#### **EMI Cores**

# ESD-R-SR Toroidal Cores for Round Cables for Low Frequency at 150 kHz (Bare, coated & with case)



#### **Overview**

The KEMET ESD-R-SR Series solid toroidal cores are designed for use on round cables. KEMET's unique core material enables high performance in low frequency range, at 150 kHz. Options are available in bare, coated and with case types. EMI cores are part of a family of passive components which address the issues of noise or electromagnetic interference (EMI) in circuits or systems

## **Applications**

- Consumer electronics
- Air conditioners
- · Power conditioners
- Refrigerators
- · Washing machines
- · Business multifunction printers
- Industrial equipment
- · General purpose inverters

#### **Benefits**

- Proprietary high impedance core material for effective noise suppression at 150kHz
- Solid construction
- Large-size ring type
- · Bare, coated and with case types available



### Part Number System

ESD-	R-	31	SR	-P
Series	Shape Type	Core Size Outer Dimension Code (mm)	Core Material	Туре
ESD-	Ring	See Table 1	SR = S15H SRH = S18H	Blank = Bare P = Coated



#### **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.

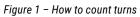
See Figure 2 for an example.

### **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.



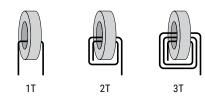
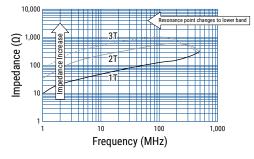
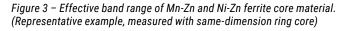
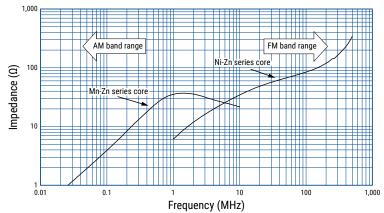


Figure 2 – Relationship between impedance and turn count. (Representative example: ESD-R-16C)







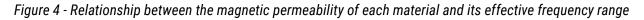


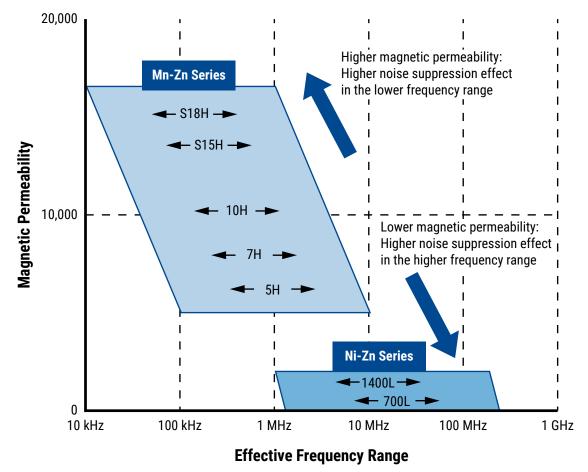
#### **Magnetic Permeability of Ferrite Material**

In order to achieve most 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 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 1. 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.

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

S18H, S15H, 10H, 7H, 5H, 1400L and 700L are KEMET's proprietary ferrite material names. Other materials can also be available on request.





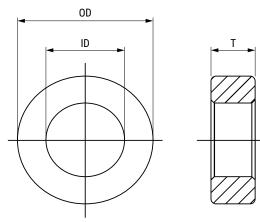


### **Environmental Compliance**

All KEMET EMI cores are RoHS compliant.

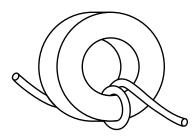


### **Dimensions – Millimeters**



See Table 1 for dimensions

# **Installation Example**



#### **Performance Characteristics**

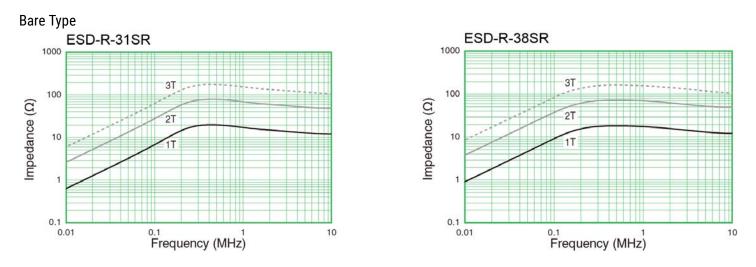
ltem	Performance Characteristics		
Operating temperature	-25°C to +85°C		
Frequency range	Low frequency		
Outer diameter	31.0 – 59.0 mm		
Inner diameter	19.0 – 36.0 mm		
Thickness	12.7 – 21.0 mm		
Туре	Bare, coated, and case		
Case flame resistant rating	UL94 V-2		
Material	MnZn S15H		

