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# SHORTING BAR, MOUNTING STRUCTURE, AND UNIT


## Abstract

A shorting bar electrically connected to a lead component including an engaging portion that is to be engaged with the lead of the lead component. The engaging portion may be a socket for receiving the lead of the lead component.



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## Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a bypass continuation application of International Application No. PCT/JP2023/012940 filed Mar. 29, 2023.

BACKGROUND

Field

[0002] The present disclosure relates to a short bar, a mounting structure, and a unit.

Discussion of the Related Art

[0003] Printed circuit boards are made by etching copper foil. Since there is an upper limit to the thickness of copper foil, printed circuit boards are not suitable for use with large currents, but are suitable for use with small currents.

[0004] When it is necessary to pass a large current through a printed circuit board, a short bar composed of a conductor is used (Japanese Unexamined Patent Publication (Kokai) Nos. 63-271996 and 04-345082).

[0005] However, when a large current is passed from a short bar to a lead part via a printed circuit board, there is a problem in that the lead part and the short bar generate a large amount of heat.

[0006] Furthermore, when the pattern of a printed circuit board is enlarged, there is a problem in that the size of the printed circuit board increases, and when the thickness of the copper foil of a printed circuit board is increased, there is a problem in that production cost increases.

[0007] As a result, the suppression of heat generation when a large current flows, the prevention of an increase in size of the overall structure, and a reduction in production costs are desired.

SUMMARY

[0008] According to a first aspect of the present disclosure, there is provided a short bar for electrical connection to a lead part, comprising an engagement part which is to be engaged with a lead of the lead part.

[0009] The objects, features, and advantages of the present disclosure will become more apparent from the following description of the embodiments in conjunction with the accompanying drawings.

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## Description

BRIEF DESCRIPTION OF DRAWINGS

[0010] FIG. **1** is a perspective view of a mounting structure comprising a short bar according to a first embodiment.

[0011] FIG. **2** is a perspective view of a mounting structure comprising a short bar according to the prior art.

[0012] FIG. **3**A is a perspective view of the short bar, etc., based on the first embodiment.

[0013] FIG. **3**B is a bottom view of FIG. **3**A.

[0014] FIG. **4** is a perspective view of a short bar based on a second embodiment.

[0015] FIG. **5**A is a view showing a first modification example of the short bar shown in FIG. **4**.

[0016] FIG. **5**B is a view showing a second modification example of the short bar shown in FIG. **4**.

[0017] FIG. **5**C is a view showing a third modification example of the short bar shown in FIG. **4**.

[0018] FIG. **6**A is a view showing a first modification example of the socket shown in FIG. **4**.

[0019] FIG. **6**B is a view showing a second modification example of the socket shown in FIG. **4**.

[0020] FIG. **7**A is a view showing a fourth modification example of the short bar shown in FIG. **4**.

[0021] FIG. **7**B is a view showing a fifth modification example of the short bar shown in FIG. **4**.

[0022] FIG. **7**C is a view showing a sixth modification example of the short bar shown in FIG. **4**.

[0023] FIG. **8**A is a first perspective view showing a mounting structure according to a third embodiment.

[0024] FIG. **8**B is a second perspective view showing the mounting structure shown in FIG. **8**A.

[0025] FIG. **8**C is a side view of FIG. **8**B.
[0026] FIG. **9**A is a first perspective view of a unit according to a fourth embodiment.
[0027] FIG. **9**B is a second perspective view of the unit according to the fourth embodiment.
[0028] FIG. **10**A is an exploded view of a unit according to a fifth embodiment.
[0029] FIG. **10**B is a perspective view of a unit according to the fifth embodiment.
[0030] FIG. **11**A is a first perspective view of a unit according to a sixth embodiment.
[0031] FIG. **11**B is a second perspective view of the unit according to the sixth embodiment.
[0032] FIG. **12**A is a first perspective view of a unit according to a seventh embodiment.
[0033] FIG. **12**B is a second perspective view of the unit according to the seventh embodiment.
[0034] FIG. **12**C is a third perspective view of the unit according to the seventh embodiment.
[0035] FIG. **12**D is a fourth perspective view of the unit according to the seventh embodiment.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

