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	Type
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.

Figure 1 – How to count turns

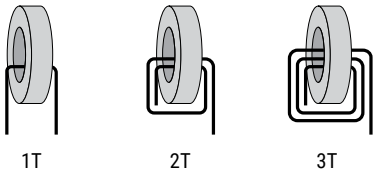
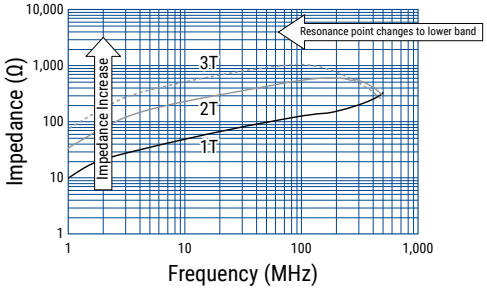


Figure 2 – Relationship between impedance and turn count. (Representative example: ESD-R-16C)



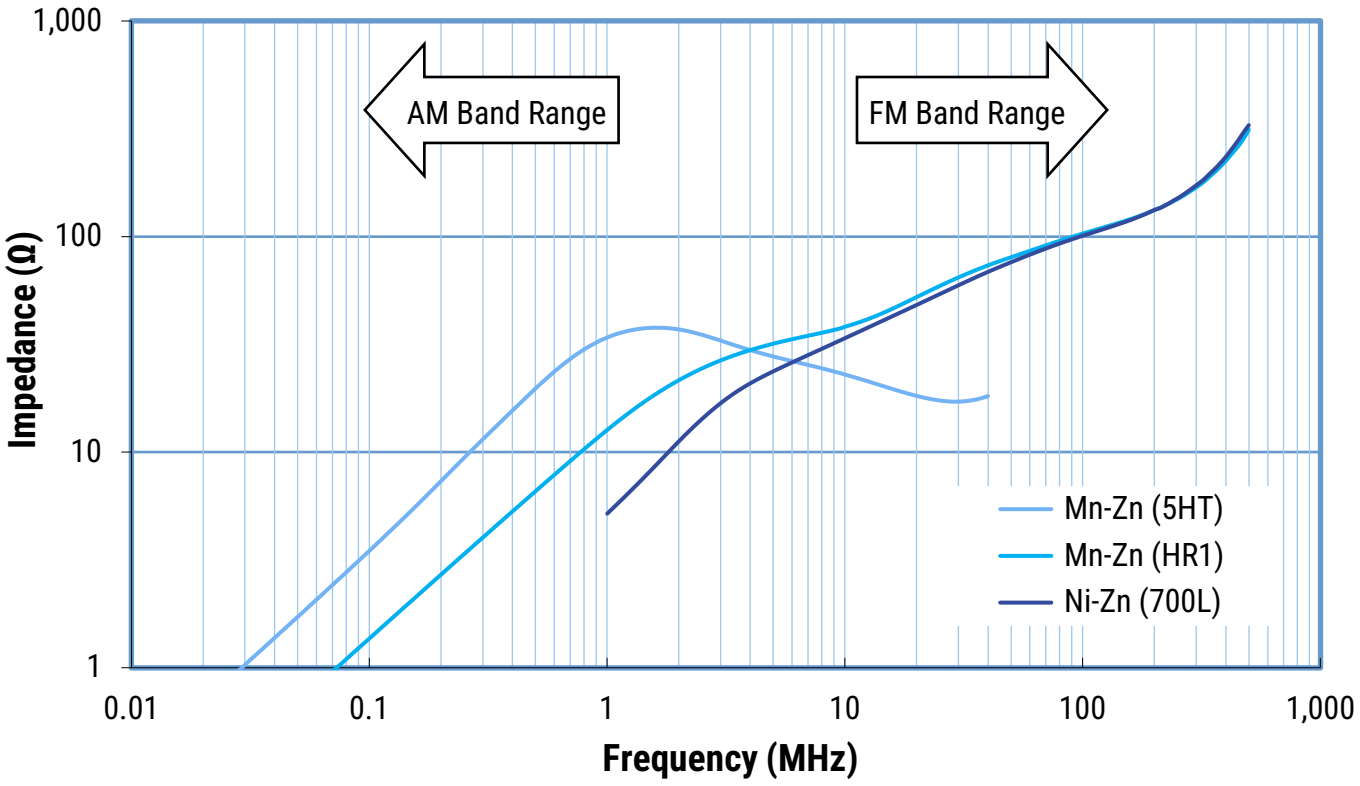
Core Material and Effective Frequency Range

