

Ferrites and accessories

RM 8, RM 8 LP
Core and accessories

Series/Type: **B65811, B65812**

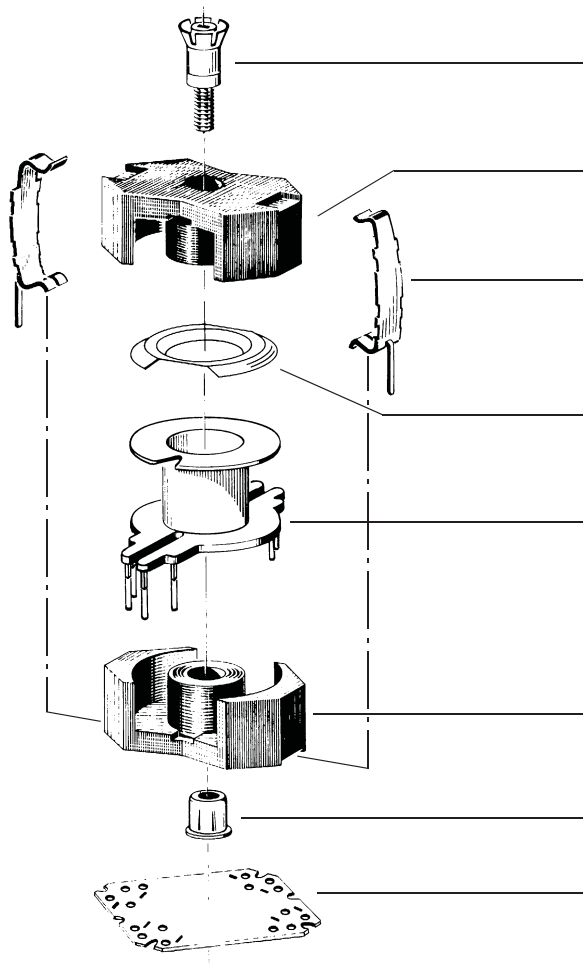
Date: February 2016

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RM 8

Core and accessories

Individual parts		Part no.	Page
	Adjusting screw	B65812	9
	Core	B65811	3
	Clamps	B65812	8
	Insulating washer 1	B65812	8
	Coil former	B65812	5
	Core	B65811	3
	Threaded sleeve (glued-in)		
	Insulating washer 2	B65812	8

FRM0051-5

Example of an assembly set

Also available:

Coil former for SMPS transformers	B65812	6
Coil former for power applications	B65812	7
<u>RM 8 low-profile:</u>		
Core	B65811P	10
Clamp	B65812	11
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RM 8

Core

B65811

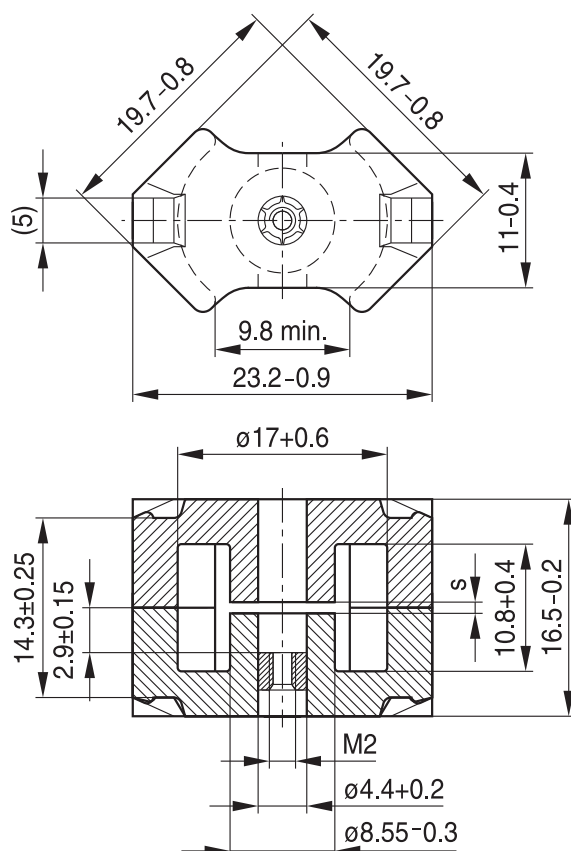
- To IEC 62317-4
- Cores without center hole for transformer applications
- Delivery mode: sets

Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma I/A$	0.68	0.59	mm ⁻¹
I_e	35.1	38	mm
A_e	52	64	mm ²
A_{min}	—	55	mm ²
V_e	1825	2430	mm ³

Approx. weight (per set)

m	10.7	12	g
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FRM0352-W

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code ¹⁾ -D with center hole -F with threaded sleeve -J without center hole
N48	250 ± 3% 315 ± 3% 400 ± 3% 630 ± 5%	0.23 0.17 0.14 0.10	134 169 215 338	B65811+0250A048 B65811+0315A048 B65811+0400A048 B65811+0630J048
N41	160 ± 3% 250 ± 5% 630 ± 5% 1600 ± 10%	0.49 0.24 0.11 0.04	76 118 298 756	B65811J0160A041 B65811J0250J041 B65811J0630J041 B65811J1600K041
N87	250 ± 3% 400 ± 3%	0.30 0.18	118 189	B65811J0250A087 B65811J0400A087

1) Replace the + by the code letter "F" or "D" for the required version. Standard version is "D".

RM 8
Core
B65811
Ungapped

Material	A _L value nH	μ _e	P _V W/set	Ordering code -D with center hole -J without center hole
N48	2900 +30/−20%	1550		B65811D0000R048
N30	5700 +30/−20%	2690		B65811J0000R030
T38	12500 +40/−30%	5910		B65811J0000Y038
N49	2200 +30/−20%	1040	< 0.37 (50 mT, 500 kHz, 100 °C)	B65811J0000R049
N87	3300 +30/−20%	1560	< 1.20 (200 mT, 100 kHz, 100 °C)	B65811J0000R087
N97	3300 +30/−20%	1560	< 1.00 (200 mT, 100 kHz, 100 °C)	B65811J0000R097
N41	4100 +30/−20%	1940	< 0.37 (200 mT, 25 kHz, 100 °C)	B65811J0000R041

Coil former, squared pins

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

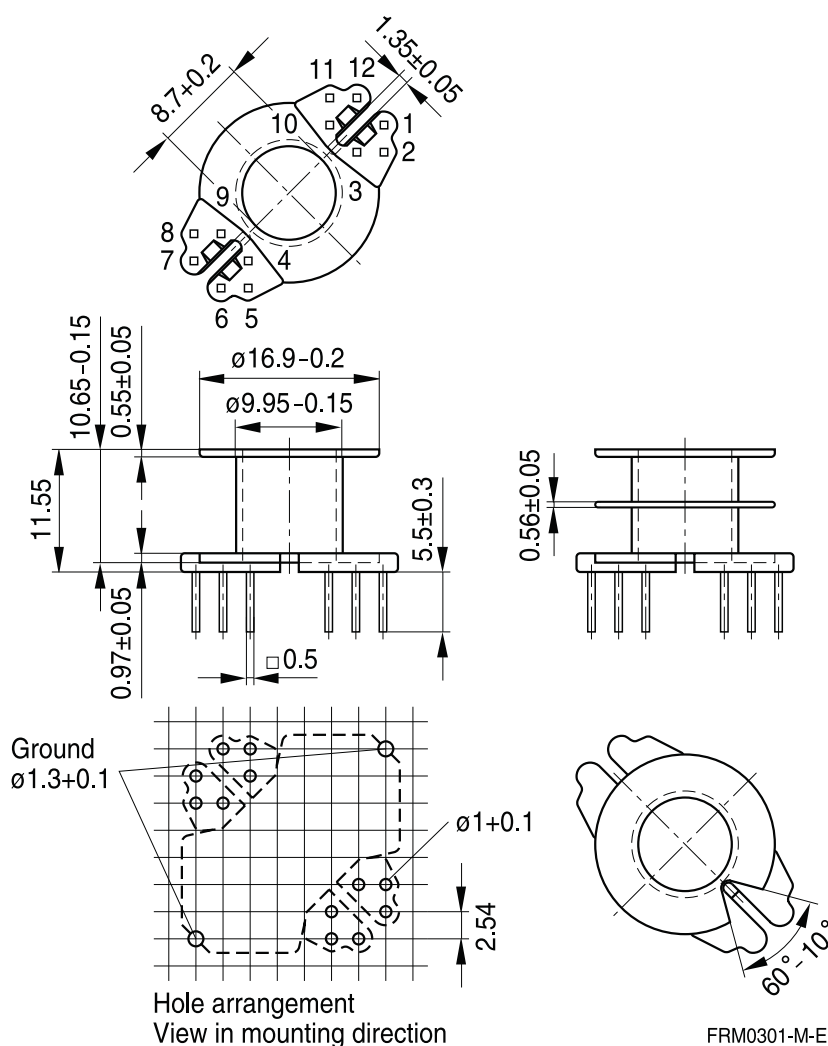
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3.5 s

