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(54) **ELECTRONIC DEVICES INCLUDING AN INDICIUM WITH A THERMAL CONDUIT**

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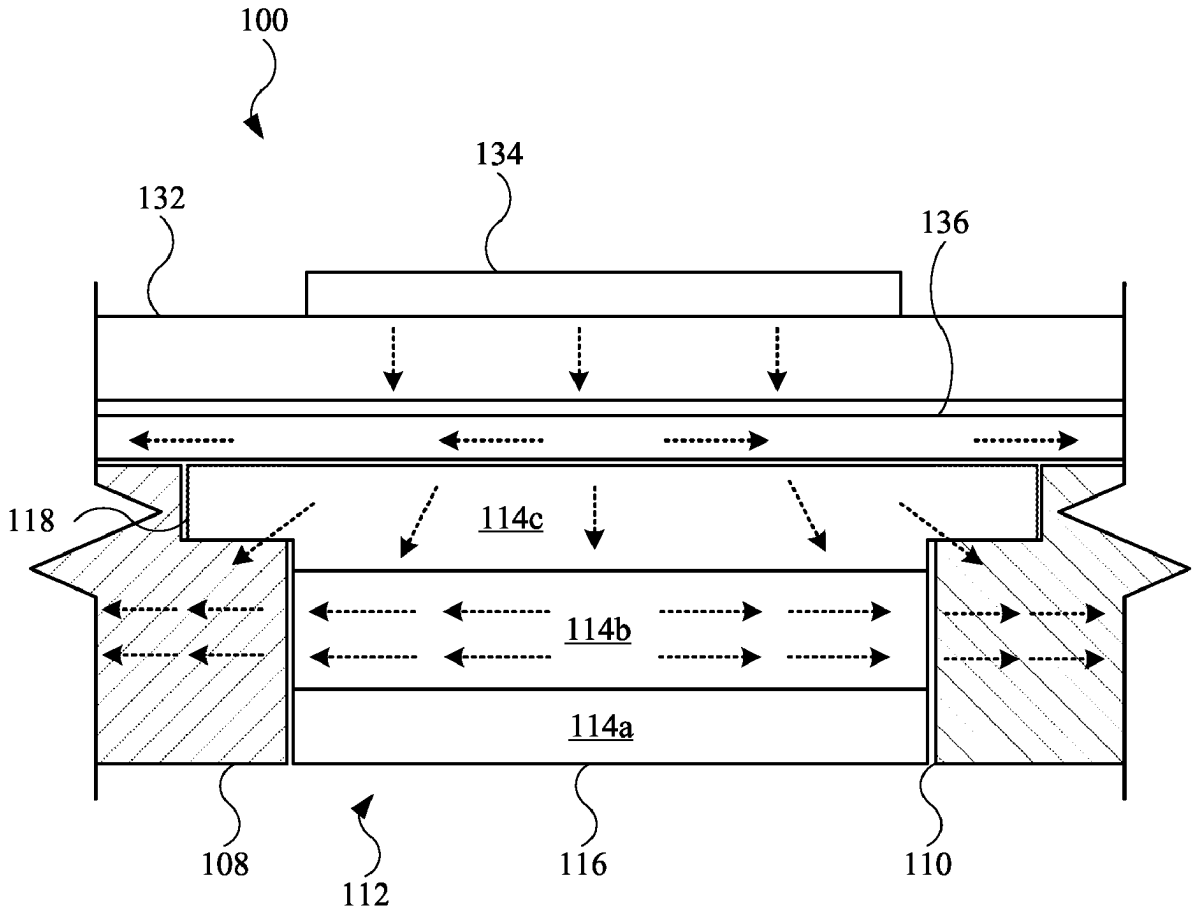
CPC ***H05K 7/20418*** (2013.01); ***G06F 1/203*** (2013.01); ***H05K 7/20963*** (2013.01)

(57) **ABSTRACT**

An indicium (e.g., logo) for an electronic device includes multiple layers of material bonded together, with at least one of the layers having a relatively higher thermal conductivity than the other layers. Using the layer with the higher thermal conductivity, the indicium may direct heat away from a heat-generating component and distribute the heat to a housing of the electronic device. In order to provide a particular appearance, the indicium may include a layer that covers the relatively higher thermally conductive layer. Based on the higher thermally conductive layer, the indicium may limit or prevent heat flow through the layer covering the thermally conductive layer.



