

EMI Suppression and Absorption

WAVETMX

PROBLEM

SOLVED



ARC
TECHNOLOGIES, INC.

The Wave-X solution

Absorber solutions across a wide range of applications

ARC Technologies developed the Wave-X family of products in response to a critical need for a simple – yet reliable – solution to the problem. That's why Wave-X is available with a range of features, sizes, and formulations.

Drawing from ARC Technologies' extensive experience in state of the art defense and commercial absorber technology, the Wave-X products are capable of attenuating noise from 5MHz to 40GHz and are simple to integrate in even the tightest of spaces.

Supports a wide range of frequencies	From 5MHz to 40GHz, Wave-X is the solution for your noise reduction requirements.
Designed for near-field suppression	Wave-X provides excellent attenuation and suppression regardless of the source.
Offered in very thin and flexible cross sections	Sub-millimeter size efficiently attenuates EMI and SAR without compromising your design.
Easy application	Optional peel and stick backing makes Wave-X incredibly easy to install.
Flexible substrate	Allows custom sizes and shapes without cracking or loss of effectiveness.
UL-FR rated and high temperature resistance	Physically stable over a broad range of temperatures.
RoHS compliant	All Wave-X products are compliant with the RoHS Directive.
Complex geometries	Molded, three dimensional parts
Halogen free	Many Wave-X products are Halogen free

The Wave-X secret

Wave-X is an effective and reliable solution for EMI and RF suppression due to its sophisticated formulation. Beginning with our specialized Wave-X fillers, we use the most advanced metallurgical processes, creating highly permeable materials that are precisely designed to disrupt and absorb EMI interference.

The metallurgy makes the difference

ARC's advanced metallurgical processes allow precise control of particle size and shape of the permeable metal fillers thereby governing the permeability and attenuation properties of each Wave-X product. Because ARC can custom mix the fillers within a variety of substrates, they have created a series of products with the flexibility, elasticity, and tensile strength required for today's engineering demands.

- | | |
|------|--|
| • WX | Specifically designed with high permeability, high temperature and corrosion resistance. |
| • WH | Wave-X Heat Shrink Absorber |
| • WK | Ultra thin EMI sheets |
| • WS | Carbon loaded silicone sheets |
| • WC | Molded configurations for easy integration over noisy IC's |
| • WE | Extrudable absorbers and suppressors |
| • WT | Rigid and flexible injection molded absorber structures |



Delivered just the way you want it

Wave-X sheets

Wave-X sheets are extremely thin, flexible, and resilient. Available in a range of thicknesses and permeabilities, these sheets can be cut and fit easily into your existing circuitry to absorb unwanted interference.

Optionally, Wave-X sheets can be supplied with a peel and stick backing, making application simple and easy.

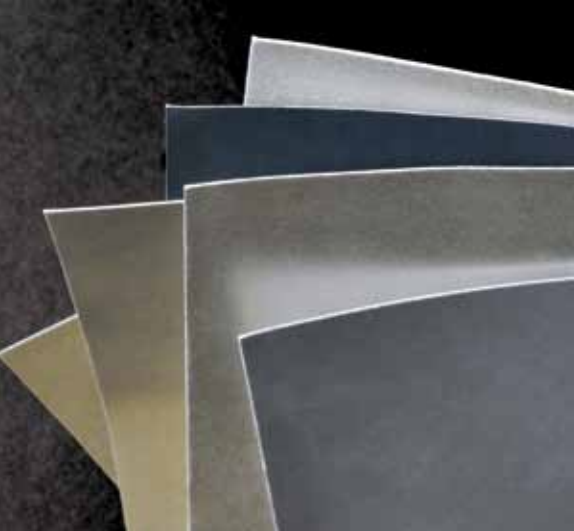
Wave-X injection molding and extrusion

Injection molding is available within the Wave-X product family, which gives you the flexibility to build a reliable and cost-effective EMI absorbing enclosure for troublesome chips and circuits. Wave-X molded terminations are an ideal alternative to costly machined waveguide loads in microwave systems.

