Conductive Elastomer
EMI Shielding/Grounding Spacer Gaskets

The integrated *conductive elastomer/plastic spacer gasket* is a low cost, easily installed system for providing EMI shielding and grounding in small electronic enclosures.

EMI Spacer Gaskets

The unique design of Chomerics' EMI spacer gaskets features a thin plastic retainer frame onto which a conductive elastomer is molded. The elastomer can be located inside or outside the retainer frame, as well as on its top and bottom surface. EMI spacer gaskets provide a new approach to designing EMI gaskets into handheld electronics such as digital cellular phones. Board-to-board spacing is custom designed to fit broad application needs. Customized cross sections and spacer shapes allow for very low closure force requirements and a perfect fit in any design or device.

Robotic Installation

Spacer gaskets can be installed quickly by robotic application. Integral locater pins in the plastic spacer help ensure accurate positioning in both manual and pick-and-place assembly. Benefits include faster assembly and lower labor costs.

CHO-SEAL® 1310 Conductive Elastomer

With EMI spacer gaskets, shielding and grounding are provided by Chomerics' CHO-SEAL 1310 conductive elastomer.

CHO-SEAL 1310 conductive elastomer is specifically formulated for custom shape molded parts. The material provides excellent shielding and isolation against electromagnetic interference (EMI), or acts as a low impedance ground path between PCB traces and shielding media. Physically tough CHO-SEAL 1310 elastomer minimizes the risk of gasket damage, in contrast to thin-walled extrusions or unsupported molded gaskets.

Silicone-based CHO-SEAL 1310 material offers excellent resistance to compression set over a wide temperature range, resulting in years of continuous service. It is filled with silver-plated-glass particles, which, because of their composition, size distribution, and morphology, provide excellent conductivity and long-term stability. The superior elongation and tensile strength of CHO-SEAL 1310 elastomer will prevent tearing in use due to mishandling.

Typical properties for CHO-SEAL 1310 material are shown on page 13.

High Shielding Performance

CHO-SEAL 1310 conductive elastomer provides more than 80 dB of shielding effectivness from 100 MHz to 10 GHz.

Low Volume Resistivity

CHO-SEAL 1310 material has exceptionally low volume resistivity, which makes it well suited for grounding applications in which a flexible electrical contact is needed.

Low Compression Gasket

Spacer gaskets are typically designed to function under low deflection forces. Chomerics uses design tools such as Finite Element Analysis (FEA) to accurately predict compression-deflection behavior of various cross section options. Refer to page 40.

LCP Plastic Spacer

Liquid crystal polymer (LCP) spacers, including those made with Vectra* A130 material, provide a

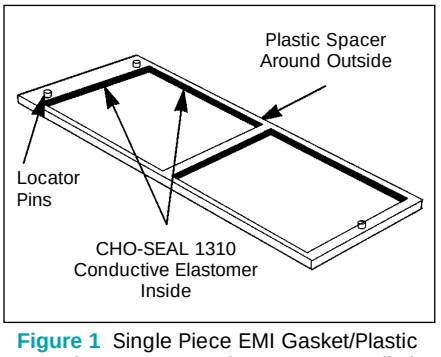

Figure 1 Single Piece EMI Gasket/Plastic Spacer for Accurate and Low Cost Installation

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stable platform for direct, high precision molding of conductive elastomers. The Vectra A130 material described in Table 1 has excellent heat deflection temperature characteristics (489°F, 254°C). For weight considerations, the LCP has a specific gravity of only 1.61. This plastic is also 100% recyclable.

Typical EMI Spacer Gasket Design Parameters

The EMI spacer gasket concept can be considered using the design parameters shown in Table 2. Some typical spacer gasket profiles are shown in Figure 2.

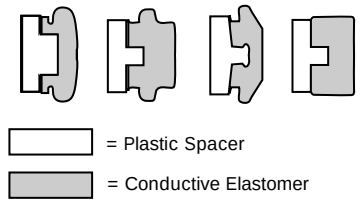

Figure 2 Typical Spacer Gasket Profiles

Applications for EMI Spacer Gaskets

The spacer gasket concept is especially suited to digital and dual board telephone handsets or other handheld electronic devices. It provides a low impedance path between peripheral ground traces on printed circuit boards and components such as:

- the conductive coating on a plastic housing
- another printed circuit board
- the keypad assembly

Typical applications for EMI spacer gaskets include:

- Digital cellular, handyphone and personal communications services (PCS) handsets
- PC cards (PCMCIA cards)
- Global Positioning Systems (GPS)
- Radio receivers
- Other handheld electronics, e.g., personal digital assistants (PDAs)
- Replacements for metal EMI shielding “fences” on printed circuit boards in wireless telecommunications devices

continued next page

AN EMI SPACER GASKET APPLICATION CASE STUDY

Design Problem

A manufacturer of cellular telephone handsets needed to provide a low impedance connection from the underside of a keyboard assembly to the ground trace on a circuit board.

Design Requirements

- Provide 360° low impedance connection from conductive coating to circuit board ground trace
- Low deflection forces available
- Low cost solution needed
- Sufficient EMI shielding of the handset needed to operate properly and meet commercial EMC regulations

Chomerics Solution

Three possible solutions were considered:

1. A small cross section conductive elastomer with conductive pressure-sensitive adhesive
2. A conductive, form-in-place elastomer
3. *An EMI spacer gasket system was chosen*, based on its ability to meet all of the manufacturer’s design requirements. It consisted of a Vectra LCP plastic spacer with Chomerics’ CHO-SEAL 1310 silver-plated-glass filled silicone elastomer injection molded onto the inside walls of the plastic frame.