#### Table 1 – Ratings & Part Number Reference

Part	Dimensions (mm)		Weight			Compatible	Frequency Range <sup>1</sup>		Material		
Number	OD	ID	т	(g)	Туре	Color	Toroid Core (Bare Type)	≤ 10 MHz (AM band range)	≤ 300 MHz (FM band range)	MnZN	NiZn
ESD-R-31SR	31.0 ±0.8	20.0 ±0.8	14.9 ±0.5	32.5	Bare	-	-	Х		S15H	-
ESD-R-38SR	38.0 ±0.8	19.0 ±0.8	12.7 ±0.5	52.5	Bare	-	-	Х		S15H	-
ESD-R-47SR	47.0 ±1.0	27.0 ±0.8	15.0 ±0.5	83.4	Bare	-	-	Х		S15H	-
ESD-R-57SR	57.0 ±1.5	36.0 ±1.0	20.0 ±0.5	139.5	Bare	-	-	Х		S15H	-
ESD-R-31SR-P	32.0 Maximum	19.0 Minimum	16.0 Maximum	32.9	Coated	Gray	-	Х		S15H	-
ESD-R-38SR-P	39.5 Maximum	18.0 Minimum	14.0 Maximum	53.3	Coated	Gray	-	Х		S15H	-
ESD-R-47SR-P	48.5 Maximum	26.0 Minimum	16.0 Maximum	84.3	Coated	Gray	-	Х		S15H	-
ESD-R-57SR-P	59.0 Maximum	34.0 Minimum	21.0 Maximum	141.5	Coated	Gray	-	Х		S15H	-
ESD-R-47SRH	51.0 Maximum	24.4 ±1.0	19.0 Maximum	92.0	Case	White with blue tape	-	Х		S18H	-

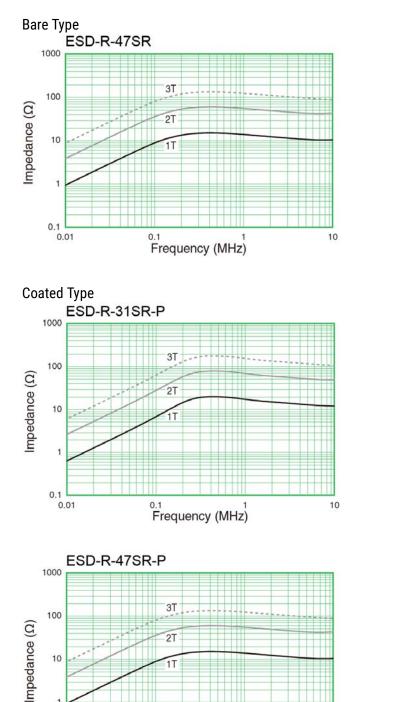
<sup>1</sup> Frequency range is for reference only. Please test with actual device before use.

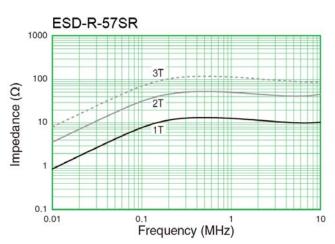
#### Impedance vs. Frequency

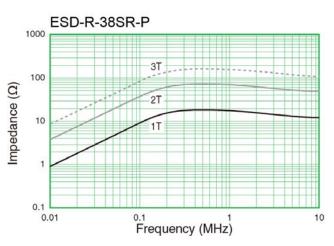


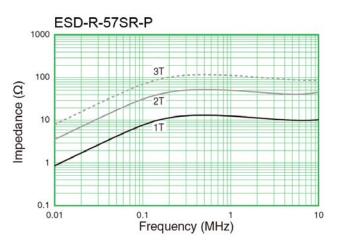


#### Impedance vs. Frequency cont.









<sup>0.1</sup> Frequency (MHz)

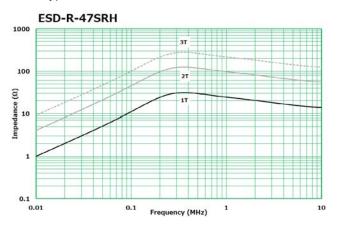
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0.1 L 0.01



#### Impedance vs. Frequency cont.

Case Type



# Packaging

Part Number	Packaging Type	Pieces per Box
ESD-R-31SR		300
ESD-R-38SR		200
ESD-R-47SR	60	100
ESD-R-57SR		60
ESD-R-31SR-P		300
ESD-R-38SR-P		200
ESD-R-47SR-P		100
ESD-R-57SR-P	]	60
ESD-R-47SRH		100



#### **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.

#### **Export Control**

#### For customers in Japan

For products that are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

#### For customers outside Japan

EMI Core products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.