Wave-X solutions can be extruded directly over wire and cable systems. This makes Wave-X one of the most innovative and customizable solutions for reducing and eliminating excess noise from cables and electronic harnesses. The ability to extrude Wave-X suppressor onto the cable virtually eliminates crosstalk and enhances cable bandwidth capabilities. Bulky ferrites and other unsightly countermeasures are no longer needed.

Implementing a simple and effective molded Wave-X solution eliminates the need for metal shielding cans, hard to install EMI gaskets, and bulky ferrites.

Wave-X can increase production efficiency, reduce part content, and ultimately compress the time-to-market cycle for your products. And the faster you introduce your products to market, the more competitive you will be.



Applications

Wave-X provides a flexible solution that supports a wide range of EMI and RF suppression requirements.

Cables	Integrates easily into cable assemblies, beneath the outer jacket, to eliminate signal radiation at the source and restrict interference from external sources.
Cell Phones and Smartphones	Eliminates interference in phone cameras, controls SAR emissions, and absorbs emissions from LCD displays. Provides control for internal RF and flat cable emissions.
Computers	Suppresses resonance and harmonics from circuitry, absorbs RF emissions from wiring, and reduces interference from internal peripheral devices.
Portable Devices	Controls board and display level interference, and optimizes RF performance.
Digital Cameras	Absorbs circuit-to-circuit EMI interference and unwanted emissions from the imaging CCD's.
Automotive Electronics	Suppresses interference from on-board electronics, such as telematics, on-board radar-based systems, GPS circuitry, and display systems.
Radio-Frequency Identification (RFID)	High-permeability Wave-X enhances the transmission range of the tag by optimizing the antenna pattern.
Satellite Receivers	Provides signal isolation at the up/down converter.
Medical Equipment	Ensures a stable and reliable signal throughout the circuitry, and absorbs emissions from LCD displays.



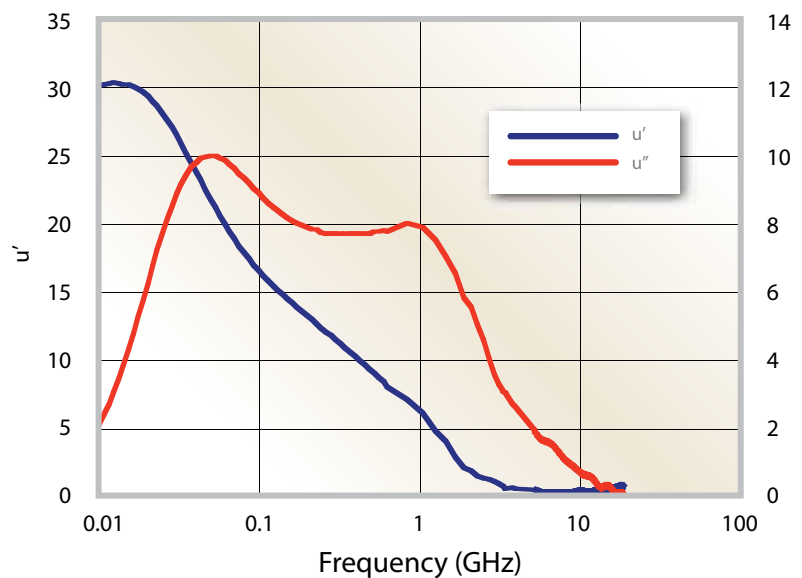
Wave-X sheet solutions

WX-A Series:

Specifically designed with high permeability, temperature and corrosion resistance.

The WX series provides superior EMI absorption by combining proprietary, high-performance magnetic materials into a flexible, resilient elastomer. By precisely blending our refined fillers in exacting ratios with polymer substrate materials, we have created a thin, flexible EMI absorbing sheet that will attenuate from 100MHz to 3GHz. Wave-X WX-A series is a Halogen free product and passes the ASTM salt fog test.

