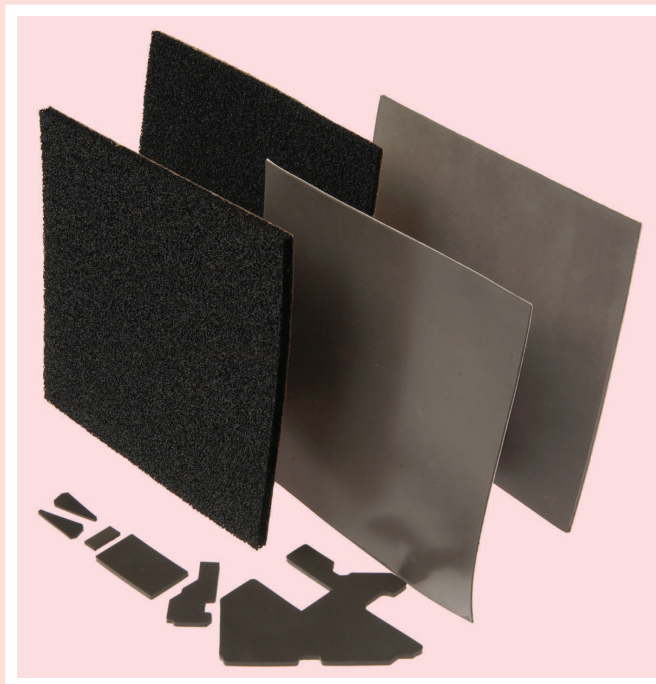


MW SERIES

MICROWAVE ABSORBERS



INTRODUCTION

THERE IS A GROWING INTEREST IN MICROWAVE ABSORBING MATERIALS. AS INDICATED IN THE NAME, MICROWAVE ABSORBERS ARE MATERIALS WHOSE ELECTRICAL AND MAGNETIC PROPERTIES ARE ALTERED TO ALLOW ABSORPTION OF MICROWAVE ENERGY AT DISCRETE OR BROADBAND FREQUENCIES. OUR GOAL IS TO BALANCE PERFORMANCE, THICKNESS, WEIGHT, MECHANICAL PROPERTIES AND COST ACCORDING TO THE CUSTOMER'S NEED.

ABSORBER TYPES

WE CAN OFFER DIFFERENT TYPES OF ABSORBERS ACCORDING TO CUSTOMER'S REQUIREMENTS.

ELASTOMERIC (RUBBER) ABSORBERS (SERIES MAG)

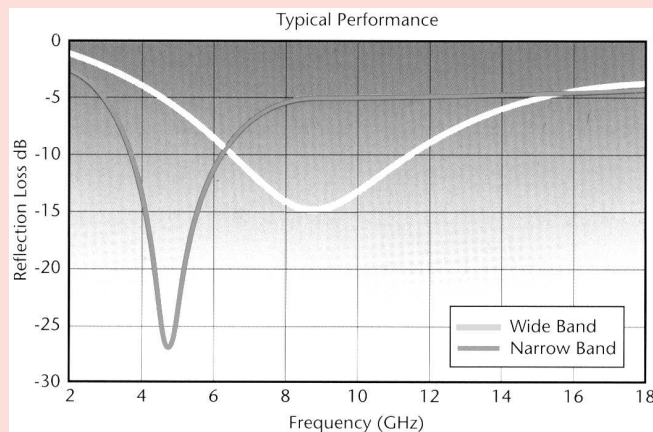
THIS SERIES COMBINES THE SUPERIOR ENERGY ABSORPTION PROPERTIES OF HIGH PERFORMANCE MAGNETIC MATERIALS WITH THE DESIRABLE PHYSICAL CHARACTERISTICS OF ELASTOMERIC BINDERS. THE RESULT IS A THIN, FLEXIBLE, RESONANT ABSORBER THAT CAN BE TUNED TO A WIDE RANGE OF FREQUENCIES AND BANDWIDTHS. IRON POWDERS AND FILLERS ARE COMBINED WITH GUMSTOCK SILICONE, NITRILE, URETHANE AND NEOPRENE RUBBERS IN EXACTING RATIOS FOR PRECISELY TUNED ABSORPTION. THROUGH COMPRESSION MOLDING, EXTRUSION, CALENDERING AND PROPRIETARY DISPENSING METHODS, WE ARE ABLE TO DELIVER PRODUCTS THAT ARE TAILORED TO YOUR SPECIFIC APPLICATION.

