

Ferrites and accessories

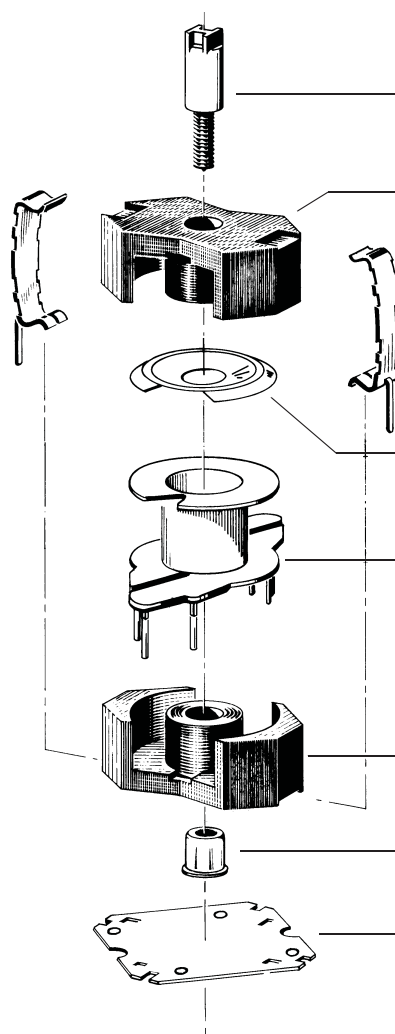
RM 5, RM 5 LP
Core and accessories

Series/Type: **B65805, B65806, B65822, B65539**

Date: February 2016

RM 5

Core and accessories

	Individual parts	Part no.	Page
	Adjusting screw	B65539 B65806	9
	Core	B65805	3
	Clamps	B65806	6
	Insulating washer 1	B65806	6
	Coil former	B65806	5
	Core	B65805	3
	Threaded sleeve (glued-in)		
	Insulating washer 2	B65806	6

FRM0005-2

Example of an assembly set

Also available:

SMD coil formers	B65822	7, 8
Clamps	B65806	7, 8
<u>RM 5 low profile:</u>		
Core	B65805P	10

RM 5

Core

B65805

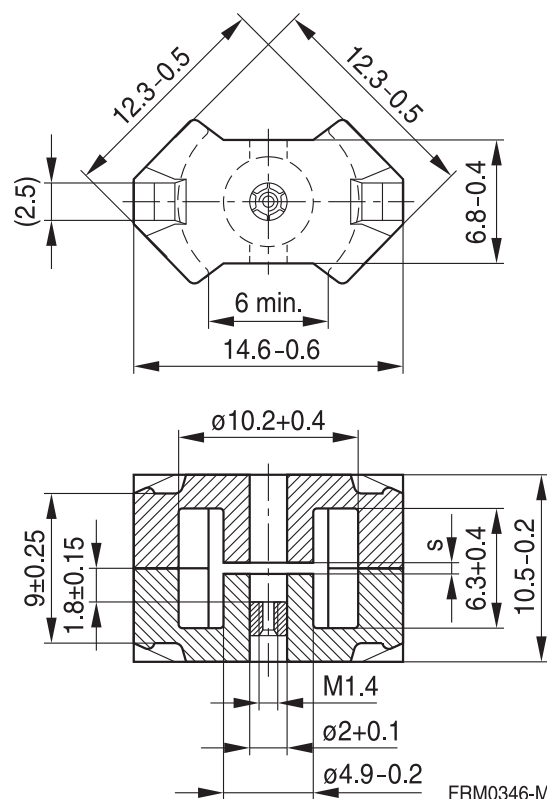
- To IEC 62317-4
- Core without center hole for transformer applications
- Delivery mode: sets

Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma I/A$	1.0	0.93	mm^{-1}
I_e	20.8	22.1	mm
A_e	20.8	23.8	mm^2
$A_{\min}$	—	18	mm^2
V_e	433	526	mm^3

Approx. weight (per set)

m	2.9	3.0	g
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Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code ¹⁾ -C with center hole -N with threaded sleeve
K1	25 ±3% 40 ±3%	1.0 0.40	19.9 31.8	B65805+0025A001 B65805+0040A001
M33	63 ±3% 100 ±3%	0.4 0.2	50.2 79.6	B65805+0063A033 B65805+0100A033
N48	160 ±3% 250 ±3% 315 ±3%	0.12 0.06 0.03	127 199 251	B65805+0160A048 B65805+0250A048 B65805+0315A048

1) Replace the + by the code letter "C" or "N" for the required version.

