

## Overview

The KEMET Magnetic Sheet for radio frequency identification (RFID) Flex Suppressor® prevents interference between a loop antenna and metallic objects and effectively improves the communication range of RFID.

The flexible sheet is a polymer base, blended with micron-sized magnetic powders dispersed throughout the material. These sheets improve the magnetic flux convergence and can be cut into a variety of shapes and sizes.

## Applications

- Cell phone with radio frequency identification (RFID) function
- Contactless IC card
- RFID reader/writer
- RFID tag

## Benefits

- Magnetic flux convergence improvement – increases the relative permeability ( $\mu'$ ) while keeping the magnetic loss ( $\mu''$ ) low.
- Effective carrier frequency 13.56 MHz and below
- Resistant to shock, not brittle
- Thin, flexible material used in portable equipment
- Virtually no limitation in where it can be used
- Less time required for installation
- Easily cut into any shape
- Easily laminates the Flex Suppressor® roll to the tag roll
- RoHS compliant and halogen-free

Sheet Type



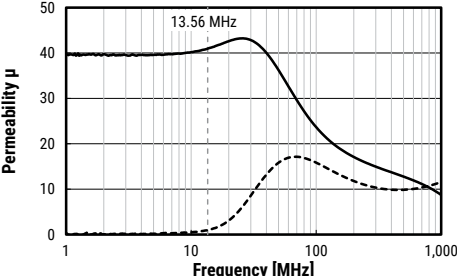
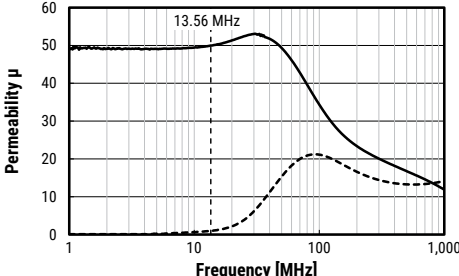
Roll Type



## Part Number System

| M4         | (100)-  | 240 X 240  | T0800                                       |
|------------|---|--|---|
| Series     | Thickness   | Standard Dimensions  | Adhesive Tape Thickness                     |
| M4<br>RM4A | (100)- = 0.1 mm<br>(200)- = 0.2 mm<br>(300)- = 0.3 mm<br>(01)- = 0.1 mm<br>(02)- = 0.2 mm<br>(025)- = 0.25 mm<br>(03)- = 0.3 mm | 90 X 70 = Sheet 90 mm x 70 mm<br>185 X 70 = Sheet 185 mm x 70 mm<br>240 X 240 = Sheet 240 x 240 mm<br>240 X 20 M = Roll 240 mm x 20 m<br>240 X 30 M = Roll 240 mm x 30 m<br>240 X 50 M = Roll 240 mm x 50 m<br>220 X 185 = Sheet 220 mm x 185 mm | T0800 = 0.03 mm<br>Blank = No adhesive tape |

## Specifications

| Features                      | High Magnetic Permeability & Low Magnetic Loss Type                                 |  |
|-------------------------------|---|--|
| Series                        | M4  | RM4A   |
| Effective Carrier Frequency   | 13.56 MHz and below   |  |
| Operating Temperature (°C)    | -40 to +105   | -40 to +85   |
| Thickness (mm)                | 0.1/0.2/0.3   | 0.1/0.2/0.25/0.3   |
| Standard Dimensions (mm)      | 240 X 240<br>(Roll on request)  | 220 X 185  |
| Permeability at 13.56 MHz     | 40 typical  | 50 typical   |
|                               |  |  |
| Specific Gravity <sup>1</sup> | 3.1 typical   | 3.6 typical  |
| Surface Resistivity (Ω/sq.)   | 1.0 X 10 <sup>7</sup> typical   |  |
| Approved Standard             | UL 94 HB<br>UL File No. E176124   | -  |
| Environment                   | RoHS  | Compliant  |
|                               | Halogen   | Free   |
|                               | PVC   | Free   |
|                               | Lead  | Free   |
|                               | Red Phosphorus  | Free   |

