12 XXX 00
R 6 x 2 x 2	11	3.8	43	0.43	5.8 ±0.2	2 ±0.2	2±0.3	0.20	232 20 XXX 00
R 6 x 3 x 2	14	3	41	0.28	6 ±0.25	3 ±0.15	2 ±0.3	0.18	232 27 XXX 00
R 6 x 3 x 3	14	4.6	64	0.41	6 +0.3	3 +0.2	3 ±0.3	30.00	232 14 XXX 00
R 6 x 3 x 5.4	14	8.5	120	0.76	6 +0.5	3 +0.2	5.4 ±0.3	0.50	232 23 XXX 00
R 8 x 3.5 x 4	17	9	150	0.66	8 ±0.2	3.5 ±0.2	4 ±0.4	0.70	232 05 XXX 00
R 9.4 x 4.6 x 1.5	20	3.9	79	0.24	9.4 ±0.2	4.6 ±0.1	1.5 ±0.15	0.40	232 56 XXX 00
R 9.4 x 4.6 x 3.5	20	8.5	170	0.53	9.4 ±0.2	4.6 ±0.1	3.5 ±0.2	0.94	232 57 XXX 00
R 9.4 x 4.6 x 4.5	20	11	230	0.70	9.4 ±0.2	4.6 ±0.1	4.6 ±0.3	1.20	232 54 XXX 00
R 10 x 6 x 3	25	5.4	130	0.27	10 ±0.3	6 ±0.2	3 ± 0.3	0.63	232 32 XXX 00
R 10 x 6 x 4	24	7.1	170	0.36	10 ±0.2	6 ±0.15	4 ±0.15	0.87	232 31 XXX 00
R 10 x 6 x 8	24	15	360	0.76	9.8 ±0.3	6 ±0.2	8 ±0.3	1.81	232 29 XXX 00
R 13 x 6.1 x 4.5	29	14	410	0.60	13 +0.6	6.1 +0.3	4.5 ±0.3	2.00	233 06 XXX 00
R 13 x 7 x 3	30	7.6	230	0.31	13 ±0.35	7 ±0.2	3 ±0.2	1.20	233 11 XXX 00
R 13 x 7 x 4	30	11	320	0.44	13 ±0.35	7 ±0.2	4 ±0.3	1.50	233 31 XXX 00
R 13 x 7 x 4.5	30	12	370	0.50	13 ±0.35	7 ±0.2	4.5 ±0.3	1.80	233 24 XXX 00
R 13 x 7 x 5	30	14	410	0.56	13 ±0.35	7 ±0.2	5 ±0.3	2.00	233 20 XXX 00
R 13 x 7 x 12	30	35	1050	1.43	13 ±0.35	7 ±0.2	12 ±0.4	4.80	233 09 XXX 00
R 13.3 x 8.3 x 5	33	12	410	0.47	13.3 ±0.3	8.3 ±0.3	5.15 -0.4	1.80	233 16 XXX 00
R 13.3 x 8.3 x 5.7	33	13	440	0.50	13.3 ±0.3	8.3 ±0.3	5.7 ±0.3	2.10	233 33 XXX 00
R 13.6 x 7.3 x 6	32	17	550	0.68	13.6 ± 0.3	7.3 ±0.2	6 ±0.4	2.60	233 17 XXX 00
R 14 x 9 x 5	36	12	410	0.41	14 ±0.4	9 ±0.4	5 ±0.3	2.00	233 14 XXX 00
R 14 x 9 x 6	36	14	500	0.50	14 ±0.4	9 ±0.3	6 ±0.3	2.40	233 08 XXX 00
R 14 x 9 x 9	36	22	770	0.76	14 ±0.4	9 ±0.4	9 ±0.4	3.50	233 07 XXX 00
R 15 x 10 x 5	39	12	460	0.39	15 ±0.5	10 ±0.5	5 ±0.3	2.20	233 05 XXX 00
R 15 x 10 x 5.7	40	12	470	0.37	15 ±0.5	10.6 ±0.4	5.7 -0.4	2.20	233 23 XXX 00

[1] Please insert material number

The A_L values for each version and each selected material can be easily calculated with the equation:
$A_L = \mu_i^* \Lambda_0$, (nH)

(Initial permeability (μ_i) of the selected material: see chapter D 1)
Calculated A_L values should be considered to be approximate values. The tolerance is ±25%.
If you need toroidal cores with other dimensions, please send us your request.

