EMI Cores

ESD-SR-H/HL Snap-on Cores for Round Cables for High Frequency (with High Heat Resistance & Cable Holding Mechanism case)

Overview

The KEMET ESD-SR-H/HL Series snap-on toroidal cores feature high heat resistance and a cable holding mechanism designed specifically for round cables. KEMET’s unique core material enables high performance in high frequency range.

EMI cores are part of a family of passive components which address the issues of noise or electromagnetic interference (EMI) in circuits or systems.

Benefits

- Proprietary core material for high performance in high frequency range
- Split construction
- Easy to install through its snap-on mechanism
- Quick solution for post-cable assembly noise issue
- Wider operating temperature range from −40°C to +100°C for H type and −40°C to +125°C for HL type (ideal for automotive environment)
- Cable holding mechanism for fixing cables with bands
- UL94 V–0 flame retardant rated case
- AEC–Q200 (HL type)

Applications

- Automotive inverters
- Automotive chargers
- Automotive DC/DC converters
- LED head lights
- Information and communication devices
- Audio-visual equipment
- Consumer electronics

Part Number System

<table>
<thead>
<tr>
<th>ESD-</th>
<th>SR-</th>
<th>160</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>Form Type</td>
<td>Core Size Outer Dimension Code (mm)</td>
<td>Case Type</td>
</tr>
<tr>
<td>ESD-</td>
<td>Snap-on</td>
<td>See Table 1</td>
<td>High heat resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>H = −40°C to 100°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HL = −40°C to 125°C</td>
</tr>
</tbody>
</table>

Built Into Tomorrow

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Turns and Impedance Characteristics

When the desired performance of an EMI core cannot be obtained with a single pass through the core, the impedance characteristics can be changed with multiple turns.

A turn is counted by the number of lead-wire windings which pass through the inner hole of the core. Windings on the outside of the core do not count.

See Figure 1 for examples of one, two, and three turns.

Adding turns will result in higher impedance while also lowering the effective frequency range.

See Figure 2 for an example.

Core Material and Effective Frequency Range

There are two ferrite material options for KEMET EMI Cores: Nickel Zinc (Ni-Zn) and Manganese Zinc (Mn-Zn). Each core material has a different resistance and effective frequency range. The MnZn core material has a lower resistance compared to the Ni-Zn; therefore, adequate insulation is required before use.

The Ni-Zn core material is typically effective for frequencies in the MHz band range such as the FM-band, while the Mn-Zn core material is typically effective for the kHz band range such as the AM-band. See Figure 3.

It is recommended to measure the actual frequency range effectiveness in the target application.
Magnetic Permeability of Ferrite Material

In order to achieve efficient noise reduction, it is important to select the material according to the target frequency band. Depending on its magnetic permeability, a particular ferrite material or metal material will be effective in a certain frequency band. A schematic representation of the relationship between the magnetic permeability of each material and the corresponding effective band range is shown in Figure 4.

Materials with higher magnetic permeability are effective in the lower frequency range, while those with lower magnetic permeability are effective in the higher frequency range. Thus, Mn-Zn products are mainly used for reducing conduction noise, while Ni-Zn products are commonly used for radiation noise countermeasures. Metal materials, however, are effective throughout the broadband frequency range, in low as well as high frequencies.

The effective frequency range varies depending on core shape, size, and number of turns. This frequency dependence of the magnetic permeability as shown in the figure serves for reference purposes only. It should be tested on the actual device to determine its effectiveness.

S18H, S15H, 10H, 7H, 7HT, 5H, 5HT, 1400L, and 700L are KEMET’s proprietary ferrite material names. Other materials are available upon request.

Figure 4 - Relationship between the magnetic permeability of each material and its effective frequency range
Environmental Compliance

All KEMET EMI cores are RoHS compliant.

Dimensions – Millimeters

ESD-SR-HL series are indicated by a white dot printing on the case.

See Table 1 for dimensions

Installation Example
EMI Core – ESD-SR-H/HL Snap-on Cores for Round Cables for High Frequency
(with High Heat Resistance & Cable Holding Mechanism case)

Performance Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Performance Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>H: −40°C to +100°C</td>
</tr>
<tr>
<td></td>
<td>HL: −40°C to +125°C</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>High frequency</td>
</tr>
<tr>
<td>Outer Diameter</td>
<td>19.5 – 30.0 mm</td>
</tr>
<tr>
<td>Inner Diameter</td>
<td>9.0 – 13.0 mm</td>
</tr>
<tr>
<td>Length</td>
<td>46.5 – 53.0 mm</td>
</tr>
<tr>
<td>Type</td>
<td>Case</td>
</tr>
<tr>
<td>Case Flame Resistant Rating</td>
<td>UL94 V–0</td>
</tr>
<tr>
<td>Material</td>
<td>NiZn 700L and NiZn 1400L</td>
</tr>
</tbody>
</table>

Table 1 – Ratings & Part Number Reference

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Dimensions (mm)</th>
<th>Weight (g)</th>
<th>Case Color</th>
<th>Frequency Range¹</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A B C D E</td>
<td></td>
<td></td>
<td>≤ 500 MHz (FM band range)</td>
<td></td>
</tr>
<tr>
<td>ESD-SR-160H</td>
<td>19.5 ±1.0 ø 9.0 ±1.0 19.5 ±1.0</td>
<td>23</td>
<td>Black</td>
<td>X</td>
<td>1400L</td>
</tr>
<tr>
<td>ESD-SR-160HL</td>
<td>19.5 ±1.0 ø 9.0 ±1.0 19.5 ±1.0</td>
<td>23</td>
<td>Black</td>
<td>X</td>
<td>700L</td>
</tr>
<tr>
<td>ESD-SR-250H</td>
<td>30.0 ±1.0 ø 13.0 ±1.0 30.0 ±1.5</td>
<td>63</td>
<td>Black</td>
<td>X</td>
<td>1400L</td>
</tr>
<tr>
<td>ESD-SR-250HL</td>
<td>30.0 ±1.0 ø 13.0 ±1.0 30.0 ±1.5</td>
<td>63</td>
<td>Black</td>
<td>X</td>
<td>700L</td>
</tr>
</tbody>
</table>

¹ Frequency range is for reference only. Please test with actual device before use.

Impedance vs. Frequency
Packaging

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Packaging Type</th>
<th>Pieces per Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD-SR-160H</td>
<td>Tray</td>
<td>210</td>
</tr>
<tr>
<td>ESD-SR-160HL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESD-SR-250H</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>ESD-SR-250HL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Handling Precautions

EMI Cores should be stored in normal working environments. While the EMI Cores themselves are quite robust in other environments, avoid exposure to high temperatures, high humidity, corrosive atmospheres and long term storage for case, snap-on and split types.

KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 75% relative humidity. Atmospheres should be free of chlorine, sulfur and alkali bearing compounds. Avoid also storage near strong magnetic fields as this might magnetize the product.

Temperature fluctuations should be minimized to avoid condensation or cracks on the parts. Mechanical shocks can bring to cracks as well.
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