RM 5
Core
B65805
Ungapped

Material	A _L value nH	μ _e	P _V W/set	Ordering code -C with center hole -J without center hole
N48	1800 +30/−20%	1430		B65805C0000R048
N45	2600 +30/−20%	1920		B65805J0000R045
N30	3500 +30/−20%	2590		B65805J0000R030
T38	6700 +40/−30%	4950		B65805J0000Y038
T66	9600 +40/−30%	7090		B65805J0000Y066
N49	1300 +30/−20%	960	< 0.06 (50 mT, 500 kHz, 100 °C)	B65805J0000R049
N87	2000 +30/−20%	1480	< 0.32 (200 mT, 100 kHz, 100 °C)	B65805J0000R087
N97	2000 +30/−20%	1480	< 0.24 (200 mT, 100 kHz, 100 °C)	B65805J0000R097
N41	2600 +30/−20%	1920	< 0.10 (200 mT, 100 kHz, 100 °C)	B65805J0000R041

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
 $H \triangleq$ max. operating temperature 155 °C), color code black
 SUMIKON PM 9630 [E41429 (M)], SUMITOMO BAKELITE CO LTD

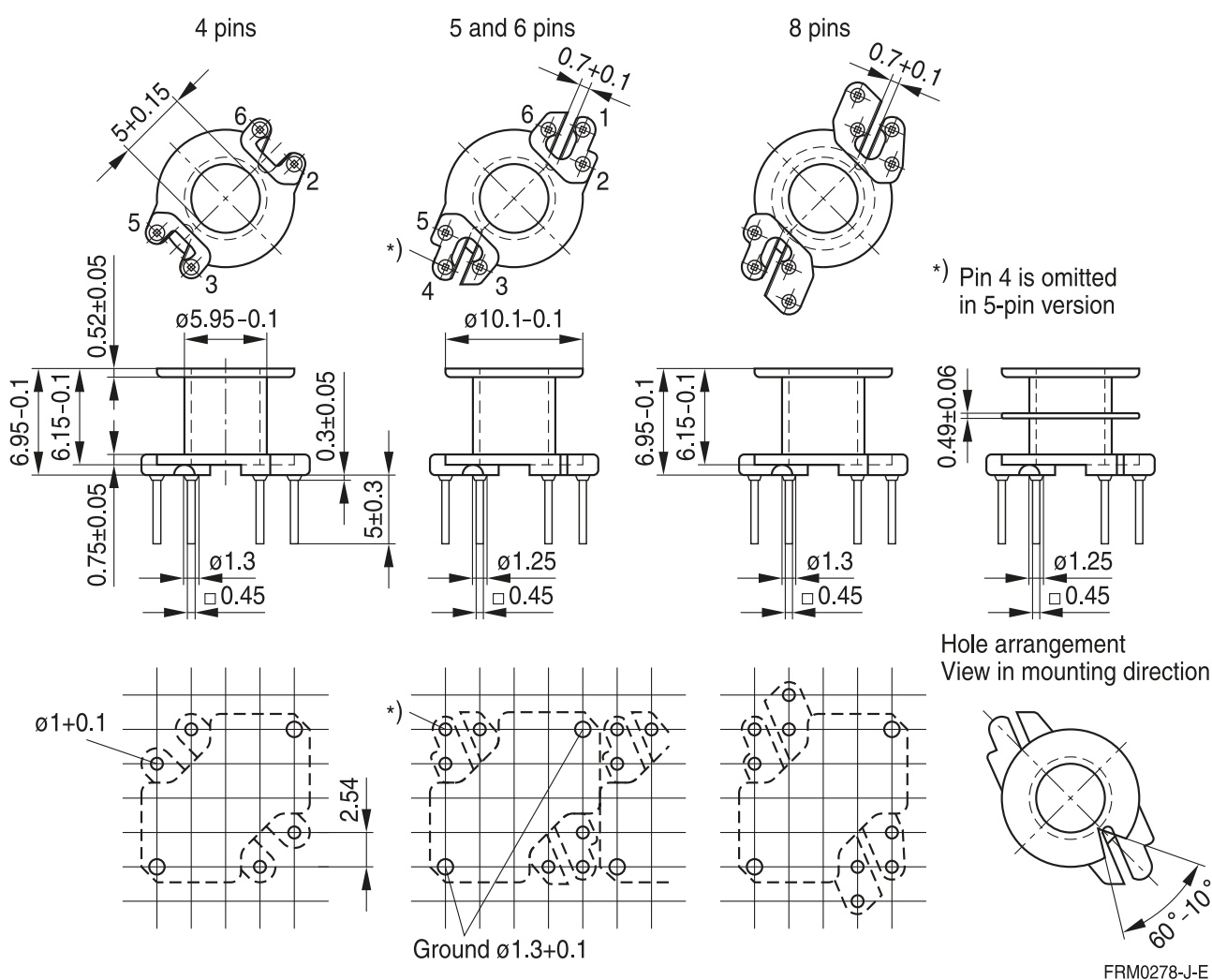
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s

Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3.5 s

Winding: see Data Book 2013, chapter "Processing notes, 2.1"

For matching clamps and insulating washers see page 6.

Sections	A_N mm ²	l_N mm	A_R value $\mu\Omega$	Pins	Ordering code
1	9.5	25	90	4 5 6 8	B65806N1104D001 B65806N1105D001 B65806N1106D001 B65806N1108D001
2	8.7	25	94	6	B65806N1106D002



RM 5

Accessories

B65806

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0.3 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Also available as strip clamp on reels on request

Insulating washer 1 between core and coil former

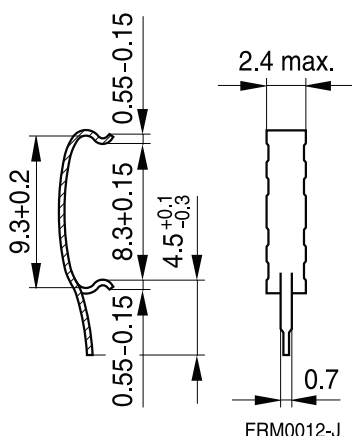
- For tolerance compensation and for insulation
- Made of polyarylate film (UL 94 V-0, insulation class to IEC 60085: E $\geq$ 120 °C), 0.08 mm thick Aryphan F685, [E167358 (M)], natural color, LOFO HIGH TECH FILM GMBH

Insulating washer 2 for double-clad PCBs

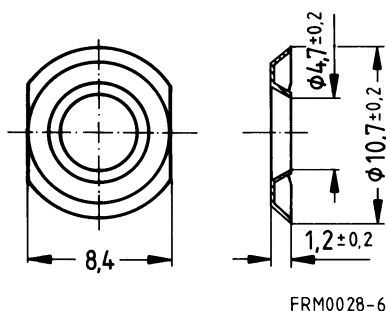
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E $\geq$ 120 °C), 0.25 mm thick Makrofol FR7-2, [E118859 (M)], natural color, BAYER MATERIALSCIENCE AG

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65806B2203X000
Insulating washer 1 (reel packing, PU = 1 reel)	B65806A5000X000
Insulating washer 2 (bulk)	B65806D2005X000