[0036] The embodiments of the present disclosure will be described below with reference to the attached drawings. In the drawings, corresponding constituent elements have been assigned common reference signs.
[0037] FIG. **1** is a perspective view of a mounting structure comprising a short bar based on a first embodiment. In FIG. **1**, at least one short bar S**1** and a part P are mounted on the surface of a printed circuit board C. The part P may be a lead part comprising at least two leads L**1**, L**2**.
[0038] The short bar S**1** is an integral member composed of a conductor, for example, a conductive metal. The short bar S**1** primarily comprises two rising parts **11**, **13** rising from the surface of the printed circuit board C, a first extension part **12** connecting the rising parts **11**, **13** at a position spaced apart from the surface of the printed circuit board C, and a second extension part **14** extending from the rising part **13** along the surface of the printed circuit board C. As can be understood from the drawing, the base part of the rising part **11** and the end part **16** of the second extension part **14** extend to the back side through the corresponding through holes of the printed circuit board C.
[0039] The configuration of the short bar S**1** is not limited to that shown in FIG. **1**, and it is sufficient that the short bar S**1** comprise at least the portions corresponding to the rising part **11** and the second extension part **14**.
[0040] The second extension part **14** includes an engagement part **15** for engagement with the lead L**1** of the part P. The engagement part **15** shown in FIG. **1** can be a through hole formed in the second extension part **14**. The engagement part **15** preferably has dimensions sufficient for mating of the lead L**1**.
[0041] Thus, when a current is passed through the short bar S**1** from the rising part **11** side, the current passes through the first extension part **12**, the rising part **13**, and the second extension part **14**, and is transmitted to the lead L**1** via the engagement part **15**. Since the current does not pass through a circuit pattern (not illustrated) on the back side of the printed circuit board C at this time, heat generation in the printed circuit board C can be suppressed. The resistance value of the short bar S**1** is lower than the resistance value of the circuit pattern (not illustrated) of the printed circuit board C. Thus, even when a relatively large current is passed through the short bar S**1**, heat generation in the short bar S**1** can be relatively small. The same is true for the part P.
[0042] FIG. **2** is a perspective view of a mounting structure comprising a short bar based on the prior art. The short bar S**0** of the prior art shown in FIG. **2** comprises two rising parts **11**, **13** similar to those described above, and a first extension part **12**. The base parts of the rising parts **11**, **13** extend to the back side of the printed circuit board C as described above. In other words, the short bar S**0** of the prior art does not comprise a second extension part **14** including an engagement part **15**.
[0043] When a current is passed through the short bar S**0** from the rising part **11** side, the current passes through the first extension part **12** and the rising part **13**, and is transmitted to the lead L**1** via a circuit pattern (not illustrated) of the printed circuit board C. Specifically, in the prior art, the

current passes through the circuit pattern (not illustrated) of the printed circuit board C, and as a result, the printed circuit board C heats up. In particular, when the current is relatively large, the heat generated by the printed circuit board C also increases accordingly. The same is true for the short bar S**0** and the part P.

[0044] Thus, in the prior art, it was necessary to form a wide pattern or to make the copper foil used to form the pattern thicker in order to suppress heat generation on the printed circuit board C. In the case of forming a wide pattern, there was a problem in that the printed circuit board C would become larger, and in the case of making the copper foil thicker, there was a problem in that the production cost would increase.

[0045] In the first embodiment shown in FIG. **1**, a large current can be transmitted from the rising part **11** of the short bar S**1** to the part P without passing through the circuit pattern of the printed circuit board C. Thus, it is possible to prevent the circuit pattern of the printed circuit board C itself from heating up, and thus, the problems described above can be avoided.

