

Description

BACKGROUND OF THE INVENTION

This invention relates to electromagnetic shields, and particularly, to radio frequency (RF) shields mounted on printed circuit boards.

It is often desirable to shield an area of printed circuit boards, or a volume associated therewith, with shielding members so that electromagnetic energy, e.g., radiated RF signals, are contained within the shielded volume or area, or excluded from the shielded volume or area. Such shielding is extensively used in television receivers, direct satellite broadcast receivers, radio receivers such as FM and shortwave, or portions of audio systems wherein low signal level circuitry is amenable to being effected by stray electromagnetic fields, e.g. 50-60 cycle fields emanating from AC power sources. Examples of circuits utilizing such shielding include RF tuner circuits which amplify low level signals received by an antenna, or low signal level audio circuits in the input stage of an audio system. Additionally, if a circuit generates a signal which can radiate either to other circuits of the same device or external of the device, the electromagnetic shielding will contain the radiation. Such a circuit can be an RF tuner local oscillator and/or a mixer.

From GB-A-2029645 there is known, for example, a high frequency circuit device such as an H.F. tuner in which circuit elements mounted on a circuit board are arranged within a casing which acts as a shield. The circuit board is supported on projections extending inwardly from the casing and secured to the casing by dip-soldering to facilitate manufacture. Partitions may be provided to shield different parts of the circuit and these are also mounted on internal projections and secured by dip-soldering. A top cover has an elastic fastening part formed around its periphery and is attached to the top of the casing with the fastening part pressing against the external side surface of the casing. The bottom cover is of the same structure as the top cover, except for slit and bent parts which are additionally formed at specific positions and which contact the lower edge of the casing.

The term "printed circuit board" as used herein refers to circuit boards having electrical conductors disposed on one or more sides of a dielectric board by deposition, etching or any other applicable process such as laminating (used for producing multi-layered boards). Modern television circuit board assemblies are generally manufactured by mounting components on the component side of the printed circuit board with their leads extending through apertures in the board to conductor pads of conductive pathways disposed on the conductor side of the board. The leads are typically soldered to the conductor pads. It should be noted that it is not uncommon for printed circuit boards to have components also mounted on the

conductor side, or to have conductors on both sides of the board. RF shields typically have a shield member mounted on the component side by the extension of tabs or protrusions from the shield through apertures formed in the board to the conductor side. These tabs most commonly are soldered to a conductor pad proximal to or surrounding the aperture.

To lower production costs, it is desirable to have as many components and circuits as possible placed on a single printed circuit board to eliminate multiple handling of printed circuit boards, and to eliminate interconnection wiring between printed circuit boards. Towards this end, tuners are now being placed on the main printed circuit board of a television receiver. This is a change from tuners having their own printed circuit boards and located close to the input of their signals, e.g. antenna, or close to the tuning controls, such as channel selection switches. For the stand alone tuners, the boards were encased in their own shielding boxes which totally surrounded the printed circuit boards except for wiring terminals for interconnection of the printed circuit boards to other circuitry. It should be noted that both the components and the wiring between components, which are disposed within the shielded volume, are shielded from electromagnetic interference caused by extraneous signals or fields. With the location of the tuner on the main printed circuit board, the interconnection of the tuner with other circuitry is accomplished with the printed circuit wiring extending through the shielding to the outside of the shielded volume. However, in such a case, the degree of shielding of the tuner is reduced because both of the need to pass these printed circuit conductors through the shield, and the need to maintain sufficient structural integrity of the printed circuit board so that the shielded tuner portion of the board will be sufficiently supported.

The effectiveness of the shield assembly is greatly impaired if there are any "gaps" in the shielding. Such gaps, or unshielded areas, can permit substantial field leakage to or from the shielded volume. Although the shield itself completely encompass or circumscribe an area on the printed circuit board, shield covers are necessary to shield the enclosed area of the printed circuit board in a direction normal to the board. In order to facilitate repairs, these shield covers are detachable from the shield. Even when the covers are in place, some leakage gaps along the locus of engagement between the shield and the shield cover occurs. The shield cover on the shield mounting side of the board (component side) usually has bent edges so that when that shield cover is mounted onto the shield, the upper edges of the shield are fully enclosed by the cover. This bent-over edge of the cover is often provided with spring-loaded protrusions to secure the cover to the shield while permitting removal.