There are three ferrite material options for KEMET EMI Cores: 700L Nickel Zinc (Ni-Zn), HR1 and 5HT 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 700L Ni-Zn core material is typically effective for frequencies in the MHz band range such as the FM band, while the 5HT Mn-Zn core material is typically effective for the kHz band range such as the AM band. The HR1 Manganese Zinc core material provides excellent performance in the MHz band range and represents a cost effective replacement solution of the traditional Ni-Zn core material in the FM band. See Figure 3.

It is recommended to measure the actual frequency range effectiveness in the target application.

Figure 3 - Effective band range of Mn-Zn and Ni-Zn ferrite core materials. (Representative example, measured with same-dimension ring core)



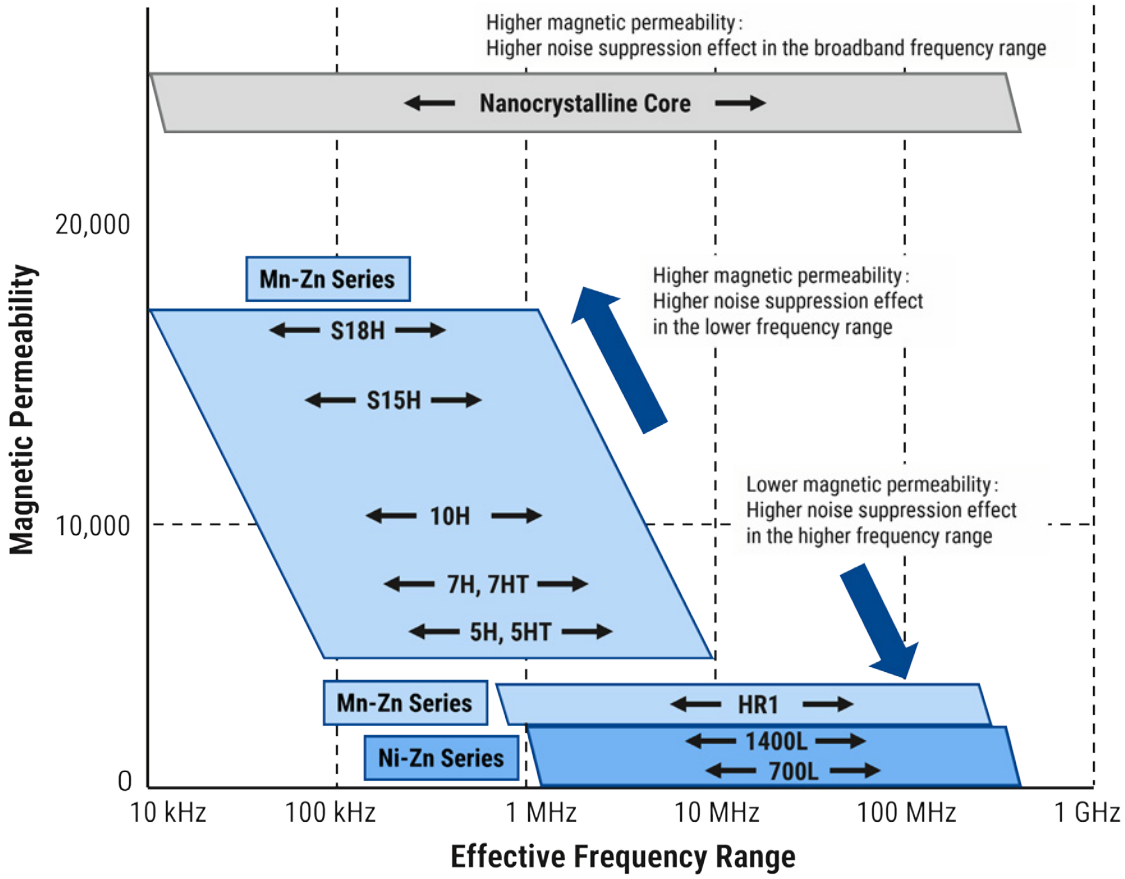
Magnetic Permeability of Ferrite Material

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 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.