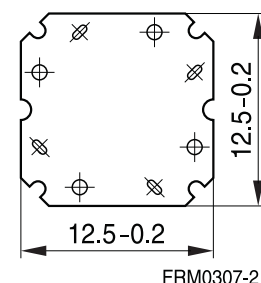
Clamp



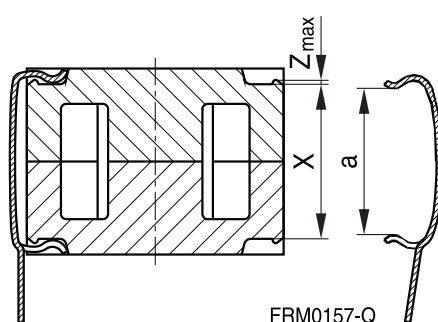
Insulating washer 1 (preliminary data)



Insulating washer 2



Clamping forces for RM 5



F_{min} : Extension of clamp from a to $a_2 = X_{min}$
 F_{max} : Extension of clamp from a to $a_1 = X_{max}$

Clamp opening a (mm)	8.3 +0.15
Core nose Z_{max} (mm)	0.15
Height of core pair X (mm)	X_{min} 8.75 X_{max} 9.25
Clamping force F (N)	F_{min} 5 F_{max} 40



SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:

F $\triangleq$ max. operating temperature 155 °C), color code black

Vectra C 130 [E83005 (M)], TICONA

Solderability: to IEC 60068-2-58, test Td, method 6 (Group 3): 245 °C, 3 s

Resistance to soldering heat: to IEC 60068-2-58, test Td, method 6 (Group 3): 255 °C, 10 s

permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s

Winding: see Data Book 2013, chapter "Processing notes, 2.1"

Clamp

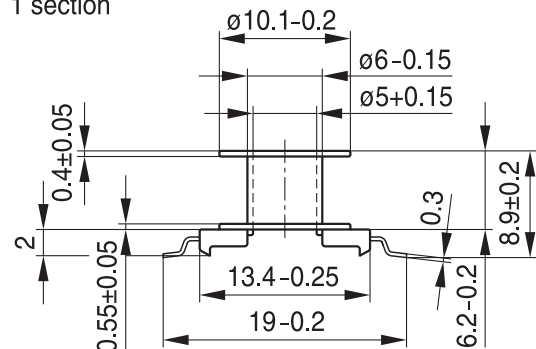
■ Without ground terminal, made of stainless spring steel, 0.335 mm thick

■ Also available as strip clamp (each carton containing 2 reels) on request

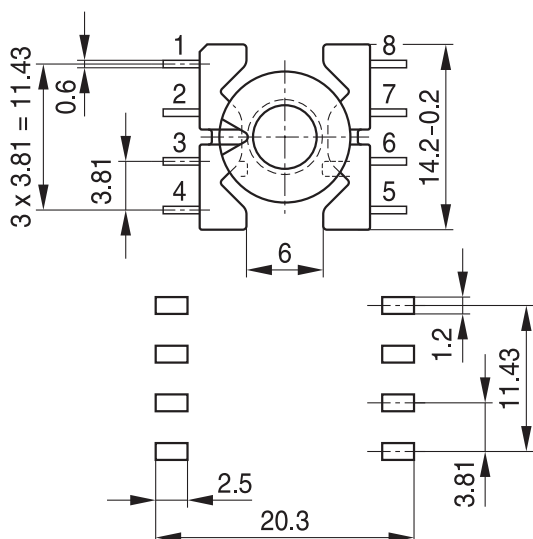
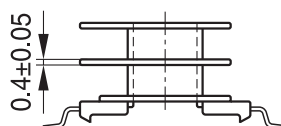
Sections	A_N mm ²	l_N mm	A_R value $\mu\Omega$	Terminals	Ordering code
1	11.1	25	77	8	B65822F1008T001
2	10.2	25	85	8	B65822F1008T002
Clamp (ordering code per piece, 2 are required)					B65806J2204X000