However, enclosing the volume from the other

side of the printed circuit board (the conductor side) is a more difficult matter. Elongated apertures or slots can be provided in the printed circuit board in order to facilitate mounting of a conductor side cover to the shield. This can be accomplished by the bottom shield having elongated protrusions extending through the printed circuit board slots to mechanically and electrically engage the sides of the shield in a manner similar to the top shield cover. However, this arrangement is not entirely satisfactory since it leaves unnecessary gaps in the shield assembly. Accordingly, it is desirable to provide a printed circuit board shielding arrangement which minimizes the leakage gaps.

SUMMARY OF THE INVENTION

Briefly, the present invention as claimed is a shield assembly, for a tuner or the like, installed on a portion of a printed circuit board. The shield assembly provides improved electromagnetic shielding while maintaining the structural integrity of the printed circuit board and allowing normal manufacturing processes be used. A shield is mounted onto the component mounting side of the printed circuit board and has a plurality of support protrusions inserted through apertures of the printed circuit board to the conductor side where they are mechanically secured to a conductive pathway, preferably by solder applied in a wave-soldering process, and electrically connected to a reference potential. A first shield cover is mounted on the shield distal of the component side of the printed circuit board and electrically and mechanically engages the shield along the locus of engagement. A second shield cover is disposed proximal the conductive pathway side of the printed circuit board. The second shield cover is provided with two pluralities of securement protrusions. The first plurality of protrusions extends through apertures in the printed circuit board to electrically and mechanically engage the body of the shield. The second plurality of protrusions electrically and mechanically engage respective support projections of the shield. In this way, a more complete shield assembly is accomplished.

BRIEF DESCRIPTION OF THE DRAWINGS:

Reference can be made to the drawings wherein:

Figure 1 shows a partial top cutaway view of the shield of the present invention mounted onto a printed circuit board.

Figure 2 is an elevational sectional view of Figure 1 generally taken along line 2-2 according to aspects of the present invention and include a component mounted on the printed circuit board external of the shield.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like members are given like numerical designation, there is shown in the Figures an RF shielding arrangement according to aspects of the present invention.

Figure 1 shows a partial top view of an electromagnetic shield assembly, generally designated 10, mounted on a printed circuit board 12. Printed circuit board 12 contains other circuitry including circuit components 14 which are enclosed by shield assembly 10. Circuit components 14 can be any kind of electronic component, e.g., a resistor, an inductor, a capacitor, an integrated circuit, a varactor, a variable resistor, a surface acoustic wave filter, or the like. The specific circuit configuration forms no part of this invention and accordingly, will not be discussed further except as may be needed in order to explain the functioning of the shield.

Shield assembly 10 includes a shield 16 mounted on the component side 18 of printed circuit board 12, and circumposes an area 20 which includes components 14. A top cover 22 electrically and mechanically engages shield 16 along an edge distal of the component side of printed circuit board 12, and is secured by spring fingers 24 to the side of shield 16. Since shield 16 is electrically coupled to a reference potential, typically ground, shield cover 22 is also coupled to electrical ground and electromagnetically shields area 20 in one direction orthogonal to the plane of printed circuit board 12. The exemplary components of shield assembly 10, i.e., shield 16, top cover 22, and bottom cover 34 (see Figure 2 and discussed more fully below), are made of a solder plated steel material. However, any other suitable material which will shield against electromagnetic fields and which preferably, is solderable, can be used.

Apertures 26 and 28 are provided in printed circuit board 12. Protrusions 30 of shield 16 extend through respective apertures 26 and are soldered to appropriate conductor pads on conductor side 36. Apertures 26 and 28 are also provided for passage therethrough of respective electrically conductive securement protrusions 32 and 42 of bottom cover 34.

Figure 2 shows a partial cutaway elevational view generally along line 2-2 of Figure 1 with an additional component 35 mounted on component mounting side 18 external of the shielded area 20. Component 35 has leads 38 extending through apertures in the board to conductor side 36 having electrically conductive pathways 37 thereon. Leads 38 are soldered to appropriate portions of pathway 37 by solder fillets 40. Shielded components 14 are mechanically and electrically mounted in a similar manner.

