CLAIMS

1. A contact probe comprising:

a shell comprising a body having a shell cavity;

at least one plunger received in the shell cavity and extending through at least one opening in at least one end of the shell; and

at least one insulation member comprising an insulative material, an outer surface of at least one of the shell and the at least one plunger is configured to exhibit a narrowed region about at least a portion of a periphery thereof bounded by at least one non-narrowed region about the periphery thereof, the narrowed region and the at least one non-narrowed region being configured such that the at least one insulation member is received about and seated in the narrowed region.

2. The contact probe of claim 1, wherein the at least one insulation member is configured to surround at least a majority of a periphery of the portion of the outer surface.

3. The contact probe of claim 1, wherein the at least one insulation member is disposed on at least a portion of an outer surface of the shell.

4. The contact probe of claim 1, wherein:

the at least one plunger includes a tail portion that is slidably received in the shell cavity and a tip portion extending through the at least one opening in the at least one end of the shell,

the at least one insulation member is disposed on at least a portion of an outer surface of the tip portion.

5. The contact probe of claim 1, wherein the at least one insulation member forms a ring.

6. The contact probe of claim 5, wherein the ring is configured to fit by compression onto at least the portion of the outer surface.

7. The contact probe of claim 5, wherein the ring is configured to couple with the narrowed region.

8. The contact probe of claim 7, wherein the narrowed region exhibits a generally U-shaped cross section.

9. The contact probe of claim 1, wherein:
the at least one end of the shell includes a first end and a second end;
the at least one opening includes a first opening in the first end and a second opening in the second end; and
the at least one plunger includes a first plunger extending through the first opening and a second plunger extending through the second opening.

10. The contact probe of claim 9, wherein:
the at least one insulation member contacts at least one of: the first plunger and the first end of the shell, and
the at least one insulation member is configured to move with the first plunger and the shell.

11. The contact probe of claim 9, wherein the at least one insulation member is fixedly disposed on the first plunger.

12. The contact probe of claim 9, wherein the first plunger is attached to the shell so that the first plunger and the shell move together when an axial force is applied to the first plunger.

13. The contact probe of claim 9, wherein the at least one insulation member includes a first insulation member disposed on a first portion of the outer surface of the shell and a second insulation member disposed on a second portion of the outer surface of the shell.

14. The contact probe of claim 13, wherein the first plunger is attached to the shell so that the first and second insulation members, the first plunger, and the shell are configured to move together.

15. The contact probe of claim 13, wherein the first plunger is configured to move independently from the first and second insulation members and the shell.

16. The contact probe of claim 13, wherein the first portion of the outer surface of the shell is located near the first end of the shell, and the second portion of the outer surface of the shell is located near the second end of the shell.

17. The contact probe of claim 9, wherein the at least one insulation member is fixedly disposed on the second plunger.

18. The contact probe of claim 1, wherein the shell and the at least one plunger each comprise at least one conductive material, and are configured to be electrically connected.

19. The contact probe of claim 1, wherein the insulative material includes polytetrafluoroethylene.

20. The contact probe of claim 1, wherein an outer diameter of the insulation member is at least approximately twice as large as an outer diameter of the shell.

21. An electrical connector assembly comprising:
a socket shell comprising a body having a socket cavity; and
a contact probe comprising:
a contact probe shell disposed in the socket cavity, the contact probe shell comprising a body having a shell cavity;
at least one plunger received in the shell cavity and extending through at least one opening in at least one end of the contact probe shell; and

at least one insulation member comprising an insulative material and disposed in the socket cavity, the at least one insulation member being disposed on and fixed to at least a portion of an outer surface of the at least one plunger.

22. The electrical connector assembly of claim 21, wherein the at least one insulation member has a cross section that spans at least a majority of an area between a portion of the socket shell and the portion of the outer surface.

23. The electrical connector assembly of claim 21, wherein at least a portion of the socket shell, the contact probe shell, and the at least one plunger each comprise at least one conductive material.

24. The electrical connector assembly of claim 23, wherein the socket shell includes a top portion comprising a second insulative material, an intermediate portion comprising a second conductive material, and a bottom portion comprising a third insulative material.

25. The electrical connector assembly of claim 24, wherein the second insulative material and the third insulative material each include plastic.