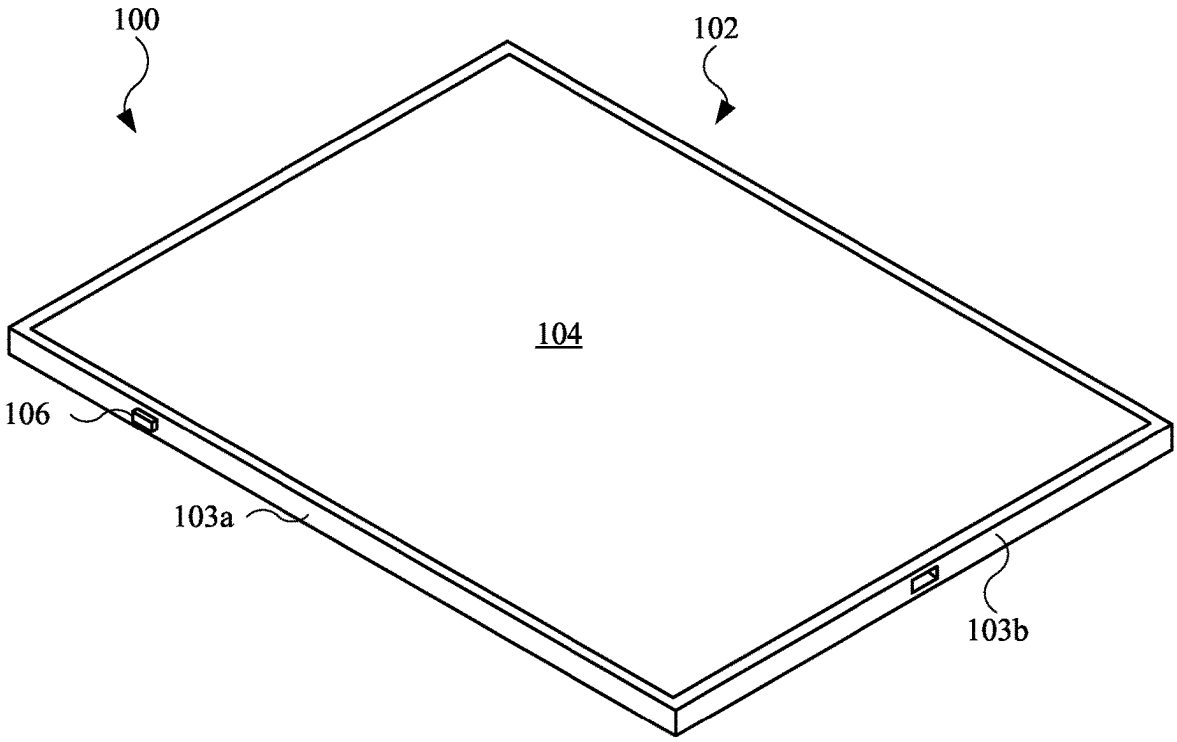


FIG. 1

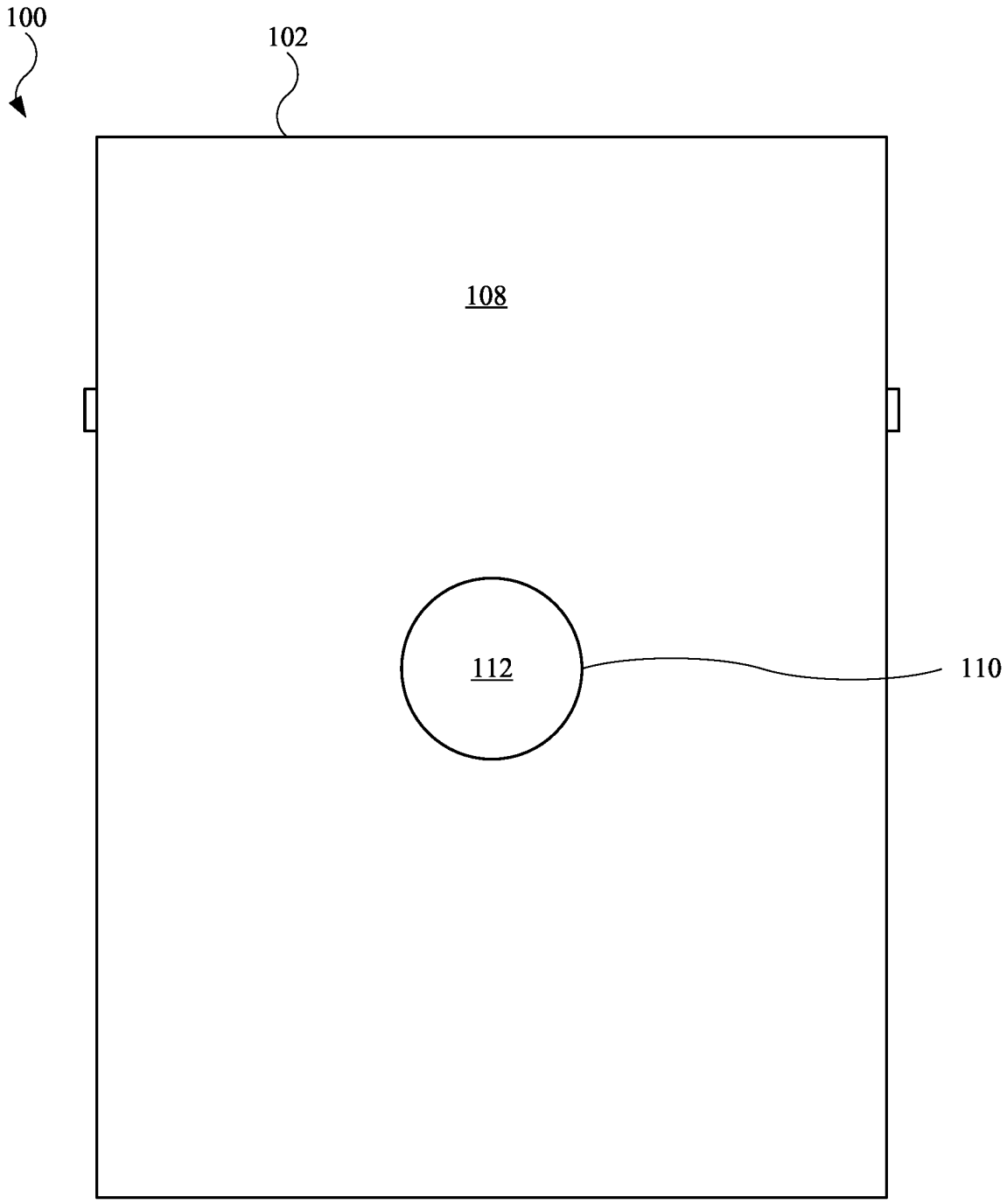


FIG. 2

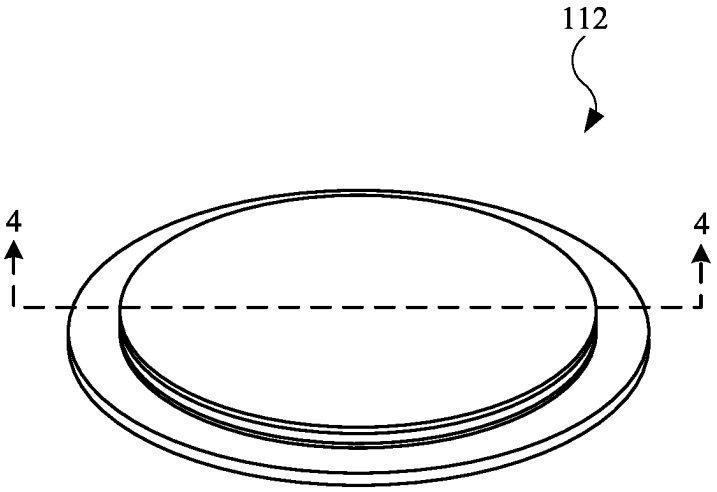


FIG. 3

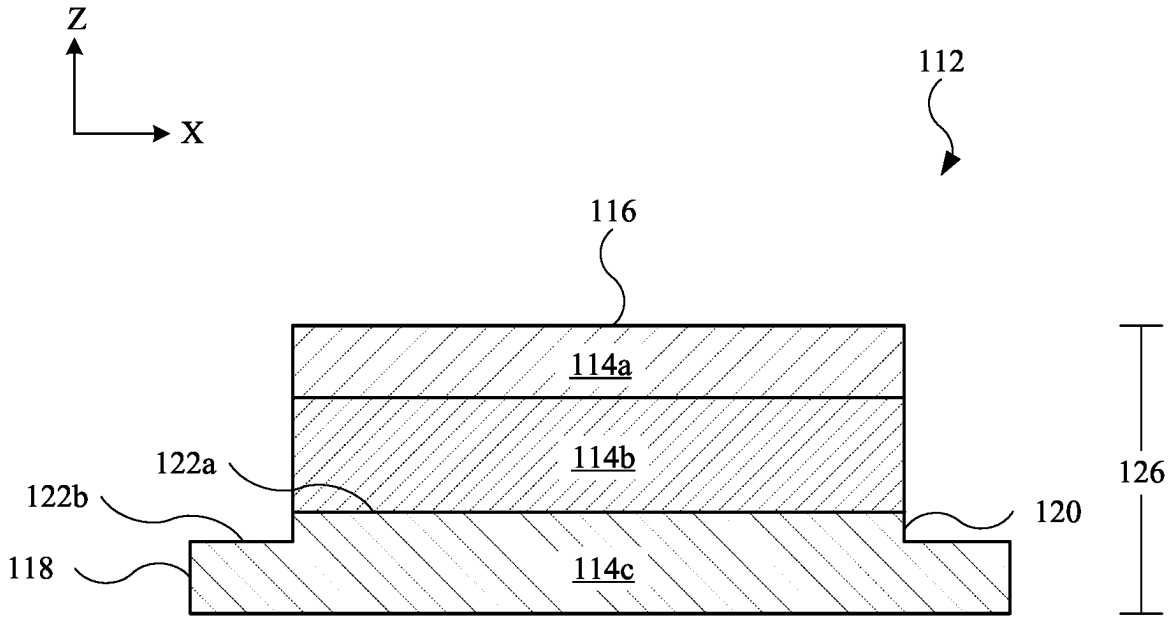


FIG. 4

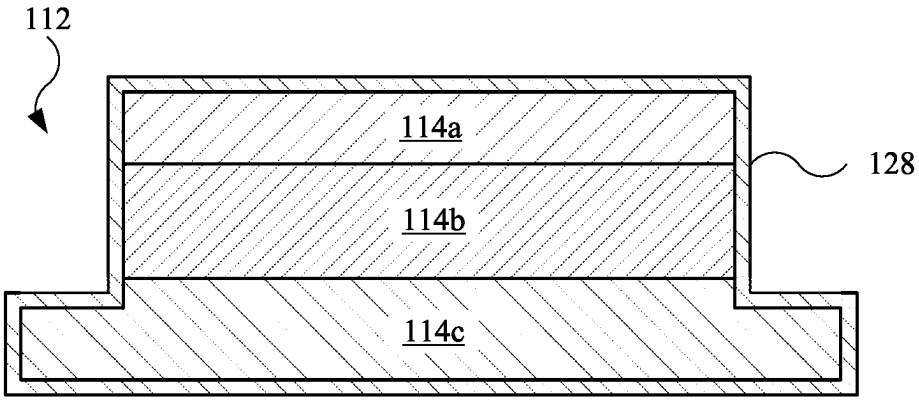


FIG. 5A

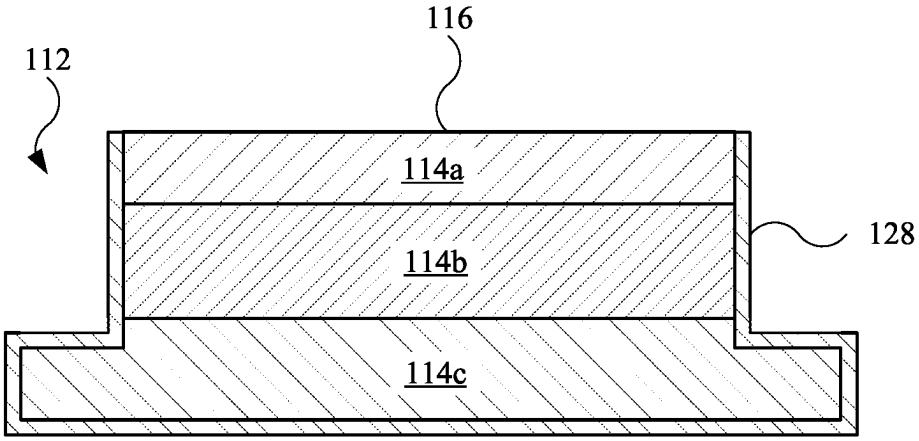


FIG. 5B

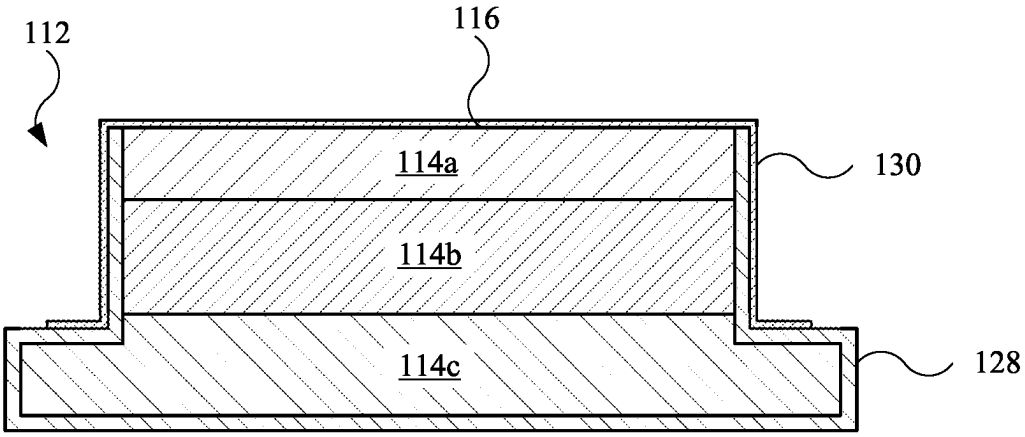


FIG. 5C

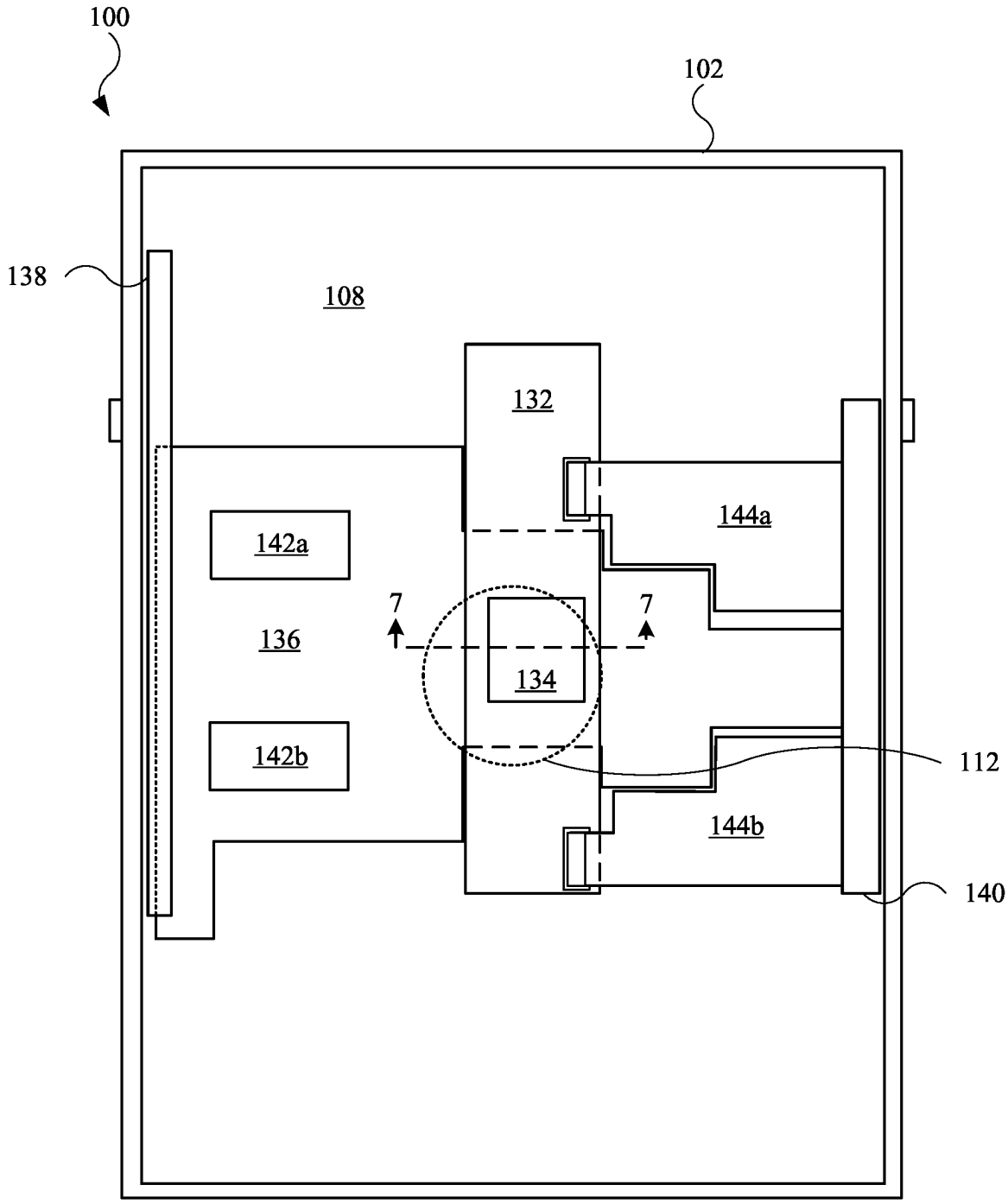


FIG. 6

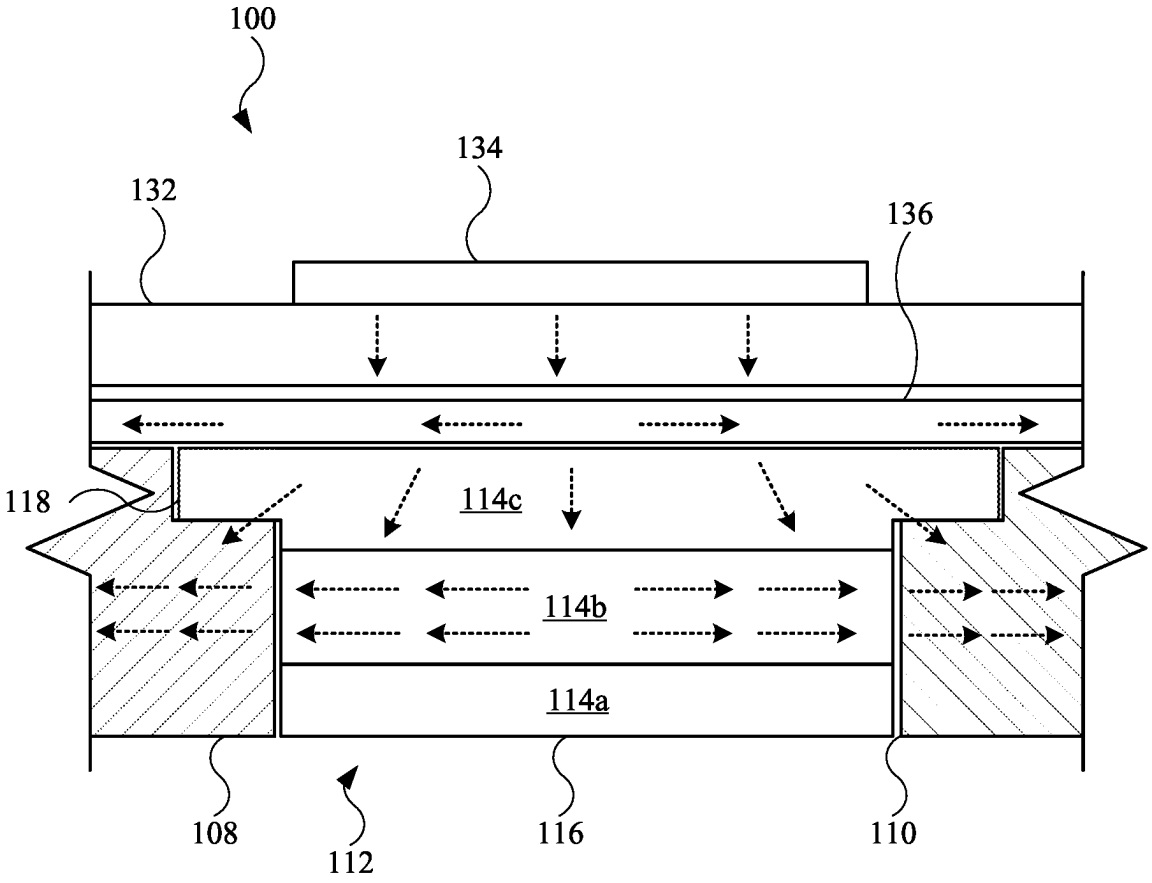


FIG. 7