Bottom cover 34 is disposed proximal the conductor side 36 of printed circuit board 12, and electromagnetically shields area 20 in the same manner as

top shield 22 except on the other side of printed circuit board 12. Bottom cover 34 is provided with a first plurality of protrusions 32 which extend through respective apertures 28 in printed circuit board 12 and mechanically and electrically engage the body of shield 16 in a spring loaded manner. According to an aspect of the present invention, bottom cover 34 is also provided with a second plurality of protrusions 42 which mechanically and electrically engage protrusions 30. In this manner, the gaps in the shield assembly are minimized.

Claims

1. An electronic apparatus having circuitry components mounted on a printed circuit board and an electromagnetic shield assembly shielding at least a portion of the the printed circuit board, the apparatus comprising:

a planar printed circuit board (12) having thickness, a component mounting side (18) wherein leads of mounted components are inserted through apertures extending through the thickness of the board, and a conductor side (36) having electrically conductive pathways disposed thereon for providing predetermined solderable electrical interconnections between the leads of the mounted components,

an electromagnetic shielding means (16) mounted on the component mounting side (18) of the printed circuit board (12) and having elongated support members (30) extending through the thickness of the printed circuit board to the conductor side and electrically connected to a reference potential through an electrically conductive pathway, the shielding means (16) having a body portion proximal the printed circuit board and an edge distal of the component side of the printed circuit board, said shielding means enclosing a predetermined area of the printed circuit board,

a first electromagnetic shielding cover means (22) extending over the predetermined area of the printed circuit board (12) and removably engaging the engagement edge of the shielding means distal of the component side of the printed circuit board for electromagnetically shielding the predetermined area in cooperation with the shielding means, and

a second electromagnetic shielding cover means (34) disposed proximal to the electrically conductive pathway side of the printed circuit board and extending over the predetermined area, the second electromagnetic shielding cover means having two pluralities of protruding members (32,42), the first plurality of members (32) extend through apertures in the printed circuit board (12) for engaging the body of the shielding

means (16) proximal the printed circuit board, the second plurality of members (42) electrically engaging the support members of the shielding means, the second electromagnetic shield cover means electromagnetically shielding the predetermined area in cooperation with the shielding means.

2. The apparatus of claim 1 wherein the apparatus is a tuner of a television receiver.
3. The apparatus of claim 1 wherein the apparatus is a tuner of a television receiver for receiving direct satellite broadcasts.

4. The apparatus of claim 1 wherein the apparatus is a tuner of a FM radio receiver.

5. The apparatus of claim 1 wherein the apparatus is an audio amplifier.

6. The apparatus of claim 1 wherein the first cover means (22) removably engages the shielding means (16), the first plurality of members (32) of the second cover means (34) removably engage the shielding means, and the second plurality of members (42) of the second cover means (34) removably engage the support members (30) of the shielding means (16).

7. An RF shield for a printed circuit board comprising:

an electromagnetic shielding means (16) for mounting onto a first side of a printed circuit board (12) and having a first edge disposable distal of the printed circuit board and a second edge disposable proximal the printed circuit board, the shielding means having elongated support protrusions (30) at the second edge for insertion through apertures in the printed circuit board, extending through the thickness of the printed circuit board, and electrically contactable to a portion of a second side of the printed circuit board,

a first electromagnetic shielding cover means (22) for engaging the first edge of the shielding means, and

a second electromagnetic shielding cover means (34) disposable proximal to the second side of the printed circuit board, the second electromagnetic shielding cover means having two pluralities of protruding members (32,42), the first plurality of members (32) being extendable through apertures of the printed circuit board engaging the shielding means (16), and a second plurality of members (42) engaging the support protrusions (30) of the shielding means (16).



top shield 22 except on the other side of printed circuit board 12. Bottom cover 34 is provided with a first plurality of protrusions 32 which extend through respective apertures 28 in printed circuit board 12 and mechanically and electrically engage the body of shield 16 in a spring loaded manner. According to an aspect of the present invention, bottom cover 34 is also provided with a second plurality of protrusions 42 which mechanically and electrically engage protrusions 30. In this manner, the gaps in the shield assembly are minimized.