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

For matching clamp and insulating washers see page 8.

Sections	A _N mm ²	l _N mm	A _R value μΩ	Pins	Ordering code
1	30	42	47	5 8 12	B65812N1005D001 B65812N1008D001 B65812N1012D001
2	28.4	42	50	5 8 12	B65812N1005D002 B65812N1008D002 B65812N1012D002

12 pins



Version	Pins omitted
5 pins	3, 4, 6, 7, 9, 10, 12
8 pins	3, 4, 9, 10

Coil former for SMPS transformers with line isolation

The creepage distances and clearances are designed such that the coil former is suitable for use in SMPS transformers with line isolation.

- Closed center flange with external wire guide
- Optimized for use with automatic winding machines

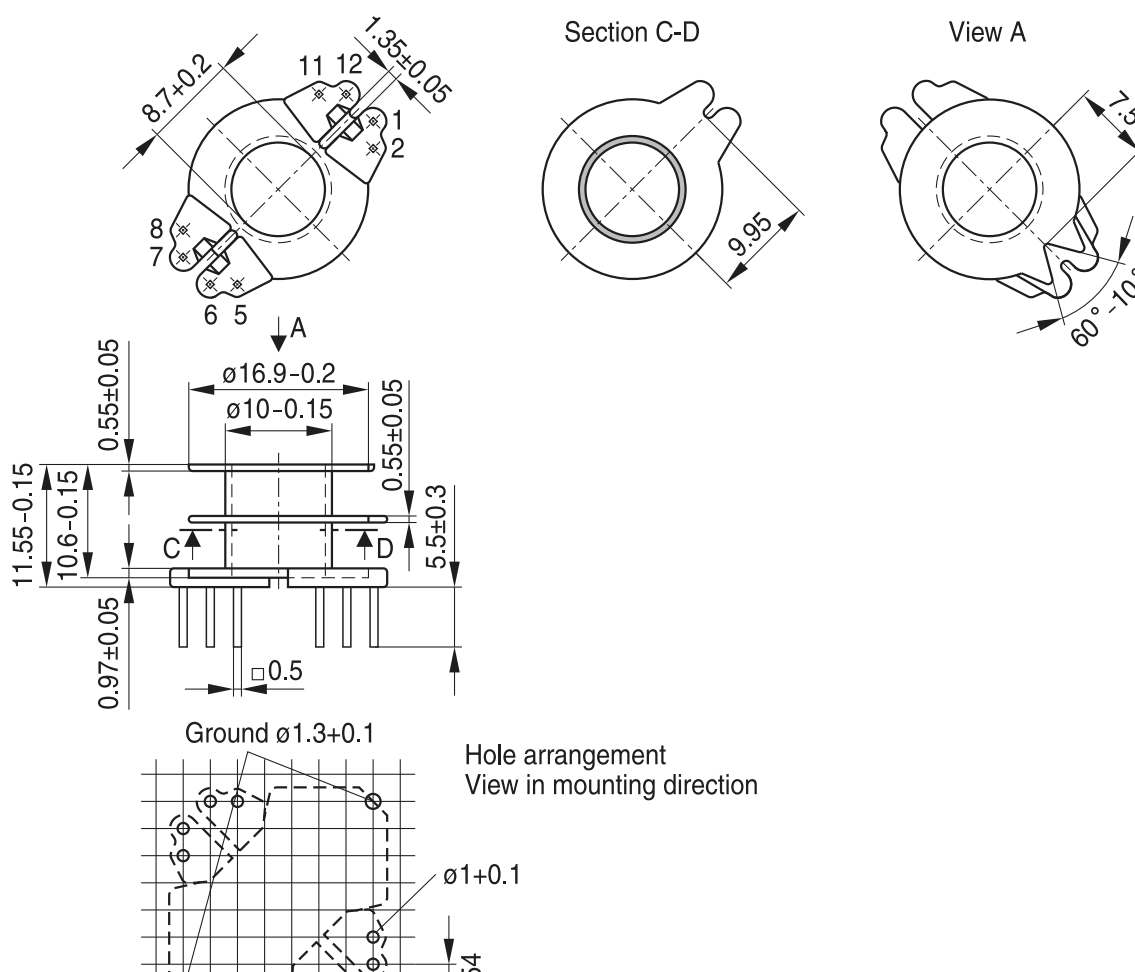