26. The electrical connector assembly of claim 21, wherein the socket shell body includes at least a top portion and a bottom portion, the socket cavity extending through the top portion and the bottom portion.

27. The electrical connector assembly of claim 26, wherein:
the at least one plunger includes a first plunger that extends through a first opening in the top portion of the socket shell body and a second plunger that extends through a second opening in the bottom portion of the socket shell body.

28. The electrical connector assembly of claim 27, wherein:
the electrical connector is configured to provide an electrical connection between an integrated circuit chip and a printed circuit board via the contact probe;

the first plunger is configured to provide an electrical contact to the integrated circuit chip; and

the second plunger is configured to provide an electrical contact to the printed circuit board.

29. The electrical connector assembly of claim 27, wherein the at least one insulation member includes an insulation member disposed on the first plunger.

30. The electrical connector assembly of claim 27, wherein the at least one insulation member includes an insulation member disposed on the second plunger.

31. The electrical connector assembly of claim 30, wherein the insulation member disposed on the second plunger is located near the bottom portion of the socket shell body.

32. The electrical connector assembly of claim 27, wherein:

the first end of the shell is proximal to the first plunger and a second end of the shell is proximal to the second plunger, and

the at least one insulation member includes a first insulation member disposed on the shell near the first end and a second insulation member disposed on the shell near the second end.

33. The electrical connector assembly of claim 21, further comprising:

a plurality of contact probes;

wherein the socket shell body comprises a plurality of socket cavities, each associated with at least one of the plurality of contact probes.

34. The electrical connector assembly of claim 33, wherein the electrical connector is configured to provide an electrical connection between an integrated circuit chip and a printed circuit board via the plurality of contact probes.

35. A method of forming an electrical connector with a coaxial structure, the method comprising:

forming a contact probe by:

inserting at least one plunger into a shell cavity in a body of a shell so that a tail portion of the at least one plunger is slidably received in the shell cavity and a tip portion of the at least one plunger extends away from the shell cavity, and

disposing a first insulation member on a first portion of an outer surface of the shell and a second insulation member on a second portion of the outer surface of the shell, wherein the second portion of the outer surface of the shell is displaced from the first portion of the outer surface of the shell such that a gap extends between the first insulation member and the second insulation member along an axis of the body of the shell, each of the first and second insulation members comprising an insulative material;

disposing the contact probe in a first socket cavity in a first portion of a socket assembly so that at least a portion of each of the first and second insulation members and the gap therebetween is disposed within the first socket cavity; and

disposing a second portion of the socket assembly with a second socket cavity adjacent the first portion of the socket assembly so that the first socket cavity is aligned with the second socket cavity, and the first portion of the socket assembly, the second portion of the socket assembly, and the contact probe form the coaxial structure.

36. The method of claim 35,

wherein at least one of the first and second insulation members includes at least one ring that is configured to fit by compression onto the corresponding first or second portion of the outer surface of the shell; and

the method further comprising pushing the at least one ring from at least one end of the shell to a desired location.

37. The method of claim 35, wherein the first portion of the outer surface of the shell includes a narrowed section.

38. The method of claim 35, wherein the first portion of the outer surface of the shell is located near a first end of the shell and the second portion of the outer surface of the shell is located near a second end of the shell.

39. The method of claim 35, wherein each of the first and second insulation members surrounds at least a majority of a periphery of the respective first and second portions of the outer surface of the shell.

40. The method of claim 35, wherein the shell and the at least one plunger each comprise at least one conductive material, and are configured to be electrically connected.

41. The method of claim 35, wherein:
the first and second portions of the socket assembly are configured to limit sliding movement of the contact probe.

42. The method of claim 41, wherein:
the first socket cavity is one of a plurality of first socket cavities in the first portion of the socket assembly;
the contact probe is one of a plurality of contact probes, each contact probe being disposed in a respective first socket cavity;
the second socket cavity is one of a plurality of second socket cavities in the second portion of the socket assembly; and
the plurality of first socket cavities are aligned with the respective plurality of second socket cavities.

43. The method of claim 35, wherein the first insulation member in its entirety, the second insulation member in its entirety, and the gap therebetween in its entirety is disposed within the first socket cavity.

