



Ferrites and accessories

P 18 × 11
Core and accessories

Series/Type: **B65651, B65652, B65655, B65659**

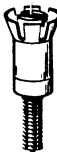
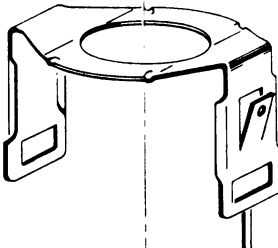
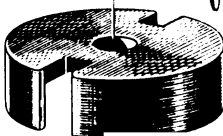
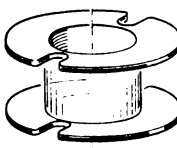

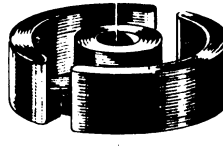

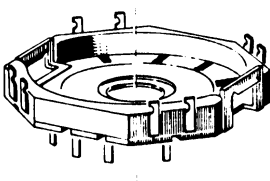
Date: **June 2013**

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P 18 × 11

Core and accessories

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	Adjusting screw	B65659	6
	Yoke	B65655	5
	Core	B65651	3
	Coil former	B65652	4
	Insulating washer		
	Core	B65651	3
	Threaded sleeve (glued-in)		
	Terminal carrier	B65655	5

FPK0021-4

Example of an assembly set for printed circuit boards

P 18 × 11

Core

B65651

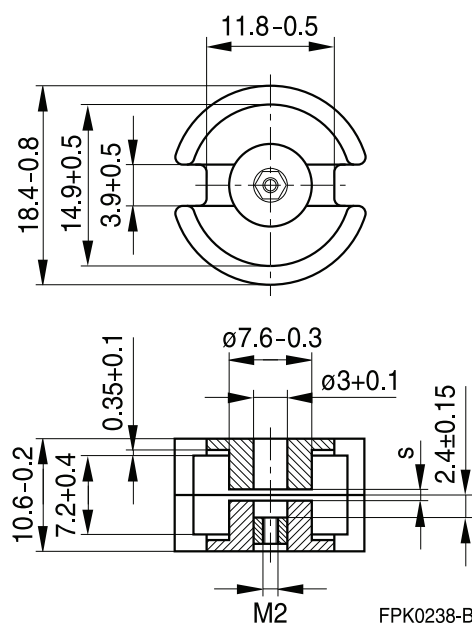
- To IEC 60133
- Delivery mode: sets

Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0.6	0.57	mm ⁻¹
l_e	25.9	26.6	mm
A_e	43	46.7	mm ²
A_{min}	—	33.9	mm ²
V_e	1114	1242	mm ³

Approx. weight (per set)

m	6.0	6.6	g



Gapped

Material	A_L value	s approx. mm	μ_e	Ordering code ¹⁾ -D with center hole -T with threaded sleeve
	nH			
K1	40 ±3%	1.60	19	B65651+0040A001
M33	100 ±3%	0.60	48	B65651+0100A033
N48	160 ±3%	0.32	77	B65651+0160A048
	250 ±3%	0.20	120	B65651+0250A048
	315 ±3%	0.15	151	B65651+0315A048
	400 ±3%	0.10	192	B65651+0400A048
	500 ±3%	0.07	240	B65651+0500A048
	630 ±5%	0.05	302	B65651D0630J048

Ungapped

Material	A_L value	μ_e	P_V W/set	Ordering code -D with center hole -W without center hole
	nH			
N48	2800 +30/-20%	1340		B65651D0000R048
N30	5900 +30/-20%	2680		B65651W0000R030
T38	12600 +40/-30%	5710		B65651W0000Y038
N87	3600 +30/-20%	1630	< 0.46 (200 mT, 100 kHz, 100 °C)	B65651W0000R087

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

P 18 × 11

Accessories

B65652

Coil former

Standard: to IEC 60133

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

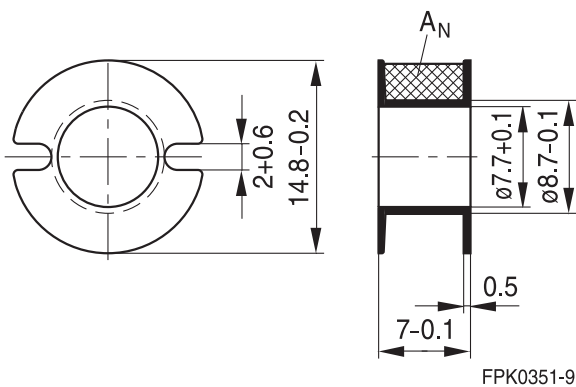
$F \triangleq$ max. operating temperature 155 °C), color code black

Valox 420-SE0® [E45329 (M)], GE PLASTICS B V

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

Coil former				Bestellnummer
Sections	A_N mm ²	l_N mm	A_R value $\mu\Omega$	
1	16	35.6	87	B65652B0000T001

Coil former



Mounting assembly for printed circuit boards

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

Terminal carrier

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
 F \triangleq max. operating temperature 155 °C), color code gray
 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