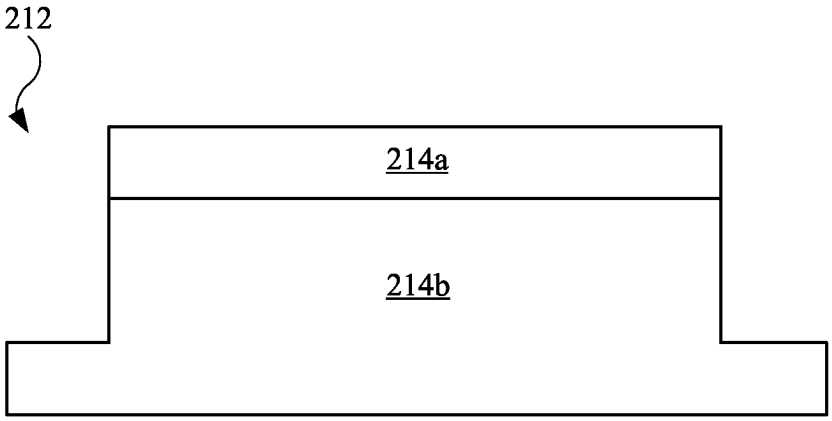


FIG. 8

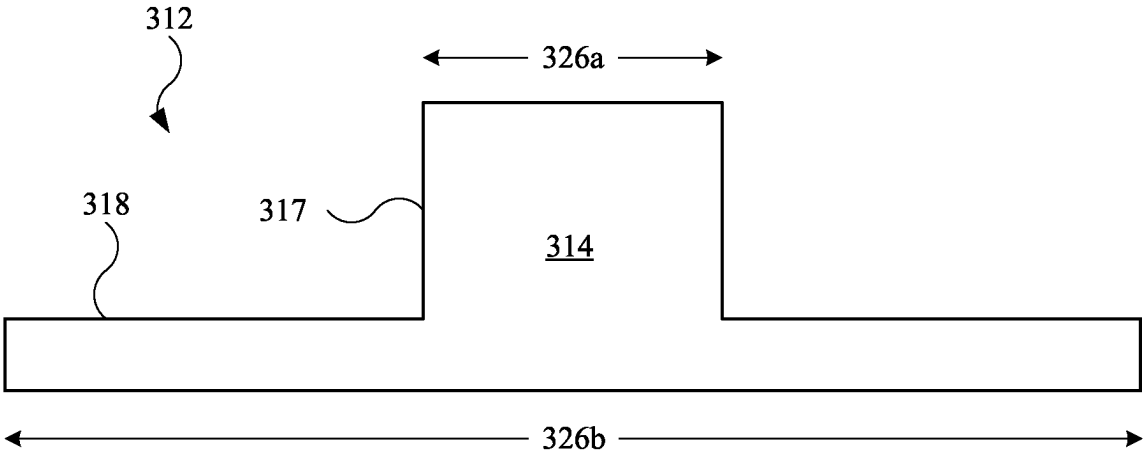


FIG. 9

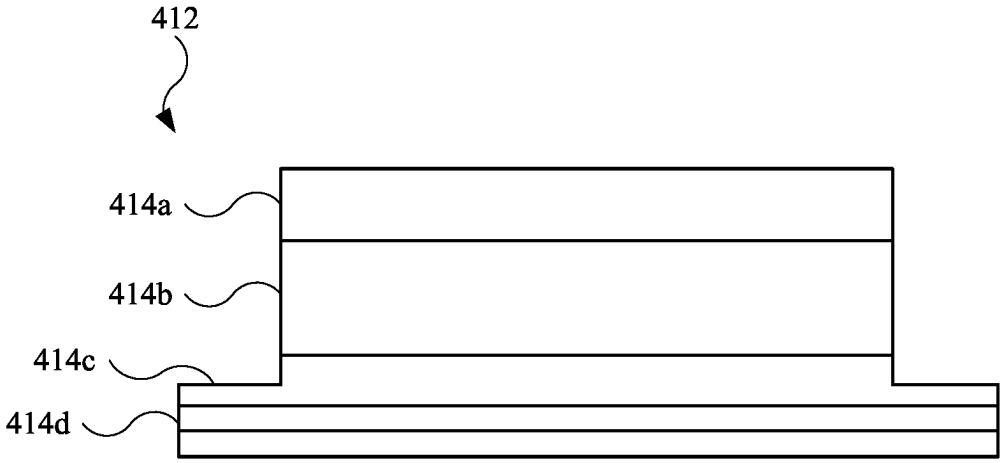


FIG. 10

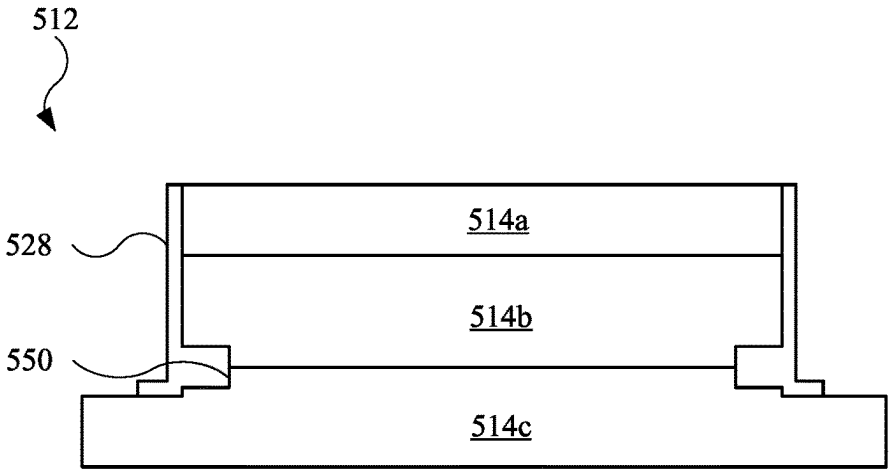


FIG. 11

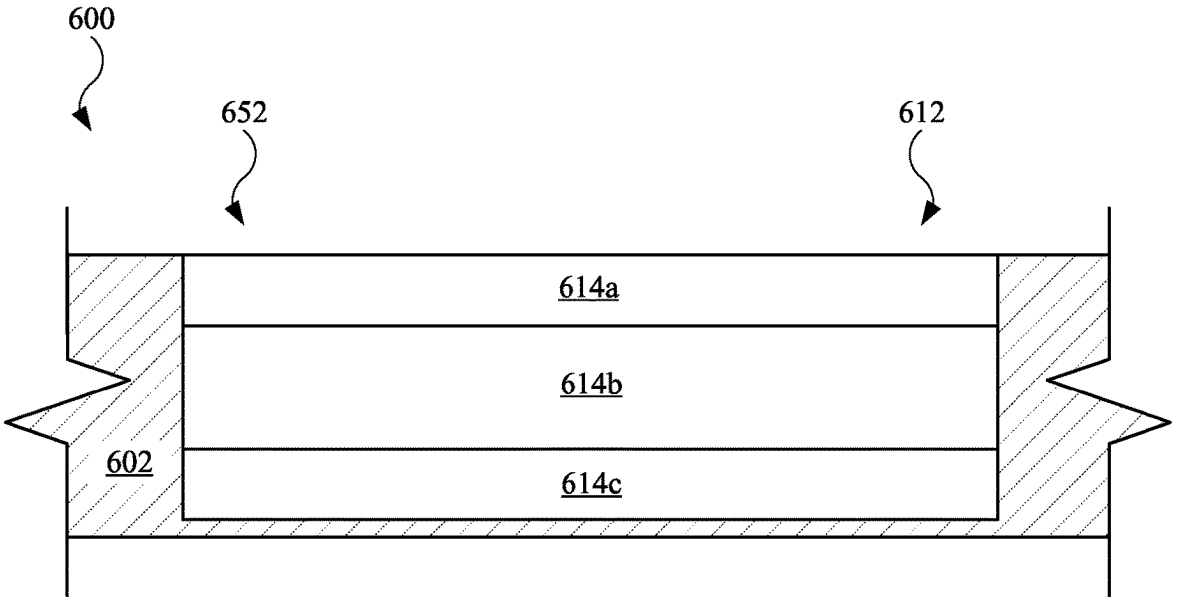


FIG. 12

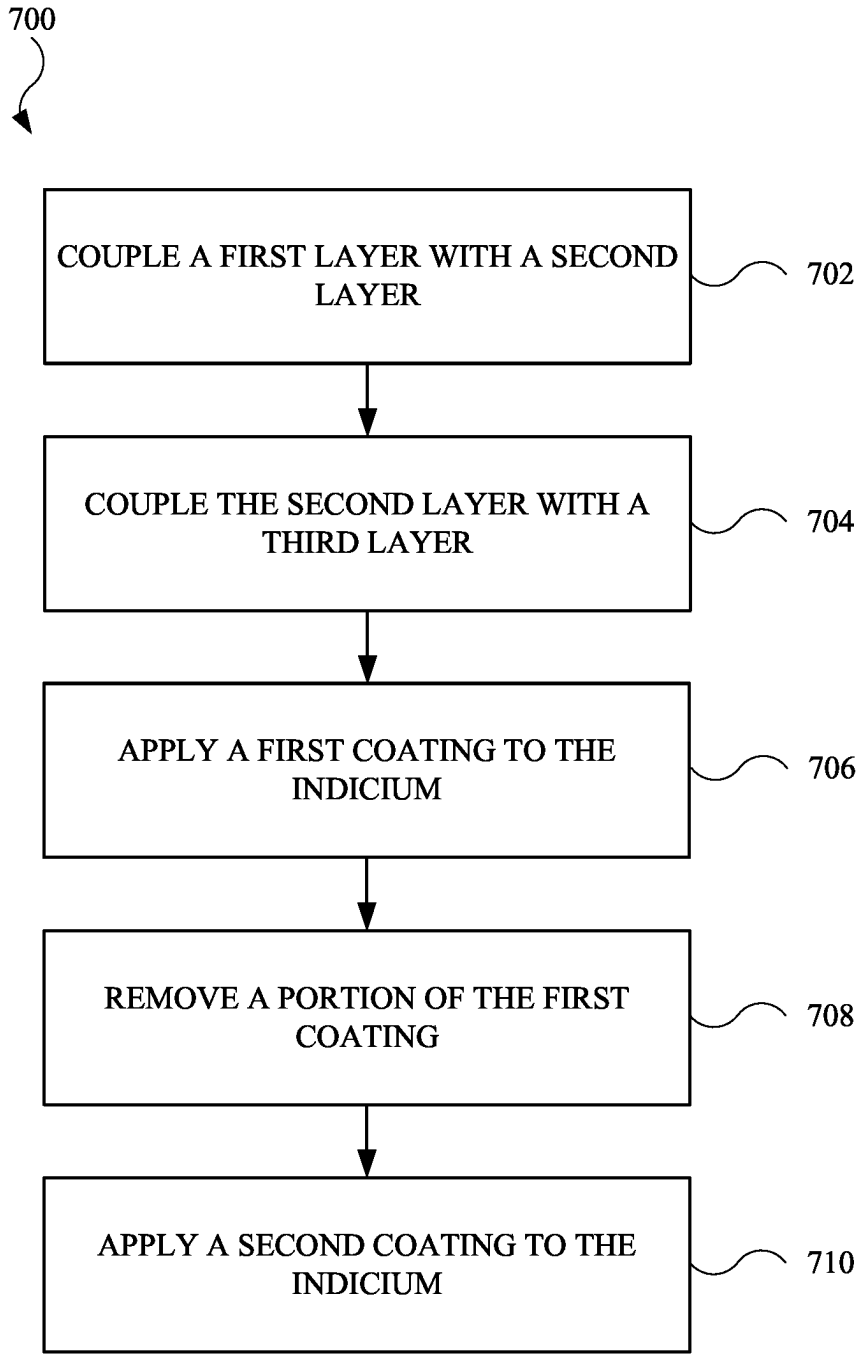

700
COUPLE A FIRST LAYER WITH A SECOND LAYER
702
COUPLE THE SECOND LAYER WITH A THIRD LAYER
704
APPLY A FIRST COATING TO THE INDICIUM
706
REMOVE A PORTION OF THE FIRST COATING
708