B2.4 TOROIDAL CORES | MADE OF FERROCARIT MATERIAL

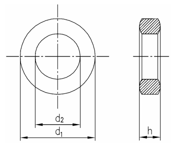


Designation	Magnetic shape parameters				Dimensions			Weight (g)	Part number [1]
	l_e (mm)	A_e (mm²)	V_e (mm³)	Λ_0 = c (nH)	d_1 (mm)	d_2 (mm)	h (mm)		
R 16.4 x 9.3 x 6.5	39	19	750	0.61	16.4 -0.8	9.3 +0.6	6.5 -0.4	4.00	234 06 XXX 00
R 17.4 x 10.4 x 7	43	20	860	0.59	17.4 -0.8	10.4 +0.6	7 -0.4	4.60	234 22 XXX 00
R 19 x 11 x 8	47	30	1390	0.80	11.2 ±0.5	11.2 ±0.25	8 ±0.5	6.50	234 08 XXX 00
R 19 x 11 x 10	47	38	1760	1.02	19.2 ±0.5	11.2 ±0.25	10 ±0.5	8.10	234 09 XXX 00
R 19 x 11 x 15	47	58	2690	1.56	19.2 ±0.5	11.2 ±0.25	15 ±0.5	12.2	234 15 XXX 00
R 20 x 10 x 6.7	45	31	1420	0.87	20 ±0.5	10 ±0.35	6.7 ±0.4	6.80	234 32 XXX 00
R 20 x 10 x 8	45	38	1710	1.05	20 ±0.5	10 ±0.35	8 ±0.4	8.10	234 19 XXX 00
R 20 x 11 x 11	47	43	2000	1.15	19.2 ±0.5	11.2 ±0.25	11 +0.5	10.00	234 01 XXX 00
R 20 x 11 x 5	49	19	920	0.48	20.3 ±0.6	11.7 ±0.4	5 ±0.4	4.10	234 05 XXX 00
R 23 x 14.8 x 7	58	26	1520	0.56	22.8 ±0.4	14.8 ±0.3	7 ±0.25	7.30	235 21 XXX 00
R 25 x 15 x 10	62	46	2870	0.93	25 ±0.5	15 +1	10 ±0.5	14.00	235 06 XXX 00
R 26 x 14.5 x 7.5	62	39	2410	0.79	26 ±0.55	14.5 ±0.35	7.5 -0.5	11.60	236 19 XXX 00
R 26 x 14.5 x 9	62	49	3030	1.00	26 ±0.55	14.5 ±0.35	9 ±0.3	14.60	236 18 XXX 00
R 26 x 14.5 x 10	62	55	3390	1.11	26 ±0.55	14.5 ±0.35	10 ±0.3	15.80	236 05 XXX 00
R 26 x 14.5 x 15	62	84	5170	1.70	26 ±0.55	14.5 ±0.35	15 ±0.4	23.70	236 09 XXX 00
R 26 x 14.5 x 20	62	112	6950	2.28	26 ±0.55	14.5 ±0.35	20 ±0.45	31.60	236 08 XXX 00
R 27 x 14 x 9	62	52	3230	1.05	27 ±0.7	14 ±0.4	9 -0.5	16.20	236 12 XXX 00
R 27 x 14 x 30	62	190	11800	3.84	27 ±0.7	14 ±0.4	30 ±0.9	54.00	236 04 XXX 00
R 27 x 14 x 40	62	255	15860	5.15	27 ±0.7	14 ±0.4	40 ±1.2	72.00	229 39 XXX 00
R 29.5 x 19 x 9	75	45	3390	0.76	29.5 ±0.7	19 ±0.5	9 ±0.3	16.30	236 21 XXX 00
R 29.5 x 19 x 15	75	77	5750	1.29	29.5 ±0.7	19 ±0.5	15 ±0.3	27.60	237 27 XXX 00
R 36 x 23 x 15	91	94	8520	1.29	36 ±0.9	23 ±0.7	15 ±0.4	39.00	238 09 XXX 00
R 45 x 23 x 17.5	103	193	19800	2.35	45 ±1.1	23 ±0.6	17.5 ±0.5	98.00	239 60 XXX 00
R 61 x 38 x 18	153	191	29100	1.57	61 ±1.5	38 ±1.2	18 ±0.8	157.00	239 51 XXX 00
R 80 x 40 x 15	181	300	54400	2.08	80 ±2.5	40 ±1.2	15 ±0.5	261.00	239 40 XXX 00