WX Series Typical Permeability



WX-B Series:

EMI Suppression and Absorption

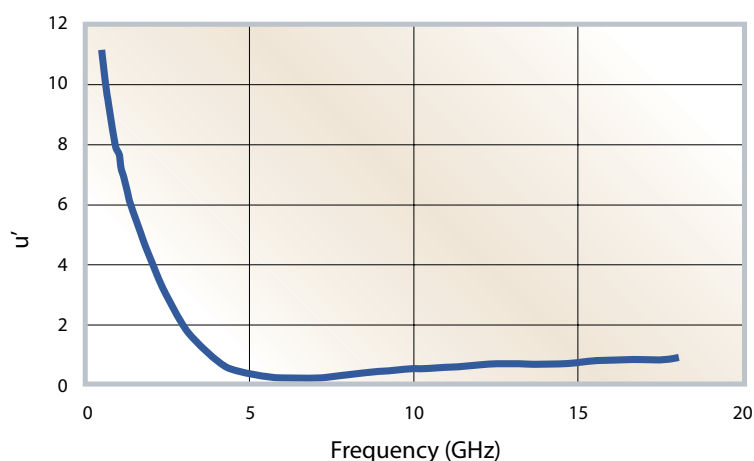
WX-B is specifically designed for UL94 VO flame retardant rating. The same specialized filters that are used in WX-A for optimum suppression and absorption are also incorporated into WX-B.

WX-C Series:

EMI Suppression and Absorption

Our ultra-thin Wave-X WX-C™ has highly effective energy absorption properties of proprietary high performance, high μ , non-conductive magnetic materials. It has the desirable physical characteristics of a flexible, strong polymer yet in cross sections as thin as 0.001" (0.025mm).

WX-C Permeability (μ')



WX Series technical specifications

	WX-A	WX-B	WX-C
Frequency range	100 MHz – 18GHz	100 MHz – 18GHz	100 MHz – 18GHz
Operating temperature	-65° to +250°F -54° to +121°C	-65° to +250°F -54° to +121°C	-65° to +250°F -54° to +121°C
Available thickness (excluding adhesive)	.005", .010", .020", .040" 0.13, 0.25, 0.5, 1.0mm (custom sizes available)	0.010" ± 0.001" 0.254mm ± 0.025mm	0.001" 0.025mm
Surface resistance	>1MΩ	>1MΩ	>200MΩ
Elongation	46%	18%	3%
Flammability	—	UL-94 V-0	—
Environmental Compliance	RoHS Compliant	RoHS Compliant	RoHS Compliant
Halogen Content	Halogen Free	—	Halogen Free
Product format	Sheets or rolls Cut to size & shape Pressure sensitive adhesive (optional) Ground plane (optional)	Sheets 12x12" ± 0.125" (30.5x30.5cm ± 3.2mm) PSA: Thickness 0.09mm (0.0035")	Sheets 6x12" ± 0.125" (15.25x30.5cm ± 3.2mm) Available in 7" width rolls upon request

Wave-X™ HEAT shrink tube solutions

Wave-X HEAT

Shrink Tube Absorber

Easily eliminate traveling waves and control cable emissions

Wave-X Heat - yet another EMI absorber innovation from ARC Technologies. Wave-X Heat is a heat-shrinkable tube absorber. It's designed to integrate seamlessly with your wire and cable assemblies, neatly sealing junctions and connector interfaces – while absorbing unwanted EMI interference.

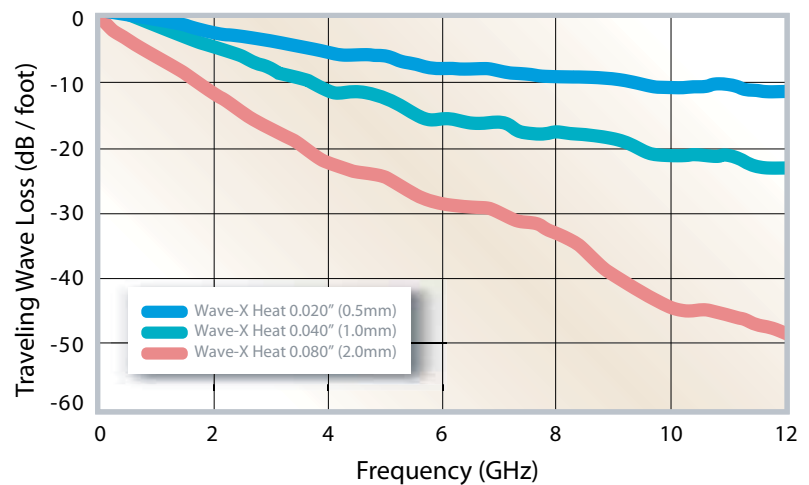
EMI interference, both conducted and radiated, is a common problem with wires, cables and interconnects. A traditional solution has been to install bulky, heavy and visually unattractive ferrite cores onto the cable and then over-mold the ferrite.