[0046] FIG. **3**A is a perspective view of the short bar based on the first embodiment. In FIG. **3**A, the engagement part **15** of the short bar S**1** and the lead L**1** of the part P are engaged with each other as described above. Such a configuration is also included in the scope of the present disclosure. Furthermore, FIG. **3**B is a bottom view of FIG. **3**A. As indicated by the dashed line in FIG. **3**B, the region including the engagement part **15** and the lead L**1** may be electrically connected by solder or solder flow. In such a case, the structure of the short bar S**1** may be simple, and the short bar S**1** can be produced at low cost.

[0047] Furthermore, it is preferable that the base part of the rising part **11** and the end part **16** of the second extension part **14** be soldered to a circuit pattern (not illustrated) formed on the back side of the printed circuit board C. The same is true for the leads L**1**, L**2** of the part P.

[0048] FIG. **4** is a perspective view of a short bar based on a second embodiment. In FIG. **4**, two short bars S**2**, S**2**′ and a part P similar to that described above are shown. Sockets **21**, **21**′are provided on the short bars S**2**, S**2**′, respectively. Holes **22**, **22**′ which can be electrically connected to the short bars S**2**, S**2**′ are formed on the sockets **21**, **21**′. When the leads L**1**, L**2** of the part P are engaged with the holes **22**, **22**′ of the sockets **21**, **21**′, respectively, the part P and the short bars S**2**, S**2**′ can be electrically connected to each other.

[0049] In this case, when it is necessary to replace the part P due to malfunction or the like, the part P can easily be removed by simply pulling out the leads L**1**, L**2** of the part P from the sockets **21**, **21**′. Furthermore, a new part P can easily be attached by simply inserting the leads L**1**, L**2** of the new part P into the holes **22**, **22**′ of the sockets **21**, **21**′.

[0050] FIGS. **5**A to **5**C are views showing modification examples of the short bar shown in FIG. **4**. In FIG. **5**A, through holes **24**, **24**′ are formed on positions of the short bars S**2**, S**2**′ where the sockets **21**, **21**′ should be provided. Fasteners **23**, **23**′, such as screws or bolts, composed of a conductor are passed through the through holes **24**, **24**′ of the short bars S**2**, S**2**′ and screwed into the openings on the lower surfaces of the sockets **21**, **21**′. As a result, the sockets **21**, **21**′ can be affixed to the short bars S**2**, S**2**′, respectively.

[0051] In FIG. **5**B, a conductor part **29** extending from the socket **21** penetrates the through hole of the short bar S**2**. The conductor part **29** and the short bar S**2** are electrically connected to each other by solder flow **25**.

[0052] In FIG. **5**C, one ends of rods **27**, **27**′ composed of a conductor are press-fitted into the through holes **26**, **26**′ formed on the short bars S**2**, S**2**′. The other ends of the rods **27**, **27**′ are similarly press-fitted into holes on the bottom surfaces of the sockets **21**, **21**′. The configuration shown in FIG. **4** can be created by any of FIGS. **5**A to **5**C.

[0053] FIGS. **6**A and **6**B are views showing modification examples of the sockets shown in FIG. **4**, etc. Though the socket **21** is shown in these drawings, the same applies to the socket **22**. A hole **31** is formed on the upper surface of the socket **21** shown in FIG. **6**A, and a plate part **32** which is rotatable about an axis O perpendicular to the insertion direction of the lead L**1** is provided in the