Claims

1. An electronic apparatus having circuitry components mounted on a printed circuit board and an electromagnetic shield assembly shielding at least a portion of the the printed circuit board, the apparatus comprising:

a planar printed circuit board (12) having thickness, a component mounting side (18) wherein leads of mounted components are inserted through apertures extending through the thickness of the board, and a conductor side (36) having electrically conductive pathways disposed thereon for providing predetermined solderable electrical interconnections between the leads of the mounted components,

an electromagnetic shielding means (16) mounted on the component mounting side (18) of the printed circuit board (12) and having elongated support members (30) extending through the thickness of the printed circuit board to the conductor side and electrically connected to a reference potential through an electrically conductive pathway, the shielding means (16) having a body portion proximal the printed circuit board and an edge distal of the component side of the printed circuit board, said shielding means enclosing a predetermined area of the printed circuit board,

a first electromagnetic shielding cover means (22) extending over the predetermined area of the printed circuit board (12) and removably engaging the engagement edge of the shielding means distal of the component side of the printed circuit board for electromagnetically shielding the predetermined area in cooperation with the shielding means, and

a second electromagnetic shielding cover means (34) disposed proximal to the electrically conductive pathway side of the printed circuit board and extending over the predetermined area, the second electromagnetic shielding cover means having two pluralities of protruding members (32,42), the first plurality of members (32) extend through apertures in the printed circuit board (12) for engaging the body of the shielding

means (16) proximal the printed circuit board, the second plurality of members (42) electrically engaging the support members of the shielding means, the second electromagnetic shield cover means electromagnetically shielding the predetermined area in cooperation with the shielding means.

2. The apparatus of claim 1 wherein the apparatus is a tuner of a television receiver.

3. The apparatus of claim 1 wherein the apparatus is a tuner of a television receiver for receiving direct satellite broadcasts.

4. The apparatus of claim 1 wherein the apparatus is a tuner of a FM radio receiver.

5. The apparatus of claim 1 wherein the apparatus is an audio amplifier.

6. The apparatus of claim 1 wherein the first cover means (22) removably engages the shielding means (16), the first plurality of members (32) of the second cover means (34) removably engage the shielding means, and the second plurality of members (42) of the second cover means (34) removably engage the support members (30) of the shielding means (16).

7. An RF shield for a printed circuit board comprising:

an electromagnetic shielding means (16) for mounting onto a first side of a printed circuit board (12) and having a first edge disposable distal of the printed circuit board and a second edge disposable proximal the printed circuit board, the shielding means having elongated support protrusions (30) at the second edge for insertion through apertures in the printed circuit board, extending through the thickness of the printed circuit board, and electrically contactable to a portion of a second side of the printed circuit board,

a first electromagnetic shielding cover means (22) for engaging the first edge of the shielding means, and

a second electromagnetic shielding cover means (34) disposable proximal to the second side of the printed circuit board, the second electromagnetic shielding cover means having two pluralities of protruding members (32,42), the first plurality of members (32) being extendable through apertures of the printed circuit board engaging the shielding means (16), and a second plurality of members (42) engaging the support protrusions (30) of the shielding means (16).



Patentansprüche

1. Elektronisches Gerät mit auf einer gedruckten Leiterplatte angebrachten Schaltungskomponenten und mit einer elektromagnetischen Abschirmanordnung, die wenigstens einen Teil der gedruckten Leiterplatte abschirmt, wobei das Gerät umfaßt:

eine ebene, eine Dicke aufweisende gedruckte Leiterplatte (12) mit einer Komponenten-anbringungsseite (18), wobei Zuleitungen der angebrachten Komponenten in Löcher, die durch die Dicke der Platte verlaufen, eingesetzt werden, und mit einer Leiterseite (36), auf der elektrisch leitende Pfade angebracht sind, um vorgegebene lötbare elektrische Verbindungen zwischen den Zuleitungen der angebrachten Komponenten vorzusehen,

elektromagnetische Abschirmmittel (16), die auf der Komponenten-anbringungsseite (18) der gedruckten Leiterplatte (12) gelagert sind, und die längliche Lagerelemente (30) aufweisen, die sich durch die Dicke der gedruckten Leiterplatte zu der Leiterseite erstrecken und elektrisch mit einem Bezugs-Potential durch einen elektrisch leitenden Pfad verbunden sind, wobei die Abschirmmittel (16) einen zu der gedruckten Leiterplatte proximalen Haupt-Körperteil und einen zu der Komponentenseite der gedruckten Leiterplatte distalen-Rand aufweisen, wobei die Abschirmmittel einen vorgegebenen Bereich der gedruckten Leiterplatte einschließen,

