Ferrite cores for RFID transponders
Introduction

Transponders are electronic devices capable of sending short RF messages upon request. These messages are commonly used to identify something where the transponder is attached, but can be used to send data as well. The term transponder comes from TRANSmitter/resPONDER.

There are many different types of transponders, depending on the final use of the transponder, and on the operating frequency. Low Frequency Magnetic Communication (below 500 kHz) commonly uses ferrite cores to increase the performance (and distance range) of the transponder.

Ferroxcube provides a wide range of ferrite cores fitting many of the existing market requirements, as well as years of experience in designing custom shapes for specific needs. New materials have been developed improving temperature stability and reaching higher permeability values. In addition, advanced features like metallized contacts or tighter tolerances on mechanical and electrical parameters are feasible.

Newly developed materials include 4B2 and 4B4 improving the temperature stability and robustness of the complete system thanks to their high density structure. Also 3B7 has been optimized for the transponder shapes. Ferroxcube materials cover a wide range of needs, from temperature stability with $\alpha_F$ as low as 1 (from −40 to 85 ºC) to high Q factor with $\text{tg} \delta/\mu$ lower than 100 x 10^{-6} at 500 kHz. They are available in Nickel Zinc (4B1, 4B2, 4B4) high resistivity and Manganese Zinc (3C90, 3B7).

Special features

**PVD metallized terminals on request.**
Best adhesion ferrite-metallization-PCB.
High accuracy layer thickness and size of the footprint.
Low height metallization provides optimum Q factor.

**Tightest length tolerance.**
Absolute tolerance down to ± 0.1 mm.
Minimizes the spread in electrical properties.

Advanced features

Diameter tolerance down to ±0.015 mm on ground rods.
Length tolerance down to ±0.2 mm on rods.
Inductance sorting out in groups of ± 1%.
Minimum rod diameter down to 0.3 mm.
Parylene-C coating on rods and other shapes.
Metallized terminals in Silver Palladium for SMD products.
Custom shapes available on request.

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<table>
<thead>
<tr>
<th>NiZn materials for high freq uncoated cores</th>
<th>4B1</th>
<th>4B2*</th>
<th>4B4*</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu$</td>
<td>25 ºC; ≤10 kHz; 1 mT</td>
<td>250 ± 20%</td>
<td>250 ± 20%</td>
</tr>
<tr>
<td>$\alpha_F$ (K)</td>
<td>-40 to 85 ºC; ≤10 kHz; 1 mT</td>
<td>=25 x 10^4</td>
<td>=1 x 10^4</td>
</tr>
<tr>
<td>$\text{tg} \delta/\mu$</td>
<td>25 ºC; 3 MHz; 1 mT</td>
<td>&lt;300 x 10^4</td>
<td>&lt;300 x 10^4</td>
</tr>
<tr>
<td>$T_c$ (ºC)</td>
<td>&gt;250</td>
<td>&gt;335</td>
<td>&gt;115</td>
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* New!
MnZn materials for high Q applications

<table>
<thead>
<tr>
<th></th>
<th>3C90</th>
<th>3B7</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu$</td>
<td>$25 ^\circ C; \leq 10 \text{ kHz}; 1 \text{ mT}$</td>
<td>$2300 \pm 20%$</td>
</tr>
<tr>
<td>$\alpha$ (K)</td>
<td>$20$ to $70 ^\circ C; \leq 10 \text{ kHz}; 1 \text{ mT}$</td>
<td>$\leq 5 \times 10^{-9}$</td>
</tr>
<tr>
<td>$\tg \delta \mu$</td>
<td>$25 ^\circ C; 500 \text{ kHz}; 1 \text{ mT}$</td>
<td>$&lt; 100 \times 10^{-6}$</td>
</tr>
<tr>
<td>$\gamma$ ($^\circ$C)</td>
<td>&gt;220</td>
<td>&gt;220</td>
</tr>
</tbody>
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**Automotive**
- Key Less Entry Vehicle antenna
- Key Less Entry User card
- Tire Pressure TPMS Tire antenna
- Immobilizer Key antenna

**Animal tracking**
- Small pets, wildlife Glass capsule
- Livestock Ceramic capsule
- Livestock Ear tag
- Heart rate monitor Rubber belt
- Illness detection Body transponder
- Runner identification Glass capsule
- Bike speed meter Rubber bracket

**Wireless sensors**
- Optimal flatness
- Temperature stable material. Optimal for SMD
- Temperature coated, sorted out in tight inductance groups

**Ferromagnetic Core**
- Optimal for high Q applications
- Frequency (MHz)
- Temperature (°C)