hole **31**. The plate part **32** is biased by a leaf spring **33** in a direction which closes the hole **31**.
[0054] Thus, when the lead L**1** of the part P is inserted into the hole **31**, the lead L**1** presses the plate part **32** against the leaf spring **33**. In the hole **31**, the lead L**1** is interposed between the inner wall part of the hole **31** and the plate part **32**. To this end, the inner wall part of the hole **31** is preferably composed of a conductor.
[0055] In FIG. **6**B, a through hole **34** is formed on the inner wall of the hole **31**. When the lead L**1** of the part P is inserted into the hole **31**, a fastener **35** composed of a conductor is inserted into the through hole **34** to press and affix the lead L**1** against an additional wall part **38** or the leaf spring in the hole **31**.
[0056] FIGS. **7**A to **7**C are views showing modification examples of the short bar shown in FIG. **4**. On the left side of FIG. **7**A, tunnels T**1**, T**1**′ are formed in the short bars S**2**, S**2**′, respectively. The tunnels T**1**, T**1**′ are raised portions in which a part of the lower surface of the short bars S**2**, S**2**′ is raised toward the upper surface, and at least one entrance is formed in each of the tunnels T**1**, T**1**′.
[0057] As shown on the right side of FIG. **7**A, portions of the leads L**1**, L**2** of the part P are curved so as to be parallel to the surfaces of the short bars S**2**, S**2**′. At this time, these portions of the leads L**1**, L**2** are parallel to each other and extend in the same direction. The part P is then slid along the surfaces of the short bars S**2**, S**2**′, thereby inserting the leads L**1**, L**2** into the interiors of the tunnels T**1**, T**1**′ from their entrances. Thereafter, the tunnels T**1**, T**1**′ are pressed so as to be crushed, thereby crimping the leads L**1**, L**2** into the tunnels T**1**, T**1**′, respectively.
[0058] On the left side of FIG. **7**B, portions of the leads L**1**, L**2** of the part P are curved so as to be parallel to the surface of the short bars S**2**, S**2**′. At this time, these portions of the leads L**1**, L**2** extend in opposite directions on the same straight line. End parts **36**, **36**′ of the short bars S**2**, S**2**′ are at least partially curved upward.
[0059] As shown on the right side of FIG. **7**B, after the portions of the leads L**1**, L**2** of the part P have abutted against the end parts **36**, **36**′ of the short bars S**2**, S**2**′, the end parts **36**, **36**′ are bent so as to fold back, thereby crimping the leads L**1**, L**2** within the folded back portions of the end parts **36**, **36**′.
[0060] In FIG. **7**C, a through hole **37** is formed in the thickness of the short bar S**2**. The same is true for the short bar S**2**′. Further, as shown in FIG. **7**B, the tips of the curved leads L**1**, L**2** are inserted into the through holes **37**, **37**′ of the short bars S**2**, S**2**′, respectively. Thereafter, the surfaces of the short bars S**2**, S**2**′ corresponding to the through holes **37**, **37**′ are pressed to crimp the leads L**1**, L**2** into the through holes **37**, **37**′.
[0061] In this manner, in the modification examples shown in FIGS. **7**A to **7**C, it is advantageous in that the leads L**1**, L**2** and the short bars S**2**, S**2**′ can be engaged to electrically connect the leads L**1**, L**2** and the short bars S**2**, S**2**′, without requiring additional parts, such as fasteners or adhesives.
[0062] FIGS. **8**A and **8**B are perspective views showing a mounting structure of a third embodiment, and FIG. **8**C is a side view of FIG. **8**B. As shown in FIG. **8**A, two short bars S**3**, S**3**′ are mounted on the surface of a printed circuit board C. These short bars S**3**, S**3**′ comprise engagement parts **15**, **15**′, for example, through holes, for engaging with the leads L**1**, L**2** of the part P, respectively. The part P also comprises an additional lead L**3** connected to the printed circuit board C in addition to the leads L**1**, L**2**.
[0063] As shown in FIG. **8**B, the leads L**1**, L**2** of the part P are engaged with the engagement parts **15**, **15**′ of the short bars S**3**, S**3**′, respectively. As a result, the leads L**1**, L**2** penetrate the corresponding through holes formed on the printed circuit board C and extend to the back surface of the printed circuit board C.
[0064] Thereafter, as shown in FIG. **8**C, the back side of the printed circuit board C is treated with solder or solder flow **25**. As a result, in the region indicated by the dashed line in FIG. **8**C, the leads L**1**, L**2**, the short bars S**3**, S**3**′, and the printed circuit board C are electrically connected in one treatment. Furthermore, in the same treatment, the lead L**3** and the printed circuit board C are also electrically connected.