erste elektromagnetische Abschirmungs-Abdeckmittel (22), die sich über den vorgegebenen Bereich der gedruckten Leiterplatte (12) erstrecken und lösbar mit dem zu der Komponentenseite der gedruckten Leiterplatte distalen Eingriffsrand der Abschirmmittel in Eingriff sind, um den vorgegebenen Bereich im Zusammenwirken mit den Abschirmmitteln abzuschirmen, und

zweite elektromagnetische Abschirmungs-Abdeckmittel (34), die proximal zu der Seite der gedruckten Leiterplatte mit den elektrisch leitenden Pfaden angeordnet sind und sich über den vorgegebenen Bereich erstrecken, wobei die zweiten elektromagnetischen Abschirmungs-Abdeckmittel zwei Vielzahlen von vorspringenden Elementen (32, 42) haben, von denen die erste Vielzahl von Elementen (32) durch Löcher in der gedruckten Leiterplatte (12) verläuft, um mit dem zur gedruckten Leiterplatte proximalen Haupt-Körper der Abschirmmittel (16) in Eingriff zu kommen, wobei die zweite Vielzahl von Elementen (42) elektrisch mit den Lagerelementen der Abschirmmittel in Eingriff ist, und wobei die zweiten elektromagnetischen Abschirmungs-Abdeckmittel den vorgegebenen Bereich im Zusammenwirken mit den Abschirmmitteln abschirmen.

2. Gerät nach Anspruch 1, dadurch gekennzeichnet, daß das Gerät ein Tuner eines Fernsehempfängers ist.

3. Gerät nach Anspruch 1, dadurch gekennzeichnet, daß das Gerät ein Tuner eines Fernsehempfängers zum Empfang von direkten Satellitensendungen ist.

4. Gerät nach Anspruch 1, dadurch gekennzeichnet, daß das Gerät der Tuner eines FM-Rundfunkempfängers ist.

5. Gerät nach Anspruch 1, dadurch gekennzeichnet, daß das Gerät ein Audio-Verstärker ist.

6. Gerät nach Anspruch 1, bei dem die ersten Abdeckmittel (22) lösbar mit den Abschirmmitteln (16) in Eingriff sind, wobei die erste Vielzahl von Elementen (32) der zweiten Abdeckmittel (34) lösbar mit den Abschirmmitteln in Eingriff sind, und wobei die zweite Vielzahl von Elementen (42) der zweiten Abdeckmittel (34) lösbar mit den Lagerelementen (30) der Abschirmmittel (16) in Eingriff ist.

7. Hochfrequenz-Abschirmung für eine gedruckte Leiterplatte, umfassend:

elektromagnetische Abschirmmittel (16) zur Anbringung auf einer ersten Seite einer gedruckten Leiterplatte (12), die einen ersten Rand, der distal zu der gedruckten Leiterplatte angeordnet werden kann, und einen zweiten Rand, der proximal zu der gedruckten Leiterplatte angeordnet werden kann, aufweist, wobei die Abschirmmittel längliche Lagervorsprünge (30) an dem zweiten Rand zum Einsetzen in die Löcher der gedruckten Leiterplatte aufweisen, die durch die Dicke der gedruckten Leiterplatte verlaufen, und die elektrisch mit einem Teil einer zweiten Seite der gedruckten Leiterplatte kontaktierbar sind,

erste elektromagnetische Abschirmungs-Abdeckmittel (22) zum Eingriff mit dem ersten Rand der Abschirmmittel und,

zweite elektromagnetische Abschirmungs-Abdeckmittel (34), die proximal zur zweiten-Seite der gedruckten Leiterplatte angeordnet werden können, wobei die zweiten elektromagnetischen Abschirmungs-Abdeckmittel zwei Vielzahlen von vorspringenden Elementen (32, 42) aufweisen, wobei die erste Vielzahl von Elementen (32) sich durch Löcher der gedruckten Leiterplatte erstreckt und mit den Abschirmmitteln (16) in Eingriff ist, und wobei die zweite Vielzahl von Elementen (42) in Eingriff mit den Lagervorsprüngen (30) der Abschirmmittel (16) ist.