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
 $F \triangleq$ max. operating temperature 155 °C), color code black
 Sumikon PM 9630® [E41429 (M)], SUMITOMO BAKELITE CO LTD

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"

Sections	A_N mm ²	I_N mm	A_R value $\mu\Omega$	Pins	Ordering code
2	28.4	42	50	8	B65812N1108D002



Coil former for power applications

Optimized for automatic winding

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:

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

Valox 420-SE0® [E45329 (M)], Sabic Innovative Plastic

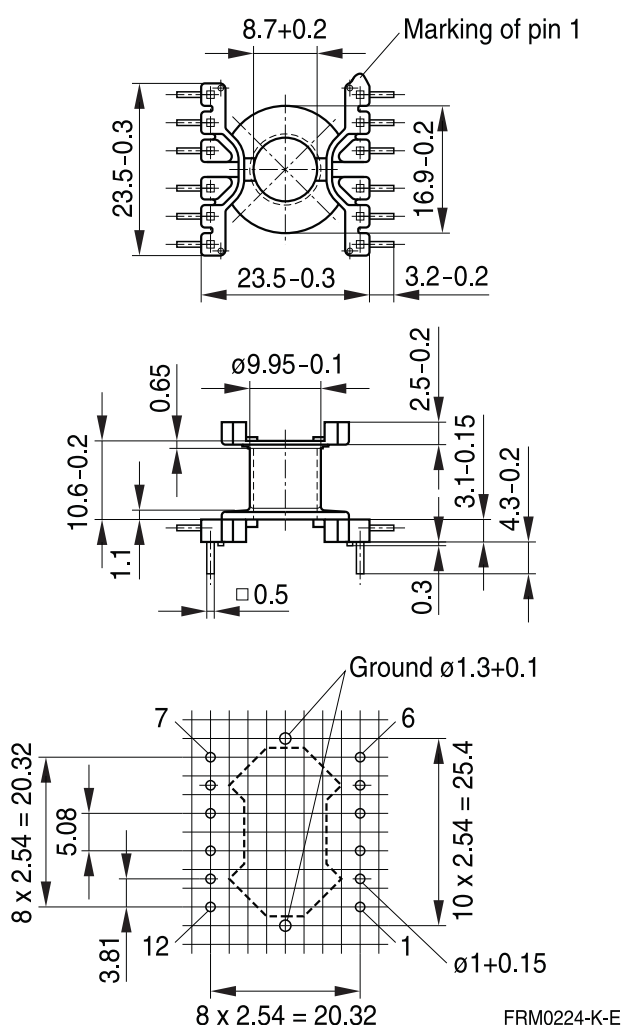
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s

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 clamp and insulating washer 1 see page 8.

