



Self Secured Housing For Electronics

Field Of The Invention

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This invention generally deals with housings for electronic assemblies and more particularly but not limited to such housings that are self secured and may provide electromagnetic shielding.

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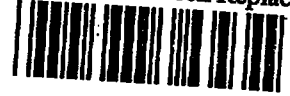
Background Of The Invention

Housings or packages for electronics are known. Such housings have taken many forms and have addressed many problems. Most such housings and associated techniques are not particularly useful where the application dictates severe constraints on the physical dimensions of the housing. Newly emerging applications with such size constraints include, for example, those defined by the Personal Computer Memory Card International Association (PCMCIA). Presently defined standards include a type I, type II, and type III package size. Generally these packages are 85.6 millimeters (mm) by 54 mm by, respectively, 3.3, 5, or 10 mm in thickness.

For these PCMCIA packages various approaches have been proposed, including essentially a frame and relatively thin covers secured to the frame by either adhesives or albeit small but nevertheless conventional mechanical fasteners or screws. This approach to a housing, while satisfying the size requirements presents problems regarding assembly efficiency, electromagnetic shielding, and possibly aesthetics.

Another approach, commercially available, that in summary represents a frame together with covers intended to lock over the periphery of the frame presents problems of housing or package integrity in many environments and does not provide satisfactory electromagnetic shielding.

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Practitioners have used a two piece shield for internal applications. Generally this includes a peripheral fence that is rigidly attached to a carrier and a cover that interlocks to the fence to provide an electromagnetic shield. Unfortunately this approach requires a rigidly fixed fence, is not sufficiently esthetically pleasing for an exterior package or housing, and the interlocking details may be subject to damage if used in an external application. Thus a clear need exists for a rugged esthetically pleasing housing that may be efficiently assembled and used for electromagnetic shielding.

Brief Description Of The Drawings

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. However, the invention together with further advantages thereof, may best be understood by reference to the accompanying drawings in which:

FIG. 1 is an exploded view, in perspective, demonstrating the major housing components in accordance with an embodiment of the instant invention.

FIG. 2 is a detailed cross sectional diagram of a portion of the FIG. 1 embodiment as assembled.

Detailed Description Of A Preferred Embodiment

Generally the instant invention provides a housing or package that may be advantageously deployed to house and protect an electronics assembly (123), such as a wireless data modem in a relatively diminutive and space efficient physical volume, such as required to satisfy a PCMCIA industry standard. Preferably the housing includes a frame together with a first and a second cover. The first and the second cover are

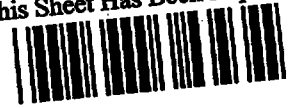


configured and arranged to interlock with one another and, preferably, to further interlock with the frame in a fashion that advantageously secures all three pieces into a housing that may be, simultaneously, small, durable, esthetically pleasing, easy to assemble, and a superior electromagnetic shield.

In particular, a preferred embodiment of the instant invention provides a 'snap together' housing that may be readily assembled and disassembled with simple single axis force and without additional tools, operations, processes, or mechanical fasteners, such as screws. Interlocking tabs among other mating features of the covers and the frame in the preferred embodiment are designed to be self-aligning and to allow for single axis assembly, thus facilitating a relatively simple robotics based manufacturing assembly process. The assembly process requires nothing other than firm pressure along the axis of assembly and the assembled housing has been shown to have exceptional integrity with no evidence of inadvertent disassembly. The covers may be fashioned from many metallic materials, such as phosphor bronze or stainless steel, and that together with controlling the dimensions of any allowed openings between, for example, the interlocking tabs results in a superior electromagnetic shield.

Additionally, the interlocking tabs which facilitate the electromagnetic shield are substantially hidden within the body of the frame when assembled, so as to require no additional cosmetic devices to conceal. Further the preferred embodiment advantageously uses covers with an external substantially planar surface to provide a natural surface that may be used, by for example painting or labeling, to establish the major aesthetic characteristics of the housing.

The present invention can be more fully appreciated by referring to the preferred embodiment depicted in the figures together with the following description. FIG. 1 illustrates an exploded view, in perspective, of the major housing components of a preferred embodiment of the instant invention. FIG. 2 is a



detailed cross sectional diagram of a portion of the FIG. 1 embodiment as assembled. Specifically, FIG. 1 depicts a self secured housing that includes a frame (101), a first cover (111), a plurality of semi flexible first fingers (113), a second cover (117),
5 and a plurality of semi flexible second fingers (119).

