The SPM series power inductors are the metal composite type wire-wound inductors that have the coils integrally molded with metallic magnetic powder. Compared to ferrite-base wire-wound inductors, the SPM series inductors realize larger current, lower $R_{dc}$, smaller size and superior DC bias characteristic. In addition, they ensure low magnetic flux leakage and are effective as a means to suppress acoustic noise of the coil. This article introduces the structure, features, and application of these products, and other information that helps you in an easy-to-understand way.

### Product summary

The SPM series are the inductors that have the coils integrally molded with metallic magnetic powder. TDK offers a large selection of the SPM series inductors, including the low-profile SPMLR series, the SPM-HZ series for automotive applications, etc.

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#### Figure 1: Product summary

<table>
<thead>
<tr>
<th>Series</th>
<th>SPM series</th>
<th>SPM-LR series</th>
<th>SPM-XT series</th>
<th>SPM-CT series</th>
<th>SPM-HZ series</th>
<th>SPM-VT series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product summary</td>
<td>Metal composite type inductor</td>
<td>Metal composite type low-profile inductor</td>
<td>Metal composite type large inductor</td>
<td>Metal composite type inductor for high frequency applications</td>
<td>Metal composite type inductor for automotive applications</td>
<td>Metal composite type inductor for automotive applications</td>
</tr>
<tr>
<td></td>
<td>The inductors that have the coils integrally molded with magnetic powder. These inductors use Fe-base alloy powder to have high saturation characteristics, i.e. allowing for large current. The inductors of this series are offered in large selection of product sizes.</td>
<td>The inductors that have the coils integrally molded with magnetic powder. These inductors use Fe-base alloy powder to have high saturation characteristics, i.e. allowing for large current. The low-profile ($H = 1.0$ to $2.0$ mm) is achieved by employing the terminal of proprietary shape.</td>
<td>The inductors that have the coils integrally molded with magnetic powder. These inductors use Fe-base alloy powder to have high saturation characteristics, i.e. allowing for large current. A simple structure without exterior terminals is achieved by employing the wire collinear electrode structure.</td>
<td>The inductors that have the coils integrally molded with magnetic powder. By using the proprietary alloy powder, low loss in the high frequency region is achieved, in addition to having high saturation characteristics.</td>
<td>The inductors that have the coils integrally molded with magnetic powder. These inductors use Fe-base alloy powder to have high saturation characteristics, i.e. allowing for large current. Compared to the SPM-HZ series, this series inductors have wider operating temperature range in automotive environments.</td>
<td></td>
</tr>
</tbody>
</table>
Features

- Large selection of products, ranging from 4 to 10 mm.
- Low inductance variance in high-temperature environments.
- With the use of a coil integrally molded with metallic magnetic material, hum noise and magnetic flux leakage are reduced.
- High quality and high productivity, and therefore stable supply is possible.

Applications

- LCD-TV, HDD
- Amusement equipment
- Other AV equipment
- Notebook computers
- Base stations, servers
- Wireless chargers
- Car accessories
- LED

- Amusement equipment
- Game equipment
- Tablet terminals
- Gaming equipment
- Industrial equipment
- IJP head drive
- Electronic power steering
- ADAS
- Engine ECUs, etc.
- Headlights, etc.

Product structures

Figure 2 shows the structure of each SPM series. The integral mold structure and the welding method for connecting the wire and terminals achieves high reliability.
### Product features

Figure 3 shows the features of each SPM series.

<table>
<thead>
<tr>
<th>Series</th>
<th>SPM series</th>
<th>SPM-LR series</th>
<th>SPM-XT series</th>
<th>SPM-CT series</th>
<th>SPM-HZ series</th>
<th>SPM-VT series</th>
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</thead>
<tbody>
<tr>
<td>Appearance</td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
<td><img src="image3" alt="Image" /></td>
<td><img src="image4" alt="Image" /></td>
<td><img src="image5" alt="Image" /></td>
<td><img src="image6" alt="Image" /></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40 to 125°C (including self-temperature rise)</td>
<td>-55 to 125°C (including self-temperature rise)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnetic material</td>
<td>Metallic magnetic material</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Terminal electrode specifications</td>
<td>Metal terminal + plating</td>
<td>Wire collinear electrode + plating</td>
<td>Metal terminal + plating</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Features</td>
<td>Standard specifications</td>
<td>Low-profile specifications</td>
<td>Large current specifications</td>
<td>High frequency &amp; High Q specifications</td>
<td>Automotive application specifications</td>
<td></td>
</tr>
</tbody>
</table>

One of the remarkable features of the SPM series is that they are made with metallic magnetic core. Compared to ferrite cores, metallic magnetic cores have higher magnetic saturation density and better DC bias characteristic. In addition, since their Curie temperature is high, they show only a small change in characteristics with ambient temperature.