[1] Please insert material number

The A_L values for each version and each selected material can be easily calculated with the equation:
$A_L = \mu_i * \Lambda_0$ (nH) (Initial permeability (μ_i) of the selected material: see chapter B 1)
Calculated A_L values should be considered to be approximate values. The tolerance is ±25%.
If you need toroidal cores with other dimensions, please send us your request.

B2.4 TOROIDAL CORES | WITH PLASTIC COAT



Designation	A_L (nH) for material			Dimensions			Part number [2]
	Fi 340 (±25%)	Fi 360 (± 25%)	Fi 410 (+30%) (-40%)	d_1 (mm)	d_2 (mm)	h (mm)	
R 10 x 6 x 4	1590 [1]	2200 [1]	4090	10.90	5.00	5.10	232 31 XXX 10
R 10 x 6 x 8	3380	4570	7640	10.90	5.00	9.10	232 29 XXX 10
R 13 x 7 x 12	6170 [1]	8600	14400	14.15	6.00	13.20	233 09 XXX 10
R 13.3 x 8.3 x 5	1870	2600	4400	14.40	7.20	6.05	233 21 XXX 10
R 13.3 x 8.3 x 5	2010	2800 [1]	4700	14.40	7.20	5.95	233 16 XXX 10
R 14 x 9 x 5	1760	2450	4100	15.30	7.90	6.10	233 14 XXX 10
R 14 x 9 x 6	2160	3000	5100	15.30	7.90	7.20	233 08 XXX 10
R 14 x 9 x 9	3270	4570	7600	15.30	7.90	10.20	233 07 XXX 10
R 15 x 10 x 5	1670	2330	3900	16.30	8.70	6.10	233 05 XXX 10
R 15 x 10 x 5.7	1600	2230	3700	16.30	9.40	6.50	233 23 XXX 10
R 16.4 x 9.3 x 6.5	2640	3680	6150	17.20	8.50	7.30	234 06 XXX 10
R 17.4 x 10.4 x 7	2540	3600	5900	18.20	9.60	7.80	234 22 XXX 10
R 19 x 11 x 8	3500 [1]	4900	8200	20.50	10.15	9.30	234 08 XXX 10
R 19 x 11 x 10	4430 [1]	6200	10350	20.50	10.15	11.30	234 09 XXX 10
R 19 x 11 x 13.5	6050	8440	14100	20.50	10.15	14.80	234 31 XXX 10
R 19 x 11 x 14	6310	8800	14700	20.50	10.15	15.30	234 10 XXX 10
R 19 x 11 x 15	6750	9500	15900	20.50	10.15	16.30	234 15 XXX 10

[1] ± 30%

[2] Please insert material number

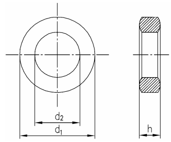
Plastic coating

The coating is 0.2 -0.4 mm thick.

The breakdown (puncture) voltage for coated cores is > 1.5 kV, 50 Hz.

If you need plastic-coated toroidal cores with other dimensions, please send us your request.