The frame (101) has a first side (203), a second side (205), a plurality of openings (107) preferably distributed along a periphery of one or more side rails (103), and one or more cross bars (104) joining the side rails (103). Each opening (107) has a
10 first side (209) separated by a thickness dimension (210) from a second side (217) and one or more bounding cross-members (216). Each of the openings (107) has a generally rectangular cross section bounded by the thickness dimension (210) and a length
15 dimension (108) representing the distance between opposite sides of the bounding cross members (216). Each opening (107) extends from the first side (203) to the second side (205) of the frame (101).

The thickness and length dimensions (210, 108) of each of these openings as well as the spacing between adjacent openings (107) was selected in view of the strength requirements of the
20 frame and the electromagnetic shielding properties required by the electronics assembly (123), specifically wireless data modem, that needed to be packaged and protected. Additionally, optimizing the physical interior volume or space available for the
wireless data modem dictated that all mechanical couplings
25 securing the various elements of the housing or package as well as the electronics assembly (123) should be located at or near the periphery or side rails (103) of the frame (101).

A minimum width (220) of 3.0 mm and a maximum thickness (222) of 3.3 mm for each side rail (103) has been
30 established by the PCMCIA packaging standard. The wireless data modem to be packaged in the preferred embodiment of the instant invention was expected to operate in the 805-825 MHz frequency band. From this the optimum thickness dimension (210) and length dimension (108) for the openings was
35 determined to be, respectively, 0.7 mm at the narrowest point



(parting line for the injection molding tool) and 6.75 mm with adjacent openings placed on 8.25 mm centers. The above dimensions leave 1.5 mm (8.25 mm - 6.75 mm) for the cross member dimension along the length dimension axis. The cross member dimension along the frame thickness dimension was selected as 2.0 mm. Together these dimensions provide a sufficiently small aperture for radio frequency (RF) energy interference at the

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The first cover (111) is substantially disposed, preferably largely in a first plane, on the first side (203) of the frame (101). The plurality of semi flexible first fingers (113) extend substantially perpendicular from and are mechanically coupled to, or preferably are formed from the same blank material as, the first cover. At least some portion of the plurality of first fingers (113) include a concave interlocking detail (215) and such first fingers are arranged and constructed for disposal in a corresponding one of the plurality of openings (107).

The material selected to fashion the first cover (111) from is a 0.2 mm thick, half hard, Stainless Steel 304, which provides a suitable combination of electrical characteristics and superior strength and stiffness properties. The first cover (111) may be manufactured using a die-cut, laser-etch, or wire Electrically Displaced Material (EDM) process, depending on the desired quantities. All bends may be created using standard forming techniques. Hence the first cover can be manufactured without

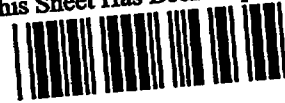


any draw forming operations and thus the associated cost of tooling for such an operation.

The semi flexible first fingers (113) depicted in their initial position (223) by the dashed outline in FIG. 2 are biased during the manufacturing process for the first cover (111) by over-
5 bending the first fingers approximately 3 degrees from their final, assembled, position. The over bending allows the semi flexible first fingers (113) to be assembled directly through the openings (107) in the frame (101) with, theoretically, zero
10 interference. Additionally, it pre-stresses the first fingers (113) so as to provide sufficient positive mechanical interference and thus electrical coupling, when assembled, with the semi flexible second fingers (119). Additionally, the ends of the semi flexible first fingers (113) are, preferably, formed into tabs (219) which
15 serve to act as guides to direct the semi flexible second fingers (119) during the assembly of the second cover (117).

The tabs (219), preferably, also engage the undercut (218) in the frame (101), as depicted in FIG. 2, thereby locking the first cover and the second cover to the frame when the housing is
20 assembled. Specifically, the self secured housing is assembled by placing the first cover (111) in position on the frame with the first fingers (113) disposed in corresponding openings (107) where each finger is occupying the initial position (223). The second cover (117) is then firmly pressed into position with the
25 second fingers (119) each urging a corresponding one of the first fingers (113) toward the first side (209) of the opening (107) and thus urging the tabs (219) to engage the undercuts (218).

The second cover (117), in the preferred embodiment, is substantially disposed largely in a second plane, on the second
30 side (205) of the frame (101). The plurality of semi flexible second fingers (119) extend substantially perpendicular from and are mechanically coupled to, or preferably are formed from the same blank material as, the second cover. At least some portion of the plurality of second fingers (119) include a convex interlocking
35 detail (221) and such second fingers are arranged and



constructed for disposal in the corresponding one of the plurality of openings (107). The second fingers (119) are each arranged to urge a corresponding one of the first fingers (113) toward the side (209) of the opening (107) and to thus engage the convex
5 interlocking detail (221) with the concave interlocking detail (215), whereby the frame (101) is secured between the first cover (111) and the second cover (117). So arranged the second fingers (119) are, preferably electrically coupled to the first fingers (113) and the first cover (111) together with the second cover (117) will
10 form an electromagnetic shield around a space or volume enclosed by the first cover (111) and the second cover.