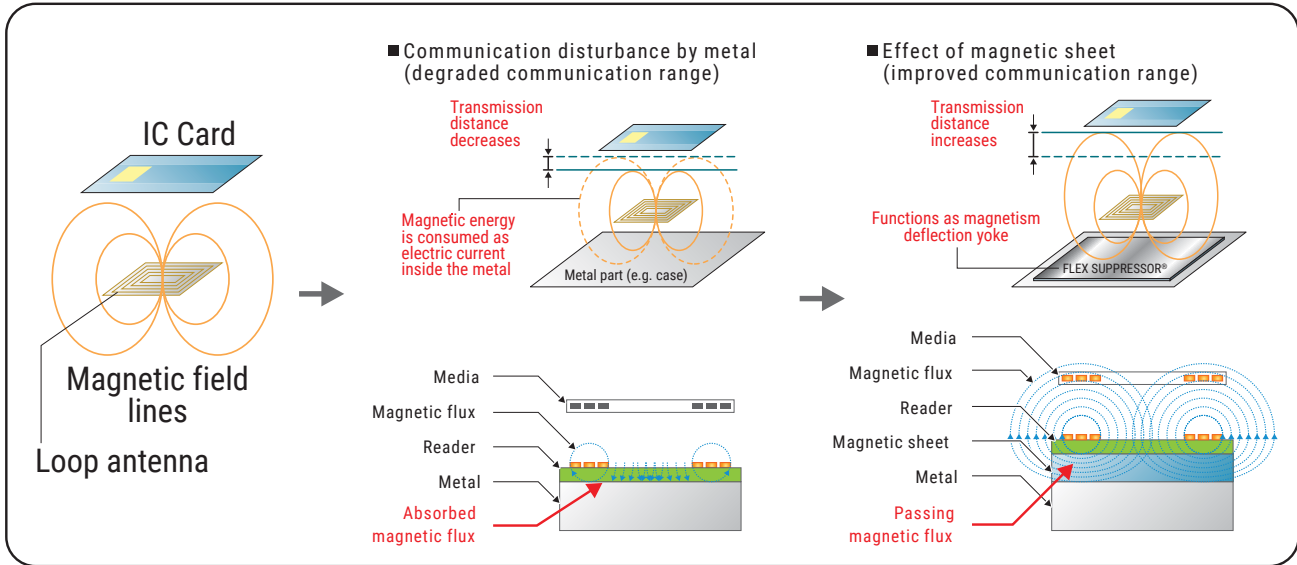
<sup>1</sup> Value in 23°C atmosphere.

Above specifications are for the Flex Suppressor® only (adhesives, etc., not included.)