APPLY A SECOND COATING TO THE INDICIUM
710

FIG. 13

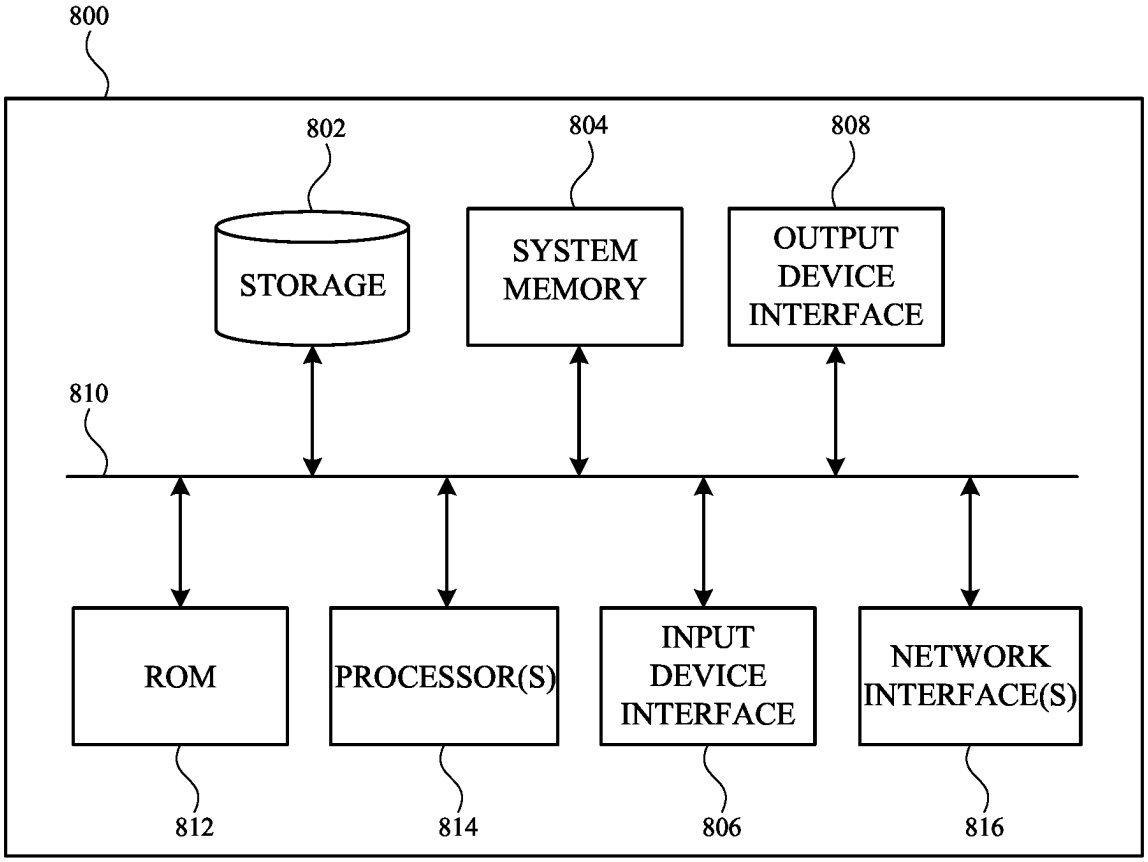

800
802
804
808
STORAGE
SYSTEM MEMORY
OUTPUT DEVICE INTERFACE
810
ROM
PROCESSOR(S)
INPUT DEVICE INTERFACE
NETWORK INTERFACE(S)
812
814
806
816

FIG. 14

ELECTRONIC DEVICES INCLUDING AN INDICIUM WITH A THERMAL CONDUIT

TECHNICAL FIELD

[0001] This application is directed to electronic devices, and more particularly, to electronic devices with an indicium with thermally conductive features.

