



Ferrites and accessories

P 9 × 5

Core and accessories

Series/Type: B65517, B65522, B65524, B65518

Date: June 2013

	Individual parts	Part no.	Page
	Yoke	B65518	6
	Core	B65517	3
	Coil former	B65522	4
	Insulating washer		
	Core	B65517	3
	Terminal carrier with thread	B65518	6
<p data-bbox="558 1489 686 1523">FPK0019-S</p> <p data-bbox="132 1534 526 1601">Example of an assembly set for printed circuit boards</p> <p data-bbox="132 1668 351 1709">Also available:</p>	SMD coil former	B65524	5

P 9 × 5

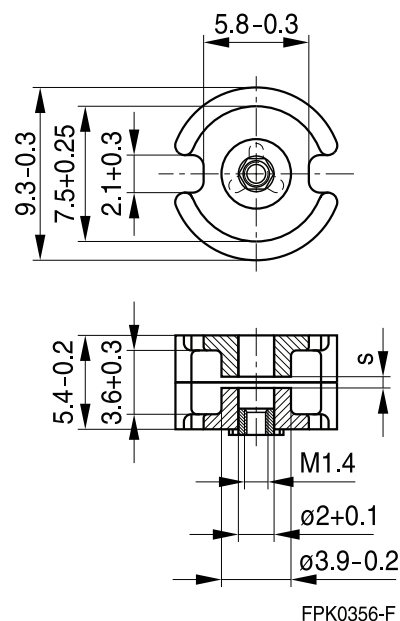
Core

B65517

- To IEC 60133
- Delivery mode: sets

Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	1.25	1.13	mm ⁻¹
l_e	12.5	13.4	mm
A_e	10	11.9	mm ²
A_{min}	—	9.3	mm ²
V_e	125	159	mm ³



Approx. weight (per set)

m	0.8	1.0	g

Gapped

Material	A_L value	s approx. mm	μ_e	Ordering code ¹⁾
	nH			-D with center hole -T with threaded sleeve
K1	25 ±3%	0.45	25	B65517+0025A001
	40 ±3%	0.26	40	B65517+0040A001
M33	63 ±3%	0.20	63	B65517D0063A033
N48	100 ±3%	0.10	100	B65517+0100A048
	160 ±3%	0.06	159	B65517+0160A048
	200 ±3%	0.04	200	B65517D0200A048
	250 ±5%	0.03	249	B65517D0250J048

Ungapped

Material	A_L value	μ_e	Ordering code
	nH		-D with center hole -W without center hole
N48	1300 +30/-20%	1290	B65517D0000R048
N30	2500 +30/-20%	2490	B65517D0000R030
T38	5500 +40/-30%	4930	B65517W0000Y038

1) Replace the + by the code letter "D" or "T" for the required version.

Coil former

Standard: to IEC 60133

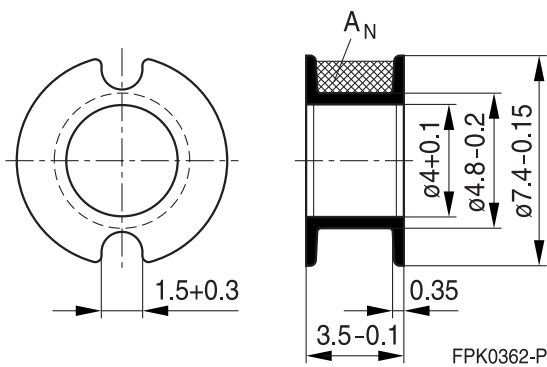
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:

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

Valox 420-SE0® [E45329 (M)], SABIC INNOVATIVE PLASTICS

Winding: see Data Book 2013, chapter “Processing notes, 2.1”

Coil former				Ordering code
Sections	A_N mm ²	l_N mm	A_R value $\mu\Omega$	
1	3.6	19.2	183	B65522B0000T001

Coil former


SMD

SMD coil former with gullwing terminals

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

F ≧ max. operating temperature 155 °C), color code black

Sumika Super E4008® [E54705 (M)], SUMITOMO CHEMICAL CO LTD

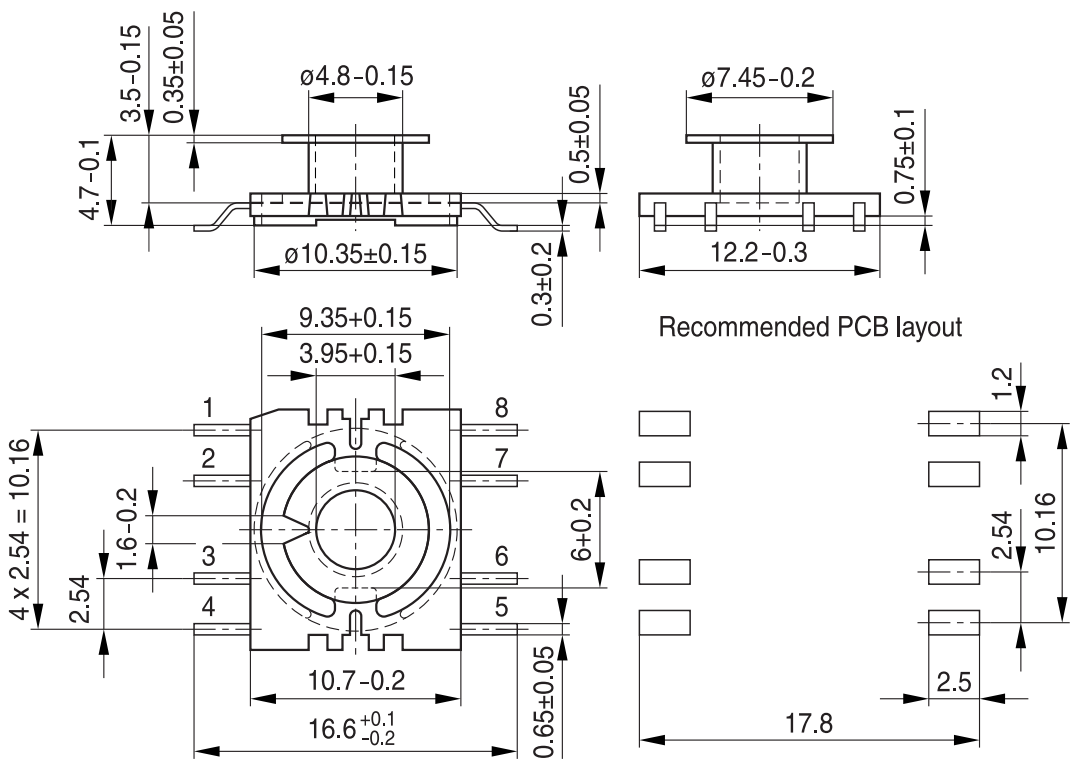
Solderability: to IEC 60068-2-58, test Td, method 6 (Group 3): 245 °C, 3 s

