Advanced EMI Architectures & New Product Design

Your Signal Solution®
Material Preparation

- Primarily comprised of varying amounts of Fe2O3, ZnO, NiO, MnO.
- Percentages of each raw material are mixed by material grade.
- Powder is calcined (low temperature sintered)
- Powder is milled
- Primary sources of variation
  - Composition
  - Raw material purity
  - Calcine
  - Particle size
FORMING

• Tooling must be designed by individual part geometry/material type
• Height adjustments possible in direction of pressing, all other dimensions fixed to tooling (minor adjust via density)
• Features blind to punch faces are not possible
SINTERING

- Pressed cores are sintered from 1800°F–2500°F depending on material type
- Duration of firing process will be a function of part mass and surface area/volume ratio
- Core will experience shrink from 10%-25% relative to pressed size
- Thin part features may induce warping
- Oxygen content may need to be controlled by material type

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>FIRING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel Zinc (NiZn)</td>
<td>Air</td>
</tr>
<tr>
<td>Manganese Zinc (MnZn)</td>
<td>Controlled Atmosphere</td>
</tr>
<tr>
<td>Magnesium Zinc (MgZn)</td>
<td>Air</td>
</tr>
</tbody>
</table>
Grinding

- Allows for reduction in tolerance on certain features from standard ~ +/-2%
- Reduction in size for certain features is possible
- Simplistic features can be added in this operation
CNC Machining

• Offers full dimensional freedom with tight tolerancing
• Occurs after the entirety of the normal production process
Geometric Performance Enhancements
Geometry Vs Material

Manipulation of the length and cross-section of the magnetic path can often yield more performance benefit than a new material grade.
Frequency Response

Certain ferrite cores can have their frequency response greatly altered by geometry.
Frequency Response

OD=25.9mm, ID=12.8mm, HT=28.6mm

- Standard Process
- Modified 1
- Modified 2
- Modified 3
DC Current Mitigation

• Generally, air gaps are used to lessen the derating of impedance due to bias currents

• Geometry tweaks can provide a similar effect while reducing compromise under low bias conditions
DC Current Mitigation

No Bias Applied

Frequency (Hz)

NI Product = 60

Frequency (Hz)
Details

• Cores in respective example curves possess the same package size and were made from the same material as one another

• Goal was to achieve improvement in performance via geometry while staying within the confines of the standard production process
Thank You!

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