Sections	A_N mm ²	l_N mm	A_R value $\mu\Omega$	Pins	Ordering code
1	30	42	47	12	B65812C1512T001



Hole arrangement
View in mounting direction
(Note half pitch!)

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0.4 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

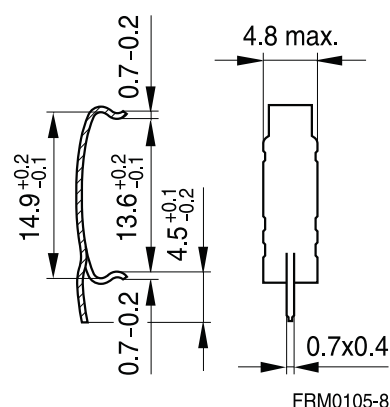
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E $\geq$ 120 °C), 0.08 mm thick Aryphan F685, [E167358 (M)], natural color, LOFO HIGH TECH FILM GMBH

Insulating washer 2 for double-clad PCBs

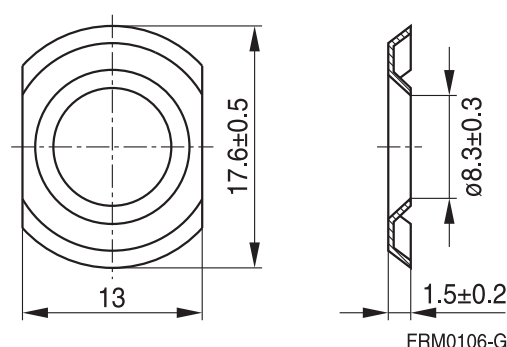
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E $\geq$ 120 °C), 0.25 mm thick Makrofol FR7-2, [E118859 (M)], natural color, BAYER MATERIALSCIENCE AG

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65812A2203X000
Insulating washer 1 (reel packing, PU = 1 reel)	B65812A5000X000
Insulating washer 2 (bulk)	B65812C2005X000

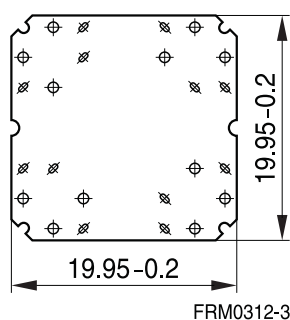
Clamp



Insulating washer 1 (preliminary data)



Insulating washer 2



RM 8

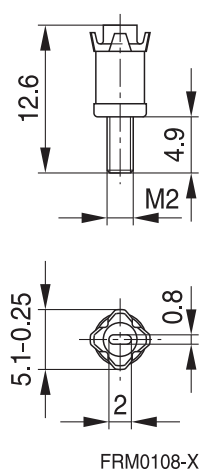
Accessories

B65812

Adjusting screw

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

Tube core Ø × length (mm)	Material	Color code	Ordering code
3.85 × 5.0	N22	gray	B65812B3003X022