Revendications

1. Appareil électronique dont les circuits sont montés sur une carte de circuits imprimés et un ensemble de blindage électromagnétique protégeant au moins une partie de la carte de circuits imprimés, ledit appareil intégrant :
 une carte de circuits imprimés plate (12) présentant une certaine épaisseur, un côté montage composants (18) caractérisé en ce que les conducteurs des composants montés sont insérés par les perçages traversant la carte, et un côté conducteur (36) doté de pistes électriquement conductrices constituant les connexions électriques soudables prédéfinies entre les conducteurs des composants montés,
 un moyen de blindage électromagnétique (16) installé sur le côté montage composants (18) de la carte de circuits imprimés (12) et comportant des éléments de support (30) de forme allongée traversant la carte de circuits imprimés jusqu'au côté conducteur, et électriquement connectés à un potentiel de référence par une piste électriquement conductrice, le moyen de blindage (16) présentant une partie du corps proche de la carte des circuits imprimés et un bord éloigné du côté composants de la carte de circuits imprimés, ledit moyen de blindage couvrant une zone prédéfinie de la carte de circuits imprimés,
 un premier couvercle de blindage électromagnétique (22) recouvrant la zone prédéfinie de la carte de circuits imprimés (12) et s'adaptant de manière amovible au bord engageable du moyen de blindage éloigné du côté composants de la carte de circuits imprimés pour protéger électromagnétiquement la zone prédéfinie en liaison avec le moyen de blindage et
 un second couvercle de blindage électromagnétique (34) proche du côté des pistes électriquement conductrices de la carte et recouvrant la zone prédéfinie, ledit second couvercle comprenant deux ensembles d'éléments saillants (32, 42), le premier ensemble desdits éléments (32) traversant les perçages de la carte de circuits imprimés (12) pour permettre l'engagement du corps du moyen de blindage (16) proche de la carte de circuits imprimés, ledit second ensemble d'éléments (42) connectant électriquement les éléments de support du moyen de blindage, et ledit second couvercle de blindage protégeant électromagnétiquement la zone prédéfinie en liaison avec les moyens de blindage.
2. Appareil selon la revendication 1 caractérisé en ce que ledit appareil est le tuner d'un récepteur télévision.
3. Appareil selon la revendication 1 caractérisé en ce que ledit appareil est le tuner d'un récepteur télévision destiné à recevoir en direct les programmes diffusés par satellite.
4. Appareil selon la revendication 1 caractérisé en ce que ledit appareil est le tuner d'un récepteur radio FM.
5. Appareil selon la revendication 1 caractérisé en ce que ledit appareil est un amplificateur audio.
6. Appareil selon la revendication 1 caractérisé en ce que le premier couvercle (22) s'adapte de manière amovible au moyen de blindage (16), le premier ensemble d'éléments (32) du second couvercle (34) s'adaptant de manière amovible au moyen de blindage et le second ensemble d'éléments (42) du second couvercle (34) de manière amovible aux éléments de support (30) du moyen de blindage (16).
7. Blindage RF d'une carte de circuits imprimés intégrant :
 un blindage électromagnétique (16) destiné à être installé sur un premier côté d'une carte de circuits imprimés (12) et présentant un premier bord pouvant être disposé à distance de la carte de circuits imprimés et un second bord pouvant être disposé de manière proche par rapport à la carte de circuits imprimés, ledit moyen de blindage présentant des protubérances de support (30) de forme allongée au droit du second bord pour permettre l'insertion par les perçages de la carte de circuits imprimés, traversant ladite carte et électriquement contactables par une partie d'un second côté de la carte,
 un premier couvercle de blindage électromagnétique (22) s'adaptant au premier bord du moyen de blindage et
 un second couvercle de blindage électromagnétique (34) pouvant être disposé de manière proche au second côté de la carte de circuits imprimés, ledit second couvercle présentant deux ensembles d'éléments saillants (32, 42), le premier ensemble d'éléments (32) pouvant traverser les perçages de la carte de circuits imprimés pour s'adapter au moyen de blindage (16), et un second ensemble d'éléments (42) s'adaptant aux protubérances de support (30) du moyen de blindage (16).