Similar to the first cover (111), the second cover is formed of 0.2 mm thick, half hard stainless steel 304. When assembled the first and the second cover should not be allowed to bow,
15 across the width of the frame, from there original substantially planar orientation as this may deviate from the PCMCIA package standards. To accomplish this, the second fingers (119) of the second cover (117) are approximately half the length of the first fingers (113) of the first cover (111), imparting a mechanical
20 advantage to the second fingers over the first fingers, thus ensuring that the bulk of any stress transferred to either the first or the second cover, as a by-product of the assembly interconnection forces, would tend to be in the form of a concave deformation in the first cover (111). Observation of experimental
25 assemblies suggests that no deformation of the first or second covers results from the forces generated by the assembly.

It will be appreciated by those of ordinary skill in the art that the apparatus disclosed provides an approach to housing or packaging an electronics assembly in a relatively small physical
30 size without unduly sacrificing other essential requirements of such a package. This inventive apparatus may be advantageously deployed as a housing for a wireless packet data modem or other electronics assembly to provide a rugged aesthetically pleasing electromagnetically shielded package fully
35 compatible with any of the PCMCIA industry standard



packages. The present invention provides an exemplary electronics package that facilitates the operation of a computer and a wireless data radio deployed in close physical proximity and thus satisfies a growing and long-felt need of the wireless data communications industry for such functionality.

It will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than the preferred form specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the invention which fall within the true spirit and scope of the invention.

What is claimed is:

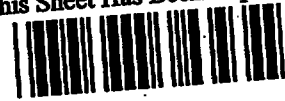


Claims

1. A self secured housing comprising in combination:
a frame having a first side, a second side, and a plurality
5 of openings, each opening having a side;
a first cover substantially disposed on said first side;
a plurality of semi flexible first fingers extending
substantially perpendicular from and mechanically coupled to
said first cover, some of said first fingers including a concave
10 interlocking detail, some of said first fingers each arranged and
constructed for disposal in a corresponding one of said openings;
a second cover substantially disposed on said second side;
and
a plurality of semi flexible second fingers extending
15 substantially perpendicular from and mechanically coupled to
said second cover, a portion of said second fingers including, a
convex interlocking detail each of said portion of said second
fingers arranged and constructed for disposal in said
corresponding one of said openings,
20 said portion of said second fingers each arranged to
urge a corresponding one of said first fingers toward said side of
said corresponding one of said openings and engage said convex
interlocking detail with said concave interlocking detail,
whereby said frame is secured between said first cover and said
25 second cover.



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2. The self secured housing of claim 1 wherein said frame further includes an undercut disposed on said side of said opening and said some of said first fingers include a tab that engages said undercut when said first fingers are urged toward
5 said side of said opening.

3. The self secured housing of claim 1 further including a length, width, and height dimension that is compatible with a Personal Computer Memory Card International Association
10 packaging standard.



4. A self secured housing for a transceiver constructed in accordance with a PCMCIA standard, comprising in combination:

5 a first cover substantially disposed in a first plane, said first cover including a plurality of semi flexible first fingers extending generally perpendicular from said first plane, some of said first fingers including, a concave interlocking detail,

10 a frame including a side rail, a portion of said rail having openings arranged such that said some of said first fingers are disposed within a corresponding one of said openings when said first cover is assembled to said frame, and

15 a second cover substantially disposed in a second plane, said second cover including a plurality of semi flexible second fingers extending substantially perpendicular from said second plane, some of said second fingers including a convex interlocking detail, each of said some of said second fingers being arranged and constructed for disposal in said corresponding one of said openings and to be electrically coupled to said some of said first fingers when said first cover and said
20 second cover are assembled to said frame, thereby forming an electromagnetic shield around a space enclosed by said first and said second cover.



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5. The self secured housing of claim 4 wherein said openings further include a side and said second fingers urge said first fingers toward said side when said first cover and said second cover are assembled to said frame.

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6. The self secured housing of claim 5 wherein said openings further includes an undercut disposed on said side of said opening and said some of said first fingers include a tab that engages said undercut when said first fingers are urged toward said side of said opening.

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