RM 8 »Low Profile«

Accessories

B65811P

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

Magnetic characteristics (per set)

$$\Sigma l/A = 0.44 \text{ mm}^{-1}$$

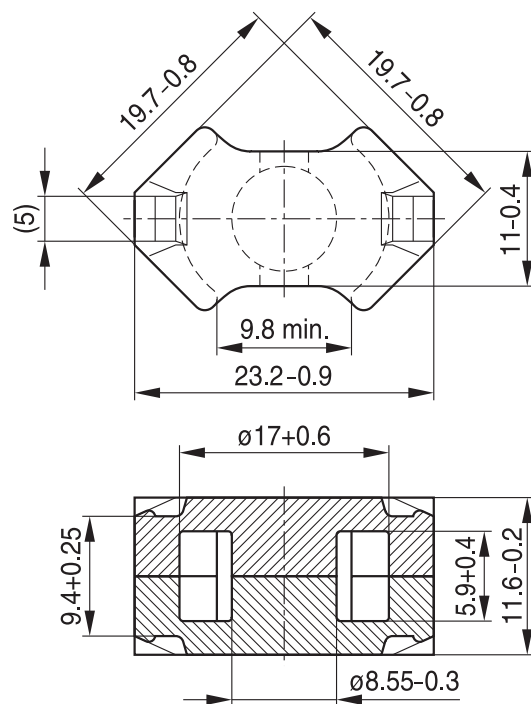
$$l_e = 28.7 \text{ mm}$$

$$A_e = 64.9 \text{ mm}^2$$

$$A_{\min} = 55.4 \text{ mm}^2$$

$$V_e = 1860 \text{ mm}^3$$

Approx. weight 9.2 g/set



FRM0353-5

Ungapped

Material	A_L value nH	μ_e	P_V W/set	Ordering code
N49	2900 +30/-20%	1020	< 0.33 (50 mT, 500 kHz, 100 °C)	B65811P0000R049
N92	3100 +30/-20%	1090	< 1.10 (200 mT, 100 kHz, 100 °C)	B65811P0000R092
N87	4100 +30/-20%	1440	< 0.92 (200 mT, 100 kHz, 100 °C)	B65811P0000R087

RM 8 »Low Profile«

Core

B65812

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0.4 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

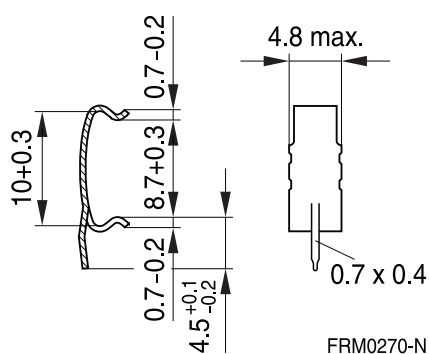
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E $\triangleq$ 120 °C), 0.08 mm thick Aryphan F685, [E167358 (M)], natural color, LOFO HIGH TECH FILM GMBH

Insulating washer 2 for double-clad PCBs

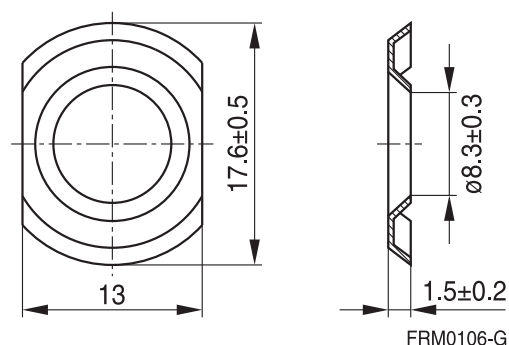
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E $\triangleq$ 120 °C), 0.25 mm thick Makrofol FR7-2, [E118859 (M)], natural color, BAYER MATERIALSCIENCE AG

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65812P2203X000
Insulating washer 1 (reel packing, PU = 1 reel)	B65812A5000X000
Insulating washer 2 (bulk)	B65812C2005X000

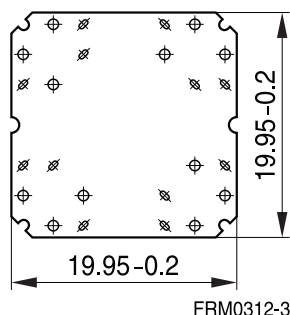
Clamp



Insulating washer 1 (preliminary data)



Insulating washer 2



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

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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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