CLAIMS

1. A contact probe comprising:

a shell comprising a body having a shell cavity;

at least one plunger received in the shell cavity and extending through at least one opening in at least one end of the shell; and

at least one insulation member comprising an insulative material, an outer surface of at least one of the shell and the at least one plunger is configured to exhibit a narrowed region about at least a portion of a periphery thereof bounded by at least one non-narrowed region about the periphery thereof, the narrowed region and the at least one non-narrowed region being configured such that the at least one insulation member is received about and seated in the narrowed region.

2. The contact probe of claim 1, wherein the at least one insulation member is configured to surround at least a majority of a periphery of the portion of the outer surface.

3. The contact probe of claim 1, wherein the at least one insulation member is disposed on at least a portion of an outer surface of the shell.

4. The contact probe of claim 1, wherein:

the at least one plunger includes a tail portion that is slidably received in the shell cavity and a tip portion extending through the at least one opening in the at least one end of the shell,

the at least one insulation member is disposed on at least a portion of an outer surface of the tip portion.

5. The contact probe of claim 1, wherein the at least one insulation member forms a ring.

6. The contact probe of claim 5, wherein the ring is configured to fit by compression onto at least the portion of the outer surface.

7. The contact probe of claim 5, wherein the ring is configured to couple with the narrowed region.

8. The contact probe of claim 7, wherein the narrowed region exhibits a generally U-shaped cross section.

9. The contact probe of claim 1, wherein:

the at least one end of the shell includes a first end and a second end;

the at least one opening includes a first opening in the first end and a second opening in the second end; and

the at least one plunger includes a first plunger extending through the first opening and a second plunger extending through the second opening.

10. The contact probe of claim 9, wherein:

the at least one insulation member contacts at least one of: the first plunger and the first end of the shell, and

the at least one insulation member is configured to move with the first plunger and the shell.

11. The contact probe of claim 9, wherein the at least one insulation member is fixedly disposed on the first plunger.

12. The contact probe of claim 9, wherein the first plunger is attached to the shell so that the first plunger and the shell move together when an axial force is applied to the first plunger.

13. The contact probe of claim 9, wherein the at least one insulation member includes a first insulation member disposed on a first portion of the outer surface of the shell and a second insulation member disposed on a second portion of the outer surface of the shell.

14. The contact probe of claim 13, wherein the first plunger is attached to the shell so that the first and second insulation members, the first plunger, and the shell are configured to move together.

15. The contact probe of claim 13, wherein the first plunger is configured to move independently from the first and second insulation members and the shell.

16. The contact probe of claim 13, wherein the first portion of the outer surface of the shell is located near the first end of the shell, and the second portion of the outer surface of the shell is located near the second end of the shell.

17. The contact probe of claim 9, wherein the at least one insulation member is fixedly disposed on the second plunger.

18. The contact probe of claim 1, wherein the shell and the at least one plunger each comprise at least one conductive material, and are configured to be electrically connected.

19. The contact probe of claim 1, wherein the insulative material includes polytetrafluoroethylene.

20. The contact probe of claim 1, wherein an outer diameter of the insulation member is at least approximately twice as large as an outer diameter of the shell.

21. An electrical connector assembly comprising:

a socket shell comprising a body having a socket cavity; and

a contact probe comprising:

a contact probe shell disposed in the socket cavity, the contact probe shell comprising a body having a shell cavity;

at least one plunger received in the shell cavity and extending through at least one opening in at least one end of the contact probe shell; and

at least one insulation member comprising an insulative material and disposed in the socket cavity, the at least one insulation member being disposed on and fixed to at least a portion of an outer surface of the at least one plunger.

22. The electrical connector assembly of claim 21, wherein the at least one insulation member has a cross section that spans at least a majority of an area between a portion of the socket shell and the portion of the outer surface.

23. The electrical connector assembly of claim 21, wherein at least a portion of the socket shell, the contact probe shell, and the at least one plunger each comprise at least one conductive material.

24. The electrical connector assembly of claim 23, wherein the socket shell includes a top portion comprising a second insulative material, an intermediate portion comprising a second conductive material, and a bottom portion comprising a third insulative material.

25. The electrical connector assembly of claim 24, wherein the second insulative material and the third insulative material each include plastic.