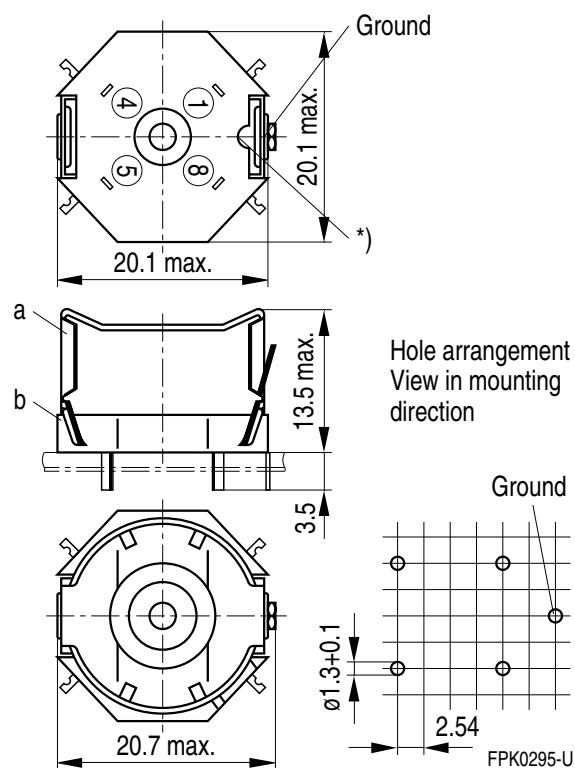
Yoke

Spring yoke, made of tinned nickel silver (0.3 mm), with ground terminal

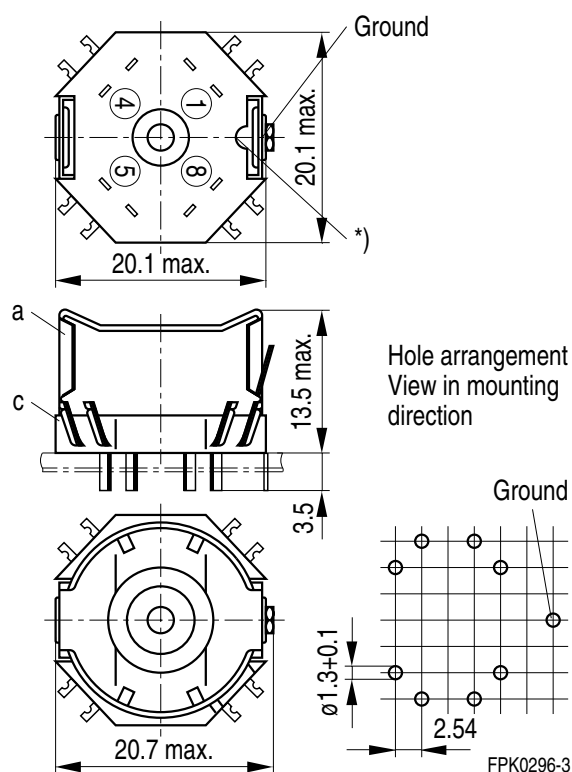
Complete mounting assembly
 (4 solder terminals)
 Ordering code: B65655B0009X000

Complete mounting assembly
 (8 solder terminals)
 Ordering code: B65655B0010X000

4 solder terminals



8 solder terminals



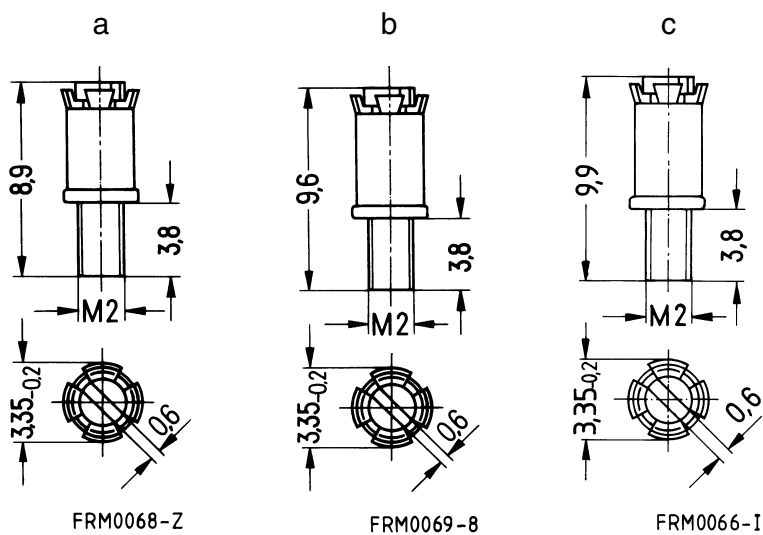
*) This recess must be on the side of the grounding pin to ensure that the yoke locks in position.

- a) Yoke
- b) Terminal carrier with 4 solder terminals
- c) Terminal carrier with 8 solder terminals

Adjusting screw

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

Figure	Tube core			Ordering code
	∅ × length (mm)	Material	Color code	
a	2.62 × 3.6	K1	green	B65659F0001X001
a	2.62 × 3.6	N22	red	B65659F0001X023
b	2.75 × 4.4	N22	black	B65659F0003X023
c	2.82 × 4.4	N22	yellow	B65659F0004X023



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 \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

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