

EMI GASKET

TECHNICAL FIELD

The present invention relates to electromagnetic interference (“EMI”) gaskets, and more particularly to EMI gaskets intended for use with shielding
5 cages that provide protection and shielding from electromagnetic interference.

BACKGROUND

It is a common practice to connect a cable to a printed circuit board (PCB) by utilising a plug connector at an end of the cable which is intended for insertion into an opposing mating connector. The mating connector is typically mounted
10 on the PCB placed within a housing of an electronic device. There may be other electronic modules mounted on the PCB. Each electronic module may emit electromagnetic interference (“EMI”) that can interfere and negatively influence the signals transmission between the connectors.

The mating connector may be shielded from EMI by using a metal
15 shielding cage (or sometimes referred to as EMI shielding cage) that is also mounted on the PCB and which surrounds the mating connector in the electronic device. The cage has an opening which opens to a faceplate. The opening defines an entrance leading towards the mating connector into which the plug connector is inserted. However, even with the use of the cage, primarily at the area where
20 the cage meets the PCB and around the opening of the faceplate into which the cage opening extends, EMI may still be present.

Conductive gaskets of various forms have been developed to address this problem. PCT Pat Publication No. 2004/088381 discloses an electrically
conductive compressible gasket for a shielding cage with multiple module-
25 receiving bays. However, gaskets made using conductive foams are prone to

tearing and other damage. The degree of EMI protection may be dependent on the amount of conductive material in the conductive foam.

For the benefit of consumers, standards have been established within the electronics industry, especially in the areas of connector mechanical interfaces, signal and data transmission protocols, and signal and data exchange protocols. This interoperability will allow an electronic module that is made by one vendor to be replaceable with a similar module from another vendor. Thus, consumers will have more product choices and can benefit from this competition with more competitive device pricing.

In the electronics industry, there are many standards committees including but not limited to, the Institute of Electric and Electronic Engineers (“IEEE”) Committee which governs the specifications for data communication, the T10 Committee which defines the standards for data storage, and the Small Form Factor (“SFF”) Committee which specifies the standards for mechanical interfaces for connectors. SFF 8088 is one such standard set by the SFF Committee and it is a specification for mini multi-lane shielded connectors.

For reasons provided earlier, there is motivation for manufacturers to use conductive metallic gaskets instead of conductive foam gaskets for EMI shielding for their electronic devices. PCT Patent Publication No. 2007/079117 discloses an EMI shroud with bidirectional contact members. At this moment, the use of a conductive metallic gasket would cause the connectors to be non SFF 8088-compliant.

SUMMARY

It would be desirable to provide a gasket that has good EMI shielding and, when in use together with an EMI shielding cage, allows a mating connector to remain SFF 8088-compliant.

In accordance with one embodiment of the present invention, there is provided a gasket for use with an electromagnetic interference (EMI) shielding cage for a connector. The gasket comprises a conductive body having an opening configured to receive a first end of the EMI shielding cage near a gasket mating wall that is incorporated on the EMI shielding cage. The conductive body comprises a first face designed to face away from the gasket mating wall, a second face designed to face the gasket mating wall, an inner perimeter and an outer perimeter. A plurality of engagement tabs are disposed along the outer perimeter and extend away from the first face. A plurality of spring tabs are disposed along the inner perimeter and extend away from the second face. When the first end of the EMI shielding cage is inserted into the opening of the conductive body and an opening of an optional complementary faceplate with the engagement tabs facing the faceplate and the spring tabs facing the gasket mating wall of the EMI shielding cage, the engagement tabs and the spring tabs cooperatively maintain a predefined separation distance D1 between the gasket mating wall and the optional complementary faceplate.