[0065] Thus, in the third embodiment, when treating the lead L**3**, which requires soldering, the leads L**1**, L**2**, the short bars S**3**, S**3**′, and the printed circuit board C can also be treated simultaneously, and the number of production steps can be reduced. It will be understood that in this treatment, the lead L**2**, the short bar S**3**′, and the printed circuit board C can also be treated simultaneously, and the number of production steps can be further reduced. Furthermore, in the third embodiment, it is not necessary for the short bars S**3**, S**3**′ to separately create an electrical connection part to the printed circuit board C and an electrical connection part to the part P. Thus, it is also possible to reduce the sizes of the short bars S**3**, S**3**′ and the printed circuit board C.
[0066] FIGS. **9**A and **9**B are perspective views of a unit according to a fourth embodiment. The unit U**1** shown in these drawings comprises at least two short bars S**4**, S**4**′, the part P to be connected to the short bars S**4**, S**4**′, and at least one electrically insulation member **40***a* to **40***c* for affixing the short bars S**4**, S**4**′ to each other in a separated state.
[0067] Each of the short bars S**4**, S**4**′ comprises at least one engagement part **15**. Thus, as shown in FIG. **9**B, engagement with at least one part P is possible. The insulation members **40***a* to **40***c* are preferably composed of a hard resin.
[0068] The insulation members **40***a* to **40***c* can prevent the short bars S**4**, S**4**′ from shorting with each other. Furthermore, the presence of the insulation members **40***a* to **40***c* can strengthen the engagement between the short bars S**4**, S**4**′ and between the short bars S**4**, S**4**′ and the leads L**1**, L**2**. Thus, a unit U**1** which is strong against external forces can be provided. Furthermore, the insulation members **40***a* to **40***c* also serve as positioning members for positioning the part P when it is mounted and when a servo amplifier (not illustrated) is attached.
[0069] FIGS. **10**A and **10**B are views showing a unit based on a fifth embodiment. The unit U**2** comprises a short bar S**5** similar to that described above and an insulation coating **41** which at least partially covers the surface of the short bar S**5**. The insulation coating **41** is preferably composed of resin.
[0070] As can be understood from FIG. **10**A, the short bar S**5** comprises at least one engagement part **15**. The insulation coating **41** comprises at least one notch **42** which generally corresponds to the at least one engagement part **15**. The insulation coating **43** is then moved laterally to be attached to the short bar S**5**.
[0071] Strictly speaking, the insulation coating **41** insulates and covers the area of the short bar S**5** excluding the at least one engagement part **15**. The insulation coating **41** may be configured to cover only one side of the short bar S**5**, or may have a bag-like structure which covers both sides of the short bar S**5**. In this case, it can be attached by moving it laterally.
[0072] In the fifth embodiment, the insulation coating **41** serves as an electrical insulator between the short bar S**5** and the part P (not illustrated in FIGS. **10**A and **10**B). Furthermore, by adjusting the thickness of the insulation coating **41**, the insulation distance between the short bar S**5** and the part P can be secured.
[0073] The insulation coating **41** fills the gap between the short bar S**5** and the part P. Thus, even if the short bar S**5** is used in a machine (not illustrated) which is subjected to excessive vibration during use, the strength of the machine against vibration can be increased.
[0074] FIGS. **11**A and **11**B are perspective views of a unit according to a sixth embodiment. The unit U**3** of the sixth embodiment primarily comprises at least one short bar S**6**, S**6**′ comprising an engagement part **15**, **15**′ (not illustrated in FIGS. **11**A and **11**B) similar to those described above, insulation coatings **43**, **43**′ similar to those described above, which at least partially cover the surfaces of the short bars S**6**, S**6**′, and a part P having a substantially rectangular parallelepiped shape.
[0075] Each of the insulation coatings **43**, **43**′ comprises a positioning part **44**, **44**′ for positioning the part P. The insulation coatings **43**, **43**′ and the positioning parts **44**, **44**′ are preferably formed integrally with each other. The insulation coatings **43**, **43**′ are attached to the short bars S**6**, S**6**′, respectively, in the same manner as described with reference to FIGS. **10**A and **10**B.