Coil former

1 section



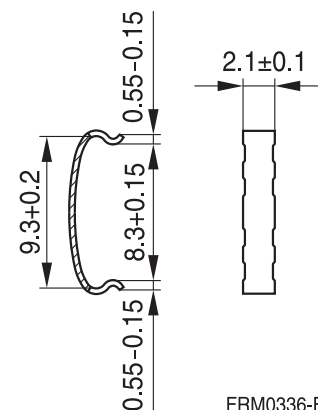
2 sections



Recommended
PCB layout

FRM0296-H-E

Clamp



FRM0336-F



SMD coil former with J terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:

F $\triangleq$ max. operating temperature 155 °C), color code black

Vectra C 130 [E83005 (M)], TICONA

Solderability: to IEC 60068-2-58, test Td, method 6 (Group 3): 245 °C, 3 s

Resistance to soldering heat: to IEC 60068-2-58, test Td, method 6 (Group 3): 255 °C, 10 s

permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s

Winding: see Data Book 2013, chapter "Processing notes, 2.1"

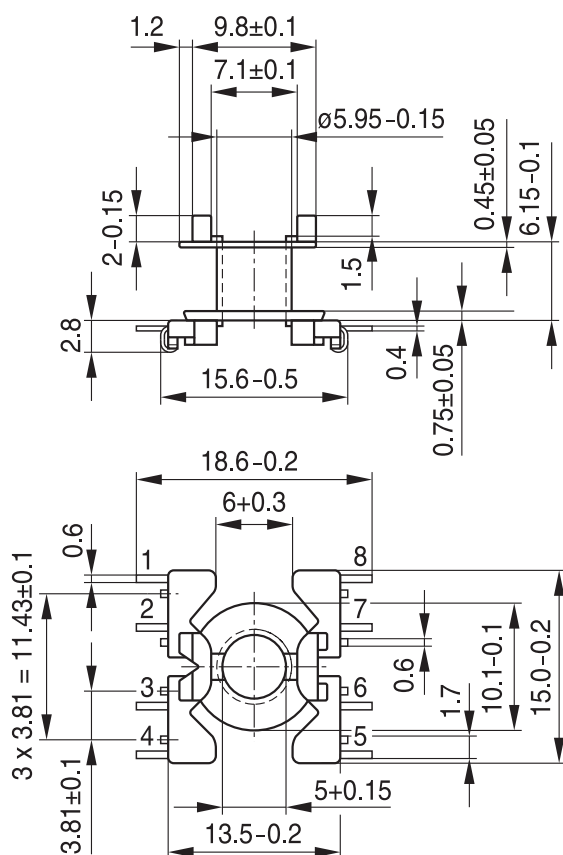
Clamp

■ Without ground terminal, made of stainless spring steel, 0.335 mm thick

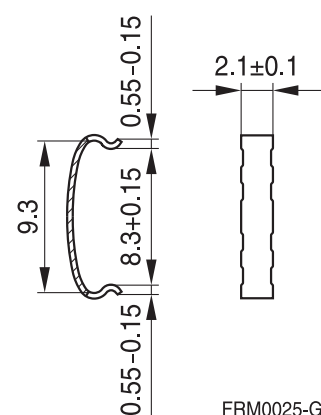
■ Also available as strip clamp (each carton containing 2 reels) on request

Sections	A _N mm ²	l _N mm	A _R value μΩ	Terminals	Ordering code
1	11.1	25	73	8	B65822J1008T001
Clamp(ordering code per piece, 2 are required)					B65806J2204X000