### Figure 4: Comparison of DC bias characteristic (Metallic magnetic core vs. ferrite core)

![Graph showing comparison of DC bias characteristic](image7)

- **Core material characteristics of high magnetic saturation**
  - Superior DC bias characteristic

![Graph showing saturation magnetic flux density](image8)

- **Saturation magnetic flux density**
  - Fe-Si alloy
  - Mn-Zn ferrite
  - Ni-Zn ferrite
Since the SPM series inductors are made with wire-wound cores integrally molded with metallic magnetic powder, they do not have a core gap and the acoustic noise is reduced. Also, they have good shielding qualities and the magnetic flux leakage is small.
List of products

Figure 8 shows the list of products by series and by shape. You can view the detailed information of the product or purchase a sample by clicking the type name.

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>SPM series</th>
<th>SPM-LR series</th>
<th>SPM-XT series</th>
<th>SPM-CT series</th>
<th>SPM-HZ series</th>
<th>SPM-VT series</th>
</tr>
</thead>
<tbody>
<tr>
<td>3mm sqa.</td>
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<td>3.2x3.0mm</td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>SPM3010-LR</td>
<td>SPM3012-LR</td>
<td>SPM3015-LR</td>
<td>SPM3020-LR</td>
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<tr>
<td>4mm sqa.</td>
<td>4.2x4.0mm</td>
<td>4.4x4.1mm</td>
<td>4.2x4.0mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPM4030</td>
<td>SPM4010-LR</td>
<td>SPM4012-LR</td>
<td>SPM4015-LR</td>
<td>SPM4020-LR</td>
<td>SPM4030-HZ</td>
</tr>
<tr>
<td>5mm sqa.</td>
<td>5.2x5.0mm</td>
<td>5.4x5.1mm</td>
<td>5.2x5.0mm</td>
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</tr>
<tr>
<td></td>
<td>SPM5030</td>
<td>SPM5010-LR</td>
<td>SPM5012-LR</td>
<td>SPM5015-LR</td>
<td>SPM5020-LR</td>
<td>SPM5030-HZ</td>
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<tr>
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<td>7.1x6.5mm</td>
<td></td>
<td>7.1x6.5mm</td>
<td>7.1x6.5mm</td>
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<td>7.5x7.0mm</td>
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<tr>
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<td>SPM6530</td>
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<td>SPM6550-CT</td>
<td>SPM6550-HZ</td>
<td></td>
<td>SPM7054-VT</td>
</tr>
<tr>
<td>7mm sqa.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10mm sqa.</td>
<td>10.7x10.0mm</td>
<td>11.5x10.0mm</td>
<td>10.7x10.0mm</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>SPM10040</td>
<td>SPM10040XT</td>
<td>SPM10040-HZ</td>
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<td></td>
<td>SPM10054-HZ</td>
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<tr>
<td>12mm sqa.</td>
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<tr>
<td></td>
<td>12.6x13.0mm</td>
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<td></td>
<td></td>
<td></td>
<td>SPM12565XT</td>
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</table>
What are power inductors?

Power inductors are inductors used for power supply circuit such as DC-DC converters. They are also called power coils or power chalks. One of the inductors’ characteristics is that they store energy by self-induction function. Chopper type DC-DC converters use inductors having such characteristics with switching devices for voltage conversion (see Figure 9).

Depending on the processing method, inductors can be classified into multilayer type, thin-film type, and wire-wound type. Since wire-wound type permits large current to flow, most of the power inductors are wire-wound type. Various wound-type power inductor products with ferrite or soft magnetic metal core are offered. Recently, the multilayer type and thin-film type, with which reduction of size and thickness can be achieved, are being improved to allow for larger current.

![Figure 9: DC-DC converter (chopper type / step-down type) and inductor](image)

The voltage is dropped to a desired level in accordance with the duty ratio (the ratio that indicates how long the switch is ON during the switching cycle) setting.

Contact Information

Inquiries on products, sales, or technical matters

Related Links

Inductor (coil) product information

Various information on TDK Group’s inductors (coils) are comprehensively provided on this page.

- Lineup
- Inductors for high frequency applications Selection Guide
- Inductors for Power Circuits Selection Guide (Commercial Grade)
- Inductors for Power Circuits Selection Guide (Automotive Grade)
- Inductors for standard circuits/decoupling circuits Selection Guide
- Application Note “Selection Guide for Power Inductors in Consideration of Leakage Flux”
- Solution Guide “Solutions for silencing DC-DC converters - Measures Against Acoustic Noise in Power Inductors”