APPLICATION

- SPECULAR RETURN (RCS, AIRCRAFT EXTERIORS,..)
- SURFACE CURRENT REDUCTION
- SYSTEM ISOLATION

CHARACTERISTICS AND BENEFITS

- ATTENUATES FROM 500 MHz TO 40 GHz
- SPACE SAVING THIN MATERIAL
- DURABILITY
- EASILY CUT TO SHAPE
- MOISTURE AND CHEMICAL RESISTANT
- FUNCTIONAL OVER A WIDE TEMPERATURE RANGE
- INTEGRATED GROUND PLANE AVAILABLE
- EASY ATTACHMENT WITH PRESSURE SENSITIVE ADHESIVE
- RESISTANT FORMULATION AVAILABLE
- UL FLAMMABILITY RATINGS



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MICROWAVE ABSORBERS

THE SUBSTRATE MATERIAL ALLOWS TO OBTAIN DIFFERENT PERFORMANCES ACCORDING YOUR REQUIREMENTS. IN THIS TABLE DIFFERENT PERFORMANCES SPECIFICATIONS ARE SUMMARIZED.

| Substrate Material | Physical Characteristics | Temperature range |
|--------------------|--|-------------------|
| Silicone | Highly flexible; excellent environmental properties; UL94-V0 rated | -50°C to 190°C |
| Urethane | High abrasion resistance and tear strength; UL94-HB rated | -50°C to 135°C |
| Neoprene | Durable, weatherproof, economical | -40°C to 105°C |
| Nitrile | High moisture, fluid and fuel resistance | -40°C to 150°C |

FOAM ABSORBERS (SERIES FOL)

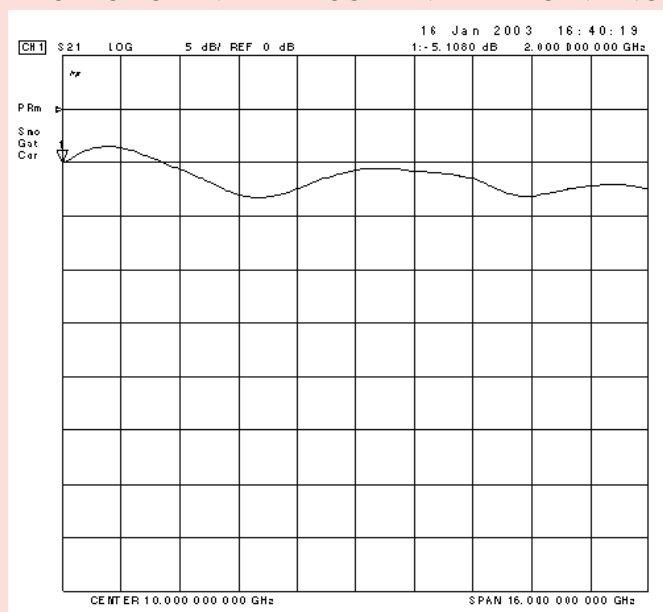
THIS FAMILY OF LOW-DENSITY, HIGH-LOSS FLEXIBLE EMI ABSORBERS ARE DESIGNED TO SOLVE A WIDE RANGE OF INTERFERENCE CONTROL PROBLEMS EASILY, QUICKLY AND COST-EFFECTIVELY. USING PROVEN FORMULAS, REFINED CARBON POWDERS IS COMBINED WITH BINDING AGENTS. THE ABSORBENT MIXTURE IS THEN INTEGRATED INTO AN OPEN CELL, POLYURETHANE FOAM STRUCTURE. THESE PRECISELY CONTROLLED, CARBON LOADED FOAM ABSORBERS OFFER EXCELLENT SUPPRESSION OF UNWANTED ELECTROMAGNETIC SIGNALS FOR A VARIETY OF APPLICATIONS INCLUDING TELECOMMUNICATIONS, HIGH-SPEED COMPUTERS, WIRELESS TECHNOLOGIES AND MICROWAVE SYSTEMS. BY VARYING THE THICKNESS AND LOADING LEVELS OF THESE UNIFORMLY LOADED FOAM SHEETS, FUTURA FOAM ABSORBERS CAN BE FREQUENCY-TUNED FOR A SPECIFIC APPLICATION.

