The TFM series of power inductors consists of compact, thin inductors developed with the skillful application of the thin-film processing techniques acquired by TDK throughout its past. By using metallic magnetic materials with high saturation magnetic flux densities, these products have furthermore achieved the outstanding DC superimposition characteristics required of power inductors. This article clearly describes and explains valuable information for our customers related to the products in the TFM series, including their structures, features, and uses.

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- Product summary
- Product structures
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- What are power inductors?
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Product summary
A summary of the TFM series is shown in Figure 1. Starting with the TFM-GHM series, various lines of products are available, each with further improved characteristics.

Figure 1: Product summary

<table>
<thead>
<tr>
<th>Series</th>
<th>TFM-GHM series</th>
<th>TFM-ALM series</th>
<th>TFM-ALC series</th>
<th>TFM-ALMA series</th>
<th>TFM-ALVA series (in development)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Summary</td>
<td>Inductors which are produced using thin-film processing. By employing our original pattern forming technology as well as metallic magnetic materials with improved saturation magnetic flux densities, these products have achieved rated currents on the order of several A despite being compact and low-profile. The risk of short-circuits is prevented by a structure which includes insulation between the coil conductors, for greater reliability.</td>
<td>Inductors which are produced using thin-film processing. Their characteristics have been enhanced even further over the GHM series, by optimizing their internal patterns.</td>
<td>Inductors which are produced using thin-film processing. Their characteristics have been enhanced even further over the ALM series, by changing their metal materials and optimizing their internal patterns.</td>
<td>Inductors which are produced using thin-film processing. The characteristics of their metal materials have been improved over the ALMA series for enhanced withstand voltage performance.</td>
<td></td>
</tr>
</tbody>
</table>
Product structures

The TFM series consists of inductors which are produced using thin-film processing. Since their coils are formed by Cu plating, they support highly flexible designs, and their use of resin electrodes also allows them to lessen stresses such as those from heat and board deflection.

Features

- Compact, support large currents
- Optimization of internal patterns has improved DC resistance and DC superimposition characteristics
- More compact than GHM and ALM
- Use of low-loss materials has successfully reduced coil losses
- Compliant with AEC-Q200
- Low magnetic leakage flux
- Compliant with AEC-Q200
- Enhancements to the insulating performance of their magnetic materials have made it possible to ensure a withstand voltage of 40V, allowing usage even in battery lines
- Low magnetic leakage flux

Applications

- Smartphones
- Tablet devices
- Other mobile devices
- ADAS
- ECU
- In-vehicle cameras
- Radar
- Automotive communication modules

Applications

- Smartphones
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- Other mobile devices
- ADAS
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Product features

The features of each TFM series are shown in Figure 3. The TFM-ALMA and TFM-ALVA series consist of products with automotive specifications, which support temperatures of 150°C.

<table>
<thead>
<tr>
<th>Series</th>
<th>TFM-GHM series</th>
<th>TFM-ALM series</th>
<th>TFM-ALC series</th>
<th>TFM-ALMA series</th>
<th>TFM-ALVA series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>2.0x1.6mm</td>
<td>2.0x1.6mm</td>
<td>1.6x0.8mm</td>
<td>2.0x1.6mm</td>
<td>2.0x1.6mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.0x1.6mm</td>
<td>2.5x2.0mm</td>
<td>2.5x2.0mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.2x3.5mm</td>
<td></td>
</tr>
<tr>
<td><strong>Operating temperature range</strong></td>
<td>-40 to 125°C (including self-heating)</td>
<td>-40 to 155°C (including self-heating)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Magnetic material</strong></td>
<td>Metallic magnetic material</td>
<td>Metallic magnetic material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Terminal electrode specifications</strong></td>
<td>Resin electrode (conductive resin layer + plating)</td>
<td>Resin electrode (conductive resin layer + plating)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>Standard specification</td>
<td>Excellent DC superimposition characteristics</td>
<td>Reduced losses achieved by revision of core material</td>
<td>Automotive specifications</td>
<td>Automotive specifications with assurance of 40V</td>
</tr>
</tbody>
</table>

The TFM series employs a newly-developed metallic magnetic material, to reduce coil losses and achieve excellent DC superimposition characteristics.

Figure 4: Improvement of power-supply circuit efficiency characteristics

- Reduced coil losses achieved by magnetic material characteristics
- Effective at improving the efficiency of power-supply circuits

Figure 5: Improvement of DC Superimposition Characteristics

- High magnetic saturation achieved by magnetic material characteristics
- Excellent DC superimposition characteristics

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Applications

Example applications which use the TFM series are shown in Figure 6. Since the inductors in the TFM series are compact and can support large currents, they are ideal for applications requiring high-density mounting such as smartphones and automotive ECUs.
List of products

A list of products by series and shape is shown in Figure 7. Detailed information can be viewed and samples can be purchased by clicking on the product type name.

![Figure 7: List of products](image)

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>Height (mm)</th>
<th>TFM-GHM series</th>
<th>TFM-ALM series</th>
<th>TFM-ALC series</th>
<th>TFM-ALMA series</th>
<th>TFM-ALVA series (in development)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6x0.8</td>
<td>0.8 Max.</td>
<td></td>
<td></td>
<td></td>
<td>TFM160808ALC</td>
<td></td>
</tr>
<tr>
<td>2.0x1.6</td>
<td>0.8 Max.</td>
<td>TFM201608ALC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0 Max.</td>
<td>TFM201610GHM</td>
<td>TFM201610ALM</td>
<td>TFM201610ALC</td>
<td>TFM201610ALMA</td>
<td>TFM201610ALVA</td>
</tr>
<tr>
<td>2.5x2.0</td>
<td>1.2 Max.</td>
<td></td>
<td></td>
<td></td>
<td>TFM252012ALMA</td>
<td>TFM252012ALVA</td>
</tr>
<tr>
<td>3.2x2.5</td>
<td>1.2 Max.</td>
<td></td>
<td></td>
<td></td>
<td>TFM322512ALVA</td>
<td></td>
</tr>
</tbody>
</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 characteristic with switching devices for voltage conversion (see Figure 8).

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 8: DC-DC converter (chopper type / step-down type) and inductor

Switching device
Energy is stored.
Switch ON
Current
Power inductor
Diode
Control circuit

Switching repeated
Energy is emitted.
Switch OFF
Current
Capacitor

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”