Ferrites and accessories

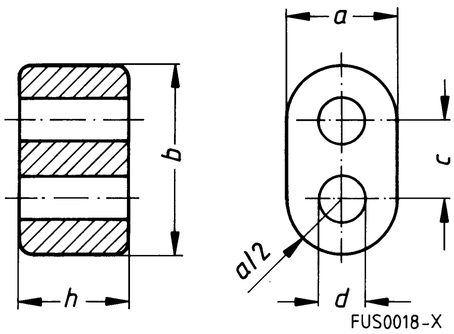
Double-aperture cores

Series/Type: **B62152**
Date: June 2013

Primarily used for broadband transformers up to high frequencies

Application examples

- SIFERRIT material N30 for low frequencies and for pulse applications
- SIFERRIT material K1 for matching transformers and baluns up to about 250 MHz in antenna feeders or in input circuits of VHF and TV receivers



Dimensions[1]					Magnetic characteristics				Weight
h (mm)	b (mm)	a (mm)	c (mm)	d (mm)	$\Sigma l/A$[2] mm^{-1}	l_e[2] mm	A_e[2] mm^2	V_e[2] mm^3	g
14.5 – 1.0	14.50 – 1.0	8.5 – 0.5	5.85 ±0.25	3.4 + 0.60	0.31	15.3	49.7	760	4.0
8.3 – 0.6	14.50 – 1.0	8.5 – 0.5	5.85 ±0.25	3.4 + 0.60	0.54	15.3	28.4	435	2.5
6.2 – 0.5	7.25 – 0.5	4.2 – 0.4	2.90 ±0.15	1.7 + 0.30	0.75	7.6	10.2	78	0.4
2.5 – 0.2	3.60 – 0.3	2.1 – 0.3	1.45 ±0.10	0.8 + 0.15	1.78	3.7	2.1	7.8	0.1
2.0 – 0.2	3.60 – 0.3	2.1 – 0.3	1.45 ±0.10	0.8 + 0.15	2.20	3.7	1.7	6.3	0.1
1.4 – 0.2	3.60 – 0.3	2.1 – 0.3	1.45 ±0.10	0.8 + 0.15	3.22	3.7	1.2	4.5	0.05

Dimensions with parylene coating[3]

Core	Max. coated h (mm)	Max. coated b (mm)	Max. coated a (mm)	Min. coated d (mm)
DL 14.5/14.5 /8.5	14.55	14.55	8.55	3.35
DL 8.3/14.5 /8.5	8.35	14.55	8.55	3.35
DL 6.2/ 7.25/4.2	6.25	7.30	4.25	1.65
DL 2.5/ 3.6 /2.1	2.55	3.65	2.15	0.75
DL 2.0/ 3.6 /2.1	2.05	3.65	2.15	0.75
DL 1.4/ 3.6 /2.1	1.45	3.65	2.15	0.75

1) Cores made of NiZn ferrite may exceed the specified dimensions by up to 5%.
2) Magnetic characteristics and A_L value are based on winding of center leg.
3) Double-aperture cores are available with parylene coating on request. Ordering code for coated version: B62152P…

Overview of available types

Core height h (mm)	Material	A_L value[1)] nH (Tol. ±30%)	Ordering code[2)]
14.5 –1.0	K1	330	B62152A0001X001
8.3 –0.6	K1 N30	190 10000	B62152A0004X001 B62152A0004X030
6.2 –0.5	K1 N30	140 7300	B62152A0007X001 B62152A0007X030
2.5 –0.2	K1 N30 M13	60 3100 1440	B62152A0008X001 B62152A0008X030 B62152A0008X013
2.0 –0.2	K1 N30 M13	42 2400 1100	B62152A0027X001 B62152A0027X030 B62152A0027X013
1.4 –0.2	N30	1600	B62152A0015X030

1) Magnetic characteristics and A_L value are based on winding of center leg.
2) Double-aperture cores are available with parylene coating on request.
Ordering code for coated version: B62152P…

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

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 ($\triangleq \mu_a$)	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

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	°C
ΔT	Temperature difference	K
T_C	Curie temperature	°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 $H \to 0$	
$\tan \delta_e$	Relative loss factor	
$\tan \delta_h$	Hysteresis loss factor	
$\tan \delta/\mu_i$	Relative loss factor of material at $H \to 0$	
U	RMS value of voltage	V
Û	Peak value of voltage	V
V_e	Effective magnetic volume	mm^3
Z	Complex impedance	Ω
Z_n	Normalized impedance $\lvert Z\rvert_n = \lvert Z\rvert /N^2 \times \Sigma (l_e/A_e)$	Ω/mm

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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