[0076] As can be understood from FIG. **11**A, when the leads L**1**, L**2** of the part P are engaged with the engagement parts **15**, **15**′ of the short bars S**6**, S**6**′, the part P is moved to the area formed by the two positioning parts **44**, **44**′. As described above, the positioning parts **44**, **44**′ are provided at positions corresponding to the engagement parts **15**, **15**′. Thus, by moving the part P so that the side parts of the part P slide along the wall parts of the positioning parts **44**, **44**′, the leads L**1**, L**2** of the part P can be easily engaged with the engagement parts **15**, **15**′.
[0077] As can be understood from FIG. **11**A, the positioning parts **44**, **44**′ are provided in the insulation coatings **43**, **43**′ at positions corresponding to the engagement parts **15**, **15**′. The positioning parts **44**, **44**′ include wall parts extending perpendicularly to the insulation coatings **43**, **43**′. The heights of the wall parts are preferably greater than half the height of the part P excluding the leads L**1**, L**2**.
[0078] In this manner, it is preferable that the positioning parts **44**, **44**′ have a shape corresponding to at least a part of the side of the part P. In this case, the positioning parts **44**, **44**′ can support at least a part of the side of the part P, and thus, the vibration resistance of the unit U**3** can be improved.
[0079] When the part P having a substantially rectangular parallelepiped shape is viewed from above, the part P has four corners. Each of the positioning parts **44**, **44**′ shown in FIGS. **11**A and **11**B has a shape corresponding to two of the four corners. In an unillustrated embodiment, each of the positioning parts **44**, **44**′ may have a shape corresponding to one of the four corners. In this case, it is preferable that the corner of the part P corresponding to the positioning part **44** not be adjacent to the corner of the part P corresponding to the positioning part **44**′.
[0080] Alternatively, each of the positioning parts **44**, **44**′ may have a shape corresponding to half of the side of the part P. Since the positioning parts **44**, **44**′ can cover the entire side of the part P in this case, the vibration resistance of the unit U**3** can be improved and the entire side of the part P can be protected.
[0081] Furthermore, the case in which a single positioning part **44** has a wall part corresponding to the entire side of the part P, and the case in which a single positioning part **44** has wall parts corresponding to three or more of the four corners of the part P are included in the scope of the present disclosure.
[0082] In the unit U**3**′ shown in FIG. **11**B, the part P comprises leads L**1**, L**2** which are longer than those described above. The positioning parts **44**, **44**′ have spacers **48**, **48**′ inside the wall parts (the spacers **48** are not illustrated). The spacers **48**, **48**′ serve to adjust the lengths of the leads L**1**, L**2** so that only a portion of the ends of the leads L**1**, L**2** engage with the corresponding engagement parts **15**, **15**′. Thus, slits **49**, **49**′ through which the leads L**1**, L**2** can pass are formed in the spacers **48**, **48**′ (the slit **49** is not illustrated). When the ends of the leads L**1**, L**2** of the part P engage with the engagement parts **15**, **15**′, the bottom surface of the part P will be seated on the top ends of the spacers **48**, **48**′. In such a case, even if the leads L**1**, L**2** of the part P are long, only a portion of the tips of the leads L**1**, L**2** can be engaged with the engagement parts **15**, **15**′.
[0083] FIGS. **12**A to **12**D are perspective views of a unit according to a seventh embodiment. The unit U**4** of the seventh embodiment primarily comprises at least one short bar S**6**, S**6**′ having engagement parts **15**, **15**′ (not illustrated in FIG. **12**A, etc.) similar to those described above, insulation coatings **43**, **43**′ which at least partially cover the surfaces of the short bars S**6**, S**6**′, and a part P having a substantially rectangular parallelepiped shape.
[0084] Each of the insulation coatings **43**, **43**′ includes a positioning part **44**, **44**′ for positioning the part P. Furthermore, at least one of the insulation coatings **43** includes a closure part **45** that at least partially closes the upper surface of the part P. As shown in FIG. **12**A, the closure part **45** is connected to the positioning part **44**. Thus, it is preferable that the insulation coating **43**, the positioning part **44**, and the closure part **45** be integrally formed. Note that the height of the wall part of the positioning part **44** of the seventh embodiment is approximately equal to the height of the part P excluding the leads L**1**, L**2**.

