

What is claimed is:

1. A smart card device comprising:

a laminated core comprising: a front substrate; a first flexible sheet having a card circuitry formed thereon; a first substrate; a second flexible sheet having an inductive circuitry formed thereon, and a second substrate in a top-to-bottom order,

wherein the front substrate provides at least one first opening which defines a perforated design and a second opening through which a contact pad is exposed,

wherein the card circuitry includes: a flip chip, a first antenna coil conductively coupled to the flip chip, the contact pad, at least one conductor path conductively coupling the contact pad to the flip chip,

wherein the inductive circuitry includes at least one LED module arranged proximate to the at least one first opening and a second antenna coil conductively coupled to the at least one LED module, and

wherein the first substrate includes at least one light guide which is arranged under the at least one first opening and configured to direct an illumination produced by the at least one LED module through the at least one first opening to illuminate the perforated design.

2. The smart card device of claim 1, further comprising:

at least one reflector arranged at a position which is between the second flexible sheet and the second substrate, and under the at least one LED module, wherein the at least one reflector is configured to direct the illumination to the at least one light guide.

3. The smart card device of claim 2, wherein the at least one light guide includes either one of the following:

a stacked arrangement comprising a plurality of polyethylene terephthalate (PET) and/or polyvinyl chloride (PVC) layers, wherein a surface of at least one of the plurality of PET and/or PVC layers is roughened, wherein the stacked arrangement is arranged within a third opening which is formed in the first substrate; and

an integral and roughened surface portion of the first substrate.

4. The smart card device of claim 2 or claim 3,

wherein the at least one first opening includes a plurality of first openings which define a plurality of perforated designs,

wherein the at least one light guide includes a plurality of light guides arranged under the plurality of first openings,

wherein the at least one LED module includes a plurality of LED modules arranged proximate to the plurality of first openings,

wherein the at least one light guide includes a plurality of light guides which are arranged under the plurality of first openings and configured to direct the illumination produced by the plurality of LED modules through the plurality of first openings to illuminate the plurality of perforated designs,

wherein the at least one reflector includes a plurality of reflectors which are arranged between the second flexible sheet and the second substrate, and under the plurality of LED modules, wherein the plurality of reflectors are configured to direct the illumination to the plurality of light guides.

5. The smart card device of claim 1, wherein the at least one light guide includes a layer of light diffusing ink applied on a surface of the first substrate, and wherein the at least one LED module is arranged at an edge of the layer of light diffusing ink.

6. The smart card device of any one of claim 1 to claim 5, wherein the card circuitry includes an additional LED module which is conductively coupled to the first antenna coil and arranged proximate to the at least one first opening such that the at least one light guide is configured to additionally direct an illumination produced by the additional LED module to the at least one first opening.

7. The smart card device of any one of claim 1 to claim 6, wherein the second flexible sheet includes a label formed thereon, wherein the second substrate provides a fourth opening through which the label is exposed.

8. The smart card device of any one of claim 1 to claim 7, wherein the first substrate includes a thermoformed projection arranged under the contact pad.

9. The smart card device of any one of claim 1 to claim 8, wherein the first substrate includes a PVC and/or PET layer.

10. The smart card device of any one of claim 1 to claim 9, wherein at least the first substrate or the second substrate includes at least one edge portion which is at least partially transparent.

11. The smart card device of any one of claim 1 to claim 10, wherein the flip chip is arranged offset relative to the contact pad.

12. The smart card device of any one of claim 1 to claim 11, wherein the at least one LED module is arranged offset relative to the at least one first opening.

13. The smart card device of any one of claim 1 to claim 12, wherein the front substrate includes a metallic layer.

14. The smart card device of claim 1 or claim 5,

wherein the at least one first opening includes a plurality of first openings which define a plurality of perforated designs,

wherein the at least one light guide includes a plurality of light guides arranged under the plurality of first openings,

wherein the at least one LED module includes a plurality of LED modules arranged proximate to the plurality of first openings,

wherein the at least one light guide includes a plurality of light guides which are arranged under the plurality of first openings and configured to direct the illumination produced by the plurality of LED modules through the plurality of first openings to illuminate the plurality of perforated designs.