BACKGROUND

[0002] Electronic devices, including portable electronic devices, include an integrated circuit used to generate and/or manage several operations. Based on its evolving technology, integrated circuits may perform several additional operations, including higher complexity operations. Based on the additional and/or complex operations performed, integrated circuits tend to convert more electrical energy into heat (e.g., thermal energy).

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Certain features of the subject technology are set forth in the appended claims. However, for purpose of explanation, several embodiments of the subject technology are set forth in the following figures.

[0004] FIG. **1** illustrates a front perspective view of an example of an electronic device, in accordance with aspects of the present disclosure.

[0005] FIG. **2** illustrates a rear plan view of an electronic device, in accordance with aspects of the present disclosure.

[0006] FIG. **3** illustrates a perspective view of an example of an indicium, in accordance with aspects of the present disclosure.

[0007] FIG. **4** illustrates a cross sectional view of the indicium shown in FIG. **3**, taken along line **4-4** in FIG. **3**, in accordance with aspects of the present disclosure.

[0008] FIG. **5**A, FIG. **5**B, and FIG. **5**C illustrate an example process for providing additional operations and/or layers to an indicium, in accordance with aspects of the present disclosure.

[0009] FIG. **6** illustrates a front plan view of an example of an electronic device, showing several internal features of the electronic device, in accordance with aspects of the present disclosure.

[0010] FIG. **7** illustrates a partial cross sectional view of the electronic device shown in FIG. **6**, taken along line **7-7** in FIG. **6**, showing heat distribution among components within the electronic device, in accordance with aspects of the present disclosure.

[0011] FIG. **8**, FIG. **9**, and FIG. **10** illustrate side views of alternate embodiments of an indicium, showing the indicium having a different number of materials, in accordance with aspects of the present disclosure.

[0012] FIG. **11** illustrates a side view of an alternate embodiment of an indicium, showing the indicium having an undercut and a coating positioned in the undercut, in accordance with aspects of the present disclosure.

[0013] FIG. **12** illustrates a partial cross sectional view of an electronic device, showing an indicium positioned in a pocket of a housing of the electronic device, in accordance with aspects of the present disclosure.

[0014] FIG. **13** illustrates a flow diagram showing an example of a process that may be performed for assembling an indicium, in accordance with aspects of the present disclosure.

[0015] FIG. **14** illustrates an electronic system with which one or more implementations of the subject technology may be implemented.

DETAILED DESCRIPTION

[0016] The detailed description set forth below is intended as a description of various configurations of the subject technology and is not intended to represent the only configurations in which the subject technology may be practiced. The appended drawings are incorporated herein and constitute a part of the detailed description. The detailed description includes specific details for the purpose of providing a thorough understanding of the subject technology. However, it will be clear and apparent to those skilled in the art that the subject technology is not limited to the specific details set forth herein and may be practiced without these specific details. In some instances, well-known structures and components are shown in block diagram form in order to avoid obscuring the concepts of the subject technology.

[0017] The present disclosure is directed to indicia (e.g., logos, symbols, or the like) with heat distribution capabilities. In particular, an indicium described herein may include multiple layers of material used to receive (e.g., absorb) heat from a heat-generating component (e.g., integrated circuit) in an electronic device and direct the heat away from the heat-generating component. In one or more implementations, one of the layers defines an external cosmetic external layer, another layer takes the form of a thermally conductive layer, and yet another layer takes the form of a support layer. Based on the heat absorbing capabilities, the indicium may function not only provide aesthetics (e.g., as a logo) for an electronic device, but also as a heat sink.

[0018] The thermally conductive layer may be positioned between the cosmetic layer and the support layer. When integrated into a housing of an electronic device, the support layer may couple, or secure, with the housing, thus placing the support layer closest to the heat-generating component and placing the cosmetic layer furthest from the heat-generating component. In this regard, when the indicium receives heat, at least some of the heat transmitted through the support layer is received by the thermally conductive layer, where the thermally conductive layer directs the received heat to the housing. When the housing includes a metal (e.g., aluminum), the heat received from the housing can be distributed throughout other locations (e.g. other locations of the housing). The thermally conductive layer may limit or prevent heat from being transmitted to the cosmetic layer, which defines a layer in which a user of the electronic device may contact. Beneficially, users of the electronic device are less likely to experience the indicium at elevated temperatures, thus reducing the likelihood of injury.

[0019] Further, at least some of the layers may include dissimilar materials. For example, the cosmetic layer and the support layer may each include steel (e.g., SUS316 stainless) and the thermally conductive layer may include copper. In order to bond the dissimilar layers together, a cladding operation may be used. Using the cladding operation, each of the layers of the indicium may be extruded through a die and pressed or rolled together under pressure.

[0020] While various examples and embodiments show and describe an indicium, other structural components with both aesthetic and heat-sinking capabilities may be contem-

plated. For example, electronic devices such as desktop computing devices, electronic devices with a display and a stand, or standalone displays may include a handle to facilitate carrying the electronic device. In one or more implementations, the handle may include a thermally conductive layer (e.g. copper) thermally coupled to a heat-generating component, as well as an aesthetic layer (e.g., stainless steel) covering the thermally conductive layer. As yet another example, a retractable holder that can be coupled (e.g., magnetically coupled) to an electronic device to allow a user to hold the electronic device may include a thermally conductive layer (e.g. copper) thermally coupled to a heat-generating component, as well as an aesthetic layer (e.g., stainless steel) covering the thermally conductive layer.

[0021] These and other embodiments are discussed below with reference to FIGS. **1**-**14**. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these Figures is for explanatory purposes only and should not be construed as limiting.

[0022] FIG. **1** illustrates a front perspective view of an example of an electronic device **100**, in accordance with aspects of the present disclosure. In one or more implementations, electronic device **100** takes the form of a handheld computing device, such as a laptop computing device. In the exemplary embodiment shown in FIG. **1**, electronic device **100** takes the form of a handheld computing device, such as a mobile wireless communication device, such as a smartphone or a tablet computing device. Electronic device **100** may take the form of other devices, such as desktop computing devices or standalone displays.

[0023] Electronic device **100** may include a housing **102**, or enclosure, designed to provide a volume (e.g., internal volume) to carry several components of electronic device **100**. In this regard, housing **102** may include several walls, including a bottom wall and several sidewalls extending from the bottom wall. For example, housing **102** includes a sidewall **103***a* and a sidewall **103***b*, each representative of additional sidewalls of housing **102**. Although not shown in FIG. **1**, some of the components may include a processing circuitry (e.g., central processing unit or CPU, graphics processing unit or GPU, application-specific integrated circuit or ASIC, system on chip or SOC), memory circuitry (e.g., read-only memory, random access memory), one or more batteries, one or more audio transducers (e.g., microphone, speaker), flexible circuitry, a wireless charging module, or a combination thereof, as non-limiting examples.

[0024] Electronic device **100** may further include a display **104**. As non-limiting examples, display **104** may take the form of a liquid crystal display (LCD), a light-emitting diode (LED) display, or an organic light-emitting diode (OLED) display. Accordingly, display **104** is designed to present visual information in the form of textual information, still images, motion images (e.g., video), or a combination thereof. Also, display **104** may be covered by a transparent layer (not shown in FIG. **1**) formed from a material such as a glass, sapphire, or plastic.

[0025] Electronic device **100** may further include one or more input mechanisms. For example, electronic device **100** includes an input mechanism **106** (representative of one or more additional input mechanisms). As non-limiting examples, input mechanism **106** may take the form of a button, a switch, a dial, or a combination thereof. Although input mechanism **106** is located on (e.g., through an opening of) sidewall **103***a*, input mechanism **106** may be located in other areas of sidewall **103***a* and/or on other sidewalls of housing **102**.

[0026] FIG. **2** illustrates a rear plan view of electronic device **100**, in accordance with aspects of the present disclosure. As shown, housing **102** includes a wall **108**, which may take the form of a bottom wall of housing **102**. As shown, wall **108** of housing **102** includes an opening **110**. Further, electronic device **100** includes an indicium **112** positioned in opening **110** of wall **108**. In one or more implementations, indicium **112** takes the form of a logo identifying, for example, the manufacturer of electronic device **100**, with the logo being representative of a symbol, one or more letters, or a combination thereof. While indicium **112** is shown in FIG. **2** as a generally circular object, indicium **112** is exemplary and may take different shapes and sizes. Also, opening **110** may include a corresponding size and shape of indicium **112**.

[0027] FIG. **3** illustrates a perspective view of an example of indicium **112**, in accordance with aspects of the present disclosure. Indicium **112** may include several layers, with at least some layers varying in terms of material makeup, thermal conductivity, thermal expansion coefficient, or a combination thereof. Based at least in part on the use of different layers, indicium **112** may provide various functions, including appearance, heat sinking, heat distribution, and structural support, as non-limiting examples.