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 and it should be tested on the actual device to determine its effectiveness.

S18H, S15H, 10H, 7H, 7HT, 5H, 5HT, HR1, 1400L and 700L are KEMET's proprietary ferrite material names.
Other materials can also be available on request.

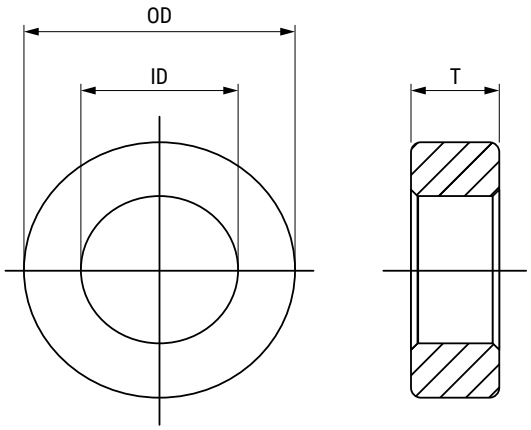
Figure 4 - Relationship between the magnetic permeability of each material and its effective frequency range



Environmental Compliance

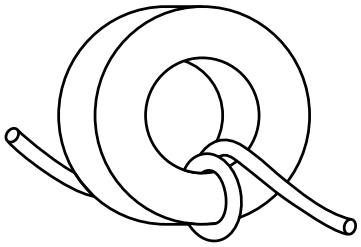
All KEMET EMI cores are RoHS compliant.

Dimensions – Millimeters



See Table 1 for dimensions

Installation Example



Performance Characteristics

Item	Performance Characteristics
Operating temperature	–25°C to +85°C
Frequency range	Low frequency
Outer diameter	25 – 59 mm
Inner diameter	15.4 – 36 mm
Thickness	12.7 – 21 mm
Type	Bare, coated and case
Case flame resistant rating	UL94 V–2
Material	MnZn S15H and MnZn S18H

Table 1 – Ratings & Part Number Reference

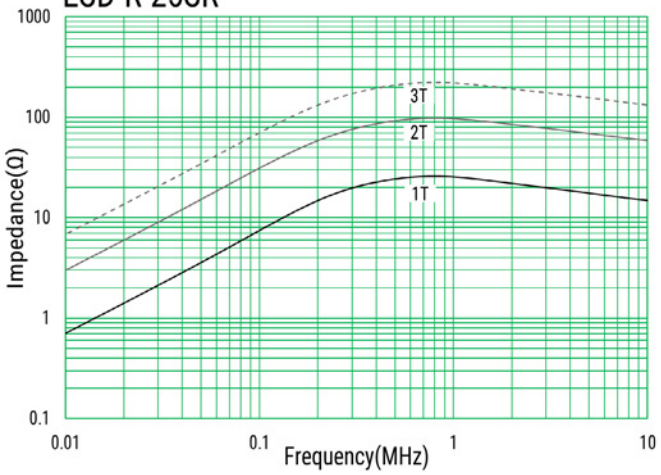
Part Number	Dimensions (mm)			Weight	Type	Color	Compatible Toroid Core (Bare Type)	Frequency Range[1]		Material	
	OD	ID	T	(g)				≤ 10 MHz (AM band range)	≤ 500 MHz (FM band range)	MnZN	NiZn
ESD-R-25SR	25.0±0.7	16.0±0.5	13.0±0.5	18.6	Bare	–	–	X		S15H	–
ESD-R-31SR	31.0 ±0.8	20.0 ±0.8	14.9 ±0.5	32.5	Bare	–	–	X		S15H	–
ESD-R-38SR	38.1 ±0.8	19.0 ±0.8	12.7 ±0.5	52.5	Bare	–	–	X		S15H	–
ESD-R-47SR	47.0 ±1.0	27.0 ±0.8	15.0 ±0.5	83.4	Bare	–	–	X		S15H	–
ESD-R-57SR	57.0 ±1.5	36.0 ±1.0	20.0 ±0.5	139.5	Bare	–	–	X		S15H	–
ESD-R-25SR-P	25.9 Maximum	15.4 Min.	13.7 Maximum	18.9	Coated	Gray	–	X		S15H	–
ESD-R-31SR-P	32.0 Maximum	19.0 Minimum	16.0 Maximum	32.9	Coated	Gray	–	X		S15H	–
ESD-R-38SR-P	39.5 Maximum	18.0 Minimum	14.0 Maximum	53.3	Coated	Gray	–	X		S15H	–
ESD-R-47SR-P	48.5 Maximum	26.0 Minimum	16.0 Maximum	84.3	Coated	Gray	–	X		S15H	–
ESD-R-57SR-P	59.0 Maximum	34.0 Minimum	21.0 Maximum	141.5	Coated	Gray	–	X		S15H	–
ESD-R-47SRH	51.0 Maximum	24.4 ±1.0	19.0 Maximum	92.0	Case	White with blue tape	–	X		S18H	–