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”

Sections	A _N mm ²	l _N mm	A _R value μΩ	Terminals	Ordering code
1	3.4	19.2	194	4	B65524C1004T001
	3.4	19.2	194	8	B65524C1008T001



In the 4-terminal version terminals 2, 3, 6 and 7 are omitted.

Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Terminal carrier

- With thread for the adjusting screw (to be combined with core version "D")

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

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

Pocan B4235® [E245249 (M)], LANXESS AG

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

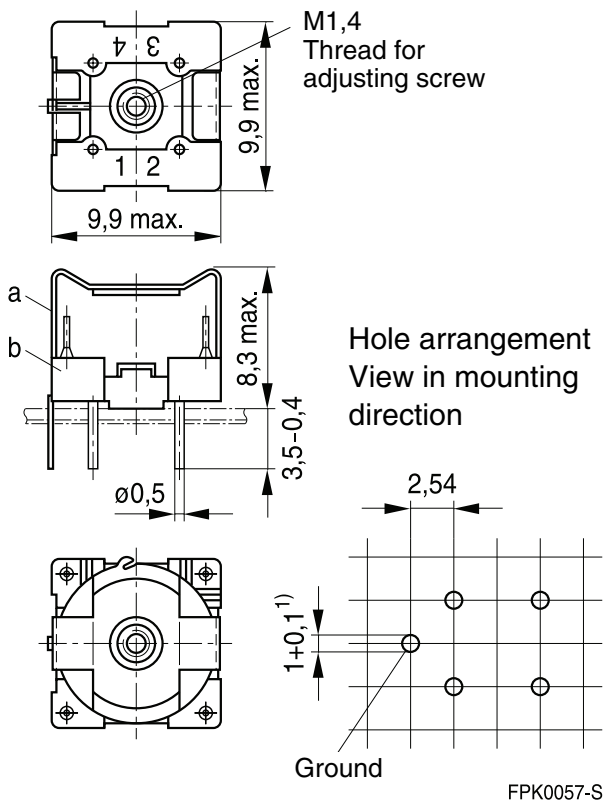
Yoke

Spring yoke, made of tinned nickel silver (0.25 mm), with ground terminal

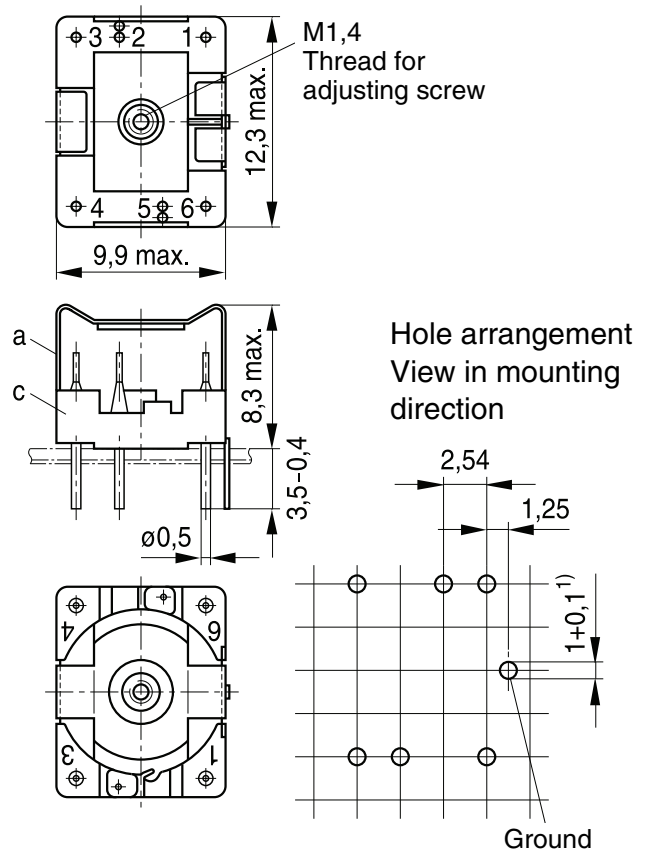
Complete mounting assembly
(4 solder terminals)
Ordering code: B65518D2001X000

Complete mounting assembly
(6 solder terminals)
Ordering code: B65518D2002X000

4 solder terminals



6 solder terminals



- 1) 1.3 hole also permissible
- a) Yoke
- b) Terminal carrier with 4 solder terminals
- c) Terminal carrier with 6 solder terminals

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.
- To strong winding forces may blast the flanges or squeeze the tube that the cores can no more be mounted.
- To 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.

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 ($\cong \mu_a$)	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 \epsilon (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

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