Ferrites and accessories

FPC film
C 350, C 351

Series/Type: **B68450, B 68451, B 68452**
Date: September 2006

Basic features

- FPC is a composite material of polymer and ferrite
- FPC film is a thin, mechanically flexible film

Technical benefits

- Stable magnetic characteristics
- Low weight: FPC film is 40% lower in density than ferrite
- High mechanical strength
- Shaping as required: customer-specific solutions possible
- Economy: easy transport and storage,
  simple, rationalized processing, low mounting volume
- C351 film suitable for high-temperature applications (up to 200 °C)
- Material C351 approved to UL 94-V0 (E 140 693)
- Various film thickness (from 0.2 to 0.4 mm)
- Self-adhesive versions
- C351 film with optional copper coatings 35 to 75 μm thick

Applications

- Implementation of low-profile coils, e.g. for
  – identification systems
  – security tags for electronic article surveillance
  – sensors
  – inductive reading of smart cards
- Electromagnetic shielding of coils from metals to prevent interference
- EMC: absorption of radiated emissions at frequencies ≥500 MHz
- Compensation of deflection yokes to correct distortion at the corners of TV screens and monitors
- Spacing between ferrite cores (as a substitute for air gaps or non-magnetic films) for
  – suppression of the leakage field
  – adjustment of the biasing curve

Ordering details

The ordering codes are structured as follows:

1st group Design	2nd group Film thickness/width		3rd group Copper coating[1]/material	
B68450 =Film on reel	A = 0.2 mm B = 0.3 mm	0080 = 80 mm	X = Default letter	350 = C350 351 = C351
B68451 =Film on reel, self-adhesive				
B68452 =Film on reel, copper-coated (only in combination with C351!)				

Material	Thickness (mm)	Extra features	Ordering code
C350	0.2		B68450A0080X350
C351	0.2		B68450A0080X351
C350	0.2	self-adhesive	B68451A0080X350[2]
C351	0.3	self-adhesive	B68451B0080X351[2]
C351	0.2	copper-coated	B68452A0080X351[2]

FPC film is supplied in units of 50 m length.

1) Copper coating only in combination with C351.
2) On request

Physical properties (material values defined on 0.2 mm thick film)

Material	Symbol	Unit	C350	C351[3)]
Initial permeability[1)] f = 1 MHz	μ_i		9 ±20%	9 ±20%
Flux density (near saturation)[1)] H = 25 kA/m f = 10 kHz	B_S	mT	255	255
Remanent flux density[1)] H = 25 kA/m f = 10 kHz	B_r	mT	9	9
Coercive field strength[1)] H = 25 kA/m f = 10 kHz	H_C	A/m	600	600
Relative loss factor[1)] f = 10 MHz f = 1 GHz	$\tan\delta/\mu_i$		 <0.005 <0.400	 <0.005 <0.400
Hysteresis material constant	η_B	10^{-3}/mT	<2	<2
Temperature coefficient[1)]	$\alpha = \Delta\mu/\mu\Delta T$	1/K	$<5 \cdot 10^{-5}$	$<5 \cdot 10^{-5}$
Density		kg/m³	2930	2930
Resistivity [1)] f = 1 kHz f = 10 MHz	ρ	Ωm	 500 100	 500 100
Dielectric constant[1)] f = 1 kHz f = 10 MHz	ε_r		 700 21	 700 21
Dielectric strength		kV/mm	1	0.8
Max. operating temperature	T_{max}	°C	120	200
Tensile strength[2)]	σ_Z	N/mm²	1.5	2.5
Tearing resistance[2)]		%	25	25
Compressibility[2)]	κ	N/mm²	70	70

1) T = 25 °C to IEC 51 (CO) 282
2) T = 23 °C and 50% r.h.
3) UL 94, flame class V0 (listed E 140 693)

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 Data Book 2007, chapter “General – Definitions, 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 Data Book 2007, chapter “General – Definitions, 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 Data Book 2007, chapter “Processing notes, 2.2”.
– 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.

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