[0028] FIG. **4** illustrates a cross sectional view of indicium **112** shown in FIG. **3**, taken along line **4**-**4** in FIG. **3**, in accordance with aspects of the present disclosure. As shown, indicium **112** includes several layers, such as a layer **114***a*, a layer **114***b*, and a layer **114***c*. While layers **114***a*, **114***b*, and **114***c* represent a discrete number (e.g., three) of layers, the number of layers of indicium **112** may vary in other example implementations.

[0029] In one or more implementations, each of layers **114***a*, **114***b*, and **114***c* take the form of a metal layer. For example, layer **114***a* may include a stainless steel layer, including SUS316 stainless steel as a non-limiting example. Additionally, layer **114***b* may include a copper layer. Also, layer **114***c* may include a stainless steel layer, including SUS316 stainless steel as a non-limiting example. In this regard, at least some layers may include a different material.

[0030] Based on the use of different materials, some layers of indicium **112** may include different properties. For example, layers **114***a* and **114***b* may include different thermal conductivity. When taking the form of stainless steel, layer **114***a* may include an approximate thermal conductivity of 16.3 Watts per meter per Kelvin (W/m*K). Further, when taking the form of copper, layer **114***b* may include an approximate thermal conductivity of 398 W/m*K. Also, when layer **114***c* is formed from the same material as that of layer **114***a*, layer **114***c* may have the same or substantially similar thermal conductivity as that of layer **114***a*. Based on the disparate thermal conductivities, indicium **112**, and in particular, layer **114***b*, may be designed to receive and distribute heat in a particular manner. Conversely, some layers (e.g., layer **114***a*) may be thermally resistant as compared to other layers (e.g., layer **114***b*). This will be shown and described in further detail below.

[0031] Additionally, when layers **114***a* and **114***c* include the same material(s), layers **114***a* and **114***c* may include the same or substantially similar thermal expansion coefficient and stiffness. In this regard, layers **114***a* and **114***c* may

expand in the same or similar manner in response to receiving heat. Beneficially, layers **114***a* and **114***c*, when having the same material makeup, may apply the same or substantially similar forces to layer **114***b*, thus minimizing or preventing layer **114***b* from unwanted bending.

[0032] When integrated into a housing of an electronic device (e.g., housing **102** of electronic device **100** shown in FIG. **2**), indicium **112** may be oriented such that a surface **116** of layer **114***a* is visible to a user. In this regard, surface **116** may represent an exterior surface (e.g., cosmetic surface) of layer **114***a*, as well as an exterior surface of indicium **112**.

[0033] Also, layer **114***c* may include a flange portion **118**, or flange, configured to couple with a housing (e.g., housing **102** shown in FIG. **2**). Flange portion **118** may provide additional lateral material for layer **114***c* as compared to layers **114***a* and **114***b*. As a result, layer **114***c* may provide a receiving surface for indicium **112** to couple with a housing. Also, based on the use of stainless steel, layer **114***c* may provide a rigid support layer for indicium **112**. Further, layer **114***c* may include a stepped portion **120** that provides for surfaces of layer **114***c* with different elevated portions. For example, based on stepped portion **120**, layer **114***c* may include a surface **122***a* and a surface **122***b* (defined by flange portion **118**), with surfaces **122***a* and **122***b* having different elevations, as measured with respect to a Z-axis of Cartesian coordinates. As shown, surface **122***a* is elevated with respect to surface **122***b*.

[0034] Indicium **112** may be formed through various operations. For example, each of layers **114***a*, **114***b*, and **114***c* may be machined from respective layers of material, and subsequently pressed together through a cladding operation. Other operations (e.g., welding) may be used to couple layers **114***a*, **114***b*, and **114***c* together. Also, subsequent to coupling layers **114***a*, **114***b*, and **114***c* together, indicium **112** may include a dimension **126** (e.g., height) approximately in the range of 0.4 millimeters to 0.8 mm. In one or more implementations, dimension **126** is 0.6 mm. Also, while each of layers **114***a*, **114***b*, and **114***c* is generally flat or planar, at least some of layers **114***a*, **114***b*, and **114***c* may be bent through an operation, such as stamping.

[0035] Alternatively, at least some of layers **114***a*, **114***b*, and **114***c* may include different materials. For example, at least one of layer **114***a* or layer **114***c* may include molybdenum or titanium. Additionally, layer **114***a* may include one or more non-metals. For example, layer **114***a* may include diamond (including synthetic diamond), carbon fiber, or ceramic. Additionally, layer **114***b* may include materials such as aluminum, as a non-limiting example.

[0036] FIG. **5**A, FIG. **5**B, and FIG. **5**C illustrate an example process for providing additional operations and/or layers to indicium **112**, in accordance with aspects of the present disclosure. Referring to FIG. **5**A, a coating **128** may be applied to indicium **112**, including to each of layers **114***a*, **114***b*, and **114***c*. In one or more implementations, coating **128** takes the form of a nickel-based coating, including an electroless nickel plating. In this regard, coating **128** may provide protection against issues such as corrosion due to liquid ingress, particularly when layer **114***b* includes copper.

[0037] Referring to FIG. **5**B, at least some of coating **128** may be removed from portions of indicium **112**. For example, coating **128** may be removed from surface **116** of layer **114***a*, while remaining on several surfaces of layers **114***b* and **114***c*. In one or more implementations, a lapping operation is used to remove coating **128** and expose surface **116**.

[0038] Referring to FIG. **5**C, a coating **130** may be applied to portions of indicium **112**. For example, coating **130** may be applied to surface **116** of layer **114***a* as well as to coating **128**, including regions of coating **128** that cover layers **114***b* and **114***c*. In one or more implementations, a physical vapor deposition (PVD) operation is used to apply coating **130**.

[0039] FIG. **6** illustrates a front plan view of an example of electronic device **100**, showing several internal features of electronic device **100**, in accordance with aspects of the present disclosure. For purposes of illustration, display **104** (shown in FIG. **1**) is removed. As shown, electronic device **100** may include a circuit board **132** and a heat-generating component **134** positioned within housing **102** (e.g., within an internal volume defined by housing **102**). As a non-limiting example, circuit board **132** may take the form of a logic board. Also, heat-generating component **134** may take the form of a CPU, a GPU, an ASIC, or an SOC, as non-limiting examples.

[0040] As shown, both indicium **112** (shown as a dotted line) and heat-generating component **134** are centrally located in electronic device **100**. For example, indicium **112** is located at a center, or approximate center, of wall **108** of housing **102**, and heat-generating component **134** is located at a center, or approximate center, of the internal volume defined by housing **102**. Accordingly, heat-generating component **134** may be aligned with indicium **112**, thus positioning heat-generating component over (in the view shown in FIG. **6**), or at least substantially over, indicium **112**. As a result of the alignment between indicium **112** and heat-generating component **134**, when heat-generating component **134** generates heat, at least some of the heat may flow into indicium **112**.

[0041] In order to distribute heat from heat-generating component **134** and/or other heat-generating components (not shown in FIG. **6**), electronic device **100** may further include a layer **136**. As a non-limiting example, layer **136** may include graphite. In this regard, layer **136** may receive and distribute heat from, for example, heat-generating component **134**. As shown, layer **136** may be positioned between heat-generating component **134** and indicium **112**.

[0042] Layer **136** may thermally couple with several components of electronic device **100**, thus allowing layer **136** to receive heat from the components. For example, layer **136** may thermally couple with a circuit board **138**, which may take the form of a timing controller board for display **104** (shown in FIG. **1**). Additionally, layer **136** may thermally couple with one or more components **140**. As non-limiting examples, one or more component **140** may include a wireless charging module and electrical contacts.

[0043] Further, layer **136** may include a design layout to not only provide heat distribution but also to accommodate various components of electronic device **100**. For example, layer **136** may include an opening **142***a* and an opening **142***b*. Openings **142***a* and **142***b* of layer **136** may provide space for an adhesive used to secure a battery (not shown in FIG. **6**). Additionally, portions of layer **136** may be removed to accommodate a circuit **144***a* and a circuit **144***b*. Each of circuits **144***a* and **144***b* may take the form of a flexible circuit that electrically couples one or more components **140** with circuit board **132**, thus electrically coupling one or more

components **140** with other components on circuit board **132** (e.g., heat-generating component **134**).

[0044] FIG. **7** illustrates a partial cross sectional view of electronic device **100** shown in FIG. **6**, taken along line **7-7** in FIG. **6**, showing heat distribution among components within electronic device **100**, in accordance with aspects of the present disclosure. Although not shown, an adhesive may be used to couple flange portion **118** of indicium **112** with wall **108**. Several dotted lines are used to represent the flow of heat, which may be generated by heat-generating component **134**. During operation, at least some heat generated by heat-generating component **134** may flow through circuit board **132** and into layer **136**. As a result, layer **136** may distribute at least some of the heat away from heat-generating component **134** and throughout wall **108**.

[0045] Based on the alignment between indicium **112** and heat-generating component **134**, indicium **112** may receive at least some of the heat passing through layer **136**. For example, heat may initially flow into layer **114***c* of indicium **112**. While layer **114***c* may distribute at least some of the received heat into wall **108**, layer **114***b* may receive heat from layer **114***c*. Based on layer **114***b* having a relatively high thermal conductivity as compared to layers **114***a* and **114***c*, layer **114***b* may readily distribute the received heat from layer **114***c* to wall **108**. Moreover, layer **114***b* may substantially distribute the received heat, thus directing the heat away from surface **116** of layer **114***a* so as to minimize or prevent surface **116** of layer **114***a* from receiving heat. Beneficially, a user making contact with surface **116** of layer **114***a* may experience little, if any heat, generated by heat-generating component **134**, even in instances when heat-generating component **134** is positioned over, and in some instances directly over, indicium **112** as shown in FIG. **7**.

[0046] Based in part on material makeup, indicium **112** may be positioned at or along an exterior of electronic device **100**. For example, as shown in FIG. **7**, layer **114***a* (e.g., a cosmetic layer) includes a surface **116** that is flush with respect to a surface of wall **108** and generally visible to users of electronic device **100**. Further, based on the position of indicium **112** within the opening **110** of wall **108**, indicium **112** may be integrated housing **102** (shown in FIG. **2**). Put another way, housing **102** may include indicium **112** as a component of housing **102**. Moreover, the material makeup of indicium **112** further allows indicium **112** to function as a heat sink, as layers **114***b* and **114***c* receive heat from heat-generating component **134** as well as limit or prevent heat from being transmitted to surface **116** of layer **114***a*.