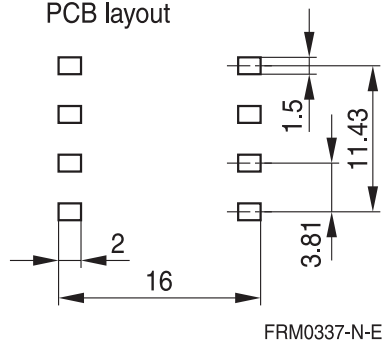
Coil former



Clamp



Recommended PCB layout



RM 5

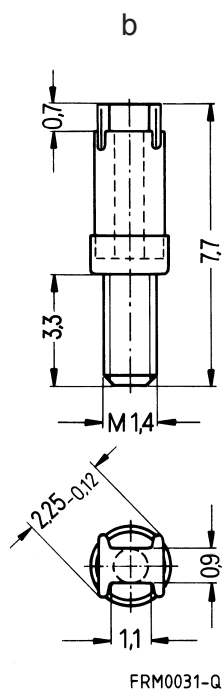
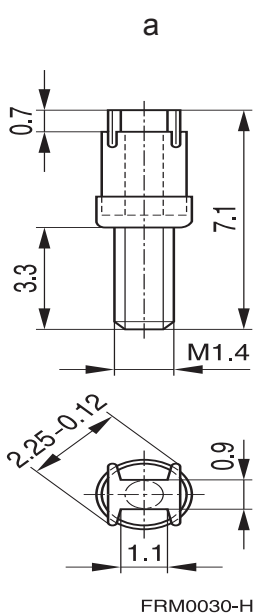
Accessories

B65539, B65806

Adjusting screw

- Tube core with thread and core brake made of GFR polyterephthalate
Pocan B3235® [E245249 (M)], LANXESS AG

Figure	Tube core $\varnothing \times \text{length (mm)}$	Material	Color code	Ordering code
a	1.81×2.0	K1	yellow	B65539C1003X001
a	1.81×2.7	N22	red	B65539C1002X022
b	1.81×3.4	N22	green	B65806C3001X022



RM 5 »Low Profile«

Core

B65805P

- To IEC 62317-4
- For compact transformers
- Without center hole
- Delivery mode: sets

Magnetic characteristics (per set)

$$\Sigma l/A = 0.71 \text{ mm}^{-1}$$

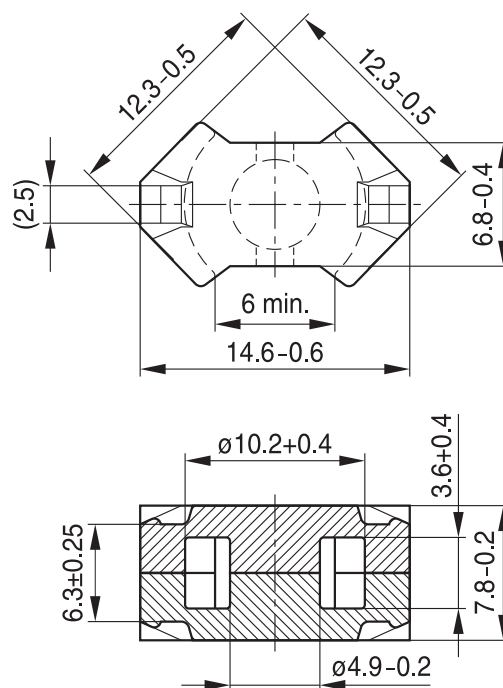
$$l_e = 17.5 \text{ mm}$$

$$A_e = 24.5 \text{ mm}^2$$

$$A_{\min} = 18 \text{ mm}^2$$

$$V_e = 430 \text{ mm}^3$$

Approx. weight 2.6 g/set



FRM0347-V

Ungapped

Material	A_L value nH	μ_e	P_V W/set	Ordering code
T38 ¹⁾	7700 +40/-30%	4380		B65805P0000Y038
N49	1700 +30/-20%	970	< 0.09 (50 mT, 500 kHz, 100 °C)	B65805P0000R049
N92	1900 +30/-20%	1080	< 0.29 (200 mT, 100 kHz, 100 °C)	B65805P0000R092
N87	2400 +30/-20%	1360	< 0.26 (200 mT, 100 kHz, 100 °C)	B65805P0000R087

1) Preliminary data

Ferrites and accessories

Cautions and warnings

Mechanical stress and mounting

Ferrite cores have to meet mechanical requirements during assembling and for a growing number of applications. Since ferrites are ceramic materials one has to be aware of the special behavior under mechanical load.

