Differential Mode Choke Coils
Application Manual

SF Series

The TDK’s SF Coil is outstanding in preventing electromagnetic interference (EMI) and radio frequency interference (RFI). The material is used which, in comparison with conventional ferrite materials, shows a marked improvement in the prevention of EMI and RFI.

SF CORE FEATURES
• Since an extremely high saturation flux density is maintained, large current use is possible and the shape is reduced for compact designing.
• As a result of outstanding permeability frequency characteristics, impedance-frequency characteristics are expansive and fully covered of the RF band.
• Temperature characteristics shows excellent linearity.
• Since the relative loss factor is very high, the EMI/RFI prevention effect is remarkable.

SF COIL FEATURES
As a result of employing the SF Core, which has the outstanding characteristics described previously, the SF Coil provides the following features.
• As compared to conventional coil which used ferrite or silicon steel cores, EMI/RFI prevention effect shows a good result.
• More compact designing is possible in comparison to conventional coils.
• Since a toroidal shape is employed, leakage flux and acoustic noise are low level.
• Outstanding effectiveness against EMI/RFI entering through the AC lines and generated from thyristor control circuit.

TEMPERATURE RANGES
Operating −25 to +105°C (Including self-temperature rise)
Storage −25 to +105°C

APPLICATIONS
prevent EMI radiation

Prevent EMI

EMI/RFI prevention

Prevent intrusion EMI

Equipment which uses thyristors (SCR, TRIAC, etc.)
• Lighting control equipment: Dimmers
• Heating control equipment: Industrial equipment, home electric heaters (electric blankets, electric jars, heaters, electric furnaces)
• Speed control equipment: Office equipment, copying machines, medical equipment, electrical machines, electrical drill, home appliance products (washing machines, electric fans, mixers, air conditioners)
• Switching power supplies spike noise
• Motors
• Others: Spike noise from various contact points

Micro computers, radio communication equipment, etc.

Prevention of malfunction of control equipment

Various terminal equipment

Car electronics equipment
CHARACTERISTICS OF SF CORE MATERIAL

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Typical value</th>
<th>Fig.</th>
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<tbody>
<tr>
<td>µi-f</td>
<td></td>
<td>75 (at 300kHz)</td>
<td>1</td>
</tr>
<tr>
<td>tanδ</td>
<td>%</td>
<td>3 (at 200kHz)</td>
<td>1</td>
</tr>
<tr>
<td>Applicable frequency</td>
<td>MHz</td>
<td>up to 10</td>
<td>1</td>
</tr>
<tr>
<td>Temperature stability</td>
<td>%</td>
<td>5.2 (–20 to +20°C)</td>
<td>2</td>
</tr>
<tr>
<td>ΔL/L</td>
<td>%</td>
<td>5.2 (20 to +60°C)</td>
<td>3</td>
</tr>
<tr>
<td>Saturation magnetic flux density Bs</td>
<td>mT</td>
<td>1400</td>
<td>3</td>
</tr>
</tbody>
</table>

TYPICAL CIRCUITS

1. PREVENT EMI RADIATION

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Circuit Diagram</th>
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<tbody>
<tr>
<td>Thyristor noise</td>
<td></td>
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<tr>
<td>Contact noise</td>
<td></td>
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<td>Semiconductor switching noise</td>
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</table>

2. PREVENTING INTRUSION EMI

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Circuit Diagram</th>
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</thead>
<tbody>
<tr>
<td>Preventing external noise, AC line</td>
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<tr>
<td>Preventing external noise, DC line</td>
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CIRCUIT DESIGN NOTES WHEN USING SF COIL

Observe the following points for effective design of circuits when employing SF coil in thyristor control circuit.

(1) CORRECT SF COIL INSTALLATION POSITION

Correct

Incorrect

The coil will float more because of C1 and C2 and its preventive effect will be reduced.

(2) CORRECT CAPACITOR INSTALLATION POSITION

Correct

Incorrect

- All specifications are subject to change without notice.
3. SUITABLE CAPACITOR
An optimum low pass filter designed can be obtained by employing a capacitor of 0.1 to 0.3µF.

TYPICAL EFFECT OF CAPACITOR

4. C.R. INSTALLATION POSITION FOR TURNOFF PREVENTION
When a low pass filter is installed in a thyristor control circuit, since ignition may become impossible due to L and C oscillating current, install turnoff prevention C.R. as shown in below.

TYPICAL RELIABILITIES
TEMPERATURE INCREASE WITH RESPECT TO RATED CURRENT

TEMPERATURE STABILITY

HUMIDITY STABILITY

All specifications are subject to change without notice.
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TYPICAL EMI PREVENTION EFFECTS

EMI PREVENTION EFFECTS (1)

EMI PREVENTION EFFECTS (2)

EMI PREVENTION EFFECTS (3)

EMI PREVENTION EFFECTS (4)

EMI PREVENTION EFFECTS (5)

EMI PREVENTION EFFECTS (6)

COMARED TO FERRITE

COMARED TO SI-STEEL AND Mo-PERMALLOY

Measuring method:
Radio wave propagation
Turn on angle 90°

0dB=1V
0dB=1µV
0dB=1µV
0dB=1µV

AC 100V 120W
L=C=0.1μF

Mn-Zn ferrite
T18×6×10 L=1mH
Mn-Zn ferrite
T8×20 L=100μH

Si-steel EL-40 L=1mH

Mo-Permalloy L=125μH

MEASURING METHOD:

L

0dB=1μV

Without SF coil

SF-T8-40S

SF-T8-50S

SF-T10-30

SF-T10-40

SF-T10-50

SF-T8-50S

SF-T12-40

SF-T12-50

SF-T12-50

SF-T8-50S

0dB=1μV

Without SF coil

SF-T8-40S

SF-T8-50S

SF-T10-30

SF-T10-40

SF-T10-50

SF-T8-50S

SF-T12-40

SF-T12-50

SF-T12-50

SF-T8-50S
TYPICAL ELECTRICAL CHARACTERISTICS

INDUCTANCE vs. DC SUPERPOSITION CHARACTERISTICS

SF-T8S

SF-T8D

SF-T10

SF-T12

Test equipment: YHP-4260A
Test frequency: 1kHz

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Test frequency: 1kHz

Test equipment: YHP-4260A
Test frequency: 1kHz

Test equipment: YHP-4260A
Test frequency: 1kHz

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