[0085] As shown in FIG. **12**B, the insulation coating **43** including the positioning part **44** and the closure part **45** is moved laterally to mount the insulation coating **43** on the short bar S**6**. Since the notch **42** is formed in the insulation coating **43** at a position corresponding to the engagement part **15**, the insulation coating **43** does not interfere with the lead L**1** of the part P when the insulation coating **43** is mounted. As a result, a part of the part P is disposed in the space defined by the positioning parts **44**, **44**′ and the closure part **45**. In this case, the side and part of the top surface of the part P are affixed, whereby the vibration resistance can be further improved.
[0086] Furthermore, the insulation coating **43** of the unit U**4**′ of FIG. **12**C comprises a positioning part **44** and a closure part **46**. The closure part **46** has a size which covers the entire upper surface of the part P. It is preferable that the insulation coating **43**, the positioning part **44**, and the closure part **46** be integrally formed. Note that the insulation coating **43**′ of FIG. **12**C has the same configuration as the insulation coating **43**′ shown in FIGS. **12**A and **12**B. It can be understood that the side and upper surfaces of the part P are affixed in FIG. **12**C, which further improves vibration resistance.
[0087] In the unit U**4**″ shown in FIG. **12**D, another part W is arranged on the closure part **46**. In other words, the closure part **46** serves as an additional positioning part **47** for positioning the other part W. Thus, a groove, a protrusion, or the like corresponding to the other part W may be provided on the upper surface of the closure part **46**. It will be understood that the additional positioning part **47** makes it easier to position the other part W. Note that the additional positioning part **47**, such as a groove or a protrusion, may be formed on the outer surface of the positioning parts **44**, **44**′, so that the other part W is positioned on the outer surface of the positioning parts **44**, **44**′.
[0088] As an effect of at least one of the embodiments described above, the short bar and the lead of the lead part are directly engaged by the engagement part. Since the resistance value of the short bar is lower than that of the printed circuit board, heat generation of the short bar can be suppressed even when a large current is passed therethrough. Furthermore, there is no need to draw a large pattern on the printed circuit board, and the printed circuit board can be made smaller. Further, since there is no need to increase the thickness of the copper foil of the printed circuit board, production costs can be reduced.
[0089] Though the embodiments of the present disclosure have been described in detail, the present disclosure is not limited to the individual embodiments described above. Various additions, replacements, modifications, or partial deletions can be made to these embodiments within the scope of the spirit of the invention, or within the scope of the idea and intent of the present invention derived from the contents described in the claims and their equivalents. For example, the order of each operation and the order of each process of the embodiments described above are shown as examples, and are not limited to these. The same applies when numerical values or formulas are used in the description of the embodiments described above. Furthermore, appropriate combinations of some of the embodiments described above are included in the scope of the present disclosure.
[0090] In relation to the embodiments and modification examples described above, the following Addenda are further disclosed
(Addendum 1)
[0091] A short bar for electrical connection to a lead part, comprising: an engagement part which is to be engaged with a lead of the lead part.
(Addendum 2)
[0092] The short bar according to Addendum 1, wherein the engagement part is a socket for receiving the lead of the lead part.
(Addendum 3)
[0093] The short bar according to Addendum 1, wherein the engagement part is a crimping portion for crimping the lead of the lead part.
(Addendum 4)