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

| Part Number            | Series        | Thickness        | Tape Thickness        | Permeability        | Specific Gravity        | Surface Resistivity        | Weight        |
|------------------------|---------------|------------------|-----------------------|---------------------|-------------------------|----------------------------|---------------|
|                        |               | mm               | mm                    | at 13.56 MHz        | Typical                 | Ω/sq. typical              | g             |
| M4(100)-90X70T0800     | M4            | 0.1              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 2.08          |
| M4(100)-185X70T0800    | M4            | 0.1              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 4.28          |
| M4(100)-240X240T0800   | M4            | 0.1              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 19.04         |
| M4(100)-240X50M        | M4            | 0.1              | --                    | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 3,479.17      |
| M4(100)-240X50MT0800   | M4            | 0.1              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 3,966.67      |
| M4(200)-90X70T0800     | M4            | 0.2              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 3.91          |
| M4(200)-185X70T0800    | M4            | 0.2              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 8.04          |
| M4(200)-240X240        | M4            | 0.2              | --                    | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 33.41         |
| M4(200)-240X240T0800   | M4            | 0.2              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 35.75         |
| M4(200)-240X30M        | M4            | 0.2              | --                    | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 4,176.25      |
| M4(200)-240X30MT0800   | M4            | 0.2              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 4,468.75      |
| M4(300)-90X70T0800     | M4            | 0.3              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 5.74          |
| M4(300)-185X70T0800    | M4            | 0.3              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 11.79         |
| M4(300)-240X240        | M4            | 0.3              | --                    | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 50.11         |
| M4(300)-240X240T0800   | M4            | 0.3              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 52.45         |
| M4(300)-240X20M        | M4            | 0.3              | --                    | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 4,175.83      |
| M4(300)-240X20MT0800   | M4            | 0.3              | 0.03                  | 40                  | 3.1                     | 1.0 X 10 <sup>7</sup>      | 4,370.83      |
| RM4A(01)-90X70T0800    | RM4A          | 0.1              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 2.52          |
| RM4A(01)-185X70T0800   | RM4A          | 0.1              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 5.19          |
| RM4A(01)-220X185T0800  | RM4A          | 0.1              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 16.31         |
| RM4A(02)-90X70T0800    | RM4A          | 0.2              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 4.79          |
| RM4A(02)-185X70T0800   | RM4A          | 0.2              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 9.85          |
| RM4A(02)-220X185T0800  | RM4A          | 0.2              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 30.96         |
| RM4A(02)-220X185       | RM4A          | 0.2              | --                    | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 29.31         |
| RM4A(025)-90X70T0800   | RM4A          | 0.25             | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 5.93          |
| RM4A(025)-185X70T0800  | RM4A          | 0.25             | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 12.18         |
| RM4A(025)-220X185T0800 | RM4A          | 0.25             | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 38.29         |
| RM4A(025)-220X185      | RM4A          | 0.25             | --                    | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 36.63         |
| RM4A(03)-90X70T0800    | RM4A          | 0.3              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 7.06          |
| RM4A(03)-185X70T0800   | RM4A          | 0.3              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 14.51         |
| RM4A(03)-220X185T0800  | RM4A          | 0.3              | 0.03                  | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 45.61         |
| RM4A(03)-220X185       | RM4A          | 0.3              | --                    | 50                  | 3.6                     | 1.0 X 10 <sup>7</sup>      | 43.96         |
|                        |               | mm               | mm                    | at 13.56 MHz        | Typical                 | Ω/sq. typical              | g             |
| <b>Part Number</b>     | <b>Series</b> | <b>Thickness</b> | <b>Tape Thickness</b> | <b>Permeability</b> | <b>Specific Gravity</b> | <b>Surface Resistivity</b> | <b>Weight</b> |

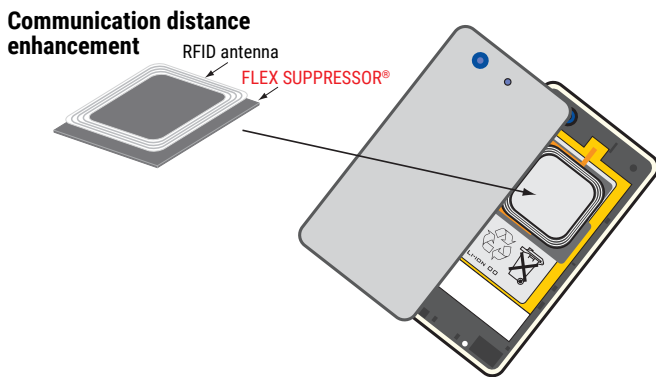
## Applications



| Devices                 | RFID Transmission Quality Improvement  |
|-------------------------|--|
| Mobile phone            | For communication distance improvement |
| Notebook PC and tablet  |  |
| RFID card reader/writer |  |
| RFID card and tag       |  |

Application example in a cell phone with RFID function.

Laminating the Flex Suppressor® roll to the tag roll

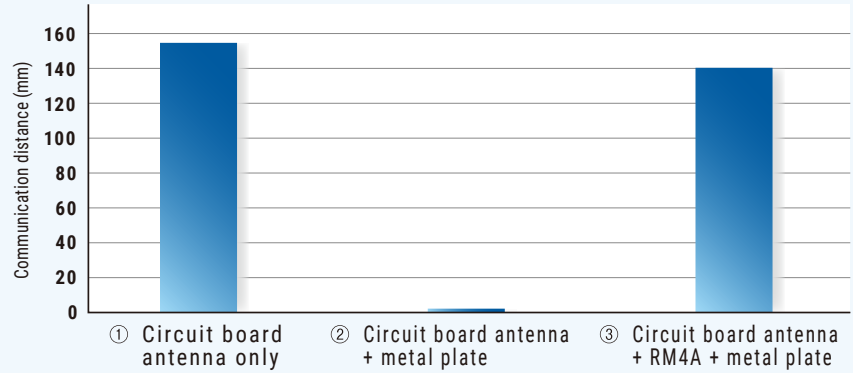


## Applications (cont'd)

Communication distance evaluation of a cell phone RFID antenna.