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

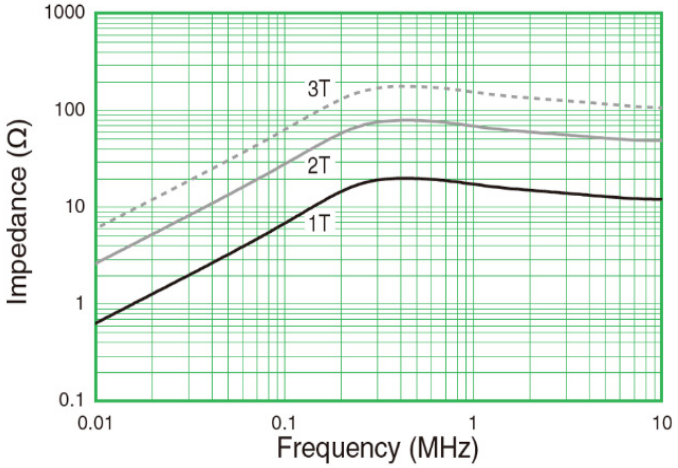
Impedance vs. Frequency

Bare Type

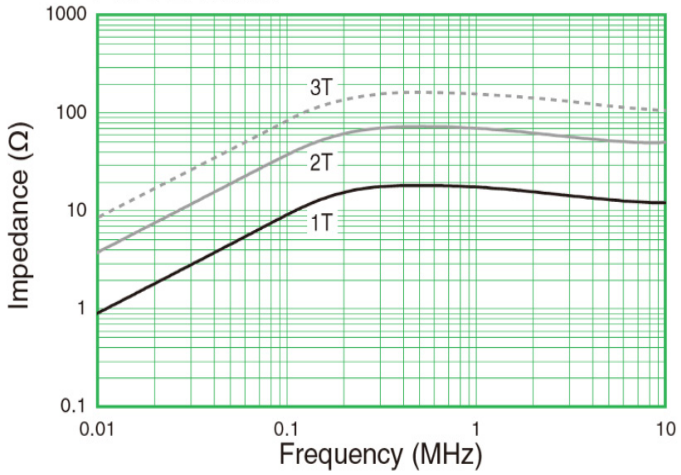
ESD-R-25SR



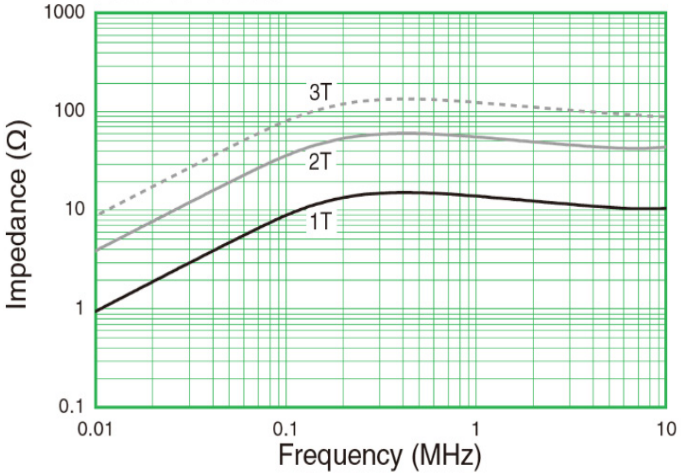