Wave-X Heat is simply slipped over the cable or connector, heat is applied and the absorber shrinks to conform.

When moderate heat is applied, the product shrinks to approximately a 3:1 ratio.



Traveling Wave Cable Loss of Wave-X Heat Shrink Tubing: Along 1 Foot Length
1 foot = 30.48cm



Wave-X HEAT Dimentional Data

ARC Part Number	Minimum Expanded ID	Rec ID Max.	Maximum Length
WH-A125-020	0.125" (3.18mm)	0.040" (1mm)	60.0 ± 0.5" (152.4 +- 1.27cm)
WH-A188-020	0.188" (4.78mm)	0.060" (1.5mm)	60.0 ± 0.5" (152.4 +- 1.27cm)
WH-A375-040	0.375" (9.5mm)	0.125" (3.2mm)	60.0 ± 0.5" (152.4 +- 1.27cm)
WH-A750-040	0.750" (19.1mm)	0.250" (6.4mm)	60.0 ± 0.5" (152.4 +- 1.27cm)
WH-A100-080	1.000" (2.54cm)	0.320" (8.13mm)	60.0 ± 0.5" (152.4 +- 1.27cm)

* Other diameters available upon request. Please email sales@arc-tech.com

Wave-X HEAT PERFORMANCE DATA

Minimum Shrink Temperature	248°F (120°C)
Operating Temperature	-67°F to 230°F (-55 °C to 110°C)
Linear Shrink	+1/-10%

Wave-X HEAT Test Procedure & Condition

Property	Test Method	Typical Performance
Physical		
Tensile Strength	ASTM D2671	1600 psi
Elongation	ASTM D2671	600%
Longitudinal Change	ASTM D2671	10% max
Specific Gravity of Jacket		1.3
Heat Resistance	168hrs @ 302 ± 41°F (150 ± 5°C)	No cracking, flowing or dripping of outer wall.
Heat Shock (4hrs @ 482°F (250°C))	ASTM D2671	No cracking, flowing, or dripping of outer wall.
Low Temperature Flexibility (4hrs @ -67°F (-55°C))	ASTM D2671	No cracking or splitting of outer wall
Flammability	ASTM D2671 Procedure B	Pass



Wave-X molded and extruded solutions

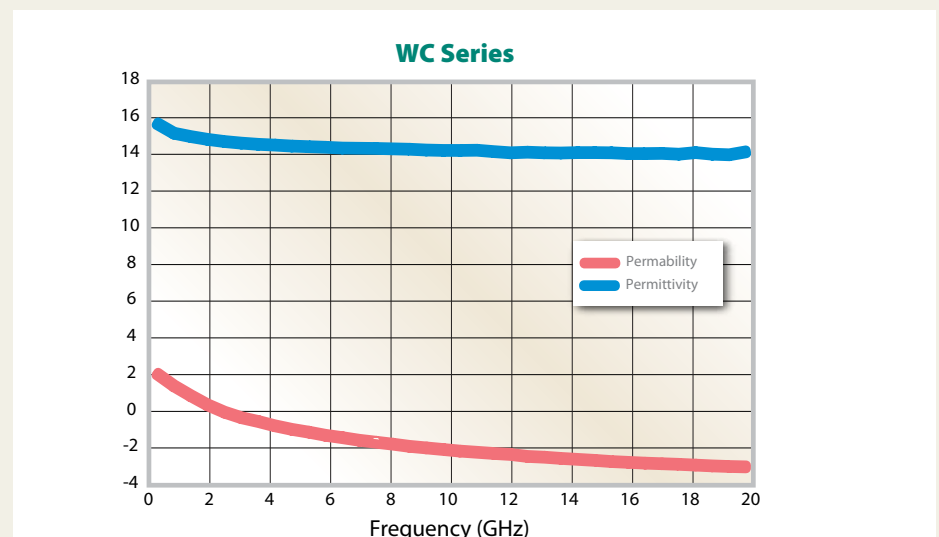
Molded configurations for easy integration

Wave-X can be custom molded into any shape and size to provide unique solutions to meet a wide variety of noise reduction and absorption challenges. Using your specifications, the Wave-X injection molding process allows for seamless integration into your products.