- **RFID** circuit board antenna for mobile phones (About 40 mm × 30 mm)
  - ① Circuit board antenna only (in open space)
  - ② Circuit board antenna with a metal plate in its proximity
  - ③ RM4A installed between the circuit board and a metal plate
- **ISO/IEC 18092** compatible Contactless reader/writer


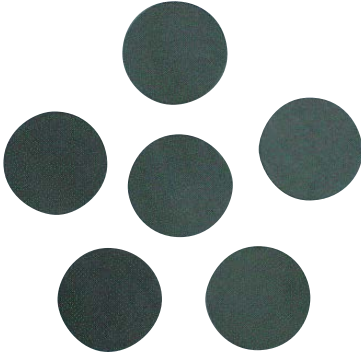

Measurement of the maximum communication distance of both of the above (3 levels)



\* This data does not represent guaranteed values.

## Examples of Shapes

KEMET Flex Suppressor® sheets can be cut into a variety of shapes and sizes:

| With holes, cut-out shapes, and circular shapes                                   |   | Precut  |
|---|---|---|
|  |  |  |

| Reel  | Roll   | With Aluminum or PET sheet  |
|---|--|---|
|  |  |  |

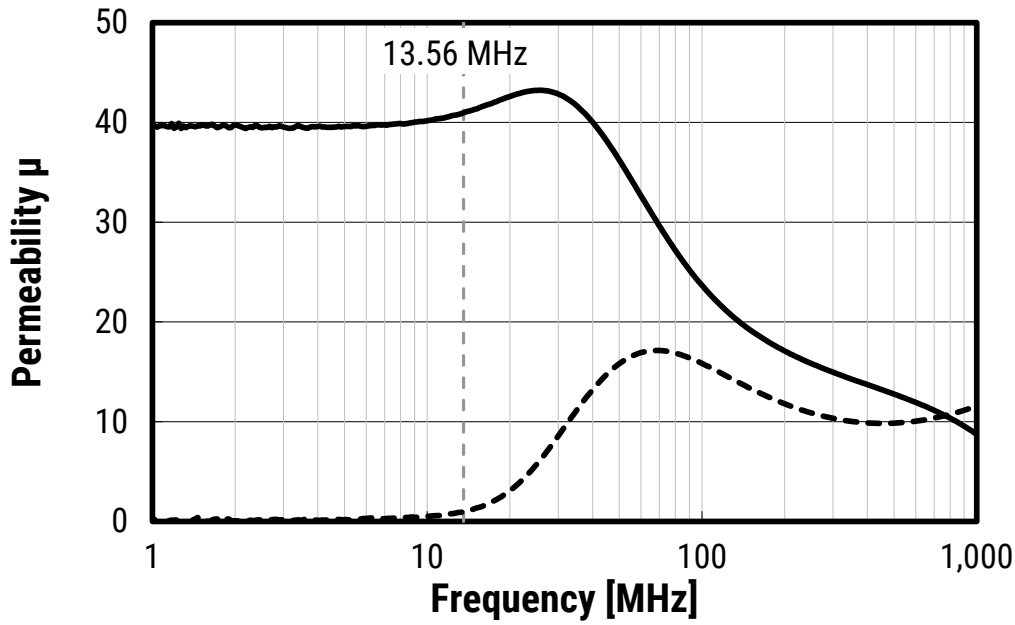
Some examples of customization, available upon request:

- The use of PET film in the front, for insulation or mechanical support
- The use of aluminum sheet in the front, for shielding effect
- The use of different adhesive tapes on the back - stronger, thinner, thicker, etc.