CHARACTERISTICS AND BENEFITS

- ABSORPTION OF ELECTROMAGNETIC ENERGY FROM 2GHZ TO 40GHZ
- FLEXIBLE, LIGHTWEIGHT AND CONFORMABLE
- BROADBAND PERFORMANCE CHARACTERISTICS
- STANDARD THICKNESSES FROM 3.18MM - 50.8MM
- CUSTOM THICKNESSES UP TO 155 MM
- LOW COST EMI SOLUTION
- INTEGRATED GROUND PLANE AVAILABLE
- CONTROLS SURFACE CURRENT
- ENVIRONMENTALLY PROTECTIVE SURFACE COATINGS AVAILABLE
- CHOICE OF DIELECTRIC PROPERTIES TO OPTIMIZE ABSORPTIVE PERFORMANCE
- EASILY ATTACHED WITH PRESSURE SENSITIVE ADHESIVE
- UL94 HB FLAMMABILITY RATING (UL FILE NO. E204422)
- EASILY CUT, DIE-CUT OR FLEXED TO ANY SHAPE OR SIZE

AMONG THE FOAM FAMILY WE HAVE DIFFERENT TYPES OF FOAM ABSORBERS:

LOSSY FLEXIBLE FOAM: LOW DENSITY, HIGH LOSS, FLEXIBLE MICROWAVE ABSORBER. BY VIRTUE OF IT'S PRECISE CARBON IMPREGNATION, LOSSY FOAM IS IDEAL FOR SUPPRESSION OF ELECTROMAGNETIC ENERGY AND UNWANTED STATIC BUILDUP. THIS ABSORBER CAN EASILY BE CUT, WRAPPED, AND FIT FOR VARIOUS APPLICATIONS. PLACING THE MATERIAL WITHIN A CAVITY WILL REDUCE MULTIPLE REFLECTIONS RESULTING IN IMPROVED PERFORMANCE.



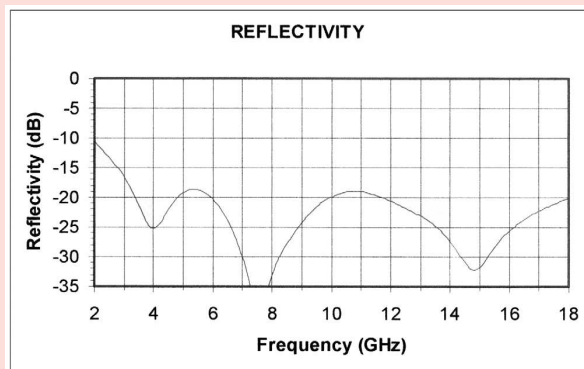
MW SERIES

MICROWAVE ABSORBERS

MULTILAYER FOAM: THE MULTILAYER SERIES IS A FAMILY OF LIGHTWEIGHT, FLEXIBLE, OPEN-CELL FOAM ABSORBERS THAT ARE DESIGNED FOR BROADBAND APPLICATIONS. MULTILAYER ABSORBERS FUNCTION ON AN IMPEDANCE MATCHING PRINCIPLE. MAXIMUM BROADBAND PERFORMANCE IS ACHIEVED BY LAMINATING INDIVIDUAL LAYERS THAT HAVE BEEN LOADED FOR PREDETERMINED LOSS TANGENTS. BECAUSE THE MULTILAYER ABSORBER IS ELECTRICALLY, RATHER THAN GEOMETRICALLY TAPERED, REFLECTION LOSS CHARACTERISTICS OF -20DB ARE ACHIEVABLE IN A SPACE EFFICIENT PACKAGE.