[0047] FIGS. **8-12** show and describe alternate embodiments of an indicium. The indicia shown and/or described in FIGS. **8-12** may include at least some features previously shown and/or described for indicium **112** (e.g., shown in FIG. **3**), including the material makeup of the layers of indicium **112**. Further, in some example implementations, indicium **112** may be modified to include at least some features shown and/or described for indicia in FIGS. **8-12**.

[0048] FIG. **8**, FIG. **9**, and FIG. **10** illustrate side views of alternate embodiments of an indicium, showing the indicium having a different number of materials, in accordance with aspects of the present disclosure. Referring to FIG. **8**, an indicium **212** includes a layer **214***a* and a layer **214***b*. Layer **214***a* may provide a cosmetic exterior for indicium **212**, and may include a material such as stainless steel. Layer **214***b* may provide heat distribution, and may include a material such a copper. Accordingly, indicium **212** may include fewer than three layers.

[0049] Referring to FIG. **9**, an indicium **312** includes a layer **314**, with layer **314** representing a single layer of material of indicium **312**. As shown, layer **314** includes an exterior portion **317** and a flange portion **318**, with exterior portion **317** and flange portion **318** having a dimension **326***a* (e.g., width) and a dimension **326***b* (e.g., width), respectively. As shown, dimension **326***b* is greater than dimension **326***a*. In one or more implementations, dimension is 5 or more times greater than dimension **326***a*. As a result, flange portion **318** provides additional material through which heat may flow. In this regard, layer **314** may be formed from a material with a more desirable finish (e.g., stainless steel) despite having a relatively lower thermal conductivity than other materials. However, the additional material from flange portion **318** provides for additional heat absorption. Accordingly, indicium **312** may include fewer than two layers.

[0050] Referring to FIG. **10**, an indicium **412** includes a layer **414***a*, a layer **414***b*, a layer **414***c*, and a layer **414***d*. As non-limiting examples, each of layers **414***a* and **414***c* includes stainless steel, and layer **414***b* includes copper. Layer **414***d* may include a non-metal thermally conductive layer, such as graphite. Graphite may include a relatively high thermal conductivity, such as 800 W/m*K or greater. By integrating layer **414***d* into layer **414***c*, the overall thermal conductivity of indicium **412** may increase.

[0051] FIG. **11** illustrates a side view of an alternate embodiment of an indicium **512**, showing indicium **512** having an undercut **550** and a coating **528** positioned in undercut **550**, in accordance with aspects of the present disclosure. As shown, indicium **512** includes a layer **514***a*, a layer **514***b*, and a layer **514***c*. As non-limiting examples, each of layers **514***a* and **514***c* includes stainless steel, and layer **514***b* includes copper. Coating **528** may be applied to indicium **512**, including to at least some surfaces of each of layers **514***a*, **514***b*, and **514***c*. In one or more implementations, coating **528** takes the form of a thermoplastic coating. In this regard, coating **528** may provide protection against issues, such as corrosion, particularly when layer **514***b* includes copper. Additionally, coating **528** may provide other functions, such as insulation. Undercut **550** may provide a location into which coating **528** is positioned, thus forming a mechanical interlock with layers **514***a*, **514***b*, and **514***c*. While undercut **550** is shown as a material removal of layer **514***b* and **514***c*, the material removal operation used to form undercut **550** may alternatively be performed to one of layer **514***b* or layer **514***c*.

[0052] FIG. **12** illustrates a partial cross sectional view of an electronic device **600**, showing an indicium **612** positioned in a pocket **652** of a housing **602** of electronic device **600**, in accordance with aspects of the present disclosure. As shown, indicium **612** includes a layer **614***a*, a layer **614***b*, and a layer **614***c*. As non-limiting examples, each of layers **614***a* and **614***c* includes stainless steel, and layer **614***b* includes copper. Pocket **652** may take the form of a cavity or blind hole formed in housing **602** to receive indicium **612**. In this regard, layer **614***c* may not require a flange portion (e.g., flange portion **118** shown in FIG. **4**), and indicium **612** may be formed with less complexities. Based on the position of indicium **612** relative to a heat-generating component (not shown in FIG. **12**), indicium **612** may nonetheless receive

heat from the heat-generating component despite pocket **652** not forming a through hole through housing **602**.

[0053] FIG. **13** illustrates a flow diagram showing an example of a process **700** that may be performed for assembling an indicium, in accordance with aspects of the present disclosure. For explanatory purposes, process **700** shown in FIG. **13** is primarily described herein with reference to indicia for electronic devices, which may include indicium **112** (shown in FIGS. **2-7**). However, process **700** shown in FIG. **13** is not limited to indicium **112**, and one or more blocks (or operations) of process **700** may be performed to assemble one or more other indicia shown and/or described herein (e.g., shown in FIGS. **8-12**). Further, for explanatory purposes, some of the blocks of process **700** are described herein as occurring in serial, or linearly. However, multiple blocks of process **700** may occur in parallel. In addition, the blocks of process **700** need not be performed in the order shown and/or one or more blocks of process **700** need not be performed and/or can be replaced by other operations.

[0054] At block **702**, a first layer is coupled with a second layer. In one or more implementations, the first layer is from stainless steel and the second layer is formed from copper. However, several exemplary materials, including metals and non-metals, described herein may be substituted. Also, the first layer may form an exterior, including an exterior surface, visible to a user, while the second layer may include a relatively high thermally conductive layer.

[0055] At block **704**, the second layer is coupled with a third layer. The third layer may provide a support layer for the indicium. In one or more implementations, the third layer is from stainless steel. However, several exemplary materials, including metals and non-metals, described herein may be substituted. Also, the first layer, the second layer, and the third layer may be coupled together by a cladding operation, as a non-limiting example.

[0056] At block **706**, a first coating is applied to the indicium. In one or more implementations, the first coating includes a nickel-based coating. In this regard, the first coating may provide corrosion resistance by prevent liquid from contact some layers, including the second layer, particularly when the second layer includes copper.

[0057] At block **708**, a portion of the first coating is removed. In one or more implementations, the first coating is removed from an exterior surface of the first layer. The removal of the first coating may be performed via lapping operation, as a non-limiting example.

[0058] At block **710**, a second coating is applied to the indicium. In one or more implementations, the second coating includes a PVD that covers at least some of the first layer (including the exterior surface), the second layer, or the third layer.

[0059] FIG. **14** illustrates an electronic system with which one or more implementations of the subject technology may be implemented. The electronic system **800** can be, and/or can be a part of, electronic device **100** as shown in FIG. **1**. The electronic system **800** may include various types of computer readable media and interfaces for various other types of computer readable media. The electronic system **800** includes a bus **810**, one or more processing units **814**, a system memory **804** (and/or buffer), a ROM **812**, a permanent storage device **802**, an input device interface **806**, an output device interface **808**, and one or more network interfaces **816**, or subsets and variations thereof.

[0060] The bus **810** collectively represents all system, peripheral, and chipset buses that communicatively connect the numerous internal devices of the electronic system **800**. In one or more implementations, the bus **810** communicatively connects the one or more processing units **814** with the ROM **812**, the system memory **804**, and the permanent storage device **802**. From these various memory units, the one or more processing units **814** retrieves instructions to execute and data to process in order to execute the processes of the subject disclosure. The one or more processing units **814** can be a single processor or a multi-core processor in different implementations.

[0061] The ROM **812** stores static data and instructions that are needed by the one or more processing units **814** and other modules of the electronic system **800**. The permanent storage device **802**, on the other hand, may be a read-and-write memory device. The permanent storage device **802** may be a non-volatile memory unit that stores instructions and data even when the electronic system **800** is off. In one or more implementations, a mass-storage device (such as a magnetic or optical disk and its corresponding disk drive) may be used as the permanent storage device **802**.

[0062] In one or more implementations, a removable storage device (such as a flash drive, and its corresponding disk drive) may be used as the permanent storage device **802**. Like the permanent storage device **802**, the system memory **804** may be a read-and-write memory device. However, unlike the permanent storage device **802**, the system memory **804** may be a volatile read-and-write memory, such as random access memory. The system memory **804** may store any of the instructions and data that one or more processing units **814** may need at runtime. In one or more implementations, the processes of the subject disclosure are stored in the system memory **804**, the permanent storage device **802**, and/or the ROM **812** (which are each implemented as a non-transitory computer-readable medium). From these various memory units, the one or more processing units **814** retrieves instructions to execute and data to process in order to execute the processes of one or more implementations.

[0063] The bus **810** also connects to the input device interface **806** and the output device interface **808**. The input device interface **806** enables a user to communicate information and select commands to the electronic system **800**. Input devices that may be used with the input device interface **806** may include, for example, alphanumeric keyboards and pointing devices (also called "cursor control devices"). The input device interface **806** may enable, for example, the display of images generated by electronic system **800**. Output devices that may be used with the input device interface **806** may include, for example, printers and display devices, such as a liquid crystal display (LCD), a light emitting diode (LED) display, an organic light emitting diode (OLED) display, a flexible display, a flat panel display, a solid state display, a projector, or any other device for outputting information. One or more implementations may include devices that function as both input and output devices, such as a touchscreen. In these implementations, feedback provided to the user can be any form of sensory feedback, such as visual feedback, auditory feedback, or tactile feedback; and input from the user can be received in any form, including acoustic, speech, or tactile input.

[0064] Finally, as shown in FIG. **14**, the bus **810** also couples the electronic system **800** to one or more networks

and/or to one or more network nodes, or through the one or more network interfaces **816**. In this manner, the electronic system **800** can be a part of a network of computers (such as a LAN, a wide area network ("WAN"), or an Intranet, or a network of networks, such as the Internet. Any or all components of the electronic system **800** can be used in conjunction with the subject disclosure.

[0065] Various examples of aspects of the disclosure are described below as clauses for convenience. These are provided as examples, and do not limit the subject technology.