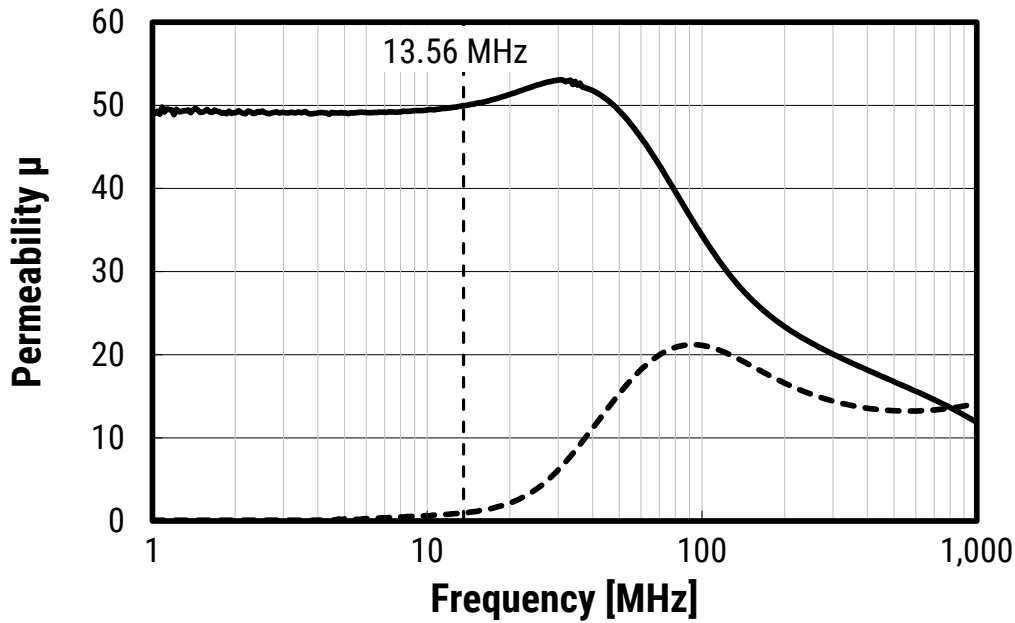
| Customization Examples  | Where | Function   |
|-------------------------|-------|--|
| PET Film                | Front | Insulation or mechanical support   |
| Aluminum sheet          | Front | Shielding effect   |
| Different adhesive tape | Back  | Stronger adhesive tape<br>Thinner or thicker tape<br>Reflow capable, double-sided tape |

## Permeable Characteristics

M4



RM4A



## Handling Precautions

Avoid high temperature, humidity and direct sunlight. Storage environment should be below 40°C and below 70% relative humidity. The surface resistance value listed in this catalog is a reference value of the circuit parameter to indicate noise suppression. The value does not represent the product's insulation characteristics. The value may become lower if an excess pressure is applied to the product. The products in this datasheet are not insulators, they need to be handled as conductors. Care must be taken when in use, so that conductive material does not contact the surface or the edge of the Flex Suppressor® sheet. Insulation process should be performed when contact to conductive material is probable. Depending on the processing procedure, powdery substance may drop out from sheet surface or the edge, if the cutting of the sheet is performed. Depending on the location, care must be taken, as this powder may effect the component's performance.

Any dust, oil or moisture must be cleaned from the surface of the installation area when using an adhesive tape to attach the sheet. The adhesive tape may begin to lose some of its adhesiveness after being in storage for six months. This has no impact on the EMI filtering effectiveness.

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## 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

Flex Suppressor® products should not be used or sold for the use in the development, production, stockpiling or utilization of any conventional weapons, mass-destruction weapons (nuclear, chemical and biological weapons or missiles) or any other weapons.



## Information on environmentally influential substances

The Flex Suppressor® does not contain any of the substances listed below:

### (1) Ozone depleting substance

- CFC (chlorofluorocarbon)
- Halon
- Carbon tetrachloride
- 1,1,1-Trichloroethane
- HCFC (hydrochlorofluorocarbon)
- HBFC (hydrobromfluorocarbon)
- Methyl bromide

### (2) Substances regulated by RoHS Directive

- Lead and lead compound
- Mercury and mercury compound
- Cadmium and cadmium compound (content of plastics that are below 5 ppm)
- Hexavalent chromium and hexavalent chromium compound
- PBB (polybrominated biphenyl) and its kind
- PBDE (polybrominated diphenylether)

### (3) Other environmentally influential substances (examples)

- PCB (polychlorinated biphenyl)
- Polychlorinated naphthalene
- Hexachlorobenzene
- Organotin compounds (tributyl tin, triphenyl tin)
- Asbestos
- Azo compound
- Chlorinated paraffin and its kind (paraffin chloride, chlorinated paraffin and chloroparaffin)
- Radioactive substance
- PVC

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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product-related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicated or that other measures may not be required.

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