In accordance with another embodiment of the present invention, there is provided an electromagnetic interference (EMI) shielding cage assembly with an EMI shielding cage and a gasket for use with the EMI shielding cage. The EMI shielding cage comprises a housing having a top panel, a back panel, two side panels and at least one slot configured at a first end of the EMI shielding cage. The EMI shielding cage provides an enclosure for EMI shielding for at least one connector when in use. The gasket comprises a conductive body having an opening configured to receive the first end of the EMI shielding cage near a gasket mating wall incorporated on the EMI shielding cage. The conductive body comprises a first face designed to face away from the gasket mating wall, a second face designed to face the gasket mating wall, an inner perimeter and an outer perimeter. The gasket further include a plurality of engagement tabs disposed along the outer perimeter which extend away from the first face and a

plurality of spring tabs disposed along the inner perimeter which extend away from the second face. When the first end of the EMI shielding cage is inserted into the opening of the conductive body and an opening of an optional complementary faceplate with the engagement tabs facing the faceplate and the
5 spring tabs facing the gasket mating wall of the EMI shielding cage, the engagement tabs and the spring tabs cooperatively maintain a predefined separation distance D1 between the gasket mating wall and the optional complementary faceplate.

The invention further includes any alternative combination of parts or
10 features mentioned herein or shown in the accompanying drawings. Known equivalents of these parts or features which are not expressly set out are nevertheless deemed to be included.

BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary form of the present invention will now be described with
15 reference to the accompanying drawings in which:

Figure 1 shows an exemplary electromagnetic interference (“EMI”) shielding cage in accordance with an aspect of the present invention, along with other devices that may be present when the EMI shielding cage is in use;

Figure 2 shows a side view of one embodiment of an EMI shielding cage
20 assembly in accordance with an aspect of the present invention;

Figure 3 shows a perspective view of the EMI shielding cage assembly in Figure 2;

Figure 4 shows a perspective view of one embodiment of an EMI gasket in accordance with an aspect of the present invention; and

Figure 5 shows a close-up side view of the EMI gasket in Figure 4 taken from the direction of arrow A.

While the above-identified drawing figures set forth several embodiments of the invention, other embodiments are also contemplated, as noted in the discussion. In all cases, this disclosure presents the invention by way of representation and not limitation. It should be understood that numerous other modifications and embodiments can be devised by those skilled in the art, which fall within the scope and spirit of the principles of the invention. The figures may not be drawn to scale. Like reference numbers have been used throughout the figures to denote like parts.

DETAILED DESCRIPTION

Figure 1 shows a perspective view of one embodiment of an electromagnetic interference (“EMI”) shielding cage **100** in accordance with an aspect of the present invention. The EMI shielding cage **100** is used for housing an electronic module. The electronic module which includes and is not limited to, a plug connector **50**, may be used to provide a connection between signal traces **126** on a printed circuit board (“PCB”) **34** and another electronic device (not shown). Such plug connectors are used commonly in data transmission servers and routers, for example. The plug connector **50** is plugged into an individual slot **2150** of the EMI shielding cage **100** wherein a mating connector **60** is mounted to the PCB **34**. The EMI shielding cage **100** has an opening at a first end **2100** that communicates with the exterior of a device (not shown), preferably through an optional complementary faceplate **28** of the device. The EMI shielding cage **100** is used to shield the connectors from external electromagnetic waves, as well as to contain electromagnetic waves emanating from the connectors.

Figure 2 shows a side view of one embodiment of an EMI shielding cage assembly **10** in accordance with an aspect of the present invention. The EMI

shielding cage assembly **10** comprises an EMI shielding cage **2000** and a gasket **1000**. The EMI shielding cage **2000** comprises a housing **2010** constructed from electrically conductive panels typically formed from sheet metal. The housing **2010** has an opening at a first end **2100** of the EMI shielding cage **2000** into
5 which the plug connector **50** will be inserted before engaging the mating connector **60**. A gasket mating wall **2200** incorporated on the housing **2010** is configured near the first end **2100** of the housing **2010**.

The electrically conductive panels comprise a bottom panel **2300**, a back panel **2130**, a pair of side panels **2140** and a top panel **2120**, all of which are
10 referred to herein as “exterior” panels of the EMI shielding cage **2000**. In a preferred embodiment, the top panel **2120** can define a cover portion of the EMI shielding cage **2000** while the bottom panel **2300**, the back panel **2130** and the side panels **2140** cooperatively define a base portion of the EMI shielding cage **2000**.