APPLICATIONS:

- CROSSTALK REDUCTION
- ANTENNA SHROUDING
- SHADOWING PARTS FOR RCS MEASUREMENTS
- SHADOWING COMPONENTS OF ANECHOIC CHAMBERS

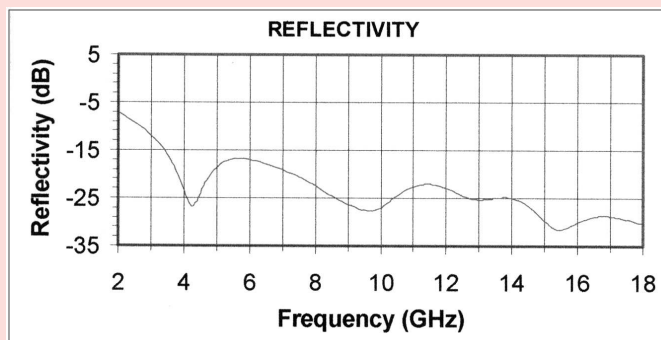


| | |
|----------------------|--|
| Standard Sheet size | 610 x 610 mm; other size available |
| Standard thicknesses | (7, 11, 19, 29, 57, 115 mm); other thicknesses available |
| Foam density | 32 Kg/m ³ |
| Color | Black |
| Temperature | -60 °C to 135 °C |

RETICULATED FOAM: THE RETICULATED SERIES IS A GROUP OF OPEN-CELL, CARBON-LOADED FOAM ABSORBERS. EXACTING CONTROL OF THE CONDUCTIVE GRADIENT PROVIDES OUTSTANDING BROADBAND PERFORMANCE. RETICULATED FOAM'S OPEN CELL STRUCTURE IS AN EXCELLENT CONDUIT FOR CONVECTIVE AIRFLOW. LIGHTWEIGHT AND FLEXIBLE, RT IS OFFERED IN FLAT FORM OR IN A CONVOLUTED FORMAT FOR HIGHER ELECTRICAL PERFORMANCE.

APPLICATIONS:

- ANTENNA AND ANTENNA ARRAY ISOLATION
- CAMOUFLAGE OF REFLECTIVE OBJECTS
- ANTENNA SHROUDS
- RF INTERFERENCE SUPPRESSION



| | |
|----------------------|---|
| Standard Sheet size | 610 x 610 mm; other size available |
| Standard thicknesses | (10 to 105 mm); other thicknesses available |
| Foam density | 32 Kg/m ³ |
| Color | Black |
| Temperature | -70 °C to 150 °C |

MW SERIES

MICROWAVE ABSORBERS

HONEYCOMB ABSORBERS

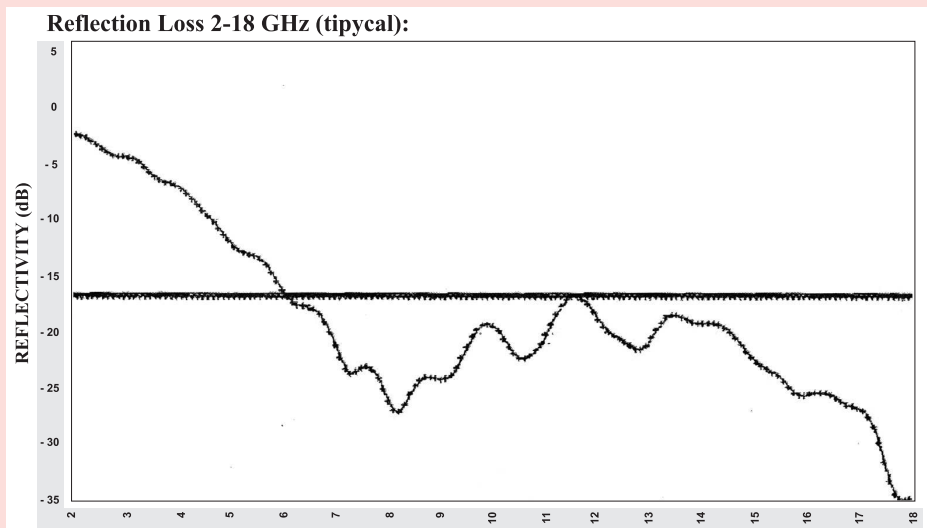
THE HONEYCOMB SERIES OFFERS EXCELLENT BROADBAND PERFORMANCE AND IS LIGHTWEIGHT YET MECHANICALLY STRONG. HC PRODUCTS ARE ENGINEERED TO MEET EACH CUSTOMER'S ELECTRICAL SPECIFICATIONS BY TAILORING PROPRIETARY COATINGS AND THEIR THICKNESS. HC PRODUCTS ARE LIKELY CANDIDATES WHEN STRUCTURAL INTEGRITY, HIGH POWER HANDLING AND CONVECTIVE COOLING ARE REQUIRED IN A BROADBAND ABSORBER.