B2.4 TOROIDAL CORES | WITH PLASTIC COAT



Designation	A_L (nH) for material			Dimensions			Part number [2]
	Fi 340 (±25%)	Fi 360 (± 25%)	Fi 410 (+30%) (-40%)	d_1 (mm)	d_2 (mm)	h (mm)	
R 20 x 10 x 6.7	3770	5250 [1]	8800	21.30	8.85	7.90	234 32 XXX 10
R 20 x 10 x 7	3950	5500	9200	21.30	8.85	8.20	234 20 XXX 10
R 20 x 10 x 8	4540	6300	10600	21.30	8.85	9.20	234 19 XXX 10
R 20 x 11 x 11	4990	6950	11600	20.80	10.35	12.30	234 01 XXX 10
R 20 x 11 x 16	7270	10100	17000	20.80	10.35	17.30	234 18 XXX 10
R 23 x 14.8 x 7	2440	3400	5700	24.00	13.70	8.05	235 21 XXX 10
R 25 x 15 x 10	4000	5580	9300	26.30	14.20	11.30	235 06 XXX 10
R 26 x 14.5 x 7.5	3420	4770	8000	27.35	13.35	8.30	236 19 XXX 10
R 26 x 14.5 x 9	4300	6000	10000	27.35	13.35	10.10	236 18 XXX 10
R 26 x 14.5 x 10	4810	6700	11200	27.35	13.35	11.10	236 05 XXX 10
R 26 x 14.5 x 15	7320	10200		27.35	13.35	16.20	236 09 XXX 10
R 26 x 14.5 x 20	9840	13730		27.35	13.35	21.25	236 08 XXX 10
R 27 x 14 x 30	16600 [1]			28.50	12.80	31.70	236 04 XXX 10
R 27 x 14 x 40	22280 [1]			28.50	12.80	42.00	229 39 XXX 10
R 29.5 x 19 x 9	3270	4570		31.00	17.70	10.10	236 21 XXX 10
R 29.5 x 19 x 15	5540	7700		31.00	17.70	16.60	237 27 XXX 10
R 30 x 19 x 10	3650	5100		31.00	17.70	11.10	236 15 XXX 10
R 36 x 23 x 15	5560	7750		37.70	21.50	16.20	238 09 XXX 10

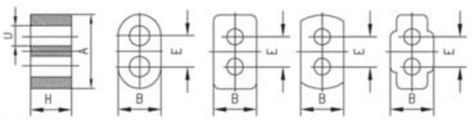
[1] ± 30%
[2] Please insert material number

Plastic coating

The coating is 0.2 -0.4 mm thick.
The breakdown (puncture) voltage for coated cores is > 1.5 kV, 50 Hz.

If you need plastic-coated toroidal cores with other dimensions, please send us your request.

B2.5 DOUBLE APERTURE CORES



Designation: Twin-hole core	Dimensions					Material	Part number [1]
	A (mm)	B (mm)	D (mm)	E (mm)	H (mm)		
ZB 3.4 x 1.95 x 1.8	3.4 ±0.2	1.95 ±0.2	0.9 ±0.1	1.45 ±0.15	1.8 ±0.2	[4]	230 88 XXX XX
ZB 3.5 x 2.4	3.45	92.01	0.86	1.45	2.36	[6]	230 00 001 00
ZB 3.6 x 2	3.6 -0.3	2.1 -0.3	0.8 +0.15	1.45 ±0.1	2.0 -0.3	[7]	230 00 002 00
ZC 3.6 x 2.5	3.6 ±0.2	2.1 ±0.2	0.8 ±0.15	1.45 ±0.15	2.5 -0.3	[3] [4] [5]	230 81 XXX XX
ZC 5 x 2.5	5.0 ±0.3	2.5 ±0.2	1.5 ±0.1	2.5 ±0.2	2.5 -0.2	[2] [3] [4] [5]	230 60 XXX XX
ZC 7 x 2.5	6.6 ±0.3	4.1 ±0.2	2.1 ±0.1	3.3 ±0.2	2.5 ±0.3	[2] [4]	230 05 XXX XX
ZC 7 x 6	6.9 ±0.3	4.3 ±0.2	2.0 ±0.3	3.0 ±0.2	6.0 ±0.3	[2]	230 06 XXX XX
ZF 7 x 4	6.95 ±0.3	3.85 ±0.2	1.2 ±0.1	3.45 ±0.2	4.0 ±0.3	[4]	230 04 XXX XX
ZH 5 x 2.5	5.3 ±0.3	3.1 ±0.25	1.4 ±0.1	2.5 ±0.2	2.5 ±0.2	[3] [4]	230 85 XXX XX