15 Although a two-portion cage is shown for the purpose of illustration, it will be understood that the exterior panels may all be formed together from a single piece of sheet metal. Those of ordinary skill in the art of sheet metal fabrication will recognise that the various exterior panels can be readily formed by bending a single, appropriately-sized sheet metal panel. In various equivalent
20 alternate embodiments, the various exterior panels **2300**, **2130**, **2140** and **2120** can also be formed from one or more individually-stamped panels that are assembled into the EMI shielding cage **2000**. Another embodiment may include the electrically conductive bottom panel **2300** replaced by a conductive layer of copper for instance, on the top surface of the PCB **34** to which the EMI shielding
25 cage **2000** would be attached.

When in use, the opening at the first end **2100** of the EMI shielding cage **2000** is aligned with an opening **30** (as shown in Figure 1) of the optional complementary faceplate **28** of the device. It is through the opening **30** that the

first end **2100** of the EMI shielding cage **2000** will pass through and be ready to receive the plug connector **50**. Since the optional complementary faceplate **28** is typically electrically conductive, it may provide some form of EMI suppression for the connectors. The optional complementary faceplate **28** is sized and shaped
5 such that the opening **30** encircles a portion of the bottom panel **2300**, the side panels **2140** and the top panel **2120**. However, the dimensions of the opening **30** of the optional complementary faceplate **28** do not normally allow for a tight mechanical and electrical connection between the optional complementary faceplate **28** and the exterior panels of the EMI shielding cage **2000**. The
10 improved electrical connection between the optional complementary faceplate **28** and the exterior panels may be provided by the gasket **1000** that is disposed on a first side **2210** of the gasket mating wall **2200** at a predefined separation distance **D1** behind the optional complementary faceplate **28** as shown in Figure 2.

In one embodiment, the base portion of the housing **2010** of the EMI
15 shielding cage **2000** is electrically and mechanically coupled to the cover portion of the EMI shielding cage **2000** and the bottom panel **2300** of the base portion be connected to a ground potential via conductive ground traces **127** (as shown in Figure 1) that exist on or within the PCB **34** on which the EMI shielding cage **2000** is disposed.

20 In one embodiment, at least one locating post **2310** is configured on the bottom panel **2300** at a distance **D2** away from a second side **2220** of the gasket mating wall **2200**. The locating post **2310** aids the alignment of the EMI shielding cage **2000** on the PCB **34** when in use so that the EMI shielding cage **2000** may be properly grounded via the conductive ground traces **127** on the PCB
25 **34**. Preferably, the distance **D2** is within the range of about 18.04 millimetres to about 18.14 millimetres which thereby would make the connectors be compliant to industry standards such as SFF 8088.

Figure 3 shows a perspective view of the EMI shielding cage assembly **10**. The exterior panels **2300**, **2130**, **2140** and **2120** of the EMI shielding cage **2000** enclose a volume **V** which is accessible via the first end **2100** of the EMI shielding cage **2000**. It is possible that an EMI shielding cage may enclose more than one mating connectors. In such a situation, it is then preferred that the connectors be isolated and shielded from each other to minimise cross-interference within the EMI shielding cage **2000**. In the exemplary embodiment illustrated by Figure 3, a separation wall **2400** is configured within the EMI shielding cage **2000** with portions (not shown) of the separation wall **2400** in contact with the top panel **2120**, bottom panel **2300** and the back panel **2130**. As a result, the volume **V** is separated into two separate bays **2150a** and **2150b**. Preferably, only one mating connector **60** is housed in one bay. Accordingly, if more mating connectors are to be housed in the EMI shielding cage **2000**, more separation walls **2400** would then need to be configured so as to provide sufficient isolated bays to house each individual mating connector.

For the benefit of consumers, standards have been established within the electronics industry, including in the areas of connector mechanical interfaces, signal and data transmission protocols, and signal and data exchange protocols. This interoperability will allow an electronic module that is made by one vendor be replaceable with a similar module from another vendor. Thus, consumers will have more product choices and can benefit from this competition with more competitive device pricing.

In the electronics industry, there are many standards committees including but not limited to, the Institute of Electric and Electronic Engineers (“IEEE”) Committee which governs the specifications for data communication, the T10 Committee which defines the standards for data storage, and the Small Form Factor (“SFF”) Committee which specifies the standards for mechanical interfaces for connectors. SFF 8088 is one such standard set by the SFF Committee and it is a specification for mini multi-lane shielded connectors.