APPLICATIONS:

- ANTENNA CAVITY INSERTS
- ENHANCE ANTENNA PERFORMANCE
- RADAR ABSORBING STRUCTURE
- REDUCED SIDE LOBE REFLECTION
- REDUCED SIDE LOBE REFLECTION

CHARACTERISTICS AND BENEFITS

- BROADBAND ABSORPTION FROM 500 MHZ TO 40 GHZ
- CAN BE FABRICATED TO CUSTOM CONFIGURATIONS
- EXCELLENT CONVECTIVE AIRFLOW
- SUPERIOR STRUCTURAL INTEGRITY AND LIGHT WEIGHT
- AVAILABLE W/SKIN FOR RAS APPLICATIONS
- CUSTOM TUNING
- AVAILABLE IN FLAT OR PYRAMIDAL FORM



CHIP CAPS

A NEW CONCEPT FOR CONTROL OF HIGH FREQUENCY INTERFERENCE FROM SURFACE MOUNT OR PLUG-IN CHIPS. FUTURA CHIP-CAP ABSORBER PRODUCTS ARE QUICKLY AND CONVENIENTLY MOUNTED OVER THE NOISY CHIP AND ARE DESIGNED TO SUPPRESS UNDESIRABLE SIGNALS OVER A WIDE RANGE OF FREQUENCIES, FROM 500MHZ TO OVER 40GHZ. THE CHIP-CAP CONSISTS OF A MAGNETIC ABSORBER LOADED WITH METALLIC POWDER, ENCAPSULATED IN FLEXIBLE POLYMER SUCH AS SILICONE OR URETHANE. THEY FUNCTION AS A MODE SUPPRESSOR OR SIGNAL ISOLATOR TO ABSORB HF ENERGY EMANATING FROM THE CHIP PACKAGE AND LEADS. ATTACHMENT IS ACCOMPLISHED BY PRESSURE SENSITIVE ADHESIVE OR THE ABSORBER CAN BE RETAINED IN PLACE BY A HEAT SINK, IF USED. MANY PARTS ARE UL94 RATED.

CHARACTERISTICS AND BENEFITS

- DESCRIPTION: HIGH PERMEABILITY FILLERS LOADED INTO FLEXIBLE SILICONE OR URETHANE RESINS
- HARDNESS, SHORE A: >70
- TEMPERATURE RANGE: -55°C TO +195°C (SILICONE), -55°C TO +135°C (URETHANE)
- ELECTRICAL PROPERTIES: DEPENDS ON FILLER AND LOADING %
- ATTENUATION FREQUENCY RANGE: 0.5 TO 40 GHZ



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MICROWAVE ABSORBERS

FU-WX SERIES

FU-WX PRODUCTS WAS INTRODUCED IN RESPONSE TO TECHNICAL NEEDS FOR A LOW PROFILE EMI ABSORBER THAT IS READILY CONFORMABLE AND EASY TO INSTALL. EMI IS NOT A SINGLE-SOURCE PROBLEM WITH A SINGLE-PRODUCT SOLUTION. THAT'S WHY FU-WX IS OFFERED IN AN ARRAY OF SIZES, FEATURES AND FORMULATIONS.