15. The smart card device of any one of claim 1 to claim 14, wherein a shape of the contact pad is an irregular shape.

16. A method for fabricating a smart card device, the method comprising:

perforating a front substrate to form at least one first opening and at least one second opening;

performing thermoforming on a first substrate to form a thermoformed projection on the first substrate;

forming a stacked arrangement using the front substrate, a first flexible sheet having a card circuitry formed thereon, the first substrate having at least one light guide, a second flexible sheet having an inductive circuitry formed thereon, and a second substrate, in a top-to-bottom order, wherein the card circuitry includes: a flip chip, a first antenna coil conductively coupled to the flip chip, the contact pad, and at least one conductor path conductively coupling the contact pad to the flip chip, wherein the inductive circuitry includes at least one LED module conductively coupled to a second antenna coil,

wherein forming the stacked arrangement includes: aligning the at least one first opening and the at least one light guide; and aligning the at least one second opening, the contact pad, and the thermoformed projection; and

laminating the stacked arrangement to produce a laminated core.

17. The method of claim 16, wherein forming the stacked arrangement includes arranging at least one reflector at a position which is between the second flexible sheet and the second substrate, and under the at least one first opening.

18. The method of claim 17, wherein prior to forming the stacked arrangement, the method further comprising either one of the following:

perforating the first substrate to form a third opening, and arranging in the third opening the at least one light guide, which includes another stacked arrangement comprising a plurality of PET and/or PVC layers wherein a surface of at least one of the plurality of PET and/or PVC layers is roughened; and

roughening an integral surface portion of the first substrate thereby providing the at least one light guide.

19. The smart card device of claim 17 or claim 18,

wherein the at least one first opening includes a plurality of first openings which define a plurality of perforated designs,

wherein the at least one light guide includes a plurality of light guides arranged under the plurality of first openings,

wherein the at least one LED module includes a plurality of LED modules arranged proximate to the plurality of first openings,

wherein the at least one light guide includes a plurality of light guides which are arranged under the plurality of first openings and configured to direct the illumination produced by the plurality of LED modules through the plurality of first openings to illuminate the plurality of perforated designs,

wherein the at least one reflector includes a plurality of reflectors which are arranged between the second flexible sheet and the second substrate, and under the plurality of LED modules, wherein the plurality of reflectors are configured to direct the illumination to the plurality of light guides.

20. The method of claim 16, wherein prior to forming the stacked arrangement, the method further comprising:

perforating the first substrate to form at least one third opening; and

applying, on the first substrate, a light diffusing ink on a surface portion adjacent to the at least one third opening, and

wherein the forming the stacked arrangement includes: receiving the at least one LED module within the at least one third opening.

21. The method of any one of claim 16 to claim 20, wherein the card circuitry includes an additional LED module which is conductively coupled to the first antenna coil.

22. The method of any one of claim 16 to claim 21, wherein the second flexible sheet includes a label formed thereon, the method further comprising:

perforating the second substrate to form at least one fourth opening;

wherein arranging the stacked arrangement includes: aligning the label with the at least one fourth opening.

23. The method of any one of claim 16 to claim 22, wherein prior to performing thermoforming on the first substrate to form the thermoformed projection on the first substrate, the method further comprising:

overlaying a PVC layer on a PET layer to provide the first substrate.

24. The method of any one of claim 16 to claim 23, wherein at least the first substrate or the second substrate includes at least one edge portion which is at least partially transparent.

25. The method of any one of claim 16 to claim 24, wherein the flip chip is arranged offset relative to the contact pad.

26. The method of any one of claim 16 to claim 25, wherein the at least one LED module is arranged offset relative to the at least one first opening.

27. The method of any one of claim 16 to claim 26, wherein the front substrate includes a metallic layer.

28. The method of claim 16 or claim 20,

wherein the at least one first opening includes a plurality of first openings which define a plurality of perforated designs,

wherein the at least one light guide includes a plurality of light guides arranged under the plurality of first openings,

wherein the at least one LED module includes a plurality of LED modules arranged proximate to the plurality of first openings,

wherein the at least one light guide includes a plurality of light guides which are arranged under the plurality of first openings and configured to direct the illumination

produced by the plurality of LED modules through the plurality of first openings to illuminate the plurality of perforated designs.

29. The method of any one of claim 16 to claim 28, further comprising: dicing the laminated core to provide a plurality of smart card devices.

30. The method of any one of claim 16 to claim 29, wherein a shape of the contact pad is an irregular shape.