The area between the optional complementary faceplate **28** and the EMI shielding cage **2000** is prone to the discharge or leakage of electromagnetic emissions during high speed data transfer that can cause EMI. Provided in accordance with an aspect of the present invention and illustrated by Figures 3, 4
5 and 5, is an exemplary EMI gasket **1000** which when used with the EMI shielding cage **2000** would shield the mating connector **60** (not shown) housed in the EMI shielding cage **2000** from EMI and allow the connectors to remain SFF 8088-compliant.

The gasket **1000** is formed from a conductive metal such as stainless steel
10 but it may also be formed from a plastic or other resilient material and coated with a conductive plating on its exterior surfaces. The gasket **1000** comprises a conductive body **1100** having a plurality of sides which are preferably interconnected to form a continuous structure. The gasket **1000** has an opening **1110** configured to receive the first end **2100** of the EMI shielding cage **2000**
15 therein. The conductive body **1100** comprises a first face **1210**, a second face **1220**, an inner perimeter **1310** and an outer perimeter **1320**. The conductive body **1100** further comprises a plurality of engagement tabs **1400** disposed along the outer perimeter **1320** and extending away from the first face **1210** and a plurality of spring tabs **1500** disposed along the inner perimeter **1310** and extending away
20 from the second face **1220**.

When in use, the engagement tabs **1400** and the spring tabs **1500** provide points of electrical engagement between the EMI shielding cage **2000**, the gasket **1000** and the optional complementary faceplate **28**.

When in use, the engagement tabs **1400** are in contact with the optional
25 complementary faceplate **28** while the spring tabs **1500** are in contact with the gasket mating wall **2200**, and the engagement tabs **1400** and the spring tabs **1500** cooperatively maintain a predefined separation distance **D1** between the optional complementary faceplate **28** and the gasket mating wall **2200**. In one

embodiment in accordance with an aspect of the present invention, the separation distance **D1** is within the range of about 1.13 millimetres to about 2.13 millimetres which thereby would make the connectors to be SFF 8088-compliant.

Functionally, the engagement tabs **1400** serve to provide good EMI
5 dissipation while the spring tabs **1500** serve to provide structural support and strength for the gasket **1000** as the gasket **1000** is compressed between the optional complementary faceplate **28** and the gasket mating wall **2200** when the gasket **1000** is in use.

In one embodiment in accordance with an aspect of the present invention,
10 as illustrated in Figure 4, each engagement tab **1400** is isolated from the other and individually extends from the conductive body **1100**. This provides multiple pathways for the EMI to be drained to ground.

In another embodiment in accordance with another aspect of the present invention, the spring tab **1500** of the gasket **1000** comprises a first section **1511**
15 configured to couple the spring tab **1500** to the gasket **1000**, a second section **1512** configured to be in contact with the gasket mating wall **2200** when in use and a kink **1510** connecting the first section **1511** to the second section **1512**. The first section **1511** of the spring tab **1500** is aligned along a first axis **X1** while the second section **1512** of the spring tab **1500** is aligned along a second axis **X2**.
20 Preferably, the conductive body **1000** is aligned along the first axis **X1** as the first section **1511** of the spring tab **1500**. This provides structural support and strength to the coupling of the spring tab **1500** to the gasket **1000**.

In one embodiment in accordance with another aspect of the present invention, the second axis **X2** is at an angle **Y** to the first axis **X1**. The separation
25 distance **D1** between the optional complementary faceplate **28** and the gasket mating wall **2200** may be adjusted by changing a variety of parameters, including but not limited to, the flexibility of the engagement tabs **1400** and the spring tabs

1500 as well as the preset angle **Y** between the first axis **X1** and the second axis **X2** before use. When in use, the optional complementary faceplate **28** exerts a force **F1** on the engagement tabs **1400** of the gasket **1000** in the direction towards the gasket mating wall **2200** of the EMI shielding cage **2000**. In return, the gasket mating wall **2200** exerts an opposite force **F2** on the spring tabs **1500** of the gasket **1000**. The differential force of **F1** and **F2** which is affected by parameters stated above, will determine the distance by which the optional complementary faceplate **28** may travel towards the gasket mating wall **2200** which therefore determines the resulting separation distance **D1**.