[1] Please insert material number
[2] Fi 221 [3] Fi 242 [4] Fi 292 [5] Fi 340
[6] 12-315-g (Fa. Ferronics) [7] M13 (Fa. EPCOS)

Core no. description

XXX XX **XXX** **XX**

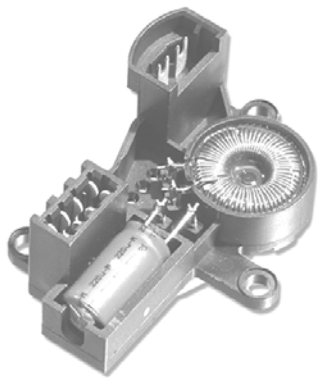
- XXX XX: **Competent shape/size**
- XXX: **Core material**
- XX: **A_L - Code**

Further, the RM, ERF, ETD, EFD and EP series cores and kits are also offered.

If you require kits which are not listed here, after the profitability is reviewed, we will be happy to add any other kit to our product line.

For large quantities, special tooling can be manufactured for your customer-specific applications, with separate tools and molds.

Please send us your inquiry



IMMOBILIZER ANTENNAS

Immobilizers are the standard system to prevent car-theft. Ring type antennas are used to establish a short range communication with the transponder chip inside the ignition key.

Features

- Customised antenna modules for mounting onto keylock-housings
- Various configurations with moulded housing, connector or cable-harness
- Optional integration of RF-antenna leads and illumination plastics
- High quality visible surface according to customer specification

Technology

- Complex shapes can be realized
- Overmoulding of the antenna winding and moulding of housing and connector in one shot
- Pressfit pin interface for solderless assembly of the transceiver electronics

PASSIVE-ENTRY ANTENNAS

Automotive passive entry and start systems require multiple antennas to clearly locate the electronic key. Low frequency technology (125kHz) allows precise control of the detection range.

Features

- Doorhandle Modules, optionally with integrated electronics and switches
- Interior Antennas, e.g. trunk mounted
- Exterior Antennas, e.g. bumper mounted
- Various configurations with cable-harness or connectors
- Optionally with integrated capacitor and resistor

Technology

- Standardized, robust design concept
- Waterproof design as an option
- Extremely low electrical tolerances and temperature co-efficient
- Highly automated mass production

XENON-IGNITER

Designed for automotive applications, Xenon Igniter Modules from SUMIDA meet the most stringent technical and quality requirements demanded by vehicle lighting systems today.

Highlights

- D1/D3 igniter modules
- D2/D4 click on igniter modules
- D2/D4 lamp socket

Patented SUMIDA HID Igniter technology

- Moulding of highly reinforced PPS plastics
- High temperature electronics, using leadframe and laser welding
- Special high-voltage transformer
- Vacuum potting

FUNCTIONAL INTEGRATED MODULES

The combination of mechanics and electronics allows the integration of several functions into one module. Such Functional Integrated Modules lead to reduced efforts for assembly and logistics at the customer.

Integrated Functions

- Carrier for power inductors and capacitors
- Interconnection between large components
- EMI-Filter
- Sensor
- Connectors
- Housing

Technology

- Plastic injection moulding
- Overmoulding of leadframe
- Various soldering and welding techniques for electrical interconnection
- Pressfit pin interface for solderless assembly

LF INITIATOR FOR TIRE PRESSURE MONITORING SYSTEMS (TPMS)

The continuous monitoring of the pressure in all tires together with the indication of the current pressure in the corresponding tire requires a reliable and exact measurement technology.

Highlights

- LFIs are utilized to initiate the communication of the sensors installed in each wheel
- For premium TPMS, LFIs in each wheelhouse provide unambiguous localisation of the sensor’s signals
- Durable, cost-effective modules using proven 125 kHz technology

Technology

- Complete manufacturing solution
- PCB assembly (SMT/THT) & test
- Housing with integrated ferrite rod antenna
- Pressfit pin interface for solderless assembly of the electronics
- Plastic laser welding
- Leakage test of each unit

INDUCTIVE SENSORS

SUMIDA's inductive sensor technology is based on the functional principle of "eddy current" losses. The distinctive feature is high immunity to magnetic interference fields, thus making them suitable for harsh environments inside electric motors and generators.