[0066] Clause A: An electronic device may include: a housing that defines an internal volume; a heat-generating component positioned in the internal volume; and an indicium thermally coupled with the heat-generating component and integrated with the housing. The indicium may include: a first layer including a first thermal conductivity; a second layer coupled with the first layer, the second layer including a second thermal conductivity different from the first thermal conductivity; and a third layer coupled with the second layer. The third layer may include a third thermal conductivity different from the second thermal conductivity.

[0067] Clause B: An electronic device may include: a heat-generating component; and a housing that defines an internal volume. The heat-generating component may be positioned within the internal volume. The housing may include an opening; and an indicium thermally coupled with the heat-generating component and positioned in the opening. The indicium may include: a first layer including a first material; and a second layer coupled with the first layer. The second layer may include a second material different from the first material. The second metal may be configured to: receive thermal energy from the heat-generating component, and direct at least some of the thermal energy to the housing.

[0068] Clause C: An indicium for an electronic device may include: a first metal layer that defines an exterior surface of the electronic device; a second metal layer coupled with the first metal layer; and a third metal layer coupled with the second metal layer. The third metal layer may include a flange portion configured to couple with a housing of the electronic device. The second metal may be configured to: receive thermal energy from the third metal layer, and direct at least some of the thermal energy away from the exterior surface.

[0069] One or more of the above clauses can include one or more of the features described below. It is noted that any of the following clauses may be combined in any combination with each other, and placed into a respective independent clause, e.g., clause A, B, or C.

[0070] Clause 1: wherein the indicium is thermally coupled with the heat-generating component.

[0071] Clause 2: wherein the indicium includes a heat sink for the heat-generating component.

[0072] Clause 3: wherein: the second thermal conductivity is greater than the first thermal conductivity, and the second thermal conductivity is greater than the third thermal conductivity.

[0073] Clause 4: wherein: the housing includes an opening, and the indicium is positioned in the opening.

[0074] Clause 5: wherein the third layer further includes: a first surface coupled with the second layer, and a second surface defined by a flange portion.

[0075] Clause 6: wherein the first surface is elevated relative to the second surface.

[0076] Clause 7: further including a third layer coupled with the second layer, the third layer including a third material different from the second material.

[0077] Clause 8: wherein: the first layer includes a first thermal conductivity, and the second layer includes a second thermal conductivity greater than the first thermal conductivity.

[0078] Clause 9: wherein the third layer includes the first thermal conductivity.

[0079] Clause 10: wherein: the first material and the third material include stainless steel, and the second material includes copper.

[0080] Clause 11: wherein: the first layer includes an exterior surface, and the exterior surface is flush with the housing.

[0081] Clause 12: wherein: the heat-generating component includes an integrated circuit, and the indicium is aligned with the integrated circuit.

[0082] Clause 13: wherein the second layer is thermally coupled with the heat-generating component and the housing.

[0083] Clause 14: wherein: the first metal layer includes a first metal, and the second metal layer includes a second metal different from the first metal.

[0084] Clause 15: wherein: the first metal layer includes a first thermal conductivity, and the second metal layer includes a second thermal conductivity greater than the first thermal conductivity.

[0085] Clause 16: wherein: the first metal layer includes stainless steel, and the second metal layer includes copper.

[0086] Clause 17: wherein the third metal layer includes the first metal.

[0087] It is well understood that the use of personally identifiable information should follow privacy policies and practices that are generally recognized as meeting or exceeding industry or governmental requirements for maintaining the privacy of users. In particular, personally identifiable information data should be managed and handled so as to minimize risks of unintentional or unauthorized access or use, and the nature of authorized use should be clearly indicated to users.

[0088] As used herein, the phrase "at least one of" preceding a series of items, with the term "and" or "or" to separate any of the items, modifies the list as a whole, rather than each member of the list (i.e., each item). The phrase "at least one of" does not require selection of at least one of each item listed; rather, the phrase allows a meaning that includes at least one of any one of the items, and/or at least one of any combination of the items, and/or at least one of each of the items. By way of example, the phrases "at least one of A, B, and C" or "at least one of A, B, or C" each refer to only A, only B, or only C; any combination of A, B, and C; and/or at least one of each of A, B, and C.

[0089] The predicate words "configured to", "operable to", and "programmed to" do not imply any particular tangible or intangible modification of a subject, but, rather, are intended to be used interchangeably. In one or more implementations, a processor configured to monitor and control an operation or a component may also mean the processor being programmed to monitor and control the operation or the processor being operable to monitor and control the operation. Likewise, a processor configured to execute code can be construed as a processor programmed to execute code or operable to execute code.

[0090] When an element is referred to herein as being "connected" or "coupled" to another element, it is to be understood that the elements can be directly connected to the other element, or have intervening elements present between the elements. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, it should be understood that no intervening elements are present in the "direct" connection between the elements. However, the existence of a direct connection does not exclude other connections, in which intervening elements may be present.

[0091] Phrases such as an aspect, the aspect, another aspect, some aspects, one or more aspects, an implementation, the implementation, another implementation, some implementations, one or more implementations, an embodiment, the embodiment, another embodiment, some embodiments, one or more embodiments, a configuration, the configuration, another configuration, some configurations, one or more configurations, the subject technology, the disclosure, the present disclosure, other variations thereof and alike are for convenience and do not imply that a disclosure relating to such phrase(s) is essential to the subject technology or that such disclosure applies to all configurations of the subject technology. A disclosure relating to such phrase(s) may apply to all configurations, or one or more configurations. A disclosure relating to such phrase (s) may provide one or more examples. A phrase such as an aspect or some aspects may refer to one or more aspects and vice versa, and this applies similarly to other foregoing phrases.

[0092] The word "exemplary" is used herein to mean "serving as an example, instance, or illustration". Any embodiment described herein as "exemplary" or as an "example" is not necessarily to be construed as preferred or advantageous over other embodiments. Furthermore, to the extent that the term "include", "have", or the like is used in the description or the claims, such term is intended to be inclusive in a manner similar to the term "comprise" as "comprise" is interpreted when employed as a transitional word in a claim.

[0093] All structural and functional equivalents to the elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. No claim element is to be construed under the provisions of 35 U.S.C. § 112, sixth paragraph, unless the element is expressly recited using the phrase "means for" or, in the case of a method claim, the element is recited using the phrase "step for".

[0094] The previous description is provided to enable any person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects. Thus, the claims are not intended to be limited to the aspects shown herein, but are to be accorded the full scope consistent with the language claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless specifically so stated, but rather "one or more". Unless specifically stated otherwise, the term "some" refers to one or more. Pronouns in the masculine (e.g., his) include the feminine and neuter gender (e.g., her and its) and vice versa. Headings and subheadings, if any, are used for convenience only and do not limit the subject disclosure.

What is claimed is:

1. An electronic device, comprising:
- a housing that defines an internal volume;
- a heat-generating component positioned in the internal volume; and
- an indicium thermally coupled with the heat-generating component and integrated with the housing, the indicium comprising:
  - a first layer comprising a first thermal conductivity;
  - a second layer coupled with the first layer, the second layer comprising a second thermal conductivity different from the first thermal conductivity; and
  - a third layer coupled with the second layer, the third layer comprising a third thermal conductivity different from the second thermal conductivity.

2. The electronic device of claim **1**, wherein the indicium is thermally coupled with the heat-generating component.

3. The electronic device of claim **1**, wherein the indicium comprises a heat sink for the heat-generating component.

4. The electronic device of claim **1**, wherein:
- the second thermal conductivity is greater than the first thermal conductivity, and
- the second thermal conductivity is greater than the third thermal conductivity.

5. The electronic device of claim **1**, wherein:
- the housing comprises an opening, and
- the indicium is positioned in the opening.

6. The electronic device of claim **1**, wherein the third layer further comprises:
- a first surface coupled with the second layer, and
- a second surface defined by a flange portion.

7. The electronic device of claim **6**, wherein the first surface is elevated relative to the second surface.

8. An electronic device, comprising:
- a heat-generating component; and
- a housing that defines an internal volume, wherein the heat-generating component is positioned within the internal volume, the housing comprising an opening; and
- an indicium thermally coupled with the heat-generating component and positioned in the opening, the indicium comprising:
  - a first layer comprising a first material; and
  - a second layer coupled with the first layer, the second layer comprising a second material different from the first material, wherein the second metal is configured to:
    - receive thermal energy from the heat-generating component, and
    - direct at least some of the thermal energy to the housing.

9. The electronic device of claim **8**, further comprising a third layer coupled with the second layer, the third layer comprising a third material different from the second material.

10. The electronic device of claim **9**, wherein:
- the first layer comprises a first thermal conductivity, and
- the second layer comprises a second thermal conductivity greater than the first thermal conductivity.

11. The electronic device of claim **10**, wherein the third layer comprises the first thermal conductivity.

12. The electronic device of claim **9**, wherein:

the first material and the third material comprise stainless steel, and

the second material comprises copper.

13. The electronic device of claim **8**, wherein:

the first layer comprises an exterior surface, and

the exterior surface is flush with the housing.

14. The electronic device of claim **8**, wherein:

the heat-generating component comprises an integrated circuit, and

the indicium is aligned with the integrated circuit.

15. The electronic device of claim **8**, wherein the second layer is thermally coupled with the heat-generating component and the housing.

16. An indicium for an electronic device, the indicium comprising:

a first metal layer that defines an exterior surface of the electronic device;

a second metal layer coupled with the first metal layer; and

a third metal layer coupled with the second metal layer, the third metal layer comprising a flange portion configured to couple with a housing of the electronic device,

wherein the second metal is configured to:

receive thermal energy from the third metal layer, and

direct at least some of the thermal energy away from the exterior surface.

17. The indicium of claim **16**, wherein:

the first metal layer comprises a first metal, and

the second metal layer comprises a second metal different from the first metal.

18. The indicium of claim **17**, wherein:

the first metal layer comprises a first thermal conductivity, and

the second metal layer comprises a second thermal conductivity greater than the first thermal conductivity.

19. The indicium of claim **17**, wherein:

the first metal layer comprises stainless steel, and

the second metal layer comprises copper.

20. The indicium of claim **17**, wherein the third metal layer comprises the first metal.

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