FU-WX PRODUCTS PROVIDE EMI SUPPRESSION AND/OR ABSORPTION OF RADIATED EMISSIONS GENERATED BY:

- TELECOM & COMPUTER SYSTEMS
- ELECTRONIC ENCLOSURES
- CABLES
- PCBS
- ISOLATED CIRCUITS
- ON-BOARD COMPONENTS
- HEAT SINKS
- INTEGRATED CIRCUITS
- MULTICHIP MODULES

| | |
|---------------------|------------------|
| FREQ. RANGE | 100 MHz - 5 GHz |
| OPERATING TEMP. | -55° / +180°C |
| THICKNESS | 0.5 mm - 6.35 mm |
| SURFACE RESISTIVITY | >1MΩ |

CHARACTERISTICS AND BENEFITS

- EXCELLENT MECHANICAL CONFORMABILITY PROPERTIES
- EASILY CUT TO ANY SIZE AND SHAPE
- 3-DIMENSIONAL/ASYMETRICAL SHAPES AVAILABLE
- EASY ATTACHMENT - JUST PEEL AND STICK WITH PRESSURE SENSITIVE ADHESIVE
- SPACE SAVING, THIN MATERIAL
- CAN BE INJECTION OR COMPRESSION MOLDED
- EFFECTIVE FREQUENCY RANGE: 100MHz to 60GHz
- EXCELLENT ATTENUATION AND MODE SUPPRESSION
- FREQUENCY-SPECIFIC PRODUCT TUNING
- IDEAL FOR ON-CHIP SUPPRESSION
- INTEGRATED GROUND PLANE AVAILABLE
- THICKNESS RANGE 0.05MM TO 6.35 MM

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MICROWAVE ABSORBERS

RIGID ABSORBER

RIGID, MAGNETICALLY-LOADED, ELECTRICALLY NON-CONDUCTIVE EPOXY. THIS MATERIAL IS EXTENSIVELY USED IN THE WAVEGUIDE INDUSTRY AS AN ABSORBER, ATTENUATOR OR FOR TERMINATION PURPOSES. APPLICATIONS ALSO EXIST IN THE ANTENNA INDUSTRY WHERE HIGH INSERTION LOSS IS NEEDED FOR ANTENNA ISOLATION OR THE SUPPRESSION OF SURFACE CURRENTS. THIS PRODUCT IS SUPPLIED IN RIGID FORM, WHICH OFFERS EXCELLENT MACHINABILITY TO CLOSE TOLERANCES USING STANDARD MACHINE TOOLS. FUTURA HAS THE CAPABILITY TO MOLD AND/OR MACHINE THIS MATERIAL TO SPECIFIED FORM FACTORS AND SIZE.

TYPICAL PROPERTIES

| | |
|-------------------------------------|---|
| COLOR: | GRAY |
| DENSITY: | 4.3 G/CM ³ |
| TEMPERATURE RANGE: | -55°C TO +155°C (-67°F TO +311°F) |
| DUROMETER: | SHORE D: >85 |
| TENSILE STRENGTH: | >555.4 KGF/CM ² (>7,900 PSI) |
| WATER ABSORPTION: | <0.3% PER 24 HOURS |
| THERMAL EXPANSION: | 30 X 10 ⁻⁶ PER C |
| DIELECTRIC CONSTANT @ 10GHZ: | 22.4 |

THE FOLLOWING TABLE SUMMERIES THE MAIN ELETRICAL PROPERTIES OF THIS KIND OF MATERIAL:

| Frequency (GHz) | 2 | 3 | 5 | 8 | 10 | 15 | 18 |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| ϵ' | 23.82 | 23.48 | 22.92 | 22.58 | 22.42 | 22.29 | 22.21 |
| ϵ'' | 1.75 | 1.74 | 1.29 | 1.42 | 1.41 | 1.32 | 1.33 |
| Loss tangent | 0.073 | 0.074 | 0.056 | 0.063 | 0.063 | 0.059 | 0.059 |
| μ' | 4.42 | 3.73 | 2.68 | 1.78 | 1.44 | 0.89 | 0.89 |
| μ'' | 2.14 | 2.31 | 2.38 | 2.09 | 1.94 | 1.52 | 1.30 |
| Mag loss tangent | 0.484 | 0.619 | 0.888 | 1.174 | 1.347 | 1.708 | 1.461 |
| dB / cm | 37.5 | 51.5 | 73.9 | 93.6 | 104.4 | 121.8 | 145.7 |