Rotor Position Sensors

- Detection of rotor position in electric motors, e.g. in hybrid electric vehicles
- Replacement of resolvers

Speed Sensors

- Detection of speed and sense of rotation, e.g. bearing sensor
- Passive wheelspeed sensors for commercial vehicles

Patented eddy current sensor technology

- High immunity to magnetic interference fields
- Scanning of electrically conductive target material
- Automotive grade ASICs available
- No permanent magnet required
- High speed operation

HIGH POWER COMPONENTS

Energy Transfer
Nowadays transformers are used in almost every clocked switching power supply. In the majority of applications, the switching frequency is between 10 kHz and 500 kHz. In an output range stretching from several hundred watts up to several kWs, optimized power transformers are applied. SUMIDA AG develops these transformers to match customer specifications taking the latest VDE and UL standards into consideration and based on winding forms with integrated creepage and clearance distances, bobbins with special wire or layer construction in open and potted versions

Energy Storage
Storage chokes are located in switching power supplies and converter systems for energy storage. When used these chokes have effective current with a frequency-specific peak current applied to them. The choice of core material depends to a major extent on the combined current shape. SUMIDA AG uses here the most varied of core materials such as iron powder, metal alloys and ferrite. The selection of conductor material also plays a major role – depending on the application involved, flat wire, solid wire or litz-wire come into operation.

Network interference suppression
The proven asymmetrical interference suppression components from SUMIDA AG are mainly used in the interference suppression of switch mode power supplies. For damping common mode interference, so-called "current compensating chokes" (common mode) are required. These inductivities are primarily based on high permeable cores with two identical windings. SUMIDA AG ensures that for relatively small sizes in customer-specific designs, windings with a smaller self-capacitance are used, which results in higher resonance frequencies.

Power Factor Correction
When limiting harmonic oscillation of the network on switch mode power supplies and frequency converters, developers tend to use so-called PFC controllers in order to ensure that the sinusoidal system voltage remains distortion free during any current drain. To enable the controller to rectify current shape and compensate for harmonic waves, optimized control chokes are required. SUMIDA AG provides both chokes with special core material as well as coils with ferrite cores and low-loss windings.

AUTOMOTIVE

As a reliable partner to the supplier industry for the development and delivery of inductive components and modules, SUMIDA has a vital role in automotive electronics. Its long-standing cooperation with important suppliers to the automotive industry enables SUMIDA to provide comprehensive know-how for tailor-made solutions for automotive electronics and mechatronics. The base for our sustained product quality is the processes certified in accordance with ISO/TS 16949, which are constantly evolving as part of our quality management process.

INDUSTRIAL

SUMIDA specializes in inductive components and modules for customer-specific requirements. Creativity and know-how enable us to develop, in close cooperation with our customers, individual and market-leading solutions. Our customers benefit from the many advantages:

- Competence, from development to production or from ferrite to the inductive component
- Design-in of switching power transmitters and storage chokes for the most varied of applications, circuit topologies and power ranges
- Design-in of signal and actuation transmitters and interference-suppression choke
- Standard-compatible design (VDE, UL, CSA), some VDE kit-family releases (e.g. EF16 TEX-E, EF20 TEX-E)
- Consideration of mechanical requirements (dimension, fastening, …)
- Optimization of power losses and thermal resistances
- Module solutions based on inductive technology, e.g. for noncontact energy and signal transfer

GREEN ENERGY

The mission of SUMIDA is to fulfill its customers' special requirements by providing market-leading inductive components; components, which in terms of technology and efficiency really set the standards. They demonstrate quite clearly our outstanding material proficiency and state-of-the-art production technology. Our customers also benefit from our long-standing experience in design. We provide tailor-made solutions for the following sectors:

- POWER quality (EMC, PFC)
- POWER transfer (SMPS)
- POWER storage (storage chokes, sinus chokes)

CONSUMER ELECTRONICS:

LIGHTING

SUMIDA provides a wide range of components for ballast units and lighting control systems in consumer, industry and automotive applications. Thanks to its long-standing technical experience and global development and production activities, SUMIDA meets customer requirements at the best and offers ideal and cost-effective solutions at all times.