[0094] The short bar according to Addendum 1 or 2, wherein the lead and the engagement part are electrically connected by solder or solder flow.
(Addendum 5)
[0095] A mounting structure, comprising: [0096] a printed circuit board, and [0097] the short bar according to Addendum 1, which is mounted on the printed circuit board, wherein [0098] the lead of the lead part which engages with the engagement part of the short bar passes over the short bar and penetrates a through hole of the printed circuit board.
(Addendum 6)
[0099] The mounting structure according to Addendum 5, wherein the lead and the engagement part are electrically connected by solder or solder flow.
(Addendum 7)
[0100] A mounting structure, comprising: [0101] the short bar according to any of Addenda 1 to 4, and [0102] a printed circuit board on which the short bar is mounted, wherein [0103] the lead of the lead part penetrates a through hole of the printed circuit board and engages with the engagement part of the short bar.
(Addendum 8)
[0104] A unit, comprising: [0105] a plurality of the short bar according to any of Addenda 1 to 4, and [0106] at least one insulation member for affixing the plurality of short bars in a separated state with each other.
(Addendum 9)
[0107] A unit, comprising: [0108] the short bar according to any of Addenda 1 to 4, and [0109] an insulation coating for insulating and covering an area of the short bar excluding the engagement part.
(Addendum 10)
[0110] The unit according to Addendum 9, wherein the insulation coating comprises a positioning part for positioning the lead part.
(Addendum 11)
[0111] The unit according to Addendum 10, wherein the positioning part further comprises a closure part for at least partially closing an upper surface of the lead part.
(Addendum 12)
[0112] The unit according to Addendum 10, wherein an additional positioning part is formed in the closure part.
DESCRIPTION OF REFERENCE SIGNS
[0113] **11**, **13** rising part [0114] **12** first extension part [0115] **14** second extension part [0116] **15**, **15′** engagement part [0117] **21**, **21′** socket [0118] **22**, **22′** hole [0119] **24**, **24′** through hole [0120] **25** solder flow [0121] **27**, **27′** rod [0122] **32** plate part [0123] **33** leaf spring [0124] **35** fastener [0125] **36**, **36′** end part [0126] **37**, **37′** through hole [0127] **38** additional wall part, leaf spring [0128] **40***a* to **40***c* insulation member [0129] **41** insulation coating [0130] **42** notch [0131] **43**, **43′** insulation coating [0132] **44**, **44′** positioning part [0133] **45**,**46** closure part [0134] **47** additional positioning part [0135] **48**, **48′** spacer [0136] **49**, **49′** slit [0137] C printed circuit board [0138] L**1**, L**2** lead [0139] P part [0140] S**1**, S**2**, S**2′**, S**3**, S**3′**, S**4**, S**4′**, S**5**, S**6**, S**6′** short bar [0141] T**1**, T**1′** tunnel [0142] U**1**, U**2**, U**3**, U**3′**, U**4**, U**4′** unit

## Claims

**1**. A short bar for electrical connection to a lead part, comprising an engagement part which is to be engaged with a lead of the lead part.
**2**. The short bar according to claim 1, wherein the engagement part is a socket for receiving the lead of the lead part.
**3**. The short bar according to claim 1, wherein the engagement part is a crimping portion for

crimping the lead of the lead part.

**4**. The short bar according to claim 1, wherein the lead and the engagement part are electrically connected by solder or solder flow.

**5**. A mounting structure, comprising: a printed circuit board, and the short bar according to claim 1, which is mounted on the printed circuit board, wherein the lead of the lead part which engages with the engagement part of the short bar passes over the short bar and penetrates a through hole of the printed circuit board.

**6**. The mounting structure according to claim 5, wherein the lead and the engagement part are electrically connected by solder or solder flow.

**7**. A mounting structure, comprising: the short bar according to claim 1, and a printed circuit board on which the short bar is mounted, wherein the lead of the lead part penetrates a through hole of the printed circuit board and engages with the engagement part of the short bar.

**8**. A unit, comprising: a plurality of the short bar according to claim 1, and at least one insulation member for affixing the plurality of short bars in a separated state with each other.

**9**. A unit, comprising: the short bar according to claim 1, and an insulation coating for insulating and covering an area of the short bar excluding the engagement part.

**10**. The unit according to claim 9, wherein the insulation coating comprises a positioning part for positioning the lead part.

**11**. The unit according to claim 10, wherein the positioning part further comprises a closure part for at least partially closing an upper surface of the lead part.

**12**. The unit according to claim 10, wherein an additional positioning part is formed in the closure part.