10 The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, since many modifications or variations thereof are possible in light of the above teaching. All such modifications and variations are within the scope of the invention. The embodiments described herein were chosen and described in order to best explain the principles of the invention and its practical application, thereby to enable others skilled in the art to utilise the invention in various embodiments and with various modifications as are suited to the particular use contemplated thereof. It is intended that the scope of the invention be defined by 15 the claims appended hereto, when interpreted in accordance with the full breadth to which they are legally and equitably suited.

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CLAIMS

1. A gasket for use with an electromagnetic interference (EMI) shielding cage for a connector, the gasket comprising:

5 a conductive body having an opening configured to receive a first end of the EMI shielding cage near a gasket mating wall incorporated on the EMI shielding cage, wherein the conductive body comprises a first face designed to face away from the gasket mating wall, a second face designed to face the gasket mating wall, an inner perimeter and an outer perimeter;

10 a plurality of engagement tabs disposed along the outer perimeter and extending away from the first face; and

a plurality of spring tabs disposed along the inner perimeter and extending away from the second face wherein when the first end of the EMI shielding cage is inserted into the opening of the conductive body and an opening of an optional complementary faceplate with the engagement tabs facing the faceplate and the spring tabs facing the gasket mating wall of the EMI shielding cage, the engagement tabs and the spring tabs cooperatively maintain a predefined separation distance D1 between the gasket mating wall and the optional complementary faceplate.

20 2. The gasket of claim 1 wherein the predefined separation distance D1 is about 1.13 millimetres to about 2.13 millimetres.

3. The gasket of one of the preceding claims 1 to 2 wherein the spring tab further comprises a first section configured to couple the spring tab to the gasket, a second section configured to be in contact with the gasket mating wall when in use and a kink connecting the first section to the second section.

25 4. The gasket of claim 3 wherein the first section of the spring tab is aligned along a first axis and the second section of the spring tab is aligned along a second axis.

5. An electromagnetic interference (EMI) shielding cage assembly comprising:

an EMI shielding cage comprising a housing having a top panel, a back panel, two side panels and at least one slot configured at a first end of the EMI shielding cage providing an enclosure for EMI shielding for at least one connector when in use;

a gasket for use with the EMI shielding cage, the gasket comprising:

a conductive body having an opening configured to receive the first end of the EMI shielding cage near a gasket mating wall incorporated on the EMI shielding cage, wherein the conductive body comprises a first face designed to face away from the gasket mating wall, a second face designed to face the gasket mating wall, an inner perimeter and an outer perimeter;

a plurality of engagement tabs disposed along the outer perimeter and extending away from the first face; and

a plurality of spring tabs disposed along the inner perimeter and extending away from the second face wherein when the first end of the EMI shielding cage is inserted into the opening of the conductive body and an opening of an optional complementary faceplate with the engagement tabs facing the faceplate and the spring tabs facing the gasket mating wall of the EMI shielding cage, the engagement tabs and the spring tabs cooperatively maintain a predefined separation distance D1 between the gasket mating wall and the optional complementary faceplate.

6. The EMI shielding cage assembly of claim 5 wherein the predefined separation distance D1 is about 1.13 millimetres to about 2.13 millimetres.

7. The EMI shielding cage assembly of claim 5 or claim 6 wherein the spring tab further comprises a first section configured to couple the spring tab to the gasket, a second section configured to be in contact with the gasket mating wall when in use and a kink connecting the first section to the second section.

8. The EMI shielding cage assembly of claim 7 wherein the first section of the spring tab is aligned along a first axis and the second section of the spring tab is aligned along a second axis.

9. The EMI shielding cage assembly of one of the preceding claims 5 to 8
5 wherein the EMI shielding cage further comprises a bottom panel coupled to the housing and the EMI shielding cage is grounded by connecting the bottom panel to a plurality of ground traces on a printed circuit board when in use.

10. The EMI shielding cage assembly of claim 9 wherein the bottom panel further comprises a pair of locating posts.

10 11. The EMI shielding cage assembly of claim 10 wherein a distance D2 between the second side of the gasket mating wall and the locating posts is about 18.04 millimetres to about 18.14 millimetres.