WC Series

The Wave-X WC Series of products are custom-designed chip cap suppressors that can be placed directly on a noisy chip, effectively eliminating undesirable signals across a wide range of frequencies from 1GHz to over 40GHz. Each chip cap consists of a magnetic metallic powder encapsulated into a flexible polymer such as TPE or urethane.

The chip caps can be easily attached to either the chip package or leads and will act as a mode suppressor that absorbs RF and EMI energy. A wide range of applications can be accommodated by using our innovative molding process. Numerous configurations are available including complete coverage, open top, and lead suppression only.



WC Series technical specifications

Hardness (Shore A)	35 – 70
Operating temperature	-60° to +375° F / -51° to +190°C Silicone
Electrical properties	Typical performance 50% or greater noise attenuation
Frequency range	0.8GHz-40GHz

Extrudable absorbers and suppressors

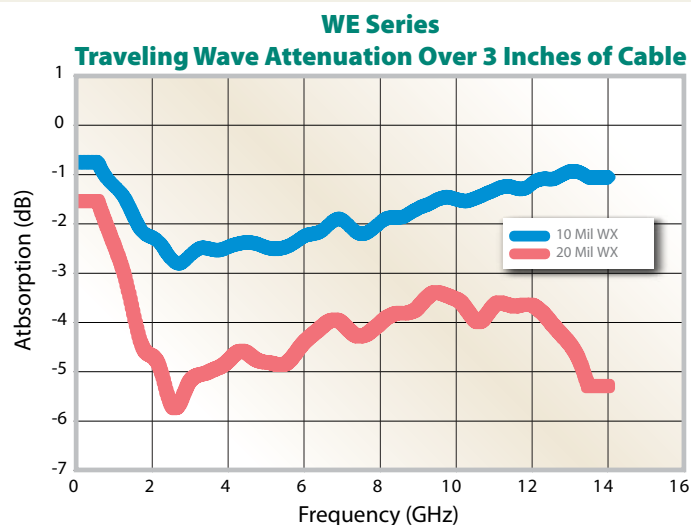
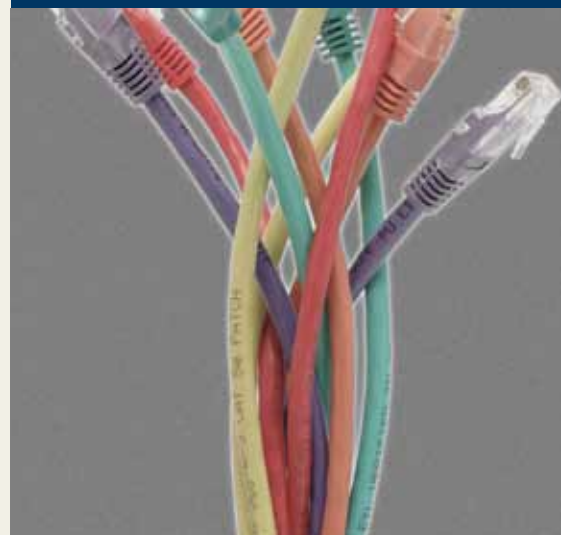
The ability to extrude Wave-X means that signal interference from system cables or interconnects can be easily controlled, while reducing manufacturing costs and increasing reliability.

WE Series

Wave-X is the only EMI noise absorption technology that can be seamlessly integrated over the wire, and directly under the outer jacket, during the cable manufacturing process. This unique product isolates the cable from external noise sources and controls cable emissions. ARC Technologies will work with you and your cable provider to develop the appropriate solution utilizing the Wave-X technology base.