ESD-R-31SR



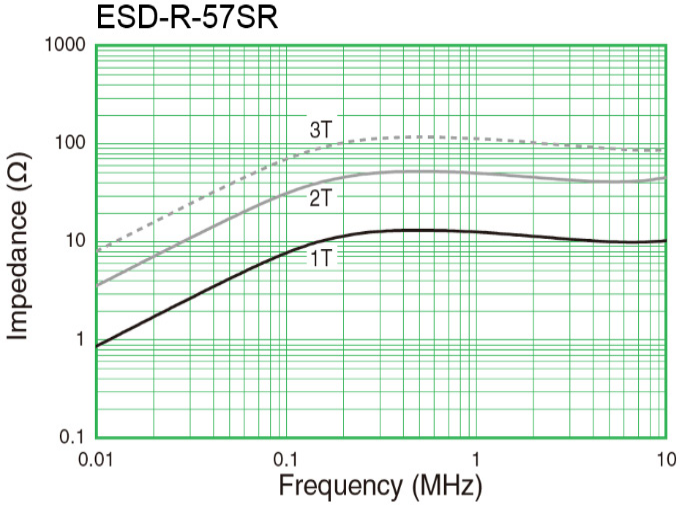
ESD-R-38SR



ESD-R-47SR



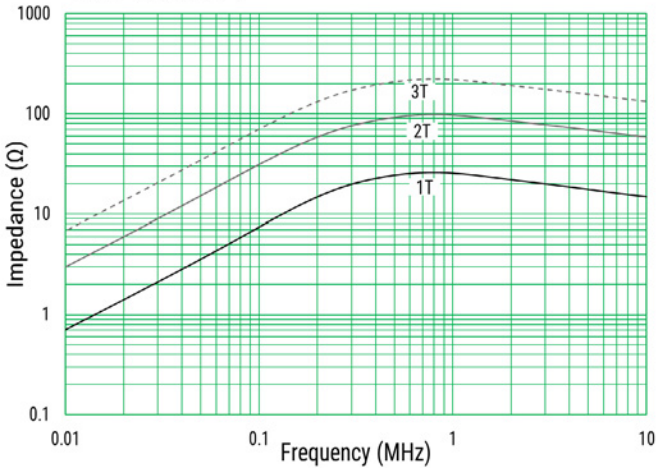
ESD-R-57SR



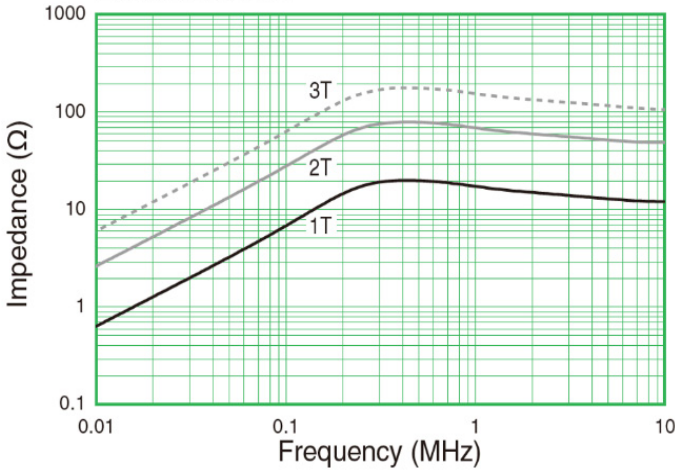
Impedance vs. Frequency cont.