26. The electrical connector assembly of claim 21, wherein the socket shell body includes at least a top portion and a bottom portion, the socket cavity extending through the top portion and the bottom portion.

27. The electrical connector assembly of claim 26, wherein:

the at least one plunger includes a first plunger that extends through a first opening in the top portion of the socket shell body and a second plunger that extends through a second opening in the bottom portion of the socket shell body.

28. The electrical connector assembly of claim 27, wherein:

the electrical connector is configured to provide an electrical connection between an integrated circuit chip and a printed circuit board via the contact probe;

the first plunger is configured to provide an electrical contact to the integrated circuit chip; and

the second plunger is configured to provide an electrical contact to the printed circuit board.

29. The electrical connector assembly of claim 27, wherein the at least one insulation member includes an insulation member disposed on the first plunger.

30. The electrical connector assembly of claim 27, wherein the at least one insulation member includes an insulation member disposed on the second plunger.

31. The electrical connector assembly of claim 30, wherein the insulation member disposed on the second plunger is located near the bottom portion of the socket shell body.

32. The electrical connector assembly of claim 27, wherein:

the first end of the shell is proximal to the first plunger and a second end of the shell is proximal to the second plunger, and

the at least one insulation member includes a first insulation member disposed on the shell near the first end and a second insulation member disposed on the shell near the second end.

33. The electrical connector assembly of claim 21, further comprising:

a plurality of contact probes;

wherein the socket shell body comprises a plurality of socket cavities, each associated with at least one of the plurality of contact probes.

34. The electrical connector assembly of claim 33, wherein the electrical connector is configured to provide an electrical connection between an integrated circuit chip and a printed circuit board via the plurality of contact probes.

35. A method of forming an electrical connector with a coaxial structure, the method comprising:

forming a contact probe by:

inserting at least one plunger into a shell cavity in a body of a shell so that a tail portion of the at least one plunger is slidably received in the shell cavity and a tip portion of the at least one plunger extends away from the shell cavity, and

disposing a first insulation member on a first portion of an outer surface of the shell and a second insulation member on a second portion of the outer surface of the

shell, wherein the second portion of the outer surface of the shell is displaced from the first portion of the outer surface of the shell such that a gap extends between the first insulation member and the second insulation member along an axis of the body of the shell, each of the first and second insulation members comprising an insulative material;

disposing the contact probe in a first socket cavity in a first portion of a socket assembly so that at least a portion of each of the first and second insulation members and the gap therebetween is disposed within the first socket cavity; and

disposing a second portion of the socket assembly with a second socket cavity adjacent the first portion of the socket assembly so that the first socket cavity is aligned with the second socket cavity, and the first portion of the socket assembly, the second portion of the socket assembly, and the contact probe form the coaxial structure.

36. The method of claim 35,

wherein at least one of the first and second insulation members includes at least one ring that is configured to fit by compression onto the corresponding first or second portion of the outer surface of the shell; and

the method further comprising pushing the at least one ring from at least one end of the shell to a desired location.

37. The method of claim 35, wherein the first portion of the outer surface of the shell includes a narrowed section.

38. The method of claim 35, wherein the first portion of the outer surface of the shell is located near a first end of the shell and the second portion of the outer surface of the shell is located near a second end of the shell.

39. The method of claim 35, wherein each of the first and second insulation members surrounds at least a majority of a periphery of the respective first and second portions of the outer surface of the shell.

40. The method of claim 35, wherein the shell and the at least one plunger each comprise at least one conductive material, and are configured to be electrically connected.

41. The method of claim 35, wherein:

the first and second portions of the socket assembly are configured to limit sliding movement of the contact probe.

42. The method of claim 41, wherein:

the first socket cavity is one of a plurality of first socket cavities in the first portion of the socket assembly;

the contact probe is one of a plurality of contact probes, each contact probe being disposed in a respective first socket cavity;

the second socket cavity is one of a plurality of second socket cavities in the second portion of the socket assembly; and

the plurality of first socket cavities are aligned with the respective plurality of second socket cavities.

43. The method of claim 35, wherein the first insulation member in its entirety, the second insulation member in its entirety, and the gap therebetween in its entirety is disposed within the first socket cavity.