By using Wave-X noise absorbing material, you can now design cable assemblies knowing that signal noise issues will be eliminated.

Wave-X WE Series combines the highly effective energy absorption properties of proprietary high performance magnetic materials with the desirable physical characteristics of flexible thermoplastic polymers. The entire WE Series product line has been engineered for durability and flexibility, even at low temperatures.



WE Series technical specifications

Frequency range	700MHz – 5.6GHz
Operating temperature	-59° to +176°F/ 50° to +80°C
Available thickness (excluding adhesive)	As required
Surface resistance	>1MΩ
Elongation	>30%

Wave-X thermoplastic solutions

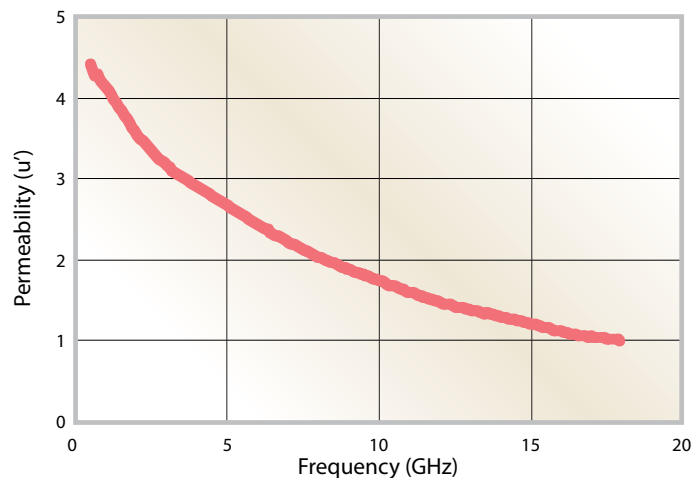
WT Series

Rigid and flexible injection molded absorber structures

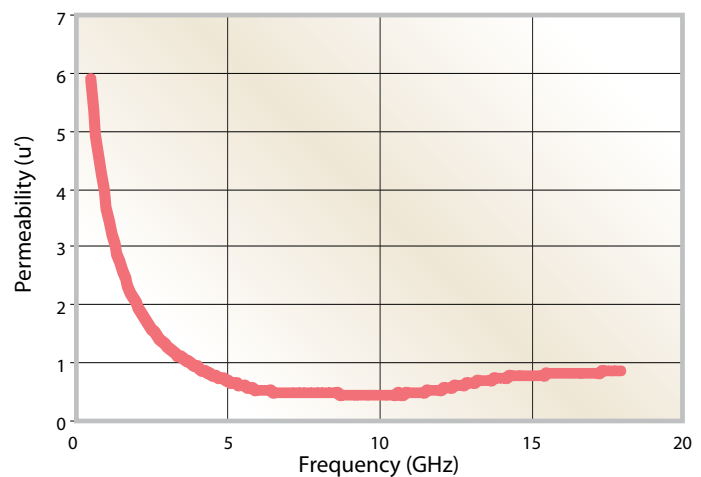
The Wave-X WT series of molded thermoplastic absorbers allows an unparalleled level of design flexibility. Solutions to EMI and RF interference problems no longer need to be an add-on component in your design. With Wave-X WT the absorber and physical structure of your product are integrated as one. Enclosures become the EMI suppression mechanism ... circuit noise is suppressed with a molded absorber structure ... RF stages are isolated with partitions eliminating the need for multiple metal shielding cans.

WT Series absorbers can be formulated with several different rigid or flexible polymers as well as permeable metal fillers to optimize the effectiveness of your design.