Table 1

LCP PLASTIC SPACER TYPICAL PROPERTIES

Property	Test Method	Typical Value
Specific Gravity	ASTM D792	1.61
Tensile Strength @ Break, 10^3 psi (MPa)	ASTM D638	30 (207)
Tensile Modulus, 10^6 psi (MPa)	ASTM D638	2.4 (16.6)
Flexural Modulus, 10^6 psi (GPa)	ASTM D790	2.1 (15)
Compression Strength,1% Deflection, 10^3 (GPa)	ASTM D695	20 (140)
Compressive Modulus, 10^6 psi (GPa)	ASTM D695	1 (12)
Izod Impact Strength, Notched, ft-lb/in (J/m)	ASTM D256	2.8 (150)
Heat Deflection Temp., 66 psi, 0.46 N/mm^2 °F (°C)	ASTM D648	489 (254)
Volume Resistivity, ohm-cm	ASTM D256	10^{15}
Minimum Thickness for UL 94V-0 rating, inch (mm)		0.018 (0.45)
Limiting Oxygen Index (LOI)	ASTM D2863	37

Table 2

DESIGN PARAMETERS

Maximum overall dimension	18 inch x 18 inch (45.7 cm x 45.7 cm)
Minimum cross section	.050 inch (1.27 mm)
Minimum plastic cross section	.020 inch (0.51 mm)
Minimum elastomer cross section	.015 inch (0.38 mm)
Minimum plastic cross-sectional area	.001 inch^2 (.025 mm^2)
Minimum elastomer cross-sectional area	.0020 inch^2 (.051 mm^2)
Cross section tolerance (typical)	±.003 inch (.076 mm)
Plan view tolerance (typical)	±.005 inch (.127 mm)

Finite Element Analysis

Chomerics, a division of the Parker Hannifin Corporation's Seal Group, is the headquarters of Parker Seal's Elastomer Simulation Group. This unit specializes in elastomer finite element analysis (FEA) using MARC K6 series software as a foundation for FEA capability.

Benefits of FEA include:

- Quickly optimizing elastomer gasket designs
- Allowing accurate predictions of alternate elastomer design concepts
- Eliminating extensive trial and error prototype evaluation

Typical use of FEA in EMI spacer gasket designs is to evaluate the force vs. deflection requirements of alternate designs. For example, one spacer design features a continuous bead of conductive elastomer molded onto a plastic spacer. An alternative design employs an "interrupted bead," where the interruptions (gaps left on the plastic frame) are sized to maintain the required level of EMI shielding. Figure 4 illustrates these alternative designs.

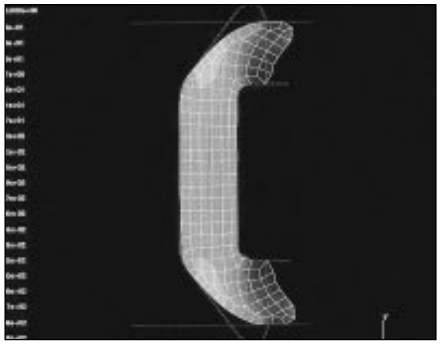

Figure 3 FEA Plot of an EMI Spacer Gasket Cross Section

Gasket Deflection

Figure 5 compares the effect of continuous and interrupted elastomer gasket designs in terms of the force required to deflect the conductive elastomer. This actual cellular handset application required a spacer gasket with interrupted bead to meet desired deflection forces.

Chomerics Design and Application Services

Chomerics will custom design a spacer for your application. Advice, analysis and design assistance will be provided by Chomerics Applications and Design engineers at no additional fee. Contact Chomerics directly at our Woburn, MA or Marlow, UK locations.

Figure 4 Continuous *(top)* and Interrupted Elastomer Gaskets

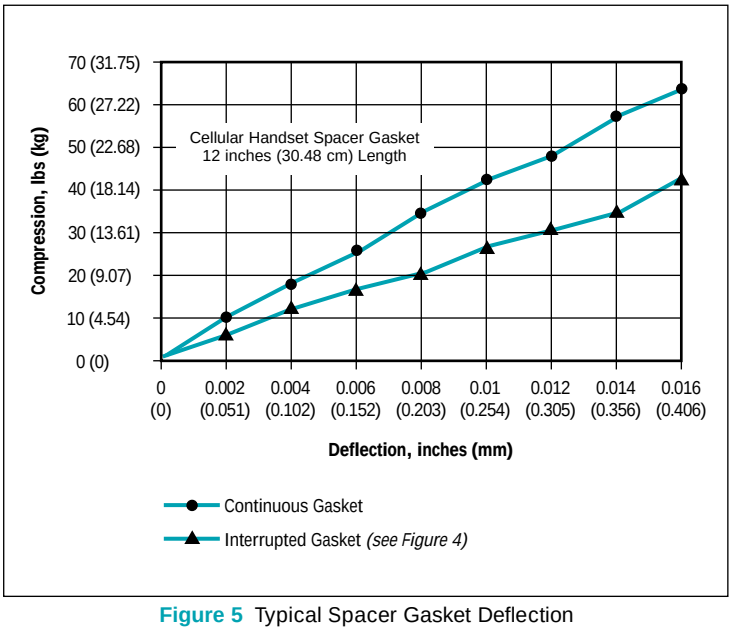

Figure 5 Typical Spacer Gasket Deflection

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