Coated Type

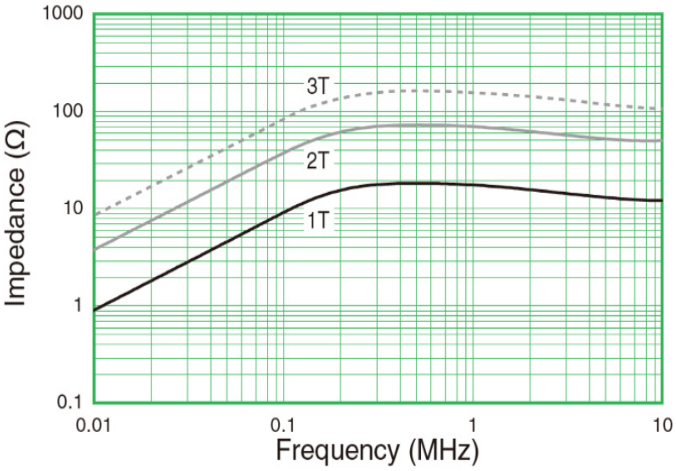
ESD-R-25SR-P



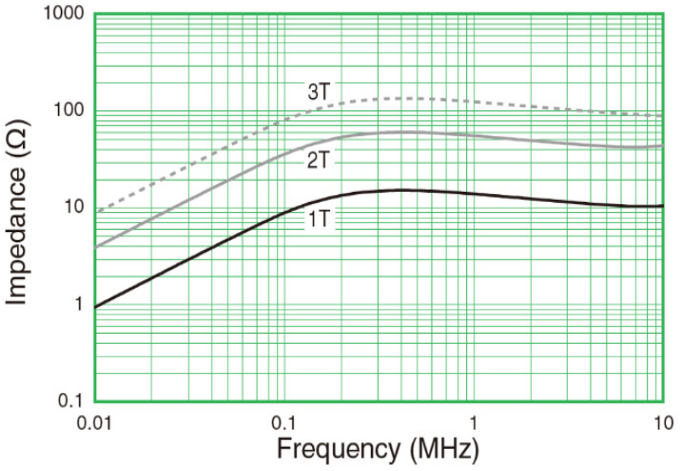
ESD-R-31SR-P



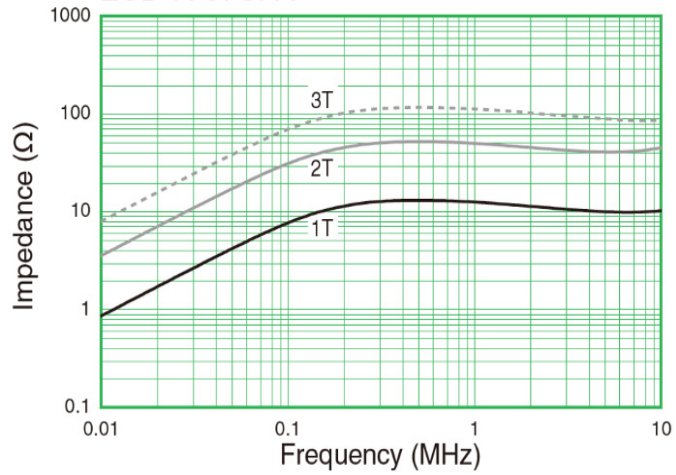
ESD-R-38SR-P



ESD-R-47SR-P

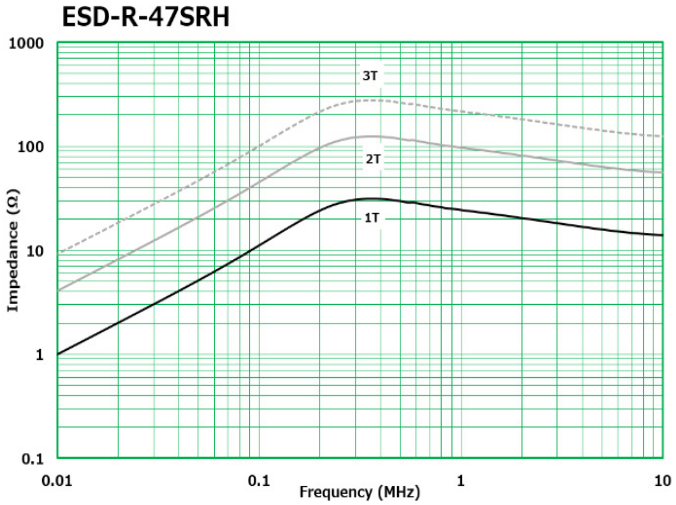


ESD-R-57SR-P



Impedance vs. Frequency cont.

Case Type



Packaging

Part Number	Packaging Type	Pieces per Box
ESD-R-25SR	Tray	300
ESD-R-31SR		300
ESD-R-38SR		200
ESD-R-47SR		100
ESD-R-57SR		60
ESD-R-25SR-P		300
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.

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