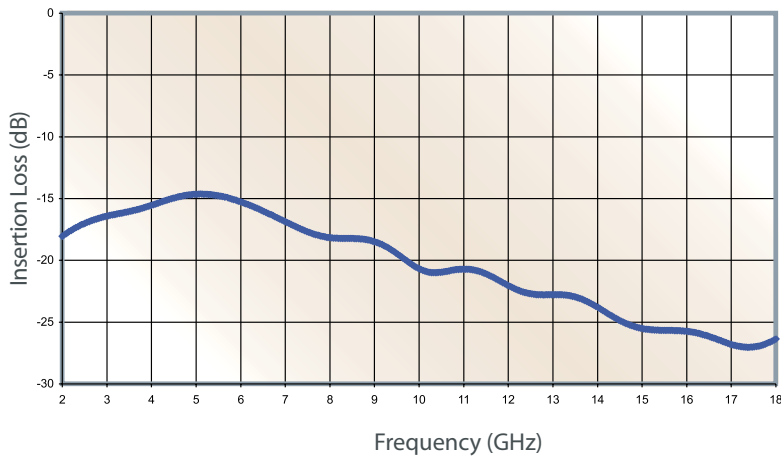
WT Series CIP



WT Series Ferrite



Typical Insertion Loss of WT-Carbon



- **WT – CARBON:** this carbon filled plastic enables the design of lightweight, physically strong absorber structures and covers able to attenuate EMI from 2 to 18GHz. Additionally, WT – C products can be designed to protect your circuits from ESD.

WT technical specifications

	WT-KPIG	WT-KFIC	WT-YPIF	WT-YFIA	Test Method
Frequency Range	800MHz – 40GHz	800MHz – 40GHz			
Part size	Can be injection molded to any configuration				
Product Form	Flexible	Flexible	Rigid	Rigid	
Operating temperature	120 °F (49 °C)	120 °F (49 °C)	180 °F (82 °C)	180 °F (82 °C)	
Tensile strength	475 psi	825 psi	2400 psi	2200 psi	ASTM D638
Elongation	250 %	8.1 %	20 %	0.6 %	ASTM D638
Specific gravity	3.85	3.18	3.25	2.87	
Surface resistance	5.2 x 10^12 Ω/sq	5.7 x 10^8 Ω/sq	1.8 x 10^13 Ω/sq	7.2 x 10^5 Ω/sq	
Color	Gray (can be painted to color match)	Black (can be painted to color match)	Gray (can be painted to color match)	Black (can be painted to color match)	
Heat Deflection Test (C)	—	—	83	99	ASTM D648-07 Method B
Heat Deflection Test (F)	—	—	182	210	ASTM D648-07 Method B
Thermal Conductivity (W / m-k)	1.12 at 25C	1.08 at 25C	4.96 at 25C	1.97 at 25C	ASTM E1530-06
Izod Impact Notched (ft lb / in)	—	—	2.5	1.5	ASTM D 256-06a Method A
Izod Impact Unnotched (ft lb / in)	—	—	> 22	9.5	ASTM D 4812-06
Flexural Strength (PSI)	—	—	2570	2930	ASTM D790-07 Procedure A
Flexural Stress at 5% Strain (PSI)	146	241	—	—	ASTM D790-07 Procedure A
Flexural Modulus (PSI)	3700	7170	98100	153000	ASTM D790-07 Procedure A



Wave-X thermoplastic solutions

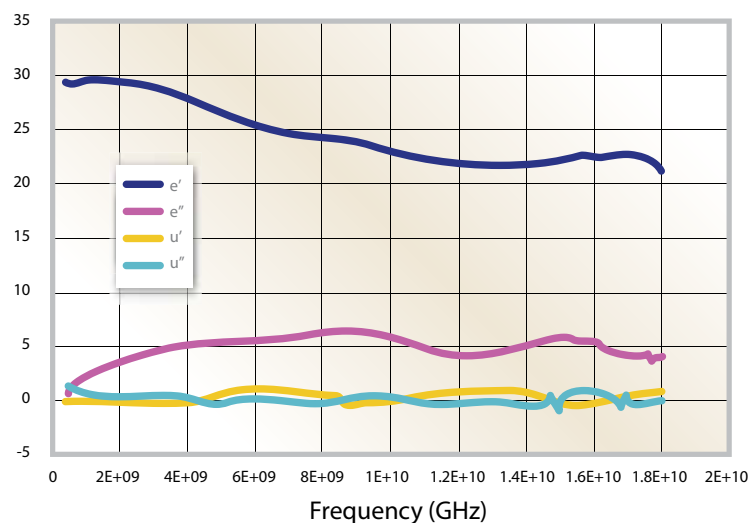
WK Series

Ultra Thin EMI Sheet Solutions

Comprised of an ultra-thin polyurethane film that has been treated on one side with a refined matrix of absorber materials, the WK Series represents a paradigm shift in absorber technology. With a thickness of only 60 microns (0.002"), WK absorbers will fit almost anywhere — even the minute spaces of a small enclosure.