As valid for any ceramic material, ferrite cores are brittle and sensitive to any shock, fast changing or tensile load. Especially high cooling rates under ultrasonic cleaning and high static or cyclic loads can cause cracks or failure of the ferrite cores.

For detailed information see chapter “*Definitions*”, section 8.1.

Effects of core combination on A_L value

Stresses in the core affect not only the mechanical but also the magnetic properties. It is apparent that the initial permeability is dependent on the stress state of the core. The higher the stresses are in the core, the lower is the value for the initial permeability. Thus the embedding medium should have the greatest possible elasticity.

For detailed information see chapter “*Definitions*”, section 8.2.

Heating up

Ferrites can run hot during operation at higher flux densities and higher frequencies.

NiZn-materials

The magnetic properties of NiZn-materials can change irreversible in high magnetic fields.

Processing notes

- The start of the winding process should be soft. Else the flanges may be destroyed.
- Too strong winding forces may blast the flanges or squeeze the tube that the cores can not be mounted any more.
- Too long soldering time at high temperature (>300 °C) may effect coplanarity or pin arrangement.
- Not following the processing notes for soldering of the J-leg terminals may cause solderability problems at the transformer because of pollution with Sn oxyd of the tin bath or burned insulation of the wire. For detailed information see chapter “*Processing notes*”, section 8.2.
- The dimensions of the hole arrangement have fixed values and should be understood as a recommendation for drilling the printed circuit board. For dimensioning the pins, the group of holes can only be seen under certain conditions, as they fit into the given hole arrangement. To avoid problems when mounting the transformer, the manufacturing tolerances for positioning the customers’ drilling process must be considered by increasing the hole diameter.

Display of ordering codes for EPCOS products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of EPCOS, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.epcos.com/orderingcodes.

Ferrites and accessories

Symbols and terms

Symbol	Meaning	Unit
A	Cross section of coil	mm ²
A _e	Effective magnetic cross section	mm ²
A _L	Inductance factor; $A_L = L/N^2$	nH
A _{L1}	Minimum inductance at defined high saturation ($\hat{=} \mu_a$)	nH
A _{min}	Minimum core cross section	mm ²
A _N	Winding cross section	mm ²
A _R	Resistance factor; $A_R = R_{Cu}/N^2$	$\mu\Omega = 10^{-6} \Omega$
B	RMS value of magnetic flux density	Vs/m ² , mT
ΔB	Flux density deviation	Vs/m ² , mT
$\hat{B}$	Peak value of magnetic flux density	Vs/m ² , mT
$\Delta \hat{B}$	Peak value of flux density deviation	Vs/m ² , mT
B _{DC}	DC magnetic flux density	Vs/m ² , mT
B _R	Remanent flux density	Vs/m ² , mT
B _S	Saturation magnetization	Vs/m ² , mT
C ₀	Winding capacitance	F = As/V
CDF	Core distortion factor	mm ^{-4.5}
DF	Relative disaccommodation coefficient $DF = d/\mu_i$	
d	Disaccommodation coefficient	
E _a	Activation energy	J
f	Frequency	s ⁻¹ , Hz
f _{cutoff}	Cut-off frequency	s ⁻¹ , Hz
f _{max}	Upper frequency limit	s ⁻¹ , Hz
f _{min}	Lower frequency limit	s ⁻¹ , Hz
f _r	Resonance frequency	s ⁻¹ , Hz
f _{Cu}	Copper filling factor	
g	Air gap	mm
H	RMS value of magnetic field strength	A/m
$\hat{H}$	Peak value of magnetic field strength	A/m
H _{DC}	DC field strength	A/m
H _c	Coercive field strength	A/m
h	Hysteresis coefficient of material	10 ⁻⁶ cm/A
h/ μ_i^2	Relative hysteresis coefficient	10 ⁻⁶ cm/A
I	RMS value of current	A
I _{DC}	Direct current	A
$\hat{I}$	Peak value of current	A
J	Polarization	Vs/m ²
k	Boltzmann constant	J/K
k ₃	Third harmonic distortion	
k _{3c}	Circuit third harmonic distortion	
L	Inductance	H = Vs/A