COMMUNICATION

SUMIDA supports the telecommunication infrastructure providers with a wide range of signal transmitters, modules and interference suppression components for applications in the latest IDSN, DSL and LAN systems. The product range also includes complete DSL splitters and splitter modules CO and CPE. The customers benefit from the broad range of innovative products and extensive technical competence.

HOUSEHOLD/TV

The goal of consumer electronics is to provide equipment with higher energy efficiency coupled with an increase in functionality. SUMIDA is working on continuous innovations – not only in terms of standard products, but also for components that are manufactured to meet customer requirements. These can be used, e.g. in energy-saving and cost-efficient power supplies or for signal processing (data exchange, control engineering, sensor technology).

This handbook presents a brief summary of our production and delivery, giving technical information to design and production engineers as well as buyers.

In this sense the data specified in this catalogue exclusively serve to describe the properties of our products. They must not be understood as guarantee-values in a juridical sense. Eventual indemnity claims against us – no matter for what legal reasons – are excluded except in cases of gross negligence or intent.

Please note that – for reasons of the given space – the whole range of available components and their variants could not be included into this catalogue. If you cannot find the component you are looking for or if you need more detailed information please send us your inquiry.

Components no longer included in this handbook are generally deliverable as long as the appropriate tools are usable. Such items, however, are no longer recommended for use in new equipment designs.

You certainly will understand that we cannot guarantee that the components, applications and procedures shown and described in this handbook are always free of the rights of third parties.

We reserve the right to perform corrections and engineering changes.

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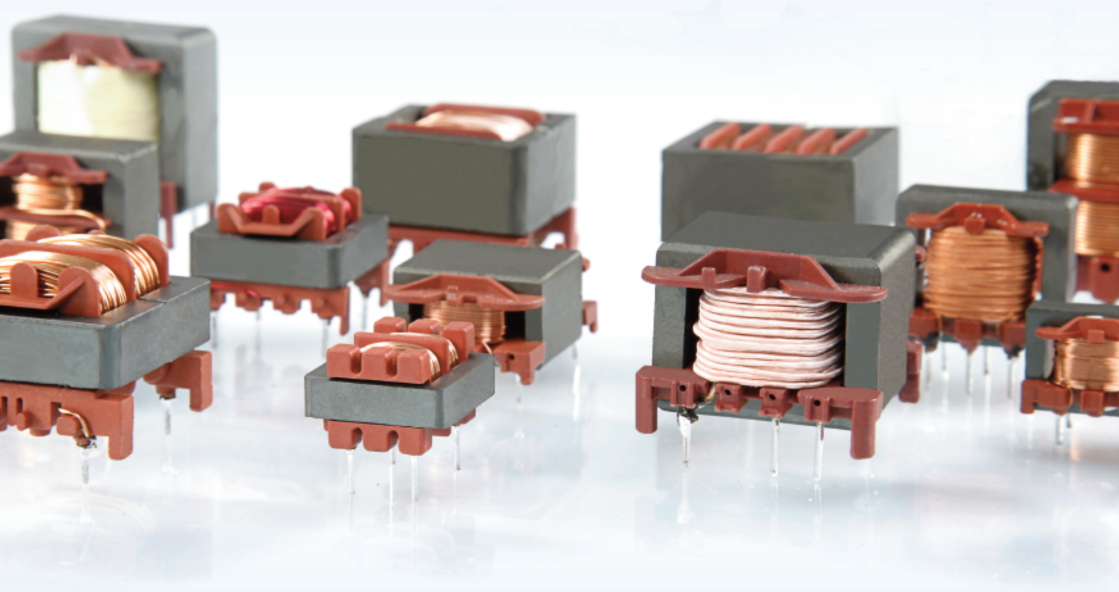

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