WK Series sheets are insulated on one side so they can be placed in contact with low power active components. Because one side is insulated, it can be placed in contact with low power, active components. WK offers effective EMI control from 100MHz to 3GHz. Optionally, the WK Series can be ordered with a simple peel and stick backing, making application quick and easy.

Permittivity and Permeability (typical):



WK Series technical specifications

Frequency range	100MHz – 3GHz
Operating temperature	-13° to +212°F / -25° to +100°C
Available thickness (excluding adhesive)	0.002" 60 micron (0.06mm)
Surface resistance	>2M Ω insulated surface; 15+/-10 Ω absorber surface
Product format	Sheets or rolls (maximum width 36"/92cm) Cut to size & shape Pressure sensitive adhesive (optional)

Stop the problem before it stops you.

Find out what ARC Technologies and Wave-X can do to streamline your time-to-market product cycle and increase product reliability by avoiding costly delays caused by unacceptable EMI and RF interference. ARC's experience and proven absorber technologies can be used to solve your most challenging issues.

When an EMI problem arises, it's usually at the end of the development cycle – when you can least afford a delay. Re-engineering is a costly and time-consuming solution for something that can be quickly and easily remedied by ARC Technologies – and Wave-X.

Understanding where a problem might occur and finding a solution, without disrupting development and production, is what we deliver to our customers. ARC Technologies on-going technical support includes product testing and development consultation.

ARC Technologies

Simple solutions to complex problems

Since 1988, ARC Technologies has led the way in the development and implementation of innovative, efficient and cost effective solutions for a wide variety of microwave, radio frequency, and electro-magnetic interference engineering challenges. ARC's commitment to offering flexible off-the-shelf and customizable solutions for all your EMI and signal reduction requirements has enabled them to provide a broad range of solutions for noise reduction and absorption.

From aerospace to consumer electronic products, ARC is uniquely positioned to provide simple solutions to your complex engineering problems.

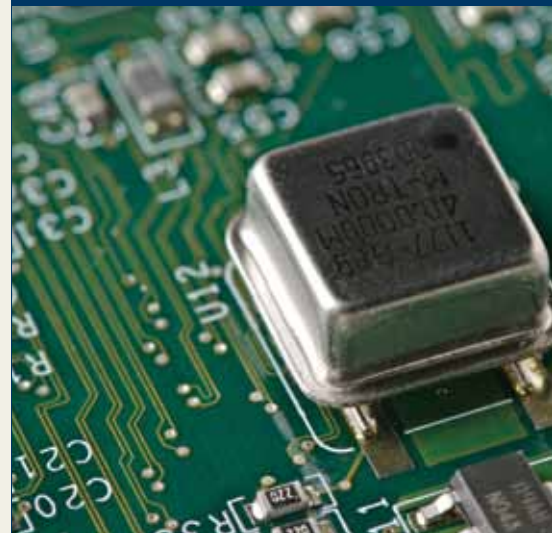
ARC Technologies provides companies with a robust suite of products for the ever increasing challenges faced by electronic engineers. From microwave and radar absorbing materials for the aerospace and defense industries to EMI and RF noise absorption solutions for consumer electronic products, ARC offers fast, effective response to all your development needs. Engineering disciplines include: Microwave, Radar, EMI/EMC, Metallurgy, Polymer Science, and Polymer Production Processes.

ARC can demonstrate that while the problems facing technology development are getting more complex, the solutions to EMI, RF, and SAR problems are often quite simple.

The ARC Technologies team will work with you in defining the requirements, and implementing and testing the material that is just right for your application.

ARC Technologies products are available worldwide, which ensures local support and availability when you need it. Contact ARC to find out more about the Wave-X family of solutions, and to see how Wave-X can be used to solve the challenges that you face today.

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