Ferrites and accessories

Symbols and terms

Symbol	Meaning	Unit
$\Delta L/L$	Relative inductance change	H
L_0	Inductance of coil without core	H
L_H	Main inductance	H
L_p	Parallel inductance	H
L_{rev}	Reversible inductance	H
L_s	Series inductance	H
l_e	Effective magnetic path length	mm
l_N	Average length of turn	mm
N	Number of turns	
P_{Cu}	Copper (winding) losses	W
P_{trans}	Transferrable power	W
P_V	Relative core losses	mW/g
PF	Performance factor	
Q	Quality factor ($Q = \omega L/R_s = 1/\tan \delta_L$)	
R	Resistance	Ω
R_{Cu}	Copper (winding) resistance ($f = 0$)	Ω
R_h	Hysteresis loss resistance of a core	Ω
ΔR_h	R_h change	Ω
R_i	Internal resistance	Ω
R_p	Parallel loss resistance of a core	Ω
R_s	Series loss resistance of a core	Ω
R_{th}	Thermal resistance	K/W
R_V	Effective loss resistance of a core	Ω
s	Total air gap	mm
T	Temperature	$^{\circ}\text{C}$
ΔT	Temperature difference	K
T_C	Curie temperature	$^{\circ}\text{C}$
t	Time	s
t_v	Pulse duty factor	
$\tan \delta$	Loss factor	
$\tan \delta_L$	Loss factor of coil	
$\tan \delta_r$	(Residual) loss factor at $H \rightarrow 0$	
$\tan \delta_e$	Relative loss factor	
$\tan \delta_h$	Hysteresis loss factor	
$\tan \delta/\mu_i$	Relative loss factor of material at $H \rightarrow 0$	
U	RMS value of voltage	V
$\hat{U}$	Peak value of voltage	V
V_e	Effective magnetic volume	mm ³
Z	Complex impedance	Ω
Z_n	Normalized impedance $ Z _n = Z /N^2 \times \varepsilon (l_e/A_e)$	Ω/mm

Ferrites and accessories

Symbols and terms

Symbol	Meaning	Unit
α	Temperature coefficient (TK)	1/K
α_F	Relative temperature coefficient of material	1/K
α_e	Temperature coefficient of effective permeability	1/K
ε_r	Relative permittivity	
Φ	Magnetic flux	Vs
η	Efficiency of a transformer	
η_B	Hysteresis material constant	mT ⁻¹
η_i	Hysteresis core constant	A ⁻¹ H ^{-1/2}
λ_s	Magnetostriction at saturation magnetization	
μ	Relative complex permeability	
μ_0	Magnetic field constant	Vs/Am
μ_a	Relative amplitude permeability	
μ_{app}	Relative apparent permeability	
μ_e	Relative effective permeability	
μ_i	Relative initial permeability	
μ_p'	Relative real (inductive) component of $\bar{\mu}$ (for parallel components)	
μ_p''	Relative imaginary (loss) component of $\bar{\mu}$ (for parallel components)	
μ_r	Relative permeability	
μ_{rev}	Relative reversible permeability	
μ_s'	Relative real (inductive) component of $\bar{\mu}$ (for series components)	
μ_s''	Relative imaginary (loss) component of $\bar{\mu}$ (for series components)	
μ_{tot}	Relative total permeability derived from the static magnetization curve	
ρ	Resistivity	Ωm^{-1}
$\Sigma l/A$	Magnetic form factor	mm ⁻¹
τ_{Cu}	DC time constant $\tau_{Cu} = L/R_{Cu} = A_L/A_R$	s
ω	Angular frequency; $\omega = 2\pi f$	s ⁻¹

All dimensions are given in mm.

SMD Surface-mount device

Important notes

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9